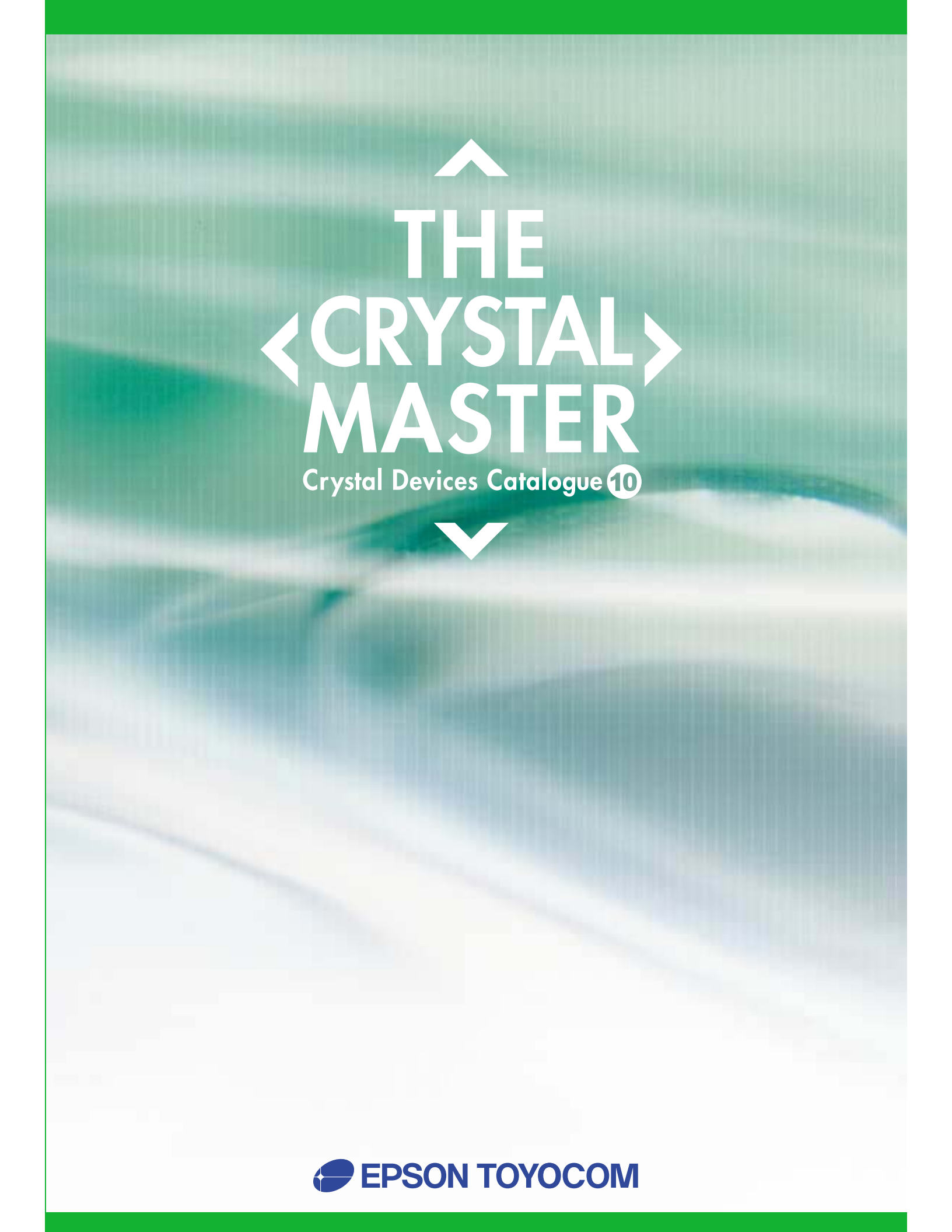




^

THE ◀ CRYSTAL ▶ MASTER

Crystal Devices Catalogue 10

▼

“QMEMS” EPSON TOYOCOM

In order to meet customer needs in a rapidly advancing digital, broadband and ubiquitous society, we are committed to offering products that are one step ahead of the market and a rank above the rest in quality. To achieve our goals, we follow a “3D (three device) strategy” designed to drive both horizontal and vertical growth. We will to grow our three device categories of “Timing Devices”, “Sensing Devices” and “Optical Devices”, and expand vertical growth through a combination of products from these categories.

A Quartz MEMS is any high added value quartz device that exploits the characteristics of quartz crystal material but that is produced using MEMS (micro-electro-mechanical system) processing technology.

Market needs are advancing faster than previously imagined toward smaller, more stable crystal products, but we will stay ahead of the curve by rolling out products that exceed market speed and quality requirements. We want to further accelerate the 3D strategy by QMEMS.

Quartz devices have become crucial in the network environment where products are increasingly intended for broadband, ubiquitous applications and where various types of terminals can transfer information almost immediately via LAN and WAN on a global scale. Epson Toyocom Corporation addresses every single aspect within a network environment. The new corporation offers “Digital Convergence” solutions to problems arising with products for consumer use, such as, core network systems and automotive systems.



PROMOTION OF ENVIRONMENTAL MANAGEMENT SYSTEM CONFORMING TO INTERNATIONAL STANDARDS

At Epson Toyocom, all environmental initiatives operate under the Plan-Do-Check-Action(PDCA) cycle designed to achieve continuous improvements. The environmental management system (EMS) operates under the ISO 14001 environmental management standard.

All of our major manufacturing and non-manufacturing sites, in Japan and overseas, completed the acquisition of ISO 14001 certification.

ISO 14000 is an international standard for environmental management that was established by the International Standards Organization in 1996 against the background of growing concern regarding global warming, destruction of the ozone layer, and global deforestation.

WORKING FOR HIGH QUALITY

In order to provide high quality and reliable products and services than meet customer needs,

Epson Toyocom made early efforts towards obtaining ISO9000 series certification and has acquired ISO9001 for all business establishments in Japan and abroad. We have also acquired ISO/TS 16949 certification that is requested strongly by major automotive manufacturers as standard.

QS-9000 is an enhanced standard for quality assurance systems formulated by leading U.S. automobile manufacturers based on the international ISO 9000 series.

ISO/TS 16949 is a global standard based on QS-9000, a severe standard corresponding to the requirements from the automobile industry.

► Explanation of the mark that are using it for the catalog

	► Pb free.
	► Complies with EU RoHS directive. *About the products without the Pb-free mark. Contains Pb in products exempted by EU RoHS directive. (Contains Pb in sealing glass, high melting temperature type solder or other.)
	► The products have been designed for high reliability applications such as Automotive.

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- These products are intended for general use in electronic equipment. When using them in specific applications that require extremely high reliability, such as the applications stated below, you must obtain permission from Epson Toyocom in advance.
 - / Space equipment (artificial satellites, rockets, etc.) / Transportation vehicles and related (automobiles, aircraft, trains, vessels, etc.)
 - / Medical instruments to sustain life / Submarine transmitters / Power stations and related / Fire work equipment and security equipment
 - / traffic control equipment / and others requiring equivalent reliability.
- In this new crystal master for Epson Toyocom, product codes and markings will remain as previously identified prior to the merger. Due to the on-going strategy of gradual unification of part numbers, please review product codes and markings, as they will change during the course of the coming months.

We apologize for the inconvenience, but we will eventually have a unified part numbering system for Epson Toyocom that will be user friendly.



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Module
Serial InterfaceReal Time Clock
Module
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Crystal Unit / Resonator

► kHz Range Crystal Unit (Tuning fork)

Page	Model	Actual size (mm)	Max.	Frequency	20 kHz	32 kHz	100 kHz	200 kHz	300 kHz
4	FC-12M		2.05×1.2×0.6 t			32 kHz	77.5 kHz		
5	FC-13D	NEW	3.2×1.5×0.38 t			● 32.768 kHz			
	FC-13E		3.2×1.5×0.48 t			● 32.768 kHz			
6	FC-13A		3.2×1.5×0.9 t			● 32.768 kHz			
7	FC-13F		3.2×1.5×0.6 t			● 32.768 kHz			
8	FC-135		3.2×1.5×0.9 t		32 kHz	77.5 kHz			
	FC-145		4.1×1.5×0.9 t			● 32.768 kHz			
	FC-255		4.9×1.8×0.9 t						
9	MC-146		7.0×1.5×1.4 t		32 kHz	100 kHz			
	MC-156		7.1×3.3×1.5 t						
10	MC-306		8.0×3.8×2.54 t	20 kHz			165 kHz		
	MC-405/406		10.41×4.06×3.6 t	20 kHz			165 kHz		● 307.2 kHz
11	MC-30A		8.0×3.8×2.54 t	20 kHz			165 kHz		
12	C-001R		Φ3.1						
	C-002RX		Φ2.0						
	C-004R		Φ1.5			● 32.768 kHz			
	C-005R		Φ1.2						
	C-2-TYPE		Φ2.0	20 kHz			165 kHz		● 307.2 kHz
	C-4-TYPE		Φ1.5		32 kHz		120 kHz	● 192 kHz	

► MHz Range Crystal Unit (AT)

Page	Model	Actual size (mm)	Max.	Frequency	1 MHz	10 MHz	20 MHz	64 MHz
13	FA-118	NEW	1.6×1.2×0.4 t				26 MHz	29.999 MHz
	FA-118T	NEW	1.6×1.2×0.35 t				30 MHz	54 MHz
14	FA-128		2.0×1.6×0.5 t				24 MHz	54 MHz
15	FA-20H		2.5×2.0×0.55 t		12 MHz		48 MHz	
16	FA-238V		3.2×2.5×0.7 t		12 MHz	15.999 MHz		
	FA-238		3.2×2.5×0.7 t			16 MHz	60 MHz	
	TSX-3225		3.2×2.5×0.6 t			16 MHz	48 MHz	
17	TSX-4025		4.0×2.5×0.7 t		12 MHz	32 MHz		
	TSX-5032		5.0×3.2×0.8 t		10 MHz	32 MHz		
18	FA-365		6.0×3.5×1.4 t			● 12 MHz		
						14 MHz	41 MHz	
19	MA-306		8.0×3.8×2.54 t			● 14.31818 MHz		
						17.734 MHz	41 MHz	
20	MA-406		11.7×4.8×3.7 t		4 MHz			64 MHz*
	MA-505/506		13.46×5.08×4.6 t					
21	CA-301		Φ3.1					

* 8.0 MHz < f_{nom} < 8.2 MHz : Unavailable.
Available frequencies from 4 MHz to less than 5.5 MHz
(4 MHz , 4.032 MHz , 4.096 MHz , 4.19 MHz , 4.194304 MHz ,
4.433619 MHz , 4.5 MHz , 4.8 MHz , 4.9152 MHz)

► Resonator (SAW)

Page	Model	Actual size (mm)	Typ.	Frequency	200 MHz	500 MHz	700 MHz	1 GHz
22	NS-21R		2.5×2.0×0.86 t		300 MHz	500 MHz		
23	NS-32R		3.8×3.8×0.98 t		312 MHz	870 MHz		
	FS-335		3.8×3.8×0.98 t		300 MHz	870 MHz		
	FS-555		4.8×5.2×1.5 t	230 MHz	500 MHz			
24	FS-585		4.8×5.2×1.5 t		300 MHz	500 MHz		



kHz RANGE CRYSTAL UNIT LOW PROFILE SMD

FC-12M

- Frequency range : 32.768 kHz (32 kHz to 77.5 kHz)
- External dimensions : 2.05 × 1.2 × 0.6 t (mm)
- Overtone order : Fundamental
- Applications : Small communications devices



Product Number (please contact us)
X1A0000x1xxxx00



Actual size

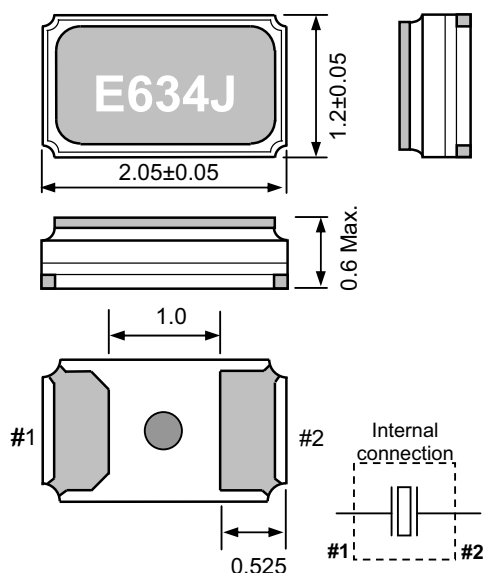


Specifications (characteristics)

Item		Symbol	Specifications		Remarks
Nominal frequency range		f_nom	32.768 kHz	32 kHz to 77.5 kHz	Please contact us for inquiries regarding available frequencies.
Temperature range	Storage temperature	T_stg	-55 °C to +125 °C		Store as bare product after unpacking
	Operating temperature	T_use	-40 °C to +85 °C		
Level of drive		DL	0.5 μW Max.		
Frequency tolerance (standard)		f_tol	±20 × 10 ⁻⁶ ±30 × 10 ⁻⁶		+25 °C, DL=0.1 μW Please ask for tighter tolerance
Turnover temperature		Ti	+25 °C ±5 °C		
Parabolic coefficient		B	-0.04 × 10 ⁻⁶ / °C ² Max.		
Load capacitance		CL	12.5 pF		
Motional resistance (ESR)		R1	90 kΩ Max.	90 kΩ to 65 kΩ	
Motional capacitance		C1	6.4 fF Typ.	7.0 fF to 2.7 fF	
Shunt capacitance		C0	1.3 pF Typ.	1.6 pF to 0.8 pF	
Frequency aging		f_age	±3 × 10 ⁻⁶ / year Max.		+25 °C, First year

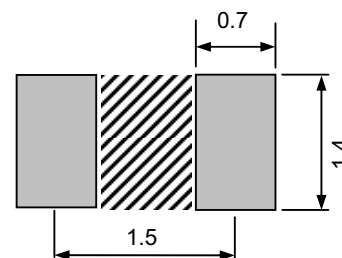
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)



*Do not design any patterns on shaded area.



kHz RANGE CRYSTAL UNIT

LOW PROFILE SMD

FC-13D / FC-13E

- Frequency range : 32.768 kHz
- External dimensions : $3.2 \times 1.5 \times 0.38$ t (mm) ...FC-13D
: $3.2 \times 1.5 \times 0.48$ t (mm) ...FC-13E
- Overtone order : Fundamental
- Applications : Small communications devices
Smart Card



Product Number (please contact us)

FC-13D : X1Axxxxxxxxxx00

FC-13E : X1A000041xxxx00



Actual size

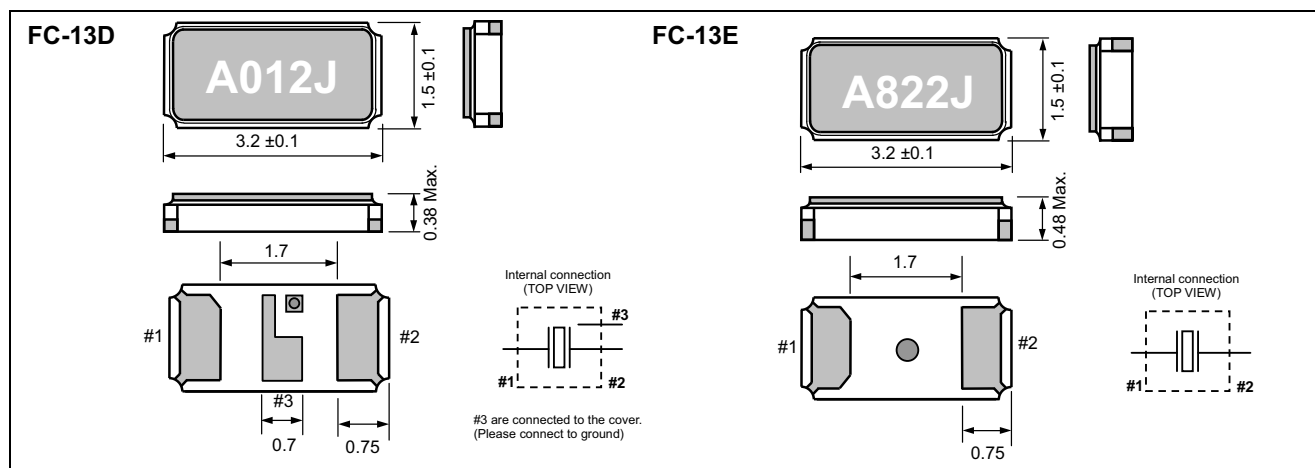
**NEW**

Specifications (characteristics)

Item	Symbol	Specifications		Remarks
		FC-13D	FC-13E	
Nominal frequency range	f _{nom}	32.768 kHz		
Temperature range	Storage temperature	-55 °C to +125 °C		Store as bare product after unpacking
	Operating temperature	-40 °C to +85 °C		
Level of drive	DL	0.5 μW Max.		
Frequency tolerance (standard)	f _{tol}	$\pm 20 \times 10^{-6}$	$\pm 100 \times 10^{-6}$	+25 °C, DL=0.1 μW Please ask for tighter tolerance
Turnover temperature	Ti	+25 °C $\pm$ 5 °C		
Parabolic coefficient	B	$-0.04 \times 10^{-6} / ^\circ\text{C}^2$ Max.		
Load capacitance	CL	7 pF, 9 pF, 12.5 pF	9 pF, 12.5 pF	Please specify
Motional resistance (ESR)	R ₁	75 kΩ Max.		
Motional capacitance	C ₁	3.4 fF Typ.		
Shunt capacitance	C ₀	1.0 pF Typ.		
Frequency aging	f _{age}	$\pm 3 \times 10^{-6} / \text{year}$ Max.		+25 °C, First year

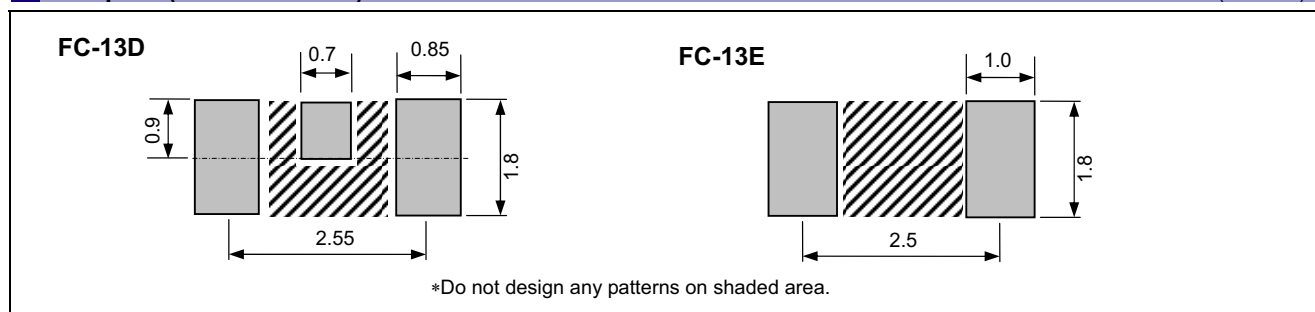
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





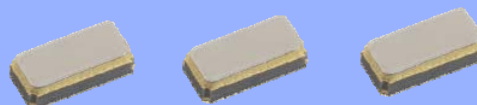
kHz RANGE CRYSTAL UNIT FOR AUTOMOTIVE APPLICATIONS LOW PROFILE SMD



Product Number (please contact us)

FC-13A

- Frequency range : 32.768 kHz
- External dimensions : 3.2 × 1.5 × 0.9 t (mm)
- Overtone order : Fundamental
- Applications : Small communications devices
Smart Card
- Conforms to AEC-Q200



Actual size

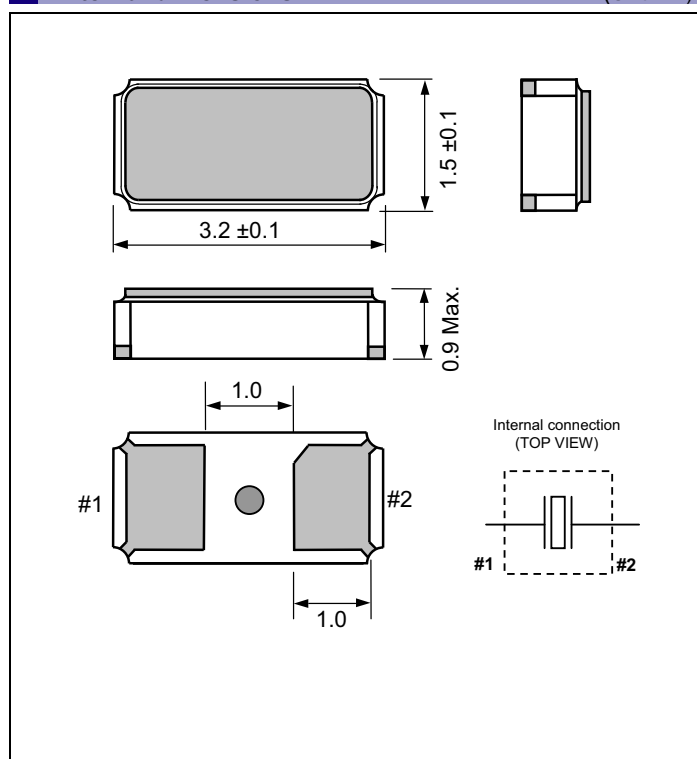
**NEW**

Specifications (characteristics)

Item		Symbol	Specifications	Remarks
Nominal frequency range		f _{nom}	32.768 kHz	
Temperature range	Storage temperature	T _{stg}	-40 °C to +125 °C	Store as bare product after unpacking
	Operating temperature	T _{use}	-40 °C to +125 °C	
Level of drive		DL	0.5 μW Max.	
Frequency tolerance (standard)		f _{tol}	$\pm 20 \times 10^{-6}$, $\pm 30 \times 10^{-6}$, $\pm 50 \times 10^{-6}$	+25 °C, DL=0.1 μW
Turnover temperature		Ti	+25 °C ±5 °C	
Parabolic coefficient		B	$-0.04 \times 10^{-6} / ^\circ\text{C}^2$ Max.	
Load capacitance		CL	9 pF, 12.5 pF	Please specify
Motional resistance (ESR)		R ₁	80 kΩ Max.	
Motional capacitance		C ₁	3.2 fF Typ.	
Shunt capacitance		C ₀	0.9 pF Typ.	
Frequency aging		f _{age}	$\pm 3 \times 10^{-6} / \text{year}$ Max.	+25 °C, First year

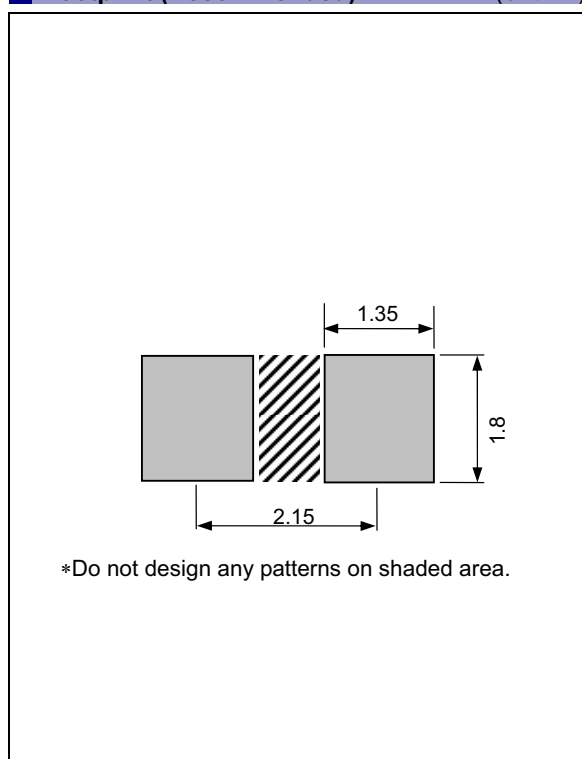
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





kHz RANGE CRYSTAL UNIT

LOW PROFILE SMD

FC-13F

- Frequency range : 32.768 kHz
- External dimensions : 3.2 × 1.5 × 0.55 t (mm) Typ.
- Overtone order : Fundamental
- Applications : Small communications devices



Product Number (please contact us)
Q1xFC13F0xxxx00



Actual size

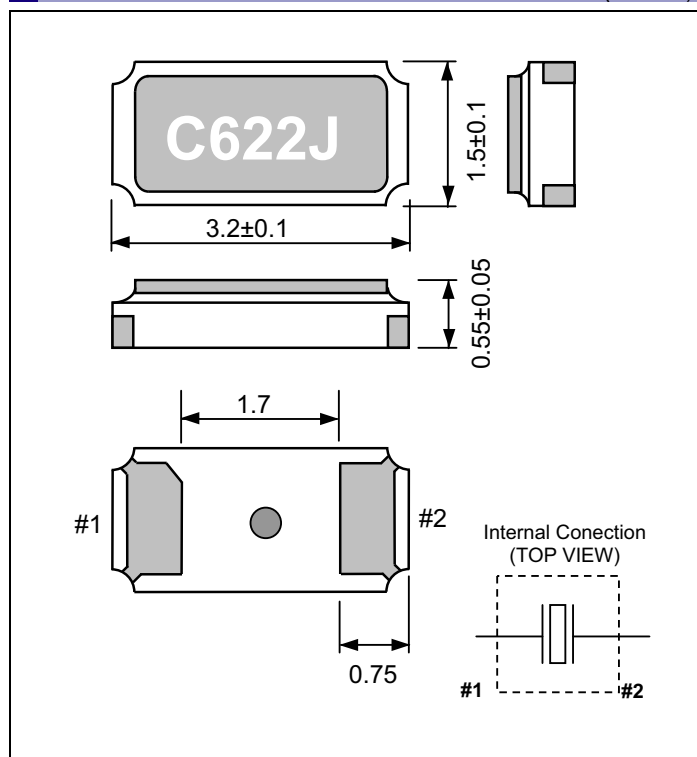


Specifications (characteristics)

Item		Symbol	Specifications	Remarks
Nominal frequency range		f_nom	32.768 kHz	Please contact us for inquiries regarding available frequencies.
Temperature range	Storage temperature	T_stg	-55 °C to +125 °C	Store as bare product after unpacking
	Operating temperature	T_use	-40 °C to +85 °C	
Level of drive		DL	0.5 μW Max.	
Frequency tolerance (standard)		f_tol	±20 × 10 ⁻⁶	+25 °C, DL=0.1 μW Please ask for tighter tolerance
Turnover temperature		Ti	+25 °C ±5 °C	
Parabolic coefficient		B	-0.04 × 10 ⁻⁶ / °C ² Max.	
Load capacitance		CL	7 pF, 9 pF, 12.5 pF	Please specify
Motional resistance (ESR)		R1	80 kΩ Max.	
Motional capacitance		C1	3.3 fF Typ.	
Shunt capacitance		C0	1.0 pF Typ.	
Frequency aging		f_age	±3 × 10 ⁻⁶ / year Max.	+25 °C, First year

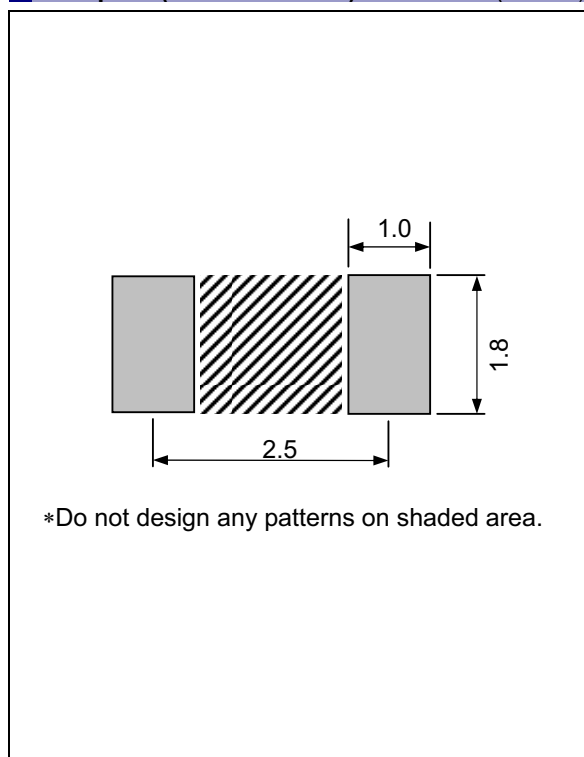
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





kHz RANGE CRYSTAL UNIT

LOW PROFILE SMD

FC-135/FC-145

FC-255

- Frequency range : 32.768 kHz (32 kHz to 100 kHz)
- External dimensions : 3.2 × 1.5 × 0.8 t (mm) ...FC-135
: 4.1 × 1.5 × 0.8 t (mm) ...FC-145
: 4.9 × 1.8 × 0.8 t (mm) ...FC-255
- Overtone order : Fundamental
- Applications : Small communications devices



Product Number (please contact us)

FC-135 : Q13FC1350xxxx00

FC-145 : Q13FC1450xxxx00

FC-255 : Q13FC2550xxxx00



Actual size

FC-135

A501J

FC-145

A501J

FC-255

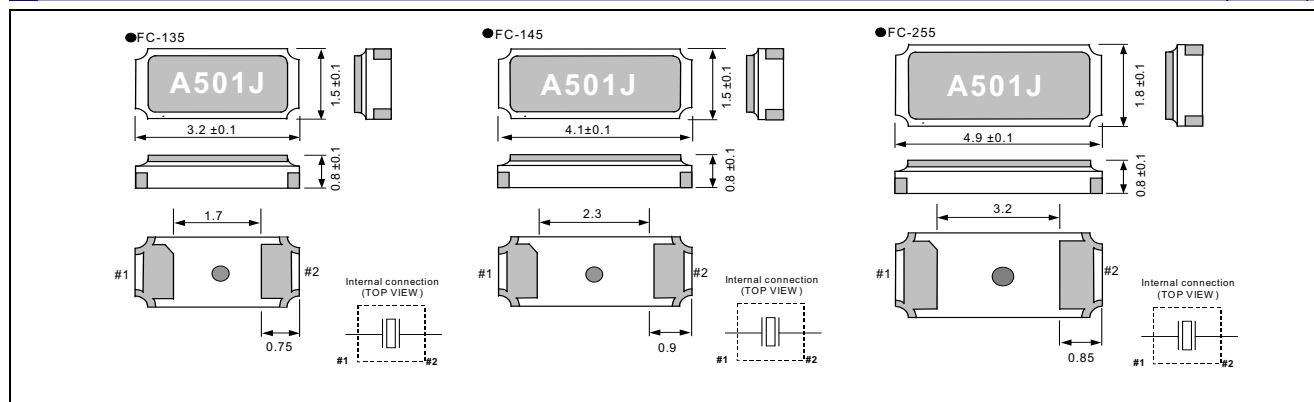
A501J

Specifications (characteristics)

Item	Symbol	Specifications				Remarks
		FC-135/145	FC-255	FC-135	FC-255	
Nominal frequency range	f_nom	32.768 kHz		32 kHz to 77.5 kHz	32 kHz to 100 kHz	Please contact us for inquiries regarding available frequencies.
Temperature range	Storage temperature	-55 °C to +125 °C				Store as bare product after unpacking
	Operating temperature					
Level of drive	DL	0.5 μW Max.				
Frequency tolerance (standard)	f_tol	±20 × 10 ⁻⁶				+25 °C, DL=0.1 μW Please ask for tighter tolerance
Turnover temperature	Ti	+25 °C ±5 °C				
Parabolic coefficient	B	-0.04 × 10 ⁻⁶ / °C ² Max.				
Load capacitance	CL	7 pF, 9 pF, 12.5 pF	7 pF, 12.5 pF	7 pF, 9 pF, 12.5 pF	7 pF, 12.5 pF	Please specify
Motional resistance (ESR)	R ₁	70 kΩ Max.	65 kΩ Max.	70 kΩ to 45 kΩ	70 kΩ to 30 kΩ	
Motional capacitance	C ₁	3.4 fF Typ.	2.0 fF Typ.	3.7 fF to 1.6 fF	2.3 fF to 0.6 fF	
Shunt capacitance	C ₀	1.0 pF Typ.	1.3 pF Typ.	1.3 pF to 0.5 pF	1.7 pF to 0.9 pF	
Frequency aging	f_age	±3 × 10 ⁻⁶ / year Max.				+25 °C, First year

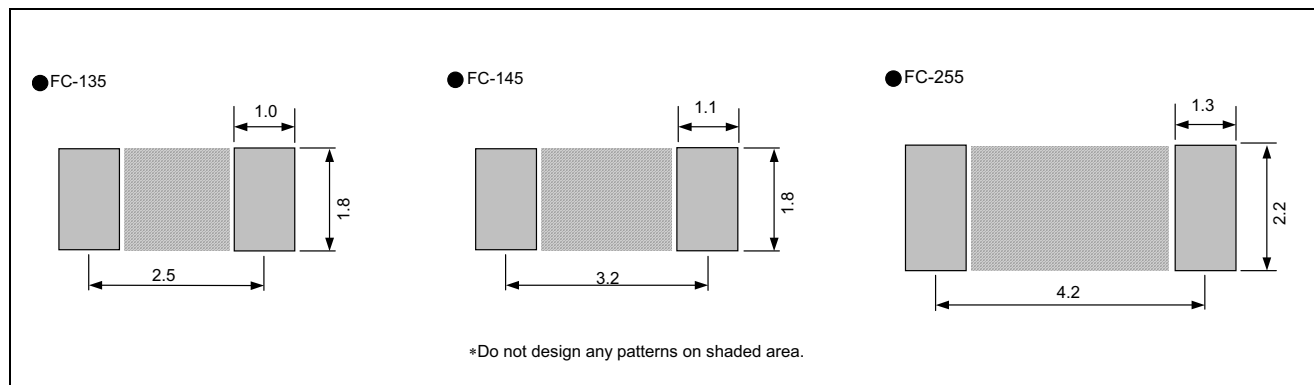
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





kHz RANGE CRYSTAL UNIT

LOW PROFILE SMD

MC-146 / MC-156

- Frequency range : 32.768 kHz (32 kHz to 100 kHz)
- External dimension : 7.0 × 1.5 × 1.4 t (mm) ...MC-146
7.1 × 3.3 × 1.5 t (mm) ...MC-156
- Overtone order : Fundamental
- Applications : Small communications devices



Product Number (please contact us)

MC-146 : Q14MC146xxxxx00

MC-156 : Q14MC156xxxxx00



Actual size

MC-146

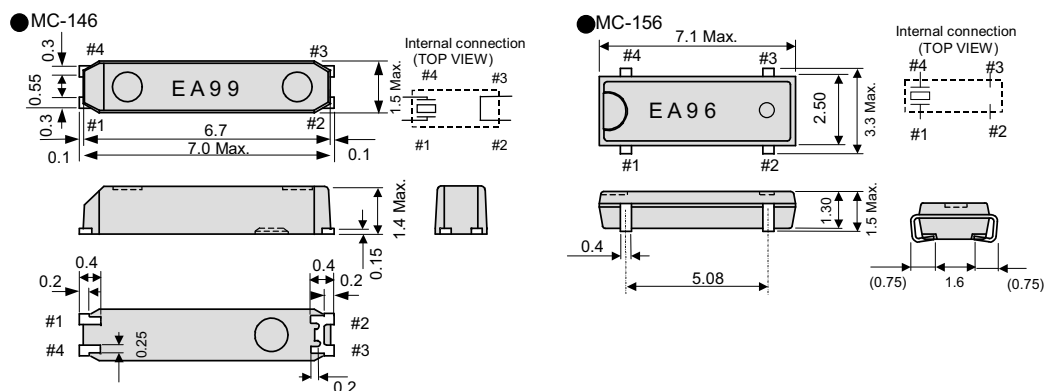
MC-156

Specifications (characteristics)

Item		Symbol	Specifications		Remarks
Nominal frequency range		f_nom	32.768 kHz	32 kHz to 100 kHz	Please contact us for inquiries regarding available frequencies
Temperature range	Storage temperature	T_stg	-55 °C to +125 °C		Store as bare product after unpacking
	Operating temperature	T_use	-40 °C to +85 °C		
Level of drive		DL	1.0 μW Max.		Operating Drive level 0.5 μW Max.
Frequency tolerance (standard)		f_tol	± 20 × 10 ⁻⁶ , ± 50 × 10 ⁻⁶	± 50 × 10 ⁻⁶ , ± 100 × 10 ⁻⁶	+25 °C, DL=0.1 μW
Turnover temperature		Ti	+25 °C ± 5 °C		
Parabolic coefficient		B	-0.04 × 10 ⁻⁶ / °C ² Max.		
Load capacitance		CL	7 pF, 9 pF, 12.5 pF		Please specify
Motional resistance (ESR)		R ₁	65 kΩ Max.	65 kΩ to 25 kΩ	
Motional capacitance		C ₁	1.9 fF Typ.	2.5 fF to 0.6 fF	
Shunt capacitance		C ₀	0.8 pF Typ.	1.2 pF to 0.5 pF	
Frequency aging		f_age	±3 × 10 ⁻⁶ / year Max.	±5 × 10 ⁻⁶ / year Max.	+25 °C, First year

External dimensions

(Unit:mm)

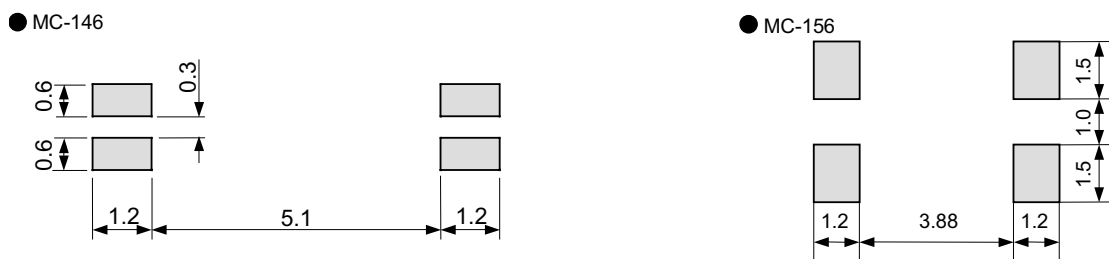


Do not connect #2 and #3 to external device.

Metal may be exposed on the top or bottom of this product. This will not affect any quality, reliability or electrical spec.

Footprint (Recommended)

(Unit:mm)





kHz RANGE CRYSTAL UNIT

SMD

MC - 306

MC - 405 / MC - 406

- Frequency range : 32.768 kHz (20 kHz to 165 kHz)
- Thickness : 8.0 × 3.8 × 2.54 t (mm) ...MC-306
10.41 × 4.06 × 3.6 t (mm) ...MC-405/406
- Overtone order : Fundamental / Overtone (307.2 kHz)
- Applications : Clock and Microcomputer



Product Number (please contact us)

MC-306 : Q13MC3061xxxx00

MC-405 : Q1xMC4051xxxx00

MC-406 : Q1xMC4061xxxx00



Actual size

MC-306

MC-405 / 406



Specifications (characteristics)

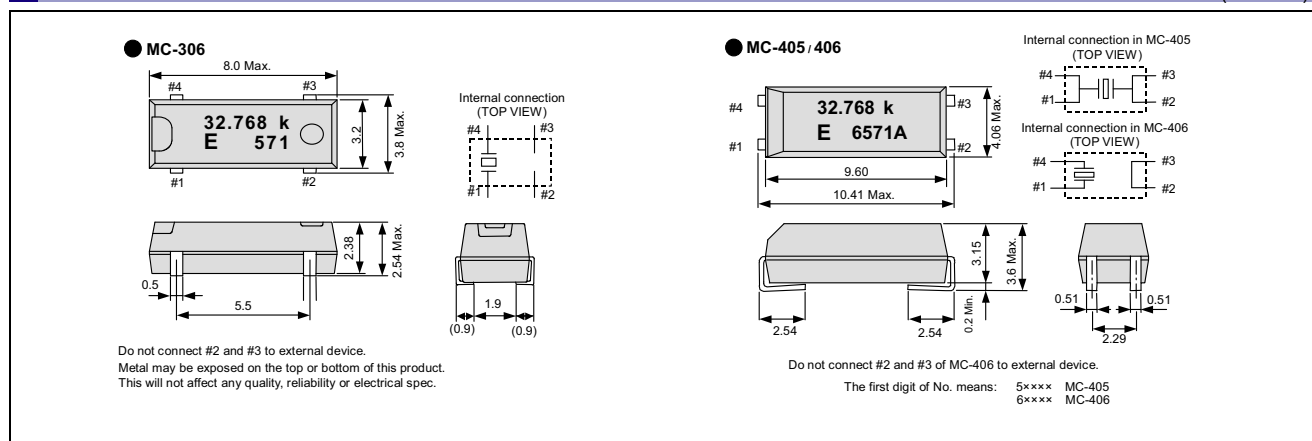
Item		Symbol	Specifications		Remarks
Nominal frequency range		f_nom	32.768 kHz	20 kHz to 165 kHz 307.2 kHz(MC-405 / 406)	Please contact us regarding available frequencies
Temperature range	Storage temperature	T_stg	-55 °C to +125 °C		Store as bare product after unpacking
	Operating temperature	T_use	-40 °C to +85 °C		
Level of drive		DL	1.0 μW Max.		
Frequency tolerance (standard)		f_tol	±20 × 10 ⁻⁶ , ±50 × 10 ⁻⁶	±50 × 10 ⁻⁶ , ±100 × 10 ⁻⁶	+25 °C, DL=0.1 μW
Turnover temperature		Ti	+25 °C ±5 °C		
Parabolic coefficient		B	-0.04 × 10 ⁻⁶ / °C² Max.		
Load capacitance		CL	6 pF to ∞ (standard :12.5 pF)		Please specify
Motional resistance (ESR)		R ₁	50 kΩ Max.	55 kΩ to 6 kΩ	As per below table
Motional capacitance		C ₁	1.8 fF Typ.	4.0 fF to 0.6 fF	MC-306
			2.0 fF Typ.		MC-405 / 406
Shunt capacitance		C ₀	0.9 pF Typ.	2.0 pF to 0.6 pF	MC-306
			0.85 pF Typ.		MC-405 / 406
Frequency aging		f_age	±3 × 10 ⁻⁶ / year Max.	±5 × 10 ⁻⁶ / year Max.	+25 °C, First year

Motional resistance (ESR)

Frequency	20 kHz ≤ f _{nom} < 31.2 kHz	31.2 kHz ≤ f _{nom} < 40 kHz	40 kHz ≤ f _{nom} < 90 kHz	90 kHz ≤ f _{nom} < 130 kHz	130 kHz ≤ f _{nom} ≤ 165 kHz	307.2 kHz
Motional resistance	55 kΩ Max.	35 kΩ Max.	20 kΩ Max.	12 kΩ Max.	10 kΩ Max.	6 kΩ Max.

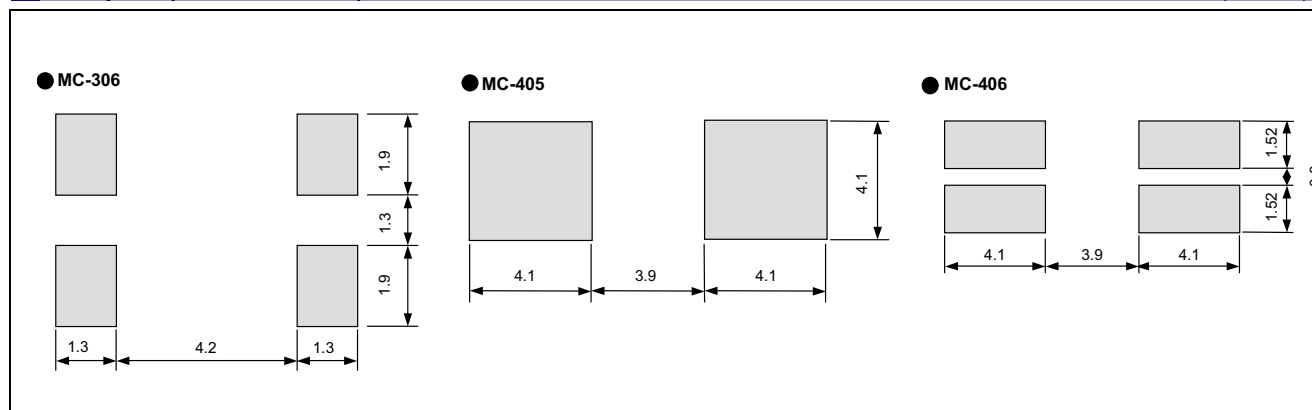
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





kHz RANGE CRYSTAL UNIT FOR AUTOMOTIVE APPLICATIONS



Product Number (please contact us)
Q13MC30A1xxxx00

MC-30A

- Frequency range : 32.768 kHz (20 kHz to 165 kHz)
- Thickness : 2.54 mm Max.
- Overtone order : Fundamental
- Applications : Accessories and ECU sub clock
- Conforms to AEC-Q200



Actual size



Specifications (characteristics)

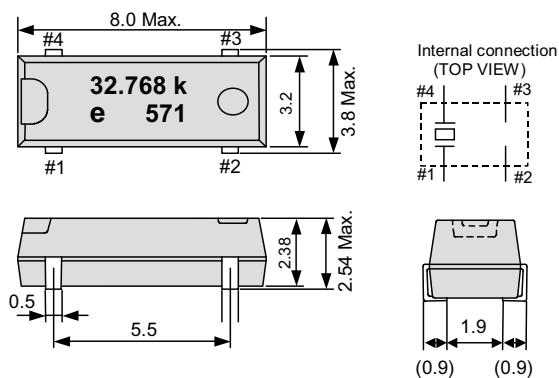
Item		Symbol	Specifications		Remarks
Nominal frequency range		f_nom	32.768 kHz	20 kHz to 165 kHz	Please contact us regarding available frequencies
Temperature range	Storage temperature	T_stg	-55 °C to +125 °C		Store as bare product after unpacking
	Operating temperature	T_use	-40 °C to +85 °C		
Level of drive		DL	1.0 μW Max.		
Frequency tolerance (standard)		f_tol	±20 × 10 ⁻⁶ , ±50 × 10 ⁻⁶	±50 × 10 ⁻⁶ , ±100 × 10 ⁻⁶	+25 °C, DL=0.1 μW
Turnover temperature		Ti	+25 °C ±5 °C		
Parabolic coefficient		B	-0.04 × 10 ⁻⁶ / °C² Max.		
Load capacitance		CL	6 pF to ∞ (standard :12.5 pF)		Please specify
Motional resistance (ESR)		R ₁	50 kΩ Max.	55 kΩ to 10 kΩ	As per below table
Motional capacitance		C ₁	1.8 fF Typ.	4.0 fF to 0.6 fF	
Shunt capacitance		C ₀	0.9 pF Typ.	2.0 pF to 0.6 pF	
Frequency aging		f_age	±3 × 10 ⁻⁶ / year Max.	±5 × 10 ⁻⁶ / year Max.	+25 °C, First year

Motional resistance (ESR)

Frequency	20 kHz ≤ f_nom ≤ 31.2 kHz	31.2 kHz ≤ f_nom ≤ 40 kHz	40 kHz ≤ f_nom ≤ 90 kHz	90 kHz ≤ f_nom ≤ 130 kHz	130 kHz ≤ f_nom ≤ 165 kHz
Motional resistance	55 kΩ Max.	35 kΩ Max.	20 kΩ Max.	12 kΩ Max.	10 kΩ Max.

External dimensions

(Unit:mm)

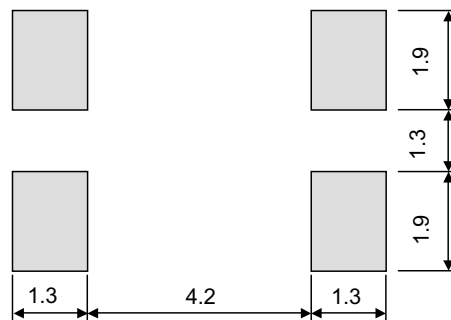


Do not connect #2 and #3 to external device.

Metal may be exposed on the top or bottom of this product.
This will not affect any quality, reliability or electrical spec.

Footprint (Recommended)

(Unit:mm)





kHz RANGE CRYSTAL UNIT CYLINDER

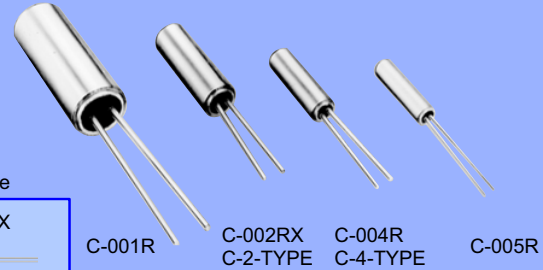
C - TYPE C - 2 - TYPE / C - 4 - TYPE

- Frequency range : 32.768 kHz (20 kHz to 307.2 kHz)
- Thickness : $\phi 1.2$ mm to $\phi 3.1$ mm
- Overtone order : Fundamental / Overtone (192 kHz, 307.2 kHz)
- Applications : Clock and Microcomputer



Product Number (please contact us)

C-001R : Q11C001R1xxxx00
 C-002RX : Q11C002RX1xxxx00
 C-004R : Q11C004R1xxxx00
 C-005R : Q11C005R1xxxx00
 C-2-TYPE : Q12C20001xxxx00
 C-4-TYPE : Q12C40001xxxx00



Actual size

C-002RX

C-001R

C-002RX

C-2-TYPE

C-004R

C-4-TYPE

C-005R

Specifications for C-TYPE (characteristics)

Item		Symbol	C-001R	C-002RX	C-004R	C-005R	Remarks
Nominal frequency range		f _{nom}	32.768 kHz				
Temperature range	Storage temperature	T _{stg}	-20 °C to +70 °C				Store as bare product after unpacking
	Operating temperature	T _{use}	-10 °C to +60 °C				
Level of drive		DL	1.0 μW Max.				
Frequency tolerance (standard)		f _{tol}	±20 ×10 ⁻⁶				+25 °C, DL=0.1 μW
Turnover temperature		T _i	+25 °C ±5 °C				
Parabolic coefficient		B	-0.04 × 10 ⁻⁶ / °C ² Max.				
Load capacitance		CL	6 pF to ∞				Please specify
Motional resistance (ESR)		R ₁	35 kΩ Max. (18 kΩ Typ.)	50 or 60 kΩ Max. (30 kΩ Typ.)	50 kΩ Max. (30 kΩ Typ.)	50 kΩ Max. (37 kΩ Typ.)	
Motional capacitance		C ₁	2.1 fF Typ.	2.0 fF	2.0 fF	1.9 fF Typ.	
Shunt capacitance		C ₀	0.9 pF Typ.	0.85 pF	0.85 pF	0.75 pF Typ.	
Frequency aging		f _{age}	±3 × 10 ⁻⁶ / year Max.				+25 °C, First year

Specifications for C-2-TYPE C-4-TYPE (characteristics)

Item		Symbol	Specifications		Remarks
			C-2-TYPE	C-4-TYPE	
Nominal frequency range		f_nom	20 kHz to 165 kHz, 307.2 kHz	32 kHz to 120 kHz, 192 kHz	
Temperature range	Storage temperature	T_stg	-20 °C to +70 °C		Store as bare product after unpacking
	Operating temperature	T_use	-10 °C to +60 °C		
Level of drive		DL	1.0 μW Max.		
Frequency tolerance (standard)		f_tol	±20 × 10 ⁻⁶ , ±50 × 10 ⁻⁶ , ±100 × 10 ⁻⁶ (307.2 kHz: ±100 × 10 ⁻⁶)	±50 × 10 ⁻⁶ , ±100 × 10 ⁻⁶	+25 °C, DL=0.1 μW
Turnover temperature		Ti	+25 °C ±5 °C		
Parabolic coefficient		B	-0.04 × 10 ⁻⁶ / °C ² Max.		
Load capacitance		CL	6 pF to ∞		Please specify
Motional resistance (ESR)		R1	55 kΩ to 6 kΩ	55 kΩ to 10 kΩ	As per below table
Motional capacitance		C1	4.0 fF to 0.6 fF		
Shunt capacitance		C0	2.0 pF to 0.6 pF		
Frequency aging		f_age	±5 × 10 ⁻⁶ / year Max.		+25 °C, First year

Motional resistance C-2-TYPE

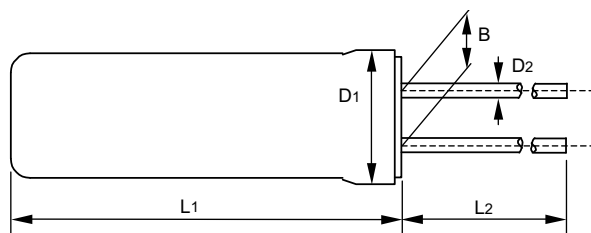
Frequency	20 kHz $\leq$ f _{nom} < 31.2 kHz	31.2 kHz $\leq$ f _{nom} < 40 kHz	40 kHz $\leq$ f _{nom} < 90 kHz	90 kHz $\leq$ f _{nom} < 130 kHz	130 kHz $\leq$ f _{nom} $\leq$ 165 kHz	307.2 kHz
Motional resistance	55 k Ω Max.	35 k Ω Max.	20 k Ω Max.	12 k Ω Max.	10 k Ω Max.	6 k Ω Max.

Motional resistance C-4-TYPE

Frequency	32 kHz $\leq$ f _{nom} < 38 kHz	38 kHz $\leq$ f _{nom} < 60 kHz	60 kHz $\leq$ f _{nom} < 74 kHz	74 kHz $\leq$ f _{nom} $\leq$ 100 kHz	100 kHz $\leq$ f _{nom} $\leq$ 120 kHz	192 kHz
Motional resistance	55 k Ω Max.	30 k Ω Max.	25 k Ω Max.	22 k Ω Max.	15 k Ω Max.	10 k Ω Max.

External dimensions

(Unit:mm)



Model	L1	L2	D1	D2	B
C-001R	8.0 Max.	9.0 Min.	$\phi 3.1$ Max.	$\phi 0.3$	1.1
C-002RX	6.0 Max.	4.0 Min.	$\phi 2.0$ Max.	$\phi 0.2$	0.7
C-2-TYPE					
C-004R	5.0 Max.	4.0 Min.	$\phi 1.5$ Max.	$\phi 0.18$	0.5
C-4-TYPE					
C-005R	4.6 Max.	4.0 Min.	$\phi 1.2$ Max.	$\phi 0.15$	0.3

160 kHz to 165 kHz, 307.2 kHz: D1 = $\phi 2.2$ Max. (C-2-TYPE)



MHz RANGE CRYSTAL UNIT

ULTRA MINIATURE SIZE LOW PROFILE SMD

FA-118/FA-118T

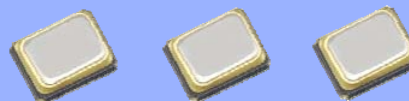
- Nominal frequency range : 26 MHz to 29.999 MHz ... FA-118
: 30 MHz to 54 MHz ... FA-118T
- External dimensions : $1.6 \times 1.2 \times 0.4$ t (mm) ... FA-118
: $1.6 \times 1.2 \times 0.35$ t (mm) ... FA-118T
- Overtone order : Fundamental
- Applications : Mobile phone, Bluetooth, W-LAN
ISM band radio, Clock for MPU



Product Number (please contact us)

FA-118 : X1E000271xxxx00

FA-118T : X1E000251xxxx00



Actual size

NEW

Specifications (characteristics)

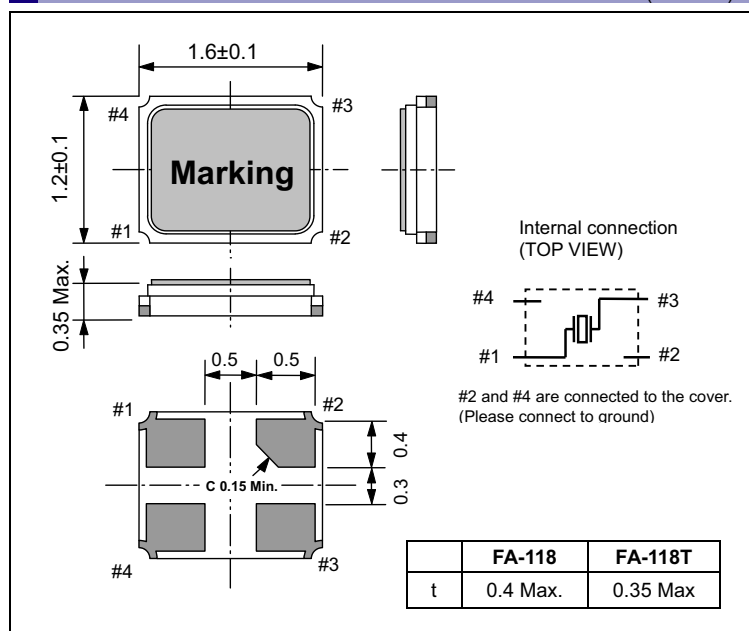
Item	Symbol	Specifications		Remarks
		For RF Reference	For Clock	
Nominal frequency range	f_nom	26.000 MHz to 29.999 MHz : FA-118 30.000 MHz to 54.000 MHz : FA-118T		Fundamental Please contact us for inquiries regarding the available frequencies.
Storage temperature range	T_stg	-40 °C to +125 °C		Store as bare product after unpacking
Operating temperature range	T_use	-40 °C to +85 °C		
Level of drive	DL	100 μ W Max.	200 μ W Max.	Recommended: 1 μ W to 100 μ W
Frequency tolerance (standard)	f_tol	$\pm 10 \times 10^{-6}$	$\pm 30 \times 10^{-6}$	+25 °C For the out of standard specifications, please contact us for inquiries.
Frequency versus temperature characteristics (standard)	f_tem	$\pm 12 \times 10^{-6}$	$\pm 30 \times 10^{-6}$	-20 °C to +75 °C For the out of standard specifications, please contact us for inquiries.
Load capacitance	CL	6 pF to ∞		Please specify.
Motional resistance (ESR)	R1	As per below table		-20 °C to +75 °C
Frequency aging	f_age	$\pm 1 \times 10^{-6}$ / year Max.	$\pm 5 \times 10^{-6}$ / year Max.	+25 °C, First year

Motional resistance (ESR)

Frequency	Motional resistance
26.0 MHz $\leq$ f_nom < 30.0 MHz	200 Ω Max.
30.0 MHz $\leq$ f_nom < 32.0 MHz	200 Ω Max.
32.0 MHz $\leq$ f_nom < 36.0 MHz	100 Ω Max.
36.0 MHz $\leq$ f_nom $\leq$ 54.0 MHz	80 Ω Max.

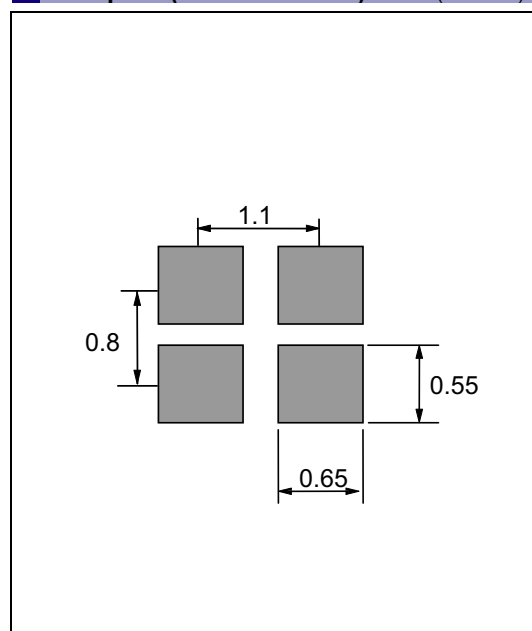
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





MHz RANGE CRYSTAL UNIT

ULTRA MINIATURE SIZE LOW PROFILE SMD

FA-128

- Nominal frequency range : 24 MHz to 54 MHz
- External dimensions : 2.0 × 1.6 × 0.5 t (mm)
- Overtone order : Fundamental
- Applications : Mobile phone, Bluetooth, W-LAN
ISM band radio, Clock for MPU



Product Number (please contact us)
Q22FA1280xxxx00



Actual size

Specifications (characteristics)

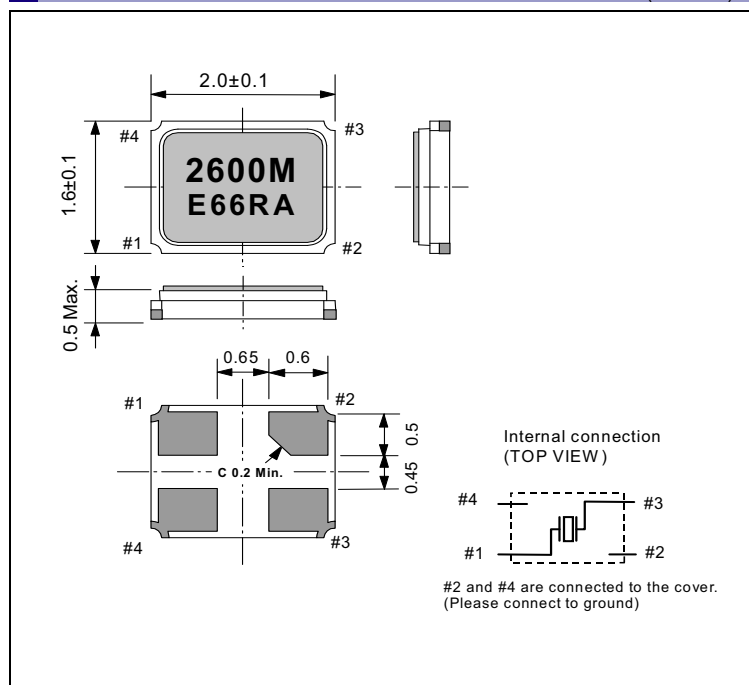
Item	Symbol	Specifications		Remarks
		For RF Reference	For Clock	
Nominal frequency range	f_nom	24.000 MHz to 54.000 MHz		Fundamental Please contact us for inquiries regarding the available frequencies.
Storage temperature range	T_stg	-40 °C to +125 °C		Store as bare product after unpacking
Operating temperature range	T_use	-40 °C to +85 °C		
Level of drive	DL	100 μW Max.	200 μW Max.	Recommended: 1 to 100 μW
Frequency tolerance (standard)	f_tol	±10 × 10 ⁻⁶	±30 × 10 ⁻⁶	+25 °C For the out of standard specifications, please contact us for inquiries.
Frequency versus temperature characteristics (standard)	f_tem	±10 × 10 ⁻⁶	±30 × 10 ⁻⁶	-20 °C to +75 °C For the out of standard specifications, please contact us for inquiries.
Load capacitance	CL	6 pF to ∞		Please specify.
Motional resistance (ESR)	R1	As per below table		-20 °C to +75 °C
Frequency aging	f_age	±1 × 10 ⁻⁶ / year Max.	±5 × 10 ⁻⁶ / year Max.	+25 °C, First year

Motional resistance (ESR)

Frequency	Motional resistance
24.0 MHz ≤ f_nom < 26.0 MHz	80 Ω Max.
26.0 MHz ≤ f_nom ≤ 54.0 MHz	60 Ω Max.

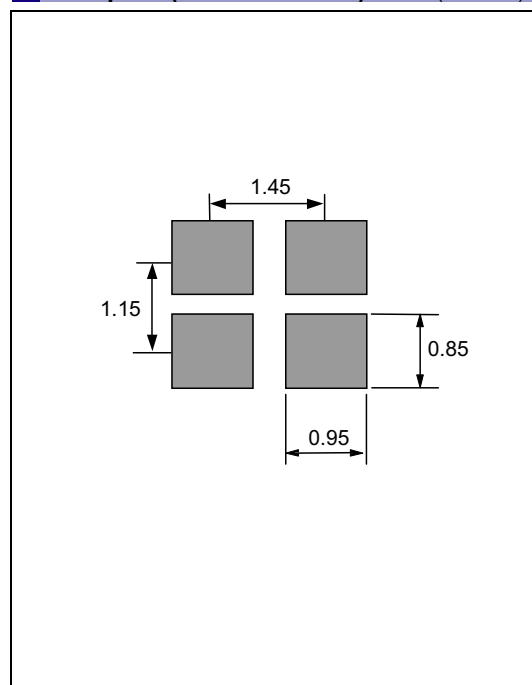
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





MHz RANGE CRYSTAL UNIT

ULTRA MINIATURE SIZE LOW PROFILE SMD

FA-20H

- Nominal frequency range : 12 MHz to 48 MHz
- External dimensions : 2.5× 2.0×0.55 t (mm)
- Overtone order : Fundamental
- Applications : Mobile phone, Bluetooth, W-LAN
ISM band radio, Clock for MPU



Product Number (please contact us)
Q24FA20H0xxxx00



Actual size



Specifications (characteristics)

Item	Symbol	Specifications		Remarks
		For RF Reference	For Clock	
Nominal frequency range	f _{nom}	12.000 MHz to 48.000 MHz		Fundamental Please contact us for inquiries regarding the available frequencies.
Storage temperature range	T _{stg}	-40 °C to +125 °C		Store as bare product after unpacking.
Operating temperature range	T _{use}	-40 °C to +85 °C		
Level of drive	DL	100 μW Max.	200 μW Max.	Recommended: 1 μW to 100 μW
Frequency tolerance	f _{tol}	±10 × 10 ⁻⁶ to ±30 × 10 ⁻⁶ *1	±30 × 10 ⁻⁶	+25 °C Please contact us for inquiries.
Frequency versus temperature characteristics	f _{tem}	±10 × 10 ⁻⁶ to ±30 × 10 ⁻⁶ *1	±30 × 10 ⁻⁶	-20 °C to +75 °C Please contact us for inquiries.
Load capacitance	CL	6 pF to ∞		Please specify.
Motional resistance (ESR)	R ₁	As per below table		-20 °C to +75 °C
Frequency aging	f _{age}	±1 × 10 ⁻⁶ to ±3 × 10 ⁻⁶ / year Max. *1		+25 °C, First year

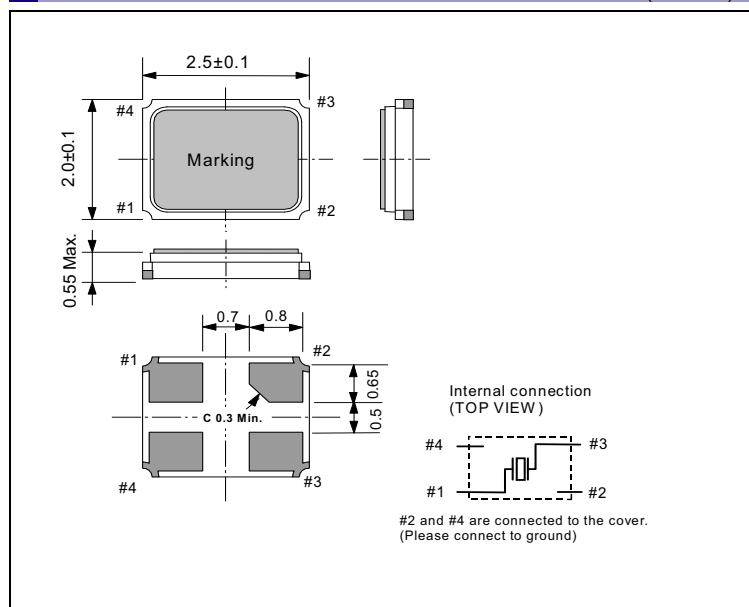
*1 Please contact us for inquiries regarding available frequency tolerance.

Motional resistance (ESR)

Frequency	Motional resistance
12.0 MHz ≤ f _{nom} < 16.0 MHz	150 Ω Max.
16.0 MHz ≤ f _{nom} ≤ 25.0 MHz	80 Ω Max.
25.0 MHz < f _{nom} ≤ 30.0 MHz	60 Ω Max.
30.0 MHz < f _{nom} ≤ 35.0 MHz	50 Ω Max.
35.0 MHz < f _{nom} ≤ 48.0 MHz	40 Ω Max.

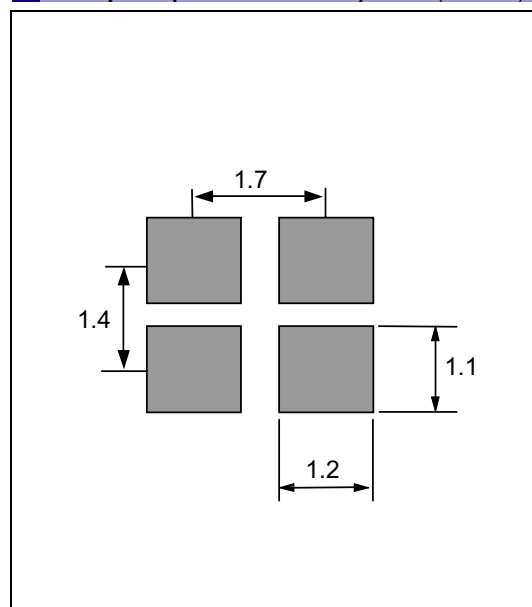
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





MHz RANGE CRYSTAL UNIT

MINIATURE SIZE LOW PROFILE SMD

FA-238V / FA-238

TSX-3225

- Frequency range : 12 MHz to 60 MHz (FA-238, FA-238V)
- External dimensions : 3.2 × 2.5 × 0.6 t (mm) ... TSX-3225
- : 3.2 × 2.5 × 0.7 t (mm) ... FA-238V / FA-238
- Overtone order : Fundamental
- Applications : Mobile phone, Bluetooth, W-LAN
- ISM band radio, Clock for MPU



Product Number (please contact us)

FA-238V : Q22FA23V0xxxx00

FA-238 : Q22FA2380xxxx00

TSX-3225 : X1E000021xxxx00



Actual size

FA-238V / FA-238

TSX-3225

Specifications (characteristics)

Item	Symbol	For Clock		For RF Reference	Remarks
		FA-238V	FA-238	TSX-3225	
Nominal frequency range	f _{nom}	12.000 MHz to 15.999 MHz	16.000 MHz to 60.000 MHz	16.000 MHz to 48.000 MHz	Fundamental *1 For the out of standard specifications, please contact us for inquiries.
Temperature Range	T _{stg} T _{use}	-40 °C to +125 °C -40 °C to +85 °C			Store as bare product after unpacking
Level of drive	DL	200 μW Max.			Recommended: 1 to 100 μW
Frequency tolerance	f _{tol}	±50 × 10 ⁻⁶ (standard), (±15 × 10 ⁻⁶ to ±50 × 10 ⁻⁶ is available)		±10 × 10 ⁻⁶	+25 °C For the out of standard specifications, please contact us for inquiries. *1
Frequency versus temperature characteristics	f _{tem}	±30 × 10 ⁻⁶ / -20 °C to +70 °C		±10 × 10 ⁻⁶ / -20 °C to +75 °C	For the out of standard specifications, please contact us for inquiries. *1
Load capacitance	CL	7 pF to ∞			For the out of standard specifications, please contact us for inquiries.
Motional resistance (ESR)	R ₁	As per below table		As per below table	-40 °C to +85 °C, DL = 100 μW
Frequency aging	f _{age}	±5 × 10 ⁻⁶ / year Max.		±1 × 10 ⁻⁶ / year Max.*2	+25 °C, First year

*1 FA-238: For over 40 MHz, only the standard specification applies.

*2 40 MHz ≤ f_{nom} : ±2 × 10⁻⁶ / year Max.

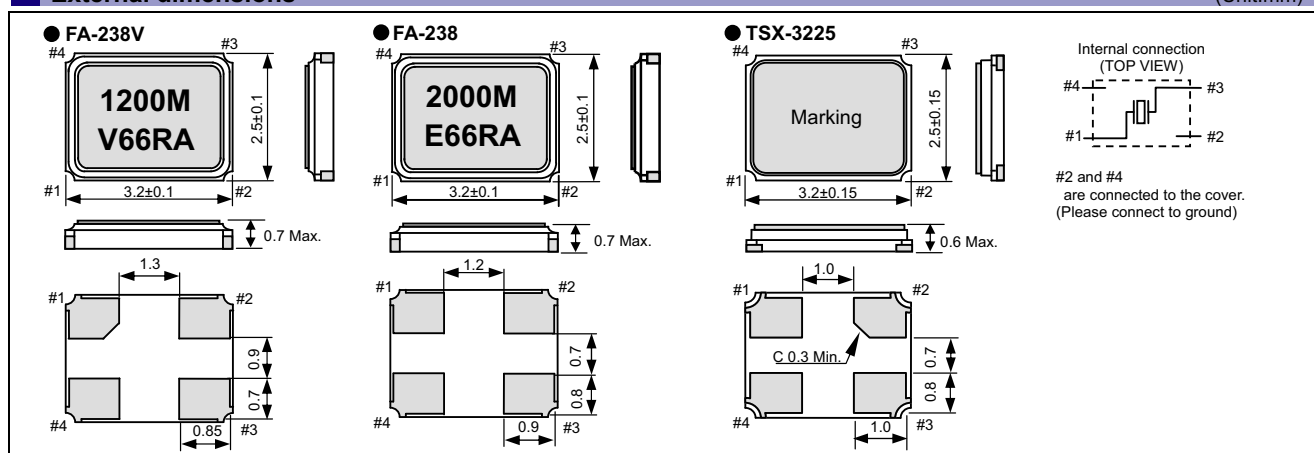
Motional resistance (ESR)

(FA-238V / FA-238) Frequency	Motional resistance
12.0 MHz ≤ f _{nom} ≤ 13.0 MHz	100 Ω Max.
13.0 MHz < f _{nom} < 20.0 MHz	80 Ω Max.
20.0 MHz ≤ f _{nom} < 25.0 MHz	60 Ω Max.
25.0 MHz ≤ f _{nom} < 30.0 MHz	50 Ω Max.
30.0 MHz ≤ f _{nom} ≤ 60.0 MHz	40 Ω Max.

(TSX-3225) Frequency	Motional resistance
16.0 MHz ≤ f _{nom} < 21.0 MHz	60 Ω Max.
21.0 MHz ≤ f _{nom} ≤ 48.0 MHz	40 Ω Max.

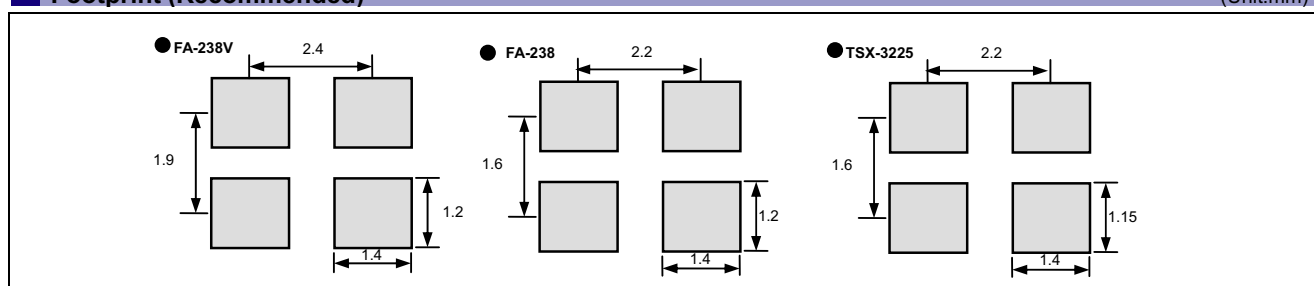
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





MHz RANGE CRYSTAL UNIT

LOW PROFILE SMD

TSX-4025 / TSX-5032

- Frequency range : 12 MHz to 32 MHz / 10 MHz to 32 MHz
- External dimensions: 4.0 × 2.5 × 0.7 t (mm) ...TSX-4025
5.0 × 3.2 × 0.8 t (mm) ...TSX-5032
- Overtone order : Fundamental
- Applications : Mobile phone, Bluetooth, W-LAN
ISM band radio, Clock for MPU



Product Number (please contact us)
 TSX-4025 : X1E000041xxxx00
 TSX-5032 : X1E000061xxxx00



Actual size

TSX-4025

TSX-5032

Specifications (characteristics)

Item	Symbol	Specification		Remarks
		TSX-4025	TSX-5032	
Nominal frequency range	f _{nom}	12.000 MHz to 32.000 MHz	10.000 MHz to 32.000 MHz	Fundamental
Storage temperature range	T _{stg}	-40 °C to +125 °C		Store as bare product after unpacking.
Operating temperature range	T _{use}	-20 °C to +75 °C		
Level of drive	DL	100 μW Max.		Recommended: 1 to 100 μW
Frequency tolerance (standard)	f _{tol}	±10 × 10 ⁻⁶		+25 °C
Frequency versus temperature characteristics (standard)	f _{tem}	±10 × 10 ⁻⁶		-20 °C to +75 °C
Load capacitance	CL	9 pF to ∞		Please specify.
Motional resistance (ESR)	R ₁	As per below table		-20 °C to +75 °C
Frequency aging	f _{age}	±1 × 10 ⁻⁶ / year Max.		+25 °C, First year

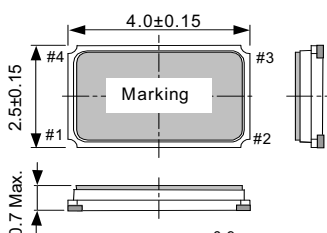
Motional resistance (ESR)

Frequency	TSX-4025	TSX-5032
10.0 MHz ≤ f _{nom} < 12.0 MHz	—	60 Ω Max.
12.0 MHz ≤ f _{nom} < 13.0 MHz	60 Ω Max.	
13.0 MHz ≤ f _{nom} < 17.0 MHz	60 Ω Max.	40 Ω Max.
17.0 MHz ≤ f _{nom} ≤ 32.0 MHz	40 Ω Max.	

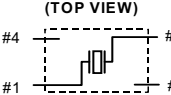
External dimensions

(Unit:mm)

● TSX-4025

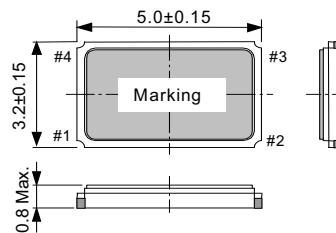


Internal Connection (TOP VIEW)

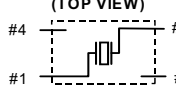


#2 and #4 are connected to the cover.
(Please connect to ground)

● TSX-5032



Internal Connection (TOP VIEW)

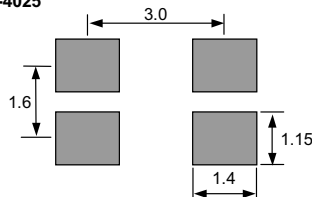


#2 and #4 are connected to the cover.
(Please connect to ground)

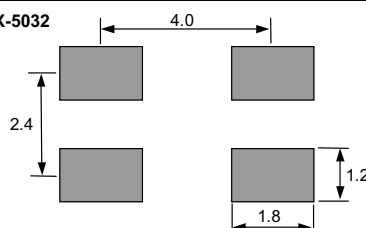
Footprint (Recommended)

(Unit:mm)

● TSX-4025



● TSX-5032



**MHz RANGE CRYSTAL UNIT**
LOW PROFILE SMD**FA - 365**

- Frequency range : 12 MHz, 14 MHz to 41 MHz
- External dimensions : 6.0 × 3.5 × 1.4 t (mm)
- Overtone order : Fundamental
- Applications : For Clock of integrated circuit

**Product Number (please contact us)**
Q22FA3650xxxx00

Actual size

**Specifications (characteristics)**

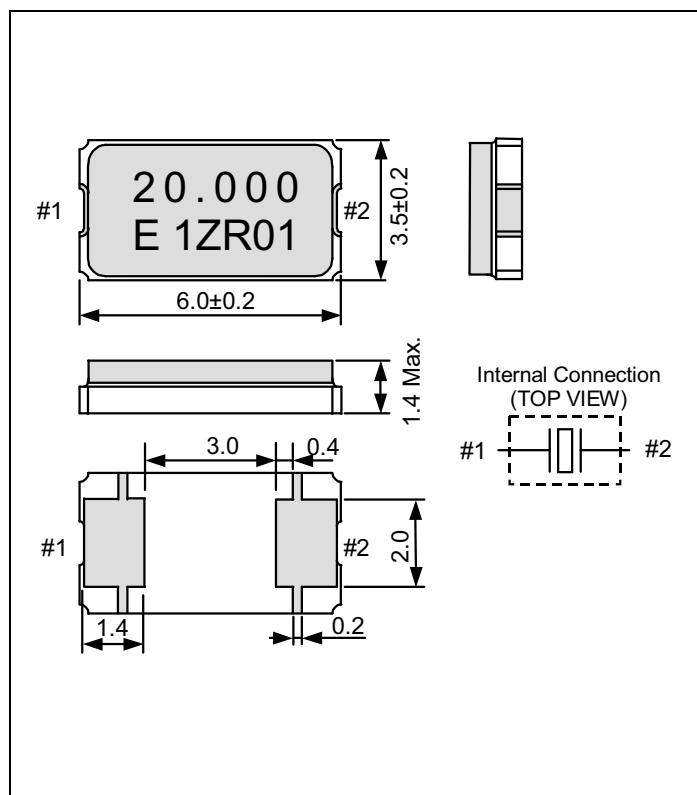
Item		Symbol	Specifications	Remarks
Nominal frequency range		f _{nom}	12.000 MHz, 14.000 MHz to 41.000 MHz	Fundamental
Temperature range	Storage temperature	T _{stg}	-55 °C to +125 °C	Store as bare product after unpacking
	Operating temperature	T _{use}	-20 °C to +70 °C	Please contact us on availability of -40 °C to +85 °C
Level of drive		DL	10 µW to 100 µW	
Frequency tolerance (standard)		f _{tol}	±50 × 10 ⁻⁶ , ±100 × 10 ⁻⁶	+25 °C
Frequency versus temperature characteristics (standard)		f _{tem}	±30 × 10 ⁻⁶	-20 °C to +70 °C For the out of standard specifications, please contact us for inquiries
Load capacitance		CL	10 pF to ∞	Please specify
Motional resistance (ESR)		R1	As per below table	-20 °C to +70 °C, DL=100 µW
Frequency aging		f _{age}	±5 × 10 ⁻⁶ / year Max.	+25 °C, First year

Motional resistance (ESR)

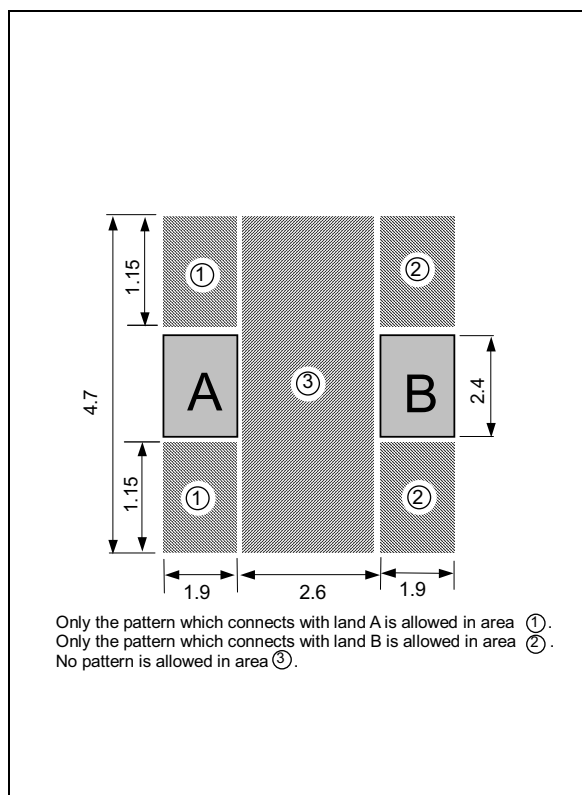
Frequency	Motional resistance
12.0 MHz	60 Ω Max.
14.0 MHz ≤ f _{nom} ≤ 41.0 MHz	50 Ω Max.

External dimensions

(Unit:mm)

**Footprint (Recommended)**

(Unit:mm)



Only the pattern which connects with land A is allowed in area ①.
Only the pattern which connects with land B is allowed in area ②.
No pattern is allowed in area ③.

**MHz RANGE CRYSTAL UNIT**
LOW PROFILE SMD**MA-306**

- Frequency range : 14.31818 MHz, 17.734 MHz to 41 MHz
- External dimensions : 8.0 × 3.8 × 2.54 t (mm) Max.
- Overtone order : Fundamental
- Applications : For Clock of integrated circuit

Product Number (please contact us)
Q22MA3061xxxx00

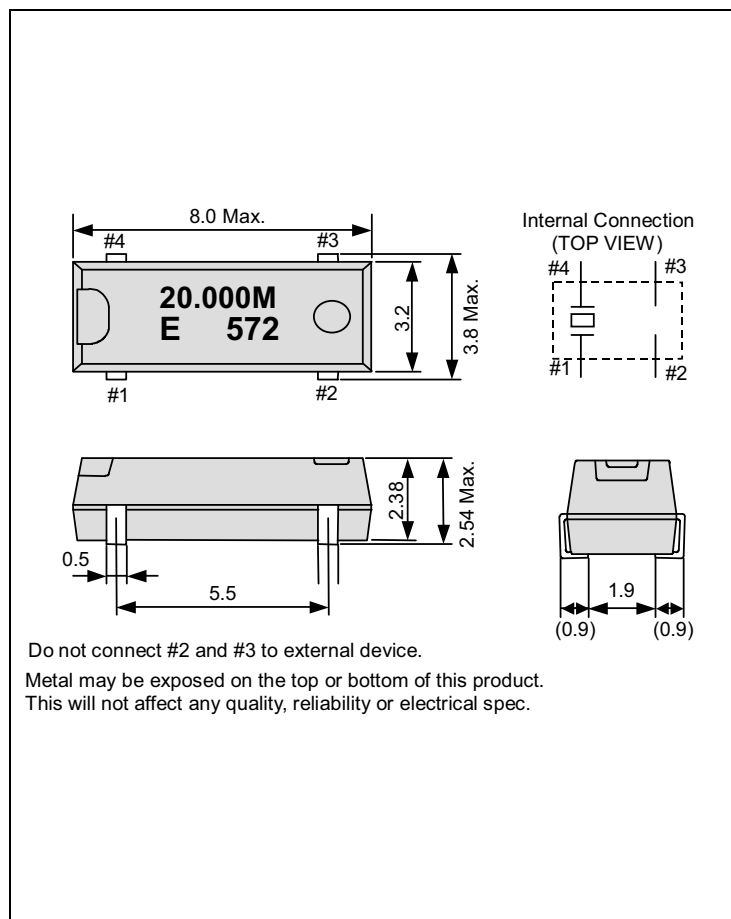
Actual size

**Specifications (characteristics)**

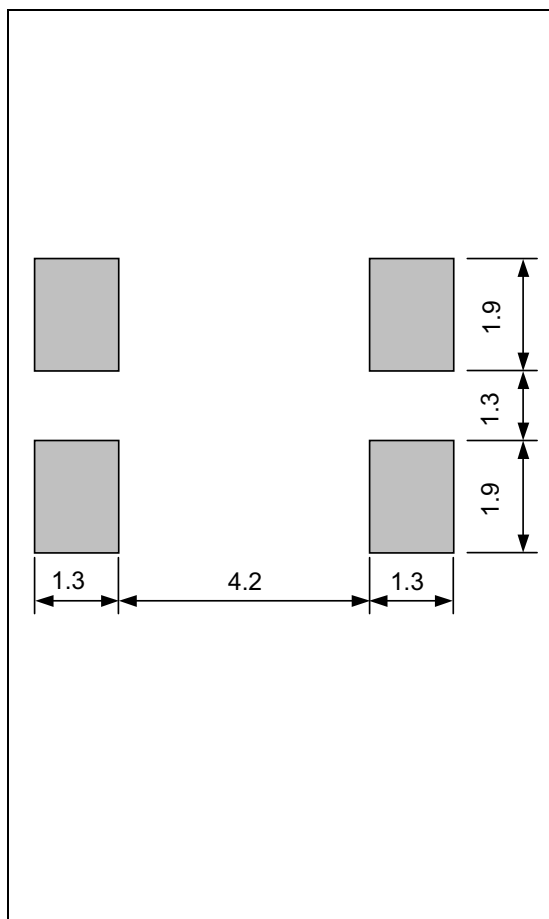
Item		Symbol	Specifications	Remarks
Nominal frequency range		f_nom	14.31818 MHz, 17.734 MHz to 41.000 MHz	Fundamental
Temperature range	Storage temperature	T_stg	-55 °C to +100 °C	Store as bare product after unpacking
	Operating temperature	T_use	-20 °C to +70 °C	
Level of drive		DL	10 µW to 100 µW	
Frequency tolerance (standard)		f_tol	±50 × 10 ⁻⁶	+25 °C
Frequency versus temperature characteristics (standard)		f_tem	±30 × 10 ⁻⁶	-20 °C to +70 °C For the out of standard specifications, please contact us for inquiries
Load capacitance		CL	10 pF to ∞	Please specify
Motional resistance (ESR)		R ₁	60 Ω Max.	-20 °C to +70 °C, DL=100 µW
Frequency aging		f_age	±5 × 10 ⁻⁶ / year Max.	+25 °C, First year

External dimensions

(Unit:mm)

**Footprint (Recommended)**

(Unit:mm)





MHz RANGE CRYSTAL UNIT SMD

MA-406 MA-505 / MA-506

- Frequency range : 4 MHz to 64 MHz
- Thickness : 11.7 × 4.8 × 3.7 t (mm) ... MA-406
13.46 × 5.08 × 4.6 t (mm) ... MA-505 / 506
- Overtone order : Fundamental
3rd overtone (30 MHz to 64 MHz)
- Applications : For Clock of integrated circuit



Product Number (please contact us)

MA-406 : Q22MA4061xxxx00

MA-505 : Q22MA5051xxxx00

MA-506 : Q22MA5061xxxx00



Actual size

MA-406



MA-505 / 506



Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Nominal frequency range	f _{nom}	4.000 MHz to 29.999 MHz	Fundamental *1
		30.000 MHz to 64.000 MHz	3rd overtone *2
Temperature range	T _{stg}	-55 °C to +125 °C	Store as bare product after unpacking
Storage temperature	T _{use}	-20 °C to +70 °C	Please contact us on availability of -40 °C to +85 °C
Operating temperature	DL	10 μW to 100 μW	
Level of drive	f _{tol}	±50 × 10 ⁻⁶	+25 °C
Frequency tolerance (standard)	f _{tem}	Under 5.5 MHz : ±50 × 10 ⁻⁶	-20 °C to +70 °C
Frequency versus temperature characteristics (standard)		Over 5.5 MHz : ±30 × 10 ⁻⁶	For the out of standard specifications, please contact us for inquiries
Load capacitance	CL	Fundamental: 10 pF to ∞	
		Overtone: 5 pF to ∞	Please specify
Motional resistance (ESR)	R ₁	As per below table	-20 °C to +70 °C, DL=100 μW
Shunt capacitance	C ₀	5 pF Max.	
Frequency aging	f _{age}	±5 × 10 ⁻⁶ / year Max.	+25 °C, First year

*1 4.0 MHz ≤ f_{nom} < 5.5 MHz : See "Available frequencies from 4.0 MHz to less than 5.5 MHz". 8.0 MHz < f_{nom} < 8.2 MHz: Unavailable.

*2 26.000 MHz ≤ f_{nom} < 30.000 MHz : please contact us for inquiries for 3rd overtone mode.

Available frequencies from 4.0 MHz to less than 5.5 MHz (MHz)

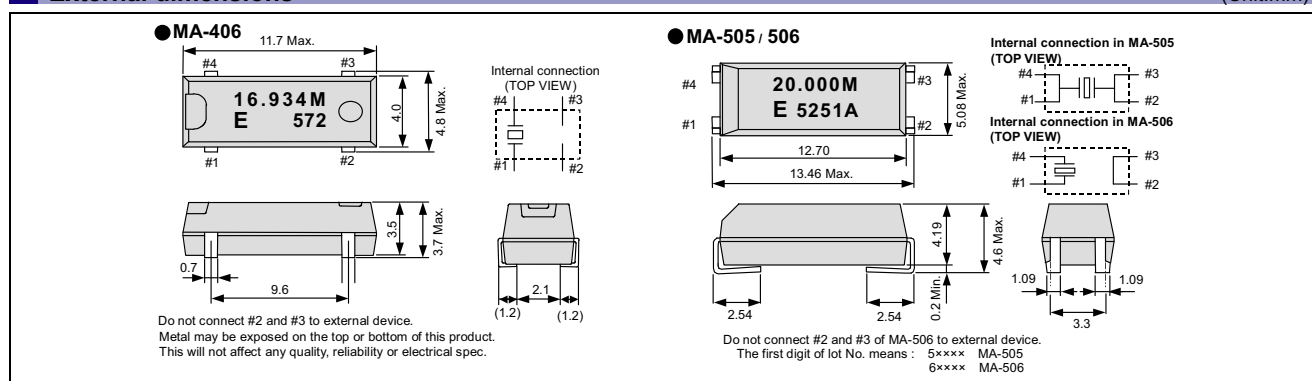
4.000	4.032	4.096	4.190	4.194304	4.433619	4.500	4.800	4.9152
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Motional resistance (ESR)

Frequency (MHz)	4 ≤ f _{nom} < 5.5	5.5 ≤ f _{nom} < 6	6 ≤ f _{nom} < 10	10 ≤ f _{nom} < 12	12 ≤ f _{nom} < 16	16 ≤ f _{nom} < 30	30 ≤ f _{nom} ≤ 36	36 < f _{nom} ≤ 64
Motional resistance	150 Ω Max.	100 Ω Max.	80 Ω Max.	60 Ω Max.	50 Ω Max.	40 Ω Max.	100 Ω Max.	80 Ω Max.
Overtone order	Fundamental						3rd overtone	

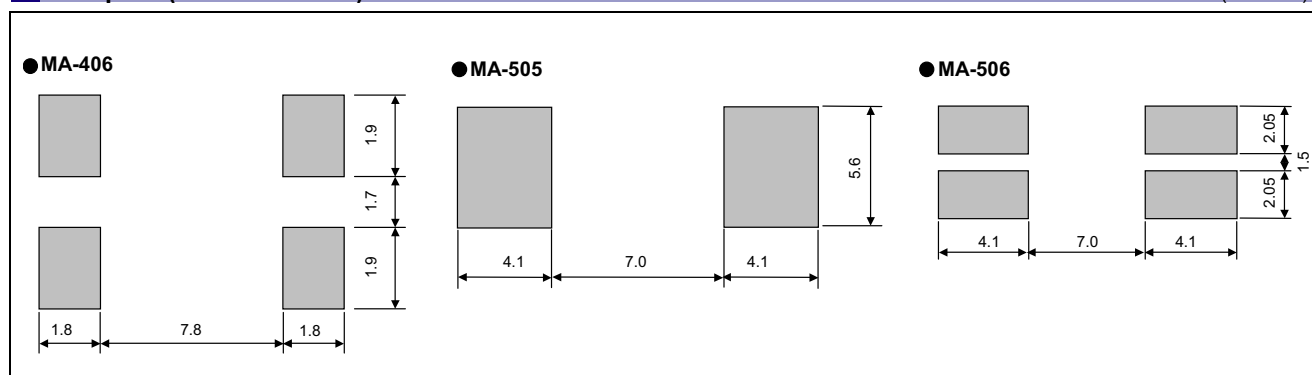
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





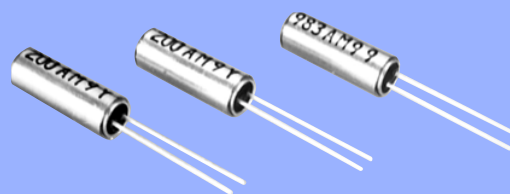
MHz RANGE CRYSTAL UNIT CYLINDER

CA-301

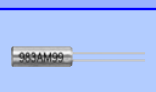
- Frequency range : 4 MHz to 64 MHz
- Thickness : $\phi 3.1$ mm Max.
- Overtone order : Fundamental
3rd overtone (30 MHz to 64 MHz)
- Applications : For Clock of integrated circuit



Product Number (please contact us)
Q21CA3011xxxx00



Actual size



Specifications (characteristics)

Item	Symbol	Specification	Remarks
Nominal frequency range	f _{nom}	4.000 MHz to 29.999 MHz	Fundamental *1
		30.000 MHz to 64.000 MHz	3rd overtone *2
Temperature range	T _{stg}	-40 °C to +85 °C	Store as bare product after unpacking
	T _{use}	-20 °C to +70 °C	The operating temperature range is -10 °C to +60 °C for 5.5 MHz and below
Level of drive	DL	10 μ W to 100 μ W	
Frequency tolerance (standard)	f _{tol}	$\pm 30 \times 10^{-6}$ (Under 5.5 MHz: $\pm 50 \times 10^{-6}$; $\pm 100 \times 10^{-6}$)	+25 °C
Frequency versus temperature characteristics (standard)	f _{tem}	Under 5.5 MHz: $\pm 50 \times 10^{-6}$	-10 °C to +60 °C
		Over 5.5 MHz: $\pm 30 \times 10^{-6}$	-20 °C to +70 °C
Load capacitance	CL	Fundamental: 10 pF to ∞ .	Please specify
		Overtone: 5 pF to ∞	
Motional resistance (ESR)	R ₁	As per below table	-20 °C to +70 °C, DL=100 μ W
Frequency aging	f _{age}	$\pm 5 \times 10^{-6}$ / year Max.	+25 °C, First year

*1 4.0 MHz $\leq$ f_{nom} < 5.5 MHz : See "Available frequencies from 4.0 MHz to less than 5.5 MHz". 8.0 MHz < f_{nom} < 8.2 MHz: Unavailable.

*2 26.000 MHz $\leq$ f_{nom} < 30.000 MHz : please contact us for inquiries for 3rd overtone mode.

Available frequencies from 4.0 MHz to less than 5.5 MHz (MHz)

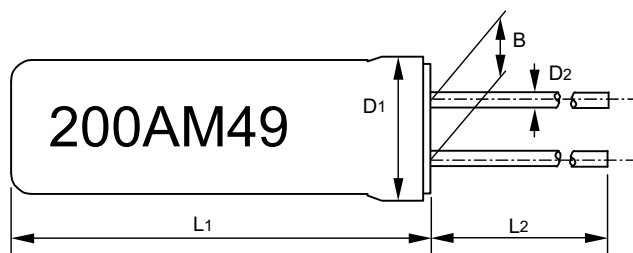
4.000	4.032	4.096	4.190	4.194304	4.433619	4.500	4.800	4.9152
-------	-------	-------	-------	----------	----------	-------	-------	--------

Motional resistance (ESR)

Frequency (MHz)	4 $\leq$ f _{nom} < 5.5	5.5 $\leq$ f _{nom} < 6	6 $\leq$ f _{nom} < 10	10 $\leq$ f _{nom} < 12	12 $\leq$ f _{nom} < 16	16 $\leq$ f _{nom} < 30	30 $\leq$ f _{nom} $\leq$ 36	36 < f _{nom} $\leq$ 64
Motional resistance	150 Ω Max.	100 Ω Max.	80 Ω Max.	60 Ω Max.	50 Ω Max.	40 Ω Max.	100 Ω Max.	80 Ω Max.
Overtone order	Fundamental						3rd overtone	

External dimensions

(Unit:mm)



Frequency	L1	L2	D1	D2	B
Under 5.5 MHz	9.3 Max.	9.5 Min.	$\phi 3.1$ Max.	$\phi 0.3$	1.1
Over 5.5 MHz	8.9 Max.	9.5 Min.	$\phi 3.1$ Max.	$\phi 0.3$	1.1

**SAW RESONATOR**

1 port-type

NS-21R

- Frequency range : 300 MHz to 500 MHz
- External dimensions : 2.5 × 2.0 × 0.86 t (mm) Typ.
- Overtone order : Fundamental
- Applications : RKE (Small wireless equipment)
- High reliability and excellent temperature characteristic.
- The smallest package size in the world.



Product Number (please contact us)
Q25NS21Rxxxxx00



Actual size

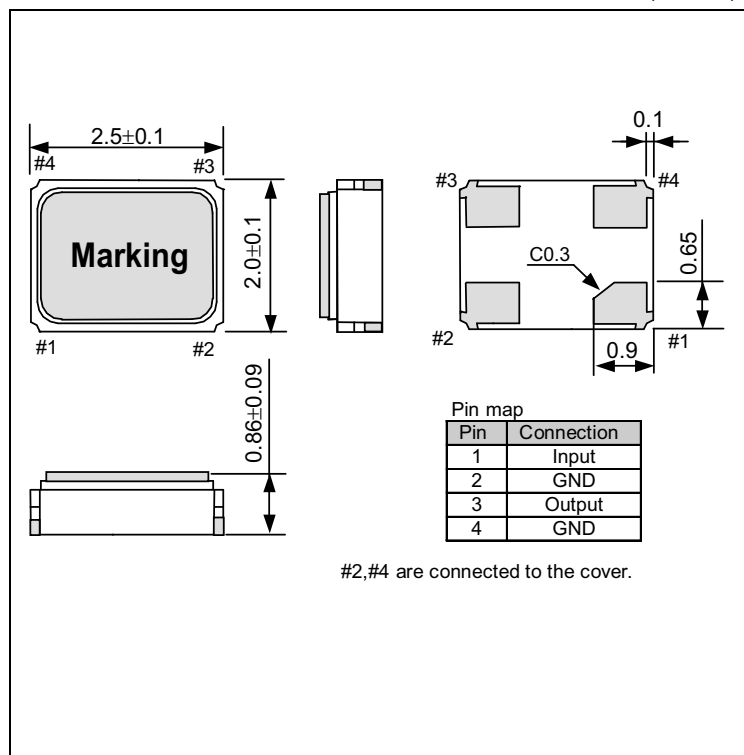
**Specifications (characteristics)**

Item	Symbol	Specifications	Remarks
Nominal frequency range	f_nom	300 MHz to 500 MHz	Please contact us for inquiries regarding available frequencies.
Temperature range	T_stg	-40 °C to +85 °C	Store as bare product after unpacking
	T_use	-40 °C to +85 °C	
Level of drive	DL	2 mW Max.	
Frequency tolerance (standard)	f_tol	$\pm 50 \times 10^{-6}$, $\pm 100 \times 10^{-6}$, $\pm 150 \times 10^{-6}$	+25 °C
Turnover temperature	Ti	+20 °C $\pm$ 20 °C	Please contact us for inquiries about Peak temperature
Parabolic coefficient	B	$-(1.6 \pm 0.4) \times 10^{-8} / ^\circ\text{C}^2$	
Harmonic ratio	Rs/ R1	2 Min.	
Motional resistance(ESR)	R1	20 Ω Max.	
Frequency aging	f_age	$\pm 10 \times 10^{-6}$ / year Max.	+25 °C
Shock resistance	S.R.	$\pm 10 \times 10^{-6}$ Max.	Nine drops on a concrete surface from 1500 mm

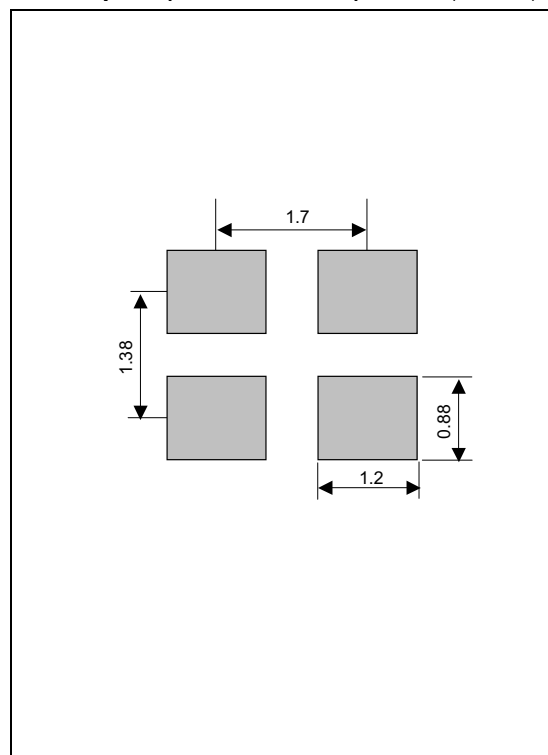
*Please contact us for except RKE use.

