INFORMATION

PRODUCT No. : **Q13MC1461**

MODEL : **MC-146**

INFO. No. : **Q03-380-1A**

DATE : **Mar. 3. 2004**

SEIKO EPSON CORPORATION

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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.

This product is not authorized for use as critical components in life support device or systems.

Contents

[1] Absolute maximum ratings

Item	Symbol	Rating value
Storage temperature	TSTG	-55°C to +125°C
Maximum drive level	DL	1.0 μW

[2] Operating range

Item	Symbol	Value		
		Min.	Typ.	Max.
Operating temperature range	TOPR	-40 °C		+85 °C
Drive level	DL	0.01 μW	0.1 μW	0.5μW
Vibration mode		Fundamental		

[3] Static characteristics

Item	Symbol	Value	Note
Frequency	fi	32.768 kHz	
Frequency tolerance	Δ f/f	$\pm 20 \times 10^{-6}$	CL = 12.5 pF Ta = +25 ± 3 °C, Drive level : 0.1 μW Not include aging
Series resistance	R1	Max. 65 kΩ	CI meter : Sanders 140B Drive level : 0.5 μW
Motional capacitance	C1	Typ. 1.9 fF	
Shunt capacitance	C0	Typ. 0.8 pF	
Turnover temperature	θT	+25 ± 5°C	Values are calculated by the frequencies at +10, +25, +40°C with C-MOS circuit.
Temperature coefficient	a	Max. $-4.0 \times 10^{-8}/°C^2$	
Isolation resistance	IR	Min. 500 MΩ	DC 100V, 60 seconds Between terminal #1 and terminal #4
Aging	fa	$\pm 3 \times 10^{-6}$／年	Ta = +25°C ± 3°C Drive level : 0.1 μW

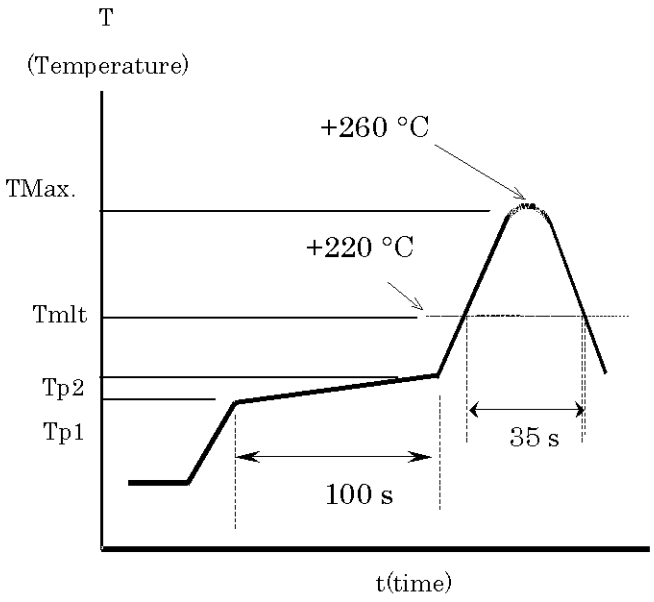
[4] Environmental and Mechanical characteristics

No.	Items	Value *1*2 $\Delta f/f$ [1×10^{-6}]	Conditions
1	Shock	*3 ± 5	100g dummy (SEIKO EPSON Standard) drop from 1500 mm height on to the concrete 3 directions 10 times
2	Vibration	*3 ± 3	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 hours , 3 directions)
3	Resistance to soldering heat (Reflow characteristics)	*3 ± 5	Treat the Reflow 2 times by the following profile in the next page
4	High temperature storage	*3 a) ± 20 b) ± 10	a) +125 °C × 1 000 h b) +85 °C × 1 000 h
5	Low temperature storage	*3 ± 10	-55°C × 1 000 h
6	Temperature humidity storage	*3 ± 10	+85°C × 85%RH × 1000 h
7	Temperature cycle	*3 ± 10	-55°C ↔ +125°C 30 minutes at each temperature 100 cycles
8	Shear	No peeling-off at a soldered part	20 N press the side for 10 s ±1 s. Ref. IEC 60068-2-21
10	Pull-off	No peeling-off at a soldered part	10 N press the side for 10 s ±1 s. Ref. IEC 60068-2-21
11	Substrate bending	No peeling-off at a soldered part	Bending width reaches 3mm and hold for 5 s ± 1 s × 1 time Ref. IEC 60068-2-21
12	Solderability	Termination must be 90% covered with fresh solder	Dip termination into solder bath at 230 ± 10°C for 3 s (Using rosin flux)
13	Solvent resistance	The marking shall be legible	Ref. JIS C 0052 or IEC 60068-2-45

