# PRODUCT SPECIFICATION SHEET




| | | | |
|---|---|---|---|
| **Customer** | | | |
| **Customer P/N** | - | | |
| **Product Type** | Temperature Sensing Crystal | | |
| **Part Number** | 1Z768T5001 | **Version** | S0 |
| **Part Description** | SMD TSX 1.6 x 1.2 (TH + Xtal) | | |
| **Nominal Frequency** | 76.8 | | |

| | |
|---|---|
| **Prepared** | Li Xiang |
| **Reviewed** | Kuro Peng |
| **Approved** | Xing Yue |
| **Date** | 2022-6-24 |

**Customer's Approval & Date：**

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RoHS COMPLIANT

Pb Lead-Free

Moisture Sensitivity Level 1

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## 1. History of Specification Revision

| Ver. | Content | Date | Reviser | Remark |
|---|---|---|---|---|
| S0 | Initial released. | 2022-6-24 | N/A | Li Xiang |

## 2. Electrical Specifications

### 2.1 Specifications for operation condition and electrical characteristics

| # | Parameter | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|
| 1 | Nominal frequency | | 76.800000 | | MHz | - |
| 2 | Crystal cut type | | AT-cut | | - | - |
| 3 | Mode of vibration | | Fundamental | | - | - |
| 4 | ESD | | HBM＞2000V | | - | JESD22-A114-B |
| 5 | MSL | | Level 1 | | - | IPC/JEDEC J-STD-033C |
| 6 | Load capacitance ($C_L$) | - | 7.0 | - | pF | Note 1. |
| 7 | Drive level | 10 | 200 | 250 | μW | - |
| 8 | Operating temperature range | -30 | - | +105 | °C | - |
| 9 | Storage temperature range | -40 | - | +105 | °C | - |
| 10 | Initial frequency tolerance | -10 | - | +22 | 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 | - | +12 | ppm | Within -30°C to +85°C. Above +85°C see Note 2. |
| 13 | Frequency aging | -0.7 | - | +0.7 | ppm/yr | - |
| 14 | Equivalent series resistance (ESR) | - | - | 30 | Ω | Note 3. |
| 15 | Insulation resistance | 500 | - | - | MΩ | - |
| 16 | Quality factor (Q) | 75,000 | - | - | - | Note 4. |
| 17 | Spurious mode series resistance | 1,100 | - | - | Ω | Within ±1 MHz offset. |
| 18 | Pullability | +10 | - | +15 | ppm/pF | - |
| 19 | Inflection point | +22.5 | - | +26.5 | °C | Specified at max drive level. $t = \left(t_0 - \frac{C2}{3C3}\right)$ |
| 20 | First-order curve fitting parameter (C1) | -0.4 | - | -0.1 | ppm/°C | Within +25°C to +35°C. Note 5. |
| 21 | Second-order curve fitting parameter (C2) | -6.0 | 0 | +6.0 | $x10^{-4}$ $ppm/°C^2$ | Note 5. |
| 22 | Third-order curve fitting parameter (C3) | +8.5 | +10.0 | +11.5 | $x10^{-5}$ $ppm/°C^3$ | 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.

