RECIPIENT

SPECIFICATIONS

Product No. : Q11C02RX1001300

MODEL : C-002RX

SPEC. No. : Q14-257-10A

DATE: Dec. 18. 2014

SEIKO EPSON CORPORATION

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CHECKED Ohashi / TD・CS Quality Assurance Department Manager
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Takashi kurumizawa

SPECIFICATIONS

1. Application

1) This document is applicable to the crystal unit that are delivered

2) This product complies with RoHS Directive.

3) 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.

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 systems, and medical equipment, the functional purpose of which is to keep extra high reliability, such as satellite, rocket and other space life.

2. Product No. / Model

The product No. of this crystal unit is Q11C02RX1001300.
The model is C-002RX.

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 of both parties.

6. Contents

[1] Absolute maximum ratings

No.	Item	Symbol	Rating value			Unit	Note
			Min.	Typ.	Max.		
1	Storage temperature range	T_stg	-20		+70	°C	Suppose to be within CI STD at +25 °C ± 3 °C.
2	Maximum level of drive	GL		1.0		μW	

[2] Operating range

No.	Item	Symbol	Rating value			Unit	Note
			Min.	Typ.	Max.		
1	Operating temperature range	T_use	-10		+60	°C	
2	Level of drive	DL		0.1		μW	
3	Vibration mode		Fundamental				

[3] Static characteristics

No.	Item		Symbol	Value	Unit	Conditions
1	Nominal Frequency		f_nom	32.768	kHz	
2	Frequency tolerance		f_tol	± 20	$\times 10^{-6}$	CL = 6 pF Ta = +25± 3°C Level of drive : 0.1 μW Not include aging
3	Quality factor		Q	5.0 Min.	$\times 10^{4}$	Decay method
4	Motional resistance		R1	50 Max.	kΩ	CI meter : Saunders 140B Level of drive :1.0 μW
5	Motional capacitance		C1	2.0 Typ.	fF	
6	Shunt capacitance		C0	0.85 Typ.	pF	
7	Frequency temperature characteristics	Turnover temperature	Ti	+25 ± 5	°C	Values are calculated by The frequencies at +10, +25, +40°C with C-MOS circuit.
		Parabolic coefficient	B	-0.04 Max.	$\times 10^{-6}/°C^2$	
8	Isolation resistance		IR	500 Min	MΩ	DC 100V, 60 sec. between terminals or terminal and case
9	Frequency Aging		f_age	± 3	$\times 10^{-6}$/year	Ta = +25 °C ± 3 °C Level of drive : 0.1 μW
10	Against pressure			± 5	$\times 10^{-6}$	Frequency shift at case cramped.

[4] Environmental characteristics

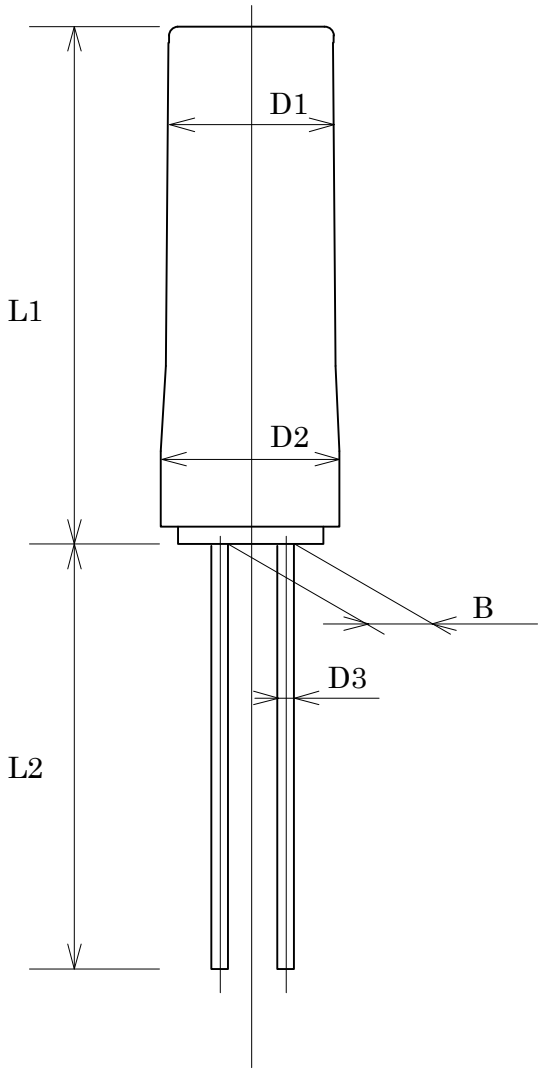
(The company evaluation condition We evaluate it by the following examination item and examination condition.)

