



RFM Integrated Device, Inc.

Part Number:  
SAFDC433MPE5X32R12

## PRODUCT SPECIFICATION

Description:

SAW FILTER, 433.580  
MHZ, 2 BW 650 KHZ, IL 3.3  
DB

Specification for SAW Filter

SAFDC433MPE5X32R12



|      |                |                    |
|------|----------------|--------------------|
| Date | March 14, 2013 | AEC-Q200 Qualified |
|------|----------------|--------------------|

1. Scope

This delivery specification specifies SAFDC433MPE5X32R12, a surface wave filter for 400MHz band used for communication equipment. Please contact us in advance if you intend to use the product for other purposes.

Country of origin: TAIWAN (TAI-SAW TECHNOLOGY Co., Ltd.)

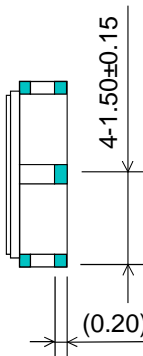
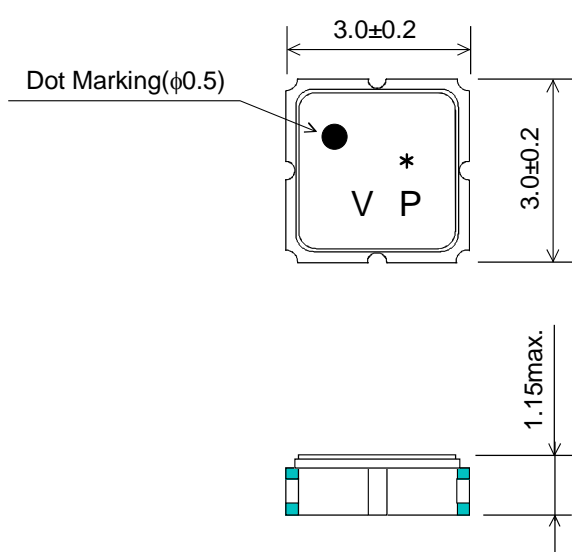
2. Customer Number

|              |  |                  |  |
|--------------|--|------------------|--|
| Customer No. |  | Customer Dwg No. |  |
|--------------|--|------------------|--|

3. RFMi Part Number

|                    |                               |
|--------------------|-------------------------------|
| SAFDC433MPE5X32R12 | Taping /packing (2000 pieces) |
|--------------------|-------------------------------|

4. Dimensions



Marking : Laser Printing

\* EIAJ Code

Terminal(Surface) : Au

thickness 0.3...1.0µm  
(Typ. 0.6µm)

Terminal(Base) : Ni

thickness 2.0~8.0µm  
(Typ. 3.5µm)

