



Network
Components
Business Unit

Quartz Crystals

Product Catalogue

2006

- CMOS IC
- Quartz Crystals
- Custom LCD Module
- Micro Batteries
- Materials





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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).

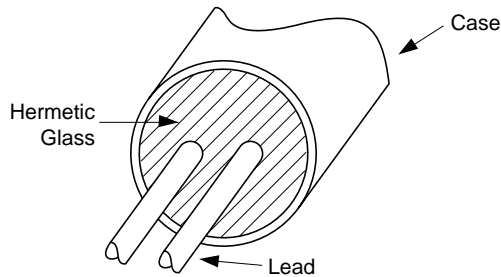


Figure 1

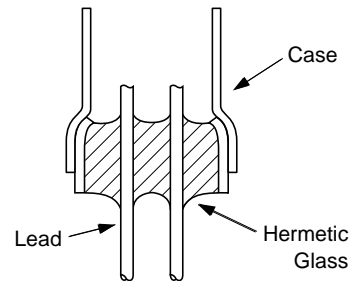


Figure 2

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).

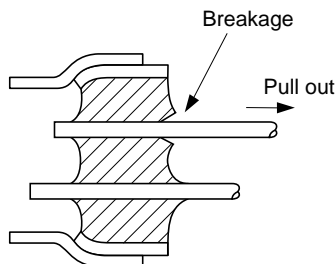


Figure 3

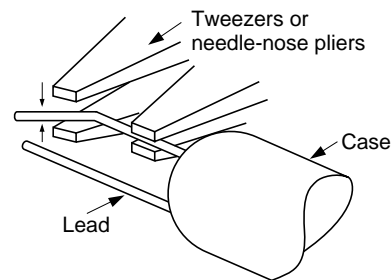


Figure 4

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).

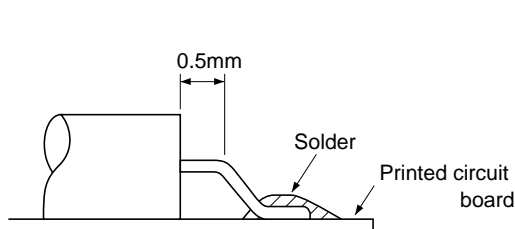


Figure 5

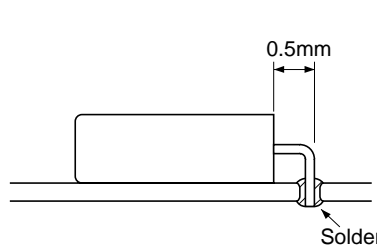


Figure 6

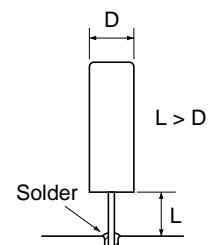


Figure 7

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

When mounting or removing a quartz crystal unit, heat the lead part at 300°C or lower for 5 seconds or less (in the case of a lead-type conventional product). 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.

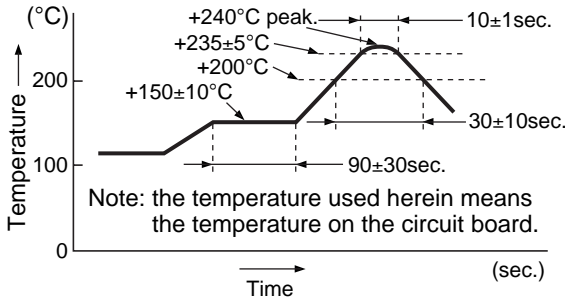
Quartz Crystal Unit Handling Precautions

1.2 SMD Type Quartz Crystal Units

1.2.1 Soldering

(1) An example of the reflow temperature profile is shown as follows (see Figure 8).

Example of SMD product soldering conditions
(230°C peak: Leaded products)



Example of SMD product soldering conditions
(260°C peak: Lead-free products)

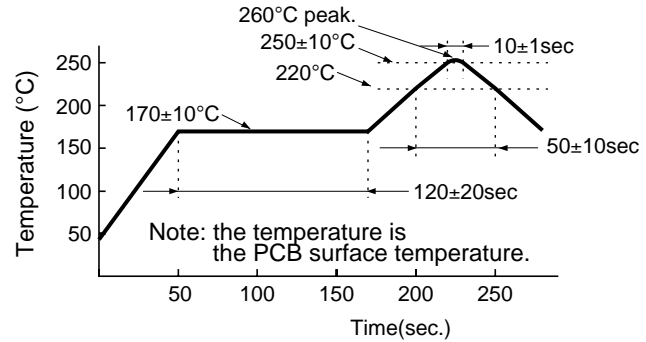


Figure.8

2. Cleaning

Since a small, thin crystal chip is used for tuning fork crystal units and the frequency approximates that of an ultrasonic cleaner, the crystal chip may break easily. Therefore, DO NOT perform ultrasonic cleaning.

3. Mechanical Shock

- (1) Quartz crystal units are designed to withstand a drop from 75 cm onto a hard wooden board at least 3 times. However, their crystal chips may break depending on the conditions when 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.
- (3) Avoid mounting crystal unit to the board with mechanical vibration source. If the crystal unit is unavoidably mounted to the same board with mechanical vibration source, ensure that the crystal unit functions normally.

4. Classification of Leaded Products and Lead-Free Products

Products that use lead-free leads are distinguished from leaded products by their product code and external appearance. Details are given below.

