

Quartz Crystal

Product Catalog





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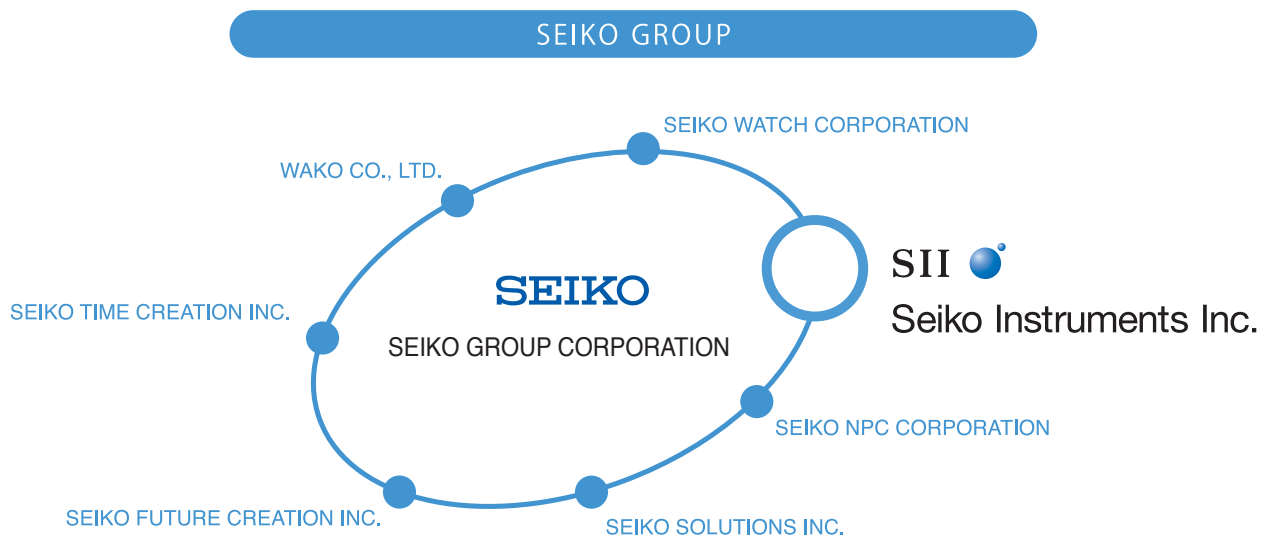
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Creating Time - Optimizing Time - Enriching Time

Seiko Instruments Inc. (SII), founded in 1937 as a member of the Seiko Group specializing in the manufacture of watches, has leveraged its core competency in high precision watches to create a wide range of new products and technologies.

Over the years SII has developed high-precision processed parts and machine tools featuring sub-micron precision manufacturing capabilities, quartz crystals that came about as a result of our quartz watch R&D, and electronic components such as micro batteries. Leveraging our extensive experience and expertise, we have since diversified into such new fields as compact, lightweight, exceedingly quiet thermal printers, and inkjet printheads, a key component in wide format inkjet printers for corporate use.

SII, in the years to come, will maintain an uncompromised dedication to its time-honored technologies and innovations of craftsmanship, miniaturization, and efficiency that meet the needs of our changing society and enrich the lives of those around us.



PRECISION, CRAFTSMANSHIP and MINIATURIZATION

Leveraging Watch Making Technology

🕒 With Precision, we apply our Craftsmanship to provide Miniaturization advantages to customers' product development around the world.

Stable and reliable

Rechargeable Battery & Capacitor

For the IoT
product

No corrosion, strong,
ultra high elasticity and
no magnetization
Superior material

"SPRON"

For material
used in harsh
environments

For magnetic
applied sensor
components

Excellent heat and
corrosion resistance

**Samarium-cobalt
Magnet**

"DIANET"

For wearable
devices

Small and powerful
Silver Oxide Battery

**Silver Oxide
Battery**

"SEIZAIKEN"

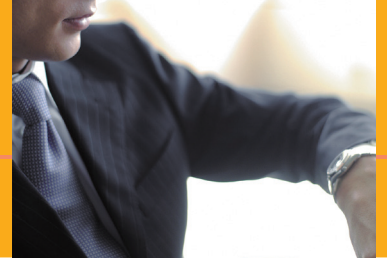
Precise Timing
with
Lowest Power
consumption

Precise Timing for
Electronic Devices

**Tuning Fork Quartz
Crystal Resonator**

Electronic Components and High-performance Materials

SII's electronic components were originally derived from the development and manufacturing of quartz watches.



Since 1953

**No corrosion, strong,
ultra high elasticity
Co-Ni alloy product**

"SPRON"

The sophisticated metal product, "SPRON", was born as a material to be used in a "mainspring", which is a drive source of mechanical watches. "SPRON" has been used for over 50 years as a drive source of watches by utilizing its high elasticity, high strength, and high heat resistance. Evaluated highly for its corrosion resistance and durable quality, "SPRON" is used for key devices in various fields.



Since 1975

**Small and powerful
Silver Oxide Battery
"SEIZAIKEN"**

A small-sized primary battery that features a large electrical capacity and almost no voltage drop until the last stage of electrical discharge even though its minimum diameter is 4 mm. Since the birth of quartz watches, we have developed batteries to increase their electrical capacity. We have also pursued better leakage resistance and long term reliability characteristics. It is expected to be used as a power supply for disposable, wearable, IoT, and the low energy Bluetooth products.



Since 1976

**Precise Timing for
Electronic Devices
Tuning Fork Quartz
Crystal Resonator**

Tuning Fork Quartz Crystal Resonators were developed as the basis for accuracy in the Quartz Watch. Our high quality and reliability was prioritized to meet the stringent requirements for watches. Recent demand in IoT developments where devices are required to operate with low power consumption and accurate communication protocol timing have increased the demand for smaller components with the same rugged reliability as is required in watches. For applications which require absolute lowest power consumption, our Timing Crystals are available in our Low CL specifications.



Since 1979

**Excellent heat and
corrosion resistance
Samarium-cobalt
Magnet
"DIANET"**

"DIANET", which has its origin in rotor magnets of quartz watches, has superior heat resistance and strong magnetic force even though its outside diameter is only 1 mm or less. The Sendai Unit acquired IATF 16949 Quality Management System for the automotive production industry. "DIANET" is used for a wide range of automotive products, and its advanced quality and performance are highly recognized. In addition, "DIANET" is also used in actuators of cameras for smart phones and medical devices.



Since 1988

**Stable and reliable
Rechargeable Battery
and Capacitor**

The rechargeable batteries supporting a wide temperature range of -40°C to 85°C are available in our lineup. They are suitable for operating very low power consumption devices, for backup power supply of clock and memory functions of a wide range of products. The capacitor will correspond to the new needs of energy harvesting devices. Capacitors are extremely useful in various applications.

Quartz Crystal Resonators

With Precision, we apply our Craftsmanship to provide Miniaturization advantages to customers' developed products around the world.

Features

- Mirror finishing wafer processing technology
- One of the largest quartz wafer manufacturing capabilities in the industry
- Manufacturing capacity for expanded wafer processing
- Extensive experience and manufacturing knowledge for Quartz tuning fork crystals

SMD type Quartz Crystal Resonator (Ceramic package)

Product name	Size (mm)	Frequency Tolerance (ppm) (*)	Parabolic Coefficient ($10^{-6}/^{\circ}\text{C}^2$)	Load Capacitance (pF)	Motional Resistance (k Ω)	Operating Temp. ($^{\circ}\text{C}$)	Storage Temp. ($^{\circ}\text{C}$)	Remarks
SC-10S	1.0x0.8x0.32	± 20	$(-0.036 \pm 10\%)$	4, 6, 7, 9, 12.5	90	-40 to +85	-55 to +125	
SC-12S	1.2x1.0x0.50	± 20	$(-0.036 \pm 10\%)$	4, 6, 7, 9, 12.5	90	-40 to +85	-55 to +125	2 terminals / 4 terminals
SC-16S	1.6x1.0x0.5	± 20	$(-0.036 \pm 10\%)$	4, 6, 7, 9, 12.5	90	-40 to +85	-55 to +125	
SC-16P	1.6x1.0x0.5	± 20	$(-0.036 \pm 10\%)$	4, 6, 7, 9, 12.5	50	-55 to +125	-55 to +125	Low ESR product
SC-20S	2.0x1.2x0.60	± 20	$(-0.030 \pm 10\%)$	4, 6, 7, 9, 12.5	70	-40 to +85	-55 to +125	
SC-20P	2.0x1.2x0.60	± 20	$(-0.030 \pm 10\%)$	4, 6, 7, 9, 12.5	50	-40 to +85	-55 to +125	Low ESR type
SC-20T	2.0x1.2x0.35/0.33	± 20	$(-0.033 \pm 10\%)$	6, 7, 9, 12.5	75	-40 to +85	-55 to +125	Low height
SC-20A	2.0x1.2x0.60	± 20	$(-0.028 \pm 10\%)$	6, 7, 9, 12.5	90	-55 to +125	-55 to +125	For automotive use AEC-Q200
SC-32S	3.2x1.5x0.85	± 20	$(-0.030 \pm 10\%)$	4, 6, 7, 9, 12.5	70	-40 to +85	-55 to +125	
SC-32P	3.2x1.5x0.85	± 20	$(-0.033 \pm 10\%)$	4, 6, 7, 9, 12.5	50	-40 to +85	-55 to +125	Low ESR product
SC-32L	3.2x1.5x0.85	± 20	$(-0.033 \pm 10\%)$	4, 6, 7, 9, 12.5	40	-40 to +85	-55 to +125	Low ESR product
SC-32A	3.2x1.5x0.85	± 20	$(-0.030 \pm 10\%)$	6, 7, 9, 12.5	70	-55 to +125	-55 to +125	For automotive use AEC-Q200

* Please contact us and specify your requirements.

SMD type Quartz Crystal Resonator (Plastic mold)

Product name	Size (mm)	Frequency Tolerance (ppm) (*)	Parabolic Coefficient ($10^{-6}/^{\circ}\text{C}^2$)	Load Capacitance (pF)	Motional Resistance (k Ω)	Operating Temp. ($^{\circ}\text{C}$)	Storage Temp. ($^{\circ}\text{C}$)	Remarks
SSP-T7-F	7.0x1.5x1.4	± 20	$(-0.033 \pm 10\%)$	7, 9, 12.5	65	-40 to +85	-55 to +125	
SSP-T7-FL	7.0x1.5x1.4	± 20	$(-0.033 \pm 10\%)$	3.7, 4.4, 6	65	-40 to +85	-55 to +125	Low CL Type

Cylinder type Quartz Crystal Resonator

Product name	Size (mm)	Frequency Tolerance (ppm) (*)	Parabolic Coefficient ($10^{-6}/^{\circ}\text{C}^2$)	Load Capacitance (pF)	Motional Resistance (k Ω)	Operating Temp. ($^{\circ}\text{C}$)	Storage Temp. ($^{\circ}\text{C}$)	Remarks
VT-200-F	$\Phi 2 \times 6$	± 20	$(-0.035 \pm 10\%)$	7, 9, 12.5	50	-40 to +85	-40 to +85	
VT-200-FL	$\Phi 2 \times 6$	± 20	$(-0.035 \pm 10\%)$	3.7, 4.4, 6	50	-40 to +85	-40 to +85	Low CL Type

SMD type Crystal Oscillator (Ceramic package)

Product name	Size (mm)	Frequency tolerance (ppm)	Frequency temperature coefficient -40 to +85 $^{\circ}\text{C}$ (ppm)	Current consumption Typ. (μA)	Supply voltage (V)	Temperature Compensated voltage (V)	Operating Temp. ($^{\circ}\text{C}$)	Storage Temp. ($^{\circ}\text{C}$)
SH-32R	3.2x1.5x0.9	± 3	± 50	1.3	1.3 to 3.63	1.5 to 3.63	-40 to +85	-40 to +105
SN-20S	2.05x1.2x0.85	± 20	+10/-120	0.35	1.2 to 5.5	--	-40 to +85	-55 to +125

Application



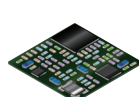
ECU / ADAS Applications



DSC



Note PC



Wireless communication module



Healthcare Devices



Medical Wearables



Car Navigation Systems



Smart meter



Surveillance camera



Wearable device

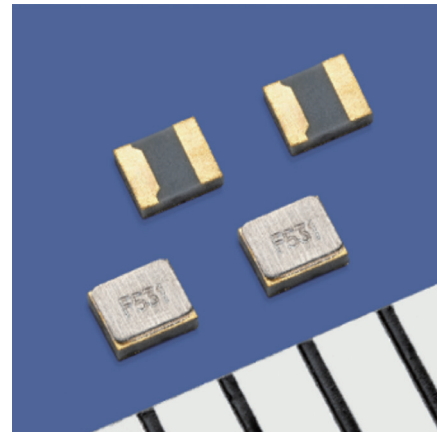
SC-10S

FEATURES

- World's smallest-class 32kHz crystal with dimensions of 1.0×0.8×0.32mm.
- SMD type suitable for high-density mounting.
- Excellent shock resistance and heat resistance.
- Completely Pb-free.
- Incorporates a crystal resonator manufactured using highly reliable photolithographic technology.

APPLICATIONS

Smart rings, GPS modules, Smartwatches, Hearing Aids, Various microcomputer sub-clocks, Various communication modules

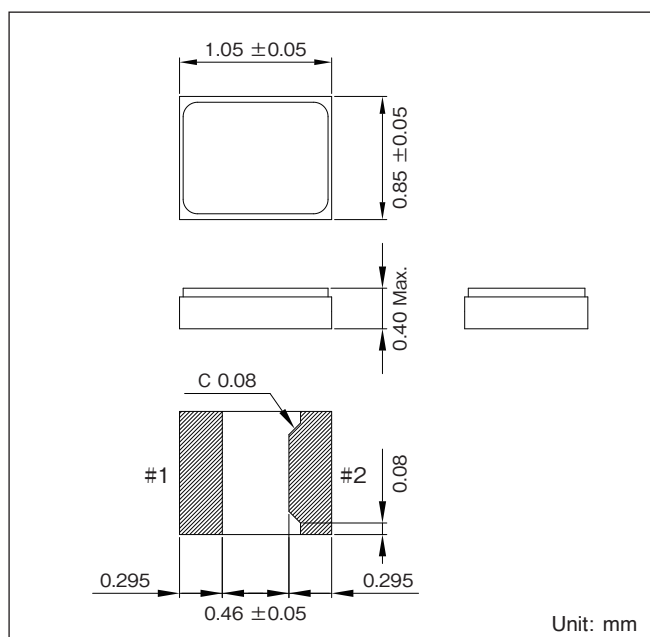


STANDARD SPECIFICATIONS

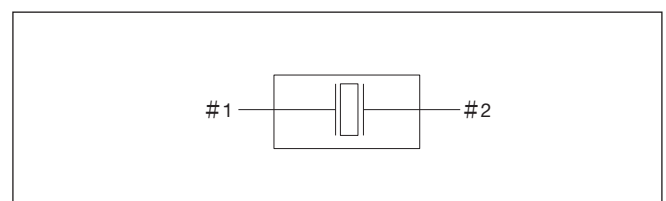
Conditions where not specified (Temperature: 25±2°C, DL: 0.1μW)

Item	Symbol	Specifications	Conditions / Notes
Nominal Frequency	f _{nom}	32.768kHz	
Frequency Tolerance	f _{tol}	±20×10 ⁻⁶	* Please contact us about available tolerance.
Turnover Temperature	T _i	+25±5°C	
Parabolic Coefficient	β	(-0.036±10%) ×10 ⁻⁶ /°C ²	
Load Capacitance	C _L	4pF, 6pF, 7pF, 9pF, 12.5pF	* Please contact us about available CL.
Motional Resistance (ESR)	R ₁	90kΩ Max.	
Absolute Maximum Drive Level	DL _{max}	0.3μW Max.	
Drive Level	DL	0.1μW Typ.	
Shunt Capacitance	C ₀	1.1pF Typ.	
Frequency Ageing	f _{age}	±5×10 ⁻⁶ /year	+25±3°C, First Year
Operating Temperature	T _{use}	-40°C to +85°C	
Storage Temperature	T _{stg}	-55°C to +125°C	Storage as single product

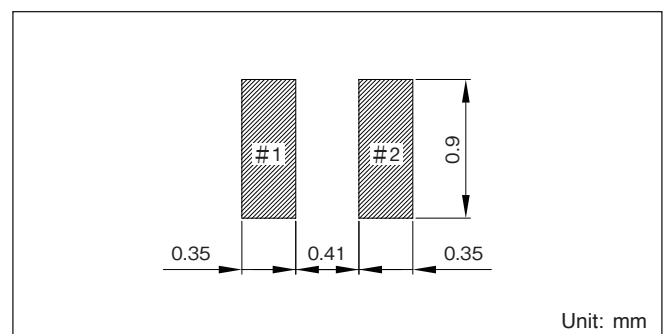
DIMENSIONS



INTERNAL LEAD CONNECTION



RECOMMENDED SOLDERING PATTERN



Remark: When designing the circuit board, do not place circuit patterns on the crystal resonator mounting area (bottom surface).

