

**MHz Range Crystal unit**

- Package size (1.6 mm × 1.2 mm × 0.35 mm)
- Fundamental mode
- Reference weight Typ.3.0 mg

**[ 1 ] Product Number / Product Name / Marking**

(1-1) Product Number / Ordering Code

**X1E0002510127xx**

Last 2 digits code(xx) defines Quantity.

The standard is "26", 6 000 pcs/Reel.

(1-2) Product Name / Model Name

FA-118T 32.000000 MHz 10.0 +10.0-10.0

**[ 2 ] Absolute maximum ratings**

| Parameter                   | Symbol | Specifications |      |      | Unit | Conditions                |
|-----------------------------|--------|----------------|------|------|------|---------------------------|
|                             |        | Min.           | Typ. | Max. |      |                           |
| Storage temperature         | T_stg  | -40            | -    | +125 | °C   | Storage as single product |
| Operating temperature range | T_use  | -40            | -    | +125 | °C   | -                         |

**[ 3 ] Specifications(characteristics)**

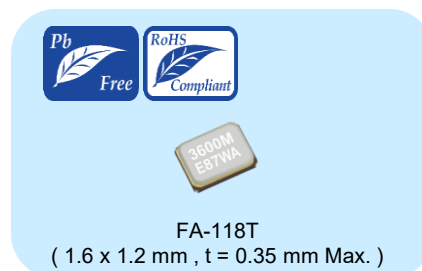
| Parameter                            | Symbol | Specifications |           |      | Unit                   | Conditions         |
|--------------------------------------|--------|----------------|-----------|------|------------------------|--------------------|
|                                      |        | Min.           | Typ.      | Max. |                        |                    |
| Nominal frequency                    | f_nom  | -              | 32.000000 | -    | MHz                    | Fundamental        |
| Frequency tolerance                  | f_tol  | -10            | -         | +10  | x 10 <sup>-6</sup>     | @+25°C             |
| Frequency Stability over temperature | f_tem  | -10            | -         | +10  | x 10 <sup>-6</sup>     | -20°C to +70°C     |
|                                      |        | -20            | -         | +20  | x 10 <sup>-6</sup>     | -40°C to +85°C     |
| Operating temperature                | T_use  | -40            | -         | +85  | °C                     |                    |
| Level of drive                       | DL     | 1              | -         | 100  | μW                     | Recommended: 10 μW |
| Load capacitance                     | CL     | -              | 10        | -    | pF                     |                    |
| Motional resistance (ESR)            | R1     | -              | -         | 60   | Ω                      |                    |
| Motional capacitance                 | C1     | -              | 1.26      | -    | fF                     |                    |
| Motional inductance                  | L1     | -              | 19.6      | -    | mH                     |                    |
| Shunt capacitance                    | C0     | -              | 0.47      | -    | pF                     |                    |
| Frequency aging                      | f_age  | -1             | -         | +1   | x10 <sup>-6</sup> /yea | @+25°C, First year |

**[ For other general specifications, please refer to the attached Full Data Sheet below ]**

## 1.6 x 1.2 mm size MHz range crystal unit: FA-118T

### Features

- Package size: 1.6 x 1.2 mm , t = 0.35 mm Max.
- Frequency range: 24 MHz to 54 MHz
- Frequency tolerance (standard):  $\pm 10 \times 10^{-6}$  (@+25 °C)
- Frequency vs. temperature characteristics (standard):
  - $\pm 12 \times 10^{-6}$  (-20 °C to +75 °C)
  - $\pm 17 \times 10^{-6}$  (-30 °C to +75 °C)
  - $\pm 20 \times 10^{-6}$  (-40 °C to +85 °C)
  - $\pm 30 \times 10^{-6}$  (-40 °C to +105 °C)
- ESR:
  - 200  $\Omega$  Max. (24 MHz  $\leq$  f<sub>nom</sub>  $\leq$  32 MHz)
  - 100  $\Omega$  Max. (32 MHz < f<sub>nom</sub>  $\leq$  36 MHz)
  - 80  $\Omega$  Max. (36 MHz < f<sub>nom</sub>  $\leq$  40 MHz)
  - 60  $\Omega$  Max. (40 MHz < f<sub>nom</sub>  $\leq$  54 MHz)



