



Management No.: S3-E12

## PRODUCT SPECIFICATION

Customer: \_\_\_\_\_

Customer P/N: \_\_\_\_\_

Product Description: SX-3225 24.000MHz 9pF ±10ppmTKD P/N: SX32Y024000B91T11GProduct Compliance: ☒Pb-free ☒RoHS 2.0 ☒REACH ☒HF

### CUSTOMER'S APPROVAL

(PLEASE RETURN A COPY WITH APPROVAL)

TKD SCIENCE AND TECHNOLOGY CO.,LTD.

|            |         |             |
|------------|---------|-------------|
| Approved   | Checked | Prepared by |
| Xiong Feng | Mei Bin | Liu Man     |

| Rev. | Revision Description | Date      | Prepared by | Checked |
|------|----------------------|-----------|-------------|---------|
| A    | Initial Release      | 2026/9/11 | Liu Man     | Mei Bin |



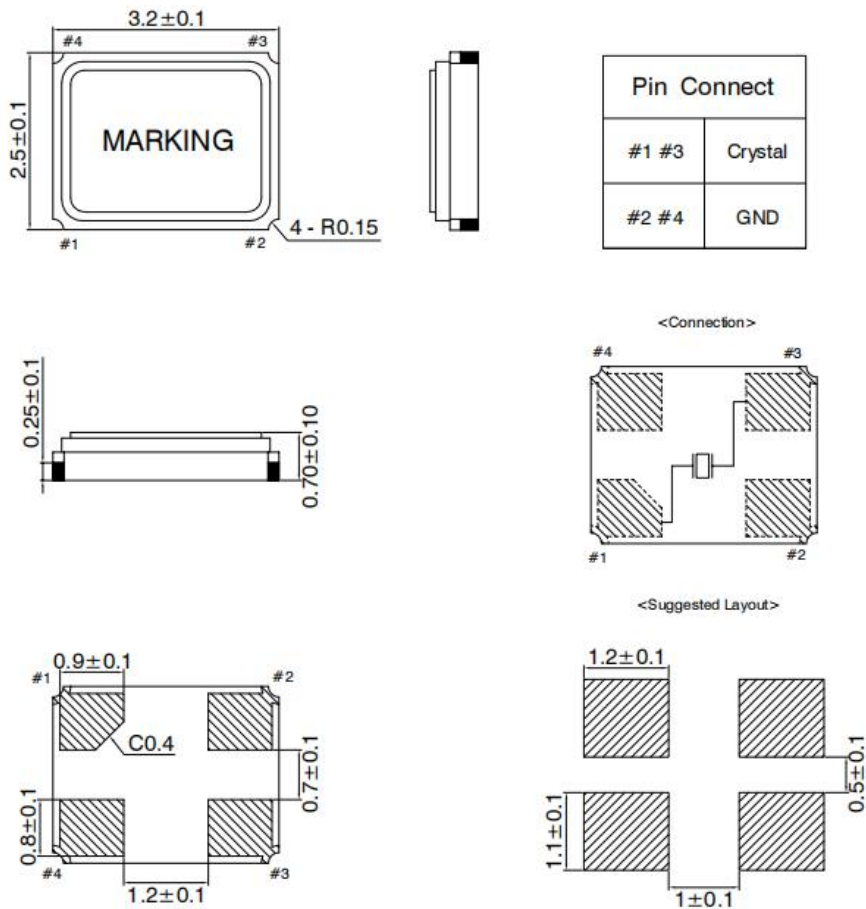
## 1. QUARTZ CRYSTAL UNIT SPECIFICATION

|                              |                  |
|------------------------------|------------------|
| ※ Description                | : Quartz Crystal |
| ※ Product Type               | : SX-3225        |
| ※ Crystal Cut                | : AT-CUT         |
| ※ Test Equipment             | : S&A 250B       |
| ※ Electrical Characteristics | :                |