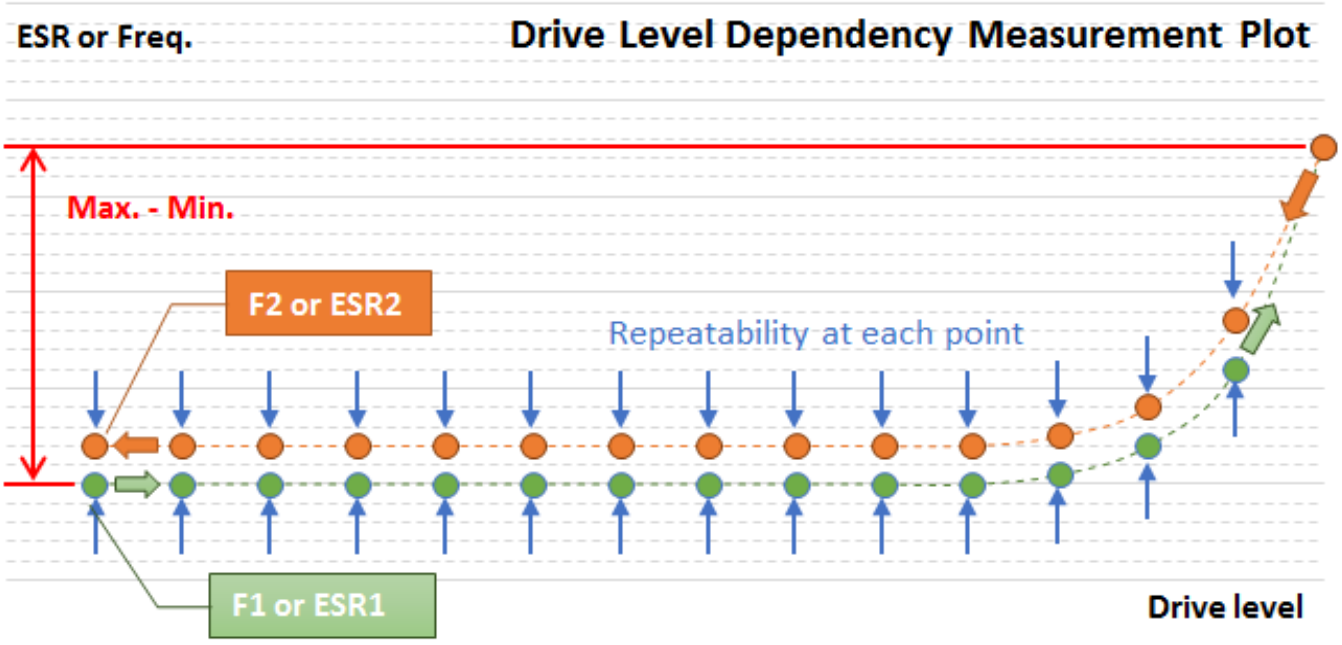
Note 5 The curve fitting parameter is obtained from the third-order polynomial as below, using the temperature inflection point t0 = 24.5°C (option A). Refer to Curve Fit Calculation Table Spreadsheet (80-V9695-23).

## 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 | - | 250 | µW | Drive level from 0.01 µW to 250 µW to 0.01 µW |
| 2 | Number of points | | 29 | | points | 15 points up and 15 points down = 29 total data points. |
| 3 | DLD Frequency (Maximum - Minimum) | - | - | 6 | ppm | Define as FDLD. Note 6. |
| 4 | DLD Frequency (Repeatability) | - | - | 0.7 | ppm | Define as FDLDH. Note 7. |
| 5 | DLD ESR (Maximum) | - | - | 20 | % | Define as RLD2. Note 8. |
| 6 | DLD ESR (Repeatability) | - | - | 10 | % | Define as DLDH3. Note 7 and Note 9. |

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.
Note 8 Maximum: ESR at 250 µW drive level is 30 Ω.
Note 9 For DLD ESR (Repeatability), the change rate is defined as (ESR2 - ESR1)/ESR1.
Note 10 ESR1: This is the first measurement on each drive level.
Note 11 ESR2: This is the second measurement on each drive level.



## 2. Electrical Specifications (Cont.)

### 2.3 Specifications for GPS quality

| # | Parameter | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|
| 1 | Drive level measurement condition | | 250 | | μW | All measurements in GPS quality are taken at 250 μW drive level. |
| 2 | Residual frequency stability slope 1 | -100 | - | +100 | ppb/°C | Within -30°C to -15°C. Note 13 and Note 14 (Condition 1A). |
| 3 | Residual frequency stability slope 2 | -50 | - | +50 | ppb/°C | Within -15°C to +70°C. Note 13 and Note 14 (Condition 1A). |
| 4 | Residual frequency stability slope 3 | -100 | - | +100 | ppb/°C | Within +70°C to +85°C. Note 13 and Note 14 (Condition 1A). |
| 5 | 5°C small orbit hysteresis 1-1 | -100 | - | +100 | ppb/°C | Within -30°C to -15°C. Note 15 (Condition 1B). |
| 6 | 5°C small orbit hysteresis 1-2 | -50 | - | +50 | ppb/°C | Within -15°C to +70°C. Note 15 (Condition 1B). |
| 7 | 5°C small orbit hysteresis 1-3 | -100 | - | +100 | ppb/°C | Within +70°C to +85°C. Note 15 (Condition 1B). |
| 8 | 5°C small orbit hysteresis 2 | | 100 (magnitude) | | ppb pk-pk | Within -30°C to +85°C. Note 16. |

