

THE CRYSTAL MASTER 2023

Crystal Devices Catalogue

kHz Range
Crystal unit

kHz Range
SPXO / TCXO

Real Time Clock
module

MHz Range
Crystal unit
Crystal unit with
Thermistor

MHz Range
SPXO / SPSO
CMOS

MHz Range
SPXO / SPSO
Differential

TCXO

TCXO (For NW)

VCXO / VCSO

RF transmitter
module

Sensor

Automotive

Appendix

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 IATF 16949 certification that is requested strongly by major automotive manufacturers as standard.

IATF 16949 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.
	► 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.)
	► Designed for automotive applications such as Car Multimedia, Body Electronics, Remote Keyless Entry etc.
	► Designed for automotive applications related to driving safety (Engine Control Unit, Air Bag, ESC etc).

NOTICE : PLEASE READ CAREFULLY BELOW BEFORE THE USE OF THIS DOCUMENT ©Seiko Epson Corporation 2020

- The content of this document is subject to change without notice. Before purchasing or using Epson products, please contact with sales representative of Seiko Epson Corporation ("Epson") for the latest information and be always sure to check the latest information published on Epson's official web sites and resources.
- This document may not be copied, reproduced, or used for any other purposes, in whole or in part, without Epson's prior consent.
- Information provided in this document including, but not limited to application circuits, programs and usage, is for reference purpose only. Epson makes no guarantees against any infringements or damages to any third parties' intellectual property rights or any other rights resulting from the information. This document does not grant you any licenses, any intellectual property rights or any other rights with respect to Epson products owned by Epson or any third parties.
- Using Epson products, you shall be responsible for safe design in your products; that is, your hardware, software, and/or systems shall be designed enough to prevent any critical harm or damages to life, health or property, even if any malfunction or failure might be caused by Epson products. In designing your products with Epson products, please be sure to check and comply with the latest information regarding Epson products (including, but not limited to this document, specifications, data sheets, manuals, and Epson's web site). Using technical contents such as product data, graphic and chart, and technical information, including programs, algorithms and application circuit examples under this document, you shall evaluate your products thoroughly both in stand-alone basis and within your overall systems. You shall be solely responsible for deciding whether to adopt/use Epson products with your products.
- Epson has prepared this document carefully to be accurate and dependable, but Epson does not guarantee that the information is always accurate and complete. Epson assumes no responsibility for any damages you incurred due to any misinformation in this document.
- No dismantling, analysis, reverse engineering, modification, alteration, adaptation, reproduction, etc., of Epson products is allowed.
- Epson products have been designed, developed and manufactured to be used in general electronic applications and specifically designated applications ("Anticipated Purpose"). Epson products are NOT intended for any use beyond the Anticipated Purpose that requires particular quality or extremely high reliability in order to refrain from causing any malfunction or failure leading to critical harm to life and health, serious property damage, or severe impact on society, including, but not limited to listed below ("Specific Purpose"). Therefore, you are strongly advised to use Epson products only for the Anticipated Purpose. Should you desire to purchase and use Epson products for Specific Purpose, Epson makes no warranty and disclaims with respect to Epson products, whether express or implied, including without limitation any implied warranty of merchantability or fitness for any Specific Purpose. Please be sure to contact our sales representative in advance, if you desire Epson products for Specific Purpose:
Space equipment (artificial satellites, rockets, etc.)/ Transportation vehicles and their control equipment (automobiles, aircraft, trains, ships, etc.) / Medical equipment/ Relay equipment to be placed on sea floor/ Power station control equipment / Disaster or crime prevention equipment/Traffic control equipment/ Financial equipment
Other applications requiring similar levels of reliability as the above
- Epson products listed in this document and our associated technologies shall not be used in any equipment or systems that laws and regulations in Japan or any other countries prohibit to manufacture, use or sell. Furthermore, Epson products and our associated technologies shall not be used for the purposes of military weapons development (e.g. mass destruction weapons), military use, or any other military applications. If exporting Epson products or our associated technologies, please be sure to comply with the Foreign Exchange and Foreign Trade Control Act in Japan, Export Administration Regulations in the U.S.A (EAR) and other export-related laws and regulations in Japan and any other countries and to follow their required procedures.
- Epson assumes no responsibility for any damages (whether direct or indirect) caused by or in relation with your non-compliance with the terms and conditions in this document or for any damages (whether direct or indirect) incurred by any third party that you give, transfer or assign Epson products.
- For more details or other concerns about this document, please contact our sales representative.
- Company names and product names listed in this document are trademarks or registered trademarks of their respective companies.



CONTENTS

kHz PRODUCTS

• Cryatal Unit / Cryatal Oscillator / INDEX.....	7 to 8
• Cryatal Unit	9 to 13
• SPXO / TCXO	14 to 15
• Real Time Clock Module / INDEX	16 to 18
• Real Time Clock Module	19 to 39

kHz Range
Crystal unitkHz Range
SPXO / TCXOReal Time Clock
module

MHz PRODUCTS

• Cryatal Unit / INDEX	40
• Cryatal Unit	41 to 46
• Cryatal Unit with thermistor	47 to 48
• SPXO / SPSO (MHz CMOS Output) / INDEX	49 to 50
• SPXO / SPSO (MHz CMOS Output)	53 to 65
• SPXO / SPSO (MHz Differential Output) / INDEX	51 to 52
• SPXO / SPSO (MHz Differential Output)	66 to 74
• TCXO / VC-TCXO / INDEX	75 to 77
• TCXO / VC-TCXO	78 to 87
• VCXO / VCXO / INDEX	88
• VCXO / VCXO	89 to 93

MHz Range
Crystal unit
Crystal unit with
ThermistorMHz Range
SPXO / SPSO
CMOSMHz Range
SPXO / SPSO
Differential

TCXO

TCXO (For NW)

VCXO / VCXO

RF Transmitter module

• RF Transmitter module	94 to 95
-------------------------------	----------

RF transmitter
module

SENSOR

• IMU / Vibration Sensor / Accelerometer / INDEX	96 to 97
• IMU / Vibration Sensor / Accelerometer	98 to 101
• Sensor / INDEX	102
• Gyro Sensor	103 to 107

Sensor

Automotive Solutions

• Automotive Solutions / INDEX	108 to 110
• Automotive Solutions	111 to 134

Automotive

APPENDIX

• Working For EU RoHS / Pb Free	135 to 138
• Handling Precautions	138 to 145
• Precautions In Designing Oscillation Circuits	146
• Packing Specifications	147 to 150
• Glossary	151 to 154
• Manufacuring Plant	155

Appendix

**kHz Products
Crystal Unit**

FC1610AN	9
FC2012AN	10
FC-12M	11
FC3215AN	12
FC-135R/135	13

**kHz Products
SPXO / SPSO****CMOS**

SG-3031CM	14
TG-3541CE(DTCXO)	15

**kHz Products
Real Time Clock Module****SPI-Bus and I²C-Bus**

RX6110SA	37
----------------	----

SPI-Bus

RX4901CE	21
RX4111CE	24
RX-4803SA/LC	29
RX-4035SA/LC	31
RX-4571LC/SA	34
RX-4045SA	39

I²C-Bus

RX8901CE	19
RX8111CE	23
RX8804CE	25
RX8130CE	26
RX8900SA/CE	27
RX-8803SA/LC	28
RX-8035SA/LC	30
RX-8731LC	32
RX-8571SA/LC	33
RX-8564LC	35
RX8010SJ	36
RX-8025SA	38

**MHz Products
Crystal Unit**

FA1008AN	41
FA1210AN	42
FA-118T	43
FA-128	44
FA-20H	45
TSX-3225	46
FA-238V/FA-238	46

Built-in Thermistor

FA1612AS	47
FA2016AS	48

**MHz Products
VCXO / VCSO****VCXO / VCSO****CMOS**

VG7050CDN	89
-----------------	----

LV-PECL

VG3225EFN	90
VG5032EFN	90
VG7050EFN	90
VG7050EBN	91
VG7050EAN(Programmable)	92
VG7050ECN(Programmable)	92

LVDS

VG3225VFN	90
VG5032VFN	90
VG7050VFN	90

**MHz Products
SPXO / SPSO****CMOS**

SG2016CAN	53
SG-210STF	53
SG3225/5032/7050CAN	53

CMOS Programmable

SG-8200CJ	55
SG-8201CJ	57
SG-8018 series	59
SG-8101 series	61

CMOS Spread Spectrum

SG-9101 series	63
----------------------	----

Programming tool

SG-Writer II	65
--------------------	----

LV-PECL

SG2016/2520EHN	66
SG2016/2520EGN	67
SG3225/5032/7050EEN	68
SG3225/5032/7050EAN	69

LV-PECL Programmable

SG-8506CA	71
-----------------	----

LV-PECL Selectable

SG-8503CA	73
SG-8504CA	73

LVDS

SG2016/2520VHN	66
SG2016/2520VGN	67
SG3225/5032/7050VEN	68
SG3225/5032/7050VAN	69

HCSL

SG3225HBN	70
-----------------	----

**MHz Products
TCXO / VC-TCXO****TCXO / VC-TCXO****Clipped sine wave**

TG2016SMN	78
TG2520SMN	78
TG1612SLN	79
TG2016SLN	80
TG2016SKA(AEC-Q100)	132
TG2016SLA(AEC-Q100)	133

CMOS

TG2520CEN	81
TG3225CEN	81

Clipped sine wave or CMOS

TG7050CMN/SMN(4pins)	82
TG7050CKN/SKN(10pins)	82
TG-5510CA/TG-5511CA	83
(10pins/4pins)	
TG-5510CB/TG-5511CB	84
(10pins/4pins)	
TG5032SKN(10pins)	85
TG5032SMN(4pins)	85
TG5032CKN(10pins)	85
TG5032CMN(4pins)	85
TG5032CFN/SFN(4pins)	86
TG5032CGN/SGN(10pins)	87

IMU

M-G330PDG0	98
M-G366PDG0	99

Vibration Sensor / Accelerometer

M-A342AD10	100
M-A352AD10	101

Automotive Solutions**kHz Products****Crystal Unit**

FC-13A(AEC-Q200)	111
MC-30A(AEC-Q200)	112

SPXO / SPSO kHz Range**CMOS**

SG-3031CMA(AEC-Q100)	113
----------------------------	-----

TCXO

TG-3541CEA(DTCXO AEC-Q100)	114
----------------------------------	-----

Real Time Clock Module**I²C-Bus**

RA8000CE(AEC-Q100)	115
RA8804CE(AEC-Q100)	119
RA8900CE(AEC-Q200)	120

SPI-Bus

RA4000CE(AEC-Q100)	117
--------------------------	-----

MHz Products**Crystal Unit**

FA2016AA(AEC-Q200)	121
FA-238A(AEC-Q200)	122
FA2016ASA(AEC-Q200)	123

SPXO / SPSO MHz Range**CMOS Spread Spectrum**

SG-9101CGA(AEC-Q100)	129
----------------------------	-----

CMOS Programmable

SG-8201CJA(AEC-Q100)	125
SG-8101CGA(AEC-Q100)	127

CMOS

SG2016CAA(AEC-Q200)	124
SG2520CAA(AEC-Q200)	124

TCXO / VC-TCXO

TG2016SKA(AEC-Q100)	132
TG2016SLA(AEC-Q100)	133

RF Transmitter Module

SR3225SAA(AEC-Q100)	131
---------------------------	-----

Gyro Sensor

XV4001B*/K*(AEC-Q200)	134
-----------------------------	-----

Gyro Sensor

XV7021BB	103
XV7081BB	104
XV7011BB	105
XV7001BB	106
XV-3510CB	107

RF Transmitter Module

SR3225SAA	95, 131
-----------------	---------



	Product	Page		Product	Page		Product	Page
F	FA1008AN	41	R	RX8130CE	26	S	SG-8201CJA(AEC-Q100)	125
	FA-118T	43		RX-8564LC	35		SG-8503CA	73
	FA1210AN	42		RX-8571SA/LC	33		SG-8504CA	73
	FA-128	44		RX-8731LC	32		SG-8506CA	71
	FA1612AS	47		RX-8803SA/LC	28		SG-9101 series	63
	FA2016AA(AEC-Q200)	121		RX8804CE	25		SG-9101CGA(AEC-Q100)	129
	FA2016AS	48		RX8900SA/CE	27		SG-WriterII	65
	FA2016ASA(AEC-Q200)	123		RX8901CE	19		SR3225SAA	95, 131
	FA-20H	45	S	SG2016CAA(AEC-Q200)	124	T	TG1612SLN	79
	FA-238	46		SG2016CAN	53		TG2016SKA	132
	FA-238V	46		SG2016EGN/VGN	67		TG2016SLA	133
	FA-238A(AEC-Q200)	122		SG2016EHN/VHN	66		TG2016SLN	80
	FC-12M	11		SG-210STF	53		TG2016SMN	78
	FC-135	13		SG2520CAA(AEC-Q200)	124		TG2520CEN	81
	FC-135R	13		SG2520EGN/VGN	67		TG2520SMN	78
	FC-13A(AEC-Q200)	111		SG2520EHN/VHN	66		TG3225CEN	81
	FC1610AN	9		SG-3031CM	14		TG-3541CE(DTCXO)	15
	FC2012AN	10		SG-3031CMA(AEC-Q100)	113		TG-3541CEA(DTCXO AEC-Q100)	114
	FC3215AN	12		SG3225CAN	53		TG5032CFN/SFN(4pins)	86
M	MC-30A(AEC-Q200)	112		SG3225EAN	69		TG5032CGN/SGN(10pins)	87
	M-A342VD10	100		SG3225EEN	68		TG5032CKN/CMN	85
	M-A352AD10	101		SG3225HBN	70		TG5032SKN/SMN	85
	M-G330PDG0	98		SG3225VAN	69		TG-5511/TG-5510CA	83
	M-G366PDG0	99		SG3225VEN	68		TG-5511/TG-5510CB	84
R	RA8000CE(AEC-Q100)	115		SG5032CAN	53		TG7050CKN/CMN	82
	RA4000CE(AEC-Q100)	117		SG5032EAN	69		TG7050SKN/SMN	82
	RA8804CE(AEC-Q100)	119		SG5032EEN	68	V	VG3225EFN/VFN	90
	RA8900CE(AEC-Q200)	120		SG5032VAN	69		VG5032EFN/VFN	90
	RX-4035SA/LC	31		SG5032VEN	68		VG7050CDN	89
	RX-4045SA	39		SG7050CAN	53		VG7050EAN(Programmable)	92
	RX4111CE	24		SG7050EAN	69		VG7050EBN	91
	RX-4571LC/SA	34		SG7050EEN	68		VG7050ECN(Programmable)	92
	RX-4803SA/LC	29		SG7050VAN	69		VG7050EFN/VFN	90
	RX4901CE	21		SG7050VEN	68	X	XV-3510CB	107
	RX6110SA	37		SG-8018 series	59		XV4001B*/K*(AEC-Q200)	134
	RX8010SJ	36		SG-8101 series	61		XV7001BB	106
	RX-8025SA	38		SG-8101CGA(AEC-Q100)	127		XV7011BB	105
	RX-8035SA/LC	30		SG-8200CJ	55		XV7021BB	103
	RX8111CE	23		SG-8201CJ	57		XV7081BB	104



■ Products Information on Epson Website

Seiko Epson is providing the products information, timing device, sensing device and more. please access here !

www5.epsondevice.com/en/

The screenshot shows the Epson website interface. At the top, there's a navigation bar with links: Products, Applications, IC Partners, Information, News, and Contact. A search bar is on the right. Below the navigation bar, a banner features the text "Three values that contribute to a smart society (省・小・精)" and "Epson's quartz crystal device". It highlights three main product areas: Real time clock module, Programmable SPXO, and Gyro sensor. To the right, it lists "Sensing solution" (High stability gyro sensor) and "Timing solution" (Unique device technology, High precision Oscillator and Module). Further right, it mentions "Power Saving Solutions" (Low power realtime clock). Below the banner, there are four buttons: "Product No. Search", "Parametric Search", "Buy Online", and "Resource Library". At the bottom, there are four product category tiles: Crystal Unit, Crystal Oscillator, RTC Module, and Gyro Sensor. Below these are four more tiles: IC Partners, Contact, Sensing System, and Semiconductors.

Search function



* IMU, Vibration sensors, and Acceleration sensor can be searched on the Sensing Systems site.

Product Information

Parametric Search

IC Partner

The screenshot shows the "Product Information" page. It features a sidebar with navigation links like "Crystal Oscillator", "RTC Module", and "Gyro Sensor". The main content area displays detailed information about a specific product, including its specifications, performance, and application examples.



The screenshot shows the "Parametric Search" page. It features a sidebar with navigation links like "Crystal Oscillator", "RTC Module", and "Gyro Sensor". The main content area displays a search form with various parameters (Frequency, Load Capacitance, etc.) and a "Search" button. Below the form, there are search results for the selected parameters.



The screenshot shows the "IC Partner" page. It features a sidebar with navigation links like "Crystal Oscillator", "RTC Module", and "Gyro Sensor". The main content area displays a list of IC partners, including Analog Devices, Atmel, and others, along with their respective product lines and contact information.



Product Information

Part No.	Frequency	Load Capacitance	Output Voltage	Package	RoHS	Stock
59600000000000000000	3.2768 MHz	15 pF	1.8 V	3-pin	Yes	10000
59600000000000000000	3.2768 MHz	15 pF	1.8 V	3-pin	Yes	10000

Search Results

Part No.	Frequency	Load Capacitance	Output Voltage	Package	RoHS	Stock
59600000000000000000	3.2768 MHz	15 pF	1.8 V	3-pin	Yes	10000
59600000000000000000	3.2768 MHz	15 pF	1.8 V	3-pin	Yes	10000

IC Partner

IC Partner	Product Line	Part No.	Frequency	Load Capacitance	Output Voltage	Package	RoHS	Stock
Analog Devices	ADXL345	ADXL345	3.2768 MHz	15 pF	1.8 V	3-pin	Yes	10000
Atmel	AT24C02	AT24C02	3.2768 MHz	15 pF	1.8 V	3-pin	Yes	10000

On the product information page, You can download brief sheets and application manuals, and check stocks of web agencies.

Parametric Search allows you to narrow down the required specifications for each product category. You can also download a detailed data sheet with the product model number on the individual page.

A list of our products that have been tested for operation in cooperation with semiconductor manufacturers is posted as IC partner information.

kHz Products (Crystal Unit, Crystal Oscillator)

kHz Crystal Unit and kHz Crystal Oscillator Recommendation Products

Size [mm]	Crystal Unit		SPXO / TCXO	
	Model	Specifications	Model	Specifications
3.2 x 2.5 mm			TG-3541CE	TCXO +/- 3.4 x 10 ⁻⁶ (-40 °C to +85 °C) +/- 8 x 10 ⁻⁶ (+85 °C to +105 °C)
			TG-3541CEA	TCXO +/- 3.4 x 10 ⁻⁶ (-40 °C to +85 °C) +/- 8 x 10 ⁻⁶ (+85 °C to +105 °C) AEC-Q100
3.2 x 1.5 mm	FC3215AN	50 kΩ, Metal lid	SG-3031CM	SPXO 0.65 μA Typ. -40 °C to +105 °C
	FC-13A	70 kΩ, AEC-Q200, Metal lid	SG-3031CMA	SPXO 0.65 μA Typ. -40 °C to +105 °C AEC-Q100
	FC-135R	50 kΩ, Glass lid		
	FC-135	70 kΩ, Glass lid		
2.0 x 1.2 mm	FC2012AN	50 kΩ, Metal lid		
1.6 x 1.0 mm		FC1610AN		
		90 kΩ, Metal lid		
	Crystal Unit		SPXO / TCXO	
	Product Category			

► kHz Crystal Unit

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

P	Model	Size [mm]	Nominal frequency range	Frequency Tolerance (+25 °C) [× 10 ⁻⁶]	Motional resistance Max. [kΩ]	Load capacitance [pF]	Operating temperature [°C]	Frequency vs temperature characteristics (Turnover Temperature: +25 °C Typ.)
9	FC1610AN	1.6 x 1.0 x 0.5t	● 32.768 kHz	±20	90	9 12.5	-40 to +85	(B): -0.04 × 10 ⁻⁶ / °C ² Max. f _{tem} = B (Ti-θx) ²
10	FC2012AN	2.05 x 1.2 x 0.6t	● 32.768 kHz	±20	50 60	9 12.5	-40 to +85 -40 to +105	
11	FC-12M	2.05 x 1.2 x 0.6t	● 32.768 kHz ■ 32 kHz 77.5 kHz	±20 ±30	90 90 to 65	12.5	-40 to +85 -40 to +85	
12	FC3215AN	3.2 x 1.5 x 0.9t	● 32.768 kHz	±20	50 60	9 12.5	-40 to +85 -40 to +105	
13	FC-135R	3.2 x 1.5 x 0.9t	● 32.768 kHz	±20	50	7 9 12.5	-40 to +85	
	FC-135		● 32.768 kHz		70		-40 to +85	
			■ 32 kHz 77.5 kHz		70 to 45		-40 to +85	
111	FC-13A (AEC-Q200)	3.2 x 1.5 x 0.9t	● 32.768 kHz	±20 ±30 ±50	70	9 12.5	-40 to +125	
112	MC-30A (AEC-Q200)	8.0 x 3.8 x 2.54t	● 32.768 kHz	±20 ±50	50	12.5	-40 to +85	

► kHz Crystal Oscillator
► SPXO

P	Model	Size [mm]	Nominal frequency range	Frequency Tolerance (+25 °C) [x 10 ⁻⁶]	Operating temperature (T _{use}) [°C]	Supply voltage [V]	Current consumption Max. [μA] (V _{CC} = 3.3 V, No load, T _{use})	Output load condition [pF]	Output control
14	SG-3031CM	3.2 × 1.5 × 0.9t	● 32.768 kHz	5 ± 23	-40 to +85	1.1 to 5.5	1.3	15	V _{IO}
113	SG-3031CMA (AEC-Q100)								

► TCXO

P	Model	Size [mm]	Nominal frequency range	Frequency tolerance [x 10 ⁻⁶] / Operating temperature (T _{use}) [°C]	Supply voltage [V]	Current consumption Max. [μA] (V _{CC} = 3.3 V, No load, T _{use})	Output load condition [pF]	Output control
15	TG-3541CE	3.2 × 2.5 × 1.0t	● 32.768 kHz	±3.4 / -40 to +85 ±5.0 / -40 to +85 ±8.0 / +85 to +105	1.5 to 5.5	3.0	30	OE
114	TG-3541CEA (AEC-Q100)							



kHz RANGE CRYSTAL UNIT

FC1610AN



Product Number
X1A000121xxxx00

- Frequency range : 32.768 kHz
- External dimensions : 1.65 × 1.05 × 0.5 mm
- Overtone order : Fundamental
- Applications : Small communications devices



Specifications (characteristics)

Item	Symbol	Specifications	Conditions / Remarks
Nominal frequency range	f_nom	32.768 kHz	
Storage temperature range	T_stg	-55 °C to +125 °C	Storage as single product.
Operating temperature range	T_use	-40 °C to +85 °C	
Level of drive	DL	0.1 μW Typ. (0.5 μW Max.)	
Frequency tolerance (standard)	f_tol	$\pm 20 \times 10^{-6}$	+25 °C, DL = 0.1 μW
Turnover temperature	Ti	+25 °C ± 5 °C	
Parabolic coefficient	B	$-0.04 \times 10^{-6} / ^\circ\text{C}^2$ Max.	
Load capacitance	CL	9 pF, 12.5 pF	Please specify
Motional resistance (ESR)	R1	90 kΩ Max.	
Motional capacitance	C1	6.0 fF Typ.	
Shunt capacitance	C0	1.2 pF Typ.	
Frequency aging	f_age	$\pm 3 \times 10^{-6} / \text{year}$ Max.	+25 °C, First year

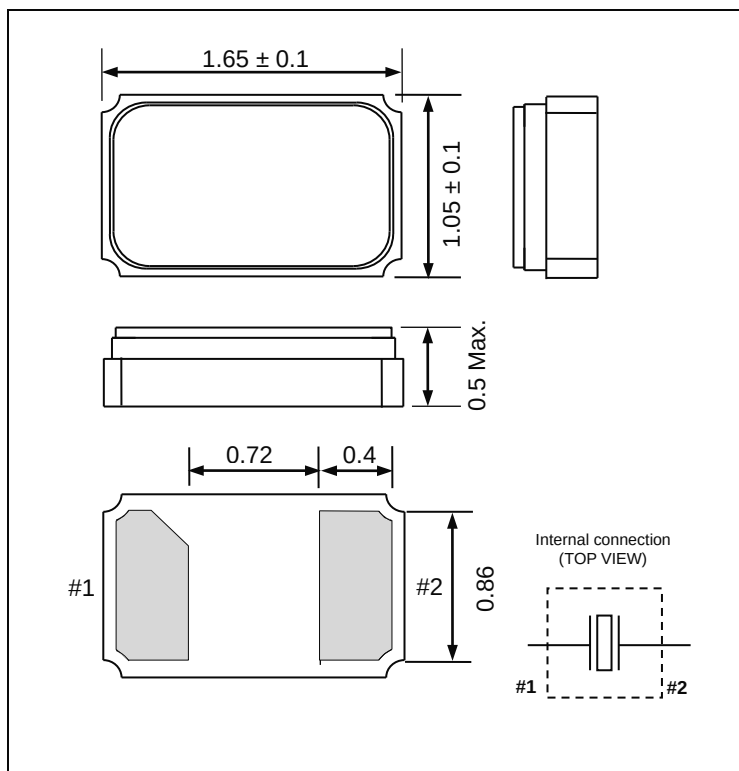
Product name

Product name FC1610AN 32.768000kHz 12.5 +20.0-20.0
(Standard form) ① ② ③ ④

①Model ②Frequency ③Load capacitance (pF) ④Frequency tolerance ($\times 10^{-6}$, +25 °C)

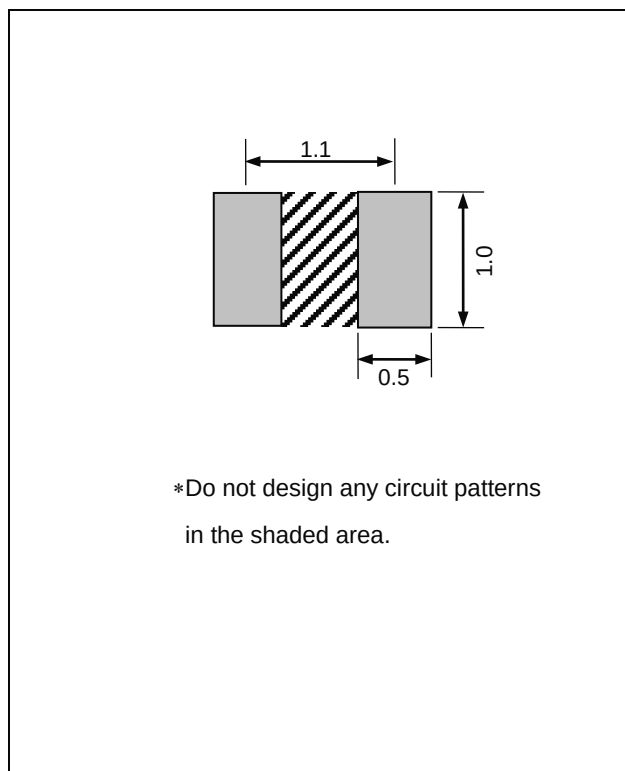
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





kHz RANGE CRYSTAL UNIT

FC2012AN

Low ESR 50 kΩ Max.



Product Number
FC2012AN: X1A000171xxxx18

- Frequency range : 32.768 kHz
- External dimensions : 2.05 x 1.2 x 0.6 mm
- Overtone order : Fundamental
- Applications : IoT Devices, Modules, etc.



Specifications (characteristics)

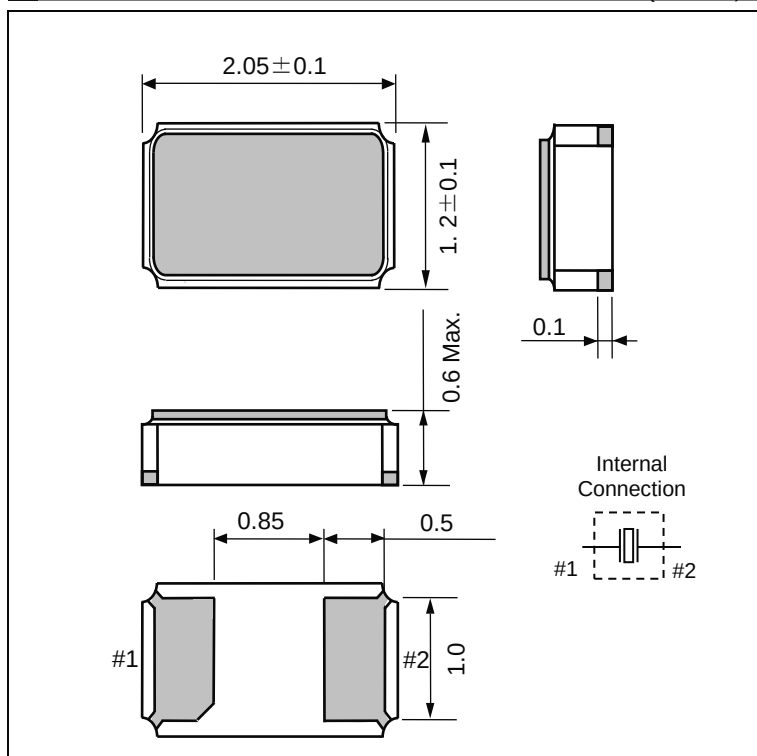
Item	Symbol	Specifications	Conditions / Remarks
Nominal frequency range	f_nom	32.768 kHz	
Storage temperature range	T_stg	-55 °C to +125 °C	Storage as single product.
Operating temperature range	T_use	-40 °C to +105 °C	
Level of drive	DL	0.5 μW Max.	
Frequency tolerance (standard)	f_tol	±20 x 10 ⁻⁶	+25 °C, DL = 0.1 μW
Turnover temperature	Ti	+25 °C ± 5 °C	
Parabolic coefficient	B	-0.04 x 10 ⁻⁶ / °C ² Max.	
Load capacitance	CL	9 pF, 12.5 pF	Contact us for other CL values
Motional resistance (ESR)	R1	35 kΩ Typ..	+25 °C,
		50 kΩ Max.	-40 °C to +85 °C
		60 kΩ Max.	-40 °C to +105 °C
Motional capacitance	C1	8.4 fF Typ.	
Shunt capacitance	C0	1.6 pF Typ.	
Frequency aging	f_age	±3 x 10 ⁻⁶ / year Max.	+25 °C, First year

Product name

Product name FC2012AN 32.768000kHz 12.5 +20.0-20.0
 (Standard form) ① ② ③ ④
 ①Model ②Frequency ③Load capacitance (pF) ④Frequency tolerance (× 10⁻⁶, +25 °C)

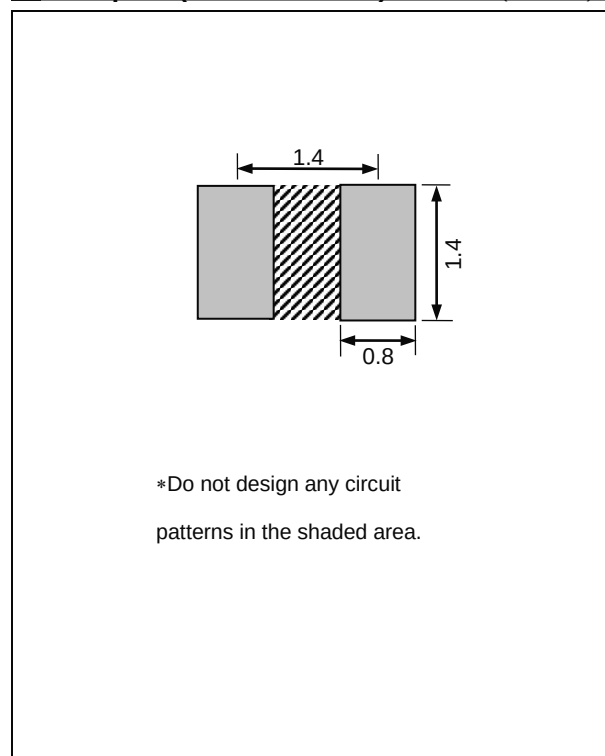
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





kHz RANGE CRYSTAL UNIT

FC-12M / FC-12M TYPE



Product Number

FC-12M : X1A000061xxxx00

FC-12M TYPE : X1A000021xxxx00

- Frequency range : FC-12M...32.768 kHz
: FC-12M TYPE...32 kHz to 77.5 kHz
- External dimensions : 2.05 x 1.2 x 0.6 mm
- Overtone order : Fundamental
- Applications : Small communications devices



Specifications (characteristics)

Item	Symbol	Specifications		Conditions / Remarks
		FC-12M	FC-12M TYPE	
Nominal frequency range	f_nom	32.768 kHz	32 kHz to 77.5 kHz	Please contact us about available frequencies.
Storage temperature range	T_stg	-55 °C to +125 °C		Storage as single product.
Operating temperature range	T_use	-40 °C to +85 °C		
Level of drive	DL	0.5 µW Max.		
Frequency tolerance (standard)	f_tol	±20 x 10 ⁻⁶ ±30 x 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 x 10 ⁻⁶ / °C ² Max.		
Load capacitance	CL	12.5 pF		Please specify
Motional resistance (ESR)	R1	90 kΩ Max.	90 kΩ to 65 kΩ	
Motional capacitance	C1	6.4 fF Typ.	7.0 fF to 2.7 fF	
Shunt capacitance	C0	1.3 pF Typ.	1.6 pF to 0.8 pF	
Frequency aging	f_age	±3 x 10 ⁻⁶ / year Max.		+25 °C, First year

Product name

Product name FC-12M 32.768000kHz 12.5 +20.0-20.0

(Standard form)

①

②

③

④

①Model

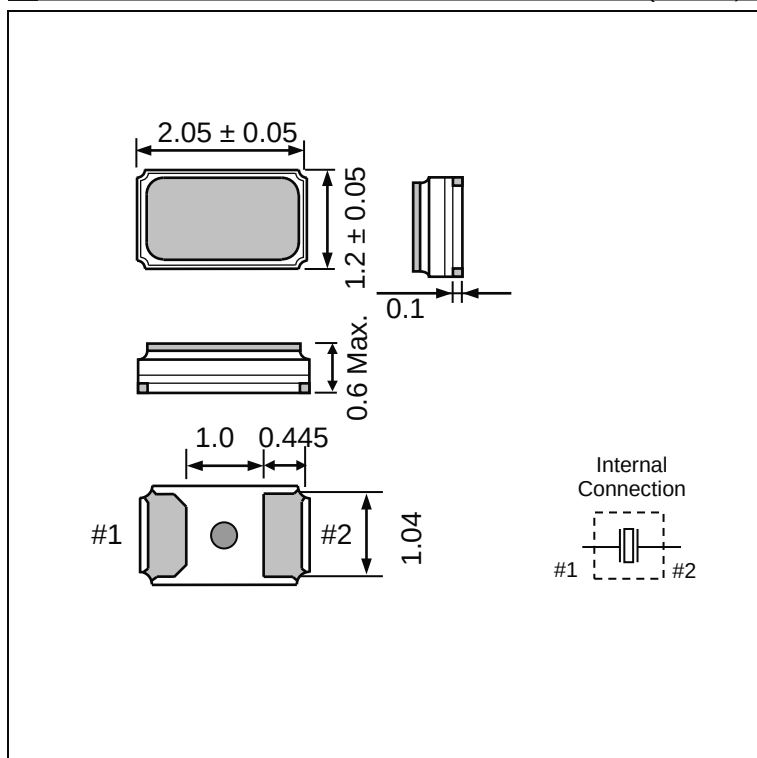
②Frequency

③Load capacitance (pF)

④Frequency tolerance (× 10⁻⁶, +25 °C)

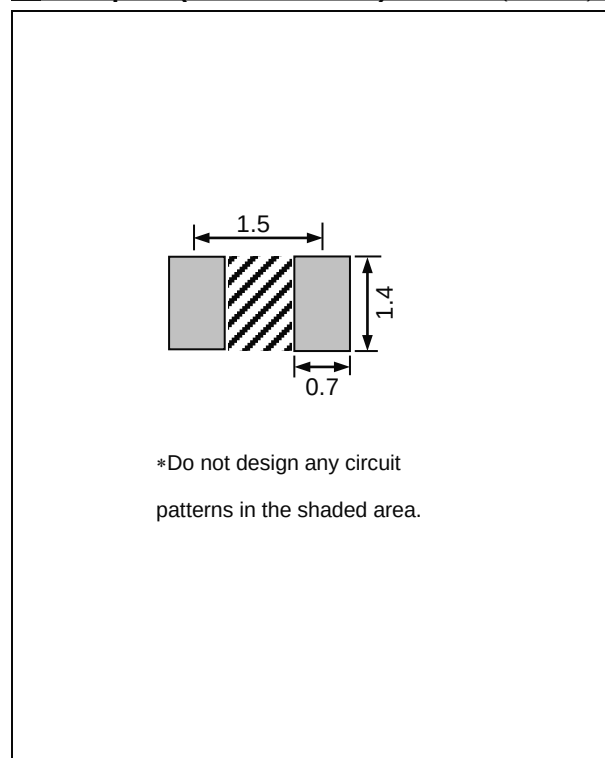
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





kHz RANGE CRYSTAL UNIT

FC3215AN

Low ESR 50 kΩ Max.



Product Number
FC3215AN: X1A000161xxxx16

- Frequency range : 32.768 kHz
- External dimensions : 3.2 x 1.5 x 0.9 mm
- Overtone order : Fundamental
- Applications : IoT Devices, Modules, etc.



Specifications (characteristics)

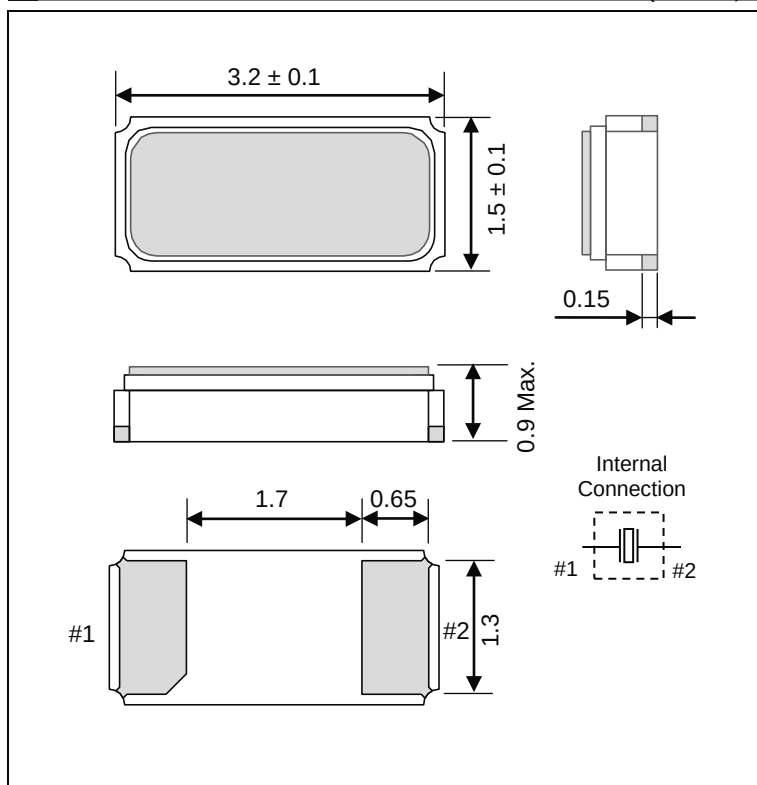
Item	Symbol	Specifications	Conditions / Remarks
Nominal frequency range	f_nom	32.768 kHz	
Storage temperature range	T_stg	-55 °C to +125 °C	Storage as single product.
Operating temperature range	T_use	-40 °C to +105 °C	
Level of drive	DL	0.5 μW Max.	
Frequency tolerance (standard)	f_tol	±20 x 10 ⁻⁶	+25 °C, DL = 0.1 μW
Turnover temperature	Ti	+25 °C ± 5 °C	
Parabolic coefficient	B	-0.04 x 10 ⁻⁶ / °C ² Max.	
Load capacitance	CL	9 pF, 12.5 pF	Contact us for other CL values
Motional resistance (ESR)	R1	35 kΩ Typ..	+25 °C,
		50 kΩ Max.	-40 °C to +85 °C
		60 kΩ Max.	-40 °C to +105 °C
Motional capacitance	C1	8.4 fF Typ.	
Shunt capacitance	C0	1.6 pF Typ.	
Frequency aging	f_age	±3 x 10 ⁻⁶ / year Max.	+25 °C, First year

Product name

Product name FC3215AN 32.768000kHz 12.5 +20.0-20.0
 (Standard form) ① ② ③ ④
 ①Model ②Frequency ③Load capacitance (pF) ④Frequency tolerance (× 10⁻⁶, +25 °C)

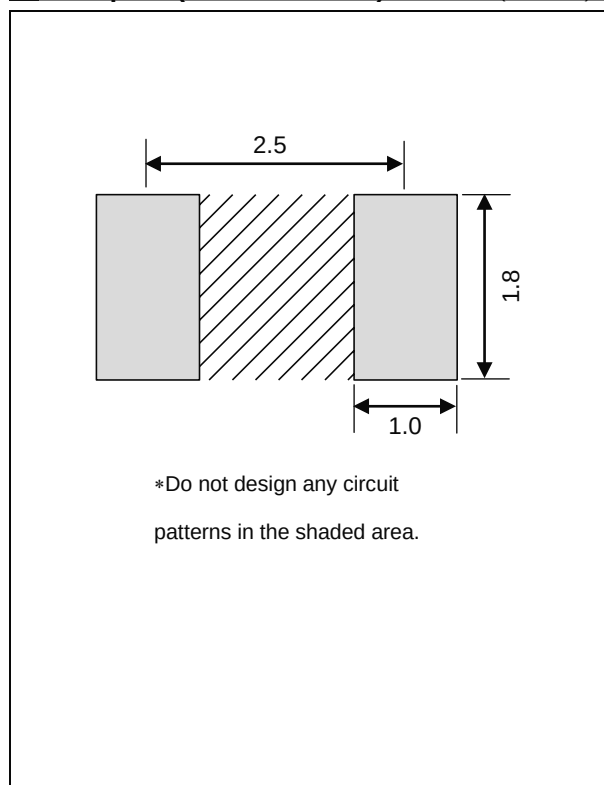
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





kHz RANGE CRYSTAL UNIT



Product Number

FC-135R : X1A000141xxxx00

FC-135 : Q13FC1350xxxx00

FC-135 TYPE : Q14FC1350xxxx00

FC-135R

FC-135 / FC-135 TYPE

- Frequency range : FC-135R / FC-135...32.768 kHz
: FC-135 TYPE...32 kHz to 77.5 kHz
- External dimensions : 3.2 × 1.5 × 0.80 mm
- Overtone order : Fundamental
- Applications : Small communications devices

**Specifications (characteristics)**

Item	Symbol	Specifications			Conditions / Remarks
		FC-135R	FC-135	FC-135 TYPE	
Nominal frequency range	f_nom	32.768 kHz	32.768 kHz	32 kHz to 77.5 kHz	Please contact us about available frequencies.
Storage temperature range	T_stg	-55 °C to +125 °C			Storage as single product.
Operating temperature range	T_use	-40 °C to +85 °C (+105 °C)			Please contact us about +85 °C < T_use
Level of drive	DL	0.5 μW (1.0 μW Max.)			Please contact us if you require 1.0 μW Max.
Frequency tolerance (standard)	f_tol	±20 × 10 ⁻⁶			+25 °C, DL=0.1 μW Please ask for tighter tolerance
Turnover temperature	Ti	+25 °C ±5 °C			
Parabolic coefficient	B	-0.04 × 10 ⁻⁶ / °C ² Max.			
Load capacitance	CL	7 pF, 9 pF, 12.5 pF			Please specify
Motional resistance (ESR)	R1	50 kΩ Max.	70 kΩ Max.	70 kΩ to 45 kΩ	
Motional capacitance	C1	3.4 fF Typ.	3.4 fF Typ.	3.7 fF to 1.6 fF	
Shunt capacitance	C0	1.0 pF Typ.	1.0 pF Typ.	1.3 pF to 0.5 pF	
Frequency aging	f_age	±3 × 10 ⁻⁶ / year Max.			+25 °C, First year

Product nameProduct name FC-135R 32.768000kHz 12.5 +20.0-20.0

(Standard form)

①

②

③

④

①Model

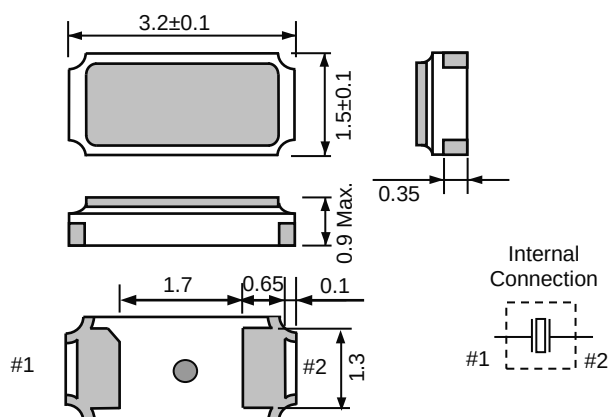
②Frequency

③Load capacitance (pF)

④Frequency tolerance (× 10⁻⁶, +25 °C)**External dimensions**

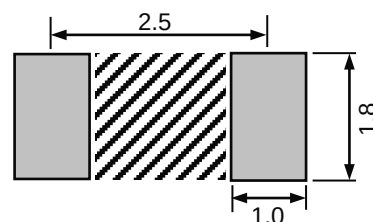
(Unit:mm)

FC-135R / FC-135

**Footprint (Recommended)**

(Unit:mm)

FC-135R / FC-135



*Do not design any circuit patterns in the shaded area.



Product Number
SG-3031CM : X1B000391000116

CRYSTAL OSCILLATOR (SPXO)

32.768 kHz

SG-3031CM



- Built-in 32.768 kHz crystal unit allows adjustment-free efficient operation.
- Operation temperature -40 °C to +105 °C
- Use of CMOS IC enables reduction of current consumption.
- V_{IO} controls swing amplitude.

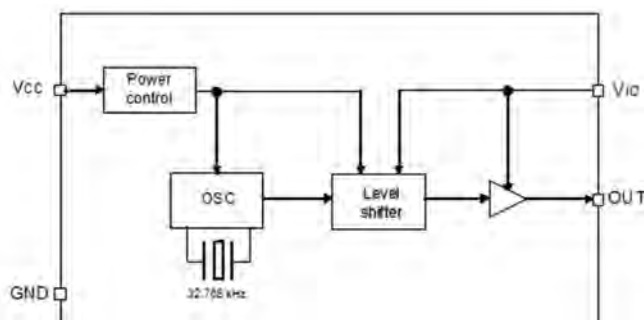
- Applications
Industrial, Security, Smart Meter,
Clock for Time counting and Sleep function

Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Output frequency range	f_o	32.768 kHz	
Supply voltage	V_{CC}	1.2 V to 5.5 V	$V_{CC} < 1.5$ V, $V_{IO} = V_{CC}$
Interface power supply voltage	V_{IO}	1.2 V to 5.5 V	
Storage temperature range	T_{stg}	-55 °C to +125 °C	Store as bare product after unpacking
Operating temperature range	T_{use}	-40 °C to +105 °C	
Frequency tolerance	f_{tol}	$+5 \pm 23 \times 10^{-6}$	+25 °C, $V_{CC} = 3.3$ V
Frequency temperature coefficient	f_o -Tc	-120×10^{-6} to $+10 \times 10^{-6}$	-20 °C to +70 °C ($V_{CC} = 3.3$ V, +25 °C is reference)
		-240×10^{-6} to $+10 \times 10^{-6}$	-40 °C to +85 °C ($V_{CC} = 3.3$ V, +25 °C is reference)
		-420×10^{-6} to $+10 \times 10^{-6}$	-40 °C to +105 °C ($V_{CC} = 3.3$ V, +25 °C is reference)
Frequency voltage coefficient	f_o - V_{CC}	$\pm 1 \times 10^{-6}$ / V Max.	$V_{CC} = 1.5$ V to 5.5 V
		$\pm 5 \times 10^{-6}$ / V Max.	$V_{CC} = 1.2$ V to 1.5 V
Current consumption (V_{CC} Pin)	I_{CC}	0.30 μ A Typ. / 0.65 μ A Max.	$V_{CC} = 1.2$ V to 5.5 V
Current consumption (V_{CC} + V_{IO} Pin)	$I_{CC}+I_{IO}$	0.38 μ A Typ.	$V_{CC} = V_{IO} = 1.2$ V, No load condition
		0.65 μ A Typ. / 1.3 μ A Max. (+105 °C)	$V_{CC} = V_{IO} = 3.3$ V, No load condition
Symmetry	SYM	45 % to 55 %	1/2 $V_{CC}(V_{IO})$ level, 1.5 V to 5.5 V
		40 % to 60 %	1/2 $V_{CC}(V_{IO})$ level, $V_{CC} < 1.5$ V
Output voltage	V_{OH} / V_{OL}	$V_{IO} - 0.4$ V Min. / 0.4 V Max.	$I_{OH} = -0.4$ mA / $I_{OL} = 0.4$ mA, $V_{IO} = 1.5$ V to 5.5 V
		$V_{IO} - 0.2$ V Min. / 0.2 V Max.	$I_{OH} = -0.1$ mA / $I_{OL} = 0.1$ mA, $V_{IO} = 1.2$ V to 1.5 V
Output load condition (CMOS)	L_{CMOS}	15 pF Max.	CMOS load
Rise time / Fall time	t_r/t_f	200 ns Max.	20 % V_{IO} to 80 % V_{IO} level, $V_{IO} = 1.2$ V to 5.5 V
		100 ns Max.	20 % V_{IO} to 80 % V_{IO} level, $V_{IO} = 1.8$ V to 5.5 V
Start-up time	t_{str}	0.15 s Typ. / 0.45 s Max.	$V_{CC} = 1.5$ V to 5.5 V
		1.0 s Max.	$V_{CC} = 1.2$ V to 1.5 V
Frequency aging	f_{age}	$\pm 5 \times 10^{-6}$ / 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.

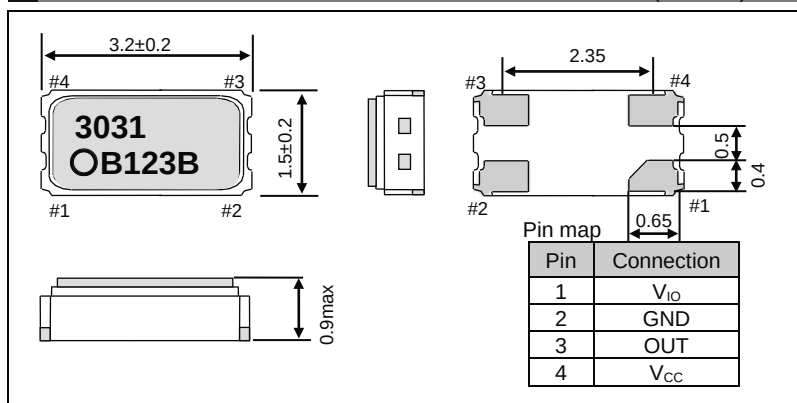
Block diagram



V_{IO} is a power supply pin for OUT output and can also be used as an OE pin. Set V_{IO} to 0 V when setting Disable.
 V_{CC} is a power supply pin for operating the 32.768 kHz oscillation.
 Power consumption can be minimized by minimizing the applied voltage of both power supplies.
 However, when $V_{CC} < 1.5$ V, $V_{IO} = V_{CC}$.

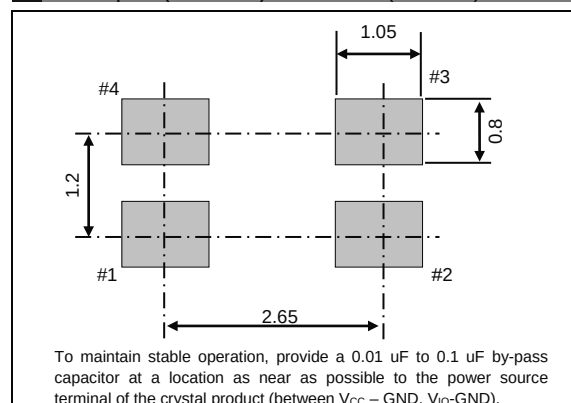
External dimension

(Unit:mm)



Footprint(ference)

(Unit:mm)



TCXO

TG-3541CE



Product Number
TG-3541CE XA: X1B000351000100
TG-3541CE XB: X1B000351000200

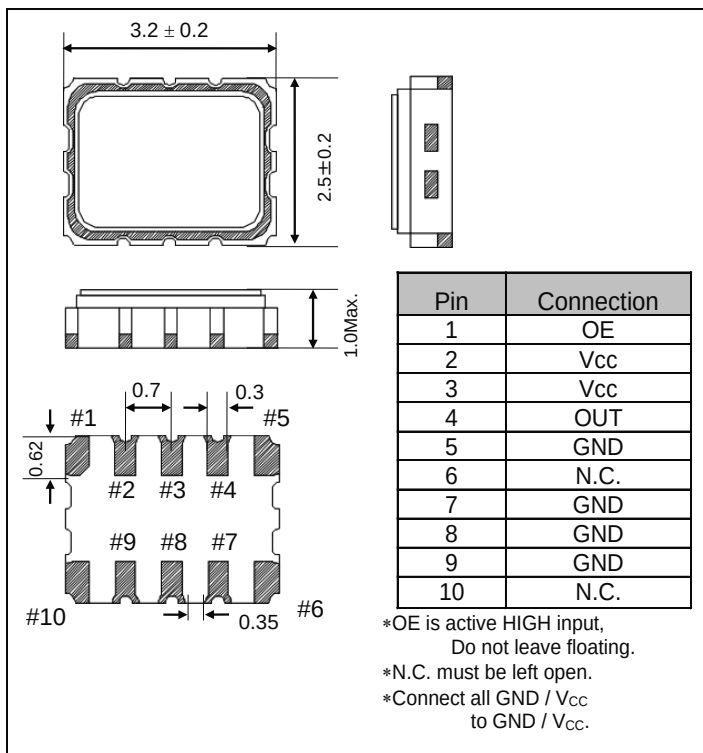


- Output frequency : 32.768 kHz
- Built-in 32.768 kHz-DTCXO
- Supply voltage : 1.5 V to 5.5 V
- Frequency tolerance :
 - XA $\pm 1.9 \times 10^{-6}$ (0 °C to +50 °C)
 - $\pm 3.4 \times 10^{-6}$ (-40 °C to +85 °C)
 - $\pm 8.0 \times 10^{-6}$ (+85 °C to +105 °C)
 - XB $\pm 3.8 \times 10^{-6}$ (0 °C to +50 °C)
 - $\pm 5.0 \times 10^{-6}$ (-40 °C to +85 °C)
 - $\pm 8.0 \times 10^{-6}$ (+85 °C to +105 °C)

Specifications (characteristics)

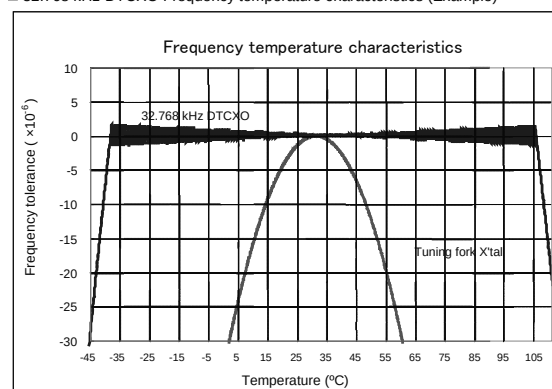
Item	Symbol	Specifications	Conditions
Output frequency range	fo	32.768 kHz	
Supply voltage	V _{CC}	1.5 V to 5.5 V	
Storage temperature	T _{stg}	-55 °C to +125 °C	
Operating temperature	T _{use}	-40 °C to +105 °C	
Frequency / Temperature Characteristics	fo_Tc	XA	$\pm 1.9 \times 10^{-6}$ Ta = 0 °C ~ +50 °C
			$\pm 3.4 \times 10^{-6}$ Ta = -40 °C ~ +85 °C
			$\pm 8.0 \times 10^{-6}$ Ta = +85 °C ~ +105 °C
	fo_Tc	XB	$\pm 3.8 \times 10^{-6}$ Ta = 0 °C ~ +50 °C
			$\pm 5.0 \times 10^{-6}$ Ta = -40 °C ~ +85 °C
			$\pm 8.0 \times 10^{-6}$ Ta = +85 °C ~ +105 °C
Current consumption	I _{CC}	1.0 μ A Typ./3.0 μ A Max.	No load condition, V _{CC} = 3.0 V
Disable current	I _{dis}	1.5 μ A Max.	OE=GND, V _{CC} = 3.0 V
Symmetry	SYM	40 % to 60 %	50 % V _{CC} level
Output voltage	V _{OH}	80 % V _{CC} Min.	IOH=-0.5 mA, V _{CC} =3.0 V
	V _{OL}	20% V _{CC} Max.	IOL=0.5 mA, V _{CC} =3.0 V
Output load condition(CMOS)	L _{CMOS}	30 pF Max.	
Start-up time	t _{str}	1 s Max.	Ta= +25 °C, V _{CC} =1.5 V to 5.5 V
Frequency aging	f _{aging}	$\pm 3 \times 10^{-6}$	Ta= +25°C, V _{CC} =3.0 V, first year

External dimensions (Unit:mm)



Frequency temperature characteristics

■ 32.768 kHz-DTCXO Frequency temperature characteristics (Example)

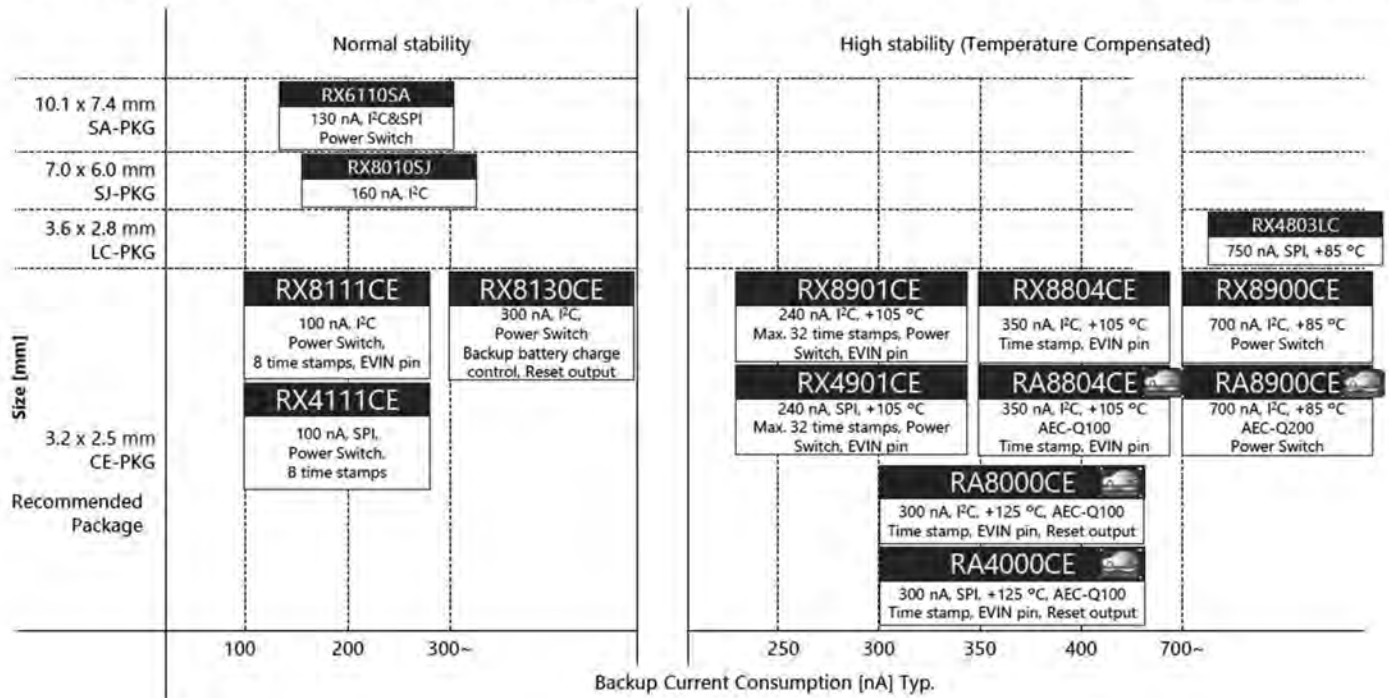


Real Time Clock modules (RTC modules)

Epson's crystal integrated RTC modules offer variety of features such as lower power, accurate clock/date information, Wake-up Timer, Power Switch, and Time-Stamp function. This will help your system lower power with multi-functionality.

Features

- Our lower power design enables our RTC modules to store abnormality on system and time errors even when the main MCU is not in operation
- Tuning Fork Crystal unit and DTCXO (Some products only) integrated RTC modules can assure and manage time information with higher accuracy



Features and Functions

Category	Summary	Use case recommendations, etc
Frequency Tolerance	The variance based on 32.768 kHz under the operating temperature on the integrated crystal inside. For an RTC module, $\pm 23 \times 10^{-6}$ approximately equals to 1 minute per month. Crystal unit inside has a quadratic curve whose peak temperature stays at a room temperature. Therefore, time accuracy varies depending on the external temperature. Epson also offers temperature compensated RTC modules whose clock accuracy has been already adjusted within the operating temperature. (DTCXO)	Temperature compensated models are suitable when.. -your system will be installed outside or a hotter place where the temperature may change drastically. -your system needs time accuracy with a standalone condition (Best accuracy option: $\pm 3.4 \times 10^{-6} \div 9$ seconds per month)
Backup current consumption	Consumption value when RTC module is individually in operation, whereas the system's main MCU is on sleep mode. "Max." shows the maximum value within the operating temperature (Ta).	Lower power RTC modules are suitable for - your system that operates with a battery. - your system that goes to sleep-mode for a long period Our low power RTC modules can manage time information or system behavior for a long term.
Time-Stamp function	This stores the time data when an event occurs. Time-stamp functions followed by several triggers. For products with EVIN pin, triggers interlock with EVIN pin inputs. For products without EVIN pin, triggers interlock with RTC module's internal operation or Bus access.	RTC modules with time-stamp are suitable for applications such as - anti-tampering for smart meters or security systems - abnormality detection for factory automation
Power Switch	This monitors the main power condition, and this will automatically change the power source to back-up mode when the voltage on the main power reduces. Please refer to application manuals for details since functions vary depending on each product.	By simplifying Diode-OR circuit, it will help reduce a leak current, as well as utilize an engineering resource and PCB area.

3.2 x 2.5 x 1.0t (CE package) Recommendation package

P	Model	Interface	Specifications								Functions					
			Operating temperature Ta [°C]		Frequency Tolerance [x 10 ⁻⁶]				Backup current consumption [μA] 3.0V							
			Min.	Max.	+25 °C	-40 °C to +85 °C	+85 °C to +105 °C	+105 °C to +125 °C	Typ. (25 °C)	Max. (Ta = Max.)	Time Stamp	Power Switch	EVIN pin	User Memory	Timer	Others
19	RX8901CE	I ² C	-40	+105	-	±3.0 ±5.0	±5.0 ±8.0	-	0.24	1.5	Max.32	✓	2 or 3	256 bit	24 bit x 1 ch. to 32 years	
21	RX4901CE	SPI	-40	+105	-	±3.0 ±5.0	±5.0 ±8.0	-	0.24	1.5	Max.32	✓	0 to 2	256 bit	24 bit x 1 ch. to 32 years	
115	RA8000CE (AEC-Q100)	I ² C	-40	+125	-	±5.0	±8.0	±50.0	0.3	1.7	2	-	0 or 2	-	24 bit x 1 ch. to 32 years	Reset output with Delay, SOUT pin
117	RA4000CE (AEC-Q100)	SPI	-40	+125	-	±5.0	±8.0	±50.0	0.3	1.7	2	-	0 to 2	-	24 bit x 1 ch. to 32 years	Reset output with Delay, SOUT pin

3.2 x 2.5 x 1.0t (CE package) Recommendation package

P	Model	Interface	Specifications								Functions					
			Operating temperature Ta [°C]		Frequency Tolerance [x 10 ⁻⁶]				Backup current consumption [μA] 3.0V							
			Min.	Max.	+25 °C	-40 °C to +85 °C	+85°C to +105°C	+105°C to +125°C	Typ. (25 °C)	Max. (Ta = Max.)	Time Stamp	Power Switch	EVIN pin	User Memory	Timer	Others
23	RX8111CE	I ² C	-40	+85	±11.5 ±23.0	-	-	-	0.1	0.45	8	✓	1	512 bit	24 bit x 1 ch. to 32 years	
24	RX4111CE	SPI	-40	+85			-	-	0.1	0.45	8	✓	-	512 bit	24 bit x 1 ch. to 32 years	
25	RX8804CE	I ² C	-40	+105	-	±3.4 ±5.0	±8.0	-	0.35	1.5	1	-	1	-	16 bit x 1ch. to 7.5 years	SOUT pin
26	RX8130CE	I ² C	-40	+85	5±23	-	-	-	0.3	0.5	-	✓	-	-	16 bit x 1 ch. to 7.5 years	Backup battery charge control, Reset output with Delay
27	RX8900CE	I ² C	-40	+85	-	±3.4 ±5.0	-	-	0.7	1.4	-	✓	-	-	12 bit x 1ch. to 2.8 days	Built-in Temp. Sensor
119	RA8804CE (AEC-Q100)	I ² C	-40	+105	-		±8.0	-	0.35	1.5	1	-	1	-	16 bit x 1ch. to 7.5 years	SOUT pin
120	RA8900CE (AEC-Q200)	I ² C	-40	+85	-		-	-	0.7	1.4	-	✓	-	-	12 bit x 1ch. to 2.8 days	Built-in Temp. Sensor

3.6 x 2.8 x 1.2t (LC package / VSOJ-12 pin)

P	Model	Interface	Specifications							Functions						
			Operating temperature Ta [°C]		Frequency Tolerance [x 10 ⁻⁶]			Backup current consumption [μA] 3.0 V								
			Min.	Max.	+25 °C	-40 °C to +85 °C	-40 °C to +105 °C	Typ. (25 °C)	Max. (Ta = Max.)	Time Stamp	Power Switch	EVIN pin	User Memory	Timer	Others	
28	RX-8803LC	I ² C	-40	+85	-	±3.4	-	0.75	2.1	-	-	1	-	to 2.8 days	Time sync. with 1 PPS	
29	RX-4803LC	SPI			±5.0	0.75		2.1	-	-	1	-	to 2.8 days	Time sync. with 1 PPS		
30	RX-8035LC	I ² C			5±23 5±5 0±5	0.4		1.2	1	✓	1	-	-			
31	RX-4035LC	SPI			5±23 5±5 0±5	0.4		1.2			1	-	-			
32	RX-8731LC	I ² C			5±23	-		-	0.35	1.4	-	-	-	EEPROM: 80 bit ID-ROM: 48 bit	to 2.8 days	
33	RX-8571LC	I ² C				0.22			0.4	-	-	-	128 bit	to 7.5 years	DAS pin	
34	RX-4571LC	SPI				0.32			0.95	-	-	-	-	to 2.8 days		
35	RX-8564LC	I ² C				0.275			0.7	-	-	-	-	to 255 min.		

6.3 x 5.2 x 1.4t (NB package / SON-22 pin)

P	Model	Interface	Specifications							Functions					
			Operating temperature Ta [°C]		Frequency Tolerance [x 10 ⁻⁶]			Backup current consumption [μA] 3.0 V							
			Min.	Max.	+25 °C	-40 °C to +85 °C	-40 °C to +105 °C	Typ. (25 °C)	Max. (Ta = Max.)	Time Stamp	Power Switch	EVIN pin	User Memory	Timer	Others
Web Site	RX-8025NB	I ² C	-40	+85	5±5	-	-	0.48	1.2	-	-	-	-	-	
	RX-4045NB	SPI			0±5			0.48	1.2	-	-	-	-	-	
	RX-8571NB	I ² C			5±23			0.2	0.4	-	-	-	128 bit	to 7.5 years	DAS pin
	RX-4571NB	SPI						0.32	0.95	-	-	-	-	to 2.8 days	

7.0 x 6.0 x 2.65t (SJ package / SOP-8 pin)

P	Model	Interface	Specifications								Functions					
			Operating temperature Ta [°C]		Frequency Tolerance [x 10 ⁻⁶]			Backup current consumption [μA] 3.0 V								
			Min.	Max.	+25 °C	-40 °C to +85 °C	-40 °C to +105 °C	Typ. (25 °C)	Max. (Ta = Max.)	Time Stamp	Power Switch	EVIN pin	User Memory	Timer	Others	
36	RX8010SJ	I ² C	-40	+85	5±23	-	-	0.16	0.32	-	-	-	128 bit	to 7.5 years	Common pin connection with SOP-8	

10.1 x 7.4 x 3.3t (SA package / SOP-14 pin)

P	Model	Interface	Specifications							Functions					
			Operating temperature Ta [°C]		Frequency Tolerance [x 10 ⁻⁶]			Backup current consumption [μA] 3.0 V							
			Min.	Max.	+25 °C	-40 °C to +85 °C	-40 °C to +105 °C	Typ. (25 °C)	Max. (Ta = Max.)	Time Stamp	Power Switch	EVIN pin	User Memory	Timer	Others
37	RX6110SA	SPI & I ² C	-40	+85	5±23	-	-	0.16	0.32	-	✓	-	128 bit	to 7.5 years	
27	RX8900SA	I ² C			-	±3.4 ±5.0		0.7	1.4	-	✓	-	-	to 2.8 days	Built-in Temp. Sensor
28	RX-8803SA	I ² C						0.75	2.1	-	1	to 2.8 days	Time sync. with 1 PPS		
29	RX-4803SA	SPI						0.75	2.1	-	1	to 2.8 days	Time sync. with 1 PPS		
30	RX-8035SA	I ² C			5±23 5±5 0±5	-		0.35	1.2	1	✓	2	-	-	
31	RX-4035SA	SPI			5±5 0±5			0.35	1.2	1	✓	2	-	-	
38	RX-8025SA	I ² C						0.48	1.2	-	-	-	-	-	
39	RX-4045SA	SPI						0.48	1.2	-	-	-	-	-	
33	RX-8571SA	I ² C			5±23			0.2	0.4	-	-	-	128 bit	to 7.5 years	DAS pin
34	RX-4571SA	SPI			-	±3.4 ±5.0		0.32	0.95	-	-	-	-	to 2.8 days	
Web site	RA8803SA (AEC-Q200)	I ² C						0.75	2.1	-	-	1	-	to 2.8 days	Time sync. with 1 PPS
Web site	RA4803SA (AEC-Q200)	SPI						0.75	2.1	-	-	1	-	to 2.8 days	Time sync. with 1 PPS
Web site	RA-4565SA (AEC-Q200)	SPI			5±23			0.8	1.6	-	-	-	-	to 255 min.	

**REAL TIME CLOCK MODULE (I²C-Bus)**

Built-in 32.768 kHz-DTCXO, +105°C operating temperature,
Low current consumption, Built-in power supply switching circuit and
Time stamp function up to 32 records

RX8901CE

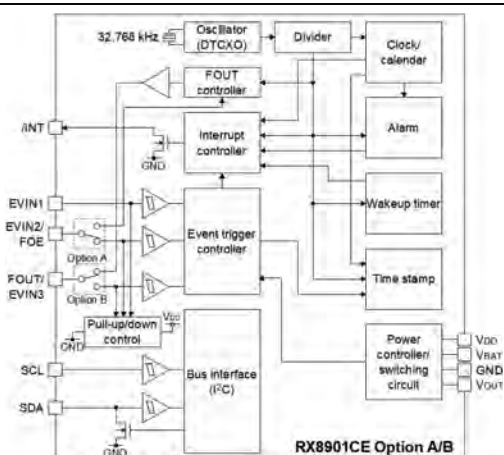
- Built in frequency adjusted 32.768 kHz crystal unit and DTCXO
- Interface Type : I²C-Bus
- Current consumption : 240 nA / 3 V (Typ.)
- Auto power switching function : Automatically switches to backup power supply by monitoring the V_{DD} / V_{BAT} voltage
- Time stamp function : Maximum 32 time stamps
- Interrupt output : Wake up every hour or every minute or every second
- Alarm interruption : Day, date, hour, minute, second
- Auto repeat wakeup timer interruption
- Self-monitoring interruption : Crystal oscillation stop, V_{BAT} low, V_{DD} low



Product Number (2,000 pcs / Reel)
RX8901CE XS A0 : X1B000481000115
RX8901CE XB A0 : X1B000481000215
RX8901CE XS B0 : X1B000481000315
RX8901CE XB B0 : X1B000481000415



RX8901CE
 (3.2 × 2.5 mm, t = 1.0 mm Max.)

Block diagram**Overview**

- Interface type
I²C-Bus interface Fast-Mode 400 kHz
- High stability
 XS : $\pm 3.0 \times 10^{-6}$ / -40 °C to +85 °C (Monthly rate: ± 8 seconds)
 $\pm 5.0 \times 10^{-6}$ / +85 °C to +105 °C (Monthly rate: ± 13.2 seconds)
 XB : $\pm 5.0 \times 10^{-6}$ / -40 °C to +85 °C (Monthly rate: ± 13.2 seconds)
 $\pm 8.0 \times 10^{-6}$ / +85 °C to +105 °C (Monthly rate: ± 21 seconds)
- Time stamp function
 Trigger source: External event (EVIN) input, voltage drop/oscillation stop status detected, command input from the host
 Record data: 1/1024 seconds to 1 second, seconds, minutes, hours, days, months, years
 Number of recordable events: Maximum 32 events
- Backup power supply switching function
 The V_{DD} and V_{BAT} voltages are monitored to switch between Normal mode (V_{DD} operation) and Backup mode (V_{BAT} operation).
- Clock output (FOUT)
 Selectable from 32.768 kHz, 1024 Hz and 1 Hz outputs
 Output can be controlled by a register or FOE input (selectable with a register).

Pin Function

Signal Name	I / O	Function
EVIN1,2,3	Input	External event input pins. Detectable even in Backup mode. Pull-up and pull-down is configurable by the resistors
SCL	Input	Serial clock input pin
SDA	Input / Output	Serial data input and output pin
FOUT	Output	Frequency output pin (CMOS). 32.768 kHz (default), 1024 Hz or 1 Hz clock output is selectable. This pin can be switched to the wakeup timer interrupt output (CMOS)
/INT	Output	Interrupt output pin (N-ch. open drain). The wakeup timer, time update, alarm, and/or event detection interrupt signals can be selected to output from this pin. When two or more signals are selected, they are NORed before being output. This pin is effective even in Backup mode.
VDD	-	Power-supply pin
VOUT	-	Internal operating voltage output pin Connect a 1 μ F bypass capacitor to this pin
VBAT	-	Backup power supply pin Connect a backup power supply such as a large-size capacitor, secondary battery, or primary battery. The operating power voltage is supplied from this pin to the internal circuits in Backup mode.
GND	-	Ground pin

Terminal connection / External dimensions (Unit: mm)

		Connection	
		Option A	Option B
	1	VDD	
	2	VOUT	
	3	VBAT	
	4	FOUT	EVIN3
	5	SCL	
	6	EVIN1	
	7	SDA	
	8	/INT	
	9	GND	
	10	EVIN2	

Specifications (characteristics)

* Refer to application manual for details

Recommended Operating Conditions

Item	Symbol	Condition	Min.	Typ.	Max.	unit
Operating voltage	V _{DD}	-	1.6	3.0	5.5	V
Clock supply voltage	V _{CLK}	-	1.1	3.0	5.5	V
Operating Temperature	T _a	-	-40	+25	+105	°C
VDD detection voltage	-VDET1	VDD, Fall	1.35	1.45	1.55	V

Frequency Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	unit
Frequency tolerance	$\Delta f/f$	XS	T _a = -40 to +85 °C	-3	-	+3
			T _a = +85 to +105 °C	-5	-	+5
		XB	T _a = -40 to +85 °C	-5	-	+5
			T _a = +85 to +105 °C	-8	-	+8
start-up time	t _{STA}	T _a = +25 °C, VDD = 1.6 V ~ 5.5 V	-	0.5	1.0	s

Current consumption

Item	Symbol	Condition	Min.	Typ.	Max.	unit
IDD	IBAT	VBAT = 3.0 V, /INT= Hi-Z, FOUT: Output OFF (Hi-Z), Temperature compensation interval: 2 s, FSEL1= FSEL0 = 1, INIEN = 1, CHGEN = 0, SCL = SDA = L	-	240	1500	nA
	I32k	VDD = 3.0 V, /INT= Hi-Z, FOUT: 32 kHz output, CL = 0 pF, Temperature compensation interval: 2 s, FSEL1 = FSEL0 = 1, INIEN = 1, CHGEN = 0, SCL = SDA = H	-	1.0	3.0	μA

Option

I/F	Option	EVIN pin Number	/INT pin Number	FOUT	Number of time stamps recorded by EVIN pin trigger	
					FIFO Mode	Direct Mode
I ² C	A	2	1	Yes	32 times	22 times
	B	3	1	-	32times	32 times



Product name

RX8901CE XS A0
① ② ③

① Model CE type package 3.2 x 2.5 x 1.0 mm

② Frequency tolerance

XS: $\pm 3.0 \times 10^{-6}$ / -40 °C to +85 °C (Monthly rate: ± 8 seconds)

$\pm 5.0 \times 10^{-6}$ / +85 °C to +105 °C (Monthly rate: ± 13.2 seconds)

XB: $\pm 5.0 \times 10^{-6}$ / -40 °C to +85 °C (Monthly rate: ± 13.2 seconds)

$\pm 8.0 \times 10^{-6}$ / +85 °C to +105 °C (Monthly rate: ± 21 seconds)

③ Pin Option

A: Option A

B: Option B

**REAL TIME CLOCK MODULE (SPI-Bus)**

Built-in 32.768 kHz-DTCXO, +105°C operating temperature,
Low current consumption, Built-in power supply switching circuit and
Time stamp function up to 32 records

RX4901CE

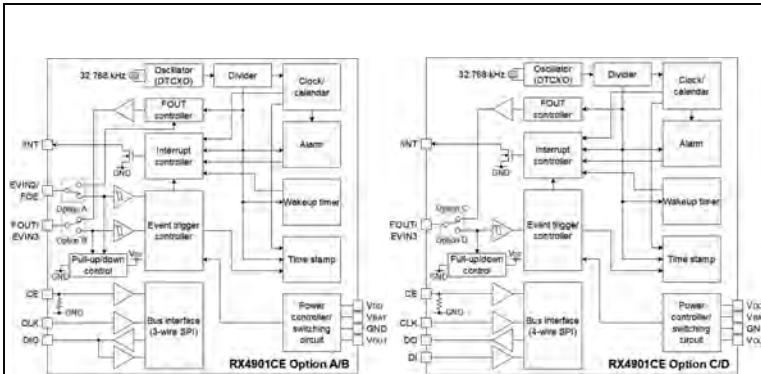
- Built in frequency adjusted 32.768 kHz crystal unit and DTCXO
- Interface Type : 3 wire / 4 wire SPI-Bus
- Current consumption : 240 nA / 3 V (Typ.)
- Auto power switching function : Automatically switches to backup power supply by monitoring the V_{DD} / V_{BAT} voltage
- Time stamp function : Maximum 32 time stamps
- Interrupt output : Wake up every hour or every minute or every second
- Alarm interruption : Day, date, hour, minute, second
- Auto repeat wakeup timer interruption
- Self-monitoring interruption : Crystal oscillation stop, V_{BAT} low, V_{DD} low



Product Number (2,000 pcs / Reel)
RX4901CE XS A0 : X1B000471000115
RX4901CE XB A0 : X1B000471000215
RX4901CE XS B0 : X1B000471000315
RX4901CE XB B0 : X1B000471000415
RX4901CE XS C0 : X1B000471000515
RX4901CE XB C0 : X1B000471000615
RX4901CE XS D0 : X1B000471000715
RX4901CE XB D0 : X1B000471000815

**RX4901CE**

(3.2 × 2.5 mm, t = 1.0 mm Max.)

Block diagram**Overview**

- Interface type : 3 wire / 4 wire SPI-Bus
- High stability
 XS : $\pm 3.0 \times 10^{-6}$ / -40 °C to +85 °C (Monthly rate: ± 8 seconds)
 : $\pm 5.0 \times 10^{-6}$ / +85 °C to +105 °C (Monthly rate: ± 13.2 seconds)
 XB : $\pm 5.0 \times 10^{-6}$ / -40 °C to +85 °C (Monthly rate: ± 13.2 seconds)
 : $\pm 8.0 \times 10^{-6}$ / +85 °C to +105 °C (Monthly rate: ± 21 seconds)
- Time stamp function
 Trigger source: External event (EVIN) input, voltage drop/oscillation stop status detected, command input from the host
 Record data: 1/1024 seconds to 1 second, seconds, minutes, hours, days, months, years
 Number of recordable events: Maximum 32 events
- Backup power supply switching function
 The V_{DD} and V_{BAT} voltages are monitored to switch between Normal mode (V_{DD} operation) and Backup mode (V_{BAT} operation).
- Clock output (FOUT)
 Selectable from 32.768 kHz, 1024 Hz and 1 Hz outputs
 Output can be controlled by a register or FOE input (selectable with a register).

Pin Function

Signal Name	I / O	Function
EVIN1,2,3	Input	External event input pins. Detectable even in Backup mode. Pull-up and pull-down is configurable by the registers
CE	Input	Slave select input pin A pull-down resistor (Typ. 300 kΩ) is included
CLK	Input	Serial clock input pin
DI	Input	Serial data input pin (4 wire)
DO	Output	Serial data output pin (4 wire)
DIO	Input / Output	Serial data input/output pin (3 wire)
FOUT	Output	Frequency output pin (CMOS). 32.768 kHz (default), 1024 Hz or 1 Hz clock output is selectable. This pin can be switched to the wakeup timer interrupt output (CMOS)
/INT	Output	Interrupt output pin (N-ch. open drain). The wakeup timer, time update, alarm, and/or event detection interrupt signals can be selected to output from this pin. When two or more signals are selected, they are NORed before being output. This pin is effective even in Backup mode.
V _{DD}	-	Power-supply pin
V _{OUT}	-	Internal operating voltage output pin Connect a 1.0 μF bypass capacitor to this pin.
V _{BAT}	-	Backup power supply pin Connect a backup power supply such as a large-size capacitor, secondary battery, or primary battery. The operating power voltage is supplied from this pin to the internal circuits in Backup mode.
GND	-	Ground pin

Terminal connection / External dimensions (Unit: mm)

RX4901CE

Pin	Connection					
	Opt. A	Opt. B	Opt. C	Opt. D		
	3 wire		4 wire			
1	VDD					
2	VOUT					
3	VBAT					
4	FOUT	EVIN3	FOUT	EVIN3		
5	CLK					
6	CE					
7	DIO		DO			
8	/INT					
9	GND					
10	EVIN2		DI			

Specifications (characteristics)

* Refer to application manual for details

Recommended Operating Conditions

Item	Symbol	Condition	Min.	Typ.	Max.	unit
Operating voltage	V _{DD}	-	1.6	3.0	5.5	V
Clock supply voltage	V _{CLK}	-	1.1	3.0	5.5	V
Operating Temperature	T _a	-	-40	+25	+105	°C
V _{DD} detection voltage	-VDET1	V _{DD} , Fall	1.35	1.45	1.55	V

Frequency Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	unit
Frequency tolerance	$\Delta f/f$	XS	T _a = -40 to +85 °C	-3	-	+3
			T _a = +85 to +105 °C	-5	-	+5
		XB	T _a = -40 to +85 °C	-5	-	+5
			T _a = +85 to +105 °C	-8	-	+8
start-up time	t _{STA}	T _a = +25 °C, V _{DD} = 1.6 V ~ 5.5 V	-	0.5	1.0	s

Current consumptionT_a = -40 °C to +105 °C

Item	Symbol	Condition	Min.	Typ.	Max.	unit
I _{DD}	I _{BAT}	V _{BAT} = 3.0 V, /INT = Hi-Z, FOUT: Output OFF (Hi-Z), Temperature compensation interval: 2 s, FSEL1 = FSEL0 = 1, INIEN = 1, CHGEN = 0, CE = L	-	240	1500	nA
	I _{32k}	V _{DD} = 3.0 V, /INT = Hi-Z, FOUT: 32 kHz output, CL = 0 pF, Temperature compensation interval: 2 s, FSEL1 = FSEL0 = 0, INIEN = 1, CHGEN = 0, CE = L	-	1.0	3.0	μA

Option

I/F	Option	EVIN pin Number	/INT pin Number	FOUT	Number of time stamps recorded by EVIN terminal trigger	
					FIFO Mode	Direct Mode
SPI 3 wire	A	1	1	Yes	32 times	12 times
	B	2	1	-	32 times	22 times
SPI 4 wire	C	0	1	Yes	0 time	0 time
	D	1	1	-	32 times	10 times

**Product name**

RX4901CE XS A0
① ② ③

① Model CE type package 3.2 x 2.5 x 1.0 mm

② Frequency tolerance

XS: $\pm 3.0 \times 10^{-6}$ / -40 °C to +85 °C (Monthly rate: ± 8 seconds)

$\pm 5.0 \times 10^{-6}$ / +85 °C to +105 °C (Monthly rate: ± 13.2 seconds)

XB: $\pm 5.0 \times 10^{-6}$ / -40 °C to +85 °C (Monthly rate: ± 13.2 seconds)

$\pm 8.0 \times 10^{-6}$ / +85 °C to +105 °C (Monthly rate: ± 21 seconds)

③ Pin Option

A: Option A

B: Option B

C: Option C

D: Option D

REAL TIME CLOCK MODULE (I²C-Bus)

Time stamp function and Low current consumption



Product Number (2,000 pcs / Reel)
RX8111CE A : X1B000421000115
RX8111CE B : X1B000421000215

RX8111CE

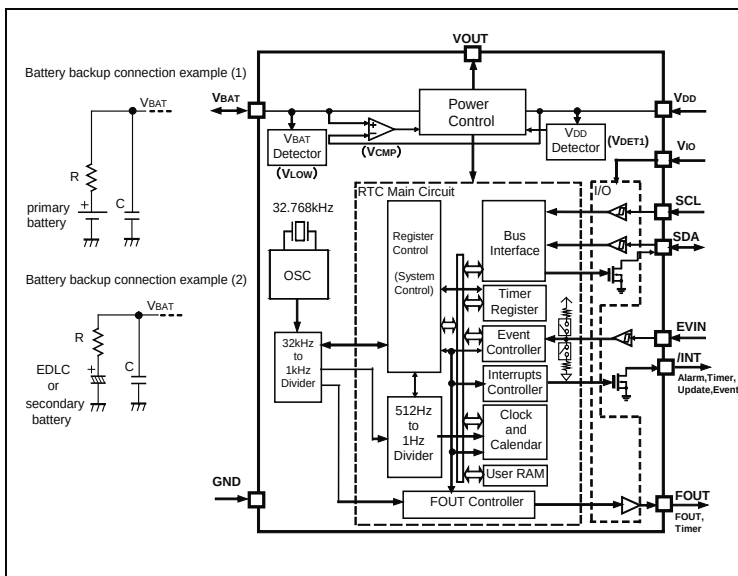
- Built in frequency adjusted 32.768 kHz crystal unit
- Interface Type : I²C -Bus
- Low backup current : 100 nA Typ. / 3 V
- Auto power switching function : Automatically switches to backup power supply by monitoring the V_{DD} voltage
- Time stamp function : 8 times stamped from year to 1/256 seconds
- Interrupt output : Wake up every minute or every second
- Alarm interruption : Day, date, hour, minute, second
- Auto repeat wakeup timer interruption
- Self-monitoring interruption : Crystal oscillation stop, V_{BAT} low, V_{DD} low



RX8111CE

(3.2 x 2.5 mm, t = 1.0 mm Max.)

