# PRODUCT SPECIFICATION SHEET




| | | | |
|---|---|---|---|
| **Customer** | – | | |
| **Customer P/N** | - | | |
| **Product Type** | Temperature Sensing Crystal | | |
| **Part Number** | 9Z26000004 | **Version** | A4 |
| **Part Description** | SMD TSX 2.0 x 1.6 (TH + Xtal) | | |
| **Nominal Frequency** | 26.000000 MHz | | |

| | |
|---|---|
| **Prepared** | Li Xiang |
| **Reviewed** | Kuro Peng |
| **Approved** | Liu Feng |
| **Date** | 2023/11/24 |

**Customer's Approval & Date：**

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RoHS COMPLIANT

Pb Lead-Free

**Moisture Sensitivity Level 1**

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* Attention

If you intend to use products on the controlling equipment that relate to medical, aeronautical, aerospace, military science, space and etc, please make sure to let us know your intentions in advance.

Ultrasonic related process may cause damage to crystal blank by resonance itself. If ultrasonic related process is used, we strongly recommend to assess the damage risk under related ultrasonic conditions before use in production.

## 1. History of Specification Revision

| Ver. | Content | Date | Reviser | Remark |
|---|---|---|---|---|
| A0 | Initial released. | 2019/2/25 | Chen XuanRu | |
| A1 | Change marking & Changepackaging requirement | 2022/11/22 | Chen XuanRu | |
| A2 | Change marking | 2022/1/13 | Han Shuang | |
| A3 | Overall version update | 2023/4/26 | Li Xiang | |
| A4 | Update electrical specifications | 2023/11/24 | Li Xiang | |
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## 2. Electrical Specifications

### 2.1 Specifications for operation condition and electrical characteristics

| # | Parameter | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|
| 1 | Nominal frequency | | 26.000000 | | MHz | - |
| 2 | Crystal cut type | | AT-cut | | - | - |
| 3 | Mode of vibration | | Fundamental | | - | - |
| 4 | Load capacitance ($C_L$) | - | 8.0 | - | pF | Note 1. |
| 5 | ESD | | HBM＞2000V | | - | JESD22-A114-B |
| 6 | MSL | | Level 1 | | - | IPC/JEDEC J-STD-033C |
| 7 | Drive level | 0.01 | 50 | 100 | μW | - |
| 8 | Operating temperature range | -40 | - | +105 | °C | - |
| 9 | Storage temperature range | -40 | - | +105 | °C | - |
| 10 | Initial frequency tolerance | -10 | - | +10 | ppm | At 25±3°C, drive level 10μW |
| 11 | Frequency drift after reflow | -2.0 | - | +2.0 | ppm | After two times of reflow |
| 12 | Frequency tolerance over temperature | -12 | - | +10 | ppm | Within -30°C to +85°C. Above +85°C see Note 2. |
| | | -30 | - | +10 | ppm | Within -40°C to +85°C. Above +85°C see Note 2. |
| | | -30 | - | +40 | ppm | Within -40°C to +105°C. Above +85°C see Note 2. |
| 13 | Frequency aging | -0.7 | - | +0.7 | ppm/First year | At 25±2°C |
| | | -1.4 | - | +1.4 | ppm/2 years | |
| | | -2.5 | - | +2.5 | ppm/5 years | |
| | | -5 | - | +5 | ppm/10 years | |
| 14 | Tuning sensitivity | 10.8 | 12.0 | 13.2 | ppm/pF | - |
| 15 | Equivalent series resistance (ESR) | - | - | 50 | Ω | Note 3. |
| 16 | Insulation resistance | 500 | - | - | MΩ | - |
| 17 | Quality factor (Q) | 75,000 | - | - | - | Note 4. |
| 18 | Inflection point | 29.0 | 30.5 | 32.0 | °C | Specified at max drive level. $t = \left(t_0 - \frac{C2}{3C3}\right)$ |
| 19 | First-order curve fitting parameter (C1) | -0.40 | -0.25 | -0.10 | ppm/°C | Note 5. |
| 20 | Second-order curve fitting parameter (C2) | -4.5 | 0 | +4.5 | $x10^{-4}$ ppm/°C$^2$ | Note 5. |
| 21 | Third-order curve fitting parameter (C3) | +8.7 | +9.85 | +11 | $x10^{-5}$ ppm/°C$^3$ | Note 5. |

Note 1 The load capacitance is measured according to IEC Standard #60444-8.

