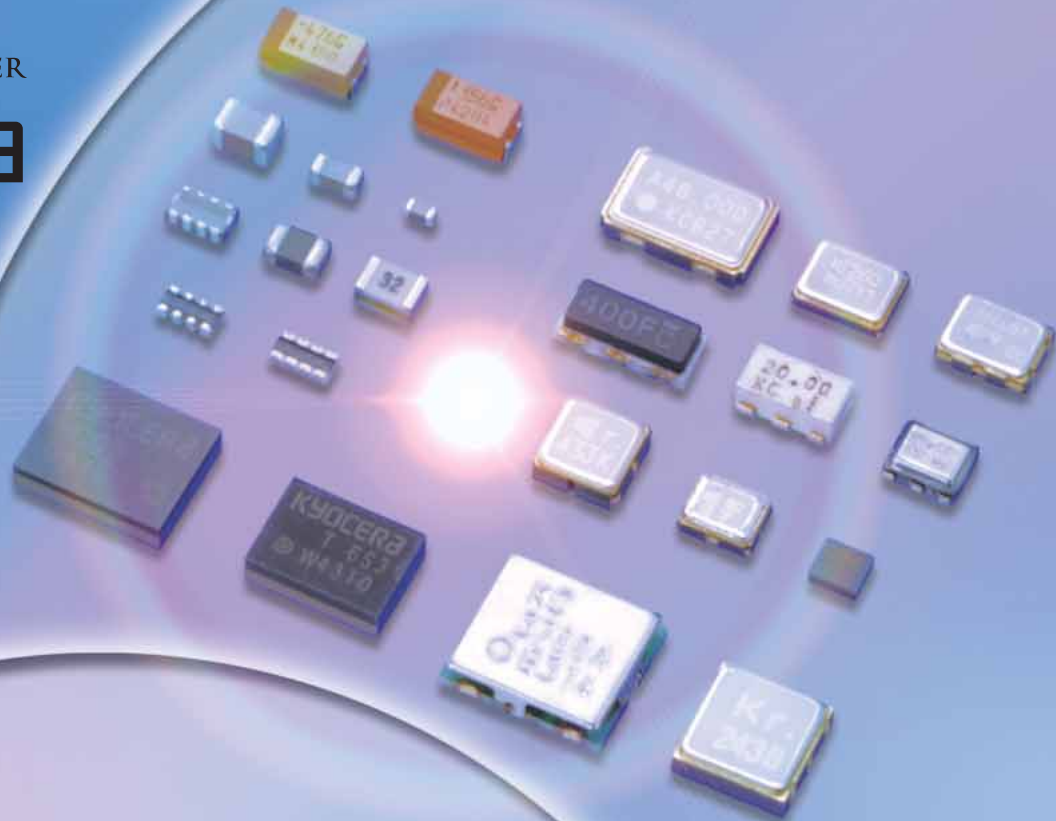


THE NEW VALUE FRONTIER



# Electronic Components & Devices 2005



THE NEW VALUE FRONTIER



# Capacitors

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Trimmer Capacitors





## Features

- SMD small & thin package
- Wide capacitance range
- Washable and non-washable types available
- Plus slot(+) suitable for auto-adjustment

## Applications

- AV equipment
- Cellular Phone
- Cordless phone
- TCXO
- Keyless Entry

## Specifications

| Part No.    |     | Capacitance(pF)       |           | Q<br>1±0.1<br>(MHz) | Temperature<br>Coefficient<br>(ppm/°C) |
|-------------|-----|-----------------------|-----------|---------------------|----------------------------------------|
|             |     | max Value<br>-0%+100% | min Value |                     |                                        |
| CTZ2<br>S/E | 03A | 3                     | 2.0       | ≥150                | NPO±500                                |
|             | 05A | 5                     | 3.0       | ≥150                | NPO±500                                |
|             | 10A | 10                    | 3.0       | ≥150                | NPO±500                                |
|             | 20C | 20                    | 5.5       | ≥150                | N750±500                               |
| CTZ3<br>S/E | 03A | 3                     | 1.0       | ≥300                | NPO±500                                |
|             | 05A | 5                     | 1.5       | ≥300                | NPO±500                                |
|             | 10A | 10                    | 2.5       | ≥300                | NPO±500                                |
|             | 10B | 10                    | 1.5       | ≥300                | N400±500                               |
|             | 20C | 20                    | 4.5       | ≥300                | N750±500                               |
|             | 30C | 30                    | 4.5       | ≥300                | N750±500                               |
|             | 40C | 40                    | 4.5       | ≥300                | N750±500                               |
|             | 50C | 50                    | 4.5       | ≥200                | N750±500                               |

| Series  | Rated<br>Voltage<br>(V•DC) | Temperature<br>Range<br>(°C) | Insulation<br>Resistance<br>(MΩ) | Torque<br>(g•cm) |
|---------|----------------------------|------------------------------|----------------------------------|------------------|
| CTZ2S/E | 25                         | -40 to +85                   | ≥10 <sup>4</sup>                 | 10 to 150        |
| CTZ3S/E | 25                         | -40 to +85                   | ≥10 <sup>4</sup>                 | 10 to 150        |

## How to Order

CTZ3 S - 05 A - W 1 - P F  
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

### ①Series

|      |             |
|------|-------------|
| CTZ3 | CTZ3 Series |
| CTZ2 | CTZ2 Series |

### ②Type

|   |                          |
|---|--------------------------|
| S | Reflow non washable type |
| E | Reflow washable type     |

### ③Maximum Capacitance

|    |      |    |      |
|----|------|----|------|
| 03 | 3pF  | 30 | 30pF |
| 05 | 5pF  | 40 | 40pF |
| 10 | 10pF | 50 | 50pF |
| 20 | 20pF |    |      |

### ④Temperature Coefficient(ppm/°C)

|   |          |   |          |
|---|----------|---|----------|
| A | NPO±500  | C | N750±500 |
| B | N400±500 |   |          |

### ⑤Packaging

|   |                    |
|---|--------------------|
| W | W Direction Taping |
| X | X Direction Taping |
| B | Bulk               |

### ⑥Taping Quantity (Unit : pcs)

|   |       |             |
|---|-------|-------------|
| 1 | 1,000 | CTZ3 Series |
| 2 | 2,000 | CTZ2 Series |

### ⑦Pin Head Type

|   |           |
|---|-----------|
| P | Plus Slot |
|---|-----------|

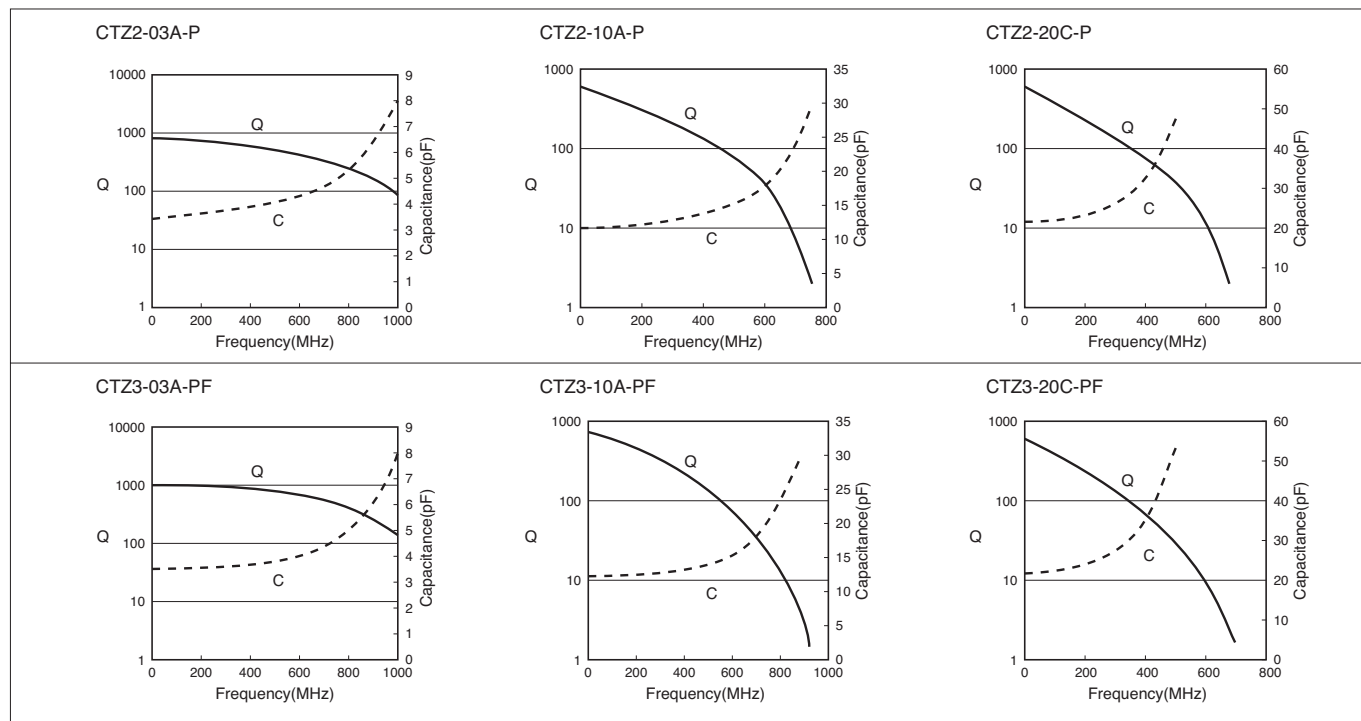
### ⑧Lead specification

|   |                                  |
|---|----------------------------------|
| F | Lead Forming Type<br>(CTZ3 type) |
|---|----------------------------------|

\* No code for standard parts

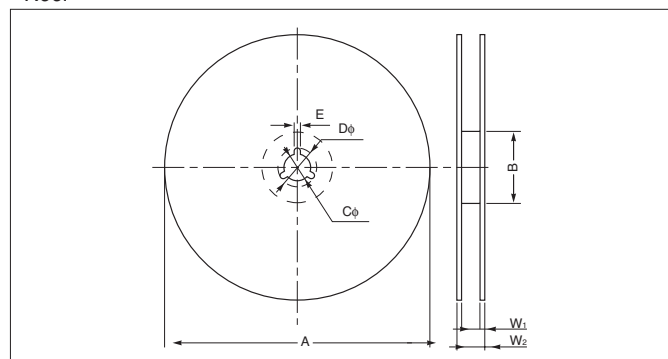
| Series      | Dimensions (Unit : mm) | Recommended Land Pattern (Unit: mm) |
|-------------|------------------------|-------------------------------------|
| CTZ2 Series |                        |                                     |
| CTZ3 Series |                        |                                     |

## Frequency Characteristics



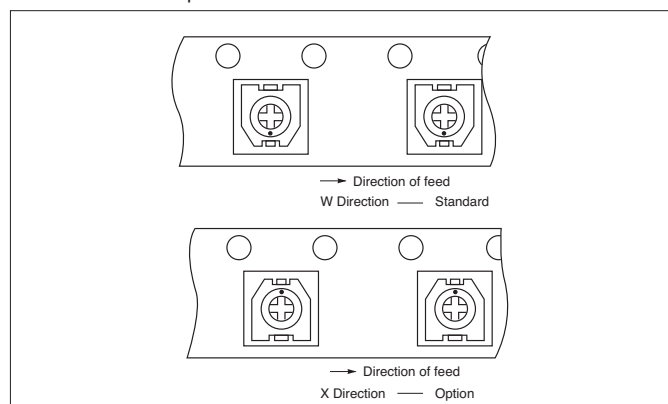
## Tape & Reel

### • Reel



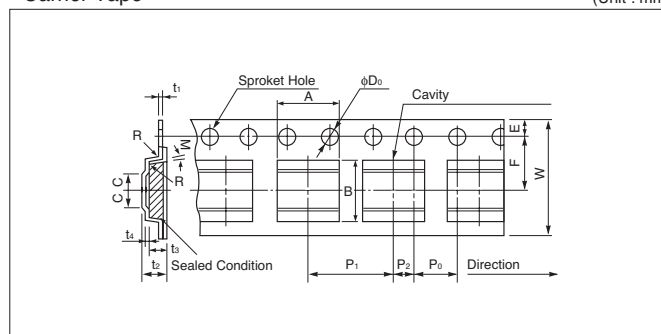
### • Tape Loading

W Direction — Standard  
X Direction — Option



### • Carrier Tape

(Unit : mm)



|            | CTZ2 Series                          | CTZ3 Series                         |
|------------|--------------------------------------|-------------------------------------|
| <b>A</b>   | 2.7±0.1                              | 3.35±0.1                            |
| <b>B</b>   | 3.2±0.1                              | 4.6 <sup>+0.2</sup> <sub>-0.0</sub> |
| <b>W</b>   | 12.0±0.3                             | 12.0±0.3                            |
| <b>F</b>   | 5.5±0.05                             | 5.5±0.05                            |
| <b>E</b>   | 1.75±0.1                             | 1.75±0.1                            |
| <b>P0</b>  | 4.0±0.1                              | 4.0±0.1                             |
| <b>P1</b>  | 4.0±0.1                              | 8.0±0.1                             |
| <b>P2</b>  | 2.0±0.05                             | 2.0±0.05                            |
| <b>φD0</b> | 1.5 <sup>+0.1</sup> <sub>-0.0</sub>  | 1.5 <sup>+0.1</sup> <sub>-0.0</sub> |
| <b>t1</b>  | 0.3±0.1                              | 0.3±0.1                             |
| <b>t2</b>  | 1.9±0.1                              | 2.5±0.1                             |
| <b>t3</b>  | 1.3 <sup>+0.15</sup> <sub>-0.0</sub> | 2.0±0.1                             |
| <b>t4</b>  | 0.3±0.1                              | 0.3±0.05                            |
| <b>C</b>   | 2.06±0.1                             | 2.7±0.1                             |

(Unit : mm)

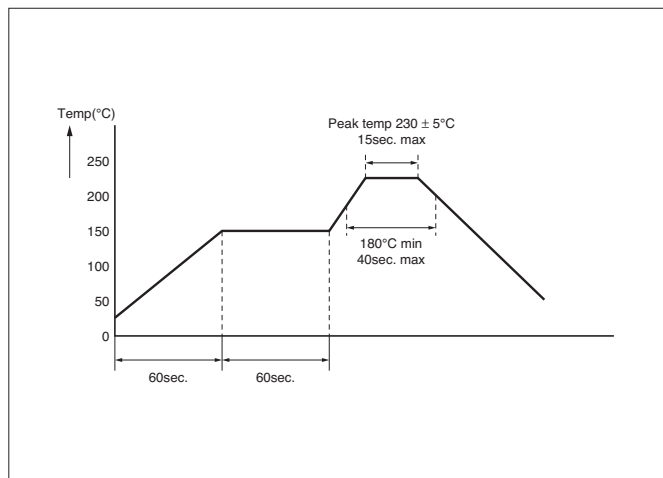
|                              | A                                   | B                                    | C        | D        | E       | W <sub>1</sub> | W <sub>2</sub> |
|------------------------------|-------------------------------------|--------------------------------------|----------|----------|---------|----------------|----------------|
| <b>CTZ2 Series(2,000pcs)</b> | 180 <sup>+0.0</sup> <sub>-3.0</sub> | 60.0 <sup>+1.0</sup> <sub>-0.0</sub> | 13.0±0.2 | 21.0±0.8 | 2.0±0.5 | 13.0±0.3       | 15.4±1.0       |
| <b>CTZ3 Series(1,000pcs)</b> |                                     |                                      |          |          |         |                |                |

## PCB Mounting

- When our recommended landpattern is not used, please check mounting alignment.
- When mounting on PCB, please do not apply pressure to trimmer capacitors over 500g.f.

## Soldering

- When using soldering iron, adjust iron tip to 280°C. max.
- Please find below recommended solder profile.



## Storage Conditions

- 1) Do not store components in corrosive condition such as chloric or sulfuric environment.
- 2) Components before use should be stored under the condition with temperature of 5 to 40 degrees Celsius and humidity of 20 to 70% RH.
- 3) It is recommended to use components within 6 months of incoming.
- 4) Do not open the minimal package until right before the use.
- 5) Do not store components under direct sunlight or dewy environment.

## Screwdrivers

Please use proper screwdriver for adjustment of the capacitor.  
Kyocera can supply suitable ceramic type screwdrivers specially designed for the use of CTZ series. Please contact your local AVX office for the details.

### CTZ-3

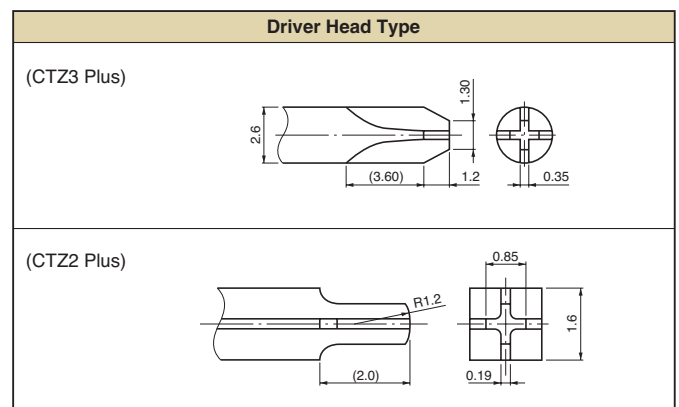
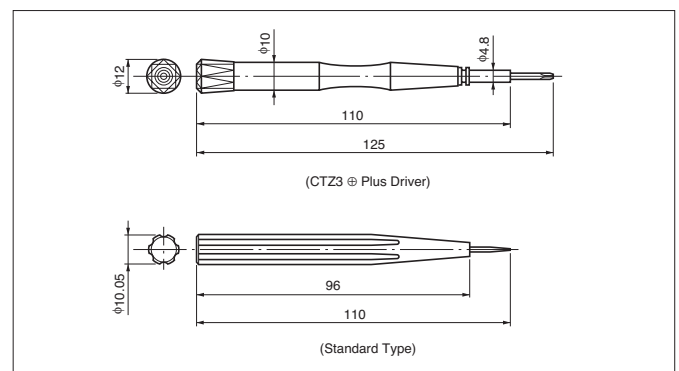
Pin Head

⊕: CTZ-3 Plus Ceramic Driver

### CTZ-2

Pin Head

⊕: CTZ-2 Plus Ceramic Driver



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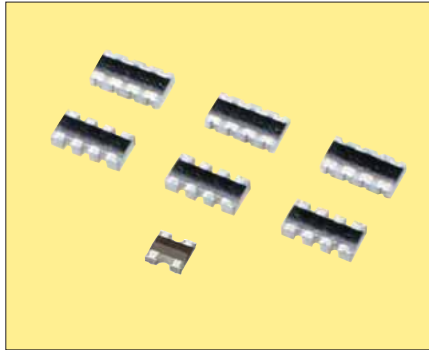


# Resistors

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**Chip Resistor Arrays**  
**Chip Resistor Networks**  
**Attenuators**  
**Low Resistance Chip Resistors**





RoHS Comforming

Miniature chip resistor arrays have 4 and 2 resistor elements integrated as a single component.

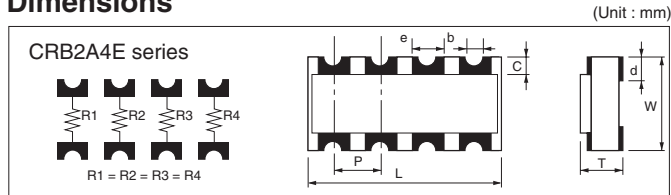
### Features

- Miniature (2.0×1.0mm) Resistor Arrays  
Max 60% space saving compared with the use of standard chip array (3.2×1.6mm)
- 0.5mm Termination pitch (Same as IC lead-pin pitch)  
Easy designing of pattern layout and improve electrical characteristics for circuit

\* Please consult combination of different resistance type.

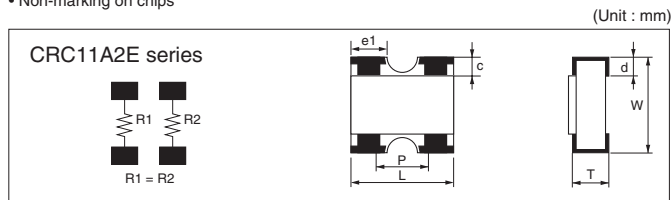
- 4 element chip Resistors Array ———— CRB2A4E series (Concave Termination)  
CRC2A4E series (Convex Termination)
- 2 element chip Resistors Array ———— CRC11A2E series (Convex Termination)

### Dimensions



| Code       | L                                     | W                                      | T                                     | P      | b        |
|------------|---------------------------------------|----------------------------------------|---------------------------------------|--------|----------|
| Dimensions | 2.0 <sup>+0.10</sup> <sub>-0.10</sub> | 1.0 <sup>+0.10</sup> <sub>-0.10</sub>  | 0.4 <sup>+0.10</sup> <sub>-0.10</sub> | 0.5typ | φ0.15typ |
| Code       | c                                     | d                                      | e                                     |        |          |
| Dimensions | 0.2 <sup>+0.15</sup> <sub>-0.15</sub> | 0.25 <sup>+0.15</sup> <sub>-0.15</sub> | 0.25typ                               |        |          |

• Non-marking on chips



| Code       | L                                      | W                                      | T                                      | P       |
|------------|----------------------------------------|----------------------------------------|----------------------------------------|---------|
| Dimensions | 1.00 <sup>+0.10</sup> <sub>-0.10</sub> | 1.00 <sup>+0.10</sup> <sub>-0.10</sub> | 0.35 <sup>+0.05</sup> <sub>-0.05</sub> | 0.65typ |
| Code       | c                                      | d                                      | e <sub>1</sub>                         |         |
| Dimensions | 0.20 <sup>+0.15</sup> <sub>-0.15</sub> | 0.20 <sup>+0.15</sup> <sub>-0.15</sub> | 0.33 <sup>+0.10</sup> <sub>-0.10</sub> |         |

• Non-marking on chips

### Rating

| Chip resistor arrays  |                                | Chip jumper array           |         |
|-----------------------|--------------------------------|-----------------------------|---------|
| Item                  | Rating                         | Item                        | Rating  |
| Rated power(70°C)     | 1/32W/element                  | Rated current               | 1A      |
| Max working * voltage | 25V                            |                             |         |
| Max Over-load voltage | 50V                            |                             |         |
| Resistance value      | 10Ω to 1MΩ                     | Conductive resistance value | 50mΩmax |
| Tolerance             | J : ±5%                        |                             |         |
| Working Temperature   | -55 to +125°C                  |                             |         |
| Number of elements    | 4E : 4Elements, 2E : 2Elements |                             |         |

### How to Order

CRB2A 4E 103 J T  
① ② ③ ④ ⑤

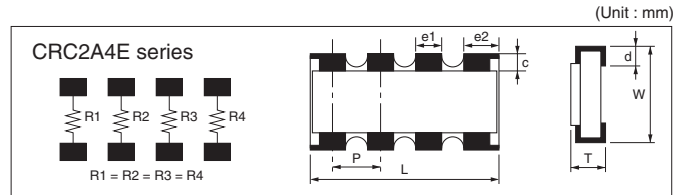
- ① Series(CRB2A: 2.0×1.0mm, concave termination, 4elements)  
(CRC2A: 2.0×1.0mm, convex termination, 4elements)  
(CRC11A: 1.0×1.0mm, convex termination, 2elements)
- ② Number of elements(4E: 4 elements)  
(2E: 2 elements)
- ③ Resistance Value(3 digits numbering)  
472 = 4.7kΩ, 103 = 10kΩ  
000 = 0Ω(Chip Jumper Array)
- ④ Tolerance

|   |     |       |                   |
|---|-----|-------|-------------------|
| J | ±5% | Blank | Chip Jumper Array |
|---|-----|-------|-------------------|

### ⑤ Packaging

| Code | Form   | Material | Packing unit  |
|------|--------|----------|---------------|
| T    | Taping | Paper    | 10000pcs/reel |

• 2mm pitch taping



| Code       | L                                      | W                                      | T                                     | P                                     |
|------------|----------------------------------------|----------------------------------------|---------------------------------------|---------------------------------------|
| Dimensions | 2.0 <sup>+0.10</sup> <sub>-0.10</sub>  | 1.0 <sup>+0.10</sup> <sub>-0.10</sub>  | 0.4 <sup>+0.10</sup> <sub>-0.10</sub> | 0.5typ                                |
| Code       | c                                      | d                                      | e1                                    | e2                                    |
| Dimensions | 0.15 <sup>+0.15</sup> <sub>-0.15</sub> | 0.25 <sup>+0.15</sup> <sub>-0.15</sub> | 0.3 <sup>+0.10</sup> <sub>-0.10</sub> | 0.4 <sup>+0.10</sup> <sub>-0.10</sub> |

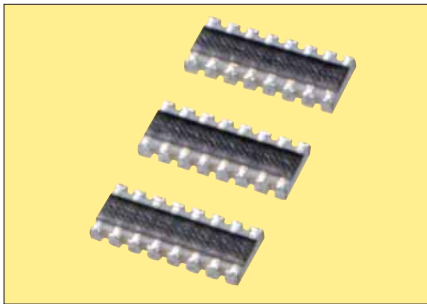
• Non-marking on chips

\* Rated Voltage :  $\sqrt{\text{Rated power} \times \text{Resistance value}}$ , whichever is less.

\* Standard Resistance Value: E-6 Series

\* Please contact sales engineer for any other requirements of the nominal resistance value and the tolerance.

## 8 element chip Resistor Array / CRC4A8E series (Convex Termination)



RoHS Conforming

## Features

- 0.5mm termination pitch (same as IC lead-pin pitch).
- Easy designing of pattern layout and improve electrical characteristics for circuit.
- 3.8mm length of the chip makes the assembly of the next chip possible without changing the pattern pitch.

## How to Order

CRC4A 8E 103 J T

① ② ③ ④ ⑤

- ① Series CRC4A
- ② Number of elements  
8E = 8 elements
- ③ Resistance value  
3 digits numbering
- ④ Tolerance
- ⑤ Packaging

J ±5%

T Taping paper 5,000pcs/reel

## Rating

| Chip Resistor Arrays  |                               |
|-----------------------|-------------------------------|
| Item                  | Rating                        |
| Rated power(70°C)     | 1/16W/element<br>1/4W/package |
| Max working voltage*  | 25V                           |
| Max over-load voltage | 50V                           |
| Resistance value      | 10Ω to 1MΩ                    |
| Tolerance             | J:±5%                         |
| Working temperature   | -55 to +125°C                 |
| Number of elements    | 8E:8elements                  |

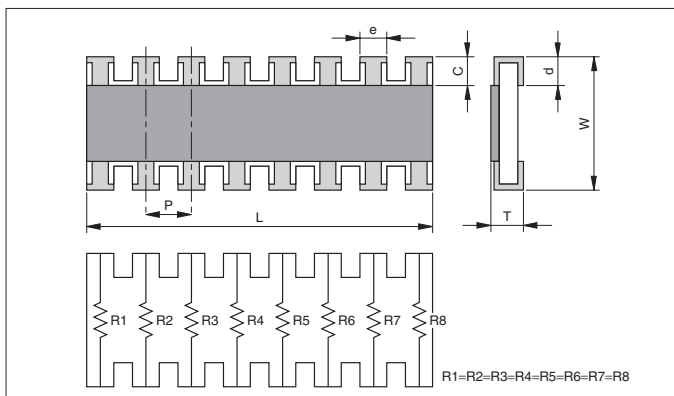
\* Rated Voltage :  $\sqrt{\text{Rated power} \times \text{Resistance value}}$ , whichever is less.

\* Standard Resistance Value: E-6 Series

\* Please contact sales engineer for any other requirements of the nominal resistance value and the tolerance.

## Dimensions

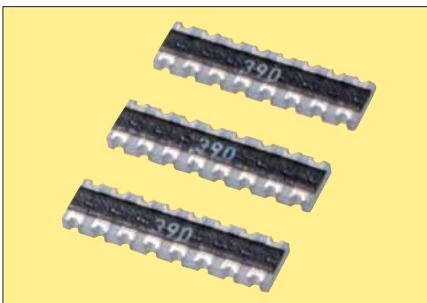
(Unit : mm)



| Code | Dimensions |
|------|------------|
| L    | 3.8±0.1    |
| W    | 1.6±0.1    |
| T    | 0.45±0.1   |
| P    | 0.5typ     |
| c    | 0.3±0.2    |
| d    | 0.3±0.15   |
| e    | 0.3±0.1    |

• No marking on chips.

## 8 element chip Resistor Array / CRB6A8E series (Concave Termination)



RoHS Conforming

## Features

- Equal length conductors can be traced out from 0.8mm pitch termination.

## How to Order

CRB6A 8E 390 G U

① ② ③ ④ ⑤

- ① Series CRB6A
- ② Number of elements  
8E = 8 elements
- ③ Resistance value  
3 digits numbering
- ④ Tolerance
- ⑤ Packaging

G ±2%

U Taping plastic 4,000pcs/reel

## Rating

| Chip Resistor Arrays  |               |
|-----------------------|---------------|
| Item                  | Rating        |
| Rated power(70°C)     | 1/16W/element |
| Max working voltage*  | 50V           |
| Max over-load voltage | 100V          |
| Resistance value      | 10Ω to 1MΩ    |
| Tolerance             | G:±2%         |
| Working temperature   | -55 to +125°C |
| Number of elements    | 8E:8elements  |

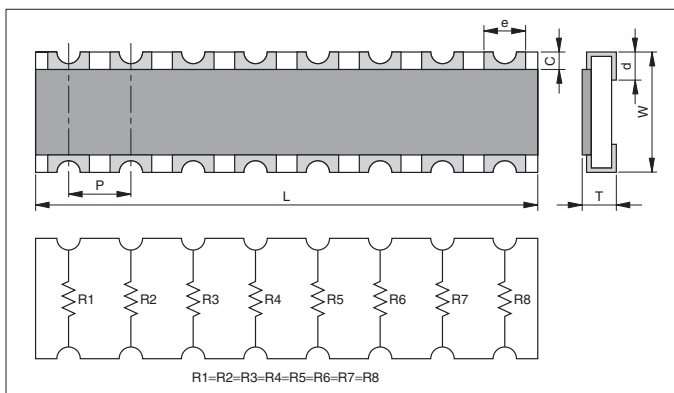
\* Rated Voltage :  $\sqrt{\text{Rated power} \times \text{Resistance value}}$ , whichever is less.

\* Standard Resistance Value: E-6 Series

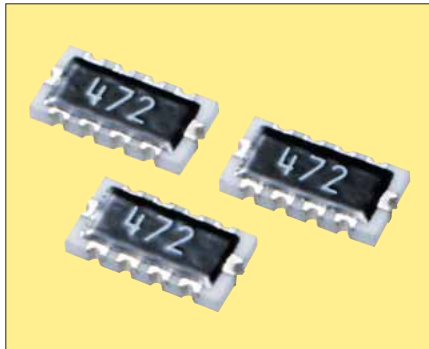
\* Please contact sales engineer for any other requirements of the nominal resistance value and the tolerance.

## Dimensions

(Unit : mm)



| Code            | Dimensions |
|-----------------|------------|
| L               | 6.4±0.2    |
| W               | 1.6±0.2    |
| T               | 0.6±0.1    |
| P               | 0.8typ     |
| c               | 0.3±0.2    |
| d               | 0.4±0.15   |
| e (Top side)    | 0.5±0.1    |
| e (Bottom side) | 0.4±0.15   |



RoHS Comforming

### Features

- Reduction in mounting costs & Process
- Save PCB space
- Eight resistors in one SMD package
- Reduction of inventory control costs

### Applications

- Lap Top Computer
- Printer
- CD ROM
- Notebook Computer
- Hard Disk Drive
- Facsimile

### How to Order

RNA4A 8E 103 J T  
① ② ③ ④ ⑤

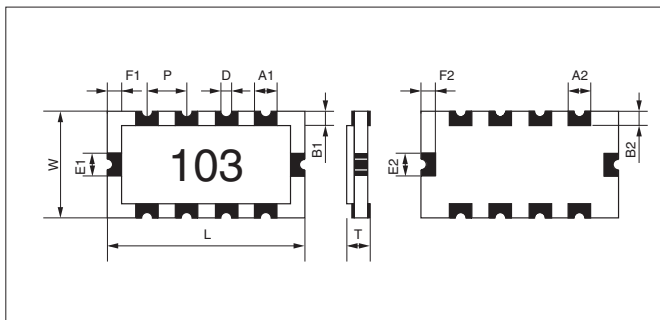
- ① Series
- ② Number of elements(8E : 8 elements)
- ③ Resistance code (3 digits)
- ④ Resistance tolerance(J :  $\pm 5\%$ )
- ⑤ Packaging

**T** Plastic Taping, 4,000pcs/reel

\* Taping Qty: 4000pcs/7 inch reel (4mm pitch)  
Carrier Tape: plastic

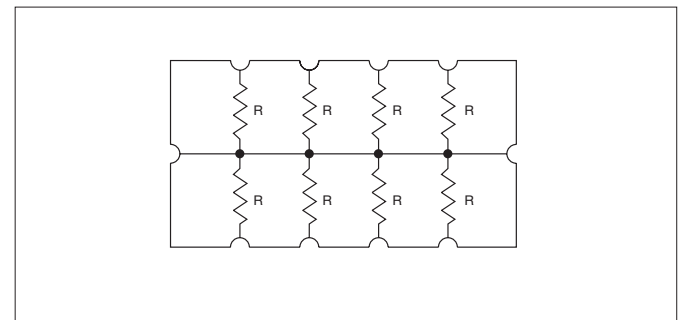
### Shape and Dimensions

(Unit : mm)



| Code       | L              | W              | T               | A1            | B1              |
|------------|----------------|----------------|-----------------|---------------|-----------------|
| Dimensions | 4.0 $\pm$ 0.15 | 2.1 $\pm$ 0.15 | 0.6 $\pm$ 0.1   | 0.5 $\pm$ 0.1 | 0.25 $\pm$ 0.15 |
| Code       | E1             | F1             | D               | P             | A2              |
| Dimensions | 0.5 $\pm$ 0.1  | 0.3 $\pm$ 0.15 | 0.3typ          | 0.8typ        | 0.4 $\pm$ 0.1   |
| Code       | B2             | E2             | F2              |               |                 |
| Dimensions | 0.4 $\pm$ 0.15 | 0.5 $\pm$ 0.1  | 0.35 $\pm$ 0.15 |               |                 |

### Circuit Diagram



\* nominal resistance value is all the same.

### Specifications

| Item                  | Rating                        |
|-----------------------|-------------------------------|
| Rated power(70°C)     | 1/16W(0.0625W)/Element        |
| Max working voltage*  | 25V                           |
| Max over-load voltage | 50V                           |
| Resistance value      | 100 $\Omega$ to 220K $\Omega$ |
| Tolerance             | J: $\pm 5\%$                  |
| Number of elements    | 8E:8 Elements                 |
| Working temperature   | -55 to +125°C                 |

\* Rated Voltage:  $\sqrt{\text{Rated power} \times \text{Resistance value}}$ , whichever is less.

\* Standard Resistance Value: E-6 Series

\* If resistance value under 100 $\Omega$  is needed, please contact sales.



RoHS Comforming

## Features

- Compared with three past in the chip resistor use, reduction in mounting costs and process, save PCB space

## How to Order

ATC 1A 2 C H  
① ② ③ ④ ⑤

① Series

② Size(1A : 1.0×1.0mm)

③ Attenuation(1 digit numbering)

1: 1dB, 2: 2dB, 3: 3dB, 4: 4dB, 5: 5dB

6: 6dB, 7: 7dB, 8: 8dB, 9: 9dB, A: 10dB

④ Attenuation tolerance

|   |        |   |        |
|---|--------|---|--------|
| C | ±0.3dB | D | ±0.5dB |
|---|--------|---|--------|

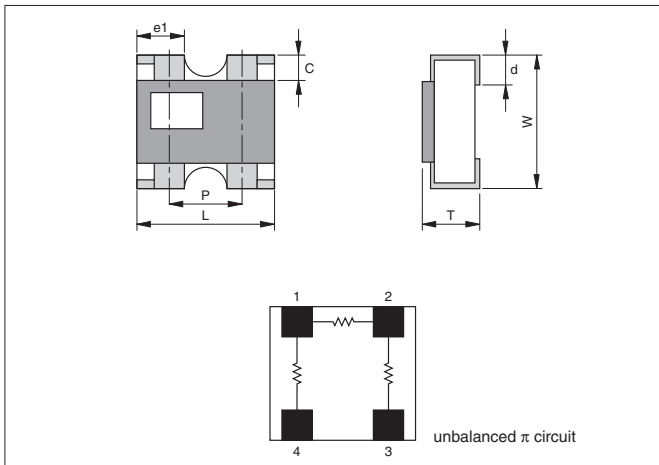
⑤ Packaging

| Code | Form   | Material | Packing unit  |
|------|--------|----------|---------------|
| H    | Taping | Paper    | 10000pcs/reel |

\* 2mm pitch taping

## Dimensions

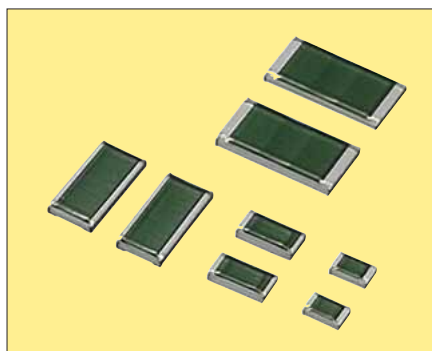
(Unit : mm)



| Code       | L         | W         | T         | P       | c         |
|------------|-----------|-----------|-----------|---------|-----------|
| Dimensions | 1.00±0.10 | 1.00±0.10 | 0.35±0.05 | 0.65typ | 0.20±0.15 |
| Code       | d         | e1        |           |         |           |
| Dimensions | 0.20±0.15 | 0.33±0.10 |           |         |           |

## Rating

| Chip attenuators      |                                                     |
|-----------------------|-----------------------------------------------------|
| Item                  | Rating                                              |
| Impedance             | 50Ω                                                 |
| Attenuation           | 1dB, 2dB, 3dB, 4dB, 5dB<br>6dB, 7dB, 8dB, 9dB, 10dB |
| Attenuation tolerance | ±0.3dB: 1dB to 5dB<br>±0.5dB: 6dB to 10dB           |
| Rated power           | 40mW/package                                        |
| Applicable frequency  | DC to 2GHz                                          |
| VSWR                  | 1.3 max                                             |
| Working temperature   | -55 to +125°C                                       |



RoHS Conforming

### Features

- Suitable for voltage detector circuit of mobile computing device and cellular phone.

### How to Order

LR 21 - R100 F - T  
① ② ③ ④ ⑤

① Series LR

② Size(EIA)

|    |      |    |      |
|----|------|----|------|
| 21 | 0805 | 50 | 1020 |
| 32 | 1206 | 63 | 2512 |

③ Resistance Value (4 digits)

R047 = 47mΩ

R330 = 330mΩ

1R00 = 1000mΩ

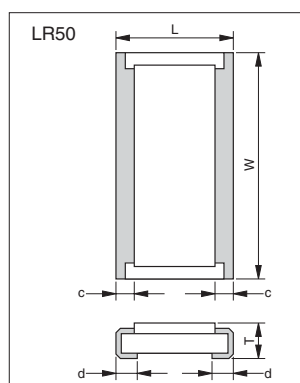
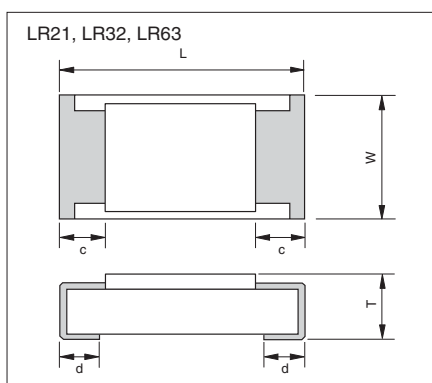
④ Tolerance

|   |      |
|---|------|
| K | ±10% |
| F | ±1%  |

⑤ Packaging

|   |                                             |
|---|---------------------------------------------|
| T | Paper Taping(LR21, LR32), 5,000pcs/7"reel   |
| U | Plastic Taping(LR50, LR63), 4,000pcs/7"reel |

### Dimensions



\*No marking

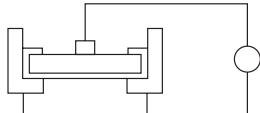
(Unit : mm)

|            | W                                      | L         | c         | d         | T                                      |
|------------|----------------------------------------|-----------|-----------|-----------|----------------------------------------|
| LR21(0805) | 1.25 <sup>+0.15</sup> <sub>-0.10</sub> | 2.00±0.10 | 0.25±0.20 | 0.40±0.20 | 0.55±0.10                              |
| LR32(1206) | 1.55 <sup>+0.15</sup> <sub>-0.10</sub> | 3.10±0.10 | 0.25±0.20 | 0.45±0.20 | 0.55 <sup>+0.10</sup> <sub>-0.05</sub> |
| LR50(1020) | 5.00±0.20                              | 2.50±0.20 | 0.20±0.15 | 0.50±0.20 | 0.60±0.10                              |
| LR63(2512) | 3.20±0.20                              | 6.30±0.20 | 0.45±0.20 | 0.45±0.20 | 0.60±0.10                              |

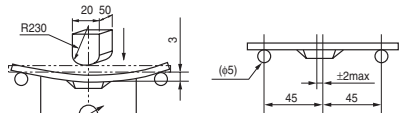
### Specifications

| Series     | Item | Rated power | Max working voltage | Resistance tolerance | Resistance value              | Working temperature | Temperature characteristics |
|------------|------|-------------|---------------------|----------------------|-------------------------------|---------------------|-----------------------------|
| LR21(0805) |      | 0.25W(1/4W) | 287mV               | F: ±1%               | 100 to 149mΩ<br>150 to 330mΩ  | -55 to +125°C       | ±150ppm/°C<br>±100ppm/°C    |
| LR32(1206) |      | 0.5W(1/2W)  | 707mV               | K: ±10%              | 20 to 50mΩ                    | -55 to +125°C       | ±3000ppm/°C                 |
|            |      |             |                     | F: ±1%               | 100 to 149mΩ<br>150 to 1000mΩ |                     | ±150ppm/°C<br>±100ppm/°C    |
| LR50(1020) |      | 1W          | 316mV               | F: ±1%               | 20 to 29mΩ<br>30 to 100mΩ     | -55 to +125°C       | ±150ppm/°C<br>±100ppm/°C    |
| LR63(2512) |      | 1W          | 1000mV              | F: ±1%               | 100 to 1000mΩ                 | -55 to +125°C       | ±100ppm/°C                  |

### Electrical Characteristics

| Item                            |              | Standard                                                                                                                                                                                                         |               | Test Conditions                                                                                                                                                     |                                                                                                                            |              |           |              |       |              |         |                                                                                                                                                                                                                                                                                                                                             |  |
|---------------------------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|--------------|-----------|--------------|-------|--------------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|                                 |              | Resistor                                                                                                                                                                                                         | Jumper        | Resistor                                                                                                                                                            | Jumper                                                                                                                     |              |           |              |       |              |         |                                                                                                                                                                                                                                                                                                                                             |  |
| DC Resistance                   |              | Within Initial Tolerance                                                                                                                                                                                         |               | Power Condtion A<br>(20°C, 65%RH)                                                                                                                                   |                                                                                                                            |              |           |              |       |              |         |                                                                                                                                                                                                                                                                                                                                             |  |
| Temperature Characteristics     |              | <table><tr><th>Resistance(Ω)</th><th>TCR(ppm/°C)</th></tr><tr><td>R &lt;10</td><td>−100 to +600</td></tr><tr><td>10≤ R ≤1M</td><td>−250 to +250</td></tr><tr><td>1M&lt; R</td><td>−500 to +300</td></tr></table> | Resistance(Ω) | TCR(ppm/°C)                                                                                                                                                         | R <10                                                                                                                      | −100 to +600 | 10≤ R ≤1M | −250 to +250 | 1M< R | −500 to +300 | 50mΩmax | Test Temperature: 25,125(°C)<br>ΔR/R=R <sub>2</sub> −R <sub>1</sub> /R <sub>1</sub> ×1/T <sub>2</sub> −T <sub>1</sub> ×10 <sup>6</sup><br>ΔR/R: Temp. Coefficient (ppm/°C)<br>T <sub>1</sub> : 25(°C)<br>T <sub>2</sub> : 125(°C)<br>R <sub>1</sub> : T <sub>1</sub> Resistance at (Ω)<br>R <sub>2</sub> : T <sub>2</sub> Resistance at (Ω) |  |
|                                 |              | Resistance(Ω)                                                                                                                                                                                                    | TCR(ppm/°C)   |                                                                                                                                                                     |                                                                                                                            |              |           |              |       |              |         |                                                                                                                                                                                                                                                                                                                                             |  |
| R <10                           | −100 to +600 |                                                                                                                                                                                                                  |               |                                                                                                                                                                     |                                                                                                                            |              |           |              |       |              |         |                                                                                                                                                                                                                                                                                                                                             |  |
| 10≤ R ≤1M                       | −250 to +250 |                                                                                                                                                                                                                  |               |                                                                                                                                                                     |                                                                                                                            |              |           |              |       |              |         |                                                                                                                                                                                                                                                                                                                                             |  |
| 1M< R                           | −500 to +300 |                                                                                                                                                                                                                  |               |                                                                                                                                                                     |                                                                                                                            |              |           |              |       |              |         |                                                                                                                                                                                                                                                                                                                                             |  |
|                                 |              |                                                                                                                                                                                                                  |               |                                                                                                                                                                     |                                                                                                                            |              |           |              |       |              |         |                                                                                                                                                                                                                                                                                                                                             |  |
| Short-time Overload             | ΔR/R         | ±(2.0%+0.10Ω)max of the inital value                                                                                                                                                                             | 50mΩmax       | (1) Apply 2.5×rated voltage for 5sec.<br>(2) Wait 30minutes<br>(3) Measure resistance                                                                               | (1) 2A for 5sec.<br>(2) Wait 30minutes<br>(3) Measure resistance                                                           |              |           |              |       |              |         |                                                                                                                                                                                                                                                                                                                                             |  |
|                                 | Visual       | No evidence of mechanical damage intermittent overload                                                                                                                                                           |               |                                                                                                                                                                     |                                                                                                                            |              |           |              |       |              |         |                                                                                                                                                                                                                                                                                                                                             |  |
| Intermittent Overload           | ΔR/R         | ±(5%+0.1Ω)max of the inital value                                                                                                                                                                                | 50mΩmax       | (1) Perform 10000voltage cycles as follows:<br>ON(2.5×rated voltage ) 1sec.<br>OFF 25sec.<br>(2) Stabilization time 30min without loading<br>(3) Measure resistance | (1) Perform 10000 current cycles as follows:<br>ON(2A) 1sec.<br>OFF 25sec.<br>(2) Wait 30minutes<br>(3) Measure resistance |              |           |              |       |              |         |                                                                                                                                                                                                                                                                                                                                             |  |
|                                 | Visual       | No evidence of mechanical damage                                                                                                                                                                                 |               |                                                                                                                                                                     |                                                                                                                            |              |           |              |       |              |         |                                                                                                                                                                                                                                                                                                                                             |  |
| Dielectric Withstanding Voltage |              | No evidence of mechanical damage                                                                                                                                                                                 |               | Apply 300VAC for 1sec                                                                                                                                               |                                                                                                                            |              |           |              |       |              |         |                                                                                                                                                                                                                                                                                                                                             |  |
| Insulation Resistance           |              | 10 <sup>8</sup> Ωmin                                                                                                                                                                                             |               | <br>Apply 100V DC.                                                             |                                                                                                                            |              |           |              |       |              |         |                                                                                                                                                                                                                                                                                                                                             |  |

## Mechanical Characteristics

| Item                      |              | Standard                                               |                  | Test Conditions                                                                                                                                                                                                |        |
|---------------------------|--------------|--------------------------------------------------------|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
|                           |              | Resistor                                               | Jumper           | Resistor                                                                                                                                                                                                       | Jumper |
| Terminal Strength         | $\Delta R/R$ | $\pm(1\%+0.05\Omega)\text{max}$ of the initial value   | 50m $\Omega$ max | <div>Apply the load as show:<br/>Measure resistance during load application</div> <div><div>Unit: mm</div></div>            |        |
|                           | Visual       | No evidence of mechanical damage after loading         |                  |                                                                                                                                                                                                                |        |
| Soldering Heat Resistance | $\Delta R/R$ | $\pm(1\%+0.05\Omega)\text{max}$ of the initial value   | 50m $\Omega$ max | <div>Immerse into molten solder at 260<math>\pm</math>5<math>^{\circ}</math>C for 10<math>\pm</math>1sec.<br/>Stabllize component at room temperature for 1hr.<br/>Measure resistance.</div>                   |        |
|                           | Visual       | No evidence of leaching                                |                  |                                                                                                                                                                                                                |        |
| Solderability             |              | Coverage $\geq$ 95% each termination end               |                  | <div>Immerse in Rogin Flux for 2<math>\pm</math>0.5 sec. and in SN62 solder at 235<math>\pm</math>5<math>^{\circ}</math>C for 2<math>\pm</math>0.5 sec.</div>                                                  |        |
| Anti-Vibration Test       | $\Delta R/R$ | $\pm(1\%+0.1\Omega)\text{max}$ of the initial value    | 50m $\Omega$ max | <div>2 hrs. each in X, Y and Z axis. (TTL 6hrs.)10 to 55 Hz sweep in 1min.at 1.5mm amplitude.</div>                                                                                                            |        |
|                           | Visual       | No evidence of mechanical damage                       |                  |                                                                                                                                                                                                                |        |
| Solvent Resistance        | $\Delta R/R$ | $\pm(0.5\%+0.05\Omega)\text{max}$ of the initial value | 50m $\Omega$ max | <div>Immerse in static state butyl acetate at 20<math>^{\circ}</math>C to 25<math>^{\circ}</math>C for 30<math>\pm</math>5sec.<br/>Stabllize component at room temperature for 30min then measure Value.</div> |        |
|                           | Visual       | No evidence of mechanical damage                       |                  |                                                                                                                                                                                                                |        |

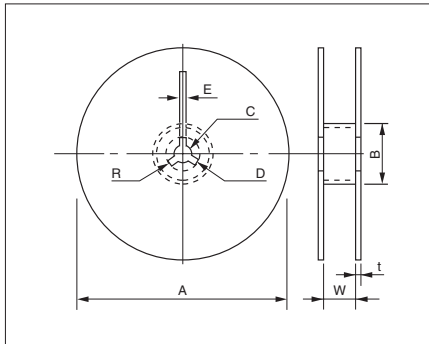
## Environmental Characteristics

| Item                     |        | Standard                            |         | Test Conditions                                                                                                                                                                                           |        |
|--------------------------|--------|-------------------------------------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
|                          |        | Resistor                            | Jumper  | Resistor                                                                                                                                                                                                  | Jumper |
| Temperature Cycle        | ΔR/R   | ±(1%+0.05Ω)max of the initial value | 50mΩmax | 1) Run 5cycles as follows: −55±3°C for 30min. 125±3°C for 30min. Room temp for 10-15min.<br>2) Stabilize component at room temperature for 1hr. then measure value.                                       |        |
|                          | Visual | No evidence of mechanical damage    |         |                                                                                                                                                                                                           |        |
| Low Temperature Storage  | ΔR/R   | ±(2%+0.1Ω)max of the initial value  | 50mΩmax | 1) Dwell in −55°C chamber without loading for 1000 <sup>+48</sup> <sub>-0</sub> hrs.<br>2) Stabilize component at room temperature for 1hr. then measure value.                                           |        |
|                          | Visual | No evidence of mechanical damage    |         |                                                                                                                                                                                                           |        |
| High Temperature Storage | ΔR/R   | ±(3%+0.1Ω)max of the initial value  | 50mΩmax | 1) Dwell in 125°C chamber without loading for 1000 <sup>+48</sup> <sub>-0</sub> hrs.<br>2) Stabilize component at room temperature for 1hr. then measure value.                                           |        |
|                          | Visual | No evidence of mechanical damage    |         |                                                                                                                                                                                                           |        |
| Moisture Resistance      | ΔR/R   | ±(3%+0.1Ω)max of the initial value  | 50mΩmax | 1) Dwell in temp: 65°C RH90 to 95%RH chamber without loading for 1000 <sup>+48</sup> <sub>-0</sub> hrs.<br>2) Stabilize component at room temperature for 1hr. then measure value.                        |        |
|                          | Visual | No evidence of mechanical damage    |         |                                                                                                                                                                                                           |        |
| Life Test                | ΔR/R   | ±(3%+0.1Ω)max of the initial value  | 50mΩmax | 1) Temp: 70±3°C Voltage: (rated voltage) on 90 min off 30min. Duration: 1000 <sup>+48</sup> <sub>-0</sub> hrs.<br>2) Stabilize component at room temperature for 1hr. then measure value.                 |        |
|                          | Visual | No evidence of mechanical damage    |         |                                                                                                                                                                                                           |        |
| Loading Life in Moisture | ΔR/R   | ±(3%+0.1Ω)max of the initial value  | 50mΩmax | 1) Temp: 40±2°C RH: 90-95% Voltage Cycle: on 90 min(rated voltage) off 30min. Duration: 1000 <sup>+48</sup> <sub>-0</sub> hrs.<br>2) Stabilize component at room temperature for 1hr. then measure value. |        |
|                          | Visual | No evidence of mechanical damage    |         |                                                                                                                                                                                                           |        |

## Tape & Reel

### • Reel

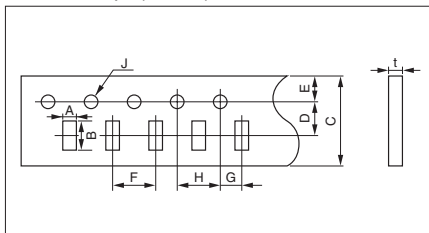
(Unit : mm)



| Code        | A                  | B                     | C                   | D                   | E             | W              | t       | R   |
|-------------|--------------------|-----------------------|---------------------|---------------------|---------------|----------------|---------|-----|
| Width: 8mm  | $\phi 178 \pm 2.0$ | $\phi 50 \text{min.}$ | $\phi 13.0 \pm 0.5$ | $\phi 21.0 \pm 0.8$ | $2.0 \pm 0.5$ | $10.0 \pm 1.5$ | 2.5MAX. | 1.0 |
| Width: 12mm |                    |                       |                     |                     |               | $13.0 \pm 1.5$ |         |     |

### • Carrier Tape( 8mm)

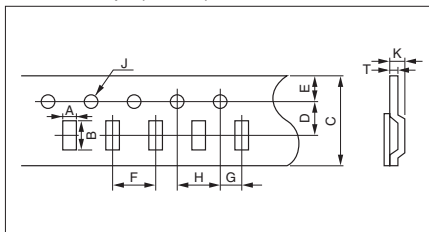
(Unit : mm)



| Dimension<br>TYPE | A        | B        | C       | D        | E        | F       | G        | H       | J                                  | t       |
|-------------------|----------|----------|---------|----------|----------|---------|----------|---------|------------------------------------|---------|
| 0404              | 1.2±0.1  | 1.2±0.1  | 8.0±0.2 | 3.5±0.05 | 1.75±0.1 | 2.0±0.1 | 2.0±0.05 | 4.0±0.1 | ϕ1.5 <sup>+0.1</sup> <sub>-0</sub> | 0.6max. |
| 0804              | 1.25±0.2 | 2.25±0.2 |         |          |          | 4.0±0.1 |          |         |                                    | 1.1max. |
| 0805              | 1.65±0.2 | 2.4±0.2  |         |          |          |         |          |         |                                    |         |
| 1206              | 2.0±0.2  | 3.6±0.2  |         |          |          |         |          |         |                                    |         |
| 1506              | 1.9±0.2  | 4.1±0.2  |         |          |          |         |          |         |                                    |         |

### • Carrier Tape(12mm)

(Unit : mm)



| Dimension Code<br>TYPE | A             | B             | C              | D              | E              | F             | G             | H             | J                      | T       | K       |
|------------------------|---------------|---------------|----------------|----------------|----------------|---------------|---------------|---------------|------------------------|---------|---------|
| 1020                   | $2.9 \pm 0.2$ | $5.3 \pm 0.2$ | $12.0 \pm 0.3$ | $5.5 \pm 0.05$ | $1.75 \pm 0.1$ | $4.0 \pm 0.1$ | $2.0 \pm 0.1$ | $4.0 \pm 0.1$ | $\phi 1.5^{+0.1}_{-0}$ | 0.6max. | 1.4max. |
| 1608                   | $2.5 \pm 0.2$ | $4.4 \pm 0.2$ |                |                |                |               |               |               |                        |         |         |
| 2512                   | $3.5 \pm 0.2$ | $6.7 \pm 0.2$ |                |                |                |               |               |               |                        |         |         |
| 2506                   | $2.0 \pm 0.2$ | $6.9 \pm 0.2$ |                |                |                |               |               |               |                        |         |         |

### • Taping Quantity per reel

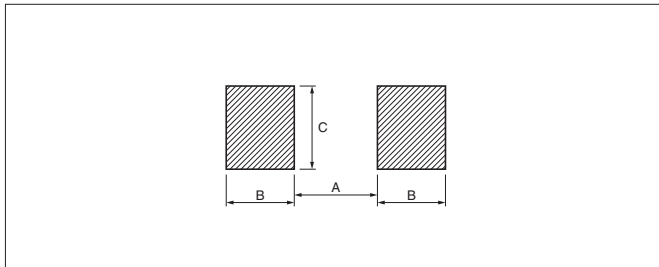
(Unit : pcs)

| TYPE | Series           | Paper( $\phi 178$ reel) |
|------|------------------|-------------------------|
| 0404 | CRC11A2E, ATC1A  | 10000(2mm pitch)        |
| 0804 | CRB2A4E, CRC2A4E | 10000(2mm pitch)        |
| 0805 | LR21             | 5000(4mm pitch)         |
| 1206 | LR32             | 5000(4mm pitch)         |
| 1506 | CRC4A8E          | 5000(4mm pitch)         |
| 1020 | LR50             | 4000(4mm pitch)         |
| 1608 | RNA4A            | 4000(4mm pitch)         |
| 2512 | LR63             | 4000(4mm pitch)         |
| 2506 | CRB6A8E          | 4000(4mm pitch)         |

## Recommended Land Patterns

### Chip Type

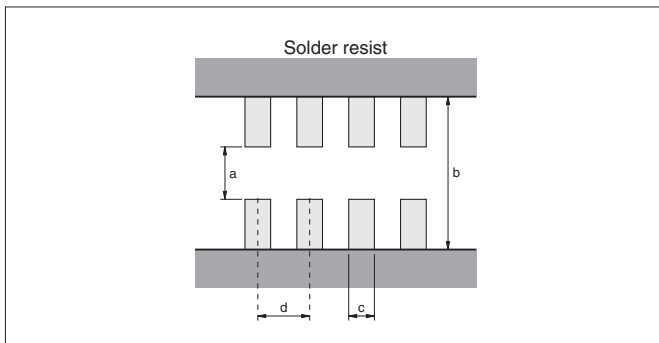
(Unit : mm)



| EIA Size | A   | B   | C   |
|----------|-----|-----|-----|
| 0805     | 1.0 | 0.8 | 1.2 |
| 1206     | 2.2 | 0.9 | 1.5 |
| 1020     | 1.4 | 1.0 | 5.0 |
| 2512     | 5.0 | 1.0 | 3.0 |

### Array Type

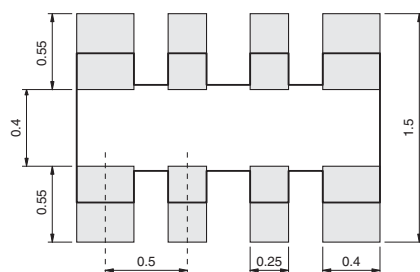
(Unit : mm)



| Series   | a   | b   | c    | d    |
|----------|-----|-----|------|------|
| CRB2A4E  | 0.4 | 1.5 | 0.25 | 0.5  |
| CRC11A2E | 0.5 | 1.5 | 0.4  | 0.65 |
| CRC4A8E  | 0.8 | 2.4 | 0.3  | 0.5  |
| CRB6A8E  | 0.7 | 2.3 | 0.4  | 0.8  |
| ATC1A    | 0.5 | 1.5 | 0.4  | 0.65 |

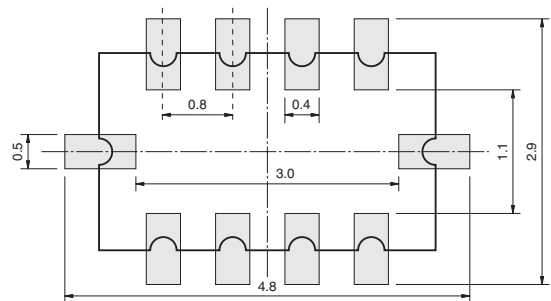
(Unit : mm)

#### CRC2A4E Series



(Unit : mm)

#### RNA4A8E Series



## Circuit design

- 1) Once application and assembly environments have been checked, the resistors may be used in conformance with the catalog and the specifications.
- 2) Please consult the manufacturer in advance when the resistors is used in devices such as: devices which deal with human life, i.e. medical devices; devices which are highly public orientated; and devices which demand a high standard of liability.
- 3) Please use the resistors in conformance with the operating temperature provided in both the catalog and the specifications.
- 4) Please keep voltage under the rated voltage which is applied to the resistor.
- 5) Do not use the resistor in an environment where it might easily exceed the respective provisions concerning shock and vibration specified in the catalog and specifications.
- 6) Please do not use the resistor in the following environments.
  - ① State that water, oil, and solvent hang in resistor
  - ② State where poisonous gas (sulfur and chlorine, etc.) exists
  - ③ State that direct sunshine, radiation, and ultraviolet, etc. are irradiated
- 7) There is a thing that resistance changes according to the stuff of the resin when the coating with the resin is given.  
Please use resin coating after confirming the characteristic.
- 8) There is a thing that resistance changes according to flux and cleaner.  
Please use flux and cleaner after confirming the characteristic.
- 9) Please consult about a lead free products.

## Storage

- 1) Keep storage place temperature +5 to +35°C, humidity 45 to 75% RH.
- 2) Please keep parts out of poisonous gas such as sulfur or chlorine in the air, and out of salty moisture. Or they may cause rust of terminal, and poor solderability. and, please consider the above-mentioned item after mounting your company.

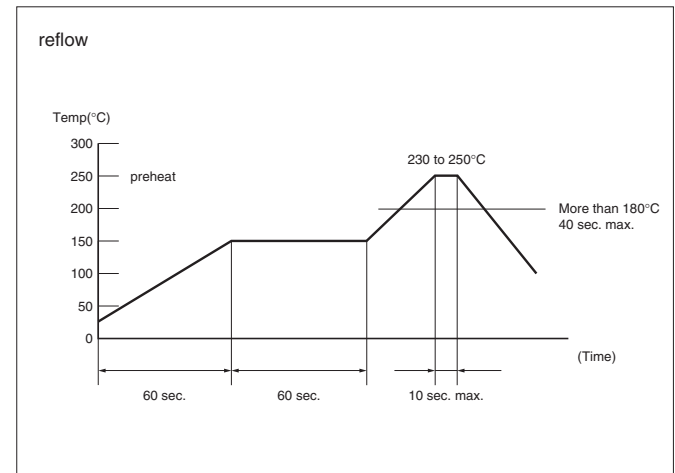
### 3) Soldering iron

|             |                          |
|-------------|--------------------------|
| Temperature | soldering iron 300±5°C * |
| Time        | 3 sec. max. *            |

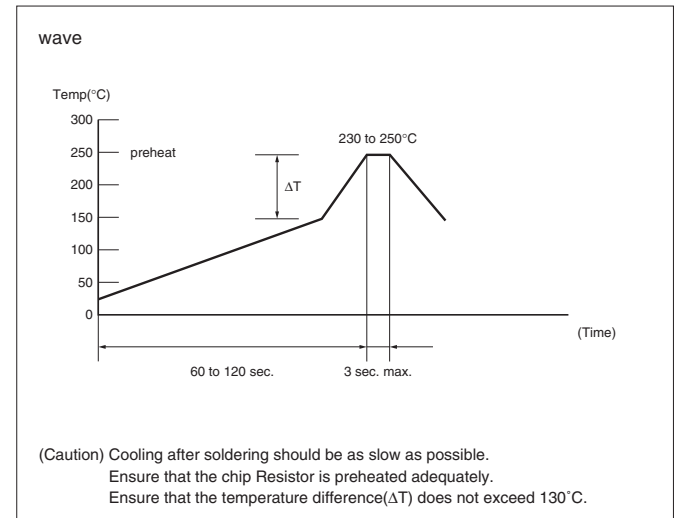
\*Do not place the soldering iron on the chip. Soldering iron is 30W max.

## Soldering method

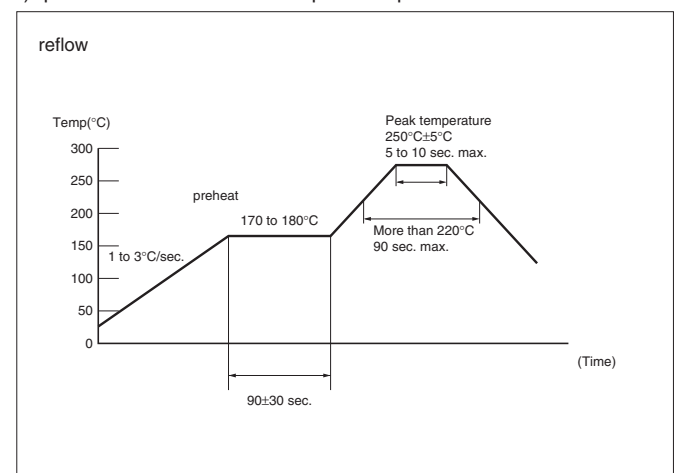
### 1) Recommendable temperature profile



### 2) Recommendable temperature profile



### 3) pb-free recommendable temperature profile



THE NEW VALUE FRONTIER



# EMC Components

---

EMI Filters





RoHS Conforming

## Features

- Distributed constant type LC filter. Prevents ringing caused by circuit impedance.
- Suitable for high speed digital circuits and video signal lines.
- Stable noise attenuation over wide frequency ranges.
- Low profile (T=0.95mm max.) suitable for miniature electronic equipments.
- First class auto-placement

## Applications

- PCs, Laser Printers, Cellular Phone, Clock Data Lines for LCD Display
  - High Speed Video Signal Circuits and interface circuits
  - High Speed Digital Circuits
  - Anti-Noise Solution
- Achieves effective noise suppression in noisy high speed circuits without signal waveform distortion

## How to Order

KNF 21 050 - W 3  
① ② ③ ④ ⑤

① Series

② Size EIA (EIAJ)  
21 :0805 (2012)

③ Frequency

|     |        |     |        |
|-----|--------|-----|--------|
| 025 | 25MHz  | 200 | 200MHz |
| 050 | 50MHz  | 400 | 400MHz |
| 100 | 100MHz |     |        |

④ Taping Direction (See Fig 1)

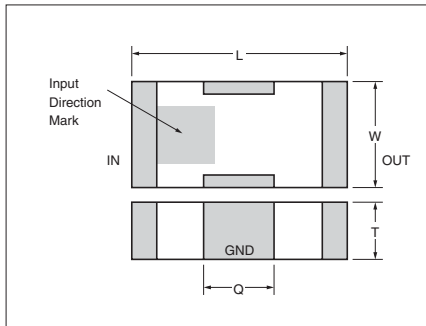
W: Standard

⑤ Quantity per Reel

|   |         |
|---|---------|
| 3 | 3000pcs |
|---|---------|

## Dimensions

(Unit : mm)



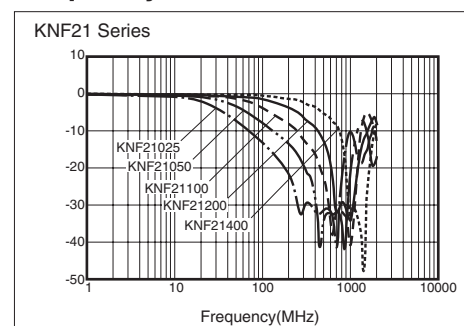
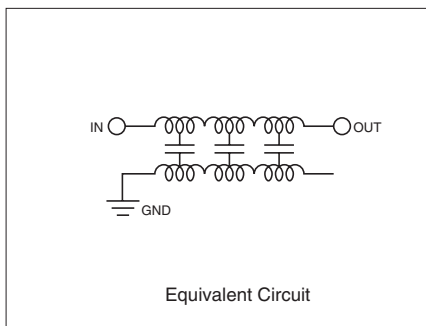
|   | KNF21    |
|---|----------|
| L | 2.0±0.2  |
| W | 1.25±0.2 |
| T | 0.8±0.15 |
| Q | 0.4±0.3  |

## Specifications

| Part Number | Cut off Freq. (MHz) | Capacitance (+50/-20%) (pF) | 20dB Attenuation (Typical) | Rated current(mA) | Rated voltage(VDC) |
|-------------|---------------------|-----------------------------|----------------------------|-------------------|--------------------|
| KNF21025    | 25MHz               | 235pF                       | 200– 600MHz                | 150mA             | 25VDC              |
| KNF21050    | 50MHz               | 130pF                       | 350– 850MHz                |                   |                    |
| KNF21100    | 100MHz              | 65pF                        | 450– 950MHz                |                   |                    |
| KNF21200    | 200MHz              | 33pF                        | 700–1200MHz                |                   |                    |
| KNF21400    | 400MHz              | 17pF                        | 900–1400MHz                |                   |                    |

\*Cut off Frequency at Attenuation typical 3dB, Max 6dB  
Operating Temperature: -25 to 85(°C)

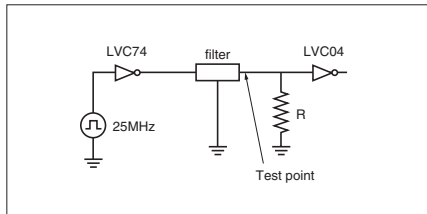
## Frequency Characteristics



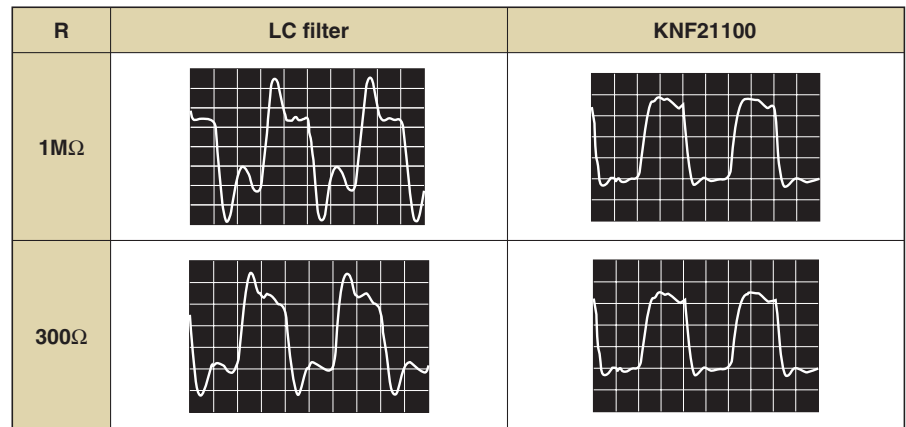
### <Impedance Matching Free>

- Stable attenuation against impedance change
- Good impedance matching without ringing on distortion even at the time of IC ON/OFF and pattern layout change

#### Test circuit

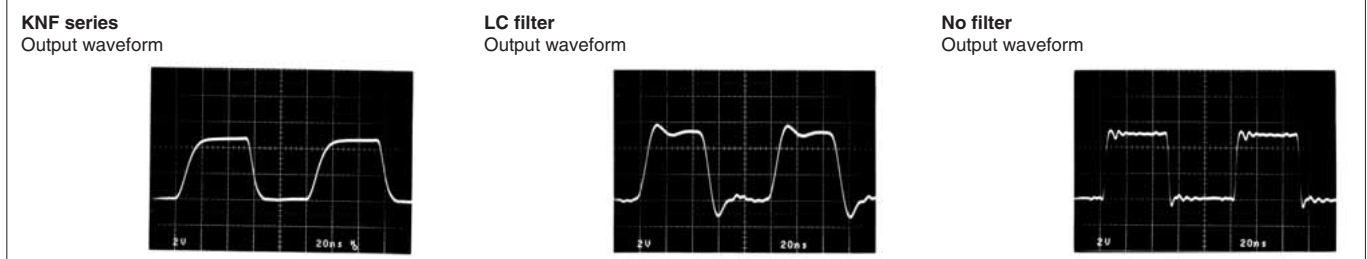


### Output Waveform(Clock frequency 25MHz)



### <No Ringing>

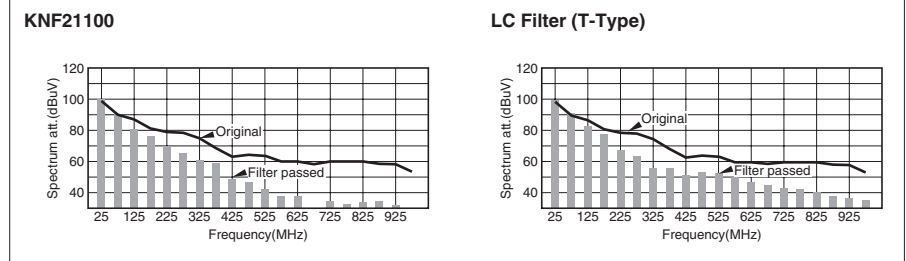
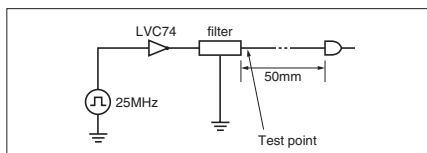
#### Excellent Impedance Matching



- Wide attenuation up to high frequency range without distortion

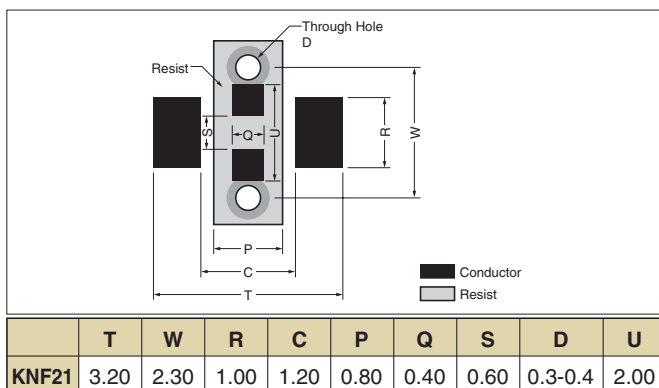
### Wide Attenuation Bandwidth

#### Test Circuit



### Recommended Land Pattern

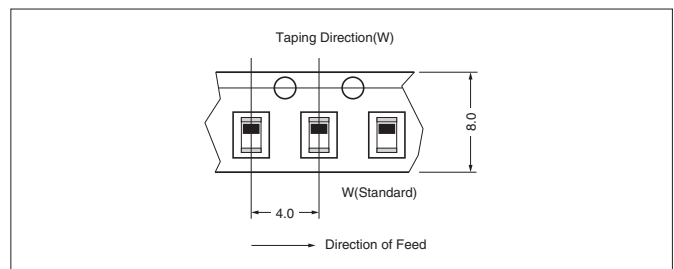
(Unit : mm)

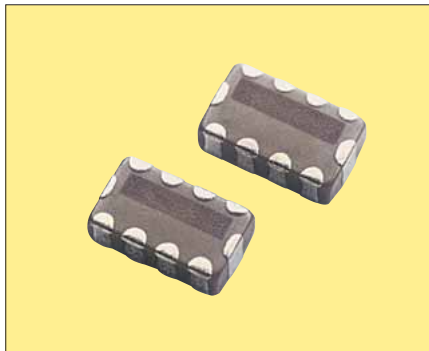


### Packaging Specification (Fig.1)

- Taping (3,000/reel)

(Unit : mm)





RoHS Conforming

### Features

- Distributed constant type LC filter. Prevents ringing caused by circuit impedance. Suitable for high speed digital circuits and video signal lines.
- Stable noise attenuation over wide frequency ranges.
- Small and low profile. (2.0x1.25x0.85mm max.)

### Applications

- Data lines for mobile phones (LCD lines, video lines, bus lines)
- Bus lines for digital equipment

### How to Order

KNA 21 400 - W 3  
① ② ③ ④ ⑤

① Series

② Size EIA (EIAJ)  
21 :0805 (2012)

③ Frequency

**400** 400MHz

\*Frequency at Attenuation typical 3dB, Max 6dB

④ Taping Direction

W: Standard

⑤ Quantity per Reel

**3** 3000pcs

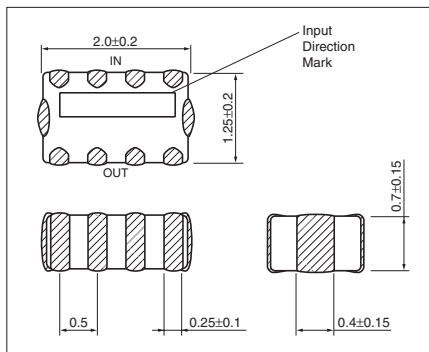
### Specifications

| Part Number | Cut off Freq. (MHz) | Capacitance (+25/-20%) (pF) | 20dB Attenuation (Typical) | Rated current(mA) | Rated voltage(VDC) |
|-------------|---------------------|-----------------------------|----------------------------|-------------------|--------------------|
| KNA21400    | 400MHz              | 18pF                        | 800 ~1000MHz               | 50mA              | 25VDC              |

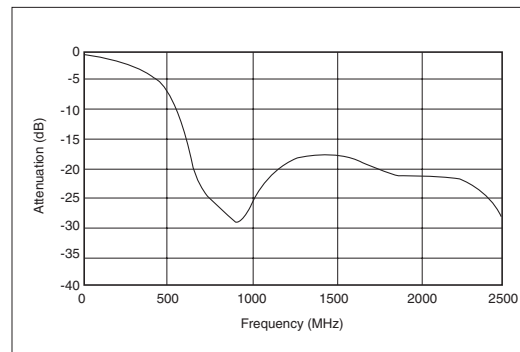
Operating Temperature: -25 to 85(°C)

### Dimensions

(Unit : mm)

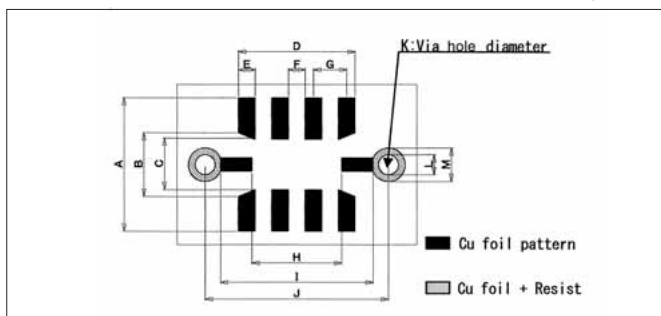


### Frequency Characteristics



### Recommended Land Pattern

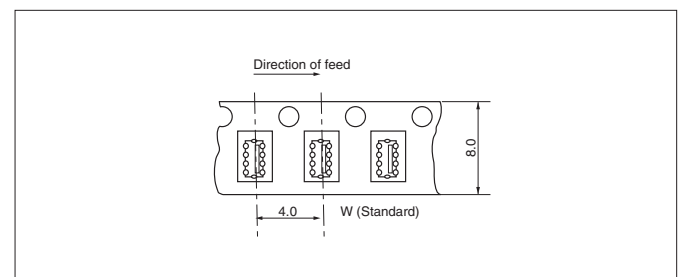
(Unit : mm)



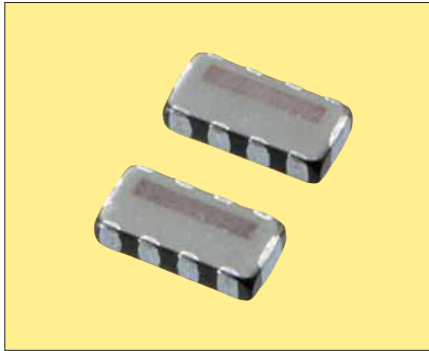
### Packaging Specification

- Taping (3,000/reel)

(Unit : mm)



| CODE      | A    | B    | C    | D    | E    | F    | G    | H    | I    | J    | K    | L    | M    |
|-----------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| DIMENSION | 2.00 | 0.95 | 0.75 | 1.75 | 0.25 | 0.25 | 0.50 | 1.35 | 2.45 | 2.75 | 0.30 | 0.20 | 0.50 |



RoHS Comforming

## Features

- Distributed constant type LC filter. Prevents ringing caused by circuit impedance. Suitable for high speed digital circuits and video signal lines.
- Stable noise attenuation over wide frequency ranges.
- Low profile (H=0.85mm max.) suitable for miniature electronic equipments.
- First class auto-placement

## Applications

- PCs, Laser Printers, Cellular Phone, Clock Data Lines for LCD Display
  - High Speed Video Signal Circuits and interface circuits
  - High Speed Digital Circuits
  - Anti-Noise Solution
- Achieves effective noise suppression in noisy high speed circuits without signal waveform distortion

## How to Order

KNA 32 050 - W 3  
① ② ③ ④ ⑤

① Series

② Size EIA (EIAJ)  
32 :1206 (3216)

③ Frequency

|     |        |     |        |
|-----|--------|-----|--------|
| 050 | 50MHz  | 200 | 200MHz |
| 100 | 100MHz |     |        |

\*Frequency at Attenuation typical 3dB, Max 6dB

④ Taping Direction (See Fig.1)

W: Standard

⑤ Quantity per Reel

|   |         |
|---|---------|
| 3 | 3000pcs |
|---|---------|

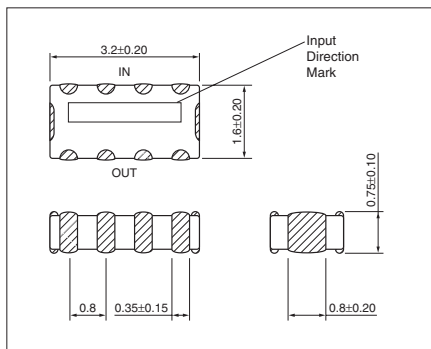
## Specifications

| Part Number | Cut off Freq. (MHz) | Capacitance (+25/-20%) (pF) | 20dB Attenuation (Typical) | Rated current(mA) | Rated voltage(VDC) |
|-------------|---------------------|-----------------------------|----------------------------|-------------------|--------------------|
| KNA32050    | 50MHz               | 115pF                       | 350 – 850MHz               | 100mA             | 25VDC              |
| KNA32075    | 75MHz               | 82pF                        | 400 – 900MHz               | 100mA             | 25VDC              |
| KNA32100    | 100MHz              | 65pF                        | 450 – 950MHz               | 100mA             | 25VDC              |
| KNA32150    | 150MHz              | 45pF                        | 600–1100MHz                | 100mA             | 25VDC              |
| KNA32200    | 200MHz              | 35pF                        | 700–1200MHz                | 100mA             | 25VDC              |

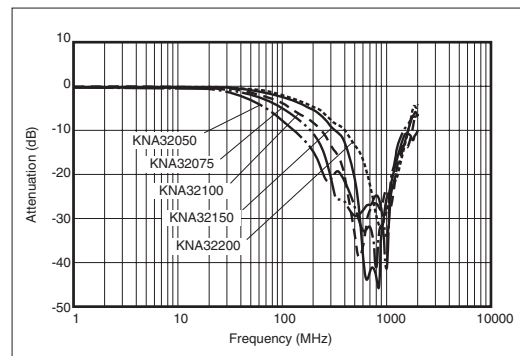
Operating Temperature: -25 to 85(°C)

## Dimensions

(Unit : mm)

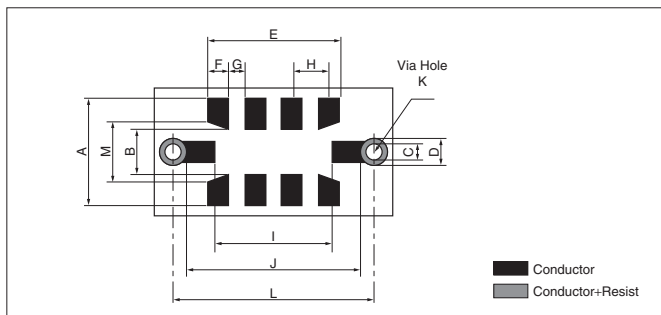


## Frequency Characteristics



## Recommended Land Pattern

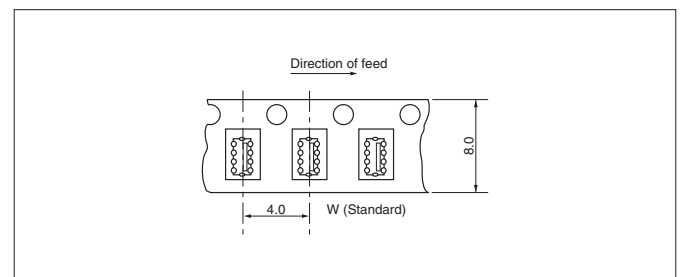
(Unit : mm)



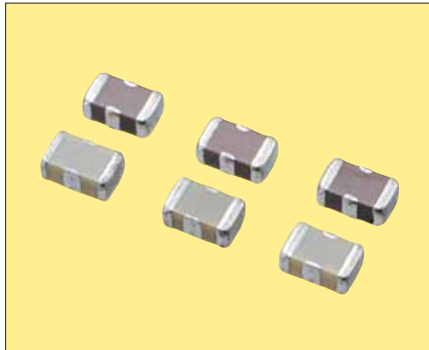
## Packaging Specification (Fig.1)

• Taping (3,000/reel)

(Unit : mm)



| CODE      | A   | B   | C   | D   | E   | F   | G   | H   | I   | J   | K          | L   | M   |
|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------------|-----|-----|
| DIMENSION | 2.2 | 1.0 | 0.4 | 0.6 | 2.8 | 0.4 | 0.4 | 0.8 | 2.6 | 3.8 | 0.3 to 0.4 | 4.2 | 1.3 |



Pb Free

RoHS Comforming

## Features

- 0805 Size. Rated current up to 2A.
- Effective for filtering noise on power (Vcc) lines.

## Applications

- PCs, Laser Printers, Cellular Phone, Power/Signal Lines for LCD Display, Office Equipments
- AV Power Supply/Signal Line, TV, VCR, etc.
- High current signal Lines

## How to Order

KNH 21 104 - 3 AA  
① ② ③ ④ ⑤

① Series

② Size EIA (EIAJ)  
21: 0805 (2012)

③ Capacitance Value

|     |       |     |       |
|-----|-------|-----|-------|
| 104 | 100nF | 101 | 100pF |
| 473 | 47nF  | 470 | 47pF  |
| 471 | 470pF | 220 | 22pF  |
| 221 | 220pF |     |       |

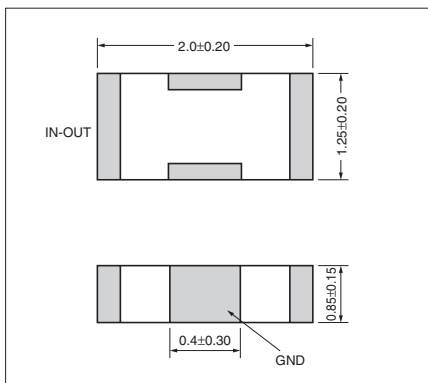
④ Quantity per Reel

3 3000pcs

⑤ Code(AA : STD)

## Dimensions

(Unit : mm)

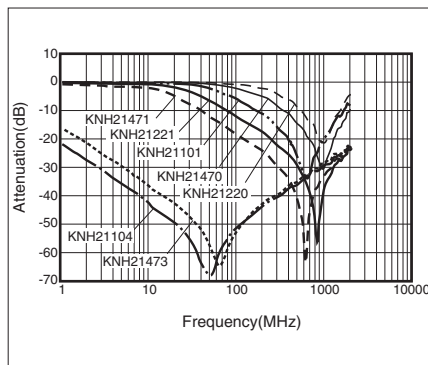


## Specifications

| Type     | Capacitance Value(pF) (+50/-20%) | Rated Current (A) | Rated Voltage (VDC) | Direct-current resistance(Ω) |
|----------|----------------------------------|-------------------|---------------------|------------------------------|
| KNH21104 | 100,000                          | 2.0               | 25                  | ≤0.02                        |
| KNH21473 | 47,000                           | 2.0               | 50                  | ≤0.02                        |
| KNH21471 | 470                              | 1.0               | 50                  | ≤0.08                        |
| KNH21221 | 220                              | 1.0               | 50                  | ≤0.08                        |
| KNH21101 | 100                              | 1.0               | 50                  | ≤0.08                        |
| KNH21470 | 47                               | 1.0               | 50                  | ≤0.08                        |
| KNH21220 | 22                               | 1.0               | 50                  | ≤0.08                        |

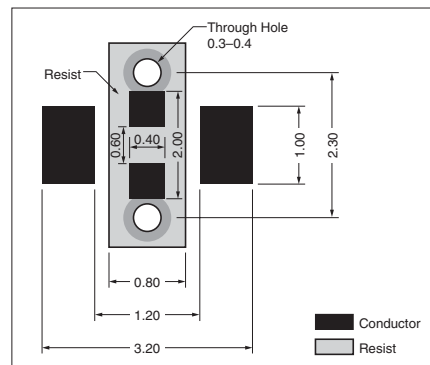
Operating Temperature: -25 to 85(°C)

## Attenuation Characteristics



## Recommended Land Pattern

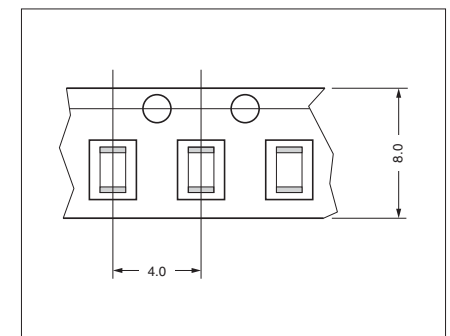
(Unit : mm)



## Packaging specifications

- Taping(3000/reel)

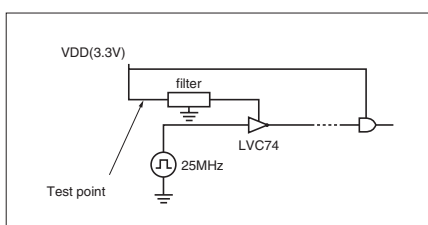
(Unit : mm)



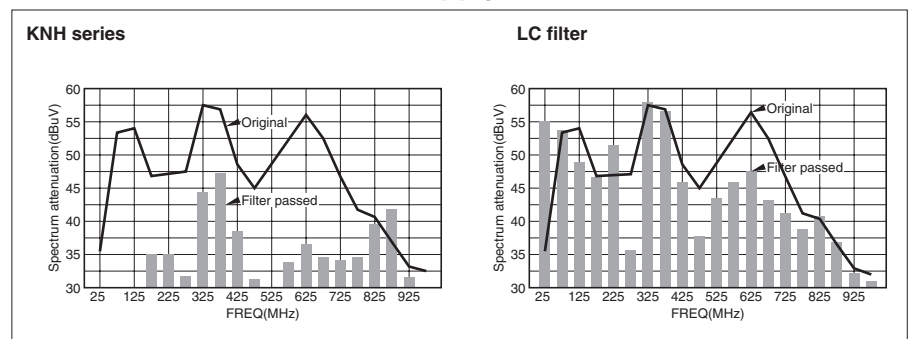
## <Electrical Characteristics>

- Wide attenuation range including surrounding circuit.