Block diagram



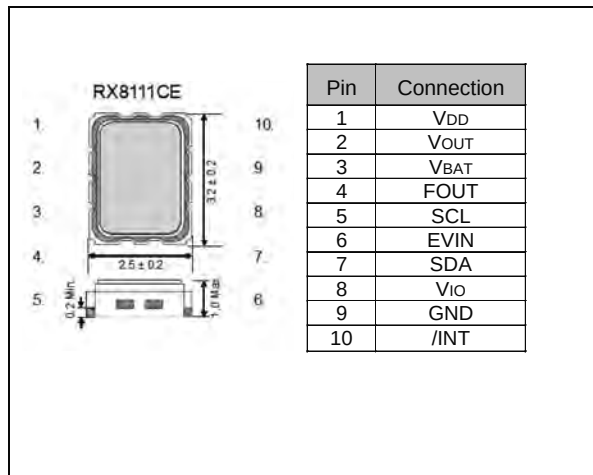
Overview

- Interface type
I²C-Bus interface Fast-Mode 400 kHz
- Auto power switch function
The V_{DD} voltage is monitored and it switches to the backup power supply by the automatic operation
Backup power supply switching voltage 1.2 V Min.
- Clock output function
Output frequency is selectable from 32.768 kHz, 1024 Hz, 1 Hz
When the clock output is not used, the FOUT pin can be used as a timer output pin (CMOS)
- Wakeup timer function
Selectable from 244 μs to 32 years (24 bit x 1 ch.)
Timer source clock selectable from 1/60 Hz, 1 Hz, 64 Hz, 4096 Hz
Auto release after interrupt output from /INT pin at timer completes
This operation is auto repeat with a selected cycle, it can be used like a watchdog timer
- Time stamp function
8 times stamped from year to 1/256 seconds
The time stamp trigger inputs from EVIN pin, self-monitoring and I²C software command
EVIN pin has function of chattering-cancel
- Alarm function
It is possible program from year to second
- Self-monitoring interruption
Crystal oscillation stop, V_{BAT} low, V_{DD} low

Pin Functin

Signal Name	I / O	Function
EVIN	Input	External event input pin (Pull up/down and polarity are selectable by software)
SCL	Input	Serial clock input pin
SDA	Input / Output	Serial data input and output pin
FOUT	Output	Frequency output pin (CMOS) (frequency selection: 32.768 kHz, 1024 Hz, 1 Hz)
/INT	Output	Interrupts output by Alarm and Timer events (N-ch. open drain)
VDD	-	Power-supply pin Possible to supply different voltage from V _{IO}
VIO	-	Interface power supply pin Input to supply the voltage same as a host
VOUT	-	Internal voltage output pin Connect bypass capacitor of 1.0 μF
VBAT	-	This is a power supply pin for backup battery Connect an EDLC, a secondary battery, a primary battery In the backup voltage range, supplied to IC, from this pin
GND	-	Ground pin

Terminal connection / External dimensions (Unit: mm)



Specifications (characteristics)

* Refer to application manual for details

■ Recommended Operating Conditions

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Operating supply voltage	V _{DD}	-	1.6	3.0	5.5	V
Clock supply voltage	V _{CLK}	-	1.1	3.0	5.5	V
Operating temperature	T _a	-	-40	+25	+85	°C
V _{DD} detect voltage	-VDET1	V _{DD} , Fall	1.20	1.40	1.60	V

■ Frequency characteristics

Item	Grade	Symbol	Conditions	Min.	Typ.	Max.	Unit
Frequency tolerance	A	Δ f / f	T _a = +25 °C V _{DD} = 3.0 V	-11.5	-	+11.5	x 10 ⁻⁶
	B			-23	-	+23	
Oscillation start-up time		t _{STA}	V _{DD} = 2.75 V to 5.5 V	-	0.3	1.0	s

■ Current consumption characteristics

T_a = -40 °C to +85 °C

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Current consumption	I _{BAT}	SCL = SDA = "L", FOUT = OFF, /INT = OFF, V _{BAT} = 3.0 V, V _{DD} = V _{IO} = 0.0 V, CHGEN = 0b, INIEN = 0b, SWSEL0 = 1, SWSEL1 = 0	-	100	450	nA
	I _{32k}	FOUT = 32.768 kHz, /INT = OFF, V _{DD} = V _{IO} = 3.0 V, FOUT pin CL = 15 pF	-	2.0	3.0	μA

REAL TIME CLOCK MODULE (SPI-Bus)

Time stamp function and Low current consumption



Product Number (2,000 pcs / Reel)
RX4111CE A : X1B000431000115
RX4111CE B : X1B000431000215

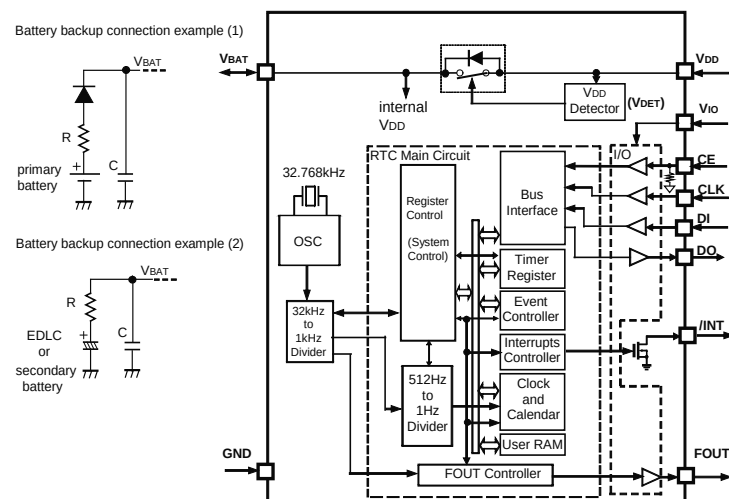
RX4111CE

- Built in frequency adjusted 32.768 kHz crystal unit
- Interface Type : SPI -Bus 4 wire
- Low backup current : 100 nA Typ. / 3 V
- Auto power switching function : Automatically switches to backup power supply by monitoring the V_{DD} voltage.
- Time stamp function : 8 times stamped from year to 1/256 seconds
- Interrupt output : Wake up every minute or every second
- Alarm interruption : Day, date, hour, minute, second
- Auto repeat wakeup timer interruption
- Self-monitoring interruption : Crystal oscillation stop, V_{BAT} low, V_{DD} low



RX4111CE
 (3.2 x 2.5 mm, t = 1.0 mm Max.)

Block diagram



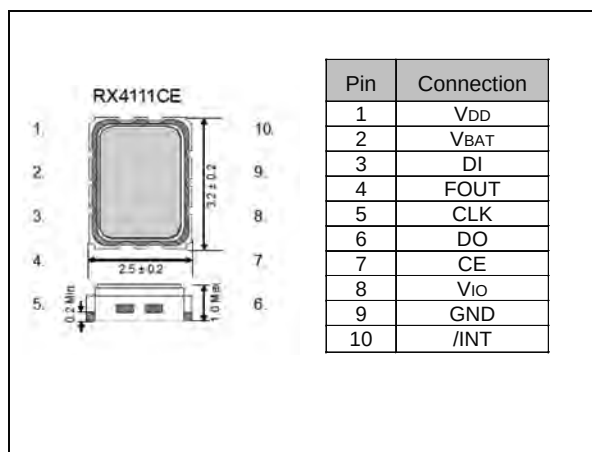
Overview

- Interface type
 SPI-Bus interface (4 wire, 4 MHz Max.)
- Auto power switch function
 The V_{DD} voltage is monitored and it switches to the backup power supply by the automatic operation
 Backup power supply switching voltage 1.2V Min.
- Clock output function
 Output frequency is selectable from 32.768 kHz, 1024 Hz, 1 Hz
 When the clock output is not used, the FOUT pin can be used as a timer output pin (CMOS)
- Wakeup timer function
 Selectable from 244 μs to 32 years (24 bit x 1 ch.)
 Timer source clock selectable from 1/60 Hz, 1 Hz, 64 Hz, 4096 Hz
 Auto release after interrupt output from /INT pin at timer completes
 This operation is auto repeat with a selected cycle, it can be used like a watchdog timer
- Time stamp function
 8 times stamped from year to 1/256 seconds
 The time stamp trigger inputs from self-monitoring and SPI command
- Alarm function
 It is possible program from year to second
- Self-monitoring interruption
 Crystal oscillation stop, V_{BAT} low, V_{DD} low

Pin Functin

Signal Name	I / O	Function
CE	Input	Chip enables input pin
CLK	Input	Serial clock input pin
DI	Input	Serial data input pin
DO	Output	Serial data output pin
FOUT	Output	Frequency output (CMOS) (frequency selection: 32.768 kHz, 1024 Hz, 1 Hz)
/INT	Output	Interrupts output by Alarm and Timer events (N-ch. open drain)
V _{DD}	—	Power supply pin Possible to supply different voltage from V _{IO}
V _{IO}	—	Interface power supply pin Input to supply the voltage same as a host
V _{BAT}	—	Power supply pin for backup battery Connect an EDLC, a secondary battery, a primary battery In the backup voltage range, supplied to IC, from this pin
GND	—	Ground pin

Terminal connection / External dimensions (Unit: mm)



Specifications (characteristics)

* Refer to application manual for details

Recommended Operating Conditions

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Operating supply voltage	V _{DD}	-	1.6	3.0	5.5	V
Clock supply voltage	V _{CLK}	-	1.1	3.0	5.5	V
Operating temperature	T _a	-	-40	+25	+85	°C
V _{DD} detect voltage	-V _{DET1}	V _{DD} , Fall	1.20	1.40	1.60	V

Frequency characteristics

Item	Grade	Symbol	Conditions	Min.	Typ.	Max.	Unit
Frequency tolerance	A	Δf / f	T _a = +25 °C V _{DD} = 3.0 V	-11.5	-	+11.5	x 10 ⁻⁶
	B			-23	-	+23	
Oscillation start-up time		t _{STA}	V _{DD} = 2.75 V to 5.5 V	-	0.3	1.0	s

Current consumption characteristics

T_a = -40 °C to +85 °C

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Current consumption	I _{BAT}	Input pins = "L", FOUT = OFF, /INT = OFF, V _{BAT} = 3.0 V, V _{DD} = V _{IO} = 0.0 V, CHGEN = 0b, INIEN = 0b, SWSEL0 = 1, SWSEL1 = 0	-	100	450	nA
	I _{32k}	Input pins = "L", FOUT = 32.768 kHz, /INT = OFF, V _{DD} = V _{IO} = 3.0 V, FOUT pin CL = 15 pF, CHGEN = 0b, INIEN = 1b	-	2.0	3.0	μA

REAL TIME CLOCK MODULE (I²C-Bus)

Built-in 32.768 kHz DTCXO, High Stability



Product Number (2,000 pcs / Reel)
 RX8804CE XA: X1B000371000100
 RX8804CE XB: X1B000371000200

RX8804CE

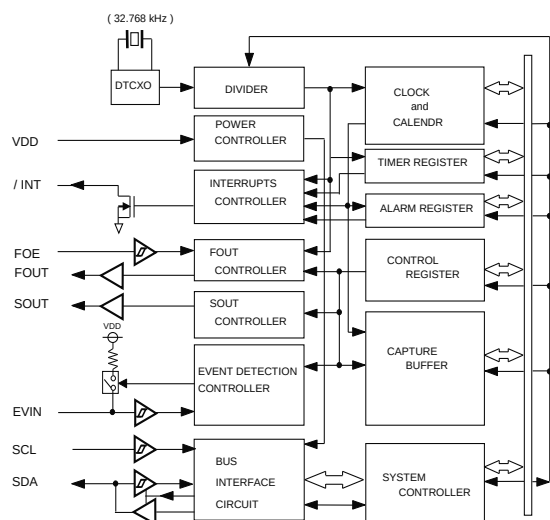
- Built-in frequency adjusted 32.768 kHz crystal unit and DTCXO
- Interface Type : I²C-Bus
- Selectable clock output : 32.768 kHz, 1024 Hz, 1 Hz
- Time stamp function : 1 time stamped from year to second
- Interrupt output : Wake up every minute or every second
- Alarm interruption : Day, date, hour, minute
- Auto repeat wakeup timer interruption
- Self-monitoring interruption : Crystal oscillation stop, V_{BAT} low, V_{DD} low
- SOUT pin outputs that selected flag bit value



RX8804CE

(3.2 × 2.5 mm, t = 1.0 mm Max.)

Block diagram



Overview

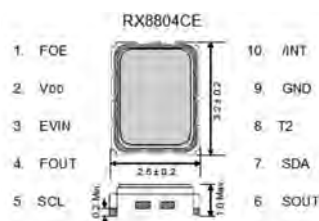
- Interface type
I²C-Bus interface Fast-Mode 400 kHz
- High stability
XA: $\pm 3.4 \times 10^{-6}$ / -40 °C to +85 °C (equivalent to ± 9 s of mo. deviation)
 $\pm 8.0 \times 10^{-6}$ / +85 °C to +105 °C (equivalent to ± 21 s of mo. deviation)
XB: $\pm 5.0 \times 10^{-6}$ / -40 °C to +85 °C (equivalent to ± 13 s of mo. deviation)
 $\pm 8.0 \times 10^{-6}$ / +85 °C to +105 °C (equivalent to ± 21 s of mo. deviation)
- Clock output function
Output frequency is selectable from 32.768 kHz, 1024 Hz, 1 Hz
- Wakeup timer function
Selectable from 244 μ s to 32 years (24 bit x 1 ch.)
Timer source clock selectable from 1/60 Hz, 1 Hz, 64 Hz, 4096 Hz
Auto release after interrupt output from /INT pin at timer completes
This operation is auto repeat with a selected cycle, it can be used like a watchdog timer
- Time stamp function
1 time stamped from year to second
The time stamp trigger inputs from EVIN pin, self-monitoring and I²C software command
EVIN pin has function of chattering-cancel
- Alarm function
It is possible program from day to minute
- Internal state output function
SOUT pin outputs selected flag-bit value or specified value (H or L)

Pin Function

Signal Name	I / O	Function
SOUT	Output	Internal state output pin
SCL	Input	Serial clock input pin
FOUT	Output	Frequency output pin (CMOS) (frequency selection: 32.768 kHz, 1024 Hz, 1 Hz)
EVIN	Input	Event input pin
VDD	-	Power-supply pin
FOE	Input	The FOUT output control pin
/INT	Output	Interrupts output by Alarm and Timer events (N-ch. open drain)
GND	-	Ground pin
T2	-	Test pin in the factory (Do not connect externally)
SDA	Input / Output	Serial data input and output pin.

Terminal connection / External dimensions

(Unit: mm)



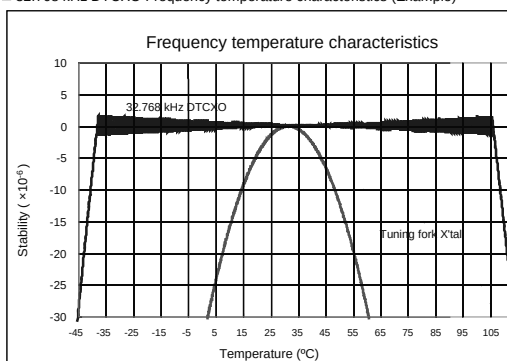
Specifications (characteristics)

* Refer to application manual for details

■ Electrical Characteristics

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Operating voltage	V _{DD}	-	1.6	3.0	5.5	V
Temp. compensated Voltage	V _{TEM}	-	1.5	3.0	5.5	V
Clock supply voltage	V _{CLK}	-	1.5	3.0	5.5	V
Operating temperature	T _a	-	-40	+25	+105	°C
Stability	$\Delta f / f$	XA	T _a = -40 °C to +85 °C		± 3.4	
			T _a = +85 °C to +105 °C		± 8.0	
		XB	T _a = -40 °C to +85 °C		± 5.0	
			T _a = +85 °C to +105 °C		± 8.0	
Current consumption (1)	I _{DD1}	fSCL = 0 Hz, /INT = V _{DD} , FOE = GND, FOUT: OFF, Temp. Compensation interval 2.0 s	V _{DD} = 5 V	-	0.4	1.6 μ A
Current consumption (2)	I _{DD2}		V _{DD} = 3 V	-	0.35	1.5 μ A

■ 32.768 kHz DTCXO Frequency temperature characteristics (Example)



REAL TIME CLOCK MODULE (I²C-Bus)

Built-in backup battery charge control function

RX8130CE

- Built-in frequency adjusted 32.768 kHz crystal unit
- Interface Type : I²C-Bus
- Low backup current : 300 nA Typ. / 3 V
- Auto power switching function : Automatically switches to backup power supply by monitoring the V_{DD} voltage
- Backup battery charge control function : For the rechargeable battery
- Reset functions with a delay : Detect a main power supply and remove the reset
- Interrupt output : Wake up every minute or every second
- Alarm interruption : Day, date, hour, minute, second
- Auto repeat wakeup timer interruption
- Self-monitoring interruption : Crystal oscillation stop, V_{BAT} low, V_{DD} low

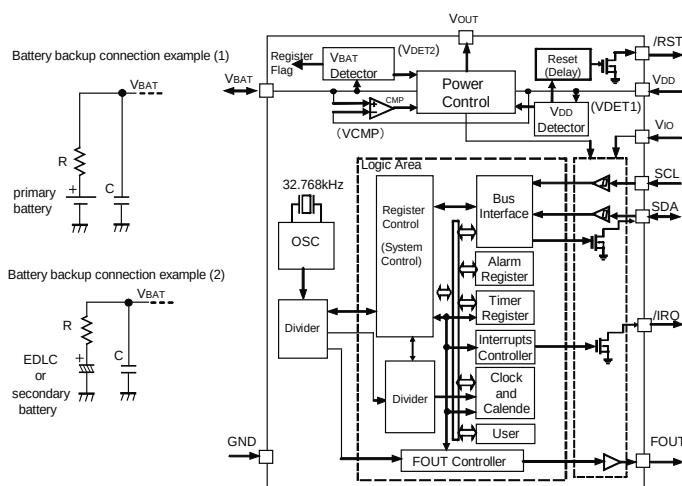


Product Number (2,000 pcs / Reel)
RX8130CE: X1B000311000100



RX8130CE
 (3.2 x 2.5 mm, t = 1.0 mm Max.)

Block diagram



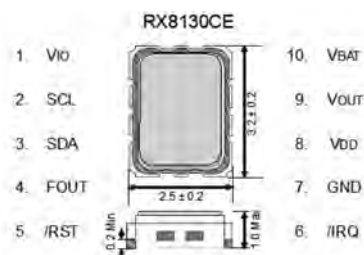
Overview

- Interface type
I²C-Bus interface Fast-Mode 400 kHz
- Auto power switch function
The V_{DD} voltage is monitored and it switches to the backup power supply by the automatic operation
Backup power supply switching voltage 1.2V Min.
- Clock output function
Output frequency is selectable from 32.768 kHz, 1024 Hz, 1 Hz
- Wakeup timer function
Selectable from 244 μ s to 7.5 years (16 bit x 1 ch.)
Timer source clock selectable from 1/3600 Hz, 1/60 Hz, 1 Hz, 64 Hz, 4096 Hz. Auto release after interrupt output from /IRQ pin at timer completes
This operation is auto repeat with a selected cycle, it can be used like a watchdog timer
- Backup battery charge control function
Stop charging automatically by detecting the full charge.
Records in the register detecting the backup power supply Voltage decrease
- Reset function with a delay
When the main power is supplied, reset output is released.
The reset/release voltage is selected by the register (2 types)
Delay time of release from backup mode is 60ms Min.

Pin Functin

Signal Name	I / O	Function
SCL	Input	Serial clock input pin
SDA	Input / Output	Serial data input and output pin
FOUT	Output	Frequency output pin (CMOS) (frequency selection: 32.768 kHz, 1024 Hz, 1 Hz)
/RST	Output	Reset output pin (N-ch. open drain) In case of V _{DD} voltage drop detection, a reset signal is outputted In case of V _{DD} voltage rise detection, a released reset signal is outputted
/IRQ	Output	Interrupts output by Alarm and Timer events (N-ch. open drain)
V _{DD}	—	Power-supply pin Possible to supply different voltage from V _{IO}
V _{IO}	—	Interface power supply pin Input to supply the voltage same as a host
V _{OUT}	—	Internal voltage output pin Connect bypass capacitor of 1.0 μ F
V _{BAT}	—	This is a power supply pin for backup battery Connect an EDLC, a secondary battery, a primary battery In the backup voltage range, supplied to IC, from this pin
GND	—	Ground pin

Terminal connection / External dimensions (Unit: mm)



Specifications (characteristics)

* Refer to application manual for details

Recommended Operating Conditions

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating supply voltage	V _{DD}	—	1.25	3.0	5.5	V
Clock supply voltage	V _{CLK}	—	1.1	3.0	5.5	V
Operating temperature	T _a	—	-40	+25	+85	°C
V _{DD} detect voltage	-V _{DET2}	V _{DD} , Fall	1.20	1.30	1.40	V

Frequency characteristics

Item	Symbol	Condition	Rating	Unit
Frequency tolerance	$\Delta f / f$	T _a = +25 °C V _{DD} = 3.0 V	B: 5 $\pm$ 23	x 10 ⁻⁶
Oscillation start-up time	t _{STA}	V _{DD} = 2.75 V to 5.5 V	1 Max.	s

Current consumption characteristics

T_a = -40 °C to +85 °C

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Current consumption	I _{BAT}	SCL = SDA = "L", V _{BAT} = 3.0 V, V _{DD} = V _{IO} = 0.0 V	—	300	500	nA
	I _{32k}	SCL = SDA = "H", FOUT = 32.768 kHz, /IRQ=OFF, V _{DD} = V _{IO} = 3.0 V, FOUT pin CL = 15 pF, CHGEN = L or V _{BAT} $\geq$ V _{DET3}	—	3.5	4.0	μ A

REAL TIME CLOCK MODULE (I²C-Bus)

Built-in 32.768 kHz DTCXO, High Stability,
Power switching



Product Number
1,000 pcs / Reel
RX8900SA UA: X1B000292000100
RX8900SA UB: X1B000292000200
RX8900SA UC: X1B000292000300

2,000 pcs / Reel
RX8900CE UA: X1B000301000100
RX8900CE UB: X1B000301000200
RX8900CE UC: X1B000301000300

RX8900SA / RX8900CE

- Built-in frequency adjusted 32.768 kHz crystal unit and DTCXO
- Interface Type : I²C-Bus
- Interface voltage range : 2.5 V to 5.5 V
- Temp. compensated voltage range : 2.0 V to 5.5 V
- Timekeeping voltage range : 1.6 V to 5.5 V
- Auto power switching function : Automatically switches to backup power supply by monitoring the V_{DD} voltage
- Interrupt output : Wake up every minute or every second
- Alarm interruption : Day, date, hour, minute
- Auto repeat wakeup timer interruption



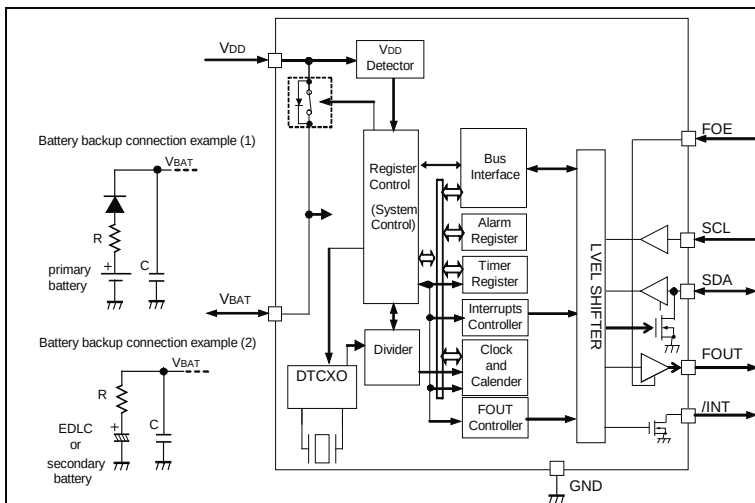
RX8900SA



RX8900CE

(10.1 x 7.4 mm, t = 3.3 mm Max.) (3.2 x 2.5 mm, t = 1.0 mm Max.)

Block diagram



Overview

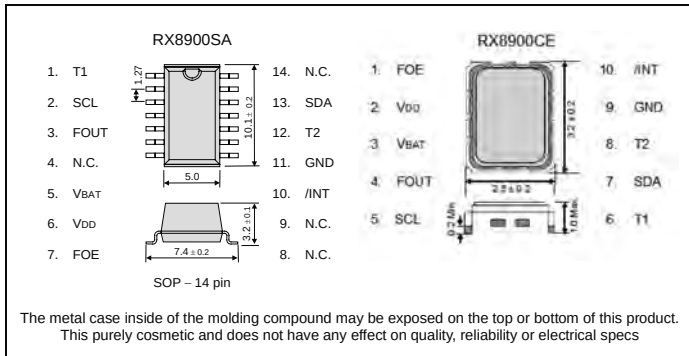
- Interface type
I²C-Bus interface Fast-Mode 400 kHz
- High stability
UA: $\pm 3.4 \times 10^{-6}$ / -40 °C to +85 °C (equiv. to ± 9 s of mo. deviation)
UB: $\pm 5.0 \times 10^{-6}$ / -40 °C to +85 °C (equiv. to ± 13 s of mo. deviation)
UC: $\pm 5.0 \times 10^{-6}$ / -30 °C to +70 °C (equiv. to ± 13 s of mo. deviation)
- Auto power switch function
The V_{DD} voltage is monitored and it switches to the backup power supply by the automatic operation
Backup power supply switching voltage 1.9 V Min.
- Clock output function
Output frequency is selectable from 32.768 kHz, 1024 Hz, 1 Hz
- Wakeup timer function
Selectable from 244 μ s to 2.8 days (12 bit x 1 ch.)
Timer source clock selectable from 1/60 Hz, 1 Hz, 64 Hz, 4096 Hz
Auto release after interrupt output from /INT pin at timer completes
This operation is auto repeat with a selected cycle, it can be used like a watchdog timer
- Alarm function
It is possible program from day to minute
- Temp. sensor function
Available readout temperature data from embedded temp sensor

Pin Function

Signal Name	I / O	Function
T1	-	Test pin in the factory (Do not connect externally)
SCL	Input	Serial clock input pin
FOUT	Output	Frequency output pin (CMOS) (frequency selection: 32.768 kHz, 1024 Hz, 1 Hz)
VBAT	-	This is a power supply pin for backup battery Connect an EDLC, a secondary battery, a primary battery. In the backup voltage range, supplied to IC, from this pin
VDD	-	Power-supply pin
FOE	Input	The FOUT output control pin
/INT	Output	Interrupt output (N-ch. open drain).
GND	-	Ground pin
T2	-	Test pin in the factory (Do not connect externally)
SDA	Input / Output	Serial data input and output pin

Terminal connection / External dimensions

(Unit: mm)



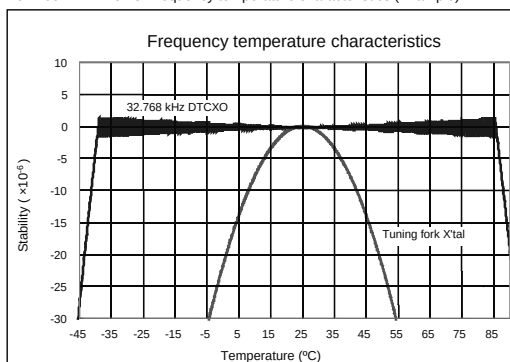
Specifications (characteristics)

* Refer to application manual for details

■ Electrical Characteristics

Item	Symbol	Conditions		Min.	Typ.	Max.	Unit
Operating voltage	V _{DD}	-		2.5	3.0	5.5	V
Temp. compensated Voltage	V _{TEM}	-		2.0	3.0	5.5	V
Clock supply voltage	V _{CLK}	-		1.6	3.0	5.5	V
V _{DD} detect voltage (3)	V _{DET3}	-		2.3	2.4	2.5	V
Operating temperature	T _A	-		-40	+25	+85	°C
Stability	Δ f / f	UA	T _A = -40 °C to +85 °C	±3.4			x 10 ⁻⁶
		UB	T _A = -40 °C to +85 °C	±5.0			
		UC	T _A = -30 °C to +70 °C				
Current consumption (1)	I _{DD1}	fSCL = 0 Hz, /INT = V _{DD} , FOE = GND, V _{DD} = V _{BAT} , FOUT: OFF, Temp. Compensation interval 2.0 s	V _{DD} = 5 V	-	0.72	1.5	μA
Current consumption (2)	I _{DD2}		V _{DD} = 3 V	-	0.70	1.4	

■ 32.768 kHz-DTCXO Frequency temperature characteristics (Example)



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

RX-8803SA / 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.

Epson prepared Linux driver for development.
(http://www5.epsondevice.com/en/information/support/linux_rtc/)
The registered trademark Linux® is used pursuant to a sublicense from LMI(Linux Mark Institute)

Product Number
RX-8803SA UB : X1B000151000100
RX-8803SA UA : X1B000151000200
RX-8803SA UC : X1B000151000300
RX-8803SA AA : X1B000151000400
RX-8803LC UA : X1B000142000100
RX-8803LC UB : X1B000142000200
RX-8803LC UC : X1B000142000300
RX-8803LC AA : X1B000142000400

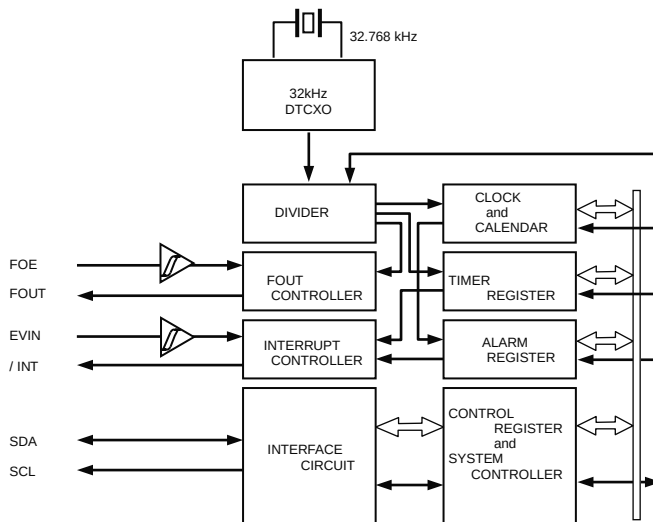


RX-8803SA



RX-8803LC

Block diagram



Overview

- **High Stability**
 - UA $\pm 3.4 \times 10^{-6}$ / -40 °C to +85 °C (Equivalent to ± 9 seconds of month deviation)
 - UB $\pm 5.0 \times 10^{-6}$ / -40 °C to +85 °C (Equivalent to ± 13 seconds of month deviation)
 - UC $\pm 5.0 \times 10^{-6}$ / -30 °C to +70 °C
 - AA $(+5 \pm 5.0) \times 10^{-6}$ / +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-8801.

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

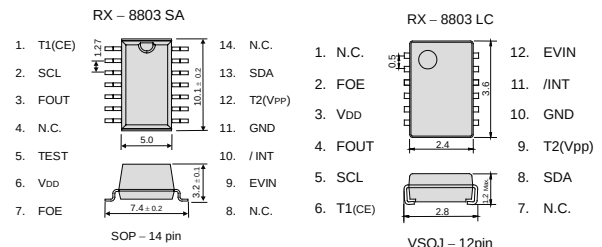
Pin Function

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.

When it is replaced to RX8803SA from RX8801SA, please do not make open state of 9pin.

Terminal connection / External dimensions

(Unit:mm)



The metal case inside of the molding compound may be exposed on the top or bottom of this product. This purely cosmetic and does not have any effect on quality, reliability or electrical specs.

Prohibition of use of glue after a mount of a product
LC package product cannot use glue and resin coating.
When such a processing is necessary, please examine a CE package product.

Specifications (characteristics)

* Refer to application manual for details.

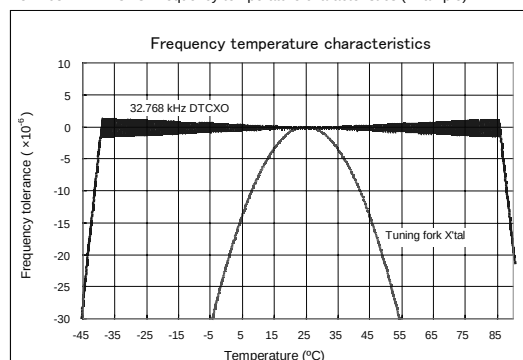
Electrical Characteristics

Item	Symbol	Conditions		Min.	Typ.	Max.	Unit	
Operating voltage	V _{DD}	Interface voltage		1.6	3.0	5.5	V	
Temp. compensated Voltage	V _{TEM}	Temp. compensated voltage		2.2	3.0	5.5	V	
Clock supply voltage	V _{CLK}	-		1.6	3.0	5.5	V	
Operating temperature	T _{OPR}	-		-40	+25	+85	°C	
Stability	Δ f / 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)	I _{DD1}	Backup Mode FOE = GND, /INT = V _{DD} FOUT output : OFF		V _{DD} = 5V	-	0.75	3.4	μA
Current consumption (2)	I _{DD2}			V _{DD} = 3V	-	0.75	2.1	

*1) Equivalent to ± 9 seconds of month deviation. *2) Equivalent to ± 13 seconds of month deviation.

*3) Equivalent to ± 13 seconds of month deviation. (excluding offset)

32.768 kHz-DTCXO Frequency temperature characteristics (Example)





REAL TIME CLOCK MODULE (SPI-Bus)

Built-in 32.768 kHz-DTCXO, High Stability

RX-4803SA / 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.

Epson prepared Linux driver for development.

[\(http://www5.epsondevice.com/en/information/support/linux_rtc/\)](http://www5.epsondevice.com/en/information/support/linux_rtc/)

The registered trademark Linux® is used pursuant to a sublicense from LMI(Linux Mark Institute)

Product Number

RX-4803SA : X1B000131xxx00

RX-4803LC : X1B000122xxx00

RX-4803LC UB : X1B000122000200

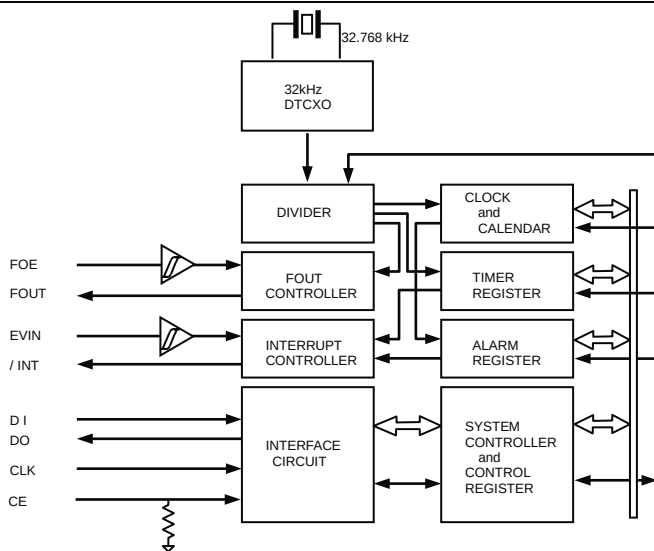


RX-4803SA



RX-4803LC

Block diagram



Overview

• High Stability

- UA $\pm 3.4 \times 10^{-6}$ / -40 °C to +85 °C
(Equivalent to ± 9 seconds of month deviation)
- UB $\pm 5.0 \times 10^{-6}$ / -40 °C to +85 °C
(Equivalent to ± 13 seconds of month deviation)
- UC $\pm 5.0 \times 10^{-6}$ / -30 °C to +70 °C
- AA $(+5 \pm 5.0) \times 10^{-6}$ / +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.

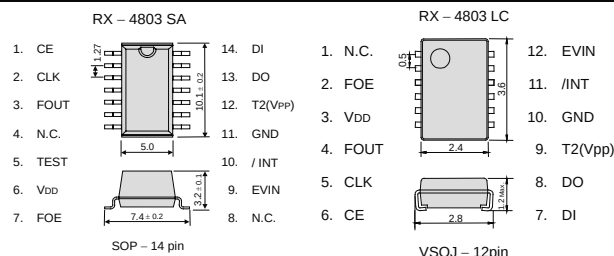
Pin Function

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. Open is prohibited
/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.
DI	input	The data input pin for serial data transfer.

When it is replaced to 4803SA from 4801SA, please do not make open state of 9pin.

Terminal connection / External dimensions

(Unit:mm)



The metal case inside of the molding compound may be exposed on the top or bottom of this product. This purely cosmetic and does not have any effect on quality, reliability or electrical specs.

Prohibition of use of glue after a mount of a product

An LC package product cannot use glue and resin coating. When such a processing is necessary, please examine a CE package product.

Specifications (characteristics)

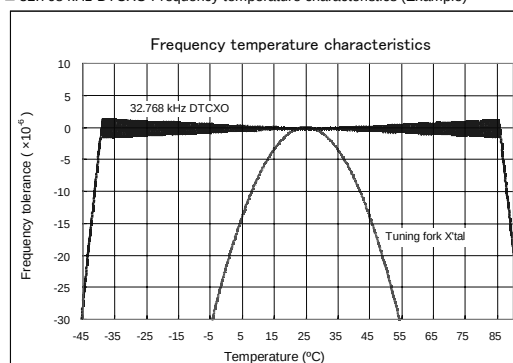
* Refer to application manual for details.

■ Electrical Characteristics

Item	Symbol	Conditions		Min.	Typ.	Max.	Unit	
Interface voltage	V _{DD}	Interface voltage		1.6	3.0	5.5	V	
Temp. compensated Voltage	V _{TEM}	Temp. compensated voltage		2.2	3.0	5.5	V	
Clock supply voltage	V _{CLK}	-		1.6	3.0	5.5	V	
Operating temperature	T _{OPR}	No condensation		-40	+25	+85	°C	
Stability	Δ f / 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)	I _{DD1}	Backup Mode FOE = GND, /INT = V _{DD} FOUT output : OFF		V _{DD} = 5V	-	0.75	3.4	μA
Current consumption (2)	I _{DD2}			V _{DD} = 3V	-	0.75	2.1	

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

■ 32.768 kHz-DTCXO Frequency temperature characteristics (Example)



REAL TIME CLOCK MODULE (I²C-Bus)

High-Stability Frequency with Built in Timestamp and Power Switching

RX-8035SA / LC



Product Number
 RX-8035SA B : X1B000172000100
 RX-8035SA AC : X1B000172000200
 RX-8035SA AA : X1B000172000300
 RX-8035LC B : X1B000182000100
 RX-8035LC AC : X1B000182000200
 RX-8035LC AA : X1B000182000300



RX-8035SA



RX-8035LC

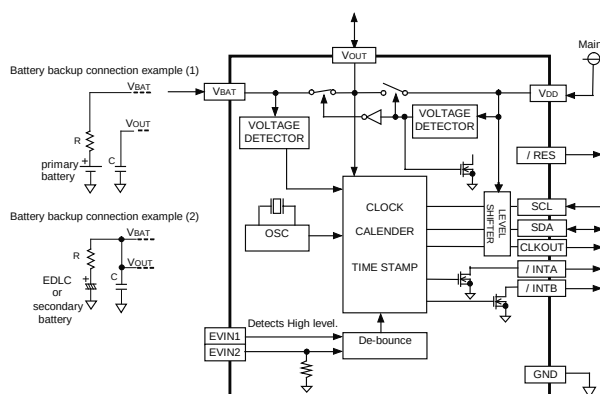
- Built-in 32.768 kHz crystal unit : Frequency adjusted for high accuracy. ($\pm 5 \times 10^{-6}$ / $T_a = +25^\circ\text{C}$)
- Interface Type : I²C-Bus Interface (400kHz)
- Operating voltage range : 2.4 V to 5.5 V
- Wide voltage for Timekeeping. : 1.0 V to 5.5 V
- Low backup current : 350 nA (SA) 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 : It switches VDD and VBAT, automatically.
- Dual Alarm, Periodic interruption.

Epson prepared Linux driver for development.

(http://www5.epsondevice.com/en/information/support/linux_rtc/)

The registered trademark Linux® is used pursuant to a sublicense from LMI(Linux Mark Institute)

Block diagram



Overview

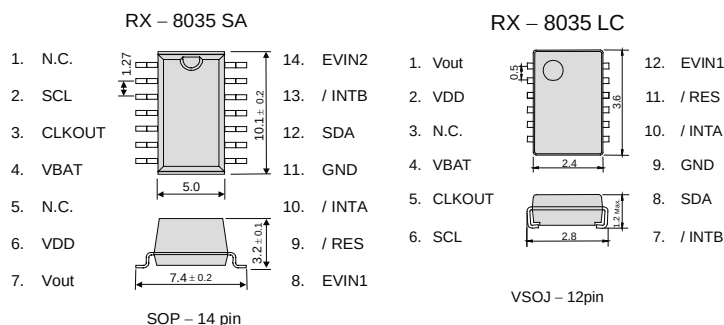
- **The event detection and Timestamp function**
 Dual event detection terminals.
 Selectable de-bounce time 35ms or 2s.
 Available event detection interrupt output.
- **Power switching functions.**
 - An external diode is unnecessary to have a reverse current prevention switch built-in in the VBAT side to connect a primary cell to.
 - 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- Dual alarm.
 - Interrupt period are selectable from 2Hz to Monthly.
 - CLKOUT outputs 32.768kHz, it powered from VDD.

Pin function

Signal Name	Input / Output	Function
SCL	Input	I ² C serial clock.
SDA	In/Out	I ² C 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)



The metal case inside of the molding compound may be exposed on the top or bottom of this product. This purely cosmetic and does not have any effect on quality, reliability or electrical specs.

Prohibition of use of glue after a mount of a product
 An LC package product cannot use glue and resin coating.
 When such a processing is necessary, please examine a CE package product.

Specifications (characteristics)

* Refer to application manual for details.

Recommended Operating Conditions

Item	Symbol	Conditions	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	Conditions	Rating	Unit
Frequency tolerance	$\Delta f / f$	$T_a = +25^\circ\text{C}$ $V_{BAT} = 3.0\text{ V}$	B: $5 \pm 23^{*1}$ AA: $5 \pm 5^{*2}$ AC: $0 \pm 5^{*2}$	$\times 10^{-6}$
Oscillation start-up time	t_{STA}	$T_a = +25^\circ\text{C}$ $V_{DD} = 3.0\text{ V}$	1 Max.	s
Frequency / voltage characteristics	f / V	$T_a = +25^\circ\text{C}$ $V_{DD} = 2.4\text{ V to } 5.5\text{ V}$	± 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

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

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Current Consumption	IBAT	RX-8035SA $V_{BAT} = 3.0\text{ V}, V_{DD} = 0.0\text{ V}$ $SCL = SDA = GND$	-	350	1200	nA
	IBAT	RX-8035LC $V_{BAT} = 3.0\text{ V}, V_{DD} = 0.0\text{ V}$ $SCL = SDA = GND$	-	400	1200	nA
	IDD	$V_{DD} = 3.0\text{ V}$ $SCL = SDA = GND$ $CLKOUT = \text{open}$	-	1.40	2.50	μA

Power supply detection voltage

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

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Voltage of low battery voltage.	VLOW	-	1.10	1.25	1.40	V
Power switching voltage (V_{DD} to V_{BAT})	VD2B	$+25^\circ\text{C}$	2.328	2.40	2.472	V



REAL TIME CLOCK MODULE (SPI-Bus)

High-Stability Frequency with Built in Timestamp and Power Switching

RX-4035SA / LC

- Built-in 32.768 kHz crystal unit : Frequency adjusted for high accuracy.
($\pm 5 \times 10^{-6}$ / $T_a = +25^\circ\text{C}$)
- Interface Type : 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 V_{DD} deteriorates than 2.4V, internal source is switched to V_{BAT} .



Product Number
 RX-4035SA B: X1B000192000100
 RX-4035SA AC: X1B000192000200
 RX-4035SA AA: X1B000192000300
 RX-4035LC B: X1B000202000100
 RX-4035LC AC: X1B000202000200
 RX-4035LC AA: X1B000202000300

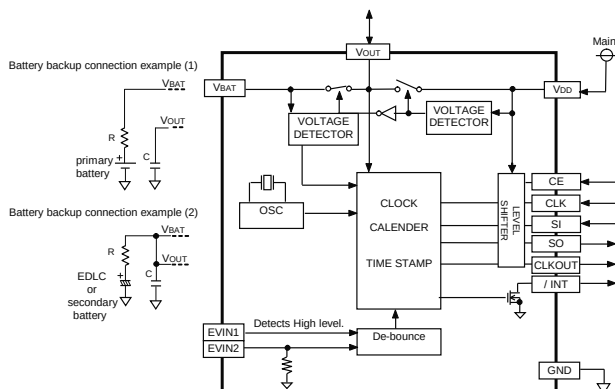


RX-4035SA



RX-4035LC

Block diagram



Overview

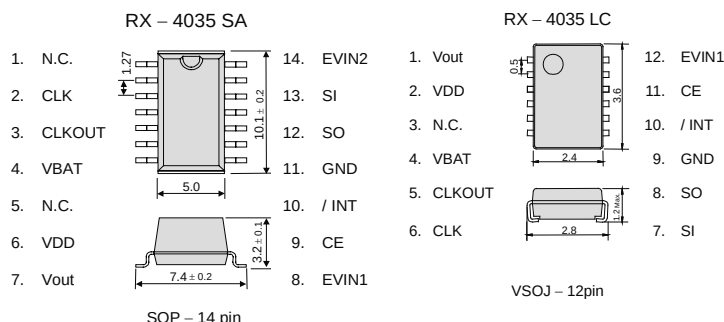
- **The event detection and Timestamp function**
Dual event detection terminals.
Selectable de-bounce time 35ms or 2s.
Available event detection interrupt output.
- **Power switching functions.**
 - An external diode is unnecessary to have a reverse current prevention switch built-in in the VBAT side to connect a primary cell to.
 - When V_{DD} is less than 2.4V, an internal source is switched to V_{BAT} .
 - Note: When the supply from V_{BAT} , 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 V_{DD} .

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)



The metal case inside of the molding compound may be exposed on the top or bottom of this product.
This purely cosmetic and does not have any effect on quality, reliability or electrical specs.

Prohibition of use of glue after a mount of a product
 An LC package product cannot use glue and resin coating.
 When such a processing is necessary, please examine a CE package product.

Specifications (characteristics)

* Refer to application manual for details.

Recommended Operating Conditions

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Operating voltage	V_{ACCESS}	V_{DD}	2.4	3.0	5.5	V
Time keeping voltage	V_{CLK}	V_{BAT}	1.0	3.0	5.5	V
Operating temperature	T_{OPR}	—	-40	+25	+85	$^\circ\text{C}$
Storage temperature	T_{STG}	—	-55	—	+125	$^\circ\text{C}$

Frequency characteristics

Item	Symbol	Conditions	Rating	Unit
Frequency tolerance	$\Delta f / f$	$T_a = +25^\circ\text{C}$ $V_{BAT} = 3.0\text{ V}$	B: $5 \pm 23^{*1}$ AA: $5 \pm 5^{*2}$ AC: $0 \pm 5^{*2}$	$\times 10^{-6}$
Oscillation start-up time	t_{STA}	$T_a = +25^\circ\text{C}$ $V_{DD} = 3.0\text{ V}$	1 Max.	s
Frequency / voltage characteristics	f / V	$T_a = +25^\circ\text{C}$ $V_{DD} = 2.4\text{ V to } 5.5\text{ V}$	± 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

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

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Current Consumption	I_{BAT}	RX-4035SA $V_{BAT} = 3.0\text{ V}$, $V_{DD} = 0.0\text{ V}$ $CE = 0\text{ V}$, $CLKOUT = \text{open}$	-	350	1200	nA
	I_{DD}	RX-4035LC $V_{BAT} = 3.0\text{ V}$, $V_{DD} = 0.0\text{ V}$ $CE = 0\text{ V}$, $CLKOUT = \text{open}$	-	400		
		$V_{DD} = 3.0\text{ V}$ $CE = 0\text{ V}$ $CLKOUT = \text{open}$	-	1.40	2.50	μA

Power supply detection voltage

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

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Voltage of low battery detection	V_{LOW}	-	1.10	1.25	1.40	V
Power switching voltage (V_{DD} to V_{BAT})	V_{D2B}	$+25^\circ\text{C}$	2.328	2.40	2.472	V

REAL TIME CLOCK MODULE (I²C-Bus)

Built-in EEPROM and Unique ID-ROM



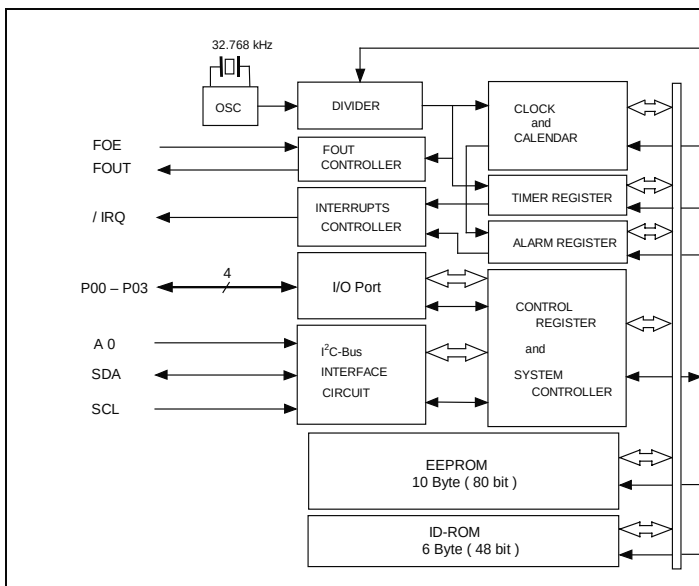
Product Number
RX-8731LC : Q418731C2000100

RX-8731LC

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



Block diagram



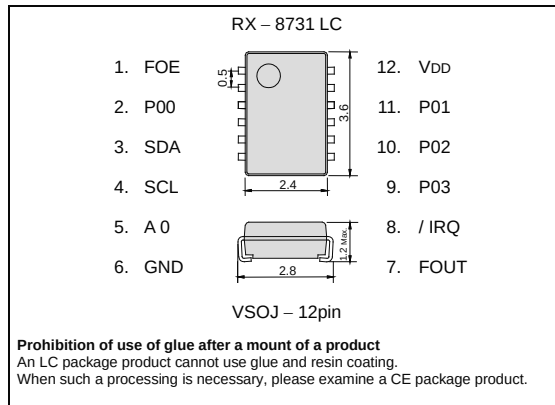
Overview

- **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	Input	FOE pin control the frequency output from FOUT pin with FSEL1-bit and FSEL0-bit.
/ IRQ	Output	Interrupt output pin. (N-ch open drain)
P00 P01 P02 P03	Bi-directional	Programmable I/O ports.
VDD	—	Connected to a positive power supply.
GND	—	Connected to a ground.

Terminal connection / External dimensions (Unit:mm)



Specifications (characteristics)

* Refer to application manual for details.

Recommended Operating Conditions

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

*Equivalent to ± 1 minute of monthly deviation

Current consumption characteristics

Ta = -40 °C to +85 °C

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Current Consumption	I _{BK}	fSCL = 0 Hz / IRQ = OFF	VDD = 5 V	-	0.45	1.5 μ A
		FOUT : output OFF (Hi - z)	VDD = 3 V	-	0.35	1.4 μ A
	I _{32k}	fSCL = 0 Hz / IRQ = OFF	VDD = 5 V	-	8.0	16.0 μ A
		FOUT : 32.768 kHz output CL = 30 pF	VDD = 3 V	-	5.0	10.0 μ A

REAL TIME CLOCK MODULE (I²C-Bus)

Low current consumption



Product Number

RX-8571SA : X1B000072000100

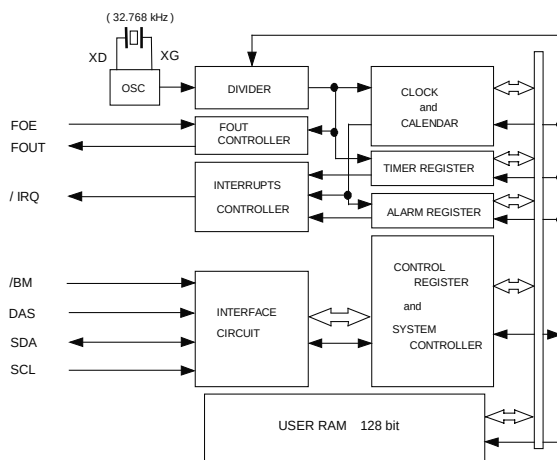
RX-8571LC : X1B000052000100

RX-8571SA / 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 voltage for timekeeping : 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
- Built-in user RAM : 128 bit (8 bit x 16, SRAM)
- The various functions include full calendar, alarm, timer, etc.
(Long-running timer : 65535 hours)



Block diagram

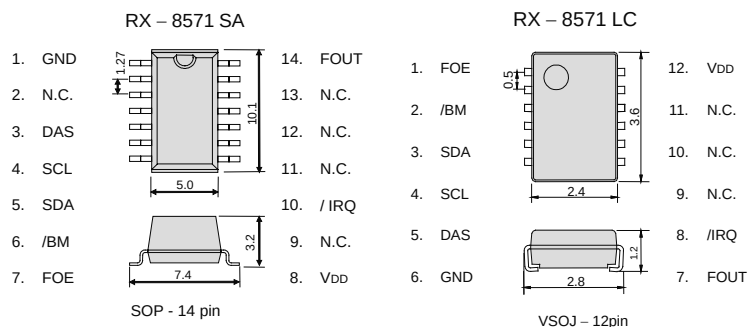


Overview

- 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.
- User RAM
 - 128 bit (8 bit x 16, SRAM)

Terminal connection / External dimensions

(Unit:mm)



The metal case inside of the molding compound may be exposed on the top or bottom of this product. This purely cosmetic and does not have any effect on quality, reliability or electrical specs.

Prohibition of use of glue after a mount of a product

LC package product cannot use glue and resin coating.

When such a processing is necessary, please examine a CE package product.

Specifications (characteristics)

* Refer to application manual for details.

Recommended Operating Conditions

Item	Symbol	Conditions	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	Conditions	Rating	Unit
Frequency tolerance	$\Delta f/f$	Ta = +25 °C VDD = 3.0 V	B: 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	Conditions	Min.	Typ.	Max.	Unit
Current Consumption	IDD	FOE=/BM="L" FOUT= OFF /IRQ= OFF VDD = 3.0V Ta = +25 °C	-	220	400	nA
		LC type				
		SA type	-	200	400	
		FOE=/BM="L" FOUT= OFF /IRQ= OFF VDD = 3.0V Ta = -40 °C to +85 °C	-	-	550	nA



REAL TIME CLOCK MODULE (SPI-Bus) LOW BACKUP VOLTAGE



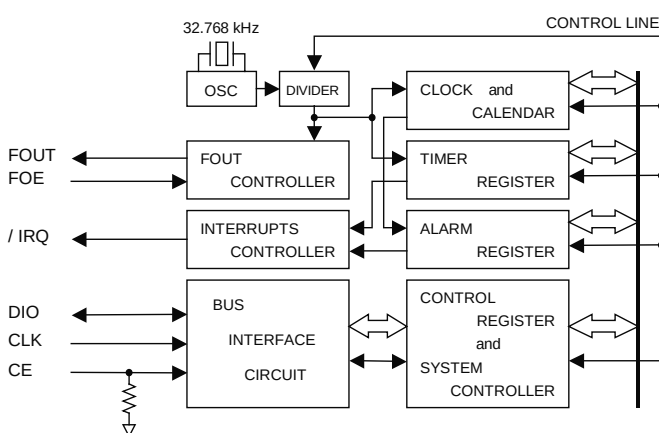
Product Number
RX-4571LC : Q414571C2000100
RX-4571SA : Q414571S2000100

RX-4571LC / 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
- The wide voltage for time keeping. : 1.0 V to 5.5 V / $T_a = +25\text{ }^{\circ}\text{C}$
- Low backup current : 0.32 μA (Typ.) / 3 V
- 32.768 kHz frequency output function : C-MOS output With OE pin.
- Real-time clock function
Clock/calendar function, auto leap year correction function,
alarm and Timer interrupt function, etc.



Block diagram



Overview

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

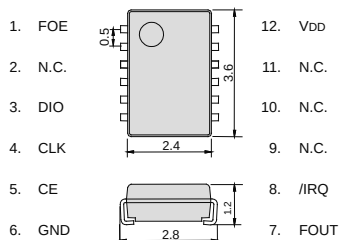
Pin Function

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

Terminal connection / External dimensions

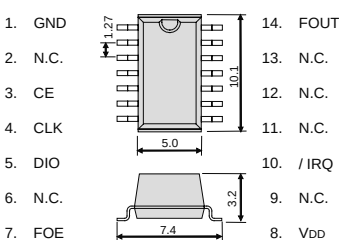
(Unit:mm)

RX - 4571 LC



VSOJ - 12pin

RX - 4571 SA



SOP - 14 pin

Prohibition of use of glue after a mount of a product

An LC package product cannot use glue and resin coating.
When such a processing is necessary, please examine a CE package product.

The metal case inside of the molding compound may be exposed on the top or bottom of this product.
This purely cosmetic and does not have any effect on quality, reliability or electrical specs.

Specifications (characteristics)

* Refer to application manual for details.

Recommended Operating Conditions

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

Frequency characteristics

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

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

Current consumption characteristics

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

Symbol	Conditions	VDD	Min.	Typ.	Max.	Unit
IBK	CE = GND /IRQ = OFF	$V_{DD} = 5\text{ V}$	-	0.40	1.00	μA
	FOUT ; output OFF (Hi - z)	$V_{DD} = 3\text{ V}$	-	0.32	0.95	
I32k	CE = GND /IRQ = OFF	$V_{DD} = 5\text{ V}$	-	8.0	14.0	μA
	FOUT ; 32.768 kHz output ON CL = 30 pF	$V_{DD} = 3\text{ V}$	-	5.0	8.5	

REAL TIME CLOCK MODULE (I²C-Bus)

Low current consumption



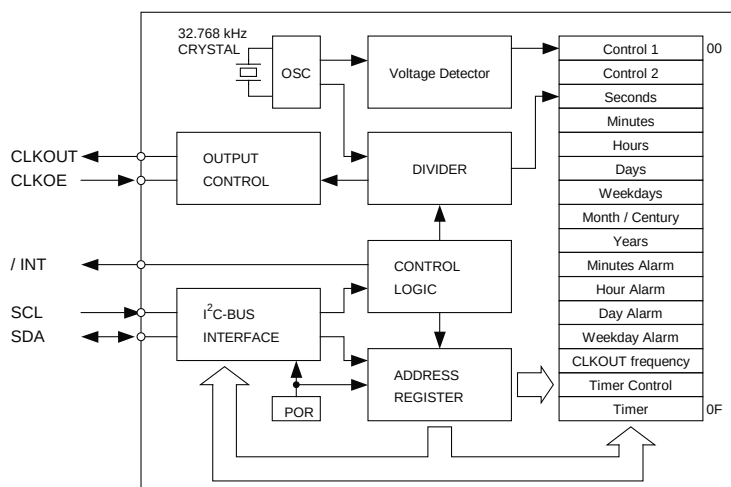
Product Number
RX-8564LC : Q418564C2000100

RX-8564LC

- Built in frequency adjusted 32.768 kHz crystal unit.
- Interface Type : I²C-Bus Interface (400 kHz)
- Operating voltage range : 1.8V to 5.5 V
- Timekeeper voltage range : 1.0V to 5.5 V / -20 °C to +70 °C
- Low backup current : 275nA / 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



Block diagram



Overview

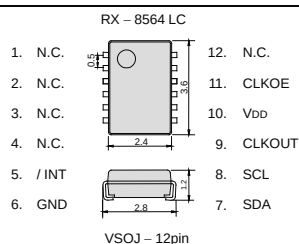
- **Interface Type**
 - I²C-Bus Interface. (Hi-speed bus specifications 400 kHz)
 - * I²C-Bus slave address : read A3h and write A2h
- **Low Timekeeper voltage range**
 - 1.0 V to 5.5 V / Ta = -20 °C to +70 °C
 - 1.1 V to 5.5 V / Ta = -40 °C to +85 °C
- **32.768 kHz frequency output function**
 - CLKOUT 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	<table border="1"> <thead> <tr> <th>CLKOE pin input</th><th>FE bit</th><th>CLKOUT pin output</th></tr> </thead> <tbody> <tr> <td>HIGH</td><td>1</td><td>Output (C-MOS)</td></tr> <tr> <td></td><td>0</td><td>OFF (LOW)</td></tr> <tr> <td>LOW</td><td>1</td><td>OFF (LOW)</td></tr> <tr> <td></td><td>0</td><td>OFF (LOW)</td></tr> </tbody> </table>	CLKOE pin input	FE bit	CLKOUT pin output	HIGH	1	Output (C-MOS)		0	OFF (LOW)	LOW	1	OFF (LOW)		0	OFF (LOW)
CLKOE pin input	FE bit	CLKOUT pin output															
HIGH	1	Output (C-MOS)															
	0	OFF (LOW)															
LOW	1	OFF (LOW)															
	0	OFF (LOW)															
/INT	Output	Interrupt output (N-ch open drain)															
VDD	—	Connected to a positive power supply.															
GND	—	Connected to a ground.															

Terminal connection / External dimensions

(Unit:mm)



Prohibition of use of glue after a mount of a product
LC package product cannot use glue and resin coating.
When such a processing is necessary, please examine a CE package product.

Specifications (characteristics)

* Refer to application manual for details.

Recommended Operating Conditions

Item	Symbol	Conditions	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	Conditions	Typ.	Max.	Unit
Low voltage detection	VLOW	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	Conditions	Rating	Unit
Frequency tolerance	Δf/f	Ta = +25 °C VDD = 3.0 V	B: 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	Conditions	Min.	Typ.	Max.	Unit
Current Consumption	I _{BK}	f _{SCL} = 0 Hz CLKOE = GND				
		CLKOUT ; output OFF (LOW)	VDD = 5 V	-	330	800 nA
	I _{32k}	f _{SCL} = 0 Hz CLKOE = VDD	VDD = 3 V	-	275	700 nA
		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 μA

REAL TIME CLOCK MODULE (I²C-Bus)

Low current consumption

RX8010SJ



Product Number
RX8010SJ : X1B000242000100

- 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 voltage for time keeping. : 1.1 V to 5.5 V
- Low backup current : 160 nA / 3 V (Typ.)
- Frequency output function : C-MOS or Open-Drain output
- Built-in user RAM : 128 bit (8 bit x 16, SRAM)
- The various functions include full calendar, alarm, timer, etc.
- This product is conform to industrial standard SOP8 package, and it can be mounted to the common land pattern.

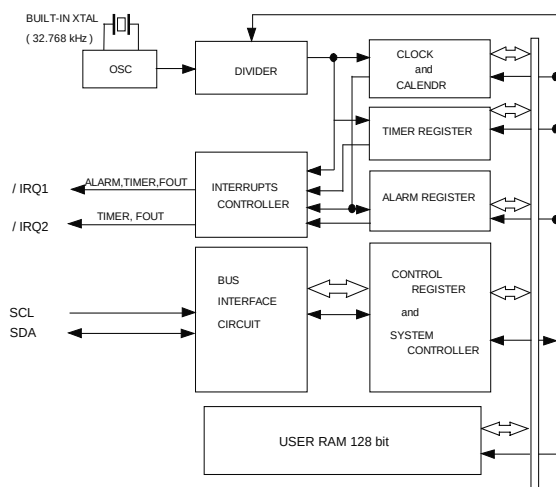
Epson prepared Linux driver for development.

(http://www5.epsondevice.com/en/information/support/linux_rtc/)

The registered trademark Linux® is used pursuant to a sublicense from LMI(Linux Mark Institute)



Block diagram



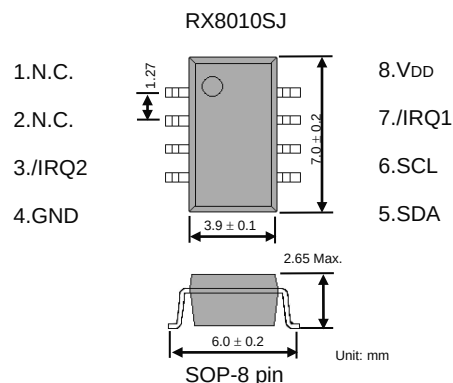
Overview

- **Interface Type**
 - I²C-Bus high-speed bus specifications. (400 kHz)
- **Frequency output function**
 - It may select a CMOS or open drain output
 - Output frequency can be selected as 32.768kHz, 1024Hz, 1Hz.
- **Timer function**
 - Timer function can be set up between 1/4096 second and 65535 hours.
 - Timing period are 1hour, 1min, 64Hz, 4096Hz.
 - It is recorded automatic to TF-bit at the time of event occurrence, and possible to output with /IRQ1 or /IRQ2 pin.
- **Alarm function**
 - Alarm function can be set to day of week, day, hour, and minute.
 - It is recorded automatic to AF-bit at the time of event occurrence, and possible to output with /IRQ1 pin.
- **User RAM**
 - 128 bit (8 bit x 16, SRAM)

Pin Function

Signal Name	Input / Output	Function
SCL	Input	This is a shift clock input pin for serial data transmission.
SDA	Input/Output	This is the data input/output pin for serial data transfer.
/IRQ1	Output	This pin outputs interrupt signals ("L" level) for alarm, timer, time update, and 32.768kHz. This is an N-ch open-drain output.
/IRQ2	Output	This pin outputs interrupt signals ("L" level) for timer and FOUT. This is a C-MOS output.
VDD	Supply	This is a power-supply pin.
GND	Supply	This pin is connected to a ground.

Terminal connection / External dimensions (Unit:mm)



Specifications (characteristics)

* Refer to application manual for details.

Recommended Operating Conditions

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Power voltage	VDD	—	1.6	3.0	5.5	V
Clock voltage	VCLK	—	1.1	3.0	5.5	V
Operating temperature	TOPR	—	-40	+25	+85	°C

Frequency characteristics

Item	Symbol	Conditions	Rating	Unit
Frequency tolerance	$\Delta f / f$	Ta = +25 °C VDD = 3.0 V	B: 5 ± 23 *	× 10 ⁻⁶
Oscillation Start-up time	tSTA	Ta = +25 °C VDD = 1.6 V ~ 5.5 V	1 Max.	s
		Ta = -40 °C to +85 °C VDD = 1.6V ~ 5.5V	3 Max.	s

*Equivalent to ±1 minute of monthly deviation

Current consumption characteristics

Ta = -40 °C to +85 °C

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Current Consumption	I _{BK}	Input pins are "L" fCLK = 0 Hz, /IRQ1,2 = OFF TSEL2="1"	VDD = 5 V	-	350	nA
			VDD = 3 V	-	160	
	I _{32k}	fCLK = 0 Hz, /IRQ1: 32.768 kHz ON, /IRQ2: OFF	VDD = 5 V	0.60	1.10	μA
			VDD = 3 V	0.52	0.90	

REAL TIME CLOCK MODULE (SPI & I²C-Bus)

Power Switching and Low current consumption



Product Number
RX6110SA B : X1B000232000100

RX6110SA B

- Built in frequency adjusted 32.768 kHz crystal unit.
- Interface Type : SPI & I²C -Bus
- Operating voltage range : 1.6 V to 5.5 V
- The wide voltage for time keeping : 1.1 V to 5.5 V
- Low backup current : 130 nA / 3 V (Typ.)
- Built-in user RAM : 128 bit (8 bit × 16, SRAM)
- Auto power switching functions : When VDD deteriorates than 1.6V, internal source is switched to VBAT.

• The various functions include full calendar, alarm, timer.

Epson prepared Linux driver for development.

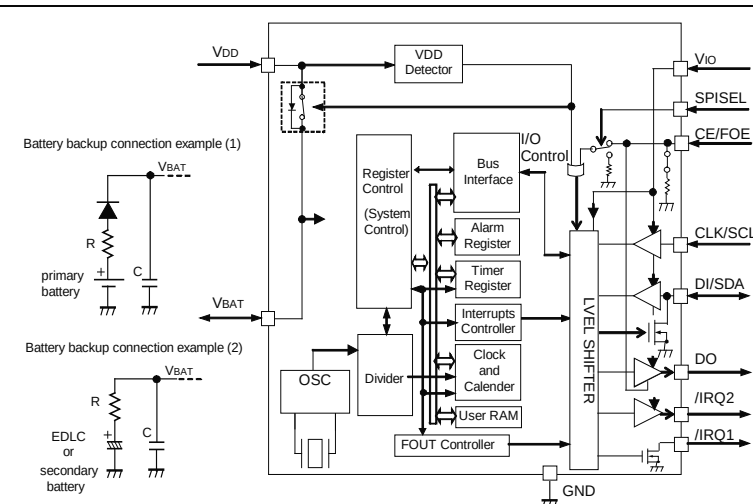
(http://www5.epsondevice.com/en/information/support/linux_rtc/)

The registered trademark Linux® is used pursuant to a sublicense from LMI(Linux Mark Institute)



Block diagram

Overview



- Interface type.
 - SPI-Bus and I²C-Bus interface.
 - By a terminal, a switchover of the interface is possible.
- Built-in auto power switching function
 - To efficiently charge from VDD to backup battery (Secondary battery. Large capacitor) connected to VBAT is possible. Detects VDD voltage drop(VDET-) and automatically switches to the backup battery.
- Frequency output function
 - Output frequency is selectable from 32.768kHz, 1024Hz, 1Hz.
- Timer function
 - Timer function is selectable in 1/4096 second from 65535 hours.
- Timer source clock are 1hour, 1min, 64Hz, 4096Hz.
 - It is recorded automatic to TF-bit at the time of event occurrence, and possible to output with /IRQ1 or /IRQ2 pin.
- Alarm function
 - Alarm function can be set to day of week, day, hour, and minute.
 - It is recorded automatic to AF-bit at the alarm occurrence, and possible to output with /IRQ1 pin output.
- User RAM
 - 128 bit (8 bit × 16, SRAM)

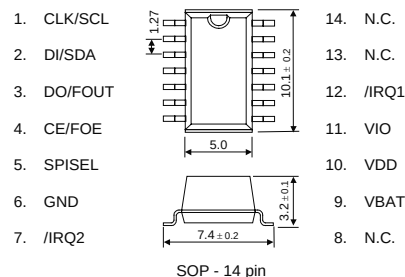
Pin Function

Terminal connection / External dimensions

(Unit:mm)

Signal Name	Input/Output	Function
SPISEL	Input	The interface select pin. SPI is chosen at a "H" level (Vio voltage) / I ² C is chosen at a "L" level (GND voltage).
CE/FOE	Input	SPI: Should be held high to allow access to the CPU. Incorporates a pull-down resistor. I ² C: It is an input pin for controlling the DO/FOUT output. When the frequency output from a DO/FOUT pin does not need, CE/FOE pin must be connected to GND.
CLK/SCL	Input	This is a shift clock input pin for serial data transmission.
DI/SDA	Input / Output	SPI: This is the data input pin for serial data transfer. I ² C: This is the data input/output pin for serial data transfer.
DO/FOUT	Output	SPI: This is the data output pin for serial data transfer. I ² C: This is the C-MOS output pin with output control provided via the CE/FOE pin. (frequency selection: 32.768 kHz / 1024 Hz / 1Hz / Hi-z)
/IRQ1	Output	This pin outputs interrupt signals ("L" level) for alarm, timer, time update, and FOUT. This is an N-ch open-drain output. This pin can output even a backup mode.
/IRQ2	Output	This pin outputs interrupt signals ("L" level) for timer and FOUT. This is an N-ch open-drain output. This pin becomes Hi-z in less than VDD=1.6V.
VDD	-	This is a power-supply pin. It can impress the voltage unlike Vio.
Vio	-	This pin is a power supply for input and the output and input / output pins. Connected to a positive power supply.
VBAT	-	Connect a secondary battery or capacitor for backup power supply. If a backup power supply is not present, this pin connect to VDD.
GND	-	Connected to a ground.

RX 6110 SA



The metal case inside of the molding compound may be exposed on the top or bottom of this product.
This purely cosmetic and does not have any effect on quality, reliability or electrical specs.

Specifications (characteristics)

* Refer to application manual for details.

Recommended Operating Conditions

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Power voltage	VDD	—	1.6	3.0	5.5	V
Clock voltage	VCLK	—	1.1	3.0	5.5	V
Operating temperature	TOPR	—	-40	+25	+85	°C

Frequency characteristics

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

*1) Equivalent to ±1 minute of monthly deviation (excluding offset.) / Standard product

Current consumption characteristics

Ta = -40 °C to +85 °C

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Current Consumption	IBK	VBAT = 3.0 V Input pins are "L", VDD = 0 V DO/FOUT=OFF, fCLK = 0 Hz, /IRQ1,2 = OFF, TSEL2="1" It include an OFF leak current of SW between the power supply (VBAT-VDD)	-	130	250	nA
	I32k	VDD = 3.0 V fCLK = 0 Hz, /IRQ1,2 = OFF, CE/FOE = VIO, DO/FOUT : 32.768 kHz ON , CL = 0 pF	-	1.5	2.1	μA

REAL TIME CLOCK MODULE (I²C-Bus)

High-Stability



Product Number
 RX-8025SA AA : Q41802552000100
 RX-8025SA AC : Q41802551000200

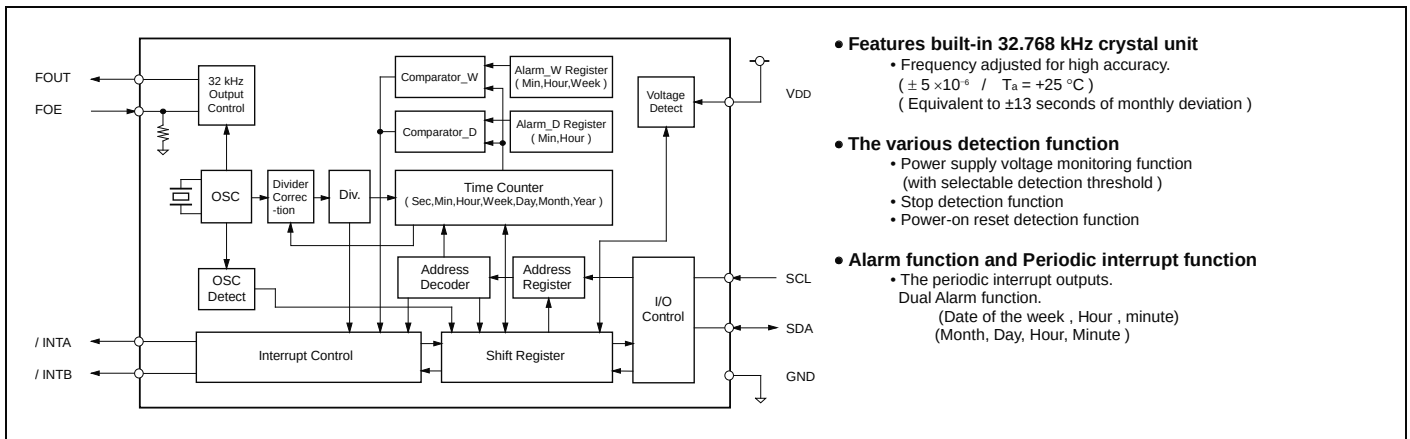
RX-8025SA

- Built-in 32.768 kHz crystal unit : Frequency adjusted for high accuracy ($\pm 5 \times 10^{-6}$ / $T_a = +25^\circ\text{C}$)
- Interface Type : I²C-Bus Interface (400 kHz)
- Operating voltage range : 1.70 V to 5.5 V
- Wide voltage for timekeeping : 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 OE pin.
- The various functions include full calendar, Dual alarm, Periodic interruption.



Block diagram

Overview

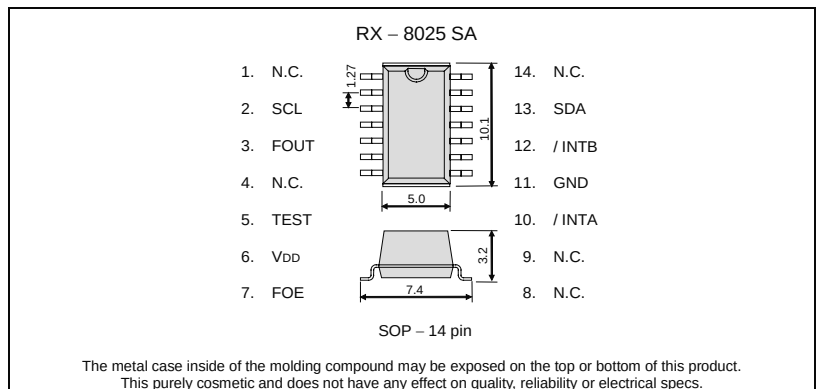


Pin Function

Signal Name	Input / output	Function																					
SCL	Input	Serial clock input pin																					
SDA	Bi-directional	Data input and output pin																					
FOUT	Output	32.768 kHz clock output pin with the output control function. (C-MOS)																					
FOE	Input	<table><tr><th>FOE input</th><th>/CLEN1 bit</th><th>/CLEN2 bit</th><th>FOUT output</th></tr><tr><td>L</td><td>X</td><td>X</td><td>OFF (LOW)</td></tr><tr><td rowspan="4">H</td><td>0</td><td>0</td><td>32.768 kHz</td></tr><tr><td>0</td><td>1</td><td>32.768 kHz</td></tr><tr><td>1</td><td>0</td><td>32.768 kHz</td></tr><tr><td>1</td><td>1</td><td>OFF(LOW)</td></tr></table>	FOE input	/CLEN1 bit	/CLEN2 bit	FOUT output	L	X	X	OFF (LOW)	H	0	0	32.768 kHz	0	1	32.768 kHz	1	0	32.768 kHz	1	1	OFF(LOW)
FOE input	/CLEN1 bit	/CLEN2 bit	FOUT output																				
L	X	X	OFF (LOW)																				
H	0	0	32.768 kHz																				
	0	1	32.768 kHz																				
	1	0	32.768 kHz																				
	1	1	OFF(LOW)																				
/ INTA	Output	Interrupt output A pin (N-ch open drain)																					
/ INTB	Output	Interrupt output B pin (N-ch open drain)																					
TEST	—	* Used by the manufacture for testing. (Do not connect externally.)																					
VDD	—	Connected to a positive power supply.																					
GND	—	Connected to a ground.																					

Terminal connection / External dimensions

(Unit:mm)



Specifications (characteristics)

* Refer to application manual for details.

Recommended Operating Conditions

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

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

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Current Consumption	I _{BK}	f _{SCL} = 0Hz FOE = GND FOUT ; output OFF(LOW)	VDD = 5 V	-	0.60	1.80 μA
			VDD = 3 V	-	0.48	1.20 μA
	I _{32k}	f _{SCL} = 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

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

Item	Symbol	Conditions	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

REAL TIME CLOCK MODULE (SPI-Bus)

High-Stability Frequency

RX-4045SA

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

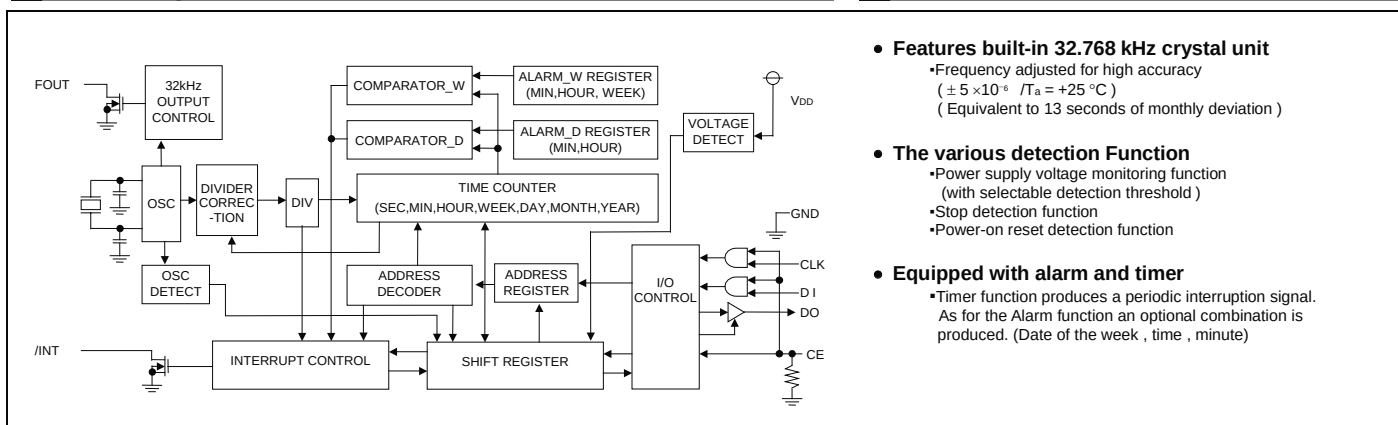


Product Number
RX-4045SA AA: Q41404552000100
RX-4045SA AC: Q41404551000200



Block diagram

Overview

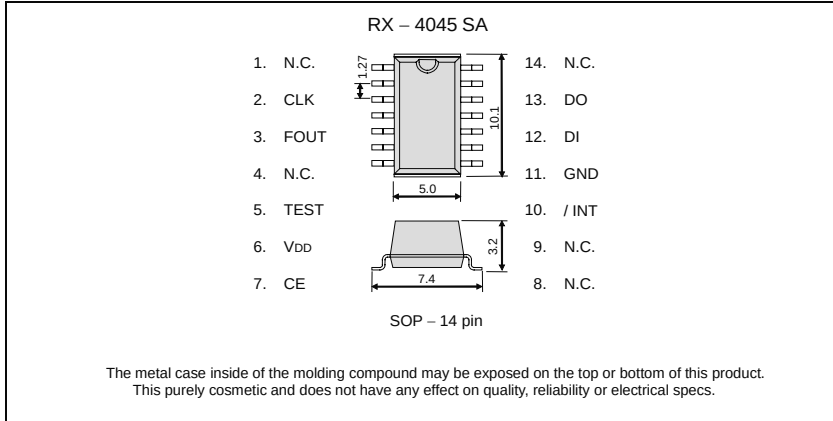


Pin function

Terminal connection / External dimensions

(Unit:mm)

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.



Specifications (characteristics)

* Refer to application manual for details.

Recommended Operating Conditions

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

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

Current consumption characteristics

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

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

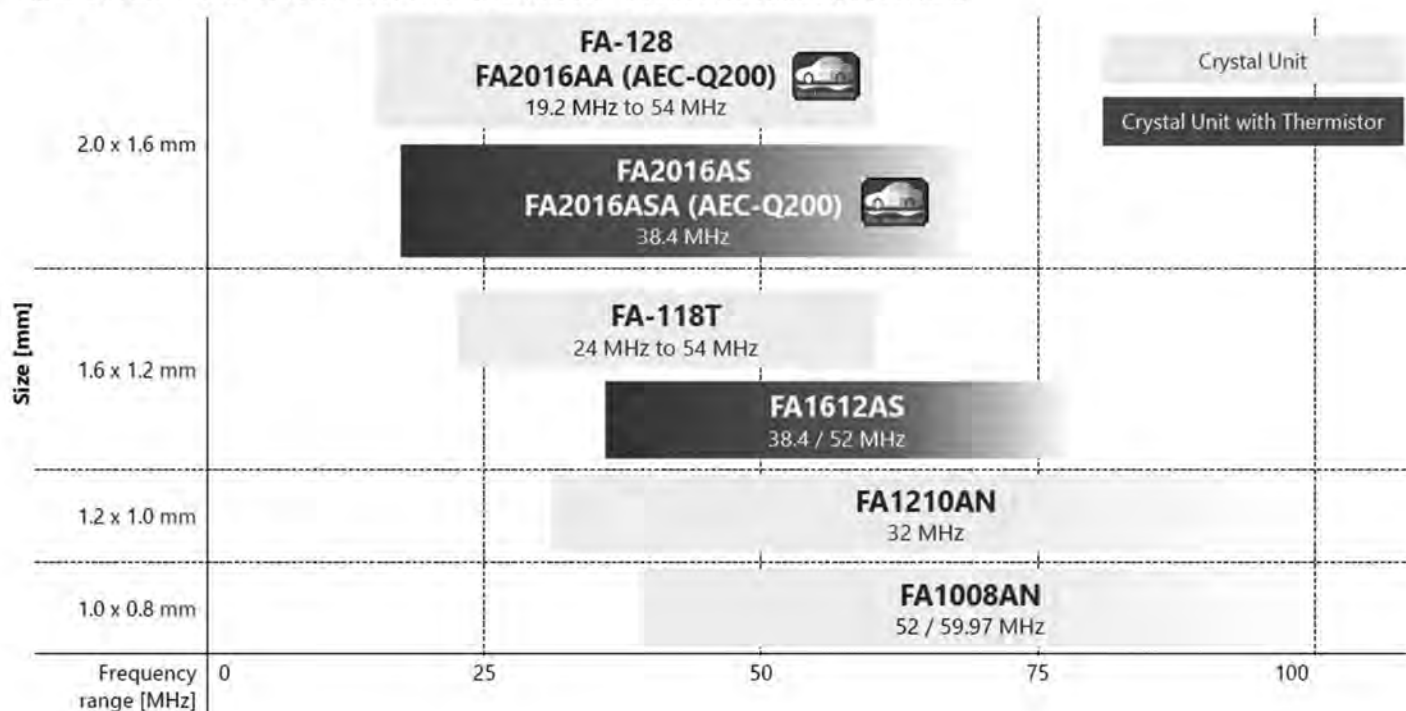
Power supply detection voltage

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

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
High-voltage mode	V _{DETH}	VDD pin	1.90	2.10	2.30	V
Low-voltage mode	V _{DETL}	VDD pin	1.15	1.30	1.45	V

MHz Crystal Units

MHz Crystal Unit, Crystal Unit with Thermistor Recommendation Products



► MHz Crystal Unit

P	Model	Size [mm]	Nominal frequency range	Frequency tolerance (+25 °C) [x 10 ⁻⁶]	Frequency vs. temperature characteristics [x10 ⁻⁶] / Operating temperature [°C]	Motional resistance Max. [Ω]	Load Capacitance [pF]	Operating temperature [°C]
41	FA1008AN	1.0 × 0.8 × 0.3t	40 MHz 100 MHz	±10	±10 / -20 to +75 ±15 / -30 to +85 ±20 / -40 to +85	60	6 to ∞	-40 to +85 (-40 to +105)
42	FA1210AN	1.2 × 1.0 × 0.3t	32 MHz 100 MHz	±10	±10 / -20 to +75 ±15 / -30 to +85 ±20 / -40 to +85	100 (32 ≤ f < 50 MHz) 60 (50 ≤ f ≤ 100 MHz)	6 to ∞	-40 to +85 (-40 to +105)
43	FA-118T	1.6 × 1.2 × 0.35t	24 MHz 54 MHz	±30	±12 / -20 to +75 ±30 / -20 to +75	200 (24 ≤ f < 32 MHz) 100 (32 ≤ f < 36 MHz) 80 (36 ≤ f ≤ 54 MHz)	6 to ∞	-40 to +85
44	FA-128	2.0 × 1.6 × 0.5t	19.2 MHz 54 MHz	±10	±10 / -20 to +75	150 (19.2 ≤ f < 20 MHz) 100 (20 ≤ f < 24 MHz) 80 (24 ≤ f < 26 MHz) 60 (26 ≤ f ≤ 54 MHz)	6 to ∞	-40 to +85 (-40 to +105)
45	FA-20H	2.5 × 2.0 × 0.55t	12 MHz 54 MHz	±30	±10 / -20 to +75 ±30 / -20 to +75	150 (12 ≤ f < 16 MHz) 80 (16 ≤ f ≤ 25 MHz) 60 (25 ≤ f < 30 MHz) 50 (30 ≤ f < 35 MHz) 40 (35 ≤ f ≤ 54 MHz)	7 to ∞	-40 to +85 (-40 to +105)
46	FA-238V	3.2 × 2.5 × 0.7t	12 MHz 15.999 MHz	±15	±30 / -20 to +70	100 (12 ≤ f ≤ 13 MHz) 80 (13 < f < 20 MHz) 60 (20 ≤ f < 25 MHz) 50 (25 ≤ f < 30 MHz) 40 (30 ≤ f ≤ 50 MHz)	7 to ∞	-40 to +85 (-40 to +105)
	FA-238	3.2 × 2.5 × 0.7t	16 MHz 50 MHz	±50	±10 / -20 to +75	60 (16 ≤ f < 21 MHz) 40 (21 ≤ f ≤ 48 MHz)	7 to ∞	-40 to +85 (-40 to +105)
	TSX-3225	3.2 × 2.5 × 0.6t	16 MHz 48 MHz	±10	±10 / -20 to +75	60 (16 ≤ f < 21 MHz) 40 (21 ≤ f ≤ 48 MHz)	7 to ∞	-40 to +85 (-40 to +105)
121	FA2016AA (AEC-Q200)	2.0 × 1.6 × 0.5t	19.2 MHz 54 MHz	±10	±20 / -40 to +85 ±50 / -40 to +125	150 (19.2 ≤ f < 20 MHz) 100 (20 ≤ f < 24 MHz) 80 (24 ≤ f < 26 MHz) 60 (26 ≤ f ≤ 54 MHz)	6 to ∞	-40 to +125
122	FA-238A (AEC-Q200)	3.2 × 2.5 × 0.7t	12 MHz 50 MHz	±15	±30 / -40 to +85 ±50 / -40 to +125	120 (12 ≤ f ≤ 13 MHz) 80 (13 < f < 20 MHz) 60 (20 ≤ f < 25 MHz) 50 (25 ≤ f ≤ 50 MHz)	7 to ∞	-40 to +125

► MHz Crystal Unit (Built-in Thermistor)

P	Model	Size [mm]	Nominal frequency range	Frequency tolerance (+25 °C) [x 10 ⁻⁶]	Frequency vs. temperature characteristics [x10 ⁻⁶] / Operating temperature [°C]	Motional resistance Max. [Ω]	Load Capacitance [pF]	Operating temperature [°C]
47	FA1612AS	1.6 × 1.2 × 0.65t	38.4 MHz 52 MHz	±10	±12 / -30 to +85	80	6 to ∞	-40 to +85
48	FA2016AS	2.0 × 1.6 × 0.65t	38.4 MHz	±10	±12 / -30 to +85	60	6 to ∞	-40 to +85
Web site	FA-20HS	2.5 × 2.0 × 1.0t	19.2 MHz 26 MHz	±10	±12 / -30 to +85	80 (19.2 MHz) 60 (26.0 MHz)	6 to ∞	-40 to +85
123	FA2016ASA (AEC-Q200)	2.0 × 1.6 × 0.68t	38.4 MHz	±10	±12 / -30 to +85 ±30 / -40 to +105	50	6 to ∞	-40 to +105

*1 Please contact us about reference temperature.



MHz RANGE CRYSTAL UNIT

FA1008AN



Product Number
FA1008AN: X1E000451xxx26



FA1008AN

(1.0 x 0.8 mm, t = 0.3 mm Max.)

