

EPSON



# THE CRYSTALMASTER

PRODUCT CATALOG

•  
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# THE CRYSTALMASTER



## ENERGY SAVING EPSON

EPSON offers effective savings to its customers through a wide range of electronic devices, such as semiconductors, liquid crystal display (LCD) modules, and crystal devices. These savings are achieved through a sophisticated melding of three different efficiency technologies.

Power saving technology provides low power consumption at low voltages.

Space saving technology provides further reductions in product size and weight through super-precise processing and high-density assembly technology.

Time saving technology shortens the time required for design and development on the customer side and shortens delivery times.

Our concept of Energy Saving technology conserves resources

by blending the essence of these three efficiency technologies. The essence of these technologies is represented in each of the products that we provide to our customers.

In the industrial sector, leading priorities include measures to counter the greenhouse effect by reducing CO<sub>2</sub>, measures to preserve the global environment, and the development of energy-efficient products. Environmental problems are of global concern, and although the contribution of energy-saving technology developed by EPSON may appear insignificant, we seek to contribute to the development of energy-saving products by our customers through the utilization of our electronic devices. EPSON is committed to the conservation of energy, both for the sake of people and of the planet on which we live.

### WORKING WITH ENVIRONMENTAL ISSUES

In 1988, Seiko Epson led in working to abolish CFCs, and perfect abolition of those ozone layer-destroying substances was achieved in 1992. In 1998, the 10th year of start of the CFC-free activity, Seiko Epson set this year as the "Second Environmental Benchmark Year" and established a new corporate General Environmental Policy. Seiko Epson is tackling with environmental issues comprehensively.

At the end of Fiscal 1988, Seiko Epson succeeded in abolishing chloric solvents doubted to be harmful to human body. In fiscal 1999, Seiko Epson started the activity with a goal of abolishing lead solder pointed out possibility of environmental pollutant.

#### Promotion of Environment Management System conforming to International Standard

To strengthen management for environmental activities, Seiko Epson Group aims at acquisition of the ISO14001 certification for Japanese and abroad main business bases (including affiliates) for manufacturing, sales, software development and others.

As of May 25, 2001, planned 68 bases of all manufacturing bases and some non-manufacturing bases have acquired the certification.



#### Co-existence Mark

The environmental mark symbolizing Epson's basic stance of "Co-existence with Nature". The design incorporates a fish, flower, and water, representing mutually supportive co-existence.



ISO14000 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

Seiko-Epson quickly began working to acquire company-wide ISO9000 series certification, and has acquired ISO9001 or ISO9002 certification with all targeted products manufactured in Japanese and overseas plants.

The Quartz Device Operations Division (Ina Japan, EPM and SZE) have acquired QS-9000 certification, which are of higher level.



#### QS-9000:

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

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## APPLICATIONS GUIDE

• HOW TO ORDER AND PRODUCT NUMBER .....	1 - 5
• STANDARD PACKING SPECIFICATIONS .....	6
• WORKING FOR Pb FREE PRODUCTS .....	7 - 8
• FREQUENCY RAUGE LIST .....	9 - 10
• SPECIFICATIONS LIST .....	11 - 12
• PACKAGE DIMENSIONS LIST .....	13 - 15
• HANDLING PRECAUTIONS .....	16 - 18
• PRECAUTIONS IN DESIGNING OSCILLATION CIRCUITS .....	18 - 19
• OUTPUT WAVEFORM AND TEST CIRCUIT .....	20

## CRYSTAL UNIT DATA SHEETS

Low / Medium-frequency (kHz range)	• FC-135 / 145 .....	21	
	• FC-255 .....	22	
	• MC-146 / 156 .....	23	
	• MC-206 .....	24	
	• MC-306 / 405 / 406 .....	25	
High-frequency (MHz range)	• C-2-TYPE C-4-TYPE C-TYPE .....	26	
	• FA-238 .....	27	
	• FA-23H (High-stability) .....	28	
	• FA-248 .....	29	
	• FA-365 .....	30	
	• MA-306 .....	31	
	• MA-406 / 505 / 506 .....	32	
	• CA-301 .....	33	
	Temperature sensing crystal	• HTS-206 .....	100

## CRYSTAL OSCILLATOR DATA SHEETS

Low / Medium-frequency (kHz range)	• SG-3030JC / JF SG-3032JC .....	34	
High-frequency (MHz range)	• SG-350 / 550 series .....	35	
	• SG-310 series .....	36	
	• SG-645 series .....	37	
	• SG-710 series .....	38	
	• SG-636 series .....	39 - 40	
	• SG-615 / 531 / 51 series .....	41 - 42	
	Programmable PLL	• SG-8002LA / LB series .....	43
		• SG-8002CE series .....	44
		• SG-8002JF series .....	45
		• SG-8002CA series .....	46
		• SG-8002JC series .....	47
		• SG-8002JA series .....	48
		• SG-8002DB / DC series .....	49
		• SG-8002 series characteristics chart .....	50 - 52
		• SG-Writer .....	53
Spread spectrum		• SG-9001CA/JC .....	54
Low jitter	• EG-2011CA (1.8 V CMOS) .....	55	
	• EG-2021CA (2.5 V CMOS) .....	56	
	• EG-2121CA (2.5 V LV-PECL / LVDS) .....	57	
	• EG-2102CA (3.3 V LV-PECL / LVDS) .....	58	
	• EG-2101CA (3.3 V LV-PECL) .....	59	
	• EG-2002CA (3.3 V LV-TTL) .....	60	
	• EG-2001CA (3.3 V CMOS) .....	61	
	High-stability	• HG-2150CA .....	62
• HG-1012JA / 2012JA .....		63	
• HG-8002JA series .....		64	
Voltage-controlled (VCXO)	• EV-2101CA .....	65	
	• EV-3101TA .....	66	
	• VG-1201CA .....	67	
	• VG-1011JA .....	68	
	• VG-4231CA .....	69	
	• VG-4010JA / 4030JA .....	70	
	• VG-2828CB .....	71	
Temperature compensated (TCXO)	• TG-5000LA .....	72	
Multi-output	• MG-5020JE .....	73	
	• MG-5100SA (PLL selectable output) .....	74	

## REAL TIME CLOCK MODULE DATA SHEETS

Serial interface	4-wire	• RX-4045SA / NB (High-stability) .....	75 - 76
		• RX-4581NB (SPI bus, built-in SRAM) .....	77 - 78
		• RTC-9701JE (SPI bus, built-in EEPROM) .....	79 - 80
	3-wire	• RTC-4553 .....	85
		• RTC-4701JE / NB RX-4702CF (built-in temperature sensor) .....	81 - 82
		• RTC-4574SA / JE / NB .....	83 - 84
I <sup>2</sup> C bus	• RTC-4543SA / SB .....	86	
	• RX-8025SA / NB (High-stability) .....	87 - 88	
	• RX-8581SA / JE / NB (High quality 32.768 kHz output) .....	89 - 90	
Parallel interface	4-bit	• RTC-8564JE / NB RX-8564CF .....	91 - 92
		• RTC-7301SF / DG (Multi function) .....	93 - 94
		• RTC-62421 / 62423 .....	95
		• RTC-72421 / 72423 .....	96

## SURFACE ACOUSTIC WAVE DATA SHEETS

Resonator	• NS-32R .....	97
	• FS-335 / 555 .....	98
	• FS-585 .....	105
Filter	• FF-555 .....	99
	• FF-585 .....	106

## PRODUCTS FOR AUTOMOTIVE DATA SHEETS

Crystal unit	Low / Medium-frequency (kHz range)	• MC-30A .....	102	
		• RA-4574SA .....	103	
Real time clock module	Serial interface	3-wire	• RA-8581SA .....	104
			I <sup>2</sup> C bus	• FS-585 .....
SAW (Sarface Acoustic Wave) Resonator	• FS-585 .....	105		
SAW (Sarface Acoustic Wave) Filter	• FF-585 .....	106		

## GLOSSARY

## ■ COMPARISON TABLE FOR MODEL AND PRODUCT NUMBER

When ordering ,please specify Product Number. For Product Number before contacting us, please confirm specifications for “xxxxx” and standard packing specifications (page 6)

### ■ CRYSTAL UNIT

Low / Medium-frequency (kHz range)

Model	Product Number	Specifications for “xxxxx”
C-001R	Q 1 1 C 0 0 1 R x x x x x 0 0	Load Capacitance Frequency Tolerance Solder-Plating (Pb-Free or not) (FC-145 : Pb-Free)
C-002RX	Q 1 1 C 0 2 R X x x x x x 0 0	
C-004R	Q 1 1 C 0 0 4 R x x x x x 0 0	
C-005R	Q 1 1 C 0 0 5 R x x x x x 0 0	
FC-145	Q 1 3 F C 1 4 5 x x x x x 0 0	
FC-135	Q 1 x F C 1 3 5 x x x x x 0 0	Nominal frequency Load capacitance Frequency tolerance Solder-Plating (Pb-Free or not) (FC-135 and FC-255 : Pb-Free)
FC-255	Q 1 x F C 2 5 5 x x x x x 0 0	
C-2 TYPE	Q 1 2 C 2 0 0 0 x x x x x 0 0	
C-4 TYPE	Q 1 2 C 4 0 0 0 x x x x x 0 0	
MC-146	Q 1 x M C 1 4 6 x x x x x 0 0	
MC-156	Q 1 x M C 1 5 6 x x x x x 0 0	
MC-206	Q 1 x M C 2 0 6 x x x x x 0 0	
MC-306	Q 1 x M C 3 0 6 x x x x x 0 0	
MC-30A	Q 1 x M C 3 0 A x x x x x 0 0	
MC-405	Q 1 x M C 4 0 5 x x x x x 0 0	
MC-406	Q 1 x M C 4 0 6 x x x x x 0 0	

**e.g.**  
**FC-135** 00.000 kHz 000 pF ±00x10<sup>-6</sup> -00°C to +00°C **Pb-Free** **Quantity**  
 Model Load Capacitance Operating Temperature range Solder Plating (Pb-Free / Pb-Solder) (Please refer to Page 5 Standard Packing Spec.)  
 Nominal Frequency Frequency Tolerance Please confirm each data sheet before ordering.

High-frequency (MHz range)

Model	Product Number	Specifications for “xxxxx”
CA-301	Q 2 1 C A 3 0 1 x x x x x 0 0	Nominal frequency Load capacitance Frequency tolerance Frequency temperature characteristics (FA-23H, FA-238, FA-248) Operating temperature range Fundamental mode or 3rd Overtone mode (26.000 MHz ≤ f < 30.000 MHz CA-301, MA-406, MA-505, MA-506) Solder-Plating (Pb-Free or not) (FA-238, FA-23H, FA-248 and FA-365 : Pb-Free)
FA-23H	Q 2 4 F A 2 3 H x x x x x 0 0	
FA-238	Q 2 2 F A 2 3 8 x x x x x 0 0	
FA-248	Q 2 2 F A 2 4 8 x x x x x 0 0	
FA-365	Q 2 2 F A 3 6 5 x x x x x 0 0	
MA-306	Q 2 2 M A 3 0 6 x x x x x 0 0	
MA-406	Q 2 2 M A 4 0 6 x x x x x 0 0	
MA-505	Q 2 2 M A 5 0 5 x x x x x 0 0	
MA-506	Q 2 2 M A 5 0 6 x x x x x 0 0	

**e.g.**  
**FA-23H** 00.000 MHz 00 pF ±00x10<sup>-6</sup> ±00x10<sup>-6</sup>/-00°C to +00°C **Pb-Free** **Quantity**  
 Model Load Capacitance Frequency Temperature Characteristics / Operating Temperature range Solder Plating (Pb-Free / Pb-Solder) (Please refer to Page 5 Standard Packing Spec.)  
 Nominal Frequency Frequency Tolerance / Operating Temperature range Please confirm each data sheet before ordering.

**e.g. (MA-406/505/506)**  
**MA-406** 00.000 MHz 0000mode 00 pF ±00x10<sup>-6</sup> ±00x10<sup>-6</sup>/-00°C to +00°C **Pb-Free** **Quantity**  
 Model Nominal Frequency Load Capacitance Frequency Temperature Characteristics / Operating Temperature range Solder Plating (Pb-Free / Pb-Solder) (Please refer to Page 5 Standard Packing Spec.)  
 Fundamental mode or Third (3<sup>rd</sup>) overtone mode (MA-406 / 505 / 506 : 26 MHz ≤ fo < 30 MHz) Frequency Tolerance / Operating Temperature range Please confirm each data sheet before ordering.

Temperature sensing crystal

Model	Product Number	Specifications for “xxxxx”
HTS-206	Q 1 9 H T 2 0 6 x x x x x 0 0	Nominal frequency Operating temperature range Solder-Plating (Pb-Free or not)

**e.g.**  
**HTS-206** 00.000 kHz -00°C to +00°C **Pb-Free** **Quantity**  
 Model Operating Temperature range Solder Plating (Pb-Free / Pb-Solder) (Please refer to Page 5 Standard Packing Spec.)  
 Nominal Frequency Please confirm each data sheet before ordering.

**CRYSTAL OSCILLATOR**

Low / Medium-frequency (kHz range)

Model	Product Number	Specifications for "xxxxx"
SG-3030JF	Q 3 1 0 2 J F 0 x x x x x 0 0	Output frequency
SG-3030JC	Q 3 1 0 2 J C 0 x x x x x 0 0	Frequency tolerance    Operating temperature range
SG-3032JC	Q 3 1 0 1 J C 0 x x x x x 0 0	Solder-Plating (Pb-Free or not)

**e.g.**  
**SG-3030JF 32.768 kHz ±□□x10<sup>-6</sup> -□□°C to +□□°C Pb-Free Quantity**

Model                      Frequency Tolerance                      Solder Plating (Pb-Free / Pb-Solder)                      Quantity

Output Frequency                      Operating Temperature range                      (Please refer to Page 5 Standard Packing Spec.)                      Please confirm each data sheet before ordering.

High-frequency (MHz range)

Model	Product Number	Specifications for "xxxxx"
SG-350	Q 3 3 3 5 0 x x x x x x 0 0	Output frequency
SG-310	Q 3 3 3 1 0 F x x x x x x 0 0	Frequency stability
SG-550	Q 3 3 5 0 x x x x x x 0 0	Operating voltage
SG-51	Q 3 2 5 1 0 x x x x x x 0 0	Operating temperature range
SG-531	Q 3 2 5 3 1 x x x x x x 0 0	Stand-by or Output enable
SG-615	Q 3 3 6 1 5 x x x x x x 0 0	CMOS or TTL
SG-636	Q 3 3 6 3 6 x x x x x x 0 0	Solder-Plating (Pb-Free or not)
SG-645	Q 3 3 6 4 5 x x x x x x 0 0	(SG-350, SG-550, SG-310, SG-710 : Pb-Free)
SG-710	Q 3 3 7 1 0 x x x x x x 0 0	

**e.g.**  
**SG-350 □□.□□□□ MHz □ □ □ □ Pb-Free Quantity**

Model    Output Frequency                      Solder Plating (Pb-Free / Pb-Solder)                      (Please refer to Page 5 Standard Packing Spec.)

Frequency Stability / Operating Temperature range  
**(S : ±25 x 10<sup>-6</sup> / -20 °C to +70 °C, B : ±50 x 10<sup>-6</sup> / -20 °C to 70 °C, C : ±100 x 10<sup>-6</sup> / -20 °C to +70 °C, L : ±50 x 10<sup>-6</sup> / -40 °C to 85 °C, M : ±100 x 10<sup>-6</sup> / -40 °C to +85 °C)**

Internal code : Alphabet or Blank  
 Operating Voltage / Logic (**T** : 5.0 V TTL, **H** : 5.0 V COMS, **C** : 3.3 V CMOS, **D** : 2.5 V CMOS, **E** : 1.8 V CMOS, Blank : TTL / CMOS)  
 <Exception> SG-636PTF : TTL / CMOS  
 Function (**P** : Output enable, **S** : Standby)

Please confirm each data sheet before ordering.

Programmable PLL high-frequency (MHz range)

Model	Product Number	Specifications for "xxxxx"
SG-8002LA	Q 3 3 2 4 L A x x x x x x 0 0	Output frequency
SG-8002LB	Q 3 3 2 3 L B x x x x x x 0 0	Frequency stability
SG-8002JF	Q 3 3 0 8 J F x x x x x x 0 0	Operating voltage
SG-8002CA	Q 3 3 0 9 C A x x x x x x 0 0	Operating temperature range
SG-8002CE	Q 3 3 2 1 C E x x x x x x 0 0	Stand-by or Output enable
SG-8002JC	Q 3 3 0 7 J C x x x x x x 0 0	CMOS or TTL
SG-8002JA	Q 3 3 0 6 J A x x x x x x 0 0	Solder-Plating (Pb-Free or not)
SG-8002DB	Q 3 2 0 3 D B x x x x x x 0 0	(SG-8002LA, SG-8002LB, SG-8002CA and SG-8002CE : Pb-Free)
SG-8002DC	Q 3 2 0 4 D C x x x x x x 0 0	

**e.g.**  
**SG-8002LA □□.□□□□ MHz □ □ □ □ Pb-Free Quantity**

Model    Output Frequency                      Solder Plating (Pb-Free / Pb-Solder)                      (Please refer to Page 5 Standard Packing Spec.)

Frequency Stability / Operating Temperature range (**B** : ±50 x 10<sup>-6</sup> / -20 °C to 70 °C, **C** : ±100 x 10<sup>-6</sup> / -20 °C to +70 °C, **M** : ±100 x 10<sup>-6</sup> / -40 °C to +85 °C)

Operating Voltage / Logic (**T** : 5.0 V TTL, **H** : 5.0 V COMS, **C** : 3.3 V CMOS)

Function (**P** : Output enable, **S** : Standby)

Please confirm each data sheet before ordering.

Programmable PLL high-frequency with Spread spectrum

Model	Product Number	Specifications for "xxxxx"
SG-9001CA	Q 3 3 3 1 x 0 x x x x x x 0 0	Output frequency    Frequency stability    Operating voltage    Operating temperature range
SG-9001JC	Q 3 3 3 1 x 1 x x x x x x 0 0	Spread spectrum (Center spread or Down spread)    Spread percentage    Solder-Plating (Pb-Free)

**e.g.**  
**SG-9001JC □□.□□□□ MHz □ □ □ □ Pb-Free Quantity**

Model    Output Frequency                      Solder Plating (Pb-Free)                      (Please refer to Page 5 Standard Packing Spec.)

Function (**P** : Output enable)

Spread percentage

Spread spectrum (**C** : Center spread, **D** : Down spread)

Please confirm each data sheet before ordering.

Low jitter high-frequency (MHz range)

Model	Product Number	Specifications for "xxxxx"
EG-2011CA	Q 3 8 0 8 C A 0 x x x x x 0 0	Output frequency      Frequency stability Operating voltage Operating temperature range      Duty LVDS or Differential LV-PECL or LV-TTL or CMOS Solder-Plating (Pb-Free)
EG-2021CA	Q 3 8 0 7 C A 0 x x x x x 0 0	
EG-2121CA	Q 3 8 0 5 C A x x x x x x 0 0	
EG-2102CA	Q 3 8 0 6 C A x x x x x x 0 0	
EG-2101CA	Q 3 8 0 3 C A 0 x x x x x 0 0	
EG-2002CA	Q 3 8 0 2 C A 0 x x x x x 0 0	
EG-2001CA	Q 3 8 0 1 C A 0 x x x x x 0 0	

e.g. (EG-2011CA / 2021CA / 2121CA / 2102CA)

**EG-2121CA**    □□.□□□□ MHz        **Pb-Free**    **Quantity**

Model      Output Frequency      Solder Plating (Pb-Free / Pb-Solder)      (Please refer to Page 5 Standard Packing Spec.)  
 Details of frequency stability : A, N etc  
 Operating Temperature range (P : 0 °C to +70 °C, R : -5 °C to +85 °C)  
 Frequency Stability (G : ±50 x 10<sup>-6</sup>, J : ±75 x 10<sup>-6</sup>, H : ±100 x 10<sup>-6</sup> etc)  
 Logic / Duty (P : PECL Duty ±5 %, D : PECL Duty ±2 %, L : LVDS Duty ±5 %, V : LVDS Duty ±2 %)

e.g. (EG-2001CA / 2002CA / 2101CA)

**EG-2001CA**    □□.□□□□ MHz        **Pb-Free**    **Quantity**

Model      Output Frequency      Solder Plating (Pb-Free / Pb-Solder)      (Please refer to Page 5 Standard Packing Spec.)  
 Details of frequency stability / Operating Temperature range : H, Y, Z etc  
 Operating voltage : (C : 3.3 V)  
 Duty (P : Duty ±5 %, D : Duty ±2 %)

Please confirm each data sheet before ordering.

High-stability high-frequency (MHz range)

Model	Product Number	Specifications for "xxxxx"
HG-1012JA	Q 3 5 1 1 J A 0 x x x x x 0 0	Output frequency      Frequency stability
HG-2012JA	Q 3 5 1 2 J A 0 x x x x x 0 0	Operating temperature range      Solder-Plating (Pb-Free or not)
HG-2150CA	Q 3 5 1 4 C A 0 x x x x x 0 0	Output frequency      Frequency stability      Operating voltage      Operating temperature range      Solder-Plating (Pb-Free)
HG-8002JA	Q 3 5 0 2 J A x x x x x x 0 0	Output frequency      Frequency stability      Operating voltage      Operating temperature range      Stand-by or Output enable      CMOS or TTL      Solder-Plating (Pb-Free or not)

e.g. (HG-1012JA / 2012JA)

**HG-1012JA**    □□.□□□□ MHz      **Pb-Free**    **Quantity**

Model      Output Frequency      Solder Plating (Pb-Free / Pb-Solder)      (Please refer to Page 5 Standard Packing Spec.)  
 Frequency Stability / Operating Temperature range  
 (SV : ±15 x 10<sup>-6</sup> / -20 °C to +70 °C, AV : ±20 x 10<sup>-6</sup> / -20 °C to +70 °C, BV : ±25 x 10<sup>-6</sup> / -20 °C to +70 °C  
 BX : ±25 x 10<sup>-6</sup> / -40 °C to +85 °C, CX : ±30 x 10<sup>-6</sup> / -40 °C to +85 °C)

e.g. (HG-2150CA)

**HG-2150CA**    □□.□□□□ MHz      **Pb-Free**    **Quantity**

Model      Output Frequency      Solder Plating (Pb-Free / Pb-Solder)      (Please refer to Page 5 Standard Packing Spec.)  
 Operating voltage / Logic (H : 5.0 V CMOS, C : 3.3 V CMOS)  
 Frequency Stability / Operating Temperature range (SV : ±15 x 10<sup>-6</sup> / -20 °C to +70 °C, BX : ±25 x 10<sup>-6</sup> / -40 °C to +85 °C)

e.g. (HG-8002JA)

**HG-8002JA**    □□.□□□□ MHz        **Pb-Free**    **Quantity**

Model      Output Frequency      Solder Plating (Pb-Free / Pb-Solder)      (Please refer to Page 5 Standard Packing Spec.)  
 Frequency Stability / Operating Temperature range (AV : ±20 x 10<sup>-6</sup> / -20 °C to +70 °C, BV : ±25 x 10<sup>-6</sup> / -20 °C to +70 °C, CX : ±30 x 10<sup>-6</sup> / -40 °C to +85 °C)  
 Operating voltage / Logic (T : 5.0 V TTL, H : 5.0 V CMOS, C : 3.3 V CMOS)  
 Function (P : Output enable, S : Standby)

Please confirm each data sheet before ordering.

Voltage-controlled

Model	Product Number	Specifications for "xxxxx"
VG-2828CB	Q 3 6 2 3 C B 0 x x x x x 0 0	Output frequency Operating voltage Operating temperature range Solder-Plating (Pb-Free)
EV-2101CA	Q 3 8 3 1 C A 0 x x x x x 0 0	Output frequency Operating voltage Operating temperature range
EV-3101TA	Q 3 8 2 1 T A 0 x x x x x 0 0	APR (Absolute Pull Range) Solder-Plating (Pb-Free)
VG-1201CA	Q 3 6 0 3 C A 0 x x x x x 0 0	Output frequency Frequency stability Operating voltage Operating temperature range Pull range Pin terminal layout (F type or T type) Solder-Plating (Pb-Free or not) (VG-1201CA, VG-4231CA) (VG-1201CA and VG-4231CA : Pb-Free)
VG-1011JA	Q 3 6 0 2 J A 0 x x x x x 0 0	
VG-4231CA	Q 3 6 1 4 C A 0 x x x x x 0 0	
VG-4010JA	Q 3 6 1 1 J A 0 x x x x x 0 0	
VG-4030JA	Q 3 6 1 2 J A 0 x x x x x 0 0	

e.g.

**VG-2828CB** 00.0000 MHz 0.0 V ± 00% ±00x10<sup>-6</sup> Max. / -00°C to +00°C 0.0 V ± 0.0 V ±00x10<sup>-6</sup> to ±00x10<sup>-6</sup> Min. **Pb-Free** **Quantity**

Model Output Frequency Operating Voltage Frequency Stability / Operating Temperature range Control Voltage Solder Plating (Pb-Free / Pb-Solder) (Please refer to Page 5 Standard Packing Spec.)

e.g.

**EV-3101TA** 00.0000 MHz     **Pb-Free** **Quantity**

Model Output Frequency Solder Plating (Pb-Free / Pb-Solder) (Please refer to Page 5 Standard Packing Spec.)

Function (S : Standby, P : Output enable)  
Operating Temperature range (P : 0 °C to +70 °C, R : -5 °C to +85 °C)  
M : -40 °C to +85 °C, Q : -10 °C to +75 °C, S : 0 °C to +85 °C  
Absolute Pull range (G : ±50 x 10<sup>-6</sup> Min., H : ±100 x 10<sup>-6</sup> Min.)  
Logic / Duty (P : PECL Duty ±5 %, D : PECL ±2 %, L : LVDS Duty ±5 %, V : LVDS Duty ±2 %)

e.g. (VG-1201CA)

**VG-1201CA** 00.0000 MHz     **Pb-Free** **Quantity**

Model Output Frequency Solder Plating (Pb-Free / Pb-Solder) (Please refer to Page 5 Standard Packing Spec.)

Operating Voltage / Logic (H : 5.0 V CMOS, C : 3.3 V CMOS)  
Pull range (K : ±75 x 10<sup>-6</sup> Min., N : ±100 x 10<sup>-6</sup> Min.)  
Frequency Stability / Operating Temperature range (A : ±20 x 10<sup>-6</sup> / -20 °C to +70 °C, B : ±25 x 10<sup>-6</sup> / -40 °C to +85 °C)

e.g. (VG-1011JA)

**VG-1011JA** 00.0000 MHz     **Pb-Free** **Quantity**

Model Output Frequency Solder Plating (Pb-Free / Pb-Solder) (Please refer to Page 5 Standard Packing Spec.)

Pull range (B : ±20 x 10<sup>-6</sup> Min., G : ±50 x 10<sup>-6</sup> Min., K : ±75 x 10<sup>-6</sup> Min., N : ±100 x 10<sup>-6</sup> Min.)  
Frequency Stability / Operating Temperature range  
(SW : ±15 x 10<sup>-6</sup> / -30 °C to +75 °C, AV : ±20 x 10<sup>-6</sup> / -20 °C to +70 °C, BX : ±25 x 10<sup>-6</sup> / -40 °C to +85 °C)

e.g. (VG-4231CA)

**VG-4231CA** 00.0000 MHz     **Pb-Free** **Quantity**

Model Output Frequency Solder Plating (Pb-Free / Pb-Solder) (Please refer to Page 5 Standard Packing Spec.)

Operating Voltage / Logic (H : 5.0 V CMOS, C : 3.3 V CMOS)  
Pull range (R : ±130 x 10<sup>-6</sup> Min.)  
Absolute pull range / Frequency Stability / Operating Temperature range  
(D : ±80 x 10<sup>-6</sup> Min. / ±35 x 10<sup>-6</sup> / -20 °C to +70 °C, G : ±65 x 10<sup>-6</sup> Min. / ±50 x 10<sup>-6</sup> / -40 °C to +85 °C)

e.g. (VG-4010JA / 4030JA)

**VG-4030JA** 00.0000 MHz **DVK** **Pb-Free** **Quantity**

Model Output Frequency Specification code Solder Plating (Pb-Free / Pb-Solder) (Please refer to Page 5 Standard Packing Spec.)

Please confirm each data sheet before ordering.

Temperature compensated

Model	Product Number	Specifications for "xxxxx"
TG-5000LA	Q 3 7 1 1 L A x x x x x 0 0	Output frequency Frequency tolerance Operating voltage Control voltage Operating temperature range Frequency control range Frequency stability vs temperature Solder-Plating (Pb-Free or not)

e.g.

**TG-5000LA** 00.0000 MHz 0.0 V ± 00% ±00x10<sup>-6</sup> Max. ±00x10<sup>-6</sup> Max. / -00°C to +00°C 0.0 V ± 0.0 V ±00x10<sup>-6</sup> to ±00x10<sup>-6</sup> Min. **Pb-Free** **Quantity**

Model Output Frequency Operating Voltage Frequency Stability vs temperature / Operating Temperature range Frequency Control Range Solder Plating (Pb-Free) (Please refer to Page 5 Standard Packing Spec.)

Please confirm each data sheet before ordering.

Multi-output

Model	Product Number	Specifications for "xxxxx"
MG-5020JE	Q 3 3 M 2 2 J E x x x x x 0 0	Output frequency Operating voltage
MG-5100SA	Q 3 3 M 2 1 S A x x x x x 0 0	Solder-Plating (Pb-Free or not)

e.g. **MG-5100SA** 00.0000 MHz 0.0 V ±00x10<sup>-6</sup> / -00°C to +00°C **Pb-Free** **Quantity**

Model Output Frequency Operating Voltage Frequency Stability / Operating Temperature range Solder Plating (Pb-Free / Pb-Solder) (Please refer to Page 5 Standard Packing Spec.)

Please confirm each data sheet before ordering.





## STANDARD PACKING SPECIFICATIONS

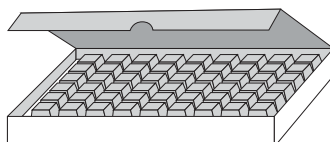
The last 2 digit of Product Number "00" means standard packing specifications. The other packing specifications are custom, therefore, the last 2 digits of Product Number is changed. Please contact us for inquiries. For SMD products, standard packing quantity is specified as below table. Please order in accordance with standard packing quantity.

### 1. Cylinder

Cylinder products are packed in vinyl bags per lot of 250 to 1000 pcs. From 5 to 20 bags are then placed in inner boxes to make a lot. Inner boxes are then placed in cartons for shipment. (the quantity varies with the model.)

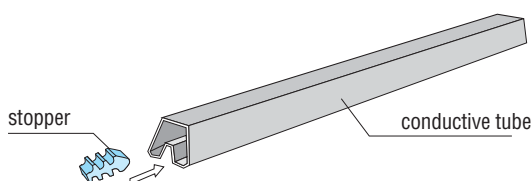
### 2. SIP

SIP products are packed in inner boxes per lot of 100 pcs. They are then placed onto the conductive foam and placed in cartons for shipment.