External dimensions

(Unit:mm)

**Footprint (Recommended)**

(Unit:mm)





SAW RESONATOR

HIGH-STABILITY

NS-32R

FS-335 / FS-555

- Frequency range : 230 MHz to 870 MHz
- External dimensions : 3.8 × 3.8 × 0.98 t (mm) ... NS-32R / FS-335
4.8 × 5.2 × 1.5 t (mm) ... FS-555
- Overtone order : Fundamental
- Applications : Small wireless equipment



Product Number (please contact us)
 NS-32R: Q25NS32R0xxxx00
 FS-335: Q25FS3350xxxx00
 FS-555: Q25FS5550xxxx00



Actual size

NS-32R

FS-335

FS-555

Specifications (characteristics)

Item		Symbol	Specifications			Remark
			NS-32R	FS-335	FS-555	
Nominal frequency range		f_nom	312 MHz to 870 MHz	300 MHz to 870 MHz	230 MHz to 500 MHz	Please contact us regarding available frequencies
Temperature range	Storage temperature	T_stg	-40 °C to +85 °C			Store as bare product after unpacking
	Operating temperature	T_use				
Level of drive		DL	1 mW Typ.	2 mW Typ.		FS-335 : f_nom >500 MHz 0.1 mW Typ.
Frequency tolerance (standard)		f_tol	As per below table			+25 °C
Turnover temperature		Ti	+25 °C±20 °C	+25 °C±15 °C		Please specify
Parabolic coefficient		B	$-(1.6 \pm 0.4) \times 10^{-8} / ^\circ\text{C}^2$	$-(3.4 \pm 0.8) \times 10^{-8} / ^\circ\text{C}^2$		
Harmonic ratio		Rs/R1	2 Min.			
Motional resistance (ESR)		R1	As per below table			
Frequency aging		f_age	$\pm 10 \times 10^{-6} / \text{year Max.}$			+25 °C
Shock resistance		S.R.	$\pm 10 \times 10^{-6} \text{ Max.}$			Nine drops on a concrete surface from 1500 mm

Frequency tolerance / Motional resistance

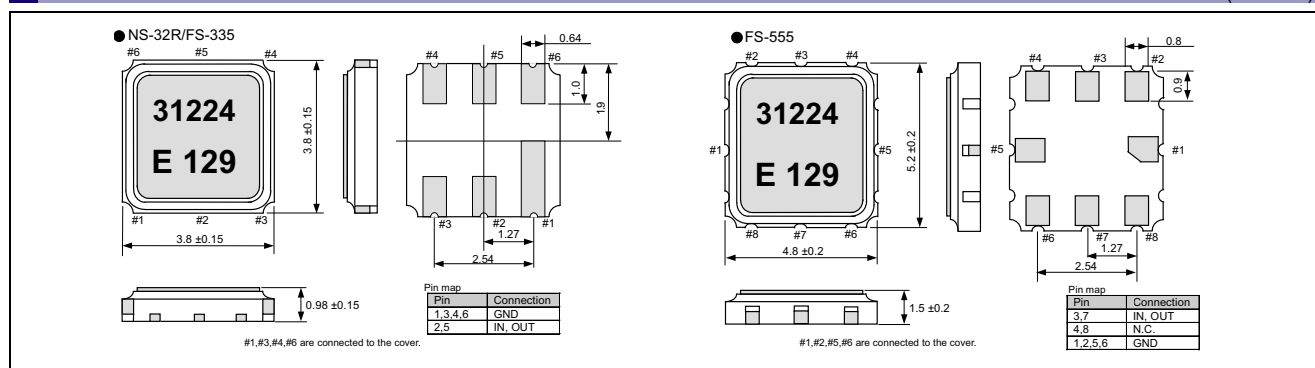
Model	Item	312 MHz to 500 MHz		500 MHz to 870 MHz	
NS-32R	Frequency tolerance (standard)	±50 × 10 ⁻⁶ , ±100 × 10 ⁻⁶ *1		±100 × 10 ⁻⁶	
	Motional resistance (ESR)	30 Ω Max.			

Model	Item	230 MHz to 250 MHz	250 MHz to 300 MHz	300 MHz to 500 MHz	500 MHz to 870 MHz
FS-335	Frequency tolerance (standard)	—	—	±50 × 10 ⁻⁶ , ±100 × 10 ⁻⁶ *1	±100 × 10 ⁻⁶
	Motional resistance (ESR)	—	—	25 Ω Max.	40 Ω Max.
FS-555	Frequency tolerance (standard)	±50 × 10 ⁻⁶ , ±100 × 10 ⁻⁶ *1			—
	Motional resistance (ESR)	40 Ω Max.	25 Ω Max.		—

*1 Please contact us regarding frequency tolerance (< ±50 × 10⁻⁶)

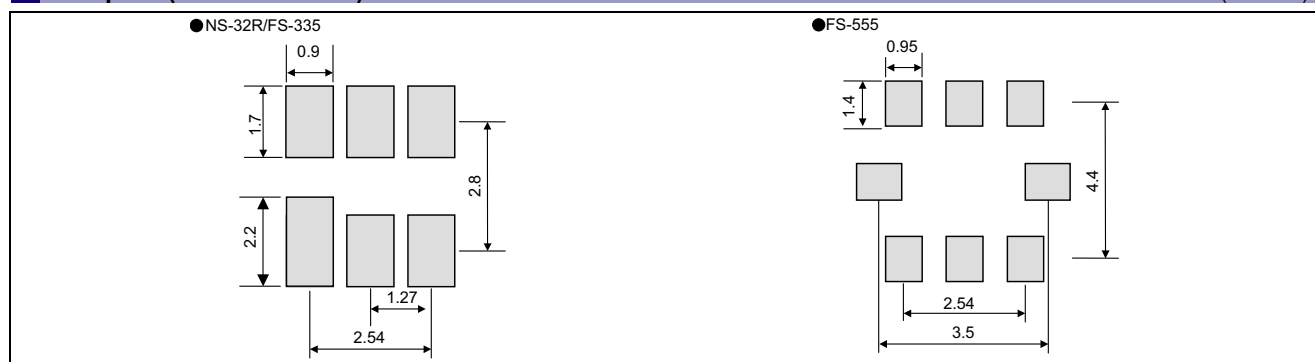
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)



**SAW RESONATOR
FOR TPMS****Product Number (please contact us)**
Q25FS5850xxxx00**FS - 585**

- Frequency range : 300 MHz to 500 MHz
- External dimensions : 4.8 × 5.2 × 1.5 t (mm) Typ.
- Overtone order : Fundamental
- Applications : TPMS, Small wireless equipment



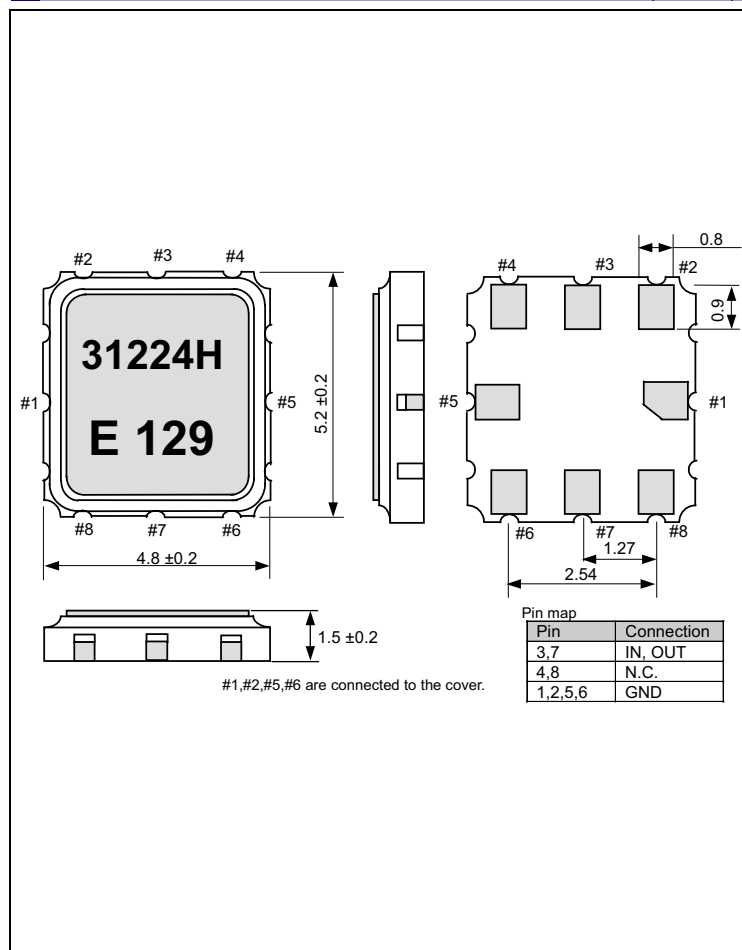
Actual size

**Specifications (characteristics)**

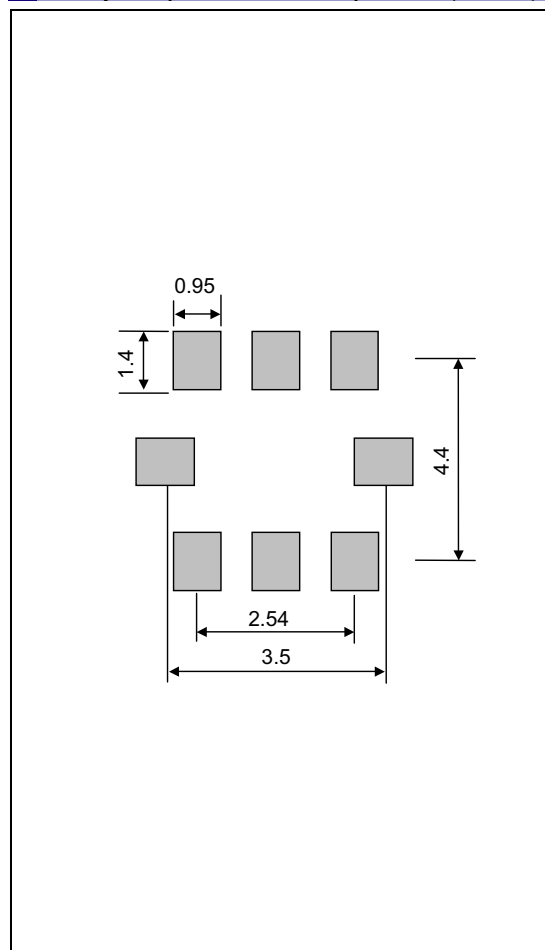
Item	Symbol	Specifications	Remarks
Nominal frequency range	f_nom	300 MHz to 500 MHz	Please contact us for inquiries regarding available frequencies.
Temperature range	Storage temperature	T_stg	-40 °C to +125 °C
	Operating temperature	T_use	-40 °C to +120 °C
Level of drive	DL	2 mW Typ.	
Frequency tolerance (standard)	f_tol	$\pm 50 \times 10^{-6}$, $\pm 100 \times 10^{-6}$	+25 °C
Turnover temperature	Ti	+40 °C $\pm$ 10 °C	Please contact us for inquiries about Peak temperature
Parabolic coefficient	B	$-(3.4 \pm 0.8) \times 10^{-8} / ^\circ\text{C}^2$	
Harmonic ratio	Rs/ R1	2 Min.	
Motional resistance (ESR)	R1	18 Ω Max.	
Frequency aging	f_age	$\pm 10 \times 10^{-6}$ / year Max.	+25 °C
Shock resistance	S.R.	$\pm 10 \times 10^{-6}$ Max.	Nine drops on a concrete surface from 1500 mm

External dimensions

(Unit:mm)

**Footprint (Recommended)**

(Unit:mm)





OSCILLATOR

CRYSTAL OSCILLATOR

► SPXO

Page	Category		Actual size (mm)	Frequency					
				1 Hz	1 MHz	50 MHz	100 MHz	500 MHz	800 MHz
28	SG-3050BC		2.2×1.4×1.0 t (Max.)						
29	SG-3030JC SG-3040JC		10.5×5.8×2.7 t (Max.)	● 32.768 kHz					
	SG-3030JF		7.1×5.1×1.5 t (Max.)						
	SG-3030LC SG-3040LC		3.6×2.8×1.2 t (Max.)						
30	SG-150 S*E		2.1×1.7×0.75 t (Typ.)	3 MHz		54 MHz			
31	SG-211 S*E		2.5×2.0×0.7 t (Typ.)	2.375 MHz		60 MHz			
32	SG-210 S*B		2.5×2.0×0.8 t (Typ.)	2 MHz		60 MHz			
33	SG-210 S*D		2.5×2.0×0.8 t (Typ.)		50 MHz		80 MHz		
34	SG-310 series		3.2×2.5×1.05 t (Typ.)	2 MHz			80 MHz		
35	SG-550 series		5.0×3.2×1.2 t (Max.)	2 MHz		48 MHz			
36	TCO-710x series		5.0×3.2×1.0 t (Typ.)	1.5 MHz		75 MHz			
37	SG-770 series		7.0×5.0×1.6 t (Typ.)		50 MHz		230 MHz		
37	SG-771 PCD		7.0×5.0×1.6 t (Typ.)		50 MHz		175 MHz		
38	TCO-708x series		7.0×5.0×1.6 t (Typ.)	1.5 MHz			160 MHz		
39_40	SG-645 series		7.1×5.1×1.5 t (Max.)	32.001 MHz			135 MHz		
	SG-636 series		10.5×5.8×2.7 t (Max.)	2.21675 MHz			135 MHz		
41_42	SG-615 series		14.0×9.8×4.7 t (Max.)	1.025 MHz			135 MHz		
	SG-531 series		DIP half size						
	SG-51 series		DIP full size	1.025 MHz		66.667 MHz			

► Programmable

Page	Category	Package lineup	Frequency					
			1 Hz	1 MHz	50 MHz	100 MHz	500 MHz	800 MHz
43_44	SG-8003 series	BA ,CE ,LB ,JF ,CA	1.0 MHz			166 MHz		

Page	Category	Package lineup	Frequency					
			1 Hz	1 MHz	50 MHz	100 MHz	500 MHz	800 MHz
45_49	SG-8002 series	CE, LB ,JF ,CA ,JC ,JA ,DC ,DB	1.0 MHz			125 MHz		

Type	BA	CE	LB	JF	CA	JC	JA	DC	DB
Actual size (mm)	2.1×1.7 0.75 t (Typ.)	3.2×2.5 1.05 t (Typ.)	5.0×3.2 1.2 t (Max.)	7.1×5.1 1.5 t (Max.)	7.0×5.0 1.4 t (Typ.)	10.5×5.8 2.7 t (Max.)	14.0×9.8 4.7 t (Max.)	DIP half size	DIP full size
									

50	SG-8002 series Outline of Specifications
51	SG-8002 series Jitter specifications and characteristics chart
52	SG-8000 series Programming Tool



OSCILLATOR

CRYSTAL OSCILLATOR

► Spread Spectrum

Page	Category	Actual size (mm)	Frequency					
			1 Hz	1 MHz	50 MHz	100 MHz	500 MHz	800 MHz
53	SG-9001 LB		5.0×3.2×1.2 t (Max.)	10 MHz			135 MHz	
	SG-9001 CA		7.0×5.0×1.4 t (Typ.)	10 MHz			166 MHz	
	SG-9001 JC		10.5×5.8×2.7 t (Max.)	10 MHz			166 MHz	

► Low-jitter SAW

Page	Category		Actual size (mm)	Frequency					
				1 Hz	1 MHz	50 MHz	100 MHz	500 MHz	800 MHz
54	XG-1000CA			7.0×5.0×1.2 t (Typ.)		50 MHz		170 MHz	
	XG-1000 CB			5.0×3.2×1.1 t (Typ.)		50 MHz		170 MHz	
55	EG-2021CA (2.5 V CMOS)			7.0×5.0×1.2 t (Typ.)		62.5 MHz		250 MHz	
	EG-2001CA (3.3 V CMOS)			7.0×5.0×1.2 t (Typ.)		106.25 MHz		170 MHz	
56	EG-2002CA (3.3 V LV-TTL)			7.0×5.0×1.2 t (Typ.)		62.5 MHz		170 MHz	
57_58	EG-2121CA	Differential LV-PECL		7.0×5.0×1.2 t (Typ.)		53.125 MHz		500 MHz	
		LVDS				53.125 MHz		700 MHz	
		HCSL NEW				100 MHz		350 MHz	
	EG-2102CA	Differential LV-PECL		7.0×5.0×1.2 t (Typ.)		100 MHz		700 MHz	
		LVDS				53.125 MHz		700 MHz	
		HCSL NEW				100 MHz		350 MHz	
59	EG-2101CA (3.3 V Differential LV-PECL)			7.0×5.0×1.2 t (Typ.)		62.5 MHz		99.999 MHz	

► High-stability

Page	Category		Actual size (mm)	Frequency					
				1 Hz	1 MHz	50 MHz	100 MHz	500 MHz	800 MHz
60	HG-2150CA			7.0×5.0×1.5 t (Max.)	1 MHz		60 MHz		
61	HG-8002JA			14.0×9.8×4.7 t (Max.)	1 MHz		125 MHz		



OSCILLATOR

CRYSTAL OSCILLATOR / RUBIDIUM ATOMIC OSCILLATOR

► VCXO

Page	MODEL	Actual size (mm)		Frequency						
				1 Hz	1 MHz	50 MHz	100 MHz	500 MHz	800 MHz	
62	VG-4231CE		3.2×2.5×1.05 t (Typ.)	3 MHz		60 MHz				
63	VG-4231CB		5.0×3.2×1.2 t (Typ.)	1 MHz		60 MHz				
	VG-4531CB		5.0×3.2×1.2 t (Typ.)		60 MHz		80 MHz			
64	VG-4231CA		7.0×5.0×1.4 t (Typ.)	1 MHz		60 MHz				
65	VG-4501/4502CA		7.0×5.0×1.6 t (Typ.)		60 MHz		80 MHz			
66	VG-4511CA		7.0×5.0×1.6 t (Typ.)			80 MHz	170 MHz			
67	VG-1201CA		7.0×5.0×1.4 t (Typ.)	1 MHz		60 MHz				
68	TCO-291J		11.4×9.6×5.0 t (Max.)		60 MHz		230 MHz			
	TCO-2000 series		13.9×9.8×4.7 t (Max.)	8 MHz		125 MHz				
	TCO-2100 series		13.9×9.8×4.7 t (Max.)	1 MHz					800 MHz	

► TCXO

Page	MODEL	Actual size (mm)		Frequency			
				1 Hz	1 MHz	50 MHz	100 MHz
71	TG-3530SA		10.1×7.4×3.2 t (Typ.)	● 32.768 kHz			
72	TG-5021BA		2.1×1.7×0.75 t (Typ.)		13 MHz	52 MHz	
73	TG-5021CG NEW		2.5×2.0×0.8 t (Typ.)		13 MHz	52 MHz	
74	TG-5025CG NEW		2.5×2.0×0.8 t (Typ.)		13 MHz	52 MHz	
75	TG-5005CE		3.2×2.5×0.9 t (Typ.)		10 MHz	40 MHz	
76	TG-5010LH		3.3×2.5×0.96 t (Typ.)		10 MHz	40 MHz	
77	TCO-5860 series		3.2×2.5×0.9 t (Typ.)		10 MHz	40 MHz	
78	TCO-5060/5160 series		7.0×5.0×1.9 t (Typ.)		10 MHz	51.84 MHz	

► OCXO

Page	MODEL	Size (mm)	Weight (Max.)	Frequency			
				1 Hz	1 MHz	50 MHz	100 MHz
79	TCO-6831 series	70×50×12 t (Max.)	100 g		5 MHz	10 MHz	
80	TCO-676 series	25.4×25.4×12.7 t (Max.)	20 g		10 MHz	20 MHz	
81	TCO-679 series	20.3×12.7×9.7 t (Typ.)	10 g		10 MHz	20 MHz	
82	TCO-6920A	50.8×50.8×25.4 t (Max.)	100 g		● 10 MHz		
83	OX-6501GG series	25.4×22×12.1 t (Typ.)	20 g		10 MHz	40 MHz	

► Rubidium Atomic oscillator

Page	MODEL	Size (mm) Typ.	Weight (Typ.)	Frequency			
				1 Hz	1 MHz	50 MHz	100 MHz
84	Rb-3310N	89(H)×110(W)×123(D)	2 kg		● 10 MHz		
85	Rb-2110 CB	99(H)×480(W)×350(D)	12 kg	●	● ● ● 100 kHz, 1 MHz, 3.58 MHz, 10 MHz		



CRYSTAL OSCILLATOR ULTRA MINIATURE SIZE LOW PROFILE

SG - 3050BC

- Output frequency : 32.768 kHz
- Supply voltage : 3.3 V Typ.
- Current consumption : 2 μ A Max. (3.3 V)
- Output load : CMOS
- Function : Output enable(OE)
- External dimensions : 2.2 $\times$ 1.4 $\times$ 1.0 t (mm)



Product Number (Please contact us)
X1B000111xxxx00



Actual size



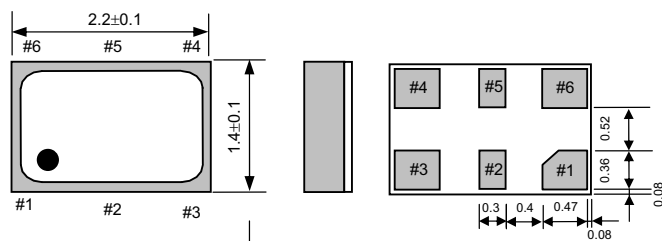
NEW

Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Output frequency range	f _o	32.768 kHz	
Supply voltage	V _{cc}	1.2 V to 5.5 V	
Temperature range	Storage temperature	T _{stg}	-55 °C to +125 °C
	Operating temperature	T _{use}	-40 °C to +85 °C
Frequency tolerance	f _{tol}	AA : 5 $\pm$ 5 $\times$ 10 ⁻⁶ B : 5 $\pm$ 23 $\times$ 10 ⁻⁶	+25 °C, V _{cc} =3.3 V
Frequency temperature coefficient	f _o -T _c	+10 $\times$ 10 ⁻⁶ / -120 $\times$ 10 ⁻⁶	-20 °C to +70 °C (+25 °C is reference)
Frequency / voltage coefficient	f _o -V _{cc}	$\pm$ 1.0 $\times$ 10 ⁻⁶ / V Typ.	+25 °C, V _{cc} = 1.5 V to 5.5 V
Current consumption	I _{cc}	2 μ A Max.	3.3 V, No load condition
Symmetry	SYM	45 % to 55 %	1/2 V _{cc} level
High output voltage	V _{OH}	V _{cc} -0.4 V Min.	I _{OH} =-0.4 mA
Low output voltage	V _{OL}	0.4 V Max.	I _{OL} = 0.4 mA
Output load condition (CMOS)	L _{CMOS}	15 pF Max.	CMOS load
Rise time / Fall time	t _r / t _f	200 ns Max.	CMOS load:20 % V _{cc} to 80 % V _{cc} level
Start-up time	t _{str}	1 s Max.	Time at minimum Supply voltage to be 0 s +25 °C, V _{cc} = 3.3 V
Frequency aging	f _{aging}	$\pm$ 3 $\times$ 10 ⁻⁶ / year Max.	+25 °C, V _{cc} = 3.3 V, First year

External dimensions

(Unit:mm)



Pin map

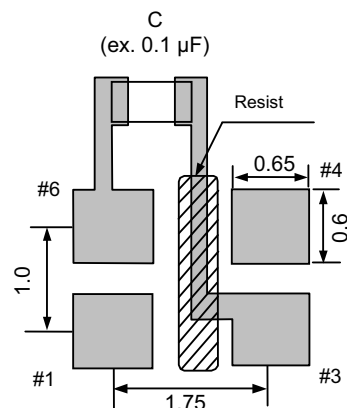
Pin	Connection
1	OE
2	(TEST)
3	GND
4	OUT
5	N.C.
6	V _{cc}

Note.
OE pin = HIGH : Specified frequency output.
OE pin = LOW : Output is high impedance.

TEST pin , N.C. pin : Do not connect externally.
(Recommend the design without the footprint.)

Footprint (Recommended)

(Unit:mm)



To maintain stable operation, provide by-pass capacitor with more than 0.1 μ F at a location as near as possible to the power source terminal of the crystal products (between V_{cc} - GND).



CRYSTAL OSCILLATOR

32.768 kHz

SG-3030LC / JF / JC
SG-3040LC / JC

- Built-in 32.768 kHz crystal unit allows adjustment-free efficient operation.
- Use of C-MOS IC enables reduction of current consumption.
- VIO controls swing amplitude.



Product Number (please contact us)

SG-3030LC : Q3102LC0xxxxxx00

SG-3030JF : Q3102JF0xxxxxx00

SG-3030JC : Q3102JC0xxxxxx00

SG-3040LC : Q3103LC0xxxxxx00

SG-3040JC : Q3103JC0xxxxxx00

SG-3030LC
SG-3040LC

Actual size



SG-3030JF



JF Type.

SG-3030JC
SG-3040JC

JC Type.

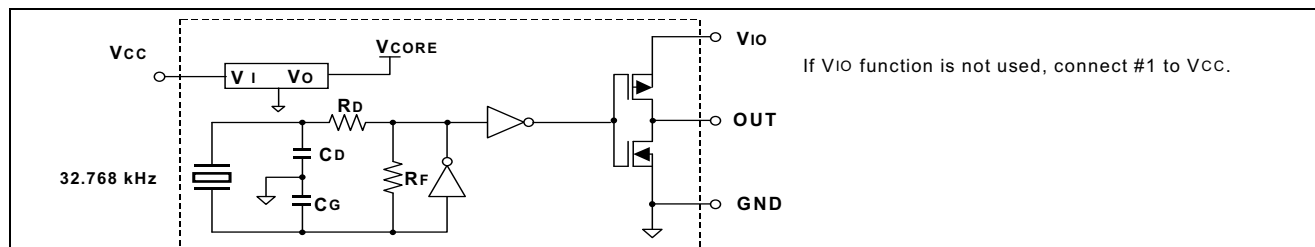


Specifications (characteristics)

Item		Symbol	Specifications		Remarks
			SG-3030LC / JF / JC	SG-3040LC / JC	
Output frequency range		f ₀	32.768 kHz		
Supply voltage		V _{cc}	1.5 V to 5.5 V	0.9 V to 3.6 V	
Interface power supply voltage		V _{io}	1.5 V to 5.5 V	0.9 V to 3.6 V	
Temperature range	Storage temperature	T _{stg}	-55 °C to +125 °C		Store as bare product after unpacking
	Operating temperature	T _{use}	-40 °C to +85 °C		
Frequency tolerance		f _{tol}	5 ±23 × 10 ⁻⁶		+25 °C, V _{cc} =3.3 V (SG-3040: V _{cc} =1.2 V)
Frequency temperature coefficient		fo-Tc	+10 × 10 ⁻⁶ / -120 × 10 ⁻⁶		-20 °C to +70 °C (+25 °C is reference)
Frequency / voltage coefficient		fo-V _{cc}	±2 × 10 ⁻⁶ / V Max.	±5 × 10 ⁻⁶ / V Max.	+25 °C
Current consumption		I _{cc}	2 μA Max.	3.1 μA Max.	3.3 V, No load condition
Symmetry		SYM	45 % to 55 %		1/2 V _{cc} (V _{io})level (SG-3040: V _{io} =1.2 V to 3.6 V)
High output voltage		V _{oh}	V _{io} -0.4 V Min.		I _{oh} =-0.4 mA (SG-3040: V _{io} =1.2 V to 3.6 V)
Low output voltage		V _{ol}	0.4 V Max.		I _{ol} = 0.4 mA (SG-3040: V _{io} =1.2 V to 3.6 V)
Output load condition (CMOS)		L _{CMOS}	15 pF Max.		CMOS load
Rise time / Fall time		t _r / t _f	200 ns Max.	100 ns Max.	CMOS load: 20 % V _{cc} (V _{io}) to 80 % V _{cc} (V _{io})level (SG-3040: V _{io} =1.2 V to 3.6 V)
Start-up time		t _{str}	1 s Max.	3 s Max.	Time at minimum Supply voltage to be 0 s
Frequency aging		f _{aging}	±5 × 10 ⁻⁶ / year Max.		+25 °C, V _{cc} = 3.3 V, First year

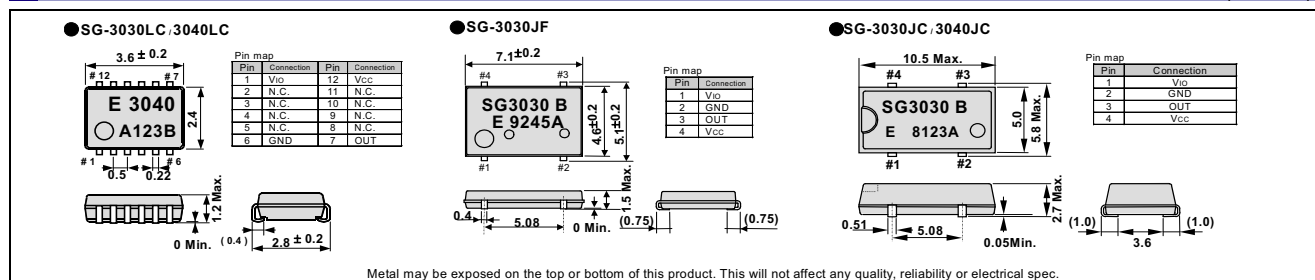
Unless otherwise stated, characteristics (specifications) shown in the above table are based on the rated operating temperature and voltage condition.

Block diagram



External dimension

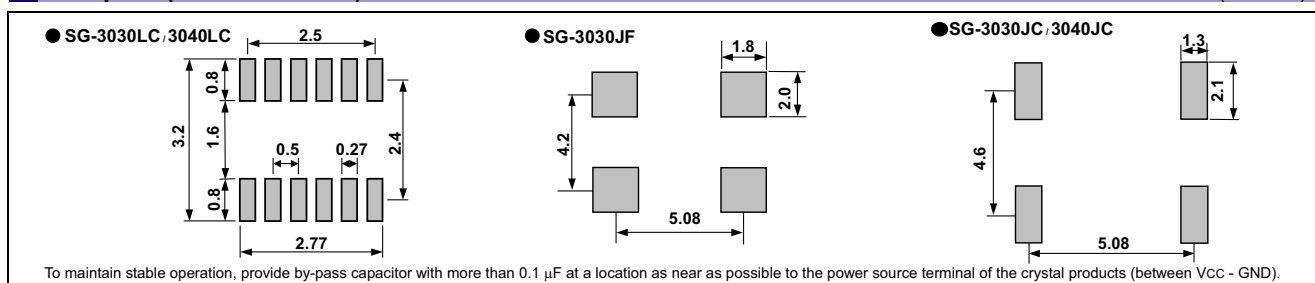
(Unit:mm)



Metal may be exposed on the top or bottom of this product. This will not affect any quality, reliability or electrical spec.

Footprint (Recommended)

(Unit:mm)





CRYSTAL OSCILLATOR

Low Profile / High stability SPXO

SG-150 S*E

- Frequency range : 3.000 MHz to 54.000 MHz
- Supply voltage : 1.8 V Typ. / 2.5 V Typ. / 3.3 V Typ.
- Current consumption : 3.3 mA Max.
(SEE 1.8 V No load condition 40 MHz)
- Function : Standby($\overline{ST}$)
- External dimensions : $2.1 \times 1.7 \times 0.75$ t (mm) Typ.



Product Number (please contact us)
X1G0036x1xxxx00



Actual size



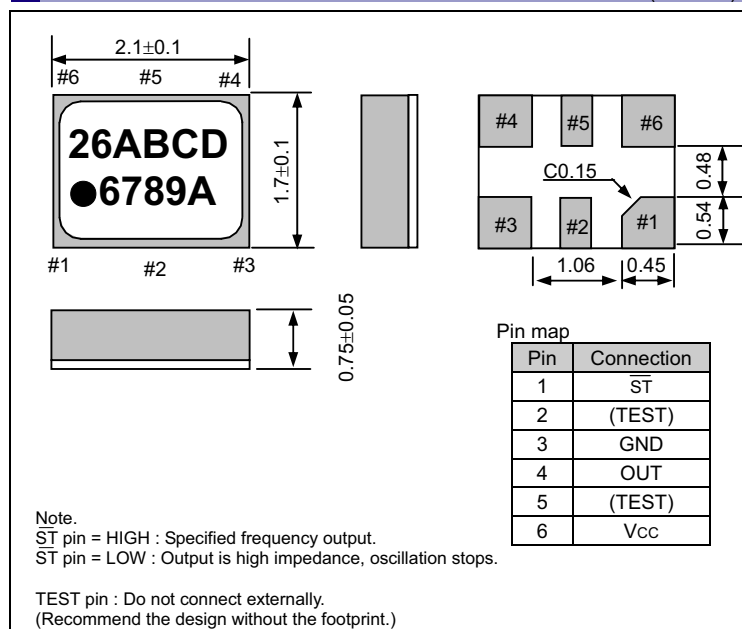
Specifications (characteristics)

Item		Symbol	Specifications			Remarks	
			SG-150SEE	SG-150SDE	SG-150SCE		
Output frequency range		f ₀	3.000 MHz to 54.000 MHz			Please contact us for inquiries regarding the available frequencies.	
Supply voltage		V _{CC}	1.8 V Typ. 1.6 V to 2.2 V	2.5 V Typ. 2.2 V to 2.7 V	3.3 V Typ. 2.7 V to 3.6 V		
Temperature range	Storage temperature	T _{stg}	-40 °C to +85 °C			Store as bare product after unpacking	
	Operating temperature	T _{use}	-40 °C to +85 °C				
Frequency tolerance *		f _{tol}	D: ±20 × 10 ⁻⁶ , E: ±15 × 10 ⁻⁶ H: ±20 × 10 ⁻⁶ , T: ±15 × 10 ⁻⁶			-20 °C to +70 °C	V _{CC} ±10%
						-40 °C to +85 °C	
Current consumption		I _{CC}	2.3 mA Max.	2.5 mA Max.	3.5 mA Max.	No load condition,3 MHz≤f ₀ ≤32 MHz	
			2.8 mA Max.	3.0 mA Max.	4.0 mA Max.	No load condition,32 MHz<f ₀ ≤40 MHz	
			3.3 mA Max.	3.5 mA Max.	4.5 mA Max.	No load condition,40 MHz<f ₀ ≤48 MHz	
			4.5 mA Max.	5.0 mA Max.	6.0 mA Max.	No load condition,48 MHz<f ₀ ≤54 MHz	
Stand-by current		I _{std}	5.0 µA Max.			ST =GND	
Symmetry		SYM	45 % to 55 %			50 % V _{CC} level,L _{CMOS} ≤ 15 pF	
High output voltage		V _{OH}	90 % V _{CC} Min.			I _{OH} =-4 mA	
Low output voltage		V _{OL}	10 % V _{CC} Max.			I _{OL} = 4 mA	
Output load condition (CMOS)		L _{CMOS}	15 pF Max.				
Output enable / disable input voltage		V _{IH}	80 % V _{CC} Min.			$\overline{ST}$ terminal	
		V _{IL}	20 % V _{CC} Max.				
Rise time / Fall time		t _r / t _f	4.5 ns Max.			20 % V _{CC} to 80 % V _{CC} level, L _{CMOS} =15 pF	
Start-up time		t _{str}	5 ms Max.			t=0 at 90 % V _{CC}	
Frequency aging		f _{aging}	This is included in frequency tolerance specification.			+25 °C, First year, V _{CC} = 1.8 V, 2.5 V, 3.3 V	

* Please contact us for inquiries regarding available frequency tolerance.

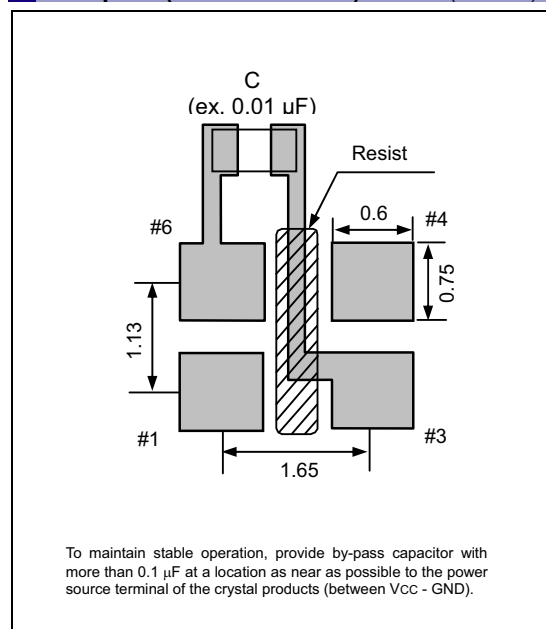
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





CRYSTAL OSCILLATOR

Low Profile / High stability SPXO

SG-211S*E

- Frequency range : 2.375 MHz to 60.000 MHz
- Supply voltage : 1.8 V Typ. / 2.5 V Typ. / 3.3 V Typ.
- Current consumption : 3.3 mA Max.
(SEE 1.8 V No load condition 40 MHz)
- Function : Standby($\overline{ST}$)
- External dimensions : 2.5 × 2.0 × 0.7 t (mm) Typ.



Product Number (please contact us)
X1G0036x1xxxx00



Actual size



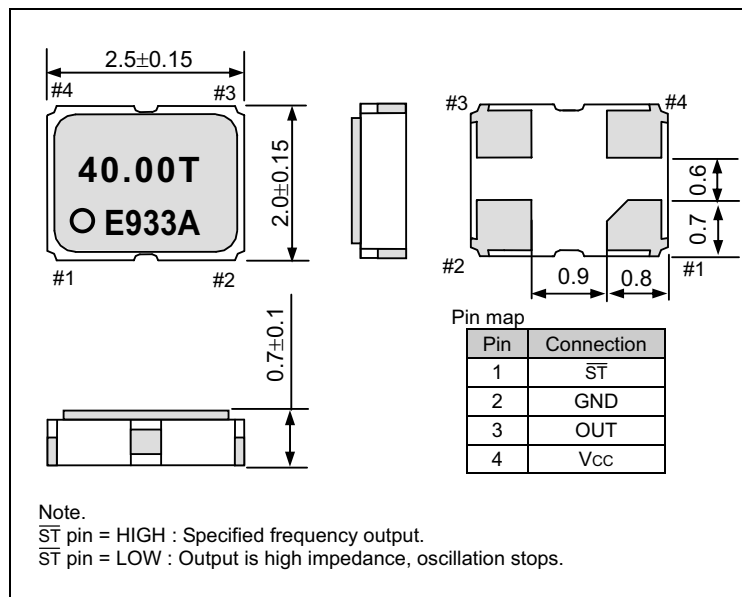
Specifications (characteristics)

Item		Symbol	Specifications			Remarks	
			SG-211SEE	SG-211SDE	SG-211SCE		
Output frequency range		f ₀	2.375 MHz to 60.000 MHz			Please contact us for inquiries regarding the available frequencies.	
Supply voltage		V _{CC}	1.8 V Typ. 1.6 V to 2.2 V	2.5 V Typ. 2.2 V to 2.7 V	3.3 V Typ. 2.7 V to 3.6 V		
Temperature range	Storage temperature	T _{stg}	-40 °C to +125 °C			Store as bare product after unpacking	
	Operating temperature	T _{use}	-40 °C to +90 °C				
Frequency tolerance *		f _{tol}	D: ±20 × 10 ⁻⁶ , E: ±15 × 10 ⁻⁶			-20 °C to +70 °C	V _{CC} ±10% included in reflow drift
			H: ±20 × 10 ⁻⁶ , T: ±15 × 10 ⁻⁶			-40 °C to +85 °C	
			a: ±15 × 10 ⁻⁶ , b: ±20 × 10 ⁻⁶ , d: ±25 × 10 ⁻⁶			-40 °C to +90 °C	
Current consumption		I _{CC}	2.3 mA Max.	2.5 mA Max.	3.5 mA Max.	No load condition, 2.375 MHz≤f ₀ ≤32 MHz	
			2.8 mA Max.	3.0 mA Max.	4.0 mA Max.	No load condition, 32 MHz<f ₀ ≤40 MHz	
			3.3 mA Max.	3.5 mA Max.	4.5 mA Max.	No load condition, 40 MHz<f ₀ ≤48 MHz	
			4.5 mA Max.	5.0 mA Max.	6.0 mA Max.	No load condition, 48 MHz<f ₀ ≤60 MHz	
Stand-by current		I _{std}	5.0 µA Max.			ST =GND	
Symmetry		SYM	45 % to 55 %			50 % V _{CC} level, L _{CMOS} ≤ 15 pF	
High output voltage		V _{OH}	90 % V _{CC} Min.			I _{OH} =-4 mA	
Low output voltage		V _{OL}	10 % V _{CC} Max.			I _{OL} = 4 mA	
Output load condition (CMOS)		L _{CMOS}	15 pF Max.				
Output enable / disable input voltage		V _{IH}	80 % V _{CC} Min.			$\overline{\text{ST}}$ terminal	
		V _{IL}	20 % V _{CC} Max.				
Rise time / Fall time		t _r / t _f	4.5 ns Max.			20 % V _{CC} to 80 % V _{CC} level, L _{CMOS} =15 pF	
Start-up time		t _{str}	5 ms Max.			t=0 at 90 % V _{CC}	
Frequency aging		f _{aging}	This is included in frequency tolerance specification.			+25 °C, First year, V _{CC} = 1.8 V, 2.5 V, 3.3 V	

* Please contact us for inquiries regarding available frequency tolerance.

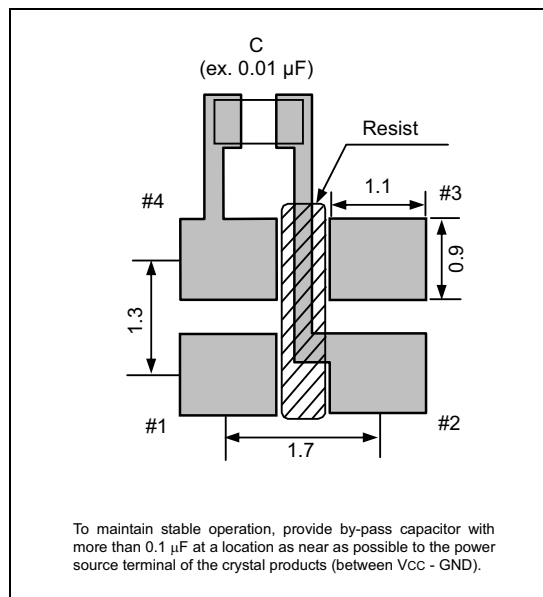
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)



CRYSTAL OSCILLATOR
SPXO

SG-210S*B

- Frequency range : 2 MHz to 60 MHz
- Supply voltage : 1.5 V Typ. / 1.8 V Typ. / 2.5 V Typ. / 3.3 V Typ.
- Current consumption : 0.9 mA Typ.
(SEB 1.8 V No load condition 48 MHz)
- Function : Standby($\overline{ST}$)
- External dimensions : $2.5 \times 2.0 \times 0.8$ t (mm) Typ.
- Operation temperature : +105 °C / +125 °C

Product Number (please contact us)
Q33210Bx0xxxx00

Actual size

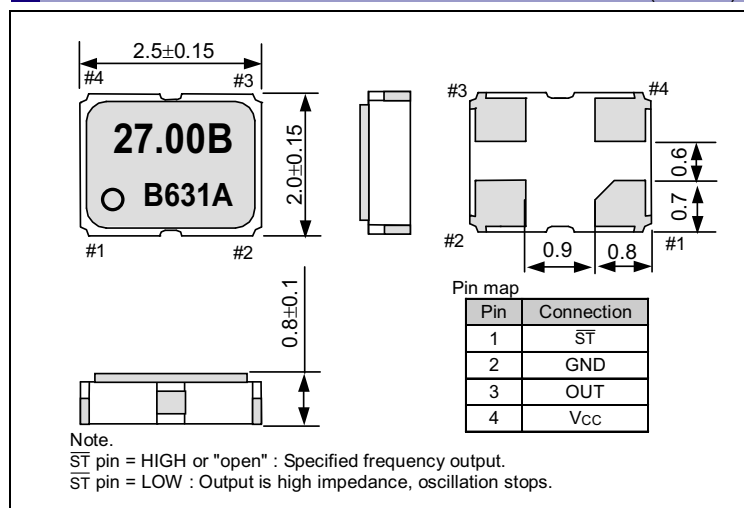


Specifications (characteristics)

Item		Symbol	Specifications				Remarks		
			SG-210SGB	SG-210SEB	SG-210SDB	SG-210SCB			
Output frequency range		f ₀	2 MHz to 32 MHz	2 MHz to 60 MHz					
Supply voltage		V _{CC}	1.5 V Typ. 1.3 V to 1.7 V	1.8 V Typ. 1.6 V to 2.2 V	2.5 V Typ. 2.2 V to 3.0 V	3.3 V Typ. 2.7 V to 3.6 V			
Temperature range	Storage temperature	T _{stg}	-40 °C to +125 °C				Store as bare product after unpacking		
	Operating temperature	T _{use}	-40 °C to +85 °C / -40 °C to +105 °C / -40 °C to +125 °C						
Frequency tolerance		f _{tol}	F: ±20 × 10 ⁻⁶				-10 °C to +60 °C, f ₀ ≤ 32 MHz, V _{CC} ±10%, except reflow drift.		
			B: ±50 × 10 ⁻⁶ , C: ±100 × 10 ⁻⁶				-20 °C to +70 °C		
			L: ±50 × 10 ⁻⁶ , M: ±100 × 10 ⁻⁶				-40 °C to +85 °C		
			—	Y: ±50 × 10 ⁻⁶ , W: ±100 × 10 ⁻⁶			-40 °C to +105 °C		
			—	Z: ±100 × 10 ⁻⁶ , X: ±150 × 10 ⁻⁶			-40 °C to +125 °C		
Current consumption		I _{CC}	1.0 mA Max.	1.6 mA Max.	2.4 mA Max.	3.0 mA Max.	No load condition		
			—	2.0 mA Max.	3.0 mA Max.	4.0 mA Max.	No load condition +105 °C, +125 °C		
Stand-by current		I _{std}	0.3 µA Max.	0.5 µA Max.	1.0 µA Max.	1.0 µA Max.	ST =GND		
			—	1.6 µA Max.	2.4 µA Max.	3.0 µA Max.	ST =GND +105 °C, +125 °C		
Symmetry		SYM	45 % to 55 %	45 % to 55 %	45 % to 55 %	45 % to 55 %	2 MHz ≤ f ₀ ≤ 16 MHz	50 % V _{CC} level L _{CMOS} ≤ 15 pF	
			40 % to 60 %				16 MHz < f ₀ ≤ 32 MHz		
			—				40 % to 60 %		32 MHz < f ₀ ≤ 60 MHz
			—				40 % to 60 %		
High output voltage		V _{OH}	90 % V _{CC} Min.				I _{OH} = -1 mA		
Low output voltage		V _{OL}	10 % V _{CC} Max.				I _{OL} = 1 mA		
Output load condition (CMOS)		L _{CMOS}	15 pF Max.						
Output enable / disable input voltage		V _{IH}	80 % V _{CC} Min.				ST terminal		
		V _{IL}	20 % V _{CC} Max.						
Rise time and Fall time		t _r / t _f	5 ns Max.	4 ns Max.	3 ns Max.		+85 °C	20 % V _{CC} to 80 % V _{CC} level, L _{CMOS} = 15 pF	
			—	7 ns Max			+105 °C, +125 °C		
Start-up time		t _{str}	3 ms Max.				t = 0 at 90 % V _{CC} (+105 °C, +125 °C : 5 ms Max.)		
Frequency aging		f _{aging}	±3 × 10 ⁻⁶ / year Max.				+25 °C, First year, V _{CC} = 1.5 V, 1.8 V, 2.5 V, 3.3 V		

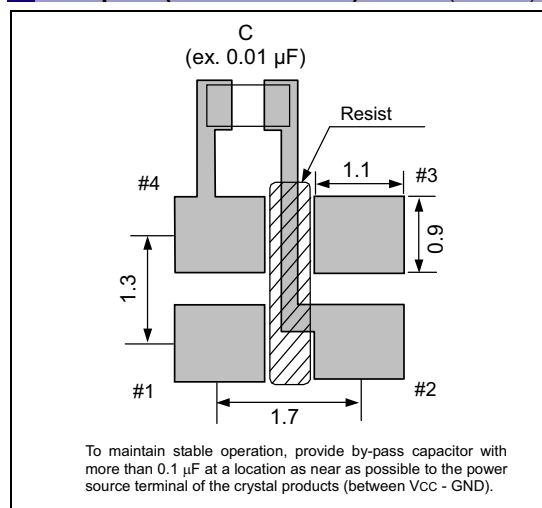
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





CRYSTAL OSCILLATOR

Low Profile / LOW-JITTER SPXO

SG-210 S*D

- Frequency range : 50.000 MHz to 80.000 MHz
- Supply voltage : 1.8 V Typ. / 2.5 V Typ. / 3.3 V Typ.
- Current consumption : 7.0 mA Max.
- Function : (SDD 2.5 V No load condition 80 MHz)
- External dimensions : 2.5 × 2.0 × 0.8 t (mm) Typ.



Product Number (please contact us)
X1G0029x1xxxx00



Actual size

**NEW**

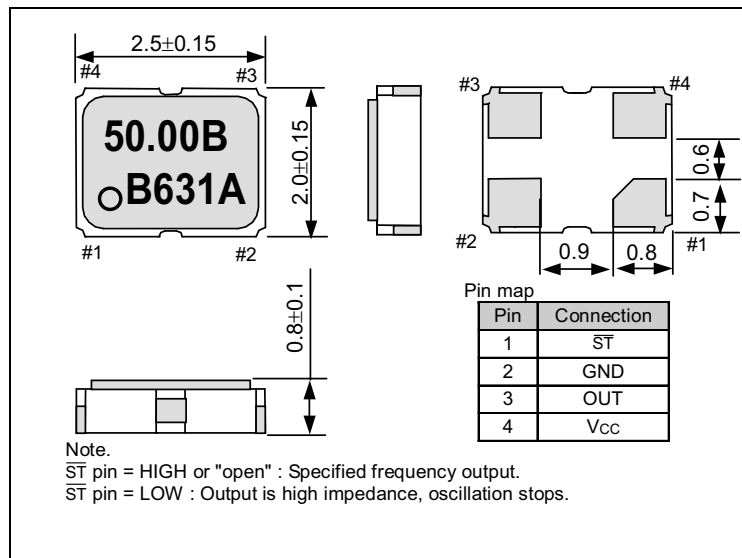
Specifications (characteristics)

Item		Symbol	Specifications			Remarks	
			SG-210SED	SG-210SDD	SG-210SCD		
Output frequency range		f ₀	50.000 MHz to 80.000 MHz				
Supply voltage		V _{CC}	1.8 V Typ. 1.6 V to 2.2 V	2.5 V Typ. 2.2 V to 3.0 V	3.3 V Typ. 2.7 V to 3.6 V		
Temperature range	Storage temperature	T _{stg}	-40 °C to +125 °C			Store as bare product after unpacking	
	Operating temperature	T _{use}	-40 °C to +85 °C				
Frequency tolerance		f _{tol}	B: ±50 × 10 ⁻⁶ , C: ±100 × 10 ⁻⁶			-20 °C to +70 °C	
			L: ±50 × 10 ⁻⁶ , M: ±100 × 10 ⁻⁶			-40 °C to +85 °C	
Current consumption		I _{CC}	6.0 mA Max.	7.0 mA Max.	8.0 mA Max.	No load condition	
Stand-by current		I _{std}	10.0 µA Max.			ST =GND	
Symmetry		SYM	45 % to 55 %			50 % V _{CC} level,L _{CMOS} ≤ 30 pF	
High output voltage		V _{OH}	V _{CC} -0.4 V Min.			I _{OH} =-8 mA(SCD,SDD), -4 mA(SED)	
Low output voltage		V _{OL}	0.4 V Max.			I _{OL} = 8 mA(SCD,SDD), 4 mA(SED)	
Output load condition (CMOS)		L _{CMOS}	30 pF Max.				
Output enable / disable input voltage		V _{IH}	70 % V _{CC} Min.			ST terminal	
		V _{IL}	30 % V _{CC} Max.				
Rise time / Fall time		t _r / t _f	4 ns Max.			20 % V _{CC} to 80 % V _{CC} level, L _{CMOS} ≤ 30 pF	
Start-up time		t _{str}	2 ms Max.			t=0 at 90 % V _{CC}	
Jitter *1		t _{DJ}	0.5 ps Typ.			Deterministic Jitter	L _{CMOS} ≤ 15 pF
		t _{RJ}	3.0 ps Typ.			Random Jitter	
		t _{RMS}	25 ps Typ.			Peak to Peak	
Phase Jitter		t _{PJ}	1.0 ps Max.			Offset frequency: 12 kHz to 20 MHz	
Frequency aging		f _{aging}	±3 × 10 ⁻⁶ / year Max..			+25 °C, First year, V _{CC} = 1.8 V, 2.5 V, 3.3 V	
			±10 × 10 ⁻⁶ / 10 years Max.			+25 °C, 10 years, V _{CC} = 1.8 V, 2.5 V, 3.3 V	

*1 Based on DTS-2075 Digital timing system made from WAVECREST with jitter analysis software VISI6.

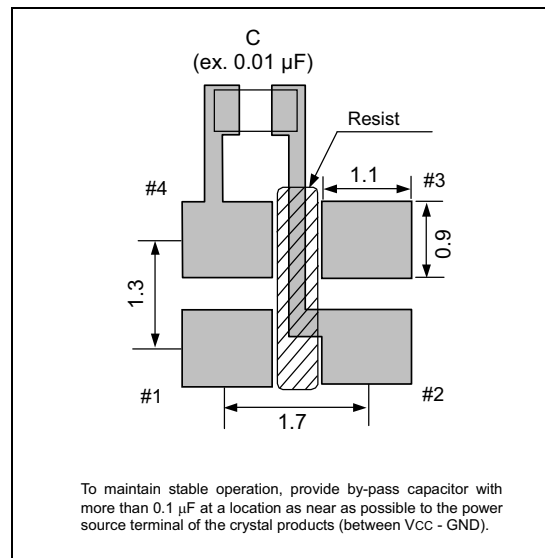
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





CRYSTAL OSCILLATOR SPXO

SG-310 series

- Frequency range : 2 MHz to 80 MHz
- Supply voltage : 1.8 V Typ. / 2.5 V Typ. / 3.3 V Typ.
- Current consumption : 1.5 mA Typ.
(SEF1.8 V No load condition 48 MHz)
- Function : Standby($\overline{ST}$)
- External dimensions : $3.2 \times 2.5 \times 1.05$ t (mm) Typ.



Product Number (please contact us)
Q33310xx0xxxx00



Actual size

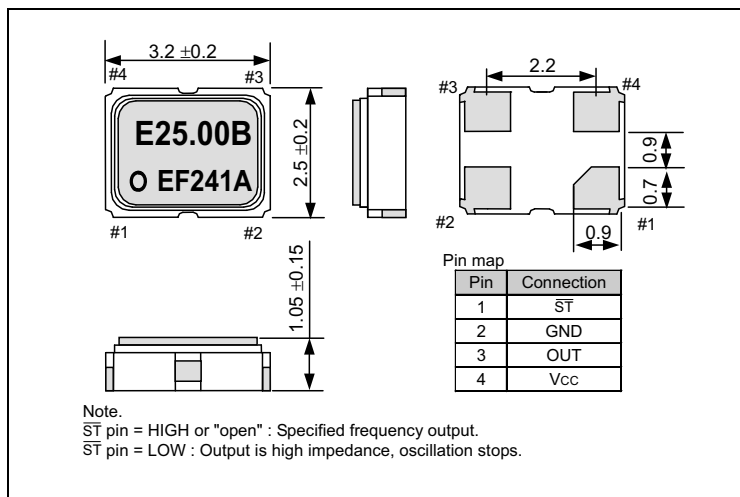


Specifications (characteristics)

Item		Symbol	Specifications					Remarks	
			SG-310 SEF	SG-310 SDF	SG-310 SCF	SG-310 SDN	SG-310 SCN		
Output frequency range		f _o	2.000 MHz to 48.000 MHz			3.000 MHz to 80.000 MHz			
Supply voltage		V _{CC}	1.8 V Typ. 1.6 V to 2.2 V	2.5 V Typ. 2.2 V to 3.0 V	3.3 V Typ. 2.7 V to 3.6 V	2.5 V Typ. 2.2 V to 2.7 V	3.3 V Typ. 2.7 V to 3.6 V		
Temperature range	Storage temperature	T _{stg}	-40 °C to +125 °C					Store as bare product after unpacking	
	Operating temperature	T _{use}	-40 °C to +85 °C						
Frequency tolerance		f _{tol}	B: ±50 × 10 ⁻⁶ , C: ±100 × 10 ⁻⁶			B: ±50 × 10 ⁻⁶ , C: ±100 × 10 ⁻⁶		-20 °C to +70 °C	
			M: ±100 × 10 ⁻⁶			M: ±100 × 10 ⁻⁶		-40 °C to +85 °C	
			—			D:±20 × 10 ⁻⁶ ,S:±25 × 10 ⁻⁶		-20 °C to +70 °C V _{CC} ±10 %	
			—			R:±25 × 10 ⁻⁶		-30 °C to +85 °C (3 MHz<f _o ≤62.5 MHz)	
			—			P:±20 × 10 ⁻⁶		-30 °C to +85 °C V _{CC} ±5 %	
Current consumption		I _{CC}	1.5 mA Max.	1.5 mA Max.	1.5 mA Max.	4.0 mA Max.	5.0 mA Max.	No load condition, 2 MHz<f _o ≤ 4 MHz	
			1.5 mA Max.	1.5 mA Max.	2.0 mA Max.			No load condition, 4 MHz<f _o ≤ 8 MHz	
			1.5 mA Max.	2.0 mA Max.	2.5 mA Max.			No load condition, 8 MHz<f _o ≤16 MHz	
			2.0 mA Max.	2.0 mA Max.	2.5 mA Max.			No load condition, 16 MHz<f _o ≤25 MHz	
			2.0 mA Max.	2.5 mA Max.	3.5 mA Max.			No load condition, 25 MHz<f _o ≤33 MHz	
			3.0 mA Max.	3.5 mA Max.	4.5 mA Max.	No load condition, 33 MHz<f _o ≤48 MHz			
			—			6.0 mA Max.	7.0 mA Max.	No load condition, 48 MHz<f _o ≤80 MHz	
Stand-by current		I _{std}	0.7 µA Max. (0.2 µA Typ.)	1.5 µA Max. (0.5 µA Typ.)	2.0 µA Max. (1.0 µA Typ.)	10 µA Max.		ST =GND	
Symmetry		SYM	45 % to 55 % 40 % to 60 %	45 % to 55 % 40 % to 60 %	45 % to 55 %	45 % to 55 %		2 MHz<f _o ≤16 MHz 16 MHz<f _o ≤40 MHz 40 MHz<f _o ≤80 MHz	50 % V _{CC} level L _{CMOS} ≤ 15 pF
High output voltage		V _{OH}	90 % V _{CC} Min.					I _{OH} =-3 mA	
Low output voltage		V _{OL}	10 % V _{CC} Max.					I _{OL} = 3 mA	
Output load condition (CMOS)		L _{CMOS}	15 pF Max.						
Output enable / disable input voltage		V _{IH} V _{IL}	80 % V _{CC} Min. 20 % V _{CC} Max.			70 % V _{CC} Min. 30 % V _{CC} Max.		ST terminal	
Rise time / Fall time		t _r / t _f	4 ns Max.					20 % V _{CC} to 80 % V _{CC} level, L _{CMOS} =15 pF	
Start-up time		t _{str}	10 ms Max.			2 ms Max.		t=0 at 90 % V _{CC}	
Frequency aging		f _{aging}	±5 × 10 ⁻⁶ / year Max. —			±3 × 10 ⁻⁶ / year Max. ±10 × 10 ⁻⁶ Max.		+25 °C, First year,V _{CC} =1.8 V, 2.5 V, 3.3 V +25 °C, 10 years	

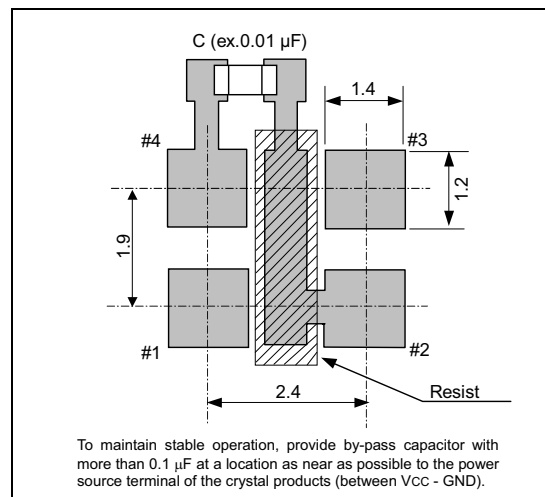
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





CRYSTAL OSCILLATOR SPXO

SG - 550 series

- Frequency range : 2 MHz to 48 MHz
- Supply voltage : 1.8 V Typ. / 2.5 V Typ. / 3.3 V Typ.
- Current consumption : SEF1.8 V No load condition 48 MHz
1.5 mA Typ.
- Function : Standby($\overline{ST}$)
- External dimensions : 5.0 × 3.2 × 1.2 t (mm)



Product Number (please contact us)
Q33550xx0xxxx00



Actual size

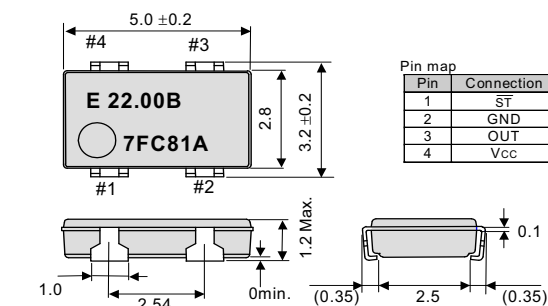


Specifications (characteristics)

Item		Symbol	Specifications			Remarks	
			SG-550SEF	SG-550SDF	SG-550SCF		
Output frequency range		f ₀	2 MHz to 48 MHz				
Supply voltage		V _{CC}	1.8 V Typ. 1.6 V to 2.2 V	2.5 V Typ. 2.2 V to 3.0 V	3.3 V Typ. 2.7 V to 3.6 V		
Temperature range	Storage temperature	T _{stg}	-40 °C to +125 °C			Store as bare product after unpacking	
	Operating temperature	T _{use}	-40 °C to +85 °C				
Frequency tolerance		f _{tol}	B: ±50 × 10 ⁻⁶ , C: ±100 × 10 ⁻⁶			-20 °C to +70 °C	
			M: ±100 × 10 ⁻⁶			-40 °C to +85 °C	
			L: ±50 × 10 ⁻⁶			-40 °C to +85 °C	V _{CC} ±5 %
Current consumption		I _{CC}	1.5 mA Max.	1.5 mA Max.	1.5 mA Max.	No load condition, 2 MHz<f ₀ ≤ 4 MHz	
			1.5 mA Max.	1.5 mA Max.	2.0 mA Max.	No load condition, 4 MHz<f ₀ ≤ 8 MHz	
			1.5 mA Max.	2.0 mA Max.	2.5 mA Max.	No load condition, 8 MHz<f ₀ ≤16 MHz	
			2.0 mA Max.	2.0 mA Max.	2.5 mA Max.	No load condition, 16 MHz<f ₀ ≤25 MHz	
			2.0 mA Max.	2.5 mA Max.	3.5 mA Max.	No load condition, 25 MHz<f ₀ ≤33 MHz	
			3.0 mA Max.	3.5 mA Max.	4.5 mA Max.	No load condition, 33 MHz<f ₀ ≤48 MHz	
Stand-by current		I _{std}	0.7 μA Max.	1.5 μA Max.	2.0 μA Max.	ST =GND	
Symmetry		SYM	45 % to 55 %	45 % to 55 %		2 MHz<f ₀ ≤16 MHz	50 % V _{CC} level L _{CMOS} ≤ 15 pF
			40 % to 60 %			16 MHz<f ₀ ≤40 MHz	
					40 MHz<f ₀ ≤48 MHz		
High output voltage		V _{OH}	90 % V _{CC} Min.			I _{OH} = -3 mA	
Low output voltage		V _{OL}	10 % V _{CC} Max.			I _{OL} = 3 mA	
Output load condition(CMOS)		L _{CMOS}	15 pF Max.				
Output enable / disable input voltage		V _{IH}	80 % V _{CC} Min.			ST terminal	
		V _{IL}	20 % V _{CC} Max.				
Rise time / Fall time		t _r / t _f	4 ns Max.			20 % V _{CC} to 80 % V _{CC} level, L _{CMOS} =15 pF	
Start-up time		t _{sta}	10 ms Max.			t=0 at 90 % V _{CC}	
Frequency aging		f _{aging}	±5 × 10 ⁻⁶ / year Max.			+25 °C, First year, V _{CC} =1.8 V, 2.5 V, 3.3 V	

External dimensions

(Unit:mm)

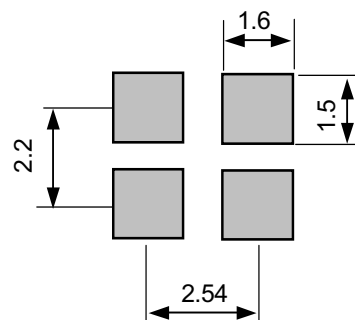


Note.
 $\overline{ST}$ pin
 $\overline{ST}$ pin = HIGH or "open" : Specified frequency output.
 $\overline{ST}$ pin = LOW : oscillation stops. High-z

Metal may be exposed on the top or bottom of this product.
This will not affect any quality, reliability or electrical spec.

Footprint (Recommended)

(Unit:mm)



To maintain stable operation, provide by-pass capacitor with more than 0.1 μF at a location as near as possible to the power source terminal of the crystal products (between V_{CC} - GND).



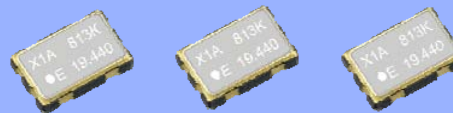
CRYSTAL OSCILLATOR SPXO

TCO-710x series

- Frequency range : 1.5 MHz to 75 MHz
- Supply voltage : 3.3 V
- External dimensions: 5.0 × 3.2 × 1.0 t (mm) Typ.
- Function : Standby (ST)



Product Number (please contact us)
X1G00xxx1xxxx00



Actual size



Specifications (characteristics)

Item	Symbol	TCO-710*X1A*	Remarks
Output frequency range	f _o	1.500 MHz to 75.000 MHz	Please contact us for inquiries regarding the available frequencies.
Supply voltage	V _{cc}	3.3 V ±0.33 V	
Storage temperature range	T _{stg}	-55 °C to +125 °C	Store as bare product after unpacking.
Operating temperature range	T _{use}	As per below description	
Frequency tolerance	f _{tol}	As per below description.	
Current consumption	I _{cc}	20 mA Max.	No load condition
Symmetry	SYM	40 % to 60 %	50 % V _{cc} level
High output voltage	V _{OH}	90 % V _{cc} Min.	I _{OH} =-5 mA
Low output voltage	V _{OL}	10 % V _{cc} Max.	I _{OL} =5 mA
Output load condition (CMOS)	L _{CMOS}	15 pF Max.	
Output enable / disable input voltage	V _{IH}	70 % V _{cc} Min.	V _{IH} or OPEN : Enable
	V _{IL}	30 % V _{cc} Max.	V _{IL} or GND : Disable
Rise time / Fall time	t _r / t _f	6 ns Max.	10 % V _{cc} to 90 % V _{cc} level
Start-up time	t _{str}	10 ms Max.	Time at minimum supply voltage to be 0 s
Frequency aging	f _{aging}	±5 × 10 ⁻⁶ / year Max.	+25 °C, V _{cc} =3.3 V, First year

* Part Number

TCO - 7 1 0 X 1 A

<Frequency tolerance / V_{cc} tolerance>
 ±50 × 10⁻⁶ Max. / V_{cc} ±10 % : 6
 ±100 × 10⁻⁶ Max. / V_{cc} ±10 % : 7

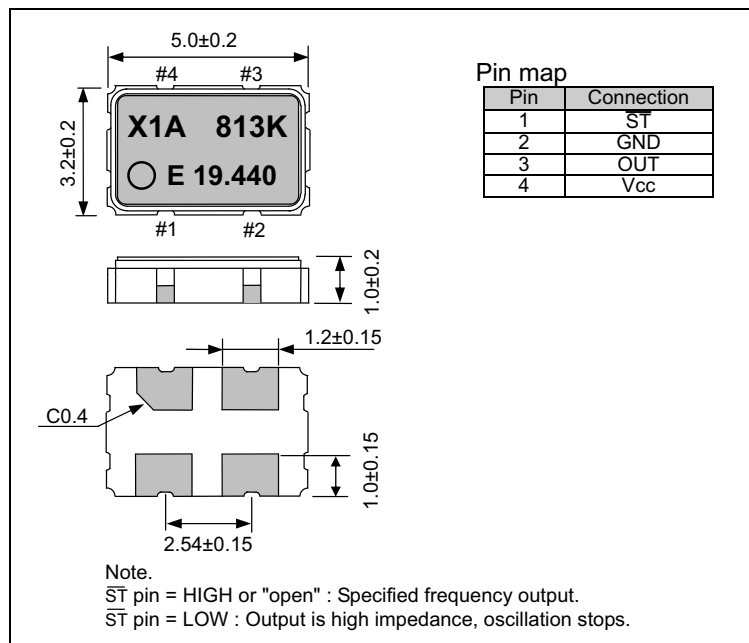


<Operating temperature range>
 BLANK: 0 °C to +70 °C
 1: -10 °C to +70 °C
 2: -20 °C to +70 °C
 4: -40 °C to +85 °C



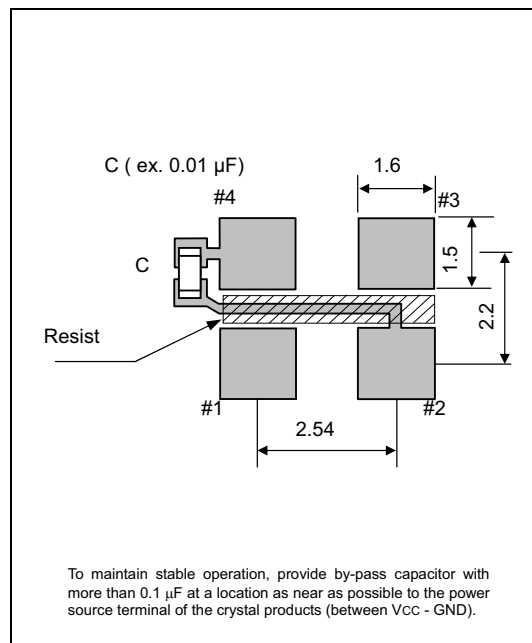
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





CRYSTAL OSCILLATOR SPXO

SG-770/SG-771 series

- Frequency range : 50 MHz to 230 MHz
- Supply voltage : 2.5 V / 3.3 V
- Output : LV-PECL
- External dimensions: 7.0 × 5.0 × 1.6 t (mm) Typ.
- Features : Fundamental mode oscillator with HFF-XTAL
- Function : Standby ($\overline{ST}$) ...SG-770 series
Output enable (OE) ...SG-771 series



Product Number (please contact us)
SG-770: X1G0023x1xxxx00
SG-771: X1G00282xxxxx00



Actual size



Specifications (characteristics)

Item	Symbol	Specifications			Remarks
		SG-770SDD	SG-770SCD	SG-771PCD	
Output frequency range	f _o	50.000 MHz to 230.000 MHz		80.000 MHz to 175.000 MHz	Please contact us for inquiries regarding the available frequencies.
Supply voltage	V _{cc}	2.5 V ±0.125 V	3.3 V ±0.165 V	3.3 V ±0.165 V	
Storage temperature range	T _{stg}	-55 °C to +125 °C			Store as bare product after unpacking
Operating temperature range	T _{use}	As per below table			
Frequency tolerance	f _{tol}	±50 × 10 ⁻⁶ Max.		As per below table	No load condition
Current consumption	I _{cc}	90 mA Max.		70 mA Max.	
Symmetry	SYM	45 % to 55 %		40 % to 60 %	at outputs crossing point
High output voltage	V _{OH}	V _{CC} -1.1 V Min.			
Low output voltage	V _{OL}	V _{CC} -1.5 V Max.			
Output load condition (ECL)	L _{ECL}	LV-PECL			
Output enable / disable input voltage	V _{IH}	70 % V _{CC} Min.			ST terminal or OE terminal
	V _{IL}	30 % V _{CC} Max.			
Rise time / Fall time	t _r / t _f	1 ns Max.			20 % to 80 % (V _{OH} -V _{OL})
Start-up time	t _{str}	10 ms Max. *1			Time at minimum supply voltage to be 0 s
Frequency aging	f _{aging}	±5 × 10 ⁻⁶ / year Max.		This is included in frequency tolerance specification.	+25 °C, V _{CC} =2.5 V or 3.3 V, First year.

*1 Rise time (0 V to 2.13 V or 3.15 V) of $V_{CC} > 150 \mu s$

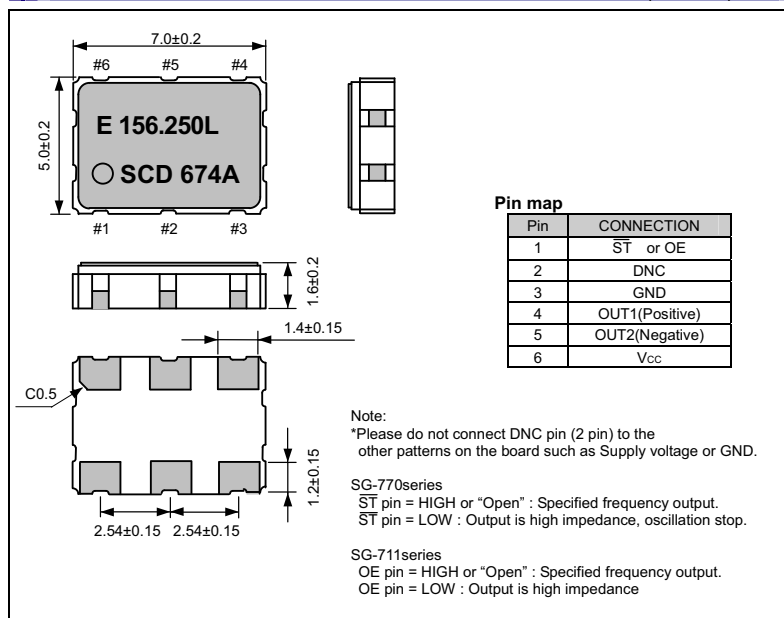
Operating temperature range

SG-770series	Operating temperature range
L	-40 °C to +85 °C
B	-20 °C to +70 °C
P	-10 °C to +70 °C
Q	0 °C to +70 °C

SG-771series	Frequency tolerance	Operating temperature range	Aging
A	$\pm 30 \times 10^{-6}$ Max.	-40 °C to +85 °C	10 years
B	$\pm 35 \times 10^{-6}$ Max.	-40 °C to +85 °C	20 years
C	$\pm 20 \times 10^{-6}$ Max.	-10 °C to +70 °C	10 years
D	$\pm 25 \times 10^{-6}$ Max.	-10 °C to +70 °C	20 years

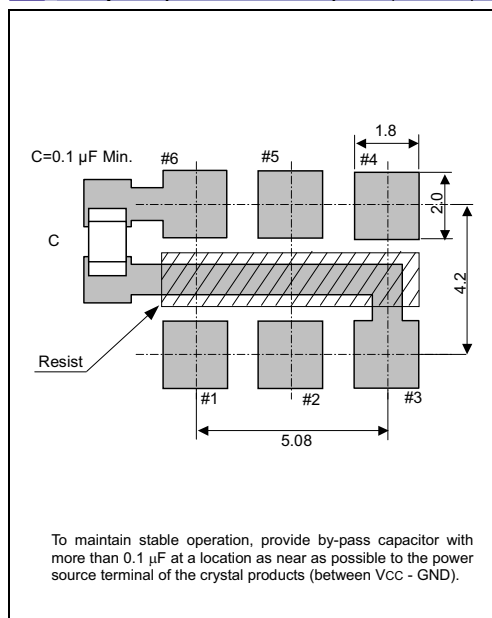
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





CRYSTAL OSCILLATOR SPXO

TCO - 708x series

- Frequency range : 1.5 MHz to 160 MHz
- Supply voltage : 3.3 V / 5.0 V
- External dimensions: 7.0 × 5.0 × 1.6 t (mm) Typ.
- Function : Standby (ST)



Product Number (please contact us)
X1G0002x1xxxx00



Actual size



Specifications (characteristics)

Item	Symbol	TCO-708*X1A*	TCO-708*D1A*	Remarks
Output frequency range	f _o	1.500 MHz to 160.000 MHz	1.500 MHz to 75.000 MHz	Please contact us for inquiries regarding the available frequencies.
Supply voltage	V _{cc}	3.3 V	5.0 V	As per below description
Storage temperature range	T _{stg}	-55 °C to +125 °C		Store as bare product after unpacking
Operating temperature range	T _{use}	As per below description		
Frequency tolerance	f _{tol}	As per below description		
Current consumption	I _{cc}	20 mA Max.	20 mA Max.	f _o < 30 MHz, No load condition.
			40 mA Max.	30 MHz ≤ f _o ≤ 75 MHz, No load condition.
		50 mA Max.	—	75 MHz < f _o ≤ 160 MHz, No load condition.
Symmetry	SYM	40 % to 60 %		50 % V _{cc} level
High output voltage	V _{OH}	90 % V _{cc} Min.		I _{OH} = -5mA(X1A) / -8mA(D1A)
Low output voltage	V _{OL}	10 % V _{cc} Max.		I _{OL} = +5mA(X1A) / +8mA(D1A)
Output load condition (CMOS)	L CMOS	15 pF Max.		
Output enable / disable input voltage	V _{IH}	70 % V _{cc} Min.		V _{IH} or OPEN : Enable
	V _{IL}	30 % V _{cc} Max.		V _{IL} or GND : Disable
Rise time / Fall time	t _r / t _f	6 ns Max.	10 ns Max.	f _o ≤ 75 MHz, 10 % V _{cc} to 90 % V _{cc} level
		3 ns Max.	—	75 MHz < f _o ≤ 160 MHz, 10 % V _{cc} to 90 % V _{cc} level
Start-up time	t _{str}	10 ms Max.		Time at minimum supply voltage to be 0 s
Frequency aging	f _{aging}	±5 × 10 ⁻⁶ / year Max.		+25 °C, First year

* Part Number

TCO - 7 0 8 1 A

<Frequency tolerance / V_{cc} tolerance>

- ±25 × 10⁻⁶ Max. / V_{cc} ±5 % : 5
- ±50 × 10⁻⁶ Max. / V_{cc} ±10 % : 6
- ±100 × 10⁻⁶ Max. / V_{cc} ±10 % : 7

<Operating temperature range>

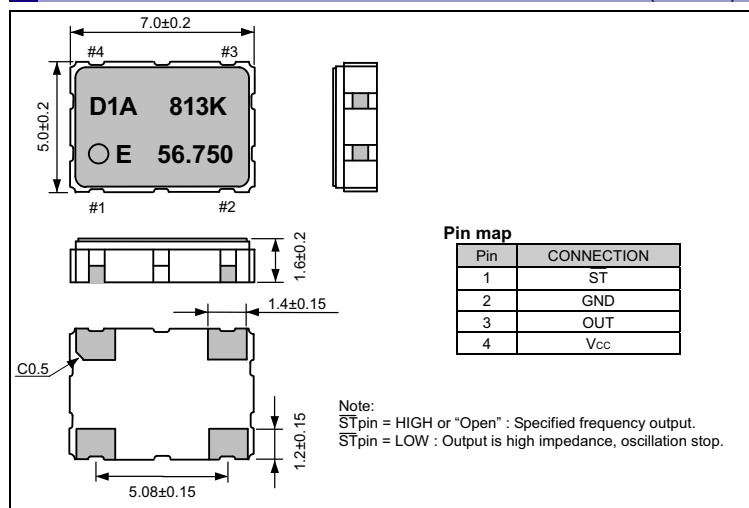
- BLANK: 0 °C to +70 °C
- 1: -10 °C to +70 °C
- 2: -20 °C to +70 °C
- 4: -40 °C to +85 °C (±50, ±100 × 10⁻⁶ only)

< Supply voltage / Frequency range>

- X : V_{cc}= 3.3 V / 1.5 MHz to 160 MHz
- D : V_{cc}= 5.0 V / 1.5 MHz to 75 MHz

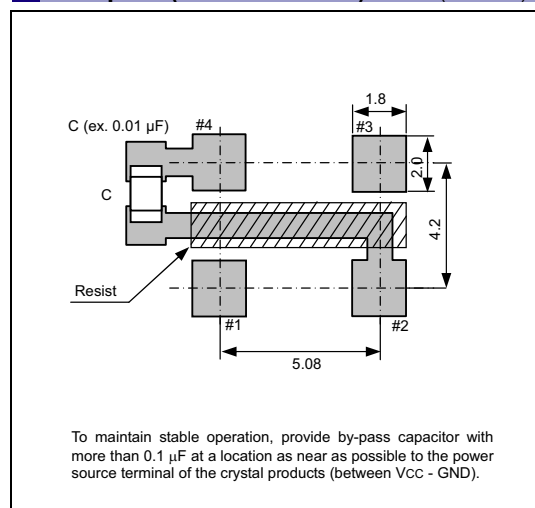
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





CRYSTAL OSCILLATOR SPXO

SG - 645 / SG - 636 series

- Frequency range : 2.21675 MHz to 135 MHz
- Supply voltage : 2.5 V / 3.3 V / 5.0 V
- Function : Output enable(OE) or Standby($\overline{ST}$)
- External dimensions : 7.1 × 5.1 × 1.5 t (mm)···SG-645
10.5 × 5.8 × 2.7 t (mm)···SG-636



Product Number (please contact us)

SG-645 : Q33645xx1xxxx00

SG-636 : Q33636xx1xxxx00



Actual size

SG-645 series



SG-636 series



Specifications (characteristics)

Item		Symbol	Specifications			Remarks
			SG-636 PTF	SG-636 PCE SG-636 SCE	SG-636 PDE	
Output frequency range		f ₀	2.21675 MHz to 41.000 MHz	2.21675 MHz to 40.000 MHz	2.21675 MHz to 40.000 MHz	
Supply voltage		V _{cc}	5.0 V ±0.5 V	3.3 V ±0.3 V	2.5 V ±0.25 V	
Temperature range	Storage temperature	T _{stg}	-55 °C to +100 °C			Store as bare product after unpacking
	Operating temperature	T _{use}	-20 °C to +70 °C			
Frequency tolerance		f _{tol}	C: ±100 × 10 ⁻⁶			-20 °C to +70 °C
Current consumption		I _{cc}	17 mA Max.	9 mA Max.	5 mA Max.	No load condition
Disable current		I _{dis}	10 mA Max.	5 mA Max.	3 mA Max.	OE=GND
Stand-by current		I _{std}	—	2 μA Max.	—	ST =GND(SCE)
Symmetry		SYM	40 % to 60 %	45 % to 55 %		CMOS load:50 % V _{cc} level
			45 % to 55 %	—		TTL load: 1.4 V level
High output voltage		V _{OH}	V _{cc} -0.4 V Min.			I _{OH} =-8 mA(PTF)/-4 mA(SCE,PCE), /-3.2 mA(PDE)
Low output voltage		V _{OL}	0.4 V Max.			I _{OL} =16 mA(PTF)/ 4 mA(SCE,PCE) /3.2 mA(PDE)
Output load condition (TTL)		L _{TTL}	10 TTL Max.	—		L _{CMOS} ≤ 15 pF
Output load condition (CMOS)		L _{CMOS}	50 pF Max.	30 pF Max.	15 pF Max.	
Output enable / disable input voltage		V _{IH}	2.0 V Min.	80 % V _{cc} Min.		OE Terminal or ST Terminal (SCE)
		V _{IL}	0.8 V Max.	20 % V _{cc} Max.		
Rise time / Fall time		t _r / t _f	7 ns Max.	5 ns Max.		CMOS load:20 % V _{cc} to 80 % V _{cc} level
			5 ns Max.	—		TTL load:0.4 V to 2.4 V level
Start-up time		t _{str}	4 ms Max.	4 ms Max.		Time at minimum supply voltage to be 0 s
Frequency aging		f _{aging}	±5 × 10 ⁻⁶ / year Max.			+25 °C, V _{cc} =5.0 V/3.3 V/2.5 V, First year

Specifications (characteristics)

Item		Symbol	Specifications			Remarks
			SG-636 PTG	SG-636 PHG	SG-636 PCG SG-636 SCG	
Output frequency range		f ₀	2.21675 MHz to 33.000 MHz *1			
Supply voltage		V _{CC}	4.5 V to 5.5 V		2.7 V to 3.6 V	
Temperature range	Storage temperature	T _{stg}	-55 °C to +100 °C			Store as bare product after unpacking
	Operating temperature	T _{use}	-20 °C to +70 °C			
Frequency tolerance		f _{tol}	B: ±50 × 10 ⁻⁶ C: ±100 × 10 ⁻⁶			-20 °C to +70 °C
Current consumption		I _{CC}	25 mA Max.		12 mA Max.	No load condition
Disable curren		I _{dis}	20 mA Max.		10 mA Max.	OE=GND (PTG,PHG,PCG)
Stand-by current		I _{std}	—		50 µA Max.	ST =GND (SCG)
Symmetry	SYM	—	45 % to 55 %			50 % V _{CC} level, L _{CMOS} =25 pF
		40 % to 60 %	—			1.4 V level, L _{CMOS} =25 pF
High output voltage	V _{OH}	2.4 V Min.	—		V _{CC} -0.4 V Min.	I _{OH} =8 mA
		—	V _{CC} -0.4 V Min.		—	I _{OH} =16 mA
Low output voltage	V _{OL}	—		0.4 V Max.		I _{OL} =8 mA
		0.4 V Max.		—		I _{OL} =16 mA
Output load condition		L _{CMOS}	25 pF Max.			
Output enable /		V _{IH}	2.0 V Min.		70 % V _{CC} Min.	OE Terminal or ST Terminal
disable input voltage		V _{IL}	0.8 V Max.		20 % V _{CC} Max.	
Rise time / Fall time	t _r / t _f	—	3.4 ns Max.		4 ns Max.	20 % V _{CC} to 80 % V _{CC} level, L _{CMOS} ≤ 25 pF
		2.4 ns Max.	—			TTL load:0.4 V to 2.4 V level, L _{CMOS} ≤ 25 pF
Start-up time		t _{str}	12 ms Max.			t=0 at 90 % V _{CC}
Frequency aging		f _{aging}	±5 × 10 ⁻⁶ / year Max.			+25 °C, V _{CC} =5.0 V/ 3.3 V, First year

*1 4.1250 MHz < f₀ < 4.4336 MHz, 8.2500 MHz < f₀ < 8.8672 MHz, 16.500 MHz < f₀ < 17.7344 MHz : Unavailable



Specifications (characteristics)

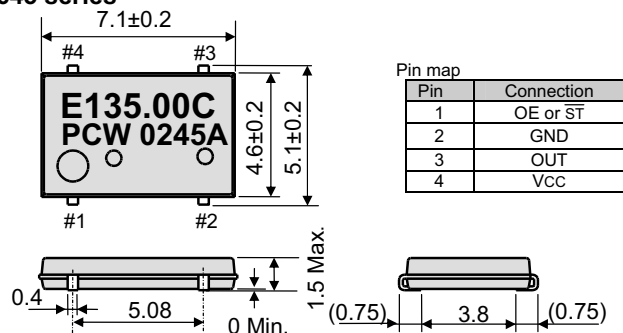
Item	Symbol	Specifications			Remarks
		SG-636 PTW / STW SG-645 PTW / STW	SG-636 PHW / SHW SG-645 PHW / SHW	SG-636 PCW / SCW SG-645 PCW / SCW	
Output frequency range	f ₀	32.001 MHz to 135.000 MHz			
Supply voltage	V _{cc}	5.0 V ±0.5 V		3.3 V ±0.3 V	
Temperature range	Storage temperature T _{stg}	SG-636P**:-55 °C to +100 °C / SG-645P**:-55 °C to +125 °C			Store as bare product after unpacking
	Operating temperature T _{use}	-20 °C to +70 °C			
		—		-40 °C to +85 °C	SG-645PCW / SCW Only
Frequency tolerance	f _{tol}	B: ±50 × 10 ⁻⁶ C: ±100 × 10 ⁻⁶		—	-20 °C to +70 °C *1
		—		M: ±50 × 10 ⁻⁶	-40 °C to +85 °C : SG-645PCW / SCW Only
Current consumption	I _{cc}	45 mA Max.		28 mA Max.	No load condition(Max. frequency range)
Disable current	I _{dis}	30 mA Max.		16 mA Max.	OE=GND (PTW,PHW,PCW)
Stand-by current	I _{std}	50 µA Max.			ST =GND (STW,SHW,SCW)
Symmetry	SYM	—	40 % to 60 %		50 % V _{cc} level, L_CMOS=Max.
		40 % to 60 %	—		1.4 V level, L_CMOS=Max.
High output voltage	V _{OH}	V _{cc} -0.4 V Min.			I _{OH} =-16 mA(PTW , STW , PHW , SHW) /-8 mA(PCW , SCW)
Low output voltage	V _{OL}	0.4 V Max.			I _{OL} = 16 mA(PTW , STW , PHW , SHW) / 8 mA(PCW , SCW)
Output load condition (TTL)	L _{TTL}	5 TTL Max.	—	—	f≤ 90 MHz, Max.Supply voltage.
Output load condition (CMOS)	L _{CMOS}	15 pF Max.			Max.frequency, Max.Supply voltage.
Output enable / disable input voltage	V _{IH}	2.0 V Min.		70 % V _{cc} Min.	OE Terminal or ST Terminal
	V _{IL}	0.8 V Max.		20 % V _{cc} Max.	
Rise time / Fall time	t _r / t _f	—	4 ns Max.		20 % V _{cc} to 80 % V _{cc} level, L_CMOS ≤ Max.
		4 ns Max.	—		0.4 V to 2.4 V level
Start-up time	t _{str}	10 ms Max.			Time at minimum supply voltage to be 0 s
Frequency aging	f _{aging}	±5 × 10 ⁻⁶ / year Max.			+25 °C, V _{cc} =5.0 V / 3.3 V, First year

*1 SG-636 series "C" tolerance : 40 MHz< f_0 <135 MHz

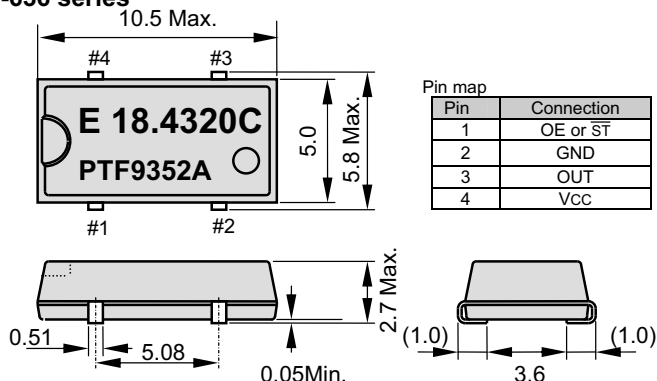
External dimensions

(Unit:mm)

● SG-645 series



● SG-636 series



Metal may be exposed on the top or bottom of this product.
This will not affect any quality, reliability or electrical spec.

Note.

OE pin (PTF,PCE,PDE,PTW,PHW,PCW,PTG,PHG,PCG)

OE pin = "H" or "open" : Specified frequency output.

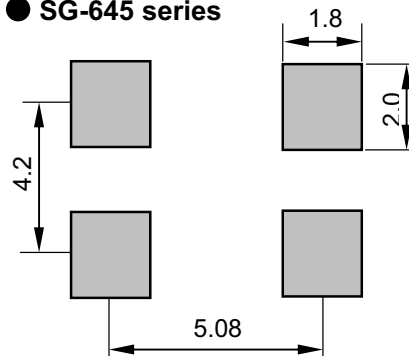
OE pin = "L" : Output is high impedance.

 $\overline{ST}$ pin (STW, SHW, SCW,SCG) $\overline{ST}$ pin = "H" or "open" : Specified frequency output. $\overline{ST}$ pin = "L" : Output is low level (weak pull - down),oscillation stops. $\overline{ST}$ pin (SCE) $\overline{ST}$ pin = "H" or "open" : Specified frequency output. $\overline{ST}$ pin = "L" : Output is low level ,oscillation stops.

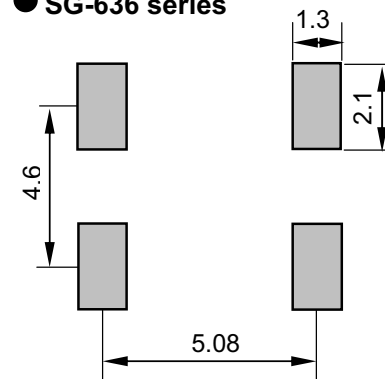
Footprint (Recommended)

(Unit:mm)

● SG-645 series



● SG-636 series



To maintain stable operation, provide by-pass capacitor with more than 0.1 μ F at a location as near as possible to the power source terminal of the crystal products (between VCC - GND).



CRYSTAL OSCILLATOR SPXO

SG-615 series SG-531 / SG-51 series

- Frequency range : 1.025 MHz to 135 MHz
- Supply voltage : 3.3 V / 5.0 V
- Function : Output enable(OE) or Standby($\overline{ST}$)
- Pin compatible with full-size metal can. (SG-51 series)
- Pin compatible with half-size metal can. (SG-531 series)



Product Number (please contact us)

SG-615 : Q33615xx1xxxx00

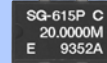
SG-531 : Q32531xx1xxxx00

SG-51 : Q32510xx1xxxx00



Actual size

SG-615



SG-531



SG-51



Specifications (characteristics)

Item		Symbol	Specifications		Remarks
			SG-615P SG-531P SG-51P	SG-615PTJ SG-531PTJ SG-51PTJ	
Output frequency range		f ₀	1.025 MHz to 26 MHz	26.001 MHz to 66.667 MHz	.
Supply voltage		V _{cc}	5.0 V ±0.5 V		
Temperature range	Storage temperature	T _{stg}	-55 °C to +125 °C		Store as bare product after unpacking
	Operating temperature	T _{use}	-20 °C to +70 °C		
Frequency tolerance		f _{tol}	B: ±50 × 10 ⁻⁶ , C: ±100 × 10 ⁻⁶		-20 °C to +70 °C *1
Current consumption		I _{cc}	23 mA Max.	35 mA Max.	No load condition
Disable current		I _{dis}	12 mA Max.	28 mA Max.	OE=GND
Symmetry	SYM		40 % to 60 %	—	CMOS load:50 % V _{cc} level
			40 % to 60 %	45 % to 55 %	TTL load: 1.4 V level
High output voltage		V _{OH}	V _{cc} -0.4 V Min.	2.4 V Min.	I _{OH} =-400 μA
Low output voltage		V _{OL}	0.4 V Max.		I _{OL} =16 mA(P)/ 8 mA(PTJ)
Output load condition (TTL)		L _{TTL}	10 TTL Max.	5 TTL Max.	L _{CMOS} ≤ 15 pF
Output load condition (CMOS)		L _{CMOS}	50 pF Max.	—	
Output enable / disable input voltage	V _{IH}		2.0 V Min.	3.5 V Min.	I _{IH} = 1 μA Max. (OE=V _{cc})
	V _{IL}		0.8 V Max.	1.5 V Max.	I _{IL} = -100 μA Min. (OE=GND), PTJ:I _{IL} = -500 μA Min.(OE=GND)
Rise time / Fall time	t _r / t _f		8 ns Max.	—	CMOS load:20 % V _{cc} to 80 % V _{cc} level
			8 ns Max.	5 ns Max.	TTL load:0.4 V to 2.4 V level
Start-up time		t _{str}	4 ms Max.	10 ms Max.	Time at minimum supply voltage to be 0 s
Frequency aging		f _{aging}	±5 × 10 ⁻⁶ / year Max.		+25 °C, V _{cc} =5.0 V, First year

*1 "B" tolerance will be available up to 55 MHz.

Specifications (characteristics)

Item		Symbol	Specifications			Remarks
			SG-615PCG SG-531PCG	SG-615SCG SG-531SCG	SG-615PCN	
Output frequency range		f ₀	1.500 MHz to 26.000 MHz		26.001 MHz to 66.667 MHz	
Supply voltage		V _{cc}	2.7 V to 3.6 V		3.0 V to 3.6 V	
Temperature range	Storage temperature	T _{stg}	-55 °C to +125 °C			Store as bare product after unpacking
	Operating temperature	T _{use}	-40 °C to +85 °C			
Frequency tolerance		f _{tol}	B: ±50 × 10 ⁻⁶ C: ±100 × 10 ⁻⁶ M: ±100 × 10 ⁻⁶			-20 °C to +70 °C -40 °C to +85 °C
Current consumption		I _{cc}	12 mA Max.		20 mA Max.	No load condition
Disable current		I _{dis}	10 mA Max.	—	10 mA Max.	OE=GND (PCG,PCN)
Stand-by current		I _{std}	—	50 μA Max.	—	ST =GND (SCG)
Symmetry		SYM	45 % to 55 %			50 % V _{cc} level, L _{CMOS} =Max.
High output voltage		V _{OH}	V _{cc} -0.4 V Min.		V _{cc} -0.4 V Min.	I _{OH} =-8 mA
Low output voltage		V _{OL}	0.4 V Max.		0.4 V Max.	I _{OL} = 8 mA
Output load condition		L _{CMOS}	25 pF Max.		15 pF Max.	
Output enable / disable input voltage		V _{IH} V _{IL}	70 % V _{cc} Min. 20 % V _{cc} Max.		70 % V _{cc} Min. 30 % V _{cc} Max.	OE Terminal or ST Terminal
Rise time / Fall time		t _r / t _f	4 ns Max.			20 % V _{cc} to 80 % V _{cc} level, L _{CMOS} ≤ Max.
Start-up time		t _{str}	12 ms Max.		10 ms Max.	t=0 at 90% V _{cc}
Frequency aging		f _{aging}	±5 × 10 ⁻⁶ / year Max.			+25 °C, V _{cc} =3.3 V, First year



Specifications (characteristics)

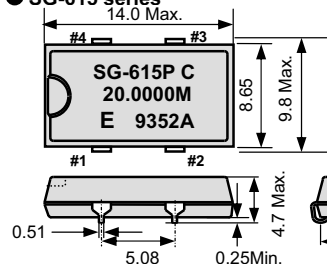
Item		Symbol	Specifications			Remarks
			SG-615PTW / STW SG-531PTW / STW	SG-615PHW / SHW SG-531PHW / SHW	SG-615PCW / SCW SG-531PCW / SCW	
Output frequency range		f ₀	55.001 MHz to 135.000 MHz			26.001 MHz to 135.000 MHz
Supply voltage		V _{CC}	5.0 V ±0.5 V			3.3 V ±0.3 V
Temperature range	Storage temperature	T _{stg}	-55 °C to +125 °C			Store as bare product after unpacking
	Operating temperature	T _{use}	-20 °C to +70 °C			
Frequency tolerance		f _{tol}	B: ±50 × 10 ⁻⁶ , C: ±100 × 10 ⁻⁶			-20 °C to +70 °C *1
			—			-40 °C to +85 °C
Current consumption		I _{CC}	45 mA Max.			28 mA Max.
Disable current		I _{dis}	30 mA Max.			16 mA Max.
Stand-by current		I _{std}	50 μA Max.			OE=GND (PTW,PHW,PCW) ST =GND (STW,SHW,SCW)
Symmetry	SYM	—		40 % to 60 %		50 % V _{CC} level, L _{CMOS} =Max.
		40 % to 60 %		—		1.4 V level ,L _{CMOS} =Max.
High output voltage		V _{OH}	V _{CC} -0.4 V Min.			I _{OH} = 16 mA(PTW,STW,PHW,SHW), -8 mA(PCW,SCW)
Low output voltage		V _{OL}	0.4 V Max.			I _{OL} = 16 mA(PTW,STW,PHW,SHW), 8 mA(PCW,SCW)
Output load condition (TTL)		L _{TTL}	5 TTL Max.	—	—	f ₀ ≤ 90 MHz , Max.supply voltage
Output load condition (CMOS)		L _{CMOS}	15 pF Max.			Max.frequency , Max.supply voltage
Output enable / disable input voltage		V _{IH}	2.0 V Min.			OE Terminal or ST Terminal
		V _{IL}	0.8 V Max.			
Rise time / Fall time		t _r / t _f	—			20 % V _{CC} to 80 % V _{CC} level, L _{CMOS} ≤ Max. 0.4 V to 2.4 V level
		4 ns Max.			4 ns Max.	
Start-up time		t _{str}	10 ms Max..			Time at minimum supply voltage to be 0 s
Frequency aging		f _{aging}	±5 × 10 ⁻⁶ / year Max.			+25 °C, V _{CC} =5.0 V / 3.3 V, First year

*1 "C" tolerance : $f_0 \geq 66.667$ MHz(PTW,STW,PHW,SHW)

External dimensions

(Unit:mm)

● SG-615 series



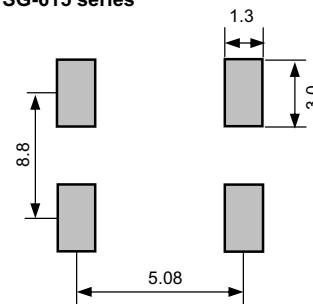
Pin map

Pin	Connection
1	OE or ST
2	GND
3	OUT
4	V _{cc}

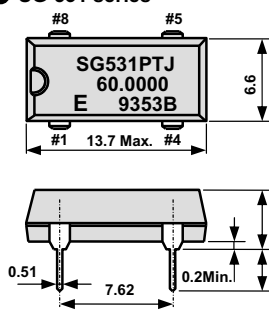
Footprint (Recommended)

(Unit:mm)

● SG-615 series

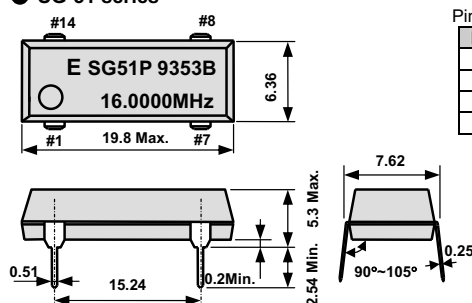


● SG-531 series



No.	Pin terminal
1	OE or ST
4	GND
5	OUT
8	V _{cc}

● SG-51 series



Pin map

Pin	Connection
1	OE or ST
7	GND
8	OUT
14	V _{cc}

Note.

