PROMOTION OF ENVIRONMENTAL MANAGEMENT SYSTEM CONFORMING TO INTERNATIONAL STANDARDS

At Seiko Epson, 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 provide high quality and reliable products and services than meet customer needs,

Seiko Epson 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.

ISO/TS16949 is the international standard that added the sector-specific supplemental requirements for automotive industry based on ISO9001.

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

Pb Free	►Pb free.
RoHS Compliant	►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.)
For Automotive	►The products have been designed for high reliability applications such as Automotive.

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Crystal Unit

Oscillator

Real Time Clock Module

Filter

Sensor

Crystal Unit / Resonator

►kHz Range Crystal Unit (Tuning fork)

*Please Contact us regarding available frequency other than 32.768 kHz.

Page	Model	External Dimensions (mm) t Max.		Frequency 20 kHz / 32 kHz / 100 kHz / 200 kHz / 300 kHz
4	FC-12D	2.05×1.25×0.35		●32.768 kHz
	FC-12M	2.05×1.2×0.6	*	32 kHz — 77.5 kHz
5	FC-13A	3.2×1.5×0.9		●32.768 kHz
6	FC-135	3.2×1.5×0.9	*	32 kHz — 77.5 kHz
	FC-255	4.9×1.8×0.9	*	32 kHz — 100 kHz
7	MC-146	7.0×1.5×1.4	*	32 kHz — 100 kHz
	MC-156	7.1×3.3×1.5	*	
8	MC-306	8.0×3.8×2.54	*	20 kHz — 120 kHz
	MC-405/406	10.41×4.06×3.6	*	20 kHz — 120 kHz
9	MC-30A	8.0×3.8×2.54	*	20 kHz — 120 kHz
10	C-002RX	Φ2.0		
	C-004R	Φ1.5		●32.768 kHz
	C-005R	Φ1.2		
	C-2-TYPE	Φ2.0	*	20 kHz — 120 kHz
	C-4-TYPE	Φ1.5	*	32 kHz — 120 kHz

►MHz Range Crystal Unit (AT)

Page	Model	External Dimensions (mm) t Max.		Frequency 1 MHz / 10 MHz / 20 MHz / 64 MHz
11	FA-118T	1.6×1.2×0.35		24 MHz — 54 MHz
12	FA-128	2.0×1.6×0.5		16 MHz — 54 MHz
13	FA-20H	2.5×2.0×0.55		12 MHz — 48 MHz
14	FA-238V	3.2×2.5×0.7		12 MHz — 15.999 MHz
	FA-238	3.2×2.5×0.7		16 MHz — 60 MHz
	TSX-3225	3.2×2.5×0.6		16 MHz — 48 MHz
15	MA-306	8.0×3.8×2.54		●14.31818 MHz 17.734 MHz — 41 MHz
16	MA-406	11.7×4.8×3.7		4 MHz — 64 MHz*
	MA-505/506	13.46×5.08×4.6		
17	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	External Dimensions (mm)		Frequency 200 MHz / 500 MHz / 700 MHz / 1 GHz
18	NS-21R	2.5×2.0×0.86		300 MHz — 500 MHz
19	NS-32R	3.8×3.8×0.98		312 MHz — 870 MHz
	FS-335	3.8×3.8×0.98		300 MHz — 870 MHz
	FS-555	4.8×5.2×1.5		230 MHz — 500 MHz
20	FS-585	4.8×5.2×1.5		300 MHz — 500 MHz

kHz RANGE CRYSTAL UNIT
LOW PROFILE SMD

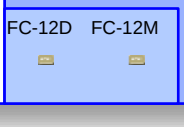
FC - 12D / FC - 12M

- Frequency range : 32.768 kHz (32 kHz to 77.5 kHz)
- External dimensions : 2.05 × 1.25 × 0.35 mm···FC-12D
  : 2.05 × 1.2 × 0.6 mm···FC-12M
- Overtone order : Fundamental
- Applications : Smart card, Small devices···FC-12D
  : Small devices···FC-12M

Pb Free
RoHS Compliant

Product Number (please contact us)
FC-12D: X1A000111xxxx00
FC-12M: X1A0000x1xxxx00

Actual size

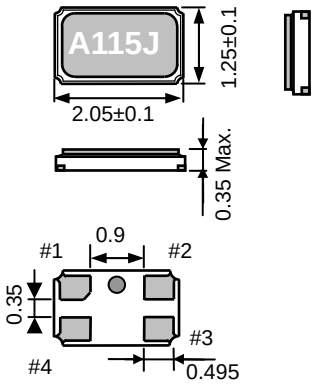


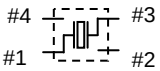
Specifications (characteristics)

Item	Symbol	Specifications			Conditions / Remarks
		FC-12D	FC-12M		
Nominal frequency range	f_nom	32.768 kHz	32.768 kHz	32 kHz to 77.5 kHz	Please contact us for inquiries regarding available frequency.
Storage temperature	T_stg	-55 °C to +125 °C			Store as bare product.
Operating temperature	T_use	-40 °C to +85 °C			
Level of drive	DL	0.25 μW Max.	0.5 μW Max.		
Frequency tolerance (standard)	f_tol	±20 × 10^{-6}	±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	7 pF, 9pF, 12.5pF	12.5pF		Please specify
Motional resistance (ESR)	R_1	75 kΩ Max.	90 kΩ Max.	90 kΩ to 65 kΩ	
Motional capacitance	C_1	3.7 fF Typ.	6.4 fF Typ.	7.0 fF to 2.7 fF	
Shunt capacitance	C_0	0.8 pF Typ.	1.3 pF Typ.	1.6 pF to 0.8pF	
Frequency aging	f_age	±3 × 10^{-6} / year Max.			+25 °C, First year

External dimensions (Unit: mm)

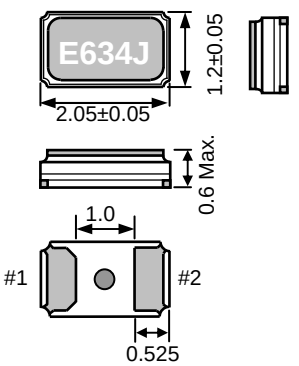
FC-12D



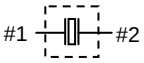


#2 is connected to cover.
Please connect to GND.
Do not connect #4 externally.

FC-12M

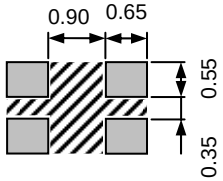


Internal connection
(TOP VIEW)



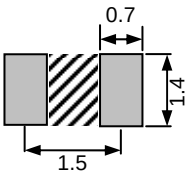
Footprint (Recommended) (Unit: mm)

FC-12D



*Do not design any pattern on shaded area.

FC-12M



*Do not design any pattern on shaded area.

kHz RANGE CRYSTAL UNIT
FOR AUTOMOTIVE APPLICATIONS
LOW PROFILE SMD

FC - 13A

- Frequency range : 32.768 kHz
- External dimensions : 3.2 × 1.5 × 0.9 mm
- Overtone order : Fundamental
- Applications : Accessories and ECU sub clock
- Conforms to AEC-Q200

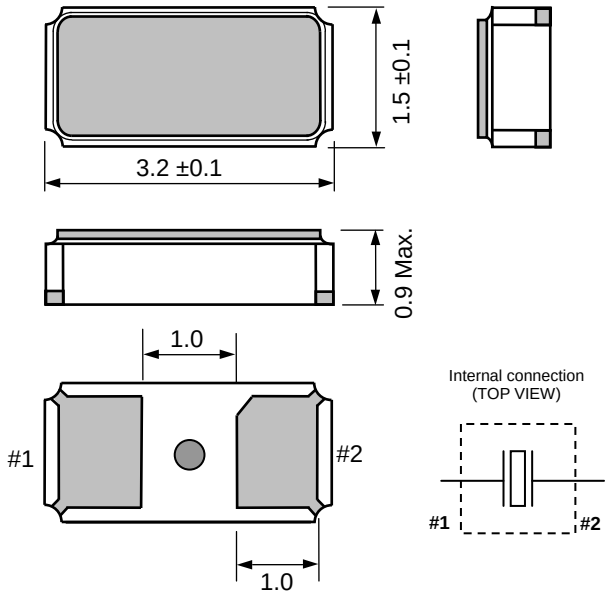
Product Number (please contact us)
X1A000091xxxx00

Actual size

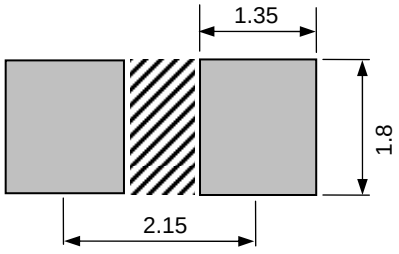
Specifications (characteristics)

Item	Symbol	Specifications	Conditions / Remarks
Nominal frequency range	f_nom	32.768 kHz	
Storage temperature	T_stg	-55 °C to +125 °C	Store as bare product.
Operating temperature	T_use	-40 °C to +125 °C	
Level of drive	DL	0.5 μW (1.0 μW Max.)	Please contact us if you require 1.0μW Max.
Frequency tolerance (standard)	f_tol	±20 × 10^{-6}, ±30 × 10^{-6}, ±50 × 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	C_L	9 pF, 12.5 pF	Please specify
Motional resistance (ESR)	R_1	70 kΩ Max.	
Motional capacitance	C1	3.2 fF Typ.	
Shunt capacitance	C0	0.9 pF Typ.	
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 - 135 / FC - 255

- Frequency range : 32.768 kHz (32 kHz to 100 kHz)
- External dimensions : 3.2 × 1.5 × 0.80 mm ···FC-135
  : 4.9 × 1.8 × 0.80 mm ···FC-255
- Overtone order : Fundamental
- Applications : Small communications devices

RoHS Compliant

Product Number (please contact us)
FC-135 : Q1xFC1350xxxx00
FC-255 : Q1xFC2550xxxx00

Actual size

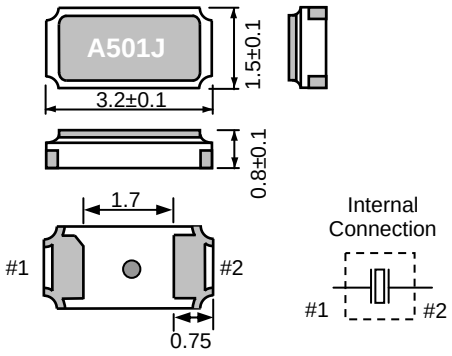
FC-135	FC-255

Specifications (characteristics)

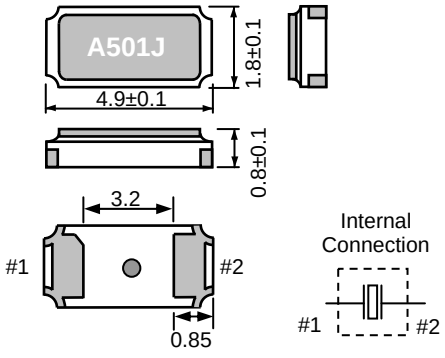
Item	Symbol	Specifications				Conditions / Remarks
		FC-135	FC-135	FC-255	FC-255	
Nominal frequency range	f_nom	32.768 kHz	32 kHz to 77.5 kHz	32.768 kHz	32 kHz to 100 kHz	Please contact us for inquiries regarding available frequencies.
Storage temperature	T_stg	-55 °C to +125 °C				Store as bare product.
Operating temperature	T_use	-40 °C to +85 °C				
Level of drive	DL	0.5 μW (1.0 μW Max.)		0.5 μW Max.		Please contact us if you require 1.0μW Max.
Frequency tolerance (standard)	f_tol	$\pm 20 \times 10^{-6}$				+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		Please specify
Motional resistance (ESR)	R1	70 kΩ Max.	70 kΩ to 45 kΩ	65 kΩ Max.	70 kΩ to 30 kΩ	
Motional capacitance	C1	3.4 fF Typ.	3.7 fF to 1.6 fF	2.0 fF Typ.	2.3 fF to 0.6 fF	
Shunt capacitance	C0	1.0 pF Typ.	1.3 pF to 0.5 pF	1.3 pF Typ.	1.7 pF to 0.9 pF	
Frequency aging	f_age	±3 × 10^{-6} / year Max.				+25 °C, First year

External dimensions (Unit:mm)

FC-135

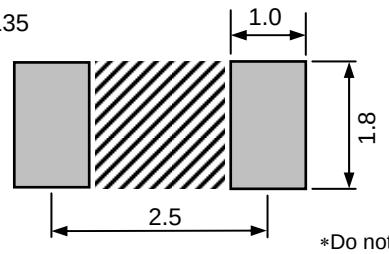


FC-255

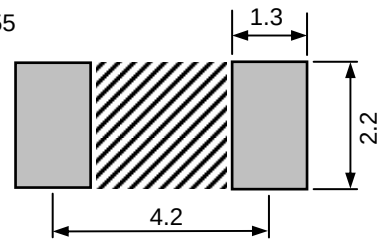


Footprint (Recommended) (Unit:mm)

FC-135



FC-255



∗Do not design any patterns on shaded area.

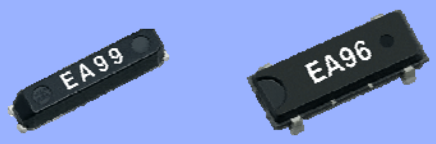
kHz RANGE CRYSTAL UNIT
LOW PROFILE SMD

MC - 146 / MC - 156

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

RoHS Compliant

Product Number (please contact us)
MC-146 : Q1xMC1462xxxx00
MC-156 : Q1xMC1562xxxx00



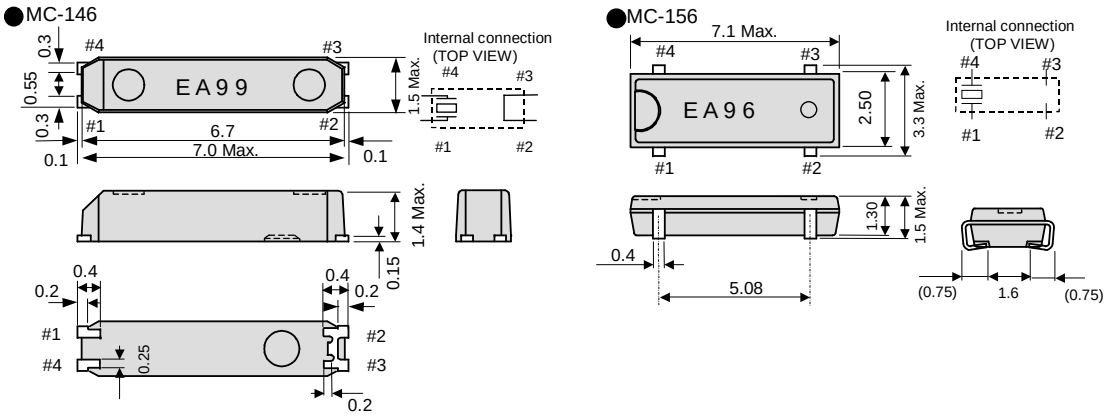
Actual size

MC-146	MC-156
	

Specifications (characteristics)

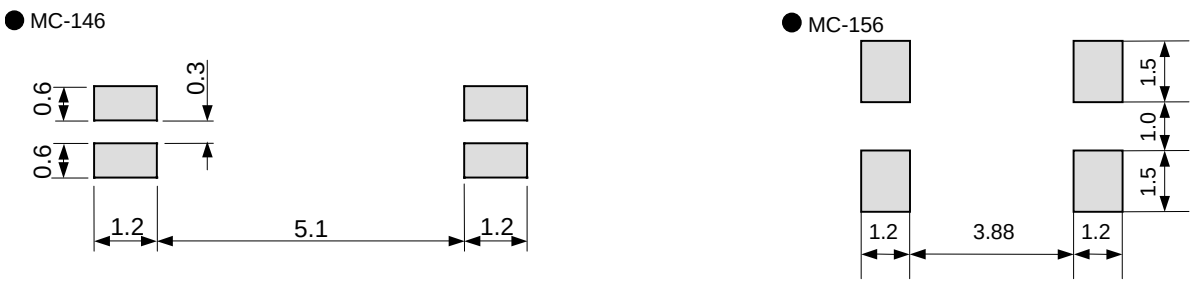
Item	Symbol	Specifications		Conditions / Remarks
Nominal frequency range	f_nom	32.768 kHz	32 kHz to 100 kHz	Please contact us for inquiries regarding available frequencies
Storage temperature	T_stg	-55 °C to +125 °C		Store as bare product.
Operating temperature	T_use	-40 °C to +85 °C		
Level of drive	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)	R1	65 kΩ Max.	65 kΩ to 25 kΩ	
Motional capacitance	C1	1.9 fF Typ.	2.5 fF to 0.6 fF	
Shunt capacitance	C0	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 120 kHz)
- Thickness : 8.0 × 3.8 × 2.54 mm ···MC-306
  10.41 × 4.06 × 3.6 mm ···MC-405 / 406
- Overtone order : Fundamental
- Applications : Clock and Microcomputer

RoHS Compliant

Product Number (please contact us)
MC-306 : Q1xMC3062xxxx00
MC-405 : Q1xMC4052xxxx00
MC-406 : Q1xMC4062xxxx00

Actual size

MC-306	MC-405 / 406
	

Specifications (characteristics)

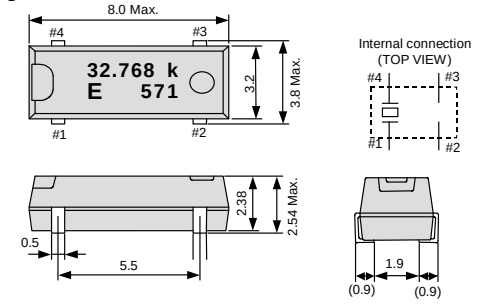
Item	Symbol	Specifications		Conditions / Remarks
Nominal frequency range	f_nom	32.768 kHz	20 kHz to 120 kHz	Please contact us regarding available frequencies
Storage temperature	T_stg	-55 °C to +125 °C		Store as bare product.
Operating temperature	T_use	-40 °C to +85 °C		
Level of drive	DL	1.0 μW Max.		
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} / °C^2 Max.		
Load capacitance	CL	6 pF to ∞ (standard :12.5 pF)		Please specify
Motional resistance (ESR)	R_1	50 kΩ Max.	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≤120 kHz
Motional resistance	55 kΩ Max.	35 kΩ Max.	20 kΩ Max.	12 kΩ Max.

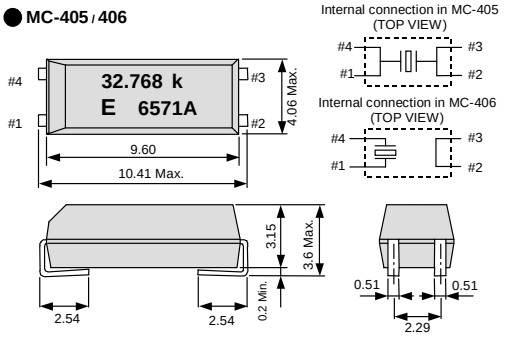
External dimensions (Unit:mm)

MC-306



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.

MC-405 / 406

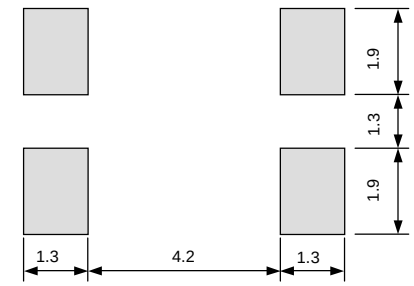


Do not connect #2 and #3 of MC-406 to external device.

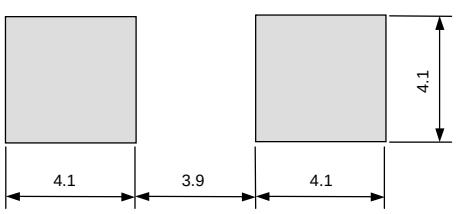
The first digit of No. means: 5×××× MC-405
6×××× MC-406

Footprint (Recommended) (Unit:mm)

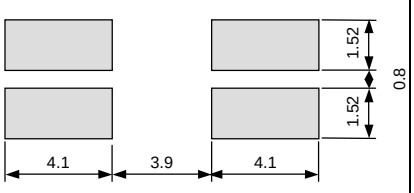
MC-306



MC-405



MC-406



kHz RANGE CRYSTAL UNIT
FOR AUTOMOTIVE APPLICATIONS

MC - 30A

- Frequency range : 32.768 kHz (20 kHz to 120 kHz)
- Thickness : 2.54 mm Max.
- Overtone order : Fundamental
- Applications : Accessories and ECU sub clock
- Conforms to AEC-Q200

Product Number (please contact us)
Q1xMC30A2xxxx00

Actual size

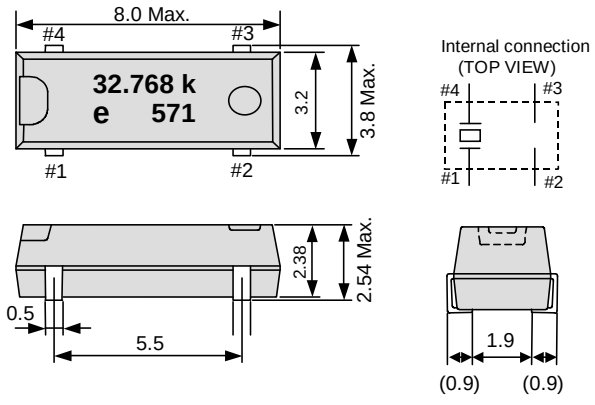
Specifications (characteristics)

Item	Symbol	Specifications		Conditions / Remarks
Nominal frequency range	f_nom	32.768 kHz	20 kHz to 120 kHz	Please contact us regarding available frequencies
Storage temperature	T_stg	-55 °C to +125 °C		Store as bare product.
Operating temperature	T_use	-40 °C to +85 °C		
Level of drive	DL	1.0 μW Max.		
Frequency tolerance (standard)	f_tol	$\pm 20 \times 10^{-6}$, $\pm 50 \times 10^{-6}$	$\pm 50 \times 10^{-6}$, $\pm 100 \times 10^{-6}$	+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 ∞ (standard :12.5 pF)		Please specify
Motional resistance (ESR)	R1	50 kΩ Max.	As per below table	
Motional capacitance	C1	1.8 fF Typ.	4.0 fF to 0.6 fF	
Shunt capacitance	C0	0.9 pF Typ.	2.0 pF to 0.6 pF	
Frequency aging	f_age	$\pm 3 \times 10^{-6}$ / year Max.	$\pm 5 \times 10^{-6}$ / 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≤120 kHz
Motional resistance	55 kΩ Max.	35 kΩ Max.	20 kΩ Max.	12 kΩ Max.

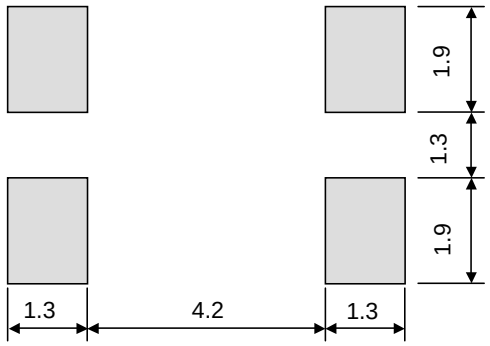
External dimensions (Unit:mm)



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)



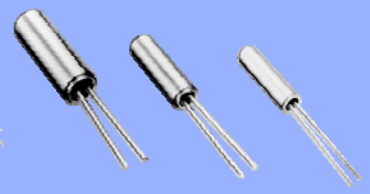
kHz RANGE CRYSTAL UNIT
CYLINDER

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

- Frequency range : 32.768 kHz (20 kHz～120 kHz)
- Thickness : φ1.2 mm ～φ2.0 mm Max.
- Overtone order : Fundamental
- Applications : Clock and Microcomputer

Pb Free
RoHS Compliant

Product Number (please contact us)
C-002RX : Q11C02RX1xxxx00
C-004R : Q11C004R1xxxx00
C-005R : Q11C005R1xxxx00
C-2-TYPE : Q12C20001xxxx00
C-4-TYPE : Q12C40001xxxx00



Actual size

C-002RX

C-002RX
C-2-TYPE

C-004R
C-4-TYPE

C-005R

Specifications for C-TYPE (characteristics)

Item	Symbol	C-002RX	C-004R	C-005R	Conditions / Remarks
Nominal frequency range	f_nom	32.768 kHz			
Storage temperature	T_stg	-20 °C～+70 °C			Store as bare product.
Operating temperature	T_use	-10 °C～+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	Ti	+25 °C ± 5 °C			
Parabolic coefficient	B	−0.04 × 10^{-6} / °C^2 Max.			
Load capacitance	CL	6 pF～ ∞			Please specify
Motional resistance (ESR)	R_1	50, 60 kΩ Max. (30 kΩ Typ.)	50 kΩ Max. (30 kΩ Typ.)	50 kΩ Max. (37 kΩ Typ.)	
Motional capacitance	C_1	2.0 fF	2.0 fF	1.9 fF Typ.	
Shunt capacitance	C_0	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		Conditions / Remarks
		C-2-TYPE	C-4-TYPE	
Nominal frequency range	f_nom	20 kHz～120 kHz	32 kHz～120 kHz	
Storage temperature	T_stg	-20 °C～+70 °C		Store as bare product.
Operating temperature	T_use	-10 °C～+60 °C		
Level of drive	DL	1.0 μW Max.		
Frequency tolerance (standard)	f_tol	±20 × 10^{-6},±50 × 10^{-6},±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～ ∞		Please specify
Motional resistance (ESR)	R_1	As per below table		
Motional capacitance	C_1	4.0 fF～0.6 fF		
Shunt capacitance	C_0	2.0 pF～0.6 pF		
Frequency aging	f_age	±5 × 10^{-6} / year Max.		+25 °C, First year

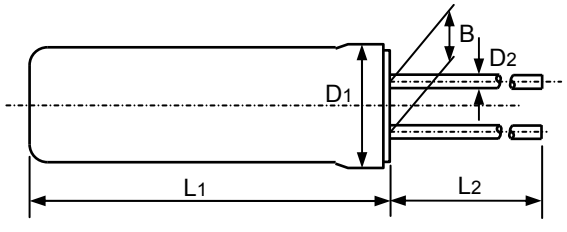
Motional resistance C-2-TYPE

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≦120 kHz
Motional resistance	55 kΩ Max.	35 kΩ Max.	20 kΩ Max.	12 kΩ Max.

Motional resistance C-4-TYPE

Frequency	32 kHz≦f_nom＜38 kHz	38 kHz≦f_nom＜60 kHz	60 kHz≦f_nom＜74 kHz	74 kHz≦f_nom≦100 kHz	100 kHz＜f_nom≦120 kHz
Motional resistance	55 kΩ Max.	30 kΩ Max.	25 kΩ Max.	22 kΩ Max.	15 kΩ Max.

External dimentions



Model	L_1	L_2	D_1	D_2	B
C-002RX C-2-TYPE	6.0 Max.	4.0 Min.	φ 2.0 Max.	φ 0.2	0.7
C-004R C-4-TYPE	5.0 Max.	4.0 Min.	φ 1.5 Max.	φ 0.18	0.5
C-005R	4.6 Max.	4.0 Min.	φ 1.2 Max.	φ 0.15	0.3

MHz RANGE CRYSTAL UNIT
ULTRA MINIATURE SIZE LOW PROFILE SMD

FA - 118T

- •Nominal frequency range : 24 MHz to 54 MHz
- •External dimensions : 1.6 × 1.2 × 0.35 mm (t: Max.)
- •Overtone order : Fundamental
- •Applications : Mobile phone, Bluetooth, W-LAN ISM band radio, Clock for MPU

Pb Free
RoHS Compliant

Product Number (please contact us)
FA-118T : X1E000251xxxx00

Actual size

Specifications (characteristics)

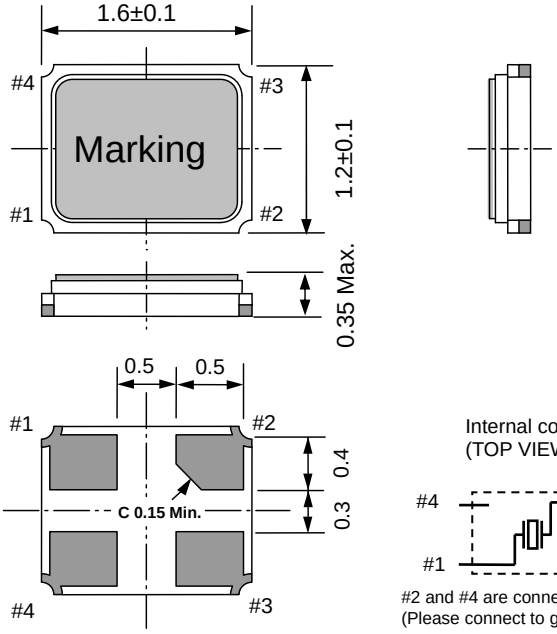
Item	Symbol	Specifications		Conditions / Remarks
		For RF Reference	For Clock	
Nominal frequency range	f_nom	24.000 MHz to 54.000 MHz		Fundamental Please contact us for inquiries regarding the available frequencies.
Storage temperature range	T_stg	-40 °C to +125 °C		Store as bare product.
Operating temperature 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 (standard)	f_tol	$\pm 10 \times 10^{-6}$ *1	$\pm 30 \times 10^{-6}$	+25 °C For the out of standard specifications, please contact us for inquiries.
Frequency versus temperature characteristics (standard)	f_tem	$\pm 12 \times 10^{-6}$ *1	$\pm 30 \times 10^{-6}$	-20 °C to +75 °C For the out of standard specifications, please contact us for inquiries.
Load capacitance	C_L	6 pF to ∞		Please specify.
Motional resistance (ESR)	R_1	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

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

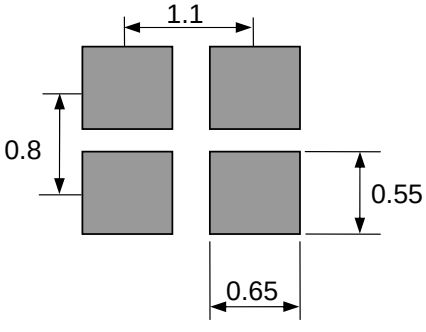
Motional resistance (ESR)

Frequency	Motional resistance
24.0 MHz ≤ f_nom < 32.0 MHz	200 Ω Max.
32.0 MHz ≤ f_nom < 36.0 MHz	100 Ω Max.
36.0 MHz ≤ f_nom ≤ 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 : 16 MHz to 54 MHz
- External dimensions : 2.0 × 1.6 × 0.5 mm
- Overtone order : Fundamental
- Applications : Mobile phone, Bluetooth, W-LAN ISM band radio, Clock for MPU

Pb Free
RoHS Compliant

Product Number (please contact us)
Q22FA1280xxxx00

Actual size

Specifications (characteristics)

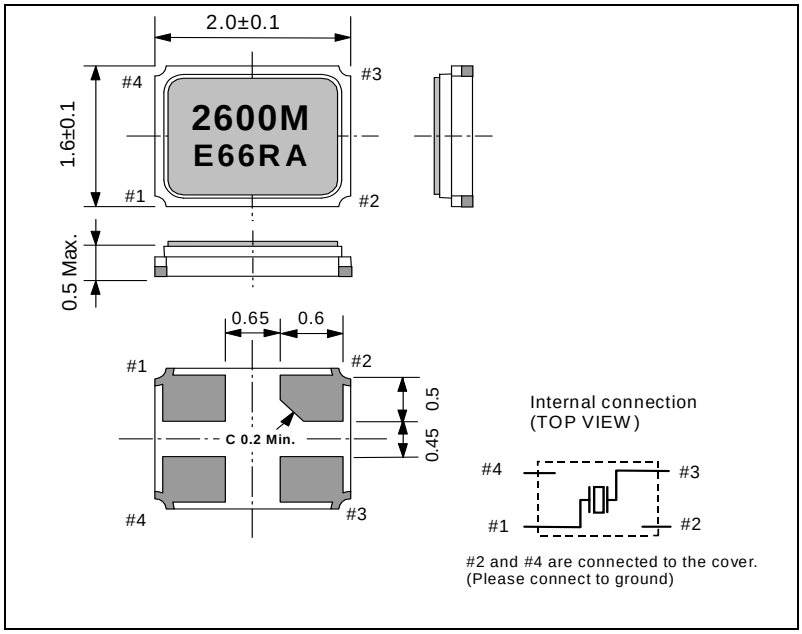
Item	Symbol	Specifications		Conditions / Remarks
		For RF Reference	For Clock	
Nominal frequency range	f_nom	16.000 MHz to 54.000 MHz		Fundamental Please contact us for inquiries regarding the available frequencies.
Storage temperature range	T_stg	-40 °C to +125 °C		Store as bare product.
Operating temperature 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	$\pm 10 \times 10^{-6}$ *1	$\pm 30 \times 10^{-6}$	+25 °C For the out of standard specifications, please contact us for inquiries.
Frequency versus temperature characteristics (standard)	f_tem	$\pm 10 \times 10^{-6}$ *1	$\pm 30 \times 10^{-6}$	-20 °C to +75 °C For the out of standard specifications, please contact us for inquiries.
Load capacitance	C_L	6 pF to ∞		Please specify.
Motional resistance (ESR)	R_1	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

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

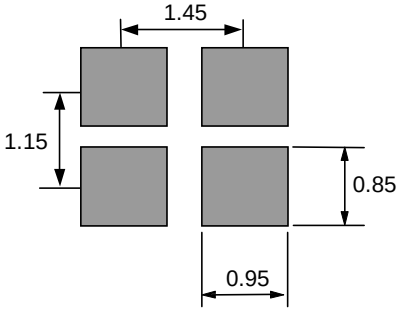
Motional resistance (ESR)

Frequency	Motional resistance
16.0 MHz ≤ f_nom < 18.0 MHz	200 Ω Max.
18.0 MHz ≤ f_nom < 20.0 MHz	150 Ω Max.
20.0 MHz ≤ f_nom < 24.0 MHz	100 Ω Max.
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 mm
- Overtone order : Fundamental
- Applications : Mobile phone, Bluetooth, W-LAN ISM band radio, Clock for MPU

Pb Free
RoHS Compliant

Product Number (please contact us)
Q24FA20H0xxxx00

Actual size

Specifications (characteristics)

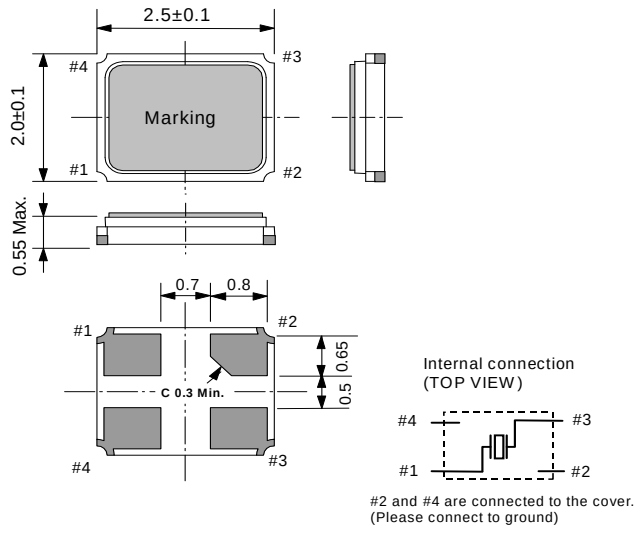
Item	Symbol	Specifications		Conditions / Remarks
		For RF Reference	For Clock	
Nominal frequency range	f_nom	12.000 MHz to 48.000 MHz		Fundamental Please contact us for inquiries regarding the available frequencies.
Storage temperature range	T_stg	-40 °C to +125 °C		Store as bare product.
Operating temperature 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	$\pm10 \times 10^{-6}$ to $\pm30 \times 10^{-6}$ *1	$\pm30 \times 10^{-6}$	+25 °C Please contact us for inquiries.
Frequency versus temperature characteristics	f_tem	$\pm10 \times 10^{-6}$ to $\pm30 \times 10^{-6}$ *1	$\pm30 \times 10^{-6}$	-20 °C to +75 °C 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	$\pm1 \times 10^{-6}$ to $\pm3 \times 10^{-6}$ / year Max. *1		+25 °C, First year

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

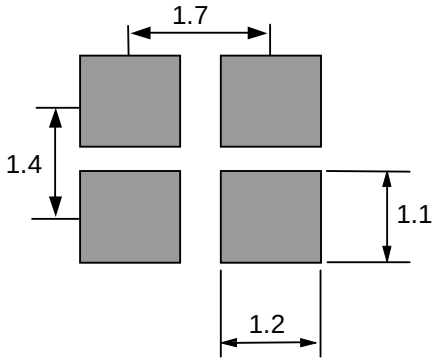
Motional resistance (ESR)

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)



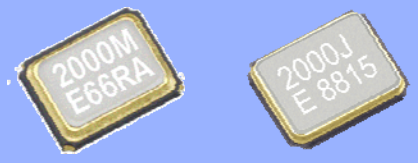
MHz RANGE CRYSTAL UNIT
MINIATURE SIZE LOW PROFILE SMD

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 mm ⋯TSX-3225
  : 3.2 × 2.5 × 0.7 mm ⋯FA-238V / FA-238
- Overtone order : Fundamental
- Applications : Mobile phone, Bluetooth, W-LAN
  ISM band radio, Clock for MPU

Pb Free
RoHS Compliant

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	Conditions / 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.
Storage temperature	T_stg	-40 °C to +125 °C			Store as bare product.
Operating temperature	T_use	-40 °C to +85 °C			
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)	R1	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

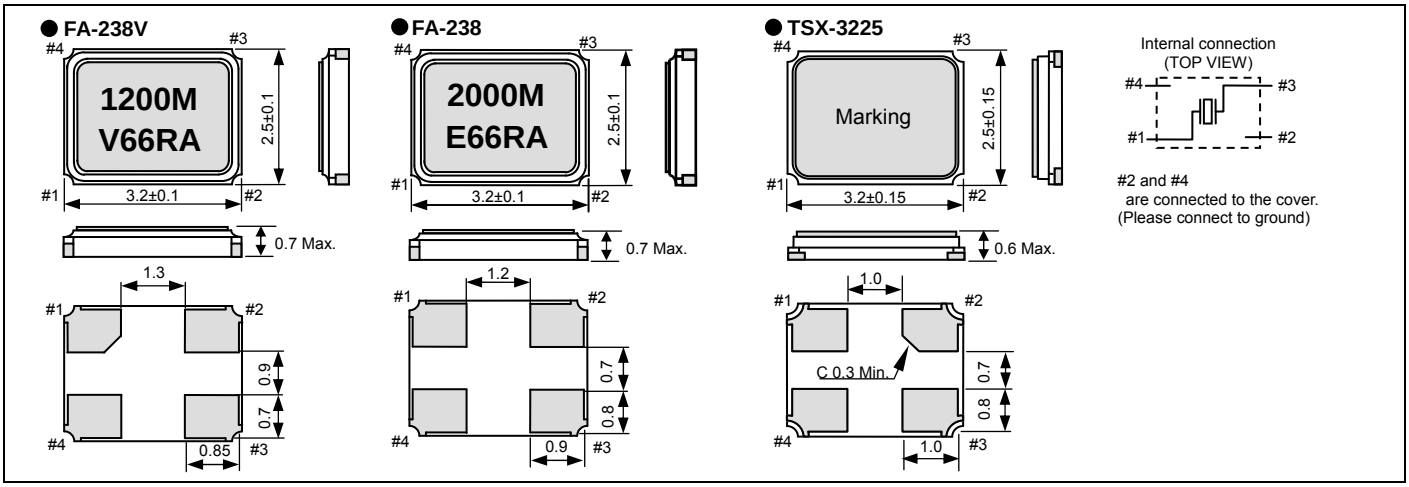
*1 FA-238: For over 40 MHz, only the standard specification applies.
*2 40 MHz ≤ f_nom : ±2 × 10^{-6} / year Max.

Motional resistance (ESR)

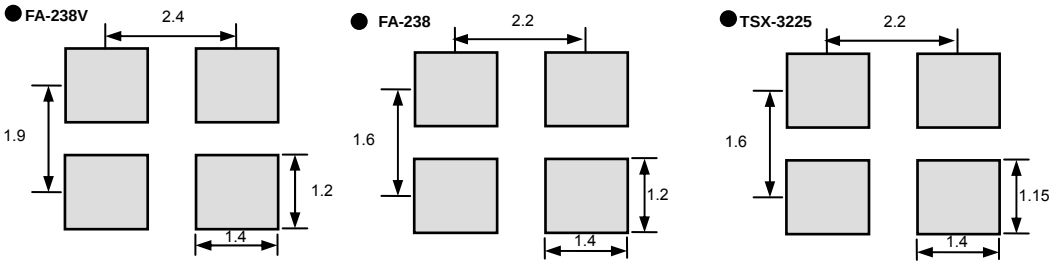
(FA-238V / FA-238) Frequency	Motional resistance
12.0 MHz ≤ f_nom ≤ 13.0 MHz	100 Ω Max.
13.0 MHz < f_nom < 20.0 MHz	80 Ω Max.
20.0 MHz ≤ f_nom < 25.0 MHz	60 Ω Max.
25.0 MHz ≤ f_nom < 30.0 MHz	50 Ω Max.
30.0 MHz ≤ f_nom ≤ 60.0 MHz	40 Ω Max.

(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

MA - 306

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

RoHS Compliant

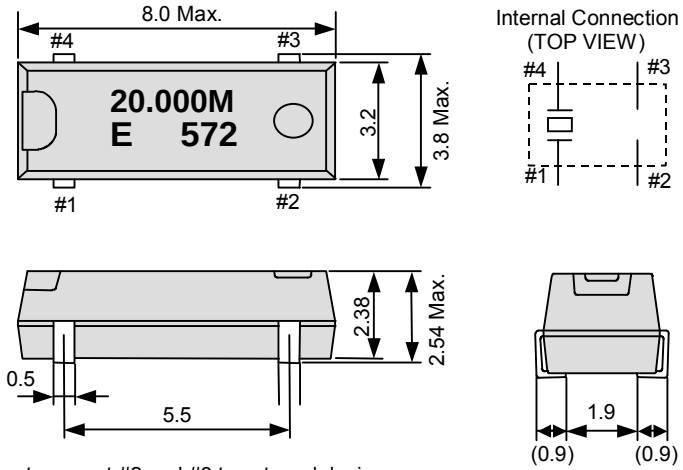
Product Number (please contact us)
Q22MA3062xxxx00

Actual size

Specifications (characteristics)

Item	Symbol	Specifications	Conditions / Remarks
Nominal frequency range	f_nom	14.31818 MHz,17.734 MHz to 41.000 MHz	Fundamental
Storage temperature	T_stg	-55 °C to +100 °C	Store as bare product.
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 inquires
Load capacitance	CL	10 pF to ∞	Please specify
Motional resistance (ESR)	R1	60 Ω Max.	-20 °C to +70 °C, DL=100 μW
Frequency aging	f_age	±5 × 10^{-6} / year Max.	+25 °C, First year

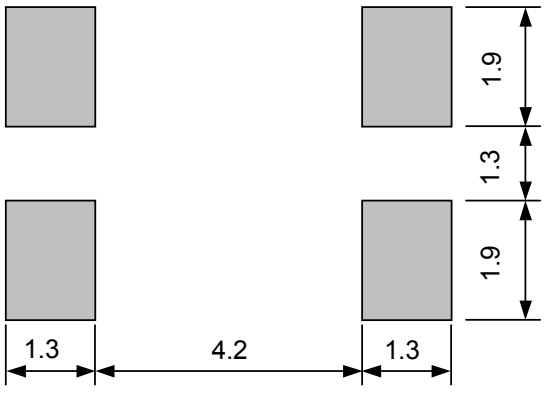
External dimensions (Unit:mm)



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)



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 mm ···MA-406
  13.46 × 5.08 × 4.6 mm ···MA-505 / 506
- •Overtone order : Fundamental
  3rd overtone (30 MHz to 64 MHz)
- •Applications : For Clock of integrated circuit

RoHS Compliant

Product Number (please contact us)
MA-406 : Q22MA4062xxxx00
MA-505 : Q22MA5052xxxx00
MA-506 : Q22MA5062xxxx00

Actual size

MA-406

MA-505 / 506

Specifications (characteristics)

Item	Symbol	Specifications	Conditions / 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
Storage temperature	T_stg	-55 °C to +125 °C	Store as bare product.
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}	+25 °C
Frequency versus temperature characteristics (standard)	f_tem	Under 5.5 MHz :±50 × 10^{-6}	-20 °C to +70 °C
		Over 5.5 MHz :±30 × 10^{-6}	For the out of standard specifications, please contact us for inquires
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 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)

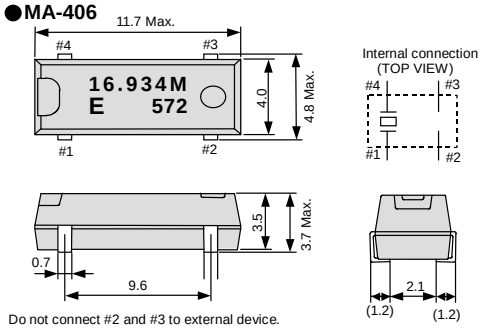
4.000	4.032	4.096	4.190	4.194304	4.433619	4.500	4.800	4.9152

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	

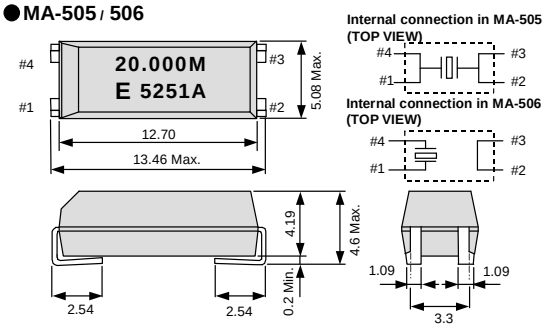
External dimensions (Unit:mm)

●MA-406



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.

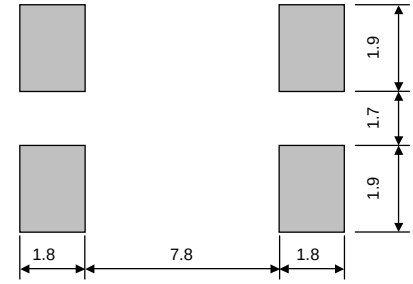
●MA-505 / 506



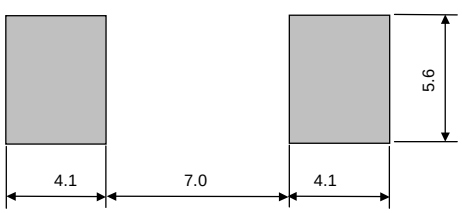
Do not connect #2 and #3 of MA-506 to external device.
The first digit of lot No. means : 5×××× MA-505
6×××× MA-506

Footprint (Recommended) (Unit:mm)

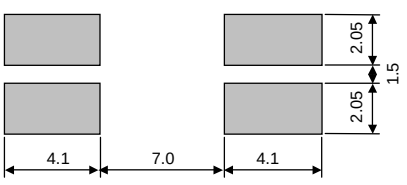
●MA-406



●MA-505



●MA-506



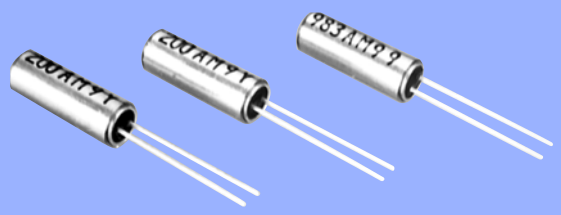
MHz RANGE CRYSTAL UNIT
CYLINDER

CA - 301

- Frequency range : 4 MHz to 64 MHz
- Thickness : ϕ3.1 mm Max.
- Overtone order : Fundamental
  3rd overtone (30 MHz to 64 MHz)
- Applications : For Clock of integrated circuit

Pb Free
RoHS Compliant

Product Number (please contact us)
Q21CA3011xxxx00



Actual size

Specifications (characteristics)

Item	Symbol	Specification	Conditions / 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
Storage temperature	T_stg	-40 °C to +85 °C	Store as bare product.
Operating temperature	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 μW to 100 μW	
Frequency tolerance (standard)	f_tol	±30 × 10^{-6}(Under 5.5 MHz:±50 × 10^{-6}, ±100 × 10^{-6})	+25 °C
Frequency versus temperature characteristics (standard)	f_tem	Under 5.5 MHz: ±50 × 10^{-6}	-10 °C to +60 °C
		Over 5.5 MHz: ±30 × 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 μW
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.

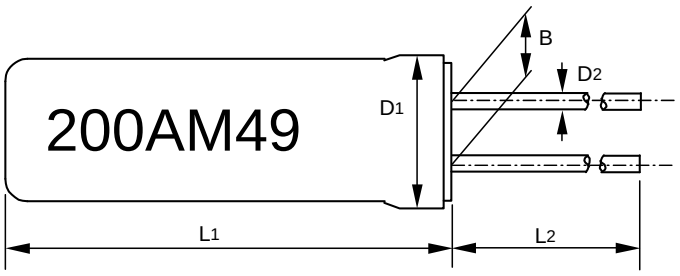
Available frequencies from 4.0 MHz to less than 5.5 MHz (MHz)

4.000	4.032	4.096	4.190	4.194304	4.433619	4.500	4.800	4.9152

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)



Frequency	L_1	L_2	D_1	D_2	B
Under 5.5 MHz	9.3 Max.	9.5 Min.	ϕ 3.1 Max.	ϕ 0.3	1.1
Over 5.5 MHz	8.9 Max.	9.5 Min.	ϕ 3.1 Max.	ϕ 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 mm
- Overtone order : Fundamental
- Applications : RKE (Small wireless equipment)
  (Please contact us for except RKE use.)
- High reliability and excellent temperature characteristic.
- The smallest package size in the world.

For Automotive

Pb Free

RoHS Compliant

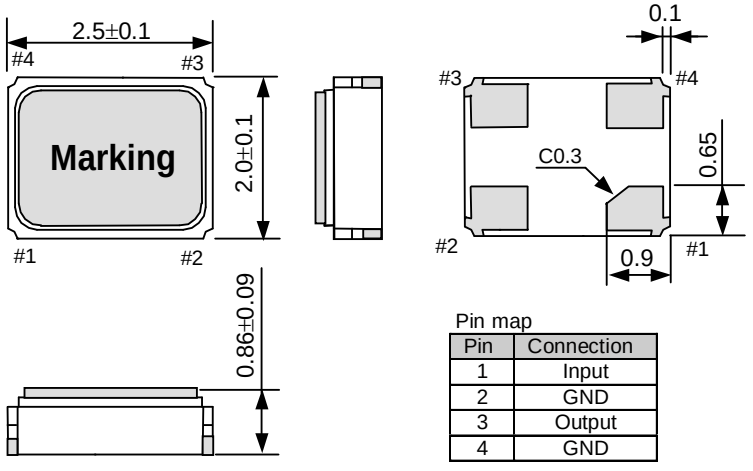
Product Number (please contact us)
Q25NS21Rxxxxx00

Actual size

Specifications (characteristics)

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

External dimensions (Unit:mm)

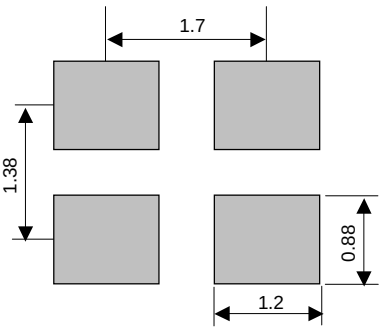


Pin map

Pin	Connection
1	Input
2	GND
3	Output
4	GND

#2,#4 are connected to the cover.

Footprint (Recommended) (Unit:mm)



For Automotive

Pb Free

RoHS Compliant

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

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 mm ···NS-32R / FS-335
  4.8 × 5.2 × 1.5 mm ···FS-555
- Overtone order : Fundamental
- Applications : Small wireless equipment, RFID, Remote Keyless Entry, Short Range Data

Actual size

NS-32R	FS-335	FS-555
		

Specifications (characteristics)

Item	Symbol	Specifications			Conditions / Remarks
		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
Storage temperature	T_stg	-40 °C to +85 °C			Store as bare product.
Operating temperature	T_use	-40 °C to +85 °C			
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	$-(1.6 \pm 0.4) \times 10^{-8}$ / °C^2	$-(3.4 \pm 0.8) \times 10^{-8}$ / °C^2		
Harmonic ratio	Rs/R1	2 Min.			
Motional resistance (ESR)	R1	As per below table			
Frequency aging	f_age	$\pm 10 \times 10^{-6}$ / year Max.			+25 °C
Shock resistance	S.R.	$\pm 10 \times 10^{-6}$ Max.			Nine drops on a concrete surface from 1500 mm

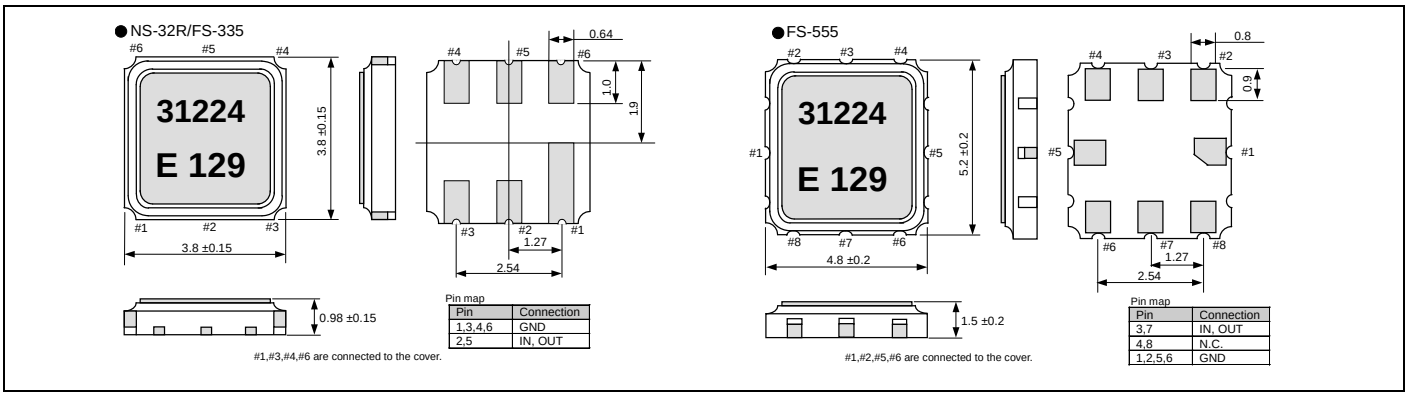
Frequency tolerance / Motional resistance

Model	Item	312 MHz to 500 MHz	500 MHz to 870 MHz
NS-32R	Frequency tolerance (standard)	$\pm 50 \times 10^{-6}$, $\pm 100 \times 10^{-6}$ *1	$\pm 100 \times 10^{-6}$
	Motional resistance (ESR)	30 Ω Max.	

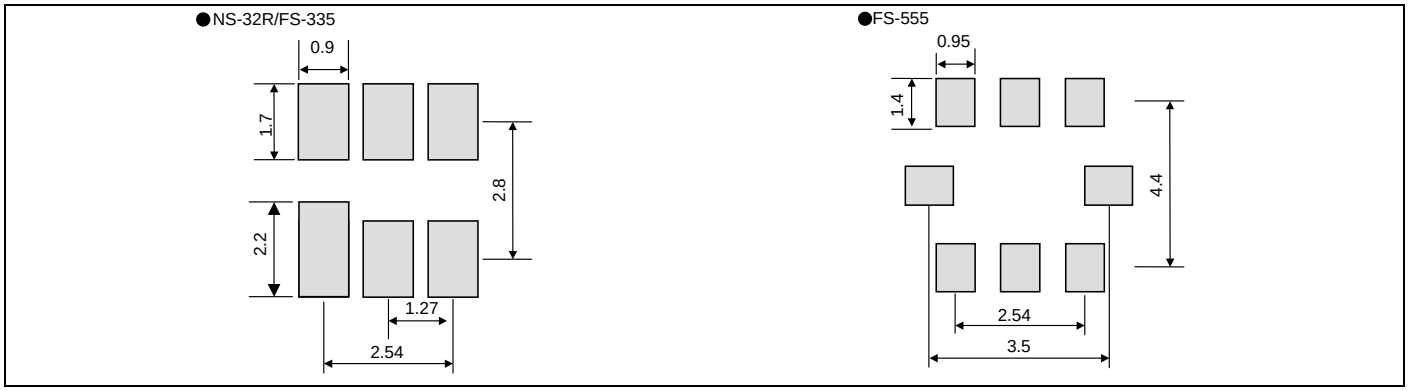
Model	Item	230 MHz to 250 MHz	250 MHz to 300 MHz	300 MHz to 500 MHz	500 MHz to 870 MHz
FS-335	Frequency tolerance (standard)	—	—	$\pm 50 \times 10^{-6}$, $\pm 100 \times 10^{-6}$ *1	$\pm 100 \times 10^{-6}$
	Motional resistance (ESR)	—	—	25 Ω Max.	40 Ω Max.
FS-555	Frequency tolerance (standard)	$\pm 50 \times 10^{-6}$, $\pm 100 \times 10^{-6}$ *1			—
	Motional resistance (ESR)	40 Ω Max.	25 Ω Max.		—

*1 Please contact us regarding frequency tolerance (< $\pm 50 \times 10^{-6}$)

External dimensions (Unit:mm)



Footprint (Recommended) (Unit:mm)



SAW RESONATOR
FOR TPMS

FS - 585

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

For Automotive

Pb Free

RoHS Compliant

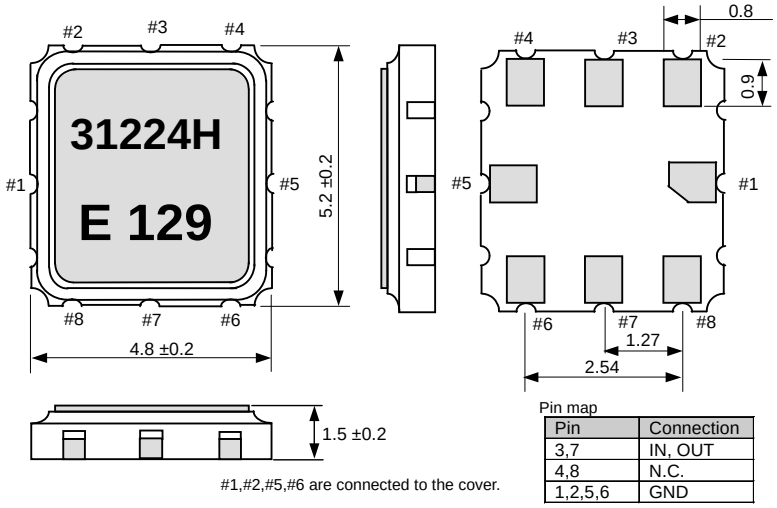
Product Number (please contact us)
Q25FS5850xxxx00

Actual size

Specifications (characteristics)

Item	Symbol	Specifications	Conditions / Remarks
Nominal frequency range	f_nom	300 MHz to 500 MHz	Please contact us for inquiries regarding available frequencies.
Storage temperature	T_stg	-40 °C to +125 °C	Store as bare product.
Operating temperature	T_use	-40 °C to +120 °C	
Level of drive	DL	2 mW Typ.	
Frequency tolerance (standard)	f_tol	±50 × 10^{-6}, ±100 × 10^{-6}	+25 °C
Turnover temperature	Ti	+40 °C ±10 °C	Please contact us for inquires about Peak temperature
Parabolic coefficient	B	-(3.4 $^{+0.8}_{-0.6}$)×10^{-8} / °C^2	
Harmonic ratio	Rs/ R1	2 Min.	
Motional resistance (ESR)	R1	18 Ω Max.	
Frequency aging	f_age	±10 × 10^{-6} / year Max.	+25 °C
Shock resistance	S.R.	±10 × 10^{-6} Max.	Nine drops on a concrete surface from 1500 mm

External dimensions (Unit:mm)

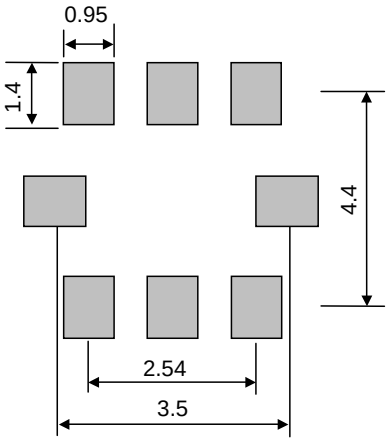


#1,#2,#5,#6 are connected to the cover.

Pin map

Pin	Connection
3,7	IN, OUT
4,8	N.C.
1,2,5,6	GND

Footprint (Recommended) (Unit:mm)



Crystal Oscillator

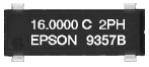
►SPXO

Page	Model		External dimensions (mm)		Frequency (1 Hz / 1 MHz / 50 MHz / 100 MHz / 500 MHz / 800 MHz)
24	SG-3030JC SG-3040JC	CMOS		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.)	
25	SG-211 S*E			2.5×2.0×0.7	2.375 MHz – 60 MHz
26	SG-210 STF		NEW	2.5×2.0×0.8	1 MHz – 60 MHz
27	SG-210 S*B			2.5×2.0×0.8	2 MHz – 60 MHz
28	SG-210 S*D			2.5×2.0×0.8	50 MHz – 80 MHz
29	SG-210 S*H		NEW	2.5×2.0×0.8	80 MHz – 170 MHz
30	SG-310 series			3.2×2.5×1.05	2 MHz – 80 MHz
31	SG-550 series			5.0×3.2×1.2 (t: Max.)	2 MHz – 48 MHz
32	TCO-710x series			5.0×3.2×1.0	1.5 MHz – 75 MHz
33	TCO-708x series			7.0×5.0×1.6	1.5 MHz – 160 MHz
34	HG-2150CA			7.0×5.0×1.4	1 MHz – 60 MHz
35_36	SG-645 series	CMOS LV-TTL		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
37_38	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
39	SG-770 series	Differential LV-PECL		7.0×5.0×1.6	50 MHz – 230 MHz
	SG-771 PCD			7.0×5.0×1.6	50 MHz – 175 MHz

► Programmable

Page	Model		Package type	Frequency (1 Hz / 1 MHz / 50 MHz / 100 MHz / 500 MHz / 800 MHz)
40_41	SG-8003 series (1.8/2.5/3.3 V)	CMOS	NEW CG, CE, LB, JF, CA	1.0 MHz – 166 MHz
42_46	SG-8002 series (3.3 / 5.0 V)		CE, LB, JF, CA, JC, JA, DC, DB	1.0 MHz – 125 MHz

47	SG-8000 series Programming Tool	NEW

Package Type	CG	CE	LB	JF	CA	JC	JA	DC	DB
External dimensions (mm)	2.5×2.0×0.8 (t: Max.)	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
	 NEW								

Crystal Oscillator

►Spread Spectrum

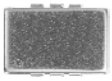
Page	Model		External dimensions (mm)		Frequency (1 Hz / 1 MHz / 50 MHz / 100 MHz / 500 MHz / 800 MHz)
48	SG-9001 LB (3.3 V)	CMOS		5.0×3.2×1.2 (t: Max.)	10 MHz – 135 MHz
	SG-9001 CA (3.3 V)			7.0×5.0×1.4	10 MHz – 166 MHz
	SG-9001 JC (3.3 V)			10.5×5.8×2.7 (t:Max.)	10 MHz – 166 MHz

► Low-jitter SAW

Page	Model		External dimensions (mm)		Frequency (1 Hz / 1 MHz / 50 MHz / 100 MHz / 500 MHz / 800 MHz)
49	XG-1000CA (1.8/2.5/3.3V)	CMOS		7.0×5.0×1.2	50 MHz – 170 MHz
	XG-1000 CB (1.8/2.5/3.3V)	CMOS		5.0×3.2×1.1	50 MHz – 170 MHz
50	EG-2021CA (2.5V)	CMOS		7.0×5.0×1.2	62.5 MHz – 250 MHz
	EG-2001CA (3.3V)	CMOS		7.0×5.0×1.2	106.25 MHz – 170 MHz
51	EG-2002CA (3.3 V)	LV-TTL		7.0×5.0×1.2	62.5 MHz – 170 MHz
52	EG-2121CB (2.5V)	Differential LV-PECL		5.0x3.2x1.4	100 MHz – 700 MHz
		LVDS			
	EG-2102CB (3.3 V)	Differential LV-PECL			
		LVDS			
53	XG-2121CA (2.5V)	Differential LV-PECL		7.0×5.0×1.2	100 MHz – 700 MHz
		LVDS			
	XG-2102CA (3.3 V)	Differential LV-PECL			
		LVDS			
54_55	EG-2121CA (2.5V)	Differential LV-PECL		7.0×5.0×1.2	53.125 MHz – 500 MHz
		LVDS			53.125 MHz – 700 MHz
		HCSL			100 MHz – 350 MHz
	EG-2102CA (3.3V)	Differential LV-PECL		7.0×5.0×1.2	100 MHz – 700 MHz
		LVDS			53.125 MHz – 700 MHz
		HCSL			100 MHz – 350 MHz
56	EG-2101CA (3.3 V)	Differential LV-PECL		7.0×5.0×1.2	62.5 MHz – 99.999 MHz
57_58	EG-4121CA (2.5V)	Differential LV-PECL		7.0×5.0×1.2	100 MHz – 700 MHz
		LVDS			100 MHz – 700 MHz
		HCSL			100 MHz – 350 MHz
	EG-4101CA (3.3V)	Differential LV-PECL		7.0×5.0×1.2	100 MHz – 700 MHz
		LVDS			100 MHz – 700 MHz
		HCSL			100 MHz – 350 MHz
59	EA-2102CB (3.3 V)	Differential LV-PECL		5.0×3.2×1.35	100 MHz

Crystal Oscillator

►VCXO / VCSO

Page	Model	外形寸法 (mm)		Frequency 1 Hz 1 MHz 50 MHz 100 MHz 500 MHz 800 MHz
60	VG-4231CE (1.8 / 2.8 / 3.3 V)		3.2×2.5×1.05	3 MHz – 60 MHz
61	VG-4231CB (3.3 V)		5.0×3.2×1.2	1 MHz – 81 MHz
62	VG-4231CA (3.3 / 5.0 V)		7.0×5.0×1.4	1 MHz – 60 MHz
	VG-4232CA (3.3 V)		7.0×5.0×1.4	60.0001 MHz – 80 MHz
63	VG-4513CA (3.3 V)	 NEW	7.0×5.0×1.6	100 MHz – 500 MHz
64	VG-4501/4502CA (3.3 V)	 NEW	7.0×5.0×1.6	80 MHz – 170 MHz (VG-4501CA) 80 MHz – 125 MHz (VG-4502CA)
65	VG-4512CA (3.3 V)		7.0×5.0×1.6	80 MHz – 200 MHz
66	EV-9100JG (3.3 V)		13.9×9.8×4.7	800 MHz – 2500 MHz

►TCXO

Page	Model	外形寸法 (mm)		Frequency 1 Hz 1 MHz 50 MHz 100 MHz
67	TG-3530SA (1.5 to 5.5 V)		10.1×7.4×3.2	●32.768 kHz
68	TG-5031CJ (1.8 V)		2.0×1.6×0.73	13 MHz – 52 MHz
69	TG-5035CJ (1.8 V)			
70	TG-5021CG (2.8 V)		2.5×2.0×0.8	13 MHz – 52 MHz
71	TG-5035CG (1.8 V)			
72	TG-5021CE (2.8 V)		3.2×2.5×0.9	10 MHz – 40 MHz
73	TG-5035CE (1.8 V)			
74	TG-5500CA	 NEW	7.0×5.0×1.5	12.8 MHz – 40 MHz

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.