(1) Product code

Leaded products and lead-free products are distinguished by the 7th digit of the product code. In the case of leaded products, the 7th digit is "0", "A" or "B"; whereas in the case of lead-free products, it is "N" or "S".

Leaded product	Q - x x x x O x x x x x x x x x
Lead-free product	Q - x x x x N x x x x x x x x x

(2) External appearance distinction

The 1st digit of the product marking, which indicates the frequency, is a number in the case of leaded products, and a letter in the case of lead-free products.

Example: 32 → C2, 75 → G5

Leaded products	Numeric representation	1 2 3 4 5 6 7 8 9 0
Lead-free products	Alphabetical representation	A B C D E F G H J K

Remarks SSP-T6 has featured a lead-free lead part from the beginning. Therefore, rules (1) and (2) do not apply to SSP-T6.

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 power level will result in the degradation of its characteristics, which may cause frequency instability or physical failure of the crystal chip.

Design your circuit within absolute maximum drive level.

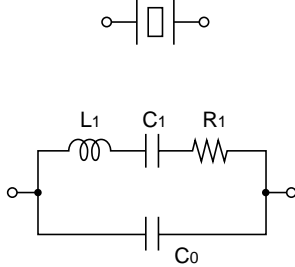


Figure 9

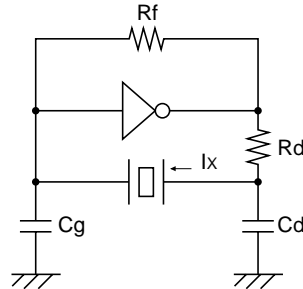


Figure 10

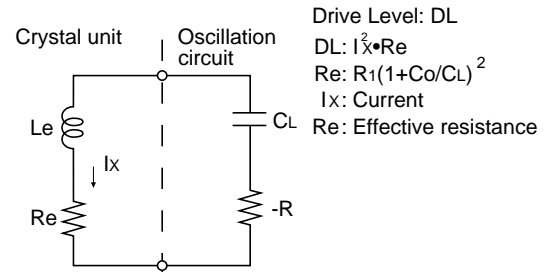


Figure 11

Drive Level: DL
 DL: $I_x^2 \cdot R_e$
 Re: $R_1(1 + C_0/C_L)^2$
 Ix: Current
 Re: Effective resistance

2. Oscillation Frequency and Load Capacitance (CL)

The load capacitance (CL) is a parameter for determining the frequency of the oscillation circuit. The CL 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 the use of the crystal unit, match the load capacitances of the oscillation circuit with the load capacitances of the crystal unit.

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

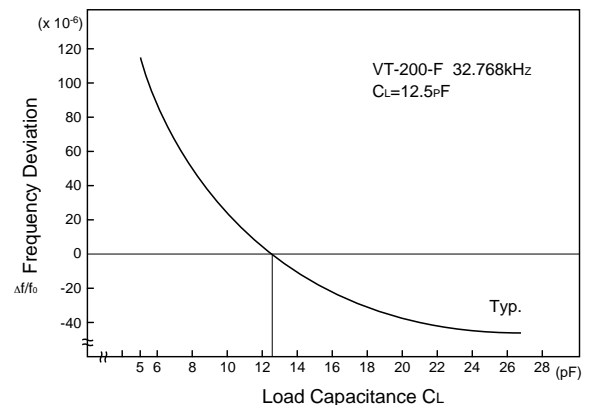


Figure 12

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). Ensure that the 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 value larger.

Negative resistance $|-R| = R_x + R_e$

$|-R|$ 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.

$$R_e = R_1 \left(1 + \frac{C_0}{C_L}\right)^2$$

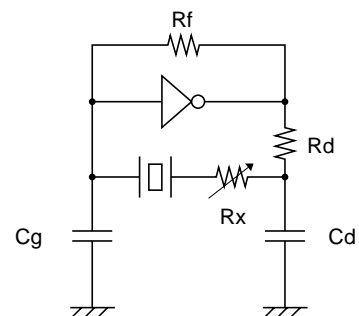


Figure 13

The following is the standard packing.

1. Lead type products

After products are inserted in polyethylene bags, the bags are placed in boxes for shipping.

Product name	Quantity per lot	Quantity per bag	Quantity per box
VT-200-F	10,000 pcs.	500 pcs.	20 bags
VTC-200-F	5,000 pcs.	100 pcs.	50 bags

2. SMD products

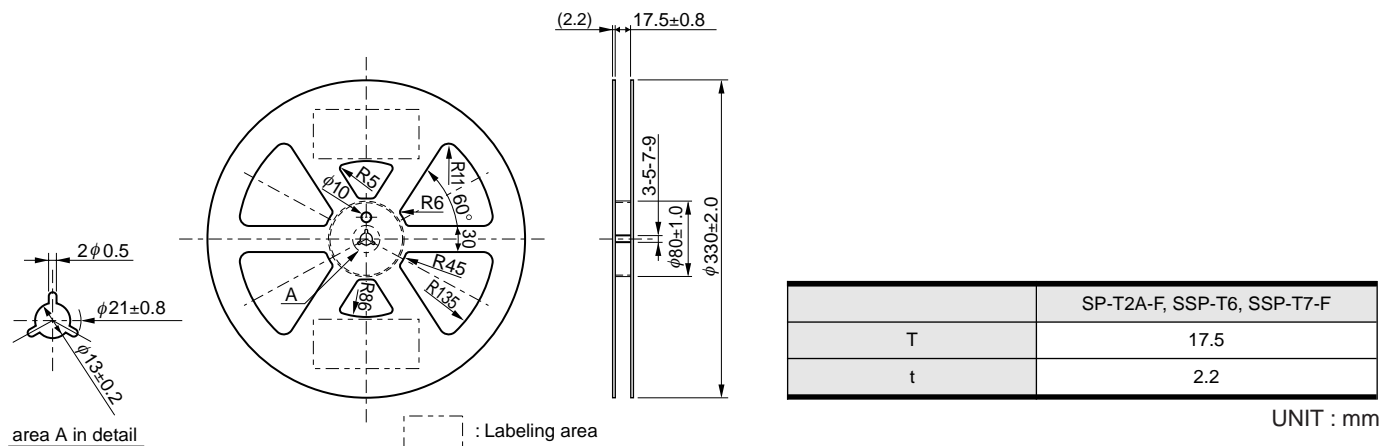
Product name	SP-T2A-F	SSP-T6	SSP-T7-F
Quantity per reel	3,000 pcs.	3,000 pcs.	3,000 pcs.

