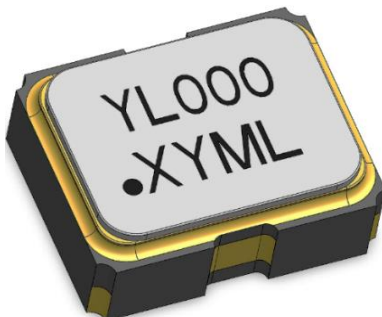




## PRODUCT SPECIFICATION SHEET



|                   |                         |         |    |
|-------------------|-------------------------|---------|----|
| Customer          | -                       |         |    |
| Customer P/N      | -                       |         |    |
| Product Type      | CMOS Crystal Oscillator |         |    |
| Part Number       | 9L24000001              | Version | S0 |
| Part Description  | SMD CMOS CXO 2.0 x 1.6  |         |    |
| Nominal Frequency | 24.000000MHz            |         |    |

|          |              |
|----------|--------------|
| Prepared | Li Xiang     |
| Reviewed | Huang Jining |
| Approved | Liu Feng     |
| Date     | 2025-6-12    |

Customer's Approval & Date :

### 广东惠伦晶体科技股份有限公司

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MSL1  
Moisture  
Sensitivity  
Level

Pb  
Lead-Free

✓  
RoHS  
Compliant

AEC-Q100 Qualified

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## ATTENTION

- [1] 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.
- [2] 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. | Contents          | Date      | Reviser  | Remark |
|------|-------------------|-----------|----------|--------|
| S0   | Initial released. | 2025-6-12 | Li Xiang |        |
|      |                   |           |          |        |
|      |                   |           |          |        |

FAITH LONG CRYSTAL

## 2. Electrical Specifications

### 2.1 Operation conditions

| # | Parameter                   | Min.             | Typ. | Max. | Unit | Remark               |
|---|-----------------------------|------------------|------|------|------|----------------------|
| 1 | Nominal frequency           | 24.000000        |      |      | MHz  | -                    |
| 2 | Supply voltage ( $V_{DD}$ ) | -                | 3.3  | -    | V    | -                    |
| 3 | Current consumption         | -                | -    | 4    | mA   | $V_{DD}=3.3V$        |
| 4 | Operating temperature range | -40              | -    | +105 | °C   | -                    |
| 5 | Storage temperature range   | -55              | -    | +125 | °C   | -                    |
| 6 | Moisture sensitivity level  | Level 1          |      |      | °C   | IPC/JEDEC J-STD-020F |
| 7 | ESD                         | HBM $\geq$ 2000V |      |      | -    | JESD22-A114-B        |

### 2.2 Output characteristics

| # | Parameter            | Min.         | Typ. | Max.         | Unit | Remark                   |
|---|----------------------|--------------|------|--------------|------|--------------------------|
| 1 | Output type          | CMOS         |      |              | -    | -                        |
| 2 | Standard output load | -            | 15   | -            | pF   | -                        |
| 3 | Output voltage high  | $90\%V_{DD}$ | -    | -            | V    | Level "1"                |
| 4 | Output voltage low   | -            | -    | $10\%V_{DD}$ | V    | Level "0"                |
| 5 | Rise time            | -            | -    | 4.5          | ns   | 20% to 80% output swing  |
| 6 | Fall time            | -            | -    | 4.5          | ns   | 80% to 20% output swing  |
| 7 | Duty cycle           | 45           | 50   | 55           | %    | Measured 50% of waveform |
| 8 | Start-up time        | -            | -    | 5            | ms   | -                        |

### 2.3 Output enable / disable function

| # | Parameter      | Min.         | Typ. | Max.         | Unit | Remark |
|---|----------------|--------------|------|--------------|------|--------|
| 1 | Output enable  | $70\%V_{DD}$ | -    | -            | V    | -      |
| 2 | Output disable | -            | -    | $30\%V_{DD}$ | V    | -      |

### 2.4 Frequency stability

| # | Parameter             | Min. | Typ. | Max. | Unit | Remark                                                 |
|---|-----------------------|------|------|------|------|--------------------------------------------------------|
| 1 | Frequency stability 1 | -50  | -    | +50  | ppm  | Within -40 to +105°C<br>refer to frequency<br>at 25°C  |
| 2 | Frequency stability 2 | -100 | -    | +100 | ppm  | Within -105 to +125°C<br>refer to frequency<br>at 25°C |
| 3 | Frequency aging       | -3   | -    | +3   | ppm  | 1st year                                               |