RoHS Compliant

Product Number
SG-3030LC : Q3102LC02000100
SG-3030JF : Q3102JF02000100
SG-3030JC : Q3102JC02000100
SG-3040LC : Q3103LC02000100
SG-3040JC : Q3103JC02000100


SG-3030LC
SG-3040LC


SG-3030JF


SG-3030JC
SG-3040JC

Actual size

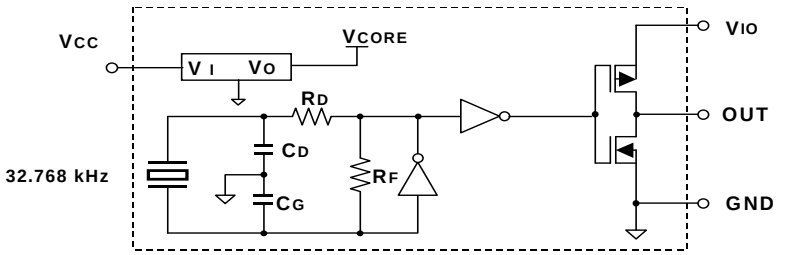
LC Type.	JF Type.	JC Type.
		

Specifications (characteristics)

Item	Symbol	Specifications		Conditions / 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	
Storage temperature	T_stg	-55 °C to +125 °C		Store as bare product .
Operating temperature	T_use	-40 °C to +85 °C		
Frequency tolerance	f_tol	$5 \pm 23 \times 10^{-6}$		+25 °C,V_{CC}=3.3 V (SG-3040: V_{CC}=1.2 V)
Frequency temperature coefficient	fo-Tc	$+10 \times 10^{-6}$ / -120×10^{-6}		-20 °C to +70 °C (+25 °C is reference)
Frequency / voltage coefficient	fo-V_{CC}	$\pm 2 \times 10^{-6}$ / V Max.	$\pm 5 \times 10^{-6}$ / 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)
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)
	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 +25 °C (SG-3030: V_{CC}= 2.0 V to 5.5 V)
Frequency aging	f_aging	$\pm 5 \times 10^{-6}$ / 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.

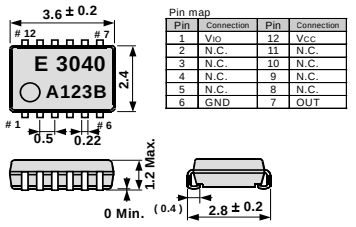
Block diagram



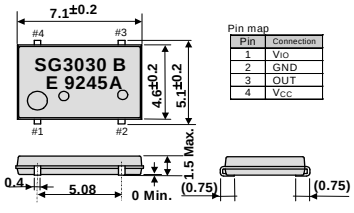
If V_{IO} function is not used, connect #1 to V_{CC}.

External dimension (Unit:mm)

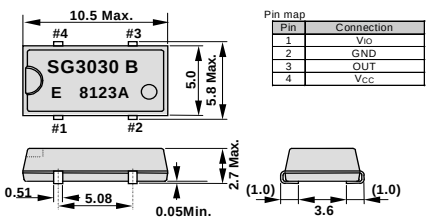
●SG-3030LC/3040LC



●SG-3030JF



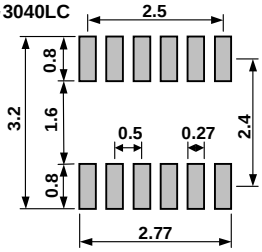
●SG-3030JC/3040JC



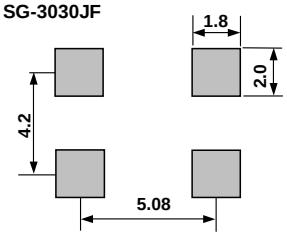
Metal may be exposed on the top or bottom of this product. This will not affect any quality, reliability or electrical spec.

Footprint (Recommended) (Unit:mm)

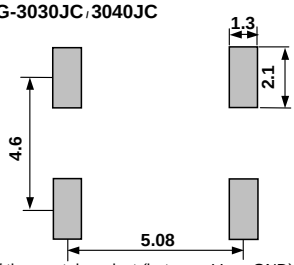
● SG-3030LC/3040LC



● SG-3030JF



●SG-3030JC/3040JC



To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

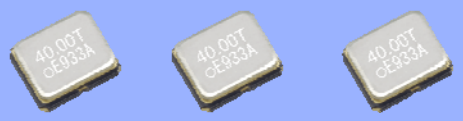
CRYSTAL OSCILLATOR
Low Profile / High stability SPXO

SG - 211 S*E

- Frequency range : 2.375 MHz to 60.000 MHz
- Supply voltage : 1.8 V / 2.5 V / 3.3 V
- Current consumption : 1.2 mA Typ. (SEE: 1.8 V No load condition 40 MHz)
- Function : Standby($\overline{ST}$)
- External dimensions : 2.5 × 2.0 × 0.7 mm

Pb Free RoHS Compliant

Product Number (please contact us)
X1G0036x1xxxx00



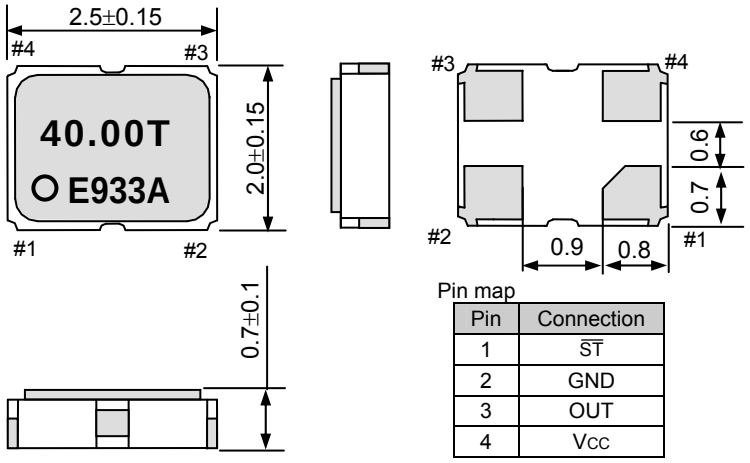
Actual size

Specifications (characteristics)

Item	Symbol	Specifications			Conditions / 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		
Storage temperature	T_stg	-40 °C to +125 °C			Store as bare product.	
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.			$\overline{ST}$ =GND	
Symmetry	SYM	45 % to 55 %			50 % V_{CC} level,L_CMOS ≤ 15 pF	
Output voltage	V_{OH}	90 % V_{CC} Min.			I_{OH}=-4 mA	
	V_{OL}	10 % V_{CC} Max.			I_{OL}= 4 mA	
Output load condition (CMOS)	L_CMOS	15 pF Max.				
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)

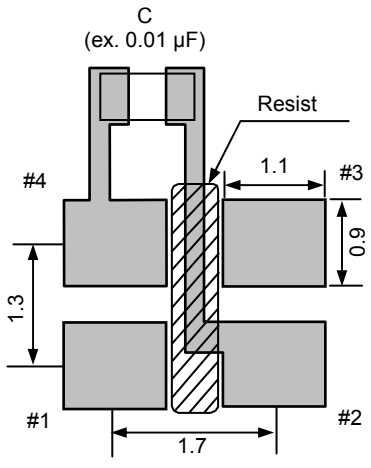


Pin map

Pin	Connection
1	$\overline{ST}$
2	GND
3	OUT
4	V_{CC}

Note.
$\overline{ST}$ pin = HIGH : Specified frequency output.
$\overline{ST}$ pin = LOW : Output is high impedance, oscillation stops.

Footprint (Recommended) (Unit:mm)



To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

NEW

CRYSTAL OSCILLATOR
SPXO

SG-210 STF

- Frequency range : 1 MHz to 60 MHz
- Supply voltage : 1.6 V to 3.6 V
- Function : Standby($\overline{ST}$)
- External dimensions : 2.5 × 2.0 × 0.8 mm
- Operation temperature : -40 to +105 °C

Pb Free RoHS Compliant

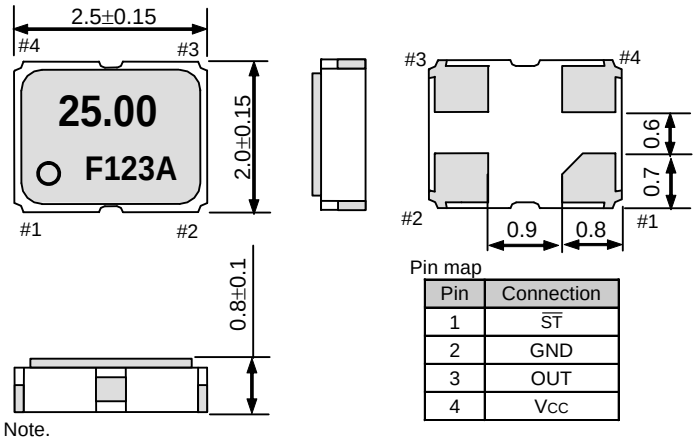
Product Number (please contact us)
X1G004171xxxx00

Actual size

Specifications (characteristics)

Item	Symbol	Specifications			Conditions / Remarks
Output frequency	f_0	Standerd Frequency 1MHz to 60MHz			Please contact us for inquiries regarding available frequencies
Supply voltage	Vcc	1.6V to 3.6V			
		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	
Storage temperature	T_stg	-40 °C to +125 °C			Store as bare product.
Operating temperature	T_use	-40 °C to +85 °C / -40 °C to +105 °C			
Frequency tolerance	f_tol	S: ±25 × 10^{-6}			-20 °C to +70 °C
		L:±50 × 10^{-6}			-40 °C to +85 °C
		Y:±50 × 10^{-6}, W:±100 × 10^{-6}			-40 °C to +105 °C
Current consumption	Icc	1.5 mA Max.	1.6 mA Max.	1.8 mA Max.	No load condition 1MHz<f_0≤20MHz
		1.8 mA Max.	2.0 mA Max.	2.2 mA Max.	No load condition 20MHz<f_0≤40MHz
		2.1 mA Max.	2.4 mA Max.	2.6 mA Max.	No load condition 40MHz<f_0≤60MHz
Stand-by current	I_std	2.1 µA Max.	2.5 µA Max.	2.7 µA Max.	$\overline{ST}$ =GND
Symmetry	SYM	45 % to 55 %			50 % Vcc level L_CMOS ≤ 15 pF
Output voltage	VOH	90% Vcc Min.			
	VOL	10% Vcc Max..			
Output load condition (CMOS)	L_CMOS	15 pF Max.			
Input voltage	VIH	80 % Vcc Min.			$\overline{ST}$ terminal
	VIL	20 % Vcc Max.			
Rise time and Fall time	t_r/ t_f	4 ns Max.	3 ns Max.		20 % Vcc to 80 % Vcc level,L_CMOS=15 pF
Start-up time	t_str	3 ms Max.			t=0 at 90 % Vcc+85°C,(+105 °C.)
Frequency aging	f_aging	±3 × 10^{-6} / year Max.			+25 °C, First year, Vcc=1.8 V, 2.5 V, 3.3 V
SSB Phase noise	C/N	-145 dBc/Hz Typ.			@1kHz ,fo=48MHz
		-158 dBc/Hz Typ.			@100kHz ,fo=48MHz
		-161 dBc/Hz Typ.			@Floor Lv.

External dimensions (Unit:mm)

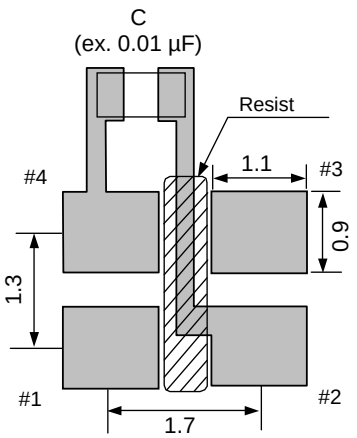


Pin map

Pin	Connection
1	$\overline{ST}$
2	GND
3	OUT
4	Vcc

Note.
$\overline{ST}$ pin = HIGH or "open" : Specified frequency output.
$\overline{ST}$ pin = LOW : Output is high impedance, oscillation stops.

Footprint (Recommended) (Unit:mm)



To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

CRYSTAL OSCILLATOR

SPXO

SG - 210 S*B

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

Pb Free RoHS Compliant

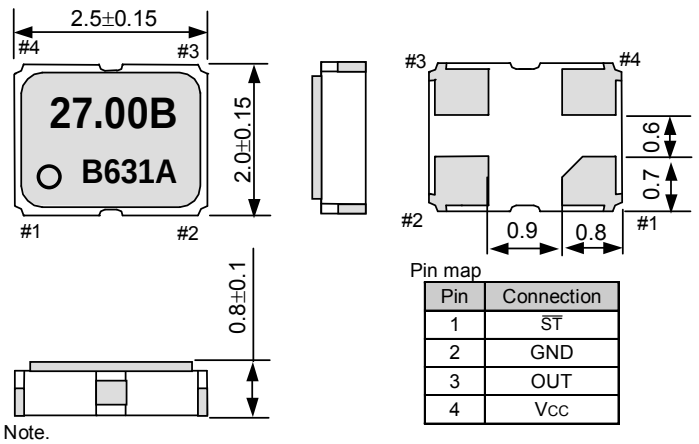
Product Number (please contact us)
Q33210Bx0xxxx00

Actual size

Specifications (characteristics)

Item	Symbol	Specifications				Conditions / 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		
Storage temperature	T_stg	-40 °C to +125 °C				Store as bare product.	
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, $f_0 \leq$ 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.	$\overline{ST}$ =GND	
		–	1.6 µA Max.	2.4 µA Max.	3.0 µA Max.	$\overline{ST}$ =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 %	40 % to 60 %		32 MHz<f_0≤60 MHz	
		–	40 % to 60 %			+105 °C,+125 °C	
Output voltage	V_{OH}	90 % V_{CC} Min.				I_{OH}=-1 mA	
	V_{OL}	10 % V_{CC} Max.				I_{OL}= 1 mA	
Output load condition (CMOS)	L_CMOS	15 pF Max.					
Input voltage	V_{IH}	80 % V_{CC} Min.				$\overline{ST}$ 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)

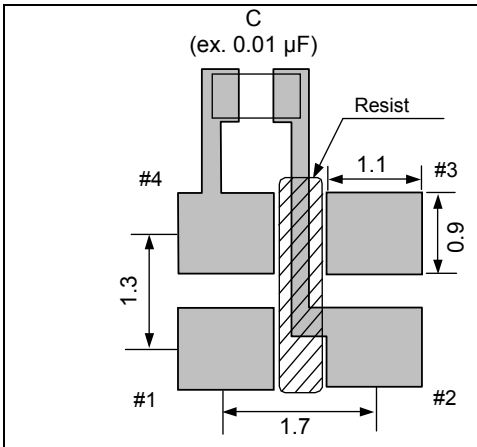


Pin map

Pin	Connection
1	$\overline{ST}$
2	GND
3	OUT
4	V_{CC}

Note.
$\overline{ST}$ pin = HIGH or "open" : Specified frequency output.
$\overline{ST}$ pin = LOW : Output is high impedance, oscillation stops.

Footprint (Recommended) (Unit:mm)



To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

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 / 2.5 V / 3.3 V
- Current consumption : 7.0 mA Max.
  : (SDD: 2.5 V No load condition 80 MHz)
- Function : Standby($\overline{ST}$)
- External dimensions : 2.5 × 2.0 × 0.8 mm

Pb Free RoHS Compliant

Product Number (please contact us)
X1G0029x1xxxx00

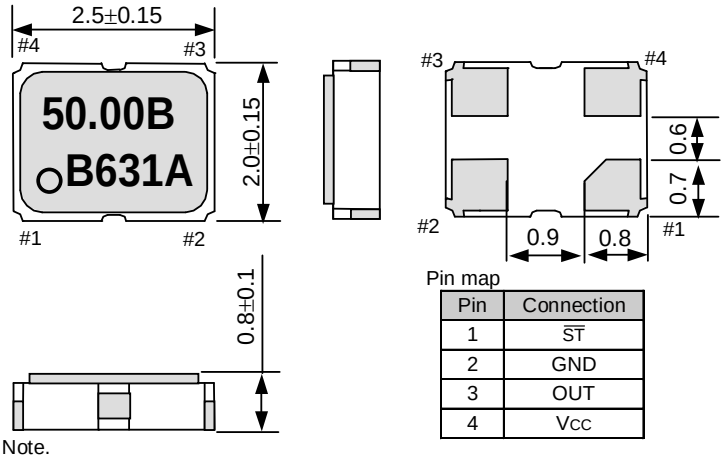
Actual size

Specifications (characteristics)

Item	Symbol	Specifications			Conditions / 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	
Storage temperature	T_stg	-40 °C to +125 °C			Store as bare product.
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.			$\overline{ST}$ =GND
Symmetry	SYM	45 % to 55 %			50 % V_{CC} level,L_CMOS ≤ 30 pF
Output voltage	V_{OH}	V_{CC} -0.4 V Min.			I_{OH}=-8 mA(SCD,SDD), -4 mA(SED)
	V_{OL}	0.4 V Max.			I_{OL}= 8 mA(SCD,SDD), 4 mA(SED)
Output load condition (CMOS)	L_CMOS	30 pF Max.			
Input voltage	V_{IH}	70 % V_{CC} Min.			$\overline{ST}$ 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}	0.1 ps Typ.	0.1 ps Typ.		Deterministic Jitter
	t_{RJ}	3.2 ps Typ.	2.7 ps Typ.		Random Jitter
	t_{RMS}	30 ps Typ.	25 ps Typ.		Peak to Peak L_CMOS ≤ 15 pF
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)

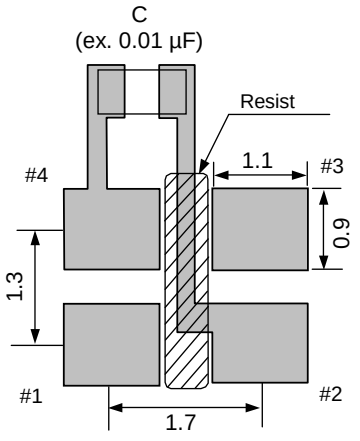


Pin map

Pin	Connection
1	$\overline{ST}$
2	GND
3	OUT
4	V_{CC}

Note.
$\overline{ST}$ pin = HIGH or "open" : Specified frequency output.
$\overline{ST}$ pin = LOW : Output is high impedance, oscillation stops.

Footprint (Recommended) (Unit:mm)



To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

NEW

CRYSTAL OSCILLATOR
LOW-JITTER SPXO

SG - 210 S*H

- Frequency range : 80.000 MHz to 170.000 MHz Fundamental mode oscillator
- Supply voltage : 1.8 V / 2.5 V / 3.3 V
- Output : CMOS
- Function : Standby($\overline{ST}$)
- External dimensions : 2.5 × 2.0 × 0.8 mm

Pb Free RoHS Compliant

Product Number (please contact us)
SG-210SCH: X1G003931xxxx00
SG-210SDH: X1G003941xxxx00
SG-210SEH: X1G003951xxxx00

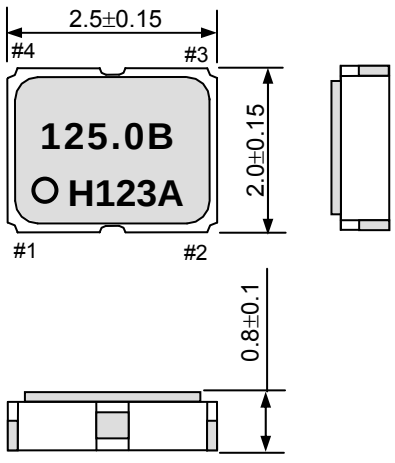
Actual size

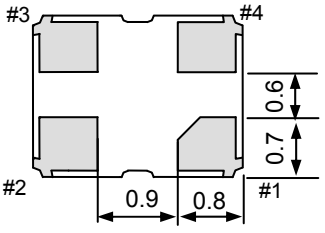
Specifications (characteristics)

Item	Symbol	Specifications			Conditions / Remarks
		SG-210SEH	SG-210SDH	SG-210SCH	
Output frequency range	fo	80.000 MHz to 170.000 MHz			
		100MHz, 106.25MHz, 125MHz, 133.33MHz, 150MHz, 156.25MHz			Standard frequency. *1
Supply voltage	Vcc	1.8 V ± 10%	2.5 V ± 10%	3.3 V ± 10%	*2
Storage temperature	T_stg	-40 °C to +125 °C			Store as bare product.
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	Icc	6.0 mA Max.	7.0 mA Max.	9.0 mA Max.	No load condition,80 MHz≤f0≤125 MHz
		8.0 mA Max.	9.0 mA Max.	11.0 mA Max.	No load condition,125 MHz<f0≤170 MHz
Stand-by current	I_std	10.0 µA Max.			$\overline{ST}$ =GND
Symmetry	SYM	45 % to 55 %			50 % Vcc level, L_CMOS ≤ 15 pF
Output voltage	VOH	90 % Vcc Min.			IOH = -4mA
	VOL	10 % Vcc Max.			IOL = 4mA
Output load condition (CMOS)	L_CMOS	15 pF Max.			
Input voltage	VIH	80 % Vcc Min.			$\overline{ST}$ terminal
	VIL	20 % Vcc Max.			
Rise time / Fall time	tr/ tf	3 ns Max.	2 ns Max.		20 % Vcc to 80 % Vcc level, L_CMOS ≤15 pF
Start-up time	t_str	5 ms Max.			T=0 at 90 % Vcc
Jitter *3	tp-p	22 ps Typ.	20 ps Typ.		Peak to Peak
Phase Jitter	tPJ	0.7 ps Max.	0.6 ps Max.		Offset frequency: 12kHz to 20MHz
Frequency aging	f_aging	±5 × 10^{-6} / year Max.			+25 °C, First year

*1 Please contact us for inquiries regarding non-standard frequencies.
*2 fo ≥ 157MHz: Vcc ± 5%
*3 Based on SIA-3100C signal integrity analyzer made from WAVECREST.

External dimensions (Unit:mm)



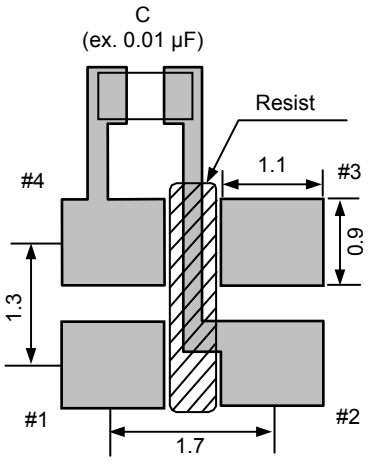


Pin map

Pin	Connection
1	$\overline{ST}$
2	GND
3	OUT
4	Vcc

Note.
$\overline{ST}$ pin = HIGH or "open": Specified frequency output.
$\overline{ST}$ pin = LOW : Output is high impedance, oscillation stops.

Footprint (Recommended) (Unit:mm)



To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

CRYSTAL OSCILLATOR
SPXO

SG-310 series

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

Pb Free RoHS Compliant

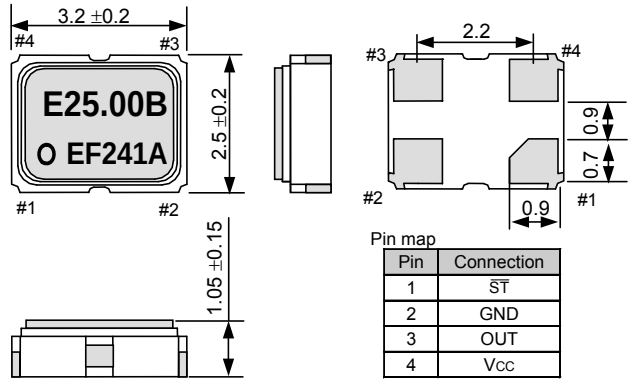
Product Number (please contact us)
Q33310xx0xxxx00

Actual size

Specifications (characteristics)

Item	Symbol	Specifications					Conditions / Remarks	
		SG-310 SEF	SG-310 SDF	SG-310 SCF	SG-310 SDN	SG-310 SCN		
Output frequency range	fo	2.000 MHz to 48.000 MHz			3.000 MHz to 80.000 MHz			
Supply voltage	Vcc	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		
Storage temperature	T_stg	-40 °C to +125 °C					Store as bare product.	
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	
		–			D:±20 × 10^{-6} ,S:±25 × 10^{-6}		-20 °C to +70 °C	
		–			R:±25 × 10^{-6}		-30 °C to +85 °C	
		–			P:±20 × 10^{-6}		-30 °C to +85 °C	
		–			J:±25 × 10^{-6}		-40 °C to +85 °C	
Current consumption	Icc	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≤fo≤ 4 MHz	
		1.5 mA Max.	1.5 mA Max.	2.0 mA Max.			No load condition, 4 MHz<fo≤ 8 MHz	
		1.5 mA Max.	2.0 mA Max.	2.5 mA Max.			No load condition, 8 MHz<fo≤16 MHz	
		2.0 mA Max.	2.0 mA Max.	2.5 mA Max.			No load condition, 16 MHz<fo≤25 MHz	
		2.0 mA Max.	2.5 mA Max.	3.5 mA Max.			No load condition, 25 MHz<fo≤33 MHz	
		3.0 mA Max.	3.5 mA Max.	4.5 mA Max.			No load condition, 33 MHz<fo≤48 MHz	
		–			6.0 mA Max.	7.0 mA Max.	No load condition, 48 MHz<fo≤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.		$\overline{ST}$ =GND	
Symmetry	SYM	45 % to 55 %	45 % to 55 %	45 % to 55 %	45 % to 55 %		2 MHz≤fo≤16 MHz	50 % Vcc level L_CMOS ≤ 15 pF
		40 % to 60 %	40 % to 60 %				16 MHz<fo≤40 MHz	
							40 MHz<fo≤80 MHz	
Output voltage	Voh	90 % Vcc Min.					Ioh=-3 mA	
	Vol	10 % Vcc Max.					Iol= 3 mA	
Output load condition (CMOS)	L_CMOS	15 pF Max.						
Input voltage	Vih	80 % Vcc Min.			70 % Vcc Min.		$\overline{ST}$ terminal	
	Vil	20 % Vcc Max.			30 % Vcc Max.			
Rise time / Fall time	tr/ tf	4 ns Max.					20 % Vcc to 80 % Vcc level, L_CMOS=15 pF	
Start-up time	t_str	10 ms Max.			2 ms Max.		t=0 at 90 % Vcc	
Frequency aging	f_aging	±5 × 10^{-6} / year Max.			±3 × 10^{-6} / year Max.		+25 °C, First year, Vcc=1.8 V, 2.5 V, 3.3 V	
		–			±10 × 10^{-6} Max.		+25 °C, 10 years	

External dimensions (Unit:mm)

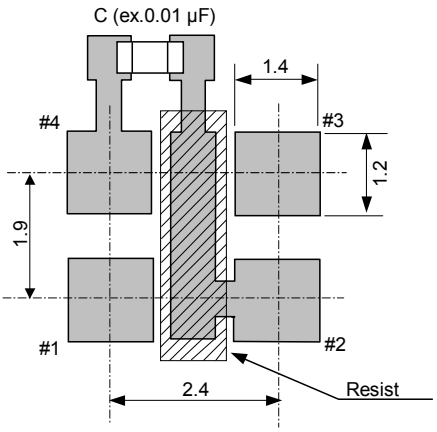


Pin map

Pin	Connection
1	$\overline{ST}$
2	GND
3	OUT
4	Vcc

Note.
$\overline{ST}$ pin = HIGH or "open" : Specified frequency output.
$\overline{ST}$ pin = LOW : Output is high impedance, oscillation stops.

Footprint (Recommended) (Unit:mm)



To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

CRYSTAL OSCILLATOR
SPXO

SG - 550 series

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

Pb Free RoHS Compliant

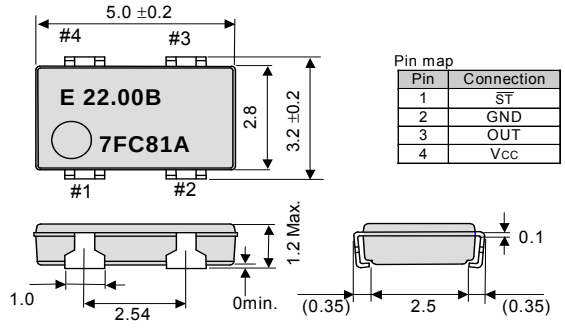
Product Number (please contact us)
Q33550xx0xxxx00

Actual size

Specifications (characteristics)

Item	Symbol	Specifications			Conditions / Remarks	
		SG-550SEF	SG-550SDF	SG-550SCF		
Output frequency range	f_0	2.000 MHz to 48.000 MHz				
Supply voltage	Vcc	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		
Storage temperature	T_stg	-40 °C to +125 °C			Store as bare product.	
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	Vcc ±5 %
Current consumption	Icc	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.	$\overline{ST}$ =GND	
Symmetry	SYM	45 % to 55 %	45 % to 55 %		2 MHz≤f_0≤16 MHz	50 % Vcc level L_CMOS ≤ 15 pF
		40 % to 60 %			16 MHz<f_0≤40 MHz	
			40 % to 60 %		40 MHz<f_0≤48 MHz	
Output voltage	VOH	90 % Vcc Min.			IOH=-3 mA	
	VOL	10 % Vcc Max.			IOL= 3 mA	
Output load condition(CMOS)	L_CMOS	15 pF Max.				
Input voltage	VIH	80 % Vcc Min.			$\overline{ST}$ terminal	
	VIL	20 % Vcc Max.				
Rise time / Fall time	t_r / t_f	4 ns Max.			20 % Vcc to 80 % Vcc level, L_CMOS=15 pF	
Start-up time	t_{sta}	10 ms Max.			t=0 at 90 % Vcc	
Frequency aging	f_aging	±5 × 10^{-6} / year Max.			+25 °C, First year, Vcc=1.8 V, 2.5 V, 3.3 V	

External dimensions (Unit:mm)



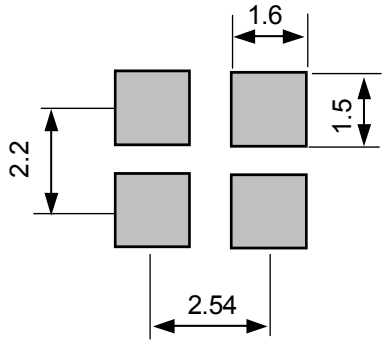
Pin map

Pin	Connection
1	$\overline{ST}$
2	GND
3	OUT
4	Vcc

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 a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

CRYSTAL OSCILLATOR

SPXO

TCO - 710x series

- Frequency range : 1.5 MHz to 75 MHz
- Supply voltage : 2.5 V / 3.3 V
- External dimensions: 5.0 × 3.2 × 1.0 mm
- Function : Standby ($\overline{ST}$)

Pb Free RoHS Compliant

Product Number (please contact us)
X1G00xxx1xxxx00

Actual size

Specifications (characteristics)

Item	Symbol	TCO-710*X3A*	TCO-710*X1A*	Conditions / Remarks
Output frequency range	fo	1.500 MHz to 75.000 MHz		Please contact us for inquiries regarding the available frequencies.
Supply voltage	Vcc	2.5 V ±0.25 V	3.3 V ±0.33 V	
Storage temperature range	T_stg	-55 °C to +125 °C		Store as bare product..
Operating temperature range	T_use	As per below description		
Frequency tolerance	f_tol	As per below description.		
Current consumption	Icc	15 mA Max.	20 mA Max.	No load condition
Symmetry	SYM	40 % to 60 %		50 % Vcc level
Output voltage	VOH	90 % Vcc Min.		
	VOL	10 % Vcc Max.		
Output load condition (CMOS)	L_CMOS	15 pF Max.		
Input voltage	VIH	70 % Vcc Min.		VIH or OPEN : Enable
	VIL	30 % Vcc Max.		VIL or GND : Disable
Rise time / Fall time	tr/ tf	7 ns Max.	6 ns Max.	10 % Vcc to 90 % Vcc 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

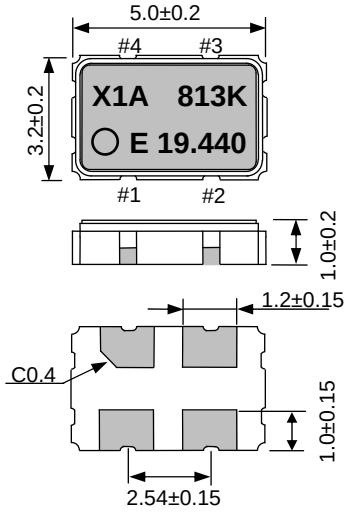
TCO - 7 1 0 _ _ A

<Frequency tolerance / Vcc tolerance>
±50 × 10^{-6} Max. / Vcc ±10 % : 6
±100 × 10^{-6} Max. / Vcc ±10 % : 7

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

< Supply voltage >
X1 : Vcc=3.3 V
X3 : Vcc=2.5 V

External dimensions (Unit:mm)

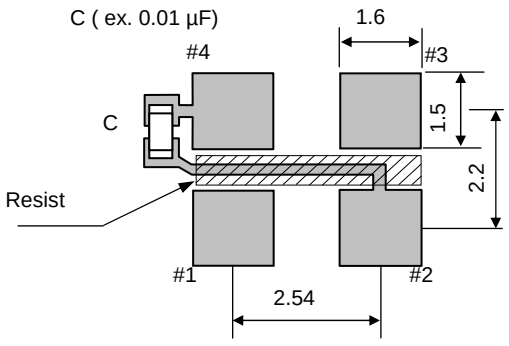


Pin map

Pin	Connection
1	$\overline{ST}$
2	GND
3	OUT
4	Vcc

Note.
$\overline{ST}$ pin = HIGH or "open" : Specified frequency output.
$\overline{ST}$ pin = LOW : Output is high impedance, oscillation stops.

Footprint (Recommended) (Unit:mm)



To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

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 mm
- Function : Standby ($\overline{ST}$)

Pb Free RoHS Compliant

Product Number (please contact us)
X1G0002x1xxxx00

Actual size

Specifications (characteristics)

Item	Symbol	TCO-708*X1A*	TCO-708*D1A*	Conditions / Remarks
Output frequency range	fo	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	Vcc	3.3 V	5.0 V	As per below description
Storage temperature range	T_stg	-55 °C to +125 °C		Store as bare product.
Operating temperature range	T_use	As per below description		
Frequency tolerance	f_tol	As per below description		
Current consumption	Icc	20 mA Max.	20 mA Max.	fo < 30 MHz, No load condition.
			40 mA Max.	30 MHz ≤ fo ≤ 75 MHz, No load condition.
		50 mA Max.	–	75 MHz < fo ≤ 160 MHz, No load condition.
Symmetry	SYM	40 % to 60 %		50 % Vcc level
Output voltage	VOH	90 % Vcc Min.		IOH=-5mA(X1A) / -8mA(D1A)
	VOL	10 % Vcc Max.		IOL=+5mA(X1A) / +8mA(D1A)
Output load condition (CMOS)	L_CMOS	15 pF Max.		
Input voltage	VIH	70 % Vcc Min.		VIH or OPEN : Enable
	VIL	30 % Vcc Max.		VIL or GND : Disable
Rise time / Fall time	tr / tf	6 ns Max.	10 ns Max.	fo ≤ 75 MHz, 10 % Vcc to 90 % Vcc level
		3 ns Max.	–	75 MHz < fo ≤160 MHz, 10 % Vcc to 90 % Vcc 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

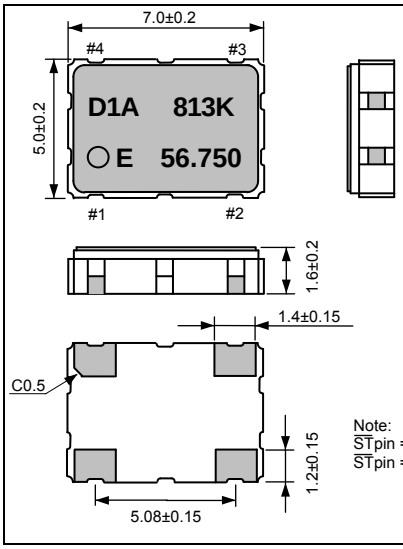
TCO - 7 0 8 ☐ 1 A

<Frequency tolerance / Vcc tolerance>
±25 × 10^{-6} Max. / Vcc ±5 % : 5
±50 × 10^{-6} Max. / Vcc ±10 % : 6
±100 × 10^{-6} Max. / Vcc ±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 : Vcc= 3.3 V / 1.5 MHz to 160 MHz
D : Vcc= 5.0 V / 1.5 MHz to 75 MHz

External dimensions (Unit:mm)

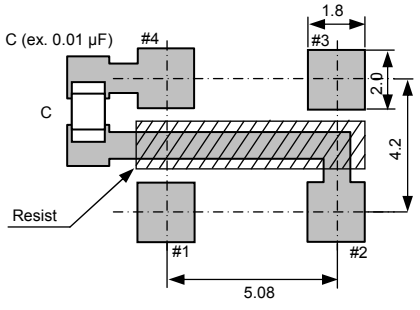


Pin map

Pin	CONNECTION
1	$\overline{ST}$
2	GND
3	OUT
4	Vcc

Note:
$\overline{ST}$pin = HIGH or "Open" : Specified frequency output.
$\overline{ST}$pin = LOW : Output is high impedance, oscillation stop.

Footprint (Recommended) (Unit:mm)



To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

CRYSTAL OSCILLATOR
HIGH-STABILITY

HG - 2150CA series

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

Pb Free RoHS Compliant

Product Number (please contact us)
Q3514CA00xxxx00

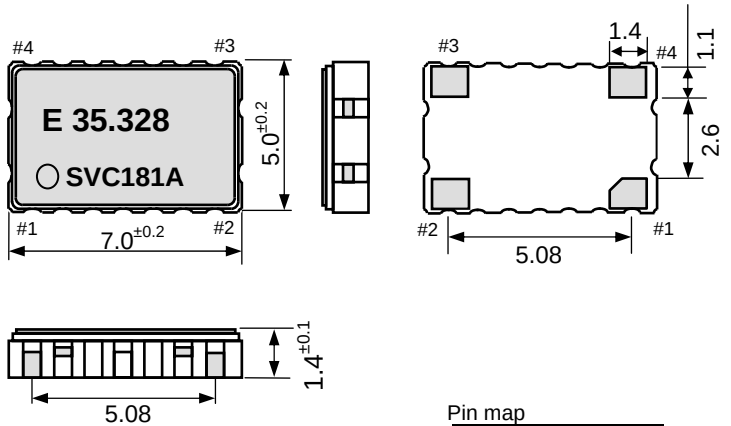
Actual size

Specifications (characteristics)

Item	Symbol	Specifications		Conditions / 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	
Storage temperature	T_stg	-40 °C to +125 °C		Store as bare product.
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
Output voltage	V_{OH}	V_{CC}-0.4 V Min.		I_{OH}=-4 mA
	V_{OL}	0.4 V Max.		I_{OL}= 4 mA
Output load condition	L_CMOS	15 pF Max.		CMOS load
Input voltage	V_{IH}	70 % V_{CC} Min.		OE 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
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_0 ≤ 60 MHz: ±15 × 10^{-6} Max.

External dimensions (Unit:mm)

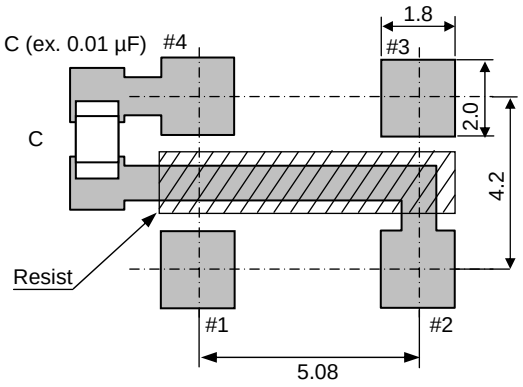


Pin map

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 a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

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 mm (t: Max.)···SG-645
  10.5 × 5.8 × 2.7 mm (t: Max.)···SG-636

RoHS Compliant

Product Number (please contact us)
SG-645 : Q33645xx2xxxx00
SG-636 : Q33636xx2xxxx00

Actual size

SG-645 series

SG-636 series

Specifications (characteristics)

Item	Symbol	Specifications			Conditions / 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	
Storage temperature	T_stg	-55 °C to +100 °C			Store as bare product.
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.	—	$\overline{ST}$ =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
Output voltage	V_{OH}	V_{CC}-0.4 V Min.			I_{OH}=-8 mA(PTF) / -4 mA(SCE,PCE) / -3.2 mA(PDE)
	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.	
Input voltage	V_{IH}	2.0 V Min.	80 % V_{CC} Min.		OE Terminal or $\overline{ST}$ 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			Conditions / 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	
Storage temperature	T_stg	-55 °C to +100 °C			Store as bare product.
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.	$\overline{ST}$ =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
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
	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.			
Input voltage	V_{IH}	2.0 V Min.		70 % V_{CC} Min.	OE Terminal or $\overline{ST}$ Terminal
	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 < fo < 4.4336 MHz, 8.2500 MHz < fo < 8.8672 MHz, 16.500 MHz < fo < 17.7344 MHz : Unavailable

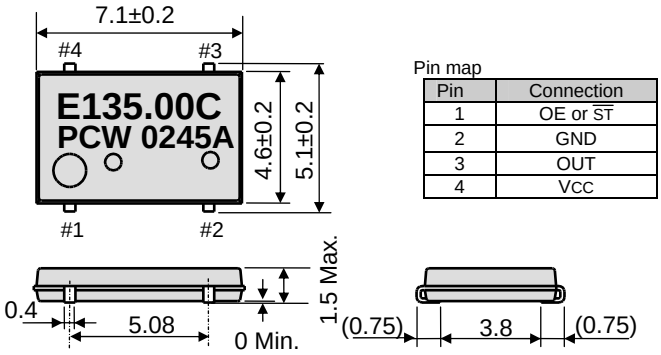
Specifications (characteristics)

Item	Symbol	Specifications			Conditions / 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	Vcc	5.0 V ±0.5 V		3.3 V ±0.3 V	
Storage temperature	T_stg	SG-636***:-55 °C to +100 °C / SG-645***:-55 °C to +125 °C			Store as bare product.
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: ±100 × 10^{-6}	-40 °C to +85 °C : SG-645PCW / SCW Only
Current consumption	Icc	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.			$\overline{ST}$ =GND (STW,SHW,SCW)
Symmetry	SYM	—	40 % to 60 %		50 % Vcc level, L_CMOS=Max.
		40 % to 60 %	—		1.4 V level, L_CMOS=Max.
Output voltage	VOH	Vcc-0.4 V Min.			IOH=-16 mA(PTW , STW , PHW , SHW) /-8 mA(PCW , SCW)
	VOL	0.4 V Max.			IOL= 16 mA(PTW , STW , PHW , SHW) / 8 mA(PCW , SCW)
Output load condition (TTL)	L_TTL	5 TTL Max.	—	—	fo≤ 90 MHz, Max.Supply voltage.
Output load condition (CMOS)	L_CMOS	15 pF Max.			Max.frequency, Max.Supply voltage.
Input voltage	VIH	2.0 V Min.		70 % Vcc Min.	OE Terminal or $\overline{ST}$ Terminal
	VIL	0.8 V Max.		20 % Vcc Max.	
Rise time / Fall time	tr / tf	—	4 ns Max.		20 % Vcc to 80 % Vcc 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, Vcc=5.0 V / 3.3 V, First year

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

External dimensions (Unit:mm)

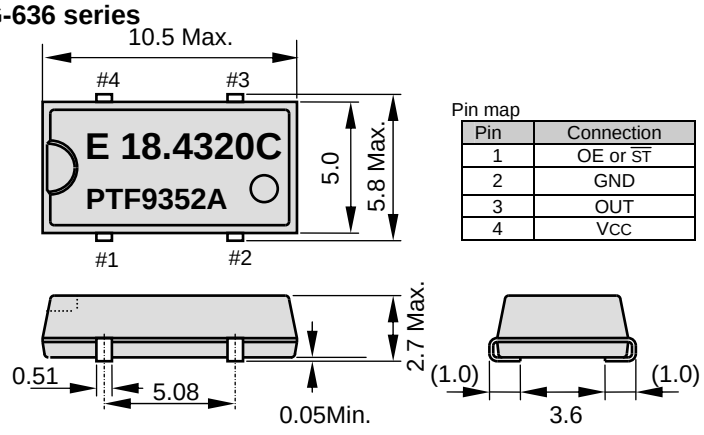
SG-645 series



Pin map

Pin	Connection
1	OE or $\overline{ST}$
2	GND
3	OUT
4	Vcc

SG-636 series



Pin map

Pin	Connection
1	OE or $\overline{ST}$
2	GND
3	OUT
4	Vcc

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

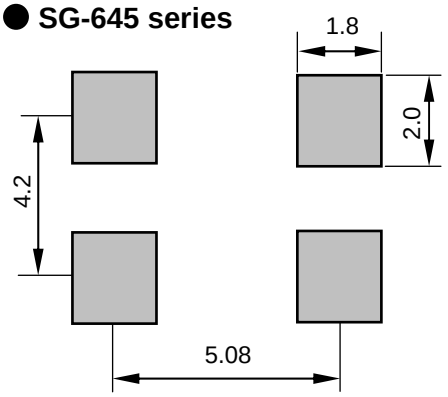
Note.
OE pin (PTF,PCE,PDE,PTW,PHW,PCW,PTG,PHG,PCG)
OE pin = "H" or "open" : Specified frequency output.
OE pin = "L" : Output is high impedance.

$\overline{ST}$ 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.

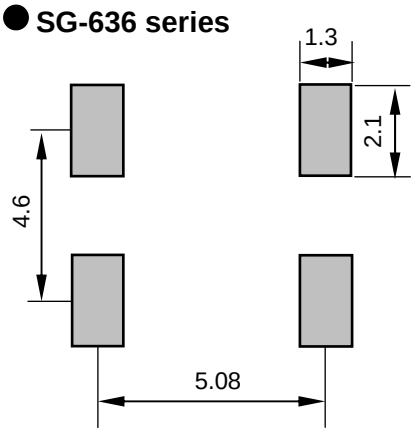
$\overline{ST}$ pin (SCE)
$\overline{ST}$ pin = "H" or "open" : Specified frequency output.
$\overline{ST}$ pin = "L" : Output is low level ,oscillation stops.

Footprint (Recommended) (Unit:mm)

SG-645 series



SG-636 series



To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (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)

RoHS Compliant

Product Number (please contact us)
SG-615 : Q33615xx2xxxx00
SG -531 : Q32531xx2xxxx00
SG -51 : Q32510xx2xxxx00

Actual size

SG-615 SG-531 SG-51

Specifications (characteristics)

Item	Symbol	Specifications		Conditions / 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	Vcc	5.0 V ±0.5 V		
Storage temperature	T_stg	-55 °C to +125 °C		Store as bare product.
Operating temperature	T_use	-20 °C to +70 °C		
Frequency tolerance	f_tol	B: $\pm 50 \times 10^{-6}$, C: $\pm 100 \times 10^{-6}$		-20 °C to +70 °C *1
Current consumption	Icc	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 % Vcc level
		40 % to 60 %	45 % to 55 %	TTL load: 1.4 V level
Output voltage	VOH	Vcc-0.4 V Min.	2.4 V Min.	IOH=-400 µA
	VOL	0.4 V Max.		IOL=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.	—	
Input voltage	VIH	2.0 V Min.	3.5 V Min.	IIH= 1 µA Max. (OE=Vcc)
	VIL	0.8 V Max.	1.5 V Max.	IIL= -100 µA Min. (OE=GND), PTJ:IIL= -500 µA Min.(OE=GND)
Rise time / Fall time	t_r / t_f	8 ns Max.	—	CMOS load:20 % Vcc to 80 % Vcc 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, Vcc=5.0 V, First year

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

Specifications (characteristics)

Item	Symbol	Specifications			Conditions / 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	Vcc	2.7 V to 3.6 V		3.0 V to 3.6 V	
Storage temperature	T_stg	-55 °C to +125 °C			Store as bare product.
Operating temperature	T_use	-40 °C to +85 °C			
Frequency tolerance	f_tol	B: $\pm 50 \times 10^{-6}$ C: $\pm 100 \times 10^{-6}$			-20 °C to +70 °C
		M: $\pm 100 \times 10^{-6}$			-40 °C to +85 °C
Current consumption	Icc	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.	—	$\overline{ST}$ =GND (SCG)
Symmetry	SYM	45 % to 55 %			50 % Vcc level, L_CMOS=Max.
Output voltage	VOH	Vcc-0.4 V Min.		Vcc-0.4 V Min.	IOH=-8 mA
	VOL	0.4 V Max.		0.4 V Max.	IOL= 8 mA
Output load condition	L_CMOS	25 pF Max.		15 pF Max.	
Input voltage	VIH	70 % Vcc Min.		70 % Vcc Min.	OE Terminal or $\overline{ST}$ Terminal
	VIL	20 % Vcc Max.		30 % Vcc Max.	
Rise time / Fall time	t_r / t_f	4 ns Max.			20 % Vcc to 80 % Vcc level, L_CMOS ≤ Max.
Start-up time	t_str	12 ms Max.		10 ms Max.	t=0 at 90% Vcc
Frequency aging	f_aging	±5 × 10^{-6} / year Max.			+25 °C, Vcc=3.3 V, First year

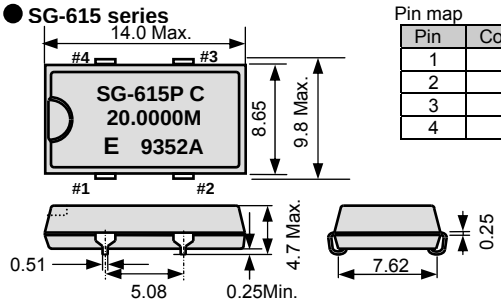
Specifications (characteristics)

Item	Symbol	Specifications			Conditions / 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	
Storage temperature	T_stg	-55 °C to +125 °C			Store as bare product.
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 *1
		—		M: ±100 × 10^{-6}	-40 °C to +85 °C
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.			$\overline{ST}$ =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.
Output voltage	V_{OH}	V_{CC}-0.4 V Min.			I_{OH}=-16 mA(PTW,STW,PHW,SHW),-8 mA(PCW,SCW)
	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
Input voltage	V_{IH}	2.0 V Min.		70 % V_{CC} Min.	OE Terminal or $\overline{ST}$ 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 "C" tolerance : fo ≥66.667 MHz(PTW,STW,PHW,SHW)

External dimensions (Unit:mm)

● SG-615 series

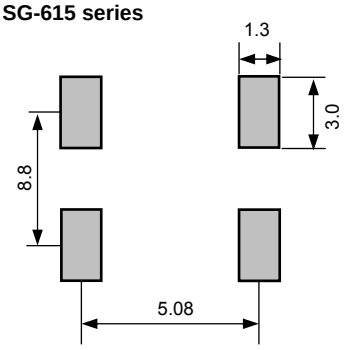


Pin map

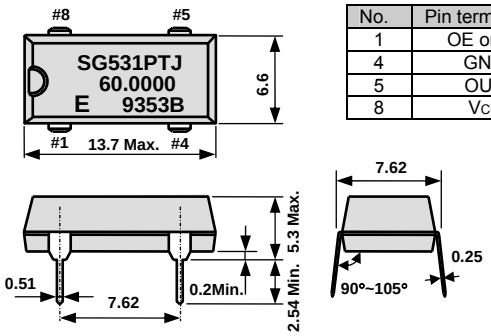
Pin	Connection
1	OE or $\overline{ST}$
2	GND
3	OUT
4	V_{CC}

Footprint (Recommended) (Unit:mm)

● SG-615 series

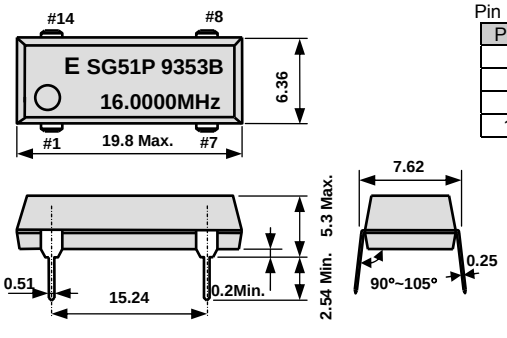


● SG-531 series



No.	Pin terminal
1	OE or $\overline{ST}$
4	GND
5	OUT
8	V_{CC}

● SG-51 series



Pin map

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

To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

CRYSTAL OSCILLATOR

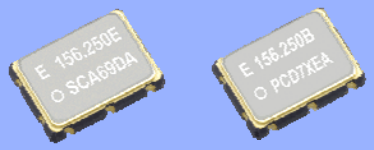
SPXO

SG-770 / SG-771 series

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

Pb Free RoHS Compliant

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



Actual size

Specifications (characteristics)

Item	Symbol	Specifications			Conditions / 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	T_stg	-55 °C to +125 °C			Store as bare product.
Operating temperature	T_use	As per below table			
Frequency tolerance	f_tol	±50 × 10^{-6} Max.		As per below table	
Current consumption	I_{CC}	90 mA Max.		70 mA Max.	50Ω
Symmetry	SYM	45 % to 55 %		40 % to 60 %	at outputs crossing point
Output voltage	V_{OH}	V_{CC}-1.1 V Min.			
	V_{OL}	V_{CC}-1.5 V Max.			
Output load condition (ECL)	L_ECL	LV-PECL			
Input voltage	V_{IH}	70 % V_{CC} Min.			$\overline{ST}$ 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.

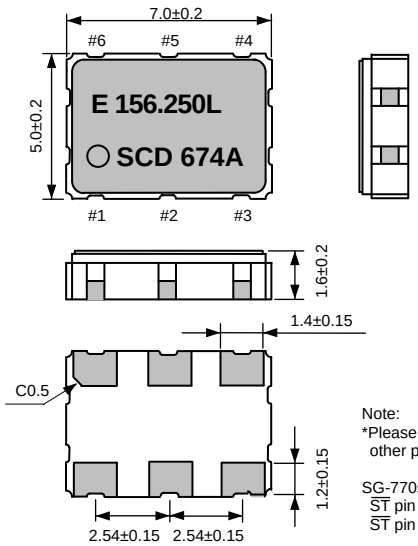
*1 Rise time (0 V to 2.13 V or 3.15 V) of V_{CC} > 150 µs

Operating temperature range / Frequency tolerance

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	±30 × 10^{-6} Max.	-40 °C to +85 °C	10 years
B	±35 × 10^{-6} Max.	-40 °C to +85 °C	20 years
C	±20 × 10^{-6} Max.	-10 °C to +70 °C	10 years
D	±25 × 10^{-6} Max.	-10 °C to +70 °C	20 years

External dimensions (Unit:mm)



Pin map

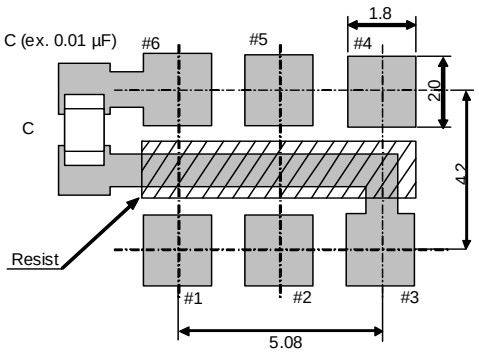
Pin	CONNECTION
1	$\overline{ST}$ or OE
2	DNC
3	GND
4	OUT1(Positive)
5	OUT2(Negative)
6	V_{CC}

Note:
*Please do not connect DNC pin (2 pin) to the other patterns on the board such as Supply voltage or GND.

SG-770series
$\overline{ST}$ pin = HIGH or "Open" : Specified frequency output.
$\overline{ST}$ pin = LOW : Output is high impedance, oscillation stop.

SG-711series
OE pin = HIGH or "Open" : Specified frequency output.
OE pin = LOW : Output is high impedance

Footprint (Recommended) (Unit:mm)



To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

NEW

CRYSTAL OSCILLATOR
PROGRAMMABLE

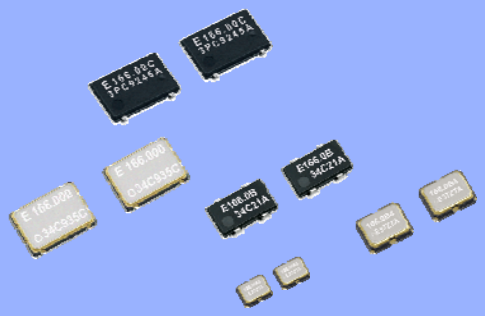
SG - 8003 series

- Frequency range : 1 MHz to 166 MHz
- Supply voltage : 1.8 V / 2.5 V / 3.0 V / 3.3V
- 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.