Note
1. *1 Each test done independently.
2. *2 Measuring 1 h to 24 h later leaving in room temperature after each test.
3. *3 Pre conditionings
    1. +125 °C × 24 h to +85 °C × 85 % × 48 h → reflow 2 times
    2. Initial value shall be after 24 h at room temperature.
4. Shift series resistance at before above tests should be less than ± 15 % or less than ± 5 kΩ
   In case high temperature storage (± 125 °C ×1 000 h) shift series resistance at before above tests should be less than ± 20 % or ± 10 kΩ

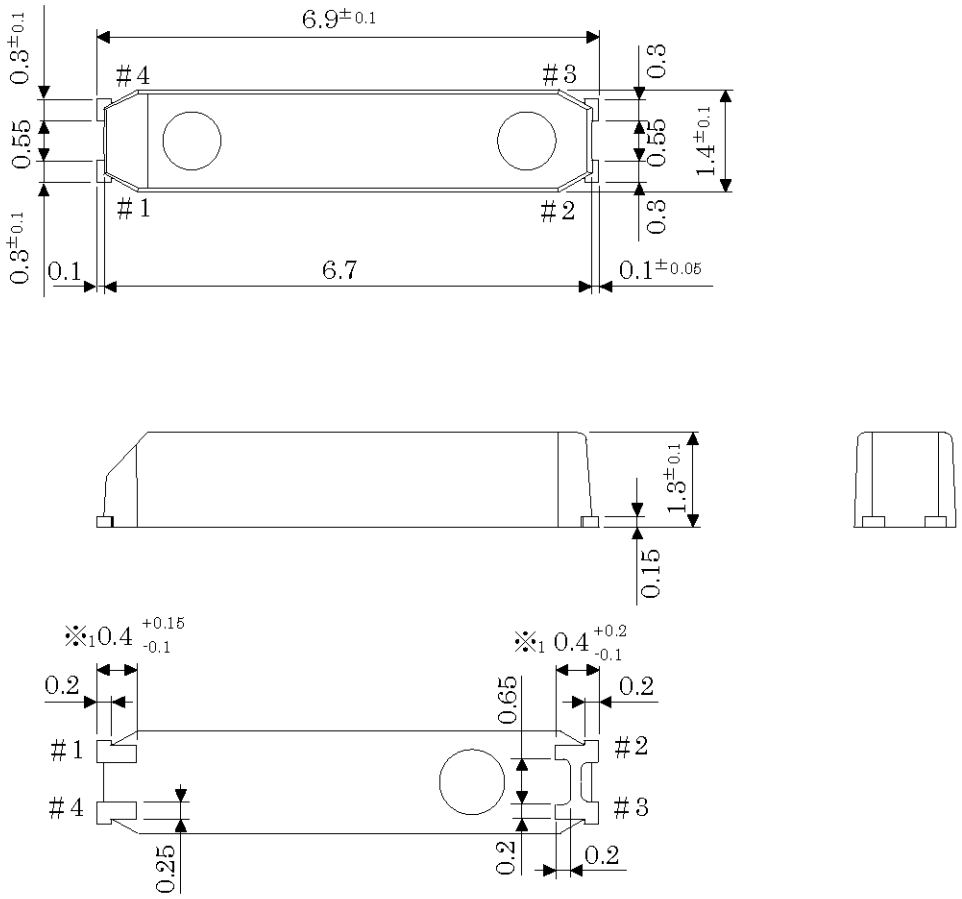
♦Air- reflow

Pre heating temperature : Tp1～Tp2 = +170 °C
Peak temperature must not exceed +260 °C and the duration of over +220 °C should be 35 s



[5] Dimensions and Marking layout

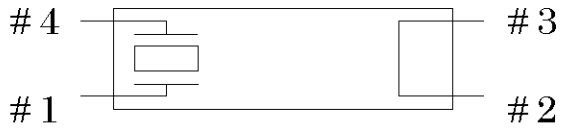
1. Dimensions



♣1 : Available area for soldering

There are some cases that a part of the case of quartz resonator expose on the surface of the molding material

2. Internal Connection



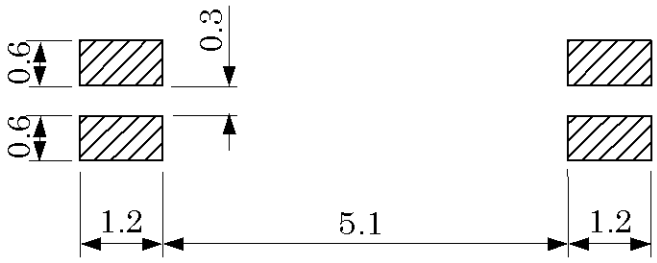
Terminal thickness	0.15mm
Lead Frame	42Alloy
Terminal treatment	Pb Free Solder plate 15 ± 10 μm
Molding	Epoxy Compound
Compound color	Black

Do not connect 2# and 3# terminals to any external circuits (including GND).

