# INFORMATION

**Model :** **VG-4513CA**

**DATE :** **12th. Sep. 2013**

**SEIKO EPSON CORPORATION**

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**OUT-13-0473 rev.2**

## INTRODUCTION

1. The contents is subject to change without notice.
   Please exchange the specification sheets regarding
   the product's warranty.

2. This sheet is not intended to guarantee or provide
   an approval of implementation of industrial patents.

3. We have prepared this sheet as carefully as possible.
   If you find it incomplete or unsatisfactory in any
   respect, We would welcome your comments.

# SPECIFICATIONS

## 1. Application

1) This specifications apply to Crystal oscillator VG-4513CA for Alcatel-Lucent.
2) This product is compliant with RoHS Directive.
3) This Product supplied (and any technical information furnished, if any) by SEIKO EPSON CORPORATION. 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.
4) 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 model is VG-4513CA-122.880000-GHCT /GGCT, VG-4513CA-491.52MHz-GFCT.

## 3. Packing

It is subject to the packing standard of SEIKO EPSON CORPORATION.

## 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

## [ 1 ] Absolute maximum ratings

| Parameter | Symbol | Value | Unit | Note |
|---|---|---|---|---|
| Supply voltage | $V_{CC}$ | -0.5 to +5.0 | V | |
| Input voltage | Vc | -0.5 to $V_{CC}$+0.5 | V | Vc Terminal |
| Storage temperature range * | T_stg | -55 to +125 | °C | Stored as bare product after unpacking. |

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

## [ 2 ] Operating range

| Parameter | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Supply voltage | $V_{CC}$ | 3.135 | 3.300 | 3.465 | V | *1 |
| Supply voltage | GND | 0.0 | 0.0 | 0.0 | V | |
| Control voltage | $V_c$ | 0.00 | 1.65 | 3.30 | V | |
| Output frequency | fo | - | 122.880<br>491.520 | - | MHz | |
| Operating temperature range | T_use | -40 | +25 | +85 | °C | |
| Output load condition | L_ECL | - | 50 | - | Ω | At Vcc-2.0V |

*1 Start up time(0 %$V_{CC}$→90 %$V_{CC}$) of power source should be more than 150 μs.

*2 By-pass capacitor (approx. 0.01 μF to 0.1 μF) should be placed closely between Vcc and GND.

## [ 3 ] Frequency characteristics

Test condition is Vcc=3.3V, Vc=1.65V, at +25°C, unless otherwise noted.