Note 2 Above 85°C, the frequency tolerance over temperature is bound by the third order coefficient range.

Note 3 The ESR max is specified at max drive level minimum Q, drives a smaller ESR; that is, design the crystal to the minimum Q.

Note 4 The minimum Q value calculated from ESR and L is smaller than this specification.

Note 5 The curve fitting parameter is obtained from the crystal curve fitting algorithm (Ta=-40°C to 85°C per 1 °C), using the temperature inflection point t0 = 30.5°C.

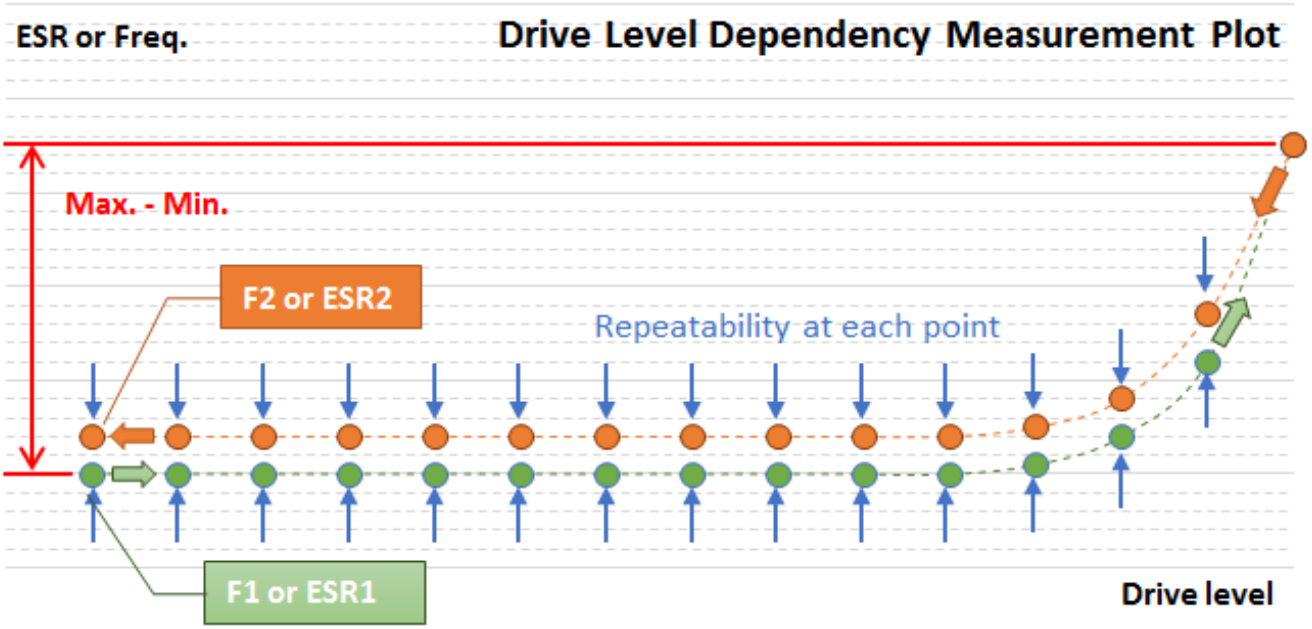
## 2. Electrical Specifications (Cont.)

### 2.2 Specifications for crystal drive level dependency (DLD)

| # | Parameter | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|
| 1 | Drive level measurement condition | 0.01 | - | 100 | μW | Drive level from 0.01 μW to 100 μW to 0.01 μW |
| 2 | DLD Frequency (maximum - minimum) | - | - | 3.5 | ppm | Define as FDLD. Note 6. |
| 3 | DLD Frequency (repeatability) | - | - | 0.7 | ppm | Define as FDLDH. Note 7. |
| 5 | DLD ESR (maximum - minimum) | - | - | 2.5 | Ω | Define as DLD2. Note 6. |
| 6 | DLD ESR (repeatability) | - | - | 1.5 | Ω | Define as DLDH2. Note 7. |

Note 6 Maximum - minimum: Difference between the maximum and minimum in a two-way measurement.

Note 7 Repeatability of the two-way measurement is defined in the above Drive level measurement condition.