Tape and reel configuration

•Reel configuration

SP-T2A-F, SSP-T6/T7-F

(Conforms with EIAJ ET-7200B)

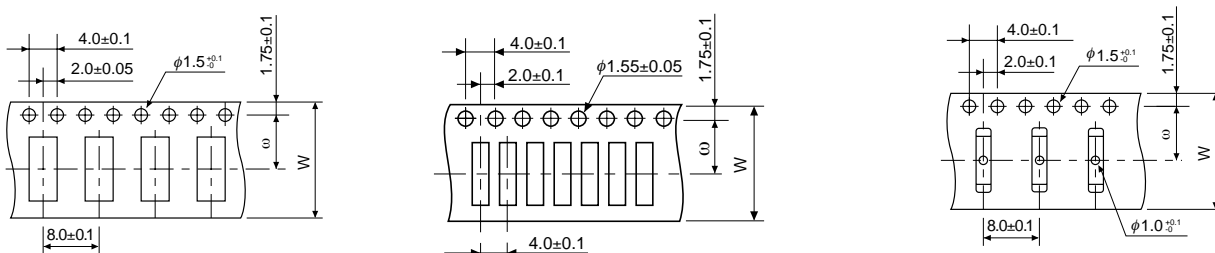


•Emboss tape configuration

SP-T2A-F

SSP-T6

SSP-T7-F

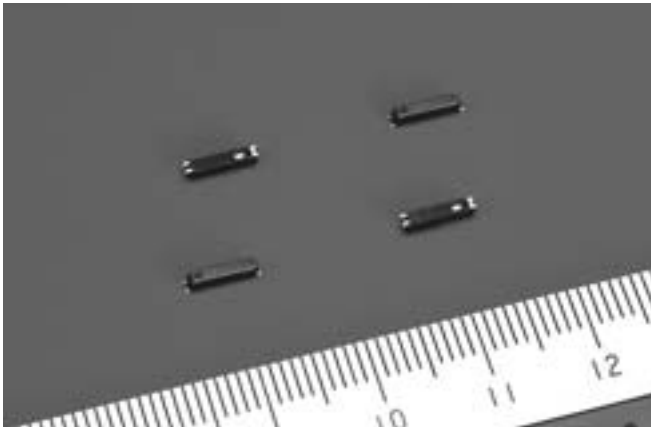


	SP-T2A-F, SSP-T6, SSP-T7-F
ω	7.5
W	16.0

UNIT : mm

Remarks Precautions for handling reels

- Store at normal temperature and normal humidity (ref. to standard conditions of JIS Z-8703 laboratory).
Avoid storing for a long time and mount the crystal units immediately after unpacked.
[Normal temperature: +15 to 35°C Normal humidity: 25 to 85%RH]
- Handle outside boxes and reels with care.
Tapes and reels may be deformed by external pressure.



FEATURES

- Ultra thin type with height 1.4mm Max.
- SMD type suitable for automatic & high density surface mounting.
- Plastic mold package containing highly reliable tubular type quartz crystal.
- Excellent shock and heat resistance.
- RoHS compliant.

APPLICATIONS

- Cellular Phones, PDA, DVC, Radio Communication Equipment, Portable Applications etc.

Under Development

Scheduled to be complete Pb-free in June, 2006

STANDARD SPECIFICATIONS

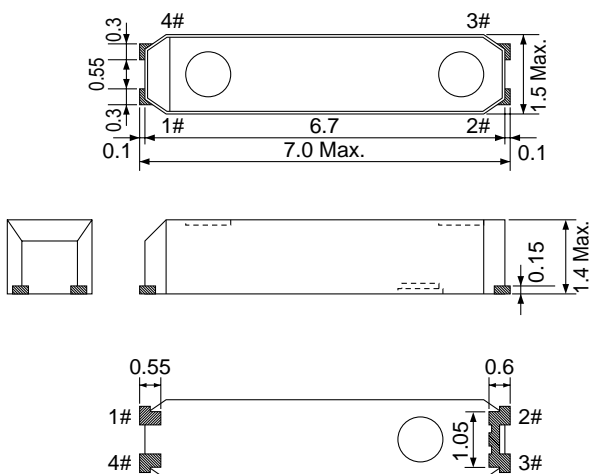
Conditions without notice (Temperature: +25±2°C, DL: 0.1μW)