Note 13 Residual = difference from fifth-order curve fit. Must meet below 1A (Note 14) and 1B (Note 15) conditions:

Note 14 Condition 1A – Test condition (continuous temperature rate change of ~1.0°C/min.):

- Measure F/T 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 15 Condition 1B – Hysteresis 1 test condition (continuous temperature rate change of ~1.0°C/minute):

- Measure F/T points every 0.5°C while cycling temperature over a 5°C small temperature orbit; an example 5°C small orbit temperature cycle is +30°C to +35°C to +30°C.
- During every individual heating/cooling cycle, there should be 11 points. Discard the first point of each heating and cooling cycle. This leaves 10 points for each heating and cooling cycle. Subtract the fifth-order polynomial best fit from 1A for each of the 10 points, and then calculate the slope of the residual for each of these heating and cooling 10 point curves.

Note 16 Hysteresis 2 test condition (continuous temperature rate change of ~1.0°C/min.):

- Measure F/T points every 0.5°C while cycling temperature over a 5°C small temperature orbit; an example 5°C small orbit temperature cycle is +30°C to +35°C to +30°C.
- During every individual heating/cooling cycle there should be 11 points; discard the first and last point of each heating and cooling cycle, which results in 9 temperature points. Calculate the average measured peak-to-peak frequency difference for these 9 temperature points.
- The average difference is the magnitude of the small orbit hysteresis 2.

## 2. Electrical Specifications (Cont.)

### 2.4 NTC thermistor specification table

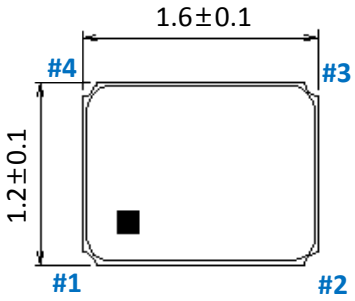
| # | Parameter | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|
| 1 | Operating temperature range | -30 | - | +105 | °C | |
| 2 | Storage temperature range | -40 | - | +105 | °C | |
| 3 | Resistance | - | 100 | - | kΩ | At 25°C |
| 4 | B-constant | - | 4,250 | - | K | At 25°C + 50°C |
| 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℃ temperature difference.
Please check the following Murata website for detail explanation.
https://www.murata.com/en-us/support/faqs/products/thermistor/ntc/pct/0001