## Test Circuit



## Attenuation Effect of Power Supply Noise



THE NEW VALUE FRONTIER



# Timing Devices

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**Ceramic Resonators**

**SAW Resonators**

**Crystal Units**

**Crystal Oscillators**

**Voltage Controlled Crystal Oscillators (VCXO)**

**Temperature Compensated Crystal Oscillators (TCXO)**

**High Precision Oscillators**



| Products           |                       | Dimensions (mm)          |         |         | Applications                                              |                                                    |                                                    |                                                                         |                                                                 | Frequency Range(MHz) |       |       |       |          | Conditions of Use |        |      |          | Lead-free Status                                                                        |      | RoHS<br>Conformance |     |     |
|--------------------|-----------------------|--------------------------|---------|---------|-----------------------------------------------------------|----------------------------------------------------|----------------------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------|----------------------|-------|-------|-------|----------|-------------------|--------|------|----------|-----------------------------------------------------------------------------------------|------|---------------------|-----|-----|
| Product Type       | Part Number           | L                        | W       | T       | Digital<br>Electronics OA,<br>PC Peripherals<br>Amusement | Car Electronics<br>ITS Car Audio<br>Car Navigation | Car Electronics<br>(ECU,Air Bag,<br>ABS, TPMS etc) | Mobile Comm.<br>Wireless LAN<br>Dedicated Short<br>Range<br>Comm.(DSRC) | Industrial Use<br>(Broadcast,<br>Medical, Base<br>Station etc.) | 1                    | 10    | 50    | 100   | 300~400  | Solder            |        |      | Washable | A: Lead-free Products<br>B: Products with Lead-free<br>Terminations<br>C: Non Lead-free |      |                     |     |     |
|                    |                       |                          |         |         |                                                           |                                                    |                                                    |                                                                         |                                                                 |                      |       |       |       |          | Manual            | Reflow | Flow |          |                                                                                         |      |                     |     |     |
| Ceramic Resonators | SSR-B                 | 3.2                      | 2.1     | 1.5     | ○                                                         | ○                                                  |                                                    | ○                                                                       |                                                                 |                      |       | 16    | ----- | 60       |                   | Yes    | Yes  | No       | No                                                                                      | B    | Yes                 |     |     |
|                    | SSR-D                 | 2.5                      | 2.0     | 1.0max  | ○                                                         | ○                                                  |                                                    | ○                                                                       |                                                                 |                      |       | 20    | ----- | 60       |                   | Yes    | Yes  | No       | No                                                                                      | B    | Yes                 |     |     |
|                    | PBRC-G/H              | 7.4                      | 3.4     | 2.0max  | ○                                                         | ○                                                  |                                                    |                                                                         | ○                                                               | 2                    | ----- | 20    |       |          |                   | Yes    | Yes  | No       | Yes                                                                                     | B    | Yes                 |     |     |
|                    | PBRC-L/M              | 4.5                      | 2.0     | 1.2max  | ○                                                         | ○                                                  |                                                    |                                                                         | ○                                                               | 3.68                 | ----- | 20    |       |          |                   | Yes    | Yes  | No       | Yes                                                                                     | B    | Yes                 |     |     |
|                    | PBRV-H                | 7.4                      | 3.4     | 2.0max  |                                                           | ○                                                  | ○                                                  |                                                                         |                                                                 | 4                    | ----- | 20    |       |          |                   | Yes    | Yes  | No       | Yes                                                                                     | B    | Yes                 |     |     |
|                    | PBRV-M                | 4.5                      | 2.0     | 1.2max  |                                                           | ○                                                  | ○                                                  |                                                                         |                                                                 | 4                    | ----- | 20    |       |          |                   | Yes    | Yes  | No       | Yes                                                                                     | B    | Yes                 |     |     |
| SAW Resonators     | PARM                  | 3.0                      | 3.0     | 1.5max  | ○                                                         | ○                                                  |                                                    | ○                                                                       |                                                                 |                      |       |       |       | 300--479 |                   | Yes    | Yes  | No       | Yes                                                                                     | A    | Yes                 |     |     |
|                    | PARS                  | 5.5                      | 3.8     | 1.5max  |                                                           | ○                                                  |                                                    | ○                                                                       |                                                                 |                      |       |       |       | 300--479 |                   | Yes    | Yes  | No       | Yes                                                                                     | A    | Yes                 |     |     |
|                    | PARV                  | 5.5                      | 3.8     | 1.5max  |                                                           |                                                    | ○                                                  |                                                                         |                                                                 |                      |       |       |       | 300--479 |                   | Yes    | Yes  | No       | Yes                                                                                     | A    | Yes                 |     |     |
| Crystal Units      | CX-2520SB             | 2.5                      | 2.0     | 0.45    | ○                                                         | ○                                                  |                                                    | ○                                                                       |                                                                 |                      |       | 26    | ----- | 60       |                   | Yes    | Yes  | No       | Yes                                                                                     | A    | Yes                 |     |     |
|                    | CX-3225SB(CX-101F)    | 3.2                      | 2.5     | 0.6max  | ○                                                         | ○                                                  |                                                    | ○                                                                       |                                                                 |                      |       | 12    | ----- | 54       |                   | Yes    | Yes  | No       | Yes                                                                                     | A    | Yes                 |     |     |
|                    | KSX-23                | 3.2                      | 2.5     | 0.85max | ○                                                         | ○                                                  |                                                    | ○                                                                       |                                                                 |                      |       | 19    | ----- | 40       |                   | Yes    | Yes  | No       | No                                                                                      | A    | Yes                 |     |     |
|                    | CX-4025S              | 4.0                      | 2.5     | 0.85max | ○                                                         | ○                                                  |                                                    | ○                                                                       |                                                                 |                      |       | 12    | ----- | 40       |                   | Yes    | Yes  | No       | Yes                                                                                     | A    | Yes                 |     |     |
|                    | CX-96F                | 5.0                      | 3.2     | 0.8max  | ○                                                         | ○                                                  |                                                    | ○                                                                       |                                                                 |                      |       | 12    | ----- | -----    | 120               |        | Yes  | Yes      | No                                                                                      | Yes  | A                   | Yes |     |
|                    | KSX-35                | 5.0                      | 3.2     | 0.95max | ○                                                         | ○                                                  |                                                    | ○                                                                       |                                                                 |                      |       | 13    | ----  | 27       |                   | Yes    | Yes  | No       | No                                                                                      | A    | Yes                 |     |     |
|                    | CX-53F                | 5.0                      | 3.2     | 1.1max  | ○                                                         | ○                                                  |                                                    |                                                                         |                                                                 |                      |       | 9.8   | ----- | 54       |                   | Yes    | Yes  | No       | Yes                                                                                     | B    | Yes                 |     |     |
|                    | KSX-36                | 6.0                      | 3.5     | 1.05max |                                                           | ○                                                  |                                                    | ○                                                                       |                                                                 |                      |       | 9     | ----- | 27       |                   | Yes    | Yes  | No       | No                                                                                      | A    | Yes                 |     |     |
|                    | CX-17F                | 8.0                      | 4.5     | 2.1max  |                                                           |                                                    | ○                                                  |                                                                         |                                                                 |                      |       | 8     | ----- | 30       |                   | Yes    | Yes  | No       | Yes                                                                                     | B    | Yes                 |     |     |
|                    | CX-8045G              | 8.0                      | 4.5     | 2.0max  | ○                                                         | ○                                                  |                                                    |                                                                         |                                                                 |                      |       | 7.2   | ----- | 48       |                   | Yes    | Yes  | No       | Yes                                                                                     | B    | Yes                 |     |     |
|                    | CX-53G                | 5.0                      | 3.2     | 1.5max  |                                                           |                                                    | ○                                                  |                                                                         |                                                                 |                      |       | 9.8   | ----- | 40       |                   | Yes    | Yes  | No       | Yes                                                                                     | B    | Yes                 |     |     |
|                    | CX-5FW                | 11.8                     | 5.5     | 2.8max  |                                                           |                                                    | ○                                                  |                                                                         |                                                                 |                      |       | 3.5   | ----- | 20       |                   | Yes    | Yes  | No       | Yes                                                                                     | B    | Yes                 |     |     |
|                    | CX-5FD                | 11.8                     | 5.5     | 2.0max  | ○                                                         | ○                                                  |                                                    |                                                                         |                                                                 |                      |       | 3.5   | ----- | 20       |                   | Yes    | Yes  | No       | Yes                                                                                     | B    | Yes                 |     |     |
|                    | CX-49F                | 11.4                     | 5.0     | 5.2max  |                                                           | ○                                                  | ○                                                  |                                                                         |                                                                 |                      |       | 3.2   | ----- | 20       |                   | Yes    | Yes  | No       | Yes                                                                                     | A    | Yes                 |     |     |
|                    | CX-49G                | 12.3                     | 4.8     | 4.5max  | ○                                                         | ○                                                  |                                                    |                                                                         |                                                                 |                      |       | 3.2   | ----- | -----    | 60                |        | Yes  | Yes      | No                                                                                      | Yes  | A                   | Yes |     |
|                    | CX-49L                | 11.05                    | 4.65    | 5.08max |                                                           |                                                    | ○                                                  |                                                                         |                                                                 |                      |       | 3.2   | ----- | 20       |                   | Yes    | Yes  | No       | Yes                                                                                     | C    | No                  |     |     |
|                    | CX-49/U-S             | 11.0                     | 5.0     | 3.5max  | ○                                                         | ○                                                  | ○                                                  |                                                                         |                                                                 |                      |       | 3.2   | ----- | -----    | 60                |        | Yes  | No       | Yes                                                                                     | Yes  | A                   | Yes |     |
|                    | CX-49/U-S(Automotive) | 11.0                     | 5.0     | 3.5max  |                                                           | ○                                                  | ○                                                  |                                                                         |                                                                 |                      |       | 3.2   | ----- | 20       |                   | Yes    | No   | Yes      | Yes                                                                                     | A    | Yes                 |     |     |
|                    | Crystal Oscillators   | KC2520                   | 2.5     | 2.0     | 0.9max                                                    | ○                                                  | ○                                                  | ○                                                                       | ○                                                               |                      |       |       | 2     | -----    | -----             | 50     |      | Yes      | Yes                                                                                     | No   | No                  | A   | Yes |
|                    |                       | K25-2C/K25-3C            | 3.2     | 2.5     | 1.0max                                                    | ○                                                  | ○                                                  |                                                                         | ○                                                               |                      |       |       | 1     | -----    | -----             | 50     |      | Yes      | Yes                                                                                     | No   | Yes                 | A   | Yes |
|                    |                       | K30-1C                   | 5.0     | 3.2     | 1.2max                                                    | ○                                                  | ○                                                  |                                                                         | ○                                                               | ○                    |       |       | 1.8   | -----    | 39.99             |        | Yes  | Yes      | No                                                                                      | Yes  | A                   | Yes |     |
|                    |                       | K30-2C                   | 5.0     | 3.2     | 1.2max                                                    | ○                                                  | ○                                                  |                                                                         | ○                                                               | ○                    |       |       | 1.8   | -----    | -----             | 67     |      | Yes      | Yes                                                                                     | No   | Yes                 | A   | Yes |
|                    |                       | K30-3C                   | 5.0     | 3.2     | 1.2max                                                    | ○                                                  | ○                                                  |                                                                         | ○                                                               | ○                    |       |       | 1.8   | -----    | -----             | 160    |      | Yes      | Yes                                                                                     | No   | Yes                 | A   | Yes |
|                    |                       | K30-3C (Heavy Load Type) | 5.0     | 3.2     | 1.2max                                                    | ○                                                  | ○                                                  |                                                                         |                                                                 | ○                    |       |       |       | 14       | ----              | 30     |      | Yes      | Yes                                                                                     | No   | Yes                 | A   | Yes |
| K30-HC             |                       | 5.0                      | 3.2     | 1.2max  | ○                                                         | ○                                                  |                                                    |                                                                         | ○                                                               |                      |       | 1.8   | ----- | -----    | 50                |        | Yes  | Yes      | No                                                                                      | Yes  | A                   | Yes |     |
| FXO-61F2           |                       | 5.0                      | 3.2     | 1.2max  | ○                                                         | ○                                                  |                                                    | ○                                                                       | ○                                                               |                      |       | 8     | ----- | 32       |                   | Yes    | Yes  | No       | No                                                                                      | A    | Yes                 |     |     |
| FXO-64F2           |                       | 5.0                      | 3.2     | 1.2max  | ○                                                         | ○                                                  |                                                    | ○                                                                       | ○                                                               |                      |       | 8     | ----- | 32       |                   | Yes    | Yes  | No       | No                                                                                      | A    | Yes                 |     |     |
| MFO-208F           |                       | 5.0                      | 3.2     | 1.45max | ○                                                         | ○                                                  |                                                    | ○                                                                       | ○                                                               |                      |       | 1.5   | ----- | -----    | 55                |        | TBA  | Yes      | No                                                                                      | No   | A                   | Yes |     |
| K53-1C             |                       | 7.0                      | 5.0     | 1.8max  | ○                                                         | ○                                                  |                                                    |                                                                         | ○                                                               |                      |       | 1.8   | ----- | 39.99    |                   | Yes    | Yes  | No       | Yes                                                                                     | A    | Yes                 |     |     |
| K53-2C             |                       | 7.0                      | 5.0     | 1.8max  | ○                                                         | ○                                                  |                                                    |                                                                         | ○                                                               |                      |       | 1.8   | ----- | -----    | 67                |        | Yes  | Yes      | No                                                                                      | Yes  | A                   | Yes |     |
| K53-3C             |                       | 7.0                      | 5.0     | 1.8max  | ○                                                         | ○                                                  |                                                    |                                                                         | ○                                                               |                      |       | 1.8   | ----- | -----    | 160               |        | Yes  | Yes      | No                                                                                      | Yes  | A                   | Yes |     |
| K53-HC             |                       | 7.0                      | 5.0     | 1.8max  | ○                                                         | ○                                                  |                                                    |                                                                         | ○                                                               |                      |       | 1.8   | ----- | -----    | 50                |        | Yes  | Yes      | No                                                                                      | Yes  | A                   | Yes |     |
| FXO-31F            |                       | 7.0                      | 5.0     | 2.0max  | ○                                                         | ○                                                  |                                                    |                                                                         | ○                                                               |                      |       | 1.8   | ----- | -----    | 50                |        | Yes  | Yes      | No                                                                                      | No   | A                   | Yes |     |
| FXO-37F            |                       | 7.0                      | 5.0     | 2.0max  | ○                                                         | ○                                                  |                                                    |                                                                         | ○                                                               |                      |       |       | 80    | -----    | 125               |        | Yes  | Yes      | No                                                                                      | No   | A                   | Yes |     |
| FXO-34F            |                       | 7.0                      | 5.0     | 2.0max  | ○                                                         | ○                                                  |                                                    |                                                                         | ○                                                               |                      |       | 1.8   | ----- | -----    | 50                |        | Yes  | Yes      | No                                                                                      | No   | A                   | Yes |     |
| K50H-3C            |                       | 7.0                      | 5.0     | 1.8max  | ○                                                         |                                                    |                                                    |                                                                         | ○                                                               |                      |       |       | 50    | -----    | -----             | 170    |      | Yes      | Yes                                                                                     | No   | Yes                 | A   | Yes |
| FSO-2B             |                       | 7.0                      | 5.0     | 2.0max  | ○                                                         |                                                    |                                                    |                                                                         | ○                                                               |                      |       |       |       | 100      | ----              | 167    |      | Yes      | Yes                                                                                     | No   | Yes*                | A   | Yes |
| FSO-2C             |                       | 7.0                      | 5.0     | 2.0max  | ○                                                         |                                                    |                                                    |                                                                         | ○                                                               |                      |       |       |       | 100      | -----             | 200    |      | Yes      | Yes                                                                                     | No   | Yes*                | A   | Yes |
| FSO-2D             |                       | 7.0                      | 5.0     | 2.0max  | ○                                                         |                                                    |                                                    |                                                                         | ○                                                               |                      |       |       |       | 100      | -----             | 170    |      | Yes      | Yes                                                                                     | No   | Yes*                | A   | Yes |
| K50-3C             |                       | 7.0                      | 5.0     | 1.8max  | ○                                                         | ○                                                  |                                                    |                                                                         |                                                                 |                      |       | 1.5   | ----- | -----    | 80                |        | Yes  | Yes      | No                                                                                      | Yes  | A                   | Yes |     |
| K50-HC             |                       | 7.0                      | 5.0     | 1.8max  | ○                                                         | ○                                                  |                                                    |                                                                         |                                                                 |                      |       | 1.5   | ----- | -----    | 68                |        | Yes  | Yes      | No                                                                                      | Yes  | A                   | Yes |     |
| JXO                |                       | 11.0                     | 5.0     | 3.6max  | ○                                                         |                                                    |                                                    |                                                                         |                                                                 |                      | 1     | ----- | ----- | 70       |                   | Yes    | Yes  | Yes      | No                                                                                      | TBA  |                     |     |     |
| EXO-3              |                       | 12.8                     | 7.0     | 5.08max | ○                                                         |                                                    |                                                    |                                                                         |                                                                 |                      |       | 12    | --    | 24.576   |                   | Yes    | No   | Yes      | No                                                                                      | TBA  |                     |     |     |
| FSO-1C / FSO-1D    |                       | 7.0                      | 5.0     | 2.0max  | ○                                                         |                                                    |                                                    |                                                                         |                                                                 | ○                    |       |       | 50    | -----    | -----             | 700    |      | Yes      | Yes                                                                                     | No   | Yes*                | A   | Yes |
| VC-FXO-65F         |                       | 5.0                      | 3.2     | 1.2max  | ○                                                         | ○                                                  |                                                    |                                                                         | ○                                                               |                      |       | 8     | ----- | 40       |                   | Yes    | Yes  | No       | No                                                                                      | A    | Yes                 |     |     |
| VC-FXO-35F         |                       | 7.0                      | 5.0     | 2.0max  | ○                                                         | ○                                                  |                                                    |                                                                         | ○                                                               |                      |       | 8     | ----- | 40       |                   | Yes    | Yes  | No       | No                                                                                      | A    | Yes                 |     |     |
| VCXO-7050/7050L    |                       | 7.0                      | 5.0     | 2.0max  | ○                                                         |                                                    |                                                    |                                                                         | ○                                                               |                      |       | 7.2   | ----- | 50       |                   | Yes    | Yes  | No       | No                                                                                      | A    | Yes                 |     |     |
| K50V-3P            |                       | 7.0                      | 5.0     | 1.8max  | ○                                                         |                                                    |                                                    |                                                                         | ○                                                               |                      |       |       |       |          | • 155.52          |        | Yes  | Yes      | No                                                                                      | Yes  | A                   | Yes |     |
| VC-FSO-1D          |                       | 7.0                      | 5.0     | 2.0max  | ○                                                         |                                                    |                                                    |                                                                         | ○                                                               |                      |       |       |       |          | 600--700          |        | Yes  | Yes      | No                                                                                      | Yes* | A                   | Yes |     |
| KT21               |                       | 3.2                      | 2.5     | 1.0max  |                                                           | ○                                                  |                                                    | ○                                                                       |                                                                 |                      |       | 12.6  | ----- | 38.4     |                   | TBA    | Yes  | No       | No                                                                                      | A    | Yes                 |     |     |
| (VC-)TCXO-214C     |                       | 3.2                      | 2.5     | 1.05max |                                                           | ○                                                  |                                                    | ○                                                                       |                                                                 |                      |       | 12.6  | ----- | 38.4     |                   | TBA    | Yes  | No       | No                                                                                      | A    | Yes                 |     |     |
| (VC-)TCXO-212C     |                       | 4.0                      | 2.5     | 1.2max  |                                                           | ○                                                  |                                                    | ○                                                                       |                                                                 |                      |       | 12.6  | ----  | 26       |                   | TBA    | Yes  | No       | No                                                                                      | A    | Yes                 |     |     |
| (VC-)TCXO-208C     |                       | 5.0                      | 3.2     | 1.45max |                                                           | ○                                                  |                                                    | ○                                                                       |                                                                 |                      |       | 12.6  | ----  | 26       |                   | TBA    | Yes  | No       | No                                                                                      | A    | Yes                 |     |     |
| KT18B              |                       | 5.0                      | 3.2     | 1.5max  |                                                           | ○                                                  |                                                    | ○                                                                       |                                                                 |                      |       | 13    | ----  | 26       |                   | TBA    | Yes  | No       | No                                                                                      | A    | Yes                 |     |     |
| KT20A              | 5.0                   | 3.2                      | 1.5max  |         | ○                                                         |                                                    | ○                                                  |                                                                         |                                                                 |                      | 19.2  | --    | 26    |          | TBA               | Yes    | No   | No       | A                                                                                       | Yes  |                     |     |     |
| (VC-)DTCXO-12A     | 30.0                  | 30.0                     | 10.0max |         |                                                           |                                                    |                                                    | ○                                                                       | 1                                                               | -----                | ----- | 32    |       |          |                   | Yes    | No   | TBA      | No                                                                                      | C    | No                  |     |     |
| (VC-)DTCXO-13A     | 40.0                  | 40.0                     | 10.0max |         |                                                           |                                                    |                                                    | ○                                                                       |                                                                 |                      |       | 30    | ----- | -----    | 320               |        | Yes  | No       | TBA                                                                                     | No   | C                   | No  |     |
| DTCXO-15A          | 14.0                  | 11.5                     | 8.0     |         |                                                           |                                                    |                                                    | ○                                                                       |                                                                 |                      | 10    | ----- | 40    |          | Yes               | No     | TBA  | No       | B                                                                                       | No   |                     |     |     |
| OCVCXO-120A        | 36.1                  | 27.2                     | 19.5max |         |                                                           |                                                    |                                                    | ○                                                                       |                                                                 |                      | •10   |       |       |          | Yes               | No     | TBA  | No       | C                                                                                       | No   |                     |     |     |
| MCXO-094B          | 480                   | 450                      | 99      |         |                                                           |                                                    |                                                    | ○                                                                       |                                                                 |                      | •10   |       |       |          | —                 | —      | —    | —        | —                                                                                       | —    |                     |     |     |

\*No ultrasonic washing



RoHS Comforming

## Features

- Miniature size (2.5×2.0×1.0 mm)
- Wide frequency range
- High precision type is available for full speed USB.

## Applications

- CD-R/W
- HDD
- DVD-ROM
- MD
- Printer
- Cellular (CDMA/PCS)
- Portable Electronic Equipment
- Memory Card
- USB

## How to Order

SSR 33.86 D R  
① ② ③ ④

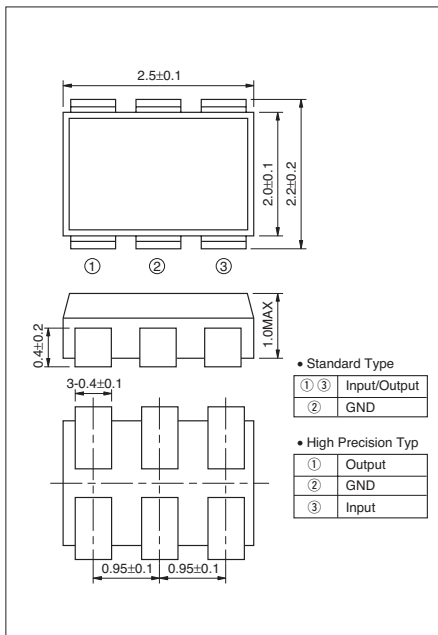
- ① Series
- ② Oscillating frequency(MHz)
- ③ Type
- ④ Packaging : Tape & Reel  
2000pcs/Reel

## Notice

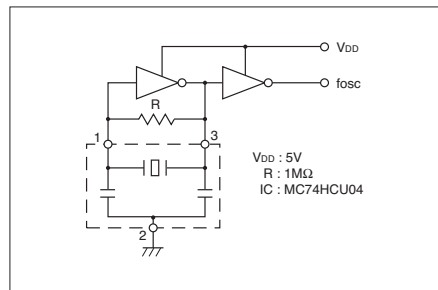
- Non washable

## Dimensions

(Unit : mm)



## Test Circuit



## Specifications

### • Standard Type

| Frequency Range  | Frequency Tolerance (25°C) | Temperature Stability (-20 to 80°C) | IC                   | Standard Frequency (MHz) |
|------------------|----------------------------|-------------------------------------|----------------------|--------------------------|
| 20.00 to 60.0MHz | ±0.5%                      | ±0.3%                               | MC74HCU04 (MOTOROLA) | 20.00, 33.86, 48.0       |

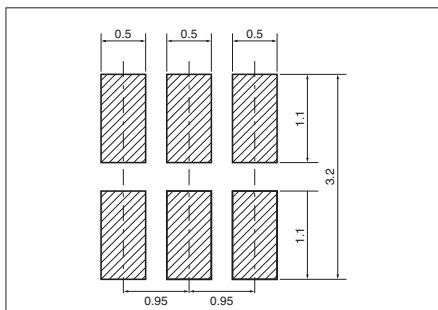
Please contact your local AVX office for IC matching.

### • High Precision Type

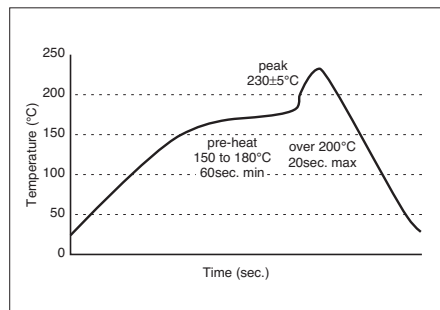
| Frequency Range  | Frequency Tolerance (25°C) | Temperature Stability (-20 to 70°C) | Aging (10 years) | IC                   | Standard Frequency (MHz) |
|------------------|----------------------------|-------------------------------------|------------------|----------------------|--------------------------|
| 30.00 to 60.0MHz | ±0.18%<br>(Option ±0.08%)  | ±0.06%                              | ±0.01%           | MC74HCU04 (MOTOROLA) | 48.0                     |

## Recommended Land Pattern

(Unit : mm)

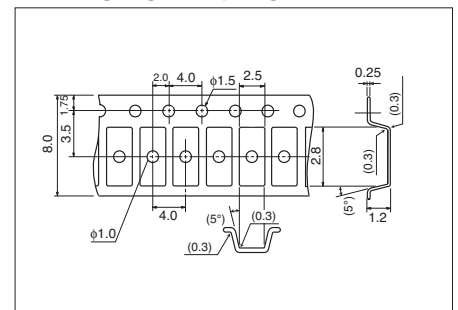


## Recommended Reflow Profile



## Packaging : Taping

(Unit : mm)





**RoHS Conforming**

## Features

- Miniature size (3.2×2.1×1.5 mm)
- Wide frequency range
- High precision type is available for full speed USB.

## Applications

- CD-ROM
- HDD
- DVD-ROM
- MD
- Printer
- Cellular (CDMA/PCS)
- Portable Electronic Equipment
- USB

## How to Order

$\frac{SSR}{(1)}$

$\frac{33.86}{(2)}$

$\frac{B}{(3)}$

$\frac{R}{(4)}$

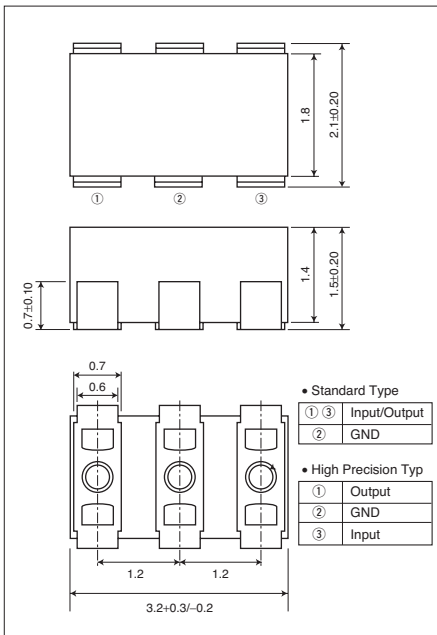
- ①Series
- ②Oscillating frequency(MHz)
- ③Type B: 3rd-overtone mode built-in Capacitor  
F: Fundamental mode built-in Capacitor
- ④Packaging : Tape & Reel  
2000pcs/Reel

## Notice

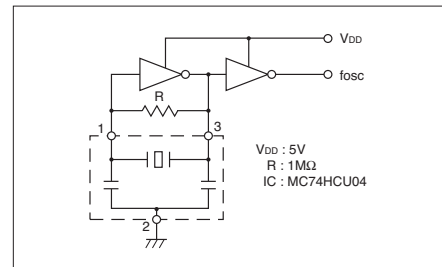
- Non washable

## Dimensions

(Unit : mm)



## Test Circuit



## Specifications

- Standard Type

|   | Frequency Range                | Frequency Tolerance (25°C) | Temperature Stability (−20 to 80°C) | IC                   | Main Frequency (MHz)           |
|---|--------------------------------|----------------------------|-------------------------------------|----------------------|--------------------------------|
| B | 16.0 to 60.0MHz (3rd-overtone) | ±0.5%                      | ±0.3%                               | MC74HCU04 (MOTOROLA) | 16.93, 20.0, 27.0, 33.86, 50.8 |
| F | 16.0 to 20.0MHz (Fundamental)  |                            |                                     |                      | 16.93                          |

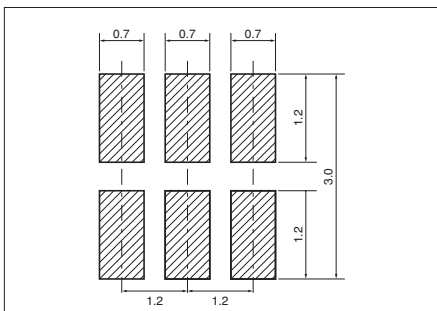
Please contact your local AVX office for IC matching.

- High Precision Type

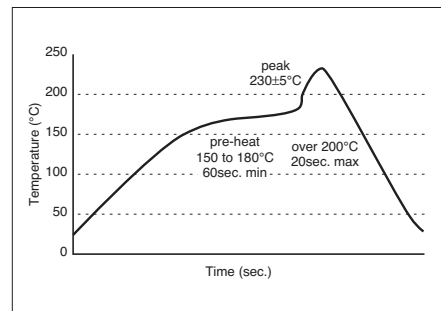
|   | Frequency Range                | Frequency Tolerance (25°C) | Temperature Stability (-20 to 70°C) | Aging (10 years) | IC                   | Main Frequency (MHz) |
|---|--------------------------------|----------------------------|-------------------------------------|------------------|----------------------|----------------------|
| B | 16.0 to 60.0MHz (3rd-overtone) | ±0.18% (Option ±0.08%)     | ±0.06%                              | ±0.01%           | MC74HCU04 (MOTOROLA) | 48.0                 |

### Recommended Land Pattern (Unit : mm)

(Unit : mm)

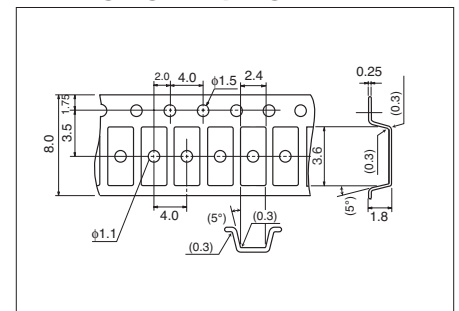


## Recommended Reflow Profile



### Packaging : Taping

(Unit : mm)





RoHS Comforming

## Features

- High reliability, high temperature withstanding ceramic case
- Rectangular shape allows easy pick and placement
- Small & low profile
- Reflow solderable
- Excellent Solderability(Nickel barrier+Au flush termination)

## How to Order

PBRC 15.00 G R 10 Y 0AB  
① ② ③ ④ ⑤ ⑥ ⑦

- ①Series (PBRC: Consumer)  
②Frequency (MHz)  
③Type(G,L)  
④Packing \_ Bulk (Null)  
R Reel

⑤Frequency Tolerance at 25°C

|    |       |    |       |
|----|-------|----|-------|
| 10 | ±0.1% | 20 | ±0.2% |
| 30 | ±0.3% | 40 | ±0.4% |
| 50 | ±0.5% | 70 | ±0.7% |

⑥Operating temperature

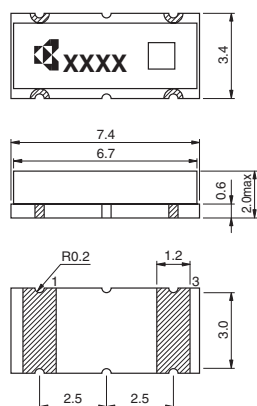
|   |             |   |             |
|---|-------------|---|-------------|
| X | -40 / 85°C  | Y | -40 / 125°C |
| Z | -40 / 150°C |   |             |

⑦Unique code

## Dimensions

(Unit : mm)

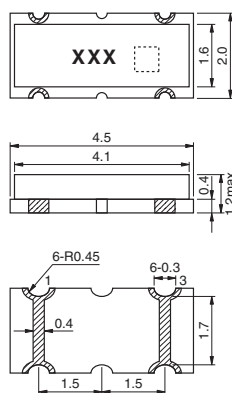
PBRC-G Type



Standard Tol. : ±0.3

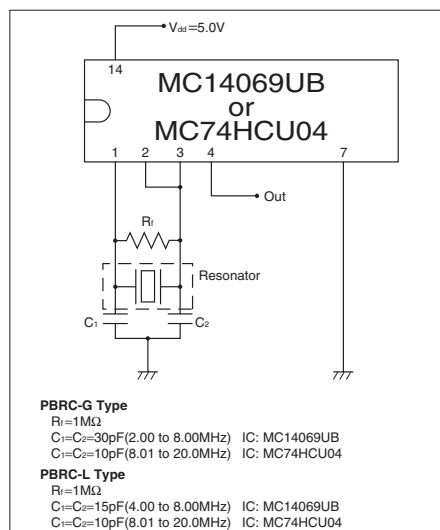
(Unit : mm)

PBRC-L Type



Standard Tol. : ±0.2

## Test Circuit

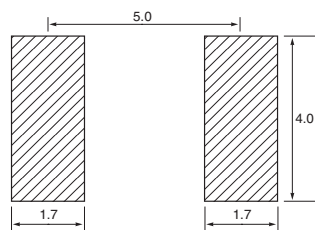


Remark:  
C1 and C2 are referenced capacitance values to measure each parameter under.  
The right test circuit(IC: MC14069UD).  
C1 and C2 values would be modified depend upon various IC to be used.

## Recommended Land Pattern

(Unit : mm)

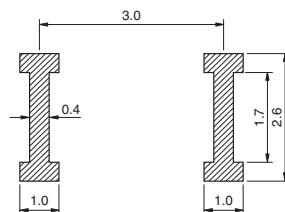
PBRC-G Type



The thickness of solder paste : 0.2mm

(Unit : mm)

PBRC-L Type



## Specifications

| Series | Frequency Range(MHz) | Frequency Tolerance(25°C) | Temperature Stability |
|--------|----------------------|---------------------------|-----------------------|
| PBRC-G | 2.00 to 8.00         | ±0.5% (op. ±0.3%)         | ±0.5% (-40 to 85°C)   |
|        | 8.01 to 20.0         | ±0.7% (op. ±0.5%)         | ±0.1% (-40 to 85°C)   |
| PBRC-L | 3.68 to 8.00         | ±0.5% (op. ±0.3%)         | ±0.5% (-40 to 85°C)   |
|        | 8.01 to 20.0         | ±0.7% (op. ±0.5%)         | ±0.1% (-40 to 85°C)   |

Please contact our local sales office if you need over 8MHz.



RoHS Compliant

## Features

- High reliability, high temperature withstanding ceramic case
- Rectangular shape allows easy pick and placement
- Small & low profile
- Reflow solderable
- Excellent Solderability(Nickel barrier+Au flush termination)

## How to Order

PBRC 15.00 H R 10 Y 0AB  
① ② ③ ④ ⑤ ⑥ ⑦

①Series (PBRC: Consumer)

②Frequency (MHz)

③Type(H,M)

④Packing \_ Bulk  
(Null)

R Reel

⑤Frequency Tolerance at 25°C

|    |       |    |       |
|----|-------|----|-------|
| 10 | ±0.1% | 20 | ±0.2% |
| 30 | ±0.3% | 40 | ±0.4% |
| 50 | ±0.5% | 70 | ±0.7% |

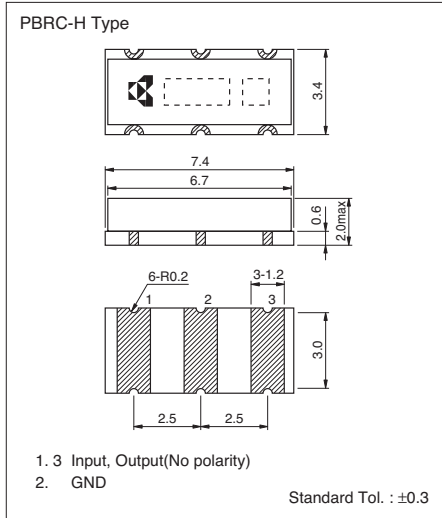
⑥Operating temperature

|   |             |   |             |
|---|-------------|---|-------------|
| X | -40 / 85°C  | Y | -40 / 125°C |
| Z | -40 / 150°C |   |             |

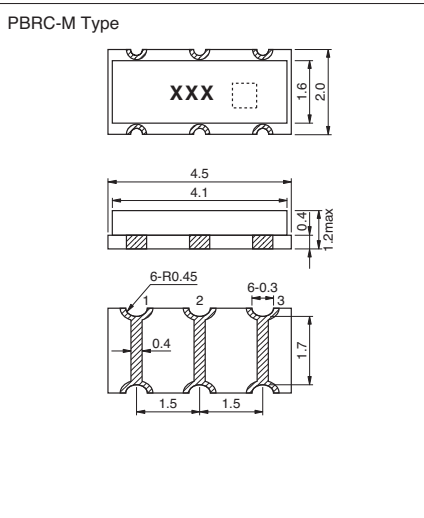
⑦Unique code

## Dimensions

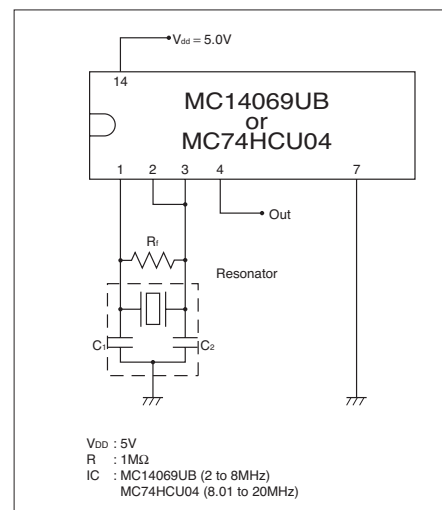
(Unit : mm)



| # | Pin #  |
|---|--------|
| 1 | Input  |
| 2 | Ground |
| 3 | Output |



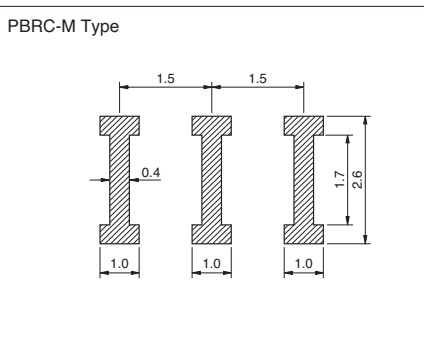
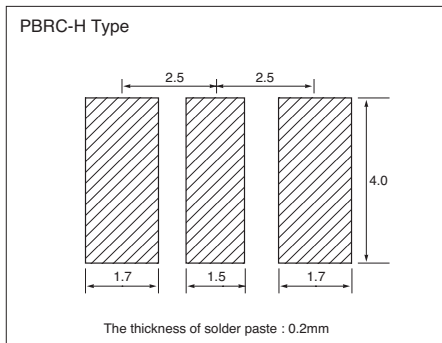
## Test Circuit



Notice  
Please refer to IC Application Guide on our WEB site for IC matching.

## Recommended Land pattern

(Unit : mm)



## Specifications

| Series | Frequency Range(MHz) | Frequency Tolerance(25°C) | Temperature Stability |
|--------|----------------------|---------------------------|-----------------------|
| PBRC-H | 2.00 to 8.00         | ±0.5% (op. ±0.3%)         | ±0.5% (-40 to 85°C)   |
|        | 8.01 to 20.0         | ±0.7% (op. ±0.5%)         | ±0.1% (-40 to 85°C)   |
| PBRC-M | 3.68 to 8.00         | ±0.5% (op. ±0.3%)         | ±0.5% (-40 to 85°C)   |
|        | 8.01 to 20.0         | ±0.7% (op. ±0.5%)         | ±0.1% (-40 to 85°C)   |

Please contact our local sales office if you need over 8MHz.



RoHS Comforming

### Features

- Miniature & low profile
- Rectangular shape allows easy pick and placement
- Component cost and space saving
- High density mounting possible
- Reflow solderable & washable
- High reliability, high temperature operating with ceramic case

### Applications

- Automotive
- ABS
- ECU
- Air-Bag System

### How to Order

PBRV 15.00 H R 10 Y 0AB  
① ② ③ ④ ⑤ ⑥ ⑦

①Series (PBRV: Automotive)

②Frequency (MHz)

③Type(H,M)

④Packing \_ Bulk  
(Null)  
R Reel

⑤Frequency Tolerance at 25°C

|    |       |    |       |
|----|-------|----|-------|
| 10 | ±0.1% | 20 | ±0.2% |
| 30 | ±0.3% | 40 | ±0.4% |
| 50 | ±0.5% | 70 | ±0.7% |

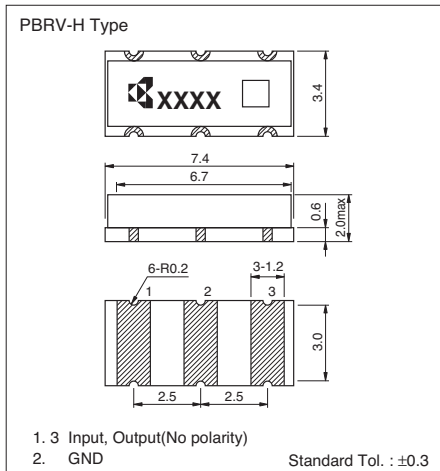
⑥Operating temperature

|   |             |   |             |
|---|-------------|---|-------------|
| X | -40 / 85°C  | Y | -40 / 125°C |
| Z | -40 / 150°C |   |             |

⑦Unique code

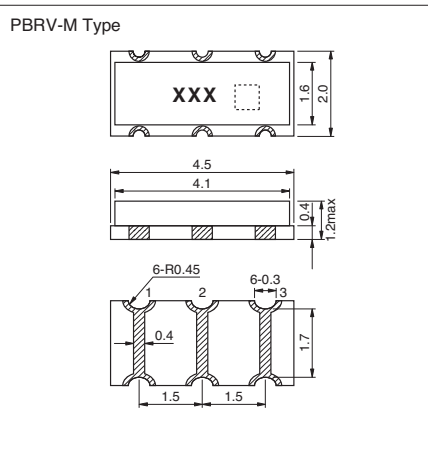
### Dimensions

(Unit : mm)

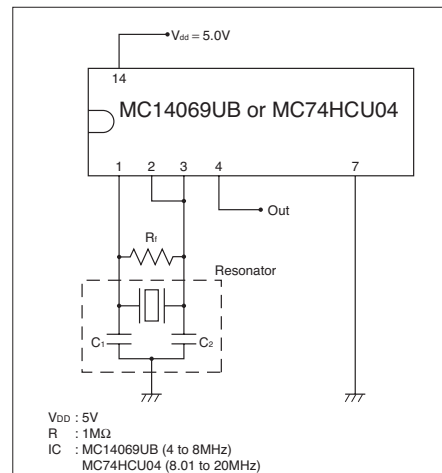


| # | Pin #  |
|---|--------|
| 1 | Input  |
| 2 | Ground |
| 3 | Output |

(Unit : mm)



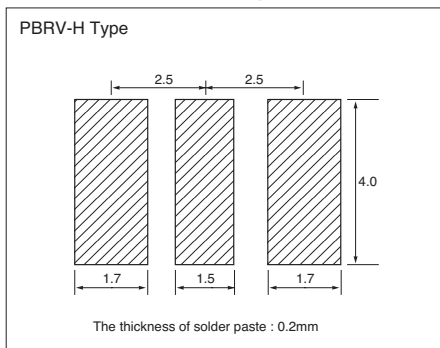
### Test Circuit



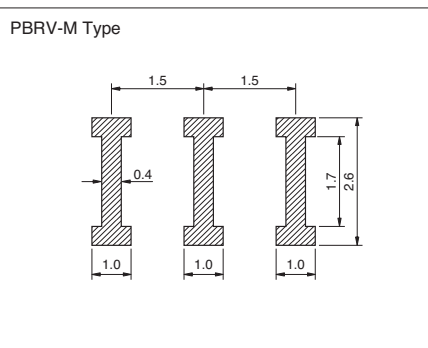
Notice  
Please refer to IC Application Guide on our WEB site for IC matching.

### Recommended Land pattern

(Unit : mm)



(Unit : mm)



### Specifications

| Series | Frequency Range(MHz) | Frequency Tolerance(25°C) | Temperature Stability                              |
|--------|----------------------|---------------------------|----------------------------------------------------|
| PBRV-H | 4.00 to 8.00         | ±0.5%<br>(op. ±0.3%)      | Y: ±0.5%(-40 to +125°C)<br>Z: ±0.5%(-40 to +150°C) |
| PBRV-M | 8.01 to 20.00        | ±0.7%<br>(op. ±0.5%)      | Y: ±0.1%(-40 to +125°C)<br>Z: ±0.2%(-40 to +150°C) |

Please contact our local sales office if you need without capacitor type and tight frequency tolerance type for CANBUS Application.



RoHS Compliant

## Features

- Improved frequency tolerance for CANBUS Application of Automotive

## How to Order

PBRV 15.00 H R 10 Y 0AB  
① ② ③ ④ ⑤ ⑥ ⑦

①Series (PBRV: Automotive)  
(PBRC: Consumer)

②Frequency (MHz)

③Type(H,M)

④Packing \_ Bulk  
(Null)  
R Reel

⑤Frequency Tolerance at 25°C

|    |       |    |       |
|----|-------|----|-------|
| 10 | ±0.1% | 20 | ±0.2% |
| 30 | ±0.3% | 40 | ±0.4% |
| 50 | ±0.5% | 70 | ±0.7% |

⑥Operating temperature

|   |             |   |             |
|---|-------------|---|-------------|
| X | -40 / 85°C  | Y | -40 / 125°C |
| Z | -40 / 150°C |   |             |

⑦Unique code

## Specifications

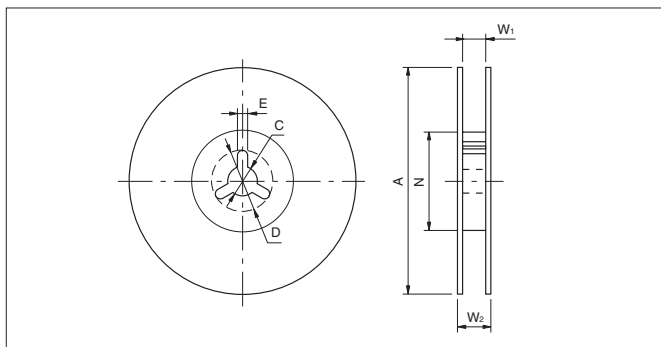
| Series                      | PBRV-HR/MR        | PBRV-HR/MR        | PBRC-HR/MR        | PBRC-HR/MR        |
|-----------------------------|-------------------|-------------------|-------------------|-------------------|
| Part Number                 | PBRV-HR/MR 10Y□□□ | PBRV-HR/MR 10Y□□□ | PBRC-HR/MR 10X□□□ | PBRC-HR/MR 10Y□□□ |
| Operating Temperature Range | -40 to +125°C     | -40 to +125°C     | -40 to +85°C      | -40 to +85°C      |
| Frequency Range             | 4.0 to 7.9MHz     | 8.0 to 20.0MHz    | 4.0 to 7.9MHz     | 8.0 to 20.0MHz    |
| Initial+Temperature         | ±0.3%             | ±0.2%             | ±0.3%             | ±0.2%             |
| Aging                       | ±0.1%             | ±0.1%             | ±0.1%             | ±0.1%             |
| Total Frequency Tolerance   | ±0.4%             | ±0.3%             | ±0.4%             | ±0.3%             |

Dimensions: See each page for each series.

Aging: 10 years at 25°C

## Packaging

Reel

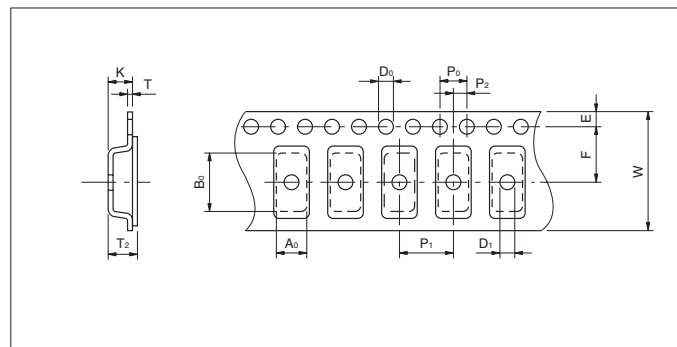


2,000pcs/Reel

| Code | A                                 | N                              | W <sub>1</sub>                       | W <sub>2</sub> |
|------|-----------------------------------|--------------------------------|--------------------------------------|----------------|
|      | 250±2.0                           | 80±2.0                         | 16.5 <sup>+1.1</sup> <sub>-0.0</sub> | 23.6max        |
|      | 180 <sup>+0</sup> <sub>-0.3</sub> | 60 <sup>+1</sup> <sub>-0</sub> | 13.0±0.3                             | 15.4±1         |
| Code | C                                 | D                              | E                                    |                |
|      | 13.0±0.5                          | 21.0±0.8                       | 2.0±0.5                              |                |
|      | 13.0±0.2                          | 21.0±0.8                       | 2.0±0.5                              |                |

\* Upper line shows external dimensions 7.4×3.4×2.0mm  
Lower line shows external dimensions 4.5×2.0×1.2mm  
7.4×3.4×2.0mm=PBRC-G, PBRC-H, PBRV-G, PBRV-H  
4.5×2.0×1.2mm=PBRC-L, PBRC-M, PBRV-L, PBRV-M

Taping



| Code | A <sub>0</sub> | B <sub>0</sub>                     | W         | F              | E        | P <sub>1</sub> |
|------|----------------|------------------------------------|-----------|----------------|----------|----------------|
|      | 3.80±0.1       | 7.80±0.1                           | 16.00±0.3 | 7.50±0.1       | 1.75±0.1 | 8.00±0.1       |
|      | 2.20±0.1       | 4.70±0.1                           | 12.00±0.2 | 5.5±0.05       | 1.75±0.1 | 4.00±0.1       |
| Code | P <sub>0</sub> | D <sub>0</sub>                     | T         | T <sub>2</sub> | K*       |                |
|      | 4.00±0.1       | 1.50 <sup>+0.1</sup> <sub>-0</sub> | 0.30±0.05 | 2.45±0.2       | 2.40±0.2 |                |
|      | 4.00±0.1       | 1.50 <sup>+0.1</sup> <sub>-0</sub> | 0.30±0.05 | 1.85max        | 1.80max  |                |

\* Upper line shows external dimensions 7.4×3.4×2.0mm  
Lower line shows external dimensions 4.5×2.0×1.2mm  
7.4×3.4×2.0mm=PBRC-G, PBRC-H, PBRV-G, PBRV-H  
4.5×2.0×1.2mm=PBRC-L, PBRC-M, PBRV-L, PBRV-M



Pb Free

RoHS Conforming

## Features

- Frequency Range 300 to 480MHz
- 1 Port Type SMD Resonator
- Small Size (5.5×3.8mm)
- Low Profile (1.5mm max)
- SMT Ceramic Package
- High Reliability Sealing
- Excellent Temperature Characteristics
- +100ppm to -250ppm (-40 to 85°C)

## Applications

- Keyless Entry Systems
- Garage Openers
- Security Systems

## How to Order

PARS 315.00 K 00 R  
① ② ③ ④ ⑤

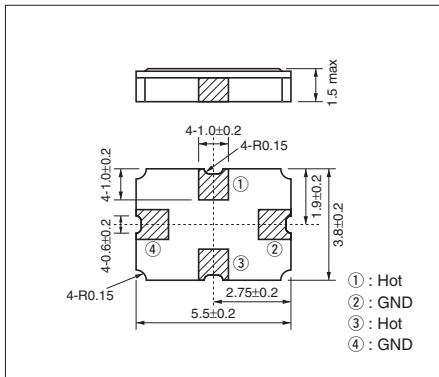
- ① Series  
② Resonant Frequency(MHz)  
③ Marking Code  
④ Freq.tolerance or Custom Spec

|    |              |    |           |
|----|--------------|----|-----------|
| 00 | ±250kHz      | 03 | ±100kHz   |
| 01 | ±200kHz      | 04 | ±75kHz    |
| 02 | ±150kHz      | 10 | Tolerance |
| 11 | Custom Spec. |    |           |

- ⑤ Packaging  
R : Tape & Reel(2000pcs/Reel)

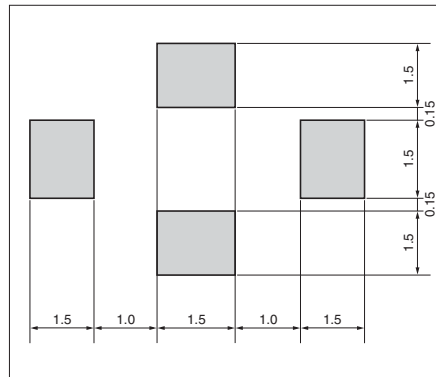
## Dimensions

(Unit : mm)



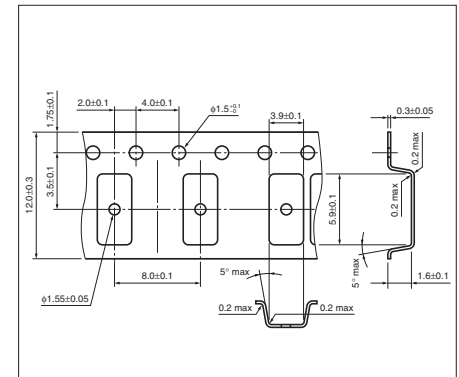
## Recommended Land Pattern

(Unit : mm)



## Packaging

(Unit : mm)

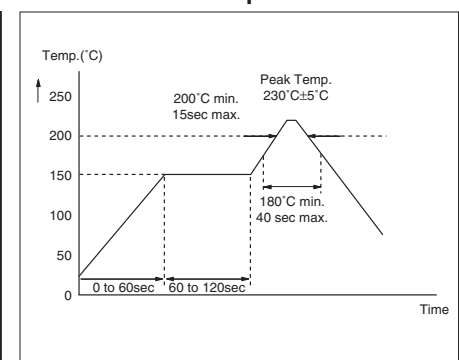


## Specifications

| Part Number    | Resonant Frequency(MHz) | Resonant Loss(dB) | Parallel Capacitance(pF) | Temperature Characteristics (ppm/°C) |
|----------------|-------------------------|-------------------|--------------------------|--------------------------------------|
| PARS303.00N00R | 303.000±0.250           | 2.5max            | 4.0max                   | ±8max                                |
| PARS303.33L00R | 303.330±0.250           |                   |                          |                                      |
| PARS303.82M00R | 303.825±0.250           |                   |                          |                                      |
| PARS303.87K00R | 303.875±0.250           |                   |                          |                                      |
| PARS304.30K00R | 304.300±0.250           |                   |                          |                                      |
| PARS304.45L00R | 304.450±0.250           |                   |                          |                                      |
| PARS310.00K00R | 310.000±0.250           |                   | 3.2max                   |                                      |
| PARS314.00K00R | 314.000±0.250           |                   |                          |                                      |
| PARS314.50L00R | 314.500±0.250           |                   |                          |                                      |
| PARS315.00K00R | 315.000±0.250           |                   |                          |                                      |
| PARS320.65K00R | 320.650±0.250           |                   |                          |                                      |
| PARS345.00K00R | 345.000±0.250           |                   |                          |                                      |
| PARS418.00K00R | 418.000±0.250           |                   |                          |                                      |
| PARS423.22K00R | 423.220±0.250           |                   |                          |                                      |
| PARS432.92K00R | 432.920±0.250           |                   |                          |                                      |
| PARS433.42L00R | 433.420±0.250           |                   |                          |                                      |
| PARS433.92K00R | 433.920±0.250           |                   |                          |                                      |
| PARS479.50K00R | 479.500±0.250           |                   |                          |                                      |

\*Please contact your local sales office for custom frequency.

## Recommended Temperature IR Reflow





Pb Free

RoHS Comforming

Surface Acoustic Wave Resonator for Remote Keyless Entry System(RKE)

## Features

- World smallest size
- 1 Port Type SMD Resonator
- High Reliability
- Excellent Temperature Characteristics

## Applications

- Remote Keyless Entry System(RKE)
- Garage Openers
- Security Systems

## How to Order

PARM 315.00 K 04 R  
① ② ③ ④ ⑤

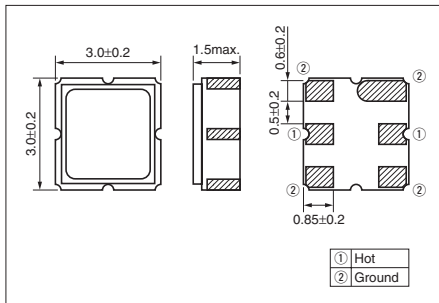
- ① Series
- ② Resonant Frequency(MHz)
- ③ Marking Code
- ④ Frequency tolerance or Custom Spec

|    |         |     |             |
|----|---------|-----|-------------|
| 00 | ±250kHz | 03  | ±100kHz     |
| 01 | ±200kHz | 04  | ±75kHz      |
| 02 | ±150kHz | 11≤ | Custom spec |

- ⑤ Type

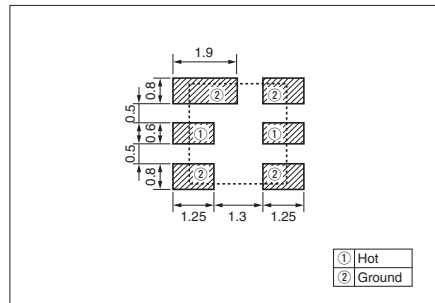
## Dimensions

(Unit : mm)



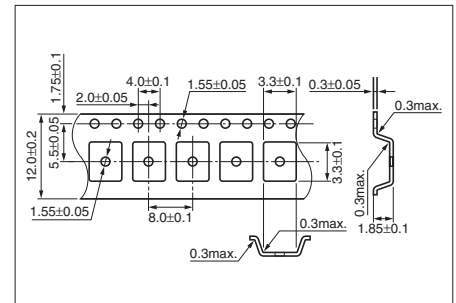
## Recommended Land Pattern

(Unit : mm)



## Packaging

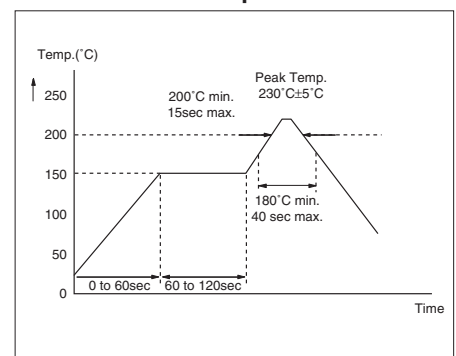
(Unit : mm)



## Specifications

| Part Number    | Resonant Frequency(MHz) | Resonant Loss(dB) | Parallel Capacitance(pF) | Temperature Characteristics(ppm/°C) | Operating Temperature(°C) | Storage Temperature(°C) |
|----------------|-------------------------|-------------------|--------------------------|-------------------------------------|---------------------------|-------------------------|
| PARM315.00K00R | 315.000±0.250           | 2.5 max.          | 4.0 max.                 | ±8 max.                             | -40 to 85                 | -40 to 85               |
| PARM433.92K00R | 433.920±0.250           |                   |                          |                                     |                           |                         |

## Recommended Temperature IR Reflow





Pb Free

RoHS Conforming

Surface Acoustic Wave Resonator for TPMS

### Features

- Low Profile
- 1 Port Type SMD Resonator
- High Reliability
- Excellent Temperature Characteristics

### Applications

- TPMS

### How to Order

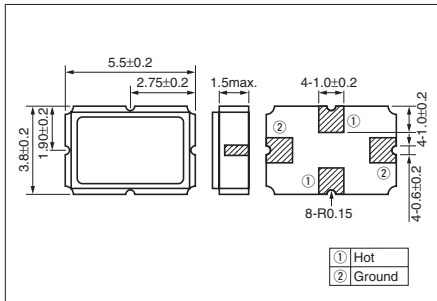
PARV 314680 A

① ② ③

- ① Series
- ② Resonant Frequency(MHz)
- ③ Type

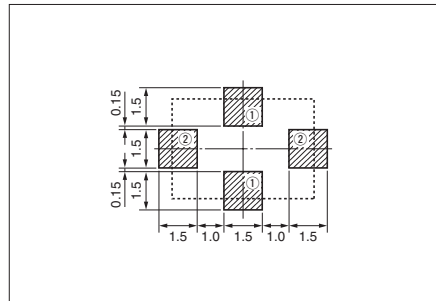
### Dimensions

(Unit : mm)



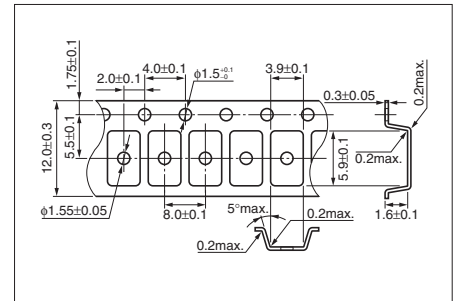
### Recommended Land Pattern

(Unit : mm)



### Packaging

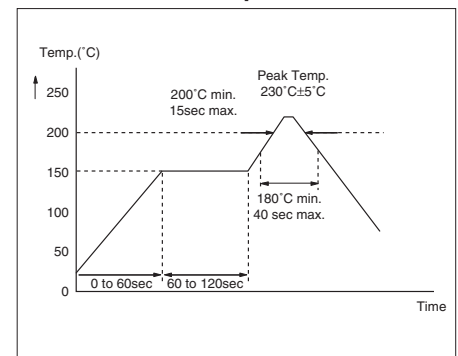
(Unit : mm)



### Specifications

| Part Number | Resonant Frequency(MHz) | Resonant Loss(dB) | Parallel Capacitance(pF) | Operating Temperature(°C) | Storage Temperature(°C) |
|-------------|-------------------------|-------------------|--------------------------|---------------------------|-------------------------|
| PARV314680A | 314.680±0.100           | 2.0 max.          | 3.2 max.                 | -40 to 120                | -40 to 120              |

### Recommended Temperature IR Reflow





**Pb Free**

**RoHS Conforming**

### Features

- Crystal Unit for Audio-Visual, Office Equipment
- Ultra-miniature and low profile. (2.5x2.0x0.45mm)
- Ceramic package.
- A lead free product.
- Reflow compatible.

### Applications

- Digital electronics
- Audio Visual, Office equipment

### Standard Frequencies (kHz)

|           |
|-----------|
| 27000.000 |
| 27120.000 |
| 30000.000 |
| 32000.000 |
| 33000.000 |
| 33333.000 |
| 40000.000 |
| 48000.000 |
| 54000.000 |

\* Please inquire about frequencies other than the above.

## Specifications

| Items                                 | Symbol           | Specification | Units | Remarks                             |
|---------------------------------------|------------------|---------------|-------|-------------------------------------|
| Frequency Range                       | F <sub>0</sub>   | 26000~60000   | kHz   |                                     |
| Overtone Order                        | —                | Fundamental   | —     |                                     |
| Frequency Tolerance                   | ΔF/F             | ±50           | ppm   | @ 25°C                              |
| Frequency Temperature Characteristics | ΔF/T             | ±50           | ppm   | ref@ 25°C Over Operating Temp Range |
| Motional Series Resistance            | Cl               | Table 1       | ohm   |                                     |
| Level of Drive                        | —                | Table 2       | μW    |                                     |
| Load Capacitance                      | C <sub>L</sub>   | 8             | pF    |                                     |
| Operating Temp. Range                 | T <sub>OPR</sub> | -10 ~ +70     | °C    |                                     |
| Storage Temp. Range                   | T <sub>STG</sub> | -40 ~ +85     | °C    |                                     |

\* Please inquire about specifications other than the above.

**Table1 Motional Series Resistances**

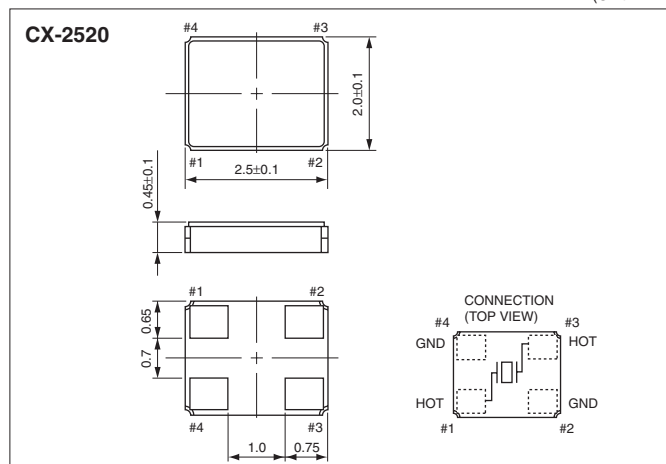
| Frequency Range | Motional Series Resistance | Units |
|-----------------|----------------------------|-------|
| 26000~34999kHz  | 100                        | ohm   |
| 35000~60000kHz  | 50                         |       |

**Table2 Level of Drive**

| Frequency Range | Level of Drive | Units |
|-----------------|----------------|-------|
| 26000~60000kHz  | 10(100 max.)   | μW    |

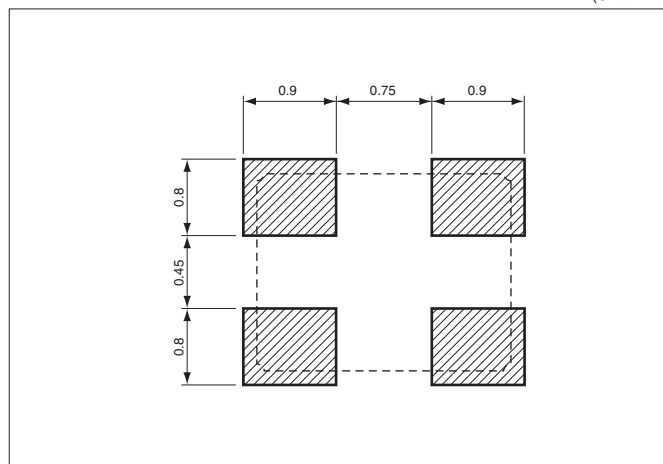
## Dimensions

(Unit : mm)



## Recommended Land Pattern

(Unit : mm)





Pb Free

RoHS Conforming

### Features

- Reference frequency for telecommunication systems
- Reflow compatible
- Using Ceramic Package resulting in high reliability
- Small and low profile

### Applications

- Mobile communications, Bluetooth, Wireless LAN

### Standard Frequencies (kHz)

|           |
|-----------|
| 26000.000 |
| 27120.000 |
| 32000.000 |
| 38400.000 |
| 40000.000 |
| 44000.000 |

\* Please inquire about frequencies other than the above.

### Specifications

| Items                                 | Symbol           | Specification | Units | Remarks                             |
|---------------------------------------|------------------|---------------|-------|-------------------------------------|
| Frequency Range                       | F <sub>0</sub>   | 26000~60000   | kHz   |                                     |
| Overtone Order                        | —                | Fundamental   | —     |                                     |
| Frequency Tolerance                   | ΔF/F             | ±10           | ppm   | @ 25°C                              |
| Frequency Temperature Characteristics | ΔF/T             | ±15           | ppm   | ref@ 25°C Over Operating Temp Range |
| Motional Series Resistance            | C <sub>1</sub>   | Table 1       | ohm   |                                     |
| Level of Drive                        | —                | Table 2       | μW    |                                     |
| Load Capacitance                      | C <sub>L</sub>   | 8             | pF    |                                     |
| Operating Temp. Range                 | T <sub>OPR</sub> | -30~+85       | °C    |                                     |
| Storage Temp. Range                   | T <sub>STG</sub> | -40~+85       | °C    |                                     |

\* Please inquire about specifications other than the above.

Table1 Motional Series Resistances

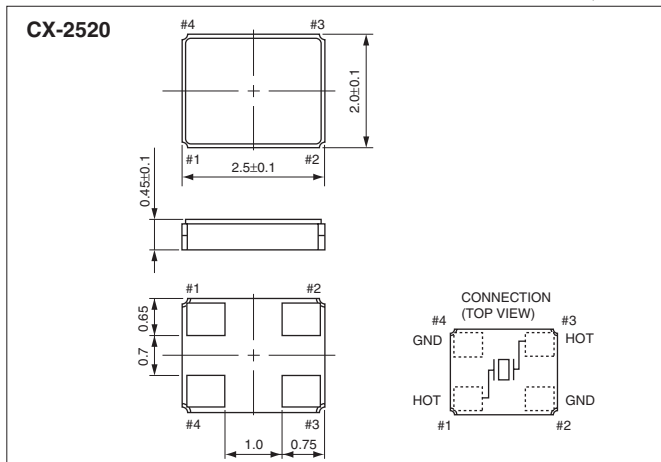
| Frequency Range | Motional Series Resistance | Units |
|-----------------|----------------------------|-------|
| 26000~34999kHz  | 100                        | ohm   |
| 35000~60000kHz  | 50                         |       |

Table2 Level of Drive

| Frequency Range | Level of Drive | Units |
|-----------------|----------------|-------|
| 26000~60000kHz  | 10(100 max.)   | μW    |

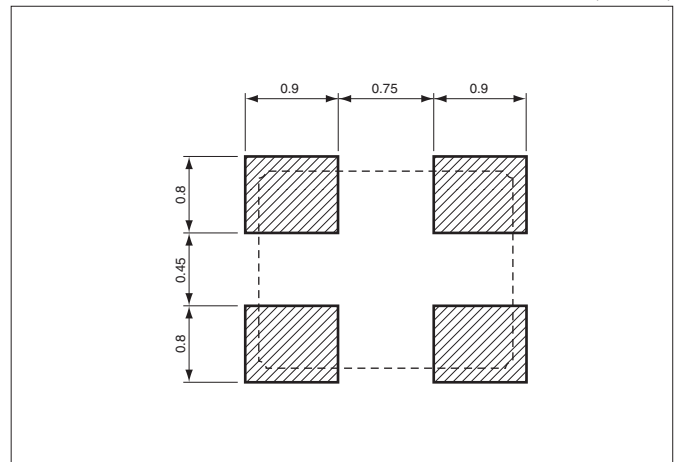
### Dimensions

(Unit : mm)



### Recommended Land Pattern

(Unit : mm)





**Pb Free**

**RoHS Comforming**

### Features

- Crystal Unit for Audio-Visual, Office Equipment.
- Miniature and low profile (3.2x2.5x0.6mm)
- Ceramic package.
- A lead free product.
- Reflow compatible.

### Applications

- Digital electronics
- Audio Visual, Office equipment

### Standard Frequencies

(kHz)

|           |           |
|-----------|-----------|
| 12000.000 | 25000.000 |
| 13560.000 | 26000.000 |
| 14318.180 | 27000.000 |
| 14745.600 | 27120.000 |
| 16000.000 | 30000.000 |
| 18432.000 | 33000.000 |
| 20000.000 | 33333.000 |
| 22579.200 | 40000.000 |
| 24000.000 | 48000.000 |
| 24576.000 | 54000.000 |

\* Please inquire about frequencies other than the above.

### Specifications

| Items                                 | Symbol           | Specification | Units   | Remarks                             |
|---------------------------------------|------------------|---------------|---------|-------------------------------------|
| Frequency Range                       | Fo               | 12000~54000   | kHz     |                                     |
| Overtone Order                        | —                | Fundamental   | —       |                                     |
| Frequency Tolerance                   | $\Delta F/F$     | $\pm 50$      | ppm     | @ 25°C                              |
| Frequency Temperature Characteristics | $\Delta F/T$     | $\pm 50$      | ppm     | ref@ 25°C Over Operating Temp Range |
| Motional Series Resistance            | Cl               | Table 1       | ohm     |                                     |
| Level of Drive                        | —                | Table 2       | $\mu W$ |                                     |
| Load Capacitance                      | C <sub>L</sub>   | 8             | pF      |                                     |
| Operating Temp. Range                 | T <sub>OPR</sub> | -10~+70       | °C      |                                     |
| Storage Temp. Range                   | T <sub>STG</sub> | -40~+85       | °C      |                                     |

\* Please inquire about specifications other than the above.

**Table1 Motional Series Resistances**

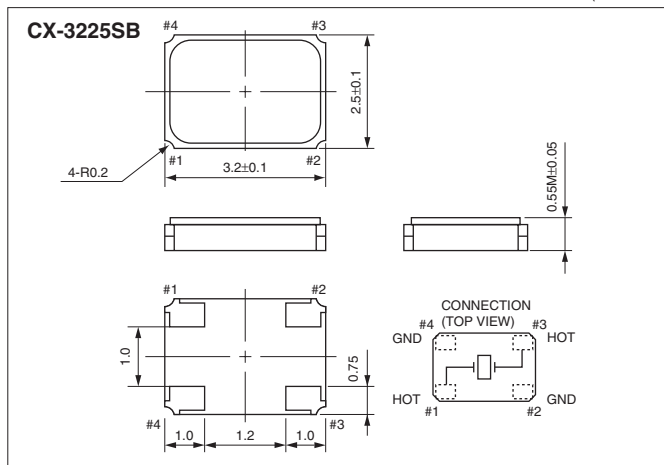
| Frequency Range | Motional Series Resistance | Units |
|-----------------|----------------------------|-------|
| 12000~13999kHz  | 300                        | ohm   |
| 14000~15999kHz  | 200                        |       |
| 16000~26999kHz  | 100                        |       |
| 27000~54000kHz  | 50                         |       |

**Table2 Level of Drive**

| Frequency Range | Level of Drive | Units   |
|-----------------|----------------|---------|
| 12000~54000kHz  | 10(100 max.)   | $\mu W$ |

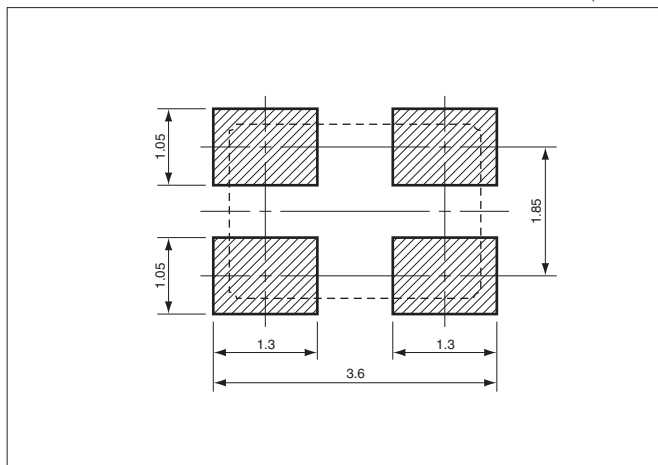
### Dimensions

(Unit : mm)



### Recommended Land Pattern

(Unit : mm)





Pb Free

RoHS Comforming

### Features

- Reference frequency for telecommunication systems
- Reflow compatible
- Using Ceramic Package resulting in high reliability
- Small and low profile

### Applications

- Mobile communications, Bluetooth, Wireless LAN

### Standard Frequencies (kHz)

|           |           |
|-----------|-----------|
| 12000.000 | 26000.000 |
| 13000.000 | 27120.000 |
| 13560.000 | 32000.000 |
| 15360.000 | 38400.000 |
| 16000.000 | 40000.000 |
| 19200.000 | 44000.000 |
| 20000.000 |           |

\* Please inquire about frequencies other than the above.

### Specifications

| Items                                 | Symbol           | Specification | Units   | Remarks                             |
|---------------------------------------|------------------|---------------|---------|-------------------------------------|
| Frequency Range                       | Fo               | 12000~54000   | kHz     |                                     |
| Overtone Order                        | —                | Fundamental   | —       |                                     |
| Frequency Tolerance                   | $\Delta F/F$     | $\pm 10$      | ppm     | @ 25°C                              |
| Frequency Temperature Characteristics | $\Delta F/T$     | $\pm 15$      | ppm     | ref@ 25°C Over Operating Temp Range |
| Motional Series Resistance            | Cl               | Table 1       | ohm     |                                     |
| Level of Drive                        | —                | Table 2       | $\mu W$ |                                     |
| Load Capacitance                      | C <sub>L</sub>   | 8             | pF      |                                     |
| Operating Temp. Range                 | T <sub>OPR</sub> | -30~+85       | °C      |                                     |
| Storage Temp. Range                   | T <sub>STG</sub> | -40~+85       | °C      |                                     |

\* Please inquire about specifications other than the above.

Table1 Motional Series Resistances

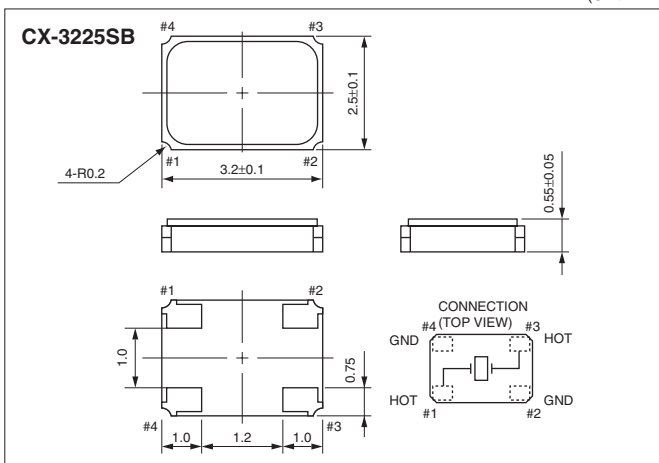
| Frequency Range | Motional Series Resistance | Units |
|-----------------|----------------------------|-------|
| 12000~13999kHz  | 300                        | ohm   |
| 14000~15999kHz  | 200                        |       |
| 16000~26999kHz  | 100                        |       |
| 27000~54000kHz  | 50                         |       |

Table2 Level of Drive

| Frequency Range | Level of Drive | Units   |
|-----------------|----------------|---------|
| 12000~54000kHz  | 10(100 max.)   | $\mu W$ |

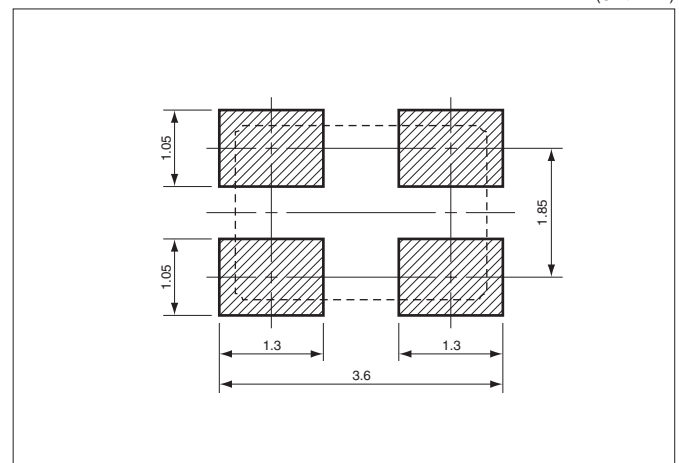
### Dimensions

(Unit : mm)

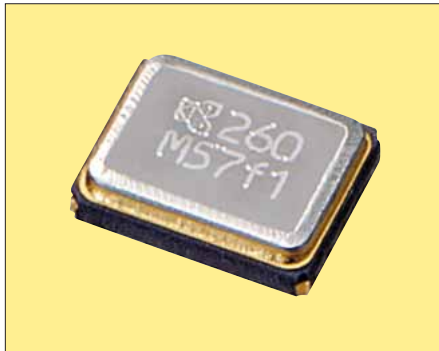


### Recommended Land Pattern

(Unit : mm)



3.2×2.5mm



Pb Free

RoHS Conforming

### Features

- Reference frequency for telecommunication systems
- Reflow compatible
- Using Ceramic Package resulting in high reliability
- Small and low profile

### Applications

- Cellular phone, IC Card, GPS

### How to Order

KSX-23-26000K C A-Q C 0 R  
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

①Type

②Nominal Frequency

| Code   | Freq.(kHz) | Code   | Freq.(kHz) |
|--------|------------|--------|------------|
| 19200K | 19200.000  | 32000K | 32000.000  |
| 19680K | 19680.000  | 38400K | 38400.000  |
| 19800K | 19800.000  | 40000K | 40000.000  |
| 26000K | 26000.000  |        |            |

\* Please inquire about frequencies other than the above.

③Load Capacitance

|   |      |
|---|------|
| C | 12pF |
|---|------|

④Frequency Stability

|   |        |
|---|--------|
| A | ±10ppm |
|---|--------|

⑤Operating Temperature

|   |                |
|---|----------------|
| Q | -30°C to +85°C |
|---|----------------|

⑥Frequency Temperature Stability

|   |        |
|---|--------|
| C | ±15ppm |
|---|--------|

⑦Frequency Offset

|   |               |
|---|---------------|
| 0 | 0Hz(Standard) |
|---|---------------|

⑧Packaging

|   |        |
|---|--------|
| R | Taping |
|---|--------|

### Specifications

| Items                           | Symbol           | Specification | Units | Remarks                             |
|---------------------------------|------------------|---------------|-------|-------------------------------------|
| Frequency Range                 | Fo               | 19200~40000   | kHz   |                                     |
| Overtone Order                  | —                | Fundamental   | —     |                                     |
| Frequency Tolerance             | ΔF/F             | ±10           | ppm   | @ 25°C                              |
| Frequency Temperature Character | ΔF/T             | ±15           | ppm   | ref@ 25°C Over Operating Temp Range |
| Motional Series Resistance      | Cl               | Table 1       | ohm   |                                     |
| Level of Drive                  | —                | Table 2       | μW    |                                     |
| Load Capacitance                | C <sub>L</sub>   | 12            | pF    |                                     |
| Operating Temp. Range           | T <sub>OPR</sub> | -30~+85       | °C    |                                     |
| Storage Temp. Range             | T <sub>STG</sub> | -40~+85       | °C    |                                     |

\* Taping packing : one unit 1,000pcs & 3,000pcs

\* Please inquire about specifications other than the above.

Table1 Motional Series Resistances

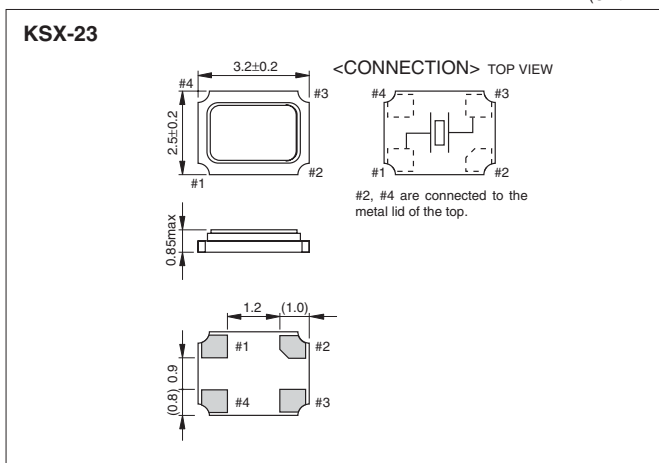
| Frequency Range | Motional Series Resistance | Units |
|-----------------|----------------------------|-------|
| 19200~24999kHz  | 60Max                      | ohm   |
| 25000~40000kHz  | 40Max                      |       |

Table2 Level of Drive

| Frequency Range | Level of Drive | Units |
|-----------------|----------------|-------|
| 19200~40000kHz  | 10(Max 100)    | μW    |

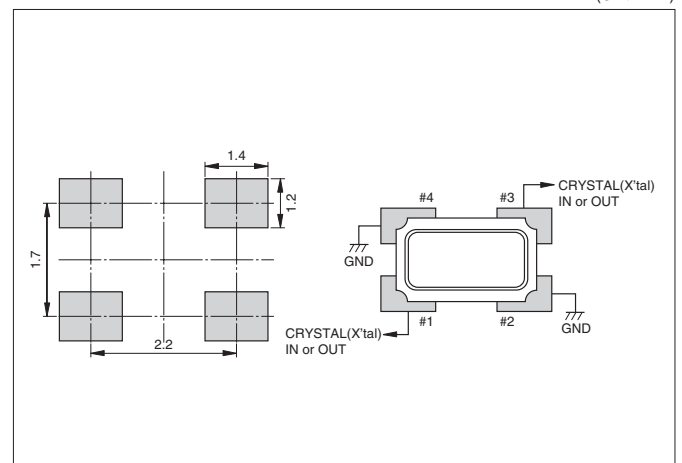
### Dimensions

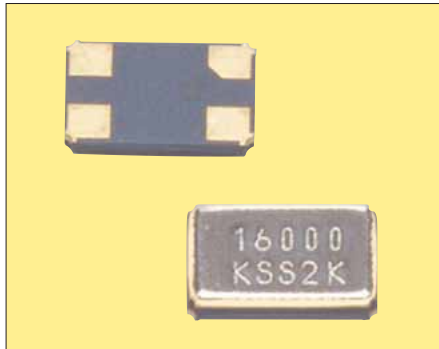
(Unit : mm)



### Recommended Land Pattern

(Unit : mm)





Pb Free

RoHS Conforming

### Features

- Reference frequency for telecommunication systems
- Reflow compatible
- Using Ceramic Package resulting in high reliability
- Small and low profile

### Applications

- Mobile communications, Bluetooth, Wireless LAN

### Standard Frequencies (kHz)

|           |           |
|-----------|-----------|
| 12000.000 | 26000.000 |
| 13000.000 | 32000.000 |
| 16000.000 | 40000.000 |
| 20000.000 |           |

\* Please inquire about frequencies other than the above.

### Specifications

| Items                                 | Symbol           | Specification | Units | Remarks                             |
|---------------------------------------|------------------|---------------|-------|-------------------------------------|
| Frequency Range                       | F <sub>0</sub>   | 12000~40000   | kHz   |                                     |
| Overtone Order                        | —                | Fundamental   | —     |                                     |
| Frequency Tolerance                   | ΔF/F             | ±10           | ppm   | @ 25°C                              |
| Frequency Temperature Characteristics | ΔF/T             | ±15           | ppm   | ref@ 25°C Over Operating Temp Range |
| Motional Series Resistance            | C <sub>1</sub>   | Table 1       | ohm   |                                     |
| Level of Drive                        | —                | Table 2       | μW    |                                     |
| Load Capacitance                      | C <sub>L</sub>   | 10            | pF    |                                     |
| Operating Temp. Range                 | T <sub>OPR</sub> | -30~+85       | °C    |                                     |
| Storage Temp. Range                   | T <sub>STG</sub> | -40~+85       | °C    |                                     |

\* Please inquire about specifications other than the above.

Table1 Motional Series Resistances

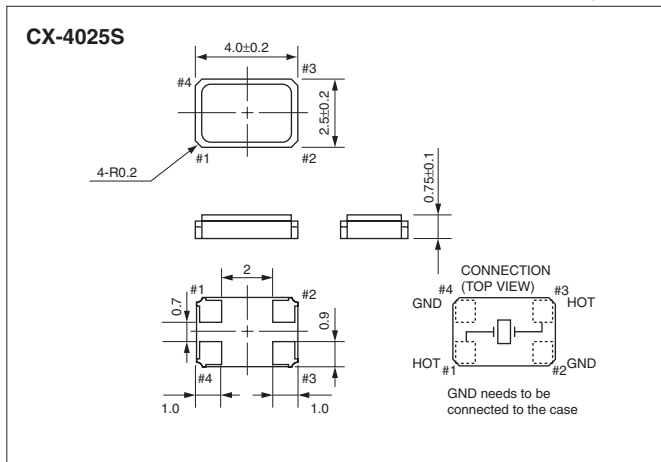
| Frequency Range | Motional Series Resistance | Units |
|-----------------|----------------------------|-------|
| 12000~1999kHz   | 80                         | ohm   |
| 20000~40000kHz  | 50                         |       |

Table2 Level of Drive

| Frequency Range | Level of Drive | Units |
|-----------------|----------------|-------|
| 12000~40000kHz  | 10(100 max.)   | μW    |

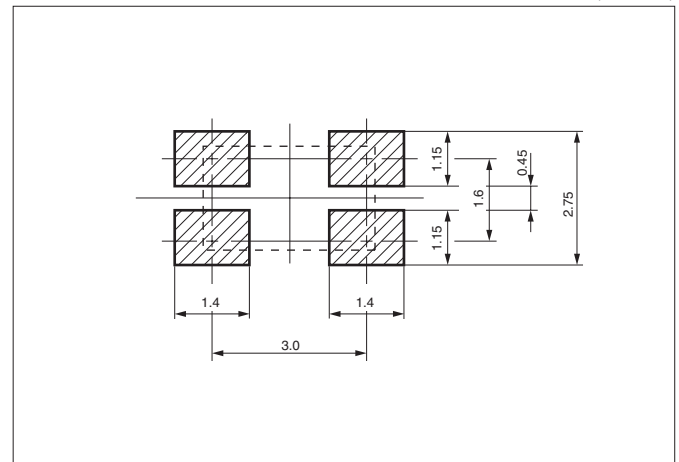
### Dimensions

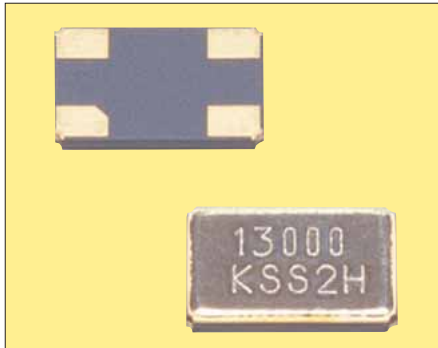
(Unit : mm)



### Recommended Land Pattern

(Unit : mm)





Pb Free

RoHS Comforming

## Features

- Reference frequency for telecommunication systems
- Reflow compatible
- Using Ceramic Package resulting in high reliability
- Small and low profile

## Applications

- Mobile communications, Bluetooth, Wireless LAN

## Standard Frequencies (kHz)

|           |           |
|-----------|-----------|
| 12000.000 | 19200.000 |
| 12800.000 | 26000.000 |
| 13000.000 | 32000.000 |
| 14400.000 | 40000.000 |
| 16000.000 | 48000.000 |

\* Please inquire about frequencies other than the above.

## Specifications

| Items                                 | Symbol           | Specification |              | Units   | Remarks                             |
|---------------------------------------|------------------|---------------|--------------|---------|-------------------------------------|
| Frequency Range                       | Fo               | 9843.75~49999 | 50~120(MHz)  | kHz     |                                     |
| Overtone Order                        | —                | Fundamental   | 3rd Overtone | —       |                                     |
| Frequency Tolerance                   | $\Delta F/F$     | $\pm 10$      |              | ppm     | @ 25°C                              |
| Frequency Temperature Characteristics | $\Delta F/T$     | $\pm 15$      |              | ppm     | ref@ 25°C Over Operating Temp Range |
| Motional Series Resistance            | Cl               | Table 1       |              | ohm     |                                     |
| Level of Drive                        | —                | Table 2       |              | $\mu W$ |                                     |
| Load Capacitance                      | C <sub>L</sub>   | 10            |              | pF      |                                     |
| Operating Temp. Range                 | T <sub>OPR</sub> | -30~+85       |              | °C      |                                     |
| Storage Temp. Range                   | T <sub>STG</sub> | -40~+85       |              | °C      |                                     |

\* Please inquire about specifications other than the above.

Table1 Motional Series Resistances

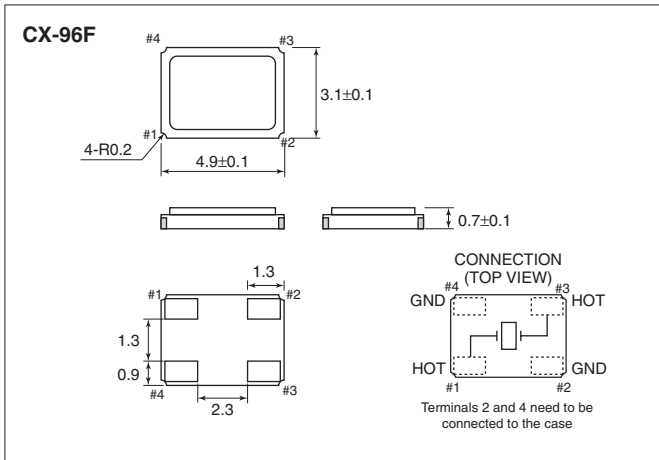
| Frequency Range | Motional Series Resistance | Units |
|-----------------|----------------------------|-------|
| 9843.75~9999kHz | 150                        | ohm   |
| 10000~11999kHz  | 80                         |       |
| 12000~25999kHz  | 50                         |       |
| 26000~49999kHz  | 40                         |       |
| 50~120(MHz)     | 80                         |       |

Table2 Level of Drive

| Frequency Range     | Level of Drive | Units   |
|---------------------|----------------|---------|
| 10000~49999kHz      | 10(100 max.)   | $\mu W$ |
| 50~120(MHz)(3rdO.T) | 10(100 max.)   |         |

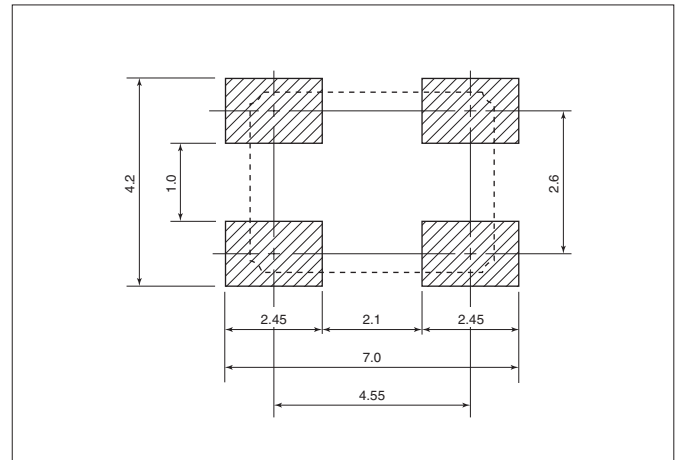
## Dimensions

(Unit : mm)



## Recommended Land Pattern

(Unit : mm)




**Pb Free**
**RoHS Comforming**

### Features

- Reference frequency for telecommunication systems
- Reflow compatible
- Using Ceramic Package resulting in high reliability
- Small, low profile and market standard dimensions

### Applications

- Cellular phone, IC Card, GPS
- Remote keyless entry

### How to Order

KSX-35-13000K C A-Q C 0 R  
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

①Type

②Nominal Frequency

| Code   | Freq.(kHz) | Code   | Freq.(kHz) |
|--------|------------|--------|------------|
| 13000K | 13000.000  | 19440K | 19440.000  |
| 13560K | 13560.000  | 19680K | 19680.000  |
| 14400K | 14400.000  | 19800K | 19800.000  |
| 16800K | 16800.000  | 26000K | 26000.000  |
| 19200K | 19200.000  |        |            |

\* Please inquire about frequencies other than the above.

③Load Capacitance

|   |      |
|---|------|
| C | 12pF |
|---|------|

④Frequency Stability

|   |        |
|---|--------|
| A | ±10ppm |
|---|--------|

⑤Operating Temperature

|   |                |
|---|----------------|
| Q | −30°C to +85°C |
|---|----------------|

⑥Frequency Temperature Stability

|   |        |
|---|--------|
| C | ±15ppm |
|---|--------|

⑦Frequency Offset

|   |               |
|---|---------------|
| 0 | 0Hz(Standard) |
|---|---------------|

⑧Packaging

|   |        |
|---|--------|
| R | Taping |
|---|--------|

### Specifications

| Items                           | Symbol           | Specification | Units | Remarks                             |
|---------------------------------|------------------|---------------|-------|-------------------------------------|
| Frequency Range                 | Fo               | 12600~27820   | kHz   |                                     |
| Overtone Order                  | —                | Fundamental   | —     |                                     |
| Frequency Tolerance             | ΔF/F             | ±10           | ppm   | @ 25°C                              |
| Frequency Temperature Character | ΔF/T             | ±15           | ppm   | ref@ 25°C Over Operating Temp Range |
| Motional Series Resistance      | Cl               | Table 1       | ohm   |                                     |
| Level of Drive                  | —                | Table 2       | μW    |                                     |
| Load Capacitance                | CL               | 12            | pF    |                                     |
| Operating Temp. Range           | T <sub>OPR</sub> | −30~+85       | °C    |                                     |
| Storage Temp. Range             | T <sub>STG</sub> | −40~+85       | °C    |                                     |

\* Taping packing : one unit 1,000pcs & 3,000pcs

\* Please inquire about specifications other than the above.

### Table1 Motional Series Resistances

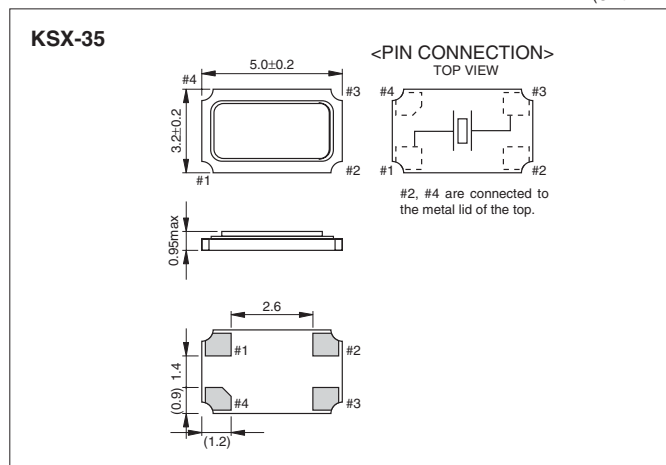
| Frequency Range | Motional Series Resistance | Units |
|-----------------|----------------------------|-------|
| 12600~18999kHz  | 60Max                      | ohm   |
| 11000~25999kHz  | 50Max                      |       |
| 26000~27820kHz  | 40Max                      |       |

### Table2 Level of Drive

| Frequency Range | Level of Drive | Units |
|-----------------|----------------|-------|
| 12600~27820kHz  | 10(Max 100)    | μW    |

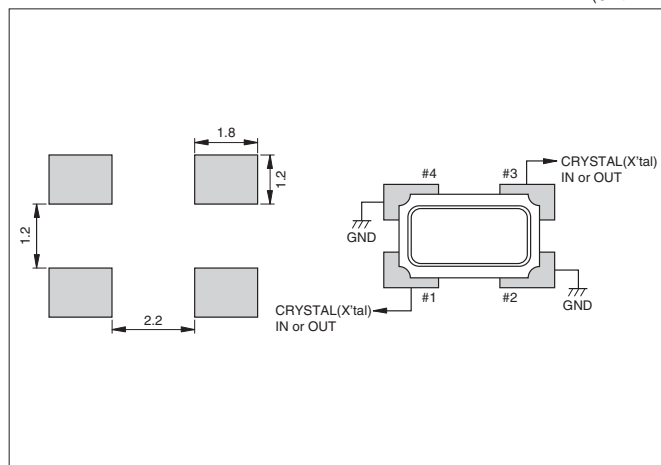
### Dimensions

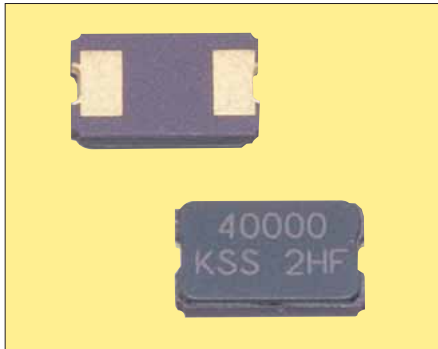
(Unit : mm)



### Recommended Land Pattern

(Unit : mm)





RoHS Comforming

### Features

- Crystal Unit for Audio-Visual, Office Equipment.
- Small and low profile.(5.0x3.2x1.1mm)
- Ceramic package.
- Product with lead free terminations.
- Reflow compatible.

### Applications

- Digital electronics
- Audio visual, Office equipment

### Standard Frequencies (kHz)

|           |           |
|-----------|-----------|
| 10000.000 | 24000.000 |
| 12000.000 | 24545.450 |
| 14318.180 | 24576.000 |
| 14745.600 | 27000.000 |
| 16934.400 | 36000.000 |
| 18432.000 | 48000.000 |
| 22579.200 | 54000.000 |

\* Please inquire about frequencies other than the above.

### Specifications

| Items                                 | Symbol           | Specification | Units | Remarks                             |
|---------------------------------------|------------------|---------------|-------|-------------------------------------|
| Frequency Range                       | F <sub>0</sub>   | 9843.75~54000 | kHz   |                                     |
| Overtone Order                        | —                | Fundamental   | —     |                                     |
| Frequency Tolerance                   | $\Delta F/F$     | ±50           | ppm   | @ 25°C                              |
| Frequency Temperature Characteristics | $\Delta F/T$     | ±50           | ppm   | ref@ 25°C Over Operating Temp Range |
| Motional Series Resistance            | C <sub>1</sub>   | Table 1       | ohm   |                                     |
| Level of Drive                        | —                | Table 2       | μW    |                                     |
| Load Capacitance                      | C <sub>L</sub>   | 12            | pF    |                                     |
| Operating Temp. Range                 | T <sub>OPR</sub> | -10~+70       | °C    |                                     |
| Storage Temp. Range                   | T <sub>STG</sub> | -40~+85       | °C    |                                     |

\* Please inquire about specifications other than the above.

**Table1 Motional Series Resistances**

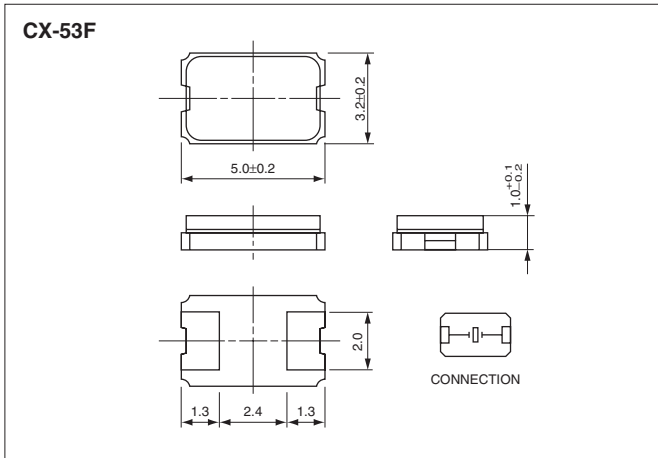
| Frequency Range  | Motional Series Resistance | Units |
|------------------|----------------------------|-------|
| 9843.75~11999kHz | 200                        | ohm   |
| 12000~13999kHz   | 150                        |       |
| 14000~29999kHz   | 100                        |       |
| 30000~54000kHz   | 50                         |       |

**Table2 Level of Drive**

| Frequency Range  | Level of Drive | Units |
|------------------|----------------|-------|
| 9843.75~15999kHz | 10(500 max.)   | μW    |
| 16000~24999kHz   | 10(300 max.)   |       |
| 25000~54000kHz   | 10(100 max.)   |       |

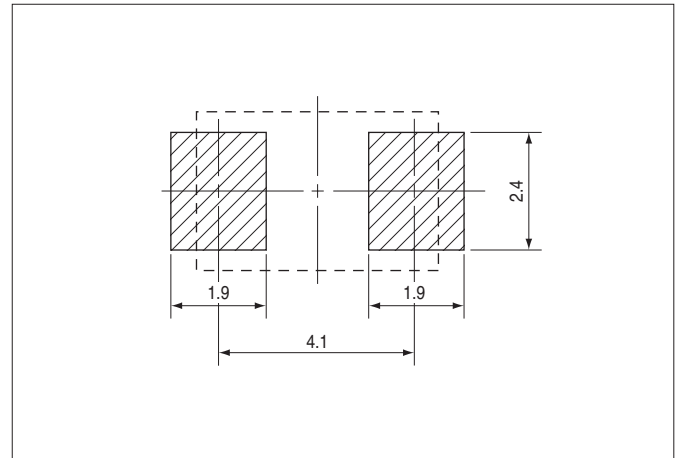
### Dimensions

(Unit : mm)



### Recommended Land Pattern

(Unit : mm)





RoHS Comforming

### Features

- Crystal Unit for Audio-Visual, Office Equipment.
- Small and low profile.(8.0x4.5x1.8mm)
- Ceramic package.
- Product with lead free terminations.
- Reflow compatible.