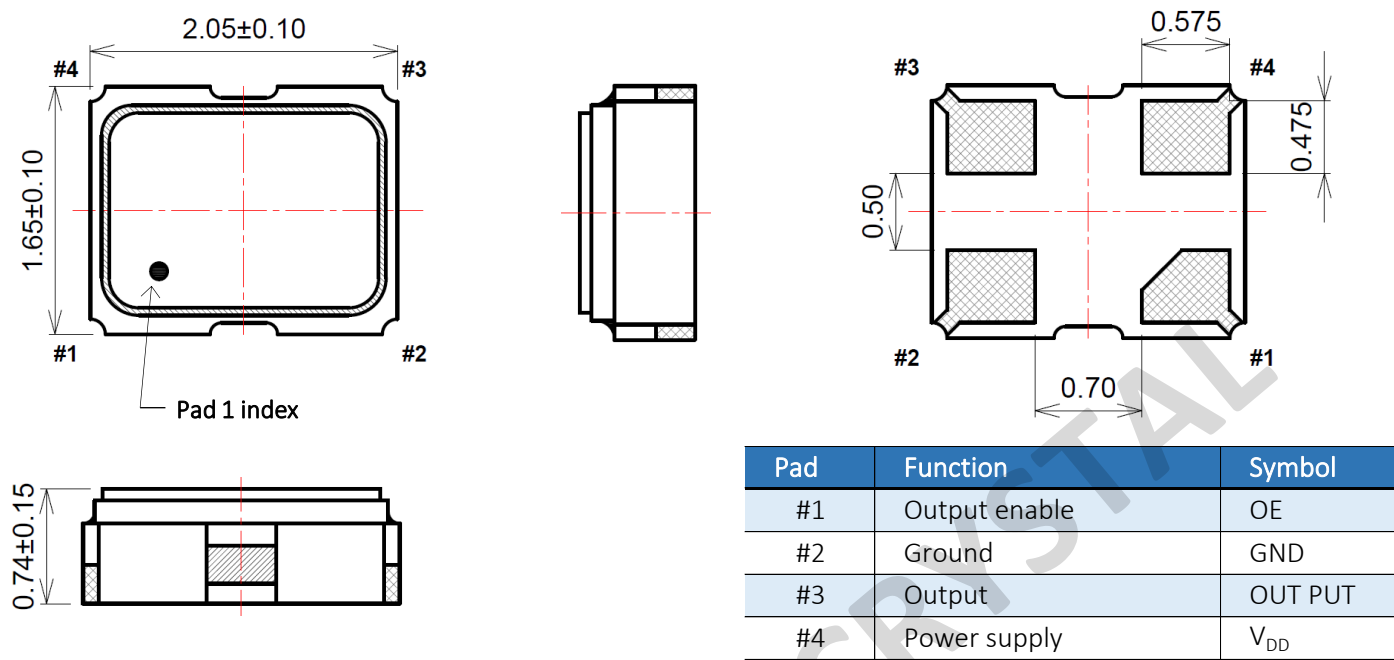
**Measure equipment:** Electrical characteristics is measured by S&A 280B or equivalent.

### Standard atmospheric conditions:

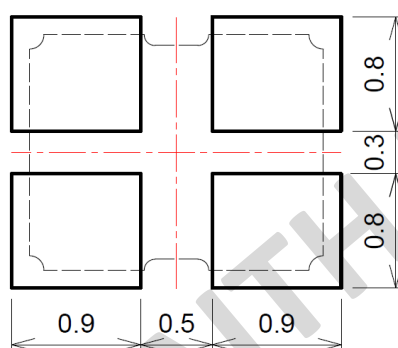
Unless otherwise specified, the standard environmental conditions for performance measurement and tests are under ambient temperature at  $(25\pm3)^{\circ}\text{C}$  and relative humidity: 40% to 70%.