OE pin (P,PTJ,PTW,PHW,PCW,PCN,PCG)
OE pin = "H" or "open" : Specified frequency output.
OE pin = "L" : Output is high impedance.

$\overline{ST}$ pin (STW, SHW, SCW,SCG)
ST pin = "H" or "open" : Specified frequency output.
ST pin = "L" : Output is low level
(weak pull - down), oscillation stops.

To maintain stable operation, provide by-pass capacitor with more than 0.1 μ F at a location as near as possible to the power source terminal of the crystal products (between V_{cc} - GND).



CRYSTAL OSCILLATOR PROGRAMMABLE

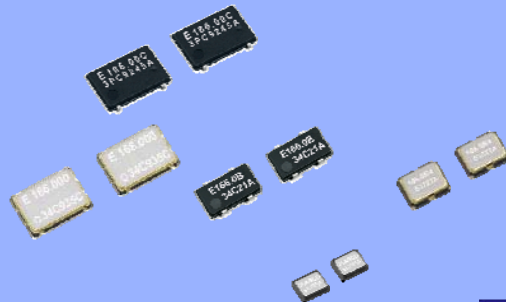
SG - 8003 series

- Frequency range : 1 MHz to 166 MHz
- Supply voltage : 1.8 V Typ. / 2.5 V Typ. / 3.3 V Typ.
- Function : Output enable(OE) or Standby($\overline{ST}$)

- Short mass production lead time by PLL technology.
- SG-Writer available to purchase.
Please contact Epson Toyocom or local sales representative.



Product Number (please contact us)
X1G003xx1xxxx00

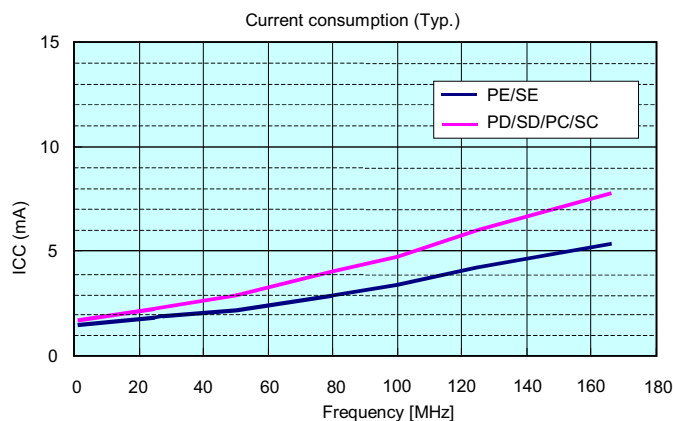


NEW

Specifications (characteristics)

Item		Symbol	Specifications			Remarks	
			PE / SE	PD / SD	PC / SC		
Output frequency range		f ₀	1 MHz to 166 MHz				
Supply voltage		V _{CC}	1.8 V Typ. 1.6 V to 2.2 V	2.5 V Typ. 2.2 V to 2.8 V	3.3 V Typ. 2.7 V to 3.6 V		
Temperature range	Storage temperature	T _{stg}	-40 °C to +85 °C			Store as bare product after unpacking	
	Operating temperature	T _{use}	-20 °C to +70 °C / -40 °C to +85 °C				
Frequency tolerance		f _{tol}	B: ±50 × 10 ⁻⁶ , C: ±100 × 10 ⁻⁶			-20 °C to +70 °C	
			L: ±50 × 10 ⁻⁶ , M: ±100 × 10 ⁻⁶			-40 °C to +85 °C	
Current consumption		I _{CC}	3.5 mA Max.	4.0 mA Max.	No load condition, 1 MHz ≤ f ₀ ≤ 25 MHz		
			5.0 mA Max.	6.5 mA Max.	No load condition, 25 MHz < f ₀ ≤ 50 MHz		
			6.0 mA Max.	8.5 mA Max.	No load condition, 50 MHz < f ₀ ≤ 75 MHz		
			7.0 mA Max.	10.5 mA Max.	No load condition, 75 MHz < f ₀ ≤ 100 MHz		
			8.5 mA Max.	12.5 mA Max.	No load condition, 100 MHz < f ₀ ≤ 125 MHz		
			10.0 mA Max.	15.0 mA Max.	No load condition, 125 MHz < f ₀ ≤ 166 MHz		
Output disable current		I _{dis}	8 mA Max.			OE=GND (PE,PD,PC)	
Stand-by current		I _{std}	50 μA Max.			ST =GND (SE,SD,SC)	
Symmetry		SYM	45 % to 55 %			50 % V _{CC} level, L _{CMOS} ≤ 15 pF	
High output voltage		V _{OH}	90 % V _{CC} Min.		V _{CC} -0.4 V Min.	I _{OH} =-4 mA(PD,SD,PE,SE), -8.0 mA(PC,SC)	
Low output voltage		V _{OL}	10 % V _{CC} Max.		0.4 V Max.	I _{OL} = 4 mA(PD,SD,PE,SE), 8.0 mA(PC,SC)	
Output load condition (CMOS)		L _{CMOS}	15 pF Max.				
Output enable / disable input voltage		V _{IH}	80 % V _{CC} Min.			OE terminal or ST terminal	
		V _{IL}	20 % V _{CC} Max.				
Rise and Fall time		tr/ tr	5.0 ns Max.			1 MHz ≤ f ₀ < 80 MHz	20 % V _{CC} to 80 % V _{CC} level, L _{CMOS} =15 pF
			2.5 ns Max.			80 MHz ≤ f ₀ ≤ 166 MHz	
Start-up time		t _{str}	5 ms Max.			t=0 at 90 % V _{CC}	
Frequency aging		f _{aging}	±3 × 10 ⁻⁶ / year Max.			+25 °C, First year, V _{CC} =1.8 V, 2.5 V, 3.3 V	

Current consumption



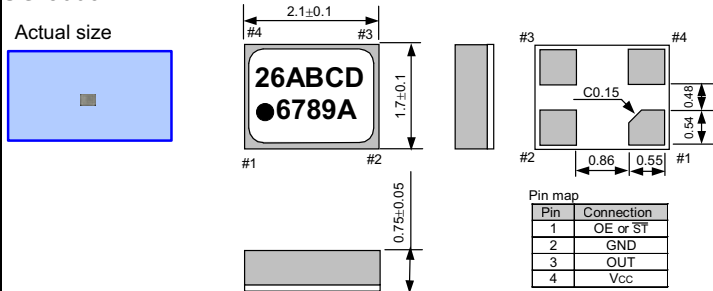


External dimensions

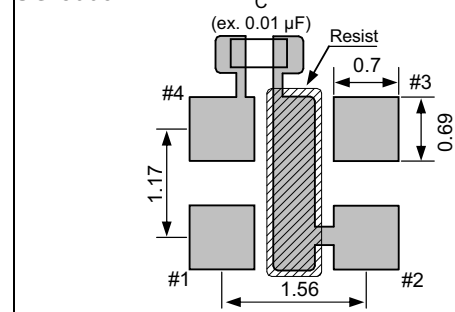
(Unit:mm)

SG-8003BA

Actual size

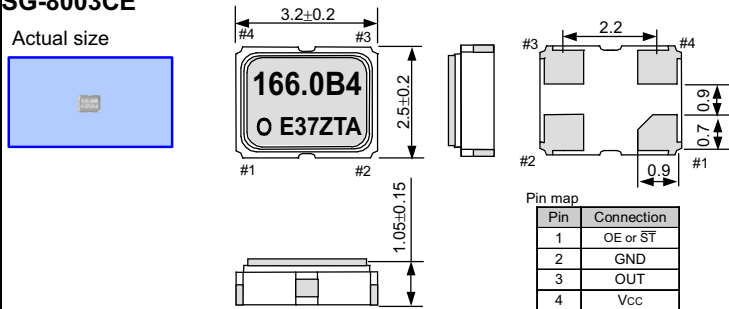


SG-8003BA

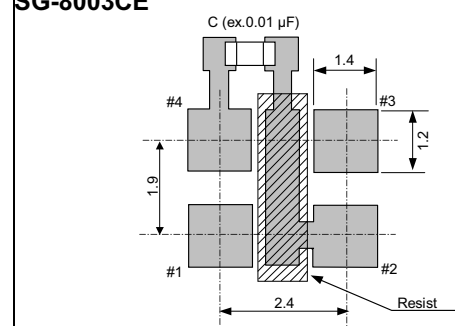


SG-8003CE

Actual size

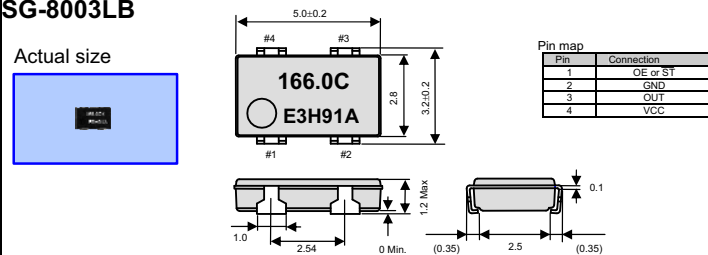


SG-8003CE



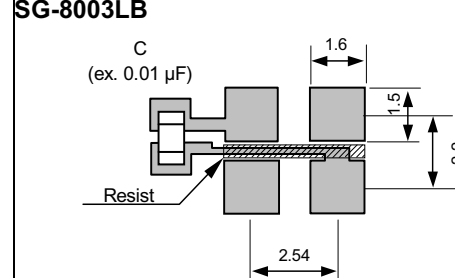
SG-8003LB

Actual size



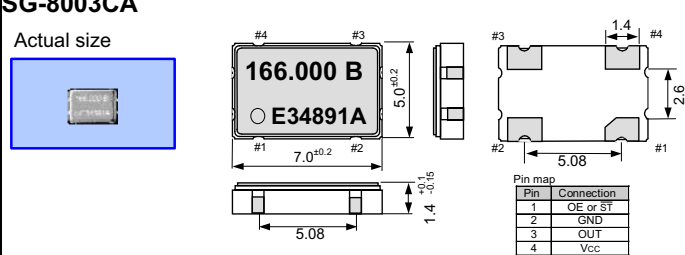
Metal may be exposed on the top or bottom of this product.
This will not affect any quality, reliability or electrical spec.

SG-8003LB

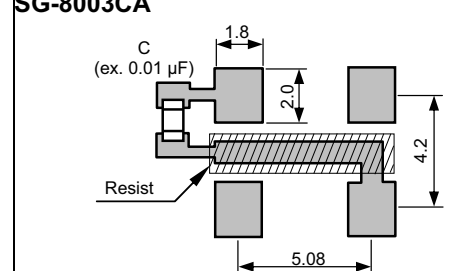


SG-8003CA

Actual size

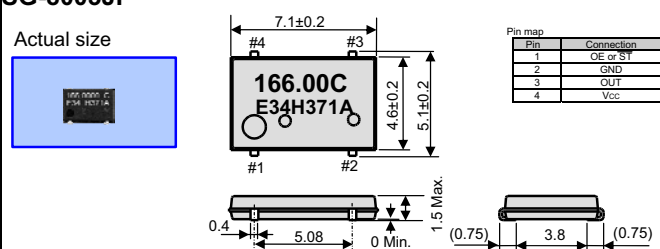


SG-8003CA

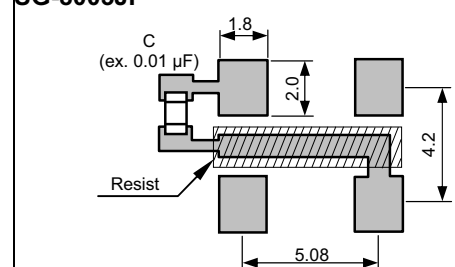


SG-8003JF

Actual size



SG-8003JF



Note.

OE Pin (PE, PD, PC)

OE Pin = "H" or "open" : Specified frequency output.

OE Pin = "L" : Output is low level (weak pull - down)

ST Pin (SE, SD, SC)

ST Pin = "H" or "open" : Specified frequency output.

ST Pin = "L" : Output is low level (weak pull - down), oscillation stops.

To maintain stable operation, provide by-pass capacitor with more than 0.1 µF at a location as near as possible to the power source terminal of the crystal products (between VCC - GND).



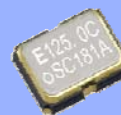
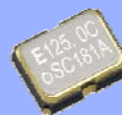
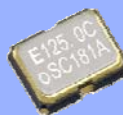
CRYSTAL OSCILLATOR PROGRAMMABLE

SG-8002CE series

- Frequency range : 1 MHz to 125 MHz
 - Supply voltage : 3.3 V / 5.0 V
 - Function : Output enable(OE) or Standby($\overline{ST}$)
 - External dimensions : $3.2 \times 2.5 \times 1.05$ t (mm) Typ.
 - Short mass production lead time by PLL technology.
 - SG-Writer available to purchase.
- Please contact Epson Toyocom or local sales representative.



Product Number (please contact us)
Q3321CExxxxx00



Actual size



Specifications (characteristics)

Item		Symbol	Specifications *2			Remarks
			PT /ST	PH /SH	PC / SC	
Output frequency range		f ₀	1 MHz to 125 MHz		—	V _{CC} =4.5 V to 5.5 V
			—		1 MHz to125 MHz	V _{CC} =3.0 V to 3.6 V
			—		1 MHz to 66.7 MHz	V _{CC} =2.7 V to 3.6 V
Supply voltage		V _{CC}	4.5 V to 5.5 V		2.7 V to 3.6 V	
Temperature range	Storage temperature	T _{stg}	-40 °C to +125 °C			Store as bare product after unpacking
	Operating temperature	T _{use}	-20 °C to +70 °C (-40 °C to +85 °C)		-40 °C to +85 °C	Refer to “Outline specifications” (Frequency range)
Frequency tolerance		f _{tol}	B: ±50 × 10 ⁻⁶ ,C: ±100 × 10 ⁻⁶			-20 °C to +70 °C
			M: ±100 × 10 ⁻⁶			-40 °C to +85 °C *3
Current consumption		I _{CC}	40 mA Max.		28 mA Max.	No load condition, Max. frequency
Disable current		I _{dis}	30 mA Max.		16 mA Max.	OE=GND
Standby current		I _{std}	50 μA Max.			ST =GND(ST,SH,SC)
Symmetry *1		SYM	—		40 % to 60 %	CMOS load:50 % V _{CC} level, Max. load condition
			40 % to 60 %			—
High output voltage		V _{OH}	V _{CC} -0.4 V Min.			I _{OH} =-16 mA(PT,ST,PH,SH),-8 mA(PC,SC)
Low output voltage		V _{OL}	0.4 V Max.			I _{OL} =16 mA(PT,ST,PH,SH), 8 mA(PC,SC)
Output load condition (TTL) *1		L _{TTL}	5 TTL Max.	—		Max. frequency and Max. Supply voltage
Output load condition (CMOS) *1		L _{CMOS}	15 pF Max.			
Output enable / disable input voltage		V _{IH}	2.0 V Min.		70 % V _{CC} Min.	ST terminal or OE terminal
		V _{IL}	0.8 V Max.		20 % V _{CC} Max.	
Rise and Fall time *1		t _r / t _f	—		3 ns Max.	CMOS load: 20 % V _{CC} to 80 % V _{CC} level
			4 ns Max.		—	TTL load: 0.4 V to 2.4 V level
Start-up time		t _{str}	10 ms Max.			Time at minimum supply voltage to be 0 s
Frequency aqing		f _{aging}	±5 × 10 ⁻⁶ / year Max.			+25 °C, V _{CC} =5.0 V / 3.3 V (PC,SC) First year

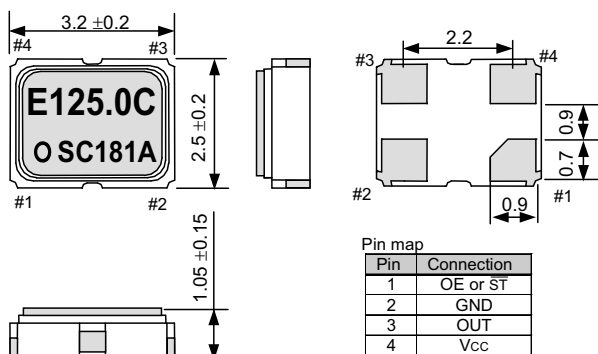
*1 Operating temperature (-40 °C to +85 °C), the available frequency, symmetry and output load conditions, please refer to "Outline specifications" page.

*2 PLL-PLL connection & Jitter specification, please refer to "Jitter specifications and characteristics chart" page.

*3 PT / ST and PH / SH for "M" tolerance will be available up to 27 MHz. Checking possible by the Frequency checking program.

External dimensions

(Unit:mm)



Note.

OE Pin (PT, PH, PC)

OE pin = "H" or "open" : Specified frequency output.

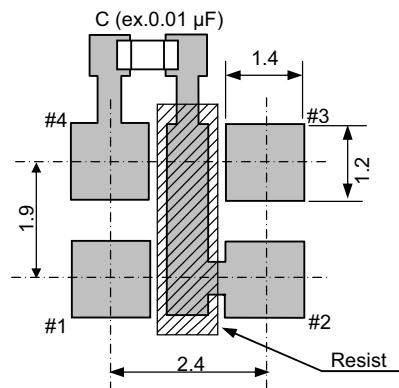
OE pin = "L" : Output is high impedance.

$\overline{ST}$ pin (ST, SH, SC)

$\overline{ST}$ pin - "H" or "open" : Specified frequency output.

$\overline{ST}$ pin - "L" : Output is low level (weak pull - down), oscillation stops.

Footprint (Recommended) (Unit:mm)



To maintain stable operation, provide by-pass capacitor with more than 0.1 μ F at a location as near as possible to the power source terminal of the crystal products (between Vcc - GND).



CRYSTAL OSCILLATOR PROGRAMMABLE

SG-8002LB series

- Frequency range : 1 MHz to 125 MHz
 - Supply voltage : 3.3 V / 5.0 V
 - Function : Output enable(OE) or Standby($\overline{\text{ST}}$)
 - External dimensions : $5.0 \times 3.2 \times 1.2$ t (mm)
 - Short mass production lead time by PLL technology.
 - SG-Writer available to purchase.
- Please contact Epson Toyocom or local sales representative.



Product Number (please contact us)
Q3323LBxxxxx00



Actual size



Specifications (characteristics)

Item	Symbol	Specifications *2		Remarks
		PH / SH	PC / SC	
Output frequency range	f_0	1 MHz to 80 MHz	—	$V_{CC}=4.5 \text{ V to } 5.5 \text{ V}$
		—	1 MHz to 125 MHz	$V_{CC}=3.0 \text{ V to } 3.6 \text{ V}$
		—	1 MHz to 66.7 MHz	$V_{CC}=2.7 \text{ V to } 3.6 \text{ V}$
Supply voltage	V_{CC}	4.5 V to 5.5 V	2.7 V to 3.6 V	
Temperature range	Storage temperature T_{stg}	-40 °C to +125 °C		Store as bare product after unpacking
	Operating temperature T_{use}	-20 °C to +70 °C (-40 °C to +85 °C)		Refer to "Outline specifications" (Frequency range)
Frequency tolerance	f_{tol}	B: $\pm 50 \times 10^{-6}$, C: $\pm 100 \times 10^{-6}$		-20 °C to +70 °C
		M: $\pm 100 \times 10^{-6}$ *3		-40 °C to +85 °C
		L: $\pm 50 \times 10^{-6}$		-40 °C to +85 °C, $V_{CC} \pm 5\%$ *3
Current consumption	I_{CC}	30 mA Max.	—	No load condition, $f_0=80 \text{ MHz}$
		—	28 mA Max.	No load condition, $f_0=125 \text{ MHz}$
Disable current	I_{dis}	25 mA Max.	—	P Type only, $f_0=80 \text{ MHz}$
		—	16 mA Max.	P Type only, $f_0=125 \text{ MHz}$
Stand-by current	I_{std}	50 μA Max.		S Type only, $\overline{\text{ST}}=\text{GND}$
Symmetry *1	SYM	40 % to 60 %	—	50 % V_{CC} , L, CMOS=15 pF, $\leq 80 \text{ MHz}$
		45 % to 55 %	—	50 % V_{CC} , L, CMOS=25 pF, $\leq 50 \text{ MHz}$
		—	40 % to 60 %	50 % V_{CC} , L, CMOS=15 pF, $V_{CC}=3.0 \text{ V to } 3.6 \text{ V}$, $\leq 125 \text{ MHz}$
		—	40 % to 60 %	50 % V_{CC} , L, CMOS=15 pF, $V_{CC}=2.7 \text{ V to } 3.6 \text{ V}$, $\leq 66.7 \text{ MHz}$
		—	45 % to 55 %	50 % V_{CC} , L, CMOS=15 pF, $V_{CC}=3.0 \text{ V to } 3.6 \text{ V}$, $\leq 40 \text{ MHz}$
High output voltage	V_{OH}	$V_{CC}-0.4 \text{ V Min.}$		$I_{OH}=-16 \text{ mA(PH,SH)}$, -8 mA(PC,SC)
Low output voltage	V_{OL}	0.4 V Max.		$I_{OL}=16 \text{ mA(PH,SH)}$, 8 mA(PC,SC)
Output load condition(CMOS) *1	L, CMOS	15 pF Max.		Max. frequency and Max. supply voltage
Output enable / disable input voltage	V_{IH} V_{IL}	2.0 V Min. 0.8 V Max.	70 % V_{CC} Min. 20 % V_{CC} Max.	$\overline{\text{ST}}$ terminal or OE terminal
Rise time / Fall time *1	t_r / t_f	3 ns Max.		20 % V_{CC} to 80 % V_{CC} level, L, CMOS=Max.
Start-up time	t_{str}	10 ms Max.		Time at minimum supply voltage to be 0 s
Frequency aging	f_{aging}	$\pm 5 \times 10^{-6}$ / year Max.		+25 °C, $V_{CC}=5.0 \text{ V / } 3.3 \text{ V (PC / SC)}$ First year

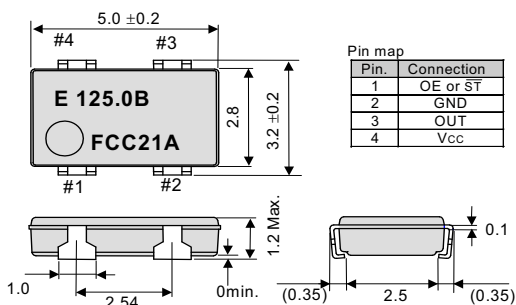
*1 Operating temperature (-40 °C to +85 °C), the available frequency, symmetry and output load conditions, please refer to "Outline specifications" page.

*2 PLL-PLL connection & Jitter specification, please refer to "Jitter specifications and characteristics chart" page.

*3 PH,SH for "M" tolerance and "L" tolerance will be available up to 27 MHz. Checking possible by the Frequency checking program.

External dimensions

(Unit:mm)



Note.

OE pin (PH, PC)

OE pin = "H" or "open" : Specified frequency output.

OE pin = "L" : Output is high impedance.

$\overline{\text{ST}}$ pin (SH, SC)

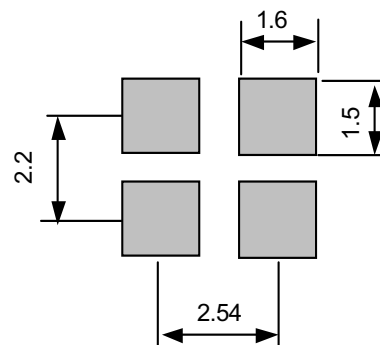
$\overline{\text{ST}}$ pin = "H" or "open" : Specified frequency output.

$\overline{\text{ST}}$ pin = "L" : Output is low level (weak pull - down), oscillation stops.

Metal may be exposed on the top or bottom of this product.
This will not affect any quality, reliability or electrical spec.

Footprint (Recommended)

(Unit:mm)



To maintain stable operation, provide by-pass capacitor with more than 0.1 μF at a location as near as possible to the power source terminal of the crystal products (between V_{CC} - GND).



CRYSTAL OSCILLATOR PROGRAMMABLE

SG-8002JF / CA series

- Frequency range : 1 MHz to 125 MHz
- Supply voltage : 3.3 V / 5.0 V
- Function : Output enable(OE) or Standby($\overline{ST}$)
- External dimensions : 7.0 × 5.0 × 1.4 t (mm) ...SG-8002CA
- Pin compatible with ceramic package crystal oscillator (7 × 5)
: SG-8002JF
- Short mass production lead time by PLL technology.
- SG-Writer available to purchase.
Please contact Epson Toyocom or local sales representative.



CA Type



JF,CA Type

Product Number (please contact us)
SG-8002JF : Q3308JFxx1xxxx00
SG-8002CA : Q3309CAxx0xxxx00



Actual size

SG-8002JF



SG-8002CA



Specifications (characteristics)

Item		Symbol	Specifications *2			Remarks
			PT / ST	PH / SH	PC / SC	
Output frequency range		f ₀	1 MHz to 125 MHz		—	Vcc=4.5 V to 5.5 V
			—		1 MHz to 125 MHz	Vcc=3.0 V to 3.6 V
			—		1 MHz to 66.7 MHz	Vcc=2.7 V to 3.6 V
Supply voltage		Vcc	4.5 V to 5.5 V		2.7 V to 3.6 V	
Temperature range	Storage temperature	T _{stg}	-55 °C to +125 °C			Store as bare product after unpacking
	Operating temperature	T _{use}	-20 °C to +70 °C (-40 °C to +85 °C)		-40 °C to +85 °C	Refer to "Outline specifications" (Frequency range)
Frequency tolerance		f _{tol}	B: ±50 × 10 ⁻⁸ , C: ±100 × 10 ⁻⁸			-20 °C to +70 °C
			M: ±100 × 10 ⁻⁶			-40 °C to +85 °C *3
Current consumption		I _{cc}	45 mA Max.		28 mA Max.	No load condition, Max. frequency range
Disable current		I _{dis}	30 mA Max.		16 mA Max.	OE=GND(PT,PH,PC)
Stand-by current		I _{std}	50 µA Max.			ST=GND(ST,SH,SC)
Symmetry*1	SYM	—		40 % to 60 %		CMOS load:50 % Vcc level, Max. load condition
		40 % to 60 %		—		TTL load: 1.4 V level, Max. load condition
High output voltage		V _{OH}	Vcc-0.4 V Min.			I _{OH} =-16 mA(PT / ST,PH / SH), -8 mA(PC / SC)
Low output voltage		V _{OL}	0.4 V Max.			I _{OL} =16 mA(PT / ST,PH / SH), 8 mA(PC / SC)
Output load condition (TTL) *1		L _{TTL}	5TTL Max.	—		f _o ≤90 MHz,Max. supply voltage
Output load condition (CMOS) *1		L _{CMOS}	15 pF Max.	15 pF Max. (CA:25 pF Max.)	15 pF Max.	Max. frequency and Max. supply voltage
Output enable / disable input voltage		V _{IH}	2.0 V Min.		70 % Vcc Min.	ST terminal or OE terminal
		V _{IL}	0.8 V Max.		20 % Vcc Max.	
Rise time / Fall time *1		t _r / t _f	—		3 ns Max.	CMOS load: 20 % Vcc to 80 % Vcc level
			4 ns Max.		—	TTL load: 0.4 V to 2.4 V level
Start-up time		t _{str}	10 ms Max.			Time at minimum supply voltage to be 0 s
Frequency aging		f _{aging}	±5 × 10 ⁻⁶ / year Max.			+25 °C, Vcc=5.0 V / 3.3 V (PC / SC) First year

*1 Operating temperature (-40 °C to +85 °C), the available frequency, symmetry and output load conditions, please refer to "Outline specifications" page.

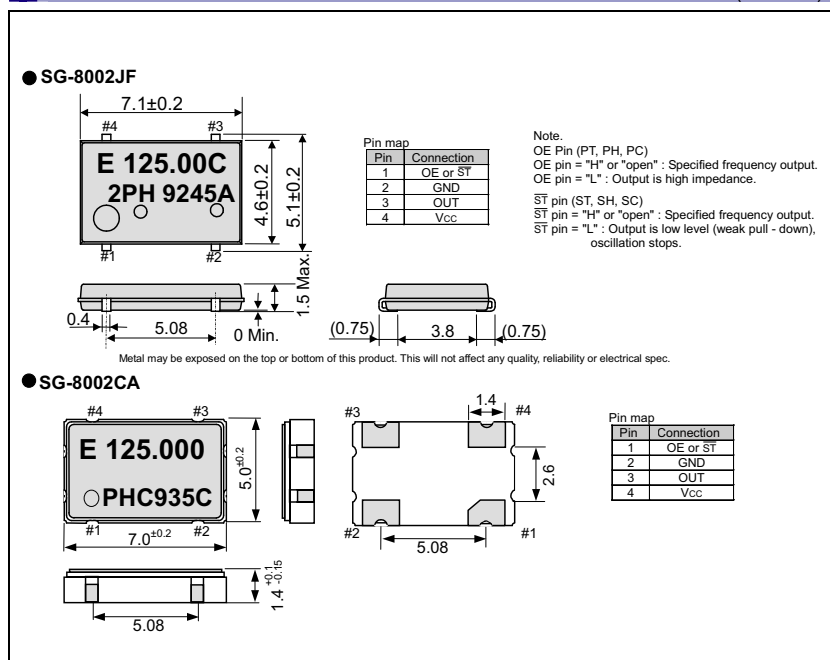
*2 PLL-PLL connection & Jitter specification, please refer to "Jitter specifications and characteristics chart" page.

*3 PT / ST and PH / SH for "M" tolerance will be available up to 55 MHz. (JF: 40 MHz)

Checking possible by the Frequency Checking Program.

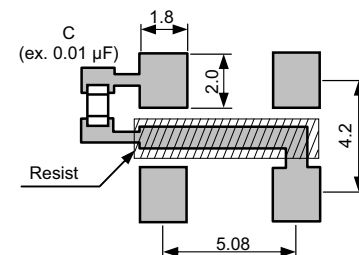
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)



To maintain stable operation, provide by-pass capacitor with more than 0.1 μ F at a location as near as possible to the power source terminal of the crystal products (between V_{CC} - GND).



CRYSTAL OSCILLATOR PROGRAMMABLE

SG - 8002JC / JA series

- Frequency range : 1 MHz to 125 MHz
- Supply voltage : 3.3 V / 5.0 V
- Function : Output enable(OE) or Standby(ST)
- Thickness : 2.7 mm Max.(SG-8002JC)
4.7 mm Max.(SG-8002JA)

Package and pin compatible with SG-636 (SG-8002JC)
Package and pin compatible with SG-615 (SG-8002JA)
•Short mass production lead time by PLL technology.
•SG-Writer available to purchase.
Please contact Epson Toyocom or local sales representative.



Product Number (please contact us)
SG-8002JC: Q3307JCx1xxxx00
SG-8002JA: Q3306JAx1xxxx00

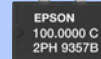


Actual size

SG-8002JC



SG-8002JA



Specifications (characteristics)

Item	Symbol	Specifications *2			Remarks
		PT / ST	PH / SH	PC / SC	
Output frequency range	f _o	1 MHz to 125 MHz			V _{CC} =4.5 V to 5.5 V
Supply voltage	V _{CC}	4.5 V to 5.5 V			V _{CC} =3.0 V to 3.6 V
		2.7 V to 3.6 V			V _{CC} =2.7 V to 3.6 V
		2.7 V to 3.6 V			V _{CC} =2.7 V to 3.6 V
Temperature range	T _{stg}	-55 °C to +125 °C (JC: -55 °C to +100 °C)			Store as bare product after unpacking
Operating temperature	T _{use}	-20 °C to +70 °C (-40 °C to +85 °C)			Refer to "Outline specifications" (Frequency range)
		-40 °C to +85 °C			SG-8002JC: -20 °C to +70 °C Only
Frequency tolerance	f _{tol}	B: ±50 × 10 ⁻⁶ , C: ±100 × 10 ⁻⁶ M: ±100 × 10 ⁻⁶			-20 °C to +70 °C -40 °C to +85 °C *3 (except SG-8002JC)
Current consumption	I _{CC}	45 mA Max.			No load condition, Max. frequency
Disable current	I _{dis}	30 mA Max.			OE=GND(PT,PH,PC)
Stand-by current	I _{std}	50 µA Max.			ST=GND(ST,SH,SC)
Symmetry *1	SYM	40% to 60%			CMOS load: 50% V _{CC} level, Max. load condition
High output voltage	V _{OH}	V _{CC} -0.4 V Min.			TTL load: 1.4 V level, Max. load condition
Low output voltage	V _{OL}	0.4 V Max.			I _{OH} =-16 mA(PT,ST,PH,SH), -8 mA(PC,SC) I _{OL} =16 mA(PT,ST,PH,SH), 8 mA(PC,SC)
Output load condition (TTL) *1	L _{TTL}	5TTL Max.			f _o ≤ 90 MHz and Max. Supply voltage
Output load condition (CMOS) *1	L _{CMOS}	15pF Max.			Max. frequency and Max. Supply voltage
Output enable / disable input voltage	V _{IH} V _{IL}	2.0 V Min. 0.8 V Max.			70% V _{CC} Min. 20% V _{CC} Max.
Rise time / Fall time *1	t _r / t _f	4 ns Max.			3 ns Max. CMOS load: 20% V _{CC} to 80% V _{CC} level
Start-up time	t _{str}	10 ms Max.			TTL load: 0.4 V to 2.4 V level
Frequency aging	f _{aging}	±5 × 10 ⁻⁶ / year Max.			Time at minimum supply voltage to be 0 s +25 °C, V _{CC} =5.0 V/ 3.3 V (PC,SC) First year

*1 Operating temperature (-40 °C to +85 °C), the available frequency, symmetry and output load conditions, please refer to "Outline specifications" page.

*2 PLL-PLL connection & Jitter specification, please refer to "Jitter specifications and characteristics chart" page.

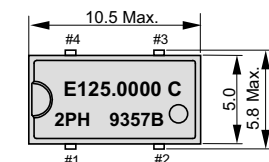
*3 PT / ST and PH / SH for "M" tolerance will be available up to 55 MHz.(Unavailable "M" tolerance of SG-8002JC)

Checking possible by the Frequency Checking Program.

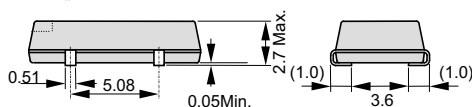
External dimensions

(Unit:mm)

● SG-8002JC

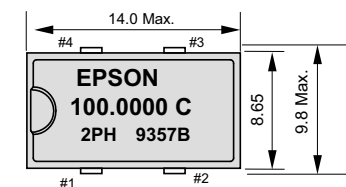


Note.
OE Pin (PT, PH, PC)
OE pin = "H" or "open" : Specified frequency output.
OE pin = "L" : Output is high impedance.
ST pin (ST, SH, SC)
ST pin = "H" or "open" : Specified frequency output.
ST pin = "L" : Output is low level (weak pull - down),
oscillation stops.

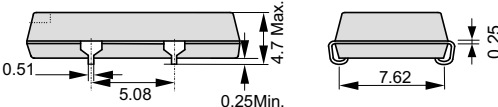


Pin	Connection
1	OE or ST
2	GND
3	OUT
4	V _{CC}

● SG-8002JA



Metal may be exposed on the top or bottom of this product.
This will not affect any quality, reliability or electrical spec.

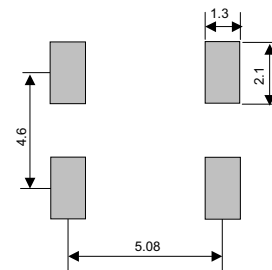


Pin	Connection
1	OE or ST
2	GND
3	OUT
4	V _{CC}

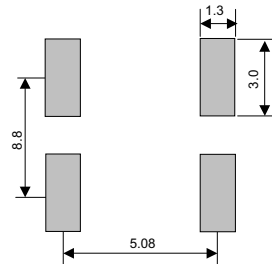
Footprint (Recommended)

(Unit:mm)

● SG-8002JC



● SG-8002JA



To maintain stable operation, provide by-pass capacitor with more than 0.1 µF at a location as near as possible to the power source terminal of the crystal products (between V_{CC} - GND).



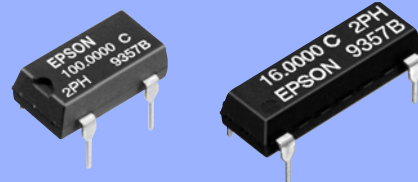
CRYSTAL OSCILLATOR PROGRAMMABLE

SG-8002DC / DB series

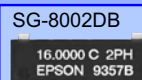
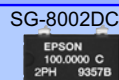
- Frequency range : 1 MHz to 125 MHz
- Supply voltage : 3.3 V / 5.0 V
- Function : Output enable(OE) or Standby($\overline{ST}$)
Pin compatible with full size and half size.
- Short mass production lead time by PLL technology.
- SG-Writer available to purchase.
Please contact EPSON TOYOCOM or local sales representative.



Product Number (please contact us)
SG-8002DC: Q3204DCx1xxxx00
SG-8002DB: Q3203DBx1xxxx00



Actual size



Specifications (characteristics)

Item		Symbol	Specifications *2			Remarks
			PT/ST	PH/SH	PC/SC	
Output frequency range		f ₀	1 MHz to 125 MHz		—	V _{CC} =4.5 V to 5.5 V
			—		1 MHz to 125 MHz	V _{CC} =3.0 V to 3.6 V
			—		1 MHz to 66.7 MHz	V _{CC} =2.7 V to 3.6 V
Supply voltage		V _{CC}	4.5 V to 5.5 V		2.7 V to 3.6 V	
Temperature range	Storage temperature	T _{stg}	-55 °C to +125 °C			Store as bare product after unpacking
	Operating temperature	T _{use}	-20 °C to +70 °C (-40 °C to +85 °C)		-40 °C to +85 °C	Refer to "Outline specifications" (Frequency range)
Frequency tolerance		f _{tol}	B: ±50 × 10 ⁻⁶ ,C: ±100 × 10 ⁻⁶			-20 °C to +70 °C
			M: ±100 × 10 ⁻⁶			-40 °C to +85 °C *3
Current consumption		I _{CC}	45 mA Max.		28 mA Max.	No load condition, Max. frequency
Disable current		I _{dis}	30 mA Max.		16 mA Max.	OE=GND(PT,PH,PC)
Stand-by current		I _{std}	50 μA Max.			ST=GND(ST,SH,SC)
Symmetry *1		SYM	—	40 % to 60 %		CMOS load:50%V _{CC} level, Max. load condition
			40 % to 60 %	—		TTL load: 1.4 V level, Max. load condition
High output voltage		V _{OH}	V _{CC} -0.4 V Min.			I _{OH} =-16 mA(PT,ST,PH,SH),-8 mA(PC,SC)
Low output voltage		V _{OL}	0.4 V Max.			I _{OL} =16 mA(PT,ST,PH,SH), 8 mA(PC,SC)
Output load condition (TTL) *1		L _{TTL}	5 TTL Max.	—		Max. frequency and
Output load condition (CMOS) *1		L _{CMOS}	15 pF Max.	25 pF Max.	15 pF Max.	Max. supply voltage
Output enable / disable input voltage		V _{IH}	2.0 V Min.		70 % V _{CC} Min.	ST terminal or OE terminal
		V _{IL}	0.8 V Max.		20 % V _{CC} Max.	
Rise time / Fall time *1		t _r / t _f	—	3 ns Max.		CMOS load: 20 % V _{CC} to 80 % V _{CC} level
			4 ns Max.	—		TTL load: 0.4 V to 2.4 V level
Start-up time		t _{str}	10 ms Max.			Time at minimum supply voltage to be 0 s
Frequency aging		f _{aging}	±5 × 10 ⁻⁶ / year Max.			+25 °C, V _{CC} =5.0 V/ 3.3 V (PC/SC) First year

*1 Operating temperature (-40 °C to +85 °C), the available frequency, symmetry and output load conditions, please refer to "Outline specifications" page.

*2 PLL-PLL connection & Jitter specification, please refer to "Jitter specifications and characteristics chart" page.

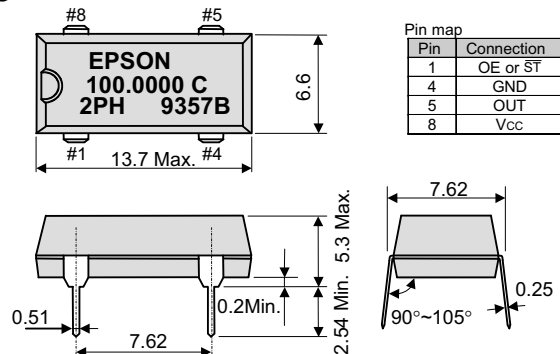
*3 PT / ST and PH / SH for "M" tolerance will be available up to 55 MHz.

Checking possible by the Frequency Checking Program.

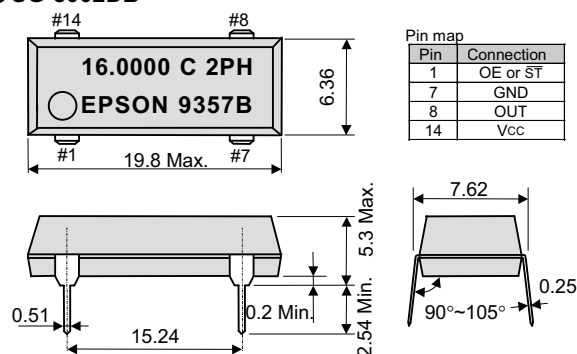
External dimensions

(Unit:mm)

SG-8002DC



SG-8002DB



Note.
OE Pin (PT, PH, PC)
OE pin = "H" or "open" : Specified frequency output.
OE pin = "L" : Output is high impedance.

$\overline{ST}$ pin (ST, SH, SC)
ST pin = "H" or "open" : Specified frequency output.
ST pin = "L" : Output is low level (weak pull - down), oscillation stops.

To maintain stable operation, provide by-pass capacitor with more than 0.1 μ F at a location as near as possible to the power source terminal of the crystal products (between Vcc - GND).



SG-8002 Series Outline of specifications

Item		Current Consumption	Supply Voltage	Output load condition	Output rise time Output fall time	Symmetry	Function
SG-8002LB (SOJ 4-pin)	PH	30 mA Max.	4.5 V to 5.5 V	15 pF	3.0 ns Max. (20 % V _{CC} to 80 % V _{CC} , L _{CMOS} =Max.)	40 % to 60 % (50 % V _{CC} , L _{CMOS} =15 pF, f ₀ ≤80 MHz/-40 °C to +85 °C)	OE
	SH						ST
	PC	28 mA Max.	3.0 V to 3.6 V (2.7 V to 3.6 V)	15 pF	3.0 ns Max. (20 % V _{CC} to 80 % V _{CC} , L _{CMOS} =Max.)	45 % to 55 % (50 % V _{CC} , L _{CMOS} =15 pF, V _{CC} =3.0 V to 3.6 V, f ₀ ≤40 MHz)	OE
	SC					40 % to 60 % (50 % V _{CC} , L _{CMOS} =15 pF, V _{CC} =3.0 V to 3.6 V, f ₀ ≤125 MHz) ↑ (50 % V _{CC} , L _{CMOS} =15 pF, V _{CC} =2.7 V to 3.6 V, f ₀ ≤66.7 MHz)	ST
SG-8002CA (SON)	PT		4.5 V to 5.5 V	5 TTL+15 pF (f ₀ ≤125 MHz/-20 °C to +70 °C) 25 pF (f ₀ ≤66.7 MHz/-20 °C to +70 °C) 5 TTL+15 pF (f ₀ ≤40 MHz/-40 °C to +85 °C) 15 pF (f ₀ ≤55 MHz/-40 °C to +85 °C)	2.0 ns Max. (0.8 V to 2.0 V, L _{CMOS} or L _{TTL} =Max.) 4.0 ns Max. (0.4 V to 2.4 V, L _{CMOS} or L _{TTL} =Max.)	45 % to 55 % (1.4 V, L _{TTL} =5 TTL+15 pF, f ₀ ≤66.7 MHz/-20 °C to +70 °C) ↑ (1.4 V, L _{TTL} =5 TTL+15 pF, f ₀ ≤40.0 MHz/-40 °C to +85 °C) 40 % to 60 % (1.4 V, L _{TTL} =5 TTL+15 pF, f ₀ ≤125 MHz/-20 °C to +70 °C) ↑ (1.4 V, L _{CMOS} =25 pF, f ₀ ≤66.7 MHz/-20 °C to +70 °C) ↑ (1.4 V, L _{CMOS} =15 pF, f ₀ ≤55.0 MHz/-40 °C to +85 °C)	OE
	ST	45 mA Max.					ST
	PH			25 pF (f ₀ ≤125 MHz/-20 °C to +70 °C) 50 pF (f ₀ ≤66.7 MHz/-20 °C to +70 °C) 15 pF (f ₀ ≤55 MHz/-40 °C to +85 °C) 25 pF (f ₀ ≤40 MHz/-40 °C to +85 °C)	3.0 ns Max. (20 % V _{CC} to 80 % V _{CC} , L _{CMOS} ≤25) 4.0 ns Max. (20 % V _{CC} to 80 % V _{CC} , L _{CMOS} =Max.)	45 % to 55 % (50 % V _{CC} , L _{CMOS} =25 pF, f ₀ ≤66.7 MHz/-20 °C to +70 °C) ↑ (50 % V _{CC} , L _{CMOS} =25 pF, f ₀ ≤40.0 MHz/-40 °C to +85 °C) 40 % to 60 % (50 % V _{CC} , L _{CMOS} =25 pF, f ₀ ≤125 MHz/-20 °C to +70 °C) ↑ (50 % V _{CC} , L _{CMOS} =50 pF, f ₀ ≤66.7 MHz/-20 °C to +70 °C) ↑ (50 % V _{CC} , L _{CMOS} =15 pF, f ₀ ≤55.0 MHz/-40 °C to +85 °C)	OE
	SH						ST
SG-8002DB (DIP 14-pin)	PC	28 mA Max.	3.0 V to 3.6 V (2.7 V to 3.6 V)	15 pF (f ₀ ≤66.7 MHz/2.7 to 3.6 V) 15 pF (f ₀ ≤125 MHz/3.0 to 3.6 V) 30 pF (f ₀ ≤40 MHz/3.0 to 3.6 V)	3.0 ns Max. (20 % V _{CC} to 80 % V _{CC} , L _{CMOS} ≤15) 4.0 ns Max. (20 % V _{CC} to 80 % V _{CC} , L _{CMOS} =Max.)	45 % to 55 % (50 % V _{CC} , L _{CMOS} =30 pF, V _{CC} =3.0 V to 3.6 V, f ₀ ≤40 MHz) 40 % to 60 % (50 % V _{CC} , L _{CMOS} =15 pF, V _{CC} =3.0 V to 3.6 V, f ₀ ≤125 MHz) ↑ (50 % V _{CC} , L _{CMOS} =15 pF, V _{CC} =2.7 V to 3.6 V, f ₀ ≤66.7 MHz)	OE
	SC						ST
SG-8002JC (SOJ 4-pin)	PT		4.5 V to 5.5 V	5 TTL + 15 pF (f ₀ ≤90 MHz/-20 to +70 °C) 15 pF (f ₀ ≤125 MHz/-20 °C to +70 °C) 25 pF (f ₀ ≤66.7 MHz/-20 °C to +70 °C)	2.0 ns Max. (0.8 V to 2.0 V, L _{CMOS} or L _{TTL} =Max.) 4.0 ns Max. (0.4 V to 2.4 V, L _{CMOS} or L _{TTL} =Max.)	45 % to 55 % (1.4 V, L _{TTL} =5 TTL+15 pF, f ₀ ≤66.7 MHz/-20 °C to +70 °C) 40 % to 60 % (1.4 V, L _{TTL} =5 TTL+15 pF, f ₀ ≤90.0 MHz/-20 °C to +70 °C) ↑ (1.4 V, L _{CMOS} =25 pF, f ₀ ≤66.7 MHz/-20 °C to +70 °C) ↑ (1.4 V, L _{CMOS} =15 pF, f ₀ ≤125 MHz/-20 °C to +70 °C)	OE
	ST	45 mA Max.					ST
	PH			15 pF (f ₀ ≤125 MHz/-20 °C to +70 °C) 25 pF (f ₀ ≤90 MHz/-20 °C to +70 °C) 50 pF (f ₀ ≤66.7 MHz/-20 °C to +70 °C)	3.0 ns Max. (20 % V _{CC} to 80 % V _{CC} , L _{CMOS} ≤25) 4.0 ns Max. (20 % V _{CC} to 80 % V _{CC} , L _{CMOS} =Max.)	45 % to 55 % (50 % V _{CC} , L _{CMOS} =25 pF, f ₀ ≤66.7 MHz/-20 °C to +70 °C) 40 % to 60 % (50 % V _{CC} , L _{CMOS} =25 pF, f ₀ ≤90.0 MHz/-20 °C to +70 °C) ↑ (50 % V _{CC} , L _{CMOS} =25 pF, f ₀ ≤125 MHz/-20 °C to +70 °C) ↑ (50 % V _{CC} , L _{CMOS} =50 pF, f ₀ ≤50 MHz/-20 °C to +70 °C)	OE
	SH						ST
	PC	28 mA Max.	3.0 V to 3.6 V (2.7 V to 3.6 V)	15 pF (f ₀ ≤66.7 MHz/2.7 to 3.6 V) 15 pF (f ₀ ≤125 MHz/3.0 to 3.6 V) 30 pF (f ₀ ≤40 MHz/3.0 to 3.6 V)	3.0 ns Max. (20 % V _{CC} to 80 % V _{CC} , L _{CMOS} ≤15) 4.0 ns Max. (20 % V _{CC} to 80 % V _{CC} , L _{CMOS} =Max.)	45 % to 55 % (50 % V _{CC} , L _{CMOS} =30 pF, V _{CC} =3.0 V to 3.6 V, f ₀ ≤40 MHz) 40 % to 60 % (50 % V _{CC} , L _{CMOS} =15 pF, V _{CC} =3.0 V to 3.6 V, f ₀ ≤125 MHz) ↑ (50 % V _{CC} , L _{CMOS} =15 pF, V _{CC} =2.7 V to 3.6 V, f ₀ ≤66.7 MHz)	OE
	SC						ST
	PT		4.5 V to 5.5 V	15 pF (f ₀ ≤125 MHz/-20 °C to +70 °C) 25 pF (f ₀ ≤66.7 MHz/-20 °C to +70 °C) 5 TTL + 15 pF (f ₀ ≤90 MHz/-20 °C to +70 °C) 15 pF (f ₀ ≤40 MHz/-40 °C to +85 °C)	2.0 ns Max. (0.8 V to 2.0 V, L _{CMOS} ≤25) 4.0 ns Max. (0.4 V to 2.4 V, L _{CMOS} or L _{TTL} =Max.)	45 % to 55 % (1.4 V, L _{TTL} =5 TTL+15 pF, f ₀ ≤66.7 MHz/-20 °C to +70 °C) 40 % to 60 % (1.4 V, L _{TTL} =5 TTL+15 pF, f ₀ ≤90 MHz/-20 °C to +70 °C) ↑ (1.4 V, L _{CMOS} =25 pF, f ₀ ≤66.7 MHz/-20 °C to +70 °C) ↑ (1.4 V, L _{CMOS} =15 pF, f ₀ ≤125 MHz/-20 °C to +70 °C) ↑ (1.4 V, L _{CMOS} =15 pF, f ₀ ≤40 MHz/-40 °C to +85 °C)	OE
	ST	45 mA Max.					ST
SG-8002JF (SOJ 4-pin)	PH			15 pF (f ₀ ≤125 MHz/-20 °C to +70 °C) 25 pF (f ₀ ≤90 MHz/-20 °C to +70 °C) 50 pF (f ₀ ≤50 MHz/-20 °C to +70 °C) 15 pF (f ₀ ≤40 MHz/-40 °C to +85 °C)	3.0 ns Max. (20 % V _{CC} to 80 % V _{CC} , L _{CMOS} ≤25) 4.0 ns Max. (20 % V _{CC} to 80 % V _{CC} , L _{CMOS} =Max.)	45 % to 55 % (50 % V _{CC} , L _{CMOS} =25 pF, f ₀ ≤66.7 MHz/-20 °C to +70 °C) 40 % to 60 % (50 % V _{CC} , L _{CMOS} =25 pF, f ₀ ≤90.0 MHz/-20 °C to +70 °C) ↑ (50 % V _{CC} , L _{CMOS} =50 pF, f ₀ ≤50.0 MHz/-20 °C to +70 °C) ↑ (50 % V _{CC} , L _{CMOS} =15 pF, f ₀ ≤125 MHz/-20 °C to +70 °C) ↑ (50 % V _{CC} , L _{CMOS} =15 pF, f ₀ ≤40 MHz/-40 °C to +85 °C)	OE
	SH						ST
	PC	28 mA Max.	3.0 V to 3.6 V (2.7 V to 3.6 V)	15 pF (f ₀ ≤66.7 MHz/2.7 to 3.6 V) 15 pF (f ₀ ≤125 MHz/3.0 to 3.6 V) 30 pF (f ₀ ≤40 MHz/3.0 to 3.6 V)	3.0 ns Max. (20 % V _{CC} to 80 % V _{CC} , L _{CMOS} ≤15) 4.0 ns Max. (20 % V _{CC} to 80 % V _{CC} , L _{CMOS} =Max.)	45 % to 55 % (50 % V _{CC} , CL=30 pF, V _{CC} =3.0 V to 3.6 V, f ₀ ≤40 MHz) 40 % to 60 % (50 % V _{CC} , CL=15 pF, V _{CC} =3.0 V to 3.6 V, f ₀ ≤125 MHz) ↑ (50 % V _{CC} , CL=15 pF, V _{CC} =2.7 V to 3.6 V, f ₀ ≤66.7 MHz)	OE
	SC						ST
	PT		4.5 V to 5.5 V	5 TTL+15 pF (f ₀ ≤125 MHz/-20 °C to +70 °C) 5 TTL+15 pF (f ₀ ≤27 MHz/-40 °C to +85 °C)	2.0 ns Max. (0.8 V to 2.0 V, L _{TTL} =Max.) 4.0 ns Max. (0.4 V to 2.4 V, L _{TTL} =Max.)	45 % to 55 % (1.4 V, L _{TTL} =5 TTL+15 pF, f ₀ ≤66.7 MHz/-20 °C to +70 °C) ↑ (1.4 V, L _{TTL} =5 TTL+15 pF, f ₀ ≤27.0 MHz/-40 °C to +85 °C) 40 % to 60 % (1.4 V, L _{TTL} =5 TTL+15 pF, f ₀ ≤125 MHz/-20 °C to +70 °C)	OE
	ST	40 mA Max.					ST
	PH			15 pF (f ₀ ≤125 MHz/-20 °C to +70 °C) 25 pF (f ₀ ≤100 MHz/-20 °C to +70 °C) 25 pF (f ₀ ≤27 MHz/-40 °C to +85 °C)	3.0 ns Max. (20 % V _{CC} to 80 % V _{CC} , L _{CMOS} =Max.)	45 % to 55 % (50 % V _{CC} , L _{CMOS} =25 pF, f ₀ ≤66.7 MHz/-20 °C to +70 °C) ↑ (50 % V _{CC} , L _{CMOS} =25 pF, f ₀ ≤27.0 MHz/-40 °C to +85 °C) 40 % to 60 % (50 % V _{CC} , L _{CMOS} =15 pF, f ₀ ≤125 MHz/-20 °C to +70 °C)	OE
	SH						ST
SG-8002CE (SON)	PC	28 mA Max.	3.0 V to 3.6 V (2.7 V to 3.6 V)	15 pF (f ₀ ≤66.7 MHz/2.7 to 3.6 V) 15 pF (f ₀ ≤125 MHz/3.0 to 3.6 V)	3.0 ns Max. (20 % V _{CC} to 80 % V _{CC} , L _{CMOS} =Max.)	45 % to 55 % (50 % V _{CC} , L _{CMOS} =15 pF, V _{CC} =3.0 V to 3.6 V, f ₀ ≤40 MHz) 40 % to 60 % (50 % V _{CC} , L _{CMOS} =15 pF, V _{CC} =3.0 V to 3.6 V, f ₀ ≤125 MHz) ↑ (50 % V _{CC} , L _{CMOS} =15 pF, V _{CC} =2.7 V to 3.6 V, f ₀ ≤66.7 MHz)	OE
	SC						ST

TABLE OF FREQUENCY RANGE

Model	Supply voltage	Frequency tolerance Operating Temperature	Frequency 1 MHz	50 MHz	100 MHz	125 MHz
SG-8002CE	PT/ ST	4.5 V to 5.5 V	B,C	1.0 MHz		125 MHz
	PH/ SH		M	1.0 MHz	27 MHz	
	PC/SC	3.0 V to 3.6 V (2.7 V to 3.6 V)	B,C,M	1.0 MHz		125 MHz
SG-8002LB	PH/ SH	5.0 V±0.5 V	B,C	1.0 MHz		80 MHz
			M,L	1.0 MHz	27 MHz	
	PC/ SC	3.3 V±0.3 V	B,C,M,L	1.0 MHz		125 MHz
SG-8002JF	PT/ ST	4.5 V to 5.5 V	B,C	1.0 MHz		125 MHz
	PH/ SH		M	1.0 MHz	40 MHz	
	PC	3.0 V to 3.6 V (2.7 V to 3.6 V)	B,C,M	1.0 MHz		125 MHz
SG-8002CA SG-8002JA SG-8002DB SG-8002DC	PT/ ST	4.5 V to 5.5 V	B,C	1.0 MHz		125 MHz
	PH/ SH		M	1.0 MHz	55 MHz	
	PC/ SC	3.0 V to 3.6 V (2.7 V to 3.6 V)	B,C,M	1.0 MHz		125 MHz
SG-8002JC	PT/ ST	4.5 V to 5.5 V	B	1.0 MHz		125 MHz
	PH/ SH		C	1.0 MHz		125 MHz
	PC/ SC	3.0 V to 3.6 V (2.7 V to 3.6 V)	B	1.0 MHz		125 MHz

Frequency tolerance : B:±50×10⁻⁶ (-20 °C to +70 °C), C:±100×10⁻⁶ (-20 °C to +70 °C), M:±100×10⁻⁶ (-40 °C to +85 °C), L:±50×10⁻⁶ (-40 °C to +85 °C)



SG / HG-8002 series_ Jitter specifications and characteristics chart

■ PLL-PLL connection

Because we use a PLL technology, there are a few cases that the jitter value will increase when SG-8002 is connected to another PLL-oscillator.

In our experience, we are unable to recommend these products for the applications such as telecom carrier use or analog video clock use. Please be careful checking in advance for these application (Jitter specification is Max.250 ps/CL=15 pF)

Jitter Specifications

Model	Supply Voltage	Jitter Item	Specifications	Remarks
PT / PH ST / SH	5.0 V $\pm$ 0.5 V	Cycle to cycle	150 ps Max.	33 MHz $\leq f_0 \leq$ 125 MHz, L_CMOS=15 pF
			200 ps Max.	1.0 MHz $\leq f_0 <$ 33 MHz, L_CMOS=15 pF
		Peak to peak	200 ps Max.	33 MHz $\leq f_0 \leq$ 125 MHz, L_CMOS=15 pF
			250 ps Max.	1.0 MHz $\leq f_0 <$ 33 MHz, L_CMOS=15 pF
SC / PC	3.3 V $\pm$ 0.3 V	Cycle to cycle	200 ps Max.	1.0 MHz $\leq f_0 \leq$ 125 MHz, L_CMOS=15 pF
		Peak to peak	250 ps Max.	1.0 MHz $\leq f_0 \leq$ 125 MHz, L_CMOS=15 pF

■ Remarks on noise management for power supply line

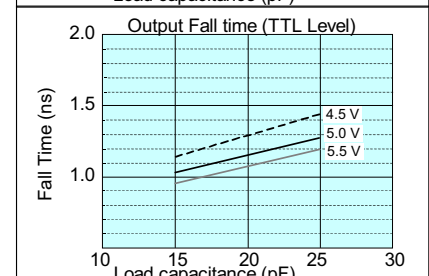
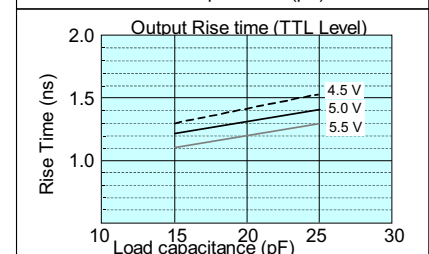
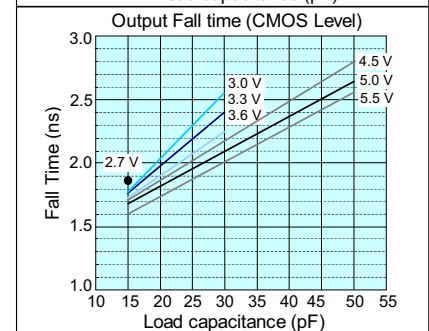
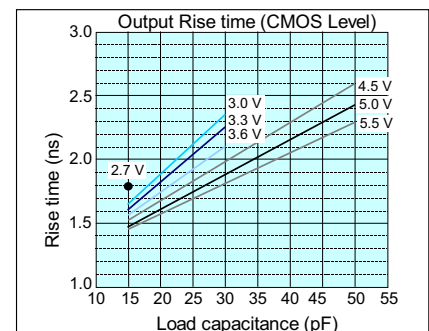
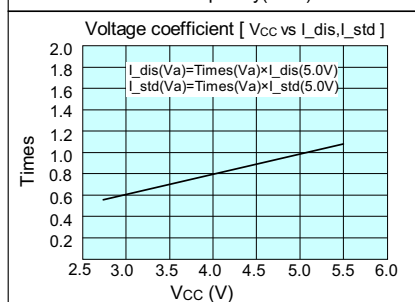
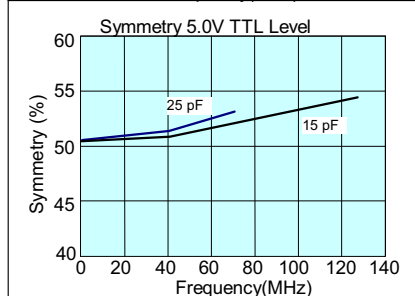
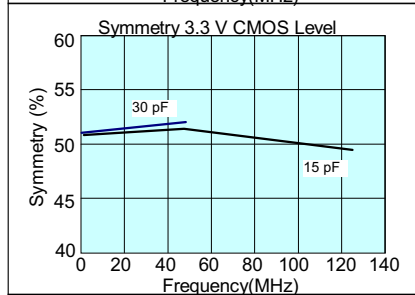
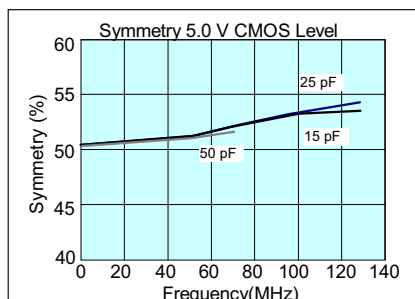
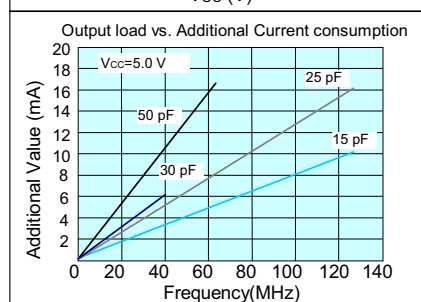
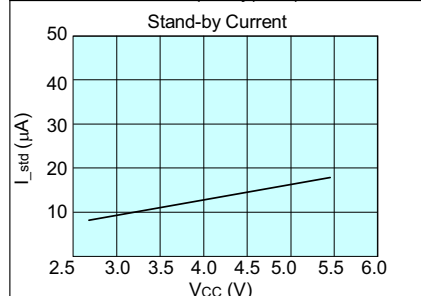
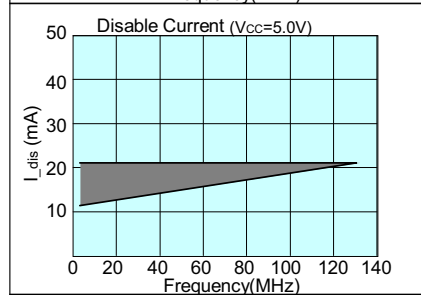
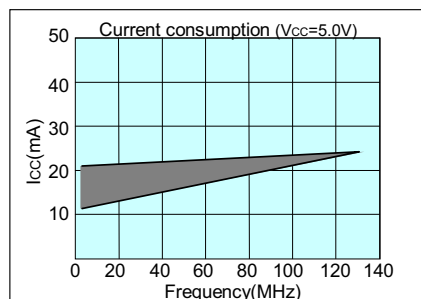
We do not recommend inserting filters or other devices in the power supply line as the counter measure of EMI noise reduction.

This device insertion might cause high-frequency impedance high in the power supply line and it affects oscillator stable drive.

When this measure is required, please evaluate circuitry and device behavior in the circuit and verify that it will not affect oscillation.

Start up time (0 % Vcc to 90 % Vcc) of power source should be more than 150 μ s.

■ SG-8002 series Characteristics chart





PROGRAMMING TOOL FOR SG-8000 SERIES



Products number
Q91PR20W1101000

SG - Writer

- Easy frequency program for Epson Toyocom SG-8000 series oscillator (Blank oscillator).
- Free power supply for USB accommodate.
- Flexible PC accommodate.
Windows 98SE, 2000, Me, XP (Except Windows 95, NT)
Windows Vista (32 bit type)
- Small body and easy carry.



Main Body Specifications

Name	SG-Writer for Epson Toyocom SG-8000 Series			
Operating Temperature	+10 °C to +40 °C Writing (+25 °C ±5 °C)			
Electric Power Supply	Via USB			
Standard Interface	USB Type B			
External Dimensions (mm)	160 × 110 × 36 (textool top)			
Weight	700 g			
Accessories	SG-Writer CD-ROM (Software and Instruction manual : Japanese, English) Documents : Japanese, English			
Software, Driver	SG-Writer *1 EPSON USB Driver			
Option	SMD socket			
	Model	Product number	Model	Product number
	SG-8003BA	Q91PR10W00024	SG-8002LB	Q91PR10W00011
	SG-8003CE	Q91PR10W00018	SG-8002CE	Q91PR10W00010
	SG-8003LB	Q91PR10W00019	SG-8002JF	Q91PR10W00006
	SG-8003JF	Q91PR10W00020	SG-8002CA	Q91PR10W00005
	SG-8003CA	Q91PR10W00021	SG-8002JC	Q91PR10W00004
			SG-8002JA	Q91PR10W00003

*1 SG-Writer software is available only from Epson Toyocom website after user registration.

Recommend PC Specifications (You need to connect the SG-Writer to a PC when you are writing.)

Accommodate OS	Windows XP, Windows Me, Windows 2000, Windows 98SE(Except Windows 95, NT) Windows Vista(32 bit type)
Recommend CPU	Pentium Processor 200 MHz equivalent and higher (Recommend Over 300 MHz)
Recommend memory Capacity	Recommend Over 64 MB
Recommend HDD Capacity	Need Over 40 MB
Other	CD-ROM drive, USB cable (Type A ↔ Type B) Need SMD *2 socket when you write SG-8000 SMD products. (Sold individually)

*2 Conventional SMD socket can be used with new SG-Writer.

Precautions

- Please write SG-8003CE always with the SG-8003CE socket.
- SG-8003CE has two types of Blank sample. Please write with correct typed sample shown below.
Vcc = 1.8 V type (For PE, SE)
Vcc = 2.5 V and 3.3 V type (For PD, SD, PC, SC)
*It is able to identify Blank sample between SG-8002 series and SG-8003 series by marking.
- SG-8000 series common software still can write SG-8002 series.



CRYSTAL OSCILLATOR SPREAD SPECTRUM

SG-9001LB / CA / JC series

- Frequency range : 10 MHz to 166 MHz
- Supply voltage : 3.3 V
- Function : Output enable(OE)...
- External dimensions : 5.0 × 3.2 × 1.2 t (mm) ... SG-9001LB
7.0 × 5.0 × 1.4 t (mm) ... SG-9001CA
- Range of spreading percentage is selectable by program
(Center or Down spread, 6 Values)



CA, LB Type



CA, LB, JC Type

Product Number (please contact us)

SG-9001LB: Q3331x2x0xxxx00

SG-9001CA: Q3331x0x0xxxx00

SG-9001JC: Q3331x1x1xxxx00



Actual size

SG-9001LB



SG-9001CA



SG-9001JC



Specifications (characteristics)

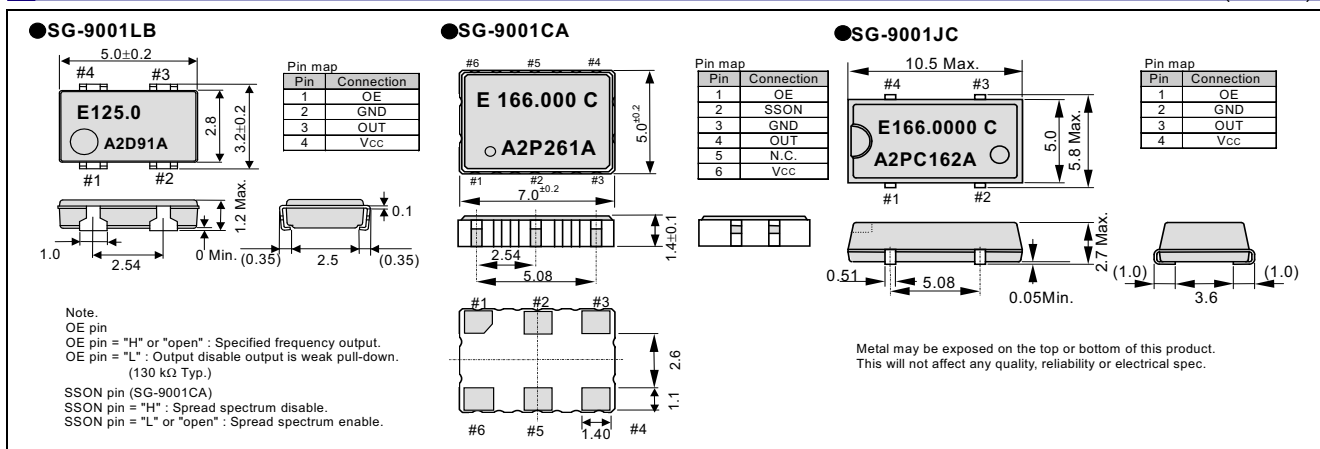
Item	Symbol	Specifications	Remarks
Output frequency range	f_0	10.000 MHz to 166.000 MHz	Please contact us for inquiries regarding available frequencies.
		10.000 MHz to 135.000 MHz	
Supply voltage	V_{CC}	3.3 V $\pm$ 0.3 V	
Temperature range	Storage temperature	-55 °C to +100 °C	Store as bare product after unpacking.
	Operating temperature	-40 °C to +125 °C	
	T_{use}	-20 °C to +70 °C	
Current consumption	I_{CC}	30 mA Max.	No load condition, $f_0 = 166$ MHz
Disable current	I_{dis}	20 mA Max.	OE=GND, $f_0 = 166$ MHz
Symmetry	SYM	45 % to 55 %	CMOS load: 50 % V_{CC} level, $L_{CMOS}=15$ pF
High output voltage	V_{OH}	$V_{CC}-0.4$ V Min.	$I_{OH}=-8$ mA
Low output voltage	V_{OL}	0.4 V Max.	$I_{OL}=8$ mA
Output load condition	L_{CMOS}	15 pF Max.	
Output enable / disable	V_{IH}	70 % V_{CC} Min.	OE terminal
input voltage	V_{IL}	30 % V_{CC} Max.	OE terminal
Rise time / Fall time	t_r / t_f	2.7 ns Max.	20 % V_{CC} to 80 % V_{CC} level, $L_{CMOS}=15$ pF.
Start-up time	t_{str}	10 ms Max.	Time at minimum supply voltage to be 0 s
Frequency aging	f_{aging}	$\pm 5 \times 10^{-6}$ / year Max.	+25 °C, First year

Spread Spectrum Specifications

Center Spread	Code	C02P	C05P	C07P	C10P	C15P	C20P
	Percentage	± 0.25 %	± 0.5 %	± 0.75 %	± 1.0 %	± 1.5 %	± 2.0 %
Down Spread	Code	D05P	D10P	D15P	D20P	D30P	D40P
	Percentage	-0.5 %	-1.0 %	-1.5 %	-2.0 %	-3.0 %	-4.0 %

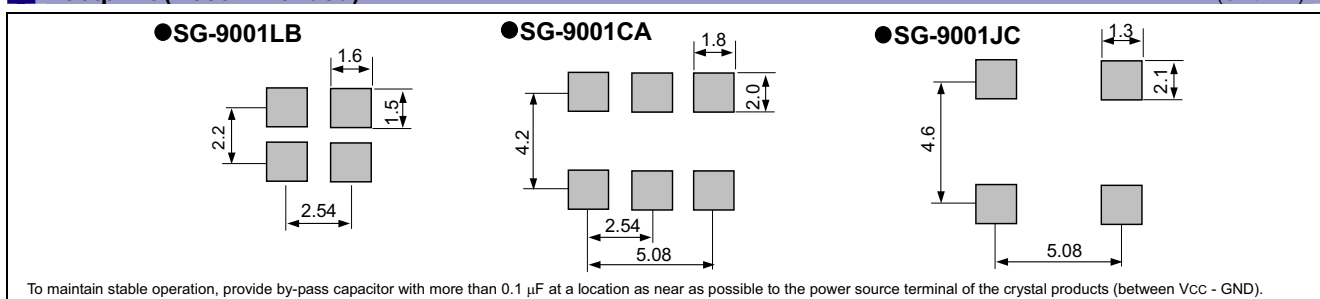
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





CRYSTAL OSCILLATOR

LOW-JITTER SAW OSCILLATOR

XG-1000CA/CB series

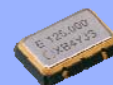
- Output frequency range : 50 MHz to 170 MHz
- Supply voltage : 1.8 V / 2.5 V / 3.3 V
- Frequency tolerance : $\pm 50 \times 10^{-6}$, $\pm 100 \times 10^{-6}$
- Output : CMOS
- Function : Output enable(OE)
- Package size : CA: 7.0 × 5.0 × 1.2 mm Typ.
CB: 5.0 × 3.2 × 1.1 mm Typ.
- Low-jitter oscillator with SAW.



Product Number (please contact us)

XG-1000CA: Q3851CA00xxxx00

XG-1000CB: Q3851CB00xxxx00



Actual size

XG-1000CA



XG-1000CB



Specifications (characteristics)

Item		Symbol	Specifications			Remarks	
			E	D	C		
Output frequency range *1		f ₀	50.000 MHz to 170.000 MHz			Standard frequency	
			75.000 MHz, 98.304 MHz, 100.000 MHz, 106.250 MHz, 125.000 MHz, 150.000 MHz				
Supply voltage		V _{cc}	1.8 V ±0.1V	2.5 V ±0.125 V	3.3 V ±0.3V		
Temperature range	Storage temperature	T _{stg}	-40 °C to +100 °C			Store as bare product after unpacking	
	Operating temperature	T _{use}	-10°C to +70°C				
Frequency tolerance *2		f _{tol}	B:±50 × 10 ⁻⁶ C:±100 × 10 ⁻⁶			-10 °C to +70 °C	
Current consumption		I _{cc}	20 mA Max.	25 mA Max.	35 mA Max.	No load condition, OE=V _{cc}	
Disable current		I _{dis}	15 mA Max.	20 mA Max.	30 mA Max.	OE=GND	
Symmetry		SYM	40 % to 60 %	45 % to 55 %		f _{os} 125 MHz	
			40 % to 60 %		fo> 125 MHz		
High output voltage		V _{OH}	V _{cc} -0.35 V Min			E:I _{oh} = -6 mA / C,D:I _{oh} = -8 mA	
Low output voltage		V _{OL}	0.35 V Max.			E:I _{ol} = 6 mA / C,D:I _{ol} = 8 mA	
Output load condition (CMOS)		L _{CMOS}	15 pF Max.			Max. frequency and Max. supply voltage range	
Output enable/		V _{IH}	70 % V _{cc} Min.			OE terminal	
Disable input voltage		V _{IL}	30 % V _{cc} Max.			OE terminal	
Rise time / Fall time		t _r / t _f	2 ns Max.			CMOS load :between 20% V _{cc} and80%of V _{cc} level	
Start-up time		t _{str}	10 ms Max.			Time at minimum supply voltage to be 0 s	
Jitter *3		t _{RMS}	3 ps Typ.			σ (RMS of total distribution)	
		t _{p-p}	25 ps Typ.			Peak to Peak	
Frequency aging		f _{aging}	±5 × 10 ⁻⁶ / year Max.			+25 °C, First year, V _{cc} =1.8 V, 2.5 V, 3.3 V	

*1 Please contact us for inquiries regarding non-standard frequencies.

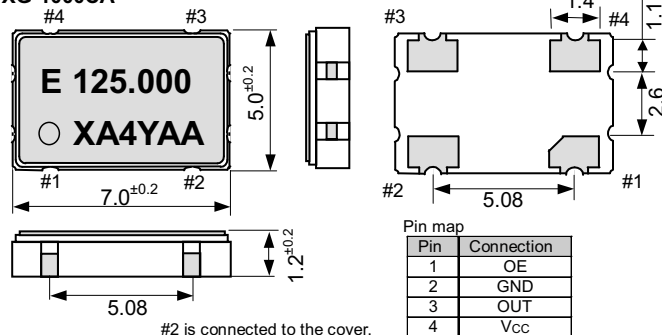
*2 This includes initial frequency tolerance, temperature variation, supply voltage variation and frequency tolerance vs. load.

*3 Based on DTS-2075 Digital timing system made from WAVECREST with jitter analysis software VISI6.

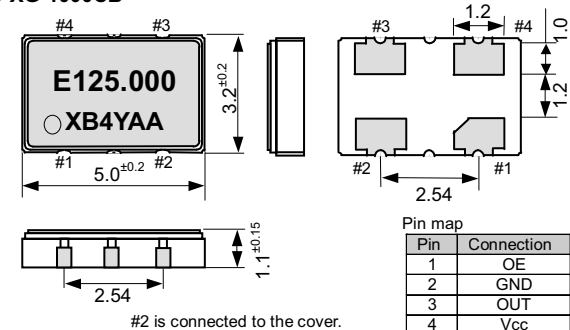
External dimensions

(Unit:mm)

● XG-1000CA



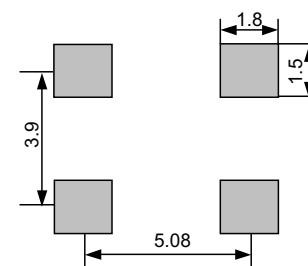
● XG-1000CB



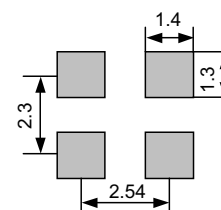
Footprint (Recommended)

(Unit:mm)

● XG-1000CA



● XG-1000CB



To maintain stable operation, provide by-pass capacitor with more than 0.1 μ F at a location as near as possible to the power source terminal of the crystal products (between V_{CC} - GND).



CRYSTAL OSCILLATOR

LOW-JITTER SAW OSCILLATOR

EG - 2021 / 2001CA series

- Frequency range : 62.5 MHz to 250 MHz
- Supply voltage : 2.5 V/ EG-2021CA
3.3 V/ EG-2001CA
- Output : CMOS
- Function : Output enable(OE)
- External dimensions : 7.0 × 5.0 × 1.2 t (mm) Typ.
- Very low jitter and low phase noise by SAW unit.



Product Number (please contact us)
EG-2021CA: Q3807CA00xxx00
EG-2001CA: Q3801CA00xxx00



Actual size

EG-2021CA



EG-2001CA



Specifications (characteristics)

Item	Symbol	Specifications		Remarks
		EG-2021CA	EG-2001CA	
Output frequency range	f_0	62.500 MHz to 170.000MHz	170.001MHz to 250.000MHz	
Supply voltage	V _{cc}	2.5 V± 0.125 V	3.3 V± 0.3 V	
Temperature range	Storage temperature	-40 °C to +100 °C		Store as bare product after unpacking
	Operating temperature	P: 0 °C to +70 °C R: -5 °C to +85 °C	0 °C to +70 °C	
Frequency tolerance	f_{tol}	G: ± 50 × 10 ⁻⁶ H: ± 100 × 10 ⁻⁶	Z: ± 50 × 10 ⁻⁶ Y,H: ± 100 × 10 ⁻⁶	P: 0 °C to 70 °C, R: -5 °C to +85 °C *1
Current consumption	I _{cc}	25 mA Max.	30 mA Max.	No load condition, Max. frequency range
Disable current	I _{dis}	600 µA Max.	10 µA Max.	OE=GND
Symmetry	SYM	45 % to 55 %	40 % to 60 %	CMOS load: 50 % V _{cc} level, L CMOS= Max.
High output voltage	V _{OH}	V _{cc} -0.35 V Min.	V _{cc} -0.4 V Min.	I _{OH} = -8 mA
Low output voltage	V _{OL}	0.35 V Max.	0.4 V Max.	I _{OL} = 8 mA
Output load condition	L CMOS	15 pF Max.		Max. frequency and Max. supply voltage range
High input voltage	V _{IH}	70 % V _{cc} Min.		OE terminal
Low input voltage	V _{IL}	30 % V _{cc} Max.		OE terminal
Rise time / Fall time	t _r / t _f	2 ns Max.		CMOS load : between 20% V _{cc} and 80% of V _{cc} level
Start-up time	t _{str}	10 ms Max.		Time at minimum supply voltage to be 0 s
Jitter *2	t _{DJ}	0.2 ps Typ.		Deterministic Jitter
	t _{RJ}	3 ps Typ.		Random Jitter
	t _{RMS}	3 ps Typ.		σ (RMS of total distribution)
	t _{p-p}	25 ps Typ.		Peak to Peak
	t _{acc}	4 ps Typ.		Accumulated Jitter(σ) n=2 to 50000 cycles
Phase Jitter	t _{PJ}	0.05 × 10 ⁻³ UI Typ. 1 ps Max.		Offset frequency: 12 kHz to 20 MHz
Frequency aging*3	f _{aging}	± 10 × 10 ⁻⁶ / year Max.	± 5 × 10 ⁻⁶ / year Max.	+25 °C, First year, V _{cc} =2.5 V, 3.3 V

*1 As per below table

*2 Based on DTS-2075 Digital timing system made from WAVECREST with jitter analysis software VISI6.

*3 Except: CHPA, CHRA, PCH

Model	EG-2021CA		
	Details of frequency tolerance	A *4	N *5
Frequency tolerance	HP: ±100×10 ⁻⁶ (0°C to +70°C)	CHPA	CHPN
	HR: ±100×10 ⁻⁶ (-5°C to +85°C)	CHRA	CHRN
	GP: ±50×10 ⁻⁶ (0°C to +70°C)	—	CGRN
	GR: ±50×10 ⁻⁶ (-5°C to +85°C)	—	CGRN*7

	EG-2001CA	
	Output mode	P: Symmetry 50 ±5 %
Frequency tolerance	H: ±100×10 ⁻⁶ (0°C to +70°C) *4	PCH
	Y: ±100×10 ⁻⁶ (0°C to +70°C) *5	PCY
	Z: ±50×10 ⁻⁶ (0°C to +70°C) *6	PCZ

*4 This includes initial frequency tolerance, temperature variation, supply voltage variation, load variation, reflow drift, and aging (+25 °C, 10 years).

*5 This includes initial frequency tolerance, temperature variation, supply voltage variation, load variation, and reflow drift. (except aging)

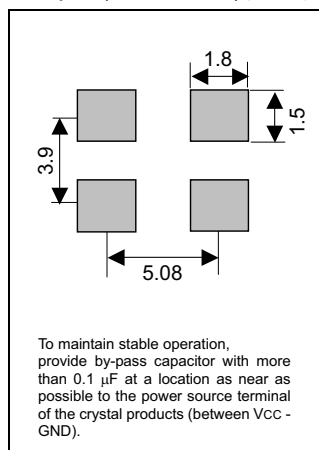
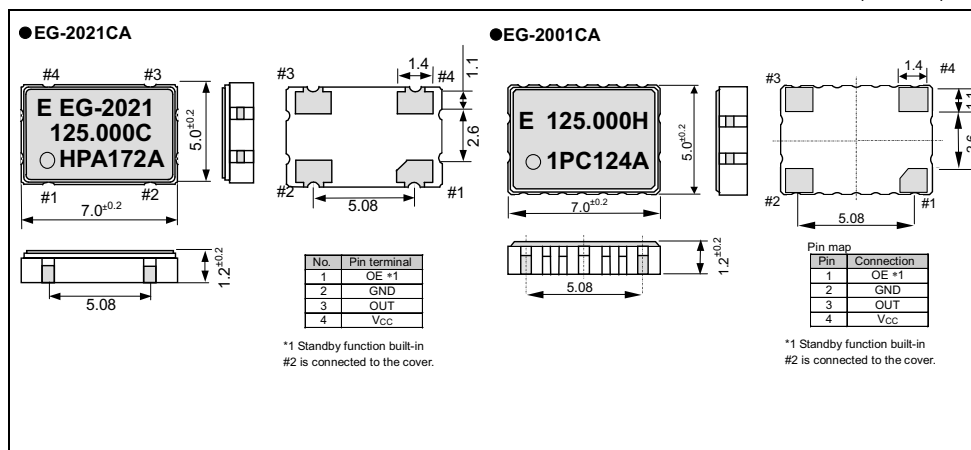
*6 This includes initial frequency tolerance, and temperature variation. (except reflow drift, supply voltage variation, load variation and aging)

*7 Please contact us for inquiries.

External dimensions

(Unit:mm)

Footprint (Recommended) (Unit:mm)





CRYSTAL OSCILLATOR LOW-JITTER SAW OSCILLATOR

EG-2002CA

- Frequency range : 62.5 MHz to 170 MHz
- Operating voltage : 3.3 V
- Output : LV-TTL
- Function : Output enable(OE)
- External dimensions : 7.0 × 5.0 × 1.2 t (mm) Typ.
- Very low jitter and low phase noise by SAW unit.



Product Number (please contact us)
Q3802CA00xxxx00



Actual size



Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Output frequency range	f_o	62.500 MHz to 170.000 MHz	Please contact us for inquiries regarding available frequencies.
Supply voltage	V_{cc}	3.3 V $\pm$ 0.3 V	
Temperature range	T_{stg}	-40 °C to +100 °C	Store as bare product after unpacking
Operating temperature	T_{use}	0 °C to +70 °C	
Frequency tolerance	f_{tol}	$\pm 50 \times 10^{-6}$, $\pm 100 \times 10^{-6}$	0 °C to +70 °C *1
Current consumption	I_{cc}	60 mA Max.	OE=V _{cc} , No load condition
Disable current	I_{dis}	25 mA Max.	OE=GND
Symmetry	SYM	45 % to 55 %	1.4 V level, L_CMOS $\leq$ Max.
High output voltage	V_{OH}	2.4 V Min.	$I_{OH} = -8$ mA
Low output voltage	V_{OL}	0.4 V Max.	$I_{OL} = 8$ mA
Output load condition	L_{CMOS}	25 pF Max. 15 pF Max.	$f_o = 62.5$ MHz $f_o > 62.5$ MHz
High input voltage	V_{IH}	70 % V_{cc} Min.	OE terminal
Low input voltage	V_{IL}	30 % V_{cc} Max.	OE terminal
Rise time / Fall time	t_r / t_f	1.5 ns Max.	Between 0.8 V and 2.0 V level, L_CMOS $\leq$ Max.
Start-up time	t_{str}	10 ms Max.	Time at minimum supply voltage to be 0 s
Jitter *2	t_{DJ}	0.2 ps Typ.	Deterministic Jitter
	t_{RJ}	3 ps Typ.	Random Jitter
	t_{RMS}	3 ps Typ.	σ (RMS of total distribution)
	t_{p-p}	25 ps Typ.	Peak to Peak
	t_{acc}	4 ps Typ.	Accumulated Jitter(σ) n=2 to 50000 cycles
Phase Jitter	t_{PJ}	0.05×10^{-3} UI Typ.	Offset frequency: 12 kHz to 20 MHz
		1 ps Max.	
Frequency aging *3	f_{aging}	$\pm 5 \times 10^{-6}$ / year Max.	+25 °C, First year, $V_{cc}=3.3$ V

*1 As per below table

*2 Based on DTS-2075 Digital timing system made from WAVECREST with jitter analysis software VISI6.

*3 Except : PCH,DCH

Frequency range (MHz)		P: 125 to 170	D: 62.5 to 124.999
Details of frequency tolerance	H: $\pm 100 \times 10^{-6}$ (0 °C to +70 °C)*4	PCH	DCH
	Y: $\pm 100 \times 10^{-6}$ (0 °C to +70 °C)*5	PCY	DCY
	Z: $\pm 50 \times 10^{-6}$ (0 °C to +70 °C)*6	PCZ	DCZ
	F: $\pm 50 \times 10^{-6}$ (0 °C to +70 °C)*5	PCF (125 MHz Only)	—

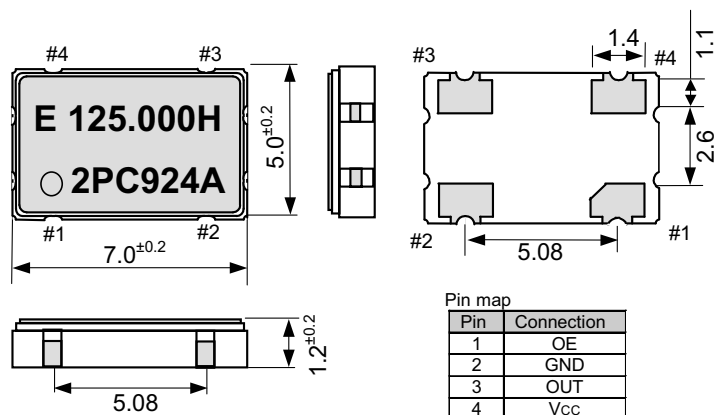
*4 This includes initial frequency tolerance, temperature variation, supply voltage variation, load variation, reflow drift, and 10 years aging(+25 °C, 10 years).

*5 This includes initial frequency tolerance, temperature variation, supply voltage variation, load variation, and reflow drift (except 10 years aging).

*6 This includes initial frequency tolerance and temperature variation (except supply voltage variation, load variation, reflow drift, and 10 years aging).

External dimensions

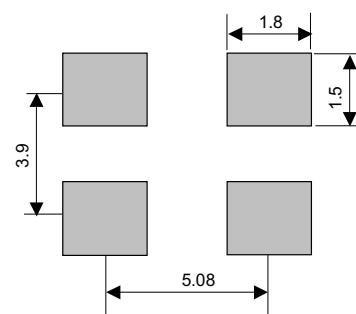
(Unit:mm)



#2 is connected to the cover.

Footprint (Recommended)

(Unit:mm)



To maintain stable operation, provide by-pass capacitor with more than 0.1 μ F at a location as near as possible to the power source terminal of the crystal products (between V_{cc} - GND).



CRYSTAL OSCILLATOR

LOW-JITTER SAW OSCILLATOR

EG-2121/2102CA series

- Frequency range : 53.125 MHz to 700 MHz
- Supply voltage : 2.5 V (EG-2121CA)
3.3 V (EG-2102CA)
- Output : Differential LV-PECL or LVDS
- Function : Output enable(OE)
- External dimensions : 7.0 × 5.0 × 1.2 t (mm) Typ.
- Very low jitter and low phase noise by SAW unit.



Product Number (please contact us)

EG-2121CA: Q3805CAx0xxx00

EG-2102CA: Q3806CA00xxx00



Actual size

EG-2121CA

EG-2102CA

Specifications (characteristics)

Item		Symbol	EG-2121CA	EG-2102CA	EG-2121CA	EG-2102CA	Remarks
			Differential LV-PECL		LVDS		
Output frequency range		f ₀	53.125 MHz to 500 MHz	100 MHz to 700 MHz	53.125 MHz to 700 MHz		Please contact us for inquiries regarding available frequencies.
Supply voltage		V _{CC}	2.5 V ±0.125 V	3.3 V ±0.3 V	2.5 V ±0.125 V	3.3 V ±0.3 V	
Temperature range	Storage temperature	T _{stg}	-40 °C to +100 °C				Store as bare product after unpacking
	Operating temperature	T _{use}	P:0 °C to +70 °C , R:-5 °C to +85 °C , S:-20 °C to +70 °C				Please contact us for inquiries about S spec.
Frequency tolerance		f _{tol}	G: ± 50 × 10 ⁻⁶ ,H: ±100 × 10 ⁻⁶				P:0 °C to +70 °C,R:-5 °C to +85 °C *1 S:-20 °C to +70 °C
Current consumption		I _{CC}	80 mA Max.	100 mA Max.	30 mA Max	45 mA Max.	OE=V _{CC} ,R _L =50 Ω or 100 Ω
Disable current		I _{dis}	20 mA Max.	32 mA Max	20 mA Max	30 mA Max.	OE=GND
Symmetry		SYM	P:45 % to 55 %	P:45 % to 55 %	L:45 % to 55 %	L:45 % to 55 %	f ₀ ≤350 MHz (at outputs crossing point) *1
Output voltage	V _{OH}		1.55 V Typ.	2.35 V Typ.	—		DC characteristics
			V _{CC} -1.025 V to V _{CC} -0.88 V				
		V _{OL}		0.8 V Typ.	1.6 V Typ.	—	
			V _{CC} -1.81 V to V _{CC} -1.62 V				
	V _{OD}			—		350 mV Typ. 247 mV to 454 mV	
	ΔV _{OD}		—		50 mV		Output change, DC characteristics
	V _{OS}		—		1.25 V Typ. 1.125 V to 1.375 V		Offset, DC characteristics
ΔV _{OS}		—		150 mV		Offset change, DC characteristics	
Output load condition		R _L	50 Ω		100 Ω		LV-PECL: Terminated to V _{CC} -2.0 V LVDS: Connected between OUT to $\overline{\text{OUT}}$
Output enable input voltage		V _{IH}	70 % V _{CC} Min.				OE terminal
Output disable input voltage		V _{IL}	30 % V _{CC} Max.				OE terminal
Rise time / Fall time		t _r / t _f	400 ps Max.				Between 20% V _{CC} and 80% of (V _{OH} -V _{OL}) Between 20 %and 80 % of Differential Output peak to peak voltage
Start-up time		t _{str}	10 ms Max.				Time at minimum supply voltage to be 0 s
Jitter *2	t _{DJ}		0.2 ps Typ.				Deterministic Jitter
	t _{RJ}		3 ps Typ.				Random Jitter
	t _{RMS}		3 ps Typ.				σ (RMS of total distribution)
	t _{p-p}		25 ps Typ.				Peak to Peak
	t _{acc}		4 ps Typ.				Accumulated Jitter(σ) n=2 to 50000 cycles
	t _{PJ}		0.05 × 10 ⁻³ UI Typ.				Offset frequency: 12 kHz to 20 MHz
Phase Jitter			1 ps Max.				
Frequency aging *3		f _{aging}	± 10 × 10 ⁻⁸ /year Max.				+25 °C,First year,V _{CC} =2.5 V,3.3 V

*1 As per below table.

*2 Based on DTS-2075 Digital timing system made from WAVECREST with jitter analysis software VISI6.

*3 Except: ***A

Output mode		P:Differential LV-PECL		D: Differential LV-PECL		L:LVDS		V:LVDS	
Frequency range	EG-2121CA	All range		$f_0 \leq 175 \text{ MHz}$		All range		$f_0 \leq 175 \text{ MHz}$	
	EG-2102CA			$f_0 \leq 350 \text{ MHz}$					
Symmetry	EG-2121CA	$50 \pm 10 \%$ ($f_0 > 350 \text{ MHz}$) $50 \pm 5 \%$ ($f_0 \leq 350 \text{ MHz}$)		$50 \pm 2 \%$		$50 \pm 10 \%$ ($f_0 > 350 \text{ MHz}$) $50 \pm 5 \%$ ($f_0 \leq 350 \text{ MHz}$)		$50 \pm 2 \%$	
	EG-2102CA	$50 \pm 5 \%$							
Details of frequency tolerance		A *4	N *5	A *4	N *5	A *4	N *5	A *4	N *5
Frequency tolerance	HP: $\pm 100 \times 10^{-6}$ (0°C to +70°C)	PHPA	PHPN	DHPA	DHPN	LHPA	LHPN	VHPA	VHPN
	HR: $\pm 100 \times 10^{-6}$ (-5°C to +85°C)	PHRA*6	PHRN*6	DHRA*6	DHRN*6	LHRA*6	LHRN*6	VHRA*6	VHRN*6
	GP: $\pm 50 \times 10^{-6}$ (0°C to +70°C)	PGPA*6	PGPN*6	DGPA*6	DGPN*6	LGPA*6	LGPN*6	VGPA*6	VGPN*6
	GR: $\pm 50 \times 10^{-6}$ (-5°C to +85°C)	—	PGRN*6	—	DGRN*6	—	LGRN*6	—	VGRN*6

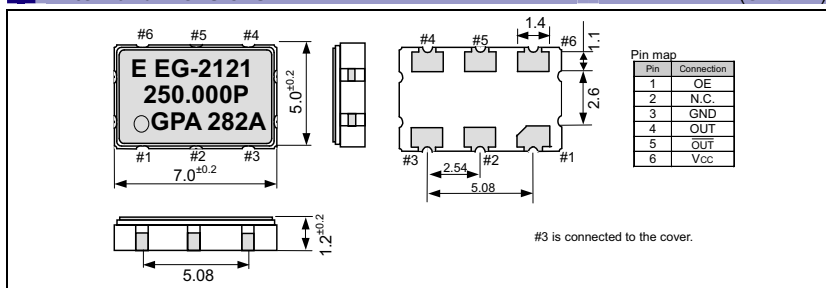
*4 This includes initial frequency tolerance, temperature variation, supply voltage variation, reflow drift, and aging(+25 °C, 10 years).

*5 This includes initial frequency tolerance, temperature variation, supply voltage variation, and reflow drift(except aging).

*6 53.125 MHz $\leq f_0 < 100$ MHz : Unavailable.

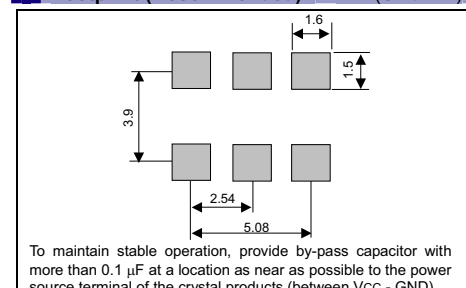
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





CRYSTAL OSCILLATOR

LOW-JITTER SAW OSCILLATOR

EG-2121/2102CA series

- Frequency range : 100 MHz to 350 MHz
- Supply voltage : 2.5 V (EG-2121CA)
3.3 V (EG-2102CA)
- Output : HCSL
- Function : Output enable(OE)
- External dimensions : 7.0 × 5.0 × 1.4 t (mm)
- Application : PCI Express™ 2.0, FB-DIMM
- Very low jitter and low phase noise by SAW unit.



Product Number (please contact us)
EG-2121CA:X1M000101xxxx00
EG-2102CA:X1M000091xxxx00



Actual size

EG-2121CA

EG-2102CA

NEW

Specifications (characteristics)

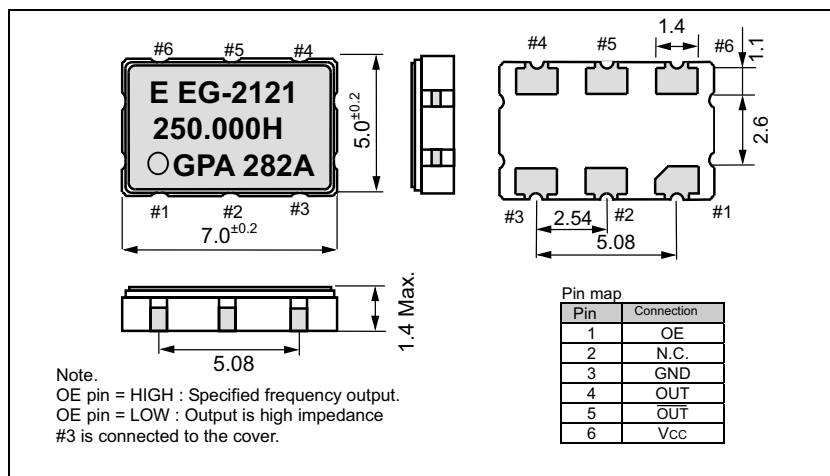
Item		Symbol	EG-2121CA	EG-2102CA	Remarks
			HCSL		
Output frequency range		f ₀	100 MHz to 350 MHz		Please contact us for inquiries regarding available frequencies.
Supply voltage		V _{CC}	2.5 V ±0.125 V	3.3 V ±0.3 V	
Temperature range	Storage temperature	T _{stg}	-40 °C to +125 °C		Store as bare product after unpacking
	Operating temperature	T _{use}	P:0 °C to +70 °C ,R:-5 °C to +85 °C ,S:-20 °C to +70 °C		
Frequency tolerance *1		f _{tol}	G: ± 50 × 10 ⁻⁶ ,H: ±100 × 10 ⁻⁶		
Current consumption		I _{CC}	80 mA Max.	85 mA Max.	OE=V _{CC} ,L_HCSL=50 Ω
Disable current		I _{dis}	20 mA Max.	35 mA Max	OE=GND
Symmetry		SYM	45 % to 55 %		at outputs crossing point
High output voltage		V _{OH}	0.75 V Typ.		DC characteristics
Low output Voltage		V _{OL}	-0.3 V Typ.		
Output load condition		L_HCSL	50 Ω		Terminated to GND
Output enable input voltage		V _{IH}	70 % V _{CC} Min.		OE terminal
Output disable input voltage		V _{IL}	30 % V _{CC} Max.		OE terminal
Rise time / Fall time		t _r / t _f	500 ps Max.		Between 0.175 V and 0.525 V of output
Start-up time		t _{str}	10 ms Max.		Time at minimum supply voltage to be 0 s
Jitter *2		t _{DJ}	0.2 ps Typ.		Deterministic Jitter
		t _{RJ}	3 ps Typ.		Random Jitter
		t _{RMS}	3 ps Typ.		σ (RMS of total distribution)
		t _{p-p}	25 ps Typ.		Peak to Peak
		t _{acc}	4 ps Typ.		Accumulated Jitter(σ) n=2 to 50000 cycles
Phase Jitter		t _{PJ}	1 ps Max.		Offset frequency: 12 kHz to 20 MHz
Frequency aging		f _{aging}	± 10 × 10 ⁻⁶ / year Max.		+25 °C,First year,V _{CC} =2.5 V,3.3 V

*1 This includes initial frequency tolerance, temperature variation, supply voltage variation, and reflow drift(except aging).