### Applications

- Audio visual, Office equipment

### Standard Frequencies

(kHz)

|           |           |           |
|-----------|-----------|-----------|
| 14318.180 | 20000.000 | 28636.360 |
| 16000.000 | 21477.270 | 30000.000 |
| 16384.000 | 24000.000 | 32000.000 |
| 16934.400 | 24576.000 | 36000.000 |
| 19660.800 | 27000.000 | 40000.000 |

\* Please inquire about frequencies other than the above.

### Specifications

| Items                                 | Symbol           | Specification | Units | Remarks                             |
|---------------------------------------|------------------|---------------|-------|-------------------------------------|
| Frequency Range                       | F <sub>0</sub>   | 7200~48000    | kHz   |                                     |
| Overtone Order                        | —                | Fundamental   | —     |                                     |
| Frequency Tolerance                   | $\Delta F/F$     | ±50           | ppm   | @ 25°C                              |
| Frequency Temperature Characteristics | $\Delta F/T$     | ±50           | ppm   | ref@ 25°C Over Operating Temp Range |
| Motional Series Resistance            | C <sub>1</sub>   | Table 1       | ohm   |                                     |
| Level of Drive                        | —                | Table 2       | μW    |                                     |
| Load Capacitance                      | C <sub>L</sub>   | 12            | pF    |                                     |
| Operating Temp. Range                 | T <sub>OPR</sub> | -10~+70       | °C    |                                     |
| Storage Temp. Range                   | T <sub>STG</sub> | -40~+85       | °C    |                                     |

\* Please inquire about specifications other than the above.

**Table1 Motional Series Resistances**

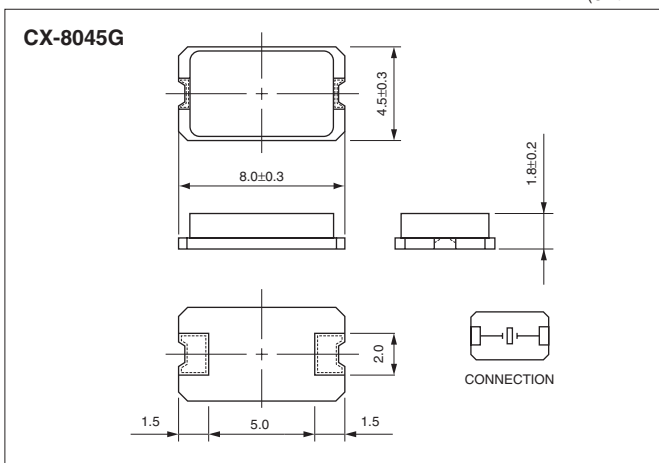
| Frequency Range | Motional Series Resistance | Units |
|-----------------|----------------------------|-------|
| 7200~9999kHz    | 200                        | ohm   |
| 10000~11999kHz  | 150                        |       |
| 12000~30000kHz  | 50                         |       |

**Table2 Level of Drive**

| Frequency Range | Level of Drive | Units |
|-----------------|----------------|-------|
| 7200~9999kHz    | 10(500 max.)   | μW    |
| 16000~24999kHz  | 10(300 max.)   |       |
| 25000~32000kHz  | 10(100 max.)   |       |

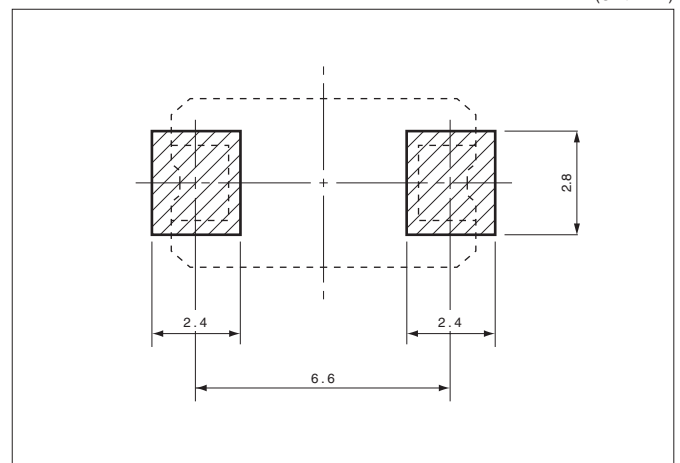
### Dimensions

(Unit : mm)



### Recommended Land Pattern

(Unit : mm)





RoHS Comforming

### Features

- Crystal Unit for Automotive Electronics.
- Small and low profile.(11.8x5.5x1.8mm)
- Ceramic package.
- Product with lead free terminations.
- Reflow compatible.

### Applications

- Digital electronics
- Audio & visual, Office equipment

### Standard Frequencies (kHz)

|           |           |
|-----------|-----------|
| 3579.545  | 14318.180 |
| 3686.400  | 16000.000 |
| 4000.000  | 16934.400 |
| 6000.000  | 19660.800 |
| 8000.000  | 20000.000 |
| 12000.000 |           |

\* Please inquire about frequencies other than the above.

### Specifications

| Items                                 | Symbol           | Specification |               | Units | Remarks                             |
|---------------------------------------|------------------|---------------|---------------|-------|-------------------------------------|
| Frequency Range                       | F <sub>0</sub>   | 3500~28999    | 29~60(MHz)    | kHz   |                                     |
| Overtone Order                        | —                | Fundamental   | 3rd. Overtone | —     |                                     |
| Frequency Tolerance                   | ΔF/F             | ±50           |               | ppm   | @ 25°C                              |
| Frequency Temperature Characteristics | ΔF/T             | ±50           |               | ppm   | ref@ 25°C Over Operating Temp Range |
| Motional Series Resistance            | C <sub>1</sub>   | Table 1       |               | ohm   |                                     |
| Level of Drive                        | —                | Table 2       |               | μW    |                                     |
| Load Capacitance                      | C <sub>L</sub>   | 12            |               | pF    |                                     |
| Operating Temp. Range                 | T <sub>OPR</sub> | -10~+70       |               | °C    |                                     |
| Storage Temp. Range                   | T <sub>STG</sub> | -40~+85       |               | °C    |                                     |

\* Please inquire about specifications other than the above.

**Table1 Motional Series Resistances**

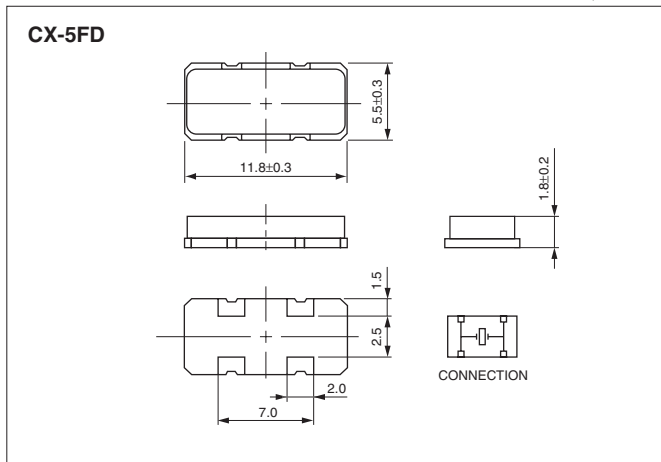
| Frequency Range | Motional Series Resistance | Units |
|-----------------|----------------------------|-------|
| 3500~3999kHz    | 300                        | ohm   |
| 4000~7999kHz    | 200                        |       |
| 8000~11999kHz   | 120                        |       |
| 12000~20000kHz  | 100                        |       |
| 29~60MHz        | 150                        |       |

**Table2 Level of Drive**

| Frequency Range | Level of Drive | Units |
|-----------------|----------------|-------|
| 3500~15999kHz   | 10(500 max.)   | μW    |
| 16000~28999kHz  | 10(300 max.)   |       |
| 29~60MHz        | 10(300 max.)   |       |

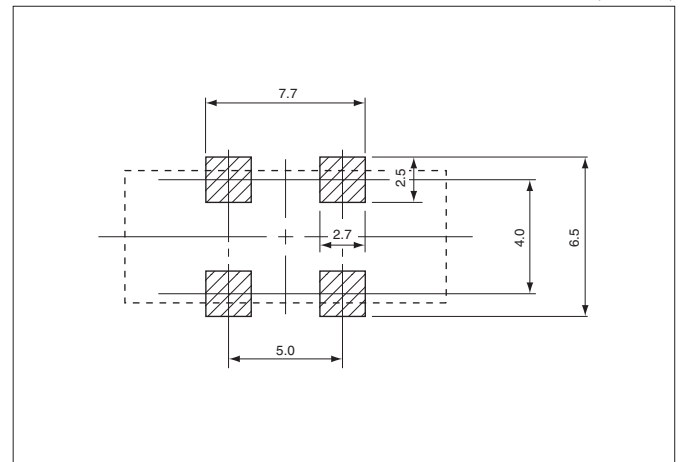
### Dimensions

(Unit : mm)



### Recommended Land Pattern

(Unit : mm)





Pb Free

RoHS Compliant

**Features**

- Crystal Unit for Audio & Visual, Office Equipment.
- Metal package, lead type.
- A resistance weld hermetic sealed type.
- Suitable for high density assembly and mass production.

**Applications**

- Digital electronics
- Audio & visual, Office equipment

**Standard Frequencies**

(kHz)

|          |           |           |
|----------|-----------|-----------|
| 3200.000 | 7200.000  | 14318.180 |
| 3579.545 | 7372.800  | 16000.000 |
| 3686.400 | 8000.000  | 16934.400 |
| 4000.000 | 10000.000 | 17280.000 |
| 4194.304 | 10240.000 | 17734.476 |
| 4332.000 | 10738.635 | 20000.000 |
| 4433.619 | 11000.000 | 21477.270 |
| 4500.000 | 11059.200 | 24000.000 |
| 4915.200 | 12000.000 | 24576.000 |
| 6000.000 | 12288.000 | 25000.000 |
| 6144.000 | 13500.000 | 27000.000 |

(MHz)

|           |           |           |
|-----------|-----------|-----------|
| 29.491200 | 35.328000 | 50.000000 |
| 32.000000 | 40.000000 | 54.000000 |
| 33.868800 | 48.000000 | 60.000000 |

\* Please inquire about frequencies other than the above.

**Specifications**

| Items                                 | Symbol           | Specification |              | Units   | Remarks                             |
|---------------------------------------|------------------|---------------|--------------|---------|-------------------------------------|
| Frequency Range                       | Fo               | 3200~33999kHz | 30~60 (MHz)  | kHz     |                                     |
| Overtone Order                        | —                | Fundamental   | 3rd Overtone | —       |                                     |
| Frequency Tolerance                   | $\Delta F/F$     | $\pm 50$      |              | ppm     | @ 25°C                              |
| Frequency Temperature Characteristics | $\Delta F/T$     | $\pm 50$      |              | ppm     | ref@ 25°C Over Operating Temp Range |
| Motional Series Resistance            | Cl               | Table 1       |              | ohm     |                                     |
| Level of Drive                        | —                | Table 2       |              | $\mu W$ |                                     |
| Load Capacitance                      | CL               | 12            |              | pF      |                                     |
| Operating Temp. Range                 | T <sub>OPR</sub> | -10~+70       |              | °C      |                                     |
| Storage Temp. Range                   | T <sub>STG</sub> | -40~+85       |              | °C      |                                     |

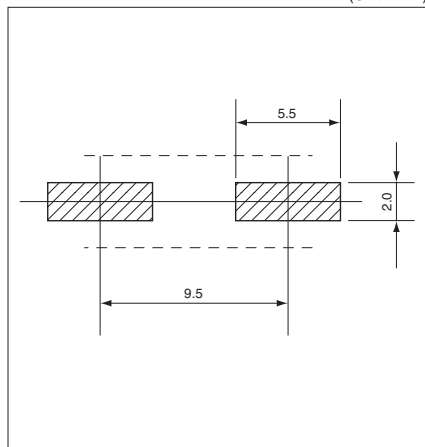
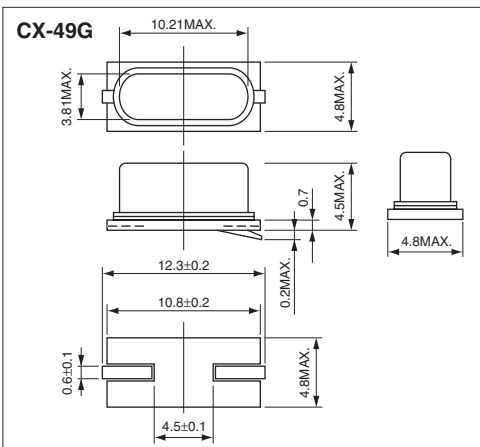
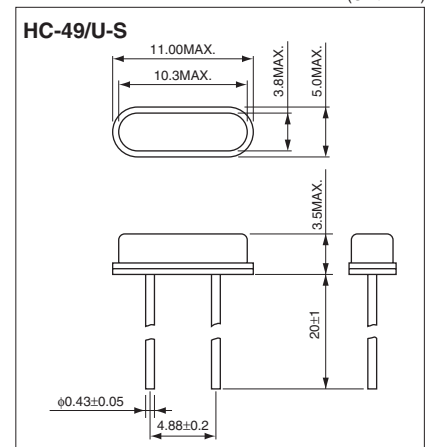
\* Please inquire about specifications other than the above.

**Table1 Motional Series Resistances**

| Frequency Range | Motional Series Resistance | Units |
|-----------------|----------------------------|-------|
| 3200~3499kHz    | 300                        | ohm   |
| 3500~4099kHz    | 150                        |       |
| 4100~4799kHz    | 120                        |       |
| 4800~5999kHz    | 100                        |       |
| 6000~11999kHz   | 90                         |       |
| 12000~13499kHz  | 70                         |       |
| 13500~33999kHz  | 50                         |       |
| 30~60MHz        | 150                        |       |

**Table2 Level of Drive**

| Frequency Range | Level of Drive | Units   |
|-----------------|----------------|---------|
| 3200~15999kHz   | 10(500 max.)   | $\mu W$ |
| 16000~24999kHz  | 10(300 max.)   |         |
| 25000~33999kHz  | 10(100 max.)   |         |
| 30~60MHz        | 10(300 max.)   |         |

**Dimensions****Recommended Land Pattern** (Unit : mm)



RoHS Comforming

### Features

- Crystal Unit for Automotive Electronics.
- Small and low profile.(5.0x3.2x1.3mm)
- Ceramic package.
- Product with lead free terminations.
- Reflow compatible.

### Applications

- Engine control

### Standard Frequencies (kHz)

|           |           |
|-----------|-----------|
| 10000.000 | 18000.000 |
| 12000.000 | 20000.000 |
| 15000.000 | 24000.000 |
| 16000.000 | 25000.000 |

\* Please inquire about frequencies other than the above.

## Specifications

| Items                                 | Symbol           | Specification | Units | Remarks                             |
|---------------------------------------|------------------|---------------|-------|-------------------------------------|
| Frequency Range                       | F <sub>0</sub>   | 9843.75~40000 | kHz   |                                     |
| Overtone Order                        | —                | Fundamental   | —     |                                     |
| Frequency Tolerance                   | ΔF/F             | ±100          | ppm   | @ 25°C                              |
| Frequency Temperature Characteristics | ΔF/T             | ±200          | ppm   | ref@ 25°C Over Operating Temp Range |
| Motional Series Resistance            | C <sub>1</sub>   | Table 1       | ohm   |                                     |
| Level of Drive                        | —                | Table 2       | μW    |                                     |
| Load Capacitance                      | C <sub>L</sub>   | 12            | pF    |                                     |
| Operating Temp. Range                 | T <sub>OPR</sub> | -40~+125      | °C    |                                     |
| Storage Temp. Range                   | T <sub>STG</sub> | -40~+150      | °C    |                                     |

\* Please inquire about specifications other than the above.

Table1 Motional Series Resistances

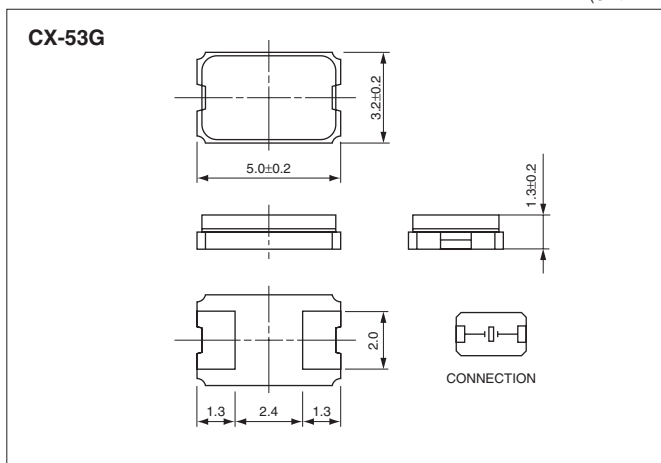
| Frequency Range  | Motional Series Resistance | Units |
|------------------|----------------------------|-------|
| 9843.75~11999kHz | 200                        | ohm   |
| 12000~13999kHz   | 150                        |       |
| 14000~29999kHz   | 100                        |       |
| 30000~40000kHz   | 50                         |       |

Table2 Level of Drive

| Frequency Range  | Level of Drive | Units |
|------------------|----------------|-------|
| 9843.75~15999kHz | 10(500 max.)   | μW    |
| 16000~24999kHz   | 10(300 max.)   |       |
| 25000~40000kHz   | 10(100 max.)   |       |

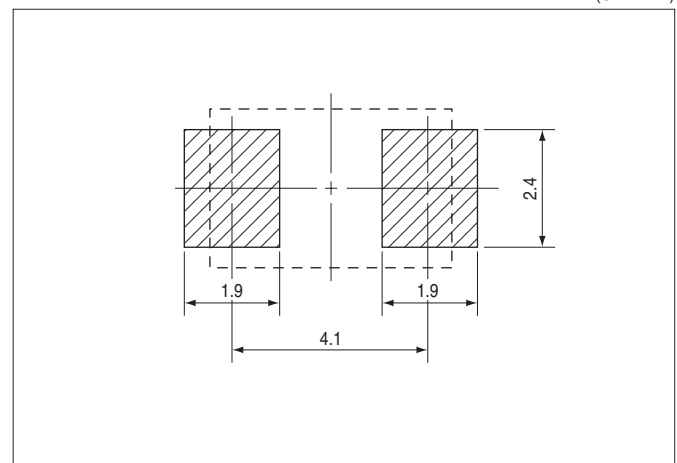
## Dimensions

(Unit : mm)



## Recommended Land Pattern

(Unit : mm)





RoHS Conforming

**Features**

- Crystal Unit for Automotive Electronics.
- Small and low profile.(8.0x4.5x1.9mm)
- Ceramic package, J lead type.
- Product with lead free terminations.
- Reflow compatible.

**Applications**

- Engine control, TPMS

**Standard Frequencies** (kHz)

|           |           |
|-----------|-----------|
| 8000.000  | 16000.000 |
| 9843.750  | 18000.000 |
| 10000.000 | 20000.000 |
| 12000.000 | 24000.000 |
| 13560.000 | 25000.000 |
| 14000.000 | 30000.000 |

\* Please inquire about frequencies other than the above.

**Specifications**

| Items                                 | Symbol           | Specification | Units | Remarks                             |
|---------------------------------------|------------------|---------------|-------|-------------------------------------|
| Frequency Range                       | F <sub>0</sub>   | 8000~30000    | kHz   |                                     |
| Overtone Order                        | —                | Fundamental   | —     |                                     |
| Frequency Tolerance                   | $\Delta F/F$     | ±100          | ppm   | @ 25°C                              |
| Frequency Temperature Characteristics | $\Delta F/T$     | ±200          | ppm   | ref@ 25°C Over Operating Temp Range |
| Motional Series Resistance            | Cl               | Table 1       | ohm   |                                     |
| Level of Drive                        | —                | Table 2       | μW    |                                     |
| Load Capacitance                      | CL               | 12            | pF    |                                     |
| Operating Temp. Range                 | T <sub>OPR</sub> | -40~+125      | °C    |                                     |
| Storage Temp. Range                   | T <sub>STG</sub> | -40~+150      | °C    |                                     |

\* Please inquire about specifications other than the above.

**Table1 Motional Series Resistances**

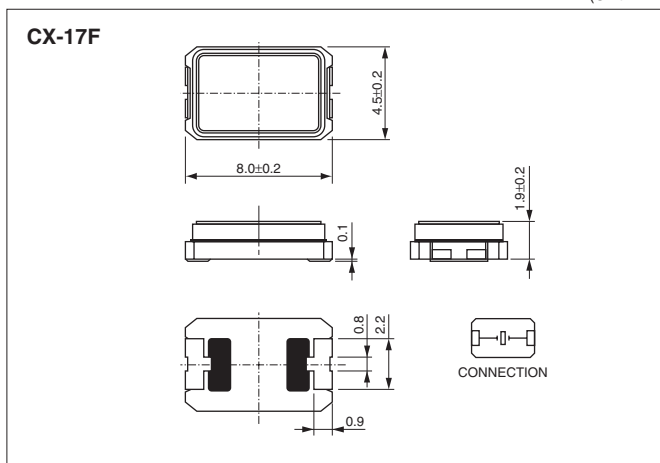
| Frequency Range | Motional Series Resistance | Units |
|-----------------|----------------------------|-------|
| 8000~9999kHz    | 200                        | ohm   |
| 10000~11999kHz  | 150                        |       |
| 12000~30000kHz  | 100                        |       |

**Table2 Level of Drive**

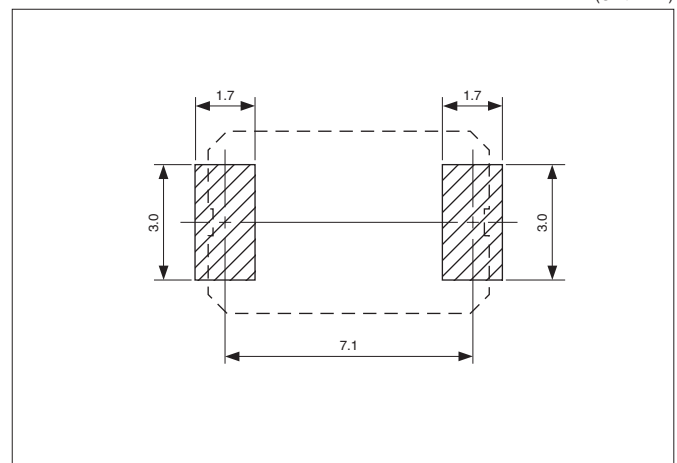
| Frequency Range | Level of Drive | Units |
|-----------------|----------------|-------|
| 8000~15999kHz   | 10(500 max.)   | μW    |
| 16000~24999kHz  | 10(300 max.)   |       |
| 25000~30000kHz  | 10(100 max.)   |       |

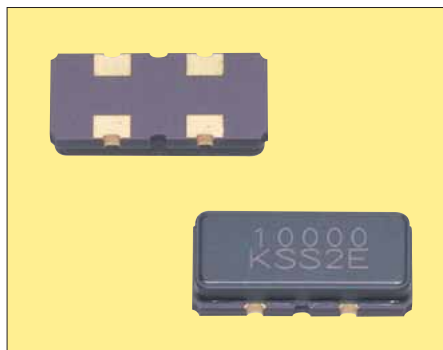
**Dimensions**

(Unit : mm)

**Recommended Land Pattern**

(Unit : mm)




**RoHS Conforming**

### Features

- Crystal Unit for Automotive Electronics.
- Small and low profile.(11.8x5.5x2.5mm)
- Ceramic package.
- Product with lead free terminations.
- Reflow compatible.

### Applications

- Engine control

### Standard Frequencies (kHz)

|           |           |
|-----------|-----------|
| 4000.000  | 12000.000 |
| 5000.000  | 16000.000 |
| 6000.000  | 18000.000 |
| 8000.000  | 20000.000 |
| 10000.000 |           |

\* Please inquire about frequencies other than the above.

## Specifications

| Items                                 | Symbol           | Specification | Units | Remarks                             |
|---------------------------------------|------------------|---------------|-------|-------------------------------------|
| Frequency Range                       | F <sub>0</sub>   | 3500~20000    | kHz   |                                     |
| Overtone Order                        | —                | Fundamental   | —     |                                     |
| Frequency Tolerance                   | ΔF/F             | ±100          | ppm   | @ 25°C                              |
| Frequency Temperature Characteristics | ΔF/T             | ±200          | ppm   | ref@ 25°C Over Operating Temp Range |
| Motional Series Resistance            | C <sub>1</sub>   | Table 1       | ohm   |                                     |
| Level of Drive                        | —                | Table 2       | μW    |                                     |
| Load Capacitance                      | C <sub>L</sub>   | 12            | pF    |                                     |
| Operating Temp. Range                 | T <sub>OPR</sub> | -40~+125      | °C    |                                     |
| Storage Temp. Range                   | T <sub>STG</sub> | -40~+125      | °C    |                                     |

\* Please inquire about specifications other than the above.

**Table1 Motional Series Resistances**

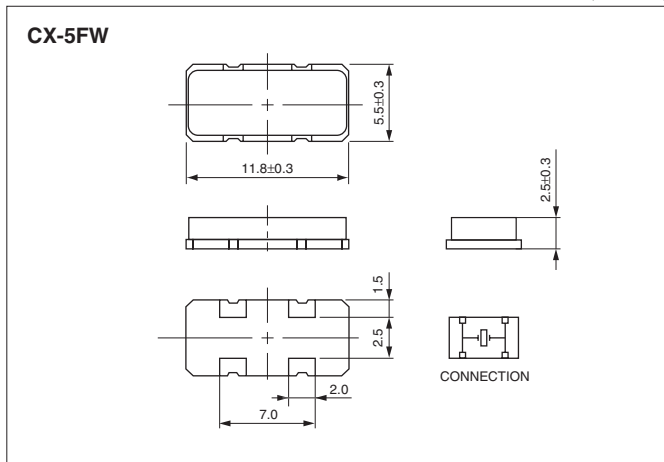
| Frequency Range | Motional Series Resistance | Units |
|-----------------|----------------------------|-------|
| 3500~3999kHz    | 300                        | ohm   |
| 4000~7999kHz    | 200                        |       |
| 8000~11999kHz   | 120                        |       |
| 12000~20000kHz  | 100                        |       |

**Table2 Level of Drive**

| Frequency Range | Level of Drive | Units |
|-----------------|----------------|-------|
| 3500~15999kHz   | 10(500 max.)   | μW    |
| 16000~20000kHz  | 10(300 max.)   |       |

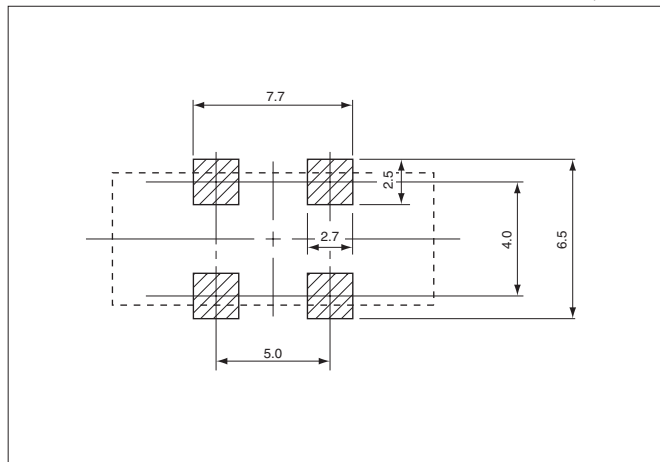
## Dimensions

(Unit : mm)



## Recommended Land Pattern

(Unit : mm)





### Features

- Crystal Unit for Automotive Electronics.
- Metal package, lead type.
- A resistance weld hermetic sealed type.
- Suitable for high density assembly and mass production.

### Applications

- Engine control

### Standard Frequencies (kHz)

|           |           |
|-----------|-----------|
| 4000.000  | 12000.000 |
| 5000.000  | 16000.000 |
| 6000.000  | 18000.000 |
| 8000.000  | 20000.000 |
| 10000.000 |           |

\* Please inquire about frequencies other than the above.

## Specifications

| Items                                 | Symbol           | Specification | Units   | Remarks                             |
|---------------------------------------|------------------|---------------|---------|-------------------------------------|
| Frequency Range                       | Fo               | 3200~20000    | kHz     |                                     |
| Overtone Order                        | —                | Fundamental   | —       |                                     |
| Frequency Tolerance                   | $\Delta F/F$     | $\pm 100$     | ppm     | @ 25°C                              |
| Frequency Temperature Characteristics | $\Delta F/T$     | $\pm 200$     | ppm     | ref@ 25°C Over Operating Temp Range |
| Motional Series Resistance            | Cl               | Table 1       | ohm     |                                     |
| Level of Drive                        | —                | Table 2       | $\mu W$ |                                     |
| Load Capacitance                      | CL               | 12            | pF      |                                     |
| Operating Temp. Range                 | T <sub>OPR</sub> | -40~+125      | °C      |                                     |
| Storage Temp. Range                   | T <sub>STG</sub> | -40~+125      | °C      |                                     |

\* Please inquire about specifications other than the above.

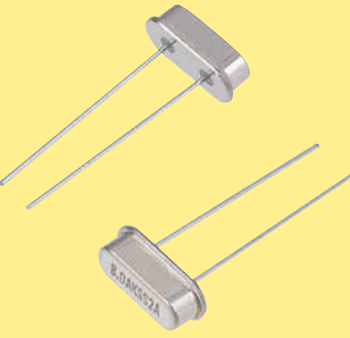
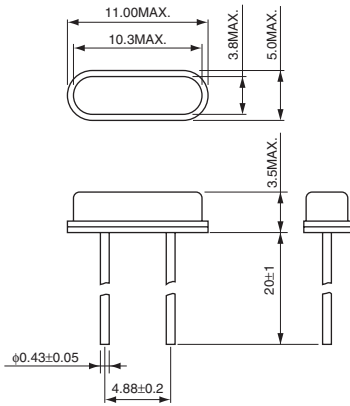
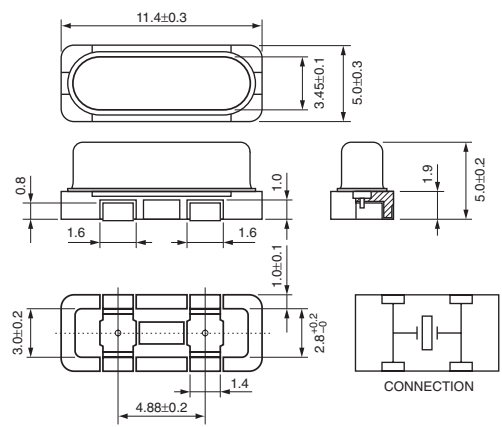
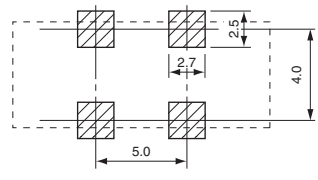
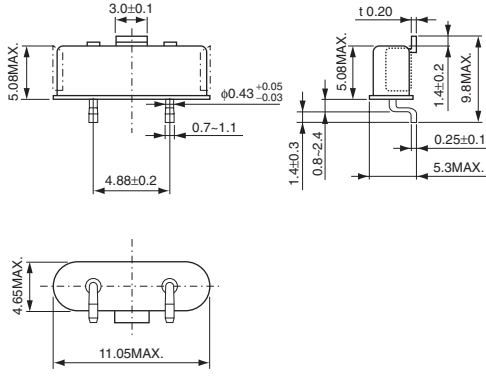
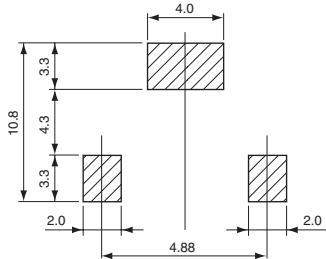
Table1 Motional Series Resistances

| Frequency Range | Motional Series Resistance | Units |
|-----------------|----------------------------|-------|
| 3200~3499kHz    | 300                        | ohm   |
| 3500~4099kHz    | 150                        |       |
| 4100~4799kHz    | 120                        |       |
| 4800~5999kHz    | 100                        |       |
| 6000~11999kHz   | 90                         |       |
| 12000~13499kHz  | 70                         |       |
| 13500~20000kHz  | 50                         |       |

Table2 Level of Drive

| Frequency Range | Level of Drive | Units   |
|-----------------|----------------|---------|
| 3200~15999kHz   | 10(500 max.)   | $\mu W$ |
| 16000~20000kHz  | 10(300 max.)   |         |

### Dimensions / Recommended Land Patterns

| Product Type                                                                                                                                   | Dimensions (Unit : mm)                                                               | Recommended Land Pattern (Unit : mm)                                                  |
|------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| <b>HC-49/U-S</b><br><br><b>Pb Free</b> <b>RoHS Conforming</b> |     |                                                                                       |
| <b>CX-49F</b><br><br><b>Pb Free</b> <b>RoHS Conforming</b>  |   |  |
| <b>CX-49L</b><br>                                           |  |  |

## 1. Shock & Drop • Vibration

Do not inflict excessive shock and mechanical vibration that exceeds the norm, such as hitting or mistakenly dropping, when transporting and mounting on a board. There are cases when pieces of crystal break, and pieces that are used become damaged, and become inoperable. When a shock or vibration that exceeds the norm has been inflicted, make sure to check the characteristics.

## 2. Cleaning

Since a crystal piece can be broken by resonance when a crystal device is cleaned by ultrasonic cleaning. Be careful when carrying out ultrasonic cleaning.

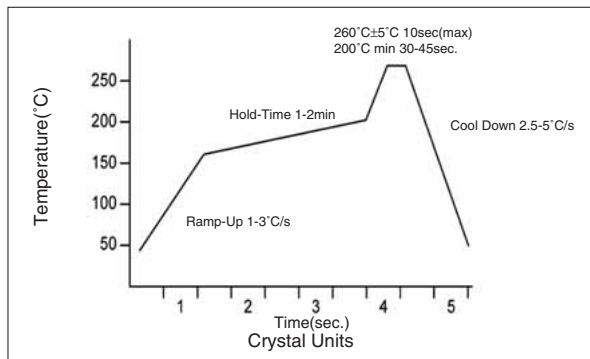
## 3. Soldering conditions

To maintain the product reliability, please follow recommended conditions.

### Standard soldering iron conditions

|                | Crystal Units  |
|----------------|----------------|
| Soldering iron | 280°C ~ 340°C  |
| Time           | 3+1/-0sec. max |

### Reflow conditions (Example)



Recommended reflow Conditions vary depending upon products.  
Please check with the respective specification for details.

## 4. Mounting Precautions

### Leaded Devices

The special glass, located where the lead of the retainer base comes out, is aligned with the coefficient of thermal expansion of the lead. If the glass is damaged and cracks appear, there may be cases in which performance deteriorates and it fails to operate.

Consequently, when making the device adhere closely and applying solder, align the gap of the hole of the board with the gap of the lead and insert without excessive force.

When making the device adhere closely to a through hole board and applying solder, be careful that the solder does not get into the metal part of the retainer base and cause a short. Putting in an insulation spacer is one more method of preventing a short circuit.

When the lead is mounted floating, fix it as far as possible so that contact with other parts and the breakage due to the fatigue, and the mechanical resonance of the lead will not occur.

When the lead is bent and used, do not bend the lead directly from the base, separate it 0.5mm or more and then bend it. When bending, before attaching to the board, fix the place where the lead comes out in advance and attach it after bending so that a crack does not occur in the glass part.

### Surface Mount Devices

The lead of the device and the pattern of the board is soldered on the surface. Since extreme deformation of the board tears off the pattern, tears off the lead metal, cracks the solder and damages the sealed part of the device and there are cases in which performance deteriorates and operation fails, use it within the stipulated bending conditions. Due to the small cracks in the board resulting from mounting, please pay sufficient attention when attaching a device at the position where the warping of the board is great.

When using an automatic loading machine, as far as possible, select a type that has a small impact and use it while confirming that there is no damage.

Surface mount devices are NOT flow soldering compatible.

## 5. Storage Condition

Since the long hour high temperature and low temperature storage, as well as the storage at high humidity are causes of deterioration in frequency accuracy and solderability.

Parts should be stored in temperature range of -5 to +40°C, humidity 40 to 60% RH, and avoid direct sunlight. Then use within 6 months.

## For Proper Use of Crystal Units

### 1. Characteristics of crystal units

The thickness of crystal vibrator of the AT cut crystal unit as described in the previous page differs depending on the overtone mode.

#### (1) Relationship between thickness of crystal blank and oscillation frequency

| Cut angle/mode overtone | Frequency range (MHz) | Formula of thickness of crystal blank |
|-------------------------|-----------------------|---------------------------------------|
| AT/Fundamental mode     | 3.5~33                | $1.67/f$                              |
| AT/3 <sup>rd</sup> O. T | 33~100                | $5.01/f$                              |
| AT/5 <sup>th</sup> O. T | 100~150               | $8.35/f$                              |
| AT/7 <sup>th</sup> O. T | 150~200               | $11.69/f$                             |

f : Series resonance frequency. (MHz)

In case of calculating the thickness of AT-cut 16MHz  
 $t=1.67/16=0.104(\text{mm})$

#### (2) Examples of specifications for frequency-temperature characteristics

The frequency-temperature characteristics of the AT cut crystal unit are tertiary curves.

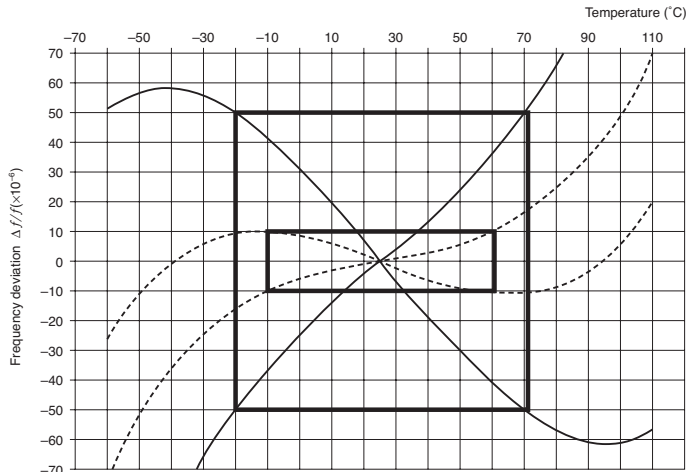
The diagram below shows examples of the tertiary curves that pass temperature range and frequency deviation specifications.

The range enclosed by the smaller rectangular satisfies the following specification:

$\pm 10 \times 10^{-6}$  (-10 to 60: 25°C)

The range enclosed by the larger rectangular satisfies the following specification:

$\pm 50 \times 10^{-6}$  (-20 to 70: 25°C)



\* These are examples. Required frequency-temperature specifications are determined through individual consultations.

#### (3) Equivalent electric circuit and equivalent constant of crystal unit

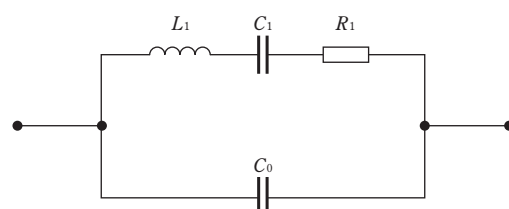
The following equivalent constants are used near the resonance frequency.

$L_1$  : Motional inductance in the equivalent electric circuit

$C_1$  : Motional capacitance in the equivalent electric circuit

$R$  : Motional resistance in the equivalent electric circuit

$C_0$  : Parallel capacitance in the equivalent electric circuit



Equivalent electric circuit of a quartz crystal unit

#### (4) Items calculated by equivalent constants and load capacitance

$$f_s: \text{Series resonance frequency} \quad f_s = \frac{1}{2\pi\sqrt{L_1 \cdot C_1}}$$

$$f_p: \text{Parallel resonance frequency} \quad f_p = \frac{1}{2\pi\sqrt{L_1 \frac{C_0 \cdot C_1}{C_0 + C_1}}}$$

$$\gamma: \text{Capacitance ratio} \quad \gamma = \frac{C_0}{C_1}$$

$$f_L: \text{Load resonance frequency} \quad f_L = f_s \left( \frac{C_1}{2 \cdot (C_0 + C_L)} + 1 \right)$$

$$R_L: \text{Load resistance} \quad R_L = R_1 \left( 1 + \frac{C_0}{C_L} \right)^2$$

$$C_L: \text{Load capacitance} \quad C_L = \frac{C_1}{2} \cdot \frac{1}{(f_L/f_s) - 1} - C_0$$

$$Q: \text{Quality factor} \quad Q = \frac{2\pi \cdot f_s \cdot L_1}{R_1} = \frac{1}{2\pi \cdot f_s \cdot C_1 \cdot R_1}$$

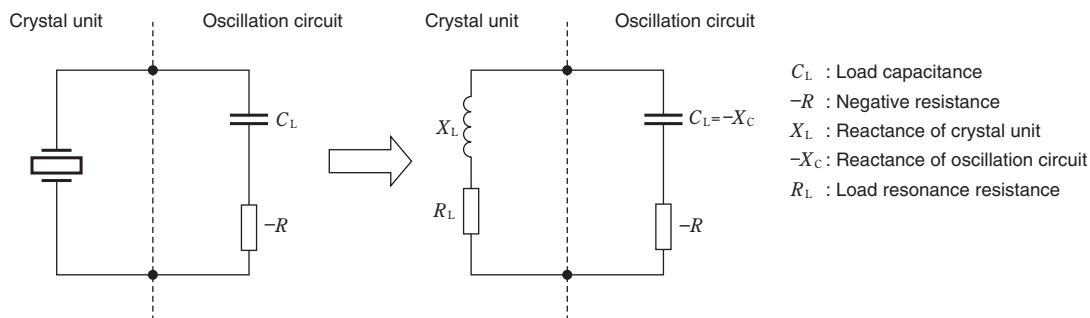
The equation  $f_L$  shows that  $f_L$  varies as load capacitance  $C_L$  connected to the crystal unit changes and that  $f_L$  becomes larger as  $C_L$  becomes smaller.

The equation  $R_L$  shows the change in impedance with a load capacitance connected. The impedance of crystal unit becomes larger as  $C_L$  becomes smaller.

## 2. Oscillation circuit and crystal unit

### (1) Equivalent circuit of oscillation circuit and oscillation conditions

A simplified equivalent circuit is shown below.



The oscillation start-up conditions are described as

$$R_L \geq |-R|$$

, and in order to oscillate the crystal unit accurately, it must be designed such that the negative resistance of the oscillation circuit becomes bigger comparing with the resonance resistance value at the time of loading. This ratio is called oscillation margin degree  $M_{OSC}$  and it is one of critical factors when designing the oscillation circuit and is described as below.

For oscillation circuit designing conditions, it is recommended that an oscillation circuit be designed using a negative resistance of a value five to ten times or more larger than  $R_L$  calculated from the resonance resistance specification value.

$$M_{OSC} = |-R| / R_L \geq 5$$

In a steady oscillation state, the load resonance resistance is given as follows:

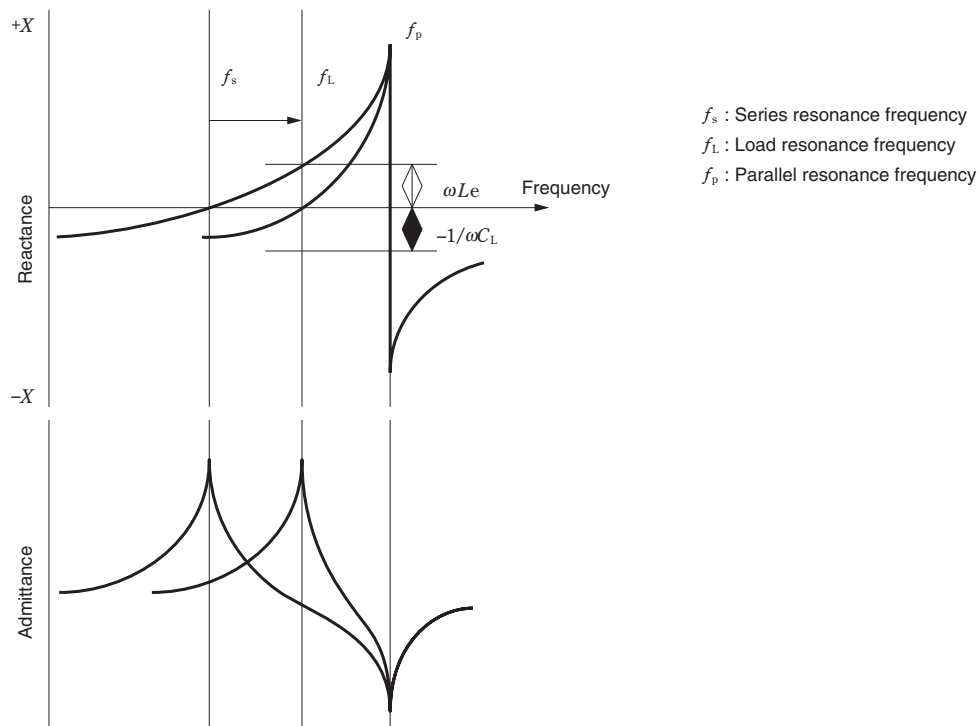
$$R_L = |-R|$$

The mutual conductance of the oscillation circuit decreases after the oscillation has started to continuously compensate for the power loss due to the load resonance resistance of the crystal unit, which continues oscillation.

The frequency condition is given as follows:

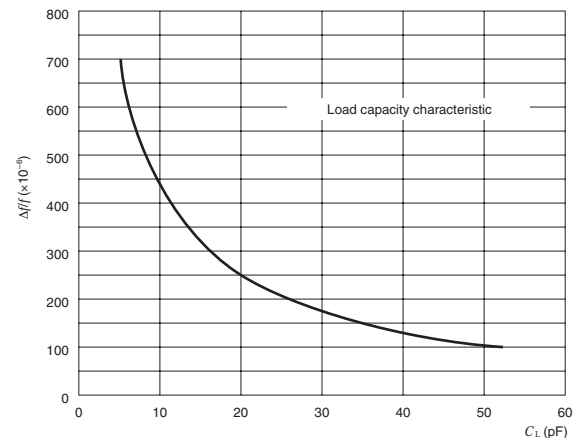
$$X_L = X_C, X_L - X_C = 0$$

As shown in the following figure, the reactance of the crystal unit varies to a value matching the load capacitance of the oscillation circuit  $C_L = X_C$ . Thus an oscillation frequency is determined.



## (2) Changes of load capacitance and oscillation frequency

As shown above, the series resonance frequency of the crystal unit changes with load capacitance  $C_L$  of the oscillation circuit. In the actual oscillation circuit, however, fine adjustments of oscillation frequencies are carried out by varying  $C_L$  by the trimmer capacitor or the like. The following figure shows an example of load capacitance characteristics. The slope of the characteristics varies depending on the frequency, shape, the number of overtone mode, etc.

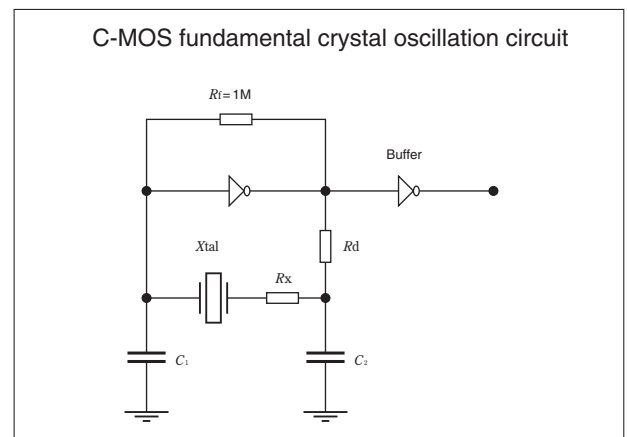


## 3. Crystal oscillation circuit

### (1) C-MOS fundamental crystal oscillation circuit

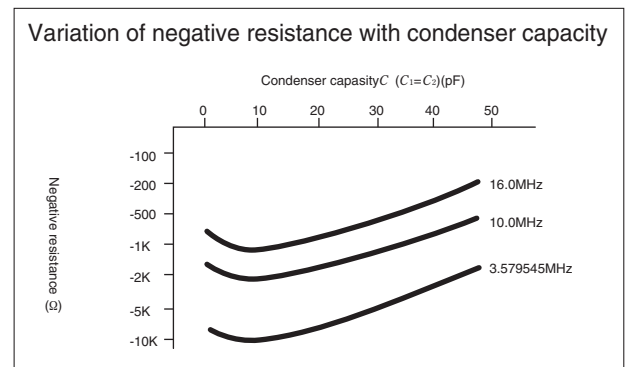
As shown above, the series resonance frequency of the crystal The figure on the right shows a standard C-MOS inverter crystal oscillation circuit for oscillating crystal unit with fundamental mode.

\*  $R_x$  is an element to reduce excitation current of the crystal unit preventing frequency fluctuation, but  $R_x$  is not used in some cases.

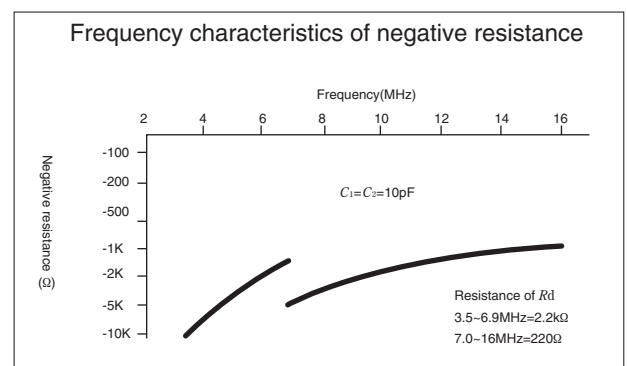


Characteristics of the circuit when load capacitances  $C_1$  and  $C_2$  are changed under the condition of  $C_1 = C_2$  are shown in the figure on the right.

It is not desirable that the excessive increase of the value of condenser leads to a decrease of the negative resistance resulting in increasing the possibility of oscillation failure.



$R_d$  mainly adjusts frequency characteristics of the negative resistance and is used to prevent oscillating by third Overtone mode. In case of a bigger circuit of the negative resistance, there is a case it is used to prevent the abnormal oscillation.



Selection of ICs and circuit constants by frequency bands

| Frequency     | 3~4.9(MHz)           | 5~6.9(MHz) | 7~9.9(MHz) | 10~19.9(MHz)                        | 20~30(MHz)                            |
|---------------|----------------------|------------|------------|-------------------------------------|---------------------------------------|
| IC            | TC4069UB<br>TC4SU69F |            |            | TC74HCU04A<br>TC7SU04F<br>TC7WU04FU | TC74VHCU04<br>TC7SHU04F<br>TC7WHU04FU |
| $R_f$         | 1M                   |            |            |                                     |                                       |
| $R_d$ *1      | 1500( )              | 470( )     | 0( )       | 0( )                                | 0( )                                  |
| $R_x$ *2      | 0~1500               |            |            |                                     |                                       |
| $C_1, C_2$ *3 | 6~22(pF)             |            |            | 6~15(pF)                            | 6~15(pF)                              |

\*1: Necessary for preventing overtone oscillation and must be changed depending on the frequency band or the  $C_1$  and  $C_2$  values.

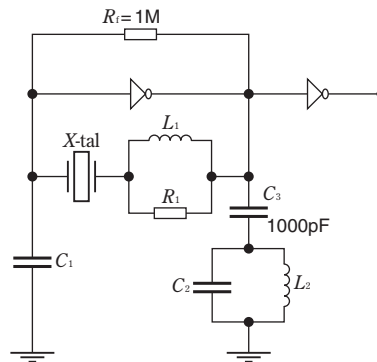
\*2: Used to reduce excitation current of the crystal unit. Necessary for stable operation of small-sized crystal units.

\*3: The optimum value differs with the values of load capacitance and  $R_d$ .

## (2) C-MOS overtone crystal oscillation circuit

This figure shows a standard C-MOS inverter crystal oscillation circuit to oscillate a crystal unit using the overtone mode.

C-MOS overtone crystal oscillation circuit



There are same cases when  $L_1$  and  $R_1$  are matched to the value of load capacitance.

## (3) Selection of ICs and circuit constants by frequency bands

| Frequency range | 20~60(MHz)                            |
|-----------------|---------------------------------------|
| IC              | TC74VHCU04<br>TC7SHU04F<br>TC7WHU04FU |
| $C_1$           | 3~10pF                                |
| $C_2$           | 10~22pF                               |

## (4) Method of selecting circuit constants and functions of elements

$C_1$  : Forms load capacitance of the circuit together with  $C_2$ ,  $L_1$  and  $L_2$ . A value of approx. 5pF is used.

$C_2$  : Forms load capacitance of the circuit together with  $C_1$ ,  $L_1$  and  $L_2$ . Prevents fundamental wave oscillation. Shall be selected so that  $C_2$  comes between the third overtone frequency at which resonance frequency with  $L_2$  is to make oscillation and 1/3 of the third overtone frequency. A value of 10 to 22pF is used.

$C_3$  : A bypath capacitor

$L_1$  : A coil to adjust load capacitance of the oscillation circuit to a value near the series. A value of several  $\mu$ H is used.

$L_2$  : Forms load capacitance of the circuit together with  $C_1$ ,  $C_2$  and  $L_1$ . Prevents fundamental wave oscillation. Shall be selected so that  $L_2$  comes between the third overtone frequency at which resonance frequency with  $C_2$  is to make oscillation and 1/3 of the third overtone frequency. A value of 10 to 22pF is used.

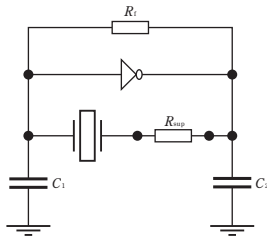
$R_1$  : A Q dump resistor for  $L_1$ . As an element for preventing self-excited oscillation, A value of several k $\Omega$  to several tens of k $\Omega$  is used.

\*  $L_1$  and  $R_1$  might not be used.

### (5) Method of checking oscillation circuit

Some ICs have a low upper-limit value of usable frequency, so refer to individual IC catalog to make sure that the IC can oscillate a crystal unit with an adequate negative resistance.

The following figure shows an example of a C-MOS oscillation circuit. Check resistance  $R_{\text{sup}}$  is connected in series with the crystal unit to check the negative resistance. Use 3 to 22pF for  $C_1$  and  $C_2$ , and see the table below for values of check resistance.



| Frequency range | Values of check resistance |
|-----------------|----------------------------|
| 3.5~4.5MHz      | 1.5k                       |
| 4.6~6.0MHz      | 1.0k                       |
| 6.1~10.0MHz     | 800                        |
| 10.1~14.0MHz    | 500                        |
| 14.1~20.0MHz    | 400                        |

Using a spectrum analyzer or oscilloscope, check that every oscillation is normally activated while turning the power on and off several times. For oscillation circuits with no power regulator ICs, carefully check changes in the negative resistance against supply voltage and in frequencies.

When oscillation is normal, remove the check resistance before using the crystal circuit.

If oscillation is unstable or is not generated, gradually decrease the values of  $C_1$  and  $C_2$  until normal oscillation is obtained.

If normal oscillation cannot be generated near 10MHz or near 20MHz, replace the IC with a new one suitable for higher frequencies.

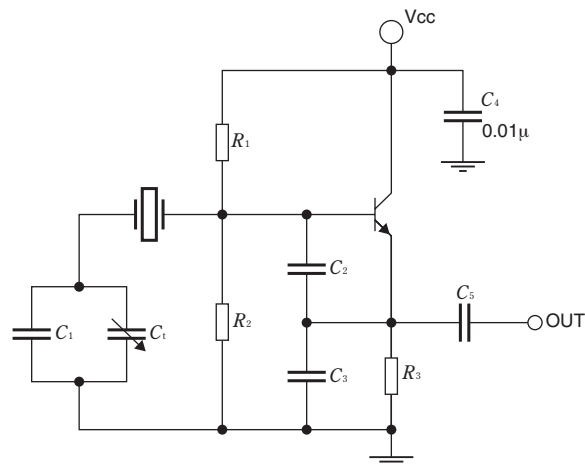
### (6) Load capacitance and oscillation frequency of transistor/fundamental crystal oscillation circuit

Viewed from the connection terminals of a crystal unit, the load capacitance  $C_L$  of an oscillation circuit is generally comprised of  $C_1$ ,  $C_i$ ,  $C_2$ , and  $C_3$  if stray capacitance of the circuit and the capacitance between base and emitter of the transistor are ignored. Since trimmer capacitor is adjusted to  $C_T = \text{MIN. to MAX.}$  for zero adjustment of the oscillation frequency, the value of  $C_L$  at this time can be obtained from the following equation.

$$C_{L\text{MIN.}} = \left( \frac{1}{C_1 + C_T} + \frac{1}{C_2} + \frac{1}{C_3} \right)^{-1} \sim C_{L\text{MAX.}} = \left( \frac{1}{C_1 + C_T} + \frac{1}{C_2} + \frac{1}{C_3} \right)^{-1}$$

When these calculation results are substituted for the following equation for load resonance frequency, the oscillation frequency can be obtained.

$$f_L = f_s \left( \frac{C_1}{2 \cdot (C_0 + C_L)} + 1 \right)$$



Select each circuit constant so that the adjustment ranges of upper and lower frequencies of this circuit are even on the basis of the frequency of a single crystal unit measured using a specified load capacity, and that the margin of  $\pm 8$  to  $10 \times 10^{-6}$  of the room temperature deviation of the crystal unit can be reserved.

To prevent the decrease in the negative resistance, always connect the crystal unit to the base of the transistor. For transistors used for oscillation circuits,  $h_{fe}$  and  $f_T$  are important.

To obtain the large negative resistance with small current consumption, select a transistor for high frequency amplification with  $h_{fe}$  of over 250 and  $f_T$  of 1GHz or more.

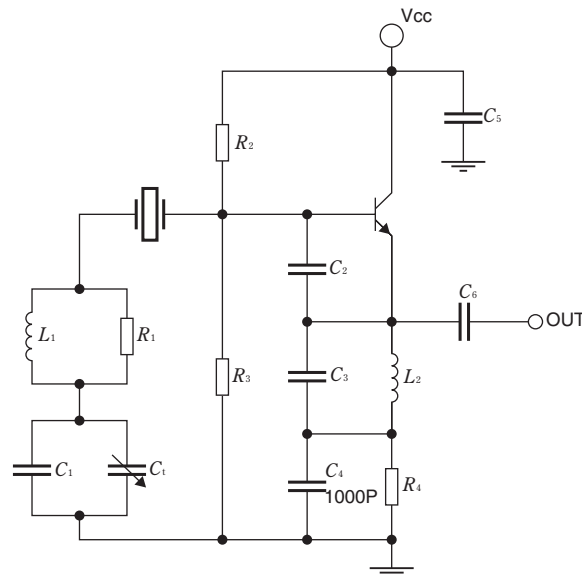
### (7) Transistor third overtone oscillation circuit

q The resonance circuit comprised of  $L_2$  and  $C_3$  is required on the emitter side for preventing fundamental mode crystal oscillation. Set the resonance frequency to a value higher than the intermediate between fundamental wave frequency and third overtone frequency.

w Use  $L_1$ , referred to as an elongation coil, to connect the load capacitance of the oscillation circuit in series.  $R_1$  prevents self-excited oscillation by  $L_1$ . Since it is difficult in general to design the oscillation circuit having adequate negative resistance in the overtone oscillation frequency band, there are no other effective means of obtaining adequate oscillation margin except for preventing the increase of load resonance resistance  $R_L$  of the crystal unit.

$R_L$  in the equation of load resonance resistance can be made equal to  $R_S$  by connecting  $C_L$  in series, or making it infinite, which prevents increase in the load resonance resistance.

$$R_L = R_1 \left( 1 + \frac{C_0}{C_L} \right)^2$$



To prevent decrease in the negative resistance, connect the crystal unit to the base of the transistor as in the fundamental mode crystal oscillation circuit. To use the crystal circuit for both oscillation and multiplication, connect a parallel resonance circuit having multiplication frequency as resonance frequency to the collector of the transistor.

When selecting circuit constants for zero adjustment range by trimmer capacitor, set the constants to values obtained by adding approx.  $\pm 12$  to  $15 \times 10^{-6}$  to the room temperature deviation of the crystal unit, centering the value obtained by measuring the crystal unit with load capacitances in series. (When the room temperature deviation specification of the crystal unit is  $\pm 10 \times 10^{-6}$ )

## (8) Excitation power of oscillation circuit

Normal operation of crystal units is not assured when excitation power is raised. The allowable excitation power varies depending on the shape of the crystal unit or the stability of targeted frequency. When highly accurate oscillation is required, however, it is recommended to use an oscillation circuit with an excitation power of 5 to 50  $\mu\text{W}$  or less. For other cases, refer to individual relevant crystal units on the pages of the catalog.

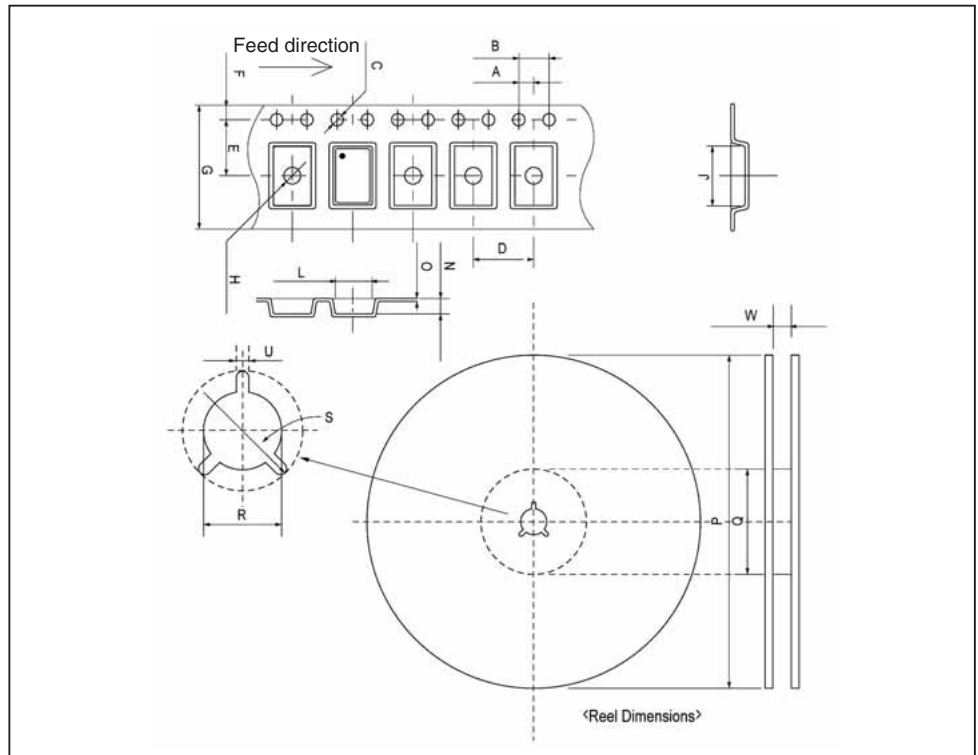
## (9) Precautions for designing printed circuit board

Be sure to design printed circuit board patterns that connect a crystal unit with other oscillation elements so that the lengths of such patterns become shortest possible to prevent deterioration of characteristics due to stray capacitances and wiring inductance. For multi-layer circuit boards, it is important not to wire the ground and other signal patterns right beneath the oscillation circuit.

## Tape & Reel Specifications

### Crystal Units

|         |     | CX-2520SB  | CX-3225SB<br>(CX-101F) |
|---------|-----|------------|------------------------|
| T A P E | A   | 2.0±0.05   | 2.0±0.05               |
|         | B   | 4.0±0.1    | 4.0±0.1                |
|         | C   | φ1.55±0.05 | φ1.55±0.05             |
|         | D   | 4.0±0.05   | 4.0±0.05               |
|         | E   | 3.5±0.05   | 3.5±0.05               |
|         | F   | 1.75±0.1   | 1.75±0.1               |
|         | G   | 8.0±0.2    | 8.0±0.2                |
|         | H   | φ1.05±0.1  | φ1.05±0.1              |
|         | J   | 3.5±0.1    | 3.5±0.1                |
|         | L   | 2.8±0.1    | 2.8±0.1                |
| R E E L | N   | 0.85±0.1   | 0.85±0.1               |
|         | O   | 0.25±0.05  | 0.25±0.05              |
|         | P   | φ180+0/-3  | φ180+0/-3              |
|         | Q   | φ60+1/-0   | φ60+1/-0               |
|         | R   | φ13±0.2    | φ13±0.2                |
|         | S   | φ21±0.8    | φ21±0.8                |
|         | U   | 2.0±0.5    | 2.0±0.5                |
|         | W   | 9±1        | 9±1                    |
|         | Qty | 3000/1000  | 3000/1000              |



|         |     | KSX-23      | CX-4025S   | KSX-35<br>CX-96F | CX-53F<br>CX-53G | CX-8045G<br>CX-17F |  | CX-49F     | CX-5FW<br>CX-5FD | CX-49L      |
|---------|-----|-------------|------------|------------------|------------------|--------------------|--|------------|------------------|-------------|
| T A P E | A   | 2.0±0.1     | 2.0±0.1    | 2.0±0.1          | 2.0±0.1          | 2.0±0.1            |  | 2.0±0.1    | 2.0±0.1          | 2.0±0.1     |
|         | B   | 4.0±0.1     | 4.0±0.1    | 4.0±0.1          | 4.0±0.1          | 4.0±0.1            |  | 4.0±0.1    | 4.0±0.1          | 4.0±0.1     |
|         | C   | φ1.5±0.1/-0 | φ1.55±0.05 | φ1.5±0.1         | φ1.55±0.1        | φ1.5±0.1           |  | φ1.55±0.05 | φ1.55±0.05       | φ1.5±0.1    |
|         | D   | 4.0±0.1     | 4.0±0.1    | 8.0±0.1          | 8.0±0.1          | 8.0±0.1            |  | 8.0±0.1    | 12.0±0.1         | 16.0±0.1    |
|         | E   | 5.5±0.1     | 5.5±0.1    | 5.5±0.1          | 5.5±0.1          | 7.5±0.1            |  | 11.5±0.1   | 11.5±0.1         | 11.5±0.1    |
|         | F   | 1.75±0.1    | 1.75±0.1   | 1.75±0.1         | 1.75±0.1         | 1.75±0.1           |  | 1.75±0.1   | 1.75±0.1         | 1.75±0.1    |
|         | G   | 12.0±0.3    | 12.0±0.3   | 12.0±0.3         | 12.0±0.2         | 16.0±0.3           |  | 24.0±0.3   | 24.0±0.3         | 24.0±0.3    |
|         | H   | φ1.5±0.1/-0 | φ1.05±0.1  | φ1.5±0.1         | φ1.55±0.1        | φ1.55±0.05         |  | φ2.05±0.05 | φ2.05±0.05       | φ2.2±0.1    |
|         | J   | 3.5±0.1     | 4.2±0.1    | 5.5±0.1          | 5.4±0.1          | 8.4±0.1            |  | 11.5±0.1   | 12.2±0.1         | —           |
|         | L   | 2.8±0.1     | 2.7±0.1    | 3.7±0.1          | 3.6±0.1          | 4.9±0.1            |  | 5.4±0.1    | 5.85±0.1         | —           |
| R E E L | N   | 1.0±0.1     | 0.95±0.05  | 1.4±0.1          | 1.7±0.1          | 2.1±0.1            |  | 5.5±0.1    | 2.8±0.1          | 6.5±0.1     |
|         | O   | 0.3±0.05    | 0.2±0.05   | 0.3±0.05         | 0.25±0.05        | 0.3±0.05           |  | 0.3±0.05   | 0.3±0.05         | 0.5±0.05    |
|         | P   | φ330±2      | φ180+0/-3  | φ330±2/φ178±2    | φ330±2/φ254±2    | φ330±2/φ254±2      |  | φ330±2     | φ330±2           | φ330±2      |
|         | Q   | φ100±1      | φ60+1/-0   | φ80±2/φ100±1     | φ100±1           | φ80±1              |  | φ100±1     | φ100±1           | φ100±1      |
|         | R   | φ13±0.2     | φ13±0.2    | φ13±0.2          | φ13±0.2          | φ13±0.2            |  | φ13±0.5    | φ13±0.5          | φ13±0.5     |
|         | S   | φ21±0.8     | φ21±0.8    | φ21±0.8          | φ21±0.8          | φ21±0.8            |  | φ21±0.5    | φ21±0.5          | —           |
|         | U   | 2.0±0.5     | 2.0±0.5    | 2.0±0.5          | 2.0±0.5          | 2.0±0.5            |  | 2.0±0.2    | 2.0±0.5          | —           |
|         | W   | 13.5±0.5    | 13±1       | 13.5+1/-0.5      | 13.4+2/-0        | 16.0+2/-0          |  | 25.5±0.5   | 24.4+2/-0        | 25.5+1/-0.5 |
|         | Qty | 5000/3000   | 3000/1000  | 5000/1000        | 3000/1000        | 3000/1000          |  | 1000       | 1000             | 5000        |

## ORDERING FORMAT FOR CRYSTAL UNITS

Please specify the following items when ordering crystal units.

1. Type \_\_\_\_\_
2. Nominal Frequency \_\_\_\_\_ Hz
3. Overtone order \_\_\_\_\_
4. Frequency Tolerance \_\_\_\_\_  $\times 10^{-6}$  MAX. (at 25°C)
5. Frequency Stability vs. Temperature Range (referred to 25°C)  
 \_\_\_\_\_  $\times 10^{-6}$  MAX, \_\_\_\_\_ °C ~ \_\_\_\_\_ °C
6. Motional Resistance \_\_\_\_\_  $\Omega$  MAX.
7. Load Capacitance( $C_L$ ) \_\_\_\_\_ pF
8. Drive Level \_\_\_\_\_ mW
9. Shunt Capacitance( $C_0$ ) \_\_\_\_\_ pF Max.
10. Others \_\_\_\_\_
11. Marking \_\_\_\_\_
12. Application \_\_\_\_\_



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### Features

- Ultra-miniature and low profile(2.5x2.0x0.8mm)
- Automatic pick-and-place, Reflow soldering compatible
- Direct drive with CMOS and TTL IC
- Supply voltage  $V_{DD}=1.8 / 2.5 / 3.3V$  available
- Tri-state function

### Applications

- Digital electronics
- Audio-visual, Office equipment
- Cellular phone with camera
- Wireless LAN

### Specifications

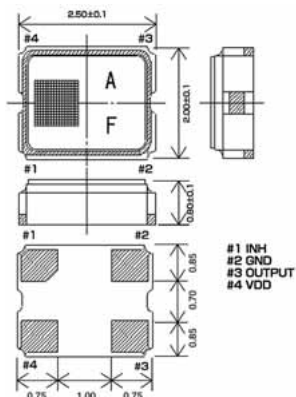
| Item                                | Symbol    | Conditions    | Min.         | Max.         | Units |
|-------------------------------------|-----------|---------------|--------------|--------------|-------|
| Output Frequency Range              | $F_{OUT}$ |               | 1            | 50           | MHz   |
| Frequency Stability(overall)        | $F_{SBY}$ |               | -30          | +30          | ppm   |
|                                     |           |               | -50          | +50          |       |
|                                     |           |               | -100         | +100         |       |
| Storage Temp. Range                 | $T_{STG}$ |               | -55          | +125         | °C    |
| Operating Temp. Range               | $T_{OPR}$ |               | -10          | +70          | °C    |
| Max. Supply Voltage                 | —         |               | -0.5         | 7.0          | Volt  |
| Supply Voltage                      | $V_{DD}$  |               | 1.71         | 1.89         | Volt  |
|                                     |           |               | 2.38         | 2.62         |       |
|                                     |           |               | 3.14         | 3.46         |       |
| Current Consumption(Maximum Loaded) | $I_{DD}$  | @50MHz        | —            | 8            | mA    |
| Standby Current                     | $I_{ST}$  |               | —            | 20           | μA    |
| Duty Ratio                          | SYM       | @50% $V_{DD}$ | 45           | 55           | %     |
| Rise/Fall Time                      | $T_r/T_f$ |               | —            | 7            | nS    |
| Output Voltage-"L"                  | $V_{OL}$  | $I_{OL}=4mA$  | —            | 0.4V         | Volt  |
| Output Voltage-"H"                  | $V_{OH}$  | $I_{OH}=-4mA$ | 90% $V_{DD}$ | —            | Volt  |
| Output Load                         | CL        |               | —            | 15           | pF    |
| Input Voltage Range                 | $V_{IN}$  |               | -0.5         | $V_{DD}+0.5$ | Volt  |
| Input Voltage-"L"                   | $V_{IL}$  |               | —            | 30% $V_{DD}$ | Volt  |
| Input Voltage-"H"                   | $V_{IH}$  |               | 70% $V_{DD}$ | —            | Volt  |
| Disable Time                        | —         |               | —            | 100          | nS    |
| Enable Time                         | —         |               | —            | 3            | mS    |
| Start-up Time                       | ST        |               | —            | 3            | mS    |

Note: Please contact us for inquiries about extended operating temperature range, available frequencies and other conditions.  
All electrical characteristics are defined at the maximum load and operating temperature range.

### Dimensions

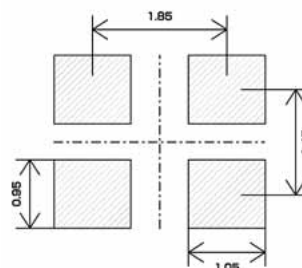
(Unit : mm)

KC2520



### Recommended Land Pattern

(Unit : mm)



Note: A capacitor of value 0.01μF between  $V_{DD}$  and GND is recommended.



Pb Free

RoHS Comforming

### Features

- Miniature ceramic package
- Highly reliable with seam welding
- CMOS output
- Supply voltage  $V_{DD}=2.5V$
- $\pm 25$ ppm available

Table 1

| Stability |           | $T_{OPR}$<br>(°C)      | Note                          |
|-----------|-----------|------------------------|-------------------------------|
| Code      | (ppm)     |                        |                               |
| 0         | $\pm 50$  | -10 to +70<br>(STD)    | Standard specifications       |
| S         | $\pm 30$  |                        | With only certain frequencies |
| U         | $\pm 25$  |                        | With only certain frequencies |
| F         | $\pm 100$ | -40 to +85<br>(Extend) | With only certain frequencies |
| G         | $\pm 50$  |                        |                               |

### How to Order

K25-2C 0 - S E 25.0000  
① ② ③ ④ ⑤

- ① Type(3.2×2.5 SMD, 2.5V)  
 ② Frequency Stability Code(See Table1)  
 ③ Duty Ratio(S: 45% to 55% STD)  
 ④ Enable/Disable Function(STD)  
 ⑤ Oscillation Frequency(Ex.: 25.0000MHz)

Packaging(Tape & Reel 2,000pcs/reel)

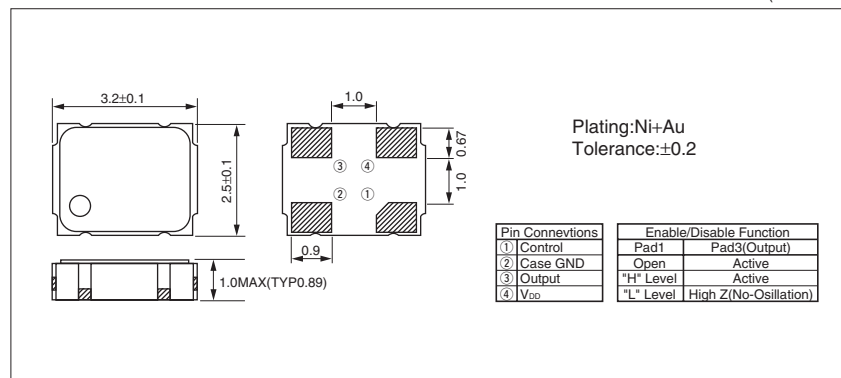
### Specifications

| Item                                                            | Symbol    | Conditions                                                                                                                                                     | Min.              | Max.              | Units   |
|-----------------------------------------------------------------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------|---------|
| Output Frequency Range                                          | $F_{OUT}$ |                                                                                                                                                                | 1                 | 50                | MHz     |
| Frequency Stability                                             | $F_{SBY}$ | Overall conditions:<br>initial tolerance, operating temperature range, rated power supply voltage change, load change, aging(1year @25°C), shock and vibration | -25<br>-30<br>-50 | +25<br>+30<br>+50 | ppm     |
| Storage Temperature Range                                       | $T_{STG}$ |                                                                                                                                                                | -55               | +125              | °C      |
| Operating Temperature Range                                     | $T_{OPR}$ | Standard<br>Extend(option)                                                                                                                                     | -10<br>-40        | +70<br>+85        |         |
| Max. Supply Voltage                                             | —         |                                                                                                                                                                | -0.5              | 7.0               | Volt    |
| Supply Voltage                                                  | $V_{DD}$  | Stability: $\pm 50$ ppm, $\pm 30$ ppm, $\pm 100$ ppm(Ext Temp)<br>Stability: $\pm 25$ ppm, $\pm 50$ ppm(Ext Temp)                                              | 2.38<br>2.43      | 2.62<br>2.57      |         |
| Current Consumption(Maximum Loaded)                             | $I_{DD}$  | @50MHz                                                                                                                                                         | —                 | 6                 | mA      |
| Standby Current                                                 | $I_{ST}$  | Standby Function                                                                                                                                               | —                 | 10                | $\mu A$ |
| Duty Ratio(Symmetry)                                            | SYM       | @50% $V_{DD}$                                                                                                                                                  | 45                | 55                | %       |
| Rise/Fall Time<br>(10% $V_{DD}$ to 90% $V_{DD}$ Maximum Loaded) | $T_r/T_f$ |                                                                                                                                                                | —                 | 5                 | nS      |
| Output Voltage-"L"                                              | $V_{OL}$  | $I_{OL}=4mA$                                                                                                                                                   | —                 | 10% $V_{DD}$      | Volt    |
| Output Voltage-"H"                                              | $V_{OH}$  | $I_{OH}=-4mA$                                                                                                                                                  | 90% $V_{DD}$      | —                 |         |
| Output Load                                                     | CL        | CMOS                                                                                                                                                           | —                 | 15                | pF      |
| Input Voltage Range                                             | $V_{IN}$  |                                                                                                                                                                | 0                 | $V_{DD}$          | Volt    |
| Input Voltage-"L"                                               | $V_{IL}$  |                                                                                                                                                                | —                 | 30% $V_{DD}$      | Volt    |
| Input Voltage-"H"                                               | $V_{IH}$  |                                                                                                                                                                | 70% $V_{DD}$      | —                 |         |
| Output Disable Time                                             | —         |                                                                                                                                                                | —                 | 150               | nS      |
| Output Enable Time                                              | —         |                                                                                                                                                                | —                 | 5                 | mS      |
| Start-up Time                                                   | ST        | @ Minimum operating Voltage to be 0sec.                                                                                                                        | —                 | 10                | mS      |

Note: Please contact us for inquiries about extended operating temperature range, available frequencies and other conditions.  
 All electrical characteristics are defined at the maximum load and operating temperature range.

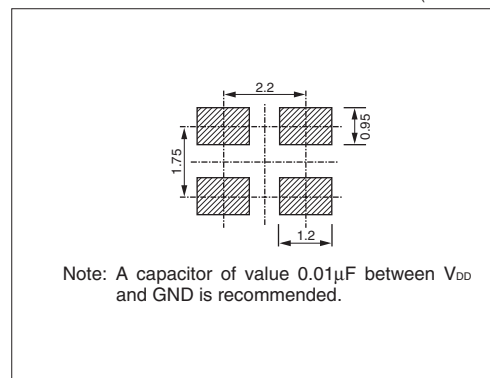
### Dimensions

(Unit : mm)



### Recommended Land Pattern

(Unit : mm)





Pb Free

RoHS Comforming

### Features

- Miniature ceramic package
- Highly reliable with seam welding
- CMOS output
- Supply voltage  $V_{DD}=3.3V$
- $\pm 25\text{ppm}$  available

Table 1

| Stability Code | Stability (ppm) | $T_{OPR}$ (°C)      | Note                          |
|----------------|-----------------|---------------------|-------------------------------|
|                |                 |                     |                               |
| 0              | $\pm 50$        | -10 to +70 (STD)    | Standard specifications       |
| S              | $\pm 30$        |                     | With only certain frequencies |
| U              | $\pm 25$        |                     | With only certain frequencies |
| F              | $\pm 100$       | -40 to +85 (Extend) | With only certain frequencies |
| G              | $\pm 50$        |                     |                               |

### How to Order

K25-3C 0 - S E 25.0000

① ② ③ ④ ⑤

- ① Type (3.2×2.5 SMD, 3.3V)
- ② Frequency Stability Code (See Table 1)
- ③ Duty Ratio (S: 45% to 55% STD)
- ④ Enable/Disable Function (STD)
- ⑤ Oscillation Frequency (Ex.: 25.0000MHz)

Packaging (Tape & Reel 2,000pcs/reel)

### Specifications

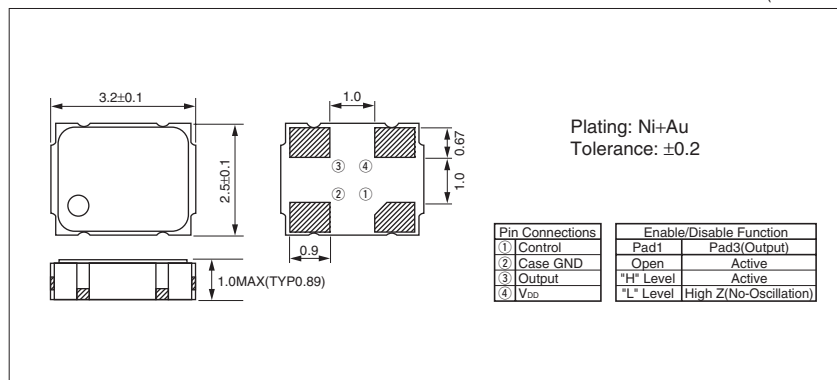
| Item                                                            | Symbol    | Conditions                                                                                                                                                        | Min.              | Max.              | Units         |
|-----------------------------------------------------------------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------|---------------|
| Output Frequency Range                                          | $F_{OUT}$ |                                                                                                                                                                   | 1                 | 50                | MHz           |
| Frequency Stability                                             | $F_{SBY}$ | Overall conditions:<br>initial tolerance, operating temperature range, rated power supply voltage change, load change, aging (1 year @ 25°C), shock and vibration | -25<br>-30<br>-50 | +25<br>+30<br>+50 | ppm           |
| Storage Temperature Range                                       | $T_{STG}$ |                                                                                                                                                                   | -55               | +125              | °C            |
| Operating Temperature Range                                     | $T_{OPR}$ | Standard<br>Extend (option)                                                                                                                                       | -10<br>-40        | +70<br>+85        |               |
| Max. Supply Voltage                                             | —         |                                                                                                                                                                   | -0.5              | 7.0               | Volt          |
| Supply Voltage                                                  | $V_{DD}$  | Stability: $\pm 50\text{ppm}$ , $\pm 30\text{ppm}$ , $\pm 100\text{ppm}$ (Ext Temp)<br>Stability: $\pm 25\text{ppm}$ , $\pm 50\text{ppm}$ (Ext Temp)              | 2.97<br>3.14      | 3.63<br>3.46      |               |
| Current Consumption (Maximum Loaded)                            | $I_{DD}$  | @ 50MHz                                                                                                                                                           | —                 | 8                 | mA            |
| Standby Current                                                 | $I_{ST}$  | Standby Function                                                                                                                                                  | —                 | 10                | $\mu\text{A}$ |
| Duty Ratio (Symmetry)                                           | SYM       | @ 50% $V_{DD}$                                                                                                                                                    | 45                | 55                | %             |
| Rise/Fall Time<br>(10% $V_{DD}$ to 90% $V_{DD}$ Maximum Loaded) | $T_r/T_f$ |                                                                                                                                                                   | —                 | 5                 | nS            |
| Output Voltage-"L"                                              | $V_{OL}$  | $I_{OL}=4\text{mA}$                                                                                                                                               | —                 | 10% $V_{DD}$      | Volt          |
| Output Voltage-"H"                                              | $V_{OH}$  | $I_{OH}=-4\text{mA}$                                                                                                                                              | 90% $V_{DD}$      | —                 |               |
| Output Load                                                     | CL        | CMOS                                                                                                                                                              | —                 | 15                | pF            |
| Input Voltage Range                                             | $V_{IN}$  |                                                                                                                                                                   | 0                 | $V_{DD}$          | Volt          |
| Input Voltage-"L"                                               | $V_{IL}$  |                                                                                                                                                                   | —                 | 30% $V_{DD}$      | Volt          |
| Input Voltage-"H"                                               | $V_{IH}$  |                                                                                                                                                                   | 70% $V_{DD}$      | —                 |               |
| Output Disable Time                                             | —         |                                                                                                                                                                   | —                 | 150               | nS            |
| Output Enable Time                                              | —         |                                                                                                                                                                   | —                 | 5                 | mS            |
| Start-up Time                                                   | ST        | @ Minimum operating Voltage to be 0sec.                                                                                                                           | —                 | 10                | mS            |

Note: Please contact us for inquiries about extended operating temperature range, available frequencies and other conditions.

All electrical characteristics are defined at the maximum load and operating temperature range.

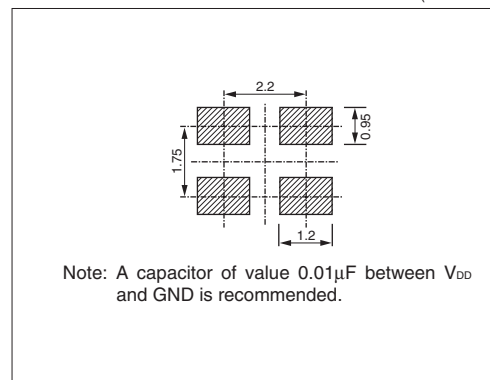
### Dimensions

(Unit : mm)



### Recommended Land Pattern

(Unit : mm)



CMOS / 1.8V / 5.0×3.2mm



Pb Free

RoHS Conforming

## Features

- Miniature ceramic package
- Highly reliable with seam welding
- CMOS output
- Supply voltage  $V_{DD}=1.8V$
- $\pm 25\text{ppm}$ ,  $\pm 20\text{ppm}$  available

Table 1

| Stability |           | $T_{OPR}$<br>(°C)      | Note                          |
|-----------|-----------|------------------------|-------------------------------|
| Code      | (ppm)     |                        |                               |
| <b>0</b>  | $\pm 50$  | -10 to +70<br>(STD)    | Standard specifications       |
| <b>S</b>  | $\pm 30$  |                        | With only certain frequencies |
| <b>U</b>  | $\pm 25$  |                        |                               |
| <b>W</b>  | $\pm 20$  |                        |                               |
| <b>F</b>  | $\pm 100$ | -40 to +85<br>(Extend) | With only certain frequencies |
| <b>G</b>  | $\pm 50$  |                        |                               |

## How to Order

K30-1C 0 - S E 25.0000

① ② ③ ④ ⑤

- ① Type(5×3.2 SMD, 1.8V)  
 ② Frequency Stability Code(See Table1)  
 ③ Duty Ratio(S: 45% to 55% STD)  
 ④ Enable/Disable Function(STD)  
 ⑤ Oscillation Frequency(Ex.: 25.0000MHz)

Packaging(Tape &amp; Reel 1,000pcs/reel)

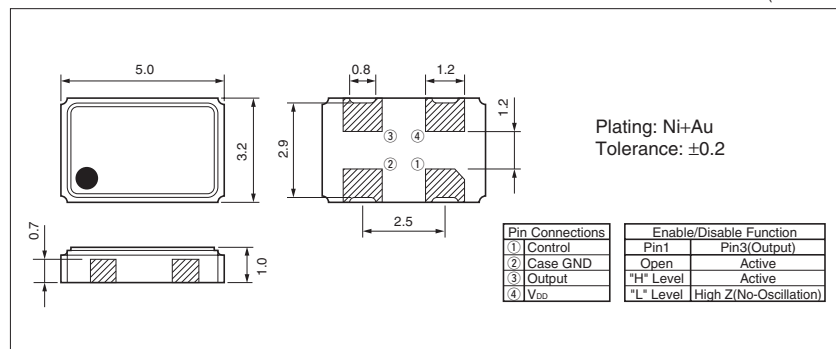
## Specifications

| Item                                                            | Symbol    | Conditions                                                                                                                                                                | Min.                     | Max.                     | Units |
|-----------------------------------------------------------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|-------|
| Output Frequency Range                                          | $F_{OUT}$ |                                                                                                                                                                           | 1.8                      | 39.99                    | MHz   |
| Frequency Stability                                             | $F_{SBY}$ | Overall conditions:<br>initial tolerance, operating temperature range, rated power<br>supply voltage change, load change, aging(1year @25°C),<br>shock and vibration      | -20<br>-25<br>-30<br>-50 | +20<br>+25<br>+30<br>+50 | ppm   |
| Storage Temperature Range                                       | $T_{STG}$ |                                                                                                                                                                           | -55                      | +125                     | °C    |
| Operating Temperature Range                                     | $T_{OPR}$ | Standard<br>Extend(option)                                                                                                                                                | -10<br>-40               | +70<br>+85               |       |
| Max. Supply Voltage                                             | —         |                                                                                                                                                                           | -0.5                     | 3.6                      | Volt  |
| Supply Voltage                                                  | $V_{DD}$  | Stability: $\pm 50\text{ppm}$ , $\pm 30\text{ppm}$ , $\pm 100\text{ppm}$ (Ext Temp)<br>Stability: $\pm 20\text{ppm}$ , $\pm 25\text{ppm}$ , $\pm 50\text{ppm}$ (Ext Temp) | 1.75<br>1.71             | 1.85<br>1.89             |       |
| Current Consumption<br>(Maximum Loaded)                         | $I_{DD}$  | $1.8 \leq F_{OUT} \leq 25\text{MHz}$<br>$25 < F_{OUT} \leq 39.99\text{MHz}$                                                                                               | —<br>—                   | 3<br>4                   | mA    |
| Standby Current                                                 | $I_{ST}$  | Standby Function                                                                                                                                                          | —                        | 10                       |       |
| Duty Ratio(Symmetry)                                            | SYM       | @50% $V_{DD}$                                                                                                                                                             | 45                       | 55                       | %     |
| Rise/Fall Time<br>(10% $V_{DD}$ to 90% $V_{DD}$ Maximum Loaded) | $T_r/T_f$ |                                                                                                                                                                           | —                        | 9                        | nS    |
| Output Voltage-"L"                                              | $V_{OL}$  | $I_{OL}=2.8\text{mA}$                                                                                                                                                     | —                        | 10% $V_{DD}$             | Volt  |
| Output Voltage-"H"                                              | $V_{OH}$  | $I_{OH}=2.8\text{mA}$                                                                                                                                                     | 90% $V_{DD}$             | —                        |       |
| Output Load                                                     | CL        | CMOS                                                                                                                                                                      | —                        | 15                       | pF    |
| Input Voltage Range                                             | $V_{IN}$  |                                                                                                                                                                           | 0                        | $V_{DD}$                 | Volt  |
| Input Voltage-"L"                                               | $V_{IL}$  |                                                                                                                                                                           | —                        | 30% $V_{DD}$             | Volt  |
| Input Voltage-"H"                                               | $V_{IH}$  |                                                                                                                                                                           | 70% $V_{DD}$             | —                        |       |
| Output Disable Time                                             | —         |                                                                                                                                                                           | —                        | 150                      | nS    |
| Output Enable Time                                              | —         |                                                                                                                                                                           | —                        | 5                        | mS    |
| Start-up Time                                                   | ST        | @ Minimum operating Voltage to be 0sec.                                                                                                                                   | —                        | 10                       | mS    |

Note: Please contact us for inquiries about extended operating temperature range, available frequencies and other conditions.  
 All electrical characteristics are defined at the maximum load and operating temperature range.

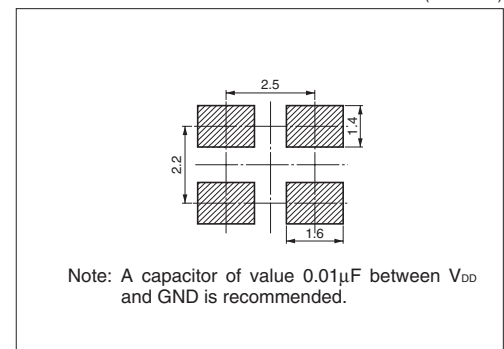
## Dimensions

(Unit : mm)



## Recommended Land Pattern

(Unit : mm)





Pb Free

RoHS Comforming

## Features

- Miniature ceramic package
- Highly reliable with seam welding
- CMOS output
- Supply voltage  $V_{DD}=2.5V$
- $\pm 25\text{ppm}$ ,  $\pm 20\text{ppm}$  available

Table 1

| Stability Code | Stability (ppm) | $T_{OPR}$ (°C)      | Note                          |
|----------------|-----------------|---------------------|-------------------------------|
|                |                 |                     |                               |
| 0              | $\pm 50$        | -10 to +70 (STD)    | Standard specifications       |
| S              | $\pm 30$        |                     | With only certain frequencies |
| U              | $\pm 25$        |                     |                               |
| W              | $\pm 20$        |                     |                               |
| F              | $\pm 100$       | -40 to +85 (Extend) | With only certain frequencies |
| G              | $\pm 50$        |                     |                               |

## How to Order

K30-2C 0 - S E 25.0000  
① ② ③ ④ ⑤

- ① Type(5×3.2 SMD, 2.5V)  
 ② Frequency Stability Code(See Table1)  
 ③ Duty Ratio(S: 45% to 55% STD)  
 ④ Enable/Disable Function(STD)  
 ⑤ Oscillation Frequency(Ex.: 25.0000MHz)

Packaging(Tape &amp; Reel 1,000pcs/reel)

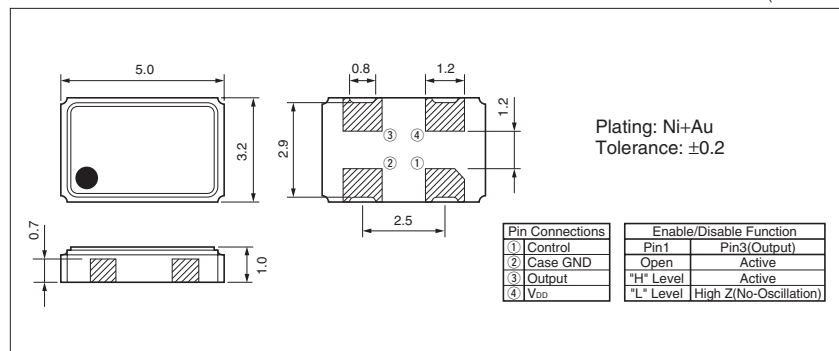
## Specifications

| Item                                                            | Symbol    | Conditions                                                                                                                                                                | Min.                     | Max.                     | Units         |
|-----------------------------------------------------------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|---------------|
| Output Frequency Range                                          | $F_{OUT}$ |                                                                                                                                                                           | 1.8                      | 67                       | MHz           |
| Frequency Stability                                             | $F_{SBY}$ | Overall conditions:<br>initial tolerance, operating temperature range, rated power<br>supply voltage change, load change, aging(1year @25°C),<br>shock and vibration      | -20<br>-25<br>-30<br>-50 | +20<br>+25<br>+30<br>+50 | ppm           |
| Storage Temperature Range                                       | $T_{STG}$ |                                                                                                                                                                           | -55                      | +125                     | °C            |
| Operating Temperature Range                                     | $T_{OPR}$ | Standard<br>Extend(option)                                                                                                                                                | -10<br>-40               | +70<br>+85               |               |
| Max. Supply Voltage                                             | —         |                                                                                                                                                                           | -0.5                     | 7.0                      | Volt          |
| Supply Voltage                                                  | $V_{DD}$  | Stability: $\pm 50\text{ppm}$ , $\pm 30\text{ppm}$ , $\pm 100\text{ppm}$ (Ext Temp)<br>Stability: $\pm 20\text{ppm}$ , $\pm 25\text{ppm}$ , $\pm 50\text{ppm}$ (Ext Temp) | 2.38<br>2.43             | 2.62<br>2.57             |               |
| Current Consumption (Maximum Loaded)                            | $I_{DD}$  | $1.8 \leq F_{OUT} \leq 20\text{MHz}$<br>$20 < F_{OUT} \leq 40\text{MHz}$<br>$40 < F_{OUT} \leq 67\text{MHz}$                                                              | —<br>—<br>—              | 5<br>10<br>15            | mA            |
| Standby Current                                                 | $I_{ST}$  | Standby Function                                                                                                                                                          | —                        | 10                       | $\mu\text{A}$ |
| Duty Ratio(Symmetry)                                            | SYM       | @50% $V_{DD}$                                                                                                                                                             | 45                       | 55                       | %             |
| Rise/Fall Time<br>(10% $V_{DD}$ to 90% $V_{DD}$ Maximum Loaded) | $T_r/T_f$ | $1.8 \leq F_{OUT} \leq 40\text{MHz}$<br>$40 < F_{OUT} \leq 67\text{MHz}$                                                                                                  | —<br>—                   | 7<br>4                   | nS            |
| Output Voltage-"L"                                              | $V_{OL}$  | $I_{OL}=4\text{mA}$ (8mA:40MHz< $F_{out}$ )                                                                                                                               | —                        | 10% $V_{DD}$             | Volt          |
| Output Voltage-"H"                                              | $V_{OH}$  | $I_{OH}=-4\text{mA}$ (-8mA:40MHz< $F_{out}$ )                                                                                                                             | 90% $V_{DD}$             | —                        |               |
| Output Load                                                     | CL        | CMOS                                                                                                                                                                      | —                        | 15                       | pF            |
| Input Voltage Range                                             | $V_{IN}$  |                                                                                                                                                                           | 0                        | $V_{DD}$                 | Volt          |
| Input Voltage-"L"                                               | $V_{IL}$  |                                                                                                                                                                           | —                        | 30% $V_{DD}$             | Volt          |
| Input Voltage-"H"                                               | $V_{IH}$  |                                                                                                                                                                           | 70% $V_{DD}$             | —                        |               |
| Output Disable Time                                             | —         |                                                                                                                                                                           | —                        | 150                      | nS            |
| Output Enable Time                                              | —         |                                                                                                                                                                           | —                        | 5                        | mS            |
| Start-up Time                                                   | ST        | @ Minimum operating Voltage to be 0sec.                                                                                                                                   | —                        | 10                       | mS            |

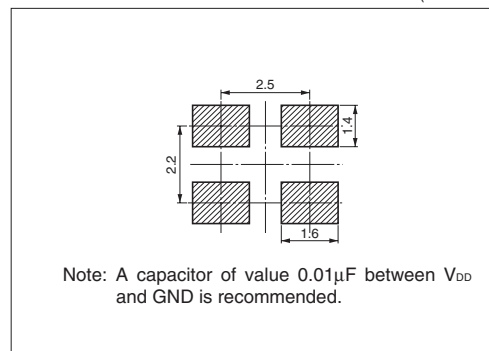
Note: Please contact us for inquiries about extended operating temperature range, available frequencies and other conditions.  
 All electrical characteristics are defined at the maximum load and operating temperature range.