## 2. Electrical Specifications (Cont.)

### 2.3 Specifications for GPS quality

| # | Parameter | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|
| 1 | Drive level measurement condition | | 100 | | μW | All measurements in GPS quality are taken at 100 μW drive level. |
| 2 | Full Cycle frequency stability slope | -50 | - | +50 | ppb/°C | Note 8. |
| 3 | 5°C Small cycle frequency stability slope | -50 | - | +50 | ppb/°C | Note 9. |
| 4 | Full cycle temperature hysteresis | -0.5 | - | +0.5 | ppm | Note 10. |
| 5 | 5°C Small cycle temperature Hysteresis | -0.05 | - | +0.05 | ppm | Note 11. |

Note 8 Test condition: Continuous temperature rate change of~ 1.0°C/min
Measure FT points every 1°C, heating up from -30 to 85°C, subtract a fifth-order polynomial best fit, and then calculate the slope of the residual.

Note 9 Test condition: Continuous temperature rate change of~ 1.0°C/min
Measure FT points every 0.5°C, heating up from -30 to 85°C, subtract a fifth-order polynomial best fit,and then calculate the slope of the residual.

Note 10 Temp. range:-30 to 85°C for each 1°C, Temp. rate: ~1.0°C/min
Test flow: 25°C(1)->-30°C->85°C->25°C(2), (25°C(1) freq. drift subtract 25°C(2) freq. drift)

Note 11 Temp. range:-30 to 85°C for each 0.5°C, Temp. rate: ~1.0°C/min, Test flow: any 5°C cycle (ex.25°C(1)->-30°C->25°C(2), 25°C(1) freq. drift subtract 25°C(2) freq. drift)

## 2. Electrical Specifications (Cont.)

### 2.4 NTC thermistor specification table

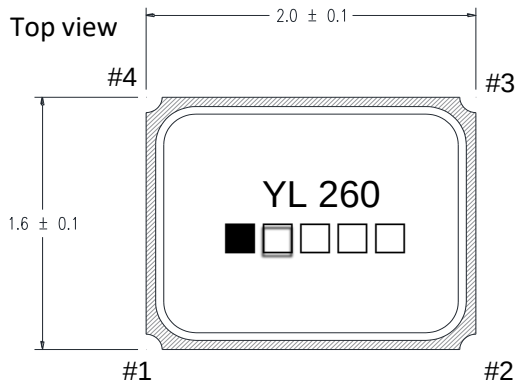
| # | Parameter | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|
| 1 | Operating temperature range | -40 | - | +105 | °C | - |
| 2 | Storage temperature range | -40 | - | +105 | °C | - |
| 3 | Resistance | - | 100 | - | kΩ | At 25°C* |
| 4 | B-constant | - | 4,250 | - | K | At 25°C - 50°C |
| 5 | Tolerance | - | - | 1 | % | - |

*In order to get the precise resistance value of the thermistor, the temperature control will be very important during testing since the resistance value will change ~4% per 1°C temperature difference.
Please check the following Murata website for detail explanation.
https://www.murata.com/en-us/support/faqs/products/thermistor/ntc/pct/0001

