| RECIPIENT |
| --- |
| |

# SPECIFICATIONS

**Product No. :** **Q33310N70006800**

**MODEL :** **SG-310SCN**

**SPEC. No. :** **A14-1712-3A**

**DATE:** **Mar. 13. 2015**


**SEIKO EPSON CORPORATION**

**8548 Naka-minowa**
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Emi Oguchi

# SPECIFICATIONS

## 1. Application

This document is applicable to the crystal oscillator that are delivered to from Seiko Epson Corp.

This product is compliant with RoHS Directive.

This Product supplied (and any technical information furnished, if any) by Seiko Epson Corporation shall not be used for the development and manufacture of weapon of mass destruction or for other military purposes. Making available such products and technology to any third party who may use such products or technologies for the said purposes are also prohibited.

This product listed here is designed as components or parts for electronics equipment in general consumer use. We do not expect that any of these products would be incorporated or otherwise used as a component or part for the equipment, which requires an extra high reliability, such as satellite, rocket and other space systems, and medical equipment, the functional purpose of which is to keep life.

## 2. Product No. / Model

The product No. of this crystal oscillator unit is Q33310N70006800.
The model is SG-310SCN.

## 3. Packing

It is subject to the packing standard of Seiko Epson Corp.

## 4. Warranty

Defective parts which are originated by us are replaced free of charge in case defects are found within 12 months after delivery.

## 5. Amendment and abolishment

Amendment and/or abolishment of this specification are subject to the agreement between both parties.

## 6. Contents


| Item No. | Item | Page |
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## [ 1 ] Absolute maximum ratings

| Parameter | Symbol | Value | Unit | Note |
|---|---|---|---|---|
| Supply voltage | $V_{CC}$-GND | -0.3 to +7.0 | V | |
| Storage temperature * | T_stg | -40 to +125 | °C | Stored as bare product after unpacking. |
| Input voltage | $V_{IN}$ | -0.3 to $V_{CC}$+0.3 | V | $\overline{ST}$ Terminal |

* Concerning the frequency change, please refer [8] Environmental and mechanical characteristics.

## [ 2 ] Operating range

| Parameter | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Supply voltage | $V_{CC}$ | 2.7 | 3.3 | 3.6 | V | |
| Supply voltage | GND | 0.0 | 0.0 | 0.0 | V | |
| Input voltage | $V_{IN}$ | GND | - | $V_{CC}$ | V | |
| Operating temperature | T_use | -40 | +25 | +85 | °C | |
| Output load condition | L_CMOS | - | - | 15 | pF | |

- Start up time(0 %$V_{CC}$→90 %$V_{CC}$) of power source should be more than 150 μs.
- By-pass capacitor (0.01 μF to 0.1 μF) is connected near Vcc between Vcc and GND.
  (Refer to [ 11 ] Recommendable patterning)

## [ 3 ] Frequency characteristics

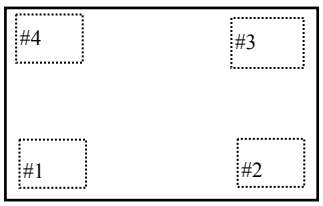
Output frequency ($f_0$) range ..... 50 MHz

| Parameter | Symbol | Value[$1 \times 10^{-6}$] | Note |
|---|---|---|---|
| Frequency tolerance * | f_tol (OSC) | J : ±25 | T_use=-40 °C to +85 °C |
| Aging | f_aging | ±3 | T_use=+25 °C, $V_{CC}$=3.3 V First year |
| | | ±10 | T_use=+25 °C, $V_{CC}$=3.3 V 10 years |

* This includes initial frequency tolerance, temperature characteristics, input voltage characteristics, and load characteristics, but excludes aging.

## [ 4 ] Terminal assignment

Top View




| Terminal name | Terminal No. | Terminal type. |
|---|---|---|
| $\overline{ST}$ | 1 | INPUT |
| GND | 2 | — |
| OUT | 3 | OUTPUT |
| VCC | 4 | — |

$\overline{ST}$ pin : High or open. → Specified frequency output = enable.

$\overline{ST}$ pin : Low. → Output is high impedance = disabled.

## [ 5 ] Electrical characteristics

(Please see page 2 [2] Operating range)

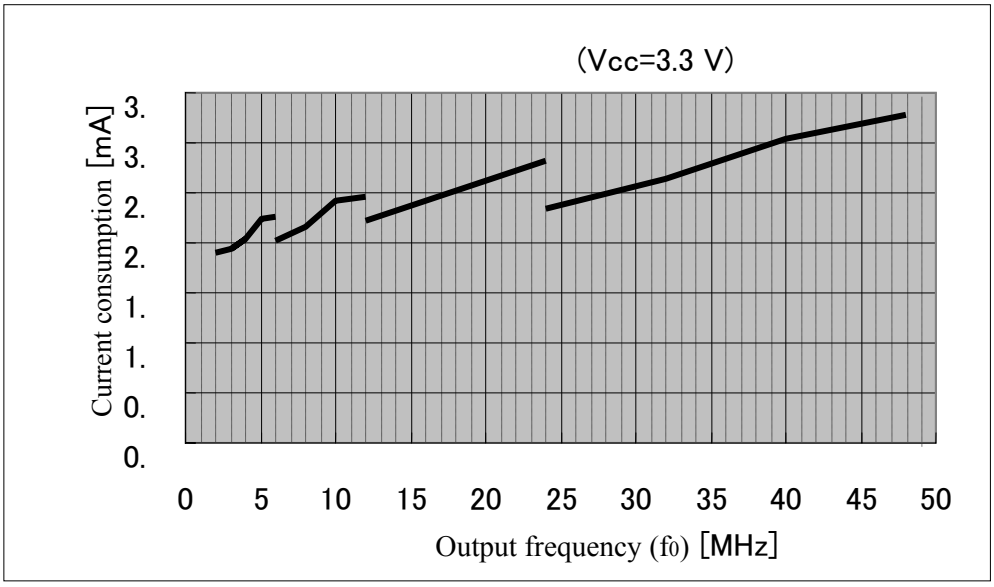
| Parameter | Symbol | Value | | Unit | Note |
|---|---|---|---|---|---|
| | | Min. | Max. | | |
| Start up time | tOSC | - | 2.0 | ms | t=0 at 90 %VCC |
| Current consumption | ICC | - | 5.0 | mA | No load |
| Standby current | I_std | - | 10.0 | μA | $\overline{ST}$ =GND |
| Output rise time ＊1 | tr | - | 4.0 | ns | 20 %Vcc → 80 %Vcc |
| Output fall time ＊1 | tf | - | 4.0 | ns | 80 %Vcc → 20 %Vcc |
| Symmetry | SYM | 45 | 55 | % | 50 %Vcc Level |
| High level output voltage | $V_{OH}$ | 0.9 Vcc | - | V | $I_{OH}$ = -3 mA |
| Low level output voltage | $V_{OL}$ | - | 0.1 Vcc | V | $I_{OL}$ = 3 mA |
| High level input voltage | $V_{IH}$ | 0.7 Vcc | - | V | $\overline{ST}$ terminal |
| Low level input voltage | $V_{IL}$ | - | 0.3 Vcc | V | $\overline{ST}$ terminal |
| Input current | $I_{IH}$ | - | 1.0 | μA | $V_{IN}$ = Vcc |
| | $I_{IL}$ | -2.4 | - | μA | $V_{IN}$ = GND |
| Output disable time ＊2 | tstp | - | 150 | ns | $\overline{ST}$ terminal High → Low |
| Output enable time ＊2 | tsta | - | 2.0 | ms | $\overline{ST}$ terminal Low → High |
| Input pull-up resistance | RUP | 1.5 | 6.0 | MΩ | $V_{IN}$=GND |
| | | 50 | 200 | kΩ | $V_{IN}$ =0.8 Vcc |