## Dimensions

(Unit : mm)



## Recommended Land Pattern (Unit : mm)





Pb Free

RoHS Compliant

## Features

- Miniature ceramic package
- Highly reliable with seam welding
- CMOS output
- Supply voltage  $V_{DD}=3.3V$
- $\pm 25\text{ppm}$ ,  $\pm 20\text{ppm}$  available

Table 1

| Stability Code | Stability (ppm) | $T_{OPR}$ (°C)      | Note                          |
|----------------|-----------------|---------------------|-------------------------------|
| O              | $\pm 50$        | -10 to +70 (STD)    | Standard specifications       |
| S              | $\pm 30$        |                     | With only certain frequencies |
| U              | $\pm 25$        |                     |                               |
| W              | $\pm 20$        |                     |                               |
| F              | $\pm 100$       | -40 to +85 (Extend) | With only certain frequencies |
| G              | $\pm 50$        |                     |                               |

## How to Order

K30-3C 0 - S E 25.0000  
① ② ③ ④ ⑤

- ① Type(5×3.2 SMD, 3.3V)  
② Frequency Stability Code(See Table1)  
③ Duty Ratio(S: 45% to 55% STD)  
④ Enable/Disable Function(STD)  
⑤ Oscillation Frequency(Ex.: 25.0000MHz)

Packaging(Tape & Reel 1,000pcs/reel)

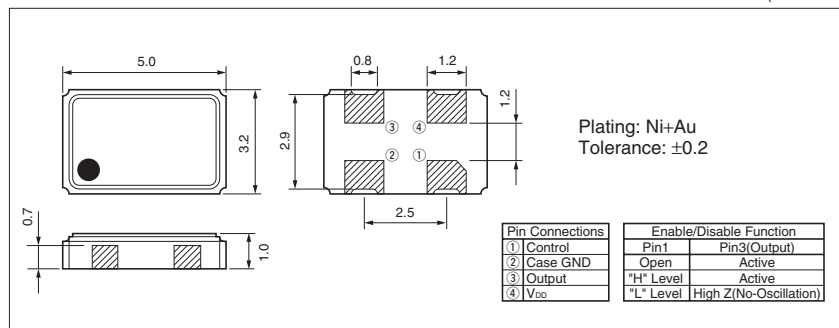
## Specifications

| Item                                                         | Symbol    | Conditions                                                                                                                                                                                                                                                        | Min.                            | Max.                                   | Units         |
|--------------------------------------------------------------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----------------------------------------|---------------|
| Output Frequency Range                                       | $F_{OUT}$ |                                                                                                                                                                                                                                                                   | 1.8                             | 160                                    | MHz           |
| Frequency Stability                                          | $F_{SBY}$ | Overall conditions:<br>initial tolerance, operating temperature range, rated power supply voltage change, load change, aging(1year @25°C), shock and vibration                                                                                                    | -20<br>-25<br>-30<br>-50        | +20<br>+25<br>+30<br>+50               | ppm           |
| Storage Temperature Range                                    | $T_{STG}$ |                                                                                                                                                                                                                                                                   | -55                             | +125                                   | °C            |
| Operating Temperature Range                                  | $T_{OPR}$ | Standard<br>Extend(option)                                                                                                                                                                                                                                        | -10<br>-40                      | +70<br>+85                             | °C            |
| Max. Supply Voltage                                          | —         |                                                                                                                                                                                                                                                                   | -0.5                            | 7.0                                    | Volt          |
| Supply Voltage                                               | $V_{DD}$  | Stability: $\pm 50\text{ppm}$ , $\pm 30\text{ppm}$ , $\pm 100\text{ppm}$ (Ext Temp)<br>Stability: $\pm 20\text{ppm}$ , $\pm 25\text{ppm}$ , $\pm 50\text{ppm}$ (Ext Temp)                                                                                         | 2.97<br>3.14                    | 3.63<br>3.46                           | Volt          |
| Current Consumption (Maximum Loaded)                         | $I_{DD}$  | 1.8 $\leq F_{OUT} \leq 20\text{MHz}$<br>20 $< F_{OUT} \leq 40\text{MHz}$<br>40 $< F_{OUT} \leq 60\text{MHz}$<br>60 $< F_{OUT} \leq 80\text{MHz}$<br>80 $< F_{OUT} \leq 100\text{MHz}$<br>100 $< F_{OUT} \leq 135\text{MHz}$<br>135 $< F_{OUT} \leq 160\text{MHz}$ | —<br>—<br>—<br>—<br>—<br>—<br>— | 10<br>15<br>30<br>35<br>40<br>50<br>60 | mA            |
| Standby Current                                              | $I_{ST}$  | Standby Function                                                                                                                                                                                                                                                  | —                               | 10                                     | $\mu\text{A}$ |
| Duty Ratio(Symmetry)                                         | SYM       | @ 50% $V_{DD}$                                                                                                                                                                                                                                                    | 45                              | 55                                     | %             |
| Rise/Fall Time (10% $V_{DD}$ to 90% $V_{DD}$ Maximum Loaded) | $T_r/T_f$ | 8 $\leq F_{OUT} \leq 26\text{MHz}$<br>26 $< F_{OUT} \leq 45\text{MHz}$<br>45 $< F_{OUT} \leq 100\text{MHz}$<br>100 $\leq F_{OUT} \leq 160\text{MHz}$                                                                                                              | —<br>—<br>—<br>—                | 10<br>8<br>5<br>2.5                    | nS            |
| Output Voltage-"L"                                           | $V_{OL}$  | $I_{OL}=8\text{mA}$                                                                                                                                                                                                                                               | —                               | 10% $V_{DD}$                           | Volt          |
| Output Voltage-"H"                                           | $V_{OH}$  | $I_{OH}=-8\text{mA}$                                                                                                                                                                                                                                              | 90% $V_{DD}$                    | —                                      | Volt          |
| Output Load                                                  | $C_L$     | CMOS                                                                                                                                                                                                                                                              | —                               | 15                                     | pF            |
| Input Voltage Range                                          | $V_{IN}$  |                                                                                                                                                                                                                                                                   | 0                               | $V_{DD}$                               | Volt          |
| Input Voltage-"L"                                            | $V_{IL}$  |                                                                                                                                                                                                                                                                   | —                               | 30% $V_{DD}$                           | Volt          |
| Input Voltage-"H"                                            | $V_{IH}$  |                                                                                                                                                                                                                                                                   | 70% $V_{DD}$                    | —                                      | Volt          |
| Output Disable Time                                          | —         |                                                                                                                                                                                                                                                                   | —                               | 150                                    | nS            |
| Output Enable Time                                           | —         |                                                                                                                                                                                                                                                                   | —                               | 5                                      | mS            |
| Start-up Time                                                | ST        | @ Minimum operating Voltage to be 0sec.                                                                                                                                                                                                                           | —                               | 10                                     | mS            |

Note: Please contact us for inquiries about extended operating temperature range, available frequencies and other conditions.  
All electrical characteristics are defined at the maximum load and operating temperature range.

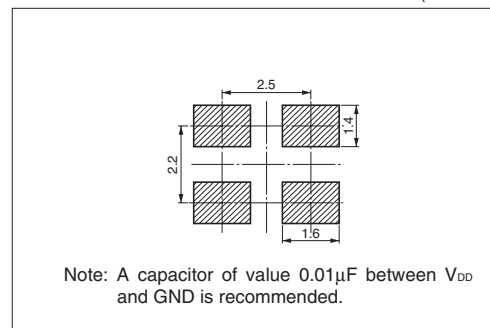
## Dimensions

(Unit : mm)



## Recommended Land Pattern

(Unit : mm)





Pb Free

RoHS Conforming

## Features

- Miniature ceramic package
- Highly reliable with seam welding
- CMOS output
- Supply voltage  $V_{DD}=3.3V$
- Heavy Load  $CL=50pF$  available

Table 1

| Stability Code | Stability (ppm) | $T_{OPR}$ (°C)   | Note                          |
|----------------|-----------------|------------------|-------------------------------|
|                |                 |                  |                               |
| 0              | ± 50            | -10 to +70 (STD) | Standard specifications       |
| S              | ± 30            |                  | With only certain frequencies |

## How to Order

K30-3C 0 - S E 25.0000 HL  
① ② ③ ④ ⑤ ⑥

- ① Type(5×3.2 SMD, 3.3V)  
 ② Frequency Stability Code(See Table1)  
 ③ Duty Ratio(S: 45% to 55% STD)  
 ④ Enable/Disable Function(STD)  
 ⑤ Oscillation Frequency(Ex.: 25.0000MHz)  
 ⑥ Suffix(CL=50pF max.)

Packaging(Tape &amp; Reel 1,000pcs/reel)

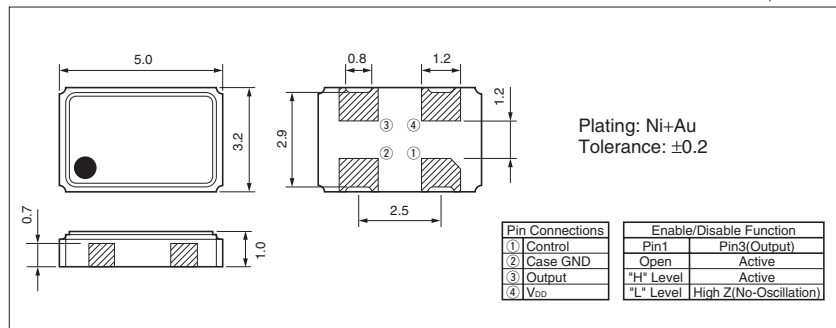
## Specifications

| Item                                           | Symbol    | Conditions                                                                                                                                                     | Min.         | Max.         | Units |
|------------------------------------------------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------|-------|
| Output Frequency Range                         | $F_{OUT}$ |                                                                                                                                                                | 14           | 30           | MHz   |
| Frequency Stability                            | $F_{SBY}$ | Overall conditions:<br>initial tolerance, operating temperature range, rated power supply voltage change, load change, aging(1year @25°C), shock and vibration | -30<br>-50   | +30<br>+50   | ppm   |
| Storage Temperature Range                      | $T_{STG}$ |                                                                                                                                                                | -55          | +125         | °C    |
| Operating Temperature Range                    | $T_{OPR}$ |                                                                                                                                                                | -10          | +70          |       |
| Max. Supply Voltage                            | —         |                                                                                                                                                                | -0.5         | 7.0          | Volt  |
| Supply Voltage                                 | $V_{DD}$  | Stability: ±50ppm, ±30ppm                                                                                                                                      | 2.97         | 3.63         |       |
| Current Consumption (Maximum Loaded)           | $I_{DD}$  | CL=15pF<br>CL=50pF                                                                                                                                             | —<br>—       | 10<br>15     | mA    |
| Standby Current                                | $I_{ST}$  | Standby Function                                                                                                                                               | —            | 10           | μA    |
| Duty Ratio(Symmetry)                           | SYM       | @50% $V_{DD}$ CL=15pF<br>CL=50pF                                                                                                                               | 45<br>40     | 55<br>60     | %     |
| Rise/Fall Time (10% $V_{DD}$ to 90% $V_{DD}$ ) | $T_r/T_f$ | CL=15pF<br>CL=50pF                                                                                                                                             | —<br>—       | 5<br>8       | nS    |
| Output Voltage-"L"                             | $V_{OL}$  | $I_{OL}=8mA$                                                                                                                                                   | —            | 10% $V_{DD}$ | Volt  |
| Output Voltage-"H"                             | $V_{OH}$  | $I_{OH}=-8mA$                                                                                                                                                  | 90% $V_{DD}$ | —            |       |
| Output Load                                    | CL        | CMOS                                                                                                                                                           | —            | 50           | pF    |
| Input Voltage Range                            | $V_{IN}$  |                                                                                                                                                                | 0            | $V_{DD}$     | Volt  |
| Input Voltage-"L"                              | $V_{IL}$  |                                                                                                                                                                | —            | 30% $V_{DD}$ | Volt  |
| Input Voltage-"H"                              | $V_{IH}$  |                                                                                                                                                                | 70% $V_{DD}$ | —            |       |
| Output Disable Time                            | —         |                                                                                                                                                                | —            | 150          | nS    |
| Output Enable Time                             | —         |                                                                                                                                                                | —            | 5            | mS    |
| Start-up Time                                  | ST        | @ Minimum operating Voltage to be 0sec.                                                                                                                        | —            | 10           | mS    |

Note: Please contact us for inquiries about extended operating temperature range, available frequencies and other conditions.  
 All electrical characteristics are defined at the maximum load and operating temperature range.

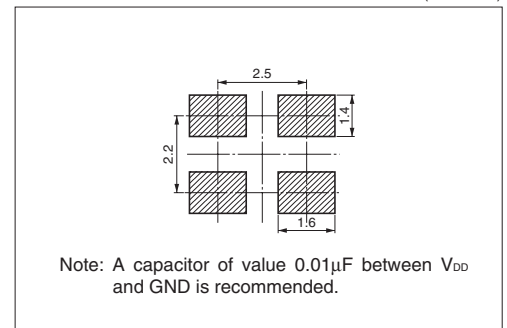
## Dimensions

(Unit : mm)



## Recommended Land Pattern

(Unit : mm)





Pb Free

RoHS Comforming

### Features

- Miniature ceramic package
- Highly reliable with seam welding
- CMOS output
- Supply voltage  $V_{DD}=5.0V$
- $\pm 25\text{ppm}$  available

Table 1

| Stability |           | $T_{OPR}$<br>(°C)      | Note                          |
|-----------|-----------|------------------------|-------------------------------|
| Code      | (ppm)     |                        |                               |
| <b>0</b>  | $\pm 50$  | -10 to +70<br>(STD)    | Standard specifications       |
| <b>S</b>  | $\pm 30$  |                        | With only certain frequencies |
| <b>U</b>  | $\pm 25$  |                        |                               |
| <b>F</b>  | $\pm 100$ | -40 to +85<br>(Extend) | With only certain frequencies |
| <b>G</b>  | $\pm 50$  |                        |                               |

### How to Order

K30-HC 0 - C S E 25.0000  
① ② ③ ④ ⑤ ⑥

- ① Type(5×3.2 SMD, 5.0V)  
 ② Frequency Stability Code(See Table1)  
 ③ CMOS Output  
 ④ Duty Ratio(S: 45% to 55% STD)  
 ⑤ Enable/Disable Function(STD)  
 ⑥ Oscillation Frequency(Ex.: 25.0000MHz)

Packaging(Tape & Reel 1,000pcs/reel)

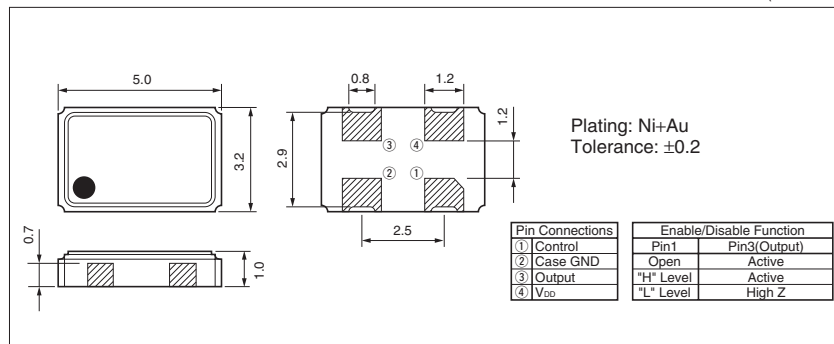
### Specifications

| Item                                                            | Symbol    | Conditions                                                                                                                                                           | Min.              | Max.              | Units |
|-----------------------------------------------------------------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------|-------|
| Output Frequency Range                                          | $F_{OUT}$ |                                                                                                                                                                      | 1.8               | 50                | MHz   |
| Frequency Stability                                             | $F_{SBY}$ | Overall conditions:<br>initial tolerance, operating temperature range, rated power<br>supply voltage change, load change, aging(1year @25°C),<br>shock and vibration | -25<br>-30<br>-50 | +25<br>+30<br>+50 | ppm   |
| Storage Temperature Range                                       | $T_{STG}$ |                                                                                                                                                                      | -55               | +125              | °C    |
| Operating Temperature Range                                     | $T_{OPR}$ | Standard                                                                                                                                                             | -10               | +70               |       |
|                                                                 |           | Extend(option)                                                                                                                                                       | -40               | +85               |       |
| Max. Supply Voltage                                             | —         |                                                                                                                                                                      | -0.5              | 7.0               | Volt  |
| Supply Voltage                                                  | $V_{DD}$  | Stability: $\pm 50\text{ppm}$ , $\pm 30\text{ppm}$ , $\pm 100\text{ppm}$ (Ext Temp)<br>Stability: $\pm 25\text{ppm}$ , $\pm 50\text{ppm}$ (Ext Temp)                 | 4.5<br>4.75       | 5.5<br>5.25       |       |
| Current Consumption<br>(Maximum Loaded)                         | $I_{DD}$  | 1.8 $\leq F_{OUT} \leq 20\text{MHz}$<br>20 $< F_{OUT} \leq 40\text{MHz}$<br>40 $< F_{OUT} \leq 50\text{MHz}$                                                         | —<br>—<br>—       | 25<br>35<br>50    | mA    |
| Disable Current                                                 | $I_{DE}$  | @ 50.0000MHz                                                                                                                                                         | —                 | 30                |       |
| Duty Ratio(Symmetry)                                            | SYM       | @ 50% $V_{DD}$                                                                                                                                                       | 45                | 55                | %     |
| Rise/Fall Time<br>(10% $V_{DD}$ to 90% $V_{DD}$ Maximum Loaded) | $T_r/T_f$ | 8 $\leq F_{OUT} \leq 26\text{MHz}$<br>26 $< F_{OUT} \leq 50\text{MHz}$                                                                                               | —<br>—            | 10<br>8           | nS    |
| Output Voltage-"L"                                              | $V_{OL}$  | $I_{OL}=16\text{mA}$                                                                                                                                                 | —                 | 10% $V_{DD}$      |       |
| Output Voltage-"H"                                              | $V_{OH}$  | $I_{OH}=16\text{mA}$                                                                                                                                                 | 90% $V_{DD}$      | —                 | Volt  |
| Output Load                                                     | CL        |                                                                                                                                                                      | —                 | 50                | pF    |
| Input Voltage Range                                             | $V_{IN}$  |                                                                                                                                                                      | 0                 | $V_{DD}$          | Volt  |
| Input Voltage-"L"                                               | $V_{IL}$  |                                                                                                                                                                      | —                 | 0.8               | Volt  |
| Input Voltage-"H"                                               | $V_{IH}$  |                                                                                                                                                                      | 2.2               | —                 |       |
| Output Disable Time                                             | —         |                                                                                                                                                                      | —                 | 100               | nS    |
| Output Enable Time                                              | —         |                                                                                                                                                                      | —                 | 100               | nS    |
| Start-up Time                                                   | ST        | @ Minimum operating Voltage to be 0sec.                                                                                                                              | —                 | 10                | mS    |

Note: Please contact us for inquiries about extended operating temperature range, available frequencies and other conditions.  
 All electrical characteristics are defined at the maximum load and operating temperature range.

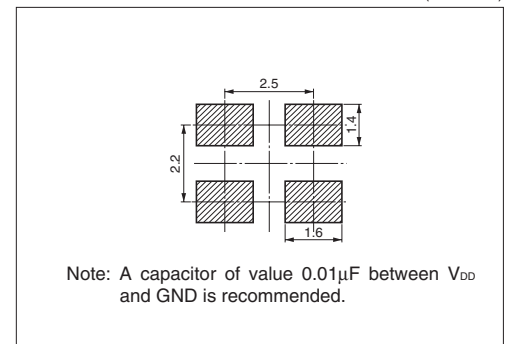
### Dimensions

(Unit : mm)



### Recommended Land Pattern

(Unit : mm)





Pb Free

RoHS Comforming

### Features

- Compact and low profile(5x3.2x1.2mm).
- Surface mount type suitable for auto pick-and-place.
- Reflow soldering compatible.
- CMOS, TTL IC direct drive is possible.
- With tri-state function
- Supply voltage  $V_{DD}=3.3 / 5.0V$  available

### Applications

- Digital electronics
- Audio visual
- Factory automation
- Amusement

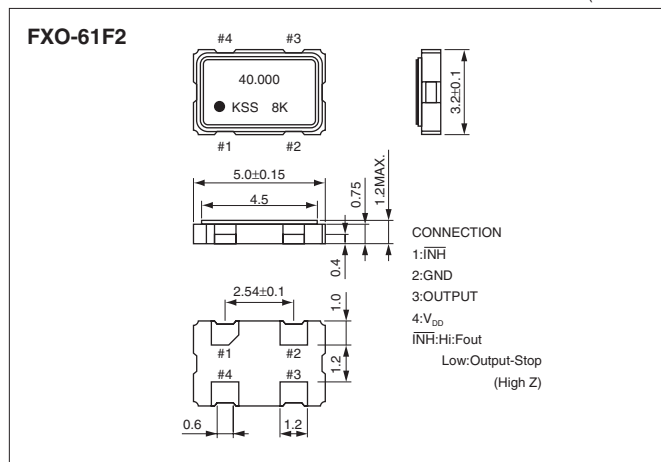
### Specifications

| Item                                    | Symbol                           | Specifications               |                        | Units |
|-----------------------------------------|----------------------------------|------------------------------|------------------------|-------|
|                                         |                                  | FXO-61F2                     | FXO-61FL2              |       |
| Output Frequency Range                  | F <sub>OUT</sub>                 | 1.8 ~ 50                     |                        | MHz   |
| Frequency Stability(overall)            | F <sub>SBY</sub>                 | ±30 (~40MHz)                 |                        | ppm   |
|                                         |                                  | ±50 (~40MHz)                 |                        |       |
|                                         |                                  | ±100                         |                        |       |
| Storage Temp. Range                     | T <sub>STG</sub>                 | −40 ~ +85                    |                        | °C    |
| Operating Temp. Range                   | T <sub>OPR</sub>                 | −10 ~ +70                    |                        | °C    |
| Max, Supply Voltage                     | —                                | 7.0 Max                      | 7.0 Max                | Volt  |
| Supply Voltage                          | V <sub>DD</sub>                  | 5 ±0.5                       | 3.3 ±0.3               | Volt  |
| Current Consumption<br>(Maximum Loaded) | I <sub>DD</sub>                  | 25 Max                       | 18 Max (1.8 ~ 39.9MHz) | mA    |
|                                         |                                  |                              | 25 Max (40 ~ 50MHz)    |       |
| Standby/Disable Current                 | I <sub>ST</sub> /I <sub>DE</sub> | 10 Max                       |                        | mA    |
| Duty Ratio                              | SYM                              | 40 ~ 60 @50% V <sub>DD</sub> |                        | %     |
| Rise/Fall Time                          | T <sub>r</sub> /T <sub>f</sub>   | 10 Max                       |                        | nS    |
| Output Voltage-"L"                      | V <sub>OL</sub>                  | 10% V <sub>DD</sub> Max      |                        | Volt  |
| Output Voltage-"H"                      | V <sub>OH</sub>                  | 90% V <sub>DD</sub> Min      |                        | Volt  |
| Output Load                             | CL                               | 15 (Max)                     | 20 (Max)               | pF    |
| Input Voltage Range                     | V <sub>IN</sub>                  | 0 to V <sub>DD</sub>         | 0 to V <sub>DD</sub>   | Volt  |
| Input Voltage-"L"                       | V <sub>IL</sub>                  | 0.8 Max                      | 0.3 Max                | Volt  |
| Input Voltage-"H"                       | V <sub>IH</sub>                  | 2.2 Min                      | 2.2 Min                | Volt  |
| Disable Time                            | —                                | 150 Max                      |                        | nS    |
| Enable Time                             | —                                | 5 Max                        |                        | mS    |
| Start-up Time                           | ST                               | 10 Max                       |                        | mS    |

Note: Please contact us for inquiries about extended operating temperature range, available frequencies and other conditions.  
All electrical characteristics are defined at the maximum load and operating temperature range.

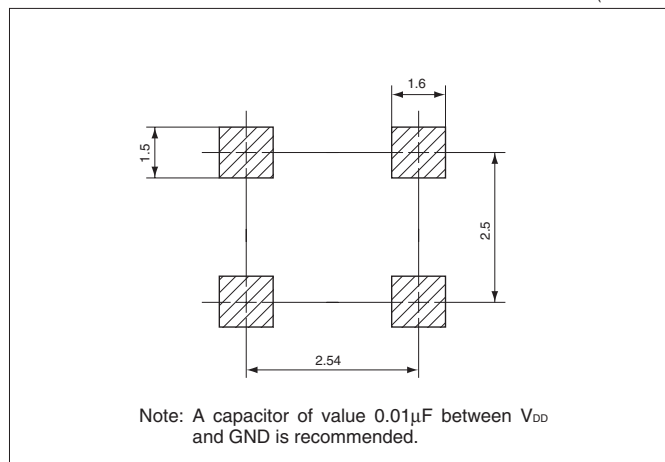
### Dimensions

(Unit : mm)



### Recommended Land Pattern

(Unit : mm)





Pb Free

RoHS Conforming

### Features

- A built-in high-precision C-MOS IC suitable for a wide range of temperature.
- Ideal for base stations and DSC,DVC,Car navigation for PHS systems etc.
- Lower noise and lower current for reduced power consumption.
- Supply voltage  $V_{DD}=3.3 / 5.0V$  available

### Applications

- PHS base stations
- DSC(Digital Still Camera)
- Digital Camcorder
- Car navigation

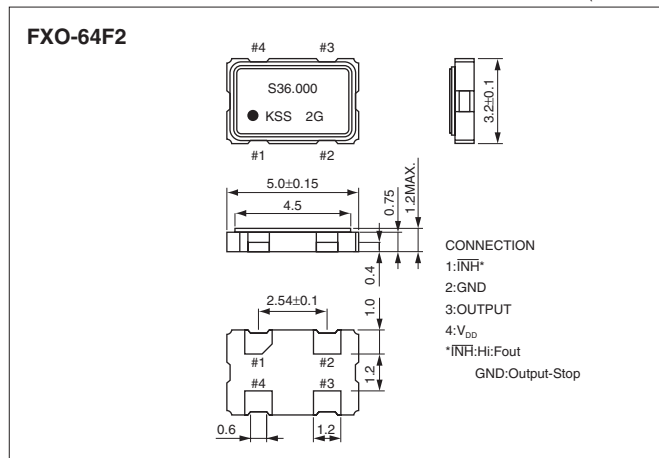
### Specifications

| Item                                | Symbol                           | Specifications               |                      | Units |
|-------------------------------------|----------------------------------|------------------------------|----------------------|-------|
|                                     |                                  | FXO-64F2                     | FXO-64FL2            |       |
| Output Frequency Range              | F <sub>OUT</sub>                 | 1.8 ~ 40                     |                      | MHz   |
| Frequency Stability(overall)        | F <sub>SBY</sub>                 | ±30                          |                      | ppm   |
|                                     |                                  | ±50                          |                      |       |
|                                     |                                  | ±100                         |                      |       |
| Storage Temp. Range                 | T <sub>STG</sub>                 | −40 ~ +85                    |                      | °C    |
| Operating Temp. Range               | T <sub>OPR</sub>                 | −30 ~ +85                    |                      | °C    |
| Max. Supply Voltage                 | —                                | 7 Max                        |                      | Volt  |
| Supply Voltage                      | V <sub>DD</sub>                  | 5 ± 5%                       | 3.3 ± 5%             | Volt  |
| Current Consumption(Maximum Loaded) | I <sub>DD</sub>                  | 12 Max                       | 10 Max               | mA    |
| Standby/Disable Current             | I <sub>ST</sub> /I <sub>DE</sub> | 8 Max                        |                      | mA    |
| Duty Ratio                          | SYM                              | 40 ~ 60 @50% V <sub>DD</sub> |                      | %     |
| Rise/Fall Time                      | T <sub>r</sub> /T <sub>f</sub>   | 12 Max                       | 16 Max               | nS    |
| Output Voltage-"L "                 | V <sub>OL</sub>                  | 10% V <sub>DD</sub> Max      |                      | Volt  |
| Output Voltage-"H"                  | V <sub>OH</sub>                  | 90% V <sub>DD</sub> Max      |                      | Volt  |
| Output Load                         | CL                               | 15 (Max)                     |                      | pF    |
| Input Voltage Range                 | V <sub>IN</sub>                  | 0 to V <sub>DD</sub>         | 0 to V <sub>DD</sub> | Volt  |
| Input Voltage-"L "                  | V <sub>IL</sub>                  | 0.8 Max                      | 0.3 Max              | Volt  |
| Input Voltage-"H"                   | V <sub>IH</sub>                  | 2.2 Min                      | 2.2 Min              | Volt  |
| Disable Time                        | —                                | 150 Max                      |                      | nS    |
| Enable Time                         | —                                | 5 Max                        |                      | mS    |
| Start-up Time                       | ST                               | 10 Max                       |                      | mS    |

Note: Please contact us for inquiries about extended operating temperature range, available frequencies and other conditions.  
All electrical characteristics are defined at the maximum load and operating temperature range.

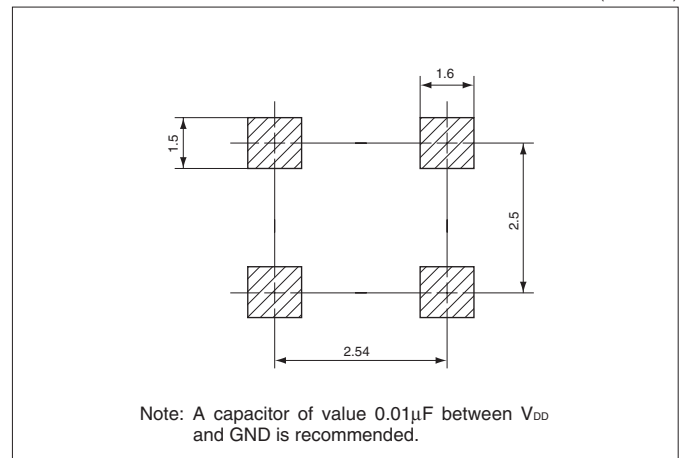
### Dimensions

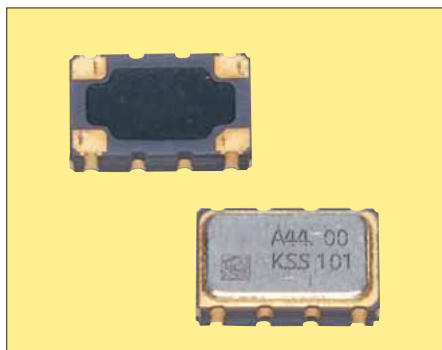
(Unit : mm)



### Recommended Land Pattern

(Unit : mm)





Pb Free

RoHS Conforming

### Features

- "H" type leadless ceramic package. (Reflow soldering compatible.)
- With tri-state function. (High Z)
- $\pm 15$ ppm /  $-40$  to  $+85^{\circ}\text{C}$  available

### Applications

- High stability clock oscillation for wireless LAN.

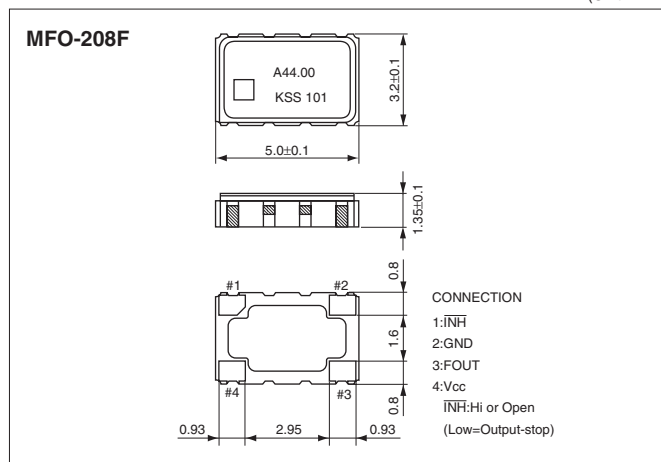
### Specifications

| Item                                 | Symbol                      | Conditions           | Min.                | Max.                | Units              |
|--------------------------------------|-----------------------------|----------------------|---------------------|---------------------|--------------------|
| Output Frequency Range               | $F_{\text{OUT}}$            |                      | 1.5                 | 55                  | MHz                |
| Frequency Stability(overall)         | $F_{\text{SBY}}$            |                      | -15                 | +15                 | ppm                |
| Storage Temp. Range                  | $T_{\text{STG}}$            |                      | -55                 | +125                | $^{\circ}\text{C}$ |
| Operating Temp. Range                | $T_{\text{OPR}}$            |                      | -40                 | +85                 | $^{\circ}\text{C}$ |
| Max. Supply Voltage                  | —                           |                      | -0.6                | 6                   | Volt               |
| Supply Voltage                       | $V_{\text{DD}}$             |                      | 2.7                 | 5.5                 | Volt               |
| Current Consumption (Maximum Loaded) | $I_{\text{DD}}$             | 1.5~25MHz            | —                   | 7                   | mA                 |
|                                      |                             | 25~55MHz             | —                   | 10                  |                    |
| Standby Current                      | $I_{\text{ST}}$             |                      | —                   | 50                  | $\mu\text{A}$      |
| Duty Ratio                           | SYM                         | @50% $V_{\text{DD}}$ | 45                  | 55                  | %                  |
| Rise/Fall Time                       | $T_{\text{r}}/T_{\text{f}}$ |                      | —                   | 6                   | nS                 |
| Output Voltage-"L"                   | $V_{\text{OL}}$             |                      | —                   | 10% $V_{\text{DD}}$ | Volt               |
| Output Voltage-"H"                   | $V_{\text{OH}}$             |                      | 90% $V_{\text{DD}}$ | —                   | Volt               |
| Output Load                          | CL                          |                      | —                   | 15                  | pF                 |
| Input Voltage Range                  | $V_{\text{IN}}$             |                      | 0                   | $V_{\text{DD}}$     | Volt               |
| Input Voltage-"L"                    | $V_{\text{IL}}$             |                      | 70% $V_{\text{DD}}$ | —                   | Volt               |
| Input Voltage-"H"                    | $V_{\text{IH}}$             |                      | —                   | 30% $V_{\text{DD}}$ | Volt               |
| Start-up Time                        | ST                          | 1.5~25MHz            | —                   | 1.5                 | mS                 |
|                                      |                             | 25~55MHz             | —                   | 1                   |                    |

Note: Please contact us for inquiries about extended operating temperature range, available frequencies and other conditions.  
All electrical characteristics are defined at the maximum load and operating temperature range.

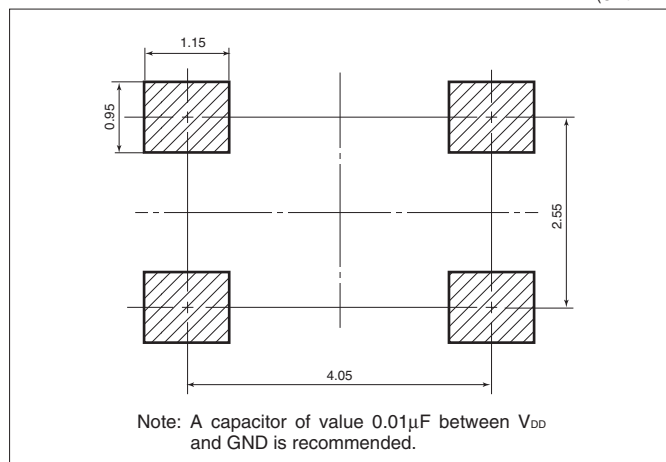
### Dimensions

(Unit : mm)



### Recommended Land Pattern

(Unit : mm)





Pb Free

RoHS Conforming

### Features

- Miniature ceramic package
- Highly reliable with seam welding
- CMOS output
- Supply voltage  $V_{DD}=1.8V$
- $\pm 25ppm$ ,  $\pm 20ppm$  available

Table 1

| Stability |       | T <sub>OPR</sub><br>(°C) | Note                             |
|-----------|-------|--------------------------|----------------------------------|
| Code      | (ppm) |                          |                                  |
| 0         | ± 50  | -10 to +70<br>(STD)      | Standard specifications          |
| S         | ± 30  |                          | With only certain<br>frequencies |
| U         | ± 25  |                          |                                  |
| W         | ± 20  |                          |                                  |
| F         | ±100  | -40 to +85<br>(Extend)   | With only certain<br>frequencies |
| G         | + 50  |                          |                                  |

### How to Order

K53-1C 0 - S E 25.0000  
① ② ③ ④ ⑤

- ① Type (7×5 SMD, 1.8V)  
 ② Frequency Stability Code (See Table 1)  
 ③ Duty Ratio (S: 45% to 55% STD)  
 ④ Enable/Disable Function (STD)  
 ⑤ Oscillation Frequency (Ex.: 25.0000MHz)

Packaging (Tape & Reel 1Kpcs/reel)

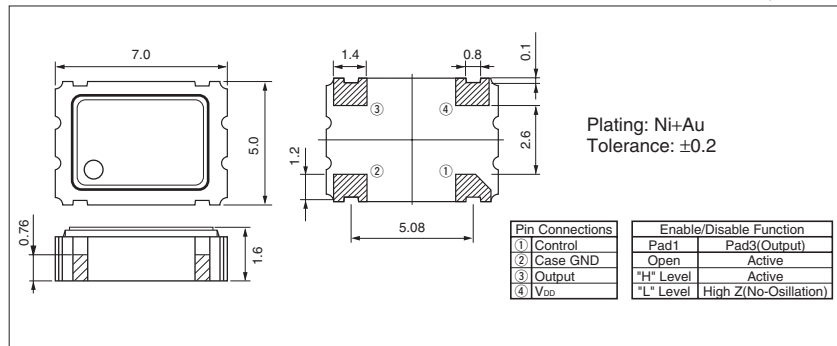
### Specifications

| Item                                                         | Symbol    | Conditions                                                                                                                                                        | Min.                     | Max.                     | Units   |
|--------------------------------------------------------------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|---------|
| Output Frequency Range                                       | $F_{OUT}$ |                                                                                                                                                                   | 1.8                      | 39.99                    | MHz     |
| Frequency Stability                                          | $F_{SBY}$ | Overall conditions:<br>initial tolerance, operating temperature range, rated power supply voltage change, load change, aging (1 year @ 25°C), shock and vibration | -20<br>-25<br>-30<br>-50 | +20<br>+25<br>+30<br>+50 | ppm     |
| Storage Temperature Range                                    | $T_{STG}$ |                                                                                                                                                                   | -55                      | +125                     | °C      |
| Operating Temperature Range                                  | $T_{OPR}$ | Standard<br>Extend(option)                                                                                                                                        | -10<br>-40               | +70<br>+85               |         |
| Max. Supply Voltage                                          | —         |                                                                                                                                                                   | -0.5                     | 3.6                      | Volt    |
| Supply Voltage                                               | $V_{DD}$  | Stability: $\pm 50ppm$ , $\pm 30ppm$ , $\pm 100ppm$ (Ext Temp)<br>Stability: $\pm 20ppm$ , $\pm 25ppm$ , $\pm 50ppm$ (Ext Temp)                                   | 1.75<br>1.71             | 1.85<br>1.89             |         |
| Current Consumption (Maximum Loaded)                         | $I_{DD}$  | $1.8 \leq F_{OUT} \leq 25MHz$<br>$25 < F_{OUT} \leq 39.99MHz$                                                                                                     | —<br>—                   | 3<br>4                   | mA      |
| Standby Current                                              | $I_{ST}$  | Standby Function                                                                                                                                                  | —                        | 10                       | $\mu A$ |
| Duty Ratio (Symmetry)                                        | SYM       | @ 50% $V_{DD}$                                                                                                                                                    | 45                       | 55                       | %       |
| Rise/Fall Time (10% $V_{DD}$ to 90% $V_{DD}$ Maximum Loaded) | $T_r/T_f$ |                                                                                                                                                                   | —                        | 9                        | nS      |
| Output Voltage-"L"                                           | $V_{OL}$  | $I_{OL}=2.8mA$                                                                                                                                                    | —                        | 10% $V_{DD}$             | Volt    |
| Output Voltage-"H"                                           | $V_{OH}$  | $I_{OH}=2.8mA$                                                                                                                                                    | 90% $V_{DD}$             | —                        |         |
| Output Load                                                  | CL        | CMOS                                                                                                                                                              | —                        | 15                       | pF      |
| Input Voltage Range                                          | $V_{IN}$  |                                                                                                                                                                   | 0                        | $V_{DD}$                 | Volt    |
| Input Voltage-"L"                                            | $V_{IL}$  |                                                                                                                                                                   | —                        | 30% $V_{DD}$             | Volt    |
| Input Voltage-"H"                                            | $V_{IH}$  |                                                                                                                                                                   | 70% $V_{DD}$             | —                        |         |
| Output Disable Time                                          | —         |                                                                                                                                                                   | —                        | 150                      | nS      |
| Output Enable Time                                           | —         |                                                                                                                                                                   | —                        | 5                        | mS      |
| Start-up Time                                                | ST        | @ Minimum operating Voltage to be 0sec.                                                                                                                           | —                        | 10                       | mS      |

Note: Please contact us for inquiries about extended operating temperature range, available frequencies and other conditions.  
 All electrical characteristics are defined at the maximum load and operating temperature range.

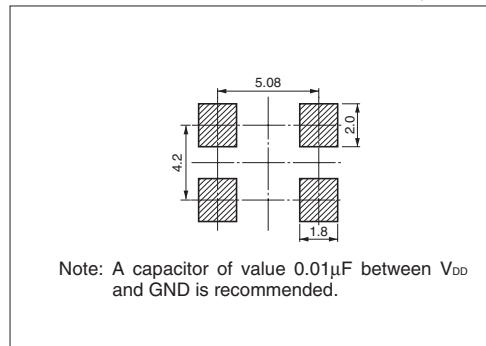
### Dimensions

(Unit : mm)



### Recommended Land Pattern

(Unit : mm)



CMOS / 2.5V / 7.0×5.0mm



Pb Free

RoHS Conforming

## Features

- Miniature ceramic package
- Highly reliable with seam welding
- CMOS output
- Supply voltage  $V_{DD}=2.5V$
- $\pm 25ppm$ ,  $\pm 20ppm$  available

Table 1

| Stability Code | Stability (ppm) | $T_{OPR}$ (°C)      | Note                          |
|----------------|-----------------|---------------------|-------------------------------|
| 0              | $\pm 50$        | -10 to +70 (STD)    | Standard specifications       |
| S              | $\pm 30$        |                     | With only certain frequencies |
| U              | $\pm 25$        |                     |                               |
| W              | $\pm 20$        |                     |                               |
| F              | $\pm 100$       | -40 to +85 (Extend) | With only certain frequencies |
| G              | $\pm 50$        |                     |                               |

## How to Order

K53-2C 0 - S E 25.0000  
① ② ③ ④ ⑤

- ① Type (7×5 SMD, 2.5V)  
 ② Frequency Stability Code (See Table 1)  
 ③ Duty Ratio (S: 45% to 55% STD)  
 ④ Enable/Disable Function (STD)  
 ⑤ Oscillation Frequency (Ex.: 25.0000MHz)

Packaging (Tape &amp; Reel 1Kpcs/reel)

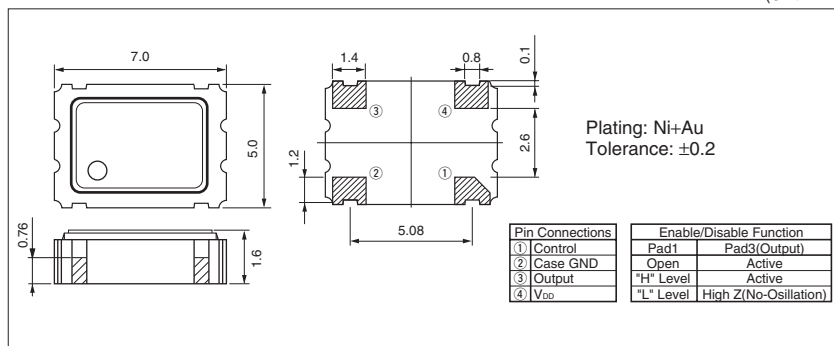
## Specifications

| Item                                                         | Symbol    | Conditions                                                                                                                                                        | Min.                     | Max.                     | Units   |
|--------------------------------------------------------------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|---------|
| Output Frequency Range                                       | $F_{OUT}$ |                                                                                                                                                                   | 1.8                      | 67                       | MHz     |
| Frequency Stability                                          | $F_{SBY}$ | Overall conditions:<br>initial tolerance, operating temperature range, rated power supply voltage change, load change, aging (1 year @ 25°C), shock and vibration | -20<br>-25<br>-30<br>-50 | +20<br>+25<br>+30<br>+50 | ppm     |
| Storage Temperature Range                                    | $T_{STG}$ |                                                                                                                                                                   | -55                      | +125                     | °C      |
| Operating Temperature Range                                  | $T_{OPR}$ | Standard<br>Extend (option)                                                                                                                                       | -10<br>-40               | +70<br>+85               |         |
| Max. Supply Voltage                                          | —         |                                                                                                                                                                   | -0.5                     | 7.0                      | Volt    |
| Supply Voltage                                               | $V_{DD}$  | Stability: $\pm 50ppm$ , $\pm 30ppm$ , $\pm 100ppm$ (Ext Temp)<br>Stability: $\pm 20ppm$ , $\pm 25ppm$ , $\pm 50ppm$ (Ext Temp)                                   | 2.38<br>2.43             | 2.62<br>2.57             |         |
| Current Consumption (Maximum Loaded)                         | $I_{DD}$  | 1.8 $\leq F_{OUT} \leq 20MHz$<br>20 $< F_{OUT} \leq 40MHz$<br>40 $< F_{OUT} \leq 67MHz$                                                                           | —<br>—<br>—              | 5<br>10<br>15            | mA      |
| Standby Current                                              | $I_{ST}$  | Standby Function                                                                                                                                                  | —                        | 10                       | $\mu A$ |
| Duty Ratio (Symmetry)                                        | SYM       | @ 50% $V_{DD}$                                                                                                                                                    | 45                       | 55                       | %       |
| Rise/Fall Time (10% $V_{DD}$ to 90% $V_{DD}$ Maximum Loaded) | $T_r/T_f$ | 1.8 $\leq F_{OUT} \leq 40MHz$<br>40 $< F_{OUT} \leq 67MHz$                                                                                                        | —<br>—                   | 7<br>4                   | nS      |
| Output Voltage-"L"                                           | $V_{OL}$  | $I_{OL}=4mA$ (8mA: 40MHz $< F_{OUT}$ )                                                                                                                            | —                        | 10% $V_{DD}$             | Volt    |
| Output Voltage-"H"                                           | $V_{OH}$  | $I_{OH}=-4mA$ (-8mA: 40MHz $< F_{OUT}$ )                                                                                                                          | 90% $V_{DD}$             | —                        |         |
| Output Load                                                  | CL        | CMOS                                                                                                                                                              | —                        | 15                       | pF      |
| Input Voltage Range                                          | $V_{IN}$  |                                                                                                                                                                   | 0                        | $V_{DD}$                 | Volt    |
| Input Voltage-"L"                                            | $V_{IL}$  |                                                                                                                                                                   | —                        | 30% $V_{DD}$             | Volt    |
| Input Voltage-"H"                                            | $V_{IH}$  |                                                                                                                                                                   | 70% $V_{DD}$             | —                        |         |
| Output Disable Time                                          | —         |                                                                                                                                                                   | —                        | 150                      | nS      |
| Output Enable Time                                           | —         |                                                                                                                                                                   | —                        | 5                        | mS      |
| Start-up Time                                                | ST        | @ Minimum operating Voltage to be 0sec.                                                                                                                           | —                        | 10                       | mS      |

Note: Please contact us for inquiries about extended operating temperature range, available frequencies and other conditions.  
 All electrical characteristics are defined at the maximum load and operating temperature range.

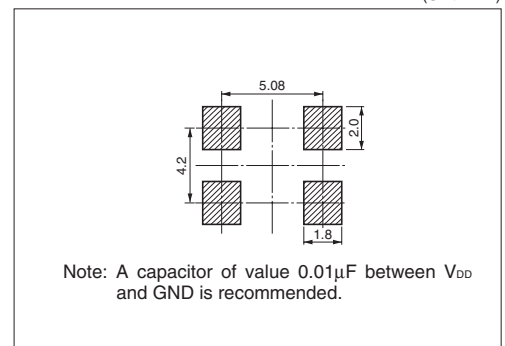
## Dimensions

(Unit : mm)



## Recommended Land Pattern

(Unit : mm)





Pb Free

RoHS Compliant

## Features

- Miniature ceramic package
- Highly reliable with seam welding
- CMOS output
- Supply voltage  $V_{DD}=3.3V$
- $\pm 25\text{ppm}$ ,  $\pm 20\text{ppm}$  available

Table 1

| Stability |           | $T_{OPR}$<br>(°C)      | Note                          |
|-----------|-----------|------------------------|-------------------------------|
| Code      | (ppm)     |                        |                               |
| 0         | $\pm 50$  | -10 to +70<br>(STD)    | Standard specifications       |
| S         | $\pm 30$  |                        | With only certain frequencies |
| U         | $\pm 25$  |                        |                               |
| W         | $\pm 20$  |                        |                               |
| F         | $\pm 100$ | -40 to +85<br>(Extend) | With only certain frequencies |
| G         | $\pm 50$  |                        |                               |

## How to Order

K53-3C 0 - S E 25.0000  
① ② ③ ④ ⑤

- ① Type(7×5 SMD, 3.3V)  
 ② Frequency Stability Code(See Table1)  
 ③ Duty Ratio(S: 45% to 55% STD)  
 ④ Enable/Disable Function(STD)  
 ⑤ Oscillation Frequency(Ex.: 25.0000MHz)

Packaging(Tape & Reel 1,000pcs/reel)

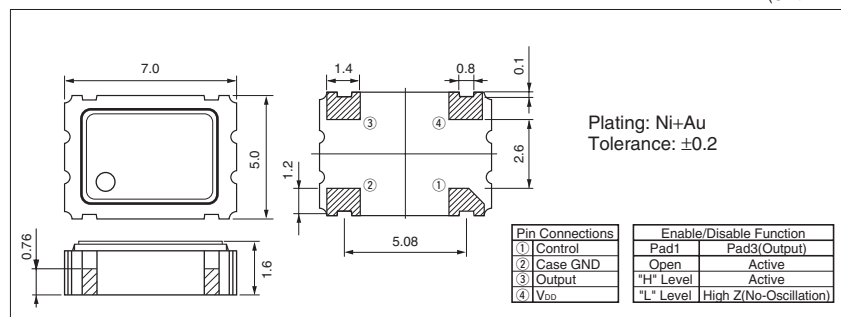
## Specifications

| Item                                                            | Symbol    | Conditions                                                                                                                                                                | Min.         | Max.         | Units         |
|-----------------------------------------------------------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------|---------------|
| Output Frequency Range                                          | $F_{OUT}$ |                                                                                                                                                                           | 1.8          | 160          | MHz           |
| Frequency Stability                                             | $F_{SBY}$ | Overall conditions:<br>initial tolerance, operating temperature range, rated power supply voltage change, load change, aging(1year @25°C), shock and vibration            | -20          | +20          | ppm           |
|                                                                 |           |                                                                                                                                                                           | -25          | +25          |               |
|                                                                 |           |                                                                                                                                                                           | -30          | +30          |               |
|                                                                 |           |                                                                                                                                                                           | -50          | +50          |               |
| Storage Temperature Range                                       | $T_{STG}$ |                                                                                                                                                                           | -55          | +125         | °C            |
| Operating Temperature Range                                     | $T_{OPR}$ | Standard<br>Extend(option)                                                                                                                                                | -10<br>-40   | +70<br>+85   |               |
| Max. Supply Voltage                                             | —         |                                                                                                                                                                           | -0.5         | 7.0          | Volt          |
| Supply Voltage                                                  | $V_{DD}$  | Stability: $\pm 50\text{ppm}$ , $\pm 30\text{ppm}$ , $\pm 100\text{ppm}$ (Ext Temp)<br>Stability: $\pm 20\text{ppm}$ , $\pm 25\text{ppm}$ , $\pm 50\text{ppm}$ (Ext Temp) | 2.97<br>3.14 | 3.63<br>3.46 |               |
| Current Consumption<br>(Maximum Loaded)                         | $I_{DD}$  | $1.8 \leq F_{OUT} \leq 20\text{MHz}$                                                                                                                                      | —            | 10           | mA            |
|                                                                 |           | $20 < F_{OUT} \leq 40\text{MHz}$                                                                                                                                          | —            | 15           |               |
|                                                                 |           | $40 < F_{OUT} \leq 60\text{MHz}$                                                                                                                                          | —            | 30           |               |
|                                                                 |           | $60 < F_{OUT} \leq 80\text{MHz}$                                                                                                                                          | —            | 35           |               |
|                                                                 |           | $80 < F_{OUT} \leq 100\text{MHz}$                                                                                                                                         | —            | 40           |               |
|                                                                 |           | $100 < F_{OUT} \leq 135\text{MHz}$                                                                                                                                        | —            | 50           |               |
| Standby Current                                                 | $I_{ST}$  | Standby Function                                                                                                                                                          | —            | 10           | $\mu\text{A}$ |
| Duty Ratio(Symmetry)                                            | SYM       | @50% VDD                                                                                                                                                                  | 45           | 55           | %             |
| Rise/Fall Time<br>(10% $V_{DD}$ to 90% $V_{DD}$ Maximum Loaded) | $T_r/T_f$ | $8 \leq F_{OUT} \leq 26\text{MHz}$                                                                                                                                        | —            | 10           | nS            |
|                                                                 |           | $26 < F_{OUT} \leq 45\text{MHz}$                                                                                                                                          | —            | 8            |               |
|                                                                 |           | $45 < F_{OUT} \leq 100\text{MHz}$                                                                                                                                         | —            | 5            |               |
|                                                                 |           | $100 \leq F_{OUT} \leq 160\text{MHz}$                                                                                                                                     | —            | 2.5          |               |
| Output Voltage-"L"                                              | $V_{OL}$  | $I_{OL}=8\text{mA}$                                                                                                                                                       | —            | 10% $V_{DD}$ | Volt          |
| Output Voltage-"H"                                              | $V_{OH}$  | $I_{OH}=-8\text{mA}$                                                                                                                                                      | 90% $V_{DD}$ | —            |               |
| Output Load                                                     | CL        | CMOS                                                                                                                                                                      | —            | 15           | pF            |
| Input Voltage Range                                             | $V_{IN}$  |                                                                                                                                                                           | 0            | $V_{DD}$     | Volt          |
| Input Voltage-"L"                                               | $V_{IL}$  |                                                                                                                                                                           | —            | 30% $V_{DD}$ | Volt          |
| Input Voltage-"H"                                               | $V_{IH}$  |                                                                                                                                                                           | 70% $V_{DD}$ | —            |               |
| Output Disable Time                                             | —         |                                                                                                                                                                           | —            | 150          | nS            |
| Output Enable Time                                              | —         |                                                                                                                                                                           | —            | 5            | mS            |
| Start-up Time                                                   | ST        | @Minimum operating Voltage to be 0sec.                                                                                                                                    | —            | 10           | mS            |

Note: Please contact us for inquiries about extended operating temperature range, available frequencies and other conditions.  
 All electrical characteristics are defined at the maximum load and operating temperature range.

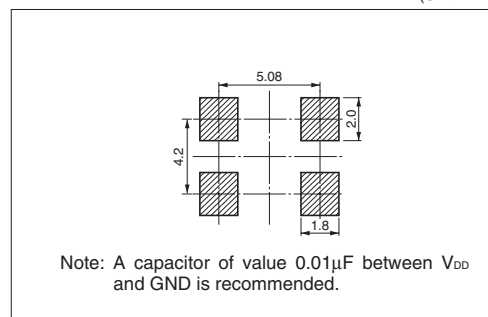
## Dimensions

(Unit : mm)



## Recommended Land Pattern

(Unit : mm)





Pb Free

RoHS Conforming

## Features

- Miniature ceramic package
- Highly reliable with seam welding
- CMOS output
- Supply voltage VDD=5.0V
- ±25ppm available

Table 1

| Stability Code | Stability (ppm) | T <sub>OPR</sub> (°C) | Note                          |
|----------------|-----------------|-----------------------|-------------------------------|
|                |                 |                       |                               |
| 0              | ± 50            | -10 to +70 (STD)      | Standard specifications       |
| S              | ± 30            |                       | With only certain frequencies |
| U              | ± 25            |                       | With only certain frequencies |
| F              | ±100            | -40 to +85 (Extend)   | With only certain frequencies |
| G              | ± 50            |                       |                               |

## How to Order

K53-HC 0 - C S E 25.0000  
① ② ③ ④ ⑤ ⑥

- ① Type(7×5 SMD, 5.0V)  
 ② Frequency Stability Code(See Table1)  
 ③ CMOS Output  
 ④ Duty Ratio(S: 45% to 55% STD)  
 ⑤ Enable/Disable Function(STD)  
 ⑥ Oscillation Frequency(Ex.: 25.0000MHz)

Packaging(Tape &amp; Reel 1,000pcs/reel)

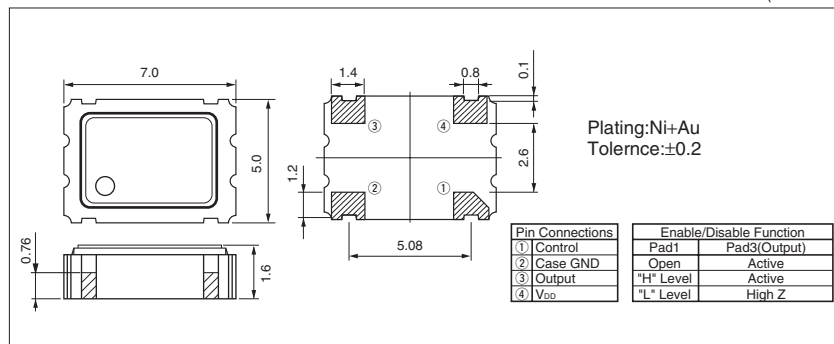
## Specifications

| Item                                                                          | Symbol                         | Conditions                                                                                                                                                           | Min.                | Max.                | Units |
|-------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------|-------|
| Output Frequency Range                                                        | F <sub>OUT</sub>               |                                                                                                                                                                      | 1.8                 | 50                  | MHz   |
| Frequency Stability                                                           | F <sub>SBY</sub>               | Overall conditions:<br>initial tolerance, operating temperature range, rated power<br>supply voltage change, load change, aging(1year @25°C),<br>shock and vibration | -25<br>-30<br>-50   | +25<br>+30<br>+50   | ppm   |
| Storage Temperature Range                                                     | T <sub>STG</sub>               |                                                                                                                                                                      | -55                 | +125                | °C    |
| Operating Temperature Range                                                   | T <sub>OPR</sub>               | Standard                                                                                                                                                             | -10                 | +70                 |       |
|                                                                               |                                | Extend(option)                                                                                                                                                       | -40                 | +85                 |       |
| Max. Supply Voltage                                                           | —                              |                                                                                                                                                                      | -0.5                | 7.0                 | Volt  |
| Supply Voltage                                                                | V <sub>DD</sub>                | Stability: ±50ppm, ±30ppm, ±100ppm(Ext Temp)<br>Stability: ±25ppm, ±50ppm(Ext Temp)                                                                                  | 4.5<br>4.75         | 5.5<br>5.25         |       |
| Current Consumption<br>(Maximum Loaded)                                       | I <sub>DD</sub>                | 1.8<F <sub>OUT</sub> ≤20MHz<br>20<F <sub>OUT</sub> ≤40MHz<br>40<F <sub>OUT</sub> ≤50MHz                                                                              | —<br>—<br>—         | 25<br>35<br>50      | mA    |
| Disable Current                                                               | I <sub>DE</sub>                | @ 50.0000MHz                                                                                                                                                         | —                   | 30                  | mA    |
| Duty Ratio(Symmetry)                                                          | SYM                            | @ 50% V <sub>DD</sub>                                                                                                                                                | 45                  | 55                  | %     |
| Rise/Fall Time<br>(10% V <sub>DD</sub> to 90% V <sub>DD</sub> Maximum Loaded) | T <sub>r</sub> /T <sub>f</sub> | 8<F <sub>OUT</sub> ≤26MHz<br>26<F <sub>OUT</sub> ≤50MHz                                                                                                              | —<br>—              | 10<br>8             | nS    |
| Output Voltage-"L"                                                            | V <sub>OL</sub>                | I <sub>OL</sub> =16mA                                                                                                                                                | —                   | 10% V <sub>DD</sub> | Volt  |
| Output Voltage-"H"                                                            | V <sub>OH</sub>                | I <sub>OH</sub> =16mA                                                                                                                                                | 90% V <sub>DD</sub> | —                   |       |
| Output Load                                                                   | CL                             |                                                                                                                                                                      | —                   | 50                  | pF    |
| Input Voltage Range                                                           | V <sub>IN</sub>                |                                                                                                                                                                      | 0                   | V <sub>DD</sub>     | Volt  |
| Input Voltage-"L"                                                             | V <sub>IL</sub>                |                                                                                                                                                                      | —                   | 0.8                 | Volt  |
| Input Voltage-"H"                                                             | V <sub>IH</sub>                |                                                                                                                                                                      | 2.2                 | —                   |       |
| Output Disable Time                                                           | —                              |                                                                                                                                                                      | —                   | 100                 | nS    |
| Output Enable Time                                                            | —                              |                                                                                                                                                                      | —                   | 100                 | nS    |
| Start-up Time                                                                 | ST                             | @ Minimum operating Voltage to be 0sec.                                                                                                                              | —                   | 10                  | mS    |

Note: Please contact us for inquiries about extended operating temperature range, available frequencies and other conditions.  
 All electrical characteristics are defined at the maximum load and operating temperature range.

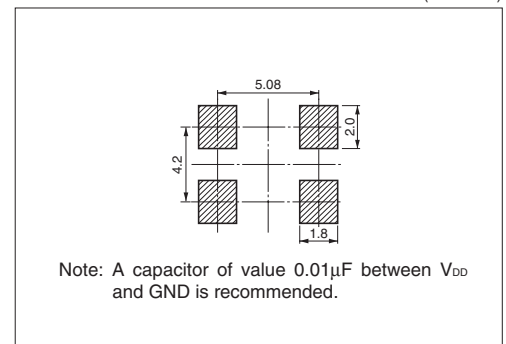
## Dimensions

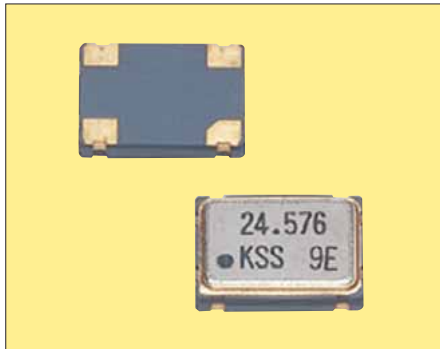
(Unit : mm)



## Recommended Land Pattern

(Unit : mm)





Pb Free

RoHS Comforming

### Features

- Surface mount type suitable for auto pick-and-place.
- Reflow soldering compatible.
- CMOS, TTL IC direct drive is possible.
- With tri-state function
- Broad frequency range from 1.8MHz to 50MHz.
- Supply voltage  $V_{DD}=3.3 / 5.0V$  available

### Applications

- Digital electronics
- Amusement
- Audio visual
- Factory automation

### Specifications

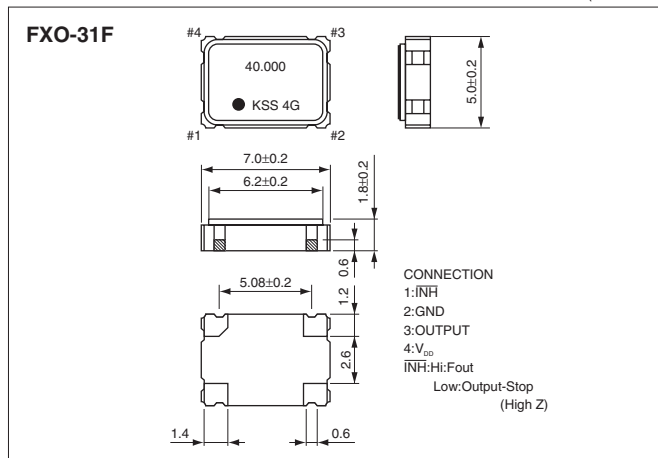
| Item                                    | Symbol                           | Specifications               |                        | Units |
|-----------------------------------------|----------------------------------|------------------------------|------------------------|-------|
|                                         |                                  | FXO-31FH                     | FXO-31FL               |       |
| Output Frequency Range                  | F <sub>OUT</sub>                 | 1.8 ~ 50                     |                        | MHz   |
| Frequency Stability(overall)            | F <sub>SBY</sub>                 | ±30                          |                        | ppm   |
|                                         |                                  | ±50                          |                        |       |
|                                         |                                  | ±100                         |                        |       |
| Storage Temp. Range                     | T <sub>STG</sub>                 | −40 ~ +85                    |                        | °C    |
| Operating Temp. Range                   | T <sub>OPR</sub>                 | −10 ~ +70                    |                        | °C    |
| Max. Supply Voltage                     | —                                | 7.0 Max                      | 7.0 Max                | Volt  |
| Supply Voltage                          | V <sub>DD</sub>                  | 5 ± 0.5                      | 3.3 ± 0.3              | Volt  |
| Current Consumption<br>(Maximum Loaded) | I <sub>DD</sub> /I <sub>DE</sub> | 25 Max (1.8 ~ 15MHz)         | 18 Max (1.8 ~ 39.9MHz) | mA    |
|                                         |                                  | 30 Max (15.1 ~ 32MHz)        |                        |       |
|                                         |                                  | 45 Max (32.1 ~ 50MHz)        | 25 Max (40 ~ 50MHz)    |       |
| Standby/Disable Current                 | I <sub>ST</sub> /I <sub>DE</sub> | 10 Max                       |                        | mA    |
| Duty Ratio                              | SYM                              | 40 ~ 60 @50% V <sub>DD</sub> |                        | %     |
| Rise/Fall Time                          | T <sub>r</sub> /T <sub>f</sub>   | 10 Max                       |                        | nS    |
| Output Voltage-"L "                     | V <sub>OL</sub>                  | 10% V <sub>DD</sub> Max      |                        | Volt  |
| Output Voltage-"H"                      | V <sub>OH</sub>                  | 90% V <sub>DD</sub> Min      |                        | Volt  |
| Output Load                             | CL                               | 50(Max)                      | 20(Max)                | pF    |
| Input Voltage Range                     | V <sub>IN</sub>                  | 0 to V <sub>DD</sub>         | 0 to V <sub>DD</sub>   | Volt  |
| Input Voltage-"L "                      | V <sub>IL</sub>                  | 0.8 Max                      | 0.3 Max                | Volt  |
| Input Voltage-"H"                       | V <sub>IH</sub>                  | 2.2 Min                      | 2.2 Min                | Volt  |
| Disable Time                            | —                                | 150 Max                      |                        | nS    |
| Enable Time                             | —                                | 5 Max                        |                        | mS    |
| Start-up Time                           | ST                               | 10 Max                       |                        | mS    |

Note: Please contact us for inquiries about extended operating temperature range, available frequencies and other conditions.

All electrical characteristics are defined at the maximum load and operating temperature range.

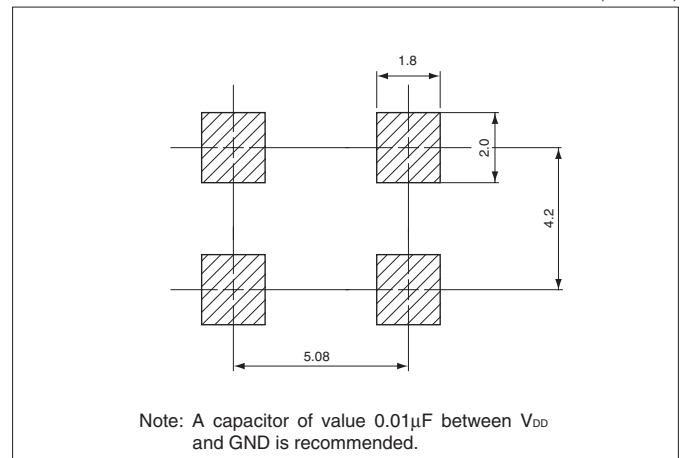
### Dimensions

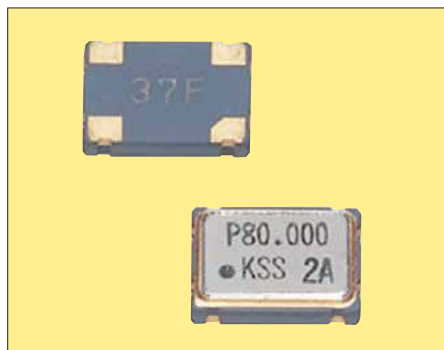
(Unit : mm)



### Recommended Land Pattern

(Unit : mm)





Pb Free

RoHS Conforming

### Features

- Surface mount type suitable for auto pick-and-place.
- Reflow compatible.
- CMOS, TTL IC direct drive is possible.
- With tri-state function.
- Broad frequency range from 50MHz to 125MHz. (PLL circuit is built in).
- Supply voltage  $V_{DD}=3.3 / 5.0V$  available

### Applications

- Digital electronics
- Audio visual
- Factory automation
- Amusement

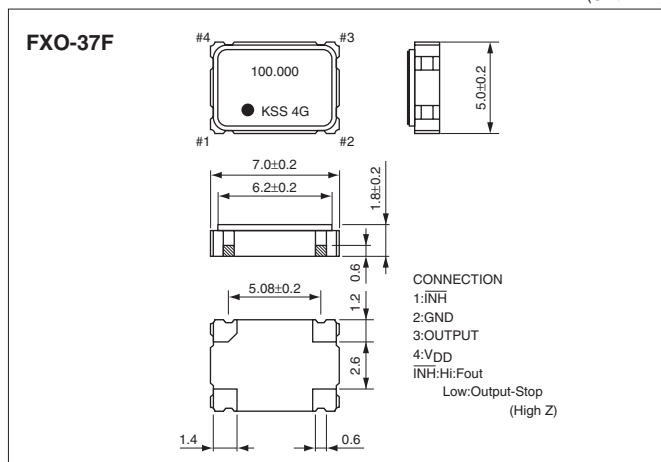
### Specifications

| Item                                | Symbol      | Conditions     | Min          | Max          | Units |
|-------------------------------------|-------------|----------------|--------------|--------------|-------|
| Output Frequency Range              | $F_{OUT}$   |                | 80           | 125          | MHz   |
| Frequency Stability(overall)        | $F_{SBY}$   |                | -50          | +50          | ppm   |
|                                     |             |                | -100         | +100         |       |
| Storage Temp. Range                 | $T_{STG}$   |                | -20          | +80          | °C    |
| Operating Temp. Range               | $T_{OPR}$   |                | 0            | +70          | °C    |
| Max. Supply Voltage                 | —           |                | —            | 6            | Volt  |
| Supply Voltage                      | $V_{DD}$    | 3.3V Type      | 3.135        | 3.465        | Volt  |
|                                     |             | 5.5V Type      | 4.75         | 5.25         |       |
| Current Consumption(Maximum Loaded) | $I_{DD}$    |                | —            | 70           | mA    |
| Standby Current                     | $I_{ST}$    |                | —            | 60           | μA    |
| Duty Ratio                          | SYM         | @ 50% $V_{DD}$ | 40           | 60           | %     |
| Output Voltage-"L"                  | $T_r / T_f$ |                | —            | 7            | nS    |
| Output Voltage-"H"                  | $V_{OL}$    |                | —            | 10% $V_{DD}$ | Volt  |
| Output Load                         | $V_{OH}$    | @ 3.3V         | 2.8          | —            | Volt  |
|                                     |             | @ 5.0V         | 4            | —            |       |
| Output Load                         | CL          |                | —            | 15           | pF    |
| Input Voltage Range                 | $V_{IN}$    |                | $V_{SS}$     | $V_{DD}$     | Volt  |
| Input Voltage-"L"                   | $V_{IL}$    |                | —            | 30% $V_{DD}$ | Volt  |
| Input Voltage-"H"                   | $V_{IH}$    |                | 70% $V_{DD}$ | —            | —     |
| Disable Time                        | —           |                | —            | 1            | mS    |
| Enable Time                         | —           |                | —            | 3            | mS    |
| Start-up Time                       | ST          |                | —            | 10           | mS    |

Note: Please contact us for inquiries about extended operating temperature range, available frequencies and other conditions.  
All electrical characteristics are defined at the maximum load and operating temperature range.

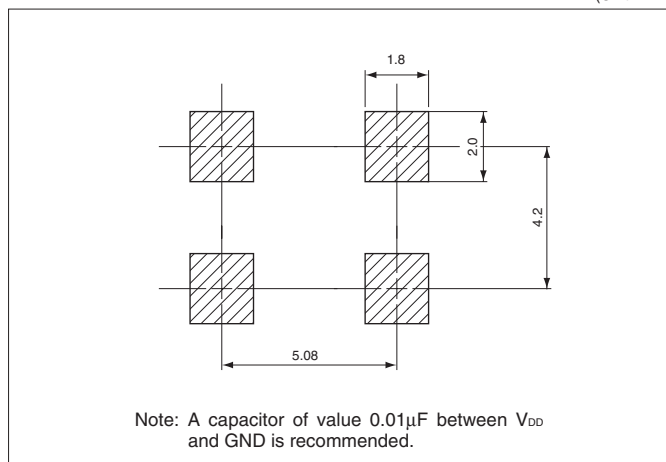
### Dimensions

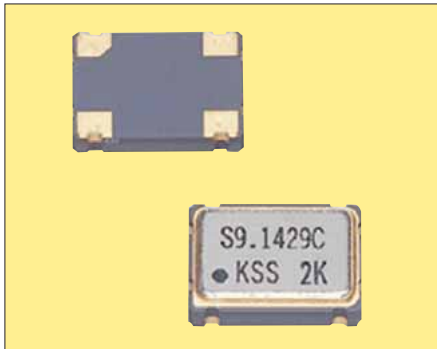
(Unit : mm)



### Recommended Land Pattern

(Unit : mm)





Pb Free

RoHS Compliant

### Features

- This crystal oscillator has a built-in high-precision C-MOS IC suitable for a wide range of temperature.
- Lower noise and lower current for reduced power consumption.
- Supply voltage  $V_{DD}=3.3 / 5.0V$  available

### Applications

- PHS base stations
- DSC(Digital Still Camera)
- Digital video Camcorder
- Car navigation

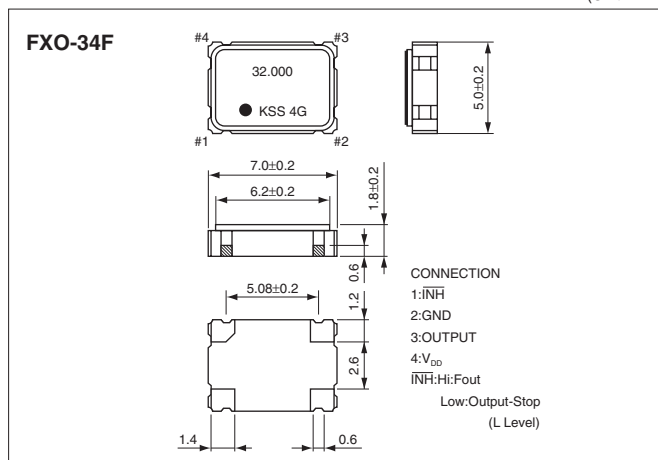
### Specifications

| Item                                | Symbol                           | Specifications               |                      | Units |
|-------------------------------------|----------------------------------|------------------------------|----------------------|-------|
|                                     |                                  | FXO-34F                      | FXO-34FL             |       |
| Output Frequency Range              | F <sub>OUT</sub>                 | 1.8 ~ 40                     |                      | MHz   |
| Frequency Stability(overall)        | F <sub>SBY</sub>                 | ±30                          |                      | ppm   |
|                                     |                                  | ±50                          |                      |       |
|                                     |                                  | ±100                         |                      |       |
| Storage Temp. Range                 | T <sub>STG</sub>                 | -40 ~ +85                    |                      | °C    |
| Operating Temp. Range               | T <sub>OPR</sub>                 | -30 ~ +85                    |                      | °C    |
| Max. Supply Voltage                 | —                                | 7 Max                        |                      | Volt  |
| Supply Voltage                      | V <sub>DD</sub>                  | 5 ± 5%                       | 3.3 ± 5%             | Volt  |
| Current Consumption(Maximum Loaded) | I <sub>DD</sub>                  | 12 Max                       | 10 Max               | mA    |
| Standby/Disable Current             | I <sub>ST</sub> /I <sub>DE</sub> | 8 Max                        |                      | mA    |
| Duty Ratio                          | SYM                              | 40 ~ 60 @50% V <sub>DD</sub> |                      | %     |
| Rise/Fall Time                      | Tr / Tf                          | 12 Max                       | 16 Max               | nS    |
| Output Voltage-"L"                  | V <sub>OL</sub>                  | 10% V <sub>DD</sub> Max      |                      | Volt  |
| Output Voltage-"H"                  | V <sub>OH</sub>                  | 90% V <sub>DD</sub> Max      |                      | Volt  |
| Output Load                         | CL                               | 15 (Max)                     |                      | pF    |
| Input Voltage Range                 | V <sub>IN</sub>                  | 0 to V <sub>DD</sub>         | 0 to V <sub>DD</sub> | Volt  |
| Input Voltage-"L"                   | V <sub>IL</sub>                  | 0.8 Max                      | 0.3 Max              | Volt  |
| Input Voltage-"H"                   | V <sub>IH</sub>                  | 2.2 Min                      | 2.2 Min              | Volt  |
| Disable Time                        | —                                | 150 Max                      |                      | nS    |
| Enable Time                         | —                                | 5 Max                        |                      | mS    |
| Start-up Time                       | ST                               | 10 Max                       |                      | mS    |

Note: Please contact us for inquiries about extended operating temperature range, available frequencies and other conditions.  
All electrical characteristics are defined at the maximum load and operating temperature range.

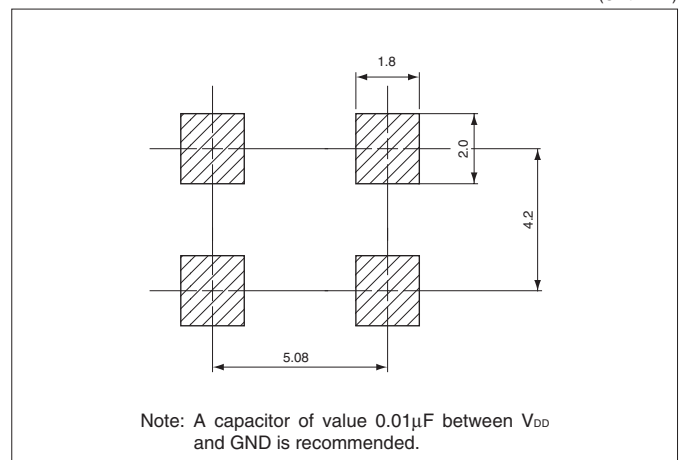
### Dimensions

(Unit : mm)



### Recommended Land Pattern

(Unit : mm)





Pb Free

RoHS Comforming

### Features

- Miniature ceramic package
- Highly reliable with seam welding
- CMOS output
- Supply voltage  $V_{DD}=3.3V$
- Internal Bypass Capacitor
- Low Jitter
- $\pm 25ppm$  available

Table 1

| Stability |           | $T_{OPR}$<br>(°C)        | Note                          |
|-----------|-----------|--------------------------|-------------------------------|
| Code      | (ppm)     |                          |                               |
| O         | $\pm 50$  | -10 to +70<br>(Standard) | Standard specifications       |
| S         | $\pm 30$  |                          | With only certain frequencies |
| U         | $\pm 25$  |                          | With only certain frequencies |
| F         | $\pm 100$ | -40 to +85<br>(Extend)   | With only certain frequencies |
| G         | $\pm 50$  |                          |                               |

### How to Order

K50H-3C 0 - S E 125.000  
① ② ③ ④ ⑤

- ① Type(7×5 SMD, 3.3V)
- ② Frequency Stability Code(See Table1)
- ③ Duty Ratio(S: 45% to 55% STD)
- ④ Enable/Disable Function(STD)
- ⑤ Oscillation Frequency(Ex.: 125.000MHz)

Packaging(Tape & Reel 1,000pcs/reel)

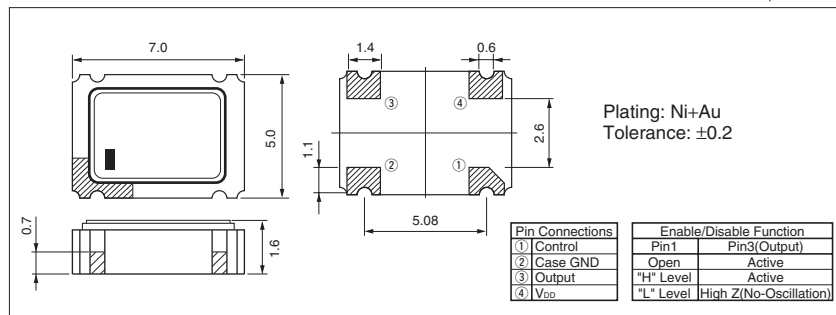
### Specifications

| Item                                                            | Symbol    | Conditions                                                                                                                                                      |                              | Min.              | Max.              | Units   |
|-----------------------------------------------------------------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-------------------|-------------------|---------|
| Output Frequency Range                                          | $F_{OUT}$ |                                                                                                                                                                 |                              | 50                | 170               | MHz     |
| Frequency Stability                                             | $F_{SBY}$ | Overall conditions:<br>initial tolerance, operating temperature range, rated power supply voltage change, load change, aging(1year @ 25°C), shock and vibration |                              | -25<br>-30<br>-50 | +25<br>+30<br>+50 | ppm     |
| Storage Temperature Range                                       | $T_{STG}$ | Standard                                                                                                                                                        |                              | -55               | +125              | °C      |
| Operating Temperature Range                                     | $T_{OPR}$ | Extend(option)                                                                                                                                                  |                              | -10<br>-40        | +70<br>+85        |         |
| Max. Supply Voltage                                             | —         |                                                                                                                                                                 |                              | -0.5              | 7.0               | Volt    |
| Supply Voltage                                                  | $V_{DD}$  | Stability: $\pm 50ppm$ , $\pm 100ppm$ (Ext Temp)<br>Stability: $\pm 25ppm$ , $\pm 30ppm$ , $\pm 50ppm$ (Ext Temp)                                               |                              | 2.97<br>3.14      | 3.63<br>3.46      |         |
| Current Consumption<br>(Maximum Loaded)                         | $I_{DD}$  | 50 $\leq F_{OUT} \leq 85MHz$                                                                                                                                    |                              | —                 | 30                | mA      |
|                                                                 |           | 85 $< F_{OUT} \leq 100MHz$                                                                                                                                      |                              | —                 | 40                |         |
|                                                                 |           | 100 $< F_{OUT} \leq 135MHz$                                                                                                                                     |                              | —                 | 50                |         |
|                                                                 |           | 135 $< F_{OUT} \leq 160MHz$                                                                                                                                     |                              | —                 | 60                |         |
| Duty Ratio(Symmetry)                                            | $I_{ST}$  | Standby Function                                                                                                                                                |                              | —                 | 10                | $\mu A$ |
| Duty Ratio(Symmetry)                                            | SYM       | @ 50% $V_{DD}$                                                                                                                                                  |                              | 45                | 55                | %       |
| Rise/Fall Time<br>(10% $V_{DD}$ to 90% $V_{DD}$ Maximum Loaded) | $T_r/T_f$ | 50 $\leq F_{OUT} < 100MHz$                                                                                                                                      | 20% $V_{DD}$ to 80% $V_{DD}$ | —                 | 3.5               | nS      |
|                                                                 |           |                                                                                                                                                                 | 10% $V_{DD}$ to 90% $V_{DD}$ | —                 | 5.0               |         |
|                                                                 |           | 100 $\leq F_{OUT} \leq 160MHz$                                                                                                                                  | 20% $V_{DD}$ to 80% $V_{DD}$ | —                 | 1.5               |         |
|                                                                 |           |                                                                                                                                                                 | 10% $V_{DD}$ to 90% $V_{DD}$ | —                 | 2.0               |         |
| Output Voltage-"L"                                              | $V_{OL}$  |                                                                                                                                                                 |                              | —                 | 10% $V_{DD}$      | Volt    |
| Output Voltage-"H"                                              | $V_{OH}$  |                                                                                                                                                                 |                              | 90% $V_{DD}$      | —                 |         |
| Output Load                                                     | CL        | CMOS                                                                                                                                                            |                              | —                 | 15                | pF      |
| Input Voltage Range                                             | $V_{IN}$  |                                                                                                                                                                 |                              | 0                 | $V_{DD}$          | Volt    |
| Input Voltage-"L"                                               | $V_{IL}$  |                                                                                                                                                                 |                              | —                 | 30% $V_{DD}$      | Volt    |
| Input Voltage-"H"                                               | $V_{IH}$  |                                                                                                                                                                 |                              | 70% $V_{DD}$      | —                 |         |
| Output Disable Time                                             | —         |                                                                                                                                                                 |                              | —                 | 5                 | mS      |
| Output Enable Time                                              | —         |                                                                                                                                                                 |                              | —                 | 150               | nS      |
| Start-up Time                                                   | ST        | @Minimum operating Voltage to be 0sec.                                                                                                                          |                              | —                 | 10                | mS      |
| Deterministic Jitter pk-pk                                      | DJ        | Measured with "Wavecrest DTS-2079", VISI 6.3.1                                                                                                                  |                              | —                 | 2                 | psec    |
| 1Sigma jitter                                                   | 1sigma    |                                                                                                                                                                 |                              | —                 | 4                 |         |

Note: Please contact us for inquiries about extended operating temperature range, available frequencies and other conditions.  
All electrical characteristics are defined at the maximum load and operating temperature range.

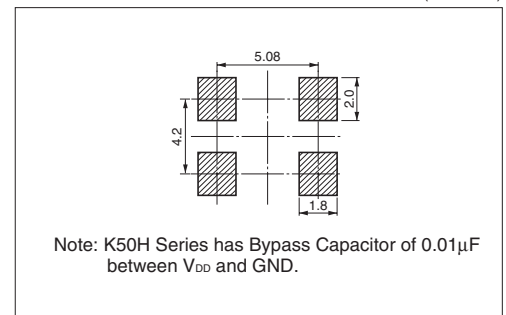
### Dimensions

(Unit : mm)



### Recommended Land Pattern

(Unit : mm)





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### Features

- Low Voltage 1.8V
- Low Jitter
- LV-CMOS Output
- Operation at Fundamental High Frequency

### Applications

- SONET/SDH.
- 1 Gbit Ethernet, 10Gbit Ethernet.
- Fibre Channel
- PCI Express
- Serial ATA

Table1

### Standard Frequencies

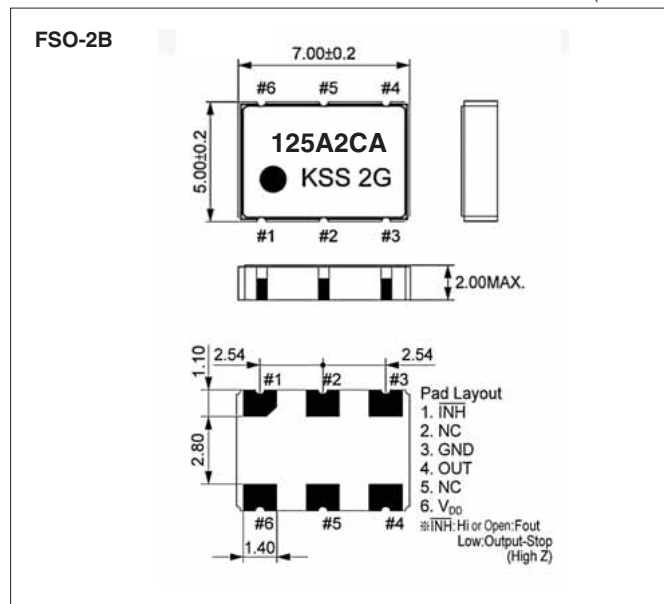
| Frequencies (MHz) |
|-------------------|
| 100               |
| 106.25            |
| 125               |
| 133               |
| 150               |
| 155.52            |
| 156.25            |
| 166               |
| 167               |

### Specifications

| Item                                | Symbol           | Conditions                                 | Min.                | Max.                | Units |
|-------------------------------------|------------------|--------------------------------------------|---------------------|---------------------|-------|
| Output Frequency Range              | F <sub>OUT</sub> | Table 1                                    | 100                 | 167                 | MHz   |
| Frequency Stability(overall)        | F <sub>SBY</sub> |                                            | -100                | 100                 | ppm   |
| Storage Temp. Range                 | T <sub>STG</sub> |                                            | -40                 | 100                 | °C    |
| Operating Temp. Range               | T <sub>OPR</sub> |                                            | 0                   | 70                  | °C    |
| Max Supply Voltage                  | —                |                                            | -0.5                | 5                   | Volt  |
| Supply Voltage                      | V <sub>DD</sub>  | 1.8                                        | 1.71                | 1.89                | Volt  |
| Current Consumption(Maximum Loaded) | I <sub>DD</sub>  |                                            | —                   | 50                  | mA    |
| Duty Ratio                          | SYM              | @ 50% V <sub>DD</sub>                      | 40                  | 60                  | %     |
| Rise/Fall Time                      | Tr/Tf            | 10% V <sub>DD</sub> to 90% V <sub>DD</sub> | —                   | 2                   | nS    |
| Output Voltage-"L"                  | V <sub>OL</sub>  |                                            | —                   | 10% V <sub>DD</sub> | Volt  |
| Output Voltage-"H"                  | V <sub>OH</sub>  |                                            | 90% V <sub>DD</sub> | —                   | Volt  |
| Output Load (CMOS)                  | CL               |                                            | —                   | 15                  | pF    |
| Input Voltage Range                 | V <sub>IN</sub>  |                                            | V <sub>SS</sub>     | V <sub>DD</sub>     | Volt  |
| Input Voltage -"L"                  | V <sub>IL</sub>  |                                            | —                   | 30% V <sub>DD</sub> | Volt  |
| Input Voltage -"H"                  | V <sub>IH</sub>  |                                            | 70% V <sub>DD</sub> | —                   | Volt  |
| Disable Time                        | —                |                                            | —                   | 200                 | nS    |
| Enable Time                         | —                |                                            | —                   | 2                   | mS    |
| Start-up Time                       | ST               |                                            | —                   | 10                  | mS    |

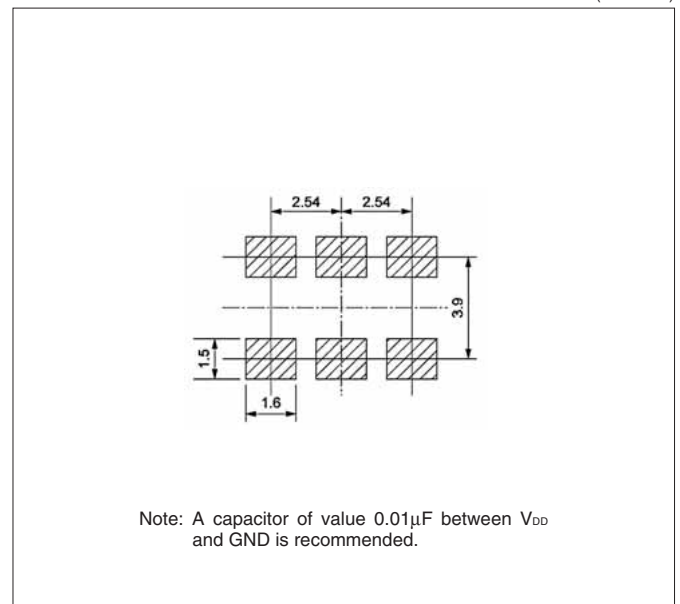
### Dimensions

(Unit : mm)



### Recommended Land Pattern

(Unit : mm)





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### Features

- Low Voltage 2.5V
- Low Jitter
- LV-CMOS Output
- Operation at Fundamental High Frequency

### Applications

- SONET/SDH.
- 1 Gbit Ethernet, 10Gbit Ethernet.
- Fibre Channel
- PCI Express
- Serial ATA

Table1

### Standard Frequencies

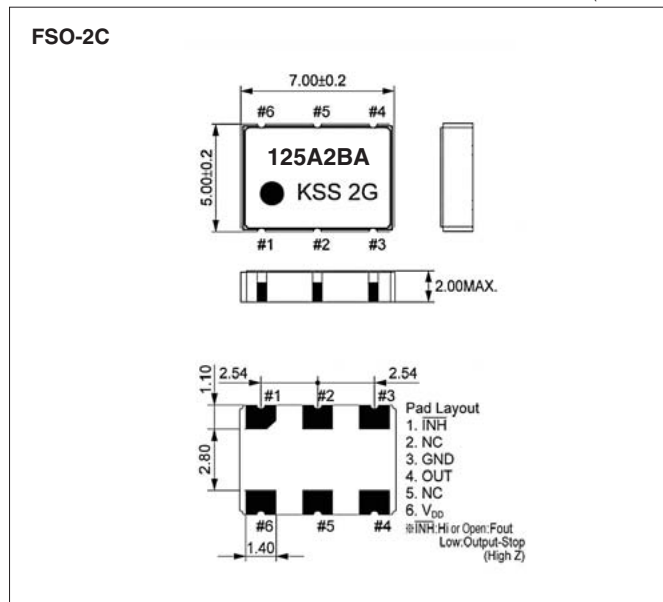
| Frequencies (MHz) |
|-------------------|
| 100               |
| 106.25            |
| 125               |
| 133               |
| 155.52            |
| 156.25            |
| 166               |
| 167               |
| 200               |

## Specifications

| Item                                | Symbol                         | Conditions                                 | Min.                | Max.                | Units |
|-------------------------------------|--------------------------------|--------------------------------------------|---------------------|---------------------|-------|
| Output Frequency Range              | F <sub>OUT</sub>               | Table 1                                    | 100                 | 200                 | MHz   |
| Frequency Stability(overall)        | F <sub>SBY</sub>               |                                            | -100                | 100                 | ppm   |
| Storage Temp. Range                 | T <sub>STG</sub>               |                                            | -40                 | 100                 | °C    |
| Operating Temp. Range               | T <sub>OPR</sub>               |                                            | 0                   | 70                  | °C    |
| Max Supply Voltage                  | —                              |                                            | -0.5                | 5                   | Volt  |
| Supply Voltage                      | V <sub>DD</sub>                | 2.5                                        | 2.38                | 2.62                | Volt  |
| Current Consumption(Maximum Loaded) | I <sub>DD</sub>                |                                            | —                   | 50                  | mA    |
| Duty Ratio                          | SYM                            | @50% V <sub>DD</sub>                       | 40                  | 60                  | %     |
| Rise/Fall Time                      | T <sub>r</sub> /T <sub>f</sub> | 10% V <sub>DD</sub> to 90% V <sub>DD</sub> | —                   | 2                   | nS    |
| Output Voltage-"L"                  | V <sub>OL</sub>                |                                            | —                   | 10% V <sub>DD</sub> | Volt  |
| Output Voltage-"H"                  | V <sub>OH</sub>                |                                            | 90% V <sub>DD</sub> | —                   | Volt  |
| Output Load (CMOS)                  | CL                             |                                            | —                   | 15                  | pF    |
| Input Voltage Range                 | V <sub>IN</sub>                |                                            | V <sub>SS</sub>     | V <sub>DD</sub>     | Volt  |
| Input Voltage -"L"                  | V <sub>IL</sub>                |                                            | —                   | 30% V <sub>DD</sub> | Volt  |
| Input Voltage -"H"                  | V <sub>IH</sub>                |                                            | 70% V <sub>DD</sub> | —                   | Volt  |
| Disable Time                        | —                              |                                            | —                   | 200                 | nS    |
| Enable Time                         | —                              |                                            | —                   | 2                   | mS    |
| Start-up Time                       | ST                             |                                            | —                   | 10                  | mS    |

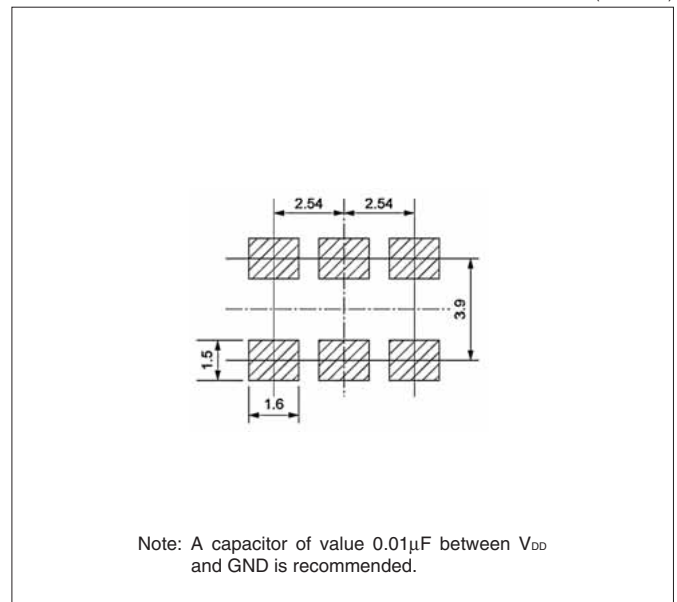
## Dimensions

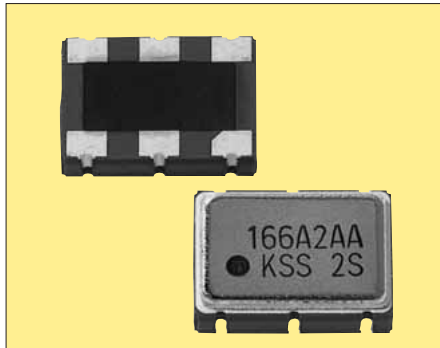
(Unit : mm)



## Recommended Land Pattern

(Unit : mm)





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### Features

- C-MOS Output 3.3V.
- Operation at fundamental High Frequency.

