

INFORMATION

Product No. : Q11C02RX1002200

Model : C-002RX

Pb free

SPEC. No. : Q05-222-12A

DATE : Sep. 8. 2005

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.

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[1] Absolute maximum ratings

No.	Parameter	Symbol	Rating value	Note
1	Storage temperature	TSTG	-20 °C to +70 °C	Suppose to be within CI STD at +25 °C ± 3 °C.
2	Maximum drive level	GL	1 μW	

[2] Operating range

No.	Parameter	Symbol	Value			Note
			Min.	Typ.	Max.	
1	Operating range	TOPR	-10 °C		+60 °C	
2	Drive level	DL		0.1 μW		
3	Vibration mode		Fundamental			

[3] Electrical characteristics

No.	Parameter	Symbol	Standard	Conditions
1	Frequency	f	32.768 kHz	
2	Frequency tolerance	$\Delta f/f$	$\pm 20 \times 10^{-6}$	CL = 12.5 pF Ta = +25 °C ± 3 °C DL = 0.1 μW Excluding aging value
3	Quality factor	Q	Min. 5.0×10^4	
4	Series resistance	R1	Max. 50.0 kΩ	CI meter : Sanders 140-B DL = 1.0 μW
5	Motional capacitance	C1	Typ. 2.0 fF	
6	Shunt capacitance	C0	Typ. 0.85 pF	
7	Turnover temperature	θT	+25 °C ± 3 °C	Value calculated on temperature
8	Parabolic coefficient	a	Max. $-4.0 \times 10^{-8} / ^\circ\text{C}^2$	+10, +25, +40 °C degree with C-MOS circuit.
9	Insulation resistance	IR	Min. 500 MΩ	DC 100V, 60 sec. between terminals or terminal and case
10	Aging		$\pm 3 \times 10^{-6} / \text{year}$	Ta = +25 °C ± 3 °C DL = 0.1 μW
11	Against pressure		$\pm 5 \times 10^{-6}$	Frequency shift at case cramped.

[4] Environmental characteristics

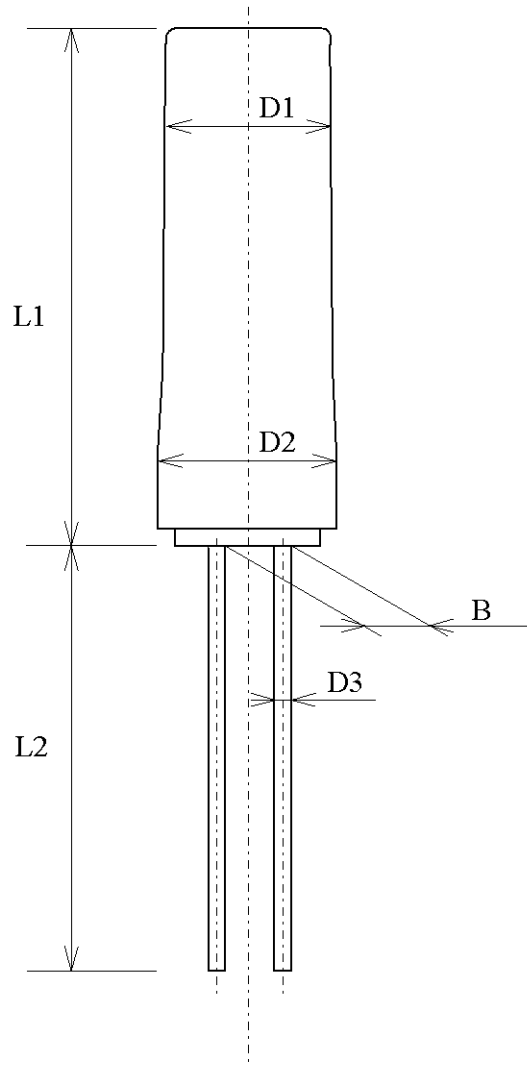
(The company evaluation condition We evaluate it by the following examination item and examination condition.)

No.	Item	Value *1 *2	Test Conditions
		$\Delta f / f [1 \times 10^{-6}]$	
1	Drop	± 5	Free drop from 750 mm height on a hard wooden board for 3 times (Board is thickness more than 30 mm)
2	Vibration	± 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	High temperature storage	± 5	+80 °C × 240 h
4	Low temperature storage	± 5	-20 °C × 240 h
5	Temperature cycle	± 5	-20 °C ↔ +80 °C 30 min. at each temp. 20 cycle
6	Resistance to soldering heat for wire termination	± 3	Dip wire termination on closer than 2 mm from the case into solder bath at +280 °C ± 10 °C for 5 s
7	Tensile test on termination	± 3 No defect for wire termination	Pulling a wire termination with 10 N weight for 5 s
8	Flexibility of termination	± 3 No defect for wire termination	A point 1 mm from the base is bent following angle : +90° → -90° → 0° (R 0.5)
9	Solderability	Termination must be 95 % covered with fresh solder	Dip termination into solder bath at +240 °C ± 10 °C for 3 s (Using Rosin Flux)

< Notes >

1. *1 Each test done independently.
2. *2 Measuring 2 h to 24 h later leaving in room temperature after each test.