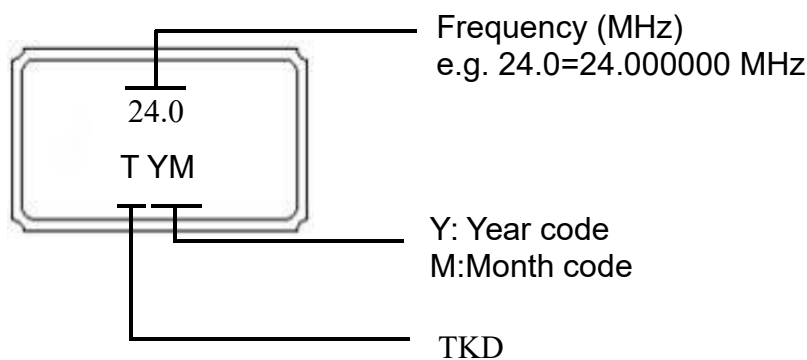
| Item | Parameters                   | Symbol | Electrical Specifications |      |      |       | Notes                                                |
|------|------------------------------|--------|---------------------------|------|------|-------|------------------------------------------------------|
|      |                              |        | Min.                      | Typ. | Max. | Units |                                                      |
| 1    | Nominal Frequency            | F0     | 24.000000                 |      |      |       | MHz                                                  |
| 2    | Oscillation Mode             | -      | Fundamental               |      |      |       | -                                                    |
| 3    | Load Capacitance             | CL     | 9                         |      |      |       | pF                                                   |
| 4    | Frequency Tolerance          | -      | -10                       | -    | 10   | ppm   | At 25°C±3°C                                          |
| 5    | Equivalent Series Resistance | ESR    | -                         | -    | 40   | Ω     |                                                      |
| 6    | Drive Level                  | DL     | -                         | -    | 100  | μW    |                                                      |
| 7    | Frequency Stability          | TC     | -20                       | -    | 20   | ppm   | Over the operating temp. range (referenced to 25 °C) |
| 8    | Operating Temperature        | -      | -40                       | -    | 105  | °C    |                                                      |
| 9    | Storage Temperature          | -      | -40                       | -    | 125  | °C    |                                                      |
| 10   | Aging                        | -      | -3                        | -    | 3    | ppm   | Per Year                                             |
| 11   | Insulation Resistance        | -      | 500                       | -    | -    | MΩ    | at 100 V DC                                          |
| 12   | Shunt Capacitance            | C0     | -                         | -    | 3    | pF    |                                                      |



2. DIMENSIONS (Unit:mm)



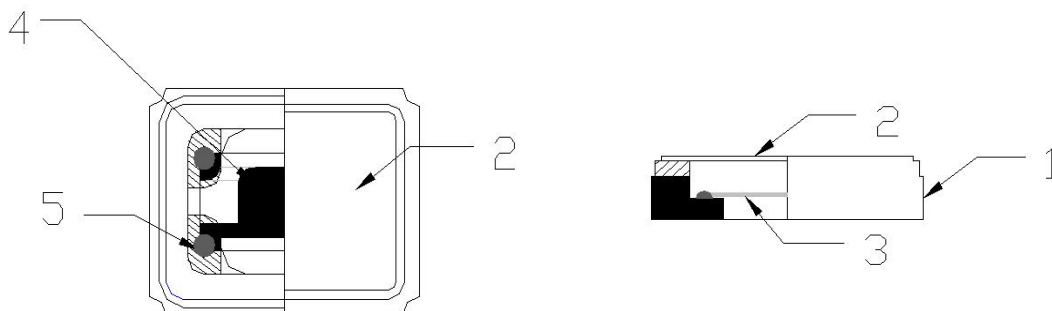
3. MARKING



|            |                                        |      |      |      |      |      |      |      |      |      |    |    |
|------------|----------------------------------------|------|------|------|------|------|------|------|------|------|----|----|
| Year       | 2021                                   | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | /  | /  |
| Year code  | 1                                      | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 0    | /  | /  |
|            | *The year code repeats every 10 years. |      |      |      |      |      |      |      |      |      |    |    |
| Month      | 1                                      | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11 | 12 |
| Month code | A                                      | B    | C    | D    | E    | F    | G    | H    | J    | K    | L  | M  |