*2 Based on SIA-3100C signal integrity analyzer made from WAVECREST.

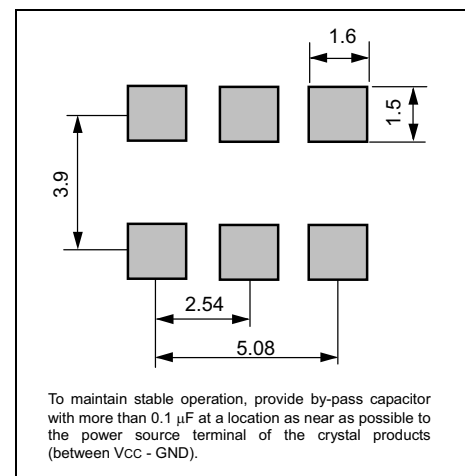
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





CRYSTAL OSCILLATOR

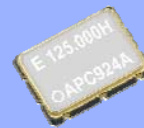
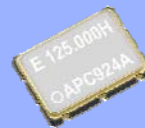
LOW-JITTER SAW OSCILLATOR

EG-2101CA

- Frequency range : 62.5 MHz to 99.999 MHz
- Supply voltage : 3.3 V
- Output : Differential LV-PECL
- Function : Output enable(OE)
- External dimensions : 7.0 × 5.0 × 1.2 t (mm) Typ.
- Very low jitter and low phase noise by SAW unit.



Product Number (please contact us)
Q3803CA00xxxx00



Actual size



Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Output frequency range	f_0	62.500 MHz to 99.999 MHz	Please contact us for inquiries regarding available frequencies
Supply voltage	V_{CC}	3.3 V ± 0.15 V	
Temperature range	Storage temperature	T_{stg}	-40 °C to +100 °C
	Operating temperature	T_{use}	0 °C to +70 °C
Frequency tolerance	f_{tol}	$\pm 50 \times 10^{-6}$, $\pm 100 \times 10^{-6}$	0 °C to +70 °C *1
Current consumption	I_{CC}	60 mA Max.	OE=V _{CC} , R _L =50 Ω
Disable current	I_{OE}	25 mA Max.	OE=GND
Symmetry *3	SYM	D:47.5 % to 52.5 %	DCH,DCY,DCZ at outputs crossing point
High output voltage	V_{OH}	2.35 V Typ. V _{CC} -1.025 V to V _{CC} -0.88 V	DC characteristics
Low output voltage	V_{OL}	1.60 V Typ. V _{CC} -1.81 V to V _{CC} -1.62 V	
Output load condition	R_L	50 Ω	Terminated to V _{CC} -2.0 V
High input voltage	V_{IH}	70 % V _{CC} Min.	OE terminal
Low input voltage	V_{IL}	30 % V _{CC} Max.	OE terminal
Rise time / Fall time	t_r / t_f	600 ps Max.	20 % to 80 % (V_{OH} - V_{OL})
Start-up time	t_{str}	10 ms Max.	Time at minimum supply voltage to be 0 s
Jitter *2	t_{DJ}	0.2 ps Typ.	Deterministic Jitter
	t_{RJ}	3 ps Typ.	Random Jitter
	t_{RMS}	3 ps Typ.	σ (RMS of total distribution)
	t_{p-p}	25 ps Typ.	Peak to Peak
	t_{acc}	4 ps Typ.	Accumulated Jitter(σ) n=2 to 50000 cycles
Phase Jitter	t_{PJ}	0.05×10^{-3} UI Typ.	Offset frequency: 12 kHz to 20 MHz
		1 ps Max.	
Frequency aging *3	f_{aging}	$\pm 5 \times 10^{-6}$ / year Max.	+25 °C, First year, V _{CC} =3.3 V

*1 As per below table

*2 Based on DTS-2075 Digital timing system made from WAVECREST with jitter analysis software VISI6.

*3 Except : PCH,DCH

Output mode (Symmetry)		D:Symmetry 50 ± 2.5 %
Details of frequency tolerance	H: $\pm 100 \times 10^{-6}$ (0 °C to +70 °C)*4	DCH
	Y: $\pm 100 \times 10^{-6}$ (0 °C to +70 °C)*5	DCY
	Z: $\pm 50 \times 10^{-6}$ (0 °C to +70 °C)*6	DCZ

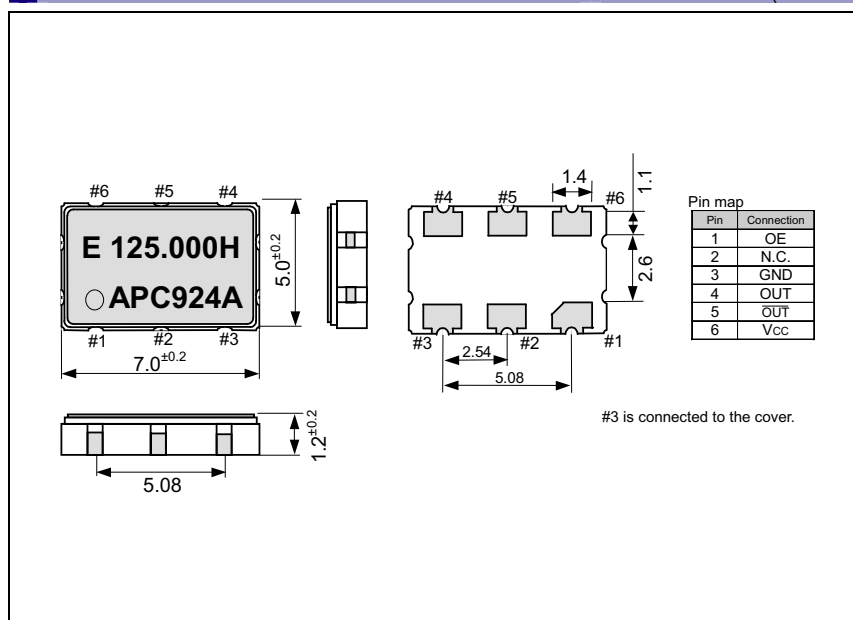
*4 This includes initial frequency tolerance, temperature variation, supply voltage variation, reflow drift, and aging(+25 °C,10 years).

*5 This includes initial frequency tolerance, temperature variation, supply voltage variation, and reflow drift(except aging).

*6 This includes initial frequency tolerance and temperature variation(except supply voltage variation, reflow drift, aging).

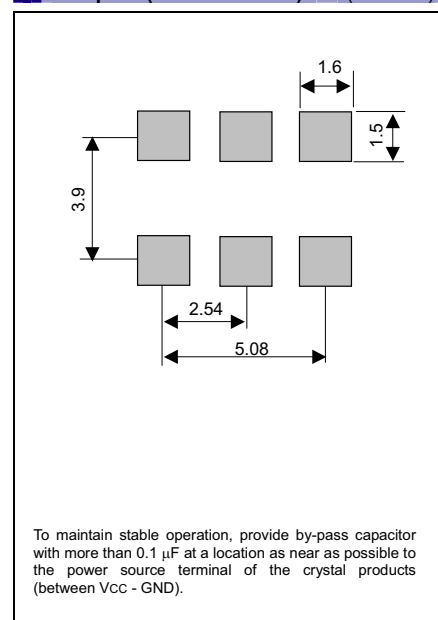
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





CRYSTAL OSCILLATOR HIGH-STABILITY

HG-2150CA series

- Frequency range : 1 MHz to 60 MHz
- Supply voltage : 3.3 V / 5.0 V
- Frequency tolerance : $\pm 15 \times 10^{-6}$ / -20 °C to +70 °C
- Function : Output enable(OE)
- External dimensions : 7.0 × 5.0 × 1.4 t (mm) Typ.



Product Number (please contact us)
Q3514CA00xxxx00



Actual size



Specifications (characteristics)

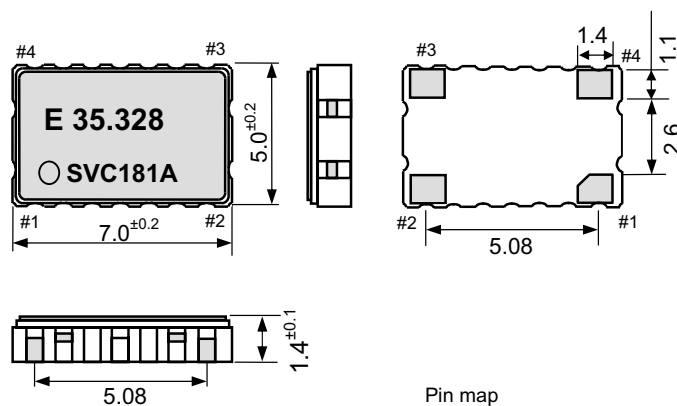
Item		Symbol	Specifications		Remarks
			SVH / BXH	SVC / BXC	
Output frequency range		f ₀	1.000 MHz to 60.000 MHz		
Supply voltage		V _{cc}	H:5.0 V ±0.5 V	C:3.3 V ±0.3 V	
Temperature range	Storage temperature	T _{stg}	-40 °C to +125 °C		Store as bare product after unpacking
	Operating temperature	T _{use}	V:-20 °C to +70 °C X:-40 °C to +85 °C		
Frequency tolerance		f _{tol}	S: ±15 × 10 ⁻⁶ *1		-20 °C to +70 °C
			B: ±25 × 10 ⁻⁶ *1		-40 °C to +85 °C
Current consumption		I _{cc}	30 mA Max.	25 mA Max.	No load condition, OE = V _{cc}
Disable current		I _{dis}	15 mA Max.	12 mA Max.	OE=GND
Symmetry		SYM	45 % to 55 %		50 % V _{cc} level
High output voltage		V _{OH}	V _{cc} -0.4 V Min.		I _{OH} = -4 mA
Low output voltage		V _{OL}	0.4 V Max.		I _{OL} = 4 mA
Output load condition		L _{CMOS}	15 pF Max.		CMOS load
Output enable input voltage		V _{IH}	70 % V _{cc} Min.		OE terminal
Output disable input voltage		V _{IL}	30 % V _{cc} Max.		OE terminal
Rise time / Fall time		t _r / t _f	4 ns Max.		20 % V _{cc} to 80 % V _{cc} level
Start-up time		t _{str}	10 ms Max.		Time at minimum supply voltage to be 0 s.
Frequency aging		f _{aging}	±10 × 10 ⁻⁶ Max. *2		+25 °C, 10 years

*1 Frequency tolerance includes variation in reflow soldering drift, operating temperature range, supply voltage range and load change.

*2 50 MHz < f_o ≤ 60 MHz: $\pm 15 \times 10^{-6}$ Max.

External dimensions

(Unit:mm)



Pin map

Pin	Connection
1	OE
2	GND
3	OUT
4	V _{cc}

Note.

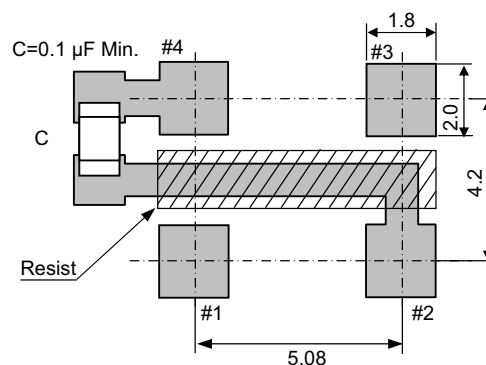
OE Pin

OE pin = "H" or "open" : Specified frequency output.

OE pin = "L" : Output is high impedance

Footprint (Recommended)

(Unit:mm)



To maintain stable operation, provide by-pass capacitor with more than 0.1 μ F at a location as near as possible to the power source terminal of the crystal products (between V_{cc} - GND).



CRYSTAL OSCILLATOR HIGH-STABILITY

HG - 8002JA series

- Frequency range : 1 MHz to 125 MHz
- Supply voltage : 3.3 V / 5.0 V
- Frequency tolerance : $\pm 20 \times 10^{-6}$ / -20 °C to +70 °C
- Function : Output enable(OE) or Standby($\overline{ST}$)
- External dimensions : 14.0 × 9.8 × 4.7 t (mm) Max.
Package and pin compatible with SG-615.



Product Number (please contact us)
Q3514JAXxxxxx00



Actual size



Specifications (characteristics)

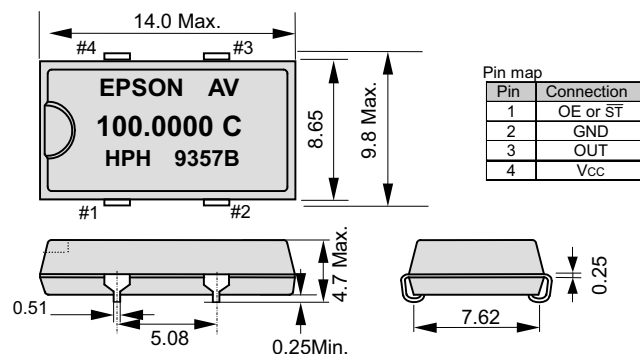
Item	Symbol	Specifications			Remarks
		PT / ST	PH / SH	PC / SC	
Output frequency range	f_0	1.000 MHz to 125.000 MHz			
Supply voltage	V_{CC}	5.0 V ± 0.25 V			3.3 V ± 0.165 V
Temperature range	Storage temperature	-55°C to $+125^{\circ}\text{C}$			Store as bare product after unpacking
	Operating temperature	-20°C to $+70^{\circ}\text{C}$ (-40°C to $+85^{\circ}\text{C}$)			-40°C to $+85^{\circ}\text{C}$
Frequency tolerance	f_{tol}	AV: $\pm 20 \times 10^{-6}$, BV: $\pm 25 \times 10^{-6}$ CX: $\pm 30 \times 10^{-6}$			-20°C to $+70^{\circ}\text{C}$ -40°C to $+85^{\circ}\text{C}$ *1
Current consumption	I_{CC}	45 mA Max.			No load condition, Max. frequency
Disable current	I_{dis}	30 mA Max.			OE=GND (PT,PH,PC)
Stand-by current	I_{std}	50 μA Max.			$\overline{ST}$ =GND (ST,SH,SC)
Symmetry	SYM	40 % to 60 %			CMOS load: 50% V_{CC} level, Max. load condition
		40 % to 60 %			TTL load: 1.4 V level, Max. load condition
High output voltage	V_{OH}	$V_{CC} - 0.4$ V Min.			$I_{OH} = -16$ mA (PT,ST,PH,SH), -8 mA (PC,SC)
Low output voltage	V_{OL}	0.4 V Max.			$I_{OL} = 16$ mA (PT,ST,PH,SH), 8 mA (PC,SC)
Output load condition (TTL)	L_{TTL}	2 TTL Max.			Max. frequency
Output load condition (CMOS)	L_{CMOS}	15 pF Max.			Max. supply voltage
Output enable / disable input voltage	V_{IH}	2.0 V Min.			$\overline{ST}$ terminal or OE terminal
	V_{IL}	0.8 V Max.			20 % V_{CC} Max.
Rise time / Fall time	t_r / t_f	3 ns Max.			CMOS load: 20 % V_{CC} to 80 % V_{CC} level
		4 ns Max.			TTL load: 0.4 V to 2.4 V level
Start-up time	t_{str}	10 ms Max.			Time at minimum supply voltage to be 0 s
Frequency aging	f_{aging}	$\pm 2 \times 10^{-6}$ / year Max.			$+25^{\circ}\text{C}$, $V_{CC} = 5.0$ V / 3.3 V (PC / SC)

PLL-PLL connection & Jitter specification, please refer to "Jitter specifications and characteristics chart" page.

*1 PT, ST and PH, SH for "CX" tolerance will be available up to 55 MHz.

External dimensions

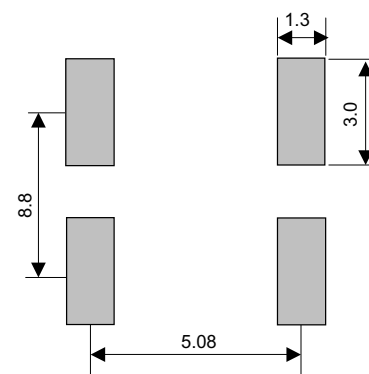
(Unit:mm)



Note.
OE Pin (PT, PH, PC)
OE pin = "H" or "open" : Specified frequency output.
OE pin = "L" : Output is high impedance.
 $\overline{ST}$ pin (ST, SH, SC)
 $\overline{ST}$ pin = "H" or "open" : Specified frequency output.
 $\overline{ST}$ pin = "L" : Output is low level (weak pull - down), oscillation stops.

Footprint (Recommended)

(Unit:mm)



To maintain stable operation, provide by-pass capacitor with more than 0.1 μF at a location as near as possible to the power source terminal of the crystal products (between V_{CC} - GND).



VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR (VCXO)

MINIATURE SIZE LOW PROFILE, WIDE PULL RANGE

VG-4231CE

- Frequency range : 3 MHz to 60 MHz
- Supply voltage : 3.3 V (PSCM / CSCM)
2.8 V (PSBM / CSBM)
1.8 V (PQEM / CQEM)
- Frequency control range : $\pm 140 \times 10^{-6}$ (*SCM / *SBM)
 $\pm 120 \times 10^{-6}$ (*QEM)
- Low current consumption : 1.0 mA Typ. (27 MHz, 3.3 V)
- External dimensions : $3.2 \times 2.5 \times 1.05$ t (mm) Typ.



Product Number (please contact us)
Q3614CE00xxxx00



Actual size



Specifications (characteristics)

Item		Symbol	Specifications			Remarks
			PSCM / CSCM	PSBM / CSBM	PQEM / CQEM	
Output frequency range		f ₀	3 MHz to 60 MHz		24 MHz to 30 MHz	Please contact us for inquiries regarding other frequencies.
Supply voltage		V _{cc}	3.3 V ±0.3 V	2.8 V ±0.2 V	1.8 V ±0.2 V	
Temperature range	Storage temperature	T _{stg}	-40 °C to +125 °C			Store as bare product after unpacking
	Operating temperature	T _{use}	As per below table			
Frequency tolerance		f _{tol}	As per below table			C : V _c =1.65 V / B : V _c =1.40 V / E : V _c =0.90 V
Current consumption		I _{cc}	7 mA Max.	6.2 mA Max.	1.2 mA Max.	No load condition
Frequency control range		f _{cont}	S:± 140 × 10 ⁻⁶ Min.		Q:± 120 × 10 ⁻⁶ Min.	V _c = 1/2 V _{cc} ± 1/2 V _{cc}
Modulation characteristics		BW	15 kHz Min.			± 3 dB (at 1 kHz)
Input resistance		R _{in}	M : 5 MΩ Min.			DC level
Frequency change polarity		—	Positive polarity			V _c =0 V to V _{cc}
Symmetry		SYM	40 % to 60 %			CMOS load:50 % V _{cc} level
High output voltage		V _{OH}	V _{cc} -0.4 V Min.			I _{OH} =-3.0 mA
Low output voltage		V _{OL}	0.4 V Max.			I _{OL} = 3.0 mA
Output load condition (CMOS)		L _{CMOS}	15 pF Max.			CMOS load
Rise time and Fall time		t _r / t _f	4 ns Max.		6 ns Max.	CMOS load: 20 % V _{cc} to 80 % V _{cc} level
Start-up time		t _{str}	5 ms Max.			Time at 90 % V _{cc} to be 0 s
Frequency aging		f _{aging}	± 5 × 10 ⁻⁶ Max.			+25 °C, 5 years

* Please keep V_c pin open or ground while powering up V_{cc} .

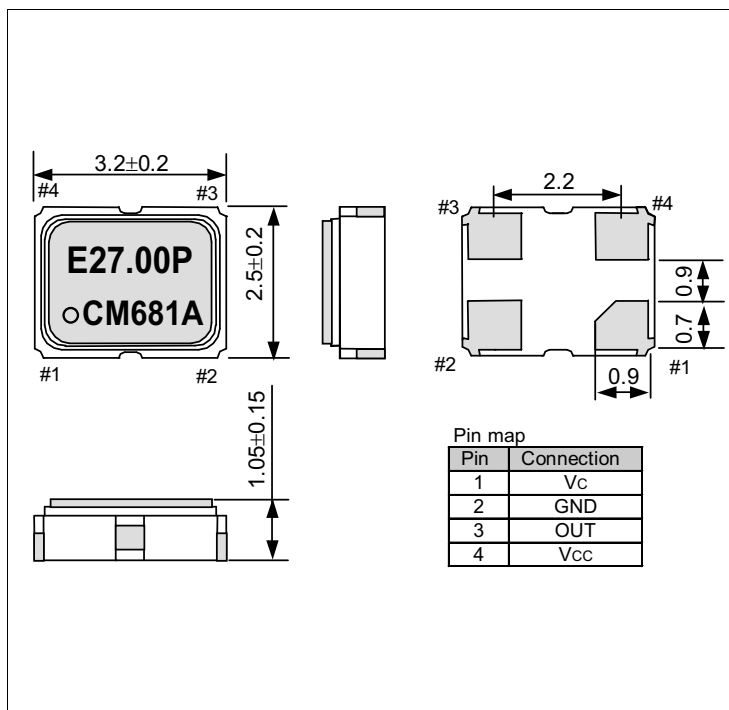
Frequency tolerance / Temperature range / Absolute pull range

	Frequency tolerance	Temperature range	Absolute pull range
CSCM / CSBM / CQEM	C $\pm 30 \times 10^{-6}$	-20°C to $+70^\circ\text{C}$	S : $\pm 100 \times 10^{-6}$ / Q : $\pm 80 \times 10^{-6}$
PSCM / PSBM / PQEM	P $\pm 37 \times 10^{-6}$	-40°C to $+85^\circ\text{C}$	S : $\pm 95 \times 10^{-6}$ / Q : $\pm 75 \times 10^{-6}$

* Absolute pull range = Frequency control range- (Frequency tolerance + 5 years Aging + Free fall + Vibration)

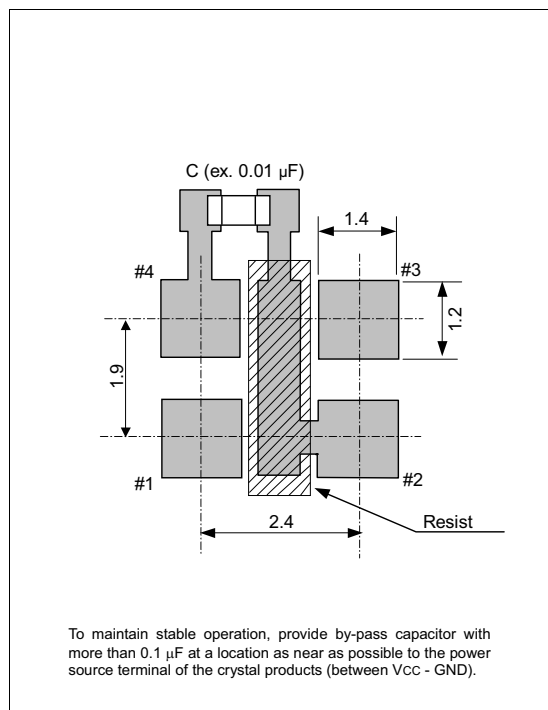
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR (VCXO)

VG-4231CB

VG-4531CB

- Frequency range : 1 MHz to 80 MHz
- Supply voltage : 3.3 V
- Absolute pull range : $\pm 50 \times 10^{-6}$
- External dimensions: 5.0 × 3.2 × 1.2 t (mm) Typ.
- Function : Output enable(OE)



Product Number (please contact us)
 VG-4231CB : X1G002861xxxx00
 VG-4531CB : X1G002881xxxx00



Actual size



Specifications (characteristics)

Item	Symbol	Specifications		Remarks
		VG-4231CB	VG-4531CB	
Output frequency range	f _o	1.000 MHz to 60.000 MHz	60.001 MHz to 80.000 MHz	Please contact us for inquiries regarding available frequencies.
Supply voltage	V _{cc}	3.3 V ± 0.165 V		
Storage temperature range	T _{stg}	-55 °C to +125 °C		Store as bare product after unpacking
Operating temperature range	T _{use}	As per blow table.		
Frequency tolerance	f _{tol}	$\pm 50 \times 10^{-6}$ Max.		Includes frequency aging (20 years)
Current consumption	I _{cc}	10 mA Max.	15 mA Max.	No load condition.
Absolute pull range	APR	$\pm 50 \times 10^{-6}$ Min.		V _c = 1.65 V ± 1.5 V
Input resistance	R _{in}	10 M Ω Min.		DC level
Frequency change polarity	—	Positive slope		V _c = 0.15 to 3.15 V
Symmetry	SYM	45 % to 55 %		50 % V _{cc} level
High output voltage	V _{OH}	V _{cc} - 0.4 V Min.		I _{OH} = -0.8 mA
Low output voltage	V _{OL}	0.4 V Max.		I _{OL} = 3.2 mA
Output load condition (CMOS)	L _{CMOS}	15 pF Max.		
Output enable / disable input voltage	V _{IH}	70 % V _{cc} Min.		V _{IH} or OPEN : Enable
	V _{IL}	30 % V _{cc} Max.		V _{IL} or GND : Disable
Rise time / Fall time	t _r / t _f	6 ns Max.		20 % V _{cc} to 80 % V _{cc} level
Start-up time	t _{str}	10 ms Max.		Time at minimum supply voltage to be 0 s
Frequency aging	f _{aging}	This is included frequency tolerance		+25 °C, V _{cc} = 3.3 V, 20 years

* Please keep V_c pin open or ground while powering up V_{cc}.

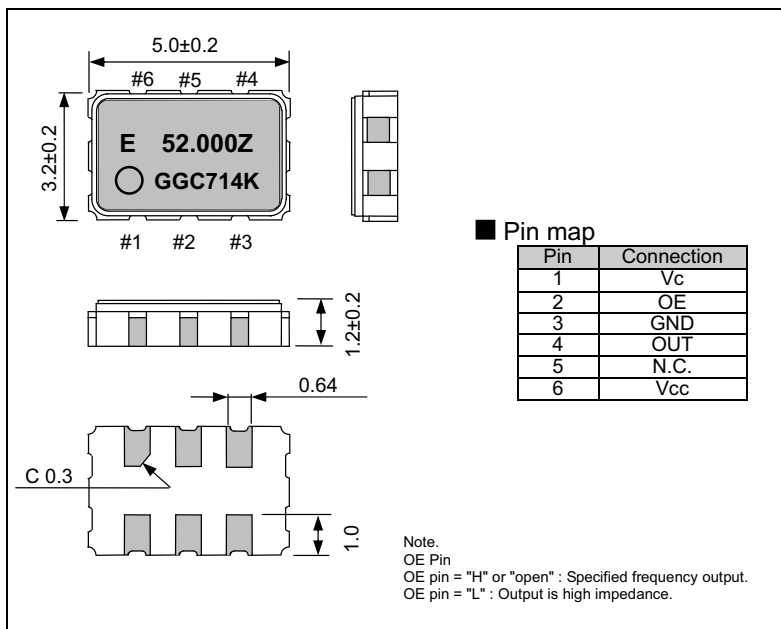
Temperature range

VG-4231CB	Operating temperature range
GGCZ	-40 °C ~ +85 °C
JGCZ	-20 °C ~ +70 °C
KGCZ	0 °C ~ +70 °C

VG-4531CB	Operating temperature range
GGCT	-40 °C ~ +85 °C
JGCT	-20 °C ~ +70 °C
KGCT	0 °C ~ +70 °C

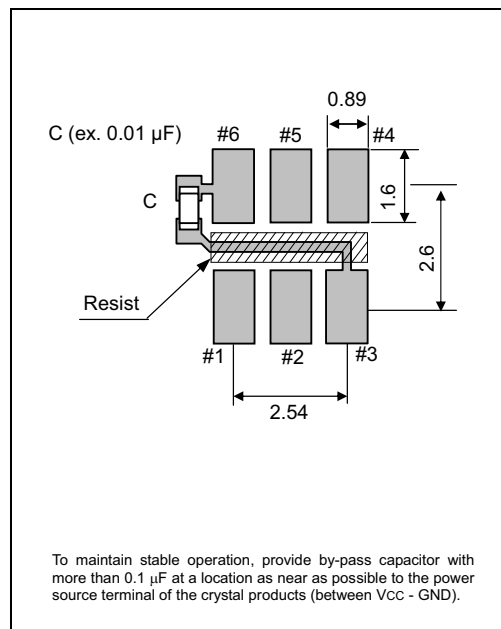
External dimensions

(Unit : mm)



Footprint (Recommended)

(Unit : mm)





VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR (VCXO) WIDE PULL RANGE

VG-4231CA

- Frequency range : 1 MHz to 60 MHz
- Supply voltage : 3.3 V (DRC, GRC)
5.0 V (DRH, GRH)
- Frequency control range: $\pm 130 \times 10^{-6}$
- External dimensions : 7.0 × 5.0 × 1.4 t (mm) Typ.



Product Number (please contact us)
Q3614CA00xxxx00



Actual size



Specifications (characteristics)

Item		Symbol	Specifications		Remarks	
			DRH / GRH	DRC / GRC		
Output frequency range		f ₀	1.000 MHz to 60.000 MHz		Please contact us for inquiries regarding available frequencies.	
Supply voltage		V _{cc}	H:5.0 V ±0.5 V	C:3.3 V ±0.3 V		
Temperature range	Storage temperature	T _{stg}	-40 °C to +125 °C		Store as bare product after unpacking	
	Operating temperature	T _{use}	As per below table			
Frequency tolerance		f _{tol}	As per below table		V _c =2.5 V(**H), V _c =1.65 V(**C)	
Current consumption		I _{cc}	20 mA Max.	10 mA Max.	No load condition	
Disable current		I _{dis}	15 mA Max.	7 mA Max.	OE=GND	
Frequency control range		f _{cont}	R:±130 × 10 ⁻⁶		V _c =2.5 V±2.0 V(**H) V _c =1.65 V±1.5 V(**C)	
Absolute pull range *1		APR	D:±80 × 10 ⁻⁶ Min., G:±65 × 10 ⁻⁶ Min.			
Modulation characteristics		BW	15 kHz Min.		± 3 dB (at 1 kHz)	
Input resistance		R _{in}	50 kΩ Min.		Connection F or T Type	DC level
			—	10 MΩ Min.	Connection M or Z Type	
Frequency change polarity		—	Positive polarity		V _c =0.5 V to 4.5 V(**H) , 0.15 V to 3.15 V(**C)	
Symmetry		SYM	40 % to 60 %		CMOS load:50 % V _{cc} level	
High output voltage		V _{OH}	V _{cc} -0.4 V Min.		I _{OH} = -0.8 mA(**C),I _{OH} =-4 mA(**H)	
Low output voltage		V _{OL}	0.4 V Max.		I _{OL} = 3.2 mA(**C),I _{OL} = 4 mA(**H)	
Output load condition (CMOS)		L _{CMOS}	15 pF Max.		CMOS load	
Output enable / disable input voltage		V _{IH}	70 % V _{cc} Min.		OE Terminal	
		V _{IL}	30 % V _{cc} Max.			
Rise time and Fall time		t _f / t _r	4 ns Max.		CMOS load: 20 % V _{cc} to 80 % V _{cc} level	
Start-up time		t _{str}	10 ms Max.		Time at 90 %V _{cc} to be 0 s	
Frequency aging		f _{aging}	±10 × 10 ⁻⁶ Max. *2		+25 °C, 10 years	

*1 Absolute pull range = Frequency control range- (Frequency tolerance + 10 years Aging + Free fall + Vibration)

*2 50 MHz < f_0 ≤ 60 MHz : $\pm 15 \times 10^{-6}$ Max.

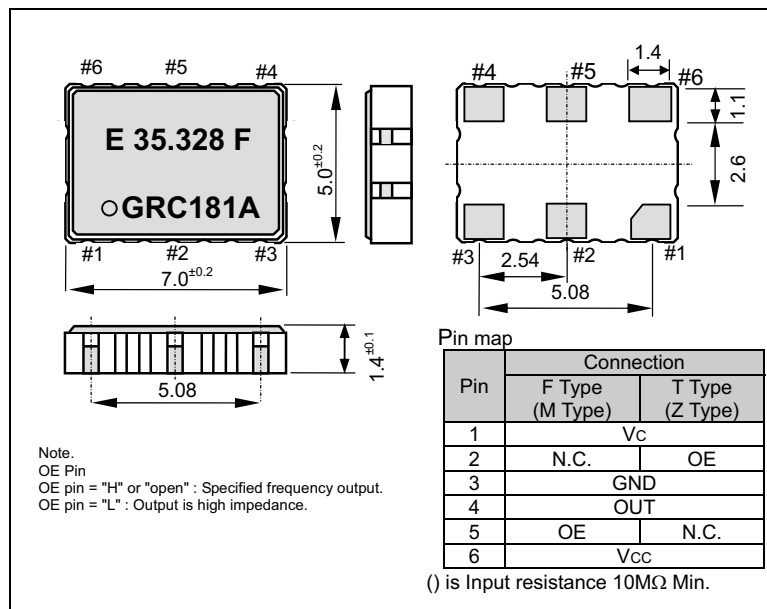
* Please keep V_C pin open or ground while powering up V_{CC} .

Frequency tolerance / Temperature range

	Frequency tolerance	Temperature range
DRC / DRH	$\pm 35 \times 10^{-6}$	-20 °C to +70 °C
GRC / GRH	$\pm 50 \times 10^{-6}$	-40 °C to +85 °C

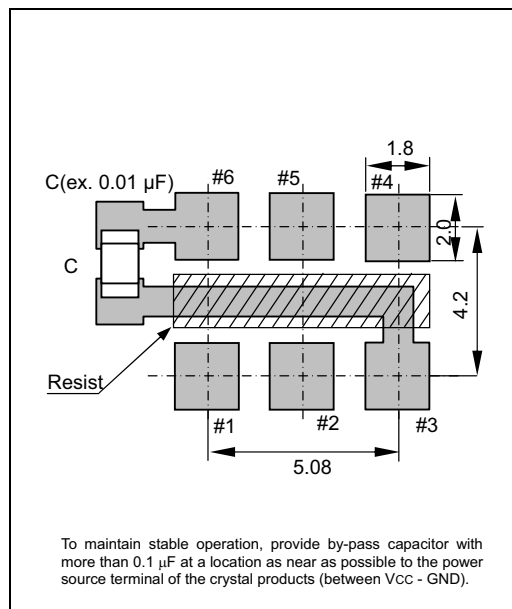
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR (VCXO)

VG-4501CA

VG-4502CA

- Frequency range : 60 MHz to 80 MHz
- Supply voltage : 3.3 V
- Absolute pull range : VG-4501CA $\pm 50 \times 10^{-6}$
VG-4502CA $\pm 100 \times 10^{-6}$
- External dimensions: 7.0 × 5.0 × 1.6 t (mm) Typ.
- Function : Output enable(OE)



Product Number (please contact us)
 VG-4501CA : X1G002371xxxx00
 VG-4502CA : X1G002871xxxx00



Actual size



Specifications (characteristics)

Item	Symbol	Specifications		Remarks
		VG-4501CA	VG-4502CA	
Output frequency range	f _o	60.000 MHz to 80.000 MHz		Please contact us for inquiries regarding available frequencies.
Supply voltage	V _{cc}	3.3 V ±0.165 V		
Storage temperature range	T _{stg}	-55 °C to +125 °C		Store as bare product after unpacking
Operating temperature range	T _{use}	As per below table.		
Frequency tolerance	f _{tol}	±50 × 10 ⁻⁶ Max.		-40 °C to +85 °C
Current consumption	I _{cc}	35 mA Max.		No load condition.
Absolute pull range*1	APR	GCT : ±50 × 10 ⁻⁶ Min.	HCT : ±100 × 10 ⁻⁶ Min.	V _c = 1.65 V ± 1.65 V
Input resistance	R _{in}	80 kΩ Min.		DC level
Frequency change polarity	—	Positive slope		V _c = 0 to 3.3 V
Symmetry	SYM	45 % to 55 %		50 % V _{cc} level
High output voltage	V _{OH}	90 % V _{cc} Min.		I _{OH} = -0.8 mA
Low output voltage	V _{OL}	10 % V _{cc} Max.		I _{OL} = 3.2 mA
Output load condition (CMOS)	L _{CMOS}	15 pF Max.		
Output enable / disable input voltage	V _{IH}	70 % V _{cc} Min.		V _{IH} or OPEN : Enable
	V _{IL}	30 % V _{cc} Max.		V _{IL} or GND : Disable
Rise time / Fall time	t _r / t _f	5 ns Max.		20 % V _{cc} to 80 % V _{cc} level
Start-up time	t _{str}	10 ms Max. *2		Time at minimum supply voltage to be 0 s
Frequency aging	f _{aging}	This is included Absolute pull range		+25 °C, V _{cc} =3.3 V, 20 years

*1 Absolute pull range = Frequency control range- (Frequency tolerance + 20 years Aging + Free fall + Vibration)

*2 Rise time (or 3.15 V) of V_{cc} > 150 μs

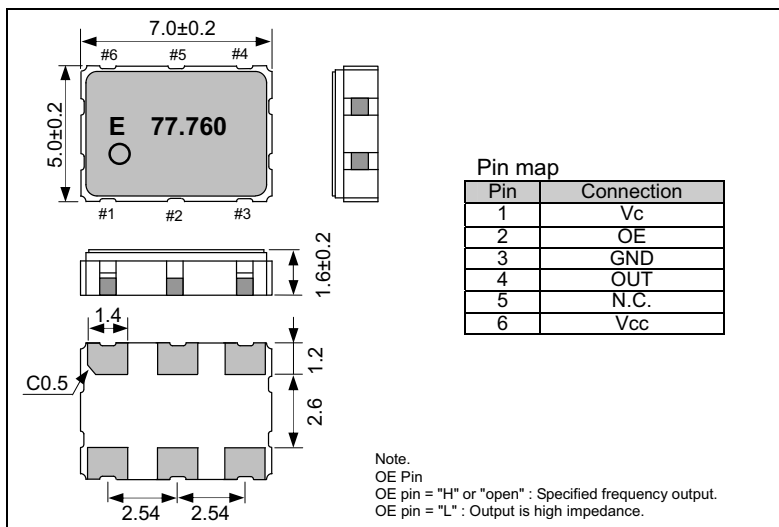
* Please keep V_c pin open or ground while powering up V_{cc}.

Operating temperature range

Operating temperature range		Absolute pull range	
		VG-4501CA ±50 × 10 ⁻⁶ Min.	VG-4502CA ±100 × 10 ⁻⁶ Min.
G	-40 °C to +85 °C	GGCT	GHCT
J	-20 °C to +70 °C	JGCT	JHCT
K	0 °C to +70 °C	KGCT	KHCT

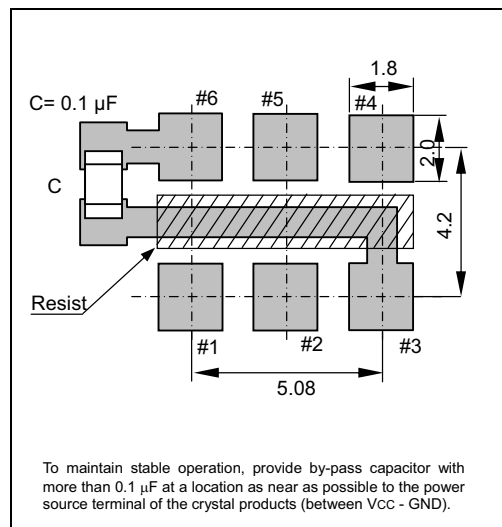
External dimensions

(Unit :mm)



Footprint (Recommended)

(Unit :mm)





VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR (VCXO)

VG-4511CA

- Frequency range : 80 MHz to 170 MHz LV-PECL
- Supply voltage : 3.3 V
- Absolute pull range : $\pm 50 \times 10^{-6}$
- External dimensions : $7.0 \times 5.0 \times 1.6$ t (mm) Typ.
- Function : Output enable(OE)



Product Number (please contact us)
X1G002781xxxx00



Actual size



Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Output frequency range	f _o	80.000 MHz to 170.000 MHz	Please contact us for inquiries regarding available frequencies.
Supply voltage	V _{cc}	3.3 V ± 0.165 V	
Storage temperature range	T _{stg}	-55 °C to +125 °C	Store as bare product after unpacking
Operating temperature range	T _{use}	As per below table.	
Frequency tolerance	f _{tol}	$\pm 50 \times 10^{-6}$ Max.	Includes frequency aging (20 years)
Current consumption	I _{cc}	70 mA Max.	No load condition.
Absolute pull range	APR	GCT: $\pm 50 \times 10^{-6}$ Min.	V _c = 1.65 V ± 1.5 V
Input resistance	R _{in}	100 k Ω Min.	DC level
Frequency change polarity	—	Positive slope	V _c = 0 to 3.3 V
Symmetry	SYM	40 % to 60 %	—
High output voltage	V _{OH}	V _{cc} -1.1 V Min.	—
Low output voltage	V _{OL}	V _{cc} -1.5 V Max.	—
Output load condition (ECL)	L _{ECL}	LV-PECL	
Output enable / disable input voltage	V _{IH}	70 % V _{cc} Min.	V _{IH} or OPEN : Enable
	V _{IL}	30 % V _{cc} Max.	V _{IL} or GND : Disable
Rise time / Fall time	t _r / t _f	1.5 ns Max.	20 % V _{cc} to 80 % V _{cc} level
Start-up time	t _{str}	10 ms Max.	Time at minimum supply voltage to be 0 s
Frequency aging	f _{aging}	This is included frequency tolerance	+25 °C, V _{cc} =3.3 V, 20 years

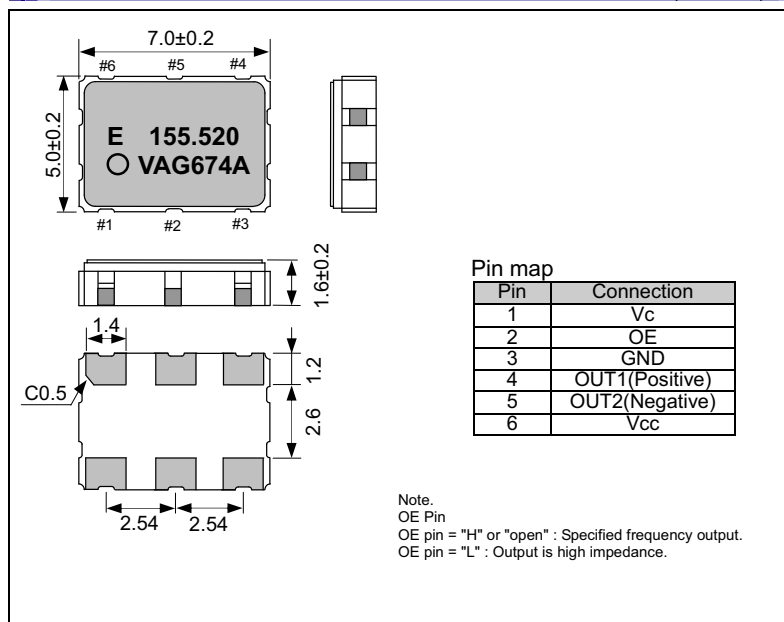
* Please keep V_c pin open or ground while powering up V_{cc}.

Operating temperature range

	Operating temperature range
GGCT	-40 °C ~ +85 °C
JGCT	-20 °C ~ +70 °C
KGCT	0 °C ~ +70 °C

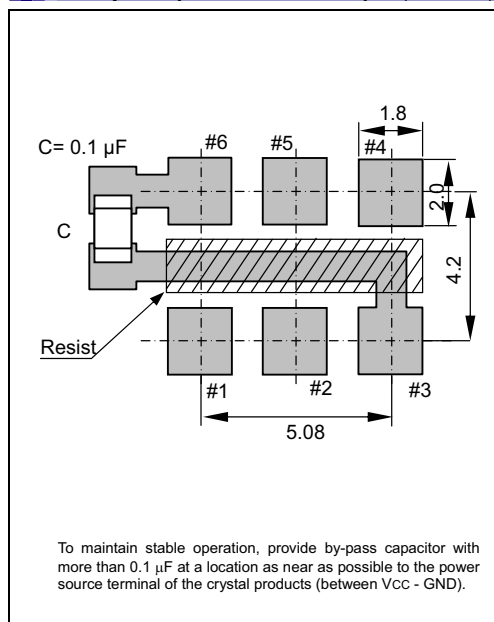
External dimensions

(Unit :mm)



Footprint (Recommended)

(Unit :mm)





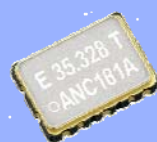
VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR (VCXO)

VG-1201CA

- Frequency range : 1 MHz to 60 MHz
- Supply voltage : 3.3 V(**C) or 5.0 V(**H)
- Function : Output enable(OE)
- External dimensions : 7.0 × 5.0 × 1.4 t (mm) Typ.



Product Number (please contact us)
Q3603CA0xxxxx00



Actual size



Specifications (characteristics)

Item	Symbol	Specifications		Remarks
		ANH / AKH / BNH / BKH	ANC / AKC / BNC / BKC	
Output frequency range	f_0	1.000 MHz to 60.000 MHz		
Supply voltage	V_{CC}	H:5.0 V ± 0.5 V	C:3.3 V ± 0.3 V	
Temperature range	T_{stg}	-40 °C to +125 °C		Store as bare product after unpacking
Storage temperature	T_{use}	As per below table		
Operating temperature	f_{tol}	As per below table		
Frequency tolerance	I_{CC}	30 mA Max.	25 mA Max.	No load condition
Current consumption	I_{dis}	15 mA Max.	12 mA Max.	OE=GND
Disable current	f_{cont}	As per below table		$V_C=2.5$ V ± 2.0 V(**H) , 1.65 V ± 1.50 V(**C)
Frequency control range	BW	20 kHz Min.		± 3 dB (at 1 kHz)
Modulation characteristics	R_{in}	5 M Ω Min.		DC level
Input resistance	—	Positive polarity		$V_C=0.5$ V to 4.5 V(**H), 0.15 V to 3.15 V(**C)
Frequency change polarity	SYM	40 % to 60 %		CMOS load:50 % V_{CC} level
Symmetry	V_{OH}	$V_{CC}-0.4$ V Min.		$I_{OH}= -4$ mA
High output voltage	V_{OL}	0.4 V Max.		$I_{OL}= 4$ mA
Low output voltage	L_{CMOS}	15 pF Max.		CMOS load
Output load condition(CMOS)	V_{IH}	70 % V_{CC} Min.		OE Terminal
Output enable /	V_{IL}	30 % V_{CC} Max.		CMOS load: 20 % V_{CC} to 80 % V_{CC} level
disable input voltage	t_r / t_f	4 ns Max.		Time at 90 % V_{CC} to be 0 s
Rise time and Fall time	t_{str}	10 ms Max.		± 25 °C, 10 years
Start-up time	f_{aging}	$\pm 10 \times 10^{-6}$ Max. *1		
Frequency aging				

*1 50 MHz $< f_0 \leq 60$ MHz : $\pm 15 \times 10^{-6}$ Max.

* Please keep V_C pin open or ground while powering up V_{CC} .

Frequency tolerance / Temperature range

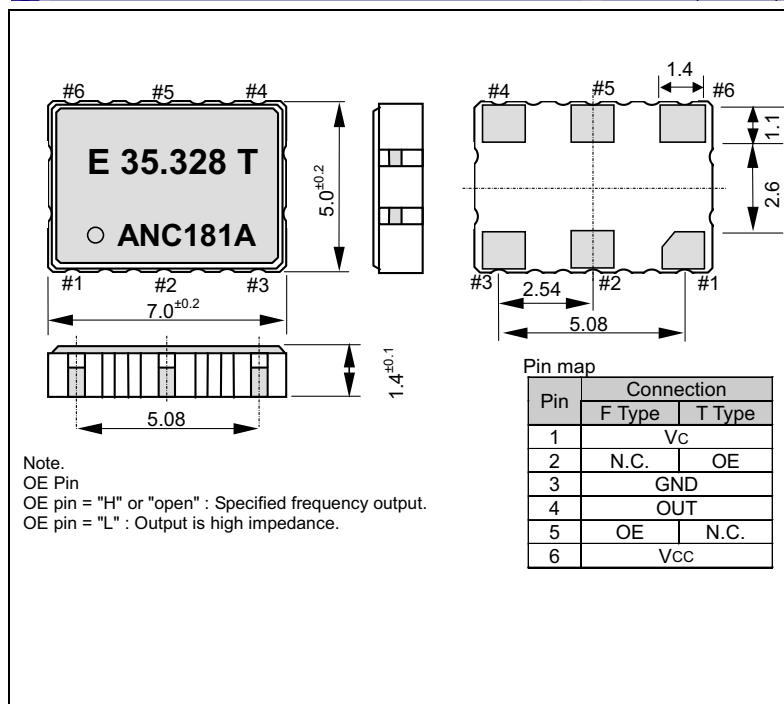
	Frequency tolerance	Temperature range
A	$\pm 20 \times 10^{-6}$	-20 °C to +70 °C
B	$\pm 25 \times 10^{-6}$	-40 °C to +85 °C

Frequency control range

	Frequency control range	Output frequency range
K	$\pm 75 \times 10^{-6}$ Min.	41 MHz $< f_0 \leq 60$ MHz
N	$\pm 100 \times 10^{-6}$ Min.	1 MHz $\leq f_0 \leq 41$ MHz

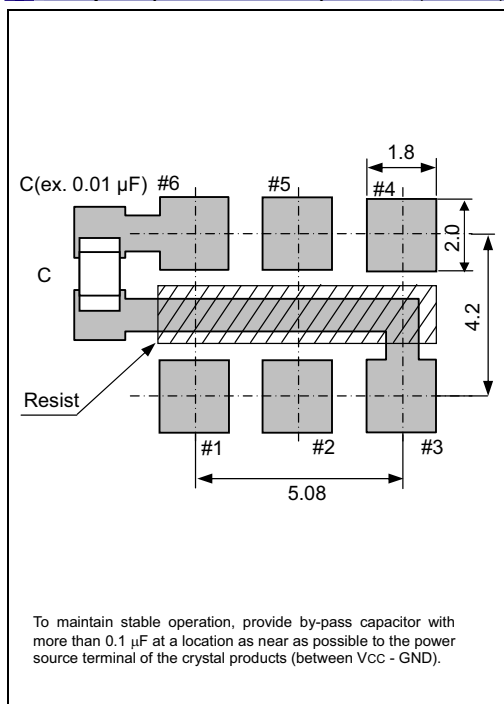
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR (VCXO)

TCO-291J

- Frequency range : 60 MHz to 230 MHz
- Supply voltage : 3.3 V
- Frequency control range : $\pm 100 \times 10^{-6}$
- Features : Wide frequency control range
: With HFF-XTAL technology
: Fundamental oscillation



Product Number (please contact us)
X1G000881xxxx00



Actual size



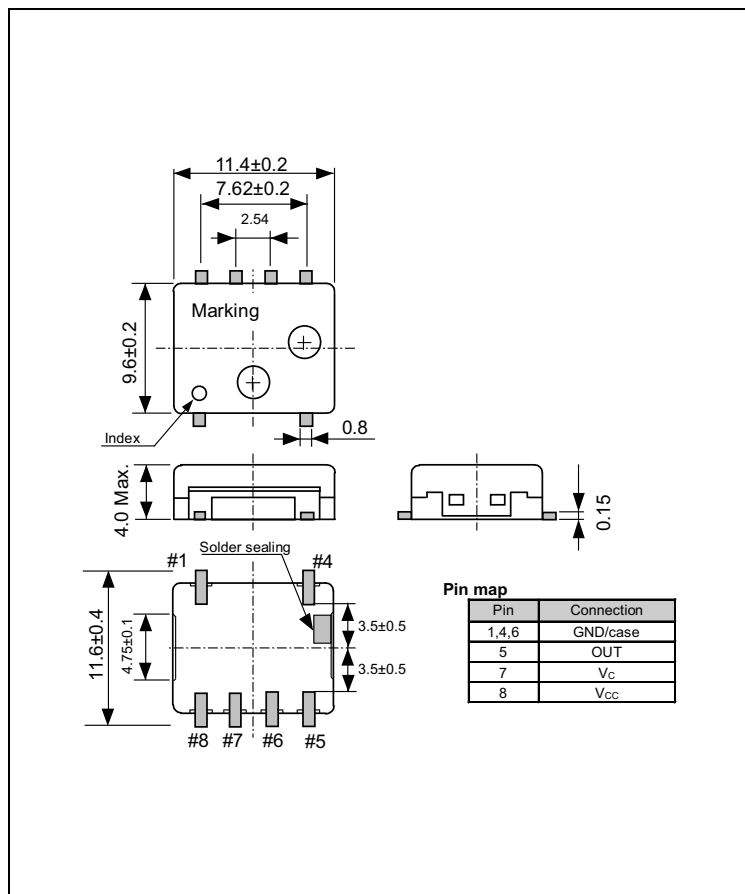
Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Output frequency range	f_o	60.000 MHz to 230.000 MHz	
Supply voltage	Vcc	3.3 V ± 0.165 V	
Storage temperature range	T_stg	-45 °C to +90 °C	Store as bare product after unpacking
Operating temperature range	T_use	-40 °C to +85 °C	
Frequency tolerance *1	f_tol	$\pm 35 \times 10^{-6}$ Max.	-40 °C to +85 °C
Current consumption	Icc	30 mA Max.	
Frequency control range	f_cont	$\pm 100 \times 10^{-6}$ Min.	Vc= 1.65 V ± 1.65 V
Input resistance	Rin	100 k Ω Min.	DC level
Frequency change polarity	—	Positive slope	Vc= 0 V to 3.3 V
Output load condition	RL	50 Ω (0 dBm Min.)	
Start-up time	t_str	10 ms Max.	Time at minimum supply voltage to be 0 s.
Frequency aging	f_aging	$\pm 5 \times 10^{-6}$ / year Max.	+25 °C, First year

*1 This does not include initial frequency tolerance because frequency is adjustable.

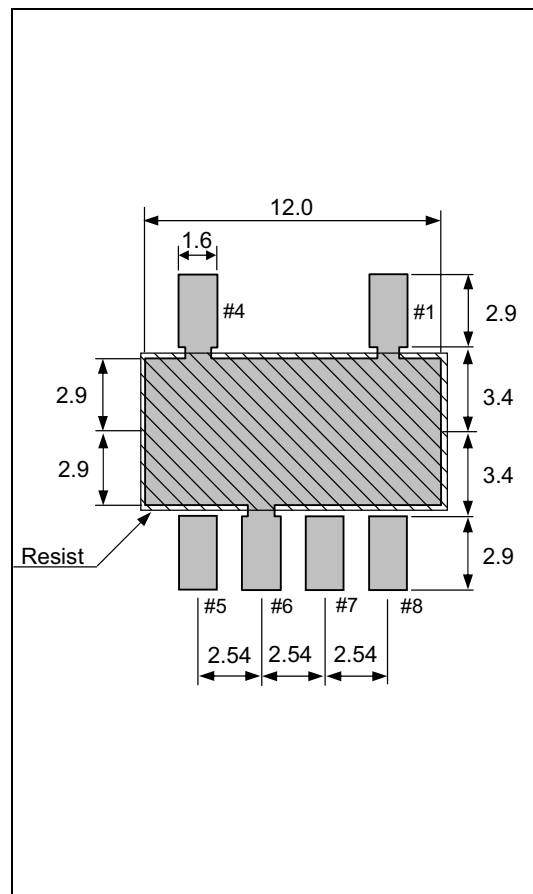
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





VOLTAGE -CONTROLLED CRYSTAL OSCILLATOR (VCXO)

TCO - 2000 / 2100 series

- Frequency range : 60 MHz to 800 MHz
- Supply voltage : 3.3 V
- Frequency control range : $\pm 100 \times 10^{-6}$ Min.
- Features : High reliability(20 years aging)
: Wide frequency control range
: Low phase noise, low jitter
: With HFF-XTAL technology
: Fundamental oscillation (60 MHz to 230 MHz)
: Multiplier oscillation (fo>230 MHz)



Product Number (please contact us)
X1G00Xxxxxxx00



Actual size

TCO-2000 Series



TCO-2100 Series



Specifications (characteristics)

Item	Symbol	Specifications		Remarks
		TCO-2002	TCO-2004	
		TCO-2102	TCO-2104	4 pin
				6 pin
Output frequency range	f _o	60.000 MHz to 125.000 MHz		
Supply voltage	V _{cc}	3.3 V ± 0.165 V		
Storage temperature range	T _{stg}	-45 °C to +90 °C		Store as bare product after unpacking
Operating temperature range	T _{use}	-40 °C to +85 °C		
Frequency tolerance	f _{tol}	As per table 1		-40 °C to +85 °C
Current consumption	I _{cc}	50 mA Max.		
Frequency control range	f _{cont}	As per table 1. (V _c =1.65 V ± 1.65 V)		
Absolute pull range	APR	As per table 1		
Input resistance	R _{in}	100 k Ω Min.		DC level
Frequency change polarity	—	Positive slope		V _c = 0 V to 3.3 V or V _c = 0.5 V to 4.5 V
Output load condition (TTL)	L _{TTL}	2 TTL Max.		
Output load condition (CMOS)	L _{CMOS}	—	15 pF Max.	
Start-up time	t _{str}	10 ms Max. *1		
Frequency aging	f _{aging}	As per table 1		+25 °C

Specifications (characteristics)

Item	Symbol	Specifications		Remarks
		TCO-2106	TCO-2107	
				6pin, OE function
Output frequency range	f _o	60.000 MHz to 80.000 MHz		
Supply voltage	V _{cc}	3.3 V ± 0.165 V		
Storage temperature range	T _{stg}	-45 °C to +90 °C		Store as bare product after unpacking
Operating temperature range	T _{use}	-40 °C to +85 °C		
Frequency tolerance	f _{tol}	As per table 1		-40 °C to +85 °C
Current consumption	I _{cc}	30 mA Max.		
Frequency control range	f _{cont}	As per table 1		V _c = 1.65 V ± 1.65 V
Absolute pull range	APR	As per table 1		
Input resistance	R _{in}	100 k Ω Min.		DC level
Frequency change polarity	—	Positive slope		V _c = 0 V to 3.3 V
Output load condition (TTL)	L _{TTL}	2 TTL Max.	—	
Output load condition (CMOS)	L _{CMOS}	—	15 pF Max.	
Start-up time	t _{str}	10 ms Max. *1		
Frequency aging	f _{aging}	As per table 1		+25 °C

Specifications (characteristics)

Item	Symbol	Specifications		Remarks
		TCO-2111	TCO-2114	
				6 pin
Output frequency range	f _o	60.000 MHz to 800.000 MHz	60.000 MHz to 230.000 MHz	
Supply voltage	V _{cc}	3.3 V ± 0.165 V		
Storage temperature range	T _{stg}	-45 °C to +90 °C		Store as bare product after unpacking
Operating temperature range	T _{use}	-40 °C to +85 °C		
Frequency tolerance	f _{tol}	As per table 1		-40 °C to +85 °C
Current consumption	I _{cc}	65 mA Max.	40 mA Max.	
Frequency control range	f _{cont}	As per table 1 (V _c = 1.65 V ± 1.65 V)	As per table 1 (V _c = 1.65 V ± 1.65 V)	
Absolute pull range	APR	As per table 1		
Input resistance	R _{in}	100 k Ω Min.		DC level
Frequency change polarity	—	Positive slope		V _c = 0 V to 3.3 V or V _c = 0.5 V to 4.5 V
Output level	—	LV-PECL	LVDS	
Start-up time	t _{str}	10 ms Max. *1		
Frequency aging	f _{aging}	As per table 1		+25 °C



Specifications (characteristics)

Item	Symbol	Specifications TCO-2131	Remarks
Output frequency range	f_o	60.000 MHz to 700.000 MHz	6pin, OE function
Supply voltage	V_{cc}	3.3 V ± 0.165 V	
Storage temperature range	T_{stg}	-45 °C to +90 °C	Store as bare product after unpacking
Operating temperature range	T_{use}	-40 °C to +85 °C	
Frequency tolerance	f_{tol}	As per table 1	-40 °C to +85 °C
Current consumption	I_{cc}	75 mA Max.	
Frequency control range	f_{cont}	As per table 1	$V_c = 1.65 \text{ V} \pm 1.65 \text{ V}$
Absolute pull range	APR	As per table 1	
Input resistance	R_{in}	100 k Ω Min.	DC level
Frequency change polarity	—	Positive slope	$V_c = 0 \text{ V}$ to 3.3 V
Output load condition	—	LV-PECL	
Start-up time	t_{str}	10 ms Max. *1.	
Frequency aging	f_{aging}	As per table 1	+25 °C

Table 1. Frequency tolerance, Absolute pull range and aging (TCO-2102-xx)

xx	Frequency tolerance	Absolute pull range *4	(Frequency control range)	Aging
AA	$\pm 50 \times 10^{-6}$ Max. *2	$\pm 50 \times 10^{-6}$ Min.	$\pm 100 \times 10^{-6}$ Min.	1 year (First year)
AB		$\pm 100 \times 10^{-6}$ Min.	$\pm 150 \times 10^{-6}$ Min.	
BA	$\pm 60 \times 10^{-6}$ Max. *3	$\pm 50 \times 10^{-6}$ Min.	$\pm 110 \times 10^{-6}$ Min.	20 years
BB		$\pm 100 \times 10^{-6}$ Min.	$\pm 160 \times 10^{-6}$ Min.	

*1 Time at minimum supply voltage to be 0 s.

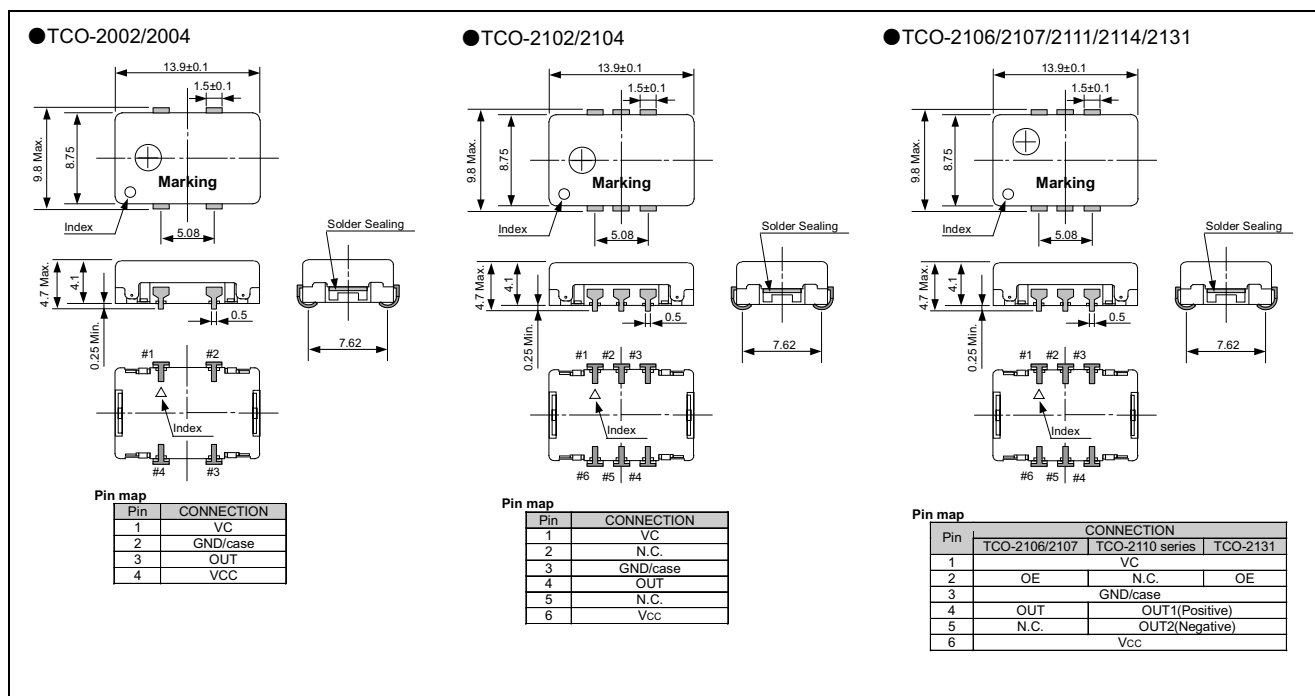
*2 This includes initial frequency tolerance, temperature variation, supply voltage variation and aging (+25°C, 1 year).

*3 This includes initial frequency tolerance, temperature variation, supply voltage variation and aging (+25°C, 20 years).

*4 Absolute pull range = Frequency control range - Frequency tolerance

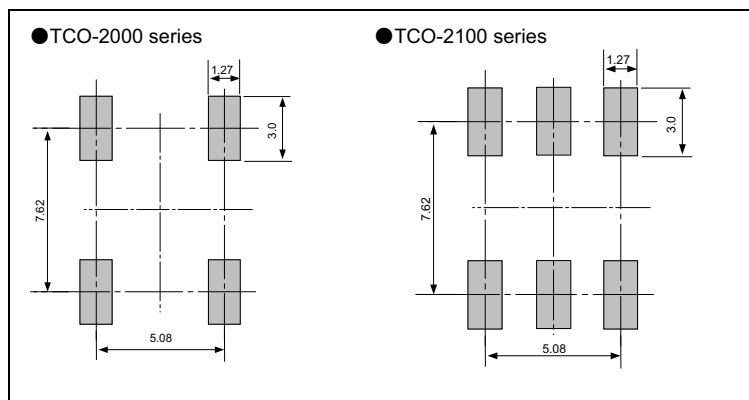
External dimensions

(Unit:mm)



External dimensions

(Unit:mm)



OE terminal

●TCO-2106 / 2107

OE pin = "H" or "open" : Specified frequency output.
 OE pin = "L" : Output is high impedance.

●TCO-2131

OE pin = "L" or "open" : Specified frequency output.
 OE pin = "H" : Output is high impedance.



TCXO 32.768 kHz

TG-3530 SA

- Built-in 32.768 kHz crystal oscillator with high accuracy.
(adjustment-free efficient operation)
- Temperature compensated circuit : Stabilized frequency tolerance at any operating temperature.
- Oscillation output voltage : 1.5 V to 5.5 V
- Temperature Compensated Voltage : 2.2 V to 5.5 V
- 32.768 kHz output : C-MOS output, output load : 15 pF



Product Number (Please contact us)
Q3721SA01xxxx00



Actual size



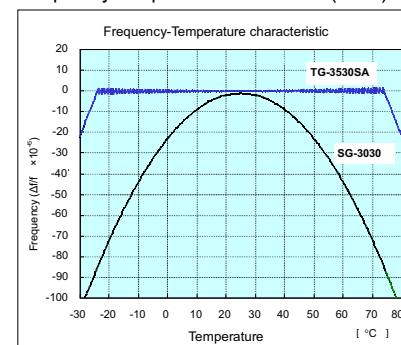
Specifications (characteristics)

Item	Symbol	Specifications	Condition
Output frequency	f_o	32.768 kHz	
Oscillation output voltage	V_{CC}	1.5 V to 5.5 V	
Temperature compensated voltage	V_{CC}	2.2 V to 5.5 V	
Storage temperature	T_{stg}	-55 °C to +125 °C	Store as bare product after unpacking
Operating temperature	T_{use}	-40 °C to +85 °C	
Frequency temperature characteristic	f_o-T_c	$\pm 3.8 \times 10^{-6}$ * Equivalent to 10 seconds of monthly deviation	-10 °C to +60 °C $V_{CC} = 3.0$ V
		$\pm 5.0 \times 10^{-6}$ * Equivalent to 13 seconds of monthly deviation	-20 °C to +70 °C $V_{CC} = 3.0$ V
Frequency voltage coefficient	f_o-V_{CC}	$\pm 1.0 \times 10^{-6} / V$ Max.	+25 °C $V_{CC} = 2.2$ V to 5.5 V
Current consumption	I_{CC}	6.0 μA (Max.) 3.0 μA (Typ.)	$V_{CC} = 5.0$ V, No load condition
		4.0 μA (Max.) 1.7 μA (Typ.)	$V_{CC} = 3.0$ V, No load condition
Output voltage ("H" level)	V_{OH}	$V_{CC} - 0.4$ V Min.	$I_{OH} = -0.1$ mA $V_{CC} = 3.0$ V
Output voltage ("L" level)	V_{OL}	0.4 V Max.	$I_{OL} = 0.1$ mA $V_{CC} = 3.0$ V
Output load condition	L_{CMOS}	15 pF Max.	CMOS load
Symmetry	SYM	40 % to 60 %	$V_{CC} = 1.5$ V to 5.5 V 1/2 V_{CC} level
Rise time	t_r	200 ns Max.	CMOS load 20 % $V_{CC} \rightarrow 80$ % V_{CC}
Fall time	t_f	200 ns Max.	CMOS load 80 % $V_{CC} \rightarrow 20$ % V_{CC}
Start-up time	t_{str}	1.0 s Max. *1)	+25 °C $V_{CC} = 3.0$ V
		3.0 s Max. *1)	-40 °C to +85 °C $V_{CC} = 3.0$ V
Frequency aging	f_{age}	$\pm 3.0 \times 10^{-6} / \text{year}$	+25 °C $V_{CC} = 3.0$ V, first year

*1) V_{CC} rise time < 10ms (10 % V_{CC} - 90 % V_{CC})

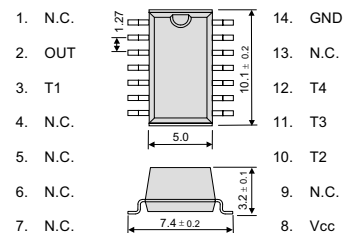
*2) If not specifically indicated, -40 °C to +85 °C.

Frequency temperature coefficient (Ex.)



Terminal connection

TG - 3530 SA



SOP - 14 pin

Signal Name	Input / Output	Function
V_{CC}	—	Connected to a positive power supply.
OUT	OUTPUT	32.768 kHz clock output pin (C-MOS).
GND	—	Connected to a ground.
T1, T2, T3, T4	—	* Used by the manufacture for testing. (Do not connect externally.)

REAL TIME CLOCK IC. For TG-3530SA

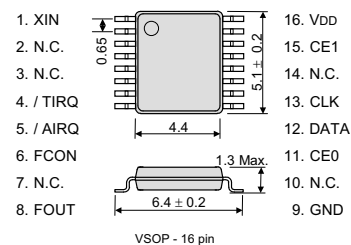
RX-4574 SG

- By combining TG-3530SA with RX-4574SG (real-time clock IC), it is possible to achieve a very high accuracy clock system.
- Functions are compatible with RX-4574 LC and RTC-4574 series (except 32 kHz oscillation function).
- Complies with EU RoHS directive

Note) RX-4574SG does not include the crystal unit.
The external clock resources (CMOS) of 32.768 kHz are necessary.
Please input it from the XIN terminal.

Pin map

RX - 4574 SG



VSOP - 16 pin



TCXO ULTRA MINIATURE SIZE LOW PROFILE

TG-5021BA

- Frequency range : 13 MHz to 52 MHz
- Supply voltage : 2.8 V Typ.
- Frequency / temperature characteristics : $\pm 2.0 \times 10^{-6}$ Max.
- External dimensions : $2.1 \times 1.7 \times 0.75$ t (mm) Typ.
- Applications : Cellular phone(GSM,CDMA,WCDMA)
- Features : World's smallest size,Low Noise



Product Number (Please contact us)
X1G003571xxxx00



Actual size



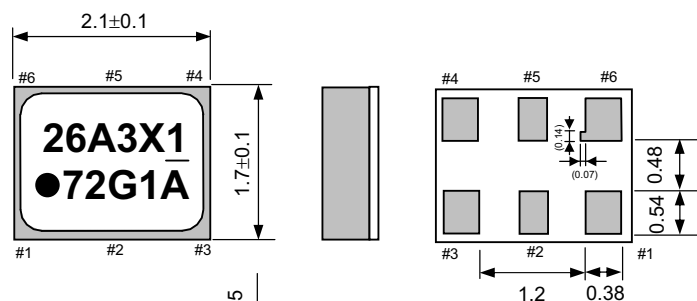
Specifications (characteristics)

Item		Symbol	Specifications		Remarks
			VC-TCXO	TCXO	
Output frequency range		f ₀	13.000 MHz to 52.000 MHz		Standard frequency
			13 MHz, 19.2 MHz, 26 MHz, 27.456 MHz,38.4 MHz		
Supply voltage		V _{cc}	2.8 V±0.14 V		Supply voltage range :2.3 V to 3.6 V
Temperature range	Storage temperature	T _{stg}	-40 °C to +85 °C		Store as bare product after unpacking
	Operating temperature	T _{use}	-30 °C to +85 °C		
Frequency tolerance		f _{tol}	±2.0 ×10 ⁻⁶ Max.		After reflow, V _c =1.4 V, +25 °C
Frequency / temperature characteristics		f ₀ -T _c	±2.0 × 10 ⁻⁶ Max.		-30 °C to +85 °C
Frequency / load coefficient		f ₀ -Load	±0.2 × 10 ⁻⁶ Max.		10 kΩ // 10 pF ±10 %
Frequency / voltage coefficient		f ₀ -V _{cc}	±0.2 ×10 ⁻⁶ Max.		2.8 V ± 0.14 V
Frequency aging		f _{age}	±1.0 × 10 ⁻⁶ Max.		+25 °C, First year, 13 MHz≤f ₀ ≤40 MHz
			±1.5 × 10 ⁻⁶ Max.		+25 °C, First year, 40 MHz<f ₀ ≤52 MHz
Current consumption		I _{cc}	2.0 mA Max.		
Input resistance		R _{in}	500 kΩ Min.	—	V _c -GND(DC)
Frequency control range		f _{cont}	±5.0 × 10 ⁻⁶ to ±12.0 ×10 ⁻⁶	—	V _c =1.4 V ±1.0 V
Frequency change polarity		—	Positive polarity		—
Symmetry		SYM	40 % to 60 %		GND level (DC cut)
Output voltage		V _{PP}	0.8 V Min.		Peak to peak
Load resistance		Load_R	10 kΩ		DC cut capacitor = 0.01 μF
Load capacitance		Load_C	10 pF		

Note:Please contact us for inquiries about specifications other than the above.

External dimensions

(Unit:mm)



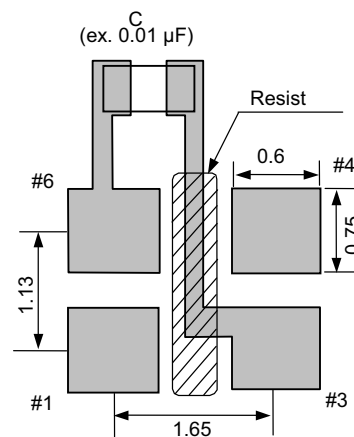
Pin map

Pin	Connection	
	VC-TCXO	TCXO
1	V _c	N.C.
2	TEST	
3	GND	
4	OUT	
5	TEST	
6	V _{cc}	

TEST pin : Do not connect externally.
(Recommend the design without the footprint.)

Footprint (Recommended)

(Unit:mm)



To maintain stable operation, provide by-pass capacitor with more than 0.1 μ F at a location as near as possible to the power source terminal of the crystal products (between V_{cc} - GND).



TCXO

MINIATURE SIZE LOW PROFILE

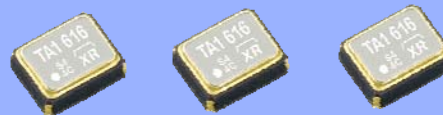
HIGH STABILITY

TG-5021CG

- Frequency range : 13 MHz to 52 MHz
- Supply voltage : 2.8 V Typ.
- Frequency / temperature characteristics : $\pm 2.0 \times 10^{-6}$ Max.
- External dimensions : $2.5 \times 2.0 \times 0.8$ t (mm) Typ.
- Applications : Cellular phone(CDMA,WCDMA,GSM)
- Features : Low noise



Product Number (Please contact us)
X1G003581xxxx00



Actual size



NEW

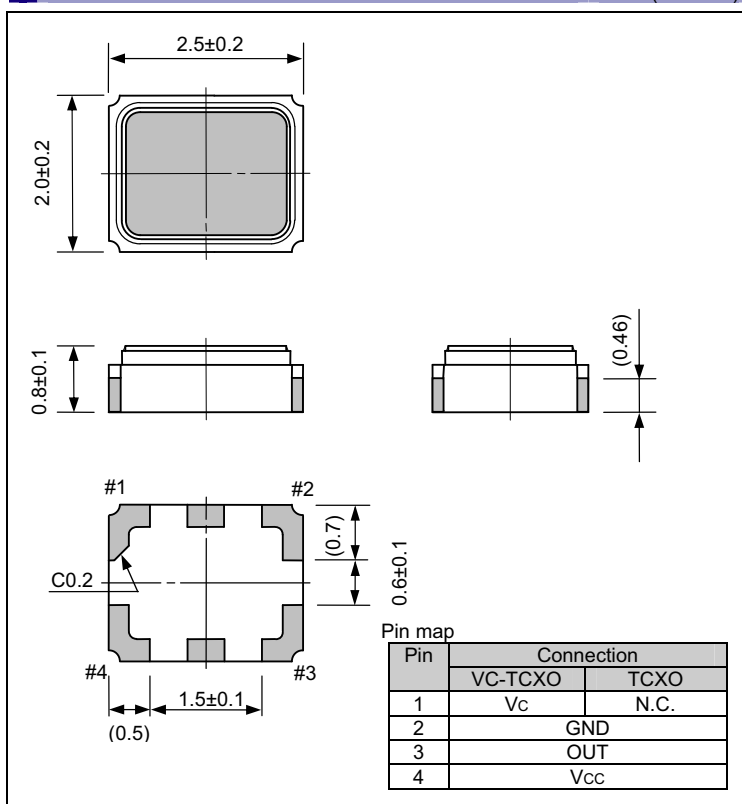
Specifications (characteristics)

Item		Symbol	Specifications		Remarks
			VC-TCXO	TCXO	
Output frequency		f ₀	13.000 MHz to 52.000 MHz		Standard frequency
			13 MHz, 19.2 MHz, 26 MHz, 27.456 MHz, 38.4 MHz		
Supply voltage		V _{cc}	2.8 V±0.14 V		Supply voltage range 2.3 V to 3.6 V
Temperature range	Storage temperature	T _{stg}	-40 °C to +85 °C		Store as bare product after unpacking
	Operating temperature	T _{use}	-30 °C to +85 °C		
Frequency tolerance		f _{tol}	±2.0 ×10 ⁻⁶ Max.		After reflow, V _C =1.4 V, +25 °C
Frequency / temperature characteristics		fo-Tc	±2.0 × 10 ⁻⁶ Max.		-30 °C to +85 °C
Frequency / load coefficient		fo-Load	±0.2 × 10 ⁻⁶ Max.		10 kΩ // 10 pF ±10 %
Frequency / voltage coefficient		fo-Vcc	±0.2 × 10 ⁻⁶ Max.		Vcc=2.8 V ± 0.14 V
Frequency aging		f _{age}	±1.0 × 10 ⁻⁶ Max.		+25 °C, First year, 13 MHz≤f ₀ ≤40 MHz
			±1.5 × 10 ⁻⁶ Max.		+25 °C, First year, 40 MHz<f ₀ ≤52 MHz
Current consumption		I _{cc}	2.0 mA Max.		
Input resistance		R _{in}	500 kΩ Min.	—	Vc- GND (DC)
Frequency control range		f _{cont}	±5.0 × 10 ⁻⁶ to ±12.0 × 10 ⁻⁶	—	Vc=1.4 V ±1.0 V
Frequency change polarity		—	Positive polarity	—	
Symmetry		SYM	40 % to 60 %		GND level (DC cut)
Output voltage		V _{PP}	0.8 V Min.		Peak to peak
Load resistance		Load_R	10 kΩ		DC cut capacitor = 0.01 μF
Load capacitance		Load_C	10 pF		

Note: Please contact us for inquiries about specifications other than the above.

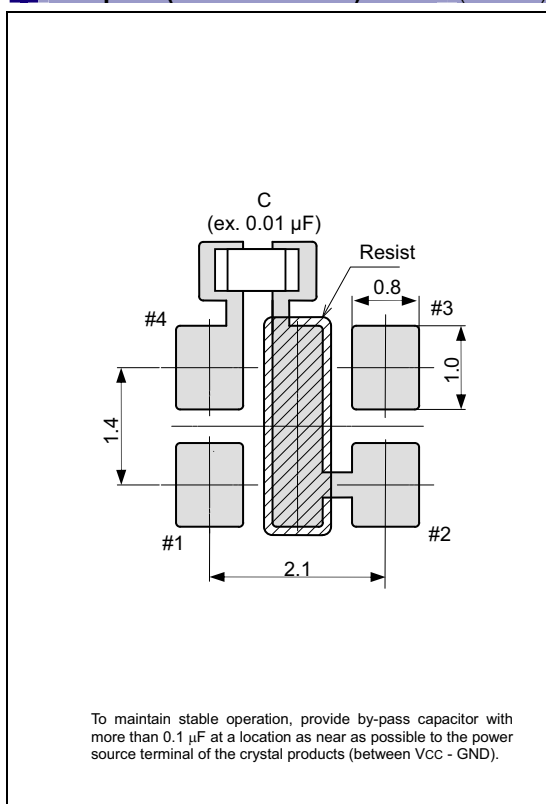
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





TCXO

ULTRA MINIATURE SIZE LOW PROFILE

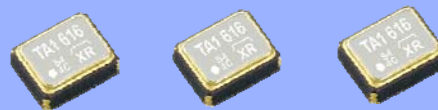
HIGH STABILITY

TG-5025CG

- Frequency range : 13 MHz to 52 MHz
- Supply voltage : 1.8 V Typ.
- Frequency / temperature characteristics : $\pm 0.5 \times 10^{-6}$ Max.
- External dimensions: 2.5 × 2.0 × 0.8 t (mm) Typ.
- Applications : Cellular phone (GPS)
- Features : High stability
- : Low supply voltage (1.8 V)



Product Number (Please contact us)
X1G002771xxxx00



Actual size

**NEW**

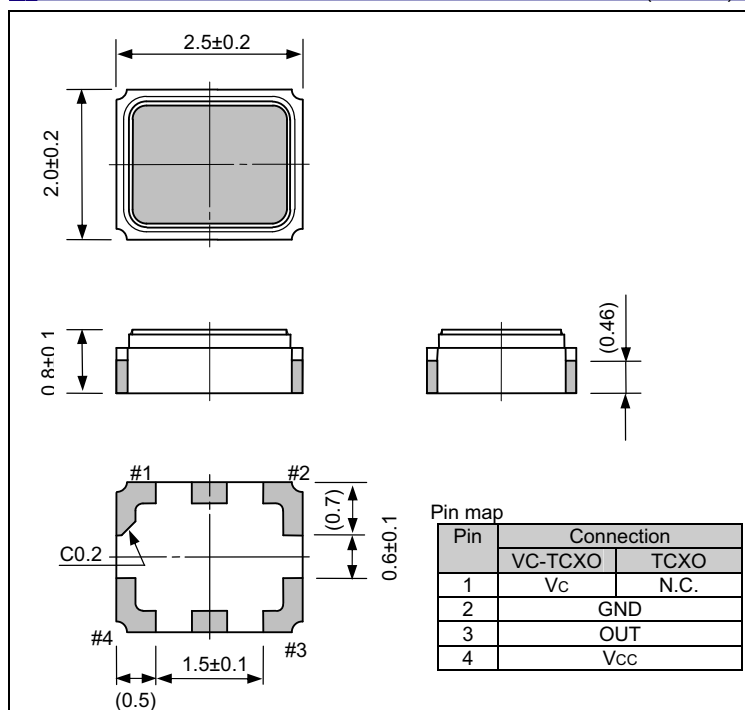
Specifications (characteristics)

Item		Symbol	Specifications		Remarks
			VC-TCXO	TCXO	
Output frequency range		fo	13.000 MHz to 52.000 MHz		Standard frequency
			13 MHz, 16.368 MHz , 19.2 MHz, 26 MHz, 27.456 MHz,38.4 MHz		
Supply voltage		Vcc	1.8 V ±0.1 V		Supply voltage range :1.7 V to 3.3 V
Temperature range	Storage temperature	T_stg	-40 °C to +85 °C		Store as bare product after unpacking
	Operating temperature	T_use	-30 °C to +85 °C		
Frequency tolerance		f_tol	±2.0 × 10 ⁻⁶ Max.		After reflow Vc=0.9 V, +25 °C
Frequency/temperature characteristics		fo-Tc	±0.5 × 10 ⁻⁶ Max.		-30 °C to +85 °C
Frequency/load coefficient		fo-Load	±0.2 × 10 ⁻⁶ Max.		10 kΩ // 10 pF ±10 %
Frequency/voltage coefficient		fo-Vcc	±0.2 × 10 ⁻⁶ Max.		Vcc=1.8 V ±0.1 V
Frequency aging		f_age	±1.0 × 10 ⁻⁶ Max.		+25 °C, First year, 13 MHz≤fo≤40 MHz
			±1.5 × 10 ⁻⁶ Max.		+25 °C, First year, 40 MHz<fo≤52 MHz
Current consumption		Icc	2.0 mA Max.		13 MHz≤fo≤40 MHz
			2.5 mA Max.		40 MHz<fo≤52 MHz
Input resistance		Rin	500 kΩ Min.	—	Vc- GND (DC)
Frequency control range		f_cont	±5.0 × 10 ⁻⁶ to ±12.0 × 10 ⁻⁶	—	Vc=0.9 V ±0.6 V
Frequency change polarity		—	Positive polarity	—	
Symmetry		SYM	40 % to 60 %		GND level (DC cut)
Output voltage		Vpp	0.8 V Min.		Peak to peak
Output load condition		Load_R	10 kΩ		DC cut capacitor = 0.01 μF
		Load_C	10 pF		

* Note : Please contact us for inquiries about specifications other than the above.

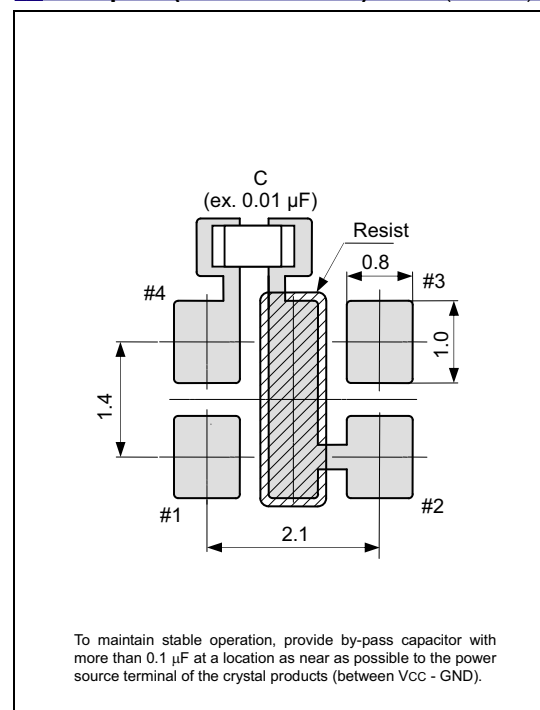
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





TCXO

MINIATURE SIZE LOW PROFILE

HIGH STABILITY

TG-5005CE

- Frequency range : 10 MHz to 40 MHz
- Supply voltage : 2.8 V Typ.
- Frequency / temperature characteristics : $\pm 0.5 \times 10^{-6}$ Max.
- External dimensions : $3.2 \times 2.5 \times 0.9$ t (mm) Typ.
- Applications : Cellular phone(GPS)
- Features : High frequency stability
: Low current consumption



Product Number (Please contact us)
X1G001521xxxx00



Actual size



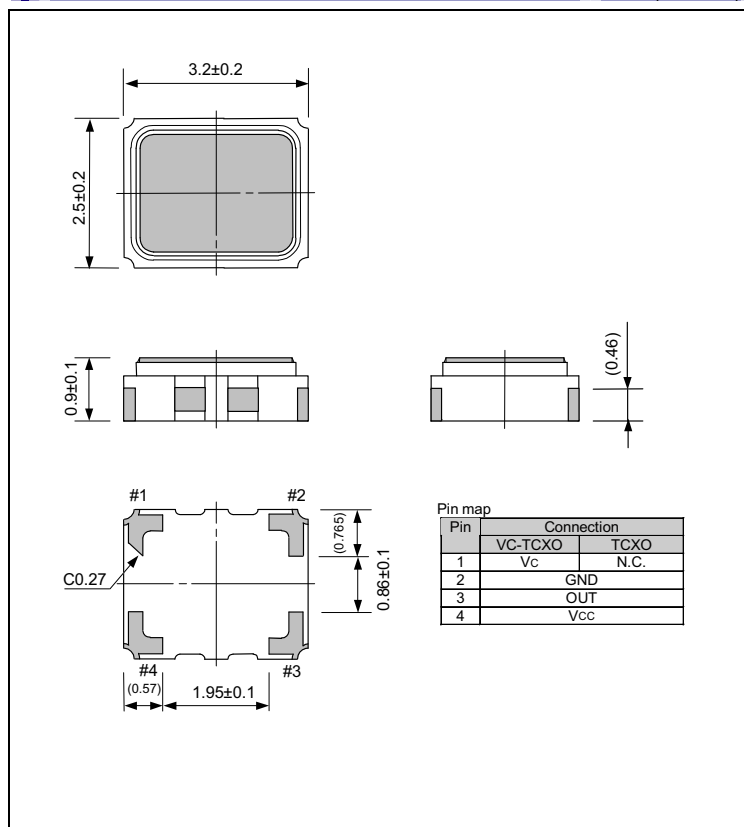
Specifications (characteristics)

Item		Symbol	Specifications		Remarks
			VC-TCXO	TCXO	
Output frequency range		f ₀	10.000 MHz to 40.000 MHz		Standard frequency
			16.369 MHz, 24.5535 MHz, 26 MHz, 27.456 MHz		
Supply voltage		V _{cc}	2.8 V±0.14 V		Supply voltage range : 2.3 V to 3.6 V
Temperature range	Storage temperature	T _{stg}	-40 °C to +85 °C		Store as bare product after unpacking
	Operating temperature	T _{use}	-30 °C to +85 °C		
Frequency tolerance		f _{tol}	±2.0 ×10 ⁻⁶ Max.		After reflow, V _c =1.4 V, +25 °C
Frequency / temperature characteristics		fo-T _c	±0.5 × 10 ⁻⁶ Max.		-30 °C to +85 °C
Frequency / load coefficient		fo-Load	±0.2 × 10 ⁻⁶ Max.		10 kΩ // 10 pF ±10 %
Frequency / voltage coefficient		fo-V _{cc}	±0.2 ×10 ⁻⁶ Max.		2.8 V ± 0.14 V
Frequency aging		f _{age}	±1.0 ×10 ⁻⁶ Max.		+25 °C, First year
Current consumption		I _{cc}	2.0 mA Max.		V _{cc} =2.8 V, 10 kΩ// 10 pF
Input resistance		R _{in}	500 kΩ Min.	—	V _c - GND (DC)
Frequency control range		f _{cont}	±5.0 × 10 ⁻⁶ to ±12.0 ×10 ⁻⁶	—	V _c =1.4 V ±1.0 V
Frequency change polarity		—	Positive polarity	—	
Symmetry		SYM	40 % to 60 %		GND level (DC cut)
Output voltage		V _{pp}	0.8 V Min.		Peak to peak
Load resistance		Load _R	10 kΩ		DC cut capacitor = 0.01 μF
Load capacitance		Load _C	10 pF		

Note: Please contact us for inquiries about specifications other than the above.

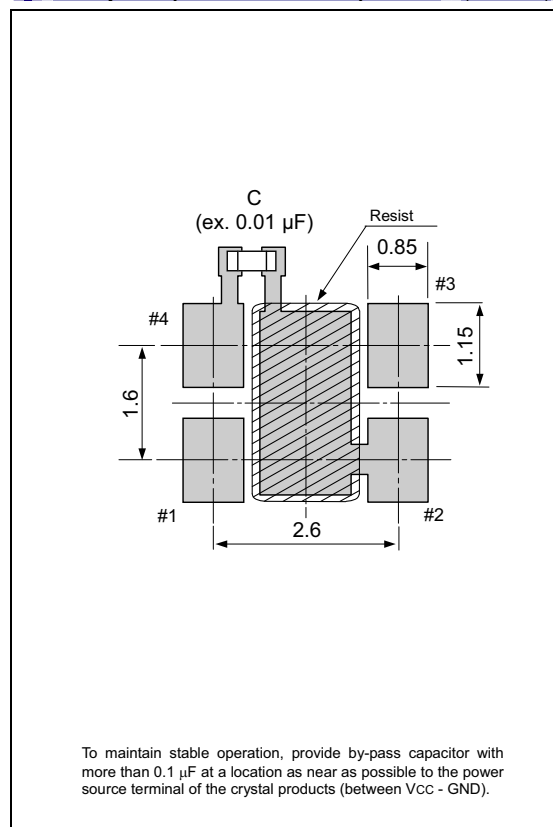
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





TCXO MINIATURE SIZE LOW PROFILE

TG-5010LH

- Frequency range : 10 MHz to 40 MHz
- Supply voltage : 2.8 V Typ.
- Frequency / temperature characteristics : $\pm 2 \times 10^{-6}$ Max.
- External dimensions : $3.3 \times 2.5 \times 0.96$ t (mm) Typ.
- Applications : Cellular phone(GSM,CDMA,WCDMA)
- Features : Miniature size (J-Lead type)
: Low current consumption



Product Number (Please contact us)
Q3716LH01xxxx00



Actual size



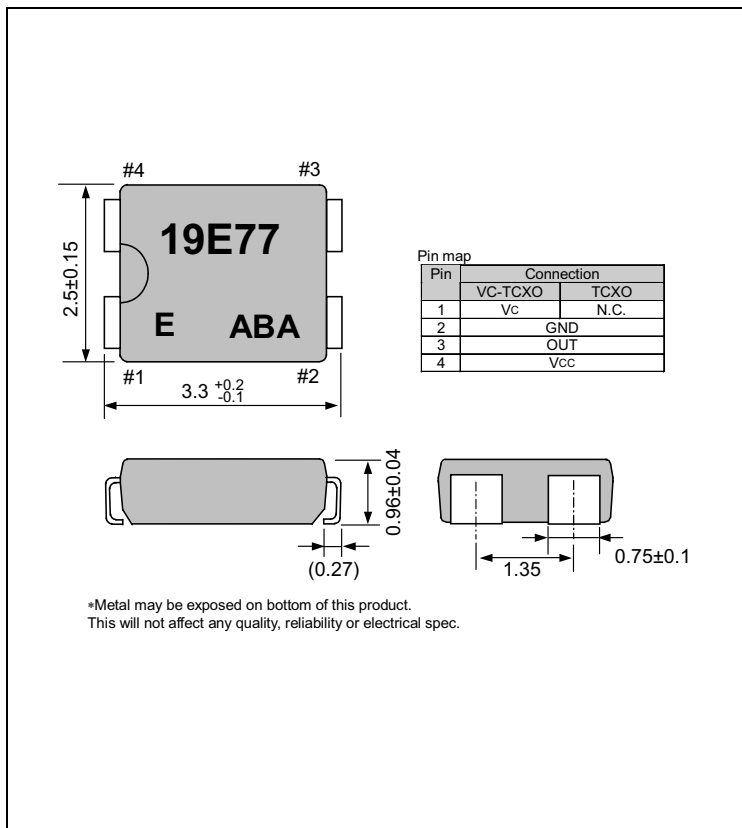
Specifications (characteristics)

Item		Symbol	Specifications		Remarks
			VC-TCXO	TCXO	
Output frequency		f ₀	10.000 MHz to 40.000 MHz		Standard frequency
			13 MHz, 19.2 MHz, 26 MHz,27.456 MHz		
Supply voltage		V _{cc}	2.8 V±0.14 V		Supply voltage range :2.3 V to 3.6 V
Temperature range	Storage temperature	T _{stg}	-40 °C to +85 °C		Store as bare product after unpacking
	Operating temperature	T _{use}	-30 °C to +85 °C		
Frequency tolerance		f _{tol}	±2.0 ×10 ⁻⁶ Max.		After reflow, V _c =1.4 V, +25 °C
Frequency / temperature characteristics		f ₀ -T _c	±2.0 × 10 ⁻⁶ Max.		-30 °C to +85 °C
Frequency / load coefficient		f ₀ -Load	±0.2 × 10 ⁻⁶ Max.		10 kΩ // 10 pF ±10 %
Frequency / voltage coefficient		f ₀ -V _{cc}	±0.2 ×10 ⁻⁶ Max.		2.8 V ± 0.14 V
Frequency aging		f _{age}	±1.0 ×10 ⁻⁶ Max.		+25 °C, First year
Current consumption		I _{cc}	2.0 mA Max.		V _{cc} =2.8 V, 10 kΩ// 10 pF
Input resistance		R _{in}	500 kΩ Min.	—	V _c - GND (DC)
Frequency control range		f _{cont}	±5.0 × 10 ⁻⁶ to ±12.0 ×10 ⁻⁶	—	V _c =1.4 V ±1.0 V
Frequency change polarity		—	Positive polarity	—	
Symmetry		SYM	40 % to 60 %		GND level (DC cut)
Output voltage		V _{PP}	0.8 V Min.		Peak to peak
Load resistance		Load_R	10 kΩ		DC cut capacitor = 0.01 μF
Load capacitance		Load_C	10 pF		

Note:Please contact us for inquiries about specifications other than the above.

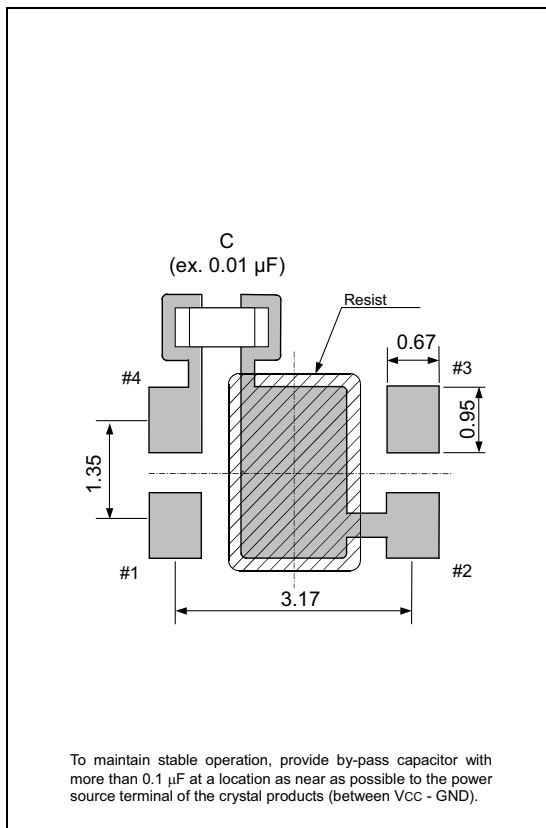
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





TCXO MINIATURE SIZE LOW PROFILE

TCO - 5860 series

- Frequency range : 10 MHz to 40 MHz
- Supply voltage : 2.8 V Typ.
- Frequency / temperature coefficient : $\pm 2 \times 10^{-6}$ Max.
- External dimensions: 3.2 × 2.5 × 0.9 t (mm) Typ.
- Applications : Cellular phone (WiMAX, CDMA, WCDMA)
- Features : Low current consumption



Product Number (Please contact us)
X1G0014xxxxxx00



Actual size



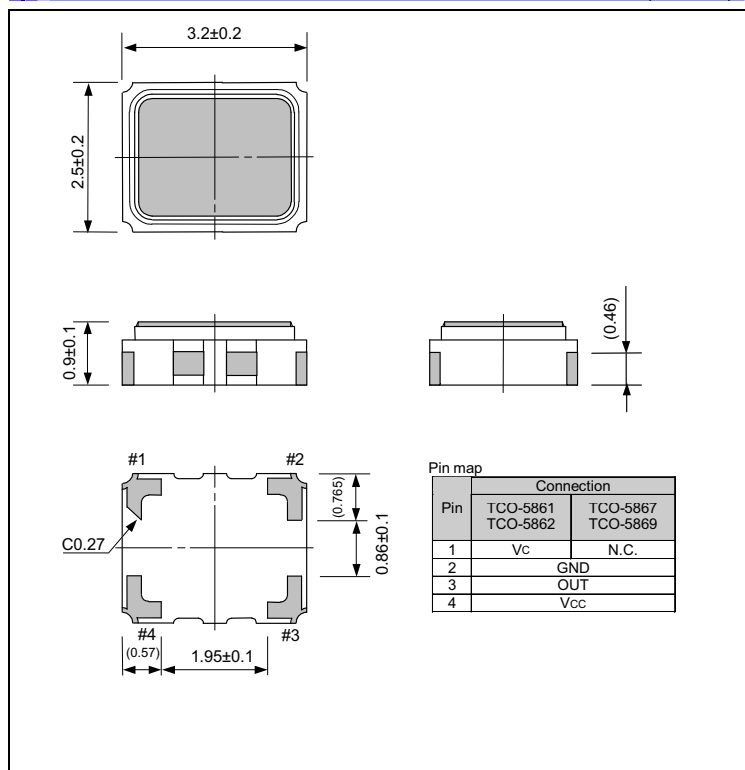
Specifications (characteristics)

Item	Symbol	VC-TCXO		TCXO		Remarks
		TCO-5861	TCO-5862	TCO-5867	TCO-5869	
Output frequency range	f _o	16 MHz to 40 MHz	10 MHz to 20 MHz	16 MHz to 40 MHz		
		16 MHz, 20 MHz , 38.4 MHz , 40 MHz				Standard frequency
Supply voltage	V _{cc}	2.8 V ±0.14 V				Supply voltage range : 2.3 V to 3.6 V
Storage temperature	T _{stg}	-40 °C to +85 °C				Store as bare product after unpacking
Operating temperature	T _{use}	-30 °C to +85 °C				
Frequency tolerance	f _{tol}	±2.0 × 10 ⁻⁶ Max.				After reflow V _c =1.4 V, +25 °C
Frequency/temperature characteristics	f _o -T _c	±2.0 × 10 ⁻⁶ Max.				-30 °C to +85 °C
Frequency/load coefficient	f _o -Load	±0.2 × 10 ⁻⁶ Max.				10 kΩ // 10 pF ± 10 %
Frequency/voltage coefficient	f _o -V _{cc}	±0.2 × 10 ⁻⁶ Max.				V _{cc} =2.8 V ±0.14 V
Frequency aging	f _{age}	±1.0 ×10 ⁻⁶ Max.				+25 °C, First year
Current consumption	I _{cc}	2.0 mA Max.				
Input resistance	R _{in}	500 kΩ Min.		—		V _c - GND (DC)
Frequency control range	f _{cont}	±5.0 × 10 ⁻⁶ to ±12.0 × 10 ⁻⁶		—		V _c =1.4 V ±1.0 V
Frequency change polarity	—	Positive polarity		—		
Symmetry	SYM	40 % to 60 %				GND level (DC cut)
Output voltage	V _{pp}	0.8 V Min.				Peak to peak
Output load condition	Load_R	10 kΩ				DC cut capacitor = 0.01 μF
	Load_C	10 pF				

* Note : Please contact us for inquiries about specifications other than the above.