Output frequency ($f_0$) ..... 122.880000 MHz, 491.520000MHz

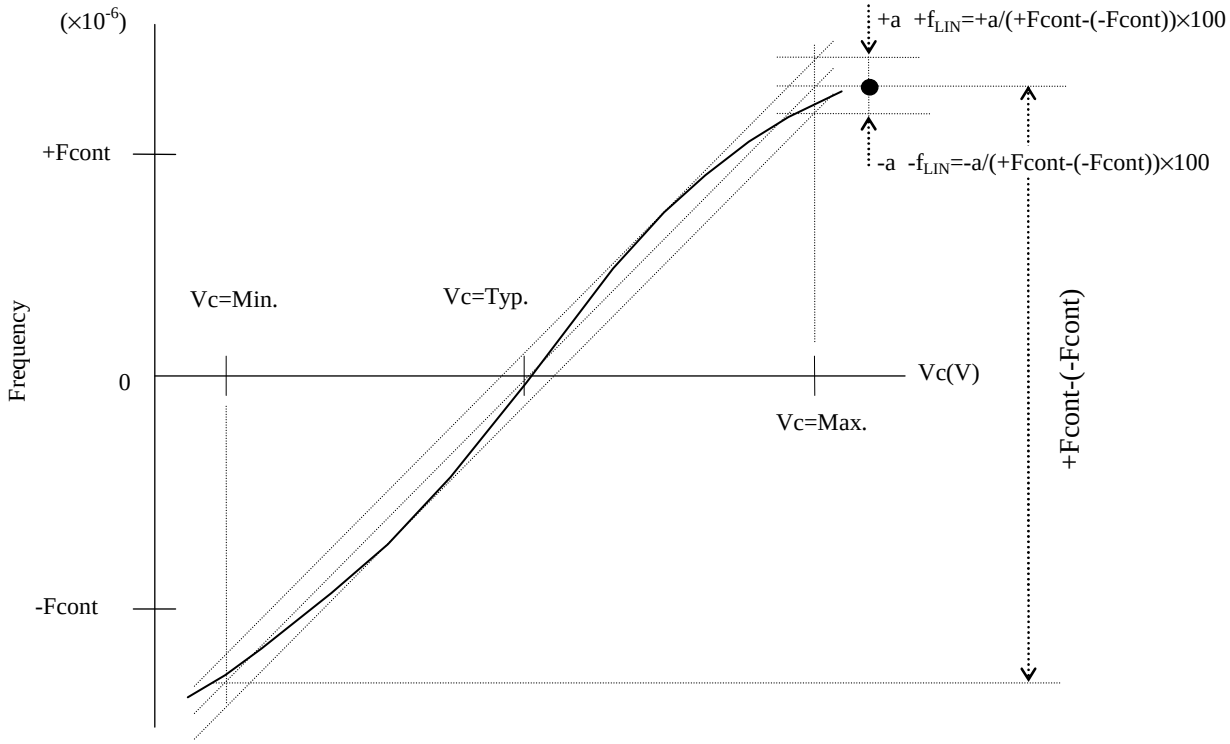
| Parameter | Symbol | Value[$1 \times 10^{-6}$] | Note |
|---|---|---|---|
| Frequency tolerance * | f_tol | ± 50 | 122.88MHz |
| | | ± 70 | 491.52MHz |

* This includes initial frequency tolerance, temperature variation, supply voltage variation, and 10 years aging(at 25 °C).

Output Frequency characteristics

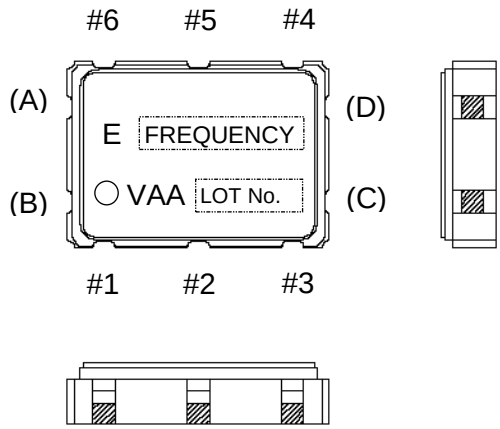
| Parameter | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Pull range Vc=1.65V±1.65V | PR | ±100 | - | - | $\times 10^{-6}$ | 122.880MHz-GGCT |
| | | ±150 | - | - | | 122.880MHz-GHCT |
| | | ±100 | - | - | | 491.520MHz-GFCT |
| Absolute pull range *1 Vc=1.65V±1.65V | APR | ±50 | - | - | $\times 10^{-6}$ | 122.880MHz-GGCT |
| | | ±100 | - | - | | 122.880MHz-GHCT |
| | | ±30 | - | - | | 491.520MHz-GFCT |
| Input resistance | Rin | 100 | - | - | kΩ | Vc terminal ( DC level ) |
| Frequency tuning linearity | $f_{LIN}$ | - | - | 5 | % | |
| Modulation band width | BW | 10 | - | - | kHz | ±3dB |
| Frequency change polarity | - | Positive polarity | | | - | |

*1 APR = Pull range – Frequency tolerance




Example of controling freaquency characteristics

## [ 4 ] Terminal description




| Name | No. | Type | Terminal description |
|---|---|---|---|
| Vc | #1 | INPUT | Vc terminal |
| OE | #2 | — | OE terminal / Active High |
| GND | #3 | — | GND terminal(*1) |
| OUT1 | #4 | OUTPUT (Positive) | Clock output terminal |
| OUT2 | #5 | OUTPUT (Negative) | Clock output terminal(Inversion output of #4) |
| Vcc | #6 | — | Vcc terminal |

* The metal part of the surface (metal cap) is connected to GND.