Terminal Assignments

(2) : Input

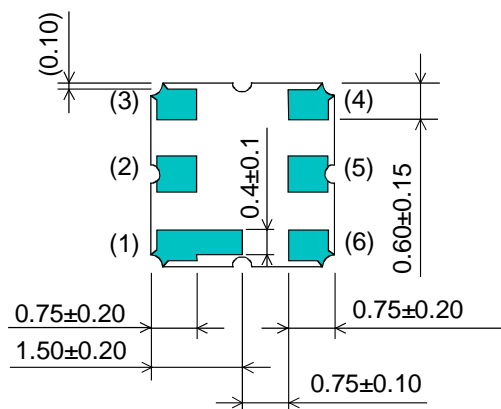
(5) : Output

Others : Ground

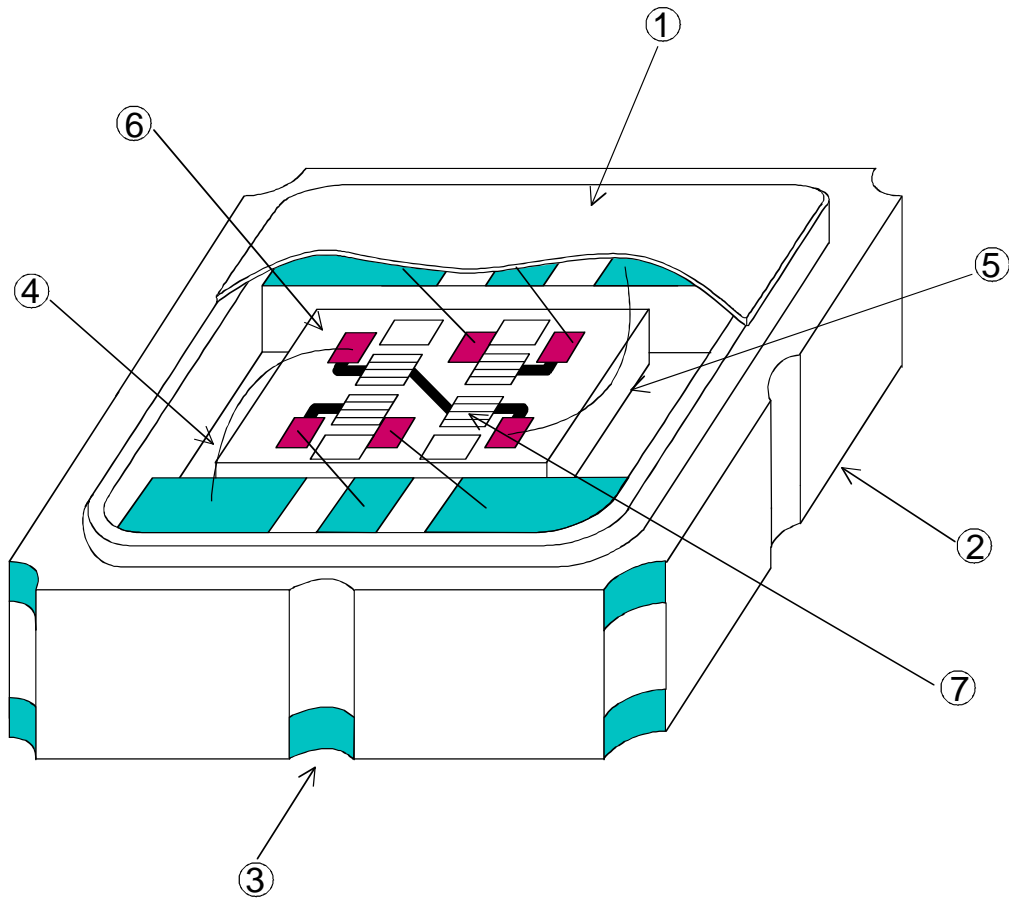
Weight : 32±5mg

Coplanarity : 0.1mm max.

Unit : mm



4.2 Diagram



|   | Product Name                    | Material           |
|---|---------------------------------|--------------------|
| ① | Metal lid                       | Kovar, Ni plating  |
| ② | Multilayer ceramic              | Alumina            |
| ③ | Terminal                        | Au plating         |
| ④ | Bonding wire                    | Al                 |
| ⑤ | Piezoelectric substrate         | LiTaO <sub>3</sub> |
| ⑥ | Wire bonding pad                | Al/Cu              |
| ⑦ | I D T (Interdigital transducer) | Al/Cu              |
| ⑧ | Protective film                 | SiO <sub>2</sub>   |

## 5. Maximum Rating

|     |  |   |
|-----|--|---|
| 5.1 | Instantaneous DC applied voltage between terminals | Maximum allowable capacity 10V (Absolute resistance above 100MΩ, 25 ± 2 °C) |
| 5.2 | DC applied voltage Between terminals               | Maximum allowable capacity 3V (25 ± 2 °C)                                   |
| 5.3 | Allowable input level (input side)                 | 1) 1 minute at 30mW (+ 14.8dBm)<br>2) 1000 hours at 20mW (+ 13dBm)          |
| 5.4 | Operating Temperature                              | -40~+85°C   |
| 5.5 | Storage Temperature                                | -40~+125°C  |
| 5.6 | Input / output impedance (nominal value) See p4    | 600 Ω // 0.6pF (305.8-299.9jΩ)  |