### Applications

- SONET/SDH.
- 1 Gbit Ethernet, 10Gbit Ethernet.
- Fibre Channel.

Table1

### Standard Frequencies

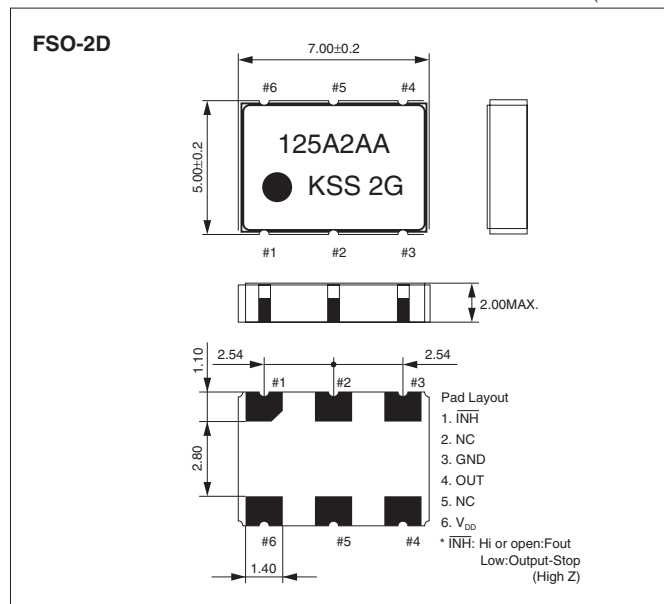
| Frequencies (MHz) |
|-------------------|
| 100               |
| 106.25            |
| 125               |
| 133               |
| 150               |
| 155.52            |
| 156.25            |
| 166               |
| 167               |

### Specifications

| Item                                | Symbol                         | Conditions                                 | Min.                | Max.                | Units |
|-------------------------------------|--------------------------------|--------------------------------------------|---------------------|---------------------|-------|
| Output Frequency Range              | F <sub>OUT</sub>               | Table 1                                    | 100                 | 170                 | MHz   |
| Frequency Stability(overall)        | F <sub>SBY</sub>               |                                            | -100                | 100                 | ppm   |
| Storage Temp. Range                 | T <sub>STG</sub>               |                                            | -40                 | 100                 | °C    |
| Operating Temp. Range               | T <sub>OPR</sub>               |                                            | 0                   | 70                  | °C    |
| Max Supply Voltage                  | —                              |                                            | -0.5                | 7                   | Volt  |
| Supply Voltage                      | V <sub>DD</sub>                | 3.3                                        | 3.14                | 3.46                | Volt  |
| Current Consumption(Maximum Loaded) | I <sub>DD</sub>                |                                            | —                   | 60                  | mA    |
| Duty Ratio                          | SYM                            | @50% V <sub>DD</sub>                       | 40                  | 60                  | %     |
| Rise/Fall Time                      | T <sub>r</sub> /T <sub>f</sub> | 10% V <sub>DD</sub> to 90% V <sub>DD</sub> | —                   | 2                   | nS    |
| Output Voltage-"L"                  | V <sub>OL</sub>                |                                            | —                   | 10% V <sub>DD</sub> | Volt  |
| Output Voltage-"H"                  | V <sub>OH</sub>                |                                            | 90% V <sub>DD</sub> | —                   | Volt  |
| Output Load (CMOS)                  | CL                             |                                            | —                   | 15                  | pF    |
| Input Voltage Range                 | V <sub>IN</sub>                |                                            | V <sub>SS</sub>     | V <sub>DD</sub>     | Volt  |
| Input Voltage -"L"                  | V <sub>IL</sub>                |                                            | —                   | 30% V <sub>DD</sub> | Volt  |
| Input Voltage -"H"                  | V <sub>IH</sub>                |                                            | 70% V <sub>DD</sub> | —                   | Volt  |
| Disable Time                        | —                              |                                            | —                   | 200                 | nS    |
| Enable Time                         | —                              |                                            | —                   | 2                   | mS    |
| Start-up Time                       | ST                             |                                            | —                   | 10                  | mS    |

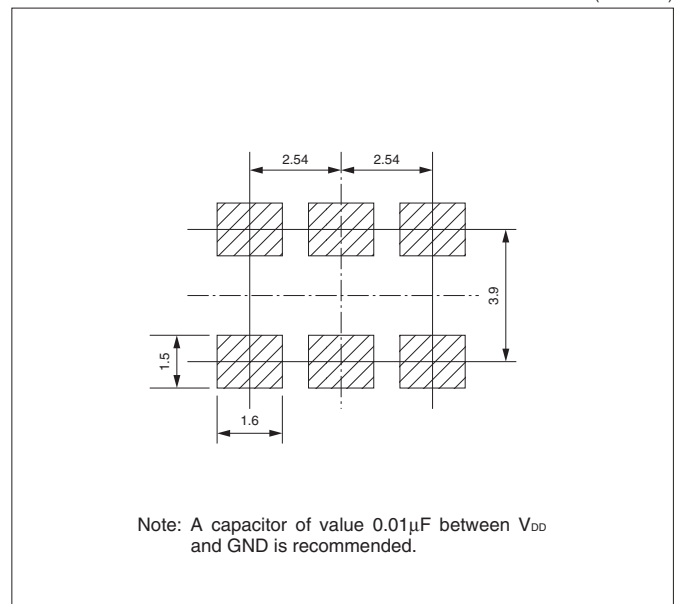
### Dimensions

(Unit : mm)



### Recommended Land Pattern

(Unit : mm)





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## Features

- Miniature ceramic package
- Highly reliable with seam welding
- CMOS output
- Supply voltage  $V_{DD}=3.3V$
- $\pm 25\text{ppm}$  available

Table 1

| Stability Code | Stability (ppm) | $T_{OPR}$ (°C)        | Note                          |
|----------------|-----------------|-----------------------|-------------------------------|
| 0              | $\pm 50$        | -10 to +70 (Standard) | Standard specifications       |
| S              | $\pm 30$        |                       | With only certain frequencies |
| U              | $\pm 25$        |                       |                               |
| F              | $\pm 100$       | -40 to +85 (Extend)   | With only certain frequencies |
| G              | $\pm 50$        |                       |                               |

## How to Order

K50-3C 0 - S E 25.0000  
① ② ③ ④ ⑤

- ① Type(7×5 SMD, 3.3V)  
 ② Frequency Stability Code(See Table1)  
 ③ Duty Ratio(S: 45% to 55% STD)  
 ④ Enable/Disable Function(STD)  
 ⑤ Oscillation Frequency(Ex.: 25.0000MHz)

Packaging(Tape &amp; Reel 1Kpcs/reel)

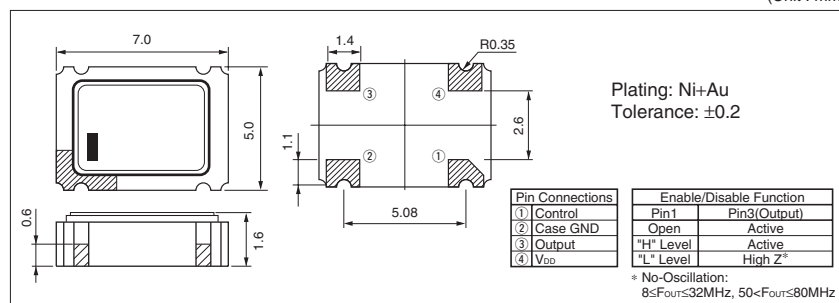
## Specifications

| Item                                                            | Symbol          | Conditions                                                                                                                                                           | Min.              | Max.                 | Units          |
|-----------------------------------------------------------------|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|----------------------|----------------|
| Output Frequency Range                                          | $F_{OUT}$       |                                                                                                                                                                      | 1.5               | 80                   | MHz            |
| Frequency Stability                                             | $F_{SBY}$       | Overall conditions:<br>initial tolerance, operating temperature range, rated power<br>supply voltage change, load change, aging(1year @25°C),<br>shock and vibration | -25<br>-30<br>-50 | +25<br>+30<br>+50    | ppm            |
| Storage Temperature Range                                       | $T_{STG}$       |                                                                                                                                                                      | -55               | +125                 | °C             |
| Operating Temperature Range                                     | $T_{OPR}$       | Standard<br>Extend(option)                                                                                                                                           | -10<br>-40        | +70<br>+85           | °C             |
| Max. Supply Voltage                                             | —               |                                                                                                                                                                      | -0.5              | 7.0                  | Volt           |
| Supply Voltage                                                  | $V_{DD}$        | Stability: $\pm 50\text{ppm}$ , $\pm 30\text{ppm}$ , $\pm 100\text{ppm}$ (Ext Temp)<br>Stability: $\pm 25\text{ppm}$ , $\pm 50\text{ppm}$ (Ext Temp)                 | 2.97<br>3.14      | 3.63<br>3.46         | Volt           |
| Current Consumption<br>(Maximum Loaded)                         | $I_{DD}$        | $1.5 \leq F_{OUT} \leq 20\text{MHz}$<br>$20 < F_{OUT} \leq 40\text{MHz}$<br>$40 < F_{OUT} \leq 60\text{MHz}$<br>$60 < F_{OUT} \leq 80\text{MHz}$                     | —<br>—<br>—<br>—  | 10<br>15<br>20<br>30 | mA             |
| Standby/Disable Current                                         | $I_{ST}/I_{DE}$ | $8 \leq F_{OUT} \leq 32\text{MHz}$ (Standby Function)<br>$32 < F_{OUT} \leq 50\text{MHz}$ (Disable Function)<br>$50 < F_{OUT} \leq 80\text{MHz}$ (Standby Function)  | —<br>—<br>—       | 10<br>15<br>10       | $\mu\text{A}$  |
| Duty Ratio(Symmetry)                                            | SYM             | @50% $V_{DD}$                                                                                                                                                        | 45                | 55                   | %              |
| Rise/Fall Time<br>(10% $V_{DD}$ to 90% $V_{DD}$ Maximum Loaded) | $T_r/T_f$       | $8 \leq F_{OUT} \leq 26\text{MHz}$<br>$26 < F_{OUT} \leq 45\text{MHz}$<br>$45 < F_{OUT} \leq 80\text{MHz}$                                                           | —<br>—<br>—       | 10<br>8<br>5         | nS             |
| Output Voltage-"L"                                              | $V_{OL}$        | $I_{OL}=8\text{mA}$                                                                                                                                                  | —                 | 10% $V_{DD}$         | Volt           |
| Output Voltage-"H"                                              | $V_{OH}$        | $I_{OH}=-8\text{mA}$                                                                                                                                                 | 90% $V_{DD}$      | —                    | Volt           |
| Output Load                                                     | CL              | CMOS                                                                                                                                                                 | —                 | 15                   | pF             |
| Input Voltage Range                                             | $V_{IN}$        |                                                                                                                                                                      | 0                 | $V_{DD}$             | Volt           |
| Input Voltage-"L"                                               | $V_{IL}$        |                                                                                                                                                                      | —                 | 30% $V_{DD}$         | Volt           |
| Input Voltage-"H"                                               | $V_{IH}$        |                                                                                                                                                                      | 70% $V_{DD}$      | —                    | Volt           |
| Output Disable Time                                             | —               |                                                                                                                                                                      | —                 | 150                  | nS             |
| Output Enable Time                                              | —               | $8 \leq F_{OUT} \leq 32\text{MHz}$<br>$32 < F_{OUT} \leq 50\text{MHz}$<br>$50 < F_{OUT} \leq 80\text{MHz}$                                                           | —<br>—<br>—       | 5<br>150<br>5        | mS<br>nS<br>mS |
| Start-up Time                                                   | ST              | @ Minimum operating Voltage to be 0sec.                                                                                                                              | —                 | 10                   | mS             |

Note: Please contact us for inquiries about extended operating temperature range, available frequencies and other conditions.  
 All electrical characteristics are defined at the maximum load and operating temperature range.

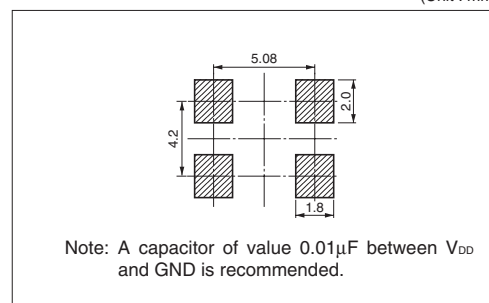
## Dimensions

(Unit : mm)



## Recommended Land Pattern

(Unit : mm)




**Pb Free**
**RoHS Conforming**

### Features

- Miniature ceramic package
- Highly reliable with seam welding
- CMOS output
- Supply voltage  $V_{DD}=5.0V$
- $\pm 25ppm$  available

**Table 1**

| Stability |           | $T_{OPR}$<br>(°C)        | Note                          |
|-----------|-----------|--------------------------|-------------------------------|
| Code      | (ppm)     |                          |                               |
| <b>0</b>  | $\pm 50$  | -10 to +70<br>(Standard) | Standard specifications       |
| <b>S</b>  | $\pm 30$  |                          | With only certain frequencies |
| <b>U</b>  | $\pm 25$  | -40 to +85<br>(Extend)   | With only certain frequencies |
| <b>F</b>  | $\pm 100$ |                          |                               |
| <b>G</b>  | $\pm 50$  |                          |                               |

### How to Order

**K50-HC 0 - C S E 25.0000**  
 ① ② ③ ④ ⑤ ⑥

- ① Type(7×5 SMD, 5.0V)
- ② Frequency Stability Code(See Table1)
- ③ CMOS Output
- ④ Duty Ratio(S: 45% to 55% STD)
- ⑤ Enable/Disable Function(STD)
- ⑥ Oscillation Frequency(Ex.: 25.0000MHz)

Packaging(Tape & Reel 1Kpcs/reel)

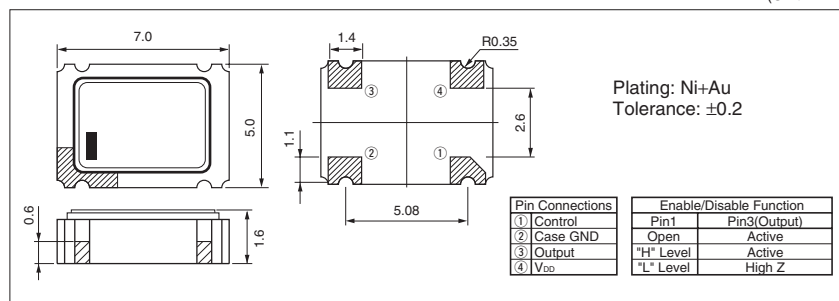
### Specifications

| Item                                                            | Symbol    | Conditions                                                                                                                                                     | Min.              | Max.              | Units |
|-----------------------------------------------------------------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------|-------|
| Output Frequency Range                                          | $F_{OUT}$ |                                                                                                                                                                | 1.5               | 68                | MHz   |
| Frequency Stability                                             | $F_{SBY}$ | Overall conditions:<br>initial tolerance, operating temperature range, rated power supply voltage change, load change, aging(1year @25°C), shock and vibration | -25<br>-30<br>-50 | +25<br>+30<br>+50 | ppm   |
| Storage Temperature Range                                       | $T_{STG}$ |                                                                                                                                                                | -55               | +125              | °C    |
| Operating Temperature Range                                     | $T_{OPR}$ | Standard<br>Extend(option)                                                                                                                                     | -10<br>-40        | +70<br>+85        |       |
| Max. Supply Voltage                                             | —         |                                                                                                                                                                | -0.5              | 7.0               | Volt  |
| Supply Voltage                                                  | $V_{DD}$  | Stability: $\pm 50ppm$ , $\pm 30ppm$ , $\pm 100ppm$ (Ext Temp)<br>Stability: $\pm 25ppm$ , $\pm 50ppm$ (Ext Temp)                                              | 4.5<br>4.75       | 5.5<br>5.25       |       |
| Current Consumption (Maximum Loaded)                            | $I_{DD}$  | $1.5 \leq F_{OUT} \leq 20MHz$<br>$20 < F_{OUT} \leq 40MHz$<br>$40 < F_{OUT} \leq 68MHz$                                                                        | —<br>—<br>—       | 25<br>35<br>50    | mA    |
| Disable Current                                                 | $I_{DE}$  | @68.0000MHz                                                                                                                                                    | —                 | 30                |       |
| Duty Ratio(Symmetry)                                            | SYM       | @50% $V_{DD}$                                                                                                                                                  | 45                | 55                | %     |
| Rise/Fall Time<br>(10% $V_{DD}$ to 90% $V_{DD}$ Maximum Loaded) | $T_r/T_f$ | $8 \leq F_{OUT} \leq 26MHz$<br>$26 < F_{OUT} \leq 45MHz$<br>$45 < F_{OUT} \leq 68MHz$                                                                          | —<br>—<br>—       | 10<br>8<br>5      | nS    |
| Output Voltage-"L"                                              | $V_{OL}$  | $I_{OL}=16mA$                                                                                                                                                  | —                 | 10% $V_{DD}$      |       |
| Output Voltage-"H"                                              | $V_{OH}$  | $I_{OH}=-16mA$                                                                                                                                                 | 90% $V_{DD}$      | —                 | Volt  |
| Output Load(CMOS)                                               | CL        | $8 \leq F_{OUT} \leq 50MHz$<br>$50 < F_{OUT} \leq 68MHz$                                                                                                       | —<br>—            | 50<br>15          |       |
| Input Voltage Range                                             | $V_{IN}$  |                                                                                                                                                                | 0                 | $V_{DD}$          | Volt  |
| Input Voltage-"L"                                               | $V_{IL}$  |                                                                                                                                                                | —                 | 0.8               | Volt  |
| Input Voltage-"H"                                               | $V_{IH}$  |                                                                                                                                                                | 2.2               | —                 |       |
| Output Disable Time                                             | —         |                                                                                                                                                                | —                 | 100               | nS    |
| Output Enable Time                                              | —         |                                                                                                                                                                | —                 | 100               | nS    |
| Start-up Time                                                   | ST        | @ Minimum operating Voltage to be 0sec.                                                                                                                        | —                 | 10                | mS    |

Note: Please contact us for inquiries about extended operating temperature range, available frequencies and other conditions.  
 All electrical characteristics are defined at the maximum load and operating temperature range.

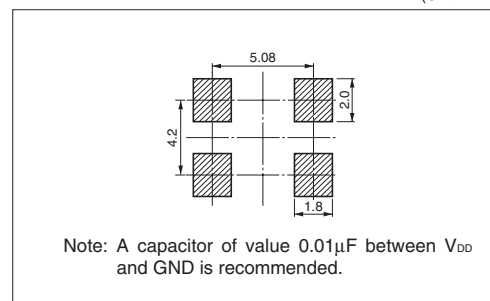
### Dimensions

(Unit : mm)



### Recommended Land Pattern

(Unit : mm)





## Features

- Compact oscillator with a C-MOS IC built in that is the same shape (height 3.5mm) as a crystal device.
- It is a hermetic sealed type with a metal case.
- The case comes with a grounding terminal.
- It is also possible to attach a stand-off (option).
- It is provided with multiple standard frequencies.

## Applications

- Amusement

## Specifications

| Item                   | Symbol    | Conditions                | Min.         | Max.         | Units |
|------------------------|-----------|---------------------------|--------------|--------------|-------|
| Output Frequency Range | $F_{OUT}$ | JXO-5 Type                | 1            | 20           | MHz   |
|                        |           | JXO-7 Type                | 20.1         | 70           |       |
| Frequency Stability    | $F_{SBY}$ |                           | -100         | +100         | ppm   |
| Storage Temp. Range    | $T_{STG}$ |                           | -20          | +80          | °C    |
| Operating Temp. Range  | $T_{OPR}$ |                           | -10          | +70          | °C    |
| Supply Voltage         | $V_{DD}$  |                           | 4.5          | 5            | Volt  |
| Current Consumption    | $I_{DD}$  | JXO-5 Type (1 ~ 20MHz)    | —            | 20           | mA    |
|                        |           | JXO-7 Type (20.1 ~ 50MHz) | —            | 25           |       |
|                        |           | JXO-7 Type (50.1 ~ 70MHz) | —            | 50           |       |
| Duty Ratio             | SYM       | @50% $V_{DD}$             | 40           | 60           | %     |
| Rise/Fall Time         | $T_r/T_f$ | JXO-5 Type (1 ~ 20MHz)    | —            | 20           | nS    |
|                        |           | JXO-7 Type (20.1 ~ 50MHz) | —            | 15           |       |
|                        |           | JXO-7 Type (50.1 ~ 70MHz) | —            | 10           |       |
| Output Voltage-"L"     | $V_{OL}$  |                           | —            | 10% $V_{DD}$ | Volt  |
| Output Voltage-"H"     | $V_{OH}$  |                           | 90% $V_{DD}$ | —            | Volt  |
| Output Load            | CL        | JXO-5 Type (1 ~ 20MHz)    | —            | 50           | pF    |
|                        |           | JXO-7 Type (20.1 ~ 70MHz) | —            | 15           |       |
| Start-up Time          | ST        | JXO-5 Type (1 ~ 20MHz)    | —            | 3            | mS    |
|                        |           | JXO-7 Type (20.1 ~ 70MHz) | —            | 10           |       |

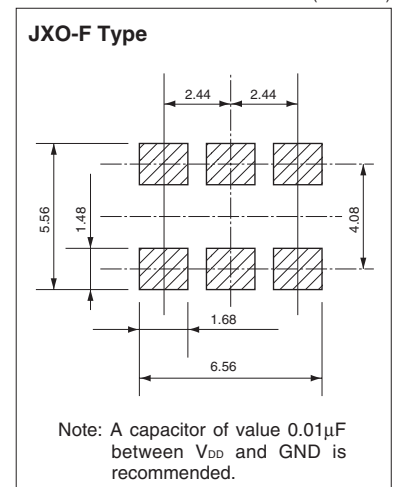
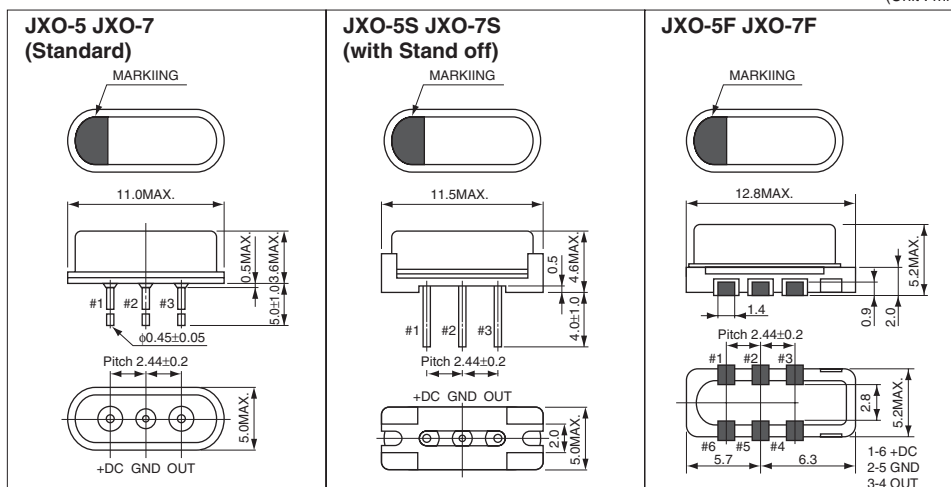
Note: Please contact us for inquiries about extended operating temperature range, available frequencies and other conditions.  
All electrical characteristics are defined at the maximum load and operating temperature range.

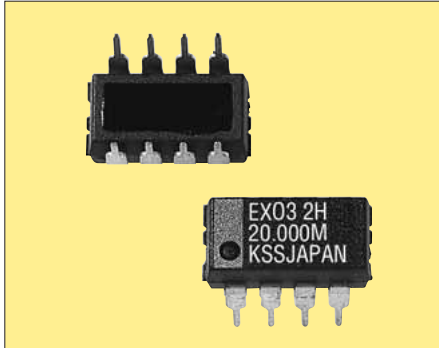
## Dimensions

(Unit : mm)

## Recommended Land Pattern

(Unit : mm)





### Features

- Since it has a frequency dividing function, it is able to obtain a frequency division of  $1/2-1/2^8$  ( $1/256$ ).
- The symmetry of frequency divided output is within  $50 \pm 2\%$ .
- The oscillation start time has the fast starting characteristic of being 1.5msec. or less.
- The pin arrangement is DIP 8PIN.
- Supply Voltage  $V_{DD}=5.0V$

### Applications

- Amusement

### Specifications

| Item                   | Symbol    | Conditions    | Min.         | Max.         | Units |
|------------------------|-----------|---------------|--------------|--------------|-------|
| Output Frequency Range | $F_{OUT}$ |               | 11.0592      | 24.576       | MHz   |
| Frequency Stability    | $F_{SBY}$ |               | -100         | +100         | ppm   |
| Storage Temp. Range    | $T_{STG}$ |               | -40          | +85          | °C    |
| Operating Temp. Range  | $T_{OPR}$ |               | -10          | +70          | °C    |
| Supply Voltage         | $V_{DD}$  |               | 4.5          | 5            | Volt  |
| Current Consumption    | $I_{DD}$  |               | —            | 20           | mA    |
| Duty Ratio             | SYM       | @50% $V_{DD}$ | 40           | 60           | %     |
| Rise/Fall Time         | $T_r/T_f$ |               | —            | 15           | nS    |
| Output Voltage-"L"     | $V_{OL}$  |               | —            | 10% $V_{DD}$ | Volt  |
| Output Voltage-"H"     | $V_{OH}$  |               | 90% $V_{DD}$ | —            | Volt  |
| Output Load            | CL        |               | —            | 50           | pF    |
| Start-up Time          | ST        |               | —            | 1.5          | mS    |

Note: Please contact us for inquiries about extended operating temperature range, available frequencies and other conditions.  
All electrical characteristics are defined at the maximum load and operating temperature range.

### Pin connection

(Divider Select)

|          |   |   |   |
|----------|---|---|---|
| $V_{DD}$ | C | B | A |
| 8        | 7 | 6 | 5 |

|                                 |   |    |     |
|---------------------------------|---|----|-----|
| EXO3 5E<br>16.000M<br>KSS JAPAN |   |    |     |
| 1                               | 2 | 3  | 4   |
| F                               | D | ST | GND |

(OUTPUT)

1.F Outputs the original frequency ( $f_0$ ) of the internal quartz crystal.

2.D Outputs the frequency of programmed dividing ratio ( $f_0/2^n$ ).

3.ST Possible to be oscillated when set to HIGH level and stopped in oscillation when set to LOW level. when this function is not needed, be sure to set the STANDBY pin to the HIGH level.

4.GND

5.A

6.B

7.C Used to program the dividing ratio for the original frequency.

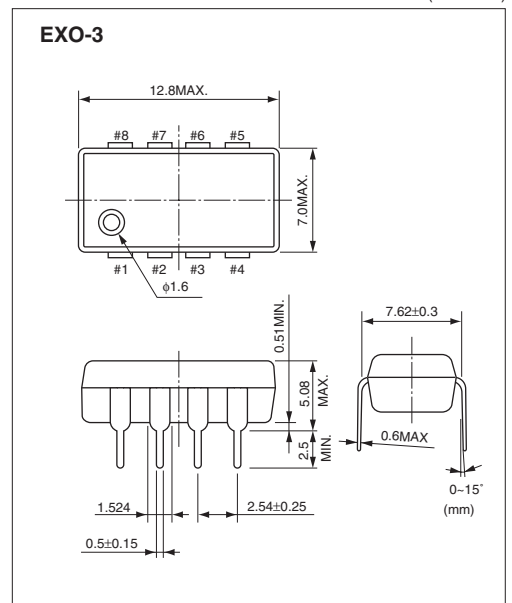
8. $V_{DD}$  Supply voltage

### Settings of the frequency division output

| Input  |   |   |    | Output             |                         |
|--------|---|---|----|--------------------|-------------------------|
| Select |   |   |    | F                  | D                       |
| C      | B | A | ST | Original Frequency | Divided Wave form       |
| L      | L | L | H  | $f_0$ clock        | $f_0 \cdot 1/2$ clock   |
| L      | L | H | H  | $f_0$ clock        | $f_0 \cdot 1/2^2$ clock |
| L      | H | L | H  | $f_0$ clock        | $f_0 \cdot 1/2^3$ clock |
| L      | H | H | H  | $f_0$ clock        | $f_0 \cdot 1/2^4$ clock |
| H      | L | L | H  | $f_0$ clock        | $f_0 \cdot 1/2^5$ clock |
| H      | L | H | H  | $f_0$ clock        | $f_0 \cdot 1/2^6$ clock |
| H      | H | L | H  | $f_0$ clock        | $f_0 \cdot 1/2^7$ clock |
| H      | H | H | H  | $f_0$ clock        | $f_0 \cdot 1/2^8$ clock |
| —      | — | — | L  | L                  | L                       |

### Dimensions

(Unit : mm)





Pb Free

RoHS Comforming

### Features

- Low Voltage 2.5V
- Low Jitter
- LVPECL Output
- Operation at Fundamental High Frequency

### Applications

- SONET/SDH.
- 1 Gbit Ethernet, 10Gbit Ethernet.
- Fibre Channel
- PCI Express
- Serial ATA

Table1

Standard Frequencies

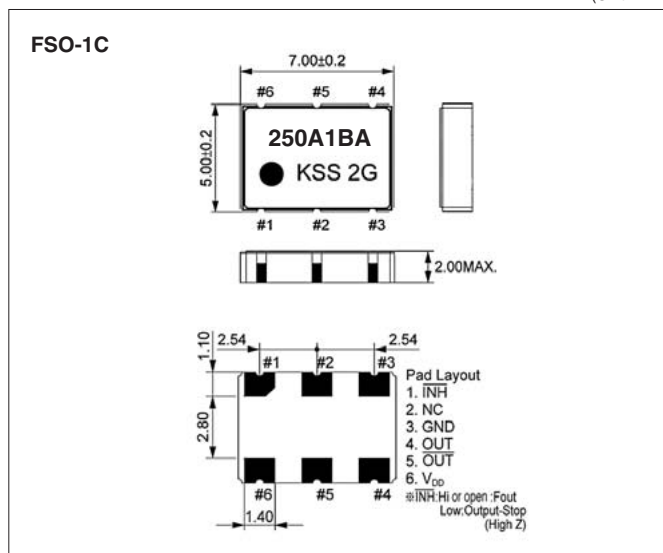
| Frequencies (MHz) |           |
|-------------------|-----------|
| 53.125            | 166       |
| 62.5              | 167       |
| 75                | 200       |
| 77.76             | 212.5     |
| 87.5              | 250       |
| 100               | 312.5     |
| 106.25            | 320       |
| 125               | 350       |
| 133               | 400       |
| 150               | 500       |
| 155.52            | 625       |
| 156.25            | 644.53125 |

### Specifications

| Item                         | Symbol           | Conditions                         | Min.                | Max.                | Units  |
|------------------------------|------------------|------------------------------------|---------------------|---------------------|--------|
| Output Frequency Range       | F <sub>OUT</sub> | Table 1                            | 50                  | 700                 | MHz    |
| Frequency Stability(overall) | F <sub>SBY</sub> |                                    | -100                | 100                 | ppm    |
| Storage Temp. Range          | T <sub>STG</sub> |                                    | -40                 | 100                 | °C     |
| Operating Temp. Range        | T <sub>OPR</sub> |                                    | 0                   | 70                  | °C     |
| Max Supply Voltage           | —                |                                    | -0.5                | 5                   | Volt   |
| Supply Voltage               | V <sub>CC</sub>  | 2.5                                | 2.38                | 2.62                | Volt   |
| Current Consumption          | I <sub>CC</sub>  |                                    | —                   | 60                  | mA     |
| Duty Ratio                   | SYM              | F<350MHz Output cross point        | 45                  | 55                  | %      |
|                              |                  | F≥350MHz                           | 40                  | 60                  |        |
| Rise/Fall Time               | Tr/Tf            | 20% , 80%                          | —                   | 600                 | ps     |
| Output Voltage-"L"           | V <sub>OL</sub>  |                                    | —                   | 1.195               | Volt   |
| Output Voltage-"H"           | V <sub>OH</sub>  |                                    | 1.415               | —                   | Volt   |
| Output Load (CMOS)           | RL               | 50Ω Terminated V <sub>CC</sub> -2V | 49.5                | 50.5                | Ω      |
| Input Voltage Range          | V <sub>IN</sub>  |                                    | GND                 | V <sub>CC</sub>     | Volt   |
| Input Voltage -"L"           | V <sub>IL</sub>  |                                    | —                   | 30% V <sub>CC</sub> | Volt   |
| Input Voltage -"H"           | V <sub>IH</sub>  |                                    | 70% V <sub>CC</sub> | —                   | Volt   |
| Disable Time                 | —                |                                    | —                   | 200                 | nS     |
| Enable Time                  | —                |                                    | —                   | 2                   | mS     |
| Start-up Time                | ST               |                                    | —                   | 10                  | mS     |
| Period Jitter                | PJ               |                                    | —                   | 5                   | ps rms |

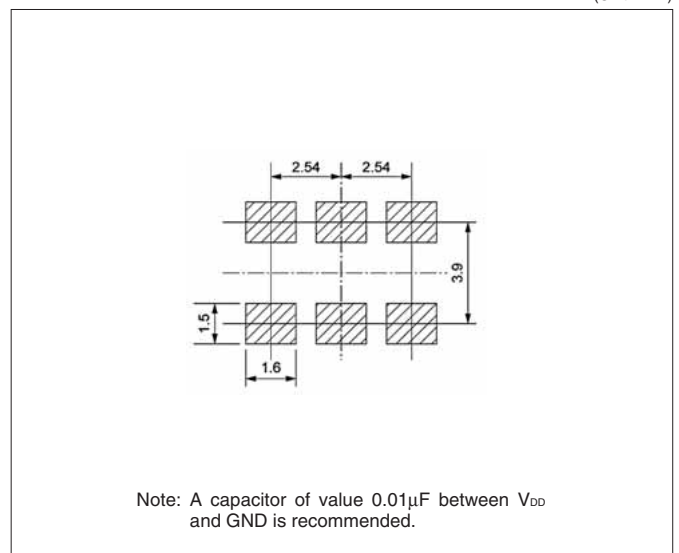
### Dimensions

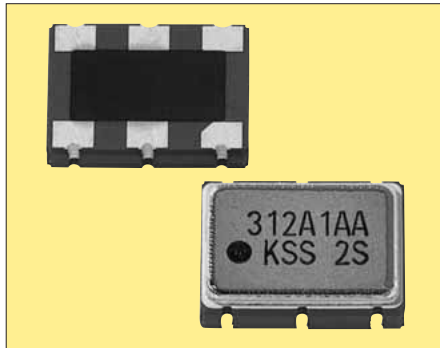
(Unit : mm)



### Recommended Land Pattern

(Unit : mm)





Pb Free

RoHS Conforming

### Features

- Low Jitter.
- Complementary LVPECL outputs.
- Operation at fundamental high frequency.

### Applications

- SONET/SDH.
- 1 Gbit Ethernet, 10Gbit Ethernet.
- Fibre Channel.

Table1

Standard Frequencies

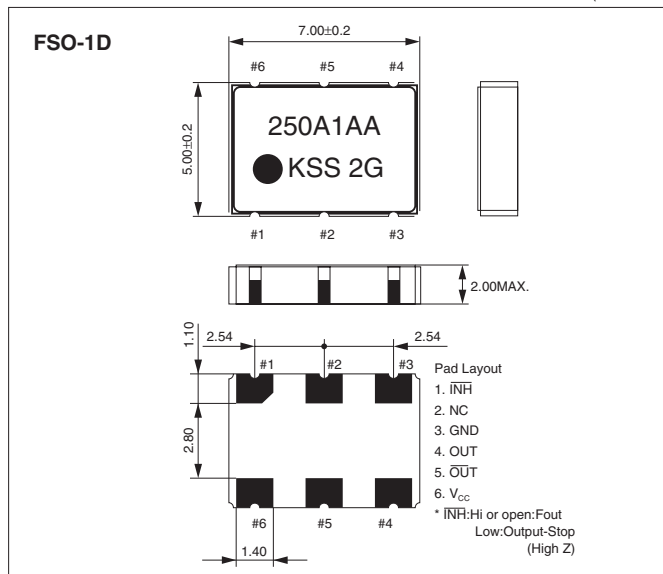
| Frequencies (MHz) |           |
|-------------------|-----------|
| 53.125            | 166       |
| 62.5              | 167       |
| 75                | 200       |
| 77.76             | 212.5     |
| 87.5              | 250       |
| 100               | 312.5     |
| 106.25            | 320       |
| 125               | 350       |
| 133               | 400       |
| 150               | 500       |
| 155.52            | 625       |
| 156.25            | 644.53125 |

### Specifications

| Item                         | Symbol           | Conditions                         | Min.                | Max.                | Units  |
|------------------------------|------------------|------------------------------------|---------------------|---------------------|--------|
| Output Frequency Range       | F <sub>OUT</sub> | Table 1                            | 50                  | 700                 | MHz    |
| Frequency Stability(Overall) | F <sub>SBY</sub> |                                    | -100                | 100                 | ppm    |
| Storage Temp. Range          | T <sub>STG</sub> |                                    | -40                 | 100                 | °C     |
| Operating Temp. Range        | T <sub>OPR</sub> |                                    | 0                   | 70                  | °C     |
| Max Supply Voltage           | —                |                                    | -0.5                | 7                   | Volt   |
| Supply Voltage               | V <sub>CC</sub>  | 3.3                                | 3.14                | 3.46                | Volt   |
| Current Consumption          | I <sub>CC</sub>  |                                    | —                   | 60                  | mA     |
| Duty Ratio                   | SYM              | F<350MHz Output cross point        | 45                  | 55                  | %      |
|                              |                  | F≥350MHz Output cross point        | 40                  | 60                  |        |
| Rise/Fall Time               | Tr/Tf            | 20% , 80%                          | —                   | 600                 | ps     |
| Output Voltage-"L"           | V <sub>OL</sub>  |                                    | —                   | 1.68                | Volt   |
| Output Voltage-"H"           | V <sub>OH</sub>  |                                    | 2.275               | —                   | Volt   |
| Output Load (CMOS)           | RL               | 50Ω Terminated V <sub>CC</sub> -2V | 49.5                | 50.5                | Ω      |
| Input Voltage Range          | V <sub>IN</sub>  |                                    | GND                 | V <sub>CC</sub>     | Volt   |
| Input Voltage -"L"           | V <sub>IL</sub>  |                                    | —                   | 30% V <sub>CC</sub> | Volt   |
| Input Voltage -"H"           | V <sub>IH</sub>  |                                    | 70% V <sub>CC</sub> | —                   | Volt   |
| Disable Time                 | —                |                                    | —                   | 200                 | nS     |
| Enable Time                  | —                |                                    | —                   | 2                   | mS     |
| Start-up Time                | ST               |                                    | —                   | 10                  | mS     |
| Period Jitter(σ)             | PJ               |                                    | —                   | 5                   | ps rms |

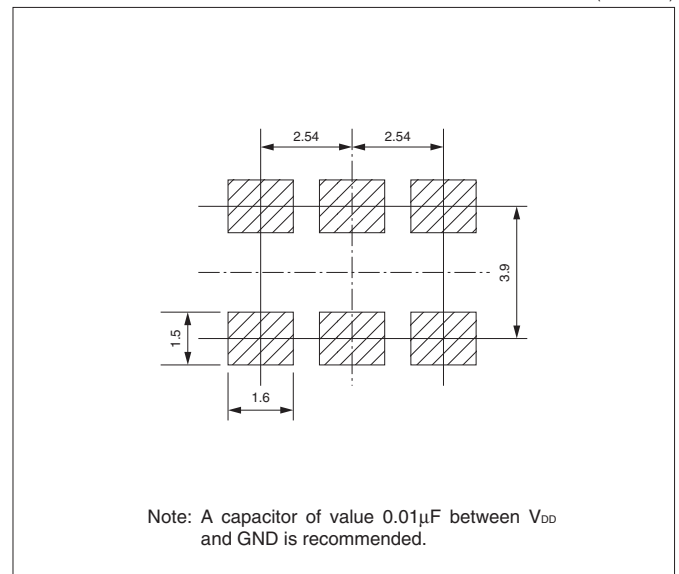
### Dimensions

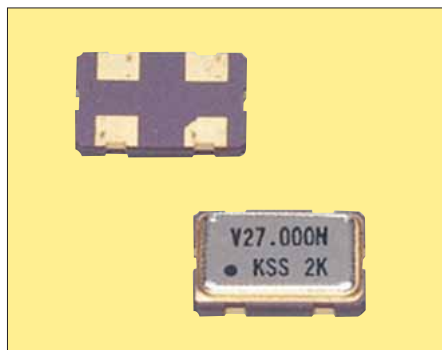
(Unit : mm)



### Recommended Land Pattern

(Unit : mm)





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## Features

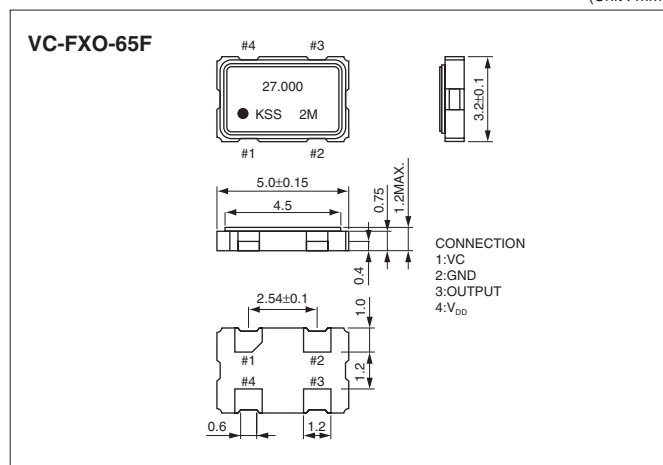
- Surface mount type suitable for auto pick-and-place.
- Reflow soldering compatible.
- Supply voltage  $V_{DD}=3.3 / 5.0V$  available

## Specifications

| Item                   | Symbol         | Specifications        |                 | Units       |
|------------------------|----------------|-----------------------|-----------------|-------------|
|                        |                | VC-FXO-65F            | VC-FXO-65FL     |             |
| Output Frequency Range | $F_{OUT}$      | 8 ~ 40                |                 | MHz         |
| Frequency Stability    | $F_{SBY}$      | $\pm 30$              |                 | ppm         |
| Storage Temp. Range    | $T_{STG}$      | $-35 \sim +85$        |                 | $^{\circ}C$ |
| Operating Temp. Range  | $T_{OPR}$      | $-10 \sim +70$        |                 | $^{\circ}C$ |
| Max. Supply Voltage    | —              | 7 Max                 |                 | Volt        |
| Supply Voltage         | $V_{DD}$       | $5 \pm 5\%$           | $3.3 \pm 5\%$   | Volt        |
| Current Consumption    | $I_{DD}$       | 20 Max                | 15 Max          | mA          |
| Duty Ratio             | SYM            | 40 ~ 60 @50% $V_{DD}$ |                 | %           |
| Rise/Fall Time         | $T_r / T_f$    | 10 Max                | 15 Max          | nS          |
| Output Voltage-"L"     | $V_{OL}$       | 0.5 Max               |                 | Volt        |
| Output Voltage-"H"     | $V_{OH}$       | 90% $V_{DD}$ Max      |                 | Volt        |
| Output Load            | CL             | 15                    |                 | pF          |
| Start-up Time          | ST             | 10 Max                |                 | mS          |
| Voltage control range  | $\Delta f / V$ | $\pm 50$ Min          | $\pm 50$ Min    | ppm         |
| Frequency Deviation    | $\Delta f / V$ | $2.5 \pm 2.0$         | $1.65 \pm 1.65$ | Volt        |

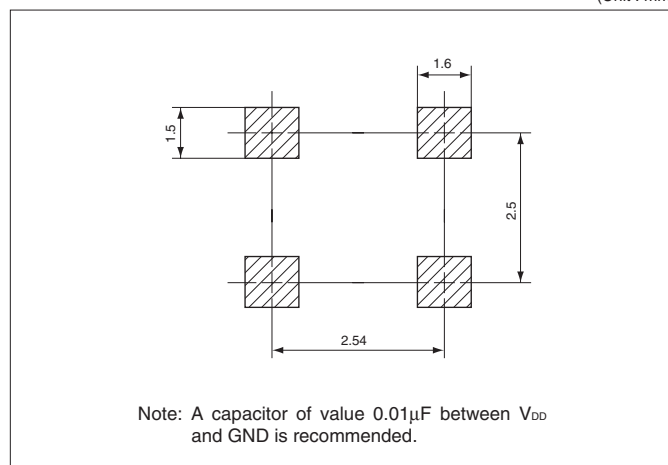
## Dimensions

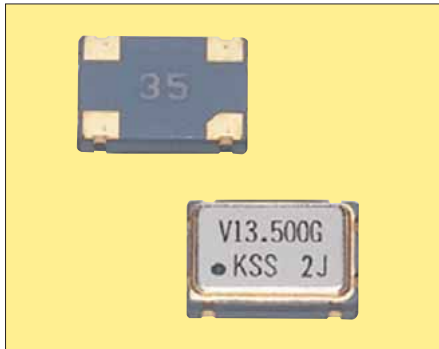
(Unit : mm)



## Recommended Land Pattern

(Unit : mm)





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### Features

- Surface mount type suitable for auto pick-and-place.
- Reflow soldering compatible.
- Supply voltage  $V_{DD}=3.3 / 5.0V$  available

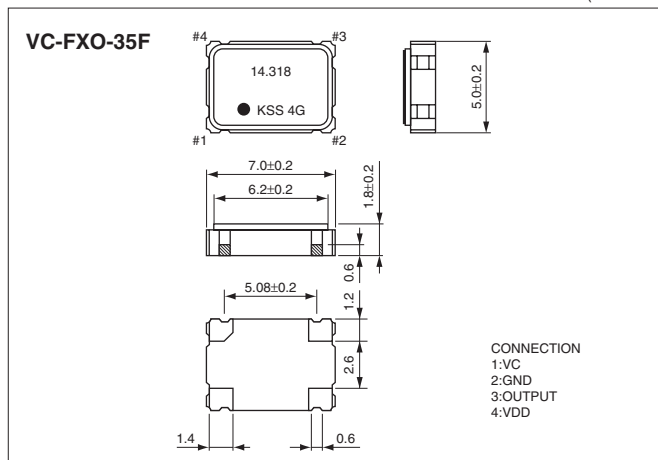
### Specifications

| Item                   | Symbol       | Specifications        |                 | Units       |
|------------------------|--------------|-----------------------|-----------------|-------------|
|                        |              | VC-FXO-35F            | VC-FXO-35FL     |             |
| Output Frequency Range | $F_{OUT}$    | 8 ~ 40                | 8 ~ 35          | MHz         |
| Frequency Stability    | $F_{SBY}$    | $\pm 30$              |                 | ppm         |
| Storage Temp. Range    | $T_{STG}$    | $-35 \sim +85$        |                 | $^{\circ}C$ |
| Operating Temp. Range  | $T_{OPR}$    | $-10 \sim +70$        |                 | $^{\circ}C$ |
| Supply Voltage         | $V_{DD}$     | $5 \pm 5\%$           | $3.3 \pm 5\%$   | Volt        |
| Current Consumption    | $I_{DD}$     | 25 Max                | 20 Max          | mA          |
| Duty Ratio             | SYM          | 40 ~ 60 @50% $V_{DD}$ |                 | %           |
| Rise/Fall Time         | $T_r/T_f$    | 10 Max                | 15 Max          | nS          |
| Output Voltage-"L"     | $V_{OL}$     | 0.5 Max               |                 | Volt        |
| Output Voltage-"H"     | $V_{OH}$     | 90% $V_{DD}$ Max      |                 | Volt        |
| Output Load            | CL           | 15                    |                 | pF          |
| Start-up Time          | ST           | 10 Max                |                 | mS          |
| Voltage control range  | $\Delta f/V$ | $\pm 50$ Min          | $\pm 50$ Min    | ppm         |
| Frequency Deviation    | $\Delta f/V$ | $2.5 \pm 2.0$         | $1.65 \pm 1.65$ | Volt        |

Note: Please contact us for inquiries about extended operating temperature range, available frequencies and other conditions.  
All electrical characteristics are defined at the maximum load and operating temperature range.

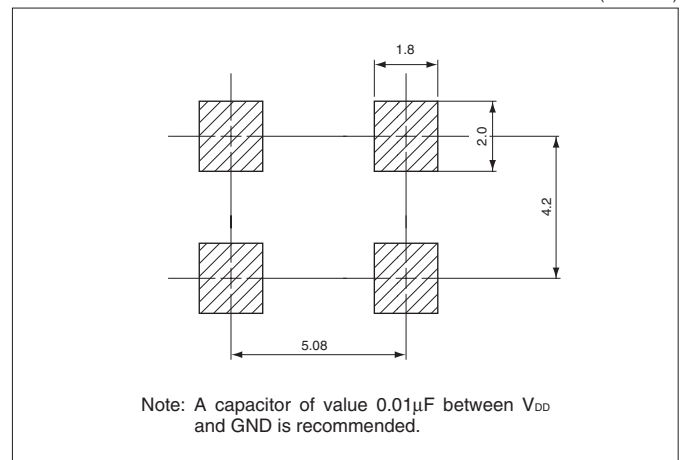
### Dimensions

(Unit : mm)



### Recommended Land Pattern

(Unit : mm)





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## Features

- "Small Size" as small as 0.063cc.(5×7×1.8mm)
- Using 1 chip HCMOS IC.
- 3-state devices are available.
- APR(Absolute Pull Range)of up to  $\pm 50$ ppm or  $\pm 100$ ppm

## Applications

- Digital switching system
- ATM SDH
- SONET
- xDSL

## Specifications

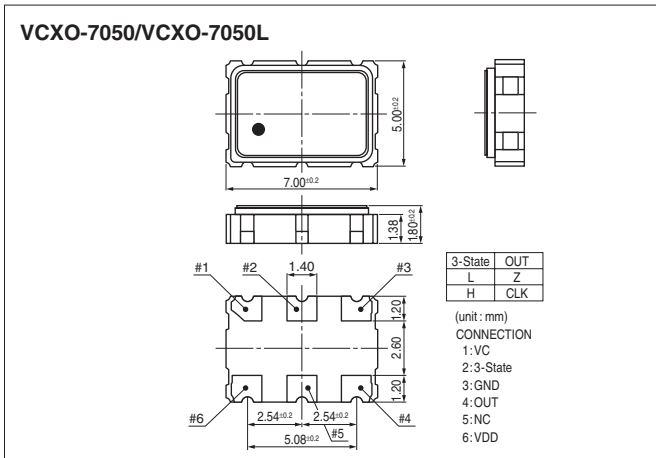
| Item                      | Symbol           | Conditions                       | Specification                       |                                     | Units |
|---------------------------|------------------|----------------------------------|-------------------------------------|-------------------------------------|-------|
|                           |                  |                                  | VCXO-7050                           | VCXO-7050L                          |       |
| Output Frequency Range    | F <sub>OUT</sub> |                                  | 7.2 ~ 50                            |                                     | MHz   |
| Storage Temp. Range       | T <sub>STG</sub> |                                  | -40 ~ +90                           |                                     | °C    |
| Operating Temp. Range     | T <sub>OPR</sub> |                                  | -40 ~ +85                           |                                     | °C    |
| Absolute pull range (APR) | APR              | Included 20years aging(at +25°C) | $\pm 50/\pm 100^*1$ (VC=0.5 ~ 4.5V) | $\pm 50/\pm 100^*1$ (VC=0.3 ~ 3.0V) | ppm   |
| Max Supply Voltage        | —                |                                  | -0.5 ~ 7                            |                                     | Volt  |
| Supply Voltage            | V <sub>DD</sub>  |                                  | 5 ± 10%                             | 3.3 ± 10%                           | Volt  |
| Current Consumption       | I <sub>DD</sub>  |                                  | 15 MAX                              |                                     | mA    |
| Control Voltage           | VC               |                                  | 2.5 ± 2.0                           | 1.65 ± 1.35                         | Volt  |
| Duty Ratio                | SYM              | 50% V <sub>DD</sub>              | 40 ~ 60                             |                                     | %     |
|                           | Tr / Tf          |                                  | 10 MAX                              |                                     | nS    |
| Output Voltage-"L"        | V <sub>OL</sub>  |                                  | 10% V <sub>DD</sub> Max             |                                     | Volt  |
| Output Voltage-"H"        | V <sub>OH</sub>  |                                  | 90% V <sub>DD</sub> Min             |                                     | Volt  |
| Output Load               | CL               |                                  | 15 ± 10%                            |                                     | pF    |

\*1 For 100×10<sup>-6</sup>, 7.2MHz to 30MHz

• APR=Absolute Pull Range is the minimum guaranteed(voltage controlled)frequency shift( $\Delta f/f$  N<sub>00</sub>)

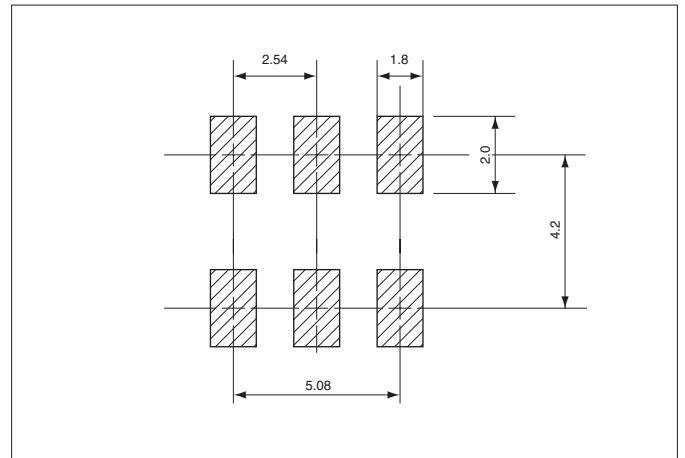
## Dimensions

(Unit : mm)



## Recommended Land Pattern

(Unit : mm)





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### Features

- Miniature Ceramic Package
- Highly reliable with seam welding
- LP-PECL output
- Supply Voltage  $V_{DD}=3.3V$
- Internal Bypass Capacitor
- Low Jitter

Table 1

| Stability Code | Stability (ppm) | $T_{OPR}$ (°C)        | Note                          |
|----------------|-----------------|-----------------------|-------------------------------|
|                |                 |                       |                               |
| 0              | ± 50            | -10 to +70 (Standard) | Standard specifications       |
| F              | ±100            | -40 to +85 (Extend)   | With only certain frequencies |
| G              | ± 50            | -40 to +85 (Extend)   | With only certain frequencies |

### How to Order

K50V-3P 0 - S E 155.520  
① ② ③ ④ ⑤

- ① Type(7×5 SMD, 3.3V, LP-PECL)
- ② Frequency Stability Code(See Table1)
- ③ Duty Ratio(S: 45% to 55% STD)
- ④ Enable/Disable Function(STD)
- ⑤ Oscillation Frequency

Packaging(Tape & Reel 1,000pcs/reel)

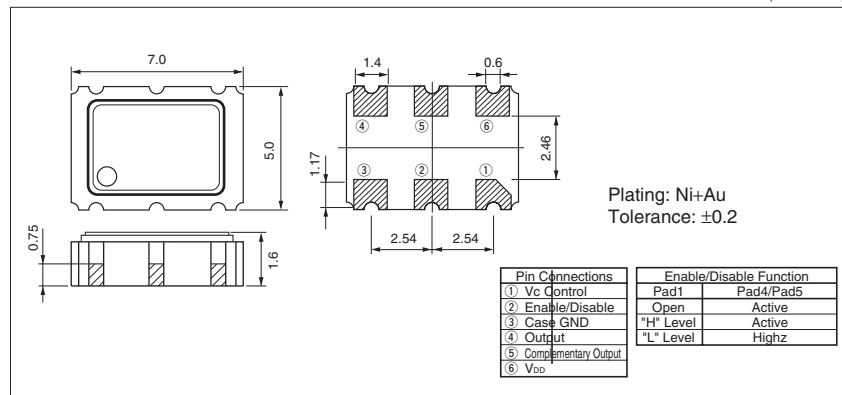
### Specifications

| Item                        | Symbol    | Conditions                                                                                                                                                     | Min.           | Max.           | Units |
|-----------------------------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------|-------|
| Output Frequency Range      | $F_{OUT}$ |                                                                                                                                                                | 155.52         |                | MHz   |
| Frequency Stability         | $F_{SBY}$ | Overall conditions:<br>initial tolerance, operating temperature range, rated power supply voltage change, load change, aging(1year @25°C), shock and vibration | -50            | +50            | ppm   |
| Storage Temperature Range   | $T_{STG}$ |                                                                                                                                                                | -55            | +90            | °C    |
| Operating Temperature Range | $T_{OPR}$ | Standard<br>Extend(option)                                                                                                                                     | -10<br>-40     | +70<br>+85     |       |
| Max. Supply Voltage         | —         |                                                                                                                                                                | -0.5           | 7.0            | Volt  |
| Supply Voltage              | $V_{DD}$  |                                                                                                                                                                | 2.97           | 3.63           | Volt  |
| Absolute Pull Range (APR)   | APR       |                                                                                                                                                                | ±100           | —              |       |
| Voltage control stability   | —         |                                                                                                                                                                | -10            | 10             | %     |
| Control Voltage             | $V_C$     |                                                                                                                                                                | 0              | 3.3            | Volt  |
| Output Voltage-"L"          | $V_{OL}$  |                                                                                                                                                                | $V_{DD}-1.810$ | $V_{DD}-1.620$ | Volt  |
| Output Voltage-"H"          | $V_{OH}$  |                                                                                                                                                                | $V_{DD}-1.025$ | $V_{DD}-0.880$ |       |
| Rise Time / Fall Time       | $T_r$     | 50ohm, 20% $V_{DD}$ -80% $V_{DD}$                                                                                                                              | —              | 0.6            | nsec  |
| Duty Ratio                  | SYM       | 50ohm, @50% output swig                                                                                                                                        | 45             | 55             | %     |
| Current Consumption         | $I_{DD}$  |                                                                                                                                                                | —              | 60             | mA    |
| Disable Current             | $I_{DE}$  |                                                                                                                                                                | —              | 10             | mA    |
| Output Load                 | —         |                                                                                                                                                                | 50             |                | ohm   |
| Input voltage range         | $V_{IN}$  |                                                                                                                                                                | 0              | $V_{DD}$       | Volt  |
| Input Voltage-"L"           | $V_{IL}$  |                                                                                                                                                                | —              | 30% $V_{DD}$   | Volt  |
| Input Voltage-"H"           | $V_{IH}$  |                                                                                                                                                                | 70% $V_{DD}$   | —              | Volt  |
| Output Disable Time         | —         |                                                                                                                                                                | —              | 150            | nsec  |
| Output Enable Time          | —         |                                                                                                                                                                | —              | 5              | msec  |
| Start-up Time               | —         | @Minimum operating Voltage to be 0sec.                                                                                                                         | —              | 10             |       |
| Deterministic Jitter*       | DJ        | DJ pk-pk                                                                                                                                                       | —              | 2              | psec  |
| 1Sigma jitter*              | 1 sigma   |                                                                                                                                                                | —              | 4              |       |

Note: Please contact us for inquiries about extended operating temperature range, available frequencies and other conditions.  
All electrical characteristics are defined at the maximum load and operating temperature range.

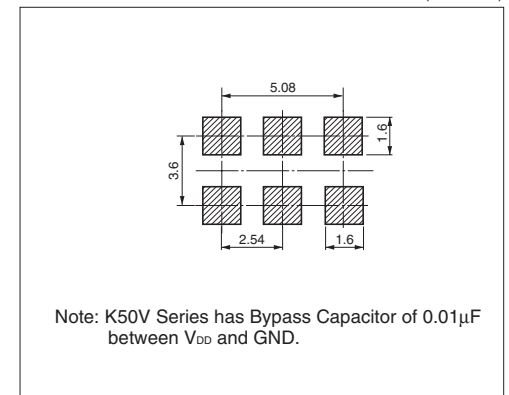
### Dimensions

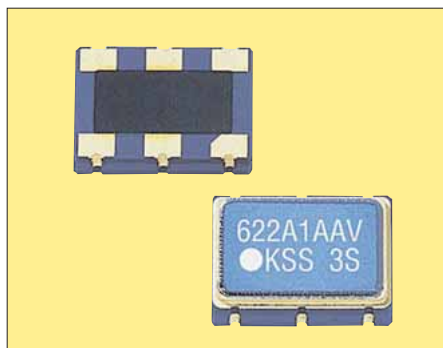
(Unit : mm)



### Recommended Land Pattern

(Unit : mm)





Pb Free

RoHS Comforming

### Features

- Low Jitter
- Differential LVPECL Outputs
- Lead free
- Wide pull range APR  $\pm 100$ ppm
- Auto pick-and-place, reflow soldering compatible.
- Operation at high frequency fundamental mode

### Applications

- SONET/SDH, 10Gbit Ethernet, WDM

Table1

### Standard Frequencies

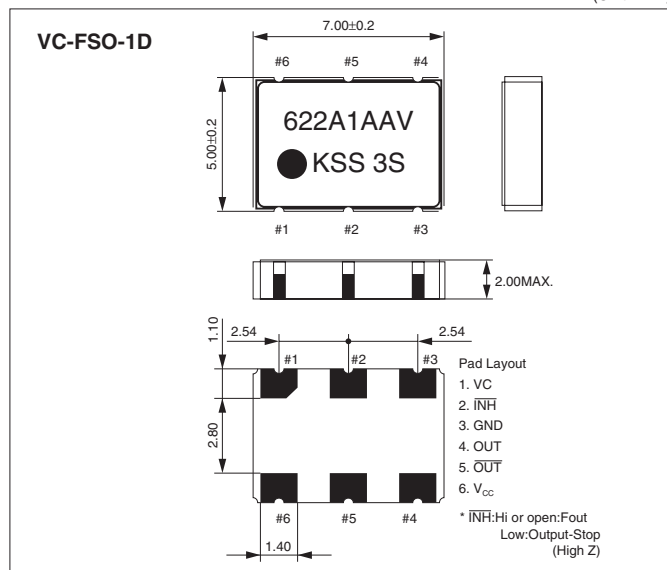
| Frequencies (MHz) |
|-------------------|
| 622.08            |
| 644.53125         |

### Specifications

| Item                            | Symbol           | Conditions                                 | Min.                | Max.                | Units      |
|---------------------------------|------------------|--------------------------------------------|---------------------|---------------------|------------|
| Output Frequency Range          | F <sub>OUT</sub> | Table 1                                    | 600                 | 700                 | MHz        |
| Storage Temp. Range             | T <sub>STG</sub> |                                            | -50                 | +100                | °C         |
| Operating Temp. Range           | T <sub>OPR</sub> |                                            | -40                 | +85                 | °C         |
| Absolute pull range (APR)       | APR              |                                            | +100                | -100                | ppm        |
| Control Voltage Range           | V <sub>CON</sub> |                                            | 0                   | 3.3                 | V          |
| Control Voltage Input Impedance | —                |                                            | 100 Typ.            |                     | K $\Omega$ |
| Transfer Slope                  | —                |                                            | Positive            |                     |            |
| Max Supply Voltage              | —                |                                            | -0.5                | 5                   | Volt       |
| Supply Voltage                  | V <sub>CC</sub>  |                                            | 3.14                | 3.46                | Volt       |
| Current Consumption             | I <sub>CC</sub>  |                                            | —                   | 80                  | mA         |
| Duty Ratio                      | SYM              | Output cross point                         | 45                  | 55                  | %          |
| Rise time/Fall time             | Tr/Tf            | 20% , 80%                                  | —                   | 400                 | ps         |
| Output Voltage-"L"              | V <sub>OL</sub>  |                                            | —                   | 1.68                | Volt       |
| Output Voltage-"H"              | V <sub>OH</sub>  |                                            | 2.275               | —                   | Volt       |
| Output Load(PECL)               | RL               | 50 $\Omega$ Terminated V <sub>CC</sub> -2V | 49.5                | 50.5                | $\Omega$   |
| Input Voltage Range             | V <sub>IN</sub>  |                                            | GND                 | V <sub>CC</sub>     | Volt       |
| Input Voltage -"L"              | V <sub>IL</sub>  |                                            | —                   | 30% V <sub>CC</sub> | Volt       |
| Input Voltage -"H"              | V <sub>IH</sub>  |                                            | 70% V <sub>CC</sub> | —                   | Volt       |
| Disable Time                    | —                |                                            | —                   | 200                 | nS         |
| Enable Time                     | —                |                                            | —                   | 2                   | mS         |
| Start-up Time                   | ST               |                                            | —                   | 10                  | mS         |
| Period Jitter                   | PJ               |                                            | —                   | 5                   | ps rms     |

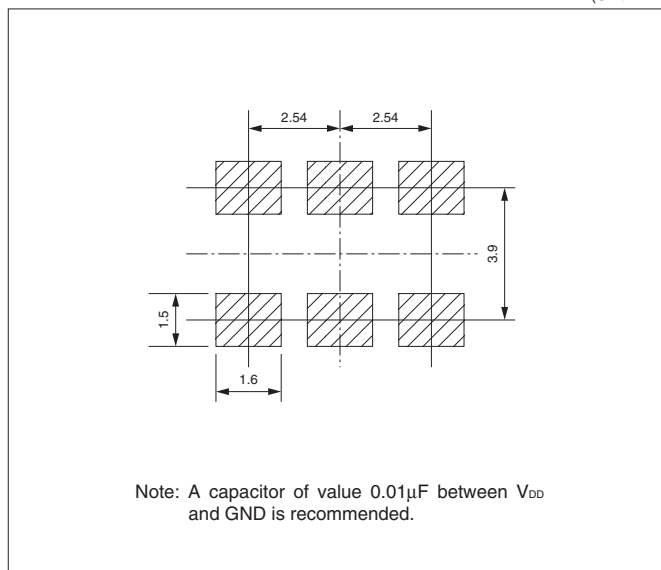
### Dimensions

(Unit : mm)



### Recommended Land Pattern

(Unit : mm)



3.2×2.5mm



Pb Free

RoHS Comforming

### Features

- Ultra-miniature SMD Type (3.2x2.5x1.0mm)
- Reflow compatible
- AFC function available
- 2.3 to 3.5V drive available
- Frequency Stability :  $\pm 2.0\text{ppm}$  at  $-30^\circ\text{C}$  to  $+85^\circ\text{C}$

### Applications

- PDC, GSM, CDMA

### How to Order

KT21 - D C V 30  $\square$  - 19.680M - T

① ② ③ ④ ⑤ ⑥ ⑦ ⑧

#### ① Series

|   |                     |
|---|---------------------|
| K | $\pm 5\text{ppm}$   |
| E | $\pm 2.5\text{ppm}$ |
| D | $\pm 2.0\text{ppm}$ |

#### ③ Lower operating temp

|   |                     |
|---|---------------------|
| C | $-30^\circ\text{C}$ |
| E | $-20^\circ\text{C}$ |
| G | $-10^\circ\text{C}$ |

#### ④ Upper operating temp

|   |                    |
|---|--------------------|
| W | $85^\circ\text{C}$ |
| V | $80^\circ\text{C}$ |
| U | $75^\circ\text{C}$ |

#### ⑤ Supply Voltage

|    |      |    |      |
|----|------|----|------|
| 28 | 2.8V | 30 | 3.0V |
|----|------|----|------|

#### ⑥ Option Code

#### ⑦ Frequency(MHz)

|        |        |        |
|--------|--------|--------|
| 12.600 | 19.200 | 26.000 |
| 13.000 | 19.440 | 38.400 |
| 14.400 | 19.680 |        |
| 16.800 | 19.800 |        |

#### ⑧ Packaging

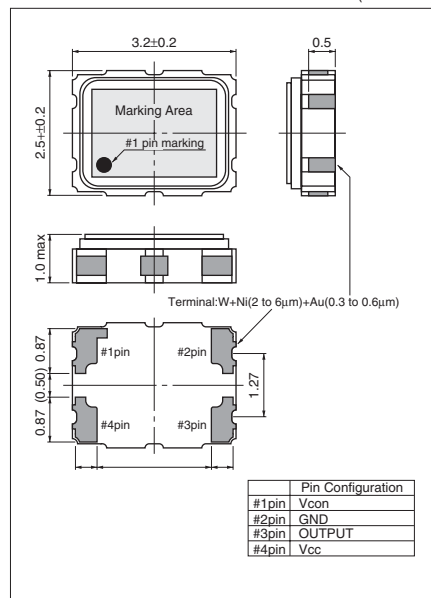
|   |               |
|---|---------------|
| T | Tape & Reel   |
|   | 2,000pcs/Reel |

### Specifications

| Item                   | Symbol                    | Conditions            | Min. | Max.  | Units            |
|------------------------|---------------------------|-----------------------|------|-------|------------------|
| Output Frequency Range | $F_{\text{OUT}}$          |                       | 12.6 | 38.4  | MHz              |
| Frequency Stability    | $\Delta f/f_0$            | vs Temperature        | -2.0 | +2.0  | ppm              |
|                        |                           | vs Load               | -0.2 | +0.2  |                  |
|                        |                           | vs Voltage            | -0.3 | +0.3  |                  |
| Storage Temp. Range    | $T_{\text{STG}}$          |                       | -40  | +85   | $^\circ\text{C}$ |
| Operating Temp. Range  | $T_{\text{OPR}}$          |                       | -30  | +85   | $^\circ\text{C}$ |
| Aging                  | $\Delta f_{\text{aging}}$ | Per Year              | -1   | 1     | ppm              |
| Voltage control range  | $\Delta f/V$              | Positive              | +/-8 | +/-15 | ppm              |
| Supply Voltage         | $V_{\text{DD}}$           |                       | 2.3  | 3.5   | Volt             |
| Output Voltage         | $V_{\text{out}}$          | 10k ohm // 10pF       | 0.8  | —     | Vp-p             |
| Current Consumption    | $I_{\text{DD}}$           |                       | —    | 2.0   | mA               |
| Duty Ratio             | SYM                       | @ 50% $V_{\text{DD}}$ | 40   | 60    | %                |
| Harmonics              | —                         |                       | —    | -5    | dBc              |

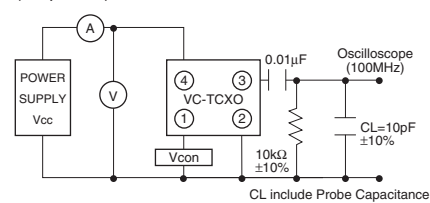
### Dimensions

(Unit : mm)

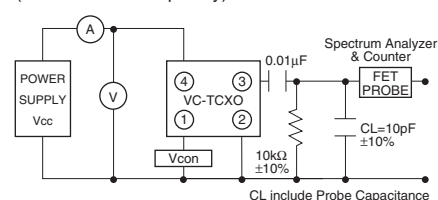


### Test Circuit

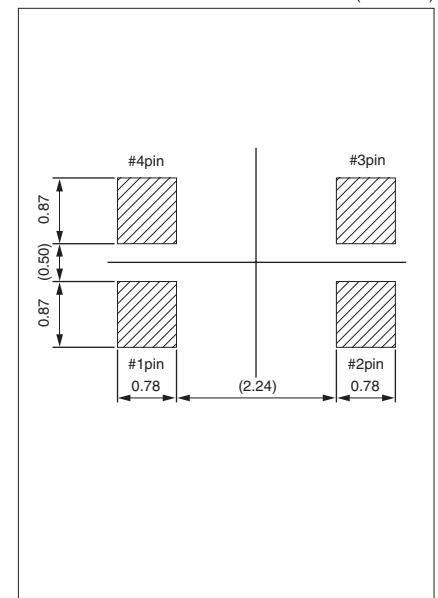
#### Test circuit 1 (Amplitude)



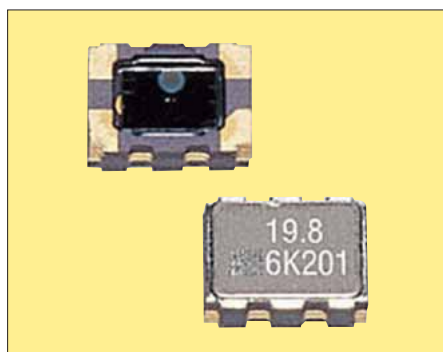
#### Test circuit 2 (Harmonics & Frequency)



### Recommended Land Pattern (Unit : mm)



3.2×2.5mm



Pb Free

RoHS Comforming

## Features

- VC-TCXO for cellular phone.
- Leadless type for auto pick-and-place.
- Ultra-miniature size. (3.2x2.5x1.05mm)
- Reflow soldering compatible.
- Low power consumption.
- Lead free

## Specifications

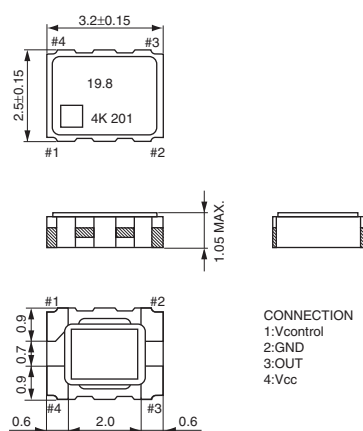
| Item                   | Symbol           | Conditions      | Min. | Max.  | Units |
|------------------------|------------------|-----------------|------|-------|-------|
| Output Frequency Range | $F_{OUT}$        |                 | 12.6 | 38.4  | MHz   |
| Frequency Stability    | $\Delta f/f_0$   | vs Temperature  | -2.0 | +2.0  | ppm   |
|                        |                  | vs Load         | -0.2 | +0.2  |       |
|                        |                  | vs Voltage      | -0.3 | +0.3  |       |
| Storage Temp. Range    | $T_{STG}$        |                 | -40  | +85   | °C    |
| Operating Temp. Range  | $T_{OPR}$        |                 | -30  | +85   | °C    |
| Aging                  | $\Delta f$ aging | Per Year        | -1   | 1     | ppm   |
| Voltage control range  | $\Delta f/V$     | Positive        | +/-8 | +/-12 | ppm   |
| Supply Voltage         | $V_{DD}$         |                 | 2.4  | 5.5   | Volt  |
| Output Voltage         | $V_{out}$        | 10k ohm // 10pF | 0.8  | —     | Vp-p  |
| Current Consumption    | $I_{DD}$         | 12.6 ~26MHz     | —    | 1.0   | mA    |
|                        |                  | 26 ~38.4MHz     | —    | 1.5   |       |
| Duty Ratio             | SYM              | @50% $V_{DD}$   | 40   | 60    | %     |
| Harmonics              | —                |                 | —    | -5    | dBc   |

Note: All electrical characteristics are defined at the maximum load and operating temperature range.

## Dimensions

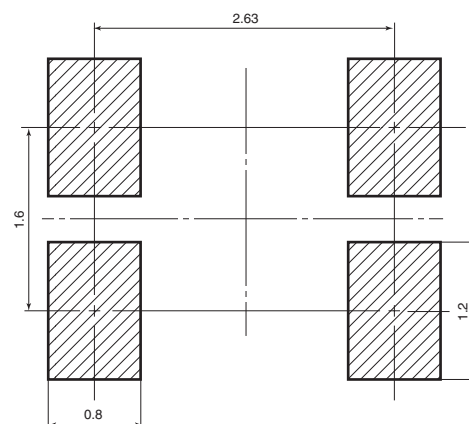
(Unit : mm)

### VC-TCXO-214C



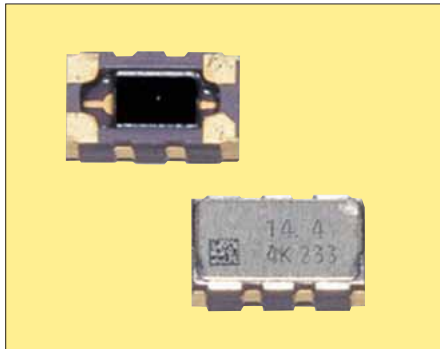
## Recommended Land Pattern

(Unit : mm)



Note: A capacitor of value 0.01μF between  $V_{DD}$  and GND is recommended.

4.0×2.5mm



Pb Free

RoHS Conforming

## Features

- VC-TCXO for Cellular Phone.
- Leadless type for auto pick-and-place.
- Miniature size. (4x2.5x1.2mm).
- Reflow soldering compatible.
- Low power consumption.

## Specifications

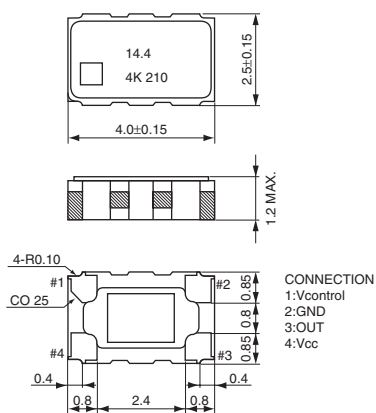
| Item                                    | Symbol           | Conditions            | Min. | Max.  | Units |
|-----------------------------------------|------------------|-----------------------|------|-------|-------|
| Output Frequency Range                  | F <sub>OUT</sub> |                       | 12.6 | 26    | MHz   |
| Frequency Stability                     | $\Delta f/f_0$   | vs Temperature        | -2.0 | +2.0  | ppm   |
|                                         |                  | vs Load               | -0.2 | +0.2  |       |
|                                         |                  | vs Voltage            | -0.3 | +0.3  |       |
| Storage Temp. Range                     | T <sub>STG</sub> |                       | -40  | +85   | °C    |
| Operating Temp. Range                   | T <sub>OPR</sub> |                       | -30  | +80   | °C    |
| Aging                                   | $\Delta f$ aging | Per Year              | -1   | 1     | ppm   |
| Voltage control range                   | $\Delta f/V$     | Positive              | +/-8 | +/-12 | ppm   |
| Supply Voltage                          | V <sub>DD</sub>  |                       | 2.4  | 5.5   | Volt  |
| Output Voltage                          | V <sub>out</sub> | 10k ohm // 10pF       | 0.8  | —     | Vp-p  |
| Current Consumption<br>(Maximum Loaded) | I <sub>DD</sub>  | 12.6 ~ 15MHz          | —    | 1.0   | mA    |
|                                         |                  | 15 ~ 26MHz            | —    | 1.5   |       |
| Duty Ratio                              | SYM              | @ 50% V <sub>DD</sub> | 40   | 60    | %     |
| Harmonics                               | —                |                       | —    | -5    | dBc   |

Note: All electrical characteristics are defined at the maximum load and operating temperature range.

## Dimensions

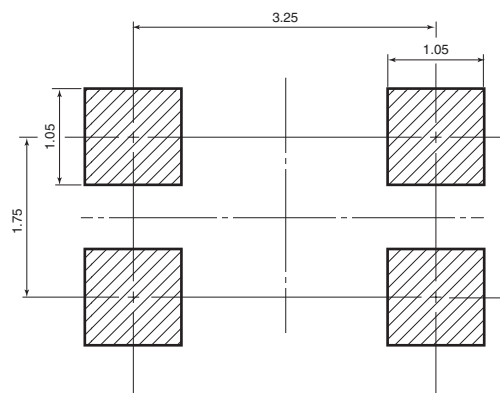
(Unit : mm)

### VC-TCXO-212C



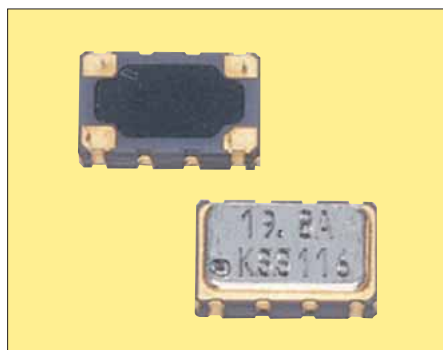
## Recommended Land Pattern

(Unit : mm)



Note: A capacitor of value 0.01μF between V<sub>DD</sub> and GND is recommended.

5.0×3.2mm



Pb Free

RoHS Conforming

## Features

- VC-TCXO for cellular phone.
- Leadless type for auto pick-and-place.
- Miniature size. (5x3.2x1.35mm)
- Reflow soldering compatible.
- Low power consumption.

## Specifications

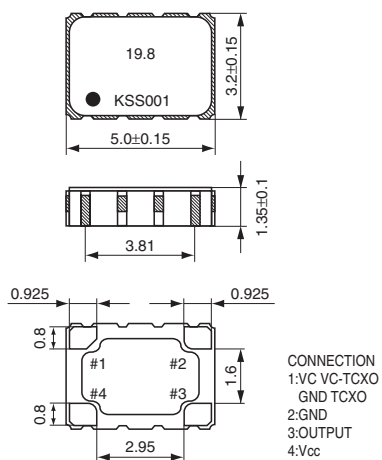
| Item                   | Symbol           | Conditions      | Min. | Max.  | Units |
|------------------------|------------------|-----------------|------|-------|-------|
| Output Frequency Range | $F_{OUT}$        |                 | 12.6 | 26    | MHz   |
| Frequency Stability    | $\Delta f/f_0$   | vs Temperature  | -2.0 | +2.0  | ppm   |
|                        |                  | vs Load         | -0.2 | +0.2  |       |
|                        |                  | vs Voltage      | -0.3 | +0.3  |       |
| Storage Temp. Range    | $T_{STG}$        |                 | -40  | +85   | °C    |
| Operating Temp. Range  | $T_{OPR}$        |                 | -30  | +80   | °C    |
| Aging                  | $\Delta f$ aging | Per Year        | -1   | 1     | ppm   |
| Voltage control range  | $\Delta f/V$     | Positive        | +/-8 | +/-12 | ppm   |
| Supply Voltage         | $V_{DD}$         |                 | 2.4  | 5.5   | Volt  |
| Output Voltage         | $V_{out}$        | 10k ohm // 10pF | 0.8  | —     | Vp-p  |
| Current Consumption    | $I_{DD}$         |                 | —    | 2.0   | mA    |
| Duty Ratio             | SYM              | @ 50% $V_{DD}$  | 40   | 60    | %     |
| Harmonics              | —                |                 | —    | -5    | dBc   |

Note: All electrical characteristics are defined at the maximum load and operating temperature range.

## Dimensions

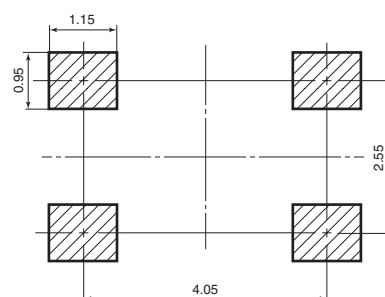
(Unit : mm)

(VC-)TCXO-208C



## Recommended Land Pattern

(Unit : mm)



Note: A capacitor of value 0.01μF between  $V_{DD}$  and GND is recommended.



Pb Free

RoHS Conforming

### Features

- Ultra-miniature SMD Type (5.0x3.2x1.5mm)
- Reflow compatible
- AFC function available
- 2.3 to 3.5V drive available
- Frequency Stability :  $\pm 2.0\text{ppm}$  at  $-30^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$

### Applications

- PDC, GSM, CDMA

### How to Order

KT18B - D C V 30  $\square$  - 19.680M - T  
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

#### ① Type

|   |                     |
|---|---------------------|
| K | $\pm 5\text{ppm}$   |
| E | $\pm 2.5\text{ppm}$ |
| D | $\pm 2.0\text{ppm}$ |

#### ③ Lower operating temp

|   |                       |
|---|-----------------------|
| C | $-30^{\circ}\text{C}$ |
| E | $-20^{\circ}\text{C}$ |
| G | $-10^{\circ}\text{C}$ |

#### ④ Upper operating temp

|   |                      |
|---|----------------------|
| W | $85^{\circ}\text{C}$ |
| V | $80^{\circ}\text{C}$ |
| U | $75^{\circ}\text{C}$ |

#### ⑤ Supply Voltage

|    |      |    |      |
|----|------|----|------|
| 28 | 2.8V | 30 | 3.0V |
|----|------|----|------|

#### ⑥ Option Code

#### ⑦ Frequency(MHz)

|        |        |        |
|--------|--------|--------|
| 13.000 | 19.200 | 19.800 |
| 14.400 | 19.440 | 26.000 |
| 16.800 | 19.680 |        |

#### ⑧ Packaging

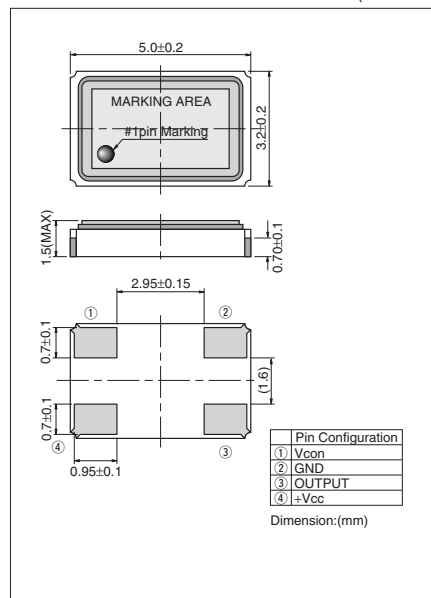
|   |               |
|---|---------------|
| T | Tape & Reel   |
|   | 4,000pcs/Reel |

### Specifications

| Item                   | Symbol                    | Conditions            | Min. | Max.  | Units              |
|------------------------|---------------------------|-----------------------|------|-------|--------------------|
| Output Frequency Range | $F_{\text{OUT}}$          |                       | 13   | 26    | MHz                |
| Frequency Stability    | $\Delta f/f_0$            | vs Temperature        | -2.0 | +2.0  | ppm                |
|                        |                           | vs Load               | -0.2 | +0.2  |                    |
|                        |                           | vs Voltage            | -0.3 | +0.3  |                    |
| Storage Temp. Range    | $T_{\text{STG}}$          |                       | -40  | +85   | $^{\circ}\text{C}$ |
| Operating Temp. Range  | $T_{\text{OPR}}$          |                       | -30  | +85   | $^{\circ}\text{C}$ |
| Aging                  | $\Delta f_{\text{aging}}$ | Per Year              | -1   | 1     | ppm                |
| Voltage control range  | $\Delta f/V$              | Positive              | +/-8 | +/-15 | ppm                |
| Supply Voltage         | $V_{\text{DD}}$           |                       | 2.3  | 3.5   | Volt               |
| Output Voltage         | $V_{\text{out}}$          | 10k ohm // 10pF       | 0.8  | —     | Vp-p               |
| Current Consumption    | $I_{\text{DD}}$           |                       | —    | 2.0   | mA                 |
| Duty Ratio             | SYM                       | @ 50% $V_{\text{DD}}$ | 40   | 60    | %                  |
| Harmonics              | —                         |                       | —    | -5    | dBc                |

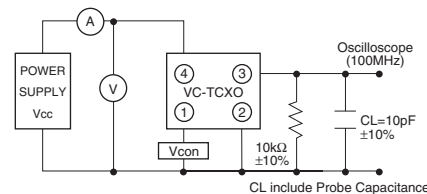
### Dimensions

(Unit : mm)

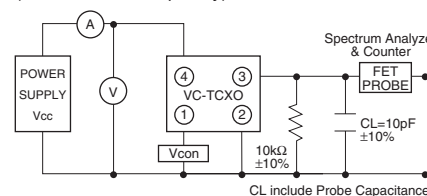


### Test Circuit

#### Test circuit 1 (Amplitude)

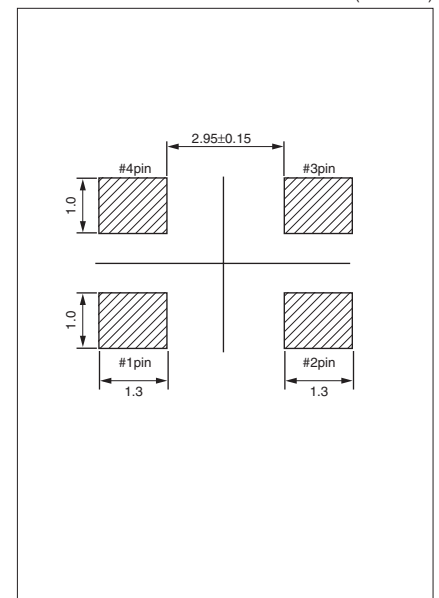


#### Test circuit 2 (Harmonics & Frequency)



### Recommended Land Pattern

(Unit : mm)



5.0×3.2mm



Pb Free

RoHS Conforming

### Features

- Miniature SMD Type (5.0x3.2x1.5mm)
- Reflow compatible
- AFC function available
- 2.7V/2.8V/3.0V drive available
- Frequency Stability :  $\pm 2\text{ppm}$  at  $-30^\circ\text{C}$  to  $+80^\circ\text{C}$
- Phase Noise  $-140\text{dBc/Hz}$  @ 1kHz offset(max)

### Applications

- GSM, CDMA

### How to Order

KT20A - D C V 30  $\square$  - 19.680M - T  
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

#### ① Series

#### ② Frequency stability

|   |                     |
|---|---------------------|
| K | $\pm 5\text{ppm}$   |
| E | $\pm 2.5\text{ppm}$ |
| D | $\pm 2.0\text{ppm}$ |

#### ③ Lower operating temp

|   |                     |
|---|---------------------|
| C | $-30^\circ\text{C}$ |
| E | $-20^\circ\text{C}$ |
| G | $-10^\circ\text{C}$ |

#### ④ Upper operating temp

|   |                    |
|---|--------------------|
| V | $80^\circ\text{C}$ |
| T | $70^\circ\text{C}$ |
| R | $60^\circ\text{C}$ |

#### ⑤ Supply Voltage

|    |      |    |      |
|----|------|----|------|
| 28 | 2.8V | 30 | 3.0V |
|----|------|----|------|

#### ⑥ Option Code

#### ⑦ Frequency(MHz)

|        |        |        |
|--------|--------|--------|
| 19.200 | 19.680 | 26.000 |
| 19.440 | 19.800 |        |

#### ⑧ Packaging

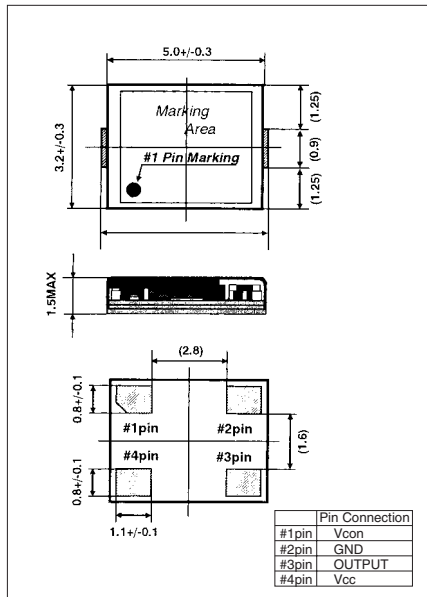
|   |               |
|---|---------------|
| T | Tape & Reel   |
|   | 4,000pcs/Reel |

### Specifications

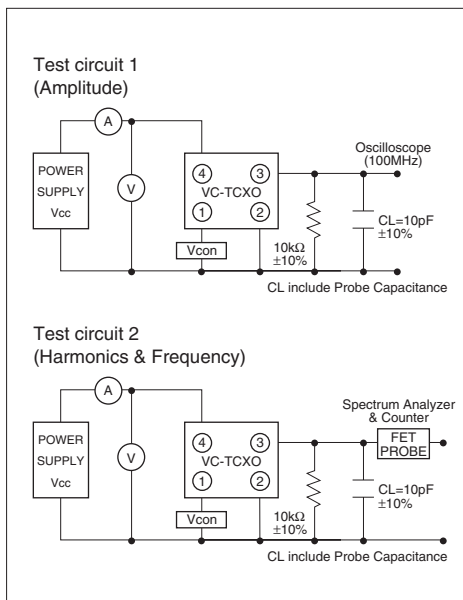
| Item                   | Symbol                    | Conditions            | Min. | Max.  | Units            |
|------------------------|---------------------------|-----------------------|------|-------|------------------|
| Output Frequency Range | $F_{\text{OUT}}$          |                       | 19.2 | 26    | MHz              |
| Frequency Stability    | $\Delta f/f_0$            | vs Temperature        | -2.0 | +2.0  | ppm              |
|                        |                           | vs Load               | -0.2 | +0.2  |                  |
|                        |                           | vs Voltage            | -0.3 | +0.3  |                  |
| Storage Temp. Range    | $T_{\text{STG}}$          |                       | -30  | +80   | $^\circ\text{C}$ |
| Operating Temp. Range  | $T_{\text{OPR}}$          |                       | -40  | +85   | $^\circ\text{C}$ |
| Aging                  | $\Delta f_{\text{aging}}$ | Per Year              | -1   | 1     | ppm              |
| Voltage control range  | $\Delta f/V$              | Positive              | +/-8 | +/-15 | ppm              |
| Supply Voltage         | $V_{\text{DD}}$           |                       | 2.8  | 3     | Volt             |
| Output Voltage         | $V_{\text{out}}$          | 10k ohm // 10pF       | 0.8  | —     | Vp-p             |
| Current Consumption    | $I_{\text{DD}}$           |                       | —    | 1.5   | mA               |
| Duty Ratio             | SYM                       | @ 50% $V_{\text{DD}}$ | 40   | 60    | %                |
| Harmonics              | —                         |                       | —    | -5    | dBc              |

### Dimensions

(Unit : mm)

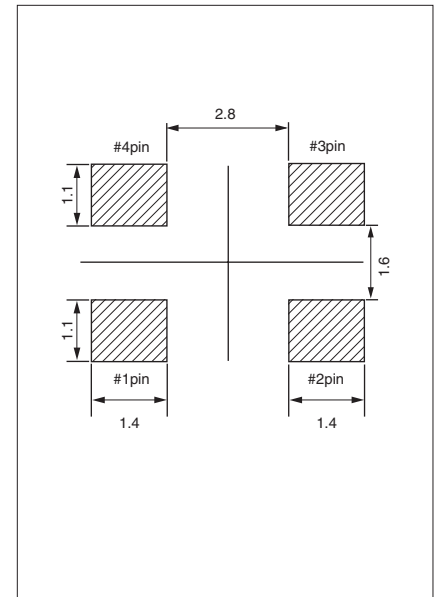


### Test Circuit



### Recommended Land Pattern

(Unit : mm)





### Features

- Digital processing Temperature Compensated Crystal Oscillator.
- Excellent Frequency temperature characteristics and Frequency aging.
- C-MOS output.

### Applications

- Reference Oscillator.
- PLL Oscillator.