## [ 5 ] Electrical characteristics

Test condition is Vcc=3.3V, Vc=1.65V, at +25°C, unless otherwise noted.

| Parameter | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|
| | | Min. | Typ | Max | | |
| Start up time | $t_{OSC}$ | - | - | 10 | ms | 0 sec at 90 % Vcc |
| Current consumption | Icc | - | - | 65 | mA | |
| Rise time (*1) | tr | - | - | 0.5 | ns | 20 %Vcc → 80 %Vcc |
| Fall time (*1) | tf | - | - | 0.5 | ns | 80 %Vcc → 20 %Vcc |
| Symmetry (*1) | SYM | 40 | - | 60 | % | 50 %Vcc Level |
| High level output voltage | VOH | Vcc-1.1 | - | - | V | |
| Low level output voltage | VOL | - | - | Vcc-1.5 | V | |
| High level input voltage | VIH | 70 %Vcc | - | - | V | |
| Low level input voltage | VIL | - | - | 30 %Vcc | V | |
| Disable time | tpxz | - | - | 1 | μs | OE terminal HIGH → LOW |
| Enable time | tpzx | - | - | 1 | μs | OE terminal LOW → HIGH |

Please see [6] Test circuit.

(*1) Please see [7] 1) Output waveform.

Phase Noise Characteristic [unit: dBc/Hz] @all operating temperature range

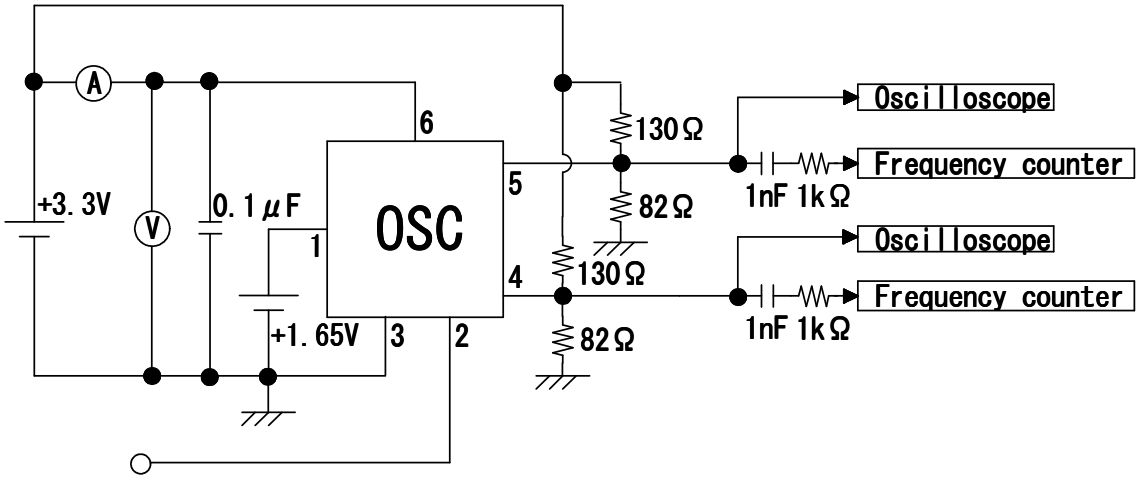
| Offset frequency | Frequency – Type | | | | | |
|---|---|---|---|---|---|---|
| | 122.880MHz-GGCT | | 122.880MHz-GHCT | | 491.520MHz-GFCT | |
| | Typ. | Max. | Typ. | Max. | Typ. | Max. |
| 10Hz | -74 | -60 | -72 | -58 | -56 | -42 |
| 100Hz | -106 | -90 | -102 | -86 | -88 | -76 |
| 1kHz | -128 | -121 | -125 | -118 | -114 | -103 |
| 10kHz | -146 | -140 | -143 | -137 | -136 | -126 |
| 100kHz | -150 | -145 | -149 | -144 | -150 | -144 |
| 1MHz | -150 | -145 | -149 | -144 | -150 | -146 |
| 10MHz | -150 | -145 | -149 | -144 | -151 | -146 |