## 6. Electrical Performance

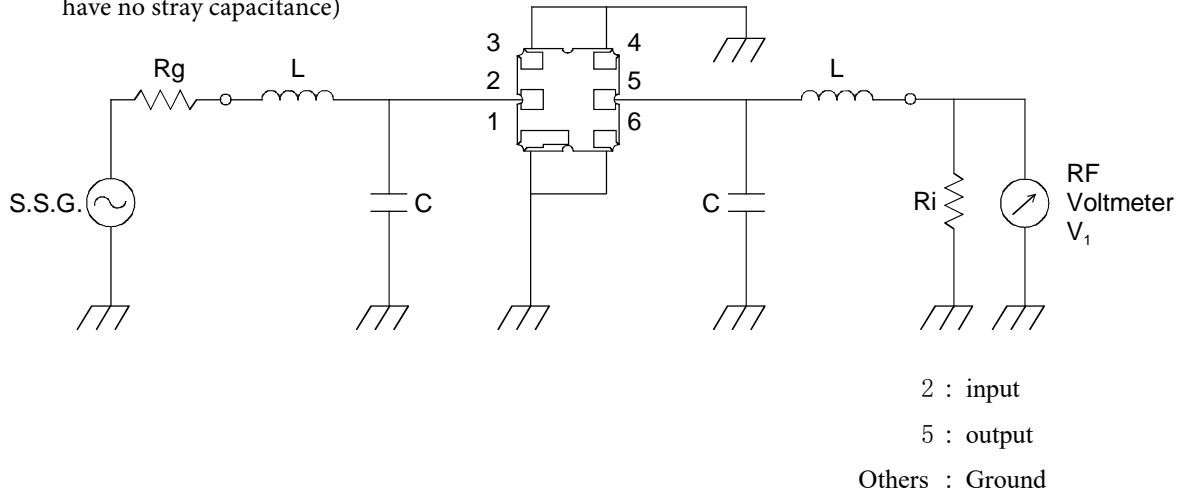
|     | Item                                       | Specification       | Initial room temperature |
|-----|--|---------------------|--------------------------|
| 6.1 | Nominal center frequency (fc)              | 433.580 MHz         |                          |
| 6.2 | 3 dB bandwidth (from minimum loss point)   | fc ± 100kHz or more | -280 kHz<br>+370 kHz     |
| 6.3 | Guaranteed attenuation                     |                     |                          |
|     | 1) 10 ~ 250 MHz                            | 60 dB min           | 74 dB                    |
|     | 2) 250 ~ 330 MHz                           | 50 dB min           | 66 dB                    |
|     | 3) 330 ~ 430 MHz                           | 33 dB min           | 37 dB                    |
|     | 4) 434.60 ~ 434.975 MHz                    | 33 dB min           | 40 dB                    |
|     | 5) 438.650 ~ 439.425 MHz                   | 50 dB min           | 69 dB                    |
|     | 6) 440 ~ 530 MHz                           | 50 dB min           | 70 dB                    |
|     | 7) 530 ~ 1000 MHz                          | 60 dB min           | 78 dB                    |
|     | 8) 1000 ~ 2500 MHz                         | 60 dB min           | 88 dB                    |
| 6.4 | Insertion loss (at the minimum loss point) | 3.3 dB max          | 2.6 dB                   |

The standard test condition is that the temperature is 25 ± 2 °C and the relative humidity is 65 ± 5%. If no doubt arises in the judgment, the test is performed at the temperature of 5 to 35 °C and the relative humidity of 45 to 85%.

Test Measurement

(a) Measurement Circuit

(Calculating the electrical characteristics assuming that the inductor and capacitor are lossless and have no stray capacitance)



(b) 0dB level



Rg: 50Ω (signal source resistance)

Ri: 50 Ω (Network analyzer or spectrum analyzer input resistance)

L: 62nH (calculated value)

C: 1.5pF (calculated value)

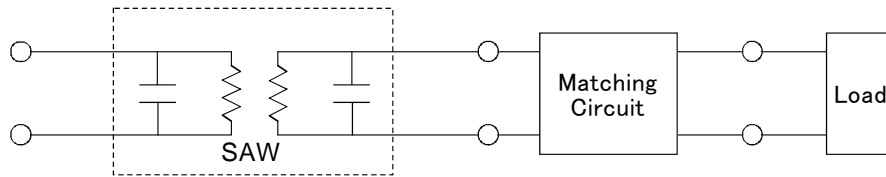
$$\text{Resonant Loss or Insertion Loss} = 20 \log (V_2 / V_1) \text{ [dB]}$$

V1 : Output Voltage of Test Circuit (a)

V2 : Output Voltage of Test Circuit (b)

## Matching Method

Adjust the matching circuit so that the impedance of the SAW filter is the complex conjugate impedance of the load. (The matching configuration varies depending on the load impedance.)