Item	Symbol	Specifications	Conditions / Notes
Nominal Frequency	f_nom	32.768kHz	
Frequency Tolerance	f_tol	±20 x 10 ⁻⁶ , ±50 x 10 ⁻⁶	
Turnover Temperature	Ti	+25±5°C	
Parabolic Coefficient	B	(-3.5±1.0) x 10 ⁻⁸ /°C ²	
Load Capacitance	CL	7.0 pF / 12.5pF	
Motional Resistance (ESR)	R1 typ./max.	44kΩ / 65kΩ	
Absolute Maximum Drive Level	DLmax	1μW	
Level of Drive	DL	0.1μW	
Shunt Capacitance	C ₀	0.8pF typ.	
Frequency Ageing	f_age	±3 x 10 ⁻⁶	+25±3°C, First Year
Operating Temperature	T_use	-40°C to +85°C	
Storage Temperature	T_stg	-55°C to +125°C	Store a pcs. part

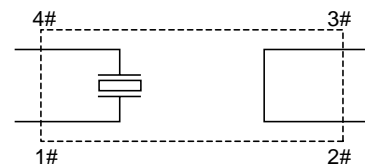
DIMENSIONS

(For details, please refer to individual specification)

UNIT: mm

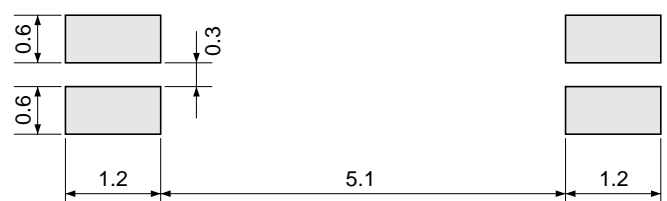


INTERNAL LEAD CONNECTION



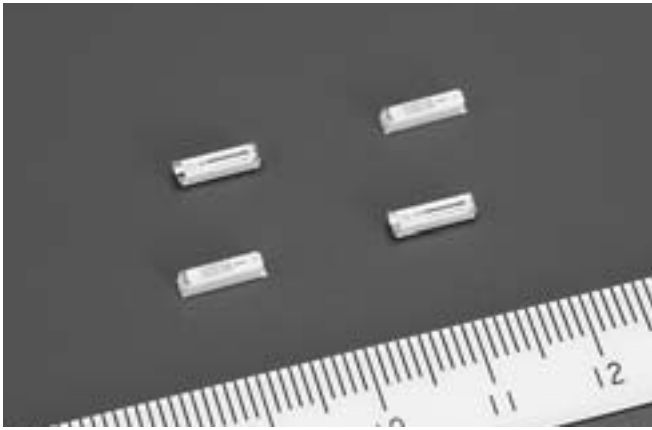
RECOMMENDED SOLDERING PATTERN

UNIT: mm



Remarks 1. Do not connect #2 and #3 to external device and GND.

2. The part of the cylinder inside resin mold may be sometimes exposed, however, it does not affect the characteristics of crystal unit.



FEATURES

- Ultra thin type with height 1.6mm Max.
- Ultra small mounting area of 16.8mm²
- SMD type suitable for automatic & high density surface mounting.
- Plastic mold package containing highly reliable tubular type quartz crystal.
- Excellent shock and heat resistance.
- RoHS compliant.

APPLICATIONS

- Cellular Phones, Pagers, Radio Communication Equipment, Portable Applications etc.

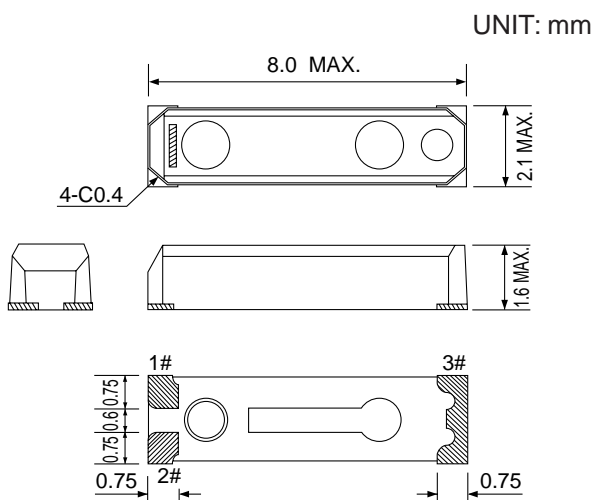
STANDARD SPECIFICATIONS

Conditions without notice (Temperature: +25±2°C, DL: 0.1μW)

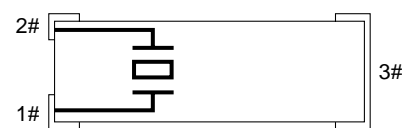
Item	Symbol	Specifications	Conditions / Notes
Nominal Frequency	f _{nom}	32.768kHz	
Frequency Tolerance	f _{tol}	±10 × 10 ⁻⁶ , ±20 × 10 ⁻⁶ , ±50 × 10 ⁻⁶	Can be used in high accurate products
Turnover Temperature	T _i	+25±5°C	
Parabolic Coefficient	B	(-3.5±1.0) × 10 ⁻⁸ /°C ²	
Load Capacitance	C _L	7.0 pF / 12.5pF	
Motional Resistance (ESR)	R ₁ typ./max.	35kΩ / 55kΩ	
Absolute Maximum Drive Level	DL _{max}	1μW	
Level of Drive	DL	0.1μW	
Shunt Capacitance	C ₀	0.95pF typ.	
Frequency Ageing	f _{age}	±3 × 10 ⁻⁶	+25±3°C, First Year
Operating Temperature	T _{use}	-40°C to +85°C	
Storage Temperature	T _{stg}	-55°C to +125°C	Store a pcs. part

