Quartz Crystal Unit Handling Precautions

1. Mounting Precautions

1.1 Lead Type Crystal Units

1.1.1.Structure

Tubular crystal units (VT, VTC) are hermetically sealed using glass (see Figures 1 and 2).

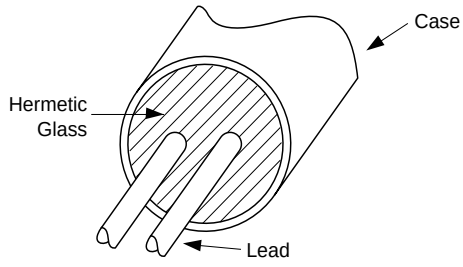


Figure 1

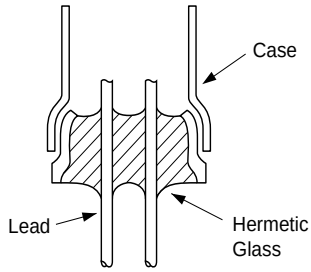


Figure 2

1.1.2 Unbending the lead

(1) DO NOT pull the lead excessively if unbending a lead or removing a crystal unit. The excessive force may crack the glass and reduce the degree of vacuum. This may eventually result in deterioration of the characteristics and may also break the crystal chip(see Figure 3).

(2) Unbend the lead by pressing on the bent part from both the upper and lower sides with fixing the bottom of lead tightly. (see Figure 4).

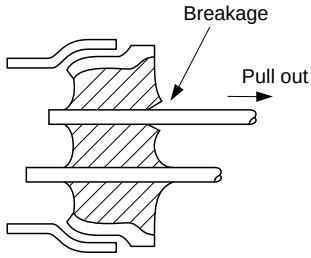


Figure 3

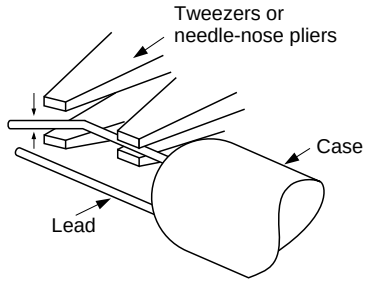


Figure 4

1.1.3 Bending the lead

(1) Bend the lead so that the lead will remain straight for more than 0.5mm from the case when soldering a crystal unit after bending. If not, the glass may be cracked (see Figures 5 and 6).

(2) Always leave a length greater than the case diameter when bending a lead after soldering (see Figure 7).

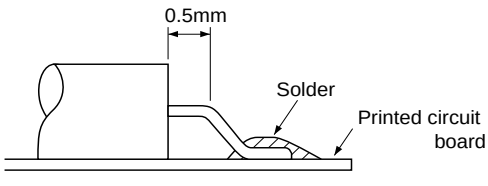


Figure 5

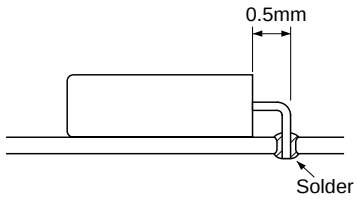


Figure 6

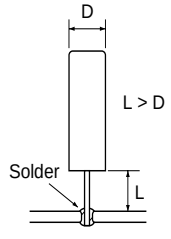


Figure 7

Soldering directly to the case will reduce the degree of vacuum and may result in deterioration of the characteristics and may break the crystal chip.

Make the length from the case to the printed circuit board (L) longer than the case diameter (D) so that the lead wire will not be pulled in case the crystal unit falls over.

1.1.4 Soldering

Heat the lead wire at a temperature of less than 280°C for 5 seconds or less, when mounting or removing a crystal unit. A long period of time of heating may result in deterioration of the characteristics and may break the crystal unit. Be sure to keep the case at or below 150°C.

1.2 SMD Type Quartz Crystal Units

1.2.1 Soldering

(1) For mounting, it is recommended to solder at less than 230°C for 20 seconds or less. An example of the infrared ray reflow temperature profile is shown as follows (see Figure 8).