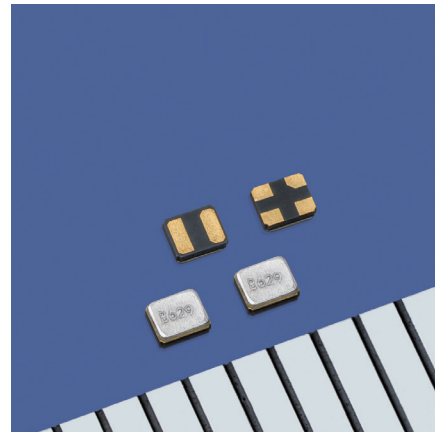
SC-12S

FEATURES

- Ultra-small package (1.2×1.0×0.5mm Max.).
- SMD type suitable for high density surface mounting.
- Excellent shock and heat resistance.
- Pb-free.
- Complies with EU RoHS directive.
- Incorporates a crystal resonator manufactured using highly reliable photolithographic technology.

APPLICATIONS

Smart rings, smartwatches, wearable devices
Various communication modules, various microcontrollers
sub-clocks, Reference clocks for real-time clock applications

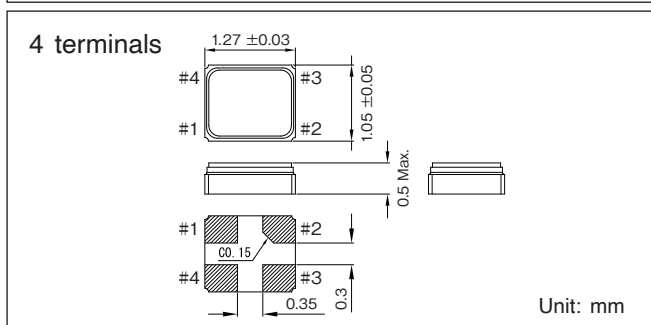
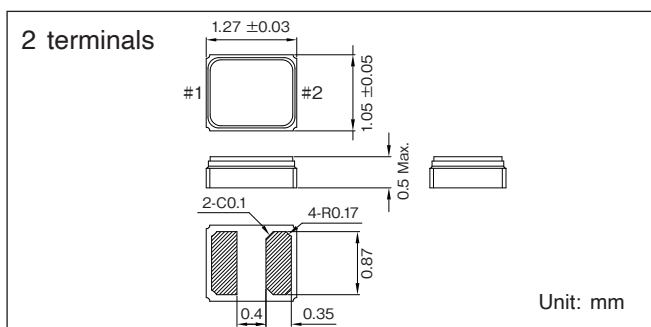


STANDARD SPECIFICATIONS

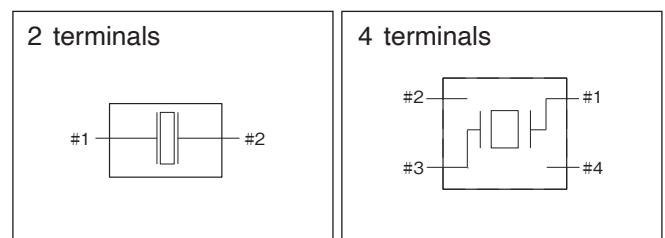
Conditions where not specified (Temperature: 25±2°C, DL: 0.1μW)

Item	Symbol	Specifications		Conditions / Notes
		2 terminals	4 terminals	
Nominal Frequency	f _{nom}	32.768kHz		
Frequency Tolerance	f _{tol}	±20×10 ⁻⁶		* Please contact us about available tolerance.
Turnover Temperature	T _i	+25±5°C		
Parabolic Coefficient	β	(−0.036±10%) × 10 ⁻⁶ /°C ²		
Load Capacitance	C _L	4pF, 6pF, 7pF, 9pF, 12.5pF		* Please contact us about available CL.
Motional Resistance (ESR)	R ₁	90kΩ Max.		
Absolute Maximum Drive Level	DLmax.	0.3μW Max.		
Drive Level	DL	0.1μW Typ.		
Shunt Capacitance	C ₀	1.4pF Typ.		
Frequency Ageing	f _{age}	±5×10 ⁻⁶		+25±3°C, First Year
Operating Temperature	T _{use}	−40°C to +85°C		
Storage Temperature	T _{stg}	−55°C to +125°C		Storage as single product

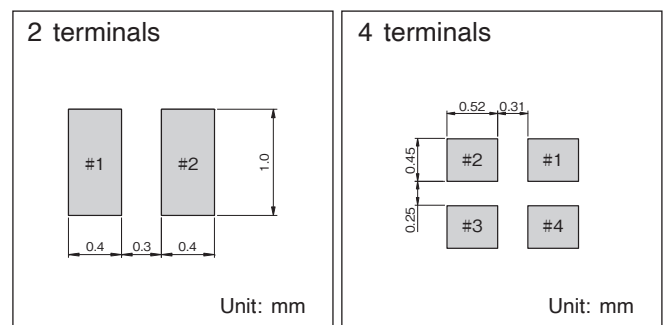
DIMENSIONS



INTERNAL LEAD CONNECTION



RECOMMENDED SOLDERING PATTERN



Remark: When designing the circuit board, do not place circuit patterns on the crystal resonator mounting area (bottom surface).

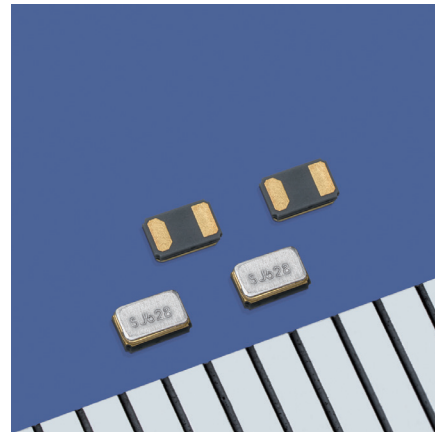
SC-16S

FEATURES

- SMD type suitable for high density surface mounting.
- Thin type with height 0.5mm max.
- Excellent shock and heat resistance.
- Pb-free.
- Complies with EU RoHS directive.
- Incorporates a crystal resonator manufactured using highly reliable photolithographic technology.

APPLICATIONS

Smart rings, smartwatches, wearable devices
Various communication modules, various microcontrollers
sub-clocks, Reference clocks for real-time clock applications

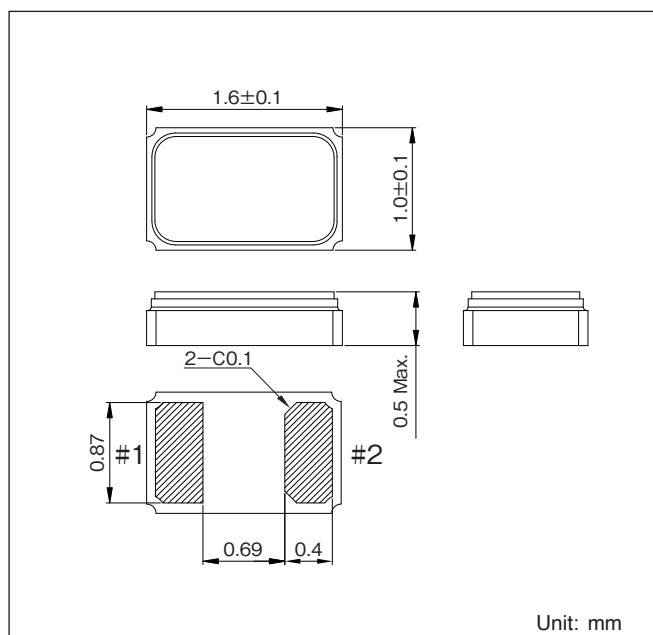


STANDARD SPECIFICATIONS

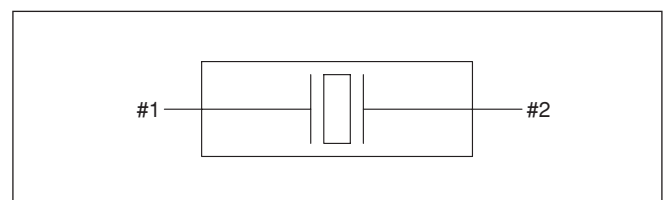
Conditions where not specified (Temperature: 25±2°C, DL: 0.1μW)

Item	Symbol	Specifications	Conditions / Notes
Nominal Frequency	f _{nom}	32.768kHz	
Frequency Tolerance	f _{tol}	±20×10 ⁻⁶	* Please contact us about available tolerance.
Turnover Temperature	T _i	+25±5°C	
Parabolic Coefficient	β	(-0.036±10%)×10 ⁻⁶ /°C ²	
Load Capacitance	C _L	4pF, 6pF, 7pF, 9pF, 12.5pF	* Please contact us about available CL.
Motional Resistance (ESR)	R ₁	90kΩ Max.	
Absolute Maximum Drive Level	DL _{max.}	0.5μW Max.	
Drive Level	DL	0.1μW Typ.	
Shunt Capacitance	C ₀	1.2pF 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	Storage as single product

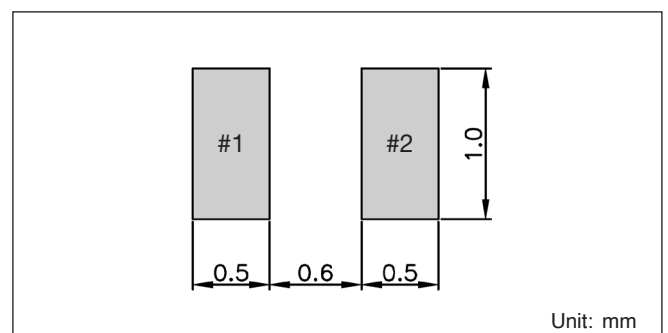
DIMENSIONS



INTERNAL LEAD CONNECTION



RECOMMENDED SOLDERING PATTERN



Remark: When designing the circuit board, do not place circuit patterns on the crystal resonator mounting area (bottom surface).

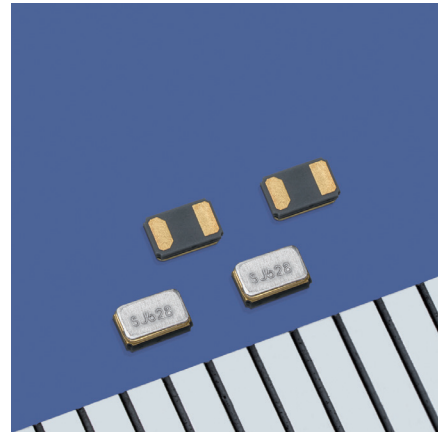
SC-16P(R1=50kΩ Max.) Low ESR Series

FEATURES

- Suitable for microcontrollers requiring low-ESR crystals (R1: 50 kΩ max.). R1 specifications are available for various operating temperature ranges.
- SMD type suitable for high-density mounting.
- Excellent shock resistance and heat resistance.
- Completely Pb-free.
- Highly reliable photolithography-processed crystal unit.

APPLICATIONS

Smart rings, PCs, Notebook, smartwatches,
Various microcontrollers sub-clocks,
Various communication modules

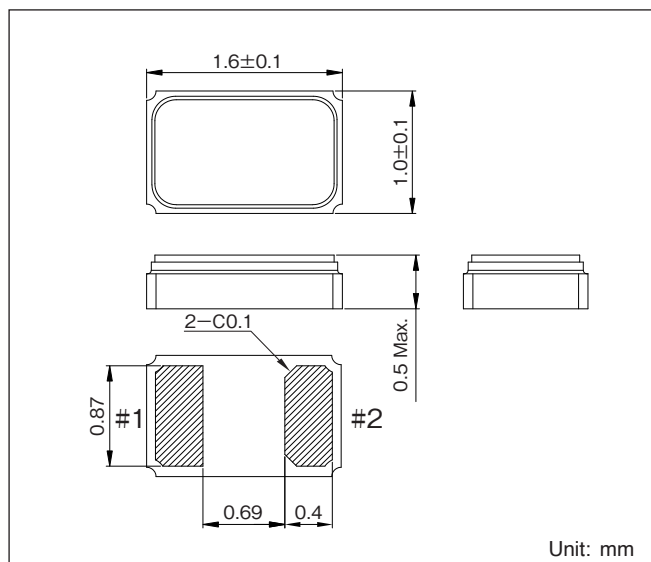


STANDARD SPECIFICATIONS

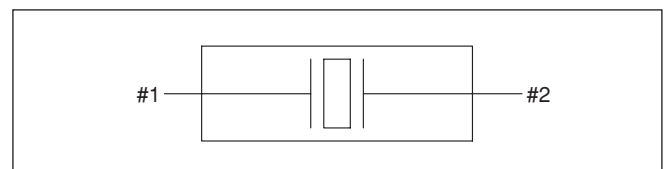
Conditions where not specified (Temperature: 25±2°C, DL: 0.1μW)

Item	Symbol	Specifications	Conditions / Notes
Nominal Frequency	f _{nom}	32.768kHz	
Frequency Tolerance	f _{tol}	±20×10 ⁻⁶	
Turnover Temperature	T _i	+25±5°C	
Parabolic Coefficient	β	(-0.035±10%)×10 ⁻⁶ /°C ²	
Load Capacitance	C _L	4pF, 6pF, 7pF, 9pF, 12.5pF	* Please contact us about available CL.
Motional Resistance (ESR)	R ₁	37kΩ Typ. / 50kΩ Max.	At room temperature
		a) 60kΩ Max.	-40°C to +85°C
		b) 70kΩ Max.	-40°C to +105°C
		c) 80kΩ Max.	-55°C to +125°C
Absolute Maximum Drive Level	DL _{max.}	0.5μW Max.	
Drive Level	DL	0.1μW Typ.	
Shunt Capacitance	C ₀	1.8pF Typ.	
Frequency Ageing	f _{age}	±3×10 ⁻⁶ /year	First Year
Operating Temperature	T _{use}	-55°C to +125°C Max.	Each specification
Storage Temperature	T _{stg}	-55°C to +125°C	Stored individually

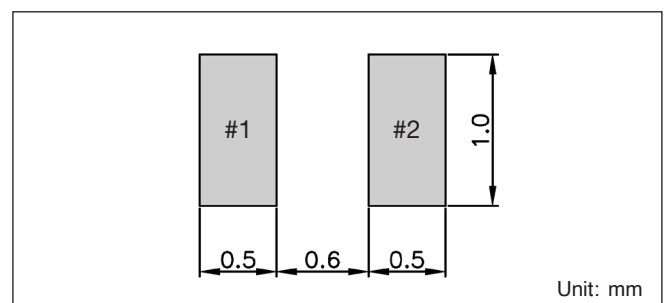
DIMENSIONS



INTERNAL LEAD CONNECTION



RECOMMENDED SOLDERING PATTERN



Remark: When designing the circuit board, do not place circuit patterns on the crystal resonator mounting area (bottom surface).