Pb Free RoHS Compliant

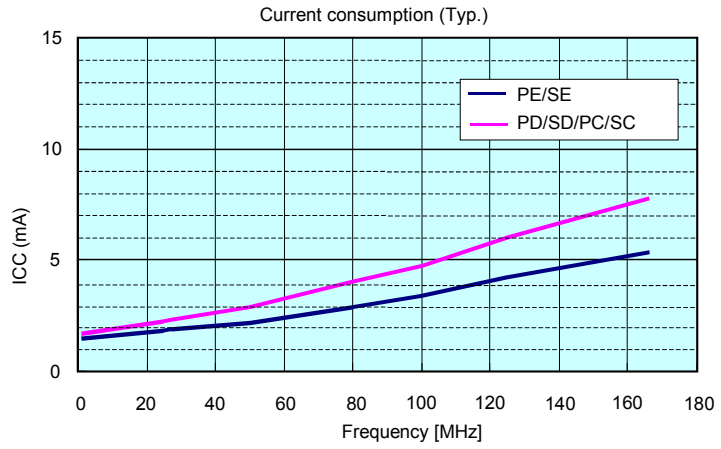
Product Number (please contact us)
X1G003xx2xxxx00



Specifications (characteristics)

Item	Symbol	Specifications			Remarks
		PE / SE	PD / SD	PC / SC	
Output frequency range	f_0	1 MHz to 166 MHz			
Supply voltage	Vcc	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	
Storage temperature	T_stg	-40 °C to +85 °C			Store as bare product.
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	Icc	3.5 mA Max.	4.0 mA Max.		No load condition, 1 MHz≦f0≦25 MHz
		5.0 mA Max.	6.5 mA Max.		No load condition, 25 MHz<f0≦50 MHz
		6.0 mA Max.	8.5 mA Max.		No load condition, 50 MHz<f0≦75 MHz
		7.0 mA Max.	10.5 mA Max.		No load condition, 75 MHz<f0≦100 MHz
		8.5 mA Max.	12.5 mA Max.		No load condition, 100 MHz<f0≦125 MHz
		10.0 mA Max.	15.0 mA Max.		No load condition, 125 MHz<f0≦166 MHz
Output disable current	I_dis	8 mA Max.			OE=GND (PE,PD,PC)
Stand-by current	I_std	50 µA Max.			$\overline{ST}$ =GND (SE,SD,SC)
Symmetry	SYM	45 % to 55 %			50 % Vcc level, L_CMOS ≤ 15 pF
Output voltage	VOH	90 % Vcc Min.		Vcc -0.4 V Min.	IOH=-4 mA(PD,SD,PE,SE), -8.0 mA(PC,SC)
	VOL	10 % Vcc Max.		0.4 V Max.	IOL= 4 mA(PD,SD,PE,SE), 8.0 mA(PC,SC)
Output load condition (CMOS)	L_CMOS	15 pF Max.			
Input voltage	VIH	80 % Vcc Min.			OE terminal or $\overline{ST}$ terminal
	VIL	20 % Vcc Max.			
Rise and Fall time	t_r/ t_f	5.0 ns Max.			1 MHz≦f0<80 MHz, 20 % Vcc to 80 % Vcc level, L_CMOS=15 pF
		2.5 ns Max.			80 MHz≦f0≦166 MHz
Start-up time	t_str	5 ms Max.			t=0 at 90 % Vcc
Frequency aging	f_aging	±3 × 10^{-6} / year Max.			+25 °C, First year, Vcc=1.8 V, 2.5 V, 3.3 V

Current consumption

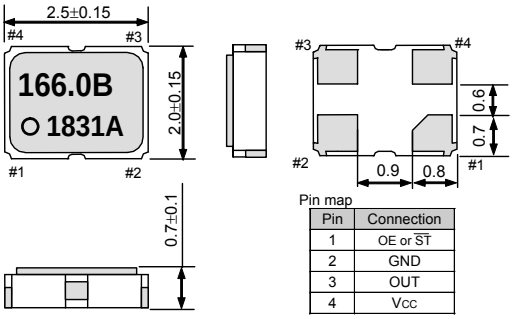


External dimensions (Unit:mm)

SG-8003CG

NEW

Actual size

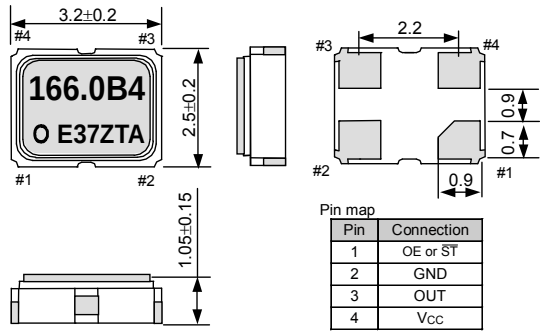


Pin map

Pin	Connection
1	OE or $\overline{ST}$
2	GND
3	OUT
4	Vcc

SG-8003CE

Actual size

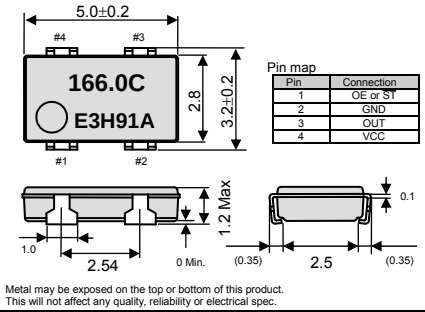


Pin map

Pin	Connection
1	OE or $\overline{ST}$
2	GND
3	OUT
4	Vcc

SG-8003LB

Actual size



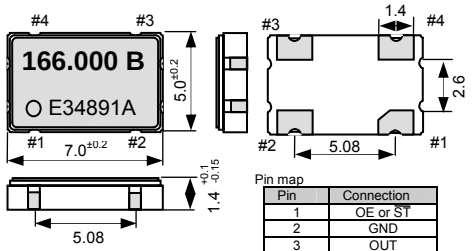
Pin map

Pin	Connection
1	OE or $\overline{ST}$
2	GND
3	OUT
4	VCC

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

SG-8003CA

Actual size

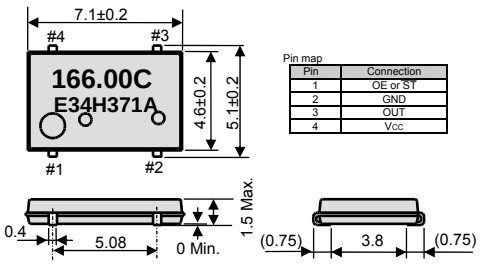


Pin map

Pin	Connection
1	OE or $\overline{ST}$
2	GND
3	OUT
4	Vcc

SG-8003JF

Actual size

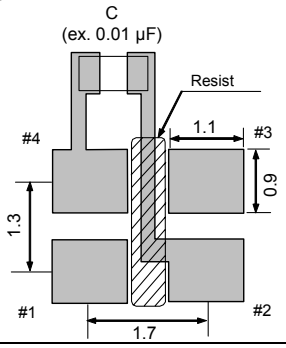


Pin map

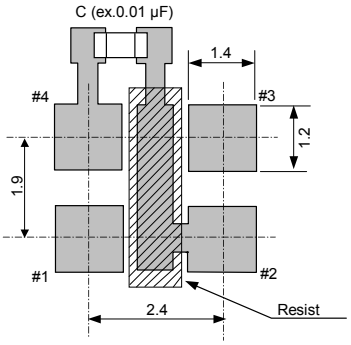
Pin	Connection
1	OE or $\overline{ST}$
2	GND
3	OUT
4	Vcc

Footprint (Recommended) (Unit:mm)

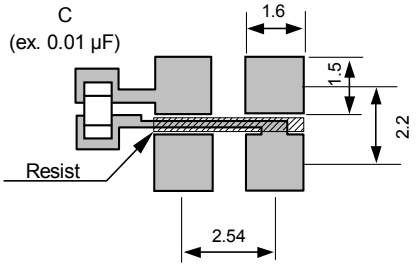
SG-8003CG



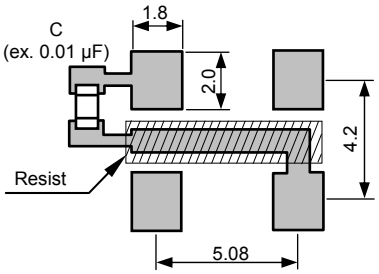
SG-8003CE



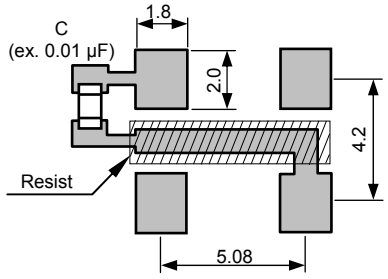
SG-8003LB



SG-8003CA



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)

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

To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

CRYSTAL OSCILLATOR
PROGRAMMABLE

SG - 8002 series

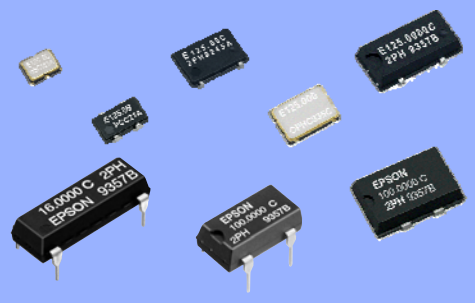
- Frequency range : 1 MHz to 125 MHz
- Supply voltage : 3.0 V / 3.3 V / 5.0 V
- Function : Output enable(OE) or Standby($\overline{ST}$)

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

Pb Free RoHS Compliant

Product Number (please contact us)

CE, LB, CA



Specifications (characteristics)

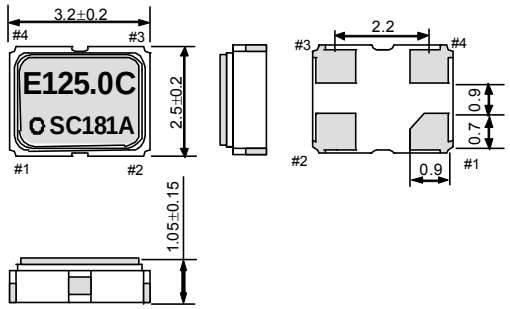
Item	Symbol	Specifications *2			Conditions / Remarks
		PT / ST	PH / SH	PC / SC	
Output frequency range	f_0	1 MHz to 125 MHz		—	Vcc = 4.5 V to 5.5 V (except SG-8002LB)
		—	1 MHz to 80 MHz	—	Vcc = 4.5 V to 5.5 V (SG-8002LB only)
		—	—	1 MHz to 125 MHz	Vcc = 3.0 V to 3.6 V
		—	—	1 MHz to 66.7 MHz	Vcc = 2.7 V to 3.6 V
Supply voltage	Vcc	4.5 V to 5.5 V		2.7 V to 3.6 V	
Storage temperature	T_stg	-55 °C to +125 °C (SG-8002CA / JF / JA / DC / DB)			Store as bare product.
		-55 °C to +100 °C (SG-8002JC)			
		-40 °C to +125 °C (SG-8002CE / LB)			
Operating temperature	T_use	-20 °C to +70 °C / -40 °C to +85 °C			*1
Frequency tolerance	f_tol	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 (except SG-8002JC) *3
		—	L:±50 × 10^{-6}	L:±50 × 10^{-6}	-40 °C to +85 °C (SG-8002LB only) *3
Current consumption	Icc	40 mA Max. (SG-8002CE)		28 mA Max.	No load condition, Max. frequency
		—	30 mA Max. (SG-8002LB)		
		45 mA Max. (SG-8002CA / JF /JC / JA / DC / DB)			
Output disable current	I_dis	30 mA Max.		16 mA Max.	OE=GND (PT.PH,PC) (except SG-8002LB)
		—	25 mA Max.	16 mA Max.	OE=GND (PH,PC) (SG-8002LB only)
Stand-by current	I_std	50 µA Max.			$\overline{ST}$ =GND (ST,SH,SC)
Symmetry *1	SYM	40 % to 60 %	—		TTL load: 1.4 V, Max. load condition (except SG-8002LB)
		—	40 % to 60 %		CMOS load:50 % VCC level, Max. load condition (except SG-8002LB)
		—	40 % to 60 %	—	50 % Vcc, L_CMOS=15 pF, ≤80 MHz (SG-8002LB)
		—	—	40 % to 60 %	50 % Vcc, L_CMOS=15 pF, Vcc=3.0 V to 3.6 V, ≤125 MHz (SG-8002LB)
		—	—	40 % to 60 %	50 % Vcc, L_CMOS=15 pF, Vcc=2.7 V to 3.6 V, ≤66.7 MHz (SG-8002LB)
		45 % to 55 %			*1
High output voltage	Voh	Vcc -0.4 V Min.			Ioh=-16 mA (PT,ST,PH,SH) , -8 mA (PC,SC)
Low output voltage	Vol	0.4 V Max.			Iol=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 (SG-8002CE / CA / JA / DC / DB)
		5 TTL Max.	—		f0 ≤ 90 MHz and Max. Supply voltage (SG-8002JF / JC)
Output load condition (CMOS) *1	L_CMOS	15 pF Max.			Max. frequency and Max. Supply voltage (SG-8002CE / JF / JC)
		—	15 pF Max.		Max. frequency and Max. Supply voltage (SG-8002LB)
		15 pF Max.	25 pF Max	15 pF Max.	Max. frequency and Max. Supply voltage (SG-8002CA / JA / DC / DB)
Output enable / disable input voltage	Vih	2.0 V Min.		70 % VCC Min.	OE terminal or $\overline{ST}$ terminal
	Vil	0.8 V Max.		20 % VCC Max.	
Rise / Fall time *1	tr/ tf	4 ns Max.	—		TTL load: 0.4 V to 2.4 V level (except SG-8002LB)
		—	3 ns Max.		CMOS load: 20 % VCC to 80 % VCC 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

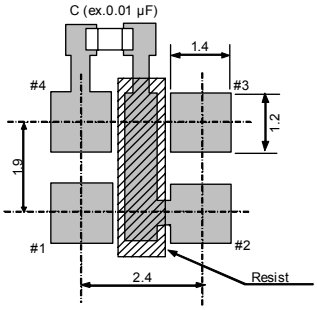
*1 Operating temperature, the available frequency, symmetry, output load conditions and rise/fall time, please refer to “Outline specifications” page.
*2 PLL-PLL connection & Jitter specification, please refer to “Jitter specifications and characteristics chart” page.
*3 Refer to “Outline specifications” (Frequency range) for “M” and ”L” tolerance availability. Checking possible by the Frequency checking program.

External dimensions and Recommended footprint

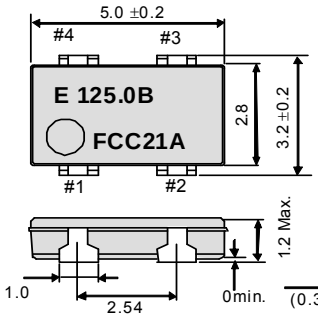
(Unit:mm)

SG-8002CE Ceramic SON 4pin 3.2x2.5x1.05 mm

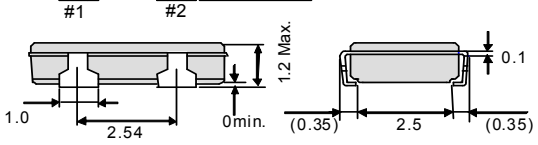


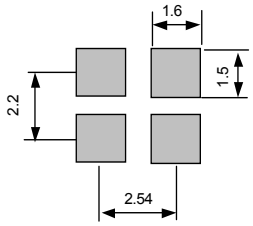


SG-8002LB SOJ 4pin 5.0x3.2x1.2 mm

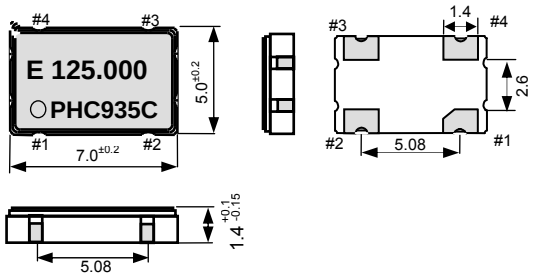


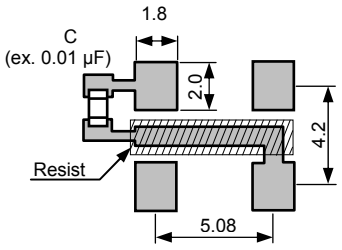
Metal may be exposed on the top or bottom of this product. This will not affect any quality, reliability or electrical spec.



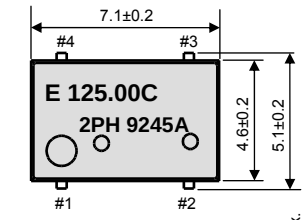


SG-8002CA Ceramic SON 4pin 7.0x5.0x1.4 mm

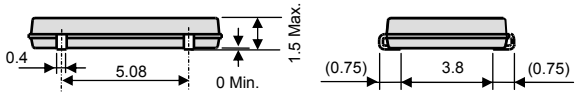


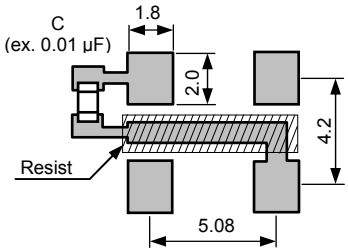


SG-8002JF SOJ 4pin 7.1x5.1x1.5 mm



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 (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.

Pin map

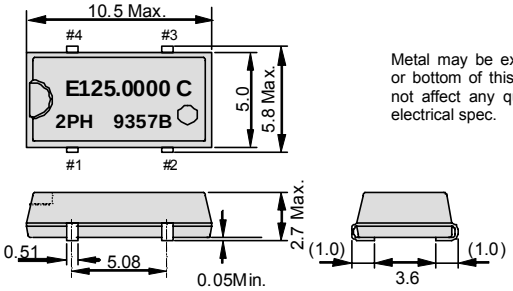
Pin	Connection
1	OE or $\overline{ST}$
2	GND
3	OUT
4	VCC

To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

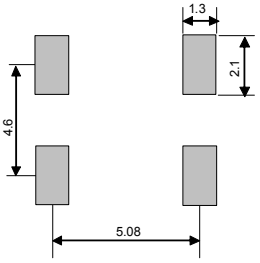
External dimensions and Recommended footprint (Continued)

(Unit:mm)

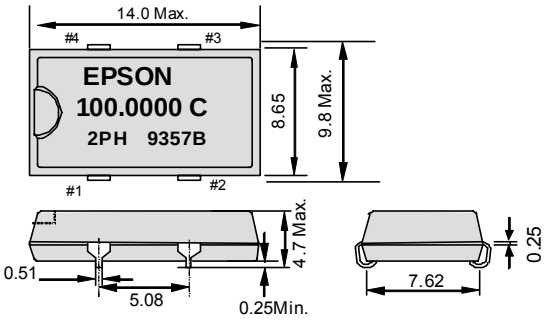
SG-8002JC **SOJ 4pin 10.5x5.8x2.7 mm** Package and pin compatible with SG-636.

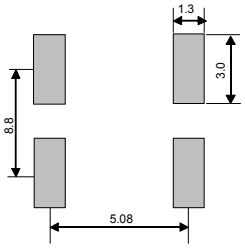


Metal may be exposed on the top or bottom of this product. This will not affect any quality, reliability or electrical spec.

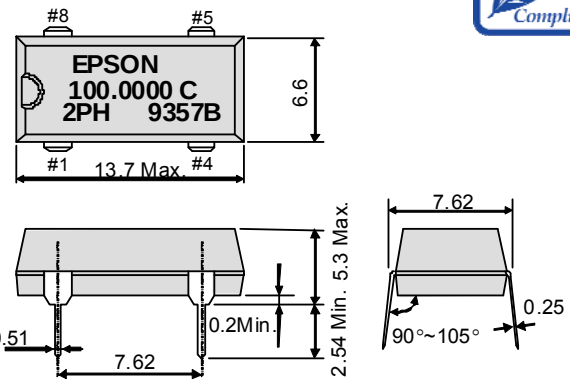


SG-8002JA **SOJ 4pin 14.0x9.8x4.7 mm** Package and pin compatible with SG-615.

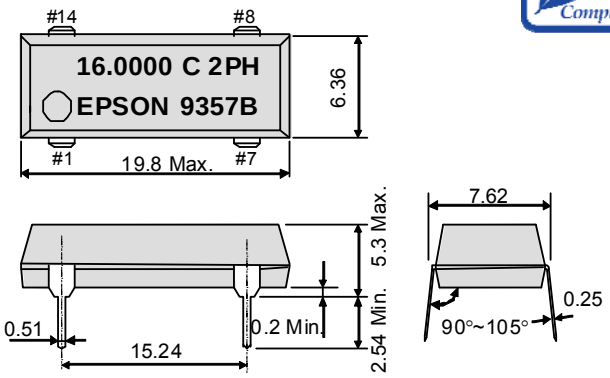




SG-8002DC **DIP half size**



SG-8002DB **DIP full size**



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.

Pin map

Pin	Connection
1	OE or $\overline{ST}$
2	GND
3	OUT
4	VCC

Pin map: SG-8002DC

Pin	Connection
1	OE or $\overline{ST}$
4	GND
5	OUT
8	VCC

Pin map: SG-8002DB

Pin	Connection
1	OE or $\overline{ST}$
7	GND
8	OUT
14	VCC

To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

Products number

(Please contact us for each product.)

SG-8002CE:	Q3321CExxxxxx00	SG-8002JC:	Q3307JCx2xxxx00
SG-8002LB:	Q3323LBxxxxxx00	SG-8002JA:	Q3306JAx2xxxx00
SG-8002CA:	Q3309CAx0xxxx00	SG-8002DC:	Q3204DCx2xxxx00
SG-8002JF:	Q3308JFx2xxxx00	SG-8002DB:	Q3203DBx2xxxx00

SG-8002 Series Outline of specifications

Model		Supply volt-age	Operating temperature	Output load condition	Symmetry	Output rise time / Output fall time
SG-8002CE	PT/ST	4.5 V to 5.5 V	-20 °C to +70 °C	5TTL+15pF	40 % to 60 % (1.4 V, L_TTL=5 TTL+15 pF, f0≤125 MHz) 45 % to 55 % (1.4 V, L_TTL=5 TTL+15 pF, f0≤66.7 MHz)	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.)
			-40 °C to +85 °C		45 % to 55 % (1.4 V, L_TTL=5 TTL+15 pF, f0≤27.0 MHz)	
	PH/SH		-20 °C to +70 °C	15 pF (f0≤125 MHz) 25 pF (f0≤100 MHz)	40 % to 60 % (50 % VCC, L_CMOS=15 pF, f0≤125 MHz) 45 % to 55 % (50 % VCC, L_CMOS=25 pF, f0≤66.7 MHz)	3.0 ns Max. (20 % VCC to 80 % VCC,L_CMOS=Max.)
			-40 °C to +85 °C	25 pF (f0≤27 MHz)	45 % to 55 % (50 % VCC, L_CMOS=25 pF, f0≤27.0 MHz)	
	PC/SC	3.0 V to 3.6 V	-40 °C to +85 °C	15 pF	40 % to 60 % (50 % VCC, L_CMOS=15 pF, f0≤125 MHz) 45 % to 55 % (50 % VCC, L_CMOS=15 pF, f0≤40 MHz)	3.0 ns Max. (20 % VCC to 80 % VCC,L_CMOS=Max.)
		2.7 V to 3.6 V			40 % to 60 % (50 % VCC, L_CMOS=15 pF, f0≤66.7 MHz)	
SG-8002LB	PH/SH	4.5 V to 5.5 V	-40 °C to +85 °C	15 pF 25pF (f0≤50 MHz)	40 % to 60 % (50 % VCC, L_CMOS=15 pF, f0≤80 MHz) 45 % to 55 % (50 % VCC, L_CMOS=25 pF, f0≤50 MHz)	3.0 ns Max. (20 % VCC to 80 % VCC,L_CMOS=Max.)
	PC/SC	3.0 V to 3.6 V	-40 °C to +85 °C	15 pF	40 % to 60 % (50 % VCC, L_CMOS=15 pF, f0≤125 MHz) 45 % to 55 % (50 % VCC, L_CMOS=15 pF, f0≤40 MHz)	3.0 ns Max. (20 % VCC to 80 % VCC,L_CMOS=Max.)
		2.7 V to 3.6 V			40 % to 60 % (50 % VCC, L_CMOS=15 pF, f0≤66.7 MHz)	
SG-8002JF	PT/ST	4.5 V to 5.5 V	-20 °C to +70 °C	5TTL+15 pF (f0≤ 90 MHz) 15 pF (f0≤125 MHz) 25 pF (f0≤66.7 MHz)	40 % to 60 % (1.4 V, L_TTL=5 TTL+15 pF, f0≤90 MHz) ↑ (1.4 V, L_CMOS=15 pF, f0≤125 MHz) ↑ (1.4 V, L_CMOS=25 pF, f0≤66.7 MHz) 45 % to 55 % (1.4 V, L_TTL=5 TTL+15 pF, f0≤66.7 MHz)	2.0 ns Max. (0.8 V to 2.0 V,L_CMOS≤25pF) 4.0 ns Max. (0.4 V to 2.4 V,L_CMOS or L_TTL=Max.)
			-40 °C to +85 °C	15 pF (f0≤40 MHz)	40 % to 60 % (1.4 V, L_CMOS=15 pF, f0≤40 MHz)	
	PH/SH		-20 °C to +70 °C	15 pF (f0≤125 MHz) 25 pF (f0≤90 MHz) 50 pF (f0≤50 MHz)	40 % to 60 % (50 % VCC, L_CMOS=15 pF, f0≤125 MHz) ↑ (50 % VCC, L_CMOS=25 pF, f0≤90.0 MHz) ↑ (50 % VCC, L_CMOS=50 pF, f0≤50.0 MHz) 45 % to 55 % (50 % VCC, L_CMOS=25 pF, f0≤66.7 MHz)	3.0 ns Max. (20 % VCC to 80 % VCC,L_CMOS≤25pF) 4.0 ns Max. (20 % VCC to 80 % VCC,L_CMOS=Max.)
			-40 °C to +85 °C	15 pF (f0≤40 MHz)	40 % to 60 % (50 % VCC, L_CMOS=15 pF, f0≤40 MHz)	
	PC/SC	3.0 V to 3.6 V	-40 °C to +85 °C	15 pF 30 pF (f0≤40 MHz)	40 % to 60 % (50 % VCC, CL=15 pF, f0≤125 MHz) 45 % to 55 % (50 % VCC, CL=30 pF, f0≤40 MHz)	3.0 ns Max. (20 % VCC to 80 % VCC,L_CMOS≤15pF) 4.0 ns Max. (20 % VCC to 80 % VCC,L_CMOS=Max.)
		2.7 V to 3.6 V		15 pF	40 % to 60 % (50 % VCC, CL=15 pF, f0≤66.7 MHz)	
SG-8002CA SG-8002JA SG-8002DB SG-8002DC	PT/ST	4.5 V to 5.5 V	-20 °C to +70 °C	5TTL+15pF (f0≤125 MHz) 25 pF (f0≤66.7 MHz)	40 % to 60 % (1.4 V, L_TTL=5 TTL+15 pF, f0≤125 MHz) ↑ (1.4 V, L_CMOS=25 pF, f0≤66.7 MHz) 45 % to 55 % (1.4 V, L_TTL=5 TTL+15 pF, f0≤66.7 MHz)	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.)
			-40 °C to +85 °C	5 TTL+15 pF (f0≤40 MHz) 15 pF (f0≤55 MHz)	40 % to 60 % (1.4 V, L_CMOS=15 pF, f0≤55.0 MHz) 45 % to 55 % (1.4 V, L_TTL=5 TTL+15 pF, f0≤40.0 MHz)	
	PH/SH		-20 °C to +70 °C	25 pF (f0≤125 MHz) 50 pF (f0≤66.7 MHz)	40 % to 60 % (50 % VCC, L_CMOS=25 pF, f0≤125 MHz) ↑ (50 % VCC, L_CMOS=50 pF, f0≤66.7 MHz) 45 % to 55 % (50 % VCC, L_CMOS=25 pF, f0≤66.7 MHz)	3.0 ns Max. (20 % VCC to 80 % VCC,L_CMOS≤25pF) 4.0 ns Max. (20 % VCC to 80 % VCC,L_CMOS=Max.)
			-40 °C to +85 °C	15 pF (f0≤55 MHz) 25 pF (f0≤40 MHz)	40 % to 60 % (50 % VCC, L_CMOS=15 pF, f0≤55.0 MHz) 45 % to 55 % (50 % VCC, L_MOS=25 pF, f0≤40.0 MHz)	
	PC/SC	3.0 V to 3.6 V	-40 °C to +85 °C	15 pF 30 pF (f0≤40 MHz)	40 % to 60 % (50 % VCC, L_CMOS=15 pF, f0≤125 MHz) 45 % to 55 % (50 % VCC, L_CMOS=30 pF, f0≤40 MHz)	3.0 ns Max. (20 % VCC to 80 % VCC,L_CMOS≤15pF) 4.0 ns Max. (20 % VCC to 80 % VCC,L_CMOS=Max.)
		2.7 V to 3.6 V		15 pF	40 % to 60 % (50 % VCC, L_CMOS=15 pF, f0≤66.7 MHz)	
SG-8002JC	PT/ST	4.5 V to 5.5 V	-20 °C to +70 °C	5TTL+15 pF (f0≤90 MHz) 15 pF (f0≤125 MHz) 25 pF (f0≤66.7 MHz)	40 % to 60 % (1.4 V,L_CMOS=15 pF, f0≤125 MHz) ↑ (1.4 V,L_TTL=5 TTL+15 pF, f0≤90.0 MHz) ↑ (1.4 V,L_CMOS=25 pF, f0≤66.7 MHz) 45 % to 55 % (1.4 V,L_TTL=5 TTL+15 pF, f0≤66.7 MHz)	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.)
	PH/SH			15 pF (f0≤125 MHz) 25 pF (f0≤90 MHz) 50 pF (f0≤66.7 MHz)	40 % to 60 % (50 % VCC, L_CMOS=15 pF, f0≤125 MHz) ↑ (50 % VCC, L_CMOS=25 pF, f0≤90 MHz) ↑ (50 % VCC, L_CMOS=50 pF, f0≤50 MHz) 45 % to 55 % (50 % VCC, L_CMOS=25 pF, f0≤66.7 MHz)	3.0 ns Max. (20 % VCC to 80 % VCC,L_CMOS≤25pF) 4.0 ns Max. (20 % VCC to 80 % VCC,L_CMOS=Max.)
	PC/SC	3.0 V to 3.6 V		15 pF 30 pF (f0≤40 MHz)	40 % to 60 % (50 % VCC, L_CMOS=15 pF, f0≤125 MHz) 45 % to 55 % (50 % VCC, L_CMOS=30 pF, f0≤40 MHz)	3.0 ns Max. (20 % VCC to 80 % VCC,L_CMOS≤15pF) 4.0 ns Max. (20 % VCC to 80 % VCC,L_CMOS=Max.)
		2.7 V to 3.6 V		15 pF	40 % to 60 % (50 % VCC, L_CMOS=15 pF, f0≤66.7 MHz)	

▶TABLE OF FREQUENCY RANGE

Model		Supply voltage	Frequency	Frequency tolerance Operating Temperature
SG-8002CE	PT/ ST PH/ SH	4.5 V to 5.5 V	1.0 MHz to 125 MHz	B,C
			1.0 MHz to 27 MHz	M
	PC/SC	3.0 V to 3.6 V	1.0 MHz to 125 MHz	B,C,M
		2.7 V to 3.6 V	1.0 MHz to 66.7 MHz	
SG-8002LB	PH/ SH	4.5 V to 5.5 V	1.0 MHz to 80 MHz	B,C
			1.0 MHz to 27 MHz	M,L
	PC/ SC	3.0 V to 3.6 V	1.0 MHz to 125 MHz	B,C,M,L
		2.7 V to 3.6 V	1.0 MHz to 66.7 MHz	
SG-8002JF	PT/ ST PH/ SH	4.5 V to 5.5 V	1.0 MHz to 125 MHz	B,C
			1.0 MHz to 40 MHz	M
	PC/ SC	3.0 V to 3.6 V	1.0 MHz to 125 MHz	B,C,M
		2.7 V to 3.6 V	1.0 MHz to 66.7 MHz	
SG-8002CA SG-8002JA SG-8002DB SG-8002DC	PT/ ST PH/ SH	4.5 V to 5.5 V	1.0 MHz to 125 MHz	B,C
			1.0 MHz to 55 MHz	M
	PC/ SC	3.0 V to 3.6 V	1.0 MHz to 125 MHz	B,C,M
		2.7 V to 3.6 V	1.0 MHz to 66.7 MHz	
SG-8002JC	PT/ ST PH/ SH	4.5 V to 5.5 V	1.0 MHz to 125 MHz	B,C
	PC/ SC	3.0 V to 3.6 V	1.0 MHz to 125 MHz	B,C
		2.7 V to 3.6 V	1.0 MHz to 66.7 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-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)

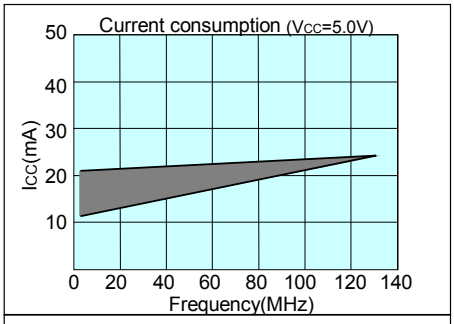
Jitter Specifications

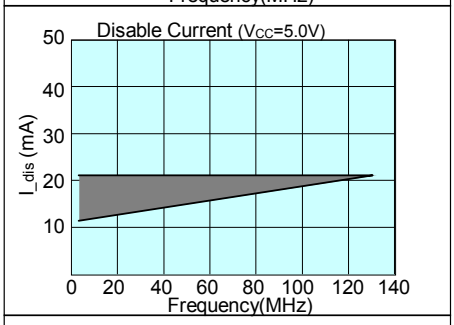
Model	Supply Voltage	Jitter Item	Specifications	Remarks
PT / PH ST / SH	5.0 V ±0.5 V	Cycle to cycle	150 ps Max.	33 MHz ≤ f0 ≤ 125 MHz, L_CMOS=15 pF
			200 ps Max.	1.0 MHz ≤ f0 < 33 MHz, L_CMOS=15 pF
		Peak to peak	200 ps Max.	33 MHz ≤ f0 ≤ 125 MHz, L_CMOS=15 pF
			250 ps Max.	1.0 MHz ≤ f0 < 33 MHz, L_CMOS=15 pF
SC / PC	3.3 V ±0.3 V	Cycle to cycle	200 ps Max.	1.0 MHz ≤ f0 ≤ 125 MHz, L_CMOS=15 pF
		Peak to peak	250 ps Max.	1.0 MHz ≤ f0 ≤ 125 MHz, L_CMOS=15 pF

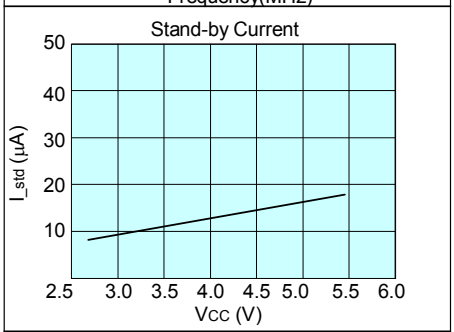
■Remarks on noise management for power supply line

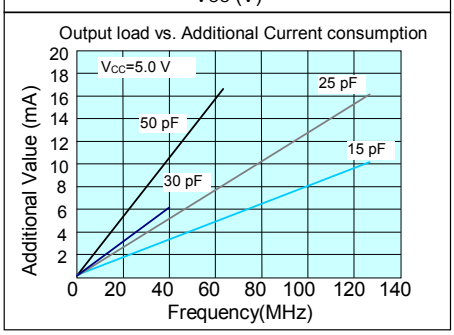
We do not recommend inserting filters or other devices in the power supply line as the counter measure of EMI noise reduction. This device insertion might cause high-frequency impedance high in the power supply line and it affects oscillator stable drive. When this measure is required, please evaluate 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 μs.

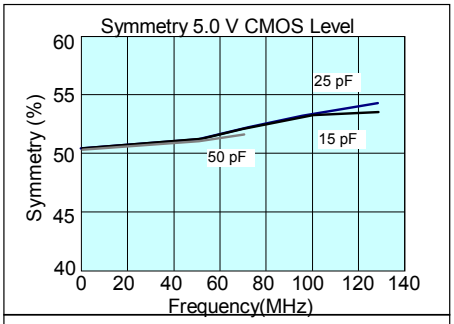
■SG-8002 series Characteristics chart

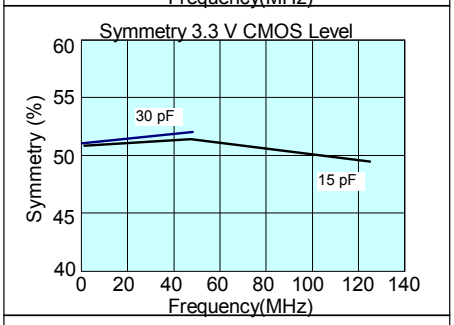


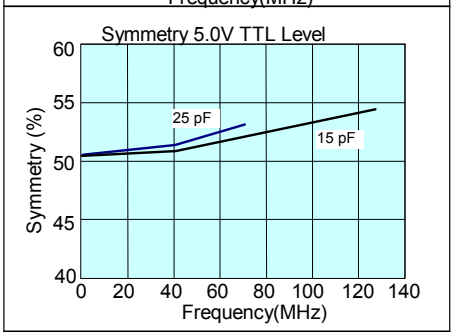


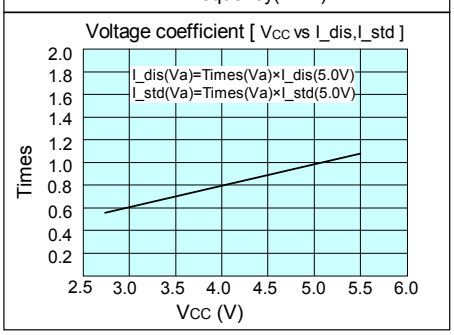


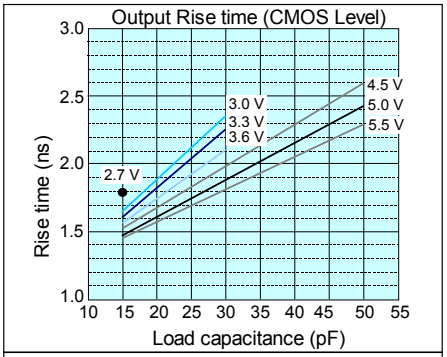


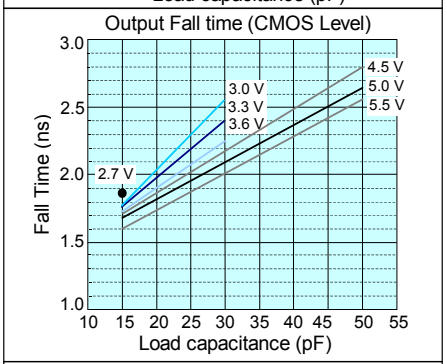


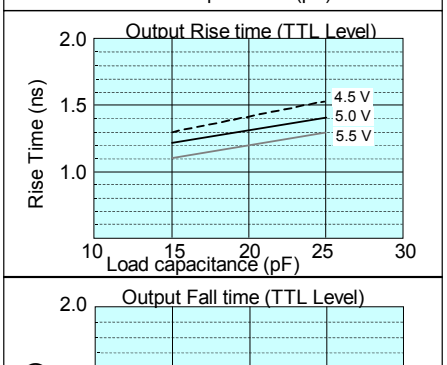


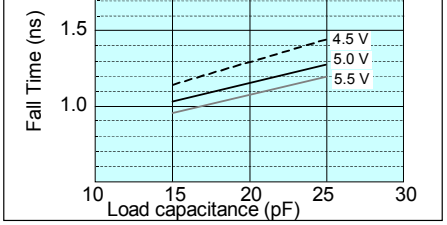












PROGRAMMING TOOL FOR SG-8000 SERIES

NEW

RoHS Compliant

SG - Writer Ⅱ

- Easy frequency program for Epson SG-8000 series oscillator (Blank oscillator).
- External power supply by USB cable.
- Available PC OS
  Windows7(32bit,64bit)etc,
- Small body and easy carry.

Main Body Specifications

Name	SG-Writer Ⅱ for Epson SG-8000 Series
Operating Temperature	+10 °C to +40 °C Writing (+25 °C ±5 °C)
Electric Power Supply	Via USB
Standard Interface	USB 2.0 (Mini-b)
Accessories	SG-Writer Ⅱ CD-ROM (Software and Instruction manual : Japanese, English) Documents : Japanese, English
Software	SG-Writer Ⅱ *1

Option
SMD socket

Model	Product number
SG-8003CG	Q91PR10W00024
SG-8003CE	Q91PR10W00018
SG-8003LB	Q91PR10W00019
SG-8003JF	Q91PR10W00020
SG-8003CA	Q91PR10W00021

Model	Product number
SG-8002LB	Q91PR10W00011
SG-8002CE	Q91PR10W00010
SG-8002JF	Q91PR10W00006
SG-8002CA	Q91PR10W00005
SG-8002JC	Q91PR10W00004
SG-8002JA	Q91PR10W00003

Option
Blank sample

Model	Product number
SG-8003CG 1.8V	X1G0039910001
SG-8003CG 2.5V,3.3V	X1G0039910002
SG-8003CE 1.8V	Q33519E000001
SG-8003CE 2.5V,3.3V	Q33519E000002
SG-8003LB 1.8V	X1G0033010001
SG-8003LB 2.5V,3.3V	X1G0033010002
SG-8003JF 1.8V	X1G0030220001
SG-8003JF 2.5V,3.3V	X1G0030220002
SG-8003CA 1.8V	X1G0032310001
SG-8003CA 2.5V,3.3V	X1G0032310002

Model	Product number
SG-8002CE	Q3321CE000001
SG-8002LB	Q3323LB020002
SG-8002JF	Q3308JF020002
SG-8002CA	Q3309CA000002
SG-8002JC	Q3307JC020002
SG-8002JA	Q3306JA020002
SG-8002DC	Q3204DC020002
SG-8002DB	Q3203DB020002

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

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

Available PC OS	Windows 7(32bit,64bit) Windows Vista(32 bit type) Windows XP(32 bit type)
Recommend CPU	Over Pentium 4 1.4GHz or equivalent Processor
Recommend memory Capacity	Windows XP : Over 512MB Windows Vista, Windows7 32bit : Over 1GB Windows 7 64bit : Over 2GB
Other	CD-ROM drive, USB cable(Type A ↔ Mini-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

- SG-8003 series 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 mm (t: Max.)···SG-9001LB
  7.0 × 5.0 × 1.4 mm···SG-9001CA
- Range of spreading percentage is selectable by program (Center or Down spread, 6 Values)

Pb Free RoHS Compliant

CA,LB Type CA,LB,JC Type

Product Number (please contact us)
SG-9001LB: Q3331x2x0xxxx00
SG-9001CA:Q3331x0x0xxxx00
SG-9001JC: Q3331x1x2xxxx00

Actual size

SG-9001LB	SG-9001CA	SG-9001JC
		

Specifications (characteristics)

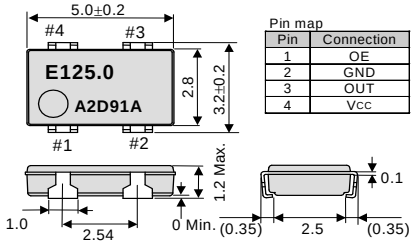
Item	Symbol	Specifications	Remarks	
Output frequency range	f_0	10.000 MHz to 166.000 MHz	SG−9001JC,CA	Please contact us for inquiries regarding available frequencies.
		10.000 MHz to 135.000 MHz	SG−9001LB	
Supply voltage	V_{CC}	3.3 V±0.3 V		
Storage temperature	T_stg	-55 °C to +100 °C	SG-9001JC	Store as bare product.
		-40 °C to +125 °C	SG-9001LB,CA	
Operating temperature	T_use	-20 °C to +70 °C		
Current consumption	I_{CC}	30 mA Max.	No load condition, fo = 166 MHz	
Disable current	I_dis	20 mA Max.	OE=GND, fo = 166 MHz	
Symmetry	SYM	45 % to 55 %	CMOS load: 50 % V_{CC} level, L_CMOS=15 pF	
Output voltage	V_{OH}	V_{CC}-0.4 V Min.	I_{OH}=-8 mA	
	V_{OL}	0.4 V Max.	I_{OL}= 8 mA	
Output load condition	L_CMOS	15 pF Max.		
Input voltage	V_{IH}	70 % V_{CC} Min.	OE terminal	
	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	±5 × 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)

●SG-9001LB



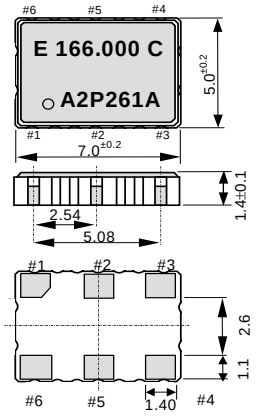
Pin map

Pin	Connection
1	OE
2	GND
3	OUT
4	Vcc

Note.
OE pin
OE pin = "H" or "open" : Specified frequency output.
OE pin = "L" : Output disable output is weak pull-down.
(130 kΩ Typ.)

SSON pin (SG-9001CA)
SSON pin = "H" : Spread spectrum disable.
SSON pin = "L" or "open" : Spread spectrum enable.

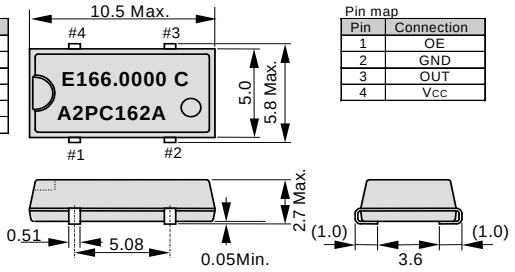
●SG-9001CA



Pin map

Pin	Connection
1	OE
2	SSON
3	GND
4	OUT
5	N.C.
6	Vcc

●SG-9001JC



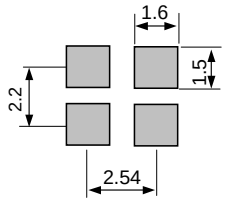
Pin map

Pin	Connection
1	OE
2	GND
3	OUT
4	Vcc

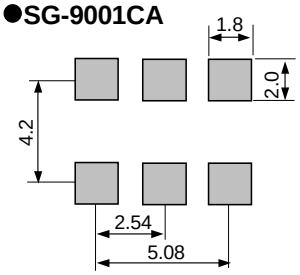
Metal may be exposed on the top or bottom of this product.
This will not affect any quality, reliability or electrical spec.

Footprint (Recommended) (Unit:mm)

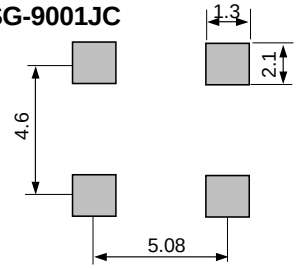
●SG-9001LB



●SG-9001CA



●SG-9001JC



To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

CRYSTAL OSCILLATOR
LOW-JITTER SAW OSCILLATOR

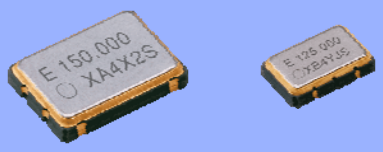
XG-1000CA / CB

- Output frequency range : 50 MHz to 170 MHz
- Supply voltage : 1.8 V / 2.5 V / 3.3 V
- Frequency tolerance : ±50×10^{-6}, ±100×10^{-6}
- Output : CMOS
- Function : Output enable (OE)
- Package size : CA: 7.0×5.0×1.2 mm
  CB: 5.0×3.2×1.1 mm

- Very low jitter and low phase noise by SAW unit.

Pb Free
RoHS Compliant

Product Number (please contact us)
XG-1000CA: Q3851CA00xxxx00
XG-1000CB: Q3851CB00xxxx00



Actual size

XG-1000CA	XG-1000CB
	

Specifications (characteristics)

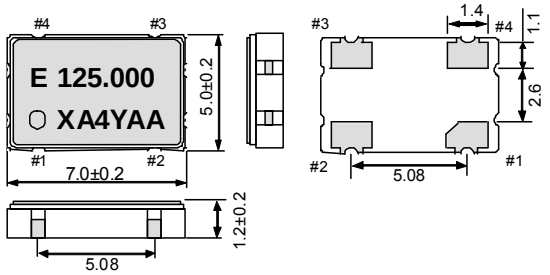
Item	Symbol	Specifications E	Specifications D	Specifications C	Conditions / Remarks
Output frequency range *1	fo	50.000 MHz to 170.000 MHz			
		75.000 MHz, 98.304 MHz, 100.000 MHz, 106.250 MHz, 125.000 MHz, 150.000 MHz			Standard frequency
Supply voltage	Vcc	1.8 V ±0.1V	2.5 V ±0.125 V	3.3 V ±0.3V	
Storage temperature	T_stg	-40 °C to +100 °C			Store as bare product.
Operating temperature	T_use	-10°C to +70°C			
Frequency tolerance *2	f_tol	B:±50 × 10^{-6} C:±100 × 10^{-6}			
Current consumption	Icc	20 mA Max.	25 mA Max.	35 mA Max.	OE=Vcc, No load condition
Disable current	I_dis	15 mA Max.	20 mA Max.	30 mA Max.	OE=GND
Symmetry	SYM	40 % to 60 %	45 % to 55 %		fo≤ 125 MHz; 50 % Vcc level, L_CMOS ≤ Max.
		40 % to 60 %			fo> 125 MHz; 50 % Vcc level, L_CMOS ≤ Max.
Output voltage	VOH	Vcc-0.35 V Min			E:IOH = -6 mA / C,D:IOH = -8 mA
	VOL	0.35 V Max.			E:IOL = 6 mA / C,D:IOL = 8 mA
Output load condition (CMOS)	L_CMOS	15 pF Max.			
Input voltage	VIH	70 % Vcc Min.			OE terminal
	VIL	30 % Vcc Max.			OE terminal
Rise time / Fall time	t_r / t_f	2 ns Max.			Between 20% Vcc and 80% Vcc level, L_CMOS ≤ Max
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, Vcc=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 load variation.
*3 Based on DTS-2075 Digital timing system made from WAVECREST with jitter analysis software VISI6.

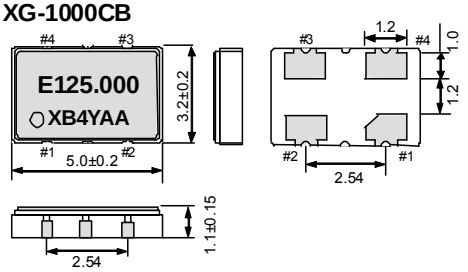
Operating voltage		E: 1.8V	D: 2.5V	C: 3.3V
Frequency tolerance and operating temperature	B: ±50 × 10^{-6}, (-10°C to +70°C)	EB	DB	CB
	C: ±100 × 10^{-6}, (-10°C to +70°C)	EC	DC	CC

External dimensions (Unit:mm)

● XG-1000CA



● XG-1000CB



Pin map

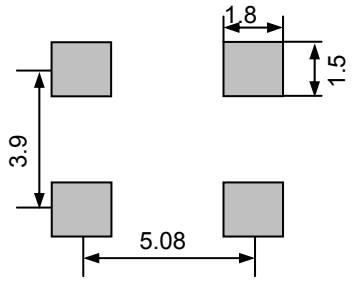
Pin	Connection
1	OE
2	GND
3	OUT
4	Vcc

#2 is connected to the cover

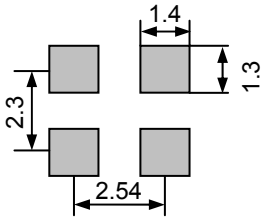
OE pin = HIGH : Specified frequency output.
OE pin = LOW : Output is high impedance

Footprint (Recommended) (Unit:mm)

● XG-1000CA



● XG-1000CB



To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

CRYSTAL OSCILLATOR
LOW-JITTER SAW OSCILLATOR

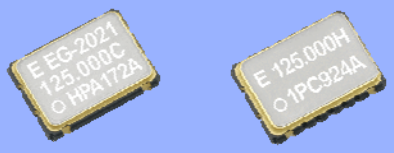
EG - 2021 / 2001CA

- 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 mm

- Very low jitter and low phase noise by SAW unit.

Pb Free RoHS Compliant

Product Number (please contact us)
EG-2021CA: Q3807CA00xxxx00
EG-2001CA: Q3801CA00xxxx00



Actual size

EG-2021CA	EG-2001CA
	

Specifications (characteristics)

Item	Symbol	Specifications			Conditions / Remarks
		EG-2021CA		EG-2001CA	
Output frequency range	fo	62.500 MHz to 170.000MHz	170.001MHz to 250.000MHz	106.250 MHz to 170.000 MHz	Please contact us for inquiries regarding available frequencies.
Supply voltage	Vcc	2.5 V± 0.125 V		3.3 V± 0.3 V	
Storage temperature	T_stg	-40 °C to +100 °C			Store as bare product.
Operating temperature *1	T_use	P: 0 °C to +70 °C R: -5 °C to +85 °C		0 °C to +70° C	
Frequency tolerance *1	f_tol	G: ± 50 × 10^{-6} H: ± 100 × 10^{-6}		Z: ± 50 × 10^{-6} Y,H: ±100 × 10^{-6}	
Current consumption	Icc	25 mA Max.	30 mA Max.	50 mA Max.	OE=Vcc, No load condition
Disable current	I_dis	600 µA Max.		10 µA Max.	OE=GND
Symmetry	SYM	45 % to 55 %	40 % to 60 %	45 % to 55 %	50 % Vcc level, L_CMOS≤ Max.
Output voltage	VOH	Vcc-0.35 V Min.		Vcc-0.4 V Min.	IOH = -8 mA
	VOL	0.35 V Max.		0.4 V Max.	IOL = 8 mA
Output load condition (CMOS)	L_CMOS	15 pF Max.			
Input voltage	VIH	70 % Vcc Min.			OE terminal
	VIL	30 % Vcc Max.			
Rise time / Fall time	t_r / t_f	2 ns Max.			Between 20% Vcc and80% Vcc level, L_CMOS≤ 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}	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, Vcc=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

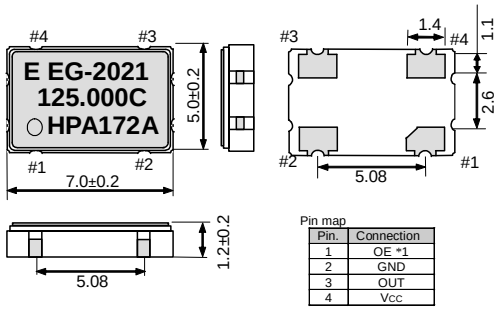
Model		EG-2021CA	
Aging		A *4	N *5
Frequency tolerance and operating temperature	HP: ±100×10^{-6} (0°C to +70°C)	CHPA	CHPN
	HR: ±100×10^{-6} (-5°C to +85°C)	CHRA	CHRN
	GP: ±50×10^{-6} (0°C to +70°C)	—	CGPN
	GR: ±50×10^{-6} (-5°C to +85°C)	—	CGRN

Model		EG-2001CA
Symmetry		P: 50 ±5 %
Frequency tolerance and operating temperature	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)

External dimensions (Unit:mm)

●EG-2021CA

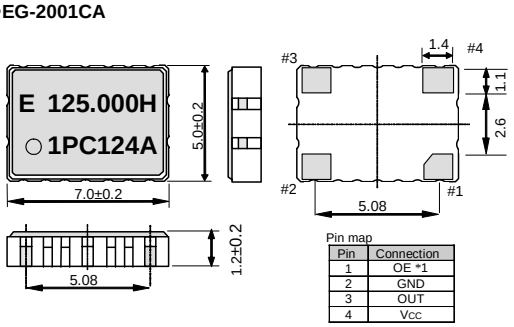


Pin map

Pin.	Connection
1	OE *1
2	GND
3	OUT
4	Vcc

*1 Standby function built-in
#2 is connected to the cover.

●EG-2001CA



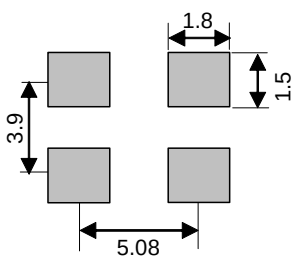
Pin map

Pin	Connection
1	OE *1
2	GND
3	OUT
4	Vcc

*1 Standby function built-in
#2 is connected to the cover.

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

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 mm

- Very low jitter and low phase noise by SAW unit.

Pb Free
RoHS Compliant

Product Number (please contact us)
Q3802CA00xxxx00

Actual size

Specifications (characteristics)

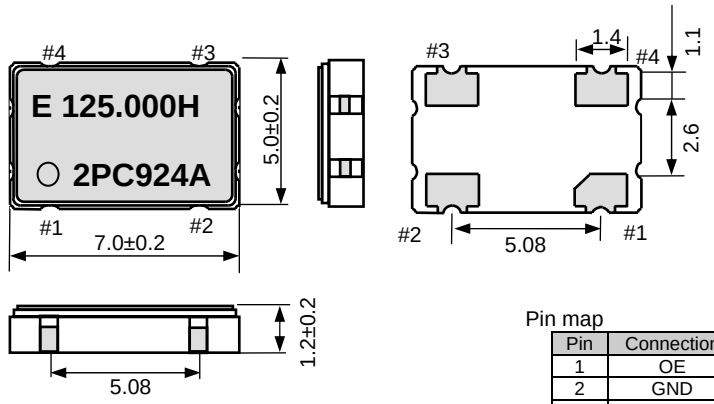
Item	Symbol	Specifications	Conditions / Remarks
Output frequency range	fo	62.500 MHz to 170.000 MHz	Please contact us for inquiries regarding available frequencies.
Supply voltage	Vcc	3.3 V ± 0.3 V	
Storage temperature	T_stg	-40 °C to +100 °C	Store as bare product.
Operating temperature	T_use	0 °C to +70 °C	
Frequency tolerance *1	f_tol	F,Z: ±50 × 10^{-6} , H,Y: ±100 × 10^{-6}	
Current consumption	Icc	60 mA Max.	OE=Vcc, No load condition
Disable current	I_dis	25 mA Max.	OE=GND
Symmetry	SYM	45 % to 55 %	1.4 V level, L_CMOS ≤ Max.
Output voltage	VOH	2.4 V Min.	IOH = -8 mA
	VOL	0.4 V Max.	IOL = 8 mA
Output load condition (CMOS)	L_CMOS	25 pF Max.	fo = 62.5 MHz
		15 pF Max.	fo > 62.5 MHz
Input voltage	VIH	70 % Vcc Min.	OE terminal
	VIL	30 % Vcc Max.	
Rise time / Fall time	t_r / t_f	1.5 ns Max.	Between 0.8 V and 2.0 V level, L_CMOS ≤ 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}	1 ps Max.	Offset frequency: 12 kHz to 20 MHz
Frequency aging *3	f_aging	± 5 × 10^{-6} / year Max.	+25 °C, First year, Vcc=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
Frequency tolerance and operating temperature	H: ±100×10^{-6} (0 °C to +70 °C) *4	PCH	DCH
	Y: ±100×10^{-6} (0 °C to +70 °C) *5	PCY	DCY
	Z: ±50×10^{-6} (0 °C to +70 °C) *6	PCZ	DCZ
	F: ±50×10^{-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 aging).
*6 This includes initial frequency tolerance and temperature variation (except supply voltage variation, load variation, reflow drift, and aging).

External dimensions (Unit:mm)



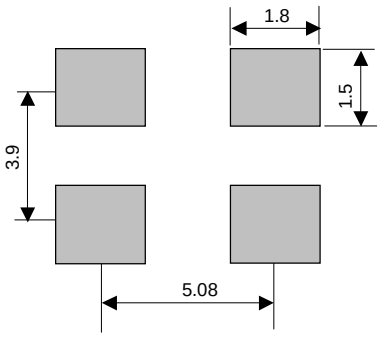
Pin map

Pin	Connection
1	OE
2	GND
3	OUT
4	Vcc

#2 is connected to the cover

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

Footprint (Recommended) (Unit:mm)



To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

CRYSTAL OSCILLATOR

LOW-JITTER SAW OSCILLATOR

EG - 2121 / 2102CB

- Frequency range : 100 MHz to 700 MHz
- Supply voltage : 2.5 V ··· EG-2121CB
  3.3 V ··· EG-2102CB
- Output : Differential LV-PECL or LVDS
- Function : Output enable (OE)
- External dimensions : 5.0 × 3.2 × 1.4 mm

- Low jitter and low phase noise by SAW unit.

Pb Free
RoHS Compliant

Product Number (please contact us)
EG-2121CB P: X1M000211xxxx00
EG-2121CB L: X1M000231xxxx00
EG-2102CB P: X1M000201xxxx00
EG-2102CB L: X1M000221xxxx00

Actual size

Specifications (characteristics)

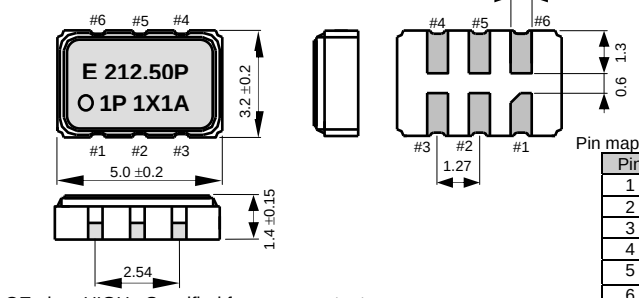
Item	Symbol	Differential LV-PECL		LVDS		Conditions / Remarks	
		EG-2121CB P	EG-2102CB P	EG-2121CB L	EG-2102CB L		
Output frequency range	fo	100 MHz to 700 MHz				Please contact us for inquiries regarding available frequencies.	
Supply voltage	VCC	2.5 V ±0.125 V	3.3 V ±0.33 V	2.5 V ±0.125 V	3.3 V ±0.33 V		
Storage temperature	T_stg	-55 °C to +125 °C				Store as bare product.	
Operating temperature *1	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	ICC	60 mA Max.		30 mA Max.		OE=VCC, L_ECL=50 Ω or L_LVDS=100 Ω	
Disable current	I_dis	2 mA Max.		15 mA Max.		OE=GND	
Symmetry	SYM	45 % to 55 %				At outputs crossing point	
Output voltage (Differential LV-PECL)	VOH	1.55 V Typ.	2.35 V Typ.	–		DC characteristics	
		VCC-1.025 V to VCC-0.88 V		–			
	VOL	0.80 V Typ.	1.60 V Typ.	–			
		VCC-1.81 V to VCC-1.62 V		–			
Output voltage (LVDS)	VOD	–		350 mV Typ, 247 mV to 454 mV		VOD1, VOD2	DC characteristics
	dVOD	–		50 mV Max.		dVOD = | VOD1-VOD2 |	
	VOS	–		1.25 V Typ, 1.125 V to 1.375 V		VOS1, VOS2	
	dVOS	–		150 mV Max.		dVOS = | VOS1-VOS2 |	
Output load condition (ECL) / (LVDS)	L_ECL	50 Ω		–		Terminated to VCC -2.0 V	
	L_LVDS	–		100 Ω		Connected between OUT to $\overline{OUT}$	
Input voltage	VIH	70 % VCC Min.				OE terminal	
	VIL	30 % VCC Max.					
Rise time / Fall time	tr / tf	400 ps Max.				Between 20 % and 80 % of (VOH-VOL). Between 20 % and 80 %of Differential Output peek to peek voltage.	
Start-up time	t_str	10 ms Max.				Time at minimum supply voltage to be 0 s	
Phase Jitter	tPJ	0.23 ps Max.		0.27 ps Max.		100 MHz ≤ fo < 150 MHz	Offset frequency: 12 kHz to 20 MHz
		0.22 ps Max.		0.24 ps Max.		150 MHz ≤ fo < 200 MHz	
		0.21 ps Max.		0.23 ps Max.		200 MHz ≤ fo < 300 MHz	
		0.18 ps Max.		0.19 ps Max.		300 MHz ≤ fo < 400 MHz	
		0.16 ps Max.		0.16 ps Max.		400 MHz ≤ fo < 500 MHz	
		0.14 ps Max.		0.14 ps Max.		500 MHz ≤ fo < 600 MHz	
		0.10 ps Max.		0.10 ps Max.		600 MHz ≤ fo ≤ 700 MHz	
Frequency aging *2	f_aging	± 10 × 10^{-6} / year Max.				+25 °C, First year, VCC=2.5 V,3.3 V	

*1 As per below table.
*2 Except : ***A

Output		P: Differential LV-PECL		L: LVDS	
Aging: A (include 10years aging at 25°C) or N (exclude aging)		A *3	N *4	A *3	N *4
Frequency tolerance and operating temperature	HP: ±100 × 10^{-6} , (0 to +70 °C)	PHPA	PHPN	LHPA	LHPN
	HR: ±100 × 10^{-6} , (-5 to +85 °C)	PHRA	PHRN	LHRA	LHRN
	HS: ±100 × 10^{-6} , (-20 to +70 °C)	PHSA	PHSN	LHSA	LHSN
	GP: ±50 × 10^{-6} , (0 to +70 °C)	PGPA	PGPN	LGPA	LGPN
	GR: ±50 × 10^{-6} , (-5 to +85 °C)	-	PGRN	-	LGRN
	GS: ±50 × 10^{-6} , (-20 to +70 °C)	-	PGSN	-	LGSN

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

External dimensions (Unit:mm)



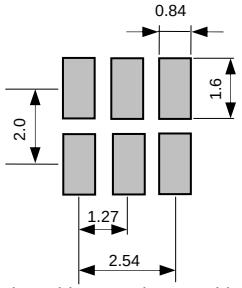
Pin map

Pin	Connection
1	OE *
2	GND
3	GND
4	OUT
5	$\overline{OUT}$
6	Vcc

*) Standby function built-in.

OE pin = HIGH : Specified frequency output.
OE pin = LOW : Output is high impedance
#2 and #3 are connected to the cover.

Footprint (Recommended) (Unit:mm)



To maintain stable operation, provide a 0.01 µF to 0.1 µF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

CRYSTAL OSCILLATOR

LOW-JITTER SAW OSCILLATOR

XG-2121/2102CA

- Frequency range : 100 MHz to 700 MHz
- Supply voltage : 2.5 V ··· XG-2121CA
  3.3 V ··· XG-2102CA
- Output : Differential LV-PECL or LVDS
- Function : Output enable (OE)
- External dimensions : 7.0 × 5.0 × 1.2 mm

- Low jitter and low phase noise by SAW unit.

Pb Free RoHS Compliant

Product Number (please contact us)
XG-2121CA P: X1M000311xxxx00
XG-2121CA L: X1M000351xxxx00
XG-2102CA P: X1M000301xxxx00
XG-2102CA L: X1M000341xxxx00

Actual size

Specifications (characteristics)

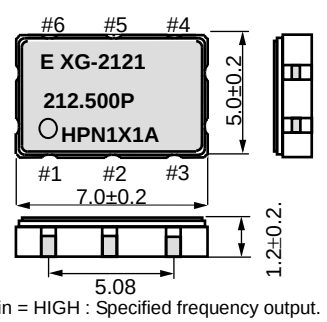
Item	Symbol	Differential LV-PECL		LVDS		Conditions / Remarks	
		XG-2121CA P	XG-2102CA P	XG-2121CA L	XG-2102CA L		
Output frequency range	fo	100 MHz to 700 MHz				Please contact us for inquiries regarding available frequencies.	
Supply voltage	Vcc	2.5 V ±0.125 V	3.3 V ±0.33 V	2.5 V ±0.125 V	3.3 V ±0.33 V		
Storage temperature	T_stg	-55 °C to +125 °C				Store as bare product.	
Operating temperature *1	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	Icc	60 mA Max.		30 mA Max.		OE=Vcc, L_ECL=50 Ω or L_LVDS=100 Ω	
Disable current	I_dis	2 mA Max.		15 mA Max.		OE=GND	
Symmetry	SYM	45 % to 55 %				At outputs crossing point	
Output voltage (Differential LV-PECL)	VOH	1.55 V Typ.	2.35 V Typ.	–		DC characteristics	
		Vcc-1.025 V to Vcc-0.88 V		–			
	VOL	0.80 V Typ.	1.60 V Typ.	–			
		Vcc-1.81 V to Vcc-1.62 V		–			
Output voltage (LVDS)	VOD	–		350 mV Typ, 247 mV to 454 mV		VOD1, VOD2	DC characteristics
	dVOD	–		50 mV Max.		dVOD = | VOD1-VOD2 |	
	VOS	–		1.25 V Typ, 1.125 V to 1.375 V		VOS1, VOS2	
	dVOS	–		150 mV Max.		dVOS = | VOS1-VOS2 |	
Output load condition (ECL) / (LVDS)	L_ECL	50 Ω		–		Terminated to Vcc -2.0 V	
	L_LVDS	–		100 Ω		Connected between OUT to $\overline{OUT}$	
Input voltage	VIH	70 % Vcc Min.				OE terminal	
	VIL	30 % Vcc Max.					
Rise time / Fall time	tr / tf	400 ps Max.				Between 20 % and 80 % of (VOH-VOL). Between 20 % and 80 %of Differential Output peek to peek voltage	
Start-up time	t_str	10 ms Max.				Time at minimum supply voltage to be 0 s	
Phase Jitter	tPJ	0.23 ps Max.		0.27 ps Max.		100 MHz ≤ fo < 150 MHz	Offset frequency: 12 kHz to 20 MHz
		0.22 ps Max.		0.24 ps Max.		150 MHz ≤ fo < 200 MHz	
		0.21 ps Max.		0.23 ps Max.		200 MHz ≤ fo < 300 MHz	
		0.18 ps Max.		0.19 ps Max.		300 MHz ≤ fo < 400 MHz	
		0.16 ps Max.		0.16 ps Max.		400 MHz ≤ fo < 500 MHz	
		0.14 ps Max.		0.14 ps Max.		500 MHz ≤ fo < 600 MHz	
		0.10 ps Max.		0.10 ps Max.		600 MHz ≤ fo ≤ 700 MHz	
Frequency aging *2	f_aging	± 10 × 10^{-6} / year Max.				+25 °C, First year, Vcc=2.5 V,3.3 V	

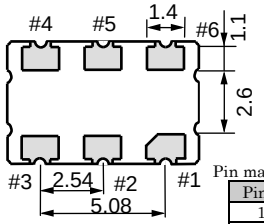
*1 As per below table.
*2 Except: ***A

Output		P: Differential LV-PECL		L: LVDS	
Aging: A (include 10years aging at 25°C) or N (exclude aging)		A*3	N*4	A*3	N*4
Frequency tolerance and operating temperature	HP: ±100 × 10^{-6} , (0 to +70 °C)	PHPA	PHPN	LHPA	LHPN
	HR: ±100 × 10^{-6} , (-5 to +85 °C)	PHRA	PHRN	LHRA	LHRN
	HS: ±100 × 10^{-6} , (-20 to +70 °C)	PHSA	PHSN	LHSA	LHSN
	GP: ±50 × 10^{-6} , (0 to +70 °C)	PGPA	PGPN	LGPA	LGPN
	GR: ±50 × 10^{-6} , (-5 to +85 °C)	-	PGRN	-	LGRN
	GS: ±50 × 10^{-6} , (-20 to +70 °C)	-	PGSN	-	LGSN

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

External dimensions (Unit:mm)





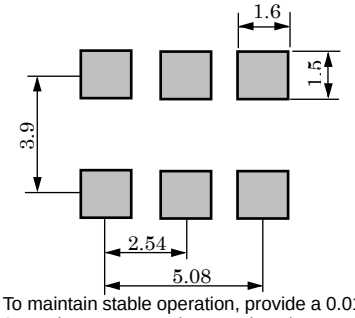
Pin map

Pin	Connection
1	OE *
2	N.C.
3	GND
4	OUT
5	$\overline{OUT}$
6	Vcc

*) Standby function built-in.
(Only Differential LV-PECL output model)

OE pin = HIGH : Specified frequency output.
OE pin = LOW : Output is high impedance
#3 is connected to the cover.