Refer to [6] Test circuit [7] Timing chart

＊1 【７】1） C-MOS load

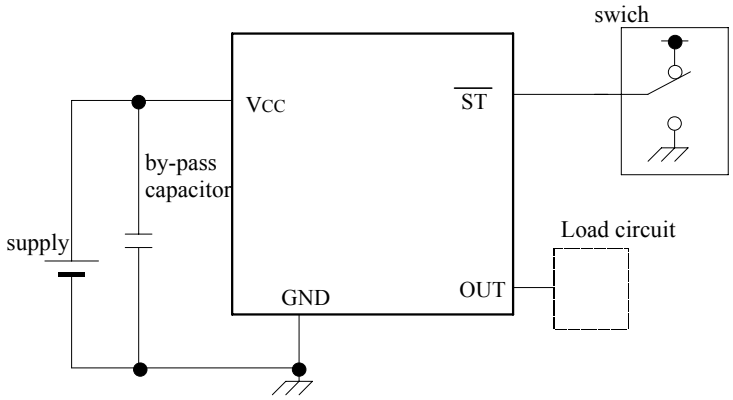
＊2 【７】2） $\overline{ST}$ function and timing

◆Reference : Current consumption Typ. Value ( VCC = 3.3 V , T_use = +25 ℃ )

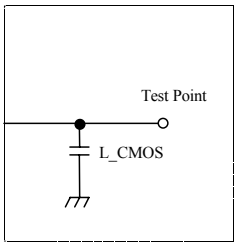


## [ 6 ] Test circuit

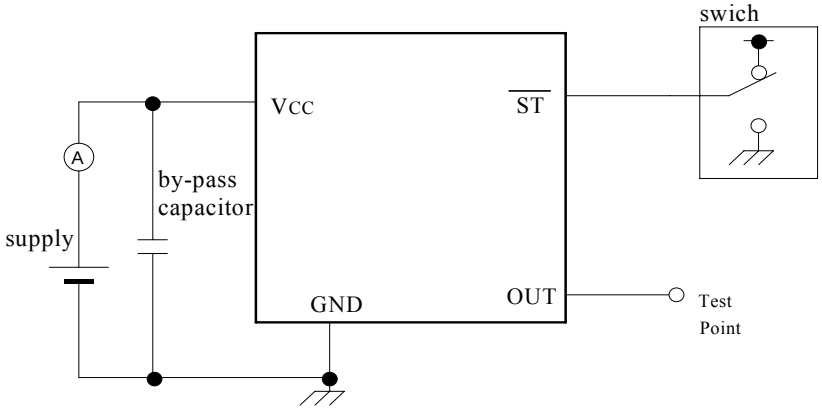
1) Waveform observation




Load circuit load capacitance




2) Current consumption




*Current consumption under the disable function should be $\overline{ST}$ = GND.

3) Condition

(1) Oscilloscope

- Band width should be minimum 5 times higher (wider) than measurement frequency.
- Probe earth should be placed closely from test point and lead length should be as short as possible.

* Recommendable to use miniature socket. (Don't use earth lead.)

(2) L_CMOS also includes probe capacitance.

(3) By-pass capacitor (0.01 μF to 0.1 μF) is placed closely between VCC and GND.

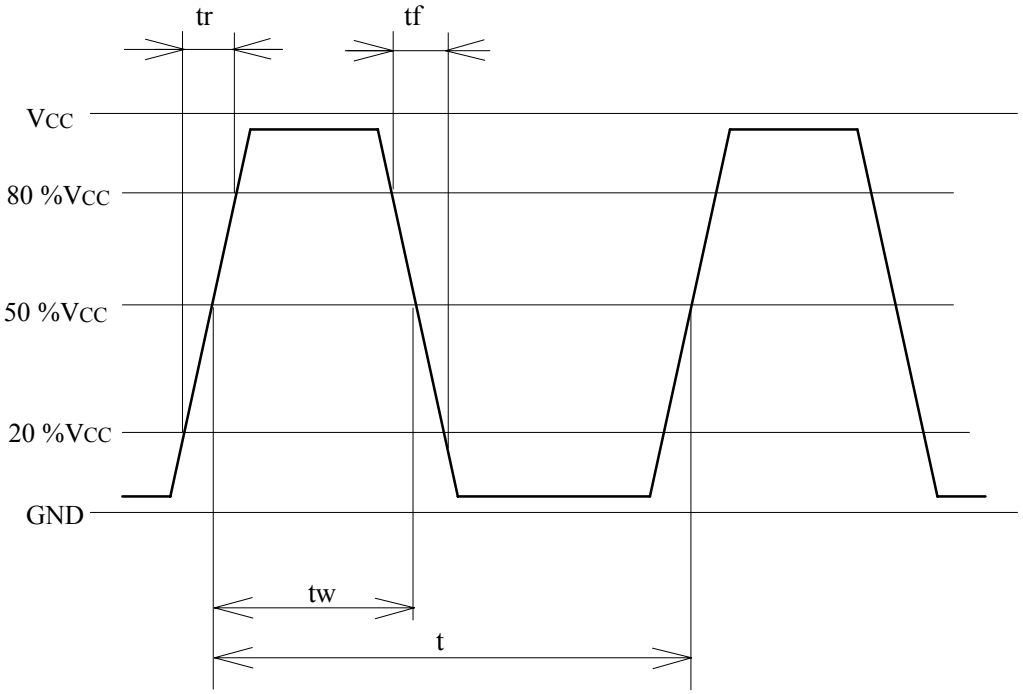
(4) Use the current meter whose internal impedance value is small.

(5) Power supply

- Start up time (0 %VCC → 90 %VCC) of power source should be more than 150 μs.
- Impedance of power supply should be as lowest as possible.

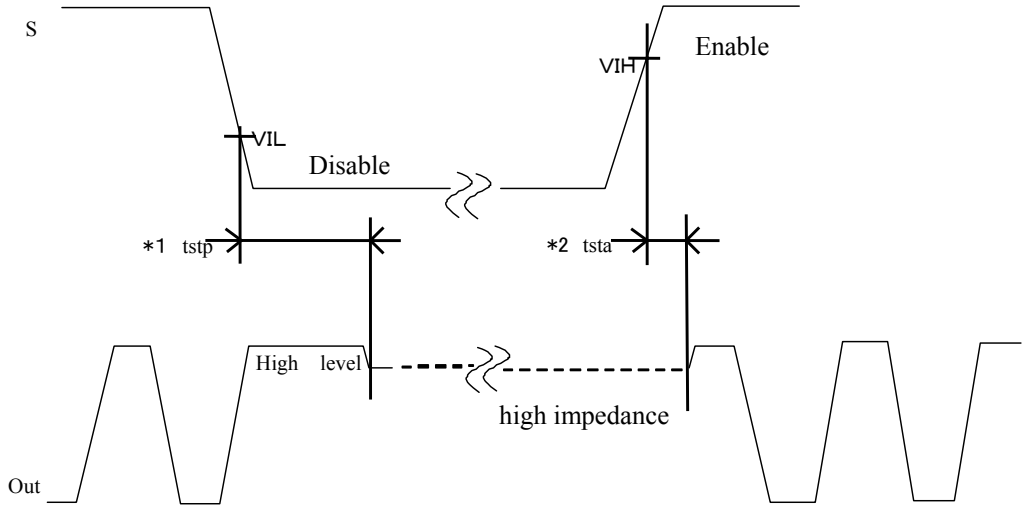
## [ 7 ] Timing chart

1) C-MOS load SYM = tw/t × 100 (%)




2) $\overline{ST}$ function and timing

| $\overline{ST}$ function | Osc. circuit | Output status |
|---|---|---|
| High or Open | Oscillation | Specified frequency is output : Enable |
| Low | Oscillation stop | Output becomes high impedance : Disable |




*1 The time taken from $\overline{ST}$ =VIL to output = Disable (high impedance)

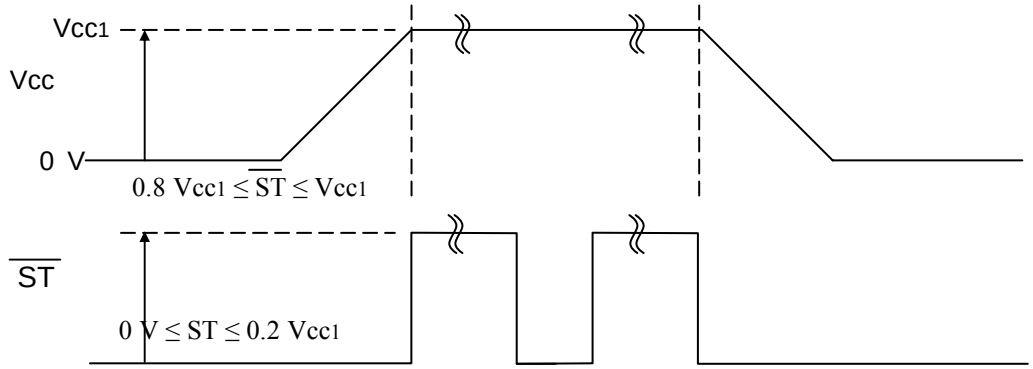
*2 The time taken from $\overline{ST}$ =VIH to output = Start