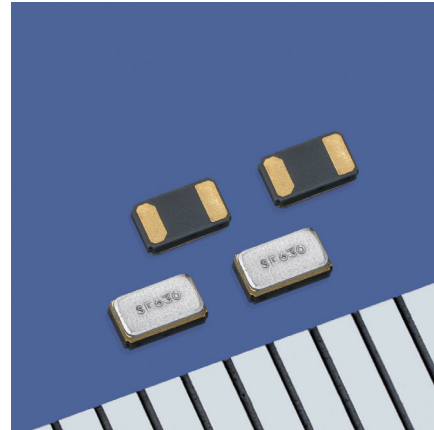
SC-20S

FEATURES

- Thin type with height 0.6mm max.
- SMD type suitable for high density surface mounting.
- Excellent shock and heat resistance.
- Pb-free.
- Complies with EU RoHS directive.
- Incorporates a crystal resonator manufactured using highly reliable photolithographic technology.

APPLICATIONS

Mobile Phones, Wearables, Modules, Sub-clock function for a variety of microcontrollers, etc.

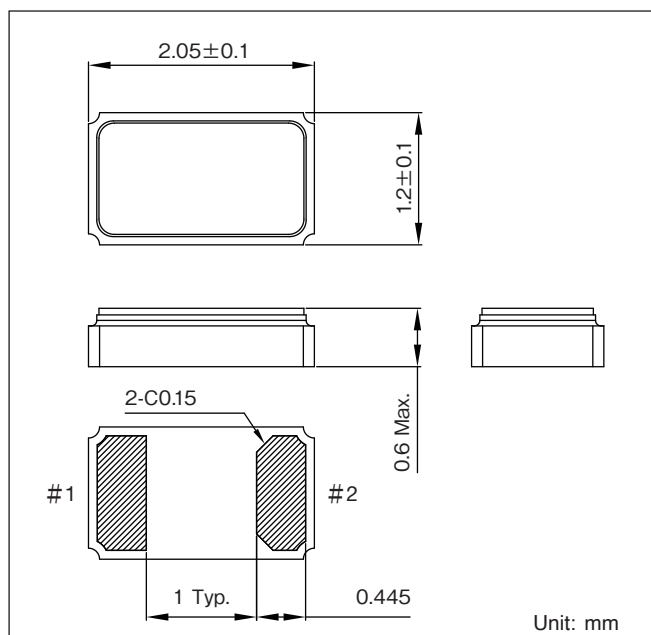


STANDARD SPECIFICATIONS

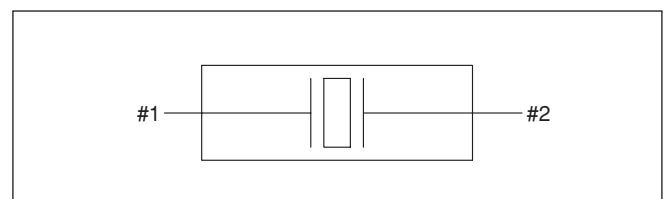
Conditions where not specified (Temperature: 25±2°C, DL: 0.1μW)

Item	Symbol	Specifications	Conditions / Notes
Nominal Frequency	f _{nom}	32.768kHz	
Frequency Tolerance	f _{tol}	±20×10 ⁻⁶	* Please contact us about available tolerance.
Turnover Temperature	T _i	+25±5°C	
Parabolic Coefficient	β	(-0.030±10%)×10 ⁻⁶ /°C ²	
Load Capacitance	C _L	4pF, 6pF, 7pF, 9pF, 12.5pF	* Please contact us about available CL.
Motional Resistance (ESR)	R ₁	70kΩ Max.	
Absolute Maximum Drive Level	DL _{max.}	1.0μW Max.	
Drive Level	DL	0.1μW Typ.	
Shunt Capacitance	C ₀	1.3pF 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	Storage as single product

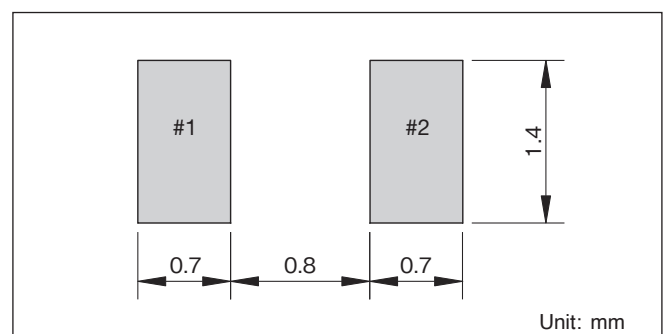
DIMENSIONS



INTERNAL LEAD CONNECTION



RECOMMENDED SOLDERING PATTERN



Remark: When designing the circuit board, do not place circuit patterns on the crystal resonator mounting area (bottom surface).

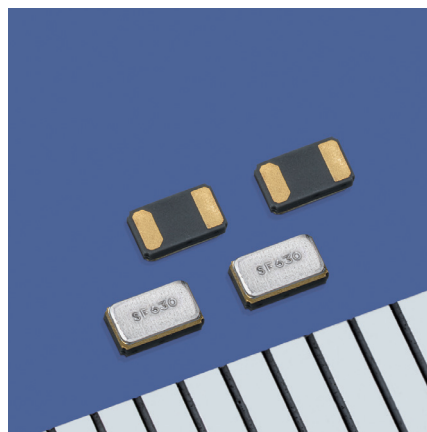
SC-20P (R1=50kΩ Max.) Low ESR Series

FEATURES

- Suitable for microcontrollers requiring low-ESR crystals (R1=50kΩ Max.).
- SMD type suitable for high density surface mounting.
- Excellent shock and heat resistance.
- Pb-free.
- Complies with EU RoHS directive.
- Incorporates a crystal resonator manufactured using highly reliable photolithographic technology.

APPLICATIONS

PCs, Tablets, Modules, Wearables, Sub-clock function for a variety of Microcontroller, etc.

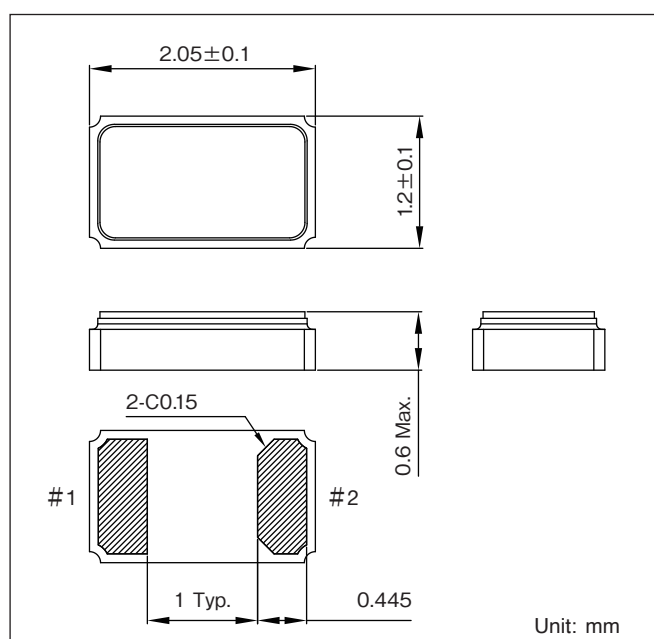


STANDARD SPECIFICATIONS

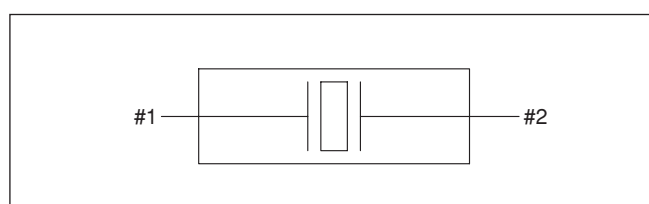
Conditions where not specified (Temperature: 25±2°C, DL: 0.1μW)

Item	Symbol	Specifications	Conditions / Notes
Nominal Frequency	f_nom	32.768kHz	
Frequency Tolerance	f_tol	±20×10 ⁻⁶	* Please contact us about available tolerance.
Turnover Temperature	Ti	+25±5°C	
Parabolic Coefficient	β	(-0.029±10%)×10 ⁻⁶ /°C ²	
Load Capacitance	C _L	4pF, 6pF, 7pF, 9pF, 12.5pF	* Please contact us about available CL.
Motional Resistance (ESR)	R ₁	50kΩ Max.	-40°C to +85°C
Absolute Maximum Drive Level	DLmax.	1.0μW Max.	
Drive Level	DL	0.1μW Typ.	
Shunt Capacitance	C ₀	1.5pF Typ.	
Frequency Ageing	f_age	±5×10 ⁻⁶	+25±3°C, First Year
Operating Temperature	T_use	-40°C to +85°C	
Storage Temperature	T_stg	-55°C to +125°C	Storage as single product

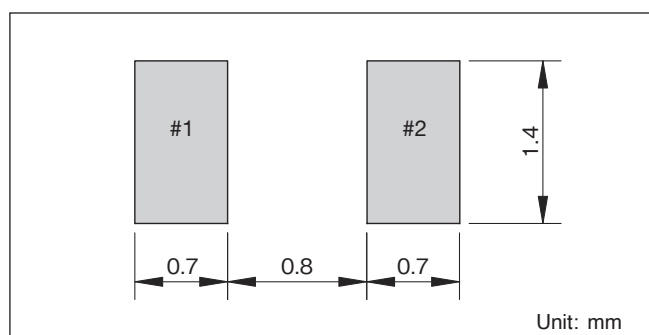
DIMENSIONS



INTERNAL LEAD CONNECTION



RECOMMENDED SOLDERING PATTERN



Remark: When designing the circuit board, do not place circuit patterns on the crystal resonator mounting area (bottom surface).

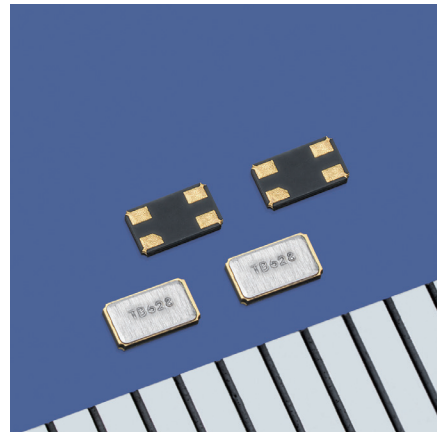
SC-20T $t=0.35\text{mm} / 0.33\text{mm}$

FEATURES

- Ultra-thin package with a maximum height of 0.35 or 0.33 mm.
- SMD type suitable for high density surface mounting.
- Excellent shock and heat resistance.
- Pb-free.
- Complies with EU RoHS directive.
- Incorporates a crystal resonator manufactured using highly reliable photolithographic technology.

APPLICATIONS

Smart card, Wearables, Modules, Sub-clock function for a variety of microcontrollers, etc.

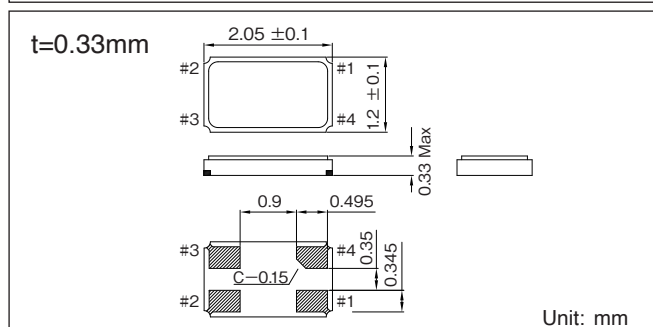
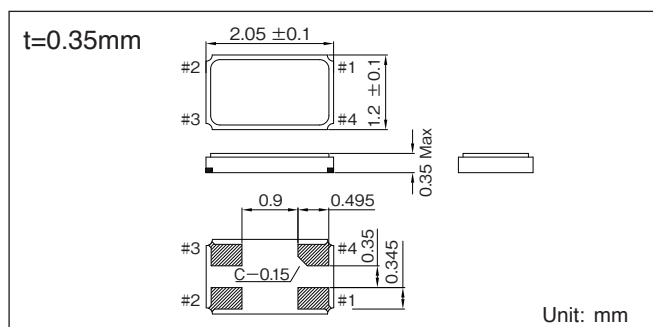


STANDARD SPECIFICATIONS

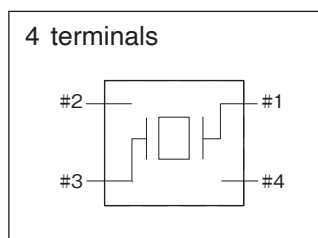
Conditions where not specified (Temperature: $25\pm 2^{\circ}\text{C}$, DL: $0.1\mu\text{W}$)

Item	Symbol	Specifications		Conditions / Notes
		0.35mm	0.33mm	
Nominal Frequency	f_{nom}	32.768kHz		
Frequency Tolerance	f_{tol}	$\pm 20 \times 10^{-6}$		* Please contact us about available tolerance.
Turnover Temperature	T_i	$+25 \pm 5^{\circ}\text{C}$		
Parabolic Coefficient	β	$(-0.033 \pm 10\%) \times 10^{-6}/^{\circ}\text{C}^2$		
Load Capacitance	C_L	6pF, 7pF, 9pF, 12.5pF		* Please contact us about available CL.
Motional Resistance (ESR)	R_1	75k Ω Max.	80k Ω Max.	
Absolute Maximum Drive Level	DLmax.	1.0 μW Max.		
Drive Level	DL	0.1 μW Typ.		
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}	-40°C to $+85^{\circ}\text{C}$		
Storage Temperature	T_{stg}	-55°C to $+125^{\circ}\text{C}$		Storage as single product

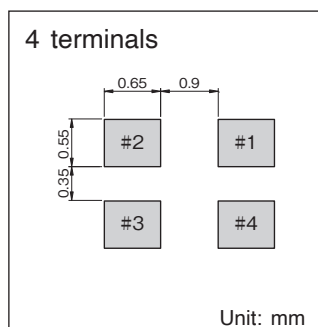
DIMENSIONS



INTERNAL LEAD CONNECTION



RECOMMENDED SOLDERING PATTERN



Remark: When designing the circuit board, do not place circuit patterns on the crystal resonator mounting area (bottom surface).

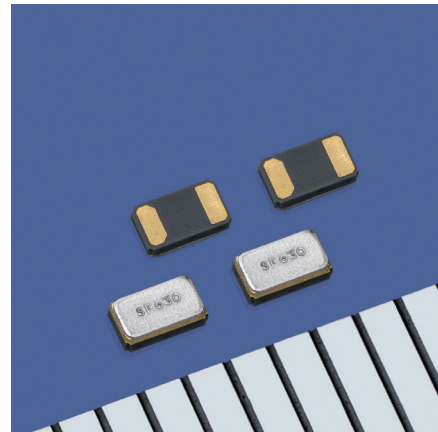
SC-20A (For automotive use)

FEATURES

- Conforms to "AEC-Q200".
- Thin type with height 0.6mm max.
- SMD type suitable for high density surface mounting.
- Excellent shock and heat resistance.
- Pb-free.
- Complies with EU RoHS directive.
- Incorporates a crystal resonator manufactured using highly reliable photolithographic technology.

APPLICATIONS

Car audio system, Car navigation System, ECU sub-clock, TPMS.