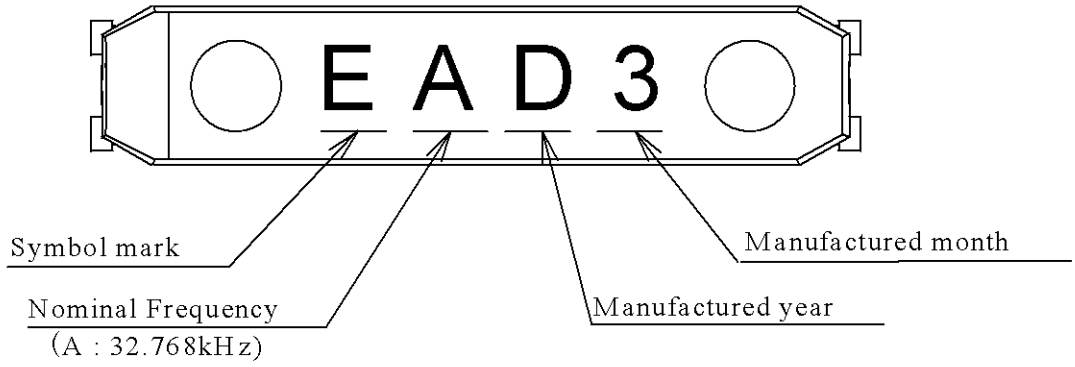
Type	MC-146	Unit	1 = 1 mm

3. Recommended soldering pattern

Unit : 1 = 1 mm



4. Marking layout



Symbol of Manufacturing year

Year digit	1	2	3	4	5	6	7	8	9	0
Marking	A	B	C	D	F	F	G	H	J	K

Year digit(1st) of the Production

Symbol of Manufacturing month

Jan.	Feb.	.....	Oct.	Nov.	Dec.
1	2	.....	X	Y	Z

◆ The above marking layout shows only marking contents and their approximate position and it is not for font, size and exact position.

Type	MC-146	Unit	1=1 mm

[6] Notes

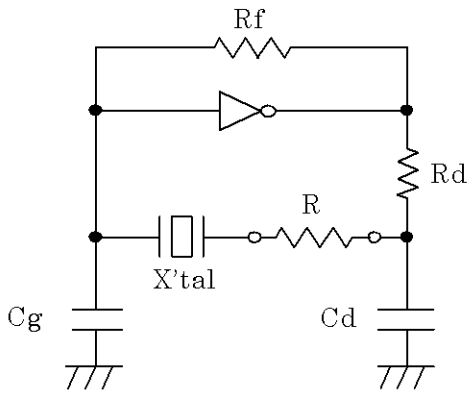
1. Max two (2) times reflow is allowed. Once miss soldering is happened, hand work soldering by soldering iron is recommended. (350°C × within 5 sec.)

2. Patterning should be followed by our recommended one.

3. Applying excessive excitation force to the crystal resonator may cause deterioration damage.

4. Unless adequate negative resistance is allocated in the oscillation circuit, start up time of oscillation may be increased, or no oscillation may occur.

   How to check the negative resistance.



(1) Connect the resistance (R) to the circuit in series with the crystal resonator.
(2) Adjust R so that oscillation can start (or stop).
(3) Measure R when oscillation just start (or stop) in above (2).
(4) Get the negative resistance
$-R = R + CI$ value.
(5) Recommended -R
$|-R| > CI \times (5 \sim 10)$

5. The shortest patterning line on board is recommendable.
   Too long line on board may cause of abnormal oscillation.

6. To avoid mull function, no pattern under or near the crystal is allowed.
   Solder paste should be more than 150 μm thickness.

7. This device must be stored at the normal temperature and humidity conditions before mounting on a board.

8. Too much exciting shock or vibration may cause deterioration on damage.
   Depending on the condition such as a shock in assembly machinery, the products may be damaged.
   Please check your condition in advance to maintain shock level to be smallest.

9. Depending on the conditions, ultrasonic cleaning may cause resonant damage of the internal crystal resonator. Since we are unable to determine the conditions (type of cleaning unit, power, time, conditions inside the bath, etc.) to be used in your company, we cannot guarantee the safety of this unit when it is cleaned in an ultrasonic cleaner.

10. Ink marking may be damaged by some kind of solvent, please take precautions when choosing solvent by your selves.

11. Please refer to packing specification regarding how to storage the products in the pack.