Output start : VOH≥80 %VCC, VOL≤20 %VCC, fout = fo±1 000×$10^{-6}$

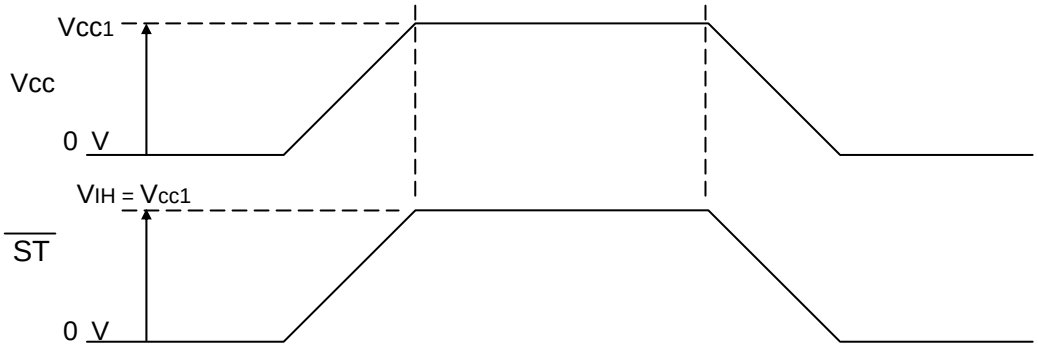
3) $\overline{ST}$ Control timing

$\overline{ST}$ function is used on the voltage below supply voltage.

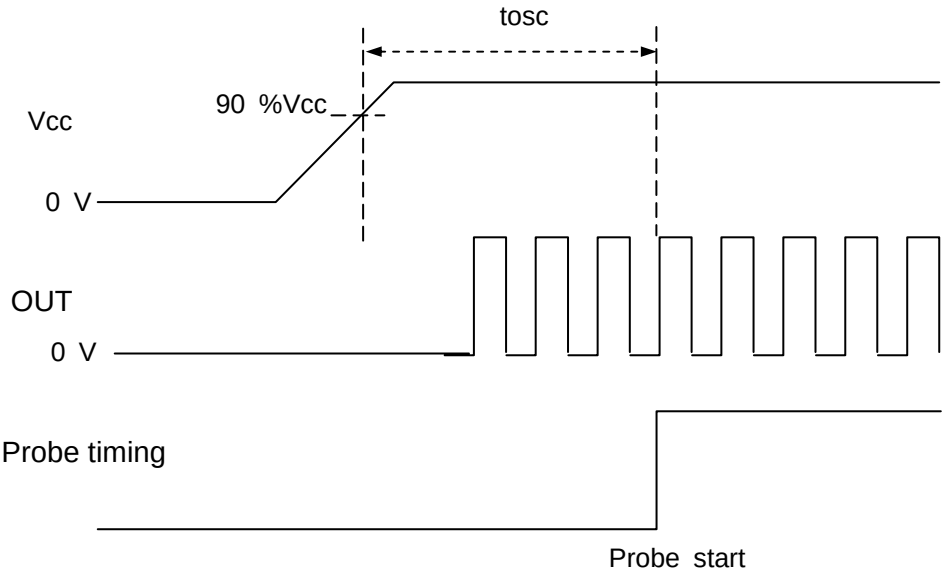
$\overline{ST}$ control timing differs from Vcc control timing




$\overline{ST}$ terminal is connected to Vcc terminal




4) Timing of an output frequency signal



## [ 8 ] Environmental and mechanical characteristics

(The company evaluation condition We evaluate it by the following examination item and examination condition.)

| No. | Item | Value *1 | | Test Conditions |
|---|---|---|---|---|
| | | Δ f / f *2 [ $1 \times 10^{-6}$ ] | Electrical characteristics | |
| 1 | High temperature storage | *3 ± 20 | Satisfy Item [5] after test. | +125 °C × 1 000 h |
| 2 | Low temperature storage | *3 ± 10 | | -40 °C × 1 000 h |
| 3 | High temperature bias | *3 ± 10 | | +85 °C × Vcc Max. × 1 000 h |
| 4 | Low temperature bias | *3 ± 10 | | -40 °C × Vcc Max. × 1 000 h |
| 5 | Temperature humidity bias | *3 ± 10 | | +85 °C × 85 %RH × Vcc Max. × 1 000 h |
| 6 | Temperature cycle | *3 ± 10 | | -40 °C ↔ +125 °C<br>30 min. at each temperature 100 cycles |
| 7 | Resistance to soldering heat | ± 2 | | Convection reflow soldering furnace (3 time)<br>Ref. IPC/JEDEC J-STD-020D.1 |
| 8 | Shock | ± 2 | | 150 g dummy Jig (SE Standard)<br>drop from 1 500 mm height on the Concrete 3 directions 10 times. |
| 9 | Vibration | ± 1 | | 10 Hz to 55 Hz amplitude 0.75 mm<br>55 Hz to 500 Hz acceleration 98 $m/s^2$<br>10 Hz → 500 Hz → 10 Hz 15 min./cycle<br>6 h (2 hours , 3 directions) |
| 10 | Seal | $1 \times 10^{-9}$ Pa·$m^3$ / s | | He leakage detector |
| 11 | Solderability | Termination must be 95 % covered with fresh solder | | Dip termination into solder bath at +235 °C ± 5 °C for 5 s. (Using Rosin Flux) |
| 12 | Pull - off | No peeling-off at a solder part | | 10 N press for 10 s ± 1 s<br>Ref. EIAJ ED-4702 |

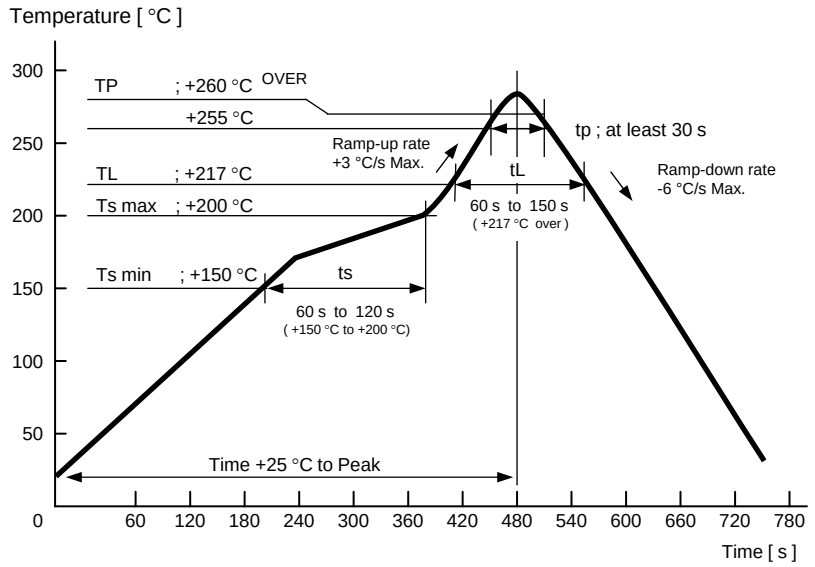
< Notes >

*1 Each test done independently.

*2 Measuring 2 h to 24 h later leaving in room temperature after each test.