### 3. DIP

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



Model	Quantity
SG-531 SG-8002DC	35 pcs / tube
SG-51 SG-8002DB RTC-62421 / 72421 / 7301DG	25 pcs / tube

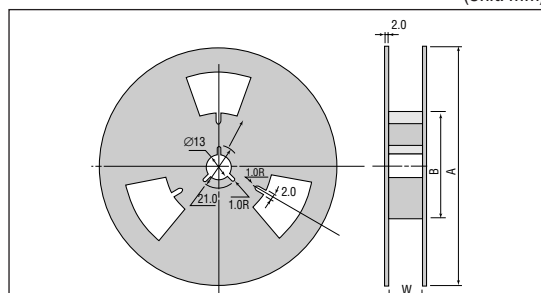
### 4. SMD

SMD products are packed in the shipping carton as below table in accordance with taping standards EIA-481A and EIAJ RC-1009B.

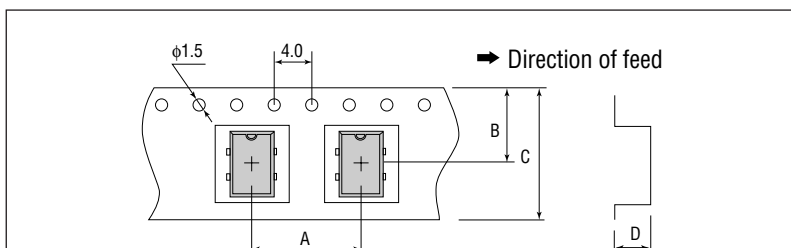
#### STANDARD PACKING QUANTITY

Model	Quantity
NS-32R, FS-335 / 555 / 585, FF-555 / 585	4000 pcs / reel
FC-135 / 145 / 255, MC-146 / 156 / 206 / 306 / 30A FA-23H / 238 / 248, MA-306	3000 pcs / reel
SG-310, SG-8002CE, SG-710**K, SG-350 VG-2828CB, TG-28**CB, SG / TG-****LA	2000 pcs / reel
EV-3101TA, EV-3201GD	500 pcs / reel
The other SMD products	1000 pcs / reel

(Unit: mm)



Model	Dimension		
	A	B	C
MC-146, MC-156, MC-206, MC-306 / 30A MC-405 / 406, MA-306 SG-3032JC / 3030JC, SG-636, SG-8002JC, SG-9001JC VSOJ 20-Pin (RX / RTC-****JE, MG-5020JE) SON 22-Pin (RX / RTC-****NB) SOP 14-Pin (RA / RX / RTC-****SA, MG-5100SA) SSOP 24-Pin (RTC-7301SF)	ø330	ø80	17.5
MA-406, MA-505 / 506, SG-615 SG-8002JA, HG-1012JA / 2012JA, VG-****JA HG-8002JA, SOP 24-Pin, EV-3101TA, EV-3201GD			25.5
SOP 18-Pin (RTC-4543SB)			24.4
FC-255, NS-32R, FS-335 / 555 / 585, FF-555 / 585 FA-248			13.5
VG-2828CB, RX-****CF, SG-8002LB, SG-550			13.4
SG-3030JF, SG-8002JF / CA SG-645, SG-9001CA, EG-2****CA, HG-2150CA VG-1201CA / 4231CA, EV-2****CA	ø254	ø100	17.5
SG-710**K		ø80	
FC-135 / 145, FA-365, SG / TG-****LA, SG-350 FA-23H / 238, SG-8002CE, SG-310	ø180	ø60	13.0 9.0



Model	Dimension				Tape type (L = left direction)
	A	B	C	D	
MC-146	8.0	9.25	16.0	1.7	TE1608L
MC-156				1.65	
MC-206				2.2	
MC-306 / 30A, MA-306				3.0	
MC-405 / 406				3.9	
SG-3032JC / 3030JC SG-636, SG-8002JC, SG-9001JC				3.3	
SG-3030JF SG-8002JF / CA, EG-2****CA, SG-645 SG-9001CA, VG-4231CA / 1201CA HG-2150CA, EV-2****CA				2.3	
SG-710**K				2.5	
EV-3101TA, EV-3201GD				2.9	
MA-406				12.0	
MA-505 / 506, SG-8002JA, SG-615 HG-8002JA, HG-1012JA / 2012JA VG-****JA	4.8				
VSOJ 20-Pin (RX / RTC-****JE, MG-5020JE) SON 22-Pin (RX / RTC-****NB) SOP 14-Pin (RA / RX / RTC-****SA, MG-5100SA) SSOP 24-Pin (RTC-7301SF)	16.0	9.25	16.0	2.0	TE1612L
SOP 18-Pin (RTC-4543SB)				1.8	
SOP 24-Pin (RTC-62423 / 72423)				3.65	
SOP 18-Pin (RTC-4543SB)	11.5	24.0	24.0	2.4	TE2412L
SOP 24-Pin (RTC-62423 / 72423)				2.5	
FS-555 / 585, FF-555 / 585	8.0	7.25	12.0	2.95	TE2416L
FS-335, NS-32R				2.0	
FC-255				1.52	
FA-365				1.1	
VG-2828CB, RX-****CF				1.6	
SG-8002LB, SG-550				1.95	
FC-135				1.4	
FC-145				1.0	
FA-248				1.55	
FA-23H / 238				1.05	
SG-8002CE, SG-310	4.0	5.25	8.0	1.4	TE0804L
SG-350, SG / TG-****LA				1.5	

Note: The above is shown in the standard packing specifications. Small-lot or sample orders may be submitted in a different packing style.

# WORKING FOR Pb FREE

## ■ Pb Free Policy of QD products and Implementation Schedule

### ● Implementation Schedule

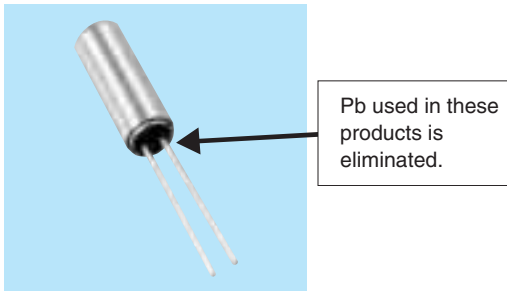
1. An announcement to our customers has been made since June, 2001.
2. Epson is ready to manufacture Pb free products in Apr., 2002.
3. Epson will start shipping all products with Pb-free from factory on Apr., 2004.
4. For the products in mass production now, Epson will switch to Pb Free Products with customer's approval.
5. For the products in considering now, when doesn't order Pb free products, please specify "Not Pb free".  
Because Pb free products are Epson's standard.

### ● Eliminated Pb

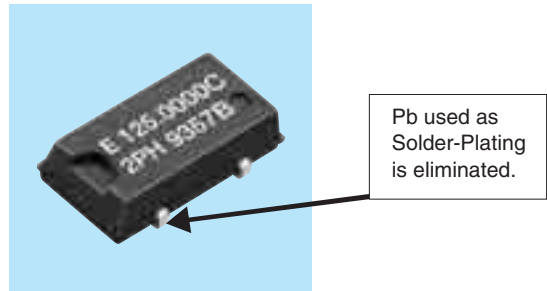
<Basic policy>

"Lead in solder" means Soldering-paste for electronic circuit board & Solder-Plating on the outer-lead of products.

#### ●Cylinder type products (complete Pb free products)



#### ●Plastic package type products (Pb free terminal products) \*1



\*1. These products are using Pb inside solder plating with heat resistance because of still under studying the alternative technology. These products includes Pb inside.

#### ●Current Pb free terminal products \*2



#### ●Current complete Pb free products \*2 \*3



\*2. Some ceramic package products are already Pb-free terminal type of product and contain Pb in sealing glass.

\*3. Ceramic package products with metallic lid are already complete Lead-free type of product.

## ■ Distinctions

### ● Distinctions between current products and Pb free products. \*1

It is distinguished by Product Number and Outer distinction.

#### (1) Product Number

The 9th position character of product number will change as follows. <Current = 0> / <Pb free = 1>

Current	Q x x x x x x 0 x x x x 0 0
Pb free	Q x x x x x x 1 x x x x 0 0

#### (2) Appearance

##### ● Plastic package type products

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

Current	Numeric	1	2	3	4	5	6	7	8	9	0
Pb free	Alphabet	A	B	C	D	E	F	G	H	J	K

##### ● Cylinder type products

The glass colour of plug will be changed as follows.

Current	Blue or Green etc
Pb free	Gray

<Exception>

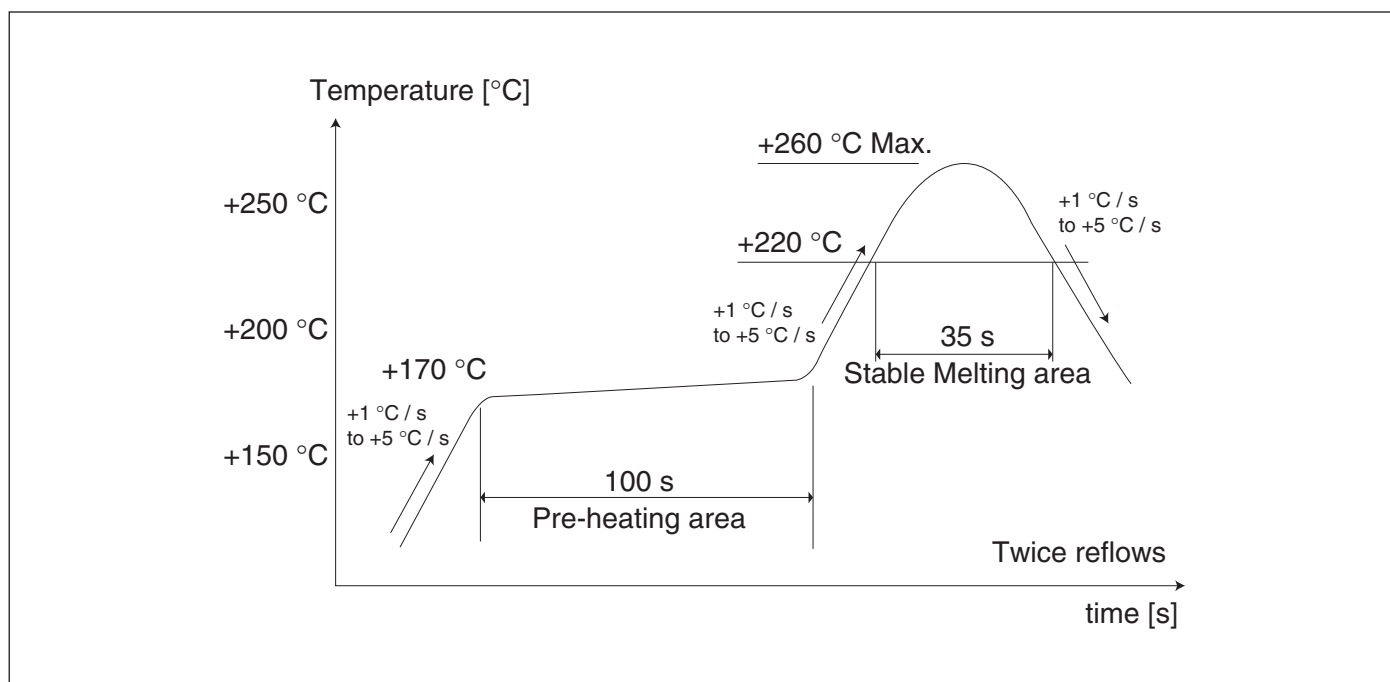
- \*1. Ceramic package type products are originally Pb free terminal designed. So, there are no change as 1) and 2) above.

## Pb Free materials of Seiko Epson QD products

Package	Object	Lead-frame material (No change)	Pb Free				Conventional	
			Sn-Bi	Sn-Ag *1	Sn-Cu	Au	Sn-Pb	Au
Cylinder	Crystal unit	Fe - Ni - Co	—	—	○	—	○	—
Plastic package	Crystal unit Crystal oscillator Real time clock module	SON	○	○ *1	—	—	○	—
		SOP	○	○ *1	—	—	○	—
		SOJ	○	○ *1	—	—	○	—
		DIP	○	—	—	—	○	—
Ceramic package	Crystal unit Crystal oscillator Real time clock module SAW Device	W (Tungsten)	—	—	—	○	—	○

\*1. Sn-Bi is applied for Epson QD products. But Sn-Ag is only applied for the products as below.  
 (SOP) RA / RX / RTC-\*\*\*\*SA, RTC-\*\*\*\*SB, RTC-\*\*\*\*SF, RTC-4553, MG-5100SA, MG-5020JE  
 (SOJ) RX / RTC-\*\*\*\*JE, (SON) RX-\*\*\*\*NB, RTC-\*\*\*\*NB  
 \*2. Cu Alloy is applied only for (SOP) RTC-7301SF.

## Evaluation Profile for heat-resistance



# TABLE OF FREQUENCY RANGE

## CRYSTAL UNITS

Low and medium-frequency crystal units (tuning fork crystal units)

page	Model	20 kHz	100 kHz	1 MHz	24 MHz	40 MHz	64 MHz	
26	C-001R	● 32.768 kHz						
	C-002RX							
	C-004R							
	C-005R							
	C-2-TYPE							20 kHz to 165 kHz, 307.2 kHz
	C-4-TYPE							32 kHz to 120 kHz, 192 kHz
21	FC-135	● 32.768 kHz						
	FC-145							
22	FC-255							
23	MC-146	32 kHz to 100 kHz						
	MC-156							
24	MC-206							
25	MC-306	20 kHz to 165 kHz						
102	MC-30A	20 kHz to 165 kHz						
25	MC-405 / 406	20 kHz to 165 kHz						

High-frequency crystal units (AT-cut crystal units)

page	Model	20 kHz	100 kHz	1 MHz	24 MHz	40 MHz	64 MHz
33	CA-301			* 4 MHz to 64 MHz			
31	MA-306		14.31818 MHz, 17.734 MHz to 41 MHz				
32	MA-406			* 4 MHz to 64 MHz			
	MA-505 / 506						
28	FA-23H			16 MHz to 32 MHz			
27	FA-238			16 MHz to 50 MHz			
29	FA-248			12 MHz to 27 MHz			
30	FA-365			12 MHz, 14 MHz to 41 MHz			

\* 8.0 MHz < f < 8.2 MHz: unavailable. For frequencies less than 5.5 MHz, please refer to the frequency list on each data sheet.

## SAW (SURFACE ACOUSTIC WAVE) DEVICES

SAW resonator

page	Model	200 MHz	500 MHz	700 MHz	1 GHz
97	NS-32R	312 MHz to 1.0 GHz			
98	FS-335	300 MHz to 870 MHz			
	FS-555		230 MHz to 500 MHz		
105	FS-585		315 MHz ● ● 433 MHz		

SAW filter

page	Model	200 MHz	500 MHz	700 MHz	1 GHz
99	FF-555	300 MHz to 500 MHz			
106	FF-585	300 MHz to 500 MHz			

## CRYSTAL OSCILLATORS

Low-frequency crystal oscillators

page	Model	1 Hz	100 kHz	1 MHz	26MHz	40 MHz	67 MHz	135 MHz	170 MHz	400 MHz	700 MHz
34	SG-3030JF	● 32.768 kHz									
	SG-3030JC										
	SG-3032JC										

High-frequency

page	Model	1 Hz	100 kHz	1 MHz	26MHz	40 MHz	67 MHz	135 MHz	170 MHz	400 MHz	700 MHz
35	SG-350	2 MHz to 48 MHz									
	SG-550										
36	SG-310										
38	SG-710	1.8 MHz to 80 MHz									
37	SG-645				32 MHz to 135 MHz						
39 40	SG-636				2.21675 MHz to 135 MHz						
41 42	SG-615	1.025 MHz to 135 MHz									
	SG-531										
	SG-51	1.025 MHz to 66.6667 MHz									

Programmable PLL high-frequency

page	Model	1 Hz	100 kHz	1 MHz	26MHz	40 MHz	67 MHz	135 MHz	170 MHz	400 MHz	700 MHz
43	SG-8002LA										
	SG-8002LB										
44	SG-8002CE										
46	SG-8002CA										
45	SG-8002JF			1 MHz to 125 MHz							
48	SG-8002JA										
47	SG-8002JC										
49	SG-8002DB										
	SG-8002DC										

Programmable PLL high-frequency with Spread spectrum

page	Model	1 Hz	100 kHz	1 MHz	26MHz	40 MHz	67 MHz	135 MHz	170 MHz	400 MHz	700 MHz
54	SG-9001CA										
	SG-9001JC			10 MHz to 166 MHz							

Low jitter high-frequency

page	Model	1 Hz	100 kHz	1 MHz	26MHz	40 MHz	67 MHz	135 MHz	170 MHz	400 MHz	700 MHz
56	EG-2021CA										
55	EG-2011CA								62.5 MHz to 170 MHz		
57	EG-2121CA								LV-PECL 53.125 MHz to 500 MHz		
									LVDS 53.125 MHz to 700 MHz		
58	EG-2102CA								LV-PECL 100 MHz to 700 MHz		
									LVDS 53.125 MHz to 700 MHz		
59	EG-2101CA								62.5 MHz to 400 MHz		
60	EG-2002CA								62.5 MHz to 170 MHz		
61	EG-2001CA								106.25 MHz to 170 MHz		

High stability high-frequency

page	Model	1 Hz	100 kHz	1 MHz	26MHz	40 MHz	67 MHz	135 MHz	170 MHz	400 MHz	700 MHz
62	HG-2150CA			1 MHz to 80 MHz							
64	HG-8002JA			1 MHz to 125 MHz							
63	HG-1012JA										
	HG-2012JA			1.5 MHz to 28.6363 MHz							

Voltage controlled

page	Model	1 Hz	100 kHz	1 MHz	26MHz	40 MHz	67 MHz	135 MHz	170 MHz	400 MHz	700 MHz
65	EV-2101CA								77.6 MHz to 700 MHz		
66	EV-3101TA								600 MHz to 700 MHz		
71	VG-2828CB			● 13 MHz							
67	VG-1201CA			1 MHz to 80 MHz							
68	VG-1011JA			1.5 MHz to 28.6363 MHz							
69	VG-4231CA			1 MHz to 60 MHz							
70	VG-4010JA										
	VG-4030JA			2.0 MHz to 28.6363 MHz							

Temperature compensated

page	Model	1 Hz	100 kHz	1 MHz	26MHz	40 MHz	67 MHz	135 MHz	170 MHz	400 MHz	700 MHz
72	TG-5000LA										19.2 MHz to 26 MHz

Multi-output

page	Model	1 Hz	100 kHz	1 MHz	26MHz	40 MHz	67 MHz	135 MHz	170 MHz	400 MHz	700 MHz
73	MG-5020JE			● 32.768 kHz			● 48.00512 kHz				
74	MG-5100SA									76.9 kHz to 100 MHz	

# TABLE OF SPECIFICATIONS

## CRYSTAL UNITS

page	Item	Dimensions	Nominal frequency	Frequency tolerance (standard)	Frequency temperature characteristics	Series resistance	Load capacitance	Storage temperature range	Operating temperature range
		L x W x H (mm)	f	$\Delta f/f$		R1	C <sub>L</sub>	T <sub>STG</sub>	T <sub>OPR</sub>
26	C-001R	ø3.1 x 8.0	32.768 kHz	$\pm 20 \times 10^{-6}$	Peak temperature ( $\theta T$ ): +25°C Typ.	35 k $\Omega$ to 50 k $\Omega$	6 pF to $\infty$	-20 °C to +70 °C	-10 °C to +60 °C
	C-002RX	ø2.0 x 6.0							
	C-004R	ø1.5 x 5.0							
	C-005R	ø1.2 x 4.6							
	C-2-TYPE	ø2.0 x 6.0	20 kHz to 165 kHz 307.2 kHz	$\pm 20 \times 10^{-6}$ to $\pm 100 \times 10^{-6}$		6 k $\Omega$ to 55 k $\Omega$			
	C-4-TYPE	ø1.5 x 5.0	32 kHz to 120 kHz 192 kHz	$\pm 50 \times 10^{-6}$ to $\pm 100 \times 10^{-6}$	10 k $\Omega$ to 50 k $\Omega$				
21	FC-135	3.2 x 1.5 x 0.9	32 kHz to 77.5 kHz	$\pm 20 \times 10^{-6}$ to $\pm 100 \times 10^{-6}$	Temperature coefficient (a): $-0.04 \times 10^{-6} / ^\circ\text{C}$ Max. $\Delta f/f = a (\theta T - \theta x)^2$	45 k $\Omega$ to 80 k $\Omega$	9.0 pF / 12.5 pF	-55 °C to +125 °C	
	FC-145	4.1 x 1.5 x 0.9	32.768 kHz	$\pm 20 \times 10^{-6}$		70 k $\Omega$ Max.			
22	FC-255	5.0 x 1.9 x 0.9				25 k $\Omega$ to 70 k $\Omega$			
23	MC-146	7.0 x 1.5 x 1.4	32 kHz to 100 kHz			25 k $\Omega$ to 65 k $\Omega$	7 pF, 12.5 pF		-40 °C to +85 °C
	MC-156	7.1 x 3.3 x 1.5							
24	MC-206	7.3 x 4.1 x 2.0		$\pm 20 \times 10^{-6}$ to $\pm 100 \times 10^{-6}$				-55 °C to +125 °C	
25	MC-306								
102	MC-30A	8.0 x 3.8 x 2.54	20 kHz to 165 kHz			6 k $\Omega$ to 55 k $\Omega$	6 pF to $\infty$		
25	MC-405 / 406	10.4 x 4.1 x 3.56	20 kHz to 165 kHz						
33	CA-301	ø3.1 x 8.9 ø3.1 x 9.3	4 MHz to 64 MHz	$\pm 30 \times 10^{-6}$ ( $\pm 50 \times 10^{-6}$ , $\pm 100 \times 10^{-6}$ )	$\pm 30 \times 10^{-6}$ ( $\pm 50 \times 10^{-6}$ )	40 $\Omega$ to 150 $\Omega$			-40 °C to +85 °C
31	MA-306	8.0 x 3.8 x 2.54	14.31818 MHz, 17.734 MHz to 41 MHz	$\pm 50 \times 10^{-6}$	$\pm 30 \times 10^{-6}$	60 $\Omega$	Fundamental: 10 pF to $\infty$ , 3rd overtone: 5 pF to $\infty$	-55 °C to +100 °C	-20 °C to +70 °C
32	MA-406	11.7 x 4.8 x 3.7	4 MHz to 64 MHz			40 $\Omega$ to 150 $\Omega$		-55 °C to +125 °C	
	MA-505 / 506	13.5 x 5.1 x 4.57							
28	FA-23H	3.2 x 2.5 x 0.7	16 MHz to 32 MHz	$\pm 10 \times 10^{-6}$	$\pm 10 \times 10^{-6}$ to $\pm 18 \times 10^{-6}$	40 $\Omega$ to 80 $\Omega$		-40 °C to +125 °C	-20 °C to +70 °C
27	FA-238	3.2 x 2.5 x 0.7	16 MHz to 50 MHz	$\pm 50 \times 10^{-6}$	$\pm 30 \times 10^{-6}$				
29	FA-248	4.0 x 2.5 x 1.0	12 MHz to 27 MHz	$\pm 10 \times 10^{-6}$ to $\pm 20 \times 10^{-6}$	$\pm 10 \times 10^{-6}$ to $\pm 20 \times 10^{-6}$ $\pm 18 \times 10^{-6}$ to $\pm 30 \times 10^{-6}$	40 $\Omega$ to 70 $\Omega$	10 pF to $\infty$	-55 °C to +125 °C	-20 °C to +70 °C -40 °C to +85 °C
30	FA-365	6.0 x 3.5 x 1.4	12 MHz, 14 MHz to 41 MHz	$\pm 50 \times 10^{-6}$ , $\pm 100 \times 10^{-6}$	$\pm 30 \times 10^{-6}$	50 $\Omega$			-20 °C to +70 °C

Note: For detailed specifications, refer to the individual specifications for each product.

## SAW (SURFACE ACOUSTIC WAVE) DEVICES

SAW resonator

page	Item	Dimensions L x W x H (33 Typ.)	Nominal frequency f	Frequency tolerance $\Delta f/f$	Temperature coefficient	Series resistance R1	Harmonic ratio Rs/R1	Storage temperature TSTG	Operating temperature TOPR
97	NS-32R	3.8 x 3.8 x 0.98	312 MHz to 1.0 GHz	$\pm 50 \times 10^{-6}$ , $\pm 100 \times 10^{-6}$	$-(1.6 \pm 0.4) \times 10^{-8} / ^\circ\text{C}^2$	35 $\Omega$ Max.			
98	FS-335	3.8 x 3.8 x 1.3	300 MHz to 870 MHz	$\pm 25 \times 10^{-6}$ , $\pm 50 \times 10^{-6}$ $\pm 100 \times 10^{-6}$	$-(3.4 \pm 0.8) \times 10^{-8} / ^\circ\text{C}^2$	25 $\Omega$ (30 $\Omega$ ) Max.	2 Min.	-40 °C to +85 °C	-40 °C to +85 °C
		FS-555	230 MHz to 500 MHz			25 $\Omega$ (40 $\Omega$ ) Max.			
105	FS-585	5.2 x 4.8 x 1.5	315 MHz, 433 MHz	$\pm 50 \times 10^{-6}$ , $\pm 100 \times 10^{-6}$	$-(3.4^{+0.8}_{-0.6}) \times 10^{-8} / ^\circ\text{C}^2$	18 $\Omega$ Max.		-40 °C to +125 °C	-40 °C to +120 °C

SAW filter

page	Item	Dimensions L x W x H (33 Typ.)	Nominal frequency f	Pass bandwidth BW	Temperature coefficient	Insertion loss IL	Rejection band ATT	Storage temperature TSTG	Operating temperature TOPR
99	FF-555	5.2 x 4.8 x 1.5		fo $\pm$ 100 kHz Min.			40 dB Min.	-55 °C to +125 °C	
106	FF-585	5.2 x 4.8 x 1.5	300 MHz to 500 MHz	fo $\pm$ 200 kHz Min.	$-(3.4 \pm 0.8) \times 10^{-8} / ^\circ\text{C}^2$	3.5 dB Max	(Fc $\pm$ 21.2)	-55 °C to +100 °C	-40 °C to +85 °C

## REAL TIME CLOCK MODULES

page	Model	Package	Interface	Clock voltage	Current consumption	Memory	Alarm	Time interval of standard pulse	Other features
75	RX-4045	SOP 14-pin SON 22-pin	4-Wire Serial	1.15 V to 5.5 V	0.48 $\mu\text{A}$ Typ. (3V)	-	Minute to Day and day of the week	32.768 kHz	High stability SPI bus
76	RX-4581	SON 22-Pin		1.6 V to 5.5 V	0.4 $\mu\text{A}$ Typ. (3V)	128 bit (SRAM)		32.768 kHz to 1/60 Hz	SPI bus
77	RTC-9701	VSOJ 20-Pin		1.8 V to 5.5 V	0.8 $\mu\text{A}$ Typ. (3V)	4 kbit (EEPROM)		32.768 kHz	
79	RTC-4553	SOP 14-Pin	3-Wire Serial	2.0 V to 5.5 V	1.0 $\mu\text{A}$ Typ. (5V)	4 bit x 30 (SRAM)	-	1024 Hz, 10 s	
81	RX-4702	SON 10-Pin		1.6 V to 5.5 V	0.5 $\mu\text{A}$ Typ. (3V)	-	Minute to Day and day of the week	32.768 kHz to 1/30 Hz	Built-in temperature sensor For Automotive
82	RTC-4701	VSOJ 20-pin SON 22-pin		1.6 V to 5.5 V	0.5 $\mu\text{A}$ Typ. (3V)	-			
103	RA-4574	SOP 14-pin	I <sup>2</sup> C Bus	1.6 V to 5.5 V	0.5 $\mu\text{A}$ Typ. (3V)	-	-	32.768 kHz, 1 Hz	
83	RTC-4574	SOP 14-pin VSOJ 20-pin SON 22-pin		1.4 V to 5.5 V	0.5 $\mu\text{A}$ Typ. (2V)	-			
84	RTC-4543	SOP 14-pin SOP 18-pin		1.15 V to 5.5 V	0.48 $\mu\text{A}$ Typ. (3V)	-	Second to Hour		High stability ( $\pm 5 \times 10^{-6}$ ) For Automotive
87	RX-8025	SOP 14-Pin SON 22-Pin	I <sup>2</sup> C Bus	1.6 V to 5.5 V	0.45 $\mu\text{A}$ Typ. (3V)	-	Minute to Day and day of the week	32.768 kHz to 1 Hz	High Quality 32.768 kHz output
88	RA-8581	SOP 14-pin		1.0 V to 5.5 V	275 nA Typ. (3V)	-			
89	RX-8581	SOP 14-Pin VSOJ 20-Pin SON 22-Pin		1.6 V to 5.5 V	0.6 $\mu\text{A}$ Typ. (3V)	-			
91	RX-8564	SON 10-Pin	Parallel 4-bit	1.6 V to 5.5 V	0.6 $\mu\text{A}$ Typ. (3V)	-	Second to day, day of the week	32.768 kHz to 1/30 Hz	High speed access 3.0 V operation
92	RTC-8564	VSOJ 20-pin SON 22-pin		2.0 V to 5.5 V	1.0 $\mu\text{A}$ Typ. (2V)	-			
93	RTC-7301	DIP 18-pin SSOP 24-pin		2.0 V to 5.5 V	0.9 $\mu\text{A}$ Typ. (2V)	-			
95	RTC-62421	DIP 18-pin							
	RTC-62423	SOP 24-pin							
96	RTC-72421	DIP 18-pin							
	RTC-72423	SOP 24-pin							

