

# **INFORMATION**

**MODEL :** **C-002RX**

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**INFO. No. :** **13A**

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**DATE :** **Feb. 25. 2007**

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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.

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[ 1 ] Absolute maximum ratings

No.	Parameter	Symbol	Rating value	Note
1	Storage temperature	T <sub>STG</sub>	-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	T <sub>OPR</sub>	-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	Δ f/f	± 20 × 10 <sup>-6</sup>	CL = 6 pF ~ ∞ Ta = +25 °C ± 3 °C DL = 0.1 μW Excluding aging value
3	Quality factor	Q	Min. 5.0 × 10 <sup>4</sup>	
4	Series resistance	R <sub>1</sub>	Max. 50.0 kΩ	CI meter : Sanders 140-B DL = 1.0 μW
5	Motional capacitance	C <sub>1</sub>	Typ. 2.0 fF	
6	Shunt capacitance	C <sub>0</sub>	Typ. 0.85 pF	
7	Turnover temperature	θT	+25 °C ± 3 °C	Value calculated on temperature
8	Parabolic coefficient	a	Max. -4.0 × 10 <sup>-8</sup> / °C <sup>2</sup>	+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		± 3 × 10 <sup>-6</sup> / year	Ta = +25 °C ± 3 °C DL = 0.1 μW
11	Against pressure		± 5 × 10 <sup>-6</sup>	Frequency shift at case cramped.

#### [ 4 ] Environmental characteristics

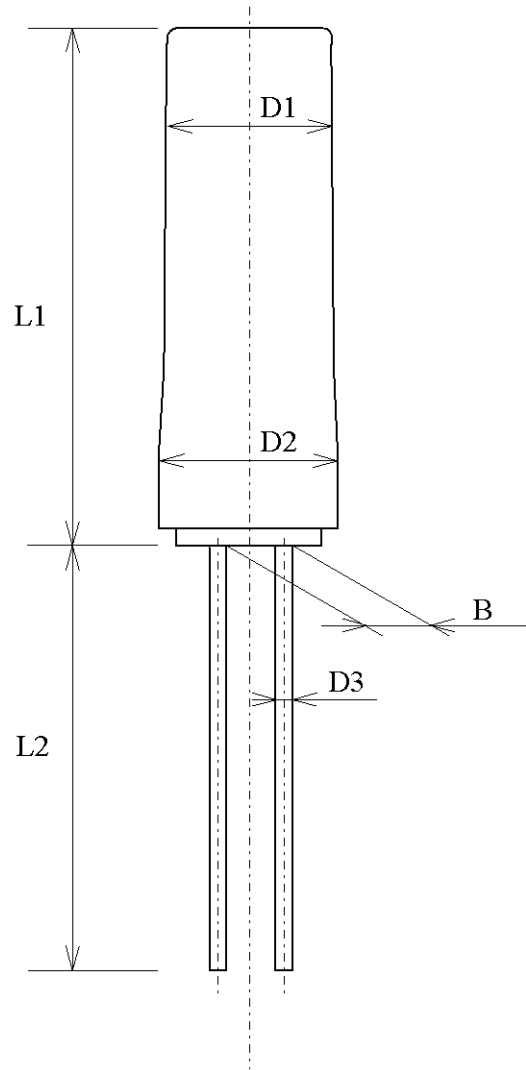
(The company evaluation condition We evaluate it by the following examination item and examination condition.)

No.	Item	Value *1 *2	Test Conditions
		$\Delta f / f \quad [ 1 \times 10^{-6} ]$	
1	Drop	$\pm 5$	Free drop from 750 mm height on a hard wooden board for 3 times (Board is thickness more than 30 mm)
2	Vibration	$\pm 3$	10 Hz to 55 Hz amplitude 0.75 mm 55 Hz to 500 Hz acceleration 98 m/s <sup>2</sup> 10 Hz → 500 Hz → 10 Hz 15 min./cycle 6 h (2 hours , 3 directions)
3	High temperature storage	$\pm 5$	+80 °C × 240 h
4	Low temperature storage	$\pm 5$	-20 °C × 240 h
5	Temperature cycle	$\pm 5$	-20 °C ↔ +80 °C 30 min. at each temp. 20 cycle
6	Resistance to soldering heat for wire termination	$\pm 3$	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	$\pm 3$ No defect for wire termination	Pulling a wire termination with 10 N weight for 5 s
8	Flexibility of termination	$\pm 3$ 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.	$\pm 0.05$	Max.	$\pm 0.07$	$\pm 0.15$
6.0	4.0	$\phi 1.88$	$\phi 2.0$	$\phi 0.2$	0.7

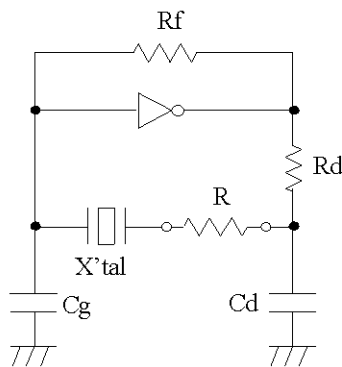
Unit : 1 = 1 mm

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.  
 $[-NR] = R + CI \text{ value}$
- (5) Recommended [ -NR ]  
 $[-NR] > CI (\text{Max.}) \times 5$