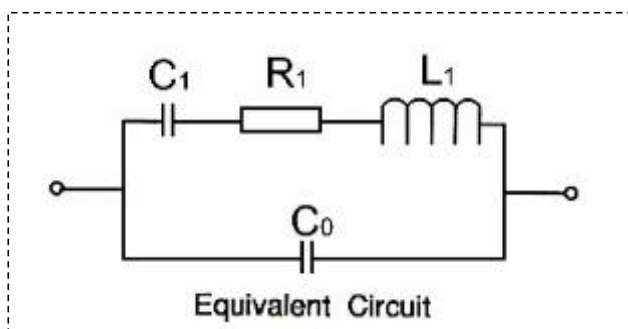
Note: Black lettering

## 4. INTERNAL STRUCTURE



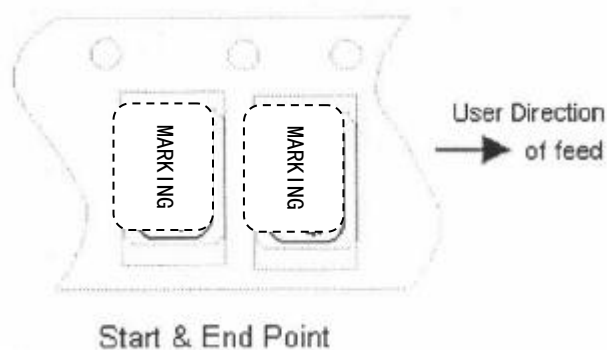
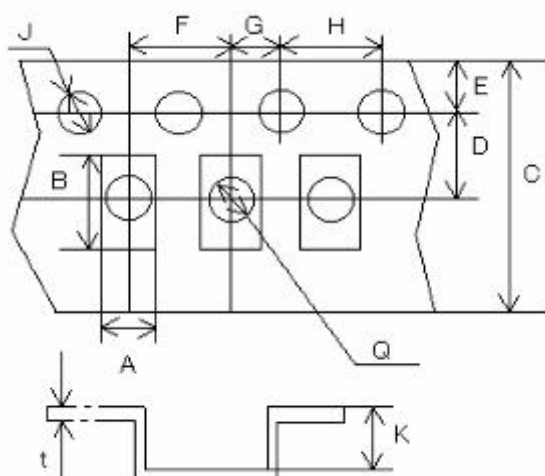
| No. | COMPONENTS    | MATERIALS                           |
|-----|---------------|-------------------------------------|
| 1   | Package       | Ceramic ( $\text{Al}_2\text{O}_3$ ) |
| 2   | Lid           | Kovar (Fe-Ni-Co alloy)              |
| 3   | Crystal blank | $\text{SiO}_2$                      |
| 4   | Electrode     | Noble Metal                         |
| 5   | Adhesive      | Resin, Ag                           |

## 5. EQUIVALENT CIRCUIT



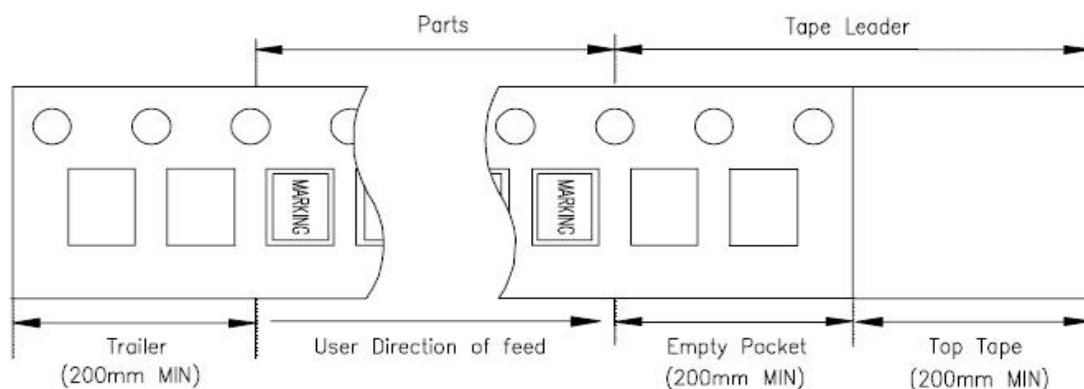
## 6. PACKAGING (Unit:mm)

※ CARRIER TAPE

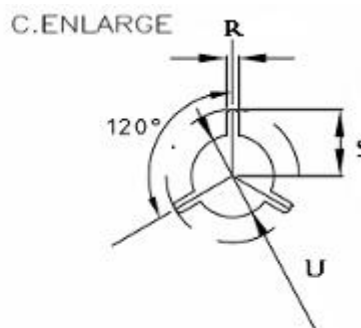
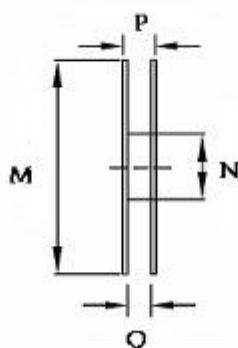
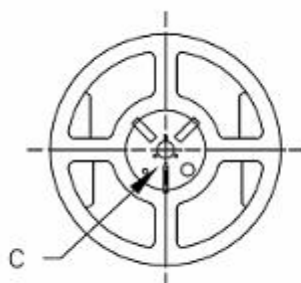


| A   | B   | C   | D   | E    | F   | G   | H   | J    | K   | t    |
|-----|-----|-----|-----|------|-----|-----|-----|------|-----|------|
| 2.7 | 3.4 | 8.0 | 3.5 | 1.75 | 4.0 | 2.0 | 4.0 | 1.55 | 1.4 | 0.25 |