A: Load impedance =  $R1 - j X1$

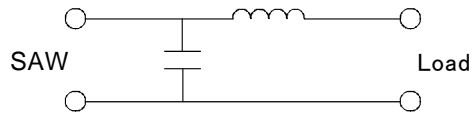
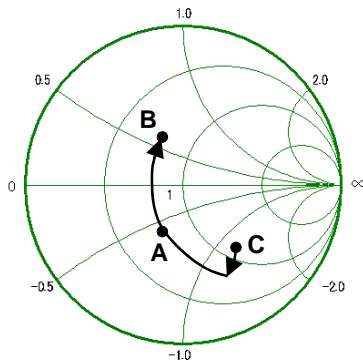
B: Complex conjugate impedance of load =  $R1 + jX1$

C: SAW impedance =  $R2 - j X2$

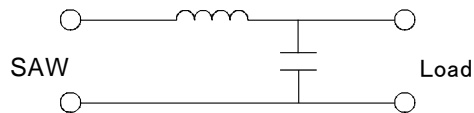
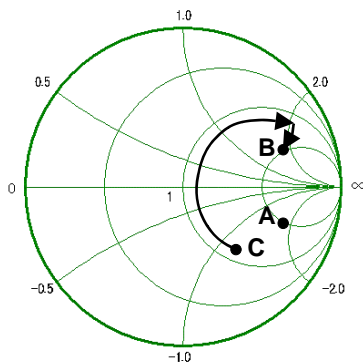
### Recommended matching circuit configuration

A series inductor configuration is recommended to avoid deterioration of insertion loss.

(1) When real part of impedance  $R1 < R2$  (when real part of SAW impedance is large)



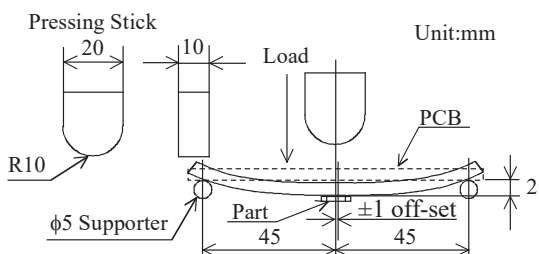
(2) When the real part of impedance is  $R1 > R2$  (when the real part of load impedance is large)



Note) Be sure to consider the stray capacitance of the board when adjusting the matching circuit.

Be sure to evaluate the termination conditions with the product mounted on your product.

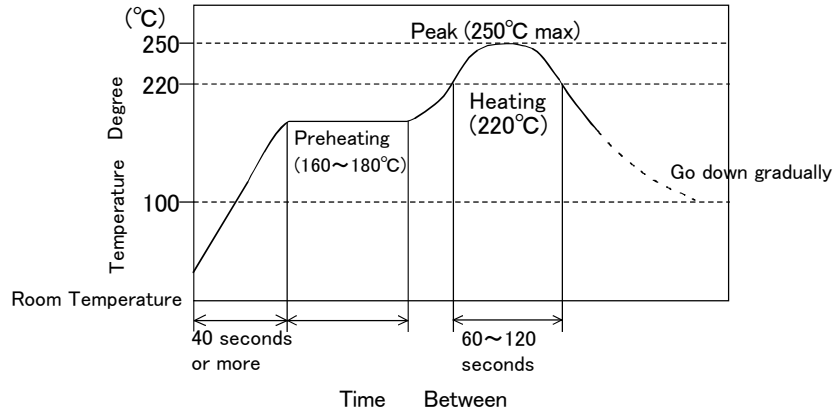
## 7. PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