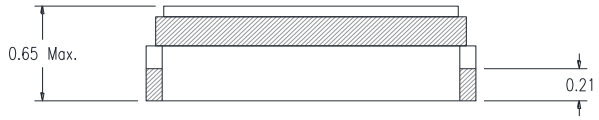
## 3. Product Design

### 3.1 Package dimensions and pad functions (Unit : mm)

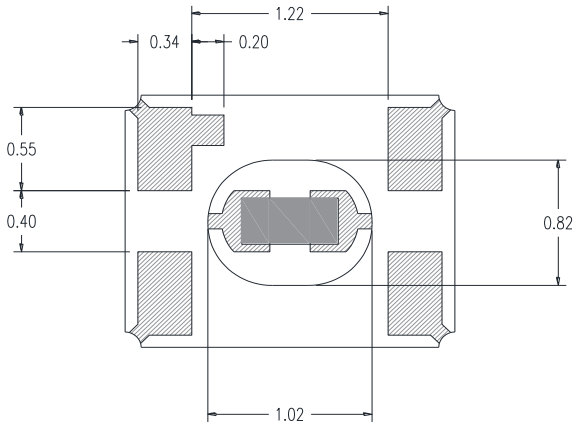
Top view




Lateral view

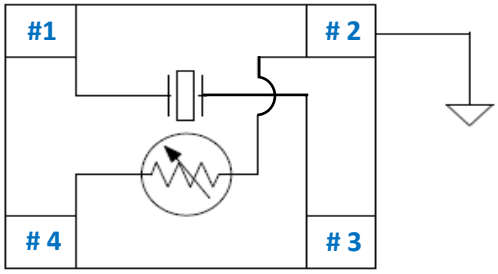



Bottom view



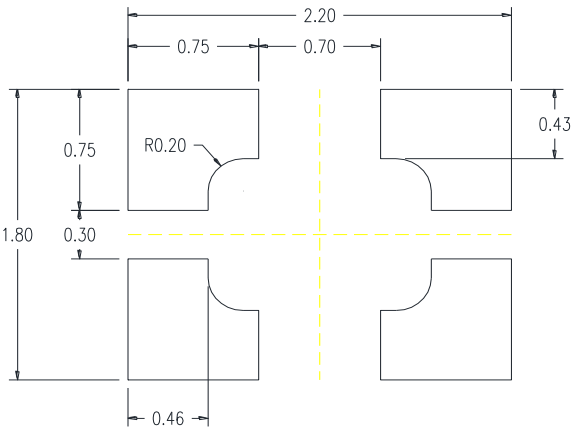

### 3.2 Pad connection diagram and function

Bottom view




| Pad | Function |
|---|---|
| 1 | Xtal in |
| 2 | Thermistor out, connecting to ground |
| 3 | Xtal out |
| 4 | Thermistor in |

### 3.3 Recommended land pattern (Unit : mm)



## 3. Product Design (Cont.)

### 3.4 Marking definition

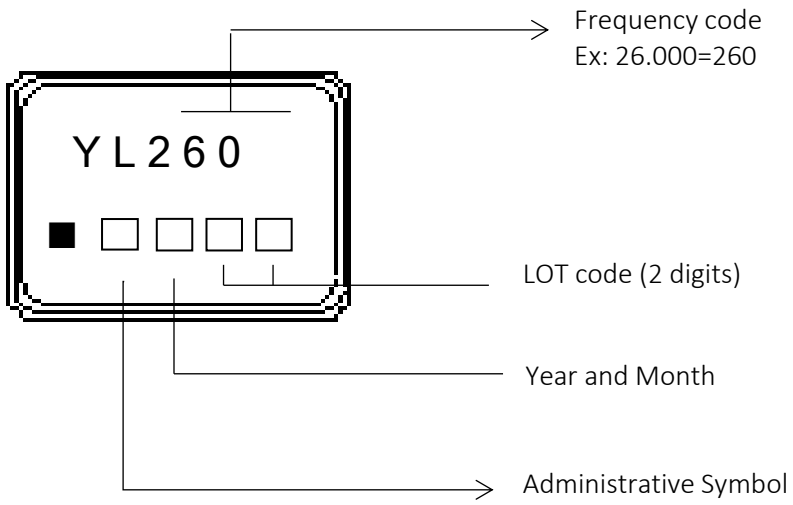
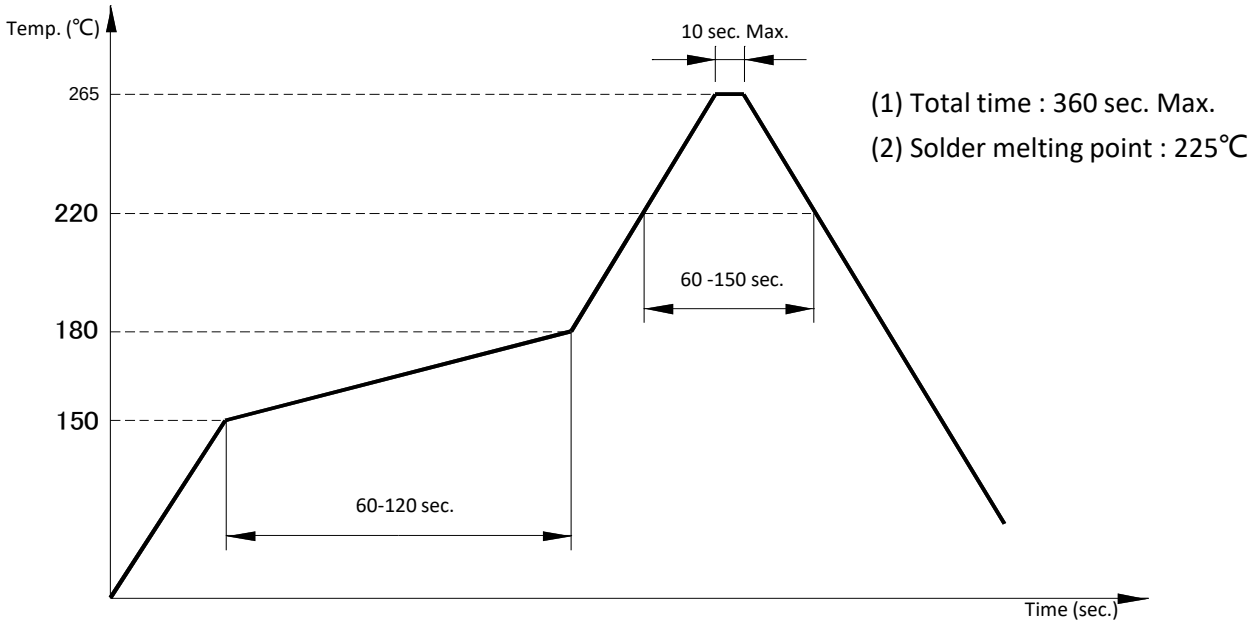