3. Product Design

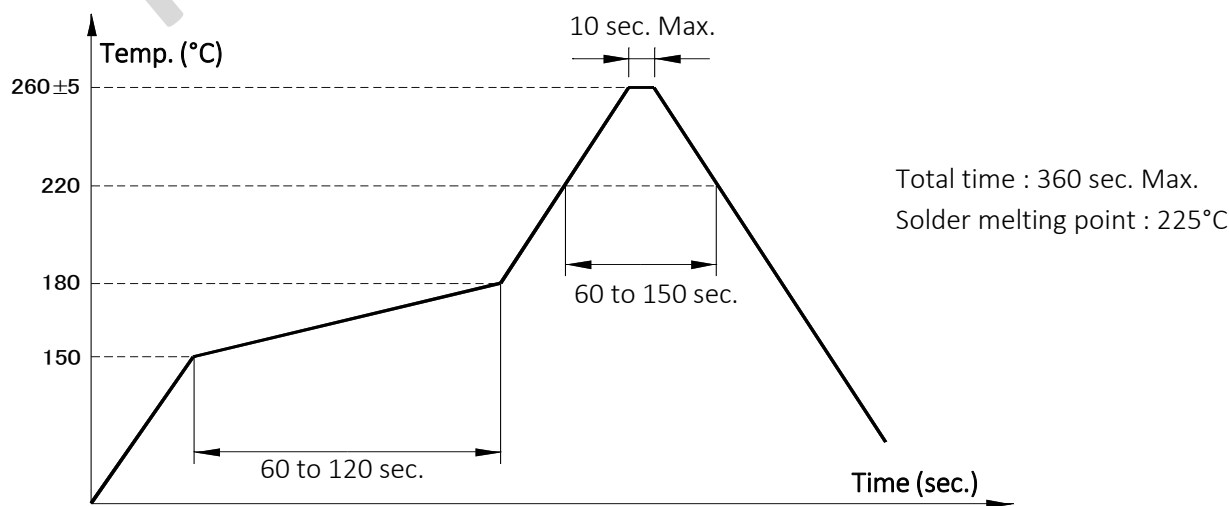
3.1 Package dimensions and pad functions (Unit : mm)