### Applications

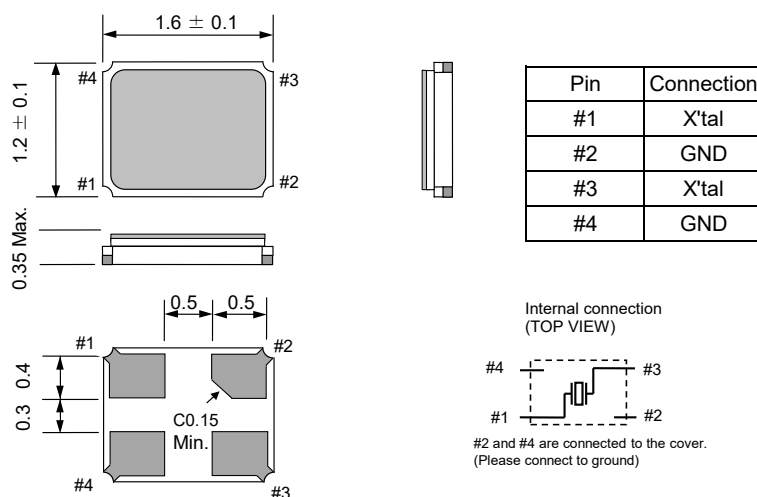
- Small communication module for consumer and industrial applications
- Wearable devices
- Clock for MCU

### Description

The FA-118T has been commercialized as a reference clock for communication modules, which requires high accuracy, and as a clock for wireless communication and microcomputers for applications that require miniaturization (TWS (True Wireless Stereo), Smart Watch, etc.).

The products created using the high-precision processing technology cultivated over many years contribute to improving the performance of the customer's system.

### Outline Drawing and Terminal Assignment



## [ 1 ] Product Number / Product Name

## (1-1) Product Number

X1E000251xxxx26 (Please contact Epson for details)

## (1-2) Product Name (Standard Form)

FA-118T 24.000000MHz 12.0 +10.0-10.0

① ② ③ ④

①Model ②Frequency ③Load capacitance (pF) ④Frequency tolerance ( $\times 10^{-6}$ , +25 °C)

In addition to the mentioned above specification items(① to ④),

please specify the frequency vs. temperature characteristics.

## [ 2 ] Absolute Maximum Ratings

| Item                      | Symbol | Rating value |      |      | Unit | Note                                                 |
|---------------------------|--------|--------------|------|------|------|------------------------------------------------------|
|                           |        | Min.         | Typ. | Max. |      |                                                      |
| Storage temperature range | T_stg  | -40          | -    | +125 | °C   | Satisfy environmental characteristics specifications |
| Level of drive            | DL     | -            | -    | 200  | μW   |                                                      |

## [ 3 ] Operating Conditions

| Item                        | Symbol | Rating value |      |      | Unit | Note                 |
|-----------------------------|--------|--------------|------|------|------|----------------------|
|                             |        | Min.         | Typ. | Max. |      |                      |
| Operating temperature range | T_use  | -40          | -    | +105 | °C   | Please contact Epson |
|                             |        | -40          | -    | +125 |      |                      |
| Level of drive              | DL     | 1            | -    | 100  | μW   | Recommended: 10 μW   |

