



Quartz Crystals

Product Catalog

Components Headquarters Product Catalog

CMOS IC
Quartz Crystals
Micro Batteries
Fiber Optics
MATERIALS
Liquid Crystal Display
Custom LCD Module

Seiko Instruments Inc.

this material copyrighted by its respective manufacturer

Contents

[Quartz Crystal Units]

Quartz Crystal Unit Handling Precautions 3

Oscillation Circuit Design Precautions 5

Packing 6

New Product SSP-T series Surface Mount Quartz Crystal Units for Low Frequencies 7

SP-T series Surface Mount Quartz Crystal Units for Low Frequencies 11

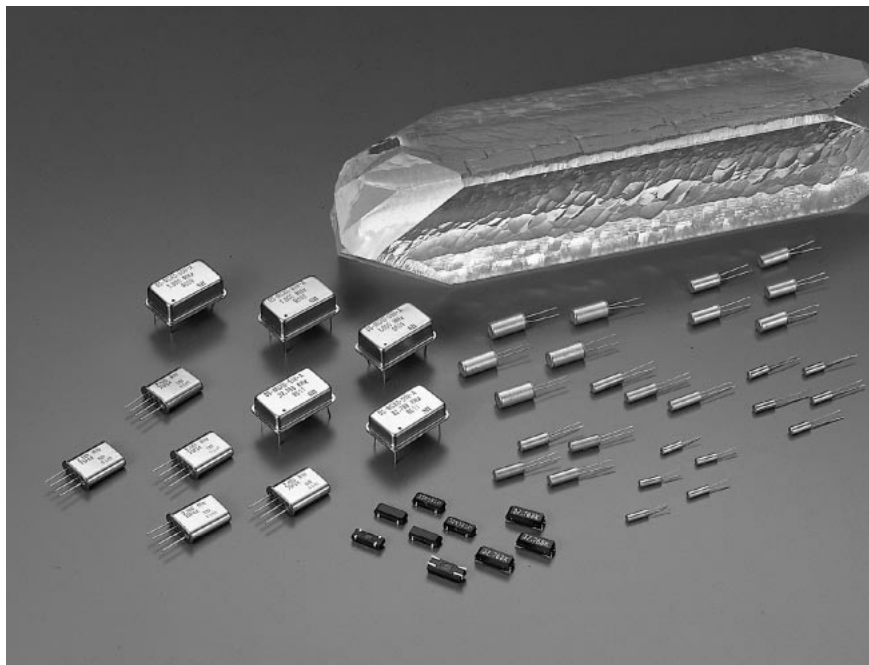
HTF-VT/VTC series Surface Mount Quartz Crystal Units for Low Frequencies 14

VT series Quartz Crystal Units for Watches 15

VTC series Quartz Crystal Units for Low Frequencies 16

High-Accuracy MAT series High Accuracy Quartz Crystal Units 17

MAT series High Frequencies Quartz Crystal Units 18



Frequency Ranges of the Quartz Crystal Units and Oscillators

Type	Page	Low Frequency				Intermediate Frequency			High Frequency				
		20kHz	50	100kHz	200	500	1MHz	2	5	10MHz	20	50	100MHz
SSP-T Series	7,8,9,10		• 32.768	• 75.0									
SP-T Series	11,12,13	24	/				615						
HTF-VT/VTC	14	32	/		153.6								
VT Series	15		• 32.768										
VTC Series	16	24	/				615						
High-Accuracy MAT Series	17								10	20			
MAT Series	18								12	/			66

Quartz Crystal Unit Handling Precautions

1. Mounting Precautions

1.1 Lead Type Crystal Units

1.1.1. Structure

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

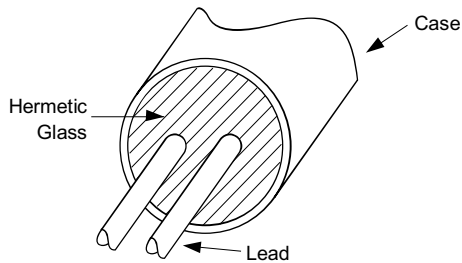


Figure 1

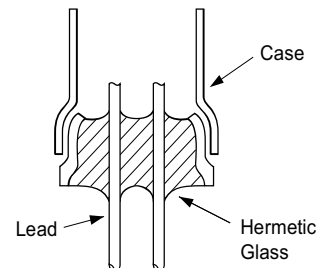


Figure 2

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).

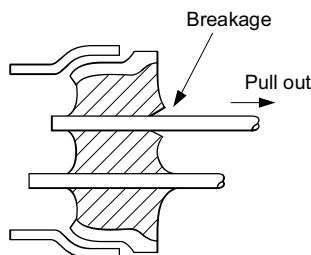


Figure 3

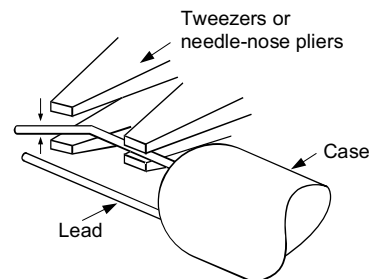


Figure 4

1.1.3 Bending the lead

- (1) Bend the lead so that the lead remains straight for more than 0.5mm from the case when soldering after bending a lead. 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).

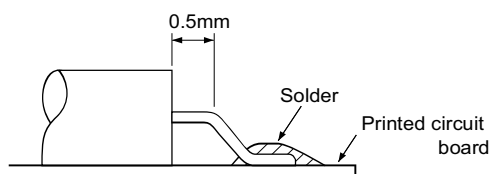


Figure 5

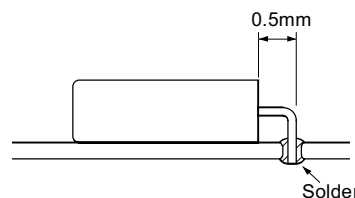


Figure 6

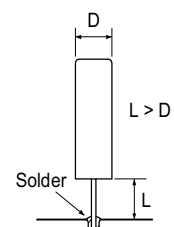


Figure 7

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 if 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)

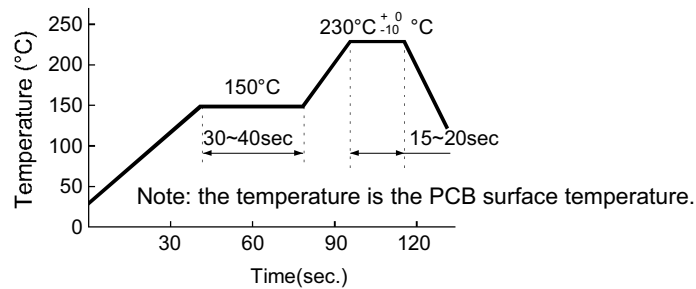


Figure.8

2. Cleaning

- (1) Since low or intermediate frequency crystal units (VT and VTC) or oscillators use a small, thin crystal chip and the frequency approximates the frequency 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 if the crystal units have been dropped or subjected to an excessive mechanical shock.
- (2) Unlike chip parts for resistors, and capacitors, the SMD crystal unit has a crystal chip which is hermetically sealed inside. Before using the crystal units, check the influence of shock caused during automatic mounting.

Oscillation Circuit Design Precautions

1. Drive Level (DL)

The drive level of a crystal unit is displayed using the power or current consumption under the operating status (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 .

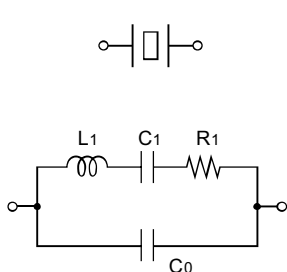


Figure 9

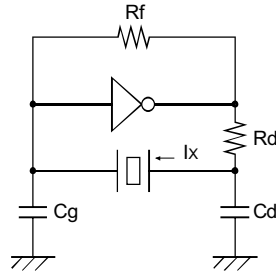


Figure 10

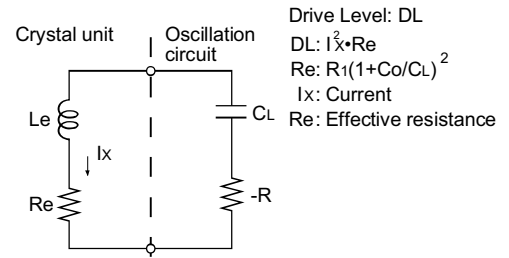


Figure 11

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 more details, please contact SII.