DIMENSIONS

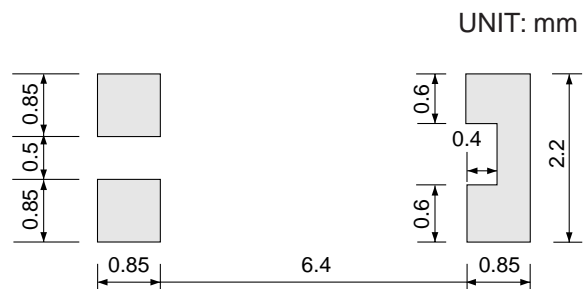
(For details, please refer to individual specification)



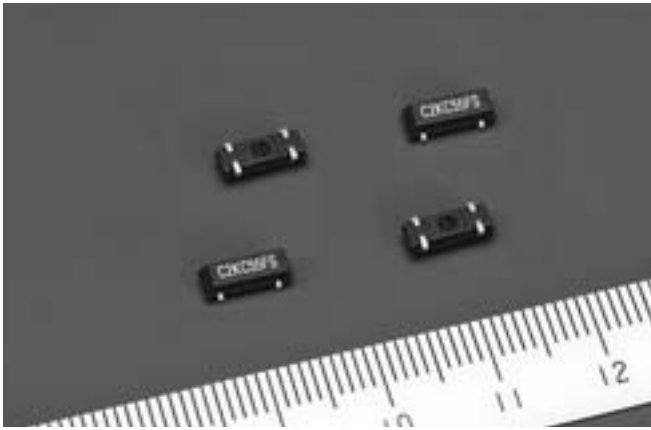
INTERNAL LEAD CONNECTION



RECOMMENDED SOLDERING PATTERN



- Remarks**
1. Do not connect #3 to external device and GND.
 2. The part of the cylinder inside resin mold may be sometimes exposed, however, it does not affect the characteristics of crystal unit.
 3. Please make sure that there is no pattern under SSP-T6 on the circuit board.



FEATURES

- Plastic mold package incorporated tubular type quartz crystal.
- Suitable for automatic and high density surface mounting.
- Excellent shock and heat resistance.
- RoHS compliant.

APPLICATIONS

- Radio Communication Equipment, Cellular Phones, Camcorders, Portable Applications, Clock Source for Micro-Computers

Under Development

Scheduled to be complete Pb-free in June, 2006

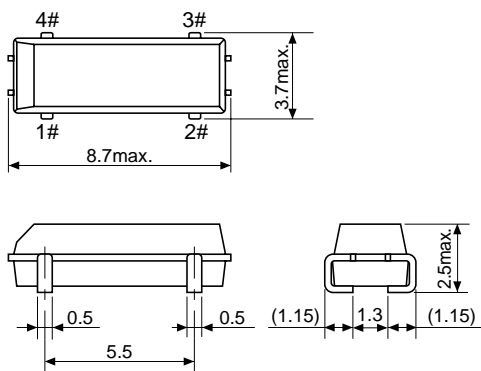
STANDARD SPECIFICATIONS

Conditions without notice (Temperature: $+25\pm 2^{\circ}\text{C}$, DL: $0.1\mu\text{W}$)

Item	Symbol	Specifications		Conditions / Notes
Nominal Frequency	f_nom	32.768kHz	32kHz to 200kHz*	
Frequency Tolerance	f_tol	$\pm 20 \times 10^{-6}$, $\pm 50 \times 10^{-6}$, $\pm 100 \times 10^{-6}$		
Turnover Temperature	Ti	$+25\pm 5^{\circ}\text{C}$	$+25\pm 8^{\circ}\text{C}$	
Parabolic Coefficient	B	$(-3.5\pm 0.8) \times 10^{-8}/^{\circ}\text{C}^2$		
Load Capacitance	C _L	6.0 to 12.5pF		
Motional Resistance (ESR)	R ₁ typ./max.	34kΩ / 50kΩ		
Absolute Maximum Drive Level	DLmax	1μW		
Level of Drive	DL	0.1μW		
Shunt Capacitance	C ₀	1.0pF typ.	0.95pF typ.	
Frequency Ageing	f_age	$\pm 5 \times 10^{-6}$		$+25\pm 3^{\circ}\text{C}$, First Year
Operating Temperature	T_use	-40°C to $+85^{\circ}\text{C}$		
Storage Temperature	T_stg	-55°C to $+125^{\circ}\text{C}$		Store a pcs. part

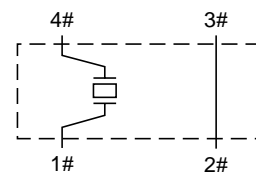
* Please feel free to contact us for inquiries about other frequencies in need.