CRYSTAL OSCILLATORS

page	Model	Item	Output frequency range	Frequency stability	Current consumption	Operating temperature	Operating voltage	Output load	Output control		
34	SG-3030JC / JF		32.768 kHz	$5 \pm 23 \times 10^{-6}$	2 $\mu$ A Max.	-40 °C to +85 °C	1.5 V to 5.5 V	15 pF	VDD		
	SG-3032JC				5 $\mu$ A Max.	-20 °C to +70 °C	1.8 V to 3.6 V		-		
35	SG-550SCF		2 MHz to 48 MHz	$\pm 50 \times 10^{-6}$ $\pm 100 \times 10^{-6}$	4.5 mA Max.	-20 °C to +70 °C	3.3 V Typ. (2.7 V to 3.6 V)	15 pF	ST		
	SG-550SDF				3.5 mA Max.		-40 °C to +85 °C			2.5 V Typ. (2.2 V to 3.0 V)	
	SG-550SEF				3.0 mA Max.	-20 °C to +70 °C				1.8 V Typ. (1.6 V to 2.2 V)	
	SG-550SCG				12 mA max.		2.7 V to 3.6 V				
	SG-350SCF				4.5 mA Max.	-40 °C to +85 °C	3.3 V Typ. (2.7 V to 3.6 V)				
	SG-350SDF				3.5 mA Max.		2.5 V Typ. (2.2 V to 3.0 V)				
SG-350SEF		3.0 mA Max.	1.8 V Typ. (1.6 V to 2.2 V)								
SG-350SCG		12 mA max.	-20 °C to +70 °C	2.7 V to 3.6 V							
36	SG-310SCF		2 MHz to 48 MHz	$\pm 50 \times 10^{-6}$ $\pm 100 \times 10^{-6}$	4.5 mA Max.	-40 °C to +85 °C	3.3 V Typ. (2.7 V to 3.6 V)	15 pF	ST		
	SG-310SDF				3.5 mA Max.		2.5 V Typ. (2.2 V to 3.0 V)				
	SG-310SEF				3.0 mA Max.		1.8 V Typ. (1.6 V to 2.2 V)				
41	SG-51 / 531 / 615P		1.025 MHz to 26 MHz	$\pm 100 \times 10^{-6}$ $(\pm 50 \times 10^{-6})$	23 mA Max.	-20 °C to +70 °C (-40 °C to +85 °C)	5 V $\pm$ 0.5 V	10 TTL, 50 pF	OE		
	SG-51 / 531 / 615PTJ		26.0001 MHz to 66.6667 MHz		35 mA Max.			5 TTL			
	SG-51 / 531 / 615PH		55.0001 MHz to 135 MHz		45 mA Max.			50 pF			
	SG-531 / 615PTW / STW		26.0001 MHz to 135 MHz		$\pm 50 \times 10^{-6}$ $\pm 100 \times 10^{-6}$	28 mA Max.	-20 °C to +70 °C	15 pF (5TTL + 15 pF, 25 pF)	OE / ST		
	SG-531 / 615PHW / SHW		1.5 MHz to 26 MHz					15 pF (25 pF, 50 pF)			
	SG-531 / 615PCW / SCW		26.0001 MHz to 66.6667 MHz					15 pF			
	SG-531 / 615PCG / SCG		2.21675 MHz to 41 MHz					25 pF			
SG-615PCN		2.21675 MHz to 41 MHz	30 mA Max.	-20 °C to +70 °C -40 °C to +85 °C	3.3 V $\pm$ 0.3 V	15 pF					
39	SG-636PTF		2.21675 MHz to 41 MHz	$\pm 100 \times 10^{-6}$	17 mA Max.	-20 °C to +70 °C	5 V $\pm$ 0.5 V	10 TTL, 50 pF	OE		
	SG-636PH		41 MHz to 70 MHz		35 mA Max.			20 pF ( $\leq$ 55 MHz) 15 pF ( $>$ 55 MHz)			
	SG-636PCE / SCE		2.21675 MHz to 40 MHz		9 mA Max.			3.3 V $\pm$ 0.3 V		30 pF	OE / ST
	SG-636PDE		2.2 MHz to 40 MHz		5 mA Max.			2.5 V $\pm$ 0.25 V		15 pF	OE
	SG-636PTW / STW		32.0001 MHz to 135 MHz		45 mA Max.			5 V $\pm$ 0.5 V		15 pF (25 pF, 50 pF)	OE / ST
	SG-636PHW / SHW		32.0001 MHz to 135 MHz		28 mA Max.			3.3 V $\pm$ 0.3 V		15 pF	
40	SG-636PCW / SCW		2.21675 MHz to 33 MHz	$\pm 50 \times 10^{-6}$ $\pm 100 \times 10^{-6}$	25 mA Max.	-20 °C to +70 °C -40 °C to +85 °C	4.5 V to 5.5 V	25 pF	OE		
	SG-636PTG / PHG		12 mA Max.		2.7 V to 3.6 V			ST			
	SG-636PCG		45 mA Max.		4.5 V to 5.5 V			OE			
	SG-636SCG		12 mA Max.		2.7 V to 3.6 V			ST			
37	SG-645PHW / SHW		32.0001 MHz to 135 MHz	$\pm 50 \times 10^{-6}$ $\pm 100 \times 10^{-6}$	45 mA Max.	-20 °C to +70 °C	4.5 V to 5.5 V	15 pF (25 pF, 50 pF)	OE / ST		
	SG-645PTW / STW				28 mA Max.			-20 °C to +70 °C -40 °C to +85 °C		3.0 V to 3.6 V	15 pF (5TTL + 15 pF, 25 pF)
	SG-645PCW / SCW				13 mA (24 mA) Max.			-10 °C to +70 °C (-40 °C to +85 °C)		5 V $\pm$ 0.5 V	10 TTL
38	SG-710PTK		1.8 MHz to 50 MHz	$\pm 100 \times 10^{-6}$ $(\pm 50 \times 10^{-6})$	40 mA Max.	-10 °C to +70 °C (-40 °C to +85 °C)	5 V $\pm$ 0.5 V	50 pF	OE		
	SG-710PHK		1.8 MHz to 80 MHz		18 mA Max.			3.3 V $\pm$ 0.3 V		15 pF	ST
	SG-710ECK		1.8 MHz to 67 MHz		40 mA max.			5.0 V $\pm$ 0.5 V		5TTL + 15 pF	OE / ST
43	SG-8002LA / LB PT / ST		1 MHz to 125 MHz	$\pm 50 \times 10^{-6}$ $\pm 100 \times 10^{-6}$	28 mA Max.	-20 °C to +70 °C -40 °C to +85 °C	3.3 V $\pm$ 0.3 V	15 pF (25pF)	OE / ST		
	SG-8002LA / LB PH / SH				45 mA max.			5.0 V $\pm$ 0.5 V		5TTL + 15 pF (15 pF, 25 pF)	
	SG-8002LA / LB PC / SC				45 mA max.			5.0 V $\pm$ 0.5 V		15 pF (25 pF, 50 pF)	
44	SG-8002CE / CA / JF / JA / JC / DB / DC PT / ST		10 MHz to 166 MHz	-	3.0 mA Max.	-20 °C to +70 °C	3.3 V $\pm$ 0.3 V	15 pF	OE		
	SG-8002CE / CA / JF / JA / JC / DB / DC PH / SH				28 mA Max.			3.3 V $\pm$ 0.3 V		15 pF (30 pF)	
54	SG-9001CA		62.5 MHz to 170 MHz	$\pm 50 \times 10^{-6}$ $\pm 100 \times 10^{-6}$	20 mA Typ.	0 °C to +70 °C	2.5 V Typ. (2.375 V to 2.625 V)	15 pF	OE		
	SG-9001JC				15 mA Typ.			-5 °C to +85 °C		1.8 V Typ. (1.7 V to 2.1 V)	15 pF
57	EG-2121CA	LV-PECL	53.125 MHz to 500 MHz	$\pm 100 \times 10^{-6}$	80 mA Max.	0 °C to +70 °C	2.5 V	50 $\Omega$	OE		
		LVDS	53.125 MHz to 700 MHz		30 mA Max.			-40 °C to +85 °C		3.3 V	50 $\Omega$
58	EG-2102CA	LV-PECL	100 MHz to 700 MHz	$\pm 100 \times 10^{-6}$	100 mA	-40 °C to +85 °C	3.3 V	50 $\Omega$	OE		
		LVDS	53.125 MHz to 700 MHz		40 mA						
59	EG-2101CA		62.5 MHz to 400 MHz	$\pm 100 \times 10^{-6}$	60 mA Max.		3.3 V $\pm$ 0.15 V	50 $\Omega$	OE		
60	EG-2002CA		62.5 MHz to 170 MHz		50 mA Max.	0 °C to +70 °C	3.3 V $\pm$ 0.3 V	25 pF (fo = 62.5 MHz) 15 pF (fo > 62.5 MHz)			
61	EG-2001CA		106.25 MHz to 170 MHz		50 mA Max.			25 pF (fo $\leq$ 135 MHz) 15 pF (fo > 135 MHz)			
62	HG-2150CA **C		1 MHz to 80 MHz	$\pm 15 \times 10^{-6}$ $\pm 25 \times 10^{-6}$	25 mA Max.	-20 °C to +70 °C -40 °C to +85 °C	3.3 V $\pm$ 0.3 V 5.0 V $\pm$ 0.5 V	15 pF	OE / ST		
	HG-2150CA **H				30 mA Max.						
64	HG-8002JA PT / ST		1 MHz to 125 MHz	$\pm 20 \times 10^{-6}$ $\pm 25 \times 10^{-6}$ $\pm 30 \times 10^{-6}$	45 mA Max.	-20 °C to +70 °C -40 °C to +85 °C	5.0 V $\pm$ 0.5 V 3.3 V $\pm$ 0.3 V	15 pF, 2TTL + 15 pF	OE / ST		
	HG-8002JA PH / SH				28 mA Max.			15 pF			
	HG-8002JA PC / SC				10 mA Max.			5 V $\pm$ 0.25 V		15 pF	
63	HG-1012 / 2012JA		1.5 MHz to 28.63636 MHz	$\pm 15 \times 10^{-6}$ to $\pm 30 \times 10^{-6}$	10 mA Max.	-40 °C to +85 °C	5 V $\pm$ 0.5 V	2 TTL 15 pF	-		
65	EV-2101CA	LV-PECL	77.76 MHz to 700 MHz	$\pm 50 \times 10^{-6}$ $\pm 100 \times 10^{-6}$	70 mA Typ.	-5 °C to +85 °C	3.3 V $\pm$ 0.3 V	50 $\Omega$	OE		
		LVDS			35 mA Typ.			-40 °C to +85 °C		100 $\Omega$	
66	EV-3101TA		600 MHz to 700 MHz	-	60 mA Typ.	0 °C to +85 °C	3.3 V $\pm$ 0.165 V	50 $\Omega$	-		
67	VG-1201CA **C		1 MHz to 80 MHz	$\pm 20 \times 10^{-6}$ $\pm 25 \times 10^{-6}$	25 mA	-20 °C to +70 °C -40 °C to +85 °C	3.3 V $\pm$ 0.3 V 5.0 V $\pm$ 0.5 V	15 pF	OE		
	VG-1201CA **H				30 mA						
71	VG-2828CB		13 MHz	$\pm 12 \times 10^{-6}$	1 mA Max.	-20 °C to +75 °C	2.8 V $\pm$ 0.1 V	9 k $\Omega$ to 11 k $\Omega$ 9 pF to 11 pF	-		
69	VG-4231CA *RC		1 MHz to 60 MHz	$\pm 35 \times 10^{-6}$ $\pm 50 \times 10^{-6}$	10 mA	-20 °C to +70 °C -40 °C to +85 °C	3.3 V $\pm$ 0.3 V 5.0 V $\pm$ 0.5 V	15 pF	OE		
	VG-4231CA *RH				20 mA						
70	VG-4010JA		2.0 MHz to 28.63636 MHz	$\pm 35 \times 10^{-6}$ $\pm 37 \times 10^{-6}$	35 mA Max.	-20 °C to +70 °C	5 V $\pm$ 0.25 V 3.3 V $\pm$ 0.17 V	2 TTL 30 pF	-		
	VG-4030JA				18 mA Max.			30 pF			
72	TG-5000LA		19.2, 19.68, 19.8 MHz	$\pm 2.0 \times 10^{-6}$	1.6 mA	-30 °C to +80 °C	2.8 V $\pm$ 5%	9 k $\Omega$ to 11 k $\Omega$ 9 pF to 11 pF	-		
			26 MHz	$\pm 2.5 \times 10^{-6}$	1.8 mA						
73	MG-5020JE		32.768 MHz	$5 \pm 23 \times 10^{-6}$	3 $\mu$ A Max.	-40 °C to +85 °C	1.8 V to 3.6 V 2.7 V to 3.6 V	15 pF (25pF)	OE		
			48.00512 MHz	$\pm 100 \times 10^{-6}$	(15 mA Max.)						
74	MG-5100SA		76.9 kHz to 100 MHz	$\pm 100 \times 10^{-6}$	100 mA Max.	-20 °C to +70 °C	5 V $\pm$ 0.5 V 3.3 V $\pm$ 0.3 V		OE		

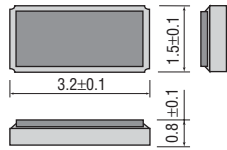
• OE: Output enable • ST: Stand-by (low output) • For detailed specifications, refer to the individual specifications for product.

# TABLE OF DIMENSIONS

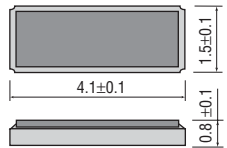
## CRYSTAL UNITS

(Unit: mm)

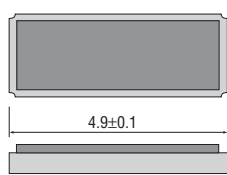
### ● FC-135



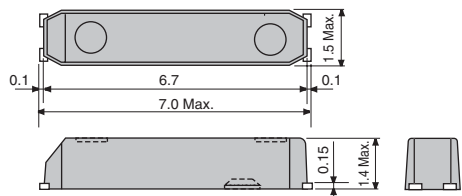
### ● FC-145



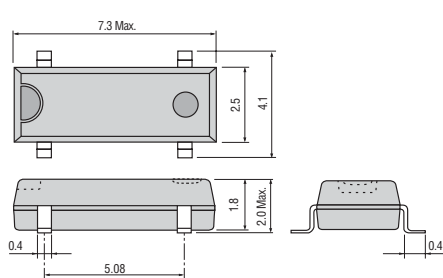
### ● FC-255



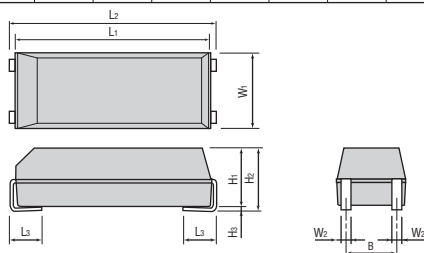
### ● MC-146



### ● MC-206

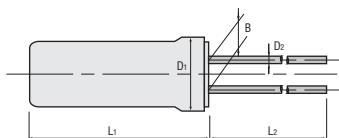


Model	L1	L2	L3	W1	W2	B	H1	H2	H3
MC-405 / 406	9.6	10.41 Max.	2.54	4.06 Max.	0.51	2.29	3.15	3.60 Max.	0.2 Min.
MA-505 / 506	12.7	13.46 Max.	2.54	5.08 Max.	1.09	3.30	4.19	4.60 Max.	0.2 Min.

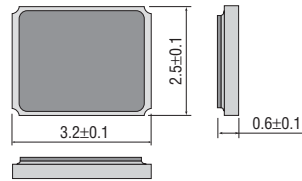


### ● Cylinder

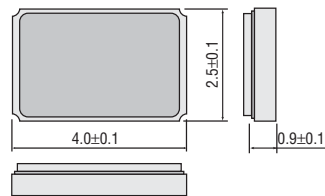
Model	L1	L2	D1	D2	B	
C-001R	8.0 Max.	9.0 Min.	ø3.1 Max.	ø0.3	1.1	
C-002RX / C-2-TYPE	6.0 Max.	4.0 Min.	ø2.0 Max.	ø0.2	0.7	
C-004R / C-4-TYPE	5.0 Max.	4.0 Min.	ø1.5 Max.	ø0.2	0.5	
C-005R	4.6 Max.	4.0 Min.	ø1.2 Max.	ø0.15	0.3	
CA-301	Over 5.5 MHz	8.9 Max.	9.5 Min.	ø3.1 Max.	ø0.3	1.1
	Under 5.5 MHz	9.3 Max.	9.5 Min.	ø3.1 Max.	ø0.3	1.1



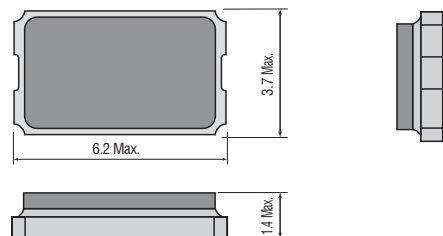
### ● FA-238 / 23H



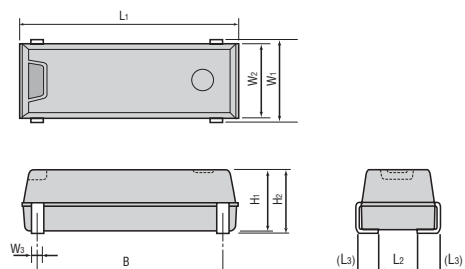
### ● FA-248



### ● FA-365



Model	L1	L2	L3	W1	W2	W3	H1	H2	B
MC-156	7.1 Max.	1.6	0.75	3.3 Max.	2.5	0.4	1.3	1.5 Max.	5.08
MC-306 / 30A MA-306	8.0 Max.	1.9	0.9	3.8 Max.	3.2	0.5	2.38	2.54 Max.	5.5
MA-406	11.7 Max.	2.1	1.2	4.8 Max.	4.0	0.7	3.50	3.7 Max.	9.6

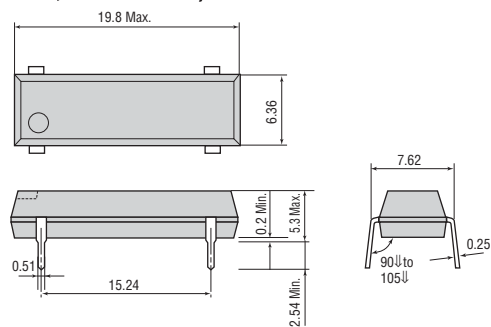




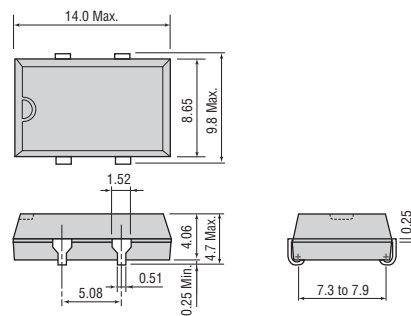
(Unit: mm)

CRYSTAL OSCILLATORS

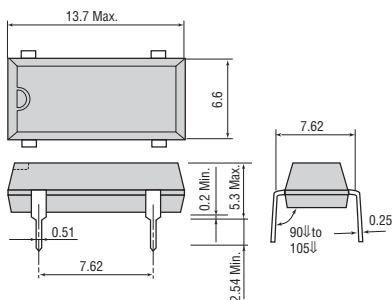
● DIP 14-pin (SG-51, SG-8002DB)



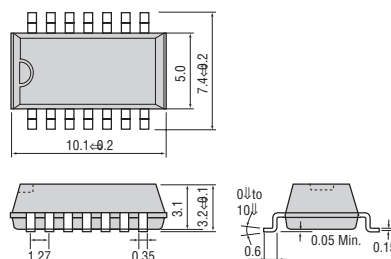
● SOJ 4-pin (SG-615, HG-1012JA / 2012JA, SG-8002JA, HG-8002JA, VG-... JA)



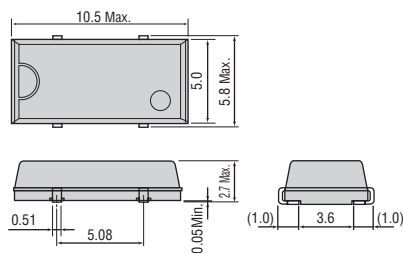
● DIP 8-pin (SG-531, SG-8002DC)



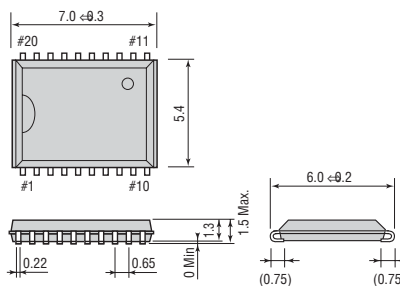
● SOP 14-pin (MG-5100SA)



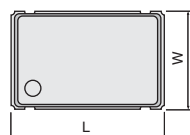
● SOJ 4-pin (SG-3032JC, SG-3030JC, SG-636, SG-8002JC, SG-9001JC)



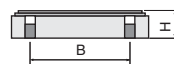
● VSOJ 20-pin (MG-5020JE)



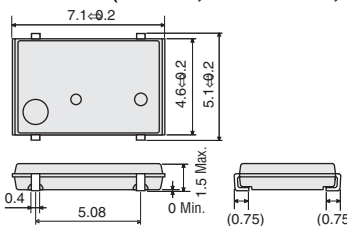
● SMD (SG-710, SG-8002CA, SG-9001CA, EG-2...CA, EV-2...CA, HG-2150CA, VG-1201CA / 4231CA)



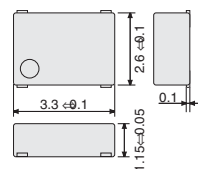
Model	L	W	H	B
SG-710...K	7.3 ±0.2	4.8 ±0.2	1.3 ±0.1	5.08
SG-8002CA				
VG-1201CA				
HG-2150CA	7.0 ±0.2	5.0 ±0.2	1.5 Max.	5.08
VG-4231CA				
SG-9001CA				
EG-2...CA	7.0 ±0.2	5.0 ±0.2	1.3 ±0.1	5.08
EV-2...CA	7.0 ±0.2	5.0 ±0.2	2.0 Max.	5.08



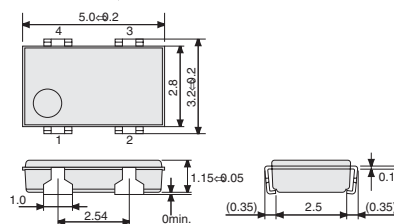
● SOJ 4-Pin (SG-645, SG-8002 JF, SG-3030JF)



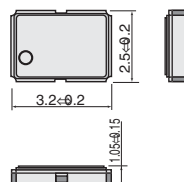
● SG-350, SG-8002LA, TG-5000LA



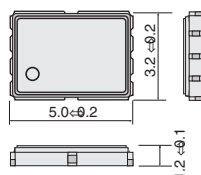
● SG-550, SG-8002LB



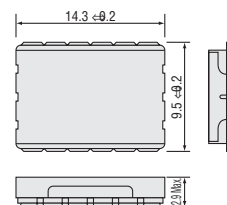
● SMD (SG-310 series, SG-8002CE series)



● SMD (VG-2828CB)



● SMD (EV-3101TA)



■ SAW DEVICES

(Unit: mm)

● FS-335, NS-32R

	L	W	H
FS-335	3.8 ±0.15	3.8 ±0.15	1.3 ±0.15
NS-32R	3.8 ±0.15	3.8 ±0.15	0.98 ±0.15

● FS-555 / 585, FF-555 / 585

■ REAL TIME CLOCK MODULES

(Unit: mm)

● SON 22-pin  
(RX-\*\*\*\*NB, RTC-\*\*\*\*NB)

● SOP 14-pin  
(RA-\*\*\*\*SA, RX-\*\*\*\*SA, RTC-\*\*\*\*SA)

● SSOP 24-pin (RTC-7301SF)

● VSOJ 20-pin  
(RX-\*\*\*\*JE, RTC-\*\*\*\*JE)

● SOP 18-pin (RTC-4543SB)

● DIP 18-pin  
(RTC-7301DG / 62421 / 72421)

● SON 10-pin  
(RX-4702CF / 8564CF)

● SOP 24-pin (RTC-62423 / 72423)

## HANDLING PRECAUTIONS

### Common points for all products

#### 1. Shock resistance

EPSON's crystal products are designed to resist physical shocks, But crystal products may be damaged under some conditions, such as dropping from the desks or giving shocks during mouting.

Please be sure to check the characteristics if there are any given shocks.

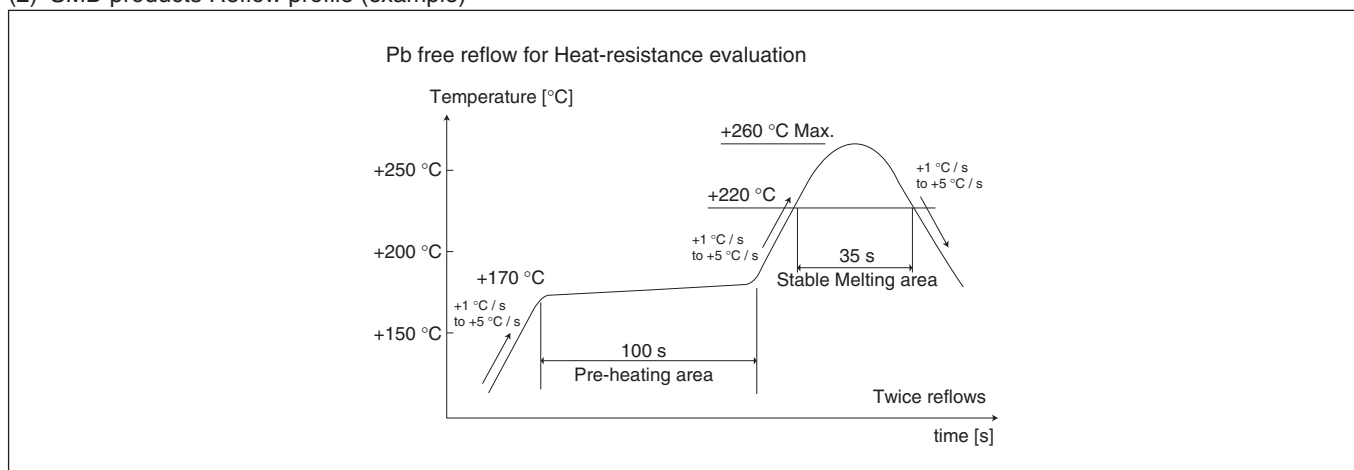
#### 2. Soldering heat resistance

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

##### (1) Cylinder products, SIP products and DIP products

Model	Soldering conditions
[Cylinder] C-TYPE, C-2-TYPE, C-4-TYPE, HTS-206	Under +280 °C within 5 s. Do not heat the package at more than +150 °C.
[Cylinder] CA-301 [DIP] SPG, SG-51 / 531, SG-8002DB / DC, RTC-62421 / 64611, RTC-72421 / 7301DG	Under +260 °C within 10 s. Do not heat the package at more than +150 °C.

##### (2) SMD products Reflow profile (example)



#### 3. Mounting precautions

##### Shocks by auto mounting

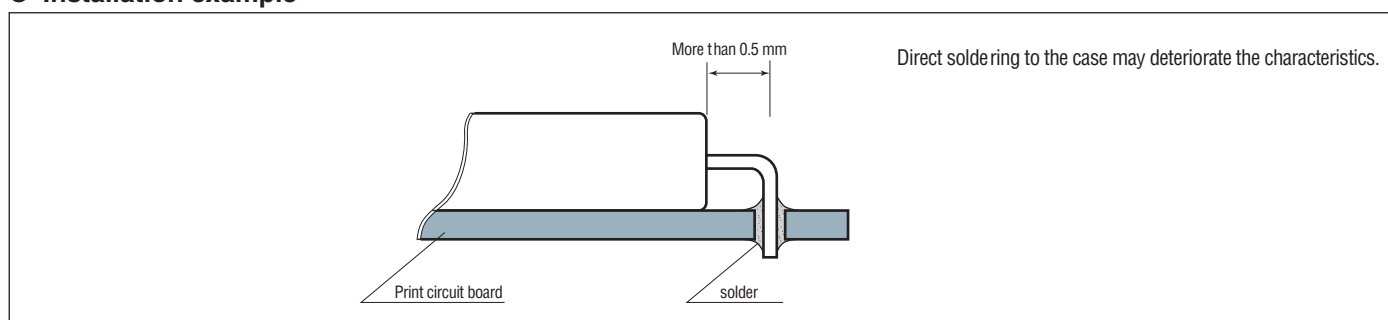
Shocks caused by auto mounting, vacuuming and chucking may deteriorate the characteristics and affect the products. Please set the mounting conditions to minimize the shocks as much as possible, and be sure that there is no effect on the characteristics before mounting. Please review the conditions after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

##### (1) Cylinder products

Bending the lead on the glass or pulling the lead strongly may cause any crack of the hermetic seal glass at the root of the lead and may cause the airtightness and the characteristics to deteriorate. When the lead of crystal products need to be bent as in the figure below, leave more than 0.5 mm of lead from the case and hold the lead to prevent the lead from cracks. When the lead needs to be repaired, do not pull it, and hold the bent part to correct it. And giving undue pressure on the portion of hermetic seal may cause the airtightness to deteriorate. Please avoid giving pressure.

And then gluing the case of product on the electric board is recommended to prevent the airtightness from deteriorating.

#### Installation example



- (2) SIP products  
If leads need to be bent, bend the part beyond the stand-off (1.3 mm or more from the case.)
- (3) DIP products  
Deformed leads cannot be inserted into board holes. Avoid applying stress sufficient to deform leads.
  - SPG-8640\*N series is not guaranteed to be auto mounted because of being sensitive to shock.
- (4) SOJ Products and SOP products  
Please avoid applying stress sufficient to deform the leads.  
Deform leads may cause wrong soldering.  
Particularly SOP products need to be handled with the greatest care.
- (5) 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 the less stressed allocation 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 the situation of repeated stern temperature change for a long period. Under these conditions, be sure to check the solderability in advance.

#### 4. Ultrasonic cleaning

- Products using AT-cut crystal and SAW resonator / filter can be cleaned by ultrasonic. But under some conditions, the crystal characteristics may be affected and internal wiring may be damaged. Please be sure to check the suitability of your system in advance.
- Products using tuning-fork crystal cannot be guaranteed to be cleaned by ultrasonic, because crystal may be destroyed.

#### 5. The affect of mechanical vibration

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

##### ● Mounting guidelines

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

#### 6. Storage

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

Normal temperature and humidity :

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

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

#### ■ Crystal unit

##### 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 6 "Drive level")

##### 2. Negative resistance

Unless adequate negative resistance is allocated in the oscillation circuit, oscillation start up time may increase or oscillation may not occur at all. To avoid this, provide enough negative resistance in the circuit design. (refer to page 6 "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 7 "Load capacitance")

## ■ Crystal oscillator and real time clock module

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

### 1. Static electricity

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

### 2. Noise

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

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

### 3. Power supply line

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

### 4. Output load

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

### 5. Treatment of unused input terminals

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

### 6. Heat impact

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

### 7. Mounting direction

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

### 8. Power on

Not recommend to power on from intermediate electric potential and / or extreme fast power on. Those powering on conditions may cause no oscillation and / or malfunction.

## ■ PRECAUTIONS IN DESIGNING OSCILLATION CIRCUITS

### 1. Drive level

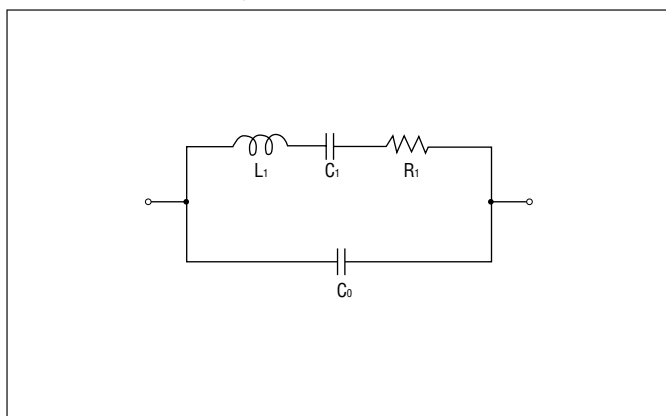
Drive level denotes electric power required to oscillate a crystal unit, which can be calculated using the following formula.

$$\text{Drive level (P)} = I^2 R_e$$

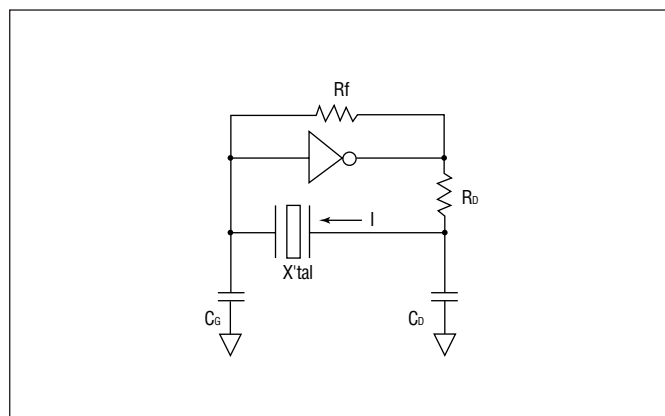
Where  $I$  stands for current to pass in the crystal unit,  $R_e$  for effective resistance of crystal unit, and  $R_e = R_1 (1 + C_0 / C_1)^2$ .