- Nominal frequency range : 40 MHz to 100 MHz
- External dimensions : 1.0 x 0.8 mm, t = 0.3 mm Max.
- Overtone order : Fundamental
- Applications : Small wireless device
Small wireless module
Wearable device
Health care equipment
Small consumer equipment etc.

Specifications (characteristics)

Item	Symbol	Specifications	Conditions / Remarks
Nominal frequency range	f_nom	40 MHz to 100 MHz	Please contact us for requirements not listed in this specification.
		52 MHz, 59.97 MHz	Standard frequency
Storage temperature range	T_stg	-40 °C to +125 °C	Storage as single product.
Operating temperature range	T_use	-40 °C to +85 °C (+105 °C)	Please contact us about +85 °C < T_use
Level of drive	DL	100 μW Max.	Recommended: 10 μW
Frequency tolerance (standard)	f_tol	$\pm 10 \times 10^{-6}$	+25 °C, Please contact us for requirements not listed in this specification.
Frequency versus temperature characteristics. (standard)	f_tem	$\pm 10 \times 10^{-6}$ / -20 °C to +75 °C	Specify from the specifications on the left Please contact us for requirements not listed in this specification.
		$\pm 15 \times 10^{-6}$ / -30 °C to +85 °C	
		$\pm 20 \times 10^{-6}$ / -40 °C to +85 °C	
Load capacitance	CL	6 pF to ∞	Please specify.
Motional resistance (ESR)	R1	60 Ω Max. (52 MHz, 59.97MHz)	-40 °C to +85 °C, DL = 10 μW
Frequency aging	f_age	$\pm 1 \times 10^{-6}$ / year Max. (52 MHz, 59.97 MHz)	+25 °C, First year

Product name

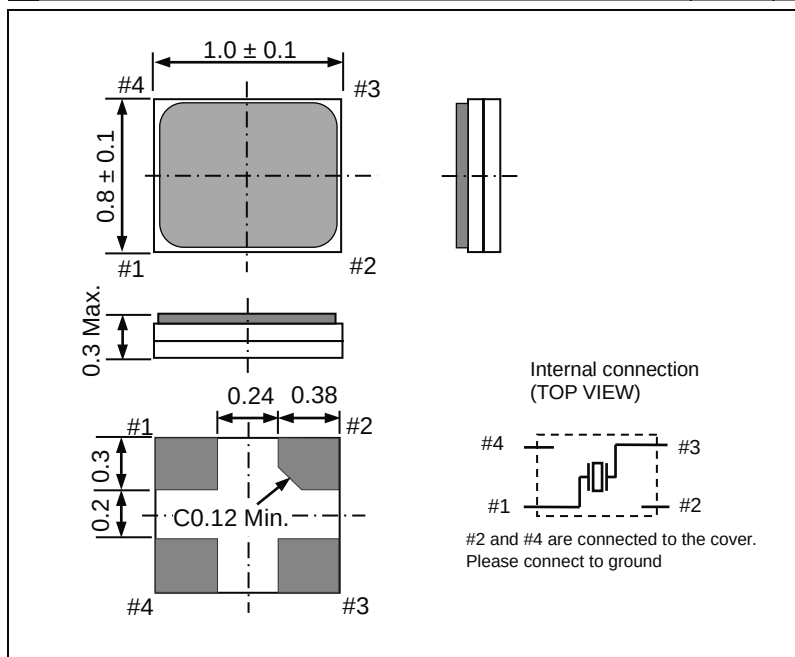
Product name (Standard form) FA1008AN 59.970000MHz 12.0 +10.0+10.0
 ① ② ③ ④

①Model ②Frequency ③Load capacitance (pF) ④Frequency tolerance ($\times 10^{-6}$, +25 °C)

In addition to the mentioned above specification item, please specify frequency temperature characteristics and operating temperature range in case of inquiry.

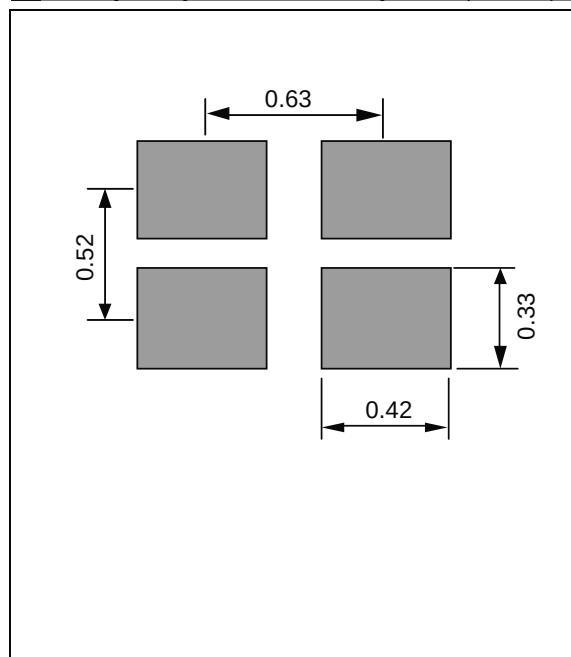
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





MHz RANGE CRYSTAL UNIT

FA1210AN



Product Number
FA1210AN: X1E000411xxxx26



FA1210AN

(1.2 x 1.0 mm t = 0.3 mm Max.)

- Nominal frequency range : 32 MHz to 100 MHz
- External dimensions : 1.2 x 1.0 mm , t = 0.3 mm Max.
- Overtone order : Fundamental
- Applications : Small wireless device
Small wireless module
Wearable device
Health care equipment
Small consumer equipment etc.

Specifications (characteristics)

Item	Symbol	Specifications	Conditions / Remarks
Nominal frequency range	f_nom	32 MHz to 100 MHz	Please contact us for requirements not listed in this specification.
		32 MHz	Standard frequency
Storage temperature range	T_stg	-40 °C to +125 °C	Storage as single product.
Operating temperature range	T_use	-40 °C to +85 °C (+105 °C)	Please contact us about +85 °C < T_use
Level of drive	DL	100 μW Max.	Recommended: 10 μW
Frequency tolerance (standard)	f_tol	±10 x 10 ⁻⁶	+25 °C, Please contact us for requirements not listed in this specification.
Frequency versus temperature characteristics. (standard)	f_tem	±10 x 10 ⁻⁶ / -20 °C to +75 °C	Specify from the specifications on the left Please contact us for requirements not listed in this specification.
		±15 x 10 ⁻⁶ / -30 °C to +85 °C	
		±20 x 10 ⁻⁶ / -40 °C to +85 °C	
Load capacitance	CL	6 pF to ∞	Please specify.
Motional resistance (ESR)	R1	100 Ω Max. (32 MHz)	-40 °C to +85 °C, DL = 10 μW
Frequency aging	f_age	±1 x 10 ⁻⁶ / year Max. (32 MHz)	+25 °C, First year

Product name

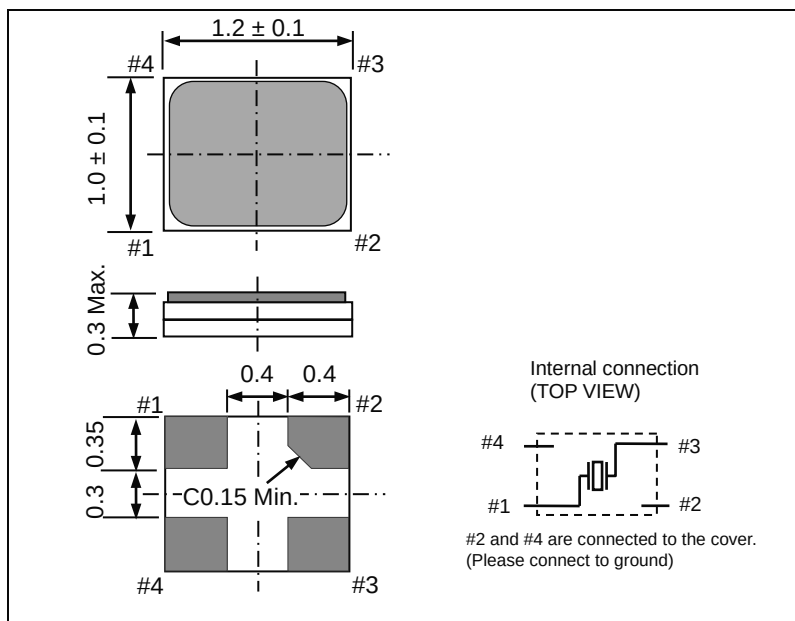
Product name FA1210AN 32.000000MHz 12.0 +10.0-10.0
(Standard form) ① ② ③ ④

①Model ②Frequency ③Load capacitance(pF) ④Frequency tolerance(× 10⁻⁶, +25 °C)

In addition to the mentioned above specification item, please specify frequency temperature characteristics and operating temperature range in case of inquiry.

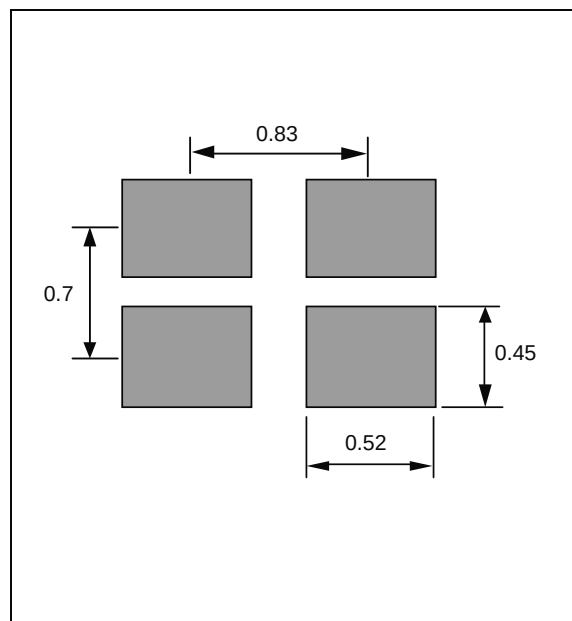
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





MHz RANGE CRYSTAL UNIT

FA-118T



Product Number
FA-118T : X1E000251xxxx26

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



Specifications (characteristics)

Item	Symbol	Specifications		Conditions / Remarks
		For RF Reference	For Clock	
Nominal frequency range	f_nom	24 MHz to 54 MHz		Fundamental Please contact us about available frequencies.
Storage temperature range	T_stg	-40 °C to +125 °C		Storage as single product.
Operating temperature range	T_use	-40 °C to +85 °C		
Level of drive	DL	100 µW Max.	200 µW Max.	Recommended: 10 µW
Frequency tolerance (standard)	f_tol	$\pm 10 \times 10^{-6}$ *1	$\pm 30 \times 10^{-6}$	+25 °C, please contact us for requirements not listed in this specification.
Frequency versus temperature characteristics. (standard)	f_tem	$\pm 12 \times 10^{-6}$ *1	$\pm 30 \times 10^{-6}$	-20 °C to +75 °C, please contact us for requirements not listed in this specification.
Load capacitance	CL	6 pF to ∞		Please specify.
Motional resistance (ESR)	R1	As per below table1.		-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 available frequency tolerances as they are dependent upon the nominal frequency.

Table 1. Motional resistance(ESR) R1

Frequency	Motional resistance
24 MHz ≤ f_nom < 32 MHz	200 Ω Max.
32 MHz ≤ f_nom < 36 MHz	100 Ω Max.
36 MHz ≤ f_nom ≤ 54 MHz	80 Ω Max.

Product name

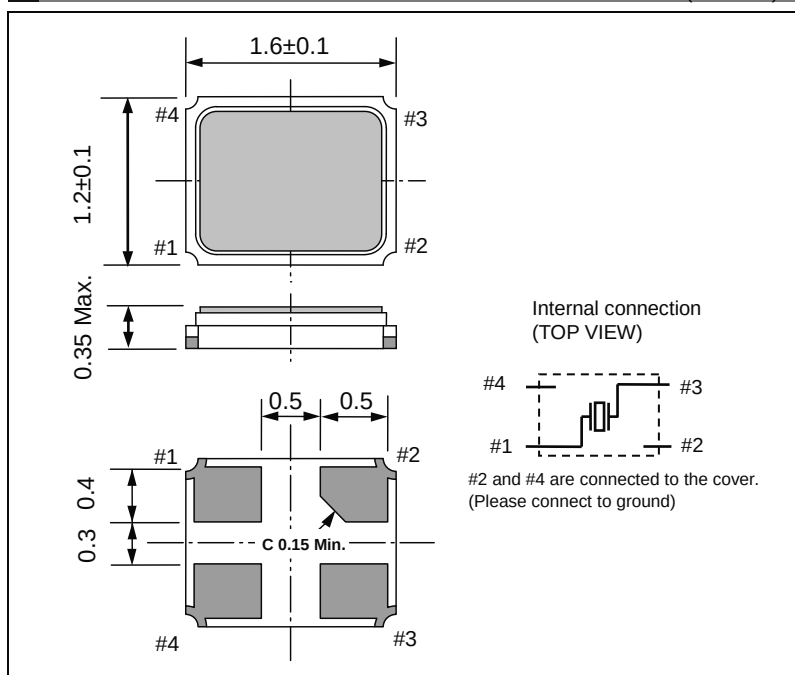
Product name FA-118T 24.000000MHz 12.0 +10.0-10.0
(Standard form) ① ② ③ ④

①Model ②Frequency ③Load capacitance(pF) ④Frequency tolerance($\times 10^{-6}$, +25 °C)

In addition to the above mentioned specification item, please specify frequency temperature characteristics and operating temperature range in case of inquiry.

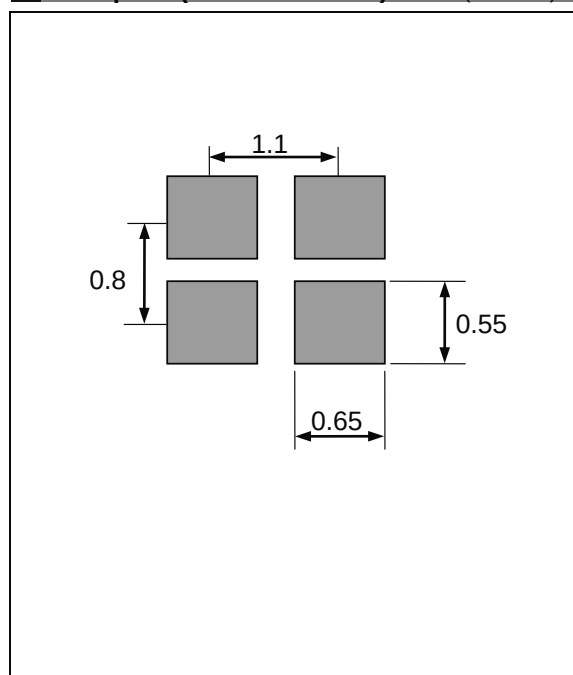
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





MHz RANGE CRYSTAL UNIT

FA-128

Product Number
Q22FA1280xxxx18

- Nominal frequency range : 19.2 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



Specifications (characteristics)

Item	Symbol	Specifications		Conditions / Remarks
		For RF Reference	For Clock	
Nominal frequency range	f_nom	19.2 MHz to 54 MHz		Fundamental Please contact us about available frequencies.
Storage temperature range	T_stg	-40 °C to +125 °C		Storage as single product.
Operating temperature range	T_use	-40 °C to +85 °C (+105 °C)		Please contact us about +85 °C < T_use
Level of drive	DL	100 µW Max.	200 µW Max.	Recommended: 10 µW
Frequency tolerance (standard)	f_tol	$\pm 10 \times 10^{-6}$ *1	$\pm 30 \times 10^{-6}$	+25 °C, please contact us for requirements not listed in this specification.
Frequency versus temperature characteristics. (standard)	f_tem	$\pm 10 \times 10^{-6}$ *1	$\pm 30 \times 10^{-6}$	-20 °C to +75 °C, please contact us for requirements not listed in this specification.
Load capacitance	CL	6 pF to ∞		Please specify.
Motional resistance (ESR)	R1	As per below Table 1.		-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 available frequency tolerances as they are dependent upon the nominal frequency.

Table 1. Motional resistance (ESR) R1

Frequency	Motional resistance
19.2 MHz ≤ f_nom < 20 MHz	150 Ω Max.
20 MHz ≤ f_nom < 24 MHz	100 Ω Max.
24 MHz ≤ f_nom < 26 MHz	80 Ω Max.
26 MHz ≤ f_nom ≤ 54 MHz	60 Ω Max.

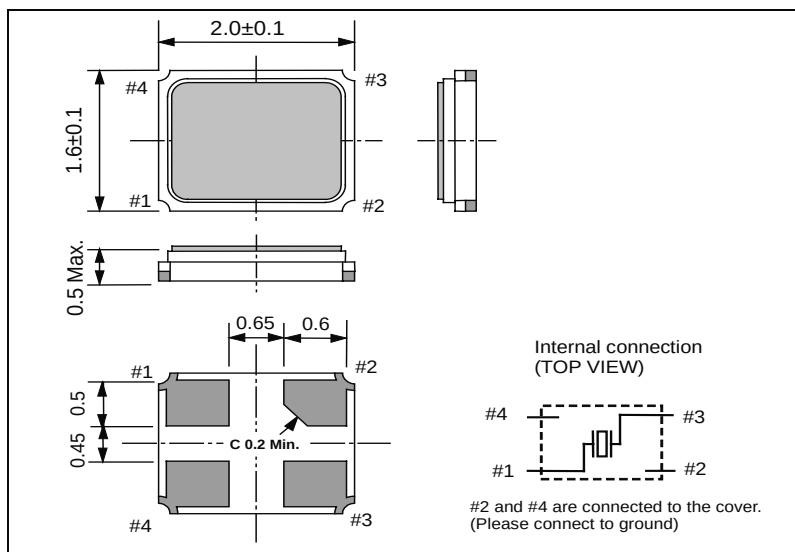
Product name

Product name FA-128 24.000000MHz 12.0 +10.0-10.0
(Standard form) ① ② ③ ④①Model ②Frequency ③Load capacitance(pF) ④Frequency tolerance($\times 10^{-6}$, +25 °C)

In addition to the above mentioned specification item, please specify frequency temperature characteristics and operating temperature range in case of inquiry.

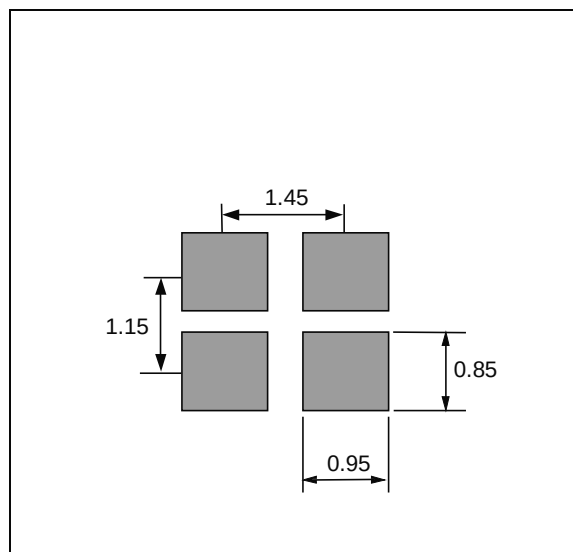
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





MHz RANGE CRYSTAL UNIT

FA-20H



Product Number
Q24FA20H0xxx18

- Nominal frequency range : 12 MHz to 54 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



Specifications (characteristics)

Item	Symbol	Specifications		Conditions / Remarks
		For RF Reference	For Clock	
Nominal frequency range	f _{nom}	12 MHz to 54 MHz		Fundamental Please contact us about available frequencies.
Storage temperature range	T _{stg}	-40 °C to +125 °C		Storage as single product.
Operating temperature range	T _{use}	-40 °C to +85 °C (+105 °C)		Please contact us about +85 °C < T _{use}
Level of drive	DL	100 μW Max.	200 μW Max.	Recommended: 10 μW
Frequency tolerance	f _{tol}	±10 × 10 ⁻⁶	±30 × 10 ⁻⁶	+25 °C Please contact us for inquiries.
Frequency versus temperature characteristics	f _{tem}	±10 × 10 ⁻⁶	±30 × 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 table1.		-20 °C to +75 °C
Frequency aging	f _{age}	±1 × 10 ⁻⁶ to ±3 × 10 ⁻⁶ / year Max. *1		+25 °C, First year

*1 Please contact us for available frequency tolerances as they are dependent upon the nominal frequency.

Table 1. Motional resistance (ESR) R1

Frequency	Motional resistance
12 MHz ≤ f _{nom} < 16 MHz	150 Ω Max.
16 MHz ≤ f _{nom} ≤ 25 MHz	80 Ω Max.
25 MHz < f _{nom} ≤ 30 MHz	60 Ω Max.
30 MHz < f _{nom} ≤ 35 MHz	50 Ω Max.
35 MHz < f _{nom} ≤ 54 MHz	40 Ω Max.

Product name

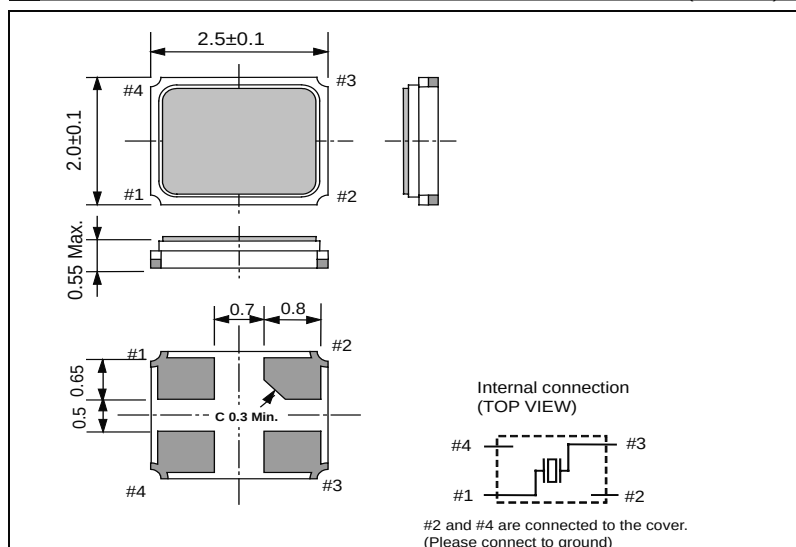
Product name FA-20H 24.000000MHz 12.0 +10.0-10.0
(Standard form) ① ② ③ ④

①Model ②Frequency ③Load capacitance(pF) ④Frequency tolerance(× 10⁻⁶, +25 °C)

In addition to the above mentioned specification item, please specify frequency temperature characteristics and operating temperature range in case of inquiry.

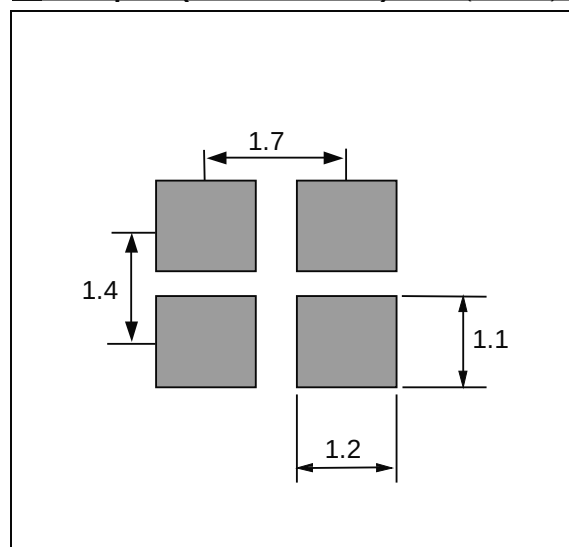
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





MHz RANGE CRYSTAL UNIT

FA-238V

FA-238

TSX-3225



Product Number
 FA-238V : Q22FA23V0xxxx17
 FA-238 : Q22FA2380xxxx17
 TSX-3225 : X1E000021xxxx17



FA-238V/FA-238



TSX-3225

- Frequency range : 12 MHz to 50 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

Specifications (characteristics)

Item	Symbol	For Clock		For RF Reference	Conditions / Remarks
		FA-238V	FA-238	TSX-3225	
Nominal frequency range	f_nom	12 MHz to 15.999 MHz	16 MHz to 50 MHz	16 MHz to 48 MHz	Fundamental *1 Please contact us about available frequencies.
Storage temperature	T_stg	-40 °C to +125 °C			Storage as single product.
Operating temperature	T_use	-40 °C to +85 °C (+105 °C)			Please contact us about +85 °C < T_use
Level of drive	DL	200 µW Max.			Recommended: 10 µW
Frequency tolerance	f_tol	±50 × 10 ⁻⁶ (standard), (±15 × 10 ⁻⁶ to ±50 × 10 ⁻⁶ is available)		±10 × 10 ⁻⁶	+25 °C Please contact us for requirements not listed in this specifications. *1
Frequency versus temperature characteristics	f_tem	±30 × 10 ⁻⁶ /20 °C to +70 °C		±10 × 10 ⁻⁶ /20 °C to +75 °C	Please contact us for requirements not listed in this specifications. *1
Load capacitance	CL	7 pF to ∞			Please specify.
Motional resistance (ESR)	R1	As per below table1.		As per below table2.	-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.

Table 1. FA-238V / FA-238 Motional resistance (ESR) R1

(FA-238V / FA-238)	Frequency	Motional resistance
	12 MHz ≤ f_nom ≤ 13 MHz	100 Ω Max.
	13 MHz < f_nom < 20 MHz	80 Ω Max.
	20 MHz ≤ f_nom < 25 MHz	60 Ω Max.
	25 MHz ≤ f_nom < 30 MHz	50 Ω Max.
	30 MHz ≤ f_nom ≤ 50 MHz	40 Ω Max.

Table 2. TSX-3225 Motional resistance (ESR) R1

(TSX-3225)	Frequency	Motional resistance
	16 MHz ≤ f_nom < 21 MHz	60 Ω Max.
	21 MHz ≤ f_nom ≤ 48 MHz	40 Ω Max.

Product name

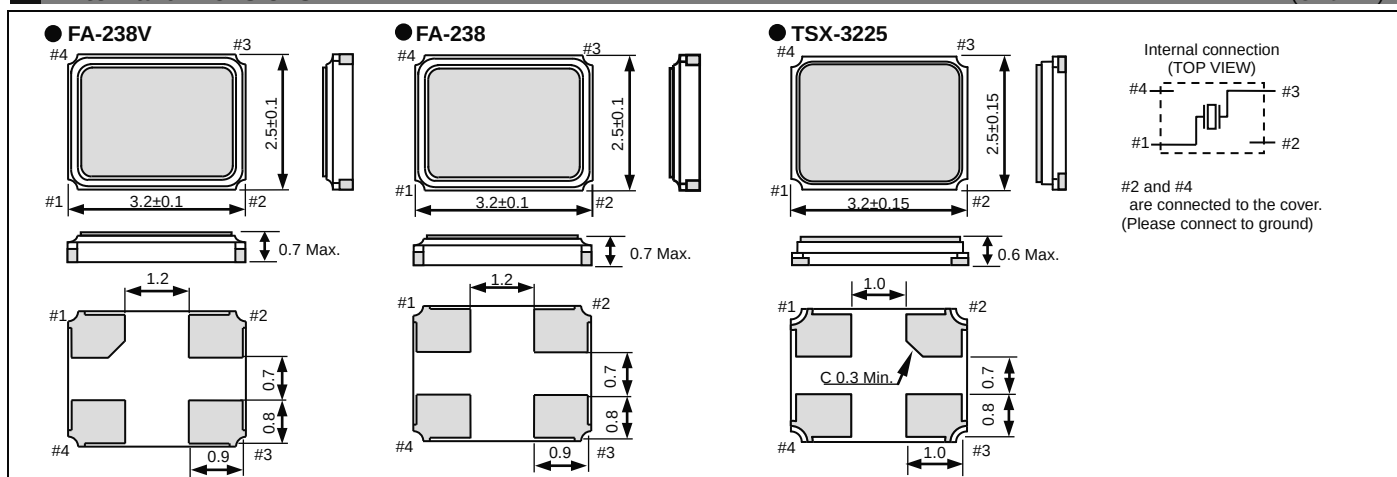
Product name FA-238V 12.000000MHz 12.0 ±15.0-15.0
 (Standard form) ① ② ③ ④

①Model ②Frequency ③Load capacitance(pF) ④Frequency tolerance(× 10⁻⁶, +25 °C)

In addition to the above mentioned specification item, please specify frequency temperature characteristics and operating temperature range in case of inquiry.

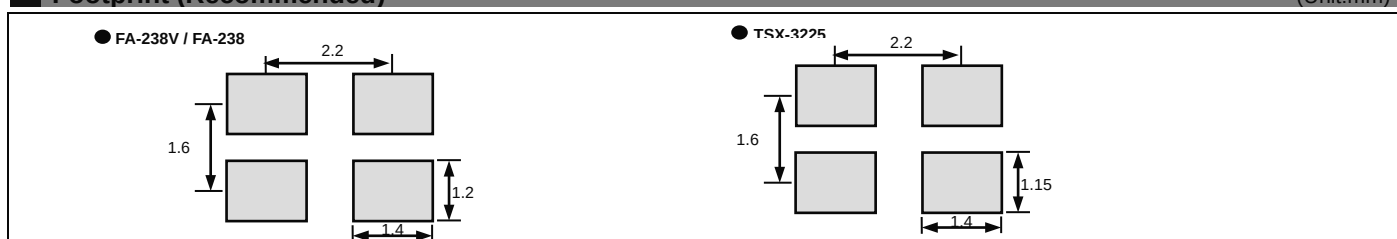
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





MHz RANGE CRYSTAL UNIT

Built-in thermistor



Product Number
FA1612AS: X1E000401xxxx18

FA1612AS

- Nominal frequency range : 38.4 MHz, 52MHz
- External dimensions : $1.6 \times 1.2 \times 0.65$ mm
- Overtone order : Fundamental
- Applications : Mobile phone, Bluetooth, W-LAN
ISM band radio, Clock for MPU
GPS, Smart phone



Specifications (characteristics)

Item	Symbol	Specifications	Conditions / Remarks
Nominal frequency range	f_nom	38.4 MHz, 52 MHz	Fundamental Please contact us about available frequencies.
Storage temperature range	T_stg	-40 °C to +125 °C	Storage as single product.
Operating temperature range	T_use	-40 °C to +85 °C	
Level of drive	DL	100 μ W Max.	Recommended: 10 μ W
Frequency tolerance	f_tol	$\pm 10 \times 10^{-6}$ *1	Please contact us about reference temperature. Please contact us for inquiries.
Frequency versus temperature characteristics	f_tem	$\pm 12 \times 10^{-6}$ *1	-30 °C to +85 °C Please contact us for inquiries.
Load capacitance	CL	6 pF to ∞	Please specify.
Motional resistance (ESR)	R1	50 Ω Max. (38.4 MHz) 30 Ω Max. (52 MHz)	-30 °C to +85 °C
Frequency aging	f_age	$\pm 1 \times 10^{-6}$ / year Max.	+25 °C, First year
Thermistor resistance	—	Please contact us about specifications.	
Thermistor B constant	—		

*1 Please contact us for available frequency tolerances as they are dependent upon the nominal frequency.

Product name

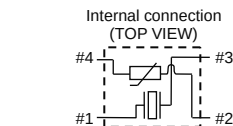
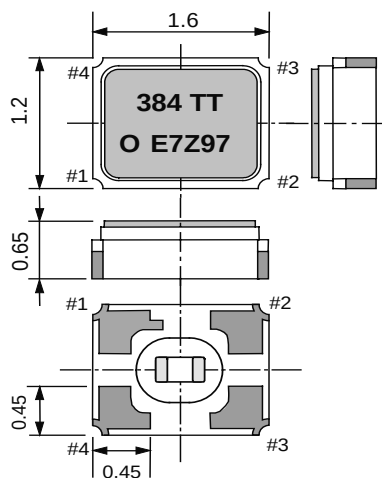
Product name FA1612AS 38.400000MHz 7.0 +10.0-10.0
(Standard form) ① ② ③ ④

①Model ②Frequency ③Load capacitance(pF) ④Frequency tolerance($\times 10^{-6}$, +25 °C)

In addition to the above mentioned specification item, please specify frequency temperature characteristics and operating temperature range in case of inquiry.

External dimensions

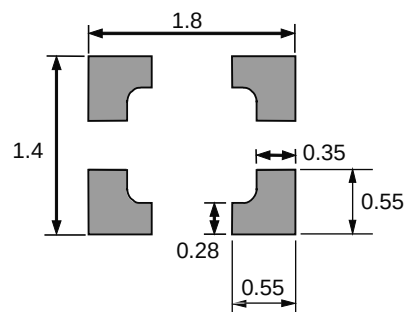
(Unit:mm)



Pin map

Pin	connection
1	Crystal
2	GND, thermistor
3	Crystal
4	thermistor

Footprint (Recommended) (Unit:mm)





MHz RANGE CRYSTAL UNIT

Built-in thermistor



Product Number
FA2016AS: X1E000371xxxx18

FA2016AS

- Nominal frequency range : 38.4 MHz
- External dimensions : $2.0 \times 1.6 \times 0.65$ mm
- Overtone order : Fundamental
- Applications : Mobile phone, Bluetooth, W-LAN
ISM band radio, Clock for MPU
GPS, Smart phone



Specifications (characteristics)

Item	Symbol	Specifications	Conditions / Remarks
Nominal frequency range	f_nom	38.4 MHz	Fundamental Please contact us about available frequencies.
Storage temperature range	T_stg	-40 °C to +125 °C	Storage as single product.
Operating temperature range	T_use	-40 °C to +85 °C	
Level of drive	DL	100 μ W Max.	Recommended: 10 μ W
Frequency tolerance	f_tol	$\pm 10 \times 10^{-6}$ *1	Please contact us about reference temperature. Please contact us for inquiries.
Frequency versus temperature characteristics	f_tem	$\pm 12 \times 10^{-6}$ *1	-30 °C to +85 °C Please contact us for inquiries.
Load capacitance	CL	6 pF to ∞	Please specify.
Motional resistance (ESR)	R1	50 Ω Max.	-30 °C to +85 °C
Frequency aging	f_age	$\pm 1 \times 10^{-6}$ / year Max.	+25 °C, First year
Thermistor resistance	—	Please contact us about specifications.	
Thermistor B constant	—		

*1 Please contact us for available frequency tolerances as they are dependent upon the nominal frequency.

Product name

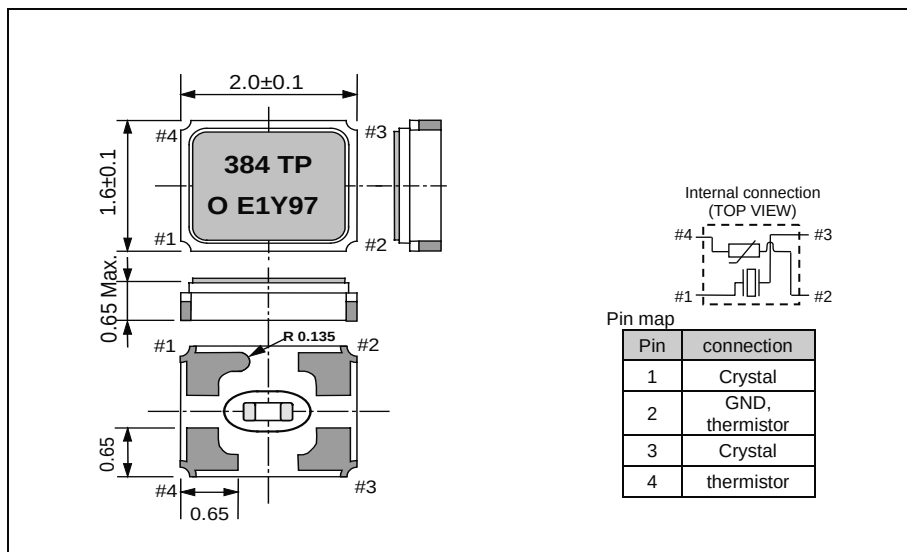
Product name FA2016AS 38.400000MHz 7.0 +10.0-10.0
(Standard form) ① ② ③ ④

①Model ②Frequency ③Load capacitance(pF) ④Frequency tolerance($\times 10^{-6}$, +25 °C)

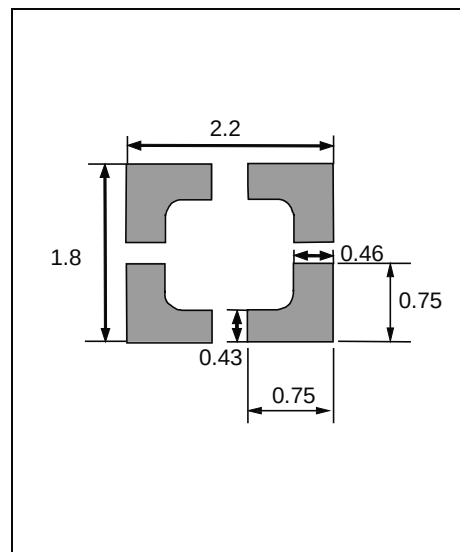
In addition to the above mentioned specification item, please specify frequency temperature characteristics and operating temperature range in case of inquiry.

External dimensions

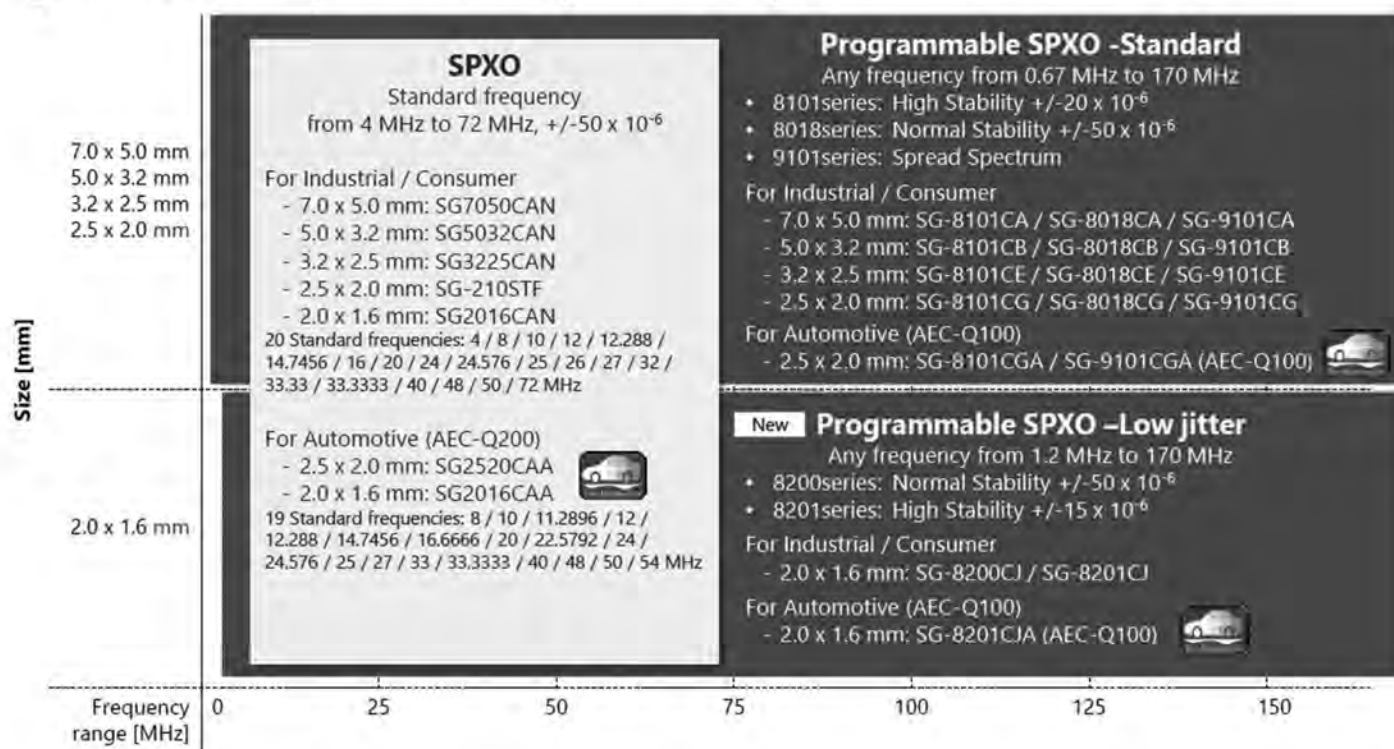
(Unit:mm)



Footprint (Recommended) (Unit:mm)



Crystal Oscillator (SPXO / SPSO) CMOS Output



► Fixed-Frequency SPXO

P	Model	Size [mm]	Nominal frequency range	Frequency Tolerance [x 10 ⁻⁶]	Operating temperature [°C]	Supply voltage [V]	Current consumption Max. [mA]	Output load condition [pF]	Output control				
53	SG2016CAN SG-210STF SG3225CAN SG5032CAN SG7050CAN	2.0 x 1.6 x 0.7t 2.5 x 2.0 x 0.8t 3.2 x 2.5 x 1.05t 5.0 x 3.2 x 1.1t 7.0 x 5.0 x 1.3t	4 MHz72 MHz 20 standard frequencies	±25 ±50 ±50, ±100	-20 to +70 -40 to +85 -40 to +105	1.6 to 2.2	2.4	15	ST				
						2.2 to 2.7	2.8						
						2.7 to 3.6	3.0						
Web Site	SG5032CCN SG7050CCN	5.0 x 3.2 x 1.1t 7.0 x 5.0 x 1.3t	2.5 MHz50 MHz	±50	-40 to +85	4.5 to 5.5	20.0	50	OE				
124	SG2016CAA (AEC-Q200)	2.0 x 1.6 x 0.7t 2.5 x 2.0 x 0.8t	8 MHz54 MHz 19 standard frequencies	±50, ±100 ±50, ±100 ±100, ±150	-40 to +85 -40 to +105 -40 to +125	1.6 to 2.2	2.9	15	ST				
124	SG2520CAA (AEC-Q200)					2.2 to 2.7	3.3						
						2.7 to 3.6	3.5						

► Programmable SPXO

P	Model	Size [mm]	Nominal frequency range	Frequency Tolerance [x 10 ⁻⁶]	Operating temperature [°C]	Supply voltage [V]	Current consumption Max. [mA]	Output load condition [pF]	Output control
55	SG-8200CJ	2.0 x 1.6 x 0.6t	1.2 MHz  170 MHz	±50	-40 to +125	1.62 to 1.98 2.25 to 2.75 2.97 to 3.63	10.4 12.4 15.0	15	OE or ST
57	SG-8201CJ	2.0 x 1.6 x 0.6t	1.2 MHz  170 MHz	±15 ±25	-40 to +105 -40 to +125	1.62 to 1.98 2.25 to 2.75 2.97 to 3.63	10.4 12.4 15.0	15	OE or ST
125	SG-8201CJA (AEC-Q100)	2.0 x 1.6 x 0.6t	1.2 MHz  170 MHz	±15 ±25 / ±50	-40 to +105 -40 to +125	1.62 to 1.98 2.25 to 2.75 2.97 to 3.63	10.4 12.4 15.0	15	OE or ST
59	SG-8018CG SG-8018CE SG-8018CB SG-8018CA	2.5 x 2.0 x 0.7t 3.2 x 2.5 x 1.05t 5.0 x 3.2 x 1.1t 7.0 x 5.0 x 1.3t	0.67 MHz  170 MHz	±50	-40 to +105	1.62 to 1.98 1.98 to 2.2 2.2 to 2.8 2.7 to 3.63	5.5 5.8 6.7 8.1	15	OE or ST
61	SG-8101CG SG-8101CE SG-8101CB SG-8101CA	2.5 x 2.0 x 0.7t 3.2 x 2.5 x 1.05t 5.0 x 3.2 x 1.1t 7.0 x 5.0 x 1.3t	0.67 MHz  170 MHz	±15 ±20 / ±50	-40 to +85 -40 to +105	1.62 to 1.98 1.98 to 2.20 2.20 to 2.80 2.70 to 3.63	5.5 5.8 6.7 8.1	15	OE or ST
127	SG-8101CGA (AEC-Q100)	2.5 x 2.0 x 0.7t	0.67 MHz  170 MHz	±15 ±20 ±50 / ±100	-40 to +85 -40 to +105 -40 to +125	1.62 to 1.98 1.98 to 2.20 2.20 to 2.80 2.70 to 3.63	5.5 5.8 6.7 8.1	15	OE or ST

► Programmable SPXO, Spread Spectrum

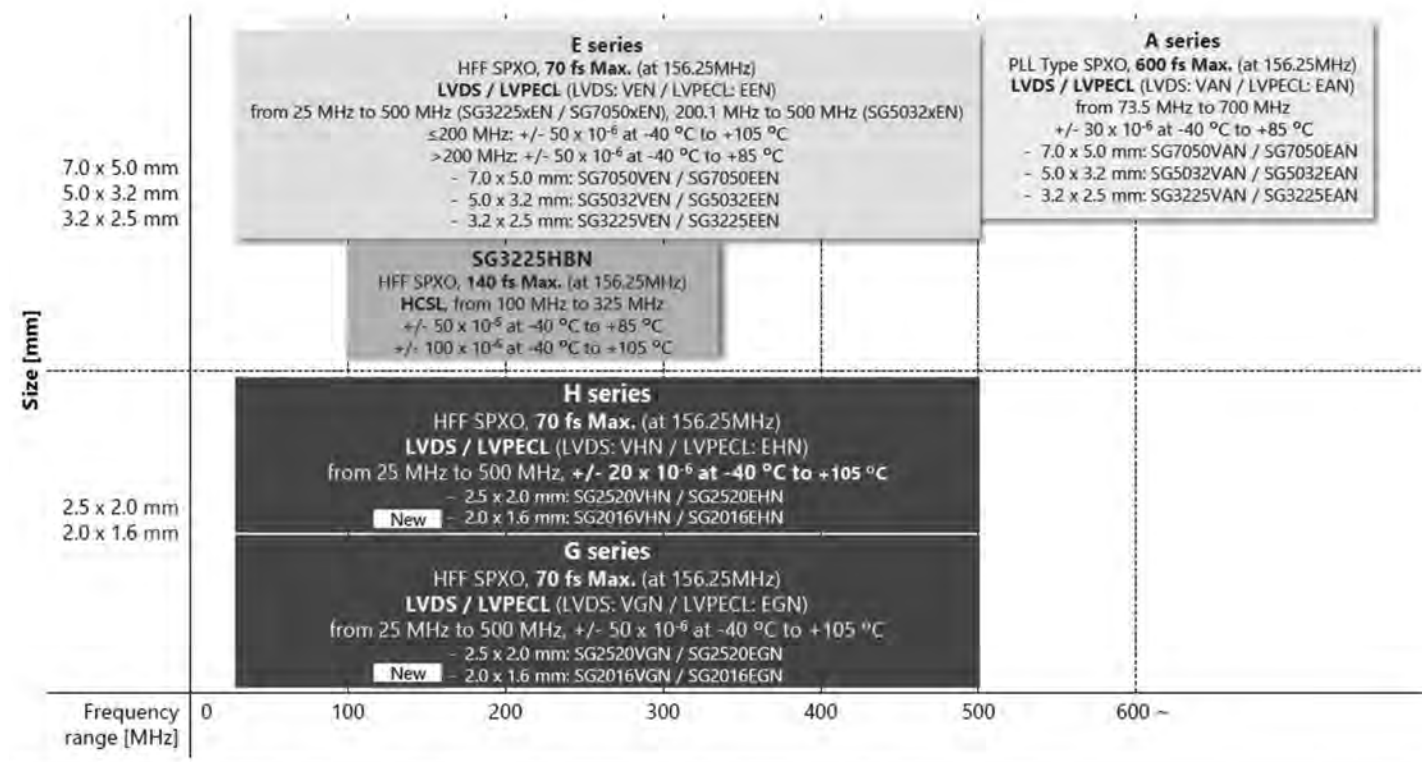
P	Model	Size [mm]	Nominal frequency range	Spread Spectrum Configuration [%]	Operating temperature [°C]	Supply voltage [V]	Current consumption Max. [mA]	Output load condition [pF]	Output control
				Upper: Center Lower: Down					
63	SG-9101CG SG-9101CE SG-9101CB SG-9101CA	2.5 x 2.0 x 0.7t 3.2 x 2.5 x 1.05t 5.0 x 3.2 x 1.1t 7.0 x 5.0 x 1.3t	0.67 MHz  170 MHz	±0.25 to ±2.0 -0.5 to -4.0	-40 to +85 -40 to +105	1.62 to 1.98 1.98 to 2.20 2.20 to 2.80 2.70 to 3.63	5.7 6.0 6.9 8.3	15	OE or ST
129	SG-9101CGA (AEC-Q100)	2.5 x 2.0 x 0.7t	0.67 MHz  170 MHz	±0.25 to ±2.0 -0.5 to -4.0	-40 to +125	1.62 to 1.98 1.98 to 2.20 2.20 to 2.80 2.70 to 3.63	5.8 6.1 7.0 8.4	15	OE or ST

Spread Spectrum Configuration Center [%]	±0.25	±0.5	±0.75	±1.0	±1.5	±2.0
Spread Spectrum Configuration Down [%]	-0.5	-1.0	-1.5	-2.0	-3.0	-4.0

► Programming tool for Programmable SPXO

P	Model
65	SG-8000 series Programming Tool (SG-Writer II)

Crystal Oscillator (SPXO / SPSO) Differential Output



► SPXO

P	Model	Size [mm]	Nominal frequency range	Frequency Tolerance [$\times 10^{-6}$]	Operating temperature [°C]	Supply voltage [V]	Current consumption Max. [mA]	Output load condition [Ω]	Phase Jitter Max. (Bandwidth: 12 kHz to 20 MHz) [fs]
66	SG2016EHN SG2520EHN	LV-PECL	25 MHz  500 MHz	± 20	-40 to +85 -40 to +105	2.5 $\pm$ 0.125 3.3 $\pm$ 0.165	60	50	90 (fo = 100.00 MHz) 70 (fo = 156.25 MHz) 60 (fo = 212.50 MHz) 50 (fo = 491.52 MHz)
	SG2016VHN SG2520VHN	LVDS				1.8 $\pm$ 0.090 2.5 $\pm$ 0.125 3.3 $\pm$ 0.165	25	100	100 (fo = 100.00 MHz) 60 (fo = 156.25 MHz) 50 (fo = 212.50 MHz) 50 (fo = 491.52 MHz) *Supply voltage = 2.5 V, 3.3 V
67	SG2016EGN SG2520EGN	LV-PECL	25 MHz  500 MHz	± 25 ± 50	-40 to +85 -40 to +105	2.5 $\pm$ 0.125 3.3 $\pm$ 0.165	60	50	90 (fo = 100.00 MHz) 70 (fo = 156.25 MHz) 60 (fo = 212.50 MHz) 50 (fo = 491.52 MHz)
	SG2016VGN SG2520VGN	LVDS				1.8 $\pm$ 0.090 2.5 $\pm$ 0.125 3.3 $\pm$ 0.165	25	100	100 (fo = 100.00 MHz) 60 (fo = 156.25 MHz) 50 (fo = 212.50 MHz) 50 (fo = 491.52 MHz) *Supply voltage = 2.5 V, 3.3 V
68	SG3225EEN SG5032EEN SG7050EEN	LV-PECL	25 MHz  500 MHz (SG3225xEN, SG7050xEN)	± 25 ± 50 ± 100	-40 to +85 -40 to +105	2.5 $\pm$ 0.125 3.3 $\pm$ 0.165	60	50	100 (fo = 100.00 MHz) 70 (fo = 156.25 MHz) 60 (fo = 212.50 MHz) 40 (fo = 491.52 MHz)
	SG3225VEN SG5032VEN SG7050VEN	LVDS					25	100	150 (fo = 100.00 MHz) 90 (fo = 156.25 MHz) 80 (fo = 212.50 MHz) 60 (fo = 491.52 MHz)
69	SG3225EAN SG5032EAN SG7050EAN	LV-PECL	73.5 MHz  700 MHz	± 20 ± 30 ± 50	-20 to +70 -40 to +85	2.375 to 3.63	65	50	600 (none of the following fo) 900 (fo = 243 MHz to 250 MHz, 486 MHz to 500 MHz)
	SG3225VAN SG5032VAN SG7050VAN	LVDS					30	100	
70	SG3225HBN	HCSL	100 MHz  325 MHz	± 50 ± 100	-40 to +85 -40 to +105	3.3 $\pm$ 0.33	35	50	180 (fo = 100.00 MHz) 140 (fo = 156.25 MHz) 125 (fo = 200.00 MHz) 110 (fo = 322.27 MHz)

► SPSO

P	Model		Size [mm]	Nominal frequency range	Frequency Tolerance [x 10 ⁻⁶]	Operating temperature [°C]	Supply voltage [V]	Current consumption Max. [mA]	Output load condition [Ω]	Phase Jitter Max. (Bandwidth: 12 kHz to 20 MHz) [fs]							
Web Site	EG-2121CB	LV-PECL	5.0 x 3.2 x 1.4t	 100 MHz 700 MHz	±50 ±100	0 to +70 -5 to +85 -20 to +70	2.5 ± 0.125	60	50	LV-PECL / LVDS 230 / 270 (fo = 100 MHz to 150 MHz) 220 / 240 (fo = 150 MHz to 200 MHz) 210 / 230 (fo = 200 MHz to 300 MHz) 180 / 190 (fo = 300 MHz to 400 MHz) 160 / 160 (fo = 400 MHz to 500 MHz) 140 / 140 (fo = 500 MHz to 600 MHz) 100 / 100 (fo = 600 MHz to 700 MHz)							
		LVDS						30	100								
	EG-2102CB	LV-PECL					3.3 ± 0.33	60	50								
		LVDS							30		100						
	XG5032HAN	HCSL	 100 MHz 200 MHz	±50 ±100	0 to +70 -5 to +85 -20 to +70	2.5 ± 0.125	35	50	300 (fo = 100 MHz to 160 MHz) 400 (fo = 160 MHz to 175 MHz) 200 (fo = 175 MHz to 200 MHz)								
	XG-2121CA	LV-PECL	 100 MHz 700 MHz	±50 ±100		2.5 ± 0.125	60	50	LV-PECL / LVDS 230 / 270 (fo = 100 MHz to 150 MHz) 220 / 240 (fo = 150 MHz to 200 MHz) 210 / 230 (fo = 200 MHz to 300 MHz) 180 / 190 (fo = 300 MHz to 400 MHz) 160 / 160 (fo = 400 MHz to 500 MHz) 140 / 140 (fo = 500 MHz to 600 MHz) 100 / 100 (fo = 600 MHz to 700 MHz)								
		LVDS					30	100									
	XG-2102CA	LV-PECL		±100		3.3 ± 0.33	60	50									
		LVDS					30	100									
	XG-2103CA	LV-PECL				3.3 ± 0.33	60	50									
		LVDS					30	100									
	MG7050EAN (Multi output)	LV-PECL	7.0 x 5.0 x 1.6t	 100 MHz 700 MHz		±50 ±100		0 to +70 -5 to +85 -20 to +70	2.5 ± 0.125	94 (2out) 170 (4out)	50	170 / 140 (fo = 100.00 MHz) 150 / 120 (fo = 156.25 MHz) 110 / 100 (fo = 312.50 MHz) 50 / 50 (fo = 700.00 MHz) (Left: 2.5 V / Right: 3.3 V)					
									3.3 ± 0.33	102 (2out) 184 (4out)							
										2.5 ± 0.125			50 (2out) 66 (4out)	100			
									3.3 ± 0.33	56 (2out) 72 (4out)							
	MG7050VAN (Multi output)	LVDS	7.0 x 5.0 x 1.6t						 100 MHz 700 MHz	±50 ±100			0 to +70 -5 to +85 -20 to +70	2.5 ± 0.125	50 (2out) 66 (4out)	100	190 / 160 (fo = 100.00 MHz) 170 / 140 (fo = 156.25 MHz) 120 / 110 (fo = 312.50 MHz) 60 / 60 (fo = 700.00 MHz) (Left: 2.5 V / Right: 3.3 V)
														3.3 ± 0.33	56 (2out) 72 (4out)		
															2.5 ± 0.125		
3.3 ± 0.33					90 (2out) 136 (4out)												
MG7050HAN (Multi output)	HCSL	7.0 x 5.0 x 1.6t	 100 MHz 200 MHz				2.5 ± 0.125	84 (2out) 128 (4out)				50 or 42.2		190 / 160 (fo = 100.00 MHz) 180 / 150 (fo = 125.00 MHz) 160 / 130 (fo = 156.25 MHz) 140 / 120 (fo = 200.00 MHz) (Left: 2.5 V / Right: 3.3 V)			
							3.3 ± 0.33	90 (2out) 136 (4out)									

► Programmable SPXO (Output: LV-PECL)

P	Model	Size [mm]	Nominal frequency range	Frequency Tolerance [x 10 ⁻⁶]	Operating temperature [°C]	Supply voltage [V]	Current consumption Max. [mA]	Output load condition [Ω]	Phase Jitter Max. (Bandwidth: 12 kHz to 20 MHz) [fs]
71	SG-8506CA (I2C-Bus, Programmable, 8 pin)	7.0 x 5.0 x 1.5t	50 MHz800 MHz	±31.5 ±50	-40 to +85	2.5 ± 0.125	90	50	300
73	SG-8503CA (Dual Selectable, 6 pin)					3.3 ± 0.33			
						2.5 ± 0.125			
						3.3 ± 0.33			
						2.5 ± 0.125			
						3.3 ± 0.33			

CRYSTAL OSCILLATOR (SPXO)

OUTPUT : CMOS



Product Number (please contact us)
 SG2016CAN: X1G004801xxxx00
 SG-210STF: X1G004171xxxx00
 SG3225CAN: X1G005961xxxx15
 SG5032CAN: X1G004451xxxx00
 SG7050CAN: X1G004481xxxx00

SG2016 / 3225 / 5032 / 7050CAN SG-210STF

- Frequency : 20 standard frequencies
- Supply voltage : 1.8 V to 3.3 V Typ.
- Function : Standby($\overline{\text{ST}}$)
- Operating temperature : -40 °C to +105 °C



Specifications (characteristics)

Item	Symbol	Specifications					Conditions / Remarks			
Output frequency	fo	4 MHz 14.7456 MHz 25 MHz 33.3333 MHz	8 MHz 16 MHz 26 MHz 40 MHz	10 MHz 20 MHz 27 MHz 48 MHz	12 MHz 24 MHz 32 MHz 50 MHz	12.288 MHz 24.576 MHz 33.33 MHz 72 MHz				
Supply voltage	VCC	1.60 V to 3.63 V					4 MHz ≤ fo ≤ 50 MHz, T_use = +105 °C Max.		Refer to Figure 1	
		1.71 V to 3.63 V					fo = 72 MHz, T_use = +85 °C Max.			
		2.25 V to 3.63 V					fo = 72 MHz, T_use = +105 °C Max.			
Storage temperature	T_stg	-55 °C to +125 °C					SG2016CAN, SG3225CAN			
		-40 °C to +125 °C					All others			
Operating temperature	T_use	-20 °C to +70 °C, -40 °C to +85 °C, -40 °C to +105 °C					See of figure *1			
Frequency tolerance	f_tol	±25 × 10 ⁻⁶					-20 °C to +70 °C			
		±50 × 10 ⁻⁶					-40 °C to +85 °C, -40 °C to +105 °C			
Current consumption	Icc	VCC = 1.8 V ± 10 %	VCC = 2.5 V ± 10 %		VCC = 3.3 V ± 10 %					
		1.5 mA Max.	1.6 mA Max.		1.8 mA Max.		No load condition, 4 MHz ≤ fo ≤ 20 MHz			
		1.8 mA Max.	2.0 mA Max.		2.2 mA Max.		No load condition, 20 MHz < fo ≤ 40 MHz			
		2.1 mA Max.	2.4 mA Max.		2.6 mA Max.		No load condition, 40 MHz < fo ≤ 50 MHz			
		2.4 mA Max.	2.8 mA Max.		3.0 mA Max.		No load condition, fo = 72 MHz			
Stand-by current	I_std	2.1 µA Max.	2.5 µA Max.		2.7 µA Max.		ST =GND			
Symmetry	SYM	45 % to 55 %					50 % VCC level, L_CMOS ≤ 15 pF			
Output voltage	VOH	90 % VCC Min.						1.8 V ± 10 %	2.5 V ± 10 %	3.3 V ± 10 %
	VOL	10 % VCC Max.					IOH	-1.5 mA	-3 mA	-4 mA
	VOH-2	VCC - 0.4 V Min.					IOL	1.5 mA	3 mA	4 mA
	VOL-2	0.4 V Max.						1.8 V±10 %	2.5 V±10 %	3.3 V±10 %
							IOH	-3 mA	-4 mA	-6 mA
Output load condition (CMOS)	L_CMOS	15 pF Max.					IOL	3 mA	4 mA	6 mA
Input voltage	VIH	80 % VCC Min.					ST terminal			
	VIL	20 % VCC Max.								
Rise time and Fall time	tr / tf	3 ns Max. 3.5 ns Max. (@1.8 V±10 %)					20 % VCC to 80 % VCC level, L_CMOS = 15 pF			
Start-up time	t_str	3 ms Max.					T = 0 at 90 % VCC			
Frequency aging	f_age	±3 × 10 ⁻⁶ / year Max.					+25 °C, First year			

[Model : SG2016 / 3225 / 5032 / 7050CAN]

Product name **SG2016 CAN 25.000000MHz T J H A**

(Standard form) ① ② ③ ④⑤⑥⑦

①Model ②Output(C: CMOS) ③Frequency ④Supply voltage

⑤Frequency tolerance ⑥Operating temperature range

⑦Internal identification code("A" is default)

④Supply voltage *See Figure 1	
T	1.8 V to 3.3 V Typ.
K	2.5 V to 3.3 V Typ.

⑤Frequency tolerance / ⑥Operating temperature range	
DB*	$\pm 25 \times 10^{-6}$ / -20 °C to +70 °C
JG	$\pm 50 \times 10^{-6}$ / -40 °C to +85 °C
JH	$\pm 50 \times 10^{-6}$ / -40 °C to +105 °C

* Please refer to Product number list on Full Data Sheet for available frequencies

[Model : SG-210STF]

Product name **SG-210 STF 25.000000MHz Y**

(Standard form) ① ②③ ④ ⑤

①Model ②Function(S: Standby) ③Supply voltage

④Frequency ⑤Frequency tolerance

③Supply voltage *See Figure 1	
T	1.8 V to 3.3 V Typ.

⑤Frequency tolerance	
S*	$\pm 25 \times 10^{-6}$ / -20 °C to +70 °C
L	$\pm 50 \times 10^{-6}$ / -40 °C to +85 °C
Y	$\pm 50 \times 10^{-6}$ / -40 °C to +105 °C

* Please refer to Product number list on Full Data Sheet for available frequencies

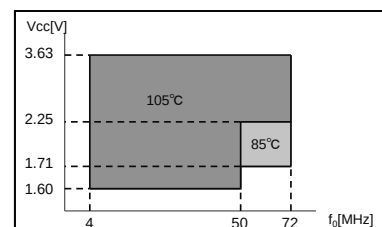


Figure 1 : The upper limit of Operating temperature and the related conditions

Please note that Supply voltage range (V_{CC}) depends on Output frequency (f_o) and upper limit of Operating temperature (T_{use} Max.).



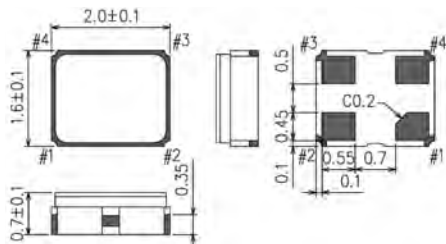
External dimensions

(Unit:mm)

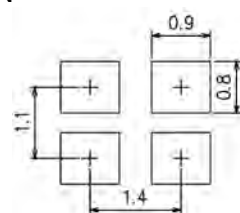
Footprint (Recommended)

(Unit:mm)

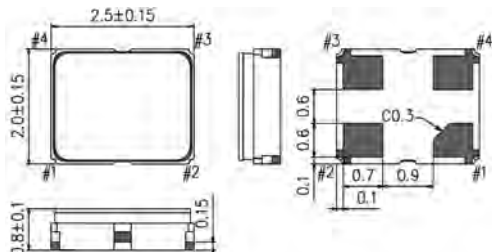
SG2016CAN



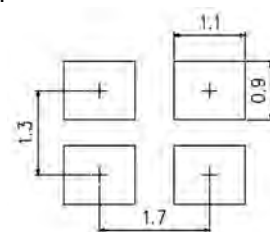
SG2016CAN



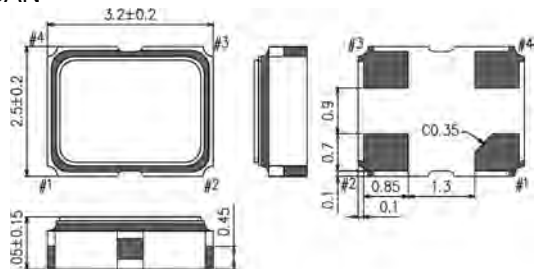
SG-210STF



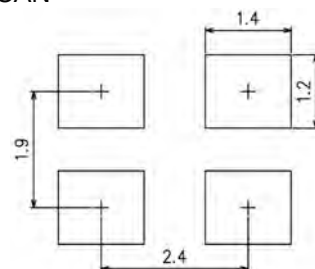
SG-210STF



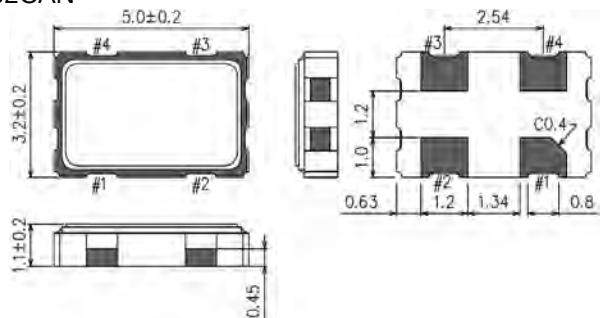
SG3225CAN



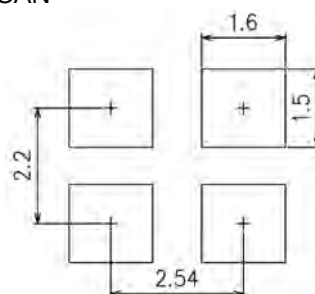
SG3225CAN



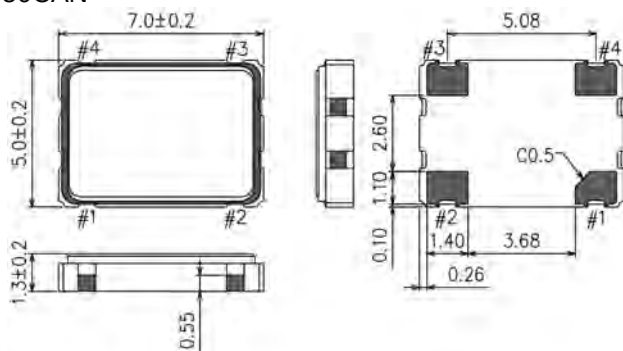
SG5032CAN



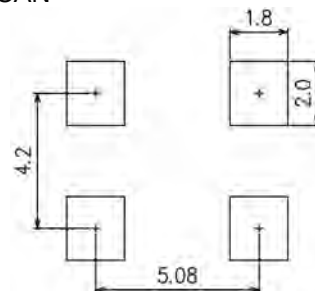
SG5032CAN



SG7050CAN



SG7050CAN



Pin Map

Pin	Connection	Function		
1	ST	ST terminal	ST function	Oscillator circuit
			HIGH or "open"	Oscillation
			LOW	Oscillation stop
2	GND	Ground	Output	
3	OUT	Clock output	Specified frequency: Enable	
4	V _{CC}	Power supply	High impedance: Disable	

■Notes: To maintain stable operation, provide a 0.01μF to 0.1μF 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 (Programmable)
OUTPUT: CMOS

SG-8200CJ

- Frequency range : 1.2 MHz to 170 MHz
- Supply voltage : 1.62 V to 3.63 V
- Function : Output enable (OE) or Standby (ST)
- Frequency tolerance, operating temperature:
±50 × 10⁻⁶ (-40 °C to +125 °C)
- External dimensions : 2.0 × 1.6 × 0.6 (mm)
- PLL technology to enable setting any output frequency



Product Number
X1G006211xxxx16



Specifications (characteristics)

Item	Symbol	Specifications			Conditions/Remarks			
Supply voltage	V _{CC}	1.80 V Typ.	2.50 V Typ.	3.30 V Typ.				
		1.62 V to 1.98 V	2.25 V to 2.75 V	2.97 V to 3.63 V				
Output frequency range	f _o	1.2 MHz to 170 MHz						
Storage temperature	T _{stg}	-55 °C to +125 °C			Storage as single product.			
Operating temperature	T _{use}	J: -40 °C to +125 °C						
Frequency tolerance ^{*1}	f _{tol}	J: ±50 × 10 ⁻⁶			T _{use} = -40 °C to +125 °C			
Current consumption	I _{CC}	5.2 mA Typ.	5.4 mA Typ.	5.6 mA Typ.	1.2 MHz ≤ f _o ≤ 25 MHz	No load, Rise/Fall time: Default		
		7.0 mA Max.	7.2 mA Max.	7.5 mA Max.				
		5.4 mA Typ.	5.7 mA Typ.	6.1 mA Typ.	25 MHz < f _o ≤ 50 MHz			
		7.3 mA Max.	7.6 mA Max.	8.1 mA Max.				
		5.7 mA Typ.	6.3 mA Typ.	7.0 mA Typ.	50 MHz < f _o ≤ 75 MHz			
		7.7 mA Max.	8.2 mA Max.	9.1 mA Max.				
		6.2 mA Typ.	6.9 mA Typ.	7.9 mA Typ.	75 MHz < f _o ≤ 100 MHz			
		8.2 mA Max.	9.1 mA Max.	10.4 mA Max.				
		6.9 mA Typ.	7.9 mA Typ.	9.1 mA Typ.	100 MHz < f _o ≤ 125 MHz			
		9.4 mA Max.	10.7 mA Max.	12.4 mA Max.				
125 MHz < f _o ≤ 170 MHz	7.8 mA Typ.	9.2 mA Typ.	11.2 mA Typ.					
	10.4 mA Max.	12.4 mA Max.	15.0 mA Max.					
Output disable current	I _{dis}	5.0 mA Typ.	5.0 mA Typ.	5.1 mA Typ.	OE = GND (Active High)			
		7.2 mA Max.	7.3 mA Max.	7.4 mA Max.	OE = V _{CC} (Active Low)			
Standby current	I _{std}	0.3 µA Typ.	0.3 µA Typ.	0.5 µA Typ.	ST = GND (Active High)			
		15.0 µA Max.	15.0 µA Max.	15.0 µA Max.	ST = V _{CC} (Active Low)			
Symmetry	SYM	45 % to 55 %			50 % V _{CC} Level, L _{CMOS} ≤ 15 pF			
Output voltage (DC characteristics)	V _{OH}	90 % V _{CC} Min.			Rise/Fall time		I _{OH}	I _{OL}
					Default 'A' Option ^{*2}	Other Options		
	V _{OL}	10 % V _{CC} Max.			fo > 125 MHz	B: Faster	-2.0 mA	2.0 mA
					75 MHz < fo ≤ 125 MHz	C: Fast	-1.0 mA	1.0 mA
					50 MHz < fo ≤ 75 MHz	D: Slow	-0.5 mA	0.5 mA
fo ≤ 50 MHz	E: Slower	-0.2 mA	0.2 mA					
Output load condition	L _{CMOS}	15 pF Max.						
Input voltage	V _{IH}	70 % V _{CC} Min.			Pin 1			
	V _{IL}	30 % V _{CC} Max.						
Rise/Fall time	tr/tf	-			Default 'A' Option ^{*2}	Other Options	20 % - 80 % V _{CC} , L _{CMOS} = 15 pF	
		2.0 ns Max.			fo > 125 MHz	B: Faster		
		2.5 ns Max.			75 MHz < fo ≤ 125 MHz	C: Fast		
		4.0 ns Max.			50 MHz < fo ≤ 75 MHz	D: Slow		
		6.0 ns Max.			fo ≤ 50 MHz	E: Slower		
Output disable time (OE)	tstp_oe	1 µs Max.			Measured from the time OE or ST pin crosses 30 % V _{CC} or measured from the time OE or ST pin crosses 70 % V _{CC}			
Output disable time (ST)	tstp_st							
Output enable time (OE)	tsta_oe	100 ns + 2 clock cycle Max.			Measured from the time OE pin crosses 70 % V _{CC} or measured from the time OE pin crosses 30 % V _{CC}			
Output enable time (ST)	tsta_st	3 ms Max.			Measured from the time ST pin crosses 70 % V _{CC} or measured from the time ST pin crosses 30 % V _{CC}			
Start-up time	t _{str}	3 ms Max.			Measured from the time V _{CC} reaches its rated minimum value, 1.62 V			
Phase Jitter	t _{PJ}	1.2 ps Typ.			fo = 25 MHz, Offset frequency: 12 kHz to 5 MHz			
		1.2 ps Typ.			fo = 50 MHz, Offset frequency: 12 kHz to 20 MHz			
		1.2 ps Typ.			fo = 75 MHz, Offset frequency: 12 kHz to 20 MHz			
		1.2 ps Typ.			fo = 100 MHz, Offset frequency: 12 kHz to 20 MHz			
		1.1 ps Typ.			fo = 125 MHz, Offset frequency: 12 kHz to 20 MHz			
		1.4 ps Typ.			fo = 150 MHz, Offset frequency: 12 kHz to 20 MHz			
		1.5 ps Typ.			fo = 170 MHz, Offset frequency: 12 kHz to 20 MHz			
Frequency aging	f _{age}	This is included in frequency tolerance specification.			+25 °C, first year			

*1 Frequency tolerance includes initial frequency tolerance, temperature variation, supply voltage variation, reflow drift, load drift and aging (+25 °C, 1 year).

*2 Default 'A' Rise/Fall time and I_{OH}/I_{OL} are dependent on programmed frequency.

Pin description

Pin	Name	I/O type	Function	
1	OE	Input	Output Enable (Active High)	High ^{*1} or Open: Specified frequency output from OUT pin Low: OUT pin is low (pull down with 500 kΩ), only output driver is disabled.
	ST	Input	Standby (Active High)	High ^{*1 *2} : Specified frequency output from OUT pin Low: OUT pin is low (pull down with 500 kΩ), Device goes to standby mode. Supply current reduces to the least as I _{std} .
	OE	Input	Output Enable (Active Low)	Low ^{*3} or Open: Specified frequency output from OUT pin High: OUT pin is low (pull down with 500 kΩ), only output driver is disabled.
	ST	Input	Standby (Active Low)	Low ^{*3 *4} : Specified frequency output from OUT pin High: OUT pin is low (pull down with 500 kΩ), Device goes to standby mode. Supply current reduces to the least as I _{std} .
2	GND	Power	Ground	
3	OUT	Output	Clock output	
4	V _{CC}	Power	Power supply	

*1 If fixing it at High, please connect to V_{CC} directly.

*2 If necessary to use Open, please select Output Enable (Active High) function.

*3 If fixing it at Low, please connect to GND directly.

*4 If necessary to use Open, please select Output Enable (Active Low) function.

Product Name

SG-8200CJ 170.000000MHz T J J P A
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

⑤ Frequency tolerance / ⑥ Operating temperature
JJ ±50 x 10⁻⁶ / -40 °C to +125 °C

⑧ Rise/Fall time

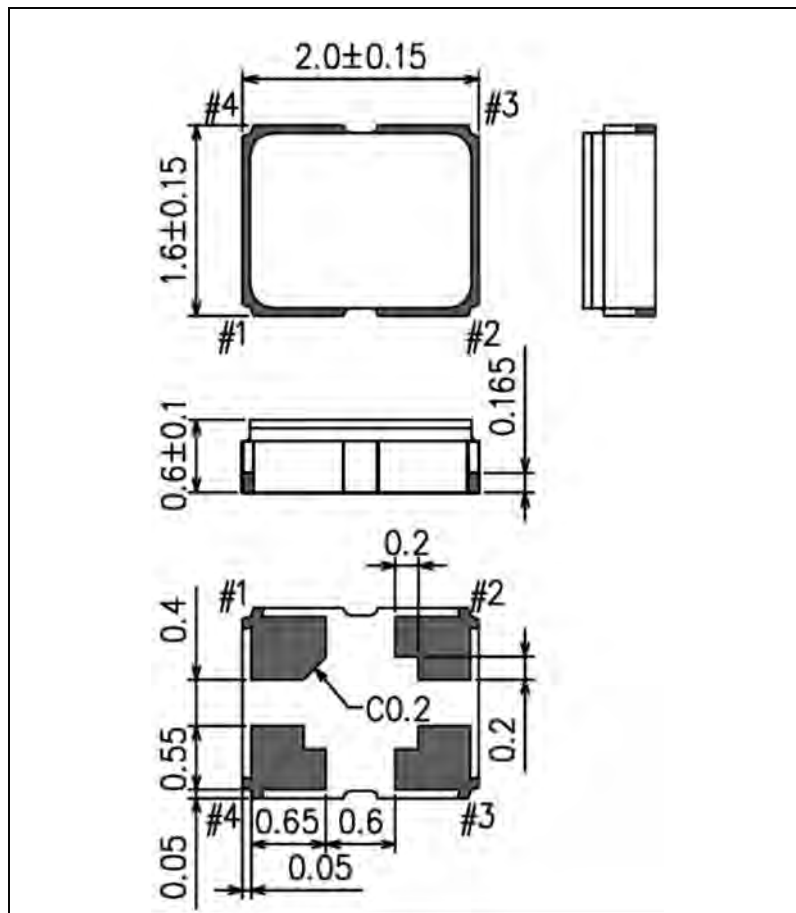
A	Default
B	Faster
C	Fast
D	Slow
E	Slower

- ① Model ② Package type (CJ: 2.0 mm × 1.6 mm)
③ Frequency ④ Supply voltage (T: 1.8 V to 3.3 V Typ.)
⑤ Frequency tolerance ⑥ Operating temperature
⑦ Function ⑧ Rise/Fall time

⑦ Function	
P	Output Enable (OE) / Active High
S	Standby (ST) / Active High
Q	Output Enable (OE) / Active Low
T	Standby (ST) / Active Low

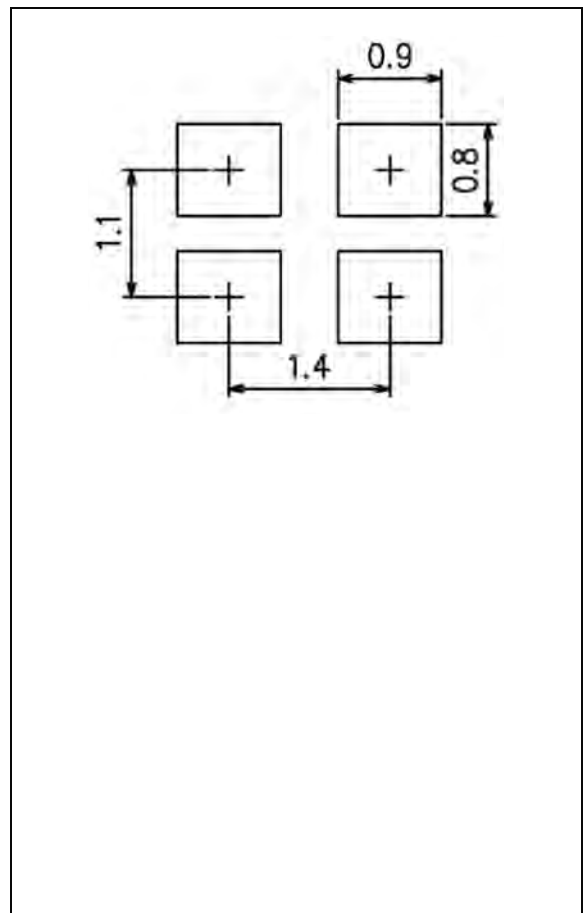
External dimensions

(Unit: mm)



Footprint (Recommended)

(Unit: mm)



Notes:

In order to achieve optimum jitter performance, the 0.01 μF to 0.1 μF capacitor between V_{CC} and GND should be placed. It is also recommended that the capacitors are placed on the device side of the PCB, as close to the device as possible and connected together with short wiring pattern.



CRYSTAL OSCILLATOR (Programmable)
OUTPUT: CMOS

SG-8201CJ

- Frequency range : 1.2 MHz to 170 MHz
- Supply voltage : 1.62 V to 3.63 V
- Function : Output enable (OE) or Standby (ST)
- Frequency tolerance, operating temperature:
 - $\pm 15 \times 10^{-6}$ (-40 °C to +105 °C)
 - $\pm 25 \times 10^{-6}$ (-40 °C to +125 °C)
- External dimensions : 2.0 × 1.6 × 0.6 (mm)
- PLL technology to enable setting any output frequency



Product Number
X1G005981xxxx16



Specifications (characteristics)

Item	Symbol	Specifications			Conditions/Remarks			
Supply voltage	V _{cc}	1.80 V Typ.	2.50 V Typ.	3.30 V Typ.				
		1.62 V to 1.98 V	2.25 V to 2.75 V	2.97 V to 3.63 V				
Output frequency range	f _o	1.2 MHz to 170 MHz						
Storage temperature	T _{stg}	-55 °C to +125 °C			Storage as single product.			
Operating temperature	T _{use}	H: -40 °C to +105 °C						
		J: -40 °C to +125 °C						
Frequency tolerance ^{*1}	f _{tol}	B: ±15 × 10 ⁻⁶			T _{use} = -40 °C to +105 °C			
		D: ±25 × 10 ⁻⁶			T _{use} = -40 °C to +125 °C			
Current consumption	I _{cc}	5.2 mA Typ.	5.4 mA Typ.	5.6 mA Typ.	1.2 MHz ≤ f _o ≤ 25 MHz	No load, Rise/Fall time: Default		
		7.0 mA Max.	7.2 mA Max.	7.5 mA Max.				
		5.4 mA Typ.	5.7 mA Typ.	6.1 mA Typ.	25 MHz < f _o ≤ 50 MHz			
		7.3 mA Max.	7.6 mA Max.	8.1 mA Max.				
		5.7 mA Typ.	6.3 mA Typ.	7.0 mA Typ.	50 MHz < f _o ≤ 75 MHz			
		7.7 mA Max.	8.2 mA Max.	9.1 mA Max.				
		6.2 mA Typ.	6.9 mA Typ.	7.9 mA Typ.	75 MHz < f _o ≤ 100 MHz			
		8.2 mA Max.	9.1 mA Max.	10.4 mA Max.				
		6.9 mA Typ.	7.9 mA Typ.	9.1 mA Typ.	100 MHz < f _o ≤ 125 MHz			
		9.4 mA Max.	10.7 mA Max.	12.4 mA Max.				
7.8 mA Typ.	9.2 mA Typ.	11.2 mA Typ.	125 MHz < f _o ≤ 170 MHz					
10.4 mA Max.	12.4 mA Max.	15.0 mA Max.						
Output disable current	I _{dis}	5.0 mA Typ.	5.0 mA Typ.	5.1 mA Typ.	OE = GND (Active High)			
		7.2 mA Max.	7.3 mA Max.	7.4 mA Max.	OE = V _{cc} (Active Low)			
Standby current	I _{std}	0.3 µA Typ.	0.3 µA Typ.	0.5 µA Typ.	ST = GND (Active High)			
		15.0 µA Max.	15.0 µA Max.	15.0 µA Max.	ST = V _{cc} (Active Low)			
Symmetry	SYM	45 % to 55 %			50 % V _{cc} Level, L _{CMOS} ≤ 15 pF			
Output voltage (DC characteristics)	V _{OH}	90 % V _{cc} Min.			Rise/Fall time		I _{OH}	I _{OL}
					Default 'A' Option ^{*2}	Other Options		
	V _{OL}	10 % V _{cc} Max.			fo > 125 MHz	B: Faster	-2.0 mA	2.0 mA
					75 MHz < fo ≤ 125 MHz	C: Fast	-1.0 mA	1.0 mA
					50 MHz < fo ≤ 75 MHz	D: Slow	-0.5 mA	0.5 mA
fo ≤ 50 MHz	E: Slower	-0.2 mA	0.2 mA					
Output load condition	L _{CMOS}	15 pF Max.						
Input voltage	V _{IH}	70 % V _{cc} Min.			Pin 1			
	V _{IL}	30 % V _{cc} Max.						
Rise/Fall time	tr/tf	-			Default 'A' Option ^{*2}	Other Options	20 % - 80 % V _{cc} , L _{CMOS} = 15 pF	
		2.0 ns Max.			fo > 125 MHz	B: Faster		
		2.5 ns Max.			75 MHz < fo ≤ 125 MHz	C: Fast		
		4.0 ns Max.			50 MHz < fo ≤ 75 MHz	D: Slow		
		6.0 ns Max.			fo ≤ 50 MHz	E: Slower		
Output disable time (OE) Output disable time (ST)	tstp_oe tstp_st	1 µs Max.			Measured from the time OE or ST pin crosses 30 % V _{cc} or measured from the time OE or ST pin crosses 70 % V _{cc}			
Output enable time (OE)	tsta_oe	100 ns + 2 clock cycle Max.			Measured from the time OE pin crosses 70 % V _{cc} or measured from the time OE pin crosses 30 % V _{cc}			
Output enable time (ST)	tsta_st	3 ms Max.			Measured from the time ST pin crosses 70 % V _{cc} or measured from the time ST pin crosses 30 % V _{cc}			
Start-up time	t _{str}	3 ms Max.			Measured from the time V _{cc} reaches its rated minimum value, 1.62 V			
Phase Jitter	t _{pj}	1.2 ps Typ.			fo = 25 MHz, Offset frequency: 12 kHz to 5 MHz			
		1.2 ps Typ.			fo = 50 MHz, Offset frequency: 12 kHz to 20 MHz			
		1.2 ps Typ.			fo = 75 MHz, Offset frequency: 12 kHz to 20 MHz			
		1.2 ps Typ.			fo = 100 MHz, Offset frequency: 12 kHz to 20 MHz			
		1.1 ps Typ.			fo = 125 MHz, Offset frequency: 12 kHz to 20 MHz			
		1.4 ps Typ.			fo = 150 MHz, Offset frequency: 12 kHz to 20 MHz			
Frequency aging	f _{age}	This is included in frequency tolerance specification.			+25 °C, first year			

*1 Frequency tolerance includes initial frequency tolerance, temperature variation, supply voltage variation, reflow drift, load drift and aging (+25 °C, 1 year).

*2 Default 'A' Rise/Fall time and I_{OH}/I_{OL} are dependent on programmed frequency.

Pin description

*1 If fixing it at High, please connect to V_{CC} directly.
*2 If necessary to use Open, please select Output Enable (Active High) function.
*3 If fixing it at Low, please connect to GND directly.
*4 If necessary to use Open, please select Output Enable (Active Low) function.

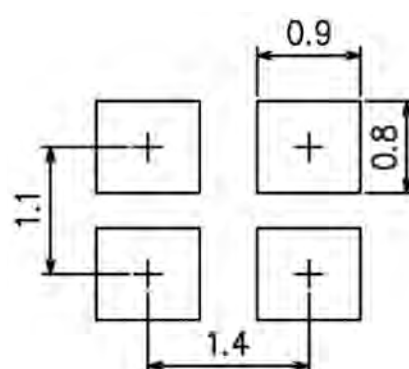
Product Name

⑧ Rise/Fall time	
A	Default
B	Faster
C	Fast
D	Slow
E	Slower

⑦Function	
P	Output Enable (OE) / Active High
S	Standby (ST) / Active High
Q	Output Enable (OE) / Active Low
T	Standby (ST) / Active Low

External dimensions (Unit: mm)

(Unit: mm)



■ Notes:
In order to achieve optimum jitter performance, the 0.1 μ F capacitor between V_{CC} and GND should be placed. It is also recommended that the capacitors are placed on the device side of the PCB, as close to the device as possible and connected together with short wiring pattern.