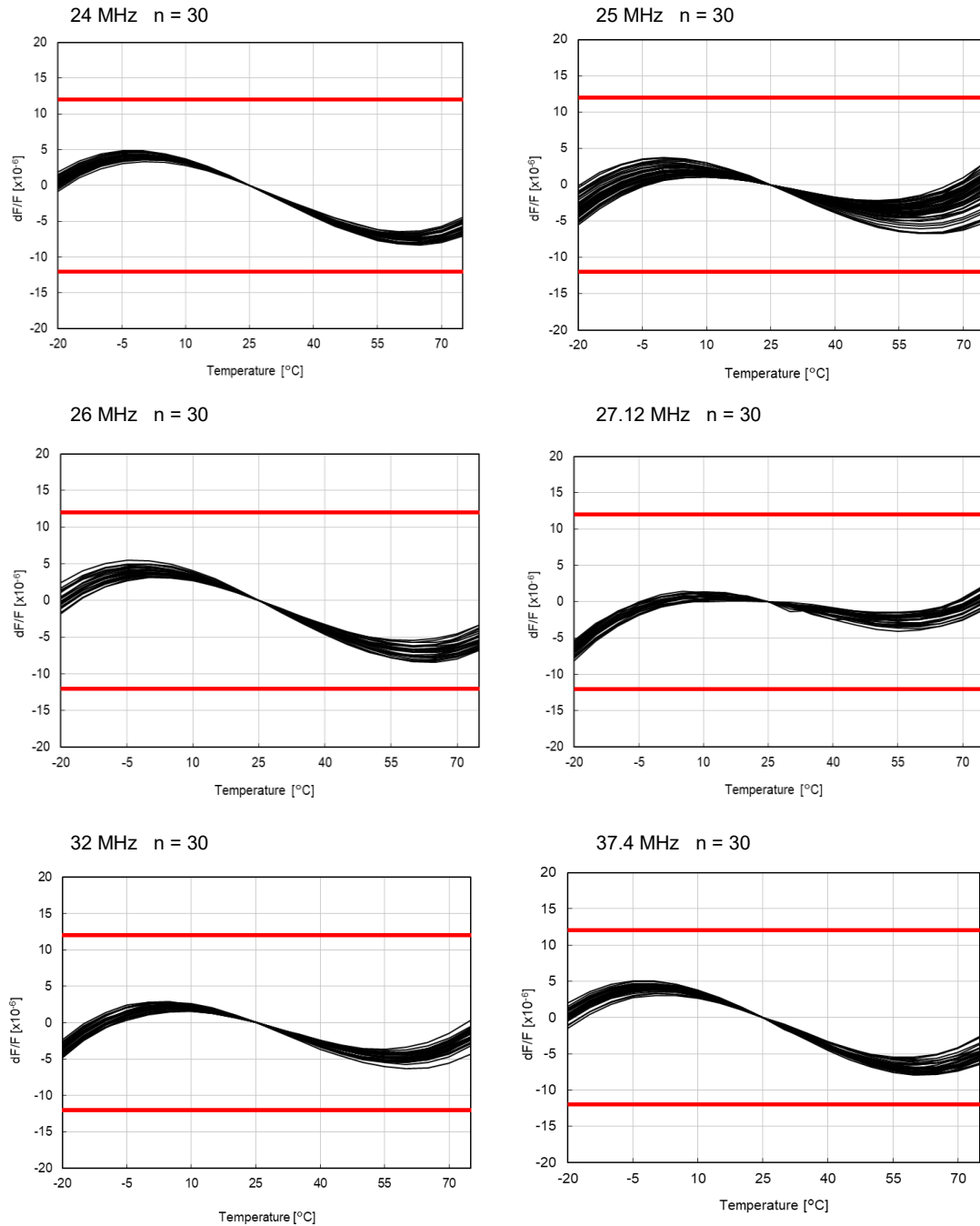
## [ 4 ] Static Characteristics

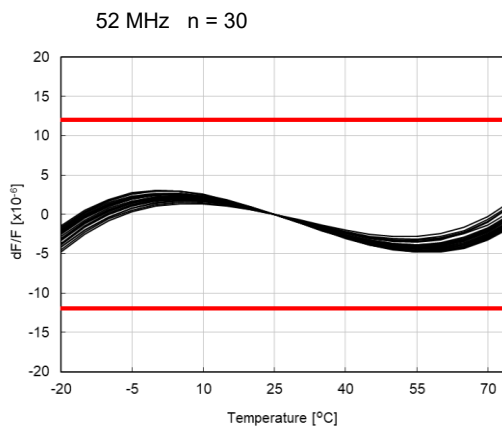
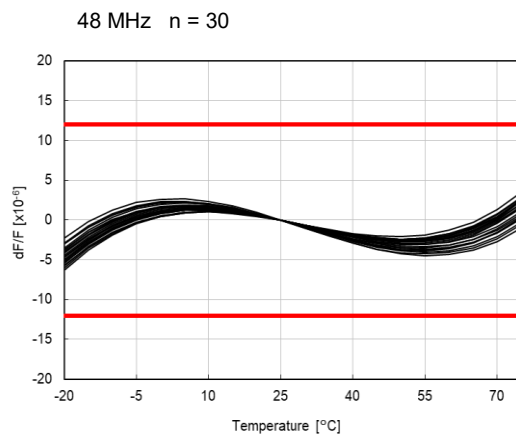
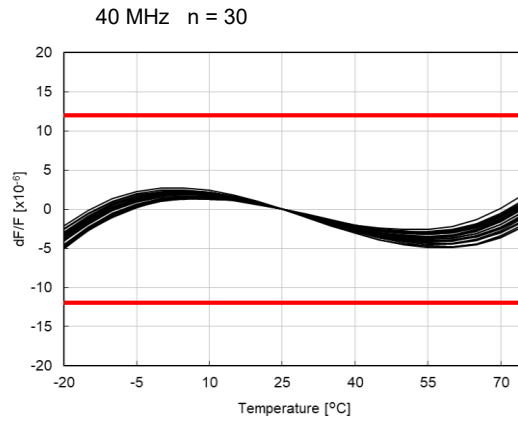
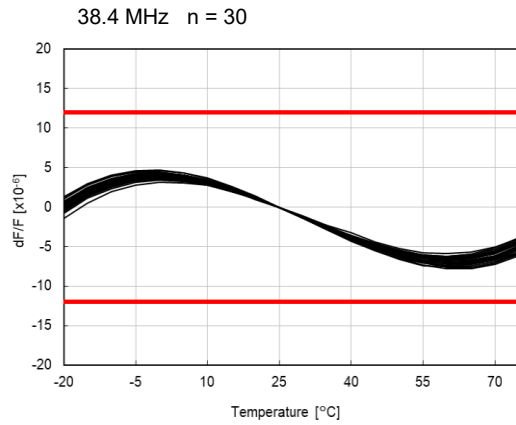
| Item                                                 | Symbol | Specifications               | Unit                    | Condition / Remarks                                                                                                                                |
|------------------------------------------------------|--------|------------------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Nominal frequency range                              | f_nom  | 24.000 to 54.000             | MHz                     | Please contact us about available frequencies.                                                                                                     |
| Frequency tolerance (Standard)                       | f_tol  | ±10                          | $\times 10^{-6}$        | T_use = +25 °C ± 3 °C<br>DL = 100 μW<br>Does not include frequency aging<br>Please contact Epson for requirements not listed in the specifications |
| Frequency vs. temperature characteristics (Standard) | f_tem  | ±12 (-20 °C to +75 °C)       | $\times 10^{-6}$        | Reference at<br>T_use = +25 °C ± 3 °C<br>Please contact Epson for requirements not listed in the specifications                                    |
|                                                      |        | ±17 (-30 °C to +85 °C)       |                         |                                                                                                                                                    |
|                                                      |        | ±20 (-40 °C to +85 °C)       |                         |                                                                                                                                                    |