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

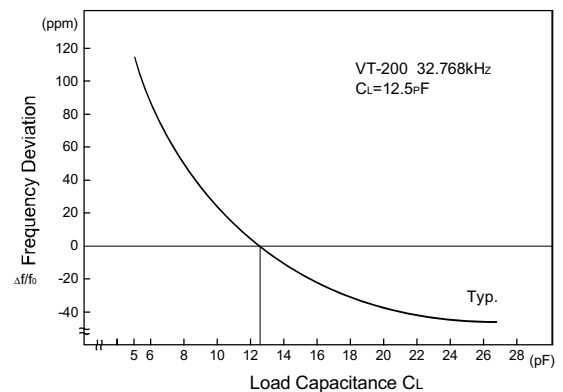


Figure 12

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 more than five times 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 $|-R| = R_x + R_e$

$|-R|$ is a value more than five times the maximum equivalent series resistance (R1 max.) of the crystal unit.

*Re is the effective resistance value during oscillation.

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

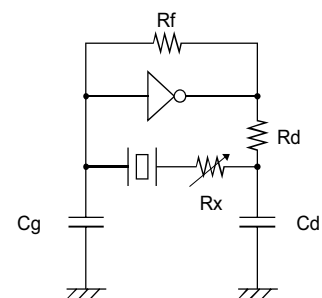


Figure 13

The following is the standard packing. In the case of a small quantity of products (less than 1 lot), this packing may differ.

1. Lead type products

One hundred to five hundred units are packed in a vinyl bag. Twenty to forty bags are packed in a box and shipped.

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
MAT Series	4,000 pcs.	100 pcs.	40 bags

2. SMD products

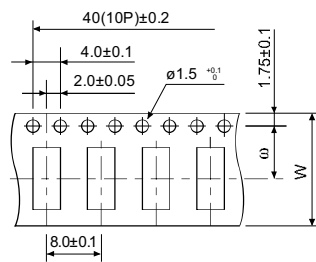
After being taped, the products are rolled onto a reel. The reels are packed in a box.

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

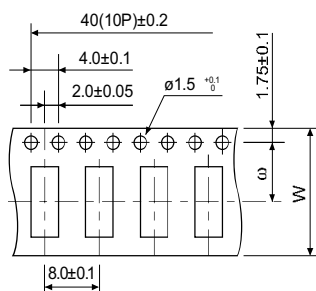
Tape and reel configuration

• Emboss taping configuration

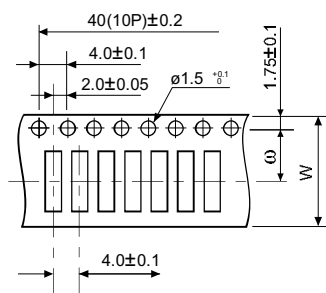
SP-T1/Tw/T3 (Conforms with EIAJ RC-1009B)



HTF-VT/VTC (Conforms with EIAJ RC-1009B)

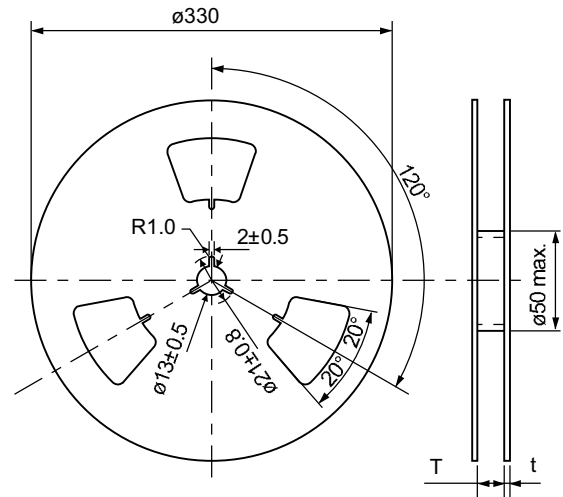


SSP-T5/T6 (Conforms with EIAJ RC-1009B)



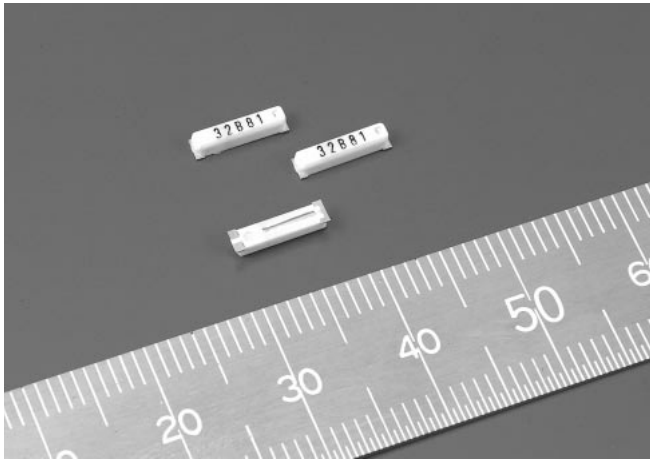
• Reel configuration

(Conforms with EIAJ RC-1009B)



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

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



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.

APPLICATIONS

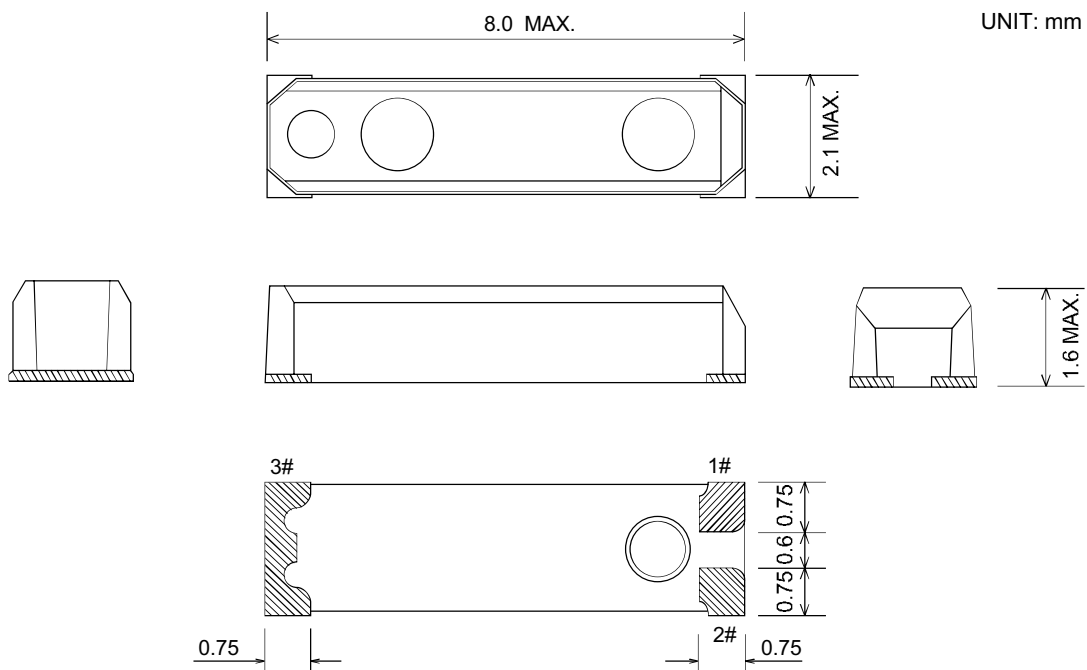
- Cellular Phones, Pagers, Radio Communication Equipment, Portable Applications etc.