[5] Dimensions



L1	L2	D1	D2	D3	B
Max.	Min.	± 0.05	Max.	± 0.07	± 0.15
6.0	4.0	$\phi 1.88$	$\phi 2.0$	$\phi 0.2$	0.7

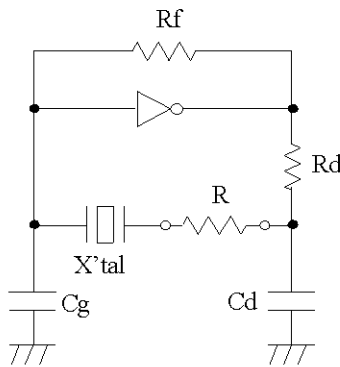
Unit : 1 = 1 mm

Type	C-002RX	Lead terminal Finish	Pb Free Solder plate	Unit	1 = 1 mm
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[6] Notes

1. If the temperature of the package exceeds +150 °C the crystal resonator may be damaged or its characteristic may be impaired.
2. Bending the lead too closely to the case or pulling the lead strongly may cause the hermetic glass seal to crack. If the lead needs to bend, please leave more than 0.5 mm from the lead to the case.
3. Excessive pressure may cause leakage of hermetically. Please take caution not to give excessive press to the sealed part of the package.
4. Excessive shock or vibration is not allowed. The internal crystal resonator may be damaged from machine shock during assembly. Please check conditions carefully prior to use.
5. To avoid condensation, do not store or use in an environment where temperatures may change rapidly. We recommend that products be stored in an environment where temperature and humidity are normal.
6. Products using a tuning fork crystal can not be guaranteed for ultrasonic cleaning because they may be damaged by resonance vibration.
7. Applying excessive drive level to the crystal resonator may cause deterioration or damage. Circuit design must be such that the proper drive level is maintained.
8. Unless adequate negative resistance is allocated in the oscillation circuit, start up time of oscillation may be increased or stopped. In order to avoid this, please provide enough negative resistance in the circuit design.

How to check the negative resistance [-NR]



- (1) Connect the resistor (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.
[-NR] = R + CI value
- (5) Recommended [-NR]
[-NR] > CI (Max.) × 5

PACKING SPECIFICATIONS

1. Application

This document is applicable to CA-30type, CA-20type, C-001type, C-2type, C-4type, C-5type, SA-315H.

2. Packing specifications

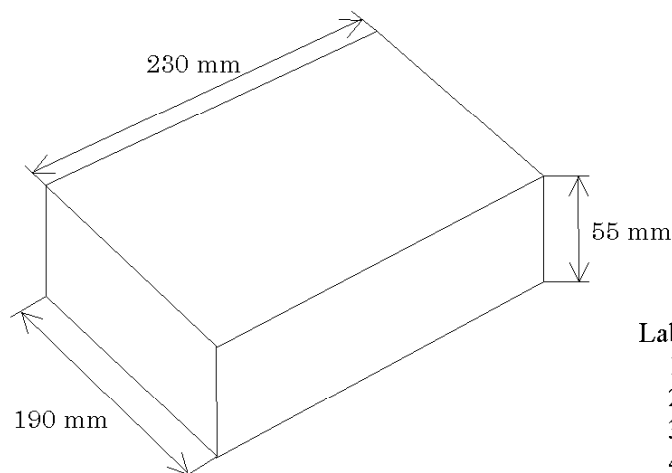
(1) • Put the crystal resonators into a polyethylene bag.

- Quantity(pcs.)..... as per below table
- Sealing to bag.

(2) • Material of box : White color carton.