Table of Year and Month code

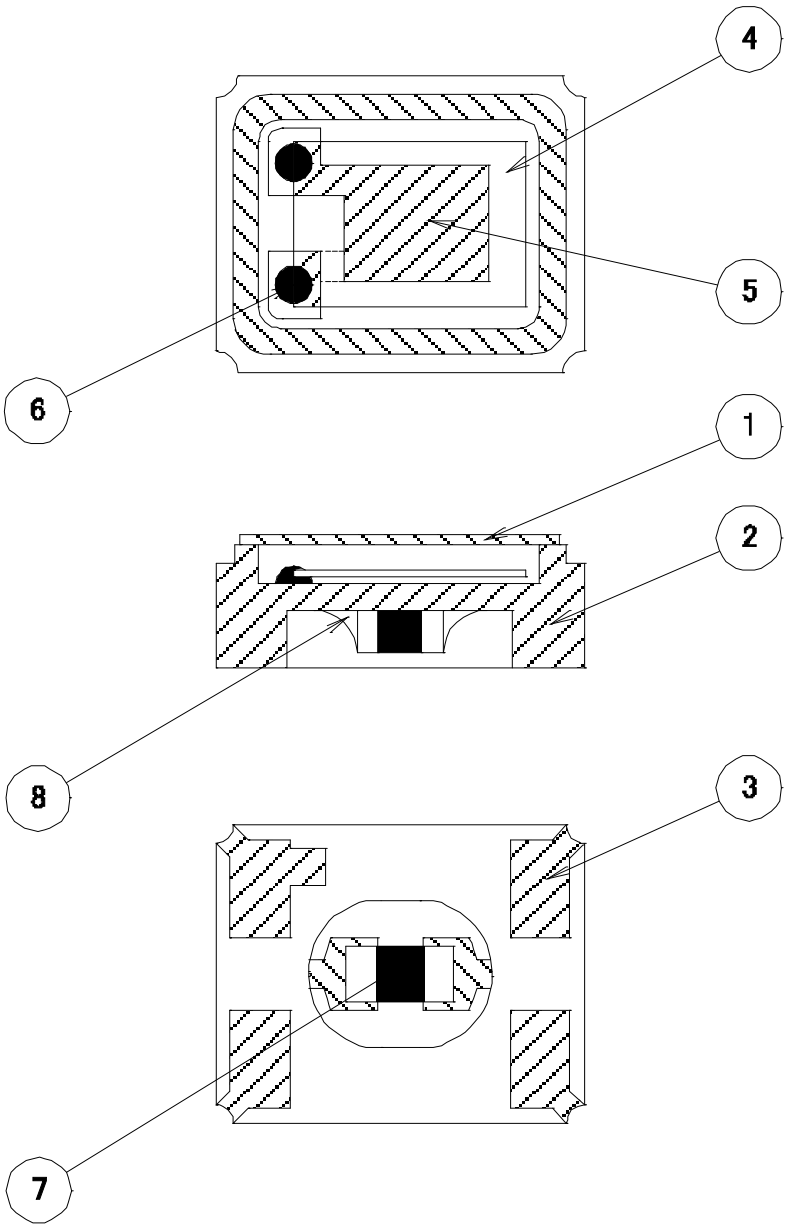
| Year \ Month | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2017 | 2021 | A | B | C | D | E | F | G | H | J | K | L | M |
| 2018 | 2022 | N | P | Q | R | S | T | U | V | W | X | Y | Z |
| 2019 | 2023 | a | b | c | d | e | f | g | h | j | k | l | m |
| 2020 | 2024 | n | p | q | r | s | t | u | v | w | x | y | z |