STANDARD SPECIFICATION

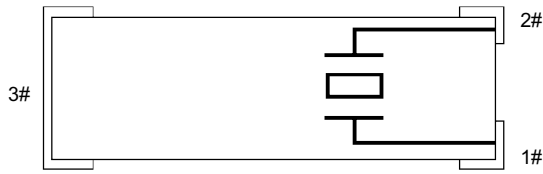
Conditions without notice (Temperature: +25°C±2°C)

Item	Symbol	Specification	Conditions / Note
Nominal Frequency	f ₀	32.768kHz/75.000kHz	
Frequency Tolerance	Δf/f ₀	±10ppm, ±20ppm, ±50ppm	Can be used in high accurate products
Turnover Temperature	T _p	+25°C±5°C	
Temperature Coefficient	K	(-3.5±1.0) x 10 ⁻⁸ /°C ²	
Load Capacitance	C _L	7.0pF/12.5pF	
Equivalent Series Resistance	R ₁	55kΩ max.	
Maximum Drive Level	DL _{max}	1μW	
Drive Level	DL	0.1μW	
Shunt Capacitance	C ₀	0.95pF typ	
Aging	Δf/f ₀	±3ppm max.	+25°C±3°C, First Year
Operating Temperature Range	T _{ope}	-20°C~+70°C	
Storage Temperature Range	T _{sto}	-40°C~+125°C	
Reflow Profile	T _{sol}	230°C max. 20sec. x 2 times	IR Reflow

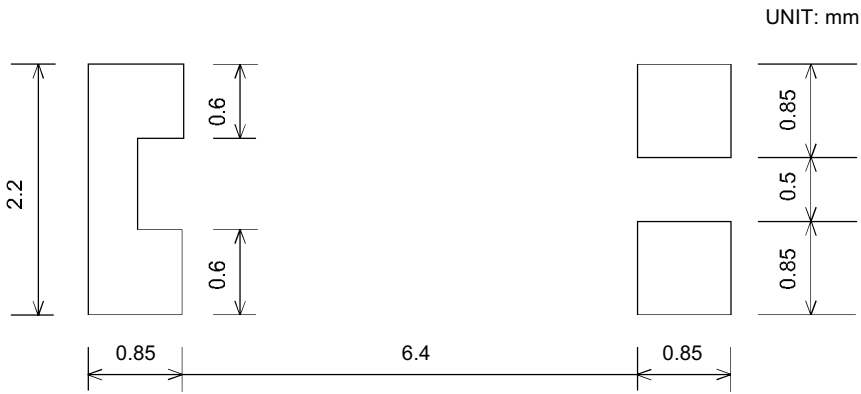
DIMENSIONS (For details, please refer to individual specification)



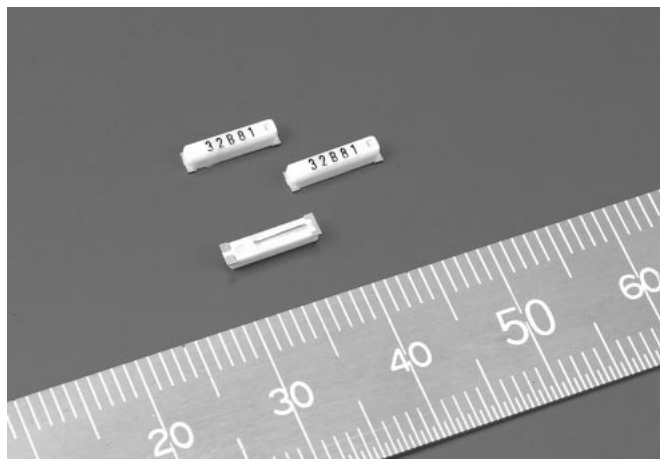
LEAD CONNECTION



TERMINAL LAND AREA



Note: Please make sure that there is no electric wire line under SSP-T6 on the circuit board.



FEATURES

- This type with height 2.1mm Max.
- Small mounting area of 23.4mm².
- SMD type suitable for automatic & high density surface mounting.
- Plastic mold package containing highly reliable tubular type quartz crystal.
- Excellent shock and heat resistance.

APPLICATIONS

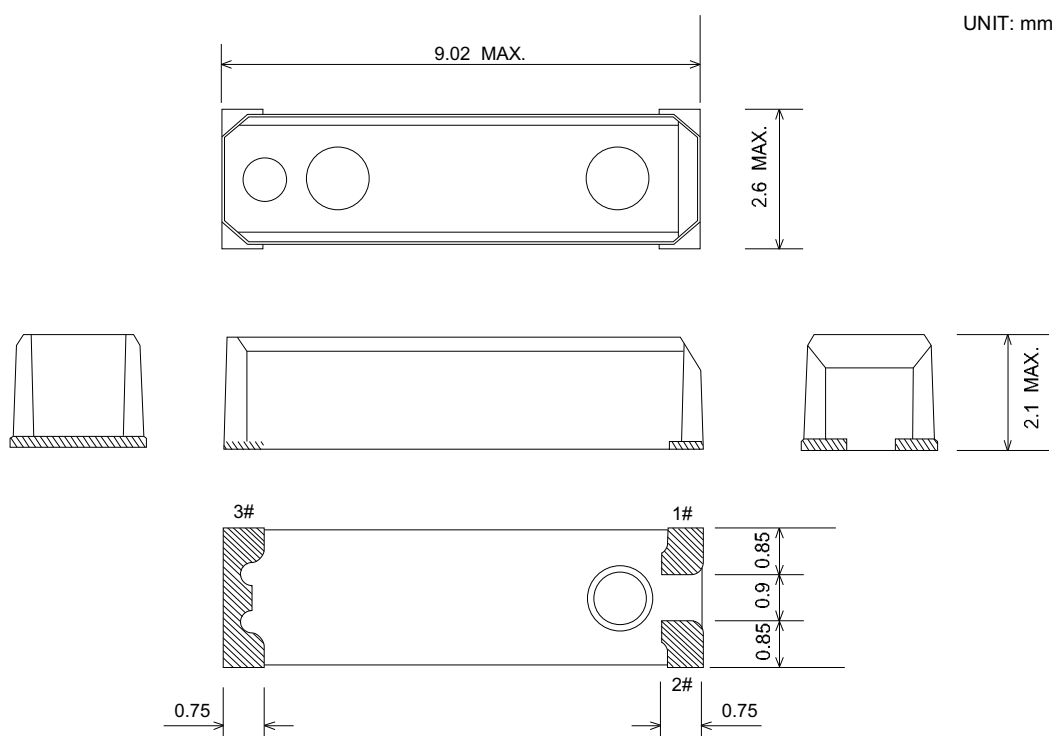
- Cellular Phones, Pagers, Radio Communication Equipment, Portable Applications etc.