- Buffer : Put buffer sheet inside of top and the bottom of box.
- Quantity(pcs.)..... as per below table

Type	Polyethylene bag. Quantity(pcs.)	Material of box Quantity(pcs.)
CA-30type	500/bag.	5000pcs./box
CA-20type	1000/bag.	10000pcs./box
C-001Rtype	250/bag.	5000pcs./box
C-2type	500/bag.	5000pcs./box
C-4type	500/bag.	5000pcs./box
C-5type	500/bag.	5000pcs./box
SA-315H	500/bag.	5000pcs./box



Label contents

- 1) Type
- 2) Frcquency
- 3) CL
- 4) Lot No.
- 5) Quantity

PROCESS QUALITY CONTROL

SEIKO EPSON Corp.
Quartz Device Division

No. A-86-3-AEE-1

Manufacturing process chart	No.	Section In Charge	Standards	Inspection, Control Item	Inspection Methods	Instruments	Record
<p>CRYSTAL BLOCK</p> <p>1 Acceptance Inspection</p> <p>2 Wafer Cutting</p> <p>3 Wafer Polishing</p> <p>4 Wafer Inspection</p> <p>5 Profile Etching</p> <p>6 Electrode Processing (Sputtering)</p> <p>7 Crystal Tuning Fork Inspection</p> <p>8 Mounting</p> <p>9 Frequency Adjustment</p> <p>10 Hermetic Sealing (Encapsulation)</p> <p>11 High Temperature Treatment</p> <p>12 Products Inspection</p> <p>13 Counting and Packing</p> <p>14 Out-going Inspection</p> <p>15 Forward</p> <p>Plug</p> <p>In-Corning Inspection</p> <p>Case</p> <p>In-Corning Inspection</p>	1	Inspection Section	Purchasing Specification, Acceptance Inspection Standard	Appearance Dimension	100% Inspection Sampling	Visual Inspection Length Gauge	In-coming Inspection Data Sheet
	1'	Inspection Section	Purchasing Specification, Acceptance Inspection Standard	Dimension Appearance	Sampling Sampling	Comparator Microscope	In-coming Inspection Data Sheet
	2	Production Section	Manufacturing Instruction Sheet	Cut Angle Dimension	Sampling 100% Inspection	X-ray Radio Graphic Equipment, Comparator	Process Data Sheet
	3	Production Section	Manufacturing Instruction Sheet	Appearance Wafer Thickness	100% Inspection Sampling	Visual Inspection Comparator	Process Data Sheet
	4	Production Section	Manufacturing Instruction Sheet	Appearance	100% Inspection	Visual Inspection	Process Data Sheet
	5	Production Section	Manufacturing Instruction Sheet	Etching Shape Dimension	Sampling Sampling	Microscope Comparator	Process Data Sheet
	6	Production Section	Manufacturing Instruction Sheet	Film Thickness Film Strength Appearance	Sampling Sampling Sampling	Thickness Measuring Instrument, Tape Microscope	Process Data Sheet
	7	Production Section	Manufacturing Instruction Sheet	Frequency Appearance	100% Inspection 100% Inspection	Frequency Inspection Machine, Microscope	Process Data Sheet
	8	Production Section	Manufacturing Instruction Sheet	Mount Strength Appearance	Sampling	Tension Gauge Microscope	Process Data Sheet
	9	Production Section	Manufacturing Instruction Sheet	Frequency	Sampling	Frequency Counter	Process Data Sheet
	10	Production Section	Manufacturing Instruction Sheet	Temp*Time	---	Thermometer, Timer	---
	11	Production Section	Manufacturing Instruction Sheet	Dimension Appearance	Sampling Sampling	Comparator Microscope	Process Data Sheet
	12	Production Section	Manufacturing Instruction Sheet	Temp*Time	---	Thermometer, Timer	---
	13	Production Section	Manufacturing Instruction Sheet	Electric Characteristics	100% Inspection	Characteristics Inspection Machine	Process Data Sheet
	14	Production Control Section	Manufacturing Instruction Sheet Shipment List	Quantity Customer	---	---	Shipment List
15	Inspection Section	Delivery Specifications, Out-going Inspection Standard	Electric Characteristics Appearance	Sampling	Frequency Counter CI-meter microscope	Process Data Sheet	