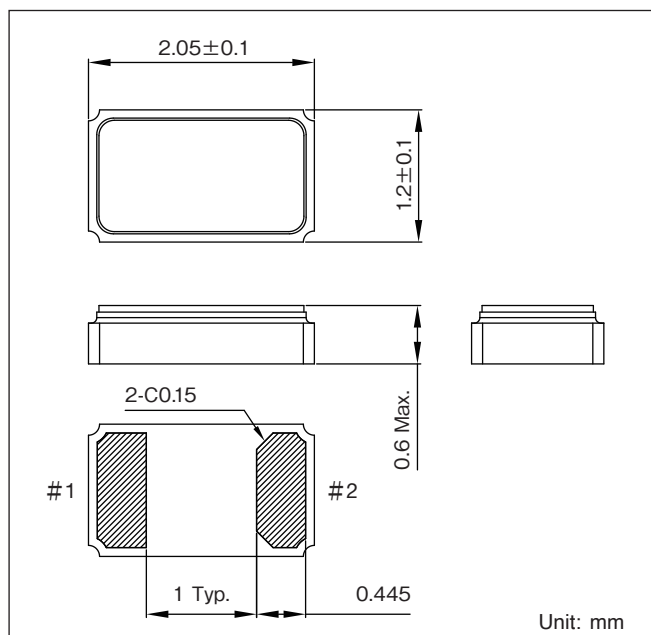


STANDARD SPECIFICATIONS

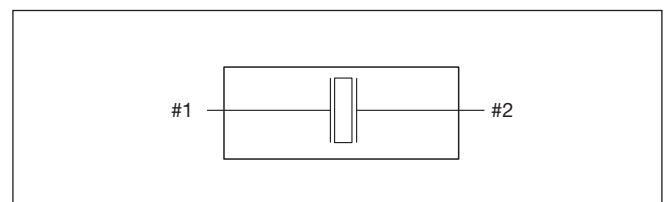
Conditions where not specified (Temperature: 25±2°C, DL: 0.1μW)

Item	Symbol	Specifications	Conditions / Notes
Nominal Frequency	f_nom	32.768kHz	
Frequency Tolerance	f_tol	±20×10 ⁻⁶	* Please contact us about available tolerance.
Turnover Temperature	Ti	+25±5°C	
Parabolic Coefficient	β	(-0.028±10%)×10 ⁻⁶ /°C ²	
Load Capacitance	C _L	6pF, 7pF, 9pF, 12.5pF	* Please contact us about available CL.
Motional Resistance (ESR)	R ₁	90kΩ Max.	
Absolute Maximum Drive Level	DLmax.	1.0μW Max.	
Drive Level	DL	0.1μW Typ.	
Shunt Capacitance	C ₀	1.3pF Typ.	
Frequency Ageing	f_age	±3×10 ⁻⁶	+25±3°C, First Year
Operating Temperature	T_use	-55°C to +125°C	
Storage Temperature	T_stg	-55°C to +125°C	Storage as single product

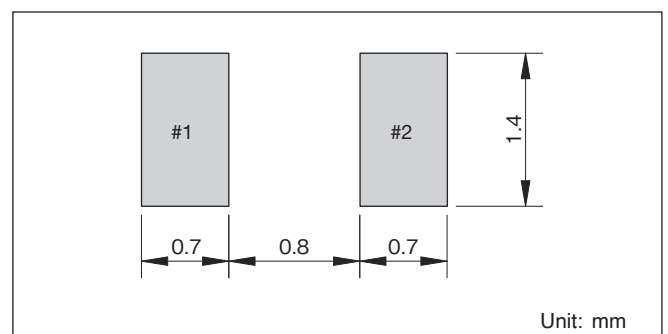
DIMENSIONS



INTERNAL LEAD CONNECTION



RECOMMENDED SOLDERING PATTERN



Remark: When designing the circuit board, do not place circuit patterns on the crystal resonator mounting area (bottom surface).

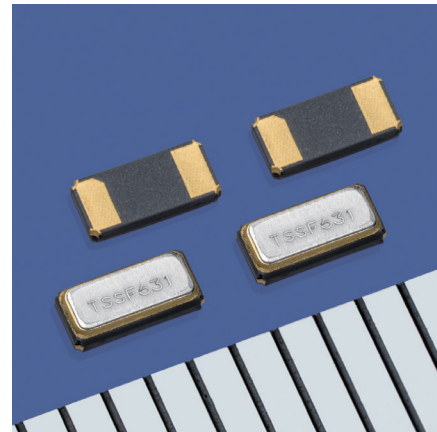
SC-32S

FEATURES

- Thin type with height 0.85mm max.
- SMD type suitable for high density surface mounting.
- Excellent shock and heat resistance.
- Pb-free.
- Complies with EU RoHS directive.
- Incorporates a crystal resonator manufactured using highly reliable photolithographic technology.

APPLICATIONS

Mobile Phones, Wearables, Modules, Sub-clock function for a variety of microcontrollers, etc.

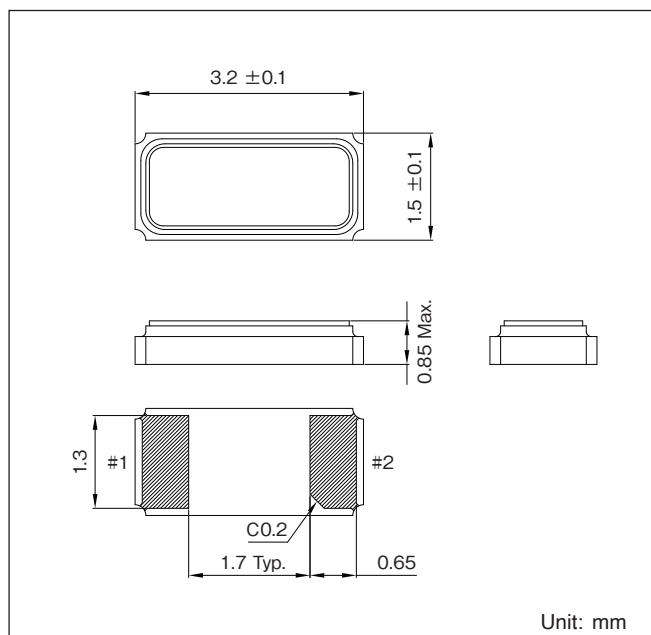


STANDARD SPECIFICATIONS

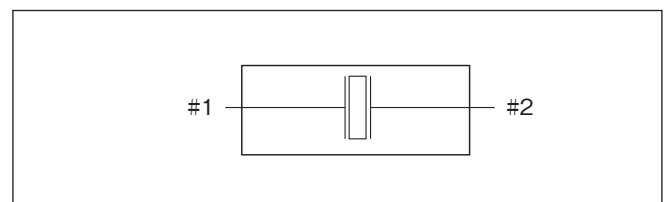
Conditions where not specified (Temperature: 25±2°C, DL: 0.1μW)

Item	Symbol	Specifications		Conditions / Notes
Nominal Frequency	f _{nom}	32.768kHz	38.4kHz	
Frequency Tolerance	f _{tol}	±20×10 ⁻⁶		* Please contact us about available tolerance.
Turnover Temperature	T _i	+25±5°C		
Parabolic Coefficient	β	(-0.030±10%)×10 ⁻⁶ /°C ²		
Load Capacitance	C _L	4pF, 6pF, 7pF, 9pF, 12.5pF		* Please contact us about available CL.
Motional Resistance (ESR)	R ₁	70kΩ Max.		
Absolute Maximum Drive Level	DL _{max.}	1.0μW Max.		
Drive Level	DL	0.1μW Typ.		
Shunt Capacitance	C ₀	1.0pF 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		Storage as single product

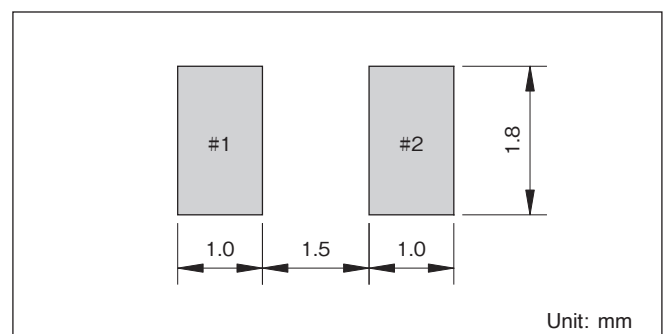
DIMENSIONS



INTERNAL LEAD CONNECTION



RECOMMENDED SOLDERING PATTERN



Remark: When designing the circuit board, do not place circuit patterns on the crystal resonator mounting area (bottom surface).

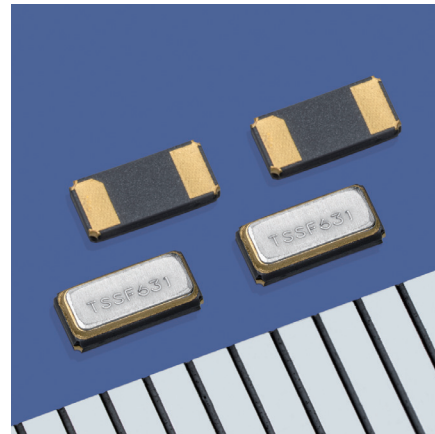
SC-32A (For automotive use)

FEATURES

- Conforms to "AEC-Q200".
- SMD type suitable for high density surface mounting.
- Excellent shock and heat resistance.
- Pb-free.
- Complies with EU RoHS directive.
- Incorporates a crystal resonator manufactured using highly reliable photolithographic technology.

APPLICATIONS

Car audio system, car navigation system, ECU sub-clock, TPMS

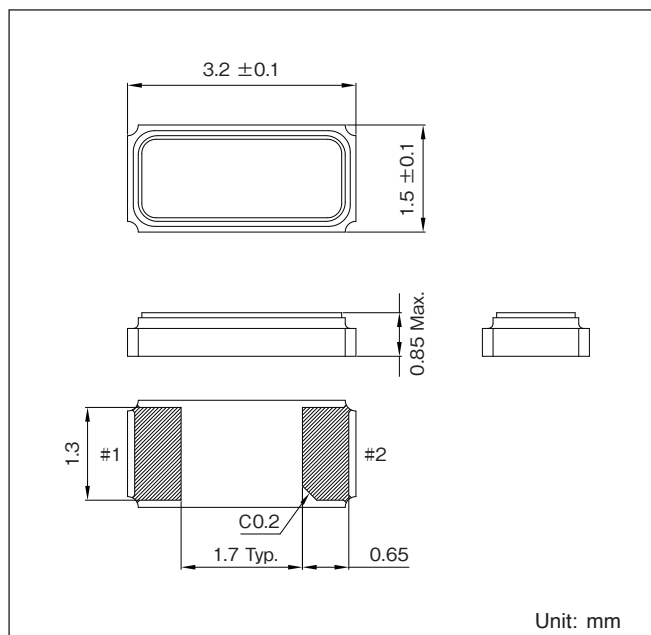


STANDARD SPECIFICATIONS

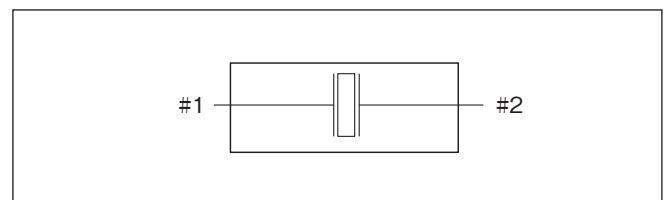
Conditions where not specified (Temperature: 25±2°C, DL: 0.1μW)

Item	Symbol	Specifications	Conditions / Notes
Nominal Frequency	f _{nom}	32.768kHz	
Frequency Tolerance	f _{tol}	±20×10 ⁻⁶	* Please contact us about available tolerance.
Turnover Temperature	T _i	+25±5°C	
Parabolic Coefficient	β	(-0.030±10%)×10 ⁻⁶ /°C ²	
Load Capacitance	C _L	6pF, 7pF, 9pF, 12.5pF	* Please contact us about available CL.
Motional Resistance (ESR)	R ₁	70kΩ Max.	
Absolute Maximum Drive Level	DL _{max}	1.0μW Max.	
Drive Level	DL	0.1μW Typ.	
Shunt Capacitance	C ₀	1.0pF Typ.	
Frequency Ageing	f _{age}	±3×10 ⁻⁶	+25±3°C, First Year
Operating Temperature	T _{use}	-55°C to +125°C	
Storage Temperature	T _{stg}	-55°C to +125°C	Storage as single product

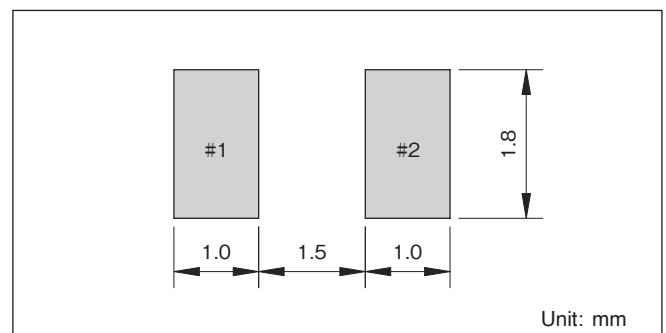
DIMENSIONS



INTERNAL LEAD CONNECTION



RECOMMENDED SOLDERING PATTERN



Remark: When designing the circuit board, do not place circuit patterns on the crystal resonator mounting area (bottom surface).

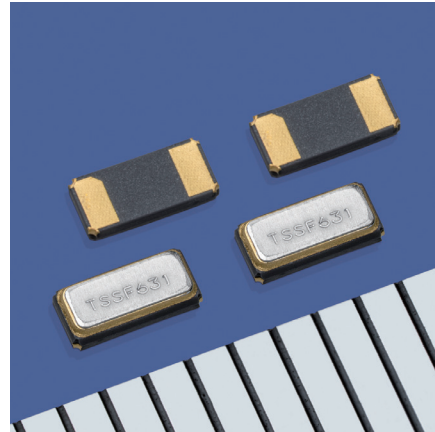
SC-32P (R1=50kΩ Max.) Low ESR Series

FEATURES

- Suitable for microcontrollers requiring low-ESR crystals (R1=50kΩ Max.).
- SMD type suitable for high density surface mounting.
- Excellent shock and heat resistance.
- Pb-free.
- Complies with EU RoHS directive.
- Incorporates a crystal resonator manufactured using highly reliable photolithographic technology.

APPLICATIONS

PCs, Tablets, Modules, Wearables, Sub-clock function for a variety of microcontrollers, etc.

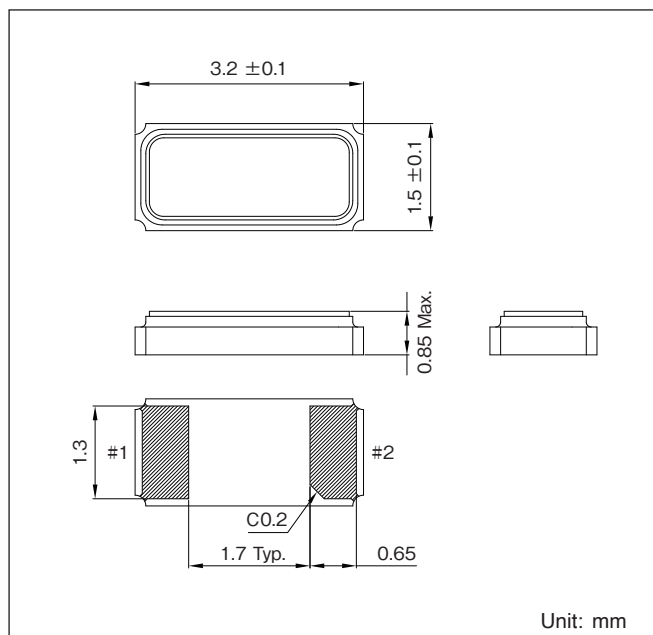


STANDARD SPECIFICATIONS

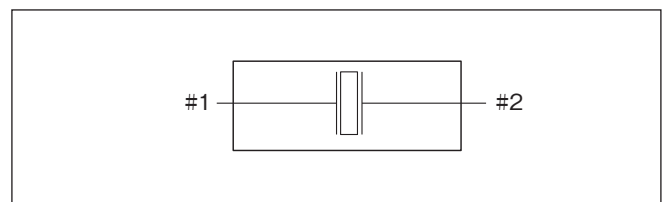
Conditions where not specified (Temperature: 25±2°C, DL: 0.1μW)

Item	Symbol	Specifications	Conditions / Notes
Nominal Frequency	f _{nom}	32.768kHz	
Frequency Tolerance	f _{tol}	±20×10 ⁻⁶	* Please contact us about available tolerance.
Turnover Temperature	T _i	+25±5°C	
Parabolic Coefficient	β	(-0.033±10%)×10 ⁻⁶ /°C ²	
Load Capacitance	C _L	4pF, 6pF, 7pF, 9pF, 12.5pF	* Please contact us about available CL.
Motional Resistance (ESR)	R ₁	50kΩ Max.	-40°C to +85°C
Absolute Maximum Drive Level	DL _{max.}	1.0μW Max.	
Drive Level	DL	0.1μW Typ.	
Shunt Capacitance	C ₀	1.0pF 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	Storage as single product

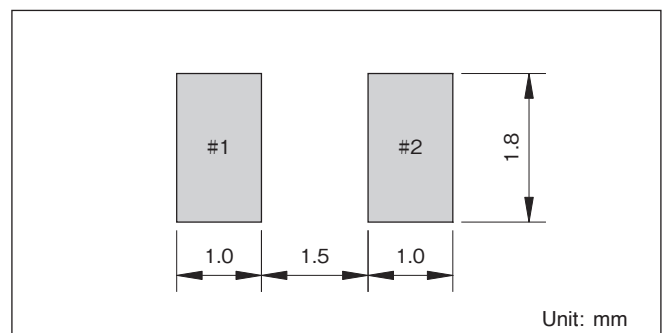
DIMENSIONS



INTERNAL LEAD CONNECTION



RECOMMENDED SOLDERING PATTERN



Remark: When designing the circuit board, do not place circuit patterns on the crystal resonator mounting area (bottom surface).