G sensitivity

2 ppb/g Max. (vibration frequency: 20Hz to 200Hz, acceleration: 2g, 3 dimensions)

## [ 6 ] Test circuit

1) To observe waveform and current




[Pin Connections]

1. Vc
2. OE
3. GND
4. OUT1 (Positive)
5. OUT2 (Negative)
6. Vcc

2) Condition

(1) Oscilloscope

- Bandwidth should be 5 times higher than DUT's output frequency.
- Probe ground should be placed closely from test point and lead length should be as short as possible.

(2) By-pass capacitor (approx. 0.01 μF～0.1 μF) should be placed closely between Vcc and GND.

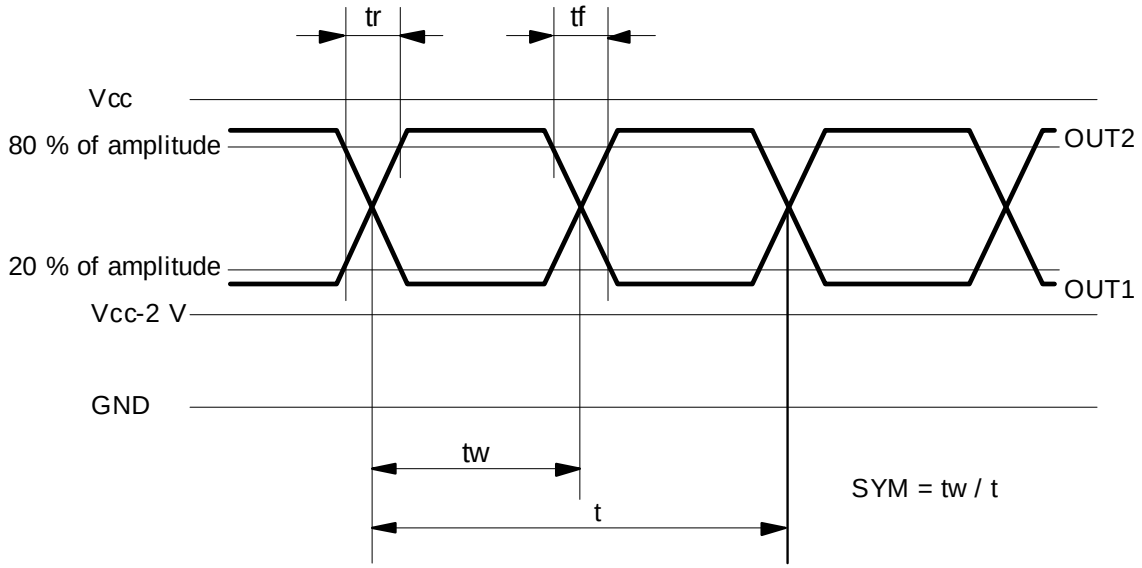
(3) Use the current meter whose internal impedance value is small.

(4) Power supply

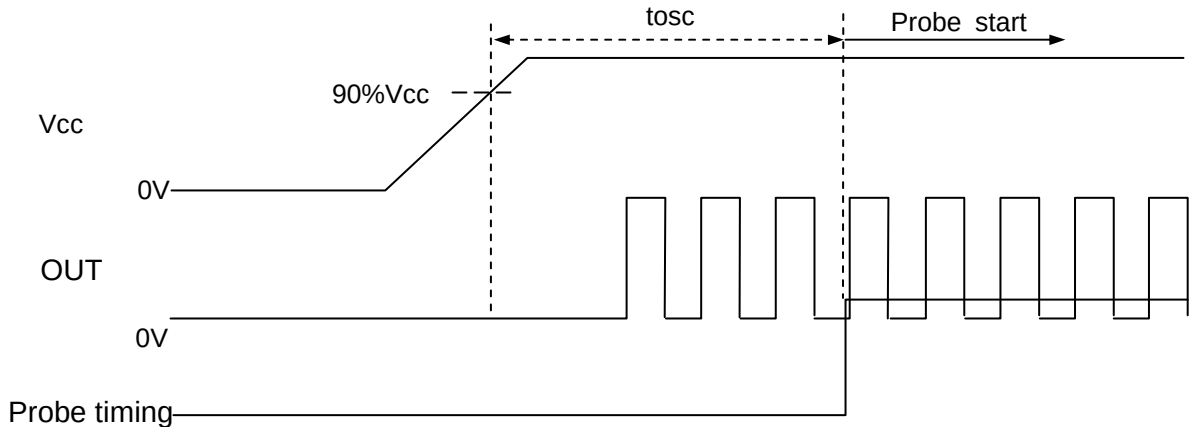
- Start up time(0 V→90 %Vcc)of power source should be more than 150 us.
- Impedance of power supply should be as low as possible.