3.2 Recommended land pattern (Unit : mm)

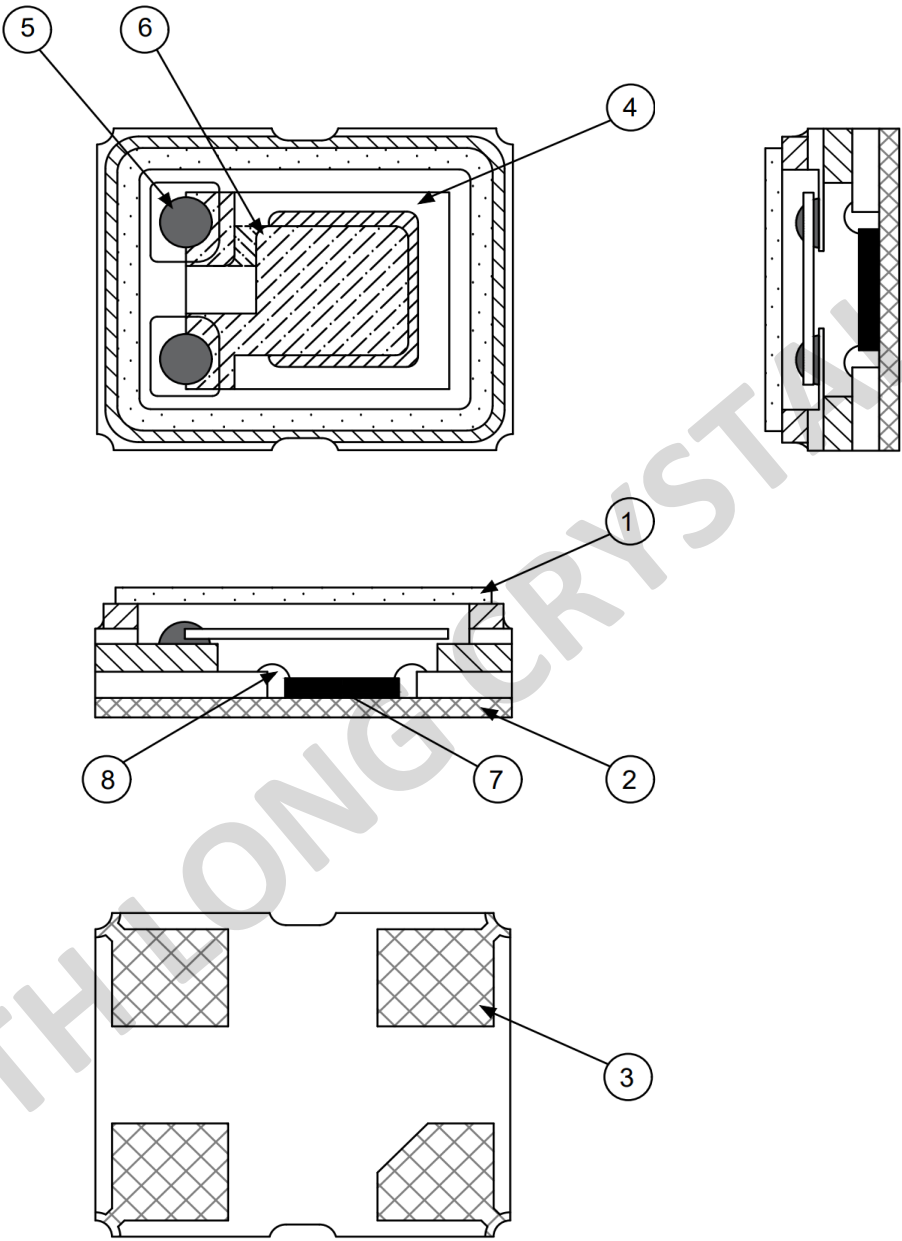


3.3 Recommended reflow profile



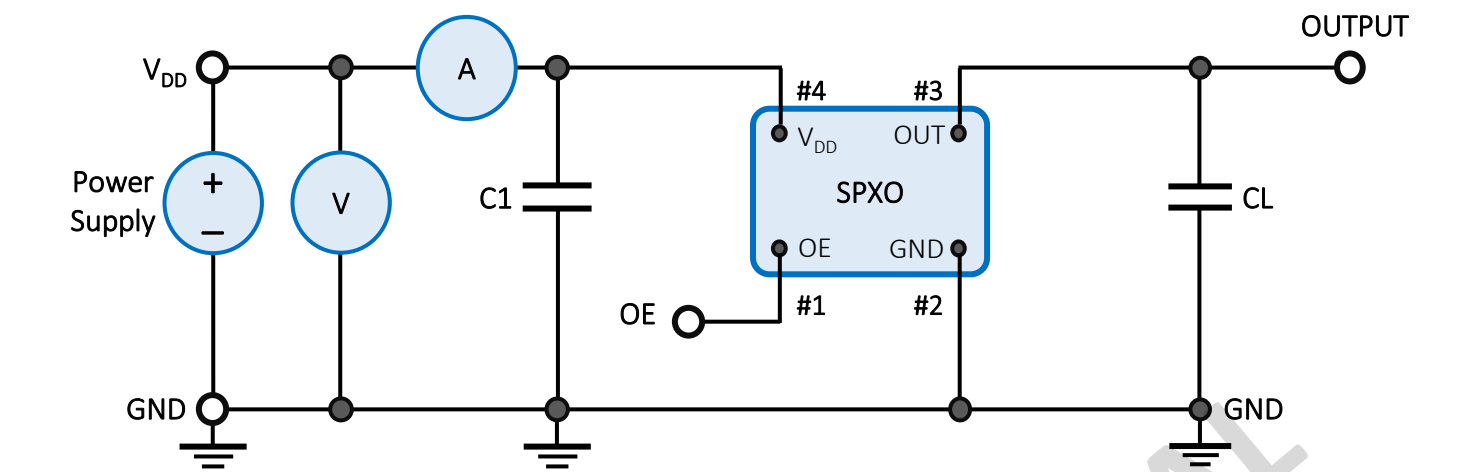
3. Product Design (Cont.)

3.4 Illustration to product structure



| # | Components          | Materials                                 | Finish/Specifications                            |
|---|---------------------|-------------------------------------------|--------------------------------------------------|
| 1 | Cap (Lid)           | Kovar (Fe/Co/Ni)                          | -                                                |
| 2 | Base (Package)      | Ceramic (Al <sub>2</sub> O <sub>3</sub> ) | Alumina ceramics                                 |
| 3 | Pad (Package)       | Au                                        | Tungsten metallization + Ni plating + Au plating |
| 4 | Crystal blank       | SiO <sub>2</sub>                          | -                                                |
| 5 | Conductive adhesive | Ag                                        | Silicone resin                                   |
| 6 | Electrode           | Noble metal                               | -                                                |
| 7 | IC chip             | Silicon (Si)                              | -                                                |
| 8 | Bonding wire        | Au                                        | -                                                |

4. Testing Circuit



External Components:

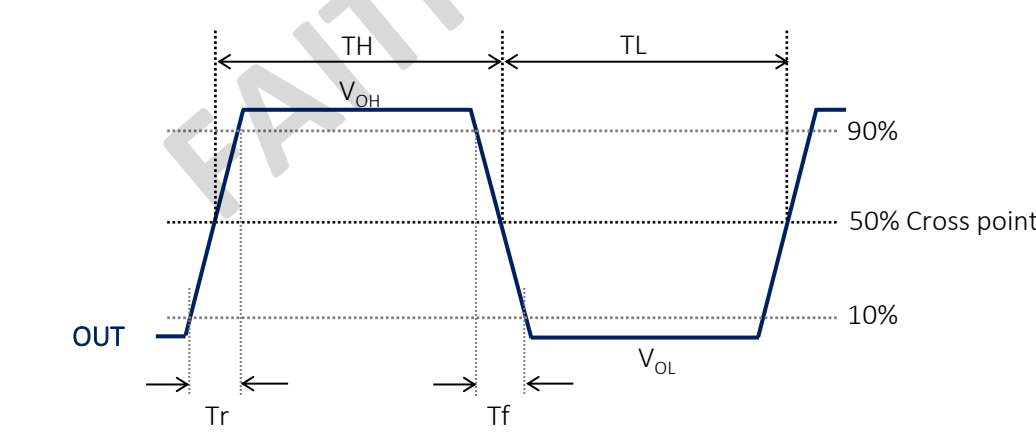
| Parts | Function                     | Recommended |
|-------|------------------------------|-------------|
| C1    | AC noise bypass for $V_{DD}$ | 10nF        |
| CL    | Load capacitance             | 15pF        |