DIMENSIONS (For details, please refer to individual specification)

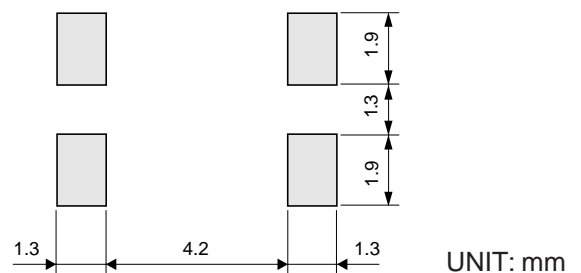


UNIT: mm

INTERNAL LEAD CONNECTION

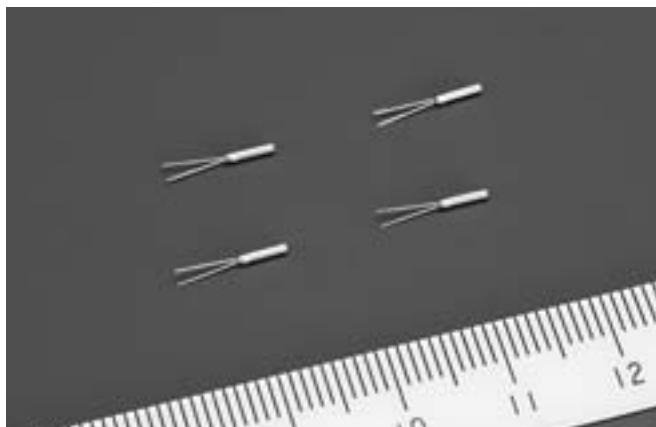


RECOMMENDED SOLDERING PATTERN



UNIT: mm

- Remarks**
1. Do not connect terminals #2, #3 to external device and GND. These are dummy terminals.
 2. The part of the cylinder inside resin mold may be sometimes exposed, however, it does not affect the characteristics of crystal unit.


FEATURES

- Compact tubular package.
- Photolithographic process.
- Excellent shock resistance and environmental characteristics.
- RoHS compliant (complete Pb-free).

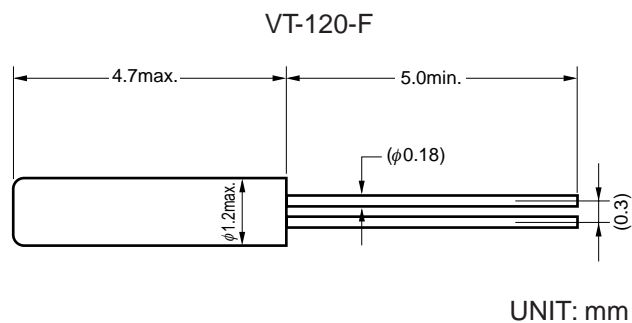
APPLICATIONS

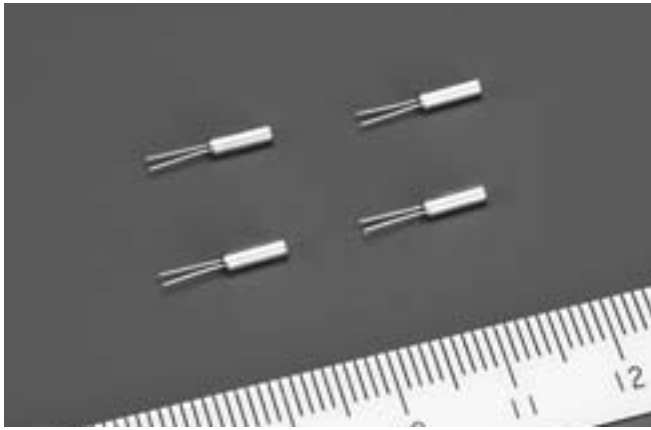
- Real Time Clocks, Radio Communication Equipment, Portable Applications

STANDARD SPECIFICATIONS

 Conditions without notice (Temperature: $+25\pm 2^{\circ}\text{C}$, DL: $0.1\mu\text{W}$)

Item	Symbol	Specifications	Conditions / Notes
Nominal Frequency	f_nom	32.768kHz	
Frequency Tolerance	f_tol	$\pm 20 \times 10^{-6}$, $\pm 30 \times 10^{-6}$	
Turnover Temperature	Ti	$+25\pm 5^{\circ}\text{C}$	
Parabolic Coefficient	B	$(-3.5\pm 1.0) \times 10^{-8}/^{\circ}\text{C}^2$	
Load Capacitance	CL	6.0 to 12.5pF	
Motional Resistance (ESR)	R1 typ./max.	37k Ω / 50k Ω	
Absolute Maximum Drive Level	DLmax	1 μW	
Level of Drive	DL	0.1 μW	
Shunt Capacitance	C ₀	0.8pF typ.	
Frequency Ageing	f_age	$\pm 3 \times 10^{-6}$	$+25\pm 3^{\circ}\text{C}$, First Year
Operating Temperature	T_use	-20°C to $+60^{\circ}\text{C}$	
Storage Temperature	T_stg	-30°C to $+70^{\circ}\text{C}$	Store a pcs. part

DIMENSIONS




FEATURES

- Compact tubular package.
- Photolithographic process.
- Excellent shock resistance and environmental characteristics.
- RoHS compliant (complete Pb-free).

APPLICATIONS

- Real Time Clocks, Timers, Pagers, Cameras, Remote-Controllers, Portable Applications

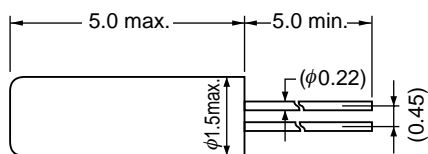
STANDARD SPECIFICATIONS

Conditions without notice (Temperature: +25±2°C, DL: 0.1μW)