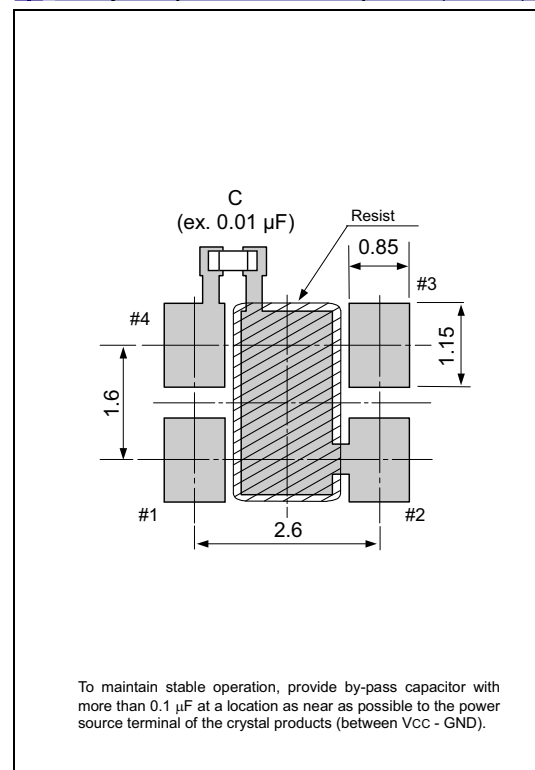
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





TCXO HIGH-STABILITY

TCO - 5060 / 5160 series

- Frequency range : 10 MHz to 51.84 MHz
- Supply voltage : 3.3 V Typ.
- External dimensions: 7.0 × 5.0 × 1.9 t (mm) Typ.
- Applications : Base station, Transmission Measurement Equipment
- Function : Output enable(OE)
- Features : High frequency stability
: CMOS Output



Product Number (Please contact us)
X1G00xxxxxxx00



Actual size



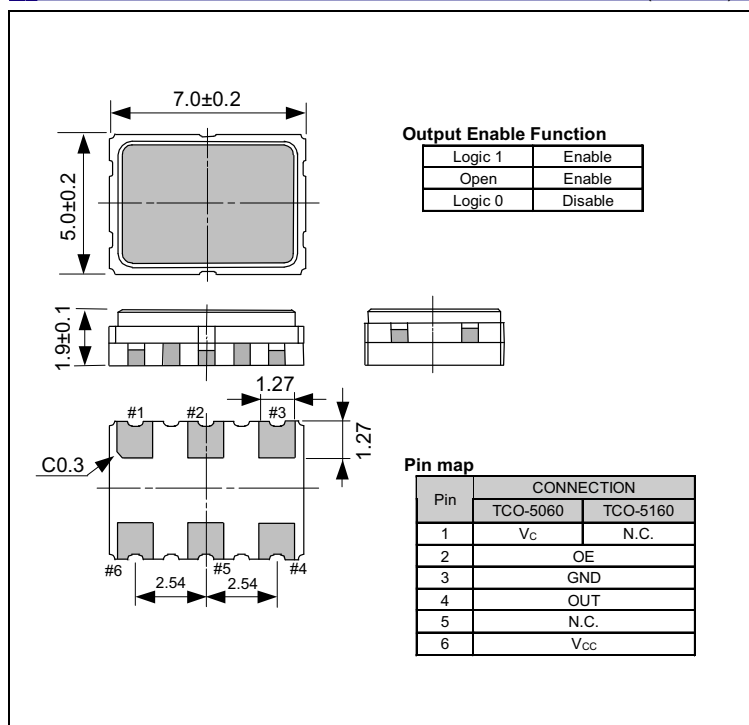
Specifications (characteristics)

Item	Symbol	VC-TCXO	TCXO	Remarks
		TCO-5060	TCO-5160	
Output frequency range	f _o	10.000 MHz to 51.840 MHz 10 MHz, 19.44 MHz, 20 MHz, 24.576 MHz, 38.88 MHz, 40 MHz, 49.152 MHz, 51.84 MHz		Standard frequency
Supply voltage	V _{cc}	3.3 V ±0.165 V		Supply voltage range : 2.8 V to 5.5 V
Storage temperature range	T _{stg}	-40 °C to +85 °C		Store as bare product after unpacking
Operating temperature range	T _{use}	-40 °C to +85 °C		
Frequency tolerance	f _{tol}	±2.0 × 10 ⁻⁶ Max.		After reflow V _c =1.65 V, +25 °C
Frequency/temperature characteristics	f _o -T _c	±1.0 × 10 ⁻⁶ Max.		-40 °C to +85 °C
Frequency/voltage coefficient	f _o -V _{cc}	±0.5 × 10 ⁻⁶ Max.		V _{cc} =3.3 V ±0.165 V
Frequency aging	f _{age}	±1.0 × 10 ⁻⁶ Max. / year (First year) ±5.0 × 10 ⁻⁶ Max. / 10 years		+25 °C, 10 MHz to 30 MHz
		±2.0 × 10 ⁻⁶ Max. / year (First year) ±10.0 × 10 ⁻⁶ Max. / 10 years		+25 °C, 30.1 MHz to 51.84 MHz
Current consumption	I _{cc}	10.0 mA Max.		
Input resistance	R _{in}	100 kΩ Min.	—	
Frequency control range	f _{cont}	±5.0 × 10 ⁻⁶ to ±25.0 × 10 ⁻⁶	—	V _c =1.65 V ±1.65 V
Frequency change polarity	—	Positive polarity	—	
Output voltage	V _{pp}	CMOS V _{OL} = 10 % V _{CC} Max. V _{OH} = 90 % V _{CC} Min.		
Symmetry	SYM	40 % to 60 %		50 % V _{CC} level
Output load condition (CMOS)	L _{CMOS}	15 pF		

* Note : Please contact us for inquiries about specifications other than the above.

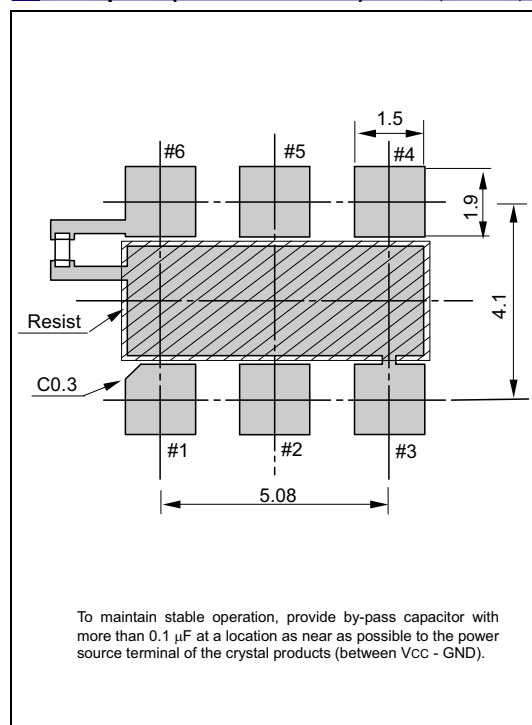
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





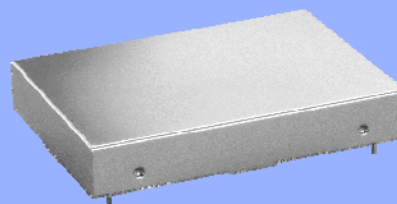
Oven Controlled Crystal Oscillator (OCXO)

TCO-6831 series

- Features
 - : Very fast warm-up and accurate stability
 - : Guarantee long term stability
 - : SC-Cut Crystal unit



Product number (please contact us)
X1G002331xxxx00

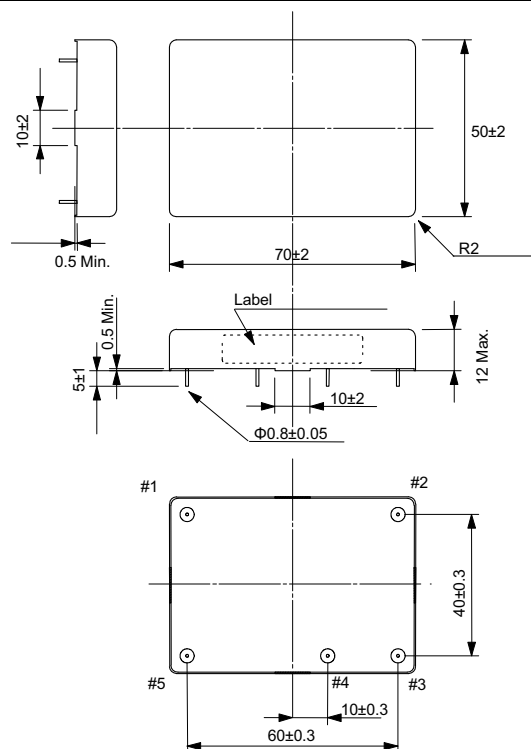


Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Output frequency range	f_o	5 MHz to 10 MHz	
		5 MHz, 10 MHz	Standard frequency
Supply voltage	V_{cc}	5 V $\pm$ 0.25 V	
Storage temperature range	T_{stg}	-20 °C to +80 °C	During transport only. Long term storage: Room temperature.
Operating temperature range	T_{use}	0 °C to +70 °C	
Frequency/temperature characteristics	f_o -Tc	$\pm 8 \times 10^{-9}$ Max.	0 °C to +70 °C
Frequency/voltage coefficient	f_o -Vcc	$\pm 2 \times 10^{-9}$ Max.	Vcc=5 V $\pm$ 0.25 V
Frequency aging	f_{age}	$\pm 2 \times 10^{-9}$ / day Max. $\pm 2 \times 10^{-8}$ / year Max.	5 MHz
Warm-up	—	$\pm 1 \times 10^{-7}$ Max. / 5 min	+25 °C
Current consumption	Warm-up	1600 mA Max.	
	Steady state	850 mA Max.	at +25 °C
Frequency control range	f_{cont}	$\pm 1 \times 10^{-7}$ Min. to $\pm 3 \times 10^{-7}$ Max.	Vc=2.5 V $\pm$ 2.0 V
Symmetry	SYM	45 % to 55 %	(V _{OH} - V _{OL})/2
High output voltage	V _{OH}	2.4 V Min.	3.3 V Level CMOS
Low output voltage	V _{OL}	0.4 V Max.	
Load resistance	Load_R	10 k Ω	
Load capacitance	Load_C	15 pF	
Weight	—	100 g Max.	

External dimensions

(Unit:mm)



Pin map

Pin	CONNECTION
1	Vc
2	GND
3	OUT
4	N.C.
5	Vcc



Oven Controlled Crystal Oscillator (OCXO)

TCO-676 series

- Features : Compact and low profile
- : Very fast warm-up
- : SC-Cut Crystal unit



Product number (please contact us)
X1G002291xxxx00

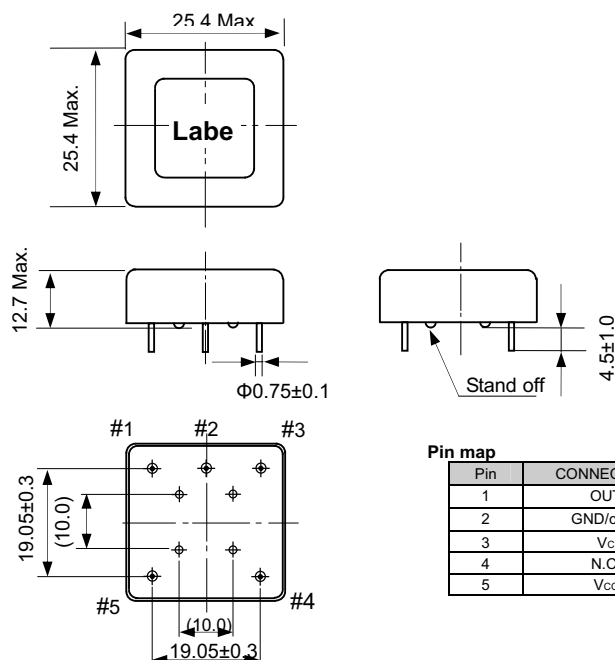


Specifications (characteristics)

Item		Symbol	Specifications			Remarks
			TCO-676R3	TCO-676R2	TCO-676R	
Output frequency range		f _o	10 MHz to 20 MHz			Standard frequency
			17 MHz	10 MHz		
Supply voltage		V _{cc}	3.3 V ±0.165 V	5 V ±0.25 V	12 V ±0.6 V	
Storage temperature range		T _{stg}	-20 °C to +80 °C			During transport only. Long term storage:Room Temperature
Operating temperature range		T _{use}	-10 °C to +70 °C			
Frequency/temperature characteristics		f _o -T _c	±2 × 10 ⁻⁸ Max.			-10 °C to +70 °C
Frequency/voltage coefficient		f _o -V _{cc}	±5 × 10 ⁻⁹ Max. V _{cc} =3.3 V ±0.165 V	±5 × 10 ⁻⁹ Max. V _{cc} =5 V ±0.25 V	±5 × 10 ⁻⁹ Max. V _{cc} =12 V ±0.6 V	
Frequency aging		f _{age}	±1 × 10 ⁻⁸ / day Max. ±1 × 10 ⁻⁷ / year Max.			
Warm-up		—	±5 × 10 ⁻⁸ / 5 min Max.			+25 °C
Current consumption	Warm-up	I _{cc}	1150 mA Max.	700 mA Max.	300 mA Max.	
	Steady state		650 mA Max.	300 mA Max.	130 mA Max.	at +25 °C
Frequency control range		f _{cont}	±1 × 10 ⁻⁶ Min. V _c =1.65 V ±1.65 V	±1 × 10 ⁻⁶ Min. V _c =2.5 V ±2.5 V		
Symmetry		SYM	45 % to 55 %			(V _{OH} -V _{OL})/2
High output voltage		V _{OH}	2.4 V Min.	4.0 V Min.	4.0 V Min.	V _{cc} =3.3 V:3.3 V Level CMOS
Low output voltage		V _{OL}	0.4 V Max.	0.5 V Max.	0.5 V Max.	V _{cc} =5 V,12 V:5 V Level CMOS
Load resistance		Load_R	10 kΩ			
Load capacitance		Load_C	10 pF			
Weight		—	20 g Max.			

External dimensions

(Unit:mm)





Oven Controlled Crystal Oscillator (OCXO)

Product number (please contact us)
X1G002311xxx00

TCO - 679 series

- Features
 - : DIP-14pin package
 - : Very fast warm-up
 - : SC-Cut Crystal unit

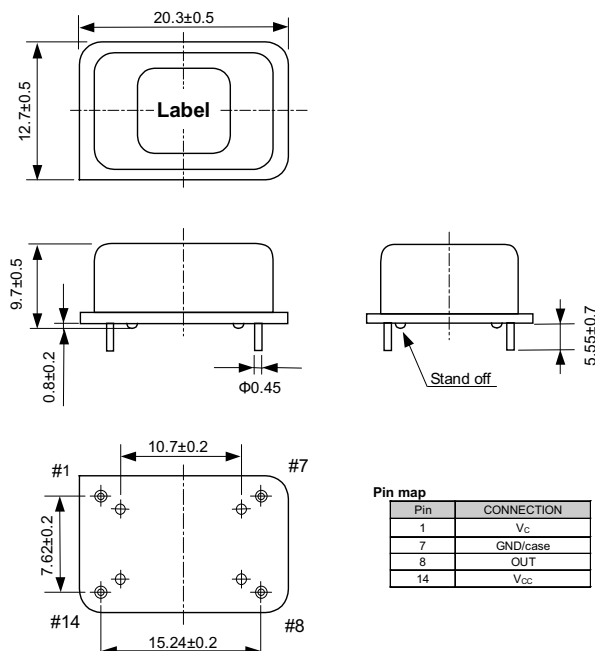


Specifications (characteristics)

Item		Symbol	Specifications		Remarks
			TCO-679S1	TCO-679S2	
Output frequency range		f _o	10 MHz to 20 MHz		Standard frequency
			10 MHz		
Supply voltage		V _{cc}	5 V ±0.25 V	12 V ±0.6 V	
Storage temperature range		T _{stg}	-20 °C to +80 °C		During transport only. Long term storage: Room Temperature.
Operating temperature range		T _{use}	0 °C to +70 °C		
Frequency/temperature characteristics		f _o -T _c	±1 × 10 ⁻⁷ Max.		0 °C to +70 °C
Frequency/voltage coefficient		f _o -V _{cc}	±1 × 10 ⁻⁷ Max. V _{cc} =5 V ±0.25 V	±1 × 10 ⁻⁷ Max. V _{cc} =12 V ±0.6 V	
Frequency aging		f _{age}	±5 × 10 ⁻⁸ / day Max. ±5 × 10 ⁻⁷ / year Max.		
Warm-up		—	±5 × 10 ⁻⁷ / 5 min Max.		at +25 °C
Current consumption	Warm-up	I _{cc}	380 mA Max.	160 mA Max.	at +25 °C
	Steady state		160 mA Max.	70 mA Max.	
Frequency control range		f _{cont}	±5 × 10 ⁻⁶ Min. V _c =2.5 V ±2.5 V	±5 × 10 ⁻⁶ Min. V _c =4.5 V ±4.5 V	
Symmetry		SYM	45 % to 55 %		(V _{OH} -V _{OL})/2
High output voltage		V _{OH}	4.0 V Min.		5 V Level CMOS
Low output voltage		V _{OL}	0.5 V Max.		
Load resistance		Load_R	10 kΩ		
Load capacitance		Load_C	15 pF		
Weight		—	10 g Max.		

External dimensions

(Unit:mm)





Oven Controlled Crystal Oscillator (OCXO) DOUBLE OVEN

TCO-6920A

- Features
 - : Ultra-High Stability
 - : Low Phase Noise
 - : SC-Cut Crystal unit
 - : Double Oven



Product number (please contact us)
X1G002341xxxx00

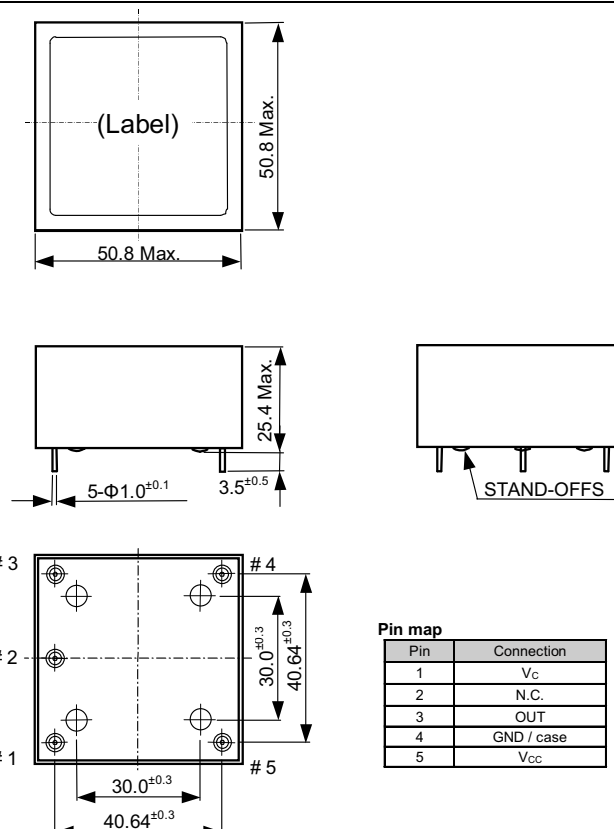


Specifications (characteristics)

Item	Symbol	Specifications	Remarks
		TCO-6920A	
Output frequency	f _o	10 MHz	
Supply voltage	V _{cc}	12 V ± 0.6 V	
Storage temperature range	T _{stg}	-40 °C to +80 °C	During transport only. Long term storage: Room Temperature.
Operating temperature range	T _{use}	-30 °C to +70 °C	
Frequency/temperature characteristics	f _o -T _c	±5 × 10 ⁻¹⁰ Max.	-30 °C to +70 °C
Frequency/voltage coefficient	f _o -V _{cc}	±2 × 10 ⁻¹⁰ Max.	V _{cc} =12 V ± 0.6 V
Frequency aging	f _{age}	±5 × 10 ⁻¹¹ / day Max.	After 30 days of operation
Warm-up	—	±2 × 10 ⁻⁸ / 10 min Max.	+25 °C
Output Waveform	—	Sine wave	
Load resistance	Load _R	50 Ω (5 dBm Min.)	
Current consumption	Warm-up	1050 mA Max.	
	Steady state at +25 °C		
Frequency control range	f _{cont}	±3 × 10 ⁻⁷ Min.	V _c =5 V ± 5 V
Weight	—	100 g Max.	

External dimensions

(Unit:mm)





Oven Controlled Crystal Oscillator (OCXO)

OX-6501GG series

- Features
 - : Low profile full SMD package
 - : Very fast warm-up and accurate stability
 - : IPC/JEDEC J-STD-020D reflowable
 - : SC-Cut Crystal unit



Product number (please contact us)
X1G002901xxxx00

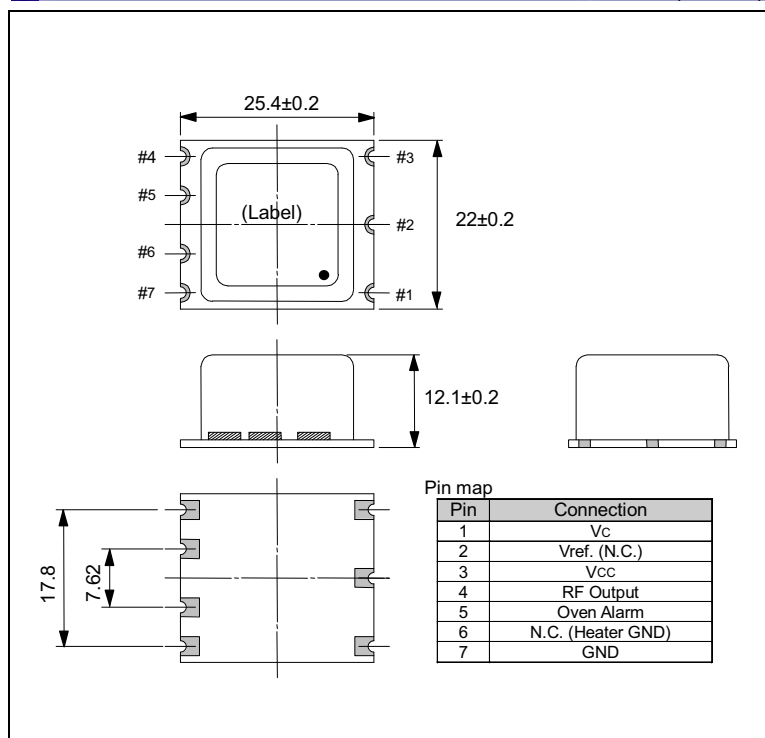


Specifications (characteristics)

Item	Symbol	Specifications	
Output frequency range	f _o	10.000 MHz to 40.000 MHz	
		10 MHz, 30.72 MHz	
Supply voltage	V _{cc}	3.3 V ±0.165 V	5.0 V ±0.25 V
Storage temperature range	T _{stg}	-40 °C to +85 °C	
		During transportation only. Long term storage : Room temperature.	
Operating temperature range	T _{use}	-10 °C to +70 °C	
Frequency/temperature characteristics	f _o -T _c	±2.5 × 10 ⁻⁸ Max.	
		-10 °C to +70 °C	
Frequency/voltage coefficient	f _o -V _{cc}	±5 × 10 ⁻⁹ Max. OP.: ±2 × 10 ⁻⁹ Max.	
		V _{cc} =3.3 V ±0.165 V V _{cc} =5.0 V ±0.25 V	
Frequency aging	f _{age}	±1 × 10 ⁻⁸ / day Max. OP.: ±1 × 10 ⁻⁹ / day Max. ±1 × 10 ⁻⁷ / year Max. OP.: ±3 × 10 ⁻⁸ / year Max.	
Warm-up	—	±5 × 10 ⁻⁸ / 5 min Max.	
Current consumption	Warm-up Steady state	750 mA Max. 300 mA Max.	600 mA Max. 200 mA Max.
Frequency control range	f _{cont}	±1 × 10 ⁻⁶ Min.	
Symmetry	SYM	45 % to 55 %	
High output voltage	V _{OH}	2.4 V Min.	2.8 V Min.
Low output voltage	V _{OL}	0.4 V Max.	0.4 V Max.
Load resistance	Load _R	10 kΩ	
Load capacitance	Load _C	15 pF	
Weight	—	10 g Max.	

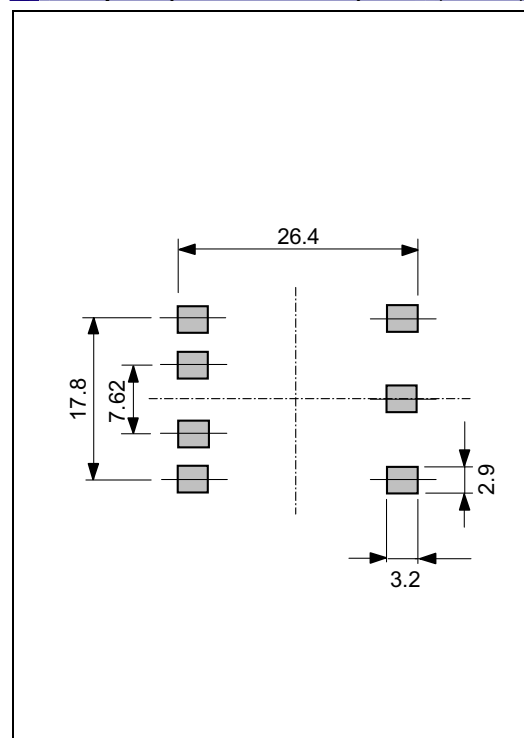
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





RUBIDIUM ATOMIC OSCILLATOR

Rb-3310N

- Features : Excellent high stability
- : EU RoHS compliant



Product number (please contact us)
X1G002401xxxx00



Specifications (characteristics)

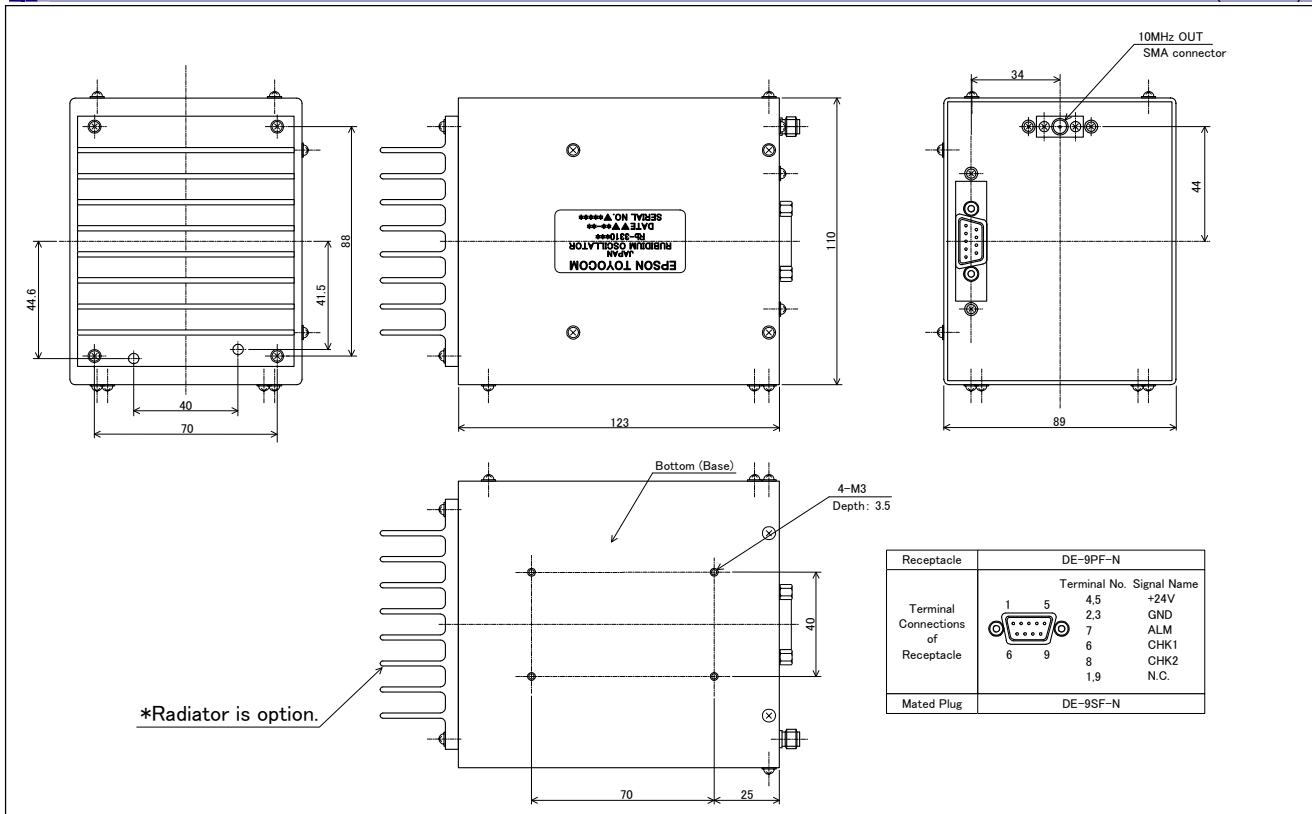
Parameter		Standard	Condition
Frequency stability	Long term	$< 2 \times 10^{-11}$ / month	—
	Short term	$< 1 \times 10^{-11}$ / s	—
	vs Temperature	$< \pm 1.5 \times 10^{-10}$ / 0 °C to +50 °C	Referred to +25 °C
	Voltage sensitivity	$< \pm 1 \times 10^{-11}$ / V	DC24 V $\pm$ 2 V
	Warm-up (locked frequency)	$< 2 \times 10^{-10}$	Within 20 minutes at +25 °C after power on (Typical)
Frequency adjustment		$> 2 \times 10^{-9}$	Internal volume
Output	Frequency	10 MHz	SMA connector
	Level	> 0.5 Vrms / 50 Ω	Sine wave (Harmonics < -20 dB)
	Alarm	Open collector	—
Supply voltage		DC 24 V $\pm$ 2 V	Noise 100 mV _{pp} Max.
Supply power		< 17 W	+25 °C (steady state)
		< 30 W	Warm up
Condition	Operating temperature	0 °C to +50 °C	
	Operating humidity	Less than 90 %RH	at less than +40 °C
Dimensions (mm)		89(H) $\times$ 110(W) $\times$ 123(D)	—
Weight		2 kg Typ.	—

1) Specifications are subject to change without notice.

2) Option : Frequency control $> 2 \times 10^{-9}$ / 2.5 V (2.5 V (by external voltage input)

External dimensions

(Unit:mm)





RUBIDIUM ATOMIC OSCILLATOR

(1PPS Synchronization Rubidium Frequency Standard)

Rb-2110CB

- Features : 19 inches rack type
- : Excellent frequency stability
- : 1PPS synchronization type

Product number (please contact us)
X1G0025400xxx



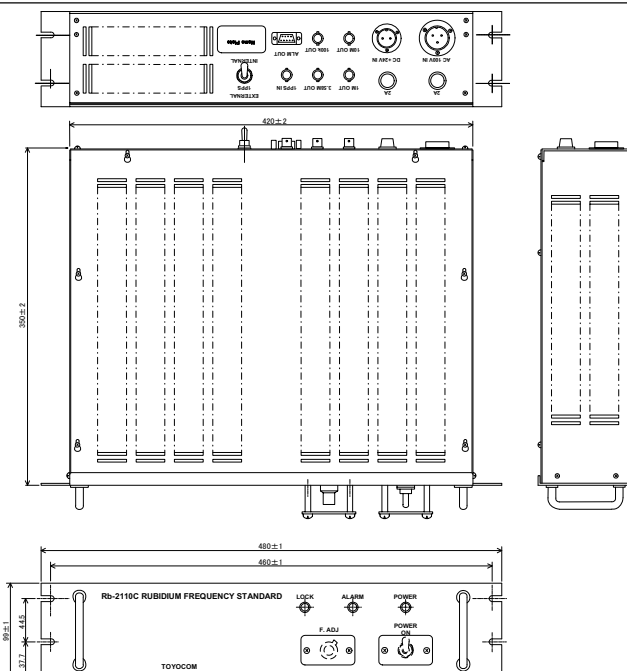
Specifications (characteristics)

Parameter		Standard	Condition
Frequency stability	Long term	$< 2 \times 10^{-11}$ / month	—
	Short term	$< 1 \times 10^{-11}$ / s	—
	vs Temperature (1)	$< \pm 1.5 \times 10^{-10}$ / 0 °C to +50 °C	Referred to +25 °C
	vs Temperature (2)	$< 1 \times 10^{-10}$ / -10 °C to 0 °C	
	Voltage sensitivity	$< \pm 1 \times 10^{-11}$	AC 100 V ± 10 % DC 24 V ± 1 V
	Warm-up (locked frequency)	$< 2 \times 10^{-10}$	Within 20 minutes at +25 °C after power on (Typical)
Output	Frequency	10 MHz, 3.58 MHz, 1 MHz, 100 kHz	Each Output has 1port
	Level	> 1 Vrms / 50 Ω (10 MHz, 1 MHz, 100 kHz) 2 V pp ± 20 %/75 Ω (3.58 MHz)	Sine wave (Harmonics < -30 dB) BNC connector on back panel
	Alarm	Relay contact on back panel connector	ALARM connector on back panel
Frequency adjustment		$> 2 \times 10^{-9}$	Front panel dial
Supply voltage	AC	AC 100 V ± 10 % (50 or 60 Hz)	1.0 A Max
	DC	DC +24 V ± 1 V	2.0 A Max. Noise 100 mVpp Max.
Battery operation		> 20 min	+25 °C after AC power off
Dimensions (mm)		99(H) $\times$ 480(W) $\times$ 350(D)(mm)	—
Weight		12 kg Typ.	—
1PPS Input		50 μ s Positive Pulse / 50 Ω TTL Level	External Synchronization Option
Frequency Synchronization Accuracy		$< \pm 1 \times 10^{-12}$ (24 h Average)	External Synchronization Option

- 1) The specification is subject to change without notice.
2) When alarm is generated, output frequency is swept about $\pm 10 \times 10^{-6}$.

External dimensions

(Unit:mm)



Pin map of each connector

	AC 100V IN	DC +24V IN
Connector code (Receptacle)	CN-2103RJ	CN-1602RJ
Connection		
Connector code (Plug)	CN-2103RP	CN-1602RP
ALARM OUT		
Connector code (Receptacle)	HDEB-9S	
Connection		
Connector code (Plug)	HDEB-9P	

**REAL TIME CLOCK MODULE****Serial 4-Wire****Serial 3-Wire****•Features**

- ▶ Serial interface which can be controlled 4 or 3 signal lines.
- ▶ Built in frequency adjusted 32.768 kHz crystal unit.

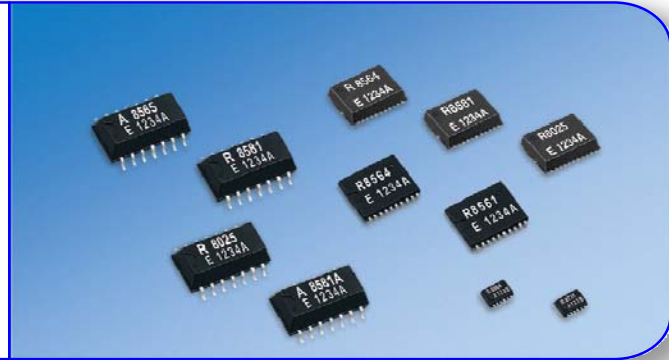
**■Serial 4-Wire / Serial 3-Wire**

Category		Model		Actual size (mm)	Features	Page
Serial 4-Wire		RX-4045SA		10.1×7.4×3.2 t (Typ.)	High-Stability	88
		RX-4045NB		6.3×5.2×1.4 t (Max.)		
		RX-4581NB		6.3×5.2×1.4 t (Max.)	Built-in SRAM	89
		RA-4565SA		10.1×7.4×3.2 t (Typ.)	For Automotive Extended operating temperature range (+125°C)	90
		RX-4801SA		10.1×7.4×3.2 t (Typ.)	Built-in DTCXO High-Stability	91
		RX-4801JE		7.3×6.2×1.5 t (Max.)		
		RX-5412SF		10.5×8.1×2.0 t (Max.)	Built-in time stamp function	92
Serial 3-Wire		RTC-4701JE		7.3×6.2×1.5 t (Max.)	Built-in Temperature Sensor	93
		RTC-4701NB		6.3×5.2×1.4 t (Max.)		
		RTC-4574SA		10.1×7.4×3.2 t (Typ.)	Simple Function	94
		RTC-4574JE		7.3×6.2×1.5 t (Max.)		
		RTC-4574NB		6.3×5.2×1.4 t (Max.)		
		RX-4574LC		3.6×2.8×1.2 t (Max.)		95
		RA-4574SA		10.1×7.4×3.2 t (Typ.)	For Automotive	96
		RTC-4543SA		10.1×7.4×3.2 t (Typ.)	Simple Function	97
		RTC-4543SB		11.6×8.0×2.0 t (Max.)		
		RX-4575LC		3.6×2.8×1.2 t (Max.)	Built-in external event detection.	98
		RX-4571LC		3.6×2.8×1.2 t (Max.)	Low Backup Voltage	99
		RX-4571NB		6.3×5.2×1.4 t (Max.)		
		RX-4571SA		10.1×7.4×3.2 t (Typ.)		

**REAL TIME CLOCK MODULE****I²C-Bus****Parallel 4-bit****•Features**

- Built in frequency adjusted 32.768 kHz crystal unit.

* The I²C-Bus is a trademark of NXP Semiconductors.

**I²C-Bus**

Category	Model		Actual size (mm)		Features	Page
I ² C Bus		RX-8025SA		10.1×7.4×3.2 t (Typ.)	High-Stability	100
		RX-8025NB		6.3×5.2×1.4 t (Max.)		
		RTC-8564JE		7.3×6.2×1.5 t (Max.)	Low power consumption	101
		RTC-8564NB		6.3×5.2×1.4 t (Max.)		
		RX-8564LC		3.6×2.8×1.2 t (Max.)		
		RA-8565SA		10.1×7.4×3.2 t (Typ.)	For Automotive Extended operating temperature range (+125°C)	102
		RX-8571SA		10.1×7.4×3.2 t (Typ.)	Low power consumption 128 bit User RAM Long-running timer (65000 hours)	103
		RX-8571NB		6.3×5.2×1.4 t (Max.)		
		RX-8571LC		3.6×2.8×1.2 t (Max.)		
		RX-8581SA		10.1×7.4×3.2 t (Typ.)	Simple Function	104
		RX-8581JE		7.3×6.2×1.5 t (Max.)		
		RX-8581NB		6.3×5.2×1.4 t (Max.)		
		RA-8581SA		10.1×7.4×3.2 t (Typ.)	For Automotive	105
		RX-8731LC		3.6×2.8×1.2 t (Max.)	Built-in EEPROM and Unique ID-ROM	106
		RX-8801SA		10.1×7.4×3.2 t (Typ.)	Built-in DTCXO	107
		RX-8801JE NEW		7.3×6.2×1.5 t (Max.)		

Parallel 4-bit

Category	Model		Actual size (mm)		Features	Page
Parallel 4-bit		RTC-7301SF		10.5×8.1×2.0 t (Max.)	Built-in Temperature Sensor	108
		RTC-7301DG		DIP 18 pin	Available Alarm and Timer	
		RTC-72421		DIP 18 pin	4-bit Simple Function	109
		RTC-72423		16.3×12.2×2.8 t (Max.)		



High-Stability Frequency SERIAL-INTERFACE REAL TIME CLOCK MODULE

RX-4045 SA / NB

- Built-in 32.768 kHz crystal unit: Frequency adjusted for high accuracy.
($\pm 5 \times 10^{-6}$ / $T_a = +25^\circ\text{C}$)
- Interface Type : 4-wire serial interface
- Operating voltage range : 1.7 V to 5.5 V
- Wide Timekeeper voltage range : 1.15 V to 5.5 V
- Various detection Functions : Oscillation stop detection function etc.
- Low backup current : 0.48 μA / 3 V (Typ.)
- 32.768 kHz clock frequency output : N-ch open drain output
- Function of time and calendar, the various detection function, and interrupt function etc.



Product Number (Please contact us)

RX-4045SA : Q41404551xxx00

RX-4045NB : Q41404591xxx00



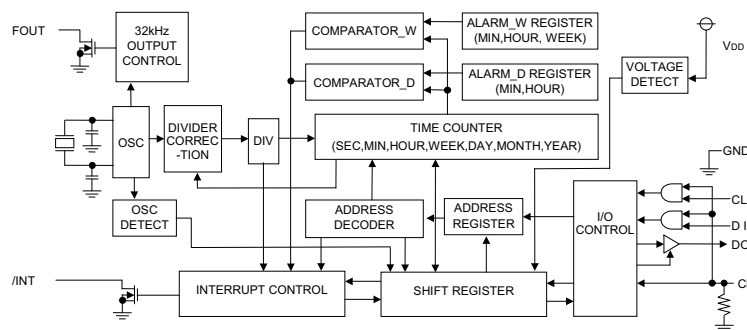
Actual size

RX-4045SA

RX-4045NB



Block diagram



Overview

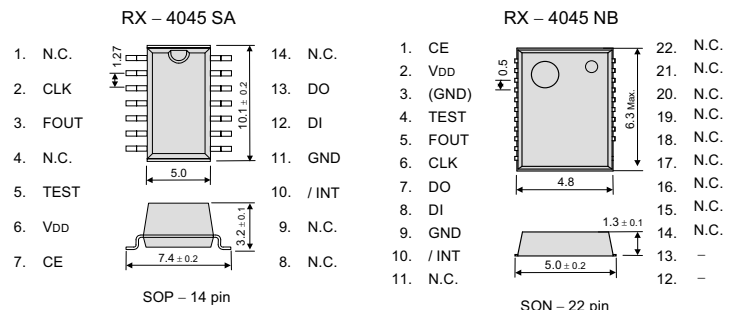
- **Features built-in 32.768 kHz crystal unit**
 - Frequency adjusted for high accuracy
($\pm 5 \times 10^{-6}$ / $T_a = +25^\circ\text{C}$)
(Equivalent to 13 seconds of monthly deviation)
- **The various detection Function**
 - Power supply voltage monitoring function
(with selectable detection threshold)
 - Stop detection function
 - Power-on reset detection function
- **Equipped with alarm and timer**
 - Timer function produces a periodic interruption signal.
As for the Alarm function an optional combination is produced. (Date of the week, time, minute)

Pin function

Signal Name	Input / Output	Function
CE	Input	The chip enabled input pin. (built-in pull-down resistance) At the "H" level, access becomes possible.
CLK	Input	The shift clock input pin for serial data transfer.
DI	Input	The data input pin for serial data transfer.
DO	Output	The data output pin for serial data transfer.
FOUT	Output	32.768 kHz clock output pin with the output control function (N-ch open drain) High impedance at the time of output off.
/INT	Output	Interrupt output (N-ch open drain)
TEST	—	* Used by the manufacturer for testing. (Do not connect externally.)
VDD	—	Connected to a positive power supply.
GND	—	Connected to a ground.

Terminal connection / External dimensions

(Unit:mm)



Metal may be exposed on the top or bottom of this product. This will not affect any quality, reliability or electrical spec.

Specifications (characteristics)

* Refer to application manual for details.

Recommended Operating Conditions

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power voltage	VDD	—	1.7	3.0	5.5	V
Clock voltage	VCLK	—	1.15	3.0	5.5	V
Operating temperature	TOPR	—	-40	+25	+85	°C

Frequency characteristics

Item	Symbol	Condition	Rating	Unit
Frequency tolerance	$\Delta f / f$	$T_a = +25^\circ\text{C}$ $V_{DD} = 3.0\text{ V}$	AA: 5 ± 5 *1) AC: 0 ± 5 *2)	$\times 10^{-6}$
Oscillation start-up time	tSTA	$T_a = +25^\circ\text{C}$ $V_{DD} = 2.0\text{ V}$	1 Max.	s
Frequency / voltage characteristics	f / V	$T_a = +25^\circ\text{C}$ $V_{DD} = 2.0\text{ V to } 5.5\text{ V}$	± 1 Max.	$\times 10^{-6}$

*1) *2) Equivalent to 13 seconds of monthly deviation (excluding offset.)

Current consumption characteristics

 $T_a = -40^\circ\text{C to } +85^\circ\text{C}$

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Current Consumption	I _{BK}	CE = GND FOUT ; output OFF (Hi-z)	$V_{DD} = 5\text{ V}$	0.60	1.80	μA
			$V_{DD} = 3\text{ V}$	0.48	1.20	
	I _{32k}	CE = GND FOUT ; 32.768 kHz output ON	$V_{DD} = 3\text{ V}$	0.65	2.00	μA

Power supply detection voltage

 $T_a = -30^\circ\text{C to } +70^\circ\text{C}$

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
High-voltage mode	VDETH	VDD pin	1.90	2.10	2.30	V
Low-voltage mode	VDETL	VDD pin	1.15	1.30	1.45	V



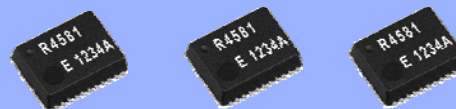
Built-in SRAM SERIAL-INTERFACE REAL TIME CLOCK MODULE

RX-4581 NB

- Built in frequency adjusted 32.768 kHz crystal unit.
- Interface Type : 4-wire serial interface
- Operating voltage range : 1.6 V to 5.5 V
- Wide Timekeeper voltage range : 1.6 V to 5.5 V
- Low backup current : 0.4 μ A / 3 V (Typ.)
- Built-in SRAM : Built-in 128 bit (8 bit $\times$ 16) RAM.
- 32.768 kHz frequency output function : C-MOS output With Control Pin
- The various functions include full calendar, alarm, timer.



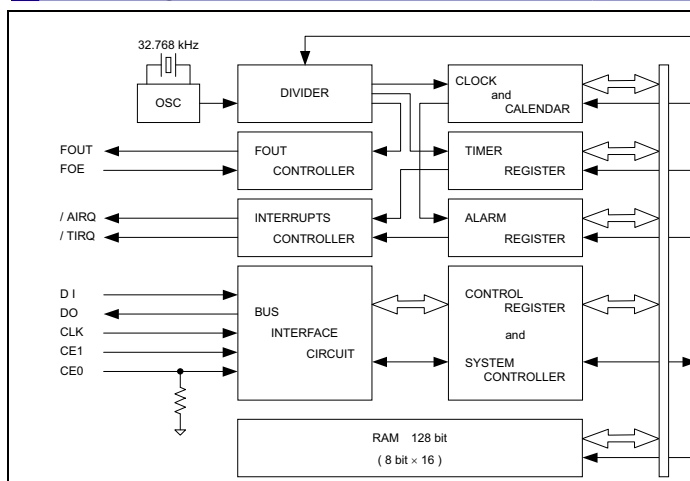
Product Number (Please contact us)
RX-4581NB : Q41458191000200



Actual size



Block diagram



Overview

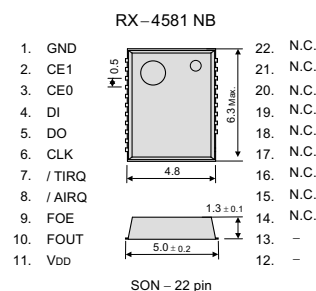
- Built-in SRAM
 - Include 128 bit (8 bit $\times$ 16) RAM.
- Interface Type
 - Serial interface in 4 lines form.
 - It is possible to make it to 3 lines by wired-OR connecting DI and DO pins.
- 32.768 kHz frequency output function
 - FOUT pin output (C-MOS output), CL=30 pF
 - FOE pin enables output on/off control.
- Timer function
 - Timer function can be set up between 1/4096 second and 4095 minutes.
 - It is recorded automatic to TF-bit at the time of event occurrence, and possible to output with /TIRQ pin output (open-drain output).
- Interrupt function
 - Alarm interrupt function, and timer interrupt function.

Pin Function

Signal Name	Input/Output	Function
CE0	Input	The chip enabled input pin 0. (It has a built-in pull-down resistance)
CE1	Input	The chip enabled input pin 1. (It does not have a built-in pull-down resistance)
CLK	Input	The shift clock input pin for serial data transfer.
DI	Input	The data input pin for serial data transfer.
DO	Output	The data output pin for serial data transfer.
FOUT	Output	This pin outputs the reference clock signal at 32.768 kHz (CMOS output). High impedance at the time of output off.
FOE	Input	The input pin for the FOUT output control.
/AIRQ	Output	The open drain output pin for alarm and time update interrupts.
/TIRQ	Output	The open drain output pin for timer interrupt.
VDD	—	Connected to a positive power supply.
GND	—	Connected to a ground.

Terminal connection / External dimensions

(Unit:mm)



Metal may be exposed on the top or bottom of this product.
This will not affect any quality, reliability or electrical spec.

Specifications (characteristics)

* Refer to application manual for details.

Recommended Operating Conditions

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power voltage	VDD	—	1.6	3.0	5.5	V
Clock voltage	VCLK	—	1.6	3.0	5.5	V
Operating temperature	TOPR	—	-40	+25	+85	°C

Frequency characteristics

Item	Symbol	Condition	Rating	Unit
Frequency tolerance	$\Delta f/f$	Ta = +25 °C VDD = 3.0 V	5 $\pm$ 23 *	$\times 10^{-6}$
Oscillation start-up time	tSTA	Ta = +25 °C VDD = 3.0 V	3 Max.	s

* Please ask for tighter tolerance. (Equivalent to 1 minute of monthly deviation)

Current consumption characteristics

Ta = -40 °C to +85 °C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Current Consumption	IBK	CE0, CE1 = GND FOE = GND	VDD = 5 V	0.6	1.2	μ A
		FOUT ; output OFF (Hi-Z)	VDD = 3 V	0.4	0.8	
	I32k	CE0, CE1 = GND FOE = VDD	VDD = 5 V	8.0	20.0	μ A
		FOUT ; 32.768 kHz output ON CL = 30 pF	VDD = 3 V	5.0	12.0	



For Automotive SERIAL INTERFACE REAL TIME CLOCK MODULE



Product Number (Please contact us)
RA-4565SA : Q41A46550xxxx00

RA - 4565 SA

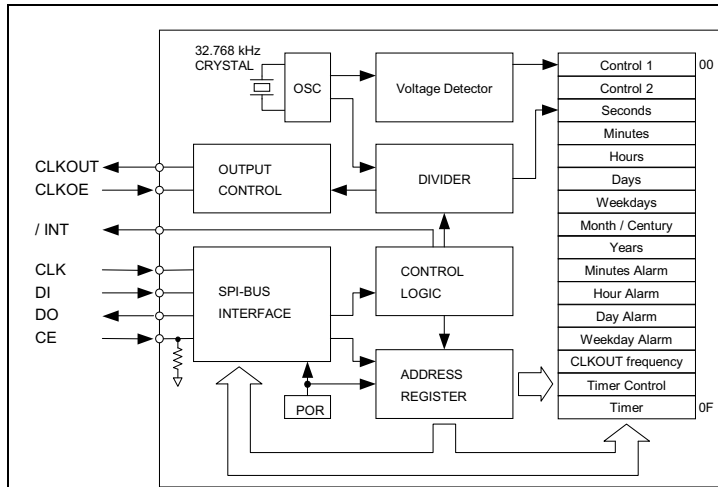
- Built in frequency adjusted 32.768 kHz crystal unit.
- Interface Type : 4-wire serial interface
- Wide operating voltage range : 1.6 V to 5.5 V
- Wide Timekeeper voltage range : 1.5 V to 5.5 V
- Extended operating temperature range: -40 °C to +125 °C
- 32.768 kHz frequency output function : Open drain output with Control Pin
- 32.768 kHz Clock/calendar function, auto leap year correction function, alarm interrupt function, etc.
- Conforms to AEC-Q200



Actual size



Block diagram



Overview

- **Wide operating temperature range**
 - -40 °C to +125 °C
- **Clocking-status detection function**
 - It can judge the validity of data after backup operation return by a status of VL-bit.
- **32.768 kHz frequency output function**
 - CLKOUT pin output (Open Drain output)
 - Output frequency can be selected as 32.768 kHz, 1024 Hz, 32 Hz, or 1 Hz.
- **The various interrupt function**
 - Timer function can be set up between 1/4096 second and 255 minutes.
 - Alarm function can be set to day of week, day, hour, or minute.

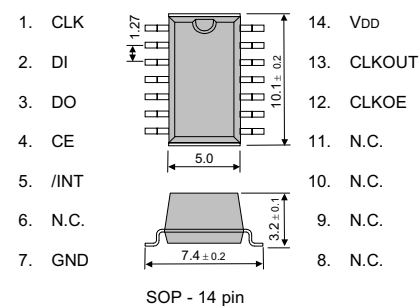
Pin Function

Terminal	Directions	Functions
CE	Input	Chip enabled input.
CLK	Input	Serial clock input.
DI	Input	Data input.
DO	Output	Data output.
CLKOUT	Output	The CLKOUT pin is a clock output (open drain output) pin with control output. (Output frequency can be selected as 32.768 kHz, 1024 Hz, 32 Hz, or 1 Hz.)
CLKOE	Input	The CLKOE pin is an input pin used to control the output mode of the CLKOUT output pin. During the initial power-on (when power is applied from 0 V), if the CLKOE input pin is at high level (= H), the power-on reset function selects 32.768 kHz as the frequency.
/INT	Output	Interrupts output by Alarm and Timer events. (Open drain output)
VDD	-	VDD
GND	-	GND

Terminal connection / External dimensions

(Unit:mm)

RA-4565 SA



Metal may be exposed on the top or bottom of this product.
This will not affect any quality, reliability or electrical spec.

Specifications (characteristics)

* Refer to application manual for details.

■ Recommended Operating Conditions

Item	Symbol	Conditions	Min.	Typ.	Max.	unit
Operating voltage	VDD	-	1.6	3.0	5.5	V
Timekeeper voltage	VCLK	-	1.5	3.0	5.5	V
Operating temperature	TOPR	-	-40	+25	+125	°C

■ Frequency characteristics

Item	Symbol	Conditions	Rating	unit
Frequency stability	$\Delta f / f$	Ta = +25 °C VDD = 3.0 V	5 ± 23 *1	× 10 ⁻⁶
Oscillation start up time	tSTA	Ta = +25 °C VDD = 1.6 V	1.5 Max.	s
		Ta = -40 °C to +125 °C VDD = 3.0 V	3.0 Max.	s

*1) Equivalent to 1 minutes of monthly deviation.

■ Current consumption under backup mode.

Item	Symbol	Conditions	Min.	Typ.	Max.	unit
Standby current.	IBK	fSCL = 0 Hz CLKOE = "L"	+125 °C	1.0	2.0	μA
		VDD = 5 V	-40 to +85 °C	0.6	1.2	
		fSCL = 0 Hz CLKOE = "L"	+125 °C	0.8	1.6	μA
		VDD = 3 V	-40 to +85 °C	0.5	1.0	



Built-in 32.768 kHz-DTCXO, High Stability SERIAL-INTERFACE REAL TIME CLOCK MODULE

RX-4801SA/JE

- Built in frequency adjusted 32.768 kHz crystal unit and DTCXO.
- Interface Type : 4-wire serial interface
- Interface voltage range : 1.6 V to 5.5 V
- Temp.compensated voltage range: 2.2 V to 5.5 V
- Wide Timekeeper voltage range : 1.6 V to 5.5 V
- 32.768 kHz frequency output function : C-MOS output With Control Pin
- The various functions include full calendar, alarm, timer.



Product Number (Please contact us)

RX-4801SA : X1B000021xxxx00

RX-4801JE : X1B000041xxxx00

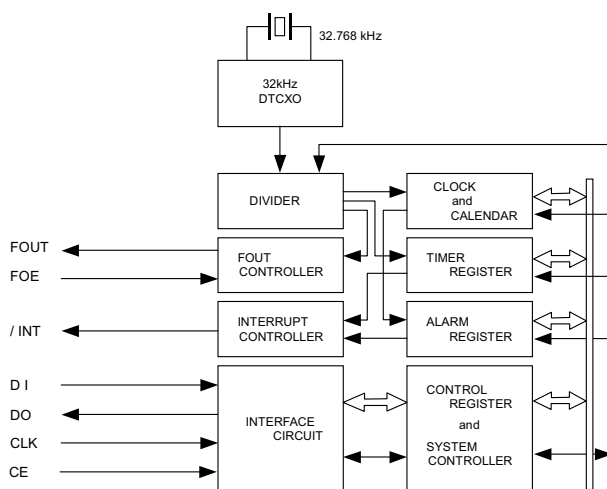


Actual size



NEW

Block diagram



Overview

- High Stability
 - UA
 - $\pm 1.9 \times 10^{-6}$ / 0°C to $+40^\circ\text{C}$
(Equivalent to 5 seconds of month deviation)
 - $\pm 3.4 \times 10^{-6}$ / -40°C to $+85^\circ\text{C}$
(Equivalent to 9 seconds of month deviation)
 - UB
 - $\pm 3.8 \times 10^{-6}$ / 0°C to $+50^\circ\text{C}$
(Equivalent to 10 seconds of month deviation)
 - $\pm 5.0 \times 10^{-6}$ / -40°C to $+85^\circ\text{C}$
(Equivalent to 13 seconds of month deviation)
- 32.768 kHz frequency output function
 - FOUT pin output (C-MOS output), CL=30 pF
 - Output selectable
< 32.768 kHz, 1024 Hz, 1 Hz >
- The various interrupt
 - Timer Function can be set up between
1/4096 second and 255 minutes.
 - Alarm Function can be set to day of week,
day, hour, or minute.

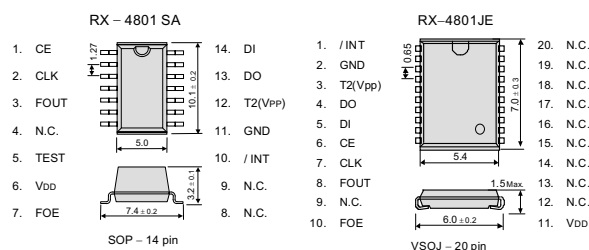
*It is possible to use it by the terminal connection as
32.768 kHz-DTCXO.

Pin Function

Signal Name	I / O	Function
/INT	Output	The open drain output for interrupt.
GND	-	Connected to a ground
T2(V _{PP})	-	* Use by the manufacture for testing. (Do not connect externally.)
DO	Output	The data output pin for serial data transfer.
DI	input	The data input pin for serial data transfer.
CE	input	The chip enable input pin.
CLK	input	The shift clock input pin for serial data transfer.
FOUT	Output	The pin outputs the reference clock signal. (CMOS output)
FOE	input	The input pin for the FOUT output control.
V _{DD}	-	Connected to a positive power supply

Terminal connection / External dimensions

(Unit:mm)



Metal may be exposed on the top or bottom of this product.
This will not affect any quality, reliability or electrical spec.

Specifications (characteristics)

* Refer to application manual for details.

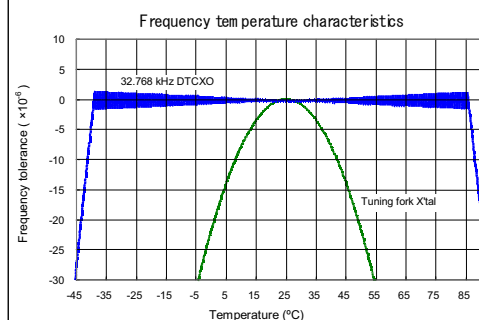
Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Interface voltage	V _{DD}	Interface voltage	1.6	3.0	5.5	V
Temp. compensated Voltage	V _{TEM}	Temp. compensated voltage	2.2	3.0	5.5	V
Clock voltage	V _{CLK}	-	1.6	3.0	5.5	V
Operating temperature	T _{OPR}	-	-40	+25	+85	°C
Stability	$\Delta f/f$	UA	Ta = 0 °C to +40 °C		± 1.9 *1	$\times 10^{-6}$
		UB	Ta = -40 °C to +85 °C		± 3.4 *2	
		UB	Ta = 0 °C to +50 °C		± 3.8 *3	
		UB	Ta = -40 °C to +85 °C		± 5.0 *4	
Current consumption (1)	I _{BK1}	Backup Mode FOE = GND, /INT = V _{DD}	V _{DD} = 5V	-	1.2	3.4
Current consumption (2)	I _{BK2}	FOUT output : OFF	V _{DD} = 3V	-	0.8	2.8

*1) Equivalent to 5 seconds of month deviation. *2) Equivalent to 9 seconds of month deviation.

*3) Equivalent to 10 seconds of month deviation. *4) Equivalent to 13 seconds of month deviation.

32.768 kHz-DTCXO Frequency temperature characteristics (Example)





Built-in TIME STAMP FUNCTION SERIAL-INTERFACE REAL TIME CLOCK MODULE

RX-5412 SF

- Built in frequency adjusted 32.768 kHz crystal unit.
- Interface Type : 4-wire serial interface
- Operating voltage range : 2.5 V to 5.5 V
- Wide Timekeeper voltage range : 1.4 V to 5.5 V
- Low backup current : 0.5 μ A / 3 V (Typ.)
- Built-in SRAM : Built-in 2048 bit (8 bit $\times$ 256)
- The various functions include full calendar, alarm, timer, time stamp, Watch dog timer, automatic power switching function.



Product Number (Please contact us)
X1B000082xxxx00

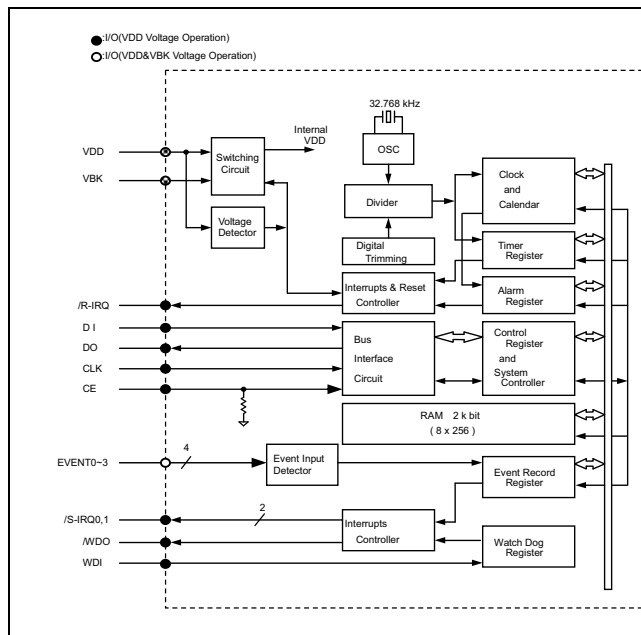


Actual size



NEW

Block diagram



Overview

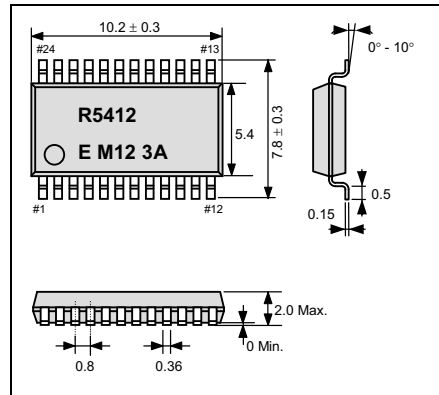
- Timer function
 - Timer function which can be set up between 1/4096 second and 4095 minutes.
- Alarm function
 - Alarm function can be set to free combination of day, day of week, hour, or minute.
- Time-stamp function
 - Event record function can record separate time data in each of event input terminal.
- Watch dog timer function
 - Watch dog timer function which can be set to 1.95 ms from 500 ms
- 2048bit S-RAM.
 - It is used for general-purpose memory and event record.

Pin Function

Signal name	Pin No.	I / O	Function	Signal name	Pin No.	I / O	Function
Vss	1	-	GND	(Vss)	24	-	
EVENT0	2	Input	Event input	(Vss)	23	-	
EVENT1	3	Input	Event input	(Vss)	22	-	
VBK	4	-	Backup power supply	(Vss)	21	-	
EVENT2	5	Input	Event input	(Vss)	20	-	
(Vss)	6	-		(Vss)	19	-	
EVENT3	7	Input	Event input	/S-IRQ1	18	Output	Event record interrupt output (open drain)
CE	8	Input	Chip enabled input	/S-IRQ0	17	Output	Event record interrupt output (open drain)
CLK	9	Input	Clock input pin for serial data transmission	WDI	16	Input	Watch dog input (open drain)
DO	10	Output	Data output pin for serial data transmission	/WDO	15	Output	Watch dog output (open drain)
DI	11	Input	Data input pin for serial data transmission	N.C.	14	-	
/R-IRQ	12	Output	RTC function interrupt output (open drain)	VDD	13	-	Power supply

External dimensions

(Unit:mm)



Specifications (characteristics)

*Refer to application manual for details.

Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power voltage	VDD	—	2.5	3.0	5.5	V
Clock voltage	VCLK	—	1.4	3.0	5.5	V
Operating temperature	TOPR	—	-40	+25	+85	°C
Frequency tolerance	$\Delta f / f$	Ta = +25 °C, VDD = 3.0 V	5 $\pm$ 23 *			$\times 10^{-6}$
Current Consumption	IDD1	Back up operation, CE = GND, /IRQ = OFF	V _{BK} =5 V	0.5	1.0	μ A
	IDD2		V _{BK} =3 V	0.5	1.0	

*Equivalent to 1 minute of monthly deviation.



Built-in Temperature Sensor SERIAL-INTERFACE REAL TIME CLOCK MODULE

RTC -4701JE / NB

- Built in frequency adjusted 32.768 kHz crystal unit.
- Interface Type : 3-wire serial interface
- Operating voltage range : 1.6 V to 5.5 V
- Wide Timekeeper voltage range : 1.6 V to 5.5 V
- Built-in temperature sensor : Detects temperature.
Converts output to analog voltage
- 32.768 kHz frequency output function : C-MOS output With Control Pin
- Function of time and calendar, the various interrupt function etc.



Product Number (Please contact us)

RTC-4701JE : Q41470171000200

RTC-4701NB: Q41470191000200



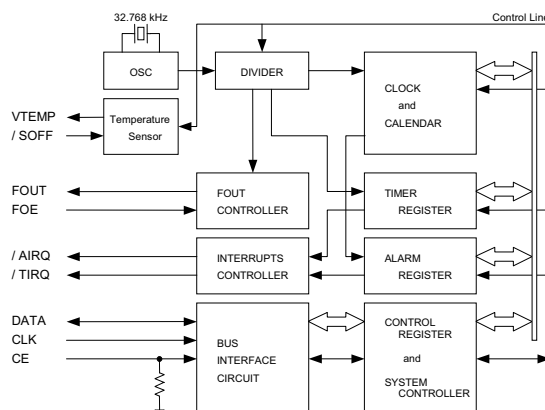
Actual size

RTC-4701JE

RTC-4701NB



Block diagram



Overview

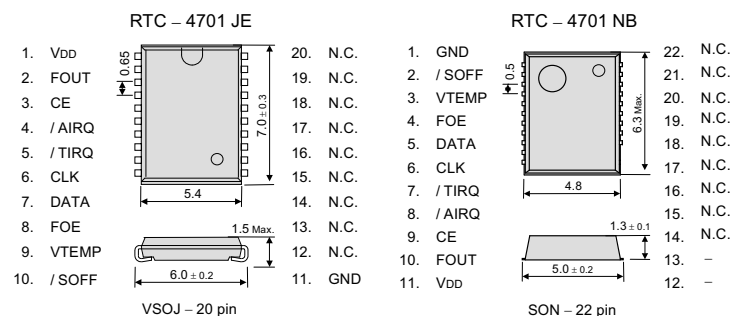
- **Built-in temperature sensor**
 - Diode temperature sensor (analog voltage output)
 - * temperature sensor operating voltage : 2.7 V to 5.5 V
 - * temperature sensor tolerance : $\pm 5^\circ\text{C}$ ($T_a = +25^\circ\text{C}$)
 - * voltage output (analog): $-7.6\text{ mV} / ^\circ\text{C}$ Typ.
- **32.768 kHz frequency output function**
 - FOUT pin output (C-MOS output), CL=30 pF
 - FOE pin enables output on/off control.
- **The various interrupt function**
 - 12 bit additional counter. (to 4095 count)
 - Timer function can be set up between 1/4096 second and 255 minutes.
 - Alarm function can be set to day of week, hour, or minute.

Pin Function

Signal Name	Input / Output	Function									
CE	Input	The chip enabled input pin. (Built-in pull-down resistance)									
CLK	Input	The shift clock input pin for serial data transfer.									
DATA	Bi-directional	The data input / output pin for serial data transfer.									
FOUT	Output	<table><tr><th>FOE input</th><th colspan="2">FOUT output</th></tr><tr><td>HIGH</td><td>32.768 kHz output</td><td>* C-MOS output</td></tr><tr><td>LOW</td><td>output OFF</td><td>* Hi - z</td></tr></table>	FOE input	FOUT output		HIGH	32.768 kHz output	* C-MOS output	LOW	output OFF	* Hi - z
FOE input	FOUT output										
HIGH	32.768 kHz output	* C-MOS output									
LOW	output OFF	* Hi - z									
FOE	Input										
VTEMP	Output	The voltage output pin for the temperature sensor (analog).									
/SOFF	Input	The input pin for the temperature sensor control.									
/AIRQ	Output	Output 1 pin (N-ch open drain)									
/TIRQ	Output	Output 2 pin (N-ch open drain)									
VDD	—	Connected to a positive power supply.									
GND	—	Connected to a ground.									

Terminal connection / External dimensions

(Unit:mm)



Metal may be exposed on the top or bottom of this product. This will not affect any quality, reliability or electrical spec.

Temperature sensor characteristics

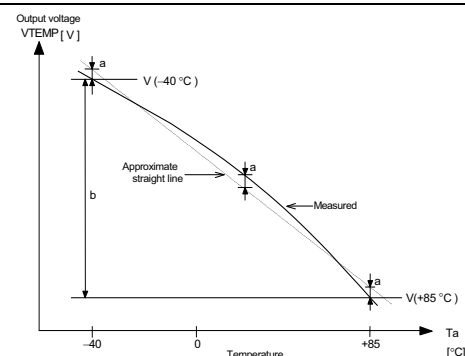
* Refer to application manual for details.

* If not specifically indicated, GND = 0 V, VDD = 2.7 V to 5.5 V, Ta = -40 °C to +85 °C						
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Temperature output voltage	VTEMP	VTEMP pin, Ta = +25 °C GND based output voltage		1.480		V
Output tolerance	TACR	Ta = +25 °C			± 5.0	°C
Temperature sensitivity	VSE	-40 °C ≤ Ta ≤ +85 °C	-7.1	-7.6	-8.1	mV / °C
Linearity	ΔNL	-40 °C ≤ Ta ≤ +85 °C			± 2.0	%
Temperature detection range	TSOP	ΔNL ≤ ± 2.0 %	-40		+85	°C
Output resistance	Ro	VTEMP pin, Ta = +25 °C GND standard and VDD standard		1.0	3.0	kΩ

* Temperature sensitivity $VSE = (V(+85^\circ\text{C}) - V(-40^\circ\text{C})) / 125 [\text{mV} / ^\circ\text{C}]$

* Linearity $\Delta NL = \frac{a}{b} \times 100 [\%]$

a : Maximum deviation between the measured value of VTEMP and approximate straight line.
b : Difference between the measured values at -40 °C and +85 °C.

* Output resistance (Ro) $Ro = \frac{\Delta V}{\Delta I} [\Omega]$ 



SERIAL-INTERFACE REAL TIME CLOCK MODULE

RTC - 4574 SA/ JE/ NB

- Built in frequency adjusted 32.768 kHz crystal unit.
- Interface Type : 3-wire serial interface
- Operating voltage range : 1.6 V to 5.5 V
- Wide Timekeeper voltage range : 1.6 V to 5.5 V
- Low backup current : 0.5 μ A / 3 V (Typ.)
- 32.768 kHz frequency output function : C-MOS output With Control Pin
- The various functions include full calendar, alarm, timer.



Product Number (Please contact us)

RTC-4574SA : Q41457451000200

RTC-4574JE : Q41457471000100

RTC-4574NB : Q41457491000100



Actual size

RTC-4574SA



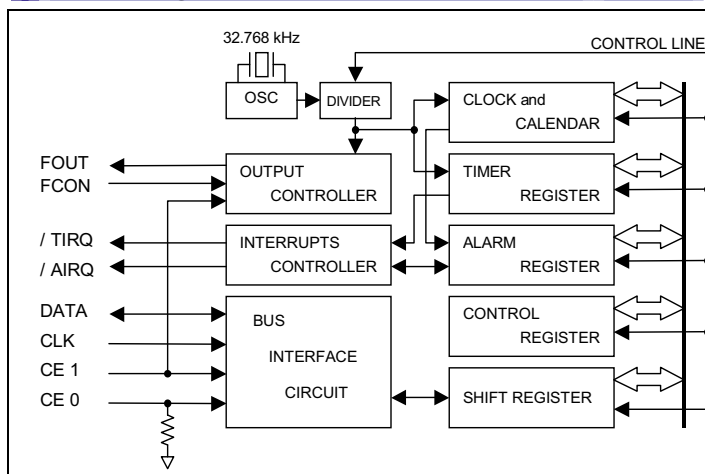
RTC-4574JE



RTC-4574NB



Block diagram



Overview

• 32.768 kHz frequency output function

- FOUT pin output (C-MOS output), CL=30 pF
- Output frequency selectable from 1/30 Hz to 32.768 kHz (32 Values)

• Timer function

- Timer function can be set up between 1/4096 second and 255 minutes.
- It is recorded automatically to TF-bit at the time of event occurrence, and it's possible to output with /TIRQ pin output (open-drain output).
- Selectable one time mode or repeat mode.

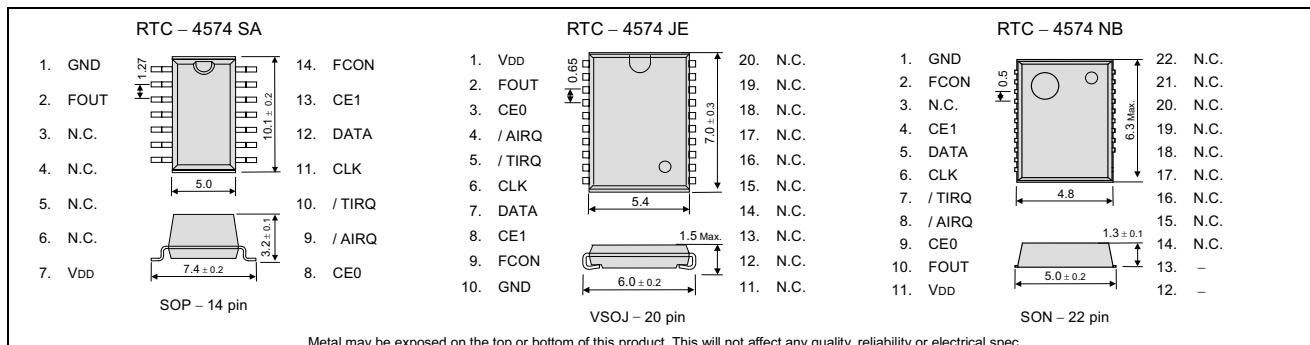
• Alarm function

- Alarm function can be set to any combination of day of week, hour, or minute.
- It is recorded automatically to AF-bit at the time of event occurrence, and it's possible to output with /AIRQ pin output (open-drain output).

• Functions are compatible with RX - 4574 LC.

Terminal connection / External dimensions

(Unit:mm)



Metal may be exposed on the top or bottom of this product. This will not affect any quality, reliability or electrical spec.

Specifications (characteristics)

* Refer to application manual for details.

■ Recommended Operating Conditions

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power voltage	VDD	—	1.6	3.0	5.5	V
Clock voltage	VCLK	—	1.6	3.0	5.5	V
Operating temperature	TOPR	—	-40	+25	+85	°C

■ Frequency characteristics

Item	Symbol	Condition	Rating	Unit
Frequency tolerance	$\Delta f/f$	Ta = +25 °C VDD = 3.0 V	5 ± 23 *	× 10 ⁻⁶
Oscillation start-up time	tSTA	Ta = +25 °C VDD = 1.6 V	3 Max.	s

* Please ask for tighter tolerance.(Equivalent to 1 minute of monthly deviation)

■ Current consumption characteristics

Ta = -40 °C to +85 °C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Current Consumption	IBK	CE0, CE1 = GND FOUT ; output OFF (Hi - z)	VDD = 5 V	1.0	2.0	μ A
			VDD = 3 V	0.5	1.0	
	I32k	CE0 = GND CE1 = VDD FOUT ; 32.768 kHz output ON CL = 30 pF	VDD = 5 V	8.0	20.0	μ A
			VDD = 3 V	5.0	12.0	



Small size, low profile model package SERIAL-INTERFACE REAL TIME CLOCK MODULE

RX-4574LC

- Built in frequency adjusted 32.768 kHz crystal unit.
- Interface Type : 3-wire serial interface
- Operating voltage range : 1.6 V to 5.5 V
- Wide Timekeeper voltage range : 1.3 V to 5.5 V
- Low backup current : 0.35 μ A / 3 V (Typ.)
- 32.768 kHz frequency output function : C-MOS output With Control Pin
- The various functions include full calendar, alarm, timer.



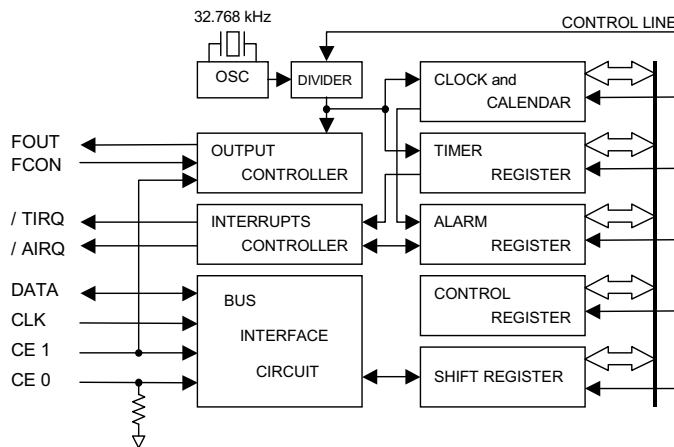
Product Number (Please contact us)
RX-4574LC : Q414574C2000300



Actual size



Block diagram



Overview

• 32.768 kHz frequency output function

- FOUT pin output (C-MOS output), CL=30 pF
- Output frequency is selectable from 1/30 Hz to 32.768 kHz (32 Values)

• Timer function

- Timer function which can be set up between 1/4096 second and 255 minutes.
- It is recorded automatically to TF-bit at the time of event occurrence, and it's possible to output with /TIRQ pin output (open-drain output).
- Selectable one time mode or repeat mode.

• Alarm function

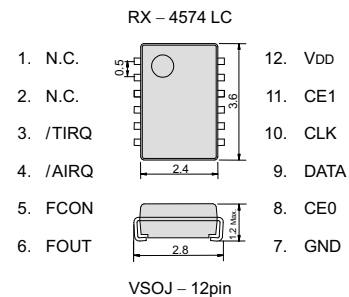
- Alarm function can be set to any combination of day of week, hour, or minute.
- It is recorded automatically to AF-bit at the time of event occurrence, and it's possible to output with /AIRQ pin output (open-drain output).

• Functions are compatible with RTC-4574 SA / JE / NB.

Pin Function

Signal Name	Input / Output	Function
CE0	Input	The chip enabled input pin 0. (Built-in pull-down resistance) When both CE0 and CE1 pins are at the "H" level, access to this Real time clock module becomes possible.
CE1	Input	The chip enabled input pin 1. When the CE1 pin is at the HIGH level, the FOUT pin is in the output state.
CLK	Input	The shift clock input pin for serial data transfer.
DATA	Bi-directional	The data input / output pin for serial data transfer.
FOUT	Output	This pin outputs the reference clock signal at 32.768 kHz (C-MOS output). High impedance at the time of output off.
FCON	Input	The input pin for the FOUT output control.
/ AIRQ	Output	The open drain output pin for alarm and time update interrupts.
/ TIRQ	Output	The open drain output pin for timer interrupt.
VDD	—	Connected to a positive power supply.
GND	—	Connected to a ground.

Terminal connection / External dimensions (Unit:mm)



Specifications (characteristics)

* Refer to application manual for details.

■ Recommended Operating Conditions

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power voltage	VDD	—	1.6	3.0	5.5	V
Clock voltage	VCLK	—	1.3	3.0	5.5	V
Operating temperature	TOPR	—	-40	+25	+85	°C

■ Frequency characteristics

Item	Symbol	Condition	Rating	Unit
Frequency tolerance	$\Delta f/f$	Ta = +25 °C VDD = 3.0 V	5 ± 23 *	× 10 ⁻⁶
Oscillation Start-up time	tSTA	Ta = +25 °C VDD = 1.6 V	1 Max.	s
		Ta = -40 °C to +85 °C VDD = 1.6 V	3 Max.	s

*Equivalent to 1 minute of monthly deviation

■ Current consumption characteristics

Ta = -40 °C to +85 °C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Current Consumption	IBK	CE0, CE1 = GND FOUT ; output OFF (Hi - z)	VDD = 5 V	0.45	0.9	μ A
			VDD = 3 V	0.35	0.7	
	I32k	CE0 = GND CE1 = VDD FOUT ; 32.768 kHz output ON CL = 30 pF	VDD = 5 V	8.0	20.0	μ A
			VDD = 3 V	5.0	12.0	



For Automotive SERIAL-INTERFACE REAL TIME CLOCK MODULE

RA - 4574 SA

- Built in frequency adjusted 32.768 kHz crystal unit.
- Interface Type : 3-wire serial interface
- Operating voltage range : 1.6 V to 5.5 V
- Wide Timekeeper voltage range : 1.6 V to 5.5 V
- Low backup current : 0.5 μ A / 3 V (Typ.)
- 32.768 kHz frequency output function : C-MOS output With Control Pin
- The various functions include full calendar, alarm, timer.
- Conforms to AEC-Q200



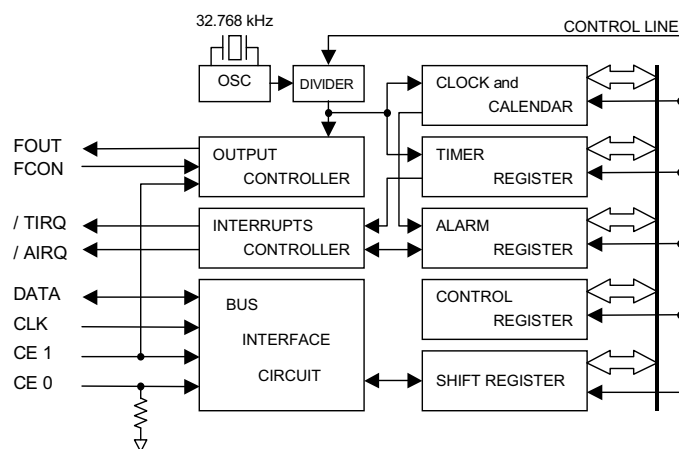
Product Number (Please contact us)
RA-4574SA : Q41A47451xxxx00



Actual size



Block diagram



Overview

• 32.768 kHz frequency output function

- FOUT pin output (C-MOS output), CL=30 pF
- Output frequency selectable from 1/30 Hz to 32.768 kHz (32 Values)

• Timer function

- Timer function can be set between 1/4096 second and 255 minutes.
- It is recorded automatically to TF-bit at the time of event occurrence, and it's possible to output with /TIRQ pin output (open-drain output).
- Selectable one time mode or repeat mode.

• Alarm function

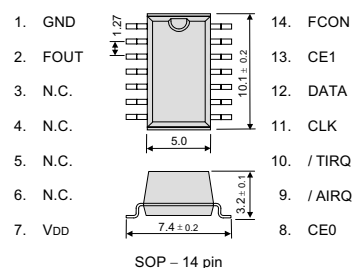
- Alarm function can be set to any combination of day of week, hour, or minute.
- It is recorded automatically to AF-bit at the time of event occurrence, and it's possible to output with /AIRQ pin output (open-drain output).

Pin Function

Signal Name	Input / Output	Function
CE0	Input	The chip enabled input pin 0. (Built-in pull-down resistance) When both CE0 and CE1 pins are at the "H" level, access to this Real time clock module becomes possible.
CE1	Input	The chip enabled input pin 1. When the CE1 pin is at the HIGH level, the FOUT pin is in the output state.
CLK	Input	The shift clock input pin for serial data transfer.
DATA	Bi-directional	The data input / output pin for serial data transfer.
FOUT	Output	This pin outputs the reference clock signal at 32.768 kHz (C-MOS output). High impedance at the time of output off.
FCON	Input	The input pin for the FOUT output control.
/AIRQ	Output	The open drain output pin for alarm and time update interrupts.
/TIRQ	Output	The open drain output pin for timer interrupt.
VDD	—	Connected to a positive power supply.
GND	—	Connected to a ground.

Terminal connection / External dimensions (Unit:mm)

RA - 4574 SA



Metal may be exposed on the top or bottom of this product.
This will not affect any quality, reliability or electrical spec.

Specifications (characteristics)

* Refer to application manual for details.

■ Recommended Operating Conditions

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power voltage	VDD	—	1.6	3.0	5.5	V
Clock voltage	VCLK	—	1.6	3.0	5.5	V
Operating temperature	T _{OPR}	—	-40	+25	+85	°C

■ Frequency characteristics

Item	Symbol	Condition	Rating	Unit
Frequency tolerance	$\Delta f / f$	T _a = +25 °C VDD = 3.0 V	5 ± 23 *	× 10 ⁻⁶
Oscillation start-up time	t _{STA}	T _a = +25 °C VDD = 1.6 V	3 Max.	s

* Equivalent to 1 minute of monthly deviation

■ Current consumption characteristics

T_a = -40 °C to +85 °C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Current Consumption	I _{BK}	CE0, CE1 = GND FOUT ; Output OFF (Hi - z)	VDD = 5 V	1.0	2.0	μ A
			VDD = 3 V	0.5	1.0	
	I _{32k}	CE0 = GND CE1 = VDD FOUT ; 32.768 kHz output ON CL = 30 pF	VDD = 5 V	8.0	20.0	μ A
			VDD = 3 V	5.0	12.0	



Simple Function SERIAL-INTERFACE REAL TIME CLOCK MODULE

RTC - 4543 SA / SB

- Built in frequency adjusted 32.768 kHz crystal unit.
- Interface type : 3-wire serial interface
- Operating voltage range : 2.5 V to 5.5 V
- Wide Timekeeper voltage range: 1.4 V to 5.5 V
- 32.768 kHz frequency output function: C-MOS output With Control Pin
- The various functions include full calendar, timer, and low voltage detection.



Product Number (Please contact us)
RTC-4543SA : Q41454351000200
RTC-4543SB : Q41454361000200



Actual size

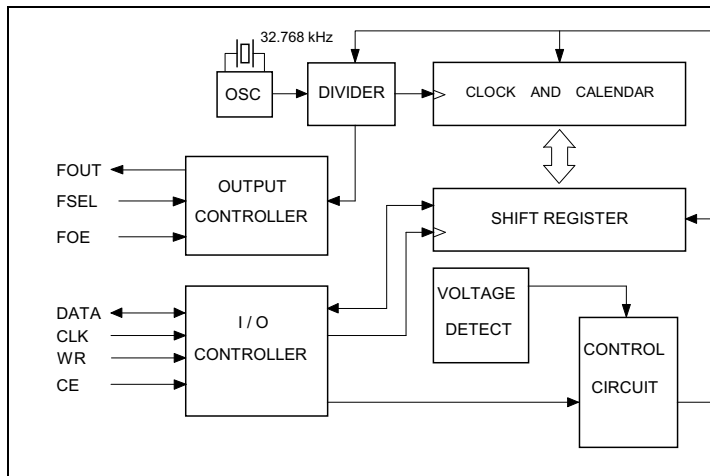
RTC-4543SA



RTC-4543SB



Block diagram



Overview

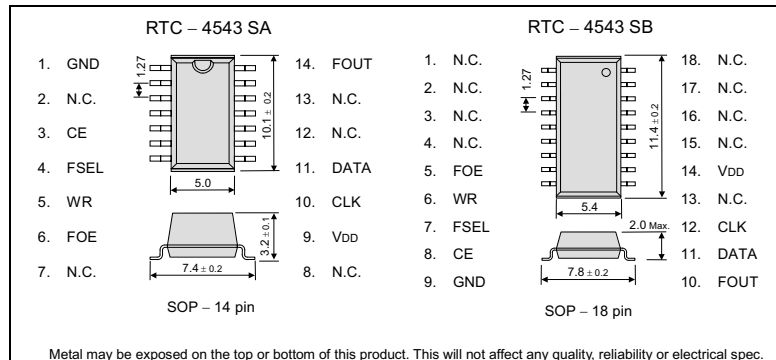
- **32.768 kHz frequency output function**
 - FOUT pin output (C-MOS output), CL=30 pF
 - FOE pin enables output on/off control.
 - FSEL pin enables output selectable 32.768 kHz or 1 Hz.
- **Power supply voltage monitoring function**
 - Detection that power supply voltage descended to 1.7 V or less.
 - Automatic record to FDT-bit at the time of power supply decline detection.

Pin Function

Signal Name	Input / Output	Function
CE	Input	The chip enabled input pin. At the HIGH level, access becomes possible.
CLK	Input	The shift clock input pin for serial data transfer.
WR	Input	DATA pin input / output switching pin.
DATA	Bi-directional	The data input / output pin for serial data transfer.
FOUT	Output	32.768 kHz or 1Hz clock output pin (C-MOS output). High impedance at output off.
FOE	Input	The input pin for the FOUT output control.
FSEL	Input	Select the frequency that is output from the FOUT pin.
VDD	—	Connected to a positive power supply.
GND	—	Connected to a ground.

Terminal connection / External dimensions

(Unit:mm)



Specifications (characteristics)

* Refer to application Manual for details.

Recommended Operating Conditions

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power voltage	VDD	—	2.5	5.0	5.5	V
Clock voltage	VCLK	—	1.4	5.0	5.5	V
Operating temperature	TOPR	—	-40	+25	+85	°C

Frequency characteristics

Item	Symbol	Condition	Rating	Unit
Frequency tolerance	$\Delta f/f$	Ta = +25 °C VDD = 5.0 V	5 ± 23 *	× 10 ⁻⁶
Oscillation start-up time	tSTA	Ta = +25 °C VDD = 2.5 V	3 Max.	s

* Please ask for tighter tolerance.(Equivalent to 1 minute of monthly deviation)

Current consumption characteristics

Ta = -40 °C to +85 °C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Current Consumption	IBK	CE = GND FOE = GND FOUT ;output OFF (Hi-Z)	VDD = 5 V	1.5	3.0	μA
		VDD = 3 V	1.0	2.0		
		VDD = 2 V	0.5	1.0		

Supply Voltage Detection Characteristic

Ta = -40 °C to +85 °C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power supply detection voltage	VDT	VDD pin	1.4	1.7	2.0	V



Built-in external event detection. SERIAL INTERFACE REAL TIME CLOCK MODULE

RX-4575LC

- Built in frequency adjusted 32.768 kHz crystal unit.
 - Interface Type : 3-wire serial interface
 - Operating voltage range : 1.6 V ~ 5.5 V
 - Wide timekeeper voltage range : 1.3 V ~ 5.5 V
 - Low backup current : 0.35 μ A / 3 V (Typ.)
 - External event detection. : Chattering free input port * 2.
- (The various functions include full calendar, alarm, timer.)



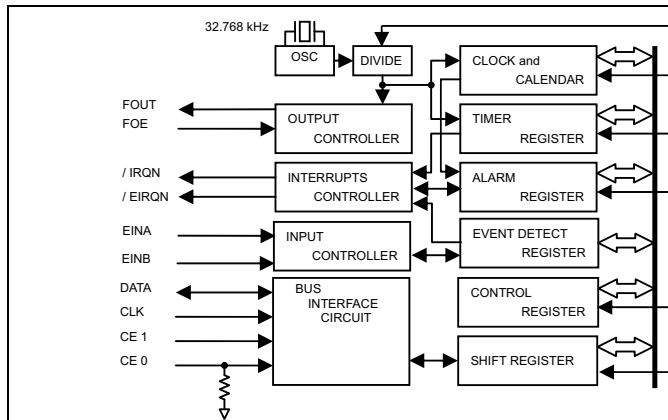
Product Number (Please contact us)
RX-4575LC : Q414575C1000100



Actual size



Block diagram



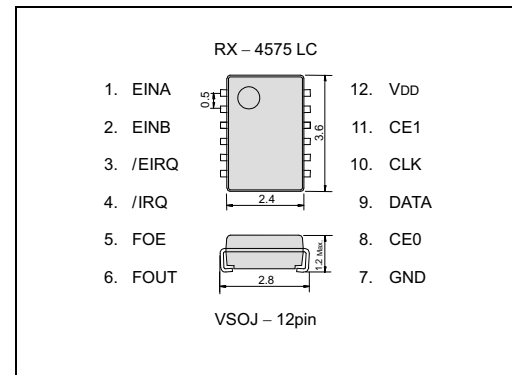
Overview

- **Event detection.**
 - Selectable Hi detection or Lo detection.
 - Recognition of detection is available both the hardware interrupt and the monitor via software.
 - Automatic interrupt release mode is available.
 - The all 'OR' interrupt output is possible via alarm, timer and event detection.
- **Performance of event input terminal.**
 - As for the chattering filter, following are prepared for. (8 ms, 31 ms, 62 ms, 125 ms)
 - Built-in resistor connect and release is possible via software. Selectable pull-up or pull-down.
- **Timer function**
 - Built in 12 bit counter.
 - Timing period are 1 min, 1 s, 64 Hz, 4096 Hz.
- **Alarm function**
 - Alarm setting is possible by combination of a day, hours, and minutes.

Pin Function

Signal Name	Input / Output	Functions
EINA EINB	Input	External event input pin.
CE 0 CE 1	Input	Interface is possible when both CE0 and CE1 is high level.
CLK	Input	Serial Clock input pin.
DATA	Bidirectional	Data input and output pin.
FOUT	Output	32.768 kHz clock output pin (C-MOS). Output is Hi-Z when OFF.
FOE	Input	32kHz is output when input is Hi, 32 kHz is OFF when input is Lo.
/ EIRQ	Output	Interrupt output pin. (N-ch open drain)
/ IRQ	Output	Interrupt output pin. (N-ch open drain)
VDD	—	Connected to a positive power supply.
GND	—	Connected to a ground.

Terminal connection / External dimensions (Unit:mm)



Specifications (characteristics)

* Refer to application

Recommended Operating conditions

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power voltage	VDD	—	1.6	3.0	5.5	V
Clock voltage	VCLK	—	1.3	3.0	5.5	V
Operating Temperature	TOPR	—	-40	+25	+85	°C

Frequency characteristics

Item	Symbol	Condition	Rating	Unit
Frequency tolerance	$\Delta f / f$	Ta = +25 °C VDD = 3.0 V	5 $\pm$ 23 *	$\times 10^{-6}$
Oscillation Start-up time	tSTA	Ta = +25 °C VDD = 1.6 V	1 Max.	s
		Ta = -40 °C ~ +85 °C VDD = 1.6 V	3 Max.	s

*Equivalent to 1 minute of monthly deviation

Current consumption characteristics

Ta = -40 °C ~ +85 °C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Current Consumption	IBK	CE0, CE1 = GND / IRQ, / EIRQ = OFF FOUT : output OFF Event detection OFF	VDD = 5 V	0.45	0.9	μ A
			VDD = 3 V	0.35	0.7	
	I32k	CE0, CE1 = GND / IRQ, / EIRQ = OFF FOUT ; CL = 30 pF 32.768 kHz output ON	VDD = 5 V	8.0	20.0	μ A
			VDD = 3 V	5.0	12.0	



LOW BACKUP VOLTAGE SERIAL-INTERFACE REAL TIME CLOCK MODULE

RX-4571 LC / NB / SA

- Built in frequency adjusted 32.768 kHz crystal unit.
- Interface Type : 3-wire serial interface
- Operating voltage range : 1.6 V to 5.5 V
- Wide Timekeeper voltage range : 1.0 V to 5.5 V / $T_a = +25^\circ\text{C}$
- Low backup current : 0.32 μA (Typ.) / 3 V
- 32.768 kHz frequency output function : C-MOS output With Control Pin
- Real-time clock function
Clock/calendar function, auto leap year correction function,
alarm interrupt function, etc.



Product Number (Please contact us)

RX-4571LC : Q414571C1000100

RX-4571NB : Q414571B1000100

RX-4571SA : Q414571S1000100



Actual size

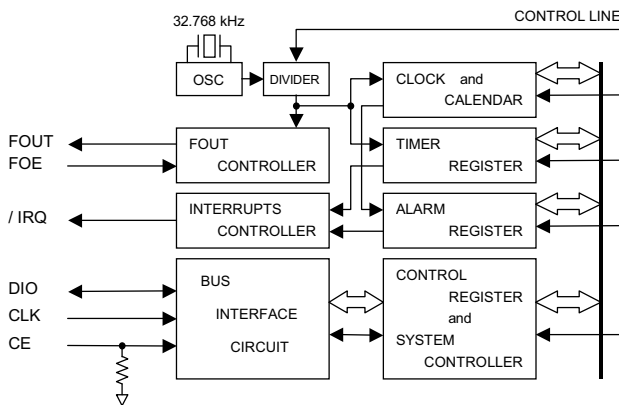
RX-4571LC

RX-4571NB

RX-4571SA



Block diagram



Overview

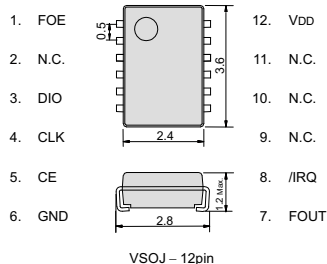
- **32.768 kHz frequency output function**
 - FOUT pin output (C-MOS output), $CL=30\text{ pF}$
- **Timer function**
 - Timer function which can be set up between 1/4096 second and 4095 minutes.
- **Alarm function**
 - Alarm function can be set to any combination of day, day of week, hour, or minute.
- **Pin Function**

Signal Name	Input / Output	Function
CE	Input	The chip enabled input pin 0. (It has a built-in pull-down resistance)
CLK	Input	The shift clock input pin for serial data transfer.
DIO	Bi-directional	The data input / output pin for serial data transfer.
FOUT	Output	32.768 kHz clock output pin with the output control function. (C-MOS)
FOE	Input	FOE pin control the condition of FOUT with FSEL1-bit, FSEL0-bit, etc.
/IRQ	Output	Interrupt output (N-ch open drain)
VDD	—	Connected to a positive power supply.
GND	—	Connected to a ground.

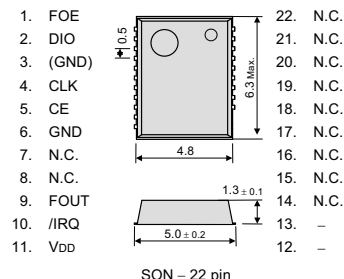
Terminal connection / External dimensions

(Unit:mm)

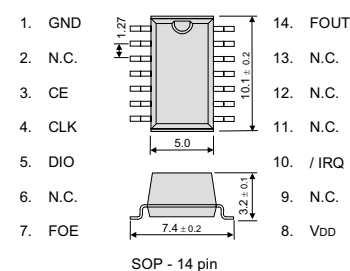
RX-4571 LC



RX-4571 NB



RX-4571 SA



Metal may be exposed on the top or bottom of this product. This will not affect any quality, reliability or electrical spec.

Specifications (characteristics)

* Refer to application manual for details.

Recommended Operating Conditions

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power voltage	VDD	—	1.6	3.0	5.5	V
Clock voltage	VCLK	$T_a = +25^\circ\text{C}$	1.0	3.0	5.5	V
		$T_a = -40$ to $+85^\circ\text{C}$	1.1	3.0	5.5	V
Operating temperature	TOPR	—	-40	+25	+85	$^\circ\text{C}$

Frequency characteristics

Item	Symbol	Condition	Rating	Unit
Frequency tolerance	$\Delta f/f$	$T_a = +25^\circ\text{C}$ $V_{DD} = 3.0\text{ V}$	$5 \pm 23^*$	$\times 10^{-6}$
Oscillation start-up time	t_{STA}	$T_a = +25^\circ\text{C}$ $V_{DD} = 1.6\text{ V}$	1 Max.	s

* Please ask for tighter tolerance. (Equivalent to 1 minute of monthly deviation)

Current consumption characteristics

 $T_a = -40^\circ\text{C}$ to $+85^\circ\text{C}$

Symbol	Condition	Min.	Typ.	Max.	Unit
I _{BK}	CE = GND /IRQ = OFF FOUT ; output OFF (Hi - z)	VDD = 5 V	0.40	1.00	μA
		VDD = 3 V	0.32	0.95	
I _{32k}	CE = GND /IRQ = OFF FOUT ; 32.768 kHz output ON CL = 30 pF	VDD = 5 V	8.0	14.0	μA
		VDD = 3 V	5.0	8.5	



High-Stability

I²C-Bus INTERFACE REAL TIME CLOCK MODULE

RX-8025SA/NB

- Built-in 32.768 kHz crystal unit : Frequency adjusted for high accuracy ($\pm 5 \times 10^{-6}$ / $T_a = +25^\circ\text{C}$)
- Interface Type : I²C-Bus Interface (400 kHz)
- Operating voltage range: 1.70 V to 5.5 V
- Wide Timekeeper voltage range : 1.15 V to 5.5 V
- Various detection Functions : Ex. Oscillation stop detection function
- Low backup current : 0.48 μA / 3 V (Typ.)
- 32.768 kHz frequency output function : C-MOS output With Control Pin
- The various functions include full calendar, alarm, timer.