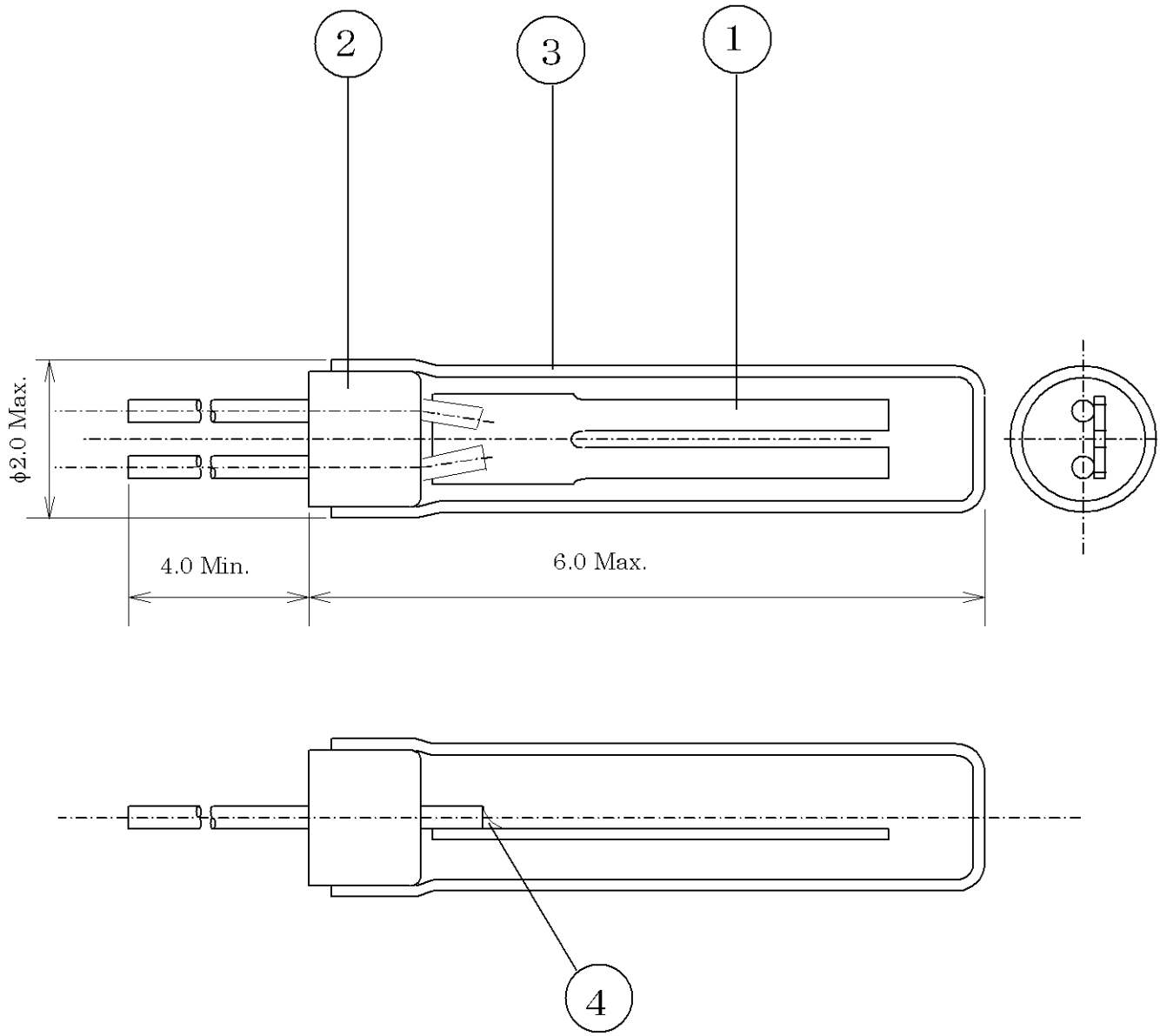
PROCESS QUALITY CONTROL

18/MAR/1998
SEIKO EPSON Corp.
Quartz Device Division

No. A-86-3-ASE-1

Manufacturing process chart	No.	Section In Charge	Standards	Inspection, Control Item	Inspection Methods	Instruments	Record
<p>CRYSTAL BLOCK</p> <p>① Acceptance Inspection</p> <p>② Wafer Cutting</p> <p>③ Wafer Polishing</p> <p>④ Wafer Inspection</p> <p>⑤ Profile Etching</p> <p>⑥ Electrode Processing (Sputtering)</p> <p>⑦ Crystal Tuning Fork Inspection</p> <p>⑧ Mounting</p> <p>⑨ Frequency Adjustment</p> <p>⑩ Hermetic Sealing (Encapsulation)</p> <p>⑪ High Temperature Treatment</p> <p>⑫ Counting and Packing</p> <p>⑬ Products Inspection</p> <p>⑭ Counting and Packing</p> <p>⑮ Out-going Inspection</p> <p>Forward</p> <p>Plug</p> <p>In-Coming Inspection</p> <p>Case</p> <p>In-Coming Inspection</p>	1	Japan	Purchasing Specification, Acceptance Inspection Standard	Appearance Dimension	100% Inspection Sampling	Visual Inspection Length Gauge	In-coming Inspection Data Sheet
	1'	Japan	Purchasing Specification, Acceptance Inspection Standard	Dimension	Sampling	Comparator	In-coming Inspection Data Sheet
	2	Japan	Manufacturing Instruction Sheet	Appearance Cut Angle Dimension	Sampling 100% Inspection	X-ray Radio Graphic Equipment, Comparator	Process Data Sheet
	3	Japan	Manufacturing Instruction Sheet	Appearance Wafer Thickness	100% Inspection Sampling	Visual Inspection Comparator	Process Data Sheet
	4	Japan	Manufacturing Instruction Sheet	Appearance	100% Inspection	Visual Inspection	Process Data Sheet
	5	Japan	Manufacturing Instruction Sheet	Etching Shape Dimension	Sampling Sampling	Microscope Comparator	Process Data Sheet
	6	Japan	Manufacturing Instruction Sheet	Film Thickness Film Strength Appearance	Sampling Sampling Sampling	Thickness Measuring Instrument, Tape Microscope	Process Data Sheet
	7	Japan	Manufacturing Instruction Sheet	Frequency Appearance	100% Inspection 100% Inspection	Frequency Inspection Machine, Microscope	Process Data Sheet
	8	China	Manufacturing Instruction Sheet	Mount Strength Appearance	Sampling	Tension Gauge Microscope	Process Data Sheet
	9	China	Manufacturing Instruction Sheet	Frequency	Sampling	Frequency Counter	Process Data Sheet
	10	China	Manufacturing Instruction Sheet	Temp·Time	---	Thermometer, Timer	---
	11	China	Manufacturing Instruction Sheet	Dimension Appearance	Sampling Sampling	Comparator Microscope	Process Data Sheet