Item	Symbol	Specifications	Conditions / Notes
Nominal Frequency	f_nom	32.768kHz	
Frequency Tolerance	f_tol	(±5 x 10 ⁻⁶), ±10 x 10 ⁻⁶ , ±20 x 10 ⁻⁶	
Turnover Temperature	Ti	+25±5°C	
Parabolic Coefficient	B	(-3.5±0.8) x 10 ⁻⁸ /°C ²	
Load Capacitance	CL	4.5 to 12.5pF	
Motional Resistance (ESR)	R1 typ./max.	30kΩ / 50kΩ	
Absolute Maximum Drive Level	DLmax	1μW	
Level of Drive	DL	0.1μW	
Shunt Capacitance	C0	0.9pF typ.	
Frequency Ageing	f_age	±5 x 10 ⁻⁶	+25±3°C, First Year
Operating Temperature	T_use	-10°C to +60°C	
Storage Temperature	T_stg	-30°C to +70°C	Store a pcs. part

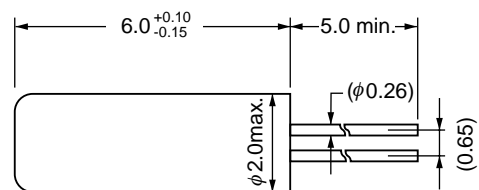
DIMENSIONS

VT-150-F

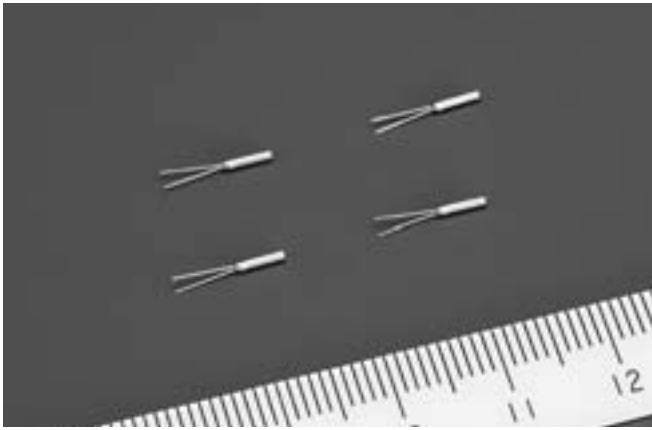


UNIT: mm

VT-200-F



UNIT: mm



FEATURES

- Compact 1.2φ tubular package.
- Photolithographic process.
- Excellent shock resistance and environmental characteristics.
- RoHS compliant (complete Pb-free).

APPLICATIONS

- Radio Controlled clocks and watches.

STANDARD SPECIFICATIONS

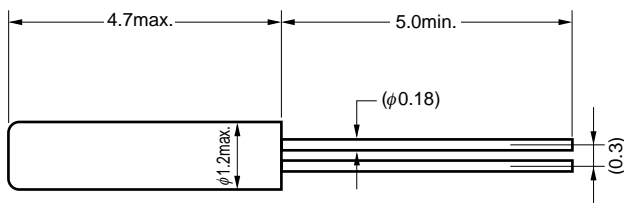
Conditions without notice (Temperature: +25±2°C, DL: 0.1μW)

Item	Symbol	Specifications		Conditions / Notes
Nominal Frequency	f_nom	40.0kHz	60.0kHz to 77.5kHz	
Frequency Tolerance	f_tol	±20 x 10 ⁻⁶ , ±50 x 10 ⁻⁶		
Turnover Temperature	Ti	+25±8°C		
Parabolic Coefficient	B	(-3.5±1.0)x10 ⁻⁸ /°C ²		
Load Capacitance	CL	Series or 10pF		
Motional Resistance (ESR)	R1 max.	65kΩ	50kΩ	
Absolute Maximum Drive Level	DLmax	1μW		
Level of Drive	DL	0.1μW		
Shunt Capacitance	C0	0.7pF to 0.8pF		
Frequency Ageing	f_age	±10 x 10 ⁻⁶		+25±3°C, First Year
Operating Temperature	T_use	-20°C to +60°C		
Storage Temperature	T_stg	-30°C to +70°C		Store a pcs. part

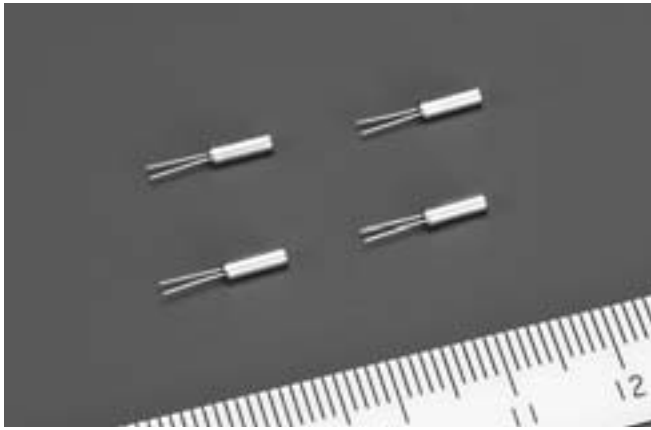
* Please feel free to contact us for inquiries about other frequencies in need.

DIMENSIONS

VTC-120-F



UNIT: mm



FEATURES

- Compact tubular package.
- Low frequency coverage from 32kHz to 200kHz.
- Photolithographic process.
- Excellent shock resistance and environmental characteristics.
- RoHS compliant (complete Pb-free).