Enable Control

| Pad 1 input        | Pad 3 output     |
|--------------------|------------------|
| Level High or open | Normal operation |
| Level Low          | Output stopped   |

- Note 1 : All the testing equipment are 50Ω terminated.
- Note 2 : OE terminal is open connection except OE function test.
- Note 3 : Power supply decoupling capacitor is recommended

5. Waveform Conditions



## 6. Reliability

### 6.1 Reliability test items (1) (based on AEC-Q100 Rev.H)

| # | Item                                                              | Stress and Test Condition                                                                                                                                                                                                                                                 | Reference                           |
|---|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| 1 | Preconditioning                                                   | bake 125°C 24 hours, MSL1, 85°C/85% RH, 168 hours, reflow x3 times.                                                                                                                                                                                                       | JEDEC J-STD-020, JESD22-A113        |
| 2 | Temperature-humidity-bias or biased HAST                          | Preconditioning before stress.<br>THB (85°C/85%RH for 1000 hours) or HAST (130°C/85%RH for 96 hours, or 110°C/85%RH for 264 hours).                                                                                                                                       | JEDEC JESD22-A101 or A110           |
| 3 | Autoclave or unbiased HAST or temperature-humidity (without Bias) | Preconditioning before stress.<br>AC (121°C/15psig for 96 hours) or TH (85°C/85%RH for 1000 hours) or unbiased HAST (130°C/85%RH for 96 hours, or 110°C/85%RH for 264 hours)                                                                                              | JEDEC JESD22-A102, A118, or A101    |
| 4 | Temperature cycling                                               | Preconditioning before stress.<br>Grade 0: -55°C to +150°C for 1500 cycles or equivalent.<br>Grade 1: -55°C to +150°C for 1000 cycles or equivalent.<br>Grade 2: -55°C to +125°C for 1000 cycles or equivalent.<br>Grade 3: -55°C to +125°C for 500 cycles or equivalent. | JEDEC JESD22-A104 and Appendix 3    |
| 5 | High temperature storage life                                     | +200°C T <sub>a</sub> for 72 hours.                                                                                                                                                                                                                                       | JEDEC JESD22-A103                   |
| 6 | High temperature operating Life                                   | Grade 0: +150°C T <sub>a</sub> for 1000 hours.<br>Grade 1: +125°C T <sub>a</sub> for 1000 hours.<br>Grade 2: +105°C T <sub>a</sub> for 1000 hours.<br>Grade 3: +85°C T <sub>a</sub> for 1000 hours.<br>V <sub>DD</sub> max.                                               | JEDEC JESD22-A108                   |
| 7 | Solderability                                                     | Perform 8 hour steam aging prior to testing (1 hour for Au-plated leads). (260 ± 5)°C, (5 ± 1)sec., immersing depth >0.5mm.                                                                                                                                               | JEDEC J-STD-002                     |
| 8 | Physical dimensions                                               | See applicable JEDEC standard outline and individual devicespec for significant dimensions and tolerances.                                                                                                                                                                | JEDE JESD22-B100 and B108, AEC Q003 |
| 9 | Electrostatic discharge human body model                          | 2kV HBM.                                                                                                                                                                                                                                                                  | AEC Q100-002                        |