|                                                      |        | ±30 (-40 °C to +105 °C)      |                         |                                                                                                                                                    |
| Load capacitance                                     | CL     | 6 to ∞                       | pF                      | Please specify                                                                                                                                     |
| Motional resistance (ESR)                            | R1     | Table 1.                     | Ω                       | π circuit IEC 60444-2<br>T_use = Operating temperature range<br>DL = 100 μW                                                                        |
| Shunt capacitance                                    | C0     | 3.0 Max.                     | pF                      |                                                                                                                                                    |
| Frequency aging                                      | f_age  | ±1 (24 MHz ≤ f_nom ≤ 40 MHz) | $\times 10^{-6}$ / year | T_use = +25 °C ± 3 °C                                                                                                                              |
|                                                      |        | ±2 (40 MHz < f_nom ≤ 54 MHz) |                         |                                                                                                                                                    |

Table 1.

| Frequency               | R1         |
|-------------------------|------------|
| 24 MHz ≤ f_nom ≤ 32 MHz | 200 Ω Max. |
| 32 MHz < f_nom ≤ 36 MHz | 100 Ω Max. |
| 32 MHz < f_nom ≤ 40 MHz | 80 Ω Max.  |
| 40 MHz < f_nom ≤ 54 MHz | 60 Ω Max.  |