No.	Item	Value *1	Test Conditions
		$\Delta f / f$ [1×10^{-6}] *2	
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
6.0 Max.	4.0 Min.	± 0.05 ϕ 1.88	ϕ 2.0 Max.	± 0.07 ϕ 0.2	± 0.15 0.7

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

[6] Notes

1. Soldering conditions: heat only a lead wire part.
   If the temperature of the package exceeds +150 °C., the crystal unit 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 unit may be damaged from machine shock during assembly. Please check conditions carefully prior to use.

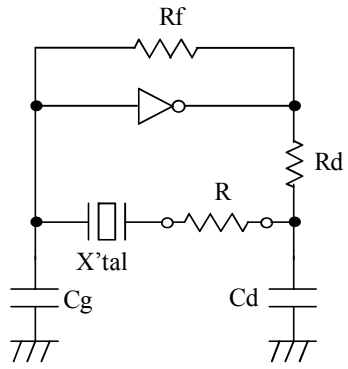
5. To avoid condensation, do not store or use in an environment where temperatures may change rapidly. We recommend that products be stored in an environment where temperature and humidity are normal.

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 unit 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 resister (R) to the circuit in series with the crystal unit.

(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

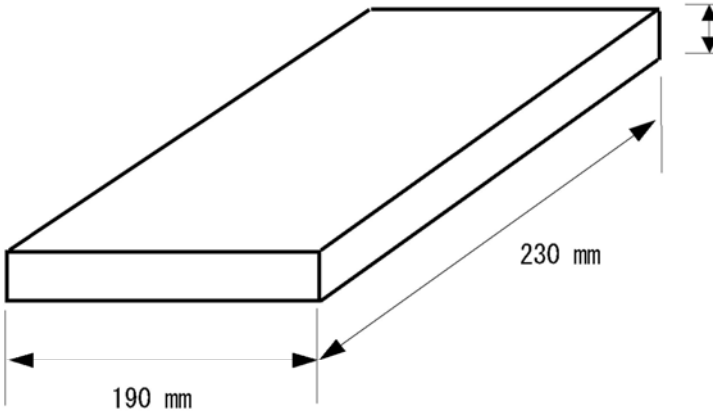
This document is applicable to C-001Type, C-002Type, C-004Type, C-005Type, C-2Type,C-4Type.

2. Packing specifications

(1) • Put the crystal resonators into a polyethylene bag.
- Quantity : as per below table
- Sealing to bag.

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

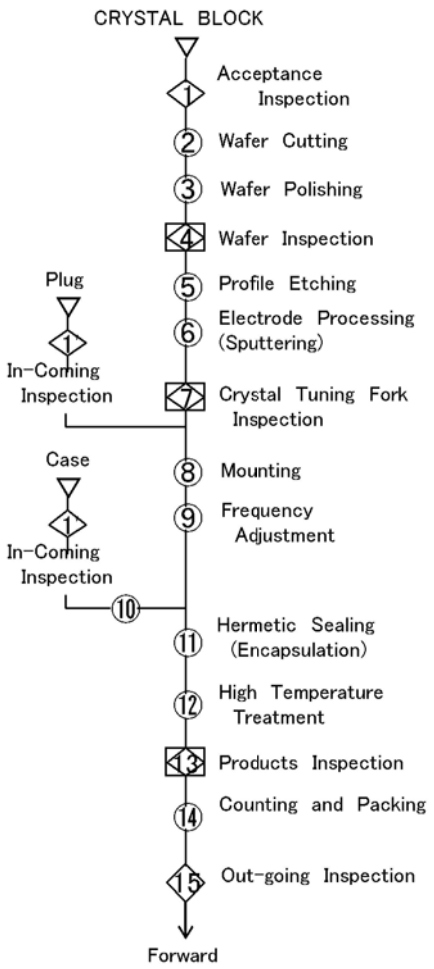
Type	Polyethylene bag. Quantity	Material of box. Quantity
C-001Type	250 pcs. / bag.	5000 pcs. / box.
C-002Type C-004Type C-005Type C-2Type C-4Type	500 pcs. / bag.	5000 pcs. / box.
Reflowable C-002SType C-004SH C-005SH	1000 pcs. / bag.	10000 pcs. / box.