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 consequent temperature rise. If excessive drive level of power is applied to the crystal unit, this may deteriorate or damage the characteristics.

Equivalent circuit of crystal unit



Oscillation circuit



## 2. Allowance for oscillation

Unless adequate negative resistance is allocated in the oscillation circuit, oscillation start-up time may be increase, or **NO OSCILLATION** may occur. In order to avoid this, provide enough negative resistance in the circuitry design.

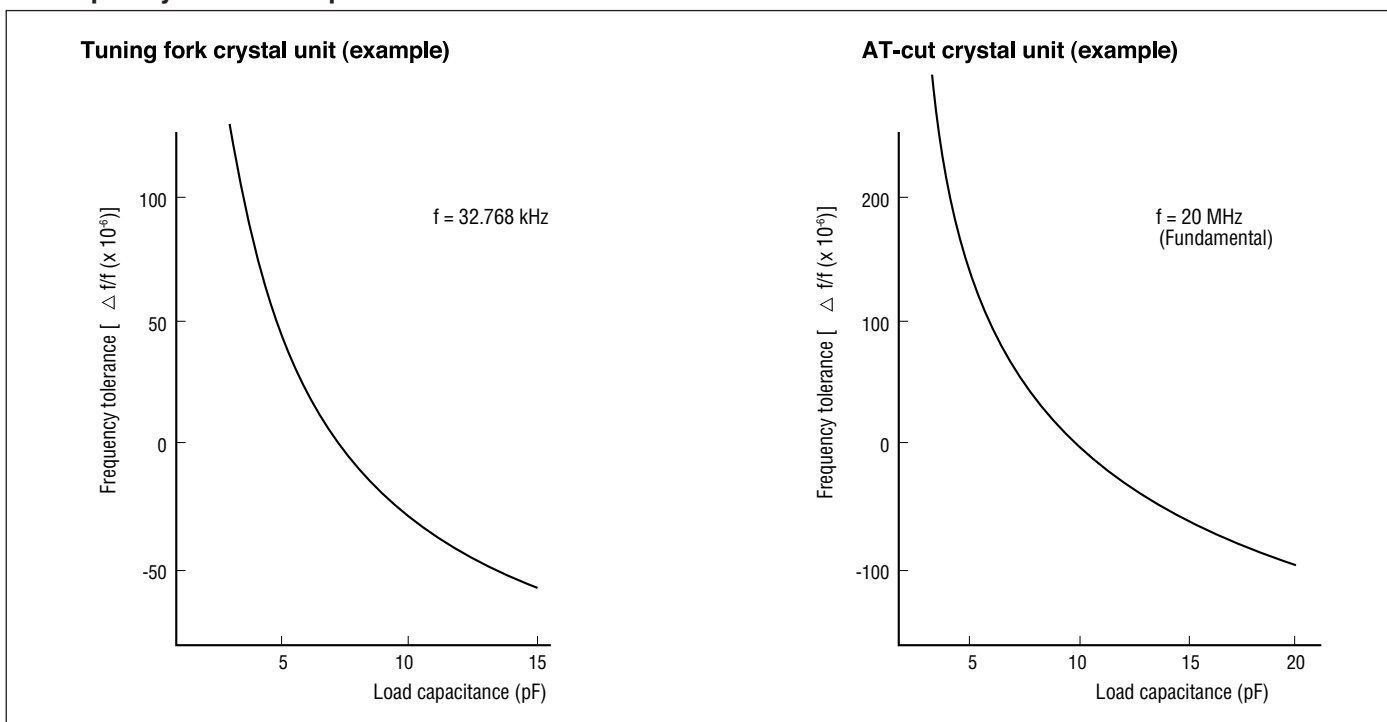
### ● How to check the allowance for oscillation

- (1) Connect the resistance (r) to the circuit in series with the crystal unit.
- (2) Adjust (r) so that oscillation can start (or stop).
- (3) Measure (r) when oscillation just starts (or stops) in (2) above.
- (4) Recommended (r)  
(r) > CI x (5 to 10)

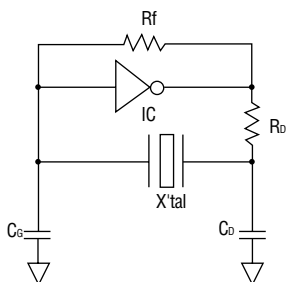
## 3. Load capacitance

Differences in the load capacitance of the oscillation circuit may result in a different oscillation frequency from the desired one, as shown in the figure below. Approximate expression of the load capacitance of the circuit  $C_L \doteq C_G \times C_D / (C_G + C_D) + C_S$ . Where CS Stands for stray capacity of the circuit.

### ● Frequency and load capacitance characteristics



## 4. Reference for setting parameters of oscillation circuit

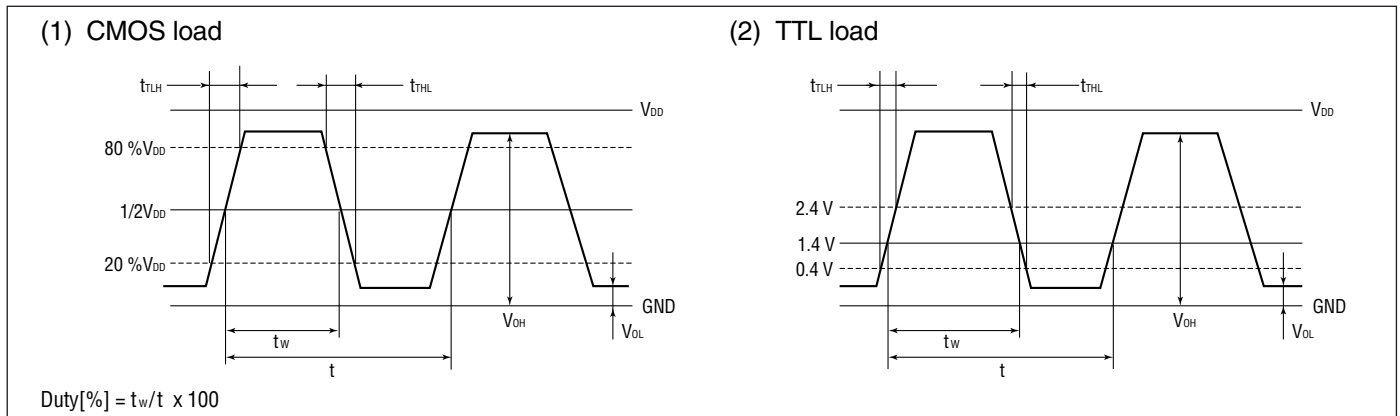


Frequency range	Symbol	R <sub>F</sub> (MΩ)	R <sub>D</sub> (kΩ)	C <sub>G</sub> (pF)	C <sub>D</sub> (pF)
20 kHz to 60 kHz		20	500	10	
60 kHz to 165 kHz		10	300		
5.5 MHz to 30 MHz (Fundamental)		1	0.5	5 to 15	
30 MHz to 50 MHz (Fundamental)				5 to 10	

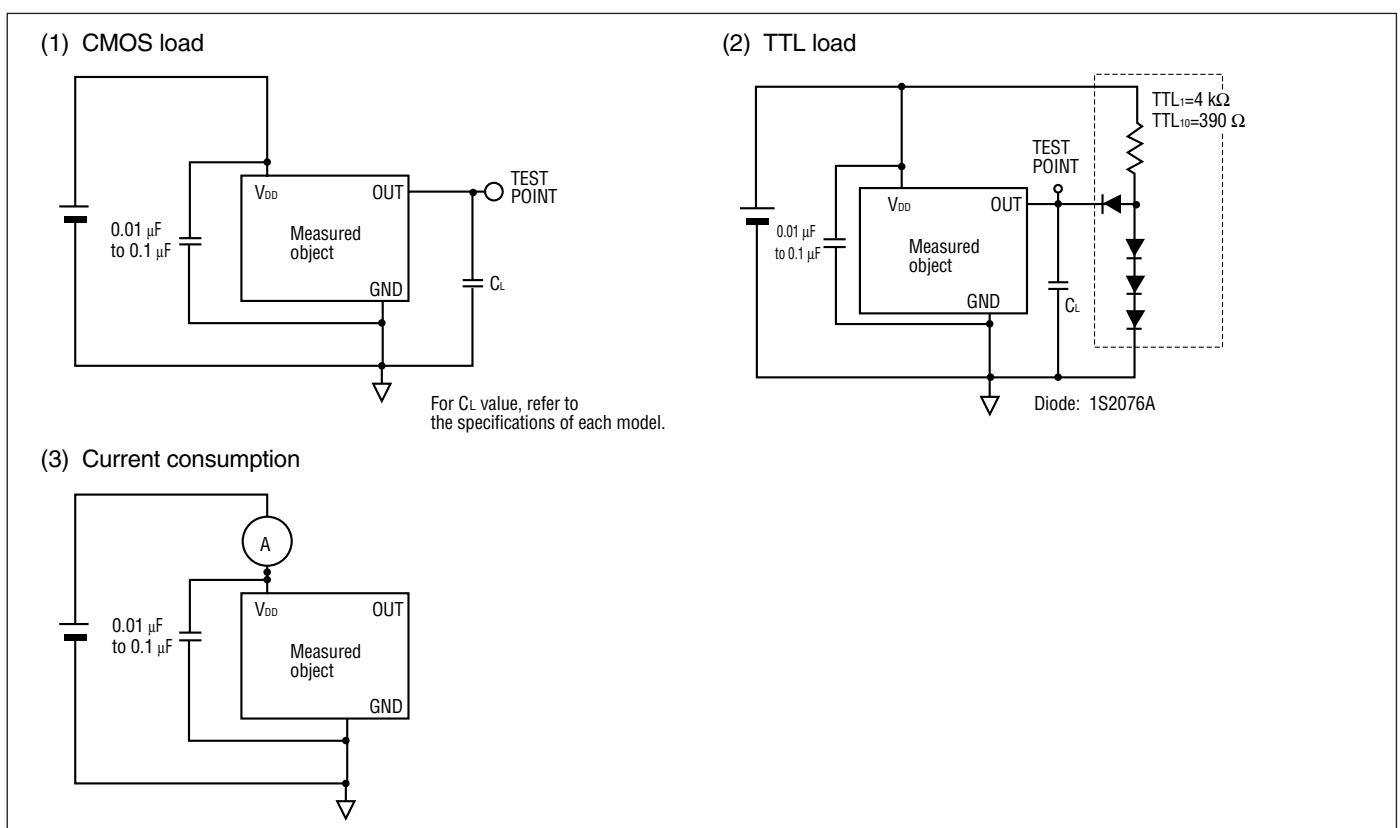
IC : equivalent to TC74HCU04 (unbuffer)  
 equivalent to TC74VHCU04 (unbuffer) (30 MHz to 50 MHz)  
 (TC74HCU04 and TC74VHCU04 are a product number of Toshiba Corp.)

## OUTPUT WAVEFORM AND TEST CIRCUIT

### 1. Timing chart



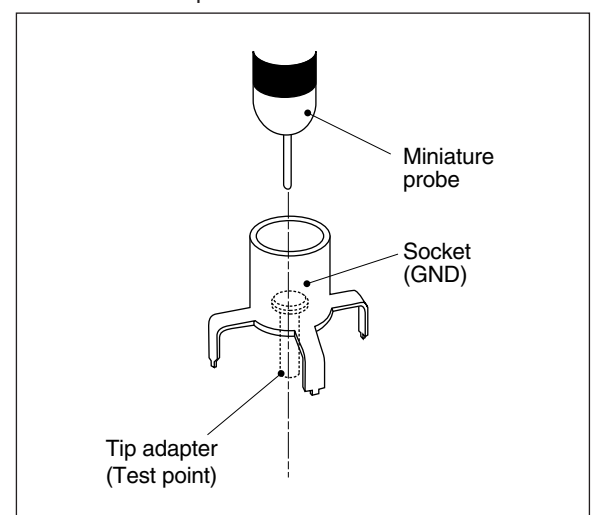
### 2. Test circuit



### 3. Test conditions

- (1) Supply voltage
  - More than 150  $\mu$ s until voltage level reaches 90 % from 0 %.
  - Supply voltage impedance is less than 2  $\Omega$  of resistance.
- (2) Oscilloscope
  - Input capacitance of less than 15 pF.
  - Frequency range of 5times or more of measurements frequency.
  - Earth lead of the probe should be as short as possible.
  - Probe impedance when measuring frequency is to be more than 1 M $\Omega$ . Simultaneous measurement of waveform (frequency and wave form) is not possible; however, measurement is possible as the wave form passes from the amplifier stage of an oscilloscope.
- (3) Miscellaneous
  - $C_L$  includes the probe capacitance.
  - Ammeter with small internal impedance should be used.
  - To observe wave form, please use a miniature socket. (do not use a long ground wire of the probe.)

#### Miniature socket parts



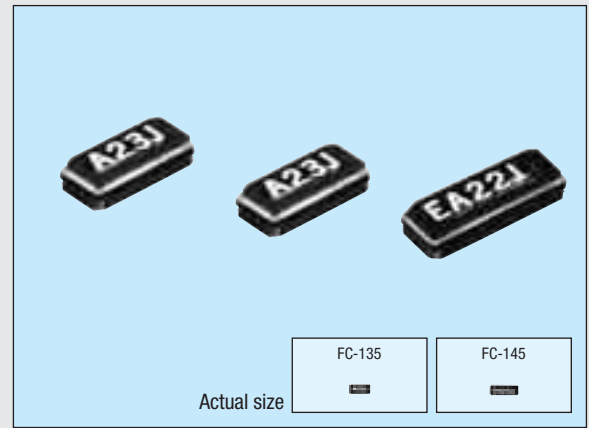
THIN SMD LOW FREQUENCY CRYSTAL UNIT

# FC-135 / 145

Product number (please refer to page 1)

**Q1 x FC135xxxxx00**  
**Q13FC145xxxxx00**

- High-density mounting-type SMD of 0.8 mm Typ. thickness.
- Small packaging area and light weight.
- Excellent environmental capability.
- Most suitable for small communications devices.
- Available for lead (Pb)-free soldering.
- Lead (Pb)-free terminal product.

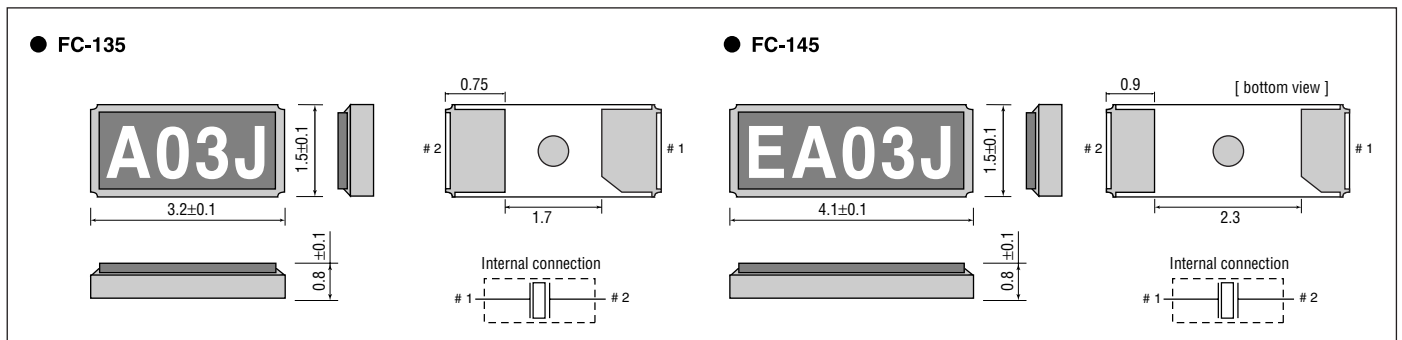


## Specifications (characteristics)

Item	Symbol	Specifications		Remarks
		FC-135 / 145	FC-135	
Nominal frequency	f	32.768 kHz	32.000 kHz to 77.5 kHz	please contact us for inquiries about the available frequency
Temperature range	Storage temperature	-55 °C to +125 °C		Stored as bare product after unpacking
	Operating temperature	-40 °C to +85 °C		
Maximum drive level	GL	0.5 μW Max.		
Recommended drive level	DL	0.1 μW		
Frequency tolerance(standard)	Δf/f	±20 x 10 <sup>-6</sup>		Ta = +25 °C, DL = 0.1 μW Please ask tighter tolerance
Peak temperature (frequency)	θT	+25 °C ±5 °C		
Temperature coefficient (frequency)	a	-0.04 x 10 <sup>-6</sup> / °C <sup>2</sup> Max.		
Load capacitance	CL	9.0 pF, 12.5 pF		Please specify
Series resistance	R <sub>1</sub>	70 kΩ Max.	80 kΩ to 45 kΩ	
Motional capacitance	C <sub>1</sub>	3.4 fF Typ.	3.4 fF to 1.4 fF	
Shunt capacitance	C <sub>0</sub>	1.0 pF Typ.	1.0 pF to 0.8 pF	
Insulation resistance	IR	500 MΩ Min.		
Aging	fa	±3 x 10 <sup>-6</sup> / year Max.		Ta = +25 °C ±3 °C, first year
Shock resistance	S.R.	±8 x 10 <sup>-6</sup> Max.		100 g dummy (Seiko Epson Standard) drop from 1500 mm height on to the concrete 3 directions 10 times.

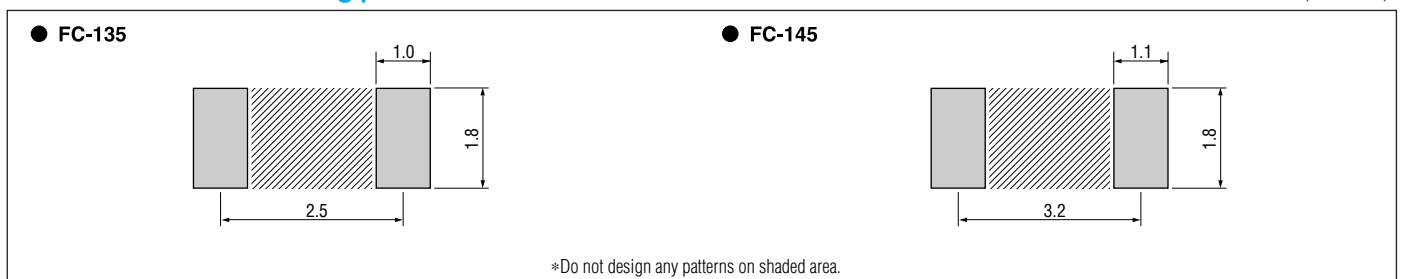
## External dimensions

(Unit: mm)



## Recommended soldering pattern

(Unit: mm)





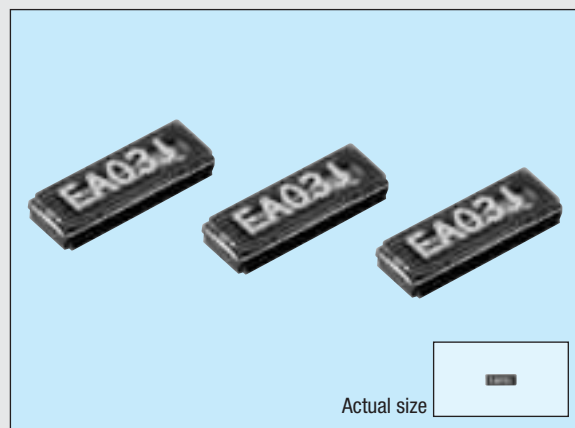
## THIN SMD LOW / MEDIUM FREQUENCY CRYSTAL UNIT

## FC-255

Product number (please refer to page 1)

Q1 x FC255xxxxx00

- High-density mounting-type SMD of 0.8 mm Typ. thickness.
- Small packaging area and light weight.
- Excellent environmental capability.
- Most suitable for small communications devices.
- Available for lead (Pb)-free soldering.
- Lead (Pb)-free terminal product.



## ■ Specifications (characteristics)

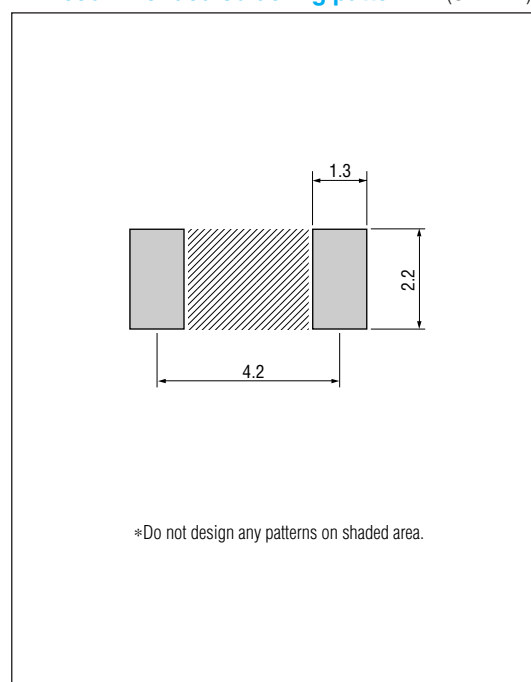
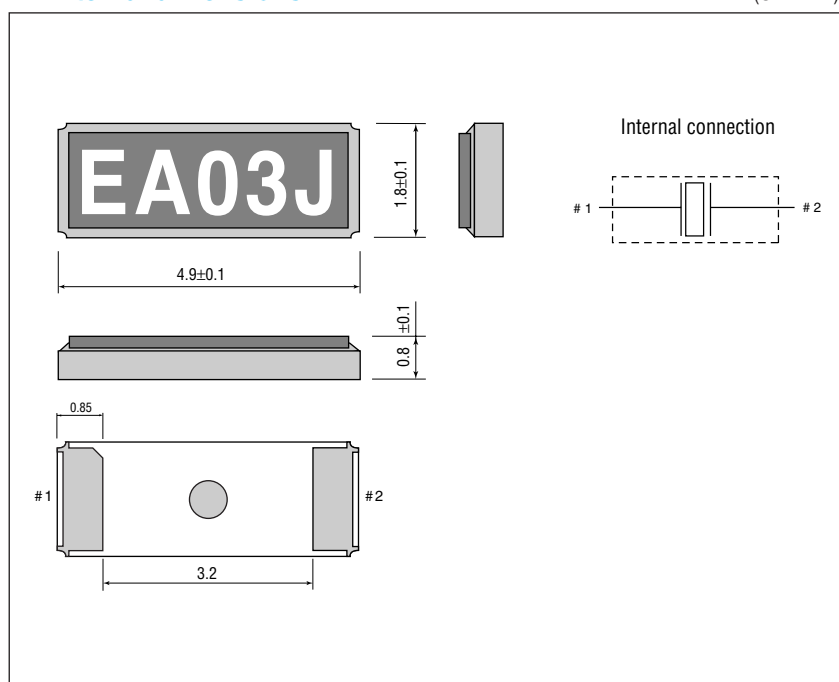
Item		Symbol	Specifications		Remarks
Nominal frequency range		f	32.768 kHz	32.000 kHz	please contact us for inquiries about the available frequency
Temperature range	Storage temperature	T <sub>STG</sub>	-55 °C to +125 °C		Stored as bare product after unpacking
	Operating temperature	T <sub>OPR</sub>	-40 °C to +85 °C		
Maximum drive level		GL	0.5 μW Max.		
Frequency tolerance (standard)		Δf/f	±20 x 10 <sup>-6</sup>	±50 x 10 <sup>-6</sup> , ±100 x 10 <sup>-6</sup>	T <sub>a</sub> = +25 °C, DL = 0.1 μW Please ask tighter tolerance
Peak temperature (frequency)		θT	+25 °C ±5 °C		
Temperature coefficient (frequency)		a	-0.04 x 10 <sup>-6</sup> / °C <sup>2</sup> Max.		
Load capacitance		C <sub>L</sub>	7 pF, 12.5 pF		Please specify
Series resistance		R <sub>1</sub>	65 kΩ Max.	70 kΩ to 25 kΩ	
Motional capacitance		C <sub>1</sub>	1.7 fF Typ.	2.5 fF to 0.7 fF	
Shunt capacitance		C <sub>0</sub>	1.3 pF Typ.	1.6 pF to 0.7 pF	
Insulation resistance		IR	500 MΩ Min.		
Aging		f <sub>a</sub>	±3 x 10 <sup>-6</sup> / year Max.		T <sub>a</sub> = +25 °C ±3 °C, first year
Shock resistance		S.R.	±8 x 10 <sup>-6</sup> Max.		100 g dummy (Seiko Epson Standard) drop from 1500 mm height on to the concrete 3 directions 10 times.

## ■ External dimensions

(Unit: mm)

## ■ Recommended soldering pattern

(Unit: mm)



THIN SMD LOW / MEDIUM-FREQUENCY CRYSTAL UNIT

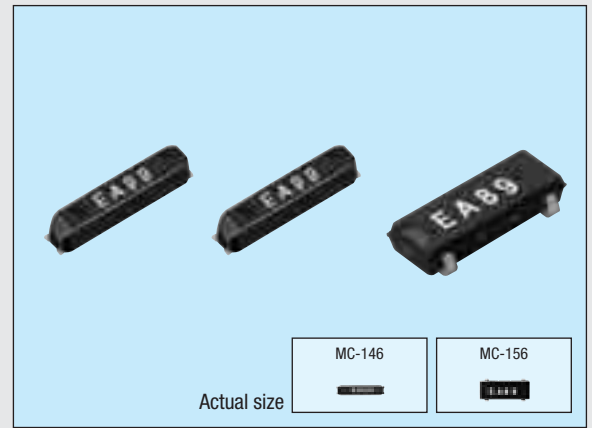
# MC-146 / 156

Product number (please refer to page 1)

Q1 x MC146xxxxx00

Q1 x MC156xxxxx00

- High-density mounting-type SMD of 1.4 mm thickness.(MC-146)
- Small packaging area and light weight.
- Excellent environmental capability.
- Most suitable for small communications devices.
- Available for lead (Pb)-free soldering.
- Available for lead (Pb)-free terminal.

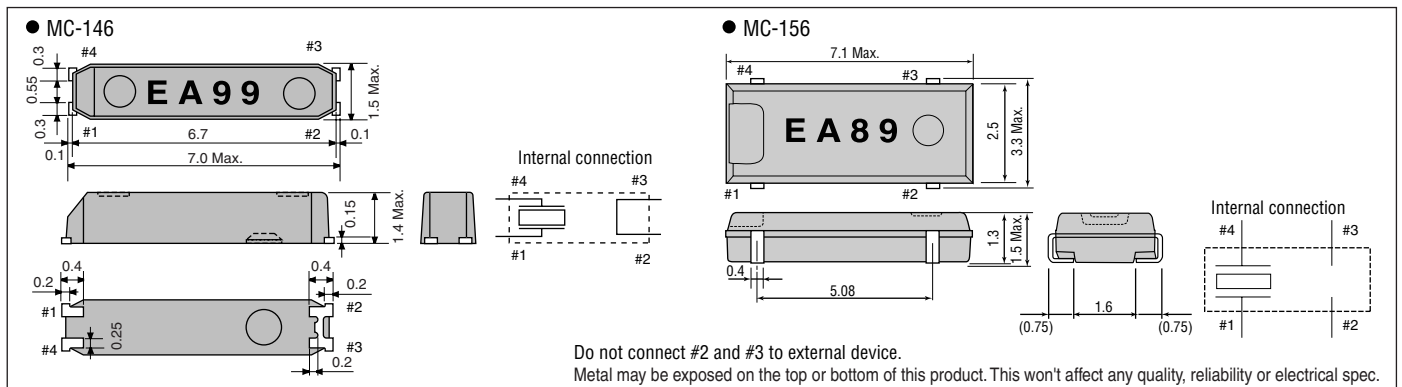


## Specifications (characteristics)

Item	Symbol	Specifications		Remarks
Nominal frequency range	f	32.768 kHz	32.000 kHz to 100.000 kHz	please contact us for inquiries about the available frequency
Temperature range	Storage temperature	-55 °C to +125 °C		Stored as bare product after unpacking
	Operating temperature	-40 °C to +85 °C		
Maximum drive level	GL	1.0 μW Max.		
Frequency tolerance (standard)	Δf/f	±20 x 10 <sup>-6</sup> , ±50 x 10 <sup>-6</sup>	±50 x 10 <sup>-6</sup> , ±100 x 10 <sup>-6</sup>	Ta = +25 °C, DL = 0.1 μW
Peak temperature (frequency)	θT	+25 °C ±5 °C		
Temperature coefficient (frequency)	a	-0.04 x 10 <sup>-6</sup> / °C <sup>2</sup> Max.		
Load capacitance	CL	7 pF, 12.5 pF		Please specify
Series resistance	R1	65 kΩ Max.	65 kΩ to 25 kΩ	
Motional capacitance	C1	1.9 fF Typ.	2.5 fF to 0.6 fF	
Shunt capacitance	C0	0.8 pF Typ.	1.2 pF to 0.5 pF	
Insulation resistance	IR	500 MΩ Min.		
Aging	fa	±3 x 10 <sup>-6</sup> / year Max.		Ta = +25 °C ±3 °C, first year
Shock resistance	S.R.	±5 x 10 <sup>-6</sup> Max.		100 g dummy (Seiko Epson Standard) drop from 1500 mm height on to the concrete 3 directions 10 times.

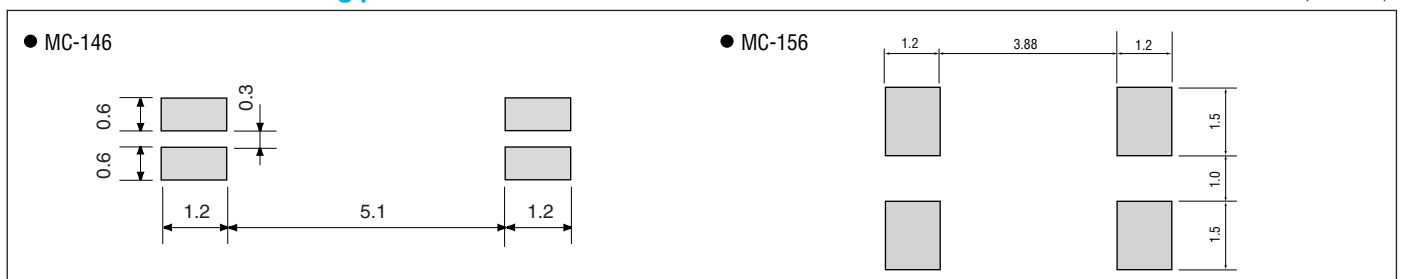
## External dimensions

(Unit: mm)



## Recommended soldering pattern

(Unit: mm)



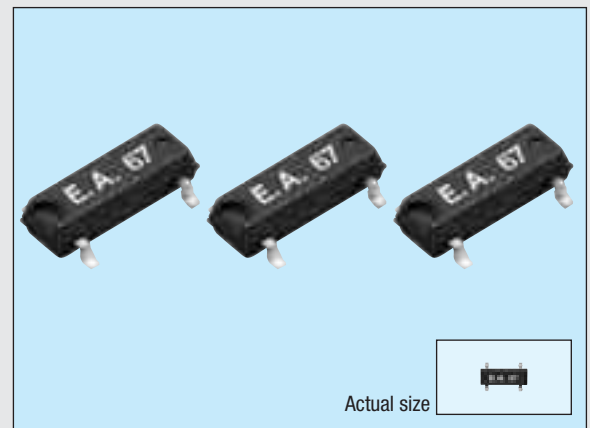
## THIN SMD LOW / MEDIUM-FREQUENCY CRYSTAL UNIT

## MC-206

Product number (please refer to page 1)

Q1 x MC206xxxxx00

- High-density mounting-type SMD of Max. 2.0 mm thickness.
- High heat resistance allows reflow soldering.
- Excellent environmental capability.
- Available for lead (Pb)-free soldering.
- Available for lead (Pb)-free terminal.