# [ 7 ] Timing chart

1) Output wave form and measurement level

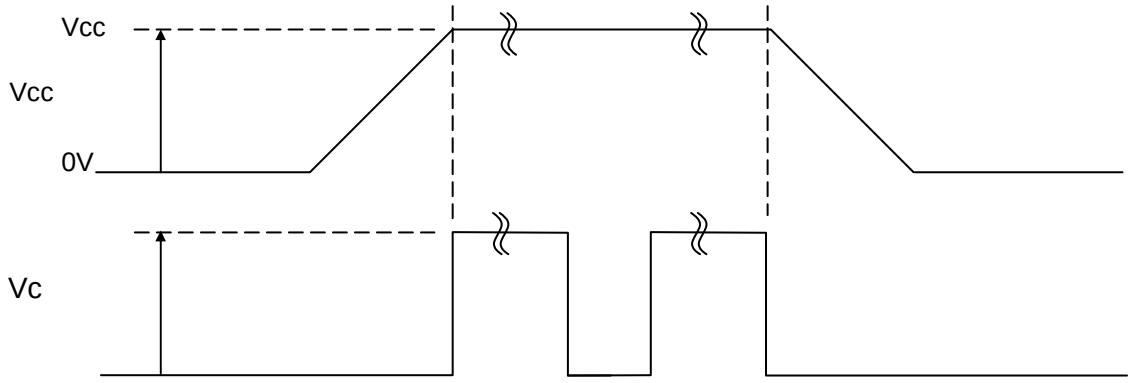



2) Output Signal timing



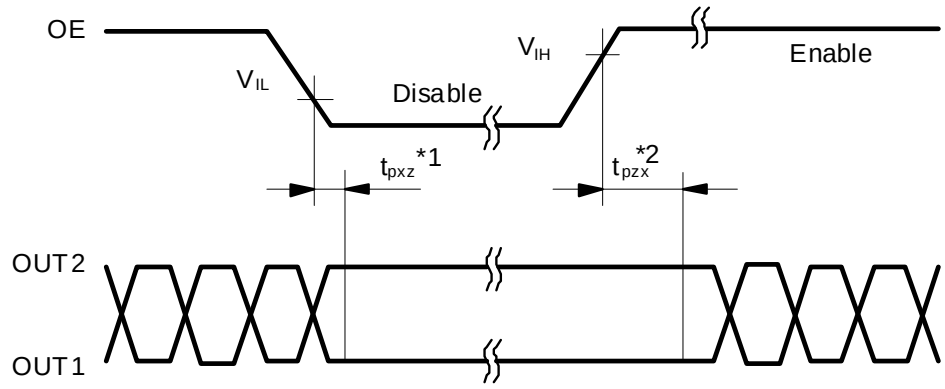

3) Vc control timing

∗ Please rise up the Vc voltage after the Vcc voltage rises up.