STANDARD SPECIFICATION

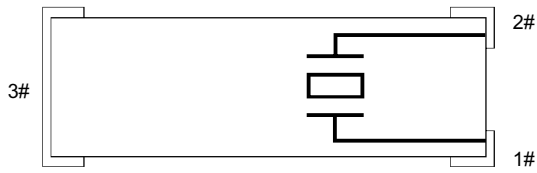
Conditions without notice (Temperature: +25°C±2°C)

Item	Symbol	Specification	Conditions / Note
Nominal Frequency	fo	32.768kHz/76.800kHz	
Frequency Tolerance	△ f/fo	±10ppm, ±20ppm, ±50ppm	Can be used in high accurate products
Turnover Temperature	Tp	+25°C±5°C	
Temperature Coefficient	K	(-3.5±0.8) x 10 ⁻⁶ /°C ²	
Load Capacitance	CL	6.0pF/12.5pF	
Equivalent Series Resistance	R1	50k max.	
Maximum Drive Level	DLmax	1μW	
Drive Level	DL	0.1μW	
Shunt Capacitance	C0	0.9pF typ	
Aging	△ f/fo	±3ppm max.	+25°C±3°C, First Year
Operating Temperature Range	Tope	-20°C~+70°C	
Storage Temperature Range	Tsto	-40°C~+125°C	
Reflow Profile	Tsol	230°C max. 20sec. x 2 times	IR Reflow

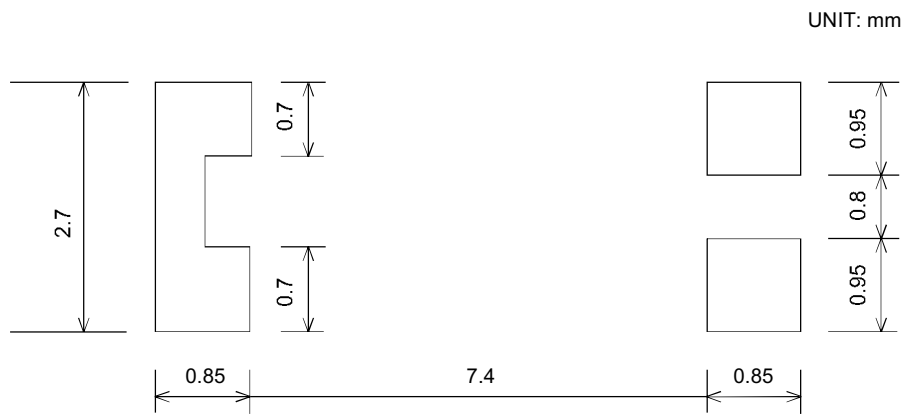
DIMENSIONS (For details, please refer to individual specification)



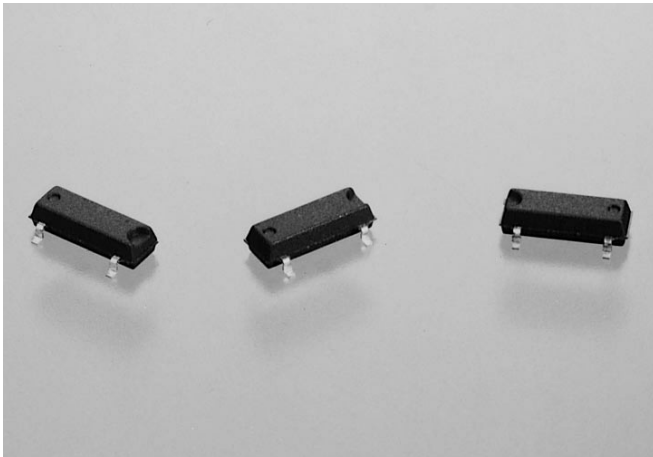
LEAD CONNECTION



TERMINAL LAND AREA



Note: Please make sure that there is no electric wire line under SSP-T5 on the circuit board.



FEATURES

- Low height 2.0mm max.
- Plastic mold package incorporated tubular type quartz crystal.
- Suitable for automatic and high density surface mounting.
- Excellent shock and heat resistance.

APPLICATIONS

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

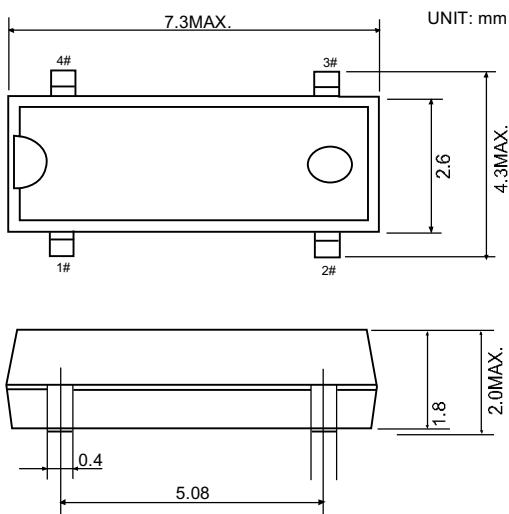
STANDARD SPECIFICATION

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

Item	Symbol	SP-T3	Conditions / Note
Nominal Frequency	f_0	32.768kHz	
Frequency Tolerance	$\Delta f/f_0$	$\pm 20\text{ppm}, \pm 30\text{ppm}, \pm 50\text{ppm}, \pm 100\text{ppm}$	Can be used in high accurate products
Turnover Temperature	T_p	+25°C±5°C	
Temperature Coefficient	K	$(-3.5 \pm 0.8) \times 10^{-8}/\text{°C}^2$	
Load Capacitance	C_L	6.0 to 12.5pF	
Equivalent Series Resistance	R_1	55kΩ max.	
Maximum Drive Level	DLmax	1μW	
Drive Level	DL	0.1μW	
Shunt Capacitance	C_0	0.9pF typ.	
Aging	$\Delta f/f_0$	±3ppm max.	+25°C±3°C, First Year
Operating Temperature Range	Tope	-40°C ~ +85°C	
Storage Temperature Range	Tsto	-55°C ~ +125°C	
Reflow Profile	Tsol	230°C max., 20sec. max. x 2 times	IR Reflow

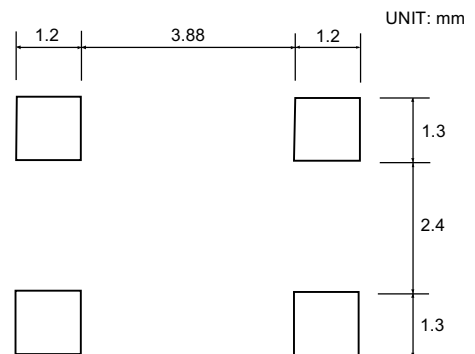
DIMENSIONS

(For details, please refer to individual specification)



TERMINAL LAND AREA

(Projection chart to the PCB surface of the electrode lead)





FEATURES

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

APPLICATIONS

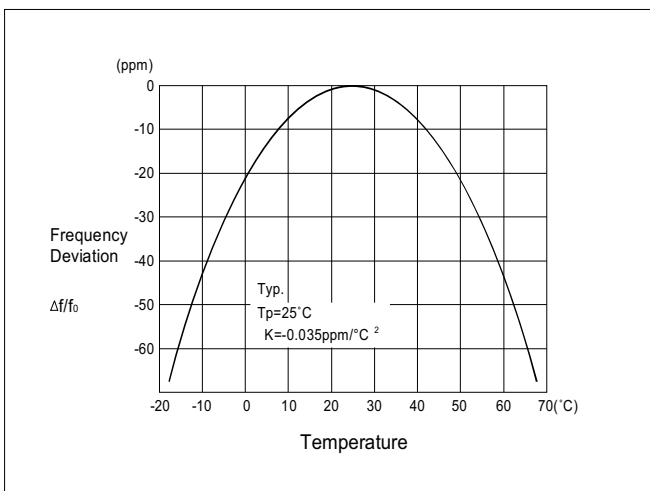
- Radio Communication Equipment, Pagers, Cellular Phones, Camcorders, Portable Applications, Clock Source for Micro-Computers

STANDARD SPECIFICATION

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

Item	Symbol	SP-T1A/B , SP-T2A/B			Conditions / Note
		32.768kHz	24kHz to 350kHz	351kHz to 615kHz	
Nominal Frequency	f_0	32.768kHz	24kHz to 350kHz	351kHz to 615kHz	
Frequency Tolerance	$\Delta f/f_0$	±20ppm, ±50ppm, ±100ppm			
Turnover Temperature	T_p	+25°C±5°C	+25°C±8°C	+25°C±15°C	
Temperature Coefficient	K	(-3.5±0.8)×10 ⁻⁸ /°C ²			
Load Capacitance	C_L	6.0 to 12.5pF			
Equivalent Series Resistance	R_1	50kΩ max.	50kΩ max.	20kΩ max.	
Excitation Level	DL	1μW max.			
Shunt Level	C_0	1.0pF typ.	0.95pF typ.	0.9pF typ.	
Aging	$\Delta f/f_0$	±5ppm max.			+25°C±3°C, First Year
Operating Temperature Range	T_{ope}	-40°C ~ +85°C			
Storage Temperature Range	T_{sto}	-55°C ~ +125°C			
Reflow Profile	T_{sol}	230°C max., 20sec. max. x 2times			IR Reflow