## 6. Reliability (Cont.)

## 6.2 Reliability test items (2) (based on AEC-Q100 Rev.H)

| #  | Item                                         | Stress and Test Condition                                                                                      | Reference               |
|----|----------------------------------------------|----------------------------------------------------------------------------------------------------------------|-------------------------|
| 10 | Electrostatic discharge charged device model | 750V corner pins, 500V all other pins.                                                                         | AEC Q100-011            |
| 11 | Latch-up                                     | Maximum ambient operating temperature, maximum operating voltage, 100mA.                                       | AEC Q100-004            |
| 12 | Mechanical shock                             | Y1 plane only, 5 pulses, 0.5 msec duration, 1500 g peak acceleration.                                          | JEDEC JESD22-B110       |
| 13 | Variable frequency vibration                 | 20 Hz to 2 kHz to 20 Hz (logarithmic variation) in >4 minutes, 4X in each orientation, 50 g peak acceleration. | JEDEC JESD22-B103       |
| 14 | Constant acceleration                        | Y1 plane only, 30 K g-force.                                                                                   | MIL-STD-883 Method 2001 |
| 15 | Gross/fine leak                              | Any single-specified fine test followed by any single-specified gross test.                                    | MIL-STD-883 Method 1014 |
| 16 | Package drop                                 | Drop part on each of 6 axes once from a height of 1.2m onto a concrete surface.                                | AEC-Q100                |
| 17 | Internal water vapor                         | 100°C, moisture <5000ppm.                                                                                      | MIL-STD-883 Method 1018 |

7. Marking and Packing

7.1 Marking definition

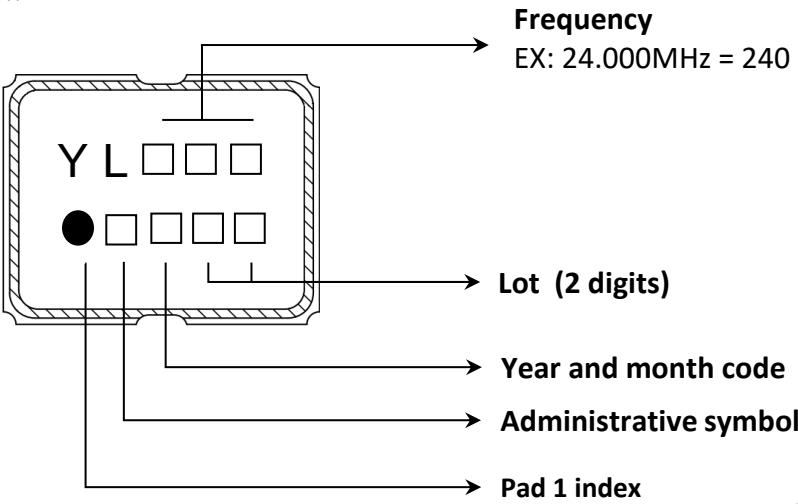
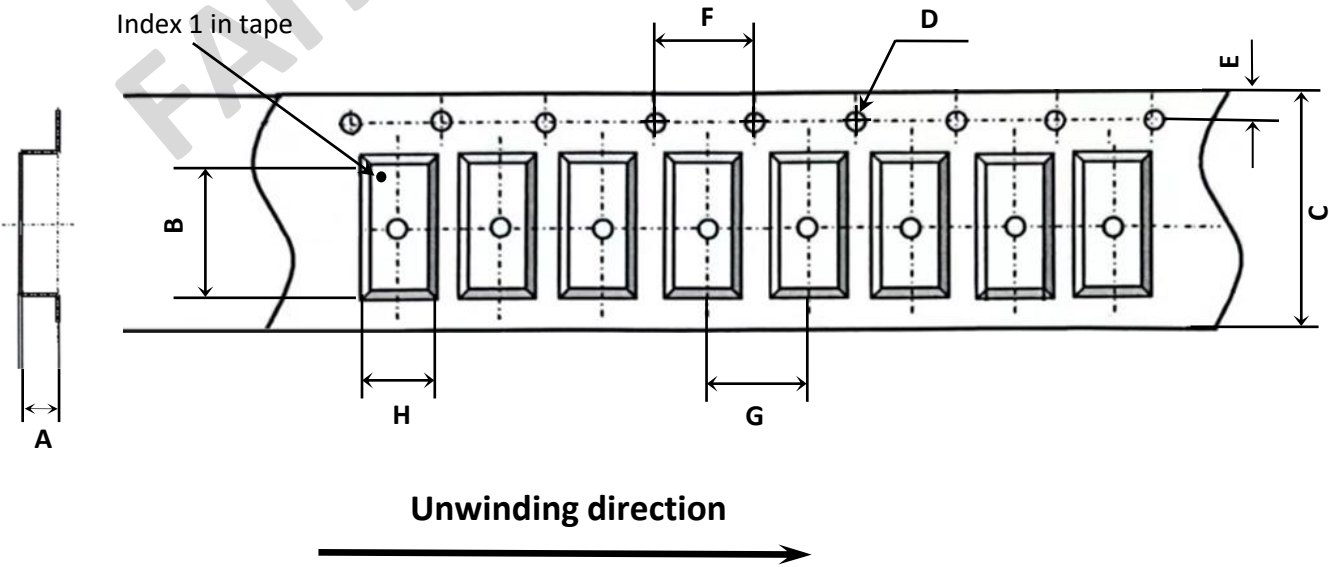