4) OE function and timing

| OE input level | Oscillation circuit | Output |
|---|---|---|
| “H” or OPEN | Oscillation | Enable : Specified frequency is output |
| “L” | Oscillation | Disable : OUT1->LOW, OUT2->HIGH |

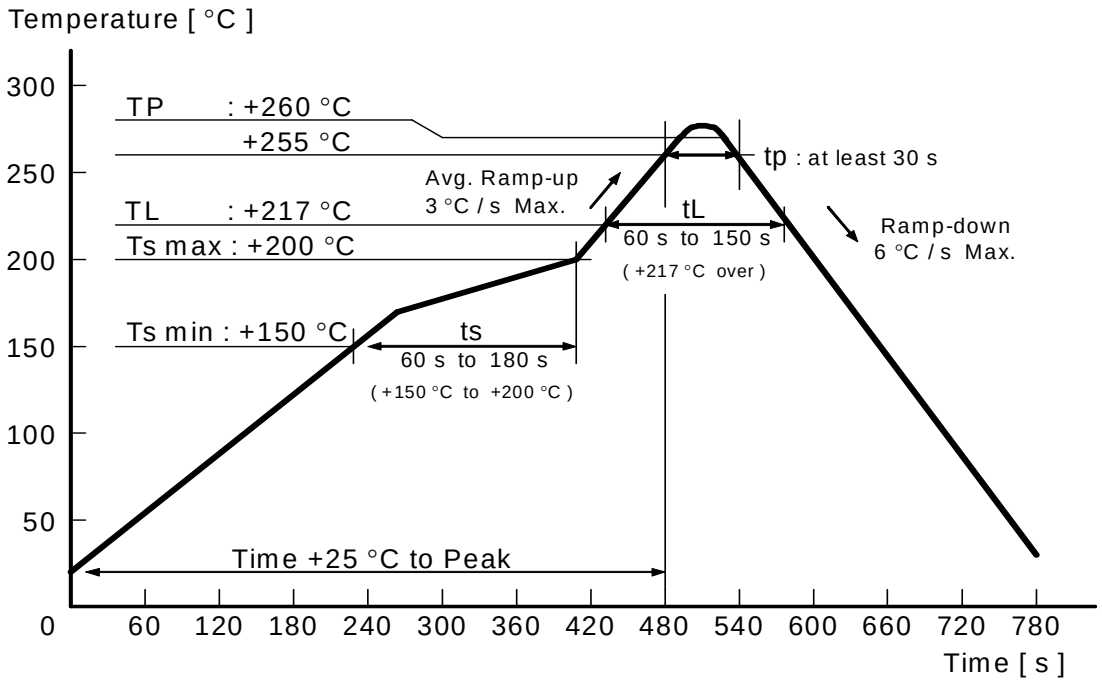



*1 The time taken from OE=$V_{IL}$ to OUT=Disable.

*2 The time taken from OE=$V_{IH}$ to OUT=Enable.