## ■ Specifications (characteristics)

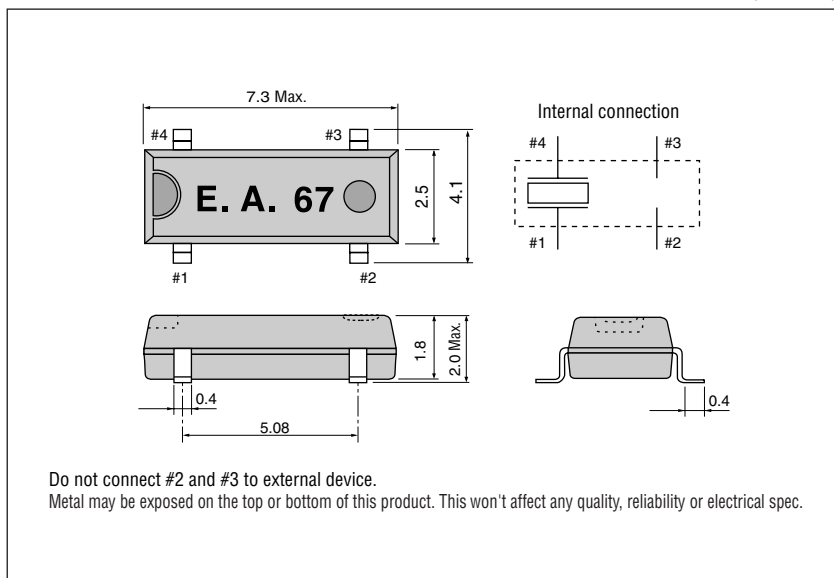
Item		Symbol	Specifications		Remarks
Nominal frequency range		f	32.768 kHz	32.000 kHz to 100.000 kHz	please contact us for inquiries about the available frequency
Temperature range	Storage temperature	T <sub>STG</sub>	-55 °C to +125 °C		Stored as bare product after unpacking
	Operating temperature	T <sub>OPR</sub>	-40 °C to +85 °C		
Maximum drive level		GL	1.0 μW Max.		
Frequency tolerance (standard)		Δf/f	±20 x 10 <sup>-6</sup> , ±50 x 10 <sup>-6</sup>	±50 x 10 <sup>-6</sup> , ±100 x 10 <sup>-6</sup>	T <sub>a</sub> = +25 °C, DL = 0.1 μW
Peak temperature (frequency)		θT	+25 °C ±5 °C		
Temperature coefficient (frequency)		a	-0.04 x 10 <sup>-6</sup> /°C <sup>2</sup> Max.		
Load capacitance		C <sub>L</sub>	7 pF, 12.5 pF		Please specify
Series resistance		R <sub>1</sub>	55 kΩ Max.	50 kΩ to 20 kΩ	As per below table
Motional capacitance		C <sub>1</sub>	1.8 fF Typ.	3.0 fF	
Shunt capacitance		C <sub>0</sub>	0.9 pF Typ.	1.5 pF	
Insulation resistance		IR	500 MΩ Min.		
Aging		f <sub>a</sub>	±3 x 10 <sup>-6</sup> / year Max.	±5 x 10 <sup>-6</sup> / year Max.	T <sub>a</sub> = +25 °C ±3 °C, first year
Shock resistance		S.R.	±5 x 10 <sup>-6</sup> Max.		Three drops on a hard board from 750 mm or excitation test with 29400 m/s <sup>2</sup> x 0.3 ms x 1/2 sine wave x 3 directions

## ■ Series resistance

Frequency (kHz)	32 ≤ f < 38	38 ≤ f < 65.536	65.536 ≤ f < 75	75 ≤ f ≤ 100
Series resistance (Ω)	50 kΩ Max.	40 kΩ Max.	25 kΩ Max.	20 kΩ Max.

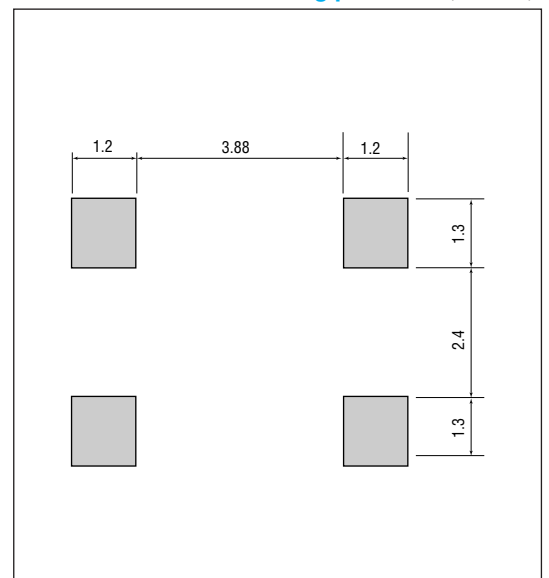
## ■ External dimensions

(Unit: mm)



## ■ Recommended soldering pattern

(Unit: mm)



SMD LOW / MEDIUM-FREQUENCY CRYSTAL UNIT

# MC-306 / 405 / 406

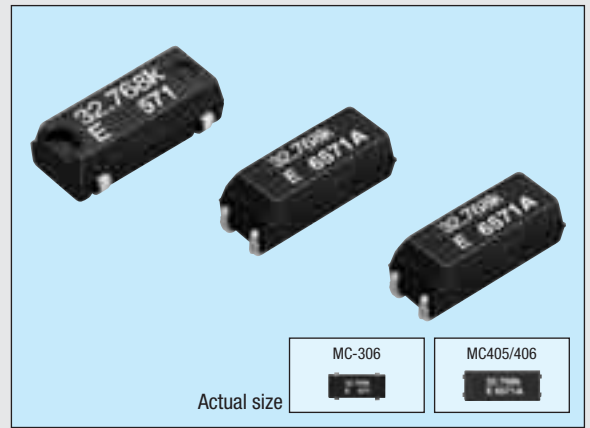
Product number (please refer to page 1)

Q1 x MC306xxxxx00

Q1 x MC405xxxxx00

Q1 x MC406xxxxx00

- High-density mounting-type SMD.
- Photolithography finished allows uniform, stable performance.
- Excellent environmental capability.
- Capable of covering low-frequency range from 20 kHz to 165 kHz.
- Suitable for time keeping of clock and microcomputer.
- Available for lead (Pb)-free soldering.
- Available for lead (Pb)-free terminal.



## Specifications (characteristics)

Item	Symbol	Specifications		Remarks
Nominal frequency range	f	32.768 kHz	20.000 kHz to 165.000 kHz	Please refer to frequency example page 14
Temperature range	Storage temperature	T <sub>STG</sub> -55 °C to +125 °C		Stored as bare product after unpacking
	Operating temperature	T <sub>OPR</sub> -40 °C to +85 °C		
Maximum drive level	GL	1.0 μW Max.		
Frequency tolerance (standard)	Δf/f	±20 x 10 <sup>-6</sup> , ±50 x 10 <sup>-6</sup>	±50 x 10 <sup>-6</sup> , ±100 x 10 <sup>-6</sup>	T <sub>a</sub> = +25 °C, DL = 0.1 μW
Peak temperature (frequency)	θT	+25 °C ±5 °C		
Temperature coefficient (frequency)	a	-0.04 x 10 <sup>-6</sup> / °C <sup>2</sup> Max.		
Load capacitance	C <sub>L</sub>	6 pF to ∞ (Standard : 12.5 pF)		Please specify
Series resistance	R <sub>1</sub>	50 kΩ Max.	55 kΩ to 10 kΩ	As per below table
Motional capacitance	C <sub>1</sub>	1.8 fF Typ.	4.0 fF to 0.6 fF	MC-306
		2.0 fF Typ.		MC-405 / 406
Shunt capacitance	C <sub>0</sub>	0.9 pF Typ.	2.0 pF to 0.6 pF	MC-306
		0.85 pF Typ.		MC-405 / 406
Insulation resistance	IR	500 MΩ Min.		
Aging	f <sub>a</sub>	±3 x 10 <sup>-6</sup> / year Max.	±5 x 10 <sup>-6</sup> / year Max.	T <sub>a</sub> = +25 °C ±3 °C, first year
Shock resistance	S.R.	±5 x 10 <sup>-6</sup> Max.		Three drops on a hard board from 750 mm or excitation test with 29400 m/s <sup>2</sup> x 0.3 ms x 1/2 sine wave x 3 directions

## Series resistance

Frequency (kHz)	20 kHz ≤ f < 31.2 kHz	31.2 kHz ≤ f < 40 kHz	40 kHz ≤ f < 90 kHz	90 kHz ≤ f < 130 kHz	130 kHz ≤ f ≤ 165 kHz
Series resistance (Ω)	55 kΩ Max.	35 kΩ Max.	20 kΩ Max.	12 kΩ Max.	10 kΩ Max.

## External dimensions

(Unit: mm)

● MC-306

Do not connect #2 and #3 to external device.  
Metal may be exposed on the top or bottom of this product. This won't affect any quality, reliability or electrical spec.

● MC-405/406

Do not connect #2 and #3 of MC-406 to external device.  
The first digit of No. means: 5XXXX - MC-405  
6XXXX - MC-406

## Recommended soldering pattern

(Unit: mm)

● MC-306

● MC-405

● MC-406

## CYLINDER LOW/MEDIUM-FREQUENCY CRYSTAL UNIT

## C-2-TYPE C-4-TYPE C-TYPE

Product number (please refer to page 1)

Q12C2000xxxxx00

Q11C001Rxxxxx00

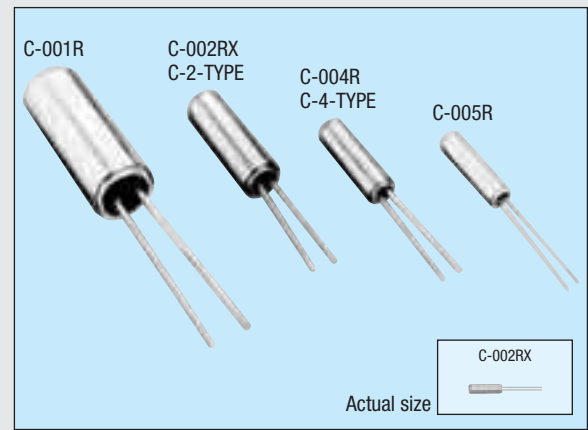
Q11C004Rxxxxx00

Q12C4000xxxxx00

Q11C02RXxxxxx00

Q11C005Rxxxxx00

- Photolithography finished allows uniform and stable performance.
- Excellent environmental capability.
- Respond to an extensive range of frequency, from 20 kHz to 165 kHz, and 307.2 kHz. (C-2-TYPE), from 32 kHz to 120 kHz and 307.2 kHz (C-4-TYPE)
- Available for complete lead (Pb)-free product.



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

Item	Symbol	Specifications		Remarks
		C-2-TYPE	C-4-TYPE	
Nominal frequency range	f	20.000 kHz to 165.000 kHz, 307.2 kHz	32.000 kHz to 120.000 kHz, 192 kHz	Please refer to frequency example page 14
Temperature range	Storage temperature	-20 °C to +70 °C		Stored as bare product after unpacking
	Operating temperature	-10 °C to +60 °C		
Maximum drive level	GL	1.0 μW Max.		
Frequency tolerance (standard)	Δf/f	±20 × 10 <sup>-6</sup> , ±50 × 10 <sup>-6</sup> , ±100 × 10 <sup>-6</sup> (307.2 kHz ±100 × 10 <sup>-6</sup> )	±50 × 10 <sup>-6</sup> , ±100 × 10 <sup>-6</sup>	Ta = +25 °C, DL = 0.1 μW
Peak temperature (frequency)	θT	+25 °C ±5 °C		
Temperature coefficient (frequency)	a	-0.04 × 10 <sup>-6</sup> / °C <sup>2</sup> Max.		
Load capacitance	CL	6 pF to ∞		Please specify
Series resistance	R <sub>1</sub>	55 kΩ to 6 kΩ	50 kΩ to 10 kΩ	As per below table
Motional capacitance	C <sub>1</sub>	4.0 fF Max.	3.0 fF Max.	
Shunt capacitance	C <sub>0</sub>	2.0 pF Max.	1.5 pF Max.	
Insulation resistance	IR	500 MΩ Min.		
Aging	fa	±5 × 10 <sup>-6</sup> / year Max.		Ta = +25 °C ±3 °C, first year
Shock resistance	S.R.	±5 × 10 <sup>-6</sup> Max.		Three drops on a hard board from 750 mm or excitation test with 29400 m/s <sup>2</sup> × 0.3 ms × 1/2 sine wave × 3 directions

## ■ Series resistance C-2-TYPE

Frequency (kHz)	20 kHz ≤ f < 31.2 kHz	31.2 kHz ≤ f < 40 kHz	40 kHz ≤ f < 90 kHz	90 kHz ≤ f < 130 kHz	130 kHz ≤ f ≤ 165 kHz	307.2 kHz
Series resistance (Ω)	55 kΩ Max.	35 kΩ Max.	20 kΩ Max.	12 kΩ Max.	10 kΩ Max.	6 kΩ Max.

## ■ Series resistance C-4-TYPE

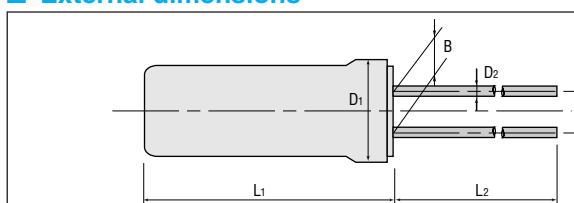
Frequency (kHz)	32 kHz ≤ f < 38 kHz	38 kHz ≤ f < 50 kHz	50 kHz ≤ f < 74 kHz	74 kHz ≤ f < 100 kHz	100 kHz ≤ f ≤ 120 kHz	192 kHz
Series resistance (Ω)	50 kΩ Max.	30 kΩ Max.	25 kΩ Max.	22 kΩ Max.	15 kΩ Max.	10 kΩ Max.

## ■ Series resistance C-TYPE

Item	Symbol	C-001R	C-002R	C-004R	C-005R	Remarks
Nominal frequency range	f	32.768 kHz				
Temperature range	Storage temperature	-20 °C to +70 °C				
	Operating temperature	-10 °C to +60 °C				
Maximum drive level	GL	1.0 μW Max.				
Frequency tolerance (standard)	Δf/f	±20 × 10 <sup>-6</sup>				Ta = +25 °C, DL = 0.1 μW
Peak temperature (frequency)	θT	+25 °C ±5 °C				
Temperature coefficient (frequency)	a	-0.04 × 10 <sup>-6</sup> / °C <sup>2</sup> Max.				
Load capacitance	CL	6 pF to ∞				Please specify
Series resistance	R <sub>1</sub>	35 kΩ Max. (18 kΩ Typ.)	50 kΩ Max. (30 kΩ Typ.)	50 kΩ Max. (37 kΩ Typ.)		
Motional capacitance	C <sub>1</sub>	2.1 fF Typ.	2.0 fF Typ.	1.9 fF Typ.		
Shunt capacitance	C <sub>0</sub>	0.9 pF Typ.	0.85 pF Typ.	0.75 pF Typ.		
Insulation resistance	IR	500 MΩ Min.				
Aging	fa	±3.0 × 10 <sup>-6</sup> / year Max.				Ta = +25 °C ±3 °C, first year
Shock resistance	S.R.	±5 × 10 <sup>-6</sup> Max.				Three drops on a hard board from 750 mm or excitation test with 29400 m/s <sup>2</sup> × 0.3 ms × 1/2 sine wave × 3 directions

## ■ External dimensions

(Unit: mm)



Model	L1	L2	L3	L4	L5
C-001R	8.0 Max.	9.0 Min.	∅3.1 Max.	∅0.3	1.1
C-002RX C-2-TYPE	6.0 Max.	4.0 Min.	∅2.0 Max.	∅0.2	0.7
C-004R C-4-TYPE	5.0 Max.	4.0 Min.	∅1.5 Max.	∅0.2	0.5
C-005R	4.6 Max.	4.0 Min.	∅1.2 Max.	∅0.15	0.3

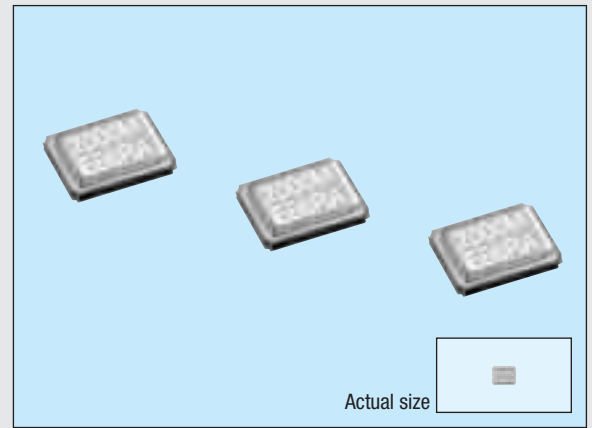
THIN SMD HIGH-FREQUENCY CRYSTAL UNIT

# FA-238

Product number (please refer to page 1)

**Q22FA238XXXXX00**

- High-density mounting-type SMD.
- Excellent shock resistance.
- Capable of covering a wide frequency range. (from 16 MHz to 50 MHz)
- 0.6 mm Typ. thickness is equal to SMD-type IC.
- Most suitable for small communication devices.
- Available for lead (Pb)-free soldering.
- Complete lead (Pb)-free product.



## Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Nominal frequency	f	16.000 MHz to 50.000 MHz	Fundamental mode
Temperature range	Storage temperature	T <sub>STG</sub> -40 °C to +125 °C	Stored as bare product after unpacking
	Operating temperature	T <sub>OPR</sub> -40 °C to +85 °C	Specified equivalent series must be satisfied.
	Operable temperature	T <sub>USE</sub> As per below table	Specified equivalent series and frequency temperature characteristics must be satisfied.
Recommended drive level	DL	10 μW to 100 μW	
Frequency tolerance	Δf/f	±50 x 10 <sup>-6</sup> (standard) (±15 x 10 <sup>-6</sup> to ±50 x 10 <sup>-6</sup> is available)	T <sub>a</sub> = +25 °C ±3 °C For the out of standard specifications, please contact us for inquiries. *1
Frequency temperature characteristics		±30 x 10 <sup>-6</sup> (standard) As per below table	-20 °C to +70 °C For the out of standard specifications, please contact us for inquiries. *1
Load capacitance	C <sub>L</sub>	7 pF to ∞ (standard:10 pF)	Please specify
Series resistance	R <sub>1</sub>	As per below table	Operable temperature range , DL = 100 μW
Shunt capacitance	C <sub>0</sub>	5.0 pF Max.	
Insulation resistance	IR	500 MΩ Min.	
Aging	fa	±5 x 10 <sup>-6</sup> / year Max.	T <sub>a</sub> = +25 °C ±3 °C, first year
Shock resistance	S.R.	±10 x10 <sup>-6</sup> Max.	100 g dummy (Seiko Epson Standard) drop from 1500 mm height on to the concrete 3 directions 10 times.

\*1 f > 40 MHz : Only standard specifications

## Frequency temperature characteristics

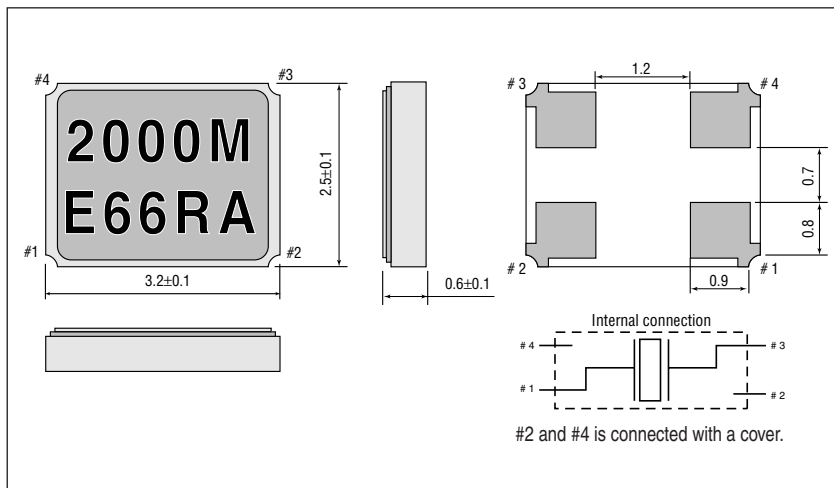
Operable temperature	Frequency tolerance
0 °C to +50 °C	± 8 x 10 <sup>-6</sup> Min.
-10 °C to +60 °C	± 12 x 10 <sup>-6</sup> Min.
-20 °C to +70 °C	± 15 x 10 <sup>-6</sup> Min.
-30 °C to +80 °C	± 20 x 10 <sup>-6</sup> Min.
-40 °C to +85 °C	± 30 x 10 <sup>-6</sup> Min.

## Series resistance (R1)

Frequency	Series resistance
16.0 MHz ≤ f < 20.0 MHz	80 Ω Max.
20.0 MHz ≤ f < 25.0 MHz	60 Ω Max.
25.0 MHz ≤ f < 30.0 MHz	50 Ω Max.
30.0 MHz ≤ f ≤ 50.0 MHz	40 Ω Max.

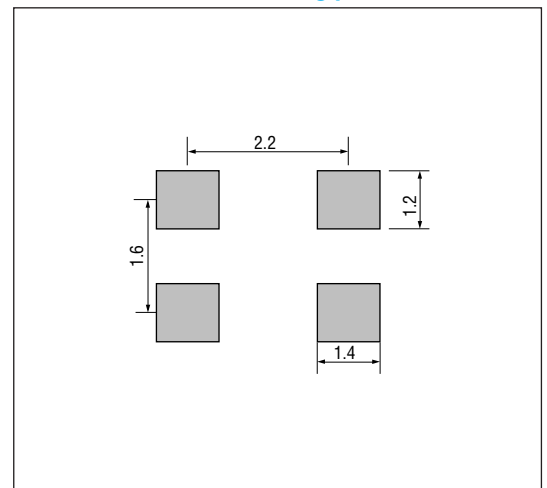
## External dimensions

(Unit: mm)



## Recommended soldering pattern

(Unit: mm)



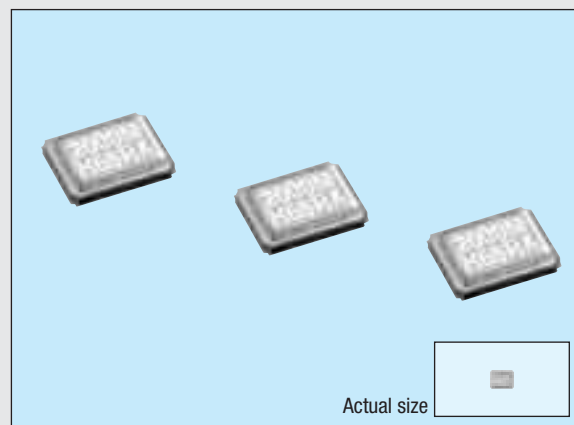
## THIN SMD HIGH-STABILITY CRYSTAL UNIT

## FA-23H

Product number (please refer to page 1)

Q24FA23Hxxxxx00

- Featuring tiny size with good tuneability for GSM RF discrete circuit.
- Suite for Bluetooth and W - LAN with stable temperature frequency characteristics.
- Good shock-resistance construction meets handheld equipment requirement.
- 0.6 mm Typ. thickness is equal to SMD-type IC.
- Available for lead (Pb)-free soldering.
- Complete lead (Pb)-free product.



## ■ Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Nominal frequency	f	16.000 MHz to 32.000 MHz Standard : 16.000 MHz / 26.000 MHz / 32.000 MHz	Fundamental mode For the out of standard specifications, please contact us for inquiries.
Recommended applications		Bluetooth / GSM / Mobile communication device	
Temperature range	Storage temperature	TSTG	-40 °C to +125 °C
	Operating temperature	TOPR	-40 °C to +85 °C
	Operable temperature	TUSE	As per below table
Recommended drive level	DL	10 μW to 100 μW	
Frequency tolerance (standard)	Δf/f	±10 x 10 <sup>-6</sup>	Ta = +25 °C For the out of standard specifications, please contact us for inquiries.
Frequency temperature characteristics (standard)		±10 x 10 <sup>-6</sup>	-20 °C to +70 °C For the out of standard specifications, please contact us for inquiries.
Load capacitance	CL	10 pF (standard)	For the out of standard specifications, please contact us for inquiries.
Series resistance	R1	As per below table	Operable temperature range, DL = 100 μW
Shunt capacitance	Co	5 pF Max.	
Insulation resistance	IR	500 MΩ Min.	
Aging	fa	±1 x 10 <sup>-6</sup> / year Max.	Ta = +25 °C, first year
Shock resistance	S.R.	±2 x 10 <sup>-6</sup> Max.	100 g dummy (Seiko Epson Standard) drop from 1500 mm height on to the concrete 3 directions 10 times.

## ■ Frequency temperature characteristics

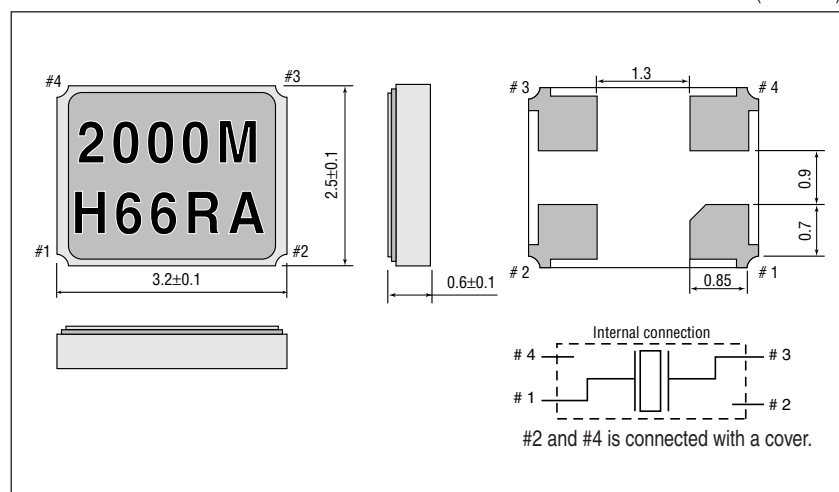
Operable temperature	Frequency tolerance
0 °C to +50 °C	±5 x 10 <sup>-6</sup> Min.
-10 °C to +60 °C	±7 x 10 <sup>-6</sup> Min.
-20 °C to +70 °C	±10 x 10 <sup>-6</sup> Min.
-30 °C to +80 °C	±15 x 10 <sup>-6</sup> Min.
-40 °C to +85 °C	±20 x 10 <sup>-6</sup> Min.

## ■ Series resistance (R1)

Frequency	Series resistance
16.0 MHz ≤ f < 20.0 MHz	80 Ω Max.
20.0 MHz ≤ f < 25.0 MHz	60 Ω Max.
25.0 MHz ≤ f < 30.0 MHz	50 Ω Max.
30.0 MHz ≤ f ≤ 50.0 MHz	40 Ω Max.

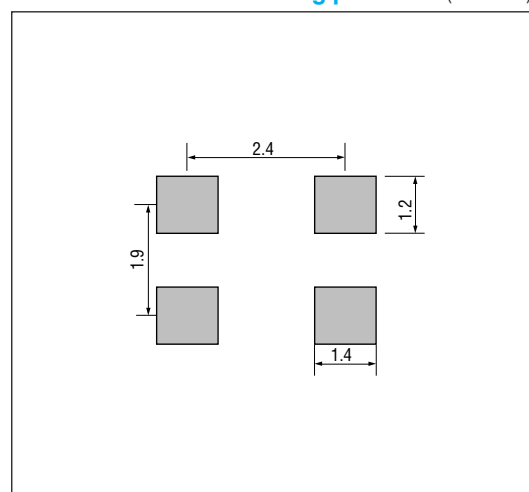
## ■ External dimensions

(Unit: mm)



## ■ Recommended soldering pattern

(Unit: mm)



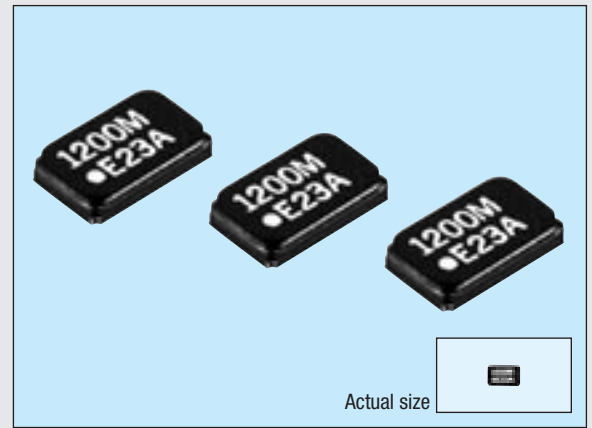
THIN SMD HIGH-FREQUENCY CRYSTAL UNIT

# FA-248

Product number (please refer to page 1)

**Q22FA248XXXXX00**

- High-density mounting-type SMD.
- Excellent shock resistance.
- Capable of covering a wide frequency range. (from 12 MHz to 27 MHz)
- 0.9 mm Typ. thickness is equal to SMD-type IC.
- Most suitable for small communication devices.
- Available for lead (Pb)-free soldering.
- Lead (Pb)-free terminal product.



## Specifications (characteristics)

Item	Symbol	Specifications	Remarks	
Nominal frequency	f	12.000 MHz to 27.000 MHz	Fundamental mode 27 MHz < f ≤ 32 MHz Please contact us for inquiries.	
Temperature range	Storage temperature	TSTG	-40 °C to +125 °C	Stored as bare product after unpacking
	Operating temperature	TOPR	-20 °C to +70 °C / -40 °C to +85 °C	Specified equivalent series must be satisfied.
	Operable temperature	TUSE	As per below table	Specified equivalent series and frequency temperature characteristics must be satisfied.
Recommended drive level	DL	10 μW to 100 μW		
Frequency tolerance	Δf/f	±10 x 10 <sup>-6</sup> , ±15 x 10 <sup>-6</sup> , ±20 x 10 <sup>-6</sup> *1	Ta = +25 °C ±3 °C	
Frequency temperature characteristics		±15 x 10 <sup>-6</sup> , ±20 x 10 <sup>-6</sup> (Standard) *1 As per below table	-20 °C to +70 °C	
Load capacitance	CL	10 pF to ∞	Please specify	
Series resistance	R <sub>1</sub>	As per below table	Operable temperature range , DL = 100 μW	
Shunt capacitance	C <sub>0</sub>	5.0 pF Max.		
Insulation resistance	IR	500 MΩ Min.		
Aging	fa	±2 x 10 <sup>-6</sup> / year Max.	Ta = +25 °C ±1 °C, first year	
Shock resistance	S.R.	±5 x 10 <sup>-6</sup> Max.	100 g dummy (Seiko Epson Standard) drop from 1500 mm height on to the concrete 3 directions 10 times.	