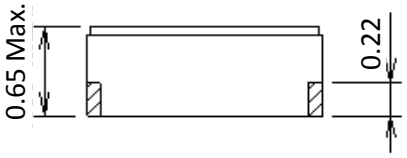
## 3. Product Design

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

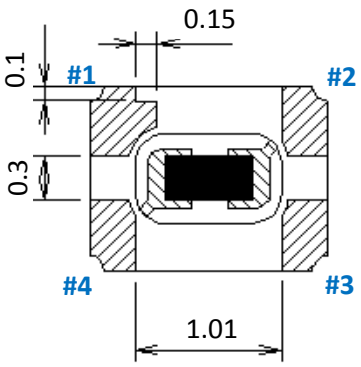
Top view




Lateral vi

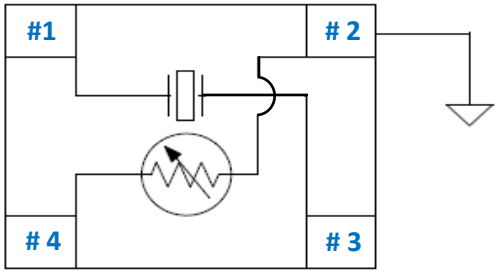



Bottom vi



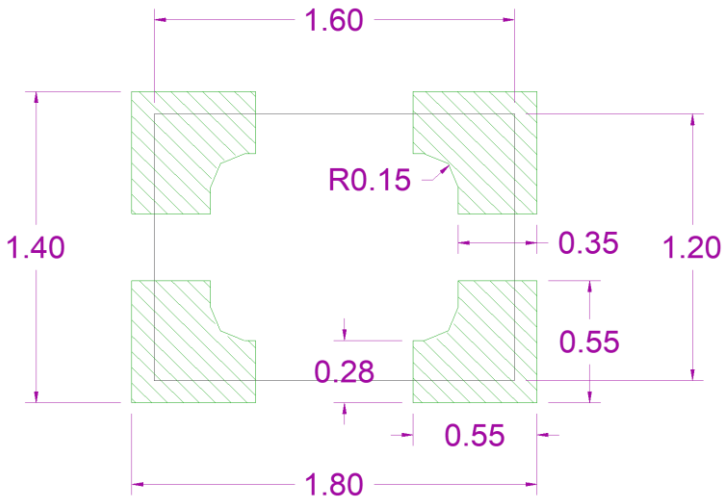

### 3.2 Pad connection diagram and function

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

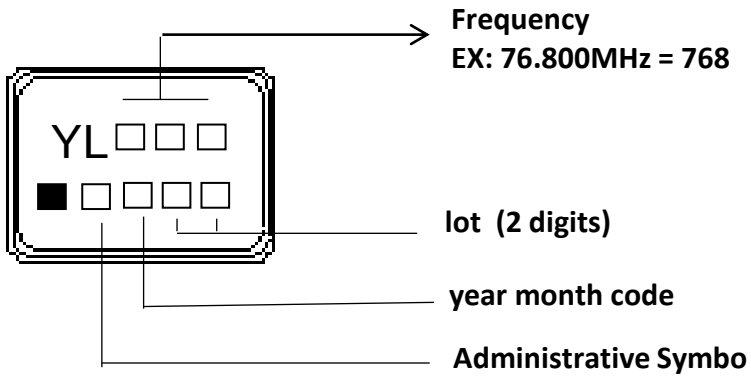
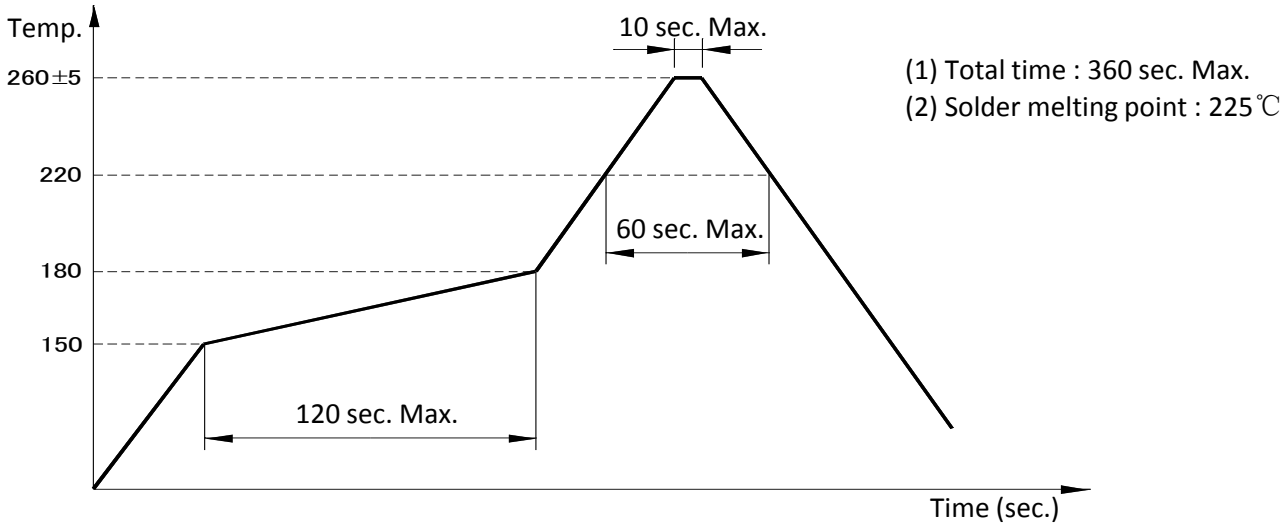



Table of Year and Month code

| Year \ Month | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2021 | 2025 | A | B | C | D | E | F | G | H | J | K | L | M |
| 2022 | 2026 | N | P | Q | R | S | T | U | V | W | X | Y | Z |
| 2023 | 2027 | a | b | c | d | e | f | g | h | j | k | l | m |
| 2024 | 2028 | n | p | q | r | s | t | u | v | w | x | y | z |