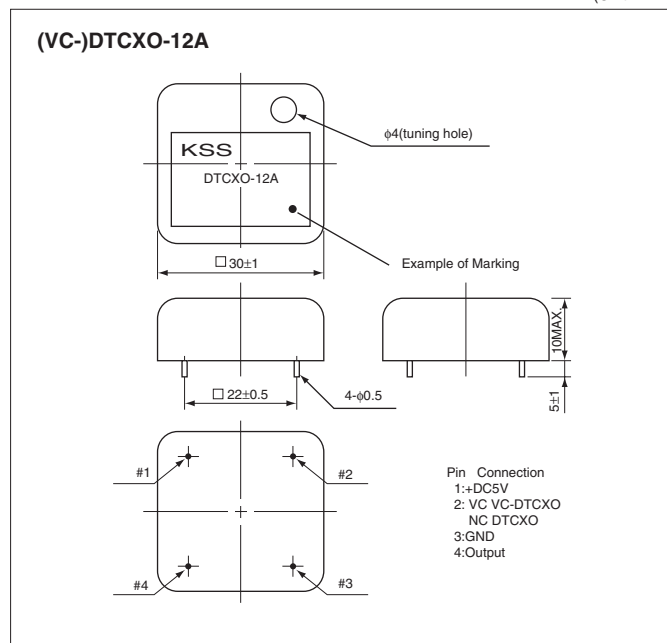
### Specifications

| Item                   | Symbol           | Conditions                                      | Min.  | Max.  | Units |
|------------------------|------------------|-------------------------------------------------|-------|-------|-------|
| Output Frequency Range | F <sub>OUT</sub> |                                                 | 1     | 32    | MHz   |
| Frequency Stability    | F <sub>SBY</sub> | vs Temperature DTCXO-12A/VC-DTCXO-12A : VC=Open | -0.1  | +0.1  | ppm   |
|                        |                  | vs Voltage                                      | -0.05 | +0.05 |       |
| Storage Temp. Range    | T <sub>STG</sub> |                                                 | -40   | +85   | °C    |
| Operating Temp. Range  | T <sub>OPR</sub> |                                                 | -35   | +85   | °C    |
| Supply Voltage         | V <sub>DD</sub>  |                                                 | 4.75  | 5.25  | Volt  |
| Current Consumption    | I <sub>DD</sub>  |                                                 | —     | 30    | mA    |
| Frequency Tuning Range | Δf tuning        | internal trimmer                                | -0.7  | 0.7   | ppm   |
| Frequency Aging        | Δf aging         | Per Year(at +25°C)                              | -0.5  | 0.5   | ppm   |
| Frequency Deviation    | Δf/V             | VC-DTCXO-12A only                               | -2.0  | 2.0   | ppm   |
| Control Voltage        | VC               | VC-DTCXO-12A only                               | 0.5   | 4.5   | Volt  |
| Duty Ratio             | SYM              | @50% V <sub>DD</sub> 1~15MHz                    | 45    | 55    | %     |
|                        |                  | @50% V <sub>DD</sub> 15~32MHz                   | 30    | 70    |       |
| Output Voltage-"L"     | V <sub>OL</sub>  |                                                 | —     | 0.5   | Volt  |
| Output Voltage-"H"     | V <sub>OH</sub>  |                                                 | 4.5   | —     | Volt  |
| Load                   | CL               |                                                 | 15    | 15    | pF    |
| Sub Harmonics          |                  |                                                 | —     | -80   | dB    |

Note: All electrical characteristics are defined at the maximum load and operating temperature range.

### Dimensions

(Unit : mm)





### Features

- Digital processing Temperature Compensated Crystal Oscillator.
- Output 50Ω
- Wide Frequency Range

### Applications

- Reference Oscillator.
- PLL Oscillator.

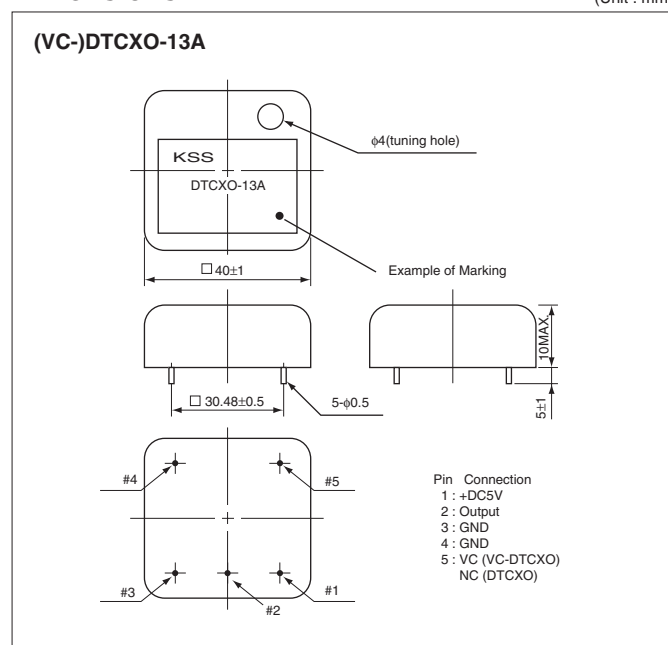
## Specifications

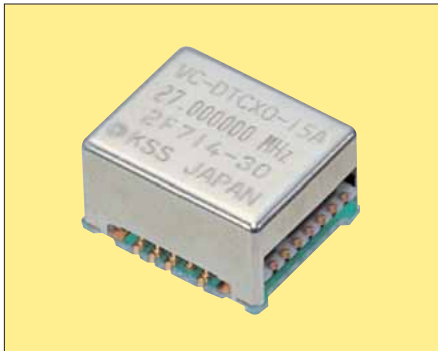
| Item                   | Symbol            | Conditions                                    | Min.  | Max.  | Units |
|------------------------|-------------------|-----------------------------------------------|-------|-------|-------|
| Output Frequency Range | $F_{OUT}$         |                                               | 30    | 320   | MHz   |
| Frequency Stability    | $F_{SBY}$         | vs Temperature DTCXO-13A/VC-DTCXO-13A:VC=Open | -0.1  | +0.1  | ppm   |
|                        |                   | vs Voltage                                    | -0.05 | +0.05 |       |
| Storage Temp. Range    | $T_{STG}$         |                                               | -40   | +85   | °C    |
| Operating Temp. Range  | $T_{OPR}$         |                                               | -20   | +70   | °C    |
| Supply Voltage         | $V_{DD}$          |                                               | 4.75  | 5.25  | Volt  |
| Current Consumption    | $I_{DD}$          |                                               | —     | 40    | mA    |
| Frequency Tuning Range | $\Delta f$ tuning | internal trimmer                              | -0.7  | 0.7   | ppm   |
| Frequency Aging        | $\Delta f$ aging  | Per Year(at +25°C)                            | -0.5  | 0.5   | ppm   |
| Frequency Deviation    | $\Delta f/V$      | VC-DTCXO-13A only                             | -2.0  | 2.0   | ppm   |
| Control Voltage        | VC                | VC-DTCXO-13A only                             | 0.5   | 4.5   | Volt  |
| Output Voltage         | $V_{out}$         | 50 ohm                                        | 0     | —     | dBm   |
| Sub Harmonics          |                   |                                               | —     | -40   | dB    |

Note: All electrical characteristics are defined at the maximum load and operating temperature range.

## Dimensions

(Unit : mm)





#### Features

- Small Size(14.0x11.5x8.0mm), Lead-less type(SMD)
- Supply voltage of 3.3V or 5.0V is available.
- Digital processing Temperature Compensated Crystal Oscillator
- High stability( $\pm 0.5 \times 10^{-6}$ MAX./-30~80°)

#### Applications

- Reference Oscillator
- PLL Oscillator

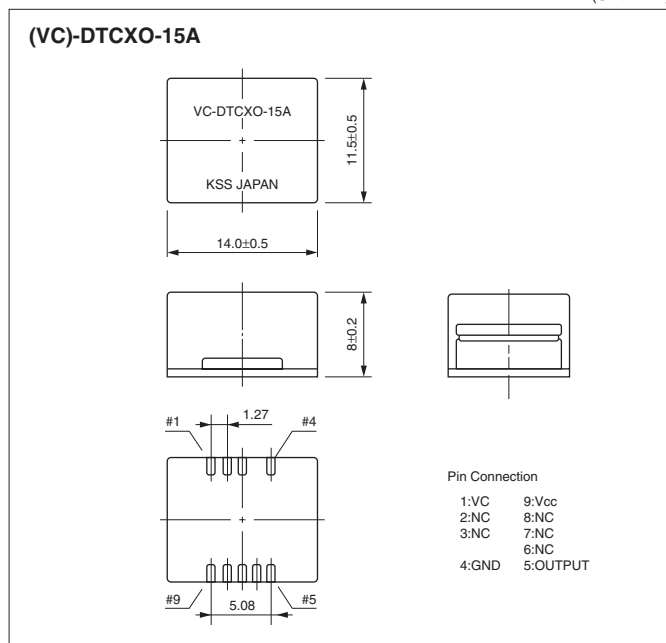
#### Specifications

| Item                   | Symbol           | Conditions             | Min.  | Max.  | Units |
|------------------------|------------------|------------------------|-------|-------|-------|
| Output Frequency Range | F <sub>OUT</sub> |                        | 10    | 40    | MHz   |
| Frequency Stability    | F <sub>SBY</sub> | vs Temperature VC=Open | -0.5  | +0.5  | ppm   |
|                        |                  | vs Voltage             | -0.05 | +0.05 |       |
| Storage Temp. Range    | T <sub>STG</sub> |                        | -40   | +85   | °C    |
| Operating Temp. Range  | T <sub>OPR</sub> |                        | -30   | +80   | °C    |
| Supply Voltage         | V <sub>DD</sub>  |                        | 3.14  | 3.46  | Volt  |
| Current Consumption    | I <sub>DD</sub>  |                        | —     | 15    | mA    |
| Frequency Aging        | $\Delta f$ aging | Per Year(at +25°C)     | -0.7  | 0.7   | ppm   |
| Frequency Deviation    | $\Delta f/V$     |                        | -10   | 10    | ppm   |
| Control Voltage        | VC               |                        | 0.5   | 2.5   | Volt  |
| Duty Ratio             | SYM              | 50% V <sub>DD</sub>    | 30    | 70    | %     |
| Output Voltage-"L"     | V <sub>OL</sub>  |                        | —     | 0.3   | Volt  |
| Output Voltage-"H"     | V <sub>OH</sub>  |                        | 3     | —     | Volt  |
| Load                   | CL               |                        | 15    | 15    | pF    |

Note: All electrical characteristics are defined at the maximum load and operating temperature range.

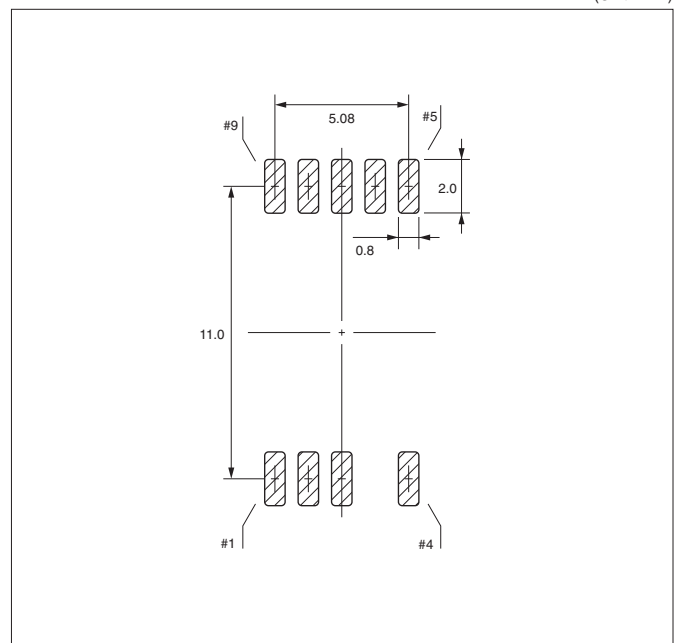
#### Dimensions

(Unit : mm)



#### Recommended Land Pattern

(Unit : mm)





#### Features

- Compact OCVCXO(36.1x27.2x20.2mm).
- High stability.
- Solder sealing type.

#### Applications

- Standard Oscillator.

#### Standard Frequencies

- 10MHz.

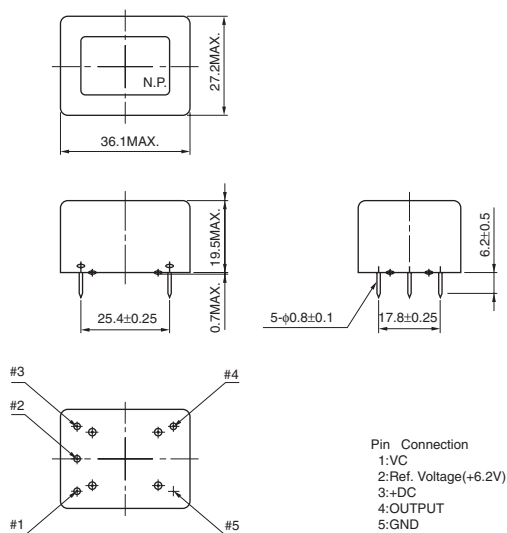
### Specifications

| Item                   | Symbol           | Conditions     | Min.   | Max.   | Units |
|------------------------|------------------|----------------|--------|--------|-------|
| Output Frequency Range | $F_{OUT}$        |                | 10     | 10     | MHz   |
| Frequency Stability    | $F_{SBY}$        | vs Temperature | -0.03  | +0.03  | ppm   |
|                        |                  | vs Voltage     | -0.002 | +0.002 |       |
| Storage Temp. Range    | $T_{STG}$        |                | -20    | +80    | °C    |
| Operating Temp. Range  | $T_{OPR}$        |                | -10    | +60    | °C    |
| Supply Voltage         | $V_{DD}$         |                | 11.4   | 12.6   | Volt  |
| Current Consumption    | $I_{DD}$         |                | —      | 450    | mA    |
| Frequency Aging        | $\Delta f$ aging | Per Year       | -0.05  | 0.05   | ppm   |
| Frequency Deviation    | $\Delta f/V$     |                | -0.5   | 0.5    | ppm   |
| Control Voltage        | VC               |                | 0      | 6.0    | Volt  |
| Output Voltage         | $V_{out}$        | 50 ohm         | 3      | —      | dBm   |
| Sub Harmonics          |                  |                | —      | -20    | dB    |

### Dimensions

(Unit : mm)

#### OCVCXO-120A





### Features

- Frequency Control Function by GPS.
- Highly stable and accurate reference frequency by Rb atom oscillator.
- Superior long term stability.
- 10MHz-8 output standard.
- DC/AC power supply automatic changeover(Built-in back-up battery).

### Applications

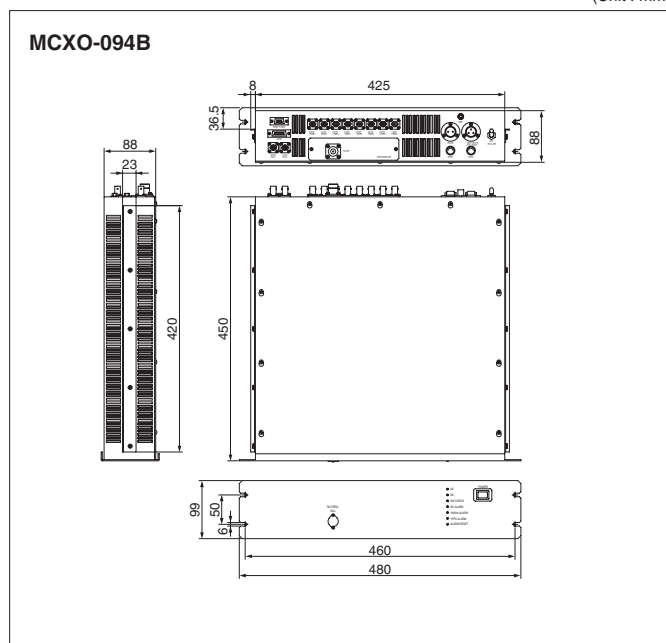
- Digital TV broadcasting station and transmitter.
- Accurate frequency reference oscillator for laboratory and factory.
- Base station for Stratum1.

### Specifications

| Item                                  | Symbol           | Conditions                                                | Min. | Max. | Units              |
|---------------------------------------|------------------|-----------------------------------------------------------|------|------|--------------------|
| Output Frequency Range                | F <sub>OUT</sub> | 8output                                                   | 10   | 10   | MHz                |
| Frequency Stability                   | F <sub>SBY</sub> | GPS locked / The temperature slope is less than 10°C/hour | -3   | 3    | ×10 <sup>-11</sup> |
| Operable Temp. Range                  | T <sub>STG</sub> |                                                           | -20  | +60  | °C                 |
| Operating Temp. Range                 | T <sub>OPR</sub> |                                                           | -10  | +45  | °C                 |
| Supply Voltage (AC)                   | V <sub>DD</sub>  |                                                           | 90   | 110  | Volt               |
|                                       |                  |                                                           | 180  | 220  |                    |
| Supply Voltage ADC                    |                  |                                                           | 22.8 | 25.2 | Volt               |
| Power Consumption (Warm-up Condition) |                  | DC +25°C                                                  | —    | 100  | W                  |
| Power Consumption (Normal Condition)  |                  | DC +25°C                                                  | —    | 50   | W                  |
| Frequency Aging                       | Δf aging         | Per Year (GPS locked ±2×10 <sup>-12</sup> /24h average)   | -5   | 5    | ×10 <sup>-10</sup> |
| Output Level                          | V <sub>out</sub> | 50 ohm                                                    | 0    | 3    | dBm                |

### Dimensions

(Unit : mm)



## 1. Shock & Drop • Vibration

Do not inflict excessive shock and mechanical vibration that exceeds the norm, such as hitting or mistakenly dropping, when transporting and mounting on a board. There are cases when pieces of crystal break, and pieces that are used become damaged, and become inoperable. When a shock or vibration that exceeds the norm has been inflicted, make sure to check the characteristics.

## 2. Cleaning

Since a crystal piece can be broken by resonance when a crystal device is cleaned by ultrasonic cleaning. Be careful when carrying out ultrasonic cleaning.

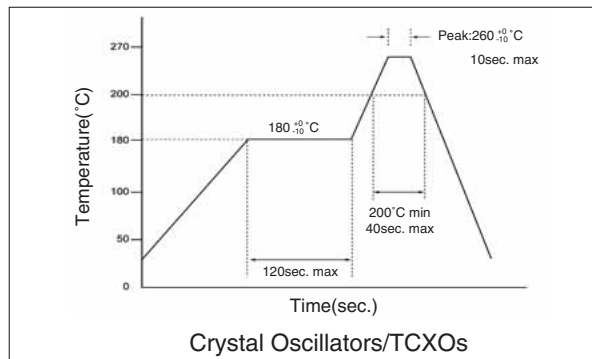
## 3. Soldering conditions

To maintain the product reliability, please follow recommended conditions.

### Standard soldering iron conditions

|                | Crystal Oscillators |
|----------------|---------------------|
| Soldering iron | 280°C ~ 340°C       |
| Time           | 3+1/-0sec. max      |

### Reflow conditions (Example)



Recommended reflow Conditions vary depending upon products.  
Please check with the respective specification for details.

## 4. Mounting Precautions

### Leaded Devices

The special glass, located where the lead of the retainer base comes out, is aligned with the coefficient of thermal expansion of the lead. If the glass is damaged and cracks appear, there may be cases in which performance deteriorates and it fails to operate.

Consequently, when making the device adhere closely and applying solder, align the gap of the hole of the board with the gap of the lead and insert without excessive force.

When making the device adhere closely to a through hole board and applying solder, be careful that the solder does not get into the metal part of the retainer base and cause a short. Putting in an insulation spacer is one more method of preventing a short circuit.

When the lead is mounted floating, fix it as far as possible so that contact with other parts and the breakage due to the fatigue, and the mechanical resonance of the lead will not occur.

When the lead is bent and used, do not bend the lead directly from the base, separate it 0.5mm or more and then bend it. When bending, before attaching to the board, fix the place where the lead comes out in advance and attach it after bending so that a crack does not occur in the glass part.

### Surface Mount Devices

The lead of the device and the pattern of the board is soldered on the surface. Since extreme deformation of the board tears off the pattern, tears off the lead metal, cracks the solder and damages the sealed part of the device and there are cases in which performance deteriorates and operation fails, use it within the stipulated bending conditions. Due to the small cracks in the board resulting from mounting, please pay sufficient attention when attaching a device at the position where the warping of the board is great.

When using an automatic loading machine, as far as possible, select a type that has a small impact and use it while confirming that there is no damage.

Surface mount devices are NOT flow soldering compatible.

## 5. Storage Condition

Since the long hour high temperature and low temperature storage, as well as the storage at high humidity are causes of deterioration in frequency accuracy and solderability.

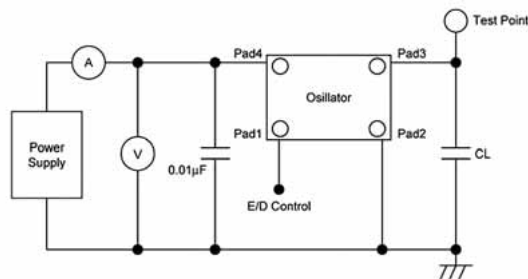
Parts should be stored in temperature range of -5 to +40°C, humidity 40 to 60% RH, and avoid direct sunlight. Then use within 6 months.

## 6. In order to use crystal oscillators

- (1) The miniature crystal oscillator for the clock utilizes a C-MOS IC and incorporates a protective circuit against static electricity. However, exercise care in the same manner as for a normal C-MOS IC.
- (2) Internal capacitor is not provided in the power supply section (+DC-GND).  
To serve as overimpressed voltage and overcurrent protective device, place a bypass capacitor (0.01  $\mu\text{F}$ ) as near as possible to the (+DC-GND) terminal.  
However, the capacity value is meant as a guideline.  
Depending on the capacitor type, frequency characteristics vary. Accordingly, use a capacitor that matches the frequency characteristics.
- (3) Applying reverse voltage could result in damage to internal parts. Take care not to connect terminals incorrectly.
- (4) Please do not use oscillators under unfavorable condition such as beyond specified range in catalog or specification sheet.
- (5) Please keep oscillators away from water, salt water or harmful gas.
- (6) K50H-3C / FSO series should be stored in humidity-controlled area after the package is unsealed, in temperature  $+25\pm 5^\circ\text{C}$  under humidity of 65%RH, and should be mounted on PCB within 7 days.
- (7) K50H-3C / FSO series has Bypass Capacitor between VDD and GND.

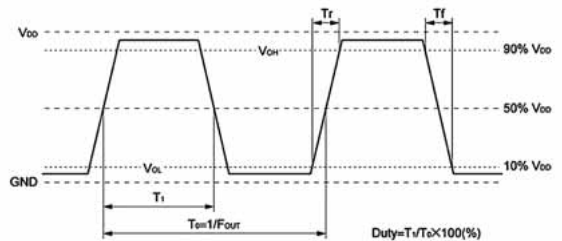
## Test Circuits and Clock Timing Chart

### CMOS Output Test Circuits

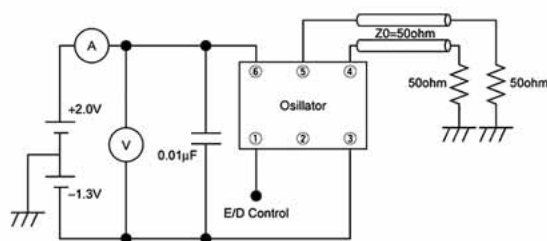


Note) Maximum load (Includes capacitances of fixture and probe)

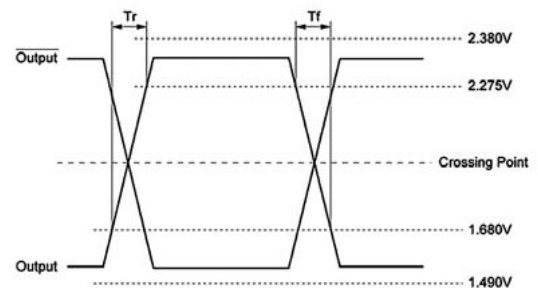
### Clock Timing chart (C-MOS Output)



### LV-PECL Output Test Circuits



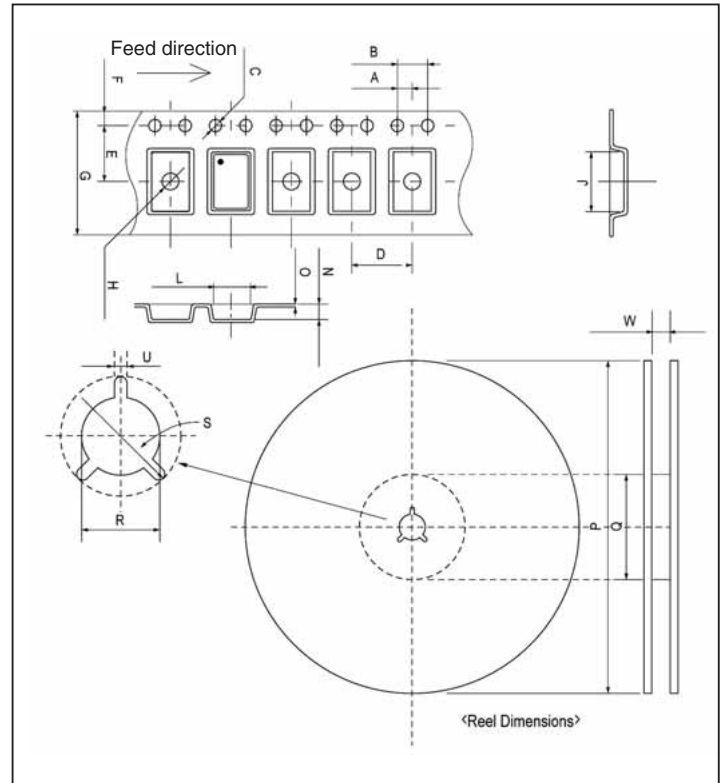
### Clock Timing chart (LV-PECL Output)



## Tape & Reel Specifications

### Crystal Oscillators

|         |   | KC2520      | K25         | K30         | FXO-61F<br>FXO-64F<br>VC-FXO-65F |
|---------|---|-------------|-------------|-------------|----------------------------------|
| T A P E | A | 2.0±0.1     | 2.0±0.1     | 2.0±0.1     | 2.0±0.1                          |
|         | B | 4.0±0.1     | 4.0±0.1     | 4.0±0.1     | 4.0±0.1                          |
|         | C | φ1.5+0.1/-0 | φ1.5+0.1/-0 | φ1.5+0.1/-0 | φ1.55±0.1                        |
|         | D | 4.0±0.1     | 8.0±0.1     | 8.0±0.1     | 8.0±0.1                          |
|         | E | 3.5±0.05    | 3.5±0.05    | 5.5±0.1     | 5.5±0.1                          |
|         | F | 1.75±0.1    | 1.75±0.1    | 1.75±0.1    | 1.75±0.1                         |
|         | G | 8.0±0.2     | 8.0±0.2     | 12.0±0.2    | 12.0±0.3                         |
|         | H | φ1.1±0.1    | φ1.55±0.1   | φ1.55±0.1   | φ1.55±0.1                        |
|         | J | 2.7±0.1     | 3.5±0.05    | 5.5±0.1     | 5.4±0.1                          |
|         | L | 2.2±0.1     | 2.8±0.05    | 3.7±0.1     | 3.6±0.1                          |
|         | N | 1.25±0.1    | 1.1±0.05    | 1.4±0.1     | 1.7±0.1                          |
| R E E L | O | 0.2±0.05    | 0.3±0.05    | 0.3±0.05    | 0.3±0.05                         |
|         | P | φ180+0/-3   | φ180+0/-3   | φ180+0/-3   | φ254±2                           |
|         | Q | φ60+1/-0    | φ60+1/-0    | φ60+1/-0    | φ100±1                           |
|         | R | φ13±0.2     | φ13±0.2     | φ13±0.2     | φ13±0.5                          |
|         | S | φ21±0.8     | φ21±0.8     | φ21±0.8     | φ21±0.8                          |
|         | W | 2.0±0.5     | 2.0±0.5     | 2.0±0.5     | 2.0±0.5                          |
| Qty     |   | 2000        | 2000        | 1000        | 1000                             |



|         |   | FSO-1C/1D<br>FSO-2B/2C/2D<br>VC-FSO-1D | FXO-31F<br>FXO-34F<br>FXO-37F<br>VC-FXO-35F<br>VCXO-7050 | K50H<br>K50<br>K53<br>K50V-3P | KT21        | (VC)TCXO-214C | (VC)TCXO-212C      | (VC)TCXO-208C<br>MFO-208F | KT18B           | KT20A       | (VC)TCXO-204C |
|---------|---|----------------------------------------|----------------------------------------------------------|-------------------------------|-------------|---------------|--------------------|---------------------------|-----------------|-------------|---------------|
| T A P E | A | 2.0±0.1                                | 2.0±0.1                                                  | 2.0±0.1                       | 2.0±0.1     | 2.0±0.1       | 2.0±0.1            | 2.0±0.1                   | 2.0±0.1         | 2.0±0.1     | 2.0±0.1       |
|         | B | 4.0±0.1                                | 4.0±0.1                                                  | 4.0±0.1                       | 4.0±0.1     | 4.0±0.1       | 4.0±0.1            | 4.0±0.1                   | 4.0±0.1         | 4.0±0.1     | 4.0±0.1       |
|         | C | φ1.55±0.1                              | φ1.55±0.1                                                | φ1.5±0.1                      | φ1.5+0.1/-0 | φ1.5+0.1/-0   | φ1.5+0.1/-0        | φ1.5+0.1/-0               | φ1.5+0.1/-0     | φ1.5+0.1/-0 | φ1.5+0.1/-0   |
|         | D | 8.0±0.1                                | 8.0±0.1                                                  | 8.0±0.1                       | 4.0±0.1     | 4.0±0.1       | 4.0±0.1            | 8.0±0.1/4.0±0.1           | 8.0±0.1/4.0±0.1 | 8.0±0.1     | 4.0±0.1       |
|         | E | 7.5±0.1                                | 7.5±0.1                                                  | 7.5±0.1                       | 3.5±0.1     | 3.5±0.05      | 5.5±0.1            | 5.5±0.1                   | 5.5±0.1         | 5.5±0.1     | 7.5±0.1       |
|         | F | 1.75±0.1                               | 1.75±0.1                                                 | 1.75±0.1                      | 1.75±0.1    | 1.75±0.1      | 1.75±0.1           | 1.75±0.1                  | 1.75±0.1        | 1.75±0.1    | 1.75±0.1      |
|         | G | 16.0±0.3                               | 16.0±0.3                                                 | 16.0±0.2                      | 8.0±0.3     | 8.0±0.2       | 8.0±0.3/12.0±0.3   | 12.0±0.3                  | 12.0±0.3        | 12.0±0.3    | 16.0±0.3      |
|         | H | φ1.55                                  | φ1.55                                                    | φ1.55±0.1                     | φ1.5+0.1/-0 | φ1.0±0.2/-0   | φ1.5+0.1/-0        | φ1.5+0.1/-0               | φ1.5+0.1/-0     | φ1.5+0.1/-0 | φ1.5+0.1/-0   |
|         | J | 8.18                                   | 8.18                                                     | 7.4±0.1                       | 3.5±0.1     | 3.6±0.1       | 4.4±0.1            | 5.5±0.1                   | 5.5±0.1         | 5.5±0.1     | 7.4±0.1       |
|         | L | 5.56                                   | 5.56                                                     | 5.4±0.1                       | 2.8±0.1     | 2.9±0.1       | 2.9±0.1            | 3.7±0.1                   | 3.7±0.1         | 3.7±0.1     | 5.4±0.1       |
|         | N | 2.16±0.1                               | 2.16±0.1                                                 | 2.0±0.1                       | 1.1±0.1     | 1.3±0.1       | 1.1±0.1/1.3±0.1    | 1.6±0.1/1.5±0.1           | 1.6±0.1/1.5±0.1 | 1.8±0.1     | 2.1±0.1       |
| R E E L | O | 0.3±0.05                               | 0.3±0.05                                                 | 0.3±0.05                      | 0.25±0.05   | 0.3±0.05      | 0.2±0.05/0.3±0.05  | 0.3±0.05                  | 0.3±0.05        | 0.3±0.05    | 0.3±0.05      |
|         | P | φ330±2/φ254±2                          | φ330±2/φ254±2                                            | φ180+0/-3                     | φ180±2      | φ180+1/-1.5   | φ254±1/φ180+1/-1.5 | φ330±1                    | φ330±1          | φ330±1      | φ254±2        |
|         | Q | φ100±1                                 | φ100±1                                                   | φ60+1/-0                      | φ60         | φ60+1/-0      | φ100±1/φ60+1/-0    | φ100±1/φ60                | φ100±1/φ60      | φ100±1      | φ100±1        |
|         | R | φ13±0.3                                | φ13±0.3                                                  | φ13±0.2                       | φ13±0.2     | φ13±0.2       | φ13±0.2            | φ13±0.2                   | φ13±0.2         | φ13±0.2     | φ13±0.2       |
|         | S | φ21±0.8                                | φ21±0.8                                                  | φ21±0.8                       | φ21±0.8     | φ21±0.8       | φ21±0.8            | φ21±0.8                   | φ21±0.8         | φ21±0.8     | φ21±0.8       |
|         | W | 2.0±0.5                                | 2.0±0.5                                                  | 2.0±0.5                       | 2.0±0.5     | 2.0±0.5       | 2.0±0.5            | 2.0±0.5                   | 2.0±0.5         | 2.0±0.2     | 2.0±0.5       |
| Qty     |   | 3000/1000                              | 3000/1000                                                | 1000                          | 2000        | 2000          | 4000/2000          | 2000                      | 4000            | 4000        | 1000          |

## ORDERING FORMAT FOR CRYSTAL OSCILLATORS

Please specify the following items when ordering crystal oscillators.

### I. Standard products shown in the catalogue:

Please specify package type and nominal frequency.

### II. Special-order products:

Please specify the following items in specification.

#### 1 . Frequency

(1) Oscillation Frequency \_\_\_\_\_ Hz

#### 2 . Frequency Stability

(1) Temperature \_\_\_\_\_  $\times 10^{-6}$  MAX. \_\_\_\_\_  $\sim$  \_\_\_\_\_  $^{\circ}\text{C}$  (On the basis of  $+25^{\circ}\text{C}$  frequency)

(2) Supply Voltage \_\_\_\_\_  $\times 10^{-6}$  MAX. \_\_\_\_\_ VDC  $\pm$  \_\_\_\_\_ %

(3) Load. \_\_\_\_\_  $\times 10^{-6}$  MAX. \_\_\_\_\_  $\Omega$ // \_\_\_\_\_ pF  $\pm$  \_\_\_\_\_ %  $\pm$  \_\_\_\_\_ %

(4) Aging \_\_\_\_\_  $\times 10^{-6}$  MAX./year

#### 3 . Frequency Tuning Range

$\pm$  \_\_\_\_\_  $\times 10^{-6}$  MIN

#### 4 . Frequency Control Range

$\pm$  \_\_\_\_\_  $\sim \pm$  \_\_\_\_\_  $\times 10^{-6}$  /+ \_\_\_\_\_ V  $\pm$  \_\_\_\_\_ V

#### 5 . Output

(1) Voltage \_\_\_\_\_ Vrms \_\_\_\_\_ V<sub>P-P</sub> MIN.

(2) Wave Form

Sine, Half sine wave, Harmonics 2nd \_\_\_\_\_ dB, 3rd \_\_\_\_\_ dB, Others \_\_\_\_\_ dB

(3) Load Resistance \_\_\_\_\_  $\Omega$ //Capacitance \_\_\_\_\_ pF

#### 6 . Supply Voltage

(1) For circuit \_\_\_\_\_ VDC  $\pm$  \_\_\_\_\_ %, \_\_\_\_\_ mA MAX.

#### 7 . Environmental Condition

(1) Operating Temperature Range \_\_\_\_\_  $\sim$  \_\_\_\_\_  $^{\circ}\text{C}$

(2) Vibration

Total Amplitude \_\_\_\_\_ mm, Vibration Frequency \_\_\_\_\_ Hz  $\sim$  \_\_\_\_\_ Hz

(3) Shock \_\_\_\_\_

#### 8 . Dimensions, Pin Connection \_\_\_\_\_

#### 9 . Application \_\_\_\_\_

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# Crystal Applied Products

---

Synthetic Quartz Crystals

Crystal Blanks

Optical Devices



## 1. Quartz Crystals... What?

The quartz crystal is a single crystal of silicon dioxide and used in important electronic components of digital equipment such as mobile communications, optic communications, video equipment and PCs as a precise source of electrical signal.

## 2. Quartz Crystals... Why?

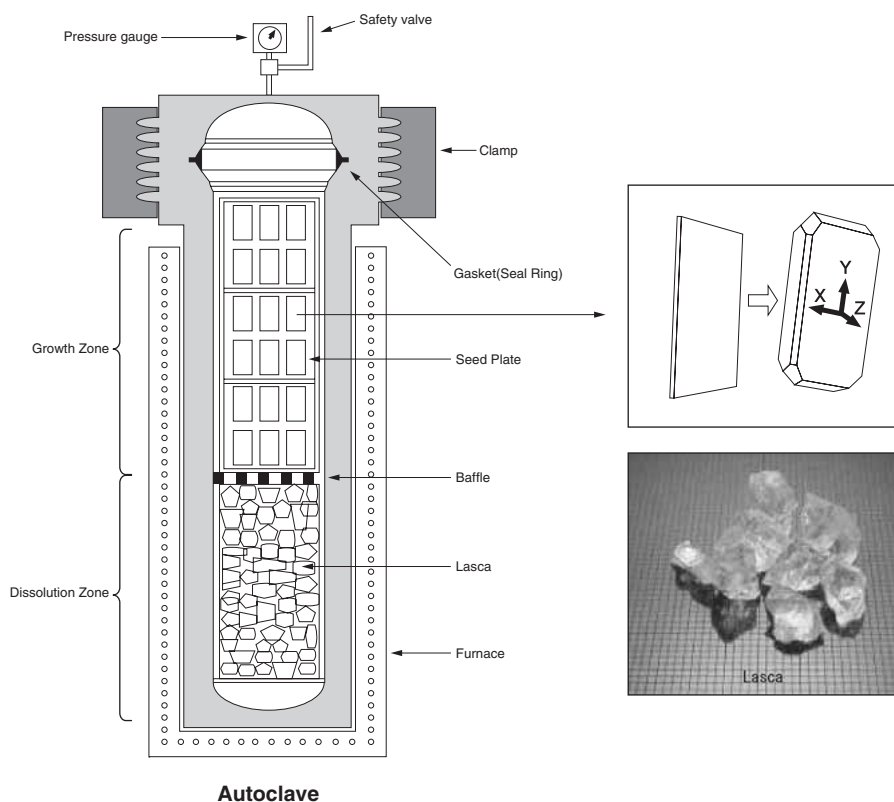
The quartz crystal has a character when the compression is applied to the direction of the crystal axis (x axis), the electric change) generates on the quartz crystal plate, and on the contrary, when the electricity is applied to the quartz crystal plate, the distortion occurs inside the crystal plate. The phenomenon is called the piezo electric effect or piezo electric reverse effect.

## 3. Synthetic Quartz Crystals... How?

The synthetic quartz crystal is grown by the hydrothermal method using the pressured container called the autoclave. The crystal is insoluble to most of the solution under the normal temperature and pressure but becomes soluble by the hydrothermal reaction in the high temperature and high pressure. The growth of the synthetic quartz crystal is taking advantage of this reaction. The high pressure necessary for growing is obtained by filling the alkaline solution up to the approximate 70-85% of the capacity of the autoclave and applying the temperature. The ordinary growing temperature is approximately 350-360°C and the growing pressure is approximately 90-145Mpa.

The autoclave, upper growing area and lower dissolution area is partitioned by the perforated panel called the baffle. Hang the seed crystal in the upper growing area and place the raw material, Lasca, a fragment of the natural quartz crystal in the lower dissolution area. By maintaining the temperature in the growing area lower than the solution area, the raw material in a saturated state in the dissolution area will rise to the growing area by the heat convection provided by the temperature difference. Since the growing area is lower than the dissolution area in temperature, the solution will become a super-saturation and re-crystallize the surface of the seed crystal.

The growing speed is approximately 0.4-0.6mm per day and the growing number of day is from about 40 days to more than 200 days depending on the applications. With the strict temperature and pressure control for a long period of time, you will get approximately 1,500-2,000kg of high quality synthetic quartz crystals in one growth process.



## Lumbered P-bar

| Type    | Orientation | Dimensions (mm) |       |     | Weight(g) |
|---------|-------------|-----------------|-------|-----|-----------|
|         |             | X±0.2           | Z±0.3 | Y±5 |           |
| LP-0918 | 0°          | 9.0             | 18.0  | 200 | 85        |
| LP-1020 | 0°          | 10.0            | 20.0  | 200 | 105       |

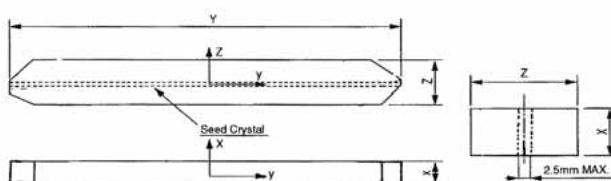
## Lumbered Z-plate

| Type    | Orientation | Dimensions (mm) |       |     | Weight (g) |
|---------|-------------|-----------------|-------|-----|------------|
|         |             | X±0.2           | Z±0.3 | Y±5 |            |
| LZ-3118 | 0°          | 31.0            | 18.0  | 210 | 303        |
| LZ-3119 | 0°          | 31.0            | 19.0  | 210 | 319        |
| LZ-3120 | 0°          | 31.0            | 20.0  | 210 | 336        |
| LZ-3122 | 0°          | 31.0            | 22.0  | 210 | 369        |
| LZ-6518 | 0°          | 65.0            | 18.0  | 210 | 602        |
| LZ-6519 | 0°          | 65.0            | 19.0  | 210 | 636        |
| LZ-6520 | 0°          | 65.0            | 20.0  | 210 | 670        |
| LZ-6522 | 0°          | 65.0            | 22.0  | 210 | 738        |
| LZ-6532 | 0°          | 65.0            | 32.0  | 200 | 950        |
| LZ-6534 | 0°          | 65.0            | 34.0  | 200 | 1079       |
| LZ-6538 | 0°          | 65.0            | 38.0  | 200 | 1160       |
| LZ-6540 | 0°          | 65.0            | 40.0  | 200 | 1220       |

## Dimensions

(Unit : mm)

### Lumbered P-bar

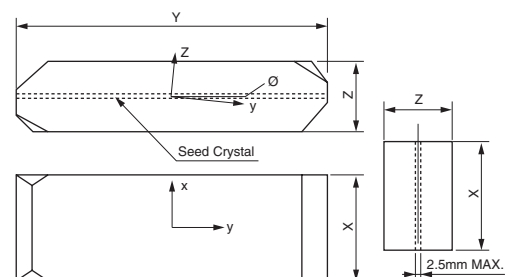


\*Please inquire about dimension other than the above.

## Dimensions

(Unit : mm)

### Lumbered Z-plate



## Specifications

- Kind of crystal : Right hand crystal unless otherwise specified.
- Twinning : No electrical or optical twinning is included.

## Infra-red quality indication $\alpha$ ( $3500\text{cm}^{-1}$ )

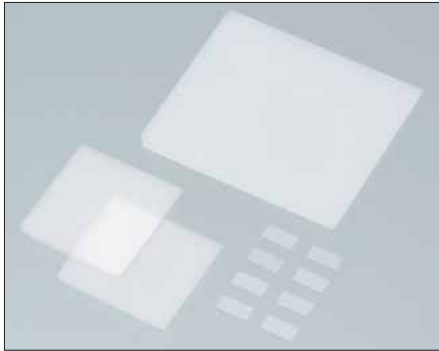
| Grades | $\alpha$ Maxima |
|--------|-----------------|
| Aa     | 0.026           |
| A      | 0.033           |
| B      | 0.045           |
| C      | 0.060           |
| D      | 0.080           |
| E      | 0.120           |

## Inclusion density

| Grades | Inclusion density (/cm <sup>3</sup> ) |                        |                         |                       |
|--------|---------------------------------------|------------------------|-------------------------|-----------------------|
|        | 10-30( $\mu\text{m}$ )                | 30-70( $\mu\text{m}$ ) | 70-100( $\mu\text{m}$ ) | >100( $\mu\text{m}$ ) |
| I a    | 2                                     | 1                      | 0                       | 0                     |
| II b   | 3                                     | 2                      | 1                       | 1                     |
| I      | 6                                     | 4                      | 2                       | 2                     |
| II     | 9                                     | 5                      | 4                       | 3                     |
| III    | 12                                    | 8                      | 6                       | 4                     |

## Etch channel density $\rho$

| Grades | Etch channel density $\rho$ (/cm <sup>2</sup> ) |
|--------|-------------------------------------------------|
| 1      | 10                                              |
| 2      | 30                                              |
| 3      | 100                                             |
| 4      | 300                                             |
| 5      | 600                                             |



### Features

- Manufactures blanks for fine and miniature crystal units.

### Applications

- Blanks for crystal units.

### Wafers for blanks

(Unit : mm)

| Model                | Basic Frequency | Dimensions | Thickness | Surface Finish | Main Face Angle     |
|----------------------|-----------------|------------|-----------|----------------|---------------------|
| 1" Rectangular plate | —               | 25.4×25.4  | 0.045MIN  | #4000          | Angle Specified±15" |
| 2" Rectangular plate | —               | 50.8×50.8  | 0.085MIN  | #4000          | Angle Specified±15" |
| 3" Rectangular plate | —               | 76.2×76.2  | 0.200MIN  | #4000          | Angle Specified±1'  |

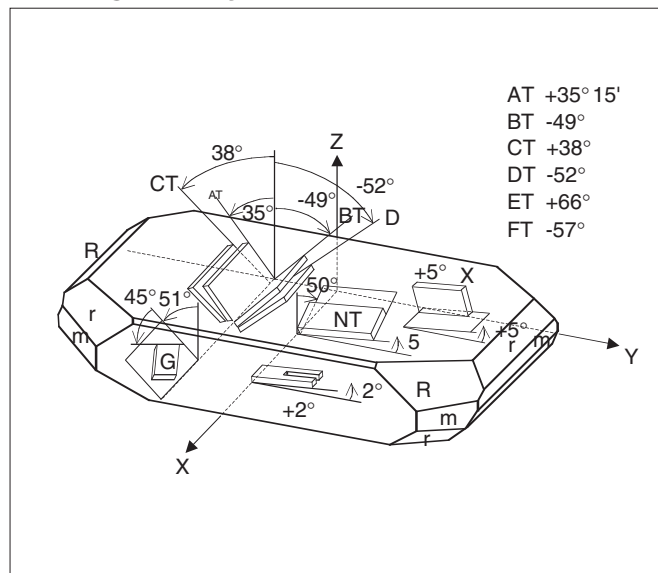
### Blanks

(Unit : mm)

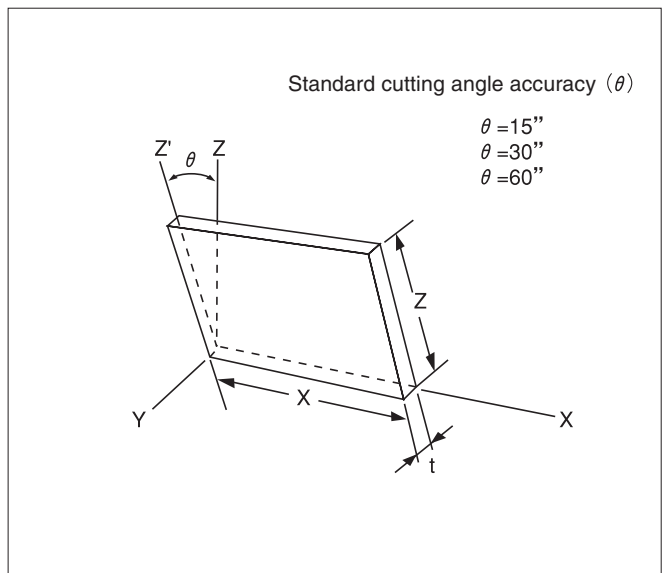
| Model      | Basic Frequency | Dimensions    | Surface Finish | Main Face Angle     | Contour Finish |
|------------|-----------------|---------------|----------------|---------------------|----------------|
| L2.0 Blank | 12MHz ~ 55MHz   | Long Side 2.0 | #4000          | Angle Specified±15" | #4000          |
| L3.5 Blank | 10MHz ~ 55MHz   | Long Side 3.5 | #4000          | Angle Specified±15" | #4000          |

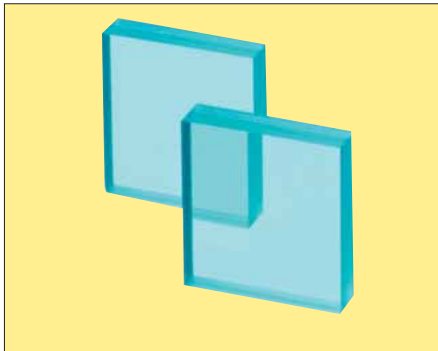
\*Size and thickness other than above shall be studied upon request

### Cut Angle of Crystal Blank



### AT Cut Plate





### Features

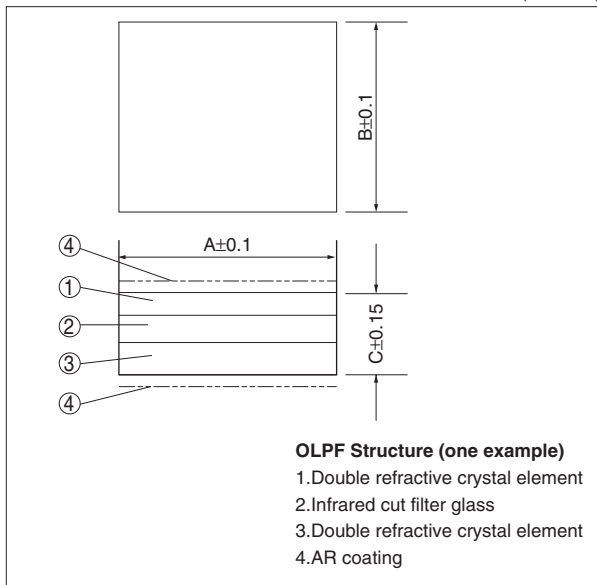
- Made of high quality synthetic quartz crystal for optical device.
- Available for requirement of various spectrum by infrared absorption glass or infrared-cut coating .
- Available with ultra violet cut coating or ultra violet-cut coating + infrared cut coating
- Available with large size aperture used for single lens reflex digital still camera.
- Flexible design depending on each separation pattern.

### Applications

- Digital video camera.
- Security camera.
- Digital still camera.

### Dimensions

(Unit : mm)



### Specifications

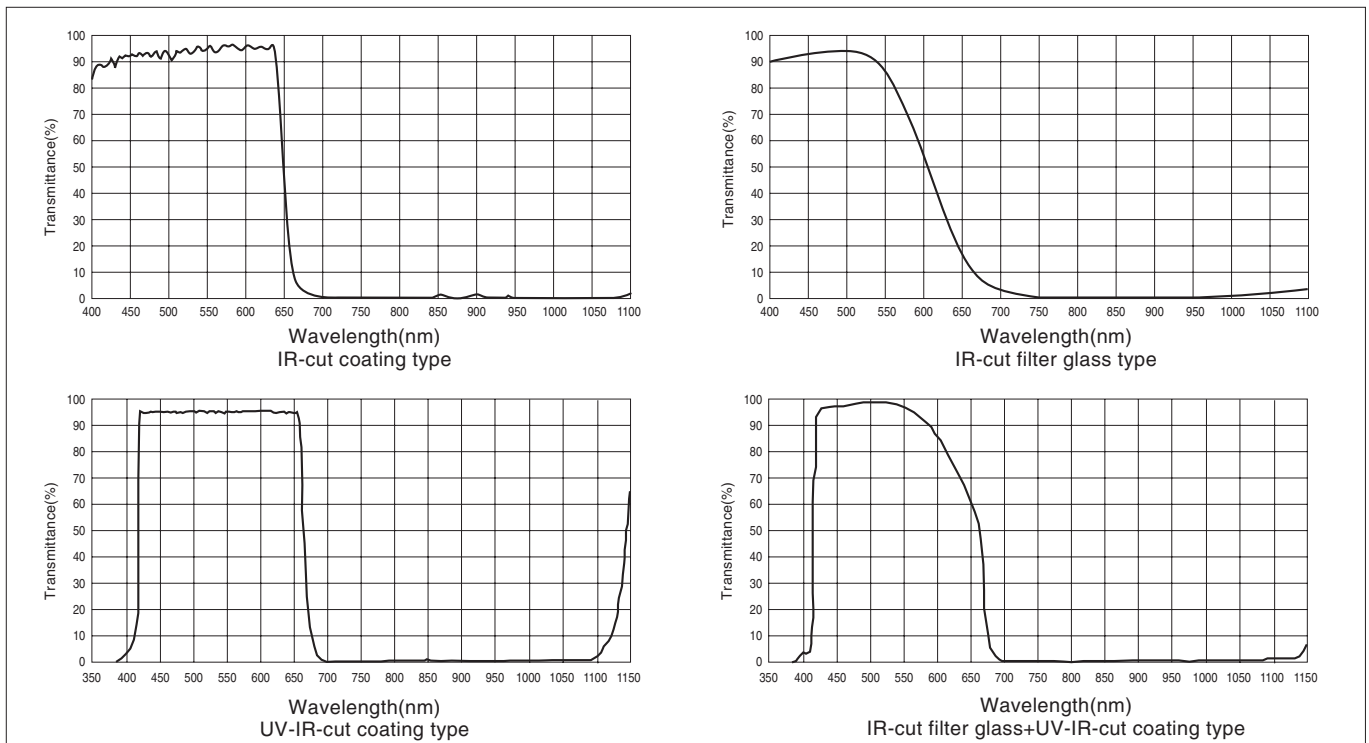
| Item                 | Specification         |
|----------------------|-----------------------|
| Outline dimensions   | 5~30mmφ               |
| Separation direction | On discussion         |
| Optic axis tolerance | ±60' MAX.             |
| Flatness             | Within 5 Newton rings |
| Defect limit         | 30μm MAX.             |
| Composition          | 1~7pieces             |
| Transmittance        | On discussion         |

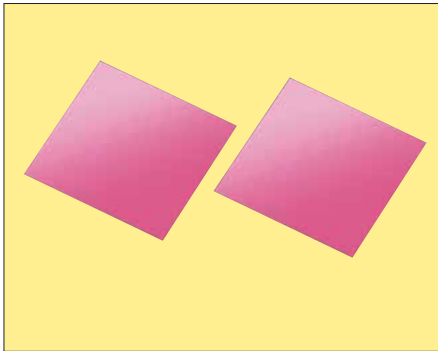
\* Please consult us if you require about specification other than above.

### Standard Dimensions

|   | 1/2 inch size                                  | 1/3 inch size | 1/4 inch size | 1/5 inch size |
|---|------------------------------------------------|---------------|---------------|---------------|
| A | 12mm                                           | 8.8mm         | 7.8mm         | 5.5mm         |
| B | 11mm                                           | 8.2mm         | 7.3mm         | 5.0mm         |
| C | Determined in accordance with CCD image sensor |               |               |               |

### Spectral Transmittance Characteristics(Example)





### Features

- Made of high quality glass for optical device.
- Available for requirement of various spectrum by infrared cut coating.

### Applications

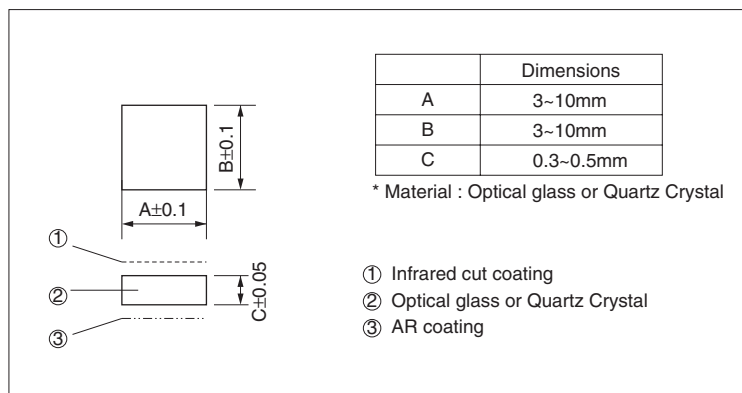
- Camera module for mobile phones.

### Specifications

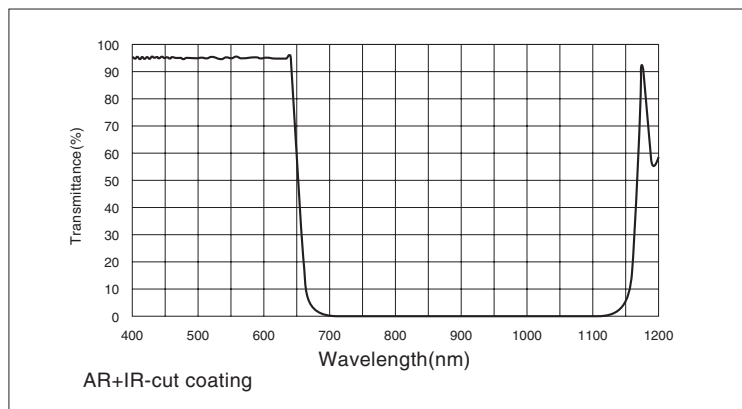
| Item               | Specifications        |
|--------------------|-----------------------|
| Outline dimensions | 3~10mm                |
| Flatness           | Within 3 Newton rings |
| Defect limit       | 30μm MAX.             |
| Transmittance      | On discussion         |

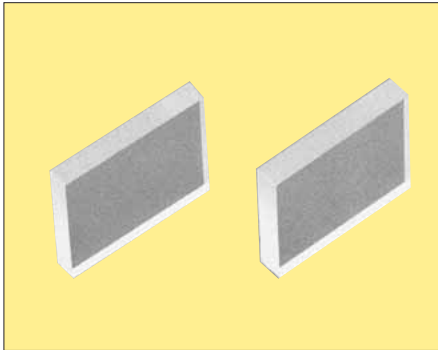
\* Please consult us if you require about specification other than above.

### Dimensions



### Spectral Transmittance Characteristics(Example)





### Features

- Made of high quality synthetic quartz crystal for optical device.
- Available with anti-reflective coating for various range of wavelength.

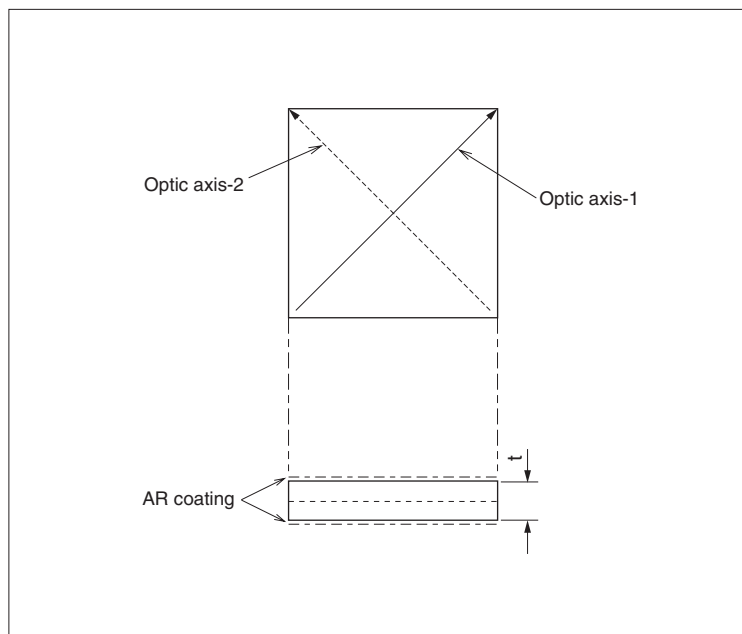
### Applications

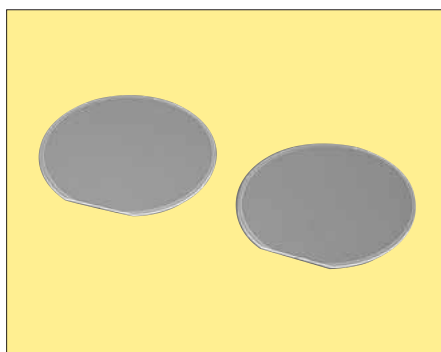
- CD-RW, DVD-RW

### Specifications

| Specifications                      | Type | Single layer                              |         | Double layers  |         |
|-------------------------------------|------|-------------------------------------------|---------|----------------|---------|
|                                     |      | 1/4Wave                                   | 1/2Wave | 1/4Wave        | 1/2Wave |
| Phase retardation                   |      | 90°                                       | 180°    | 90°            | 180°    |
| Phase retardation tolerance         |      | ±3°(at center wavelength)                 |         |                |         |
| Crystal plate azimuth               |      | Rotated Z-cut *1                          |         | Y-cut or X-cut |         |
| Center wavelength                   |      | 400nm~800nm                               |         |                |         |
| Optic axis tolerance                |      | ±1°                                       |         |                |         |
| Outline dimensions(mm)              |      | 3 x 3 ~ 6±0.1                             |         |                |         |
| Thickness(mm)                       |      | 0.4±0.1                                   | 0.8±0.1 | 1.0±0.1        |         |
| Angle of incidence                  |      | Vertical                                  |         |                |         |
| Transmittance                       |      | More than 98%(AR coating on both surface) |         |                |         |
| Wave front aberration(Transmission) |      | On discussion                             |         |                |         |

### Dimensions





### Features

- Made of high quality synthetic quartz crystal for optical device.
- Available with large size aperture.

### Applications

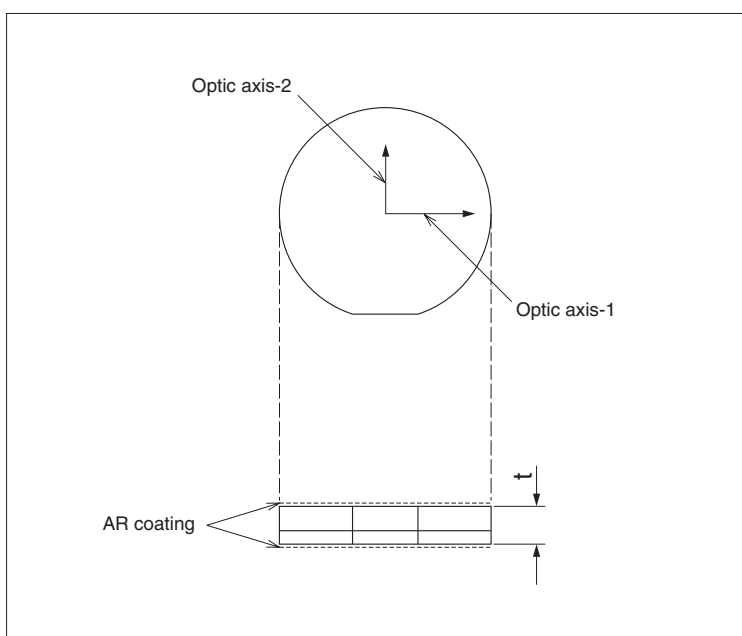
- Liquid crystal projector.

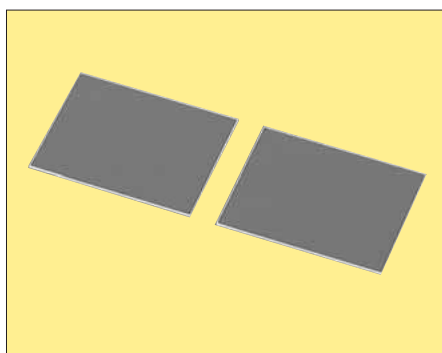
### Specifications

| Specification                       | Type | Double Layers Quarter Wave Plates                 |
|-------------------------------------|------|---------------------------------------------------|
| Phase retardation                   |      | $90^{\circ} \pm 5^{\circ}$ (at center wavelength) |
| Crystal plate azimuth               |      | Y-cut or X-cut                                    |
| Wave length                         |      | 420nm~680nm                                       |
| Optic axis tolerance                |      | $\pm 1^{\circ}$                                   |
| Outline dimensions(mm)              |      | $\phi 20 \times 20 \sim 30 \times 30 * 1$         |
| Thickness(mm)                       |      | 0.4~1.0                                           |
| Angle of incident                   |      | Vertical                                          |
| Transmittance                       |      | More than 98%(AR coating on both surface)         |
| Wave front aberration(Transmission) |      | On discussion                                     |

\* Please consult us if you require about specification other than above.

### Dimensions





### Features

- Excellent thermal radiation characteristics.

### Applications

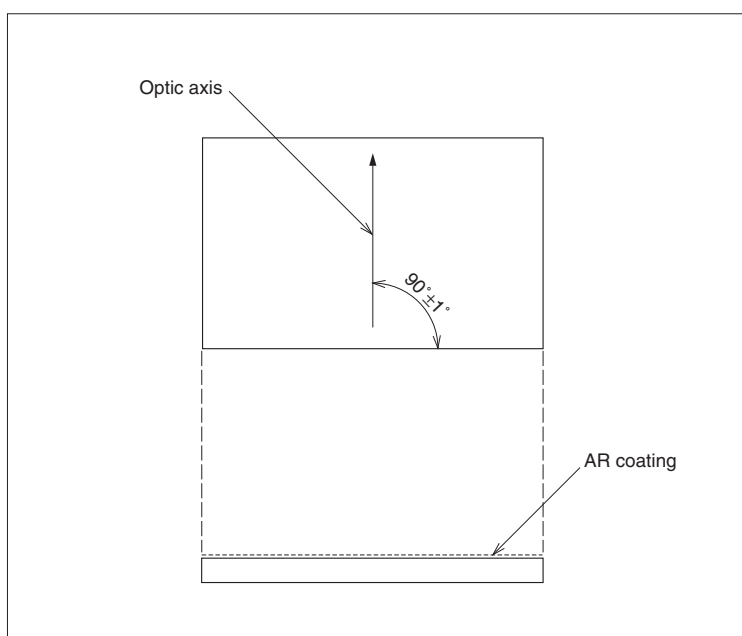
- Liquid crystal projector.

### Specifications

|                        |                           |
|------------------------|---------------------------|
| Center wave length     | 420nm~680nm               |
| Outline dimensions(mm) | 50 x 50MAX.               |
| Thickness(mm)          | 0.4~1.0±0.1               |
| Reflectance            | Less than 0.5% (One side) |
| Optic axis tolerance   | 90°±1°                    |

\* Crystal element without AR coating is possible.

### Dimensions



## ORDERING FORMAT for OPTICAL LOW PASS FILTERS

Please specify the following items when ordering Optical Low Pass Filter.

## 1 . Application

Video camera      Security camera      Digital still camera  
PC camera    Other (                  )

## 2. CCD imager specifications

Maker \_\_\_\_\_ Model \_\_\_\_\_ Video output (NTSC.PAL. \_\_\_\_\_ )  
 Inch size \_\_\_\_\_ Total Pixels Number \_\_\_\_\_  
 Unit Cell Size (CCD pixel pitch)  
 Horizontal \_\_\_\_\_  $\mu\text{m}$   $\times$  Vertical \_\_\_\_\_  $\mu\text{m}$

### 3 . O.L.P.F. Specifications

(1)Dimensions  
Length \_\_\_\_\_ μm × Width \_\_\_\_\_ μm × Thickness \_\_\_\_\_ μm

(2)Composition ( ) pieces  
45° Double refractive crystal element ( ) pieces  
0° Double refractive crystal element ( ) pieces  
90° Double refractive crystal element ( ) pieces  
\_\_\_\_\_ ° Double refractive crystal element ( ) pieces  
IR-cut filter      need      not need  
IR-cut filter Glass      IR-cut coat

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# Filters

---

**SAW Filters**

**Monolithic Crystal Filters (MCF)**



**Pb Free**

**RoHS Conforming**

## Features

- Small and low profile
- Low insertion loss
- High Selectivity
- Withstanding High Voltage

## Applications

- PCS
- GPS

## How to Order

$$\frac{\text{SF } 16}{\textcircled{1}} - \frac{1575}{\textcircled{3}} \frac{\text{F } 4}{\textcircled{4}} \frac{\text{UU } 01}{\textcircled{6}} \textcircled{7}$$

- ①Series
- ②Package Size
- ③Frequency
- ④Application
- ⑤Terminals
- ⑥Input/Output Condition
- ⑦Custom Specification

## Dimensions

(Unit : mm)

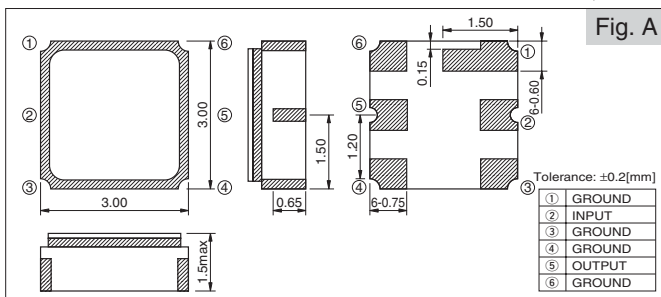


Fig. A

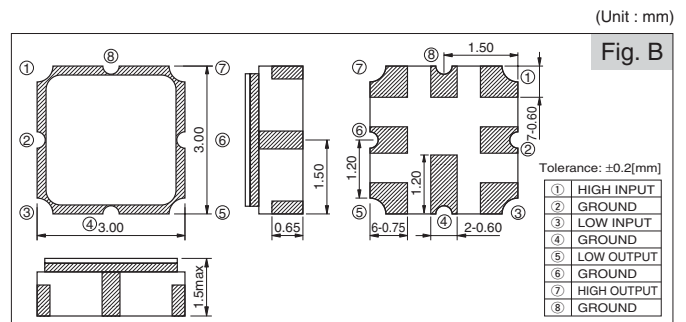


Fig. B

(Unit : mm)

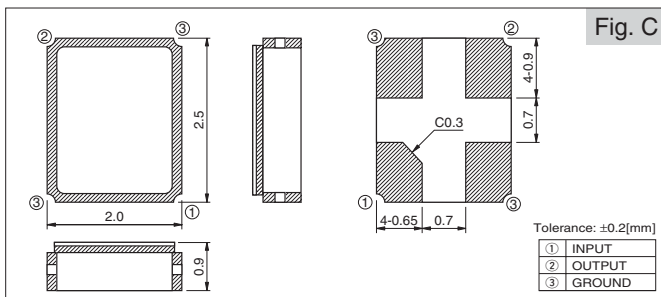


Fig. C

(Unit : mm)

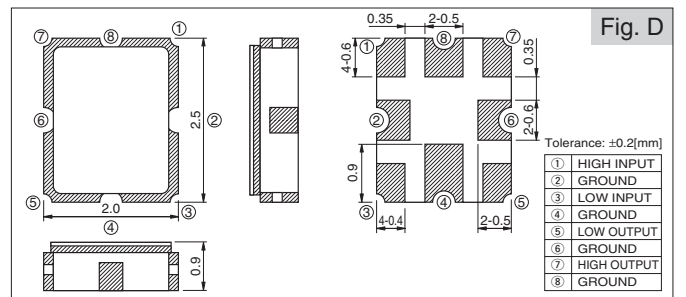


Fig. D

(Unit : mm)

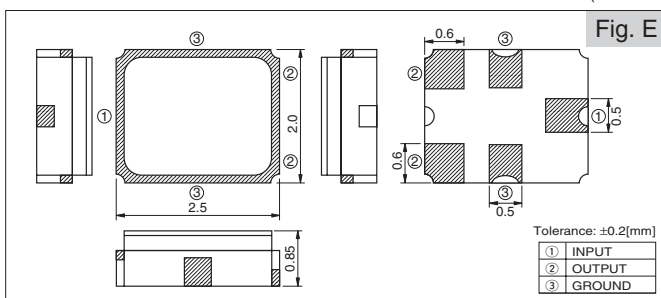


Fig. E

(Unit : mm)

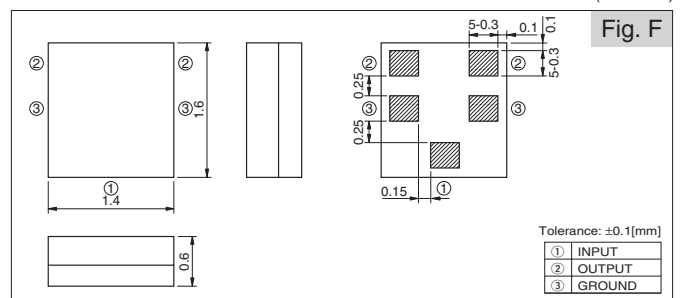


Fig. F

(Unit : mm)

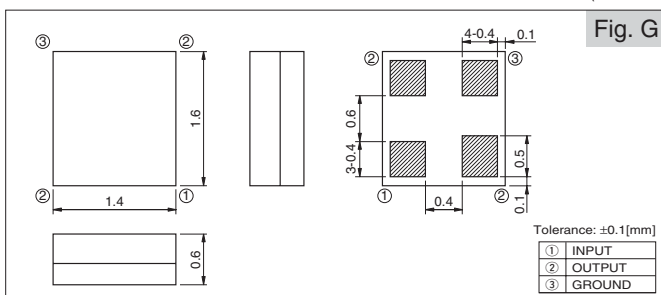
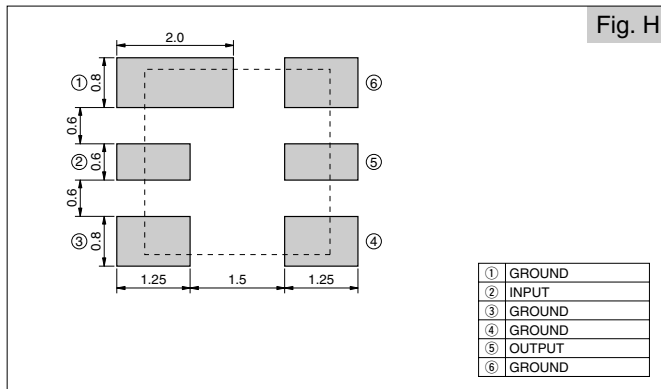


Fig. G

## Recommended Land Pattern

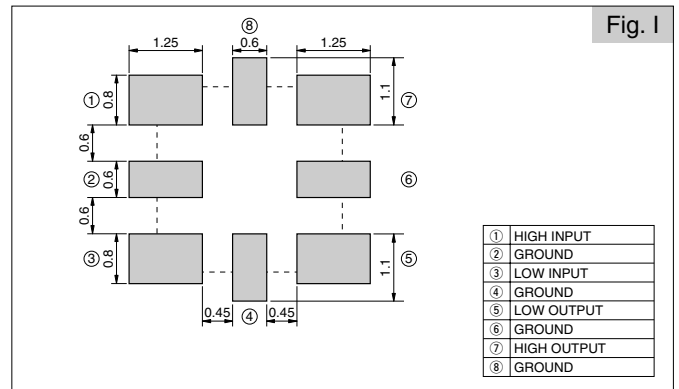
(Unit : mm)

Fig. H



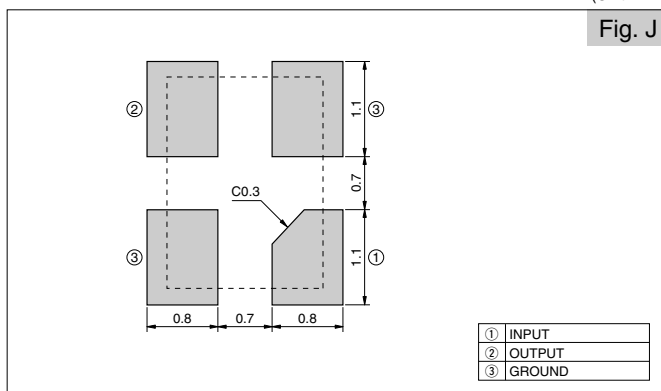
(Unit : mm)

Fig. I



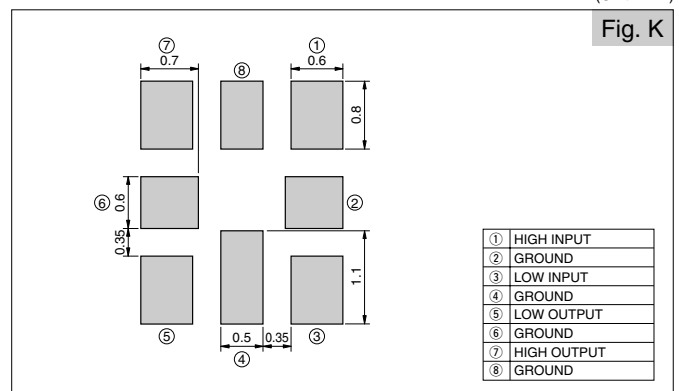
(Unit : mm)

Fig. J



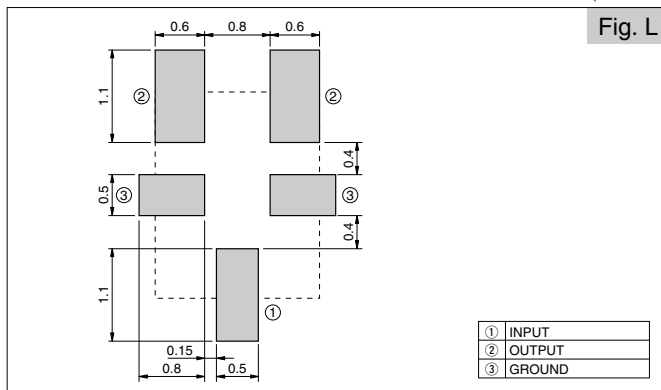
(Unit : mm)

Fig. K



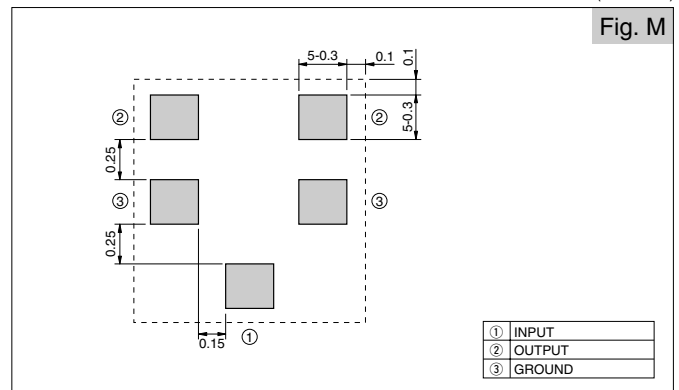
(Unit : mm)

Fig. L



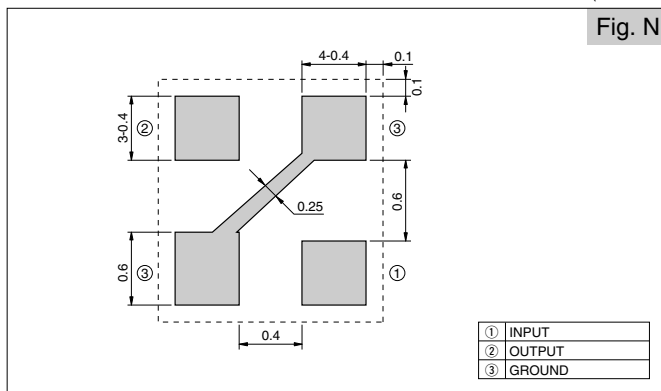
(Unit : mm)

Fig. M



(Unit : mm)

Fig. N

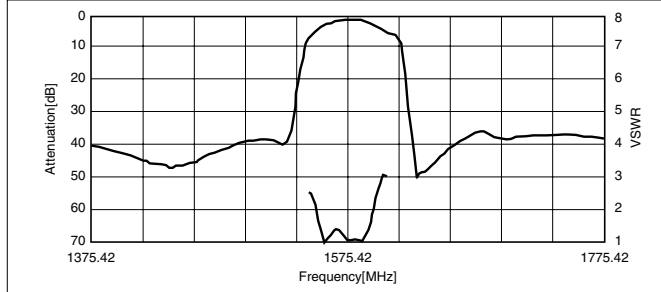


## Specifications

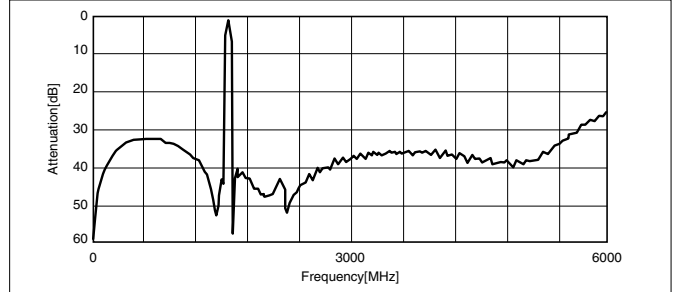
| Parts No.       | Application |              | Pass Band Frequency      | Pass Band Insertion Loss | Pass Band Variation | Pass Band VSWR | Absolute Rejection             |                                   |                                |                                      |                                |                                | Operating Temperature | Storage Temperature | Dimensions | Test Circuit | Recommended Land Pattern | Taping Dimensions |
|-----------------|-------------|--------------|--------------------------|--------------------------|---------------------|----------------|--------------------------------|-----------------------------------|--------------------------------|--------------------------------------|--------------------------------|--------------------------------|-----------------------|---------------------|------------|--------------|--------------------------|-------------------|
| SF16-0881M5UB01 | Cellular    | Differential | 869MHz<br>894MHz         | 3.0dB max                | 1.5dB max           | 2.5 max        | 0MHz<br>824MHz<br>35dB min     | 824MHz<br>849MHz<br>30dB min      | 915MHz<br>960MHz<br>23dB min   | 960MHz<br>3000MHz<br>40dB min        |                                |                                | -30 to +85°C          | -40 to +85°C        | Fig. F     | Fig. R       | Fig. M                   | Dimensions 4      |
| SF16-1575F4UU01 | GPS         | Front End    | 1573.92MHz<br>1576.92MHz | 1.8dB max                | 1.0dB max           | 2.0 max        | 810MHz<br>960MHz<br>27dB min   | 1429MHz<br>1501MHz<br>37dB min    | 1893MHz<br>2170MHz<br>35dB min |                                      |                                | Fig. G                         |                       |                     | Fig. Q     | Fig. N       | Dimensions 4             |                   |
| SF16-1575M4UU01 | GPS         | Inter Stage  | 1573.92MHz<br>1576.92MHz | 1.8dB max                | 1.0dB max           | 2.5 max        | 810MHz<br>960MHz<br>35dB min   | 1208.22MHz<br>1210MHz<br>45dB min | 1207MHz<br>1210MHz<br>45dB min | 1522.42MHz<br>1628.42MHz<br>25dB min | 1850MHz<br>1910MHz<br>30dB min | Fig. G                         |                       |                     | Fig. Q     | Fig. N       | Dimensions 4             |                   |
| SF16-1960M5UB01 | PCS         | Differential | 1930MHz<br>1990MHz       | 4.1dB max                | 2.0dB max           | 2.5 max        | 0MHz<br>1850MHz<br>30dB min    | 1850MHz<br>1910MHz<br>15dB min    | 2200MHz<br>2200MHz<br>25dB min | 2800MHz<br>2800MHz<br>30dB min       | 3400MHz<br>6000MHz<br>20dB min | Fig. F                         |                       |                     | Fig. R     | Fig. M       | Dimensions 4             |                   |
| SF25-0881M5UB02 | Cellular    | Differential | 869MHz<br>894MHz         | 3.0dB max                | 1.5dB max           | 2.5 max        | 0MHz<br>824MHz<br>35dB min     | 824MHz<br>849MHz<br>30dB min      | 915MHz<br>960MHz<br>23dB min   | 960MHz<br>3000MHz<br>40dB min        |                                |                                |                       |                     | Fig. E     | Fig. R       | Fig. L                   | Dimensions 3      |
| SF25-1575F4UU01 | GPS Single  | Front End    | 1573.92MHz<br>1576.92MHz | 1.8dB max                | 1.0dB max           | 2.0 max        | 810MHz<br>960MHz<br>27dB min   | 1429MHz<br>1501MHz<br>37dB min    | 1893MHz<br>2170MHz<br>35dB min |                                      |                                | Fig. C                         |                       |                     | Fig. Q     | Fig. J       | Dimensions 3             |                   |
| SF25-1575M5UB01 | GPS         | Differential | 1573.92MHz<br>1576.92MHz | 1.8dB max                | 0.7dB max           | 2.5 max        | 0MHz<br>1475MHz<br>30dB min    | 1475MHz<br>1525MHz<br>10dB min    | 1625MHz<br>1675MHz<br>10dB min | 1675MHz<br>3155MHz<br>30dB min       | 3155MHz<br>6000MHz<br>20dB min | Fig. E                         |                       |                     | Fig. R     | Fig. L       | Dimensions 3             |                   |
| SF25-1575S4UU01 | GPS Single  | Inter Stage  | 1573.92MHz<br>1576.92MHz | 3.0dB max                | 1.0dB max           | 2.0 max        | 810MHz<br>960MHz<br>45dB min   | 1429MHz<br>1501MHz<br>40dB min    | 1895MHz<br>1916MHz<br>35dB min |                                      |                                | Fig. C                         |                       |                     | Fig. Q     | Fig. J       | Dimensions 3             |                   |
| SF25-1880H8UU00 | PCS (Half)  | Tx(Low)      | 1850MHz<br>1880MHz       | 2.2dB max                | 1.5dB max           | 2.0 max        | 0MHz<br>1700MHz<br>20dB min    | 1700MHz<br>1760MHz<br>15dB min    | 1770MHz<br>1800MHz<br>15dB min | 1930MHz<br>1960MHz<br>32dB min       | 2040MHz<br>2100MHz<br>25dB min | 2100MHz<br>2500MHz<br>20dB min |                       |                     | Fig. D     | Fig. P       | Fig. K                   | Dimensions 3      |
|                 |             | Tx(High)     | 1880MHz<br>1910MHz       | 2.2dB max                | 1.5dB max           | 2.0 max        | 0MHz<br>1700MHz<br>20dB min    | 1700MHz<br>1760MHz<br>15dB min    | 1800MHz<br>1830MHz<br>15dB min | 1960MHz<br>1990MHz<br>32dB min       | 2040MHz<br>2100MHz<br>25dB min | 2100MHz<br>2500MHz<br>20dB min |                       |                     |            |              |                          |                   |
| SF25-1960M5UB01 | PCS         | Differential | 1930MHz<br>1990MHz       | 4.1dB max                | 2.0dB max           | 2.5 max        | 0MHz<br>1850MHz<br>30dB min    | 1850MHz<br>1910MHz<br>15dB min    | 2040MHz<br>2200MHz<br>25dB min | 2200MHz<br>2800MHz<br>30dB min       | 2800MHz<br>3400MHz<br>30dB min | 3400MHz<br>6000MHz<br>20dB min |                       |                     | Fig. E     | Fig. R       | Fig. L                   | Dimensions 3      |
| SF30-1575F6UU03 | GPS Single  | Front End    | 1573.92MHz<br>1576.92MHz | 1.8dB max                | 1.0dB max           | 2.0 max        | 810MHz<br>958MHz<br>25dB min   | 1429MHz<br>1501MHz<br>25dB min    | 1687MHz<br>1893MHz<br>25dB min | 1893MHz<br>1920MHz<br>25dB min       | 1920MHz<br>2170MHz<br>25dB min | 2450MHz<br>18dB min            |                       |                     | Fig. A     | Fig. O       | Fig. H                   | Dimensions 1      |
| SF30-1575S6UU03 | GPS Single  | Inter Stage  | 1573.92MHz<br>1576.92MHz | 3.0dB max                | 1.0dB max           | 2.0 max        | DC<br>810MHz<br>25dB min       | 810MHz<br>958MHz<br>45dB min      | 1429MHz<br>1501MHz<br>40dB min | 1701MHz<br>1920MHz<br>40dB min       | 1893MHz<br>1920MHz<br>40dB min | 1920MHz<br>3000MHz<br>30dB min |                       |                     | Fig. A     | Fig. O       | Fig. H                   | Dimensions 1      |
| SF30-1880M6UU00 | PCS         | Tx           | 1850MHz<br>1910MHz       | 4.5dB max                | 2.8dB max           | 2.5 max        | 1590MHz<br>1650MHz<br>20dB min | 1720MHz<br>1780MHz<br>20dB min    | 1930MHz<br>1990MHz<br>7dB min  | 3400MHz<br>4800MHz<br>15dB min       |                                |                                |                       |                     | Fig. A     | Fig. O       | Fig. H                   | Dimensions 1      |
| SF30-1880H8UU00 | PCS (Half)  | Tx(Low)      | 1850MHz<br>1880MHz       | 3.0dB max                | 1.7dB max           | 2.3 max        | 0<br>1700MHz<br>20dB min       | 1700MHz<br>1760MHz<br>15dB min    | 1930MHz<br>1960MHz<br>32dB min | 2200MHz<br>2700MHz<br>20dB min       | 2700MHz<br>3000MHz<br>7dB min  |                                |                       |                     | Fig. B     | Fig. P       | Fig. I                   | Dimensions 1      |
|                 |             | Tx(High)     | 1880MHz<br>1910MHz       | 3.0dB max                | 1.7dB max           | 2.3 max        | 0<br>1700MHz<br>20dB min       | 1700MHz<br>1760MHz<br>15dB min    | 1990MHz<br>1990MHz<br>32dB min | 2700MHz<br>2700MHz<br>20dB min       | 3000MHz<br>7dB min             |                                |                       |                     |            |              |                          |                   |
| SF30-1960M6UU00 | PCS         | Rx           | 1930MHz<br>1990MHz       | 4.0dB max                | 2.8dB max           | 2.0 max        | 1509MHz<br>1780MHz<br>20dB min | 1850MHz<br>1910MHz<br>10dB min    | 2100MHz<br>2375MHz<br>24dB min | 3400MHz<br>4350MHz<br>10dB min       |                                |                                |                       |                     | Fig. A     | Fig. O       | Fig. H                   | Dimensions 1      |

## Characteristics

<GPS Single Front End>Parts No. : SF16-1575F4UU01

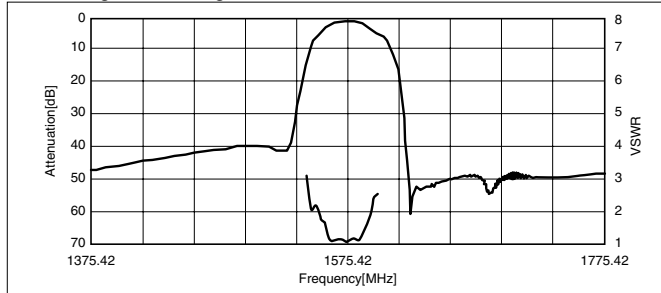


Pass Band Characteristics

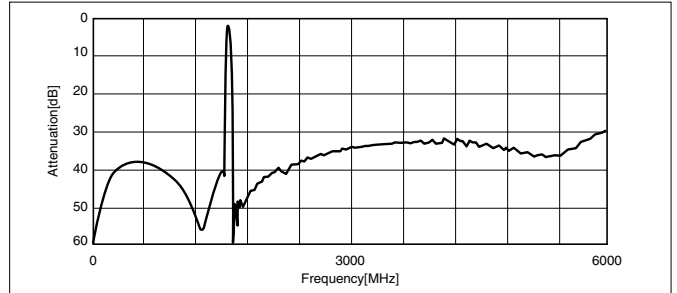


Spurious Characteristics

<GPS Single Inter Stage>Parts No. : SF16-1575M4UU01

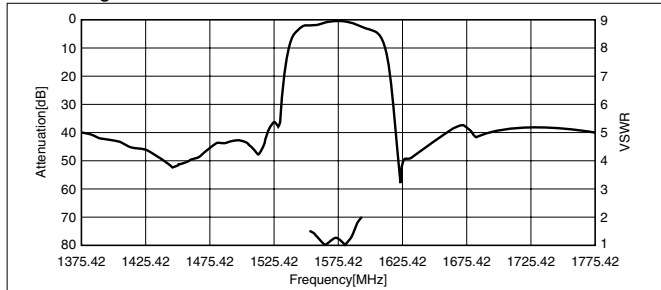


Pass Band Characteristics

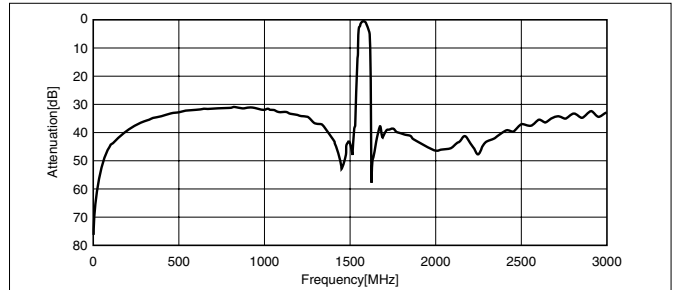


Spurious Characteristics

<GPS Single Front End>Parts No. : SF25-1575F4UU00

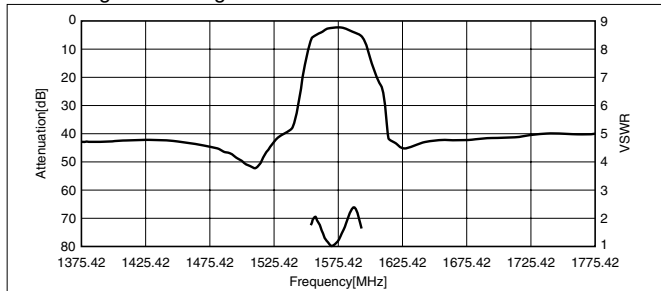


Pass Band Characteristics

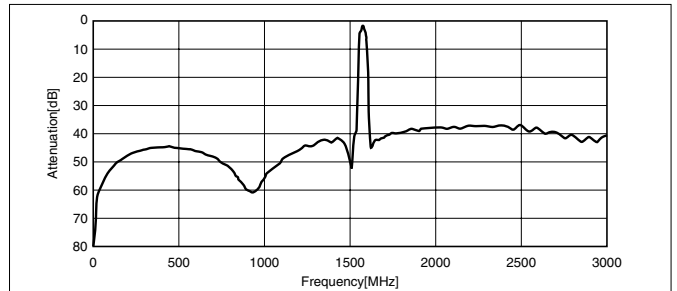


Spurious Characteristics

<GPS Single Inter Stage>Parts No. : SF25-1575S4UU00



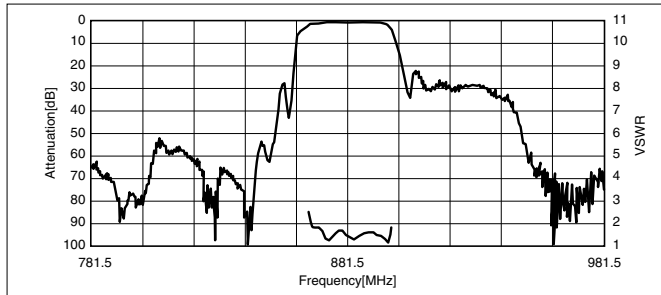
Pass Band Characteristics



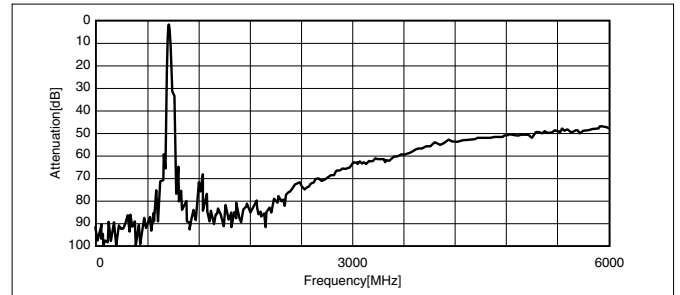
Spurious Characteristics

## Characteristics

<Cellular Rx>Parts No. : SF16-0881M5UB01

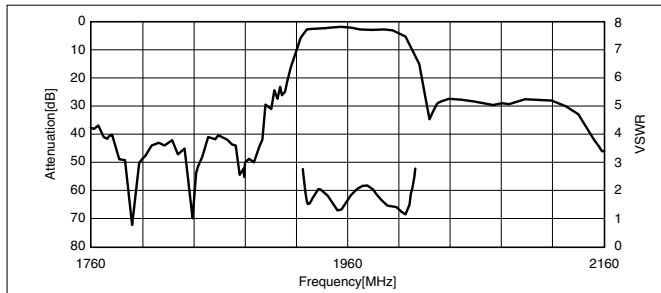


Pass Band Characteristics

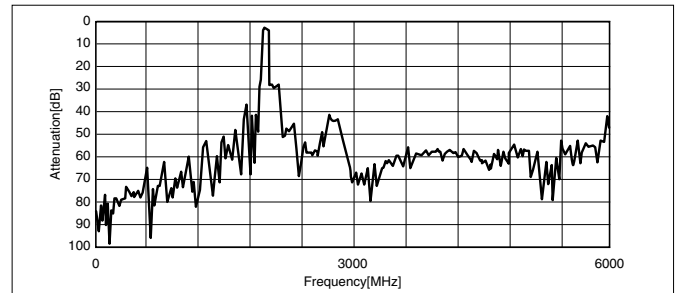


Spurious Characteristics

<PCS Rx>Parts No. : SF16-1960M5UB01

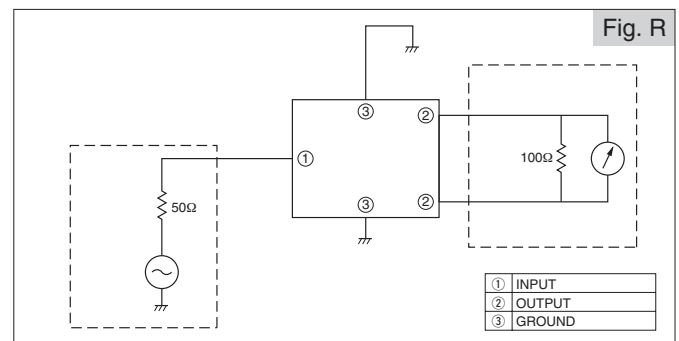
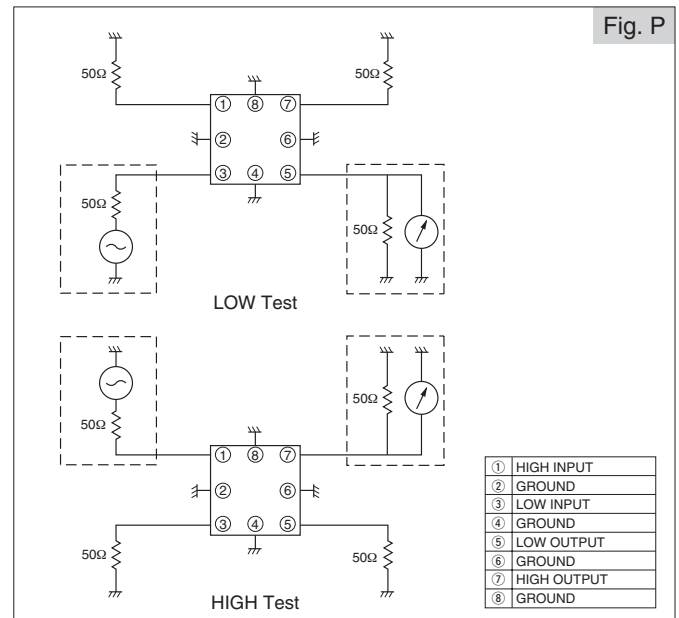
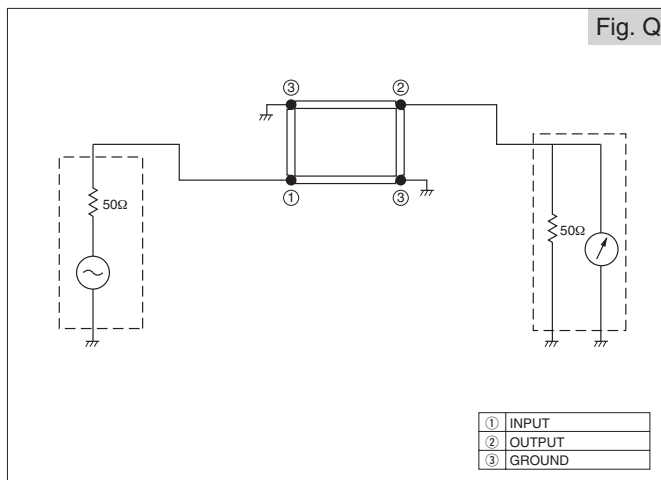
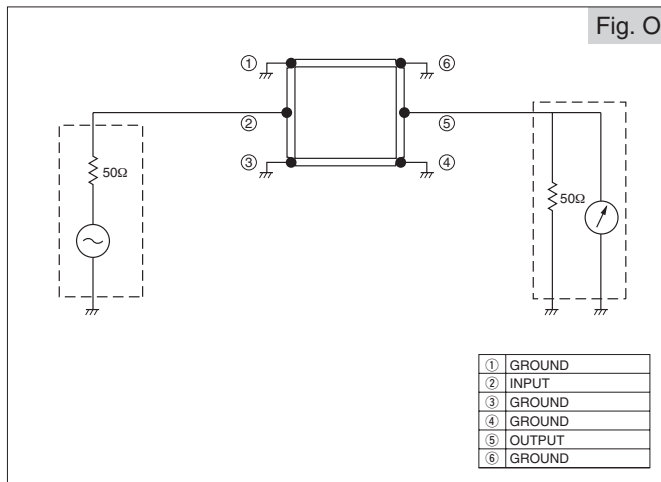


Pass Band Characteristics

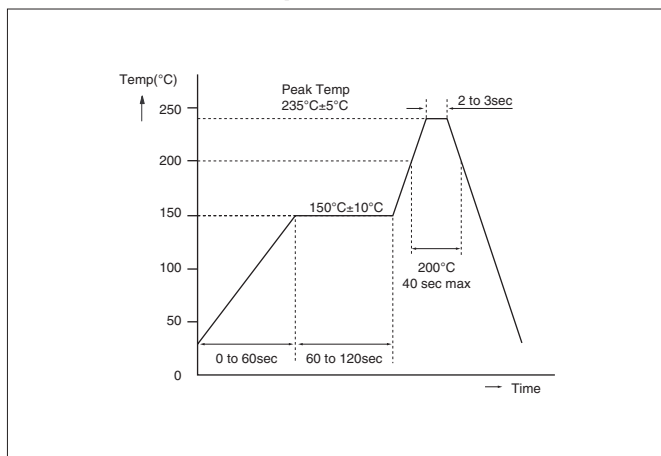


Spurious Characteristics

## Test Circuit

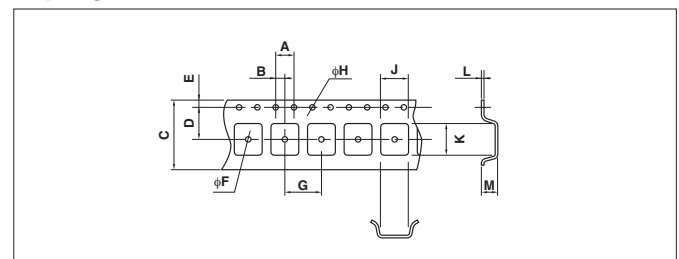


## Recommended Temperature Profile IR Reflow

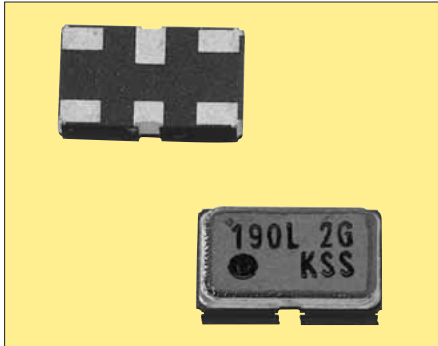


## Taping Dimensions

(Unit : mm)



| Code        | A   | B   | C    | D   | F    | G   | H    | J   | K   | L    | M    |
|-------------|-----|-----|------|-----|------|-----|------|-----|-----|------|------|
| Dimensions1 | 4.0 | 2.0 | 12.0 | 5.5 | 1.55 | 8.0 | 1.55 | 3.3 | 3.3 | 0.3  | 1.85 |
| Dimensions2 | 4.0 | 2.0 | 12.0 | 5.5 | 1.55 | 8.0 | 1.55 | 4.0 | 4.0 | 0.3  | 1.40 |
| Dimensions3 | 4.0 | 2.0 | 12.0 | 5.5 | 1.10 | 4.0 | 1.55 | 2.4 | 2.9 | 0.3  | 1.20 |
| Dimensions4 | 4.0 | 2.0 | 8.0  | 3.5 | 1.10 | 4.0 | 1.50 | 1.7 | 1.8 | 0.25 | 0.85 |



Pb Free

RoHS Conforming

### Features

- Wide-Band IF filter for W-CDMA.
- Because it is leadless type, automatic mounting is possible.
- Excellent phase characteristics.
- Balance connection type of input and output is available.