|      | Test Item                                  | Test Condition   | Criteria  |
|------|--|--|---|
| 7.1  | PCB bend strength                          | <p>Solder on a board with a thickness of 0.8 mm, hold it as shown below, and then press the center of the board 5 times at a rate of 1 second once for 1 second to bend the board 2 mm. return.</p>  | Satisfies the item 6 and does not cause any abnormality in the terminal and body. |
| 7.2  | Vibration                                  | Sine vibration with a frequency of 10 to 55Hz and a total amplitude of 1.5mm is applied in the X.Y.Z direction for 2 hours each.   | Satisfies item 6  |
| 7.3  | Impact resistance                          | A load of 100 g from a height of 150 cm is applied and dropped onto concrete three times on each of six sides.   |   |
| 7.4  | Solderability                              | The terminals were immersed in a rosin ethanol solution (rosin ratio 20-25%) for about 5 seconds, and then H63A, H60A, or Sn-3.0Ag-0.5Cu of JIS-Z-3282 was melted at $230 \pm 5^\circ \text{C}$ . Immerse in solder bath for $5 \pm 0.5$ seconds.                                      | 90% minimum of the immersed surface should be covered with solder.                |
| 7.5  | Resistance to solder heat                  | After preheating at $170 \pm 10^\circ \text{C}$ for 90 seconds or more, immerse in solder at $255 \pm 5^\circ \text{C}$ for $3 \pm 1$ seconds so that all electrodes are completely hidden. Remove from the bath to room temperature and measure 2 hours later.                        | Satisfies item 6  |
| 7.6  | Temperature Characteristics                | Measure in the range of $-40$ to $+85^\circ \text{C}$ .  |   |
| 7.7  | Humidity                                   | Keep in a constant temperature and humidity chamber at a temperature of $60^\circ \text{C}$ and relative humidity of 90 to 95% for 1000 hours, take it out to room temperature, and measure 2 hours later.   |   |
| 7.8  | High temperature retention characteristics | Hold in a constant temperature bath at a temperature of $125^\circ \text{C}$ for 1000 hours, take out to room temperature, and measure 2 hours later.  |   |
| 7.9  | Low temperature retention characteristics  | Keep in a constant temperature bath of $-40^\circ \text{C}$ for 1000 hours, take out to room temperature and measure 2 hours later.  |   |
| 7.10 | Thermal Shock Characteristics              | One cycle consists of $-40^\circ \text{C}$ for 30 minutes and $+125^\circ \text{C}$ for 30 minutes. After 1000 cycles, take it out to room temperature and measure 2 hours later.  |   |
| 7.11 | Reflux Resistance                          | After performing reflow twice according to the reflow profile on page 7, take out at room temperature and pressure and measure after 24 hours.   |   |

## Reflow profile

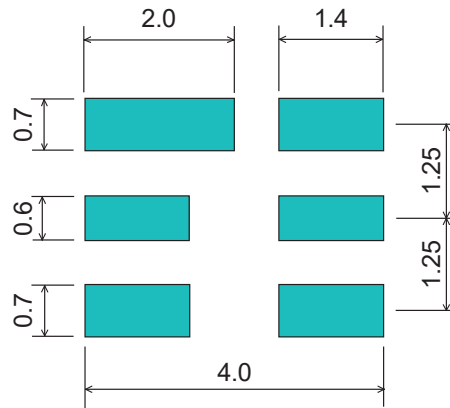
- Profile A


- 1) Set the preheating temperature to 160 to 180 °C for 60 to 120 seconds.
- 2) The heating speed up to the preheating temperature of 170 °C shall be 5 °C / sec or more.
- 3) The heating temperature is 220 °C for 60 seconds, and the peak temperature is 250 °C.



## Recommended Land Pattern

- 1) Recommended land pattern is as follows.



 : Land Pattern  
Unit : mm



## 8. TAPING METHOD OF PLASTIC TAPE PACKAGE

8.1 The components are packed to be prevented from being damaged. Part number, quantity and inspection number are indicated on each minimum packing unit.