Footprint (Recommended) (Unit:mm)



To maintain stable operation, provide a 0.01 µF to 0.1µF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

CRYSTAL OSCILLATOR

LOW-JITTER SAW OSCILLATOR

EG-2121/2102CA

- 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 or HCSL
- Function : Output enable (OE)
- External dimensions : 7.0 × 5.0 × 1.2 mm

- Very low jitter and low phase noise by SAW unit.

Pb Free RoHS Compliant

Product Number (please contact us)
EG-2121CA: Q3805CAx0xxxx00
: X1M000101xxxx00
EG-2102CA: Q3806CA00xxxx00
: X1M000091xxxx00

Actual size

EG-2121CA	EG-2102CA
	

Specifications (characteristics)

►Differential LV-PECL Output

Item	Symbol	EG-2121CA	EG-2102CA	Conditions / Remarks
		Differential LV-PECL		
Output frequency range	fo	53.125 MHz to 500 MHz	100 MHz to 700 MHz	Please contact us for inquiries regarding available frequencies.
Supply voltage	Vcc	2.5 V ±0.125 V	3.3 V ±0.3 V	
Storage temperature	T_stg	-40 °C to +100 °C		Store as bare product .
Operating temperature *1	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	Icc	80 mA Max.	100 mA Max.	OE=Vcc, L_ECL=50 Ω
Disable current	I_dis	20 mA Max.	32 mA Max	OE=GND
Symmetry	SYM	P:40 % to 60 % (fo > 350 MHz)	P:45 % to 55 %	at outputs crossing point
		P:45 % to 55 % (fo ≤ 350 MHz)		
		D:48 % to 52 % (fo ≤ 175 MHz)	D:48 % to 52 % (fo ≤ 350 MHz)	
Output voltage	VOH	1.55 V Typ.	2.35 V Typ.	DC characteristics
		Vcc-1.025 V to Vcc-0.88 V		
	VOL	0.8 V Typ.	1.6 V Typ.	
		Vcc-1.81 V to Vcc-1.62 V		
Output load condition (ECL)	L_ECL	50 Ω		Terminated to Vcc -2.0 V
Input voltage	VIH	70 % Vcc Min.		OE terminal
	VIL	30 % Vcc Max.		
Rise time / Fall time	tr / tf	400 ps Max.		Between 20% and 80% of (VOH-VOL)
Start-up time	t_str	10 ms Max.		Time at minimum supply voltage to be 0 s
Phase Jitter	tPJ	0.8 ps Max.		fo < 100 MHz; Offset frequency: 12 kHz to 20 MHz
		0.5 ps Max.		100 MHz ≤ fo < 200 MHz; Offset frequency: 12 kHz to 20 MHz
		0.3 ps Max.		200 MHz ≤ fo; Offset frequency: 12 kHz to 20 MHz
Frequency aging *2	f_aging	± 10 × 10^{-6} / year Max.		+25 °C, First year, Vcc=2.5 V,3.3 V

*1 As per below table 1.
*2 Except: ***A

►LVDS Output

Item	Symbol	EG-2121CA	EG-2102CA	Conditions / Remarks
		LVDS		
Output frequency range	fo	53.125 MHz to 700 MHz		Please contact us for inquiries regarding available frequencies.
Supply voltage	Vcc	2.5 V ±0.125 V	3.3 V ±0.3 V	
Storage temperature	T_stg	-40 °C to +100 °C		Store as bare product.
Operating temperature *1	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	Icc	30 mA Max	45 mA Max.	OE=Vcc, L_LVDS= 100 Ω
Disable current	I_dis	20 mA Max	30 mA Max.	OE=GND
Symmetry	SYM	L:40 % to 60 % (fo > 350 MHz)	L:40 % to 60 % (fo > 350 MHz)	at outputs crossing point
		L:45 % to 55 % (fo ≤ 350 MHz)	L:45 % to 55 % (fo ≤ 350 MHz)	
		V:48 % to 52 % (fo ≤ 175 MHz)	V:48 % to 52 % (fo ≤ 175 MHz)	
Output voltage	VOD	350 mV Typ. 247 mV to 454 mV		VOD1, VOD2; DC characteristics
	dVOD	50 mV Max.		dVOD = | VOD1-VOD2 |
	VOS	1.25 V Typ. 1.125 V to 1.375 V		VOS1, VOS2
	dVOS	150 mV Max.		dVOS = | VOS1-VOS2 |
Output load condition (LVDS)	L_LVDS	100 Ω		Connected between OUT to $\overline{OUT}$
Input voltage	VIH	70 % Vcc Min.		OE terminal
	VIL	30 % Vcc Max.		
Rise time / Fall time	tr / tf	400 ps Max.		Between 20 % and 80 %of Differential Output peek to peek voltage
Start-up time	t_str	10 ms Max.		Time at minimum supply voltage to be 0 s
Phase Jitter	tPJ	0.8 ps Max.		fo < 100 MHz; Offset frequency: 12 kHz to 20 MHz
		0.5 ps Max.		100 MHz ≤ fo < 200 MHz; Offset frequency: 12 kHz to 20 MHz
		0.3 ps Max.		200 MHz ≤ fo; Offset frequency: 12 kHz to 20 MHz
Frequency aging *2	f_aging	± 10 × 10^{-6} / year Max.		+25 °C, First year, Vcc=2.5 V,3.3 V

*1 As per below table 1.
*2 Except: ***A

►HCSL Output

Item	Symbol	EG-2121CA	EG-2102CA	Conditions / Remarks
		HCSL		
Output frequency range	fo	100 MHz to 350 MHz		Please contact us for inquiries regarding available frequencies.
Supply voltage	Vcc	2.5 V ±0.125 V	3.3 V ±0.3 V	
Storage temperature	T_stg	-40 °C to +125 °C		Store as bare product.
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	Icc	80 mA Max.	85 mA Max.	OE=Vcc,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
Output Voltage	VOH	0.75 V Typ.		DC characteristics
	VOL	-0.3 V Typ.		
Output load condition (HCSL)	L_HCSL	50 Ω		Terminated to GND
Input voltage	VIH	70 % Vcc Min.		OE terminal
	VIL	30 % Vcc Max.		
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
Phase Jitter	t_{PJ}	0.8 ps Max.		fo < 100 MHz; Offset frequency: 12 kHz to 20 MHz
		0.5 ps Max.		100 MHz ≤ fo < 200 MHz
		0.3 ps Max.		200 MHz ≤ fo
Frequency aging *2	f_aging	± 10 × 10^{-6} / year Max.		+25 °C, First year, Vcc=2.5 V,3.3 V

*1 As per below table 1.
*2 Except: ***A

Table 1 Frequency tolerance and aging

Output and Symmetry		P: Differential LV-PECL		D: Differential LV-PECL		L: LVDS		V: LVDS		H: HCSL	
Frequency range		All range		EG-2121CA: fo ≤ 175 MHz EG-2102CA: fo ≤ 350 MHz		All range		fo ≤ 175 MHz		All range	
Aging		A *3	N *4	A *3	N *4	A *3	N *4	A *3	N *4	A *3	N *4
Frequency tolerance and operating temperature	HP: ±100 × 10^{-6} (0°C to +70°C)	PHPA	PHPN	DHPA	DHPN	LHPA	LHPN	VHPA	VHPN	HHPA	HHPN
	HR: ±100 × 10^{-6} (-5°C to +85°C)	PHRA *5	PHRN *5	DHRA *5	DHRN *5	LHRA *5	LHRN *5	VHRA *5	VHRN *5	HHRA	HHRN
	GP: ±50 × 10^{-6} (0°C to +70°C)	PGPA *5	PGPN *5	DGPA *5	DGPN *5	LGPA *5	LGPN *5	VGPA *5	VGPN *5	HGPA	HGPN
	GR: ±50 × 10^{-6} (-5°C to +85°C)	—	PGRN *5	—	DGRN *5	—	LGRN *5	—	VGRN *5	—	HGRN
	HS: ±100 × 10^{-6} (-20°C to +70°C)	PHSA *5	PHSN *5	DHSA *5	DHSN *5	LHSA *5	LHSN *5	VHSA *5	VHSN *5	HHSA	HHSN
	GS: ±50 × 10^{-6} (-20°C to +70°C)	—	PGSN *5	—	DGSN *5	—	LGSN *5	—	VGSN *5	—	HGSN

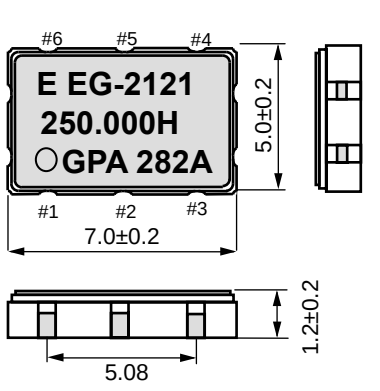
*3 This includes initial frequency tolerance, temperature variation, supply voltage variation, reflow drift, and aging(+25 °C,10 years).
*4 This includes initial frequency tolerance, temperature variation, supply voltage variation, and reflow drift(except aging).
*5 53.125 MHz ≤ fo < 100 MHz : Unavailable.

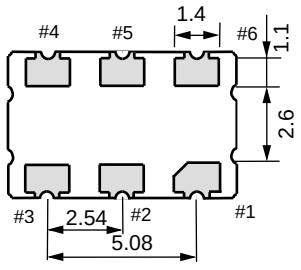
Table 2 Jitter

Item	Symbol	Specifications	Remarks
Jitter *	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

* Based on DTS-2075 Digital timing system made from WAVECREST with jitter analysis software VISI6. : Differential LV-PECL, LVDS output
* Based on SIA-3100C signal integrity analyzer made from WAVECREST. : HCSL output

External dimensions (Unit:mm)





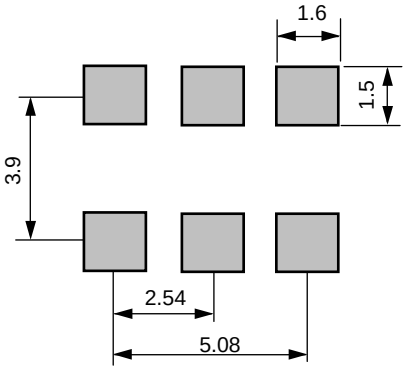
Pin map

Pin	Connection
1	OE
2	N.C.
3	GND
4	OUT
5	$\overline{OUT}$
6	VCC

#3 is connected to the cover.

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

Footprint (Recommended) (Unit:mm)



To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

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 mm

- Very low jitter and low phase noise by SAW unit.

Pb Free RoHS Compliant

Product Number (please contact us)
Q3803CA00xxxx00

Actual size

Specifications (characteristics)

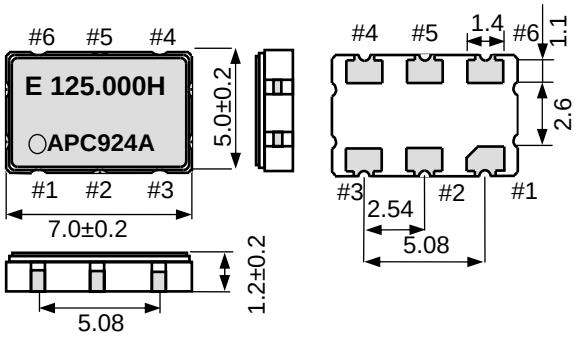
Item	Symbol	Specifications	Conditions / Remarks
Output frequency range	fo	62.500 MHz to 99.999 MHz	Please contact us for inquiries regarding available frequencies
Supply voltage	Vcc	3.3 V ±0.15 V	
Storage temperature	T_stg	-40 °C to +100 °C	Store as bare product.
Operating temperature	T_use	0 °C to +70 °C	
Frequency tolerance *1	f_tol	Z: ±50 × 10^{-6} , H,Y: ±100 × 10^{-6}	
Current consumption	Icc	60 mA Max.	OE=Vcc, L_ECL=50 Ω
Disable current	I_dis	25 mA Max.	OE=GND
Symmetry	SYM	D:47.5 % to 52.5 %	at outputs crossing point
Output voltage	VOH	2.35 V Typ. Vcc-1.025 V to Vcc-0.88 V	DC characteristics
	VOL	1.60 V Typ. Vcc-1.81 V to Vcc-1.62 V	
Output load condition (ECL)	L_ECL	50 Ω	Terminated to Vcc -2.0 V
Input voltage	VIH	70 % Vcc Min.	OE terminal
	VIL	30 % Vcc Max.	
Rise time / Fall time	t_r / t_f	600 ps Max.	Between 20% and 80% of (VOH-VOL)
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}	0.8 ps Max.	fo < 100 MHz; Offset frequency: 12 kHz to 20 MHz
		0.5 ps Max.	100 MHz ≤ fo < 200 MHz; Offset frequency: 12 kHz to 20 MHz
		0.3 ps Max.	200 MHz ≤ fo; Offset frequency: 12 kHz to 20 MHz
Frequency aging	f_aging	± 5 × 10^{-6}/ year Max.	+25 °C, First year, Vcc=3.3 V

*1 As per below table
*2 Based on DTS-2075 Digital timing system made from WAVECREST with jitter analysis software VISI6.

Symmetry		D: 50 ±2.5 %
frequency tolerance and operating temperature	H: ±100 × 10^{-6} (0 °C to +70 °C) *3	DCH
	Y: ±100 × 10^{-6} (0 °C to +70 °C) *4	DCY
	Z: ±50 × 10^{-6} (0 °C to +70 °C) *5	DCZ

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

External dimensions (Unit:mm)



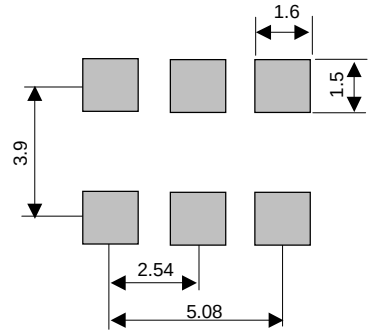
Pin map

Pin	Connection
1	OE
2	N.C.
3	GND
4	OUT
5	$\overline{OUT}$
6	Vcc

#3 is connected to the cover.

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

Footprint (Recommended) (Unit:mm)



To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

CRYSTAL OSCILLATOR

LOW-JITTER SAW OSCILLATOR

EG-4121/4101CA

- Frequency range : 100 MHz to 700 MHz
- Supply voltage : 2.5 V ··· EG-4121CA
  3.3 V ··· EG-4101CA
- Output : Differential LV-PECL or LVDS or HCSL
- Function : Output enable (OE)
- External dimensions : 7.0 × 5.0 × 1.2 mm

- Very low jitter and low phase noise by SAW unit.

Pb Free RoHS Compliant

Product Number (please contact us)
X1M0001x1xxxx00


Actual size

EG-4121CA	EG-4101CA
	

Specifications (characteristics)

►Differential LV-PECL Output

Item	Symbol	EG-4121CA P	EG-4101CA P	Conditions / Remarks
		Differential LV-PECL		
Output frequency range	fo	100 MHz to 700 MHz		Please contact us for inquiries regarding available frequencies.
Supply voltage	Vcc	2.5 V ±0.125 V	3.3 V ±0.33 V	
Storage temperature	T_stg	-55 °C to +125 °C		Store as bare product.
Operating temperature *1	T_use	W:-40 °C to +85 °C		
Frequency tolerance *1	f_tol	G: ± 50 × 10^{-6}		
Current consumption	Icc	60 mA Max.		OE=Vcc, L_ECL =50 Ω
Disable current	I_dis	2 mA Max.		OE=GND
Symmetry	SYM	45 % to 55 %		at outputs crossing point
Output voltage	VOH	1.55 V Typ.	2.35 V Typ.	DC characteristics
		Vcc-1.025 V to Vcc-0.88 V		
	VOL	0.8 V Typ.	1.6 V Typ.	
		Vcc-1.81 V to Vcc-1.62 V		
Output load condition (ECL)	L_ECL	50 Ω		Terminated to Vcc -2.0 V
Input voltage	VIH	70 % Vcc Min.		OE terminal
	VIL	30 % Vcc Max.		
Rise time / Fall time	tr / tf	400 ps Max.		Between 20 % and 80 % of (VOH-VOL)
Start-up time	t_str	10 ms Max.		Time at minimum supply voltage to be 0 s
Phase Jitter	tPJ	0.23 ps Max.		100 MHz ≤ fo < 150 MHz; Offset frequency: 12 kHz to 20 MHz
		0.22 ps Max.		150 MHz ≤ fo < 200 MHz
		0.21 ps Max.		200 MHz ≤ fo < 300 MHz
		0.18 ps Max.		300 MHz ≤ fo < 400 MHz
		0.16 ps Max.		400 MHz ≤ fo < 500 MHz
		0.14 ps Max.		500 MHz ≤ fo < 600 MHz
		0.10 ps Max.		600 MHz ≤ fo ≤ 700 MHz

*1 As per below table 1.

►LVDS Output

Item	Symbol	EG-4121CA L	EG-4101CA L	Conditions / Remarks
		LVDS		
Output frequency range	fo	100 MHz to 700 MHz		Please contact us for inquiries regarding available frequencies.
Supply voltage	Vcc	2.5 V ±0.125 V	3.3 V ±0.33 V	
Storage temperature	T_stg	-55 °C to +125 °C		Store as bare product.
Operating temperature *1	T_use	W:-40 °C to +85 °C		
Frequency tolerance *1	f_tol	G: ± 50 × 10^{-6}		
Current consumption	Icc	30 mA Max		OE=Vcc, L_LVDS=100 Ω
Disable current	I_dis	15 mA Max		OE=GND
Symmetry	SYM	45 % to 55 %		at outputs crossing point
Output voltage	VOD	350 mV Typ. 247 mV to 454 mV		VOD1, VOD2; DC characteristics
	dVOD	50 mV Max.		dVOD = | VOD1-VOD2 |
	VOS	1.25 V Typ. 1.125 V to 1.375 V		VOS1, VOS2
	dVOS	150 mV Max.		dVOS = | VOS1-VOS2 |
Output load condition (LVDS)	L_LVDS	100 Ω		Connected between OUT to $\overline{OUT}$
Input voltage	VIH	70 % Vcc Min.		OE terminal
	VIL	30 % Vcc Max.		
Rise time / Fall time	tr / tf	400 ps Max.		Between 20 % and 80 % of Differential Output peek to peek voltage.
Start-up time	t_str	10 ms Max.		Time at minimum supply voltage to be 0 s
Phase Jitter	tPJ	0.27 ps Max.		100 MHz ≤ fo < 150 MHz; Offset frequency: 12 kHz to 20 MHz
		0.24 ps Max.		150 MHz ≤ fo < 200 MHz
		0.23 ps Max.		200 MHz ≤ fo < 300 MHz
		0.19 ps Max.		300 MHz ≤ fo < 400 MHz
		0.16 ps Max.		400 MHz ≤ fo < 500 MHz
		0.14 ps Max.		500 MHz ≤ fo < 600 MHz
		0.10 ps Max.		600 MHz ≤ fo ≤ 700 MHz

*1 As per below table 1.

►HCSL Output

Item	Symbol	EG-4121CA H	EG-4101CA H	Conditions / Remarks	
		HCSL			
Output frequency range	fo	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		
Storage temperature	T_stg	-55 °C to +125 °C		Store as bare product.	
Operating temperature	T_use	W:-40 °C to +85 °C			
Frequency tolerance *1	f_tol	G: ± 50 × 10^{-6}			
Current consumption	I_{CC}	75 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	
Output Voltage	V_{OH}	0.75 V Typ.		DC characteristics	
	V_{OL}	-0.3 V Typ.			
Output load condition (HCSL)	L_HCSL	50 Ω		Terminated to GND	
Input voltage	V_{IH}	70 % V_{CC} Min.		OE terminal	
	V_{IL}	30 % V_{CC} Max.			
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	
Phase Jitter	t_{PJ}	0.8 ps Max.		fo < 100 MHz	Offset frequency: 12 kHz to 20 MHz
		0.5 ps Max.		100 MHz ≤ fo < 200 MHz	
		0.3 ps Max.		200 MHz ≤ fo	

*1 As per below table 1.

Table 1 Frequency tolerance and aging

Output		P: Differential LV-PECL	L: LVDS	H: HCSL
Aging		A *2	A *2	A *2
Frequency tolerance and Operating temperature	GW: ±50 × 10^{-6} (-40°C to +85°C)	PGWA	LGWA	HGWA

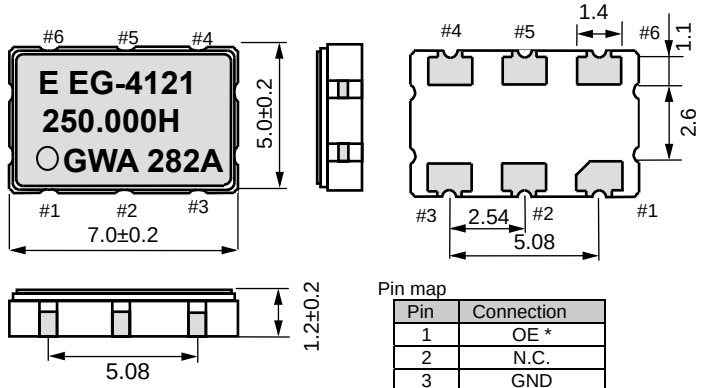
*2 This includes initial frequency tolerance, temperature variation, supply voltage variation, reflow drift, and aging(+25 °C,10 years).

Table 2 Jitter

Item	Symbol	Specifications	Remarks
Jitter *	t_{DJ}	0.2 ps Typ.	Deterministic Jitter
	t_{RJ}	3 ps Typ.	Random Jitter
	t_{RMS}	2 ps Typ.	σ (RMS of total distribution)
	t_{p-p}	20 ps Typ.	Peak to Peak
	t_{acc}	4 ps Typ.	Accumulated Jitter(σ) n=2 to 50000 cycles

* Based on DTS-2075 Digital timing system made from WAVECREST with jitter analysis software VISI6. : Differential LV-PECL, LVDS output
* Based on SIA-3100C signal integrity analyzer made from WAVECREST. : HCSL output

External dimensions (Unit:mm)



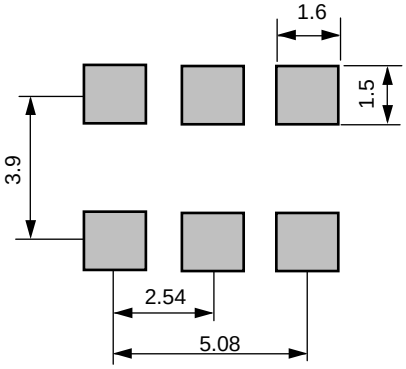
Pin map

Pin	Connection
1	OE *
2	N.C.
3	GND
4	OUT
5	$\overline{OUT}$
6	V_{CC}

OE pin = HIGH : Specified frequency output.
OE pin = LOW : Output is high impedance
#3 is connected to the cover.

*) Standby function is built-in
(Only Differential LV-PECL output model).

Footprint (Recommended) (Unit:mm)



To maintain stable operation, provide a 0.01 µF to 0.1 µF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between V_{CC} - GND).

CRYSTAL OSCILLATOR
FOR AUTOMOTIVE APPLICATION
LOW-JITTER SAW OSCILLATOR

EA-2102CB

- Frequency range : 100 MHz
- Operating voltage : 3.3 V
- Output : Differential LV-PECL
- Function : Output enable (OE)
- External dimensions : 5.0 × 3.2 × 1.35 mm

- Very low jitter and low phase noise by SAW unit.
- Conforms to AEC-Q200

Product Number (please contact us)
Q3861CB00xxxx00

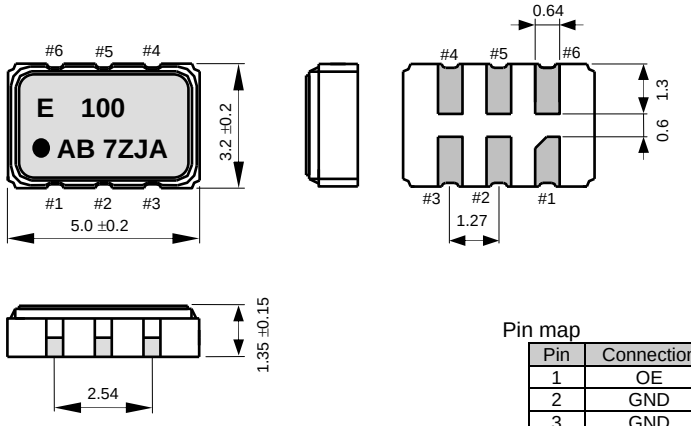
Actual size

Specifications (characteristics)

Item	Symbol	Specifications	Conditions / Remarks
Output frequency range	fo	100.0000 MHz	Please contact us for inquiries regarding available frequencies.
Supply voltage	Vcc	3.3 V ± 0.3 V	
Storage temperature	T_stg	-40 °C to +100 °C	Store as bare product.
Operating temperature	T_use	-40 °C to +85 °C	
Frequency tolerance *1	f_tol	$\pm 300 \times 10^{-6}$	
Current consumption	Icc	80 mA Max.	OE=Vcc, L_ECL = 50 Ω
Disable current	I_dis	35 mA Max.	OE=GND
Symmetry	SYM	47.5 % to 52.5 %	At outputs crossing point
Output voltage	VOH	2.35 V Typ. Vcc-1.025 V to Vcc-0.88 V	DC characteristics
	VOL	1.60 V Typ. Vcc-1.81 V to Vcc-1.62 V	
Output load condition (ECL)	L_ECL	50 Ω	Terminate to Vcc-2.0 V
Input voltage	VIH	70 % Vcc Min.	OE terminal
	VIL	30 % Vcc Max.	
Rise time / Fall time	tr / tf	600 ps Max.	Between 20% and 80% of (VOH-VOL)
Start-up time	t_str	10 ms Max.	Time at minimum supply voltage to be 0 s
Jitter *2	tDJ	0.2 ps Typ.	Deterministic Jitter
	tRJ	3 ps Typ.	Random Jitter
	tRMS	3 ps Typ.	σ (RMS of total distribution)
	tp-p	25 ps Typ.	Peak to Peak
	tacc	4 ps Typ.	Accumulated Jitter(σ) n=2 to 50000 cycles
Phase Jitter	tPJ	1 ps Max.	Offset frequency: 12 kHz to 20 MHz

*1 Includes initial frequency tolerance, temperature variation, supply voltage variation, reflow drift, and aging (+25deg.C, 10 years).
*2 Based on DTS-2075 Digital timing system made from WAVECREST with jitter analysis software VISI6.

External dimensions (Unit:mm)



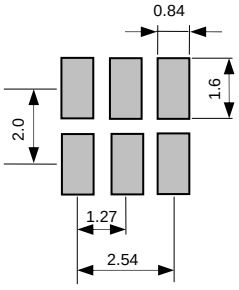
OE pin = HIGH : Specified frequency output.
OE pin = LOW : Output is high impedance

Pin map

Pin	Connection
1	OE
2	GND
3	GND
4	OUT
5	$\overline{OUT}$
6	Vcc

#2 and #3 are connected to the cover

Footprint (Recommended) (Unit:mm)



To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - 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 : ±140 × 10^{-6} (*SCM / *SBM)
  ±120 × 10^{-6} (*QEM)
- Low current consumption : 1.0 mA Typ. (27 MHz , 3.3 V)
- External dimensions : 3.2 × 2.5 × 1.05 mm

Pb Free
RoHS Compliant

Product Number (please contact us)
Q3614CE00xxxx00

Actual size

Specifications (characteristics)

Item	Symbol	Specifications			Conditions / 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	Vcc	3.3 V ±0.3 V	2.8 V ±0.2 V	1.8 V ±0.2 V	
Storage temperature	T_stg	-40 °C to +125 °C			Store as bare product.
Operating temperature	T_use	As per below table			
Frequency tolerance	f_tol	As per below table			C : Vc=1.65 V / B : Vc=1.40 V / E : Vc=0.90 V
Current consumption	Icc	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.	Vc = 1/2 Vcc ± 1/2 Vcc
Modulation characteristics	BW	15 kHz Min.			± 3 dB (at 1 kHz)
Input resistance	Rin	M : 5 MΩ Min.			DC level
Frequency change polarity	—	Positive polarity			Vc=0 V to Vcc
Symmetry	SYM	40 % to 60 %			CMOS load:50 % Vcc level
Output voltage	VOH	Vcc-0.4 V Min.			IOH=-3.0 mA
	VOL	0.4 V Max.			IOL= 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 % Vcc to 80 % Vcc level
Start-up time	t_str	5 ms Max.			Time at 90 % Vcc to be 0 s
Frequency aging	f_aging	± 5 × 10^{-6} Max.			+25 °C, 5 years

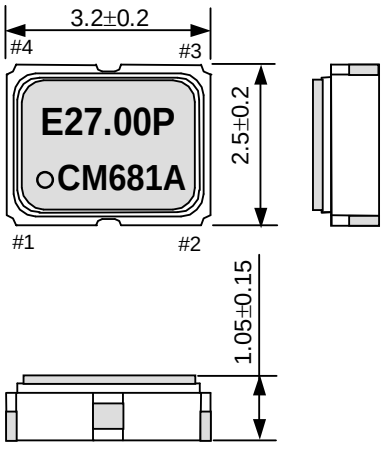
* Please keep Vc pin open or ground while powering up Vcc.

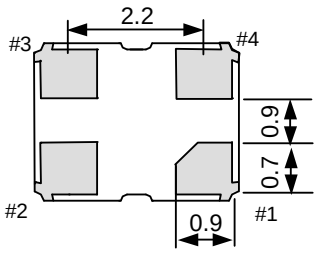
Frequency tolerance / Temperature range / Absolute pull range

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

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

External dimensions (Unit:mm)

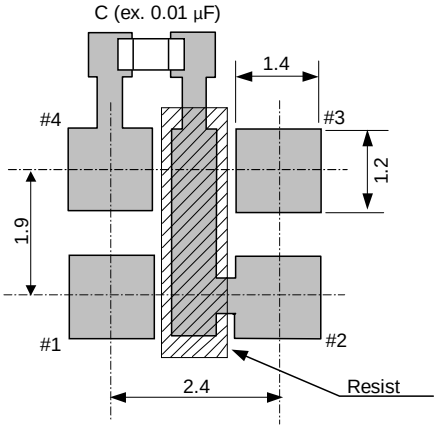




Pin map

Pin	Connection
1	Vc
2	GND
3	OUT
4	Vcc

Footprint (Recommended) (Unit:mm)



To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

VOLTAGE -CONTROLLED CRYSTAL OSCILLATOR (VCXO)

VG - 4231CB

- Frequency range : 1 MHz to 81 MHz
- Supply voltage : 3.3 V
- Absolute pull range : ±50 × 10^{-6}
- Function : Output enable (OE)
- External dimensions: 5.0 × 3.2 × 1.2 mm

Pb Free RoHS Compliant

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

Actual size

Specifications (characteristics)

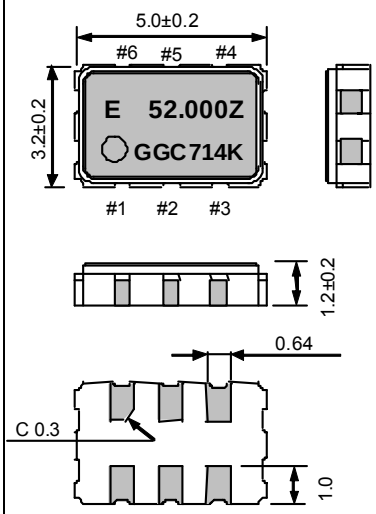
Item	Symbol	Specifications	Conditions / Remarks
Output frequency range	fo	1.000 MHz to 81.000 MHz	Please contact us for inquiries regarding available frequencies.
Supply voltage	Vcc	3.3 V ±0.165 V	
Storage temperature range	T_stg	-40 °C to +85 °C	Store as bare product.
Operating temperature range	T_use	As per below table	
Frequency tolerance	f_tol	±50 × 10^{-6} Max.	
Current consumption	Icc	10 mA Max.	No load condition.
Absolute pull range	APR	GCZ : ±50 × 10^{-6} Min.	Vc=1.65 V±1.5 V
Input resistance	Rin	10 MΩ Min.	DC level
Frequency change polarity	—	Positive slope	Vc=0.15 to 3.15 V
Symmetry	SYM	45 % to 55 %	50 % Vcc level
Output voltage	VOH	Vcc to 0.4 V Min.	I_{OH} = -0.8 mA
	VOL	0.4 V Max.	I_{OL} = 3.2 mA
Output load condition (CMOS)	L_CMOS	15 pF Max.	
Input voltage	VIH	70 % Vcc Min.	
	VIL	30 % Vcc Max.	
Rise time / Fall time	tr / tf	6 ns Max.	20 % Vcc to 80 % Vcc level
Start-up time	t_str	10 ms Max.	Time at minimum supply voltage to be 0 s
Frequency aging	f_aging	Be included in Frequency tolerance	+25 °C, Vcc=3.3 V, 20 years (fo ≤ 60MHz), +25 °C, Vcc=3.3 V, 10 years (60MHz < fo)

* Please keep Vc pin open or ground while powering up Vcc.

Operating temperature range

	Operating temperature
GGCZ	G: −40 °C to +85 °C
JGCZ	J: −20 °C to +70 °C
KGCZ	K: 0 °C to +70 °C

External dimensions (Unit: mm)

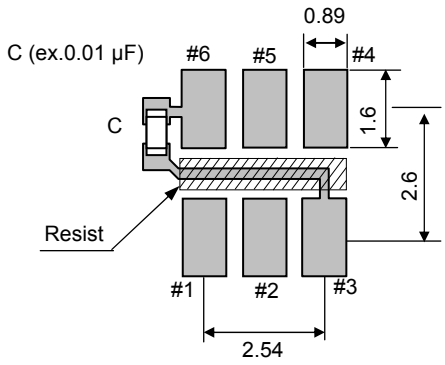


Pin map

Pin	Connection
1	Vc
2	OE
3	GND
4	OUT
5	N.C.
6	Vcc

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

Footprint (Recommended) (Unit: mm)



To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

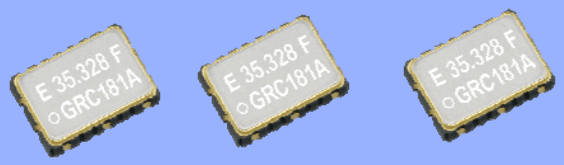
VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR (VCXO)
WIDE PULL RANGE

VG-4231CA
VG-4232CA

- Frequency range : 1 MHz to 80 MHz
- Supply voltage : 3.3 V / 5.0V ··· VG-4231CA
  3.3 V ··· VG-4232CA
- Absolute pull range : ±80 × 10^{-6}, ±65 × 10^{-6} ··· VG-4231CA
  ±50 × 10^{-6} ··· VG-4232CA
- External dimensions : 7.0 × 5.0 × 1.4 mm

Pb Free RoHS Compliant

Product Number (please contact us)
VG-4231CA: Q3614CA00xxxx00
VG-4232CA: X1G003921xxxx00



Actual size

Specifications (characteristics)

Item	Symbol	VG-4231CA	VG-4232CA	Conditions / Remarks
Output frequency range	f_0	1.000 MHz to 60.000 MHz	60.001 MHz to 80.000 MHz	Please contact us for inquiries regarding available frequencies.
Supply voltage	Vcc	H:5.0 V ±0.5 V, C:3.3 V ±0.3 V	C:3.3 V ±0.165 V	
Control voltage	Vc	H:2.5 V ±2.0 V, C:1.65 V ±1.5 V	1.65 V ±1.65 V	
Storage temperature	T_stg	-40 °C to +125 °C	-55 °C to +125 °C	Store as bare product.
Operating temperature	T_use	As per below table		
Frequency tolerance	f_tol	As per below table		Vc=2.5 V(**H), Vc=1.65 V(**C)
Current consumption	Icc	H:20 mA Max. , C: 10 mA Max.	35mA Max.	No load condition
Disable current	I_dis	H:15 mA Max. , C: 7 mA Max.	25mA Max.	OE=GND
Frequency control range	F_cont	R:±130 × 10^{-6}	—	
Absolute pull range *1	APR	D:±80 × 10^{-6} Min., G:±65 × 10^{-6} Min.	±50 × 10^{-6} Min.	
Modulation characteristics	BW	15 kHz Min.	5 kHz Min.	±3 dB (at 1 kHz)
Input resistance	Rin	50 kΩ Min.	80 kΩ Min.	F or T Type / DC Level
		H: — , C:10 MΩ Min.	—	M or Z Type / DC Level
Frequency change polarity	—	Positive polarity		
Symmetry	SYM	40 % to 60 %	45 % to 55 %	CMOS load: 50 % Vcc level
Output voltage	VOH	Vcc-0.4 V Min.	90 % Vcc Min.	IOH=-4 mA(**H), IOH=-0.8 mA(**C)
	VOL	0.4 V Max.	10 % Vcc Max.	IOL=4 mA(**H), IOL=3.2 mA(**C)
Output load condition	L_CMOS	15 pF Max.		CMOS load
Input voltage	VIH	70 % Vcc Min.		OE terminal
	VIL	30 % Vcc Max.		
Rise time and Fall time	t_r / t_f	4 ns Max.	5 ns Max.	CMOS load: 20 % Vcc to 80 % Vcc level
Start-up time	t_str	10 ms Max.		Time at 90 % Vcc to be 0s
Frequency aging	f_aging	±10 × 10^{-6} Max.*2	Included in Frequency tolerance.	+25 °C, 10 years

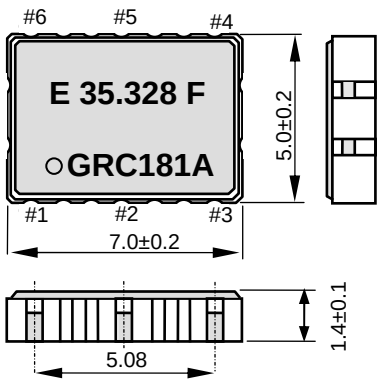
*1 Absolute pull range = Frequency control range- (Frequency tolerance + 10 years Aging + Free fall + Vibration)
*2 50 MHz < f_0 ≤ 60 MHz : ±15 × 10^{-6} Max.
* Please keep Vc pin open or ground while powering up Vcc.

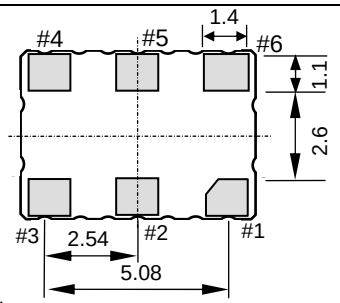
Frequency tolerance / Operating temperature

VG-4231CA		Frequency tolerance	Operating temperature
GRC / GRH	G	±50 × 10^{-6}	−40 °C to +85 °C
DRC / DRH	D	±35 × 10^{-6}	-20 °C to +70 °C

VG-4232CA		Frequency tolerance	Operating temperature
GGC	G	±50 × 10^{-6}	−40 °C to +85 °C
JGC	J	±50 × 10^{-6}	-20 °C to +70 °C
KGC	K	±50 × 10^{-6}	0 °C to +70 °C

External dimensions (Unit: mm)



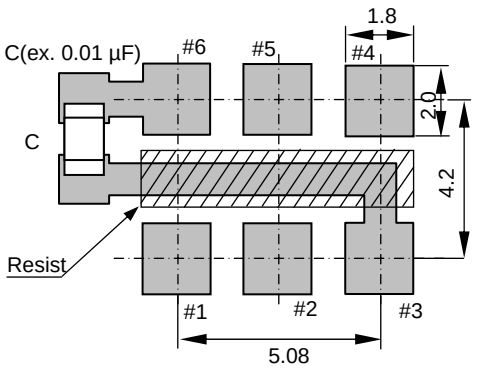


Pin map

Pin	Connection F Type M Type	Connection T Type Z Type
1	Vc	
2	N.C.	OE
3	GND	
4	OUT	
5	OE	N.C.
6	Vcc	

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

Footprint (Recommended) (Unit: mm)



To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

VOLTAGE -CONTROLLED CRYSTAL OSCILLATOR (VCXO)

VG-4513CA

NEW

- Frequency range : 100 MHz to 500 MHz
- Supply voltage : 3.3 V
- Absolute pull range : 30 × 10^{-6}, 50 × 10^{-6}, 100 × 10^{-6}
- External dimensions : 7.0 × 5.0 × 1.6 t (mm) Typ.
- Function : Output Enable(OE) Active High
- Output : LV-PECL

Pb Free RoHS Compliant

Product Number (please contact us)
X1G004141xxxx00

Actual size

Absolute Maximum ratings

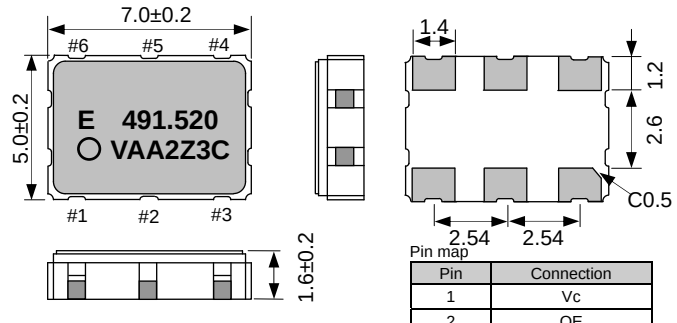
Item	Symbol	Specifications	Remarks
Supply voltage	Vcc	-0.5 V to 5.0 V	
Control voltage	Vc	-0.5V to Vcc+0.5 V	
Operating temperature range	T_use	-40 ℃to +85 ℃	
Storage temperature range	T_stg	-55 °C to +125 °C	

Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Output frequency range	fo	100.000 MHz～500.000 MHz	
Supply voltage	Vcc	3.3 V ±0.165 V	
Current consumption	Icc	65 mA Max.	
Frequency tolerance (includes 10years aging)	f_tol	fo≦200MHz : ±50 × 10^{-6} Max. fo＞200MHz : ±70 × 10^{-6} Max.	Includes 10years aging
Absolute pull range	APR	±30 × 10^{-6} Min. ±50 × 10^{-6} Min. ±100 × 10^{-6} Min.	Vc= 0 V to 3.3 V
Pull range	PR	fo≦200MHz ±80 × 10^{-6} to ±160 × 10^{-6} (APR ±30 × 10^{-6} Min.) ±100 × 10^{-6} to ±200 × 10^{-6} (APR ±50 × 10^{-6} Min.) ±150 × 10^{-6} to ±300 × 10^{-6} (APR ±100 × 10^{-6} Min.) fo＞200MHz ±100 × 10^{-6} to ±200 × 10^{-6} (APR ±30 × 10^{-6} Min.) ±120 × 10^{-6} to ±240 × 10^{-6} (APR ±50 × 10^{-6} Min.) ±170 × 10^{-6} to ±340 × 10^{-6} (APR ±100 × 10^{-6} Min.)	Vc= 0 V to 3.3 V
Input resistance	Rin	100 kΩ Min.	DC level
Output load condition	L_ECL	50Ω at Vcc -2.0V	
High output voltage	VOH	Vcc-1.1 V Min.	
Low output voltage	VOL	Vcc-1.5 V Max.	
Symmetry	SYM	40 % to 60 %	At Vcc-1.30 V, Vc=1/2Vcc V
Rise/Fall times	Tr/Tf	0.5 ns Max.	At 20 % to 80 % output swing
High input voltage	VIH	70% Vcc	VIH or OPEN => Enable
Low input voltage	VIH	30% Vcc	VIL or GND => Disable
Oscillation start up time	toec	10ms Max.	

Item	Offset frequency	122.88 MHz	153.6 MHz	245.76 MHz	368.64 MHz	491.52 MHz
Phase noise (Typical value) APR ±50 × 10^{-6} Min.	10 Hz	-75 dBc/Hz	-70 dBc/Hz	-64 dBc/Hz	-57 dBc/Hz	-55 dBc/Hz
	100 Hz	-105 dBc/Hz	-100 dBc/Hz	-94 dBc/Hz	-87 dBc/Hz	-85 dBc/Hz
	1 kHz	-129 dBc/Hz	-124 dBc/Hz	-118 dBc/Hz	-114 dBc/Hz	-110 dBc/Hz
	10 kHz	-147 dBc/Hz	-143 dBc/Hz	-138 dBc/Hz	-137 dBc/Hz	-132 dBc/Hz
	100 kHz	-151 dBc/Hz	-152 dBc/Hz	-149 dBc/Hz	-152 dBc/Hz	-150 dBc/Hz

External dimensions (Unit :mm)

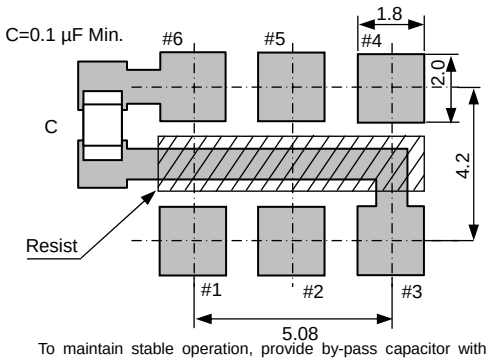


Note
OE pin = "H" or "open" : Specified frequency output.
OE pin = "L" : Output is disable.

Pin map

Pin	Connection
1	Vc
2	OE
3	GND
4	OUT1(Positive)
5	OUT2(Negative)
6	Vcc

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 Vcc - GND).

VOLTAGE -CONTROLLED CRYSTAL OSCILLATOR (VCXO)

VG-4501CA
VG-4502CA

NEW

- Frequency range : 80 MHz ～ 170 MHz (VG-4501CA)
  : 80 MHz ～ 125 MHz (VG-4502CA)
- Supply voltage : 3.3 V
- Absolute pull range : ±50 × 10^{-6} Min./ ±100 × 10^{-6} Min.
- External dimensions: 7.0 × 5.0 × 1.6 mm
- Function : Output enable (OE), Active High

RoHS Compliant

Product Number (please contact us)
VG-4501CA :
X1G003771xxxx00 (fo ≦125MHz)
X1G004191xxxx00 (125 MHz＜fo)
VG-4502CA :
X1G003751xxxx00

Actual size

Specifications (characteristics)

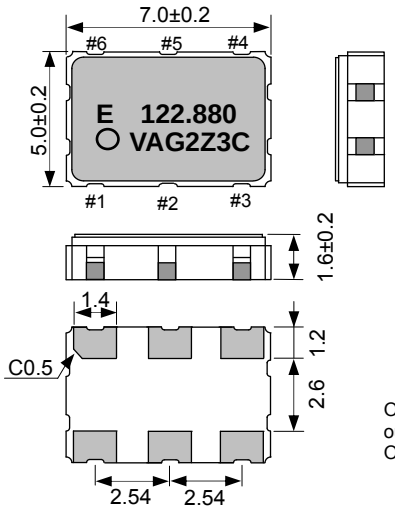
Item	Symbol	Specifications		Conditions / Remarks
		VG-4501CA	VG-4502CA	
Output frequency range	fo	80.000 MHz～170.000 MHz	80.000 MHz～125.000 MHz	Please contact us for inquiries regarding available frequencies.
Supply voltage	Vcc	3.3 V ±0.165 V		
Storage temperature	T_stg	-55 °C～+125 °C		Store as bare product.
Operating temperature	T_use	As per below table.		
Frequency tolerance	f_tol	±50 × 10^{-6} Max.		-40 °C to +85 °C
Current consumption	Icc	25 mA Max. (fo≦125MHz) 35 mA Max. (125 MHz＜fo)	25 mA Max.	L_CMOS= 15pF
Absolute pull range*1	APR	GCT: ±50 × 10^{-6} Min. (80 MHz≦fo≦170MHz) HCT: ±100 × 10^{-6} Min. (125 MHz＜fo)	HCT: ±100 × 10^{-6} Min.	Vc=1.65 V ±1.65 V
Input resistance	Rin	80 kΩ Min.		DC level
Frequency change polarity	—	Positive slope		Vc=0～3.3 V
Symmetry	SYM	45 %～55 %		50 % Vcc level
Output voltage	VOH	90 % Vcc Min.		IOH = -0.8 mA
	VOL	10 % Vcc Max.		IOL = 3.2 mA
Output load condition (CMOS)	L_CMOS	15 pF Max.		
Input voltage	VIH	70 % Vcc Min.		
	VIL	30 % Vcc Max.		
Rise time / Fall time	tr / tf	4 ns Max. (fo≦125MHz) 2 ns Max. (125 MHz＜fo)	4 ns Max.	20 % Vcc to 80 % Vcc 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 Absolute pull range		+25 °C, Vcc=3.3 V,20 years

*1 Absolute pull range = Frequency control range - Frequency tolerance
* Please keep Vc pin open or ground while powering up Vcc.

Operating temperature range

Operating temperature range		Absolute pull range	
		±50 × 10^{-6} Min.	±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)

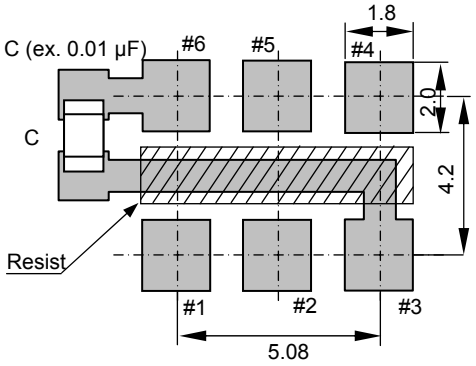


Pin map

Pin	Connection
1	Vc
2	OE
3	GND
4	OUT
5	N.C.
6	Vcc

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

Footprint (Recommended) (Unit :mm)



To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

VOLTAGE -CONTROLLED CRYSTAL OSCILLATOR (VCXO)

VG-4512CA

- Frequency range : 80 MHz to 200 MHz
- Supply voltage : 3.3 V
- Absolute pull range : 50 × 10^{-6}, 100 × 10^{-6}
- External dimensions : 7.0 × 5.0 × 1.6 mm
- Function : Output enable (OE) Active High or Low
- Output : LV-PECL

Pb Free RoHS Compliant

Product Number (please contact us)
X1G002861xxxx00

Actual size

Specifications (characteristics)

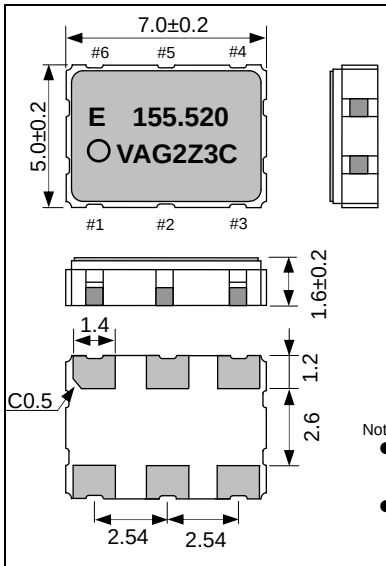
Item	Symbol	Specifications	Conditions / Remarks
Output frequency range	f_O	80.000 MHz to 200.000 MHz	Please contact us for inquiries regarding available frequencies.
Supply voltage	V_{CC}	3.3 V ±0.165 V	
Storage temperature	T_stg	-55 °C to +125 °C	Store as bare product.
Operating temperature	T_use	As per below table.	
Frequency tolerance	f_tol	±50 × 10^{-6} Max.	Includes frequency aging (20 years)
Current consumption	I_{CC}	60 mA Max.	50Ω
Absolute pull range *1	APR	As per below table.	V_C= 1.65 V ± 1.50 V
Input resistance	Rin	100 kΩ Min.	DC level
Frequency change polarity	—	Positive slope	V_C= 0.15 to 3.15 V
Symmetry	SYM	45 % to 55 %	Vcc= 1.3V, Vc= 1/2Vcc
Output voltage	V_{OH}	Vcc-1.1 V Min.	–
	V_{OL}	Vcc-1.5 V Max.	–
Output load condition (ECL)	L_ECL	LV-PECL	
Input voltage	V_{IH}	70 % V_{CC} Min.	
	V_{IL}	30 % V_{CC} Max.	
Rise time / Fall time	t_r / t_f	1.0 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

*1 Absolute pull range = Frequency control range - Frequency tolerance
* Please keep Vc pin open or ground while powering up Vcc.

Operating temperature range

Operating temperature range	Absolute pull range			
	±50 × 10^{-6} Min.		±100 × 10^{-6} Min.	
	Active High	Active Low	Active High	Active Low
G: -40 °C to +85 °C	GGCT	GGCL	GHCT	GHCL
J: -20 °C to +70 °C	JGCT	JGCL	JHCT	JHCL
K: 0 °C to +70 °C	KGCT	KGCL	KHCT	KHCL

External dimensions (Unit :mm)

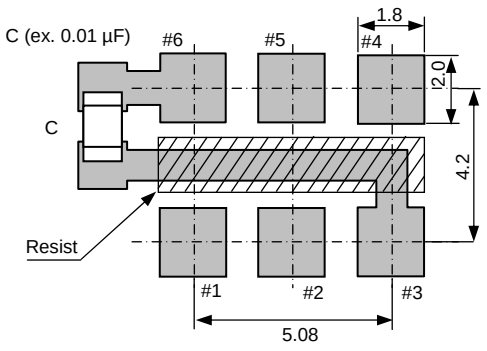


Pin map

Pin	Connection
1	Vc
2	OE
3	GND
4	OUT1(Positive)
5	OUT2(Negative)
6	Vcc

Note .
- Active High
  OE pin = "H" or "open" : Specified frequency output.
  OE pin = "L" : Output is high impedance, oscillation stops.
- Active Low
  OE pin = "L" or "open" : Specified frequency output.
  OE pin = "H" : Output is high impedance, oscillation stops.

Footprint (Recommended) (Unit :mm)



To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

VOLTAGE -CONTROLLED SAW OSCILLATOR (VCSO)

LOW-JITTER, LOW PHASE NOISE

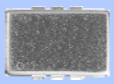
EV - 9100JG

- Frequency range : 800 MHz to 2500 MHz
- Supply voltage : 3.3 V
- Absolute pull range : $\pm 50 \times 10^{-6}$
- External dimensions: 13.9 × 9.8 × 4.7 mm (t: Max.)
- Output : LV-PECL or Sine Wave

RoHS Compliant

Product Number (please contact us)
LV-PECL: X1M000242xxxxxx
Sine wave: X1M000262xxxxxx

Actual size



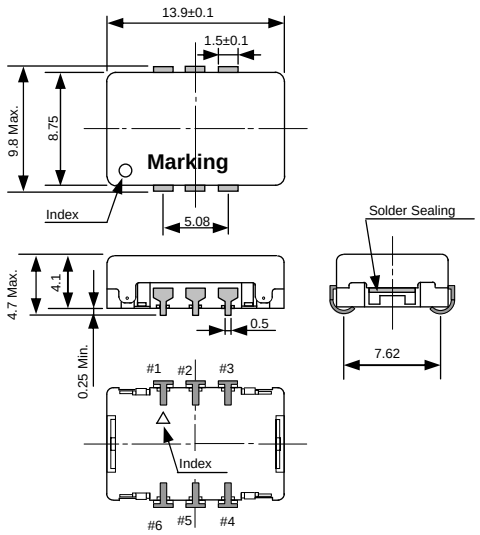
Specifications (characteristics)

Item	Symbol	LV-PECL	Sine wave	Conditions / Remarks
		CPGMA/ CPGVA/ CPGUA	CSGMA/ CSGVA/ CSGUA	
Output frequency range	fo	800 MHz to 2500 MHz		Please contact us for inquiries regarding available frequencies.
Supply voltage	Vcc	3.3 V ±0.165 V		
Storage temperature	T_stg	-45 °C to +90 °C		Store as bare product.
Operating temperature	T_use	As per blow table.		
Frequency tolerance *1	f_tol	-100×10^{-6} to $+150 \times 10^{-6}$		
Current consumption	Icc	100 mA Max.		
Absolute pull range *2	APR	$\pm 50 \times 10^{-6}$ Min.		Vc = 0 V to Vcc
Input resistance	Rin	100 kΩ Min.		DC level
Frequency change polarity	—	Positive slope		
Symmetry	SYM	40 % to 60 %	—	Vcc -1.45 V, Vc = 1/2 Vcc
Output voltage	VOH	Vcc -1.3 V Min.	—	fo ≤ 2.0 GHz
		Vcc -1.4 V Min.		fo > 2.0 GHz
	VOL	Vcc -1.65 V Max.	—	fo ≤ 2.0 GHz
		Vcc -1.6 V Max.		fo > 2.0 GHz
Output level	—	—	0 dBm Min.	
Output load condition	L_ECL	50 Ω	—	Terminated to Vcc-2.0V
	Load_R	—	50 Ω	Terminated to GND
Rise time / Fall time	tr / tf	0.5 ns Max.	—	Between 20 % and 80 % of (VOH-VOL)
Start-up time	t_str	10 ms Max.		Time at 90 %Vcc to be 0 s
Phase Jitter	tPJ	0.05 ps Max.	0.03 ps Max.	1.7 G ≤ fo ≤ 2.0 GHz / Offset frequency:
		0.1 ps Max.	0.05 ps Max.	800 M ≤ fo < 1.7 GHz / 12 kHz to 20 MHz
				2.0 G < fo ≤ 2.5 GHz / 50 kHz to 100 MHz

*1 Frequency tolerance includes initial frequency tolerance, temperature variation, supply voltage variation, reflow drift, and aging (+25°C, 10 years).
*2 Absolute pull range (APR) = Frequency control range - Frequency tolerance

Output		P: LV-PECL	S: Sine wave
Operating temperature	M: -40 °C to +85 °C	CPGMA	CSGMA
	V: -20 °C to +85 °C	CPGVA	CSGVA
	U: -10 °C to +85 °C	CPGUA	CSGUA

External dimensions (Unit :mm)

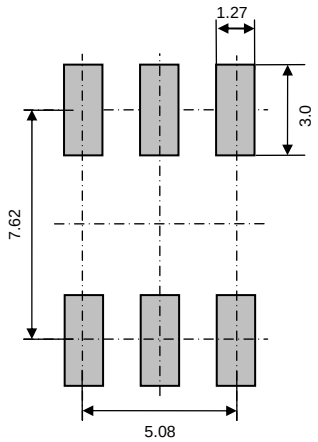


Pin map

Pin	Connection	
	LV-PECL	Sine Wave
1	Vc	
2	GND	
3	GND	
4	OUT1 (Positive)	OUT
5	OUT2 (Negative)	N.C.
6	Vcc	

#2 and #3 are connected to the cover.

Footprint (Recommended) (Unit :mm)

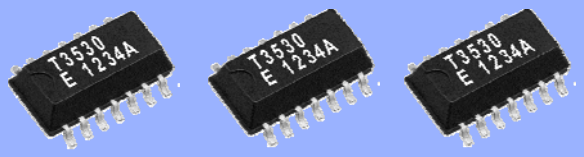


TCXO
32.768 kHz

TG-3530 SA

RoHS Compliant

Product Number
Q3721SA02000100



Actual size

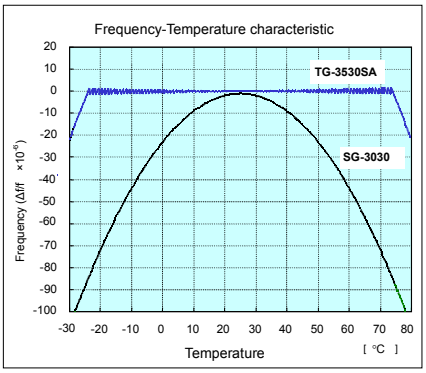
- Built-in 32.768 kHz crystal oscillator with high accuracy. (adjustment-free efficient operation)
- Temperature compensated circuit : Stabilized frequency tolerance at any operating temperature.
- Oscillation output voltage : 1.5 V to 5.5 V
- Temperature Compensated Voltage : 2.2 V to 5.5 V
- 32.768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

Specifications (characteristics)

Item	Symbol	Specifications	Conditions
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.
Operating temperature	T_use	–40 °C to +85 °C	
Frequency temperature characteristic	fo-Tc	± 3.8 × 10^{-6} ∗ Equivalent to 10 seconds of monthly deviation	-10 °C to +60 °C V_{CC} = 3.0 V
		± 5.0 × 10^{-6} ∗ Equivalent to 13 seconds of monthly deviation	–20 °C to +70 °C V_{CC} = 3.0 V
Frequency voltage coefficient	fo-V_{CC}	± 1.0 × 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} → 80 % V_{CC}
Fall time	t_f	200 ns Max.	CMOS load 80 % V_{CC} → 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	± 3.0 × 10^{-6} / year	+25 °C V_{CC} = 3.0 V , first year

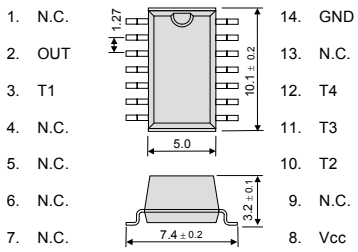
∗1) V_{CC} rise time< 10ms (10 % V_{CC} – 90 % V_{CC})
∗2) If not specifically indicated, –40 °C to +85 °C.

■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

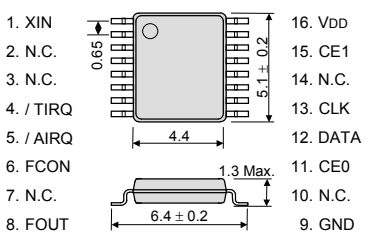
RX-4574 SG

- 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

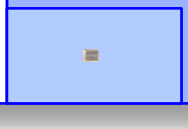
TG-5031CJ

- Frequency range : 13 MHz to 52 MHz
- Supply voltage : 1.8 V Typ.
- Frequency / temperature characteristics : ±2.0 × 10^{-6} Max.
- External dimensions: 2.0 × 1.6 × 0.73 mm
- Applications : Cellular phone (CDMA, WCDMA, LTE)
- Features : Low supply voltage (1.8 V)
  Low phase noise

Pb Free RoHS Compliant

Product Number (Please contact us)
X1G003891xxxx00

Actual size

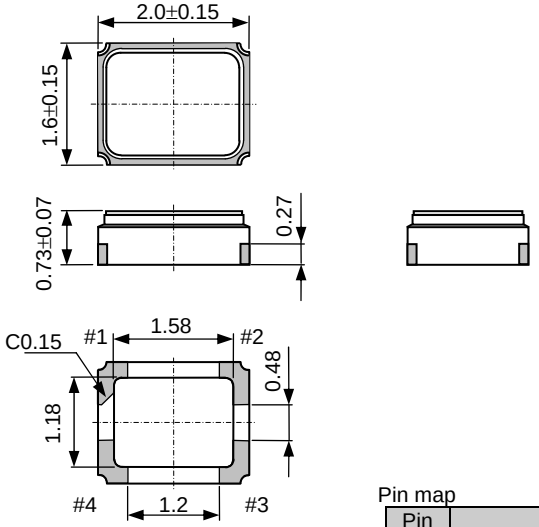


Specifications (characteristics)

Item	Symbol	Specifications		Conditions / Remarks
		VC-TCXO	TCXO	
Output frequency range	fo	13.000 MHz to 52.000 MHz		
		13 MHz, 19.2 MHz, 26 MHz, 27.456 MHz, 38.4 MHz		Standard frequency
Supply voltage	Vcc	1.8 V ±0.1 V (Supply voltage range :1.7 V to 3.3 V)		
Storage temperature	T_stg	-40 °C to +85 °C		Store as bare product.
Operating temperature	T_use	-30 °C to +85 °C		
Frequency tolerance	f_tol	±2.0 × 10^{-6} Max.		After reflow, +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=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.		
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.