Example of SMD product soldering conditions

(reflow conditions)

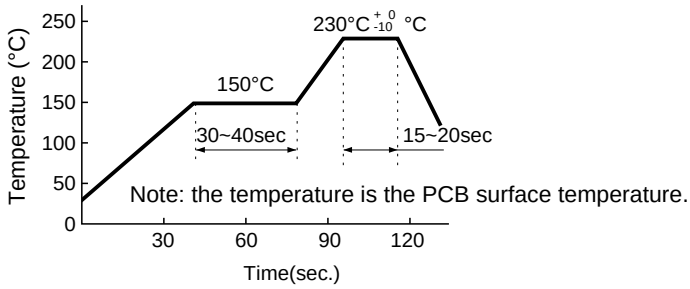


Figure.8

2. Cleaning

(1) Since a small, thin crystal chip is used for low or intermediate frequency crystal units and the frequency approximates that of an ultrasonic cleaner, the crystal chip may break easily. Therefore, DO NOT perform ultrasonic cleaning.

(2) Other crystal units may also break depending upon the ultrasonic cleaning condition. Please check the ultrasonic cleaning condition.

3. Mechanical Shock

(1) The quartz crystal units are designed to withstand a drop from a height of 75 cm onto a hard wooden board at least three times. However, the crystal chip may break if dropped, depending upon how they are dropped. Ensure that the crystal unit functions normally before use if the crystal units have been dropped or subjected to an excessive mechanical shock.

(2) Unlike chip parts such as resistors, and capacitors, the SMD crystal unit has a crystal chip which is hermetically sealed inside. Therefore, check the influence of shock caused during automatic mounting before use.

Oscillation Circuit Design Precautions

1. Drive Level (DL)

The drive level of a crystal unit is shown by the level of the operating power or the current consumption (see Figures 9, 10, and 11).
Operating the crystal unit at an excessive drive level may cause deterioration of characteristics such as the stability of the oscillation frequency or may break the crystal chip.
Depending upon the type of the crystal unit, the appropriate drive level range differs. Ensure that the drive level is appropriate .

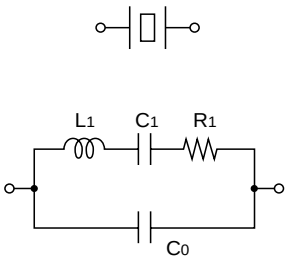


Figure 9

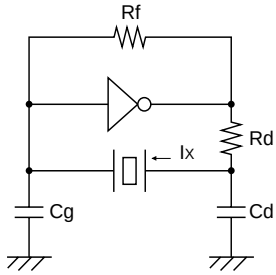
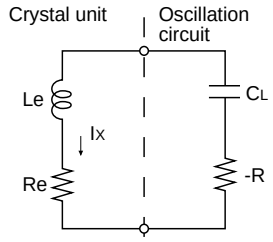


Figure 10



Drive Level: DL
DL: $I_x^2 \cdot Re$
Re: $R_1(1+Co/C_L)^2$
Ix: Current
Re: Effective resistance

Figure 11

2. Oscillation Frequency and Load Capacitance (C_L)

The load capacitance (C_L) is a parameter for determining the frequency of the oscillation circuit. The C_L is represented by an effective equivalent capacitance that is loaded from the oscillation circuit to both ends of the crystal unit (see Figures 10 and 11).
The oscillation frequency varies depending upon the load capacitance of the oscillation circuit. In order to obtain the desirable frequency accuracy, matching between the load capacitances of the oscillation circuit and the crystal unit is required. When set to a small load capacitance, the frequency may be influenced by tolerance in the circuit elements. For more details, please contact SII.

Figure 12 shows an example of the frequency vs. load capacitance of a 32.768 kHz VT-200.

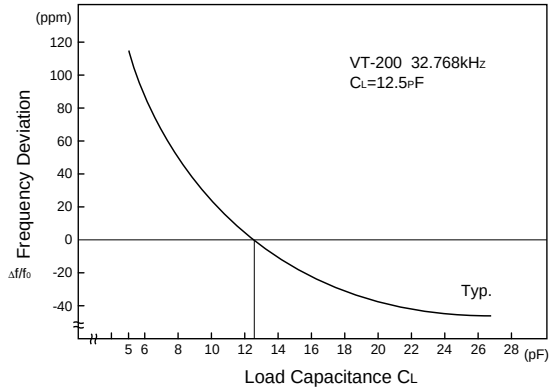


Figure 12

3. Oscillation Allowance

To ensure stable oscillation, the negative resistance of the circuit should be significantly larger than the equivalent series resistance (the oscillation allowance is large). The targeted oscillation allowance is at least five times as large as the equivalent series resistance.