Label contents
1) Type
2) Frequency
3) CL
4) Lot No.
5) Quantity

PROCESS QUALITY CONTROL

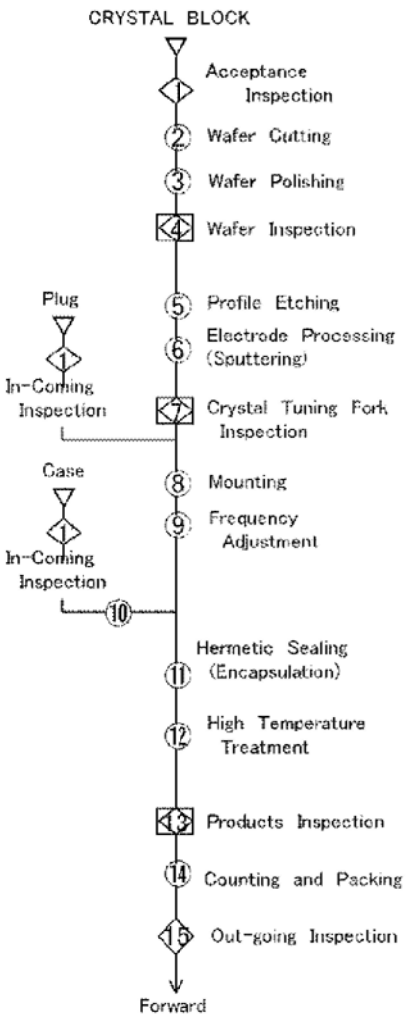
No. A－86－3－AEE－1

Manufacturing process chart	No.	Section In Charge	Standards	Inspection, Control Item	Inspection Methods	Instruments	Record
	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