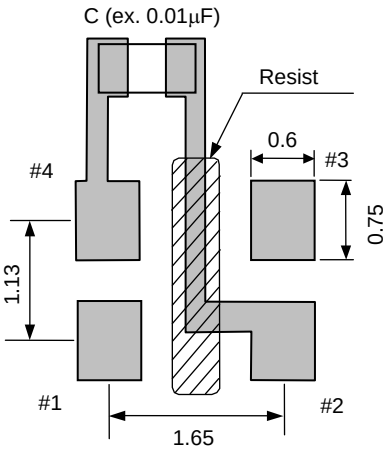
External dimensions (Unit:mm)



Pin map

Pin	Connection	
	VC-TCXO	TCXO
1	Vc	N.C.
2	GND	
3	OUT	
4	Vcc	

Footprint (Recommended) (Unit:mm)



To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

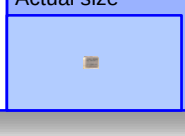
TCXO
ULTRA MINIATURE SIZE LOW PROFILE
HIGH STABILITY
TG - 5035CJ

- Frequency range : 13 MHz to 52 MHz
- Supply voltage : 1.8 V Typ.
- Frequency / temperature characteristics : ±0.5 × 10^{-6} Max.
- External dimensions: 2.0 × 1.6 × 0.73 mm
- Applications : Cellular phone (GPS)
- Features : High stability
  : Low supply voltage (1.8 V)
  Stand-by function (OPTION)

Pb Free RoHS Compliant

Product Number (Please contact us)
X1G003841xxxx00

Actual size

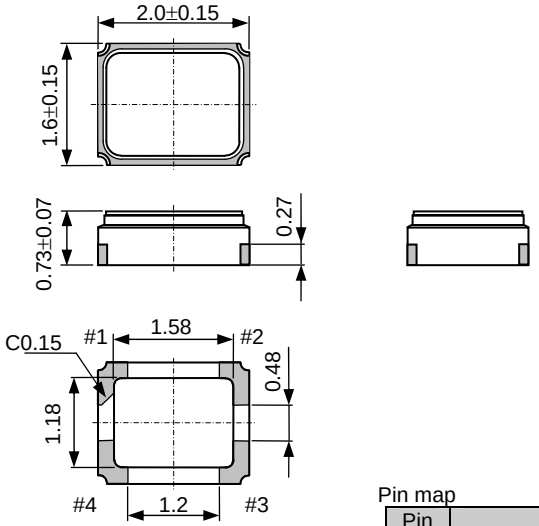


Specifications (characteristics)

Item	Symbol	Specifications		Conditions / Remarks
		VC-TCXO	TCXO	
Output frequency range	fo	13.000 MHz to 52.000 MHz		
		13 MHz, 16.368 MHz, 19.2 MHz, 26 MHz, 27.456 MHz, 38.4 MHz		Standard frequency
Supply voltage	Vcc	1.8 V ±0.1 V (Supply voltage range :1.7 V to 3.3 V)		
Storage temperature	T_stg	-40 °C to +85 °C		Store as bare product.
Operating temperature	T_use	-30 °C to +85 °C		
Frequency tolerance	f_tol	±2.0 × 10^{-6} Max.		After reflow, +25 °C
Frequency/temperature characteristics	fo-Tc	±0.5 × 10^{-6} Max. / -30 °C to +85 °C ±0.5 × 10^{-6} Max. / -40 °C to +85 °C (Option)		
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.

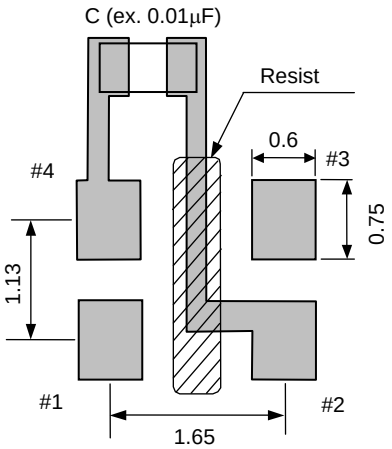
External dimensions (Unit:mm)



Pin map

Pin	Connection	
	VC-TCXO	TCXO
1	Vc	N.C.
2	GND	
3	OUT	
4	Vcc	

Footprint (Recommended) (Unit:mm)



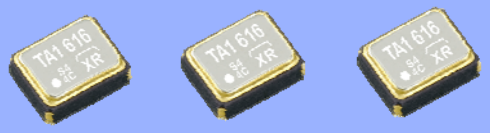
To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

TCXO
MINIATURE SIZE LOW PROFILE HIGH STABILITY
TG-5021CG

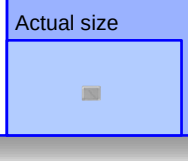
- Frequency range : 13 MHz to 52 MHz
- Supply voltage : 2.8 V Typ.
- Frequency / temperature characteristics : ±2.0 × 10^{-6} Max.
- External dimensions : 2.5 × 2.0 × 0.8 mm
- Applications : Cellular phone(CDMA,WCDMA,GSM)
- Features : Low noise

Pb Free RoHS Compliant

Product Number (Please contact us)
X1G003581xxxx00



Actual size

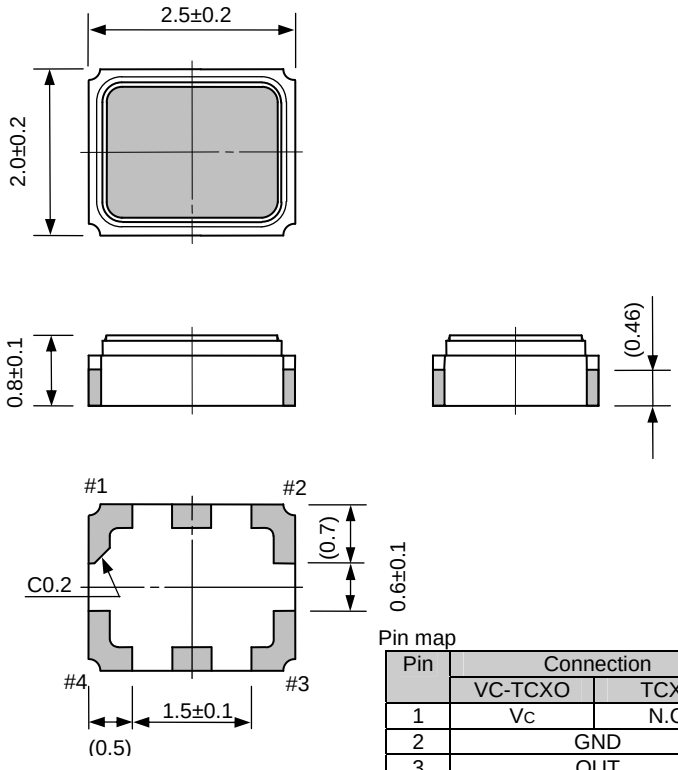


Specifications (characteristics)

Item	Symbol	Specifications		Conditions / Remarks
		VC-TCXO	TCXO	
Output frequency	f_0	13.000 MHz to 52.000 MHz		
		13 MHz, 19.2 MHz, 26 MHz, 27.456 MHz, 38.4 MHz		Standard frequency
Supply voltage	Vcc	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.
Operating temperature	T_use	-30 °C to +85 °C		
Frequency tolerance	f_tol	±2.0 ×10^{-6} Max.		After reflow, +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≦fo≦40 MHz
		±1.5 × 10^{-6} Max.		+25 °C, First year, 40 MHz＜fo≦52 MHz
Current consumption	Icc	2.0 mA Max.		
Input resistance	Rin	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	Vpp	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.

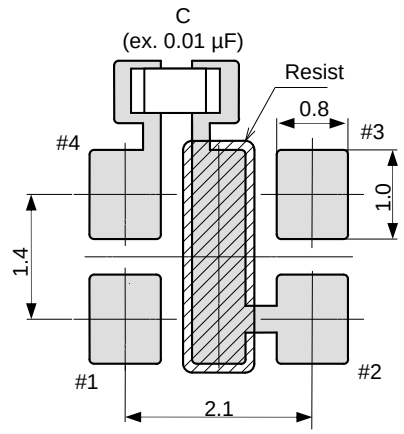
External dimensions (Unit:mm)



Pin map

Pin	Connection	
	VC-TCXO	TCXO
1	Vc	N.C.
2	GND	
3	OUT	
4	Vcc	

Footprint (Recommended) (Unit:mm)



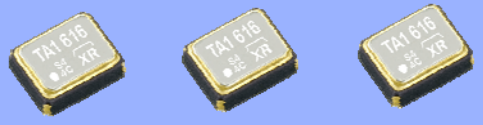
To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

TCXO
MINIATURE SIZE LOW PROFILE
HIGH STABILITY
TG - 5035CG

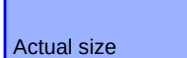
- Frequency range : 13 MHz to 52 MHz
- Supply voltage : 1.8 V Typ.
- Frequency / temperature characteristics : ±0.5× 10^{-6} Max.
- External dimensions: 2.5 × 2.0 × 0.8 mm
- Applications : Cellular phone (GPS)
- Features : High stability
  : Low supply voltage (1.8 V)

Pb Free RoHS Compliant

Product Number (Please contact us)
X1G003591xxxx00



Actual size

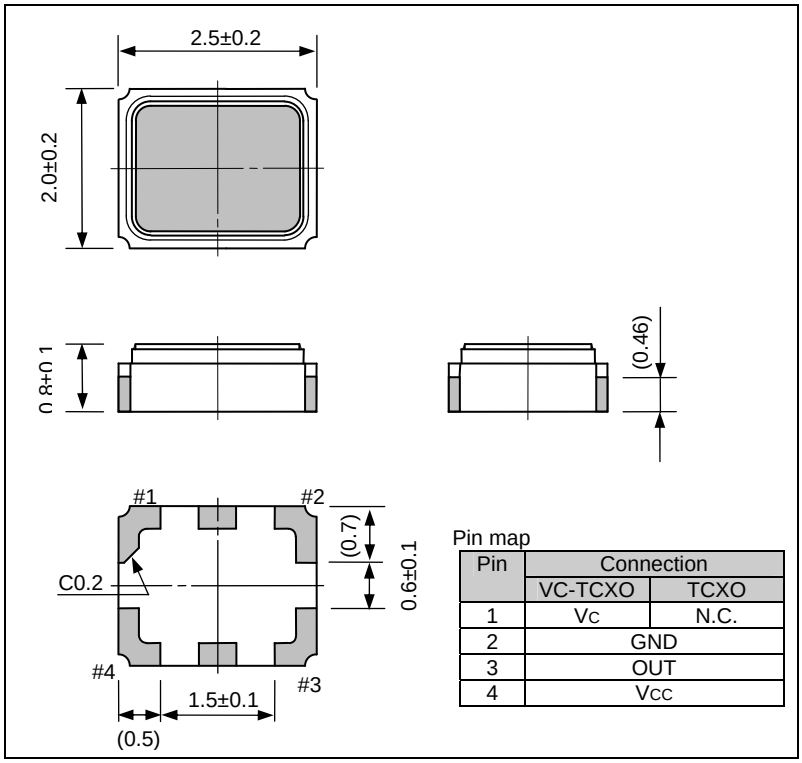


Specifications (characteristics)

Item	Symbol	Specifications		Conditions / Remarks
		VC-TCXO	TCXO	
Output frequency range	fo	13.000 MHz to 52.000 MHz		
		13 MHz, 16.368 MHz , 19.2 MHz, 26 MHz, 27.456 MHz,38.4 MHz		Standard frequency
Supply voltage	Vcc	1.8 V ±0.1 V(Supply voltage range :1.7 V to 3.3 V)		
Storage temperature	T_stg	-40 °C to +85 °C		Store as bare product.
Operating temperature	T_use	-30 °C to +85 °C		
Frequency tolerance	f_tol	±2.0 × 10^{-6} Max.		After reflow, +25 °C
Frequency/temperature characteristics	fo-Tc	±0.5 × 10^{-6} Max. / -30 °C to +85 °C ±0.5 × 10^{-6} Max. / -40 °C to +85 °C (Option)		
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.

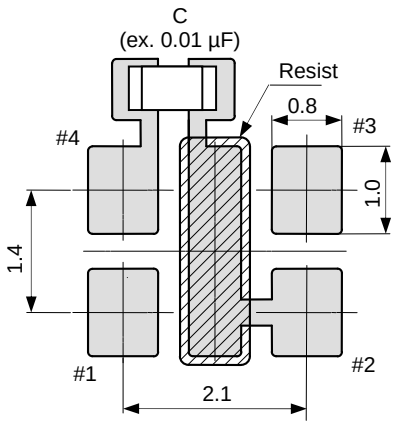
External dimensions (Unit:mm)



Pin map

Pin	Connection	
	VC-TCXO	TCXO
1	Vc	N.C.
2	GND	
3	OUT	
4	Vcc	

Footprint (Recommended) (Unit:mm)



To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

TCXO
MINIATURE SIZE LOW PROFILE

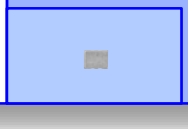
TG - 5021CE

- Frequency range : 10 MHz to 40 MHz
- Supply voltage : 2.8 V Typ.
- Frequency / temperature characteristics: ±2.0 × 10^{-6} Max.
- External dimensions : 3.2 × 2.5 × 0.9 mm
- Applications : Cellular phone(CDMA , WCDMA , LTE)
- Features : Low phase noise

Pb Free RoHS Compliant

Product Number (Please contact us)
X1G003821xxxx00

Actual size

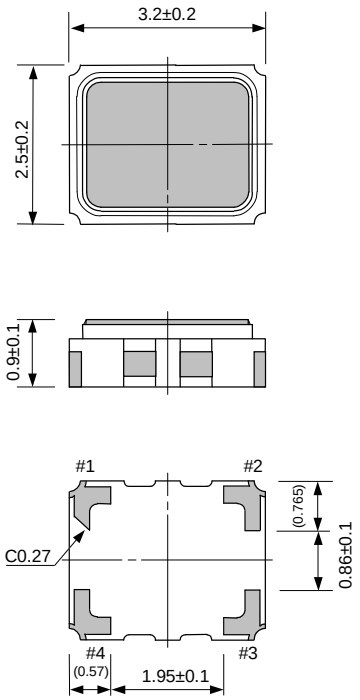


Specifications (characteristics)

Item	Symbol	Specifications		Conditions / Remarks
		VC-TCXO	TCXO	
Output frequency range	f_0	10.000 MHz to 40.000 MHz		
		13 MHz, 19.2 MHz, 26 MHz		Standard frequency
Supply voltage	Vcc	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.
Operating temperature	T_use	-30 °C to +85 °C		
Frequency tolerance	f_tol	±2.0 ×10^{-6} Max.		After reflow, +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.		2.8 V ± 0.14 V
Frequency aging	f_age	±1.0 ×10^{-6} Max.		+25 °C, First year
Current consumption	Icc	2.0 mA Max.		Vcc=2.8 V, 10 kΩ// 10 pF
Input resistance	Rin	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	Vpp	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.

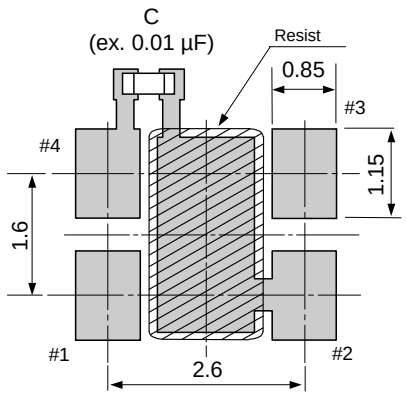
External dimensions (Unit:mm)



Pin map

Pin	Connection	
	VC-TCXO	TCXO
1	Vc	N.C.
2	GND	
3	OUT	
4	Vcc	

Footprint (Recommended) (Unit:mm)



To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

TCXO
MINIATURE SIZE LOW PROFILE
HIGH STABILITY

TG - 5035CE

- Frequency range : 10 MHz to 40 MHz
- Supply voltage : 1.8 V Typ.
- Frequency / temperature characteristics : ±0.5× 10^{-6} Max.
- External dimensions: 3.2 × 2.5 × 0.9 mm
- Applications : Cellular phone (GPS)
- Features : High stability
  : Low power consumption

Pb Free RoHS Compliant

Product Number (Please contact us)
X1G003831xxxx00

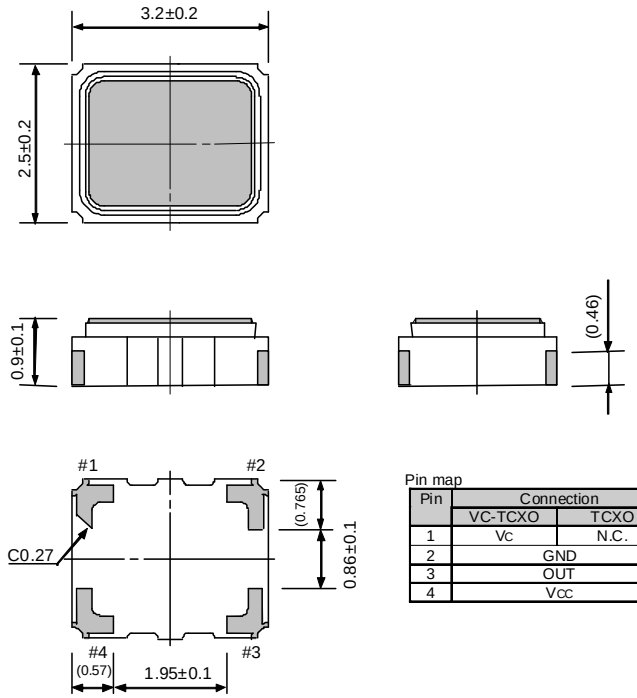
Actual size

Specifications (characteristics)

Item	Symbol	Specifications		Conditions / Remarks
		VC-TCXO	TCXO	
Output frequency range	f0	10.000 MHz to 40.000 MHz		
		16.369 MHz, 24.5535 MHz, 26 MHz, 27.456 MHz		Standard frequency
Supply voltage	Vcc	1.8 V±0.1 V (Supply voltage range :1.7 V to 3.3 V)		
Storage temperature	T_stg	-40 °C to +85 °C		Store as bare product.
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.		1.8 V ± 0.1 V
Frequency aging	f_age	±1.0 ×10^{-6} Max.		+25 °C , First year
Current consumption	Icc	2.0 mA Max.		Vcc=1.8 V, 10 kΩ// 10 pF
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 レベル (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.

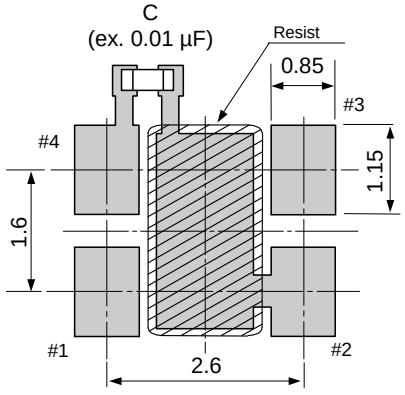
External dimensions (Unit: mm)



Pin map

Pin	Connection	
	VC-TCXO	TCXO
1	Vc	N.C.
2	GND	
3	OUT	
4	Vcc	

Footprint (Recommended) (Unit: mm)



To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

TCXO
ULTRA HIGH STABILITY

NEW

TG-5500CA

- Frequency range : 12.8 MHz to 40 MHz
- Supply voltage : 3.3 V
- Frequency / temperature characteristics : ±0.28× 10^{-6} Max.
- External dimensions: 7.0 × 5.0 × 1.5 mm
- Applications : Network system, Stratum3
- Features : Ultra high stability

Pb Free RoHS Compliant

Product Number (Please contact us)
X1G003561xxxx00

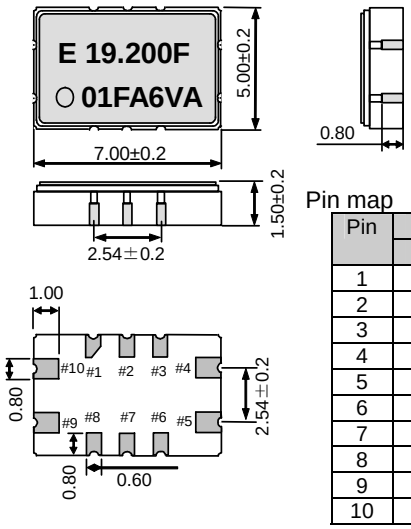
Actual size

Specifications (characteristics)

Item	Symbol	Specifications		Conditions / Remarks
		VC-TCXO	TCXO	
Output frequency range	f0	12.8 MHz to 40.0 MHz		
		12.8, 16.368, 19.2, 20, 25.6, 26, 32.736, 40 MHz		Standard frequency
Supply voltage	Vcc	3.3 V± 0.165V (Supply voltage range :2.7 V to 5.5 V)		
Storage temperature	T_stg	-40 °C to +90 °C		Store as bare product.
Operating temperature	T_use	-40 °C to +85 °C		
Frequency tolerance	f_tol	±1.0 ×10^{-6} Max.		After reflow, +25 °C
Frequency/temperature characteristics	fo-Tc	±0.28 × 10^{-6} Max.		-40 °C to +85 °C
Frequency/load coefficient	fo-Load	±0.1 × 10^{-6} Max.		15 pF ±10 %
Frequency/voltage coefficient	fo-Vcc	±0.1 ×10^{-6} Max.		Vcc=3.3 V ± 0.165 V
Frequency aging	f_age	±0.5 ×10^{-6} Max.		+25 °C , First year
		±3.0 ×10^{-6} Max.		+25 °C , 20 years
Current consumption	Icc	5.0 mA Max.		12.8 MHz≦f0≦26 MHz
		6.0 mA Max.		26 MHz＜f0≦40 MHz
Input resistance	Rin	100 kΩ Min.	—	Vc- GND (DC)
Frequency control range	f_cont	±5.0 × 10^{-6} to ±12.0 ×10^{-6}	—	Vc=1.65 V ± 1.65 V
Frequency change polarity	—	Positive polarity	—	
Symmetry	SYM	40 % to 60 %		GND level (DC cut)
Output voltage	VOH	0.9 V Min.		
	VOL	0.1 V Max.		
Output load condition (CMOS)	L_CMOS	15 pF Max.		
Input voltage	VIH	2.4 V Min.		OE terminal
	VIL	0.6 V Max.		

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

External dimensions (Unit: mm)

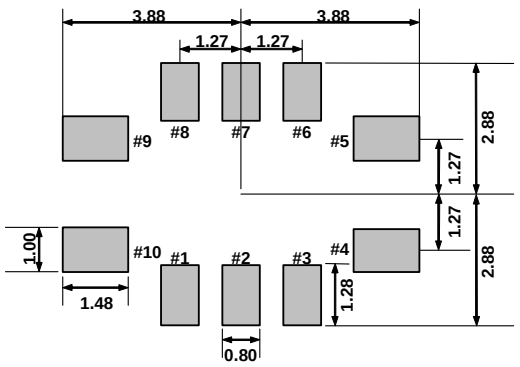


Pin map

Pin	Connection	
	VC-TCXO	TCXO
1	N.C	
2	N.C	
3	N.C	
4	GND	
5	OUT	
6	N.C	
7	N.C	
8	OE	
9	Vcc	
10	VC	N.C

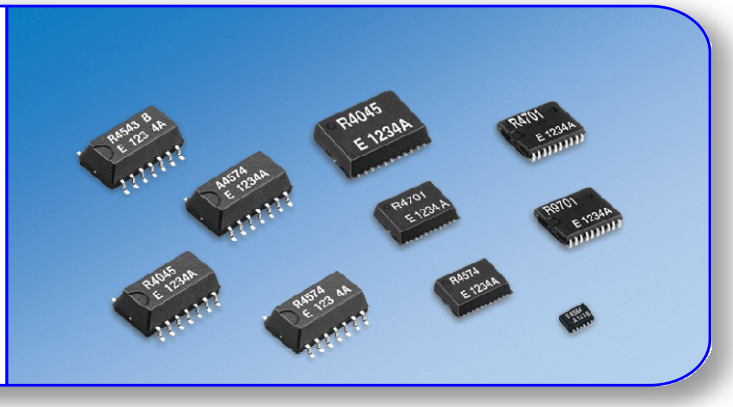
OE pin = "H" or "open": Specified frequency output.
OE pin = "L" : Output is high impedance.

Footprint (Recommended) (Unit: mm)



To maintain stable operation, provide a 0.01uF to 0.1uF by-pass capacitor at a location as near as possible to the power source terminal of the crystal product (between Vcc - GND).

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

Model		External dimensions (mm)		Features	Page
	RX-4803SA		10.1×7.4×3.2 (t: Typ.)	Built-in DTCXO	77
	RX-4803LC		3.6×2.8×1.2 (t: Max.)		
	RX-4035SA	 NEW	10.1×7.4×3.2 (t: Typ.)	High-Stability Frequency with Built in Timestamp and Power Switching	78
	RX-4035LC	 NEW	3.6×2.8×1.2 (t: Max.)		
	RX-4045SA		10.1×7.4×3.2 (t: Typ.)	High-Stability	79
	RX-4045NB		6.3×5.2×1.4 (t: Max.)		
	RX-4581NB		6.3×5.2×1.4 (t: Max.)	Built-in SRAM	80

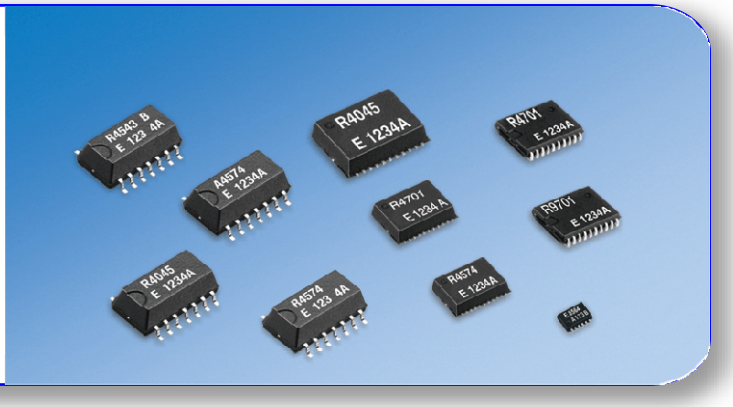
►Serial 3-Wire

Model		External dimensions (mm)		Features	Page
	RX-4571SA		10.1×7.4×3.2 (t: Typ.)	Low Backup Voltage	81
	RX-4571NB		6.3×5.2×1.4 (t: Max.)		
	RX-4571LC		3.6×2.8×1.2 (t: Max.)		
	RTC-4701JE		7.3×6.2×1.5 (t: Max.)	Built-in Temperature Sensor	82
	RTC-4701NB		6.3×5.2×1.4 (t: Max.)		
	RTC-4574SA		10.1×7.4×3.2 (t: Typ.)	Simple Function	83
	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.)		84
	RTC-4543SA		10.1×7.4×3.2 (t: Typ.)		85
	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	86

REAL TIME CLOCK MODULE
I²C-Bus
Parallel Interface
Automotive

Features
►Built in frequency adjusted 32.768 kHz crystal unit.

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



►I²C-Bus

Model		External dimensions (mm)		Features	Page
	RX-8571SA		10.1×7.4×3.2 (t: Typ.)	Low power consumption 128 bit User RAM Long-running timer (65000 hours)	87
	RX-8571NB		6.3×5.2×1.4 (t: Max.)		
	RX-8571LC		3.6×2.8×1.2 (t: Max.)		
	RTC-8564JE		7.3×6.2×1.5 (t: Max.)	Low current consumption	88
	RTC-8564NB		6.3×5.2×1.4 (t: Max.)		
	RX-8564LC		3.6×2.8×1.2 (t: Max.)		
	RX-8803SA		10.1×7.4×3.2 (t: Typ.)	Built-in DTCXO	89
	RX-8803LC		3.6×2.8×1.2 (t: Max.)		
RoHS Compliant	RX-8035SA	NEW	10.1×7.4×3.2 (t: Typ.)	High-Stability Frequency with Built in Timestamp and Power Switching	90
	RX-8035LC	NEW	3.6×2.8×1.2 (t: Max.)		
	RX-8025SA		10.1×7.4×3.2 (t: Typ.)	High-Stability	91
	RX-8025NB		6.3×5.2×1.4 (t: Max.)		
	RX-8731LC		3.6×2.8×1.2 (t: Max.)	EEPROM・Unique ID-ROM	92
	RX-8581SA		10.1×7.4×3.2 (t: Typ.)	Simple Function	93
	RX-8581JE		7.3×6.2×1.5 (t: Max.)		
	RX-8581NB		6.3×5.2×1.4 (t: Max.)		

►Parallel Interface

Model		External dimensions (mm)		Features	Page
	RTC-7301SF		10.5×8.1×2.0 (t: Max.)	Built-in Temperature Sensor	94
	RTC-7301DG		DIP 18 pin	Available Alarm and Timer	
RoHS Compliant	RTC-72421		DIP 18 pin	4-bit Simple Function	95
	RTC-72423		16.3×12.2×2.8 (t: Max.)		

►Automotive

Model		External dimensions (mm)		Features	Page
	RA-4565SA		10.1×7.4×3.2 (t: Typ.)	For Automotive Extended operating temperature range (+125℃)	96
For Automotive RoHS Compliant	RA-4574SA		10.1×7.4×3.2 (t: Typ.)	For Automotive	97
	RA-8565SA		10.1×7.4×3.2 (t: Typ.)	For Automotive Extended operating temperature range (+125℃)	98
	RA-8581SA		10.1×7.4×3.2 (t: Typ.)	For Automotive	99

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

RX - 4803 SA / LC

- Built in frequency adjusted 32.768 kHz crystal unit and DTCXO.
- 1/100s resolution Time register
- 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
- Clock supply voltage range : 1.6 V to 5.5 V
- Selectable clock output (32.768 kHz, 1024 Hz, 1 Hz)
- The various functions include full calendar, alarm, timer, EVIN input.

RoHS Compliant

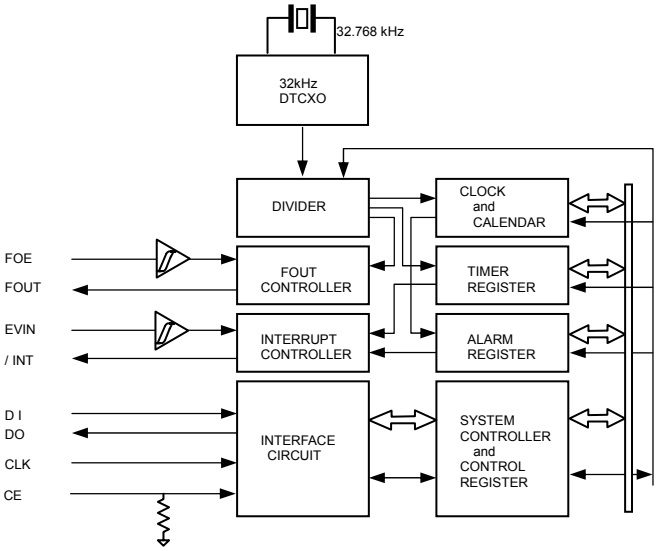
Product Number (Please contact us)
RX-4803SA: X1B000132xxxx00
RX-4803LC: X1B000122xxxx00

Actual size

RX-4803SA

RX-4803LC

Block diagram



Overview

- **High Stability**
  - UA ± 3.4 x 10^{-6} / -40 °C to +85 °C
    (Equivalent to 9 seconds of month deviation)
  - UB ± 5.0 x 10^{-6} / -40 °C to +85 °C
    (Equivalent to 13 seconds of month deviation)
  - UC ± 5.0 x 10^{-6} / -30 °C to +70 °C
  - AA (+5 ± 5.0) x 10^{-6} / +25 °C
- **High Resolution:** 1/100s Time register with capture buffer
- **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 between 1/ 4096 second and 4095 minutes.
  - Alarm Function can be set to day of week, day, hour, or minute.
  - EVIN input.
- **Time synchronize function with 1PPS signal input**
- **Register compatibility:** upper compatible with RX-4801.

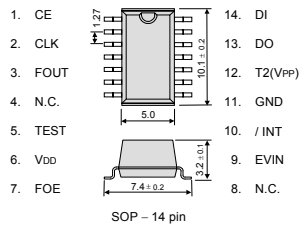
*It is possible to use it by the terminal connection as 32.768 kHz-DTCXO.

Pin Function

Signal Name	I / O	Function
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)
TEST	input	Use by the manufacture for testing. (Do not connect externally. RX-4803SA only.)
VDD	-	Connected to a positive power supply
FOE	input	The input pin for the FOUT output control.
EVIN	input	External event input.
/ INT	Output	Interrupt output (N-ch. open drain).
GND	-	Connected to a ground
T2(VPP)	-	Use by the manufacture for testing. (Do not connect externally.)
DO	Output	The data output pin for serial data transfer.
D I	input	The data input pin for serial data transfer.

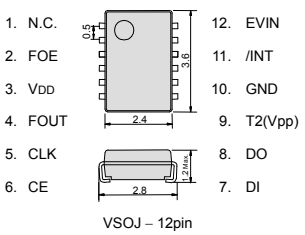
Terminal connection / External dimensions (Unit:mm)

RX – 4803 SA



SOP – 14 pin

RX – 4803 LC



VSOJ – 12pin

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

Specifications (characteristics)

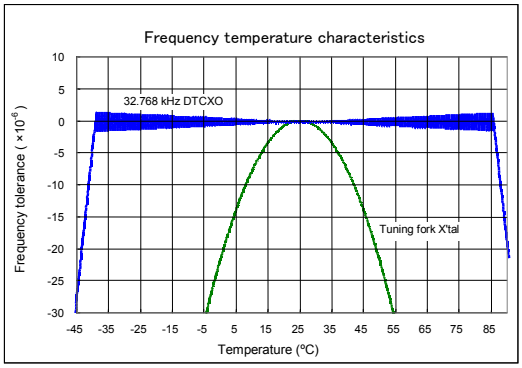
∗ Refer to application manual for details.

■ 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 supply voltage	VCLK	-		1.6	3.0	5.5	V
Operating temperature	TOPR	No condensation□		-40	+25	+85	°C
Stability	Δf / f	UA	Ta = -40 °C to +85 °C	±3.4 *1			× 10^{-6}
		UB	Ta = -40 °C to +85 °C	±5.0 *2			
		UC	Ta = -30 °C to +70 °C				
		AA	Ta = +25 °C	5 ± 5.0□□ *3			
Current consumption (1)	IDD1	Backup Mode FOE = GND, /INT = VDD FOUT output : OFF	VDD = 5V	-	1.2	3.4	μA
Current consumption (2)	IDD2		VDD = 3V	-	0.8	2.1	

*1) Equivalent to 9 seconds of month deviation. *2) *3) Equivalent to 13 seconds of month deviation. (excluding offset)

■ 32.768 kHz-DTCXO Frequency temperature characteristics (Example)



High-Stability Frequency with Built in Timestamp and Power Switching
SPI-Bus REAL TIME CLOCK MODULE NEW

RX - 4035 SA / LC

- Built-in 32.768 kHz crystal unit : Frequency adjusted for high accuracy. ($\pm 5 \times 10^{-6}$ / Ta = +25 °C)
- Interface Type : SPI-Bus (1MHz)
- Operating voltage range : 2.4 V to 5.5 V
- Timekeeping voltage range : 1.0 V to 5.5 V
- Low backup current : 350 nA (SA) 400 nA (LC) / 3 V (Typ.)
- Event detection and Time stamp : One-shot full timestamp and interrupt.
- Dual event detection ports : Each terminal has a de-bounce circuit.
- Auto power switching functions : When VDD deteriorates than 2.4V, internal source is switched to VBAT.

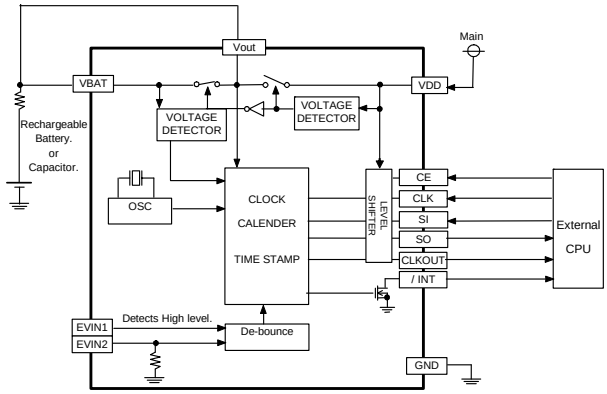
RoHS Compliant

Product Number (Please contact us)
RX-4035SA: X1B000192xxxx00
RX-4035LC: X1B000202xxxx00

Actual size

RX-4035SA	RX-4035LC
	

Block diagram



Overview

- **The event detection and Timestamp function**
  Dual event detection terminals.
  Selectable de-bounce period 35ms or 2s.
  Available event detection interrupt output.

- **Power switching functions.**
  - When VDD is less than 2.4V, an internal source is switched to VBAT.
  - Note: When the supply from VBAT, SPI interface are disabled.

- **Alarm, Periodic interrupt, 32.768kHz clock output.**
  - Available monthly-alarm and weekly-alarm.
  - Interrupt period are selectable from 2Hz to Monthly.
  - CLKOUT outputs 32.768kHz clock powered by VDD.

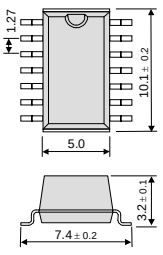
Pin function

Signal Name	Input / Output	Function
VBAT	—	Power supply for backup.
Vout	Output	Switched power out. (maximum output current 20mA)
CE	Input	SPI chip enable.
CLK	Input	SPI serial clock.
SO	Output	SPI data out.
SI	Input	SPI data in.
GND	—	Ground
EVIN1	Input	Event detection input 1
EVIN2	Input	Event detection input 2
/ INT	Output	Interrupt out.
CLKOUT	Output	32.768kHz output. (CMOS. Can not inhibit.)
N.C.	—	Do not connect.
VDD	—	Main power supply.

Terminal connection / External dimensions (Unit:mm)

RX – 4035 SA

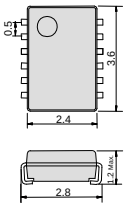
1.	N.C.	14.	EVIN2
2.	CLK	13.	SI
3.	CLKOUT	12.	SO
4.	VBAT	11.	GND
5.	N.C.	10.	/ INT
6.	VDD	9.	CE
7.	Vout	8.	EVIN1



SOP – 14 pin

RX – 4035 LC

1.	Vout	12.	EVIN1
2.	VDD	11.	CE
3.	N.C.	10.	/ INT
4.	VBAT	9.	GND
5.	CLKOUT	8.	SO
6.	CLK	7.	SI



VSOJ – 12pin

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
Operating voltage	VACCESS	VDD	2.4	3.0	5.5	V
Time keeping voltage	VCLK	VBAT	1.0	3.0	5.5	V
Operating temperature	TOPR	—	-40	+25	+85	°C
Storage temperature	TSTG	—	-55	—	+125	°C

■ Frequency characteristics

Item	Symbol	Condition	Rating	Unit
Frequency tolerance	Δf / f	Ta = +25°C VBAT = 3.0 V	B: 5 ± 23 *1) AA: 5 ± 5 *2) AC: 0 ± 5 *2)	$\times 10^{-6}$
Oscillation start-up time	tSTA	Ta = +25 °C VDD = 3.0 V	1 Max.	s
Frequency / voltage characteristics	f / V	Ta = +25 °C VDD = 2.4 V to 5.5 V	± 1 Max.	$\times 10^{-6}$

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

■ Current consumption characteristics

Ta = –40 °C to +85 °C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Current Consumption	IBAT	RX-4035SA VBAT = 3.0V, VDD = 0.0V CE = 0V, CLKOUT = open	-	350	1200	nA
		RX-4035LC VBAT = 3.0V, VDD = 0.0V CE = 0V, CLKOUT = open		400		
	IDD	VDD = 3.0V CE = 0V CLKOUT = open	-	1.40	2.50	µA

■ Power supply detection voltage

Ta = –40 °C to +85 °C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
VBAT detect voltage	VLOW	-	1.10	1.25	1.40	V
Power switching voltage (VDD to VBAT)	VD2B	+25 °C	2.328	2.40	2.472	V

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. ($\pm 5 \times 10^{-6}$ / Ta = +25 °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.

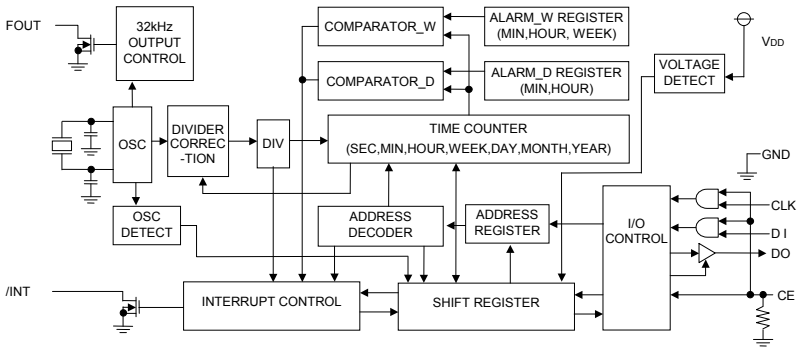
RoHS Compliant

Product Number (Please contact us)
RX-4045SA : Q41404552xxxx00
RX-4045NB : Q41404592xxxx00

Actual size

RX-4045SA	RX-4045NB
	

Block diagram



Overview

- **Features built-in 32.768 kHz crystal unit**
  - ▪Frequency adjusted for high accuracy ($\pm 5 \times 10^{-6}$ /Ta = +25 °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)

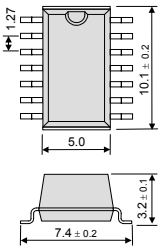
Pin function

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)

RX – 4045 SA

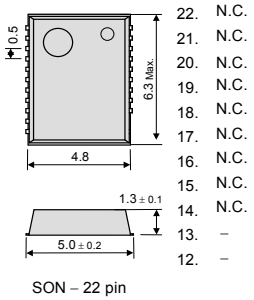
1.	N.C.	14.	N.C.
2.	CLK	13.	DO
3.	FOUT	12.	DI
4.	N.C.	11.	GND
5.	TEST	10.	/ INT
6.	VDD	9.	N.C.
7.	CE	8.	N.C.



SOP – 14 pin

RX – 4045 NB

1.	CE	22.	N.C.
2.	VDD	21.	N.C.
3.	(GND)	20.	N.C.
4.	TEST	19.	N.C.
5.	FOUT	18.	N.C.
6.	CLK	17.	N.C.
7.	DO	16.	N.C.
8.	DI	15.	N.C.
9.	GND	14.	N.C.
10.	/ INT	13.	–
11.	N.C.	12.	–



SON – 22 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	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	Δf / f	Ta = +25°C VDD = 3.0 V	AA: 5 ± 5 *1) AC: 0 ± 5 *2)	$\times 10^{-6}$
Oscillation start-up time	tSTA	Ta = +25 °C VDD = 2.0 V	1 Max.	s
Frequency / voltage characteristics	f / V	Ta = +25 °C VDD = 2.0 V to 5.5 V	± 1 Max.	$\times 10^{-6}$

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

■ Current consumption characteristics

Ta = –40 °C to +85 °C

Item	Symbol	Condition		Min.	Typ.	Max.	Unit
Current Consumption	IBK	CE = GND FOUT ;output OFF (Hi-z)	VDD = 5 V		0.60	1.80	µA
			VDD = 3 V		0.48	1.20	
	I32k	CE = GND FOUT ;32.768 kHz output ON	VDD = 3 V		0.65	2.00	µA

■ Power supply detection voltage

Ta = –30 °C to +70 °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

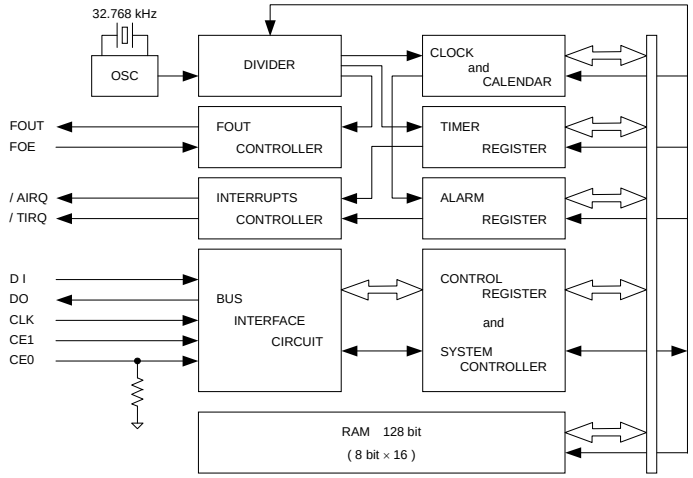
- Built in frequency adjusted 32.768 kHz crystal unit.
- Interface Type : 4-wire serial interface
- Operating voltage range : 1.6 V to 5.5 V
- Wide Timekeeper voltage range : 1.6 V to 5.5 V
- Low backup current : 0.4 µA / 3 V (Typ.)
- Built-in SRAM : Built-in 128 bit (8 bit × 16) RAM.
- 32.768 kHz frequency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

RoHS Compliant

Product Number (Please contact us)
RX-4581NB : Q41458192000200

Actual size

Block diagram



Overview

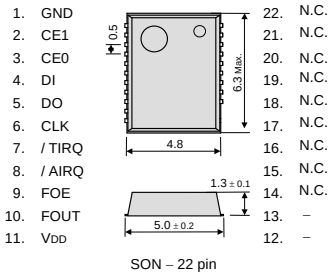
- **Built-in SRAM**
  - Include 128 bit (8 bit × 16) RAM.
- **Interface Type**
  - Serial interface in 4 lines form.
  - ∗ It is possible to make it to 3 lines by wired-OR connecting DI and DO pins.
- **32.768 kHz frequency output function**
  - FOUT pin output (C-MOS output), CL=30 pF
  - FOE pin enables 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 trasfer.
DO	Output	The data output pin for serial data trasfer.
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.
V_{DD}	—	Connected to a positive power supply.
GND	—	Connected to a ground.

Terminal connection / External dimensions (Unit:mm)

RX−4581 NB



SON − 22 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	Condition	Min.	Typ.	Max.	Unit
Power voltage	V_{DD}	—	1.6	3.0	5.5	V
Clock voltage	V_{CLK}	—	1.6	3.0	5.5	V
Operating temperature	T_{OPR}	—	−40	+25	+85	°C

■ Frequency characteristics

Item	Symbol	Condition	Rating	Unit
Frequency tolerance	Δ f / f	T_a = +25 °C V_{DD} = 3.0 V	5 ± 23 ∗	× 10^{-6}
Oscillation start-up time	t_{STA}	T_a = +25 °C V_{DD} = 3.0 V	3 Max.	s

∗ Please ask for tighter tolerance. **(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 FOE = GND FOUT ;output OFF (Hi - z)	V_{DD} = 5 V		0.6	1.2	µA
			V_{DD} = 3 V		0.4	0.8	
	I_{32k}	CE0, CE1 = GND FOE = V_{DD} FOUT ; 32.768 kHz output ON CL = 30 pF	V_{DD} = 5 V		8.0	20.0	µA
			V_{DD} = 3 V		5.0	12.0	

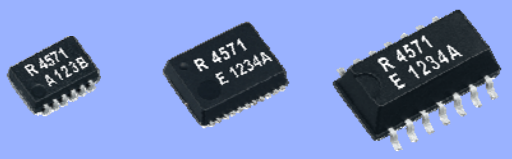
LOW BACKUP VOLTAGE SERIAL-INTERFACE REAL TIME CLOCK MODULE

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 / Ta = +25 °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.

RoHS Compliant

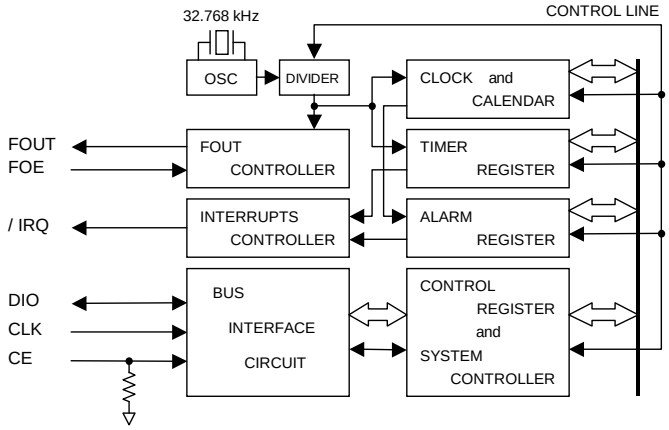
Product Number (Please contact us)
RX-4571LC : Q414571C2000100
RX-4571NB : Q41457192000100
RX-4571SA : Q41457152000100



Actual size

RX-4571LC	RX-4571NB	RX-4571SA
		

Block diagram



Overview

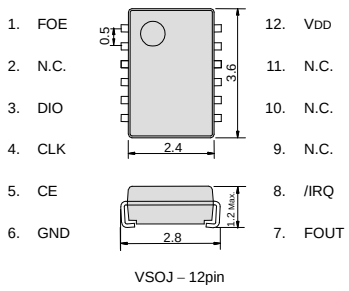
- **32.768 kHz frequency output function**
  - FOUT pin output (C-MOS output) , CL=30 pF
- **Timer function**
  - Timer function which can be set up between 1/4096 second and 4095 minutes.
- **Alarm function**
  - Alarm function can be set to any combination of day, day of week, hour, or minute.
- **Pin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

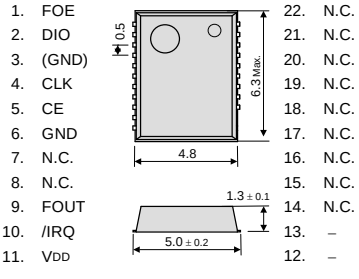
(Unit:mm)

RX – 4571 LC



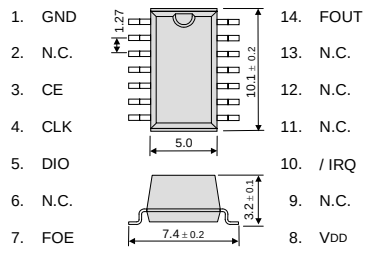
VSOJ – 12pin

RX – 4571 NB



SON – 22 pin

RX – 4571 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	Condition	Min.	Typ.	Max.	Unit
Power voltage	VDD	–	1.6	3.0	5.5	V
Clock voltage	VCLK	Ta = +25 °C	1.0	3.0	5.5	V
		Ta = –40 to +85 °C	1.1	3.0	5.5	V
Operating temperature	TOPR	–	–40	+25	+85	°C

■ Frequency characteristics

Item	Symbol	Condition	Rating	Unit
Frequency tolerance	Δ 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

Ta = –40 °C to +85 °C

Symbol	Condition		Min.	Typ.	Max.	Unit
IBK	CE = GND /IRQ = OFF FOUT ; output OFF (Hi - z)	VDD = 5 V		0.40	1.00	µA
		VDD = 3 V		0.32	0.95	
I32k	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	

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

RTC - 4701 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
- 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.

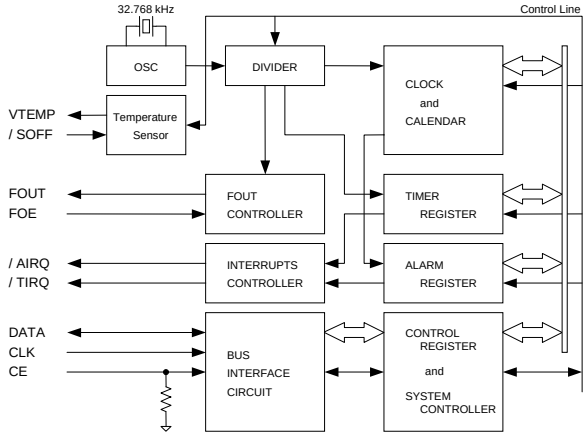
RoHS Compliant

Product Number (Please contact us)
RTC-4701JE : Q41470171000200
RTC-4701NB: Q41470192000200

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 : ±5 °C (T_a = +25 °C)
    - voltage output (analog): −7.6 mV / °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.

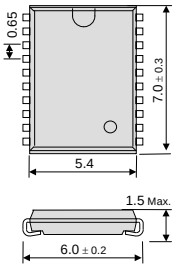
Pin Function

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	FOE input: HIGH → FOUT output: 32.768 kHz output ∗ C-MOS output; FOE input: LOW → FOUT output: 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)
V_{DD}	—	Connected to a positive power supply.
GND	—	Connected to a ground.

Terminal connection / External dimensions (Unit:mm)

RTC – 4701 JE

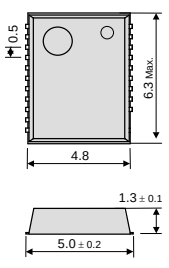
1.	V_{DD}	20.	N.C.
2.	FOUT	19.	N.C.
3.	CE	18.	N.C.
4.	/ AIRQ	17.	N.C.
5.	/ TIRQ	16.	N.C.
6.	CLK	15.	N.C.
7.	DATA	14.	N.C.
8.	FOE	13.	N.C.
9.	VTEMP	12.	N.C.
10.	/ SOFF	11.	GND



VSOJ – 20 pin

RTC – 4701 NB

1.	GND	22.	N.C.
2.	/ SOFF	21.	N.C.
3.	VTEMP	20.	N.C.
4.	FOE	19.	N.C.
5.	DATA	18.	N.C.
6.	CLK	17.	N.C.
7.	/ TIRQ	16.	N.C.
8.	/ AIRQ	15.	N.C.
9.	CE	14.	N.C.
10.	FOUT	13.	–
11.	V_{DD}	12.	–



SON – 22 pin

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 , V_{DD} = 2.7 V to 5.5 V , T_a = −40 °C to +85 °C

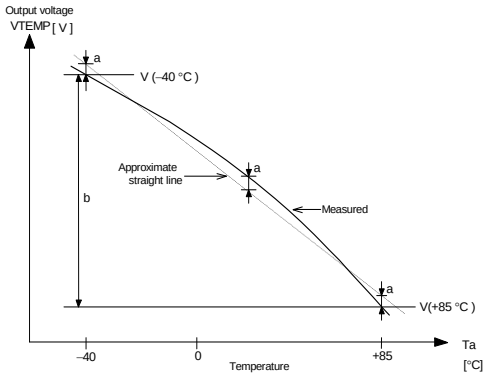
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Temperature output voltage	V_{TEMP}	VTEMP pin, T_a = +25 °C GND based output voltage		1.480		V
Output tolerance	T_{ACR}	T_a = +25 °C			±5.0	°C
Temperature sensitivity	V_{SE}	-40 °C ≤ T_a ≤ +85 °C	-7.1	-7.6	-8.1	mV / °C
Linearity	ΔNL	-40 °C ≤ T_a ≤ +85 °C			±2.0	%
Temperature detection range	T_{SOP}	ΔNL ≤ ±2.0 %	−40		+ 85	°C
Output resistance	R_O	VTEMP pin, T_a = +25 °C GND standard and V_{DD} standard		1.0	3.0	kΩ

∗ Temperature sensitivity V_{SE} = (V (+85 °C) − V (−40 °C)) / 125 [mV / °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) $R_O = \frac{\Delta V_1}{\Delta I_1}$ [Ω]



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 µA / 3 V (Typ.)
- 32.768 kHz frequency output function : C-MOS output With Control Pin
- The various functions include full calendar, alarm, timer.

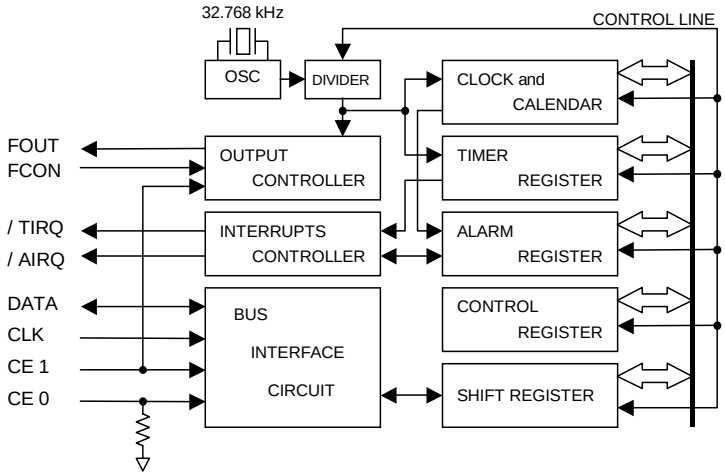
RoHS Compliant

Product Number (Please contact us)
RTC-4574SA : Q41457452000200
RTC-4574JE : Q41457471000100
RTC-4574NB : Q41457492000100

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 from1/30 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).

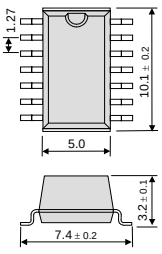
*** Functions are compatible with RX - 4574 LC.**

Terminal connection / External dimensions

(Unit:mm)

RTC – 4574 SA

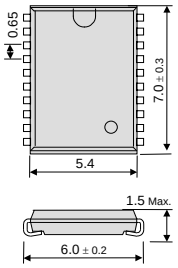
1.	GND	14.	FCON
2.	FOUT	13.	CE1
3.	N.C.	12.	DATA
4.	N.C.	11.	CLK
5.	N.C.	10.	/ TIRQ
6.	N.C.	9.	/ AIRQ
7.	VDD	8.	CE0



SOP – 14 pin

RTC – 4574 JE

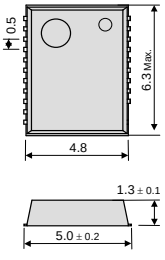
1.	VDD	20.	N.C.
2.	FOUT	19.	N.C.
3.	CE0	18.	N.C.
4.	/ AIRQ	17.	N.C.
5.	/ TIRQ	16.	N.C.
6.	CLK	15.	N.C.
7.	DATA	14.	N.C.
8.	CE1	13.	N.C.
9.	FCON	12.	N.C.
10.	GND	11.	N.C.



VSOJ – 20 pin

RTC – 4574 NB

1.	GND	22.	N.C.
2.	FCON	21.	N.C.
3.	N.C.	20.	N.C.
4.	CE1	19.	N.C.
5.	DATA	18.	N.C.
6.	CLK	17.	N.C.
7.	/ TIRQ	16.	N.C.
8.	/ AIRQ	15.	N.C.
9.	CE0	14.	N.C.
10.	FOUT	13.	–
11.	VDD	12.	–



SON – 22 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	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	Δf/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	µA
			VDD = 3 V		0.5	1.0	
	I32k	CE0 = GND CE1 = VDD FOUT ; 32.768 kHzoutput ON CL = 30 pF	VDD = 5 V		8.0	20.0	µA
			VDD = 3 V		5.0	12.0	

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

RX - 4574 LC

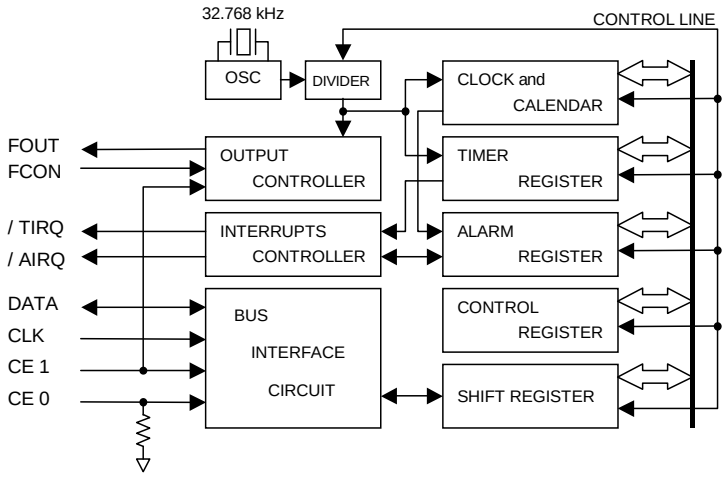
- Built in frequency adjusted 32.768 kHz crystal unit.
- Interface Type : 3-wire serial interface
- Operating voltage range : 1.6 V to 5.5 V
- Wide Timekeeper voltage range : 1.3 V to 5.5 V
- Low backup current : 0.35 µA / 3 V (Typ.)
- 32.768 kHz frequency output function : C-MOS output With Control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

RoHS Compliant

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).

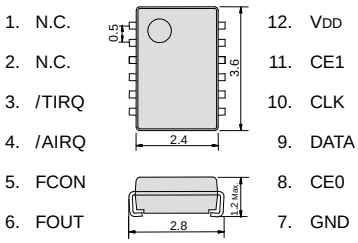
*** Functions are compatible with RTC-4574 SA / JE / NB.**

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)

RX – 4574 LC



VSOJ – 12pin

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	Δf/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	µA
			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	µA
			VDD = 3 V		5.0	12.0	

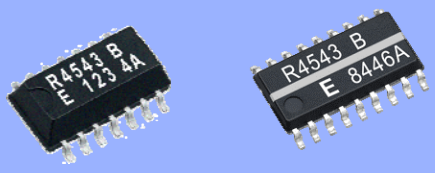
Simple Function
SERIAL-INTERFACE REAL TIME CLOCK MODULE

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.

RoHS Compliant

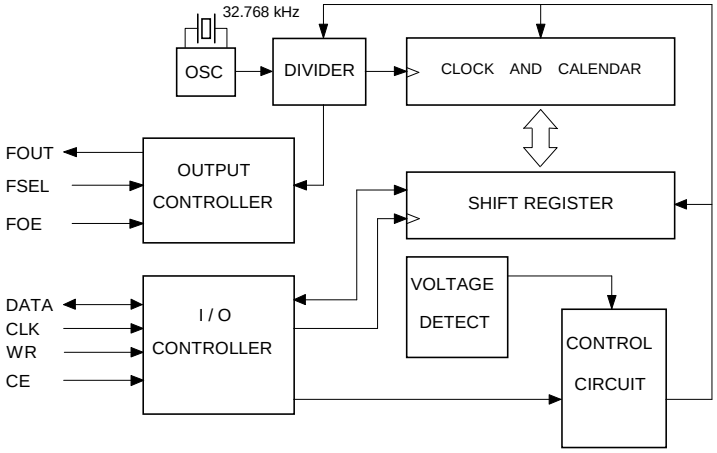
Product Number (Please contact us)
RTC-4543SA : Q4145435200200
RTC-4543SB : Q4145436100200



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.

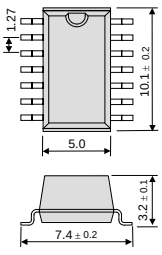
Pin Function

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.
V_{DD}	—	Connected to a positive power supply.
GND	—	Connected to a ground.

Terminal connection / External dimensions (Unit:mm)

RTC – 4543 SA

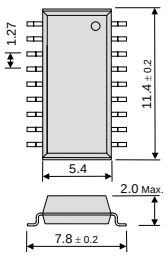
1.	GND	14.	FOUT
2.	N.C.	13.	N.C.
3.	CE	12.	N.C.
4.	FSEL	11.	DATA
5.	WR	10.	CLK
6.	FOE	9.	V_{DD}
7.	N.C.	8.	N.C.



SOP – 14 pin

RTC – 4543 SB

1.	N.C.	18.	N.C.
2.	N.C.	17.	N.C.
3.	N.C.	16.	N.C.
4.	N.C.	15.	N.C.
5.	FOE	14.	V_{DD}
6.	WR	13.	N.C.
7.	FSEL	12.	CLK
8.	CE	11.	DATA
9.	GND	10.	FOUT



SOP – 18 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	Condition	Min.	Typ.	Max.	Unit
Power voltage	V_{DD}	—	2.5	5.0	5.5	V
Clock voltage	V_{CLK}	—	1.4	5.0	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 V_{DD} = 5.0 V	5 ± 23 *	× 10^{-6}
Oscillation start-up time	t_{STA}	T_a = +25 °C V_{DD} = 2.5 V	3 Max.	s

* Please ask for tighter tolerance.(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}	CE = GND FOE = GND FOUT ;output OFF (Hi-z)	V_{DD} = 5 V		1.5	3.0	µA
			V_{DD} = 3 V		1.0	2.0	
			V_{DD} = 2 V		0.5	1.0	

■ Supply Voltage Detection Characteristic

T_a = -40 °C to +85 °C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power supply detection voltage	V_{DT}	V_{DD} 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 µA / 3 V (Typ.)
- External event detection. : Chattering free input port * 2.

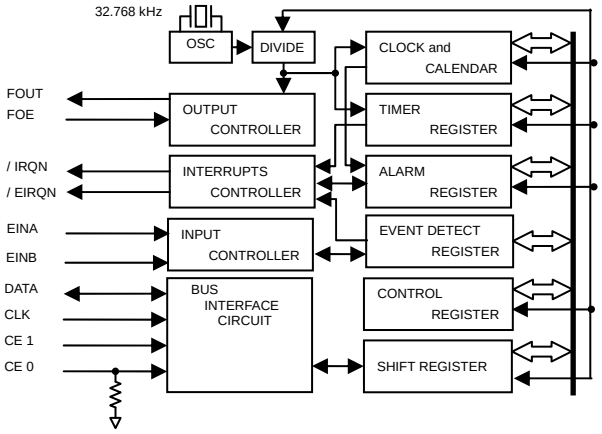
(The various functions include full calendar, alarm, timer.)