8.2 Dimensions of Plastic Tape See Figure. 2.

### 8.3 Taping Method

- 1) The tape shall be wound clockwise. (The feeding holes shall be to the right side when the tape is pulled toward user.)
- 2) Cover tape shall not cover the feeding holes of cavity tape or overlap the edge of cavity tape.
- 3) Trailer tape shall be 160...190 mm and leader cavity shall be 80...120 mm (refer to Figure. 1.)
- 4) The tip of the cover tape shall be adhered to the side of reel with adhesive tape (50...120 mm: Reference value).
- 5) The cover tape peel strength force shall be 0.2...0.6N (Reference value) which measured at 170 degrees with respect to the carrier tape.
- 6) The orientation is ruled as Figure. 2 shows.
- 7) All the filters shall be packed continuously into the tape without vacant cavities except the leader cavity and trailer tape area.
- 8) A reel shall contain 2000 pcs of filters.  
(Please place the order with 2000 pcs times integer number. In case of small quantity shipment, bulk packing may be applied.)
- 9) Cover tape and cavity tape are made of anti-static material.
- 10) Part number, customer part number, quantity and inspection lot number shall be marked on each reel.  
(The reel side containing the label will visible when the reel is oriented in a direction that dispenses the tape from the top of the reel and in a clockwise direction.)
- 11) The product which has ROHS-Y<\*> mark on the packaging label is compliance with RoHS directives. The alphabet in blank <\*> will be changed A to B, B to C, and so on with every revision of the RoHS directives. Please refer to the document, "The Marking for the directives on the restriction of the hazardous substances' use," to check the directives corresponding to alphabets in <\*>.

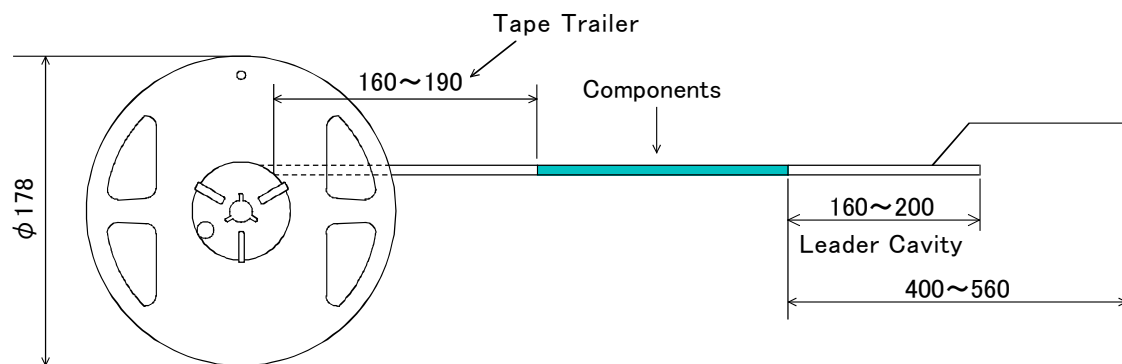
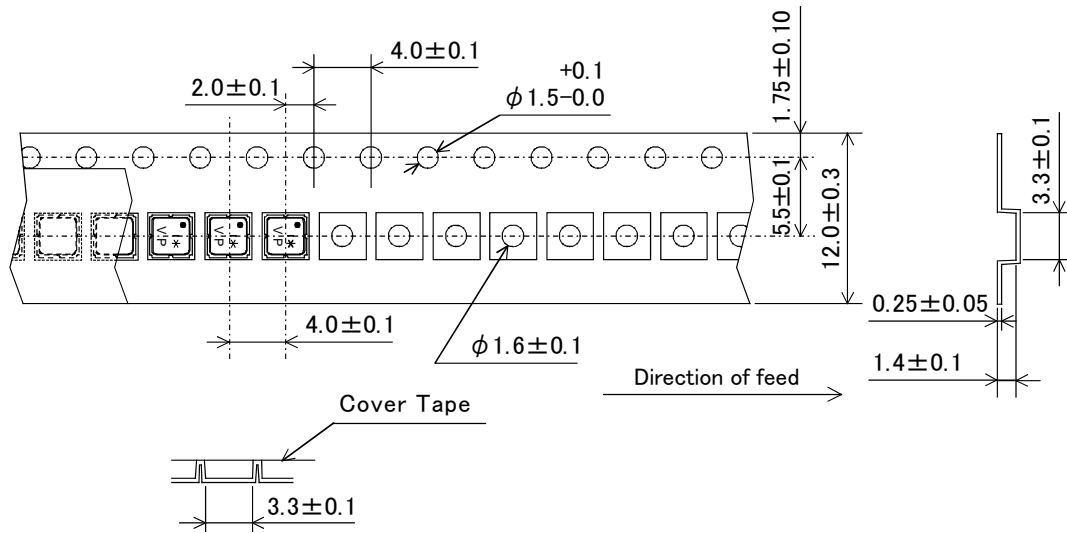