## [ 5 ] Example of Frequency Temperature Characteristics





## [ 6 ] Marking Description

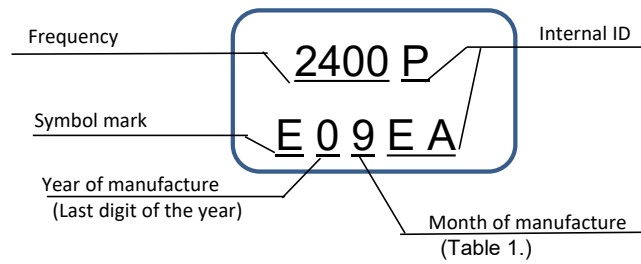
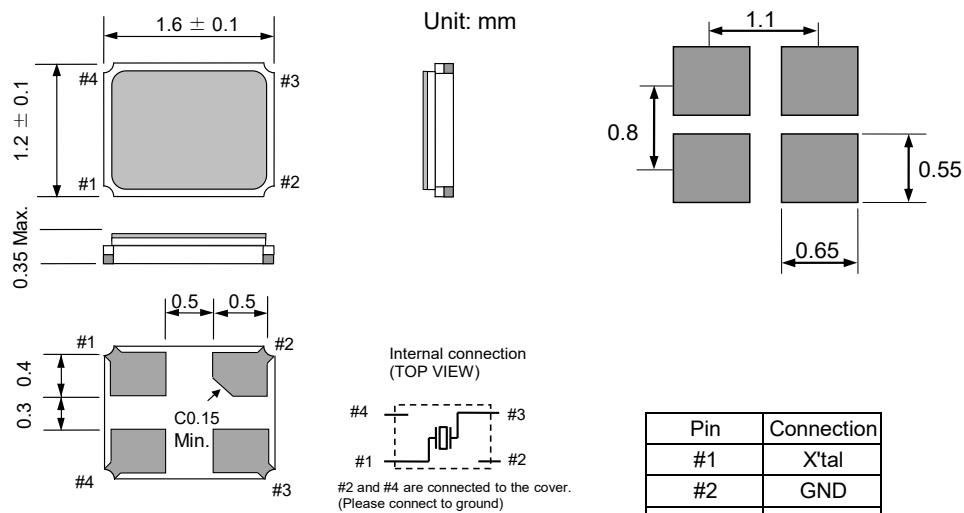


Table 1. Month of manufacture

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Code  | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | X   | Y   | Z   |

## [ 7 ] Outline Drawing and Recommended Footprint



| Pin | Connection |
|-----|------------|
| #1  | X'tal      |
| #2  | GND        |
| #3  | X'tal      |
| #4  | GND        |

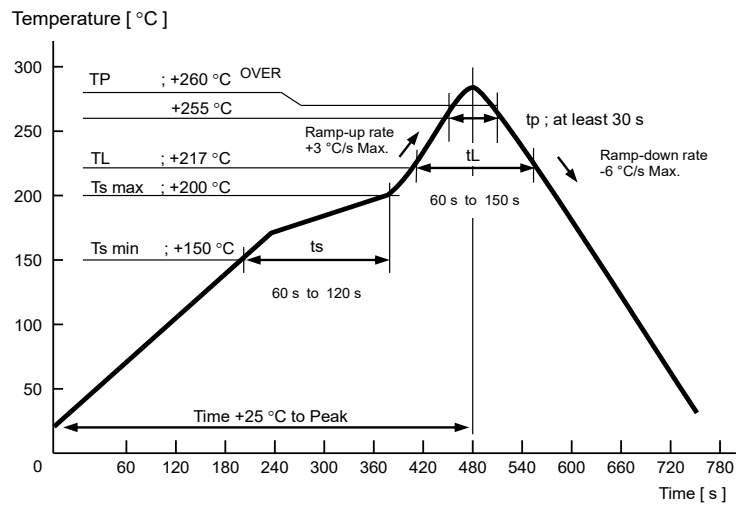
Reference weight Typ.: 3 mg

Terminal coating: Au plating

## [ 8 ] Moisture Sensitivity Level

| Parameter | Specification | Conditions          |
|-----------|---------------|---------------------|
| MSL       | LEVEL1        | JEDEC J-STD-020D.01 |

## [ 9 ] Reflow Profile (JEDEC J-STD-020D.01)



## [ 10 ] Packing Information

### (1) Packing Quantity

The last two digits of the Product Number (X1E000251xxxxx) are a code that defines the packing quantity. The standard is "26" for a 6 000 pcs / Reel.