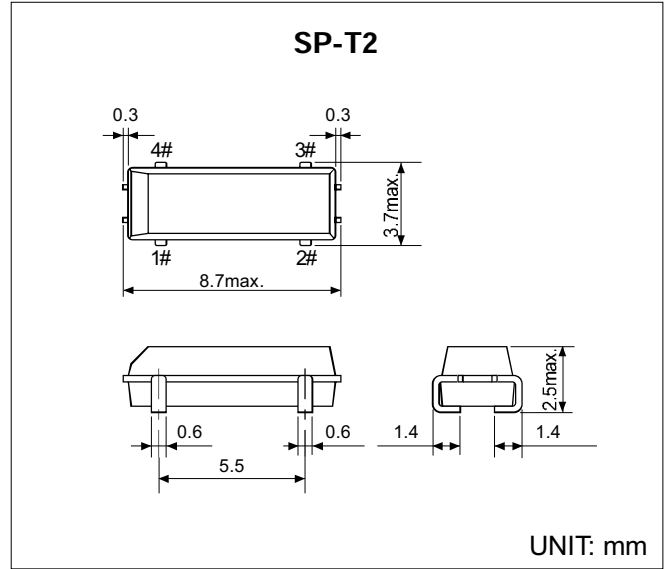
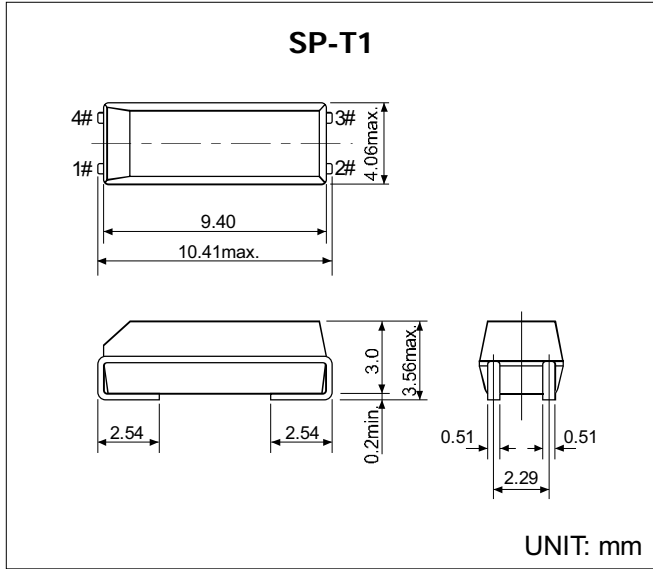
FREQUENCY-TEMPERATURE CURVE



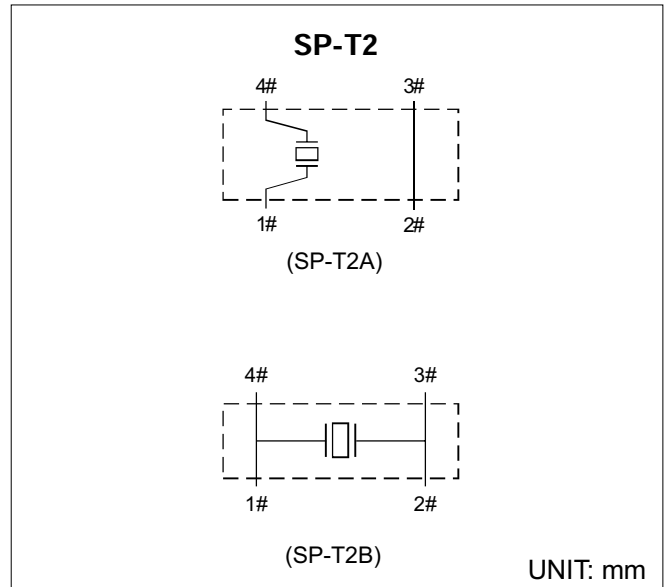
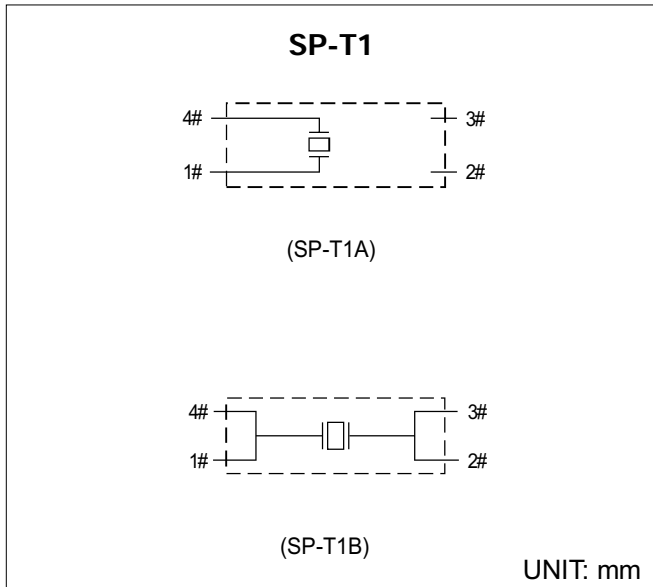
STANDARD FREQUENCIES (kHz)

SP-T1/SP-T2			
24.000	40.000	77.500	150.000
26.667	65.536	96.000	153.600
31.200	75.000	99.660	200.000
32.000	76.800	100.000	307.200
32.768	77.025	106.000	614.400
38.000	770.40	130.000	
38.400	77.056	131.072	

DIMENSIONS (For details, please refer to individual specification)

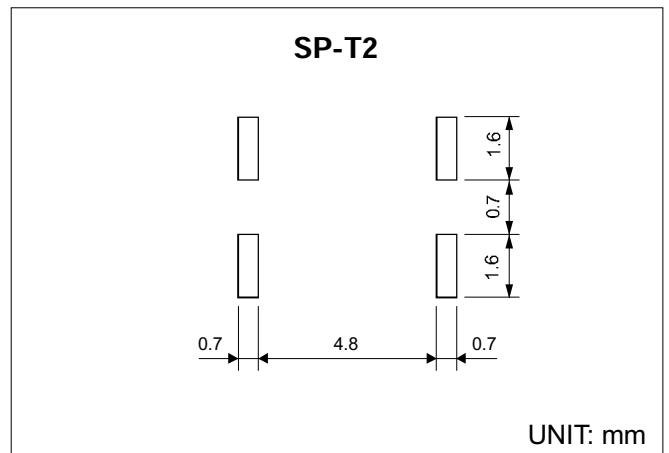
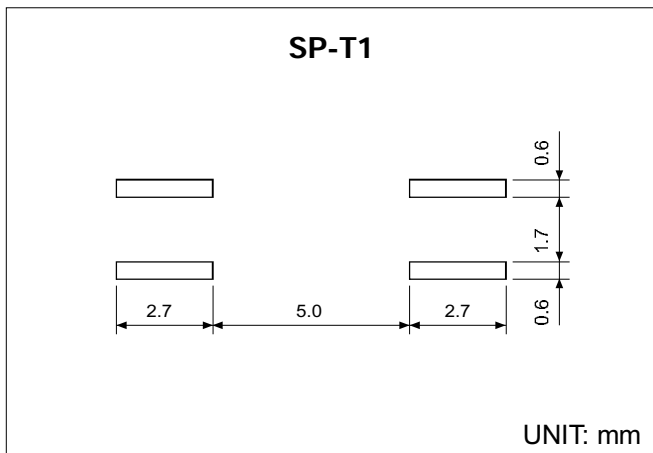


LEAD CONNECTION

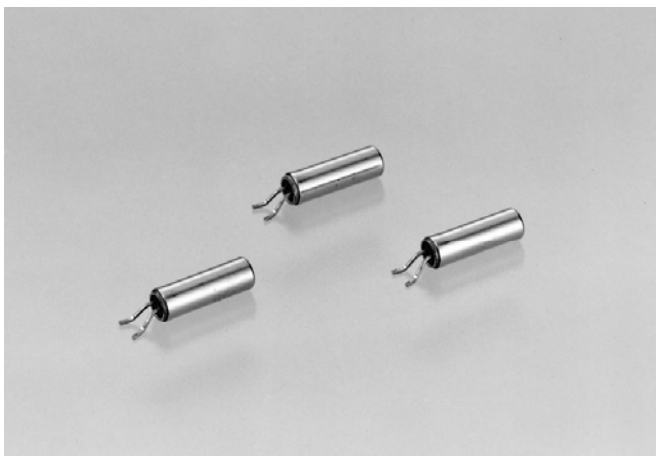


Note: Do not connect terminals #2, #3 of T1A and T2A to the outside electrode. These are dummy terminals.