Figure1

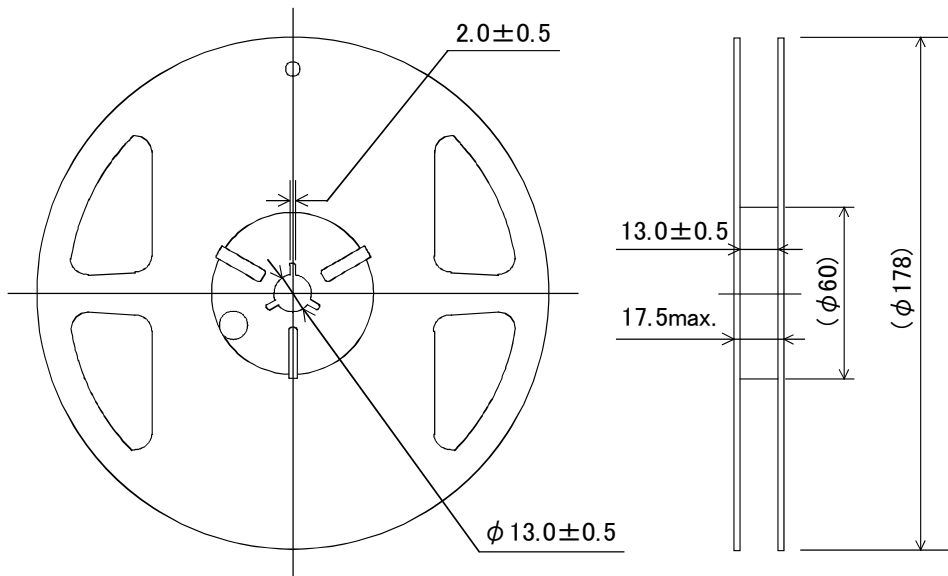
Unit : mm

Dimensions of Carrier Tape



The marked part number faces the cover tape side.

Dimensions of Reel Tape and Reel Standard per ANSI/EIA-481



Unit : mm

Figure 2

## 9. NOTICE

### 9.1 Usage Conditions

- 1) Use this component within operating temperature range. It might not meet the specification of electrical performance out of operating temperature range. Usage on the condition exceeding operating temperature range might cause degradation or destruction of the component. Even a short time usage on such conditions might cause degradation of reliability.
- 2) This product is designed for use of electrical equipment in the standard environment (temperature, humidity, atmospheric pressure etc.) Do not use in the following environments, since it causes degradation of characteristics and reliability.
  - Ambient air containing corrosive gas (Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>x</sub>, NO<sub>x</sub>, etc.)
  - Ambient air containing combustible gas and substance with high volatility
  - In dusty place
  - In the places where the water splashes or precipitates
  - Under direct sunlight
  - In the places under the strong influence of static electricity or electric fieldContact us before using the component in such conditions.
- 3) This component can not be used in liquid (water, oil, chemical solution, organic solvents, etc.)
- 4) Apply electrical power lower than specified in the specification. When the component is used with higher rating power than specified in the specification, it might cause degradation or destruction of the component. Even if a short time, it might cause degradation of reliability under such a condition.
- 5) Do not let the component contact with other components, since its coating is not insulated.
- 6) Rapid temperature change of this component makes electric charge. Include discharge circuit between port and ground, since it might cause degradation or destruction of this component and other components around this component.