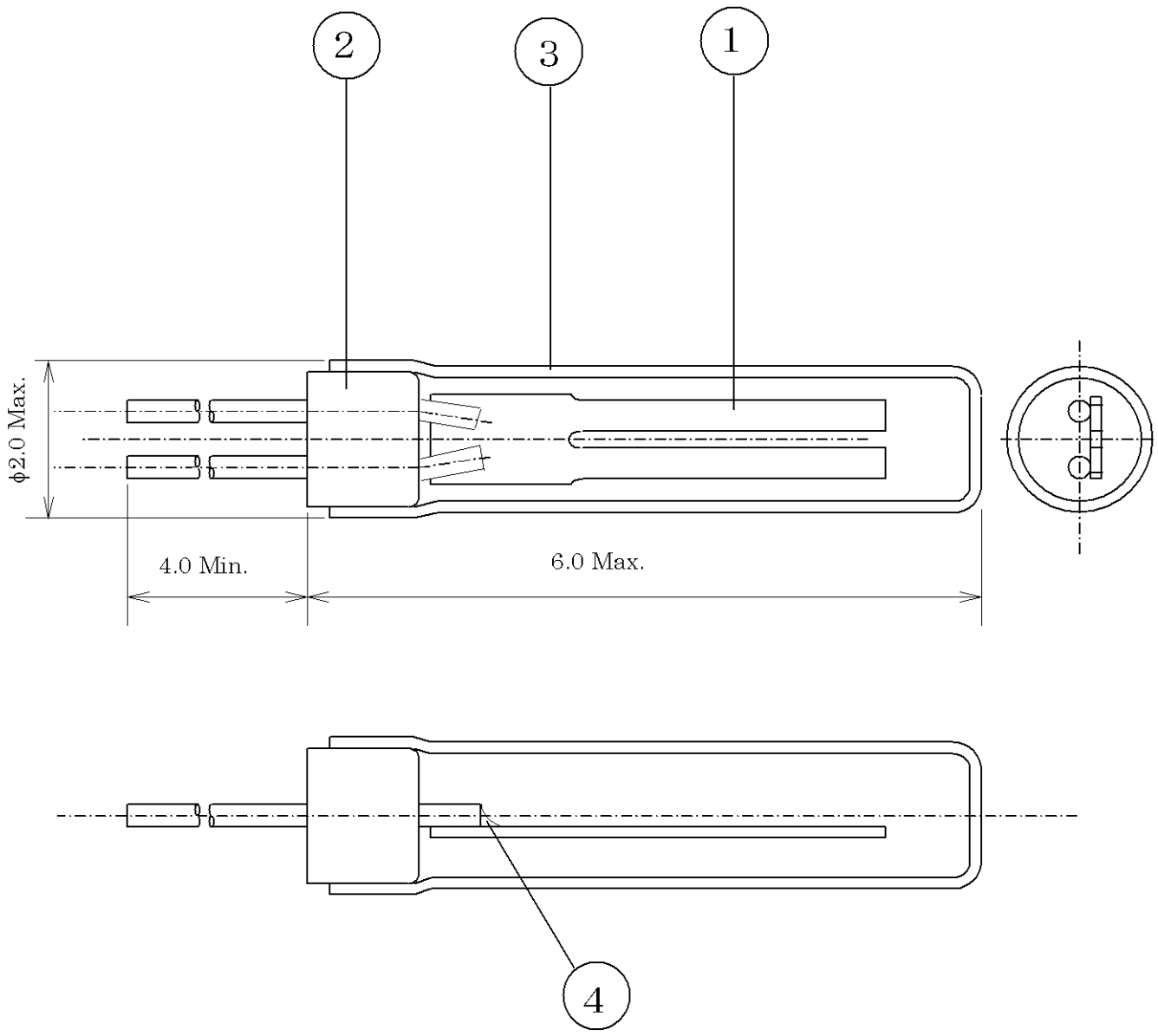
18/MAR/1998

No. A−86−3−ASE−1



No.	Section In Charge	Standards	Inspection, Control Item	Inspection Methods	Instruments	Record
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 Appearance	Sampling Sampling	Comparator Microscope	In-coming Inspection Data Sheet
2	Japan	Manufacturing Instruction Sheet	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

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-86-3-02-011EH**

No.	ITEM	TEST CONDITIONS	VALUE *1 *2 Δ f / f [1 × 10^{-6}]	TEST Qty [n]	FAIL 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 → 500 Hz → 10 Hz 15 min / cycle 6 h (2 h × 3 directions)	± 3	22	0
3	High temperature storage	+80 ℃× 240 h	± 5	22	0
4	Low temperature storage	-20 ℃× 240 h	± 5	22	0
5	Temperature cycle	-20 ℃⇔ +80 ℃ 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 ℃ ± 10 ℃ for 5 s	± 3	11	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 ℃ ± 10 ℃ for 3 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.