### 3.5 Recommended reflow profile



## 3. Product Design (Cont.)

### 3.6 Structure illustration



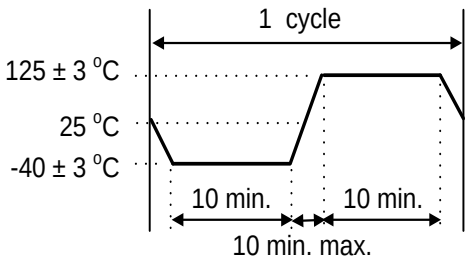

| # | Components | Materials | QTY | Finish/Specifications |
|---|---|---|---|---|
| 1 | Cap (Lid) | Kovar (Fe + Co + Ni) | 1 | Ni plating |
| 2 | Base (Package) | Ceramic ($Al_2O_3$) + Kovar (Fe + Co + Ni) | 1 | Alumina ceramics |
| 3 | Pad (Package) | Ni + Au | 4 | Tungsten metalization + Ni plating + Au plating |
| 4 | Crystal blank | $SiO_2$ | 1 | - |
| 5 | Electrode | Cr + Nobel material | 2 | |
| 6 | Conductive adhesive | Ag | 2 | Silicone resin |
| 7 | Thermistor | Alumina Ceramics ($Al_2O_3$), Ni + Ag+ Sn | 1 | - |
| 8 | Solder | Sn + Ag + Cu | 2 | - |