TERMINAL LAND AREA (Projection to the PCB surface of the electrode lead)



Note: The drawings are not a PCB layout.



FEATURES

- IR reflowable tubular type crystal with lead bent in tape/reel.
- Suitable for automatic and high, density surface mounting.
- Excellent shock and heat resistance.

APPLICATIONS

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

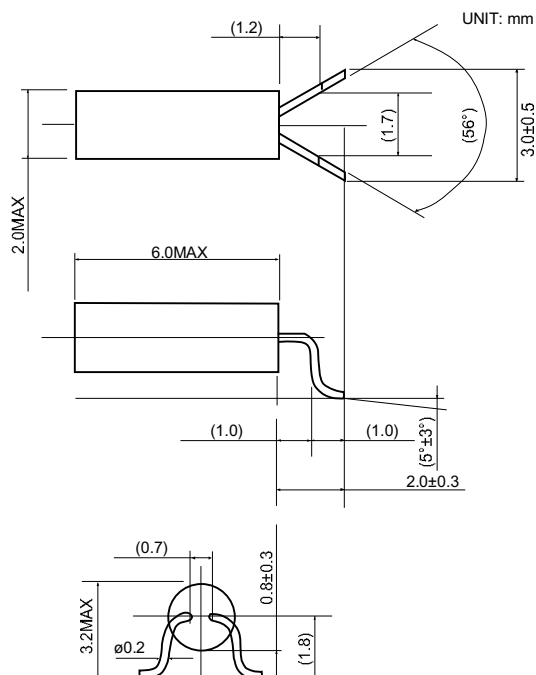
STANDARD SPECIFICATION

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

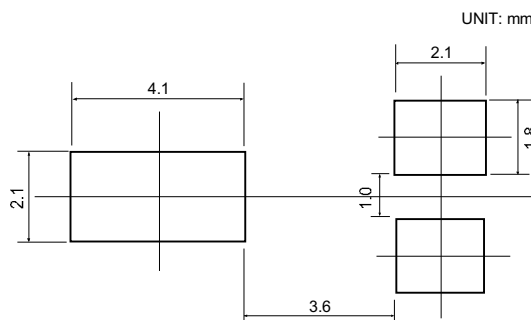
Item	Symbol	HTF-VT/VTC		Conditions / Note
Nominal Frequency	f ₀	32.768kHz	32.0kHz ~ 153.6kHz	
Frequency Tolerance	Δ f/f ₀	±30ppm, ±50ppm, ±100ppm		
Tuenover Temperature	T _p	+25°C±5°C	+25°C±8°C	
Temperature Coefficient	K	(-3.5±0.8)×10 ⁻⁹ /°C ²		
Load Capacitance	C _L	6.0 to 12.5pF		
Equivalent Series Resistance	R ₁	50kΩ max.		
Maximum Drive Level	DL _{max}	1.0μW		
Maximum Drive Level	DL	0.1μW		
Shunt Capacitance	C ₀	0.8pF typ.	0.5~0.9pF typ.	
Aging	Δ f/f ₀	±3ppm max.	±5ppm max.	+25°C±3°C, First Year
Operating Temperature Range	Tope	-20°C ~ +70°C		
Storage Temperature Range	Tsto	-40°C ~ +80°C		
Solderability	Tsol	230°C max., 20 sec. max. x 2times		IR Reflow

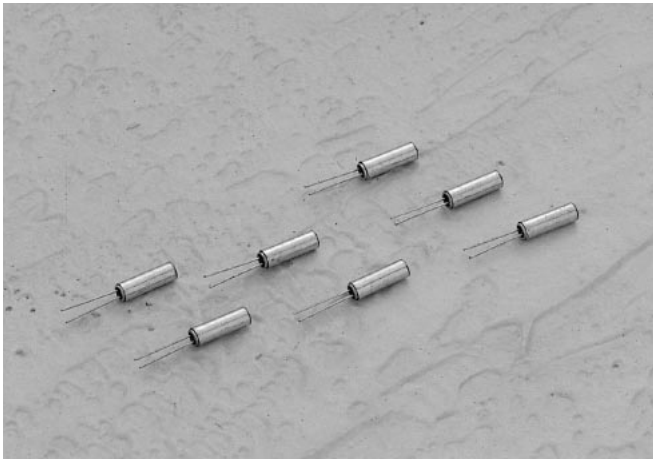
DIMENSIONS

(For details, please refer to individual specifications)



TERMINAL LAND AREA





FEATURES

- Compact tubular package.
- Photolithographic process.
- Excellent shock resistance and environmental characteristics.

APPLICATIONS

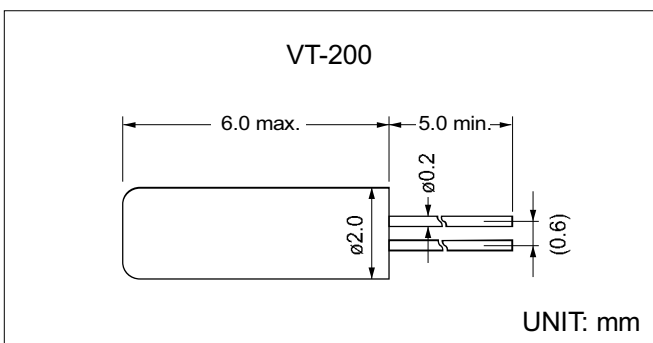
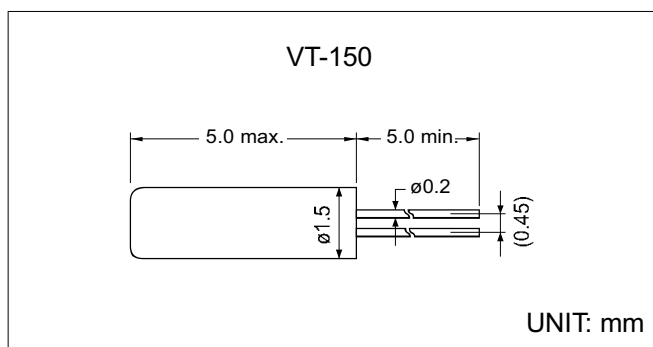
- Real Time Clocks, Timers, Pagers, Cameras, Remote-Controllers, Portable Applications