CRYSTAL OSCILLATOR (Programmable)

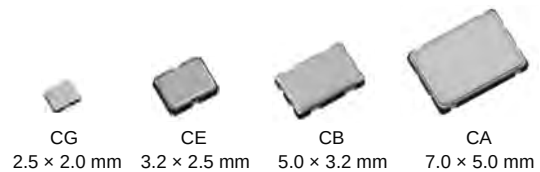
OUTPUT: CMOS

SG-8018 series

- Frequency range : 0.67 MHz to 170 MHz (1 ppm Step)
- Supply voltage : 1.62 V to 3.63 V
- Function : Output enable (OE) or Standby (ST)
- Frequency tolerance : ± 50 ppm (-40°C to $+105^{\circ}\text{C}$)
Including frequency aging($+25^{\circ}\text{C}$, 10 years)
- PLL technology to enable short lead time
- Available field oscillator programmer "SG-Writer II"



Product Number
 SG-8018CG: X1G005601xxxx00
 SG-8018CE: X1G005591xxxx00
 SG-8018CB: X1G005581xxxx00
 SG-8018CA: X1G005571xxxx00



Specifications (characteristics)

Item		Symbol	Specifications				Conditions/Remarks						
Supply voltage		V _{CC}	1.80 V Typ.		2.50 V Typ.	3.30 V Typ.	-						
			1.62 V to 1.98 V	1.98 V to 2.20 V	2.20 V to 2.80 V	2.70 V to 3.63 V							
Output frequency range		f _o	0.67 MHz to 170 MHz										
Storage temperature		T _{stg}	-40 °C to +125 °C				Storage as single product.						
Operating temperature		T _{use}	-40 °C to +105 °C				-						
Frequency tolerance ^{*1}		f _{tol}	J: ±50 × 10 ⁻⁶				T _{use} = -40 °C to +105 °C						
Current consumption		I _{CC}	3.2 mA Max.	3.3 mA Max.	3.4 mA Max.	3.5 mA Max.	T _{use} = +105 °C	No load, f _o = 20 MHz					
			2.7 mA Typ.		2.9 mA Typ.	3.0 mA Typ.	T _{use} = +25 °C						
			5.5 mA Max.	5.8 mA Max.	6.7 mA Max.	8.1 mA Max.	T _{use} = +105 °C	No load, f _o = 170 MHz					
			4.7 mA Typ.		5.7 mA Typ.	6.8 mA Typ.	T _{use} = +25 °C						
Output disable current		I _{dis}	3.2 mA Max.	3.2 mA Max.	3.3 mA Max.	3.5 mA Max.	OE = GND, f _o = 170 MHz						
Standby current		I _{std}	0.9 µA Max.	1.0 µA Max.	1.5 µA Max.	2.5 µA Max.	T _{use} = +105 °C	ST = GND					
			0.3 µA Typ.	0.4 µA Typ.	0.5 µA Typ.	1.1 µA Typ.	T _{use} = +25 °C						
Symmetry		SYM	45 % to 55 %				50 % V _{CC} Level						
Output voltage (DC characteristics)		V _{OH}	90 % V _{CC} Min.				I _{OH} /I _{OL} Conditions [mA]						
							Rise/Fall time		V _{CC}	*A	*B	*C	*D
							Default (f _o > 40 MHz), Fast		I _{OH}	-2.5	-3.5	-4.0	-5.0
									I _{OL}	2.5	3.5	4.0	5.0
		V _{OL}	10 % V _{CC} Max.				Default (f _o ≤ 40 MHz)		I _{OH}	-1.5	-2.0	-2.5	-3.0
									I _{OL}	1.5	2.0	2.5	3.0
							Slow		I _{OH}	-1.0	-1.5	-2.0	-2.5
									I _{OL}	1.0	1.5	2.0	2.5
*A: 1.62 V to 1.98 V, *B: 1.98 V to 2.20 V, *C: 2.20 V to 2.80 V, *D: 2.70 V to 3.63 V													
Output load condition		L _{CMOS}	15 pF Max.				-						
Input voltage		V _{IH}	70 % V _{CC} Min.				OE or ST						
		V _{IL}	30 % V _{CC} Max.										
Rise time /Fall time	Default	tr/tf	3.0 ns Max.				f _o > 40 MHz		20 % - 80 % V _{CC} , L _{CMOS} = 15 pF				
	6.0 ns Max.				f _o ≤ 40 MHz								
	Fast		3.0 ns Max.				f _o = 0.67 MHz to 170 MHz						
	Slow		10.0 ns Max.				f _o = 0.67 MHz to 20 MHz						
Output disable time (OE) Output disable time (ST)		tstp_oe tstp_st	1 µs Max.				Measured from the time OE or ST pin crosses 30 % V _{CC}						
Output enable time (OE)		tsta_oe	1 µs Max.				Measured from the time OE pin crosses 70 % V _{CC}						
Output enable time (ST)		tsta_st	3 ms Max.				Measured from the time ST pin crosses 70 % V _{CC}						
Start-up time		t _{str}	3 ms Max.				Measured from the time V _{CC} reaches its rated minimum value, 1.62 V						
Frequency aging		f _{age}	This is included in frequency tolerance specification.				+25 °C, 10 years						

*1 Frequency tolerance includes initial frequency tolerance, frequency / temperature characteristics, frequency / voltage coefficient, frequency / load coefficient and frequency aging ($+25^{\circ}\text{C}$, 10 years).

Pin description

Pin	Name	I/O type	Function	
1	OE	Input	Output enable	High ^{*2} : Specified frequency output from OUT pin Low: Out pin is low (weak pull down), only output driver is disabled.
	ST	Input	Standby	High ^{*2} : Specified frequency output from OUT pin Low: Out pin is low (weak pull down), Device goes to standby mode. Supply current reduces to the least as I_{std} .
2	GND	Power	Ground	
3	OUT	Output	Clock output	
4	V_{CC}	Power	Power supply	

*2 Please do not use the OE/ST terminal in the open state.



Product Name

SG-8018CG 25.000000MHz T J H P A
 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧

- ① Model ② Package type ③ Frequency
 ④ Supply voltage (T: 1.8 V to 3.3 V Typ.)
 ⑤ Frequency tolerance (J: $\pm 50 \times 10^{-6}$)
 ⑥ Operating temperature (H: -40 °C to +105 °C)
 ⑦ Function ⑧ Rise/Fall time

② Package type

CG	2.5 mm × 2.0 mm
CE	3.2 mm × 2.5 mm
CB	5.0 mm × 3.2 mm
CA	7.0 mm × 5.0 mm

⑦ Function

P	Output enable
S	Standby

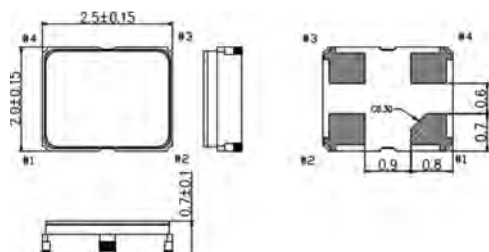
⑧ Rise time/Fall time

A	Default
B	Fast
C	Slow

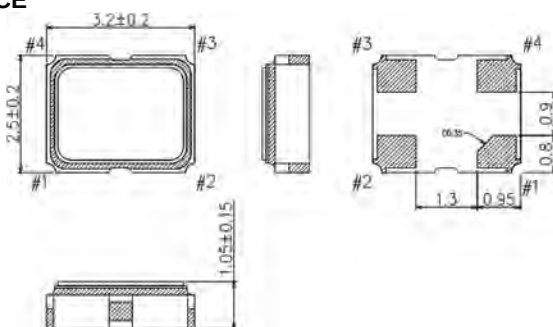
External dimensions

(Unit: mm)

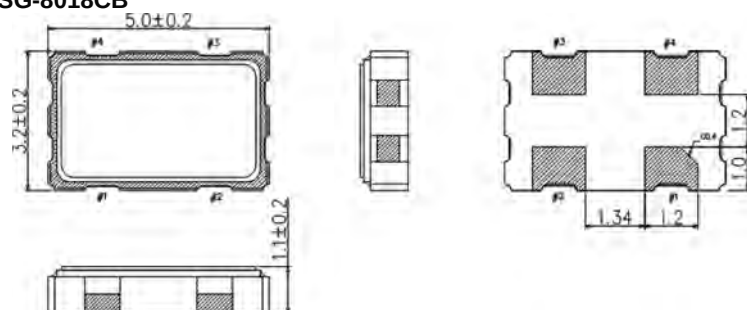
SG-8018CG



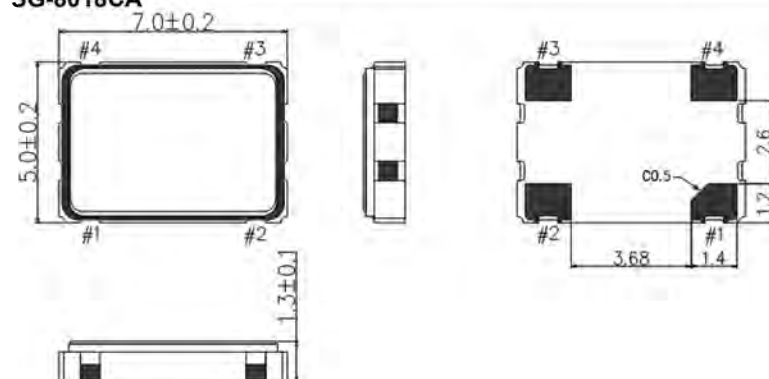
SG-8018CE



SG-8018CB



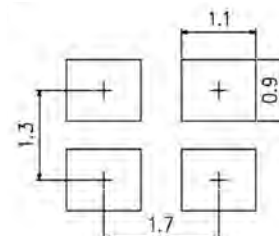
SG-8018CA



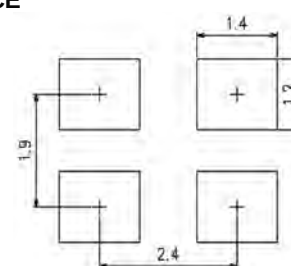
Footprint (Recommended)

(Unit: mm)

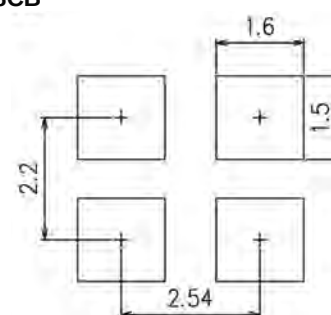
SG-8018CG



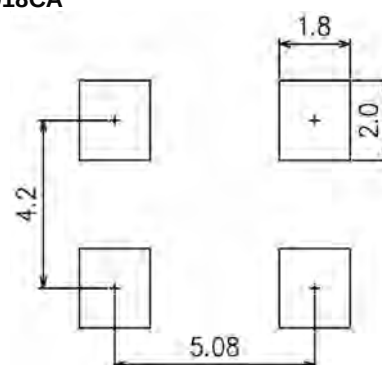
SG-8018CE



SG-8018CB



SG-8018CA



■ Notes:

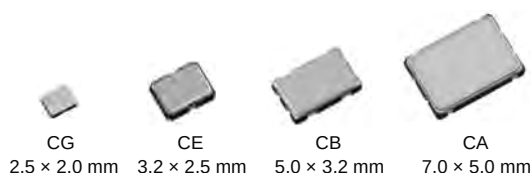
In order to achieve optimum jitter performance, the 0.1 μ F capacitor between V_{CC} and GND should be placed. It is also recommended that the capacitors are placed on the device side of the PCB, as close to the device as possible and connected together with short wiring pattern.

CRYSTAL OSCILLATOR (Programmable)
OUTPUT: CMOS**SG-8101** series

- Frequency range : 0.67 MHz to 170 MHz (1×10^{-6} Step)
- Supply voltage : 1.62 V to 3.63 V
- Function : Output enable (OE) or Standby (ST)
- Frequency tolerance : $\pm 15 \times 10^{-6}$ (-40 °C to +85 °C)
 $\pm 20 \times 10^{-6}$, $\pm 50 \times 10^{-6}$ (-40 °C to +105 °C)
- PLL technology to enable short lead time
- Available field oscillator programmer "SG-Writer II"



Product Number
SG-8101CG: X1G005181xxxx00
SG-8101CE: X1G005211xxxx00
SG-8101CB: X1G005201xxxx00
SG-8101CA: X1G005191xxxx00



Specifications (characteristics)

Item		Symbol	Specifications				Conditions/Remarks					
Supply voltage		V _{CC}	1.80 V Typ.		2.50 V Typ.	3.30 V Typ.	-					
			1.62 V to 1.98 V	1.98 V to 2.20 V	2.20 V to 2.80 V	2.70 V to 3.63 V						
Output frequency range		f _o	0.67 MHz to 170 MHz									
Storage temperature		T _{stg}	-40 °C to +125 °C				Storage as single product.					
Operating temperature		T _{use}	-40 °C to +85 °C				-					
			-40 °C to +105 °C									
Frequency tolerance ^{*1}		f _{tol}	B: ±15 × 10 ⁻⁶				T _{use} = -40 °C to +85 °C					
			C: ±20 × 10 ⁻⁶				T _{use} = -40 °C to +105 °C					
			J: ±50 × 10 ⁻⁶				T _{use} = -40 °C to +105 °C					
Current consumption		I _{CC}	3.2 mA Max.	3.3 mA Max.	3.4 mA Max.	3.5 mA Max.	T _{use} = +105 °C	No load, f _o = 20 MHz				
			2.7 mA Typ.		2.9 mA Typ.	3.0 mA Typ.	T _{use} = +25 °C					
			5.5 mA Max.	5.8 mA Max.	6.7 mA Max.	8.1 mA Max.	T _{use} = +105 °C	No load, f _o = 170 MHz				
			4.7 mA Typ.		5.7 mA Typ.	6.8 mA Typ.	T _{use} = +25 °C					
Output disable current		I _{dis}	3.2 mA Max.	3.2 mA Max.	3.3 mA Max.	3.5 mA Max.	OE = GND, f _o = 170 MHz					
Standby current		I _{std}	0.9 µA Max.	1.0 µA Max.	1.5 µA Max.	2.5 µA Max.	T _{use} = +105 °C	ST = GND				
			0.3 µA Typ.	0.4 µA Typ.	0.5 µA Typ.	1.1 µA Typ.	T _{use} = +25 °C					
Symmetry		SYM	45 % to 55 %				50 % V _{CC} Level					
Output voltage (DC characteristics)		V _{OH}	90 % V _{CC} Min.				[mA]					
							Rise/Fall time	V _{CC}	*A	*B	*C	*D
							Default (f _o > 40 MHz), Fast	I _{OH}	-2.5	-3.5	-4.0	-5.0
		V _{OL}	10 % V _{CC} Max.				Default (f _o ≤ 40 MHz)	I _{OL}	2.5	3.5	4.0	5.0
							Slow	I _{OH}	-1.5	-2.0	-2.5	-3.0
								I _{OL}	1.5	2.0	2.5	3.0
Output load condition		L _{CMOS}	15 pF Max.				-					
Input voltage		V _{IH}	70 % V _{CC} Min.				OE or ST					
		V _{IL}	30 % V _{CC} Max.									
Rise time /Fall time	Default Fast Slow	tr/tf	3.0 ns Max.				f _o > 40 MHz		20 % - 80 % V _{CC} , L _{CMOS} = 15 pF			
			6.0 ns Max.				f _o ≤ 40 MHz					
			3.0 ns Max.				f _o = 0.67 MHz to 170 MHz					
			10.0 ns Max.				f _o = 0.67 MHz to 20 MHz					
Output disable time (OE)		tstp_oe	1 µs Max.				Measured from the time OE or ST pin crosses 30 % V _{CC}					
Output disable time (ST)		tstp_st										
Output enable time (OE)		tsta_oe	1 µs Max.				Measured from the time OE pin crosses 70 % V _{CC}					
Output enable time (ST)		tsta_st	3 ms Max.				Measured from the time ST pin crosses 70 % V _{CC}					
Start-up time		t _{str}	3 ms Max.				Measured from the time V _{CC} reaches its rated minimum value, 1.62 V					
Frequency aging		f _{age}	This is included in frequency tolerance specification.				+25 °C, first year					

*1 Frequency tolerance includes initial frequency tolerance, frequency / temperature characteristics, frequency / voltage coefficient, frequency / load coefficient and frequency aging (+25 °C, 1 year).

Pin description

Pin	Name	I/O type	Function	
1	OE	Input	Output enable	High ^{*2} : Specified frequency output from OUT pin Low: Out pin is low (weak pull down), only output driver is disabled.
	ST	Input	Standby	High ^{*2} : Specified frequency output from OUT pin Low: Out pin is low (weak pull down), Device goes to standby mode. Supply current reduces to the least as I_{std} .
2	GND	Power	Ground	
3	OUT	Output	Clock output	
4	V_{CC}	Power	Power supply	

*2 Please do not use the OE/ST terminal in the open state.



Product Name

SG-8101CG 25.000000MHz TCHPA
① ② ③ ④⑤⑥⑦⑧

- ①Model ②Package type
③Frequency ④Supply voltage (T: 1.8 V to 3.3 V Typ.)
⑤Frequency tolerance ⑥Operating temperature
⑦Function ⑧Rise/Fall time

②Package type

CG	2.5 mm × 2.0 mm
CE	3.2 mm × 2.5 mm
CB	5.0 mm × 3.2 mm
CA	7.0 mm × 5.0 mm

⑤Frequency tolerance / ⑥Operating temperature

BG	$\pm 15 \times 10^{-6}$ / -40 °C to +85 °C
CH	$\pm 20 \times 10^{-6}$ / -40 °C to +105 °C
JH	$\pm 50 \times 10^{-6}$ / -40 °C to +105 °C

⑦Function

P	Output enable
S	Standby

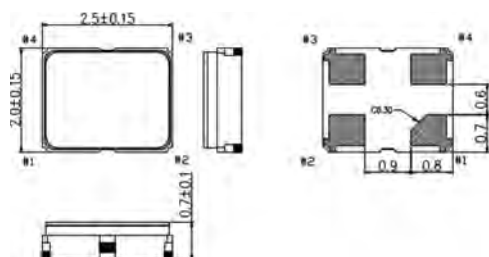
⑧Rise time/Fall time

A	Default
B	Fast
C	Slow

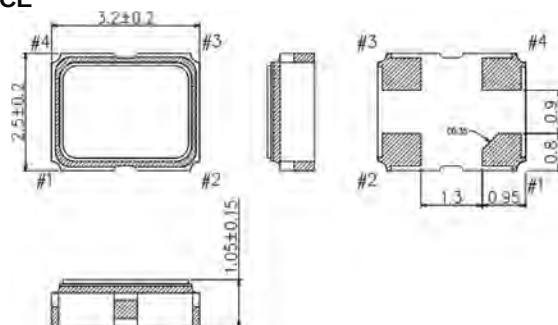
External dimensions

(Unit: mm)

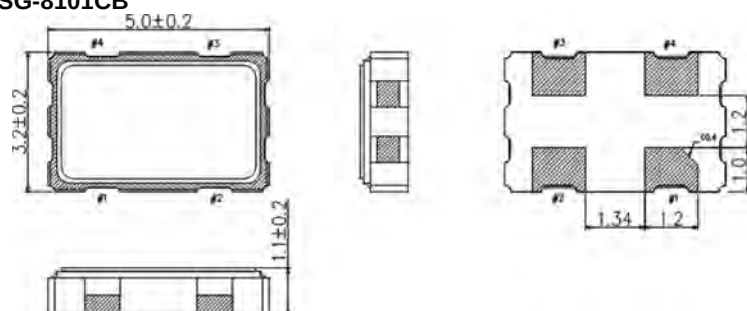
SG-8101CG



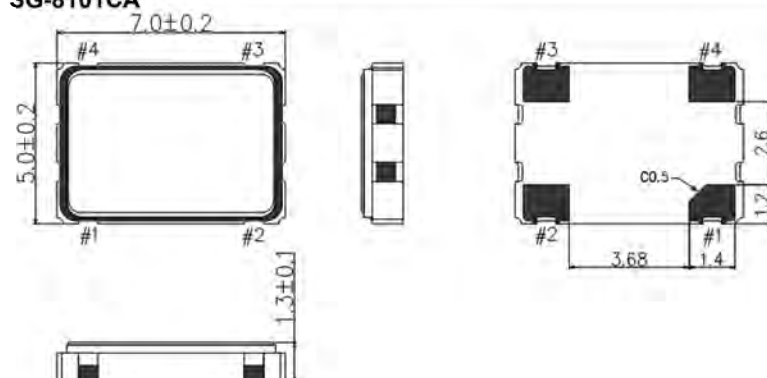
SG-8101CE



SG-8101CB



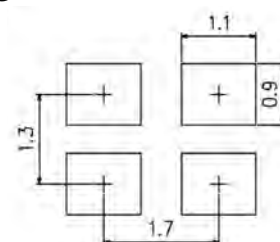
SG-8101CA



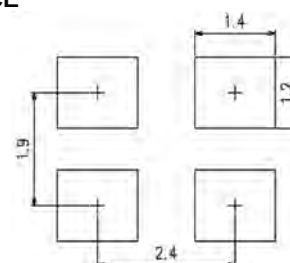
Footprint (Recommended)

(Unit: mm)

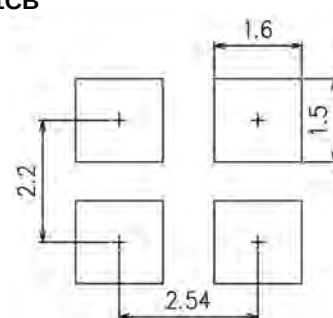
SG-8101CG



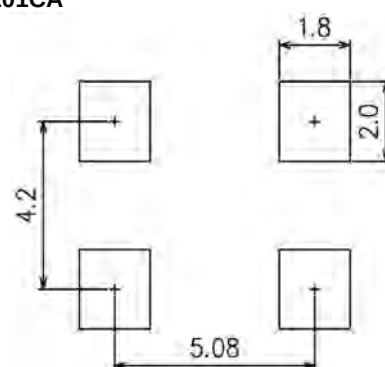
SG-8101CE



SG-8101CB



SG-8101CA



■Notes:

In order to achieve optimum jitter performance, the 0.1 μ F capacitor between V_{CC} and GND should be placed. It is also recommended that the capacitors are placed on the device side of the PCB, as close to the device as possible and connected together with short wiring pattern.



CRYSTAL OSCILLATOR (Programmable)

SPREAD SPECTRUM

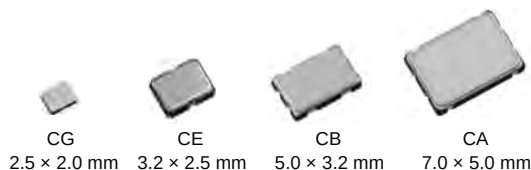
OUTPUT: CMOS

SG-9101 series

- Frequency range : 0.67 MHz to 170 MHz (1 ppm Step)
- Supply voltage : 1.62 V to 3.63 V
- Function : Output enable (OE) or Standby (ST)
- Configurable spread spectrum settings:
2 kinds of spread type, 6 kinds of spread width
4 kinds of modulation frequency, 3 kinds of spread profile
- PLL technology to enable short lead time
- Available field oscillator programmer "SG-Writer II"



Product Number
SG-9101CA: X1G005301xxxx00
SG-9101CB: X1G005311xxxx00
SG-9101CE: X1G005321xxxx00
SG-9101CG: X1G005291xxxx00



Specifications (characteristics)

Item		Symbol	Specifications				Conditions/Remarks					
Supply voltage		V _{CC}	1.80 V Typ.		2.50 V Typ.	3.30 V Typ.	-					
			1.62 V to 1.98 V	1.98 V to 2.20 V	2.20 V to 2.80 V	2.70 V to 3.63 V						
Output frequency range		f _o	0.67 MHz to 170 MHz									
Storage temperature		T _{stg}	-40 °C to +125 °C				Storage as single product.					
Operating temperature		T _{use}	-40 °C to +85 °C									
			-40 °C to +105 °C									
Frequency tolerance*1		f _{tol}	±50 × 10 ⁻⁶				Average frequency of 1s gate time.					
Current consumption		I _{CC}	3.4 mA Max.	3.5 mA Max.	3.6 mA Max.	3.7 mA Max.	T _{use} = +105 °C	No load, f _o = 20 MHz				
			2.9 mA Typ.		3.0 mA Typ.	3.2 mA Typ.	T _{use} = +25 °C					
			5.7 mA Max.	6.0 mA Max.	6.9 mA Max.	8.3 mA Max.	T _{use} = +105 °C	No load, f _o = 170 MHz				
			4.9 mA Typ.		5.9 mA Typ.	7.0 mA Typ.	T _{use} = +25 °C					
Output disable current		I _{dis}	3.4 mA Max.	3.4 mA Max.	3.5 mA Max.	3.7 mA Max.	OE = GND, f _o = 170 MHz					
Standby current		I _{std}	0.9 μA Max.	1.0 μA Max.	1.5 μA Max.	2.5 μA Max.	T _{use} = +105 °C	ST = GND				
			0.3 μA Typ.	0.4 μA Typ.	0.5 μA Typ.	1.1 μA Typ.	T _{use} = +25 °C					
Symmetry		SYM	45 % to 55 %				50 % V _{CC} Level					
Output voltage (DC characteristics)		V _{OH}	90 % V _{CC} Min.				I _{OH} /I _{OL} Conditions [mA]					
							Rise/Fall time		V _{CC}	*A	*B	*C
		Default (f _o > 40 MHz), Fast		I _{OH}	-2.5	-3.5	-4.0	-5.0				
				I _{OL}	2.5	3.5	4.0	5.0				
		Default (f _o ≤ 40 MHz)		I _{OH}	-1.5	-2.0	-2.5	-3.0				
				I _{OL}	1.5	2.0	2.5	3.0				
		Slow		I _{OH}	-1.0	-1.5	-2.0	-2.5				
I _{OL}	1.0			1.5	2.0	2.5						
							*A : 1.62 V to 1.98 V, *B : 1.98 V to 2.20 V, *C : 2.20 V to 2.80 V, *D : 2.70 V to 3.63 V					
Output load condition		L _{CMOS}	15 pF Max.				-					
Input voltage		V _{IH}	70 % V _{CC} Min.				OE or ST					
		V _{IL}	30 % V _{CC} Max.									
Rise time /Fall time	Default	tr/tf	3.0 ns Max.			f _o > 40 MHz			20 % - 80 % V _{CC} , L _{CMOS} = 15 pF			
	6.0 ns Max.			f _o ≤ 40 MHz								
	Fast		3.0 ns Max.			f _o = 0.67 MHz to 170 MHz						
	Slow		10.0 ns Max.			f _o = 0.67 MHz to 20 MHz						
Output disable time (OE)		tstp_oe	1 μs Max.				Measured from the time OE or ST pin crosses 30 % V _{CC}					
Output disable time (ST)		tstp_st										
Output enable time (OE)		tsta_oe	1 μs Max.				Measured from the time OE pin crosses 70 % V _{CC}					
Output enable time (ST)		tsta_st	3 ms Max.				Measured from the time ST pin crosses 70 % V _{CC}					
Start-up time		t _{str}	3 ms Max.				Measured from the time V _{CC} reaches its rated minimum value, 1.62 V					
Frequency aging		f _{age}	This is included in frequency tolerance specification.				+25 °C, first year					

*1 Frequency tolerance includes initial frequency tolerance, frequency / temperature characteristics, frequency / voltage coefficient, frequency / load coefficient and frequency aging (+25 °C, 1 year).

Pin description

Pin	Name	I/O type	Function	
1	OE	Input	Output enable	High ^{*2} : Specified frequency output from OUT pin Low: Out pin is low (weak pull down), only output driver is disabled.
	ST	Input	Standby	High ^{*2} : Specified frequency output from OUT pin Low: Out pin is low (weak pull down), Device goes to standby mode. Supply current reduces to the least as I _{std} .
2	GND	Power	Ground	
3	OUT	Output	Clock output	
4	V _{CC}	Power	Power supply	

*2 Please do not use the OE/ST terminal in the open state.



Product Name

SG-9101CG 170.000000MHz C 20 P H A A A
 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

- ① Model ② Package type ③ Frequency
 ④ Spread type ⑤ Spread width
 ⑥ Function ⑦ Operating temperature
 ⑧ Modulation frequency ⑨ Spread profile
 ⑩ Rise/Fall time

② Package type	
CG	2.5 mm × 2.0 mm
CE	3.2 mm × 2.5 mm
CB	5.0 mm × 3.2 mm
CA	7.0 mm × 5.0 mm

④ Spread type	
C	Center spread
D	Down spread

⑤ Spread width		
	Center spread	Down spread
02	±0.25 %	
05	±0.5 %	-0.5 %
07	±0.75 %	
10	±1.0 %	-1.0 %
15	±1.5 %	-1.5 %
20	±2.0 %	-2.0 %
30		-3.0 %
40		-4.0 %

⑧ Modulation frequency	
A	25.4 kHz (Default)
B	12.7 kHz
C	8.5 kHz
D	6.3 kHz

⑨ Spread profile	
A	Hershey-kiss (Default)
B	Sine-wave
C	Triangle

⑥ Function	
P	Output enable
S	Standby

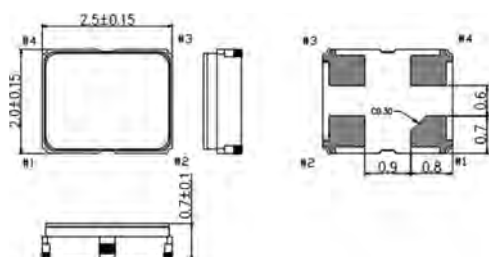
⑩ Rise/Fall time	
A	Default
B	Fast
C	Slow

⑦ Operating temperature	
G	-40 °C to +85 °C
H	-40 °C to +105 °C

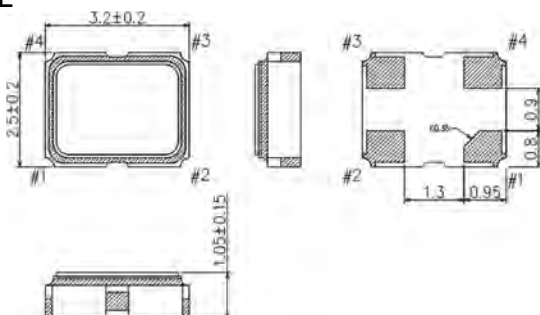
External dimensions

(Unit: mm)

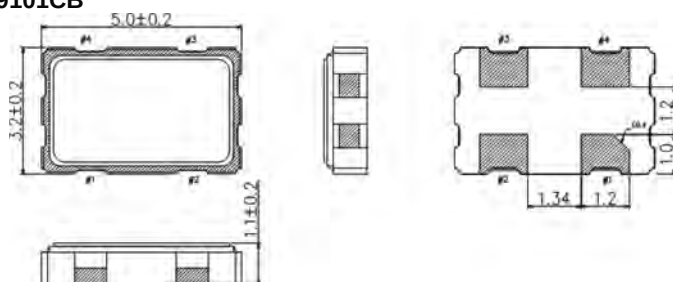
SG-9101CG



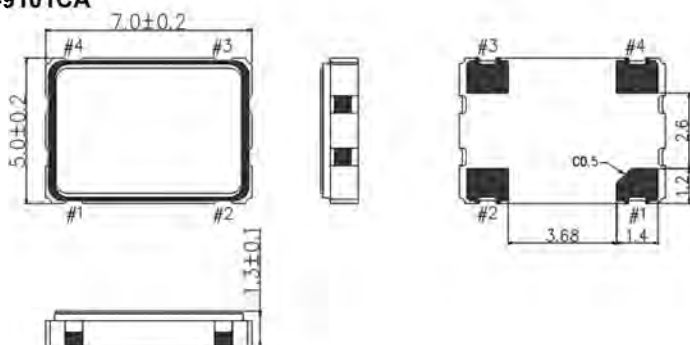
SG-9101CE



SG-9101CB



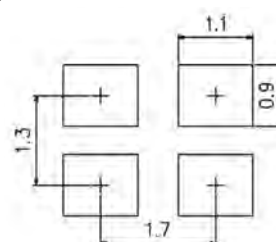
SG-9101CA



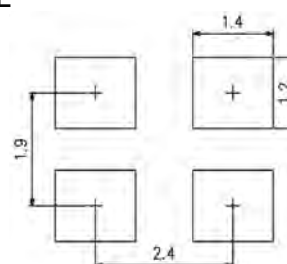
Footprint (Recommended)

(Unit: mm)

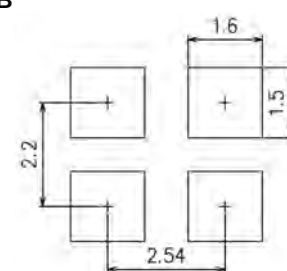
SG-9101CG



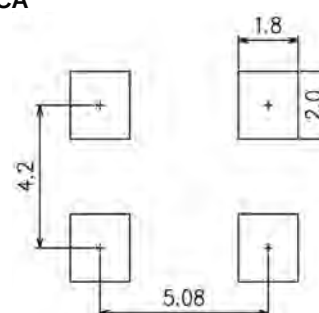
SG-9101CE



SG-9101CB



SG-9101CA



■ Notes:

In order to achieve optimum jitter performance, the 0.1 μF capacitor between V_{CC} and GND should be placed. It is also recommended that the capacitors are placed on the device side of the PCB, as close to the device as possible and connected together with short wiring pattern.



Programming tool for Programmable Crystal Oscillator SG-Writer II



Product Number
Q91PR20W1102000

- Programming tool for programmable oscillator:
SG-8018, SG-8101, SG-9101, SG-8503, SG-8504 and
SG-8506 series (Blank sample)
- Able to program required frequency at customer side
- External power supply by USB cable
- Available PC OS: Windows 10, etc
- Small body and easy carry



Main Body Specifications

Name	SG-Writer II for programmable oscillator: SG-8018, SG-8101, SG-9101, SG-8503, SG-8504 and SG-8506 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, Instruction manual (Documents: English, Japanese)		
Software	SG-Writer II		
Option SG-Writer IC socket *1	Model		Product number
	SG-8018CA, SG-8101CA, SG-9101CA		Q91PR10W00021
	SG-8018CB, SG-8101CB, SG-9101CB		Q91PR10W00025
	SG-8018CE, SG-8101CE, SG-9101CE		Q91PR10W00018
	SG-8018CG, SG-8101CG, SG-9101CG		Q91PR10W00024
	SG-8503CA		Q91PR10W00026
	SG-8504CA		Q91PR10W00027
	SG-8506CA		Q91PR10W00028
Option Blank sample	Model		Product number
	SG-8018CA		X1G0055710001
	SG-8018CB		X1G0055810001
	SG-8018CE		X1G0055910001
	SG-8018CG		X1G0056010001
	SG-8101CB		X1G0052010001
	SG-8101CE		X1G0052110001
	SG-8101CG		X1G0051810001
	SG-9101CA		X1G0053010001
	SG-9101CB		X1G0053110001
	SG-9101CE		X1G0053210001
	SG-9101CG		X1G0052910001
	Model		Product number
	SG-8503CA		X1G0050111001
	SG-8504CA		X1G0050211001
	SG-8506CA		X1G0050311001

*1 If you have IC socket of either SG-8002CA/CE it can use for both SG-8018CA/CE, SG-8101CA/CE and SG-9101CA/CE.

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

Available PC OS	Windows 7 (32 bit, 64 bit), Windows Vista (32 bit), Windows XP (32 bit) Windows 10 (32 bit, 64 bit)
Recommend CPU	Over Pentium 4 1.4 GHz or equivalent Processor
Recommend memory Capacity	Windows XP : Over 512 MB Windows Vista, Windows7 32 bit : Over 1 GB Windows 7 64 bit : Over 2 GB Windows 10 : Over 2 GB
Other	USB cable (Type A ↔ mini-B) Need SMD *2 socket when you write SG-8000 SMD products. (Sold separately)

*2 Conventional IC socket for PROM Writer or SG-Writer (the previous model) can be used for SG-Writer II.

Precautions

- The Blank sample of each series can be identified by marking
- The firmware update is required to program SG-8018, SG-8101, SG-9101, SG-8503, SG-8504 and SG-8506 series.
For details please contact your supplier.

CRYSTAL OSCILLATOR (SPXO)

OUTPUT : LV-PECL, LVDS



Product Number
 SG2016EHN: X1G006141xxxx15
 SG2016VHN: X1G006121xxxx15
 SG2520EHN: X1G005921xxxx15
 SG2520VHN: X1G005941xxxx15

SG2016EHN/VHN

SG2520EHN/VHN

- Frequency range : 25 MHz to 500 MHz
- Supply voltage : 1.8 V Typ. (LVDS only) / 2.5 V Typ. / 3.3 V Typ.
- Frequency tolerance : $\pm 20 \times 10^{-6}$
- Operating temperature : -40 °C to +85 °C, -40 °C to +105 °C
- Function : Output enable (OE) or Standby (ST)
- Phase jitter : 50 fs Max. (391 MHz < $f_o \leq 500$ MHz, $V_{CC} = 2.5$ V, 3.3 V)

SG2016EHN
 SG2016VHN
 (2.0 × 1.6 × 0.63 mm)

SG2520EHN
 SG2520VHN
 (2.5 × 2.0 × 0.74 mm)

Specifications (characteristics)

Item	Symbol	Specifications		Conditions / Remarks
		LV-PECL SG2016EHN / SG2520EHN	LVDS SG2016VHN / SG2520VHN	
Output frequency range	f_o	25 MHz to 500 MHz		Please contact us for available frequencies.
Supply voltage	V_{CC}	C: 3.3 V $\pm 5\%$ D: 2.5 V $\pm 5\%$		E: 1.8 V $\pm 5\%$
Storage temperature	T_{stg}	-55 °C to +125 °C		
Operating temperature	T_{use}	G: -40 °C to +85 °C, H: -40 °C to +105 °C		
Frequency tolerance	f_{tol}	C: $\pm 20 \times 10^{-6}$ Max.		Includes initial frequency tolerance, frequency / temperature characteristics, frequency / voltage coefficient and 10 years aging (+25 °C)
Current consumption	I_{CC}	60 mA Max.	—	OE or ST = V_{CC} , L_ECL = 50 Ω
		—	25 mA / 30 mA / 25 mA Max. 28 mA / 35 mA / 28 mA Max. 28 mA / 35 mA / 30 mA Max.	25 MHz $\leq f_o < 212$ MHz 212 MHz $\leq f_o < 392$ MHz 392 MHz $\leq f_o \leq 500$ MHz
		—	25 mA / — / 25 mA Max.	OE or ST = V_{CC} , Output option: A / B / C
Disable current	I_{dis}	35 mA Max.	20 mA Max.	OE = GND
Stand-by current	I_{std}	30 μ A Max. 60 μ A Max.	—	ST = GND, T_{use} Max. = +85 °C ST = GND, T_{use} Max. = +105 °C
Symmetry	SYM	45 % to 55 %		At output crossing point
Output voltage (LV-PECL)	V_{OH}	$V_{CC} - 1.1$ V Min.	—	Output option: A, DC characteristic
	V_{OL}	$V_{CC} - 1.5$ V Max.	—	
Differential swing	V_{SW}	0.8 V to 2.0 V	500 mV to 900 mV	Output option: A
		—	800 mV to 1 600 mV	Output option: B
		—	600 mV to 1 200 mV	Output option: C
Output voltage (LVDS)	V_{OD}	—	250 mV to 450 mV	Output option: A
		—	400 mV to 800 mV	Output option: B
		—	300 mV to 600 mV	Output option: C
	dV_{OD}	—	50 mV Max.	Differential output voltage, V_{OD1} , V_{OD2}
	V_{OS}	—	1.15 V to 1.35 V	Offset voltage, V_{OS1} , V_{OS2}
	dV_{OS}	—	50 mV Max.	$dV_{OS} = V_{OS1} - V_{OS2} $
Output load condition	L_ECL	50 Ω	—	Terminated to $V_{CC} - 2.0$ V
	L_LVDS	—	100 Ω	Connected between OUT and $\overline{OUT}$
Input voltage	V_{IH}	70 % V_{CC} Min.		OE or ST terminal
	V_{IL}	30 % V_{CC} Max.		
Rise/Fall times	tr/tf	0.35 ns Max.		LV-PECL: 20 % - 80 % ($V_{OH} - V_{OL}$) LVDS: 20 % - 80 % differential output peak to peak
Start-up time	t_{str}	10 ms Max.		$t = 0$ at 90 % V_{CC}
Phase jitter	t_{PJ}	250 fs Max.	250 fs Max.	25 MHz $\leq f_o < 100$ MHz
		90 fs Max.	100 fs Max.	100 MHz $\leq f_o \leq 156$ MHz
		70 fs Max.	60 fs Max.	156 MHz $< f_o \leq 212$ MHz
		60 fs Max.	—	212 MHz $< f_o \leq 391$ MHz
		50 fs Max.	50 fs Max.	391 MHz $< f_o \leq 500$ MHz
		—	60 fs Max.	—

Product Name SG2016 EHN 156.250000MHz C C H P Z A

(Standard form)

① ② ③ ④⑤⑥⑦⑧⑨

①Model ②Output (E: LV-PECL, V: LVDS) ③Frequency ④Supply voltage ⑤Frequency tolerance

⑥Operating temperature ⑦Function ⑧Output disable type (Z: High impedance) ⑨Output option

④Supply voltage
C 3.3 V Typ.
D 2.5 V Typ.
E* 1.8 V Typ.

⑤Freq. tolerance
C $\pm 20 \times 10^{-6}$

⑥Operating temp.
G -40 °C to +85 °C
H -40 °C to +105 °C

⑦Function
P OE
S ST

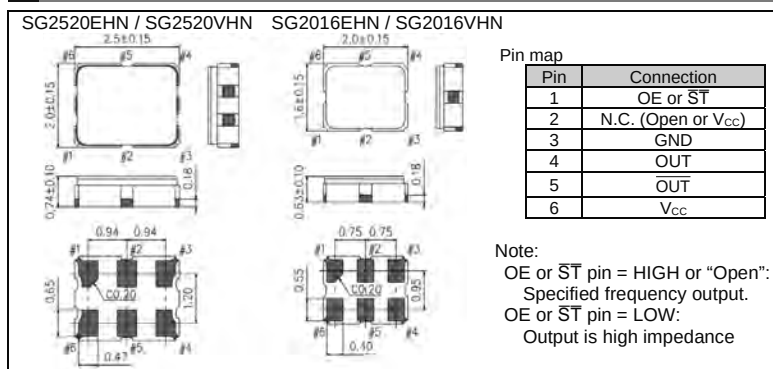
⑨Output option	SG2016EHN / SG2520EHN	SG2016VHN / SG2520VHN
A Default	—	$V_{OD} = 250$ mV to 450 mV
B*	—	$V_{OD} = 400$ mV to 800 mV
C	—	$V_{OD} = 300$ mV to 600 mV

*E is only for SG2016VHN and SG2520VHN

*Not available for $V_{CC} = 1.8$ V Typ.

External dimensions

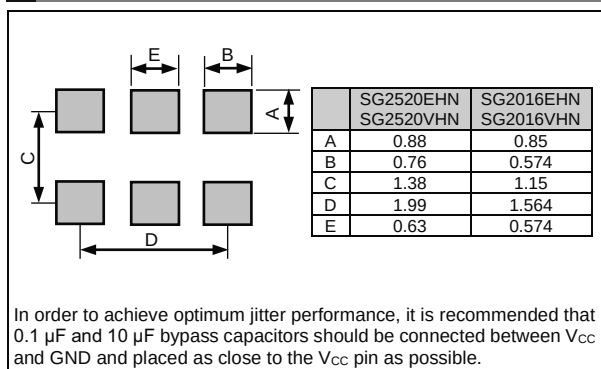
(Unit:mm)



Note:
 OE or ST pin = HIGH or "Open":
 Specified frequency output.
 OE or ST pin = LOW:
 Output is high impedance

Footprint (Recommended)

(Unit:mm)



In order to achieve optimum jitter performance, it is recommended that 0.1 μ F and 10 μ F bypass capacitors should be connected between V_{CC} and GND and placed as close to the V_{CC} pin as possible.

CRYSTAL OSCILLATOR (SPXO)

OUTPUT : LV-PECL, LVDS

SG2016EGN/VGN SG2520EGN/VGN

- Frequency range : 25 MHz to 500 MHz
- Supply voltage : 1.8 V Typ. (LVDS only) / 2.5 V Typ. / 3.3 V Typ.
- Frequency tolerance : $\pm 25 \times 10^{-6}$, $\pm 50 \times 10^{-6}$
- Operating temperature : -40 °C to +85 °C, -40 °C to +105 °C
- Function : Output enable (OE) or Standby (ST)
- Phase jitter : 50 fs Max. (391 MHz < $f_o \leq 500$ MHz, $V_{CC} = 2.5$ V, 3.3 V)



Product Number
SG2016EGN: X1G006131xxxx15
SG2016VGN: X1G006111xxxx15
SG2520EGN: X1G005881xxxx15
SG2520VGN: X1G005901xxxx15



SG2016EGN
SG2016VGN
(2.0 × 1.6 × 0.63 mm)



SG2520EGN
SG2520VGN
(2.5 × 2.0 × 0.74 mm)

Specifications (characteristics)

Item	Symbol	Specifications			Conditions / Remarks	
		LV-PECL	LVDS			
		SG2016EGN / SG2520EGN	SG2016VGN / SG2520VGN			
Output frequency range	f _o	25 MHz to 500 MHz			Please contact us for available frequencies.	
Supply voltage	V _{CC}	C: 3.3 V ± 5 % D: 2.5 V ± 5 %		E: 1.8 V ± 5 %		
Storage temperature	T _{stg}	-55 °C to +125 °C				
Operating temperature	T _{use}	G: -40 °C to +85 °C, H: -40 °C to +105 °C				
Frequency tolerance	f _{tol}	D: ±25 × 10 ⁻⁶ Max. J: ±50 × 10 ⁻⁶ Max.			Includes initial frequency tolerance, frequency / temperature characteristics, frequency / voltage coefficient and 10 years aging (+25 °C)	
Current consumption	I _{CC}	60 mA Max.	—		OE or $\overline{ST}$ = V _{CC} , L _{ECL} = 50 Ω	
		—	25 mA / 30 mA / 25 mA Max. 28 mA / 35 mA / 28 mA Max. 28 mA / 35 mA / 30 mA Max.	25 mA / — / 25 mA Max.	25 MHz ≤ f _o < 212 MHz 212 MHz ≤ f _o < 392 MHz 392 MHz ≤ f _o ≤ 500 MHz	
			OE or $\overline{ST}$ = V _{CC} , Output option: A / B / C			
Disable current	I _{dis}	35 mA Max.	20 mA Max.		OE = GND	
Stand-by current	I _{std}	30 µA Max. 60 µA Max.			$\overline{ST}$ = GND, T _{use} Max. = +85 °C $\overline{ST}$ = GND, T _{use} Max. = +105 °C	
Symmetry	SYM	45 % to 55 %			At output crossing point	
Output voltage (LV-PECL)	V _{OH}	V _{CC} - 1.1 V Min.	—		Output option: A, DC characteristic	
	V _{OL}	V _{CC} - 1.5 V Max.				
Differential swing	V _{SW}	0.8 V to 2.0 V	500 mV to 900 mV	500 mV to 900 mV	Output option: A	
		—	800 mV to 1 600 mV	—	Output option: B	
		—	600 mV to 1 200 mV	600 mV to 1 200 mV	Output option: C	
Output voltage (LVDS)	V _{OD}	—	250 mV to 450 mV	250 mV to 450 mV	Output option: A	
			400 mV to 800 mV	—	Output option: B	
			300 mV to 600 mV	300 mV to 600 mV	Output option: C	
	dV _{OD}	—	50 mV Max.		dV _{OD} = V _{OD1} - V _{OD2}	
	V _{OS}	—	1.15 V to 1.35 V	0.65 V to 0.85 V	Offset voltage, V _{OS1} , V _{OS2}	
	dV _{OS}	—	50 mV Max.		dV _{OS} = V _{OS1} - V _{OS2}	
Output load condition	L _{ECL}	50 Ω	—		Terminated to V _{CC} - 2.0 V	
	L _{LVDS}	—	100 Ω		Connected between OUT and $\overline{OUT}$	
Input voltage	V _{IH}	70 % V _{CC} Min.			OE or $\overline{ST}$ terminal	
	V _{IL}	30 % V _{CC} Max.				
Rise/Fall times	tr/tf	0.35 ns Max.			LV-PECL: 20 % - 80 % (V _{OH} - V _{OL}) LVDS: 20 % - 80 % differential output peak to peak	
Start-up time	t _{str}	10 ms Max.			t = 0 at 90 % V _{CC}	
Phase jitter	t _{PJ}	250 fs Max.	250 fs Max.	400 fs Max.	25 MHz ≤ f _o < 100 MHz	Offset frequency fo < 50 MHz: 12 kHz to 5 MHz fo ≥ 50 MHz: 12 kHz to 20 MHz
		90 fs Max.	100 fs Max.	130 fs Max.	100 MHz ≤ fo ≤ 156 MHz	
		70 fs Max.	60 fs Max.	70 fs Max.	156 MHz < fo ≤ 212 MHz	
		60 fs Max.	50 fs Max.	60 fs Max.	212 MHz < fo ≤ 391 MHz	
		50 fs Max.			391 MHz < fo ≤ 500 MHz	

Product Name SG2016 EGN 156.250000MHz C D H P Z A

(Standard form)

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

①Model ②Output (E: LV-PECL, V: LVDS) ③Frequency ④Supply voltage ⑤Frequency tolerance

⑥Operating temperature ⑦Function ⑧Output disable type (Z: High impedance) ⑨Output option

④Supply voltage
C 3.3 V Typ.
D 2.5 V Typ.
E* 1.8 V Typ.

⑤Freq. tolerance
D $\pm 25 \times 10^{-6}$
J $\pm 50 \times 10^{-6}$

⑥Operating temp.
G -40 °C to +85 °C
H -40 °C to +105 °C

⑦Function
P OE
S ST

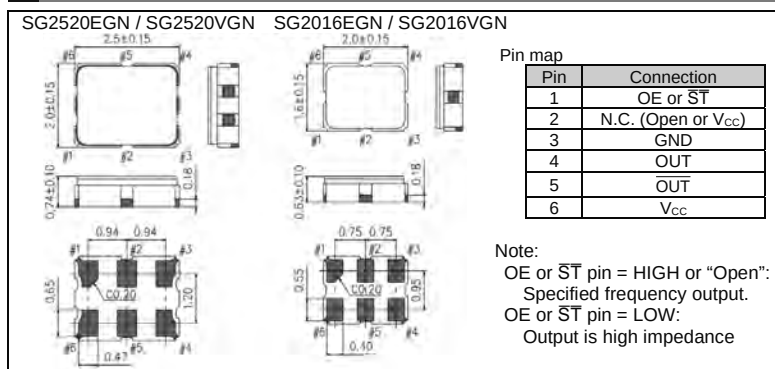
⑨Output option	SG2016EGN / SG2520EGN	SG2016VGN / SG2520VGN
A Default	—	$V_{OD} = 250$ mV to 450 mV
B*	—	$V_{OD} = 400$ mV to 800 mV
C	—	$V_{OD} = 300$ mV to 600 mV

*E is only for SG2016VGN and SG2520VGN

*Not available for $V_{CC} = 1.8$ V Typ.

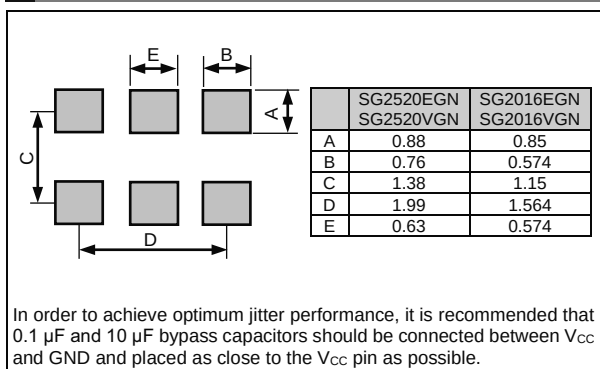
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)



CRYSTAL OSCILLATOR (SPXO)

OUTPUT : LV-PECL, LVDS

SG3225 / 5032 / 7050EEN SG3225 / 5032 / 7050VEN

- Frequency range : 25 MHz to 500 MHz
- Supply voltage : 2.5 V Typ. / 3.3 V Typ.
- Output : LV-PECL or LVDS
- Function : Output enable (OE)
- Phase jitter : 50 fs Typ. (fo = 156.25 MHz, LV-PECL)
- Operating temperature : -40 °C to +105 °C



Product Number
SG3225EEN: X1G005221xxxx00 (fo ≤ 200 MHz)
X1G005511xxxx00 (fo > 200 MHz)
SG5032EEN: X1G005531xxxx00
SG7050EEN: X1G005131xxxx00 (fo ≤ 200 MHz)
X1G005551xxxx00 (fo > 200 MHz)
SG3225VEN: X1G005351xxxx00 (fo ≤ 200 MHz)
X1G005521xxxx00 (fo > 200 MHz)
SG5032VEN: X1G005541xxxx00
SG7050VEN: X1G005331xxxx00 (fo ≤ 200 MHz)
X1G005561xxxx00 (fo > 200 MHz)



Specifications (characteristics)

Item	Symbol	Specifications		Conditions / Remarks	
		LV-PECL	LVDS		
		SG3225EEN / SG5032EEN / SG7050EEN	SG3225VEN / SG5032VEN / SG7050VEN		
Output frequency range	f _o	25 MHz to 500 MHz 200.1 MHz to 500 MHz		Except for SG5032EEN / SG5032VEN SG5032EEN / SG5032VEN	Please contact us for available frequencies.
Supply voltage	V _{CC}	D: 2.5 V ± 0.125 V, C: 3.3 V ± 0.165 V			
Storage temperature	T _{stg}	-55 °C to +125 °C			
Operating temperature	T _{use}	G: -40 °C to +85 °C, H: -40 °C to +105 °C			
Frequency tolerance	f _{tol}	D: ±25 × 10 ⁻⁶ Max.		Includes initial frequency tolerance, temperature variation, supply voltage change and 5 years aging (+25 °C)	Refer to figure *1
		J: ±50 × 10 ⁻⁶ Max.		Includes initial frequency tolerance, temperature variation, supply voltage change and 10 years aging (+25 °C)	
		L: ±100 × 10 ⁻⁶ Max.			
Current consumption	I _{CC}	60 mA Max.	25 mA Max.	OE = V _{CC} , L ECL = 50 Ω or L LVDS = 100 Ω	
Disable current	I _{dis}	25 mA Max.	15 mA Max.	OE = GND	
Symmetry	SYM	45 % to 55 %		At output crossing point	
Output voltage (LV-PECL)	V _{OH}	V _{CC} - 1.1 V Min.	—	DC characteristics	
	V _{OL}	V _{CC} - 1.5 V Max.	—		
Output voltage (LVDS)	V _{OD}	—	250 mV to 450 mV	Differential output voltage, V _{OD1} , V _{OD2}	DC characteristics
	dV _{OD}	—	50 mV Max.	dV _{OD} = V _{OD1} - V _{OD2}	
	V _{OS}	—	1.15 V to 1.35 V	Offset voltage, V _{OS1} , V _{OS2}	
	dV _{OS}	—	50 mV Max.	dV _{OS} = V _{OS1} - V _{OS2}	
Output load condition	L ECL	50 Ω	—	Terminated to V _{CC} - 2.0 V	
	L LVDS	—	100 Ω	Connected between OUT to $\overline{\text{OUT}}$	
Input voltage	V _{IH}	70 % V _{CC} Min.		OE terminal	
	V _{IL}	30 % V _{CC} Max.			
Rise/Fall times	tr / tf	0.3 ns Max.	0.3 ns Max.	V _{CC} = 3.3 V, 25 MHz ≤ f _o ≤ 200 MHz	LV-PECL: Between 20 % and 80 % of (V _{OH} - V _{OL})
		0.35 ns Max.		All other	LVDS: Between 20 % and 80 % of Differential Output peak to peak voltage
Startup time	t _{str}	10 ms Max.		Time at minimum supply voltage to be 0 s	

Phase Jitter

Product Name	100 MHz	125 MHz	156.25 MHz	200 MHz	312.5 MHz	491.52 MHz	Conditions
SG3225EEN / SG5032EEN / SG7050EEN	75 fs Typ.	60 fs Typ.	50 fs Typ.	40 fs Typ.	30 fs Typ.	20 fs Typ.	Offset frequency:
SG3225VEN / SG5032VEN / SG7050VEN	90 fs Typ.	70 fs Typ.	60 fs Typ.	50 fs Typ.	40 fs Typ.	30 fs Typ.	12 kHz to 20 MHz

Product Name **SG3225 EEN 156.250000MHz C D G A** (⑤⑥: Unavailable code DH, DG and JH at fo > 200 MHz, Refer to figure *1)

(Standard form) ① ② ③ ④⑤⑥⑦

①Model ②Output (E: LV-PECL, V: LVDS) ③Frequency ④Supply voltage

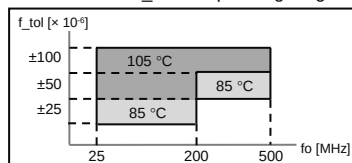
⑤Frequency tolerance ⑥Operating temperature ⑦Internal identification code("A" is default)

④Supply voltage	
C	3.3 V Typ.
D	2.5 V Typ.

⑤Frequency tolerance	
D	±25 × 10 ⁻⁶
J	±50 × 10 ⁻⁶
L	±100 × 10 ⁻⁶

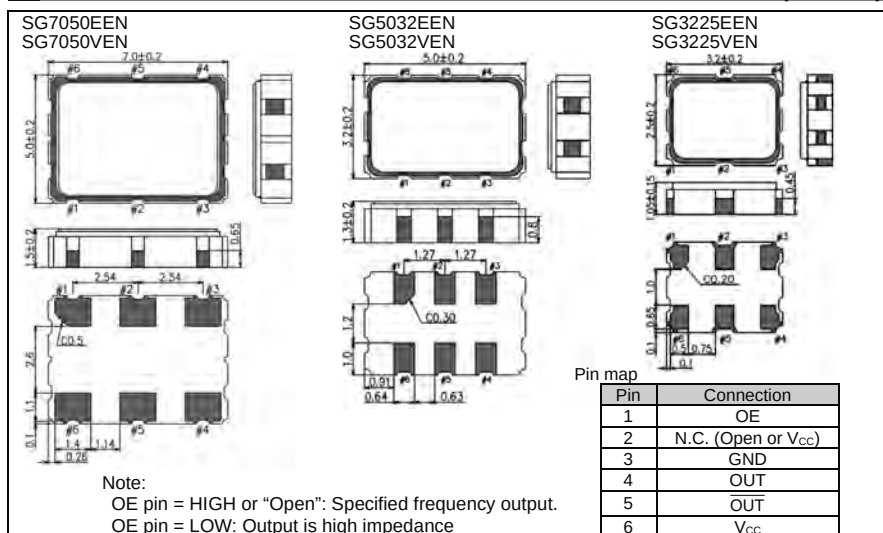
⑥Operating temperature	
G	-40 to +85 °C
H	-40 to +105 °C

*1 : Maximum T_{use} of operating range



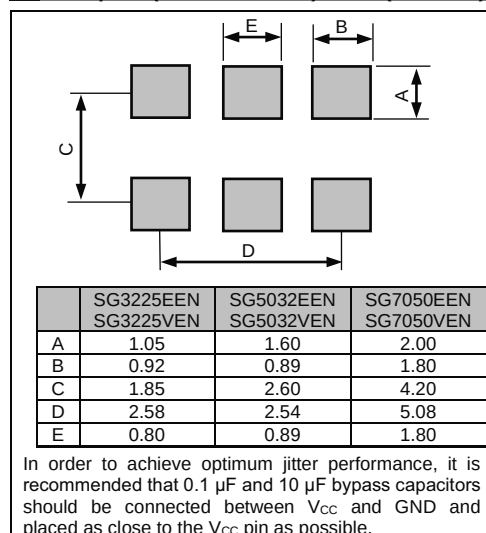
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





CRYSTAL OSCILLATOR (SPXO)

OUTPUT : LV-PECL, LVDS

SG3225EAN / VAN

SG5032EAN / VAN

SG7050EAN / VAN

- Achieved wide frequency range by PLL technology and Fundamental AT crystal units
- Frequency range : 73.5 MHz to 700 MHz
- Supply voltage : 2.5 V to 3.3 V
- Function : Output enable (OE)
- Output : LV-PECL or LVDS



Product Number

SG3225EAN: X1G004251xxxx00

SG3225VAN: X1G004241xxxx00

SG5032EAN: X1G004271xxxx00

SG5032VAN: X1G004261xxxx00

SG7050EAN: X1G004291xxxx00

SG7050VAN: X1G004281xxxx00

SG3225EAN/VAN
(3.2 × 2.5 × 1.05 mm)SG5032EAN/VAN
(5.0 × 3.2 × 1.0 mm)SG7050EAN/VAN
(7.0 × 5.0 × 1.4 mm)

Specifications (characteristics)

Item	Symbol	Specifications		Conditions / Remarks			
		LV-PECL				LVDS	
		SG3225EAN / SG5032EAN / SG7050EAN				SG3225VAN / SG5032VAN / SG7050VAN	
Output frequency range	f _o	73.5 MHz to 700 MHz		Please contact us about available frequencies.			
Supply voltage	V _{cc}	K: 2.5 V - 10 % to 3.3 V + 10 %					
Storage temperature	T _{stg}	-40 °C to +125 °C		Storage as single product.			
Operating temperature	T _{use}	B: -20 °C to +70 °C, G: -40 °C to +85 °C					
Frequency tolerance	f _{tol}	J: ± 50 × 10 ⁻⁶ , E: ± 30 × 10 ⁻⁶ , C: ± 20 × 10 ⁻⁶					
Current consumption	I _{cc}	65 mA Max.	30 mA Max.	OE = V _{cc} , L _{ECL} = 50 Ω or L _{LVDS} = 100 Ω			
Disable current	I _{dis}	20 mA Max.		OE = GND			
Symmetry	SYM	45 % to 55 %		At outputs crossing point			
Output voltage (LV-PECL)	V _{OH}	V _{cc} - 1.0 V to V _{cc} - 0.8 V	—	DC characteristics			
	V _{OL}	V _{cc} - 1.78 V to V _{cc} - 1.62 V	—				
Output voltage (LVDS)	V _{OD}	—	250 mV to 450 mV	V _{OD1} , V _{OD2}	DC characteristics		
	dV _{OD}	—	50 mV Max.	dV _{OD} = V _{OD1} -V _{OD2}			
	V _{OS}	—	1.15 V to 1.35 V	V _{OS1} , V _{OS2}			
	dV _{OS}	—	150 mV Max.	dV _{OS} = V _{OS1} -V _{OS2}			
	Output load condition (ECL) / (LVDS)	L _{ECL}	50 Ω	—	Terminated to V _{cc} -2.0 V		
L _{LVDS}		—	100 Ω	Connected between OUT to $\overline{\text{OUT}}$			
Input voltage	V _{IH}	70 % V _{cc} Min.		OE terminal			
	V _{IL}	30 % V _{cc} Max.					
Rise time / Fall time	t _r / t _f	350 ps Max.	300 ps Max.	LV-PECL: Between 20 % and 80 % of (V _{OH} -V _{OL}). LVDS: Between 20 % and 80 % of Differential Output peak to peak voltage			
Start-up time	t _{str}	3 ms Max.		Time at minimum supply voltage to be 0 s			
Phase Jitter	t _{pj}	0.6 ps Max.*1		Offset frequency: 12 kHz to 20 MHz			
Frequency aging	f _{age}	± 5 × 10 ⁻⁶ / year Max.		+25 °C, First year, V _{cc} = 2.5 V, 3.3 V			

*1 0.9 ps Max. (f_o = 243 MHz ~ 250 MHz, 486 MHz ~ 500 MHz)

Product Name SG3225 EAN 156.250000MHz K J G A (⑤⑥: CG is not available)

(Standard form)

① Model ② Output (E: LV-PECL, V: LVDS) ③ Frequency ④ Supply voltage ⑤ Frequency tolerance

⑥ Operating temperature ⑦ Internal identification code ("A" is default)

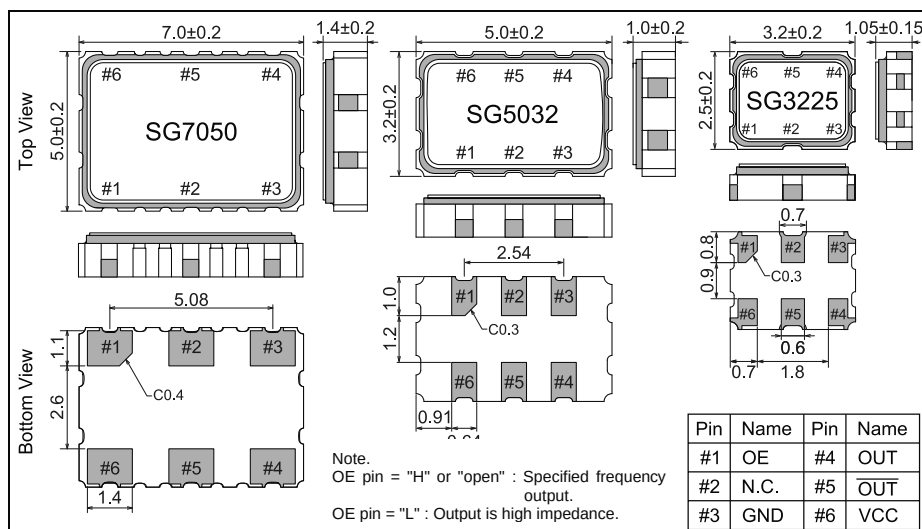
④ Supply voltage	
K	2.5 V ~ 3.3 V

⑤ Frequency tolerance	
J	± 50 × 10 ⁻⁶
E	± 30 × 10 ⁻⁶
C	± 20 × 10 ⁻⁶

⑥ Operating temperature	
B	-20 °C ~ +70 °C
G	-40 °C ~ +85 °C

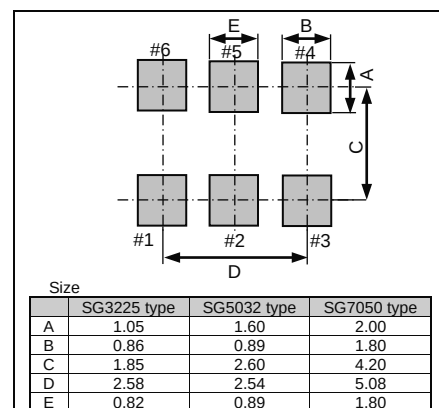
External dimensions

(Unit: mm)



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 (SPXO)

OUTPUT : HCSL



Product Number
X1G005141xxxx00

SG3225HBN

- Frequency range : 100 MHz to 325 MHz
- Supply voltage : 2.5V, 3.3 V
- Output : HCSL
- Function : Output enable (OE)
- External dimensions : 3.2 × 2.5 × 1.05 mm
- Phase jitter : 85 fs Typ (fo = 156.25MHz)



Specifications (characteristics)

Item	Symbol	Specifications	Conditions / Remarks
Output frequency range	fo	100 MHz to 325 MHz	Please contact us for inquiries regarding available frequencies.
Supply voltage	V _{CC}	D : 2.5 V ± 0.125 V , C : 3.3 V ± 0.165 V	
Storage temperature	T _{stg}	-55 °C to +125 °C	Store as bare product.
Operating temperature	T _{use}	G: -40 °C to +85 °C, H: -40 °C to +105 °C	
Frequency tolerance	f _{tol}	J: ± 50 × 10 ⁻⁶ (Not available H : -40 °C to +105 °C) L: ± 100 × 10 ⁻⁶	Includes initial frequency tolerance, temperature variation, supply voltage change and 10 years aging(+25 °C)
Current consumption	I _{CC}	25 mA Typ. 35 mA Max.	OE= V _{CC} , with output load
Disable current	I _{dis}	15 mA Max.	OE=GND
Symmetry	SYM	45 % to 55 %	At outputs crossing point
Output voltage	V _{OH} V _{OL}	0.75 V Typ., 0.66 V to 0.85 V 0 V Typ., -0.15 V to 0.15 V	DC characteristics, single output
Crossing voltage	V _{CR}	0.25 V to 0.55 V	
Output load condition	L _{HCSL} R _S	50 Ω 33 Ω	
Input voltage	V _{IH} V _{IL}	70 % V _{CC} Min. 30 % V _{CC} Max.	OE terminal
differential output rise slew rate/ fall slew rate	Rr / Rf	1 V/ns to 4 V/ns	Between -0.15 V and 0.15 V of differential output
Start-up time	t _{str}	10 ms Max.	Time at minimum supply voltage to be 0 s

Phase Jitter

	Output frequency	100 MHz	125 MHz	156.25 MHz	200 MHz	322.265625 MHz	Supply voltage
Phase Jitter [fs]	Typ.	110	95	85	75	65	V _{CC} =3.3V±0.165V
(Offset Frequency 12k to 20MHz)	Max.	180	160	140	125	110	

Product Name **SG3225 HBN 156.250000MHz C J G A** (⑤⑥: Not Available code JH)

(Standard form)

① ② ③ ④⑤⑥⑦

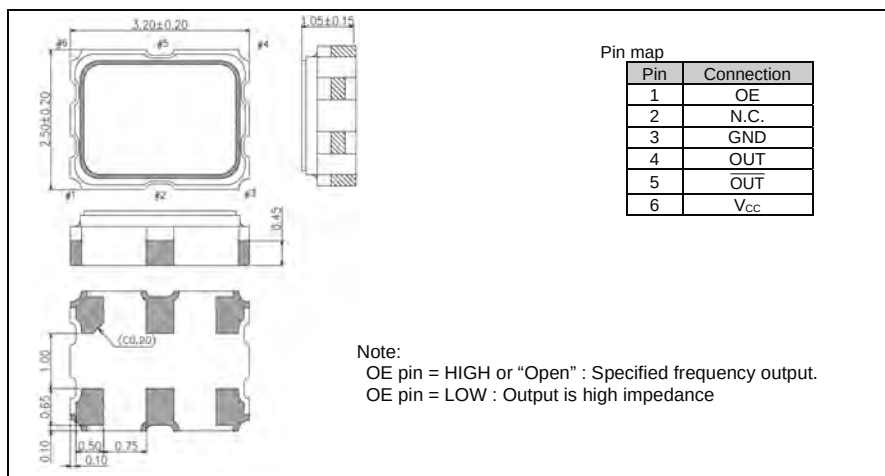
①Model ②Output (H: HCSL) ③Frequency ④Supply voltage (D: 2.5 V Typ. , C: 3.3 V Typ.)

⑤Frequency tolerance (J: ±50 × 10⁻⁶ L: ±100 × 10⁻⁶)

⑥Operating temperature (G:-40 to +85°C, H:-40 to +105°C) ⑦Internal identification code("A" is default)

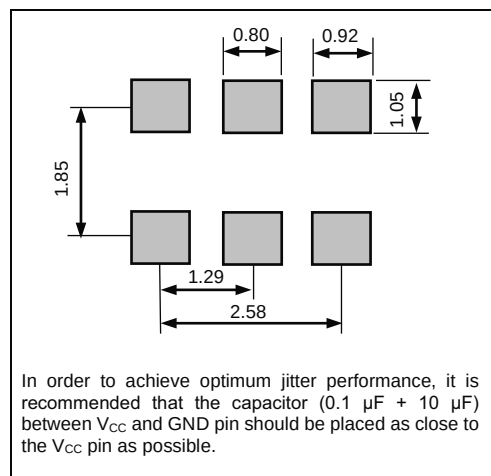
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)



I²C-Bus Programmable Crystal Oscillator (SPXO)

Output: LV-PECL

SG-8506CA

- Frequency range : 50 MHz to 800 MHz
- Supply voltage : 2.5 V to 3.3 V
- External dimensions : 7.0 × 5.0 × 1.5 mm (8 pins)

Features

- User-specified one startup frequency, 7-bit I²C
- User Programming: I²C Interface
- High frequency fundamental tone crystal, Low jitter PLL technology
- Available field oscillator programmer "SG-Writer II"

Application

- OTN, BTS, Test Instrument

*The I²C-Bus is a trademark of
NXP Semiconductors



Product Number
X1G005031xxxx00



Specifications (characteristics)

Item	Symbol	Specifications	Conditions / Remarks
Output frequency range	f _o	50 MHz to 800 MHz	It can be changed by I ² C
Supply voltage	V _{CC}	2.5 V - 0.125 V to 3.3 V + 0.33 V	-
Storage temperature	T _{stg}	-55 °C to +125 °C	Store as bare product after packing
Operating temperature	T _{use}	-40 °C to +85 °C	-
Frequency tolerance *1	f _{tol}	K : ±31.5 × 10 ⁻⁶	Customized Product (Option)
		L : ±50 × 10 ⁻⁶	
Current consumption	I _{CC}	90 mA Max.	OE Active, L _{ECL} =50 Ω
Disable current	I _{dis}	40 mA Max.	OE Inactive, Output Standby: Hi-Z mode
		70 mA Max.	OE Inactive, Output Standby: Fix mode
Symmetry	SYM	45 % to 55 %	At outputs crossing point
Output voltage	V _{OH}	V _{CC} - 1.025 V Min.	DC characteristics
	V _{OL}	V _{CC} - 1.62 V Max.	
Output load condition	L _{ECL}	50 Ω	Termination to V _{CC} - 2.0 V
Input voltage	V _{IH}	70% V _{CC} Min.	OE, SDA and SCL
	V _{IL}	30% V _{CC} Max.	
Rise time / Fall time	t _r / t _f	400 ps Max.	Between 20% and 80% of (V _{OH} - V _{OL})
Start-up time	t _{str}	10 ms Max.	Time at minimum supply voltage to be 0 s
Setting time for frequency change	t _{SET1}	1.5 ms Max.	From setting NEW_FREQ bit to output new frequency

*1 Frequency tolerance includes initial frequency tolerance, temperature variation, supply voltage change, reflow drift and 10 years aging at +25 °C.

Product Name SG-8506 CA 156.2MHz 0x37 A P R L Z
(Standard form) ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

① Model, ② Package type,

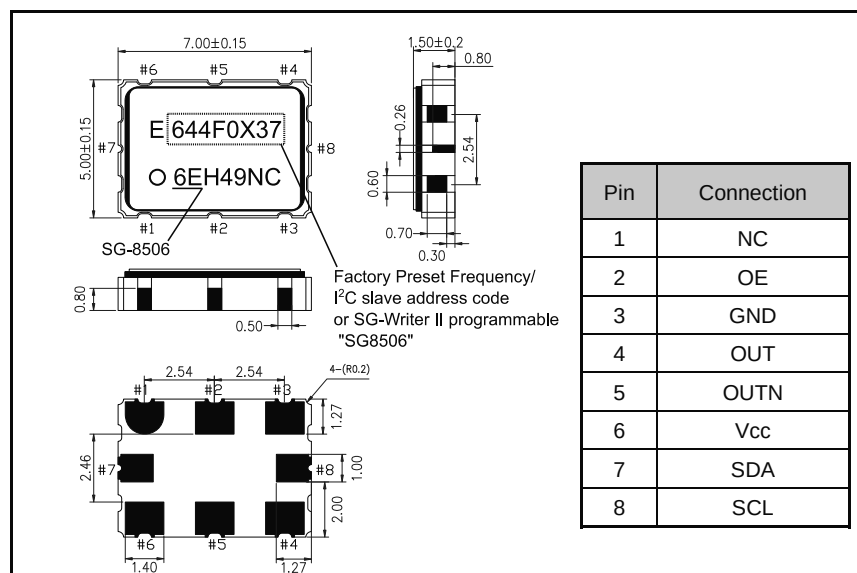
③ Power-on default output frequency (50 ~ 800 MHz), ④ I²C slave address, ⑤ Internal crystal frequency,

⑥ Output enable pin Polarity, ⑦ Supply voltage/Output format, ⑧ Frequency tolerance/Operating temperature, ⑨ Output standby type

⑤ Internal crystal frequency	⑥ Output enable pin Polarity	⑦ Supply voltage/Output format	⑧ Frequency tolerance/Operating temperature	⑨ Output standby type
A 114.1444 MHz	P Active High	R 2.5 V ~ 3.3 V/LVPECL	K ±31.5 × 10 ⁻⁶ /-40 to +85 °C	F Fix (OUT="L", OUTN="H")
	Q Active Low		L ±50 × 10 ⁻⁶ /-40 to +85 °C	Z High-Z

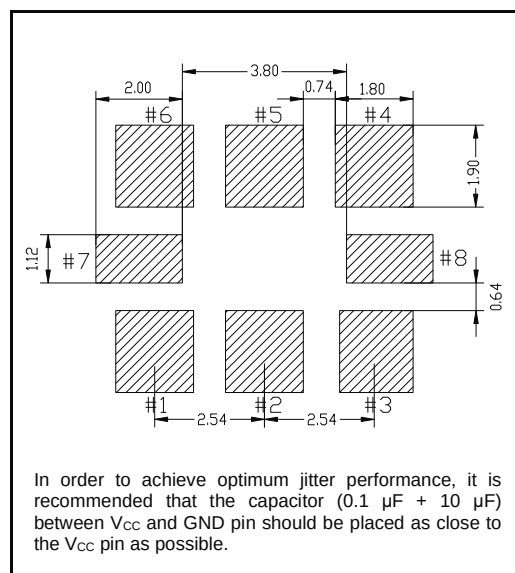
External dimensions

(Unit: mm)



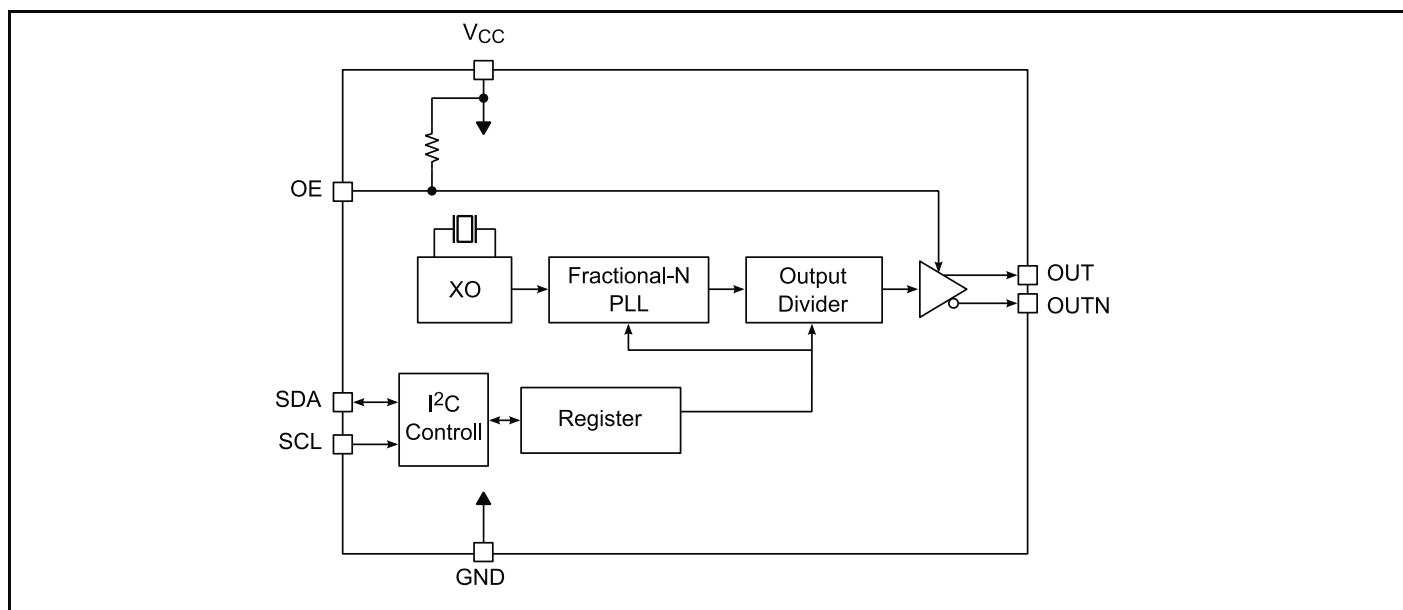
Footprint (Recommended)

(Unit: mm)

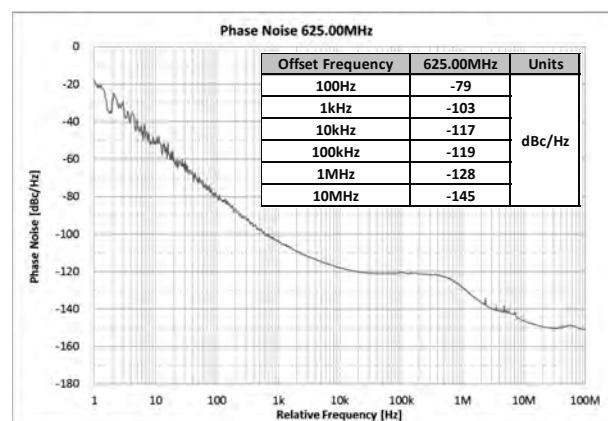
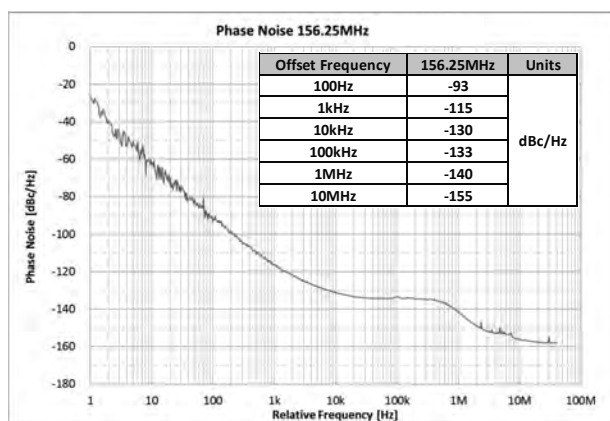




Block diagram



Phase Noise



Phase Jitter

	Offset Frequency	100.00 MHz	125.00 MHz	156.25 MHz	250.00 MHz	312.50 MHz	500.00 MHz	625.00 MHz
Phase jitter *2 Typ.	12 kHz to 20 MHz	0.31 ps	0.30 ps	0.26 ps	0.26 ps	0.29 ps	0.28 ps	0.29 ps

*2 In order to achieve optimum jitter performance, it is recommended that the capacitor (0.1 μ F + 10 μ F) between VCC and GND pin should be placed as close to the VCC pin as possible.



Dual or Quad Selectable Programmable Crystal Oscillator

Output: LV-PECL

SG-8503CA / SG-8504CA

- Dual frequency Selectable: SG-8503CA, 7.0 × 5.0 × 1.5 mm (6 pins)
- Quad frequency Selectable: SG-8504CA, 7.0 × 5.0 × 1.5 mm (8 pins)
- Frequency range: 50 MHz to 800 MHz
- Supply voltage: 2.5 V to 3.3 V

Features

- User-specified two (FSEL) or four (FSEL0, FSEL1) startup frequencies
- High frequency fundamental tone crystal, Low jitter PLL technology
- Available field oscillator programmer "SG-Writer II"

Application

- OTN, BTS, Test Instrument



Product Number
 SG-8503CA : X1G005011xxxx00
 SG-8504CA : X1G005021xxxx00



Specifications (characteristics)

Item	Symbol	Specifications	Conditions / Remarks
Output frequency range	f _o	50 MHz to 800 MHz	-
Supply voltage	V _{CC}	2.5 V - 0.125 V to 3.3 V + 0.33 V	-
Storage temperature	T _{stg}	-55 °C to +125 °C	Store as bare product after packing
Operating temperature	T _{use}	-40 °C to +85 °C	-
Frequency tolerance *1	f _{tol}	K : ±31.5 × 10 ⁻⁶ L : ±50 × 10 ⁻⁶	Customized Product (Option)
Current consumption	I _{CC}	90 mA Max.	OE Active, L _{ECL} = 50 Ω
Disable current	I _{dis}	40 mA Max. 70 mA Max.	OE Inactive, Output Standby: Hi-Z mode OE Inactive, Output Standby: Fix mode
Symmetry	SYM	45 % to 55 %	At outputs crossing point
Output voltage	V _{OH} V _{OL}	V _{CC} - 1.025 V Min. V _{CC} - 1.62 V Max.	DC characteristics
Output load condition	L _{ECL}	50 Ω	Termination to V _{CC} - 2.0 V
Input voltage	V _{IH} V _{IL}	70% V _{CC} Min. 30% V _{CC} Max.	SG-8503CA : OE, FSEL SG-8504CA : OE, FSEL0, FSEL1
Rise time / Fall time	t _r / t _f	400 ps Max.	Between 20% and 80% of (V _{OH} - V _{OL})
Start-up time	t _{str}	10 ms Max.	Time at minimum supply voltage to be 0 s
Setting time for frequency change	t _{SET1}	1.5 ms Max.	SG-8503CA : From setting FSEL pin to output new frequency SG-8504CA : From setting FSEL0 / FSEL1 pin to output new frequency

*1 Frequency tolerance includes initial frequency tolerance, temperature variation, supply voltage change, reflow drift and 10 years aging at +25 °C.

Product Name SG-8503 CA 156MHz 625MHz A P R L Z
 (Standard form) ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

① Model, ② Package type,

③ Frequency-0 (50 ~ 800 MHz), ④ Frequency-1 (50 ~ 800 MHz), ⑤ Internal crystal frequency, ⑥ Output enable pin Polarity,

⑦ Supply voltage/Output format, ⑧ Frequency tolerance/Operating temperature, ⑨ Output standby type

Product Name SG-8504 CA 156.2MHz nnnn A P R L Z
 (Standard form) ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

① Model, ② Package type,

③ Frequency-0 (50 ~ 800 MHz), ④ Parameter identifier, ⑤ Internal crystal frequency, ⑥ Output enable pin Polarity,

⑦ Supply voltage/Output format, ⑧ Frequency tolerance/Operating temperature, ⑨ Output standby type

⑤ Internal crystal frequency	⑥ Output enable pin Polarity	⑦ Supply voltage/ Output format	⑧ Frequency tolerance/ Operating temperature	⑨ Output standby type
A 114.1444 MHz	P Active High Q Active Low	R 2.5 V ~ 3.3 V/LVPECL	K ±31.5 × 10 ⁻⁶ /-40 to +85 °C L ±50 × 10 ⁻⁶ /-40 to +85 °C	F Fix (OUT="L", OUTN="H") Z High-Z

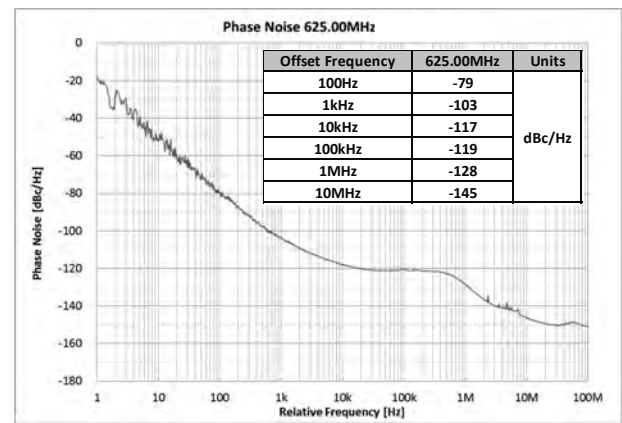
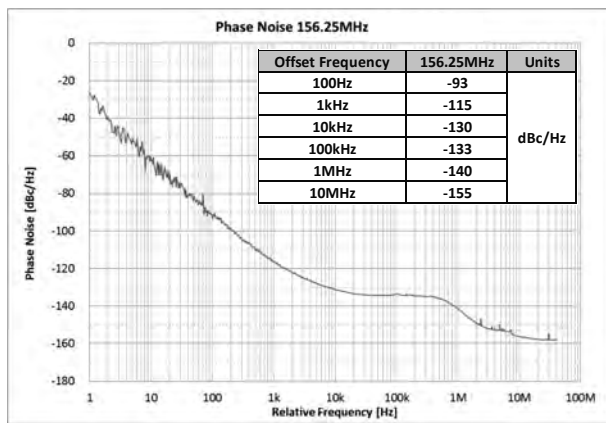
Phase Jitter

	Offset Frequency	100.00 MHz	125.00 MHz	156.25 MHz	250.00 MHz	312.50 MHz	500.00 MHz	625.00 MHz
Phase jitter *2 Typ.	12 kHz to 20 MHz	0.31 ps	0.30 ps	0.26 ps	0.26 ps	0.29 ps	0.28 ps	0.29 ps

*2 In order to achieve optimum jitter performance, it is recommended that the capacitor (0.1 μF + 10 μF) between V_{CC} and GND pin should be placed as close to the V_{CC} pin as possible.

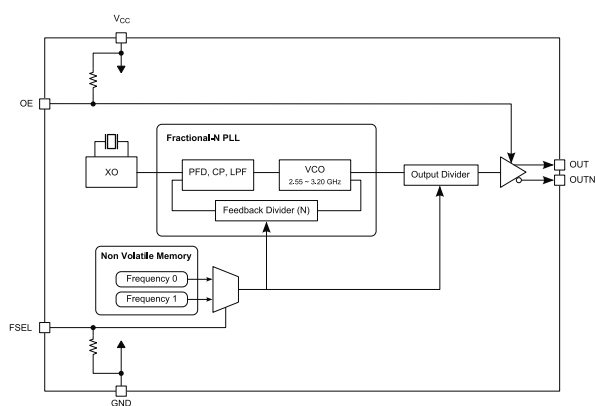


Phase Noise

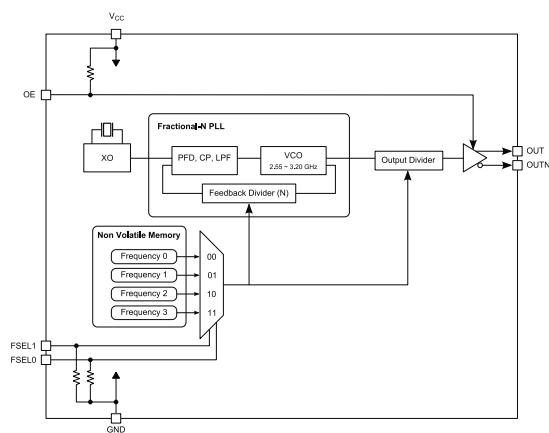


Block diagram

SG-8503CA



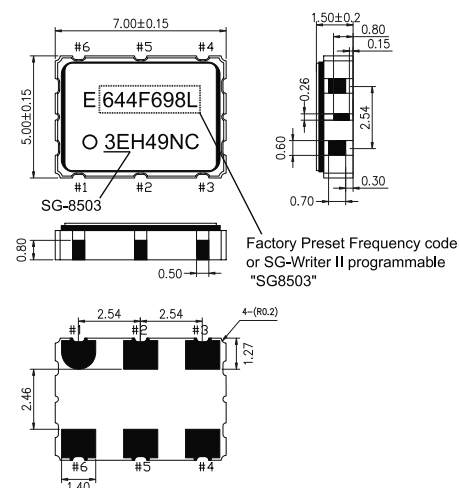
SG-8504CA



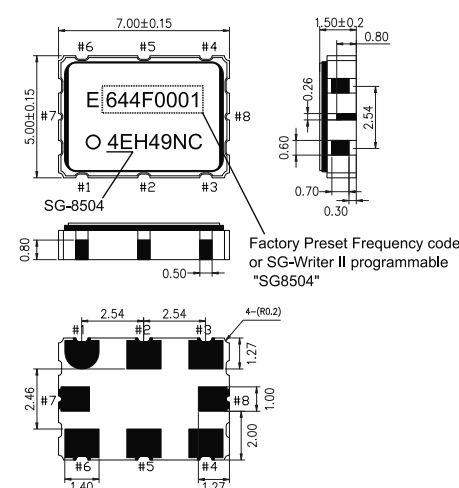
External dimensions

(Unit: mm)

SG-8503CA



SG-8504CA



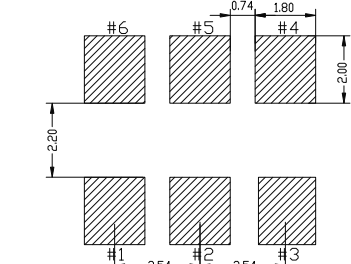
Pin	Connection
1	OE
2	FSEL (L = Frequency-0, H = Frequency-1)
3	GND
4	OUT
5	OUTN
6	Vcc

Pin	Connection	Pin	Connection
1	NC	5	OUTN
2	OE	6	Vcc
3	GND	7	FSEL0
4	OUT	8	FSEL1

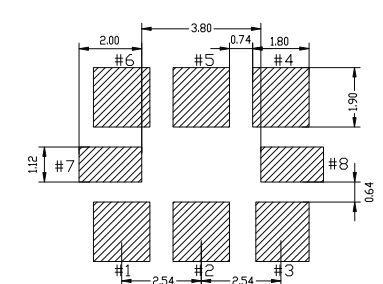
FSEL1, FSEL0	Output Frequency
LL	Frequency-0
LH	Frequency-1
HL	Frequency-2
HH	Frequency-3

Footprint (Recommended)(Unit: mm)

SG-8503CA



SG-8504CA



In order to achieve optimum jitter performance, it is recommended that the capacitor (0.1 μ F + 10 μ F) between Vcc and GND pin should be placed as close to the Vcc pin as possible.