## 4. Reliability Assurance

### 4.1 Mechanical endurance

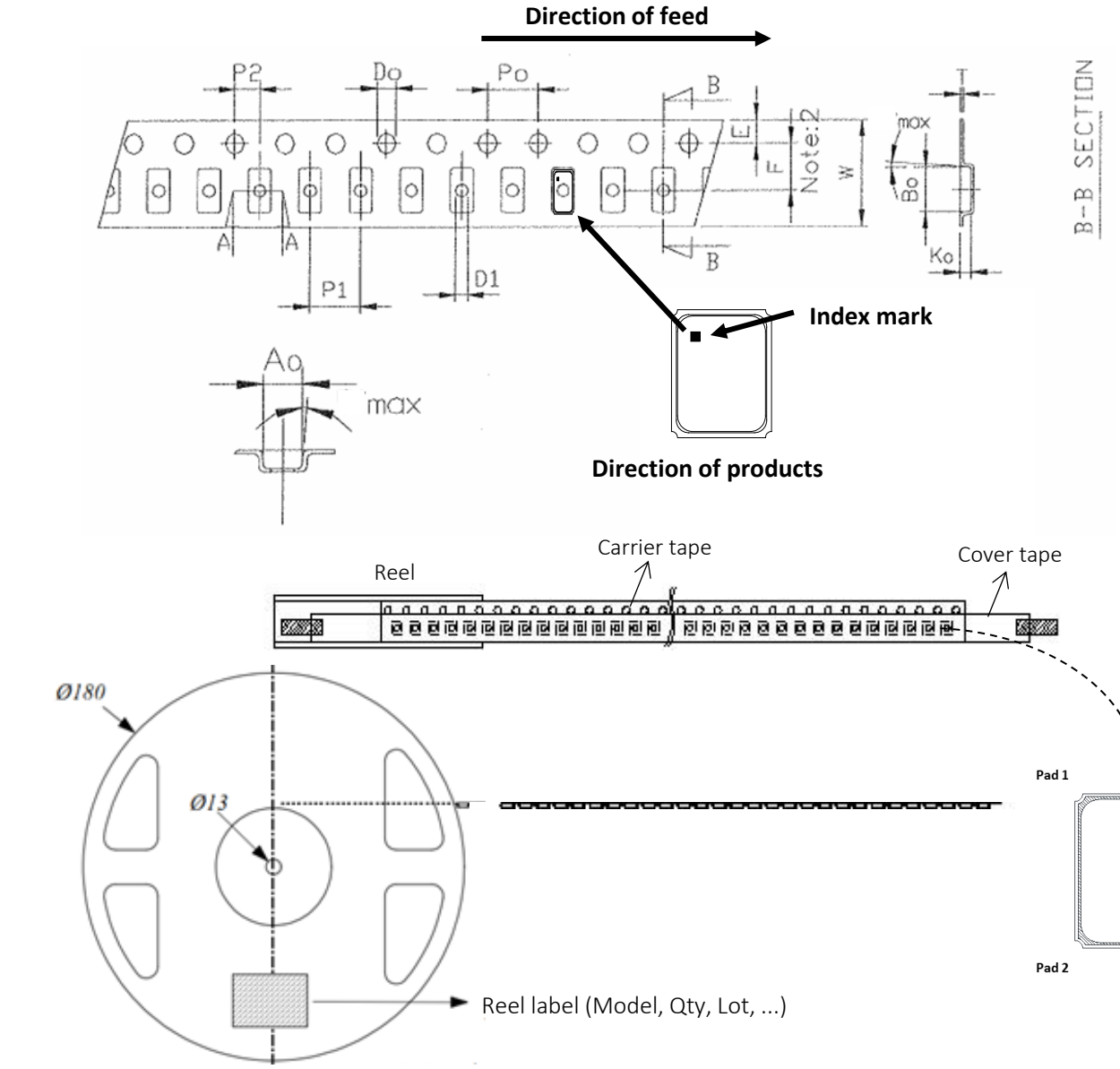
| # | Item | Test Condition | Reference |
|---|---|---|---|
| 1 | Drop test | 150 cm height, fall freely onto stainless plate, 3 times. | JIS C6701 |
| 2 | Shock test | 150 g weight, 150 cm height onto concrete floor.<br>Each direction (±x, ±y, ±z) for 3 cycles. | IEC-68-02-27 |
| 3 | Mechanical shock | Half sine wave 1000 G. Three mutually perpendicular axes, each axis for 3 times. Duration time 1.0ms. | MIL-STD-202F |
| 4 | Vibration | 10 to 55 Hz 0.75mm, 55 to 2000Hz 20G, 4 hours to each three axis (x, y, z). Total test time 6 hours. | MIL-STD-883E |
| 5 | Gross Leak | Standard sample for automatic gross leak detector.<br>Test pressure: 2kg /$cm^2$. | MIL-STD-883E |
| 6 | Fine Leak | Helium bombing 4.5 $kgf/cm^2$ for 2 hours. | MIL-STD-883E |
| 7 | Solderability | Temperature : 260°C ± 5°C<br>Immersing depth : 0.5 mm minimum<br>Immersion time : 5 ±1 seconds<br>Flux : Rosin resin methyl alcohol solvent (1:4) | GB/T 2424.17-2008 / IEC 60068-2-44:1995；<br>GB/T 2423.28-2005 / IEC 60068-2-20:1979 |

### 4.2 Environmental endurance

| # | Item | Test Condition | Reference |
|---|---|---|---|
| 1 | High temperature storage | Temperature : +125°C ± 3°C<br>Duration : 500 ± 12 hours | MIL-STD-883E |
| 2 | Low temperature storage | Temperature : -40°C ± 3°C<br>Duration : 500 ± 12 hours | MIL-STD-883E |
| 3 | Thermal shock<br>(Air to Air) | Total 100 cycles of the following temperature cycle<br> | MIL-STD-883E |
| 4 | High temperature & humidity | Temperature : 85°C ± 3°C<br>Humidity : RH 85%<br>Duration : 500 hours | JIS C5023 |

## 5. Taping and Packing

### 5.1 Tape and reel (EIA-481-2)




| Package Type | Dimension (Unit : mm) | | | | | | |
|---|---|---|---|---|---|---|---|
| 2016 TSX (8mm) | $A_0$ | $B_0$ | $K_0$ | T | W | E | F |
| | 1.90±0.1 | 2.30±0.1 | 1.25±0.1 | 0.25±0.05 | 8.00±0.3 | 1.75±0.2 | 3.50±0.1 |
| | P1 | P2 | D1 | $D_0$ | $P_0$ | | |
| | 4.00±0.1 | 2.00±0.1 | 1.00±0.1 | 1.55±0.05 | 4.00±0.1 | | |

Standard Reel Quantity is 3000 pcs per reel.