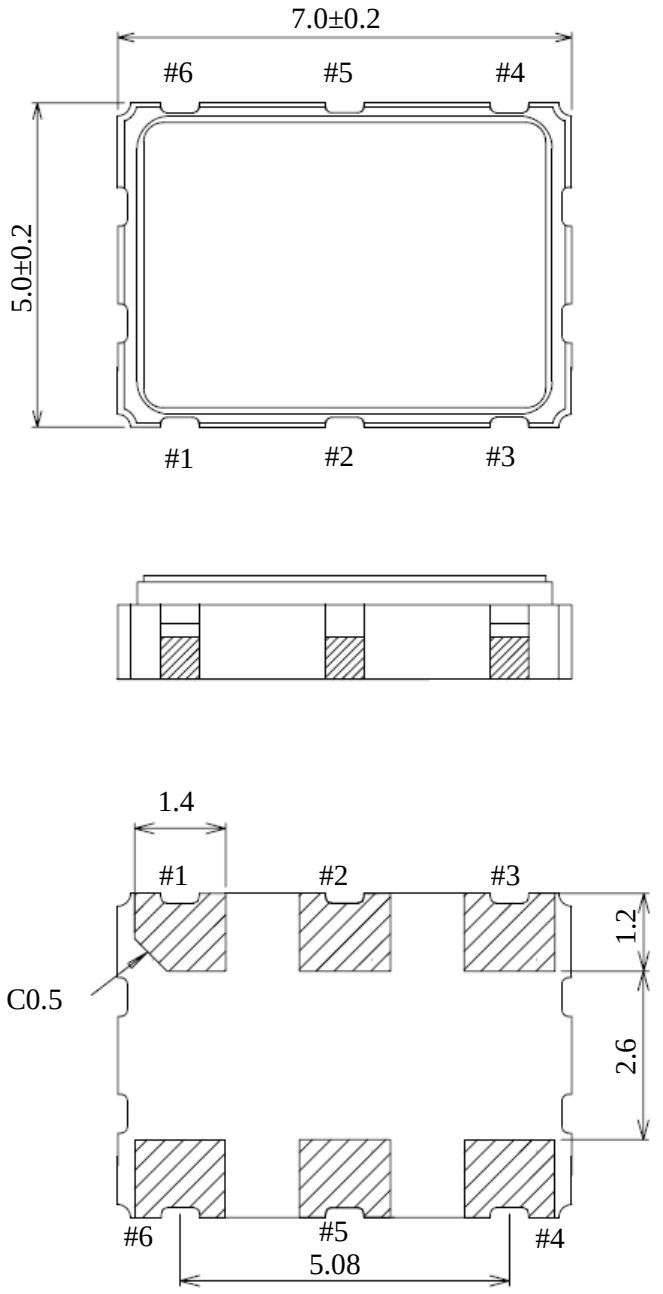
## [ 8 ] Reflow condition

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



# [ 9 ] Dimensions and marking layout

1) Dimensions

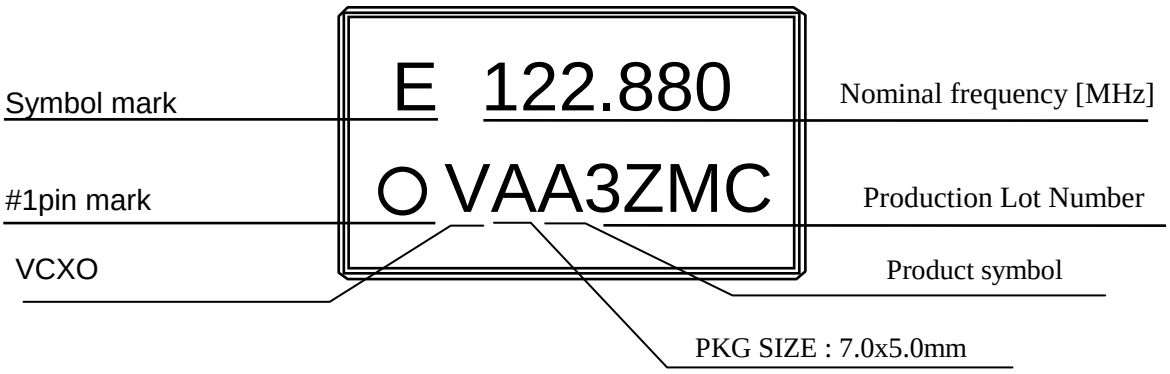



| No | Name |
|---|---|
| 1 | Vc |
| 2 | OE |
| 3 | GND |
| 4 | OUT1 |
| 5 | OUT2 |
| 6 | Vcc |