RoHS Compliant

Product Number (Please contact us)
RX-4575LC : Q414575C2000100

Actual size

Block diagram



Overview

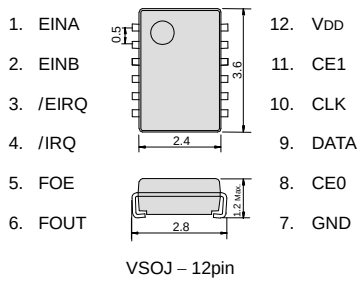
- **Event detection.**
  - Selectable Hi detection or Lo detection.
  - Recognition of detection is available both the hardware interrupt and the monitor via software.
  - Automatic interrupt release mode is available.
  - The all 'OR' interrupt output is possible via alarm, timer and event detection.
- **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)

RX – 4575 LC



VSOJ – 12pin

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	Δf / 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 ~ +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	µA
			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	µA
			VDD = 3 V		5.0	12.0	

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

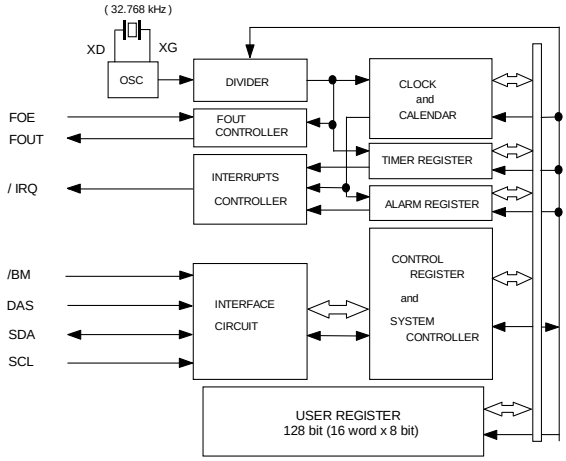
RoHS Compliant

Product Number (Please contact us)
RX-8571SA : X1B000072xxxx00
RX-8571NB : X1B000062xxxx00
RX-8571LC : X1B000052xxxx00

Actual size

RX-8571SA	RX-8571NB	RX-8571LC
		

Block diagram



Overview

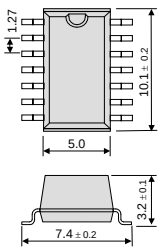
- 32.768 kHz frequency output function
  - FOE pin enable output on/off control.
  - Output frequency can be selected as 32.768 kHz, 1024 Hz, 1 Hz.
- Timer Function
  - Timer function can be set up between 1/4096 second and 65535 hours.
  - Timing period are 1 h, 1 min, 64 Hz, 4096 Hz.
  - It is recorded 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)

RX – 8571 SA

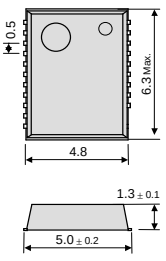
1.	GND	14.	FOUT
2.	N.C.	13.	N.C.
3.	DAS	12.	N.C.
4.	SCL	11.	N.C.
5.	SDA	10.	/ IRQ
6.	/BM	9.	N.C.
7.	FOE	8.	VDD



SOP - 14 pin

RX – 8571 NB

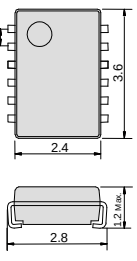
1.	FOE	22.	N.C.
2.	/BM	21.	N.C.
3.	(GND)	20.	N.C.
4.	SDA	19.	N.C.
5.	SCL	18.	N.C.
6.	DAS	17.	N.C.
7.	GND	16.	N.C.
8.	N.C.	15.	N.C.
9.	FOUT	14.	N.C.
10.	/IRQ	13.	–
11.	VDD	12.	–



SON – 22 pin

RX – 8571 LC

1.	FOE	12.	VDD
2.	/BM	11.	N.C.
3.	SDA	10.	N.C.
4.	SCL	9.	N.C.
5.	DAS	8.	/IRQ
6.	GND	7.	FOUT



VSOJ – 12pin

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	Δ 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	LC type		220	400	nA
			SA/NB type		200	400	
		FOE=/BM="L" FOUT= OFF /IRQ = OFF VDD =3.0V Ta= -40 °C to +85 °C				550	nA

Low current consumption
I²C-Bus INTERFACE REAL TIME CLOCK MODULE

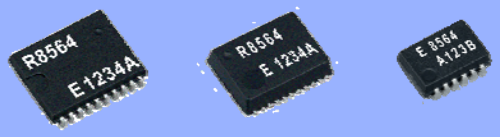
RTC-8564JE/NB
RX-8564LC

- 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

RoHS Compliant

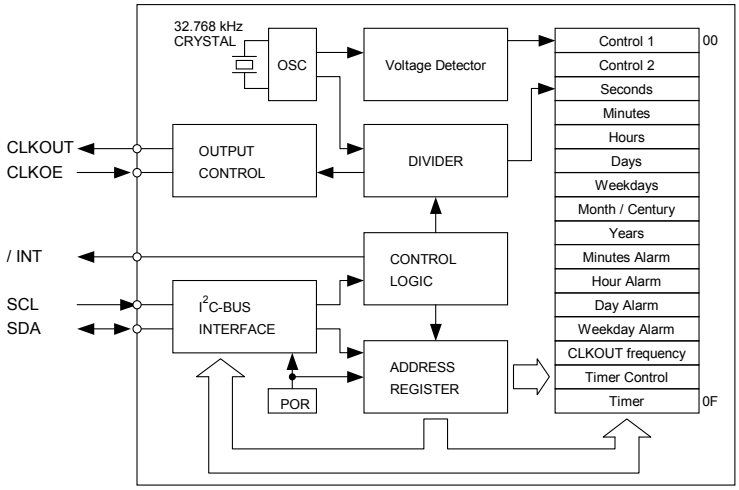
Product Number (Please contact us)
RTC-8564JE : Q41856471000100
RTC-8564NB : Q41856492000200
RX-8564LC : Q418564C2xxxx00



Actual size

RTC-8564JE	RTC-8564NB	RX-8564LC
		

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 / Ta = -20 °C to +70 °C
- 1.1 V to 5.5 V / Ta = -40 °C to +85 °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.

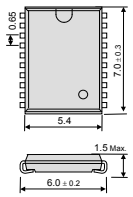
Pin Function

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); HIGH 0 OFF (LOW); LOW 1 OFF (LOW); LOW 0 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)

RTC – 8564 JE

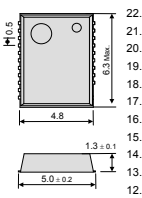
1.	N.C.	20.	N.C.
2.	N.C.	19.	N.C.
3.	CLKOE	18.	N.C.
4.	VDD	17.	N.C.
5.	CLKOUT	16.	N.C.
6.	SCL	15.	N.C.
7.	SDA	14.	N.C.
8.	(GND)	13.	N.C.
9.	GND	12.	N.C.
10.	/ INT	11.	N.C.



VSOJ – 20 pin

RTC – 8564 NB

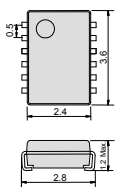
1.	/ INT	22.	N.C.
2.	GND	21.	N.C.
3.	(GND)	20.	N.C.
4.	N.C.	19.	N.C.
5.	SDA	18.	N.C.
6.	SCL	17.	N.C.
7.	CLKOUT	16.	N.C.
8.	VDD	15.	N.C.
9.	CLKOE	14.	N.C.
10.	N.C.	13.	–
11.	N.C.	12.	–



SON – 22 pin

RX – 8564 LC

1.	N.C.	12.	N.C.
2.	N.C.	11.	CLKOE
3.	N.C.	10.	VDD
4.	N.C.	9.	CLKOUT
5.	/ INT	8.	SCL
6.	GND	7.	SDA



VSOJ – 12pin

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	—	VLOW	3.0	5.5	V
Operating temperature	TOPR	—	-40	+25	+85	°C

■ Low voltage detection

Item	Symbol		Condition	Typ.	Max.	Unit
Low voltage detection	VLOW	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	Δf / f	Ta = +25 °C, VDD = 3.0 V	5 ± 23 *	× 10^{-6}

* 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 Consumtion	IBK	fSCL = 0 Hz, CLKOE = GND, CLKOUT ; output OFF (LOW)	VDD = 5 V		330	800	nA
			VDD = 3 V		275	700	
	I32k	fSCL = 0 Hz, CLKOE = VDD, CLKOUT ; 32.768 kHz output ON (Output=OPEN ; CL = 0 pF)	VDD = 5 V		2.5	3.4	µA
			VDD = 3 V		1.5	2.2	

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

RX - 8803 SA / LC

- Built in frequency adjusted 32.768 kHz crystal unit and DTCXO.
- 1/100s resolution Time register
- Interface Type : I²C-Bus interface (400kHz)
- Interface voltage range : 1.6 V to 5.5 V
- Temp. compensated voltage range : 2.2 V to 5.5 V
- Clock supply voltage range : 1.6 V to 5.5 V
- Selectable clock output (32.768 kHz, 1024 Hz, 1 Hz)
- The various functions include full calendar, alarm, timer, EVIN input.

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

RoHS Compliant

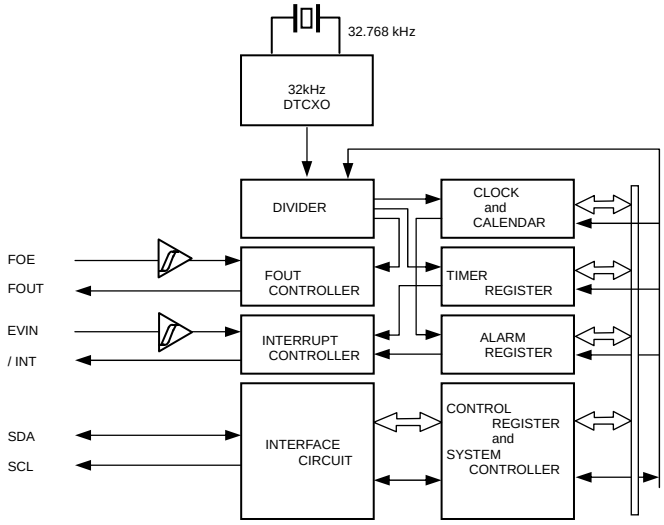
Product Number (Please contact us)
RX-8803SA: X1B000152xxxx00
RX-8803LC: X1B000142xxxx00

Actual size

RX-8803SA

RX-8803LC

Block diagram



Overview

- **High Stability**
  - UA ± 3.4 x 10^{-6} / -40 ºC to +85 ºC
    (Equivalent to 9 seconds of month deviation)
  - UB ± 5.0 x 10^{-6} / -40 ºC to +85 ºC
    (Equivalent to 13 seconds of month deviation)
  - UC ± 5.0 x 10^{-6} / -30 ºC to +70 ºC
  - AA (+5 ± 5.0) x 10^{-6} / +25 ºC
- **High Resolution:** 1/100s Time register with capture buffer
- **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 between 1/ 4096 second and 4095 minutes.
  - Alarm Function can be set to day of week, day, hour, or minute.
  - EVIN input.
- **Time synchronize function with 1PPS signal input**
- **Register compatibility:** upper compatible with RX-8801.

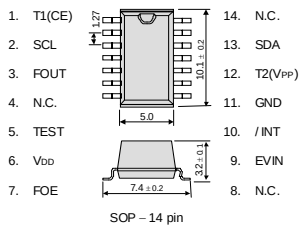
*It is possible to use it by the terminal connection as 32.768 kHz-DTCXO.

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. RX-8803SA only.)
VDD	-	Connected to a positive power supply
FOE	input	The input pin for the FOUT output control.
EVIN	input	External event input.
/ INT	Output	Interrupt output (N-ch. open drain).
GND	-	Connected to a ground
T2(VPP)	-	Use by the manufacture for testing. (Do not connect externally.)
SDA	I/O	Data input and output pin.

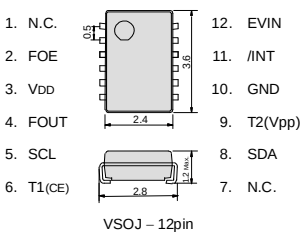
Terminal connection / External dimensions (Unit:mm)

RX – 8803 SA



SOP – 14 pin

RX – 8803 LC



VSOJ – 12pin

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

Specifications (characteristics)

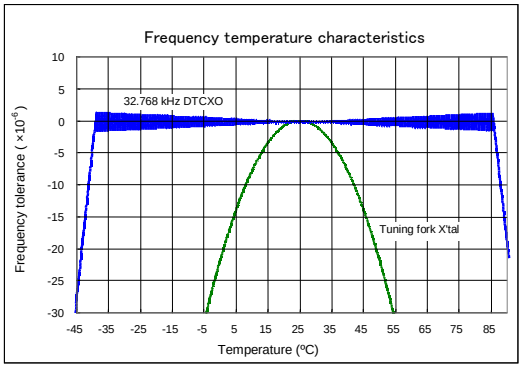
* Refer to application manual for details.

■ Electrical Characteristics

Item	Symbol	Condition		Min.	Typ.	Max.	Unit
Operating 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 supply voltage	VCLK	-		1.6	3.0	5.5	V
Operating temperature	TOPR	-		–40	+25	+85	ºC
Stability	Δ f / f	UA	Ta = -40 ºC to +85 ºC	±3.4 *1			× 10^{-6}
		UB	Ta = -40 ºC to +85 ºC	±5.0 *2			
		UC	Ta = -30 ºC to +70 ºC				
		AA	Ta = +25 ºC	5 ±5.0 *3			
Current consumption (1)	IDD1	Backup Mode FOE = GND, /INT = VDD FOUT output : OFF	VDD = 5V	-	1.2	3.4	µA
Current consumption (2)	IDD2		VDD = 3V	-	0.8	2.1	

*1) Equivalent to 9 seconds of month deviation. *2)*3) Equivalent to 13 seconds of month deviation. (excluding offset)

■ 32.768 kHz-DTCXO Frequency temperature characteristics (Example)



High-Stability Frequency with Built in Timestamp and Power Switching I²C-Bus REAL TIME CLOCK MODULE

NEW

RX-8035 SA / LC

- Built-in 32.768 kHz crystal unit : Frequency adjusted for high accuracy. (± 5 ×10⁻⁶ / Ta = +25 °C)
- Interface Type : I²C-Bus Interface (400kHz)
- Operating voltage range : 2.4 V to 5.5 V
- Timekeeping voltage range : 1.0 V to 5.5 V
- Low backup current : 350 nA (SA) 400 nA (LC) / 3 V (Typ.)
- Event detection and Time stamp : One-shot full timestamp and interrupt.
- Dual event detection ports : Each terminal has a de-bounce circuit.
- Auto power switching functions : When VDD deteriorates than 2.4V, internal source is switched to VBAT.

The I²C-Bus is a trademark of NXP Semiconductors

RoHS Compliant

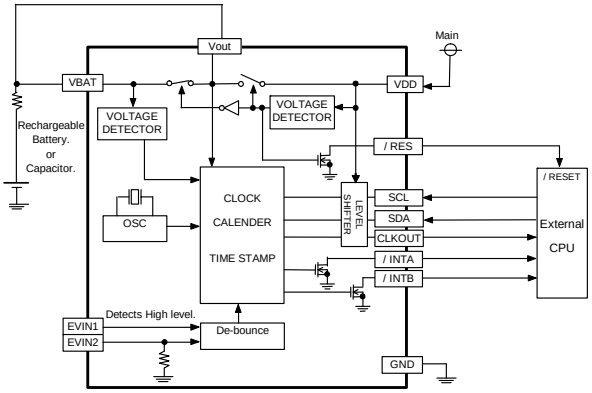
Product Number (Please contact us)
RX-8035SA: X1B000172xxxx00
RX-8035LC: X1B000182xxxx00

Actual size

RX-8035SA

RX-8035LC

Block diagram



Overview

- **The event detection and Timestamp function**
  Dual event detection terminals.
  Selectable de-bounce period 35ms or 2s.
  Available event detection interrupt output.

- **Power switching functions.**
  - When VDD is less than 2.4V, an internal source is switched to VBAT, and /RES is Low level. When VDD voltage rises to higher than 2.52V, an internal source is switched to VDD, and /RES is released with 105ms delay.
  - Note: When the supply from VBAT, SCL and SDA are disabled.

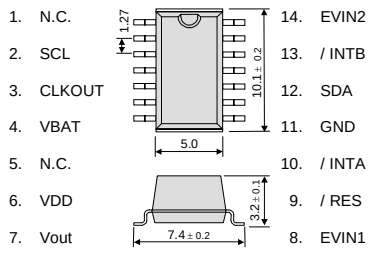
- **Alarm, Periodic interrupt, 32.768kHz clock output.**
  - Available monthly-alarm and weekly-alarm.
  - Interrupt period are selectable from 2Hz to Monthly.
  - CLKOUT outputs 32.768kHz clock powered by VDD.

Pin function

Signal Name	Input / Output	Function
SCL	Input	I2C serial clock.
SDA	In/Out	I2C data in/out.
VDD	—	Main power supply.
VBAT	—	Power supply for backup.
Vout	Output	Switched power out. (maximum output current 20mA)
/ RES	Output	VDD voltage state.
GND	—	Ground
EVIN1	Input	Event detection input 1
EVIN2	Input	Event detection input 2
/ INTA	Output	Interrupt out A.
/ INTB	Output	Interrupt out B.
CLKOUT	Output	32.768kHz output. (CMOS. Can not inhibit.)
N.C.	—	Do not connect.

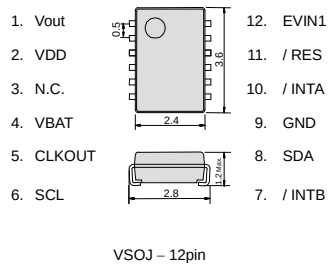
Terminal connection / External dimensions (Unit:mm)

RX – 8035 SA



SOP – 14 pin

RX – 8035 LC



VSOJ – 12pin

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
Operating voltage	VACCESS	VDD	2.4	3.0	5.5	V
Time keeping voltage	VCLK	VBAT	1.0	3.0	5.5	V
Operating temperature	TOPR	—	-40	+25	+85	°C
Storage temperature	TSTG	—	-55	—	+125	°C

■ Frequency characteristics

Item	Symbol	Condition	Rating	Unit
Frequency tolerance	Δf / f	Ta = +25°C VBAT = 3.0 V	B: 5 ± 23 *1) AA: 5 ± 5 *2) AC: 0 ± 5 *2)	× 10⁻⁶
Oscillation start-up time	tSTA	Ta = +25 °C VDD = 3.0 V	1 Max.	s
Frequency / voltage characteristics	f / V	Ta = +25 °C VDD = 2.4 V to 5.5 V	± 1 Max.	× 10⁻⁶

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

■ Current consumption characteristics

Ta = –40 °C to +85 °C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Current Consumption	IBAT	RX-8035SA VBAT = 3.0V, VDD = 0.0V SCL=SDA = GND	-	350	1200	nA
		RX-8035LC VBAT = 3.0V, VDD = 0.0V SCL=SDA = GND		400		
	IDD	VDD = 3.0V SCL=SDA = GND CLKOUT = open	-	1.40	2.50	µA

■ Power supply detection voltage

Ta = –40 °C to +85 °C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
VBAT detect voltage	VLOW	-	1.10	1.25	1.40	V
Power switching voltage (VDD to VBAT)	VD2B	+25 °C	2.328	2.40	2.472	V

High-Stability
I²C-Bus INTERFACE REAL TIME CLOCK MODULE

RX - 8025 SA / NB

- Built-in 32.768 kHz crystal unit : Frequency adjusted for high accuracy (±5 ×10⁻⁶ / Ta = +25 °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

RoHS Compliant

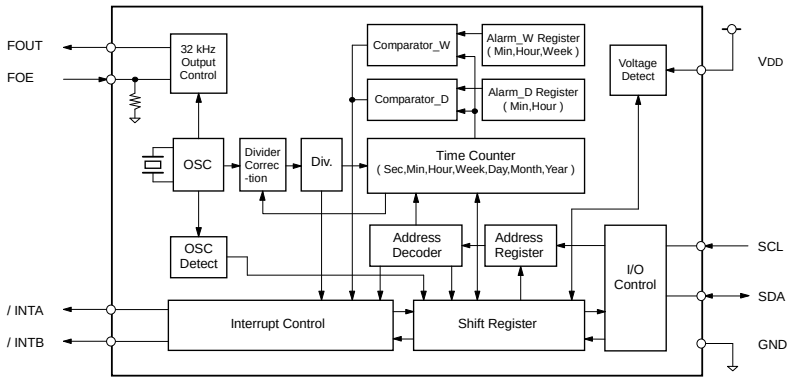
Product Number (Please contact us)
RX-8025SA : Q41802552xxxx00
RX-8025NB : Q41802592xxxx00

Actual size

RX-8025SA

RX-8025NB

Block diagram



Overview

• Features built-in 32.768 kHz crystal unit
- Frequency adjusted for high accuracy.
  (±5 ×10⁻⁶ / Ta = +25 °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

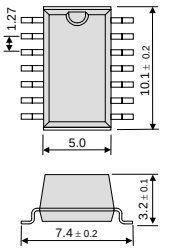
Signal Name	Input / output	Function
SCL	Input	Serial clock input pin
SDA	Bi-directional	Data input and output pin
FOUT	Output	32.768 kHz clock output pin with the output control function. (C-MOS)
FOE	Input	
/ INTA	Output	Interrupt output A pin (N-ch open drain)
/ INTB	Output	Interrupt output B pin (N-ch 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.

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)

Terminal connection / External dimensions (Unit:mm)

RX – 8025 SA

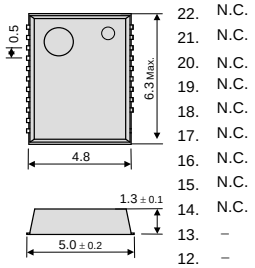
1. N.C.
2. SCL
3. FOUT
4. N.C.
5. TEST
6. VDD
7. FOE
14. N.C.
13. SDA
12. / INTB
11. GND
10. / INTA
9. N.C.
8. N.C.



SOP – 14 pin

RX – 8025 NB

1. FOE
2. VDD
3. (GND)
4. TEST
5. FOUT
6. SCL
7. SDA
8. / INTB
9. GND
10. / INTA
11. N.C.
22. N.C.
21. N.C.
20. N.C.
19. N.C.
18. N.C.
17. N.C.
16. N.C.
15. N.C.
14. N.C.
13. –
12. –



SON – 22 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	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	Δ f / f	Ta = +25 °C VDD = 3.0 V	AA: 5 ± 5 *1) AC: 0 ± 5 *2)	× 10⁻⁶
Oscillation start-up time	tSTA	Ta = +25 °C VDD = 2.0 V	1 Max.	s
Frequency voltage characteristics	f / V	Ta = +25 °C VDD = 2.0 V to 5.5 V	± 1 Max.	× 10⁻⁶

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

■ Current consumption characteristics

Ta = –40 °C to +85 °C

Item	Symbol	Condition		Min.	Typ.	Max.	Unit
Curent Consumption	IBK	fSCL = 0Hz FOE = GND FOUT ; output OFF(LOW)	VDD = 5 V		0.60	1.80	µA
			VDD = 3 V		0.48	1.20	
	I32k	fSCL = 0Hz VDD, FOE = 5.5 V FOUT ; output ON (Output=OPEN; CL = 0 pF)	VDD = 5.5 V		3.0	6.5	µA

■ Power supply detection voltage

Ta = –30 °C to +70 °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 EEPROM and Unique ID-ROM
I²C-Bus INTERFACE REAL TIME CLOCK MODULE

RX - 8731 LC

- 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 µA / 3 V (Typ.)
- 32.768 kHz frequency output function : C-MOS output With Control Pin
- The various functions include full calendar, alarm, timer.

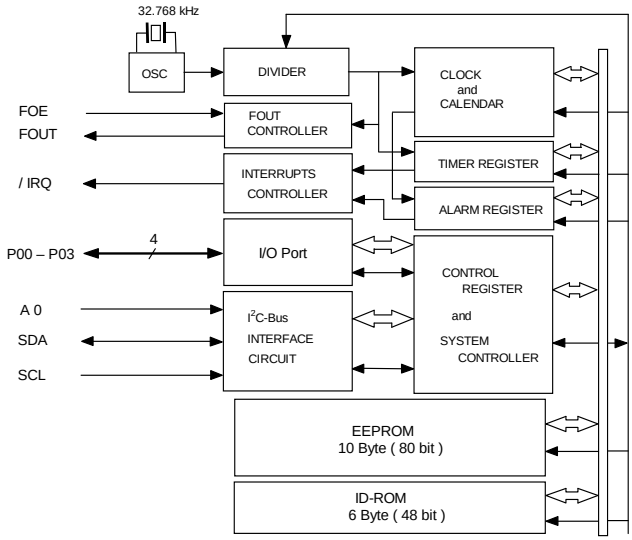
* The I²C-Bus is a trademark of NXP Semiconductors

RoHS Compliant

Product Number (Please contact us)
RX-8731LC : Q418731C2000100

Actual size

Block diagram



Overview

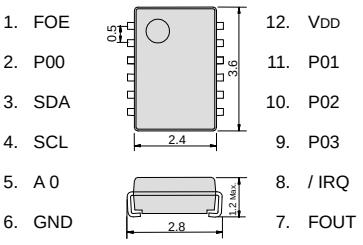
- **Built in EEPROM and ID-ROM**
  - Built in 10 Byte (80 bit) EEPROM
  - Built in 6 Byte (48 bit) ID-ROM
- **Programmable I/O ports**
  - 4 Programmable I/O ports
- **Interface Type**
  - I²C-Bus high-speed bus specifications. (400 kHz)
- **32.768 kHz frequency output function**
  - FOUT pin output (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.
A 0	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 pin control the frequency output from FOUT pin with FSEL1-bit and FSEL0-bit.
FOE	Input	
/ 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)

RX – 8731 LC



VSOJ – 12pin

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	Δ 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	fSCL = 0 Hz / IRQ = OFF FOUT : output OFF (Hi - z)	VDD = 5 V		0.45	1.5	µA
			VDD = 3 V		0.35	1.4	
	I32k	fSCL = 0 Hz / IRQ = OFF FOUT : 32.768 kHz output CL = 30 pF	VDD = 5 V		8.0	16.0	µA
			VDD = 3 V		5.0	10.0	

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 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

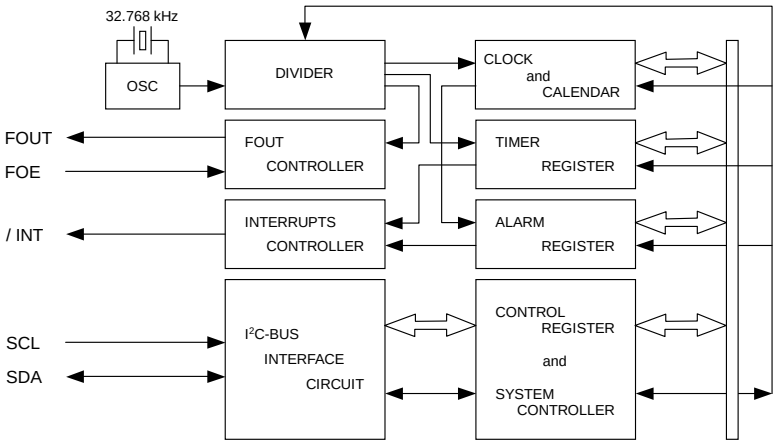
RoHS Compliant

Product Number (Please contact us)
RX-8581SA : Q41858152xxxx00
RX-8581JE : Q41858171xxxx00
RX-8581NB : Q41858192000200

Actual size

RX-8581SA	RX-8581JE	RX-8581NB
		

Block diagram



Overview

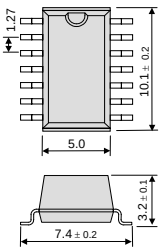
- **Interface Type**
  - I²C-Bus interface. (Hi-speed bus specifications 400 kHz)
  - * I²C-Bus slave address : read A3h and write A2h
- **32.768 kHz frequency output function**
  - FOUT pin output (C-MOS output), CL=30 pF
  - 32.768 kHz clock frequency output. (Duty 50 ±5 %)
- **Timer function**
  - 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)

RX – 8581 SA

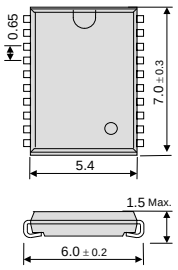
1.	N.C.	14.	FOUT
2.	SCL	13.	N.C.
3.	SDA	12.	N.C.
4.	N.C.	11.	VDD
5.	GND	10.	FOE
6.	N.C.	9.	N.C.
7.	/ INT	8.	N.C.



SOP – 14 pin

RX – 8581 JE

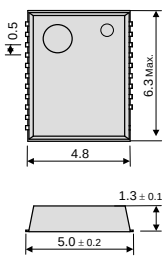
1.	N.C.	20.	N.C.
2.	N.C.	19.	N.C.
3.	FOE	18.	N.C.
4.	VDD	17.	N.C.
5.	FOUT	16.	N.C.
6.	SCL	15.	N.C.
7.	SDA	14.	N.C.
8.	(VDD)	13.	N.C.
9.	GND	12.	N.C.
10.	/ INT	11.	N.C.



VSOJ – 20 pin

RX – 8581 NB

1.	/ INT	22.	N.C.
2.	GND	21.	N.C.
3.	(VDD)	20.	N.C.
4.	N.C.	19.	N.C.
5.	SDA	18.	N.C.
6.	SCL	17.	N.C.
7.	FOUT	16.	N.C.
8.	VDD	15.	N.C.
9.	FOE	14.	N.C.
10.	N.C.	13.	–
11.	N.C.	12.	–



SON – 22 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	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	Δ f / f	Ta = +25 °C VDD = 3.0 V	5 ± 23 *	× 10⁻⁶
FOUT output Duty	tw / t	Ta = -40 °C to +85 °C VDD = 2.4 V to 5.5 V	50 ± 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 FOUT ; output OFF (LOW)	VDD = 5 V		0.65	1.2	µA
			VDD = 3 V		0.45	0.8	
	I32k	fSCL = 0 Hz FOE = VDD FOUT ; 32.768 kHz output ON CL = 30 pF	VDD = 5 V		8.0	20.0	µA
			VDD = 3 V		5.0	12.0	

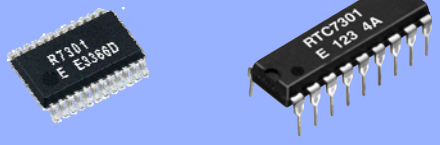
4-bit REAL TIME CLOCK MODULE

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: ±192 × 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 µA / 3 V Typ.)
- High speed parallel interface compatible with SRAM

RoHS Compliant

Product Number (Please contact us)
RTC-7301SF : Q42730182000200
RTC-7301DG : Q42730112000200

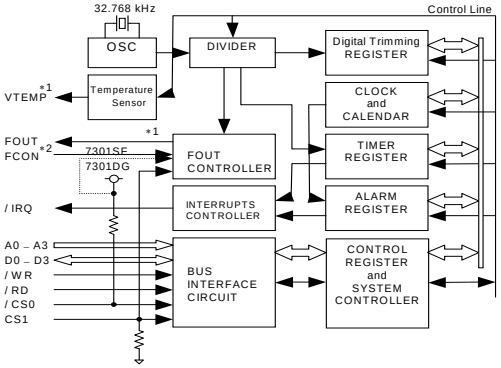


Actual size

RTC-7301SF

RTC-7301DG

Block diagram



This is a block diagram for RTC-7301SF.

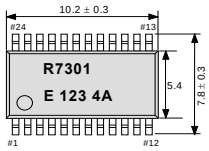
Be aware that RTC-7301DG differs according to the following 2 points.

∗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

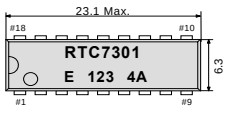
(Unit:mm)

● RTC-7301SF (SSOP 24-pin)

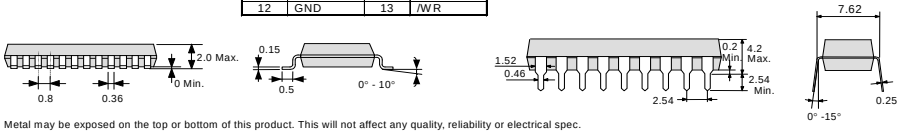


No.	Pin terminal	No.	Pin terminal
1	/CS0	24	VDD
2	FCON	23	(VDD)
3	FOUT	22	(VDD)
4	VTEMP	21	(VDD)
5	(VDD)	20	(VDD)
6	/IRQ	19	(VDD)
7	A0	18	CS1
8	A1	17	D0
9	A2	16	D1
10	A3	15	D2
11	/RD	14	D3
12	GND	13	/WR

● RTC-7301DG (DIP 18-pin)



No.	Pin terminal	No.	Pin terminal
1	/CS0	18	VDD
2	FOUT	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	Conditions	Min.	Max.	Unit
Supply voltage	VDD	VDD to GND	-0.3	+7.0	V
Input voltage	VIN	Input terminal, D0 to D3 pins	GND-0.3	VDD+0.3	
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.	-55	+125	°C

■Operating range

GND = 0 V

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

■Frequency characteristics

Item	Symbol	Conditions	Range	Unit
Frequency precision	Δf /f	Ta=+25 °C,VDD=3.0 V	B:±23 (*1)	×10^{-6}
Oscillation Start up time	tSTA	Ta=+25 °C,VDD=2.4 V	3.0 Max.	s
Frequency temperature characteristics	TOP	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
Aging	fa	Ta=+25 °C, VDD=3.0 V First year	±5.0 Max.	×10^{-6}/year

(*1) Please ask tighter tolerance

■DC characteristics

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

Item	Symbol	Conditions		Min.	Typ.	Max.	Unit
Current consumption (When non-accessed) FOUT =Output OFF VTEMP=Output OFF	IDD1	/CS0,/RD,/WR=VDD A0-A3,CS1=GND D0-D3,/IRQ=Hi-z FOUT=Hi-z(OFF) VTEMP=Hi-z(OFF)	VDD=5 V	—	1.0	2.0	µA
	IDD2		VDD=3 V	—	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.

■Temperature sensor characteristics

GND=0 V,Ta=-40 °C to +85 °C

Item	Symbol	Conditions	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	TACR	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	TSOP	ΔNL≤ ±2.0 %,VDD=2.7 V to 5.5 V	-40		+85	°C
Output resistance	R0	Ta=25 °C,VTEMP pins,VDD=2.7 V to 5.5 V GND standard and VDD standard		1.0	3.0	kΩ
Load condition	CL	VDD=2.7 V to 5.5 V			100	pF
	RL	VDD=2.7 V to 5.5 V	500			kΩ
Response time	tRSP	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.

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).

RoHS Compliant

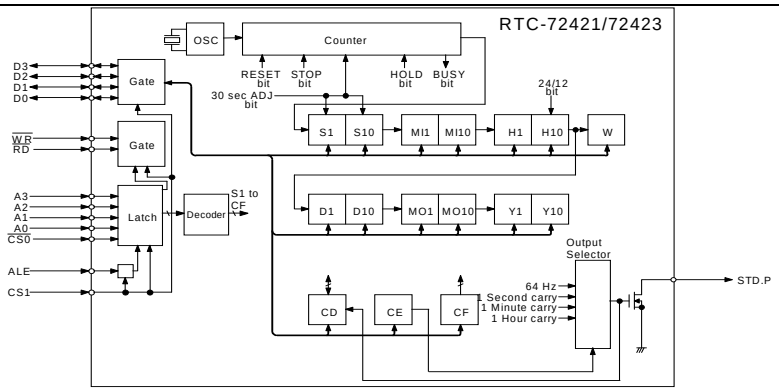
Product Number (Please contact us)
RTC-72421 : Q42724212xxxx00
RTC-72423 : Q42724232xxxx00

Actual size

RTC-72421

RTC-72423

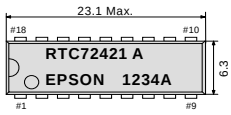
Block diagram



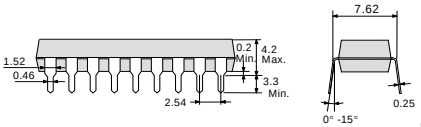
Terminal connection/External dimensions

(Unit:mm)

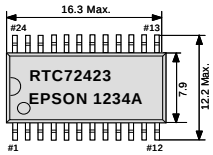
● **RTC-72421 (DIP 18-pin)**



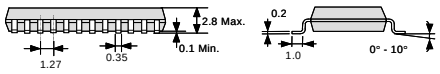
No.	Pin terminal	No.	Pin terminal
1	STD.P	18	VDD
2	/CS0	17	(VDD)
3	ALE	16	(VDD)
4	A0	15	CS1
5	A1	14	C0
6	A2	13	D1
7	A3	12	D2
8	/RD	11	D3
9	GND	10	/WR



● **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	VI/O	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 produc after unpacking

Frequency characteristics

Item	Symbol	Condition		Range	Unit
Frequency precision	Δf /f	Ta=+25 °C VDD=5.0 V	72421A	±10	×10-6
			72421B	±50	
			72423A	±20	
			72423B	±50	
Frequency temperature characteristics	TOP	-10 °C to +70 °C (+25 °C)		+10 / -120	×10-6
		-40 °C to +85 °C(+25 °C)		+10 / -220	
Frequency voltage characteristics	f/V	Ta=+25 °C,VDD=2.0 V to 5.5 V		±5.0 Max.	×10-6/V
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	IDD1	CS1= 0 V Exclude input/ output current	VDD=5 V	—	1	10	μA	—
	IDD2		VDD=2 V		0.9	5		—
HIGH input voltage (1)	VIH1	—		2.2	—	—	V	All inputs other than CS1
LOW input voltage (1)	VIL1			—	—	0.8		
LOW output voltage (1)	VOL1	IOL=2.5 mA		—	—	0.4	V	D0 to D3
HIGH output voltage	VOH	IOH=-400 μA		2.4	—	—		
LOW output voltage (2)	VOL2	IOL=2.5 mA		—	—	0.4		STD.P
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			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		
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		D0 to D3

For Automotive
SERIAL INTERFACE REAL TIME CLOCK MODULE

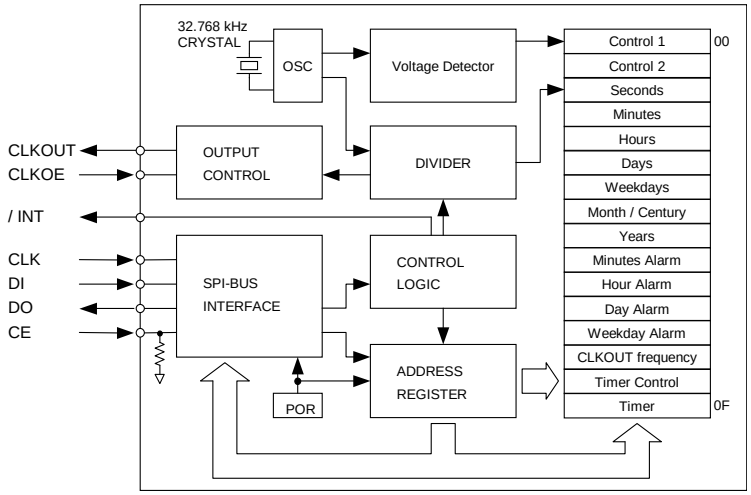
RA - 4565 SA

- 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
  T_a = –40 °C to +125 °C
- 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

Product Number (Please contact us)
RA-4565SA : Q41A46552xxxx00

Actual size

Block diagram



Overview

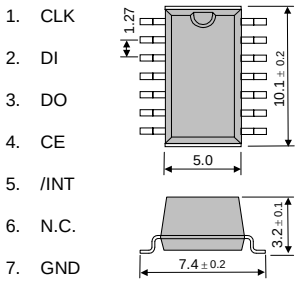
- **Wide operating temperature range**
  - –40 °C to +125 °C
- **Clocking-status detection function**
  - It can judge the validity of data after backup operation return by a status of VL-bit.
- **32.768 kHz frequency output function**
  - CLKOUT pin output (Open Drain output)
  - Output frequency can 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



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	–	1.6	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	Δ f / f	Ta = +25 °C VDD = 3.0 V	5 ± 23 *1	× 10 –6
Oscilation 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" VDD = 5 V	+125 °C		1.0	2.0	µA
			-40 to +85 °C		0.6	1.2	
		fSCL = 0 Hz CLKOE = "L" VDD = 3 V	+125 °C		0.8	1.6	µA
			-40 to +85 °C		0.5	1.0	

For Automotive

SERIAL-INTERFACE REAL TIME CLOCK MODULE

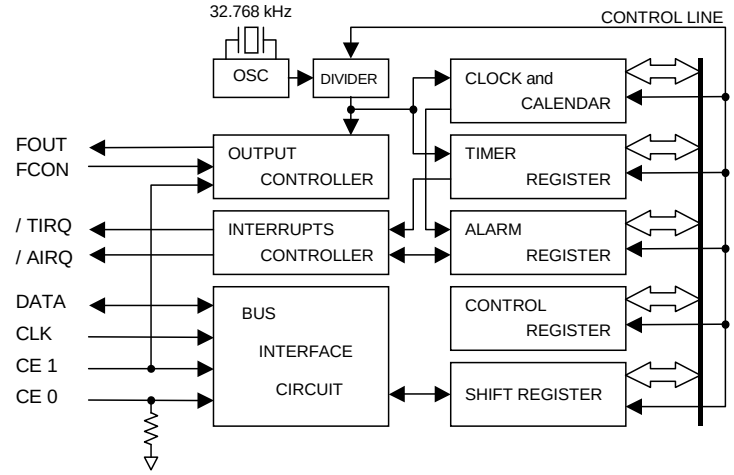
RA - 4574 SA

- 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 μA / 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 : Q41A47452xxxx00

Actual size

Block diagram



Overview

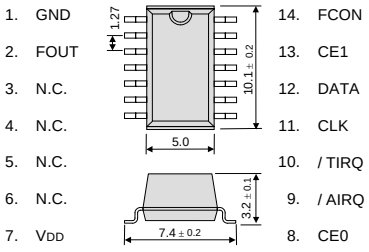
- **32.768 kHz frequency output function**
  - FOUT pin output (C-MOS output), CL=30 pF
  - Output frequency selectable from 1/30 Hz to 32.768 kHz(32 Values)
- **Timer function**
  - Timer function can be set between 1/4096 second and 255 minutes.
  - It is recorded automatically to TF-bit at the time 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.
V_{DD}	—	Connected to a positive power supply.
GND	—	Connected to a ground.

Terminal connection / External dimensions (Unit:mm)

RA – 4574 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	Condition	Min.	Typ.	Max.	Unit
Power voltage	V_{DD}	—	1.6	3.0	5.5	V
Clock voltage	V_{CLK}	—	1.6	3.0	5.5	V
Operating temperature	T_{OPR}	—	−40	+25	+85	°C

■ Frequency characteristics

Item	Symbol	Condition	Rating	Unit
Frequency tolerance	Δf / f	T_a = +25 °C V_{DD} = 3.0 V	5 ± 23 *	× 10^{-6}
Oscillation start-up time	t_{STA}	T_a = +25 °C V_{DD} = 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)	V_{DD} = 5 V		1.0	2.0	μA
			V_{DD} = 3 V		0.5	1.0	
	I_{32k}	CE0 = GND CE1 = V_{DD} FOUT ; 32.768 kHz output ON CL = 30 pF	V_{DD} = 5 V		8.0	20.0	μA
			V_{DD} = 3 V		5.0	12.0	

For Automotive

I²C-Bus INTERFACE REAL TIME CLOCK MODULE

RA - 8565 SA

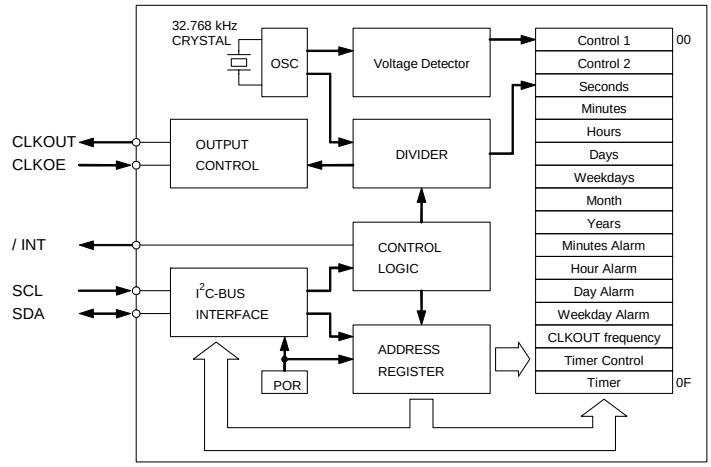
- Built in frequency adjusted 32.768 kHz crystal unit.
- Interface Type : I²C-Bus Interface (400 kHz)
- Wide operating voltage range : 1.8 V to 5.5 V
- Wide Timekeeper voltage range : 1.7 V to 5.5 V
  Ta = –40 °C to +125 °C
- Extended operating temperature range: –40 °C to +125 °C
- 32.768 kHz frequency 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 : Q41A86552xxxx00

Actual size

Block diagram



Overview

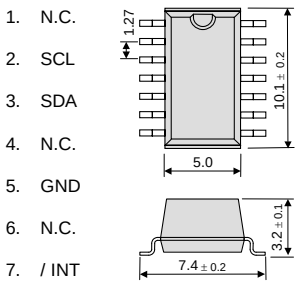
- Wide operating temperature range for automotive
  - –40 °C to +125 °C
- Clocking-status detection function
  - It can judge the validity of data after backup operation return by a status of VL-bit.
- 32.768 kHz frequency output function
  - CLKOUT pin output (N-ch Open Drain output)
  - Output frequency 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.) 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.
CLKOE	Input	
/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	Δf/f	Ta = +25 °C VDD = 3.0 V	5 ± 23 *1	× 10⁻⁶
Oscilation start up time	tSTA	Ta = +25 °C VDD = 1.8 V	1.5 Max.	s
		Ta = –40 °C to +125 °C VDD = 3.0 V	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	fSCL = 0 Hz CLKOE = LOW VDD = 5 V	+125 °C		1.10	1.8	µA
			-40 °C to +85 °C		0.60	1.2	
		fSCL = 0 Hz CLKOE = LOW VDD = 3 V	+125 °C		1.00	1.6	µA
			-40 °C to +85 °C		0.55	1.0	

For Automotive

I²C-Bus INTERFACE REAL TIME CLOCK MODULE

RA - 8581 SA

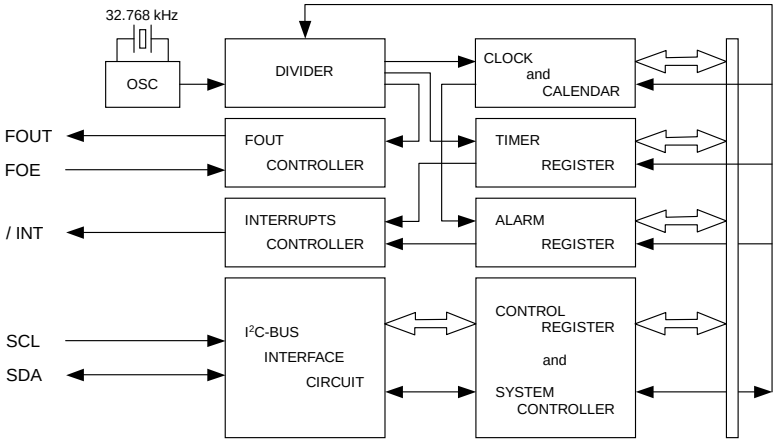
- Built-in frequency adjusted 32.768 kHz crystal unit.
- Interface Type : I²C-Bus Interface (400 kHz)
- Operating voltage range : 1.8 V to 5.5 V
- Wide Timekeeper voltage range : 1.6 V to 5.5 V
- Low backup current : 0.45 µA / 3 V (Typ.)
- 32.768 kHz frequency output function : C-MOS output With Control 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 : Q41A88152xxxx00

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 ±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.

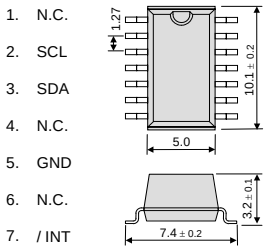
Pin Function

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	
/INT	Output	Interrupt output (N-ch open drain)
VDD	—	Connected to a positive power supply.
GND	—	Connected to a ground.

FOE pin input	FOUT pin output	
HIGH	Output	(C-MOS)
LOW	OFF	(LOW)

Terminal connection / External dimensions (Unit:mm)

RA – 8581 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	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	Δf / f	Ta = +25 °C VDD = 3.0 V	5 ± 23 *	× 10⁻⁶
FOUT output Duty	tw / t	Ta = -40 °C to +85 °C VDD = 2.4 V to 5.5 V	50 ± 5	%

* Equivalent to 1 minute of monthly deviation

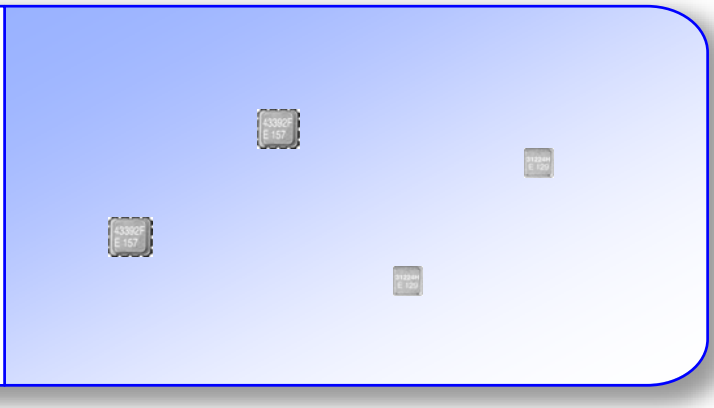
■ Current consumption characteristics

Ta = -40 °C to +85 °C

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

FILTER
SAW Filter

Features
► Custom designs are available upon request.
Please inquire it.



►SAW Filter

Model		External dimensions (mm)		Nominal frequency (MHz)	Passband (MHz)	Applications	Page
	FF-555		5.2 x 4.8 x 1.5	300 to 500	0.2	RKE RF	**101**
	FF-32N		3.8 x 3.8 x 0.98	300 to 500	0.4(0.6)		**102**

SAW FILTER

FF - 555

- 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.

For Automotive

Pb Free

RoHS Compliant

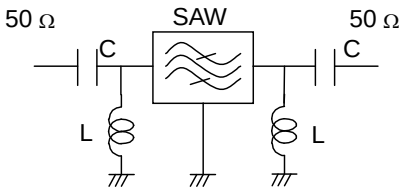
Product number (please contact us)
FF-555 : Q51FF5550xxxx00

Actual size

Specifications (characteristics)

Item	Symbol	Specifications FF-555	Conditions / Remarks
Nominal frequency range	f_nom	300 MHz to 500 MHz	
Storage temperature	T_stg	-55 °C to +125 °C	Store as bare product.
Operating temperature	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)	
Attenuation	G_Att	f_nom -21.4 MHz 40 dB Min. f_nom -10.7 MHz 40 dB Min.	Reference to Through level
Turnover temperature	Ti	+25 °C ±15 °C	
Temperature coefficient	B	$-(3.4\pm 0.8) \times 10^{-8}$ / °C^2	
Terminal impedance	Zt	370 Ω Typ.	Ex : 315 MHz
		160 Ω Typ.	Ex : 433.92 MHz

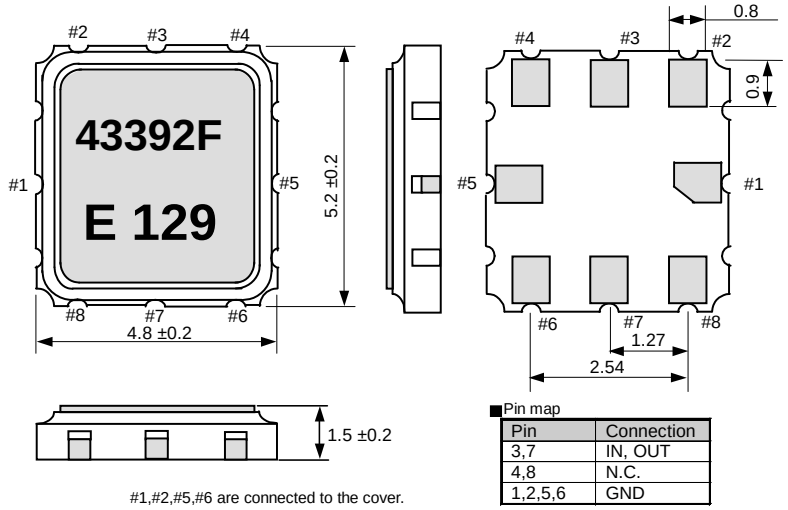
Test fixture



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)

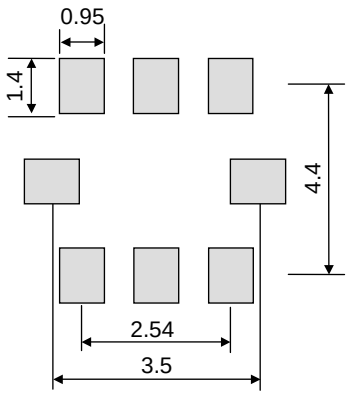


#1,#2,#5,#6 are connected to the cover.

■Pin map

Pin	Connection
3,7	IN, OUT
4,8	N.C.
1,2,5,6	GND

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)
- Narrow band for SRD Front-end filters.
- Low-loss, Narrow Pass bandwidth, High stability by using crystal substrate.

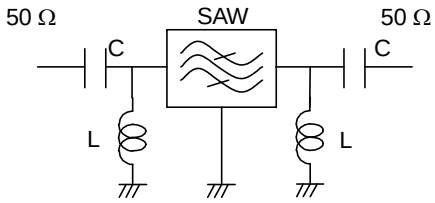
Product number (please contact us)
FF-32N : Q51FF32N0xxxx00

Actual size

Specifications (characteristics)

Item	Symbol	Specifications		Conditions / Remarks
Nominal frequency range	f_nom	300 MHz to 500 MHz	426 MHz, 429 MHz band*	*ARIB std. T67 in Japan
Storage temperature	T_stg	-55 °C to +125 °C	-55 °C to +125 °C	Store as bare product.
Operating temperature	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	Ti	+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	Zt	370 Ω Typ.		Ex: 315 MHz
		160 Ω Typ.		Ex: 433.92 MHz
			220 Ω Typ.	Ex: 429.45 MHz

Test fixture



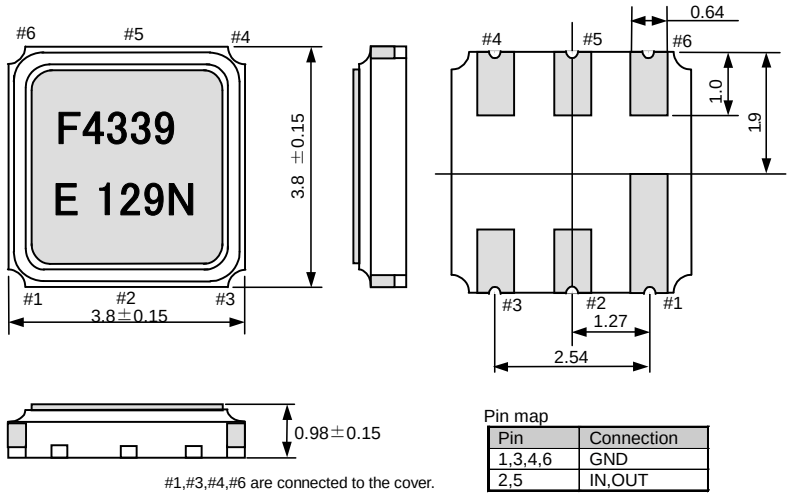
Remarks

Ex: f_nom =315 MHz
Series Capacitance = 4 pF
Parallel Inductance =33 nH

Ex: f_nom =433.92 MHz
Series Capacitance =5 pF
Parallel Inductance =18 nH

Ex: f_nom =429.45 MHz
Series Capacitance =4 pF
Parallel Inductance =18 nH

External dimension (Unit:mm)

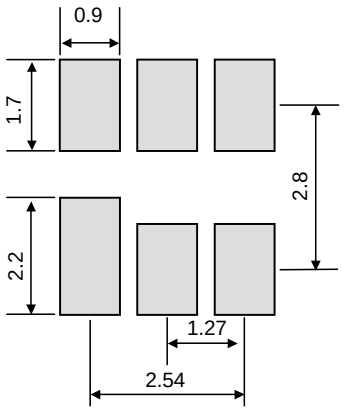


#1,#3,#4,#6 are connected to the cover.

Pin map

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

Footprint (Recommended) (Unit:mm)



SENSING DEVICE

Inertial Sensor
Gyro Sensor
Quartz Pressure Sensor
Temperature Sensing Crystal

►6-DOF Inertial Sensor

Model		External Dimensions (mm).	Supply Voltage (V)	Gyro			Accelerometer			Operating Temperature	Recommended Application	Page
				Scale Factor (mV/(°/s))	Range (°/s)	Non linearity (%FS)	Scale factor (mV/G)	Range (G)	Non linearity (%FS)			
	AH-6120LR	 10.0x8.0x3.8	2.7 to 3.3	1.0	±1000	±2	200	±6	±0.5	-40 to +85°C	Motion tracking, Measurement, Dead reckoning, Healthcare	104
	AP-6110LR		2.85 to 3.6	3.0	±300	±0.5	400	±3	±0.5	-40 to +85°C		
	AH-6120LR EB02 / AP-6110LR EB02 NEW		AH-6120/AP-6110LR Evaluation Board									105

►Gyro Sensor

Model		External Dimensions (mm)	Supply Voltage(V)	Bias	Rate Range (°/s)	Scale Factor (mV/(°/s))	Non Linearity (%FS)	Operating Temperature	Recommended Application	Page
	XV-9100LV	 NEW 7.0×6.8×3.3	4.75 to 5.25	0.5* V_{DD} V	±100	0.004* V_{DD}	±0.5	-40 °C to +125 °C	Electric Stability Control System, Rollover Protection System	106
	XV-9300LV				±300	0.0012* V_{DD}				
	XV-9100LP	 NEW 9.5×5.0×7.2			±100	0.004* V_{DD}				
	XV-9300LP				±300	0.0012* V_{DD}				
	XV-8000LK	 6.0×4.8×3.3 Inclined	4.75 to 5.25	0.5* V_{DD} V	±60	0.005* V_{DD}	±0.5	-40 °C to +85 °C	Car navigation system	107
	XV-8000CB	 5.0×3.2×1.3								
	XV-8100CB	 5.0×3.2×1.3	2.85 to 3.15	1350 mV	±100	2.5	±0.5	-40 °C to +85 °C	Portable type GPS,PND	108
	XV-3900CB	 NEW 5.0×3.2×1.3	2.7 to 3.3	1500 mV	±100	8.0	±1	-20 °C to +80 °C	Detection picture stabilization	109
	XV-3500CB	 5.0×3.2×1.3	2.7 to 3.3	1350 mV	±100	0.67	±5	-20 °C to +80 °C		110
	XV-3510CB	 NEW 5.0×3.2×1.3		1430 mV	±300	3.0	±0.5			
	XV-3700CB	 5.0×3.2×1.3	2.7 to 3.3	1500 mV	±300	3.624	±5	-20 °C to +80 °C	Motion UI Hobby	111
					±1500	0.8				

►Quartz Pressure Sensor

Model		External Dimensions (mm)	Pressure measurement range	Linearity after linearization	Accuracy (Linearity, Repeatability, Hysteresis)	Operating Temperature	Page
	TSU-20G	(W)87× (H)22	0 to 200 kPa	0.01 % FS Max.	0.023 % FS Max.	-10 °C to +70 °C	112
	TSU-70G	(W)87× (H)22	0 to 700 kPa				
	TSU-100G	(W)87× (H)22	0 to 1 MPa				

►Temperature Sensing Crystal

Model		Actual size (mm) Max.	Frequency Tolerance	Temperature coefficient			Motional resistance	Operating Temperature	Page
				1st.	2nd.	3rd.			
	HTS-206	Φ2.0	±2 %	-26.0 × 10^{-6} / °C	-5.8 × 10^{-8} / °C^2	-1.5 × 10^{-10} / °C^3 Max.	35 kΩ Max.	-40 °C to +85 °C	113

SENSOR
6-DOF INERTIAL SENSOR

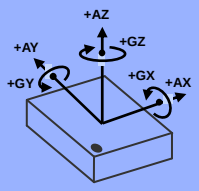
AH-6120LR
AP-6110LR

- 3-axis gyro plus 3-axis accelerometer
- Factory adjusted accuracy scale factor and bias
- Analog output for mixed signaling systems
- Low noise and stability over temperature angular rate detection
- Low current consumption
- External dimensions: 10.0 x 8.0 x 3.8 mm

- Recommended application: Motion tracking and measurement, Dead reckoning and Healthcare

RoHS Compliant

Product number (please contact us)
AH-6120LR:X2M000031xxxx00
AP-6110LR:X2M000021xxxx00



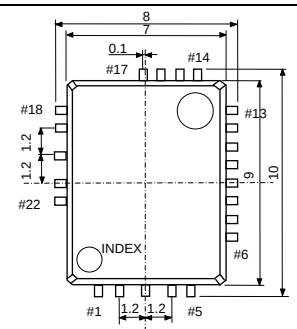
Actual size

Specifications (characteristics)

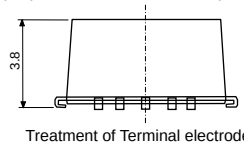
Item	Symbol	AH-6120LR	AP-6110LR	Remarks
Supply Voltage	VDD	3.0V±0.3V	2.85V to 3.6V	
Storage Temperature	TSTG	-40°C to +85°C		
Operating Temperature	TOPR	-40°C to +85°C		
Current consumption	Iop	6.1mA Typ.	6.8mA Typ.	
- Gyro sensor -				
Scale factor	So	1.0mV/(°/s) Typ.	3.0 mV/(°/s) Typ.	Ta=+25°C
Scale factor variation with temp.	-	±3%	-3% to +2%	Based on Ta=+25°C
Bias	Vo	Vr±20mV	Vr±15mV	VDD=3V,Ta=+25°C
Bias variation with temp.	Vo- Vr	±25mV	±24mV	Based on Ta=+25°C
Reference voltage	Vr	1350mV±20mV	1430mV±15mV	Ta=+25°C
Range	I	±1000°/s	±300°/s	
Non linearity	NL	±2% FS	±0.5% FS	Ta=+25°C
LPF bandwidth	BW	223Hz Typ.	200Hz Typ.	90 degree phase delay
Noise density	Nd	0.006(°/s)/√Hz Typ.	0.004(°/s)/√Hz Typ.	AH-6120LR: 10 to 100Hz Ave. AP-6110LR : 1 to 100Hz Ave.
- Accelerometer -				
Scale factor	SF	200mV/G Typ.	400mV/G Typ.	VDD=3V, Ta=+25°C
Scale factor variation with temp.	-	±3% Typ.		Based on Ta=+25°C
Scale factor ratiometric error	-	±1% Typ.		VDD=3V±5%, Ta=+25°C Based on VDD=3V
Bias	-	1500mV Typ.		VDD=3V, Ta=+25°C
Bias variation with temp.	-	±150mG Typ.		VDD=3V,Based on Ta=+25°C
Range	-	±6G Typ.	±3G Typ.	Ta=+25°C
Non linearity	NL	±0.5% FS Typ.		Ta=+25°C
LPF bandwidth	BW	1000Hz Typ.		45 degree phase delay

External Dimensions and recommended footprint

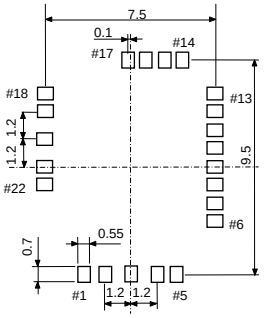
(Unit:mm)



pin pitch is 0.8mm otherwise specified.



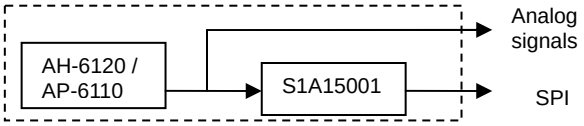
Treatment of Terminal electrodes:
Sn-Bi plating



the pad pitch is 0.8mm otherwise specified.

Pin No.	Name	Function	Pin No.	Name	Function
1	GND GY	Y axis gyro ground	12	Reserved	Connect to Pin 10(GND Acc)
2	Vout GY	Y axis gyro angular rate output	13	VDD Acc	Accelerometer power supply
3	Vref GY	Y axis gyro ref. voltage output	14	GND GZ	Z axis gyro ground
4	VDD GY	Y axis gyro power supply	15	VDD GZ	Z axis gyro power supply
5	Reserved	Do not connect	16	Vref GZ	Z axis gyro ref. voltage output
6	Reserved	Connect to Pin 13(VDD Acc)	17	Vout GZ	Z axis gyro angular rate output
7	Vout AX	X axis Acceleration output	18	GND GX	X axis gyro ground
8	Vout AY	Y axis Acceleration output	19	Vout GX	X axis gyro angular rate output
9	Vout AZ	Z axis Acceleration output	20	Vref GX	X axis gyro ref. voltage output
10	GND Acc	Accelerometer ground	21	VDD GX	X axis gyro power supply
11	Reserved	Do not connect	22	Reserved	Do not connect

The evaluation board of each sensor (AH-6120LR EB02, AP-6110LR EB02) which has both analog and digital output with dedicated AFE-IC (S1A15001) is available.