Oscillation Allowance Evaluation Method

Add resistor “Rx” to the crystal unit in series and ensure that the oscillation starts or stops. The approximate negative resistance of the circuit is the value obtained by adding the effective resistance “Re” to the maximum resistance “Rx” when the oscillation starts or stops after gradually making “Rx” larger.

Negative resistance |-R| = Rx + Re

|-R| is a value at least five times as large as the maximum equivalent series resistance (R1 max.) of the crystal unit.
*Re is the effective resistance value during oscillation.

$$Re = R_1 \cdot (1+\frac{C_O}{C_L})^2$$

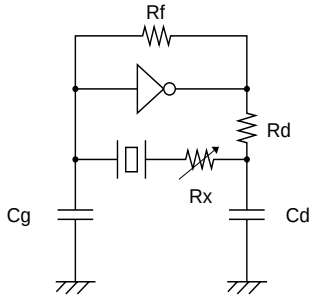


Figure 13

Packing

The following is the standard packing.

1. Lead type products

Product name	Quantity per lot	Quantity per bag	Quantity per box
VT Series	10,000 pcs.	500 pcs.	20 bags
VTC Series	10,000 pcs.	500 pcs.	20 bags

2. SMD products

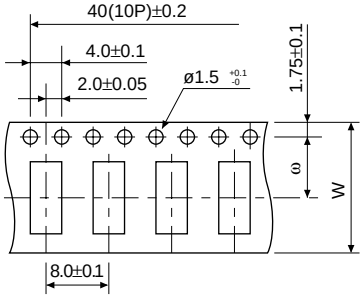
After being taped, the products are rolled onto a reel. The reels are packed in a box.

SP Series	SP-T1	SP-T2	SP-T3	HTF-VT/VTC	SSP-T5	SSP-T6	SSP-T7
Quantity per reel	2,000 pcs.	3,000 pcs.	3,000 pcs.	3,000 pcs.	6,000 pcs.	9,000 pcs.	3,000 pcs.

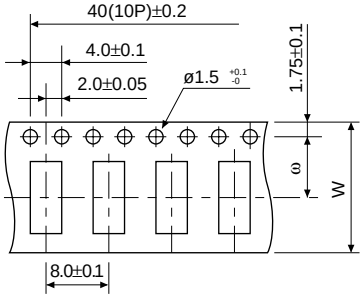
Tape and reel configuration

•Emboss taping configuration

SP-T1/T2/T3 (Conforms with IEC60286-3)

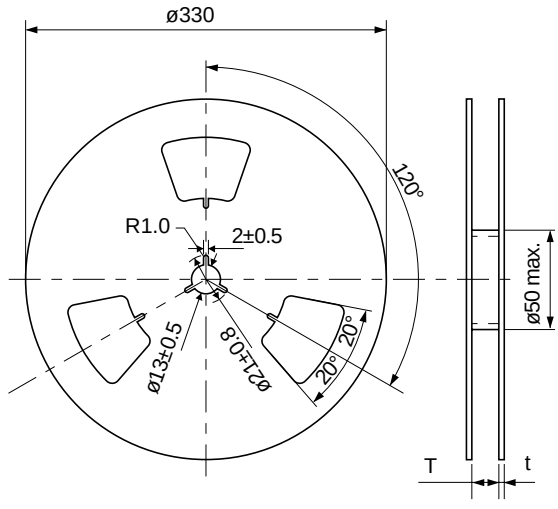


HTF-VT/VTC (Conforms with IEC60286-3)

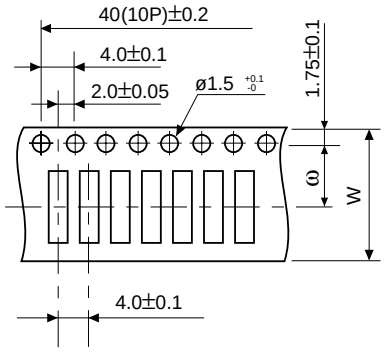


•Reel configuration

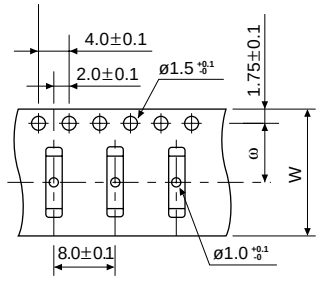
(Conforms with IEC60286-3)