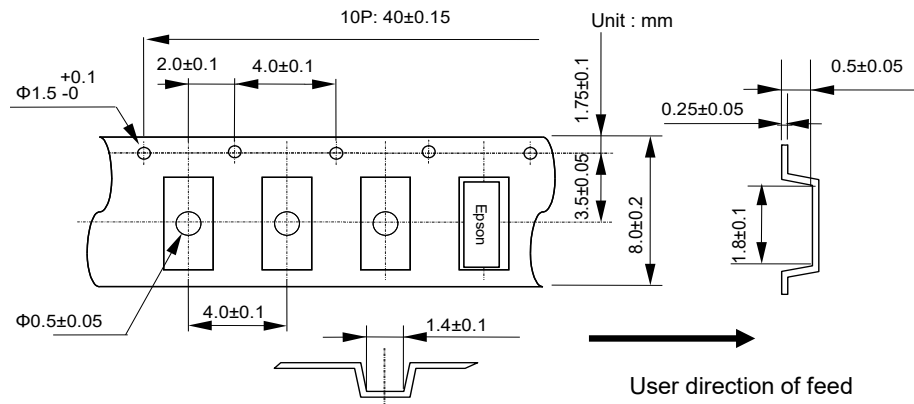
## (2) Taping Specification

Subject to EAI-481, IEC 60286 and JIS C0806

### (2-1) Tape Dimensions

Carrier Tape Material : PS (Polystyrene)

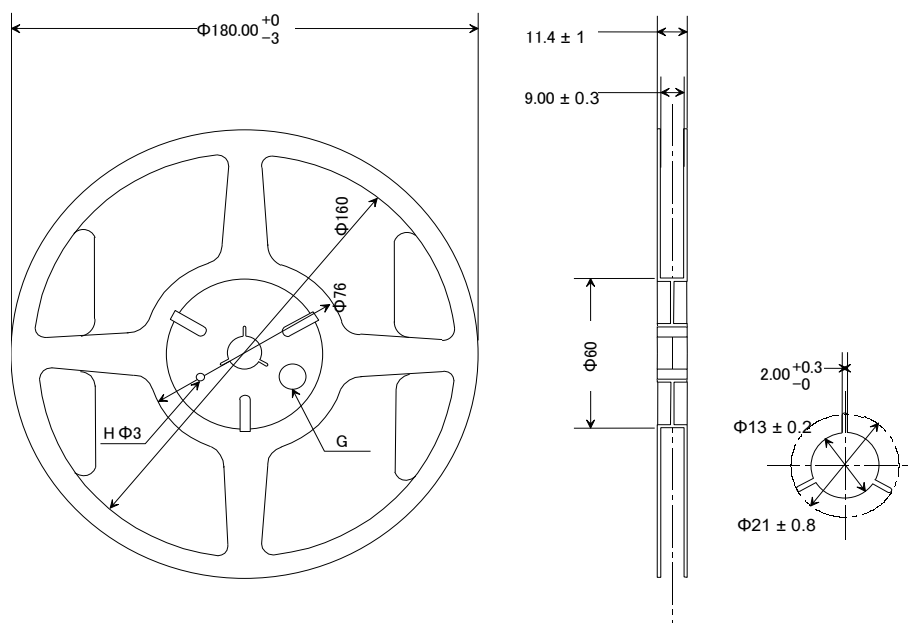
Top Tape Material : PET (Polyethylene Terephthalate) + PE (Polyethylene)



## (2-2) Reel Dimensions

Center Material : PS (Polystyrene)

Reel Material : PS (Polystyrene)



## [ 11 ] Handling Precautions

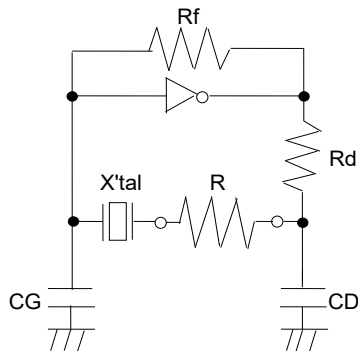
Prior to using this product, please carefully read the section entitled "Precautions" on our Web site (<https://www.epsondevice.com/crystal/en/support/precaution/>) for instructions on how to handle and use the product properly to ensure optimal performance of the product in your equipment.