Table of Year and Month code

| Month |      | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|-------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Year  |      |     |     |     |     |     |     |     |     |     |     |     |     |
| 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   |

7.2 Packing (EIA-481-2)

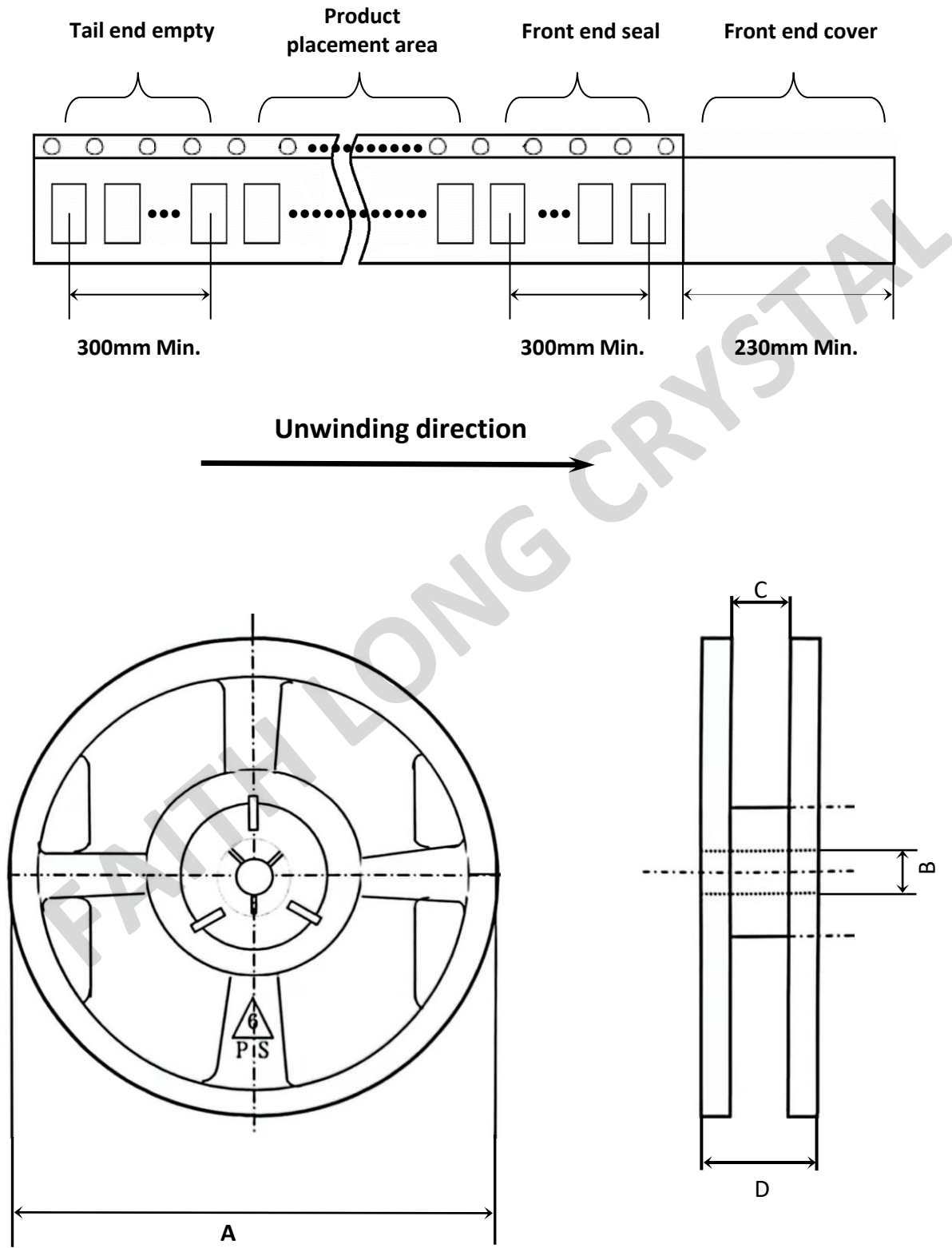
8mm-4mm, 3,000pcs/reel, Φ178



| Tape dimension (Unit : mm) |          |         |           |          |          |          |          |
|----------------------------|----------|---------|-----------|----------|----------|----------|----------|
| A                          | B        | C       | D         | E        | F        | G        | H        |
| 1.25±0.1                   | 2.45±0.1 | 8.0±0.3 | 1.55±0.05 | 1.75±0.1 | 4.00±0.2 | 4.00±0.1 | 2.00±0.1 |