\*1 Please ask tighter tolerance.

## Frequency temperature characteristics

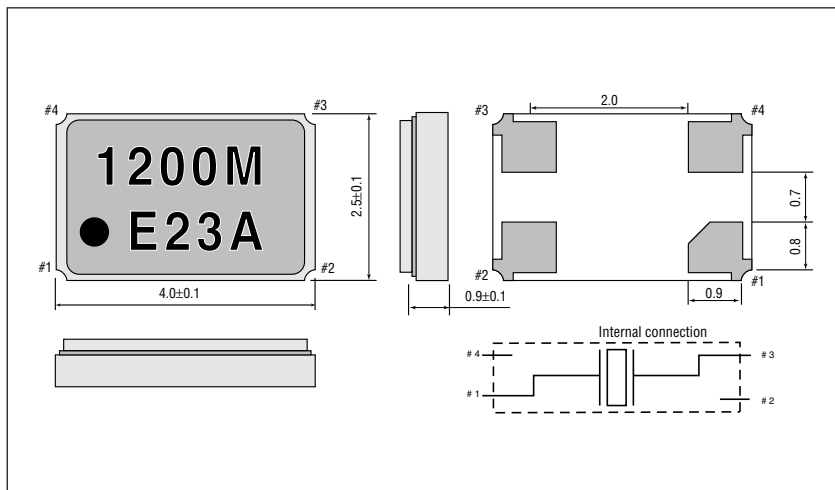
Operable temperature	Frequency tolerance
0 °C to +50 °C	±5 x 10 <sup>-6</sup> Min.
-10 °C to +60 °C	±7 x 10 <sup>-6</sup> Min.
-20 °C to +70 °C	±10 x 10 <sup>-6</sup> Min.
-30 °C to +80 °C	±15 x 10 <sup>-6</sup> Min.
-40 °C to +85 °C	±20 x 10 <sup>-6</sup> Min.

## Series resistance (R1)

Frequency	Series resistance
12.0 MHz ≤ f < 13.0 MHz	70 Ω Max.
13.0 MHz ≤ f < 16.0 MHz	60 Ω Max.
16.0 MHz ≤ f < 20.0 MHz	50 Ω Max.
20.0 MHz ≤ f ≤ 27.0 MHz	40 Ω Max.

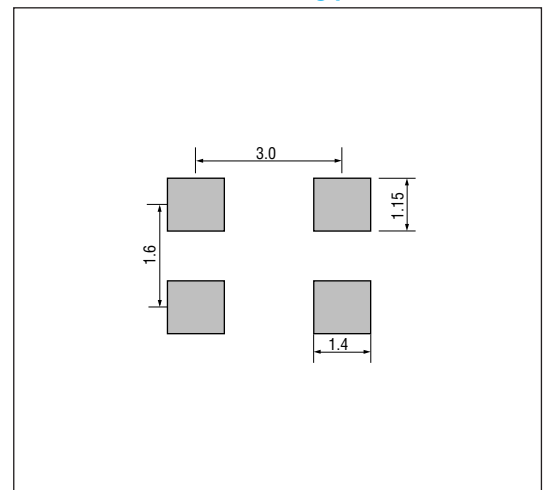
## External dimensions

(Unit: mm)



## Recommended soldering pattern

(Unit: mm)





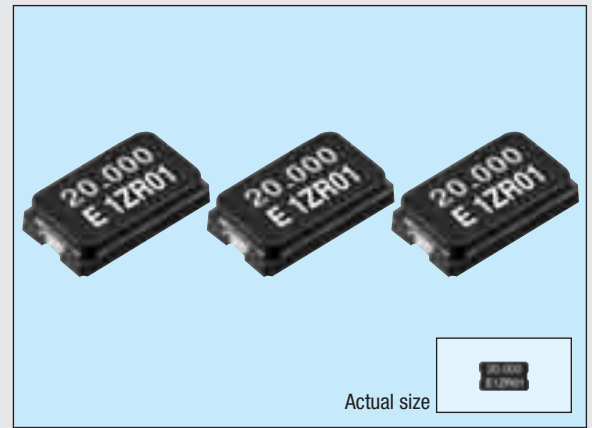
## THIN SMD HIGH-FREQUENCY CRYSTAL UNIT

## FA-365

Product number (please refer to page 1)

Q22FA365XXXXX00

- High-density mounting-type SMD.
- Excellent reliability and environment capability.
- Capable of covering a wide frequency range. (12 MHz and from 14 MHz to 41 MHz)
- 1.4 mm thickness is equal to SMD-type IC.
- Available for lead (Pb)-free soldering.
- Lead (Pb)-free terminal product.

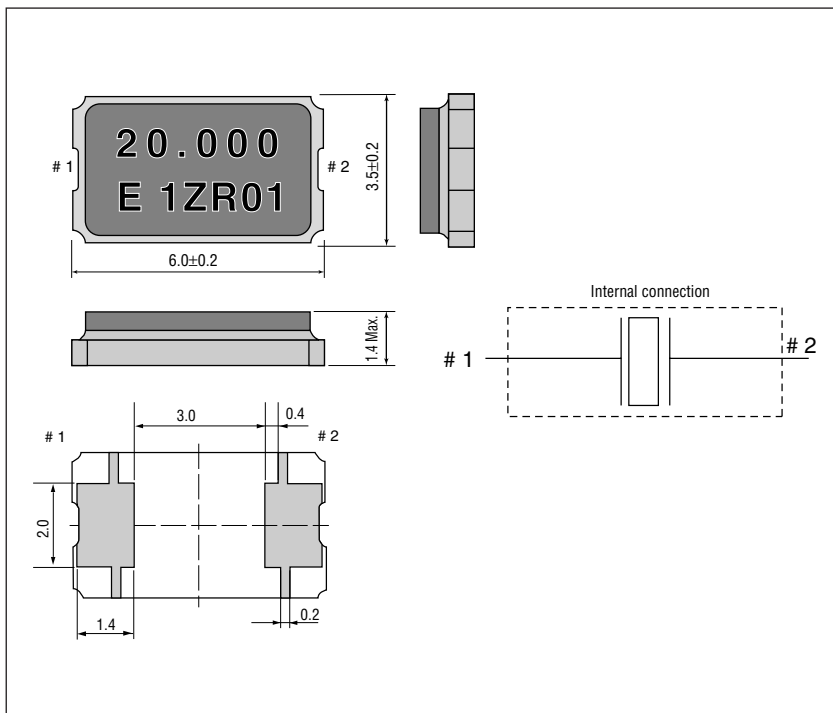


## ■ Specifications (characteristics)

Item	Symbol	Specifications	Remarks	
Nominal frequency	f	12.000 MHz, 14.000 MHz to 41.000 MHz	Fundamental mode	
Temperature range	Storage temperature	TSTG	-55 °C to +125 °C	Stored as bare product after unpacking
	Operating temperature	TOPR	-20 °C to +70 °C	Please contact us on availability of -40 °C to +85 °C
Recommended drive level	DL	10 μW to 100 μW		
Frequency tolerance (standard)	Δf/f	±50 x 10 <sup>-6</sup> , ±100 x 10 <sup>-6</sup>	Ta = +25 °C ±3 °C	
Frequency temperature characteristics (standard)		±30 x 10 <sup>-6</sup>	-20 °C to +70 °C For the out of standard specifications, please contact us for inquires	
Load capacitance	CL	10 pF to ∞	Please specify	
Series resistance	R1	60 Ω Max. (12.000 MHz)	-20 °C to +70 °C, DL = 100 μW	
		50 Ω Max. (14.000 MHz to 41.000MHz)		
Shunt capacitance	Co	5.0 pF Max.		
Insulation resistance	IR	500 MΩ Min.		
Aging	fa	±5 x 10 <sup>-6</sup> / year Max.	Ta = +25 °C ±3 °C, first year	
Shock resistance	S.R.	±10 x 10 <sup>-6</sup> Max.	Three drops on a hard board from 750 mm or excitation test with 29400 m/s <sup>2</sup> x 0.3 ms x 1/2 sine wave x 3 directions	

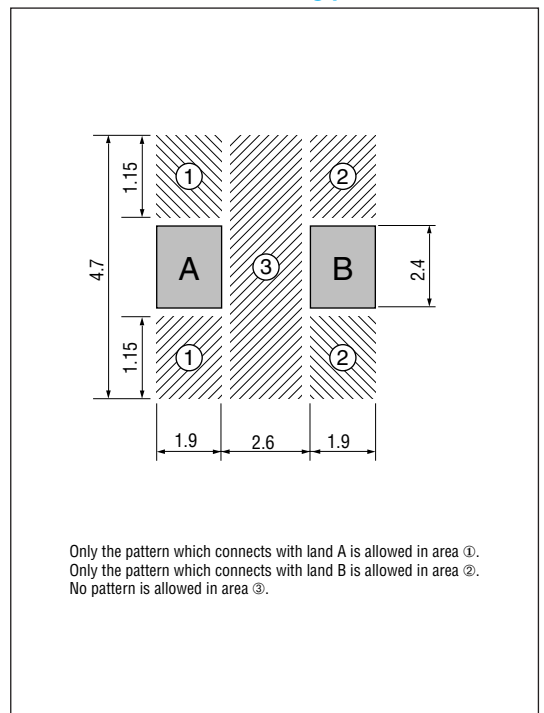
## ■ External dimensions

(Unit: mm)



## ■ Recommended soldering pattern

(Unit: mm)



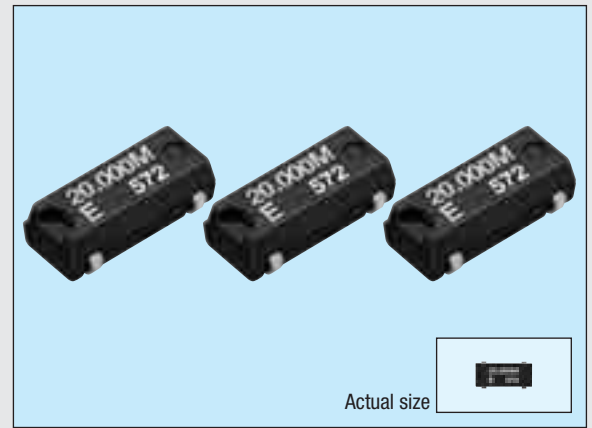
SMALL SMD HIGH - FREQUENCY CRYSTAL UNIT

# MA-306

Product number (please refer to page 1)

**Q22MA306xxxxx00**

- High-density mounting-type SMD.
- Excellent reliability and environment capability.
- Capable of covering a wide frequency range. (14.31818 MHz and 17.734 MHz to 41 MHz)
- Available for lead (Pb)-free soldering.
- Available for lead (Pb)-free terminal.

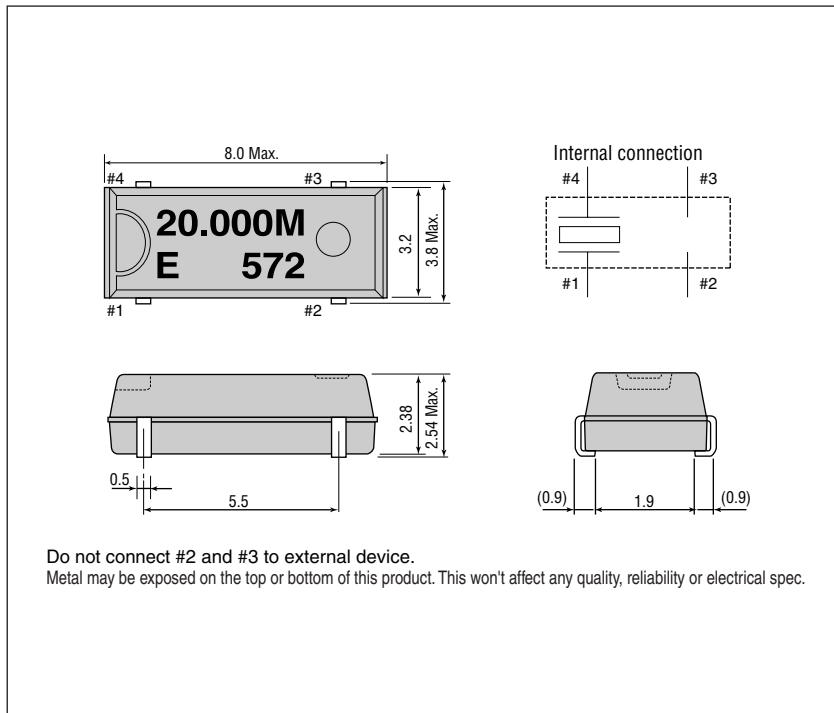


## Specifications (characteristics)

Item	Symbol	Specifications	Remarks	
Nominal frequency	f	14.31818 MHz, 17.734 MHz to 41.000 MHz	Fundamental mode	
Temperature range	Storage temperature	TSTG	-55 °C to +100 °C	Stored as bare product after unpacking
	Operating temperature	TOPR	-20 °C to +70 °C	
Recommended drive level	DL	10 μW to 100 μW		
Frequency tolerance (standard)	Δf/f	±50 x 10 <sup>-6</sup>	Ta = +25 °C ±3 °C	
Frequency temperature characteristics (standard)		±30 x 10 <sup>-6</sup>	-20 °C to +70 °C	
Load capacitance	CL	10 pF to ∞	Please specify	
Series resistance	R1	60 Ω Max.	-20 °C to +70 °C, DL = 100 μW	
Shunt capacitance	C0	5 pF Max.		
Insulation resistance	IR	500 MΩ Min.		
Aging	fa	±5 x 10 <sup>-6</sup> / year Max.	Ta = +25 °C ±3 °C, first year	
Shock resistance	S.R.	±10 x 10 <sup>-6</sup> Max.	Three drops on a hard board from 750 mm or excitation test with 29400 m/s <sup>2</sup> x 0.3 ms x 1/2 sine wave x 3 directions	

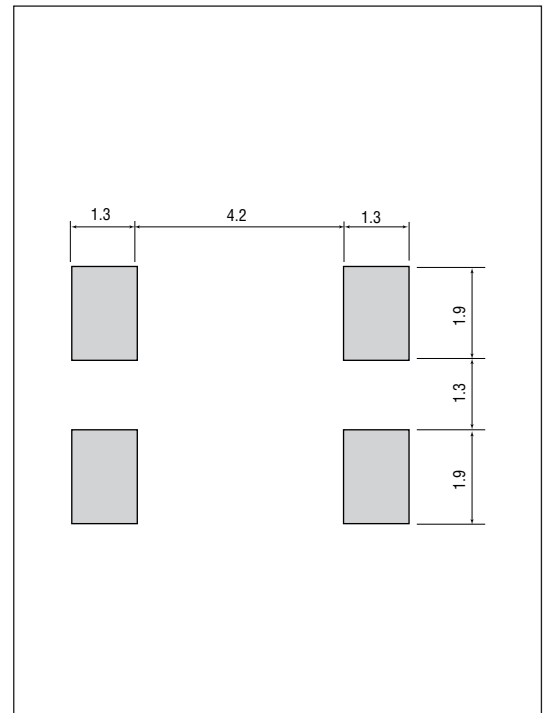
## External dimensions

(Unit: mm)



## Recommended soldering pattern

(Unit: mm)



SMD HIGH-FREQUENCY CRYSTAL UNIT

# MA-406 / 505 / 506

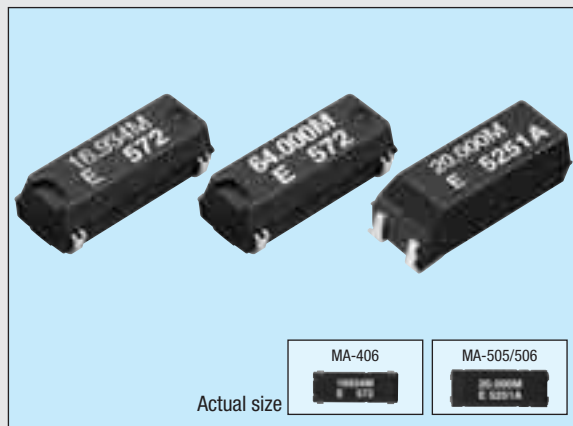
Product number (please refer to page 1)

Q22MA406XXXXX00

Q22MA505XXXXX00

Q22MA506XXXXX00

- Excellent environment capability.
- Cover a wide frequency range, from 4 MHz to 64 MHz.
- Available for lead (Pb)-free soldering.
- Available for lead (Pb)-free terminal.



## Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Nominal frequency range	f	4.000 MHz to 29.999 MHz *1	Fundamental mode
		30.000 MHz to 64.000 MHz *2	3rd overtone mode
Temperature range	Storage temperature	TSTG	-55 °C to +125 °C
	Operating temperature	TOPR	-20 °C to +70 °C
Recommended drive level	DL	10 μW to 100 μW	Stored as bare product after unpacking
Frequency tolerance (standard)	Δf/f	±50 x 10 <sup>-6</sup>	Ta = +25 °C ±3 °C
Frequency temperature characteristics (standard)		Under 5.5 MHz : ±50 x 10 <sup>-6</sup>	-20 °C to +70 °C
		Over 5.5 MHz : ±30 x 10 <sup>-6</sup>	
Load capacitance	CL	Fundamental: 10 pF to ∞	Please specify
		Over tone: 5 pF to ∞	
Series resistance	R1	As per below table	-20 °C to +70 °C , DL = 100 μW
Shunt capacitance	Co	5 pF Max.	
Insulation resistance	IR	500 MΩ Min.	
Aging	fa	±5 x 10 <sup>-6</sup> / year	Ta = +25 °C ±3 °C , first year
Shock resistance	S.R.	±10 x 10 <sup>-6</sup> Max.	Three drops on a hard board from 750 mm or excitation test with 29400 m/s <sup>2</sup> x 0.3 ms x 1/2 sine wave x 3 directions

\*1 4.0 MHz ≤ f < 5.5 MHz : See "Available frequencies form 4.0 MHz to less than 5.5 MHz". 8.0 MHz < f < 8.2 MHz: Unavailable.

\*2 26.000 MHz ≤ f < 30.000 MHz :please contact us for inquiries for 3rd overtone mode.

## Available frequency from 4.0 MHz to less than 5.5 MHz

4.000	4.032	4.096	4.190	4.194304	4.433619	4.500	4.800	4.842673	4.9152
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## Series resistance

Frequency (MHz)	4.0 ≤ f < 5.5	5.5 ≤ f < 6.0	6.0 ≤ f < 10.0	10.0 ≤ f < 16.0	12.0 ≤ f < 16.0	16.0 ≤ f < 30.0	26.0 ≤ f ≤ 36.0	36.0 < f ≤ 64.0
Series resistance (Ω)	150 Ω Max.	100 Ω Max.	80 Ω Max.	60 Ω Max.	50 Ω Max.	40 Ω Max.	100 Ω Max.	80 Ω Max.
Oscillation mode	Fundamental mode						3rd overtone mode	

## External dimensions

(Unit: mm)

● MA-406

Do not connect #2 and #3 to external device.  
Metal may be exposed on the top or bottom of this product. This won't affect any quality, reliability or electrical spec.

● MA-505/506

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

## Recommended soldering pattern

(Unit: mm)

● MA-406

● MA-505

● MA-506

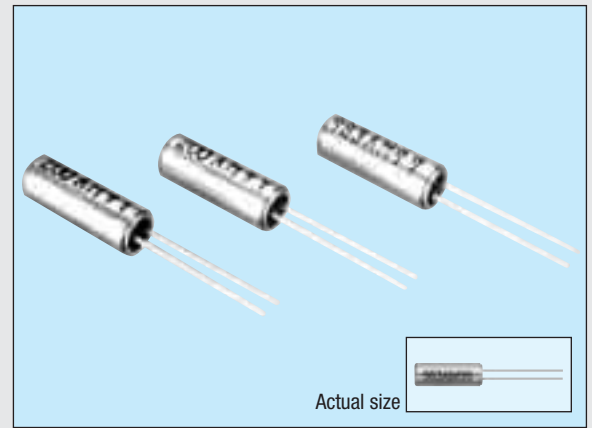
CYLINDER HIGH-FREQUENCY CRYSTAL UNIT

# CA-301

Product number (please refer to page 1)

**Q21CA301xxxxx00**

- Compact design with case as small as 3 mm in diameter while still maintaining excellent characteristics of AT-cut.
- High-stability assured with tight vacuum sealing.
- Capable of covering a frequency range from 4 MHz to 64 MHz.
- Available for complete lead (Pb)-free product.



## Specifications (characteristics)

Item	Symbol	Specifications	Remarks	
Nominal frequency	f	4.000 MHz to 29.999 MHz	Fundamental mode	
		30.000 MHz to 64.000 MHz	3rd overtone mode	
Temperature range	Storage temperature	T <sub>STG</sub>	-40 °C to +85 °C	Stored as bare product after unpacking
	Operating temperature	T <sub>OPR</sub>	-20 °C to +70 °C	The operating temperature range is -10 °C to +60 °C for 5.5 MHz and below
Recommended drive level	DL	10 μW to 100 μW		
Frequency tolerance (standard)	Δf/f	±30 x 10 <sup>-6</sup> (Under 5.5 MHz: ±50 x 10 <sup>-6</sup> , ±100 x 10 <sup>-6</sup> )	T <sub>a</sub> = +25 °C	
Frequency temperature characteristics (standard)		Under 5.5 MHz: ±50 x 10 <sup>-6</sup>	-10 °C to +60 °C	
		Over 5.5 MHz: ±30 x 10 <sup>-6</sup>	-20 °C to +70 °C	
Load capacitance	C <sub>L</sub>	Fundamental: 10 pF to ∞. Over tone: 5 pF to ∞	Please specify	
Series resistance	R <sub>1</sub>	As per below table	-20 °C to +70 °C, DL = 100 μW	
Shunt capacitance	C <sub>0</sub>	5 pF Max.		
Insulation resistance	IR	500 MΩ Min.		
Aging	f <sub>a</sub>	±5 x 10 <sup>-6</sup> / year Max.	T <sub>a</sub> = +25 °C ±3 °C, first year	
Shock resistance	S.R.	±10 x 10 <sup>-6</sup> Max.	Three drops on a hard board from 750 mm or excitation test with 29400 m/s <sup>2</sup> x 0.3 ms x 1/2 sine wave x 3 directions	

\*1 8.0 MHz < f < 8.2 MHz: Unavailable. 4.0 MHz f < 5.5 MHz : As per below table.

\*2 26.000 MHz ≤ f < 30.000 MHz : please contact us for inquiries for 3rd overtone mode.

## Series resistance

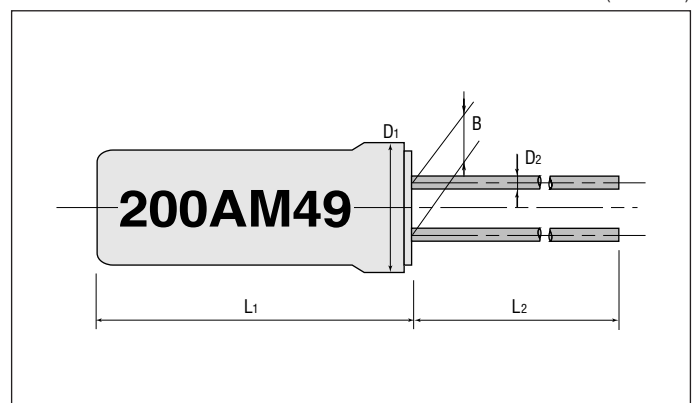
Frequency (MHz)	Series resistance (Ω)	mode
4.0 ≤ f < 5.5	150 Ω Max.	Fundamental
5.5 ≤ f < 6.0	100 Ω Max.	
6.0 ≤ f < 10.0	80 Ω Max.	
10.0 ≤ f < 12.0	60 Ω Max.	
12.0 ≤ f < 16.0	50 Ω Max.	
16.0 ≤ f < 30.0	40 Ω Max.	
26.0 ≤ f < 36.0	100 Ω Max.	3rd overtone
36.0 ≤ f ≤ 64.0	80 Ω Max.	

## Available frequencies from 4.0 MHz to less than 5.5 MHz

Frequency (MHz)	
4.000 MHz	4.433619 MHz
4.032 MHz	4.500 MHz
4.096 MHz	4.800 MHz
4.190 MHz	4.842673 MHz
4.194304 MHz	4.9152 MHz

## External dimensions

(Unit: mm)



Model	L1	L2	D1	D2	B	
CA-301	Under 5.5 MHz	9.3 Max.	9.5 Min.	ø3.1 Max.	ø0.3	1.1
	Over 5.5 MHz	8.9 Max.	9.5 Min.	ø3.1 Max.	ø0.3	1.1

Sample products are without marking.

32kHz CRYSTAL OSCILLATOR

# SG-3030JC / JF

# SG-3032JC

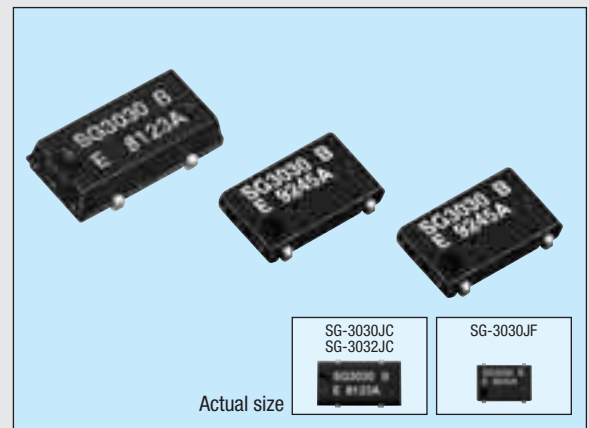
Product number (please refer to page 2)

Q3102JC0xxxxx00

Q3102JF0xxxxx00

Q3101JC0xxxxx00

- No adjustment required with 32.768 kHz crystal unit built-in.
- Use of C-MOS IC enables reduction of current consumption.
- Thin&Small suited to high-density mounting.
- $V_{IO}$  controls swing amplitude (SG-3030JC / JF).
- Available for lead (Pb)-free soldering.
- Available for lead (Pb)-free terminal.



## Specifications (characteristics)

Item	Symbol	Specifications		Remarks	
		SG-3030JC / JF	SG-3032JC		
Output frequency	$f_o$	32.768 kHz			
Power source voltage	Max. supply voltage	$V_{DD-GND}$	-0.3 V to +7.0 V	-0.3 V to +4.3 V	
	Operating voltage	$V_{DD}$	1.5 V to 5.5 V	1.8 V to 3.6 V	
	Interface power supply voltage	$V_{IO}$	1.5 V to 5.5 V	-	SG-3030JC / JF
Temperature range	Storage temperature	$T_{STG}$	-55 °C to +125 °C		Stored as bare product after unpacking
	Operating temperature	$T_{OPR}$	-40 °C to +85 °C	-20 °C to +70 °C	
Frequency tolerance	$\Delta f/f_o$	$5 \pm 23 \times 10^{-6}$		$V_{DD} = 3.3 V, T_a = +25 °C$	
Frequency temperature characteristics	$T_{OP}$	$+10 \times 10^{-6} / -120 \times 10^{-6}$		-20 °C to +70 °C, taking $T_a = +25 °C$ as the reference	
Frequency voltage characteristics	$f/V$	$\pm 2 \times 10^{-6} / V$ Max.		$T_a = +25 °C$	
Current consumption	$I_{OP}$	2 $\mu A$ Max.	5 $\mu A$ Max.	3.3 V, No load condition	
Duty	$tw/t$	45 % to 55 %	40 % to 60 %	1/2 $V_{DD}$ level	
Output voltage	$V_{OH}$	$V_{DD} - 0.4 V$ Min.		$I_{OH} = -0.4 mA$ (SG-3030JC / JF), $-0.5 mA$ (SG-3032JC)	
	$V_{OL}$	0.4 V Max.		$I_{OL} = +0.4 mA$ (SG-3030JC / JF), $+0.5 mA$ (SG-3032JC)	
Output load condition (fan out)	CL	15 pF Max.		CMOS load	
Output rise time	$t_r$	200 ns Max.	100 ns Max.	CMOS load: 20% $\rightarrow$ 80% $V_{DD}$	
Output fall time	$t_f$	200 ns Max.	100 ns Max.	CMOS load: 80% $\rightarrow$ 20% $V_{DD}$	
Oscillation start up time	$t_{OSC}$	3 s Max.		Time at minimum operating voltage to be 0 s	
Aging	$f_a$	$\pm 5 \times 10^{-6} / \text{year}$ Max.		$T_a = +25 °C, V_{DD} = 3.3 V$ , first year	
Shock resistance	S.R.	$\pm 5 \times 10^{-6}$ Max.		Three drops on a hard board from 750 mm or excitation test with 29400 m/s <sup>2</sup> x 0.3 ms x 1/2 sine wave x 3 directions	

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

## External dimensions

(Unit: mm)

● SG-3030JC, SG-3032JC

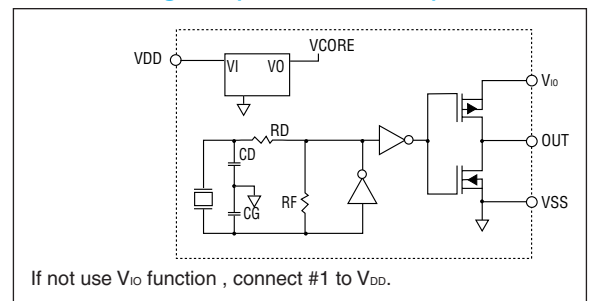
● SG-3030JF

NO.	Pin terminal
1	$V_{IO}$ / NC
2	GND
3	OUT
4	$V_{DD}$

If not use  $V_{IO}$  function, connect #1 to  $V_{DD}$ .

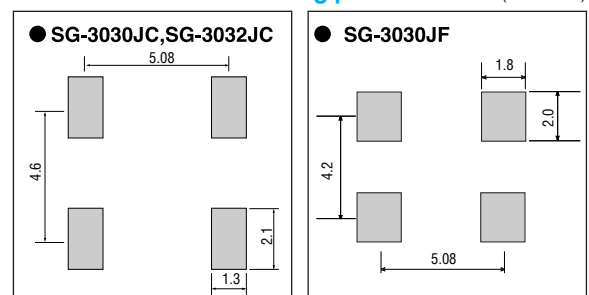
Metal may be exposed on the top or bottom of this product. This won't affect any quality, reliability or electrical spec.