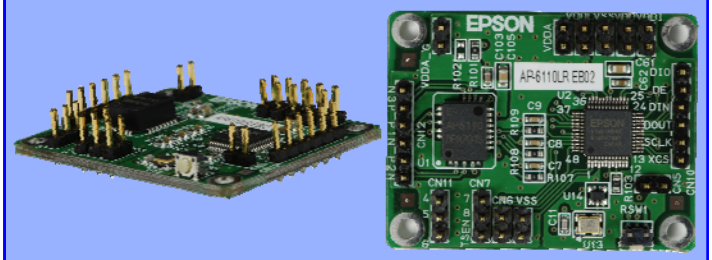
SENSOR
6-DOF INERTIAL SENSOR EVALUATION BOARD

AH-6120LR EB02
AP-6110LR EB02

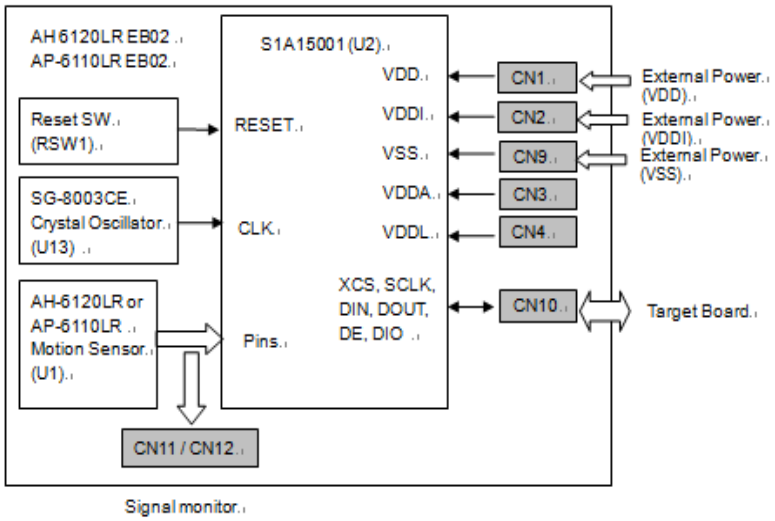
NEW

- Able to evaluate Inertial sensor by SPI signal from analog output
- Installed 12bit ADC
- Installed regulator for control

Product number (please contact us)
XZZ21P1460-0000



Block Diagram

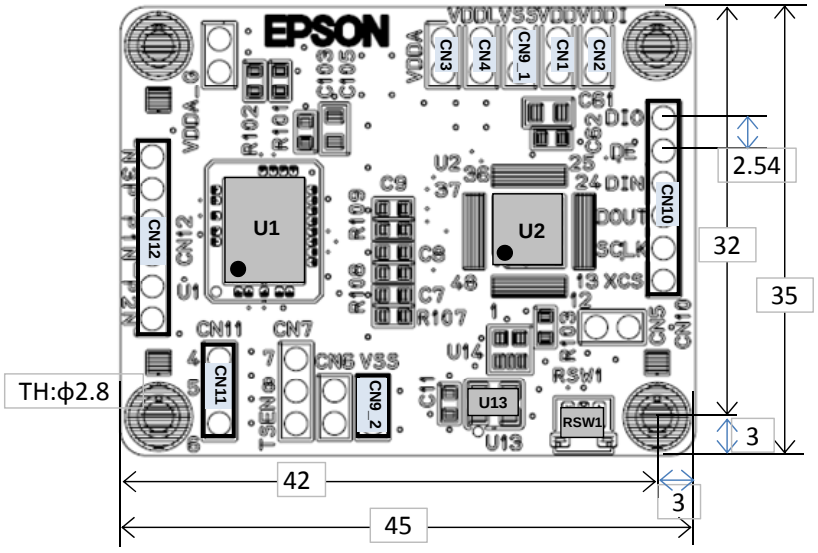


I/F connecter(CN10) Pin map

Pin name	Note
XCS	Chip select terminal “L”: active. It’s possible data / command input “H”: non active
SCLK	Data transmitting clock input. Max: 10MHz
DIN	Data input terminal.
DOUT	Data output terminal. All terminals disable when chip select is non-active.
DE	Non-measuring(Before measurement start command input) Enable I/F signal acceptance condition. “H” is reset released. Under measuring flag. (start to stop) Enable ADC data read.
DIO	General I/O port.

External Dimensions

(Unit:mm)



Supply voltage range

Item	Symbol	AH-6120LR / AP-6110LR	Condition
Supply voltage	VDD	3.0 V ±0.3 V	
	VDDI	1.65V～VDD	
	VDDA	1.8V±0.15 V	Internal regulator not used, Using externally supplied
	VDDL	2.85V～3.6V	
Internal regulator output voltage	VDDA	3.0V±0.01 V	VDD≧3.2V
	VDDL	1.8V±0.1 V	

MINIATURE SIZE GYRO SENSOR (FOR Automotive)

XV-9100LV / LP
XV-9300LV / LP

For Automotive

NEW

- Wide temperature support, up to +125degree, good for engine room usage.
- High reliability by installing the self diagnosis function
- Ultra small and light weight using the original Double-T structure quartz crystal element.
- Excellent performance of shock-resistance and vibration-resistance.
- High reliability and connectivity to PCB using J-lead terminal.

Recommended Application

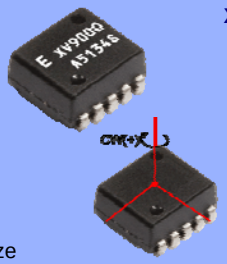
- Electric Stability Control System / Rollover Protection System

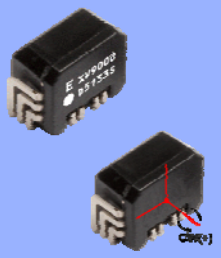
Pb Free

RoHS Compliant

Product number (please contact us)

XV-9100LV: X2A000031xxxx00
XV-9100LP: X2A000041xxxx00
XV-9300LV: X2A000051xxxx00
XV-9300LP: X2A000061xxxx00





Actual size

LV-PKG

LP-PKG

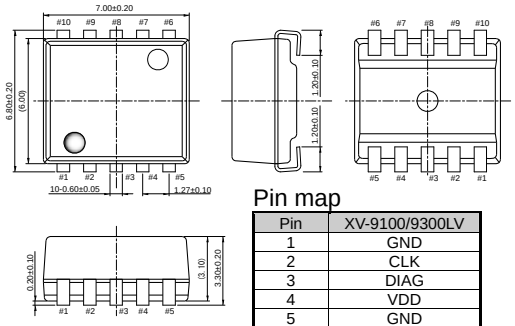
Specifications (characteristics)

Item		Symbol	Specifications		Remarks
			XV-9100LV / LP	XV-9300LV / LP	
Supply Voltage		V_{DD}	5.0 V ±0.25 V		V_{SS}=0 V
Temperature range	Storage Temperature	T_{STG}	-40 °C to +125 °C		
	Operating Temperature	T_{OPR}	-40 °C to +125 °C		
Scale factor		So	0.004*V_{DD} mV/(°/s)	0.0012*V_{DD} mV/(°/s)	
Bias		V_0	0.5*V_{DD} V Typ.		
Rate range		I	±100 °/s	±300 °/s	
Non linearity		NL	±0.5 % FS		T_a=+25 °C
Frequency response		BW	10 Hz Typ.	50 Hz Typ.	-3dB point
Cross axes		OS	±5 %		T_a=+25 °C
Current consumption		Iop	5.5 mA Typ.		V_O : Output No load condition
Noise		rN	1.0 (°/s) p-p Max.		5kHz sampled at 200ms
Start-up time		T_{ACT}	300 ms Max.		

External Dimensions

(Unit:mm)

•XV-9100LV / XV-9300LV

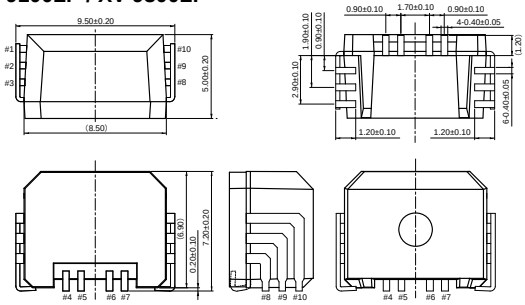


Pin map

Pin	XV-9100/9300LV
1	GND
2	CLK
3	DIAG
4	VDD
5	GND
6	N.C.
7	Vout
8	GND
9	CHECK
10	N.C.

Do not connect “N.C.” to external

•XV-9100LP / XV-9300LP



Pin map

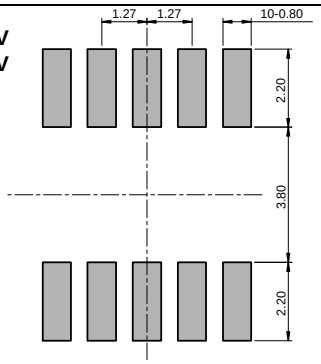
Pin	XV-9100/9300LP
1	CHECK
2	GND
3	Vout
4	N.C.
5	N.C.
6	GND
7	GND
8	VDD
9	DIAG
10	CLK

Do not connect “N.C.” to external

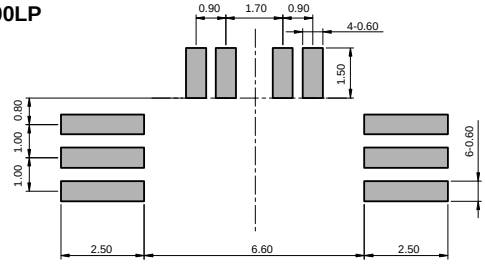
Footprint (Recommended)

(Unit:mm)

•XV-9100LV
•XV-9300LV



•XV-9100LP
•XV-9300LP



ULTRA MINIATURE SIZE GYRO SENSOR (FOR CAR NAVIGATION SYSTEM)

XV-8000CB / LK

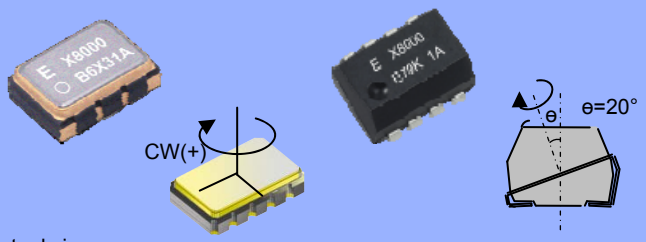
For Automotive

Pb Free RoHS Compliant

Product number (please contact us)
XV-8000CB: Q71800020xxxx00
XV-8000LK: X2A000011xxxx00

- 5.0V operable device (Ratio metric output)
- High stability using vibration crystal
- With output terminal of temperature sensor
- External dimensions: 5.0 x 3.2 x 1.3 mm ··· XV-8000CB
  6.0 x 4.8 x 3.3 mm ··· XV-8000LK
- Inclined angle: 20 degrees (XV-8000LK)

Recommended Application
- Car navigation system



Actual size

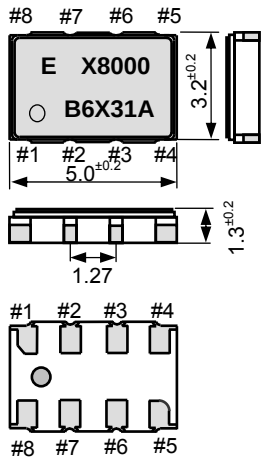
XV-8000CB	XV-8000LK
	

Specifications (characteristics)

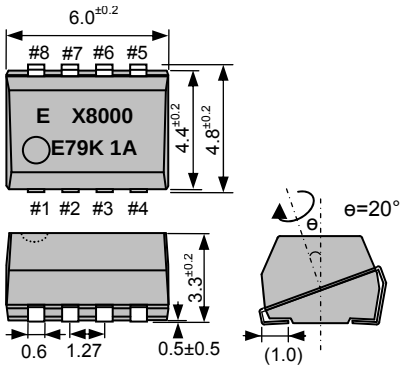
Item		Symbol	Specifications	Remarks
Supply Voltage		V_{DD}	5.0 V ±0.25 V	V_{SS}=0 V
Temperature range	Storage Temperature	T_{STG}	-40 °C to +85 °C	
	Operating Temperature	T_{OPR}	-40 °C to +85 °C	
Scale factor		So	0.005* V_{DD} mV/(°/s)	
Bias		V_0	0.5* V_{DD} V Typ.	T_a=+25 °C
Rate range		I	±60 °/s	
Non linearity		NL	±0.5 % FS	T_a=+25 °C
Frequency response		BW	10 Hz Typ.	Phase delay angle 90°
Cross axes		OS	±5 %	T_a=+25 °C
Current consumption		Iop	4 mA Typ.	V_O : Output No load condition
Noise		rN	3 mVp-p Typ	

External Dimensions (Unit:mm)

•XV-8000CB



•XV-8000LK



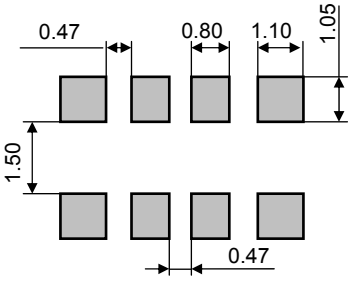
Pin map

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.

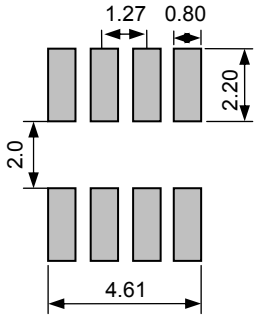
Do not connect "N.C." to external device

Footprint (Recommended) (Unit:mm)

•XV-8000CB



•XV-8000LK



SENSOR
ULTRA MINIATURE SIZE GYRO SENSOR
(For portable GPS, PND applications)

XV-8100CB

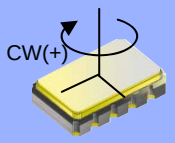
- Ultra Small Package size SMD(5 × 3.2 × 1.3 mm)
- Hermetic sealing provides excellent sustainable environmental capability
- 3.0 V operable device, Low current consumption
- High stability using vibration crystal
- Low Noise

Recommended Application
- Portable type GPS, PND (Personal Navigation Device)

Pb Free
RoHS Compliant

Product number (please contact us)
Q71810020xxxx00

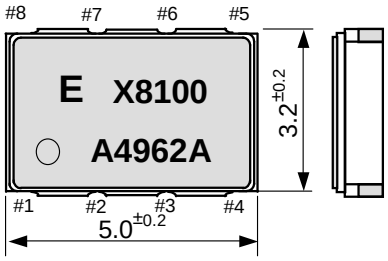
Actual size

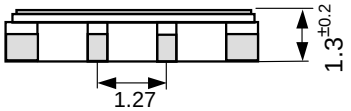


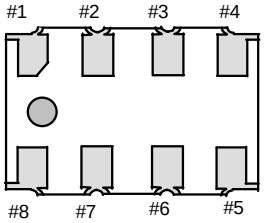
Specifications (characteristics)

Item		Symbol	Specifications	Remarks
Supply voltage		V_{DD}	3.0 V ±0.15 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		So	2.5 mV/(°/s)	
Bias		V_0	1350 mV Typ.	T_a=+25 °C
Reference voltage		Vr	1350 mV Typ.	T_a=+25 °C
Rate range		I	±100 °/s	
Non linearity		NL	±0.5 % FS.	T_a=+25 °C
Cross axes		OS	±5 %.	T_a=+25 °C
Current consumption		Iop	1.7 mA Typ.	V_O,V_{REF} : Output No load condition
Noise		Nd	0.004(°/s)/√Hz Typ.	at 10 Hz

External Dimensions (Unit:mm)





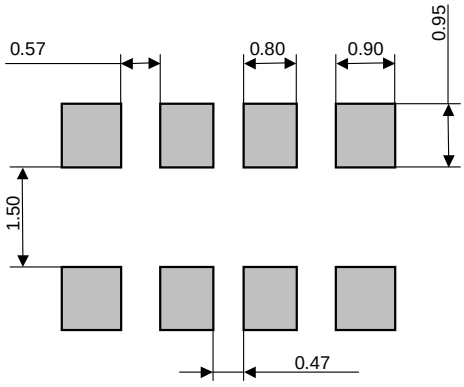


■Pin map

Pin	Connection
1	N.C.
2	N.C.
3	N.C.
4	GND
5	V_{OUT}
6	V_{REF}
7	N.C.
8	V_{DD}

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

Footprint (Recommended) (Unit:mm)



SENSOR
ULTRA MINIATURE SIZE VIBRATION GYRO SENSOR
(angular rate sensor)

XV-3900CB

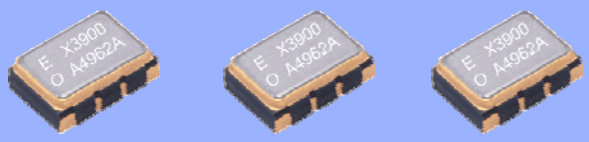
NEW

- Ultra Small Package size SMD(5 × 3.2 × 1.3 mm)
- Hermetic sealing provides excellent sustainable environmental capability
- High stability using vibration crystal
- Low noise density

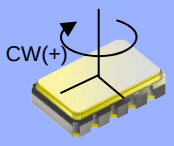
Recommended Application
- Detection picture stabilization of DVC and DSC
- Detection of moving with man machine interface

Pb Free
RoHS Compliant

Product number (please contact us)
X2A000091xxxx00



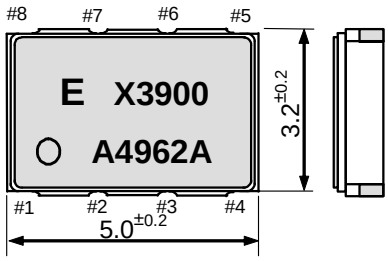
Actual size

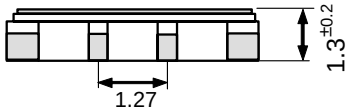


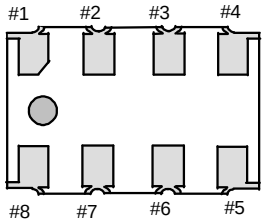
Specifications (characteristics)

Item		Symbol	Specifications	Remarks
Supply voltage		V_{DD}	3.0 V ±0.3 V	V_{SS}=0 V
Temperature range	Storage Temperature	T_{STG}	-40 °C to +85 °C	
	Operating Temperature	T_{OPR}	-20 °C to +80 °C	
Scale Factor		So	8.0 mV/(°/s)	
Bias		V_0	1500 mV Typ.	T_a=+25 °C
Reference Voltage		Vr	1500 mV Typ.	T_a=+25 °C
Rate Range		I	±100 °/s	
Non linearity		NL	±1 % FS	T_a=+25 °C
Phase Delay		ϕ20	4 deg.	at 20Hz phase delay angle
Band Width		BW	200 Hz Typ.	phase delay angle 90°
Current consumption		Iop	5.4 mA Typ.	V_O,Vr : Output No load condition
Noise		Nd	0.0015 (°/s)/ √Hz Typ.	at 10 Hz

External Dimensions (Unit:mm)





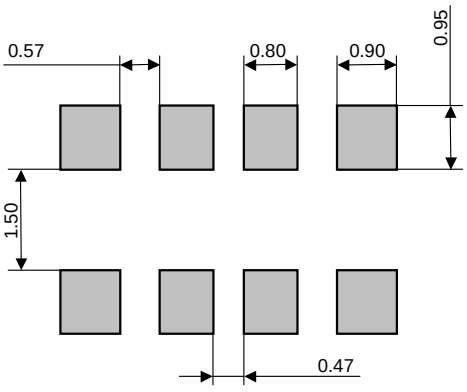


■Pin map

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

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

Footprint (Recommended) (Unit:mm)



SENSOR
ULTRA MINIATURE SIZE VIBRATION GYRO SENSOR
(angular rate sensor)

XV-3500CB
XV-3510CB

NEW

- 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 (XV-3500CB only)

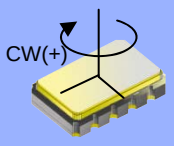
Recommended Application

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

Pb Free
RoHS Compliant

Product number (please contact us)
XV-3500CB:Q71350020xxxx00
XV-3510CB:X2A000121xxxx00

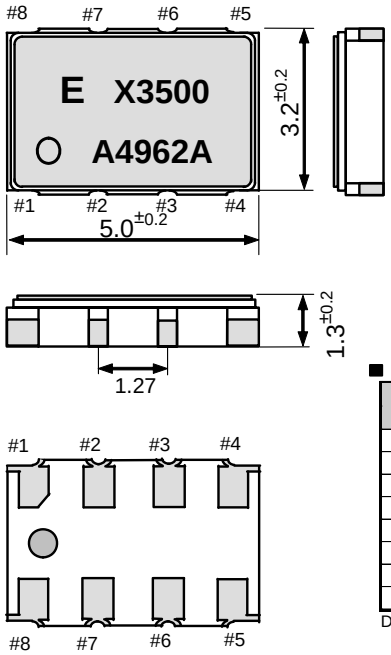
Actual size



Specifications (characteristics)

Item		Symbol	Specifications		Remarks
			XV-3500CB	XV-3510CB	
Supply voltage		VDD	3.0 V ±0.3 V		VSS=0 V
Temperature range	Storage Temperature	TSTG	-40 °C to +85 °C		
	Operating Temperature	TOPR	-20 °C to +80 °C		
Scale Factor		So	0.67 mV/(°/s)	3.0 mV/(°/s)	
Bias		V0	1350 mV Typ.	1430 mV Typ.	Ta=+25 °C
Reference Voltage		Vr	1350 mV Typ.	1430 mV Typ.	Ta=+25 °C
Rate Range		I	±100 °/s	±300 °/s	
Non linearity		NL	±5 % FS	±0.5 % FS	Ta=+25 °C
Phase Delay		ϕ20	4 deg.	9 deg.	at 20Hz phase delay angle
Current consumption	In Operating	Iop	1.7 mA Typ.	2.2 mA Typ.	VO,Vr : Output No load condition
	Sleep Mode	Isleep	1 mA Typ.	-	VO,Vr : Output No load condition

External Dimensions (Unit:mm)

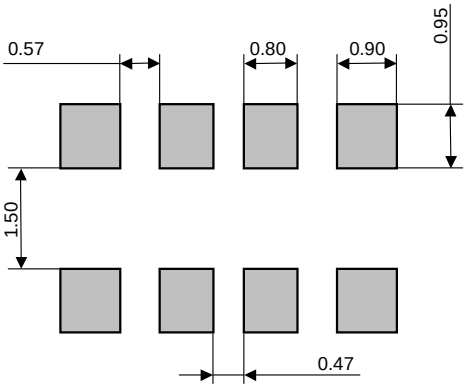


■ Pin map

Pin	Connection	
	XV-3500CB	XV-3510CB
1	N.C.	N.C.
2	N.C.	N.C.
3	N.C.	N.C.
4	GND	GND
5	VOUT	VOUT
6	VREF	VREF
7	Sleep	N.C.
8	VDD	VDD

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

Footprint (Recommended) (Unit:mm)



ULTRA MINIATURE SIZE GYRO SENSOR
High stability double output

XV-3700CB

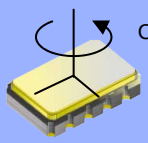
- Ultra Small Package size SMD(5 × 3.2 × 1.3 mm)
- Hermetic sealing provides excellent sustainable environmental capability
- High stability using vibration crystal
- Two separate outputs for high speed mode and low speed mode

Recommended Application
- Motion UI , RC helicopter and hobby with high detection range needs

Pb Free
RoHS Compliant

Product number (please contact us)
X2A000021xxxx00

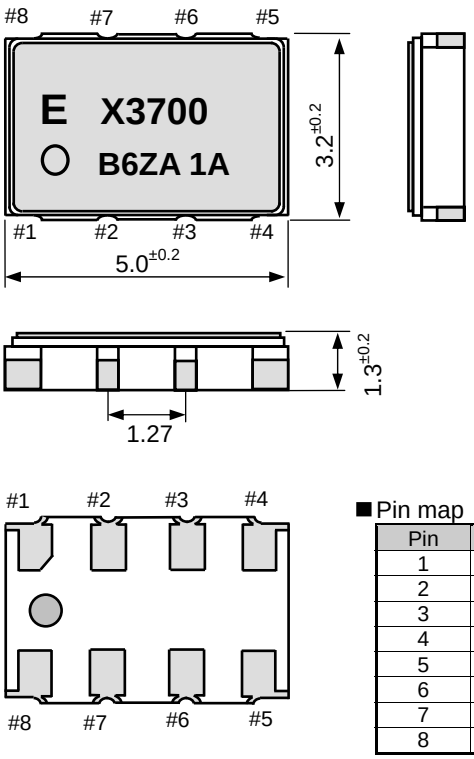
Actual size



Specifications (characteristics)

Item		Symbol	Specifications	Remarks
Supply voltage		V_{DD}	3.0 V ±0.3 V	V_{SS}=0 V
Temperature range	Storage Temperature	T_{STG}	-40 °C to +85 °C	
	Operating Temperature	T_{OPR}	-20 °C to +80 °C	
Scale Factor	V_{O1}	S_{O1}	0.8 mV/(°/s)	
	V_{O2}	S_{O2}	3.624 mV/(°/s).	
Rate Range	V_{O1}	I_1	±1500 °/s	For the out of standard specifications, please contact us for inquiries.
	V_{O2}	I_2	±300 °/s	
Non linearity		NL	±5 % FS.	T_a=+25 °C
Bias (V_{O1}, V_{O2})		V_0	1500 mV Typ.	T_a=+25 °C
Reference Voltage		Vr	1500 mV Typ.	T_a=+25 °C
Current consumption		Iop	2.2 mA Typ.	V_O,Vr : Output No load condition

External Dimensions (Unit:mm)

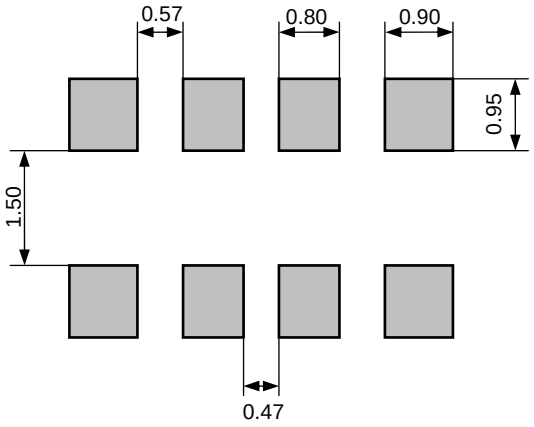


■Pin map

Pin	Connection
1	N.C.
2	N.C.
3	N.C.
4	GND
5	V_{O1}
6	V_{REF}
7	V_{O2}
8	V_{DD}

Do not connect “N.C.” to external devices.

Footprint (Recommended) (Unit:mm)



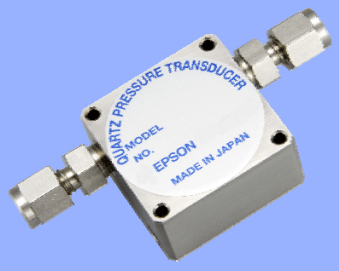
SENSOR
QUARTZ PRESSURE SENSOR

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

RoHS Compliant

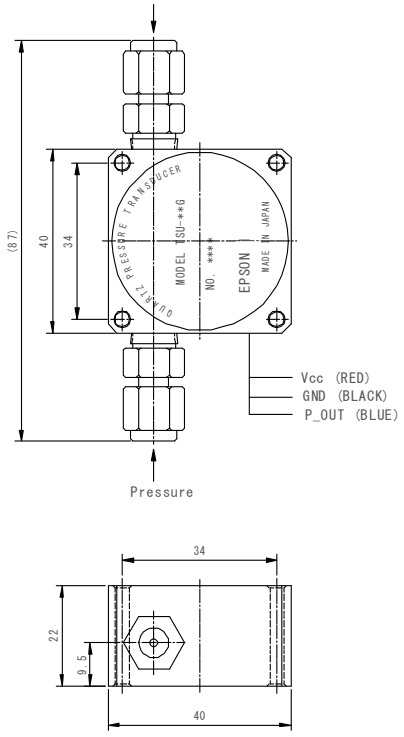
Product number (please contact us)
X2C0000xxxxxx00



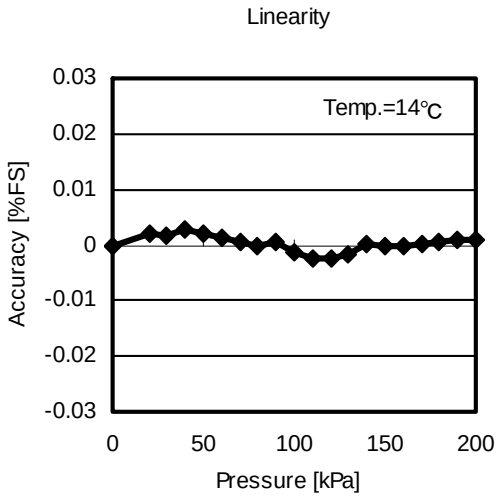
Specifications (characteristics)

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		
Tilt correction	—	Equipped		
Built-in temperature sensor	—	Option	Option	Option
Output frequency without pressure	—	39 kHz Typ.		
Maximum frequency change	—	4 kHz Typ.		7 kHz Typ.
Output voltage	Vpp	3.2 Vpp Min. (output load 600 Ω) Clipped sine DC cut		
Supply voltage	Vcc	12 V（Standard）		
Current consumption	Icc	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



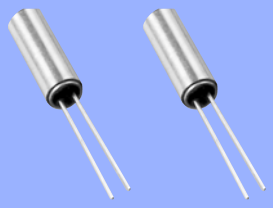
SENSOR
TEMPERATURE SENSING CRYSTAL

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 (32.4 kHz) enables low current consumption.
- Wide temperature range (-40 °C to +85 °C).
- Suitable for DTCXO and temperature equipment.

RoHS Compliant

Product number (please contact us)
Q19HT2060xxxx00

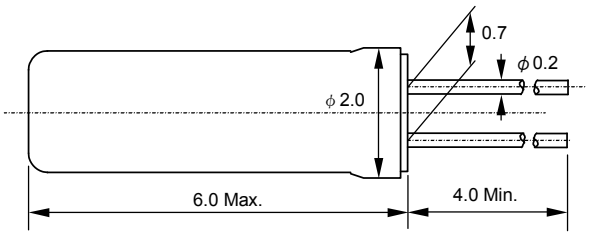


Actual size

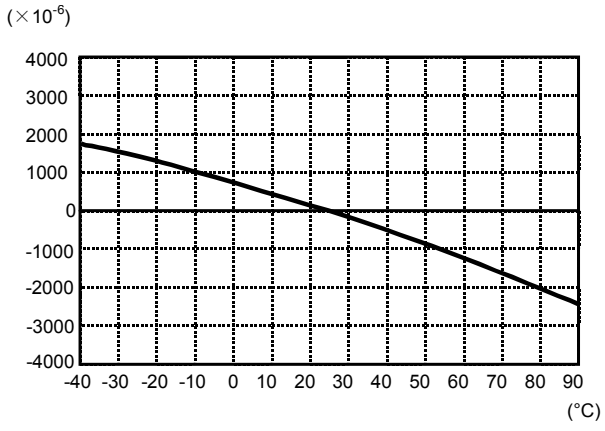
Specifications (characteristics)

Item		Symbol	Specifications	Remarks
Nominal frequency range		f_nom	32.4 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 %	Ta=+25 °C ,DL=0.1 μW
1st.Temperature coefficient		α	-26.0×10^{-6} / °C (±2 %)	
2nd.Temperature coefficient		β	-5.8×10^{-8} / °C^2 (±8 %)	
3rd.Temperature coefficient		γ	-1.5×10^{-10} / °C^3 Max.	
Motional resistance (ESR)		R1	35 kΩ Max.	Ta=+25 °C,DL=0.1 μW
Motional capacitance		C1	1.8 fF Typ.	
Shunt capacitance		C0	0.8 pF Typ.	
Frequency aging		f_age	$\pm 3 \times 10^{-6}$ / year Max.	Ta=+25 °C

External dimensions (Unit:mm)



Frequency Temperature coefficient



WORKING FOR EU RoHS / Pb FREE

■EU RoHS / Pb Free Products

The standard crystal products are 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.) indicates as follows.

	Last digit of year	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

■Temrminal materials of crystal 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.

Category	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 unit	C-002RX	Fe-Ni-Co	Sn-Cu	O	O		52 mg
	C-004R	Fe-Ni-Co	Sn-Cu	O	O		30 mg
	C-005R	Fe-Ni-Co	Sn-Cu	O	O		17 mg
	C-2-TYPE	Fe-Ni-Co	Sn-Cu	O	O		52 mg
	C-4-TYPE	Fe-Ni-Co	Sn-Cu	O	O		30 mg
	FC-12D	Mo	Au	O	O		3.1 mg
	FC-12M	Mo	Au	O	O		5 mg
	FC-135	W	Au	O		Contains Pb in sealing glass exempted by RoHS directive.	11 mg
	FC-13A	Mo	Au	O	O		6 mg
	FC-255	W	Au	O		Contains Pb in sealing glass exempted by RoHS directive.	22 mg
	MC-146	42 Alloy	Sn or Sn-Bi	O		High melting temperature type solder. (Pb85%)	29 mg
	MC-156	42 Alloy	Sn or Sn-Bi	O		High melting temperature type solder. (Pb85%)	50 mg
	MC-306	42 Alloy	Sn or Sn-Bi	O		High melting temperature type solder. (Pb85%)	126 mg
	MC-30A	42 Alloy	Sn or Sn-Bi	O		High melting temperature type solder. (Pb85%)	126 mg
	MC-405	42 Alloy	Sn or Sn-Bi	O		High melting temperature type solder. (Pb85%)	229 mg
	MC-406	42 Alloy	Sn or Sn-Bi	O		High melting temperature type solder. (Pb85%)	229 mg
MHz Range Crystal unit	CA-301	Fe-Ni-Co	Sn-Cu	O	O		172 mg
	FA-118T	Mo	Au	O	O		3 mg
	FA-128	W	Au	O	O		7 mg
	FA-20H	W	Au	O	O		11 mg
	FA-238	W	Au	O	O		16 mg
	FA-238V	W	Au	O	O		16 mg
	MA-306	42 Alloy	Sn or Sn-Bi	O		High melting temperature type solder. (Pb85%)	124 mg
	MA-406	42 Alloy	Sn or Sn-Bi	O		High melting temperature type solder. (Pb85%)	330 mg
	MA-505	42 Alloy	Sn or Sn-Bi	O		High melting temperature type solder. (Pb85%)	505 mg
	MA-506	42 Alloy	Sn or Sn-Bi	O		High melting temperature type solder. (Pb85%)	505 mg
	TSX-3225	W	Au	O	O		17 mg
SAW Resonator	FS-335	W	Au	O	O		56 mg
	FS-555	W	Au	O	O		112 mg
	FS-585	W	Au	O	O		112 mg
	NS-21R	W	Au	O	O		13 mg
	NS-32R	W	Au	O	O		49 mg

Category	Model	Terminal Material	Terminal Plating	Complies With EU RoHS directive	Pb Free	Remarks (Contains Pb in products exempted by RoHS directive.)	Reference weight (Typ.)
Crystal Oscillator	EA-2102CB	W	Au	O	O		64 mg
	EG-2001CA	W	Au	O	O		130 mg
	EG-2002CA	W	Au	O	O		135 mg
	EG-2021CA	W	Au	O	O		135 mg
	EG-2101CA	W	Au	O	O		134 mg
	EG-2102CA	W	Au	O	O		129 mg
	EG-2102CB	W	Au	O	O		71 mg
	EG-2121CA	W	Au	O	O		133 mg
	EG-2121CB	W	Au	O	O		71 mg
	EG-4101CA	W	Au	O	O		140 mg
	EG-4121CA	W	Au	O	O		140 mg
	HG-2150CA	W	Au	O	O		153 mg
	SG-210 STF	W	Au	O	O		12 mg
	SG-210 SxB	W	Au	O	O		15 mg
	SG-210 SxD	W	Au	O	O		15 mg
	SG-210 SxH	W	Au	O	O		14 mg
	SG-211 series	W	Au	O	O		13 mg
	SG-3030JC	42 Alloy	Sn or Sn-Bi	O		High melting temperature type solder. (Pb85%)	239 mg
	SG-3030JF	42 Alloy	Sn or Sn-Bi	O		High melting temperature type solder. (Pb85%)	90 mg
	SG-3030LC	42 Alloy	Sn	O		Contains Pb in sealing glass exempted by RoHS directive.	25 mg
	SG-3040JC	42 Alloy	Sn or Sn-Bi	O		High melting temperature type solder. (Pb85%)	239 mg
	SG-3040LC	42 Alloy	Sn	O		Contains Pb in sealing glass exempted by RoHS directive.	25 mg
	SG-310 series	W	Au	O	O		26 mg
	SG-51 series	42 Alloy	Sn or Sn-Bi	O		High melting temperature type solder. (Pb85%)	952 mg
	SG-531 series	42 Alloy	Sn or Sn-Bi	O		High melting temperature type solder. (Pb85%)	698 mg
	SG-550 series	42 Alloy	Sn-Bi	O	O		41 mg
	SG-615 series	42 Alloy	Sn or Sn-Bi	O		High melting temperature type solder. (Pb85%)	917 mg
	SG-636 series	42 Alloy	Sn or Sn-Bi	O		High melting temperature type solder. (Pb85%)	241 mg
	SG-645 series	42 Alloy	Sn or Sn-Bi	O		High melting temperature type solder. (Pb85%)	98 mg
	SG-770 series	W	Au	O	O		166 mg
	SG-8002CA	W	Au	O	O		148 mg
	SG-8002CE	W	Au	O	O		27 mg
	SG-8002DB	42 Alloy	Sn orSn-Bi	O		High melting temperature type solder. (Pb85%)	942 mg
	SG-8002DC	42 Alloy	Sn or Sn-Bi	O		High melting temperature type solder. (Pb85%)	699 mg
	SG-8002JA	42 Alloy	Sn or Sn-Bi	O		High melting temperature type solder. (Pb85%)	894 mg
	SG-8002JC	42 Alloy	Sn or Sn-Bi	O		High melting temperature type solder. (Pb85%)	234 mg
	SG-8002JF	42 Alloy	Sn or Sn-Bi	O		High melting temperature type solder. (Pb85%)	98 mg
	SG-8002LB	42 Alloy	Sn-Bi	O	O		41 mg
	SG-8003CA	W	Au	O	O		148 mg
	SG-8003CE	W	Au	O	O		27 mg
	SG-8003CG	W	Au	O	O		13 mg
	SG-8003JF	42 Alloy	Sn orSn-Bi	O	O		98 mg
	SG-8003LB	42 Alloy	Sn-Bi	O	O		41 mg
	SG-9001CA	W	Au	O	O		155 mg
	SG-9001JC	42 Alloy	Sn or Sn-Bi	O		High melting temperature type solder. (Pb85%)	239 mg
	SG-9001LB	42 Alloy	Sn-Bi	O	O		41 mg
	TCO-708x series	W	Au	O	O		158 mg
	TCO-710x series	W	Au	O	O		53 mg
	XG-1000CA	W	Au	O	O		126 mg
	XG-1000CB	W	Au	O	O		56 mg
	XG-2102CA	W	Au	O	O		133 mg
	XG-2121CA	W	Au	O	O		133 mg
VCXO / VCSO	EV-9100JG	Sn-P-Cu	Sn	O		Contains Pb in sealing glass exempted by RoHS directive.	1023 mg
	VG-4231CA	W	Au	O	O		153 mg
	VG-4231CB	W	Au	O	O		54 mg
	VG-4231CE	W	Au	O	O		26 mg
	VG-4232CA	W	Au	O	O		153 mg
	VG-4501CA	W	Au	O		Contains Pb in sealing glass exempted by RoHS directive.	169 mg
	VG-4502CA	W	Au	O		Contains Pb in sealing glass exempted by RoHS directive.	164 mg
	VG-4512CA	W	Au	O	O		169 mg
	VG-4513CA	W	Au	O	O		162 mg
TCXO	TG-3530SA	42 Alloy	Sn	O		High melting temperature type solder. (Pb85%)	290 mg
	TG-5021CE	W	Au	O	O		29 mg
	TG-5021CG	W	Au	O	O		16 mg
	TG-5031CJ	Mo	Au	O	O		9.1mg
	TG-5035CE	W	Au	O	O		29 mg
	TG-5035CG	W	Au	O	O		16 mg
	TG-5035CJ	Mo	Au	O	O		9.1mg
	TG-5500CA	W	Au	O	O		165mg

Category	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	RA-4565SA	42 Alloy	Sn	O		High melting temperature type solder. (Pb85%)	309 mg
	RA-4574SA	42 Alloy	Sn	O		High melting temperature type solder. (Pb85%)	289 mg
	RA-8565SA	42 Alloy	Sn	O		High melting temperature type solder. (Pb85%)	309 mg
	RA-8581SA	42 Alloy	Sn	O		High melting temperature type solder. (Pb85%)	289 mg
	RTC-4543SA	42 Alloy	Sn	O		High melting temperature type solder. (Pb85%)	291 mg
	RTC-4543SB	42 Alloy	Sn-Ag	O		High melting temperature type solder. (Pb85%)	238 mg
	RTC-4574JE	42 Alloy	Sn-Ag	O		High melting temperature type solder. (Pb85%)	118 mg
	RTC-4574NB	Cu Alloy	Sn or Sn-Ag	O		High melting temperature type solder. (Pb85%)	83 mg
	RTC-4574SA	42 Alloy	Sn	O		High melting temperature type solder. (Pb85%)	289 mg
	RTC4701JE	42 Alloy	Sn-Ag	O		High melting temperature type solder. (Pb85%)	120 mg
	RTC-4701NB	Cu Alloy	Sn or Sn-Ag	O		High melting temperature type solder. (Pb85%)	83 mg
	RTC-72421	42 Alloy	Sn or Sn-Bi	O		High melting temperature type solder. (Pb85%)	1090 mg
	RTC-72423	42 Alloy	Sn or Sn-Bi	O		High melting temperature type solder. (Pb85%)	661 mg
	RTC-7301DG	42 Alloy	Sn or Sn-Bi	O		High melting temperature type solder. (Pb85%)	1082 mg
	RTC-7301SF	Cu Alloy	Sn or Sn-Ag	O		High melting temperature type solder. (Pb85%)	233 mg
	RTC-8564JE	42 Alloy	Sn-Ag	O		High melting temperature type solder. (Pb85%)	119 mg
	RTC-8564NB	Cu Alloy	Sn or Sn-Ag	O		High melting temperature type solder. (Pb85%)	83 mg
	RX-4035LC	42 Alloy	Sn	O		Contains Pb in sealing glass exempted by RoHS directive.	25mg
	RX-4035SA	42 Alloy	Sn	O		High melting temperature type solder. (Pb85%)	314mg
	RX-4045NB	Cu Alloy	Sn or Sn-Ag	O		High melting temperature type solder. (Pb85%)	84 mg
	RX-4045SA	42 Alloy	Sn	O		High melting temperature type solder. (Pb85%)	290 mg
	RX-4571LC	42 Alloy	Sn	O		Contains Pb in sealing glass exempted by RoHS directive.	25 mg
	RX-4571NB	Cu Alloy	Sn or Sn-Ag	O		High melting temperature type solder. (Pb85%)	83 mg
	RX-4571SA	42 Alloy	Sn	O		High melting temperature type solder. (Pb85%)	309 mg
	RX-4574LC	42 Alloy	Sn	O		Contains Pb in sealing glass exempted by RoHS directive.	25 mg
	RX-4575LC	42 Alloy	Sn	O		Contains Pb in sealing glass exempted by RoHS directive.	25 mg
	RX-4581NB	Cu Alloy	Sn or Sn-Ag	O		High melting temperature type solder. (Pb85%)	84 mg
	RX-4803LC	42 Alloy	Sn	O		Contains Pb in sealing glass exempted by RoHS directive.	25 mg
	RX-4803SA	42Alloy	Sn	O		High melting temperature type solder. (Pb85%)	314 mg
	RX-8025NB	Cu Alloy	Sn or Sn-Ag	O		High melting temperature type solder. (Pb85%)	84 mg
	RX-8025SA	42 Alloy	Sn	O		High melting temperature type solder. (Pb85%)	292 mg
	RX-8035LC	42 Alloy	Sn	O		Contains Pb in sealing glass exempted by RoHS directive.	25mg
	RX-8035SA	42 Alloy	Sn	O		High melting temperature type solder. (Pb85%)	314mg
	RX-8564LC	42 Alloy	Sn	O		Contains Pb in sealing glass exempted by RoHS directive.	25 mg
	RX-8571LC	42 Alloy	Sn	O		Contains Pb in sealing glass exempted by RoHS directive.	25 mg
	RX-8571NB	Cu Alloy	Sn	O		High melting temperature type solder. (Pb85%)	84 mg
	RX-8571SA	42 Alloy	Sn	O		High melting temperature type solder. (Pb85%)	311 mg
	RX-8581JE	42 Alloy	Sn-Ag	O		High melting temperature type solder. (Pb85%)	111 mg
	RX-8581NB	Cu Alloy	Sn or Sn-Ag	O		High melting temperature type solder. (Pb85%)	84 mg
	RX-8581SA	42 Alloy	Sn	O		High melting temperature type solder. (Pb85%)	289 mg
	RX-8731LC	42 Alloy	Sn	O		Contains Pb in sealing glass exempted by RoHS directive.	25 mg
	RX-8803LC	42 Alloy	Sn	O		Contains Pb in sealing glass exempted by RoHS directive.	25 mg
	RX-8803SA	42Alloy	Sn	O		High melting temperature type solder. (Pb85%)	314 mg
SAW Filter	FF-32N	W	Au	O	O		49 mg
	FF-555	W	Au	O	O		112 mg
Sensor	AH-6120LR	Cu Alloy	Sn-Bi	O		Contains Pb in sealing glass exempted by RoHS directive.	555 mg
	AP-6110LR	Cu Alloy	Sn-Bi	O		Contains Pb in sealing glass exempted by RoHS directive.	555 mg
	XV-3500CB	W	Au	O	O		65 mg
	XV-3510CB	W	Au	O	O		65 mg
	XV-3700CB	W	Au	O	O		65 mg
	XV-3900CB	W	Au	O	O		65 mg
	XV-8000CB	W	Au	O	O		65 mg
	XV-8000LK	Cu Alloy	Ni-Pd-Au	O	O		191 mg
	XV-8100CB	W	Au	O	O		65 mg
	XV-9100LP	Cu Alloy	Ni-Pd-Au	O	O		651mg
	XV-9100LV	Cu Alloy	Ni-Pd-Au	O	O		317mg
	XV-9300LP	Cu Alloy	Ni-Pd-Au	O	O		651mg
	XV-9300LV	Cu Alloy	Ni-Pd-Au	O	O		317mg
	TSU-20G	Cu	Sn	O		Contains Pb in sealing glass exempted by RoHS directive.	200 g
	TSU-70G	Cu	Sn	O		Contains Pb in sealing glass exempted by RoHS directive.	200 g
	TSU-100G	Cu	Sn	O		Contains Pb in sealing glass exempted by RoHS directive.	200 g
	HTS-206	Fe-Ni-Co	Sn-Cu	O		High melting temperature type solder. (Pb85%)	52 mg

■HANDLING PRECAUTIONS

Please use the each product under the conditions provided in respective specifications and catalogues.
The crystal products are designed and manufactured to satisfy its specification, and quality and reliability of the products are ensured through our stringent reliability tests before shipments. However, it is essential to store, mount, and use the products under proper conditions in order to keep the quality and reliability. Please pay careful attention to following precautions and use the products under the optimal conditions. We shall not be responsible for any deteriorated performance of the products caused by any application or usage of the products adopted at customer's own discretion. .

■Common points for all products

1. Shock resistance

Crystal products may be damaged under some conditions, such as dropping from desks or receiving shocks during mounting. Please do not use the products if products have received any excessive shocks.

2. Radiation

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

3. Chemicals / pH

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

4. 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.)

5. 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.

6. Static electricity

Excessive levels of static electricity may damage the product, please treat it in anti-static condition. Choose conductive materials for containers and packing materials. Use a soldering gun and a measurement circuit free from high-voltage leakage and provide grounding conduction when working with them.

7. When designing

7.1 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 crystal products are designed to minimize the effect of mechanical vibration, we recommend to check them in advance and to follow the PCB design guidelines as below.

7.2PCB design guidelines

(1) Ideally, the mechanical buzzer source should be mounted on a separate PCB from the crystal device. It is advisable to use cushion or cutting PCB, if you mount on same PCB. Traveling mechanical vibration differs when applied to the PCB only vs. inside the body. It is advisable to confirm characteristics in the body.
(2) Refer to the recommend footprint when designing.
(3) In case of using solder flux, please use it on the basis of the flux of the JIS standard (JIS C 60068-2-20/IEC 60,068-2-20).
(4) Please use the solder on the basis of the JIS standard (JIS Z 3282, Pb content 1000ppm, 0.1wt% or less) lead -free solder.

8. Notes on storage

(1) Storing the crystal products under higher or lower temperature or high humidity for a long period may affect frequency stability or solderability. 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 C 60068-1/IEC 60068-1)
(2) Please carefully handle the inner and outer boxes and reel. External pressure may cause deformation of reel and tape.

9. Mounting precautions

9.1 Soldering heat resistance

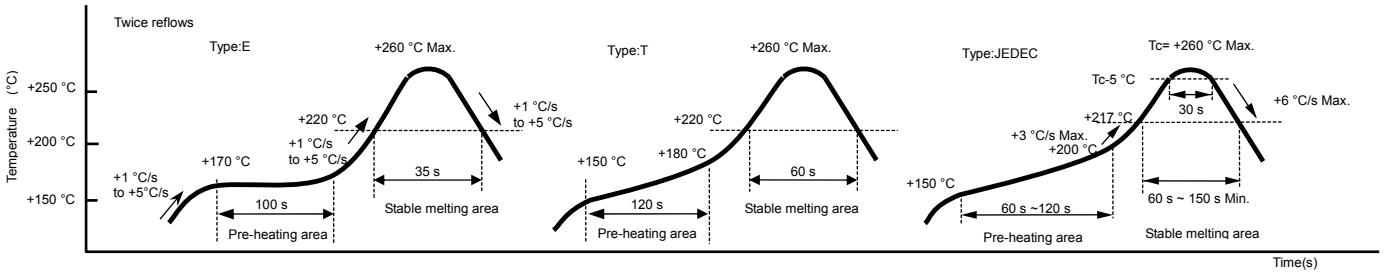
The crystal products except SMD products use solder having a +180°C to +200°C melting point. Heating up the package more than +150°C may deteriorate the characteristics or damage the products. If the crystal products need to be soldered at temperature of more than +150°C, SMD products are recommended. 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 are 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.

(2) SMD products Reflow profile (example)

The availability of the heat resistance for reflow conditions of JEDEC-STD-020D.01 is judged individually. Please inquire it.



Please make temperature rate as gentle a curve as possible.

	Model	Type.E	Type:T	Type:JEDEC	Remarks
kHz Range Crystal unit	FC-12D			√	
	FC-12M			√	
	FC-135	√		Please contact us	
	FC-13A	√		Available	
	FC-255	√		Please contact us	
	MC-146	√		Please contact us	
	MC-156	√		Please contact us	
	MC-306	√		Available	
	MC-30A	√		Available	
	MC-405	√		Available	
	MC-406	√		Available	
MHz Range Crystal unit	FA-118T			√	
	FA-128			√	
	FA-20H			√	
	FA-238	√		Available	
	FA-238V	√		Available	
	MA-306	√		Please contact us	
	MA-406	√		Available	Tc=+250 °C
	MA-505	√		Available	Tc=+250 °C
	MA-506	√		Available	Tc=+250 °C
	TSX-3225			√	
SAW Resonator	NS-21R			√	
	NS-32R	√		Available	
	FS-335	√		Please contact us	
	FS-555	√		Please contact us	
	FS-585	√		Please contact us	
SPXO	HG-2150CA	√		Available	
	SG-210 series			√	
	SG-211S*E			√	
	SG-3030 series	√		Please contact us	
	SG-3040 series	√		Please contact us	
	SG-310 series			√	
	SG-550 series	√		Available	
	SG-615 series	√		Available	Tc=+245 °C
	SG-636 series	√		Please contact us	Tc=+250 °C
	SG-645 series	√			
	SG-770 series			√	
	TCO-708x series			√	
	TCO-710x series			√	
Programmable Oscillator	SG-8002CA	√		Available	
	SG-8002CE	√		Available	
	SG-8002JA	√		Available	Tc=+245 °C
	SG-8002JC	√		Please contact us	Tc=+250 °C
	SG-8002JF	√			
	SG-8002LB	√		Available	
	SG-8003CA			√	
	SG-8003CE			√	
	SG-8003CG			√	
	SG-8003JF			√	
	SG-8003LB			√	
Spread Spectrum	SG-9001LB	√		Available	
	SG-9001CA	√		Available	
	SG-9001JC	√		Please contact us	Tc=+250 °C

√ : Standard Spec.

	Model	Type.E	Type:T	Type:JEDEC	Remarks
SAW Oscillator	EA-2102CB			√	
	EG-2001CA			√	
	EG-2002CA			√	
	EG-2021CA			√	
	EG-2101CA			√	
	EG-2102CA			√	
	EG-2102CB			√	
	EG-2121CA			√	
	EG-2121CB			√	
	EG-4101CA			√	
	EG-4121CA			√	
	XG-1000CA			√	
	XG-1000CB			√	
	XG-2102CA			√	
	XG-2121CA			√	
VCXO / VCSO	EV-9100JG			√	One time
	VG-4231CA	√		Available	
	VG-4231CB			√	
	VG-4231CE			√	
	VG-4232CA			√	
	VG-4501CA			√	
	VG-4502CA			√	
	VG-4512CA			√	
	VG-4513CA			√	
TCXO	TG-3530SA	√		Please contact us	Tc=+250 ºC
	TG-5021CE		√	Please contact us	
	TG-5021CG		√	Please contact us	
	TG-5031CJ		√	Please contact us	
	TG-5035CE		√	Please contact us	
	TG-5035CG		√	Please contact us	
	TG-5035CJ		√	Please contact us	
	TG-5500CA		√	Please contact us	
Sensor	AH-6120LR			√	Tc=+250 ºC
	AP-6110LR			√	Tc=+250 ºC
	XV-3500CB			√	
	XV-3510CB			√	
	XV-3700CB			√	
	XV-3900CB			√	
	XV-8000CB			√	
	XV-8000LK			√	Tc=+250 ºC
	XV-8100CB			√	
	XV-9100LP			√	
	XV-9100LV			√	
	XV-9300LP			√	
	XV-9300LV			√	
Real Time Clock Module	RA-4565SA			√	Tc=+250 ºC
	RA-4574SA	√		Please contact us	Tc=+250 ºC
	RA-8565SA			√	Tc=+250 ºC
	RA-8581SA	√		Please contact us	Tc=+250 ºC
	RTC-4543SA	√		Please contact us	Tc=+250 ºC
	RTC-4543SB	√		Please contact us	
	RTC-4574JE	√		Please contact us	
	RTC-4574NB	√		Please contact us	
	RTC-4574SA	√		Please contact us	Tc=+250 ºC
	RTC-4701JE	√		Please contact us	
	RTC-72423	√		Please contact us	Tc=+245 ºC
	RTC-7301SF	√		Please contact us	
	RTC-8564JE	√		Please contact us	
	RTC-8564NB	√		Please contact us	
	RX-4035LC			√	
	RX-4035SA			√	
	RX-4045NB	√		Please contact us	
	RX-4045SA	√		Please contact us	Tc=+250 ºC
	RX-4571LC			√	
	RX-4571NB			√	
	RX-4571SA			√	Tc=+250 ºC
	RX-4574LC	√		Please contact us	
	RX-4575LC			√	
	RX-4581NB	√		Please contact us	
	RX-4803LC			√	
	RX-4803SA			√	Tc=+250 ºC

√ : Standard Spec.

	Model	Type.E	Type:T	Type:JEDEC	Remarks
Real Time Clock Module	RX-8025NB	√		Please contact us	
	RX-8025SA	√		Please contact us	Tc=+250 ºC
	RX-8035LC			√	
	RX-8035SA			√	
	RX-8564LC	√		Please contact us	
	RX-8571LC			√	
	RX-8571NB			√	
	RX-8571SA			√	Tc=+250 ºC
	RX-8581JE	√		Please contact us	
	RX-8581SA	√		Please contact us	Tc=+250 ºC
	RX-8731LC			√	
	RX-8803LC			√	
	RX-8803SA			√	Tc=+250 ºC
Filter	FF-32N	√		Please contact us	
	FF-555	√		Please contact us	

√ : Standard Spec.

9.2 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.

9.3 Notes for each package type

(1) 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.

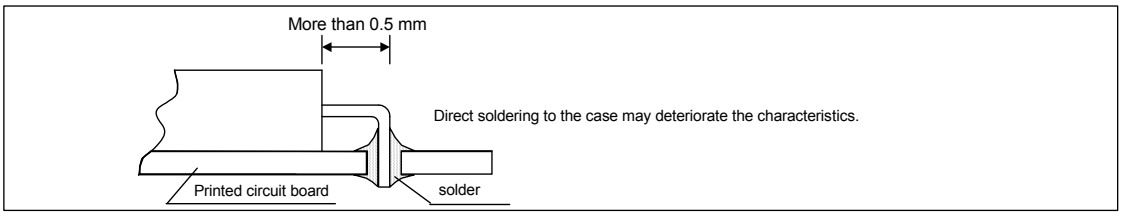
(2) Ceramic package products

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.

(3)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



(4)DIP products

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

(5)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.

9.4 Ultrasonic cleaning

(1)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.

(2)Products using tuning-fork crystals and gyro sensors cannot be guaranteed if cleaned using ultrasonic methods, because crystal may be destroyed.

(3)Do not wash open-type products.

(4)With washable products, avoid the use of cleaners or solvents that may negatively affect the product.

(5) By solder flux residual moisture absorption and solidification, it may course of migration etc. So, it may affect the reliability and quality of the product negatively. Please clean up the residue of flux and dry the PCB.

10. Handling

Do not touch the surface of IC directly with tweezers or any hard tools, jigs.

11. Use environment (temperature and humidity)

Please use the products within rating temperature range in concern temperature distribution in body and seasonal changes. In high humidity environment, it may cause malfunction caused by the dew condensation. Please prevent dew condensation.

■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 an IC.

1. 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.

2. Power supply line

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

3. Output Load

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

4. 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.

5. 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.

6. Mounting direction

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

7. 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.

■ Sensing device

1. Interference between the sensors

The crystal sensor may catch the interference by board vibration and power supply common impedance.

2. Protection against vibration

Please consider about protection against vibration when the crystal sensor is operated in vibration condition.

■PRECAUTIONS IN DESIGNING OSCILLATION CIRCUITS

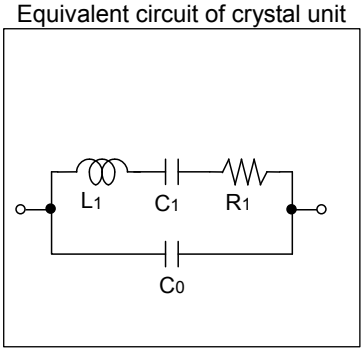
1. Drive level

Drive level denotes electric power required to oscillate a crystal unit, which can be calculated using the following formula.

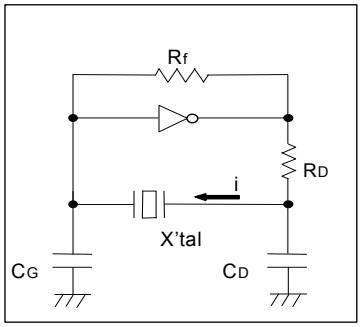
Drive level (P) = i^2 • Re

Where i stands for current to pass in the crystal unit, Re for effective resistance of crystal unit, and $Re=R_1(1+C_0/C_L)^2$.
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



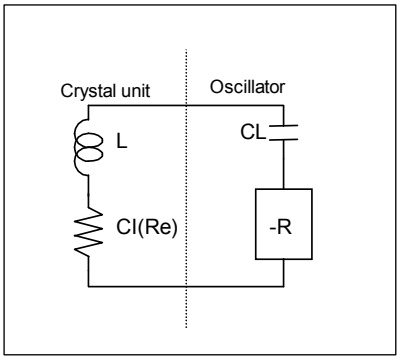
Oscillation circuit



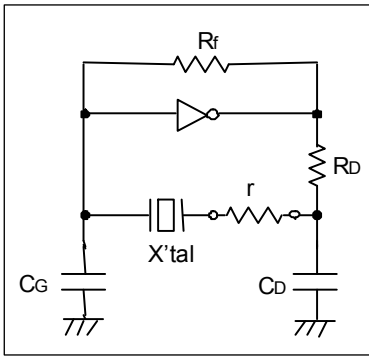
2. Allowance for oscillation

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



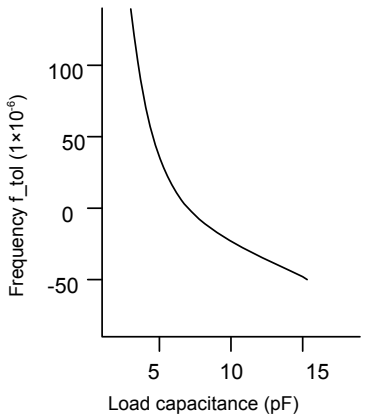
1. Connect the resistance (r) to the circuit in series with the crystal unit.
2. Adjust (r) so that oscillation can start (or stop).
3. Measure (r) when oscillation just starts (or stops) in (2) above.
4. Recommended (r)

   (r) > CI ×(5 to 10)

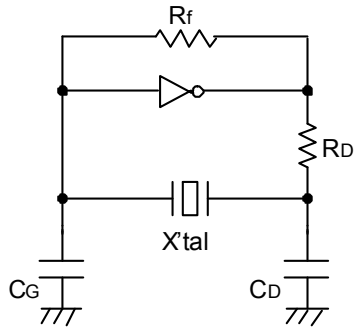
3. Load capacitance

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 $CL \fallingdotseq CG \times CD / (CG+CD)+CS$.
Where CS stands for stray Capacity of the circuit.

● Frequency and load capacitance characteristics



● Reference for setting parameters of oscillation circuit



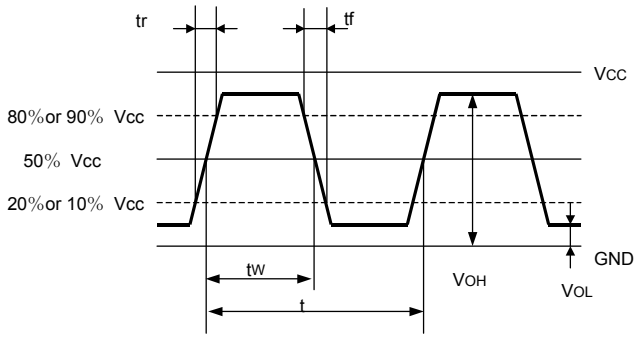
Symbol / Frequency range	Rf (MΩ)	RD (kΩ)	CG (pF)	CD (pF)
20 kHz to 60 kHz	20	500	10	10
60 kHz to 165 kHz	10	300	10	10
5.5 MHz to 30 MHz (Fundamental)	1	0.5	5～15	5～15
30 MHz～50 MHz (Fundamental)			5～10	5～10

IC: equivalent to TC74HCU04 (Unbuffer)
IC: equivalent to TC74VHCU04 (Unbuffer) (30 MHz to 50 MHz)
(TC74HCU04 and TC74VHCU04 are product number of Toshiba Corp.)

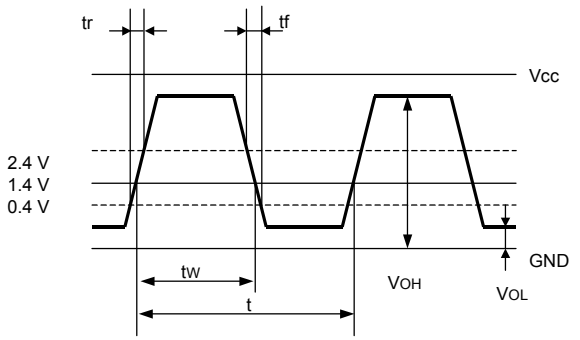
OUTPUT WAVEFORM AND TEST CIRCUIT

1. Timing chart

(1) CMOS load



(2) TTL load



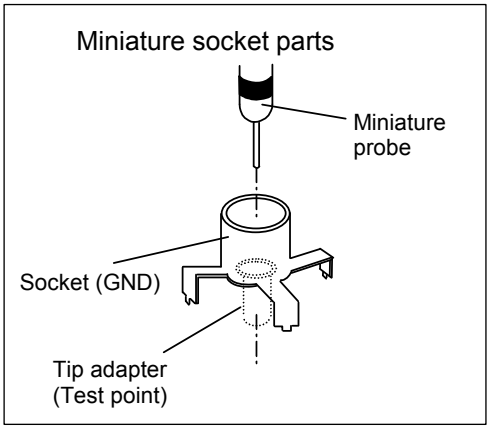
NOTE : SYM=tw/t×100%

2. Test conditions

(1) Supply voltage
- •More than 150µs 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 MΩ. Simultaneous measurement is possible as the wave form passes from the amplifier stage of an oscilloscope.