High Precision Oscillator (TCXO / VC-TCXO)

Size [mm]	Clipped sine wave		CMOS output	
	3.2 x 2.5 mm		For Industrial / Consumer (+85 °C Operation, H-Shape) - 3.2 x 2.5 mm: TG3225CEN - 2.5 x 2.0 mm: TG2520CEN 11 Standard frequencies: 12 / 16 / 24 / 25 / 26 / 27 / 32 / 36 / 38.4 / 39 / 48 / 40 MHz	
	2.5 x 2.0 mm	For Industrial / Consumer (+85 °C Operation, H-Shape) - 2.5 x 2.0 mm: TG2520SMN - 2.0 x 1.6 mm: TG2016SMN SMN Series 18 Standard frequencies: 16 / 16.368 / 16.369 / 19.2 / 20 / 24 / 25 / 25.6 / 26 / 27 / 27.6 / 30 / 32 / 38.4 / 40 / 48 / 50 / 52 MHz		
	2.0 x 1.6 mm	For Automotive (AEC-Q100, Single-seal) Operating Temp. Max. SKA: +105 °C / SLA: +85 °C - 2.0 x 1.6 mm: TG2016SKA 26 / 49.58 MHz - 2.0 x 1.6 mm: TG2016SLA 26 / 49.58 MHz		
	1.6 x 1.2 mm	For Industrial / Consumer (+105 °C Operation, ST-Function, Single-seal) - 2.0 x 1.6 mm: TG2016SLN 26 / 38.4 MHz - 1.6 x 1.2 mm: TG1612SLN 26 MHz		

► Output: Clipped sine wave

P	Model	Size [mm]	Nominal frequency range	Frequency tolerance (× 10 ⁻⁶)	Frequency / Temperature Characteristics (× 10 ⁻⁶)	Operating temperature [°C]	Supply voltage [V]	Current consumption Max. [mA]	Output load condition	Output control
78	TG2016SMN	2.0 × 1.6 × 0.73t	10 MHz — 55 MHz	±1.5	±0.5	-40 to +85	1.8 ± 0.1 2.8 ± 5 % 3.0 ± 5 % 3.3 ± 5 %	1.5 (≤ 26 MHz) 1.8 (≤ 40 MHz) 2.0 (≤ 50 MHz) 2.1 (≤ 55 MHz)	10 kΩ/10 pF	-
	TG2520SMN	2.5 × 2.0 × 0.8t								
79	TG1612SLN	1.6 × 1.2 × 0.45t	13 MHz — 55.2 MHz	±2.0	±0.5 (≤ 85 °C) ±5.0 (≤ 105 °C)	-40 to +105	1.8 ± 0.1 2.8 ± 5 % 3.0 ± 5 % 3.3 ± 5 %	1.7 (≤ 26 MHz) 2.0 (≤ 38.4 MHz) 2.5 (≤ 55.2 MHz)	10 kΩ/10 pF	ST
80	TG2016SLN	2.0 × 1.6 × 0.7t	10 MHz — 55.2 MHz							
132	TG2016SKA (AEC-Q100)	2.0 × 1.6 × 0.7t	13 MHz — 55 MHz	±2.0	±0.5	-40 to +105	1.8 ± 0.1 2.8 ± 5 % 3.0 ± 5 % 3.3 ± 5 %	2.0 (≤ 40 MHz) 2.5 (≤ 55 MHz)	10 kΩ/10 pF	ST
133	TG2016SLA (AEC-Q100)	2.0 × 1.6 × 0.7t	13 MHz — 55 MHz	±2.0	±0.5	-40 to +85	1.8 ± 0.1 2.8 ± 5 % 3.0 ± 5 % 3.3 ± 5 %	2.0 (≤ 40 MHz) 2.5 (≤ 55 MHz)	10 kΩ/10 pF	ST
Web site	TG-5006CJ	2.0 × 1.6 × 0.73t	13 MHz — 52 MHz	±2.0	±0.5	-30 to +85	1.8 ± 0.1 2.8 ± 5 % 3.0 ± 5 % 3.3 ± 5 %	1.5 (≤ 26 MHz) 2.0 (> 26 MHz)	10 kΩ/10 pF	-
	TG-5006CG	2.5 × 2.0 × 0.8t								
	TG-5006CE	3.2 × 2.5 × 0.9t	13 MHz 20 MHz 26 MHz — 40 MHz							

► Output: CMOS

P	Model	Size [mm]	Nominal frequency range	Frequency tolerance (× 10 ⁻⁶)	Frequency / Temperature Characteristics (× 10 ⁻⁶)	Operating temperature [°C]	Supply voltage [V]	Current consumption Max. [mA]	Output load condition	Output control
81	TG2520CEN	2.5 × 2.0 × 0.8t	12 MHz — 52 MHz	±2.0	±2.0	-40 to +85	2.8 ± 5 % 3.0 ± 5 % 3.3 ± 5 %	4.0 (≤ 26 MHz) 6.0 (≤ 39 MHz) 6.5 (≤ 52 MHz)	15pF	-
	TG3225CEN	3.2 × 2.5 × 0.9t	12 MHz — 52 MHz	±2.0	±2.0	-40 to +85	2.8 ± 5 % 3.0 ± 5 % 3.3 ± 5 %	4.0 (≤ 26 MHz) 6.0 (≤ 39 MHz) 6.5 (≤ 52 MHz)	15pF	-

Wired network/Wireless network Solutions (TCXO / VC-TCXO)

TCXO		VC-TCXO	
Size [mm]	7.0 x 5.0 mm	TG7050SKN / TG7050SMN Clipped sine wave, +/- 100 x 10⁻⁹ at -40 °C to +105 °C SKN: 10pin, SMN: 4pin From 10MHz to 54MHz	
		TG7050CKN / TG7050CMN CMOS, +/- 100 x 10⁻⁹ at -40 °C to +105 °C CKN: 10pin, CMN: 4pin From 10MHz to 54MHz	
		TG-5510CA / TG-5511CA Clipped sine wave/CMOS, +/- 280 x 10⁻⁹ at -40 °C to +85 °C TG-5510CA: 10pin, TG-5511CA: 4pin From 10MHz to 54MHz	
5.0 x 3.2 mm		TG5032SKN / TG5032SMN Clipped sine wave, +/- 100 x 10⁻⁹ at -40 °C to +105 °C SKN: 10pin, SMN: 4pin From 10MHz to 54MHz	
		TG5032CKN / TG5032CMN CMOS, +/- 100 x 10⁻⁹ at -40 °C to +105 °C CKN: 10pin, CMN: 4pin From 10MHz to 54MHz	
		TG-5510CB / TG-5511CB Clipped sine wave/CMOS, +/- 280 x 10⁻⁹ at -40 °C to +85 °C TG-5510CB: 10pin, TG-5511CB: 4pin From 10MHz to 54MHz	
		TG5032SGN / TG5032SFN Clipped sine wave, +/- 100 x 10⁻⁹ at -40 °C to +85 °C SGN: 10pin, SFN: 4pin From 10MHz to 40MHz	
		TG5032CGN / TG5032CFN CMOS, +/- 100 x 10⁻⁹ at -40 °C to +85 °C CGN: 10pin, CFN: 4pin From 10MHz to 40MHz	

► Output: Clipped sine wave or CMOS

P	Model	Size [mm]	Nominal frequency range	Frequency tolerance (× 10 ⁻⁶)	Frequency / Temperature Characteristics (× 10 ⁻⁶)	Operating temperature [°C]	Supply voltage [V]	Current consumption Max. [mA]	Output load condition	Output control
82	TG7050CKN (CMOS)	7.0 × 5.0 × 1.5t (10 pin)	10 MHz 54 MHz	±1.0	±0.1	-40 to +105	3.3 ±5 %	7.0 (≤ 26 MHz) 9.0 (≤ 40 MHz) 10.0 (≤ 54 MHz)	15 pF	OE
	TG7050SKN (Clipped sine wave)							6.0	10 kΩ/10 pF	
	TG7050CMN (CMOS)	7.0 × 5.0 × 1.5t (4 pin)	10 MHz 54 MHz	±1.0	±0.1	-40 to +105	3.3 ±5 %	7.0 (≤ 26 MHz) 9.0 (≤ 40 MHz) 10.0 (≤ 54 MHz)	15 pF	-
	TG7050SMN (Clipped sine wave)							6.0	10 kΩ/10 pF	
83	TG-5510CA (CMOS)	7.0 × 5.0 × 1.5t (10 pin)	10 MHz 54 MHz	±1.0	±0.28	-40 to +85 (+105 option)	3.3 ±5 %	7.0 (≤ 26 MHz) 9.0 (≤ 40 MHz) 10.0 (≤ 54 MHz)	15 pF	OE
	TG-5510CA (Clipped sine wave)							6.0	10 kΩ/10 pF	
	TG-5511CA (CMOS)	7.0 × 5.0 × 1.5t (4 pin)	10 MHz 54 MHz	±1.0	±0.28	-40 to +85 (+105 option)	3.3 ±5 %	7.0 (≤ 26 MHz) 9.0 (≤ 40 MHz) 10.0 (≤ 54 MHz)	15 pF	-
	TG-5511CA (Clipped sine wave)							6.0	10 kΩ/10 pF	
85	TG5032CKN (CMOS)	5.0 × 3.2 × 1.45t (10 pin)	10 MHz 54 MHz	±1.0	±0.1	-40 to +105	3.3 ±5 %	7.0 (≤ 26 MHz) 9.0 (≤ 40 MHz) 10.0 (≤ 54 MHz)	15 pF	OE
	TG5032SKN (Clipped sine wave)							6.0	10 kΩ/10 pF	
	TG5032CMN (CMOS)	5.0 × 3.2 × 1.45t (4 pin)	10 MHz 54 MHz	±1.0	±0.1	-40 to +105	3.3 ±5 %	7.0 (≤ 26 MHz) 9.0 (≤ 40 MHz) 10.0 (≤ 54 MHz)	15 pF	-
	TG5032SMN (Clipped sine wave)							6.0	10 kΩ/10 pF	
84	TG-5510CB (CMOS)	5.0 × 3.2 × 1.45t (10 pin)	10 MHz 54 MHz	±1.0	±0.28	-40 to +85 (+105 option)	3.3 ±5 %	7.0 (≤ 26 MHz) 9.0 (≤ 40 MHz) 10.0 (≤ 54 MHz)	15 pF	OE
	TG-5510CB (Clipped sine wave)							6.0	10 kΩ/10 pF	
	TG-5511CB (CMOS)	5.0 × 3.2 × 1.45t (4 pin)	10 MHz 54 MHz	±1.0	±0.28	-40 to +85 (+105 option)	3.3 ±5 %	7.0 (≤ 26 MHz) 9.0 (≤ 40 MHz) 10.0 (≤ 54 MHz)	15 pF	-
	TG-5511CB (Clipped sine wave)							6.0	10 kΩ/10 pF	



P	Model	Size [mm]	Nominal frequency range	Frequency tolerance ($\times 10^{-6}$)	Frequency / Temperature Characteristics ($\times 10^{-6}$)	Operating temperature [°C]	Supply voltage [V]	Current consumption Max. [mA]	Output load condition	Output control
87	TG5032CGN (CMOS)	5.0 $\times$ 3.2 $\times$ 1.45t (10 pin)	 10 MHz 40 MHz	± 1.0	± 0.1	-40 to +85	2.375 to 3.63	5.0 (≤ 26 MHz) 6.0 (> 26 MHz)	15 pF	OE
	TG5032SGN (Clipped sine wave)							5.0	10 k Ω /10 pF	
86	TG5032CFN (CMOS)	5.0 $\times$ 3.2 $\times$ 1.45t (4 pin)	 10 MHz 40 MHz	± 1.0	± 0.1	-40 to +85	2.375 to 3.63	5.0 (≤ 26 MHz) 6.0 (> 26 MHz)	15 pF	-
	TG5032SFN (Clipped sine wave)							5.0	10 k Ω /10 pF	



TCXO / VC-TCXO

HIGH STABILITY / Low noise



Product Number
TG2016SMN : X1G005441xxxx25
TG2520SMN : X1G005421xxxx27

TG2016SMN / TG2520SMN

- Output frequency : 10 MHz to 55 MHz
- Supply voltage : 1.8 V Typ./ 2.8 V Typ./ 3.0 V Typ./ 3.3 V Typ.
- Frequency / temperature characteristics
 - : $\pm 0.5 \times 10^{-6}$ Max. (-40 °C to +85 °C)
 - : $\pm 2.0 \times 10^{-6}$ Max. (-40 °C to +85 °C)
- External dimensions: 2.0 × 1.6 × 0.73 mm / 2.5 × 2.0 × 0.8 mm
- Applications : GPS, RF
Wireless communication devices
(LTE, WiMAX, Wi-Fi, W-LAN, IoT other)
- Features : Low noise



TG2016SMN
(2.0 × 1.6 × 0.73 mm)



TG2520SMN
(2.5 × 2.0 × 0.8 mm)

Specifications (characteristics)

Item	Symbol	TCXO	VC-TCXO	Conditions / Remarks
Output frequency range	fo	10 MHz to 55MHz		Standard frequency
		16, 16.368, 16.369, 19.2, 20, 24, 25, 26, 27, 27.6, 30, 32, 38.4, 40, 48, 50, 52 MHz		
Supply voltage	V _{CC}	1.8 V ± 0.1 V / 2.8 V ± 5 % / 3.0 V ± 5 % / 3.3 V ± 5 %		Supply voltage range :1.7 V to 3.63 V
Storage temperature range	T _{stg}	-40 °C to +90 °C		Storage as single product.
Operating temperature range	T _{use}	G: -40 °C to +85 °C		
Frequency tolerance	f _{tol}	±1.5 × 10 ⁻⁶ Max.		After reflow, +25 °C
Frequency/temperature characteristics	fo-T _C	C: ±0.5 × 10 ⁻⁶ Max. / -40 °C to +85 °C F: ±2.0 × 10 ⁻⁶ Max. / -40 °C to +85 °C		Standard stability version
Frequency/load coefficient	fo-Load	±0.1 × 10 ⁻⁶ Max.		10 kΩ // 10 pF ± 10 %
Frequency/voltage coefficient	fo-V _{CC}	±0.1 × 10 ⁻⁶ Max.		V _{CC} ± 5 %
Frequency aging	f _{age}	±0.5 × 10 ⁻⁶ Max.		+25 °C, First year, fo = 10MHz, 12 MHz ≤ fo ≤ 20 MHz, 24 MHz ≤ fo ≤ 40 MHz
		±1.5 × 10 ⁻⁶ Max.		+25 °C ,First year, 10 MHz < fo < 12 MHz, 20 MHz < fo < 24 MHz, 40 MHz < fo ≤ 55 MHz
Current consumption	I _{CC}	1.5 mA Max.		10 MHz ≤ fo ≤ 26 MHz
		1.8 mA Max.		26 MHz < fo ≤ 40 MHz
		2.0 mA Max.		40 MHz < fo ≤ 50 MHz
		2.1 mA Max.		50 MHz < fo ≤ 55 MHz
Input impedance	Zin	500 kΩ Min.	-	Vc - GND (DC)
Frequency control range	f _{cont}	-	±5.0 × 10 ⁻⁶ Min.	B: Vc = 0.9 V ± 0.6 V (V _{CC} = 1.8 V) or C: Vc = 1.4 V ± 1.0 V (V _{CC} = 2.8 V) or D: Vc = 1.5 V ± 1.0 V (V _{CC} = 3.0 V) or E: Vc = 1.65 V ± 1.0 V (V _{CC} = 3.3 V)
Frequency change polarity	f _{cp}	-	Positive polarity	
Symmetry	SYM	40 % to 60 %		GND level (DC cut)
Output voltage	Vpp	0.8 V Min.		Peak to Peak
Start-up time	t _{str}	1.0 ms Max.		t = 0 at 90% V _{CC}
Output load	Load_R	10 kΩ		DC cut capacitor = 0.01 μF
	Load_C	10 pF		

* Note : Please contact us for requirements not listed in this specification.

Product Name **TG2016 SMN 26.000000MHz** **E C G N N M**
 (Standard form) ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

① Model (TG2016, TG2520)

② Output (S: Clipped sine wave) ③ Frequency

④ Supply voltage (Refer to symbol table) ⑤ Frequency / temperature characteristics (C: ±0.5 × 10⁻⁶ Max., F: ±2.0 × 10⁻⁶ Max.)

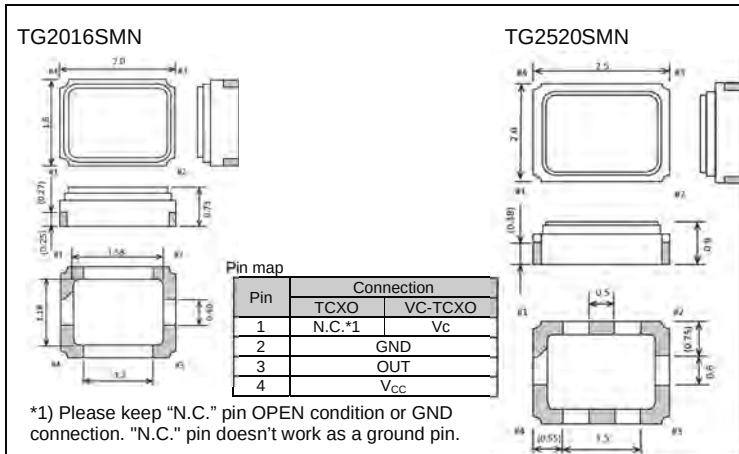
⑥ Operating temperature (G: -40 °C to +85 °C) ⑦ ST function (N: Non)

⑧ V_c function (Refer to symbol table, A: V_c=any) ⑨ Internal identification code ("M" is default)

④ Supply voltage[V _{CC}], ⑧ V _c function[V _c] (Symbol table)					
Voltage [V]	TCXO	VC-TCXO			
④ V _{CC} (Typ.)	E:1.8 M:2.8 to 3.3	E:1.8	B:2.8	A:3.0	C:3.3
⑧ V _c (Typ.)	N: Non	B 0.9	C:1.4	D 1.5	E 1.65

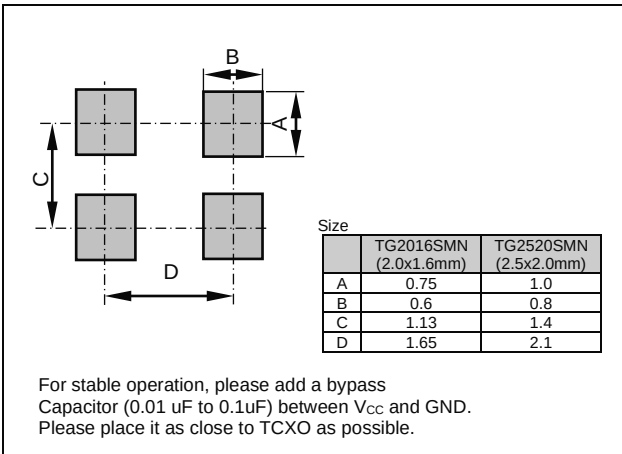
External dimensions

(Unit: mm)



Footprint (Recommended)

(Unit: mm)



TCXO / TCXO-Standby
105 °C High temperature range



Product Number
TG1612SLN : X1G005721xxx16

TG1612SLN

- Output frequency : 13 MHz to 55.2 MHz
- Supply voltage : 1.8 V Typ./ 2.8 V Typ./ 3.0 V Typ./ 3.3 V Typ.
- Frequency / temperature characteristics : $\pm 0.5 \times 10^{-6}$ Max. (-40 °C to +85 °C) and $\pm 5.0 \times 10^{-6}$ Max. (+85 °C to +105 °C)
- External dimensions: 1.6 × 1.2 × 0.45 mm Max.
- Applications : Smart phone, LPWA module
Wireless communication devices
- Features : 105 °C High temp, Standby function (ST)



TG1612SLN
(1.6 × 1.2 × 0.45 mm)

Specifications (characteristics)

Item	Symbol	TCXO		TCXO-Standby	Conditions / Remarks
Output frequency range	f _o	13 MHz to 55.2 MHz 26 MHz			Standard frequency
Supply voltage	V _{CC}	1.8 V ± 0.1 V / 2.8 V ± 5 % / 3.0 V ± 5 % / 3.3 V ± 5 %			Supply voltage range :1.7 V to 3.63 V
Storage temperature range	T _{stg}	-40 °C to +125 °C			Storage as single product.
Operating temperature range	T _{use}	G: -40 °C to +85 °C / H: -40 °C to +105 °C			
Frequency tolerance	f _{tol}	±2.0 × 10 ⁻⁶ Max.			After reflow, +25 °C
Frequency/temperature characteristics	f _o -T _C	C: W:	±0.5 × 10 ⁻⁶ Max. / -40 °C to +85 °C And ±5.0 × 10 ⁻⁶ Max. / +85 °C to +105 °C (Option)		Standard stability version Customized product (Option)
Frequency/load coefficient	f _o -Load	±0.1 × 10 ⁻⁶ Max.			10 kΩ // 10 pF ± 10 %
Frequency/voltage coefficient	f _o -V _{CC}	±0.2 × 10 ⁻⁶ Max.			V _{CC} ± 5 %
Frequency aging	f _{age}	±1.0 × 10 ⁻⁶ Max.			+25 °C, First year, 13 MHz ≤ f _o ≤ 20 MHz, 26 MHz ≤ f _o ≤ 40 MHz
		±1.5 × 10 ⁻⁶ Max.			+25 °C ,First year, 20 MHz < f _o < 26 MHz, 40 MHz < f _o ≤ 55.2 MHz
Current consumption	I _{CC}	1.5 mA Max. 1.7 mA Max. 2.0 mA Max. 2.5 mA Max.			13 MHz < f _o ≤ 26 MHz (-40 to +85 °C) 13 MHz < f _o ≤ 26 MHz (-40 to +105 °C) 26 MHz < f _o ≤ 38.4 MHz (-40 to +105 °C) 38.4 MHz < f _o ≤ 55.2 MHz (-40 to +105 °C)
Stand-by current	I _{std}	-		3 μA Max.	ST = GND
Input voltage	V _{IH}	-		80 % V _{CC} Min.	ST terminal
	V _{IL}	-		20 % V _{CC} Max.	
Symmetry	SYM	45 % to 55 %			GND level (DC cut)
Output voltage	V _{pp}	0.8 V Min.			Peak to Peak
Start-up time	t _{str}	1.0 ms Max.			t = 0 at 90 % V _{CC}
Output load	Load _R	10 kΩ			DC cut capacitor = 0.01 μF
	Load _C	10 pF			

* Note : Please contact us for requirements not listed in this specification.

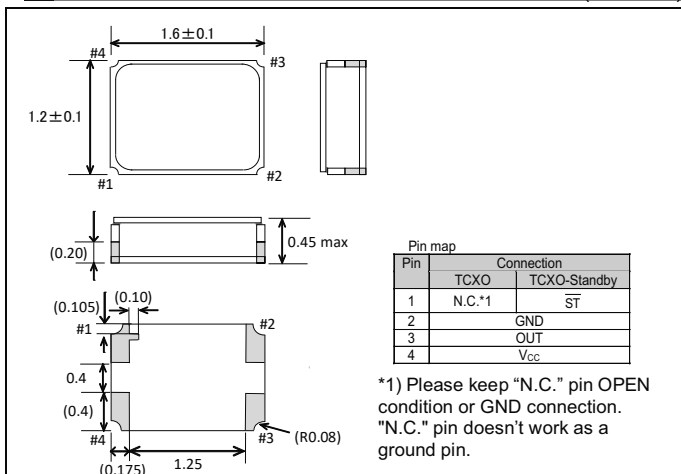
Product Name TG1612 SLN 26.000000MHz E W H S N M
(Standard form) ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

④ Supply voltage [V _{CC}], ⑧ V _C function [V _C] (Symbol table)				
④, ⑧ Type: Function		Suffix symbol: Voltage(Typ.) [V]		
④ V _{CC} : Common		E: 1.8	B: 2.8	A: 3.0 C: 3.3
⑧ V _C :		N: Non		

- ① Model ② Output (S: Clipped sine wave)
 ③ Frequency ④ Supply voltage (Refer to symbol table)
 ⑤ Frequency / temperature characteristics (C: $\pm 0.5 \times 10^{-6}$ Max., F: $\pm 2.0 \times 10^{-6}$ Max., W: $\pm 0.5 \times 10^{-6}$ Max. and $\pm 5.0 \times 10^{-6}$ Max.)
 ⑥ Operating temperature (H: -40 °C to +105 °C, G: -40 °C to +85 °C) ⑦ ST function (N: Non, S: Standby)
 ⑧ V_C function (N: Non for TCXO, Standby mode) ⑨ Internal identification code ("M" is default)

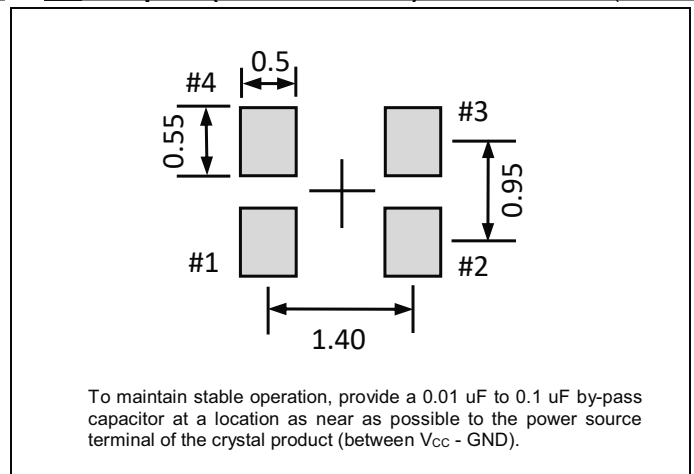
External dimensions

(Unit: mm)



Footprint (Recommended)

(Unit: mm)



TCXO / TCXO-Standby
105 °C High temperature range



Product Number
TG2016SLN : X1G005731xxx16

TG2016SLN

- Output frequency : 10 MHz to 55.2 MHz
- Supply voltage : 1.8 V Typ. / 2.8 V Typ. / 3.0 V Typ. / 3.3 V Typ.
- Frequency / temperature characteristics
 - : $\pm 0.5 \times 10^{-6}$ Max. (-40 °C to +85 °C) and
 - $\pm 5.0 \times 10^{-6}$ Max. (+85 °C to +105 °C)
- External dimensions: 2.0 × 1.6 × 0.7 mm Max.
- Applications : GNSS, Industrial,
Wireless communication devices
- Features : 105 °C High temp, Stand-by function ($\overline{ST}$)



TG2016SLN
(2.0 × 1.6 × 0.7 mm)

Specifications (characteristics)

Item	Symbol	TCXO		TCXO-Standby	Conditions / Remarks
Output frequency range	f _o	10 MHz to 55.2 MHz 26, 38.4 MHz			Standard frequency
Supply voltage	V _{CC}	1.8 V ± 0.1 V / 2.8 V ± 5 % / 3.0 V ± 5 % / 3.3 V ± 5 %			Supply voltage range: 1.7 V to 3.63 V
Storage temperature range	T _{stg}	-40 °C to +105 °C			Storage as single product.
Operating temperature range	T _{use}	G: -40 °C ~ +85 °C / H: -40 °C to +105 °C			
Frequency tolerance	f _{tol}	±2.0 × 10 ⁻⁶ Max.			After 3times reflow, +25 °C
Frequency/temperature characteristics	f _o -T _C	C:	±0.5 × 10 ⁻⁶ Max. / -40 °C to +85 °C		
		W:	C and ±5.0 × 10 ⁻⁶ Max. / +85 °C to +105 °C (Option)		
Frequency/load coefficient	f _o -Load	±0.2 × 10 ⁻⁶ Max.			10 kΩ // 10 pF ± 10 %
Frequency/voltage coefficient	f _o -V _{CC}	±0.2 × 10 ⁻⁶ Max.			V _{CC} ± 5 %
Frequency aging	f _{age}	±1.0 × 10 ⁻⁶ Max.			+25 °C, First year, 10 MHz ≤ f _o ≤ 20 MHz, 26 MHz ≤ f _o ≤ 40 MHz
		±1.5 × 10 ⁻⁶ Max.			+25 °C ,First year, 20 MHz < f _o < 26 MHz 40 MHz < f _o ≤ 55.2 MHz
Current consumption	I _{CC}	1.5 mA Max.			f _o ≤ 26 MHz (-40 °C to +85 °C)
		1.7 mA Max.			f _o ≤ 26 MHz (-40 °C to +105 °C)
		2.0 mA Max.			10 MHz ≤ f _o ≤ 38.4 MHz (-40 °C to +105 °C)
		2.5 mA Max.			38.4MHz < f _o ≤ 55.2 MHz (-40 °C to +105 °C)
Stand-by current	I _{std}	-		3 μA Max.	$\overline{ST}$ = GND
Input voltage	V _{IH}	-		80% V _{CC} Min.	$\overline{ST}$ terminal
	V _{IL}	-		20 % V _{CC} Max.	
Symmetry	SYM	45 % to 55 %			GND level (DC cut)
Output voltage	V _{pp}	0.8 V Min. / 1.5 V Max.			Peak to Peak
Start-up time	t _{str}	2.0 ms Max.			t = 0 at 90% V _{CC}
Output load	Load _R	10 kΩ			DC cut capacitor = 0.01 μF
	Load _C	10 pF			

* Note : Please contact us for requirements not listed in this specification.

Product Name **TG2016 SLN 26.000000MHz** **E W H S N M**
(Standard form) ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

①Model ②Output (S: Clipped sine wave)

③Frequency ④Supply voltage (Refer to symbol table)

⑤Frequency / temperature characteristics (C: $\pm 0.5 \times 10^{-6}$ Max., F: $\pm 2.0 \times 10^{-6}$ Max., W: $\pm 0.5 \times 10^{-6}$ Max. and $\pm 5.0 \times 10^{-6}$ Max.)

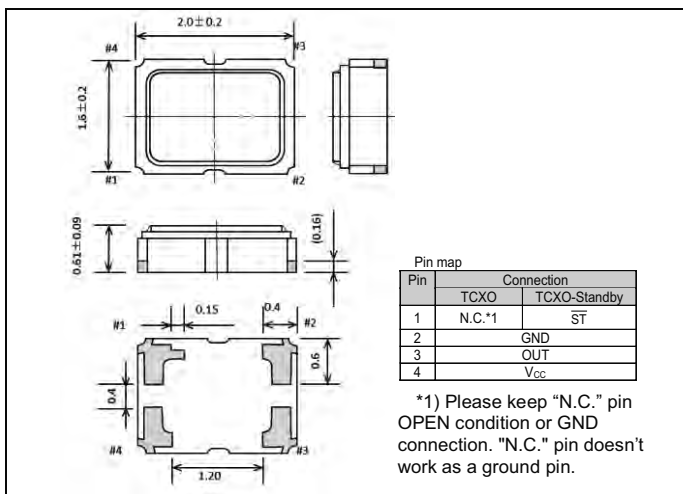
⑥Operating temperature (G: -40 °C ~ +85 °C, H: -40 °C to +105 °C) ⑦ST function (N: Non, S: Standby)

⑧Vc function (N: Non) ⑨Internal identification code ("M" is default)

④Supply voltage [V _{CC}] , ⑧Vc function [Vc] (Symbol table)				
Voltage [V]				
TCXO				
④V _{CC}	E: 1.8	B: 2.8	A: 3.0	C: 3.3
⑧Vc	N: Non			

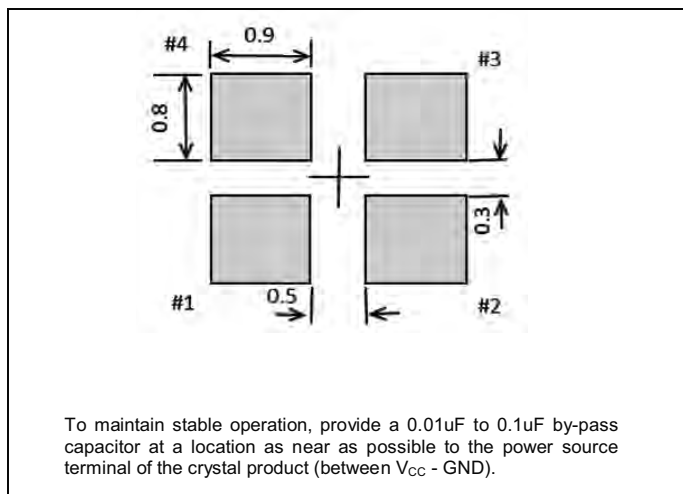
External dimensions

(Unit: mm)



Footprint (Recommended)

(Unit: mm)



TCXO / VC-TCXO HIGH STABILITY, CMOS OUTPUT

TG3225CEN / TG2520CEN

- Output frequency : 12 MHz to 52 MHz
- Supply voltage : 2.8 V Typ. / 3.0 V Typ. / 3.3 V Typ.
- Frequency / temperature characteristics : $\pm 2.0 \times 10^{-6}$ Max.
- External dimensions: 3.2 × 2.5 × 0.9 mm / 2.5 × 2.0 × 0.8 mm
- Applications : Reference clock for measurement machine
Wireless communication devices
(Smart meter, Telemeter, other)
- Features : High stability, CMOS output



Product Number
TG3225CEN : X1G005101xxxxxx
TG2520CEN : X1G005161xxxxxx



TG3225CEN
(3.2 × 2.5 × 0.9 mm)



TG2520CEN
(2.5 × 2.0 × 0.8 mm)

Specifications (characteristics)

Item	Symbol	TCXO	VC-TCXO	Conditions / Remarks
Output frequency range	fo	12 MHz to 52 MHz 12 MHz, 20 MHz, 24 MHz, 25 MHz, 26 MHz, 27 MHz, 32 MHz, 36 MHz, 38.4 MHz, 39 MHz and 40 MHz		Standard frequency
Supply voltage	V _{CC}	2.8 V ± 5 % / 3.0 V ± 5 % / 3.3 V ± 5 %		Supply voltage range: 2.375 V to 3.63 V
Storage temperature range	T _{stg}	-40 °C to +90 °C		Storage as single product.
Operating temperature range	T _{use}	G: -40 °C to +85 °C		
Frequency tolerance	f _{tol}	±2.0 × 10 ⁻⁶ Max.		After reflow, +25 °C
Frequency/temperature characteristics	fo-Tc	F: ±2.0 × 10 ⁻⁶ Max. / -40 °C to +85 °C		Standard stability version
Frequency/load coefficient	fo-Load	±0.2 × 10 ⁻⁶ Max.		15 pF ± 10 %
Frequency/voltage coefficient	fo-V _{CC}	±0.3 × 10 ⁻⁶ Max.		V _{CC} ± 5 %
Frequency aging	f _{age}	±1.0 × 10 ⁻⁶ Max.		+25 °C, First year, 12 MHz ≤ fo ≤ 20 MHz, 24 MHz ≤ fo ≤ 40 MHz
		±1.5 × 10 ⁻⁶ Max.		+25 °C, First year, 20 MHz < fo < 24 MHz, 40 MHz < fo ≤ 52 MHz
Current consumption	I _{CC}	4.0 mA Max.		12 MHz ≤ fo ≤ 26 MHz
		6.0 mA Max.		26 MHz < fo ≤ 39 MHz
		6.5 mA Max.		39 MHz < fo ≤ 52 MHz
Input impedance	Z _{in}	-	500 kΩ Min.	V _c - GND (DC)
Frequency control range	f _{cont}	-	±5.0 × 10 ⁻⁶ Min.	C: V _c = 1.4 V ± 1.0 V (V _{CC} = 2.8 V) or D: V _c = 1.5 V ± 1.0 V (V _{CC} = 3.0 V) or E: V _c = 1.65 V ± 1.0 V (V _{CC} = 3.3 V)
Frequency change polarity	f _{cp}	-	Positive polarity	
Symmetry	SYM	45 % to 55 %		50 % V _{CC} level, L _{CMOS} ≤ 15 pF
Output voltage	V _{OH}	90 % V _{CC} Min.		
	V _{OL}	10 % V _{CC} Max.		
Start-up time	t _{str}	2.0 ms Max.		t = 0 at 90 % V _{CC}
Rise time / Fall time	tr/tf	8.0 ns Max.		10 % V _{CC} to 90 % V _{CC} level, Load: 15 pF
CMOS load condition	L _{CMOS}	15 pF		15 pF ± 10 %

* Note : Please contact us for requirements not listed in this specification.

Product Name TG3225 CEN 39.000000MHz K F G N N M
(Standard form) ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

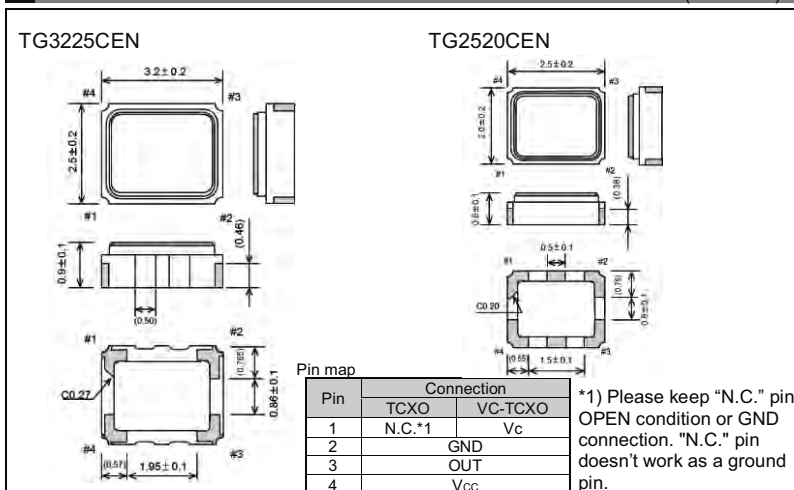
- ①Model ②Output (C: CMOS)
③Frequency ④Supply voltage (Refer to symbol table)
⑤Frequency / temperature characteristics (F: ±2.0 × 10⁻⁶ Max.)
⑥Operating temperature (G: -40 °C to +85 °C)
⑦OE function (N: Non) ⑧V_c function (Refer to symbol table, A: V_c = any)

④Supply voltage [V _{CC}], ⑧V _c function [V _c] (Symbol table)				
Voltage [V]	TCXO	VC-TCXO		
④V _{CC} (Typ.)	K: 2.5 to 3.3	K: 2.5 to 3.3	P: 2.6 to 3.3	M: 2.8 to 3.3
⑧V _c (Typ.)	N: Non	C: 1.4	D: 1.5	E: 1.65

⑨Internal identification code ("M" is default)

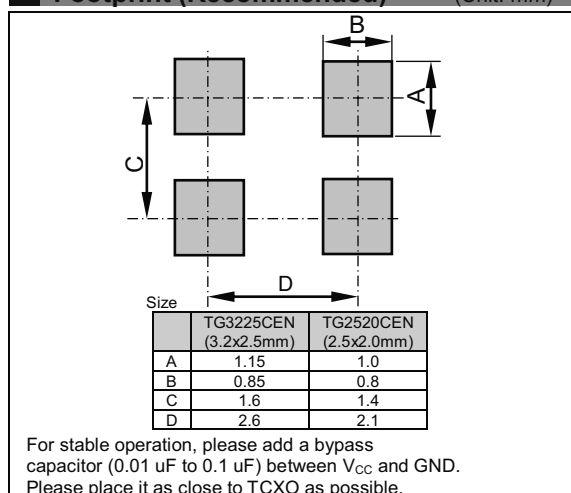
External dimensions

(Unit: mm)



Footprint (Recommended)

(Unit: mm)





TCXO HIGH STABILITY
105 °C HIGH TEMPERATURE



Product Number
TG7050CKN: X1G005661xxxx99
TG7050SKN: X1G005671xxxx99
TG7050CMN: X1G005681xxxx99
TG7050SMN: X1G005691xxxx99

TG7050CKN / TG7050SKN TG7050CMN / TG7050SMN

- Frequency range : 10 MHz to 54 MHz
- Supply voltage : 3.3 V Typ.
- Frequency / temperature characteristics : $\pm 0.1 \times 10^{-6}$ Max. (-40 °C to +105 °C)
- Free-run accuracy : $\pm 4.6 \times 10^{-6}$ Max. / 20 years (for Stratum3)
- External dimensions : 7.0 × 5.0 × 1.5 mm (10 pins or 4 pins)
- Applications : Network synchronization, Stratum3, BTS, SyncE, IEEE1588, Microwave, BTS
- Features : 105 °C High temp, High stability



TG7050CKN
TG7050SKN
(10 pins)



TG7050CMN
TG7050SMN
(4 pins)

Specifications (characteristics)

Item	Symbol	CMOS	Clipped sine wave	Condition
Output frequency range	f _o	10 MHz to 54 MHz		Please contact us about available frequencies.
Supply voltage	V _{CC}	3.3 V ± 5 %		
Storage temperature	T _{stg}	-40 °C to +105 °C		Storage as single product.
Operating temperature	T _{use}	-40 °C to +105 °C		
a) Frequency tolerance	f _{tol}	±1.0 × 10 ⁻⁶ Max.		After reflow, +25 °C
b) Frequency/temperature characteristics	f _o -T _c	±0.1 × 10 ⁻⁶ Max.		-40 °C to +105 °C
c) Frequency/load coefficient	f _o -Load	±0.1 × 10 ⁻⁶ Max.		Load ± 10 %
d) Frequency/voltage coefficient	f _o -V _{CC}	±0.1 × 10 ⁻⁶ Max.		V _{CC} ± 5 %
e) Frequency aging	f _{age}	±0.5 × 10 ⁻⁶ Max.		+25 °C, First year
		±3.0 × 10 ⁻⁶ Max.		+25 °C, 20 years
Holdover stability (Constant temperature)	-	±0.01 × 10 ⁻⁶ Max. (+25 °C, 24 hours)		After 10 days of continuous operation
		±0.04 × 10 ⁻⁶ Max. (+25 °C, 24 hours)		After 48 hours of continuous operation
Wander generation (MTIE, TDEV)	-	Compliant with GR-1244CORE, ITU-T G.8262		
Free-run accuracy	-	±4.6 × 10 ⁻⁶ Max. / 20 years		This includes Item a), b), c), d) and e)
Current consumption	I _{CC}	7.0 mA Max.	6.0 mA Max.	10 MHz ≤ f _o ≤ 26 MHz
		9.0 mA Max.		26 MHz < f _o ≤ 40 MHz
		10.0 mA Max.		40 MHz < f _o ≤ 54 MHz
Symmetry	SYM	45 % to 55 %	-	GND level (DC cut)
Output voltage	V _{OH}	90 % V _{CC} Min.	-	
	V _{OL}	10 % V _{CC} Max.	-	
Rise time / Fall time	tr/tf	8.0 ns Max.	-	10 % V _{CC} to 90 % V _{CC} level, Load: 15 pF
Start-up time	t _{str}	5 ms. Max.		t = 0 at 90 % V _{CC}
Output level	V _{pp}	-	0.8 V Min.	Peak to Peak
Output load condition	Load	15 pF	10 kΩ // 10 pF	
Input voltage	V _{IH}	70 % V _{CC} Min.		OE terminal (Enable voltage)
	V _{IL}	30 % V _{CC} Max.		OE terminal (Disable voltage)

* Note : Please contact us for requirements not listed in this specification.

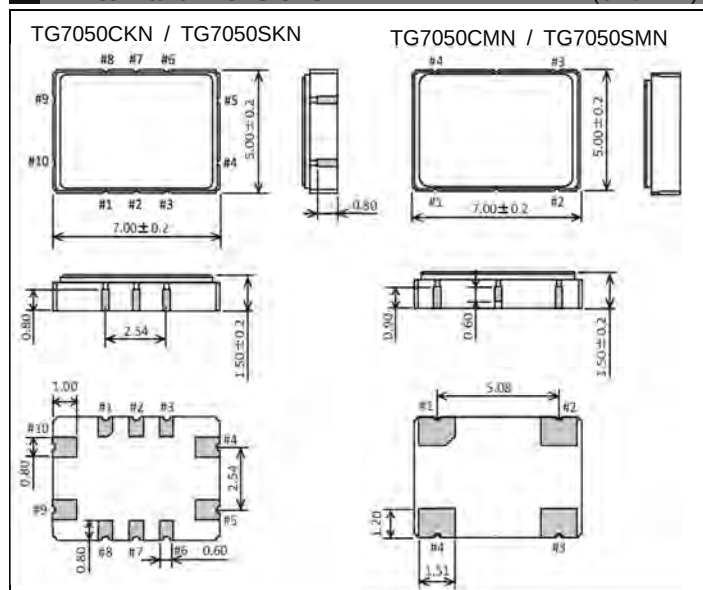
Product Name TG7050CKN30.720000MHz C A H H G A

(Standard form) ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

- ①Model ②Output (C: CMOS, S: Clipped sine wave) ③Package type (K: 10 pins, M: 4 pins) ④Frequency ⑤Supply voltage (C: 3.3 V Typ.)
⑥Frequency / temperature characteristics (A: $\pm 0.1 \times 10^{-6}$ Max.) ⑦Operating temperature (H: -40 °C to +105 °C)
⑧OE function (H: Active High, N: Non) ⑨V_c function (G: V_c Non) ⑩Internal identification code ("A" is default)

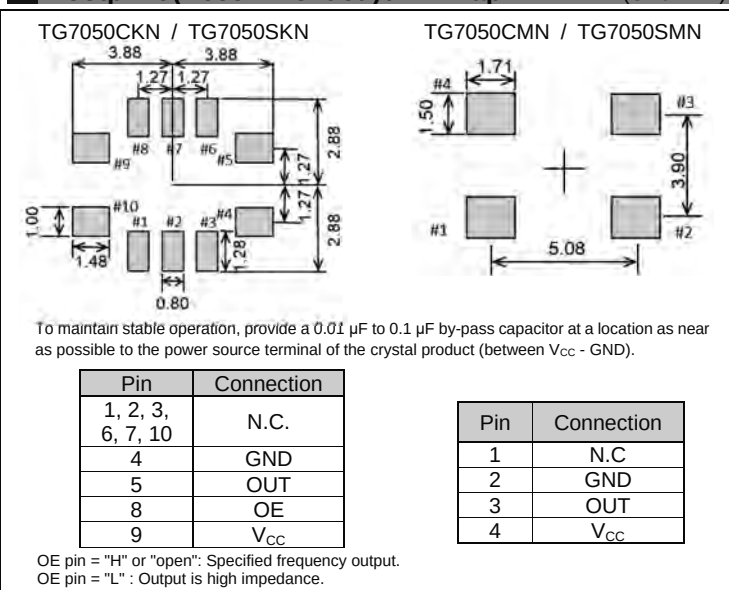
External dimensions

(Unit: mm)



Footprint (Recommended) / Pin Map

(Unit: mm)



TCXO HIGH STABILITY
105 °C HIGH TEMPERATURE



Product Number
TG-5510CA: X1G006001xxxx99
TG-5511CA: X1G006011xxxx99

TG-5510CA / TG-5511CA

- Frequency range : 10 MHz to 54 MHz
- Supply voltage : 3.3 V Typ.
- Frequency / temperature characteristics : $\pm 0.28 \times 10^{-6}$ Max. (-40 °C to +85 °C, 105 °C option)
- Free-run accuracy : $\pm 4.6 \times 10^{-6}$ Max. / 20 years (for Stratum3)
- External dimensions : 7.0 × 5.0 × 1.5 mm (10 pins or 4 pins)
- Applications : Network synchronization, Stratum3, BTS, SyncE, IEEE1588, Microwave, BTS
- Features : 105 °C High temp, High stability



TG-5510CA
(10 pins)



TG-5511CA
(4 pins)

Specifications (characteristics)

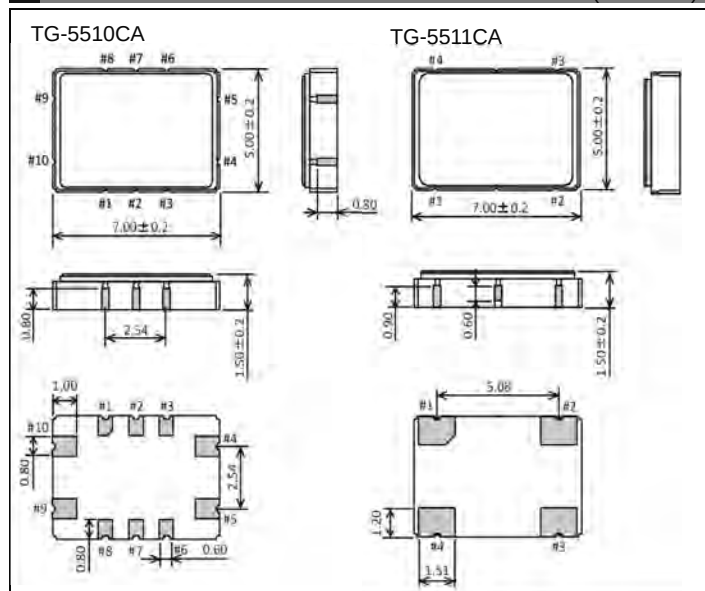
Item	Symbol	CMOS	Clipped sine wave	Condition
Output frequency range	f _o	10 MHz to 54 MHz		Please contact us about available frequencies.
Supply voltage	V _{CC}	3.3 V ± 5 %		
Storage temperature	T _{stg}	-40 °C to +105 °C		Storage as single product.
Operating temperature	T _{use}	-40 °C to +85 °C (-40 °C to +105 °C)		Standard (Option)
a) Frequency tolerance	f _{tol}	$\pm 1.0 \times 10^{-6}$ Max.		After reflow, +25 °C
b) Frequency/temperature characteristics	f _o -T _c	$\pm 0.28 \times 10^{-6}$ Max. ($\pm 0.25 \times 10^{-6}$ Max.)		Standard (Option)
c) Frequency/load coefficient	f _o -Load	$\pm 0.1 \times 10^{-6}$ Max.		Load ± 10 %
d) Frequency/voltage coefficient	f _o -V _{CC}	$\pm 0.1 \times 10^{-6}$ Max.		V _{CC} ± 5 %
e) Frequency aging	f _{age}	$\pm 0.5 \times 10^{-6}$ Max. $\pm 3.0 \times 10^{-6}$ Max.		+25 °C, First year +25 °C, 20 years
Holdover stability (Constant temperature)	-	$\pm 0.01 \times 10^{-6}$ Max. (+25 °C, 24 hours) $\pm 0.04 \times 10^{-6}$ Max. (+25 °C, 24 hours)		After 10 days of continuous operation After 48 hours of continuous operation
Wander generation (MTIE, TDEV)		Compliant with GR-1244CORE, ITU-T G.8262		
Free-run accuracy	-	$\pm 4.6 \times 10^{-6}$ Max. / 20 years		
Current consumption	I _{CC}	7.0 mA Max.	6.0 mA Max.	This includes Item a), b), c), d) and e)
		9.0 mA Max.		10 MHz ≤ f _o ≤ 26 MHz
		10.0 mA Max.		26 MHz < f _o ≤ 40 MHz
Symmetry	SYM	45 % to 55 %	-	40 MHz < f _o ≤ 54 MHz GND level (DC cut)
Output voltage	V _{OH}	90 % V _{CC} Min.	-	
	V _{OL}	10 % V _{CC} Max.	-	
Rise time / Fall time	tr/tf	8.0 ns Max.	-	10 % V _{CC} to 90 % V _{CC} level, Load: 15 pF
Start-up time	t _{str}	5 ms. Max.	-	t = 0 at 90 % V _{CC}
Output level	V _{pp}	-	0.8 V Min.	Peak to Peak
Output load condition	Load	15 pF	10 kΩ // 10 pF	
Input voltage	V _{IH}	70 % V _{CC} Min.		OE terminal (Enable voltage)
	V _{IL}	30 % V _{CC} Max.		OE terminal (Disable voltage)

* Note : Please contact us for requirements not listed in this specification.

Product Name TG-5510CA-*** 30.720000MHz
(Standard form) ① ② ③ ④
①Model ②Package type ③Spec segment (Please contact us) ④Frequency

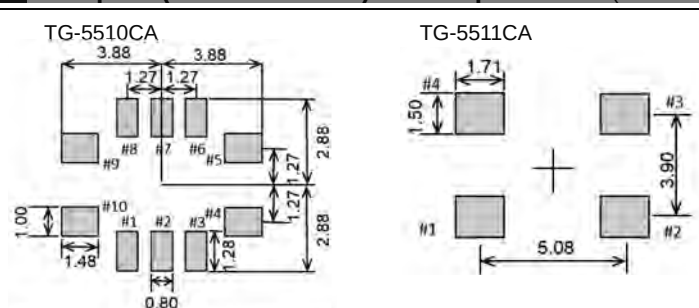
External dimensions

(Unit : mm)



Footprint (Recommended) / Pin Map

(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).

Pin	Connection
1, 2, 3, 6, 7, 10	N.C.
4	GND
5	OUT
8	OE
9	V _{CC}

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

Pin	Connection
1	N.C
2	GND
3	OUT
4	V _{CC}



TCXO HIGH STABILITY 105 °C HIGH TEMPERATURE



Product Number
TG-5510CB: X1G006061xxxx14
TG-5511CB: X1G006071xxxx14

TG-5510CB / TG-5511CB

- Frequency range : 10 MHz to 54 MHz
- Supply voltage : 3.3 V Typ.
- Frequency / temperature characteristics : $\pm 0.28 \times 10^{-6}$ Max. (-40 °C to +85 °C, 105 °C option)
- Free-run accuracy : $\pm 4.6 \times 10^{-6}$ Max. / 20 years (for Stratum3)
- External dimensions : 5.0 × 3.2 × 1.45 mm (10 pins or 4 pins)
- Applications : Network synchronization, Stratum3, BTS, SyncE, IEEE1588, Microwave, BTS
- Features : 105 °C High temp, High stability



TG-5510CB
(10 pins)



TG-5511CB
(4 pins)

Specifications (characteristics)

Item	Symbol	CMOS	Clipped sine wave	Condition
Output frequency range	f _o	10 MHz to 54 MHz		Please contact us about available frequencies.
Supply voltage	V _{CC}	3.3 V ± 5 %		
Storage temperature	T _{stg}	-40 °C to +105 °C		Storage as single product.
Operating temperature	T _{use}	-40 °C to +85 °C (-40 °C to +105 °C)		Standard (Option)
a) Frequency tolerance	f _{tol}	±1.0 × 10 ⁻⁶ Max.		After reflow, +25 °C
b) Frequency/temperature characteristics	f _o -T _c	±0.28 × 10 ⁻⁶ Max. (±0.25 × 10 ⁻⁶ Max.)		Standard (Option)
c) Frequency/load coefficient	f _o -Load	±0.1 × 10 ⁻⁶ Max.		Load ± 10 %
d) Frequency/voltage coefficient	f _o -V _{CC}	±0.1 × 10 ⁻⁶ Max.		V _{CC} ± 5 %
e) Frequency aging	f _{age}	±0.5 × 10 ⁻⁶ Max. ±3.0 × 10 ⁻⁶ Max.		+25 °C, First year +25 °C, 20 years
Holdover stability (Constant temperature)	-	±0.01 × 10 ⁻⁶ Max. (+25 °C, 24 hours) ±0.04 × 10 ⁻⁶ Max. (+25 °C, 24 hours)		After 10 days of continuous operation After 48 hours of continuous operation
Wander generation (MTIE, TDEV)		Compliant with GR-1244CORE, ITU-T G.8262		
Free-run accuracy	-	±4.6 × 10 ⁻⁶ Max. / 20 years		
Current consumption	I _{CC}	7.0 mA Max.	6.0 mA Max.	This includes Item a), b), c), d) and e)
		9.0 mA Max.		10 MHz ≤ f _o ≤ 26 MHz
		10.0 mA Max.		26 MHz < f _o ≤ 40 MHz
Symmetry	SYM	45 % to 55 %	-	40 MHz < f _o ≤ 54 MHz GND level (DC cut)
Output voltage	V _{OH}	90 % V _{CC} Min.	-	
	V _{OL}	10 % V _{CC} Max.	-	
Rise time / Fall time	tr/ff	8.0 ns Max.	-	10 % V _{CC} to 90 % V _{CC} level, Load: 15 pF
Start-up time	t _{str}	5 ms. Max.	-	t = 0 at 90 % V _{CC}
Output level	V _{pp}	-	0.8 V Min.	Peak to Peak
Output load condition	Load	15 pF	10 kΩ // 10 pF	
Input voltage	V _{IH}	70 % V _{CC} Min.		OE terminal (Enable voltage)
	V _{IL}	30 % V _{CC} Max.		OE terminal (Disable voltage)

* Note : Please contact us for requirements not listed in this specification.

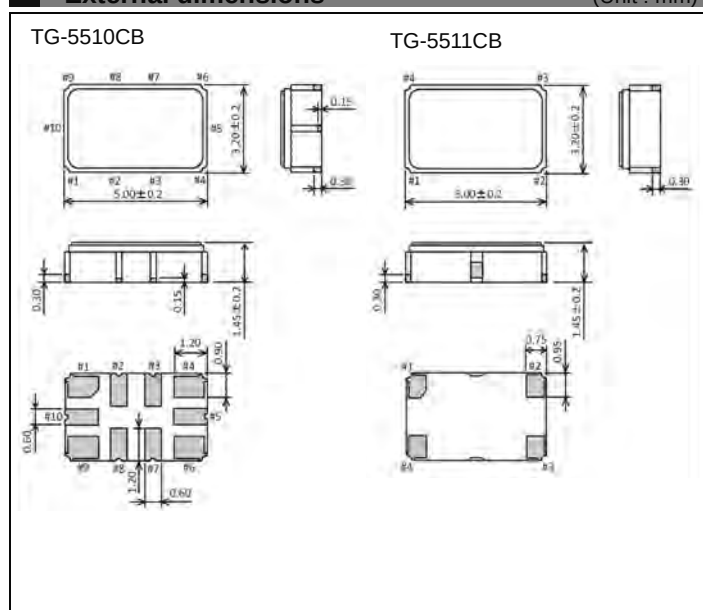
Product Name **TG-5510CB-***** **38.880000MHz**

(Standard form) ① ② ③ ④

①Model ②Package type ③Spec segment (Please contact us) ④Frequency

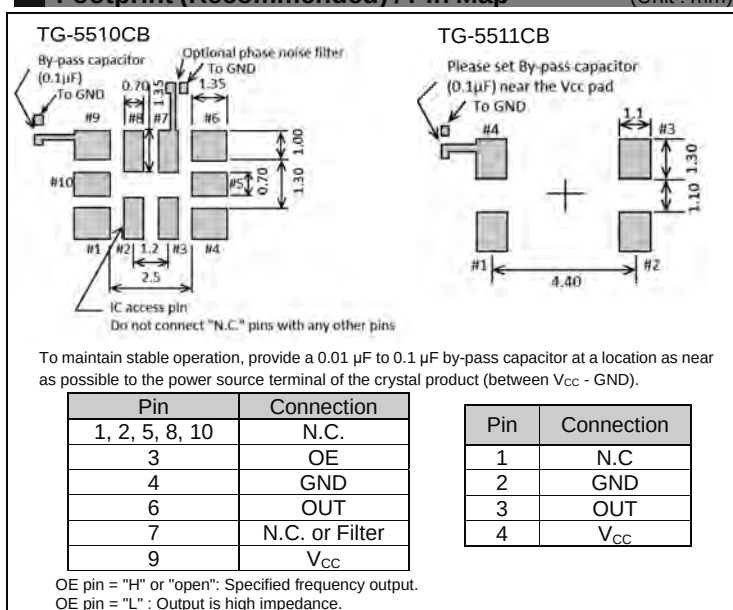
External dimensions

(Unit : mm)



Footprint (Recommended) / Pin Map

(Unit : mm)





TCXO HIGH STABILITY
105 °C HIGH TEMPERATURE



Product Number
TG5032CKN: X1G006021xxxx14
TG5032SKN: X1G006031xxxx14
TG5032CMN: X1G006041xxxx14
TG5032SMN: X1G006051xxxx14

TG5032CKN / TG5032SKN

TG5032CMN / TG5032SMN

- Frequency range : 10 MHz to 54 MHz
- Supply voltage : 3.3 V Typ.
- Frequency / temperature characteristics : $\pm 0.1 \times 10^{-6}$ Max. (-40 °C to +105 °C)
- Holdover stability : $\pm 4.6 \times 10^{-6}$ Max. / 20 years (for Stratum3)
- External dimensions : 5.0 × 3.2 × 1.45 mm (10 pins or 4 pins)
- Applications : Network synchronization, Stratum3, BTS, SyncE, IEEE1588, Microwave
- Features : 105 °C High temp, High stability



TG5032CKN
TG5032SKN
(10 pins)



TG5032CMN
TG5032SMN
(4 pins)

Specifications (characteristics)

Item	Symbol	CMOS	Clipped sine wave	Condition
Output frequency range	fo	10 MHz to 54 MHz		Please contact us about available frequencies.
Supply voltage	V _{CC}	3.3 V ± 5 %		
Storage temperature	T _{stg}	-40 °C to +105 °C		Storage as single product.
Operating temperature	T _{use}	-40 °C to +105 °C		
a) Frequency tolerance	f _{tol}	±1.0 × 10 ⁻⁶ Max.		After reflow, +25 °C
b) Frequency/temperature characteristics	fo-Tc	±0.1 × 10 ⁻⁶ Max.		-40 °C to +105 °C
c) Frequency/load coefficient	fo-Load	±0.1 × 10 ⁻⁶ Max.		Load ± 10 %
d) Frequency/voltage coefficient	fo-V _{CC}	±0.1 × 10 ⁻⁶ Max.		V _{CC} ± 5 %
e) Frequency aging	f _{age}	±0.5 × 10 ⁻⁶ Max.		+25 °C, First year
		±3.0 × 10 ⁻⁶ Max.		+25 °C, 20 years
Wander generation (MTIE, TDEV)		Compliant with GR-1244CORE, ITU-T G.8262.1, G.8273.2		
Holdover stability (Free-run accuracy)	f _{hos}	±4.6 × 10 ⁻⁶ Max. / 20 years		This includes Item a), b), c), d) and e)
Current consumption	I _{CC}	7.0 mA Max.	6.0 mA Max.	10 MHz ≤ fo ≤ 26 MHz
		9.0 mA Max.		26 MHz < fo ≤ 40 MHz
		10.0 mA Max.		40 MHz < fo ≤ 54 MHz
Symmetry	SYM	45 % to 55 %	-	GND level (DC cut)
Output voltage	V _{OH}	90 % V _{CC} Min.	-	
	V _{OL}	10 % V _{CC} Max.	-	
	V _{pp}	-	0.8 V Min.	Peak to Peak
Rise time / Fall time	tr/tf	8.0 ns Max.	-	10 % V _{CC} to 90 % V _{CC} level, Load: 15 pF
Start-up time	t _{str}	5 ms. Max.		t = 0 at 90 % V _{CC}
Output load condition	Load	15 pF	10 kΩ // 10 pF	
Input voltage	V _{IH}	70% V _{CC} Min.		OE terminal (Enable voltage)
	V _{IL}	30% V _{CC} Max.		OE terminal (Disable voltage)

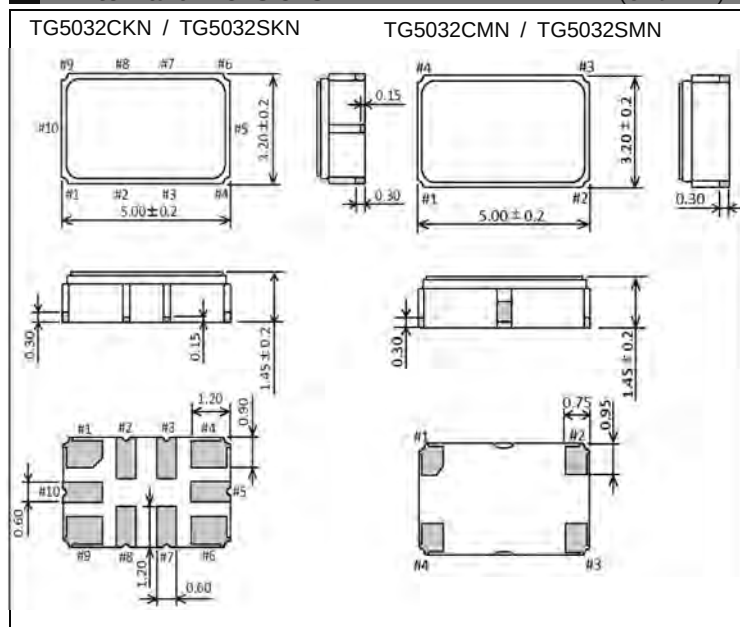
* Note : Please contact us for requirements not listed in this specification.

Product Name TG5032CKN 38.880000MHz C A H H G A
(Standard form) ① ②③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

- ①Model ②Output (C: CMOS, S: Clipped sine wave) ③Package type (K: 10 pins, M: 4 pins) ④Frequency ⑤Supply voltage (C: 3.3 V Typ.)
⑥Frequency / temperature characteristics (A: $\pm 0.1 \times 10^{-6}$ Max.) ⑦Operating temperature (H: -40 °C to +105 °C)
⑧OE function (H: Active High, N: Non) ⑨Filter function (G: Filter-ON, N: NO-Filter) ⑩Internal identification code ("A" is default)

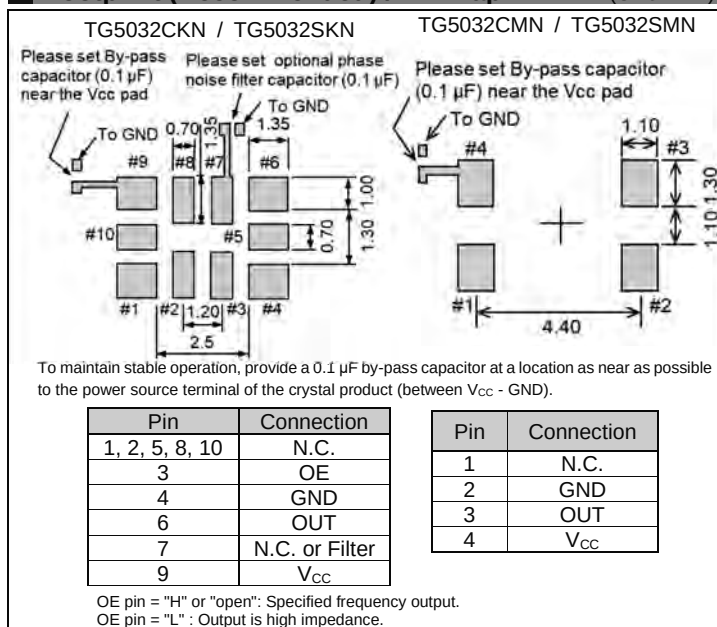
External dimensions

(Unit : mm)



Footprint (Recommended) / Pin Map

(Unit : mm)



TCXO / VC-TCXO
HIGH STABILITY



Product Number
TG5032CFN :X1G005391xxxxxx
TG5032SFN :X1G005401xxxxxx

TG5032CFN / TG5032SFN

- Frequency range : 10 MHz to 40 MHz
- Supply voltage : 3.3 V Typ.
- Frequency / temperature characteristics : $\pm 0.1 \times 10^{-6}$ Max. (-40 °C to +85 °C)
- Frequency aging : $\pm 3.0 \times 10^{-6}$ Max. / 20years
- External dimensions: 5.0 × 3.2 × 1.45 mm (4 pins)
- Applications : Small Cells, Stratum3, SyncE, IEEE1588
- Features : High stability, Wide temperature range



Specifications (characteristics)

Item	Symbol	TG5032CFN (CMOS output)		TG5032SFN(Clipped sine wave)		Conditions / Remarks
		TCXO	VC-TCXO	TCXO	VC-TCXO	
Output frequency range	f _o	10 MHz to 40 MHz				Standard frequency
Supply voltage	V _{CC}	10, 12.8, 19.2, 20, 24.576, 25, 25.6, 26, 30.72, 38.4, 38.88, 40 MHz				
Storage temperature	T _{stg}	C: 3.3 V ± 5 % (Supply voltage range: 2.375 V to 3.63 V)				Storage as single product
Operating temperature	T _{use}	-40 °C to +90 °C				Standard temp. range
a) Frequency tolerance	f _{tol}	G: -40 °C to +85 °C				After reflow, +25 °C
b) Frequency/temperature Characteristics	f _o -T _c	±1.0 × 10 ⁻⁶ Max.				Reference to (f _{max} + f _{min}) / 2
c) Frequency/load coefficient	f _o -Load	A: ±0.1 × 10 ⁻⁶ Max. / -40 °C to +85 °C				
d) Frequency/voltage coefficient	f _o -V _{CC}	H: ±0.25 × 10 ⁻⁶ Max. / -40 °C to +85 °C				
e) Frequency aging	f _{age}	B: ±0.28 × 10 ⁻⁶ Max. / -40 °C to +85 °C				
Holdover stability (Constant temperature)	-	±0.1 × 10 ⁻⁶ Max.				Load ± 10 %
Wander generation (MTIE, TDEV)	-	±0.1 × 10 ⁻⁶ Max.				V _{CC} ± 5%
Free-run accuracy	-	±0.5 × 10 ⁻⁶ Max.				+25 °C, First year
Current consumption	I _{CC}	±3.0 × 10 ⁻⁶ Max.				+25 °C, 20 years
Input resistance	R _{in}	±0.01 × 10 ⁻⁶ Max. (+25 °C , 24 hours)				After 10 days of continuous operation.
Frequency control range	f _{cont}	±0.04 × 10 ⁻⁶ Max. (+25 °C , 24 hours)				After 48 hours of continuous operation.
Frequency change polarity	-	-				Compliant with GR-1244CORE , ITU-T G.8262
Symmetry	SYM	±4.6 × 10 ⁻⁶ Max.				This includes Item a), b), c), d) and e)
Output voltage	V _{OH} V _{OL}	5.0 mA Max.		5.0 mA Max.		10 MHz ≤ f _o ≤ 26 MHz
Output level	V _{pp}	6.0 mA Max.		-		26 MHz < f _o ≤ 40 MHz
Rise time / Fall time	tr/tf	-	100 kΩ Min.	-	100 kΩ Min.	V _{CC} - GND (DC)
Start-up time	t _{str}	-	±5 ×10 ⁻⁶ to ±10 ×10 ⁻⁶	-	±5 ×10 ⁻⁶ to ±10 ×10 ⁻⁶	D :V _c = 1.5 V ± 1.0 V at V _{CC} = 3.3 V
Output load condition	Load	-	Positive polarity	-	Positive polarity	E :V _c = 1.65 V ± 1.0 V at V _{CC} = 3.3 V
		45 % to 55 %		-		50 % V _{CC} level, L_CMOS ≤ 15 pF
		90 % V _{CC} Min.		-		
		10 % V _{CC} Max.		-		
		-		0.8 V Min.		Peak to Peak
		8.0 ns Max.		-		10 % V _{CC} to 90 % V _{CC} level, Load: 15 pF
		5.0 ms Max.				t = 0 at 90% V _{CC}
		15 pF		10 kΩ // 10 pF		

**TCXO / VC-TCXO
HIGH STABILITY**



Product Number
TG5032CGN : X1G005231xxxxxx
TG5032SGN : X1G005241xxxxxx

TG5032CGN / TG5032SGN

- Frequency range : 10 MHz to 40 MHz
- Supply voltage : 3.3 V Typ.
- Frequency / temperature characteristics : $\pm 0.1 \times 10^{-6}$ Max. (-40 °C to +85 °C)
- Frequency aging : $\pm 3.0 \times 10^{-6}$ Max. / 20 years
- External dimensions : 5.0 × 3.2 × 1.45 mm (10 pins)
- Applications : Small Cells, Stratum3, SyncE, IEEE1588
- Features : High stability, Wide temperature range



TG5032CGN
(CMOS)



TG5032SGN
(Clipped Sine)

Specifications (characteristics)

Item	Symbol	TG5032CGN (CMOS)		TG5032SGN(Clippped sine wave)		Conditions / Remarks
		TCXO	VC-TCXO	TCXO	VC-TCXO	
Output frequency range	f _o	10 MHz to 40 MHz				Standard frequency
Supply voltage	V _{CC}	10,12.8, 19.2, 20, 24.576, 25, 25.6, 26, 30.72, 38.4, 38.88, 40 MHz				
Storage temperature	T _{stg}	C: 3.3 V ± 5 % (Supply voltage range: 2.375 V to 3.63 V)				Storage as single product
Operating temperature	T _{use}	-40 °C to +90 °C				
a) Frequency tolerance	f _{tol}	G: -40 °C to +85 °C				After reflow, +25 °C
b) Frequency/temperature Characteristics	fo-Tc	±1.0 × 10 ⁻⁶ Max.				
c) Frequency/load coefficient	fo-Load	A: ±0.1 × 10 ⁻⁶ Max. / -40 °C to +85 °C				Reference to (fmax + fmin) / 2
d) Frequency/voltage coefficient	fo-V _{CC}	H: ±0.25 × 10 ⁻⁶ Max. / -40 °C to +85 °C				
e) Frequency aging	f _{age}	B: ±0.28 × 10 ⁻⁶ Max. / -40 °C to +85 °C				Load ± 10 %
		±0.1 × 10 ⁻⁶ Max.				
		±0.1 × 10 ⁻⁶ Max.				V _{CC} ± 5 %
		±0.5 × 10 ⁻⁶ Max.				
		±3.0 × 10 ⁻⁶ Max.				+25 °C, First year
		±0.01 × 10 ⁻⁶ Max. (+25 °C , 24 hours)				
Holdover stability (Constant temperature)	-	±0.04 × 10 ⁻⁶ Max. (+25 °C , 24 hours)				After 10 days of continuous operation.
Wander generation (MTIE, TDEV)	-	-				
Free-run accuracy	-	±4.6 × 10 ⁻⁶ Max.				Compliant with GR-1244CORE , ITU-T G.8262
Current consumption	I _{CC}	5.0 mA Max.		5.0 mA Max.		
		6.0 mA Max.				10 MHz ≤ fo ≤ 26 MHz
Input resistance	R _{in}	-	100 kΩ Min.	-	100 kΩ Min.	
Frequency control range	f _{cont}	-	±5 × 10 ⁻⁶ to ±10 × 10 ⁻⁶	-	±5 × 10 ⁻⁶ to ±10 × 10 ⁻⁶	Vc - GND (DC)
Frequency change polarity	-	-	Positive polarity	-	Positive polarity	
Symmetry	SYM	45 % to 55 %		-		E, K :Vc = 1.65 V ± 1.0 V at V _{CC} = 3.3 V
Output voltage	V _{OH}	90 % V _{CC} Min.		-		
	V _{OL}	10 % V _{CC} Max.		-		
Output level	V _{pp}	-		0.8 V Min.		
Rise time / Fall time	tr/ta	8.0 ns Max.		-		10 % V _{CC} to 90 % V _{CC} level, Load: 15 pF
Start-up time	t _{str}	5.0 ms Max. (Non-Filter: Standard) / 2.0 sec. Max. (Filter: Option)				
Output load condition	Load	15 pF		10 kΩ // 10 pF		OE terminal (Enable voltage)
Input voltage	V _{IH}	70% V _{CC} Min.				
	V _{IL}	30% V _{CC} Max.				

* Note : Please contact us for requirements not listed in this specification.

Product Name **TG5032 C GN 30.720000MHz C A G H D A**
(Standard form) ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

① Model ② Output (C: CMOS, S: Clipped sine wave)

③ Frequency ④ Supply voltage (C: 3.3 V Typ)

⑤ Frequency / temperature characteristics (A: $\pm 0.1 \times 10^{-6}$ Max., H: $\pm 0.25 \times 10^{-6}$ Max., B: $\pm 0.28 \times 10^{-6}$ Max.)

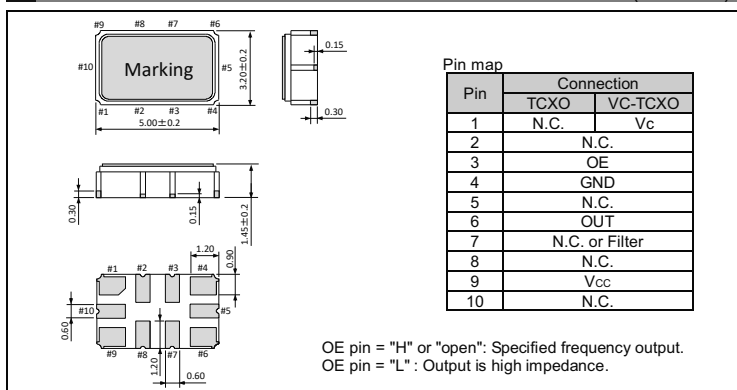
⑥ Operating temperature (G: -40 °C to +85 °C) ⑦ OE function (H: Active High)

⑧ Vc function (Refer to symbol table) ⑨ Internal identification code ("A" is default)

⑧ Vc function (symbol table)				
Vc [V]	Non	1.5	1.65	Any
Non Filter	N	D	E	A
Filter ON	G	J	K	F

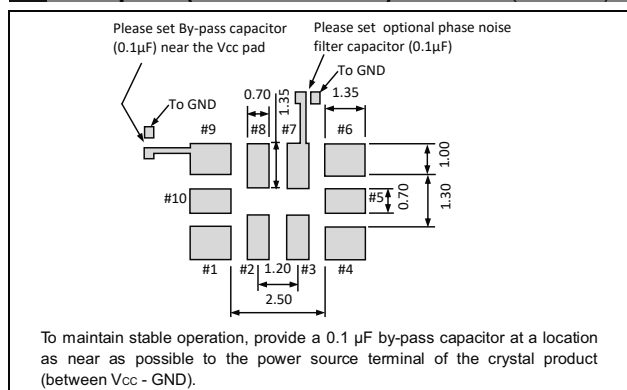
External dimensions

(Unit: mm)



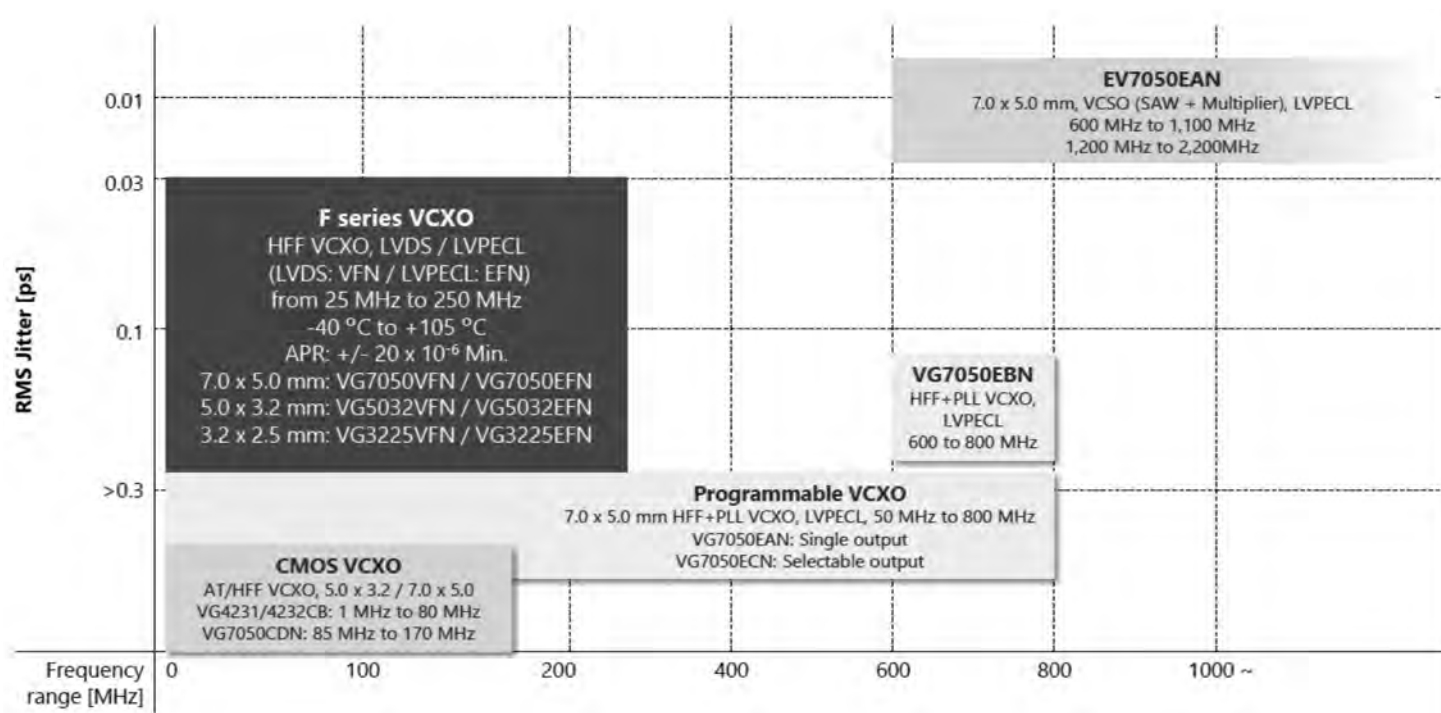
Footprint (Recommended)

(Unit: mm)





VCXO / VCSO



► Output: CMOS

P	Model	Size [mm]	Nominal frequency range	Frequency tolerance (× 10 ⁻⁶)	Operating temperature [°C]	Absolute pull range (× 10 ⁻⁶)	Supply voltage [V]	Current consumption Max. [mA]	Output Load condition [pF]	Output control
89	VG7050CDN	7.0×5.0×1.6t	85 MHz 170MHz	±50	-40 to +85 -40 to +105	±50	3.3±0.165	30	15	OE

► Output: LV-PECL

P	Model	Size [mm]	Nominal frequency range	Frequency tolerance (× 10 ⁻⁶)	Operating temperature [°C]	Absolute pull range (× 10 ⁻⁶)	Supply voltage [V]	Current consumption Max. [mA]	Output Load condition [pF]	Output control
90	VG3225EFN VG5032EFN VG7050EFN	3.2×2.5×1.05t 5.0×3.2×1.3t 7.0×5.0×1.5t	25 MHz 250MHz	±50	-40 to +85 -40 to +105	±50 ~170 MHz ±20 ~250 MHz ±50 ~170 MHz ±20 ~250 MHz	3.3±0.165	60	50	OE
91	VG7050EBN	7.0×5.0×1.5t	600 MHz 800 MHz	±50	-40 to +85	±50 ±100	3.3±0.33 2.5 ±0.125 3.3±0.33 2.5±0.125	90	50	OE
Web site	EV7050EAN	7.0×5.0×1.6t	600MHz 1100MHz 1200MHz 2200MHz	±100 ±120	-10 to +85 -40 to +85	±50 ±30	3.3 ±0.165	115 175	50	OE
92	VG7050EAN (Programmable 1 setup Freq.)	7.0×5.0×1.5t	50 MHz 800 MHz	±50	-40 to +85	0 to ±180	3.3 ±0.165 2.5 ±0.125	90	50	OE/ST (Active High or Low)
	VG7050ECN (Programmable 4 setup Freq.)	7.0×5.0×1.5t	50 MHz 800 MHz	±50	-40 to +85	0 to ±180	3.3±0.165 2.5 ±0.125	90	50	OE (Active High or Low)

► Output: LVDS

P	Model	Size [mm]	Nominal frequency range	Frequency tolerance (× 10 ⁻⁶)	Operating temperature [°C]	Absolute pull range (× 10 ⁻⁶)	Supply voltage [V]	Current consumption Max. [mA]	Output Load condition [pF]	Output control
90	VG3225VFN VG5032VFN VG7050VFN	3.2×2.5×1.05t 5.0×3.2×1.3t 7.0×5.0×1.5t	25 MHz 250MHz	±50	-40 to +85 -40 to +105	±50 ~170MHz ±20 ~250MHz ±50 ~170MHz ±20 ~250MHz	3.3 ±0.165	25	100	OE



VOLTAGE -CONTROLLED CRYSTAL OSCILLATOR (VCXO)

Product Number
X1G004861xxxx00

VG7050CDN

- Frequency range : 85 MHz to 170 MHz
- Supply voltage : 3.3 V
- Absolute pull range : $\pm 50 \times 10^{-6}$ min.
- External dimensions : $7.0 \times 5.0 \times 1.5$ mm (t: Typ.)
- Operation temperature : +85 °C / +105 °C
- Function : Output enable(OE)
- Output : CMOS



Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Output frequency range	f _o	85 MHz to 170 MHz	Please contact us for inquiries regarding available frequencies.
Supply voltage	V _{cc}	3.3 V $\pm$ 0.165 V	
Storage temperature range	T _{stg}	-55 °C to +125 °C	Store as bare product after unpacking
Operating temperature range	T _{use}	G: -40 °C to +85 °C, H: -40 °C to +105 °C	
Frequency tolerance	f _{tol}	$\pm 50 \times 10^{-6}$ Max.	Includes initial tolerance, temperature change, V _{cc} change and 10 years aging at +25 °C. At V _c = 1.65 V, reference to f _o
Current consumption	I _{cc}	30 mA Max.	L _{CMOS} = 15 pF
Absolute pull range*1	APR	$\pm 50 \times 10^{-6}$ Min.	V _c = 1.65 V $\pm$ 1.65 V
Input resistance	R _{in}	10 MΩ Min.	DC level
Frequency change polarity	—	Positive slope	V _c = 0 V to 3.3 V
Symmetry	SYM	45 % to 55 %	50 % V _{cc} level
High output voltage	V _{OH}	90 % V _{cc} Min.	
Low output voltage	V _{OL}	10 % V _{cc} Max.	
Output load condition (CMOS)	L _{CMOS}	15 pF Max.	
Output enable / disable input voltage	V _{IH}	70 % V _{cc} Min.	V _{IH} or OPEN : Enable
	V _{IL}	30 % V _{cc} Max.	V _{IL} or GND : Disable
Rise time / Fall time	t _r / t _f	2 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

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

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

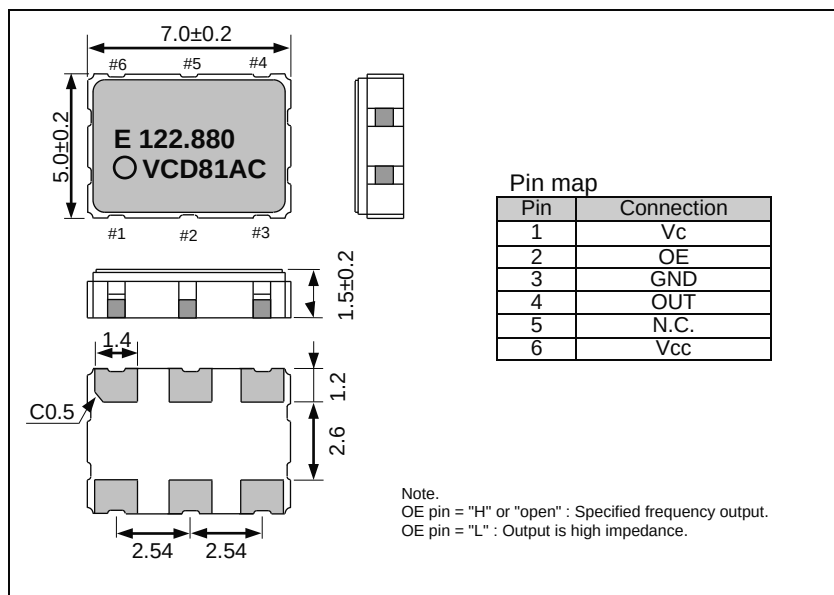
Product name VG7050 CDN 122.880000 MHz C J G H B A
 (Standard form) ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

①Model ②Output (C: CMOS) ③Frequency ④Supply voltage (C: 3.3 V Typ)

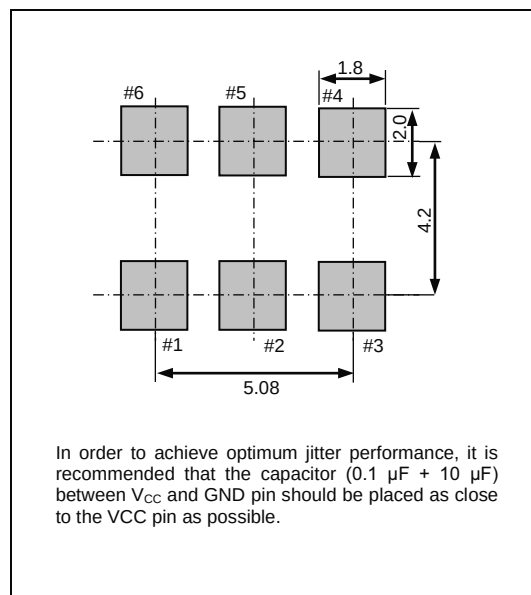
⑤Frequency tolerance (J: $\pm 50 \times 10^{-6}$ Max.) ⑥Operating temperature (G: -40 °C to +85 °C, H: -40 °C to +105 °C)⑦OE Function (H: Active High) ⑧Absolute Pull Range (B: $\pm 50 \times 10^{-6}$ Min.) ⑨Output Standby Type (A: High-Z)

External dimensions

(Unit :mm)



Footprint (Recommended) (Unit :mm)



VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR (VCXO)

OUTPUT : LV-PECL, LVDS



Product Number
 VG3225EFN X1G005361xxxx00
 VG5032EFN X1G005471xxxx00
 VG7050EFN X1G005491xxxx00
 VG3225VFN X1G005461xxxx00
 VG5032VFN X1G005481xxxx00
 VG7050VFN X1G005501xxxx00

VG3225 / 5032 / 7050EFN VG3225 / 5032 / 7050VFN

- Frequency range : 25 MHz to 250 MHz
- Supply voltage : 3.3 V Typ.
- Output : LV-PECL or LVDS
- Function : Output enable (OE)
- Absolute pull range : $\pm 10 \times 10^{-6}$ Min. / $\pm 20 \times 10^{-6}$ Min. / $\pm 50 \times 10^{-6}$ Min
- Operating temperature : -40 °C to +85 °C / -40 °C to +105 °C



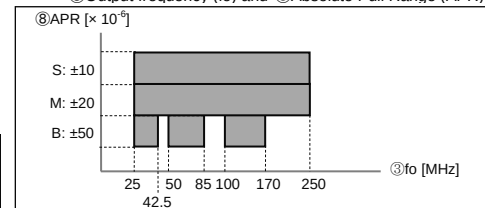
Specifications (characteristics)

Item	Symbol	Specifications		Conditions / Remarks	
		LV-PECL	LVDS		
		VG3225EFN / VG5032EFN / VG7050EFN	VG3225VFN / VG5032VFN / VG7050VFN		
Output frequency range	f _o	25 MHz to 250 MHz		Please contact us for available frequencies, and frequency inquiries above 250 MHz.	
Supply voltage	V _{CC}	C: 3.3 V ± 0.165 V			
Control voltage	V _c	1.65 V ±1.65 V			
Storage temperature	T _{stg}	-55 °C to +125 °C			
Operating temperature	T _{use}	G: -40 °C to +85 °C, H: -40 °C to +105 °C			
Frequency tolerance	f _{tol}	J: ±50 × 10 ⁻⁶ Max.			
Absolute Pull range *1	APR	B: ±50 × 10 ⁻⁶ Min.		Includes initial frequency tolerance, temperature variation, supply voltage change and 10 years aging (+25 °C) at V _c = 1.65 V	
		M: ±20 × 10 ⁻⁶ Min.		25 MHz ≤ f _o ≤ 42.5 MHz, 50 MHz ≤ f _o ≤ 85 MHz, 100 MHz ≤ f _o ≤ 170 MHz	
		S: ±10 × 10 ⁻⁶ Min.		Full frequency range	
Current consumption	I _{CC}	60 mA Max.	25 mA Max.	OE = V _{CC} , L _{ECL} = 50 Ω or L _{LVDS} = 100 Ω	
Disable current	I _{dis}	25 mA Max.	15 mA Max.	OE = GND	
Input impedance	Z _{in}	10 MΩ Min.		DC level	
Frequency change polarity	-	Positive slope		V _c = 0 V to 3.3 V	
Symmetry	SYM	45 % to 55 %		At output crossing point	
Output voltage (LV-PECL)	V _{OH}	V _{CC} - 1.1 V Min.	—	DC characteristics	
	V _{OL}	V _{CC} - 1.5 V Max.	—		
Output voltage (LVDS)	V _{OD}	—	250 mV to 450 mV	Differential output voltage, V _{OD1} , V _{OD2}	
	V _{OS}	—	1.15 V to 1.35 V	Offset voltage, V _{OS1} , V _{OS2}	
ECL load condition	L _{ECL}	50 Ω	—	Terminated to V _{CC} - 2.0 V	
LVDS load condition	L _{LVDS}	—	100 Ω	Connected between OUT to $\overline{\text{OUT}}$	
Input voltage	V _{IH}	70 % V _{CC} Min.		OE terminal	
	V _{IL}	30 % V _{CC} Max.			
Rise/Fall times	t _r / t _f	0.5 ns Max..	0.3 ns Max.	LV-PECL: Between 20 % and 80 % of (V _{OH} - V _{OL}) LVDS: Between 20 % and 80 % of Differential Output peak to peak voltage	
Startup time	t _{str}	10 ms Max.		Time at minimum supply voltage to be 0 s	
Phase Jitter	t _{pj}	120 fs Max.	160 fs Max.	f _o = 122.88 MHz	
		80 fs Max.	80 fs Max.	f _o = 245.76 MHz	
				Offset Frequency 12 kHz to 20 MHz	

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

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

Figure 1 Available combination of
 ③Output frequency (f_o) and ⑧Absolute Pull Range (APR)



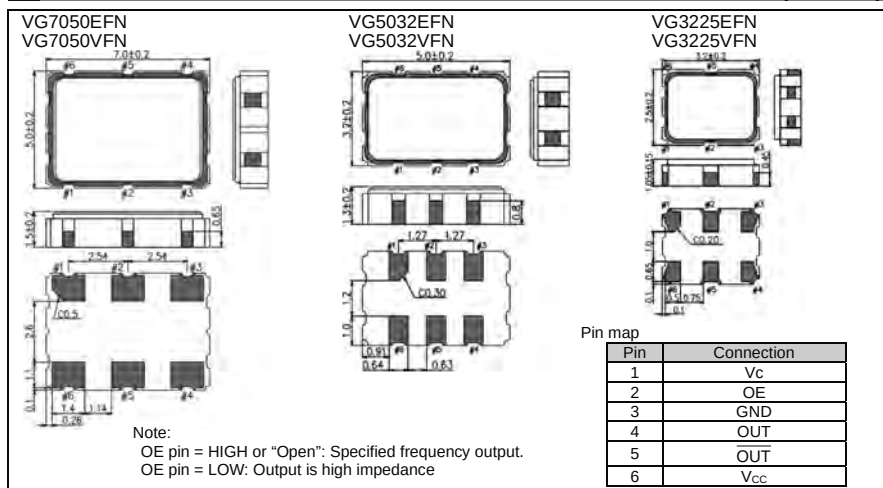
Product Name **VG3225 EFN 122.880000MHz** C J G H B A
 (Standard form) ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

①Model ②Output (E: LV-PECL, V: LVDS) ③Frequency
 ④Supply voltage (C: 3.3 V Typ.) ⑤Frequency tolerance ⑥Operating temperature
 ⑦OE Function ⑧Absolute Pull Range ⑨Output Standby Type (A: High-Z)

⑤Frequency tolerance	⑥Operating temperature	⑦OE Function	⑧Absolute Pull Range
J $\pm 50 \times 10^{-6}$	G -40 to +85 °C	H Active High	B $\pm 50 \times 10^{-6}$
	H -40 to +105 °C		M $\pm 20 \times 10^{-6}$
			S $\pm 10 \times 10^{-6}$

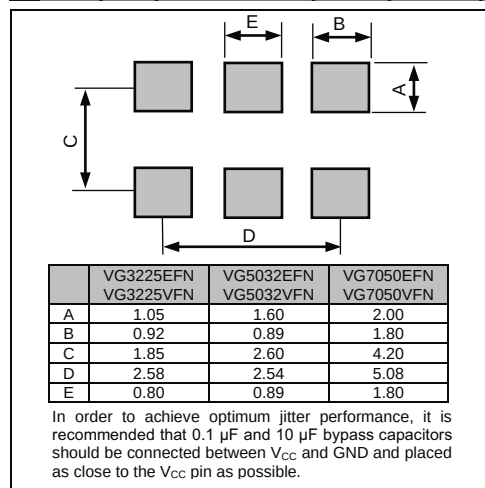
External dimensions

(Unit:mm)



Fprint (Recommended)

(Unit:mm)





VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR (VCXO)

OUTPUT: LV-PECL

Product Number
X1G004551xxxx00

VG7050EBN

- Frequency range : 600 MHz to 800 MHz
- Supply voltage : 2.5 V / 3.3 V
- External dimensions : 7.0 × 5.0 × 1.5 mm (6 pins)
- Absolute Pull Range : $\pm 50 \times 10^{-6}$ Min., $\pm 100 \times 10^{-6}$ Min.
- Function : Output Enable(OE)
- Output : LV-PECL



Specifications (characteristics)

Item	Symbol	Specifications	Conditions / Remarks
Output frequency range	f _o	600.000 MHz to 800.000 MHz 698.8123 MHz, 753.6211 MHz, 794.7278 MHz	Please contact us about available frequencies. Standard frequency
Supply voltage	V _{cc}	D: 2.5 V $\pm$ 0.125 V, C: 3.3 V $\pm$ 0.33 V	
Storage temperature range	T _{stg}	-55 °C to +125 °C	Store as bare product after packing
Operating temperature range	T _{use}	G: -40 °C to +85 °C	
Frequency tolerance*1	f _{tol}	J: $\pm 50 \times 10^{-6}$ Max.	Includes frequency aging (10 years)
Current consumption	I _{cc}	90 mA Max.	
Absolute pull range	APR	B: $\pm 50 \times 10^{-6}$ Min. C: $\pm 100 \times 10^{-6}$ Min.	V _c = 1.65 V $\pm$ 1.35 V (V _{cc} = 3.3 V) V _c = 1.25 V $\pm$ 1.00 V (V _{cc} = 2.5 V)
Input resistance	R _{in}	5 M Ω Min.	DC level
Frequency change polarity	-	Positive slope	V _c = 0 V to V _{cc}
Symmetry	SYM	45 % to 55 %	at outputs cross point
High output voltage	V _{OH}	V _{cc} - 1.025 V Min.	DC characteristics
Low output voltage	V _{OL}	V _{cc} - 1.62 V Max.	
Output load condition	L _{ECL}	50 Ω	Terminated to V _{cc} - 2.0 V
High input voltage	V _{IH}	70 % V _{cc} Min.	
Low input voltage	V _{IL}	30 % V _{cc} Max.	
Rise/Fall times	t _r / t _f	0.4 ns Max.	between 20 % and 80 % of (V _{OH} - V _{OL})
Oscillation start up time	t _{str}	10 ms Max.	Time at minimum supply voltage to be 0 s
Phase Jitter	t _{pj}	0.2 ps Typ.	Offset Frequency 12 kHz to 20 MHz

*1 Frequency tolerance includes initial frequency tolerance, temperature variation, supply voltage change and reflow drift and 10 years aging at +25 °C.