Before using the product under any conditions other than those specified therein, please consult with us to verify and confirm that the performance of the product will not be negatively affected by use under such conditions.

In addition to the foregoing precautions, in order to avoid the deteriorating performance of the product, we strongly recommend that you DO NOT use the product under ANY of the following conditions:

1. Max three (3) times re-flow is allowed. Its recommended to manually solder when not enough/no solder detected.( Using soldering iron at +350 °C Max × within 5 seconds)
2. Avoid using the products if it received any excessive shocks and vibrations  
Crystal products may be damaged under some conditions during mounting if exposed to excess shock.  
Please set the mounting conditions to a slow mounting speed on the PCB to minimize shock as much as possible.  
Please review the conditions after the changed are made.
3. Keep the electrode wiring as short as possible to ensure normal oscillation.
4. Store the crystal products at normal temperature (+15 ° C to +35 ° C) and humidity (25 %RH to 85 %RH)  
Storing the crystal products under higher temperature or high humidity over one year may affect frequency stability or solderability.  
Contact Epson before use if the product has been stored outside the conditions mentioned above.
5. Ultrasonic equipment used for cleaning or bonding may deteriorate the characteristics of the product.  
Be sure to check in advance.
6. In high humidity environment, dew condensation on the PCB board may cause malfunction such frequency shift or no oscillation.
7. Applying excessive drive level to the crystal units may cause deterioration of characteristics or damage.  
Design and test the circuit so that the proper drive level is maintained.
8. The characteristic such as frequency, etc. may differ from your measurement depending on the measurement method or conditions.  
Contact Epson for any questions.
9. In order to avoid malfunction by other signal lines, design pattern other signal lines away from the product.  
and in case of multi-layered PCB board, do not lay out other signal lines under.  
If shielding with GND is required, shield the surface farthest from the oscillation circuits.
10. Ensure adequate negative resistance is allocated in the oscillation circuit,  
otherwise oscillation startup time may increase or no oscillation may occur.  
In order to avoid this, provide enough negative resistance that is 5 to 10 time the motional resistance(R1)
11. Aging specifications are estimated from environmental reliability tests and expected frequency variation over time.  
They do not provide a guarantee of aging over the product lifecycle.
12. Should any customer use the product in any manner contrary to the precautions and/or advice herein,  
such use shall be done at the customer's own risk.

How to check the negative resistance.



- 1) Insert a pure resistance R in series with the X'tal.
- 2) Adjust R and find the maximum R value that starts oscillation.
- 3) Check the value of R in the oscillation state of 2).  
Negative resistance of the circuit  $|-R| =$   
 $R + \text{Series resistance value } R1 \text{ of the } X'tal$
- 4) Negative resistance  $|-R|$  guideline:  
 $|-R| > R1 \text{ Max. } \times 5 \text{ to } 10$

## PROMOTION OF ENVIRONMENTAL MANAGEMENT SYSTEM CONFORMING TO INTERNATIONAL STANDARDS

At Seiko Epson, all environmental initiatives operate under the Plan-Do-Check-Action (PDCA) cycle designed to achieve continuous improvements. The environmental management system (EMS) operates under the ISO 14001 environmental management standard.

All of our major manufacturing and non-manufacturing sites, in Japan and overseas, completed the acquisition of ISO 14001 certification.

ISO 14000 is an international standard for environmental management that was established by the International Standards Organization in 1996 against the background of growing concern regarding global warming, destruction of the ozone layer, and global deforestation.

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In order provide high quality and reliable products and services than meet customer needs, Seiko Epson made early efforts towards obtaining ISO9000 series certification and has acquired ISO9001 for all business establishments in Japan and abroad. We have also acquired IATF 16949 certification that is requested strongly by major manufacturers as standard.

IATF 16949 is the international standard that added the sector-specific supplemental requirements for automotive industry based on ISO9001.

### ■ Explanation of marks used in this datasheet

|                                                                                   |                                                                                                                                                                                                                                      |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | ● <b>Pb free.</b>                                                                                                                                                                                                                    |
|  | ● <b>Complies with EU RoHS directive.</b><br>*About the products without the Pb-free mark.<br>Contains Pb in products exempted by EU RoHS directive<br>(Contains Pb in sealing glass, high melting temperature type solder or other) |

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