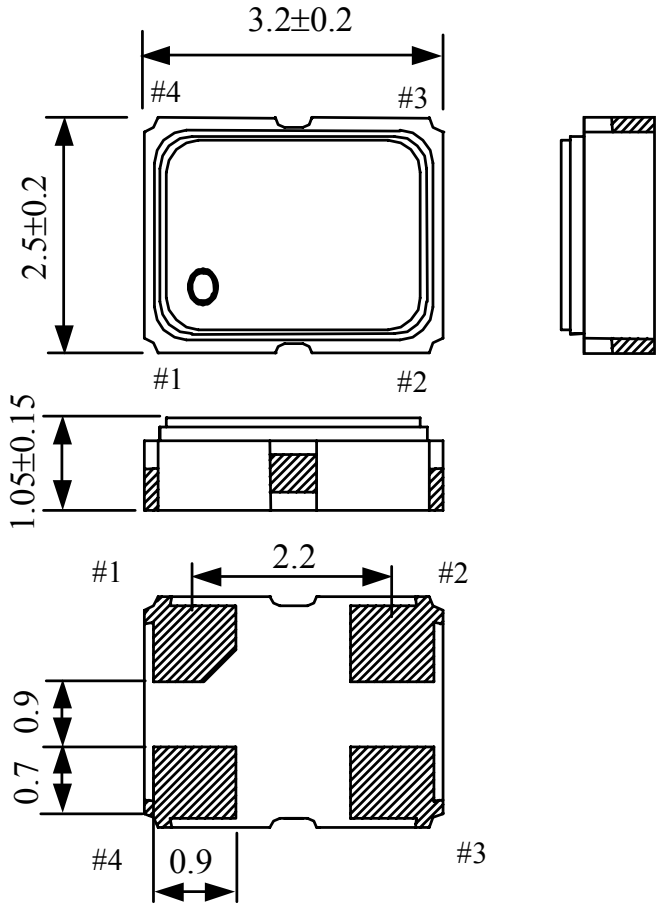
*3 Initial value shall be measured after 24 h storage at room temperature after pre-conditioning.
Pre-conditioning: Reflow (3 time)

Convection reflow condition (Ref. IPC/JEDEC J-STD-020D.1)



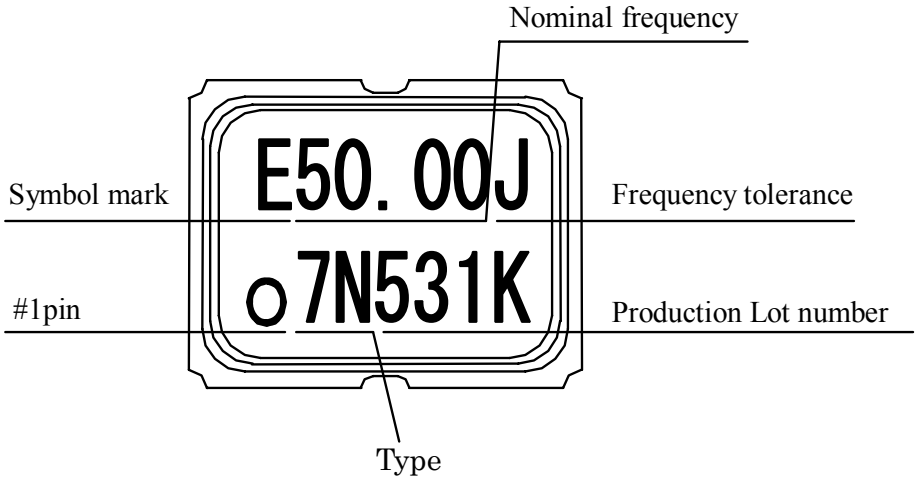
## [ 9 ] Dimensions and marking layout

1) Dimensions




Terminal treatment : Au plating
Unit : mm

2) Marking layout




- The above marking layout shows only marking contents and their approximate position and it is not for font, size and exact position.
- Output frequency shall indicate 5 digits (include decimal point), if the value of frequency over 5 digits, the least significant digits will be omitted.

## [ 10 ] Notes

1) This device is made with C-MOS IC.
Please take necessary precautions to prevent damage due to electrical static discharge.

2) Seiko Epson recommends a 0.01 μF to 0.1 μF capacitor must be connected near Vcc between Vcc and GND to obtain stable operation and protect against power line ripple.

3) Vcc and GND pattern shall be as large as possible so that high frequency impedance shall be small.

4) Seiko Epson cannot recommend putting filtering element into power line so as to reduce noise. Oscillator might be unstable oscillation because high frequency impedance of power line becomes higher. When use filtering element, please verify electrical construction and or element's spec.

5) Seiko Epson doesn't recommend to power on from intermediate electric voltage or extreme fast power on, those powering conditions may cause no oscillation or abnormal oscillation.

6) Power ripple: 200 mV P-P max. Start up time (0 %$V_{CC}$→90 %$V_{CC}$) of power source should be more than 150 μs.

7) A long output line may cause irregular output, so try to make the output line as short as possible.

8) Other high-level signal lines may cause incorrect operation, so please do not place high level signal line close to this device.

9) This device contains a crystal resonator, so please don't expose excessive shock or vibration. Seiko Epson recommends store device under normal temperature and humidity to keep the specification.

10) An automatic insertion is available, however, the internal crystal resonator might be damaged in case that too much shock or vibration is applied by machine condition.
Be sure to check your machine condition in advance.

11) Ultrasonic cleaning can be used on the SG-310SCN, however, since the oscillator might be damaged under some conditions, please exercise in advance.

12) Seiko Epson recommends to use and store under room temperature and normal humidity to secure frequency accuracy and prevent moisture.

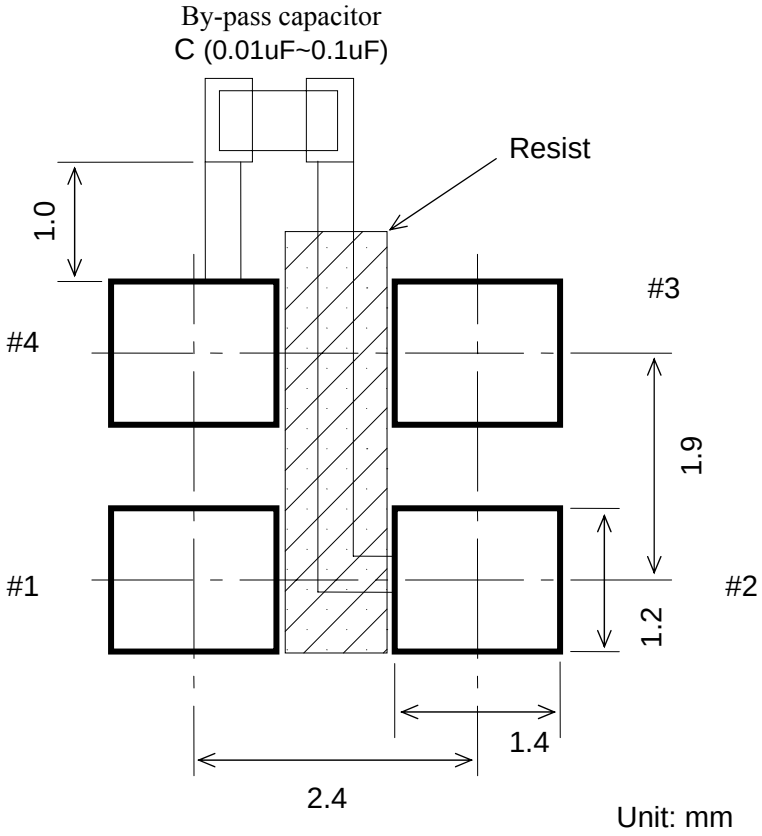
13) $\overline{ST}$ -pin has pull-up resistor internally. The resistor value is switched depending on input voltage. Please refer to electrical characteristics.

14) Lid is electrically disconnected to package.
However output frequency might be affected when apply voltage to Lid.

## [ 11 ] Recommendable patterning

The soldering pad sample indicated as like following:

Soldering position (Unit : mm)



# TAPING SPECIFICATION

## Ⅰ. Application

This standard will apply to 3.2×2.5 Ceramic package.