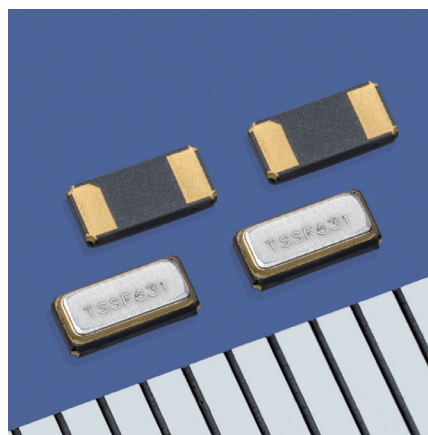
SC-32L (R1=40kΩ Max.) Low ESR Series

FEATURES

- Suitable for microcontrollers requiring low-ESR crystals (R1=40kΩ Max.).
- SMD type suitable for high density surface mounting.
- Excellent shock and heat resistance.
- Pb-free.
- Complies with EU RoHS directive.
- Incorporates a crystal resonator manufactured using highly reliable photolithographic technology.

APPLICATIONS

PCs, Tablets, Modules, Wearables, Sub-clock function for a variety of microcontrollers, etc.

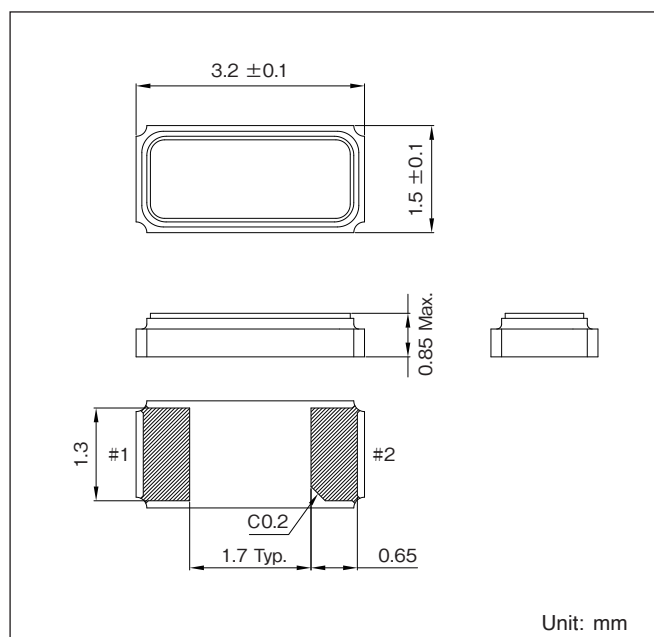


STANDARD SPECIFICATIONS

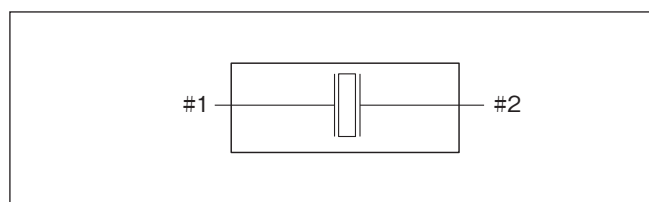
Conditions where not specified (Temperature: 25±2°C, DL: 0.1μW)

Item	Symbol	Specifications	Conditions / Notes
Nominal Frequency	f _{nom}	32.768kHz	
Frequency Tolerance	f _{tol}	±20×10 ⁻⁶	* Please contact us about available tolerance.
Turnover Temperature	T _i	+25±5°C	
Parabolic Coefficient	β	(-0.033±10%)×10 ⁻⁶ /°C ²	
Load Capacitance	C _L	4pF, 6pF, 7pF, 9pF, 12.5pF	* Please contact us about available CL.
Motional Resistance (ESR)	R ₁	40kΩ Max.	-40°C to +85°C
Absolute Maximum Drive Level	DL _{max.}	1.0μW Max.	
Drive Level	DL	0.1μW Typ.	
Shunt Capacitance	C ₀	1.2pF 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	Storage as single product

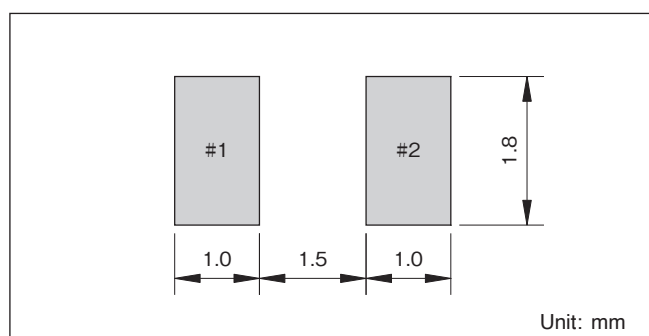
DIMENSIONS



INTERNAL LEAD CONNECTION



RECOMMENDED SOLDERING PATTERN



Remark: When designing the circuit board, do not place circuit patterns on the crystal resonator mounting area (bottom surface).

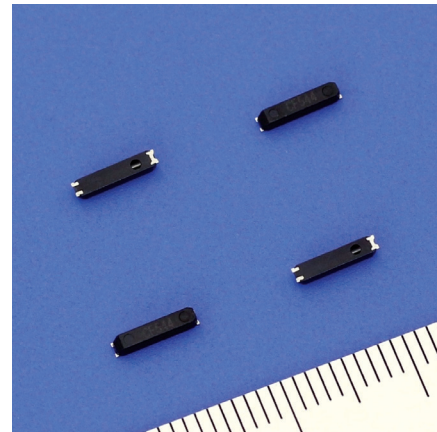
SSP-T7-F

FEATURES

- Thin type with height 1.4mm max.
- SMD type suitable for high density surface mounting.
- Excellent shock and heat resistance.
- Complies with EU RoHS directive.
- Completely halogen-free.
- Incorporates a crystal resonator manufactured using highly reliable photolithographic technology.

APPLICATIONS

Clock for time display and timer, Power/water meter, Sub-clock function for a variety of microcontrollers, etc.

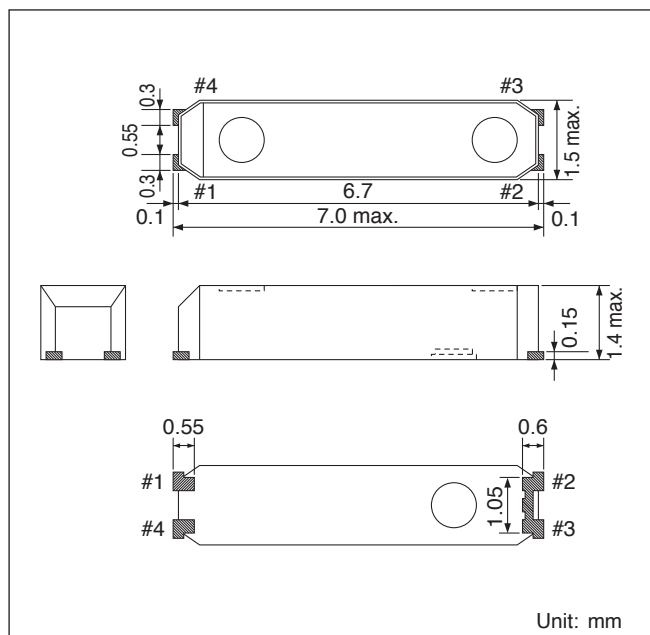


STANDARD SPECIFICATIONS

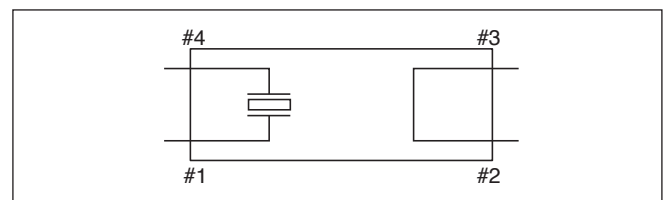
Conditions where not specified (Temperature: 25±2°C, DL: 0.1μW)

Item	Symbol	Specifications	Conditions / Notes
Nominal Frequency	f _{nom}	32.768kHz	
Frequency Tolerance	f _{tol}	±20×10 ⁻⁶	* Please contact us about available tolerance.
Turnover Temperature	T _i	+25±5°C	
Parabolic Coefficient	β	(-0.033±10%)×10 ⁻⁶ /°C ²	
Load Capacitance	C _L	7pF, 9pF, 12.5pF	* Please contact us about available CL.
Motional Resistance (ESR)	R ₁	65kΩ Max.	
Absolute Maximum Drive Level	DL _{max}	1.0μW Max.	
Drive Level	DL	0.1μW Typ.	
Shunt Capacitance	C ₀	0.9pF 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	Storage as single product

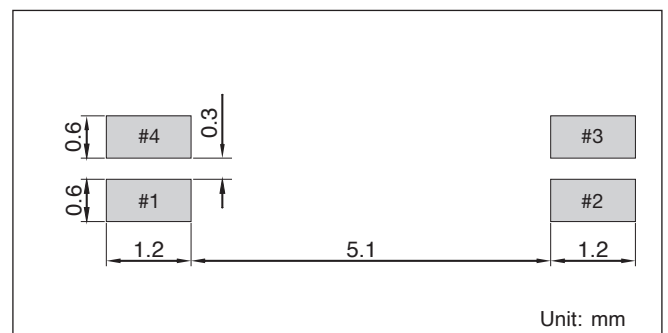
DIMENSIONS



INTERNAL LEAD CONNECTION



RECOMMENDED SOLDERING PATTERN



Remark: When designing the circuit board, do not place circuit patterns on the crystal resonator mounting area (bottom surface).

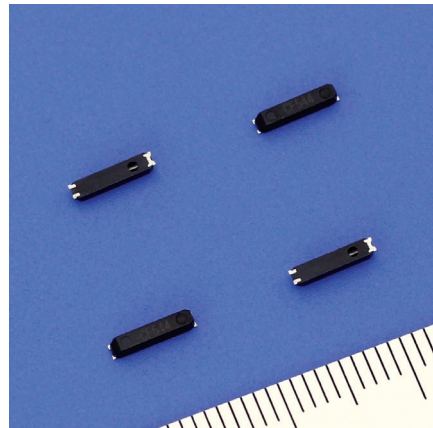
SSP-T7-FL (SMD type low CL resonator for low-power microcontrollers)

FEATURES

- Consumes approximately one-tenth of the standby power of general crystal resonators (with a load capacitance of 12.5 pF) (*1).
 - Excellent low drive characteristics.
 - Complies with EU RoHS directive.
 - Incorporates a crystal resonator manufactured using highly reliable photolithographic technology.
- (*1) When using a microcontroller that supports low CL.

APPLICATIONS

- Consumer electronic devices designed to reduce standby power consumption.
- Battery-powered devices requiring long operating life.

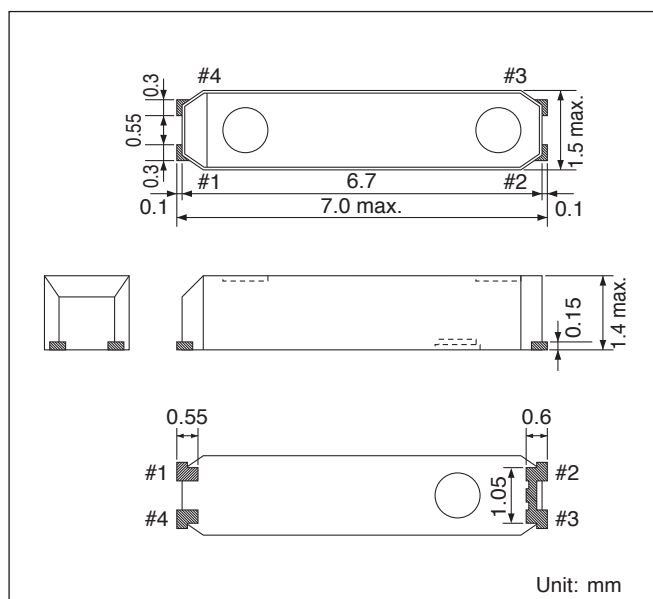


STANDARD SPECIFICATIONS

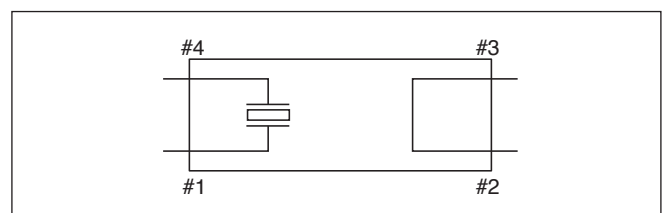
Conditions where not specified (Temperature: 25±2°C, DL: 0.01μW)

Item	Symbol	Specifications	Conditions / Notes
Nominal Frequency	f _{nom}	32.768kHz	
Frequency Tolerance	f _{tol}	±20×10 ⁻⁶	* Please contact us about available tolerance.
Turnover Temperature	T _i	+25±5°C	
Parabolic Coefficient	β	(-0.033±10%)×10 ⁻⁶ /°C ²	
Load Capacitance	C _L	3.7pF, 4.4pF, 6pF	* Please contact us about available CL.
Motional Resistance (ESR)	R ₁	65kΩ Max.	
Absolute Maximum Drive Level	DL _{max.}	1.0μW Max.	
Drive Level	DL	0.01μW Typ.	
Shunt Capacitance	C ₀	0.9pF 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	Storage as single product

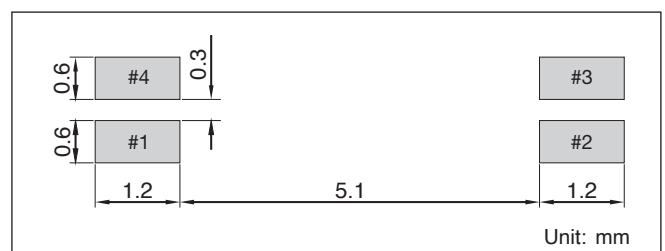
DIMENSIONS



INTERNAL LEAD CONNECTION



RECOMMENDED SOLDERING PATTERN



Remark: When designing the circuit board, do not place circuit patterns on the crystal resonator mounting area (bottom surface).

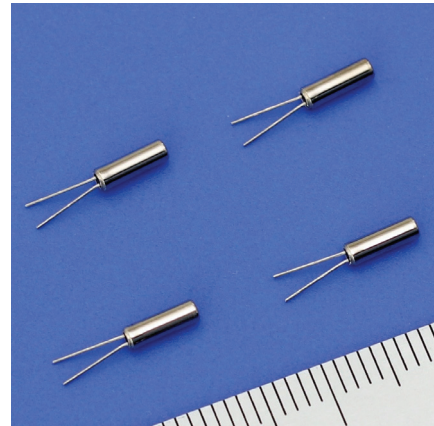
VT-200-F

FEATURES

- 2.0 mm diameter cylindrical package.
- Incorporates a crystal resonator manufactured using highly reliable photolithographic technology.
- Excellent shock resistance and environmental characteristics.
- Pb-free.
- Complies with EU RoHS directive.

APPLICATIONS

Clocks, Timers, Water/Electricity Meters,
Remote controllers,
Sub-clock function for a variety of microcontrollers, etc.