### Standard Frequencies

- 190.0MHz.

### How to Order

LSF B 54 - 190 - 004M 2  
① ② ③ ④ ⑤ ⑥

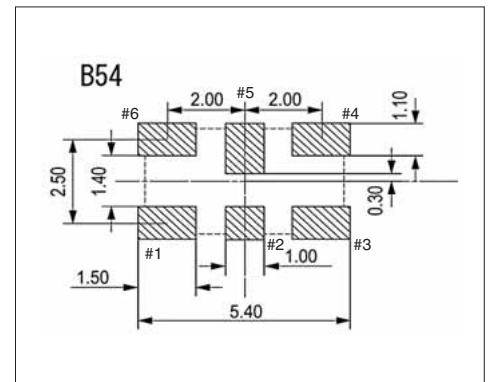
- ① LSF..... Li<sub>2</sub>B<sub>4</sub>O<sub>7</sub> SAW Filter
- ② B..... Seam weld type
- ③ 54..... Package Number (01, 02.....)
- ④ 190..... Nominal Frequency
- ⑤ 004M..... Pass Bandwidth 4MHz
- ⑥ 2..... Sub-Number

### Specifications

| Item                        | Unit | Conditions   | Specifications    |
|-----------------------------|------|--------------|-------------------|
| Nominal Frequency           | MHz  | —            | 190.0             |
| Operating Temperature Range | °C   | -20~+75      | —                 |
| Storage Temperature Range   | °C   | -40~+80      | —                 |
| Pass Bandwidth              | MHz  | -3dB         | ±2.3 * ±1.92 MIN. |
| Ripple                      | dB   | ±1.92MHz     | 0.8 * 1.5 MAX.    |
| Insertion Loss              | dB   | Minimum Loss | 6.5 * 9.0 MAX.    |
| Guaranteed Attenuation      | dB   | Fo±5MHz      | 38 * 20 MIN.      |
|                             |      | Fo±10MHz     | 45 * 40 MIN.      |
| Group Delay Deviation       | ns   | Fo±1.92MHz   | 88 * 140 MAX.     |

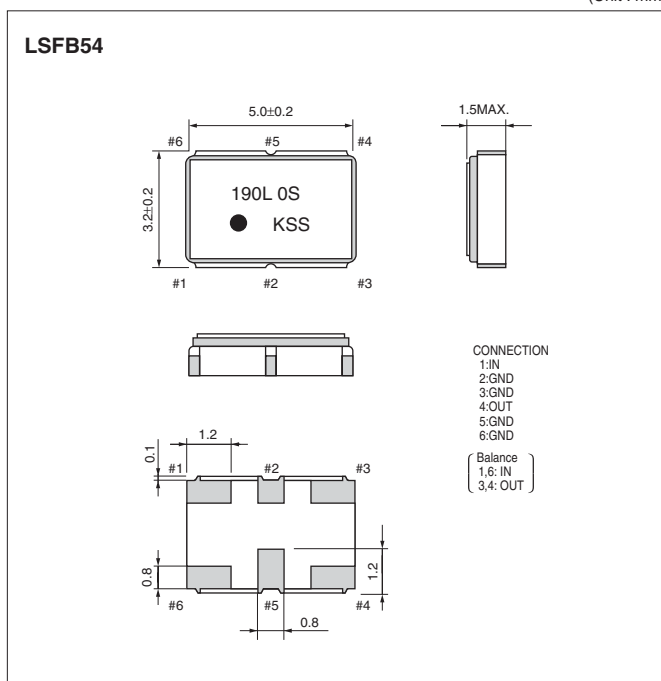
\*:Typ.

### Recommended Land Pattern (Unit : mm)

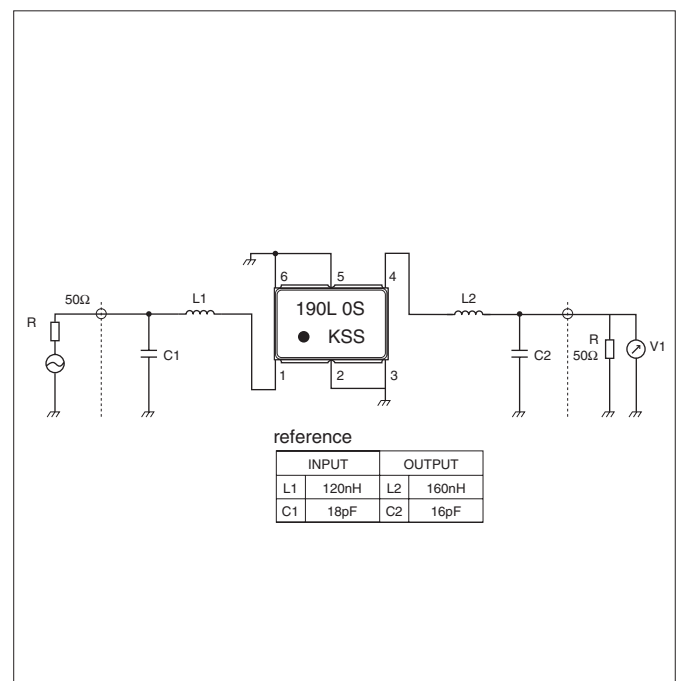


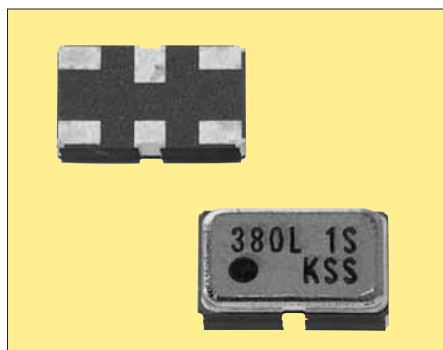
### Dimensions

(Unit : mm)



### Test Circuit





Pb Free

RoHS Conforming

### Features

- Wide-Band IF filter for W-CDMA.
- Because it is leadless type, automatic mounting is possible.
- Excellent phase characteristics.
- Balance connection type of input and output is available.

### Standard Frequencies

- 380MHz.

### How to Order

LSF B 54 - 380 - 004M 0

① ② ③ ④ ⑤ ⑥

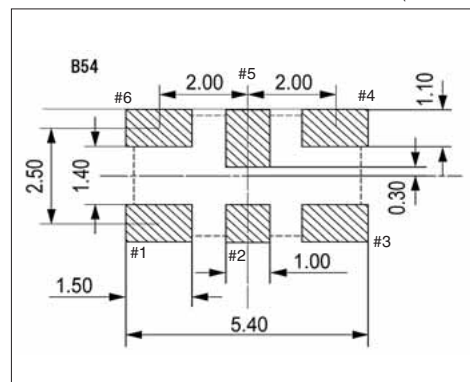
- ① LSF.....Li<sub>2</sub>B<sub>4</sub>O<sub>7</sub> SAW Filter
- ② B..... Seam weld type
- ③ 54..... Package Number (01, 02.....)
- ④ 380.....Nominal Frequency
- ⑤ 004M....Pass Bandwidth 4MHz
- ⑥ 0.....Sub-Number

### Specifications

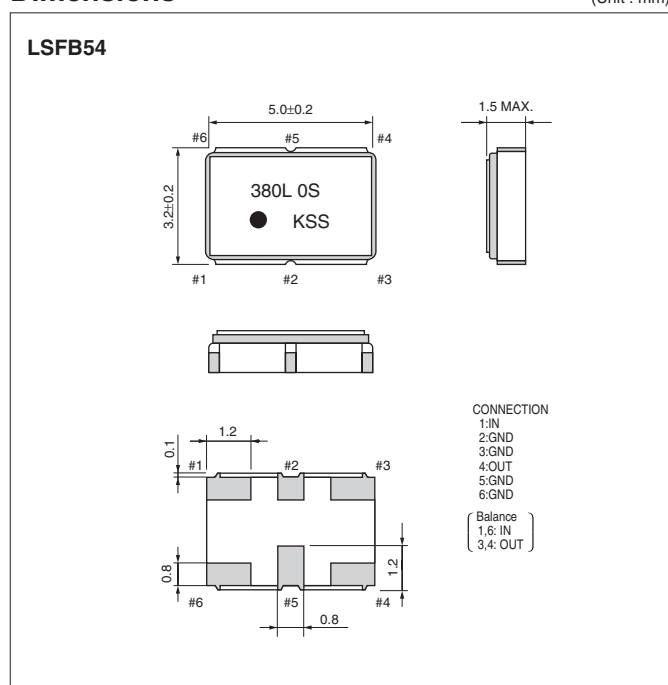
| Item                        | Unit | Conditions             | Specifications             |
|-----------------------------|------|------------------------|----------------------------|
| Nominal Frequency           | MHz  | —                      | 380.0                      |
| Operating Temperature Range | °C   | -20~+75                | —                          |
| Storage Temperature Range   | °C   | -40~+80                | —                          |
| Pass Bandwidth              | MHz  | -3dB                   | -2.5/+2.8MHz *; ±1.92 MIN. |
| Ripple                      | dB   | ±1.92MHz               | 1.0 *; 2.0 MAX.            |
| Insertion Loss              | dB   | Maximum Loss(±1.92MHz) | 7.0 *; 10.0 MAX.           |
| Guaranteed Attenuation      | dB   | Fo±5MHz                | -5/35dB *; 25 MIN.         |
|                             |      |                        | +5/33dB *; 25 MIN.         |
|                             |      | Fo±10MHz               | -10/39dB *; 30 MIN.        |
|                             |      |                        | +10/55dB *; 30 MIN.        |
| Group Delay Deviation       | ns   | Fo±1.92MHz             | 140 *; 300 MAX.            |

\*: Typ.

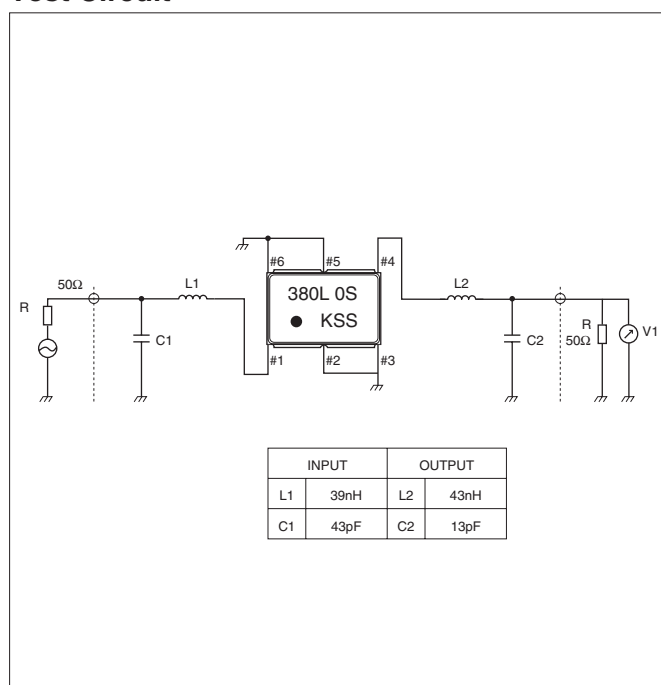
### Recommended Land Pattern (Unit : mm)

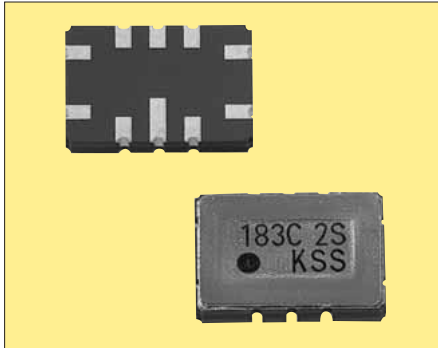


### Dimensions (Unit : mm)



### Test Circuit





#### Features

- Wide-Band IF filter for cdmaOne.
- Because it is leadless type, automatic mounting is possible.
- Excellent phase characteristics.
- Balance connection type of input and output is available.

#### Standard Frequencies

- 183.6MHz

#### How to Order

MSF C 30 - 183 - 001M 0  
① ② ③ ④ ⑤ ⑥

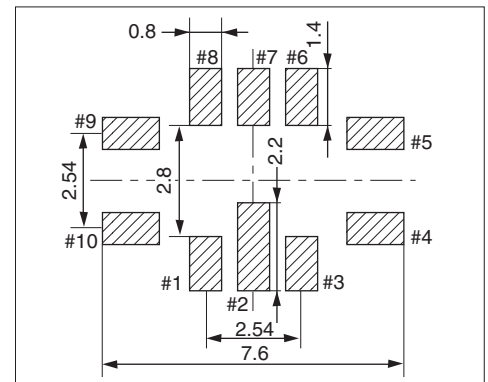
- ①MSF..... Monolithic SAW Filter (Quartz Crystal)
- ②C..... Solder weld type
- ③30..... Package Number (01, 02.....)
- ④183..... Nominal Frequency
- ⑤001M.... Pass Bandwidth 1MHz
- ⑥0..... Sub-Number

#### Specifications

| Item                        | Unit | Conditions   | Specifications                      |
|-----------------------------|------|--------------|-------------------------------------|
| Nominal Frequency           | MHz  | —            | 183.6                               |
| Operating Temperature Range | °C   | -30~+80      | —                                   |
| Storage Temperature Range   | °C   | -40~+85      | —                                   |
| Pass Bandwidth              | kHz  | -5dB         | -635 *<br>+670 *<br>±615 MIN.       |
| Ripple                      | dB   | Fo±300kHz    | 0.4 *<br>1.0 MAX.                   |
| Insertion Loss              | dB   | Minimum loss | 6.5 *<br>9.0 MAX.                   |
| Guaranteed Attenuation      | dB   | Fo±900kHz    | -900/38 *<br>+900/40 *<br>33 MIN.   |
|                             |      |              |                                     |
|                             |      | Fo±1.25MHz   | +1.25/38 *<br>+1.25/40 *<br>33 MIN. |
|                             |      |              |                                     |
| Group Delay Deviation       | ns   | Fo±300kHz    | 290 *<br>500 MAX.                   |

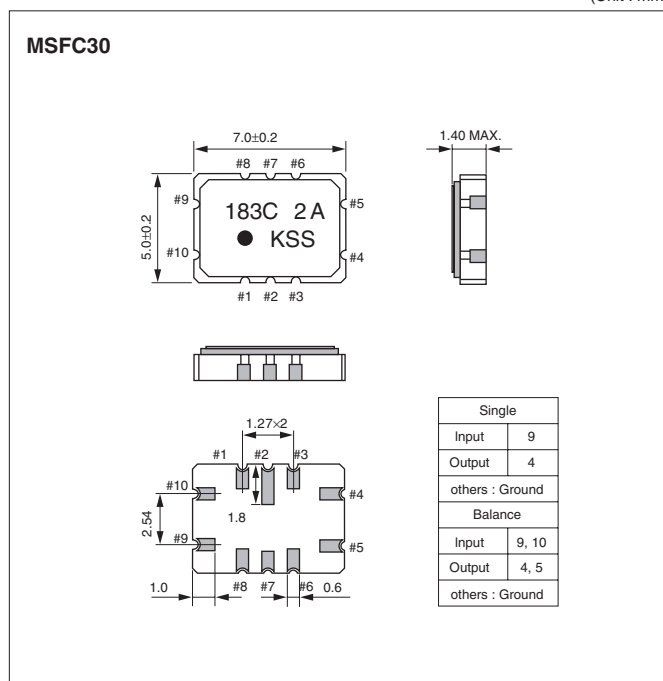
\* : Typ.

#### Recommended Land Pattern (Unit : mm)

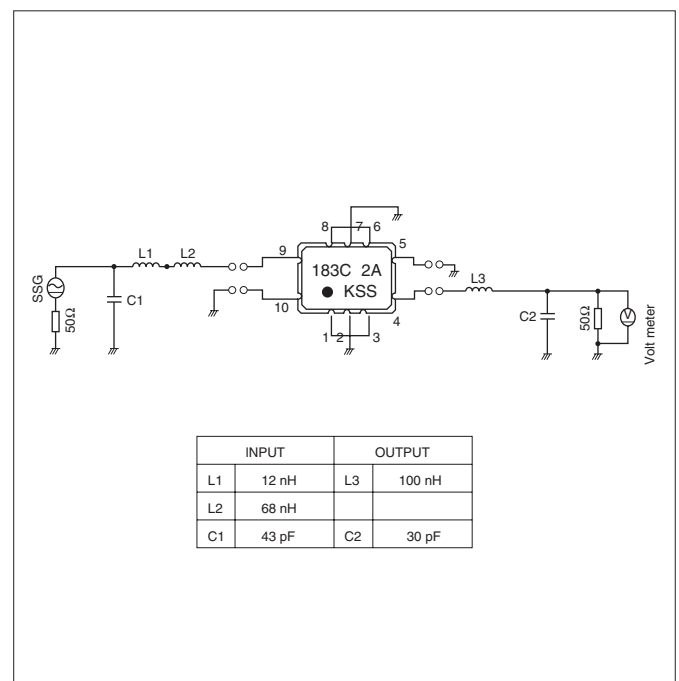


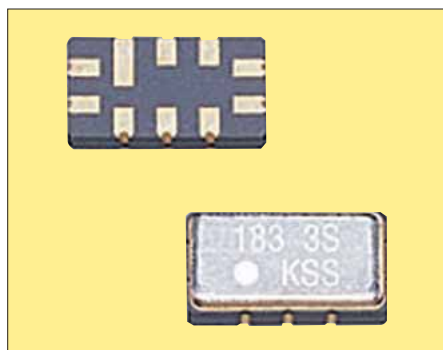
#### Dimensions

(Unit : mm)



#### Test Circuit





Pb Free

RoHS Conforming

### Features

- Compact and thin.
- Wide-Band IF filter for CDMA.
- Excellent group delay distortion characteristics.
- Balance connection type of input and output is available.
- Automatic pick-and-place, reflow soldering.
- A lead free product.

### Standard Frequencies

- 183.6MHz

### How to Order

MSF B 55 - 183 - 001M 0

① ② ③ ④ ⑤ ⑥

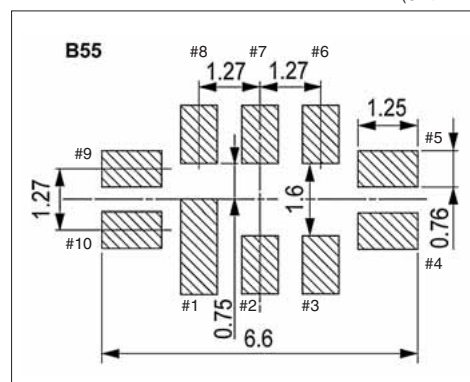
- ① MSF..... Monolithic SAW Filter (Quartz Crystal)
- ② B..... Seam weld type
- ③ 55..... Package Number (01, 02.....)
- ④ 183..... Nominal Frequency
- ⑤ 001M.... Pass Bandwidth 1MHz
- ⑥ 0..... Sub-Number

### Specifications

| Item                        | Unit | Conditions   | Specifications |           |
|-----------------------------|------|--------------|----------------|-----------|
| Nominal Frequency           | MHz  | —            | 183.6          |           |
| Operating Temperature Range | °C   | −30~+80      | —              |           |
| Storage Temperature Range   | °C   | −40~+85      | —              |           |
| Pass Bandwidth              | kHz  | −5dB         | ±650           | ±615 MIN. |
| Ripple                      | dB   | fo±300kHz    | 0.3 *          | 1.0 MAX.  |
| Insertion Loss              | dB   | Minimum loss | 8.0 *          | 10.5 MAX. |
| Guaranteed Attenuation      | dB   | Fo±900kHz    | −900/40 *      | 33 MIN.   |
|                             |      |              | +900/40 *      | 33 MIN.   |
|                             |      | Fo±1.25MHz   | −1.25/39 *     | 33 MIN.   |
|                             |      |              | +1.25/40 *     | 33 MIN.   |
| Group Delay Deviation       | ns   | fo±300kHz    | 250 *          | 500 MAX.  |

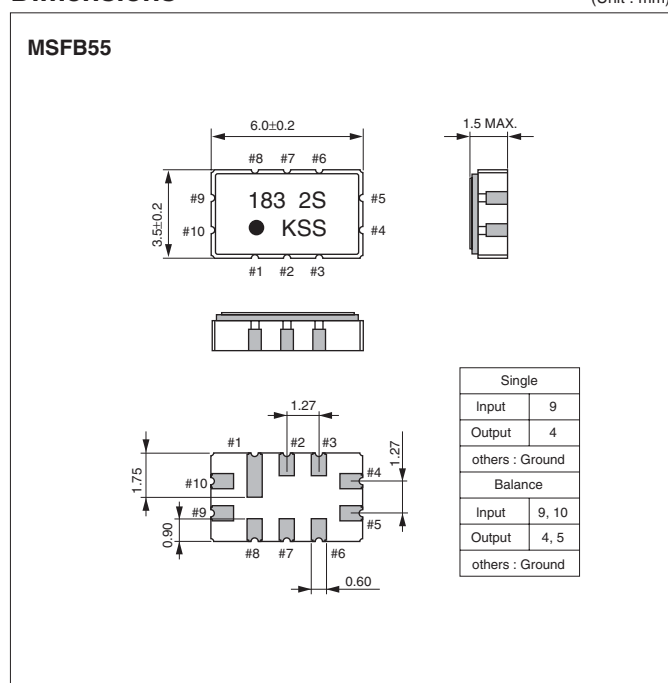
\* : Typ.

### Recommended Land Pattern (Unit : mm)

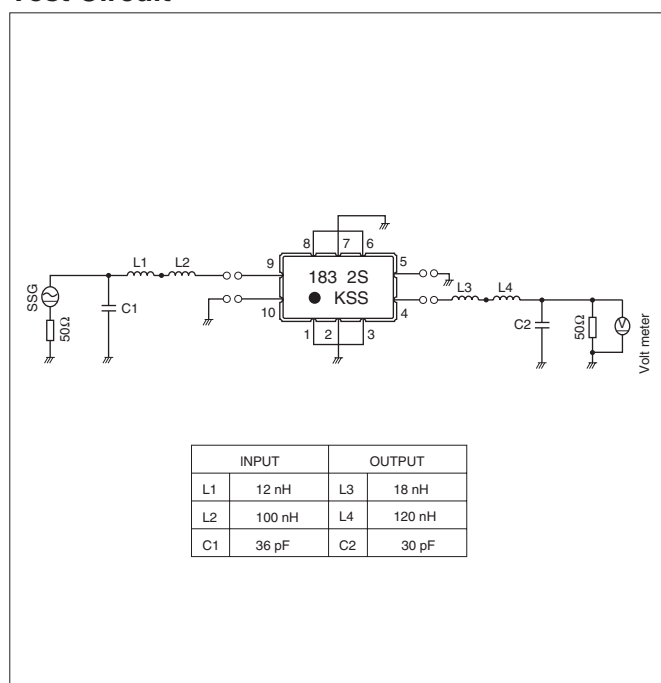


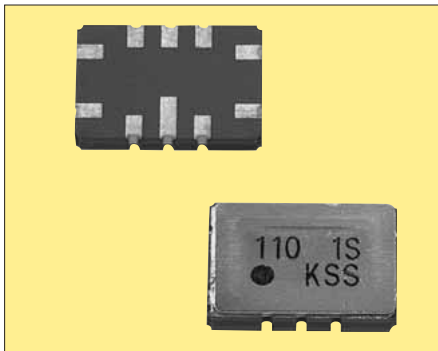
### Dimensions

(Unit : mm)



### Test Circuit





### Features

- Wide-Band IF filter for cdmaOne.
- Because it is leadless type, automatic mounting is possible.
- Excellent phase characteristics.
- Balance connection type of input and output is available.

### Standard Frequencies

- 110.0MHz

### How to Order

MSF C 30 - 110 - 001M 0  
① ② ③ ④ ⑤ ⑥

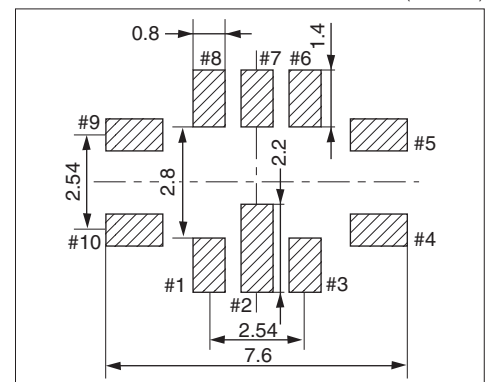
- ①MSF..... Monolithic SAW Filter (Quartz Crystal)
- ②C..... Solder weld type
- ③30..... Package Number (01, 02.....)
- ④110..... Nominal Frequency
- ⑤001M.... Pass Bandwidth 1MHz
- ⑥0..... Sub-Number

### Specifications

| Item                        | Unit | Conditions   | Specifications             |
|-----------------------------|------|--------------|----------------------------|
| Nominal Frequency           | MHz  | —            | 110.00                     |
| Operating Temperature Range | °C   | -30~+80      | —                          |
| Storage Temperature Range   | °C   | -40~+85      | —                          |
| Pass Bandwidth              | kHz  | -5dB         | -645 * ±620 MIN.<br>+670 * |
| Ripple                      | dB   | Fo±300kHz    | 0.2 * 1.0 MAX.             |
| Insertion Loss              | dB   | Minimum Loss | 9.4 * 12.0 MAX.            |
| Guaranteed Attenuation      | dB   | Fo±900kHz    | -900/43 * 33 MIN.          |
|                             |      |              | +900/40 *                  |
|                             |      | Fo±1.7MHz    | -1.7/43 * 33 MIN.          |
|                             |      |              | +1.7/38 *                  |
| Group Delay Deviation       | ns   | Fo±300kHz    | 280 * 500 MAX.             |

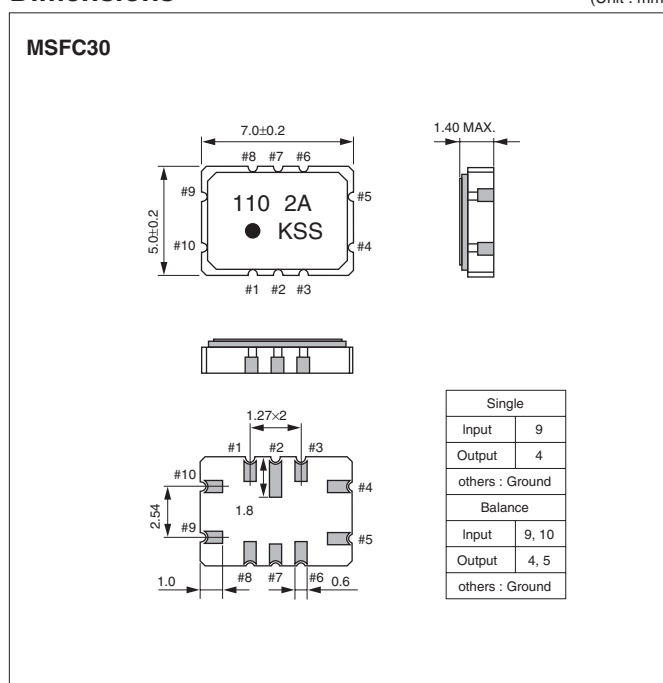
\* : Typ.

### Recommended Land Pattern (Unit : mm)

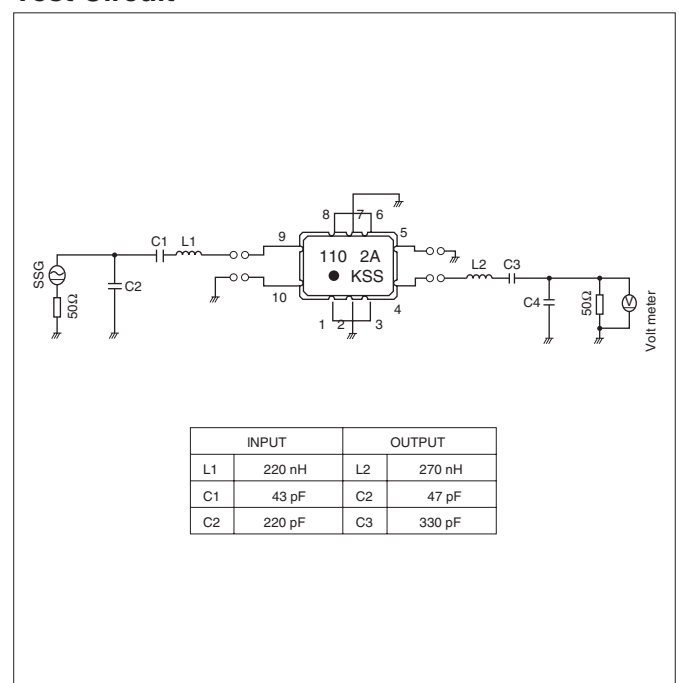


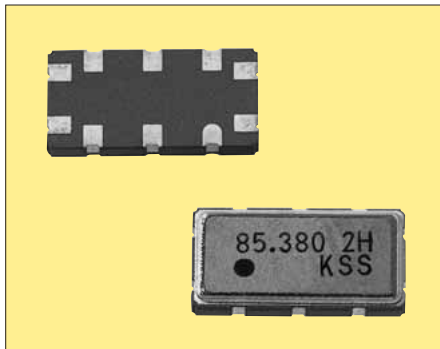
### Dimensions

(Unit : mm)



### Test Circuit





Pb Free

RoHS Conforming

### Features

- Wide-Band IF filter for cdmaOne.
- Because it is leadless type, automatic mounting is possible.
- Excellent phase characteristics.
- Balance connection type of input and output is available.

### Standard Frequencies

- 85.380MHz

### How to Order

MSF B 43 - 85 - 001M 0

① ② ③ ④ ⑤ ⑥

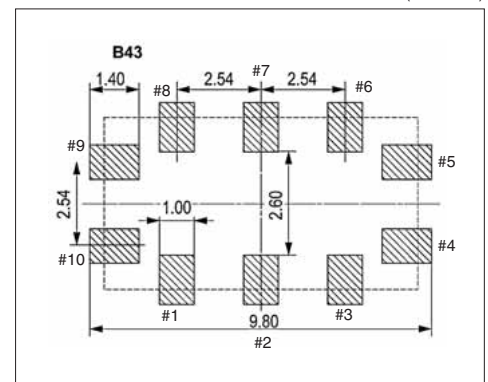
- ① MSF..... Monolithic SAW Filter (Quartz Crystal)
- ② B..... Seam weld type
- ③ 43..... Package Number (01, 02.....)
- ④ 85..... Nominal Frequency
- ⑤ 001M.... Pass Bandwidth 1MHz
- ⑥ 0..... Sub-Number

### Specifications

| Item                        | Unit | Conditions | Specifications                    |
|-----------------------------|------|------------|-----------------------------------|
| Nominal Frequency           | MHz  | —          | 85.38                             |
| Operating Temperature Range | °C   | -30~+80    | —                                 |
| Storage Temperature Range   | °C   | -40~+85    | —                                 |
| Pass Bandwidth              | kHz  | -5dB       | -640 *    ±620 MIN.<br>+650 *     |
| Ripple                      | dB   | Fo±300kHz  | 0.4 *    1.0 MAX.                 |
| Insertion Loss              | dB   | Fo         | 9.1 *    12 MAX.                  |
| Guaranteed Attenuation      | dB   | Fo±900kHz  | -900/48 *    33 MIN.<br>+900/42 * |
| Group Delay Deviation       | ns   | Fo±300kHz  | 270 *    500 MAX.                 |

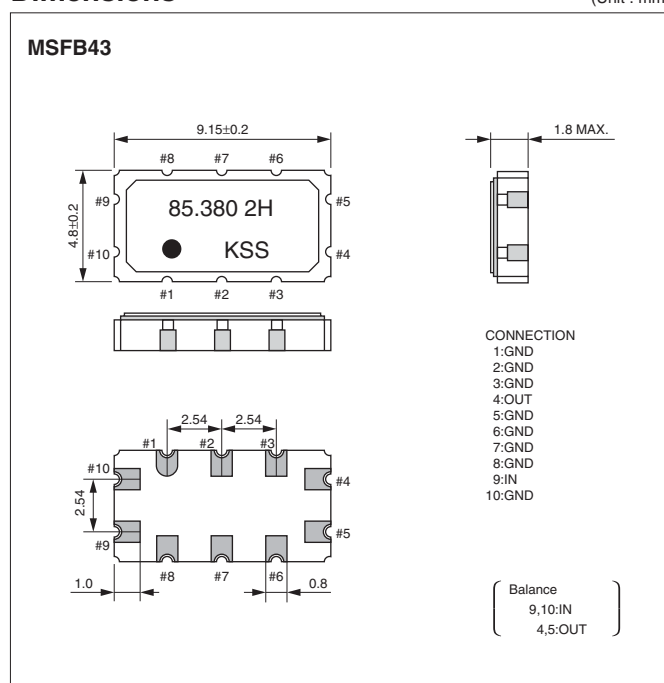
\* : Typ.

### Recommended Land Pattern (Unit : mm)

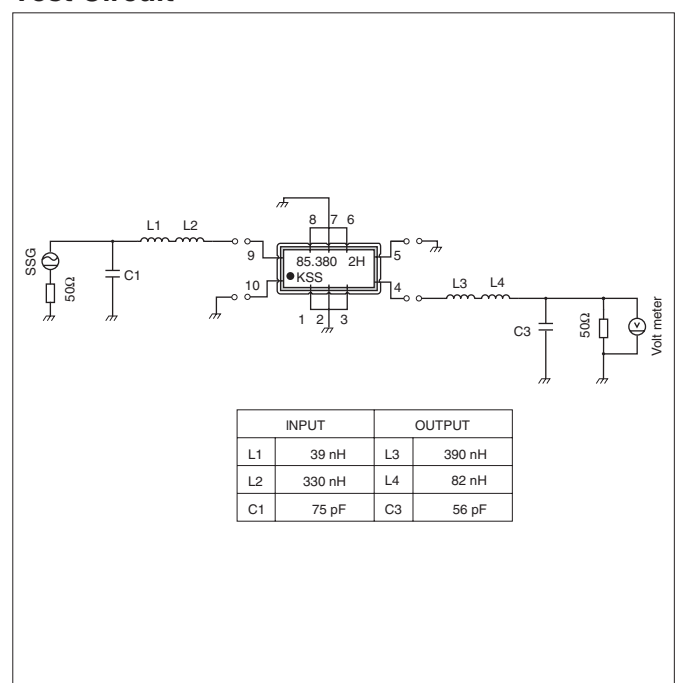


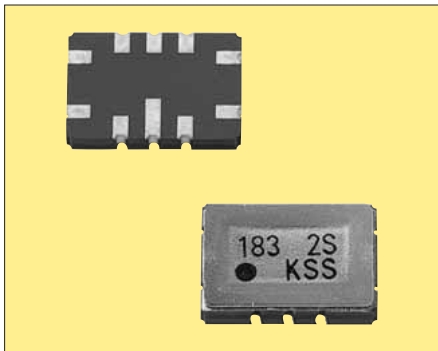
### Dimensions

(Unit : mm)



### Test Circuit





#### Features

- IF filter for AMPS.
- Because it is leadless type, automatic mounting is possible.
- Excellent group delay distortion characteristics.

#### Standard Frequencies

- 183.6MHz

#### How to Order

MSF C 30 - 183 - 022K 0

① ② ③ ④ ⑤ ⑥

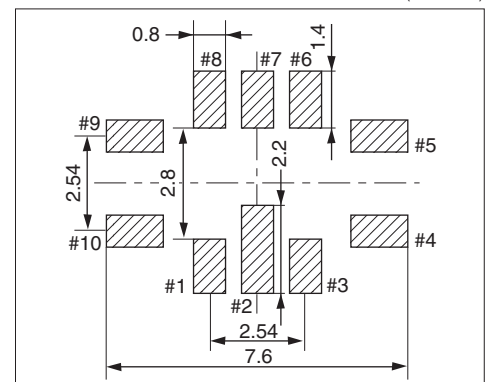
- ①MSF..... Monolithic SAW Filter  
(Quartz Crystal)
- ②C..... Solder weld type
- ③30..... Package Number (01, 02.....)
- ④183..... Nominal Frequency
- ⑤022K.... Pass Bandwidth 22kHz
- ⑥0..... Sub-Number

#### Specifications

| Item                        | Unit | Conditions   | Specifications     |          |
|-----------------------------|------|--------------|--------------------|----------|
| Nominal Frequency           | MHz  | —            | 183.6              |          |
| Operating Temperature Range | °C   | -25~+75      | —                  |          |
| Storage Temperature Range   | °C   | -35~+85      | —                  |          |
| Pass Bandwidth              | kHz  | -3dB         | ±11 MIN.           |          |
| Ripple                      | dB   | Fo±11kHz     | 0 *                | 1.5 MAX. |
| Insertion Loss              | dB   | Minimum loss | 4.5 *              | 5.5 MAX. |
| Guaranteed Attenuation      | dB   | Fo±60kHz     | -60/27<br>+60/21   | 11 MIN.  |
|                             |      | Fo±120kHz    | -120/51<br>+120/49 | 40 MIN.  |
| Group Delay Deviation       | μs   | Fo±11kHz     | 1.2 *              | 15 MAX.  |

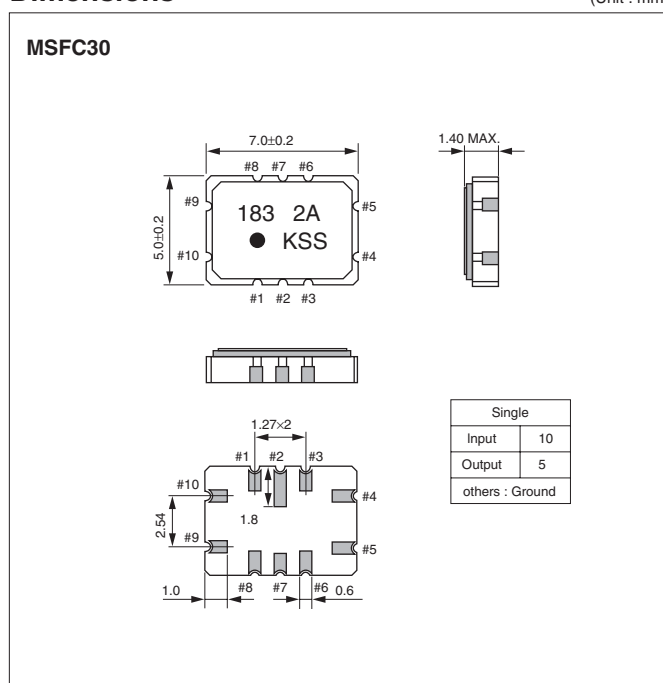
\* : Typ.

#### Recommended Land Pattern (Unit : mm)

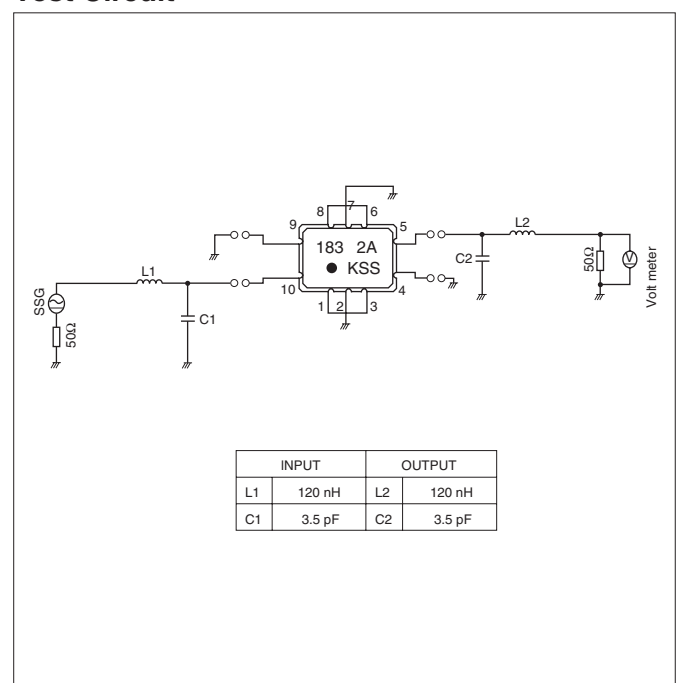


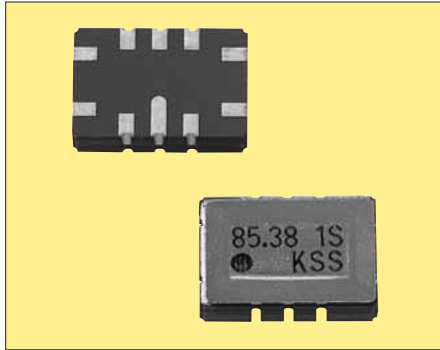
#### Dimensions

(Unit : mm)



#### Test Circuit





#### Features

- IF filter for AMPS.
- Because it is leadless type, automatic mounting is possible.
- Excellent group delay distortion characteristics.

#### Standard Frequencies

- 83.16MHz.
- 85.38MHz.

#### How to Order

MSF C 12 - 83 - 026K 0  
① ② ③ ④ ⑤ ⑥

- ① MSF..... Monolithic SAW Filter (Quartz Crystal)
- ② C..... Solder weld type
- ③ 12..... Package Number (01, 02.....)
- ④ 83..... Nominal Frequency
- ⑤ 026K.... Pass Bandwidth 26kHz
- ⑥ 0..... Sub-Number

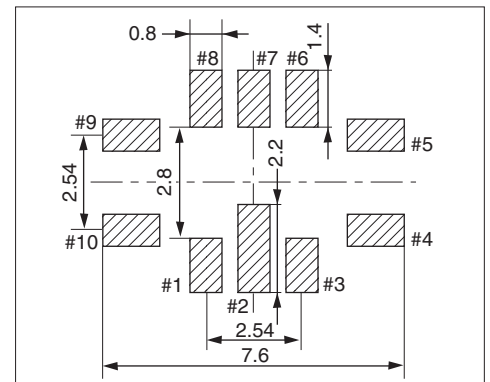
#### Specifications

| Type                        |      |              | MSFC12-83-026K0 |              | MSFC12-85-026K1 |
|-----------------------------|------|--------------|-----------------|--------------|-----------------|
| Item                        | Unit | Conditions   | Specifications  | Conditions   | Specifications  |
| Nominal Frequency           | MHz  | —            | 83.16           | —            | 85.38           |
| Operating Temperature Range | °C   | -25~+75      | —               | -30~+80      | —               |
| Storage Temperature Range   | °C   | -35~+85      | —               | -40~+85      | —               |
| Pass Bandwidth              | kHz  | -3dB         | Fo±13 MIN.      | -3dB         | Fo±13 MIN.      |
| Ripple                      | dB   | Fo±13kHz     | 0 * 1.5 MAX.    | Fo±10kHz     | 0 * 1.5 MAX.    |
| Insertion Loss              | dB   | Minimum Loss | 3.5 * 5.0 MAX.  | Minimum Loss | 3.5 * 5.0 MAX.  |
| Guaranteed Attenuation      | dB   | Fo-120kHz    | 64 * 50 MIN.    | Fo-120kHz    | 59 * 40 MIN.    |
|                             |      | Fo±60kHz     | 35 * 25 MIN.    | Fo±60kHz     | 33 * 25 MIN.    |
|                             |      | Fo+120kHz    | 60 * 50 MIN.    | Fo+120kHz    | 65 * 40 MIN.    |
| Group Delay Deviation       | μS   | Fo±13kHz     | 6 * 10 MAX.     | Fo±10kHz     | 5 * 12 MAX.     |
| Terminating Impedance       | Ω/pF | —            | 810/-1.5        | MSFC12       | 980/-1.2        |

\* : Typ.

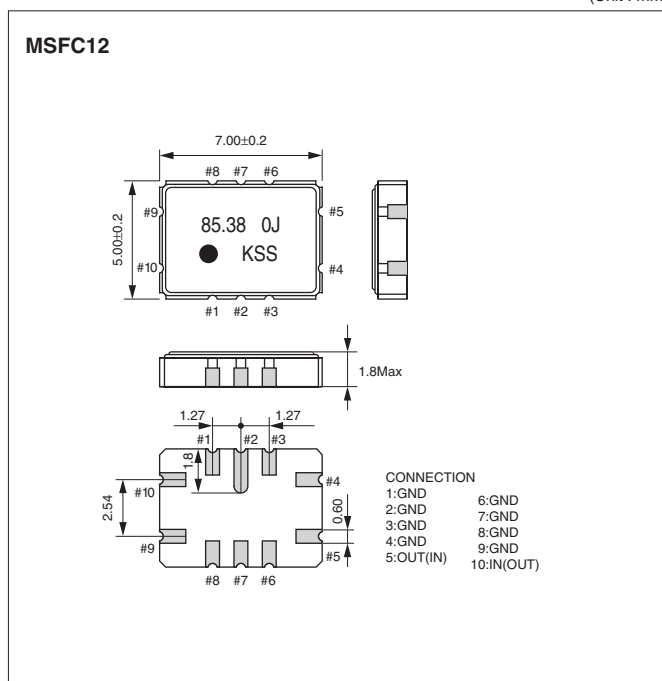
\* : Typ.

#### Recommended Land Pattern (Unit : mm)

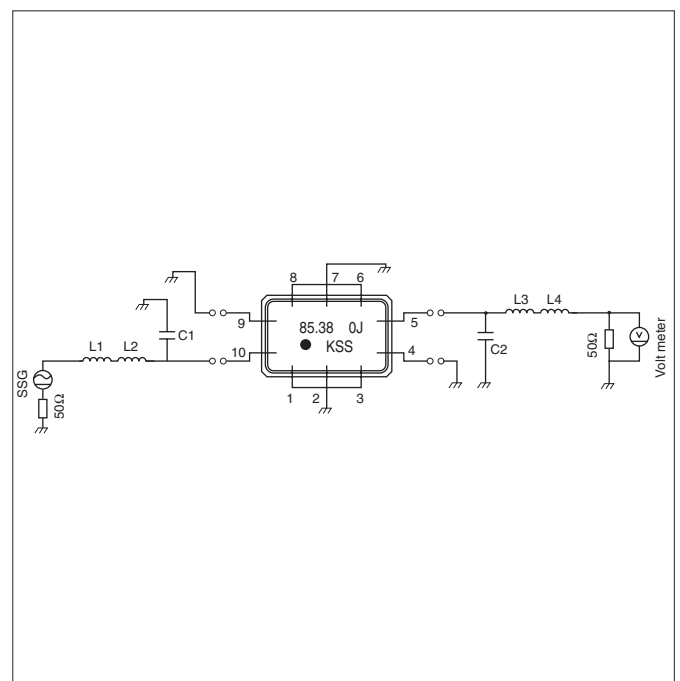


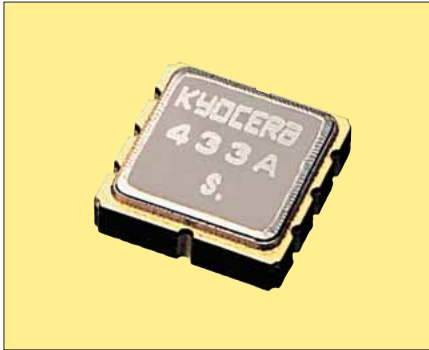
#### Dimensions

(Unit : mm)



#### Test Circuit





Pb Free

RoHS Conforming

## Features

- Small and low profile
- Flat pass band characteristics
- Low insertion loss
- Excellent temperature stability

## Application

- Remote Keyless Entry

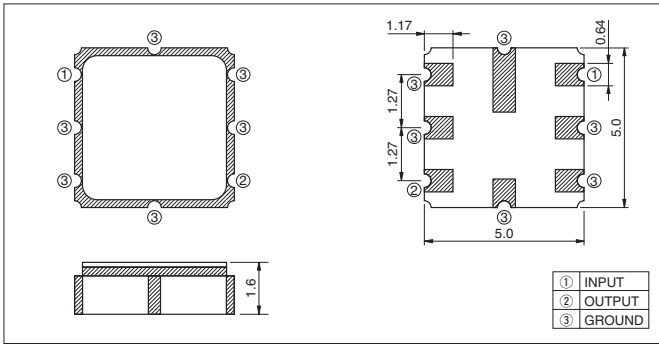
## How to Order

PAFC 433.92 AR 00  
① ② ③ ④

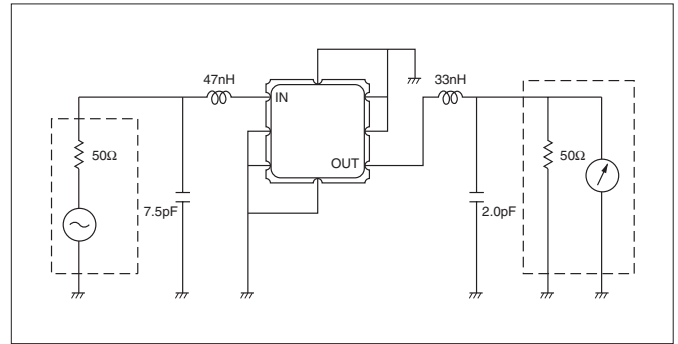
- ① Series
- ② Center Frequency
- ③ Type
- ④ Option

## Dimensions

(Unit : mm)



## Test Circuit

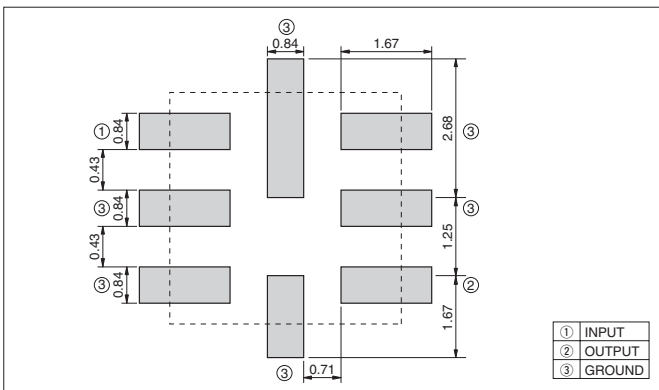


## Specifications

| Parts No.      | Nominal Center Frequency (fn) | Insertion Loss | Pass Band Width (at 3dB) | Stop Band Attenuation |           |           |           |           |           | Operating Temperature | Storage Temperature |
|----------------|-------------------------------|----------------|--------------------------|-----------------------|-----------|-----------|-----------|-----------|-----------|-----------------------|---------------------|
| PAFC433.92AR00 | 433.920 MHz                   | 4.0dB max.     | Fn±200kHz min.           | 10MHz                 | 414MHz    | 428MHz    | 434.92MHz | 442MHz    | 550MHz    | -40 to 85°C           | -40 to 85°C         |
|                |                               |                |                          | 414MHz                | 428MHz    | 432.92MHz | 442MHz    | 550MHz    | 1000MHz   |                       |                     |
|                |                               |                |                          | 42dB min.             | 35dB min. | 15dB min. | 10dB min. | 35dB min. | 40dB min. |                       |                     |

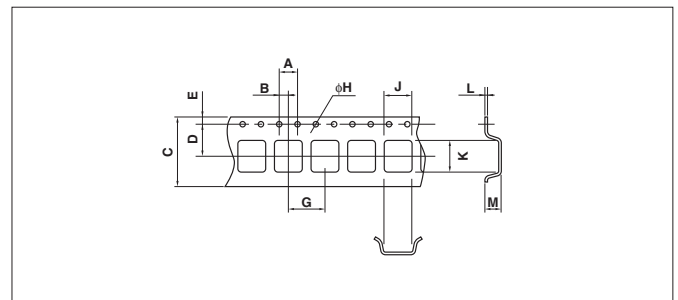
## Recommended Land Pattern

(Unit : mm)



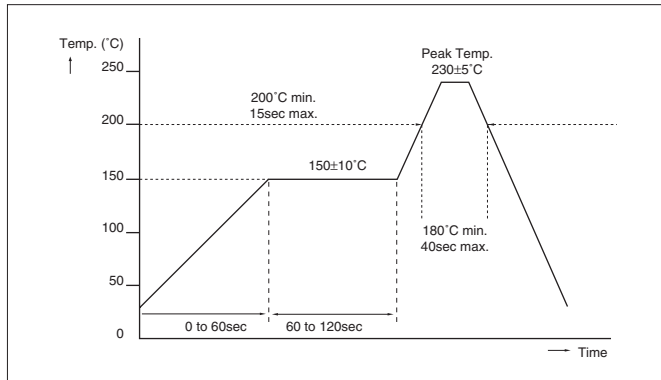
## Taping Dimensions

(Unit : mm)



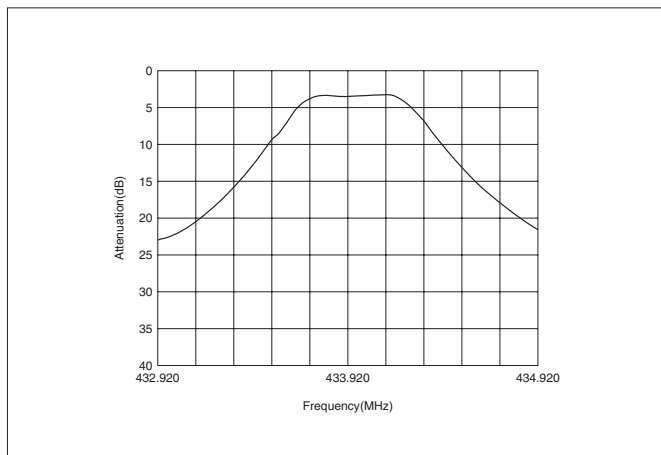
| Code       | A   | B   | C    | D   | G   | H    | J   | K   | L   | M    |
|------------|-----|-----|------|-----|-----|------|-----|-----|-----|------|
| Dimensions | 4.0 | 2.0 | 12.0 | 5.5 | 8.0 | 1.55 | 5.3 | 5.3 | 0.3 | 2.10 |

## Recommended Temperature IR Reflow

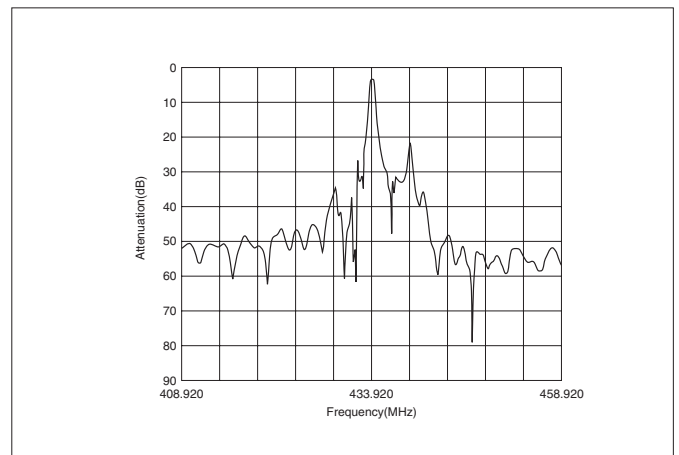


## Characteristics

### • Pass Band Characteristics



### • Spurious Characteristics





Pb Free

RoHS Comforming

#### Features

- Small and low profile
- For European remote keyless entry system
- For auto pick-and-place
- Reflow compatible
- Lead free

#### Standard Frequencies

- 868.3MHz.

#### How to Order

MSF B 47 - 868 - 600K 0

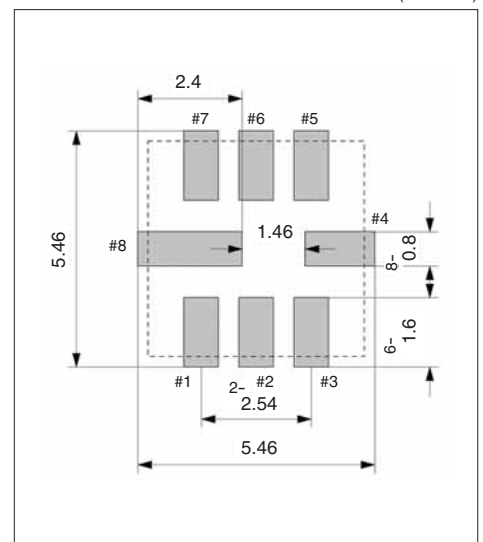
① ② ③ ④ ⑤ ⑥

- ① MSF..... Monolithic SAW Filter (Quartz Crystal)
- ② B..... Seam weld type
- ③ 47..... Package Number (01, 02.....)
- ④ 868..... Nominal Frequency
- ⑤ 600..... Pass Bandwidth 600kHz
- ⑥ 0..... Sub-Number

#### Specifications

| Item                        | Unit  | Conditions                                                                                                                                                  | Specifications                                 |
|-----------------------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
| Nominal Frequency           | MHz   | —                                                                                                                                                           | 868.3                                          |
| Operation Temperature Range | °C    | -45~+90                                                                                                                                                     | —                                              |
| Storage Temperature Range   | °C    | -45~+90                                                                                                                                                     | —                                              |
| Pass Bandwidth              | kHz   | -3dB                                                                                                                                                        | ±300MIN.                                       |
| Ripple                      | dB    | Fo±300kHz                                                                                                                                                   | 1.5MAX.                                        |
| Insertion Loss              | dB    | Minimum loss                                                                                                                                                | 4.2MAX.                                        |
| Guaranteed Attenuation      | dB    | -168.3MHz ~ -38.3MHz<br>-38.3MHz ~ -18.3MHz<br>-18.3MHz ~ -3.3MHz<br>+2.7MHz ~ +6.2MHz<br>+6.2MHz ~ +14.7MHz<br>+14.7MHz ~ +31.7MHz<br>+31.7MHz ~ +131.7MHz | 35<br>32<br>25<br>11<br>22<br>30<br>35<br>MIN. |
| Terminating Impedance       | Ω//pF |                                                                                                                                                             | 315//—1.1                                      |

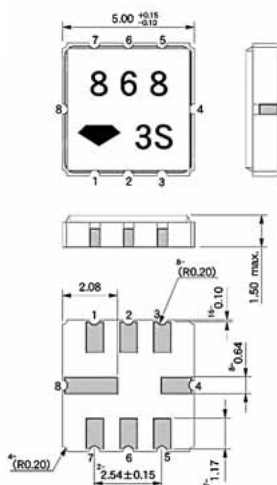
#### Recommended Land Pattern (Unit : mm)



#### Dimensions

(Unit : mm)

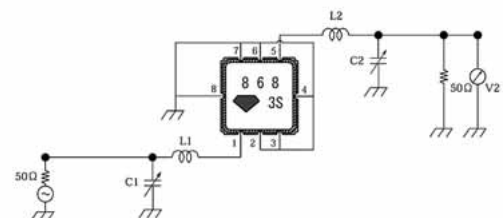
MSFB47



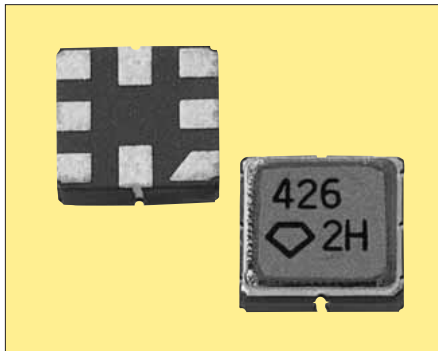
Terminal conection

1. IN
2. GND
3. GND
4. GND
5. OUT
6. GND
7. GND
8. GND
9. GND
10. GND

#### Test Circuit



| INPUT           | OUTPUT          |
|-----------------|-----------------|
| L1 = 12nH       | L2 = 12nH       |
| C1 = 2~6pF      | C2 = 2~6pF      |
| MEMO)           | MEMO)           |
| Tolerance : ±5% | Tolerance : ±5% |



Pb Free

RoHS Comforming

### Features

- RF filter for transmission and reception.
- Low power consumption.
- Miniature size and light weight

### Applications

- For engine-starter.
- For transceiver.
- For pager.
- For radio phone.

### How to Order

LSF B 44 - 426 - 800K 0  
① ② ③ ④ ⑤ ⑥

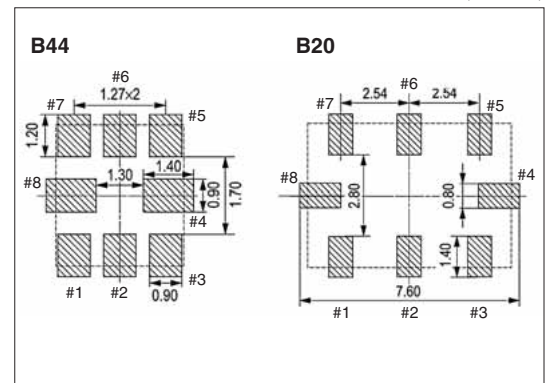
- ① LSF..... Li<sub>2</sub> B<sub>4</sub> O<sub>7</sub> SAW Filter
- ② B..... Seam weld type
- ③ 44..... Package Number (01, 02.....)
- ④ 426..... Nominal Frequency
- ⑤ 800..... Pass Bandwidth 800kHz
- ⑥ 0..... Sub-Number

### Standard Frequency

| Nominal Frequency(MHz) | Type                                 |
|------------------------|--------------------------------------|
| 421.90000              | LSFA02-422-800K0                     |
| 426.08125<br>426.54    | LSFA02-426-400K0<br>LSFB44-426-800K0 |
| 429.5500               | LSFA02-429-800K0<br>LSFB44-429-800K0 |
| 433.9200               | LSFA02-434-002M0                     |
| 440.2000               | LSFA02-440-400K0<br>LSFB44-440-400K0 |
| 469.1875               | LSFB20-469-001M0                     |

### Recommended Land Pattern

(Unit : mm)



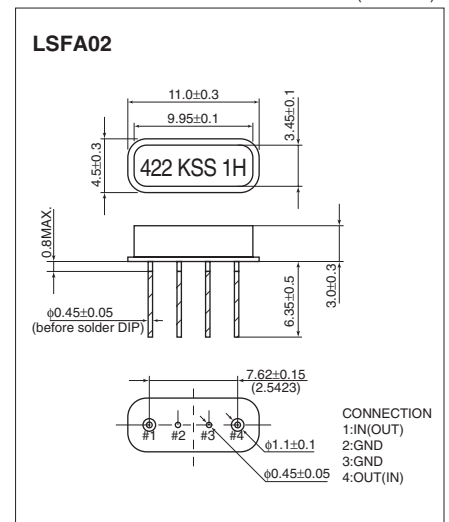
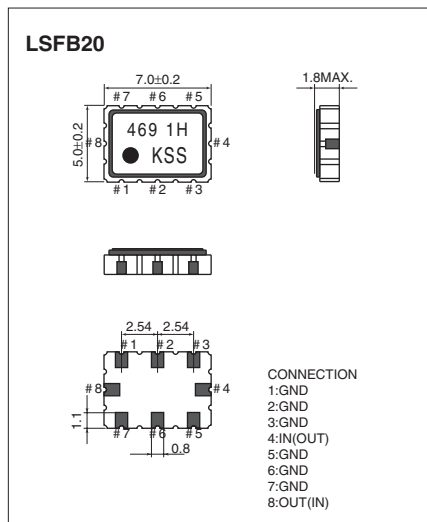
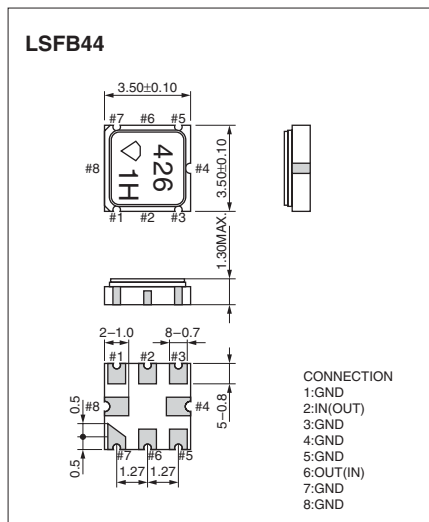
### Specifications

| Item                        | Unit | Conditions      | LSFB44-426-800K0 Specifications |          |
|-----------------------------|------|-----------------|---------------------------------|----------|
| Nominal Frequency           | MHz  | —               | 426.54                          |          |
| Operating Temperature Range | °C   | -10~+60         | —                               |          |
| Storage Temperature Range   | °C   | -30~+70         | —                               |          |
| Ripple                      | dB   | Fo ± 400kHz     | 0.4 *                           | 1.5 MAX. |
| Insertion Loss              | dB   | Fo ± 400kHz     | 2.8 *                           | 3.5 MAX. |
| Guaranteed Attenuation      | dB   | (F-21.4)±400kHz | 60 *                            | 50 MIN.  |
| Terminating Impedance       | Ω    | —               | 50 Typical                      |          |

\* : Typ.

### Dimensions

(Unit : mm)





Pb Free

RoHS Conforming

### Features

- Small size(3.0x3.0x1.5mm max)
- Ceramic package type
- Flat pass band characteristics
- Low insertion loss
- Circuit simplification

### Standard Frequencies

- PHS

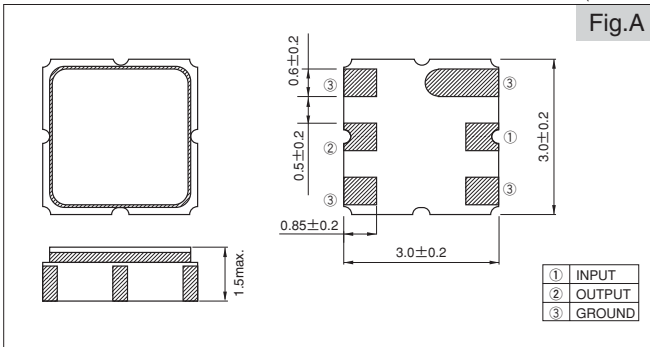
### How to Order

PAFA 243 A R 01  
① ② ③ ④ ⑤

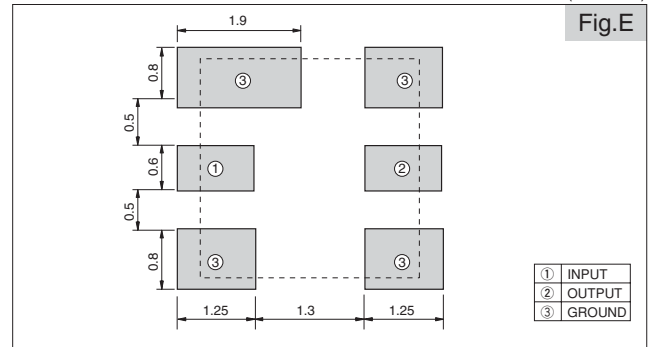
- ① Series
- ② Center Frequency
- ③ Marking code
- ④ Packaging
- ⑤ Frequency tolerance or Custom spec

### Dimensions

(Unit : mm)



(Unit : mm)

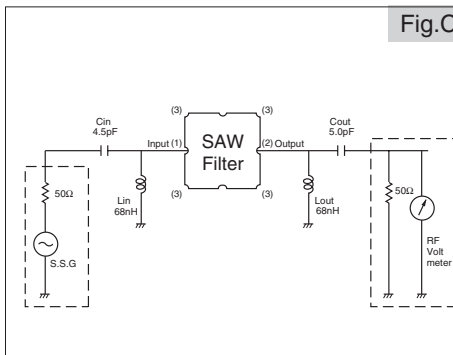


### Specifications

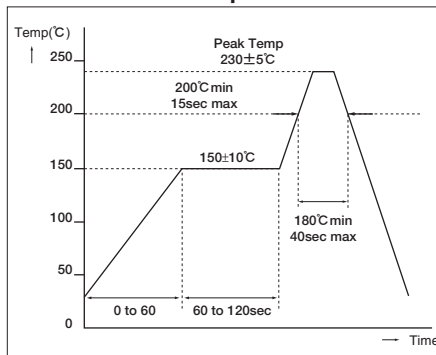
| Parts No.   | Nominal Center Frequency (fn) | Insertion Loss | Pass Band Width (at 3dB) | Stop Band Attenuation |           |              | Ripple (fn±110kHz) | Group Delay Time (fn±110kHz) | Operating Temperature | Storage Temperature | Dimensions | Test Circuit | Recommended Land Pattern | Taping Dimensions |
|-------------|-------------------------------|----------------|--------------------------|-----------------------|-----------|--------------|--------------------|------------------------------|-----------------------|---------------------|------------|--------------|--------------------------|-------------------|
|             |                               |                |                          | fn±600kHz             | fn±1.2MHz | fn±fa MHz(+) |                    |                              |                       |                     |            |              |                          |                   |
| PAFA243AR01 | 243.95MHz                     | 4.5dB          | ±130kHz min              | 30dB min              | 40dB min  | 60dB min     | 1.5dB max          | 1.2μs max                    | -10 to 60°C           | -20 to 80°C         | Fig. A     | Fig. C       | Fig. E                   | Fig. F            |

### Test Circuit

Fig.C

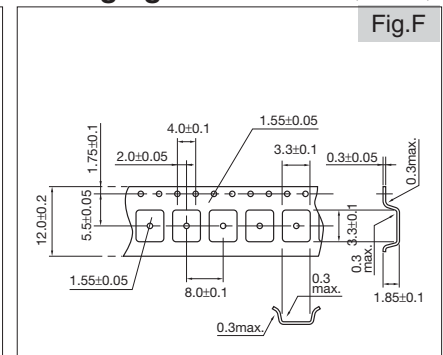


### Recommended Temperature IR Reflow

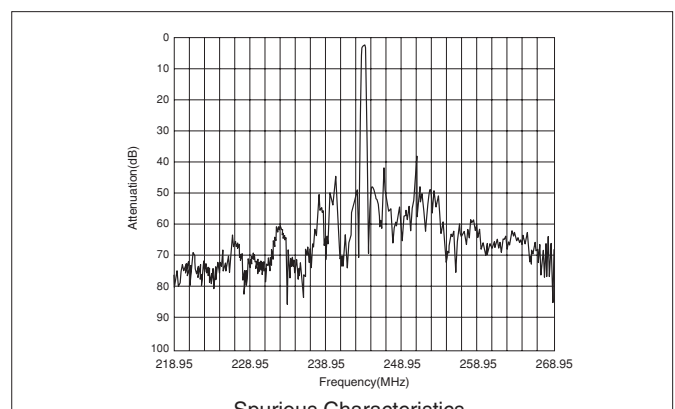
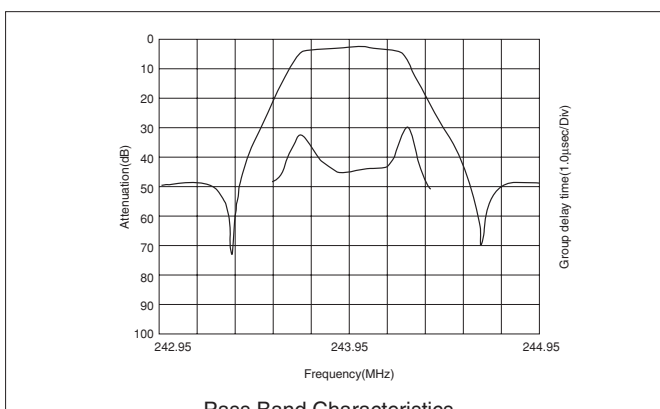


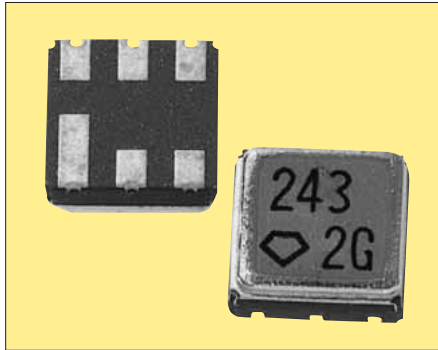
### Packaging

(Unit : mm)



### Characteristics





Pb Free

RoHS Conforming

### Features

- SAW IF filter for PHS.
- Miniature size and light weight.
- Because it is leadless type, automatic mounting is possible.

### Standard Frequencies

- 243.95MHz.
- 248.45MHz.

### How to Order

LSF B 19 - 243 - 220K 0

① ② ③ ④ ⑤ ⑥

- ① LSF..... L<sub>12</sub> B<sub>4</sub> O<sub>7</sub> SAW Filter
- ② B..... Seam weld type
- ③ 19..... Package Number (01, 02.....)
- ④ 243..... Nominal Frequency
- ⑤ 220..... Pass Bandwidth 220kHz
- ⑥ 0..... Sub-Number

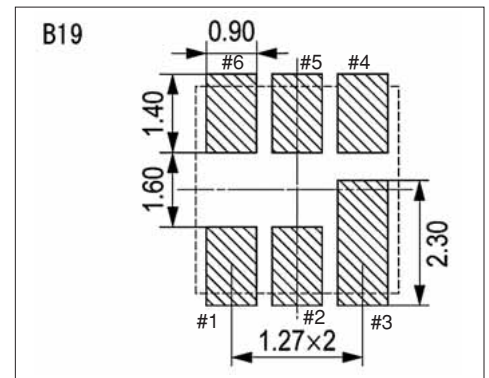
### Specifications

| Item                        | Unit | Conditions   | LSFB19-243-220K0 Specifications | LSFB44-243-220K0 Specifications |
|-----------------------------|------|--------------|---------------------------------|---------------------------------|
| Nominal Frequency           | MHz  | —            | 243.95                          | 248.45                          |
| Operating Temperature Range | °C   | -10~+60      | —                               | —                               |
| Storage Temperature Range   | °C   | -35~+85      | —                               | —                               |
| Insertion Loss              | dB   | Minimum Loss | 2.6 * 5.0 MAX.                  | 2.6 * 5.0 MAX.                  |
| Guaranteed Attenuation      | dB   | Fo±0.6MHz    | -0.6/52 * 25 MIN.<br>+0.6/34 *  | -0.6/55 * 25 MIN.<br>+0.6/36 *  |
|                             |      | Fo±1.2MHz    | -1.2/47 * 40 MIN.<br>+1.2/43 *  | -1.2/55 * 35 MIN.<br>+1.2/43 *  |
|                             |      | Fo-21.6MHz   | 70 * 60 MIN.                    | 65 * 60 MIN.                    |
| Group Delay Deviation       | μsec | Fo±110kHz    | 0.5 * 1.2 MAX.                  | 0.3 * 1.2 MAX.                  |

\* : Typ.

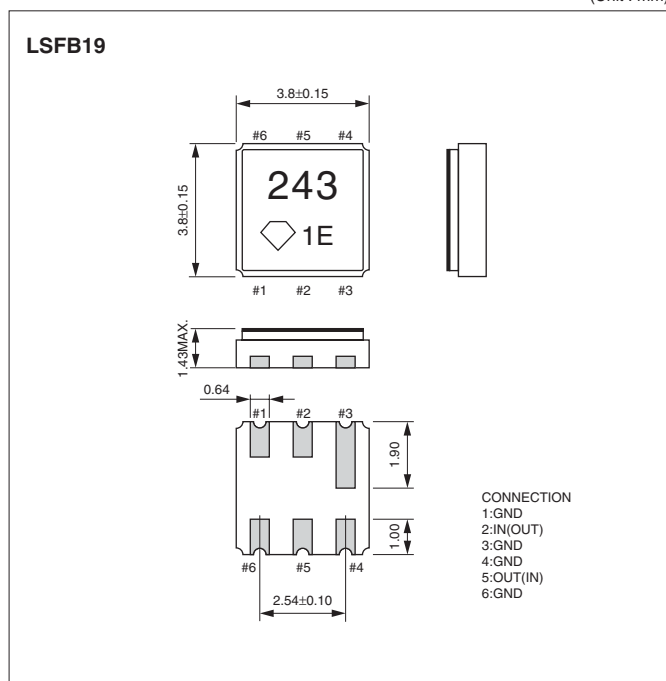
\* : Typ.

### Recommended Land Pattern (Unit : mm)

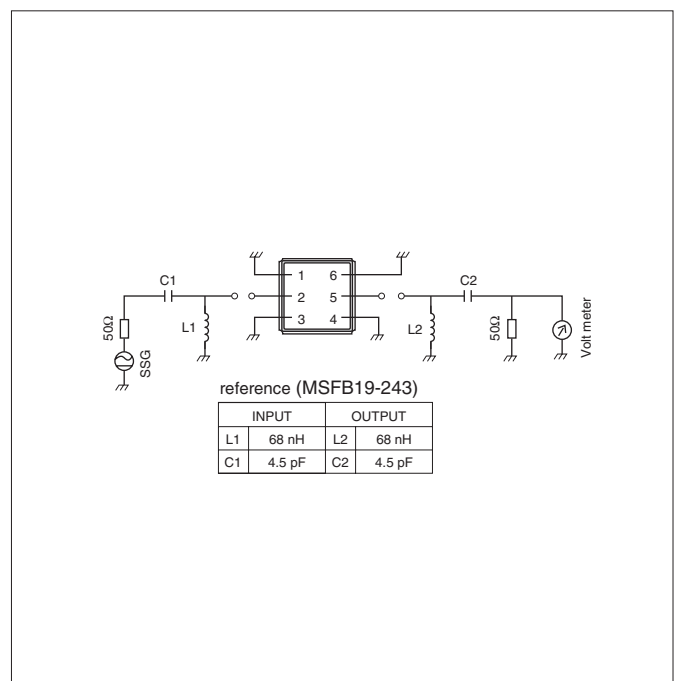


### Dimensions

(Unit : mm)



### Test Circuit





Pb Free

RoHS Conforming

### Features

- Small and low profile
- Ceramic package type
- Flat pass band characteristics
- Low insertion loss
- Circuit simplification

### Application

- PHS

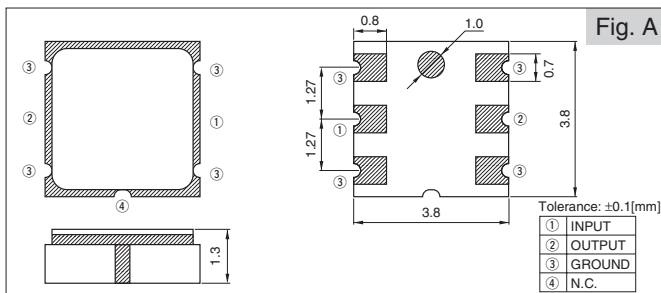
### How to Order

PAFC 243 B  
① ② ③

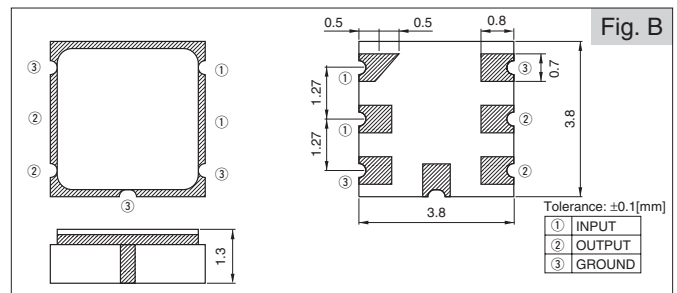
- ① Series  
② Center Frequency  
③ Type

### Dimensions

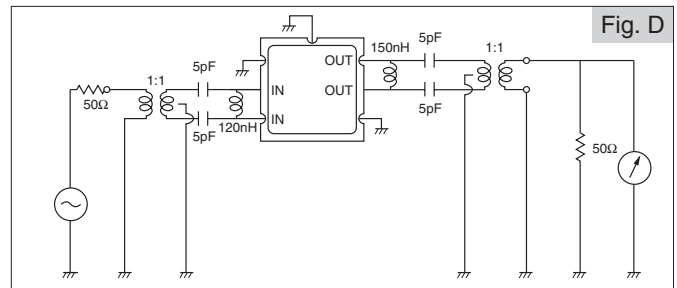
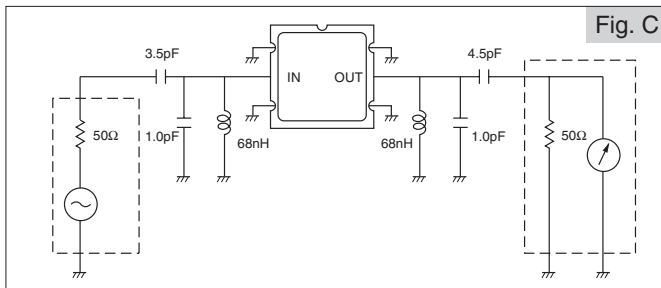
(Unit : mm)



(Unit : mm)



### Test Circuit



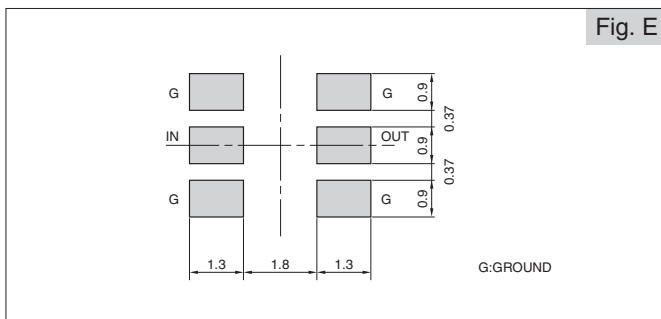
### Specifications

| Parts No. | Nominal Center Frequency (fn) | Insertion Loss | Pass Band Width (at 3dB) | Stop Band Attenuation |           |              | Ripple (fn±110kHz) | Group Delay Time (fn±110kHz) | Operating Temperature | Storage Temperature | Dimensions | Test Circuit | Recommended Land Pattern | Taping Dimensions |
|-----------|-------------------------------|----------------|--------------------------|-----------------------|-----------|--------------|--------------------|------------------------------|-----------------------|---------------------|------------|--------------|--------------------------|-------------------|
|           |                               |                |                          | fn±600kHz             | fn±1.2MHz | fn±fa MHz(±) |                    |                              |                       |                     |            |              |                          |                   |
| PAFC243B  | 243.95MHz                     | 4.0dB max      | ±130kHz min              | 30dB min              | 40dB min  | 60dB min     | 1.5dB max          | 1.2μs max                    | -10 to 60°C           | -20 to 80°C         | Fig. A     | Fig. C       | Fig. E                   | Fig. G            |
| PAFC248C  | 248.45MHz                     | 4.5dB max      | ±130kHz min              | 30dB min              | 35dB min  | 60dB min     | 1.5dB max          | 1.2μs max                    |                       |                     | Fig. B     | Fig. D       | Fig. F                   | Fig. G            |

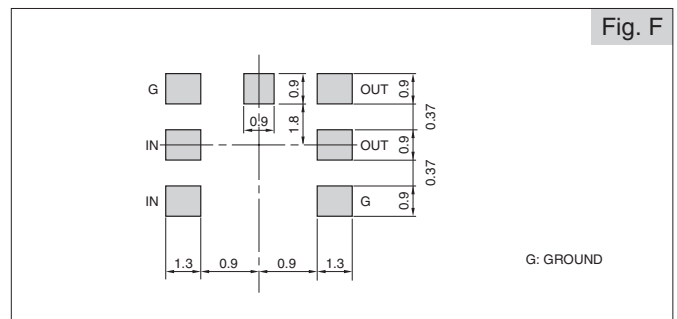
\* Note PAFC248C : fa=21.5MHz  
PAFC243B : fa=21.6MHz

### Recommended Land Pattern

(Unit : mm)



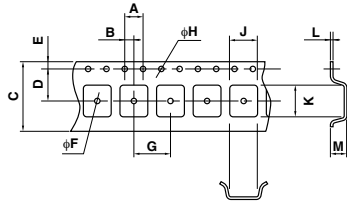
(Unit : mm)



## Taping Dimensions

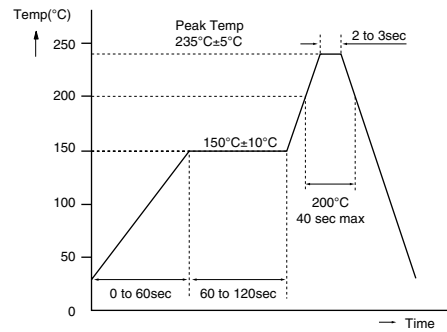
(Unit : mm)

Fig. G



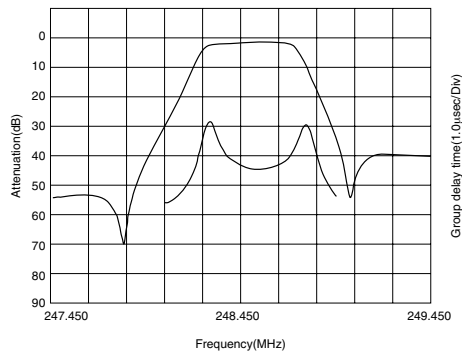
| Code      | A   | B   | C    | D   | E    | F    | G   | H    | J   | K   | L   | M    |
|-----------|-----|-----|------|-----|------|------|-----|------|-----|-----|-----|------|
| Dimension | 4.0 | 2.0 | 12.0 | 5.5 | 1.75 | 1.55 | 8.0 | 1.55 | 4.3 | 4.3 | 0.3 | 2.05 |

## Recommended Temperature Profile IR Reflow

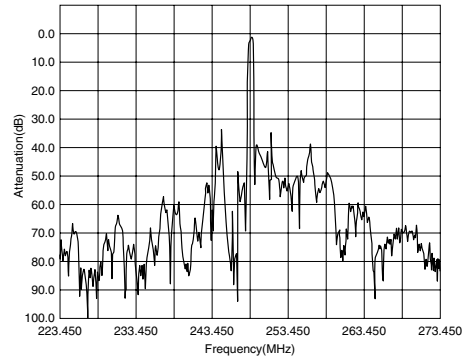


## Characteristics

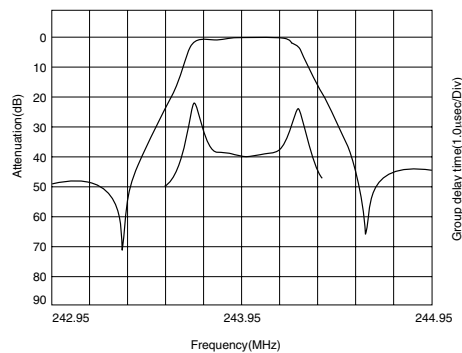
### PAFC248C(Pass Band Characteristics)



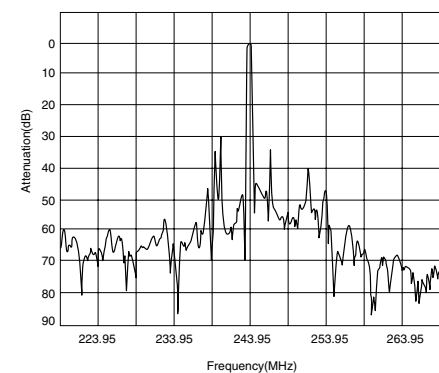
### PAFC248C(Spurious Characteristics)



### PAFC243B(Pass Band Characteristics)



### PAFC243B(Spurious Characteristics)





Pb Free

RoHS Conforming

#### Features

- SAW IF filter for PHS.
- Miniature size and light weight.
- Because it is leadless type, automatic mounting is possible.

#### Standard Frequencies

- 243.95MHz.
- 248.45MHz.

#### How to Order

LSF B 44 - 243 - 220K 0  
① ② ③ ④ ⑤ ⑥

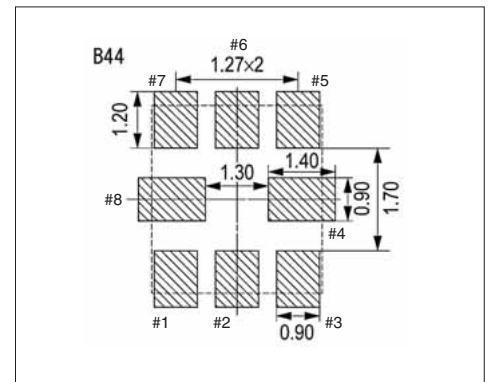
- ① LSF..... Li<sub>2</sub> B<sub>4</sub> O<sub>7</sub> SAW Filter
- ② B..... Seam weld type
- ③ 44..... Package Number (01, 02.....)
- ④ 243..... Nominal Frequency
- ⑤ 220..... Pass Bandwidth 220kHz
- ⑥ 0..... Sub-Number

#### Specifications

| Item                        | Unit | Conditions   | LSFB44-243-220K0 Specifications |          |
|-----------------------------|------|--------------|---------------------------------|----------|
| Nominal Frequency           | MHz  | —            | 243.95                          |          |
| Operating Temperature Range | °C   | -10~+60      | —                               |          |
| Storage Temperature Range   | °C   | -35~+85      | —                               |          |
| Insertion Loss              | dB   | Minimum Loss | 2.7 *                           | 5.0 MAX. |
| Guaranteed Attenuation      | dB   | Fo±0.6MHz    | -0.6/40 *                       | 25 MIN.  |
|                             |      |              | +0.6/35 *                       |          |
|                             |      | Fo±1.2MHz    | -1.2/45 *                       | 40 MIN.  |
|                             |      |              | +1.2/42 *                       |          |
| Group Delay Deviation       | μsec | Fo-21.6MHz   | 70 *                            | 60 MIN.  |
|                             |      | Fo±110kHz    | 0.4 *                           | 1.2 MAX. |

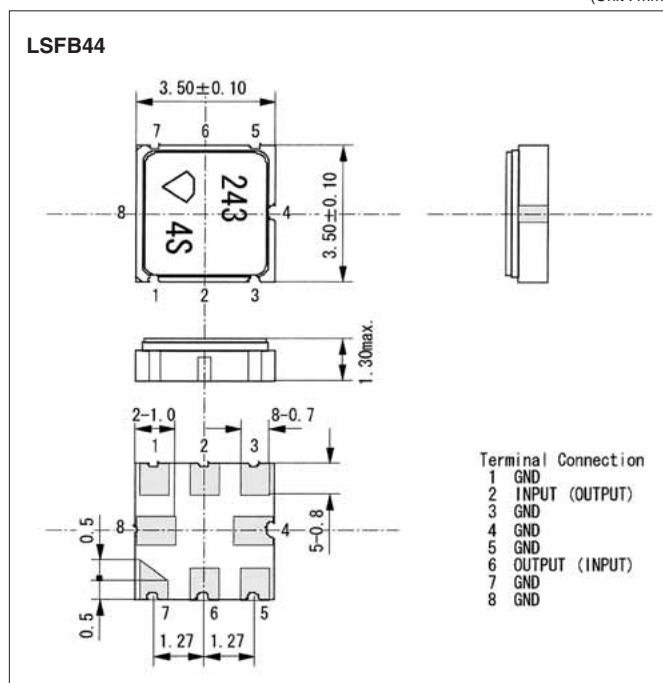
\* : Typ.

#### Recommended Land Pattern (Unit : mm)

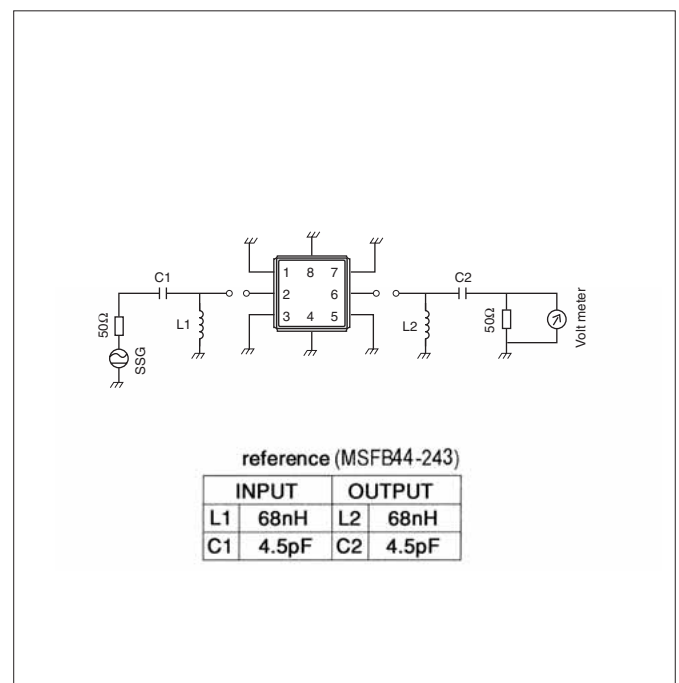


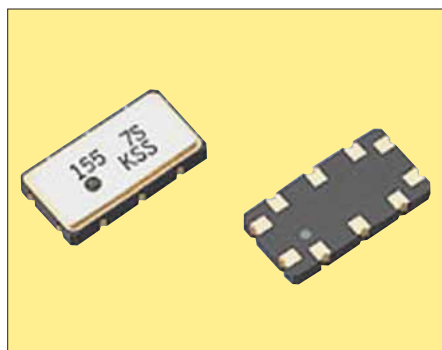
#### Dimensions

(Unit : mm)



#### Test Circuit





**Pb Free**

**RoHS Conforming**

## Features

- For Fiber Optic Communications.
  - Miniature size and light weight.
  - Because it is leadless type, automatic mounting is possible.
- \* Synchronous Transfer Mode.