APPLICATIONS

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

STANDARD SPECIFICATIONS

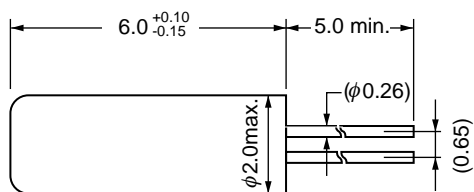
Conditions without notice (Temperature: +25±2°C, DL: 0.1μW)

Item	Symbol	Specifications		Conditions / Notes
Nominal Frequency	f _{nom}	38.4kHz	75.0kHz	
Frequency Tolerance	f _{tol}	±30 x 10 ⁻⁶ , ±50 x 10 ⁻⁶		
Turnover Temperature	T _i	+25±8°C		
Parabolic Coefficient	B	(-3.5±0.8) x 10 ⁻⁸ /°C ²		
Load Capacitance	C _L	6.0 to 12.5pF		
Motional Resistance (ESR)	R ₁ max.	50kΩ	35kΩ	
Absolute Maximum Drive Level	DL _{max}	1μW		
Level of Drive	DL	0.1μW		
Shunt Capacitance	C ₀	0.9pF typ.	0.8pF typ.	
Frequency Ageing	f _{age}	±5 x 10 ⁻⁶		+25±3°C, First Year
Operating Temperature	T _{use}	-10°C to +60°C		
Storage Temperature	T _{stg}	-30°C to +70°C		Store a pcs. part

* Please feel free to contact us for inquiries about other frequencies in need.

DIMENSIONS

VTC-200-F



UNIT: mm

Environmental Activities at Seiko Instruments Inc. Quartz Crystal Division

SII GROUP ENVIRONMENTAL CONCEPT:

As a good corporate citizen, the SII Group aims to realize harmony between corporate activities and the global environment. SII works to preserve and continually improve the environment, aiming to create a sustainable society where all living things can coexist in harmony.

Environmental Actions taken by Quartz Crystal Division

1) Provide Environmentally Friendly Products and Services

- Promote LCA (Life Cycle Assessment)
- Promote lead-free soldering
- Expand "Green Purchasing"
- Expand lineup of SII's green products
- Scheduled to be Halogen-free

**Complete lead-free product:
VT, VTC series**

2) Save Energy and Contribute to diminish Global Warming

- Energy Saving in Production Process

Promote measures for more efficient operation of air conditioning equipment, etc. to reduce CO2 emissions while expanding sales.

3) Maintain zero emissions and promote resource saving as well as recycling and the reduction of industrial waste.

- Promoting to abolish any toxic or dangerous material, use environment-friendly substitutes and re-use; quartz crystal electrode membrane, plastic mold resin, lead frame, etc.
- Promoting resource saving and 3R [Reduce, Re-use, Re-cycle] activities.




4) Encourage Employees to contribute to the Protection of the Environment in their every day life, personal as well as the professional.

- Stop using ozone-layer depleting materials:
 - * SII discontinued specific fluorine at the end of 1991;
 - * SII discontinued trichloroethane at the end of 1992;
 - * SII discontinued mehtylene chloride at the end of 1996;
- Establish a green procurement standard, specify materials to be entirely eliminated from products, and promote activities to observe international legal regulations (RoHS and WEEE directives, etc.).

5) Green Life

Our manufacturing site is located close to Taiheyzan Natural Park. Accordingly we promote planting trees at our site and contribute to neighboring community with closer communication.

6) Trend of Miniaturizing of SMD Quartz Crystal Unit

Series	SP-T2A-F	SSP-T6	SSP-T7-F
Area(mm ²)	34	16.8	10.5
Height(mm)	2.5	1.6	1.4
Weight(mg)	120	50	28
			



Check List for Quartz Crystal Unit Selection

Please use this check list for your best selection of quartz crystal unit

Fax Transmittal

To : Quartz Crystal Sales, Network Components Business Unit
Seiko Instruments Inc. Fax : +81-43-211-8030

LOW FREQUENCY QUARTZ CRYSTAL UNIT

Crystal Product Name		<input type="checkbox"/> SSP-T7-F <input type="checkbox"/> SSP-T6 <input type="checkbox"/> SP-T2A-F <input type="checkbox"/> VT-120-F <input type="checkbox"/> VT-150-F <input type="checkbox"/> VT-200-F <input type="checkbox"/> VTC-120-F <input type="checkbox"/> VTC-200-F
Nominal Frequency	f_nom	_____ KHZ
Allowable Frequency Tolerance	f_tol	<input type="checkbox"/> $\pm 10 \times 10^{-6}$ <input type="checkbox"/> $\pm 20 \times 10^{-6}$ <input type="checkbox"/> $\pm 30 \times 10^{-6}$ <input type="checkbox"/> $\pm 50 \times 10^{-6}$ <input type="checkbox"/> _____ $\times 10^{-6}$
Load Capacitance	CL	<input type="checkbox"/> 6pF <input type="checkbox"/> 7pF <input type="checkbox"/> 12.5pF <input type="checkbox"/> _____ pF

OTHER SPECIAL REQUIREMENTS

Customer's Name and Address

Company name / Station _____

Name _____

Telephone _____

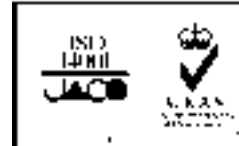
Facsimile _____

E-mail _____



TAKUMI, only achieved by the finest artisans and craftsmen in Japan's long history. Based on our 60 years history of precision watch manufacturing, SII embodies TAKUMI as the core of our DNA.

Our TAKUMI spirit comes to life in all of our components through lower power consumption, high precision and continuous commitment to challenge and improve.



The Quartz Crystal Division of Seiko Instruments Inc. who manufactures the products described in this catalog holds the ISO-9001 quality management system certificate, and the ISO-14001 environmental management systems certificate.

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