Product name
(Standard form)

VG7050 EBN 698.812335MHz C J G H B Z

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

①Model ②Output (E: LV-PECL) ③Frequency ④Supply voltage (C: 3.3 V Typ., D: 2.5 V Typ.)

⑤Frequency tolerance (J: $\pm 50 \times 10^{-6}$ Max.) ⑥Operating temperature (G: -40 to +85 °C)⑦OE Function (H: Active High, L: Active Low) ⑧Absolute Pull Range (B: $\pm 50 \times 10^{-6}$ Min., C: $\pm 100 \times 10^{-6}$ Min.)

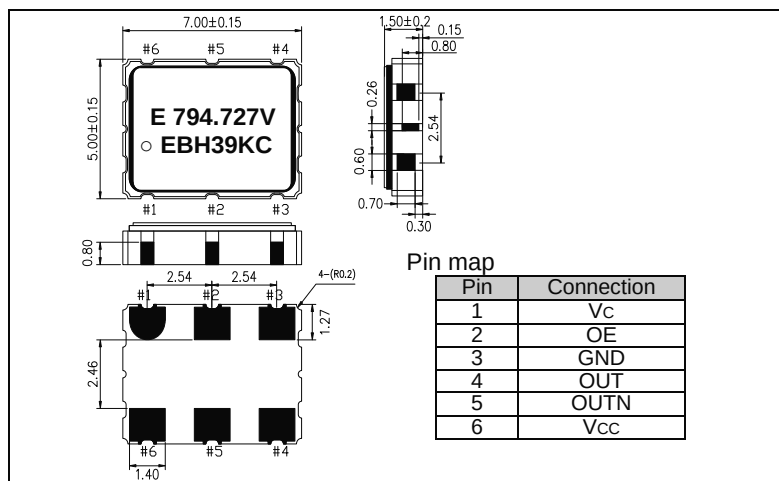
⑨Output Standby Type (F: Fix (OUT = "L", OUTN = "H"), Z: High-Z)

OE Function / OE Standby Type

OE Function	OE Standby Type	Output Enable	Output Disable	
		OE pin	OE pin	OUT, OUTN pin
H: High Active	Z: High-Z	"H" or "OPEN"	"L"	High Impedance
L: Low Active		"L" or "OPEN"	"H"	
H: High Active	F: Fix	"H" or "OPEN"	"L"	OUT = "L", OUTN = "H"
L: Low Active		"L" or "OPEN"	"H"	

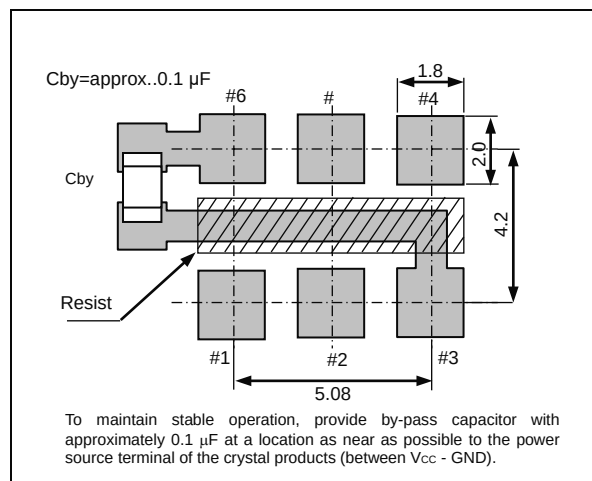
External dimensions

(Unit :mm)



Footprint (Recommended)

(Unit :mm)





Programmable Voltage Controlled Oscillator (VCXO)

Output: LV-PECL

VG7050EAN / ECN

- Frequency range : 50 MHz to 800 MHz
(Tuning resolution: $2.2 \text{ to } 2.8 \times 10^{-9}$)
- Supply voltage : 2.5 V / 3.3 V
- External dimensions : EAN : $7.0 \times 5.0 \times 1.5 \text{ mm}$ (8 pins)
ECN : $7.0 \times 5.0 \times 1.5 \text{ mm}$ (10 pins)
- Absolute Pull Range : $\pm 0 \times 10^{-6}$ to $\pm 180 \times 10^{-6}$ (12 steps selectable)

Features

- EAN : User-specified one startup frequency, APR and 7-bit I²C address
- ECN : User-specified four startup frequency, APR and 7-bit I²C address
- User Programming : I²C Interface
- Low jitter PLL technology

Applications

SONET/SDH, OTN, GbE, Fibre Channel



Product Number
EAN : X1G004541xxxx00
ECN : X1G004561xxxx00



Specifications (characteristics)

Item	Symbol	Specifications	Conditions / Remarks
Output frequency range	f _o	50 MHz to 800 MHz	It can be changed by I ² C
Supply voltage	V _{CC}	D: 2.5 V $\pm$ 0.125 V, C: 3.3 V $\pm$ 0.33 V	
Storage temperature	T _{stg}	-55 °C to +125 °C	Store as bare product after packing
Operating temperature	T _{use}	-40 °C to +85 °C	
Frequency tolerance *1	f _{tol}	$\pm 50 \times 10^{-6}$	Includes frequency aging (10 years)
Current consumption	I _{CC}	90 mA Max.	OE Active, L_ECL=50 Ω
Disable current	I _{dis}	40 mA Max.	OE Inactive, Output Standby: Hi-Z mode
		70 mA Max.	OE Inactive, Output Standby: Fix mode
Absolute pull range	APR	$\pm 0 \times 10^{-6}$ to $\pm 180 \times 10^{-6}$ Min.	V _c = 1.65 V $\pm$ 1.35 V (V _{CC} = 3.3 V)
		$\pm 0 \times 10^{-6}$ to $\pm 180 \times 10^{-6}$ Min.	V _c = 1.25 V $\pm$ 1.00 V (V _{CC} = 2.5 V)
Control voltage tuning range	V _c	0 V to V _{CC}	
Frequency change polarity	-	Positive slope	
Symmetry	SYM	45 % to 55 %	At outputs crossing point
Output voltage	V _{OH}	V _{CC} - 1.025 V Min.	DC characteristics
	V _{OL}	V _{CC} - 1.62 V Max.	
Output load condition	L _{ECL}	50 Ω	Termination to V _{CC} - 2.0 V
Input voltage	V _{IH}	70 % V _{CC} Min.	EAN : OE, SDA and SCL ECN : OE, FSEL0, FSEL1, SDA and SCL
	V _{IL}	30 % V _{CC} Max.	
Rise time / Fall time	t _r / t _f	400 ps Max.	Between 20 % and 80 % of (V _{OH} - V _{OL})
Start-up time	t _{str}	10 ms Max.	Time at minimum supply voltage to be 0 s

*1 Frequency tolerance includes initial frequency tolerance, temperature variation, supply voltage change, reflow drift and 10 years aging at +25 °C.

Product name
(Standard form)

VG7050 EAN SM18xxxx C J G H P Z
① ② ③ ④⑤⑥⑦⑧⑨

①Model

②Output (E: LV-PECL)

③Parameter Designator (EAN: SM18xxxx, ECN: SM20xxxx)

④Supply voltage (C: 3.3 V Typ., D: 2.5 V Typ.)

⑤Frequency tolerance (J: $\pm 50 \times 10^{-6}$)

⑥Operating temperature (G: -40 °C to +85 °C)

⑦OE Function (H: Active High, L: Active Low)

⑧Absolute Pull Range (P: Programmable)

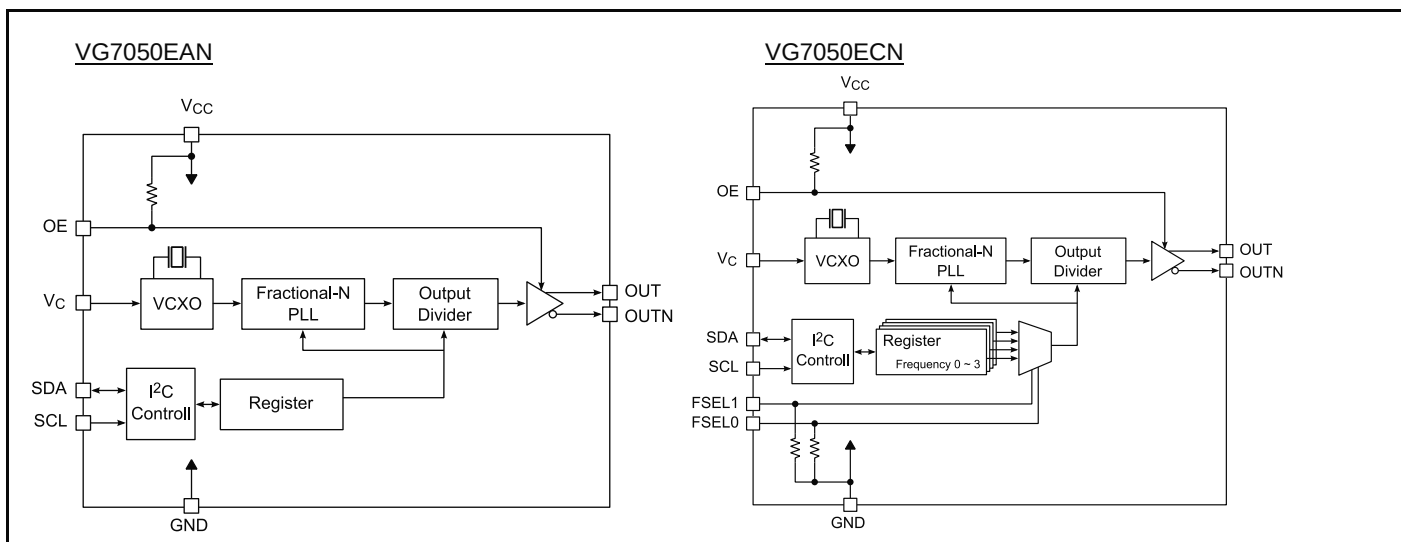
⑨Output Standby Type (F: Fix (OUT="L", OUTN="H"), Z: High-Z)

Phase Jitter

	Offset Frequency	125.00 MHz	156.25 MHz	250.00 MHz	425.00 MHz	622.08 MHz	669.33 MHz	794.73 MHz
Phase jitter*2 Typ.	12 kHz to 20 MHz	0.30 ps	0.26 ps	0.26 ps	0.25 ps	0.26 ps	0.26 ps	0.26 ps
	20 kHz to 50 MHz	0.30 ps	0.27 ps	0.27 ps	0.26 ps	0.27 ps	0.27 ps	0.27 ps
	50 kHz to 80 MHz	0.29 ps	0.27 ps	0.27 ps	0.26 ps	0.27 ps	0.27 ps	0.27 ps

*2 In order to achieve optimum jitter performance, it is recommended that the capacitor (0.1 μ F + 10 μ F) between V_{CC} and GND pin should be placed as close to the V_{CC} pin as possible.

Block diagram



OE Function / OE Standby Type

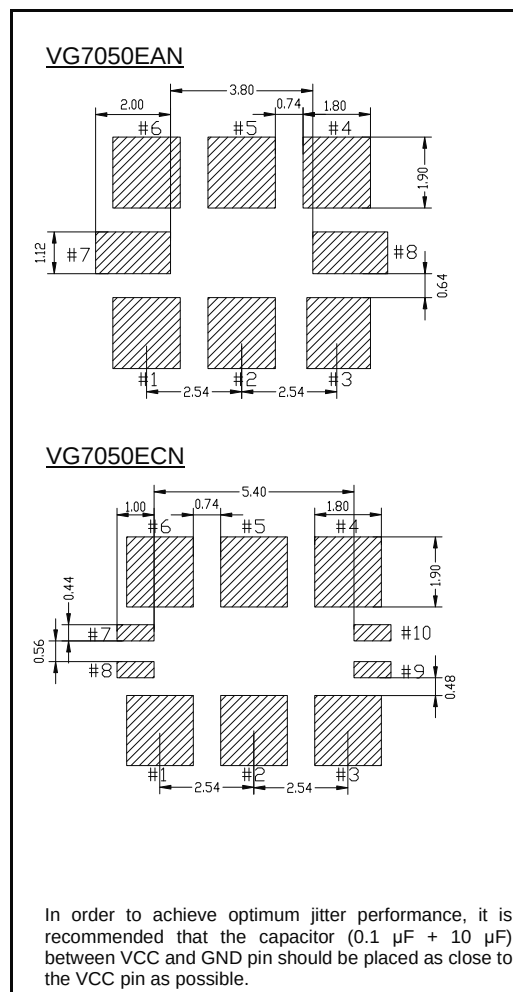
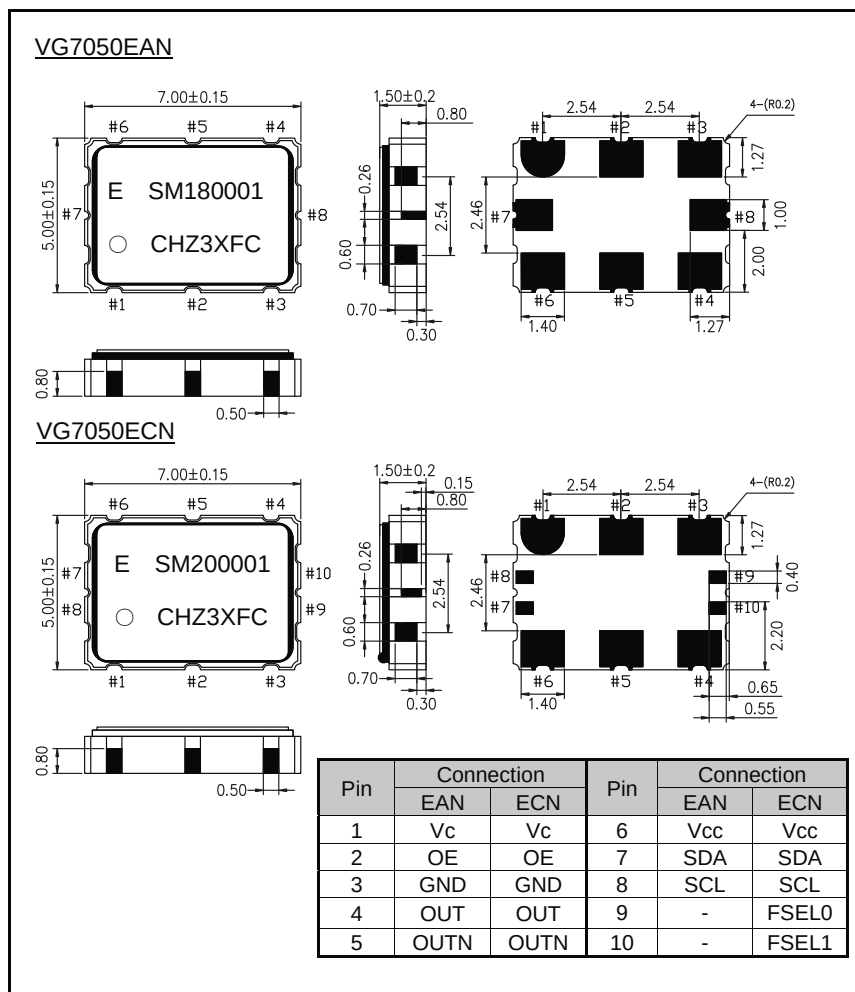
OE Function	OE Standby Type	Output Enable			Output Disable	
		OE pin		OE pin	OUT, OUTN pin	
H: High Active	Z: High-Z	"H" or "OPEN"		"L"	High Impedance	
L: Low Active		"L" or "OPEN"		"H"		
H: High Active	F: Fix	"H" or "OPEN"		"L"	OUT = "L", OUTN = "H"	
L: Low Active		"L" or "OPEN"		"H"		

External dimensions

(Unit: mm)

Footprint (Recommended)

(Unit: mm)



► RF Transmitter Module

P	Model	Size (mm)	Feature	Operating temperature	Supply voltage	Current consumption (Max.)
95 131	SR3225SAA (AEC-Q100)	3.2×2.5×1.0 (t: Typ.)	UHF range wireless transmitter module. 300 ~ 400 MHz (0.25 kHz step) 600 ~ 930 MHz (0.49 kHz step) Modulation types: ASK / OOK / FSK SPI interface	-40 to +85 °C	1.8 V to 3.6V	16 mA

RF Transmitter Module AEC-Q100 compliant SR3225SAA

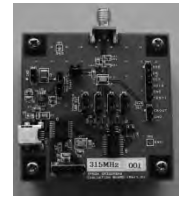


Product Number
SR3225SAA: X1G00479xxxxx00

SR3225SAA is a wireless transmitter module for UHF range. Crystal resonator, oscillator, PLL and Power Amp are integrated in 3.2 mm x 2.5 mm ceramic package. The wireless transmission function can be configured by connect to the external control devices. It is suitable for small wireless transmitter. The evaluation kit is available.

Application

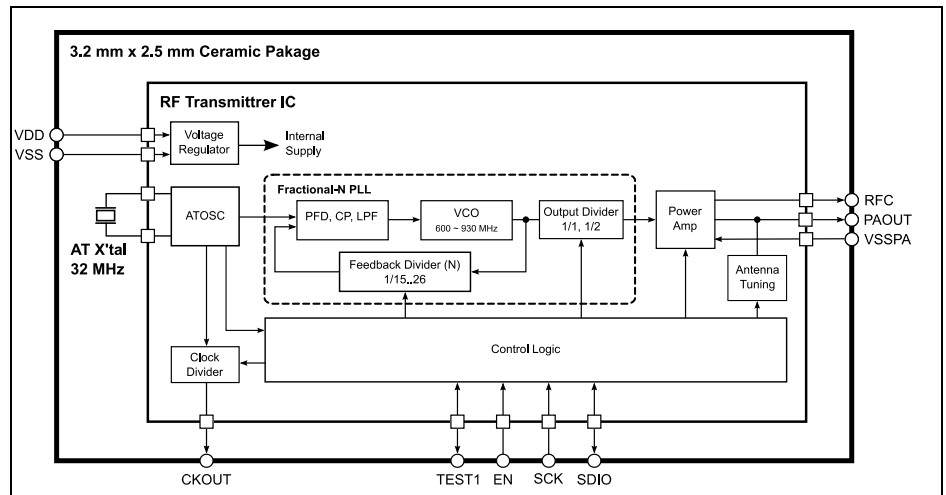
- Remote Keyless Entry, Passive Entry
- Short range radio data transmitter
- Garage door opener
- Transmitter for RFID tag



Overview

- Carrier frequency bands:
300 MHz ~ 465 MHz (0.25 kHz Step),
600 MHz ~ 930 MHz (0.49 kHz Step)
- $\Delta\Sigma$ fractional-N based PLL
- Programmable Power Amp output power:
-15 ~ 11 dBm, 128 steps
- Modulation types: ASK/OOK/FSK with Soft-ASK and/or Soft FSK shaping
- 3-wire/4-wire SPI interface
- SFR (Special Function Register)
- Embedded 32 MHz crystal resonator and oscillation circuit
- Programmable clock output via CKOUT
- Programmable voltage threshold of Under Voltage Detection: 4 steps (1.8 V ~ 2.4 V)
- Fail-Safe mechanism (PLL Loss of Lock, VCO auto-calibration error, Under Voltage Detection)

Block diagram

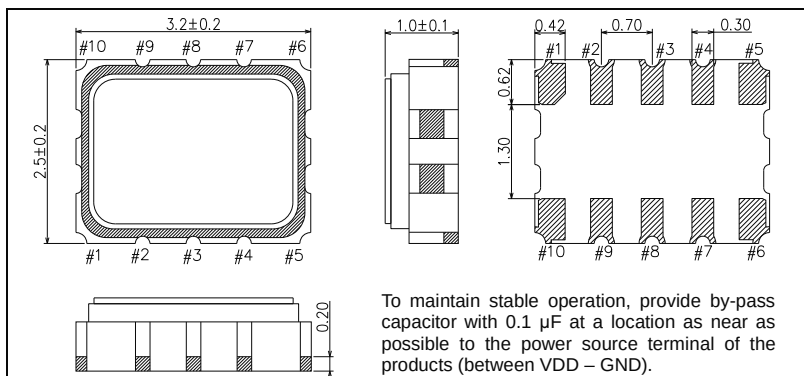


Specification (characteristics)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage	VDD	-	1.8	3.0	3.6	V
Operation temperature	Ta	-	-40	-	+85	°C
Storage temperature	Tstg	-	-40	-	+125	°C
Supply current Powerdown Mode	I _{DDPD}	VDD = 3.0 V, Ta = +25 °C	-	20	100	nA
Supply current Transmitter-Active Mode	I _{DDTMA}	F _{TX} = 315 MHz, P _{out} = 5 dBm,	-	10.0	11.0	mA
		F _{TX} = 315 MHz, P _{out} = 8 dBm,	-	12.7	13.7	
		F _{TX} = 315 MHz, P _{out} = 10 dBm,	-	15.0	16.0	
Carrier frequency bands	F _{TX}	-	300	-	465	MHz
			600	-	930	
ASK Bit rate	R _{ASK}	NRZ	-	-	100	kbps
FSK Bit rate	R _{FSK}	NRZ	-	-	50	kbps
Crystal frequency tolerance	F _{TOL}	Ta = +25 °C, without aging	-2	-	2	ppm
Crystal temperature variation	F _{TC}	-40 °C ~ +85 °C	-20	-	20	ppm
Nominal output power	P _{OUT}	Ta = +25 °C, VDD = 3.0 V, F _{TX} = 315 MHz, HPWR = 1, AM* = 0x3F	10	11	12	dBm
		Ta = +25 °C, VDD = 3.0 V, F _{TX} = 315 MHz, HPWR = 0, AM* = 0x01	-16	-15	-14	

External dimensions

(Unit: mm)



IMU Product Line-up

- M-G370PDS0 : Low Noise and High Stability IMU
- M-G370PDF1 : Wide Dynamic Range and High Stability IMU
- New** • M-G366PDG0 / M-G330PDG0 : Dynamic Tilt Function IMU
- M-G552 Series : Water and Dust Proof IMU with J1939, CANopen and RS422 Interface (Interface is selectable)

Product Name			M-G370PDS0	M-G370PDF1	New M-G366PDG0	New M-G330PDG0	M-G552 Series*1
Features			Low Noise High Stability	Wide Range High Stability	Standard Model Dynamic Tilt	Basic Model Dynamic Tilt	Water and Dust proof
Gyroscope	Bias Instability	°/h	0.8	0.8	1.2	3	0.8
	Output Range	°/s	± 200	± 450	± 450	± 400	± 450
	Random Walk	°/√h	0.03	0.06	0.08	0.1	0.06
	Band Width	Hz(Max.)	189	189	472	500	189
Accelerometer	Output Range	G	± 10	± 10	± 8 / ± 16 *2	± 8 / ± 16 *2	± 10
	Initial Bias	mG, σ	2	2	3	4	3
Misalignment (Gyro/Accelerometer)		°	0.01				0.01
Current Consumption		mA(Typ.)	16				32 @12 V
Voltage Supply		V	3.3				9 ~ 32
Operating Temperature		°C	- 40 ~ + 85				-30 ~ +80
Interface			SPI / UART				J1939 (CANopen and RS422 is selectable by product code)
Size		mm ³	24 x 24 x 10				65 x 60 x 30
Weight		g	10				115
Dynamic Tilt Function EKF(Extended Kalman Filter)			---	---	Built in	Built in	---
Functions			External Trigger Input, etc				IP67
Product Image							

Please contact us for information on RoHS and Reach.

*1 The product model number and specification values are determined by the built-in IMU.

The values on this page are the specifications of M-G552PJ7x. Please contact us for detailed information on other products.
Interface is selectable by product code.

* 2 Selectable by register setting.



■ Vibration Sensor / Accelerometer Product Line-up

- M-A342VD10 : Built-in Type Vibration sensor (UART / SPI Interface), ISO 10816 and ISO 20816 compliant
- M-A542VR10 : Water and Dust Proof Vibration sensor (RS422 Interface), ISO 10816 and ISO 20816 compliant
- M-A352AD10 : Built-in Type Accelerometer (UART / SPI Interface), Detectable in the range from DC
- M-A552AC10/AR10 : Water and Dust Proof Accelerometer (CAN / RS422 Interface) , Detectable in the range from DC

Vibration Sensor

Product Name		M-A342VD10	M-A542VR10
Features		Built-in Type	Water and Dust Proof (IP67)
Interface		UART / SPI Selectable	RS422
Transfer Speed	bps	115.2 k~921.6 k(Default 460.8 k)	
Detected Axis		3(X/Y/Z)	
Physical Output Formats		Velocity and Displacement	
Output Formats		raw, rms, p-p (digital output)	
Output Range	Velocity mm/s	± 100	
	Displacement mm	± 200	
Measured Frequency Range	Velocity Hz	10 ~ 1,000	
	Displacement Hz	1 ~ 100	
Operating Temperature	°C	-30 ~ +85	-30 ~ +70
Current Consumption	mA(Typ.)	29 @ 3.3 V	51 @12 V
Voltage Supply	V	3.15 ~ 3.45	9 ~ 32
Size	mm ³	48 x 24 x 16	65 x 60 x 30
Weight	g	25	128
Product Image			

Accelerometer

Product Name		M-A352AD10	M-A552AC10 M-A552AR10
Features		Built-in Type	Water and Dust Proof (IP67)
Interface		UART / SPI Selectable	CANopen:M-A552AC10 RS-422 :M-A552AR10
Noise Density	μG/Hz	0.2	0.5
Output Range	G	± 15	± 15
Detected Axis		3(X/Y/Z)	3(X/Y/Z)
Physical Output Formats		Acceleration, Tilt Angle (Selectable on each axis)	Acceleration, Tilt Angle (Selectable on each axis)
Measured Frequency Range	Hz	DC ~ 460	DC ~ 460
Output Rate	Sps(Max.)	1,000	1,000
Resolution	μG/LSB	0.06	0.06
Shock	G(Max.)	1,000	1,000
Operating Temperature	°C	-30 ~ +85	-30 ~ +70
Current Consumption	mA(Typ.)	13.2	35@12 V:M-A552AC10 49@12 V:M-A552AR10
Voltage Supply	V	3.3	9 ~ 32
Size	mm ³	48 x 24 x 16	65 x 60 x 30
Weight	g	25	128
Product Image			

Please contact us for information on RoHS and Reach.



IMU (Inertial Measurement Unit)

M-G330PDG0

- Small size & Light Weight: 24 x 24 x 10 mm³, 10 g
- Low-Noise, High-Stability
 - Gyro Bias Instability: 3 °/h
 - Angular Random Walk: 0.1 °/√h
- Calibrated Stability (Bias, Scale Factor, Axial Alignment)
- Interface: SPI / UART
- Calibration Temperature: -40 °C to +85 °C
- Power Supply Voltage: 3.3 V



Product Name and Number
M-G330PDG0 : X2G000201000100



Recommended Application

- Autonomous Vehicle
- Navigation Systems
- Vibration Control and Stabilization Pointing and Tracking Systems

RECOMMENDED OPERATING CONDITION

Parameter	Condition	Min.	Typ.	Max.	Unit
Power Supply Voltage, V _{CC}		3.15	3.3	3.45	V
Digital Input Voltage		GND	—	V _{CC}	V
Digital Output Voltage		-0.3	—	V _{CC} + 0.3	V
Calibration Temperature	Performance parameters are applicable	-40	—	+85	°C
Operating Temperature		-40	—	+85	°C

SPECIFICATIONS

T_a = 25 °C, V_{CC} = 3.3 V, Angular rate = 0 °/s, ≤ ±1 G, unless otherwise noted.

Parameter	Test Condition / Comment	Min.	Typ.	Max.	Unit
GYRO SENSORS					
Sensitivity					
Output Range		—	±400	—	°/s
Scale Factor	16 bit, when 32 bit x 2 ¹⁶	-0.2 %	66	+0.2 %	LSB/(°/s)
Nonlinearity	1σ	—	0.05	—	% of FS
Misalignment	1σ, Axis-to-axis, Δ = 90 ° ideal	—	0.01	—	°
Bias					
Initial Error	1 σ, -10 °C ≤ T _A ≤ +60 °C	—	720	—	°/h
	1 σ, -40 °C ≤ T _A ≤ +85 °C	—	1800	—	°/h
Repeatability ^{*1}	1σ, Turn-on to Turn-on ^{*1}	—	36	—	°/h
Bias Instability	Average	—	3	—	°/h
Angular Random Walk	Average	—	0.1	—	°/√h
Noise Density	f = 10 Hz to 20 Hz	—	7	—	(°/h)/√Hz, rms
Frequency Property					
3dB Bandwidth		—	—	500	Hz
ACCELEROMETERS					
Sensitivity					
Output Range		—	±8 / ±16 ^{*7}	—	G
Scale Factor	16 bit, when 32 bit x 2 ¹⁶	-0.2%	4(8 G)/2(16 G)	+0.2%	LSB/mG
Nonlinearity	1 σ, < 1 G	—	0.1	—	% of FS
Misalignment	1 σ, Axis-to-Axis, Δ = 90 ° ideal	—	0.01	—	°
Bias					
Initial Error	1 σ, -40 °C ≤ T _A ≤ +85 °C	—	4	—	mG
Repeatability ^{*1}	1σ, Turn-on to Turn-on ^{*1}	—	4	—	mG
Bias Instability	Average	—	34	—	μG
Velocity Random Walk	Average	—	0.03	—	(m/s)/√h
Noise Density	f = 10 Hz to 20 Hz	—	70	—	μG/√Hz, rms
Frequency Property					
3dB Bandwidth		—	—	333	Hz
ATTITUDE OUTPUT					
Dynamic Range	Inclination Mode	-80	—	+80	°
	Euler Mode	-45	—	+45	
	ANG2:Pitch	-180	—	+180	
	ANG3:Yaw ^{*4}	-180	—	+180	
Scale Factor	16bit	—	0.00012207	—	rad/LSB
		—	0.00699411	—	°/LSB
Accuracy ^{*4*6}	1 σ, Static	—	0.3	—	°
	1 σ, Dynamic ^{*5} (100 °/s, Max.)	—	0.3	—	
TEMPERATURE SENSOR					
Scale Factor ^{*1*2}	Output = 0 @+25 °C	—	0.00390625	—	°C/LSB

*1) This is a reference value used for internal temperature compensation. There is no guarantee that the value gives an absolute value of the internal temperature.

*2) This is the temperature scale factor for the upper 16 bit (TEMP_HIGH). *3) Turn-on to turn-on / Day by day, estimated variation during 5 consecutive days.

*4) Yaw axis is not compensated for errors caused by drift.

*5) Dynamic accuracy is based on measurement data that has been measured from a stationary state. The accuracy that can be achieved depends on the input movement.

*6) Attitude output accuracy is based on measurement data for GLOB_CMD2[0x16(W1)], bit[5:4]= 00: modeA. *7) Selectable by register setting.

Note) The values in the specifications are based on the data calibrated at the factory. The values may change according to the way the product is used.

Note) The Typ. values in the specifications are average values or 1 σ values.

Note) Unless otherwise noted, the Max. / Min. values in the specifications are design values or Max. / Min. values at the factory tests.



IMU (Inertial Measurement Unit)

M-G366PDG0

- Small size & Light Weight: 24 x 24 x 10 mm³, 10 g
- Low-Noise, High-Stability
 - Gyro Bias Instability: 1.2 °/h
 - Angular Random Walk: 0.08 °/√h
- Calibrated Stability (Bias, Scale Factor, Axial Alignment)
- Interface: SPI / UART
- Calibration Temperature: -40 °C to +85 °C
- Power Supply Voltage: 3.3 V



Product Name and Number
M-G366PDG0 : X2G000191000100



Recommended Application

- Autonomous Vehicle
- Navigation Systems
- Vibration Control and Stabilization Pointing and Tracking Systems

RECOMMENDED OPERATING CONDITION

Parameter	Condition	Min.	Typ.	Max.	Unit
Power Supply Voltage, V _{CC}		3.15	3.3	3.45	V
Digital Input Voltage		GND	—	V _{CC}	V
Digital Output Voltage		-0.3	—	V _{CC} + 0.3	V
Calibration Temperature	Performance parameters are applicable	-40	—	+85	°C
Operating Temperature		-40	—	+85	°C

SPECIFICATIONS

T_a = 25 °C, V_{CC} = 3.3 V, Angular rate = 0 °/s, ≤ ±1 G, unless otherwise noted.

Parameter	Test Condition / Comment	Min.	Typ.	Max.	Unit
GYRO SENSORS					
Sensitivity					
Output Range		—	±450	—	°/s
Scale Factor	16 bit, when 32 bit x 2 ¹⁶	-0.2 %	66	+0.2 %	LSB/(°/s)
Nonlinearity	1σ	—	0.05	—	% of FS
Misalignment	1σ, Axis-to-axis, Δ = 90 ° ideal	—	0.01	—	°
Bias					
Initial Error	1 σ, -40 °C ≤ T _A ≤ +85 °C	—	360	—	°/h
Repeatability ^{*1}	1σ, Turn-on to Turn-on ^{*1}	—	36	—	°/h
Bias Instability	Average	—	1.2	—	°/h
Angular Random Walk	Average	—	0.08	—	°/√h
Noise Density	f = 10 Hz to 20 Hz	—	6.9	—	(°/h)/√Hz, rms
Frequency Property					
3dB Bandwidth		—	—	472	Hz
ACCELEROMETERS					
Sensitivity					
Output Range		—	±8 / ±16 ^{*7}	—	G
Scale Factor	16 bit, when 32 bit x 2 ¹⁶	-0.1 %	4(8 G)/2(16 G)	+0.1 %	LSB/mG
Nonlinearity	1 σ, < 1 G	—	0.1	—	% of FS
Misalignment	1 σ, Axis-to-Axis, Δ = 90 ° ideal	—	0.01	—	°
Bias					
Initial Error	1 σ, -40 °C ≤ T _A ≤ +85 °C	—	3	—	mG
Repeatability ^{*1}	1σ, Turn-on to Turn-on ^{*1}	—	3	—	mG
Bias Instability	Average	—	24	—	μG
Velocity Random Walk	Average	—	0.02	—	(m/s)/√h
Noise Density	f = 10 Hz to 20 Hz	—	50	—	μG/√Hz, rms
Frequency Property					
3dB Bandwidth		—	—	333	Hz
ATTITUDE OUTPUT					
Dynamic Range	Inclination Mode	-80	—	+80	°
	Euler Mode	-45	—	+45	
	ANG1:Roll	-180	—	+180	
	ANG2:Pitch	-180	—	+180	
Scale Factor	16bit	—	0.00012207	—	rad/LSB
		—	0.00699411	—	°/LSB
Accuracy ^{*4,6}	1 σ, Static	—	0.2	—	°
	1 σ, Dynamic ^{*5} (100 °/s, Max.)	—	0.2	—	
TEMPERATURE SENSOR					
Scale Factor ^{*1,2}	Output = 0 @ +25 °C	—	0.00390625	—	°C/LSB

*1) This is a reference value used for internal temperature compensation. There is no guarantee that the value gives an absolute value of the internal temperature.

*2) This is the temperature scale factor for the upper 16 bit (TEMP_HIGH). *3) Turn-on to turn-on / Day by day, estimated variation during 5 consecutive days.

*4) Yaw axis is not compensated for errors caused by drift.

*5) Dynamic accuracy is based on measurement data that has been measured from a stationary state. The accuracy that can be achieved depends on the input movement.

*6) Attitude output accuracy is based on measurement data for GLOB_CMD2[0x16(W1)], bit[5:4] = 00: modeA. *7) Selectable by register setting.

Note) The values in the specifications are based on the data calibrated at the factory. The values may change according to the way the product is used.

Note) The Typ. values in the specifications are average values or 1 σ values.

Note) Unless otherwise noted, the Max. / Min. values in the specifications are design values or Max. / Min. values at the factory tests.



3 Axis Vibration Sensor M-A342VD10

- Capable of measuring velocity, velocity RMS, and velocity P-P (ISO10816 / ISO20816 compliant)
- Frequency response characteristics: 10 Hz to 1,000 Hz (-3dB)
- Insensitive to magnetic influences
- High dynamic range: ± 100 mm/s (110 dB)
- 3-axis digital output SPI / UART
- Power consumption : 29 mA Typ.



Product number
M-A342VD10 : X2F000021000100



Recommended Application

- MHM (Machine Health Monitoring) • Condition Based Maintenance (CBM) • Motion analysis and control
- SHM (Structural Health Monitoring) • Vibration analysis, control and stabilization • Lissajous analysis

Recommended Operating Condition

Parameter	Condition	Min	Typ	Max	Unit
VCC to GND		3.15	3.3	3.45	V
Digital Input Voltage to GND		GND		VCC	V
Digital Output Voltage to GND		-0.3		VCC +0.3	V
Operating Temperature Range		-30		85	°C
Start up Time	Power-on to start output.			900	ms.

Specifications

T_A= -30 °C to +85 °C, VCC=3.15 V~3.45 V, $\leq \pm 1$ G, unless otherwise noted.

Parameter	Test Conditions / Comments	Min	Typ	Max	Unit
VELOCITY					
Sensitivity					
Output Range	f = 10 Hz ~ 1000 Hz			± 100	mm/s
Scale Factor	2 ⁻²² m/s/LSB		2.38*10 ⁻⁴		mm/s/LSB
Sensitivity Error	25 °C, ≤ 1 G	-1550		1550	$\times 10^{-6}$ (ppm)
Nonlinearity	≤ 1 G, Best fit straight line, RT	-0.15		0.15	% of FS
Cross Axis Sensitivity	No alignment correction		± 0.9 *3		%
Noise					
Noise Density	25 °C, Avg, f = 200 Hz ~ 1000 Hz		1.4*10 ⁻⁴		mm/s/ $\sqrt{\text{Hz}}$, rms
Cantilever Resonance Frequency	25 °C, VCC 3.3 V		4,460		Hz
Frequency Property					
Frequency Range	-3 dB at 25 °C		10~1,000		Hz
DISPLACEMENT					
Sensitivity					
Output Range	f = 1 Hz ~ 100 Hz			± 200	mm
Scale Factor	2 ⁻²² m/LSB		2.38*10 ⁻⁴		mm/LSB
Nonlinearity	≤ 1 G, Best fit straight line, RT	-0.15		0.15	% of FS
Cross Axis Sensitivity			± 0.9 *3		%
Noise					
Noise Density	25 °C, Avg, f = 20 Hz ~ 100 Hz		0.7*10 ⁻⁵		mm/ $\sqrt{\text{Hz}}$, rms
Frequency Property					
Frequency Range	-3 dB at 25 °C		1~100		Hz
TEMPERATURE SENSOR					
Output Range		-40		85	°C
16bit Scale Factor *1	Output=2634(0x0A4A) at 25 °C		-0.0037918		°C/LSB
8bit Scale Factor *1	Output=2634(0x0A4A) at 25 °C		-0.9707008		°C/LSB
RELIABILITY					
MTBF*2	JIS-C5003 TA = 25 °C	87,600			hour

*1) This is a reference value used for the internal temperature correction, and is not guaranteed to accurately output the interior temperature.

*2) The MTBF is an estimated value derived from the result of high temperature operation with a system requirement of TA=25°C and a 60% reliability level.

*3) When the alignment is corrected by the host, the other axis sensitivity is Typ. 0.1 %.

Note) The values in the specifications are based on the data calibrated at the factory. The values may change according to the way the product is used.

Note) The Max/Min value is the maximum/minimum value of the design or factory shipment examination, unless otherwise specified.

Note) The calibrated standard 1G gravitational acceleration value is 9.80665 m/s²



3 Axis Accelerometer M-A352AD10

- Ultra-low noise : $0.2\mu\text{G}/\sqrt{\text{Hz}}$ Typ.
- Improved shock resistance: 1,000G
- Selectable output format: Acceleration / Tilt Angle
- 3-axis digital output SPI / UART
- Programmable low-pass digital filters
- Low jitter external trigger function for synchronous sampling
- Solid Metallic Case (Size : $48 \times 24 \times 16 \text{ mm}^3$, Weight: 25g)



Product number
M-A352AD10 : X2F000011000100



Recommended Application

- MHM (Machine Health Monitoring) • Earthquake detection • Environmental vibration measurement
- Industrial equipment monitoring • Unmanned vehicles • Measurement of the vibration and path of industrial equipment and vehicles.

Recommended Operating Condition

Parameter	Condition	Min	Typ	Max	Unit
VCC to GND		3.15	3.3	3.45	V
Digital Input Voltage to GND		GND		VCC	V
Digital Output Voltage to GND		-0.3		VCC +0.3	V
Operating Temperature Range		-30		85	°C
Start up Time	Power-on to start output.			900	ms.

Specifications

T_A= -30 °C to +85 °C, VCC=3.15 V~3.45 V, $\pm 1 \text{ G}$, unless otherwise noted.

Parameter	Test Conditions / Comments	Min	Typ	Max	Unit
SPECIFICATIONS					
Output Range	f = DC ~ 460 Hz			± 15	G
Scale Factor	2^{-24} G/LSB		0.06		$\mu\text{G/LSB}$
Sensitivity Error	25 °C, $\leq 1 \text{ G}$		± 500		$\times 10^{-6}$ (ppm)
Nonlinearity	$\leq 1 \text{ G}$, Best fit straight line, RT			± 0.03	% of FS
Misalignment	25 °C			± 0.1	Deg
Initial Error	25 °C			± 2	mG
Bias Repeatability	T _A =25 °C and VCC=3.3 V for one year after shipment		3		mG
Bias Temperature Error	25 °C			± 2	mG
Noise Density	25 °C, Avg, f = 0.5 Hz ~ 6 Hz		0.2	0.7	$\mu\text{G}/\sqrt{\text{Hz}}$, rms
Cantilever Resonance frequency	25 °C, VCC3.3 V		850		Hz
VRC	at 50 Hz, 25 °C, VCC3.3 V			± 50	$\mu\text{G/G}^2$
Power Supply Current	Standard noise floor condition, 200 Sps, Average		13.2	18.0	mA
	Reduced noise floor condition, 200 Sps, Average		16.2	20.0	mA
	Sleep mode		1.3	2.0	mA
FUNCTION					
Built-in LPF Cut off	-6 dB at 25 °C, selectable	9		460	Hz
User LPF		4, 64, 128, 512			Tap
Output Data Rate		50		1,000	Sps
Ext.Trigger Input Cycle		1		20	ms
Ext.Trigger Jitter	ADC's completion to Ext.Trigger input	0		5	μs
RECOMMENDED OPERATING CONDITION					
VCC to GND		3.15	3.3	3.45	V
Operating temperature range	No condensation	-30		85	°C
ABSOLUTE MAXIMUM RATINGS					
Acceleration/Shock	Half-sine 0.2 msec	1,000			G
MTBF	JIS-C5003, 60 % reliability leve	87,600			Hour
Storage Temperature Range	No condensation	-40		85	°C

*1) This is a reference value used for the internal temperature correction, and is not guaranteed to accurately output the interior temperature.

*2) The MTBF is an estimated value derived from the result of high temperature operation with a system requirement of T_A=25 °C and a 60 % reliability level.

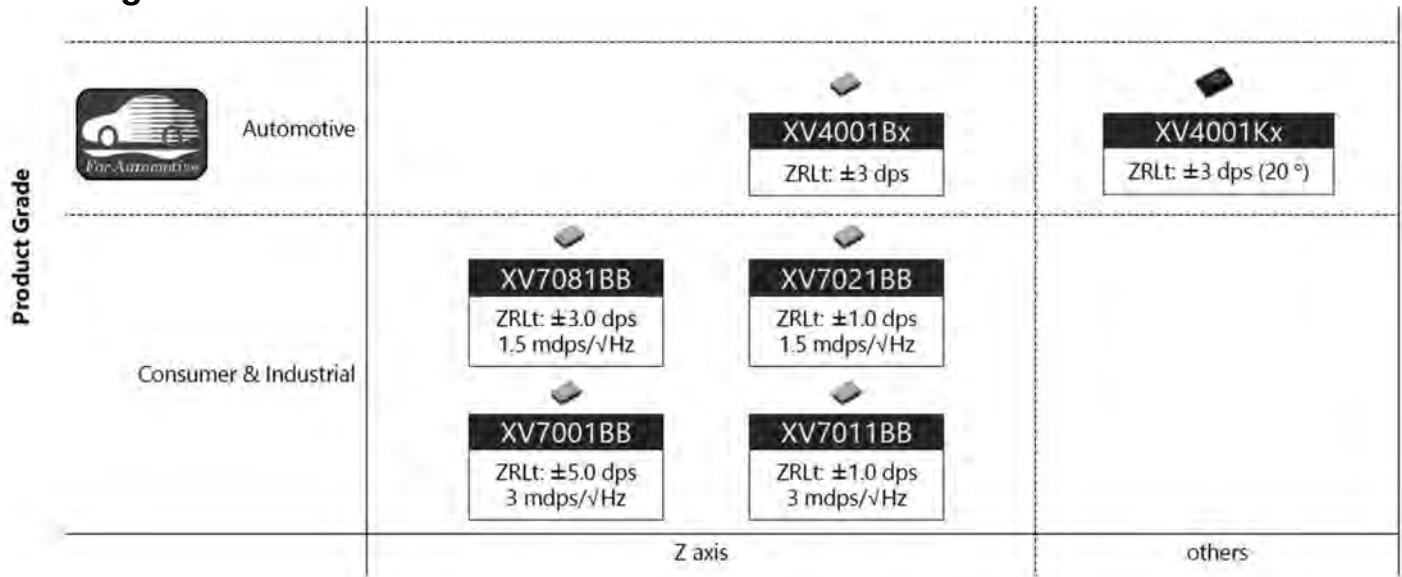
*3) When the alignment is corrected by the host, the other axis sensitivity is Typ. 0.1 %.

Note) The values in the specifications are based on the data calibrated at the factory. The values may change according to the way the product is used.

Note) The Max. /Min. value is the maximum/minimum value of the design or factory shipment examination, unless otherwise specified.

Note) The calibrated standard 1 G gravitational acceleration value is 9.80665 m/s²

Sensing Device



► Gyro Sensor

P	Model	Size [mm]	Supply Voltage [V]	Interface Type	Bias	Rate Range [°/s]	Scale Factor [mV/(°/s)]	Non Linearity [%FS]	Operating Temperature [°C]	Recommended Application
103	XV7021BB	5.0×3.2×1.3t	2.7 to 3.6	Digital (SPI / I ² C)	0 [LSB] Typ. ± 1 [°/s]	±400	24bit: 17920 [LSB/(°/s)] ± 5 [%]	± 0.5	-20 to +80 (Please contact us about -40 °C to +85 °C)	Anti vibration and attitude control for industrial applications etc. Motion detection for Man machine interface
104	XV7081BB									
105	XV7011BB					±100	24bit: 71680 [LSB/(°/s)] ± 5 [%]			
106	XV7001BB						16bit: 280 [LSB/(°/s)] ± 5 [%]		-20 to +80	
107	XV-3510CB		2.7 to 3.3	Analog Voltage	1430 [mV]	±300	3.0	± 0.5	-20 to +80	Detection picture stabilization

► Gyro sensor for automotive

P	Model	Size [mm]	Supply Voltage [V]	Interface Type	Bias	Rate Range [°/s]	Scale Factor [mV/(°/s)]	Non Linearity [%FS]	Operating Temperature [°C]	Recommended Application
Web site	XV-9100CD (AEC-Q100)	5.0×5.0×1.3t	4.75 to 5.25	Analog Voltage	0.5 × V _{DD} [V]	±100	0.004 × V _{DD}	± 0.5	-40 to +105	Electric Stability Control System, Rollover Protection System
	XV-9300CD (AEC-Q100)					±300	0.0012 × V _{DD}			
	XV-9100LP (AEC-Q100)	9.5×5.0×7.2t				±100	0.004 × V _{DD}		-40 to +125	
	XV-9300LP (AEC-Q100)					±300	0.0012 × V _{DD}			
134	XV4001KC (AEC-Q200)	6.0×4.8×3.3t Inclined	3.0 to 3.6	Digital (I ² C-Bus)	0 [LSB] Typ. ± 2 [°/s]	±70	370 [LSB/(°/s)] ±1.5 [%]	± 0.5	-40 to +85	Car navigation system
	XV4001KD (AEC-Q200)			Digital (SPI-Bus)						
	XV4001BC (AEC-Q200)	5.0×3.2×1.3t		Digital (I ² C-Bus)						
	XV4001BD (AEC-Q200)			Digital (SPI-Bus)						



GYRO SENSOR (Digital Output)

XV7021BB



Product number
XV7021BB: X2A000311xxxx00

- Excellent bias temperature coefficient 0.0016 (°/s)/°C Typ.
- Low angle random walk 0.065 °/√h Typ.
- Integrated user-selectable digital filter and detuning frequency eliminate filter
- SPI or I²C serial interface
- Angular rate output (16 bits or 24 bits resolution)
- Operating temperature -20 °C to +80 °C
- Embedded temperature sensor
- Low current consumption 900 µA Typ.



Recommended Application

- Anti-vibration and attitude control for industrial applications etc.
- Motion detection for human machine interface

*The I²C-Bus is a trademark of NXP Semiconductors

Specifications (characteristics)

Item	Symbol	Specifications	Conditions / Remarks
Supply voltage	V _{DDM}	2.7 V to 3.6 V	
Supply voltage for interface	V _{DDI}	1.65 V to 3.6 V	
Storage temperature	T _{STG}	-40 °C to +85 °C	
Operating temperature	T _{OPR}	-20 °C to +80 °C	
Scale factor	S ₀	70 LSB/(°/s) ±2 %	16 bits, T _a = +25 °C
		17920 LSB/(°/s) ±2 %	24 bits, T _a = +25 °C
Scale factor variation over temperature	S _{pt}	±3.0 %	V _{DDM} = 3 V, T _a = +25 °C reference
Bias	ZRL	±1 °/s (0 LSB Typ.)	T _a = +25 °C
Bias variation over temperature A	ZRL _{ta}	±0.25 °/s	-10 °C to +50 °C, T _a = +25 °C reference
Bias variation over temperature B	ZRL _{tb}	±1 °/s	-20 °C to +80 °C, T _a = +25 °C reference
Bias temperature coefficient	ZRL _s	0.0016 (°/s)/°C Typ.	V _{DDM} = 3 V, Average of absolute value, ΔT = 1 °C
Rate range	I	±400 °/s	
Non-linearity	NI	±0.5 %FS	T _a = +25 °C
Cross-axis sensitivity	CS	±5 %	T _a = +25 °C
Current consumption	I _{op1}	900 µA Typ.	
Sleep current	I _{op3}	3 µA Typ.	
Noise density	N _d	0.0015 (°/s)/√Hz	@ 10Hz, LPF default setting
Angle random walk	N	0.065 °/√h	

Product Name
(Standard form)

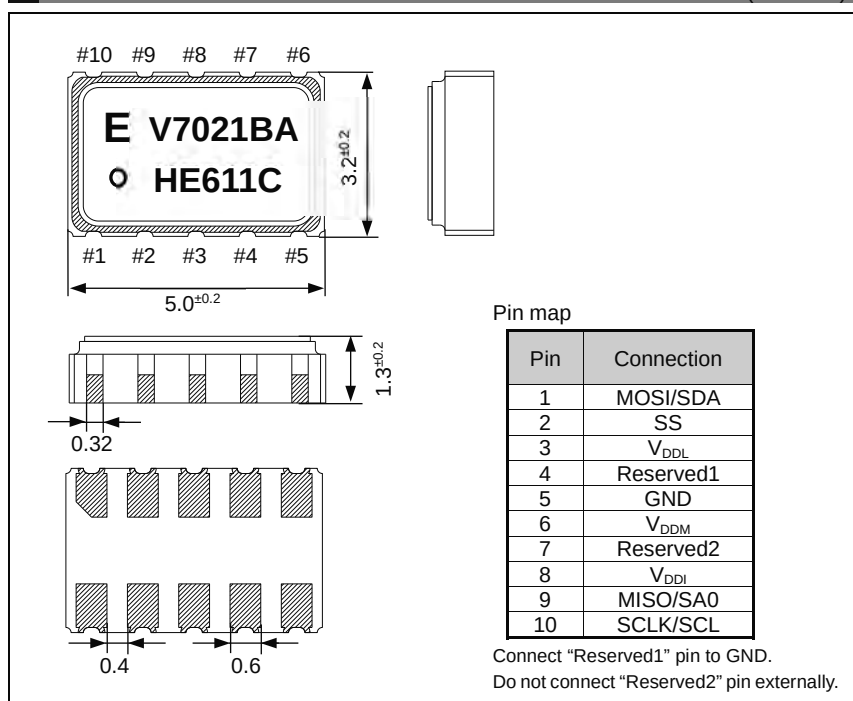
XV7021BB * *

① ②③④ ⑤ ⑥

① Model ② Detection axis (1: Z axis) ③ Package type (B: Ceramics 5032 size)
④ Output (B: SPI/I²C) ⑤ Frequency ⑥ Custom recognition (not necessary to specify)

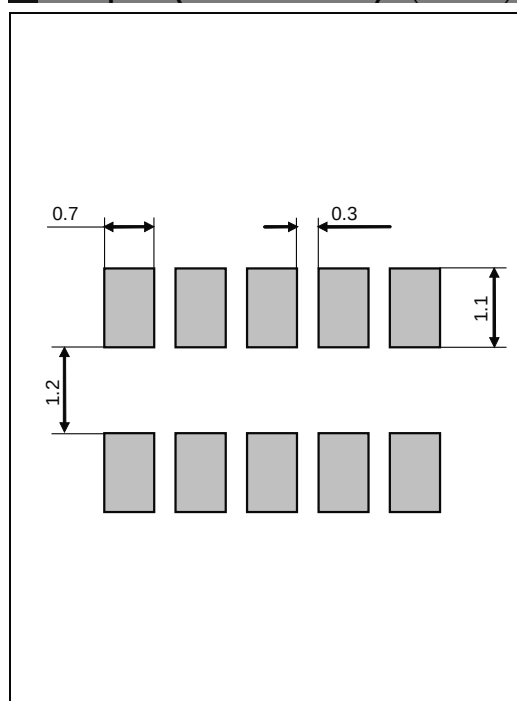
External Dimensions

(Unit: mm)



Footprint (Recommended)

(Unit: mm)





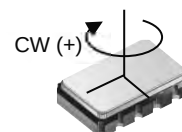
GYRO SENSOR (Digital Output)

XV7081BB



Product number
XV7081BB: X2A000351xxxx00

- Excellent bias temperature coefficient 0.0024 (°/s)/°C Typ.
- Low angle random walk 0.065 °/√h Typ.
- SPI or I²C serial interface
- Integrated user-selectable digital filter
- Angular rate output (16 bits or 24 bits resolution)
- Operating temperature -20 °C to +80 °C
- Embedded temperature sensor
- Low current consumption 900 µA Typ.



Recommended Application

- Anti-vibration, attitude control for industrial applications.
- Autonomous machines

*The I²C-Bus is a trademark of NXP Semiconductors

Specifications (characteristics)

Item	Symbol	Specifications	Conditions / Remarks
Supply voltage	V _{DDM}	2.7 V to 3.6 V	
Supply voltage for interface	V _{DDI}	1.65 V to 3.6 V	
Storage temperature	T _{STG}	-40 °C to +85 °C	
Operating temperature	T _{OPR}	-20 °C to +80 °C	
Scale factor	S ₀	70 LSB/(°/s) ±2 %	16 bits, T _a = +25 °C
		17920 LSB/(°/s) ±2 %	24 bits, T _a = +25 °C
Scale factor variation over temperature	S _p	±3.0 %	V _{DDM} = 3 V, T _a = +25 °C reference
Bias	ZRL	±1 °/s (0 LSB Typ.)	T _a = +25 °C
Bias variation over temperature	ZRL _t	±3.0 °/s	V _{DDM} = 3 V, T _a = +25 °C reference
Bias temperature coefficient	ZRL _s	0.0024 (°/s)/°C Typ.	V _{DDM} = 3 V, Average of absolute value, ΔT = 1 °C.
Rate range	I	±400 °/s	
Non-linearity	NI	±0.5 %FS	T _a = +25 °C
Cross-axis sensitivity	CS	±5 %	T _a = +25 °C
Current consumption	I _{op1}	900 µA Typ.	
Stand-by current	I _{op2}	160 µA Typ.	
Sleep current	I _{op3}	3 µA Typ.	
Noise density	N _d	0.0015 (°/s)/√Hz	@ 10Hz, LPF default setting
Angle random walk	N	0.065 °/√h	

Product Name
(Standard form)

XV7081B * *

① ②③④ ⑤ ⑥

① Model ② Detection axis (1: Z axis)

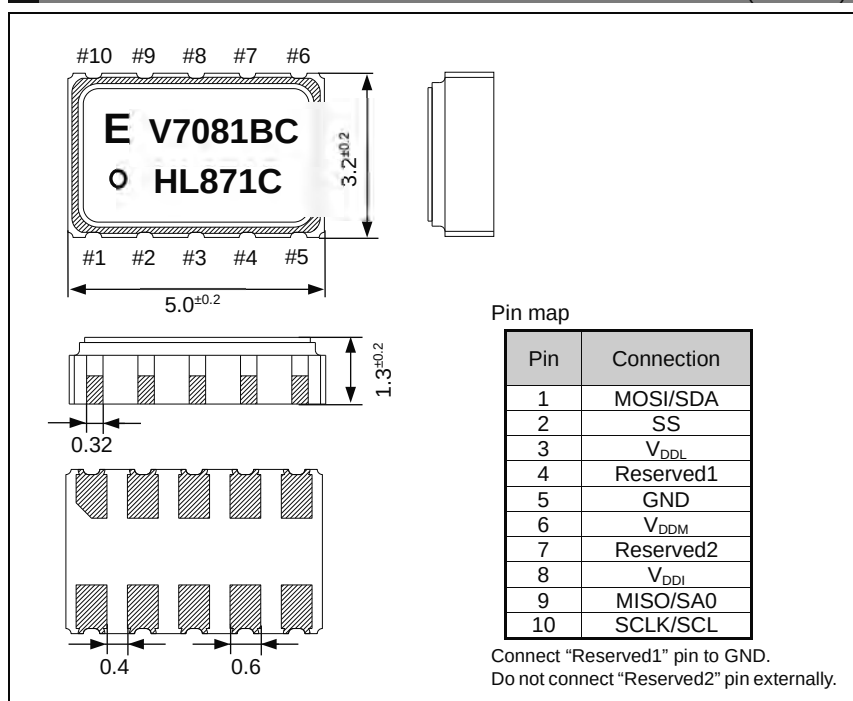
③ Package type (B: Ceramics 5032 size)

④ Output (B: SPI/I²C)

⑤ Frequency ⑥ Custom recognition (not necessary to specify)

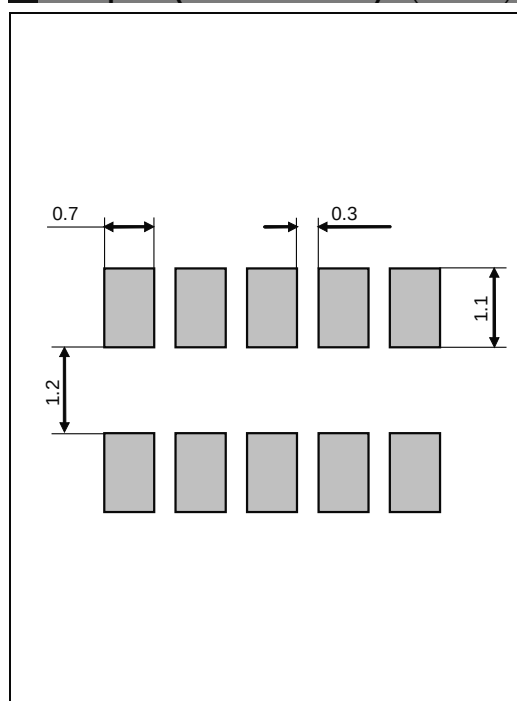
External Dimensions

(Unit: mm)



Footprint (Recommended)

(Unit: mm)





GYRO SENSOR (Digital Output)

XV7011BB



Product number
XV7011BB: X2A000271xxxx00

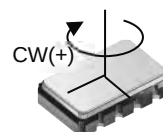
- SPI or I²C serial interface
- Angular rate output (16/24bit)
- Excellent bias stability over temperature
- Operating temperature range -20 °C to +80 °C
(Option: -40 °C to +85 °C)

- Built-in temperature sensor
- Built-in selectable digital filter
- Low power consumption

Recommended Application

- Anti vibration and attitude control for industrial applications etc.
- Motion detection for man machine interface

*The I2C-Bus is a trademark of NXP Semiconductors

**Specifications (characteristics)**

Item	Symbol	Specifications	Conditions / Remarks
Supply Voltage	VDDM	2.7 to 3.6 V	
Supply Voltage for interface	VDDI	1.65 V to 3.60 V	
Temperature range	Storage Temperature	T _{STG}	-40 °C to +85 °C
	Operating Temperature	T _{OPR}	-20 °C to +80 °C Option: -40 °C to +85 °C
Scale factor	S _o	280 LSB/(°/s) ±5 %	16bit, Ta=+25 °C
		71680 LSB/(°/s) ±5 %	24bit, Ta=+25 °C
Bias	ZRL	±1 %/s (0 LSB Typ.)	Ta=+25 °C
Bias over temperature	ZRL _t	±1 %/s	Variation from Ta = +25 °C
Rate range	I	±100 °/s	
Non linearity	NI	±0.5 %FS	Ta=+25 °C
Cross axes	CS	±5 %	Ta=+25 °C
Current consumption	I _{op1}	0.9 mA Typ.	Not communicating
Stand-by current	I _{op2}	160 µA Typ.	
Sleep current	I _{op3}	3 µA Typ.	
Noise	N _d	0.003 (°/s)/√Hz	at 10Hz

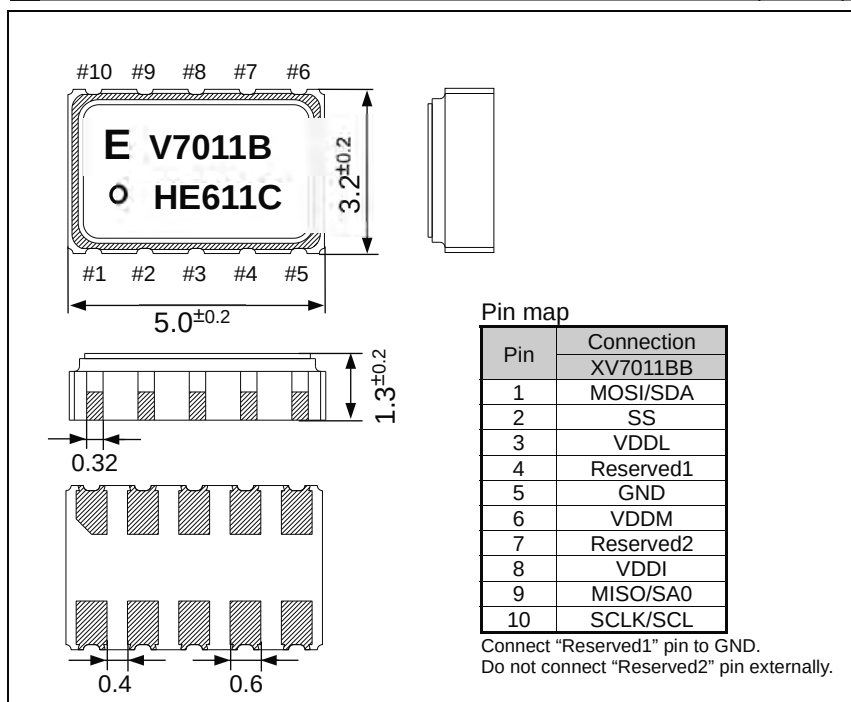
Product Name
(Standard form)

XV7011BB * *

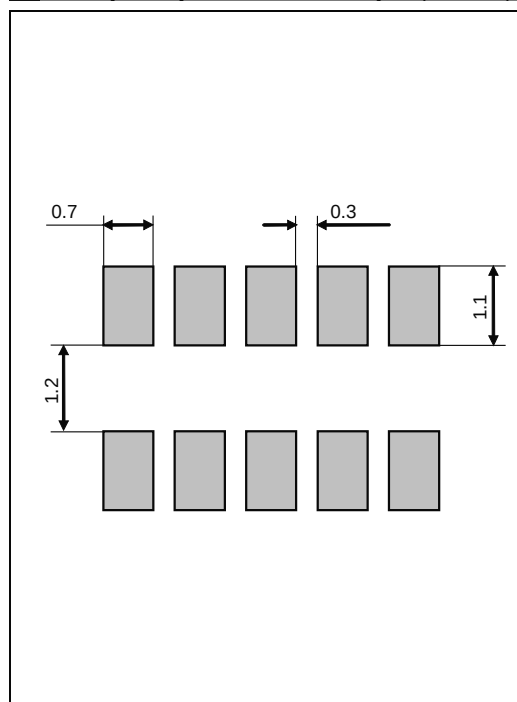
①Model ②Detection axis (1:Z-axis) ③Package type(B: Ceramic 5032size)
④Output (B: SPI/I²C) ⑤Frequency ⑥Custom recognition(not necessary to specify)

External Dimensions

(Unit:mm)

**Footprint (Recommended)**

(Unit:mm)





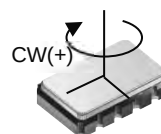
GYRO SENSOR (Digital Output)

XV7001BB



Product number
XV7001BB: X2A000261xxxx00

- SPI or I²C serial interface
- Angular rate output (16bit)
- Built-in temperature sensor
- Built-in selectable digital filter
- Low power consumption



Recommended Application

- Anti vibration and attitude control for industrial applications etc.
- Motion detection for man machine interface

*The I2C-Bus is a trademark of NXP Semiconductors

Specifications (characteristics)

Item	Symbol	Specifications	Conditions / Remarks
Supply Voltage	VDDM	2.7 to 3.6 V	
Supply Voltage for interface	VDDI	1.65 V to 3.60 V	
Temperature range	Storage Temperature	T _{STG}	-40 °C to +85 °C
	Operating Temperature	T _{OPR}	-20 °C to +80 °C
Scale factor	So	280 LSB/(°/s) ±5 %	16bit, Ta=+25 °C
Bias	ZRL	±1 %/s (0 LSB Typ.)	Ta=+25 °C
Bias over temperature	ZRL _t	±5 %/s	Variation from Ta = +25 °C
Rate range	I	±100 °/s	
Non linearity	NI	±0.5 %FS	Ta=+25 °C
Cross axes	CS	±5 %	Ta=+25 °C
Current consumption	Iop1	0.9 mA Typ.	Not communicating
Stand-by current	Iop2	160 µA Typ.	
Sleep current	Iop3	3 µA Typ.	
Noise	Nd	0.003 (°/s)/√Hz	at 10Hz

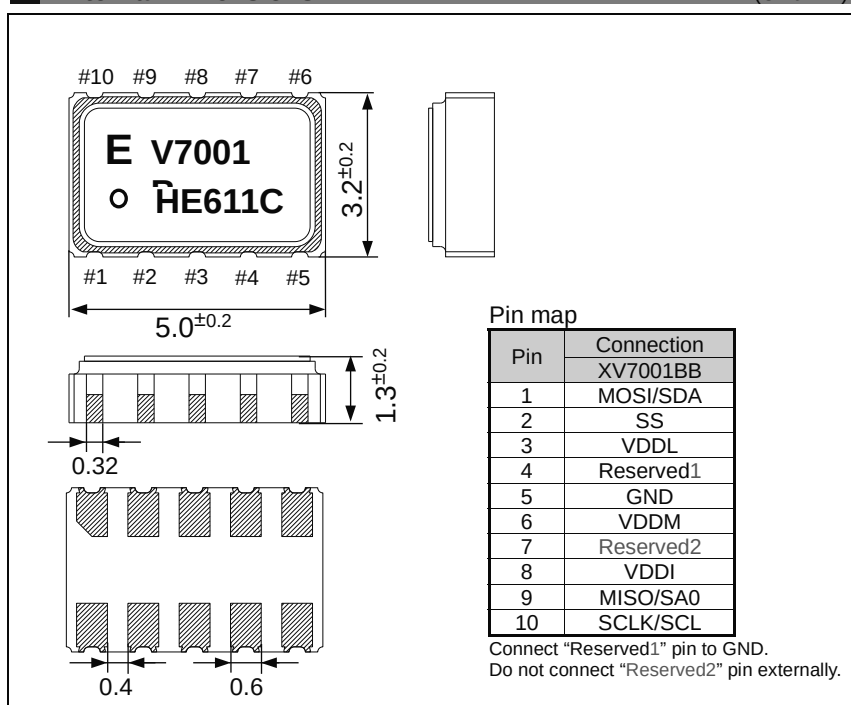
Product Name
(Standard form)

XV700 1 B B * *

- ①Model ②Detection axis (1:Z-axis) ③Package type(B: Ceramic 5032size)
④Output (B: SPI/I²C) ⑤Frequency ⑥Custom recognition(not necessary to specify)

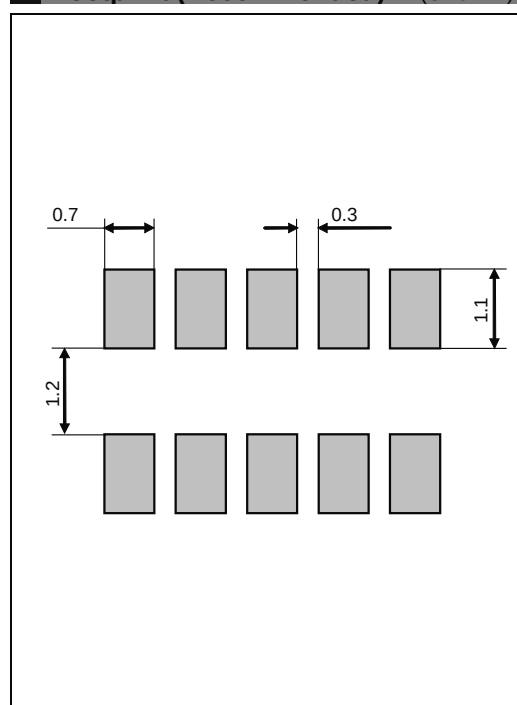
External Dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)



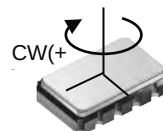


GYRO SENSOR

XV-3510CB



Product number
XV-3510CB:X2A000121xxxxxx



- Small Package size SMD(5.0 × 3.2 × 1.3 mm)
- Hermetic sealing provides excellent sustainable environmental capability
- High stability using vibration crystal

Recommended Application

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

Specifications (characteristics)

Item		Symbol	Specifications	Conditions / Remarks
			XV-3510CB	
Supply voltage		V _{DD}	3.0 V ±0.3 V	
Temperature range	Storage Temperature	T _{STG}	-40 °C to +85 °C	
	Operating Temperature	T _{OPR}	-20 °C to +80 °C	
Scale Factor		S ₀	3.0 mV/(°/s)	
Bias		V ₀	V _r ± 30 mV	T _a =+25 °C
Reference Voltage		V _r	1430 ± 20 mV	T _a =+25 °C
Rate Range		I	±300 °/s	
Non linearity		NL	±0.5 % FS	T _a =+25 °C
Phase Delay		φ ₂₀	9 deg.	at 20Hz phase delay angle
Current consumption		I _{op}	2.2 mA Typ.	V ₀ ,V _r : Output No load condition

Product Name
(Standard form)

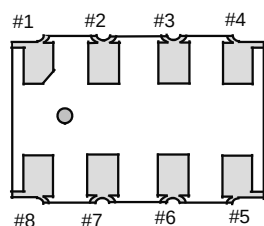
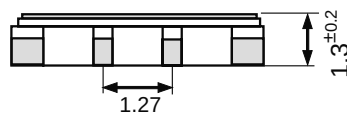
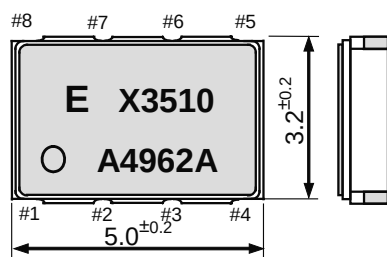
XV-3510 CB * ** .***** kHz

① ② ③ ④

①Model ②Package type ③Spec segment ④Frequency (not necessary to specify)

External Dimensions

(Unit:mm)



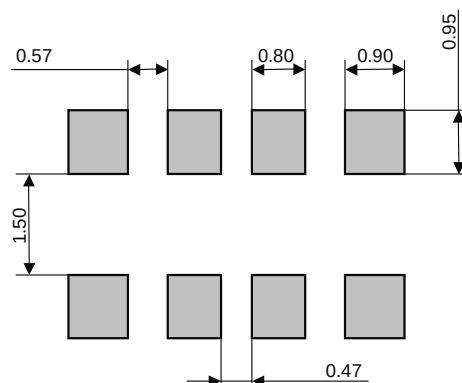
Pin map

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." pins externally.

Footprint (Recommended)

(Unit:mm)



Automotive Solutions
► kHz Crystal Unit

P	Model	Size [mm]	Nominal frequency range	Frequency Tolerance (+25 °C) [x 10 ⁻⁶]	Motional resistance Max. [kΩ]	Load capacitance [pF]	Operating temperature [°C]	Frequency vs temperature characteristics (Turnover Temperature: +25 °C Typ.)
111	FC-13A (AEC-Q200)	3.2 x 1.5 x 0.9t	● 32.768 kHz	±20 ±30 ±50	70	9 12.5	-40 to +125	Parabolic coefficient (B): -0.04 x 10 ⁻⁶ / °C ² Max. f _{tem} = B (Ti - θx) ²
112	MC-30A (AEC-Q200)	8.0 x 3.8 x 2.54t	● 32.768 kHz	±20 ±50	50	12.5	-40 to +85	

► kHz Crystal Oscillator
► SPXO

P	Model	Size [mm]	Nominal frequency range	Frequency Tolerance (+25 °C) [x 10 ⁻⁶]	Operating temperature (T _{use}) [°C]	Supply voltage [V]	Current consumption Max. [μA] (V _{CC} = 3.3 V, No load, T _{use})	Output load condition [pF]	Output control
113	SG-3031CMA (AEC-Q100)	3.2 x 1.5 x 0.9t	● 32.768 kHz	5 ± 23	-40 to +85	1.1 to 5.5	1.3	15	V _{IO}

► TCXO

P	Model	Size [mm]	Nominal frequency range	Frequency tolerance [x 10 ⁻⁶] / Operating temperature (T _{use}) [°C]	Supply voltage [V]	Current consumption Max. [μA] (V _{CC} = 3.3 V, No load, T _{use})	Output load condition [pF]	Output control
114	TG-3541CEA (AEC-Q100)	3.2 x 2.5 x 1.0t	● 32.768 kHz	±3.4 / -40 to +85 ±5.0 / -40 to +85 ±8.0 / +85 to +105	1.5 to 5.5	3.0	30	OE

► Real Time Clock Module
3.2 x 2.5 x 1.0t (CE package) Recommendation package

P	Model	Interface	Specifications								Functions					
			Operating temperature Ta [°C]		Frequency Tolerance [x 10 ⁻⁶]				Backup current consumption [µA] 3.0V							
			Min.	Max.	+25 °C	-40 °C to +85 °C	+85 °C to +105 °C	+105 °C to +125 °C	Typ. (25 °C)	Max. (Ta = Max.)	Time Stamp	Power Switch	EVIN pin	User Memory	Timer	Others
115	RA8000CE (AEC-Q100)	I ² C	-40	+125	-	± 5.0	± 8.0	± 50.0	0.3	1.7	2	-	0 or 2	-	24 bit x 1 ch. to 32 years	Reset output with Delay, SOUT pin
117	RA4000CE (AEC-Q100)	SPI	-40	+125	-	± 5.0	± 8.0	± 50.0	0.3	1.7	2	-	0 to 2	-	24 bit x 1 ch. to 32 years	Reset output with Delay, SOUT pin
119	RA8804CE (AEC-Q100)	I ² C	-40	+105	-	± 3.4	± 8.0	-	0.35	1.5	1	-	1	-	16 bit x 1ch. to 7.5 years	SOUT pin
120	RA8900CE (AEC-Q200)	I ² C	-40	+85	-	± 5.0	-	-	0.7	1.4	-	✓	-	-	12 bit x 1ch. to 2.8 days	Built-in Temp. Sensor

10.1 x 7.4 x 3.3t (SA package / SOP-14 pin)

P	Model	Interface	Specifications							Functions					
			Operating temperature Ta [°C]		Frequency Tolerance [x 10 ⁻⁶]			Backup current consumption [μA] 3.0 V							
			Min.	Max.	+25 °C	-40 °C to +85 °C	-40 °C to +105 °C	Typ. (25 °C)	Max. (Ta = Max.)	Time Stamp	Power Switch	EVIN pin	User Memory	Timer	Others
Web Site	RA8803SA (AEC-Q200)	I ² C	-40	+85	-	± 3.4 ± 5.0	-	0.75	2.1	-	-	1	-	to 2.8 days	Time sync. with 1 PPS
Web Site	RA4803SA (AEC-Q200)	SPI						0.75	2.1	-	-	1	-	to 2.8 days	Time sync. with 1 PPS
Web site	RA-4565SA (AEC-Q200)	SPI			5 ± 23	-		0.8	1.6	-	-	-	-	to 255 min.	