STANDARD SPECIFICATION

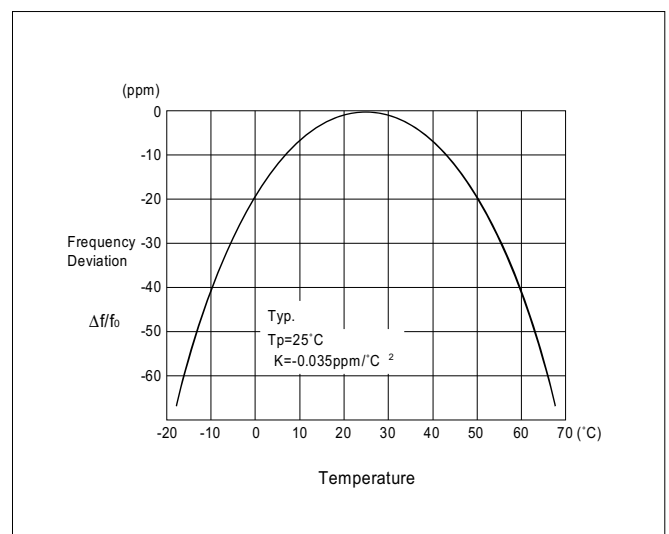
Conditions without notice (Temperature: +25°C±2°C)

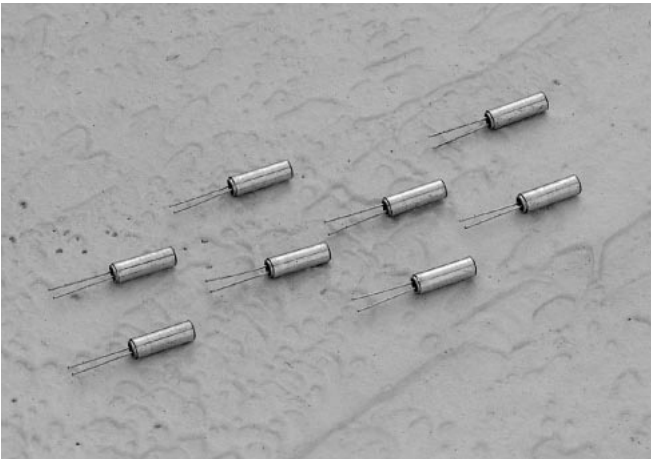
Item	Symbol	VT-150/VT-200	Conditions / Note
Nominal Frequency	f_0	32.768 kHz	
Frequency Tolerance	$\Delta f/f_0$	(±5ppm) ±10ppm, ±20ppm	
Turnover Temperature	T_p	+25°C±5°C	
Temperature Coefficient	K	$(-3.5 \pm 0.8) \times 10^{-8} / ^\circ\text{C}^2$	
Load Capacitance	C_L	4.5 to 12.5pF	
Equivalent Series Resistance	R_1	50kΩ max.	
Maximum Drive Level	DL	1μW max.	
Shunt Capacitance	C_0	0.86pF typ.	
Aging	$\Delta f/f_0$	±5ppm max.	+25°C±3°C, First Year
Operating Temperature Range	T_{ope}	-10°C to +60°C	
Storage Temperature Range	T_{sto}	-30°C to +70°C	
Reflow Profile	T_{sol}	280°C max. 5sec. max (Package 150°C max.)	Leads Only

DIMENSIONS



FREQUENCY-TEMPERATURE CURVE





FEATURES

- Compact tubular package.
- Low frequency coverage from 24kHz to 615kHz.
- Photolithographic process.
- Excellent shock resistance and environmental characteristics.

APPLICATIONS

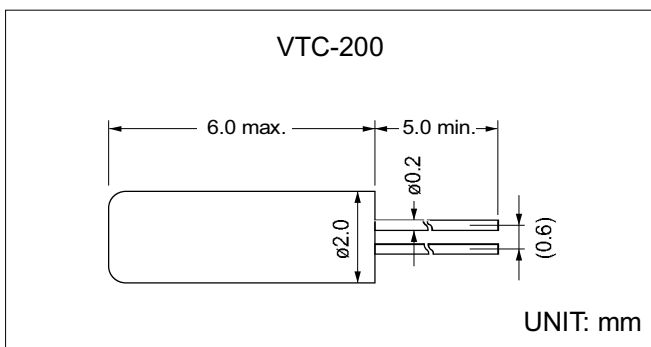
- Radio Communication Equipment, Clock Source for Micro-Computers, Pagers, Portable Applications

STANDARD SPECIFICATION

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

Item	Symbol	VTC-200				Conditions / Note
		24kHz to 49.9kHz	50kHz to 79.9kHz	80kHz to 350kHz	351kHz to 615kHz	
Nominal Frequency	f_0	24kHz to 49.9kHz	50kHz to 79.9kHz	80kHz to 350kHz	351kHz to 615kHz	
Frequency Tolerance	$\Delta f/f_0$	±30ppm, ±50ppm			±100ppm	
Turnover Temperature	T_p	+25°C±8°C			+25°C±15°C	
Temperature Coefficient	K	(-3.5±0.8)×10 ⁻⁸ /°C ²				
Load Capacitance	C_L	6.0 to 12.5pF				
Equivalent Series Resistance	R_1	50kΩ max.	35kΩ max.	25kΩ max.	15kΩ max.	
Maximum Drive Level	DL	1μW max.				
Shunt Level	C_0	0.8pF typ.		0.75pF typ.	0.7pF typ.	
Aging	$\Delta f/f_0$	±5ppm max.			+25°C±3°C, First Year	
Operating Temperature Range	T_{ope}	-10°C ~ +60°C				
Storage Temperature Range	T_{sto}	-30°C ~ +70°C				
Solderability	T_{sol}	280°C max., 5sec. max (Package 150°C max.)				Leads Only

DIMENSIONS

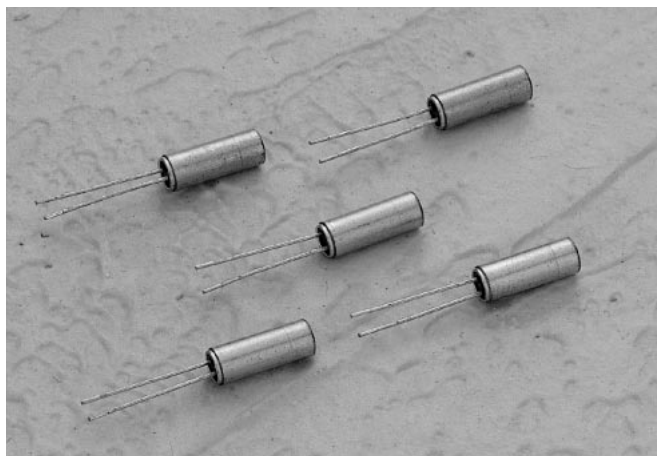


STANDARD FREQUENCIES

VTC-200			
24.000	75.000	100.000	307.200
26.667	76.800	106.000	614.400
31.200	77.025	130.000	
32.000	77.040	131.072	
38.000	77.056	150.000	
38.400	77.500	153.600	
40.000	96.000	200.000	
65.536	99.660	249.600	

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

High-Accuracy MAT Series High Accuracy Quartz Crystal Units



FEATURES

- Compact.
- Can be adapted for reflow.