### Standard Frequencies

- 155.520MHz, 622.080MHz.

## How to Order

MSF B 22 - 622 - 622K 0

① ② ③      ④      ⑤ ⑥

- ①MSF..... Monolithic SAW Filter  
(Quartz Crystal)
- ②B..... Seam weld type
- ③22..... Package Number (01, 02.....)
- ④622..... Nominal Frequency
- ⑤622..... Pass Bandwidth 622kHz
- ⑥0..... Sub-Number

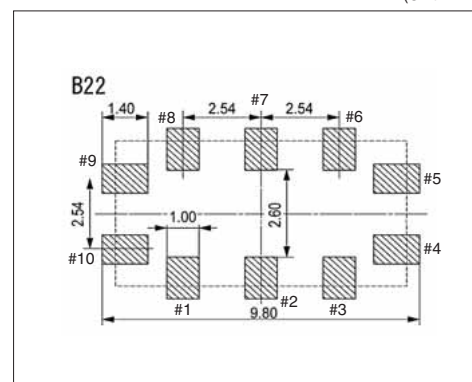
## Specifications

| Type                        |      | MSFB22-155-155K0     |                | MSFB22-622-622K0     |                |
|-----------------------------|------|----------------------|----------------|----------------------|----------------|
| Item                        | Unit | Conditions           | Specifications | Conditions           | Specifications |
| Nominal Frequency           | MHz  |                      | 155.52         |                      | 622.08         |
| Operating Temperature Range | °C   | -20~+75              |                | -20~+75              |                |
| Storage Temperature Range   | °C   | -40~+85              |                | -40~+85              |                |
| Q Value                     |      | 600 < Q < 1000 910 * |                | 600 < Q < 1000 830 * |                |
| Insertion Loss              | dB   | Minimum Loss         | 8 MAX. *       | Minimum Loss         | 7.2 MAX. *     |
| Guaranteed Attenuation      | dB   | DC~152MHz            | 30 MIN.        | DC~606MHz            | 30 MIN.        |
|                             |      | 159~312MHz           | 30 MIN.        | 699~1245MHz          | 25 MIN.        |
| Terminating Impedance       | Ω    |                      | 50             |                      | 50             |

\* : Typ.

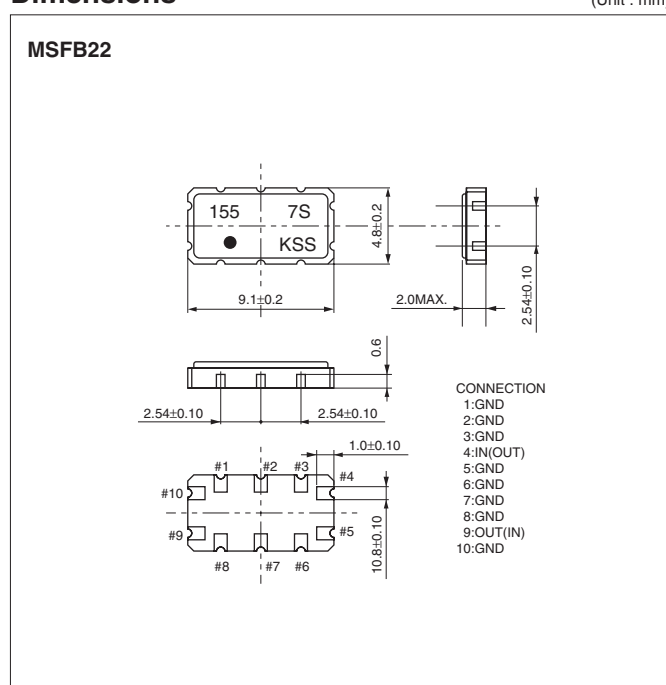
\* : Typ.

### Recommended Land Pattern (Unit : mm)

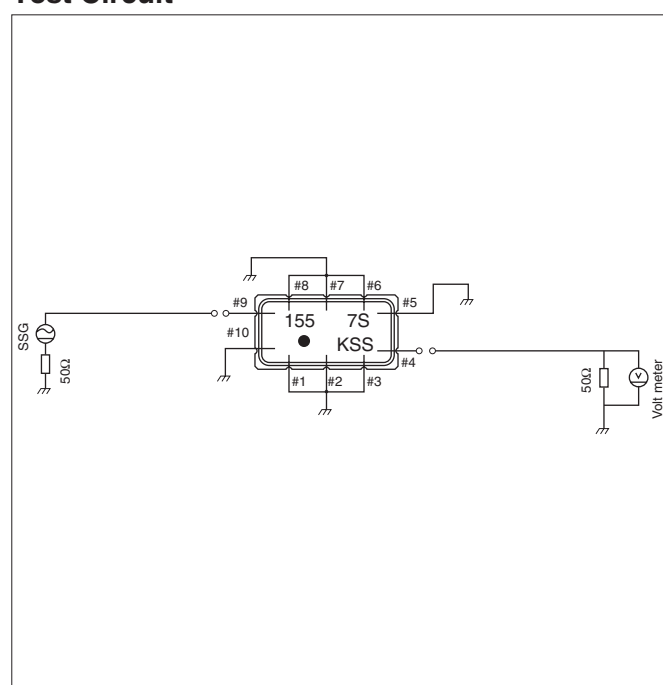


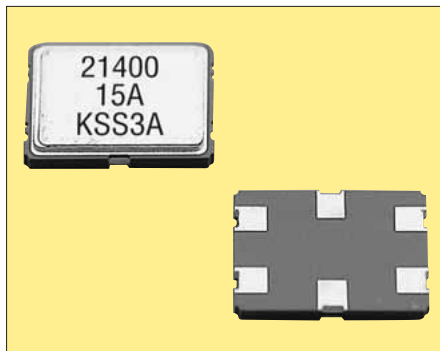
## Dimensions

(Unit : mm)



## Test Circuit





Ph Free

RoHS Conforming

## Features

- Compact and low profile.(Height=1.3mm)
- Excellent vibration resistance and shock resistance.
- Designed for automatic mounting and reflow soldering.

## Applications

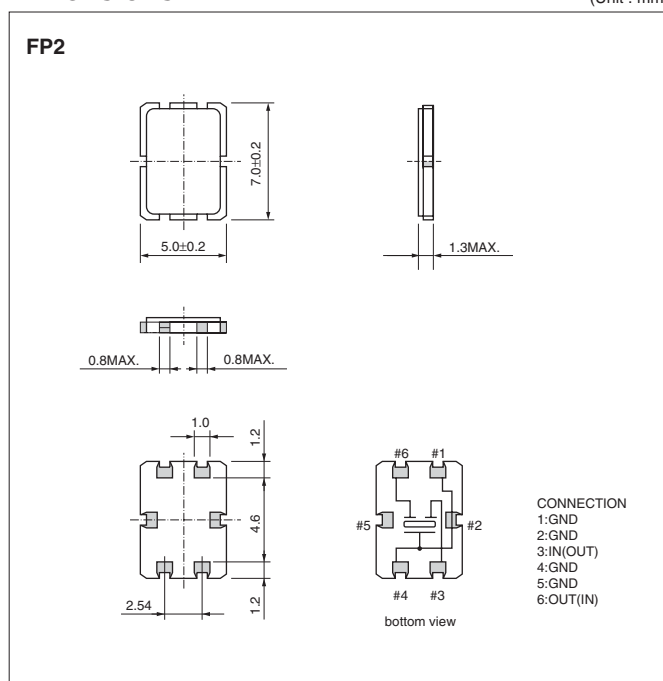
- Mobile communication

## Specifications

| Type            | Number of inner units | Pass Bandwidth |           | Ripple | Insertion Loss | Stop Bandwidth |            | Terminating Impedance | Operating Temp.Range |
|-----------------|-----------------------|----------------|-----------|--------|----------------|----------------|------------|-----------------------|----------------------|
|                 |                       | dB             | kHz MIN   | dB MAX | dB MAX         | dB             | kHz MAX    | $\Omega$ /pF          | °C                   |
| MXF21.4-15A-FP2 | 1                     | 3              | $\pm 7.5$ | 0.5    | 1.5            | 18             | $\pm 25$   | 1.5k/2.5              | -20~+70              |
| MXF21.7-8A-FP2  | 1                     | 3              | $\pm 3.5$ | 1      | 2              | 16             | $\pm 12.5$ | 1.5k/6                | -20~+70              |
| MXF45-15AF-FP2  | 1                     | 3              | $\pm 7.5$ | 1      | 2.5            | 14             | $\pm 25$   | 550/3                 | -20~+70              |
| MXF45-30AF-FP2  | 1                     | 3              | $\pm 15$  | 1      | 2              | 15             | $\pm 50$   | 1.2k/1.5              | -20~+70              |
| MXF55-26AF-FP2  | 1                     | 3              | $\pm 13$  | 1      | 3              | 27             | $\pm 100$  | 750/2.7               | -20~+70              |

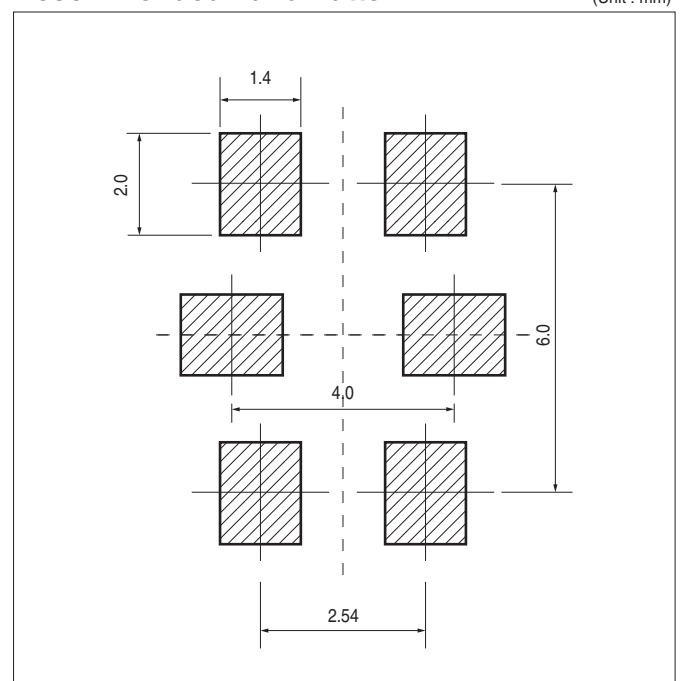
## Dimensions

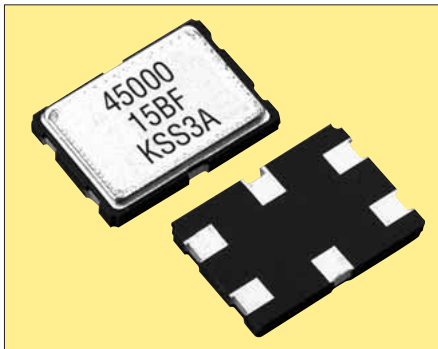
(Unit : mm)



## Recommended Land Pattern

(Unit : mm)





Pb Free

RoHS Conforming

## Features

- Compact size.(7x5x1.3mm, 4pole)
- Excellent vibration resistance and shock resistance.
- Designed for automatic mounting and reflow soldering.

## Applications

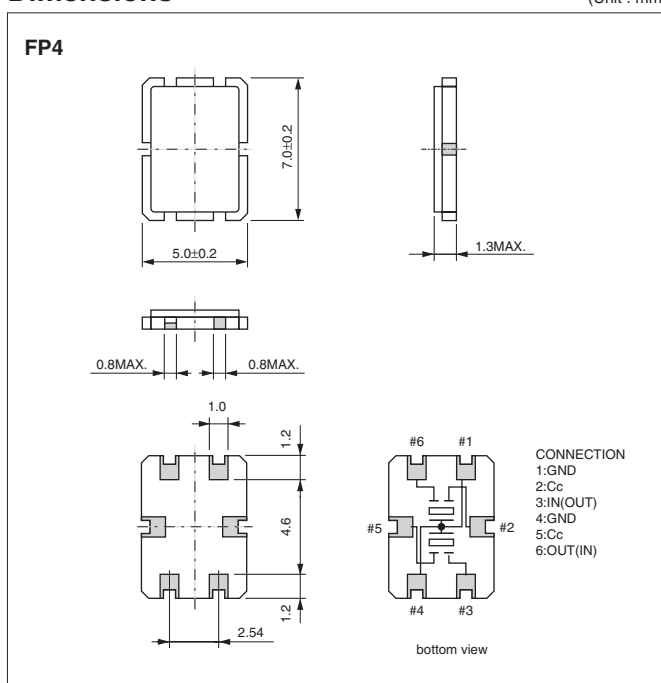
- Mobile communication

## Specifications

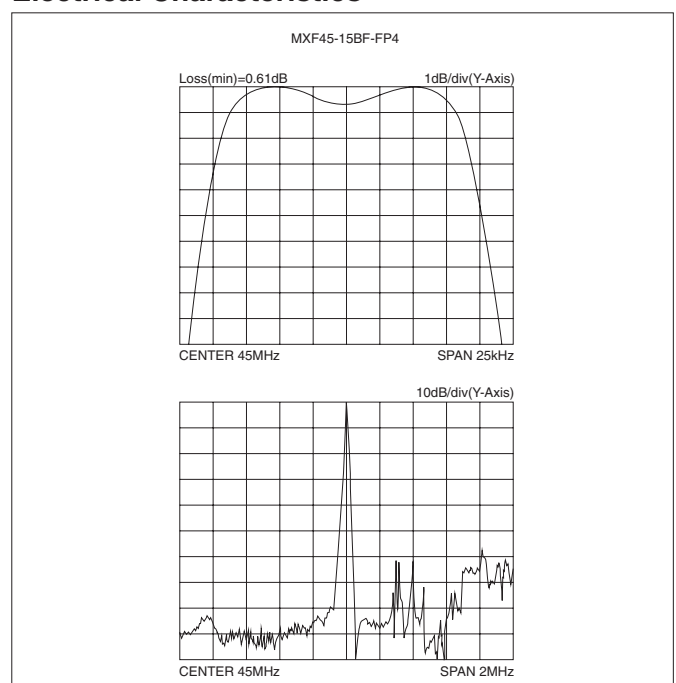
| Type            | Number of inner units | Pass Bandwidth |            | Ripple | Insertion Loss | Stop Bandwidth |          | Terminating Impedance | Operating Temp.Range |
|-----------------|-----------------------|----------------|------------|--------|----------------|----------------|----------|-----------------------|----------------------|
|                 |                       | dB             | kHz MIN    | dB MAX | dB MAX         | dB             | kHz MAX  | $\Omega$ //pF         | °C                   |
| MXF45-7.5BF-FP4 | 1                     | 3              | $\pm 3.75$ | 1      | 4              | 30             | $\pm 15$ | 500//4.5<br>Cc(13pF)  | -20~+70              |
| MXF45-15BF-FP4  | 1                     | 3              | $\pm 7.5$  | 1.5    | 2              | 30             | $\pm 25$ | 600//2.3<br>Cc(7.5pF) | -20~+70              |
| MXF45-30BF-FP4  | 1                     | 3              | $\pm 15$   | 1      | 3              | 30             | $\pm 40$ | 1.2k//1<br>Cc(2.5pF)  | -20~+70              |

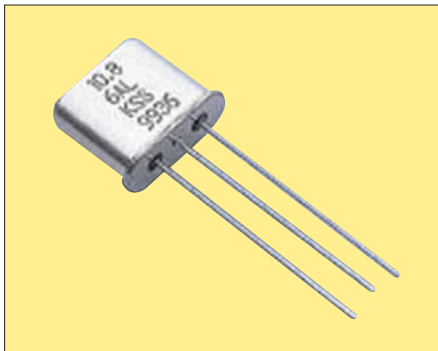
## Dimensions

(Unit : mm)



## Electrical Characteristics





## Features

- Compact and light weight.
- Excellent vibration resistance and shock resistance.
- Stable temperature characteristics.

## Applications

- Car audio

\*Pb Free and RoHS conformance planned on Jan. 2005.

## Specifications

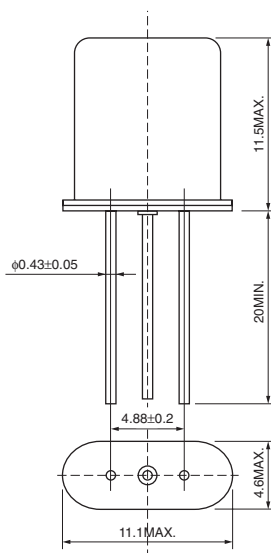
| Type          | Number of inner units | Pass Bandwidth |                   | Ripple | Insertion Loss | Stop Bandwidth |          | Terminating Impedance | Operating Temp.Range | Outline |
|---------------|-----------------------|----------------|-------------------|--------|----------------|----------------|----------|-----------------------|----------------------|---------|
|               |                       | dB             | kHz               | dB MAX | dB MAX         | dB             | kHz MAX  | $\Omega/\mu\text{F}$  | $^{\circ}\text{C}$   |         |
| MXF10.7-6A    | 1                     | 3              | $\pm(2.5\sim3.5)$ | 1      | 1.5            | 30             | 55       | 1.5k//3               | $-40\sim+85$         | Fig.1   |
| MXF10.7-6AL   | 1                     | 3              | $\pm(2.5\sim3.5)$ | 1      | 3              | 30             | 55       | 1.5k//3               | $-40\sim+85$         | Fig.2   |
| MXF10.7-7.5A  | 1                     | 3              | $\pm 3.75$ MIN    | 0.5    | 1.5            | 20             | $\pm 18$ | 1.8k//5               | $-40\sim+85$         | Fig.1   |
| MXF10.7-7.5AL | 1                     | 3              | $\pm 3.75$ MIN    | 0.5    | 3              | 20             | $\pm 18$ | 1.8k//5               | $-40\sim+85$         | Fig.2   |
| MXF10.8-6A    | 1                     | 3              | $\pm(2.5\sim3.5)$ | 1      | 1.5            | 30             | 55       | 1.5k//3               | $-40\sim+85$         | Fig.1   |
| MXF10.8-6AL   | 1                     | 3              | $\pm(2.5\sim3.5)$ | 1      | 3              | 30             | 55       | 1.5k//3               | $-40\sim+85$         | Fig.2   |
| MXF10.8-16AL  | 1                     | 3              | $\pm(7.5\sim8.5)$ | 1      | 3              | 20             | 55       | 2.2k//2.5             | $-40\sim+85$         | Fig.2   |

## Dimensions

(Unit : mm)

Fig. 1

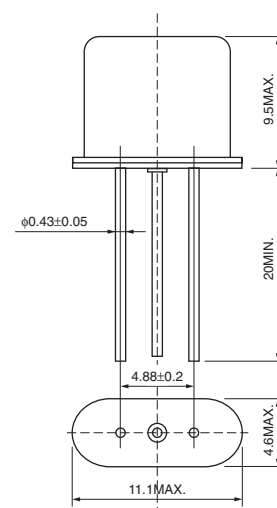
49/U-11



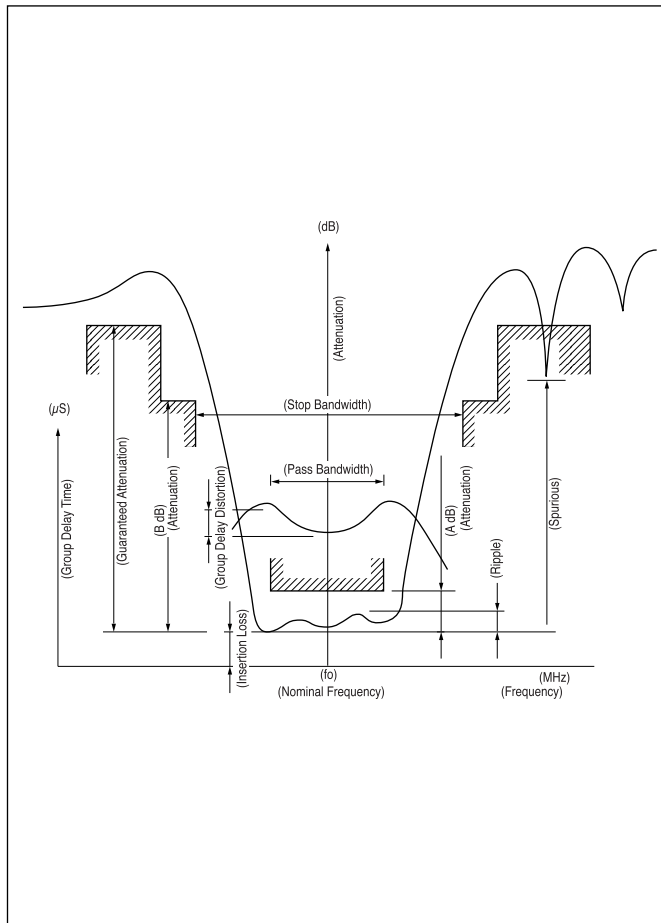
(Unit : mm)

Fig. 2

49/U-9



## Characteristic diagram and terms of crystal filters

**■Nominal Frequency**

This is the nominal value of the center frequency ( $f_0$ ) and is used as the reference frequency of related standards.

**■Pass Bandwidth**

This is the frequency interval in which the relative attenuation (the attenuation from the minimum insertion loss) is equal to the specified value "A dB" (Usually 3dB).

**■Insertion Loss**

This is the difference of attenuation when a filter is and isn't inserted. The minimum insertion loss is the minimum value of insertion loss and becomes as the reference level of attenuation characteristics specification. The constant loss is the insertion loss at the nominal frequency.

**■Ripple**

This is the maximum value of the difference between the peak value of attenuation in the pass band and the minimum insertion loss.

**■Stop Bandwidth**

This is the frequency interval in which the relative attenuation is equal to the specified value "B dB".

**■Guaranteed Attenuation**

This is the relative attenuation guaranteed in the specified range within attenuation band scope.

**■Spurious Response**

This is the value of relative attenuation generated by the secondary vibration in the specified range within attenuation band scope.

**■Group Delay Time**

This is the difference between the maximum and the minimum value of the group delay in the specified range of the pass band.

**■Terminating Impedance**

This is the impedance value terminated to the input and the output side of filter and is indicated by the resistance portion and the parallel capacity portion including the floating capacity.

## ORDERING FORMAT for CRYSTAL FILTERS

Please specify the following items when ordering crystal filters.

**I. Standard product in catalog Indicate type name.**

for example : MXF10.7-6A

**II. Indicate following items in specification if you order special type.****1. Electrical Characteristics**

- |                           |                                     |
|---------------------------|-------------------------------------|
| (1)Nominal Frequency      | _____MHz                            |
| (2)Pass Bandwidth         | at _____dB $\pm$ _____kHz MIN.      |
| (3)Stop Bandwidth         | at _____dB $\pm$ _____kHz MAX.      |
| (4)Guaranteed Attenuation | _____dB MINn. ( $f_0 \pm$ _____kHz) |
| (5)Spurious Response      | _____dB MIN.                        |
| (6)Ripple                 | _____dB MAX.                        |
| (7)Insertion Loss         | _____dB MAX.                        |
| (8)Terminating Impedance  | _____Ω//_____pF                     |

**2. Environmental Condition**

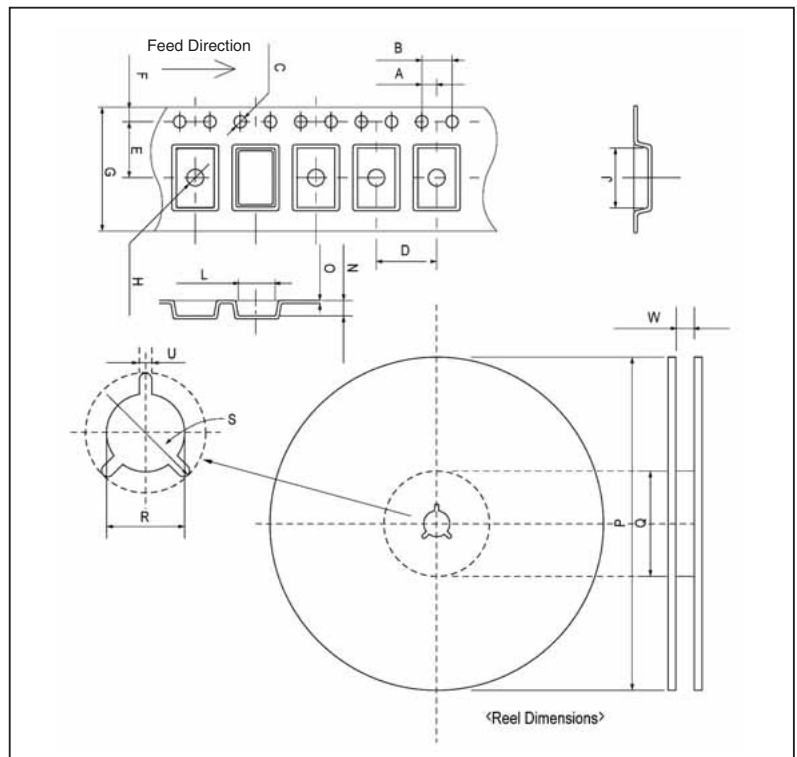
- (1)Operating Temperature Range \_\_\_\_\_°C ~ \_\_\_\_\_°C

**3. Dimensions****4. Application**

## Tape & Reel Specifications

### SAW FILTERS / MCFs

| SAW FILTERS |   |           |              |              |
|-------------|---|-----------|--------------|--------------|
|             |   | SF16      | SF25         | SF30         |
| T A P E     | A | 2.0±0.05  | 2.0±0.05     | 2.0±0.05     |
|             | B | 4.0±0.1   | 4.0±0.1      | 4.0±0.1      |
|             | C | φ1.5±0.1  | φ1.55±0.1/-0 | φ1.55±0.1/-0 |
|             | D | 4.0±0.1   | 4.0±0.1      | 8.0±0.1      |
|             | E | 3.5±0.05  | 5.5±0.05     | 5.5±0.05     |
|             | F | 1.75±0.1  | 1.75±0.1     | 1.75±0.1     |
|             | G | 8.0±0.2   | 12.0±0.2     | 12.0±0.2     |
|             | H | φ1.1±0.1  | φ1.1±0.1     | φ1.55±0.1    |
|             | J | 1.9±0.1   | 2.9±0.1      | 3.3±0.1      |
|             | L | 1.85±0.1  | 2.4±0.1      | 3.3±0.1      |
|             | N | 0.95±0.1  | 1.2±0.1      | 1.85±0.1     |
| R E E L     | O | 0.25±0.05 | 0.3±0.05     | 0.3±0.05     |
|             | P | φ178±2    | φ330±2       | φ330±2       |
|             | Q | φ80±2     | φ100±2       | φ100±2       |
|             | R | φ13±0.2   | φ13±0.2      | φ13±0.2      |
|             | S | φ21±0.8   | φ21±0.8      | φ21±0.8      |
|             | U | 2±0.5     | 2±0.5        | 2±0.5        |
| Qty         |   | 3000      | 3000         | 3000         |



| SAW FILTERS |   |            |             |             |              |            |            |            |            | MCF        |
|-------------|---|------------|-------------|-------------|--------------|------------|------------|------------|------------|------------|
|             |   | PAFA       | PAFC243B    | PAFC433.92A | B54          | B22<br>B43 | B19<br>B25 | C12<br>C30 | B44        | FP2<br>FP4 |
| T A P E     | A | 2.0±0.05   | 2.0±0.05    | 2.0±0.05    | 2.0±0.10     | 2.0±0.10   | 2.0±0.05   | 2.0±0.10   | 2.0±0.10   | 2.0±0.1    |
|             | B | 4.0±0.1    | 4.0±0.1     | 4.0±0.1     | 4.0±0.1      | 4.0±0.1    | 4.0±0.1    | 4.0±0.1    | 4.0±0.1    | 4.0±0.1    |
|             | C | φ1.55±0.05 | φ1.5±0.1/-0 | φ1.5±0.1/-0 | φ1.55±0.05   | φ1.55±0.05 | φ1.55±0.05 | φ1.55±0.05 | φ1.55±0.05 | φ1.55±0.05 |
|             | D | 8.0±0.1    | 8.0±0.1     | 8.0±0.1     | 8.0±0.1      | 8.0±0.1    | 8.0±0.1    | 8.0±0.1    | 8.0±0.1    | 8.0±0.1    |
|             | E | 5.5±0.05   | 5.5±0.05    | 5.5±0.05    | 5.5±0.1      | 7.5±0.1    | 5.5±0.05   | 7.5±0.1    | 5.5±0.05   | 7.5±0.1    |
|             | F | 1.75±0.1   | 1.75±0.1    | 1.75±0.1    | 1.75±0.1     | 1.75±0.1   | 1.75±0.1   | 1.75±0.1   | 1.75±0.1   | 1.75±0.1   |
|             | G | 12.0±0.2   | 12.0±0.2    | 12.0±0.3    | 12.0±0.3     | 16.0±0.3   | 12.0±0.15  | 16.0±0.3   | 12.0±0.2   | 16.0±0.3   |
|             | H | φ1.55±0.05 | φ1.55±0.1   | φ1.55±0.1   | φ1.5±0.05/-0 | φ1.55±0.05 | φ1.55±0.05 | φ1.55±0.05 | φ1.55±0.05 | φ1.55±0.05 |
|             | J | 3.3±0.1    | 4.3±0.1     | 5.3±0.1     | 5.25±0.1     | 9.4±0.1    | 4.2±0.1    | 7.6±0.1    | 3.95±0.2   | 7.5±0.1    |
|             | L | 3.3±0.1    | 4.3±0.1     | 5.3±0.1     | 3.45±0.1     | 5.1±0.1    | 4.2±0.1    | 5.6±0.1    | 3.95±0.2   | 5.5±0.1    |
|             | N | 1.85±0.1   | 2.05±0.1    | 2.1±0.1     | 1.5±0.1/-0   | 2.0±0.1    | 1.8±0.1    | 1.94±0.1   | 1.35±0.1   | 1.8±0.1    |
| R E E L     | O | 0.3±0.05   | 0.3±0.05    | 0.3±0.05    | 0.3±0.1      | 0.3±0.05   | 0.3±0.05   | 0.3±0.05   | 0.2±0.05   | 0.3±0.05   |
|             | P | φ255±2     | φ255±2      | φ255±2      | φ330±1       | φ330±1     | φ178±2     | φ330±1     | φ178±2     | φ178±2     |
|             | Q | φ100±2     | φ80±2       | φ80±2       | φ100±1       | φ100±1     | φ80±1      | φ100±1     | φ80±1      | φ80±2      |
|             | R | φ13±0.2    | φ13±0.2     | φ13±0.2     | φ13±0.3      | φ13±0.3    | φ13±0.5    | φ13±0.3    | φ13±0.5    | φ13±0.5    |
|             | S | φ21±0.8    | φ21±0.8     | φ21±0.8     | φ21±0.5      | φ21±0.5    | φ21±0.5    | φ21±0.5    | φ21±0.5    | φ21±0.8    |
|             | U | 2±0.5      | 2±0.5       | 2±0.5       | 2±0.5        | 2±0.5      | 2±0.5      | 2±0.5      | 2±0.5      | 2±0.5      |
| Qty         |   | 2000       | 2000        | 2000        | 3000         | 3000       | 1000       | 3000       | 1000       | 1000       |

THE NEW VALUE FRONTIER



# RF Modules

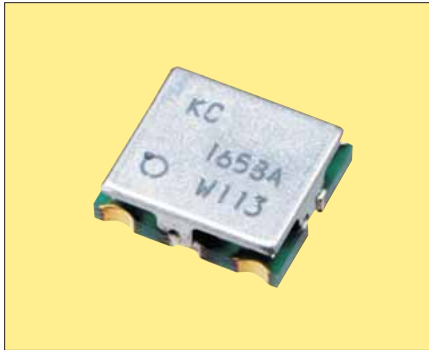
---

**Voltage Controlled Oscillators (VCO)**

**Antenna Switch Modules**

**Bluetooth™ RF Modules**





### Features

- Small and Low Profile
- Application for AMPS(CDMA), PCS, PHS (Japan, China)

### How to Order

YK S1 M N A 1668 ☐  
 ① ② ③ ④ ⑤ ⑥ ⑦

① Series

② Type

**S1** 5.5×4.8mm

③ Output

**M** 1

④ Oscillating Mode

**N** Normal

⑤ Combination of Control Voltage and Band Selector Terminals

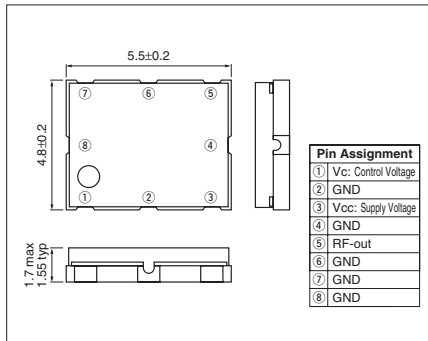
**A** Normal **G** With PS Terminal

⑥ Frequency(MHz)

⑦ Custom Specification

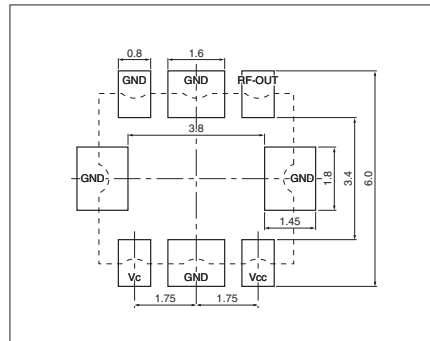
### Dimensions

(Unit : mm)

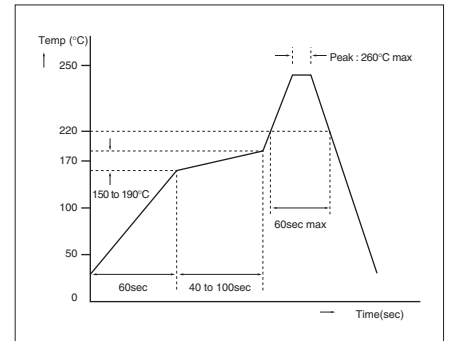


### Recommended Land Pattern

(Unit : mm)



### Recommended Reflow Profile



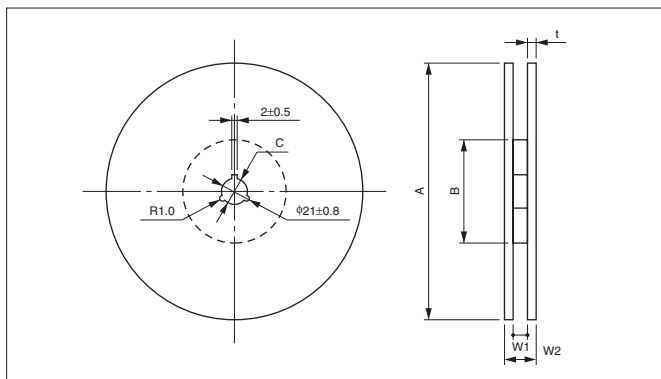
### Specifications

| Part No.    | System | Function | Frequency (MHz)  | V <sub>cc</sub> (V) | I <sub>cc</sub> (mA) | P <sub>o</sub> (dBm) | f <sub>TU</sub> (MHz/V) | C/N(dBC/Hz) |
|-------------|--------|----------|------------------|---------------------|----------------------|----------------------|-------------------------|-------------|
| YKS1MNA1668 | PHS    | RF       | 1649.7 to 1686.3 | 3.0±0.06            | ≤6.5                 | ≥-7                  | 39±8                    | ≥125@600kHz |
| YKS1MNG1752 | cdma   | RF       | 1715 to 1788     | 2.8±0.2             | ≤10                  | -3±3                 | 48±10                   | ≥108@30kHz  |

V<sub>cc</sub> : Power supply I<sub>cc</sub> : Current consumption P<sub>o</sub> : Output level f<sub>TU</sub> : Tuning voltage sensitivity

### Tape & Reel Dimensions

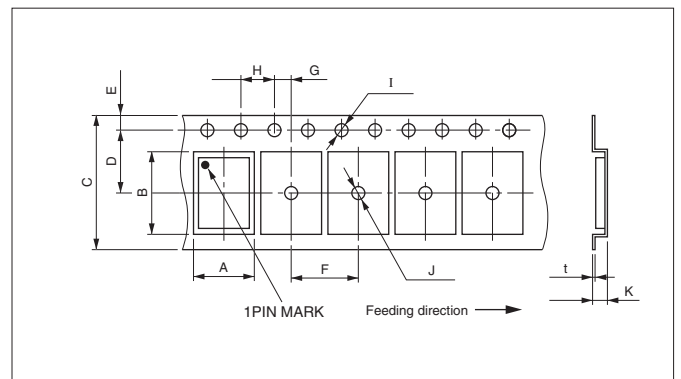
(Unit : mm)



|      | A    | B    | C  | W1   | W2   |
|------|------|------|----|------|------|
| YKS1 | φ330 | φ100 | 13 | 13.5 | 18.5 |

### Taping

(Unit : mm)



|      | A   | B   | C    | D   | E    | F   | G   | H   | I     | J     | K   | t   |
|------|-----|-----|------|-----|------|-----|-----|-----|-------|-------|-----|-----|
| YKS1 | 5.3 | 6.0 | 12.0 | 5.5 | 1.75 | 8.0 | 2.0 | 4.0 | φ1.55 | φ1.55 | 1.8 | 0.3 |

### Packaging Quantity

| Part number | Packaging quantity(pcs/reel) |
|-------------|------------------------------|
| YKS1        | 4,000                        |



Pb Free

RoHS Conforming

### Features

- Small Size
- Low Loss
- Built-in 2LPF for Receiver

### Applications

- GSM900/DCS
- GSM850/PCS
- GSM900/PCS

### How to Order

LM - D 5 18 S2 - 2 □  
① ② ③ ④ ⑤ ⑥

① Series

② Circuit

**D** Dual

③ Type

④ Height

**18** 1.8mm max

⑤ S2: GSM900/DCS

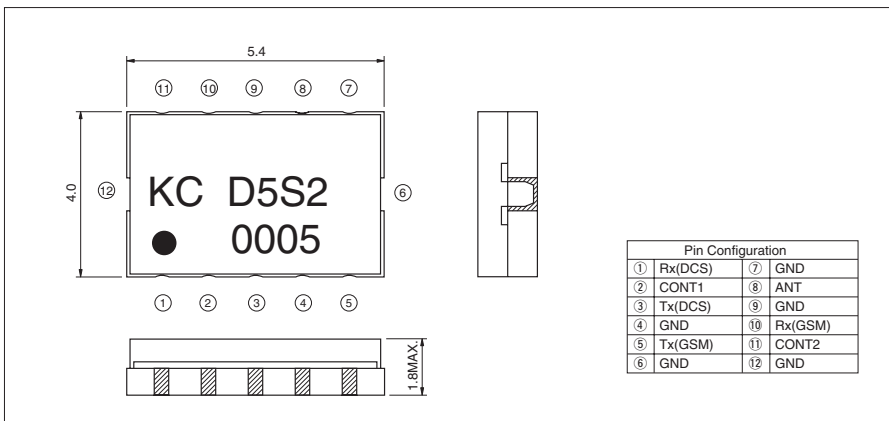
S4: GSM850/PCS

S6: GSM900/PCS

⑥ Custom Specification

### Dimensions

(Unit : mm)



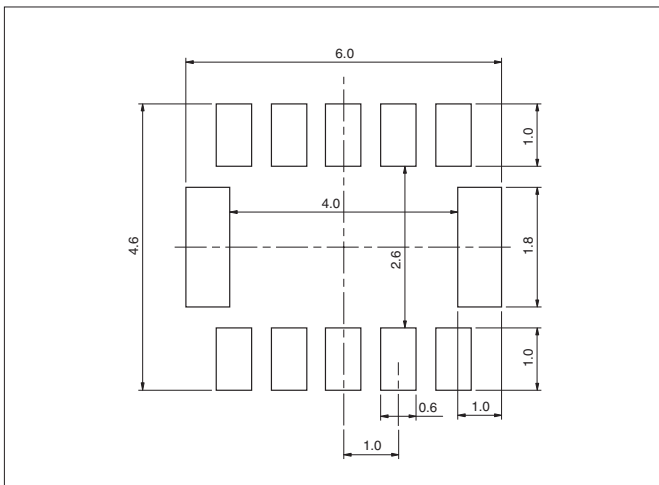
### Specifications

(at 25°C)

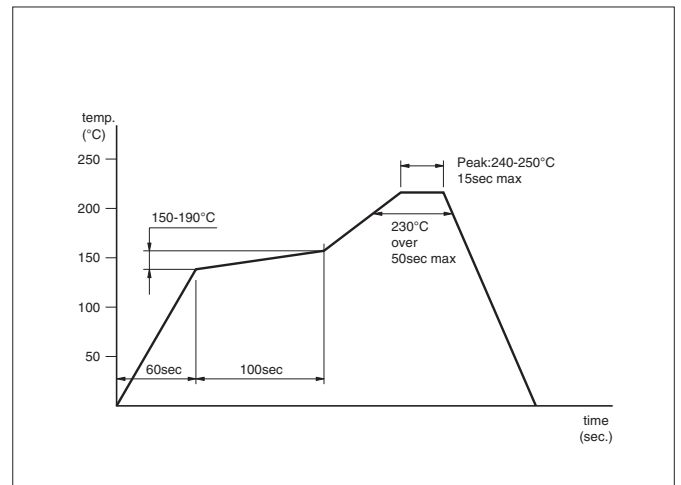
| Part No.    | GSM         |                |                       |             |                | DCS          |                |                       |              |                |
|-------------|-------------|----------------|-----------------------|-------------|----------------|--------------|----------------|-----------------------|--------------|----------------|
|             | TX          |                |                       | RX          |                | TX           |                |                       | RX           |                |
|             | Freq. (MHz) | Ins. Loss (dB) | Att.(2*f0, 3*f0) (dB) | Freq. (MHz) | Ins. Loss (dB) | Freq. (MHz)  | Ins. Loss (dB) | Att.(2*f0, 3*f0) (dB) | Freq. (MHz)  | Ins. Loss (dB) |
| LM-D518S2-2 | 880 to 915  | ≤1.1           | ≥30                   | 925 to 960  | ≤1.0           | 1710 to 1785 | ≤1.3           | ≥25                   | 1805 to 1880 | ≤1.2           |

### Recommended Land Pattern

(Unit : mm)



### Recommended Reflow Profile





Pb Free

RoHS Conforming

### Features

- Built-in ESD Protection Circuit
- Built-in 2Coupling Capacitors and bias circuit to drive the switch
- Built-in 2LPF for Receiver
- Small and Low profile

### Applications

- GSM/DCS/PCS

### How to Order

LM - T 1 18 SQ E 2 □  
① ② ③ ④ ⑤ ⑥ ⑦

① Series

② Circuit

T Triple

③ Type

④ Height

18 1.8mm max

⑥ ESD Function

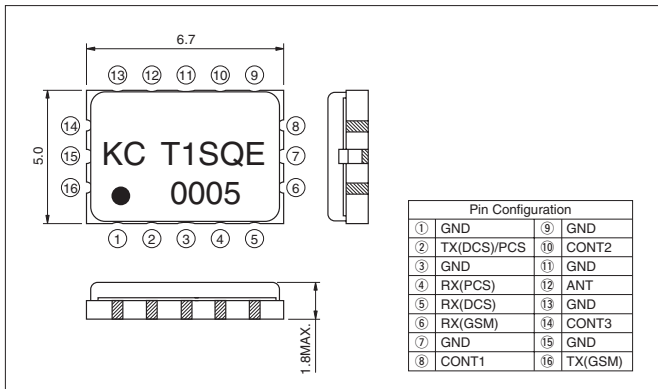
ESD Protection

E YES

⑤, ⑦ Custom Specification

### Dimensions

(Unit : mm)



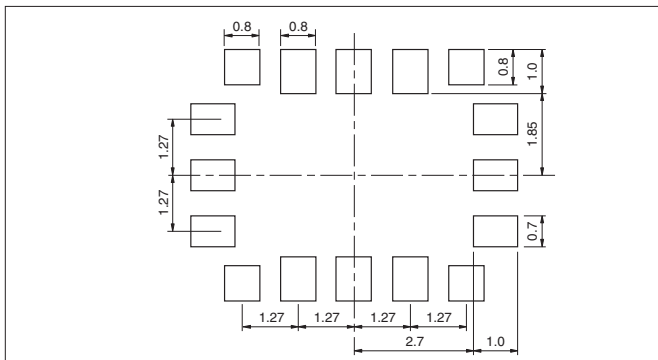
### Specifications

(at 25°C)

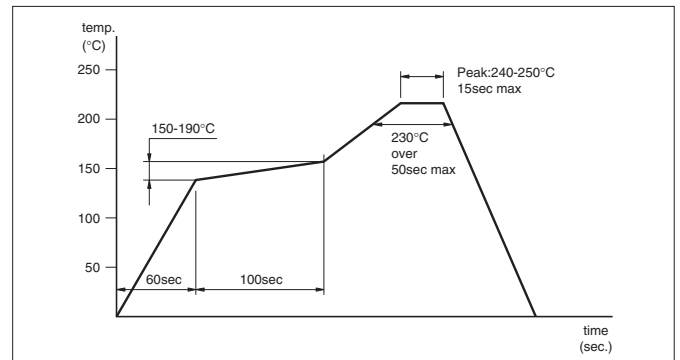
| Part No.    | GSM         |                |                       |             |                | DCS/PCS      |                |                       |              |                |
|-------------|-------------|----------------|-----------------------|-------------|----------------|--------------|----------------|-----------------------|--------------|----------------|
|             | TX          |                |                       | RX          |                | TX           |                |                       | RX           |                |
|             | Freq. (MHz) | Ins. Loss (dB) | Att.(2*f0, 3*f0) (dB) | Freq. (MHz) | Ins. Loss (dB) | Freq. (MHz)  | Ins. Loss (dB) | Att.(2*f0, 3*f0) (dB) | Freq. (MHz)  | Ins. Loss (dB) |
| LM-T118SQE2 | 880 to 915  | ≤1.3           | ≥35(2*f0), ≥30(3*f0)  | 925 to 960  | ≤1.3           | 1710 to 1785 | ≤1.6           | ≥28(2*f0), ≥30(3*f0)  | 1805 to 1880 | ≤1.6           |
|             |             |                |                       |             |                | 1850 to 1910 |                |                       | 1930 to 1990 |                |

### Recommended Land Pattern

(Unit : mm)



### Recommended Reflow Profile





**Pb Free**

**RoHS Conforming**

### Features

- Small and Low profile
- Low Loss
- Built-in 2LPF for Receiver
- Excellent shock-resistant
- Support multiple bands(GSM850/GSM900/DCS(GSM1800)/PCS(GSM1900))

### Applications

- GSM850/GSM900/DCS/PCS

### How to Order

**LM - D 6 15 S3**

① ② ③ ④ ⑤

① Series

② Circuit

**D** Dual

③ Type

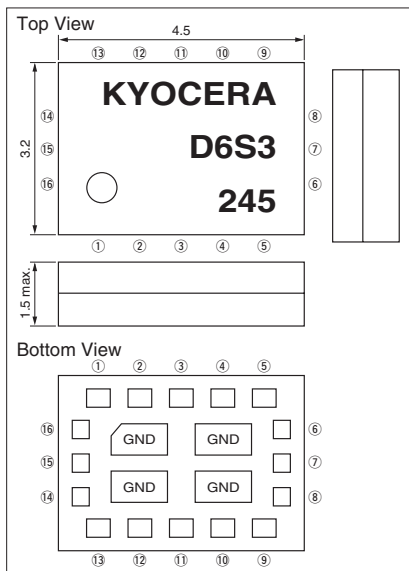
④ Height

**15** 1.5mm max

⑤ Custom Specification

### Dimensions (LM-D615S3)

(Unit : mm)

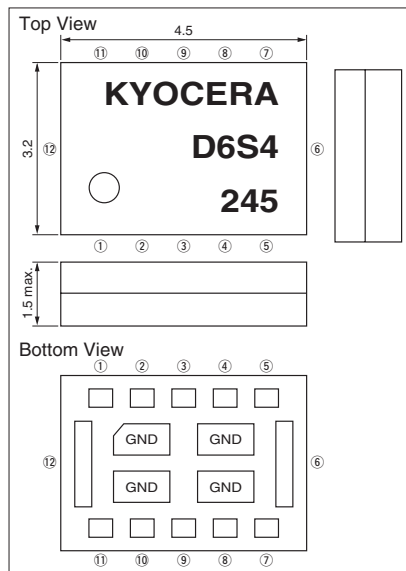


### Pin Assingment (LM-D615S3)

|   |                 |
|---|-----------------|
| ① | GND             |
| ② | TX1(GSM850/900) |
| ③ | GND             |
| ④ | N.C             |
| ⑤ | RX2(DCS/PCS)    |
| ⑥ | N.C             |
| ⑦ | RX1(GSM850/900) |
| ⑧ | N.C             |
| ⑨ | N.C             |
| ⑩ | VCont1          |
| ⑪ | GND             |
| ⑫ | ANT             |
| ⑬ | GND             |
| ⑭ | VCont2          |
| ⑮ | GND             |
| ⑯ | TX2(DCS/PCS)    |

### Dimensions (LM-D615S4)

(Unit : mm)



### Pin Assingment (LM-D615S4)

|   |                 |
|---|-----------------|
| ① | RX2(DCS/PCS)    |
| ② | VCont1          |
| ③ | TX2(DCS/PCS)    |
| ④ | GND             |
| ⑤ | TX1(GSM850/900) |
| ⑥ | GND             |
| ⑦ | GND             |
| ⑧ | ANT             |
| ⑨ | GND             |
| ⑩ | RX1(GSM850/900) |
| ⑪ | VCont2          |
| ⑫ | GND             |

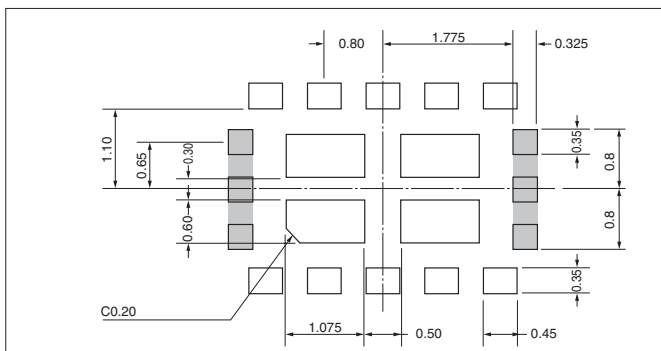
### Specifications

(at 25°C)

| Part No.  | GSM         |                |                                                 |             |                | DCS          |                |                                                 |              |                |
|-----------|-------------|----------------|-------------------------------------------------|-------------|----------------|--------------|----------------|-------------------------------------------------|--------------|----------------|
|           | TX          |                |                                                 | RX          |                | TX           |                |                                                 | RX           |                |
|           | Freq. (MHz) | Ins. Loss (dB) | Att.(2*f <sub>0</sub> , 3*f <sub>0</sub> ) (dB) | Freq. (MHz) | Ins. Loss (dB) | Freq. (MHz)  | Ins. Loss (dB) | Att.(2*f <sub>0</sub> , 3*f <sub>0</sub> ) (dB) | Freq. (MHz)  | Ins. Loss (dB) |
| LM-D615S3 | 824 to 849  | ≤1.2           | ≥35(2*f <sub>0</sub> ), ≥30(3*f <sub>0</sub> )  | 869 to 894  | ≤1.1           | 1710 to 1785 | ≤1.4           | ≥30                                             | 1805 to 1880 | ≤1.3           |
|           | 880 to 915  |                |                                                 | 925 to 960  |                | 1850 to 1910 |                |                                                 | 1930 to 1990 |                |
| LM-D615S4 | 824 to 849  | ≤1.2           | ≥35(2*f <sub>0</sub> ), ≥30(3*f <sub>0</sub> )  | 869 to 894  | ≤1.0           | 1710 to 1785 | ≤1.4           | ≥25                                             | 1805 to 1880 | ≤1.2           |
|           | 880 to 915  |                |                                                 | 925 to 960  |                | 1850 to 1910 |                |                                                 | 1930 to 1990 |                |

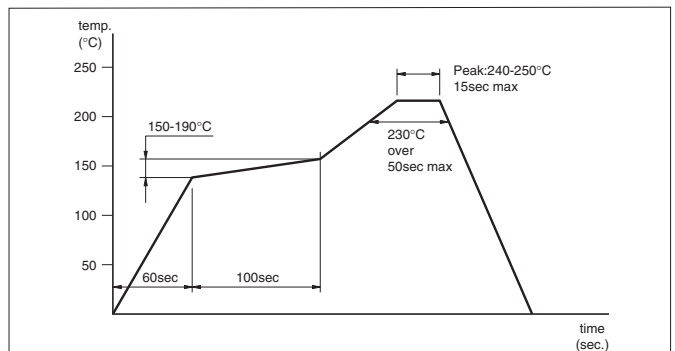
### Recommended Land Pattern

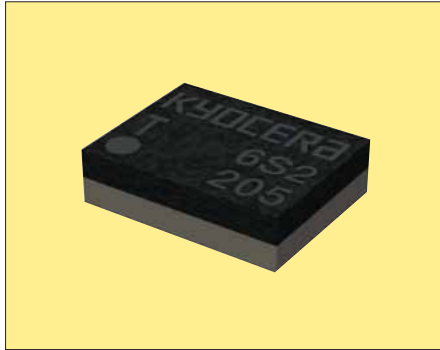
(Unit : mm)



Shaded land area for LM-D615S4.

### Recommended Reflow Profile





**Pb Free**

**RoHS Comforming**

### Features

- Small and Low profile
- Low Loss
- Built-in 2LPF for Receiver
- Excellent shock-resistant
- Support multiple bands(GSM850/GSM900/DCS(GSM1800)/PCS(GSM1900))

### Applications

- GSM850/GSM900/DCS/PCS

### How to Order

**LM - T 6 15 S2**  
 ① ② ③ ④ ⑤

① Series

② Circuit

**T** Triple

③ Type

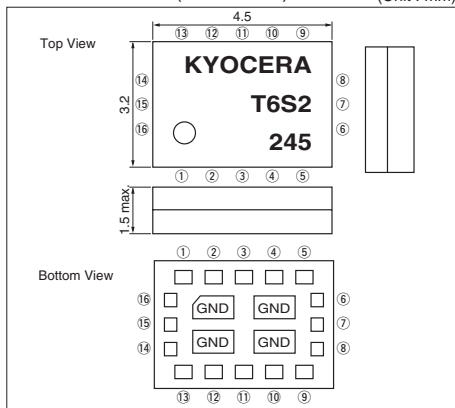
④ Height

**15** 1.5mm max

⑤ Custom Specification

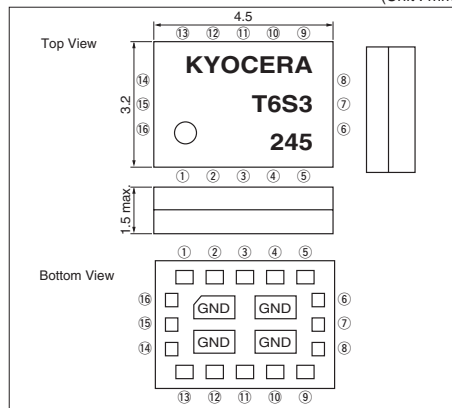
### Dimensions (LM-D615S1)

(Unit : mm)



### Dimensions (LM-D615S2)

(Unit : mm)



### Pin Assingment (LM-D615S2)

|                   |                   |
|-------------------|-------------------|
| ① GND             | ⑨ GND             |
| ② N.C             | ⑩ ANT             |
| ③ RX1(GSM850/900) | ⑪ N.C             |
| ④ RX2(DCS)        | ⑫ GND             |
| ⑤ RX3(PCS)        | ⑬ GND             |
| ⑥ VCont1          | ⑭ TX2(DCS/PCS)    |
| ⑦ VCont2          | ⑮ GND             |
| ⑧ VCont3          | ⑯ TX1(GSM850/900) |

### Pin Assingment (LM-D615S3)

|                   |                |
|-------------------|----------------|
| ① GND             | ⑨ N.C          |
| ② TX1(GSM850/900) | ⑩ VCont1       |
| ③ GND             | ⑪ GND          |
| ④ RX3(PCS)        | ⑫ ANT          |
| ⑤ RX2(DCS)        | ⑬ GND          |
| ⑥ N.C             | ⑭ VCont2       |
| ⑦ RX1(GSM850/900) | ⑮ GND          |
| ⑧ N.C             | ⑯ TX2(DCS/PCS) |

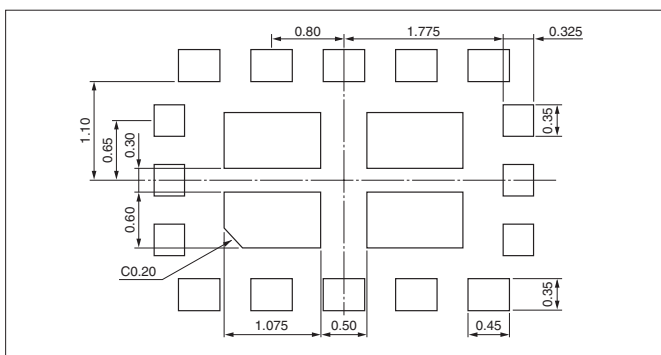
### Specifications

(at 25°C)

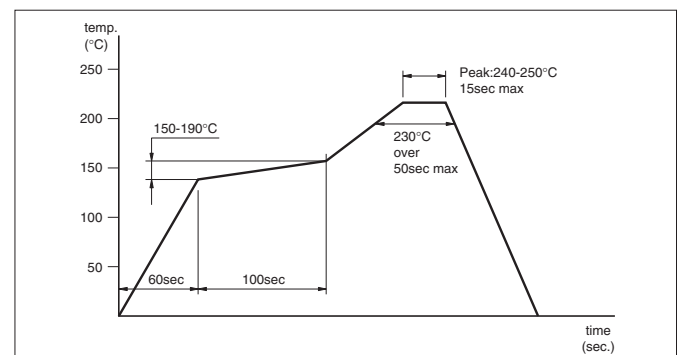
| Part No.  | GSM         |                |                                                 |             |                | DCS         |                |                                                 |             |                |
|-----------|-------------|----------------|-------------------------------------------------|-------------|----------------|-------------|----------------|-------------------------------------------------|-------------|----------------|
|           | Freq. (MHz) | Ins. Loss (dB) | Att.(2*f <sub>0</sub> , 3*f <sub>0</sub> ) (dB) | Freq. (MHz) | Ins. Loss (dB) | Freq. (MHz) | Ins. Loss (dB) | Att.(2*f <sub>0</sub> , 3*f <sub>0</sub> ) (dB) | Freq. (MHz) | Ins. Loss (dB) |
| LM-T615S2 | 824~849     | ≤1.2           | ≥30(2*f <sub>0</sub> ), ≥30(3*f <sub>0</sub> )  | 869~894     | ≤1.0           | 1710~1785   | ≤1.5           | ≥30(2*f <sub>0</sub> , 3*f <sub>0</sub> )       | 1805~1880   | ≤1.4           |
|           | 880~915     |                |                                                 | 925~960     |                | 1850~1910   |                |                                                 | 1930~1990   |                |
| LM-T615S3 | 824~849     | ≤1.2           | ≥30(2*f <sub>0</sub> ), ≥30(3*f <sub>0</sub> )  | 869~894     | ≤1.0           | 1710~1785   | ≤1.5           | ≥30(2*f <sub>0</sub> , 3*f <sub>0</sub> )       | 1805~1880   | ≤1.4           |
|           | 880~915     |                |                                                 | 925~960     |                | 1850~1910   |                |                                                 | 1930~1990   |                |

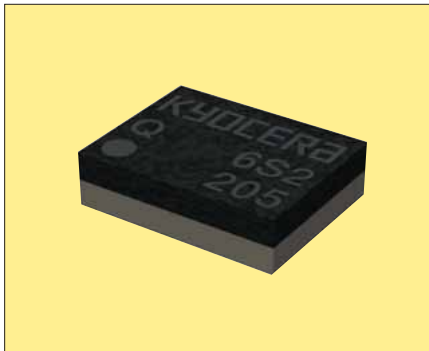
### Recommended Land Pattern

(Unit : mm)



### Recommended Reflow Profile





**Pb Free**

**RoHS Comforming**

### Features

- Small and Low profile
- Low Current Consumption
- Built-in 2LPF for Receiver
- Built-in ESD Protection Circuit
- Excellent shock-resistant
- Support multiple bands(GSM850/GSM900/DCS(GSM1800)/PCS(GSM1900))
- Include ESD Protection

### Applications

- GSM850/GSM900/DCS/PCS

### How to Order

LX - Q 6 15 S2 E  
① ② ③ ④ ⑤ ⑥

① Series

② Circuit

**Q** Quad

③ Type

④ Height

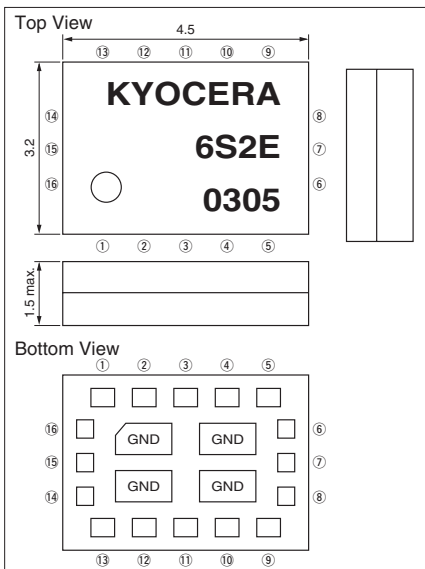
**15** 1.5mm max

⑤ Custom Specification

⑥ ESD Protection

### Dimensions

(Unit : mm)



### Pin Assingment

|               |                   |
|---------------|-------------------|
| ① GND         | ⑨ GND             |
| ② RX1(GSM850) | ⑩ ANT             |
| ③ RX2(GSM900) | ⑪ V <sub>DD</sub> |
| ④ RX3(DCS)    | ⑫ GND             |
| ⑤ RX4(PCS)    | ⑬ GND             |
| ⑥ VCont1      | ⑭ TX2(DCS/PCS)    |
| ⑦ VCont2      | ⑮ GND             |
| ⑧ VCont3      | ⑯ TX1(GSM850/900) |

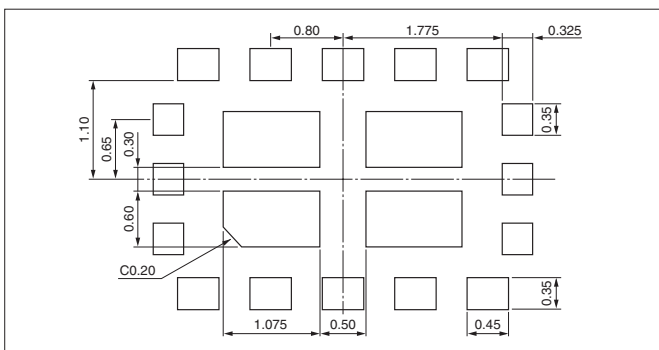
### Specifications

(at 25°C)

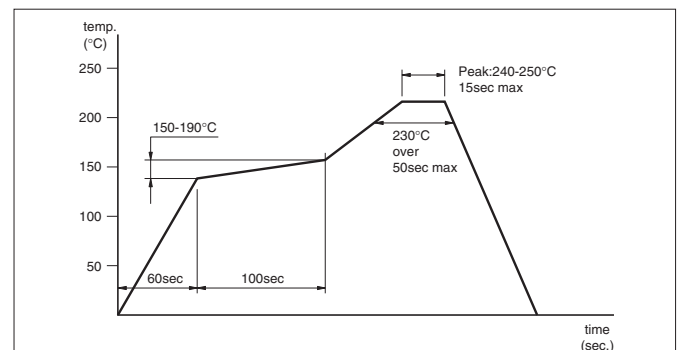
| Part No.   | GSM         |                |                                                 |             |                | DCS/PCS      |                |                                                 |              |                |
|------------|-------------|----------------|-------------------------------------------------|-------------|----------------|--------------|----------------|-------------------------------------------------|--------------|----------------|
|            | TX          |                |                                                 | RX          |                | TX           |                |                                                 | RX           |                |
|            | Freq. (MHz) | Ins. Loss (dB) | Att.(2*f <sub>0</sub> , 3*f <sub>0</sub> ) (dB) | Freq. (MHz) | Ins. Loss (dB) | Freq. (MHz)  | Ins. Loss (dB) | Att.(2*f <sub>0</sub> , 3*f <sub>0</sub> ) (dB) | Freq. (MHz)  | Ins. Loss (dB) |
| LX-Q615S2E | 824 to 849  | ≤1.45          | ≥30(2*f <sub>0</sub> , 3*f <sub>0</sub> )       | 869 to 894  | 1.5            | 1710 to 1785 | ≤1.55          | ≥30(2*f <sub>0</sub> , 3*f <sub>0</sub> )       | 1805 to 1880 | ≤1.5           |
|            | 880 to 915  |                |                                                 | 925 to 960  | 1.6            | 1850 to 1910 |                |                                                 | 1930 to 1990 |                |

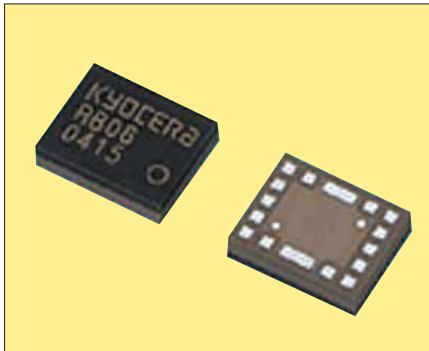
### Recommended Land Pattern

(Unit : mm)



### Recommended Reflow Profile





Pb Free

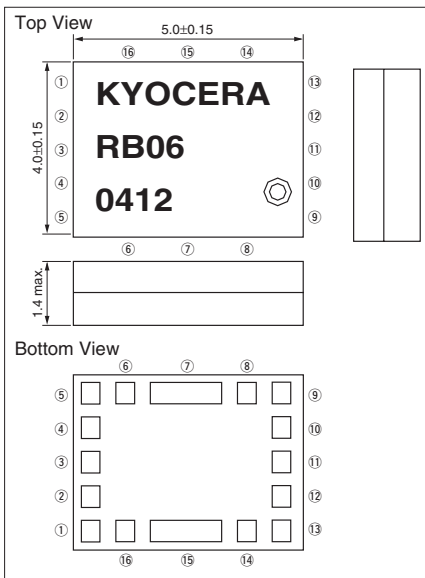
RoHS Conforming

### Features

- Best solution for CDMA cell phone with Bluetooth function
- Miniature size of 5.0 x 4.0 x 1.4mm
- Improved reception sensitivity (-88dBm typ)
- Low power consumption (Tx:36mA typ, Rx: 38mA typ)
- Wide operating temperature range of -30 to +75 degrees °C

### Dimensions

(Unit : mm)



### Pin Assignments

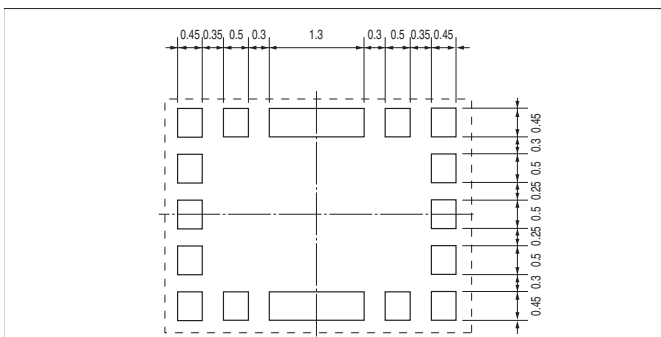
| No. | Name           | Direction | Description                                                                                             |
|-----|----------------|-----------|---------------------------------------------------------------------------------------------------------|
| ①   | GND            |           |                                                                                                         |
| ②   | LD01           | O         | Bypass capacitor for voltage.                                                                           |
| ③   | LD02           | O         | Bypass capacitor for voltage.                                                                           |
| ④   | XTAL_IN        | I         | System clock crystal positive input or clock input (12, 19.2, 19.68, and 19.8MHz).                      |
| ⑤   | SYNC_DET/TX_EN | I         | Signal generated by the baseband to indicate the start of TX or RX ramp-up.                             |
| ⑥   | SBST           | I         | SBI slave select that enables the LBDA254AP0 as the target.                                             |
| ⑦   | GND            |           |                                                                                                         |
| ⑧   | RX_BB/TX_BB    | I/O       | Received data from radio; or transmit data when configured as bi-directional I/O.                       |
| ⑨   | CLK_REF        | O         | Selectable clock output to external baseband controller (12MHz).                                        |
| ⑩   | SBCK           | I         | Clock input used for synchronous data transfer on the Serial Bus Interface (SBI)bus.                    |
| ⑪   | SBDT           | I/O       | SBI data input / output port.                                                                           |
| ⑫   | VDD_MSM        | I         | Supply voltage to on-chip I/O interface I/O pin; RX_BB/TX_BB, SBCK, SBST, SBDT, CLK_REF, SYNC_DET/TX_EN |
| ⑬   | NC             |           |                                                                                                         |
| ⑭   | VDD_A          | I         | Supply voltage to internal analog voltage regulator.                                                    |
| ⑮   | GND            |           |                                                                                                         |
| ⑯   | ANT            | I/O       | RF signal I/O                                                                                           |

### Specifications

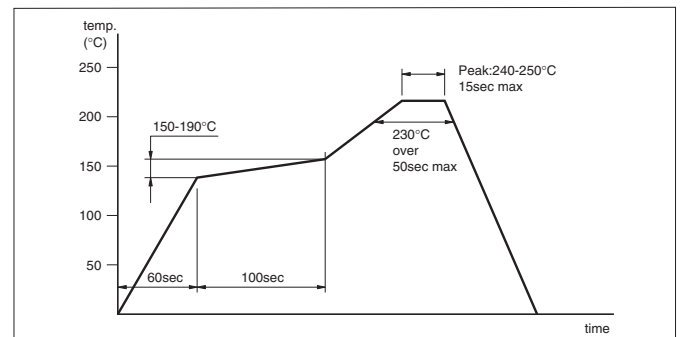
|                                                     | Unit | min | typ | max |
|-----------------------------------------------------|------|-----|-----|-----|
| <b>Power Supply VDD_MSM</b>                         | V    | 2.5 | 2.6 | 2.7 |
| <b>Current Consumption</b>                          |      |     |     |     |
| Receive Mode                                        | mA   | —   | 37  | 45  |
| Transmit Mode                                       | mA   | —   | 36  | 45  |
| Standby Mode                                        | μA   | —   | 9   | 50  |
| <b>Ambient Temperature</b>                          | °C   | -30 | 25  | 85  |
| <b>Receiver RF Specifications</b>                   |      |     |     |     |
| RCV/CA/02/C (Sensitivity-Multi Slot Packets)<br>DH5 | dBm  | —   | -88 | -81 |
| <b>Transmitter RF Specifications</b>                |      |     |     |     |
| TRM/CA/01/C (Output Power)<br>Class 2 Pave          | dBm  | -2  | 0.5 | 3   |

### Recommended Land Pattern

(Unit : mm)



### Recommended Reflow Profile



THE NEW VALUE FRONTIER



# Others

---

**Piezo Ceramic Elements**

**Piezo Buzzers**

**Low Temperature Cofired Ceramics (LTCC)**





### Features

- Wide variety of tones by connecting to IC.
- Low current consumption, thin and light design.
- High reliability and no contact noise.

### Applications

- Clocks, electronic calculators, pagers, cameras.
- Equipment using microcontrollers (microwave ovens, TVs, stereos, automobiles, etc.).
- Telecommunications (facsimile machines, telephones)
- Electronic medical instruments

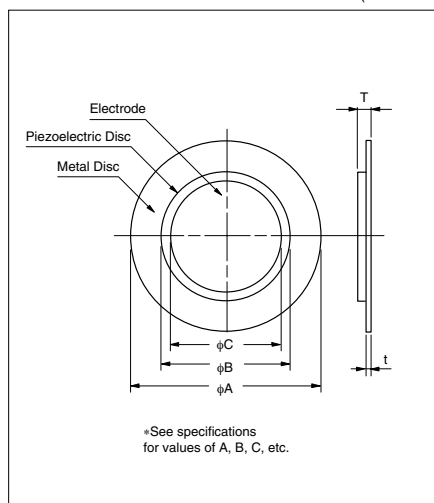
### How to Order

KBS - 20 DA - 7 A □ -1  
① ② ③ ④ ⑤ ⑥ ⑦

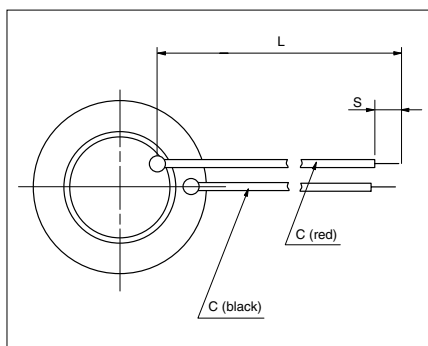
- ① Series
- ② Diameter(mm)
- ③ Appearance (Disc-Shaped Buzzer)
- ④ Resonant Frequency
- ⑤ 2-Electrode Type  
(A:Element Only, C:With lead)
- ⑥ Metal(Blank:Brass)
- ⑦ Option Spec (Lead-wire Spec etc.)

### Dimensions

(Unit : mm)



### Standard Leads

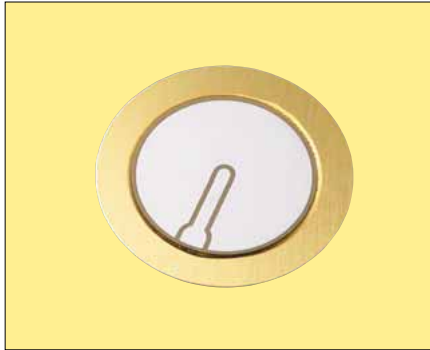


|               |                    |
|---------------|--------------------|
| W: Thickness  | AWG-32 UL-1571     |
| L: Length(mm) | 50±5, 75±5, 100±10 |
| S: Strip(mm)  | 3±1                |
| C: Color      | red, black         |

### Specifications (A type)

| Part Number   | Resonant Frequency [kHz] | Resonant Impedance [Ω] | Capacitance [pF] | Dimensions (mm) |                   |                |                     |                          | Metal Disc Material |
|---------------|--------------------------|------------------------|------------------|-----------------|-------------------|----------------|---------------------|--------------------------|---------------------|
|               |                          |                        |                  | Metal Disc (ϕA) | Ceramic Disc (ϕB) | Electrode (ϕC) | Total Thickness (T) | Metal Disc Thickness (t) |                     |
| KBS-13DA-12A  | 12.0±1.2                 | 700                    | 5,000±30%        | 13.4±0.1        | 10.0±0.3          | (9.0)          | 0.36±0.1            | 0.15±0.03                | Brass               |
| KBS-15DA-9A-2 | 10.5±3.0                 | 600                    | 8,000±30%        | 15.0±0.1        | 12.0±0.3          | (11.0)         | 0.42±0.1            | 0.20±0.03                | Brass               |
| KBS-20DA-7A   | 6.6±1.0                  | 300                    | 10,000±30%       | 20.0±0.1        | 14.2±0.3          | (13.0)         | 0.45±0.1            | 0.20±0.03                | Brass               |
| KBS-23DA-4A   | 4.0±1.0                  | 600                    | 12,000±30%       | 22.8±0.1        | 15.0±0.3          | (14.0)         | 0.41±0.1            | 0.15±0.03                | Brass               |
| KBS-27DA-5A   | 4.6±0.5                  | 200                    | 20,000±30%       | 27.0±0.1        | 20.2±0.3          | (19.0)         | 0.53±0.1            | 0.25±0.03                | Brass               |
| KBS-30DA-1A   | 1.4±0.5                  | 500                    | *48,000±30%      | 30.0±0.1        | 20.2±0.3          | (19.0)         | 0.23±0.1            | 0.10±0.03                | Brass               |
| KBS-35DA-3A   | 2.9±0.5                  | 200                    | 30,000±30%       | 35.0±0.1        | 25.0±0.5          | (23.5)         | 0.53±0.1            | 0.25±0.03                | Brass               |

\* Measured at 120Hz, all others at 1kHz



### Features

- High sound pressure level and clear sound by connecting to a self oscillating circuit.
- Thin and light design.
- High reliability and no contact noise.

### Applications

- Smoke detectors, security alarms and other warning devices
- Pagers, electronic calculators, alarm signals
- Telephones

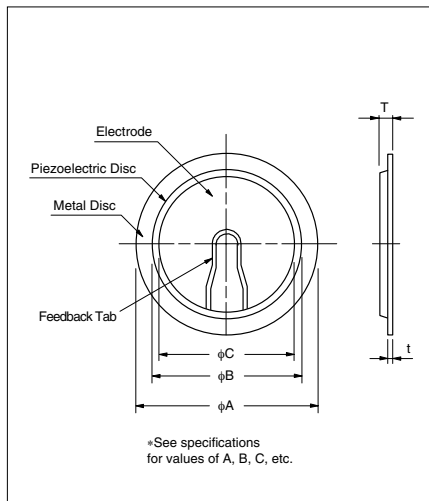
### How to Order

KBS - 35 DA - 3 G □ - 3  
 ① ② ③ ④ ⑤ ⑥ ⑦

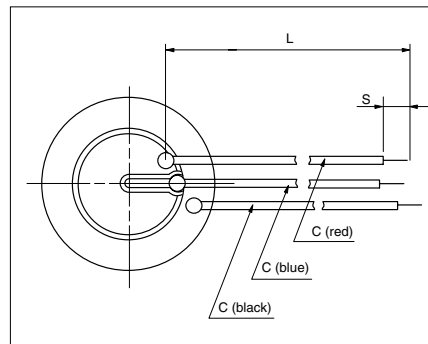
- ① Series
- ② Diameter(mm)
- ③ Appearance (Disc-Shaped Buzzer)
- ④ Resonant Frequency
- ⑤ 3-Electrode Type  
(G:G-Pattern, GC:G-Pattern with Leads)
- ⑥ Metal(Blank:Brass)
- ⑦ Option Spec (Lead-wire Spec etc.)

### Dimensions

(Unit : mm)



### Standard Leads



|               |                    |
|---------------|--------------------|
| W: Thickness  | AWG-32 UL-1571     |
| L: Length(mm) | 50±5, 75±5, 100±10 |
| S: Strip(mm)  | 3±1                |
| C: Color      | red, black, blue   |

### Specifications (G type)

| Part Number | Resonant Frequency [kHz] | Resonant Impedance [Ω] | Capacitance [pF] | Dimensions (mm) |                   |                |                     |                          | Metal Disc Material |
|-------------|--------------------------|------------------------|------------------|-----------------|-------------------|----------------|---------------------|--------------------------|---------------------|
|             |                          |                        |                  | Metal Disc (φA) | Ceramic Disc (φB) | Electrode (φC) | Total Thickness (T) | Metal Disc Thickness (t) |                     |
| KBS-27DA-5G | 4.6±0.5                  | 200                    | 16,000±30%       | 27.0±0.1        | 20.2±0.3          | (19.0)         | 0.53±0.1            | 0.25±0.03                | Brass               |
| KBS-35DA-3G | 2.9±0.5                  | 200                    | 25,000±30%       | 35.0±0.1        | 25.0±0.3          | (23.6)         | 0.53±0.1            | 0.25±0.03                | Brass               |



## Features

- Low current consumption - High sound pressure
- Compact, light design
- High reliability and no contact noise
- Easy-mounting
- Wide variety of tones can be made by cavity designing
- Functions over a wide range of Input Voltage

## Applications

- Confirmation tone for various office automation equipment
- Automobiles, microwave ovens, refrigerators
- Clocks, toys, game machines

## How to Order

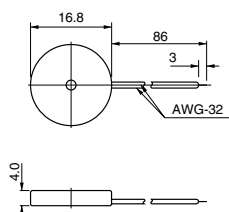
KBS - 27 DB - 3 A  
① ② ③ ④ ⑤

- ① Series
- ② Diameter(mm)
- ③ Appearance (Buzzer with casing)
- ④ Resonant Frequency
- ⑤ Type of Terminals  
(A:With lead, P:Round pin)

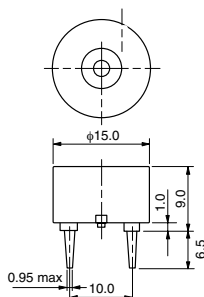
## Dimensions

(Unit : mm)

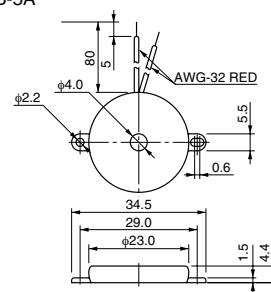
KBS-15DB-4A



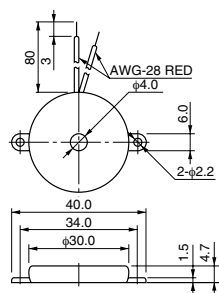
KBS-13DB-4P-2



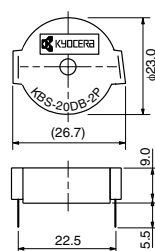
KBS-20DB-5A



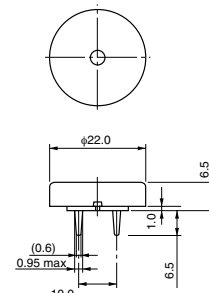
KBS-27DB-3A



KBS-20DB-2P-0



KBS-20DB-4P-0

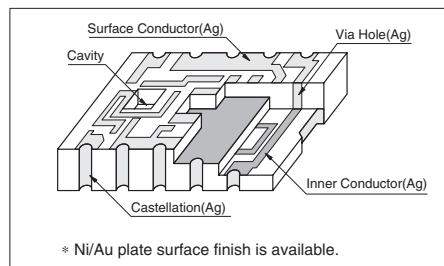


## Specifications

| Part Number   | Sound Pressure Level             | Capacitance |
|---------------|----------------------------------|-------------|
| KBS-13DB-4P-2 | 73db min 4.096kHz 10Vp-p SQ 30cm | 10nF±30%    |
| KBS-20DB-2P-0 | 75db min 2.048kHz 10Vp-p SQ 30cm | 24nF±30%    |
| KBS-20DB-4P-0 | 77db min 4.096kHz 10Vp-p SQ 30cm | 14nF±30%    |
| KBS-15DB-4A   | 72db min 4.096kHz 10Vp-p SQ 30cm | 9.5nF±30%   |
| KBS-20DB-5A   | 75db min 5.0kHz 10Vp-p SQ 30cm   | 10nF±30%    |
| KBS-27DB-3A   | 75db min 3.0kHz 10Vp-p SQ 30cm   | 20nF±30%    |



### LTCC Structure



With increasing demands for high density and miniature modules, Kyocera LTCC featuring thick film printing and multi-layer technologies offers the best fit solutions for those market demands.

This LTCC is especially suited for telecom devices such as RF power amplifier, antenna switch module, VCO and RF modules including some filter functions with the following characteristics.

### Features

- **High Density Module**  
Miniature modules are realized by inner layer circuitry with fine lines and very small via holes.
- **Low Circuit Resistance**  
Low circuit impedance is achieved by the use of silver as inner conductor material.
- **Low Profile**  
Low profile modules can be achieved by the use of cavity and castellation structure.
- **Higher Reliability in Structure**  
Higher environmental temperature reliability by selecting materials which suitably match thermal expansion coefficient with mounted components.
- **Improved Electro-magnetic Compatibility**  
Effective for reducing electro-magnetic radiation for its feasibility to build ground or shield in the internal layer.
- **Suited for High Frequency Circuit**  
For its high dielectric constant of ceramic materials, it is suited for high frequency application where distributed constant circuitry is utilized.
- **Dust Free**  
Unlike an organic printed circuit board, LTCC ceramic board does not accompany dust which leads to cleaner environment.
- **Excellent Thermal Conductivity**  
Highly thermal conductive structure is achieved by building heat sink with silver thermal vias in the bare chip assembly area.
- **Built-in Functions**  
It is possible to embed functions such as BPF, LPF and Balun inside the substrate.

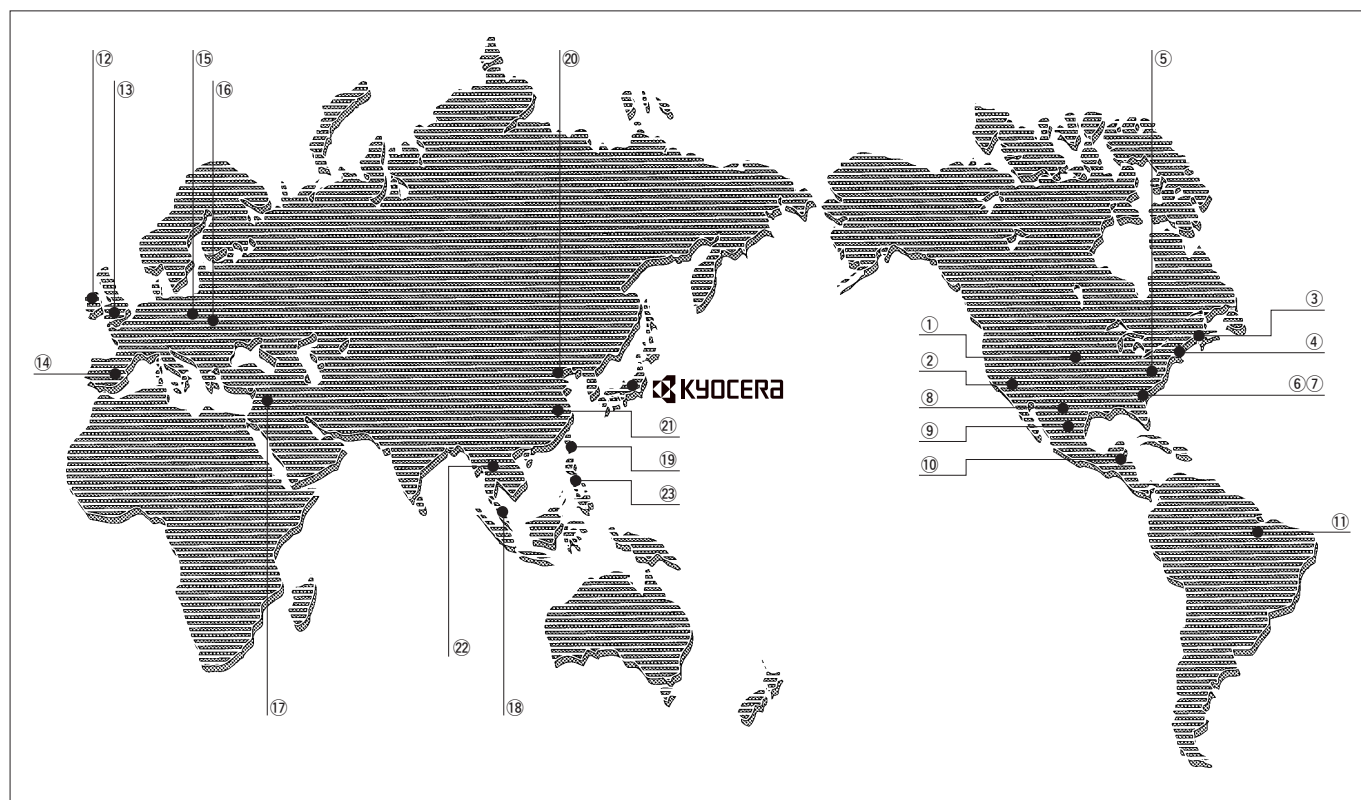
### Material Characteristics (Ceramics)

| Parameters              | Unit              | LTCC(JHB62)       | LTCC(JIB62)       | LTCC(AAB62)       | LTCC(ACB62)       | FR-4(Ref.) |
|-------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|------------|
| Sintered Density        | g/cm <sup>3</sup> | 3.2               | 3.5               | 3.2               | 3.25              | 3.0        |
| Bend Strength           | MPa               | 260               | 210               | 220               | 400               | 500        |
| Thermal Expansion       | ppm/°C            | 6.3               | 10.7              | 10.7              | 8.5               | 20         |
| Thermal Conductivity    | W/mK              | 2.5               | 3.1               | 3.9               | 4.2               | 0.2        |
| Volume Fixed Resistance | Ωcm               | >10 <sup>14</sup> | >10 <sup>14</sup> | >10 <sup>14</sup> | >10 <sup>14</sup> | —          |
| Dielectric Constant     | —                 | 7.9(3.2MHz)       | 18.7(7GHz)        | 9.4(9GHz)         | 9.4(9GHz)         | 4.5        |
| Dielectric Loss Angle   | —                 | 0.002(2GHz)       | 0.00025(2GHz)     | 0.0005(3.2GHz)    | 0.0013(2GHz)      | 0.02       |
| Moisture Absorption     | %                 | <0.1              | <0.1              | <0.1              | <0.1              | 0.1        |

### Material Characteristics (Conductors)

| Parameters            | Unit                | LTCC(JHB62) | LTCC(JIB62)       | LTCC(AAB62)       | LTCC(ACB62)       | Remarks                                     |
|-----------------------|---------------------|-------------|-------------------|-------------------|-------------------|---------------------------------------------|
| Surface Conductor     | Materials           | —           | Ag, Ag/Pt         | Ag, Ag/Pt         | Ag                |                                             |
|                       | Resistivity         | mΩ/sq       | ≤2.5              | ≤2.5              | ≤2.5              | Standard Specification                      |
|                       |                     |             | ≤1.5              | ≤1.5              | ≤1.5              | High Conductivity Specification             |
| Bondability           | gf                  | >10         | >10               | >10               | >10               | Au Wire φ27μm                               |
| Inner Conductor       | Materials           | —           | Ag, Ag/Pt         | Ag, Ag/Pt         | Ag                |                                             |
|                       | Resistivity         | mΩ/sq       | ≤2.5              | ≤2.5              | ≤2.5              | Standard Specification                      |
|                       |                     |             | ≤1.5              | ≤1.5              | ≤1.5              | High Conductivity Specification             |
| Cavity                | Conductor Materials | —           | Ag, Ag/Pt         | Ag, Ag/Pt         | Ag                |                                             |
| Castellation          | Conductor Materials | —           | Ag/Pt             | Ag/Pt             | Ag/Pt             |                                             |
| Insulation Resistance | Between Lines       | Ω           | >10 <sup>12</sup> | >10 <sup>12</sup> | >10 <sup>12</sup> |                                             |
|                       | Between Laiers      | Ω           | >10 <sup>12</sup> | >10 <sup>12</sup> | >10 <sup>12</sup> |                                             |
| Surface Finish        | Plating             | —           | * Ni+Au           | Ni+Au             | Ni+Au             | * Surface without plating is also available |

## ■ Manufacturing Plants (Kyocera & AVX Group)



| North America  |          |
|----------------|----------|
| Plant          | Location |
| ① Colorado     | U.S.A    |
| ② Sun Valley   |          |
| ③ Biddeford    |          |
| ④ Olean        |          |
| ⑤ Raleigh      |          |
| ⑥ Conway       |          |
| ⑦ Myrtle Beach |          |

| Central, South America |             |
|------------------------|-------------|
| Plant                  | Location    |
| ⑧ Juarez               | Mexico      |
| ⑨ Chihuahua            |             |
| ⑩ El Salvador          | El Salvador |
| ⑪ Manaus               | Brazil      |

| Europe      |          |
|-------------|----------|
| Plant       | Location |
| ⑫ Coleraine | Ireland  |
| ⑬ Paignton  | U.K.     |
| ⑭ Dijon     | France   |
| ⑮ Lanskroun | Czech    |
| ⑯ Üherskê   |          |

| Middle East |          |
|-------------|----------|
| Plant       | Location |
| ⑰ Jerusalem | Israel   |

| Asia      |          |
|-----------|----------|
| Plant     | Location |
| ⑱ Penang  | Malaysia |
| ⑲ Taiwan  | Taiwan   |
| ⑳ Tianjin | P.R.C    |

| KYOCERA Plant |          |
|---------------|----------|
| Plant         | Location |
| ⑳ SKE         | Shanghai |

| KYOCERA KINSEKI Plant                    |             |
|------------------------------------------|-------------|
| Plant                                    | Location    |
| ㉑ KYOCERA KINSEKI ELECTRONICS (Thailand) | Thailand    |
| ㉒ KYOCERA KINSEKI PHILIPPINES            | Philippines |

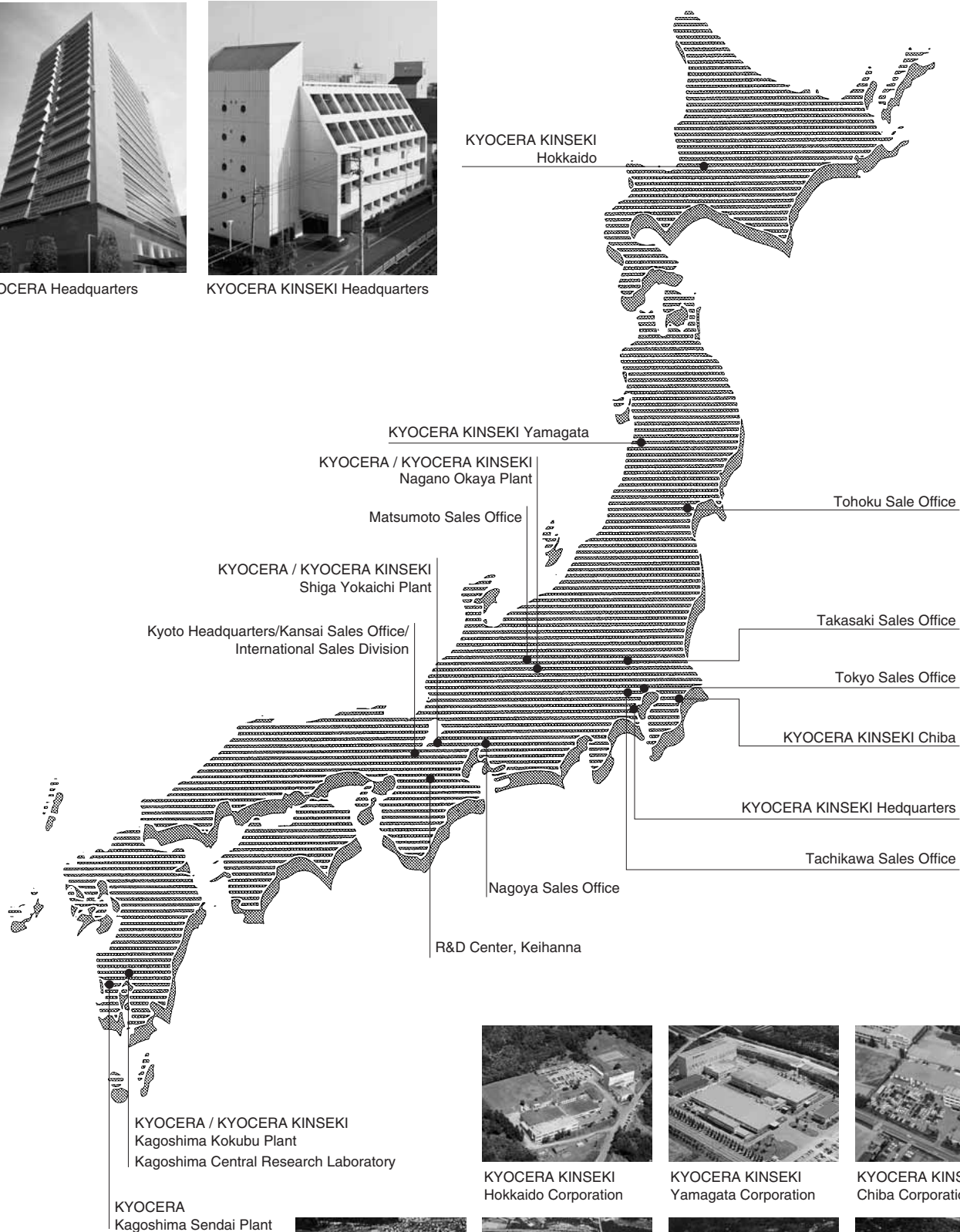
## Kyocera Network in Japan



KYOCERA Headquarters



KYOCERA KINSEKI Headquarters



KYOCERA KINSEKI  
Hokkaido Corporation



KYOCERA KINSEKI  
Yamagata Corporation



KYOCERA KINSEKI  
Chiba Corporation



KYOCERA / KYOCERA KINSEKI  
Nagano Okaya Plant



KYOCERA / KYOCERA KINSEKI  
Shiga Yokaichi Plant



KYOCERA  
Kagoshima Sendai Plant



KYOCERA / KYOCERA KINSEKI  
Kagoshima Kokubu Plant

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5897 Oberlin Drive, Suite 205 San Diego, CA 92121  
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#### • KYOCERA ELECTRONICS DEVICES LLC, FREMONT OFFICE

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