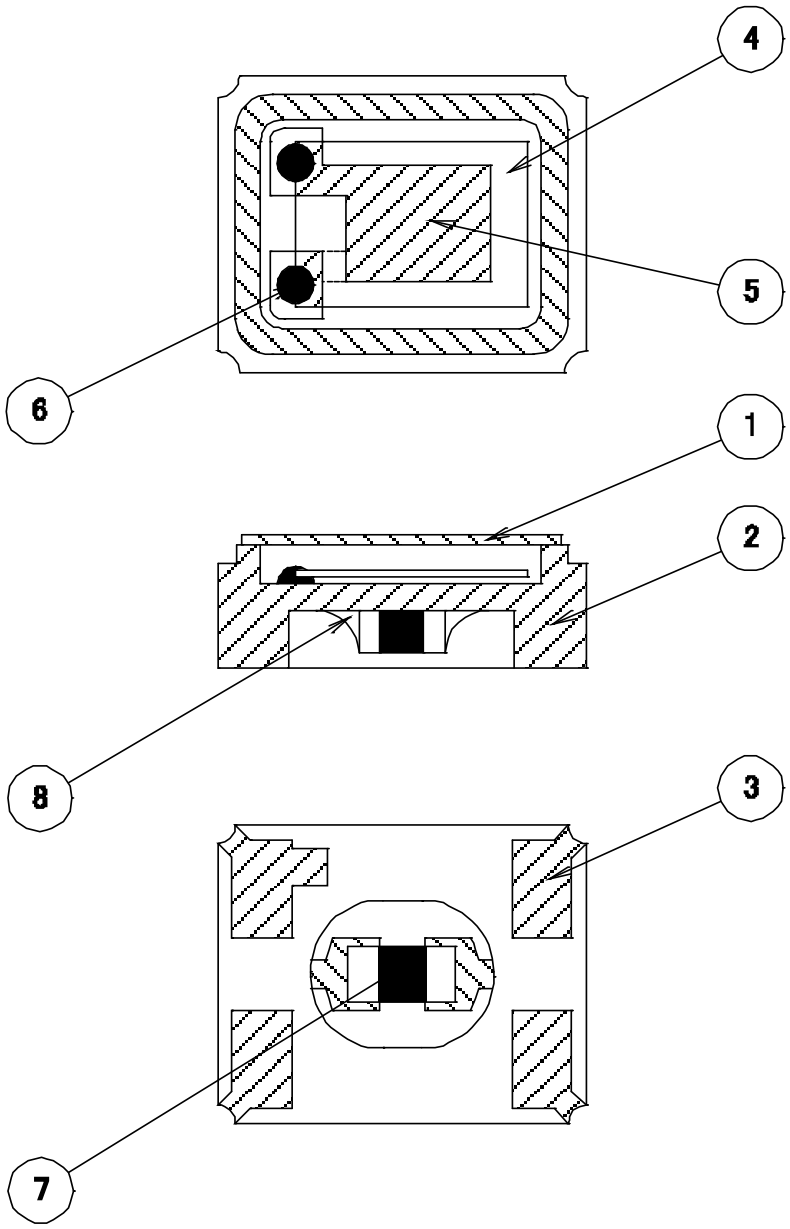
### 3.5 Recommended reflow profile




(1) Total time : 360 sec. Max.
(2) Solder melting point : 225℃

## 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 | - |

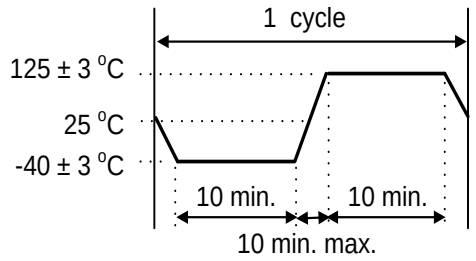
## 4. Reliability Assurance

### 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. 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. 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； GB/T 2423.28-2005 / IEC 60068-2-20:1979 |