APPLICATIONS

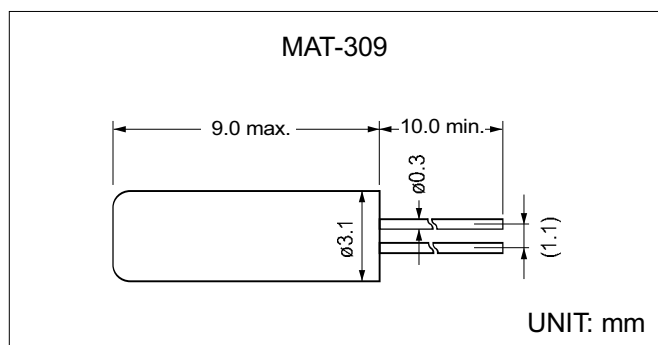
- Radio Communication Equipment, Pagers, Cellular Phones, Cordless Phones, PLL Standard Clock

STANDARD SPECIFICATIONS

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

Item	Symbol	MAT-309	Conditions / Note
Nominal Frequency	f_0	Please see the table below.	Fundamental
Frequency Tolerance	$\Delta f/f_0$	±10ppm	+25°C±3°C
Frequency Temperature Stability	$\Delta f/f_0$	Please see the table below.	
Load Capacitance	CL	Please see the table below.	
Equivalent Series Resistance	R ₁	30Ω max.	
Drive Level	DL	1 μW to 100 μW (10 μW TYP)	
Shunt Capacitance	C ₀	2.0pF±1.0pF	
Aging	$\Delta f/f_0$	±1ppm/Year (±1ppm/85°C x168H)	+25°C±1°C Subject to the test conditions for aging assessment shown in parenthesis.
Operating Temperature Range	Tope	-20°C ~ +70°C	
Storage Temperature Range	Tsto	-40°C ~ +85°C	
Solderability	Tsol	280°C max., 5sec. max (Package 150°C max.)	Leads Only

DIMENSIONS



STANDARD FREQUENCY & LOAD CAPACITANCE

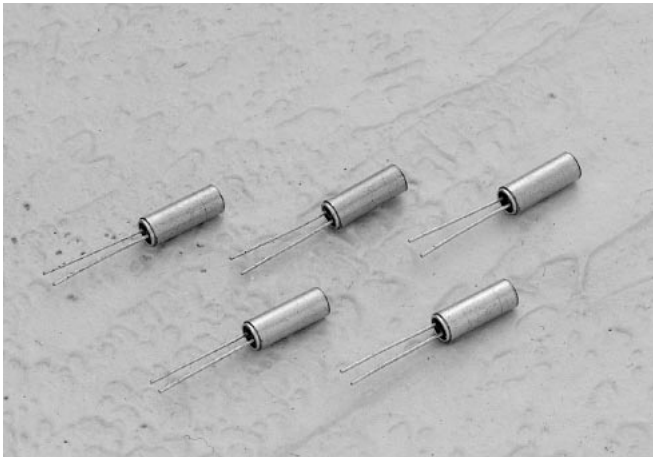
Standard Frequency	Load Capacitance	Standard Frequency	Load Capacitance
12.6 MHz	13PF	14.85 MHz	13PF
12.8 MHz	13PF	15.36 MHz	15PF
12.84 MHz	13PF	16.8 MHz	13PF
13.0 MHz	13PF	19.2 MHz*	13PF
14.4 MHz	13PF		

*19.199935MHz

FREQUENCY TEMPERATURE STABILITY

Operating Temperature Range	Frequency Temperature Stability
-20°C ~ +70°C	±7ppm max.
0°C ~ +50°C	±3ppm max.

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



FEATURES

- Wide frequency range coverage from 12MHz to 66MHz.

APPLICATIONS

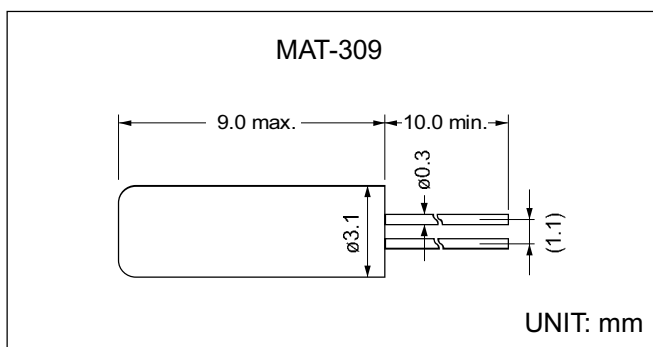
- Radio Communication Equipment, Pagers, Cellular Phones, Cordless Telephones, Clock Source for MicroComputers

STANDARD SPECIFICATION

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

Item	Symbol	MAT-309	Conditions / Note
Nominal Frequency	f ₀	12 MHz to 28 MHz	Fundamental
		28.1 MHz to 66 MHz	3rd Overtone
Frequency Tolerance	Δ f/f ₀	±15ppm, ±30ppm	
Frequency Temperature Stability	Δ f/f ₀	±15ppm, ±30ppm, ±50ppm	-10°C to +70°C
Load Capacitance	C _L	18pF	
Equivalent Series Resistance	R ₁	Please see the table below.	
Maximum Drive Level	DL	100 μW max.	
Shunt Capacitance	C ₀	5.0pF max.	
Aging	Δ f/f ₀	±5ppm max.	+25°C±3°C, First Year
Operating Temperature Range	Tope	-10°C ~ +70°C	
Storage Temperature Range	T _{sto}	-45°C ~ +80°C	
Solderability	T _{sol}	280°C max. 5sec. max (Package 150°C max.)	Leads Only

DIMENSIONS

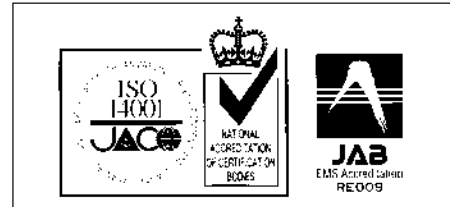


EQUIVALENT SERIES RESISTANCE

Type	Frequency	E.S.R
MAT-309	12.0MHz to 28.0MHz	60Ω max.
	28.1MHz to 66.0MHz	100Ω max.

IMPORTANT

1. The information herein is subject to change without notice.
2. Neither reproduction nor duplication of this catalog in whole or part is allowed without the prior written approval of Seiko Instruments Inc.
3. Circuits and respective application methods described herein are for reference only. Seiko Instruments Inc. is not responsible for any and all infringement or damages to the rights of third parties (including industrial properties) caused by the use of circuits or application methods herein. Seiko Instruments Inc. shall not license any industrial properties owned by Seiko Instruments Inc. or any third party through this catalog.
4. When products described herein include Strategic Products (or Services) stipulated in the Foreign Exchange and Trade Control Law, they shall not be exported without permission of governmental authorities.
5. The products described herein are consumer goods and not designed for application in life-sustaining equipment or other devices requiring very high-reliability. Seiko Instruments Inc. shall not bear any responsibilities arising out of or in connection to the use of the products contained herein for those applications.



SII Quartz Techno Ltd. who manufactures the products described in this catalog holds the ISO-9001, ISO-14001 quality system certificate.

SII 
Seiko Instruments Inc.
www.sii.co.jp/compo

Seiko Instruments Inc.

1-8, Nakase, Mihama-ku, Chiba-shi, Chiba 261, Japan
 Components Sales Div.
 Telephone :+81-43-211-1207 Facsimile :+81-43-211-8032
 E-mail:component@sii.co.jp

Seiko Instruments USA Inc.

Electronic Components Div.
 2990 W. Lomita Blvd., Torrance, CA 90505, U.S.A.
 Telephone :+1-310-517-7770 Facsimile :+1-909-975-5699
 (Free dial :800-934-9334)
 E-mail :seiko-eed@salessupport.com

Seiko Instruments GmbH

Siemensstrasse 9b 63263 Neu-Isenburg, Germany
 Telephone :+49-6102-297-0 Facsimile :+49-6102-297-320
 E-mail :sig@compuserve.com

Seiko Instruments (H.K.) Ltd.

4-5 / F, Wyler Centre 2,200 Tai Lin Pai Road, Kwai Chung,
 N.T., Kowloon, Hong Kong
 Telephone :+852-2421-8611 Facsimile :+852-2480-5479
 E-mail :sales@sih.com.hk

Seiko Instruments Taiwan Inc.

4FL, No.40, Sec. 2, Min Chuan E. Rd., Taipei, Taiwan, R.O.C.
 Telephone :+886-2-2563-5001 Facsimile :+886-2-2521-9519
 E-mail :public@sic.com.tw

Seiko Instruments Singapore Pte. Ltd.

2, Marsiling Lane Singapore 739144
 Telephone :+65-269-1370 Facsimile :+65-269-9729
 E-mail :seikocsd@pacific.net.sg

(Specification are subject to change without notice.)

This catalog is printed on recycled paper.

Released in Oct. 1998

CAT. NO. MATE. 5D1
 1-9807-020-MS/AC