### 9.2 Storage Conditions

- 1) Keep the component in the package or sealed container on the following conditions.  
[Temperature: -10...+40°C, Humidity: 30...85% R.H.]  
Examine solderability before using this component, after longer than 6 months storage since it might cause degradation of solderability. Notice that long-term storage might cause discoloration.
- 2) To keep solderability of outer-electrode, do not store in the following environments.
  - Ambient air containing corrosive gas (Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>x</sub>, NO<sub>x</sub>, etc.)
  - Ambient air containing combustible gas and substance with high volatility
  - In dusty place
  - In the places where the water splashes or precipitates
  - Under direct sunlight
  - In the places under the strong influence of static electricity or electric field
- 3) Do not open the package until usage.

### 9.3 Soldering Conditions

- 1) Solder on the following condition. Contact us before soldering this component on conditions other than following since it might cause destruction.
  - a. Soldering with soldering iron
    - Preheating condition : 150±20°C, 60 seconds min.
    - Temperature at the tip of the soldering iron : 260±10°C or 350±5°C
    - Duration : 3 seconds max.
    - Diameter at the tip of the soldering iron : φ3mm max.
    - Power of soldering iron : 30W max.Avoid the contact with iron other than back or side terminals part.
  - b. Reflow soldering
    - Solder on the reflow soldering condition specified in this specification
- 2) Use land pattern recommended in this specification, since excess solder might cause destruction of chip by mechanical stress to supply too much solder.
- 3) Use rosin flux. Do not use strong acid flux [ex. Flux with more than 0.2wt% Halogen compound content (converted to chlorine content.)]
- 4) Use JIS-Z-3282 H63A, H60A, H50A solder or Lead free solder (Sn-3.0Ag-0.5Cu). Contact us before using other solders than above.
- 5) Solder with reflow soldering. Soldering with soldering iron shall be soldered on the condition specified in this specification. Since the lack of preheating gives this component rapid temperature change, it might cause degradation and destruction. Contact us before using the component on other conditions than specified in this specification.
- 6) Notice that the duration of soldering with soldering iron must be considered to be accumulated time, when soldering is repeated.
- 7) Use this component after examining that the outer electrodes are smoothly covered with solder thicker than 0.1mm.

### 9.4 Cleaning Conditions

- 1) Isopropyl alcohol and ethyl alcohol can be used for cleaning. Contact us before using other cleaning solvents than above. Do not use flon, trichloroethane etc in the point of view to protect for global environment.
- 2) Clean this component after ensuring that the temperature of the component is room temperature, since rapid temperature change by cleaning after reflow soldering might cause degradation or destruction.
- 3) Do not use ultrasonic cleaning, since ultrasonic vibration might cause degradation or destruction.
- 4) Dry this component immediately after cleaning.
- 5) In the case that cleaning process is included in the manufacturing process, examine the influence to the performance of the component with mounting on PCB before use.

### 9.5 Handling Conditions

- 1) Notice that it might cause destruction to apply larger shock than specified in the specification while handling.
- 2) Notice that it might cause reliability degradation to apply excessive shock or vibration during transportation.
- 3) Do not apply any shock or pressure to this component during transportation when the component is on PCB.
- 4) Do not apply static electricity or excessive voltage while assembling and measuring, since it might cause degradation or destruction to apply static electricity to this component.
- 5) Do not handle this component with bare hand.

### 9.6 Mounting Conditions

- 1) Mount this component not to apply a stress caused by warp or bend of PCB.
- 2) Abraded positioning claw, pick-up nozzle, etc of component placement machine might apply excessive shock on the component on PCB and cause destruction. Keep the maintenance which is instructed on each machine regularly to prevent the component from these kinds of troubles.
- 3) Mount all terminals, or terminal strength might be degraded.
- 4) Mount the component on PCB with no space between component and PCB.

### 9.7 Limitation of Applications

Please contact us before using our products for the applications listed below which require especially for the prevention of defects which might directly cause damage to the third party's life, body or property.

- a. Aircraft equipment
- b. Aerospace equipment
- c. Undersea equipment
- d. Nuclear control equipment
- e. Medical equipment
- f. Transportation equipment (vehicles, trains, ships, etc.)
- g. Traffic signal equipment
- h. Disaster prevention / crime prevention equipment
- i. Data - processing equipment
- j. Application of similar complexity and / or reliability requirements to the applications listed in the above