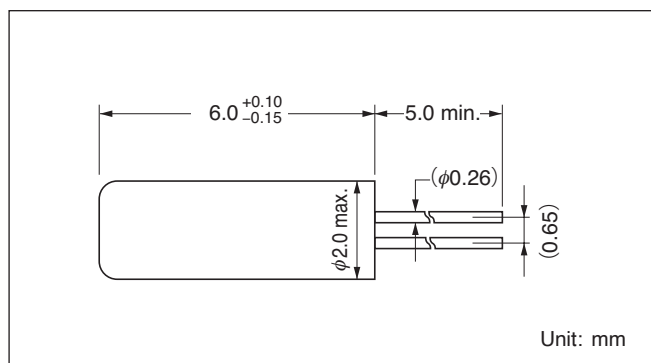


STANDARD SPECIFICATIONS

Conditions where not specified (Temperature: 25±2°C, DL: 0.1μW)

Item	Symbol	Specifications	Conditions / Notes
Nominal Frequency	f _{nom}	32.768kHz	
Frequency Tolerance	f _{tol}	±20×10 ⁻⁶	* Please contact us about available tolerance.
Turnover Temperature	T _i	+25±5°C	
Parabolic Coefficient	β	(-0.035±10%)×10 ⁻⁶ /°C ²	
Load Capacitance	C _L	7pF, 9pF, 12.5pF	* Please contact us about available CL.
Motional Resistance (ESR)	R ₁	50kΩ Max.	
Absolute Maximum Drive Level	DL _{max.}	1.0μW Max.	
Drive Level	DL	0.1μW Typ.	
Shunt Capacitance	C ₀	0.9pF 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}	-40°C to +85°C	Storage as single product

DIMENSIONS

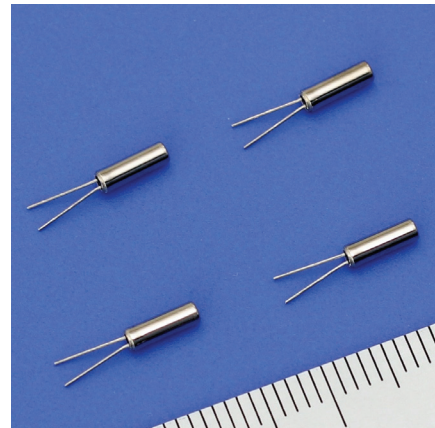


Remark: When designing the circuit board, do not place circuit patterns on the crystal resonator mounting area (bottom surface).

VT-200-FL (Cylinder type low CL resonator for low-power microcontrollers)

FEATURES

- Consumes approximately one-tenth of the standby power of general crystal resonators (with a load capacitance of 12.5 pF) (*1).
 - Incorporates a crystal resonator manufactured using highly reliable photolithographic technology.
 - Excellent low drive characteristics.
 - Pb-free.
 - Complies with EU RoHS directive.
- (*1) When using a microcontroller that supports low CL.



APPLICATIONS

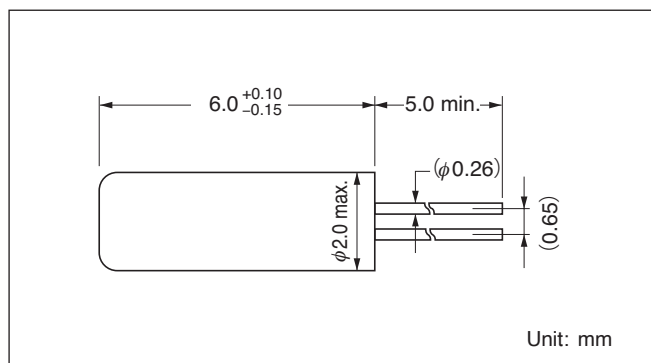
- Consumer-electronics products for saving standby energy consumption.
- Battery-powered devices requiring long operating life.

STANDARD SPECIFICATIONS

Conditions where not specified (Temperature: 25±2°C, DL: 0.01μW)

Item	Symbol	Specifications	Conditions / Notes
Nominal Frequency	f _{nom}	32.768kHz	
Frequency Tolerance	f _{tol}	±20×10 ⁻⁶	* Please contact us about available tolerance.
Turnover Temperature	T _i	+25±5°C	
Parabolic Coefficient	β	(-0.035±10%)×10 ⁻⁶ /°C ²	
Load Capacitance	C _L	3.7pF, 4.4pF, 6pF	* Please contact us about available CL.
Motional Resistance (ESR)	R ₁	50kΩ max.	
Absolute Maximum Drive Level	DL _{max.}	1.0μW max.	
Drive Level	DL	0.01μW typ.	
Shunt Capacitance	C ₀	0.9pF 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}	-40°C to +85°C	Storage as single product

DIMENSIONS



Remark: When designing the circuit board, do not place circuit patterns on the crystal resonator mounting area (bottom surface).

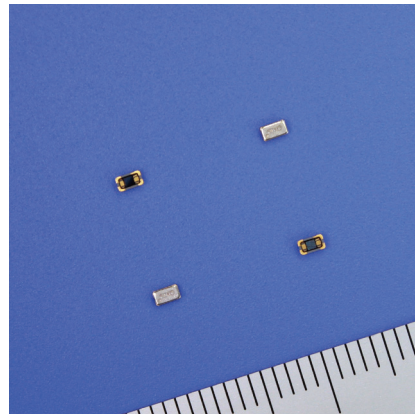
Low-Power 32.768kHz Crystal Oscillator SN-20S

FEATURES

- Small size package (2.0×1.2×0.85mm).
- Ultra low current consumption 0.5μA Typ. ($V_{DD}=3.3V$)
- Pb-free.
- Incorporates a crystal resonator manufactured using highly reliable photolithographic technology.

APPLICATIONS

Wearables, Modules, Sub-clock functions for various microcontrollers

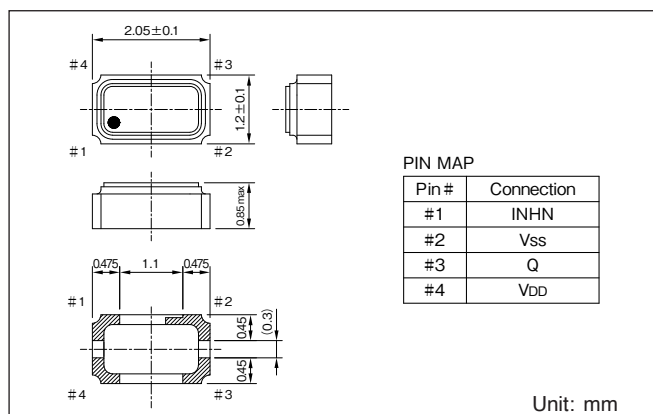


STANDARD SPECIFICATIONS

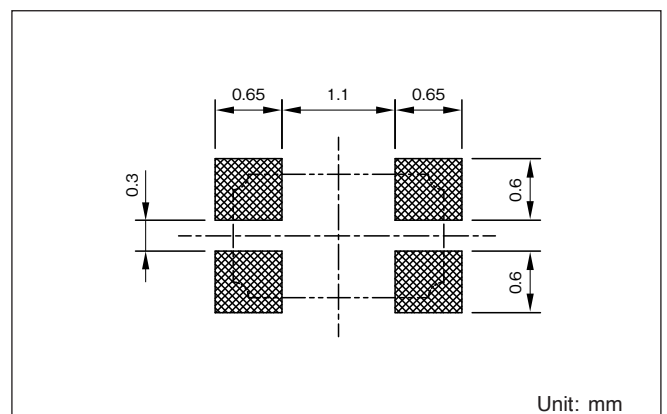
Item	Symbol	Specifications	Unit	Conditions / Notes
Nominal Frequency	f_{nom}	32.768	kHz	
Frequency tolerance	f_{tol}	± 20	$\times 10^{-6}$	
Voltage	V_{DD}	1.2 to 5.5	V	
Storage Temperature	T_{stg}	-55 to +125	°C	
Operating Temperature	T_{use}	-40 to +85	°C	
Turnover Temperature	T_i	25 ± 5	°C	
Parabolic Coefficient	β	$-0.030 \pm 10\%$	$\times 10^{-6}/^{\circ}C^2$	
Frequency / voltage coefficient	$f_{0-V_{DD}}$	± 1	$\times 10^{-6}/V$	$V_{DD}=1.2$ to $5.5V$
Current consumption	I_{DD}	0.35 Typ./0.65 Max.	μA	$V_{DD}=1.8V$, No load condition
		0.50 Typ./0.80 Max.	μA	$V_{DD}=3.3V$, No load condition
Current consumption(sleep)	I_{DD2}	0.25 Typ./0.60 Max.	μA	$V_{DD}=1.2$ to $5.5V$, No load condition
Symmetry	SYM	50 ± 10	%	Load : 15pF
Rise time / Fall time	t_r/t_f	200 Max.	ns	Load : 15pF, $0.1V_{DD}$ to $0.9V_{DD}$ / $0.9V_{DD}$ to $0.1V_{DD}$
Input voltage	V_{IL}	$0.2V_{DD}$ Max.	V	INHN terminal
	V_{IH}	$0.8V_{DD}$ Min.	V	INHN terminal
Output voltage	V_{OL}	0.4 Max.	V	Q terminal
	V_{OH}	$V_{DD}-0.4$ Min.	V	Q terminal
Output load condition (CMOS)	C_{LOUT}	15 Max.	pF	CMOS Loading
Start-up time	t_{str}	0.15 Typ./0.50 Max.	sec	
Frequency aging	f_{age}	± 3	$\times 10^{-6}$	First Year

*Unless otherwise stated, characteristics (specifications) shown in the above table are based on $T_a=+25^{\circ}C \pm 3^{\circ}C$, $V_{DD}=3.3V \pm 10\%$.

DIMENSIONS



RECOMMENDED SOLDERING PATTERN



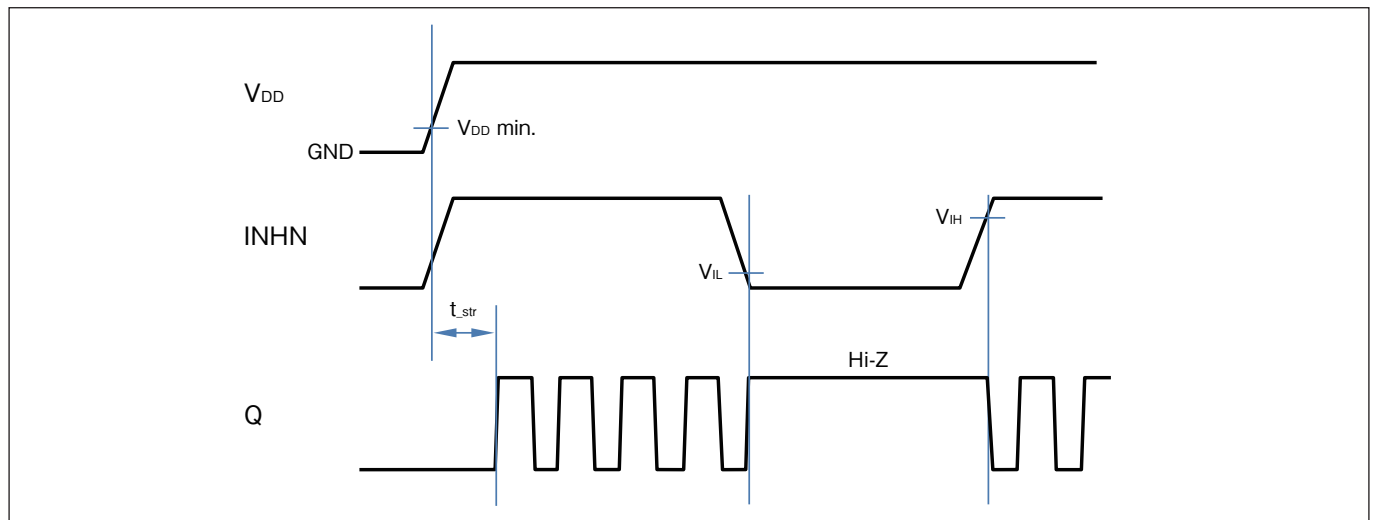
Low-Power 32.768kHz Crystal Oscillator SN-20S

Absolute Maximum Ratings

Item	Symbol	Rated value	Unit	Conditions
Supply voltage range	V_{DD}	-0.5 to +7.0	V	$V_{DD}-V_{SS}$
Input voltage range	V_{inI}	-0.5 to +7.0	V	input terminal (INHN)
Output voltage range	V_{out}	-0.5 to $V_{DD}+0.5$	V	Output terminal (Q)
Output current	I_{out}	25	mA	Output terminal (Q)

*It is a value that should not be exceeded even for a moment.

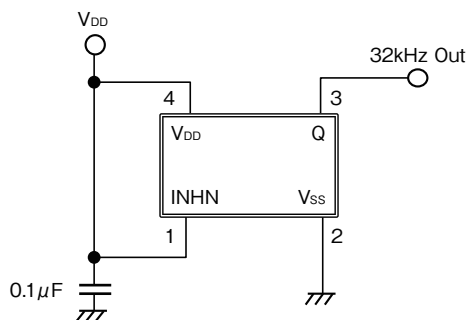
Input/output waveform



Circuit connection with MCU

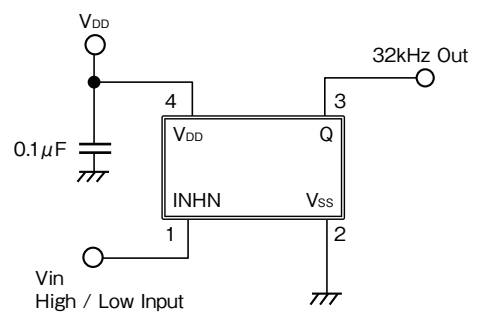
Connection example 1

Connect the V_{DD} pin and the $INHN$ pin if the 32kHz output ON/OFF operation is not to be performed.



Connection example 2

Input High/Low to the $INHN$ pin to turn ON/OFF the 32kHz output.



It is recommended that a bypass capacitor ($0.01\mu F$ to $0.1\mu F$) between V_{DD} and GND be mounted as close as possible to the V_{DD} pins.

Q terminal output setting

Terminal INHN (V_{in})		Terminal Q	Remarks
High	$0.8V_{DD}$ min.	32kHz Output	—
Low	$0.2V_{DD}$ max.	Hi-Z	—
OPEN	—	—	Do not use

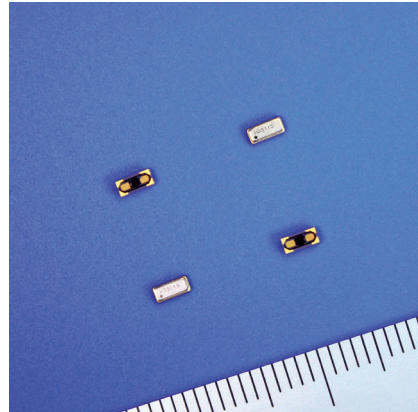
High-Accuracy Crystal Oscillator 32.768kHz SH-32R

FEATURES

- Excellent frequency accuracy and temperature characteristics.
- Low current consumption.
- Pb-free.
- Complies with the EU RoHS Directive.
- Incorporated highly reliable photolithographic crystal resonator.

APPLICATIONS

Smart Meter, IoT, Wearable device, Industrial Devices, High-Precision Timing Devices, Event data recorder.