REMARK:



※ Quantity: 3,000 pcs/reel



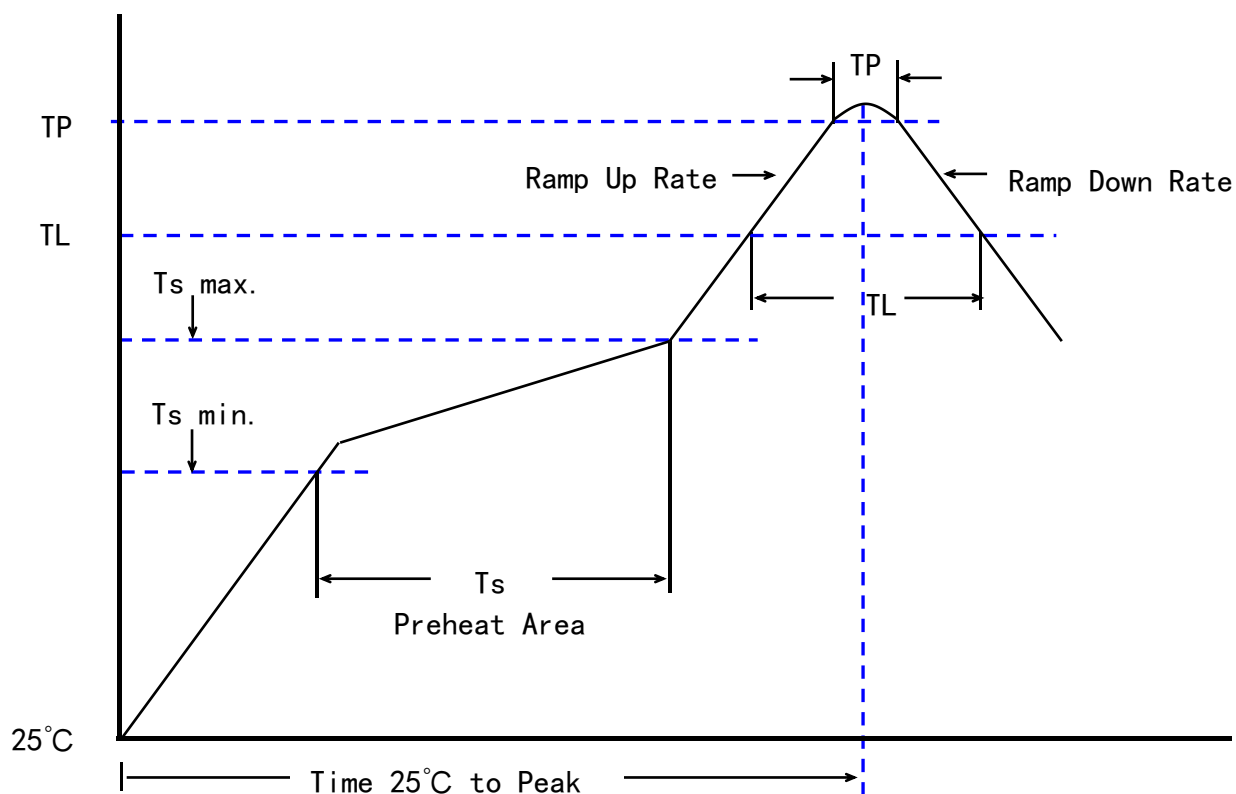
| M     | N    | P    | Q   | R   | S    | U    |
|-------|------|------|-----|-----|------|------|
| 178.0 | 60.2 | 11.5 | 8.0 | 2.5 | 11.0 | 13.0 |