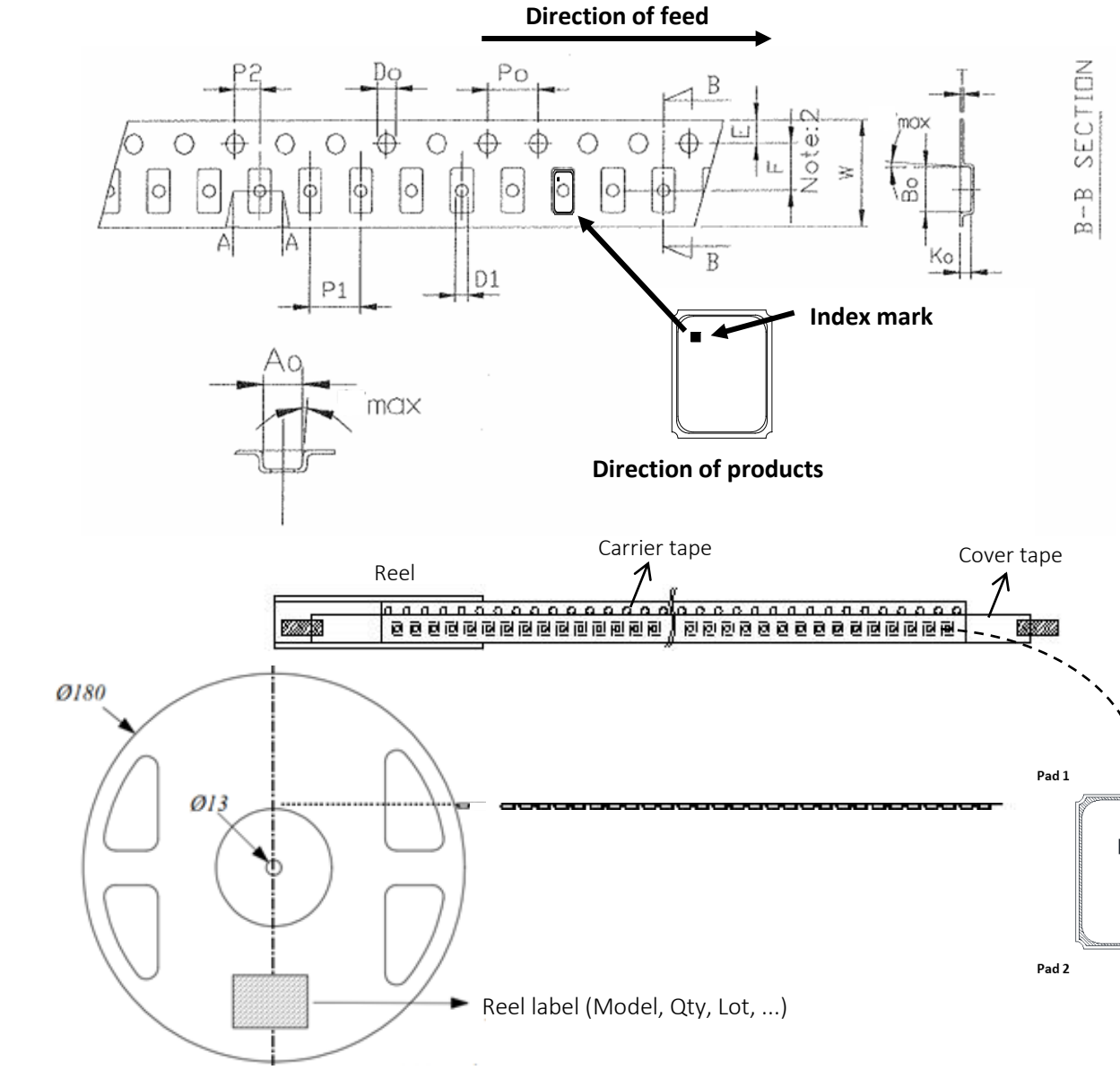
*Storage conditions： 18 months *Constant humidity： 40~70%

### 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 (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) | | | | | | |
|---|---|---|---|---|---|---|---|
| 1612 TSX (8mm) | $A_0$ | $B_0$ | $K_0$ | T | W | E | F |
| | 1.45±0.1 | 1.85±0.1 | 0.8±0.10 | 0.25±0.05 | 8.00±0.3 | 1.75±0.1 | 3.50±0.1 |
| | P1 | P2 | D1 | $D_0$ | $P_0$ | | |
| | 4.00±0.1 | 2.00±0.1 | 1.20±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 | 1612 - 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 |  | 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 |  | 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 |