Spec：CE package

## Ⅱ. Contents


| Item No. | Item | Page |
|---|---|---|
| 〔1〕 | Taping specification | 1 to 2 |
| 〔2〕 | Inner Sleeve | 3 |
| 〔3〕 | Shipping carton | |
| 〔4〕 | Marking | 4 |
| 〔5〕 | Quantity | |
| 〔6〕 | Storage environment | |
| 〔7〕 | Handling | |

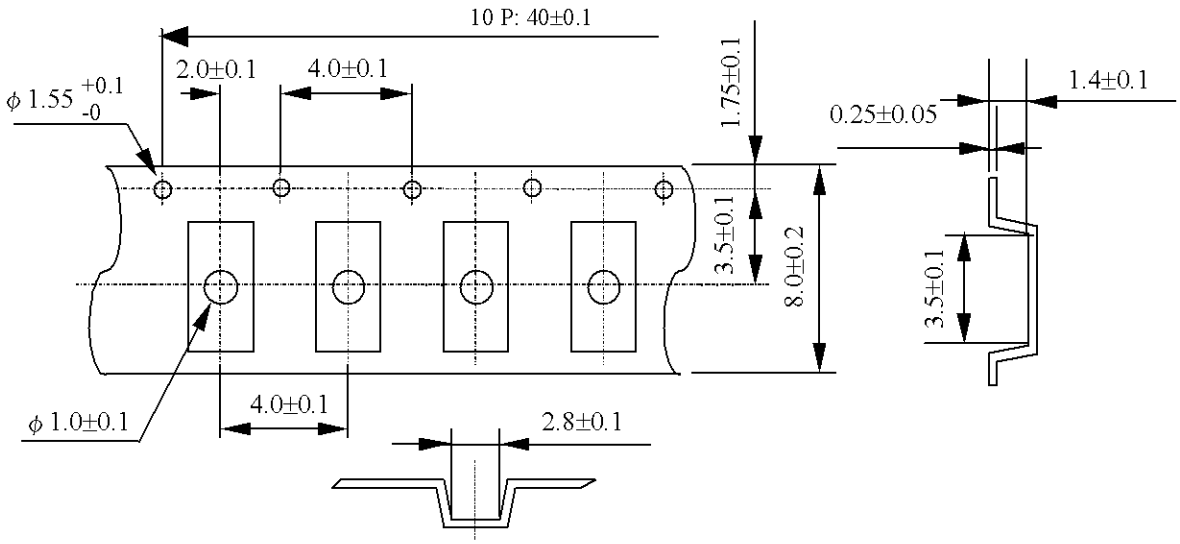
〔1〕 Taping specification

Subject to「EIA-481」and「IEC-60286」

(1) Tape dimensions

Material of the carrier tape : P S

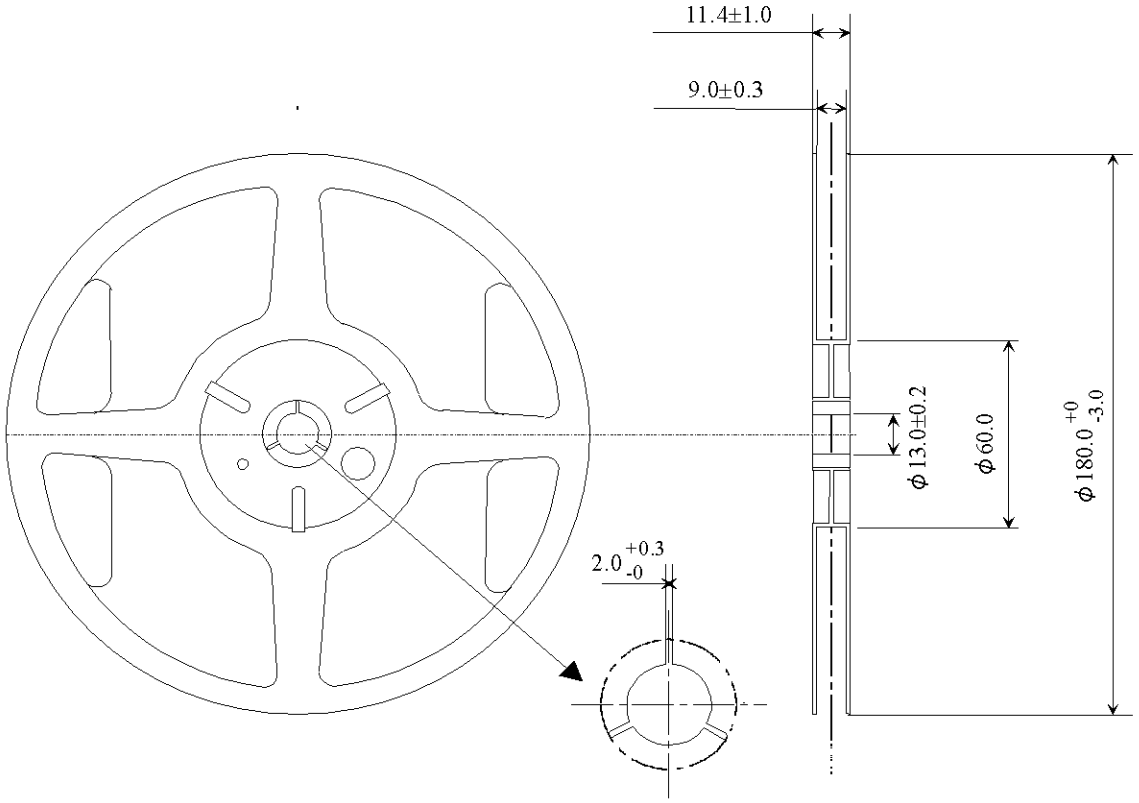
Material of the top tape : PET+PE




Unit : mm

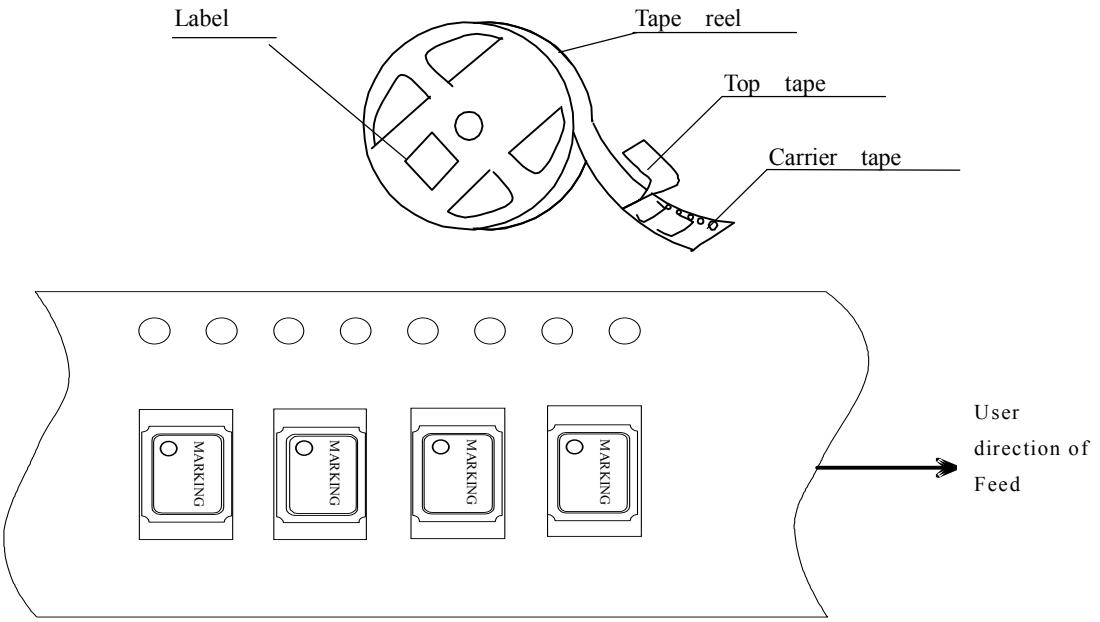
(2) Reel dimensions

Material of the reel : Conductive polystyrene

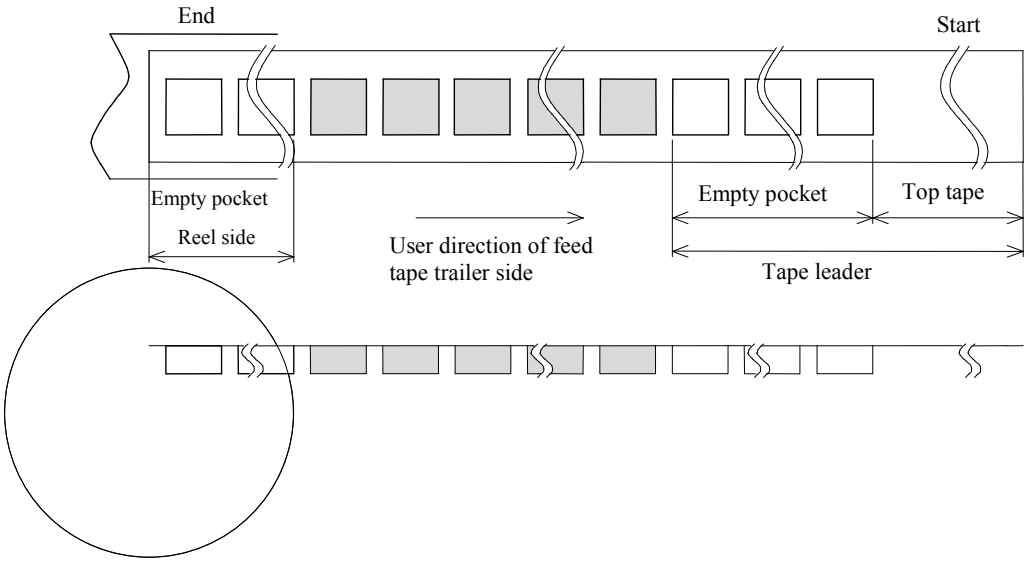


(3) Packing

①Tape & reel



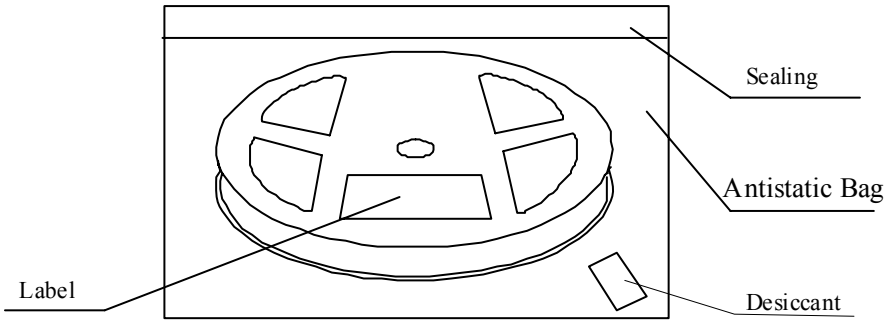

②Start & end point



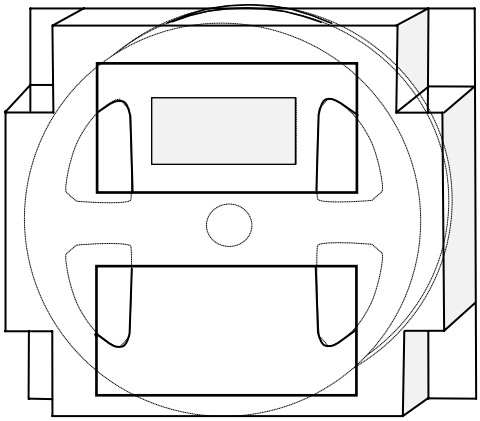

| Item | | Empty space |
|---|---|---|
| Tape leader | Top tape | Min. 1 000 mm |
| | Carrier tape | Min. 160 mm |
| Tape trailer | Top tape | Min. 0 mm |
| | Carrier tape | Min. 160 mm |

〔2〕 Inner sleeve

a) Packing to antistatic bag

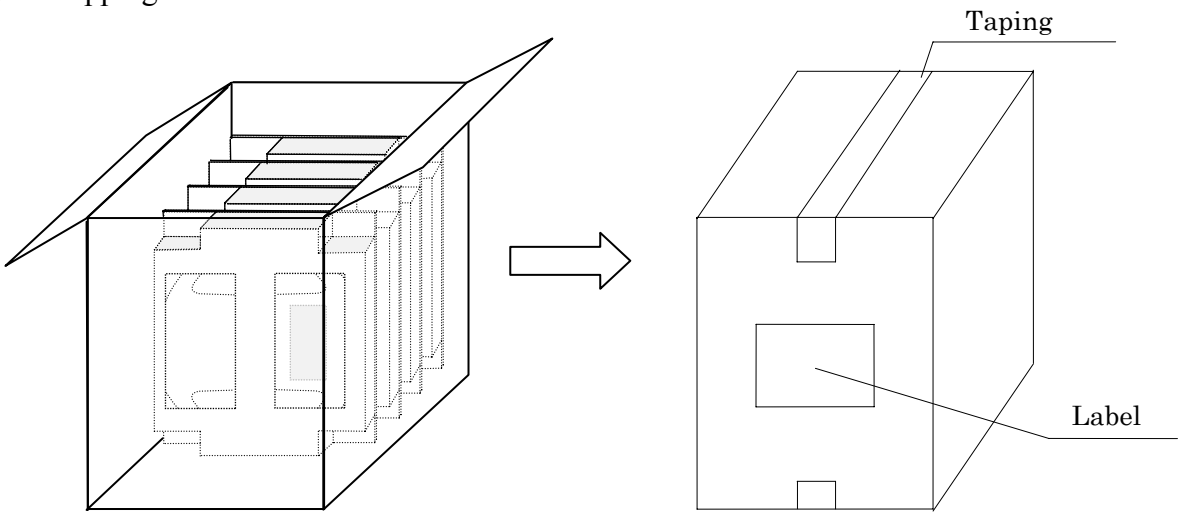