## 7. REFLOW SOLDERING PROFILE

Reference: JEDEC J-STD-020D

| Profile Parameter                                                                                               | Pb-Free Assembly                 |
|-----------------------------------------------------------------------------------------------------------------|----------------------------------|
| Preheat/Soak<br>Temperature Min. (Ts min.)<br>Temperature Max. (Ts max.)<br>Time (Ts) from (Ts min. to Ts max.) | 150°C<br>200°C<br>60-120 seconds |
| Ramp-up rate (TL to TP)                                                                                         | 3°C/second max.                  |
| Liquidus temperature (TL)<br>Time maintained above TL                                                           | 217°C<br>60-150 seconds          |
| Peak/Classification Temperature (TP)                                                                            | 260±5°C                          |
| Time within 5°C of actual Peak<br>Temperature (TP)                                                              | 20~40 seconds                    |
| Ramp-down rate (TP to TL)                                                                                       | 6°C/second max.                  |
| Time from 25 °C to peak temperature                                                                             | 8 minutes max.                   |
| Suggest reflow times                                                                                            | 3 Times max.                     |



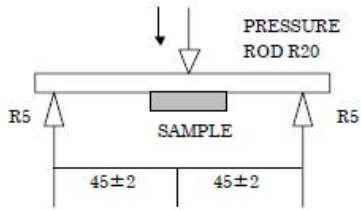


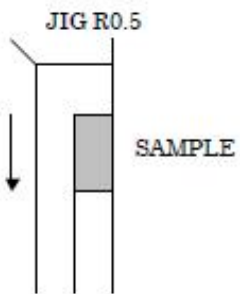
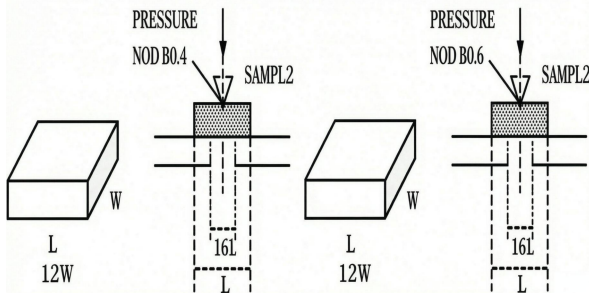
## 8. RELIABILITY SPECIFICATION

REFER: JIS C 6701

| No. | Item                        | Conditions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Criteria |
|-----|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 1   | High Temperature            | Samples shall be stored at $125\pm 2^{\circ}\text{C}$ for $1000\pm 12\text{h}$ . Electrical parameters shall be measured by 250B within 24h after conditioning for more than 2h at room temperature( $25\pm 2^{\circ}\text{C}$ ).<br>If the customer's required temperature range exceeds the standard range, the test shall be conducted under the customer-specified conditions.                                                                                                                                                                                                                       | B,C      |
| 2   | Low Temperature             | Samples shall be stored at $-40 \pm 2^{\circ}\text{C}$ for $500 \pm 12\text{h}$ . Electrical parameters shall be measured using an S&A 250B within 24h after conditioning for more than 2h at room temperature( $25\pm 2^{\circ}\text{C}$ ).<br>If the customer's required temperature range exceeds the standard range, the test shall be conducted under the customer-specified conditions.                                                                                                                                                                                                            | A,C      |
| 3   | High Temperature & Humidity | Stored at $85\pm 2^{\circ}\text{C}$ and humidity 85% for $1000\pm 12\text{h}$ . The characteristic parameters of 250B must be tested in 24h after conditioning for more than 2h at room temperature( $25\pm 2^{\circ}\text{C}$ ).                                                                                                                                                                                                                                                                                                                                                                        | B,C,D    |
| 4   | Temperature Shock           | The crystal unit should undergo 100 temperature shocks, and then be left to stand at room temperature ( $25\pm 2^{\circ}\text{C}$ ) for at least 2 hours and tested at 250B within 24 hours. The conditions for each temperature shock are as follows:<br>1. Last for 2~3 minutes at a temperature of $-40+0/-6^{\circ}\text{C}$<br>2. Last for $30\pm 3$ minutes at a temperature of $25^{\circ}\text{C}\pm 2^{\circ}\text{C}$<br>3. Last for $30\pm 3$ minutes at a temperature of $125+4/-0^{\circ}\text{C}$<br>4. Last for 2~3 minutes at a temperature of $25^{\circ}\text{C}\pm 2^{\circ}\text{C}$ | A,C      |
| 5   | Solderability               | The lead is immersed in a $245\pm 5^{\circ}\text{C}$ solder bath within $2\pm 0.6$ seconds.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | G        |