* The I²C-Bus is a trademark of NXP Semiconductors



Product Number (Please contact us)

RX-8025SA : Q41802551xxxx00

RX-8025NB : Q41802591xxxx00



Actual size

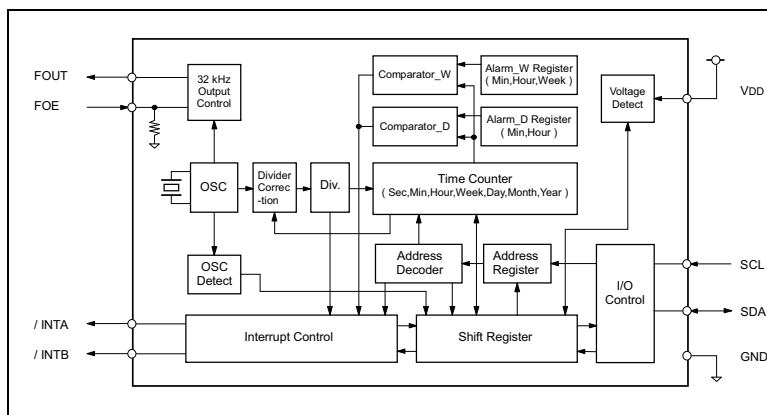
RX-8025SA



RX-8025NB



Block diagram



Overview

Features built-in 32.768 kHz crystal unit

- Frequency adjusted for high accuracy. ($\pm 5 \times 10^{-6}$ / $T_a = +25^\circ\text{C}$) (Equivalent to 13 seconds of monthly deviation)

The various detection function

- Power supply voltage monitoring function (with selectable detection threshold)
- Stop detection function
- Power-on reset detection function

Alarm function and Timer function

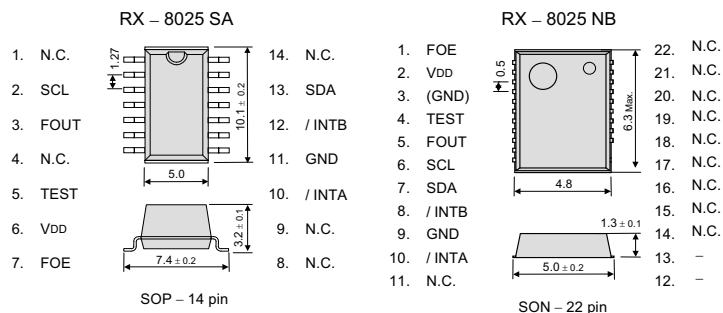
- Timer function produces a periodic interruption signal. As for the Alarm function an optional combination is produced. (Date of the week, time, minute)

Pin Function

Signal Name	Input / output	Function																						
SCL	Input	Serial clock input pin																						
SDA	Bi-directional	Data input and output pin																						
FOUT	Output	32.768 kHz clock output pin with the output control function. (C-MOS)																						
FOE	Input	<table><tr><th>FOE input</th><th>/CLEN1 bit</th><th>/CLEN2 bit</th><th>FOUT output</th></tr><tr><td>L</td><td>X</td><td>X</td><td>OFF (LOW)</td></tr><tr><td rowspan="3">H</td><td>0</td><td>0</td><td>32.768 kHz</td></tr><tr><td>0</td><td>1</td><td>32.768 kHz</td></tr><tr><td>1</td><td>0</td><td>32.768 kHz</td></tr><tr><td></td><td>1</td><td>1</td><td>OFF(LOW)</td></tr></table>	FOE input	/CLEN1 bit	/CLEN2 bit	FOUT output	L	X	X	OFF (LOW)	H	0	0	32.768 kHz	0	1	32.768 kHz	1	0	32.768 kHz		1	1	OFF(LOW)
FOE input	/CLEN1 bit	/CLEN2 bit	FOUT output																					
L	X	X	OFF (LOW)																					
H	0	0	32.768 kHz																					
	0	1	32.768 kHz																					
	1	0	32.768 kHz																					
	1	1	OFF(LOW)																					
/ INTA	Output	Interrupt output A pin (N-ch open drain)																						
/INTB	Output	Interrupt output B pin (N-ch open drain)																						
TEST	—	* Used by the manufacture for testing. (Do not connect externally.)																						
VDD	—	Connected to a positive power supply.																						
GND	—	Connected to a ground.																						

Terminal connection / External dimensions

(Unit:mm)



Metal may be exposed on the top or bottom of this product. This will not affect any quality, reliability or electrical spec.

Specifications (characteristics)

* Refer to application manual for details.

Recommended Operating Conditions

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power voltage	VDD	—	1.7	3.0	5.5	V
Clock voltage	VCLK	—	1.15	3.0	5.5	V
Operating temperature	TOPR	—	-40	+25	+85	°C

Frequency characteristics

Item	Symbol	Condition	Range	Unit
Frequency tolerance	$\Delta f / f$	$T_a = +25^\circ\text{C}$ $V_{DD} = 3.0\text{ V}$	AA: 5 ± 5 ^{*1)} AC: 0 ± 5 ^{*2)}	$\times 10^{-6}$
Oscillation start-up time	tSTA	$T_a = +25^\circ\text{C}$ $V_{DD} = 2.0\text{ V}$	1 Max.	s
Frequency voltage characteristics	f / V	$T_a = +25^\circ\text{C}$ $V_{DD} = 2.0\text{ V to } 5.5\text{ V}$	± 1 Max.	$\times 10^{-6}$

*1) *2) Equivalent to 13 seconds of monthly deviation (excluding offset).

Current consumption characteristics

 $T_a = -40^\circ\text{C to } +85^\circ\text{C}$

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Current Consumption	I _{BK}	f _{SCL} = 0Hz FOE = GND FOUT ; output OFF(LOW)	V _{DD} = 5 V	0.60	1.80	μA
	I _{32k}	f _{SCL} = 0Hz V _{DD} , FOE = 5.5 V FOUT ; output ON (Output=OPEN; CL = 0 pF)	V _{DD} = 5.5 V	3.0	6.5	

Power supply detection voltage

 $T_a = -30^\circ\text{C to } +70^\circ\text{C}$

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
High-voltage mode	VD _{ETH}	V _{DD} pin	1.90	2.10	2.30	V
Low-voltage mode	VD _{ETL}	V _{DD} pin	1.15	1.30	1.45	V

Low current consumption

RTC - 8564 JE / NB
RX - 8564 LC

- Built in frequency adjusted 32.768 kHz crystal unit.
- Interface Type : I²C-Bus Interface (400 kHz)
- Operating voltage range : 1.8 V to 5.5 V
- Timekeeper voltage range : 1.0 V to 5.5 V / -20 °C to +70 °C
- Low backup current : 275 nA / 3.0 V(Typ.)
- 32.768 kHz frequency output function : C-MOS output With Control Pin
- The various functions include full calendar, alarm, timer, and power supply voltage monitoring function

* The I²C-Bus is a trademark of NXP Semiconductors



Product Number (Please contact us)

Product Number (Please contact us)
RTC-8564JE : Q41856471000100

RTC-8564NB : Q41856491000200

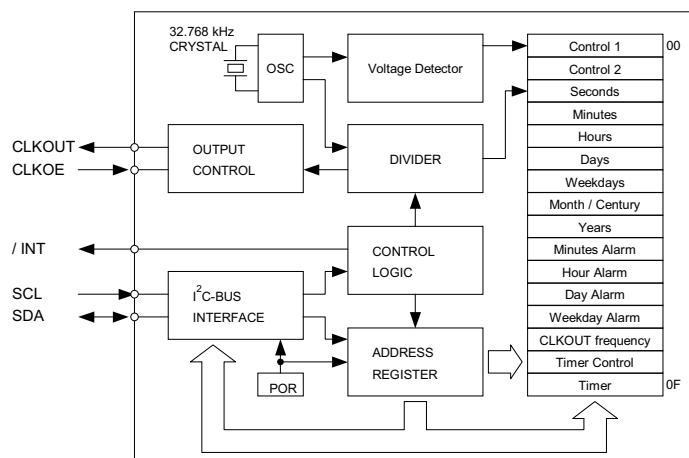
RX-8564LC : Q418564C0xxxx00



Actual size



Block diagram



Overview

- **Interface Type**

- I²C-Bus Interface. (Hi-speed bus specifications 400 kHz)
- * I²C-Bus slave address : read A3h and write A2h

- **Low Timekeeper voltage range**

- 1.0 V to 5.5 V / $T_a = -20\text{ }^{\circ}\text{C}$ to $+70\text{ }^{\circ}\text{C}$
- 1.1 V to 5.5 V / $T_a = -40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$

- 32.768 kHz frequency output function

- CLKOUT pin output (C-MOS output), CL=30 pF
- CLKOE pin enables output on/off control.
- Output selectable
<32.768 kHz, 1024 Hz, 32 Hz, 1 Hz>

- The various interrupt function

- Timer function can be set up between 1/4096 second and 255 minutes.
- Alarm function can be set to any combination of day of week, hour, or minute.

Pin Function

Signal Name	Input/Output	Function			
SCL	Input	Serial clock input pin.			
SDA	Bi-directional	Data input and output pin.			
CLKOUT	Output	32.768 kHz clock output pin with the output control function. (C-MOS) CLKOE pin control the condition of CLKOUT with FE-bit, etc.			
CLKOE	Input	CLKOE pin input	FE bit	CLKOUT pin output	
		HIGH	1	Output	(C-MOS)
			0	OFF	(LOW)
		LOW	1	OFF	(LOW)
			0	OFF	(LOW)
/INT	Output	Interrupt output (N-ch open drain)			
V _{DD}	—	Connected to a positive power supply.			
GND	—	Connected to a ground.			

Terminal connection / External dimensions

RTC - 8564 JE				RTC - 8564 NB				RX - 8564 LC			
1. N.C.		20. N.C.	1. /INT		22. N.C.	1. N.C.		12. N.C.			
2. N.C.		19. N.C.	2. GND		21. N.C.	2. N.C.		11. CLKOE			
3. CLKOE		18. N.C.	3. (GND)		20. N.C.	3. N.C.		10. VDD			
4. VDD		17. N.C.	4. N.C.		19. N.C.	4. N.C.		9. CLKOUT			
5. CLKOUT		16. N.C.	5. SDA		18. N.C.	5. /INT		8. SCL			
6. SCL		15. N.C.	6. SCL		17. N.C.	6. GND		7. SDA			
7. SDA		14. N.C.	7. CLKOUT		16. N.C.						
8. (GND)		13. N.C.	8. VDD		15. N.C.						
9. GND		12. N.C.	9. CLKOE		14. N.C.						
10. /INT		11. N.C.	10. N.C.		13. -						
			11. N.C.								
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											

Metal may be exposed on the top or bottom of this product. This will not affect any quality , reliability or electrical spec.

Specifications (characteristics)

■ Recommended Operating Conditions

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power voltage	V _{DD}	—	1.8	3.0	5.5	V
Clock voltage	V _{CLK}	—	V _{LOW}	3.0	5.5	V
Operating temperature	T _{OPR}	—	-40	+25	+85	°C

- Low voltage detection

Low voltage detection						
Item	Symbol		Condition	Typ.	Max.	Unit
Low voltage detection	V _{LOW}	JE,NB	Ta = -20 °C ~ +70 °C	0.9	1.0	V
			Ta = -40 °C ~ +85 °C	0.9	1.1	V
		LC	Ta = -20 °C ~ +70 °C	0.9	1.2	V
			Ta = -40 °C ~ +85 °C	0.9	1.3	V

■ Frequency characteristics

Item	Symbol	Condition	Rating	Unit
Frequency tolerance	$\Delta f/f$	Ta = +25 °C V _{DD} = 3.0 V	5 ± 23 *	× 10 ⁻⁶

* Please ask for tighter tolerance. (Equivalent to 1 minute of monthly deviation)

■ Current consumption characteristics

$T_a = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Current Consumption	I _{bk}	f _{SCL} = 0 Hz CLKOE = GND	V _{DD} = 5 V	330	800	nA
		CLKOUT ; output OFF (LOW)	V _{DD} = 3 V	275	700	
	I _{32k}	f _{SCL} = 0 Hz CLKOE = V _{DD}	V _{DD} = 5 V	2.5	3.4	μA
		CLKOUT ; 32.768 kHz output ON (Output=OPEN ; CL = 0 pF)	V _{DD} = 3 V	1.5	2.2	



For Automotive I²C-Bus INTERFACE REAL TIME CLOCK MODULE

RA - 8565 SA

- Built in frequency adjusted 32.768 kHz crystal unit.
- Interface Type : I²C-Bus Interface (400 kHz)
- Wide operating voltage range : 1.8 V to 5.5 V
- Wide Timekeeper voltage range : 1.7 V to 5.5 V
- $T_a = -40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$
- Extended operating temperature range: $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$
- 32.768 kHz frequency output function: N-ch Open drain output With Control Pin
- The various functions include full calendar, alarm, timer, etc.
- Conforms to AEC-Q200
- * The I²C-Bus is a trademark of NXP Semiconductors



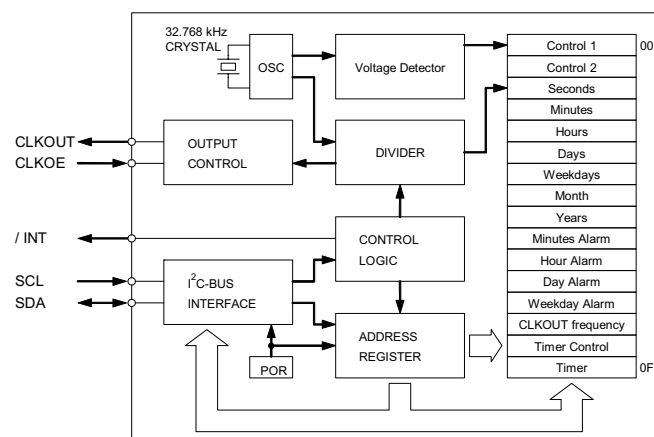
Product Number (Please contact us)
RA-8565SA : Q41A86551xxxx00



Actual size



Block diagram



Overview

- Wide operating temperature range for automotive
 - $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$
- Clocking-status detection function
 - It can judge the validity of data after backup operation return by a status of VL-bit.
- 32.768 kHz frequency output function
 - CLKOUT pin output (N-ch Open Drain output)
 - Output frequency can be selected as 32.768 kHz, 1024 Hz, 32 Hz, or 1 Hz.
- The various interrupt function
 - Timer function can be set up between 1/4096 second and 255 minutes.
 - Alarm function can be set to day of week, day, hour, or minute.

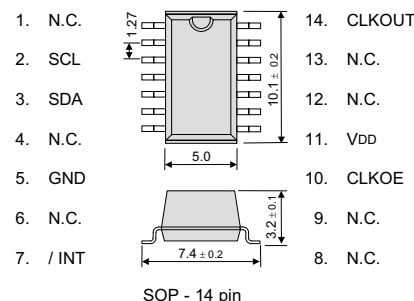
Pin Function

Terminal	Directions	Functions
SCL	Input	Serial clock input.
SDA	Bi-directional	Data input and output.
CLKOUT	Output	The CLKOUT pin is a clock output (open drain output) pin with control output. (Output frequency can be selected as 32.768 kHz, 1024 Hz, 32 Hz, or 1 Hz.)
CLKOE	Input	The CLKOE pin is an input pin used to control the output mode of the CLKOUT output pin. During the initial power-on (when power is applied from 0 V) , if the CLKOE input pin is at high level (= H) , the power-on reset function selects 32.768 kHz as the frequency.
/INT	Output	Interrupts output by Alarm and Timer events. (Open drain output)
VDD	—	Connected to a positive power supply.
GND	—	Connected to a ground.

Terminal connection / External dimensions

(Unit:mm)

RA - 8565 SA



SOP - 14 pin

Metal may be exposed on the top or bottom of this product.
This will not affect any quality, reliability or electrical spec.

Specifications (characteristics)

* Refer to application manual for details.

■ Recommended Operating Conditions

Item	Symbol	Conditions	Min.	Typ.	Max.	unit
Operating voltage	VDD	—	1.8	3.0	5.5	V
Timekeeper voltage	VCLK	—	1.7	3.0	5.5	V
Operating temperature	TOPR	—	-40	+25	+125	°C

■ Frequency characteristics

Item	Symbol	Conditions	Rating	unit
Frequency stability	$\Delta f/f$	$T_a = +25\text{ }^{\circ}\text{C}$ $V_{DD} = 3.0\text{ V}$	$5 \pm 23\text{ }^{*1}$	$\times 10^{-6}$
Oscillation start up time	t_{STA}	$T_a = +25\text{ }^{\circ}\text{C}$ $V_{DD} = 1.8\text{ V}$ $T_a = -40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ $V_{DD} = 3.0\text{ V}$	1.5 Max. 3 Max.	s

*1) Equivalent to 1 minutes of monthly deviation.

■ Current consumption under backup mode.

Item	Symbol	Conditions	Min.	Typ.	Max.	unit
Standby current.	IBK	$f_{SCL} = 0\text{ Hz}$ $CLKOE = \text{LOW}$	$+125\text{ }^{\circ}\text{C}$	1.10	1.80	μA
		$V_{DD} = 5\text{ V}$		0.60	1.2	
		$f_{SCL} = 0\text{ Hz}$ $CLKOE = \text{LOW}$	$-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$	1.00	1.6	μA
		$V_{DD} = 3\text{ V}$		0.55	1.0	



Low current consumption I²C-Bus INTERFACE REAL TIME CLOCK MODULE

RX-8571 SA/NB/LC

- Built-in frequency adjusted 32.768 kHz crystal unit.
- Interface Type : I²C-Bus Interface (400 kHz)
- Operating voltage range : 1.6 V to 5.5 V
- Wide Timekeeper voltage range : 1.3 V to 5.5 V
- Low backup current : 220 nA / 3 V (Typ.)
- 32.768 kHz frequency output function : C-MOS output With Control Pin
- User RAM : 128 bit
- The various functions include full calendar, alarm, timer, etc.
(Long-running timer : 65535 hours)
- * The I²C-Bus is a trademark of NXP Semiconductors



Product Number (Please contact us)

RX-8571SA : X1B000071xxxx00

RX-8571NB : X1B000061xxxx00

RX-8571LC : X1B000051xxxx00



Actual size

RX-8571SA



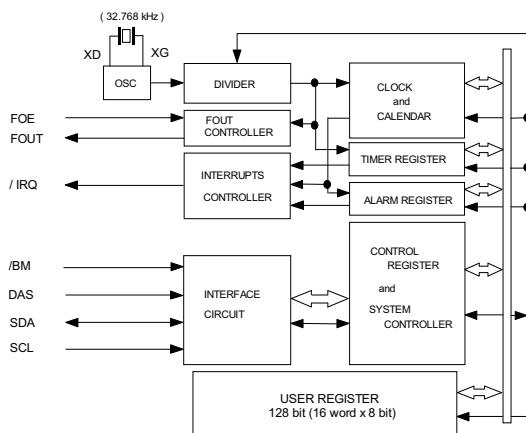
RX-8571NB



RX-8571LC



Block diagram

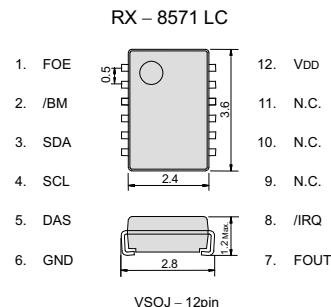
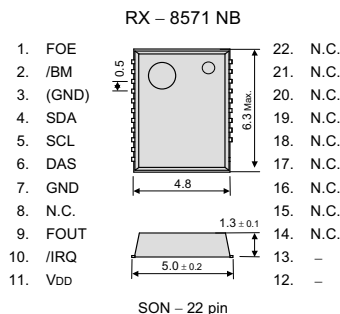
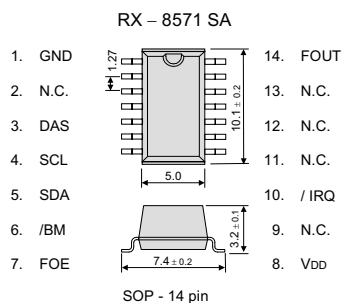


Overview

- 32.768 kHz frequency output function
 - FOE pin enable output on/off control.
 - Output frequency can be selected as 32.768 kHz, 1024 Hz, 1 Hz.
- Timer Function
 - Timer function can be set up between 1/4096 second and 65535 hours.
 - Timing period are 1 h, 1 min, 64 Hz, 4096 Hz.
 - It is recorded automatically to TF-bit at the time of event occurs, and possible to output with /IRQ pin output.
- Alarm function
 - Alarm function can be set to day of week, day, hour, or minute.
 - It is recorded automatically to AF-bit at the time of event occurs, and possible to output with /IRQ pin output.
- Built-in RAM
 - 128 bit (16 word x 8 bit)

Terminal connection / External dimensions

(Unit:mm)



Metal may be exposed on the top or bottom of this product. This will not affect any quality, reliability or electrical spec.

Specifications (characteristics)

* Refer to application manual for details.

Recommended Operating Conditions

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power voltage	VDD	—	1.6	3.0	5.5	V
Clock voltage	VCLK	—	1.3	3.0	5.5	V
Operating temperature	TOPR	—	-40	+25	+85	°C

Frequency characteristics

Item	Symbol	Condition	Rating	Unit
Frequency tolerance	$\Delta f/f$	Ta = +25 °C VDD = 3.0 V	5 ± 23 *	× 10 ⁻⁶
Oscillation start up time	tSTA	Ta = +25 °C VDD = 1.6 V	1 Max.	s

* Please ask for tighter tolerance. (Equivalent to 1 minute of monthly deviation)

Current consumption characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Current Consumption	IDD	FOE=/BM="L" FOUT= OFF /IRQ = OFF VDD =3.0V Ta= +25 °C		220	400	nA
				200	400	nA
		FOE=/BM="L" FOUT= OFF /IRQ = OFF VDD =3.0V Ta= -40 °C to +85 °C			550	nA

I²C-Bus INTERFACE REAL TIME CLOCK MODULE

RX-8581 SA/ JE/ NB

- Built-in frequency adjusted 32.768 kHz crystal unit.
- Interface Type : I²C-Bus Interface (400 kHz)
- Operating voltage range : 1.8 V to 5.5 V
- Wide Timekeeper voltage range : 1.6 V to 5.5 V
- Low backup current : 0.45 μ A / 3 V (Typ.)
- 32.768 kHz frequency output function : C-MOS output With Control Pin
- The various functions include full calendar, alarm, timer.

* The I²C-Bus is a trademark of NXP Semiconductors

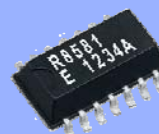


Product Number (Please contact us)

RX-8581SA : Q41858151xxxx00

RX-8581JE : Q41858171xxxx00

RX-8581NB : Q41858191000200



Actual size

RX-8581SA



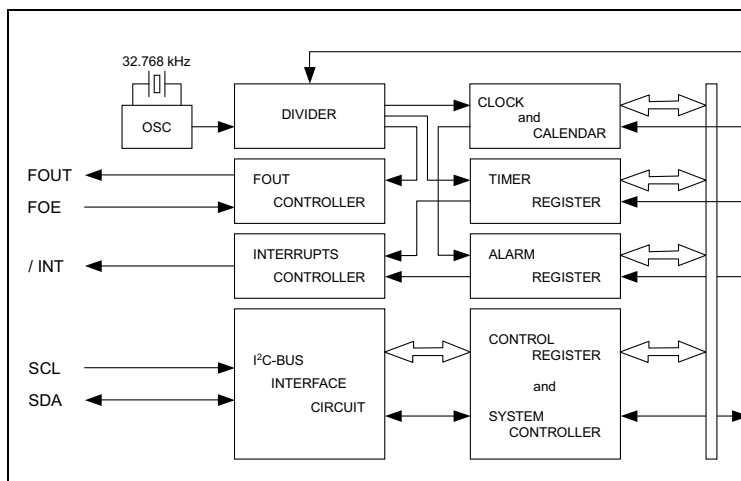
RX-8581JE



RX-8581NB



Block diagram



Overview

• Interface Type

- I²C-Bus interface. (Hi-speed bus specifications 400 kHz)
- * I²C-Bus slave address : read A3h and write A2h

• 32.768 kHz frequency output function

- FOUT pin output (C-MOS output), CL=30 pF
- 32.768 kHz clock frequency output. (Duty 50 $\pm$ 5 %)

• Timer function

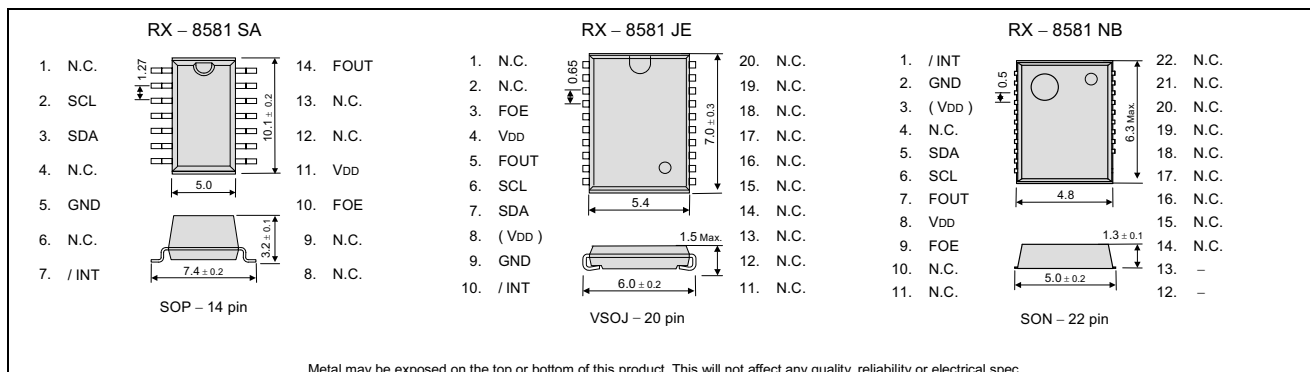
- Timer interrupt function can be set up between 1/4096 second and 4095 minutes.
- It is recorded automatic to TF-bit at the time of event occurrence, and possible to output with /TIRQ pin output (N-ch open-drain output).

• Interrupt function

- Alarm interrupt function, Time update interrupt function.

Terminal connection / External dimensions

(Unit:mm)



Metal may be exposed on the top or bottom of this product. This will not affect any quality, reliability or electrical spec.

Specifications (characteristics)

* Refer to application manual for details.

■ Recommended Operating Conditions

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power voltage	VDD	—	1.8	3.0	5.5	V
Clock voltage	VCLK	—	1.6	3.0	5.5	V
Operating temperature	TOPR	—	-40	+25	+85	°C

■ Frequency characteristics

Item	Symbol	Condition	Rating	Unit
Frequency tolerance	$\Delta f / f$	Ta = +25 °C VDD = 3.0 V	5 $\pm$ 23 *	$\times 10^{-6}$
FOUT output Duty	tw / t	Ta = -40 °C to +85 °C VDD = 2.4 V to 5.5 V	50 $\pm$ 5	%

* Please ask for tighter tolerance. (Equivalent to 1 minute of monthly deviation)

■ Current consumption characteristics

Ta = -40 °C to +85 °C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Current Consumption	IBK	fSCL = 0 Hz FOE = GND	VDD = 5 V	0.65	1.2	μ A
		FOUT ; output OFF (LOW)	VDD = 3 V	0.45	0.8	
	I32k	fSCL = 0 Hz FOE = VDD	VDD = 5 V	8.0	20.0	μ A
		FOUT ; 32.768 kHz output ON CL = 30 pF	VDD = 3 V	5.0	12.0	



For Automotive I²C-Bus INTERFACE REAL TIME CLOCK MODULE

RA - 8581 SA

- Built-in frequency adjusted 32.768 kHz crystal unit.
- Interface Type : I²C-Bus Interface (400 kHz)
- Operating voltage range : 1.8 V to 5.5 V
- Wide Timekeeper voltage range : 1.6 V to 5.5 V
- Low backup current : 0.45 μ A / 3 V (Typ.)
- 32.768 kHz frequency output function : C-MOS output With Control Pin
- The various functions include full calendar, alarm, timer.
- Conforms to AEC-Q200

* The I²C-Bus is a trademark of NXP Semiconductors



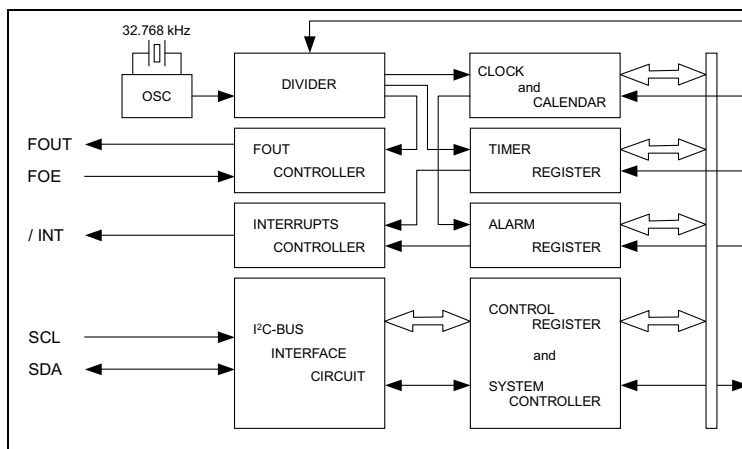
Product Number (Please contact us)
RA-8581SA : Q41A88151xxx00



Actual size



Block diagram



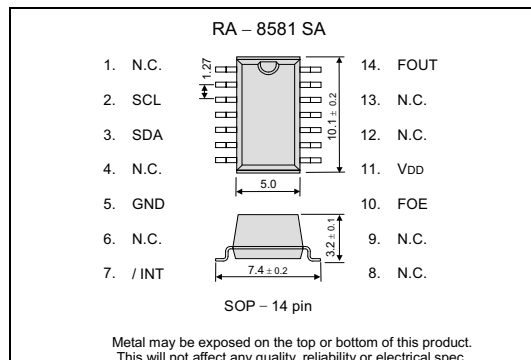
Overview

- **Interface Type**
 - I²C-Bus interface. (Hi-speed bus specifications 400 kHz)
 - * I²C-Bus slave address : read A3h and write A2h
- **32.768 kHz frequency output function**
 - FOUT pin output (C-MOS output), CL=30 pF
 - 32.768 kHz clock frequency output. (Duty 50 $\pm$ 5%)
- **Timer function**
 - Timer interrupt function can be set up between 1/4096 second and 4095 minutes.
 - It is recorded automatic to TF-bit at the time of event occurrence, and possible to output with /TIRQ pin output (N-ch open-drain output).
- **Interrupt function**
 - Alarm interrupt function, Time update interrupt function.

Pin Function

Signal Name	Input / Output	Function									
SCL	Input	Serial clock input pin									
SDA	Bi-directional	Data input and output pin									
FOUT	Output	FOUT pin outputs the reference clock signal at 32.768 kHz. FOE pin inputs the FOUT output control.									
FOE	Input	<table><tr><th>FOE pin input</th><th colspan="2">FOUT pin output</th></tr><tr><td>HIGH</td><td>Output</td><td>(C-MOS)</td></tr><tr><td>LOW</td><td>OFF</td><td>(LOW)</td></tr></table>	FOE pin input	FOUT pin output		HIGH	Output	(C-MOS)	LOW	OFF	(LOW)
FOE pin input	FOUT pin output										
HIGH	Output	(C-MOS)									
LOW	OFF	(LOW)									
/INT	Output	Interrupt output (N-ch open drain)									
VDD	—	Connected to a positive power supply.									
GND	—	Connected to a ground.									

Terminal connection / External dimensions (Unit:mm)



Specifications (characteristics)

* Refer to application manual for details.

Recommended Operating Conditions

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power voltage	VDD	—	1.8	3.0	5.5	V
Clock voltage	VCLK	—	1.6	3.0	5.5	V
Operating temperature	TOPR	—	-40	+25	+85	°C

Frequency characteristics

Item	Symbol	Condition	Rating	Unit
Frequency tolerance	$\Delta f / f$	Ta = +25 °C VDD = 3.0 V	5 $\pm$ 23 *	$\times 10^{-6}$
FOUT output Duty	tw / t	Ta = -40 °C to +85 °C VDD = 2.4 V to 5.5 V	50 $\pm$ 5	%

* Equivalent to 1 minute of monthly deviation

Current consumption characteristics

Ta = -40 °C to +85 °C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Current Consumption	I _{BK}	f _{SCL} = 0 Hz FOE = GND FOUT ; Output OFF (LOW)	VDD = 5 V	0.65	1.2	μ A
			VDD = 3 V	0.45	0.8	
	I _{32k}	f _{SCL} = 0 Hz FOE = VDD FOUT ; 32.768 kHz Output ON CL = 30 pF	VDD = 5 V	8.0	20.0	μ A
			VDD = 3 V	5.0	12.0	



Built-in EEPROM and Unique ID-ROM I²C-Bus INTERFACE REAL TIME CLOCK MODULE

RX-8731LC

- Built in frequency adjusted 32.768 kHz crystal unit.
- Interface Type : I²C-Bus interface (400 kHz)
- Operating voltage range : 1.7 V to 5.5 V
- Wide Timekeeper voltage range : 1.3 V to 5.5 V
- Low backup current : 0.35 μ A / 3 V (Typ.)
- 32.768 kHz frequency output function : C-MOS output With Control Pin
- The various functions include full calendar, alarm, timer.

* The I²C-Bus is a trademark of NXP Semiconductors

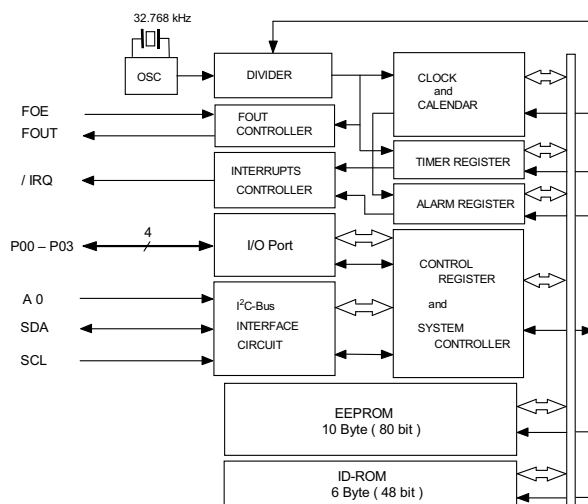


Product Number (Please contact us)
RX-8731LC : Q418731C1000100



Actual size

Block diagram



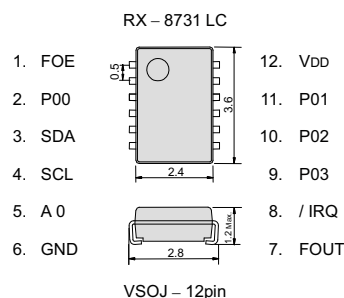
Overview

- **Built in EEPROM and ID-ROM**
 - Built in 10 Byte (80 bit) EEPROM
 - Built in 6 Byte (48 bit) ID-ROM
- **Programmable I/O ports**
 - 4 Programmable I/O ports
- **Interface Type**
 - I²C-Bus high-speed bus specifications. (400 kHz)
- **32.768 kHz frequency output function**
 - FOUT pin output (C-MOS output), CL=30 pF
 - FOE pin enables output on/off control.
 - Output frequency is selectable.
< 32.768 kHz, 1024 Hz, 1 Hz >
- **The various interrupt function**
 - Alarm interrupt function
 - Timer interrupt function
 - Update interrupt function

Pin Function

Signal Name	Input / Output	Function
SCL	Input	Serial Clock input pin.
SDA	Bi-directional	Data input and output pin.
A0	Input	Device address A0 input pin.
FOUT	Output	FOUT pin is 32.768 kHz clock output pin (C-MOS) that output control is possible.
FOE	Input	FOE pin control the frequency output from FOUT pin with FSEL1-bit and FSEL0-bit.
/IRQ	Output	Interrupt output pin. (N-ch open drain)
P00 P01 P02 P03	Bi-directional	Programmable I/O ports.
VDD	—	Connected to a positive power supply.
GND	—	Connected to a ground.

Terminal connection / External dimensions (Unit:mm)



Specifications (characteristics)

* Refer to application manual for details.

Recommended Operating Conditions

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power voltage	VDD	—	1.7	3.0	5.5	V
Clock voltage	VCLK	—	1.3	3.0	5.5	V
Operating temperature	TOPR	—	-40	+25	+85	°C

Frequency characteristics

Item	Symbol	Condition	Rating	Unit
Frequency tolerance	$\Delta f/f$	Ta = +25 °C VDD = 3.0 V	5 $\pm$ 23 *	$\times 10^{-6}$
Oscillation Start-up time	tSTA	Ta = +25 °C VDD = 1.6 V	1 Max.	s
		Ta = -40 °C to +85 °C VDD = 1.6 V	3 Max.	s

*Equivalent to 1 minute of monthly deviation

Current consumption characteristics

Ta = -40 °C to +70 °C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Current Consumption	I _{BK}	f _{SCL} = 0 Hz /IRQ = OFF	VDD = 5 V	0.45	0.9	μ A
		FOUT : output OFF (Hi - z)	VDD = 3 V	0.35	0.7	
	I _{32k}	f _{SCL} = 0 Hz /IRQ = OFF	VDD = 5 V	8.0	16.0	μ A
		FOUT : 32.768 kHz output CL = 30 pF	VDD = 3 V	5.0	10.0	



Built-in 32.768 kHz-DTCXO, High Stability I²C-Bus INTERFACE REAL TIME CLOCK MODULE

RX-8801SA/JE

- Built in frequency adjusted 32.768 kHz crystal unit and DTCXO.
- Interface Type : I²C-Bus Interface (400 kHz)
- Interface voltage range : 1.6 V to 5.5 V
- Temp.compensated voltage range: 2.2 V to 5.5 V
- Wide Timekeeper voltage range : 1.6 V to 5.5 V
- 32.768 kHz frequency output function : C-MOS output With Control Pin
- The various functions include full calendar, alarm, timer.

* The I²C-Bus is a trademark of NXP Semiconductors



Product Number (Please contact us)

RX-8801SA : X1B000011xxx00

RX-8801JE : X1B000031xxx00

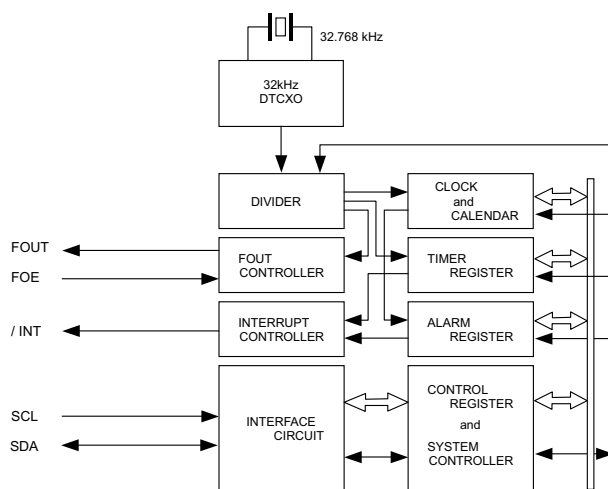


Actual size



NEW

Block diagram



Overview

- High Stability
 - UA
 - $\pm 1.9 \times 10^{-6}$ / 0°C to $+40^\circ\text{C}$
(Equivalent to 5 seconds of month deviation)
 - $\pm 3.4 \times 10^{-6}$ / -40°C to $+85^\circ\text{C}$
(Equivalent to 9 seconds of month deviation)
 - UB
 - $\pm 3.8 \times 10^{-6}$ / 0°C to $+50^\circ\text{C}$
(Equivalent to 10 seconds of month deviation)
 - $\pm 5.0 \times 10^{-6}$ / -40°C to $+85^\circ\text{C}$
(Equivalent to 13 seconds of month deviation)
- 32.768 kHz frequency output function
 - FOUT pin output (C-MOS output), CL=30 pF
 - Output selectable
< 32.768 kHz, 1024 Hz, 1 Hz >
- The various interrupt
 - Timer Function can be set up between
1/ 4096 second and 255 minutes.
 - Alarm Function can be set to day of week,
day, hour, or minute.

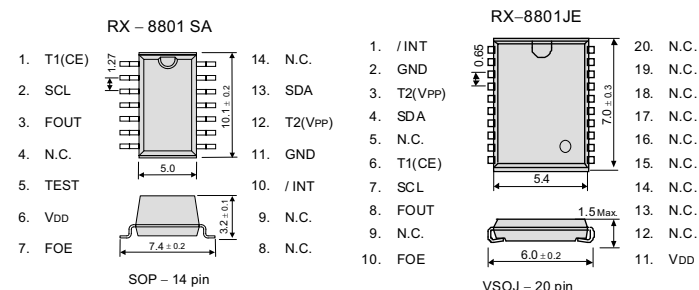
*It is possible to use it by the terminal connection as 32.768 kHz-DTCXO.

Pin Function

Signal Name	I / O	Function
T1(CE)	input	* Use by the manufacture for testing. (Do not connect externally.)
SCL	input	Serial clock input pin
FOUT	Output	The pin outputs the reference clock signal. (CMOS output)
TEST	input	* Use by the manufacture for testing. (Do not connect externally.)
VDD	-	Connected to a positive power supply
FOE	input	The input pin for the FOUT output control.
/INT	Output	Interrupt output (N-ch open drain)
GND	-	Connected to a GND
T2(VPP)	-	* Use by the manufacture for testing. (Do not connect externally.)
SDA	I / O	Data input and output pin

Terminal connection / External dimensions

(Unit:mm)



Metal may be exposed on the top or bottom of this product.
This will not affect any quality, reliability or electrical spec.

Specifications (characteristics)

* Refer to application manual for details.

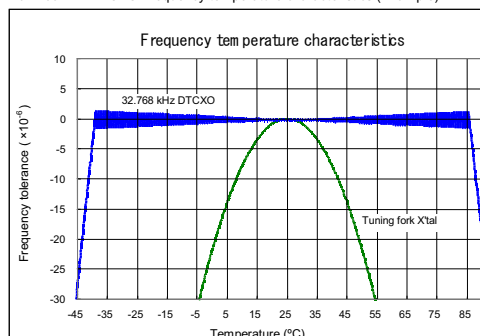
Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Interface voltage	VDD	Interface voltage	1.6	3.0	5.5	V
Temp. compensated Voltage	VTEM	Temp. compensated voltage	2.2	3.0	5.5	V
Clock voltage	VCLK	-	1.6	3.0	5.5	V
Operating temperature	TOPR	-	-40	+25	+85	°C
Stability	$\Delta f/f$	UA	Ta = 0 °C to +40 °C		± 1.9 *1	$\times 10^{-6}$
		UB	Ta = -40 °C to +85 °C		± 3.4 *2	
		UA	Ta = 0 °C to +50 °C		± 3.8 *3	
		UB	Ta = -40 °C to +85 °C		± 5.0 *4	
Current consumption (1)	IBK1	Backup Mode FOE = GND, /INT = VDD FOUT output : OFF	VDD = 5V	-	1.2	3.4
Current consumption (2)	IBK2		VDD = 3V	-	0.8	2.8

*1) Equivalent to 5 seconds of month deviation. *2) Equivalent to 9 seconds of month deviation.

*3) Equivalent to 10 seconds of month deviation. *4) Equivalent to 13 seconds of month deviation.

32.768 kHz-DTCXO Frequency temperature characteristics (Example)





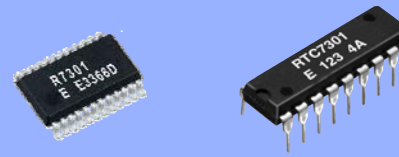
4-bit REAL TIME CLOCK MODULE

RTC - 7301SF / DG

- Built-in crystal unit 32.768 kHz with frequency adjusted
- Frequency selectable clock output (32.768 kHz to 1/30 Hz)
- Built-in 30 second adjustment function, digital pace adjustment function (Max. adjustment: $\pm 192 \times 10^{-6}$)
- Built-in alarm and timer interrupt functions.
- Built-in semiconductor temperature sensor (Voltage output: -7.8 mV / °C, RTC-7301SF)
- Operating voltage range: 2.4 V to 5.5 V, time keeping voltage range: 1.6 V to 5.5 V
- Low current consumption (0.6 μ A / 3 V Typ.)
- High speed parallel interface compatible with SRAM



Product Number (Please contact us)
 RTC-7301SF : Q42730181000200
 RTC-7301DG : Q42730111000200

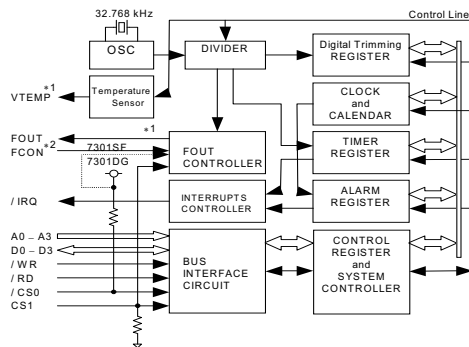


RTC-7301SF

RTC-7301DG



Block diagram



This is a block diagram for RTC-7301SF.

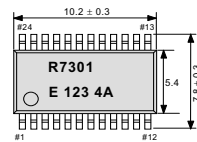
Be aware that RTC-7301DG differs according to the following 2 points.

- *1) The VTEMP output is not connected to an external pin.
- *2) The FCON input pin is not connected to an external pin, but is fixed at "H" internally.

External dimensions/Terminal connection

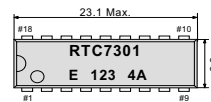
(Unit:mm)

● RTC-7301SF (SSOP 24-pin)

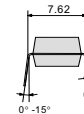
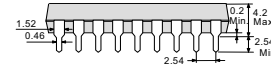
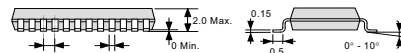


No.	Pin terminal	No.	Pin terminal
1	/CS0	24	VDD
2	FCON	23	(VDD)
3	FOUT	22	(VDD)
4	VTEMP	21	(VDD)
5	(VDD)	20	(VDD)
6	/IRQ	19	(VDD)
7	A0	18	CS1
8	A1	17	D0
9	A2	16	D1
10	A3	15	D2
11	/RD	14	D3
12	GND	13	/WR

● RTC-7301DG (DIP 18-pin)



No.	Pin terminal	No.	Pin terminal
1	/CS0	18	VDD
2	FCON	17	(VDD)
3	/IRQ	16	(VDD)
4	A0	15	CS1
5	A1	14	D0
6	A2	13	D1
7	A3	12	D2
8	/RD	11	D3
9	GND	10	/WR



Metal may be exposed on the top or bottom of this product. This will not affect any quality, reliability or electrical spec.

Specifications (characteristics)

*Refer to application manual for details.

■ Absolute Max. rating

GND=0 V

Item	Symbol	Condition	Min.	Max.	Unit
Supply voltage	VDD	VDD to GND	-0.3	+7.0	
Input voltage	VIN	Input terminal, D0 to D3 pins	GND-0.3	VDD+0.3	V
Output voltage(1)	VOUT1	/IRQ pin		+8.0	
Output voltage(2)	VOUT2	FOUT, D0-D3, VTEMP pin		VDD+0.3	
Storage temperature	TSTG	Stored as bare product after unpacking	-55	+125	°C

■ DC characteristics

(GND=0 V, VDD=1.6 V to 5.5 V, Ta=-40 °C to +85 °C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Current consumption (When non-accessed) FOUT=Output OFF VTEMP=Output OFF	I _{DD1}	/CS0, /RD, /WR=VDD A0-A3, CS1=GND D0-D3, /IRQ=Hi-z	—	1.0	2.0	μ A
	I _{DD2}	FOUT=Hi-z(OFF) VTEMP=Hi-z(OFF)		0.6	1.0	

Note) There is no VTEMP pin on the RTC-7301DG so standards for the VTEMP pin within the conditions described above do not apply.

■ Operating range

GND = 0 V

Item	Symbol	Condition	Min.	Max.	Unit
Power voltage	VDD	—	2.4	5.5	V
Clock voltage	VCLK	—	1.6		V
Operating temperature	TOPR	No condensation	-40	+85	°C

■ Temperature sensor characteristics

GND=0 V, Ta=-40 °C to +85 °C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Temperature output voltage	VTEMP	Ta=+25 °C, GND based output voltage VTEMP pins, VDD=2.7 V to 5.5 V		1.470		V
Output precision	T _{ACR}	Ta=+25 °C, VDD=2.7 V to 5.5 V			±5.0	°C
Temperature sensitivity	VSE	-40 °C ≤ Ta ≤ +85 °C, VDD=2.7 V to 5.5 V	-7.3	-7.8	-8.3	mV/°C
Linearity	ΔNL	-40 °C ≤ Ta ≤ +85 °C, VDD=2.7 V to 5.5 V			±2.0	%
Temperature detection range	T _{SDP}	ΔNL ≤ ±2.0 %, VDD=2.7 V to 5.5 V	-40		+85	°C
Output resistance	R ₀	Ta=25 °C, VTEMP pins, VDD=2.7 V to 5.5 V GND standard and VDD standard		1.0	3.0	kΩ
	R _L	VDD=2.7 V to 5.5 V			100	pF
Load condition	CL	VDD=2.7 V to 5.5 V				
	RL	VDD=2.7 V to 5.5 V	500			kΩ
Response time	t _{RSP}	VDD=3.3 V CL=50 pF, RL=500 kΩ, Max. ±1 °C			200	μs

Note) There is no temperature sensor function on the RTC-7301DG.

■ Frequency characteristics

Item	Symbol	Condition	Range	Unit
Frequency precision	Δf/f	Ta=+25 °C, VDD=3.0 V	B: ±23 (*1)	×10 ⁻⁶
Oscillation Start up time	t _{STA}	Ta=+25 °C, VDD=2.4 V	3.0 Max.	s
Frequency temperature characteristics	T _{OP}	Ta=-10 °C to +70 °C VDD=3.0 V, +25 °C	+10 / -120	×10 ⁻⁶
Frequency voltage characteristics	f/V	Ta=+25 °C, VDD=1.6 V to 5.5 V	±2.0 Max.	×10 ⁻⁶ /V
	fa	Ta=+25 °C, VDD=3.0 V First year	±5.0 Max.	×10 ⁻² /year

(*1) Please ask tighter tolerance



4-bit REAL TIME CLOCK MODULE

RTC-72421
RTC-72423

- Built-in crystal unit allows adjustment-free efficient operation.
- 24 h / 12 h changeable and leap year automatically adjustable (Gregorian calendar).



Product Number (Please contact us)

RTC-72421 : Q42724211xxxx00

RTC-72423 : Q42724231xxxx00



Actual size

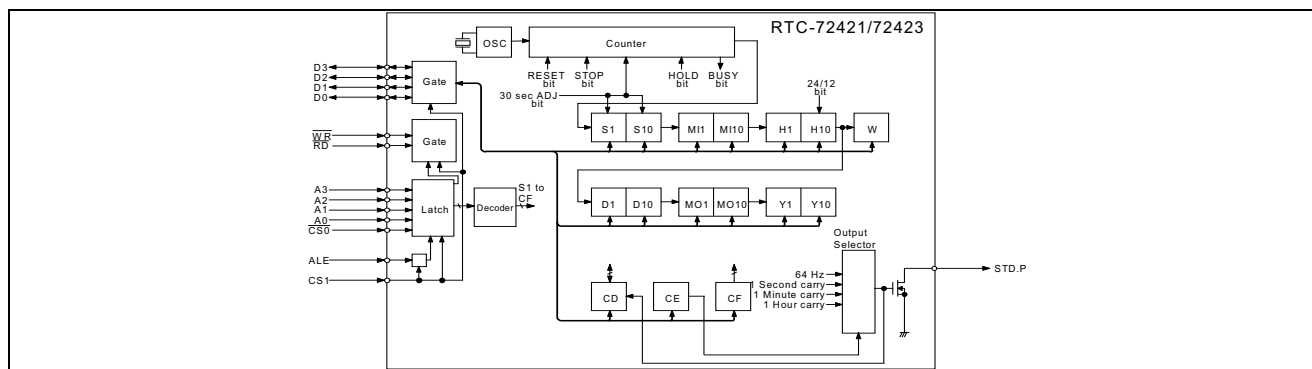
RTC-72421

RTC72421 A
EPSON 1234A

RTC-72423

RTC72423 A
EPSON 1234A

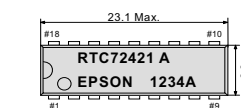
Block diagram



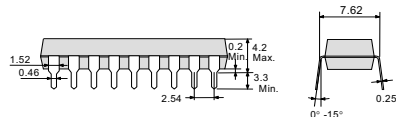
Terminal connection/External dimensions

(Unit:mm)

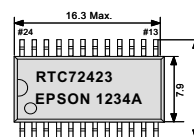
● RTC-72421 (DIP 18-pin)



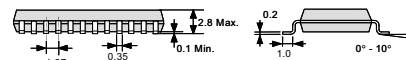
No.	Pin terminal	No.	Pin terminal
1	STD.P	18	VDD
2	/CS0	17	(VDD)
3	ALE	16	(VDD)
4	A0	15	CS1
5	A1	14	C0
6	A2	13	D1
7	A3	12	D2
8	/RD	11	D3
9	GND	10	/WR



● RTC-72423 (SOP 24-pin)



No.	Pin terminal	No.	Pin terminal
1	STD.P	24	VDD
2	/CS0	23	(VDD)
3	N.C.	22	(VDD)
4	ALE	21	N.C.
5	A0	20	CS1
6	N.C.	19	D0
7	A1	18	N.C.
8	N.C.	17	N.C.
9	A2	16	D1
10	A3	15	D2
11	/RD	14	D3
12	GND	13	/WR



Metal may be exposed on the top or bottom of this product. This will not affect any quality, reliability or electrical spec.

Specifications (characteristics)

*Refer to application manual for details.

Absolute Max. rating

Item	Symbol	Condition	Min.	Max.	Unit
Supply voltage	VDD	Ta=+25 °C	-0.3	+7.0	V
Input voltage	VIO	Ta=+25 °C	GND-0.3	VDD+0.3	V
Storage temperature *	TSTG	RTC-72421	-55	+85	°C
		RTC-72423	-55	+125	°C

*Stored as bare product after unpacking

Operating range

Item	Symbol	Condition	Min.	Max.	Unit
Power voltage	VDD	—	4.5	5.5	V
Clock voltage	VCLK	—	2.0	5.5	V
Operating temperature	TOPR	RTC-72421	-10	+70	°C
		RTC-72423	-40	+85	°C

Stored as bare product after unpacking

Frequency characteristics

Item	Symbol	Condition	Range	Unit
Frequency precision	Δf/f	Ta=+25 °C VDD=5.0 V	72421A 72421B 72423A 72423	±10 ±50 ±20 ±50
Frequency temperature characteristics	TOP	-10 °C to +70 °C (+25 °C) -40 °C to +85 °C (+25 °C)		+10 / -120 +10 / -220
Frequency voltage characteristics	f/V	Ta=+25 °C, VDD=2.0 V to 5.5 V		±5.0 Max.
Aging	fa	Ta=+25 °C, VDD=5.0 V, First year		±5.0 Max. ×10 ⁻⁶ /year

DC characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Applicable terminal
Current consumption	ID01	CS1= 0 V	—	1	10	μA	—
	ID02	Exclude input/output current	—	0.9	5	μA	—
HIGH input voltage (1)	VIH1	—	2.2	—	—	V	All inputs other than CS1
LOW input voltage (1)	VIL1	—	—	—	0.8	V	D0 to D3
LOW output voltage (1)	VOL1	IOL=2.5 mA	—	—	0.4	V	STD.P
HIGH output voltage	VOH	IOL=400 μA	2.4	—	—	V	—
LOW output voltage (2)	VOL2	IOL=2.5 mA	—	—	0.4	V	—
OFF leak current	IOFFLK	V1=VDD/0 V	—	—	10/-10	μA	—
Input capacity	C1	Input frequency 1 MHz	—	10	—	pF	Input other than D0 to D3
			—	20	—	pF	D0 to D3, STD.P
HIGH input voltage (2)	VIH2	VDD=2.0 V to 5.5 V	4/5 VDD	—	—	V	CS1
LOW input voltage (2)	VIL2	—	—	—	1/5 VDD	V	—
Input leak current (1)	ILK1	V1=VDD/0 V	—	—	1/-1	μA	Input other than D0 to D3
Input leak current (2)	ILK2	—	—	—	10/-10	μA	D0 to D3

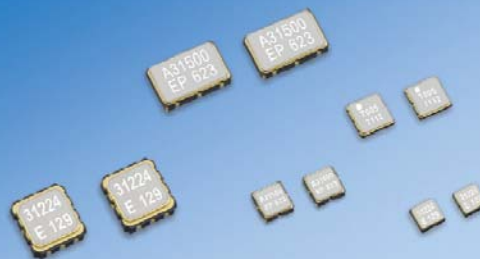


FILTER

Monolithic Crystal Filter (MCF) SAW Filter

•Features

- ▶ Wide selection of types according to application.
- ▶ Custom designs available upon request.
Please inquire it.



■Monolithic Crystal Filter (MCF)

▶ HF series

Applications	Frequency	Pole (Filter order)	Passband		Model	External dimension (mm)			Page
	MHz		kHz	dB					
Radio Equipment / IF (For miniature size Equipments)	130.05	2	±15	3	HF-232A		2.5 × 2.0 × 0.9 t		111
	130.05	3	±15	3	HF-233A				
	122.88	2	±6	3	HF-362A		3.0 × 3.0 × 0.9 t		112
	243	3	±10	3	HF-363A				
	61.44	2	±6	3	HF-372A		3.8 × 3.8 × 1.0 t		113
	73.35	3	±6	3	HF-373A				
Radio Equipment / IF	73.35	4	±7.5	3	HF-734A		7.0 × 5.0 × 1.1 t		114

*Models for other frequencies are available upon request.

▶ MF series

Applications	Frequency	Pole (Filter order)	Passband		Model	External dimension (mm)			Page	
	MHz		kHz	dB						
Radio Equipment / IF (For miniature size Equipments)	45	2	±7.5	3	MF-372A		3.8×3.8×1.0 t		115	
	130.05	3	±14	3	MF-373A					
Radio Equipment / IF	21.4 21.7	2	±7.5	3	MF-722A		7.0×5.0×1.0 t			116
	45	2	±15	3						
	45	3	±15	3	MF-723A		7.0×5.0×1.1 t			117
	45	4	±7.5	3	MF-734A					

*Models for other frequencies are available upon request.

■SAW Filter

Application		Nominal frequency (MHz)	Passband (MHz)	Model	External dimension			Page
					Actual size	Typ. (mm)		
TPMS, RKE/RF ARIB std.T67 in Japan / RF	RKE TPMS ARIB T67	300 to 500	0.2	FF-555		5.2 × 4.8 × 1.5 t		118
		300 to 500	0.4	FF-585				
		300 to 500	0.4(0.6)	FF-32N		3.8 × 3.8 × 0.98 t		119
		300 to 450	0.6 to 4	TF-330A / C		3.0 × 3.0 × 1.11 t		120
ISM/RF	Europe	869	2	TQS-557AA-7R		3.0 × 3.0 × 1.11 t		121
GPS, Car navigation / RF		1575.42	2.4	TQS-949AD-7G		2.5 × 2.0 × 0.8 t		122
W-LAN/IF		374	17	TQS-471BB-7R		3.0 × 3.0 × 1.11 t		123
Cellular phone / IF	W-CDMA/UMTS	190	4.6	TQS-477AA-7R		3.0 × 3.0 × 1.11 t		124
Base station / IF	W-CDMA Base Station	380	4.4	TQS-472BA-7R		7.0 × 5.0 × 1.5 t		125

RKE : Remote Keyless Entry

TPMS : Tire Pressure Monitoring System



Pb

Free



HF-233A : X1F000021xxxx00

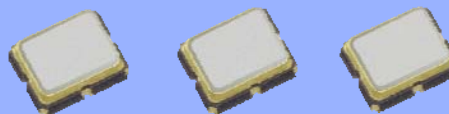
HF - 232A

- Number of poles : 2 pole
- Available frequency range : 70 MHz to 180 MHz
- Old name : TE2-D0AD6

HF - 233A

- Number of poles : 3 pole
- Available frequency range : 100 MHz to 150 MHz
- Old name : TF3-D0AC7

- High frequency and outstanding mechanical strength with original inverted-mesa structure.
- High frequency 3 pole filters with original process technology.
- Applications : Various kinds of miniature size radio equipment



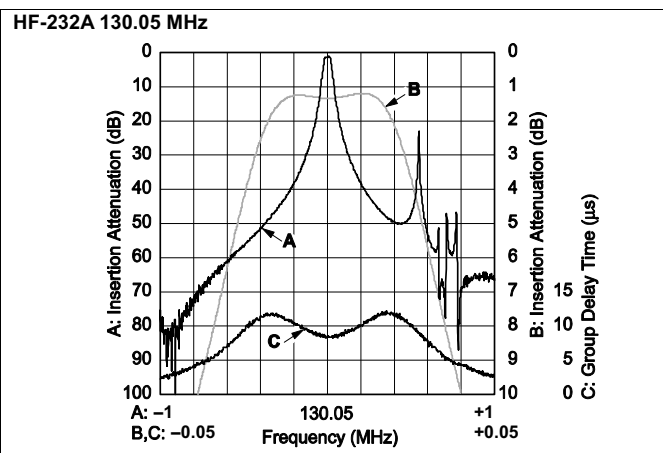
Actual size



Specifications (characteristics)

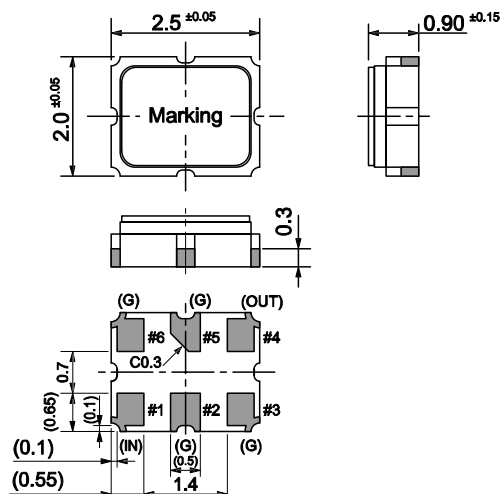
Item	Symbol	HF-232A	HF-233A	Remarks
Nominal frequency	f_nom	130.05 MHz	130.05 MHz	Other frequency and pass bandwidth are available upon request.
Storage temperature range	T_stg	-40 °C to +85 °C	-40 °C to +85 °C	
Operating temperature range	T_use	-30 °C to +85 °C	-30 °C to +85 °C	
Number of poles	—	2	3	
Pass bandwidth	P_Bw	f_nom ±15 kHz Min.	f_nom ±15 kHz Min.	
Insertion loss	IL	3 dB Max.	4 dB Max.	
Ripple	Ripple	1 dB Max.	1 dB Max.	
Stop bandwidth	S_Bw	10 dB Min.	20 dB Min.	f_nom ±50 kHz
Guaranteed attenuation	G_Att	70 dB Min.	70 dB Min.	f_nom -900 kHz
Terminating impedance	Zt	200 Ω // 1.7 pF	250 Ω // -1.0 pF	
Package	—	TS-2520	TS-2520	

Electrical DATA



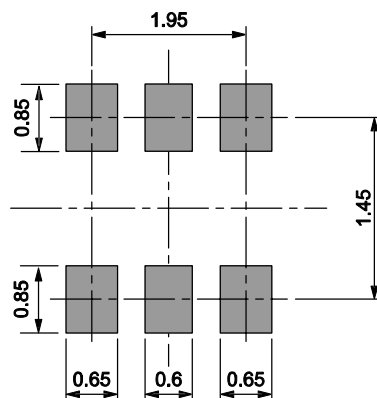
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





CRYSTAL FILTER FOR MINIATURE SIZE RADIO EQUIPMENT/ IF

HF-362A

- Number of poles : 2 pole
- Available frequency range : 40 MHz to 325 MHz
- Old name : TF2-D0AC5

HF-363A

- Number of poles : 3 pole
- Available frequency range : 60 MHz to 250 MHz
- Old name : TF3-J3DC5
- High frequency and outstanding mechanical strength with original inverted-mesa structure.
- High frequency 3 pole filters with original process technology.
- Applications : Various kinds of miniature size radio equipment



Product number (please contact us)

HF-362A : X1F000031xxxx00

HF-363A : X1F000041xxxx00



Actual size

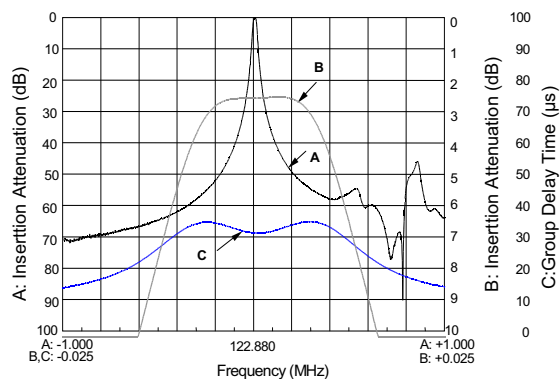


Specifications (characteristics)

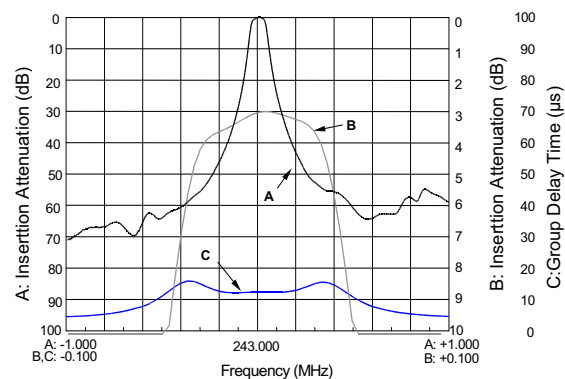
Item	Symbol	HF-362A	HF-363A		Remarks
Nominal frequency	f_nom	122.88 MHz	156.525 MHz	243 MHz	Other frequency and pass bandwidth are available upon request.
Storage temperature range	T_stg	-40 °C to +85 °C	-40 °C to +85 °C	-40 °C to +85 °C	
Operating temperature range	T_use	-30 °C to +85 °C	-30 °C to +85 °C	-30 °C to +85 °C	
Number of poles	—	2	3	3	
Pass bandwidth	P_Bw	f_nom±6 kHz Min.	f_nom±10 kHz Min.	f_nom±10 kHz Min.	
Insertion loss	IL	4 dB Max.	5 dB Max.	5 dB Max.	
Ripple	Ripple	1 dB Max.	1 dB Max.	1 dB Max.	
Stop bandwidth	S_Bw	f_nom ±60 kHz: 28 dB Min.	f_nom ±50 kHz: 20 dB Min.	f_nom ±100 kHz: 20 dB Min.	
Guaranteed attenuation	G_Att	f_nom -900 kHz: 70 dB Min.	f_nom -900 kHz: 70 dB Min.	f_nom -900 kHz: 65 dB Min.	
Terminating impedance	Zt	150 Ω // 3.0 pF	120 Ω // -0.8 pF	150 Ω // -1.0 pF	
Package	—	TS-30	TS-30	TS-30	

Electrical DATA

HF-362A 122.88 MHz

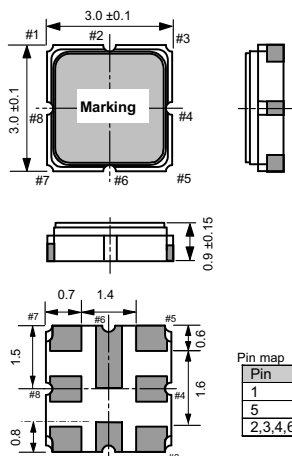


HF-363A 243 MHz



External dimensions

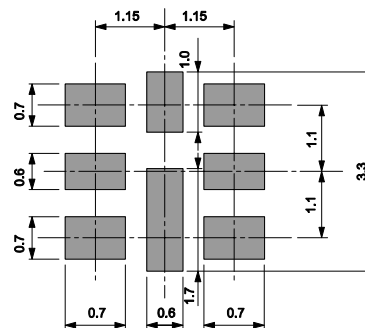
(Unit:mm)



Pin	Connection
1	INPUT
5	OUTPUT
2,3,4,6,7,8	GND

Footprint (Recommended)

(Unit:mm)





CRYSTAL FILTER FOR MINIATURE SIZE RADIO EQUIPMENT/ IF

HF-372A

- Number of poles : 2 pole
- Available frequency range : 40 MHz to 250 MHz
- Old name : TF2-45BB1

HF-373A

- Number of poles : 3 pole
- Available frequency range : 60 MHz to 250 MHz
- Old name : TF3-A9AB1

- High frequency and outstanding mechanical strength with original inverted-mesa structure.
- High frequency 3 pole filters with original process technology.
- Applications : Various kinds of miniature size radio equipment



Product number (please contact us)

HF-372A : X1F000051xxxx00

HF-373A : X1F000201xxxx00



Actual size

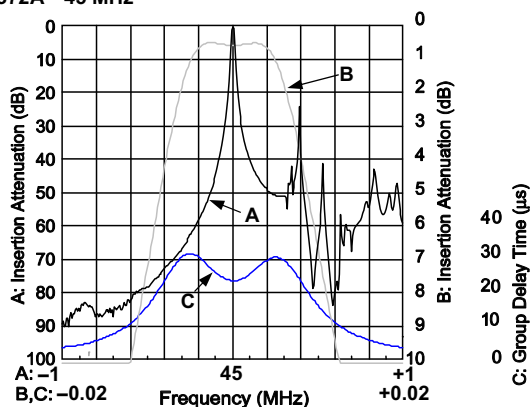


Specifications (characteristics)

Item	Symbol	HF-372A		HF-373A	Remarks
Nominal frequency	f_nom	45 MHz	61.44 MHz	73.35 MHz	Other frequency and pass bandwidth are available upon request.
Storage temperature range	T_stg	-40 °C to +85 °C	-40 °C to +85 °C	-40 °C to +85 °C	
Operating temperature range	T_use	-30 °C to +85 °C	-30 °C to +85 °C	-30 °C to +85 °C	
Number of poles	—	2	2	3	
Pass bandwidth	P_Bw	f_nom ±7.5 kHz Min.	f_nom ±6 kHz Min.	f_nom ±6 kHz Min	
Insertion loss	IL	3.5 dB Max.	3 dB Max.	4.5 dB Max.	
Ripple	Ripple	1 dB Max.	1 dB Max.	1 dB Max.	
Stop bandwidth	S_Bw	f_nom ±25 kHz: 15 dB Min.	f_nom ±60 kHz: 30 dB Min.	f_nom ±25 kHz: 20 dB Min.	
Guaranteed attenuation	G_Att	f_nom -800 kHz to -1000 kHz: 70 dB Min.	—	f_nom -900 kHz: 70 dB Min.	
Terminating impedance	Zt	650 Ω // 1.5 pF	650 Ω // 1.5 pF	400 Ω // -1.0 pF	
Package	—	TS-38	TS-38	TS-38	

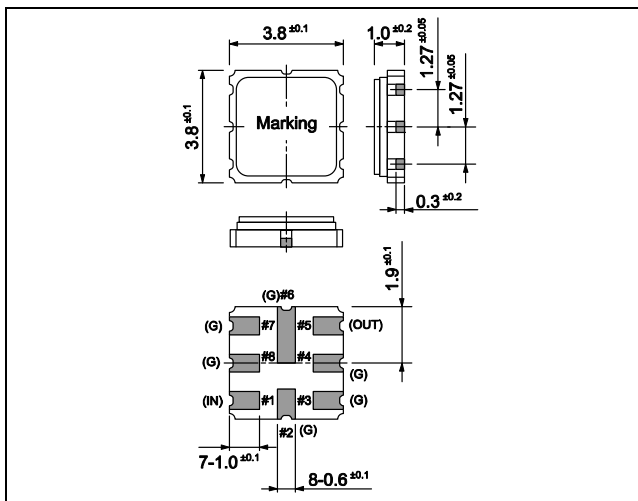
Electrical DATA

HF-372A 45 MHz



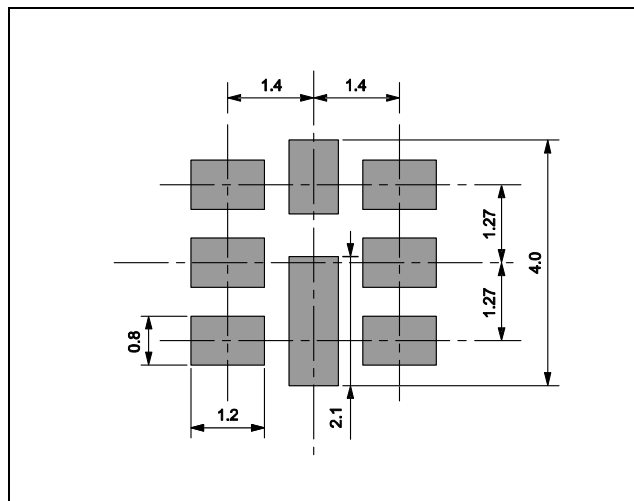
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





CRYSTAL FILTER FOR MINIATURE SIZE RADIO EQUIPMENT/ IF

HF-734A

- Number of poles : 4 pole
- Available frequency range : 40 MHz to 180 MHz
- Old name : TF4-73BA2

- Superb attenuation with 4 pole filters.
- Applications : Various kinds of radio equipment



Product number (please contact us)
HF-734A : X1F000081xxxx00



Actual size

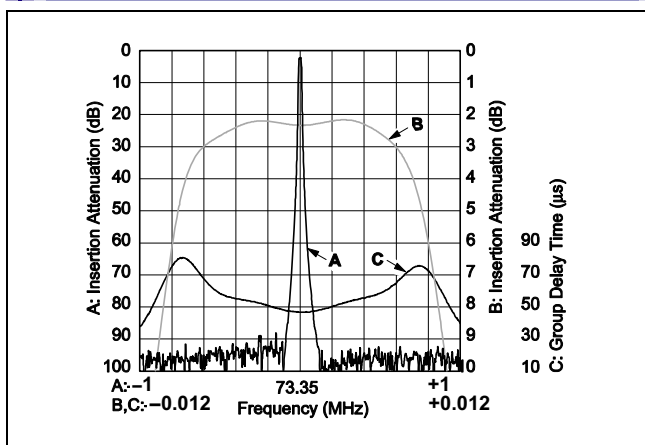


Specifications (characteristics)

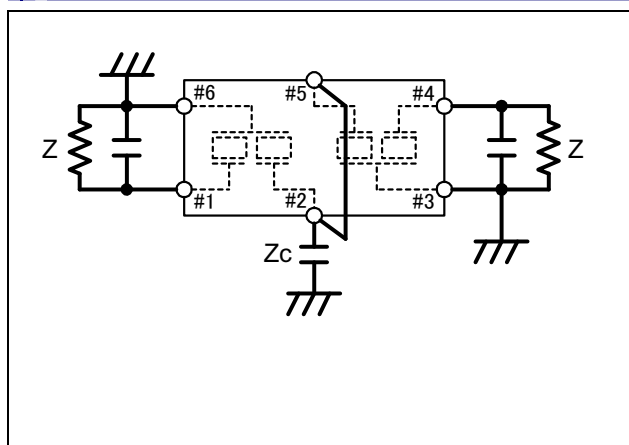
Item	Symbol	HF-734A	Remarks
Nominal frequency	f_nom	73.35 MHz	Other frequency and pass bandwidth are available upon request.
Storage temperature range	T_stg	-40 °C to +85 °C	
Operating temperature range	T_use	-30 °C to +85 °C	
Number of poles	—	4	
Pass bandwidth	S_Bw	f_nom ±7.5 kHz Min.	
Insertion loss	IL	5 dB Max.	
Ripple	Ripple	1 dB Max.	
Stop bandwidth	P_Bw	f_nom ±25 kHz	30 dB Min.
Guaranteed attenuation	G_Att	f_nom -800 kHz to -1000 kHz: 70 dB Min.	
Terminating impedance	Zt	500 Ω // +3.5 pF	Zc : 7.0 pF *1
Package	—	TS-75B	

*1 Zc is connected from pin 2 and 5 to ground. (As per pin connection of 4pole)

Electrical DATA

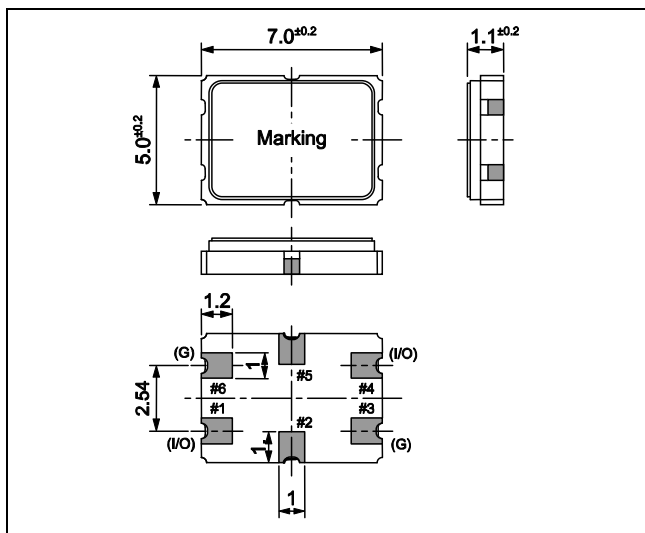


Pin connection



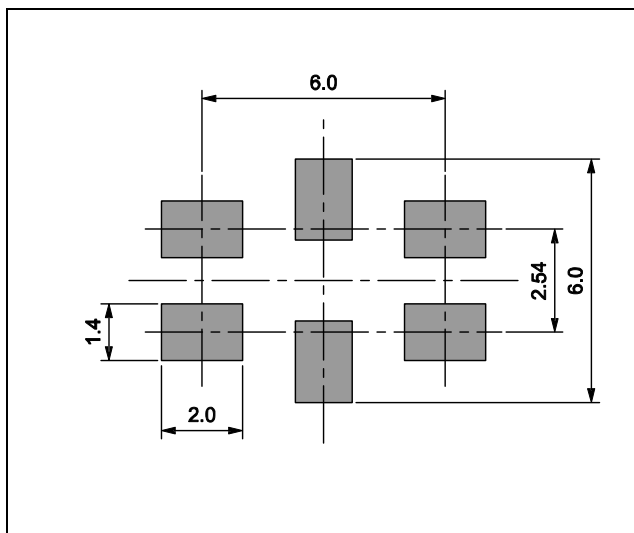
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





CRYSTAL FILTER FOR MINIATURE SIZE RADIO EQUIPMENT/ IF

MF-372A

- Number of poles : 2 pole
- Available frequency range : 19 MHz to 150 MHz
- Old name : TS2-45B31

MF-373A

- Number of poles : 3 pole
- Available frequency range : 40 MHz to 150 MHz
- Old name : TS3-D0A31

- High frequency 3 pole filters with original process technology.
- Applications : Various kinds of miniature size radio equipment.



Product number (please contact us)

MF-372A : X1F000111xxxx00

MF-373A : X1F000121xxxx00



Actual size

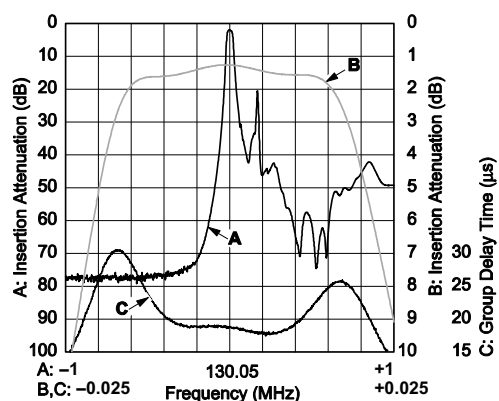


Specifications (characteristics)

Item	Symbol	MF-372A	MF-373A	Remarks
Nominal frequency	f_nom	45 MHz	130.05 MHz	Other frequency and pass bandwidth are available upon request.
Storage temperature range	T_stg	-40 °C to +85 °C	-40 °C to +85 °C	
Operating temperature range	T_use	-30 °C to +85 °C	-30 °C to +85 °C	
Number of poles	—	2	3	
Pass bandwidth	P_Bw	f_nom ±7.5 kHz Min.	f_nom ±14 kHz Min.	
Insertion loss	IL	3.5 dB Max.	3 dB Max.	
Ripple	Ripple	1 dB Max.	1 dB Max.	
Stop bandwidth	S_Bw	f_nom ±25 kHz:15 dB Min.	f_nom ±50 kHz:20 dB Min.	
Guaranteed attenuation	G_Att	f_nom -800 kHz to -1000 kHz :70 dB Min.	f_nom -800 kHz to -1000 kHz :70 dB Min.	
Terminating impedance	Zt	650 Ω // 1.5 pF	950 Ω // -1.2 pF	
Package	—	TS-38	TS-38	

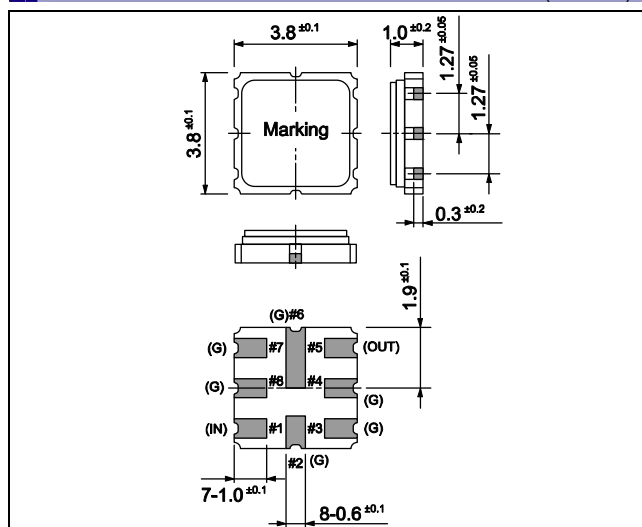
Electrical DATA

MF-373A 130.05 MHz



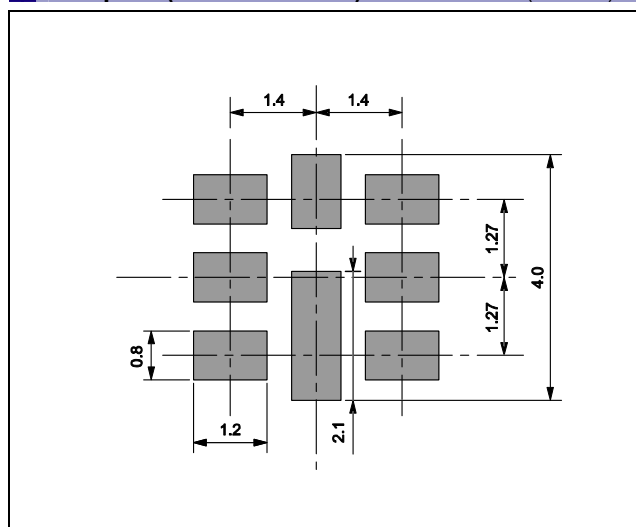
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





CRYSTAL FILTER FOR MINIATURE SIZE RADIO EQUIPMENT/ IF

MF-722A

- Number of poles : 2 pole
- Available frequency range : 19 MHz to 150 MHz
- Old name : TF2-21B14

MF-723A

- Number of poles : 3 pole
- Available frequency range : 19 MHz to 150 MHz
- Old name : TS3-45A01

- High frequency 3 pole filters with original process technology.
- Applications : Various kinds of miniature size radio equipment



Product number (please contact us)

MF-722A : X1F000131xxxx00

MF-723A : X1F000141xxxx00



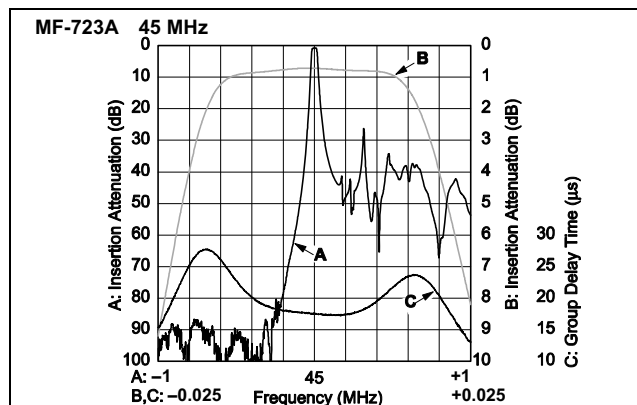
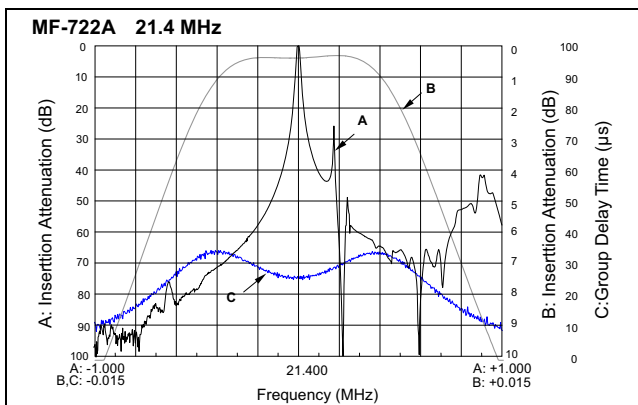
Actual size



Specifications (characteristics)

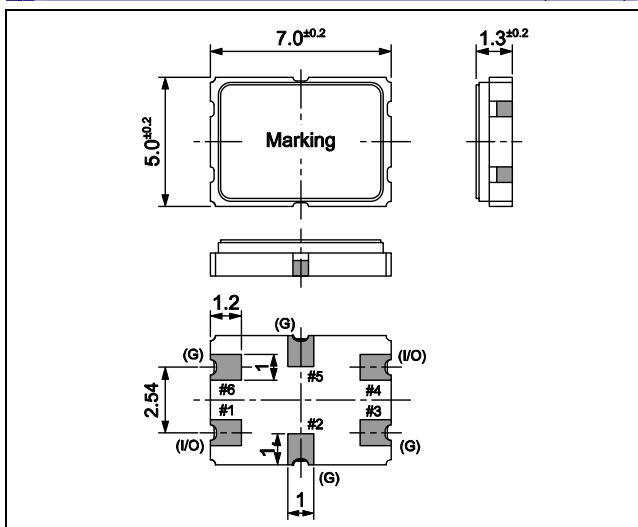
Item	Symbol	MF-722A		MF-723A	Remarks
Nominal frequency	f_nom	21.4 MHz , 21.7 MHz	45 MHz	45 MHz	Other frequency and pass bandwidth are available upon request.
Storage temperature range	T_stg	-40 °C to +85 °C	-40 °C to +85 °C	-40 °C to +85 °C	
Operating temperature range	T_use	-30 °C to +85 °C	-30 °C to +85 °C	-30 °C to +85 °C	
Number of poles	—	2	2	3	
Pass bandwidth	P_Bw	f_nom ±7.5 kHz Min.	f_nom ±15 kHz Min.	f_nom ±15 kHz Min.	
Insertion loss	IL	1.5 dB Max.	3 dB Max.	3 dB Max.	
Ripple	Ripple	1 dB Max.	1 dB Max.	1 dB Max.	
Stop bandwidth	S_Bw	f_nom±25 kHz:15 dB Min.	f_nom±50 kHz:15 dB Min.	f_nom±50 kHz:20 dB Min.	
Guaranteed attenuation	G_Att	f_nom -910 kHz:70 dB Min.	f_nom -800 kHz to -1000 kHz:70 dB Min.	f_nom -800 kHz to -1000 kHz:70 dB Min.	
Terminating impedance	Zt	1500 Ω // 1.0 pF	1100 Ω // 0 pF	1200 Ω // -1.0 pF	
Package	—	TS-75A	TS-75A	TS-75A	

Electrical DATA



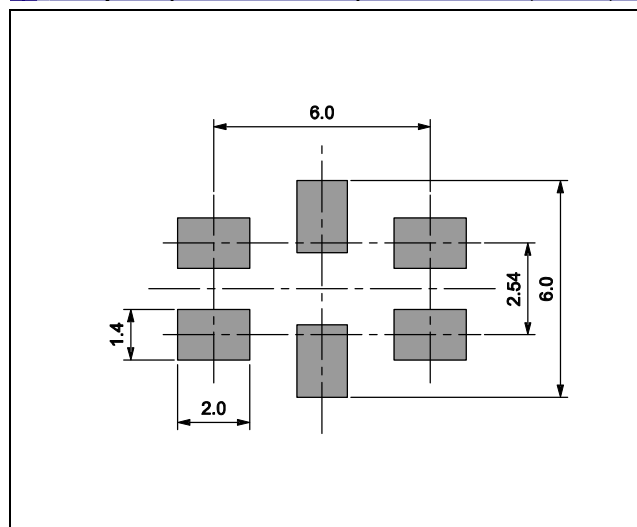
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





CRYSTAL FILTER FOR MINIATURE SIZE RADIO EQUIPMENT/ IF

MF-734A

- Number of poles : 4 pole
- Available frequency range : 19 MHz to 150 MHz
- Old name : TS4-45B01
- Superb attenuation with 4 pole filters.
- Applications : Various kinds of radio equipment.



Product number (please contact us)
MF-734A : X1F000171xxxx00



Actual size

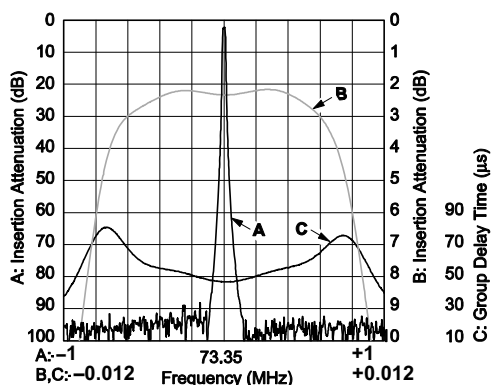


Specifications (characteristics)

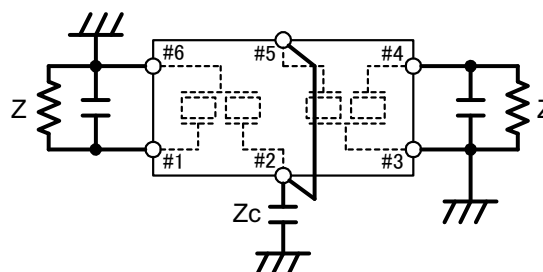
Item	Symbol	MF-734A	Remarks
Nominal frequency	f_nom	45 MHz	Other frequency and bandwidth are available upon request
Storage temperature range	T_stg	-40 °C to +85 °C	
Operating temperature range	T_use	-30 °C to +85 °C	
Number of poles	—	4	
Pass bandwidth	P_Bw	f_nom ±7.5 kHz Min.	
Insertion loss	IL	3 dB Max.	
Ripple	Ripple	1 dB Max.	
Stop bandwidth	S_Bw	f_nom ±25 kHz	30 dB Min.
Guaranteed attenuation	G_Att	f_nom -800 kHz to -1000 kHz:70 dB Min.	
Terminating impedance	Zt	650 Ω // +3.0 pF	Zc : 7.0 pF *1
Package	—	TS-75B	

*1 Zc is connected from pin 2 and 5 to ground. (As per pin connection of 4pole)

Electrical DATA

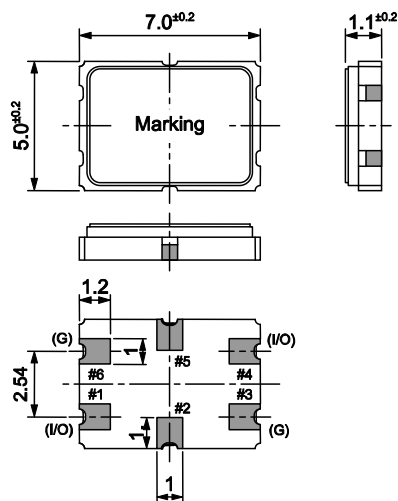


Pin connection



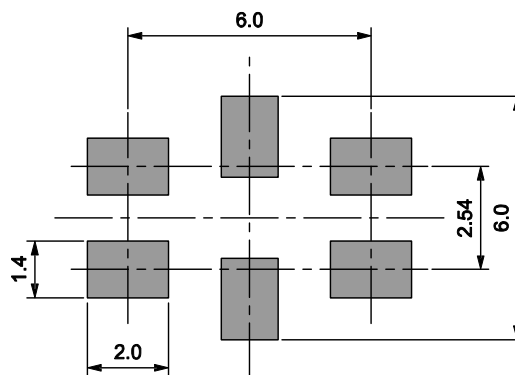
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





SAW FILTER

FF - 555 / FF - 585

- Frequency range : 300 MHz to 500 MHz
- Thickness : 1.5 mm Typ.
- Applications : Wireless remote-control, Security (Automotive keyless entry)
- Excellent shock resistance and environmental capability (prevention for contamination)
- Low-loss, Narrow Pass bandwidth, High stability by using crystal substrate.



Product number (please contact us)

FF-555 : Q51FF5550xxxx00

FF-585 : Q51FF5850xxxx00



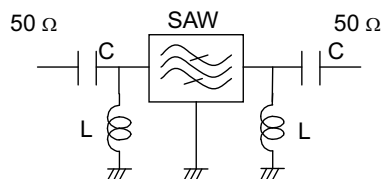
Actual size



Specifications (characteristics)

Item	Symbol	Specifications		Remarks
		FF-555	FF-585	
Nominal frequency range	f _{nom}	300 MHz to 500 MHz		
Storage temperature range	T _{stg}	-55 °C to +125 °C		Store as bare product after unpacking
Operating temperature range	T _{use}	-40 °C to +85 °C		
Insertion Loss	IL	3.5 dB Max.		Minimum Loss
Pass bandwidth	P _{Bw}	f _{nom} ± 100 kHz Min. / Reference to Through level (3.5 dB down)	f _{nom} ± 200 kHz Min. / Reference to minimum loss (3.5 dB down)	
Attenuation	G _{Att}	f _{nom} -21.4 MHz 40 dB Min. f _{nom} -10.7 MHz 40 dB Min.	f _{nom} +21.4 MHz 40 dB Min. f _{nom} -21.4 MHz 40 dB Min.	Reference to Through level
Turnover temperature	Ti	+25 °C ±15 °C		
Temperature coefficient	B	-(3.4 ± 0.8) × 10 ⁻⁸ / °C ²		
Terminal impedance	Zt	370 Ω Typ.		Ex : 315 MHz
		160 Ω Typ.		Ex : 433.92 MHz

Test fixture



Remarks

Ex: f_{nom} = 315 MHz

C = 4 pF

L = 33 nH

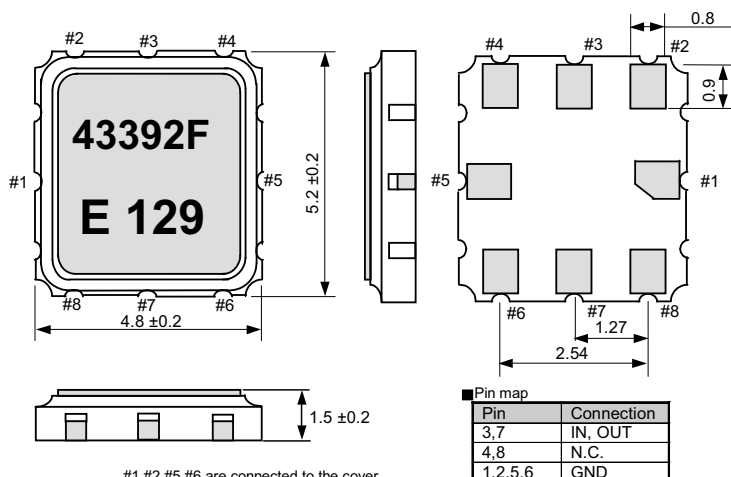
Ex: f_{nom} = 433.92 MHz

C = 5 pF

L = 18 nH

External dimensions

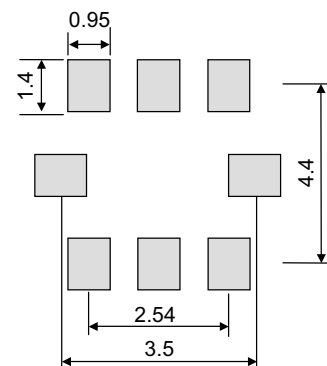
(Unit:mm)



#1, #2, #5, #6 are connected to the cover.

Footprint (Recommended)

(Unit:mm)





SAW FILTER

FF-32N

- Frequency range : 300 MHz to 500 MHz
- Thickness : 0.98 mm Typ.
- Applications : Wireless remote-control, Security (Automotive keyless entry, ARIB std. T67 in Japan)
- Filter of low impedance by an original design.
- Low-loss, Narrow Pass bandwidth, High stability by using crystal substrate.