b) Packing to inner sleeve



* There is also a case to put the two reels

〔3〕 Shipping carton



〔4〕 Marking

(1) Reel marking

・Reel marking shall consist of :

1) Parts name
2) Quantity
3) Manufacturing date or symbol
4) Manufacturer's date or symbol
5) Others (if necessary)

(2) Shipping carton marking

・Shipping carton marking shall consist of :

1) Parts name
2) Quantity

〔5〕 Quantity

・ 2,000 pcs./reel

〔6〕 Storage environment

(1) Before open the packing, we recommend to keep less than +30 ℃ and 85 %RH of Humidity, and to use it less than 6 months after delivery.

(2) We recommend to open Package in immediately before use. After open Package, We recommend to keeps less than 6 month. No need dry air before soldering work if it is less than temperature +30 ℃, 85 humidity %RH.

(3) Not to expose the sun.

(4) Not to storage with some erosive chemicals.

(5) Nothing is allowed to put on the reel or carton to prevent mechanical damage.

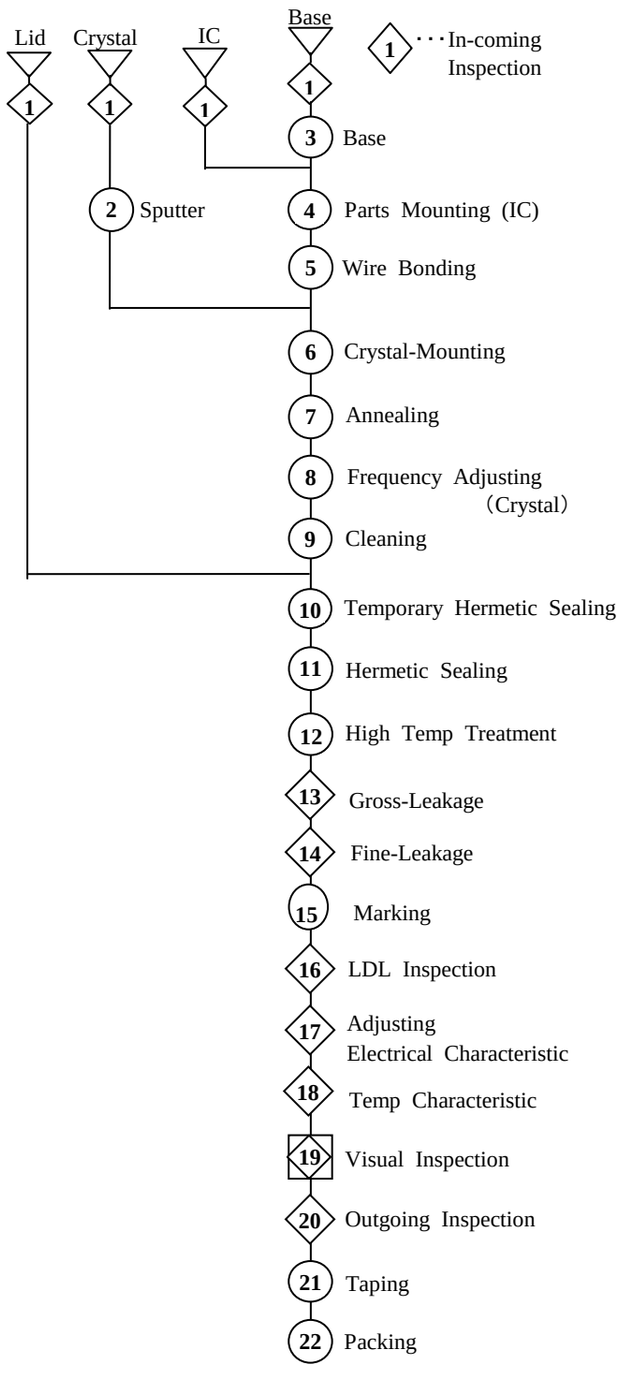
〔7〕 Handling

・To handle with care to prevent the damage of tape, reel and products.