## Block diagram (SG-3030JC / JF)



## Recommended soldering pattern

(Unit: mm)



SMALL HIGH-FREQUENCY CRYSTAL OSCILLATOR

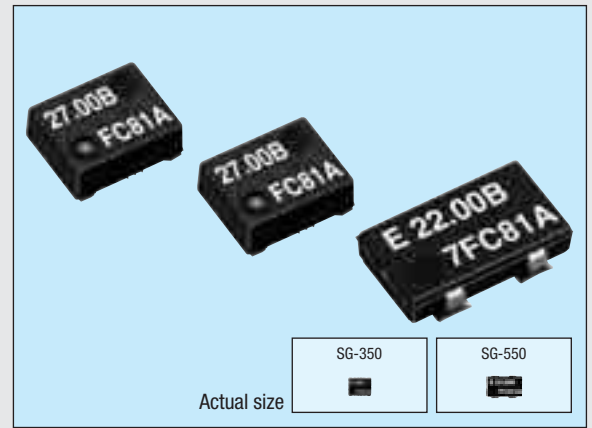
# SG-350 / 550 series

Product number (please refer to page 2)

Q33350XXXXXXXX00

Q33550XXXXXXXX00

- Operable 1.8 V. (SEF)
- Low current consumption due to use of CMOS technology. (SEF 1.8 V Noload, 48 MHz 1.5 mA Typ.)
- Low current consumption by standby function (ST).
- Available for lead (Pb)-free soldering.
- Complete lead (Pb)-free product.

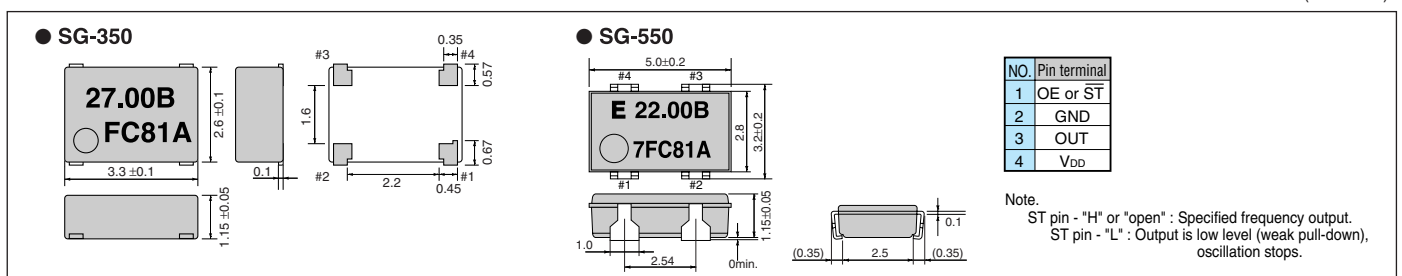


## Specifications (characteristics)

Item	Symbol	Specifications				Remarks		
		SEF	SDF	SCF	SCG			
Output frequency range	fo	2.000 MHz to 48.0000 MHz						
Power source voltage	Max. supply voltage	VDD-GND	-0.3 V to +4.2 V		-0.5 V to +7.0 V	VDD = GND		
	Operating voltage	VDD	1.8 V Typ. 1.6 V to 2.2 V	2.5 V Typ. 2.2 V to 3.0 V	3.3 V Typ. 2.7 V to 3.6 V	2.7 V to 3.6 V	1.8 V Typ. 1.6 V to 2.2 V	
Temperature range	temperature	TSTG	-40 °C to +125 °C				Stored as bare product	
	temperature	TOPR	-40 °C to +85 °C					
Frequency stability	Δf/fo		B : ±50 x 10 <sup>-6</sup> Max.		-	-20 °C to +70 °C		
			C : ±100 x 10 <sup>-6</sup> Max.		-	-20 °C to +70 °C		
			M : ±100 x 10 <sup>-6</sup> Max.		-	-40 °C to +85 °C		
			-	-	S : ±25 x 10 <sup>-6</sup>	-20 °C to +70 °C	VDD ±5%	
			L : ±50 x 10 <sup>-6</sup> Max.		-	-40 °C to +85 °C		
Current consumption	Iop		1.5 mA Max.	1.5 mA Max.	1.5 mA Max.	-	No load, 2.0 MHz ≤ fo ≤ 4.0 MHz	
			1.5 mA Max.	1.5 mA Max.	2.0 mA Max.	-	No load, 4.0 MHz < fo ≤ 8.0 MHz	
			1.5 mA Max.	2.0 mA Max.	2.5 mA Max.	-	No load, 8.0 MHz < fo ≤ 16 MHz	
			2.0 mA Max.	2.0 mA Max.	2.5 mA Max.	-	No load, 16 MHz < fo ≤ 25 MHz	
			2.0 mA Max.	2.5 mA Max.	3.5 mA Max.	-	No load, 25 MHz < fo ≤ 33 MHz	
			3.0 mA Max.	3.5 mA Max.	4.5 mA Max.	-	No load, 33 MHz < fo ≤ 48 MHz	
Standby current	IST	0.7 μA Max. (0.2 μA Typ.)	1.5 μA Max. (0.5 μA Typ.)	2.0 μA Max. (1.0 μA Typ.)	12 mA Max.	50 μA Max.	No load, Max. frequency range.	
Duty	tw/ t		45 % to 55 %		-	-	2 MHz ≤ fo ≤ 16 MHz	50% VDD CL ≤ 15 pF
			40 % to 60 %	45 % to 55 %	-	-	16 MHz < fo ≤ 33 MHz	
			-	-	-	-	33 MHz < fo ≤ 40 MHz	
			-	-	-	-	40 MHz < fo ≤ 48 MHz	
			-	-	-	40 % to 60 %	VDD = 2.7 V to 3.6 V	
	-	-	-	45 % to 55 %	VDD = 3.0 V to 3.6 V			
High output voltage	VOH		0.9 VDD Min.		VDD - 0.4 Min.		Ioh = -3.0 mA (SEF / SDE / SCF) / -8.0 mA (SCG)	
Low output voltage	VOL		0.1 VDD Max.		0.4 V Max.		Iol = 3.0 mA (SEF / SDE / SCF) / 8.0 mA (SCG)	
Output load condition	CL		15 pF Max.				Max. frequency and Max. operating voltage range.	
Output enable disable input voltage	VIH		80 % VDD Min.		70 % VDD Min.		ST Pin	
	VIL		20% VDD Min.					
Output rise time	tr		4.0 ns Max.		3.0 ns Max.		20 % → 80 % VDD, CL ≤ 15 pF	
Output fall time	tf		4.0 ns Max.		3.0 ns Max.		80 % → 20 % VDD, CL ≤ 15 pF	
Oscillation start up time	tosc		10 ms Max.		12 ms Max.		Time at minimum operating voltage to be 0 s	
Aging	fa		±5 x 10 <sup>-6</sup> Max.		±10 x 10 <sup>-6</sup> Max.		Ta = +25 °C, 10 year / SG-510, first year / SG-550	

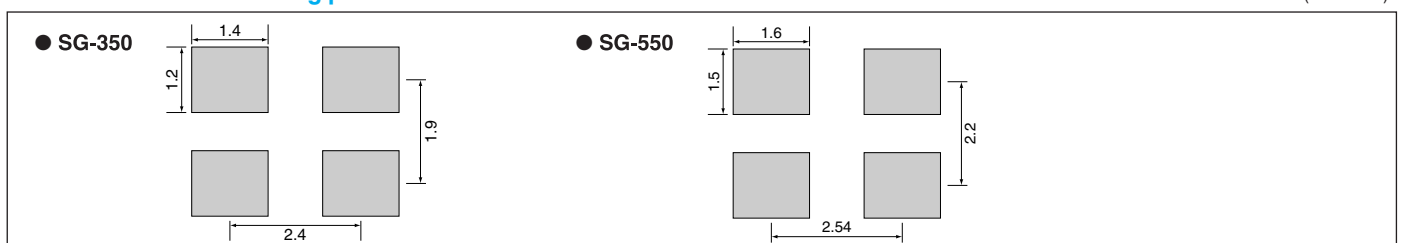
## External dimensions

(Unit: mm)



## Recommended soldering pattern

(Unit: mm)



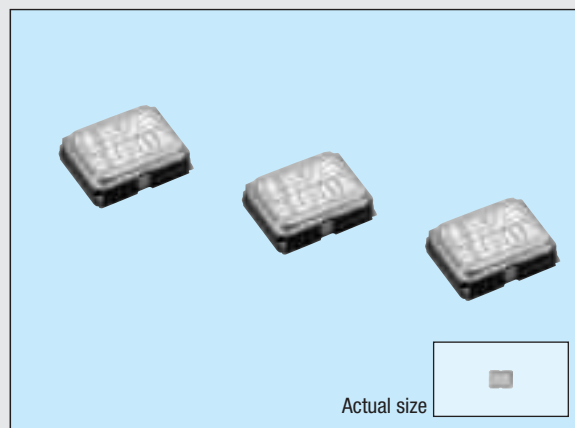
# HIGH-FREQUENCY CRYSTAL OSCILLATOR

## SG-310 series

Product number (please refer to page 2)

**Q33310Fxxxxx00**

- Very low current consumption.
- Reflowable and high density mounting type smallest SMD package. (3.2 mm x 2.5 mm x 1.05 mm Typ.)
- Operable 3.3 V / 2.5 V / 1.8 V
- Output frequencies from 2 MHz to 48 MHz.
- Standby (ST) function allows more low current consumption.
- Available for lead (Pb)-free soldering.
- Complete lead (Pb)-free product.

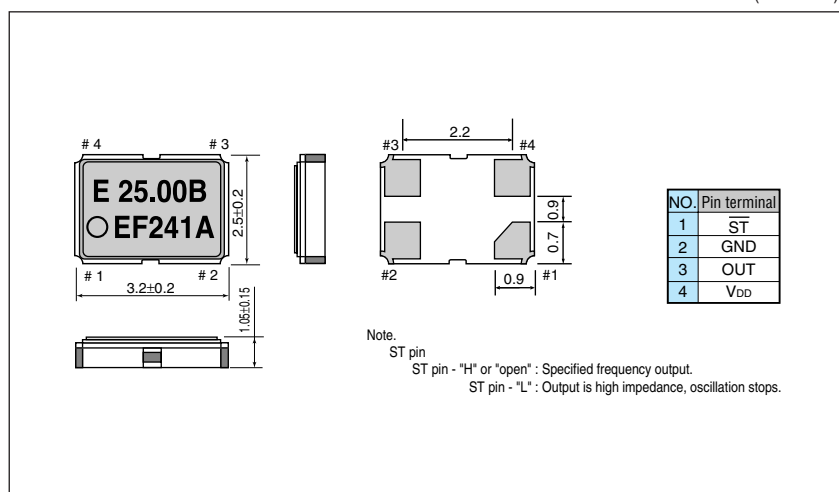


### Specifications (characteristics)

Item	Symbol	Specifications			Remarks
		SCF	SDF	SEF	
Nominal frequency range	f <sub>0</sub>	2.0000 MHz to 48.0000 MHz			Refer to Operating condition and Frequency range
Power source voltage	Max. supply voltage	V <sub>DD-GND</sub>	-0.3 V to +7.0 V		
	Operating voltage	V <sub>DD</sub>	3.3 V Typ. 2.7 V to 3.6 V	2.5 V Typ. 2.2 V to 3.0 V	1.8 V Typ. 1.6 V to 2.2 V
Temperature range	Storage temperature	T <sub>STG</sub>	-40 °C to +125 °C		Stored as bare product after unpacking
	Operating temperature	T <sub>OPR</sub>	-40 °C to +85 °C		Refer to Operating condition and Frequency range
Frequency stability	Δf/f <sub>0</sub>	B: ±50 x 10 <sup>-6</sup> C: ±100 x 10 <sup>-6</sup>			-20 °C to +70 °C
		M: ±100 x 10 <sup>-6</sup>			-40 °C to +85 °C
Current consumption	I <sub>OP</sub>	1.5 mA Max.	1.5 mA Max.	1.5 mA Max.	No load, 2.0 MHz ≤ f <sub>0</sub> ≤ 4.0 MHz
		2.0 mA Max.	1.5 mA Max.	1.5 mA Max.	No load, 4.0 MHz < f <sub>0</sub> ≤ 8.0 MHz
		2.5 mA Max.	2.0 mA Max.	1.5 mA Max.	No load, 8.0 MHz < f <sub>0</sub> ≤ 16 MHz
		2.5 mA Max.	2.0 mA Max.	2.0 mA Max.	No load, 16 MHz < f <sub>0</sub> ≤ 25 MHz
		3.5 mA Max.	2.5 mA Max.	2.0 mA Max.	No load, 25 MHz < f <sub>0</sub> ≤ 33 MHz
		4.5 mA Max.	3.5 mA Max.	3.0 mA Max.	No load, 33 MHz < f <sub>0</sub> ≤ 48 MHz
Standby current	I <sub>ST</sub>	2.0 μA MAX. (1.0 μA Typ.)	1.5 μA MAX. (0.5 μA Typ.)	0.7 μA MAX. (0.2 μA Typ.)	ST = GND
Duty	tw/ t	45% to 55%		45% to 55%	2 MHz ≤ f <sub>0</sub> ≤ 16 MHz
		40% to 60%		40% to 60%	16 MHz < f <sub>0</sub> ≤ 33 MHz
					33 MHz < f <sub>0</sub> ≤ 40 MHz
					40 MHz < f <sub>0</sub> ≤ 48 MHz
High output voltage	V <sub>OH</sub>	0.9 V <sub>DD</sub> Min.		I <sub>OH</sub> = -3.0 mA	
Low output voltage	V <sub>OL</sub>	0.1 V <sub>DD</sub> Max.		I <sub>OL</sub> = 3.0 mA	
Output load condition	C <sub>L</sub>	15 pF Max.		Max. frequency and Max. operating voltage range	
Output enable / disable input voltage	V <sub>IH</sub>	80% V <sub>DD</sub> Min.			
	V <sub>IL</sub>	20% V <sub>DD</sub> Max.			
Output rise time	t <sub>r</sub>	4 ns Max.		CMOS load: 20 % → 80 % V <sub>DD</sub>	
Output fall time	t <sub>f</sub>	4 ns Max.		CMOS load: 80 % → 20 % V <sub>DD</sub>	
Oscillation start up time	t <sub>OSC</sub>	10 ms Max.		Time at minimum operating voltage to be 0 s	
Aging	f <sub>a</sub>	±5 x 10 <sup>-6</sup> / year Max.		T <sub>a</sub> = +25 °C First year	

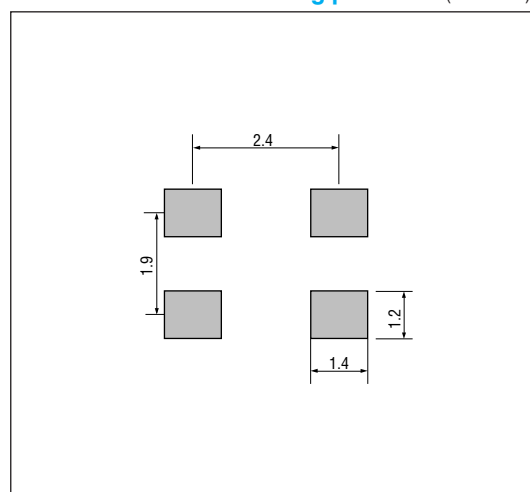
### External dimensions

(Unit: mm)



### Recommended soldering pattern

(Unit: mm)



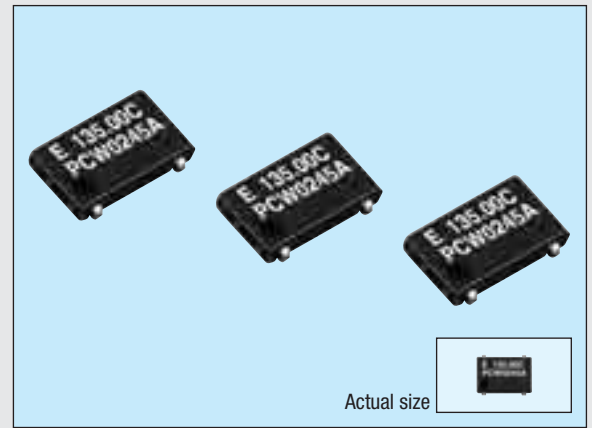
# SOJ HIGH-FREQUENCY CRYSTAL OSCILLATOR

## SG-645 series

Product number (please refer to page 2)

**Q33645XXXXXXXX00**

- Reflowable and high-density mounting-type SMD.
- Operable 3.3 V or 5.0 V.
- Output frequency from 32 MHz to 135 MHz.
- Output enable (OE:P type) or Standby (ST:S Type) function allow more low current consumption.
- Available for lead (Pb)-free soldering.
- Available for lead (Pb)-free terminal.

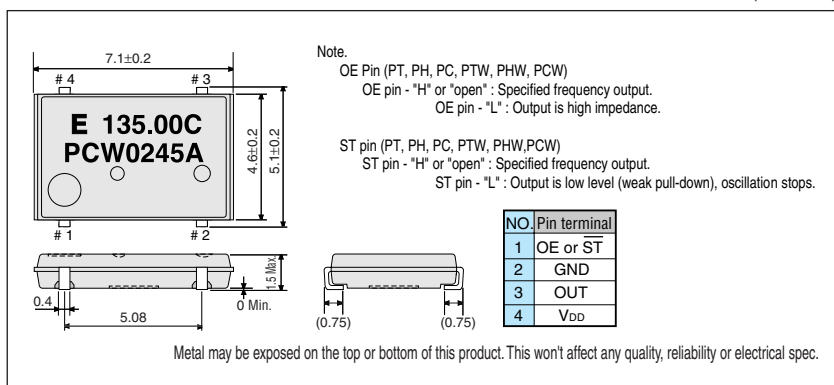


### Specifications (characteristics)

Item	Symbol	Specifications			Remarks
		SG-645PTW / STW	SG-645PHW / SHW	SG-645PCW / SCW	
Output frequency range	fo	32.0001 MHz to 135.0000 MHz			Refer to Operating condition and Frequency range
Power source voltage	Max. supply voltage	VDD-GND -0.5 V to +7.0 V			
	Operating voltage	4.5 V to 5.5 V		3.0 V to 3.6 V	
Temperature range	Storage temperature	TSTG -55 °C to +125 °C			Stored as bare product after unpacking
	Operating temperature	TOPR -20 °C to +70 °C		-40 °C to +85 °C	Refer to Operating condition and Frequency range
Frequency stability	Δf/fo	B: ±50 x 10 <sup>-6</sup> C: ±100 x 10 <sup>-6</sup>			-20 °C to +70 °C
		-		M: ±100 x 10 <sup>-6</sup>	-40 °C to +85 °C
Current consumption	Iop	45 mA Max.		28 mA Max.	No load condition (fo = 135 MHz)
Output disable current	Ioe	30 mA Max.		16 mA Max.	OE = GND (P*W), fo = 135 MHz
Standby current	Ist	50 μA Max.		-	ST = GND (S*W)
Duty	tw/ t	-	40 % to 60 %	-	50 % VDD, CL = Max.
		-	45 % to 55 %	-	50 % VDD, CL = 25 pF (fo ≤ 66.6667 MHz)
		40 % to 60 %	-	-	1.4 V, CL = Max.
		45 % to 55 %	-	-	1.4 V, 5TTL +15 pF (fo ≤ 66.6667 MHz)
Output voltage	VoH	VDD -0.4 V		-	IOH = -16 mA (*TW / *HW) IOH = -8 mA (*CW)
		0.4 V		0.4 V	IOL = 16 mA (*TW / *HW) IOL = 8 mA (*CW)
Output load condition (fan out)	CL	15 pF	-	-	(fo ≤ 135 MHz)
		5 TTL + 15 pF	-	-	(fo ≤ 90 MHz)
		25 pF	-	-	(fo ≤ 66.6667 MHz)
		-	15 pF	-	(fo ≤ 135 MHz)
		-	25 pF	-	(fo ≤ 90 MHz)
-	50 pF	-	(fo ≤ 50 MHz)		
-	-	15 pF	-	(fo ≤ 135 MHz)	
Output enable disable input voltage	VIH	2.0 V Max.		0.7 VDD	OE,ST
		0.8 V Max.		0.2 VDD	
Output rise time	CMOS level	-	4.0 ns	3.0 ns	20 % → 80 % VDD CL = Max.
	TTL level	2.0 ns	-	-	20 % → 80 % VDD CL ≤ 25 pF
Output fall time	CMOS level	-	4.0 ns	3.0 ns	0.8 V → 2.0 V CL = Max.
	TTL level	2.0 ns	-	-	0.4 V → 2.4 V CL = Max.
Oscillation start up time	tosc	10 ms Max.			
Aging	fa	±5 x 10 <sup>-6</sup> year Max.			Ta = +25 °C, VDD = 5.0 V / 3.3 V, First year
Shock resistance	S.R.	±20 x 10 <sup>-6</sup> Max.			Three drops on a hard board from 750 mm or excitation test with 29400 m/s <sup>2</sup> x 0.3 ms x 1/2sine wave in 3 directions

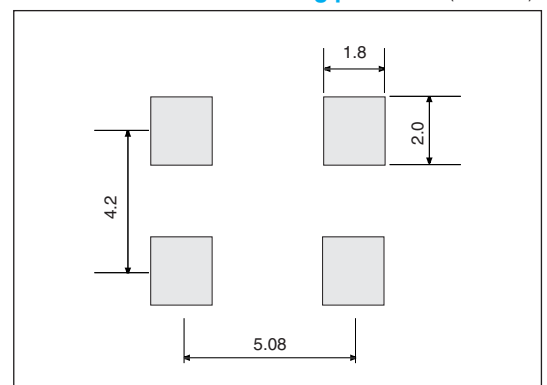
### External dimensions

(Unit: mm)



### Recommended soldering pattern

(Unit: mm)





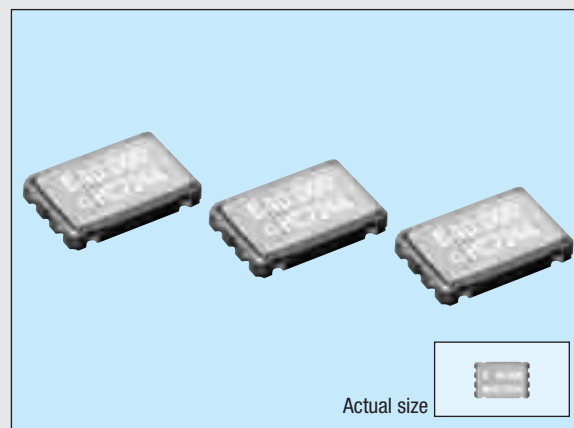
## HIGH-FREQUENCY CRYSTAL OSCILLATOR

## SG-710 series

Product number (please refer to page 2)

Q33710xxxxxx00

- Ceramic package with 1.5 mm thickness.
- Excellent environmental capability.
- Low current consumption due to use of CMOS technology.
- Low current consumption by output enable function (OE) or standby function (ST).
- Available for lead (Pb)-free soldering.
- Complete lead (Pb)-free product.

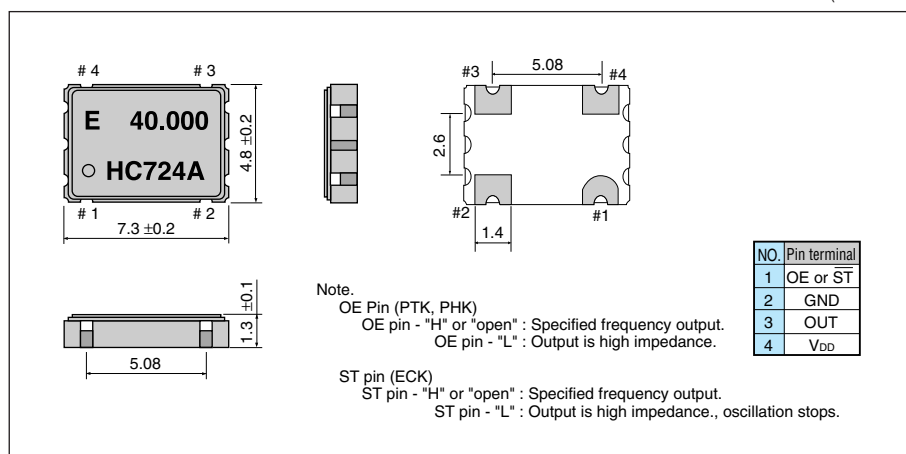


## Specifications (characteristics)

Item	Symbol	Specifications			Remarks	
		SG-710PTK	SG-710PHK	SG-710ECK		
Output frequency range	fo	1.8000 MHz to 50.0000 MHz	1.8000 MHz to 80.0000 MHz	1.8000 MHz to 67.0000 MHz	Refer to Operating condition and Frequency range	
Power source voltage	Max. supply voltage	VDD-GND			-0.5 V to +7.0 V	
	Operating voltage	VDD			5.0 V ±0.5 V	3.3 V ±0.3 V
Temperature range	Storage temperature	TSTG			-55 °C to +125 °C	Stored as bare product after unpacking
	Operating temperature	TOPR			-10 °C to +70 °C (-40 °C to +85 °C)	Refer to Operating condition and Frequency range
Frequency stability	Δf/fo	B: ±50 x 10 <sup>-6</sup> C: ±100 x 10 <sup>-6</sup>			B,C: -10 °C to +70 °C, M: -40 °C to +85 °C	
		M: ±100 x 10 <sup>-6</sup>				
Current consumption	Iop	13 mA Max.	15 mA Max.	8 mA Max.	Fo ≤ 25 MHz, No load condition (ECK: Fo ≤ 32 MHz, No load condition)	
		24 mA Max.	26 mA Max.	15 mA Max.	Fo ≤ 50 MHz, No load condition	
		–	34 mA Max.	18 mA Max.	Fo ≤ 67 MHz, No load condition	
		–	40 mA Max.	–	Fo ≤ 80 MHz, No load condition	
Output disable current	IOE	6 mA Max.	5 mA Max.	–	Fo ≤ 25 MHz, OE = GND (PTK, PHK)	
		12 mA Max.	10 mA Max.	–	Fo ≤ 50 MHz, OE = GND (PTK, PHK)	
		–	13 mA Max.	–	Fo ≤ 67 MHz, OE = GND (PTK, PHK)	
		–	16 mA Max.	–	Fo ≤ 80 MHz, OE = GND (PTK, PHK)	
Standby current	IST	–			10 μA Max.	ST = GND (ECK)
Duty	tw / t	–	45 % to 55 %	40 % to 60 %	CMOS load: 1/2 VDD level	
		45 % to 55 %	40 % to 60 %	–	TTL load: 1.4 V level	
High output voltage	VOH	2.4 V Min.	VDD -0.5 V Min.	0.9 VDD Min.	IOH = -16 mA (PTK,PHK), -2 mA (ECK)	
Low output voltage	VOL	0.4 V Max.	0.5 V Max.	0.1 VDD Max.	IOL = 16 mA (PTK,PHK), 2 mA (ECK)	
Output load condition (fan out)	TTL	N	10 TTL Max.	10 TTL Max.	–	
	CMOS	CL	(15 pF Max.)	50 pF Max.	15 pF Max.	
Output enable / disable input voltage	VIH	2.0 V Min.	2.0 V Min.	0.7 VDD Min.	OE terminal (PTK,PHK)	
	VIL	0.8 V Max.	0.8 V Max.	0.3 VDD Max.	ST terminal (ECK)	
Output rise time	tr	–	5 ns Max.	6 ns Max.	CMOS load: 10 % → 90 % VDD	
		5 ns Max.	–	–	TTL load: 0.4 V → 2.4 V	
Output fall time	tf	–	5 ns Max.	6 ns Max.	CMOS load: 90 % → 10 % VDD	
		5 ns Max.	–	–	TTL load: 2.4 V → 0.4 V	
Oscillation start up time	tosc	–			10 ms Max.	Time at minimum operating voltage to be 0 s
Aging	fa	–			±5 x 10 <sup>-6</sup> / year Max.	Ta = +25 °C, VDD = 3.3 V / 2.5 V / 1.8 V, First year
Shock resistance	S.R.	–			±10 x 10 <sup>-6</sup> Max.	Three drops on a hard board from 750 mm or excitation test with 29400 m/s <sup>2</sup> x 0.3 ms x 1/2sine wave in 3 directions

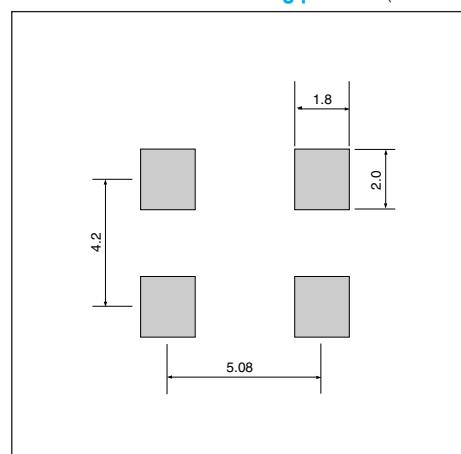
## External dimensions

(Unit: mm)



## Recommended soldering pattern

(Unit: mm)



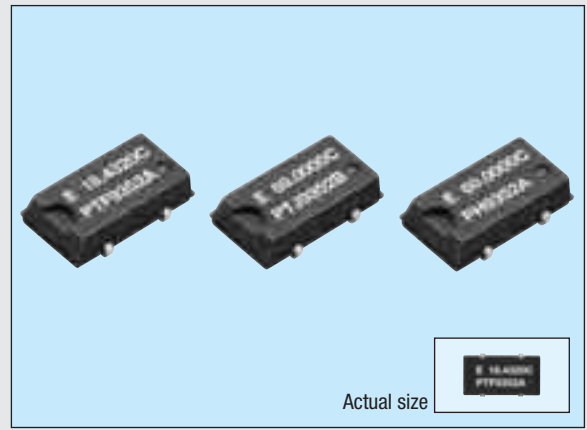
HIGH-FREQUENCY CRYSTAL OSCILLATOR

# SG-636 series

Product number (please refer to page 2)

**Q33636xxxxxx00**

- A small SMD that enables high-density mounting.
- Low current consumption by output enable function(OE) or standby function(ST).
- Available for lead (Pb)-free soldering.
- Available for lead (Pb)-free terminal.