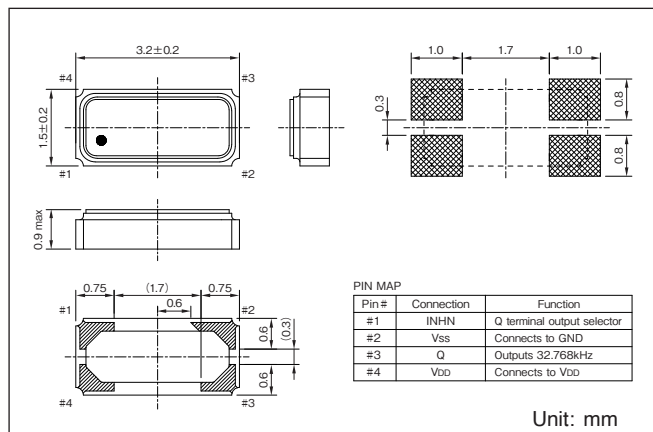


STANDARD SPECIFICATIONS

Item	Symbol	Specifications	Unit	Conditions / Notes
Nominal Frequency	f _{nom}	32.768	kHz	
Frequency Tolerance	f _{tol}	±3	×10 ⁻⁶	
Temperature range	f ₀ -T _c	±50	×10 ⁻⁶	-40 to +85°C (+25°C is reference)
Frequency / voltage coefficient	f ₀ -V _{DD}	±1	×10 ⁻⁶ /V	V _{DD} =1.5 to 3.63V
Voltage	V _{DD}	1.5 to 3.63	V	
Storage Temperature	T _{stg}	-40 to +105	°C	
Operating Temperature	T _{use}	-40 to +85	°C	
Current consumption	I _{DD}	1.3 Typ.	μA	No load condition
		2.5 Max.	μA	
Symmetry	SYM	40/60	%	Load : 30pF
Rise time / Fall time	tr/tf	40 Max.	ns	Load : 30pF, 0.1V _{DD} to 0.9V _{DD} /0.9V _{DD} to 0.1V _{DD}
Input voltage	V _{IL}	0.2V _{DD} Max.	V	INH terminal
	V _{IH}	0.8V _{DD} Min.	V	INH terminal
Output voltage	V _{OL}	0.1V _{DD} Max.	V	Q terminal
	V _{OH}	0.9V _{DD} Min.	V	Q terminal
Output load condition (CMOS)	C _{LOUT}	30 Max.	pF	CMOS Loading
Start-up time	t _{str}	0.5 Max.	sec	
Frequency aging	f _{age}	±3	×10 ⁻⁶	First Year

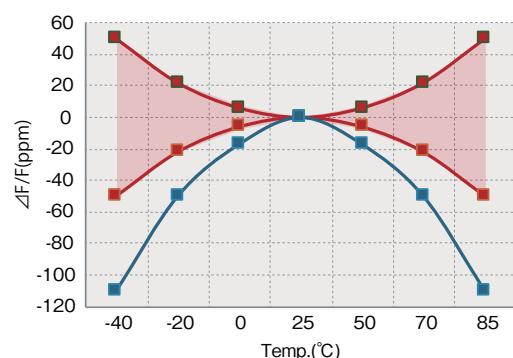
*Unless otherwise stated, characteristics (specifications) shown in the above table are based on T_a=+25°C±3°C, V_{DD}=3.3V±10%.

DIMENSIONS



TEMPERATURE CHARACTERISTIC

Typical Frequency-Temperature Characteristics ◆ Crystal ■ SH-32R



High Accuracy Crystal Oscillator 32.768kHz SH-32R

Maximum rating

Item	Symbol	Rated value	Unit	Conditions
Supply voltage range	V_{DD}	-0.3 to +4.5	V	$V_{DD}-V_{SS}$
Input voltage range	V_{in}	-0.3 to $V_{DD}+0.3$	V	input terminal (INHN)
Output voltage range	V_{out}	-0.3 to $V_{DD}+0.3$	V	Output terminal (Q)
Output current	I_{out}	± 10	mA	Output terminal (Q)

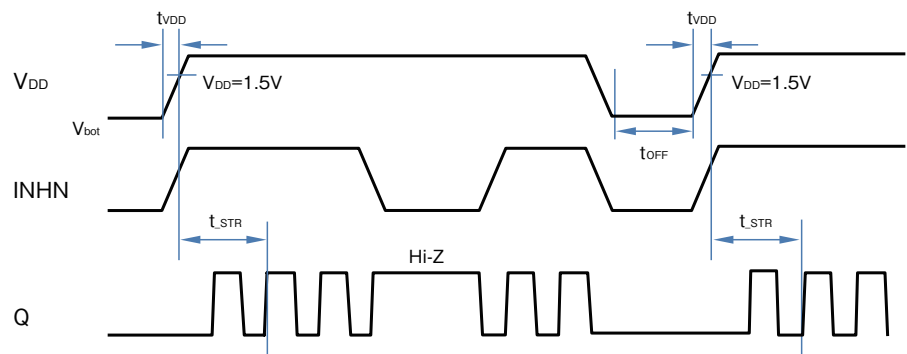
*It is a value that should not be exceeded even for a moment.

Operating condition

Item	Symbol	Min.	Typ.	Max.	Unit
V_{DD} rise time	t_{VDD}	-	-	10	ms/V
V_{DD} OFF time	t_{OFF}	0.5	-	-	msec
V_{DD} OFF voltage	V_{bot}	-	-	0	V

*In order to start oscillation correctly, V_{DD} must be kept at 0V for 0.5msec or more, and then start up at less than 10ms/V. Please note that 32.768kHz oscillation will not start if V_{DD} is restarted without dropping to 0V.

Timing chart for applying power supply voltage

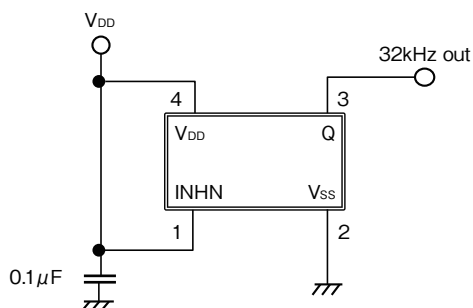


*Oscillation startup time (t_{STR}) is operated by the boot circuit, and the oscillation frequency is not 32.768kHz $\pm$ 3ppm.

Circuit connection with MCU

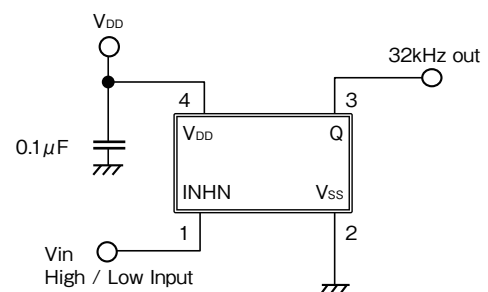
Connection example 1

Connect the V_{DD} pin and the INHN pin if the 32kHz output ON/OFF operation is not to be performed.



Connection example 2

Input High/Low to the INHN pin to turn the 32kHz output ON/OFF.



Connect a bypass capacitor (0.01 μ F to 0.1 μ F) between the power supply pins ($V_{DD}-V_{SS}$).

Q terminal output setting

Terminal INHN (V_{in})		Terminal Q	Remarks
High	$0.8V_{DD} \sim V_{DD}+0.3$	32.768kHz Output	-
Low	$-0.3V \sim 0.2V_{DD}$	Hi-Z	-
OPEN	-	-	Do not use

Check sheet for crystal products selection

When considering our crystal resonator / oscillator, please inform the following items. We will recommend suitable products and characteristics based on your operating conditions.

1. Products of interest

- | | | | |
|------------------------------------|-----------------------------------|------------------------------------|---------------------------------|
| (1) Cylinder type resonator | ☐ VT-200-F | ☐ VT-200-FL | |
| (2) Plastic mold type resonator | ☐ SSP-T7-F | ☐ SSP-T7-FL | |
| (3) Ceramic package type resonator | ☐ SC-32S | ☐ SC-32A | ☐ SC-32P |
| | ☐ SC-32L | ☐ SC-20S | ☐ SC-20A |
| | ☐ SC-20P | ☐ SC-20T | ☐ SC-16S |
| | ☐ SC-16P | ☐ SC-12S | ☐ SC-10S |
| (4) Oscillator | ☐ SH-32R | ☐ SN-20S | |

2. Applications

3. Semiconductor Information

- (1) Semiconductors
- | | | | |
|--|-------------------------------|------------------------------|---------------------------------|
| ☐ Microcontroller | ☐ ASIC | ☐ RTC | ☐ Others |
|--|-------------------------------|------------------------------|---------------------------------|
- ☐ Manufacturer and Product Name _____
- (2) Purpose of usage
- | | | |
|--------------------------------------|-----------------------------------|--|
| ☐ Timekeeping | ☐ Stand-by | ☐ Communication |
|--------------------------------------|-----------------------------------|--|
- ☐ Others _____

4. Required Specifications for the Resonator

- (1) Nominal Frequency (f_{nom})
- | | |
|------------------------------------|---|
| ☐ 32.768kHz | ☐ Others _____ kHz |
|------------------------------------|---|
- (2) Operating Temperature (T_{use})
- | | |
|---------------------------------------|--|
| ☐ -40 to +85°C | ☐ Others _____ °C |
|---------------------------------------|--|
- (3) Frequency Tolerance (25±2°C) (f_{tol})
- | | | |
|---|---------------------------------|--------------------------------|
| ☐ ±20ppm | ☐ ±10ppm | ☐ ±5ppm |
| ☐ Others _____ ppm | | |
- (4) Load Capacitance (C_L)
- | | | | |
|--|------------------------------|------------------------------|------------------------------|
| ☐ 12.5pF | ☐ 9pF | ☐ 7pF | ☐ 6pF |
| ☐ Others _____ pF | | | |
- (5) Number of terminals (For SC-12S)
- | | |
|--------------------------------------|--------------------------------------|
| ☐ 2 terminals | ☐ 4 terminals |
|--------------------------------------|--------------------------------------|

5. Required Specifications for the Oscillator

- (1) Frequency-temperature coefficient (f_0/T_c)
- | | |
|--|--|
| ☐ ±50ppm (-40 to +85°C) | ☐ ±40ppm (-20 to +70°C) |
| ☐ ±30ppm (-10 to +60°C) | ☐ ±20ppm (0 to +50°C) |

6. Special Requirements

e.g.) Automotive usage or medical device usage or special quality requirement.

7. Others

Environmental Policy

The Seiko Group recognizes that the preservation of the global environment is one of the most important issues in the world today. We will constantly strive to help realize a sustainable society that will benefit everyone.

1. We are committed to a wide range of environmentally responsible activities, and we will continue to make unceasing efforts to improve our environmental performance, thereby providing increased value for all our stakeholders.
2. We not only comply with all relevant laws and regulations, but also go far beyond legal compliance in our efforts to reduce environmental risks and prevent pollution.
3. Being acutely aware of the part we have to play in mitigating climate change, we are working hard to reduce greenhouse gas emissions.
4. Because we recognize the limits of our precious natural resources, we are increasing our efforts to reuse and recycle every resource possible.
5. We are also working to preserve biodiversity, recognizing that our business activities inevitably affect surrounding ecosystems, and that we also benefit from the health and diversity of those systems.
6. We rigorously ensure proper management of all chemical substances used in production as well as any that are contained in our finished products.
7. We consider the environment throughout the entire life cycle of our products. We are proud that our products and services actively contribute to environmental conservation.
8. Environmental responsibility starts as a management imperative, but to effectively carry out that mission requires the understanding and cooperation of every employee throughout our Group. With that in mind, we are working to raise everyone's environmental awareness so that all of us can work together to protect and nurture our natural environment.
9. Transparency is another part of our social responsibility. We are therefore promoting active disclosure of material information about our environmental activities and promoting increased communication with local, regional, and global stakeholders.
10. In order to derive maximum benefits from these policies, we establish clear environmental targets and strategies to attain them. Then we steadily improve our efforts by constantly re-examining both our targets and our progress towards achieving them.



This mark means that the product complies with SII's own environmental standards.

Quartz Crystal Unit Handling Precautions

1. MOUNTING PRECAUTIONS Lead Type Crystal Units

- Structure

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

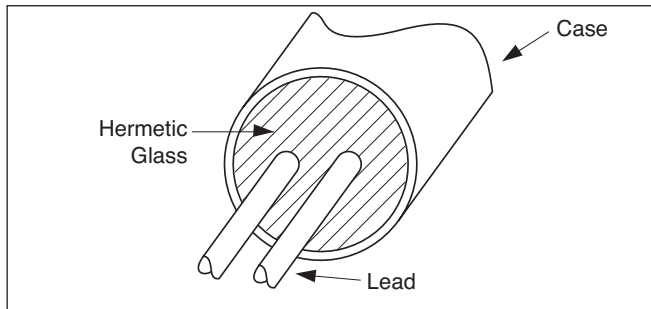


Figure 1

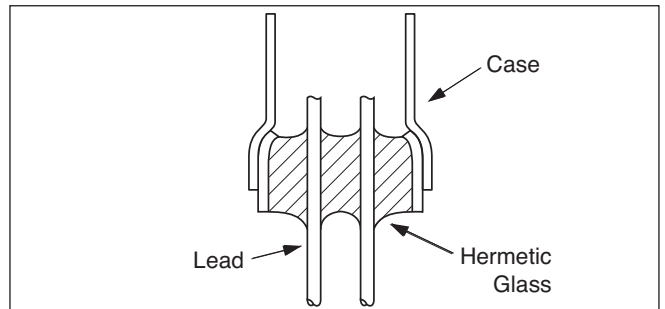


Figure 2

- 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).

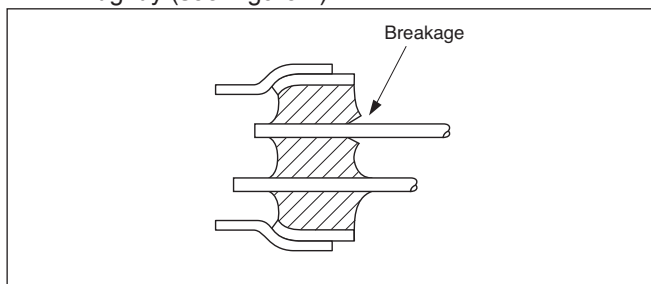


Figure 3

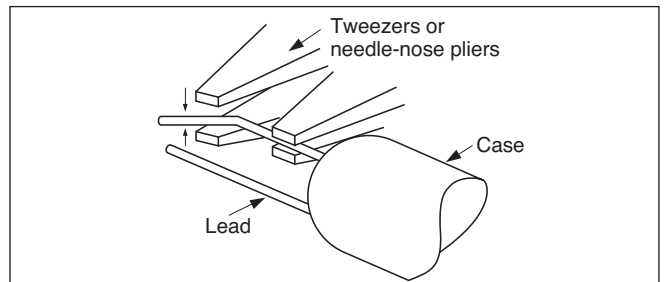


Figure 4

- 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 2.0mm when bending a lead after soldering (see Figure 7).

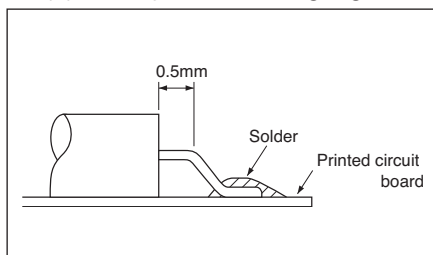


Figure 5

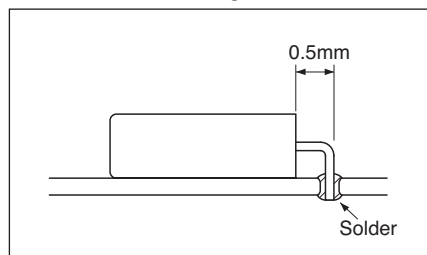


Figure 6

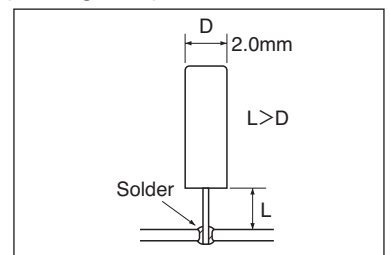


Figure 7

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.

2. Mounting Precautions for Plastic-Molded Products

- If the board is deformed such as bending after mounting on the board, peeling of the soldered part between the crystal resonator and the board, the crack in the plastic molding, destruction of the internal element, etc. may occur. Especially when dividing the board on which it is mounted, there is a possibility that a large stress may be applied at the time of division. Please consider board layout and cutting method to minimize stress on products.
- When the product is automatically mounted on the board, if a large impact is applied to the crystal resonator, there is a possibility that characteristics may change / deteriorate or the product may be broken. When mounting automatically, please set conditions considering the shock to the crystal unit. Also, please conduct the mounting test beforehand and confirm that there is no influence on the characteristics to the crystal resonator.