## - PROCESS QUALITY CONTROL

No. SG310S*N - 00 - ASE - 2　　CRYSTAL OSCILLATOR : SG-310S*N

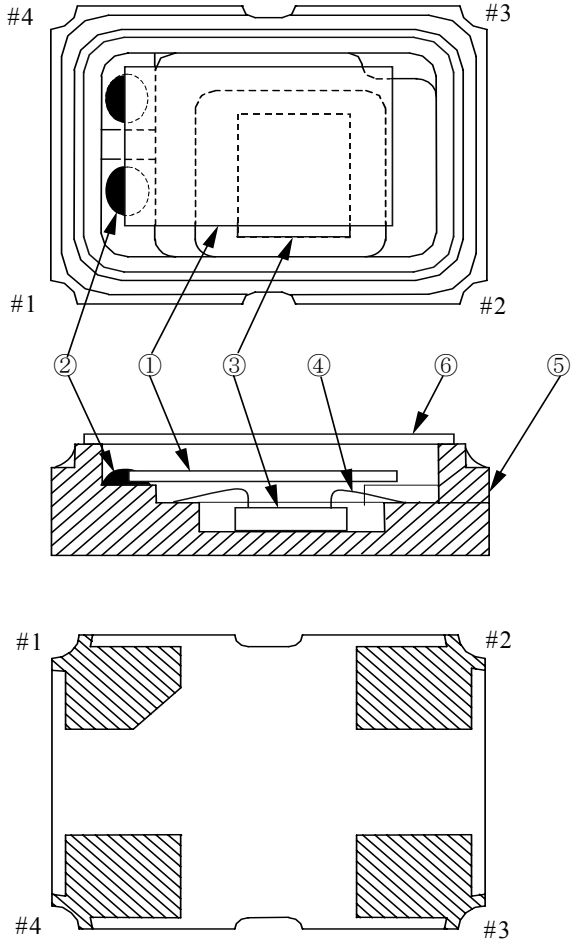
SG310SxN_Q_0001
'08.03.03




| No. | Section In Charge | Standards | Inspection, Control Item | Instruments | Inspection Methods | Record |
|---|---|---|---|---|---|---|
| 1 | Inspection Section | Purchasing Specification<br>Incoming Inspection Standard | Appearance Dimension | Microscope | Sampling | Data sheet |
| 2 | Production Section | Manufacturing Instruction Sheet | Appearance<br>Peeling Strength<br>Frequency | Microscope<br>Scratch<br>CI Meter | Sampling | Data sheet |
| 3 | Production Section | Manufacturing Instruction Sheet | Appearance | Microscope | Sampling | Data sheet |
| 4 | Production Section | Manufacturing Instruction Sheet | Appearance | Microscope | Sampling | Data sheet |
| 5 | Production Section | Manufacturing Instruction Sheet | Bonding strength<br>Appearance | Gauge<br>Microscope | Sampling<br>100% Inspection | Data sheet |
| 6 | Production Section | Manufacturing Instruction Sheet | Appearance | Microscope | 100% Inspection | Data sheet |
| 7 | Production Section | Manufacturing Instruction Sheet | Appearance | Microscope | Sampling | Data sheet |
| 8 | Production Section | Manufacturing Instruction Sheet | — | — | — | — |
| 9 | Production Section | Manufacturing Instruction Sheet | Appearance | Visual Inspection | 100% Inspection | Data sheet |
| 10 | Production Section | Manufacturing Instruction Sheet | Appearance | Microscope | Sampling | Data sheet |
| 11 | Production Section | Manufacturing Instruction Sheet | Appearance<br>Frequency | Microscope<br>Counter | Sampling<br>Sampling | Data sheet |
| 12 | Production Section | Manufacturing Instruction Sheet | — | — | — | — |
| 13 | Production Section | Manufacturing Instruction Sheet | Leakage Inspection | Measuring equipment | 100% Inspection | Data sheet |
| 14 | Production Section | Manufacturing Instruction Sheet | Leakage Inspection | Measuring equipment | 100% Inspection | Data sheet |
| 15 | Production Section | Manufacturing Instruction Sheet | Appearance | Visual Inspection | Sampling | Data sheet |
| 16 | Production Section | Manufacturing Instruction Sheet | Characteristic Inspection | Measuring equipment | 100% Inspection | Data sheet |
| 17 | Production Section | Manufacturing Instruction Sheet | Electrical Characteristic | Measuring equipment | 100% Inspection | Data sheet |
| 18 | Production Section | Manufacturing Instruction Sheet | Temp Characteristic Inspection | Measuring equipment | Sampling | Data sheet |
| 19 | Production Section | Manufacturing Instruction Sheet | Appearance | Microscope | Sampling | Data sheet |
| 20 | Production Section | Delivery Specifications<br>Outgoing Inspection Standard | Electrical Characteristic<br>Appearance | Measuring equipment<br>Visual Inspection | Sampling | Data sheet |
| 21 | Production Section | Manufacturing Instruction Sheet | Tape peeling Strength | Peeling strength test machine | Sampling | Data sheet |
| 22 | Production Control Section | Manufacturing Instruction Sheet<br>Daily Shipping List | Customers<br>Type<br>Quantity | — | — | Delivery Slip |

# Structure Diagram 構造図

| | | |
|---|---|---|
| Model<br>型式 | **SG-310SxN** | |
| Document No.<br>管理№ | IG-0601-01-1 | SG310SxN_D_0001 |




| | | |
|---|---|---|
| ⑥ | Lid<br>ﾘｯﾄﾞ | |
| ⑤ | Package<br>ﾊﾟｯｹｰｼﾞ | |
| ④ | Bonding Wire<br>ﾎﾞﾝﾃﾞｨﾝｸﾞﾜｲﾔｰ | |
| ③ | IC<br>IC | |
| | IC Conductive Adhesive<br>IC ﾏｳﾝﾄ材 | |
| ② | Crystal adhesive<br>水晶振動子ﾏｳﾝﾄ材 | |
| ① | Crystal Chip<br>水晶振動子 | |
| No. | Name of Part<br>部品名 | |