Terminal treatment : Au plating

Unit : mm

2) Marking layout

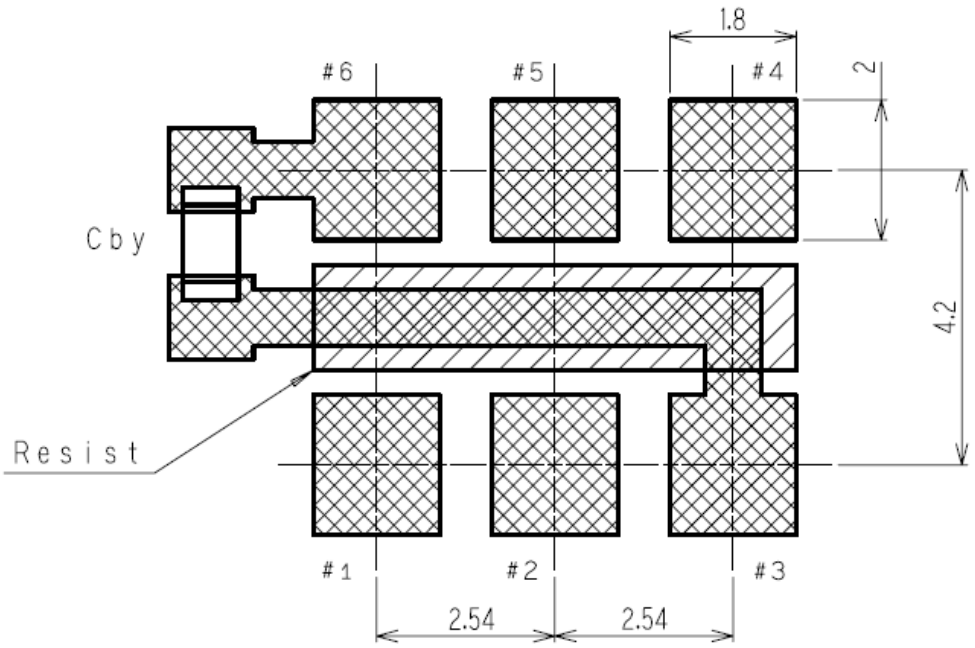



* The above marking layout shows only marking contents and their approximate position, not actual font, size and exact position.
* Nominal frequency omits the figure below the forth place of decimals.

## [ 11 ] Board patterning

The soldering pad sample indicated as like following:
Soldering position (Unit : mm)

Cby = 0.01 µF ~ 0.1 µF



# [ 12 ] Notes

1) This device use IC.
Please take necessary precautions to prevent damage due to electrical static discharge.

2) We recommend placing a 0.01 to 0.1 μF capacitor closely between Vcc and GND to obtain stable operation and protest 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 CORPORATION cannot recommend to put filtering element into power line so as to reduce noise. Oscillator might be unstable oscillation because high frequency impedance of power line become higher.
When use filtering element, please verify electrical construction and or element's spec.

5) SEIKO EPSON CORPORATION 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) Start up time (0 → 90 % Vcc) of power source should be more than 150 μs.

7) Please design the two output lines as short as possible.
A long output line may cause irregular output.

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 do not expose to excessive shock or vibration.

10) An automatic assembly is available, however, the internal Crystal resonator might be damaged in case that too much shock or vibration is produced mechanically.
Be sure to check your machine condition in advance.

11) Ultrasonic cleaning can be used on this product, however, since the oscillator might be damaged under some conditions, please exercise caution in advance.

12) We recommend to use and store under room temperature and normal humidity to secure frequency accuracy and prevent moisture.

13) The metal part of the surface (metal cap) is connected to GND #3 pin.
Please take necessary precautions to prevent short circuit to GND by contact with the metal cap.

14) Side leads (A) to (D) are connected to IC internally.
Therefore be careful for short or a fall of insulation resistance etc.

15) When not use OE pin connection, please use connecting to Vcc.
We recommend installation a resistor in between to mitigate effect by surge etc.

16) Recommendation reflow times are less than 2 times.
When there was a soldering error, please do alteration with a soldering iron.
In this case, the iron ahead is equal to or less than +350 °C and asks within 5 s.
In case that this device is reflow soldered on the back side of your circuit board, please carefully verify the device is properly secured to prevent coming detached from card.

[About soldering method]

| Soldering method | OK or NG |
|---|---|
| Reflow soldering (top side) | OK |
| Reflow soldering (back side) | Please carefully verify the device is properly secured to prevent coming detached from card. |
| Solder pot<br>(static solder pot / flow solder pot) | NG |
| Iron soldering | OK |

17) Connect output terminals to load resistance individually to prevent destruction the internal IC.

18) Aging in the frequency tolerance is from environmental tests results to the expectation of the amount of the frequency variation.

19) Please do not place signal lines and supply voltage lines on the area, its internal layers, and the back side of where the oscillators are soldered. This may affect the performances of the oscillators.

20) We will announce the discontinuance and switch to our successor before six months or more.