Product number (please contact us)
FF-32N : Q51FF32N0xxxx00



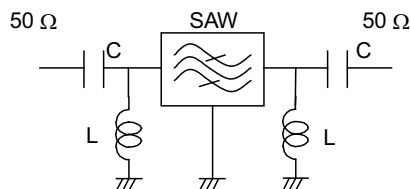
Actual size



Specifications (characteristics)

Item	Symbol	Specifications		Remarks
Nominal frequency range	f _{nom}	300 MHz to 500 MHz	426 MHz, 429 MHz band*	*ARIB std. T67 in Japan
Storage temperature range	T _{stg}	-55 °C to +125 °C	-55 °C to +125 °C	Store as bare product after unpacking
Operating temperature range	T _{use}	-40 °C to +85 °C	-10 °C to +60 °C	
Insertion Loss	IL	3.5 dB Max.	3.5 dB Max.	Minimum Loss
Pass bandwidth	P _{Bw}	f _{nom} ±200 kHz Min.	f _{nom} ±300 kHz Min.	Reference to minimum loss (3 dB down)
Guaranteed attenuation	G _{Att}	f _{nom} -21.4 MHz : 40 dBMin. f _{nom} -10.7 MHz : 35 dBMin.	f _{nom} -21.4 MHz : 40 dB Min. f _{nom} -10.7 MHz : 35 dB Min.	Reference to minimum loss
Turnover temperature	T _i	+25 °C ±15 °C	+25 °C ±15 °C	
Temperature coefficient	B	-(3.4±0.8) × 10 ⁻⁸ / °C ²	-(3.4±0.8) × 10 ⁻⁸ / °C ²	
Terminal impedance	Z _t	370 Ω Typ.		Ex: 315 MHz
		160 Ω Typ.		Ex: 433.92 MHz
			220 Ω Typ.	Ex: 429.45 MHz

Test fixture



Remarks

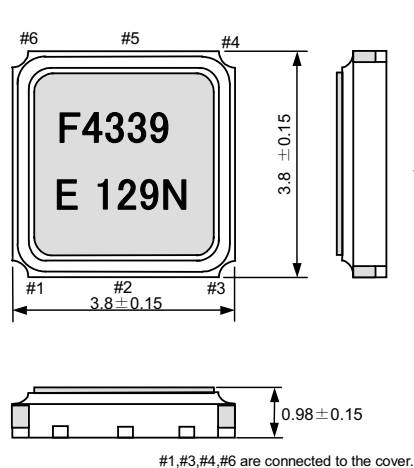
Ex: f_{nom} = 315 MHz
Series Capacitance = 4 pF
Parallel Inductance = 33 nH

Ex: f_{nom} = 429.45 MHz
Series Capacitance = 4 pF
Parallel Inductance = 18 nH

Ex: f_{nom} = 433.92 MHz
Series Capacitance = 5 pF
Parallel Inductance = 18 nH

External dimension

(Unit:mm)

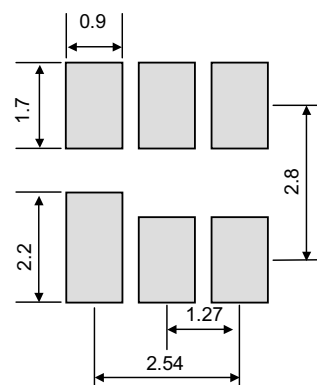


Pin map

Pin	Connection
1,3,4,6	GND
2,5	IN,OUT

Footprint (Recommended)

(Unit:mm)





SAW FILTER

FOR TPMS, RKE, Japan ARIB std. T67 / RF

TF-330A/C

- Lowest insertion loss.
- Excellent shock resistance and environmental capability (Prevention for contamination)



Product number (please contact us)

TF-330A : X1L000371xxxx00

TF-330C : X1L000381xxxx00



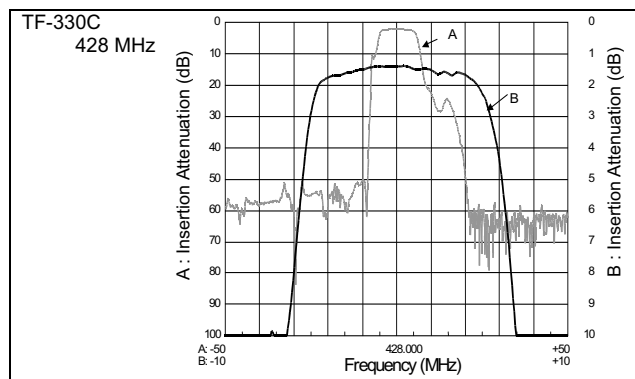
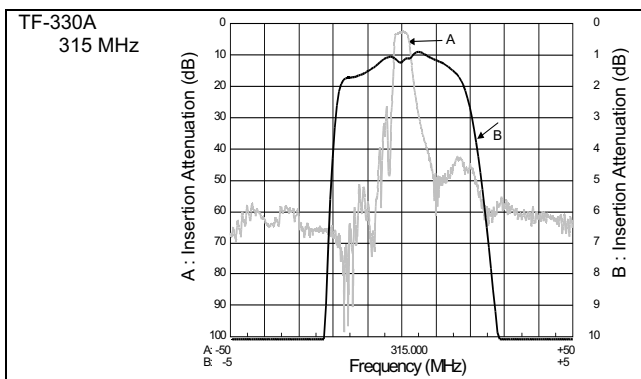
Actual size



Specifications (characteristics)

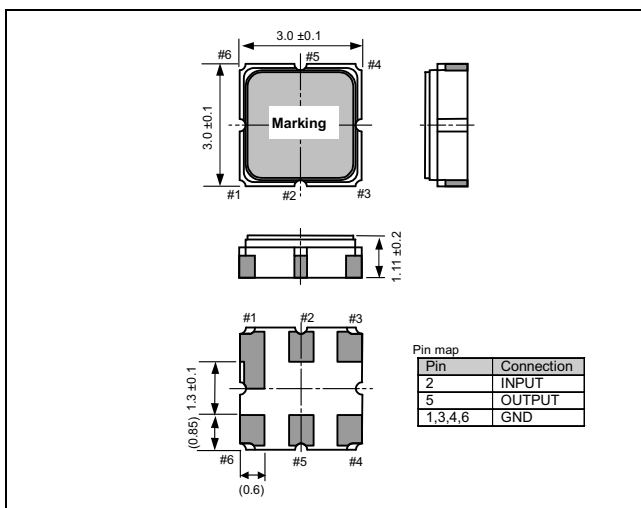
Item	Symbol	TF-330A								TF-330C	
Nominal frequency	f_nom	315 MHz			433.92 MHz			426.425 MHz	429.550 MHz	428 MHz	
Storage temperature range	T_stg	-40 °C to +110 °C			-40 °C to +110 °C			-40 °C to +110 °C		-40 °C to +110 °C	
Operating temperature range	T_use	-40 °C to +85 °C		-40 °C to +110 °C	-40 °C to +85 °C			-40 °C to +85 °C		-40 °C to +85 °C	
Pass bandwidth	P_Bw	±300 kHz	±600 kHz	±300 kHz	±300 kHz	±870 kHz	±425 kHz	±400 kHz		±2 MHz	
Insertion loss	IL	2.0 dB Max.	2.5 dB Max.	2.5 dB Max.	2.0 dB Max.	2.5 dB Max.	2.1 dB Max.	2.1 dB Max.		2.3 dB Max.	
Deviation in PB	Dev	1.0 dB Max.	1.5 dB Max.	1.5 dB Max.	1.0 dB Max.	1.5 dB Max.	1.2 dB Max.	1.2 dB Max.		1.0 dB Max.	
VSWR	—	2.2 Max.	2.3 Max.	2.3 Max.	2.2 Max.	2.4 Max.	2.2 Max.	2.2 Max.		2.0 Max.	
Guaranteed attenuation	G_Att	f_nom -21.4 MHz : 50 dB Min.			f_nom -43.4 MHz to f_nom -42.8 MHz : 50 dB Min.			f_nom -43.4 MHz to f_nom -42.8 MHz : 50 dB Min.			383 MHz to 388 MHz : 50 dB Min.
		f_nom -10.7 MHz : 35 dB Min.			f_nom -21.7 MHz to f_nom -21.4 MHz : 50 dB Min.			f_nom -21.7 MHz to f_nom -21.4 MHz : 50 dB Min.			404 MHz to 409 MHz : 45 dB Min.
		f_nom +10.7 MHz : 35 dB Min.			f_nom -10.7 MHz : 32 dB Min.			f_nom -10.7 MHz : 35 dB Min.			447 MHz to 452 MHz : 22 dB Min.
		f_nom +21.4 MHz : 40 dB Min.			f_nom +10.7 MHz : 30 dB Min.			f_nom +10.7 MHz : 33 dB Min.			468 MHz to 473 MHz : 50 dB Min.
					f_nom +21.4 MHz to f_nom +21.7 MHz : 40 dB Min.			f_nom +21.4 MHz to f_nom +21.7 MHz : 40 dB Min.			
Terminating impedance	Zt	50 Ω (Unbalance)			50 Ω (Unbalance)			50 Ω (Unbalance)		50 Ω (Unbalance)	
Package	—	SS-30S1(GH)			SS-30S1(GH)			SS-30S1(GH)		SS-30S1(GH)	

Electrical DATA



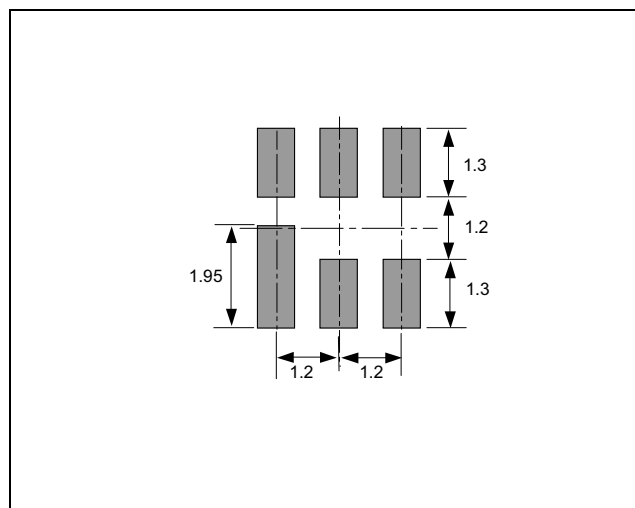
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)

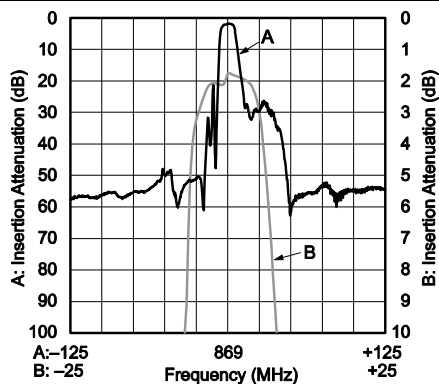


**SAW FILTER
FOR ISM BAND / RF****TQS-557AA-7R**Product number (please contact us)
TQS-557AA-7R : X1L000201000200

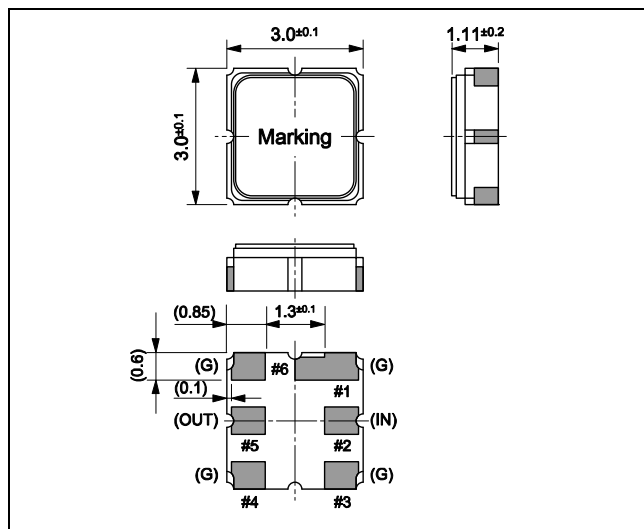
Actual size

**Specifications (characteristics)**

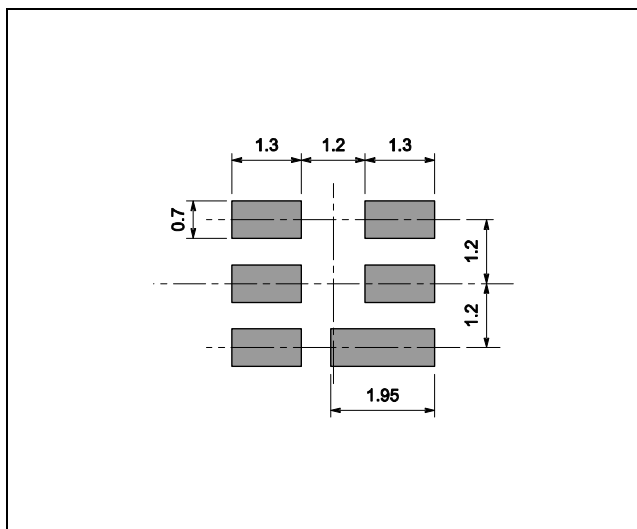
Item	Symbol	TQS-557AA-7R	Remarks
Nominal frequency	f _{nom}	869 MHz	
Storage temperature range	T _{stg}	-40 °C to +85 °C	
Operating temperature range	T _{use}	-10 °C to +60 °C	
Pass bandwidth	P _{Bw}	868 to 870 MHz	
Insertion loss	IL	3 dB Max.	IL in Pass bandwidth
Ripple	Ripple	1.5 dB p-p Max.	
VSWR	—	2.5 Max.	
Guaranteed attenuation	G _{Att}	DC to 828 MHz : 45 dB Min. 828 to 849 MHz : 30 dB Min. 880 to 890 MHz : 10 dB Min. 890 to 925 MHz : 22 dB Min. 925 to 1740 MHz : 40 dB Min.	Relative to through level
Terminating impedance	Z _t	50 Ω	Unbalanced
Package	—	SS-30S1(G)	

Electrical DATA**External dimension**

(Unit:mm)

**Footprint (Recommended)**

(Unit:mm)



SAW FILTER FOR GPS / RF

TQS -949AD -7G

- FCB technology achieves miniature size and low profile.



Product number (please contact us)
TQS-949AD-7G : X1L000171000300



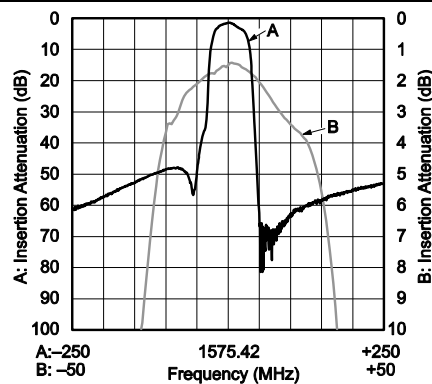
Actual size



Specifications (characteristics)

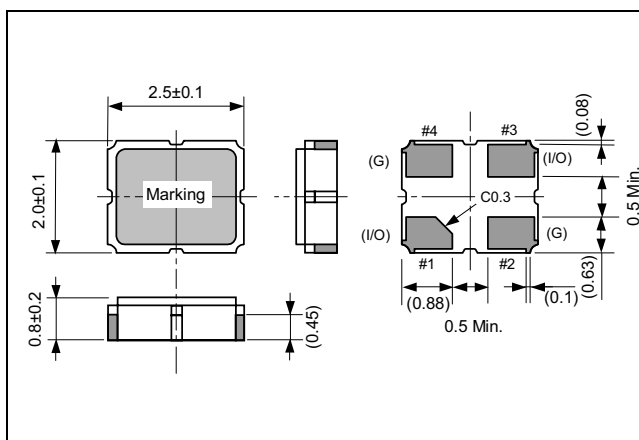
Item	Symbol	TQS-949AD-7G	Remarks
Nominal frequency	f_nom	1575.42 MHz	
Storage temperature range	T_stg	-40 °C to +85 °C	
Operating temperature range	T_use	-40 °C to +85 °C	
Pass bandwidth	P_Bw	1574.22 to 1576.62 MHz	
Insertion loss	IL	2.3 dB Max.	IL in Pass bandwidth
Ripple	Ripple	0.6 dB p-p Max.	
VSWR	—	2.0 Max.	
Guaranteed attenuation	G_Att	824 to 960 MHz : 45 dB Min. 1475.42 MHz : 40 dB Min. 1525.42 MHz : 35 dB Min. 1625.42 MHz : 35 dB Min. 1675.42 MHz : 50 dB Min. 1710 to 1880 MHz : 45 dB Min. 1850 to 1990 MHz : 40 dB Min. 1920 to 2170 MHz : 40 dB Min.	Relative to through level
Terminating impedance	Zt	50 Ω (Unbalanced)	
Package	—	SS-2520(E)	

Electrical DATA



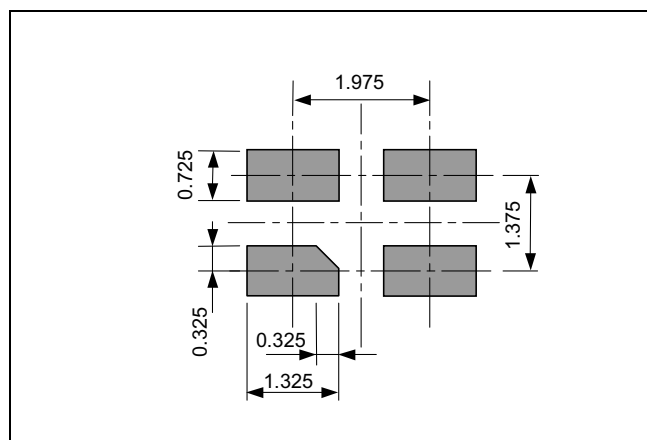
External dimension

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





SAW FILTER FOR W-LAN / IF

TQS-471BB-7R

- Excellent performance in small size with original design algorithm.



Product number (please contact us)
TQS-471BB-7R : X1L000011xxx00



Actual size

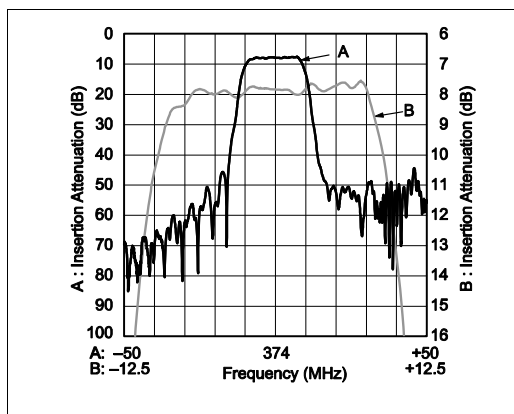


Specifications (characteristics)

Item	Symbol	TQS-471BB-7R	Remarks
Nominal frequency	f _{nom}	374 MHz	
Storage temperature range	T _{stg}	-40 °C to +85 °C	
Operating temperature range	T _{use}	-30 °C to +70 °C	
Pass bandwidth	P _{Bw}	f _{nom} ±8.5 MHz Min.	3 dB relative to IL at f _{nom}
Insertion loss	IL	9 dB Max. (-30 °C to +30 °C) * 10 dB Max. (-30 °C to +70 °C) *	at f _{nom}
Deviation in PB	DEV	1.5 dB Max.	
Ripple	Ripple	1.5 dB Max.	
Group delay distortion	GDD	100 ns Max.	
Stop bandwidth	S _{Bw}	f _{nom} -41.5 MHz to f _{nom} -22 MHz : 40 dB Min. f _{nom} -22 MHz to f _{nom} -16.5 MHz : 35 dB Min. f _{nom} +16.5 MHz to f _{nom} +41.5 MHz : 35 dB Min.	relative to IL at f _{nom}
Terminating impedance	Z _t	Input : 680 Ω // 88 nH Output : 780 Ω // 120 nH	Balanced or Unbalanced
Package	—	SS-30S1(D)	

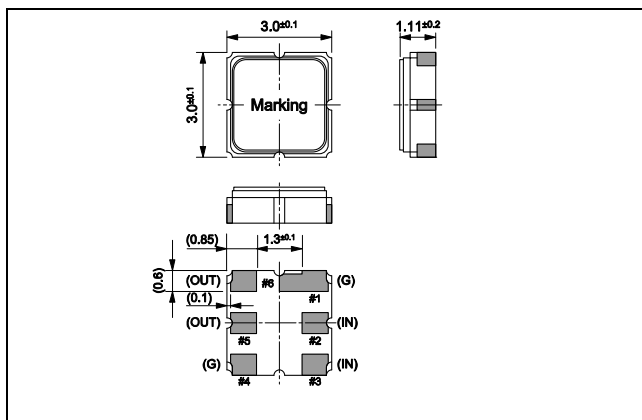
* Includes losses in matching circuit (Matching inductor size : 1.6 × 0.8 mm)

Electrical DATA



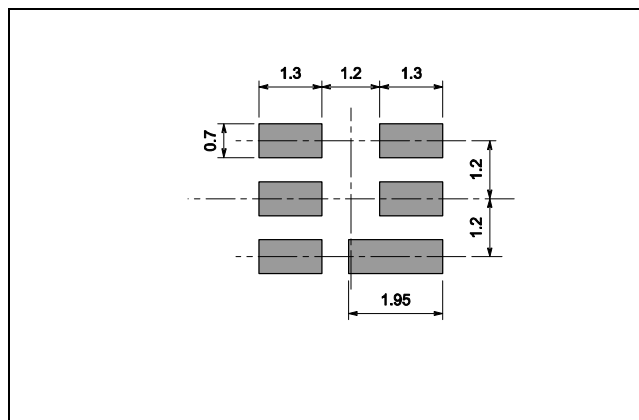
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





SAW FILTER FOR CELLULAR / IF

TQS-477AA-7R

- Excellent performance in small size with original design algorithm.



Product number (please contact us)
TQS-477AA-7R : X1L000301000100



Actual size

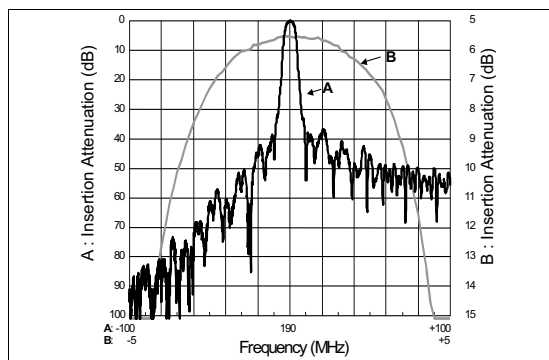


Specifications (characteristics)

Item	Symbol	TQS-477AA-7R	Remarks
Nominal frequency	f_nom	190 MHz	
Storage temperature range	T_stg	-40 °C to +85 °C	
Operating temperature range	T_use	-30 °C to +85 °C	
Pass bandwidth	P_Bw	f_nom ±2.3 MHz Min.	3 dB relative to IL at f_nom
Insertion loss	IL	7 dB Max.	at f_nom
Ripple	Ripple	2 dB Max.	f_nom -2 MHz to f_nom +2 MHz
Group delay distortion	GDD	100 ns Max.	f_nom -2 MHz to f_nom +2 MHz
Guaranteed attenuation	G_Att	f_nom -100 MHz to f_nom -12.5 MHz : 40 dB Min. f_nom -12.5 MHz to f_nom -7.5 MHz : 25 dB Min. f_nom -7.5 MHz to f_nom -5 MHz : 10 dB Min. f_nom +5 MHz to f_nom +7.5 MHz : 10 dB Min. f_nom +7.5 MHz to f_nom +12.5 MHz : 25 dB Min. f_nom +12.5 MHz to f_nom +100 MHz : 40 dB Min.	relative to IL at f_nom
Terminating impedance	Zt	Input : 1000 Ω // -5.0 pF Output : 1000 Ω // -4.0 pF	Balanced or Unbalanced
Package	—	SS-30S1(DE)	

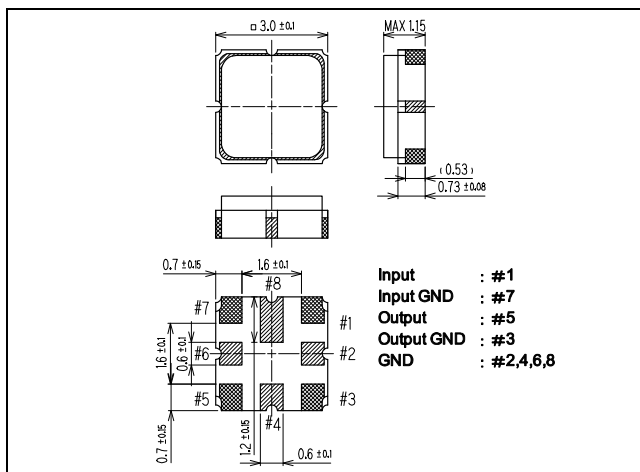
* Includes losses in matching circuit (Matching inductor size : 1.6 × 0.8 mm)

Electrical DATA



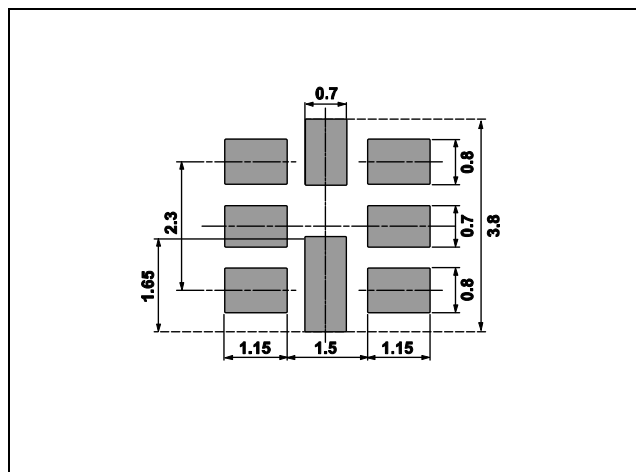
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





SAW FILTER FOR CELLULAR BASE STATION / IF

TQS-472BA-7R

- Excellent performance in small size with original design algorithm



Product number (please contact us)
TQS-472BA-7R : X1Lxxxxxxxxx00



Actual size

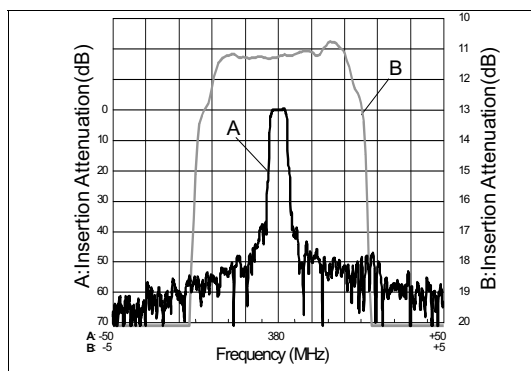


Specifications (characteristics)

Item	Symbol	TQS-472BA-7R	Remarks
Nominal frequency	f_nom	380 MHz	
Storage temperature range	T_stg	-40 °C to +85 °C	
Operating temperature range	T_use	-30 °C to +85 °C	
Pass bandwidth	P_Bw	f_nom ±2.2 MHz Min.	3 dB relative to IL at f_nom
Insertion loss	IL	12.5 dB Max. *	at f_nom
Ripple	Ripple	1.2 dB Max.	f_nom ±1.92 MHz
Group delay distortion	GDD	180 ns Max.	f_nom ±1.92 MHz
Phase linearity	PHL	4 deg rms Max.	f_nom ±1.92 MHz
Stop band attenuation	S_Bw	10 dB BW: f_nom ±3.25 MHz Max. 20 dB BW: f_nom ±3.65 MHz Max. 30 dB BW: f_nom ±4.00 MHz Max.	Relative to IL at f_nom
Guaranteed attenuation	G_Att	DC to f_nom -25 MHz : 45 dB Min. f_nom -25 MHz to f_nom -10 MHz : 42 dB Min. f_nom -10 MHz to f_nom -5.0 MHz : 35 dB Min. f_nom -5 MHz to f_nom -4 MHz : 30 dB Min. f_nom +4 MHz to f_nom +5 MHz : 30 dB Min. f_nom +5.0 MHz to f_nom +10 MHz : 35 dB Min. f_nom +10 MHz to f_nom +40 MHz : 40 dB Min. f_nom +40 MHz to f_nom +100 MHz : 45 dB Min.	Relative to IL at f_nom
Terminating impedance	Zt	Input : 365 Ω // -8.0 pF Output : 525 Ω // -5.0 pF	Unbalanced
Package	—	SS-752(H)	

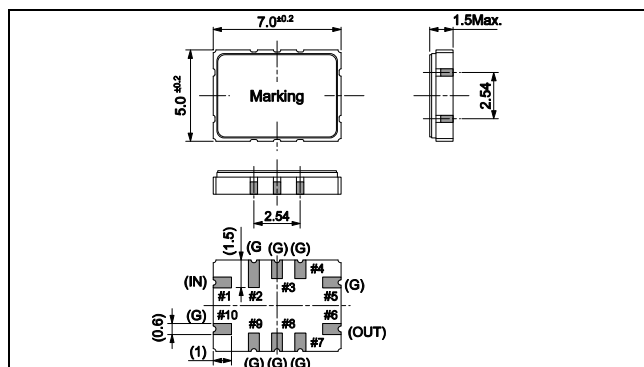
* Includes losses in matching circuit (Matching inductor size : 1.6 × 0.8 mm)

Electrical DATA



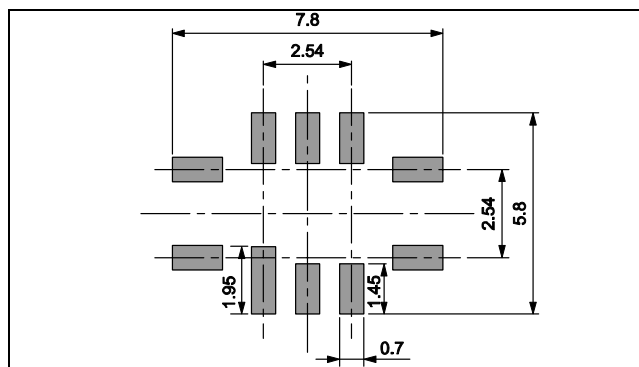
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





SAW FILTER FOR ISM BAND / RF

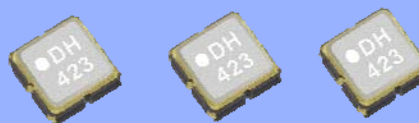
TQS-566AA-7R TQS-557AA-7R



Product number (please contact us)

TQS-566AA-7R : X1L000201000400

TQS-557AA-7R : X1L000201000200



Actual size

TQS-566AA-7R

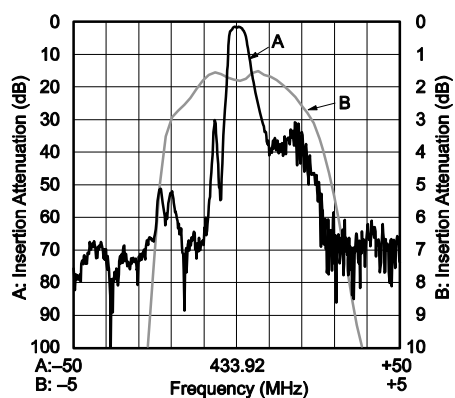
TQS-557AA-7R

Specifications (characteristics)

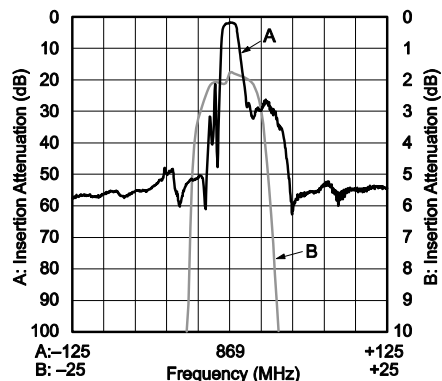
Item	Symbol	TQS-566AA-7R	TQS-557AA-7R	Remarks
Nominal frequency	f_nom	433.92 MHz	869 MHz	
Storage temperature range	T_stg	-40 °C to +85 °C	-40 °C to +85 °C	
Operating temperature range	T_use	-30 °C to +85 °C	-10 °C to +60 °C	
Pass bandwidth	P_Bw	433.05 to 434.79 MHz	868 to 870 MHz	
Insertion loss	IL	3.4 dB Max.	3 dB Max.	IL in Pass bandwidth
Ripple	Ripple	2 dB p-p Max.	1.5 dB p-p Max.	
VSWR	—	2.0 Max.	2.5 Max.	
Stop bandwidth	S_Bw	DC to 392 MHz : 55 dB Min. 392 to 414 MHz : 45 dB Min. 414 to 424.3 MHz : 40 dB Min. 443 to 475 MHz : 25 dB Min. 475 to 479 MHz : 55 dB Min. 479 to 1000 MHz : 40 dB Min.	DC to 828 MHz : 45 dB Min. 828 to 849 MHz : 30 dB Min. 880 to 890 MHz : 10 dB Min. 890 to 925 MHz : 22 dB Min. 925 to 1740 MHz : 40 dB Min.	Relative to through level
Terminating impedance	Zt	50 Ω	50 Ω	Unbalanced
Package	—	SS-30S1(G)	SS-30S1(G)	

Electrical DATA

TQS-566AA-7R

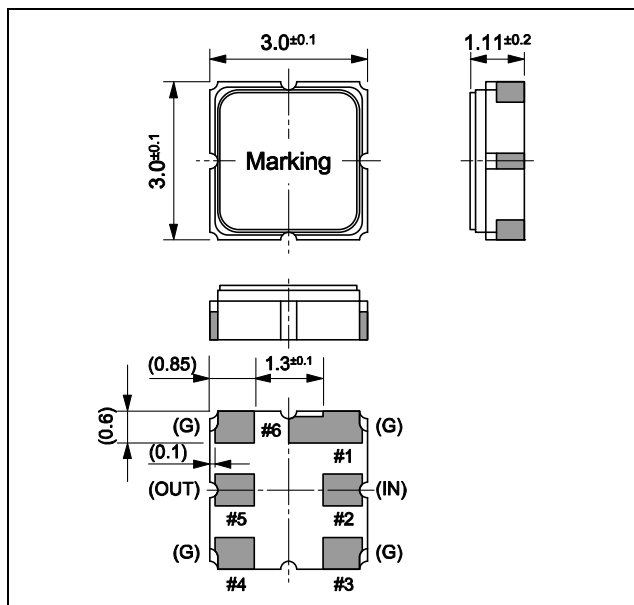


TQS-557AA-7R



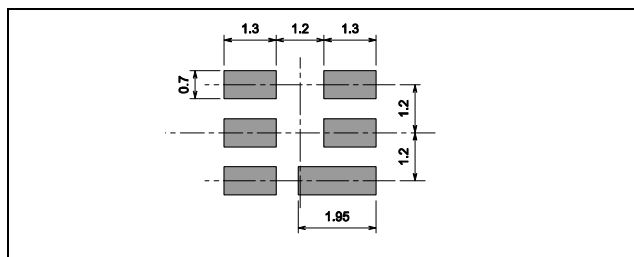
External dimensions

(Unit:mm)



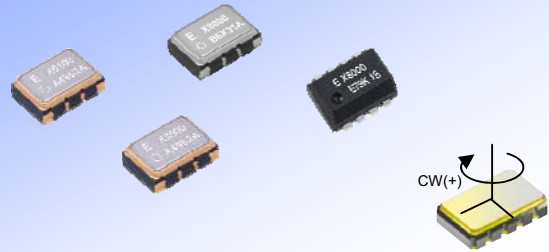
Footprint (Recommended)

(Unit:mm)



**GYRO SENSOR****XV series**

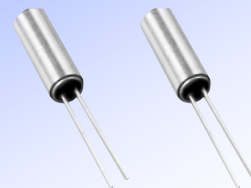
- Ultra Small Package size SMD ($5 \times 3.2 \times 1.3$ mm)
- Hermetic sealing provides excellent sustainable environmental capability.
- High stability using vibration crystal.

**► Gyro sensor**

Model	Operating Voltage	Reference Voltage	Detection Range	Scale Factor	Non Linearity	Recommended Application	Page
XV-8000LK	4.75 to 5.25 V	50 % V _{DD}	±60 deg/s	25 mV/(°·s ⁻¹) Typ.	±0.5 %FS	Car navigation system	127
XV-8000CB	4.75 to 5.25 V	50 % V _{DD}	±60 deg/s	25 mV/(°·s ⁻¹) Typ.	±0.5 %FS	Car navigation system	128
XV-8100CB	2.85 to 3.15 V	1350 mV	±100 deg/s	2.50 mV/(°·s ⁻¹) Typ.	±0.5 %FS	Portable type GPS,PND	129
XV-3500CB	2.7 to 3.3 V	1350 mV	±100 deg/s	0.67 mV/(°·s ⁻¹) Typ.	±5 %FS	Detection picture stabilization	130

TEMPERATURE SENSING CRYSTAL**HTS-206**

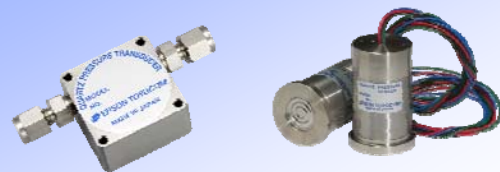
- 2 mm in diameter and 6 mm in length.
- Good linearity frequency and temperature.
- Low frequency (40 kHz) enables low current consumption.
- Wide temperature range (-40 °C to +85 °C).
- Suitable for DTCXO and temperature equipment.

**► Temperature Sensing Crystal**

Model	Frequency Tolerance	Temperature coefficient			Motional resistance	Page
		1st.	2ed.	3rd.		
HTS-206	±2 %	$-26.0 \times 10^{-6} / ^\circ\text{C}$	$-5.8 \times 10^{-8} / ^\circ\text{C}^2$	$-1.5 \times 10^{-10} / ^\circ\text{C}^3$ Max.	30 kΩ Max.	131

QUARTZ PRESSURE SENSOR**TSU series****XP-7000 series**

- High resolution and accuracy

**► Quartz Pressure Sensor**

Model	Pressure measurement range	Linearity after linearization	Accuracy (Linearity, Repeatability, Hysteresis)	Operating Temperature	Page
XP-7000MB	0 to 100 kPa	0.01 % FS Max.	0.05 % FS	-10 °C to +50 °C	132
TSU-20G	0 to 200 kPa		0.023 % FS Max.	-10 °C to +70 °C	133
TSU-70G	0 to 700 kPa				
TSU-100G	0 to 1 MPa				



Product number (please contact us)
X2A000011xxx00

SENSOR

MINIATURE SIZE INCLINED GYRO SENSOR (FOR CAR NAVIGATION SYSTEM)

XV-8000LK

- Small Package size SMD (6.0 × 4.8 × 3.3 mm)
- Inclined angles: 20 degrees
- 5.0V operable device (Ratio metric output)
- High stability using vibration crystal
- With output terminal of temperature sensor

Recommended Application

- Car navigation system



Actual size

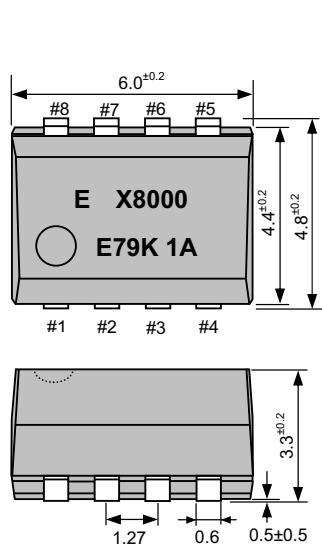


Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Power source Voltage	Operating Voltage	V _{DD}	5.0 V ±0.25 V
Temperature range	Storage Temperature	T _{STG}	-40 °C to +85 °C
	Operating Temperature	T _{OPR}	-40 °C to +85 °C
Scale factor	S ₀	25 mV/(°·s ⁻¹) Typ.	
Bias	V ₀	50 % V _{DD}	T _a =+25 °C
Rate range	I	±60 deg/s	θ=0 °
Non linearity	NI	±0.5 % FS Max.	T _a =+25 °C
Frequency response	BW	10 Hz Typ.	Phase delay angle 90°
Cross axes	OS	±5 % Max.	T _a =+25 °C
Current consumption	I _{OP}	4 mA Typ.	V _O : Output No load condition
Quiescent noise	rN	3 mVp-p Typ	

External Dimensions

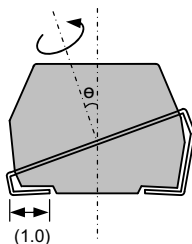
(Unit:mm)



Pin map

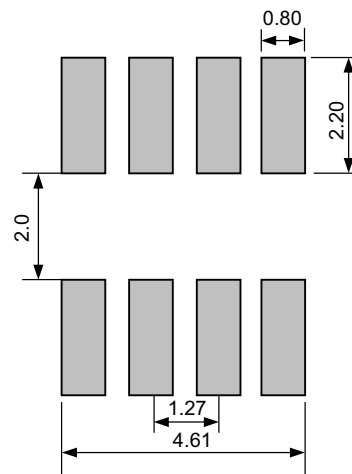
Pin	Connection
1	N.C.
2	GND
3	V _{DD}
4	N.C.
5	N.C.
6	V _{OUT}
7	V _{TEMP}
8	N.C.

Do not connect "N.C." to external device



Footprint (Recommended)

(Unit:mm)





SENSOR

ULTRA MINIATURE SIZE GYRO SENSOR (FOR CAR NAVIGATION SYSTEM)

XV-8000CB

- Ultra Small Package size SMD (5 × 3.2 × 1.3 mm)
- 5.0V operable device (Ratio metric output)
- High stability using vibration crystal
- With output terminal of temperature sensor

Recommended Application

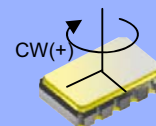
- Car navigation system



Product number (please contact us)
Q71800020xxxx00



Actual size

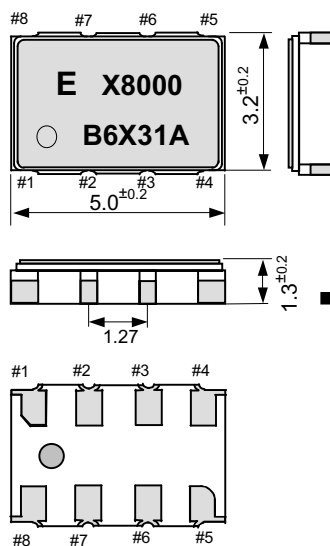


Specifications (characteristics)

Item		Symbol	Specifications	Remarks
Power source Voltage	Operating Voltage	V _{DD}	5.0 V ±0.25 V	V _{SS} =0 V
Temperature range	Storage Temperature	T _{STG}	-40 °C to +85 °C	
	Operating Temperature	T _{OPR}	-40 °C to +85 °C	
Scale factor		S ₀	25 mV/(°·s ⁻¹) Typ.	
Bias		V ₀	50 % V _{DD}	T _a =+25 °C
Rate range		I	±60 deg/s	
Non linearity		NI	±0.5 % FS Max.	T _a =+25 °C
Frequency response		BW	10 Hz Typ.	Phase delay angle 90°
Cross axes		OS	±5 % Max.	T _a =+25 °C
Current consumption		I _{op}	4 mA Typ.	V _o : Output No load condition
Quiescent noise		r _N	3 mVp-p Typ	

External Dimensions

(Unit:mm)



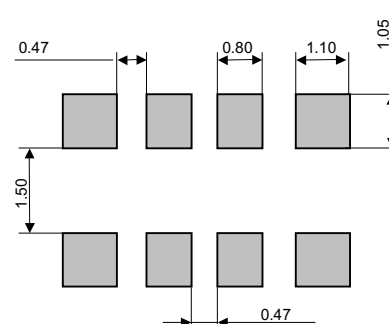
Pin map

Pin	Connection
1	N.C.
2	GND
3	V _{DD}
4	N.C.
5	N.C.
6	V _{OUT}
7	V _{TEMP}
8	N.C.

Do not connect "N.C." to external device

Footprint (Recommended)

(Unit:mm)





SENSOR

ULTRA MINIATURE SIZE GYRO SENSOR

(For portable GPS, PND applications)

XV-8100CB

- Ultra Small Package size SMD (5 × 3.2 × 1.3 mm)
- Hermetic sealing provides excellent sustainable environmental capability
- 3.0 V operable device, Low current consumption
- High stability using vibration crystal
- Low Noise

Recommended Application

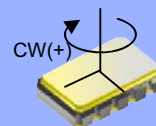
- Portable type GPS, PND (Personal Navigation Device)



Product number (please contact us)
Q71810020xxxx00



Actual size

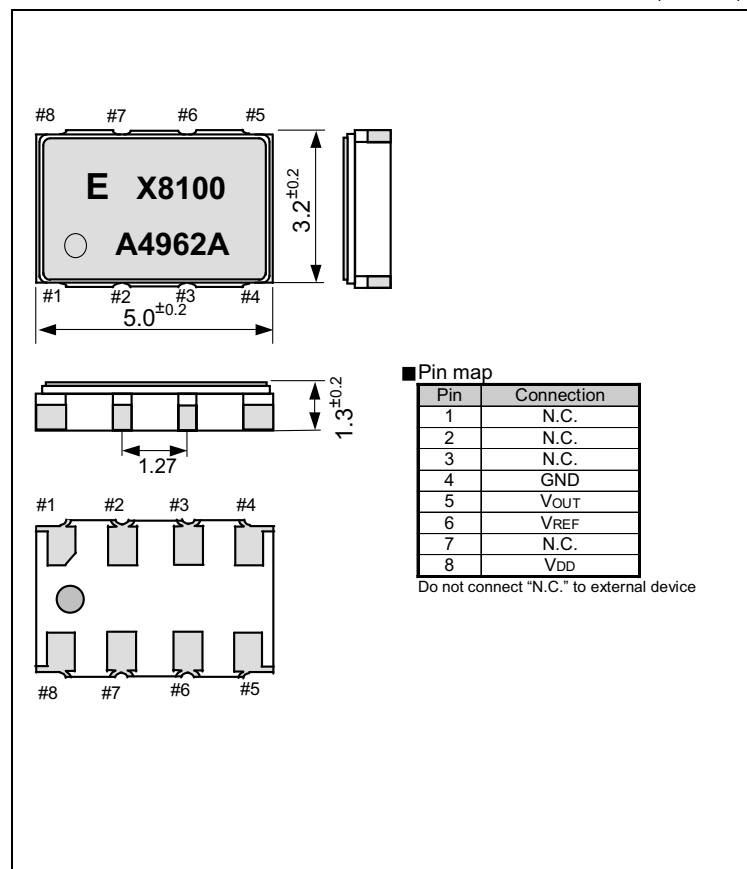


Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Power source Voltage	Operating Voltage	V _{DD}	3.0 V ±0.15 V
Temperature range	Storage Temperature	T _{STG}	-40 °C to +85 °C
	Operating Temperature	T _{OPR}	-40 °C to +85 °C
Scale factor	S ₀	2.5 mV/(°·s ⁻¹) Typ.	
Bias	V ₀	1350 mV Typ.	T _a =+25 °C
Reference voltage	V _r	1350 mV Typ.	T _a =+25 °C
Rate range	I	±100 deg/s	
Non linearity	NI	±0.5 % FS Max.	T _a =+25 °C
Cross axes	OS	±5 % Max.	T _a =+25 °C
Current consumption	I _{OP}	1.7 mA Typ.	V _O , V _{REF} : Output No load condition
Noise	r _N	0.004 deg/s/√Hz	at 10 Hz

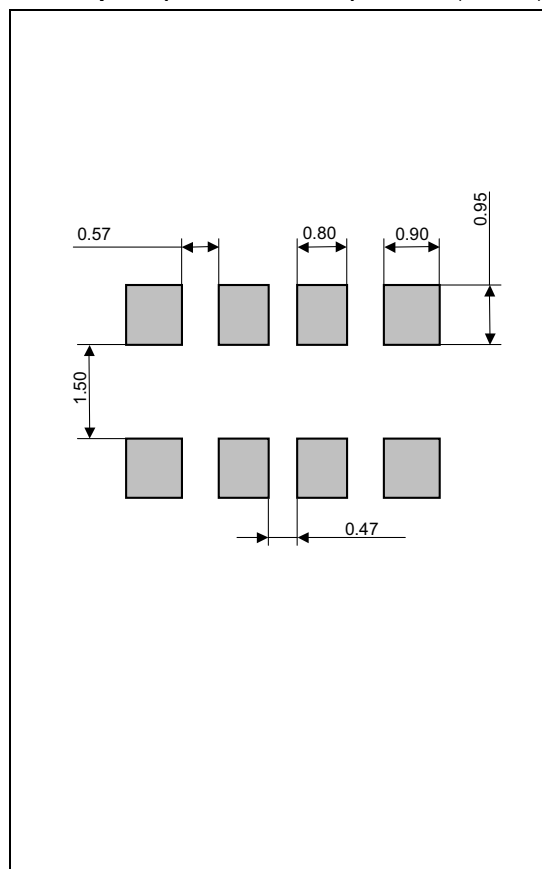
External Dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





SENSOR

ULTRA MINIATURE SIZE VIBRATION GYRO SENSOR

(angular rate sensor)

XV-3500CB

- Ultra Small Package size SMD (5 × 3.2 × 1.3 mm)
- Hermetic sealing provides excellent sustainable environmental capability
- High stability using vibration crystal
- Clipped startup time and low power consumption with sleep mode

Recommended Application

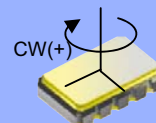
- Detection picture stabilization of DVC and DSC
- Detection of moving with man machine interface



Product number (please contact us)
Q71350020xxxx00



Actual size

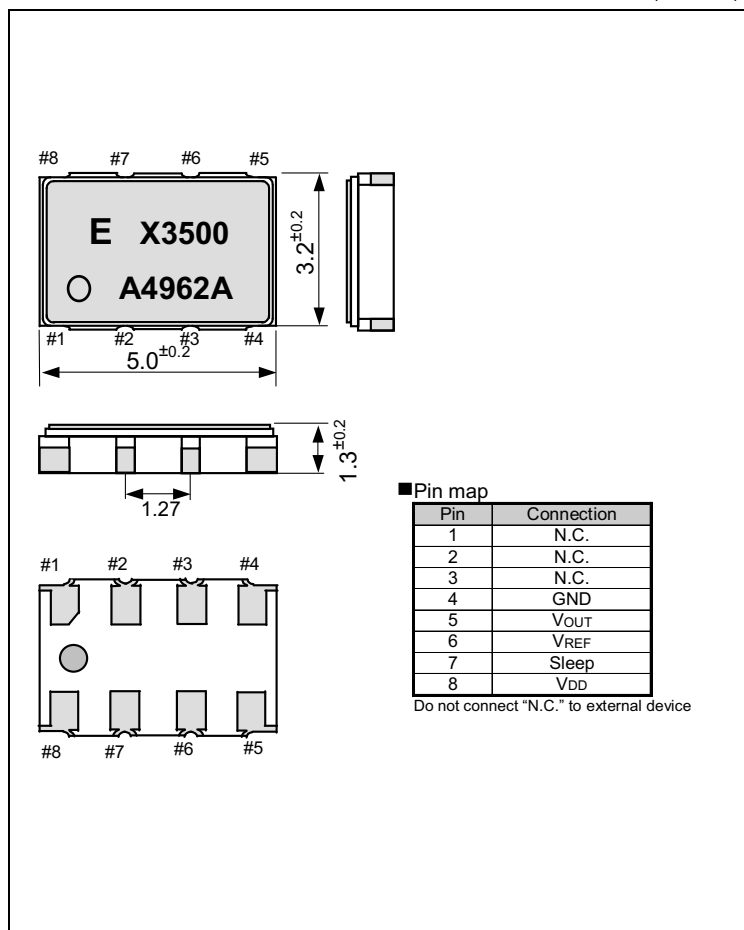


Specifications (characteristics)

Item		Symbol	Specifications	Remarks
Power source Voltage	Operating Voltage	V _{DD}	3.0 V ±0.3 V	V _{SS} =0 V
	Storage Temperature	T _{STG}	-40 °C to +85 °C	
Temperature range	Operating Temperature	T _{OPR}	-20 °C to +80 °C	
	Scale Factor	S ₀	0.67 mV/(°·s ⁻¹) Typ.	
Bias		V ₀	V _r	T _a =+25 °C
Reference Voltage		V _r	1350 mV Typ.	T _a =+25 °C
Rate Range		I	±100 deg/s	For the out of standard specifications, please contact us for inquiries.
Phase Delay		φ ₂₀	4 (Degree)	at 20Hz phase delay angle
Power Consumption	In Operating	I _{op}	1.7 mA Typ.	V ₀ , V _r : Output No load condition
	Sleep Mode	I _{sleep}	1 mA Typ.	V ₀ , V _r : Output No load condition

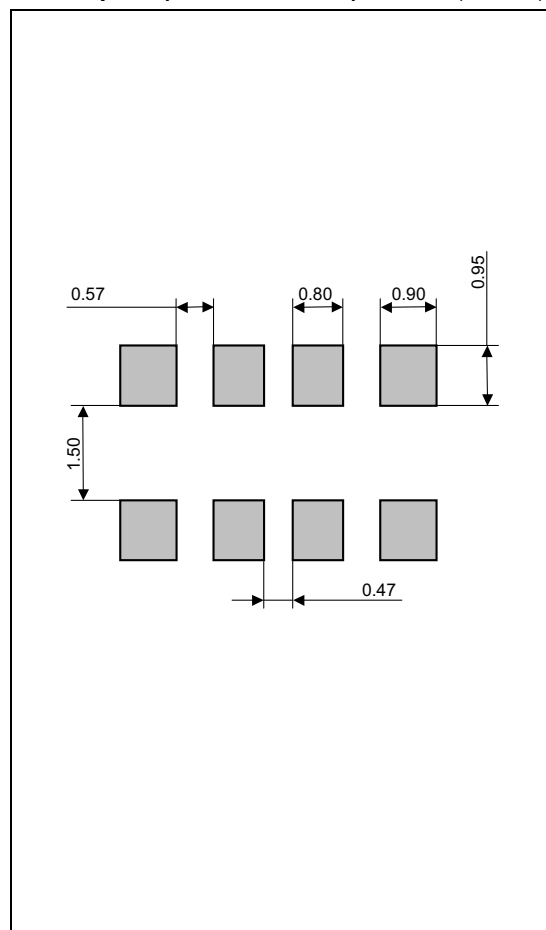
External Dimensions

(Unit:mm)



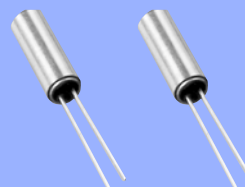
Footprint (Recommended)

(Unit:mm)



**SENSOR
TEMPERATURE SENSING CRYSTAL****HTS -206**

- Crystal used to sense the change in temperature.
- 2 mm in diameter and 6 mm in length.
- Good linearity frequency and temperature.
- Low frequency (40 kHz) enables low current consumption.
- Wide temperature range (-40 °C to +85 °C).
- Suitable for DTCXO and temperature equipment.

Product number (please contact us)
Q19HT2060xxxx00

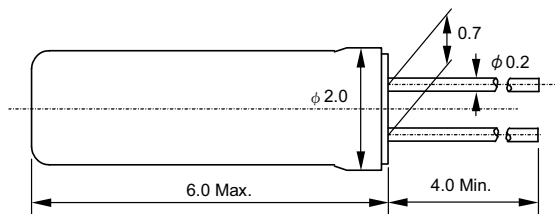
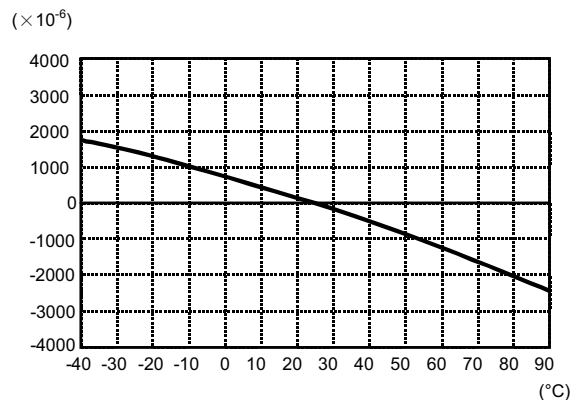
Actual size

**Specifications (characteristics)**

Item		Symbol	Specifications	Remarks
Nominal frequency range		f_nom	40 kHz	
Temperature range	Storage temperature	T_stg	-55 °C to +125 °C	Store as bare product after unpacking
	Operating temperature	T_use	-40 °C to +85 °C	
Level of drive		DL	0.1 μW Typ.	GL:1.0 μW Max.
Frequency tolerance		f_tol	±2 %	+25 °C ,DL=0.1 μW
1st.Temperature coefficient		α	$-26.0 \times 10^{-6} / ^\circ\text{C}$ (±2 %)	
2nd.Temperature coefficient		β	$-5.8 \times 10^{-8} / ^\circ\text{C}^2$ (±8 %)	
3rd.Temperature coefficient		γ	$-1.5 \times 10^{-10} / ^\circ\text{C}^3$ Max.	
Motional resistance (ESR)		R1	30 kΩ Max.	+25 °C,DL=0.1 μW
Motional capacitance		C1	2.0 fF Typ.	
Shunt capacitance		C0	0.9 pF Typ.	
Frequency aging		f_age	$\pm 3 \times 10^{-6} / \text{year}$ Max.	+25 °C

External dimensions

(Unit:mm)

**Frequency Temperature coefficient**

SENSOR
QUARTZ PRESSURE SENSOR

XP-7000 series

- High resolution and accuracy
- Clean measurement can be done.
Diaphragm of metal (SUS316L)
- Small size
- Applications : Various kinds of pressure measurement for industrial use



Product Number (Please contact us)
X2C0000x1xxxx00

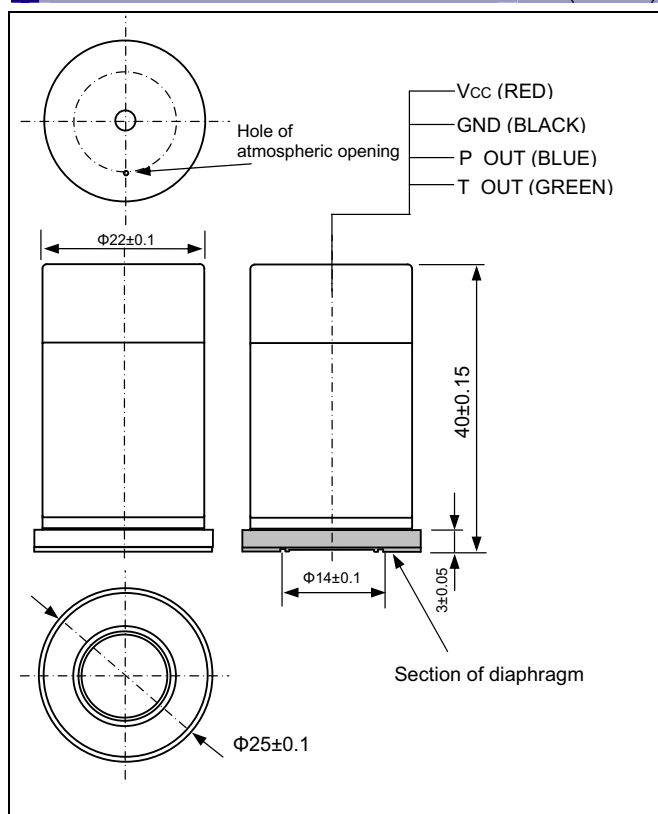
**NEW**

Specifications (characteristics)

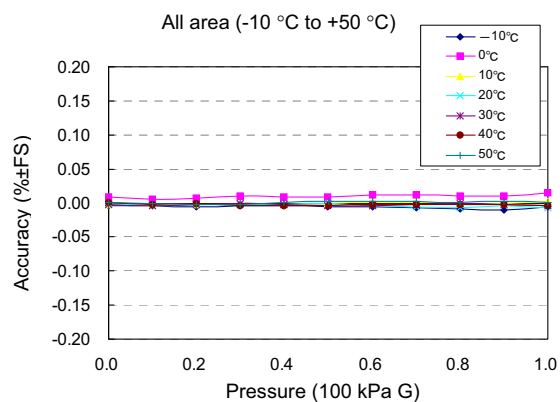
Item		Symbol	Specifications	Remarks
Pressure measurement range		—	0 to 100 kPa (Gage pressure)	Measurement of water level : 0 to 10 m
Accuracy		—	±0.05 %FS Max.	Include of Linearity, Repeatability and Hysteresis
			±0.05 %FS Max.	After doing the correction processing by the value of a built-in temperature sensor
Temperature range	Storage temperature	T_stg	-20 °C to +60 °C	
	Operating temperature	T_use	-10 °C to +50 °C	
Supply voltage		Vcc	+12 V (DC)	
Output Waveform			3.2 Vp-p Min. (square wave)	Frequency of no load condition : 39 kHz Typ.
Current consumption		Icc	4.0 mA Max.	XP-7000MB(Buffer circuit : non)
Maximum pressure measurement range		—	140 %	Pressure not destroyed
Size		—	Φ22 × 40 mm	projection part is not contain

External dimensions

(Unit:mm)



Typical Data





SENSOR QUARTZ PRESSURE SENSOR

TSU series

- High resolution and accuracy
- Excellent repeatability with minimal hysteresis
- High stability against temperature variation
- Output frequency is unaffected by IN/OUT cable length.
- Applications : Various kinds of pressure measurement for industrial use



Product number (please contact us)
X2C0000xxxxxx00

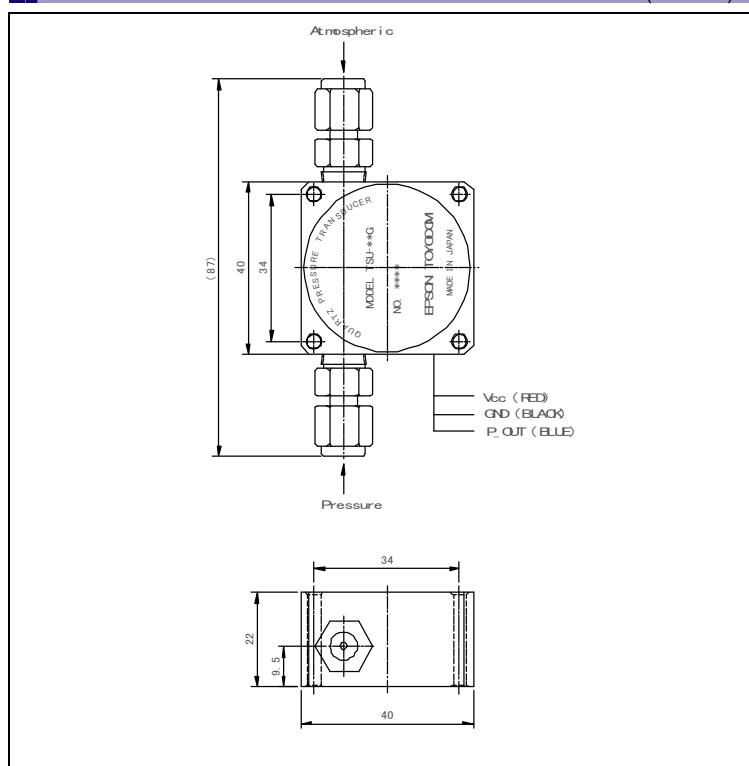


Specifications (characteristics)

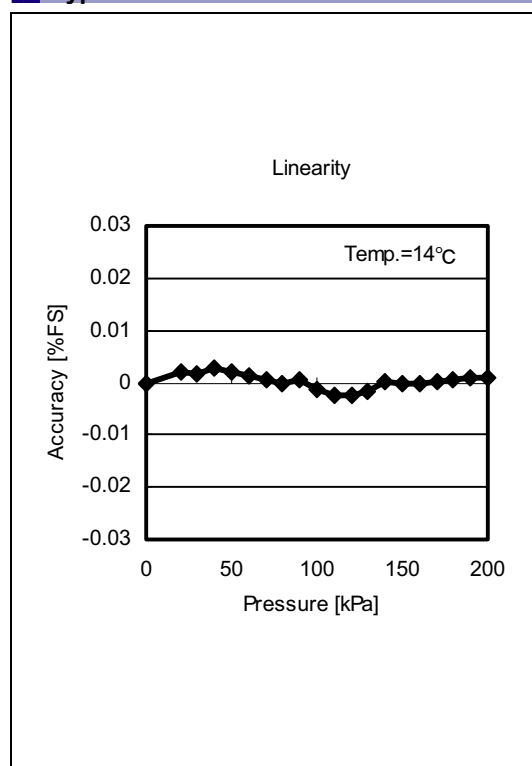
Item	Symbol	TSU-20G	TSU-70G	TSU-100G
Pressure measurement range	—	0 to 200 kPa	0 to 700 kPa	0 to 1 MPa
Linearity after linearization	—	0.01 %FS Max.		
Accuracy (Linearity, Repeatability, Hysteresis)	—	0.023 %FS Max.		
Operating temperature range	T _{use}	-10 °C to +70 °C		
Storage temperature range	T _{stg}	-20 °C to +80 °C		
Operating humidity range	—	0 % to 95 %		
Tilt correction	—	Equipped		
Built-in temperature sensor	—	Option	Option	Option
Output frequency without pressure	—	39 kHz Typ.		
Maximum frequency change	—	4 kHz Typ.		
Output voltage	V _{pp}	3.2 V _{pp} Min. (output load 600 Ω) Clipped sine DC cut		
Supply voltage	V _{cc}	12 V (Standard)		
Current consumption	I _{cc}	2 mA Typ. (4 mA Typ. : Built-in temperature sensor)		
Pressure input/output port	—	1/8" Fitting		
Weight	—	200 g		
Material	—	SUS304		

External dimensions

(Unit:mm)



Typical Data

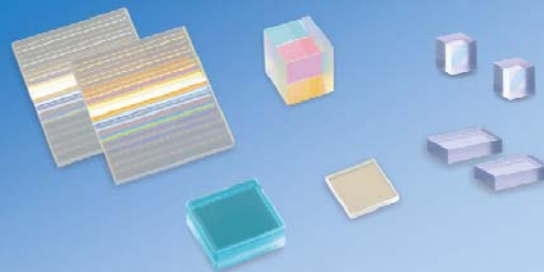




OPTICAL DEVICE

•Features

- Wide selection of types according to application.
- Custom designs available upon request.
Please inquire it.



►Optical Device

Applications		Model	Wavelength (nm)	Optical Specification	Incident Angle (°)	Dimension (Ex.) (mm)	Page
Optical Pickup	DVD CD	1/4 Wave plate C type (Single plate)	660 or 785	Phase retardation:90° ±5 (0° Incident angle)	0° ±0.5°	4 DVD:0.35 t CD:0.45 t	135
		1/4 Wave plate D type (Double plate)			0° ±5°	4 DVD:1.1 t CD:1.1 t	
		1/4 Wave plate G type (Double plate)			0° ±5°	4 DVD:0.55 t CD:0.7 t	
		1/2 Wave plate C type (Single plate)		0° ±0.5°	4 DVD:0.7 t CD:0.85 t		
		1/2 Wave plate D type (Double plate)		0° ±5°	4 DVD:1.1 t CD:1.1 t		
		1/2Wave plate G type (Double plate)		0° ±5°	4 DVD:0.7 t CD:0.7 t		
	Blue	1/4 Wave plate C type (Single plate)	405	Phase retardation:90° ±5° (0° Incident angle)	0° ±0.5°	4 0.3 t	136
		1/4 Wave plate D type (Double plate)			0° ±5°	4 0.6 t	
		1/2 Wave plate D type (Double plate)		Phase retardation:180° ±5° (0° Incident angle)	0° ±5°	4 0.6 t	
	DVD CD	Dichroic Prism DVD penetrate type	660	Tp ≥ 90 % Ts ≥ 90 % (0° Incident angle)	0° ±5°	3 × 3 3 t	137
			785	Rp ≥ 88 % Rs ≥ 92 % (0° Incident angle)			
		Dichroic Prism DVD reflection type	660	Rp ≥ 80 % Rs ≥ 97 % (0° Incident angle)	0° ±5°	3 × 3 3 t	
			785	Tp ≥ 94 % Ts ≥ 94 % (0° Incident angle)			
	Blue	PBS Prism	405	Tp ≥ 93 % Rs ≥ 90 % (0° Incident angle)	0° ±6°	3 × 3 3 t	138
	Blue DVD CD	Trichroic Prism	405	Rp ≥ 84 % Rs ≥ 93 % (0° Incident angle)	0° ±6°	4 × 4 4 t	
			660	Tp ≥ 93 % Ts ≥ 93 % (0° Incident angle)			
			785	Tp ≥ 94 % Ts ≥ 94 % (0° Incident angle)			
	Blue DVD CD	Grating	405 or 660 or 785	Grating ratio=1:10:1 Grating pitch 20 μm	0°	3 × 2 0.5 t	140
	DVD CD	Dichroic Filter	660,785	Peripheral 660 nm T ≥ 95 % 785 nm T ≤ 5 % Center 660 nm T ≥ 95 % 785 nm T ≥ 95 %	0°	4 × 4 0.5 t	
Camera (Cellular)	DSC DVC	OLPF IR-cut Filter	400 to 1200	50 % Wavelength 650 nm ±10 nm	0°	8 × 7	141
		OLPF UV-IRcut-Filter	410 to 1200	50 % Wavelength UV: 410 nm ±10 nm 50 % Wavelength IR: 650 nm ±10 nm			
	DSLR	OLPF Anti-dust coat	400 to 1200	50 % Wavelength UV: 410 nm ±10 nm 50 % Wavelength IR: 650 nm ±10 nm	0°	22 × 28	
Projector	3LCD	PS Converter	420 to 680	Tp ≥ 94% Rs ≥ 95 % (0°Incident angle)	0°	34.6 × 35 4.2 t	139
		Heat Sink Plate	420 to 680	1 % Max. (0° Incident angle)	0°	23.5 × 20	



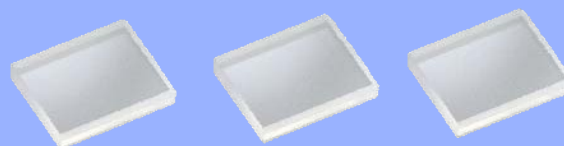
OPTICAL DEVICE

1/4 Wave Plate

1/2 Wave Plate

- Corresponds to DVD.
- Corresponds to CD.

Product number (please contact us)
X3Gxxxxxxxxx00

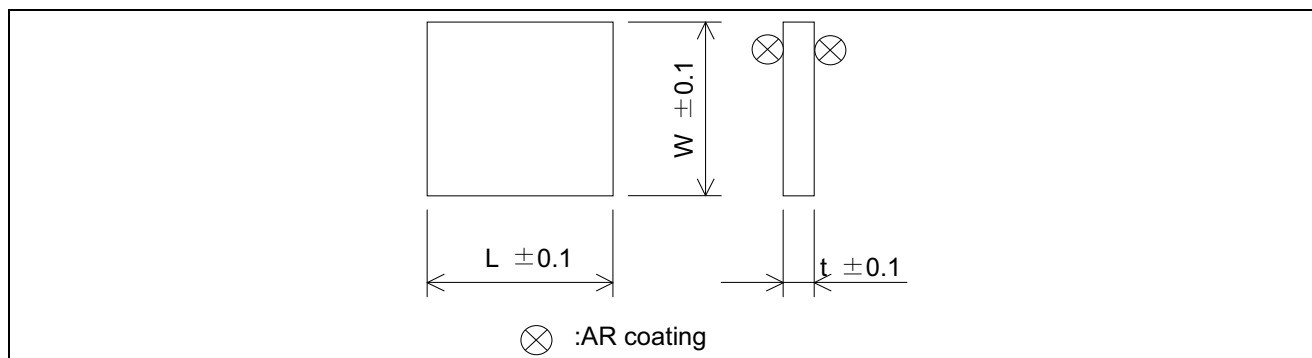


Specifications

Type	1/4 Wave plate						1/2 Wave plate					
	C type (Single plate)		D type (Double plate)		G type (Double plate)		C type (Single plate)		D type (Double plate)		G type (Double plate)	
Material	Synthetic quartz											
Wavelength (nm)	660	785	660	785	660	785	660	785	660	785	660	785
Incident Angle	0 ° ±0.5 °		0 ° ±5 °				0 ° ±0.5 °		0 ° ±5 °			
Dimensions(Ex.) L × W (mm)	Standard: 4.0 × 4.0 Other dimensions upon request											
Thickness t (mm)	0.35	0.45	1.10		0.55	0.70	0.70	0.85	1.10		0.70	
Phase retardation (Incident angle: 0 °)	90 ° ±5 °						180 ° ±5 °					
Reflectance of AR coating	0.5 % Max. (Incident angle: 0 °)											
Wavefront aberration	0.020 λ rms (φ3 mm)		0.025 λ rms (φ3 mm)				0.020 λ rms (φ3 mm)		0.025 λ rms (φ3 mm)			

Outline Drawing

(Unit :mm)



Optical Axis Direction

90° type	45° type	22.5° type
$\theta = 90^\circ \pm 1^\circ$	$\theta = 45^\circ \pm 1^\circ$	$\theta = 22.5^\circ \pm 1^\circ$



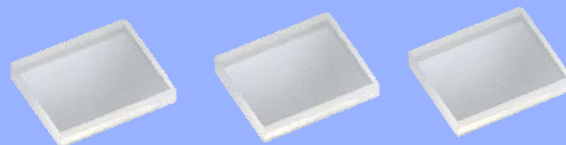
OPTICAL DEVICE

1/4 Wave Plate

1/2 Wave Plate

- Corresponds to Blue Laser.
- Glue Less and High stability type : GL series

Product number (please contact us)
X3Gxxxxxxxxx00

**NEW****Specifications****Standard type**

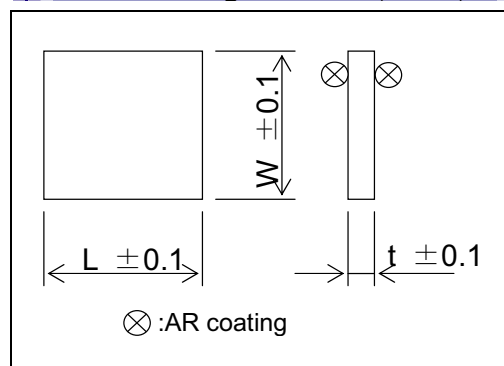
Type	1/4 Wave plate		1/2 Wave plate
	C Type (Single plate)	D Type (Double plate)	D Type (Double plate)
Material	Synthetic quartz		
Wavelength	405 nm		
Incident Angle	0 ° ±0.5 °	0 ° ±5 °	0 ° ±5 °
Dimensions (Ex.) L × W (mm)	Standard: 4.0 × 4.0 Other dimensions upon request		
Thickness t(mm)	0.30	0.60	0.60
Phase retardation (Incident angle: 0 °)	90 ° ±5 °	90 ° ±5 °	180 ° ±5 °
Reflectance of AR coating	0.5 % Max. (Incident angle: 0 °)		
Wavefront aberration	0.020 λ rms (φ3 mm, λ= 405 nm)	0.025 λ rms (φ3 mm, λ= 405 nm)	

High stability type (GL series)

Type	1/4 Wave plate	1/2 Wave plate
	D Type (Double plate)	D Type (Double plate)
Material	Synthetic quartz	
Wavelength	405 nm	
Incident Angle	0 ° ±5 °	0 ° ±5 °
Dimensions (Ex.) L × W (mm)	Standard: 4.0 × 4.0 Other dimensions upon request	
Thickness t(mm)	0.60	0.60
Phase retardation (Incident angle: 0 °)	90 ° ±5 °	180 ° ±5 °
Reflectance of AR coating	0.5 % Max. (Incident angle: 0 °)	
Wavefront aberration	0.020 λ rms (φ3 mm, λ= 405 nm)	

OutlineDrawing

(Unit:mm)

**Optical Axis Direction**

90 ° type	45 ° type	22.5 ° type
$\theta = 90^\circ \pm 1^\circ$	$\theta = 45^\circ \pm 1^\circ$	$\theta = 22.5^\circ \pm 1^\circ$

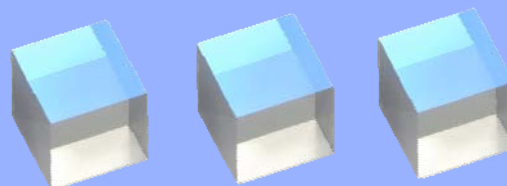


OPTICAL DEVICE

Dichroic Prism

- Corresponds to DVD,CD.

Product number (please contact us)
X3Axxxxxxxxx00

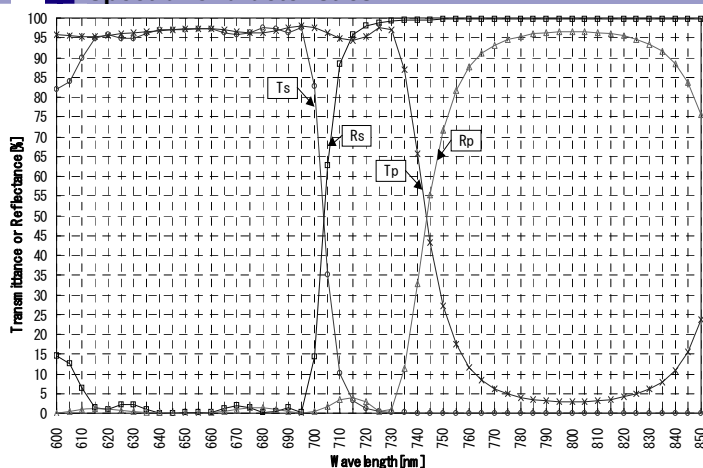


DVD penetrate type

Specifications

Material	BK7 or equivalent		
Wavelength	660 nm $\pm$ 10 nm, 785 nm $\pm$ 10 nm		
Incident angle	0 ° $\pm$ 5 °		
Dimensions (Ex.)	3.0 $^{+0.1}_{-0.1}$ $\times$ 3.0 $^{+0.1}_{-0.1}$ $\times$ 3.0 $^{+0.1}_{-0.1}$ (mm)		
Clear aperture	ϕ 2 mm		
Wavefront aberration	0.02 λ rms Max. (Transmission, λ = 660 nm)		
Dichroic coating characteristics	Wavelength	Incident angle	Characteristics
	660 nm	0 °	Tp $\geq$ 90 % Ts $\geq$ 90 %
	785 nm	0 °	Rp $\geq$ 88 % Rs $\geq$ 92 %
Reflectance of AR coating	0.5 % Max. (Incident angle: 0 °)		

Spectral Characteristics



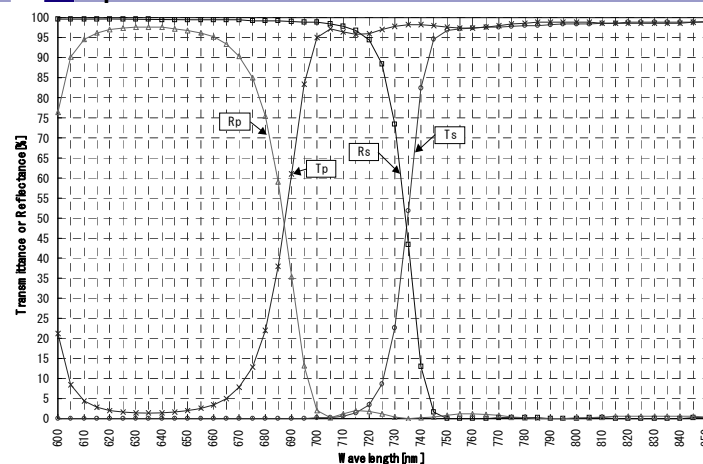
TP: Transmittance P polarization RP: Reflectance P polarization
TS: Transmittance S polarization RS: Reflectance S polarization

DVD reflection type

Specifications

Material	BK7 or equivalent		
Wavelength	660 nm $\pm$ 10 nm, 785 nm $\pm$ 10 nm		
Incident angle	0 ° $\pm$ 5 °		
Dimensions (Ex.)	3.0 $^{+0.1}_{-0.1}$ $\times$ 3.0 $^{+0.1}_{-0.1}$ $\times$ 3.0 $^{+0.1}_{-0.1}$ (mm)		
Clear aperture	ϕ 2 mm		
Wavefront aberration	0.02 λ rms max (Reflection, λ = 660 nm)		
Dichroic coating characteristics	Wavelength	Incident angle	Characteristics
	660 nm	0 °	Rp $\geq$ 80 % Rs $\geq$ 97 %
	785 nm	0 °	Tp $\geq$ 94 % Ts $\geq$ 94 %
Reflectance of AR coating	0.5 % Max. (Incident angle: 0 °)		

Spectral Characteristics



TP: Transmittance P polarization RP: Reflectance P polarization
TS: Transmittance S polarization RS: Reflectance S polarization



OPTICAL DEVICE

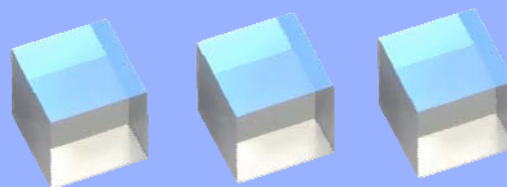
PBS-Prism for Blue

- Corresponds to Blue Laser.

Trichroic Prism

- Corresponds to three wavelength.(Blue,DVD,CD)

Product number (please contact us)
X3Axxxxxxxxx00

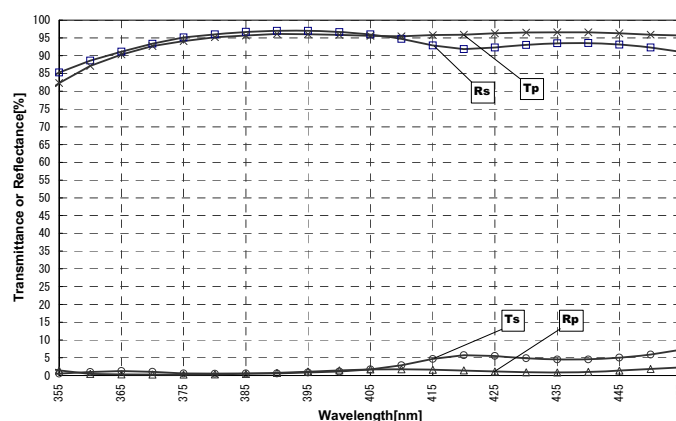


PBS-Prism for Blue

Specifications

Material	BK7 or equivalent		
Wavelength	405 nm $\pm$ 10 nm		
Incident angle	0° $\pm$ 6°		
Dimensions (Ex.)	3.0 $^{+0.1}_{-0.1}$ $\times$ 3.0 $^{+0.1}_{-0.1}$ $\times$ 3.0 $^{+0.1}_{-0.1}$ (mm)		
Clear aperture	ϕ 2.0 mm		
Wavefront aberration	0.030 λ rms Max. (λ = 405 nm)		
Dichroic coating characteristics	Wavelength	Incident angle	Characteristics
		405 $\pm$ 10 nm	0° Tp $\geq$ 93 % Rs $\geq$ 90 %
		0° $\pm$ 6°	Tp $\geq$ 89 % Rs $\geq$ 90 %
Reflectance of AR coating	0.5 % Max. (Incident angle: 0°)		

Spectral Characteristics (Ex.)

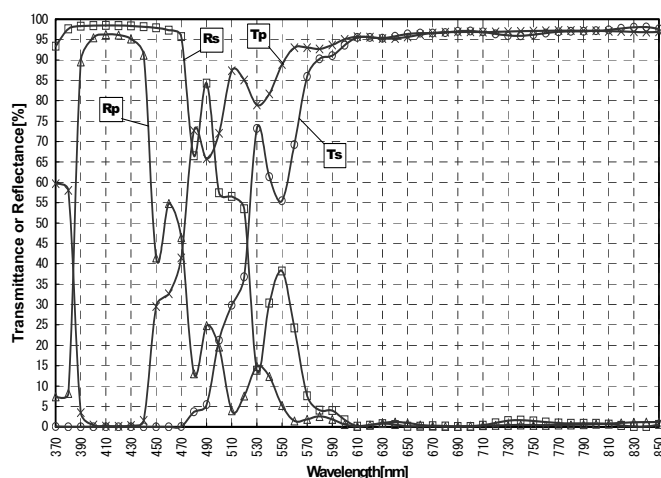


Trichroic Prism

Specifications

Material	BK7 or equivalent		
Wavelength	405 nm $\pm$ 5 nm, 660 nm $\pm$ 15 nm, 785 nm $\pm$ 15 nm		
Incident angle	0° $\pm$ 6°		
Dimensions (Ex.)	4.0 $^{+0.1}_{-0.1}$ $\times$ 4.0 $^{+0.1}_{-0.1}$ $\times$ 4.0 $^{+0.1}_{-0.1}$ (mm)		
Clear aperture	ϕ 3.0 mm		
Wavefront aberration	0.030 λ rms Max.(Ref. λ = 405 nm) 0.025 λ rms Max.(Tra. λ = 660 nm)		
Trichroic coating characteristics	Wavelength	Incident angle	Characteristics
	405 $\pm$ 5 nm	0° $\pm$ 6°	Rp $\geq$ 84 % Rs $\geq$ 93 %
	660 $\pm$ 10 nm	0° $\pm$ 6°	Tp $\geq$ 93 % Ts $\geq$ 93 %
	785 $\pm$ 15 nm	0° $\pm$ 6°	Tp $\geq$ 94 % Ts $\geq$ 94 %
Reflectance of AR coating	1.0 % Max. (Incident angle: 0°)		

Spectral Characteristics (Ex.)





OPTICAL DEVICE

PS Converter

- Polarization beam splitter

Heat Sink Plate

- For projector

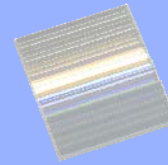
Product number (please contact us)

PS Converter

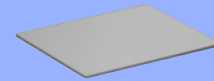
X3Kxxxxxxxxx00

Heat sink Plate

X3Hxxxxxxxxx00



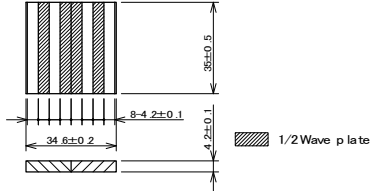
PS Converter



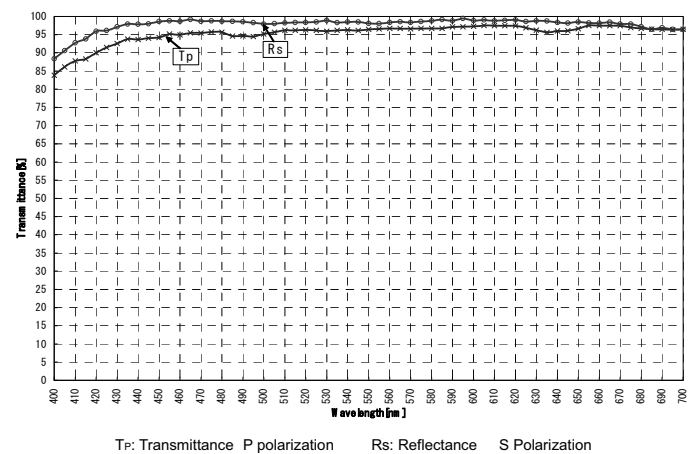
Heat Sink Plate

PS Converter

Specification

Material	B270 or equivalent		
Wavelength	420 nm to 680 nm		
Dimensions (Ex.)	$34.6^{+0.2} \times 35.0^{+0.5} \times 4.2^{+0.1}$ (mm) 		
PBS coating Characteristics	Wavelength	Incident angle	Characteristics
	420 nm to 680 nm	0°	$T_p(\text{Ave.}) \geq 94\%$ $R_s(\text{Ave.}) \geq 95\%$
Reflectance of AR coating	Average 0.5 % Max.		

Spectral Characteristics (Ex.)



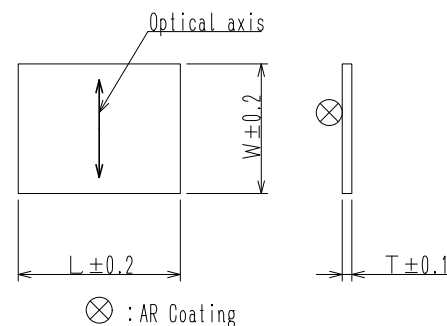
Heat Sink Plate

Specifications

Material	Synthetic Quartz
Wavelength	420 nm to 680 nm
Accuracy against optical axis	Angle between optical axis and L $90^\circ \pm 0.5^\circ$
	Angle between optical axis and W $0^\circ \pm 0.5^\circ$
Reflectance of AR coating	1.0 % Max. (Incident Angle: 0°)

Outline Drawing

(Unit:mm)



L	W	T
20.0	18.0	on discussion
23.5	16.0	
23.5	20.0	
26.0	21.0	
28.0	22.0	



OPTICAL DEVICE

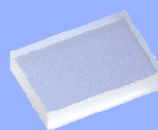
Grating

- Corresponds to three wavelength.(Blue,DVD,CD)

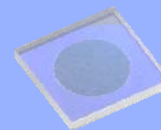
Dichroic Filter

- Allows the DVD and CD wavelength to transmit selectively

Product number (please contact us)
X3Dxxxxxxxxx00



Grating



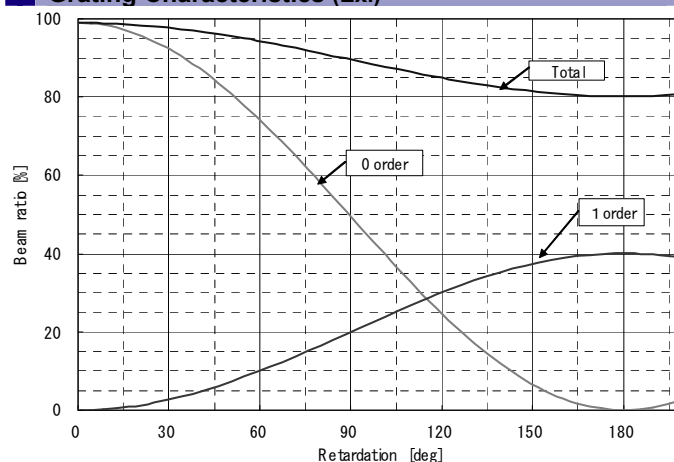
Dichroic Filter

Grating

Specifications

Material	Non-alkaline glass		
Wavelength (nm)	405 ±10	660 ±10	785 ±10
Dimensions (Ex.)	3.0 ^{±0.1} × 2.0 ^{±0.1} (mm)		
Thickness	0.3 ^{±0.05} , 0.5 ^{±0.05} (mm)		
Grating pitch	20 μm (Duty 1:1) Other pitches upon request		
Wavefront aberration	0.02 λrms Max. (λ = 660 nm, φ1.4 mm)		
Grating ratio	-1 order:0 order:+1 order=1:10:1 Other ratio upon request		
Reflectance of AR coating	0.5 % Max. (Incident angle: 0 °)		

Grating Characteristics (Ex.)

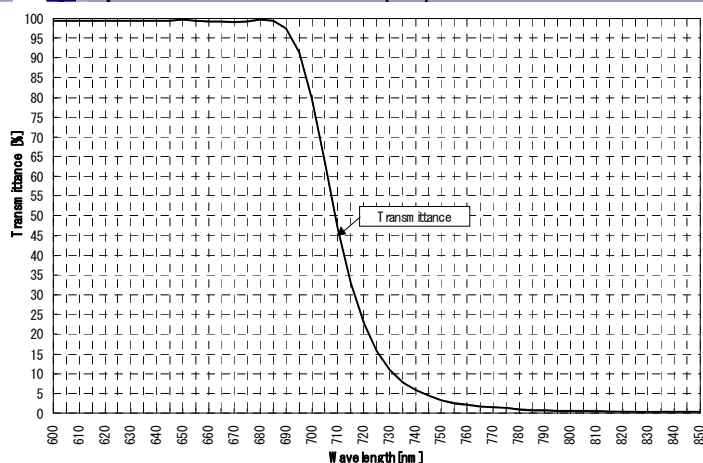


Dichroic Filter

Specifications

Material	Non-alkaline glass		
Wavelength	660 nm ±10 nm, 785 nm ±10 nm		
Dimensions (Ex.)	4.0 ^{±0.1} × 4.0 ^{±0.1} (mm)		
Thickness	0.3 ^{±0.05} , 0.5 ^{±0.05} (mm)		
Wavefront aberration	0.025 λrms Max. (λ = 660 nm, φ2.0 mm)		
Transmittance	Peripheral area	Wavelength	Characteristics
		660 nm	≥ 95 %
	Center	785 nm	≤ 5 %
		660 nm	≥ 95 %
		785 nm	≥ 95 %
Reflectance of AR coating	0.5 % Max. (Incident angle: 0 °)		

Spectral Characteristics (Ex.)





OPTICAL DEVICE

OLPF

IR-cut Filter

- Sharply cut infrared ray

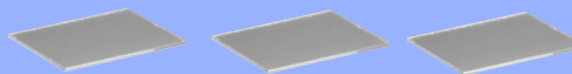
UV·IR-cut

- Sharply cut infrared ray

Anti-Dust coat

- Reduce dust adhesion, improve dust removal

Product number (please contact us)
X3Fxxxxxxxxx00

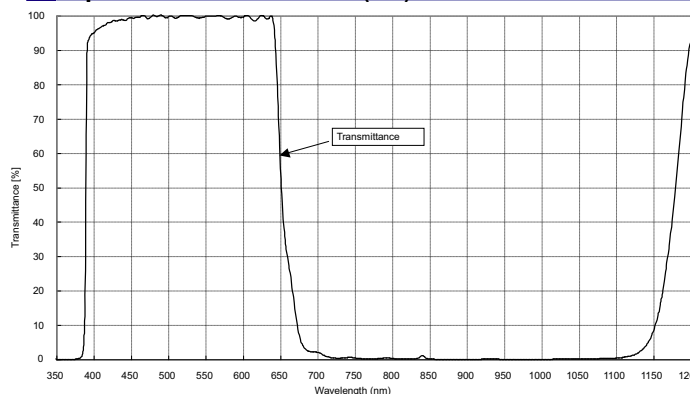


IR-cut Filter

Specifications

Material	Synthetic Quartz ,glass
Wavelength	400 nm to 1200 nm
Dimensions (Ex.)	$8.0^{+0.05} \times 7.0^{+0.05}$ (mm)
Accuracy against optical axis	Angle of optical axis (from cutting)
	$45^{\circ} \pm 1^{\circ}$
	Separation angle $\pm 1^{\circ}$
IR-cut filter characteristics	50 % wavelength of IR : 650 nm ± 10 nm
Reflectance of AR coating	1.0 % Max. (Incident angle: 0° , $\lambda = 420$ nm to 680 nm)

Spectral Characteristics (Ex.)

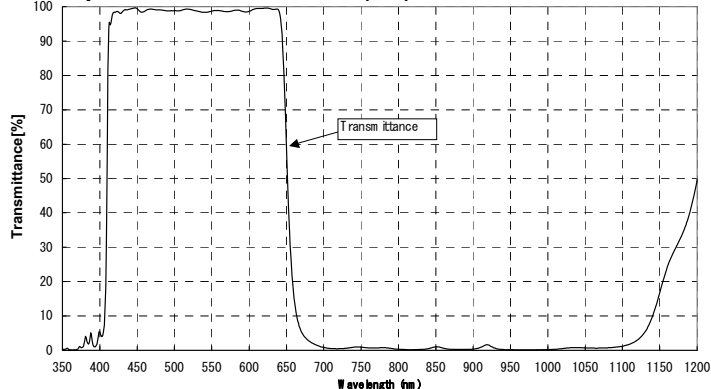


UV·IR-cut Filter

Specifications

Material	Synthetic Quartz ,glass
Wavelength	400 nm to 1200 nm
Dimensions (Ex.)	$8.0^{+0.05} \times 7.0^{+0.05}$ (mm)
Accuracy against optical axis	Angle of optical axis (from cutting)
	$45^{\circ} \pm 1^{\circ}$
	Separation angle $\pm 1^{\circ}$
UV·IR-cut filter characteristics	UV: 50 % Wavelength : 410 nm ± 10 nm IR : 50 % Wavelength : 650 nm ± 10 nm
Reflectance of AR coating	1.0% Max. (Incident angle: 0° , $\lambda = 420$ nm to 680 nm)

Spectral Characteristics (Ex.)

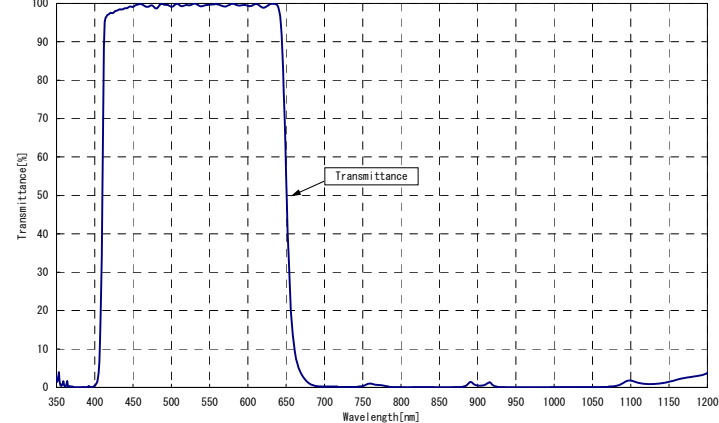


Anti-Dust coat OLPF

Specifications

Material	Synthetic Quartz (Glass)
Wavelength	400 nm~1200 nm
Dimensions(Ex.)	$22.0^{+0.05} \times 28.0^{+0.05}$ (mm)
Accuracy against optical axis	Angle of optical axis (from cutting)
	(θ) $45^{\circ} \pm 1^{\circ}$
	Separation angle (ϕ) $0^{\circ} \pm 1^{\circ}$
UV·IR-cut coat characteristics	UV: 50 % Wavelength : 410 nm ± 10 nm IR: 50 % Wavelength : 650 nm ± 10 nm
Reflectance of AR coating	1.0 % max. (Incident Angle 0° , $\lambda = 450$ nm~650 nm)
Anti-Dust coating side	AR coat side or UVIR coat side
Anti-Dust characteristics	Please inquire

Spectral Characteristics (Ex.)





WORKING FOR EU RoHS / Pb FREE

■ EU RoHS / Pb Free Products of Epson Toyocom

Epson Toyocom's standard product offering is compliant with EU RoHS directives.

The appropriate symbol is displayed on individual product pages as applicable.

	● Pb free.
	● Complies with EU RoHS directive. *About the products without the Pb-free mark. Contains Pb in products exempted by EU RoHS directive. (Contains Pb in sealing glass, high melting temperature type solder or other.)

■ DISTINCTIONS

Distinctions between the products with Pb plating terminals and the products that comply with EU RoHS directives.

- Plastic packaged type products.

Marking (year part lot No.) will be changed as follows.

Products with Pb plating terminals (Terminal Plating ; Sn-Pb)	Numeric	1	2	3	4	5	6	7	8	9	0
Products Complied with EU RoHS directive (Terminal Plating ; Sn-Bi or Sn-Ag)	Alphabet	A	B	C	D	E	F	G	H	J	K
Products Complied with EU RoHS directive (Terminal Plating ; Sn)	Alphabet	M	N	R	S	T	U	V	W	X	Z

- Cylinder type products

The color of glass plug will be changed as follows.

Terminal Pb Plating products	Blue or Green etc
Complies with EU RoHS directive products	Gray or White

■ Terminal materials of Epson Toyocom products that comply with EU RoHS directive

We will deliver products that comply with EU RoHS directives for new orders.

Sn plating of terminals is our standard for the products that offer two types of plating.

	Model	Terminal Material	Terminal Plating	Complies With EU RoHS directive	Pb Free	Remarks (Contains Pb in products exempted by RoHS directive.)	Reference weight (Typ.)
kHz range Crystal units	C-001R	Fe-Ni-Co	Sn-Cu	○	○		148 mg
	C-002RX / C-2-TYPE	Fe-Ni-Co	Sn-Cu	○	○		52 mg
	C-004R/C-4-TYPE	Fe-Ni-Co	Sn-Cu	○	○		30 mg
	C-005R	Fe-Ni-Co	Sn-Cu	○	○		17 mg
	FC-12M	W or Mo	Au	○	○		5 mg
	FC-13E	W	Au	○	○		8 mg
	FC-13F	W	Au	○		Contains Pb in sealing glass exempted by RoHS directive.	8 mg
	FC-135	W	Au	○		Contains Pb in sealing glass exempted by RoHS directive.	11 mg
	FC-145	W	Au	○		Contains Pb in sealing glass exempted by RoHS directive.	15 mg
	FC-255	W	Au	○		Contains Pb in sealing glass exempted by RoHS directive.	22 mg
	MC-146	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	29 mg
	MC-156	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	50 mg
MHz range Crystal units	CA-301	Fe-Ni-Co	Sn-Cu	○	○		172 mg
	FA-118T	Mo	Au	○	○		3 mg
	FA-128	W	Au	○	○		7 mg
	FA-20H	W	Au	○	○		11 mg
	FA-238	W	Au	○	○		16 mg
	TSX-3225	W	Au	○	○		17 mg
	TSX-4025	W	Au	○	○		24 mg
	TSX-5032	W	Au	○	○		40 mg
	FA-365	W	Au	○		Contains Pb in sealing glass exempted by RoHS directive.	84 mg
	MA-306	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	124 mg
	MA-406	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	330 mg
	MA-505/MA-506	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	505 mg
Resonator	NS-21R	W	Au	○	○		13 mg
	NS-32R	W	Au	○	○		49 mg
	FS-335	W	Au	○	○		56 mg
	FS-555	W	Au	○	○		112 mg
	FS-585	W	Au	○	○		112 mg



	Model	Terminal Material	Terminal Plating	Complies With EU RoHS directive	Pb Free	Remarks (Contains Pb in products exempted by RoHS directive.)	Reference weight (Typ.)
SPXO	SG-150 series	Cu	Au	○	○		9 mg
	SG-211 series	W	Au	○	○		13 mg
	SG-210 series	W	Au	○	○		15 mg
	SG-310 series	W	Au	○	○		26 mg
	SG-550 series	42 Alloy	Sn-Bi	○	○		41 mg
	TCO-710x series	W	Au	○	○		53 mg
	SG-770 series	W	Au	○	○		166 mg
	TCO-708x series	W	Au	○	○		158 mg
	SG-645 series	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	98 mg
	SG-636 series	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	241 mg
	SG-615 series	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	917 mg
	SG-531 series	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	698 mg
	SG-51 series	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	952 mg
	SG-8003BA	Cu	Au	○	○		9 mg
	SG-8002CE/SG-8003CE	W	Au	○	○		27 mg
	SG-8002LB/SG-8003LB	42 Alloy	Sn-Bi	○	○		41 mg
	SG-8002JF	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	98 mg
	SG-8002CA/SG-8003CA	W	Au	○	○		148 mg
	SG-8002JC	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	234 mg
	SG-8002JA	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	894 mg
	SG-8002DC	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	699 mg
	SG-8002DB	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	942 mg
	SG-8003JF	42 Alloy	Sn or Sn-Bi	○	○		98 mg
	SG-9001LB	42 Alloy	Sn-Bi	○	○		41 mg
	SG-9001CA	W	Au	○	○		155 mg
	SG-9001JC	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	239 mg
	XG-1000CA	W	Au	○	○		126 mg
	XG-1000CB	W	Au	○	○		56 mg
	EG-2021CA series	W	Au	○	○		135 mg
	EG-2001CA series	W	Au	○	○		130 mg
	EG-2002CA series	W	Au	○	○		135 mg
	EG-2121CA series	W	Au	○	○		133 mg
	EG-2102CA series	W	Au	○	○		129 mg
	EG-2101CA series	W	Au	○	○		134 mg
	HG-2150CA series	W	Au	○	○		153 mg
	HG-8002JA series	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	896 mg
	SG-3030LC/3040LC	42 Alloy	Sn or Sn-Ag	○		Contains Pb in sealing glass exempted by RoHS directive.	25 mg
	SG-3030JF	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	90 mg
	SG-3030JC/3040JC	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	239 mg
VCXO	VG-4231CE	W	Au	○	○		26 mg
	VG-4231CB	W	Au	○	○		54 mg
	VG-4531CB	W	Au	○	○		53 mg
	VG-4231CA	W	Au	○	○		153 mg
	VG-4501CA	W	Au	○	○		169 mg
	VG-4502CA	W	Au	○	○		164 mg
	VG-4511CA	W	Au	○	○		169 mg
	VG-1201CA	W	Au	○	○		158 mg
	TCO-291J	Sn-P-Cu	Sn	○		Contains Pb in sealing glass exempted by RoHS directive.	742 mg
	TCO-2000 series	Sn-P-Cu	Sn	○		Contains Pb in sealing glass exempted by RoHS directive.	971 mg
TCXO	TCO-2100 series	Sn-P-Cu	Sn	○		Contains Pb in sealing glass exempted by RoHS directive.	1018 mg
	TG-3530SA	42 Alloy	Sn-Ag	○		High melting temperature type solder. (Pb85%)	290 mg
	TG-5021BA	Cu	Au	○	○		9 mg
	TG-5021CG	W	Au	○	○		16 mg
	TG-5025CG	W	Au	○	○		16 mg
	TG-5005CE	W	Au	○	○		29 mg
	TG-5010LH	42 Alloy	Sn-Bi	○	○		22 mg
	TCO-5860 series	W	Au	○	○		29 mg
OCXO	TCO-5060 / 5160 series	W	Au	○	○		214 mg
	TCO-6831	Fe-Ni(50 %)	Sn-Cu	○		Contains Pb in sealing glass exempted by RoHS directive.	55.5 g
	OX-6501GG	Cu	Au	○		Contains Pb in sealing glass exempted by RoHS directive.	7.0 g
	TCO-6600 series	Fe-Ni(50 %)	Sn-Cu	○		Contains Pb in sealing glass exempted by RoHS directive.	27.5 g
	TCO-676 series	Fe-Ni(50 %)	Sn-Cu	○		Contains Pb in sealing glass exempted by RoHS directive.	10.0 g
	TCO-679 series	Fe-Ni-Co	Sn-Ag-Cu	○		Contains Pb in sealing glass exempted by RoHS directive.	4.5 g
	TCO-6920A	Fe-Ni(50 %)	Sn-Cu	○		Contains Pb in sealing glass exempted by RoHS directive.	91.0 g



	Model	Terminal Material	Terminal Plating	Complies With EU RoHS directive	Pb Free	Remarks (Contains Pb in products exempted by RoHS directive.)	Reference weight (Typ.)
Real Time Clock Module	RX-4045SA	42Alloy	Sn or Sn-Ag	○		High melting temperature type solder. (Pb85%)	290 mg
	RX-4045NB	Cu Alloy	Sn or Sn-Ag	○		High melting temperature type solder. (Pb85%)	84 mg
	RX-4581NB	Cu Alloy	Sn or Sn-Ag	○		High melting temperature type solder. (Pb85%)	84 mg
	RTC4701JE	42 Alloy	Sn-Ag	○		High melting temperature type solder. (Pb85%)	120 mg
	RTC-4701NB	Cu Alloy	Sn or Sn-Ag	○		High melting temperature type solder. (Pb85%)	83 mg
	RTC-4574SA	42Alloy	Sn or Sn-Ag	○		High melting temperature type solder. (Pb85%)	289 mg
	RTC-4574JE	42 Alloy	Sn-Ag	○		High melting temperature type solder. (Pb85%)	118 mg
	RTC-4574NB	Cu Alloy	Sn or Sn-Ag	○		High melting temperature type solder. (Pb85%)	83 mg
	RX-4574LC	42 Alloy	Sn or Sn-Ag	○		Contains Pb in sealing glass exempted by RoHS directive.	25 mg
	RA-4574SA	42Alloy	Sn-Ag	○		High melting temperature type solder. (Pb85%)	289 mg
	RTC-4543SA	42 Alloy	Sn-Ag	○		High melting temperature type solder. (Pb85%)	291 mg
	RTC-4543SB	42 Alloy	Sn-Ag	○		High melting temperature type solder. (Pb85%)	238 mg
	RX-4575LC	42 Alloy	Sn or Sn-Ag	○		Contains Pb in sealing glass exempted by RoHS directive.	25 mg
	RX-4571LC	42 Alloy	Sn or Sn-Ag	○		Contains Pb in sealing glass exempted by RoHS directive.	25 mg
	RX-4571NB	Cu Alloy	Sn or Sn-Ag	○		High melting temperature type solder. (Pb85%)	83 mg
	RX-4571SA	42Alloy	Sn or Sn-Ag	○		High melting temperature type solder. (Pb85%)	309 mg
	RA-4565SA	42Alloy	Sn-Ag	○		High melting temperature type solder. (Pb85%)	309 mg
	RX-4801SA	42Alloy	Sn	○		High melting temperature type solder. (Pb85%)	313 mg
	RX-4801JE	42 Alloy	Sn-Ag	○		High melting temperature type solder. (Pb85%)	118 mg
	RX-5412SF	Cu Alloy	Sn	○		High melting temperature type solder. (Pb85%)	241 mg
	RX-8025SA	42Alloy	Sn or Sn-Ag	○		High melting temperature type solder. (Pb85%)	292 mg
	RX-8025NB	Cu Alloy	Sn or Sn-Ag	○		High melting temperature type solder. (Pb85%)	84 mg
	RTC-8564JE	42 Alloy	Sn-Ag	○		High melting temperature type solder. (Pb85%)	119 mg
	RTC-8564NB	Cu Alloy	Sn or Sn-Ag	○		High melting temperature type solder. (Pb85%)	83 mg
	RX-8564LC	42 Alloy	Sn or Sn-Ag	○		Contains Pb in sealing glass exempted by RoHS directive.	25 mg
	RA-8565SA	42Alloy	Sn-Ag	○		High melting temperature type solder. (Pb85%)	309 mg
	RX-8571LC	42 Alloy	Sn	○		Contains Pb in sealing glass exempted by RoHS directive.	25 mg
	RX-8571NB	Cu Alloy	Sn	○		High melting temperature type solder. (Pb85%)	84 mg
	RX-8571SA	42Alloy	Sn	○		High melting temperature type solder. (Pb85%)	311 mg
	RX-8581SA	42Alloy	Sn or Sn-Ag	○		High melting temperature type solder. (Pb85%)	289 mg
	RX-8581JE	42 Alloy	Sn-Ag	○		High melting temperature type solder. (Pb85%)	111 mg
	RX-8581NB	Cu Alloy	Sn or Sn-Ag	○		High melting temperature type solder. (Pb85%)	84 mg
	RA-8581SA	42Alloy	Sn-Ag	○		High melting temperature type solder. (Pb85%)	289 mg
	RX-8731LC	42 Alloy	Sn or Sn-Ag	○		Contains Pb in sealing glass exempted by RoHS directive.	25 mg
	RX-8801SA	42Alloy	Sn	○		High melting temperature type solder. (Pb85%)	313 mg
	RX-8801JE	42 Alloy	Sn-Ag	○		High melting temperature type solder. (Pb85%)	118 mg
	RTC-7301SF	Cu Alloy	Sn or Sn-Ag	○		High melting temperature type solder. (Pb85%)	233 mg
	RTC-7301DG	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	1082 mg
	RTC-72423	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	661 mg
	RTC-72421	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	1090 mg
Crystal Filter (MCF)	HF-232A/233A	W	Au	○	○		16 mg
	HF-362A/363A	W	Au	○	○		25 mg
	HF-372A/373A	W	Au	○	○		42 mg
	HF-734	W	Au	○	○		129 mg
	MF-372A/373A	W	Au	○	○		42 mg
	MF-722A/723A	W	Au	○	○		150 mg
	MF-734A	W	Au	○	○		124 mg
SAW Filter	TF-330A/C	W	Au	○	○		33 mg
	FF-32N	W	Au	○	○		49 mg
	FF-555/FF-585	W	Au	○	○		112 mg
	TQS-570AA-7R	W	Au	○			33 mg
	TQS-566AA-7R	W	Au	○	○		33 mg
	TQS-557AA-7R	W	Au	○	○		34 mg
	TQS-949AD-7G	W	Au	○	○		18 mg
	TQS-471BB-7R	W	Au	○	○		30 mg
	TQS-477AA-7R	W	Au	○	○		35 mg
Sensor	TQS-472BA-7R	W	Au	○			170 mg
	XV-8000LK	42 Alloy	Sn-Ag	○	○		191 mg
	XV-3500CB	W	Au	○	○		65 mg
	XV-8000CB	W	Au	○	○		65 mg
	XV-8100CB	W	Au	○	○		65 mg
	HTS-206	Fe-Ni-Co	Sn-Pb	○		High melting temperature type solder. (Pb85%)	54 mg
	TSU-20G	Cu	Sn	○		Contains Pb in sealing glass exempted by RoHS directive.	200 g
	TSU-70G	Cu	Sn	○		Contains Pb in sealing glass exempted by RoHS directive.	200 g
	TSU-100G	Cu	Sn	○		Contains Pb in sealing glass exempted by RoHS directive.	200 g



HANDLING PRECAUTIONS

When using Epson Toyocom products, it is essential to observe the operating conditions specified in their respective specifications or catalogs.