RELIABILITY TEST DATA

## Product Name : SG-310**N series (48～80 MHz)

The Company evaluation condition

We evaluate environmental and mechanical characteristics by the following test condition . **No. OUT8-34-0201E**

| No. | ITEM | TEST CONDITIONS | VALUE *1 | | TEST Qty [ n ] | FAIL Qty [ n ] |
|---|---|---|---|---|---|---|
| | | | Δ f / f *2 [1 × $10^{-6}$] | Electrical characteristics | | |
| 1 | High temperature storage | +125 ℃ × 1 000 h | *3 ± 20 | Satisfy specification after test | 22 | 0 |
| 2 | Low temperature storage | -40 ℃ × 1 000 h | *3 ± 10 | | 22 | 0 |
| 3 | High temperature bias | +85 ℃ × Spec bias × 1 000 h | *3 ± 10 | | 22 | 0 |
| 4 | Low temperature bias | -40 ℃ × Spec bias × 1 000 h | *3 ± 10 | | 22 | 0 |
| 5 | Temperature humidity bias | +85 ℃ × 85 %RH × Spec bias × 1 000 h | *3 ± 10 | | 22 | 0 |
| 6 | Temperature cycle | -40 ℃ ⇔ +125 ℃ 30 min at each temp. 100 cycles | *3 ± 10 | | 22 | 0 |
| 7 | Resistance to soldering heat | For convention reflow soldering furnace (3 times) Ref. IPC/JEDEC J-STD-020D.1 | ± 3 | | 22 | 0 |
| 8 | Shock | 150 g dummy (SEIKO EPSON Standard) drop from 1 500 mm height on to the concrete 3 directions 10 times | ± 2 | | 22 | 0 |
| 9 | Vibration | 10 Hz to 55 Hz amplitude 0.75 mm 55 Hz to 500 Hz acceleration 98 $m/s^2$ 10 Hz → 500 Hz → 10 Hz 15 min / cycle 6 h ( 2 h × 3 directions ) | ± 1 | | 22 | 0 |
| 10 | Seal | He leakage detector | $1 \times 10^{-9}$ Pa･$m^3$/s Max. | | 11 | 0 |
| 11 | Pull-off | 10N press for 10s ± 1s Ref.EIAJ ED-4702 | No Peeling-off at a solder part | | 11 | 0 |
| 12 | Solderability | Dip termination into solder bath at +235 ℃ ± 5 ℃ for 5 s (Using Rosin Flux) | Termination must be 95 % covered with fresh solder | | 11 | 0 |

Notes

1. *1 Each test done independently.
2. *2 Measuring 2 h to 24 h later leaving in room temperature after each test.
3. *3 Initial value shall be measured after 24 h storage at room temperature after pre-conditioning.
   Pre-conditioning: Reflow (3 time)

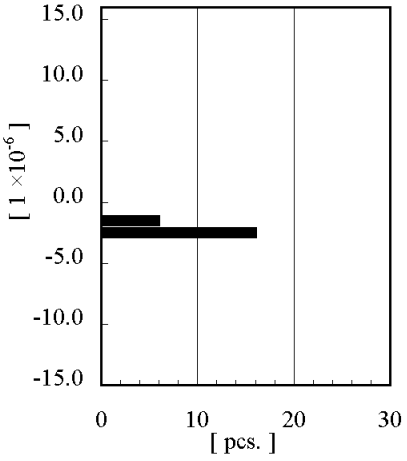
**Qualification Data**

# Product Name : SG-310**N series (48～80 MHz)

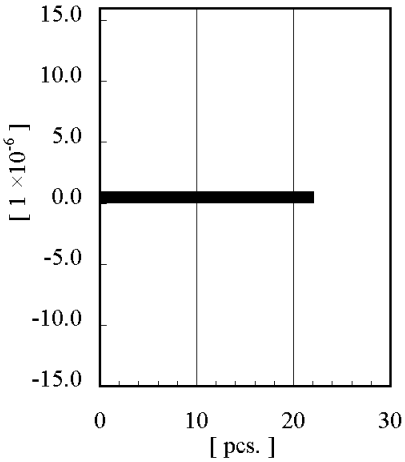
Δf / f

**No. OUT8-34-0201E**

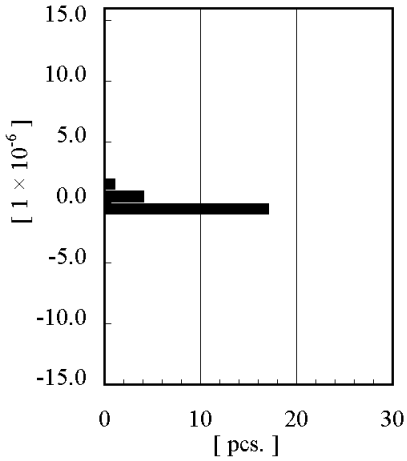
1. High temp. storage
+125℃ × 1 000 h



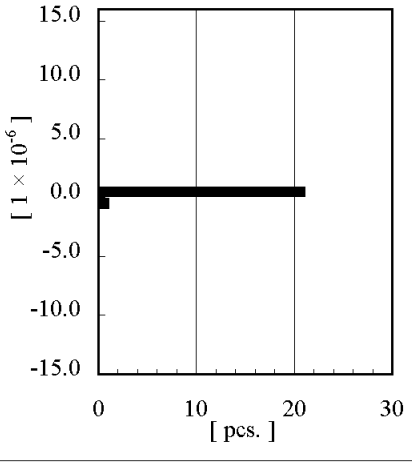

2. Low temp. storage
-40 ℃ × 1 000 h



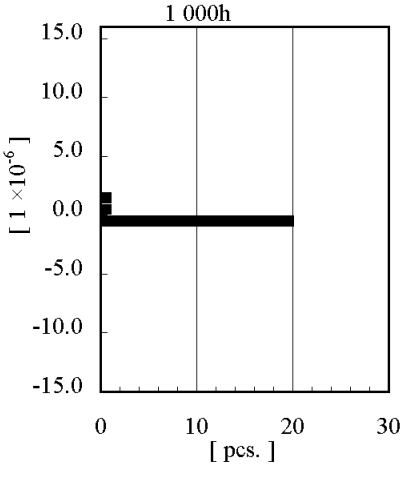

3. High temp. bias
+85 ℃ × spec bias × 1 000 h



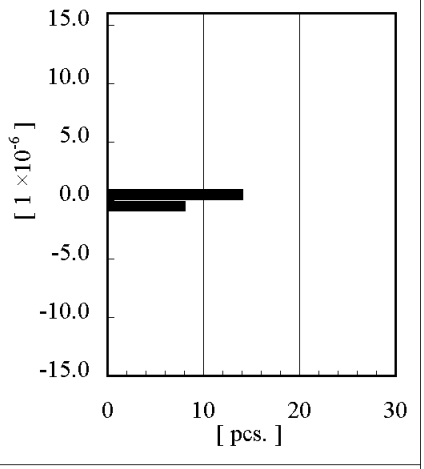

4. Low temp. bias
-40℃ × spec bias × 1 000 h



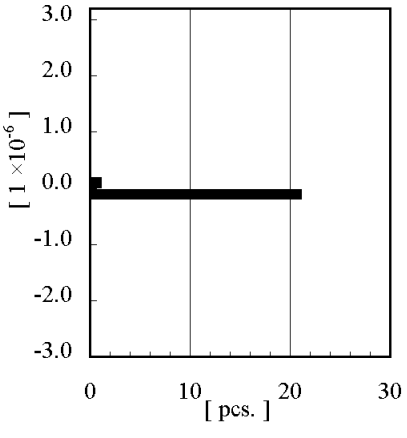

5.Temp humidity bias
85℃ × 85%RH × spec bias × 1 000h



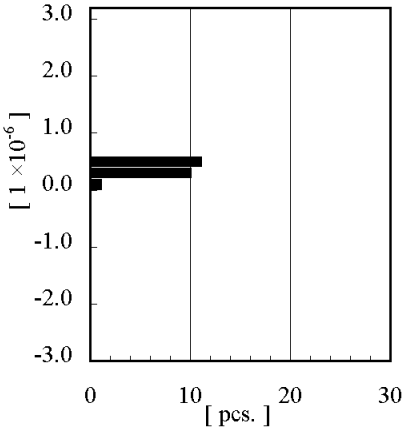

6. Temp. cycle
-40 ℃ ⇔ +125 ℃ 100 cycles



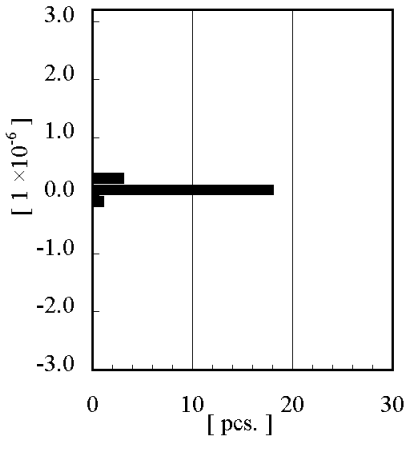

7. Resistance to soldering heat
For convention reflow soldering furnace (3 times)




8. Shock
150g jig 1500mm height × 3 directions 10 times




9. Vibration
10 Hz to 55 Hz amplitude 0.75 mm
55 Hz to 500 Hz acceleration 98 m/s²
15 min / cycle 6 h ( 2 h × 3 directions )




**Qualification Data**