The inspection standard of tape tension

| Item | | Defect | Method |
|---|---|---|---|
| Appearance | All | 1. The tape is not coincidence<br>2. The bubble | Visual inspection |
| Tape tension | 2016 - 8mm | Overstep 34±6g (28 to 40g) | Pull test |

## 5. Taping and Packing (Cont.)

### 5.2 Packing standard

Out-going packing instruction

| Reel packing | Inner packing | Carton |
|---|---|---|
| Name：Reel<br>Standard：Diameter 18cm<br>Material：Plastics<br>Name：Anti-static shielding bag<br>Standard：205×250mm<br>Material：APET/CPP | Name：Bubble wrap<br>Standard：430×330×(t)20mm<br>Material：HDPE<br>Quantity : Max.15 reels | Name：Carton<br>Standard：400×400×(H)280mm<br>Material：AB corrugated paper<br>Quantity：4 bags |
|  |  | <br> |

The label information

| Label | Label Drawing | Name of Article | Spec. | Label size | Printing |
|---|---|---|---|---|---|
| L1 | PART NO : 3S26000389<br>LOT NO : 20041400<br>Q'TY : 3000<br>FREQ : 26.000000MHz<br>MSL 1<br>惠伦晶体 FAITH LONG CRYSTAL<br>MADE IN CHINA | 条码标签<br>Bar Code Label<br>(Chintz Paper) | 1. Part No.<br>2. Lot No.<br>3. Q'ty<br>4. Freq. | 70×50mm | White |
| L2 | PART NO : 3S26000389<br>DATE CODE: 2015<br>Q'TY : 30000<br>FREQ : 26.000000MHz<br>MSL 1<br>惠伦晶体 FAITH LONG CRYSTAL<br>MADE IN CHINA | 条码标签<br>Bar Code Label<br>(Chintz Paper) | 1. Part No.<br>2. Date Code<br>3. Q'ty<br>4. Freq. | 70×50mm | White |

Remark: Specifications on the label is for default templates purpose and may change with different product.
If any specified requirements for labels packaging is needed, please provide the instruction information.

## 6. Specification of the Environment-related Substances

| # | Range | Max. concentration (ppm; mg/kg) | |
|---|---|---|---|
| | Banned Substances | Product | Packing |
| 1 | 镉及镉化合物<br>Cadmium and cadmium compounds | 100 | 100 |
| 2 | 铅及铅化合物<br>Lead and lead compounds | 1000 | 100 |
| 3 | 汞及汞化合物<br>Mercury and mercury compounds | 1000 | 100 |
| 4 | 六价铬化合物<br>Hexavalent-Chromium VI ($Cr^{+6}$) | 1000 | 100 |
| 5 | 聚溴联苯 PBB<br>Polybrominated biphenyls | 1000 | N/A |
| 6 | 聚溴二苯醚 PBDE<br>Polybrominated diphenyl ethers | 1000 | N/A |
| 7 | 邻苯二甲酸二(2-乙基己基)酯 DEHP<br>Di (2-ethylhexyl) phthalate | 1000 | N/A |
| 8 | 邻苯二甲酸丁苄酯 BBP<br>Butyl Benzyl Phthalate | 1000 | N/A |
| 9 | 邻苯二甲酸二丁酯 DBP<br>Dibutyl Phthalate | 1000 | N/A |
| 10 | 邻苯二甲酸二异丁酯 DIBP<br>Diisobutyl Phthalate | 1000 | N/A |
| 11 | 氟(F)、氯(Cl)、溴(Br)、碘(I)<br>Fluorine, Chlorine, Bromine, Iodine | 900、900、900、900<br>注：Br + Cl < 1000 | N/A |
| 12 | 包装材料中重金属(汞、镉、六价铬、铅、PBB、PBDE)之总量<br>Heavy metals (mercury, cadmium, lead, $Cr^{+6}$,PBB and PBDE) in packing materials | N/A | 100<br>铅(Pb) + 镉(Cd) + 汞(Hg) + 六价铬(Cr+6) <100ppm |
| 13 | 高度关注物质<br>SVHC-Substances of Very High Concern | 1000 | N/A |