► MHz Crystal Unit

P	Model	Size [mm]	Nominal frequency range	Frequency tolerance (+25 °C) [x 10 ⁻⁶]	Frequency vs. temperature characteristics [x10 ⁻⁶] / Operating temperature [°C]	Motional resistance Max. [Ω]	Load Capacitance [pF]	Operating temperature [°C]
121	FA2016AA (AEC-Q200)	2.0 x 1.6 x 0.5t	19.2 MHz 54 MHz	±10	±20 / -40 to +85 ±50 / -40 to +125	150 (19.2 ≤ f < 20 MHz) 100 (20 ≤ f < 24 MHz) 80 (24 ≤ f < 26 MHz) 60 (26 ≤ f ≤ 54 MHz)	6 to ∞	-40 to +125
122	FA-238A (AEC-Q200)	3.2 x 2.5 x 0.7t	12 MHz 50 MHz	±15	±30 / -40 to +85	120 (12 ≤ f ≤ 13 MHz) 80 (13 < f < 20 MHz) 60 (20 ≤ f < 25 MHz) 50 (25 ≤ f ≤ 50 MHz)	7 to ∞	-40 to +125

► MHz Crystal Unit (Built-in Thermistor)

P	Model	Size [mm]	Nominal frequency range	Frequency tolerance (+25 °C) [x 10 ⁻⁶]	Frequency vs. temperature characteristics [x10 ⁻⁶] / Operating temperature [°C]	Motional resistance Max. [Ω]	Load Capacitance [pF]	Operating temperature [°C]
123	FA2016ASA (AEC-Q200)	2.0 × 1.6 × 0.68t	● 38.4 MHz	±10	±12 / -30 to +85 ±30 / -40 to +105	50	6 to ∞	-40 to +105

*1 Please contact us about reference temperature.

► Fixed-Frequency SPXO

P	Model	Size [mm]	Nominal frequency range	Frequency Tolerance [x 10 ⁻⁶]	Operating temperature [°C]	Supply voltage [V]	Current consumption Max. [mA]	Output load condition [pF]	Output control
124	SG2016CAA (AEC-Q200)	2.0 × 1.6 × 0.7t	 1 MHz 75 MHz 1.2 MHz (SG2016CAA)	±50, ±100 ±50, ±100 ±100, ±150	-40 to +85 -40 to +105 -40 to +125	1.6 to 2.2	2.9	15	ST
	SG2520CAA (AEC-Q200)	2.5 × 2.0 × 0.8t				2.2 to 2.7	3.3		
						2.7 to 3.6	3.5		

► Programmable SPXO

P	Model	Size [mm]	Nominal frequency range	Frequency Tolerance [x 10 ⁻⁶]	Operating temperature [°C]	Supply voltage [V]	Current consumption Max. [mA]	Output load condition [pF]	Output control
125	SG-8201CJA (AEC-Q100)	2.0 × 1.6 × 0.6t	 1.2 MHz 170 MHz	±15 ±25 / ±50	-40 to +105 -40 to +125	1.62 to 1.98	10.4	15	OE or ST
						2.25 to 2.75	12.4		
						2.97 to 3.63	15.0		
127	SG-8101CGA (AEC-Q100)	2.5 × 2.0 × 0.7t	 0.67 MHz 170 MHz	±15 ±20 ±50 / ±100	-40 to +85 -40 to +105 -40 to +125	1.62 to 1.98	5.5	15	OE or ST
						1.98 to 2.20	5.8		
						2.20 to 2.80	6.7		
						2.70 to 3.63	8.1		
129	SG-9101CGA (AEC-Q100)	2.5 × 2.0 × 0.7t	 0.67 MHz 170 MHz	±0.25 to ±2.0 -0.5 to -4.0	-40 to +125	1.62 to 1.98	5.8	15	OE or ST
						1.98 to 2.20	6.1		
						2.20 to 2.80	7.0		
						2.70 to 3.63	8.4		

► RF Transmitter Module

P	Model	Size [mm]	Feature	Operating Temperature [°C]	Supply voltage [V]	Current consumption Max. [mA]
95 131	SR3225SAA (AEC-Q100)	3.2×2.5×1.0t	UHF range wireless transmitter module. 300 ~ 400 MHz (0.25 kHz step) 600 ~ 930 MHz (0.49 kHz step) Modulation types: ASK / OOK / FSK SPI interface	-40 to +85	1.8 to 3.6	16

► High Precision Oscillator (TCXO / VC-TCXO)

P	Model	Size [mm]	Nominal frequency range	Frequency tolerance (× 10 ⁻⁶)	Frequency / Temperature Characteristics (× 10 ⁻⁶)	Operating temperature [°C]	Supply voltage [V]	Current consumption Max. [mA]	Output load condition	Output control
132	TG2016SKA (AEC-Q100)	2.0 × 1.6 × 0.7t	13 MHz 55 MHz	±2.0	±0.5	-40 to +105	1.8 ± 0.1 3.3 ± 5 %	2.0 (≤ 40 MHz) 2.5 (≤ 55 MHz)	10 kΩ/10 pF	ST
133	TG2016SLA (AEC-Q100)	2.0 × 1.6 × 0.7t	13 MHz 55 MHz	±2.0	±0.5	-40 to +85	1.8 ± 0.1 3.3 ± 5 %	2.0 (≤ 40 MHz) 2.5 (≤ 55 MHz)	10 kΩ/10 pF	ST

► Gyro sensor for automotive

P	Model	Size [mm]	Supply Voltage [V]	Interface Type	Bias	Rate Range [°/s]	Scale Factor [mV/(°/s)]	Non Linearity [%FS]	Operating Temperature [°C]	Recommended Application
134	XV4001KC (AEC-Q200)	6.0×4.8×3.3t Inclined	3.0 to 3.6	Digital (I ² C-Bus)	0 [LSB] Typ. ⊕ 2 [°/s]	±70	370 [LSB/(°/s)] ⊕ 1.5 [%]	± 0.5	-40 to +85	Car navigation system
	XV4001KD (AEC-Q200)			Digital (SPI-Bus)						
	XV4001BC (AEC-Q200)	5.0×3.2×1.3t		Digital (I ² C-Bus)						
	XV4001BD (AEC-Q200)			Digital (SPI-Bus)						

► Gyro sensor for automotive

P	Model	Size [mm]	Supply Voltage [V]	Interface Type	Bias	Rate Range [°/s]	Scale Factor [mV/(°/s)]	Non Linearity [%FS]	Operating Temperature [°C]	Recommended Application
Web site	XV-9100CD (AEC-Q100)	5.0×5.0×1.3t	4.75 to 5.25	Analog Voltage	0.5 × V _{DD} [V]	±100	0.004 × V _{DD}	± 0.5	-40 to +105	Electric Stability Control System, Rollover Protection System
	XV-9300CD (AEC-Q100)					±300	0.0012 × V _{DD}			
Web site	XV-9100LV (AEC-Q100)	7.0×6.8×3.3t				±100	0.004 × V _{DD}		-40 to +125	
	XV-9300LV (AEC-Q100)	9.5×5.0×7.2t				±300	0.0012 × V _{DD}			
	XV-9100LP (AEC-Q100)					±100	0.004 × V _{DD}			
	XV-9300LP (AEC-Q100)					±300	0.0012 × V _{DD}			
134	XV4001KC (AEC-Q200)	6.0×4.8×3.3t Inclined	3.0 to 3.6	Digital (I ² C-Bus)	0 [LSB] Typ. ± 2 [°/s]	±70	370 [LSB/(°/s)] ±1.5 [%]	± 0.5	-40 to +85	Car navigation system
	XV4001KD (AEC-Q200)			Digital (SPI-Bus)						
	XV4001BC (AEC-Q200)	5.0×3.2×1.3t		Digital (I ² C-Bus)						
	XV4001BD (AEC-Q200)			Digital (SPI-Bus)						

kHz RANGE CRYSTAL UNIT
For AutomotiveProduct Number
X1A000091xxxx00

FC-13A

- Frequency range : 32.768 kHz
- External dimensions : $3.2 \times 1.5 \times 0.9$ mm
- Overtone order : Fundamental
- Applications : Car audio, ECU sub clock,
Car navigation system, Clock
- AEC-Q200 compliant



Specifications (characteristics)

Item	Symbol	Specifications	Conditions / Remarks
Nominal frequency range	f_nom	32.768 kHz	
Storage temperature range	T_stg	-55 °C to +125 °C	Storage as single product.
Operating temperature range	T_use	-40 °C to +125 °C	
Level of drive	DL	0.5 μ W (1.0 μ W Max.)	Please contact us if you require 1.0 μ W Max.
Frequency tolerance (standard)	f_tol	$\pm 20 \times 10^{-6}$, $\pm 30 \times 10^{-6}$, $\pm 50 \times 10^{-6}$	+25 °C, DL = 0.1 μ W
Turnover temperature	Ti	+25 °C $\pm$ 5 °C	
Parabolic coefficient	B	-0.04×10^{-6} / °C ² Max.	
Load capacitance	CL	9 pF, 12.5 pF	Please specify
Motional resistance (ESR)	R1	70 k Ω Max.	
Motional capacitance	C1	3.2 fF Typ.	
Shunt capacitance	C0	0.9 pF Typ.	
Frequency aging	f_age	$\pm 3 \times 10^{-6}$ / year Max.	+25 °C, First year

Product name

Product name FC-13A 32.768000kHz 12.5 +20.0-20.0

(Standard form)

①

②

③

④

①Model

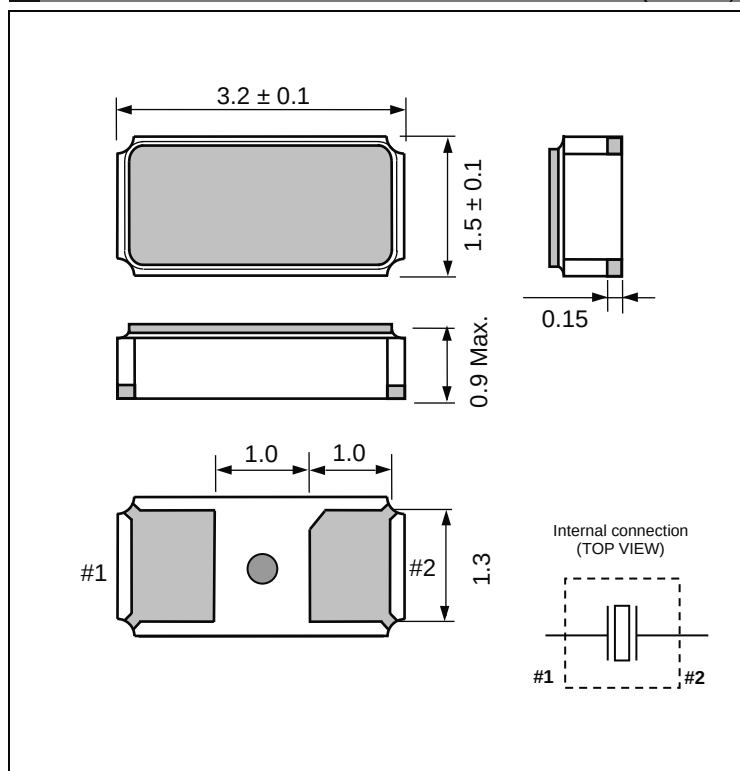
②Frequency

③Load capacitance (pF)

④Frequency tolerance ($\times 10^{-6}$, +25 °C)

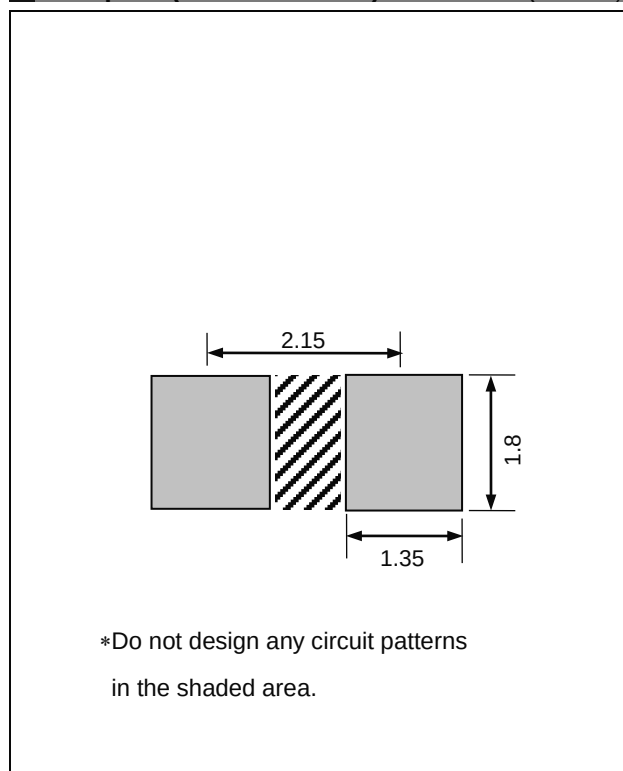
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





kHz RANGE CRYSTAL UNIT For Automotive



Product Number
Q1xMC30A2xxxx00

MC-30A

- Frequency range : MC-30A
- External dimensions : $8.0 \times 3.8 \times 2.54$ mm
- Overtone order : Fundamental
- Applications : Car audio, ECU sub clock,
Car navigation system, Clock
- AEC-Q200 compliant



Specifications (characteristics)

Item	Symbol	Specifications	Conditions / Remarks
Nominal frequency range	f_nom	32.768 kHz	
Storage temperature	T_stg	-55 °C to +125 °C	Storage as single product.
Operating temperature	T_use	-40 °C to +85 °C	
Level of drive	DL	1.0 μ W Max.	
Frequency tolerance (standard)	f_tol	$\pm 20 \times 10^{-6}$, $\pm 50 \times 10^{-6}$	+25 °C, DL=0.1 μ W
Turnover temperature	Ti	+25 °C $\pm$ 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 k Ω Max.	
Motional capacitance	C1	1.8 fF Typ.	
Shunt capacitance	C0	0.9 pF Typ.	
Frequency aging	f_age	$\pm 3 \times 10^{-6}$ / year Max.	+25 °C, First year

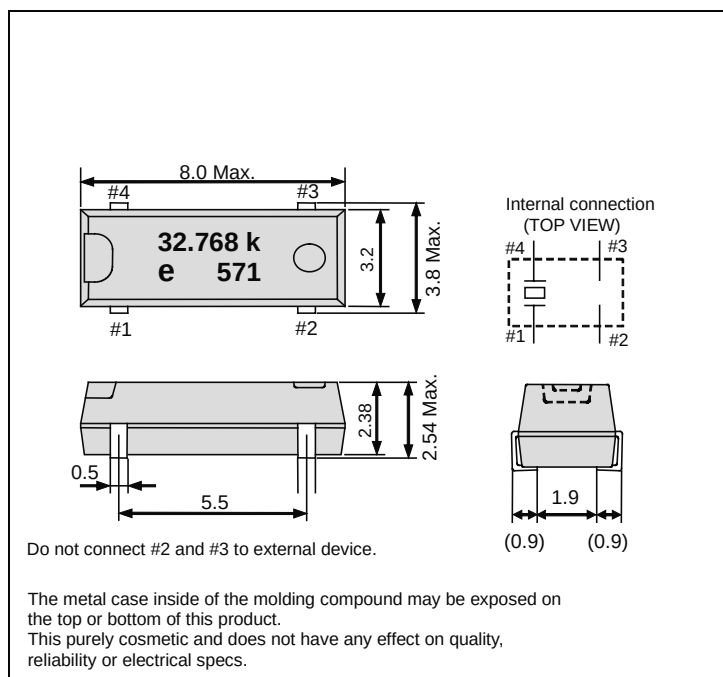
Product name

Product name (Standard form) MC-30A 32.768000kHz 12.5 +20.0-20.0

① Model ② Frequency ③ Load capacitance(pF) ④ Frequency tolerance($\times 10^{-6}$, +25 °C)

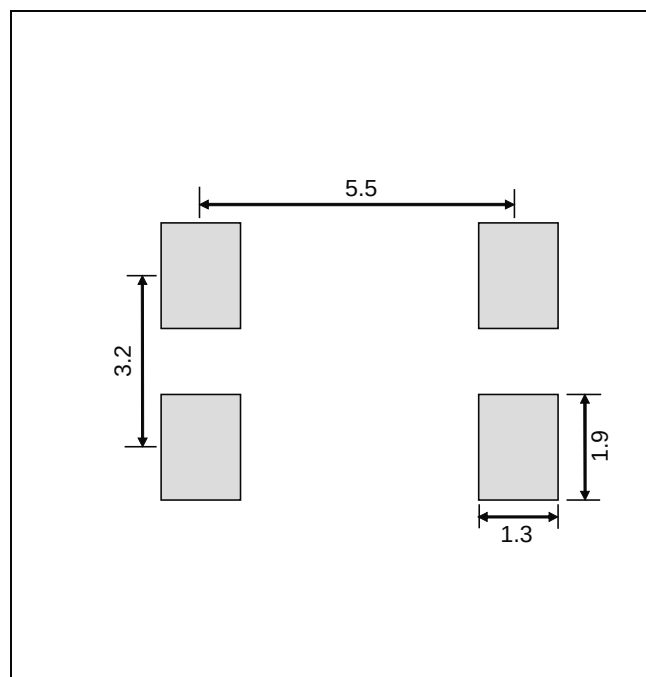
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)



**CRYSTAL OSCILLATOR (SPXO)
FOR AUTOMOTIVE**
32.768 kHz



Product Number
SG-3031CMA : X1B000401A00116

SG-3031CMA



- Built-in 32.768 kHz crystal unit allows adjustment-free efficient operation.
- Operation temperature -40 °C to +105 °C
- Use of CMOS IC enables reduction of current consumption.
- V_{IO} controls swing amplitude.
- AEC-Q100 compliant

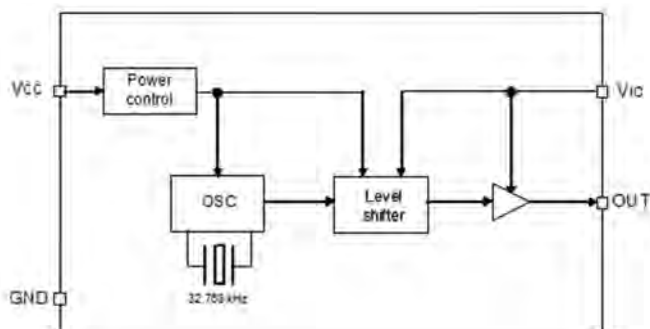
- Applications
Infotainment and communication devices, Body (ECU*)
Clock for Time counting and Sleep function. *ECU: Electronic control unit

Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Output frequency range	f_o	32.768 kHz	
Supply voltage	V_{CC}	1.2 V to 5.5 V	$V_{CC} < 1.5$ V, $V_{IO} = V_{CC}$
Interface power supply voltage	V_{IO}	1.2 V to 5.5 V	
Storage temperature range	T_{stg}	-55 °C to +125 °C	Store as bare product after unpacking
Operating temperature range	T_{use}	-40 °C to +105 °C	
Frequency tolerance	f_{tol}	$+5 \pm 23 \times 10^{-6}$	+25 °C, $V_{CC} = 3.3$ V
Frequency temperature coefficient	f_o -Tc	-120×10^{-6} to $+10 \times 10^{-6}$	-20 °C to +70 °C ($V_{CC} = 3.3$ V +25 °C is reference)
		-240×10^{-6} to $+10 \times 10^{-6}$	-40 °C to +85 °C ($V_{CC} = 3.3$ V +25 °C is reference)
		-420×10^{-6} to $+10 \times 10^{-6}$	-40 °C to +105 °C ($V_{CC} = 3.3$ V +25 °C is reference)
Frequency voltage coefficient	f_o - V_{CC}	$\pm 1 \times 10^{-6}$ / V Max.	$V_{CC} = 1.5$ V to 5.5 V
		$\pm 5 \times 10^{-6}$ / V Max.	$V_{CC} = 1.2$ V to 1.5 V
Current consumption (V_{CC} Pin)	I_{CC}	0.30 μ A Typ. / 0.65 μ A Max.	$V_{CC} = 1.2$ V to 5.5 V
Current consumption (V_{CC} + V_{IO} Pin)	$I_{CC}+I_{IO}$	0.38 μ A Typ.	$V_{CC} = V_{IO} = 1.2$ V, No load condition
		0.65 μ A Typ. / 1.3 μ A Max. (+105 °C)	$V_{CC} = V_{IO} = 3.3$ V, No load condition
Symmetry	SYM	45 % to 55 %	1/2 V_{CC} (V_{IO}) level, 1.5 V to 5.5 V
		40 % to 60 %	1/2 V_{CC} (V_{IO}) level, $V_{CC} < 1.5$ V
Output voltage	V_{OH} / V_{OL}	$V_{IO} - 0.4$ V Min. / 0.4 V Max.	$I_{OH} = -0.4$ mA / $I_{OL} = 0.4$ mA, $V_{IO} = 1.5$ V to 5.5 V
		$V_{IO} - 0.2$ V Min. / 0.2 V Max.	$I_{OH} = -0.1$ mA / $I_{OL} = 0.1$ mA, $V_{IO} = 1.2$ V to 1.5 V
Output load condition (CMOS)	L_{CMOS}	15 pF Max.	CMOS load
Rise time / Fall time	t_r/t_f	200 ns Max.	20 % V_{IO} to 80 % V_{IO} level, $V_{IO} = 1.2$ V to 5.5 V
		100 ns Max.	20 % V_{IO} to 80 % V_{IO} level, $V_{IO} = 1.8$ V to 5.5 V
Start-up time	t_{str}	0.15 s Typ. / 0.45 s Max.	$V_{CC} = 1.5$ V to 5.5 V
		1.0 s Max.	$V_{CC} = 1.2$ V to 1.5 V
Frequency aging	f_{age}	$\pm 5 \times 10^{-6}$ / 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.

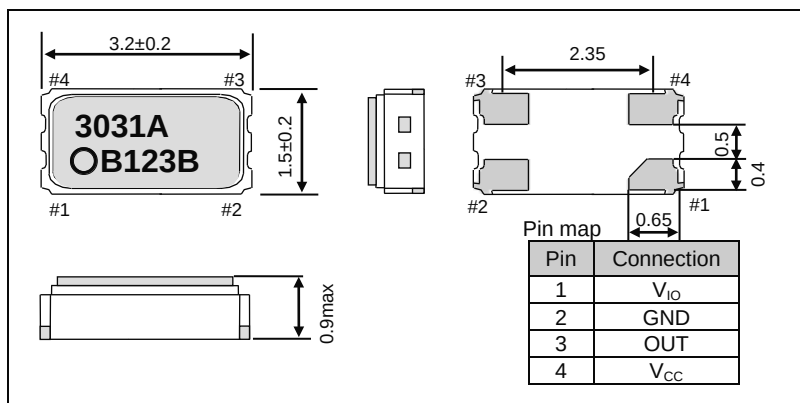
Block diagram



V_{IO} is a power supply pin for OUT output and can also be used as an OE pin. Set V_{IO} to 0 V when setting Disable.
 V_{CC} is a power supply pin for operating the 32.768 kHz oscillation.
Power consumption can be minimized by minimizing the applied voltage of both power supplies. However, when $V_{CC} < 1.5$ V, $V_{IO} = V_{CC}$.

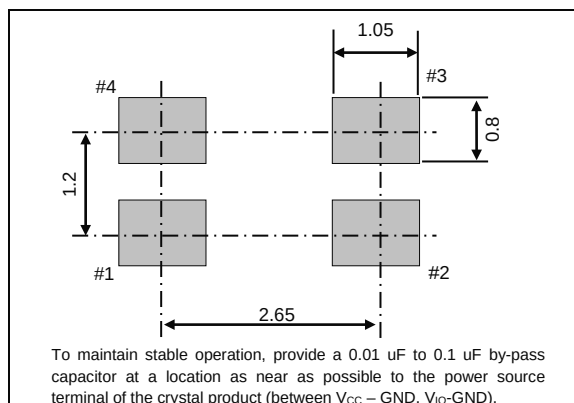
External dimension

(Unit:mm)



Footprint(rference)

(Unit:mm)





TCXO
For Automotive



Product Number
TG-3541CEA XA : X1B000361A00100
TG-3541CEA XB : X1B000361A00200

TG-3541CEA

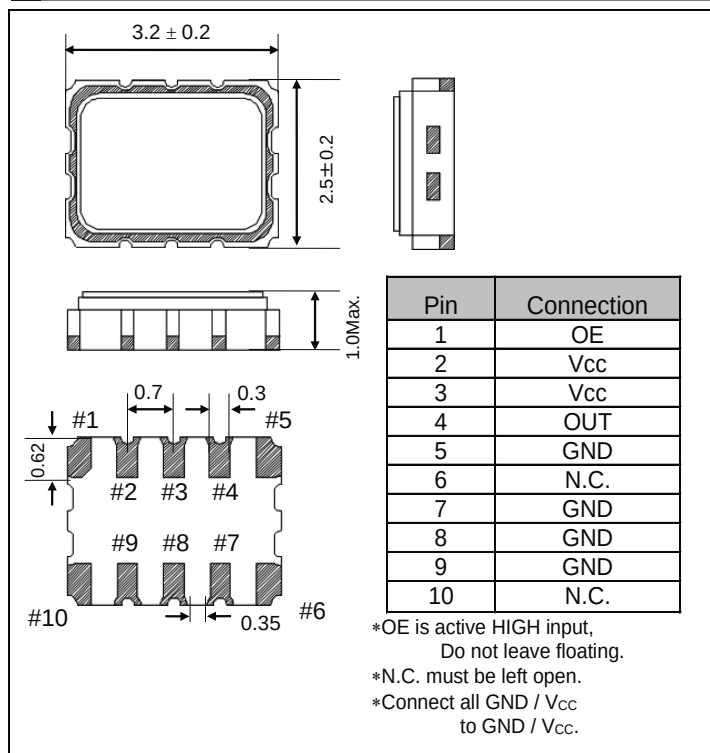
- Output frequency : 32.768 kHz
- Built-in 32.768 kHz-DTCXO
- Supply voltage : 1.5 V to 5.5 V
- Frequency / Temperature Characteristics
 - XA $\pm 1.9 \times 10^{-6}$ (0 °C to +50 °C)
 - $\pm 3.4 \times 10^{-6}$ (-40 °C to +85 °C)
 - $\pm 8.0 \times 10^{-6}$ (+85 °C to +105 °C)
 - XB $\pm 3.8 \times 10^{-6}$ (0 °C to +50 °C)
 - $\pm 5.0 \times 10^{-6}$ (-40 °C to +85 °C)
 - $\pm 8.0 \times 10^{-6}$ (+85 °C to +105 °C)
- AEC-Q100 compliant



Specifications (characteristics)

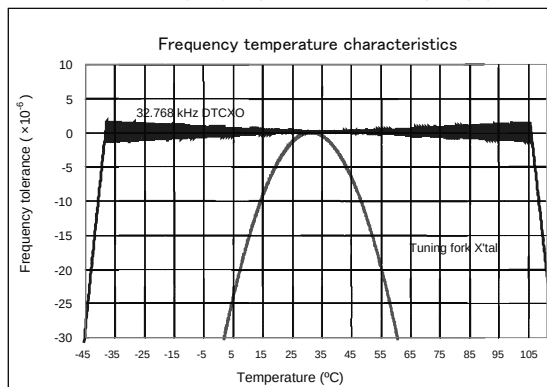
Item	Symbol	Specifications	Conditions
Output frequency range	f _o	32.768 kHz	
Supply voltage	V _{CC}	1.5 V to 5.5 V	
Storage temperature	T _{stg}	-55 °C to +125 °C	
Operating temperature	T _{use}	-40 °C to +105 °C	
Frequency / Temperature Characteristics	fo_Tc	XA	$\pm 1.9 \times 10^{-6}$ Ta = 0 °C ~ +50 °C
			$\pm 3.4 \times 10^{-6}$ Ta = -40 °C ~ +85 °C
			$\pm 8.0 \times 10^{-6}$ Ta = +85 °C ~ +105 °C
	fo_Tc	XB	$\pm 3.8 \times 10^{-6}$ Ta = 0 °C ~ +50 °C
			$\pm 5.0 \times 10^{-6}$ Ta = -40 °C ~ +85 °C
			$\pm 8.0 \times 10^{-6}$ Ta = +85 °C ~ +105 °C
Current consumption	I _{CC}	1.0 μ A Typ./3.0 μ A Max.	No load condition, V _{CC} = 3.0 V
Disable current	I _{dis}	1.5 μ A Max.	OE=GND, V _{CC} = 3.0 V
Symmetry	SYM	40 % to 60 %	50 % V _{CC} level
Output voltage	V _{OH}	80 % V _{CC} Min.	IOH=-0.5 mA, V _{CC} =3.0 V
	V _{OL}	20% V _{CC} Max.	IOL=0.5 mA, V _{CC} =3.0 V
Output load condition(CMOS)	L _{CMOS}	30 pF Max.	
Start-up time	t _{str}	1 s Max.	Ta= +25 °C, V _{CC} =1.5 V to 5.5 V
Frequency aging	f _{aging}	$\pm 3 \times 10^{-6}$	Ta= +25°C, V _{CC} =3.0 V, first year

External dimensions (Unit:mm)



Frequency temperature characteristics

■ 32.768 kHz-DTCXO Frequency temperature characteristics (Example)



REAL TIME CLOCK MODULE (I²C)

For Automotive, Built-in 32.768 kHz DTCXO,
High Stability, +125 °C

RA8000CE

- Built in frequency adjusted 32.768 kHz crystal unit and DTCXO
- Interface Type : I²C-Bus
- Time stamp function : 2 times stamped from year to second
- Reset functions with a delay : Detect a main power supply and remove the reset
- Interrupt output : Wake up every minute or every second
- Alarm interruption : Day, date, hour, minute, second
- Auto repeat wakeup timer interruption
- Self-monitoring interruption : Crystal oscillation stop, V_{DD} low
- AEC-Q100 compliant

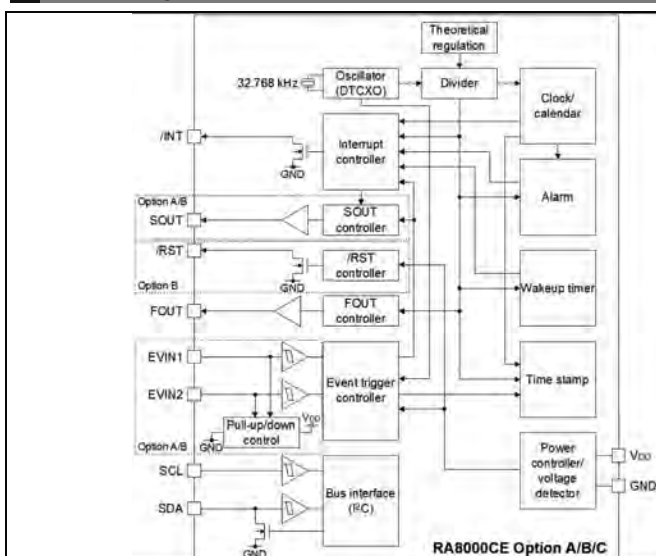


Product Number (2,000 pcs / Reel)
RA8000CE YB A0 : X1B000501A00115
RA8000CE YB B8 : X1B000501A00915
RA8000CE YB C0 : X1B000501A01015



RA8000CE
(3.2 × 2.5 mm, t = 1.0 mm Max.)

Block diagram



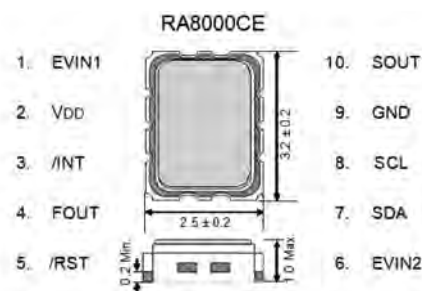
Overview

- Interface type
I²C-Bus interface Fast-Mode 400 kHz
- High stability
YB : $\pm 5.0 \times 10^{-6}$ / -40 °C to +85 °C (Monthly rate: ± 13.2 seconds)
 $\pm 8.0 \times 10^{-6}$ / +85 °C to +105 °C (Monthly rate: ± 21 seconds)
 $\pm 50.0 \times 10^{-6}$ / +105 °C to +125 °C (Monthly rate: ± 132 seconds)
- Clock output function
Output frequency is selectable from 32.768 kHz, 1024 Hz, 1 Hz
- Wakeup timer function
Can generate an interrupt in 976.56 μ s to 32-year cycle.
Can be used as a time integration meter.
Can be used as a watchdog timer.
- Time stamp function
Record data: 1/1024 seconds to 1 second, seconds, minutes, hours, days, months, years.
Number of recordable events: 2 events
Trigger source: External event (EVIN) input, voltage drop/oscillation stop status detected, command input from the host.
EVIN pin has function of chattering-cancel.
- Reset function with a delay
Can output a reset signal when a V_{DD} voltage drop status is detected.
- Status output (SOUT)
Can output the selected internal flag (interrupt flag, voltage drop detection flag) status.

Pin Function

Signal Name	I / O	Function
EVIN1, 2	Input	External event input pins Pull-up and pull-down is configurable by the resistors
SCL	Input	Serial clock input pin
SDA	Input / Output	Serial data input and output pin
FOUT	Output	Frequency output pin (CMOS). 32.768 kHz (default), 1024 Hz or 1 Hz clock output is selectable. This pin can be switched to the wakeup timer interrupt output (CMOS)
/INT	Output	Interrupt output pin (N-ch. open drain). The wakeup timer, time update, alarm, and/or event detection interrupt signals can be selected to output from this pin. When two or more signals are selected, they are NORed before being output.
/RST	Output	Reset output pin (N-ch. open drain)
SOUT	Output	Status output pin
V _{DD}	-	Power-supply pin
GND	-	Ground pin

Terminal connection / External dimensions (Unit: mm)



*The above diagram is the terminal layout for Option B.
For other options, please refer to the Pin Option section.

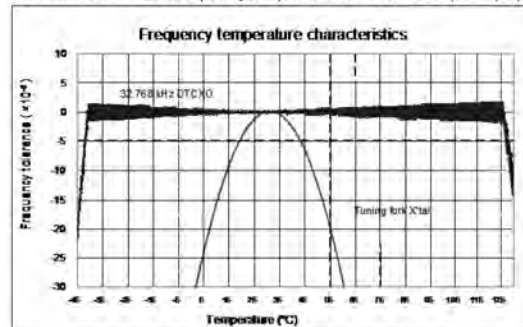
Specifications (characteristics)

* Refer to application manual for details

■ Electrical Characteristics

Item	Symbol	Conditions		Min.	Typ.	Max.	Unit		
Operating voltage	V _{DD}	-		1.6	3.0	5.5	V		
Temp. compensated Voltage	V _{TEM}	-		1.6	3.0	5.5	V		
Clock supply voltage	V _{CLK}	-		1.3	3.0	5.5	V		
Operating temperature	T _a	-		-40	+25	+125	°C		
Frequency tolerance	$\Delta f / f$	YB	T _a = -40 °C to +85 °C			±5.0	x 10 ⁻⁶		
			T _a = +85 °C to +105 °C			±8.0			
			T _a = +105 °C to +125 °C			±50.0			
Current consumption	I _{DD1}	/INT = Hi-Z, FOUT: Output OFF (Hi-Z), Temp. Compensation interval 2.0 s, SCL = SDA = H	No /RST pin	V _{DD} = 5 V	-	0.35	1.8	μA	
	I _{DD2}			V _{DD} = 3 V	-	0.3			1.7
	I _{DD11}		With /RST pin	V _{DD} = 5 V	-	1.5			3.7
	I _{DD12}			V _{DD} = 2 V	-	0.6			2.25

■ 32.768 kHz-DTCXO Frequency temperature characteristics (Example)





Pin Option

Pin No.	Pin name		
	Option A	Option B	Option C
1	EVIN1		N.C.
2	V _{DD}		
3	/INT		
4	FOUT		
5	N.C.	/RST	N.C.
6	EVIN2		N.C.
7	SDA		
8	SCL		
9	GND		
10	SOUT		N.C.

Pin name	No.	No.	Pin name
EVIN1	1	10	SOUT
V _{DD}	2	9	GND
/INT	3	8	SCL
FOUT	4	7	SDA
N.C.	5	6	EVIN2

Option A

Pin name	No.	No.	Pin name
EVIN1	1	10	SOUT
V _{DD}	2	9	GND
/INT	3	8	SCL
FOUT	4	7	SDA
/RST	5	6	EVIN2

Option B

Pin name	No.	No.	Pin name
N.C.	1	10	N.C.
V _{DD}	2	9	GND
/INT	3	8	SCL
FOUT	4	7	SDA
N.C.	5	6	N.C.

Option C

Product name

RA8000CE YB A 0

① ② ③④

- ① Model CE type package 3.2 x 2.5 x 1.0 mm
- ② Frequency tolerance
 - YB: $\pm 5.0 \times 10^{-6}$ / -40 °C to +85 °C (Monthly rate: ± 13.2 seconds)
 - $\pm 8.0 \times 10^{-6}$ / +85 °C to +105 °C (Monthly rate: ± 21 seconds)
 - $\pm 50.0 \times 10^{-6}$ / +105 °C to +125 °C (Monthly rate: ± 132 seconds)
- ③ Pin Option
 - A: Option A
 - B: Option B
 - C: Option C
- ④ Reset output function
 - 0: No /RST pin
 - 8: With /RST pin (V_{DD} drop detection voltage: +2.4 V Typ.)



Product Number (2,000 pcs / Reel)

RA4000CE YB A0 : X1B000491A00115

RA4000CE YB B8 : X1B000491A00915

RA4000CE YB C0 : X1B000491A01015

RA4000CE YB D0 : X1B000491A01115

RA4000CE YB E8 : X1B000491A01915

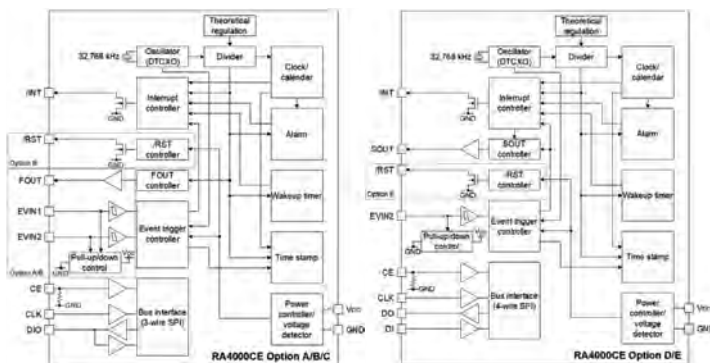
REAL TIME CLOCK MODULE (SPI)For Automotive, Built-in 32.768 kHz DTCXO,
High Stability, +125 °C**RA4000CE**

- Built in frequency adjusted 32.768 kHz crystal unit and DTCXO
- Interface Type : 3 wire / 4 wire SPI-Bus
- Time stamp function : 2 time stamps from year to second
- Reset functions with a delay : Output a reset signal when a V_{DD} voltage drop status is detected.
- Interrupt output : Wake up every minute or every second
- Alarm interruption : Day, date, hour, minute, second
- Auto repeat wakeup timer interruption
- Self-monitoring interruption : Crystal oscillation stop, V_{DD} low
- AEC-Q100 compliant



RA4000CE

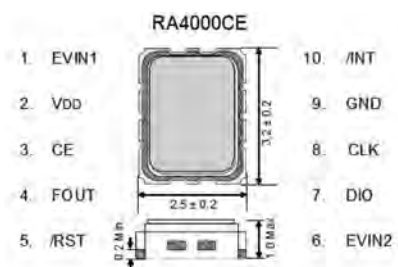
(3.2 × 2.5 mm, t = 1.0 mm Max.)

Block diagram**Overview**

- Interface type
3 wire / 4 wire SPI-Bus
- High stability
± 5.0 × 10⁻⁶ / -40 °C to +85 °C (Monthly rate: ±13.2 seconds)
± 8.0 × 10⁻⁶ / +85 °C to +105 °C (Monthly rate: ±21 seconds)
± 50.0 × 10⁻⁶ / +105 °C to +125 °C (Monthly rate: ±132 seconds)
- Clock output function
Selectable from 32.768 kHz, 1024 Hz and 1 Hz outputs
- Wakeup timer function
Selectable from 976.56 μs to 32 years cycle
Can be used as a time integration meter
Can be used like a watchdog timer
- Time stamp function
Record data: 1/1024 seconds to 1 second, seconds, minutes, hours, days, months, years
Number of recordable events: 2 events
Trigger source: External event (EVIN) input, voltage drop/oscillation stop status detected, command input from the host
EVIN pin has function of chattering-cancel
- Reset function with a delay
Can output a reset signal when a V_{DD} voltage drop status is detected
- Status output (SOUT)
Can output the selected internal flag (interrupt flag, voltage drop detection flag) status.

Pin Function

Signal Name	I / O	Function
EVIN1, 2	Input	External event input pins Pull-up and pull-down is configurable by the registers
CE	Input	Slave select input pin A pull-down resistor (Typ. 300 kΩ) is included
CLK	Input	Serial clock input pin
DI	Input	Serial data input pin (4 wire)
DO	Output	Serial data Output pin (4 wire)
DIO	Input / Output	Serial data input/output pin (3 wire)
FOUT	Output	Frequency output pin (CMOS). 32.768 kHz (default), 1024 Hz or 1 Hz clock output is selectable. This pin can be switched to the wakeup timer interrupt output (CMOS)
/INT	Output	Interrupt output pin (N-ch. open drain). The wakeup timer, time update, alarm, and/or event detection interrupt signals can be selected to output from this pin. When two or more signals are selected, they are NORed before being output.
/RST	Output	Reset output pin (N-ch. open drain)
SOUT	Output	Status output pin
V _{DD}	-	Power-supply pin
GND	-	Ground pin

Terminal connection / External dimensions (Unit: mm)

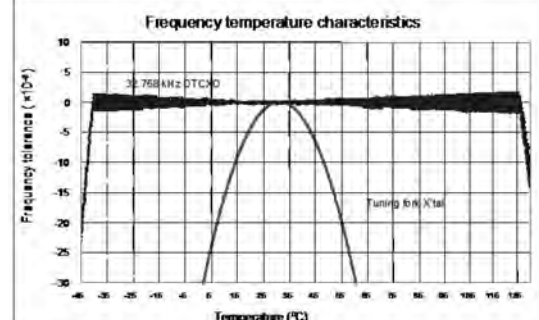
*The above diagram is the terminal layout for Option B.
For other options, please refer to the Pin Option section.

Specifications (characteristics)

* Refer to application manual for details

Electrical Characteristics

Item	Symbol	Conditions		Min.	Typ.	Max.	Unit	
Operating voltage	V _{DD}	-		1.6	3.0	5.5	V	
Temp. compensated Voltage	V _{TEM}	-		1.6	3.0	5.5	V	
Clock supply voltage	V _{CLK}	-		1.3	3.0	5.5	V	
Operating temperature	T _a	-		-40	+25	+125	°C	
Frequency tolerance	Δ f / f	YB	T _a = -40 °C to +85 °C	±5.0			x 10 ⁻⁶	
			T _a = +85 °C to +105 °C	±8.0				
			T _a = +105 °C to +125 °C	±50.0				
Current consumption	I _{DD1}	/INT = Hi-Z, FOUT: Output OFF (Hi-Z), Temp. Compensation interval 2.0 s, CE = L	No /RST pin	V _{DD} = 5 V	-	0.35	1.8	μA
	I _{DD2}		/RST pin	V _{DD} = 3 V	-	0.3	1.7	
	I _{DD11}		With /RST pin	V _{DD} = 5 V	-	1.5	3.7	
	I _{DD12}		V _{DD} = 2 V	-	0.6	2.25		

32.768 kHz-DTCXO Frequency temperature characteristics (Example)



Pin Option

Pin No.	Pin name				
	Option A	Option B	Option C	Option D	Option E
	3 wire			4 wire	
1	EVIN1		N.C.	DI	
2	VDD				
3	CE				
4	FOUT		/INT		
5	N.C.	/RST	N.C.		/RST
6	EVIN2		N.C.	EVIN2	
7	DIO			DO	
8	CLK				
9	GND				
10	/INT		N.C.	SOUT	

Pin name	No.	No.	Pin name
EVIN1	1	10	/INT
V _{DD}	2	9	GND
CE	3	8	CLK
FOUT	4	7	DIO
N.C.	5	6	EVIN2

Option A

Pin name	No.	No.	Pin name
EVIN1	1	10	/INT
V _{DD}	2	9	GND
CE	3	8	CLK
FOUT	4	7	DIO
/RST	5	6	EVIN2

Option B

Pin name	No.	No.	Pin name
N.C.	1	10	N.C.
V _{DD}	2	9	GND
CE	3	8	CLK
/INT	4	7	DIO
N.C.	5	6	N.C.

Option C

Pin name	No.	No.	Pin name
DI	1	10	SOUT
V _{DD}	2	9	GND
CE	3	8	CLK
/INT	4	7	DO
N.C.	5	6	EVIN2

Option D

Pin name	No.	No.	Pin name
DI	1	10	SOUT
V _{DD}	2	9	GND
CE	3	8	CLK
/INT	4	7	DO
/RST	5	6	EVIN2

Option E

Product name

RA4000CE YB A 0
① ② ③④

- ① Model CE type package 3.2 x 2.5 x 1.0 mm
- ② Frequency tolerance
YB: $\pm 5.0 \times 10^{-6}$ / -40 °C to +85 °C (Monthly rate: ± 13.2 seconds)
 $\pm 8.0 \times 10^{-6}$ / +85 °C to +105 °C (Monthly rate: ± 21 seconds)
 $\pm 50.0 \times 10^{-6}$ / +105 °C to +125 °C (Monthly rate: ± 132 seconds)
- ③ Pin Option
A: Option A
B: Option B
C: Option C
D: Option D
E: Option E
- ④ Reset output function
0: No /RST pin
8: With /RST pin (V_{DD} drop detection voltage: +2.4 V Typ.)

REAL TIME CLOCK MODULE (I²C-Bus)

For Automotive

Built-in 32.768 kHz DTCXO, High Stability



Product Number (2,000 pcs / Reel)

RA8804CE XA: X1B000381A00100

RA8804CE XB: X1B000381A00200

RA8804CE

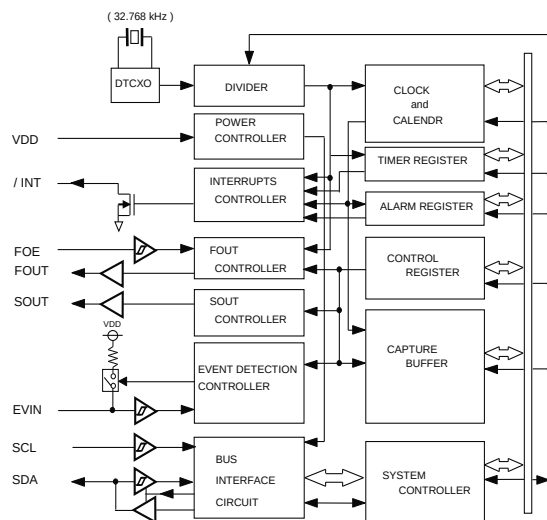
- Built in frequency adjusted 32.768 kHz crystal unit and DTCXO
- Interface Type : I²C-Bus
- Selectable clock output : 32.768 kHz, 1024 Hz, 1 Hz
- Time stamp function : 1 time stamped from year to second
- Interrupt output : Wake up every minute or every second
- Alarm interruption : Day, date, hour, minute
- Auto repeat wakeup timer interruption
- Self-monitoring interruption : Crystal oscillation stop, V_{BAT} low, V_{DD} low
- SOUT pin outputs that selected flag bit value
- AEC-Q100 compliant



RA8804CE

(3.2 × 2.5 mm, t = 1.0 mm Max.)

Block diagram



Overview

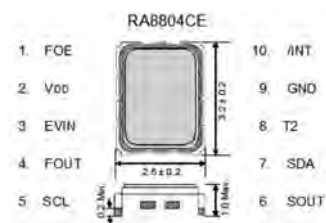
- Interface type
I²C-Bus interface Fast-Mode 400 kHz
- High stability
XA: $\pm 3.4 \times 10^{-6}$ / -40 °C to +85 °C (equivalent to ± 9 s of mo. deviation)
 $\pm 8.0 \times 10^{-6}$ / +85 °C to +105 °C (equivalent to ± 21 s of mo. deviation)
XB: $\pm 5.0 \times 10^{-6}$ / -40 °C to +85 °C (equivalent to ± 13 s of mo. deviation)
 $\pm 8.0 \times 10^{-6}$ / +85 °C to +105 °C (equivalent to ± 21 s of mo. deviation)
- Clock output function
Output frequency is selectable from 32.768 kHz, 1024 Hz, 1 Hz
- Wakeup timer function
Selectable from 244 μ s to 32 years (24 bit x 1 ch.)
Timer source clock selectable from 1/60 Hz, 1 Hz, 64 Hz, 4096 Hz
Auto release after interrupt output from /INT pin at timer completes
This operation is auto repeat with a selected cycle, it can be used like a watchdog timer
- Time stamp function
1 time stamped from year to second
The time stamp trigger inputs from EVIN pin, self-monitoring and I²C software command
EVIN pin has function of chattering-cancel
- Alarm function
It is possible program from day to minute
- Internal state output function
SOUT pin outputs selected flag-bit value or specified value (H or L)

Pin Function

Signal Name	I / O	Function
SOUT	Output	Internal state output pin
SCL	Input	Serial clock input pin
FOUT	Output	Frequency output pin (CMOS) (frequency selection: 32.768 kHz, 1024 Hz, 1 Hz)
EVIN	Input	Event input pin
VDD	-	Power-supply pin
FOE	Input	The FOUT output control pin
/INT	Output	Interrupts output by Alarm and Timer events (N-ch. open drain)
GND	-	Ground pin
T2	-	Test pin in the factory (Do not connect externally)
SDA	Input / Output	Serial data input and output pin.

Terminal connection / External dimensions

(Unit: mm)



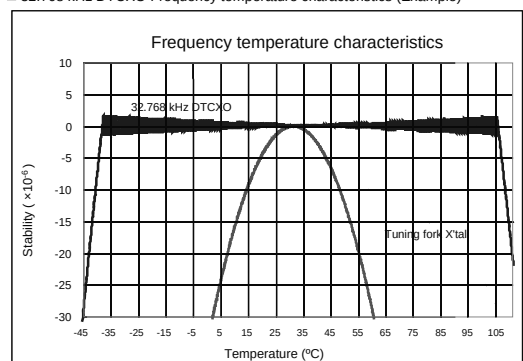
Specifications (characteristics)

* Refer to application manual for details

■ Electrical Characteristics

Item	Symbol	Conditions		Min.	Typ.	Max.	Unit	
Operating voltage	V _{DD}	-		1.6	3.0	5.5	V	
Temp. compensated Voltage	V _{TEM}	-		1.5	3.0	5.5	V	
Clock supply voltage	V _{CLK}	-		1.5	3.0	5.5	V	
Operating temperature	T _a	-		-40	+25	+105	°C	
Stability	Δ f / f	XA	T _a = -40 °C to +85 °C	±3.4			x 10 ⁻⁶	
			T _a = +85 °C to +105 °C	±8.0				
		XB	T _a = -40 °C to +85 °C	±5.0				
			T _a = +85 °C to +105 °C	±8.0				
Current consumption (1)	I _{DD1}	fSCL = 0 Hz, /INT = V _{DD} , FOE = GND, FOUT: OFF,		V _{DD} = 5 V	-	0.4	1.6	μA
Current consumption (2)	I _{DD2}	Temp. Compensation interval 2.0 s		V _{DD} = 3 V	-	0.35	1.5	

■ 32.768 kHz DTCXO Frequency temperature characteristics (Example)



REAL TIME CLOCK MODULE (I²C-Bus)

For Automotive, Power switching,
Built-in 32.768 kHz DTCXO, High Stability



Product Number (2,000 pcs / Reel)

RA8900CE UA: X1B000271A00400

RA8900CE UB: X1B000271A00500

RA8900CE

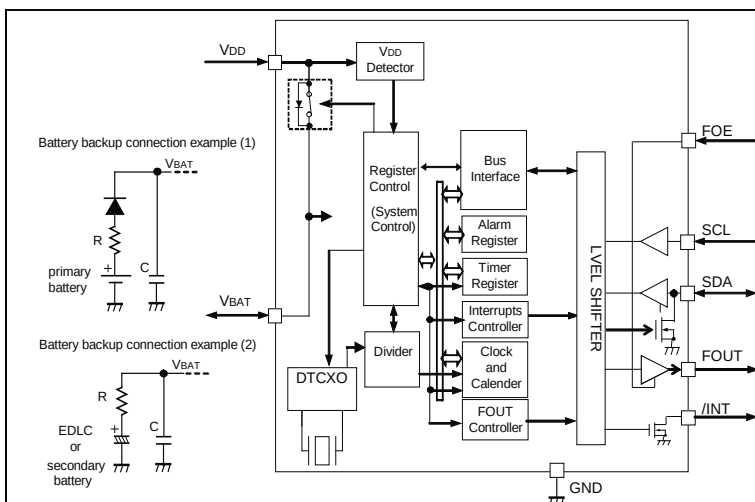
- Built-in frequency adjusted 32.768 kHz crystal unit and DTCXO
- Interface Type : I²C-Bus
- Interface voltage range : 2.5 V to 5.5 V
- Temp. compensated voltage range : 2.0 V to 5.5 V
- Timekeeping voltage range : 1.6 V to 5.5 V
- Auto power switching function : Automatically switches to backup power supply by monitoring the V_{DD} voltage
- Interrupt output : Wake up every minute or every second
- Alarm interruption : Day, date, hour, minute
- Auto repeat wakeup timer interruption
- AEC-Q200 compliant



RA8900CE

(3.2 x 2.5 mm, t = 1.0 mm Max.)

Block diagram



Overview

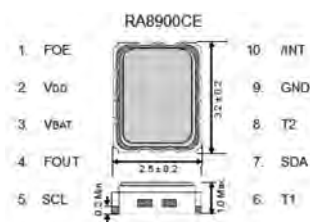
- Interface type
I²C-Bus interface Fast-Mode 400 kHz
- High stability
UA: $\pm 3.4 \times 10^{-6}$ / -40 °C to +85 °C (equiv. to ± 9 s of mo. deviation)
UB: $\pm 5.0 \times 10^{-6}$ / -40 °C to +85 °C (equiv. to ± 13 s of mo. deviation)
- Auto power switch function
The V_{DD} voltage is monitored and it switches to the backup power supply by the automatic operation
Backup power supply switching voltage 1.9 V Min.
- Clock output function
Output frequency is selectable from 32.768 kHz, 1024 Hz, 1 Hz
- Wakeup timer function
Selectable from 244 μ s to 2.8 days (12 bit x 1 ch.)
Timer source clock selectable from 1/60 Hz, 1 Hz, 64 Hz, 4096 Hz
Auto release after interrupt output from /INT pin at timer completes
This operation is auto repeat with a selected cycle, it can be used like a watchdog timer
- Alarm function
It is possible program from day to minute
- Temp. sensor function
Available readout temperature data from embedded temp sensor

Pin Function

Signal Name	I / O	Function
T1	-	Test pin in the factory (Do not connect externally)
SCL	Input	Serial clock input pin
FOUT	Output	Frequency output pin (CMOS) (frequency selection: 32.768 kHz, 1024 Hz, 1 Hz)
V _{BAT}	-	This is a power supply pin for backup battery Connect an EDLC, a secondary battery, a primary battery In the backup voltage range, supplied to IC, from this pin
V _{DD}	-	Power-supply pin
FOE	Input	The FOUT output control pin
/INT	Output	Interrupt output (N-ch. open drain).
GND	-	Ground pin
T2	-	Test pin in the factory (Do not connect externally)
SDA	Input / Output	Serial data input and output pin

Terminal connection / External dimensions

(Unit: mm)



Specifications (characteristics)

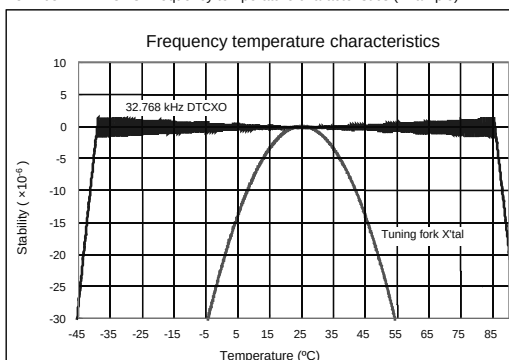
* Refer to application manual for details

■ Electrical Characteristics

Item	Symbol	Conditions		Min.	Typ.	Max.	Unit	
Operating voltage	V _{DD}	-		2.5	3.0	5.5	V	
Temp. compensated Voltage	V _{TEM}	-		2.0	3.0	5.5	V	
Clock supply voltage	V _{CLK}	-		1.6	3.0	5.5	V	
V _{DD} detect voltage (3)	V _{DET3}	-		2.3	2.4	2.5	V	
Operating temperature	T _A	-		-40	+25	+85 ⁺¹	°C	
Stability	Δ f / f	UA	T _A = -40 °C to +85 °C	±3.4			x 10 ⁻⁶	
		UB	T _A = -40 °C to +85 °C	±5.0				
		UC	T _A = -30 °C to +70 °C					
Current consumption (1)	I _{DD1}	fSCL = 0 Hz, /INT = V _{DD} , FOE = GND, V _{DD} = V _{BAT} , FOUT: OFF, Temp. Compensation interval 2.0 s		V _{DD} = 5 V	-	0.72	1.5	μA
Current consumption (2)	I _{DD2}			V _{DD} = 3 V	-	0.70	1.4	

*1) Please contact us about +85 °C < T_a

■ 32.768 kHz-DTCXO Frequency temperature characteristics (Example)





MHz RANGE CRYSTAL UNIT

For Automotive

Product Number
X1E000381Axxx18

FA2016AA

- Nominal frequency range : 19.2 MHz to 54 MHz
- External dimensions : 2.0 × 1.6 × 0.5 mm
- Overtone order : Fundamental
- Applications : Car audio, Vehicle camera system,
Car navigation system, ECU clock,
Clock, Meter, Remote keyless entry
- AEC-Q200 compliant



Specifications (characteristics)

Item	Symbol	Specifications	Conditions / Remarks
		For Automotive	
Nominal frequency range	f_nom	19.2 MHz to 54 MHz	Fundamental Please contact us about available frequencies.
Storage temperature range	T_stg	-40 °C to +125 °C	Storage as single product.
Operating temperature range	T_use	-40 °C to +125 °C	
Level of drive	DL	200 µW Max.	Recommended: 1 µW to 100 µW
Frequency tolerance	f_tol	±10 × 10 ⁻⁶	+25 °C Please contact us for requirements not listed in this specifications.
Frequency versus temperature characteristics	f_tem	±20 × 10 ⁻⁶ / -40 °C to +85 °C ±50 × 10 ⁻⁶ / -40 °C to +125 °C	Please contact us for requirements not listed in this specifications.
Load capacitance	CL	6 pF to ∞	Please specify.
Motional resistance (ESR)	R1	As per below table1.	-40 °C to +125 °C, DL=100 µW
Frequency aging	f_age	±3 × 10 ⁻⁶ / year Max.	+25 °C, First year

Table 1. Motional resistance (ESR) R1

Frequency	Motional resistance
19.2 MHz ≤ f_nom < 20 MHz	150 Ω Max.
20 MHz ≤ f_nom < 24 MHz	100 Ω Max.
24 MHz ≤ f_nom < 26 MHz	80 Ω Max.
26 MHz ≤ f_nom ≤ 54 MHz	60 Ω Max.

Product name

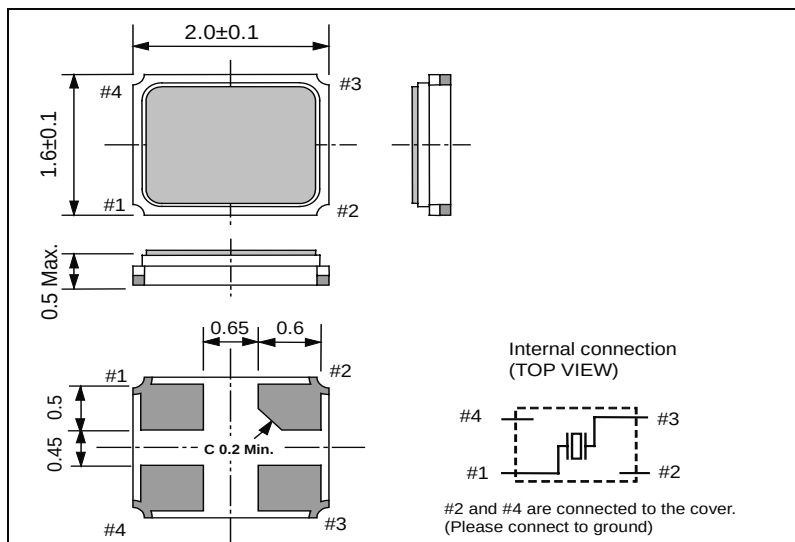
Product name (Standard form) FA2016AA 24.000000MHz 12.0 +10.0-10.0
 ① ② ③ ④

①Model ②Frequency ③Load capacitance(pF) ④Frequency tolerance(× 10⁻⁶, +25 °C)

In addition to the above mentioned specification item, please specify frequency temperature characteristics and operating temperature range in case of inquiry.

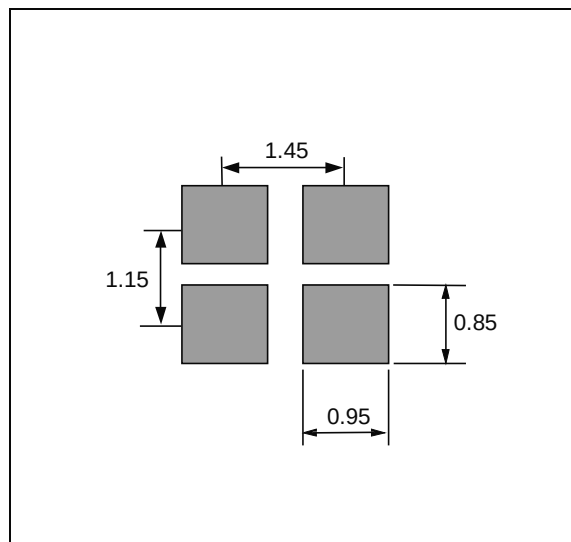
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





MHz RANGE CRYSTAL UNIT

For Automotive



Product Number
X1E000341xxxx00

FA-238A

- Nominal frequency range : 12 MHz to 50 MHz
- External dimensions : 3.2× 2.5×0.7 mm
- Overtone order : Fundamental
- Applications : Car audio, ECU clock, Clock,
Car navigation system,
Meter, Remote keyless entry
- AEC-Q200 compliant



Specifications (characteristics)

Item	Symbol	Specifications	Conditions / Remarks
		For Automotive	
Nominal frequency range	f_nom	12 MHz to 50 MHz	Fundamental Please contact us about available frequencies.
Storage temperature range	T_stg	-40 °C to +125 °C	Storage as single product.
Operating temperature range	T_use	-40 °C to +125 °C	
Level of drive	DL	200 μW Max.	Recommended: 1 μW to 100 μW
Frequency tolerance	f_tol	$\pm 15 \times 10^{-6}$ to $\pm 50 \times 10^{-6}$	+25 °C Please contact us for requirements not listed in this specifications.
Frequency versus temperature characteristics	f_tem	$\pm 30 \times 10^{-6}$ / -40 °C to +85 °C $\pm 50 \times 10^{-6}$ / -40 °C to +125 °C	Please contact us for requirements not listed in this specifications.
Load capacitance	CL	7 pF to ∞	Please specify.
Motional resistance (ESR)	R1	As per below table1.	-40 °C to +125 °C, DL=100 μW
Frequency aging	f_age	$\pm 5 \times 10^{-6}$ / year Max.	+25 °C, First year

Table 1. Motional resistance (ESR) R1

Frequency	Motional resistance
12 MHz ≤ f_nom ≤ 13 MHz	120 Ω Max.
13 MHz < f_nom < 20 MHz	80 Ω Max.
20 MHz ≤ f_nom < 25 MHz	60 Ω Max.
25 MHz ≤ f_nom ≤ 50 MHz	50 Ω Max.

Product name

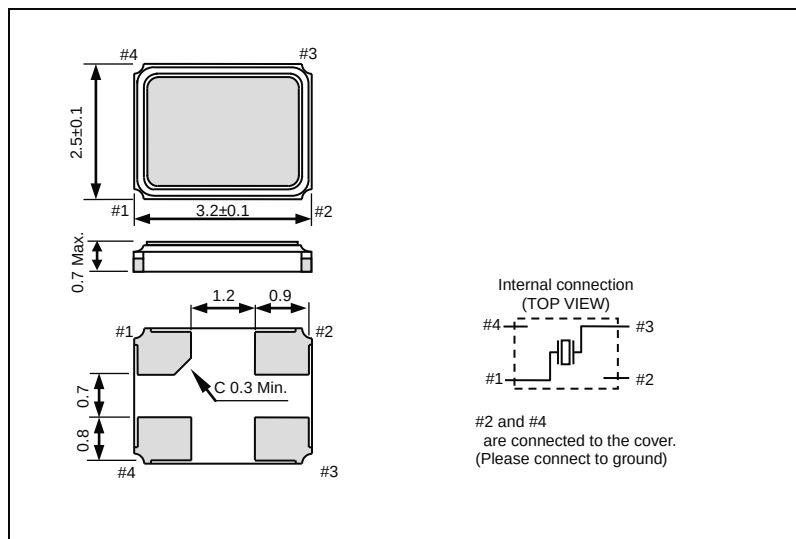
Product name FA-238A 28.636360MHz 18.0 +15.0-15.0
(Standard form) ① ② ③ ④

①Model ②Frequency ③Load capacitance(pF) ④Frequency tolerance($\times 10^{-6}$, +25 °C)

In addition to the above mentioned specification item, please specify frequency temperature characteristics and operating temperature range in case of inquiry.

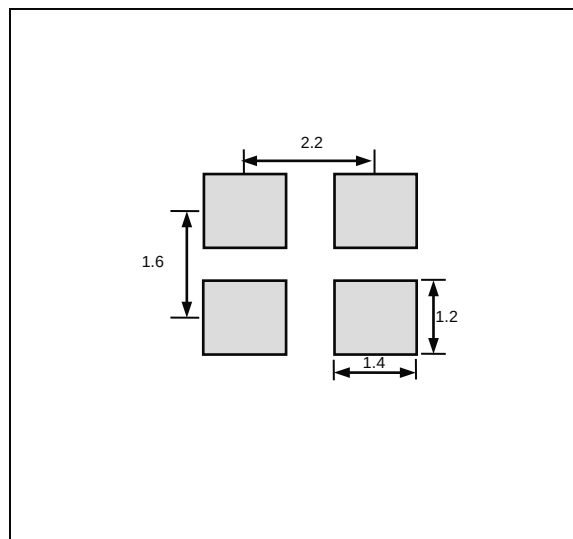
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





MHz RANGE CRYSTAL UNIT

Built-in thermistor

For Automotive



Product Number
FA2016ASA: X1E000431xxxx16

FA2016ASA

- Nominal frequency range : 38.4 MHz
- External dimensions : 2.0 × 1.6 × 0.68 mm
- Overtone order : Fundamental
- Applications : GPS module, Telematics module
Car navigation system, etc.
- AEC-Q200 compliant



Specifications (characteristics)

Item	Symbol	Specifications	Conditions / Remarks
Nominal frequency range	f_nom	38.4 MHz	Fundamental Please contact us about available frequencies.
Storage temperature range	T_stg	-40 °C to +125 °C	Storage as single product.
Operating temperature range	T_use	-40 °C to +105 °C	
Level of drive	DL	200 µW Max.	Recommended: 1 µW to 100 µW
Frequency tolerance	f_tol	±10 × 10 ⁻⁶	Please contact us about reference temperature. Please contact us for inquiries.
Frequency versus temperature characteristics	f_tem	±12 × 10 ⁻⁶	-30 °C to +85 °C Please contact us for inquiries.
		±30 × 10 ⁻⁶	-40 °C to +105 °C Please contact us for inquiries.
Load capacitance	CL	6 pF to ∞	Please specify.
Motional resistance (ESR)	R1	50 Ω Max.	-40 °C to +105 °C
Frequency aging	f_age	±1 × 10 ⁻⁶ / year Max.	+25 °C, First year
Thermistor resistance	—	Please contact us about specifications.	
Thermistor B constant	—		

Product name

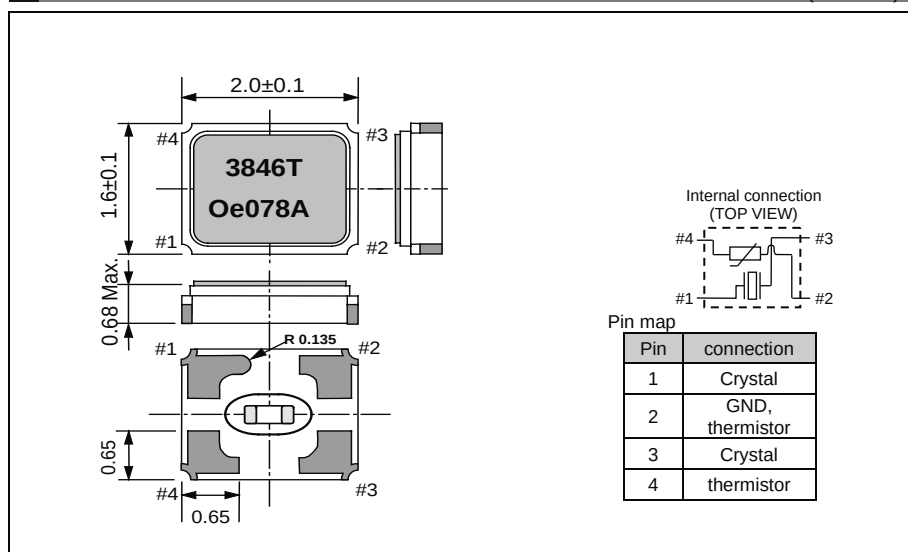
Product name FA2016ASA 38.400000MHz 7.0 +10.0-10.0
(Standard form) ① ② ③ ④

①Model ②Frequency ③Load capacitance(pF) ④Frequency tolerance(× 10⁻⁶, +25 °C)

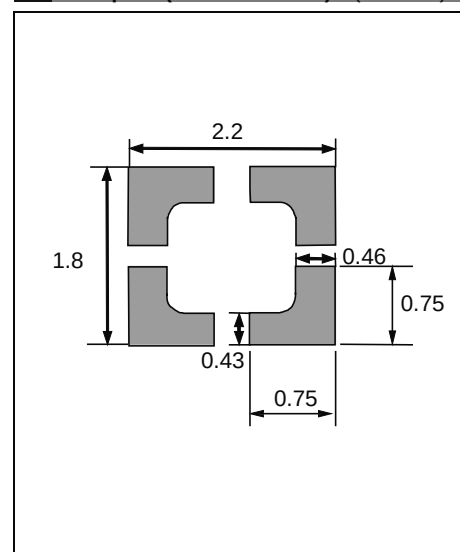
In addition to the above mentioned specification item, please specify frequency temperature characteristics and operating temperature range in case of inquiry.

External dimensions

(Unit:mm)



Footprint (Recommended) (Unit:mm)





CRYSTAL OSCILLATOR (SPXO)

OUTPUT : CMOS



Product Number
 SG2016CAA: X1G005341xxxx00
 SG2520CAA: X1G005951xxxx16

SG2016CAA

SG2520CAA

- Frequency : 19 standard frequencies
- Supply voltage : 1.8 V to 3.3 V Typ.
- Function : Standby ($\overline{\text{ST}}$)
- Operation temperature : -40 °C to +125 °C
- AEC-Q200 compliant



SG2016CAA
(2.0 x 1.6 x 0.7 mm)



SG2520CAA
(2.5 x 2.0 x 0.8 mm)

Specifications (characteristics)

Item	Symbol	Specifications	Conditions / Remarks
Output frequency	f_o	8 MHz 10 MHz 11.2896 MHz 12 MHz 12.288 MHz 14.7456 MHz 16.6666 MHz 20 MHz 22.5792 MHz 24 MHz 24.576 MHz 25 MHz 27 MHz 33 MHz 33.3333 MHz 40 MHz 48 MHz 50 MHz 54 MHz	
Supply voltage	V_{CC}	T: 1.60 V to 3.63 V	
Storage temperature	T_{stg}	-55 °C to +125 °C	Storage as single product.
Operating temperature	T_{use}	H: -40 °C to +105 °C J: -40 °C to +125 °C	
Frequency tolerance	f_{tol}	J: $\pm 50 \times 10^{-6}$ L: $\pm 100 \times 10^{-6}$	
Current consumption	I_{CC}	$V_{CC} = 1.8 \text{ V} \pm 10 \%$	$V_{CC} = 2.5 \text{ V} \pm 10 \%$
		2.0 mA Max.	2.1 mA Max.
		2.3 mA Max.	2.5 mA Max.
		2.6 mA Max.	2.9 mA Max.
Stand-by current	I_{std}	2.7 μA Max.	3.1 μA Max.
Symmetry	SYM	45 % to 55 %	50 % V_{CC} level, $L_{\text{CMOS}} \leq 15 \text{ pF}$
Output voltage	V_{OH}	90 % V_{CC} Min.	1.8 V $\pm 10 \%$ 2.5 V $\pm 10 \%$ 3.3 V $\pm 10 \%$
	V_{OL}	10 % V_{CC} Max.	-1.5 mA -3 mA -4 mA
	V_{OH}	$V_{CC} - 0.4 \text{ V}$ Min.	1.8 V $\pm 10 \%$ 2.5 V $\pm 10 \%$ 3.3 V $\pm 10 \%$
	V_{OL}	0.4 V Max.	-3 mA -4 mA -6 mA
Output load condition	L_{CMOS}	15 pF Max.	
Input voltage	V_{IH}	80 % V_{CC} Min.	$\overline{\text{ST}}$ terminal
	V_{IL}	20 % V_{CC} Max.	
Rise time and Fall time	t_r / t_f	3 ns Max. 3.5 ns Max. (@1.8 V $\pm 10 \%$)	20 % V_{CC} to 80 % V_{CC} level, $L_{\text{CMOS}} = 15 \text{ pF}$
Start-up time	t_{str}	5 ms Max.	$t = 0$ at 90 % V_{CC}
Frequency aging	f_{age}	$\pm 3 \times 10^{-6}$ / year Max.	+25 °C, First year

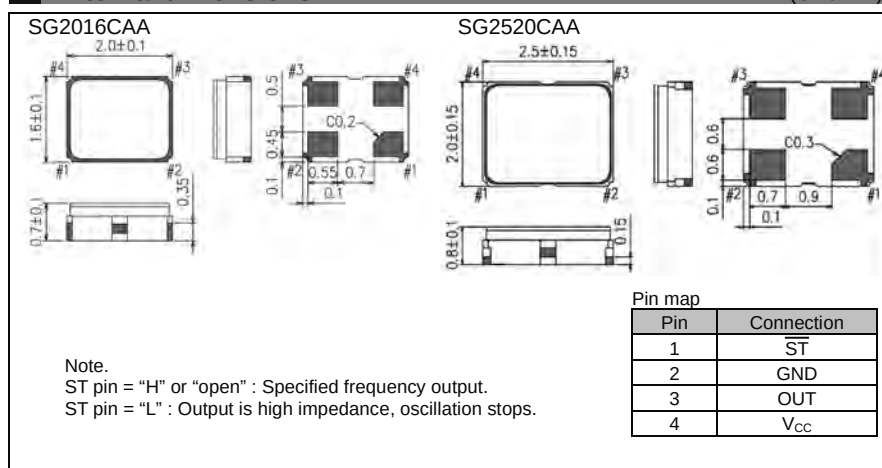
Product Name SG2016CAA 25.000000MHz I J H A
 (Standard form) Model Name Frequency ①②③ — Standard Specification A

①Supply voltage
T 1.8 V to 3.3 V Typ.

②Frequency tolerance / ③Operating temperature
JH $\pm 50 \times 10^{-6}$ / -40 °C to +105 °C
LJ $\pm 100 \times 10^{-6}$ / -40 °C to +125 °C

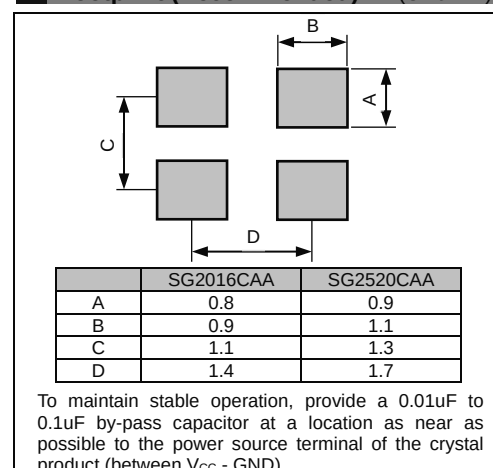
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





CRYSTAL OSCILLATOR (Programmable)
OUTPUT: CMOS



Product Number
X1G005991xxxx16

SG-8201CJA

- Frequency range : 1.2 MHz to 170 MHz
- Supply voltage : 1.62 V to 3.63 V
- Function : Output enable (OE) or Standby (ST)
- Frequency tolerance, operating temperature:
 $\pm 15 \times 10^{-6}$ (-40 °C to +105 °C)
 $\pm 25 \times 10^{-6}$, $\pm 50 \times 10^{-6}$ (-40 °C to +125 °C)
- External dimensions : 2.0 × 1.6 × 0.6 (mm)
- PLL technology to enable short lead time
- AEC-Q100 compliant



Specifications (characteristics)

Item	Symbol	Specifications			Conditions/Remarks			
Supply voltage	V _{CC}	1.80 V Typ.	2.50 V Typ.	3.30 V Typ.				
		1.62 V to 1.98 V	2.25 V to 2.75 V	2.97 V to 3.63 V				
Output frequency range	f _o	1.2 MHz to 170 MHz						
Storage temperature	T _{stg}	-55 °C to +150 °C			Storage as single product.			
Operating temperature	T _{use}	H: -40 °C to +105 °C						
		J: -40 °C to +125 °C						
Frequency tolerance* ¹	f _{tol}	B: ±15 × 10 ⁻⁶			T _{use} = -40 °C to +105 °C			
		D: ±25 × 10 ⁻⁶			T _{use} = -40 °C to +125 °C			
		J: ±50 × 10 ⁻⁶			T _{use} = -40 °C to +125 °C			
Current consumption	I _{CC}	5.2 mA Typ.	5.4 mA Typ.	5.6 mA Typ.	1.2 MHz ≤ f _o ≤ 25 MHz	No load, Rise/Fall time: Default		
		7.0 mA Max.	7.2 mA Max.	7.5 mA Max.				
		5.4 mA Typ.	5.7 mA Typ.	6.1 mA Typ.	25 MHz < f _o ≤ 50 MHz			
		7.3 mA Max.	7.6 mA Max.	8.1 mA Max.				
		5.7 mA Typ.	6.3 mA Typ.	7.0 mA Typ.	50 MHz < f _o ≤ 75 MHz			
		7.7 mA Max.	8.2 mA Max.	9.1 mA Max.				
		6.2 mA Typ.	6.9 mA Typ.	7.9 mA Typ.	75 MHz < f _o ≤ 100 MHz			
		8.2 mA Max.	9.1 mA Max.	10.4 mA Max.				
		6.9 mA Typ.	7.9 mA Typ.	9.1 mA Typ.	100 MHz < f _o ≤ 125 MHz			
		9.4 mA Max.	10.7 mA Max.	12.4 mA Max.				
7.8 mA Typ.	9.2 mA Typ.	11.2 mA Typ.	125 MHz < f _o ≤ 170 MHz					
10.4 mA Max.	12.4 mA Max.	15.0 mA Max.						
Output disable current	I _{dis}	5.0 mA Typ.	5.0 mA Typ.	5.1 mA Typ.	OE = GND (Active High)			
		7.2 mA Max.	7.3 mA Max.	7.4 mA Max.	OE = V _{CC} (Active Low)			
Standby current	I _{std}	0.3 μA Typ.	0.3 μA Typ.	0.5 μA Typ.	ST = GND (Active High)			
		15.0 μA Max.	15.0 μA Max.	15.0 μA Max.	ST = V _{CC} (Active Low)			
Symmetry	SYM	45 % to 55 %			50 % V _{CC} Level, L _{CMOS} ≤ 15 pF			
Output voltage (DC characteristics)	V _{OH}	90 % V _{CC} Min.			Rise/Fall time		I _{OH}	I _{OL}
					Default 'A' Option ²	Other Options		
	V _{OL}	10 % V _{CC} Max.			f _o > 125 MHz	B: Faster	-2.0 mA	2.0 mA
					75 MHz < f _o ≤ 125 MHz	C: Fast	-1.0 mA	1.0 mA
					50 MHz < f _o ≤ 75 MHz	D: Slow	-0.5 mA	0.5 mA
f _o ≤ 50 MHz					E: Slower	-0.2 mA	0.2 mA	
Output load condition	L _{CMOS}	15 pF Max.						
Input voltage	V _{IH}	70 % V _{CC} Min.			Pin 1			
	V _{IL}	30 % V _{CC} Max.						
Rise/Fall time	tr/tf	-			Default 'A' Option ²	Other Options	20 % - 80 % V _{CC} , L _{CMOS} = 15 pF	
		2.0 ns Max.			f _o > 125 MHz	B: Faster		
		2.5 ns Max.			75 MHz < f _o ≤ 125 MHz	C: Fast		
		4.0 ns Max.			50 MHz < f _o ≤ 75 MHz	D: Slow		
		6.0 ns Max.			f _o ≤ 50 MHz	E: Slower		
Output disable time (OE) Output disable time (ST)	tstp_oe tstp_st	1 μs Max.			Measured from the time OE or ST pin crosses 30 % V _{CC} or measured from the time OE or ST pin crosses 70 % V _{CC}			
Output enable time (OE)	tsta_oe	100 ns + 2 clock cycle Max.			Measured from the time OE pin crosses 70 % V _{CC} or measured from the time OE pin crosses 30 % V _{CC}			
Output enable time (ST)	tsta_st	3 ms Max.			Measured from the time ST pin crosses 70 % V _{CC} or measured from the time ST pin crosses 30 % V _{CC}			
Start-up time	t _{str}	3 ms Max.			Measured from the time V _{CC} reaches its rated minimum value, 1.62 V			
Phase Jitter	t _{pj}	1.2 ps Typ.			f _o = 25 MHz, Offset frequency: 12 kHz to 5 MHz			
		1.2 ps Typ.			f _o = 50 MHz, Offset frequency: 12 kHz to 20 MHz			
		1.2 ps Typ.			f _o = 75 MHz, Offset frequency: 12 kHz to 20 MHz			
		1.2 ps Typ.			f _o = 100 MHz, Offset frequency: 12 kHz to 20 MHz			
		1.1 ps Typ.			f _o = 125 MHz, Offset frequency: 12 kHz to 20 MHz			
		1.4 ps Typ.			f _o = 150 MHz, Offset frequency: 12 kHz to 20 MHz			
		1.5 ps Typ.			f _o = 170 MHz, Offset frequency: 12 kHz to 20 MHz			
Frequency aging	f _{age}	This is included in frequency tolerance specification.			+25 °C, first year			

^{*1} Frequency tolerance includes initial frequency tolerance, temperature variation, supply voltage variation, reflow drift, load drift and aging (+25 °C, 1 year).

^{*2} Default 'A' Rise/Fall time and I_{OH}/I_{OL} are dependent on programmed frequency.



Pin description

Pin	Name	I/O type	Function	
1	OE	Input	Output Enable (Active High)	High ^{*1} or Open: Specified frequency output from OUT pin Low: OUT pin is low (pull down with 500 kΩ), only output driver is disabled.
	ST	Input	Standby (Active High)	High ^{*1 *2} : Specified frequency output from OUT pin Low: OUT pin is low (pull down with 500 kΩ), Device goes to standby mode. Supply current reduces to the least as I _{std} .
	OE	Input	Output Enable (Active Low)	Low ^{*3} or Open: Specified frequency output from OUT pin High: OUT pin is low (pull down with 500 kΩ), only output driver is disabled.
	ST	Input	Standby (Active Low)	Low ^{*3 *4} : Specified frequency output from OUT pin High: OUT pin is low (pull down with 500 kΩ), Device goes to standby mode. Supply current reduces to the least as I _{std} .
2	GND	Power	Ground	
3	OUT	Output	Clock output	
4	V _{CC}	Power	Power supply	

*1 If fixing it at High, please connect to V_{CC} directly.

*2 If necessary to use Open, please select Output Enable (Active High) function.

*3 If fixing it at Low, please connect to GND directly.

*4 If necessary to use Open, please select Output Enable (Active Low) function.

Product Name

SG-8201CJA 170.000000MHz T D J P A
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

- ①Model ②Package type (CJ: 2.0 mm × 1.6 mm)
③Frequency ④Supply voltage (T: 1.8 V to 3.3 V Typ.)
⑤Frequency tolerance ⑥Operating temperature
⑦Function ⑧Rise/Fall time

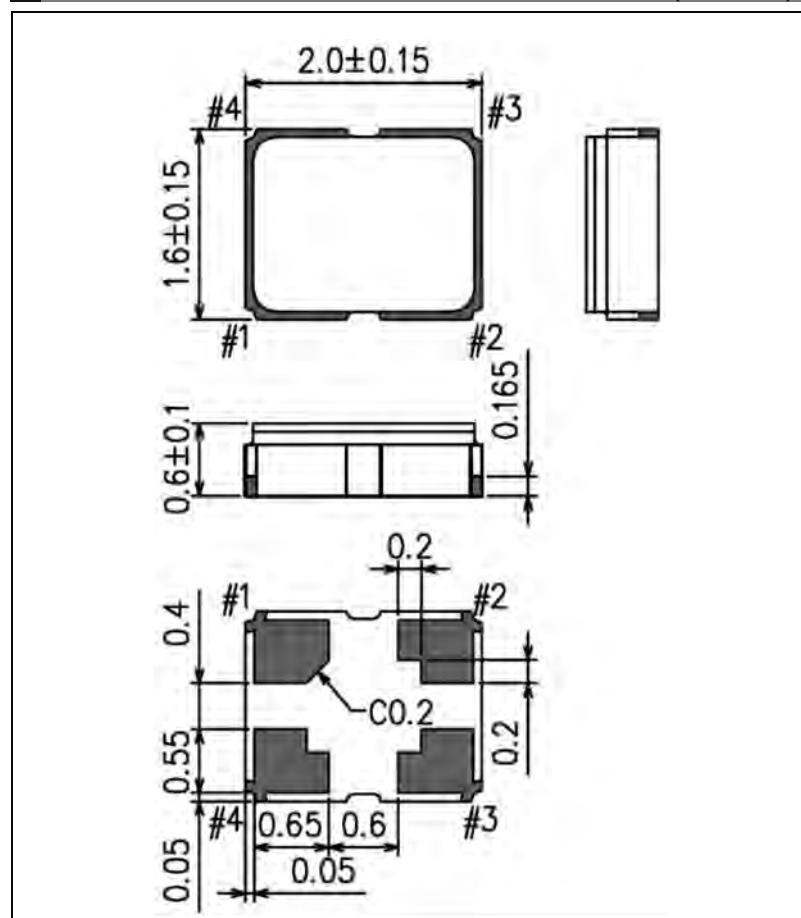
⑤Frequency tolerance / ⑥Operating temperature	
BH	±15 × 10 ⁻⁶ / -40 °C to +105 °C
DJ	±25 × 10 ⁻⁶ / -40 °C to +125 °C
JJ	±50 × 10 ⁻⁶ / -40 °C to +125 °C

⑧Rise/Fall time	
A	Default
B	Faster
C	Fast
D	Slow
E	Slower

⑦Function	
P	Output Enable (OE) / Active High
S	Standby (ST) / Active High
Q	Output Enable (OE) / Active Low
T	Standby (ST) / Active Low

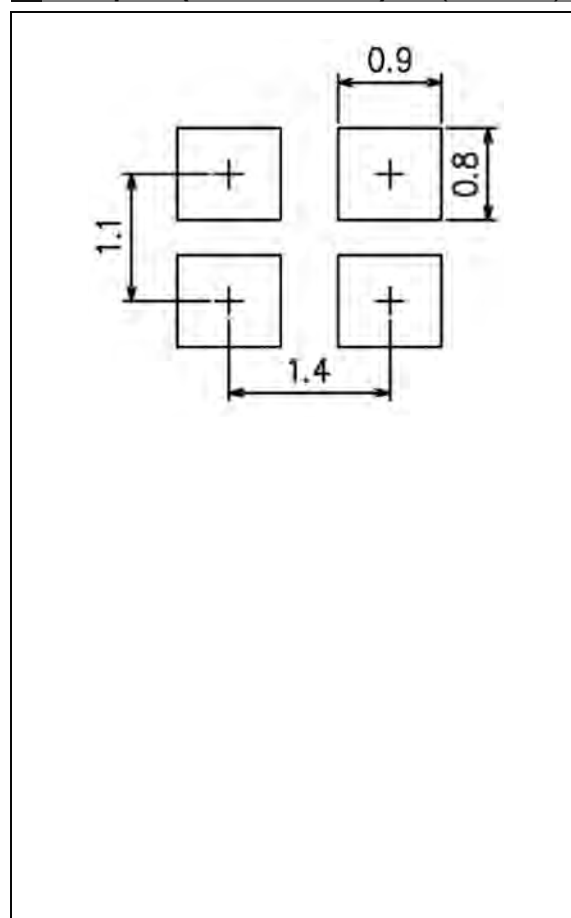
External dimensions

(Unit: mm)



Footprint (Recommended)

(Unit: mm)



■ Notes:

In order to achieve optimum jitter performance, the 0.01 μF to 0.1 μF capacitor between V_{CC} and GND should be placed. It is also recommended that the capacitors are placed on the device side of the PCB, as close to the device as possible and connected together with short wiring pattern.