	12	China	Manufacturing Instruction Sheet	Temp·Time	---	Thermometer, Timer	---
	13	China	Manufacturing Instruction Sheet	Electric Characteristics	100% Inspection	Characteristics Inspection Machine	Process Data Sheet
	14	China	Manufacturing Instruction Sheet Shipment List	Quantity Customer	---	---	Shipment List
15	China	Delivery Specifications, Out-going Inspection Standard	Electric Characteristics Appearance	Sampling	Frequency Counter CI-meter microscope	Process Data Sheet	

Construction Tuning fork crystal unit type (C-002RX)



④	Solder Mounting	Sn/Cu	
③	Case	Nickel Silver	Ni-P
②	Plug	42alloy and Glass	Cu-P + Sn/Cu-P
①	Crystal chip	Crystal chip	Base Electrode Cr+Au
No.	Name of Part	Material	Plating

EPSON

SEIKO EPSON Quartz Device Div.

RELIABILITY TEST DATA

Product Name : C-002RX

The Company evaluation condition

We evaluate environmental and mechanical characteristics by the following test condition .

No. F-A-86-3-02-009E

No.	ITEM	TEST CONDITIONS	VALUE *1 *2	TEST	FAIL
			$\Delta f / f$ [1×10^{-6}]	Qty [n]	Qty [n]
1	Drop	Free drop from 750 mm height on a hard wooden board for 3 times (Board is thickness more than 30 mm)	± 5	22	0
2	Vibration	10 Hz to 55 Hz amplitude 0.75 mm 55 Hz to 500 Hz acceleration 98 m/s^2 10 Hz \rightarrow 500 Hz \rightarrow 10 Hz 15 min / cycle 6 h (2 h \times 3 directions)	± 3	22	0
3	High temperature storage	+80 °C \times 240 h	± 5	22	0
4	Low temperature storage	-20 °C \times 240 h	± 5	22	0
5	Temperature cycle	-20 °C \leftrightarrow +80 °C 30 min at each temp. 20 cycles	± 5	22	0
6	Resistance to soldering heat for wire termination	Dip wire termination on closer than 2 mm from the case into solder bath at +280 °C \pm 10 °C for 5 s	± 3	22	0
7	Tensile test on termination	Pulling a wire termination with 10 N weight for 5 s	± 3 No defect for wire termination	11	0
8	Flexibility of termination	A point 1 mm from the base is bend following angle : +90 ° to -90 ° to 0 ° (R0.5)	± 3 No defect for wire termination	11	0
9	Solderability	Dip termination into solder bath at +240 °C \pm 10 °C for 3 s (Using Rosin Flux)	Termination must be 95 % covered with fresh solder	11	0

Notes

- *1 Each test done independently.
- *2 Measuring 2 h to 24 h later leaving in room temperature after each test.

SEIKO EPSON CORP. Quartz Device Div.

Qualification Data

Product Name : C-002RX

$\Delta f/f$

No. F-A-86-3-02-010E