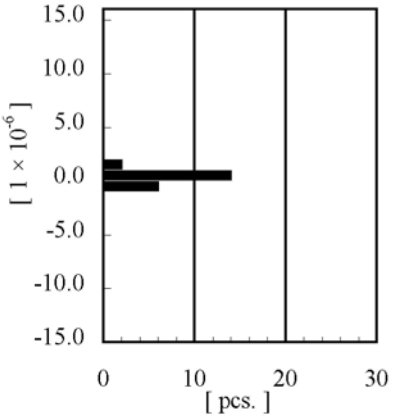
Qualification Data

Product Name : C-002RX

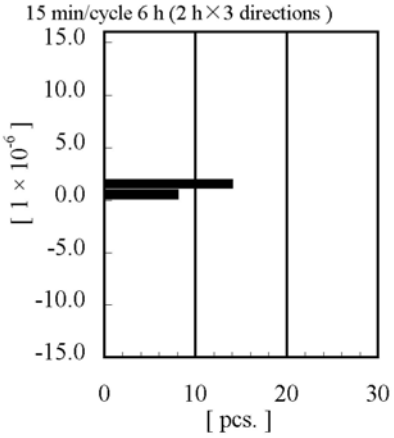
Δ f / f

No. F-A-86-3-02-012EH

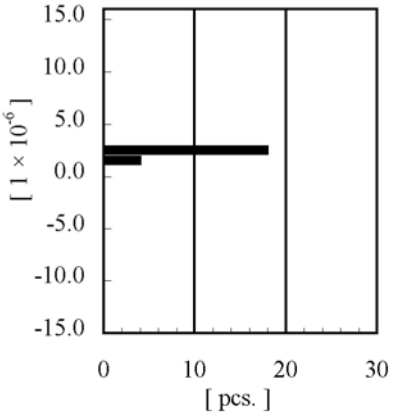
1. Drop
750 mm × 3 times



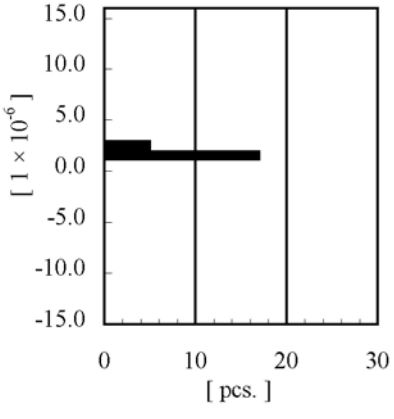
2. Vibration
10 Hz to 55 Hz amplitude 0.75 mm
55 Hz to 500 Hz acceleration 98 m/s^2
15 min/cycle 6 h (2 h×3 directions)



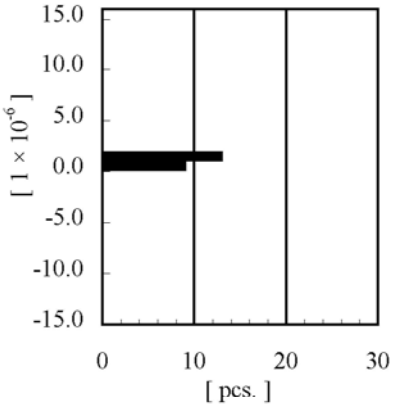
3. High temp. storage
+80 ℃× 240 h



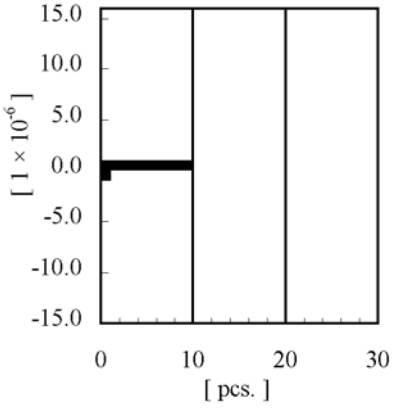
4. Low temp. storage
-20 ℃× 240 h



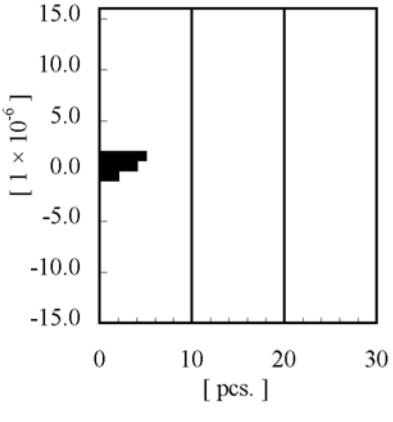
5. Temp. cycle
-20 ℃⇔ +80 ℃
20 cycles



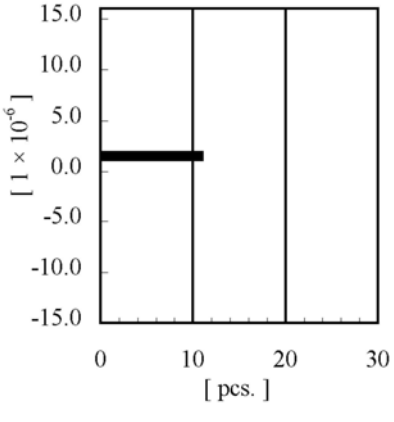
6. Resistance to soldering heat for wire termination
+280 ℃× 5 s



7. Tensile test on termination
10 N × 5 s



8.Flexibility of termination
A point 1 mm from the base is bend following angle
: +90° to -90° to 0° (R0.5)



Qualification Data