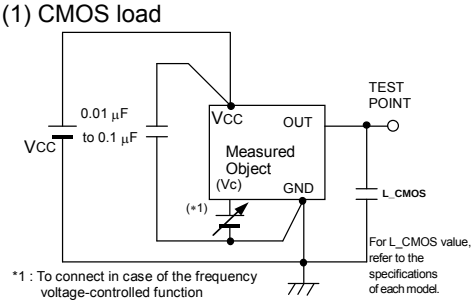
(3) MISCELLANEOUS
- •CL includes the probe capacitance.
- •Ammeter with small internal impedance should be used.
- •To observe wave form, please use a miniature socket. (do not use a long ground wire of the probe.)



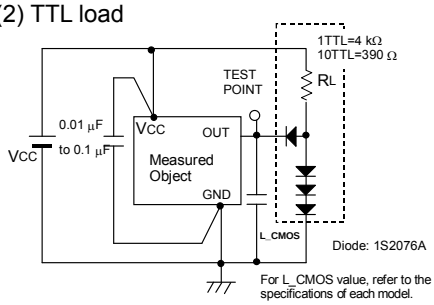
3. Test circuit

SG/EG/HG/VG series

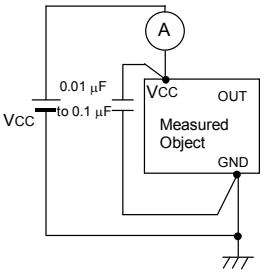
(1) CMOS load



(2) TTL load



(3) Current consumption

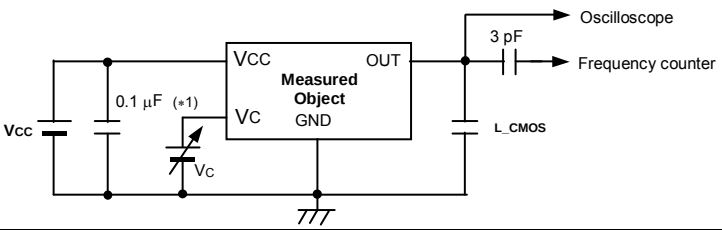


TCO-****/VG/TG/EG/XG series

*1 : To connect in case of the frequency voltage-controlled function

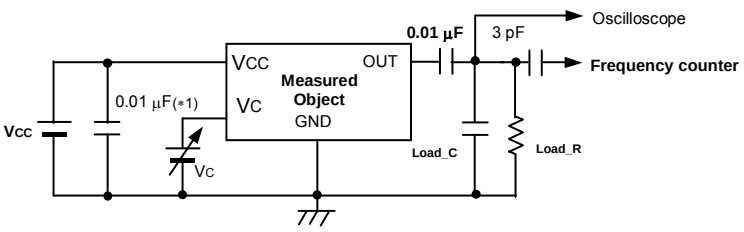
(1) CMOS load

Model:
TCO-710x
TCO-708*X1A



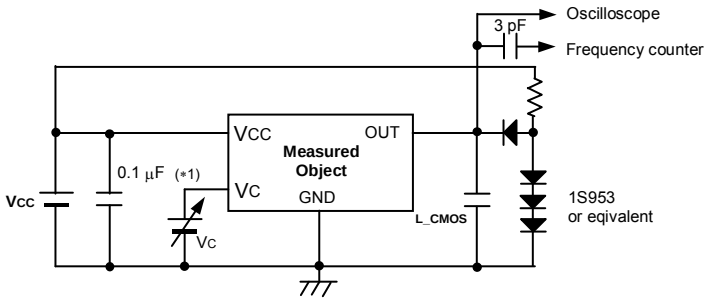
(2) Resistance, Capacity load

Model:
TG-5021CG/CE
TG-5031CJ
TG-5035CG/CE/CJ



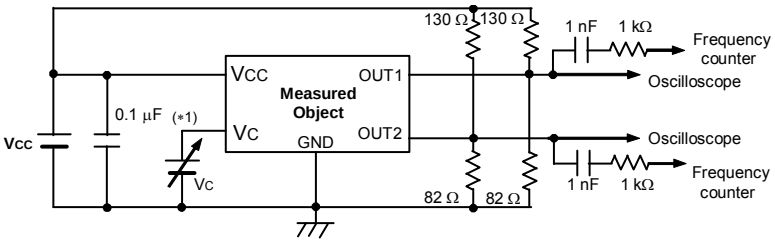
(3) TTL load

Model:
TCO-708*A1A



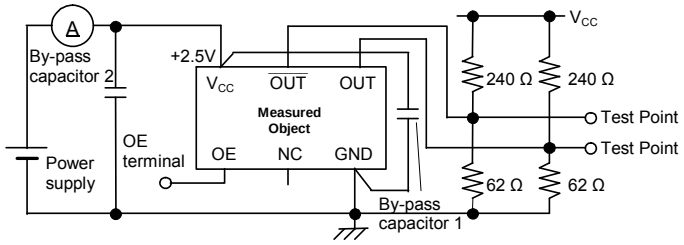
(4) LV-PECL load

Model:
VG-4512CA



(5) LV−PECL load

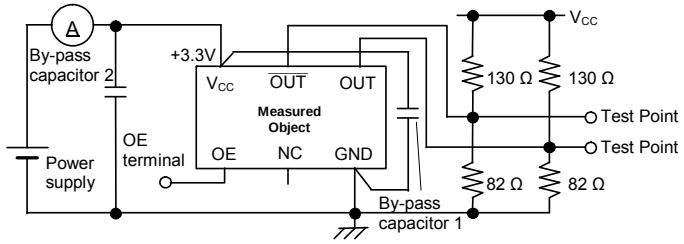
Model:
EG-2121CB/CA
XG-2121CA
EG-4121CA



By-pass capacitor 1 (approx. 0.01 µF to 0.1 µF) places closely between Vcc and GND.
By-pass capacitor 2 (approx. 10 µF) places closely between power supply terminals on the board.

(6) LV−PECL load

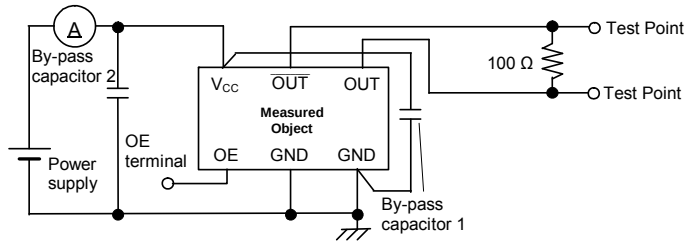
Model:
EG-2102CB/CA
XG-2102CA
EG-2101CA
EG-4101CA
EA-2102CB



By-pass capacitor 1 (approx. 0.01 µF to 0.1 µF) places closely between Vcc and GND.
By-pass capacitor 2 (approx. 10 µF) places closely between power supply terminals on the board.

(7) LVDS load

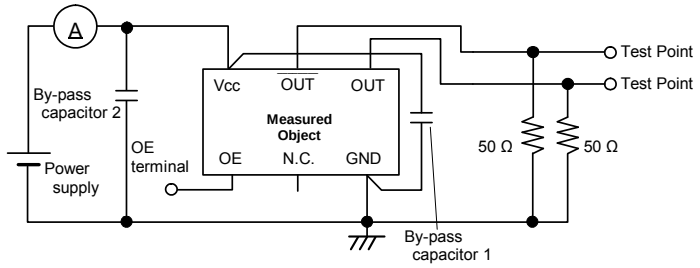
Model:
EG-2121/2102CB
XG-2121/2102CA
EG-2121/2102CA
EG-2101CA
EG-4121/4101CA
EA-2102CB



By-pass capacitor 1 (approx. 0.01 µF to 0.1 µF) places closely between Vcc and GND.
By-pass capacitor 2 (approx. 10 µF) places closely between power supply terminals on the board.

(8) HCSL load

Model:
EG-2121/2102CA
EG-4121/4101CA

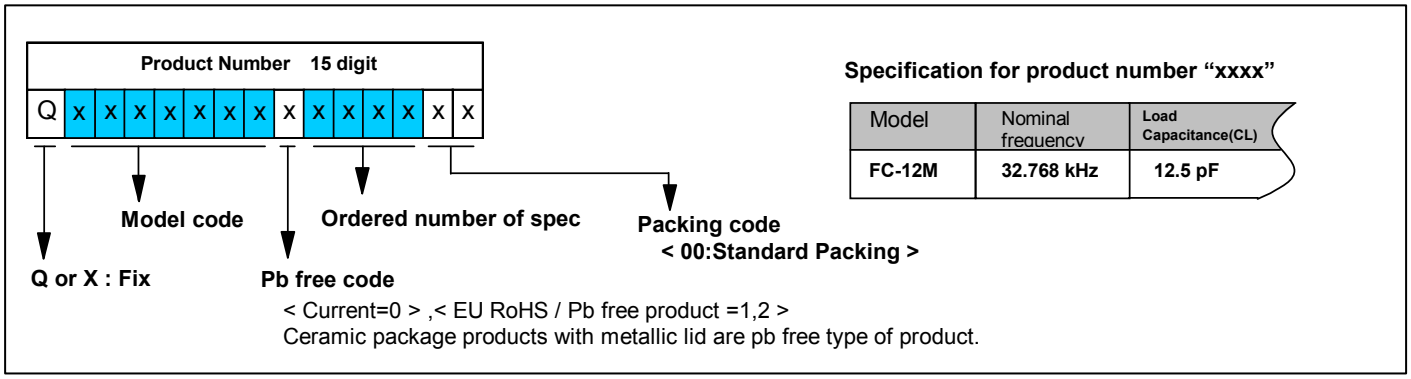


By-pass capacitor 1 (approx. 0.01 µF to 0.1 µF) places closely between Vcc and GND.
By-pass capacitor 2 (approx. 10 µF) places closely between power supply terminals on the board.

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
X	1A00011	1	0004	00	FC-12D	32.768 kHz	12.0 pF	±20	3000 pcs / Reel "L"
X	1A00006	1	0003	00	FC-12M	32.768 kHz	12.5 pF	±30	3000 pcs / Reel "L"
X	1A00009	1	0001	00	FC-13A	32.768 kHz	12.5 pF	±20	3000 pcs / Reel "L"
Q	13FC135	0	0004	00	FC-135	32.768 kHz	12.5 pF	±20	3000 pcs / Reel "L"
Q	13FC255	0	0004	00	FC-255	32.768 kHz	12.5 pF	±20	3000 pcs / Reel "L"
Q	13MC146	2	0002	00	MC-146	32.768 kHz	12.5 pF	±20	3000 pcs / Reel "L"
Q	13MC156	2	0004	00	MC-156	32.768 kHz	12.5 pF	±20	3000 pcs / Reel "L"
Q	13MC306	2	0003	00	MC-306	32.768 kHz	12.5 pF	±20	3000 pcs / Reel "L"
Q	13MC405	2	0002	00	MC-405	32.768 kHz	12.5 pF	±20	1000 pcs / Reel "L"
Q	13MC406	2	0001	00	MC-406	32.768 kHz	12.5 pF	±20	1000 pcs / Reel "L"
Q	11C02RX	1	0022	00	C-002RX	32.768 kHz	12.5 pF	±20	500 pcs / Vinyl bags
Q	11C004R	1	0020	00	C-004R	32.768 kHz	8.7 pF	±20	500 pcs / Vinyl bags
Q	11C005R	1	0023	00	C-005R	32.768 kHz	8.2 pF	±20	500 pcs / Vinyl bags
Q	12C2000	1	0254	00	C-2-TYPE	40.000 kHz	12.5 pF	±50	500 pcs / Vinyl bags
Q	12C4000	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
X	1E00025	1	0014	00	FA-118T	26.000 MHz	9.0 pF	±10	±12 / -20 °C to +75 °C	Fundamental	6000 pcs / Reel "L"
Q	22FA128	0	0022	00	FA-128	24.000 MHz	10.0 pF	±10	±10 / -20 °C to +75 °C	Fundamental	3000 pcs / Reel "L"
Q	24FA20H	0	0037	00	FA-20H	40.000 MHz	12.0 pF	±10	±15 / -20 °C to +75 °C	Fundamental	3000 pcs / Reel "L"
Q	22FA23V	0	0019	00	FA-238V	12.000 MHz	10.0 pF	±50	±30 / -20 °C to +70 °C	Fundamental	3000 pcs / Reel "L"
Q	22FA238	0	0264	00	FA-238	20.000 MHz	10.0 pF	±50	±30 / -20 °C to +70 °C	Fundamental	3000 pcs / Reel "L"
X	1E00002	1	0172	00	TSX-3225	40.000 MHz	9.0 pF	±10	±10 / -20 °C to +75 °C	Fundamental	2000 pcs / Reel "L"
Q	22MA306	2	0022	00	MA-306	20.000 MHz	10.0 pF	±50	±30 / -20 °C to +70 °C	Fundamental	3000 pcs / Reel "L"
Q	22MA406	2	0563	00	MA-406	20.000 MHz	10.0 pF	±50	±30 / -20 °C to +70 °C	Fundamental	1000 pcs / Reel "L"
Q	22MA505	2	0208	00	MA-505	20.000 MHz	16.0 pF	±50	±30 / -20 °C to +70 °C	Fundamental	1000 pcs / Reel "L"
Q	22MA506	2	0426	00	MA-506	20.000 MHz	16.0 pF	±50	±30 / -20 °C to +70 °C	Fundamental	1000 pcs / Reel "L"
Q	21CA301	1	0529	00	CA-301	20.000 MHz	16.0 pF	±30	±30 / -20 °C to +70 °C	Fundamental	500 pcs / Vinyl bags

●SAW Resonator

Product Number					Model	Nominal frequency	Frequency tolerance ($\times 10^{-6}$)	Operating temperature range	Standard packing
Q	25NS21R	0	0004	00	NS-21R	314.017 MHz	±50	-40 °C to +85°C	3000 pcs / Reel "L"
Q	25NS32R	0	0001	00	NS-32R	314.890 MHz	±50	-40 °C to +85°C	4000 pcs / Reel "R"
Q	25FS335	0	0052	00	FS-335	315.000 MHz	±100	-40 °C to +85°C	4000 pcs / Reel "R"
Q	25FS555	0	0016	00	FS-555	315.000 MHz	±100	-40 °C to +85°C	4000 pcs / Reel "R"
Q	25FS585	0	0015	00	FS-585	434.000 MHz	±50	-40 °C to +120°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 ±23	+5 to -20 / -20 °C to +70 °C	1000 pcs / Reel "L"
Q 3102JF0 2 0001 00	SG-3030JF	32.768 kHz	5 ±23	+5 to -20 / -20 °C to +70 °C	1000 pcs / Reel "L"
Q 3102JC0 2 0001 00	SG-3030JC	32.768 kHz	5 ±23	+5 to -20 / -20 °C to +70 °C	1000 pcs / Reel "L"
Q 3103LC0 2 0001 00	SG-3040LC	32.768 kHz	5 ±23	+5 to -20 / -20 °C to +70 °C	1000 pcs / Reel "L"
Q 3103JC0 2 0001 00	SG-3040JC	32.768 kHz	5 ±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: ±50 / -20 °C to +70 °C	1000 pcs / Reel "L"
Q 33645W7 2 0043 00	SG-645SCW	40.000 MHz	S:Standby	C:3.3 V	M: ±100 / -40 °C to +85 °C	1000 pcs / Reel "L"
Q 33636E4 2 0009 00	SG-636PCE	20.000 MHz	P: OE	C:3.3 V	C: ±100 / -20 °C to +70 °C	1000 pcs / Reel "L"
Q 3361501 2 0772 00	SG-615P	20.000 MHz	P:OE	5.0 V	C: ±100 / -20 °C to +70 °C	1000 pcs / Reel "L"
Q 3253101 2 0355 00	SG-531P	20.000 MHz	P:OE	5.0 V	C: ±100 / -20 °C to +70 °C	35 pcs / Tube
Q 3251001 2 0002 00	SG-51P	20.000 MHz	P:OE	5.0 V	C: ±100 / -20°C to +70 °C	25 pcs / Tube
Q 33211C7 0 0009 00	SG-211SCC	25.000 MHz	Standby	3.3 V	H: ±20 / -40 °C to +85 °C	3000 pcs / Reel "L"
Q 33210BG 0 0004 00	SG-210SGB	24.000 MHz	Standby	1.5 V	C: ±100 / -20 °C to +70 °C	3000 pcs / Reel "L"
X 1G00292 1 0010 00	SG-210SCD	66.6666 MHz	Standby	3.3 V	B: ±50 / -20 °C to +70 °C	3000 pcs / Reel "L"
X 1G00393 1 0011 00	SG-210SCH	125.000 MHz	Standby	3.3 V	B: ±50 / -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: ±100 / -20 °C to +70 °C	2000 pcs / Reel "L"
X 1G00036 1 0008 00	TCO-7106X1A4	25.000 MHz	Standby	3.3 V	±50 / -40 °C to +85 °C	1000 pcs / Reel "L"
X 1G00037 1 0003 00	TCO-7107X1A4	25.000 MHz	Standby	3.3 V	±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:±50 / -40 °C to +85 °C	1000 pcs / Reel "L"
X 1G00021 1 0031 00	TCO-7085X1A1	25.000 MHz	Standby	3.3 V	±25 / -10 °C to +70 °C	1000 pcs / Reel "L"
X 1G00022 1 0065 00	TCO-7086X1A4	25.000 MHz	Standby	3.3 V	±50 / -40 °C to +85 °C	1000 pcs / Reel "L"
X 1G00023 1 0013 00	TCO-7087D1A1	25.000 MHz	Standby	5.0 V	±100 / -10 °C to +70 °C	1000 pcs / Reel "L"

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: ±25 / -40 °C to +85 °C	OE	C:3.3 V	1000 pcs / Reel "L"	BXC

●Programmable

Product Number	Model	Output frequency	Function	Operating Voltage	Frequency tolerance / Operating temperature range ($\times 10^{-6}$)	Standard packing
X 1G00401 1 0002 00	SG-8003CG SC	27.000 MHz	S:Standby	C:3.3 V	L: ±50 / -40 °C to +85 °C	3000 pcs / Reel "L"
Q 33519E7 0 0026 00	SG-8003CE SC	20.000 MHz	S:Standby	C:3.3 V	C: ±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: ±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: ±100 / -20 °C to +70 °C	1000 pcs / Reel "L"
Q 3308JF7 2 0047 00	SG-8002JF SC	20.000 MHz	S:Standby	C:3.3 V	C: ±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: ±100 / -20 °C to +70 °C	1000 pcs / Reel "L"
Q 3307JC7 2 0003 00	SG-8002JC SC	20.000 MHz	S:Standby	C:3.3 V	C: ±100 / -20 °C to +70 °C	1000 pcs / Reel "L"
Q 3306JA7 2 0103 00	SG-8002JA SC	20.000 MHz	S:Standby	C:3.3 V	C: ±100 / -20 °C to +70 °C	1000 pcs / Reel "L"
Q 3204DC7 2 0003 00	SG-8002DC SC	20.000 MHz	S:Standby	C:3.3 V	C: ±100 / -20 °C to +70 °C	35 pcs / Tube
Q 3203DB7 2 0001 00	SG-8002DB SC	20.000 MHz	S:Standby	C:3.3 V	C: ±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:±1.0 %	P:OE	2000 pcs / Reel "L"	C10P
Q 3331701 0 0016 00	SG-9001CA	100.000 MHz	C:Centre	15:±1.5 %	P:OE	1000 pcs / Reel "L"	C15P
Q 3331E11 2 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:±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:±50 /-10 °C to +70°C	-	2000 pcs / Reel "L"	EB
Q 3807CA0 0 0001 00	EG-2021CA	125 MHz	C:CMOS SYM ±5 %	2.5 V	GP:±50 / 0 °C to +70°C	N	1000 pcs / Reel "L"	CGPN
Q 3801CA0 0 0002 00	EG-2001CA	125 MHz	P:CMOS SYM ±5 %	C:3.3 V	H :±100 / 0 °C to +70 °C	-	1000 pcs / Reel "L"	PCH
Q 3802CA0 0 0020 00	EG-2002CA	125 MHz	P:LV-TTL SYM ±5 %	C:3.3 V	Z:±50 / 0 °C to +70 °C	-	1000 pcs / Reel "L"	PCZ
X 1M00022 1 0001 00	EG-2102CB	212.5MHz	L: LVDS	3.3V	HR:±100/ -5°C to +85°C	A	2000 pcs / Reel "L"	LHRA
X 1M00023 1 0001 00	EG-2121CB	212.5MHz	L: LVDS	3.3V	HR:±100/ -5°C to +85°C	A	2000 pcs / Reel "L"	LHRA
X 1M00030 1 0001 00	XG-2102CA	212.5MHz	P: LV-PECL	3.3V	HR:±100/ -5°C to +85°C	A	1000 pcs / Reel "L"	PHRA
X 1M00031 1 0001 00	XG-2121CA	212.5MHz	P: LV-PECL	3.3V	HR:±100/ -5°C to +85°C	A	1000 pcs / Reel "L"	PHRA
Q 3805CA0 0 0002 00	EG-2121CA	125 MHz	P:LV-PECL SYM ± 5 %	2.5 V	HP:±100 / 0 °C to +70 °C	A	1000 pcs / Reel "L"	PHPA
Q 3805CA1 0 0003 00	EG-2121CA	125 MHz	L:LVDS SYM ±5 %	2.5 V	HP:±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±5 %	3.3 V	HP:±100 / 0 °C to +70 °C	A	1000 pcs / Reel "L"	PHPA
Q 3806CA1 0 0039 00	EG-2102CA	125 MHz	L:LVDS SYM ±5 %	3.3 V	HP:±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 ±2.5 %	C:3.3 V	H:±100 / 0 °C to +70 °C	-	1000 pcs / Reel "L"	DCH
X 1M00014 1 0003 00	EG-4101CA	100 MHz	P:LV-PECL SYM ±5 %	3.3 V	GW:±50 / -40 °C to +70 °C	A	1000 pcs / Reel "L"	PGWA
Q 3861CB0 0 0001 00	EA-2102CB	100.0MHz	LV-PECL	3.3V	±300/ -40°C to +85°C	-	2000 pcs / Reel "L"	-

A: Includes initial frequency tolerance, temperature variation, supply voltage variation, reflow drift, and aging (+25deg.C, 10years).

N: Includes initial frequency tolerance, temperature variation, supply voltage variation, reflow drift.

●Voltage Control (VCXO/VCSO)

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
X	1G00286	1	0002	00	VG-4231CB	54.000 MHz	J: ±50 / -20 °C to +70 °C	G: ±50	C:3.3 V	1000 pcs./ Reel "L"	JGC-Z
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	1G00392	1	0004	00	VG-4232CA	70.656 MHz	G: ±50 / -40 °C to +85 °C	G: ±50	C:3.3 V	1000 pcs./ Reel "L"	GGC-T
X	1G00377	1	0002	00	VG-4501CA	122.880 MHz	G: ±50 / -40 °C to +85 °C	G: ±50	C:3.3 V	1000 pcs./ Reel "L"	GGC-T
X	1G00375	1	0002	00	VG-4502CA	122.880 MHz	G: ±50 / -40 °C to +85 °C	H: ±100	C:3.3 V	1000 pcs./ Reel "L"	GHC-T
X	1M00024	2	0001	00	EV-9100JG	1986.819MHz	-100 ~ +150 / -10~+85 °C	APR: ±50	3.3 V	1000 pcs./ Reel "L"	CPGUA

■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"

■REAL TIME CLOCK MODULE

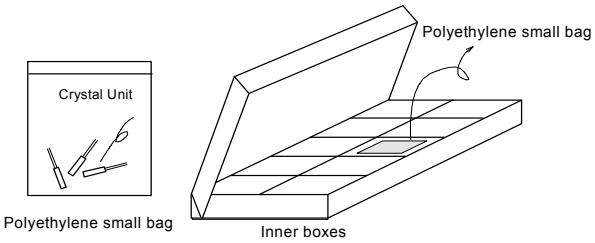
Product Number					Model	Frequency tolerance ($\times 10^{-6}$)	Standard packing
X	1B00013	2	0001	00	RX-4803SA	UB: ±5.0 × 10^{-6} / -40 °C to +85 °C	1000 pcs / Reel "L"
X	1B00012	2	0002	00	RX-4803LC	UB: ±5.0 × 10^{-6} / -40 °C to +85 °C	2000 pcs / Reel "L"
X	1B00019	2	0001	00	RX-4035SA	B : 5 ±23 × 10^{-6}	1000 pcs / Reel "L"
X	1B00020	2	0001	00	RX-4035LC	B : 5 ±23 × 10^{-6}	2000 pcs / Reel "L"
Q	4140455	2	0001	00	RX-4045SA	AA : 5 ±5	1000 pcs / Reel "L"
Q	4140459	2	0001	00	RX-4045NB	AA : 5 ±5	1000 pcs / Reel "L"
Q	4145819	2	0002	00	RX-4581NB	B : 5 ±23	1000 pcs / Reel "L"
Q	4147017	1	0002	00	RTC-4701JE	B : 5 ±23 × 10^{-6}	1000 pcs / Reel "L"
Q	4147019	2	0002	00	RTC-4701NB	B : 5 ±23	1000 pcs / Reel "L"
Q	4145745	2	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	2	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	2	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	2	0001	00	RX-4575LC	B : 5 ±23	2000 pcs / Reel "L"
Q	414571C	2	0001	00	RX-4571LC	B : 5 ±23	2000 pcs / Reel "L"
Q	4145719	2	0001	00	RX-4571NB	B : 5 ±23	1000 pcs / Reel "L"
Q	4145715	2	0001	00	RX-4571SA	B : 5 ±23	1000 pcs / Reel "L"
Q	4180255	2	0001	00	RX-8025SA	AA : 5 ±5	1000 pcs / Reel "L"
Q	4180259	2	0001	00	RX-8025NB	AA : 5 ±5	1000 pcs / Reel "L"
X	1B00017	2	0003	00	RX-8035SA	AA : 5 ±5 × 10^{-6}	1000 pcs / Reel "L"
X	1B00018	2	0003	00	RX-8035LC	AA : 5 ±5 × 10^{-6}	2000 pcs / Reel "L"
Q	4185647	1	0001	00	RTC-8564JE	B : 5 ±23	1000 pcs / Reel "L"
Q	4185649	2	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"
X	1B00007	2	0001	00	RX-8571SA	B : 5 ±23 × 10^{-6}	1000 pcs / Reel "L"
X	1B00006	2	0001	00	RX-8571NB	B : 5 ±23 × 10^{-6}	1000 pcs / Reel "L"
X	1B00005	2	0001	00	RX-8571LC	B : 5 ±23 × 10^{-6}	2000 pcs / Reel "L"
Q	4185815	2	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	2	0002	00	RX-8581NB	B : 5 ±23	1000 pcs / Reel "L"
Q	418731C	2	0001	00	RX-8731LC	B : 5 ±23	2000 pcs / Reel "L"
X	1B00015	2	0001	00	RX-8803SA	UB: ±5.0 × 10^{-6} / -40 °C to +85 °C	1000 pcs / Reel "L"
X	1B00014	2	0002	00	RX-8803LC	UB: ±5.0 × 10^{-6} / -40 °C to +85 °C	2000 pcs / Reel "L"
Q	4273018	2	0002	00	RTC-7301SF	B : 5 ±23	1000 pcs / Reel "L"
Q	4273011	2	0002	00	RTC-7301DG	B : 5 ±23	1000 pcs / Reel "L"
Q	4272421	2	0001	00	RTC-72421	A : ±10	25 pcs / Tube
Q	4272423	2	0006	00	RTC-72423	A : ±20	1000 pcs / Reel "L"
Q	41A4655	2	0003	00	RA-4565SA	B : 5 ±23 × 10^{-6}	1000 pcs / Reel "L"
Q	41A4745	2	0001	00	RA-4574SA	B : 5 ±23 × 10^{-6}	1000 pcs / Reel "L"
Q	41A8655	2	0001	00	RA-8565SA	B : 5 ±23 × 10^{-6}	1000 pcs / Reel "L"
Q	41A8815	2	0001	00	RA-8581SA	B : 5 ±23 × 10^{-6}	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

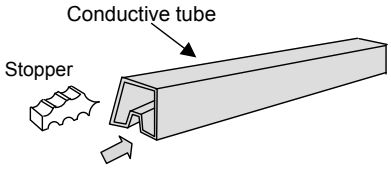
Cylinder products are packed in vinyl bags per lot of 250 to 1000pcs.
From 1 to 20 bags are then placed in inner boxes to make a lot.
Inner boxes are then placed in cartons for shipment. (the quantity varies with the model.)



Model	Quantity
C-2-TYPE C-4-TYPE C-002RX C-004R C-005R CA-301 HTS-206	500 pcs / vinyl bags

2. DIP

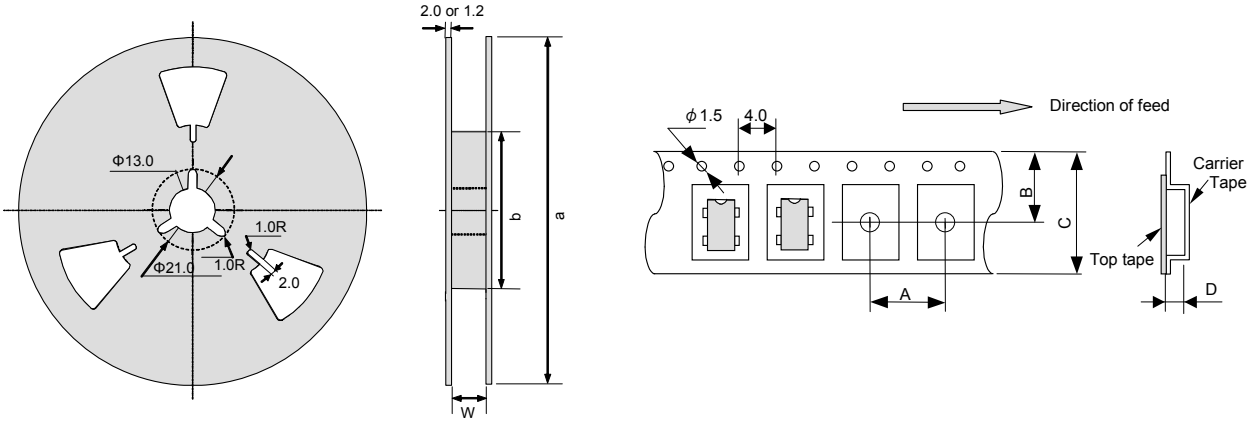
DIP products are placed into antistatic IC tubes and packed into boxes for shipment.



Model	Quantity
SG-531 SG-8002DC	35 pcs / tube
SG-51 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	
kHz Range Crystal unit									
FC-12D	3000	Φ180	Φ60	9	4	5.25	8	0.45	L
FC-12M	3000	Φ180	Φ60	9	4	5.25	8	0.75	L
FC-135	3000	Φ180	Φ60	13	4	7.25	12	1	L
FC-13A	3000	Φ180	Φ60	13	4	7.25	12	1	L
FC-255	3000	Φ180	Φ80 or Φ100	13.5	4	7.25	12	1.1	L
MC-146	3000	Φ180	Φ80 or Φ100	17.5	4	9.25	16	1.6	L
MC-156	3000	Φ330	Φ80 or Φ100	17.5	8	9.25	16	1.65	L
MC-306	3000	Φ330	Φ80 or Φ100	17.5	8	9.25	16	2.7	L
MC-30A	3000	Φ330	Φ80 or Φ100	17.5	8	9.25	16	2.7	L
MC-405	1000	Φ330	Φ80 or Φ100	17.5	8	9.25	16	3.8	L
MC-406	1000	Φ330	Φ80 or Φ100	17.5	8	9.25	16	3.8	L
MHz Range Crystal unit									
FA-118T	6000	Φ180	Φ60	9	4	5.25	8	0.5	L
FA-128	3000	Φ180	Φ60	9	4	5.25	8	0.7	L
FA-20H	3000	Φ180	Φ60	9	4	5.25	8	0.75	L
FA-238	3000	Φ180	Φ60	9	4	5.25	8	1.05	L
FA-238V	3000	Φ180	Φ60	9	4	5.25	8	1.05	L
MA-306	3000	Φ330	Φ80 or Φ100	17.5	8	9.25	16	2.7	L
MA-406	1000	Φ330	Φ80 or Φ100	25.5	12	13.25	24	4	L
MA-505	1000	Φ330	Φ80 or Φ100	25.5	12	13.25	24	4.8	L
MA-506	1000	Φ330	Φ80 or Φ100	25.5	12	13.25	24	4.8	L
TSX-3225	2000	Φ180	Φ60	9	4	5.25	8	1	L

Model	Quantity (pcs/Reel)	Reel dimension			Career Tape dimension				Direction of feed (L=left direction)
		a	b	W	A	B	C	D	
SAW Resonator									
FS-335	4000	Φ330	Φ80 or Φ100	13.5	8	7.25	12	1.52	R
FS-555	4000	Φ330	Φ80 or Φ100	13.5	8	7.25	12	2	R
FS-585	4000	Φ330	Φ80 or Φ100	13.5	8	7.25	12	2	R
NS-21R	3000	Φ180	Φ60	9	4	5.25	8	1.15	Individual regulations
NS-32R	4000	Φ330	Φ80 or Φ100	13.5	8	7.25	12	1.52	R
●Crystal Oscillator									
EA-2102CB	2000	Φ254	Φ100	13.4	8	7.25	12	1.4	L
EG-21xxCB	2000	Φ254	Φ100	13.4	8	7.25	12	1.4	L
EG-2xxxCA	1000	Φ254	Φ100	17.5	8	9.25	16	2.3	L
EG-4101CA	1000	Φ254	Φ100	17.5	8	9.25	16	2.3	L
EG-4121CA	1000	Φ254	Φ100	17.5	8	9.25	16	2.3	L
HG-2150CA	1000	Φ254	Φ100	17.5	8	9.25	16	2.3	L
SG-210 series	3000	Φ180	Φ60	9	4	5.25	8	1.15	L
SG-211 series	3000	Φ180	Φ60	9	4	5.25	8	1.15	L
SG-3030JC	1000	Φ330	Φ80 or Φ100	17.5	8	9.25	16	3.3	L
SG-3030JF	1000	Φ254	Φ100	17.5	8	9.25	16	2.3	L
SG-3030LC	2000	Φ180	Φ60	13	4	7.25	12	1.45	L
SG-3040JC	1000	Φ330	Φ80 or Φ100	17.5	8	9.25	16	3.3	L
SG-3040LC	2000	Φ180	Φ60	13	4	7.25	12	1.45	L
SG-310 series	2000	Φ180	Φ60	9	4	5.25	8	1.4	L
SG-615 series	1000	Φ330	Φ80 or Φ100	25.5	12	13.25	24	4.8	L
SG-636 series	1000	Φ330	Φ80 or Φ100	17.5	8	9.25	16	3	L
SG-645 series	1000	Φ254	Φ100	17.5	8	9.25	16	2.3	L
SG-7xx series	1000	Φ180	Φ60	17	8	9.25	16	2.1	L
SG-8002CA	1000	Φ254	Φ100	17.5	8	9.25	16	2.3	L
SG-8002CE	2000	Φ180	Φ60	9	4	5.25	8	1.4	L
SG-8002JA	1000	Φ330	Φ80 or Φ100	25.5	12	13.25	24	4.8	L
SG-8002JC	1000	Φ330	Φ80 or Φ100	17.5	8	9.25	16	3.3	L
SG-8002JF	1000	Φ254	Φ100	17.5	8	9.25	16	2.3	L
SG-8002LB	2000	Φ254	Φ100	13.4	8	7.5	12	1.4	L
SG-8003BA	3000	Φ180	Φ60	9	4	5.25	8	0.95	L
SG-8003CA	1000	Φ254	Φ100	17.5	8	9.25	16	2.3	L
SG-8003CE	2000	Φ180	Φ60	9	4	5.25	8	1.4	L
SG-8003CG	3000	Φ180	Φ60	9	4	5.25	8	1.15	L
SG-8003JF	1000	Φ254	Φ100	17.5	8	9.25	16	2.3	L
SG-8003LB	2000	Φ254	Φ100	13.4	8	7.5	12	1.4	L
SG-9001CA	1000	Φ254	Φ100	17.5	8	9.25	16	2.3	L
SG-9001JC	1000	Φ330	Φ80 or Φ100	17.5	8	9.25	16	3.3	L
SG-9001LB	2000	Φ254	Φ100	13.4	8	7.5	12	1.4	L
TCO-708x series	1000	Φ254	Φ100	17.5	8	9.25	16	2.1	L
TCO-710x series	1000	Φ180	Φ60	13	8	7.25	12	1.4	L
XG-1000CA	1000	Φ254	Φ100	17.5	8	9.25	16	2.3	L
XG-1000CB	2000	Φ254	Φ100	13.4	8	7.25	12	1.4	L
XG-21xxCA	1000	Φ254	Φ100	17.5	8	9.25	16	2.3	L
●VCXO / VCSO									
EV-9100JG	1000	Φ330	Φ80	25.5	12	13.25	24	5.3	L
VG-4231CA	1000	Φ254	Φ100	17.5	8	9.25	16	2.3	L
VG-4231CB	1000	Φ180	Φ60	13	8	7.25	12	1.4	L
VG-4231CE	2000	Φ180	Φ60	9	4	5.25	8	1.4	L
VG-4232CA	1000	Φ254	Φ100	17.5	8	9.25	16	2.3	L
VG-4501CA	1000	Φ180	Φ60	17	8	9.25	16	2.1	L
VG-4502CA	1000	Φ180	Φ60	17	8	9.25	16	2.1	L
VG-4512CA	1000	Φ180	Φ60	17	8	9.25	16	2.1	L
VG-4513CA	1000	Φ180	Φ60	17	8	9.25	16	2.1	L
●TCXO									
TG-3530SA	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	3.65	L
TG-5021CE	2000	Φ180	Φ60	9	4	5.25	8	1.4	L
TG-5021CG	2000	Φ180	Φ60	9	4	5.25	8	1.15	L
TG-5031CJ	12000	Φ330	Φ100	9.4	4	5.25	8	1	L
TG-5035CE	2000	Φ180	Φ60	9	4	5.25	8	1.4	L
TG-5035CG	2000	Φ180	Φ60	9	4	5.25	8	1.15	L
TG-5035CJ	12000	Φ330	Φ100	9.4	4	5.25	8	1	L
TG-5500CA	1000	Φ254	Φ100	17.5	8	9.25	16	2.3	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	
RA-4565SA	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	3.65	L
RA-4574SA	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	3.65	L
RA-8565SA	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	3.65	L
RA-8581SA	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	3.65	L
RTC-4543SA	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	3.65	L
RTC-4543SB	1000	Φ330	Φ80 or Φ100	25.5	12	11.5	24	2.5	L
RTC-4574JE	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	2	L
RTC-4574NB	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	1.8	L
RTC-4574SA	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	3.65	L
RTC-4701JE	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	2	L
RTC-4701NB	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	1.8	L
RTC-72423	1000	Φ330	Φ80 or Φ100	25.5	16	13.25	24	2.95	L
RTC-7301SF	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	2.4	L
RTC-8564JE	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	2	L
RTC-8564NB	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	1.8	L
RX-4035LC	2000	Φ180	Φ60	13	4	7.25	12	1.45	L
RX-4035SA	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	3.65	L
RX-4045NB	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	1.8	L
RX-4045SA	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	3.65	L
RX-4571LC	2000	Φ180	Φ60	13	4	7.25	12	1.45	L
RX-4571NB	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	1.8	L
RX-4571SA	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	3.65	L
RX-4574LC	2000	Φ180	Φ60	13	4	7.25	12	1.45	L
RX-4575LC	2000	Φ180	Φ60	13	4	7.25	12	1.45	L
RX-4581NB	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	1.8	L
RX-4803LC	2000	Φ180	Φ60	13	4	7.25	12	1.45	L
RX-4803SA	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	3.65	L
RX-8025NB	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	1.8	L
RX-8025SA	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	3.65	L
RX-8035LC	2000	Φ180	Φ60	13	4	7.25	12	1.45	L
RX-8035SA	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	3.65	L
RX-8564LC	2000	Φ180	Φ60	13	4	7.25	12	1.45	L
RX-8571LC	2000	Φ180	Φ60	13	4	7.25	12	1.45	L
RX-8571NB	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	1.8	L
RX-8571SA	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	3.65	L
RX-8581JE	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	2	L
RX-8581NB	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	1.8	L
RX-8581SA	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	3.65	L
RX-8731LC	2000	Φ180	Φ60	13	4	7.25	12	1.45	L
RX-8803LC	2000	Φ180	Φ60	13	4	7.25	12	1.45	L
RX-8803SA	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	3.65	L

●SAW Filter

FF-555	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

●Sensor

AH-6120LR	1000	Φ330	Φ100	25.4	12	13.25	24	4	L
AP-6110LR	1000	Φ330	Φ100	25.4	12	13.25	24	4	L
XV-3500CB	2000	Φ254	Φ100	13.4	8	7.25	12	2.1	L
XV-3510CB	2000	Φ254	Φ100	13.4	8	7.25	12	2.1	L
XV-3700CB	2000	Φ254	Φ100	13.4	8	7.25	12	2.1	L
XV-3900CB	2000	Φ254	Φ100	13.4	8	7.25	12	2.1	L
XV-8000CB	2000	Φ254	Φ100	13.4	8	7.25	12	2.1	L
XV-8000LK	1000	Φ254	Φ100	13.4	8	7.25	12	3.7	L
XV-8100CB	2000	Φ254	Φ100	13.4	8	7.25	12	2.1	L
XV-9100LP	500	Φ330	Φ80 or Φ100	25.4	12	13.25	24	8.5	R
XV-9100LV	1000	Φ330	Φ80 or Φ100	17.4	12	9.25	16	4.5	L
XV-9300LP	500	Φ330	Φ80 or Φ100	25.4	12	13.25	24	8.5	R
XV-9300LV	1000	Φ330	Φ80 or Φ100	17.4	12	9.25	16	4.5	L

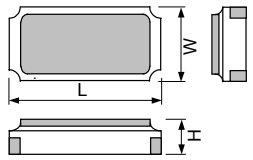
TABLE OF DIMENSIONS

(Unit:mm)

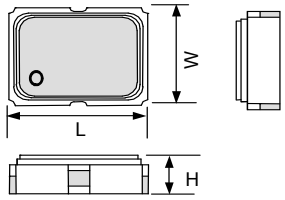
■SMD Type

●SON

Glass Lid type

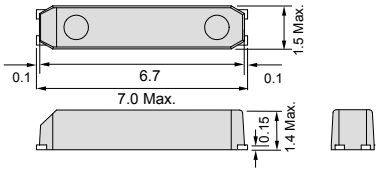


Metal Lid type

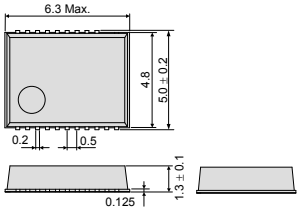


Category	Model	Dimension (mm)			Pin
		L	W	H	
Crystal Unit	FC-12D	2.05±0.1	1.25±0.1	0.35 Max.	4
	FC-12M	2.05±0.05	1.2±0.05	0.6 Max.	2
	FC-13A	3.2±0.1	1.5±0.1	0.9 Max.	2
	FC-135	3.2±0.1	1.5±0.1	0.8±0.1	2
	FC-255	4.9±0.1	1.8±0.1	0.8±0.1	2
	FA-118T	1.6±0.1	1.2±0.1	0.35 Max.	4
	FA-128	2.0±0.1	1.6±0.1	0.5 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 / FA-238V	3.2±0.1	2.5±0.1	0.6±0.1	4
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/ SG-8003CG	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
	EA-2102CB	5.0±0.2	3.2±0.2	1.35±0.15	6
	EG-20**CA	7.0±0.2	5.0±0.2	1.2±0.2	4
	EG-2121CB / EG-2102CB	5.0±0.2	3.2±0.2	1.4±0.15	6
	XG-2121CA / XG-2102CA	7.0±0.2	5.0±0.2	1.2±0.2	6
	EG-21**CA / EG-41**CA	7.0±0.2	5.0±0.2	1.2±0.2	6
VCXO	VG-4231CE	3.2±0.2	2.5±0.2	1.05±0.15	4
	VG-4231CB	5.0±0.2	3.2±0.2	1.2±0.2	6
	VG-4231CA / VG-4232CA	7.0±0.2	5.0±0.2	1.4±0.1	6
	VG-4501CA / VG-4502CA / VG-4512CA/ VG-4513CA	7.0±0.2	5.0±0.2	1.6±0.2	6
TCXO	TG-5031CJ / TG-5035CJ	2.0±0.15	1.6±0.15	0.73±0.07	4
	TG-5021CG/ TG-5035CG	2.5±0.2	2.0±0.2	0.8±0.1	4
	TG-5021CE / TG-5035CE	3.2±0.2	2.5±0.2	0.9±0.1	4
	TG-5500CA	7.0±0.2	5.0±0.2	1.5±0.2	10
SAW Filter	FF-32N	3.8±0.15	3.8±0.15	0.98±0.15	6
	FF-555	4.8±0.2	5.2±0.2	1.5±0.2	8
Gyro Sensor	XV-3500CB/XV-3510CB /XV-3700CB XV-3900CB XV-8100CB/XV-8000CB	5.0±0.2	3.2±0.2	1.3±0.2	8

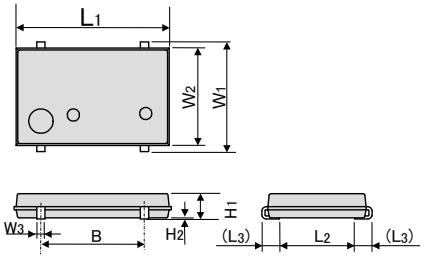
●SON (Crystal Unit) MC-146



●SON: RX-****NB / RTC-****NB



●SOJ / VSOJ

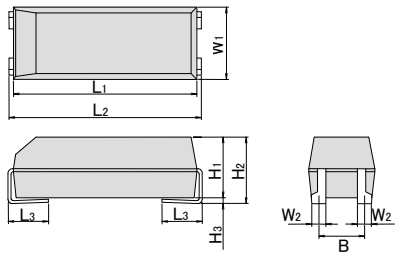


Category	Model	L_1	L_2	(L_3)	W_1	W_2	W_3	H_1	H_2	B	Pin
Crystal Unit	MC-156	7.1 Max.	1.6	(0.75)	3.3 Max.	2.5	0.4	1.5 Max.	—	5.08	4
	MC-306 / 30A MA-306	8.0 Max.	1.9	(0.9)	3.8 Max.	3.2	0.5	2.54 Max.	—	5.5	4
	MA-406	11.7 Max.	2.1	(1.2)	4.8 Max.	4.0	0.7	3.7 Max.	—	9.6	4
Crystal Oscillator	SG-**LB	5.0 ±0.2	2.5	(0.35)	3.2 ±0.2	2.8	1.0	1.2 Max.	0.0 Min.	2.54	4
	SG-645 SG-**JF	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-636 SG-**JC	10.5 Max.	3.6	(1.0)	5.8 Max.	5.0	0.51	2.7 Max.	0.05 Min.	5.08	4
	SG-615 SG-**JA	14.0 Max.	7.62	—	9.8 Max.	8.65	0.51	4.7 Max.	0.25 Min.	5.08	4
Real time Clock Module	SG-**LC RX-**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 RTC-**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

■SMD Type

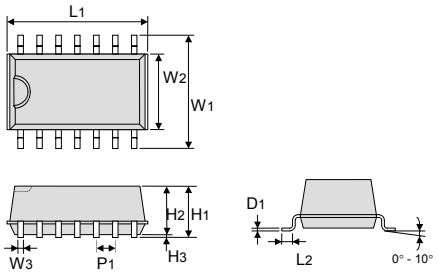
(Unit:mm)

●SOJ (Crystal Unit)



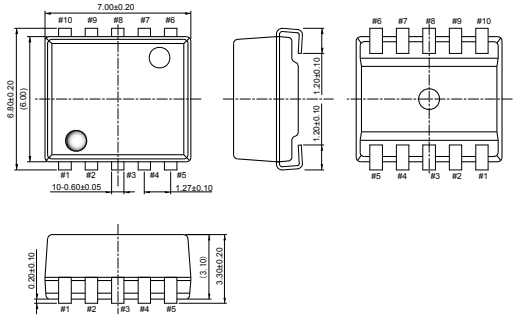
Category	Model	L1	L2	L3	W1	W2	B	H1	H2	H3
Crystal Unit	MC-405 / 406	9.6	10.41 Max.	2.54	4.06 Max.	0.51	2.29	3.15	3.6 Max.	0.2 Min.
	MA-505 / 506	12.7	13.46 Max.	2.54	5.08 Max.	1.09	3.3	4.19	4.6 Max.	0.2 Min.

●SOP / VSOP

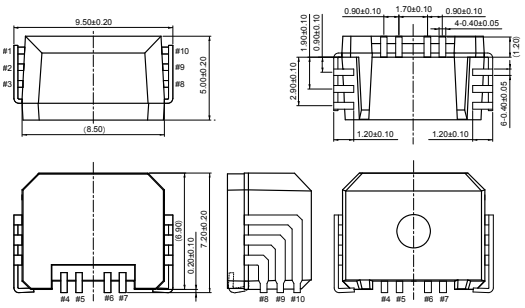


Category	Model	L1	L2	W1	W2	W3	H1	H2	H3	D1	P1	Pin
Real time Clock Module	RTC-****SA RX-****SA RA-****SA	10.1 ±0.2	0.6	7.4 ±0.2	5.0	0.35	3.2 ±0.1	3.1	0.05 Min.	0.15	1.27	14
	RTC-4543SB	11.4 ±0.2	0.6	7.8 ±0.2	5.4	0.4	2.0 Max.	1.8	0 Min.	0.15	1.27	18
	RTC-72423	16.3 Max.	1.0	12.2 Max.	7.9	0.35	2.8 Max.	—	0.1 Min.	0.2	1.27	24
	RX-5412SF RTC-7301SF	10.2 ±0.3	0.5	7.8 ±0.3	5.4	0.36	2.0 Max.	—	0 Min.	0.15	0.8	24

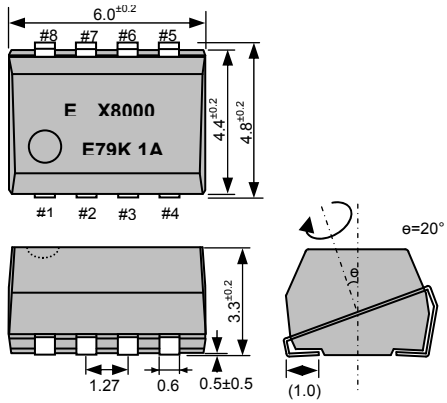
●SOJ (Gyro sensor)
XV-9100LV / XV-9300LV



●SOJ (Gyro sensor)
XV-9100LP / XV-9300LP



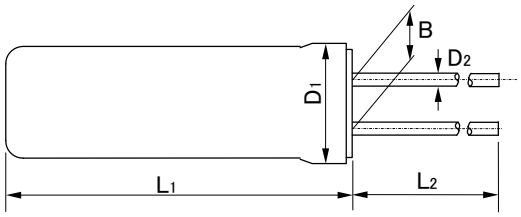
●SOJ (Gyro sensor)
XV-8000LK



(Unit:mm)

■Dip Type

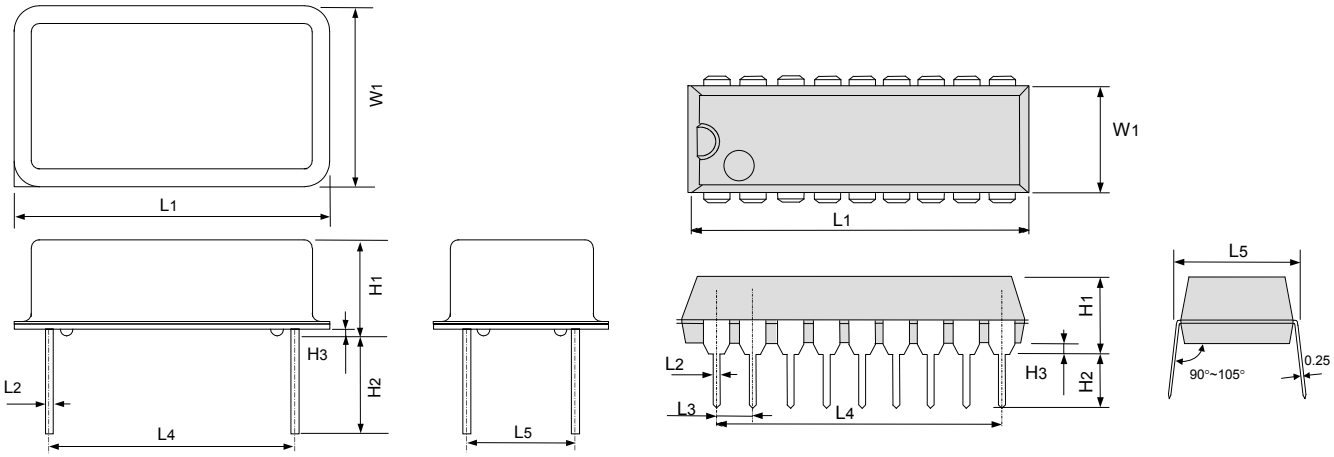
●Cylinder



Category	Model		L1	L2	D1	D2	B
Crystal Unit	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	1.1
		Under 5.5 MHz	9.3 Max.	9.5 Min.	Φ3.1 Max.	Φ0.3	1.1

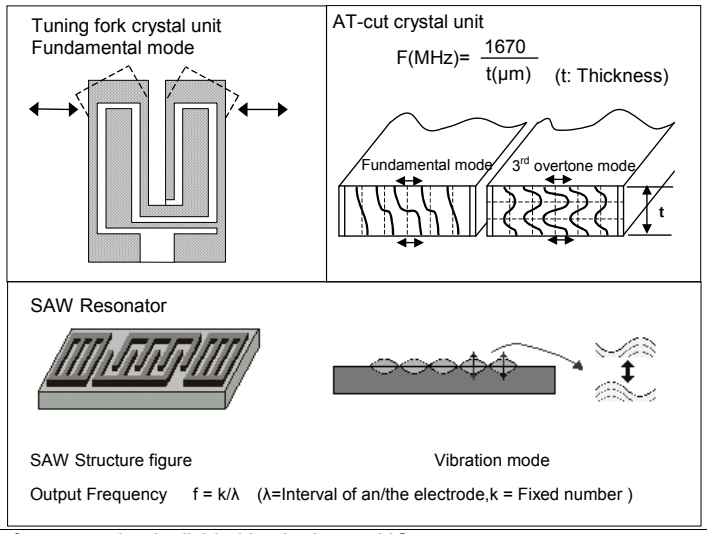
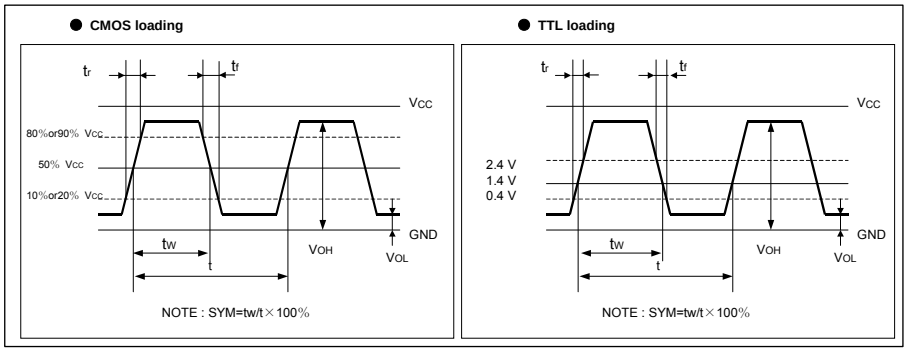
160 kHz to 165 kHz,307.2 kHz:D1= ø 2.2 Max.(C-2-TYPE)

●DIP

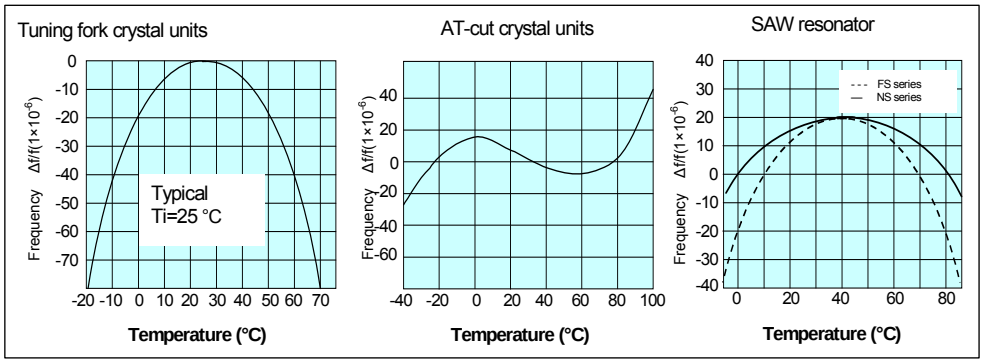
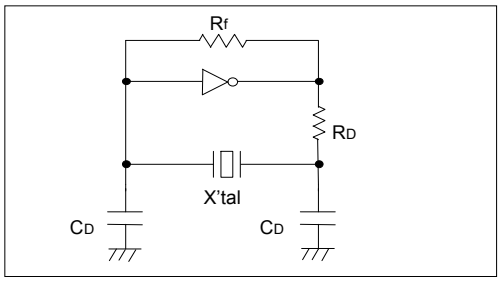


Category	Model	L1	L2	L3	L4	L5	H1	H2	H3	W1	Pin
Crystal Oscillator	SG-51 SG-8002DB	19.8 Max.	0.51	—	15.24	7.62	5.3 Max.	2.54 Min.	0.2 Min.	6.36	4 Pin
	SG-531 SG-8002DC	13.7 Max.	0.51	—	7.62	7.62	5.3 Max.	2.54 Min.	0.2 Min.	6.6	4 Pin
Real time clock Module	RTC-7301DG	23.1 Max.	0.46	2.54	20.32	7.62	4.2 Max.	2.54 Min.	0.2 Min.	6.3	18 Pin
	RTC-72421	23.1 Max.	0.65	2.54	20.32	7.62	4.2 Max.	3.3 Min.	0.2 Min.	6.3	18 Pin

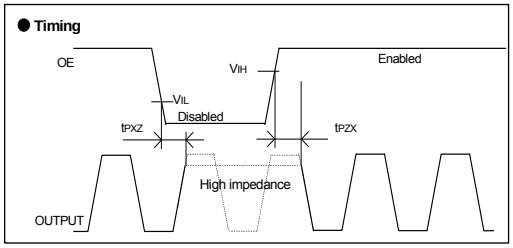
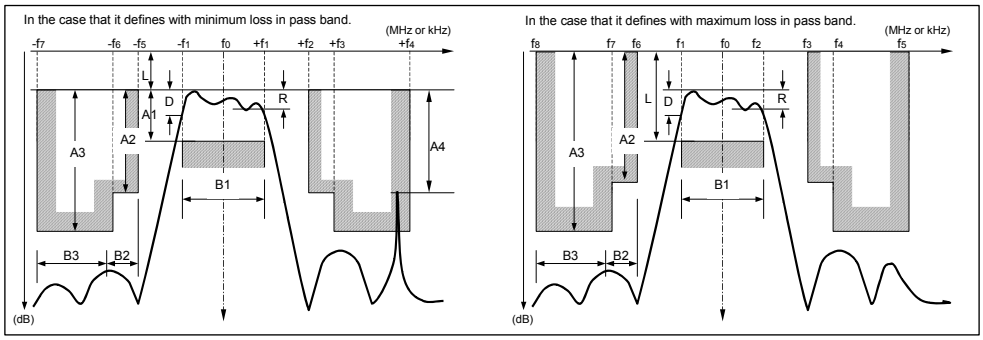
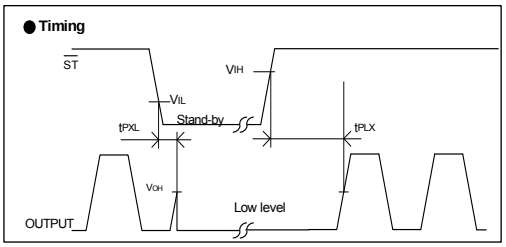
■Glossary

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. 	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. 	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(Hz)=1/t(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 are available on the 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. $\Delta f/f = B(Ti-\theta X)^2$ θX: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 (C_L)	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:C_L	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 (V_{CC}-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 (f_o)	Oscillation source frequency of oscillator inside oscillation system.	OSC
Fall time(t_f)	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(t_r)	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

X'tal:Crystal Unit, OSC:Crystal Oscillator More details are available on the website.

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_0)	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 μA, I_{OL} = 1.6 mA and for LS-TTL as I_{OH} = -20 μA, 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 Vcc pin which will support continuous operation with specification characteristics.	OSC
Terminating impedance (Zt)	Either of the impedances presented to the filter by the source or by the load. (Rt: Resistive portion, Ct: Parallel capacitive portion including stray capacitance)	Filter
VSWR	Voltage Standing Wave Ratio	Filter

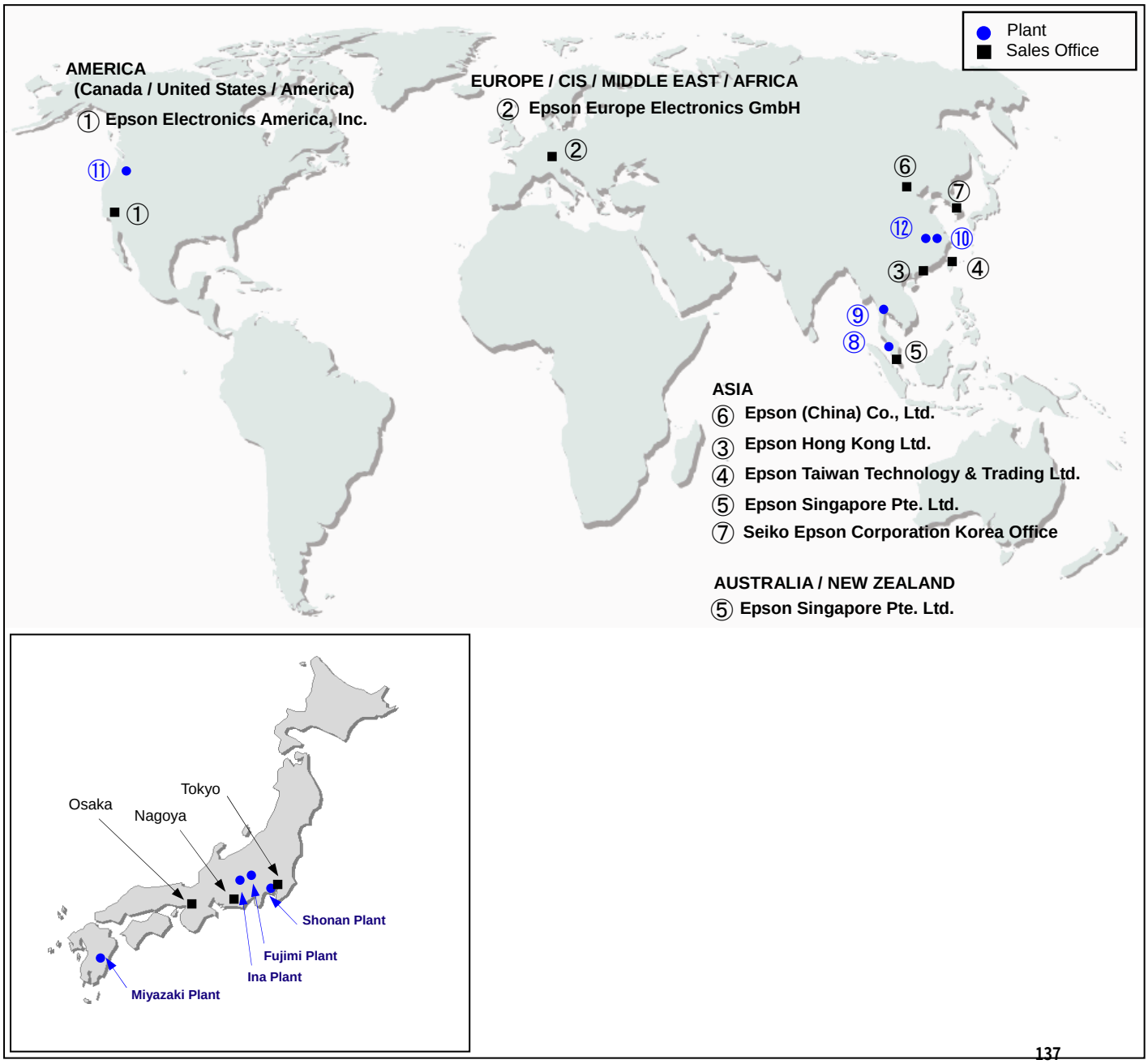
X'tal:Crystal Unit, OSC:Crystal Oscillator More details are available on the website.

■Manufacturing Plant

Plant	Date Operations Commenced	Products
Ina Plant / Seiko Epson Corp.	Jun.1959	Crystal unit, Crystal oscillator, Real time clock module, Surface acoustic wave device, Sensing device
Shonan Plant	Jun.1963	–
Miyazaki Plant	Jun.1984	Synthetic quartz

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, Surface acoustic wave device Crystal oscillator
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, Crystal oscillator

■Business area



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