SSP-T5/T6 (Conforms with IEC60286-3)



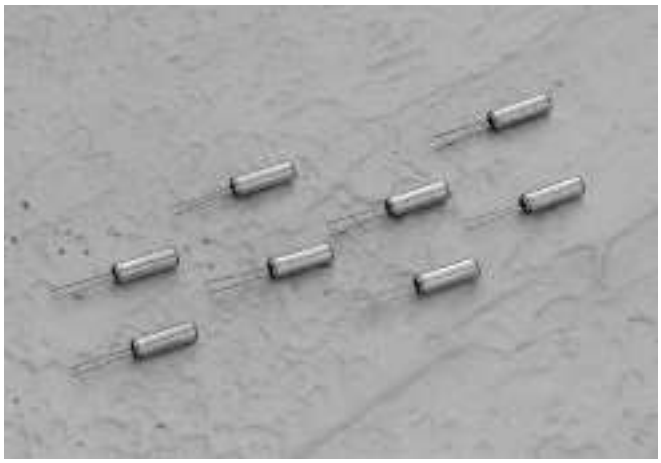
SSP-T7 (Conforms with IEC60286-3)



	SSP-T5/T6/T7, SP-T1/T2/T3, HTF-VT/VTC
ω	7.5
W	16.0

	SSP-T5/T6/T7, SP-T1/T2/T3, HTF-VT /VTC
T	16.4
t	2.0

UNIT : mm



FEATURES

- •Compact tubular package.
- •Low frequency coverage from 32kHz to 200kHz.
- •Photolithographic process.
- •Excellent shock resistance and environmental characteristics.

APPLICATIONS

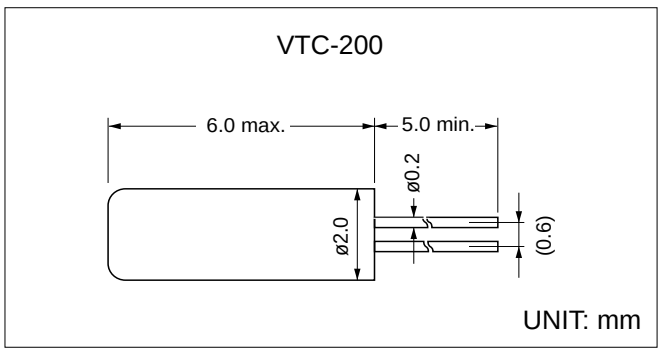
- • Radio Communication Equipment, Clock Source for Micro-Computers, Pagers, Portable Applications

STANDARD SPECIFICATIONS

Conditions without notice (Temperature: +25°C±2°C)

Item	Symbol	Specifications			Conditions / Notes
Nominal Frequency	fo	32kHz ~ 49.9kHz	50kHz ~ 79.9kHz	80kHz ~ 200kHz	
Frequency Tolerance	△f/fo	±30ppm, ±50ppm			
Turnover Temperature	Tp	+25°C±8°C			
Temperature Coefficient	K	$(-3.5\pm0.8)\times10^{-8}/°C^2$			
Load Capacitance	C_L	6.0 ~12.5pF			
Equivalent Series Resistance	R_1	50kΩ max.	35kΩ max.	25kΩ max.	
Maximum Drive Level	DLmax	1μW			
Drive Level	DL	0.1μW			
Shunt Capacitance	C_0	0.8pF typ.	0.75pF typ.		
Aging	△f/fo	±5ppm max.			+25°C±3°C, First Year
Operating Temperature Range	Tope	-10°C ~ +60°C			
Storage Temperature Range	Tsto	-30°C ~ +70°C			
Solderability	Tsol	280°C max., 5sec. max (Package 150°C max.)			Leads Only

DIMENSIONS



STANDARD FREQUENCIES

VTC-200		
32.000	96.000	153.600
38.400	100.000	200.000
40.000	106.000	
75.000	130.000	
76.800	150.000	

Note: For more information regarding available frequencies, please contact with us.