Quartz Crystal Unit Handling Precautions

3. Precautions for mounting ceramic package products

- If the board is deformed such as bending after mounting on the board, peeling of the soldered part between the crystal resonator and the board, the crack in the ceramic package, destruction of the internal element, etc. may occur. Especially when dividing the board on which it is mounted, there is a possibility that a large stress may be applied at the time of division. Please consider board layout and cutting method to minimize stress on products.
- When the product is automatically mounted on the board, if a large impact is applied to the crystal resonator, there is a possibility that characteristics may change / deteriorate or the product may be broken. When mounting automatically, please set conditions considering the shock to the crystal unit. Also, please conduct the mounting test beforehand and confirm that there is no influence on the characteristics to the crystal resonator.
- Cracks may occur in the solder joints by repeating the harsh temperature change for a long time when mounting the product on a board having an expansion coefficient different from that of the ceramics used in the crystal package. When using under such circumstances, please conduct test beforehand at your company and confirm that the crystal unit is not adversely affected.
- Ceramic packages are small and thin products. So when you repair the rework after mounting, please give due consideration to the selection and handling of the tools to be used.

4. SOLDERING

- Cylinder

The soldering position has to be at the lead wire more than 1.0mm away from the glass seal.

A long time for heating at high temperature may result in deterioration of the characteristics and may break the crystal unit.

If crystal unit is unavoidably heated, heat the lead part at 300°C or lower for 5 seconds or less and please make sure to keep the case below 150°C.

- Ceramic package, Plastic mold, Oscillator

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

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

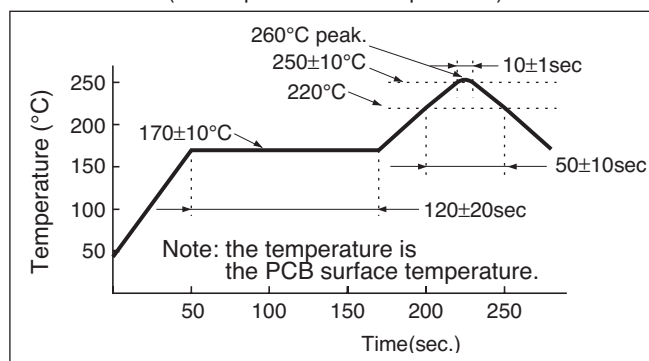


Figure 8

5. 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.

6. MECHANICAL SHOCK

- Quartz crystal units are designed to withstand a drop from 75cm onto a concrete 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.
- 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 during automatic mounting or influence of deposition of case to the board by ultrasonic vibration before use.
- Avoid mounting crystal unit to the board with mechanical vibration source including ultrasonic vibration source. If the crystal unit is unavoidably mounted to the same board with mechanical vibration source, check that the crystal unit functions normally.

Quartz Crystal Unit Handling Precautions

7. Handling

- The crystal oscillator has an IC mounted on the backside of the package. Although it is resin-sealed, please do not directly touch the IC surface with tweezers, rigid tools and fixtures. If you scratch the IC, it may cause a malfunction, so be very careful.

8. Usage Condition

- Consider temperature and humidity in the product to be used, please use in the environment within the temperature range. When used in applications exposed to high humidity, malfunction due to dew condensation is a concern, so please take sufficient measures to prevent dew condensation.

9. Precautions for Oscillator

- Mounting
The oscillator has polarity, it may cause malfunctions or destruction. if mounted in the reverse orientation.
- About the input terminals
Please follow the specifications of each product when use the input terminal.
- Board wiring
Power supply line / Ground pattern line should use a thick pattern to reduce the impedance.
Use a wide trace for the signal line to reduce the impedance. It should be short for the distance to the connected IC.
To minimize the effects of noise, please make sure there is no pattern under crystal unit.
- Noise
If excessive external noise is applied to the terminals, issues such as latch-up and electrostatic breakdown may occur.
- Heat stress
There is a risk of degradation of the crystal unit / IC due to a sudden temperature change. Use the product within the specified operating conditions.
- Power-On Timing
For avoid malfunction, it should be careful power-on time.

10. Precautions for handling reels

- Crystal products are degraded in characteristics when exposed for long periods under high or low temperature environments. Then, it should store at normal temperature and normal humidity.
Avoid storing for a long time and mount the crystal units immediately after unpacked.

Normal temperature / humidity conditions: +15 to 35°C / 25 to 85%RH

- When delivered with tape reel, the tape reel may deform if large impact is applied.

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.

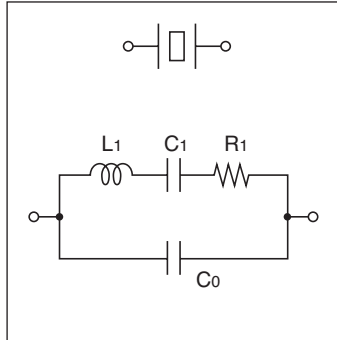


Figure 9

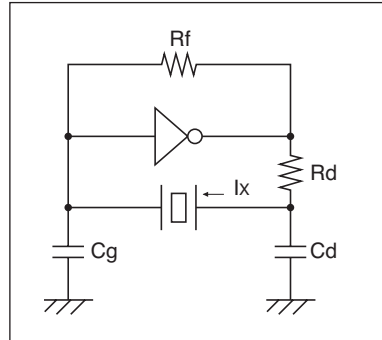


Figure 10

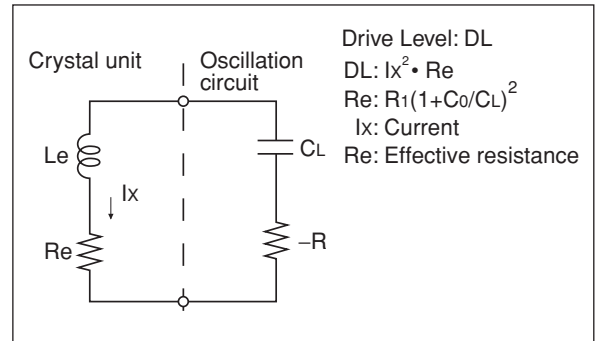


Figure 11

2. OSCILLATION FREQUENCY AND LOAD CAPACITANCE (CL)

- 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 Figure 12).

The oscillation frequency varies depending upon the load capacitance of the oscillation circuit. To obtain the desired frequency accuracy, matching between the load capacitances of the oscillation circuit and the crystal unit is required. For the use of the crystal unit, match the load capacitances of the oscillation circuit with the load capacitances of the crystal unit.

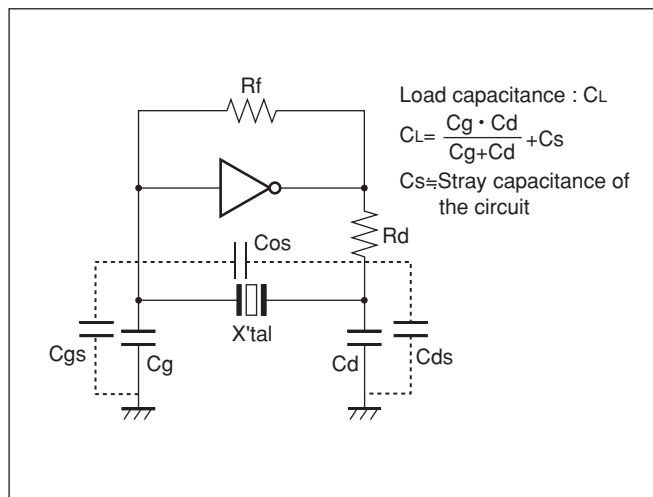


Figure 12

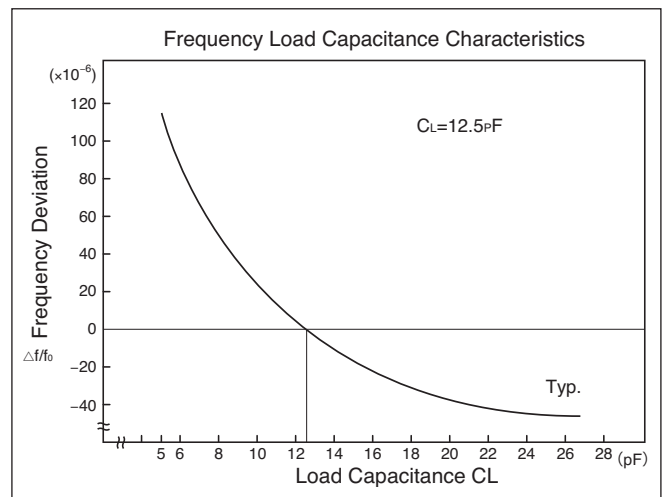


Figure 13

* C_g , C_{ds} , and C_{os} represent PCB trace capacitance and component parasitic capacitance.

Oscillation Circuit Design Precautions

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 $-R_l = R_x + R_e$

$-R_l$ is a value at least five times as large as the maximum equivalent series resistance (R_1 max.) of the crystal unit.

* R_e is the effective resistance value during oscillation.

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

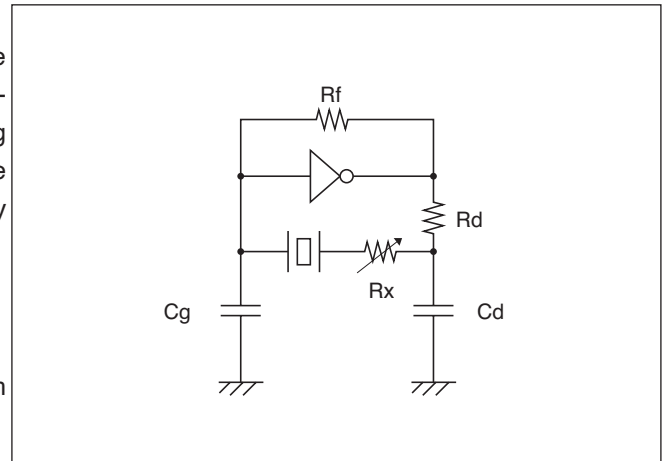
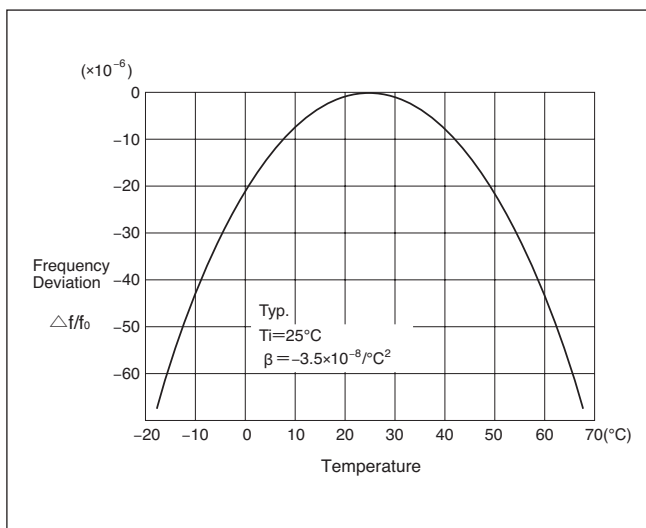


Figure 14

FREQUENCY-TEMPERATURE CURVE



Frequency Temperature Characteristics

The frequency-temperature characteristics of tuning-fork crystals are shown by negative quadratic curve which has a peak at 25°C in the graph on the left. Please make sure to consider the temperature range and frequency accuracy you need since magnitude of frequency variation becomes larger and larger as the temperature range becomes wider.

[Approximation formula of frequency temperature characteristics]

$$f_{\text{tem}} = B (T - T_i)^2$$

β : Parabolic coefficient

T : Given temperature

T_i : Turnover temperature

LEAD TYPE PRODUCTS

The products are packed in polyethylene bags and then placed in shipping cartons.

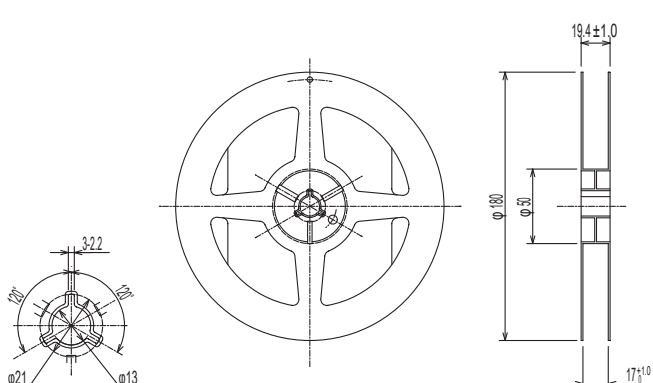
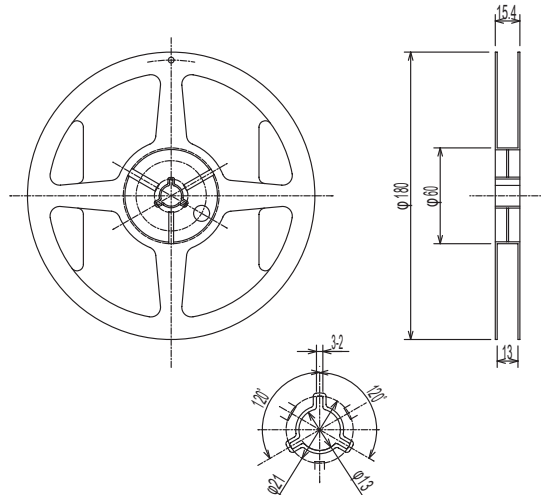
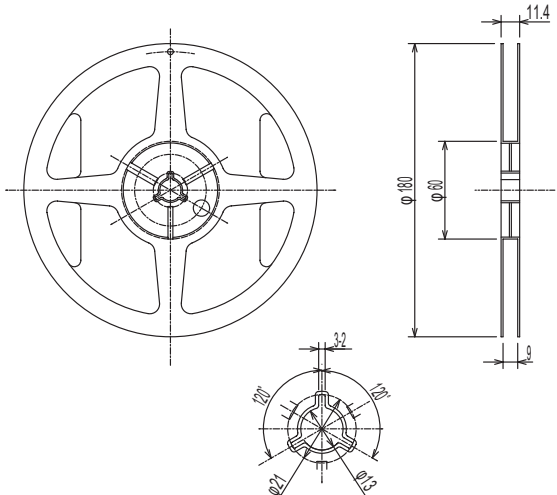
Product name	Quantity per lot	Quantity per bag	Quantity per box
VT-200-F / VT-200-FL	10,000 pcs	500 pcs	20 bags

SMD PRODUCTS

Product name	Quantity per reel
SSP-T7-F / SSP-T7-FL SC-32S / SC-32A / SC-32P / SC-32L / SC-20S / SC-20A / SC-20P / SH-32R	3,000 pcs
SN-20S	4,000 pcs
SC-16S / SC-16P / SC-12S / SC-10S	5,000 pcs
SC-20T	6,000 pcs

TAPE AND REEL CONFIGURATION

• Reel configuration

Product name	Reel inner width	Reel outer width	Product name	Reel inner width	Reel outer width
SSP-T7-F / SSP-T7-FL	17.0mm	19.4mm	SC-32S / SC-32A / SC-32P / SC-32L / SH-32R	13.0mm	15.4mm
					
Product name	Reel inner width	Reel outer width			
SC-20S / SC-20P / SC-20T / SC-20A / SC-16S / SC-16P / SC-12S / SC-10S	9.0mm	11.4mm			
					

• Emboss tape configuration

Unit: mm

Product name SSP-T7-F / SSP-T7-FL	Product name SC-32S / SC-32A / SC-32P / SC-32L / SH-32R
Product name SC-20S / SC-20A / SC-20P / SC-20T / SN-20S	Product name SC-16S / SC-16P
Product name SC-12S	Product name SC-10S

• Precautions for handling reels

- (1) Store at normal temperature and normal humidity (refer to standard conditions of JIS Z-8703 laboratory). Avoid long-term storage, and mount the crystal units promptly after opening the package.
[Normal temperature: +15 to 35°C Normal humidity: 25 to 85%RH]
- (2) Handle outside boxes and reels with care.
Tapes and reels may be deformed by external pressure.



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(Specifications are subject to change without notice.)

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