|    |                              |                                                                                                                                                                                                                                                                    |     |
|----|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 6  | Gross Leak                   | Standard part of automatic gross leakage detector,<br>test pressure: 0.2 MPa                                                                                                                                                                                       | E   |
| 7  | Fine Leak                    | Helium bombing 5.0~5.5 Kg/cm <sup>2</sup> ,for 2 hours.                                                                                                                                                                                                            | F   |
| 8  | Resistance to Soldering Heat | 3 reflows,the maximum temperature & time is 260℃±5℃,<br>15±5 seconds. The characteristic parameters of 250B must be tested in 24h after conditioning for more than 4h at room temperature(25±2℃).                                                                  | A,C |
| 9  | Free Fall                    | Fall freely from a height of 100cm three times onto a hard wooden board.                                                                                                                                                                                           | A,C |
| 10 | Vibration                    | Frequency Range: 10~55Hz<br>Amplitude (total excursion): The scanning frequency is 0.75oct/min, and the peak acceleration is 5g.<br>Sweep time: 3 direction(x, y, z) each for 2 hours.                                                                             | A,C |
| 11 | Board Flex                   | Weld the sample onto the PCB and apply a force of 10N on the reverse side of the sample until the bending of the board reaches 3mm, then maintain this state for 5 seconds.<br> | A,C |

|    |                            |                                                                                                                                                                                                                                                                          |     |
|----|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 12 | Folding- plate thrust test | <p>Apply a final force of 10 N onto the movable jig with R0.5 mm radius, and hold the force for 10 seconds.</p>                                                                         | A,C |
| 13 | Body load test             | <p>Apply a force at the center of the sample for 10 seconds.<br/>If the sample is greater than 1.6x1.2mm, apply 10N; if the sample is less than or equal to 1.6x1.2mm, apply 5N.</p>  | A,C |
| 14 | Mechanical Shock           | 100g,6ms, half sine shock pulse, 6 axis*3 times                                                                                                                                                                                                                          | A,C |

**SPECIFICATIONS**

|   |                                                                          |                                                                         |
|---|--------------------------------------------------------------------------|-------------------------------------------------------------------------|
| A | Frequency change permitted.                                              | $\Delta F \leq 5 \text{ ppm}$                                           |
| B | Frequency change permitted.                                              | $\Delta F \leq 10 \text{ ppm}$                                          |
| C | Equivalent series resistance change permitted.                           | $\Delta CI \leq 5 \Omega$ or 15 % of initial value, whichever is larger |
| D | Insulation resistance                                                    | $> 500 \text{ M}\Omega$                                                 |
| E | Pressure gap less than                                                   | $< 1 \times 10^{-4} \text{ Pa} \cdot \text{m}^3/\text{s}$               |
| F | Leak rate less than                                                      | $< 1 \times 10^{-9} \text{ Pa} \cdot \text{m}^3/\text{s}$               |
| G | A new uniform coating of solder shall cover a minimum 95% of the surface |                                                                         |

**Remark:**

- ※ Each test item shall be performed on separate samples.
- ※ Measurement condition:Electrical parameters shall be measured using S&A 250B or equivalent tester.

**Notes:****1. Ultrasonic cleaning**

General cleaning solutions or ultrasonic cleaning method may be used to clean our products. However, under certain circumstances, ultrasonic cleaning machine could generate resonance at the oscillation frequency of our products and thus deteriorate the electrical characteristics in devices, and even damage the overall structure of devices. Therefore, verification test is recommended before cleaning.

**2. Ultrasonic welding**

Avoid mounting and processing by ultrasonic welding. This method has a possibility of excessive vibration spreading inside the crystal products and becoming the cause of characteristic deterioration and non-oscillation.

**3. Storage Conditions**

Storage Temperature is only for the product itself. The storage temperature range for packing material is 5°C~40°C.

**4. Prohibited Environments**

This product shall not be used in toxic, harmful, or corrosive environments such as mercury, chlorine, sulfur, acid-base environments etc.

**5. Application Restrictions**

TKD products are designed specifically for general and specific electronic applications. Without confirmation, they shall not be used in critical areas beyond expectations, such as space technology, vehicle control, military weapon development, etc., to avoid significant risks to safety, health, property, or society. These products are intended solely for designated applications. There is no additional guarantee for special-purpose applications. If you need products for specific purposes, please consult TKD sales representatives in advance.