CRYSTAL OSCILLATOR (Programmable)
OUTPUT: CMOS



Product Number
X1G005171xxxx00

SG-8101CGA

- Frequency range : 0.67 MHz to 170 MHz (1 ppm Step)
- Supply voltage : 1.62 V to 3.63 V
- Function : Output enable (OE) or Standby (ST)
- Frequency tolerance, operating temperature:
 - ±15 ppm (-40 °C to +85 °C)
 - ±20 ppm (-40 °C to +105 °C)
 - ±50 ppm (-40 °C to +125 °C)
 - ±100 ppm (-40 °C to +125 °C)
- Package : 2.5 x 2.0 (mm)
- PLL technology to enable short lead time
- AEC-Q100 compliant



Specifications (characteristics)

Item		Symbol	Specifications				Conditions/Remarks								
Supply voltage		V _{CC}	1.80 V Typ.		2.50 V Typ.	3.30 V Typ.									
			1.62 V to 1.98 V	1.98 V to 2.20 V	2.20 V to 2.80 V	2.70 V to 3.63 V									
Output frequency range		f _o	0.67 MHz to 170 MHz												
Storage temperature		T _{stg}	-40 °C to +125 °C				Storage as single product.								
Operating temperature		T _{use}	-40 °C to +85 °C												
			-40 °C to +105 °C												
Frequency tolerance* ¹		f _{tol}	-40 °C to +125 °C												
			B : ±15 × 10 ⁻⁶				T _{use} = -40 °C to +85 °C								
			C : ±20 × 10 ⁻⁶				T _{use} = -40 °C to +105 °C								
			J : ±50 × 10 ⁻⁶				T _{use} = -40 °C to +125 °C								
Current consumption		I _{CC}	3.3 mA Max.		3.4 mA Max.	3.5 mA Max.	3.6 mA Max.	T _{use} = +125 °C			No load, f _o = 20 MHz				
			3.2 mA Max.		3.3 mA Max.	3.4 mA Max.	3.5 mA Max.	T _{use} = +105 °C							
			2.7 mA Typ.		2.9 mA Typ.	3.0 mA Typ.	T _{use} = +25 °C								
			5.6 mA Max.		5.9 mA Max.	6.8 mA Max.	8.2 mA Max.	T _{use} = +125 °C			No load, f _o = 170 MHz				
			5.5 mA Max.		5.8 mA Max.	6.7 mA Max.	8.1 mA Max.	T _{use} = +105 °C							
Output disable current		I _{dis}	4.7 mA Typ.		5.7 mA Typ.	6.8 mA Typ.	T _{use} = +25 °C			OE = GND, f _o = 170 MHz					
			3.3 mA Max.		3.4 mA Max.	3.4 mA Max.	3.6 mA Max.	T _{use} = +125 °C							
Standby current		I _{std}	3.2 mA Max.		3.3 mA Max.	3.3 mA Max.	3.5 mA Max.	T _{use} = +105 °C			ST = GND				
			2.3 µA Max.		2.5 µA Max.	3.0 µA Max.	4.2 µA Max.	T _{use} = +125 °C							
			0.9 µA Max.		1.0 µA Max.	1.5 µA Max.	2.5 µA Max.	T _{use} = +105 °C							
Symmetry		SYM	45 % to 55 %				50 % V _{CC} Level								
Output voltage (DC characteristics)		V _{OH}	90 % V _{CC} Min.				I _{OH} /I _{OL} Conditions [mA]								
							Rise/Fall time selection		V _{CC}	*A	*B	*C	*D		
		Default (f _o > 40 MHz), Fast		I _{OH}	-2.5	-3.5	-4.0	-5.0							
				I _{OL}	2.5	3.5	4.0	5.0							
				V _{OL}	10 % V _{CC} Max.				Default (f _o ≤ 40 MHz)		I _{OH}	-1.5	-2.0	-2.5	-3.0
											I _{OL}	1.5	2.0	2.5	3.0
Slow									I _{OH}	-1.0	-1.5	-2.0	-2.5		
									I _{OL}	1.0	1.5	2.0	2.5		
Output load condition		L _{CMOS}	15 pF Max.												
Input voltage		V _{IH}	70 % V _{CC} Min.				OE or ST								
		V _{IL}	30 % V _{CC} Max.												
Rise and Fall time	Default	tr/tf	3.0 ns Max.		f _o > 40 MHz		20 % - 80 % V _{CC} , L _{CMOS} = 15 pF								
			6.0 ns Max.		f _o ≤ 40 MHz										
	Fast		3.0 ns Max.		f _o = 0.67 MHz to 170 MHz										
			Slow	10.0 ns Max.		f _o = 0.67 MHz to 20 MHz									
Disable Time		t _{stp}		1 µs Max.				Measured from the time OE or ST pin crosses 30 % V _{CC}							
Enable Time		t _{sta}	1 µs Max.				Measured from the time OE pin crosses 70 % V _{CC}								
Resume Time		t _{res}	3 ms Max.				Measured from the time ST pin crosses 70 % V _{CC}								
Start-up time		t _{str}	3 ms Max.				Measured from the time V _{CC} reaches its rated minimum value, 1.62 V								
Frequency aging		f _{aging}	This is included in frequency tolerance specification.				+25 °C, first year								

*1 Frequency tolerance includes initial frequency tolerance, temperature variation, supply voltage variation, reflow drift, load drift and aging (+25 °C, 1 year).

Pin description

Pin	Name	I/O type	Function	
1	OE	Input	Output enable	High: Specified frequency output from OUT pin
				Low: Out pin is low (weak pull down), only output driver is disabled.
	ST	Input	Standby	High: Specified frequency output from OUT pin
				Low: Out pin is low (weak pull down), Device goes to standby mode. Supply current reduces to the least as I _{std} .
2	GND	Power	Ground	
3	OUT	Output	Clock output	
4	V _{CC}	Power	Power supply	



Product Name

SG-8101CGA 170.000000MHz T C H P A

① ② ③ ④⑤⑥⑦⑧

- ① Model, ② Package type,
③ Frequency, ④ Supply voltage,
⑤ Frequency tolerance, ⑥ Operating temperature,
⑦ Function, ⑧ Rise/Fall time

② Package type

CG: 2.5 mm x 2.0 mm

④ Supply voltage

T: 1.8 V to 3.3 V Typ.

⑤⑥ ⑤ Frequency tolerance

BG B: 15×10^{-6} CH C: 20×10^{-6} JJ J: 50×10^{-6} LJ L: 100×10^{-6}

⑥ Operating temperature

G: -40 °C to +85 °C

H: -40 °C to +105 °C

J: -40 °C to +125 °C

⑦ Function

P: Output Enable

S: Standby

⑧ Rise/Fall time

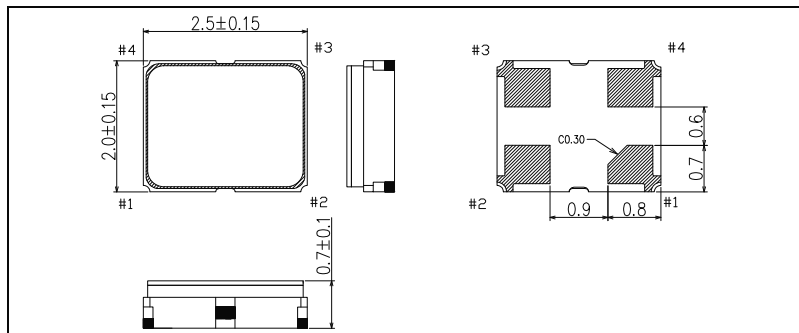
A: Default

B: Fast

C: Slow

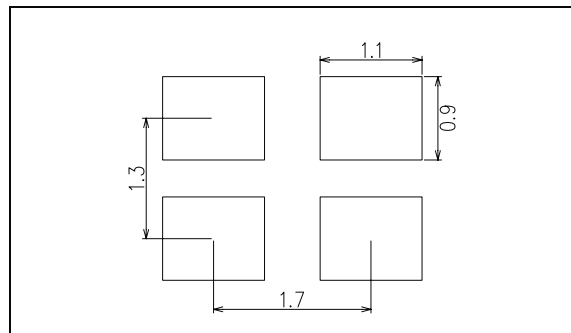
External dimensions

(Unit: mm)



Footprint (Recommended)

(Unit: mm)



■ Notes:

In order to achieve optimum jitter performance, the 0.1 μ F capacitor between V_{CC} and GND should be placed. It is also recommended that the capacitors are placed on the device side of the PCB, as close to the device as possible and connected together with short wiring pattern.



CRYSTAL OSCILLATOR (Programmable)
SPREAD SPECTRUM
OUTPUT: CMOS



Product Number
X1G005281xxxx00

SG-9101CGA

- Frequency range : 0.67 MHz ~ 170 MHz (1 ppm Step)
- Supply voltage : 1.62 V ~ 3.63 V
- Function : Output enable (OE) or Standby (ST)
- Down or Center spread modulation
- Configurable spreading
 - 3 modulation profile (Hershey-kiss, Sine-wave, Triangle),
 - 4 modulation frequency, 6 spread percentage
- Package : 2.5 x 2.0 (mm)
- PLL technology to enable short lead time
- AEC-Q100 compliant



Specifications (characteristics)

Item	Symbol	Specifications				Conditions/Remarks						
Supply voltage	V _{CC}	1.80 V Typ.		2.50 V Typ.	3.30 V Typ.							
		1.62 V to 1.98 V	1.98 V to 2.20 V	2.20 V to 2.80 V	2.70 V to 3.63 V							
Output frequency range	f _o	0.67 MHz to 170 MHz										
Storage temperature	T _{stg}	-40 °C to +125 °C				Storage as single product.						
Operating temperature	T _{use}	-40 °C to +125 °C										
Frequency tolerance ¹	f _{tol}	±100 × 10 ⁻⁶				Average frequency of 1s gate time.						
Current consumption	I _{CC}	3.5 mA Max.	3.6 mA Max.	3.7 mA Max.	3.8 mA Max.	T _{use} = +125 °C		No load, f _o = 20 MHz				
		3.4 mA Max.	3.5 mA Max.	3.6 mA Max.	3.7 mA Max.	T _{use} = +105 °C						
		2.9 mA Typ.		3.0 mA Typ.	3.2 mA Typ.	T _{use} = +25 °C						
		5.8 mA Max.	6.1 mA Max.	7.0 mA Max.	8.4 mA Max.	T _{use} = +125 °C		No load, f _o = 170 MHz				
		5.7 mA Max.	6.0 mA Max.	6.9 mA Max.	8.3 mA Max.	T _{use} = +105 °C						
		4.9 mA Typ.		5.9 mA Typ.	7.0 mA Typ.	T _{use} = +25 °C						
Output disable current	I _{dis}	3.5 mA Max.	3.5 mA Max.	3.6 mA Max.	3.8 mA Max.	T _{use} = +125 °C		OE = GND, f _o = 170 MHz				
		3.4 mA Max.	3.4 mA Max.	3.5 mA Max.	3.7 mA Max.	T _{use} = +105 °C						
Standby current	I _{std}	2.3 µA Max.	2.5 µA Max.	3.0 µA Max.	4.2 µA Max.	T _{use} = +125 °C		ST = GND				
		0.9 µA Max.	1.0 µA Max.	1.5 µA Max.	2.5 µA Max.	T _{use} = +105 °C						
		0.3 µA Typ.	0.4 µA Typ.	0.5 µA Typ.	1.1 µA Typ.	T _{use} = +25 °C						
Symmetry	SYM	45 % to 55 %				50 % V _{CC} Level						
Output voltage (DC characteristics)	V _{OH}	90 % V _{CC} Min.				I _{OH} /I _{OL} Conditions [mA]						
						Rise/Fall time		V _{CC}	*A	*B	*C	*D
						Default (f _o > 40 MHz), Fast		I _{OH}	-2.5	-3.5	-4.0	-5.0
								I _{OL}	2.5	3.5	4.0	5.0
	V _{OL}	10 % V _{CC} Max.				Default (f _o ≤ 40 MHz)		I _{OH}	-1.5	-2.0	-2.5	-3.0
								I _{OL}	1.5	2.0	2.5	3.0
						Slow		I _{OH}	-1.0	-1.5	-2.0	-2.5
								I _{OL}	1.0	1.5	2.0	2.5
						*A : 1.62 V to 1.98 V, *B : 1.98 V to 2.20 V, *C : 2.20 V to 2.80 V, *D : 2.70 V to 3.63 V						
Output load condition	L _{CMOS}	15 pF Max.										
Input voltage	V _{IH}	70 % V _{CC} Min.				OE or ST						
	V _{IL}	30 % V _{CC} Max.										
Rise and Fall time	Default Fast Slow	tr/ft	3.0 ns Max.		f _o > 40 MHz			20 % - 80 % V _{CC} , L _{CMOS} = 15 pF				
			6.0 ns Max.		f _o ≤ 40 MHz							
			3.0 ns Max.		f _o = 0.67 MHz ~ 170 MHz							
			10.0 ns Max.		f _o = 0.67 MHz ~ 20 MHz							
Disable Time	t _{stp}	1 µs Max.				Measured from the time OE or ST pin crosses 30 % V _{CC}						
Enable Time	t _{sta}	1 µs Max.				Measured from the time OE pin crosses 70 % V _{CC}						
Resume Time	t _{res}	3 ms Max.				Measured from the time ST pin crosses 70 % V _{CC}						
Start-up time	t _{str}	3 ms Max.				Measured from the time V _{CC} reaches its rated minimum value, 1.62 V						
Frequency aging	f _{aging}	This is included in frequency tolerance specification.				+25 °C, first year						

*1 Frequency tolerance includes initial frequency tolerance, temperature variation, supply voltage variation, reflow drift, load drift and aging (+25 °C, 1 year).

Pin description

Pin	Name	I/O type	Function	
1	OE	Input	Output enable	High: Specified frequency output from OUT pin Low: Out pin is low (weak pull down), only output driver is disabled.
	ST	Input	Standby	High: Specified frequency output from OUT pin Low: Out pin is low (weak pull down), Device goes to standby mode. Supply current reduces to the least as I _{std} .
2	GND	Power	Ground	
3	OUT	Output	Clock output	
4	V _{CC}	Power	Power supply	



Product Name

SG-9101CGA 170.000000MHz C 20 P J A A A

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

④ Spread type

C: Center spread

D: Down spread

⑦ Operating temperature

J: -40 °C to +125 °C

⑨ Modulation profile

A: Hershey-kiss (default)

B: Sine-wave

C: Triangle

① Model, ② Package type, ③ Frequency,

④ Spread type, ⑤ Spread percentage code,

⑥ Function, ⑦ Operating temperature,

⑧ Modulation frequency, ⑨ Modulation profile, ⑩ Rise/Fall time

② Package Type

CG: 2.5 mm x 2.0 mm

⑥ Function

P: Output enable

S: Standby

⑧ Modulation frequency

A: 25.4 kHz (default)

B: 12.7 kHz

C: 8.5 kHz

D: 6.3 kHz

⑩ Rise/Fall time

A: Default

B: Fast

C: Slow

Spread spectrum configuration

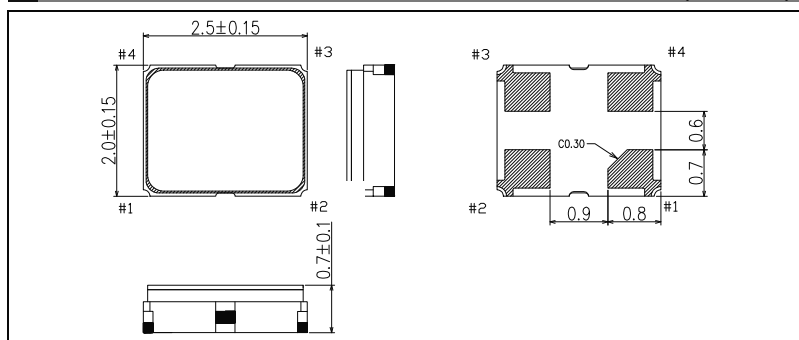
④	C: Center spread modulation	⑤ Code	02	05	07	10	15	20
	Spread percentage		±0.25 %	±0.5 %	±0.75 %	±1.0 %	±1.5 %	±2.0 %
④	D: Down spread modulation	⑤ Code	05	10	15	20	30	40
	Spread percentage		-0.5 %	-1.0 %	-1.5 %	-2.0 %	-3.0 %	-4.0 %

Modulation frequency: 25.4 kHz (default), 6.3 kHz, 8.5 kHz, 12.7 kHz

Modulation profile: Hershey-kiss (default), Sine-wave, Triangle

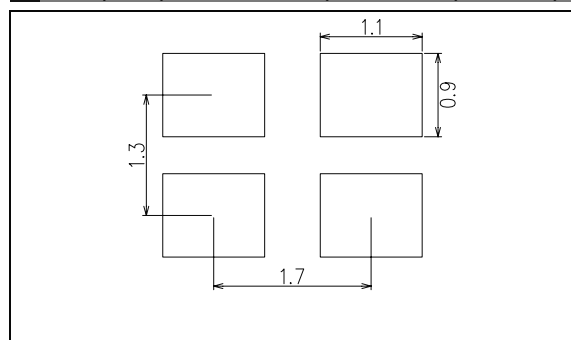
External dimensions

(Unit: mm)



Footprint (Recommended)

(Unit: mm)



■ Notes:

In order to achieve optimum jitter performance, the 0.1 μ F capacitor between V_{CC} and GND should be placed. It is also recommended that the capacitors are placed on the device side of the PCB, as close to the device as possible and connected together with short wiring pattern.

RF Transmitter Module Conforms to AEC-Q100 SR3225SAA



Product Number
SR3225SAA: X1G00479xxxxx00

SR3225SAA is a wireless transmitter module for UHF range. Crystal resonator, oscillator, PLL and Power Amp are integrated in 3.2 mm x 2.5 mm ceramic package. The wireless transmission function can be configured by connect to the external control devices. It is suitable for small wireless transmitter. The evaluation kit is available.

Application

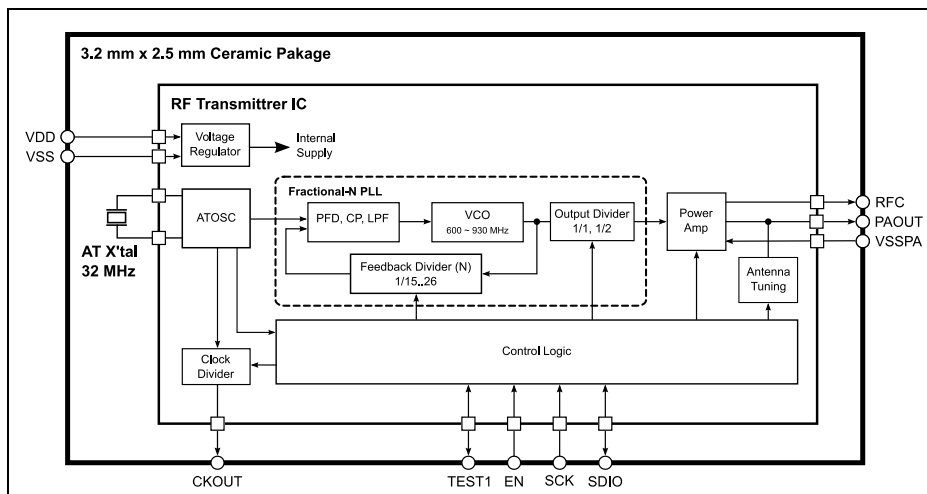
- Remote Keyless Entry, Passive Entry
- Short range radio data transmitter
- Garage door opener
- Transmitter for RFID tag



Overview

- Carrier frequency bands:
300 MHz ~ 465 MHz (0.25 kHz Step),
600 MHz ~ 930 MHz (0.49 kHz Step)
- $\Delta\Sigma$ fractional-N based PLL
- Programmable Power Amp output power:
-15 ~ 11 dBm, 128 steps
- Modulation types: ASK/OOK/FSK with
Soft-ASK and/or Soft FSK shaping
- 3-wire/4-wire SPI interface
- SFR (Special Function Register)
- Embedded 32 MHz crystal resonator and
oscillation circuit
- Programmable clock output via CKOUT
- Programmable voltage threshold of Under
Voltage Detection: 4 steps (1.8 V ~ 2.4 V)
- Fail-Safe mechanism (PLL Loss of Lock,
VCO auto-calibration error, Under Voltage
Detection)

Block diagram

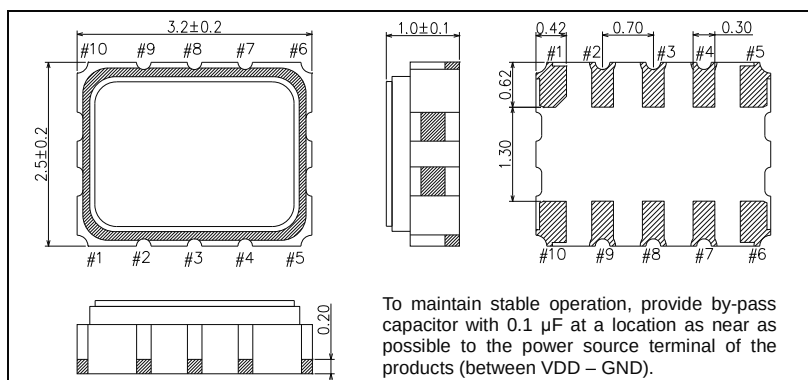


Specification (characteristics)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage	VDD	-	1.8	3.0	3.6	V
Operation temperature	Ta	-	-40	-	+85	°C
Storage temperature	Tstg	-	-40	-	+125	°C
Supply current Powerdown Mode	I _{DDPD}	VDD = 3.0 V, Ta = +25 °C	-	20	100	nA
Supply current Transmitter-Active Mode	I _{DDTMA}	F _{TX} = 315 MHz, P _{out} = 5 dBm,	-	10.0	11.0	mA
		F _{TX} = 315 MHz, P _{out} = 8 dBm,	-	12.7	13.7	
		F _{TX} = 315 MHz, P _{out} = 10 dBm,	-	15.0	16.0	
Carrier frequency bands	F _{TX}	-	300	-	465	MHz
			600	-	930	
ASK Bit rate	R _{ASK}	NRZ	-	-	100	kbps
FSK Bit rate	R _{FSK}	NRZ	-	-	50	kbps
Crystal frequency tolerance	F _{TOL}	Ta = +25 °C, without aging	-2	-	2	ppm
Crystal temperature variation	F _{TC}	-40 °C ~ +85 °C	-20	-	20	ppm
Nominal output power	P _{OUT}	Ta = +25 °C, VDD = 3.0 V, F _{TX} = 315 MHz, HPWR =1, AM* = 0x3F	10	11	12	dBm
		Ta = +25 °C, VDD = 3.0 V, F _{TX} = 315 MHz, HPWR =0, AM* = 0x01	-16	-15	-14	

External dimensions

(Unit: mm)





TCXO / VC-TCXO / TCXO-Standby For Automotive 105 °C High temperature range



Product Number (Please contact us)
TG2016SKA : X1G005371xxxx16

TG2016SKA

- Output frequency : 13 MHz to 55 MHz
- Supply voltage : 1.8 V Typ. / 3.3 V Typ.
- Frequency / temperature characteristics : $\pm 0.5 \times 10^{-6}$ Max. (-40 °C to +105 °C)
- External dimensions: 2.0 × 1.6 × 0.7 mm Max.
- Applications : GNSS for Automotive, V2X (TCU, DSRC)*
- Features : Low noise, 105 °C High temp, Stand-by function ($\overline{ST}$)
- AEC-Q100 compliant

* GNSS: Global Navigation Satellite System V2X: Vehicle to Everything TCU: Telematics control unit DSRC: Dedicated Short Range Communication



TG2016SKA

(2.0 × 1.6 × 0.7 mm)

Specifications (characteristics)

Item	Symbol	TCXO	VC-TCXO	TCXO-Standby	Conditions / Remarks
Output frequency range	f _o	13 MHz to 55 MHz 26 MHz, 49.58 MHz			Standard frequency
Supply voltage	V _{CC}	1.8 V ± 0.1 V / 3.3 V ± 5 %			Supply voltage range: 1.7 V to 3.63 V
Storage temperature range	T _{stg}	-55 °C to +125 °C			Storage as single product.
Operating temperature range	T _{use}	H: -40 °C to +105 °C			Standard
Frequency tolerance	f _{tol}	±2.0 × 10 ⁻⁶ Max.			After 3 times reflow, +25 °C
Frequency/temperature Characteristics	f _o -T _c	C: ±0.5 × 10 ⁻⁶ Max.			Standard stability version
Frequency/load coefficient	f _o -Load	±0.2 × 10 ⁻⁶ Max.			10 kΩ // 10 pF ± 10 %
Frequency/voltage coefficient	f _o -V _{CC}	±0.2 × 10 ⁻⁶ Max.			V _{CC} ± 5 %
Frequency aging	f _{age}	±1.0 × 10 ⁻⁶ Max.			+25 °C, First year, 13 MHz ≤ f _o ≤ 20 MHz, 26 MHz ≤ f _o ≤ 40 MHz
		±1.5 × 10 ⁻⁶ Max.			+25 °C, First year, 20 MHz < f _o < 26 MHz 40 MHz < f _o ≤ 55 MHz
Current consumption	I _{CC}	2.0 mA Max. 2.5 mA Max.			13 MHz ≤ f _o ≤ 40 MHz 40 MHz < f _o ≤ 55 MHz
Input resistance	Z _{in}	-	500 kΩ Min.	-	V _c - GND (DC)
Frequency control range	f _{cont}	-	±5.0 × 10 ⁻⁶ Min.	-	B: V _c = 0.9 V ± 0.6 V (V _{CC} = 1.8 V) or E: V _c = 1.65 V ± 1.0 V (V _{CC} = 3.3 V)
Frequency change polarity	f _{cp}	-	Positive polarity	-	
Stand-by current	I _{std}	-		10 μA Max.	$\overline{ST}$ = GND
Input voltage	V _{IH}	-		80 % V _{CC} Min.	$\overline{ST}$ terminal
	V _{IL}	-		20 % V _{CC} Max.	
Symmetry	SYM	40 % to 60 %			GND level (DC cut)
Output voltage	V _{pp}	0.8 V Min.			Peak to Peak
Start-up time	t _{str}	2.0 ms Max.			t = 0 at 90 % V _{CC}
Output load	Load_R	10 kΩ			DC cut capacitor = 0.01 μF
	Load_C	10 pF			
G-sensitivity	G _s	1.5 × 10 ⁻⁹ / G Max.			30 Hz to 3 kHz, sinewave, 3axes

* Note : Please contact us for requirements not listed in this specification.

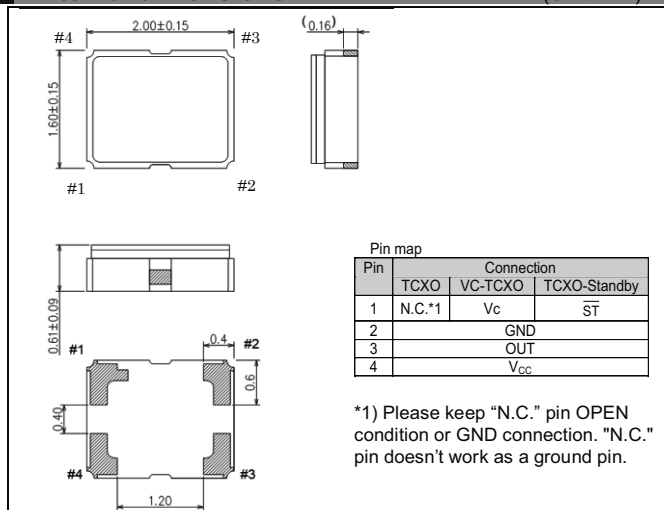
Product Name **TG2016 SKA 26.000000MHz** **E C H N N M**
(Standard form) ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

- ① Model (TG2016) ② Output (S: Clipped sine wave)
③ Frequency ④ Supply voltage (Refer to symbol table)
⑤ Frequency / temperature characteristics (C: ±0.5 × 10⁻⁶ Max.)
⑥ Operating temperature (H: -40 °C to +105 °C) ⑦ ST function (N: Non, S: Standby)
⑧ V_c function (Refer to symbol table) ⑨ Internal identification code

④ Supply voltage[V _{CC}] ⑧ V _c function[V _c] (Symbol table)			
Voltage [V]	TCXO	VC-TCXO	
④ V _{CC} (Typ.)	E: 1.8 C: 3.3	E: 1.8	C: 3.3
⑧ V _c (Typ.)	N: Non	B: 0.9	E: 1.65

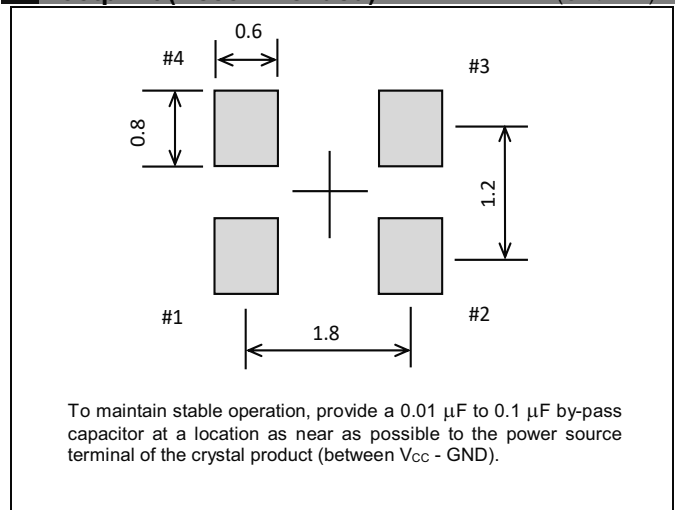
External dimensions

(Unit: mm)



Footprint (Recommended)

(Unit: mm)





TCXO / VC-TCXO / TCXO-Standby

For Automotive

85 °C High temperature range



Product Number (Please contact us)
TG2016SLA : X1G005741xxxx16

TG2016SLA

- Output frequency : 13 MHz to 55 MHz
- Supply voltage : 1.8 V Typ. / 3.3 V Typ.
- Frequency / temperature characteristics : $\pm 0.5 \times 10^{-6}$ Max. (-40 °C to +85 °C)
- External dimensions: 2.0 × 1.6 × 0.7 mm Max.
- Applications : GNSS for Automotive, V2X (TCU, DSRC)*
- Features : Low noise, Stand-by function ($\overline{ST}$)
- AEC-Q100 compliant

* GNSS: Global Navigation Satellite System V2X: Vehicle to Everything TCU: Telematics control unit DSRC: Dedicated Short Range Communication



TG2016SLA

(2.0 × 1.6 × 0.7 mm)

Specifications (characteristics)

Item	Symbol	TCXO	VC-TCXO	TCXO-Standby	Conditions / Remarks
Output frequency range	fo	13 MHz to 55 MHz 26 MHz, 49.58 MHz			Standard frequency
Supply voltage	V _{CC}	1.8 V ± 0.1 V / 3.3 V ± 5 %			Supply voltage range: 1.7 V to 3.63 V
Storage temperature range	T _{stg}	-55 °C to +125 °C			Storage as single product.
Operating temperature range	T _{use}	G: -40 °C to +85 °C			Standard
Frequency tolerance	f _{tol}	±2.0 × 10 ⁻⁶ Max.			After 3 times reflow, +25 °C
Frequency/temperature characteristics	fo-Tc	C: ±0.5 × 10 ⁻⁶ Max.			Standard stability version
Frequency/load coefficient	fo-Load	±0.2 × 10 ⁻⁶ Max.			10 kΩ // 10 pF ± 10 %
Frequency/voltage coefficient	fo-V _{CC}	±0.2 × 10 ⁻⁶ Max.			V _{CC} ± 5 %
Frequency aging	f _{age}	±1.0 × 10 ⁻⁶ Max.			+25 °C, First year, 13 MHz ≤ fo ≤ 20 MHz, 26 MHz ≤ fo ≤ 40 MHz
		±1.5 × 10 ⁻⁶ Max.			+25 °C, First year, 20 MHz < fo < 26 MHz, 40 MHz < fo ≤ 55 MHz
Current consumption	I _{CC}	2.0 mA Max. 2.5 mA Max.			13 MHz ≤ fo ≤ 40 MHz 40 MHz < fo ≤ 55 MHz
Input resistance	Z _{in}	-	500 kΩ Min.	-	V _C - GND (DC)
Frequency control range	f _{cont}	-	±5.0 × 10 ⁻⁶ Min.	-	B: V _C = 0.9 V ±0.6 V (V _{CC} = 1.8 V) or E: V _C = 1.65 V ±1.0 V (V _{CC} = 3.3 V)
Frequency change polarity	f _{cp}	-	Positive polarity	-	
Stand-by current	I _{std}	-		10 μA Max.	ST = GND
Input voltage	V _{IH}	-		80 % V _{CC} Min.	ST terminal
	V _{IL}	-		20 % V _{CC} Max.	
Symmetry	SYM	40 % to 60 %			GND level (DC cut)
Output voltage	V _{pp}	0.8 V Min.			Peak to Peak
Start-up time	t _{str}	2.0 ms Max.			t = 0 at 90 % V _{CC}
Output load	Load_R	10 kΩ			DC cut capacitor = 0.01 μF
	Load_C	10 pF			
G-sensitivity	G _s	1.5 × 10 ⁻⁹ / G Max.			30 Hz to 3 kHz.sinewave.3axes

* Note : Please contact us for requirements not listed in this specification.

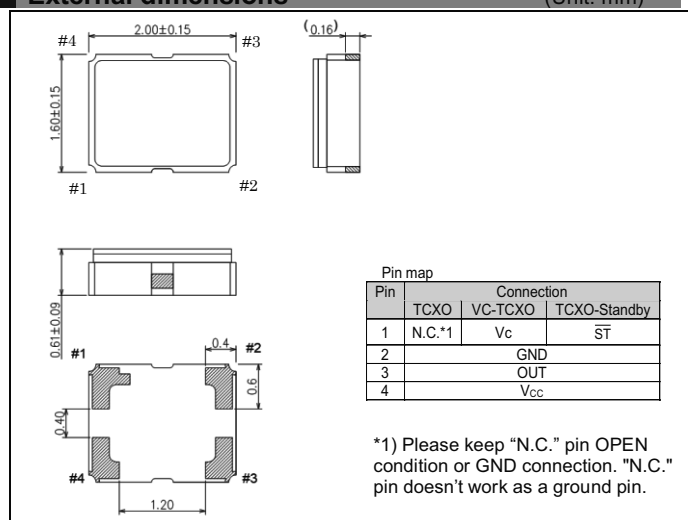
Product Name TG2016 SLA 26.000000MHz E C G N N M
(Standard form) ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

- ① Model (TG2016) ② Output (S: Clipped sine wave)
③ Frequency ④ Supply voltage (Refer to symbol table)
⑤ Frequency / temperature characteristics (C: $\pm 0.5 \times 10^{-6}$ Max.)
⑥ Operating temperature (G: -40 °C to +85 °C) ⑦ ST function (N: Non, S: Standby)
⑧ Vc function (Refer to symbol table) ⑨ Internal identification code

④ Supply voltage [V_{CC}] ⑧ Vc function [Vc] (Symbol table)			
Voltage [V]	TCXO	VC-TCXO	
④ V_{CC} (Typ.)	E: 1.8 C: 3.3	E: 1.8	C: 3.3
⑧ Vc (Typ.)	N: Non	B: 0.9	E: 1.65

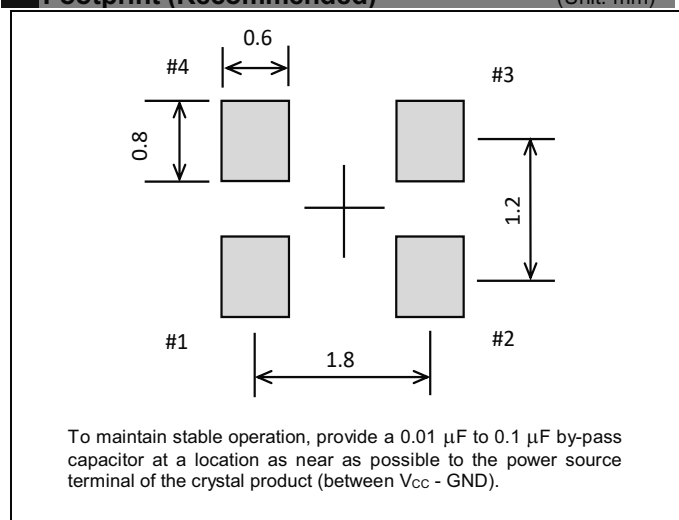
External dimensions

(Unit: mm)



Footprint (Recommended)

(Unit: mm)





GYRO SENSOR (Digital Output) FOR AUTOMOTIVE

XV4001BC / BD

XV4001KC / KD



Product number

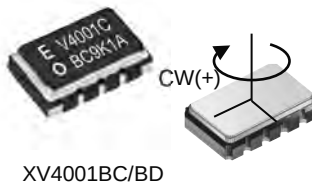
XV4001BC: X2A000201xxxx00

XV4001BD: X2A000161xxxx00

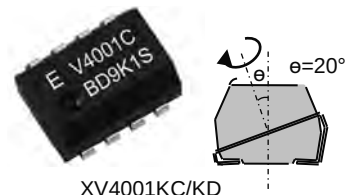
XV4001KC: X2A000211xxxx00

XV4001KD: X2A000171xxxx00

- SPI or I²C serial interface
 - Angular rate output (16bit), Temperature output (11bit)
 - Inclined angle: 20 degrees (XV4001KC/KD)
XV4001BC ... I²C / 5.0 x 3.2 x 1.3 mm
XV4001BD ... SPI / 5.0 x 3.2 x 1.3 mm
XV4001KC ... I²C / 6.0 x 4.8 x 3.3 mm
XV4001KD ... SPI / 6.0 x 4.8 x 3.3 mm
 - AEC-Q200 compliant
- Recommended Application**
- Car navigation system, Telematics



XV4001BC/BD



XV4001KC/KD

Specifications (characteristics)

Item	Symbol	Specifications	Conditions / Remarks
Supply Voltage	V _{DD}	3.3 V ±0.3 V	
Temperature range	Storage Temperature	T _{STG}	-50 °C to +105 °C
	Operating Temperature	T _{OPR}	-40 °C to +85 °C
Scale factor	S ₀	370 LSB/(°/s) ±1.5 %	Ta=+25 °C
Bias	V ₀	±2 %/s (0 LSB Typ.)	Ta=+25 °C
Rate range	I	±70 °/s	
Non linearity	NL	±0.5 % FS	Ta=+25 °C
Frequency response	BW	10 Hz Typ.	LPF Gain -3dB bandwidth
Cross axes	OS	±5 %	Ta=+25 °C
Current consumption	I _{op}	3.5 mA Typ.	not rotation and not communicating
Noise	rN	0.05 °/s RMS Typ.	

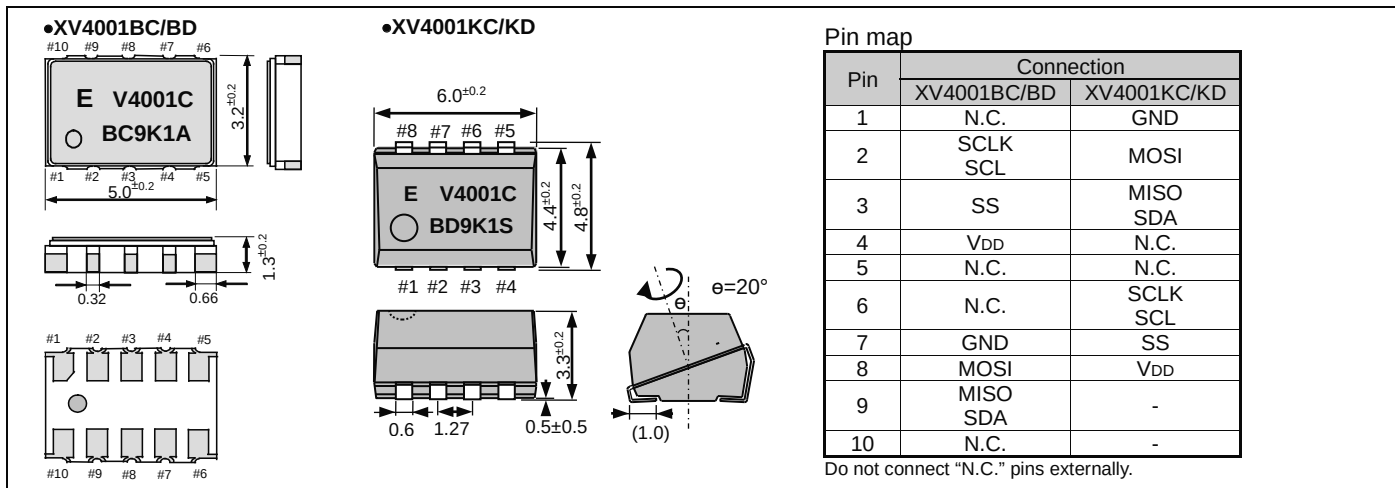
Product Name
(Standard form)

XV4001BC * * *

- ①Model ②Detection axis (1:Z-axis) ③Package type(B: Ceramic 5032size, K: Lead frame K-Type)
④Output (C: I²C, D: SPI) ⑤Frequency ⑥,⑦Internal identification code (⑤⑥⑦ are not necessary to specify)

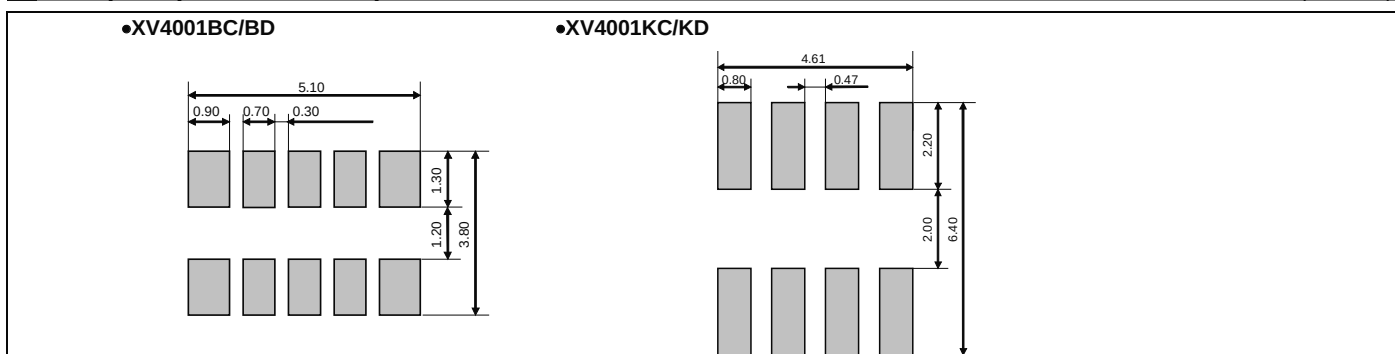
External Dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





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

■Terminal 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.

Model	Terminal Material	Terminal Plating	Complies With EU RoHS	Pb Free	Remarks (Contains Pb in products exempted by RoHS directive.)	Reference weight (Typ.)
kHz Range Crystal unit						
FC-12M	Mo	Au	O	O		5 mg
FC-135 / FC-135R	W	Au	O		7(c) - I	11 mg
FC-13A	Mo	Au	O	O		14 mg
FC1610AN	Mo	Au	O	O		3 mg
FC2012AN	Mo	Au	O	O		4.3 mg
FC3215AN	W	Au	O	O		13mg
MC-146	42 Alloy	Sn or Sn-Bi	O		7(a)	29 mg
MC-306	42 Alloy	Sn or Sn-Bi	O		7(a)	126 mg
MC-30A	42 Alloy	Sn or Sn-Bi	O		7(a)	126 mg
MHz Range Crystal unit						
FA1008AN	Mo	Au	O	O		0.8 mg
FA-118T	Mo	Au	O	O		3 mg
FA1210AN	Mo	Au	O	O		1 mg
FA-128	W	Au	O	O		7 mg
FA1612AS	W	Au	O	O		5 mg
FA2016AA	W	Au	O	O		7 mg
FA2016AS	W	Au	O	O		8 mg
FA2016ASA	W	Au	O	O		8 mg
FA-20H	W	Au	O	O		11 mg
FA-238	W	Au	O	O		16 mg
FA-238A	W	Au	O	O		16 mg
FA-238V	W	Au	O	O		16 mg
TSX-3225	W	Au	O	O		17 mg



Model	Terminal Material	Terminal Plating	Complies With EU RoHS	Pb Free	Remarks (Contains Pb in products exempted by RoHS directive.)	Reference weight (Typ.)
SPXO						
SG2016CAN / CAA	W	Au	O	O		9.9 mg
SG2016EGN / VGN	Mo	Au	O	O		7.6 mg
SG2016EHN / VHN	Mo	Au	O	O		7.6 mg
SG-210 STF	W	Au	O	O		12 mg
SG2520EGN	W	Au	O	O		12 mg
SG2520EHN	W	Au	O	O		12 mg
SG2520VGN	W	Au	O	O		12 mg
SG2520VHN	W	Au	O	O		12 mg
SG-3031CM	W	Au	O	O		13 mg
SG-3031CMA	W	Au	O	O		13 mg
SG3225CAN	W	Au	O	O		25 mg
SG3225EAN / VAN	W	Au	O	O		25 mg
SG3225EEN	W	Au	O	O		26 mg
SG3225HBN	W	Au	O	O		26 mg
SG3225VEN	W	Au	O	O		26 mg
SG5032CAN / CCN	W	Au	O	O		52 mg
SG5032EAN / VAN	W	Au	O	O		52 mg
SG5032EEN / VEN	W	Au	O	O		165 mg
SG7050CAN / CCN	W	Au	O	O		147 mg
SG7050EAN / VAN	W	Au	O	O		149 mg
SG7050EEN	W	Au	O	O		165 mg
SG7050VEN	W	Au	O	O		165 mg
Selectable SPXO						
SG-8503CA	W	Au	O	O		167mg
SG-8504CA	W	Au	O	O		168 mg
SG-8506CA	W	Au	O	O		167 mg
SPSO (Low-jitter SAW)						
EG-2102CB	W	Au	O	O		71 mg
EG-2121CB	W	Au	O	O		71 mg
XG-2102CA	W	Au	O	O		133 mg
XG-2103CA	W	Au	O	O		133 mg
XG-2121CA	W	Au	O	O		133 mg
XG5032HAN	W	Au	O	O		70 mg
Programmable SPXO						
SG-8018CA	W	Au	O	O		143 mg
SG-8018CB	W	Au	O	O		51 mg
SG-8018CE	W	Au	O	O		25 mg
SG-8018CG	W	Au	O	O		13 mg
SG-8101CA	W	Au	O	O		143 mg
SG-8101CB	W	Au	O	O		51 mg
SG-8101CE	W	Au	O	O		25 mg
SG-8101CG	W	Au	O	O		13 mg
SG-8101CGA	W	Au	O	O		14 mg
SG-8200CJ	Mo	Au	O	O		7.3 mg
SG-8201CJ	Mo	Au	O	O		7.3 mg
SG-8201CJA	Mo	Au	O	O		7.3 mg



Model	Terminal Material	Terminal Plating	Complies With EU RoHS	Pb Free	Remarks (Contains Pb in products exempted by RoHS directive.)	Reference weight (Typ.)
Spread Spectrum Programmable SPXO						
SG-9101CA	W	Au	O	O		143 mg
SG-9101CB	W	Au	O	O		51 mg
SG-9101CE	W	Au	O	O		25 mg
SG-9101CG	W	Au	O	O		13 mg
SG-9101CGA	W	Au	O	O		14 mg
VCXO / VCSO						
VG3225EFN	W	Au	O	O		26 mg
VG3225VFN	W	Au	O	O		26 mg
VG5032EDN	W	Au	O	O		64 mg
VG5032EFN	W	Au	O	O		66 mg
VG5032VDN	W	Au	O	O		64 mg
VG5032VFN	W	Au	O	O		66 mg
VG7050CDN	W	Au	O	O		168 mg
VG7050EAN	W	Au	O	O		167 mg
VG7050EBN	W	Au	O	O		166 mg
VG7050ECN	W	Au	O	O		168 mg
VG7050EFN	W	Au	O	O		172mg
VG7050VFN	W	Au	O	O		172mg
TCXO						
TG1612SLN	Mo	Au	O	O		4 mg
TG2016SKA	W	Au	O	O		8.2 mg
TG2016SLA	W	Au	O	O		8.2 mg
TG2016SLN	W	Au	O	O		8.1 mg
TG2016SMN	W	Au	O	O		8.7 mg
TG2520CEN	W	Au	O	O		16 mg
TG2520SMN	W	Au	O	O		16 mg
TG3225CEN	W	Au	O	O		26 mg
TG-3541CE	W	Au	O	O		24 mg
TG-3541CEA	W	Au	O	O		24 mg
TG-5006CE	W	Au	O	O		28 mg
TG-5006CG	W	Au	O	O		16 mg
TG-5006CJ	Mo	Au	O	O		9.1 mg
TG5032CFN / SFN	W	Au	O	O		71 mg
TG5032CGN / SGN	W	Au	O	O		72 mg
TG5032CKN / SKN	W	Au	O	O		72 mg
TG5032CMN / SMN	W	Au	O	O		71 mg
TG-5510CA	W	Au	O	O		165 mg
TG-5510CB	W	Au	O	O		72 mg
TG-5511CA	W	Au	O	O		167 mg
TG-5511CB	W	Au	O	O		71 mg
TG7050xKN	W	Au	O	O		165 mg
TG7050xMN	W	Au	O	O		167 mg
Multi Output Oscillator						
MG7050EAN / VAN / HAN	W	Au	O	O		163 mg
Module						
SR3225SAA	W	Au	O	O		24 mg



Model	Terminal Material	Terminal Plating	Complies With EU RoHS	Pb Free	Remarks (Contains Pb in products exempted by RoHS directive.)	Reference weight (Typ.)
Real Time Clock Module						
RA4000CE	W	Au	O	O		24 mg
RA-4565SA	42 Alloy	Sn	O		7(a)	309 mg
RA4803SA	42 Alloy	Sn	O		7(a)	314 mg
RA8000CE	W	Au	O	O		24 mg
RA8803SA	42Alloy	Sn	O		7(a)	314 mg
RA8804CE	W	Au	O	O		24 mg
RA8900CE	W	Au	O	O		24 mg
RTC-8564JE	42 Alloy	Sn-Ag	O		7(a)	119 mg
RTC-8564NB	Cu Alloy	Sn or Sn-Ag	O		7(a)	83 mg
RX-4035LC	42 Alloy	Sn-Ag	O		7(c) - I	25mg
RX-4035SA	42 Alloy	Sn	O		7(a)	314 mg
RX-4045NB	Cu Alloy	Sn or Sn-Ag	O		7(a)	84 mg
RX-4045SA	42 Alloy	Sn	O		7(a)	290 mg
RX4111CE	W	Au	O	O		24 mg
RX-4571LC	42 Alloy	Sn-Ag	O		7(c) - I	25 mg
RX-4571NB	Cu Alloy	Sn or Sn-Ag	O		7(a)	83 mg
RX-4571SA	42 Alloy	Sn	O		7(a)	309 mg
RX-4803LC	42 Alloy	Sn-Ag	O		7(c) - I	25 mg
RX-4803SA	42 Alloy	Sn	O		7(a)	314 mg
RX4901CE	W	Au	O	O		24 mg
RX6110SA	42 Alloy	Sn	O		7(a)	313 mg
RX8010SJ	Cu Alloy	Sn	O		7(a)	150 mg
RX-8025NB	Cu Alloy	Sn or Sn-Ag	O		7(a)	84 mg
RX-8025SA	42 Alloy	Sn	O		7(a)	292 mg
RX-8035LC	42 Alloy	Sn-Ag	O		7(c) - I	25 mg
RX-8035SA	42 Alloy	Sn	O		7(a)	314 mg
RX8111CE	W	Au	O	O		24 mg
RX8130CE	W	Au	O	O		24 mg
RX-8564LC	42 Alloy	Sn-Ag	O		7(c) - I	25 mg
RX-8571LC	42 Alloy	Sn-Ag	O		7(c) - I	25 mg
RX-8571SA	42 Alloy	Sn	O		7(a)	311 mg
RX-8731LC	42 Alloy	Sn-Ag	O		7(c) - I	25 mg
RX-8803LC	42 Alloy	Sn-Ag	O		7(c) - I	25 mg
RX-8803SA	42Alloy	Sn	O		7(a)	314 mg
RX8804CE	W	Au	O	O		24 mg
RX8900CE	W	Au	O	O		24 mg
RX8900SA	42Alloy	Sn	O		7(a)	313 mg
RX8901CE	W	Au	O	O		24 mg
Sensor						
XV-3510CB	W	Au	O	O		65 mg
XV4001Bx	W	Au	O	O		68 mg
XV4001Kx	Cu Alloy	Ni-Pd-Au	O	O		194 mg
XV7001BB	W	Au	O	O		65 mg
XV7011BB	W	Au	O	O		65 mg
XV7021BB	W	Au	O	O		67 mg
XV7081BB	W	Au	O	O		67 mg

*For IMU, Vibration sensor, Accelerometer, please contact an Epson sales representative in your region.



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.

7.2 PCB 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

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

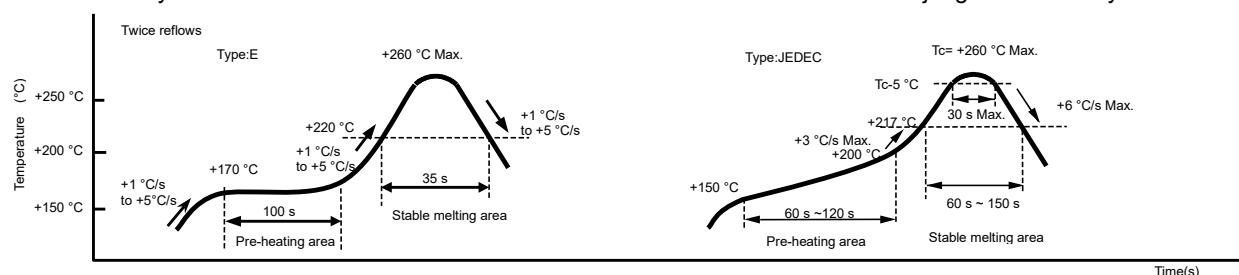
9. Mounting precautions

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. *2 for inquiries about heat-resistance if crystal products need to be soldered over the following profile.

- (1) 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:JEDEC	Remarks
kHz Range Crystal unit			
FC-12M		√	
FC-135 / FC-135R	√	*2	
FC-13A	√	*1	
FC1610AN		√	
FC2012AN		√	
FC3215AN		√	
MC-146	√	*2	
MC-306	√	*1	
MC-30A	√	*1	
MHz Range Crystal unit			
FA1008AN		√	
FA-118T		√	
FA1210AN		√	
FA-128		√	
FA1612AS		√	
FA2016AA		√	
FA2016AS		√	
FA2016ASA		√	
FA-20H		√	
FA-238	√	*1	
FA-238A	*1	√	
FA-238V	√	*1	
TSX-3225		√	

√ : Standard Spec.

*1: Support is *1.

*2: Customization is possible, but product specifications must be changed. Also, depending on the application and accuracy, it may not be possible.



Model	Type:E	Type:JEDEC	Remarks
SPXO			
SG2016CAN / CAA		√	
SG2016EGN / VGN		√	
SG2016EHN / VHN		√	
SG-210 STF		√	
SG2520EGN / VGN		√	
SG2520EHN / VHN		√	
SG-3031CM		√	
SG-3031CMA		√	
SG3225CAN		√	
SG3225EAN / VAN / EEN / VEN		√	
SG3225HBN		√	
SG5032CAN / CCN		√	
SG5032EAN / VAN / EEN / VEN		√	
SG7050CAN / CCN		√	
SG7050EAN / VAN / EEN / VEN		√	
Selectable SPXO			
SG-8503CA		√	
SG-8504CA		√	
SG-8506CA		√	
SPSO (Low-jitter SAW)			
EG-2102CB		√	
EG-2121CB		√	
XG-2102CA		√	
XG-2103CA		√	
XG-2121CA		√	
XG5032HAN		√	
Programmable SPXO			
SG-8018CA / CB / CE / CG		√	
SG-8101CA / CB / CE / CG		√	
SG-8101CGA		√	
SG-8200CJ		√	
SG-8201CJ		√	
SG-8201CJA		√	

√ : Standard Spec.

*1: Support is *1.

*2: Customization is possible, but product specifications must be changed. Also, depending on the application and accuracy, it may not be possible.



Model	Type:E	Type:JEDEC	Remarks
Spread Spectrum Programmable SPXO			
SG-9101CA / CB / CE / CG		√	
SG-9101CGA		√	
VCXO / VCSO			
VG3225 / 5032 / 7050EFN		√	
VG3225 / 5032 / 7050VFN		√	
VG5032EDN / VDN		√	
VG7050CDN		√	
VG7050EAN / EBN / ECN		√	
TCXO			
TG1612SLN		√	
TG2016SKA		√	
TG2016SLA		√	
TG2016SLN		√	
TG2016SMN		√	
TG2520CEN		√	
TG2520SMN		√	
TG3225CEN		√	
TG-3541CE		√	
TG-3541CEA		√	
TG-5006CE / CG / CJ		√	
TG5032CFN / SFN		√	
TG5032CGN / SGN		√	
TG5032CKN / SKN		√	
TG5032CMN / SMN		√	
TG-5510CA / TG-5511CA		√	
TG-5510CB / TG-5511CB		√	
TG7050CKN / SKN		√	
TG7050CMN / SMN		√	
Multi output Oscillator			
MG7050 series		√	
Module			
SR3225SAA		√	

√ : Standard Spec.

*1: Support is *1.

*2: Customization is possible, but product specifications must be changed. Also, depending on the application and accuracy, it may not be possible.



Model	Type:E	Type:JEDEC	Remarks
Real Time Clock Module			
RA4000CE		√	
RA-4565SA		√	Tc=+250 °C
RA4803SA		√	Tc=+250 °C
RA8000CE		√	
RA8803SA		√	Tc=+250 °C
RA8804CE		√	
RA8900CE		√	
RTC-8564JE	√	*2	
RTC-8564NB	√	*2	
RX-4035LC		√	
RX-4035SA		√	
RX-4045NB	√	*2	
RX-4045SA	√	*2	Tc=+250 °C
RX4111CE		√	
RX-4571LC		√	
RX-4571NB		√	
RX-4571SA		√	Tc=+250 °C
RX-4803LC		√	
RX-4803SA		√	Tc=+250 °C
RX4901CE		√	
RX6110SA		√	Tc=+250 °C
RX8010SJ		√	Tc=+250 °C
RX-8025NB	√	*2	
RX-8025SA	√	*2	Tc=+250 °C
RX-8035LC		√	
RX-8035SA		√	
RX8111CE		√	
RX8130CE		√	
RX-8564LC	√	*2	
RX-8571LC		√	
RX-8571SA		√	Tc=+250 °C
RX-8731LC		√	
RX-8803LC		√	
RX-8803SA		√	Tc=+250 °C
RX8804CE		√	
RX8900CE		√	
RX8900SA		√	Tc=+250 °C
RX8901CE		√	
Sensor			
XV-3510CB		√	
XV4001Bx		√	
XV4001Kx		√	
XV7001BB		√	
XV7011BB		√	
XV7021BB		√	
XV7081BB		√	

√ : Standard Spec.

*1: Support is *1.

*2: Customization is possible, but product specifications must be changed. Also, depending on the application and accuracy, it may not be possible.



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) 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, 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 cause 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

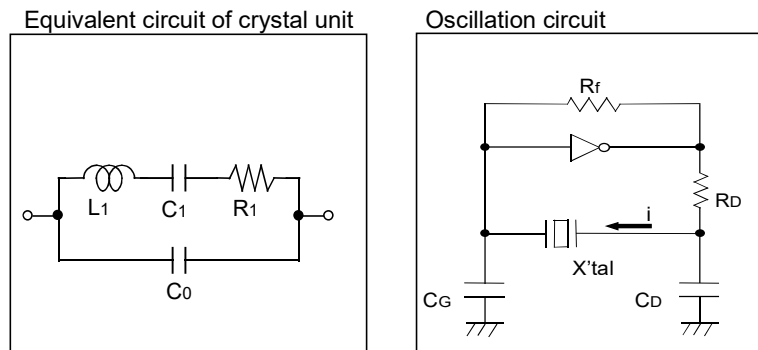
1. Drive level

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

$$\text{Drive level (P)} = i^2 \cdot R_e$$

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

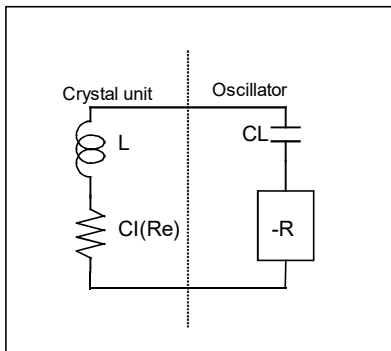
If the Drive level (P) exceeds the specified level, oscillation frequency will shift. This occurs because an excessive level of power causes stress for the crystal and, consequently, temperature rises. If excessive drive level of power is applied to the crystal unit, this may deteriorate or damage the characteristics.



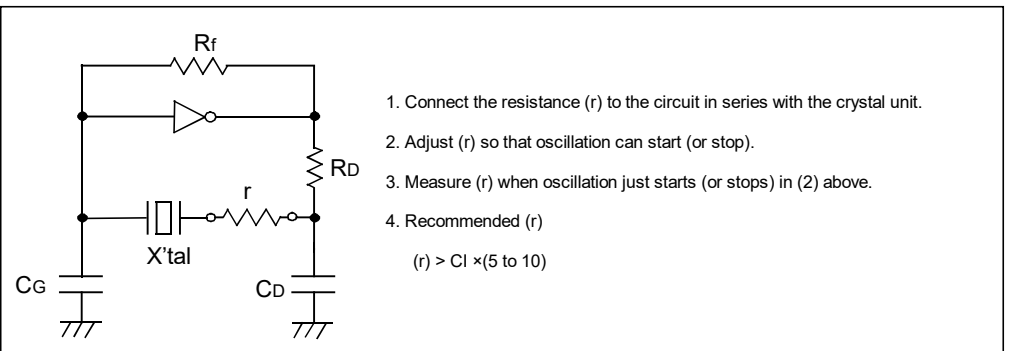
2. Allowance for oscillation

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

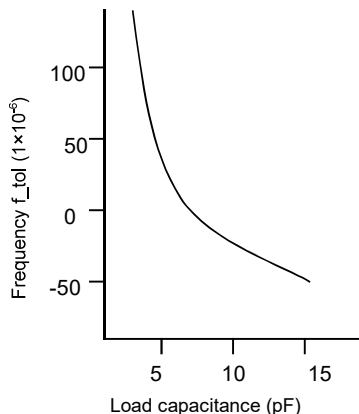


3. Load capacitance

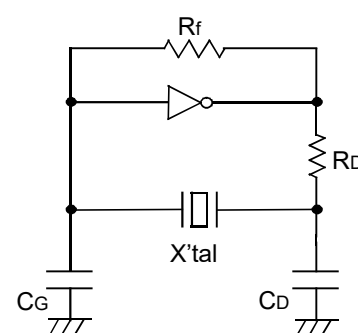
Differences in the load capacitance of the oscillation circuit may result in a different oscillation frequency from the desired one, as shown in the figure below. Approximate expression of the load capacitance of the circuit $CL \cong CG \times CD / (CG + CD) + CS$.

Where CS stands for stray Capacity of the circuit.

● Frequency and load capacitance characteristics



● Reference for setting parameters of oscillation circuit



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

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

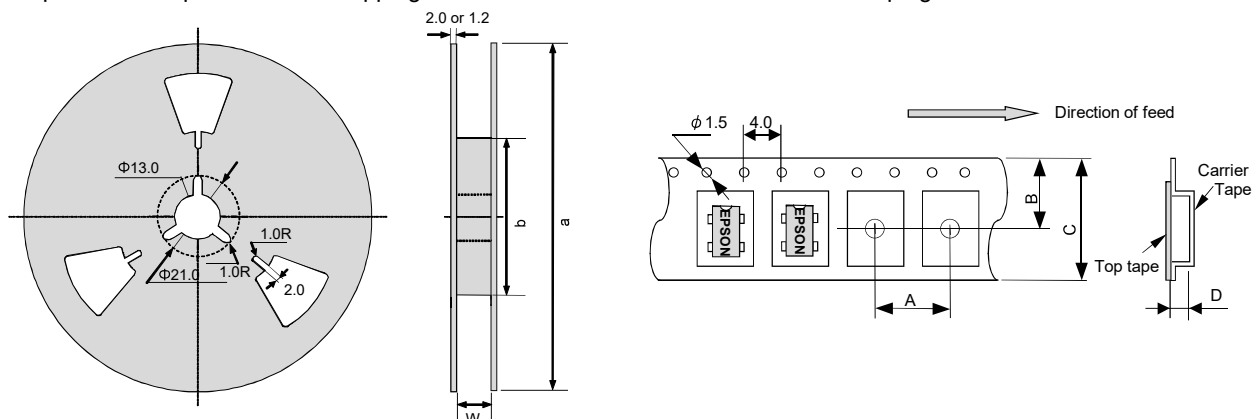


PACKING SPECIFICATIONS

For SMD products, recommendation packing quantity is specified as below table. Please order in accordance with packing quantity.

1. SMD

SMD products are packed in the shipping carton as below table in accordance with taping standards EIA-481 and IEC-60286.



RECOMMENDATION PACKING QUANTITY and DIMENSION (Unit: mm)

●Crystal unit

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-12M	5000	Φ180	Φ60	9	4	5.25	8	0.75	L
FC-135 / FC-135R	3000	Φ180	Φ60	13	4	7.25	12	1	L
FC-13A	3000	Φ180	Φ60	13	4	7.25	12	1	L
FC1610AN	5000	Φ180	Φ60	9	4	5.25	8	0.65	L
FC2012AN	5000	Φ180	Φ60	9	4	5.25	8	0.75	L
FC3215AN	3000	Φ180	Φ60	13	4	7.25	12	1	L
MC-146	9000	Φ330	Φ80 or Φ100	17	4	9.25	16	1.6	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
MHz Range Crystal unit									
FA1008AN	6000	Φ180	Φ60	9	4	5.25	8	0.35	L
FA-118T	6000	Φ180	Φ60	9	4	5.25	8	0.5	L
FA1210AN	6000	Φ180	Φ60	9	4	5.25	8	0.45	L
FA-128	5000	Φ180	Φ60	9	4	5.25	8	0.7	L
FA1612AS	5000	Φ180	Φ60	9	4	5.25	8	0.7	L
FA2016AA	5000	Φ180	Φ60	9	4	5.25	8	0.7	L
FA2016AS	5000	Φ180	Φ60	9	4	5.25	8	0.7	L
FA2016ASA	3000	Φ180	Φ60	9	4	5.25	8	0.7	L
FA-20H	5000	Φ180	Φ60	9	4	5.25	8	0.75	L
FA-238	4000	Φ180	Φ60	9	4	5.25	8	1.05	L
FA-238A	4000	Φ180	Φ60	9	4	5.25	8	1.05	L
FA-238V	4000	Φ180	Φ60	9	4	5.25	8	1.05	L
TSX-3225	4000	Φ180	Φ60	9	4	5.25	8	1	L



●SPXO

Model	Quantity (pcs/Reel)	Reel dimension			Career Tape dimension				Direction of feed (L=left direction)
		a	b	W	A	B	C	D	
SG2016CAN / CAA	3000	Φ180	Φ60	9	4	5.25	8	1	L
SG2016EGN / VGN	2000	Φ180	Φ60	9	4	5.25	8	1	L
SG2016EHN / VHN	2000	Φ180	Φ60	9	4	5.25	8	1	L
SG-210 STF	3000	Φ180	Φ60	9	4	5.25	8	1.15	L
SG2520EGN / VGN	2000	Φ180	Φ60	9	4	5.25	8	1.15	L
SG2520EHN / VHN	2000	Φ180	Φ60	9	4	5.25	8	1.15	L
SG-3031CM	3000	Φ180	Φ60	13	4	7.25	12	1	L
SG-3031CMA	3000	Φ180	Φ60	13	4	7.25	12	1	L
SG3225CAN	2000	Φ180	Φ60	9	4	5.25	8	1.4	L
SG3225EAN / VAN / EEN / VEN	2000	Φ180	Φ60	9	4	5.25	8	1.4	L
SG3225HBN	2000	Φ180	Φ60	9	4	5.25	8	1.4	L
SG5032CAN / CCN	1000	Φ180	Φ60	13	8	7.25	12	1.4	L
SG5032EAN / VAN / EEN / VEN	1000	Φ180	Φ60	13	8	7.25	12	1.4	L
SG7050CAN / CCN	1000	Φ254	Φ100	17.4	8	9.25	16	2	L
SG7050EAN / VAN	1000	Φ254	Φ100	17.4	8	9.25	16	2	L
SG7050EEN / VEN	1000	Φ180	Φ60	17	8	9.25	16	2	L
SG-850xCA	1000	Φ180	Φ60	17	8	9.25	16	2	L

●SPSO(Low-Jitter SAW)

EG-2102CA	1000	Φ180	Φ60	17	8	9.25	16	2	L
EG-2102CB	1000	Φ180	Φ60	13	8	7.25	12	1.7	L
EG-2121CB	1000	Φ180	Φ60	13	8	7.25	12	1.7	L
XG-2102CA	1000	Φ180	Φ60	17	8	9.25	16	2	L
XG-2103CA	1000	Φ180	Φ60	17	8	9.25	16	2	L
XG-2121CA	1000	Φ180	Φ60	17	8	9.25	16	2	L
XG5032HAN	1000	Φ180	Φ60	13	8	7.25	12	1.7	L

●Programmable & Spread Spectrum

SG-8101CA / SG-8018CA	1000	Φ254	Φ100	17.4	8	9.25	16	2	L
SG-8101CB / SG-8018CB	1000	Φ180	Φ60	13	8	7.25	12	1.4	L
SG-8101CE / SG-8018CE	2000	Φ180	Φ60	9	4	5.25	8	1.4	L
SG-8101CG	3000	Φ180	Φ60	9	4	5.25	8	1.15	L
SG-8018CG / CGA	3000	Φ180	Φ60	9	4	5.25	8	1.15	L
SG-8200CJ	3000	Φ180	Φ60	9	4	5.25	8	1	L
SG-8201CJ / CJA	3000	Φ180	Φ60	9	4	5.25	8	1	L
SG-9101CA	1000	Φ254	Φ100	17.4	8	9.25	16	2	L
SG-9101CB	1000	Φ180	Φ60	13	8	7.25	12	1.4	L
SG-9101CE	2000	Φ180	Φ60	9	4	5.25	8	1.4	L
SG-9101CG / CGA	3000	Φ180	Φ60	9	4	5.25	8	1.15	L

●VCXO/VCSO

VG3225EFN / VFN	2000	Φ180	Φ60	9	4	5.25	8	1.4	L
VG5032EFN / VFN	1000	Φ180	Φ60	13	8	7.25	12	1.4	L
VG5032EDN / VDN	1000	Φ180	Φ60	13	8	7.25	12	1.4	L
VG7050CDN	1000	Φ180	Φ60	17	8	9.25	16	2	L
VG7050EAN / EBN / ECN	1000	Φ180	Φ60	17	8	9.25	16	2	L
VG7050EFN / VFN	1000	Φ180	Φ60	17	8	9.25	16	2	L



●Real Time Clock Module

Model	Quantity (pcs/Reel)	Reel dimension			Career Tape dimension				Direction of feed (L=left direction)
		a	b	W	A	B	C	D	
RA-4565SA	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	3.65	L
RA4803SA	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	3.65	L
RA8803SA	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	3.65	L
RX****CE/ RA****CE	2000	Φ180	Φ60	9	4	5.25	8	1.4	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-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
RX6110SA	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	3.65	L
RX8010SJ	1000	Φ330	Φ80	17.5	12	9.25	16	2.95	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-8571SA	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
RX8900SA	1000	Φ330	Φ80 or Φ100	17.5	12	9.25	16	3.65	L



●TCXO

Model	Quantity (pcs/Reel)	Reel dimension			Career Tape dimension				Direction of feed (L=left direction)
		a	b	W	A	B	C	D	
TG1612SLN	3000	Φ180	Φ60	9.4	4	5.25	8	1.15	L
TG2016SLN	3000	Φ180	Φ60	9.4	4	5.25	8	1.15	L
TG2016SMN	12000	Φ330	Φ100	9.4	4	5.25	8	1	L
	3000	Φ180	Φ60	9	4	5.25	8	1	L
TG2520CEN	10000	Φ330	Φ100	9.4	4	5.25	8	1	L
	3000	Φ180	Φ60	9	4	5.25	8	1	L
TG2520SMN	10000	Φ330	Φ100	9.4	4	5.25	8	1	L
	3000	Φ180	Φ60	9	4	5.25	8	1	L
TG3225CEN	2000	Φ180	Φ60	9	4	5.25	8	1.4	L
TG-3541CE / TG3541CEA	2000	Φ180	Φ60	9	4	5.25	8	1.4	L
TG-5006CE	2000	Φ180	Φ60	9	4	5.25	8	1.4	L
TG-5006CG	2000	Φ180	Φ60	9	4	5.25	8	1.15	L
TG-5006CJ	12000	Φ330	Φ100	9.4	4	5.25	8	1	L
	3000	Φ180	Φ60	9	4	5.25	8	1	L
TG5032CFN / SFN	1000	Φ180	Φ60	13	8	7.25	12	1.4	L
TG5032CGN / SGN	1000	Φ180	Φ60	13	8	7.25	12	1.4	L
TG5032CKN / SKN	1000	Φ180	Φ60	13	8	7.25	12	1.4	L
TG5032CMN / SMN	1000	Φ180	Φ60	13	8	7.25	12	1.4	L
TG-5510CA / TG-5511CA	1000	Φ180	Φ60	17	8	9.25	16	2	L
TG-5510CB / TG-5511CB	1000	Φ180	Φ60	13	8	7.25	12	1.4	L
TG7050xKN / xMN	1000	Φ180	Φ60	17	8	9.25	16	2	L

●Multi output oscillator

MG7050 series	1000	Φ180	Φ60	17	8	9.25	16	2.1	L
---------------	------	------	-----	----	---	------	----	-----	---

●Module

SR3225SAA	3000	Φ180	Φ60	9	4	5.25	8	1.4	L
-----------	------	------	-----	---	---	------	---	-----	---

●Sensor

XV-3510CB	2000	Φ254	Φ100	13.4	8	7.25	12	2.1	L
XV4001Bx	2000	Φ254	Φ100	13.4	8	7.25	12	2.1	L
XV4001Kx	1000	Φ254	Φ100	13.4	8	7.25	12	3.7	L
XV7011BB / XV7001BB	2000	Φ254	Φ100	13.4	8	7.25	12	2.1	L
XV7021BB / XV7081BB	2000	Φ254	Φ100	13.4	8	7.25	12	2.1	L



Glossary

Item	Content	Object
Fundamental mode	First harmonic crystal vibration mode. The AT resonance frequency is determined by the thickness of the crystal, but even with the same thickness the third overtone will be about three times the frequency of the fundamental. With tuning fork crystal unit, the second overtone is about six times the fundamental. Tuning fork crystal unit Fundamental mode AT-cut crystal unit $F(\text{MHz}) = \frac{1670}{t(\mu\text{m})} \quad (t: \text{Thickness})$ Fundamental mode, 3rd overtone mode SAW Resonator SAW Structure figure Output Frequency $f = k/\lambda$ (λ=Interval of an/the electrode, k= Fixed number) Vibration mode	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. CMOS NOTE: SYM=tw/t × 100% TTL NOTE: SYM=tw/t × 100% Clipped Sine SYM=tw/t × 100% LV-PECL SYM=tw/t LVDS SYM=tw/t $dV_{out} = V_{out} - V_{in}$ $dV_{in} = V_{in} - V_{out}$ HCSL SYM=tw/t	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

X'tal:Crystal unit, OSC:Crystal oscillator

More details are available on the website.

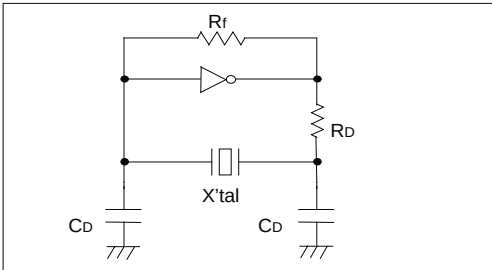
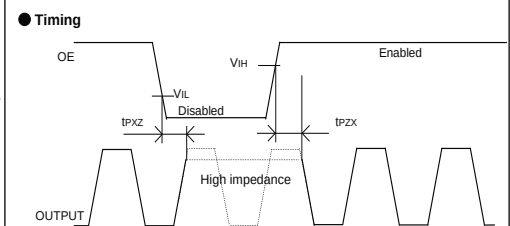
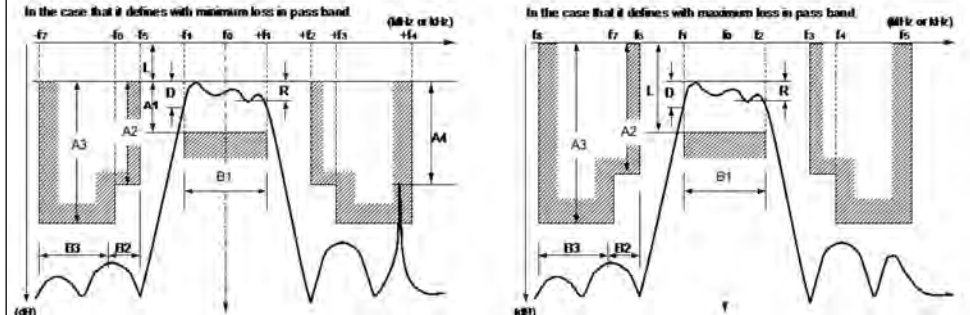


Item	Content	Object
Drive level (DL)	Current or voltage level in the oscillating (operating) state. (Drive power= power required to oscillate crystal unit.)	X'tal
Deviation in PB	The difference between the max. and min. attenuations within a pass band.	Filter
Frequency (f)	Number of waves (cycles) per second. The relation between frequency and cycle is $f(\text{Hz})=1/t(\text{s})$.	ALL
(Frequency) aging (f_age, f_aging)	Amount of frequency drift when operated under the specified conditions for a specified term.	ALL
Frequency tolerance precision (f_tol)	Under specified conditions at an ambient temperature of +25 °C, the difference in actual (measured) frequency from the nominal frequency.	X'tal
Frequency voltage Coefficient	Taking the output frequency at the central voltage in the operating voltage range as the reference, the change in output frequency to voltage. Causes of this change are changes in crystal deformation, and changes in IC internal constants for chips mounted in the oscillator and Real time clock module. The effects of the ICs are larger.	OSC
Frequency tolerance (f_tol)	Within standard temperature and operational voltage ranges, the drift in the output frequency. The output frequency drift including frequency temperature characteristics and frequency voltage characteristics. When there is an annotation in the margin, It is given to priority.	OSC
HFF-XTAL	HFF-XTAL is a high frequency fundamental mode crystal unit using inverted-mesa shape AT-cut blank fabricated with photolithographic technology. Therefore it has an excellent stability for temperature, aging and shock.	OSC
Frequency temperature characteristics	Taking the frequency at 25 degrees Centigrade as the reference, the change in frequency in response to ambient temperature. ● Tuning fork crystal unit. SAW Resonator. $\Delta f/f = B(T_i - \theta X)^2 \quad \theta X: \text{specified temperature}$ ● AT crystal unit. $\Delta f/f = \alpha(\theta X - 25) + \beta(\theta X - 25)^2 + \chi(\theta X - 25)^3$ Examples of frequency temperature characteristics	ALL
Group delay distortion (Δt)	The difference between the max. and min. group delay within a pass band B1 unless otherwise specified.	Filter
Insulation resistance (IR)	Resistance between lead and lead, or between lead and case package. (conductive package)	ALL
Insertion loss (L)	The logarithmic ratio of the power delivered to the load impedance before insertion of the filter to the power delivered to the load impedance after insertion of the filter.	Filter
Load capacitance (CL)	Effective capacitance (series equivalent charge capacitance) of the oscillation circuit as seen from the pins of the crystal unit. This capacitance is determined as a condition when the crystal unit is connected to the oscillation circuit and will determine the output frequency. Load capacitance approximation: CL	X'tal
Max. drive level (GL)	Rating for the drive level. Current or power input over this level may result in characteristic degradation or destruction.	X'tal
Max. supply voltage (Vcc-GND)	Maximum rated value for power input to the power supply pin. Input over this value may result in characteristic degradation or destruction.	OSC
Max. input level (R)	The max. power that can be delivered to the filter without destructing the filter.	Filter
Nominal frequency (f_nom)	Nominal value of frequency of crystal unit. A frequency given in specification, to which other frequencies may be referred.	X'tal Filter
Operating temperature Range (T_use)	Temperature range where specification characteristics are fulfilled, unless otherwise specified.	ALL
Origin frequency (fo)	Oscillation source frequency of oscillator inside oscillation system.	OSC

X'tal: Crystal unit, OSC: Crystal oscillator

More details are available on the website.

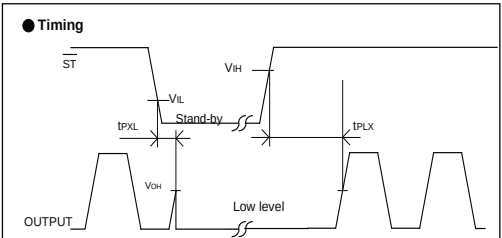


Item	Content	Object
Fall time(t_f)	The time it takes for the output wave form to change from the high voltage(high level) to the low voltage(low level). Also called wave form fall time. See waveform diagram under Symmetry.	OSC
Rise time(t_r)	The time it takes for the output wave form to change from the 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
Start-up time (t_{str})	The time from power on until the wave form stabilizes. However, voltage rise times depend on the power supply, Therefore, the time depends on the power supply, and the time is measured from a specific set of initial conditions.	OSC
Output enable(OE)	Output is switched to high impedance, and wired OR connection can be used to select multiple outputs(frequency). OE pin: High or open. Specified frequency output = enabled. OE pin: Low. Output is high impedance=disabled. Oscillation is not stopped, so after the clock is disabled, it is not synchronized with OE (clock is continuous). 	OSC
Output frequency (f_o)	The frequency output from the oscillator circuit or the crystal oscillator system.	OSC
Output load conditions	The types and quantities (power) of the loads that can be connected to the oscillator. Calculated for 1 TTL as $I_{OH} = -40 \mu A$, $I_{OL} = 1.6 \text{ mA}$ and for LS-TTL as $I_{OH} = -20 \mu A$, $I_{OL} = 0.4 \text{ mA}$.	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(C_o)	Charge capacitance between the two electrodes in the crystal unit.	X'tal

X'tal:Crystal Unit, OSC:Crystal Oscillator

More details are available on the website.



Item	Content	Object
Soldering conditions (Tsol)	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. ● Timing 	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 (Vcc)	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.

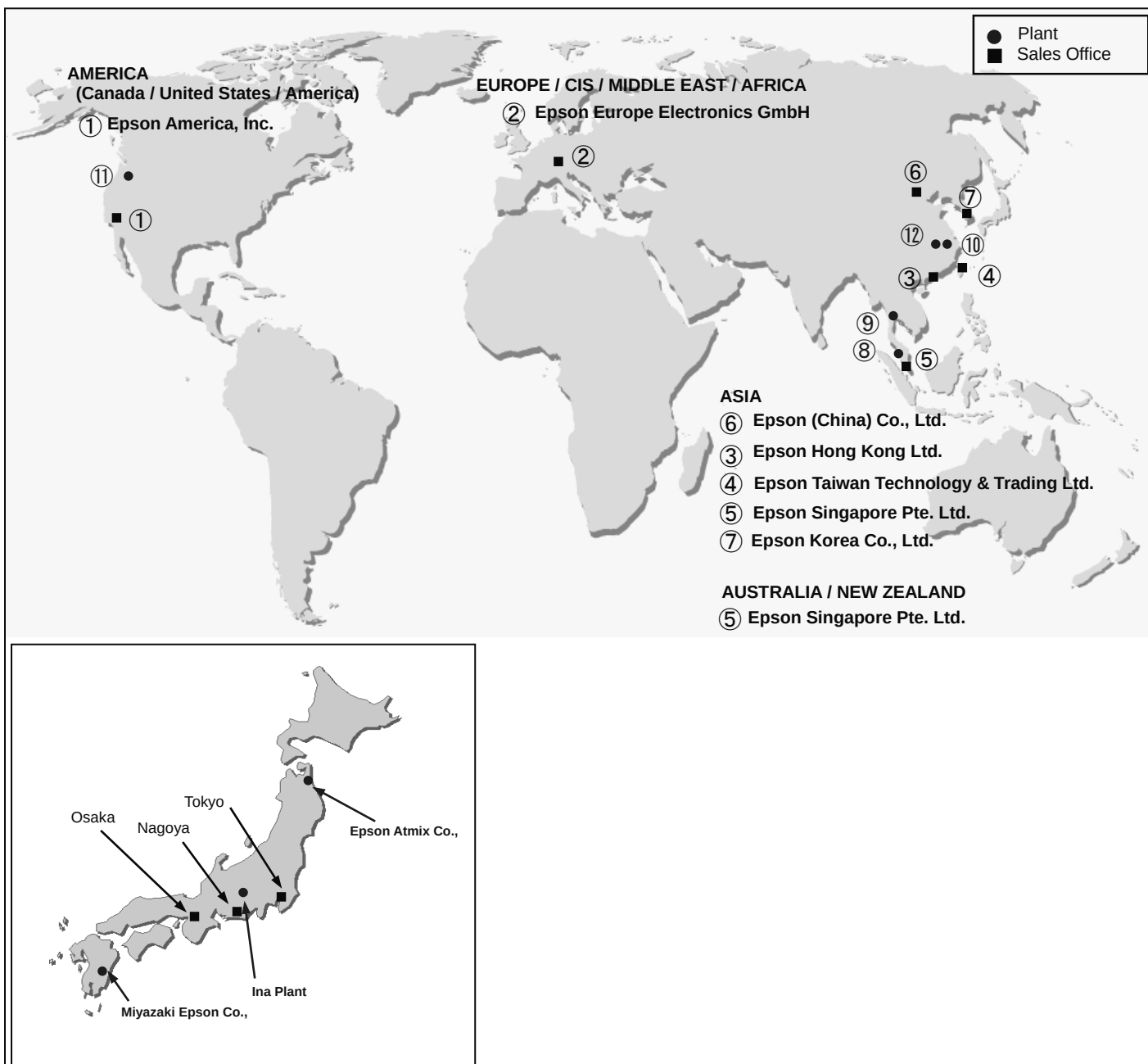


■ Manufacturing Plant

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
Fujimi Plant / Seiko Epson Corp.	Apr.1980	IMU, Vibration sensor, Accelerometer
Miyazaki Epson Co.,	Jun.1984	Crystal Chip, Synthetic quartz
Epson Atmix Co.,	Oct.1999	Synthetic quartz

Plant	Date Operations Commenced	Products
⑧: Epson Precision Malaysia Sdn. Bhd.	Dec.1974	Crystal unit, Crystal oscillator, Sensing device, Real time clock module
⑨: Epson Precision (Thailand) Ltd.	May.1988	Crystal unit, Surface acoustic wave device Crystal oscillator
⑩: Epson Precision Suzhou Co.,Ltd.	Mar.1997	Crystal unit, Crystal oscillator Real time clock module
⑪: Epson Portland ,Inc.	Jun.2000	Synthetic quartz

■ Business area



MEMO

[illegible]

AMERICA

Epson America, Inc.

Headquarter	3131 Katella Ave. Los Alamitos, CA 90720, USA Phone: (1)-562-290-4677 www.epson.com/microdevices
San Jose Office	2860 Zanker Road Suite 204 San Jose, CA 95134, USA Phone: Toll Free (1)- 800-463-7766

EUROPE

Epson Europe Electronics GmbH

Headquarter	Riesstrasse 15, 80992 Munich, Germany Phone: (49)-89-14005-0 Fax: (49)-89-14005-110 www.epson-electronics.de
-------------	--

ASIA

Epson (China) Co., Ltd.

Headquarter	4F, Tower 1 of China Central Place, 81 Jianguo Street, Chaoyang District, Beijing 100025 China Phone: (86) 10-8522-1199 Fax: (86) 10-8522-1125 www.epson.com.cn
Shanghai Branch	Rm. 601-603, Building A One East, No.325 East Longhua Road, Shanghai 200233, China Phone: (86) 21-5330-4888 Fax: (86) 21-5423-4677
Shenzhen Branch	Room.603/604, 6 Floor, Tower 7, One Shenzhen Bay, No.3008 Center Rd, Shenzhen, 518054, China Phone: (86) 755-3299-0588 Fax: (86) 755-3299-0560

Epson Hong Kong Ltd.

Unit 715-723 7/F Trade Square, 681 Cheung Sha Wan Road, Kowloon, Hong Kong
Phone: (86) 755-3299-0588 Fax: (86) 755-3299-0560 (Shenzhen Branch)
www.epson.com.hk

Epson Taiwan Technology & Trading Ltd.

15F., No.100, Songren Rd., Sinyi Dist.,
Taipei City, 11073 TAIWAN
Phone: (886) 2-8786-6688
www.epson.com.tw

Epson Singapore Pte. Ltd.

Electronic Devices Sales Division Alexandra Technopark Block B, #04-01/04 438B Alexandra Rd, Singapore 119968
Phone: (65) 6586-5500 Fax: (65) 6271-3182
www.epson.com.sg

Epson Korea Co., Ltd

10F Posco Tower Yeoksam, Teheranro 134 Gangnam-gu, Seoul, 06235, Korea
Phone: (82) 2-3420-6695
www.epson.co.kr

Distributor

CRYSTAL MASTER 2023

Issued on Mar. 2023

Seiko Epson Corporation

Device Sales Department



www5.epsondevice.com/en/