7. Marking and Packing (Cont.)

7.2 Packing (EIA-481-2) (Cont.)



3,000 pcs/reel

| Reel dimension (Unit : mm) |          |         |          |
|----------------------------|----------|---------|----------|
| A                          | B        | C       | D        |
| 178±2.0                    | 13.2±0.5 | 9.0±0.5 | 11.5±1.4 |

## 7. Marking and Packing (Cont.)

## 7.3 SMD product packing standard

Out-going packing instruction

| Reel packing                                                                       | Inner packing                                                                       | Carton                                                                                       |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| Name: reel<br>Standard: diameter 18cm<br>Material: plastics                        | Name: bubble wrap<br>Standard: 430×330×20mm<br>Material: HDPE<br>Quantity: 15 reels | Name: carton<br>Standard: 400×400×280mm<br>Material: AB corrugated paper<br>Quantity: 4 bags |
|   |    |           |
|  |   |          |

The label instruction

| Label drawing                                                                      | Mark | Name of article                  | Items                                         | Size    | Printing |
|------------------------------------------------------------------------------------|------|----------------------------------|-----------------------------------------------|---------|----------|
|  | L1   | Bar Code Label<br>(Chintz Paper) | 1.Part No.<br>2.Lot No.<br>3.Q'ty<br>4.Freq   | 70x50mm | White    |
|  | L2   | Bar Code Label<br>(Chintz Paper) | 1.Part No.<br>2.Date Code<br>3.Q'ty<br>4.Freq | 70x50mm | White    |

Remark: The above instruction of label drawing is used for template and may vary with different product specifications .  
 If customer has specified requirements for labels packaging, please provide the operation procedure.

Product storage conditions:

- [1] Temperature: 15 to 35°C.
- [2] Humidity: 30 to 70% RH.
- [3] Time: within 6 months after delivery.
- [4] Please store the products in a dry, clean, well-ventilated area and avoid direct sunlight exposure, heat, and vibration.

## 8. Environmental substance

| #  | Banned substances                                                                                       | Max. concentration (ppm; mg/kg)              |                                                   |
|----|---------------------------------------------------------------------------------------------------------|----------------------------------------------|---------------------------------------------------|
|    |                                                                                                         | Products                                     | Packing                                           |
| 1  | Cadmium (Cd) and cadmium compounds<br>镉及镉化合物                                                            | 100                                          | 100                                               |
| 2  | Lead (Pb) and lead compounds<br>铅及铅化合物                                                                  | 1,000                                        | 100                                               |
| 3  | Mercury (Hg) and mercury compounds<br>汞及汞化合物                                                            | 1,000                                        | 100                                               |
| 4  | Hexavalent-chromium VI (Cr+6)<br>六价铬化合物                                                                 | 1,000                                        | 100                                               |
| 5  | Polybrominated biphenyls (PBBs)<br>聚溴联苯 PBB                                                             | 1,000                                        | N/A                                               |
| 6  | Polybrominated diphenyl ethers (PBDEs)<br>聚溴二苯醚 PBDE                                                    | 1,000                                        | N/A                                               |
| 7  | Di (2-ethylhexyl) phthalate (DEHP)<br>邻苯二甲酸二(2-乙基己基)酯 DEHP                                              | 1,000                                        | N/A                                               |
| 8  | Butyl benzyl phthalate (BBP)<br>邻苯二甲酸丁苄酯 BBP                                                            | 1,000                                        | N/A                                               |
| 9  | Dibutyl phthalate (DBP)<br>邻苯二甲酸二丁酯 DBP                                                                 | 1,000                                        | N/A                                               |
| 10 | Diisobutyl Phthalate (DIBP)<br>邻苯二甲酸二异丁酯 DIBP                                                           | 1,000                                        | N/A                                               |
| 11 | Fluorine (F), Chlorine (Cl), Bromine (Br), Iodine (I)<br>氟(F)、氯(Cl)、溴(Br)、碘(I)                          | 900, 900, 900, 900<br>Note : Br + Cl < 1,000 | N/A                                               |
| 12 | Heavy metals (Hg, Cd, Pb, Cr+6, PBBs and PBDEs) in packing materials<br>包装材料中重金属(汞、镉、六价铬、铅、PBB、PBDE)之总量 | N/A                                          | 100<br>铅(Pb) + 镉(Cd) + 汞(Hg) + 六价铬(Cr+6) < 100ppm |
| 13 | (SVHC) Substances of very high concern<br>高度关注物质                                                        | 1,000                                        | N/A                                               |