Common points for all products

1. Shock resistance

Epson Toyocom's crystal products are designed to resist physical shocks, but crystal products may be damaged under some conditions, such as dropping from desks or receiving shocks during mounting. Please be sure to re-check the characteristics if product has received any shocks.

2. Soldering heat resistance

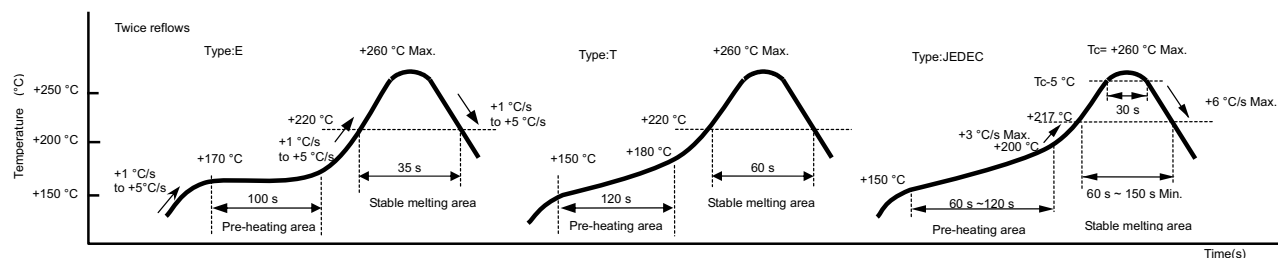
Epson Toyocom's crystal products except SMD products use solder having a +180°C to +200°C melting point. Heating up the package more than +150°C may deteriorate the characteristics or damage the products. If the crystal products need to be soldered at temperature of more than +150°C, SMD products are recommended. Using higher temperatures over the following reflow conditions to crystal products, even SMD products, may cause the characteristics to deteriorate. The reflow conditions within following profile is recommended. Always check the soldering temperature and time before mounting these products. Also, please check them again when the mounting conditions are changed. Please contact us for inquiries about heat-resistance if crystal products need to be soldered over the following profile.

(1) Cylinder products and DIP products

Model	Soldering conditions
[Cylinder] C-TYPE, C-2-TYPE, C-4-TYPE, HTS-206	+280 °C or under @ Max. 5 s. Do not heat the package at more than +150 °C.
[Cylinder] CA-301 [DIP] SG-51 / 531, SG-8002DB / DC, RTC-72421 / 7301DG	+260 °C or under @ Max. 10 s. Do not heat the package at more than +150 °C.
[DIP] TCO-6831 / TCO-676 / TCO-679 TCO-6920A	Temperature in point of soldering iron +370 °C or under @ Max. 5 s. (Each terminal) Do not heat the package at more than +150 °C.

(2) SMD products Reflow profile (example)

The availability of the heat resistance for reflow conditions of JEDEC-STD-020D is judged individually. Please inquire it.



Please make temperature rate as gentle a curve as possible. Also, if the package is cellular, the possibility of cracking is inevitable, so please store it for a short duration and take measures to protect product from dampness when you store it in high humidity.

	Model	Type:E	Type:T	Type:JEDEC	Remarks
kHz Range Crystal unit	FC-12M	○	—	Please contact us	
	FC-13E	○	—	—	
	FC-13F	○	—	Please contact us	
	FC-135	○	—	Please contact us	
	FC-145	○	—	Please contact us	
	FC-255	○	—	Please contact us	
	MC-146	○	—	Please contact us	
	MC-156	○	—	Please contact us	
	MC-306	○	—	○	
	MC-30A	○	—	○	
	MC-405/406	○	—	○	
MHz Range Crystal unit	FA-118T	○	○	○	
	FA-128	○	○	○	
	FA-20H	○	○	○	
	FA-238V	○	—	○	
	FA-238	○	—	○	
	TSX-3225	—	○	○	
	TSX-4025	—	○	○	
	TSX-5032	—	○	○	
	FA-365	○	—	○	
	MA-306	○	—	Please contact us	
	MA-406	○	—	○	Tc=+250 °C
	MA-505/506	○	—	○	Tc=+250 °C
	FH-33H	—	○	○	
	NS-21R	—	—	○	
	NS-32R	○	—	○	
SAW Resonator	FS-335	○	—	○	
	FS-555/585	○	—	Please contact us	



	Model	Type:E	Type:T	Type:JEDEC	Remarks
SPXO	SG-3030 series	○	—	Please contact us	
	SG-3040 series	○	—	Please contact us	
	SG-150S*E	—	—	○	
	SG-211S*E	—	—	○	
	SG-210 series	○	—	○	
	SG-310 series	○	—	○	
	SG-550 series	○	—	○	
	TCO-710x series	—	○	○	
	SG-770 series	—	—	○	
	TCO-708x series	—	○	○	
	SG-645 series	○	—	—	
	SG-636 series	○	—	Please contact us	Tc=+250 °C
	SG-615 series	○	—	○	Tc=+245 °C
Programmable	SG-8003BA	—	—	○	
	SG-8003CE	—	—	○	
	SG-8003LB	—	—	○	
	SG-8003CA	—	—	○	
	SG-8003JF	—	—	○	
	SG-8002CE	○	—	○	
	SG-8002LB	○	—	○	
	SG-8002JF	○	—	—	
	SG-8002CA	○	—	○	
	SG-8002JC	○	—	Please contact us	Tc=+250 °C
	SG-8002JA	○	—	○	Tc=+245 °C
Spread Spectrum	SG-9001LB	○	—	○	
	SG-9001CA	○	—	○	
	SG-9001JC	○	—	Please contact us	Tc=+250 °C
SAW	XG-1000CA	○	—	○	
	XG-1000CB	○	—	○	
	EG-2021CA series	○	—	○	
	EG-2001CA series	○	—	○	
	EG-2002CA series	○	—	○	
	EG-2121CA series	○	—	○	
	EG-2102CA series	○	—	○	
	EG-2101CA series	○	—	○	
High-Stability	HG-2150CA series	○	—	○	
	HG-8002JA series	○	—	○	Tc=+245 °C
VCXO	VG-4231CE	○	—	○	
	VG-4231CB	—	—	○	
	VG-4531CB	—	—	○	
	VG-4231CA	○	—	○	
	VG-4501CA	—	—	○	
	VG-4502CA	—	—	○	
	VG-4511CA	—	—	○	
	VG-1201CA	○	—	○	
	TCO-2152	—	○	○	
	TCO-2000 series	—	○	○	Tc=+245 °C
TCXO	TCO-2100 series	—	○	○	Tc=+245 °C
	TG-3530SA	○	—	Please contact us	Tc=+250 °C
	TG-5021BA	○	○	Please contact us	
	TG-5021CG	—	○	Please contact us	
	TG-5025CG	—	○	Please contact us	
	TG-5005CE	—	○	Please contact us	
	TG-5010LH	○	—	Please contact us	
	TCO-5860 series	—	○	Please contact us	
OCXO	TCO-5060/5160 series	—	○	Please contact us	
	OX-6501GG series	—	—	○	Tc=+245 °C
Sensor	XV-8000LK	○	—	○	Tc=+250 °C
	XV-3500CB	○	—	○	
	XV-8000CB	○	—	○	
	XV-8100CB	○	—	○	



	Model	Type:E	Type:T	Type:JEDEC	Remarks
Real Time Clock Module	RX-4045SA	○	—	Please contact us	Tc=+250 °C
	RX-4045NB	○	—	Please contact us	
	RX-4581NB	○	—	Please contact us	
	RTC-4701JE	○	—	Please contact us	
	RTC-4574SA	○	—	Please contact us	Tc=+250 °C
	RTC-4574JE	○	—	Please contact us	
	RTC-4574NB	○	—	Please contact us	
	RX-4574LC	○	—	Please contact us	
	RA-4574SA	○	—	Please contact us	Tc=+250 °C
	RTC-4543SA	○	—	Please contact us	Tc=+250 °C
	RTC-4543SB	○	—	Please contact us	
	RX-4575LC	○	—	○	
	RX-4571LC	○	—	○	
	RX-4571NB	○	—	○	
	RX-4571SA	○	—	○	Tc=+250 °C
	RX-5412SF	○	—	○	
	RA-4565SA	○	—	○	Tc=+250 °C
	RX-4801SA	○	—	○	Tc=+250 °C
	RX-4801JE	○	—	Please contact us	
	RX-5412SF	○	—	○	
	RX-8025SA	○	—	Please contact us	Tc=+250 °C
	RX-8025NB	○	—	Please contact us	
	RTC-8564JE	○	—	Please contact us	
	RTC-8564NB	○	—	Please contact us	
	RX-8564LC	○	—	Please contact us	
	RA-8565SA	○	—	○	Tc=+250 °C
	RX-8571LC	○	—	○	
	RX-8571NB	○	—	○	
	RX-8571SA	○	—	○	Tc=+250 °C
	RX-8581SA	○	—	Please contact us	Tc=+250 °C
	RX-8581JE	○	—	Please contact us	
	RA-8581SA	○	—	Please contact us	Tc=+250 °C
	RX-8731LC	○	—	○	
	RX-8801SA	○	—	○	Tc=+250 °C
	RX-8801JE	○	—	Please contact us	
	RTC-7301SF	○	—	Please contact us	
	RTC-72423	○	—	Please contact us	Tc=+245 °C
Filter	HF-232A/233A	—	○	○	
	HF-362A/363A	—	○	○	
	HF-372A/373A	—	○	○	
	HF-734	—	○	○	
	MF-372A/373A	—	○	○	
	MF-722A/723A	—	○	○	
	MF-734A	—	○	○	
	TF-330A/C	—	—	○	
	FF-32N	○	—	Please contact us	
	FF-555/FF-585	○	—	Please contact us	
	TQS-557AA-7R	—	○	○	
	TQS-949AD-7G	—	○	○	
	TQS-471BB-7R	—	○	○	
	TQS-477AA-7R	—	○	○	
	TQS-472BA-7R	—	○	○	

3. Mounting precautions

Shocks by auto mounting

Shocks caused by auto mounting and vacuuming may deteriorate the characteristics and affect the products. Please set the mounting conditions to minimize the shocks as much as possible, and be sure that there is no affect on the characteristics before mounting. Please review the conditions after the conditions are changed. Also please be sure that crystal products don't hit machines or other electric boards, etc. before or after mounting.

(1) a) Ceramic package products and SON products

Bending the board after soldering ceramic package products and SON products (MC-146,RTC-****NB,RX-****NB) may cause peeling off portions of soldering or package cracks by mechanical stress. Particularly, in the case of cutting boards after soldering these products, please be sure to layout the crystal on a less stressed location and use less stressed cutting method.

b) Ceramic package products

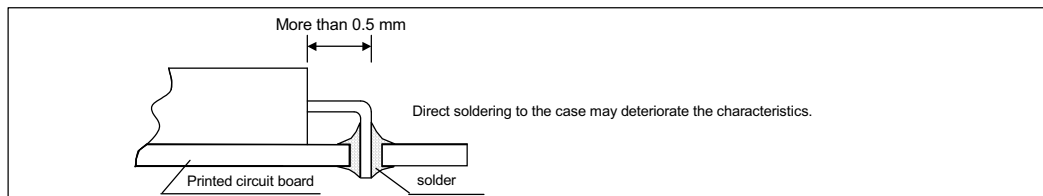
In the case of soldering ceramic package products on a different expansion-coefficient board (ex. Epoxy Glass),soldering crack at the foot pattern would be expected under repeated temperature changes for a long period. Under these conditions, be sure to check the solderability in advance.



(2) Cylinder products

Bending the lead on the glass or pulling the lead strongly may cause cracking of the hermetic seal glass at the root of the lead and may cause the airtightness and the characteristics to deteriorate. When the lead of crystal products need to be bent as in the figure below, leave more than 0.5 mm of lead from the case and hold the lead to prevent the lead from cracks. When the lead needs to be repaired, do not pull it, and hold the bent part to correct it. Giving undue pressure on this portion of hermetic seal may cause the airtightness to deteriorate. Please avoid applying pressure. Gluing the case of products on the electric board is recommended to prevent the airtightness from deteriorating.

● Installation example



(3) DIP products

Deformed leads cannot be inserted into board holes. Avoid applying stress sufficient to deform leads.

(4) SOJ Products and SOP products

Please avoid applying stress sufficient to deform the leads.

Deformed leads may cause incorrect soldering.

Particularly SOP products need to be handled with the greatest care.

4. Ultrasonic cleaning

- Products using AT-cut crystal and SAW resonator/filter can be cleaned by ultrasonic methods. But under some conditions, the crystal characteristics may be affected and internal wiring may be damaged. Please be sure to check the suitability of your system in advance.
- Products using tuning-fork crystals and gyro sensors cannot be guaranteed if cleaned using ultrasonic methods, because crystal may be destroyed.
- Do not wash open-type products.
- With washable products, avoid the use of cleaners or solvents that may negatively affect the product.

5. The affect of mechanical vibration

While there is any given shock or mechanical vibration periodically to crystal products, such as, a piezo sounder, a piezo buzzer, and speaker, to crystal products, output frequency and amplitude can be changed. Especially the quality of telecommunication equipment could be affected by this phenomenon. Although Epson Toyocom's crystal products are designed to minimize the effect of mechanical vibration, Epson Toyocom recommends to check them in advance and then follow the Mounting guidelines as below.

● Mounting guidelines

- (1) Ideally, the mechanical buzzer source should be mounted on a separate PCB from the crystal device.
- (2) It is advisable to use cushion or cutting PCB, if you mount on same PCB.
- (3) Traveling mechanical vibration differs when applied to the PCB only vs. inside the body. Last of all, it is advisable to conform to inside body characteristics.

6. Storage

- (1) Storing the crystal products under higher or lower temperature or high humidity for a long period may affect frequency stability or solder ability. Please store the crystal products at the normal temperature and humidity, avoid storing them for a long period and mount them as soon as possible after unpacking.

Normal temperature and humidity:

Temp, +15 °C to +35 °C, humidity 25 % RH to 85 % RH (refer to the standard conditions of test site JIS Z-8703)

- (2) Please carefully handle the inner and outer boxes and reel. External pressure may cause deformation of reel and tape.

7. Radiation

Exposure to radiation can cause deterioration in performance, so avoid irradiation.

8. Chemicals / pH

Do not use or store the product in a pH range that may cause corrosion or dissolution of the materials or packaging.

9. Adhesive

Do not use an adhesive that may cause corrosion of the packing materials, terminals, components, glass materials, and vapor deposited materials used in the products.

(For example, a chlorine-based adhesive may corrode the metal parts "lid" of a crystal unit to diminish the hermetic qualities, lowering the performance.)

10. Halogen Compound

Do not use products in halogen gas. Even a slight amount of halogen gas, such as that found in chlorine gas in the air or in metal parts used in the package, may corrode. Also, do not use any resin that emits halogen gas.



■Crystal unit / Resonator

1. Drive level

Applying excessive drive level to the crystal units may cause deterioration of characteristics or damage. Circuit design must be such as to maintain a proper drive level.(refer to page “Drive level”)

2. Negative resistance

Unless adequate negative resistance is allocated in the oscillation circuit, oscillation or oscillation start up time may increase (refer to page “Allowance for Oscillation”).)

3. Load capacitance

Differences in the load capacitance in the oscillation circuit may result in deviations in the oscillation frequency from the desired frequency. Attempting to tune by force may merely cause abnormal oscillation. Before use, please specify the load capacitance of the oscillation circuit.(refer to page “Load capacitance”)

■Crystal Oscillator and real time clock module

All crystal oscillators and real time clock modules are provided with a CMOS IC. Please pay attention to the following points.

1. Static electricity

Although an anti-static-electricity protection circuit is provided in the circuit, excessive levels of static electricity may damage the IC. Choose conductive materials for containers and packing material. Use a soldering gun and a measuring circuit free from high-voltage leakage and provide grounding connection when working with them.

2. Noise

Applying excessive level of extraneous noise to power source or input terminal may cause latch up or spurious phenomenon, which results in malfunction and breakdown.

To maintain stable operation, provide by-pass capacitor with more than 0.1 μF at a location as near as possible to the power source terminal of the crystal products (between Vcc - GND). Do not permit any objects which emit a high level of noise in a location near the crystal oscillator.

3. Power supply line

Line impedance of a power supply should be as low as possible.

4. Output Load

It is recommended that output load is installed as close as possible to an oscillator (within 20 mm).

5. Treatment of unused input terminals

Unused pins that are left open may collect noise, thereby resulting in malfunction. Also, power consumption may increase when both P-channel and N-channel are turned on, therefore connect unused input terminals to Vcc or GND.

6. Heat impact

Repeated large changes in temperature may degrade the characteristics of a deteriorated crystal unit and cause breakage of wires inside the plastic mold. This must be avoided.

7. Mounting direction

Incorrect mounting of the oscillator may cause malfunction and breakdown, so please check the mounting direction when installing.

8. Power on

It is not recommended to power on from intermediate electric potential and / or extreme fast power on. Powering on under such conditions may cause no oscillation and / or malfunction.

■Optical device

1. Chemicals

Do not use chemicals that may negatively affect the glass materials, vapor deposited materials, or adhesives used in the product.



PRECAUTIONS IN DESIGNING OSCILLATION CIRCUITS

1. Drive level

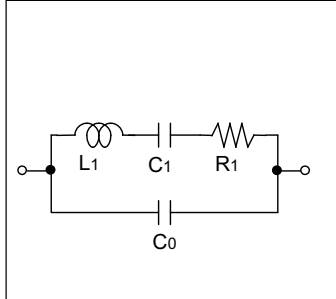
Drive level denotes electric power required to oscillate a crystal unit, which can be calculated using the following formula.

$$\text{Drive level (P)} = i^2 \cdot R_e$$

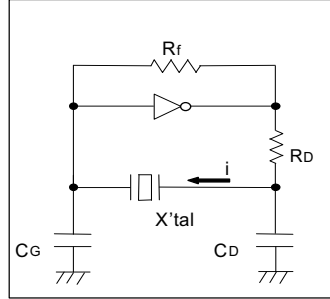
Where i stands for current to pass in the crystal unit, R_e for effective resistance of crystal unit, and $R_e = R_1(1 + C_0/C_L)^2$.

If the Drive level (P) exceeds the specified level, oscillation frequency will shift. This occurs because an excessive level of power causes stress for the crystal and, consequently, temperature rises. If excessive drive level of power is applied to the crystal unit, this may deteriorate or damage the characteristics.

Equivalent circuit of crystal unit



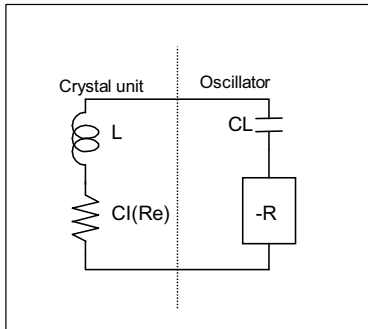
Oscillation circuit



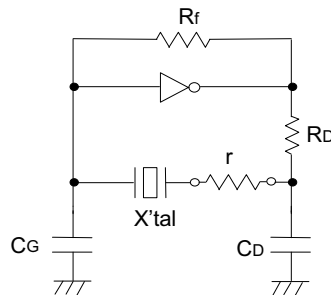
2. Allowance for oscillation

Unless adequate negative resistance is allocated in the oscillation circuit, oscillation start-up time may be increased, or No oscillation may occur. In order to avoid this, provide enough negative resistance in the circuitry design.

● Crystal unit and Oscillator



● Check of Negative resistance



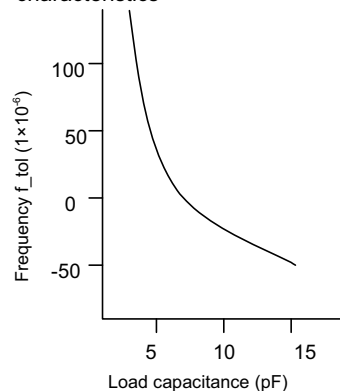
1. Connect the resistance (r) to the circuit in series with the crystal unit.
2. Adjust (r) so that oscillation can start (or stop).
3. Measure (r) when oscillation just starts (or stops) in (2) above.
4. Recommended (r)
(r) > CL × (5 to 10)

3. Load capacitance

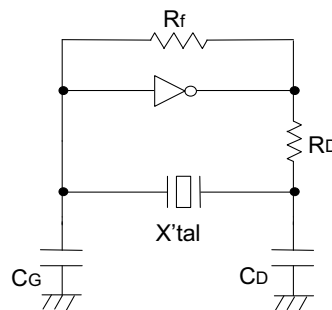
Differences in the load capacitance of the oscillation circuit may result in a different oscillation frequency from the desired one, as shown in the figure below. Approximate expression of the load capacitance of the circuit $CL \approx CG \times CD / (CG + CD) + CS$.

Where CS stands for stray Capacity of the circuit.

● Frequency and load capacitance characteristics



● Reference for setting parameters of oscillation circuit



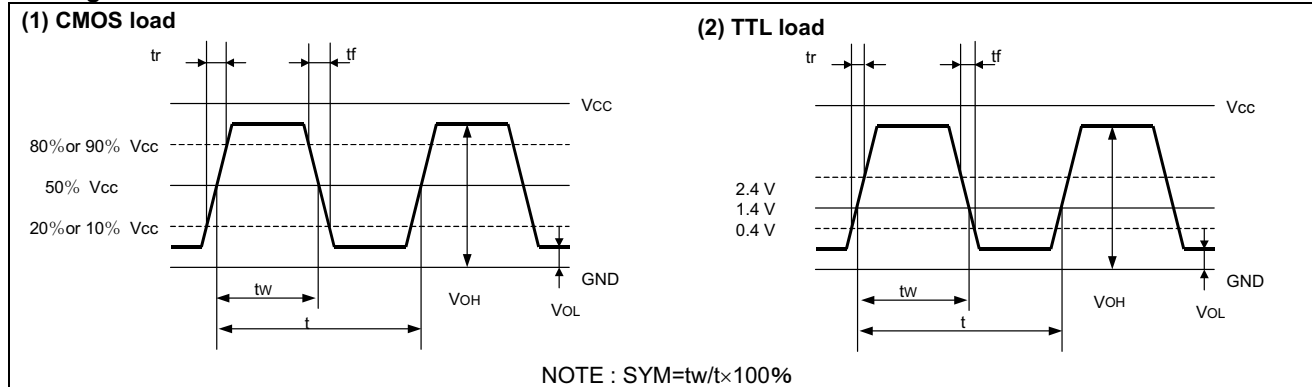
Symbol	Rf (MΩ)	Rd (kΩ)	CG (pF)	CD (pF)
Frequency range				
20 kHz to 60 kHz	20	500	10	10
60 kHz to 165 kHz	10	300	10	10
5.5 MHz to 30 MHz (Fundamental)	1	0.5	5~15	5~15
30 MHz~50 MHz (Fundamental)			5~10	5~10

IC: equivalent to TC74HCU04 (Unbuffer)
 IC: equivalent to TC74VHC04 (Unbuffer) (30 MHz to 50 MHz)
 (TC74HCU04 and TC74VHC04 are product number of Toshiba Corp.)



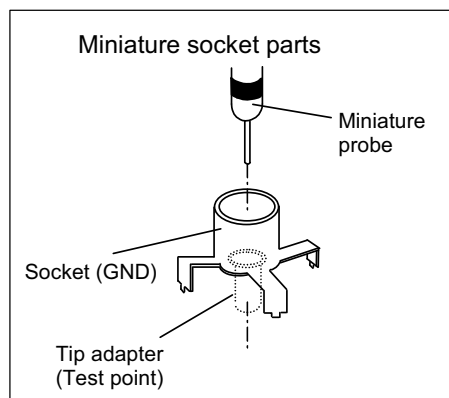
OUTPUT WAVEFORM AND TEST CIRCUIT

1. Timing chart

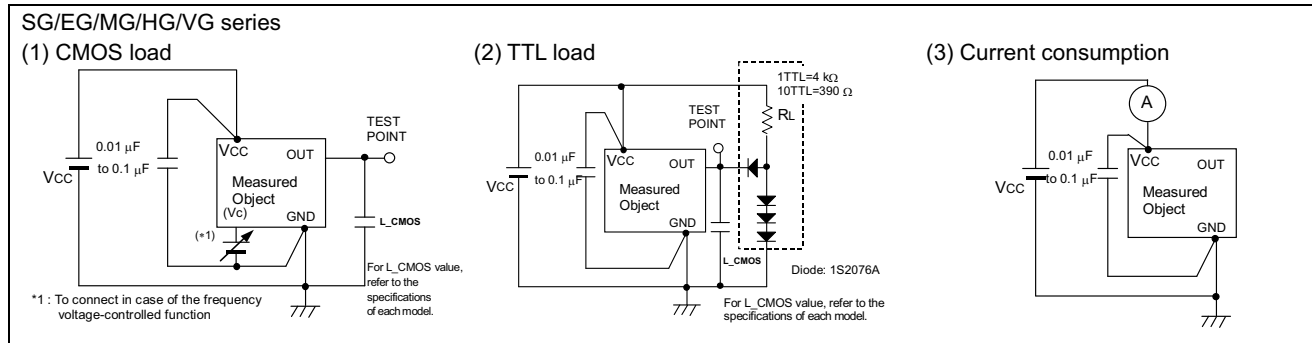


2. Test conditions

- (1) Supply voltage
 - More than 150 μ s until voltage level reaches 90 % from 0 %.
 - Supply voltage impedance is less than 2 Ω of resistance.
- (2) Oscilloscope
 - Input capacitance of less than 15 pF
 - Frequency range of 5 times or more of measurements frequency.
 - Earth lead of the probe should be as short as possible.
 - Probe impedance when measuring frequency is to be more than 1 M Ω . Simultaneous measurement is possible as the wave form passes from the amplifier stage of an oscilloscope.
- (3) MISCELLANEOUS
 - CL includes the probe capacitance.
 - Ammeter with small internal impedance should be used.
 - To observe wave form, please use a miniature socket. (do not use a long ground wire of the probe.)



3. Test circuit

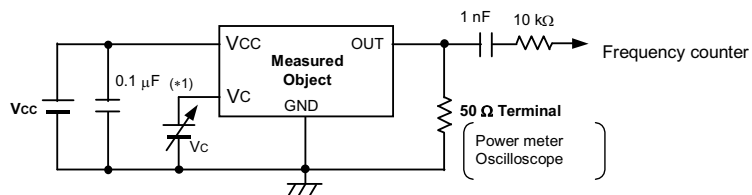


TCO-***series

*1 : To connect in case of the frequency voltage-controlled function

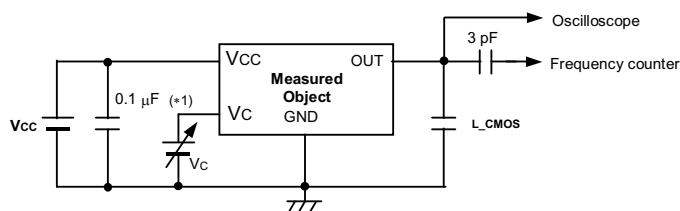
(1) 50 Ω load

Model:
TCO-6920A
TCO-291J



(2) CMOS load-1

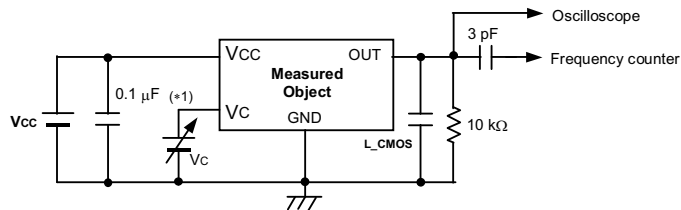
Model:
TCO-2004 VG-4501CA
TCO-2104 VG-4502CA
TCO-710x series
TCO-5060/5160 series
TCO-708*X1A series





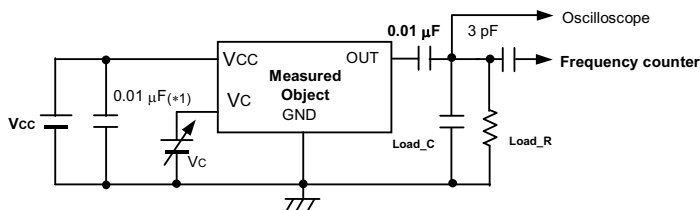
(3) CMOS load-2

Model:
TCO-676
TCO-679



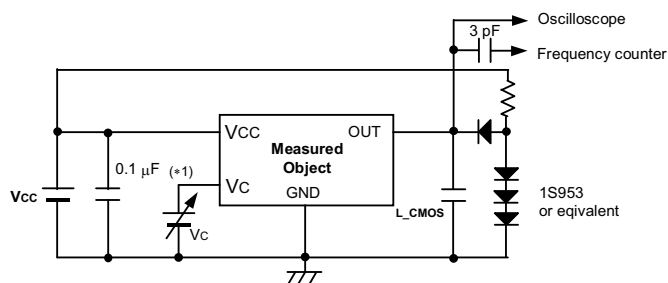
(4) Resistance, Capacity load

Model:
TCO-5860 series
TG-5021CG
TG-5025CG
TG-5010LH
TG-5005CE
TG-5021BA



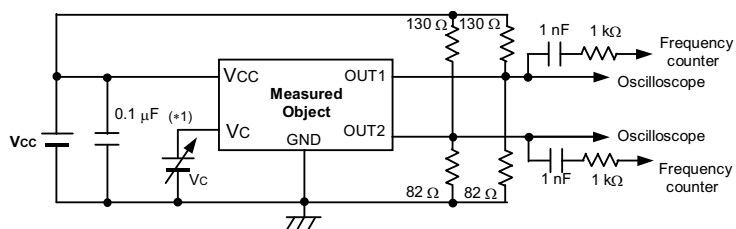
(5) TTL load

Model:
TCO-2002
TCO-2102
TCO-6730
TCO-708*A1A series



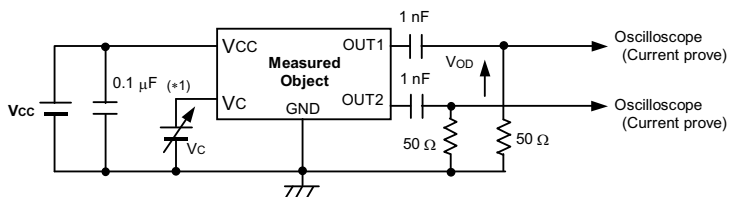
(6) LV-PECL load

Model:
TCO-2111
TCO-2131



(7) LVDS load

Model:
TCO-2114

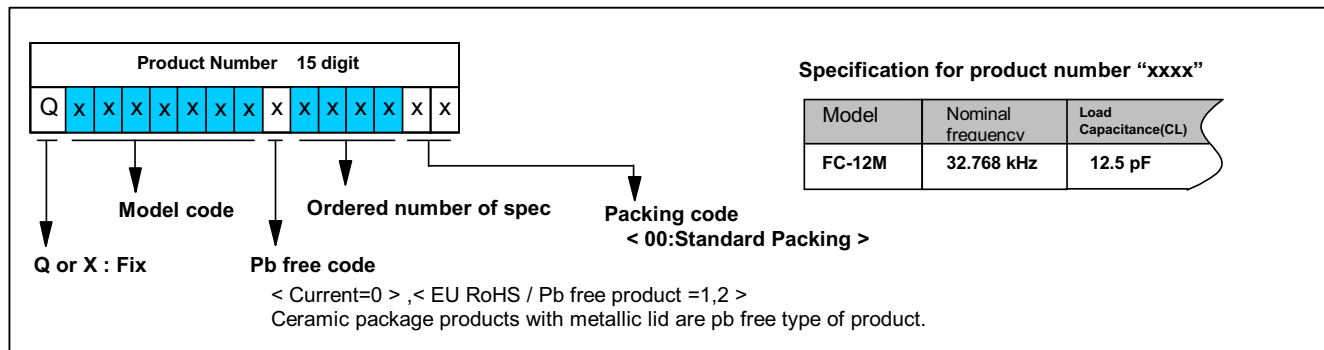




COMPARISON TABLE FOR MODEL AND PRODUCT NUMBER

The Product Number expresses the specification of the product with the codes of 15 columns.

As for the order, please use the Product Number.



When ordering, please specify Product Number. Please confirm your specifications and consult our standard packing specifications before contacting us for Product Number specifications and standard packing specifications.

See below for examples of our standard frequency specifications.

CRYSTAL UNIT

kHz range Crystal Units

Product number	Model	Nominal frequency	Load capacitance (CL)	Frequency tolerance ($\times 10^{-6}$)	Standard packing
X1A00006 1 0001 00	FC-12M	32.768 kHz	12.5 pF	± 30	3000 pcs / Reel "L"
Q13FC13F 0 0001 00	FC-13F	32.768 kHz	12.5 pF	± 30	3000 pcs / Reel "L"
Q13FC135 0 0004 00	FC-135	32.768 kHz	12.5 pF	± 20	3000 pcs / Reel "L"
Q13FC145 0 0006 00	FC-145	32.768 kHz	12.5 pF	± 20	3000 pcs / Reel "L"
Q13FC255 0 0004 00	FC-255	32.768 kHz	12.5 pF	± 20	3000 pcs / Reel "L"
Q13MC146 1 0002 00	MC-146	32.768 kHz	12.5 pF	± 20	3000 pcs / Reel "L"
Q13MC156 1 0004 00	MC-156	32.768 kHz	12.5 pF	± 20	3000 pcs / Reel "L"
Q13MC306 1 0003 00	MC-306	32.768 kHz	12.5 pF	± 20	3000 pcs / Reel "L"
Q13MC405 1 0002 00	MC-405	32.768 kHz	12.5 pF	± 20	1000 pcs / Reel "L"
Q13MC406 1 0001 00	MC-406	32.768 kHz	12.5 pF	± 20	1000 pcs / Reel "L"
Q11C001R 1 0021 00	C-001R	32.768 kHz	12.5 pF	± 20	250 pcs / Vinyl bags
Q11C02RX 1 0022 00	C-002RX	32.768 kHz	12.5 pF	± 20	500 pcs / Vinyl bags
Q11C004R 1 0020 00	C-004R	32.768 kHz	8.7 pF	± 20	500 pcs / Vinyl bags
Q11C005R 1 0023 00	C-005R	32.768 kHz	8.2 pF	± 20	500 pcs / Vinyl bags
Q12C2000 1 0254 00	C-2-TYPE	40.000 kHz	12.5 pF	± 50	500 pcs / Vinyl bags
Q12C4000 1 0010 00	C-4-TYPE	40.000 kHz	12.5 pF	± 50	500 pcs / Vinyl bags

MHz range Crystal units

Product Number	Model	Nominal Frequency	Load capacitance (CL)	Frequency tolerance ($\times 10^{-6}$)	Frequency temperature characteristics ($\times 10^{-6}$)	Overtone order	Standard packing
Q22FA128 0 0022 00	FA-128	24.000 MHz	10.0 pF	± 10	$\pm 10 / -20 ^\circ\text{C to } +75 ^\circ\text{C}$	Fundamental	3000 pcs / Reel "L"
Q24FA20H 0 0037 00	FA-20H	40.000 MHz	12.0 pF	± 10	$\pm 15 / -20 ^\circ\text{C to } +75 ^\circ\text{C}$	Fundamental	3000 pcs / Reel "L"
Q22FA23V 0 0019 00	FA-238V	12.000 MHz	10.0 pF	± 50	$\pm 30 / -20 ^\circ\text{C to } +70 ^\circ\text{C}$	Fundamental	3000 pcs / Reel "L"
Q22FA238 0 0264 00	FA-238	20.000 MHz	10.0 pF	± 50	$\pm 30 / -20 ^\circ\text{C to } +70 ^\circ\text{C}$	Fundamental	3000 pcs / Reel "L"
X1E00002 1 0172 00	TSX-3225	40.000 MHz	9.0 pF	± 10	$\pm 10 / -20 ^\circ\text{C to } +75 ^\circ\text{C}$	Fundamental	2000 pcs / Reel "L"
X1E00006 1 0045 00	TSX-5032	10.000 MHz	18.0 pF	± 10	$\pm 10 / -20 ^\circ\text{C to } +75 ^\circ\text{C}$	Fundamental	2000 pcs / Reel "L"
Q22FA365 0 0065 00	FA-365	20.000 MHz	10.0 pF	± 50	$\pm 30 / -20 ^\circ\text{C to } +70 ^\circ\text{C}$	Fundamental	1000 pcs / Reel "L"
Q22MA306 1 0022 00	MA-306	20.000 MHz	10.0 pF	± 50	$\pm 30 / -20 ^\circ\text{C to } +70 ^\circ\text{C}$	Fundamental	3000 pcs / Reel "L"
Q22MA406 1 0563 00	MA-406	20.000 MHz	10.0 pF	± 50	$\pm 30 / -20 ^\circ\text{C to } +70 ^\circ\text{C}$	Fundamental	1000 pcs / Reel "L"
Q22MA505 1 0208 00	MA-505	20.000 MHz	16.0 pF	± 50	$\pm 30 / -20 ^\circ\text{C to } +70 ^\circ\text{C}$	Fundamental	1000 pcs / Reel "L"
Q22MA506 1 0426 00	MA-506	20.000 MHz	16.0 pF	± 50	$\pm 30 / -20 ^\circ\text{C to } +70 ^\circ\text{C}$	Fundamental	1000 pcs / Reel "L"
Q21CA301 1 0529 00	CA-301	20.000 MHz	16.0 pF	± 30	$\pm 30 / -20 ^\circ\text{C to } +70 ^\circ\text{C}$	Fundamental	500 pcs / Vinyl bags

SAW Resonator

Product Number	Model	Nominal frequency	Frequency tolerance ($\times 10^{-6}$)	Operating temperature range	Standard packing
Q25NS32R 0 0001 00	NS-32R	314.890 MHz	± 50	$-40 ^\circ\text{C to } +85 ^\circ\text{C}$	4000 pcs / Reel "R"
Q25FS335 0 0052 00	FS-335	315.000 MHz	± 100	$-40 ^\circ\text{C to } +85 ^\circ\text{C}$	4000 pcs / Reel "R"
Q25FS555 0 0016 00	FS-555	315.000 MHz	± 100	$-40 ^\circ\text{C to } +85 ^\circ\text{C}$	4000 pcs / Reel "R"
Q25FS585 0 0015 00	FS-585	434.000 MHz	± 50	$-40 ^\circ\text{C to } +120 ^\circ\text{C}$	4000 pcs / Reel "R"



■ CRYSTAL OSCILLATOR

● SPXO (32.768 kHz)

Product Number	Model	Output frequency	Frequency tolerance ($\times 10^{-6}$)	Frequency temperature characteristics	Standard packing
Q 3102LC0 2 0001 00	SG-3030LC	32.768 kHz	5 $\pm$ 23	+5 to -20 / -20 °C to +70 °C	1000 pcs / Reel "L"
Q 3102JF0 2 0001 00	SG-3030JF	32.768 kHz	5 $\pm$ 23	+5 to -20 / -20 °C to +70 °C	1000 pcs / Reel "L"
Q 3102JC0 2 0001 00	SG-3030JC	32.768 kHz	5 $\pm$ 23	+5 to -20 / -20 °C to +70 °C	1000 pcs / Reel "L"
Q 3103LC0 1 0001 00	SG-3040LC	32.768 kHz	5 $\pm$ 23	+5 to -20 / -20 °C to +70 °C	1000 pcs / Reel "L"
Q 3103JC0 1 0001 00	SG-3040JC	32.768 kHz	5 $\pm$ 23	+5 to -20 / -20 °C to +70 °C	1000 pcs / Reel "L"

● SPXO

Product Number	Model	Output frequency	Function	Operating Voltage	Frequency tolerance / Operating temperature range ($\times 10^{-6}$)	Standard packing
Q 33550FE 1 0008 00	SG-550SEF	20.000 MHz	S:Standby	1.8 V	B: $\pm$ 50 / -20 °C to +70 °C	1000 pcs / Reel "L"
Q 33645W7 1 0043 00	SG-645SCW	40.000 MHz	S:Standby	C:3.3 V	M: $\pm$ 100 / -40 °C to +85 °C	1000 pcs / Reel "L"
Q 33636E4 1 0009 00	SG-636PCE	20.000 MHz	P: OE	C:3.3 V	C: $\pm$ 100 / -20 °C to +70 °C	1000 pcs / Reel "L"
Q 3361501 1 0772 00	SG-615P	20.000 MHz	P:OE	5.0 V	C: $\pm$ 100 / -20 °C to +70 °C	1000 pcs / Reel "L"
Q 3253101 1 0355 00	SG-531P	20.000 MHz	P:OE	5.0 V	C: $\pm$ 100 / -20 °C to +70 °C	35 pcs / Tube
Q 3251001 1 0002 00	SG-51P	20.000 MHz	P:OE	5.0 V	C: $\pm$ 100 / -20 °C to +70 °C	25 pcs / Tube
Q 33211C7 0 0009 00	SG-211SCC	25.000 MHz	Standby	3.3 V	H: $\pm$ 20 / -40 °C to +85 °C	3000 pcs / Reel "L"
Q 33210B6 0 0004 00	SG-210SGB	24.000 MHz	Standby	1.5 V	C: $\pm$ 100 / -20 °C to +70 °C	3000 pcs / Reel "L"
Q 33310F7 0 0017 00	SG-310SCF	20.000 MHz	S:Standby	3.3 V	C: $\pm$ 100 / -20 °C to +70 °C	2000 pcs / Reel "L"
X 1G00036 1 0008 00	TCO-7106X1A4	25.000 MHz	Standby	3.3 V	$\pm$ 50 / -40 °C to +85 °C	1000 pcs / Reel "L"
X 1G00037 1 0003 00	TCO-7107X1A4	25.000 MHz	Standby	3.3 V	$\pm$ 100 / -40 °C to +85 °C	1000 pcs / Reel "L"
X 1G00235 1 0028 00	SG-770SCD	106.250 MHz	Standby	3.3 V	L: $\pm$ 50 / -40 °C to +85 °C	1000 pcs / Reel "L"
X 1G00021 1 0031 00	TCO-7085X1A1	25.000 MHz	Standby	3.3 V	$\pm$ 25 / -10 °C to +70 °C	1000 pcs / Reel "L"
X 1G00022 1 0065 00	TCO-7086X1A4	25.000 MHz	Standby	3.3 V	$\pm$ 50 / -40 °C to +85 °C	1000 pcs / Reel "L"
X 1G00023 1 0013 00	TCO-7087D1A1	25.000 MHz	Standby	5.0 V	$\pm$ 100 / -10 °C to +70 °C	1000 pcs / Reel "L"

● Programmable

Product Number	Model	Output frequency	Function	Operating Voltage	Frequency tolerance / Operating temperature range ($\times 10^{-6}$)	Standard packing
Q 33519E7 0 0026 00	SG-8003CE SC	20.000 MHz	S:Standby	C:3.3 V	C: $\pm$ 100 / -20 °C to +70 °C	2000 pcs / Reel "L"
Q 3321CE7 0 0041 00	SG-8002CE SC	20.000 MHz	S:Standby	C:3.3 V	C: $\pm$ 100 / -20 °C to +70 °C	2000 pcs / Reel "L"
Q 3323LB2 1 0004 00	SG-8002LB PH	20.000 MHz	P:OE	H:5.0 V	C: $\pm$ 100 / -20 °C to +70 °C	1000 pcs / Reel "L"
Q 3308JF7 1 0047 00	SG-8002JF SC	20.000 MHz	S:Standby	C:3.3 V	C: $\pm$ 100 / -20 °C to +70 °C	1000 pcs / Reel "L"
Q 3309CA7 0 0062 00	SG-8002CA SC	20.000 MHz	S:Standby	C:3.3 V	C: $\pm$ 100 / -20 °C to +70 °C	1000 pcs / Reel "L"
Q 3307JC7 1 0003 00	SG-8002JC SC	20.000 MHz	S:Standby	C:3.3 V	C: $\pm$ 100 / -20 °C to +70 °C	1000 pcs / Reel "L"
Q 3306JA7 1 0103 00	SG-8002JA SC	20.000 MHz	S:Standby	C:3.3 V	C: $\pm$ 100 / -20 °C to +70 °C	1000 pcs / Reel "L"
Q 3204DC7 1 0003 00	SG-8002DC SC	20.000 MHz	S:Standby	C:3.3 V	C: $\pm$ 100 / -20 °C to +70 °C	35 pcs / Tube
Q 3203DB7 1 0001 00	SG-8002DB SC	20.000 MHz	S:Standby	C:3.3 V	C: $\pm$ 100 / -20 °C to +70 °C	25 pcs / Tube

● Spread spectrum

Product Number	Model	Output frequency	Modulation type	Spread percentage	Function	Standard packing	Suffix
Q 3331521 1 0007 00	SG-9001LB	100.000 MHz	C:Centre	10: $\pm$ 1.0 %	P:OE	2000 pcs / Reel "L"	C10P
Q 3331701 0 0016 00	SG-9001CA	100.000 MHz	C:Centre	15: $\pm$ 1.5 %	P:OE	1000 pcs / Reel "L"	C15P
Q 3331E11 1 0007 00	SG-9001JC	100.000 MHz	D:Down	20: -2.0 %	P:OE	1000 pcs / Reel "L"	D20P

● Low-jitter SAW

Product Number	Model	Output frequency	Output condition Symmetry	Operating voltage	Frequency tolerance ($\times 10^{-6}$)	Standard packing	Suffix
Q 3851CA0 0 0027 00	XG-1000CA	125 MHz	CMOS	D:2.5 V	B: $\pm$ 50 / -10 °C to +70 °C	-	1000 pcs / Reel "L" DB
Q 3851CB0 0 0028 00	XG-1000CB	125 MHz	CMOS	E:1.8 V	B: $\pm$ 50 / -10 °C to +70 °C	-	2000 pcs / Reel "L" EB
Q 3807CA0 0 0001 00	EG-2021CA	125 MHz	C:CMOS SYM $\pm$ 5 %	2.5 V	GP: $\pm$ 50 / 0 °C to +70 °C	N	1000 pcs / Reel "L" CGPN
Q 3801CA0 0 0002 00	EG-2001CA	125 MHz	P:CMOS SYM $\pm$ 5 %	C:3.3 V	H: $\pm$ 100 / 0 °C to +70 °C	-	1000 pcs / Reel "L" PCH
Q 3802CA0 0 0020 00	EG-2002CA	125 MHz	P:LV-TTL SYM $\pm$ 5 %	C:3.3 V	Z: $\pm$ 50 / 0 °C to +70 °C	-	1000 pcs / Reel "L" PCZ
Q 3805CA0 0 0002 00	EG-2121CA	125 MHz	P:LV-PECL SYM $\pm$ 5 %	2.5 V	HP: $\pm$ 100 / 0 °C to +70 °C	A	1000 pcs / Reel "L" PHPA
Q 3805CA1 0 0003 00	EG-2121CA	125 MHz	L:LVDS SYM $\pm$ 5 %	2.5 V	HP: $\pm$ 100 / 0 °C to +70 °C	A	1000 pcs / Reel "L" LHPA
Q 3806CA0 0 0029 00	EG-2102CA	125 MHz	P:LV-PECL SYM $\pm$ 5 %	3.3 V	HP: $\pm$ 100 / 0 °C to +70 °C	A	1000 pcs / Reel "L" PHPA
Q 3806CA1 0 0039 00	EG-2102CA	125 MHz	L:LVDS SYM $\pm$ 5 %	3.3 V	HP: $\pm$ 100 / 0 °C to +70 °C	A	1000 pcs / Reel "L" LHPA
Q 3803CA0 0 0023 00	EG-2101CA	125 MHz	D:LV-PECL SYM $\pm$ 2.5 %	C:3.3 V	H: $\pm$ 100 / 0 °C to +70 °C	-	1000 pcs / Reel "L" DCH

● High-stability

Product Number	Model	Output frequency	Frequency tolerance ($\times 10^{-6}$)	Function	Operating voltage	Standard packing	Suffix
Q 3514CA0 0 0019 00	HG-2150CA	20.000 MHz	BX: $\pm$ 25 / -40 °C to +85 °C	OE	C:3.3 V	1000 pcs / Reel "L"	BXC
Q 3502JA7 1 0054 00	HG-8002JA	20.000 MHz	BV: $\pm$ 25 / -20 °C to +70 °C	S:Standby	C:3.3 V	1000 pcs / Reel "L"	SC BV



●Voltage Control (VCXO)

Product Number	Model	Output frequency	Frequency tolerance ($\times 10^{-6}$)	Pull range	Operating voltage	Standard packing	Suffix
Q 3614CE0 0 0012 00	VG-4231CE	27.000 MHz	C: ± 30 / -20 °C to $+70$ °C	S: ± 140	C: 3.3 V	2000 pcs / Reel "L"	CSC-M
Q 3603CA0 0 0043 00	VG-1201CA	27.000 MHz	B: ± 25 / -40 °C to $+85$ °C	N: ± 100	C: 3.3 V	1000 pcs / Reel "L"	BNC-F
Q 3614CA0 0 1018 00	VG-4231CA	27.000 MHz	G: ± 50 / -40 °C to $+85$ °C	R: ± 130	C: 3.3 V	1000 pcs / Reel "L"	GRC-F
X 1G00062 1 0051 00	TCO-2111	500 MHz	± 50 / -40 °C to $+85$ °C	± 100	3.3 V	700 pcs / Reel "L"	AA

■TEMPERATURE SENSING CRYSTAL

Product Number	Model	Nominal frequency	Frequency tolerance	Operating temperature range	Standard packing
Q 19HT206 0 0001 00	HTS-206	40.000 kHz	± 2 %	-10 °C to $+60$ °C	500 pcs / Vinyl bags

■SAW FILTER

Product Number	Model	Nominal frequency	Pass bandwidth	Insertion loss	Operating temperature	Standard packing
Q 51FF32N 0 0001 00	FF-32N	429.450 MHz	f _{nom} ± 300 kHz Min.	3.5 dB Max.	-10 °C to $+60$ °C	4000 pcs / Reel "R"
Q 51FF555 0 0007 00	FF-555	315.000 MHz	f _{nom} ± 100 kHz Min.	3.5 dB Max.	-40 °C to $+85$ °C	4000 pcs / Reel "R"
Q 51FF585 0 0003 00	FF-585	315.000 MHz	f _{nom} ± 200 kHz Min.	3.5 dB Max.	-40 °C to $+85$ °C	4000 pcs / Reel "R"
X 1L00001 1 0002 00	TQS-471BB-7R	374.000 MHz	f _{nom} ± 8.5 MHz Min.	10 dB Max.	-30 °C to $+70$ °C	2000 pcs / Reel
X 1L00017 1 0003 00	TQS-949AD-7G	1575.420 MHz	f _{nom} ± 200 kHz Min.	2.3 dB Max.	-40 °C to $+85$ °C	3000 pcs / Reel

■REAL TIME CLOCK MODULE

Product Number	Model	Frequency tolerance ($\times 10^{-6}$)	Standard packing
Q 4140455 1 0001 00	RX-4045SA	AA : 5 ± 5	1000 pcs / Reel "L"
Q 4140459 1 0001 00	RX-4045NB	AA : 5 ± 5	1000 pcs / Reel "L"
Q 4145819 1 0002 00	RX-4581NB	B : 5 ± 23	1000 pcs / Reel "L"
Q 4147019 1 0002 00	RTC-4701NB	B : 5 ± 23	1000 pcs / Reel "L"
Q 4145745 1 0002 00	RTC-4574SA	B : 5 ± 23	1000 pcs / Reel "L"
Q 4145747 1 0001 00	RTC-4574JE	B : 5 ± 23	1000 pcs / Reel "L"
Q 4145749 1 0001 00	RTC-4574NB	B : 5 ± 23	1000 pcs / Reel "L"
Q 414574C 2 0003 00	RX-4574LC	B : 5 ± 23	2000 pcs / Reel "L"
Q 4145435 1 0002 00	RTC-4543SA	B : 5 ± 23	1000 pcs / Reel "L"
Q 4145436 1 0002 00	RTC-4543SB	B : 5 ± 23	1000 pcs / Reel "L"
Q 414575C 1 0001 00	RX-4575LC	B : 5 ± 23	2000 pcs / Reel "L"
Q 414571C 1 0001 00	RX-4571LC	B : 5 ± 23	2000 pcs / Reel "L"
Q 4145719 1 0001 00	RX-4571NB	B : 5 ± 23	1000 pcs / Reel "L"
Q 4145715 1 0001 00	RX-4571SA	B : 5 ± 23	1000 pcs / Reel "L"
Q 4180255 1 0001 00	RX-8025SA	AA : 5 ± 5	1000 pcs / Reel "L"
Q 4180259 1 0001 00	RX-8025NB	AA : 5 ± 5	1000 pcs / Reel "L"
Q 4185647 1 0001 00	RTC-8564JE	B : 5 ± 23	1000 pcs / Reel "L"
Q 4185649 1 0002 00	RTC-8564NB	B : 5 ± 23	1000 pcs / Reel "L"
Q 418564C 2 0001 00	RX-8564LC	B : 5 ± 23	2000 pcs / Reel "L"
Q 4185815 1 0002 00	RX-8581SA	B : 5 ± 23	1000 pcs / Reel "L"
Q 4185817 1 0002 00	RX-8581JE	B : 5 ± 23	1000 pcs / Reel "L"
Q 4185819 1 0002 00	RX-8581NB	B : 5 ± 23	1000 pcs / Reel "L"
Q 418731C 1 0001 00	RX-8731LC	B : 5 ± 23	2000 pcs / Reel "L"
Q 4273018 1 0002 00	RTC-7301SF	B : 5 ± 23	1000 pcs / Reel "L"
Q 4273011 1 0002 00	RTC-7301DG	B : 5 ± 23	1000 pcs / Reel "L"
Q 4272421 1 0001 00	RTC-72421	A : ± 10	25 pcs / Tube
Q 4272423 1 0006 00	RTC-72423	A : ± 20	1000 pcs / Reel "L"



STANDARD PACKING SPECIFICATIONS

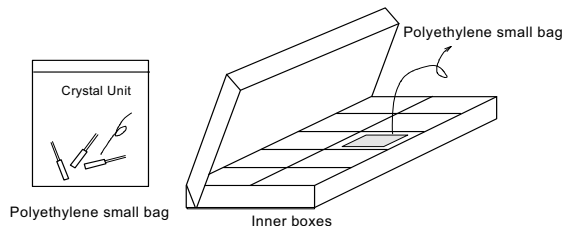
For SMD products, standard packing quantity is specified as below table. Please order in accordance with packing quantity.

1. Cylinder

Cylinder products are packed in vinyl bags per lot of 250 to 1000 pcs.

From 1 to 20 bags are then placed in inner boxes to make a lot.

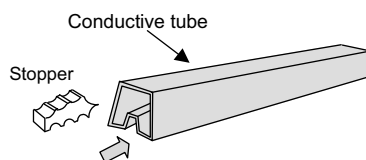
Inner boxes are then placed in cartons for shipment. (the quantity varies with the model.)



Model	Quantity
C-001R	250 pcs / vinyl bags
C-2-TYPE C-4-TYPE C-002RX C-004R C-005R CA-301	500 pcs / vinyl bags

2. DIP

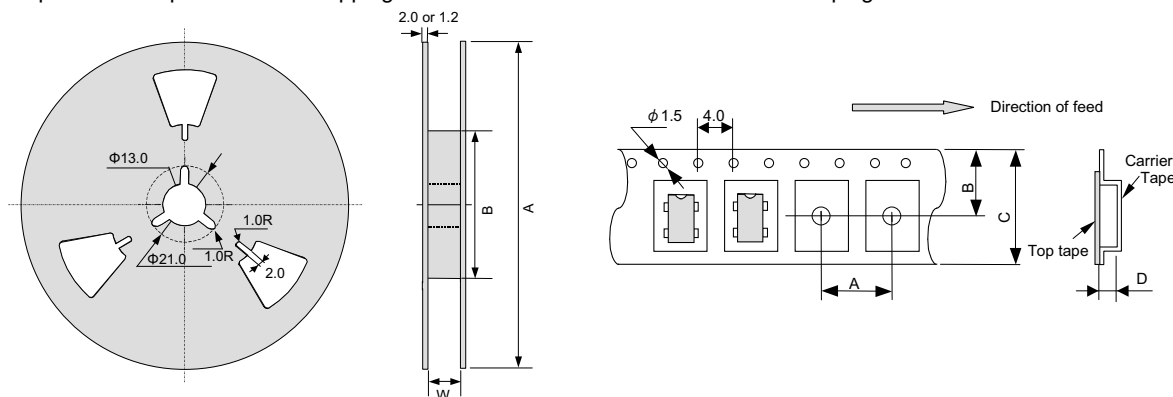
DIP products are placed into antistatic IC tubes and packed into boxes for shipment.



Model	Quantity
SG-531 SG-8002DC SG-51	35 pcs / tube
SG-8002DB RTC-72421 RTC-7301DG	25 pcs / tube

3. SMD

SMD products are packed in the shipping carton as below table in accordance with taping standards EIA-481 and IEC-60286 .



STANDARD PACKING QUANTITY and dimension (Unit:mm)

● Crystal Unit / Resonator

Model	Quantity (pcs/Reel)	Reel dimension			Career Tape dimension				Direction of feed (L=left direction)
		A	B	W	A	B	C	D	
FC-12M	3000	Φ180	Φ60	9.0	4.0	5.25	8.0	0.75	L
FC-13E	3000	Φ180	Φ60	13.0	4.0	7.25	12.0	0.7	L
FC-13F	3000	Φ180	Φ60	13.0	4.0	7.25	12.0	0.7	L
FC-135	3000	Φ180	Φ60	13.0	4.0	7.25	12.0	1.0	L
FC-145	3000	Φ180	Φ60	13.0	4.0	7.25	12.0	1.0	L
FC-255	3000	Φ330	Φ80 or Φ100	13.5	8.0	7.25	12.0	1.1	L
MC-146	3000	Φ330	Φ80 or Φ100	17.5	8.0	9.25	16.0	1.7	L
MC-156	3000	Φ330	Φ80 or Φ100	17.5	8.0	9.25	16.0	1.65	L
FA-118T	3000	Φ180	Φ60	9.0	4.0	5.25	8.0	0.5	L
FA-128	3000	Φ180	Φ60	9.0	4.0	5.25	8.0	0.7	L
FA-20H	3000	Φ180	Φ60	9.0	4.0	5.25	8.0	0.75	L
TSX-3225	2000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.0	L
FA-238V / 238	3000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.05	L
TSX-4025	2000	Φ180	Φ60	13.0	4.0	7.25	12.0	0.9	L
TSX-5032	2000	Φ180	Φ60	13.0	8.0	7.25	12.0	1.0	L
FA-365	1000	Φ180	Φ60	13.0	8.0	7.25	12.0	1.6	L
MC-306/30A	3000	Φ330	Φ80 or Φ100	17.5	8.0	9.25	16.0	2.7	L
MC-405/406	1000	Φ330	Φ80 or Φ100	17.5	8.0	9.25	16.0	3.8	L
MA-306	3000	Φ330	Φ80 or Φ100	17.5	8.0	9.25	16.0	2.7	L
MA-406	1000	Φ330	Φ80 or Φ100	25.5	12.0	13.25	24.0	4.0	L
MA-505/506	1000	Φ330	Φ80 or Φ100	25.5	12.0	13.25	24.0	4.8	L
NS-21R	3000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.15	Individual regulations
NS-32R	4000	Φ330	Φ80 or Φ100	13.5	8.0	7.25	12.0	1.52	R
FS-335	4000	Φ330	Φ80 or Φ100	13.5	8.0	7.25	12.0	1.52	R
FS-555	4000	Φ330	Φ80 or Φ100	13.5	8.0	7.25	12.0	2.0	R
FS-585	4000	Φ330	Φ80 or Φ100	13.5	8.0	7.25	12.0	2.0	R



●Crystal Oscillator

Model	Quantity (pcs/reel)	Reel dimension			Career Tape dimension				Direction of feed (L=left direction)
		A	B	W	A	B	C	D	
SG-3030/3040JC	1000	Φ330	Φ80 or Φ100	17.5	8.0	9.25	16.0	3.3	L
SG-3030JF	1000	Φ254	Φ100	17.5	8.0	9.25	16.0	2.3	L
SG-3030/3040LC	2000	Φ180	Φ60	13.0	4.0	7.25	12.0	1.45	L
SG-150 series	3000	Φ180	Φ60	9.0	4.0	5.25	8.0	0.95	L
SG-645 series	1000	Φ254	Φ100	17.5	8.0	9.25	16.0	2.3	L
SG-636 series	1000	Φ330	Φ80 or Φ100	17.5	8.0	9.25	16.0	3.0	L
SG-615 series	1000	Φ330	Φ80 or Φ100	25.5	12.0	13.25	24.0	4.8	L
SG-210 series	3000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.15	L
SG-211 series	3000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.15	L
SG-310 series	2000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.4	L
TCO-710x series	1000	Φ180	Φ60	13.0	8.0	7.25	12.0	1.4	L
SG-770/771 series	1000	Φ180	Φ60	17.0	8.0	9.25	16.0	2.1	L
TCO-708x series	1000	Φ254	Φ100	17.5	8.0	9.25	16.0	2.1	L
SG-8003BA	3000	Φ180	Φ60	9.0	4.0	5.25	8.0	0.95	L
SG-8002CE/SG-8003CE	2000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.4	L
SG-8002LB/SG-8003LB	2000	Φ254	Φ100	13.4	8.0	7.50	12.0	1.4	L
SG-8002JF/SG-8003JF	1000	Φ254	Φ100	17.5	8.0	9.25	16.0	2.3	L
SG-8002CA/SG-8003CA	1000	Φ254	Φ100	17.5	8.0	9.25	16.0	2.3	L
SG-8002JC	1000	Φ330	Φ80 or Φ100	17.5	8.0	9.25	16.0	3.3	L
SG-8002JA	1000	Φ330	Φ80 or Φ100	25.5	12.0	13.25	24.0	4.8	L
SG-9001LB	2000	Φ254	Φ100	13.4	8.0	7.50	12.0	1.4	L
SG-9001CA	1000	Φ254	Φ100	17.5	8.0	9.25	16.0	2.3	L
SG-9001JC	1000	Φ330	Φ80 or Φ100	17.5	8.0	9.25	16.0	3.3	L
XG-1000CA	1000	Φ254	Φ100	17.5	8.0	9.25	16.0	2.3	L
XG-1000CB	2000	Φ254	Φ100	13.4	8.0	7.25	12.0	1.95	L
EG-2000 series	1000	Φ254	Φ100	17.5	8.0	9.25	16.0	2.3	L
HG-2150CA	1000	Φ254	Φ100	17.5	8.0	9.25	16.0	2.3	L
HG-8002JA	1000	Φ330	Φ80 or Φ100	25.5	12.0	13.25	24.0	4.8	L

●VCXO

VG-4231CE	2000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.4	L
VG-4231CB	1000	Φ180	Φ60	13.0	8.0	7.25	12.0	1.4	L
VG-4531CB	1000	Φ180	Φ60	13.0	8.0	7.25	12.0	1.4	L
VG-4231CA	1000	Φ254	Φ100	17.5	8.0	9.25	16.0	2.3	L
VG-4501CA	1000	Φ180	Φ60	17.0	8.0	9.25	16.0	2.1	L
VG-4502CA	1000	Φ180	Φ60	17.0	8.0	9.25	16.0	2.1	L
VG-4511CA	1000	Φ180	Φ60	17.0	8.0	9.25	16.0	2.1	L
VG-1201CA	1000	Φ254	Φ100	17.5	8.0	9.25	16.0	2.3	L
TCO-291J	1000	Φ330	Φ80	25.5	16.0	13.25	24.0	4.2	L
TCO-2000/2100 series	700	Φ330	Φ80	25.5	16.0	13.25	24.0	5.4	L

●TCXO

TG-3530SA	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	3.65	L
TG-5021BA	3000	Φ180	Φ60	9.0	4.0	5.25	8.0	0.95	L
TG-5021CG	2000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.15	L
TG-5025CG	2000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.15	L
TG-5005CE	2000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.4	L
TG-5010LH	3000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.4	L
TCO-5860 series	2000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.4	L
TCO-5060/5160 series	1000	Φ180	Φ60	17.5	8.0	9.25	16.0	2.2	L



●Real time clock module

Model	Quantity (pcs/reel)	Reel dimension			Career Tape dimension				Direction of feed (L=left direction)
		A	B	W	A	B	C	D	
RX-4045SA	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	3.65	L
RX-4045NB	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	1.8	L
RX-4581NB	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	1.8	L
RA-4565SA	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	3.65	L
RX-4801SA	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	3.65	L
RX-4801JE	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	2.0	L
RTC-4701JE	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	2.0	L
RTC-4701NB	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	1.8	L
RTC-4574SA	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	3.65	L
RTC-4574JE	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	2.0	L
RTC-4574NB	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	1.8	L
RX-4574LC	2000	Φ180	Φ60	13.0	4.0	7.25	12.0	1.45	L
RA-4574SA	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	3.65	L
RTC-4543SA	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	3.65	L
RTC-4543SB	1000	Φ330	Φ80 or Φ100	24.4	12.0	11.50	24.0	2.5	L
RX-4575LC	2000	Φ180	Φ60	13.0	4.0	7.25	12.0	1.45	L
RX-4571LC	2000	Φ180	Φ60	13.0	4.0	7.25	12.0	1.45	L
RX-4571NB	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	1.8	L
RX-4571SA	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	3.65	L
RX-5412SF	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	2.4	L
RX-8025SA	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	3.65	L
RX-8025NB	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	1.8	L
RTC-8564JE	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	2.0	L
RTC-8564NB	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	1.8	L
RX-8564LC	2000	Φ180	Φ60	13.0	4.0	7.25	12.0	1.45	L
RA-8565SA	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	3.65	L
RX-8571LC	2000	Φ180	Φ60	13.0	4.0	7.25	12.0	1.45	L
RX-8571NB	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	1.8	L
RX-8571SA	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	3.65	L
RX-8581SA	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	3.65	L
RX-8581JE	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	2.0	L
RX-8581NB	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	1.8	L
RA-8581SA	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	3.65	L
RX-8731LC	2000	Φ180	Φ60	13.0	4.0	7.25	12.0	1.45	L
RX-8801SA	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	3.65	L
RX-8801JE	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	2.0	L
RTC-7301SF	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	2.4	L
RTC-72423	1000	Φ330	Φ80 or Φ100	25.5	16.0	13.25	24.0	2.95	L

●Monolithic Crystal Filter

HF-232A/ HF-233A	3000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.15	L
HF-362A/ HF-363A	2000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.5	L
HF-372A/ HF-373A	1000	Φ180	Φ60	13.0	8.0	7.25	12.0	1.35	L
HF-734A	1000	Φ180	Φ60	17.0	8.0	9.25	16.0	1.8	L
MF-372A/ MF-373A	1000	Φ180	Φ60	13.0	8.0	7.25	12.0	1.35	L
MF-722A/ MF-723A	1000	Φ180	Φ60	17.0	8.0	9.25	16.0	1.8	L
MF-734A	1000	Φ180	Φ60	17.0	8.0	9.25	16.0	1.8	L

●SAW Filter

FF-555	4000	Φ330	Φ80 or Φ100	13.5	8.0	7.25	12.0	2.0	R
FF-585	4000	Φ330	Φ80 or Φ100	13.5	8.0	7.25	12.0	2.0	R
FF-32N	4000	Φ330	Φ80 or Φ100	13.5	8.0	7.25	12.0	1.52	R
TF-330A/C	2000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.5	Individual regulations
TQS-557AA-7R	2000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.5	Individual regulations
TQS-949AD-7G	3000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.5	Individual regulations
TQS-471BB-7R	2000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.5	Individual regulations
TQS-477AA-7R	2000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.5	Individual regulations
TQS-472BA-7R	1000	Φ180	Φ60	17.0	12.0	9.25	16.0	1.9	L

●Gyro Sensor

XV-3500CB	2000	Φ254	Φ100	13.4	8.0	7.25	12.0	2.1	L
XV-8000CB	2000	Φ254	Φ100	13.4	8.0	7.25	12.0	2.1	L
XV-8100CB	2000	Φ254	Φ100	13.4	8.0	7.25	12.0	2.1	L
XV-8000LK	1000	Φ254	Φ100	13.4	8.0	7.25	12.0	3.7	L



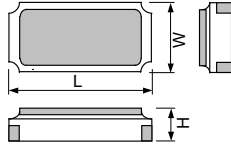
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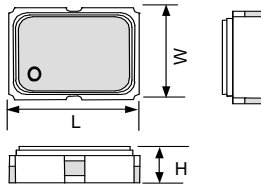
■ SMD Type

● SON

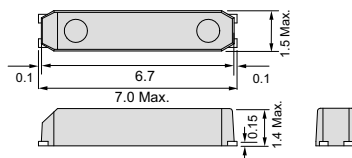
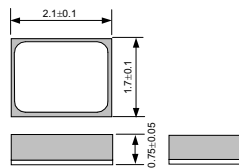
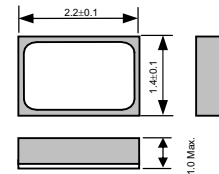
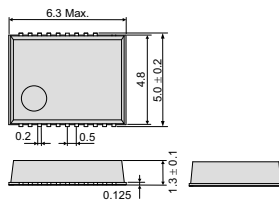
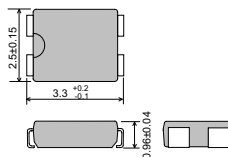
Glass Lid type



Metal Lid type



Category	Model	Dimension (mm)			Pin
		L	W	H	
Crystal Unit	FC-12M	2.05±0.05	1.2±0.05	0.6 Max.	2
	FC-13E	3.2±0.1	1.5±0.1	0.48 Max.	2
	FC-13D	3.2±0.1	1.5±0.1	0.38 Max.	2
	FC-13A	3.2±0.1	1.5±0.1	0.9 Max.	2
	FC-13F	3.2±0.1	1.5±0.1	0.6 Max.	2
	FC-135	3.2±0.1	1.5±0.1	0.8±0.1	2
	FC-145	4.1±0.1	1.5±0.1	0.8±0.1	2
	FC-255	4.9±0.1	1.8±0.1	0.8±0.1	2
	FA-118	1.6±0.1	1.2±0.1	0.4 Max.	4
	FA-118T	1.6±0.1	1.2±0.1	0.35 Max.	4
	FA-128	2.0±0.1	1.6±0.1	0.5 Max.	4
	FA-20H	2.5±0.1	2.0±0.1	0.55 Max.	4
	TSX-3225	3.2±0.15	2.5±0.15	0.6 Max.	4
	FA-238 / 238V	3.2±0.1	2.5±0.1	0.6±0.1	4
	TSX-4025	4.0±0.15	2.5±0.15	0.7 Max.	4
	TSX-5032	5.0±0.15	3.2±0.15	0.8 Max.	4
	FA-365	6.0±0.2	3.5±0.2	1.4 Max.	2
SAW Resonator	NS-21R	2.5±0.1	2.0±0.1	0.86±0.9	4
	FS-335 / NS-32R	3.8±0.15	3.8±0.15	0.98±0.15	6
	FS-555 / 585	4.8±0.2	5.2±0.2	1.5±0.2	8
Crystal Oscillator	SG-211	2.5±0.15	2.0±0.15	0.7±0.1	4
	SG-210	2.5±0.15	2.0±0.15	0.8±0.1	4
	SG-310 / SG-8002CE / SG-8003CE	3.2±0.2	2.5±0.2	1.05±0.15	4
	TCO-710x series	5.0±0.2	3.2±0.2	1.0±0.2	4
	SG-770 / SG-771 series	7.0±0.2	5.0±0.2	1.6±0.2	6
	TCO-708x series	7.0±0.2	5.0±0.2	1.6±0.2	4
	SG-8002CA / SG-8003CA	7.0±0.2	5.0±0.2	1.5 Max.	4
	HG-2150CA	7.0±0.2	5.0±0.2	1.5 Max.	4
	SG-9001CA	7.0±0.2	5.0±0.2	1.4±0.1	6
	XG-1000CA	7.0±0.2	5.0±0.2	1.2±0.2	4
	XG-1000CB	5.0±0.2	3.2±0.2	1.1±0.15	4
	EG-20**CA	7.0±0.2	5.0±0.2	1.2±0.2	4
	EG-21**CA	7.0±0.2	5.0±0.2	1.2±0.2	6
	VG-4231CE	3.2±0.2	2.5±0.2	1.05±0.15	4
	VG-4231CB / VG-4531CB	5.0±0.2	3.2±0.2	1.2±0.2	6
VCXO	VG-4231CA / VG-1201CA	7.0±0.2	5.0±0.2	1.4±0.1	6
	VG-4501CA / VG-4502CA / VG-4511CA	7.0±0.2	5.0±0.2	1.6±0.2	6
TCXO	TG-5021CG / TG-5025CG	2.5±0.2	2.0±0.2	1.0 Max.	4
	TCO-5860 series / TG-5005CE	3.2±0.2	2.5±0.2	1.0 Max.	4
	TCO-5060 / 5160 series	7.0±0.2	5.0±0.2	1.9±0.1	6
SAW Filter	TQS-949AD-7G	2.5±0.1	2.0±0.1	0.8±0.2	4
	TQS-570AA-7R				
	TQS-557AA-7R / TQS-566AA-7R	3.0±0.1	3.0±0.1	1.11±0.2	6
	TQS-471BA-7R				
	TQS-477AA-7R	3.0±0.1	3.0±0.1	1.15 Max.	8
	FF-32N	3.8±0.15	3.8±0.15	0.98±0.15	6
	FF-555 / 585	4.8±0.2	5.2±0.2	1.5±0.2	8
	TF-330A / C	3.0±0.1	3.0±0.1	1.11±0.2	6
	TQS-472BA-7R	7.0±0.2	5.0±0.2	1.5 Max.	10
	HF-232A / HF-233A	2.5±0.05	2.0±0.05	0.9±0.15	6
MCF	HF-362A / HF-363A	3.0±0.1	3.0±0.1	0.9±0.15	8
	HF-372A / HF-373A / MF-372A / MF-373A	3.8±0.1	3.8±0.1	1.0±0.2	8
	HF-722A / HF-723A	7.0±0.2	5.0±0.2	1.3±0.2	6
	HF-734A / MF-734A	7.0±0.2	5.0±0.2	1.1±0.2	6
Gyro Sensor	XV-3500CB / XV-8100CB / XV-8000CB	5.0±0.2	3.2±0.2	1.3±0.2	8

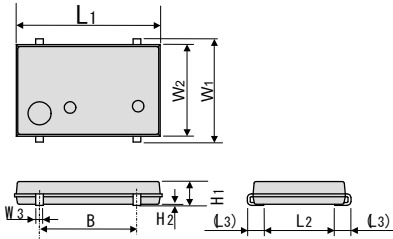
● SON (Crystal Unit)
MC-146● SON (Crystal Oscillator)
SG-150 / SG-8003BA / TG-5021BA● SON (Crystal Oscillator)
SG-3050BC● SON (Real time clock module:NB Package)
RX-***NB / RTC-***NB● SON (TCXO)
TG-5010LH



■ SMD Type

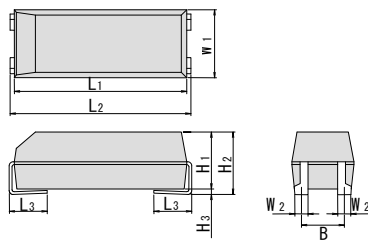
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● SOJ / VSOJ



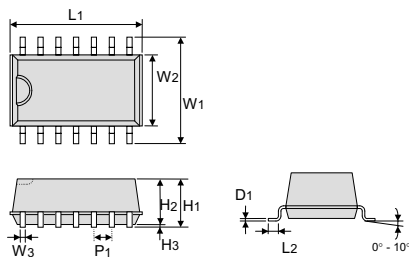
Category	Model	L ₁	L ₂	(L ₃)	W ₁	W ₂	W ₃	H ₁	H ₂	B	Pin
Crystal Unit	MC-156	7.1 Max.	1.6	(0.75)	3.3 Max.	2.5	0.4	1.5 Max.	—	5.08	4
	MC-306 / 30A MA-306	8.0 Max.	1.9	(0.9)	3.8 Max.	3.2	0.5	2.54 Max.	—	5.5	4
	MA-406	11.7 Max.	2.1	(1.2)	4.8 Max.	4.0	0.7	3.7 Max.	—	9.6	4
	SG-**LB	5.0 ±0.2	2.5	(0.35)	3.2 ±0.2	2.8	1.0	1.2 Max.	0.0 Min.	2.54	4
Crystal Oscillator	SG-645	7.1 ±0.2	3.8	(0.75)	5.1 ±0.2	4.6 ±0.2	0.4	1.5 Max.	0.0 Min.	5.08	4
	SG-**JF	10.5 Max.	3.6	(1.0)	5.8 Max.	5.0	0.51	2.7 Max.	0.05 Min.	5.08	4
	SG-636	14.0 Max.	7.62	—	9.8 Max.	8.65	0.51	4.7 Max.	0.25 Min.	5.08	4
	SG-**JC	13.9 ±0.1	7.62	—	9.8 Max.	8.75	0.5	4.7 Max.	0.25 Min.	5.08	4
VCXO	TCO-2000 series	13.9 ±0.1	7.62	—	9.8 Max.	8.75	0.5	4.7 Max.	0.25 Min.	5.08	4
	TCO-2100 series									2.54	6
	TCO-2131									2.54	6
Real time Clock Module	SG-**LC	3.6 ±0.2	2.0	(0.4)	2.8 ±0.2	2.4	0.22	1.2 Max.	0.0 Min.	0.5	12
	RX-**JE	7.0 ±0.3	4.5	(0.75)	6.0 ±0.2	5.4	0.22	1.5 Max.	0.0 Min.	0.65	20
	RTC-**JE										

● SOJ (Crystal Unit)

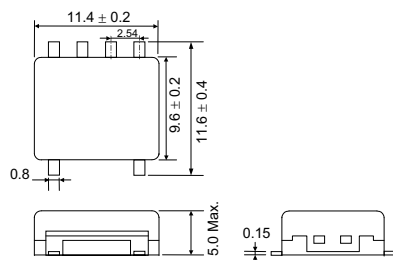
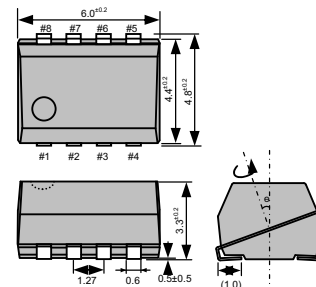


Category	Model	L ₁	L ₂	L ₃	W ₁	W ₂	B	H ₁	H ₂	H ₃
Crystal Unit	MC-405 / 406	9.6	10.41 Max.	2.54	4.06 Max.	0.51	2.29	3.15	3.6 Max.	0.2 Min.
	MA-505 / 506	12.7	13.46 Max.	2.54	5.08 Max.	1.09	3.3	4.19	4.6 Max.	0.2 Min.

● SOP / VSOP



Category	Model	L ₁	L ₂	W ₁	W ₂	W ₃	H ₁	H ₂	H ₃	D ₁	P ₁	Pin
Real time Clock Module	RTC-****SA RX-****SA RA-****SA	10.1 ±0.2	0.6	7.4 ±0.2	5.0	0.35	3.2 ±0.1	3.1	0.05 Min.	0.15	1.27	14
	RTC-4543SB	11.4 ±0.2	0.6	7.8 ±0.2	5.4	0.4	2.0 Max.	1.8	0 Min.	0.15	1.27	18
	RTC-72423	16.3 Max.	1.0	12.2 Max.	7.9	0.35	2.8 Max.	—	0.1 Min.	0.2	1.27	24
	RX-5412SF	10.2 ±0.3	0.5	7.8 ±0.3	5.4	0.36	2.0 Max.	—	0 Min.	0.15	0.8	24
	RTC-7301SF											

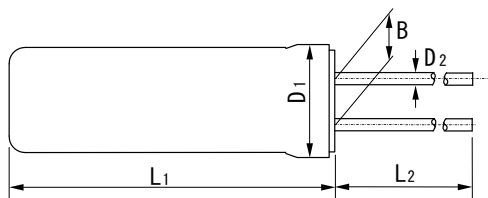
● SOP (Crystal Oscillator)
TCO-291J● SOJ (Gyro sensor)
XV-8000LK



(Unit:mm)

■ Dip Type

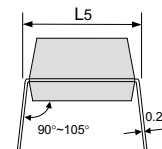
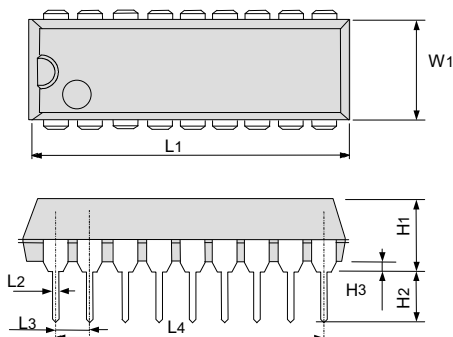
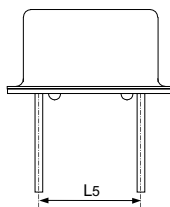
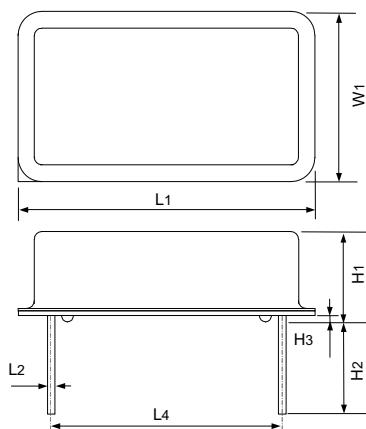
● Cylinder



Category	Model	L ₁	L ₂	D ₁	D ₂	B
Crystal Unit	C-001R	8.0 Max.	9.0 Min.	Φ3.1 Max.	Φ0.3	1.1
	C-002RX / C-2-TYPE	6.0 Max.	4.0 Min.	Φ2.0 Max.	Φ0.2	0.7
	C-004R / C-4-TYPE	5.0 Max.	4.0 Min.	Φ1.5 Max.	Φ0.18	0.5
	C-005R	4.6 Max.	4.0 Min.	Φ1.2 Max.	Φ0.15	0.3
	CA-301	Over 5.5 MHz	8.9 Max.	9.5 Min.	Φ3.1 Max.	Φ0.3
		Under 5.5 MHz	9.3 Max.	9.5 Min.	Φ3.1 Max.	Φ0.3

160 kHz to 165 kHz, 307.2 kHz: D1= ø 2.2 Max. (C-2-TYPE)

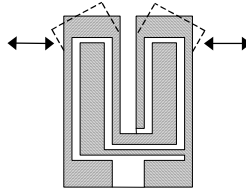
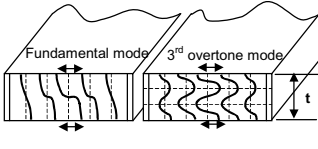
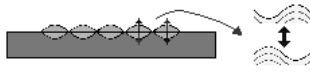
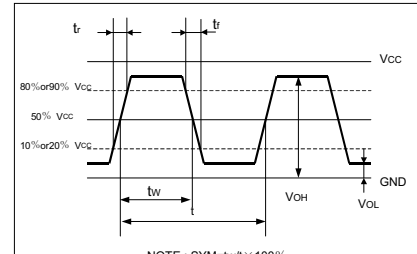
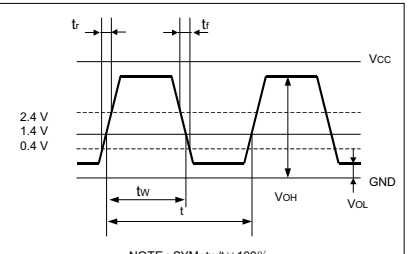
● DIP



Category	Model	L ₁	L ₂	L ₃	L ₄	L ₅	H ₁	H ₂	H ₃	W ₁	Pin
Crystal Oscillator	SG-51	19.8	0.51	—	15.24	7.62	5.3	2.54	0.2	6.36	4 Pin
	SG-8002DB	Max.					Max.	Min.	Min.		
	SG-531	13.7	0.51	—	7.62	7.62	5.3	2.54	0.2	6.6	4 Pin
	SG-8002DC	Max.					Max.	Min.	Min.		
OCXO	TCO-6831 series	72.0	Φ0.8	—	60.0	40.0	12.0	5.0	0.5 Min.	52.0	5 Pin
		Max.			±0.3	±0.3	Max.			Max.	
	TCO-676 series	25.4	Φ0.75	—	19.05	19.05	12.7	4.5	Inside H1	25.4	5 Pin
		Max.			±0.3	±0.3	Max.	±0.1		Max.	
	TCO-679 series	20.3	Φ0.45	—	15.24	7.62	9.7	5.55	0.8	12.7	4 Pin
Real time clock Module		±0.5			±0.2	±0.2	±0.5	±0.7	±0.2	±0.5	
	TCO-6920A	50.8	Φ1.0	—	40.64	40.64	25.4	3.5	Inside H1	50.8	5 Pin
		Max.			±0.3	±0.3	Max.	±0.5		Max.	
	RTC-7301DG	23.1	0.46	2.54	20.32	7.62	4.2	2.54	0.2	6.3	18 Pin
		Max.					Max.	Min.	Min.		
	RTC-72421	23.1	0.65	2.54	20.32	7.62	4.2	3.3	0.2	6.3	18 Pin
		Max.					Max.	Min.	Min.		



Glossary

Item	Content	Object
Fundamental mode	First harmonic crystal vibration mode. The AT resonance frequency is determined by the thickness of the crystal, but even with the same thickness the third overtone will be about three times the frequency of the fundamental. With tuning fork crystal unit, the second overtone is about six times the fundamental. Tuning fork crystal unit Fundamental mode  AT-cut crystal unit $F(\text{MHz}) = \frac{1670}{t(\mu\text{m})} \quad (t: \text{Thickness})$  SAW Resonator   SAW Structure figure Vibration mode Output Frequency $f = k/\lambda$ (λ=Interval of an/the electrode, k = Fixed number)	X'tal ,OSC
Divided frequency	The output frequency that is divided by the internal IC.	OSC
Symmetry (tw/t) (SYM)	Ratio of full and half cycles. For CMOS loading duty is rated at 1/2 Vcc, and for TTL loading at 1.4V. ● CMOS loading  NOTE : SYM=tw/t × 100% ● TTL loading  NOTE : SYM=tw/t × 100%	OSC
(Equivalent)series capacitance (C ₁) (motional capacitance)	Energy distortion to the (equivalent) internal charge capacitance component of the crystal unit, at the series resonant frequency.	X'tal
(Equivalent)series resonant resistance (R ₁)	Vibration loss to the (equivalent) internal charge capacitance component of the crystal unit, at the series resonant frequency. A measure of the easiness of oscillation.	X'tal
Drive level (DL)	Current or voltage level in the oscillating (operating)state.(Drive power= power required to oscillate crystal unit.)	X'tal
Deviation in PB	The difference between the max. and min. attenuations within a pass band.	Filter
Frequency (f)	Number of waves (cycles)per second. The relation between frequency and cycle is $f(\text{Hz})=1/t(\text{s})$.	ALL
(Frequency)aging (f _{age} , f _{aging})	Amount of frequency drift when operated under the specified conditions for a specified term.	ALL
Frequency tolerance precision (f _{tol})	Under specified conditions at an ambient temperature of +25 °C,the difference in actual (measured) frequency from the nominal frequency.	X'tal
Frequency voltage Coefficient	Taking the output frequency at the central voltage in the operating voltage range as the reference, the change in output frequency to voltage. Causes of this change are changes in crystal deformation, and changes in IC internal constants for chips mounted in the oscillator and Real time clock module. The effects of the ICs are larger.	OSC
Frequency tolerance (f _{tol})	Within standard temperature and operational voltage ranges, the drift in the output frequency. The output frequency drift including frequency temperature characteristics and frequency voltage characteristics. When there is an annotation in the margin, It is given to priority.	OSC
HFF-XTAL	HFF-XTAL is a high frequency fundamental mode crystal unit using inverted-mesa shape AT-cut blank fabricated with photolithographic technology. Therefore it has an excellent stability for temperature, aging and shock.	OSC

X'tal:Crystal unit, OSC:Crystal oscillator

More details available on Epson Toyocom website.



Item	Content	Object
Frequency temperature characteristics	Taking the frequency at 25 degrees Centigrade as the reference, the change in frequency in response to ambient temperature. ● Tuning fork crystal unit. SAW Resonator. $\Delta f/f = B(T_i - \theta X)^2 \quad \theta X: \text{specified temperature}$ ● AT crystal unit. $\Delta f/f = \alpha(\theta X - 25) + \beta(\theta X - 25)^2 + \chi(\theta X - 25)^3$ Examples of frequency temperature characteristics	ALL
Group delay distortion (Δt)	The difference between the max. and min. group delay within a pass band B1 unless otherwise specified.	Filter
Insulation resistance (IR)	Resistance between lead and lead, or between lead and case package.(conductive package)	ALL
Insertion loss (L)	The logarithmic ratio of the power delivered to the load impedance before insertion of the filter to the power delivered to the load impedance after insertion of the filter.	Filter
Load capacitance (CL)	Effective capacitance (series equivalent charge capacitance) of the oscillation circuit as seen from the pins of the crystal unit. This capacitance is determined as a condition when the crystal unit is connected to the oscillation circuit and will determine the output frequency. Load capacitance approximation:CL	X'tal
Max.drive level (GL)	Rating for the drive level. Current or power input over this level may result in characteristic degradation or destruction.	X'tal
Max. supply voltage (Vcc-GND)	Maximum rated value for power input to the power supply pin. Input over this value may result in characteristic degradation or destruction.	OSC
Max. input level (R)	The max. power that can be delivered to the filter without destructing the filter.	Filter
Nominal frequency (f_nom)	Nominal value of frequency of crystal unit. A frequency given in specification, to which other frequencies may be referred.	X'tal Filter
Operating temperature Range(T_use)	Temperature range where specification characteristics are fulfilled,unless otherwise specified.	ALL
Origin frequency (fo)	Oscillation source frequency of oscillator inside oscillation system.	OSC
Fall time(tr)	The time it takes for the output wave form to change from the high voltage(high level) to the low voltage(low level). Also called wave form fall time. See waveform diagram under Symmetry.	OSC
Rise time(tr)	The time it takes for the output wave form to change from the low voltage (low level) to the high voltage (high level). Also called wave form fall time. See wave from diagram under Symmetry.	OSC
Oscillation circuit	Circuit needed to oscillate crystal unit. Circuit Constants will differ with type of crystal unit and frequency. Basic oscillation circuit using CMOS IC	X'tal



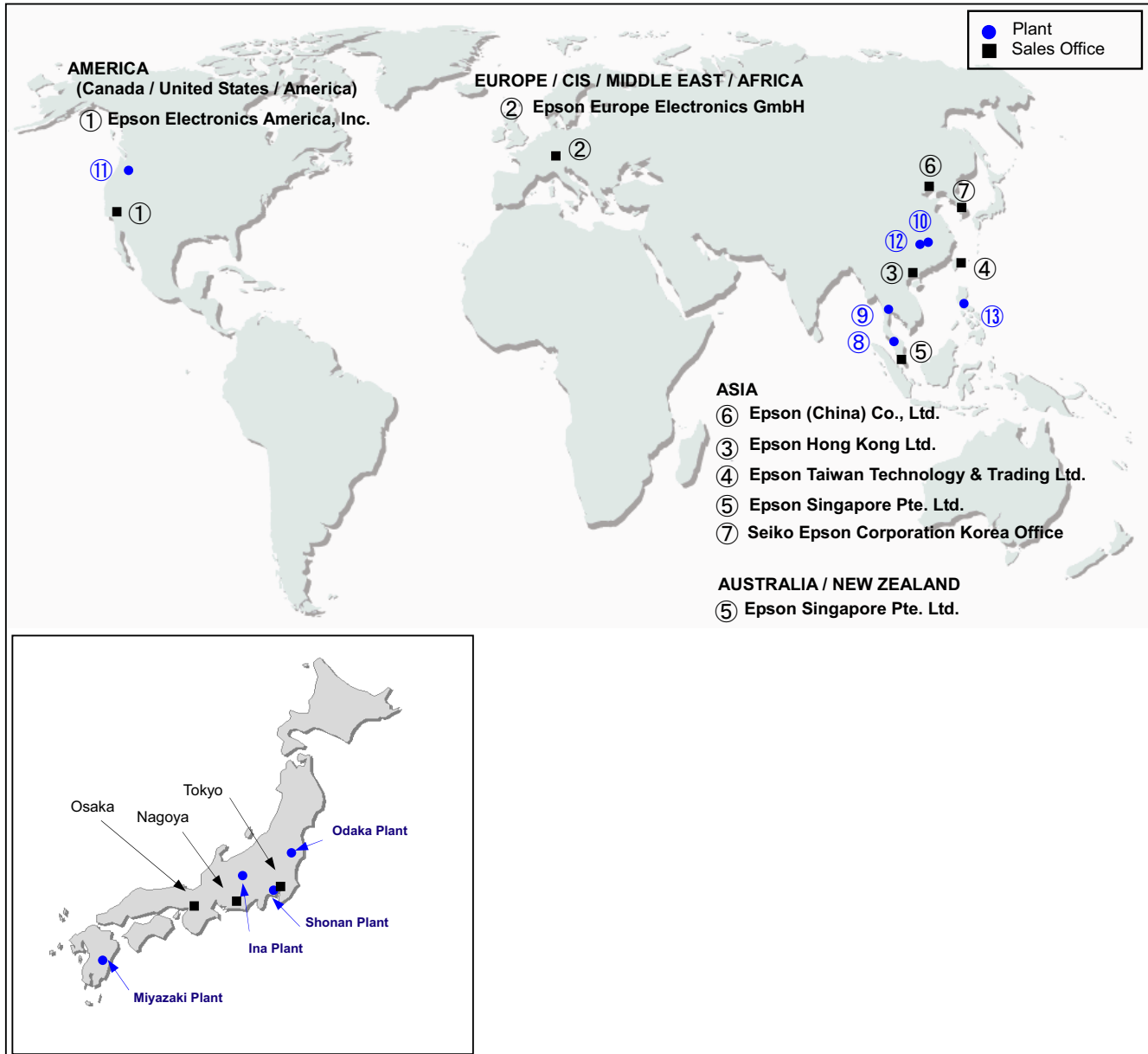
Item	Content	Object
Start-up time (t _{str})	The time from power on until the wave form stabilizes. However, voltage rise times depend on the power supply. Therefore, the time depends on the power supply, and the time is measured from a specific set of initial conditions.	OSC
Output enable(OE)	Output is switched to high impedance, and wired OR connection can be used to select multiple outputs(frequency). OE pin: High or open. Specified frequency output = enabled. OE pin: Low. Output is high impedance=disabled. Oscillation is not stopped, so after the clock is disabled, it is not synchronized with OE (clock is continuous).	OSC
Output frequency (f _o)	The frequency output from the oscillator circuit or the crystal oscillator system.	OSC
Output load conditions	The types and quantities (power) of the loads that can be connected to the oscillator. Calculated for 1 TTL as I _{OH} = -40 μ A, I _{OL} = 1.6 mA and for LS-TTL as I _{OH} = -20 μ A, I _{OL} = 0.4 mA.	OSC
Overtone	Vibration state when crystal is vibrating as a high harmonic(see base wavelength). It is harder To match the overtone oscillation circuit with the crystal unit than the fundamental oscillation circuit.	X'tal,OSC
Pass band (BW)	Pass band (BW) A band of frequencies B1 in which the attenuation is equal to or less than a specified value A1 A band of frequencies B1 in which the attenuation is equal to or less than the insertion loss L. Stop band attenuation Bands of frequencies B2 and B3 in which the attenuations are equal to or greater than specified values A2 and A3 respectively.	Filter
Ripple (R)	The difference between the max. and min. peak attenuation within a pass band.	Filter
Recommended drive level (DL)	Excitation level for optimum oscillation characteristics.	X'tal
Shunt capacitance(Co)	Charge capacitance between the two electrodes in the crystal unit.	X'tal
Soldering conditions (T _{SOL})	Temperatures or times over these limits may result in characteristic degradation or destruction.	ALL
Stand-by ($\overline{ST}$)	Function that halts crystal unit oscillation and frequency Division. Cuts the current consumed by the oscillators circuit and the frequency division stage. $\overline{ST}$ pin-high or open: Specified frequency output. $\overline{ST}$ pin-low: Output is low level, oscillation stops. : Output is low level (weak pull-down), oscillation stops. : Output is high impedance, oscillation stops. Please refer to each data sheet.	OSC
Shortage temperature Range(T _{stg})	Maximum absolute rating for the discharged state (no input of voltage, current or power). Exposure to temperatures over this level may result in characteristic degradation or destruction. To assure precision, store at room temperature whenever possible.	ALL
Spurious response A4 (dB)	Min. attenuation caused by extraordinary response in the stop band. Spurious response usually appears at a higher frequency than the center frequency.	Filter
Supply voltage (V _{cc})	Voltage input to V _{cc} pin which will support continuous operation with specification characteristics.	OSC
Terminating impedance (Z _t)	Either of the impedances presented to the filter by the source or by the load. (R _t : Resistive portion, C _t : Parallel capacitive portion including stray capacitance)	Filter
VSWR	Voltage Standing Wave Ratio	Filter

■ Manufacturing Plant

Plant	Date Operations Commenced	Products
Ina Plant	Jun.1959	Crystal unit, Crystal oscillator, Real time clock module, Surface acoustic wave device, Sensing device, Optical device
Shonan Plant	Jun.1963	—
Odaka Plant	Jan.1977	Crystal unit, Crystal oscillator, Module Surface acoustic wave device Monolithic crystal filter
Miyazaki Plant	Jun.1984	Synthetic quartz, ,Crystal oscillator Optical device

Plant	Date Operations Commenced	Products
⑧: Epson Toyocom Malaysia Sdn.Bhd.	Dec.1974	Crystal unit, Crystal oscillator, Sensing device, Real time clock module
⑨: Epson Toyocom (Thailand) LTD.	May.1988	Crystal unit, SAW, Optical device
⑩: Epson Toyocom Suzhou CO.,LTD.	Mar.1997	Crystal unit, Crystal oscillator Real time clock module
⑪: Epson Toyocom Seattle,Inc.	Jun.2000	Synthetic quartz
⑫: Epson Toyocom (Wuxi)CO.,LTD.	Jul.2001	Crystal unit, Optical device Crystal unit, Crystal oscillator
⑬: Epson Precision (Philippines) Inc.	Feb.2002	Crystal unit

■ Business area



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