## Specifications (characteristics)

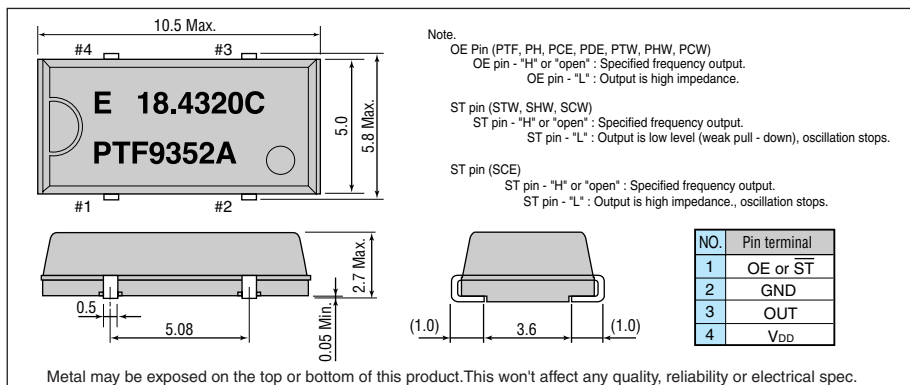
Item	Symbol	Specifications				Remarks
		SG-636PTF	SG-636PH	SG-636PCE / SCE	SG-636PDE	
Output frequency range	f <sub>0</sub>	2.21675 MHz to 41.0000 MHz	41.0001 MHz to 70.0000 MHz	2.21675 MHz to 40.0000 MHz	2.21675 MHz to 40.0000 MHz	Refer to Operating condition and Frequency range
Power source voltage	Max. supply voltage	-0.5 V to +7.0 V				
	Operating voltage	5.0 V ±0.5 V		3.3 V ±0.3 V	2.5 V ±0.25 V	
Temperature range	Storage temperature	-55 °C to +100 °C				Stored as bare product after unpacking
	Operating temperature	-20 °C to +70 °C				Refer to Operating condition and Frequency range
Frequency stability	Δf/f <sub>0</sub>	C: ±100 x 10 <sup>-6</sup>				
Current consumption	I <sub>op</sub>	17 mA Max.	35 mA Max.	9 mA Max.	5 mA Max.	No load condition
Output disable current	I <sub>OE</sub>	10 mA Max.	20 mA Max.	5 mA Max.	3 mA Max.	OE = GND, ST = GND 2 μA Max. (SCE)
Duty	CMOS level	40 % to 60 %		45 % to 55 %		CMOS load : 1/2 V <sub>DD</sub> level
	TTL level	45 % to 55 %		-		TTL load : 1.4 V level
Output voltage	V <sub>OH</sub>	V <sub>DD</sub> -0.4 V Min.				I <sub>OH</sub> = -8 mA (PTF) / -4 mA (PH / SCE / PCE / PDE)
	V <sub>OL</sub>	0.4 V Max.				I <sub>OL</sub> = 16 mA (PTF) / 4 mA (PH / SCE / PCE / PDE)
Output load condition (fan out)	CMOS level	CL	50 pF Max. 20 pF Max. (≤ 55 MHz) 15 pF Max. (> 55 MHz)	30 pF Max.	15 pF Max.	
	TTL level	N	10 TTL Max. 5 LSTTL Max.	-		C <sub>L</sub> ≤ 15 pF
Output enable disable input voltage	V <sub>IH</sub>	2.0 V Min.		0.8 V <sub>DD</sub> Min.		OE, ST (SCE)
	V <sub>IL</sub>	0.8 V Max.		0.2 V <sub>DD</sub> Max.		
Output rise time	CMOS level	t <sub>r</sub>	7 ns Max.	5 ns Max.		CMOS load : 20 % → 80 % V <sub>DD</sub>
	TTL level	t <sub>r</sub>	5 ns Max.	-		TTL load : 0.4 V → 2.4 V
Output fall time	CMOS level	t <sub>f</sub>	7 ns Max.	5 ns Max.		CMOS load : 80 % → 20 % V <sub>DD</sub>
	TTL level	t <sub>f</sub>	5 ns Max.	-		TTL load : 2.4 V → 0.4 V
Oscillation start up time	t <sub>osc</sub>	4 ms Max.	10 ms Max.	4 ms Max.		Time at minimum operating voltage to be 0 s
Aging	f <sub>a</sub>	±5 x 10 <sup>-6</sup> / year Max.				T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 5.0 V / 3.3 / 2.5 V, First year
Shock resistance	S.R.	±20 x 10 <sup>-6</sup> Max.				Three drops on a hard board from 750 mm or excitation test with 29400 m/s <sup>2</sup> x 0.3 ms x 1/2sine wave in 3 directions

Note: • Unless otherwise stated, characteristics (specifications) shown in the above table are based on the rated operating temperature and voltage condition.  
• External by-pass capacitor is required.

## Operating condition and frequency range

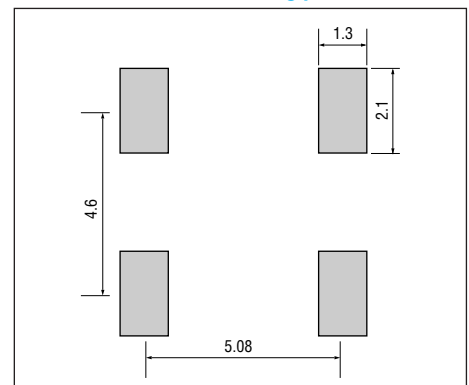
Operating Voltage	Frequency stability(Operating temperature)	1 MHz	50 MHz	100 MHz	135 MHz
5 V ±0.5 V	B: ±50 x 10 <sup>-6</sup> (-20 °C to +70 °C)	2.21675 SG-636PTG/PHG	33 SG-636PH	70 SG-636PTW/STW/PHW/SHW	135 SG-636PTW/STW/PHW/SHW
	C: ±400 x 10 <sup>-6</sup> (-20 °C to +70 °C)	2.21675 SG-636PTF SG-636PTG/PHG	33 SG-636PH	41 SG-636PH	70 SG-636PTW/STW/PHW/SHW
3.3 V ±0.3 V	B: ±50 x 10 <sup>-6</sup> (-20 °C to +70 °C)	2.21675 SG-636PCG/SCG	33 SG-636PCE/SCE	40 SG-636PCW/SCW	135 SG-636PCW/SCW
	C: ±400 x 10 <sup>-6</sup> (-20 °C to +70 °C)	2.21675 SG-636PCE/SCE SG-636PCG/SCG	33 SG-636PCE/SCE	40 SG-636PCW/SCW	40 SG-636PCW/SCW
2.5 V ±0.25 V	C: ±400 x 10 <sup>-6</sup> (-20 °C to +70 °C)	2.21675 SG-636PDE	40 SG-636PDE	40 SG-636PDE	40 SG-636PDE

## External dimensions



(Unit: mm)

## Recommended soldering pattern (Unit: mm)



## ■ Specifications (characteristics)

Item	Symbol	Specifications			Remarks	
		SG-636PTG	SG-636PHG	SG-636PCG / SCG		
Output frequency range	fo	2.21675 MHz to 33.0000 MHz *1			Refer to Operating condition and Frequency range	
Power source voltage	Max. supply voltage	VDD-GND -0.5 V to +7.0 V				
	Operating voltage	VDD	4.5 V to 5.5 V	2.7 V to 3.6 V		
Temperature range	Storage temperature	TSTG -55 °C to +100 °C			Stored as bare product after unpacking	
	Operating temperature	TOPR -20 °C to +70 °C			Refer to Operating condition and Frequency range	
Frequency stability	$\Delta f/fo$	B : $\pm 50 \times 10^{-6}$ C : $\pm 100 \times 10^{-6}$			-20 °C to +70 °C	
Current consumption	IOP	25 mA Max.		12 mA Max.	No load condition	
Output disable current	IOE	20 mA Max.		10 mA Max.	OE = GND (P*G)	
Standby current	IST	-		50 $\mu$ A Max.	ST = GND (SCG)	
Duty	CMOS level	-		45 % to 55 %	50 % VDD, CL = 25 pF	
	TTL level	40 % to 60 %		-	1.4 V Level, CL = 25 pF	
Output voltage	VOH	2.4 V Min.	-	VDD -0.4 V Min.	IOH = -8 mA IOH = -16 mA	
	VOL	-	0.4 V Max.	-	IOH = 8 mA IOL = 16 mA	
Output load condition (fan out)	CL	25 pF				
Output enable disable input voltage	VIH	2.0 V Min.		0.7 VDD Min.	OE, ST	
	VIL	0.8 V Max.		0.2 VDD Max.	OE, ST	
Output rise time	CMOS level	-		3.4 ns Max.	4.0 ns Max.	-20 % $\rightarrow$ 80 % VDD, CL $\leq$ 25 pF
	TTL level	1.2 ns Max. 2.4 ns Max.	-	-	-	0.8 V $\rightarrow$ 2.0 V CL $\leq$ 25 pF 0.4 V $\rightarrow$ 2.4 V CL $\leq$ 25 pF
Output fall time	CMOS level	-		3.4 ns Max.	4.0 ns Max.	80 % $\rightarrow$ 20 % VDD CL $\leq$ 25 pF
	TTL level	1.2 ns Max. 2.4 ns Max.	-	-	-	2.0 V $\rightarrow$ 0.8 V CL $\leq$ 25 pF 2.4 V $\rightarrow$ 0.4 V CL $\leq$ 25 pF
Oscillation start up time	tosc	12 ms Max.			Time at minimum operating voltage to be 0 s	
Aging	fa	$\pm 5 \times 10^{-6}$ / year Max.			Ta = +25 °C, VDD = 5.0 V / 3.3 V, First year	
Shock resistance	S.R.	$\pm 20 \times 10^{-6}$ Max.			Three drops on a hard board from 750 mm or excitation test with 29400 m/s <sup>2</sup> x 0.3 ms x 1/2sine wave in 3 directions	

\*1) 4.1250 MHz < fo < 4.4336 MHz, 8.2500 MHz < fo < 8.8672 MHz, 16.5000 MHz < fo < 17.7344 MHz : Unavailable

## ■ Specifications (characteristics)

Item	Symbol	Specifications			Remarks
		SG-636PTW / STW	SG-636PHW / SHW	SG-636PCW / SCW	
Output frequency range	fo	32.0001 MHz to 135.0000 MHz			Refer to Operating condition and Frequency range
Power source voltage	Max. supply voltage	VDD-GND -0.5 V to +7.0 V			
	Operating voltage	VDD	5.0 V $\pm$ 0.5 V	3.3 V $\pm$ 0.3 V	
Temperature range	Storage temperature	TSTG -55 °C to +100 °C			Stored as bare product after unpacking
	Operating temperature	TOPR -20 °C to +70 °C			Refer to Operating condition and Frequency range
Frequency stability	$\Delta f/fo$	B : $\pm 50 \times 10^{-6}$ C : $\pm 100 \times 10^{-6}$			
Current consumption	IOP	45 mA Max.		28 mA Max.	No load condition
Output disable current	IOE	30 mA Max.		16 mA Max.	OE = GND (P*W)
Standby current	IST	-		50 $\mu$ A Max.	ST = GND (S*W)
Duty	tw / t	40 % to 60 % 45 % to 55 %	-	-	TTL load : 1.4 V, CL = Max. TTL load : 1.4 V, 5TTL + 15 pF, fo $\leq$ 66.6667 MHz
		-	40 % to 60 % 45 % to 55 %	40 % to 60 %	CMOS load : 50% VDD, CL = Max. CMOS load : 50% VDD, CL = 25 pF, fo $\leq$ 66.6667 MHz
Output voltage	VOH	VDD -0.4 V Min.			IOH = -16 mA (*TW / *HW) / -8 mA (*CW)
	VOL	0.4 V Max.			IOL = 16 mA (*TW / *HW) / 8 mA (*CW)
Output load condition (fan out)	CL	15 pF 5 TTL + 15 pF 25 pF	-	-	fo $\leq$ 135 MHz fo $\leq$ 90 MHz fo $\leq$ 66.6667 MHz
		-	15 pF	15 pF	fo $\leq$ 135 MHz fo $\leq$ 90 MHz
		-	25 pF	-	fo $\leq$ 90 MHz
		-	50 pF	-	fo $\leq$ 66.6667 MHz
Output enable disable input voltage	VIH	2.0 V Min.		0.7 VDD Min.	OE, ST
	VIL	0.8 V Max.		0.2 VDD Max.	OE, ST
Output rise time	tr	2.0 ns Max. 4.0 ns Max.	-	-	TTL load : 0.8 V $\rightarrow$ 2.0 V, CL = Max. TTL load : 0.4 V $\rightarrow$ 2.4 V, CL = Max.
		-	3.0 ns Max. 4.0 ns Max.	-	CMOS load : 20 % $\rightarrow$ 80 % VDD, CL = 25 pF CMOS load : 20 % $\rightarrow$ 80 % VDD, CL = 50 pF
		-	-	3.0 ns Max.	CMOS load : 20 % $\rightarrow$ 80 % VDD, CL = 15 pF
		-	-	-	
Output fall time	tf	2.0 ns Max. 4.0 ns Max.	-	-	TTL load : 2.0 V $\rightarrow$ 0.8 V, CL = Max. TTL load : 2.4 V $\rightarrow$ 0.4 V, CL = Max.
		-	3.0 ns Max. 4.0 ns Max.	-	CMOS load : 80 % $\rightarrow$ 20 % VDD, CL = 25 pF CMOS load : 80 % $\rightarrow$ 20 % VDD, CL = 50 pF
		-	-	3.0 ns Max.	CMOS load : 80 % $\rightarrow$ 20 % VDD, CL = 15 pF
		-	-	-	
Oscillation start up time	tosc	10 ms Max.			Time at minimum operating voltage to be 0 s
Aging	fa	$\pm 5 \times 10^{-6}$ / year Max.			Ta = +25 °C, VDD = 5.0 V / 3.3 V, first year
Shock resistance	S.R.	$\pm 20 \times 10^{-6}$ Max.			Three drops on a hard board from 750 mm or excitation test with 29400 m/s <sup>2</sup> x 0.3 ms x 1/2sine wave in 3 directions

SOJ HIGH-FREQUENCY CRYSTAL OSCILLATOR

# SG-615 / 531 / 51 series

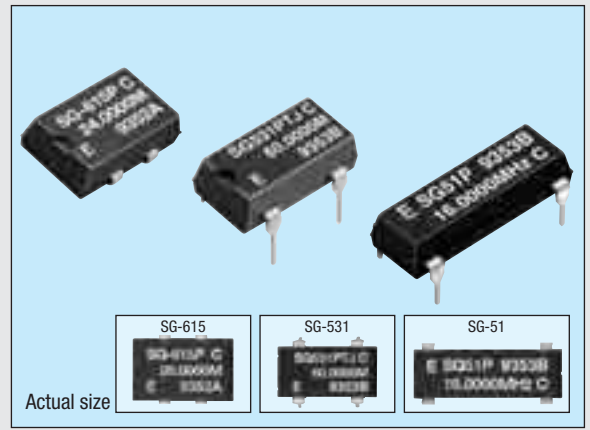
Product number (please refer to page 2)

Q33615XXXXXXXX00

Q32531XXXXXXXX00

Q32510XXXXXXXX00

- High-density mounting-type SMD.
- Cylindrical AT crystal unit builtin, thus assuring high reliability.
- Low current consumption by output enable function (OE) or standby function (ST).
- Pin compatible with full-size metal can. (SG-51 series)
- Pin compatible with half-size metal can. (SG-531 series)
- Available for lead (Pb)-free soldering. • Available for lead (Pb)-free terminal.



## Specifications (characteristics)

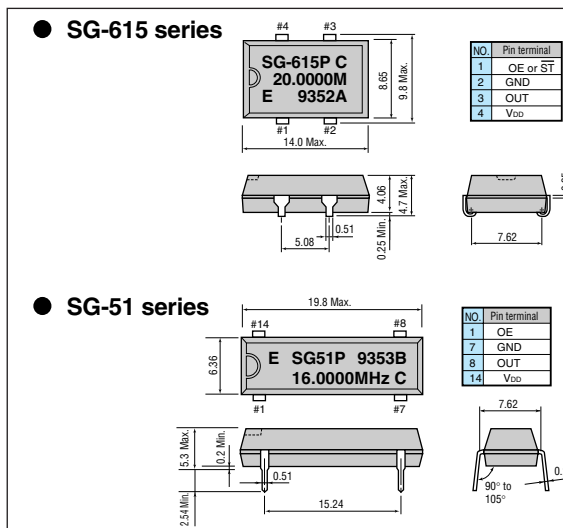
Item	Symbol	Specifications				Remarks
		SG-615P	SG-531P	SG-51P	SG-615PTJ SG-531PTJ SG-51PTJ	
Output frequency range	f <sub>o</sub>	1.0250 MHz to 26.0000 MHz	26.0001 MHz to 66.6667 MHz		Refer to Operating condition and Frequency range	
Power source voltage	Max. supply voltage	-0.3 V to +7.0 V			-0.5 V to +7.0 V	
	Operating voltage	5.0 V±0.5 V				
Temperature range	Storage temperature	-55 °C to +125 °C			Stored as bare product after unpacking	
	Operating temperature	-20 °C to +70 °C (-40 °C to +85 °C)			Refer to Operating condition and Frequency range	
Frequency stability	Δf/f <sub>o</sub>	B: ±50 x 10 <sup>-6</sup> C: ±100 x 10 <sup>-6</sup>			Refer to Operating condition and Frequency range	
Current consumption	I <sub>op</sub>	23 mA Max.	35 mA Max.		No load condition	
Output disable current	I <sub>OE</sub>	12 mA Max.	28 mA Max.	20 mA Max.	OE = GND	
Duty	t <sub>w</sub> / t	40 % to 60 %	—	40 % to 60 %	CMOS load: 1/2 V <sub>DD</sub>	
		45 % to 55 %		—	TTL load: 1.4 V	
Output voltage	V <sub>OH</sub>	V <sub>DD</sub> -0.4 V Min.	2.4 V Min.	V <sub>DD</sub> -0.4 V Min.	I <sub>OH</sub> = -400 μA (P,PTJ) / -4 mA (PH)	
	V <sub>OL</sub>	—	0.4 V Max.	—	I <sub>OL</sub> = 16 mA (P) / 8 mA (PTJ) / 4 mA (PH)	
Output load condition (fan out)	CL	50 pF Max.	—	50 pF Max.	C <sub>L</sub> ≤ 15 pF	
	N	10 TTL Max.	5 TTL Max.	—		
Output enable / disable input voltage	V <sub>IH</sub>	2.0 V Min.	3.5 V Min.	2.0 V Min.	I <sub>IH</sub> = 1 μA Max. (OE = V <sub>DD</sub> )	
	V <sub>IL</sub>	0.8 V Max.	1.5 V Max.	0.8 V Max.	I <sub>IL</sub> = -100 μA Min. (OE = GND), PTJ: I <sub>IL</sub> = -500 μA Min. (OE = GND)	
Output rise time	t <sub>r</sub>	8 ns Max.	—	7 ns Max.	CMOS load: 20 % → 80 % V <sub>DD</sub>	
Output fall time	t <sub>f</sub>	8 ns Max.	5 ns Max.	—	TTL load: 0.4 V → 2.4 V	
			—	7 ns Max.	—	CMOS load: 80 % → 20 % V <sub>DD</sub>
Oscillation start up time	t <sub>OSC</sub>	4 ms Max.	10 ms Max.		Time at 4.5 V to be 0 s	
Aging	f <sub>a</sub>	±5 x 10 <sup>-6</sup> / year Max.			T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 5 V, first year	
Shock resistance	S.R.	±20 x 10 <sup>-6</sup> Max.			Three drops on a hard board from 750 mm or excitation test with 29400 m/s <sup>2</sup> x 0.3 ms x 1/2sine wave in 3 directions	

Note: • Unless otherwise stated, characteristics (specifications) shown in the above table are based on the rated operating temperature and voltage condition.  
• External by-pass capacitor is recommended.

## Operating condition and frequency range

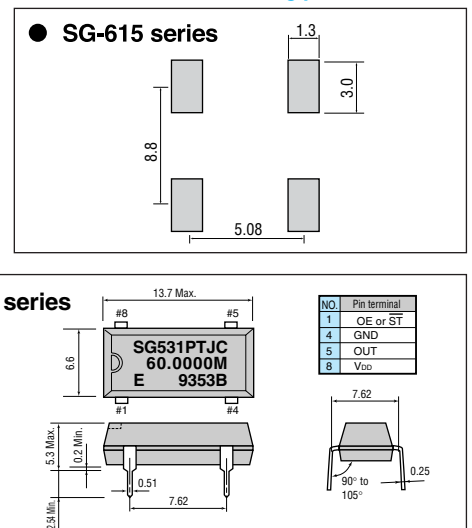
Operating Voltage	Frequency stability(Operating temperature)	1 MHz	50 MHz	100 MHz	150 MHz
5 V±0.5 V	B: ±50 x 10 <sup>-6</sup> (-20 °C to +70 °C)	1.025	26	55	135
	C: ±100 x 10 <sup>-6</sup> (-20 °C to +70 °C)	1.025	26	66.6667	135
3.3 V±0.3 V	B: ±50 x 10 <sup>-6</sup> C: ±100 x 10 <sup>-6</sup> M: ±100 x 10 <sup>-6</sup> (-40 °C to +85 °C)	1.5	26	66.6667	135

## External dimensions



(Unit: mm)

## Recommended soldering pattern



## ■ Specifications (characteristics)

Item	Symbol	Specifications			Remarks
		SG-615PCG SG-531PCG	SG-615SCG SG-531SCG	SG-615PCN	
Nominal frequency range	fo	1.5000 MHz to 26.0000 MHz		26.0001 MHz to 66.6667 MHz	Refer to Operating condition and Frequency range
Power source voltage	Max. supply voltage	VDD-GND	-0.5 V to +7.0 V		
	Operating voltage	VDD	2.7 V to 3.6 V	3.0 V to 3.6 V	
Temperature range	Storage temperature	TSTG	-55 °C to +125 °C		Stored as bare product after unpacking
	Operating temperature	TOPR	-40 °C to +85 °C		Refer to Operating condition and Frequency range
Frequency stability	Δf/fo	B : ±50 x 10 <sup>-6</sup> C : ±100 x 10 <sup>-6</sup>			-20 °C to +70 °C
		M : ±100 x 10 <sup>-6</sup>			-40 °C to +85 °C
Current consumption	IOP	12 mA Max.		30 mA Max.	No load condition
Output disable current	IOE	10 mA Max.	–	15 mA Max.	OE = GND (PCG / PCN)
Standby current	Ist	–	50 μA Max.	–	ST = GND (SCG)
Duty	tw/ t	45 % to 55 %			50 % VDD, CL = Max.
Output voltage	VOH	VDD -0.4 V Min.		2.2 V Min.	IOH = -8 mA
	VOL	0.4 V Max.		0.4 V Max.	IOL = 8 mA
Output load condition	CL	25 pF		15 pF	
	VIH	0.7 VDD Min.		0.7 VDD Min.	OE, ST
Output enable / disable input voltage	VIL	0.2 VDD Max.		0.3 VDD Max.	OE, ST
	tr	4.0 ns Max.		7 ns Max.	20 % → 80 % VDD, CL ≤ Max.
Output fall time	tf	4.0 ns Max.		7 ns Max.	80 % → 20 % VDD, CL ≤ Max.
Oscillation start up time	tosc	12 ms Max.		10 ms Max.	Time at minimum operating voltage to be 0 s
Aging	fa	±5 x 10 <sup>-6</sup> / year Max.			Ta = +25 °C, VDD = 3.3 V First year
Shock resistance	S.R.	±20 x 10 <sup>-6</sup> Max.			Three drops on a hard board from 750 mm or excitation test with 29400 m/s <sup>2</sup> x 0.3 ms x 1/2sine wave in 3 directions

## ■ Specifications (characteristics)

Item	Symbol	Specifications			Remarks	
		SG-615PTW / STW SG-531PTW / STW	SG-615PHW / SHW SG531PHW / SHW	SG-615PCW / SCW SG-531PCW / SCW		
Nominal frequency range	fo	55.0001 MHz to 135.0000 MHz		26.0001 MHz to 135.0000 MHz	Refer to Operating condition and Frequency range	
Power source voltage	Max. supply voltage	VDD-GND	-0.5 V to +7.0 V			
	Operating voltage	VDD	5.0 V ± 0.5 V	3.3 V ± 0.3 V		
Temperature range	Storage temperature	TSTG	-55 °C to +100 °C		Stored as bare product after unpacking	
	Operating temperature	TOPR	-20 °C to +70 °C	-40 °C to +85 °C	Refer to Operating condition and Frequency range	
Frequency stability	Δf/fo	B : ±50 x 10 <sup>-6</sup> C : ±100 x 10 <sup>-6</sup>			-20 °C to +70 °C	
		–			M : ±100 x 10 <sup>-6</sup>	-40 °C to +85 °C
Current consumption	IOP	45 mA Max.		28 mA Max.	No load condition	
Output disable current	IOE	30 mA Max.		16 mA Max.	OE = GND (P*W)	
Standby current	Ist	50 μA Max.			ST = GND (S*W)	
Duty	tw/ t	40 % to 60 %	–	–	TTL load : 1.4 V, CL = Max.	
		45 % to 55 %	–	–	TTL load : 1.4 V, 5TTL + 15 pF, fo ≤ 66.6667 MHz	
		–	40 % to 60 %	40 % to 60 %	CMOS load : 50% VDD, CL = Max.	
		–	45 % to 55 %	–	CMOS load : 50% VDD, CL = 25 pF, fo ≤ 66.6667 MHz	
Output voltage	VOH	VDD -0.4 V Min.			IOH = -16 mA (*TW / *HW) / -8 mA (*CW)	
		VOL	0.4 V Max.			IOH = -16 mA (*TW / *HW) / 8 mA (*CW)
			15 pF	–	–	fo ≤ 135 MHz
			5 TTL + 15 pF	–	–	fo ≤ 90 MHz
Output load condition	CL	25 pF	–	–	fo ≤ 66.6667 MHz	
		–	15 pF	15 pF	fo ≤ 135 MHz	
		–	25 pF	–	fo ≤ 125 MHz	
		–	50 pF	–	fo ≤ 66.6667MHz	
Output enable / disable input voltage	VIL	2.0 V Min.		0.7 VDD Min.	OE, ST	
		0.8 V Max.		0.2 VDD Max.	OE, ST	
		2.0 ns Max.	–	–	TTL load: 0.8 V → 2.0 V, CL = Max.	
		4.0 ns Max.	–	–	TTL load: 0.4 V → 2.4 V, CL = Max.	
Output rise time	tr	–	3.0 ns Max.	–	CMOS load: 80 % → 20 % VDD, CL = 25 pF	
		–	–	3.0 ns Max.	CMOS load: 80 % → 20 % VDD, CL = 15 pF	
		–	4.0 ns Max.	4.0 ns Max.	CMOS load: 80 % → 20 % VDD, CL = Max.	
		–	–	–		
Output fall time	tf	2.0 ns Max.	–	–	TTL load: 2.0 V → 0.8 V, CL = Max.	
		4.0 ns Max.	–	–	TTL load: 2.4 V → 0.4 V, CL = Max.	
		–	3.0 ns Max.	–	CMOS load: 80 % → 20 % VDD, CL = 25 pF	
		–	–	3.0 ns Max.	CMOS load: 80 % → 20 % VDD, CL = 15 pF	
Oscillation start up time	tosc	10 ms Max.			Time at minimum operating voltage to be 0 s	
		±5 x 10 <sup>-6</sup> / year Max.			Ta = +25 °C, VDD = 5.0 V / 3.3 V, First year	
Shock resistance	S.R.	±20 x 10 <sup>-6</sup> Max.			Three drops on a hard board from 750 mm or excitation test with 29400 m/s <sup>2</sup> x 0.3 ms x 1/2sine wave in 3 directions	

HIGH-FREQUENCY CRYSTAL OSCILLATOR

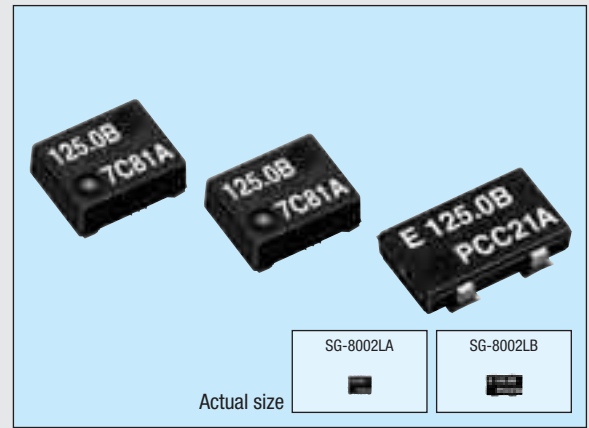
# SG-8002LA / LB series

Product number (please refer to page 2)

**Q3324LAXXXXXX00**

**Q3323LBXXXXXX00**

- Using PLL technology and One time PROM programmability for quick-turn custom version.
- Reflowable and high density mounting type smallest SMD package (3.2 mm x 2.5 mm).
- Operable 3.3 V and 5.0 V.
- Output enable (OE : P type) or Standby (ST : S type) function allow more low current consumption.
- Available for lead (Pb)-free soldering.
- Complete lead (Pb)-free product.



## Specifications (characteristics)

Item	Symbol	Specifications *2		Remarks
		PH / SH	PC / SC	
Output frequency range	fo	1.0 MHz to 80 MHz	—	VDD = 4.5 V to 5.5 V
		—	1.0 MHz to 125 MHz	VDD = 3.0 V to 3.6 V
		—	1.0 MHz to 66.7 MHz	VDD = 2.7 V to 3.6 V
Power source voltage	Max. supply voltage	-0.5 V to +7.0 V		
	Operating voltage	4.5 V to 5.5 V	2.7 V to 3.6 V	
Temperature range	Storage temperature	-40 °C to +125 °C		Stored as bare product after unpacking
	Operating temperature	-20 °C to +70 °C (-40 °C to +85 °C)		
Frequency stability	Δf/fo	B: ±50 x 10 <sup>-6</sup> C: ±100 x 10 <sup>-6</sup>		-20 °C to +70 °C
		M: ±100 x 10 <sup>-6</sup> *3		-40 °C to +85 °C
		—	L: ±50 x 10 <sup>-6</sup>	-40 °C to +85 °C, VDD ±5%
Current consumption	Iop	35 mA Max.	—	No load (fo = 80 MHz)
		—	28 mA Max.	No load (fo = 125 MHz)
Output disable current	IoE	20 mA Max.	—	P type only (OE = GND, fo = 80 MHz)
		—	16 mA Max.	P type only (OE = GND, fo = 125 MHz)
Standby current	IST	50 μA Max.		S Type Only
Duty *1	tw/ t	40 % to 60 %	—	50 % VDD, CL = 15 pF, ≤ 80 MHz
		—	40 % to 60 %	50 % VDD, CL = 15 pF, VDD = 3.0 V to 3.6 V, ≤ 125 MHz
		—	40 % to 60 %	50 % VDD, CL = 15 pF, VDD = 2.7 V to 3.6 V, ≤ 66.7 MHz
		—	45 % to 55 %	50 % VDD, CL = 15 pF, VDD = 3.0 V to 3.6 V, ≤ 40 MHz
High output voltage	VoH	VDD - 0.4 V Min.	—	IoH = -16 mA (PH / SH), IoH = -8 mA (PC / SC)
Low output voltage	VoL	0.4 V Max.	—	IoL = 16 mA (PH / SH), IoL = 8 mA (PC / SC)
Output load *1 condition (fan out)	CMOS	CL	15 pF	Max. frequency and Max. operating voltage range.
Output enable / disable input voltage	VIH VIL	2.0 V Min.	70 % VDD Min.	ST, OE terminal
		0.8 V Max.	20 % VDD Min.	
Output rise time *1	CMOS level	tr	4 ns Max.	20 % → 80 % VDD, CL = Max.
	TTL level			
Output fall time *1	CMOS level	tf	4 ns Max.	80 % → 20 % VDD, CL = Max.
	TTL level			
Oscillation start up time	tosc	10 ms Max.		Time at minimum operating voltage to be 0 s
Aging	fa	±5 x 10 <sup>-6</sup> / year Max.		Ta = +25 °C, First year
Shock resistance	S.R.	±20 x 10 <sup>-6</sup> Max.		Three drops on a hard board from 750 mm or excitation test with 29400 m/s <sup>2</sup> x 0.3 ms x 1/2sine wave in 3 directions

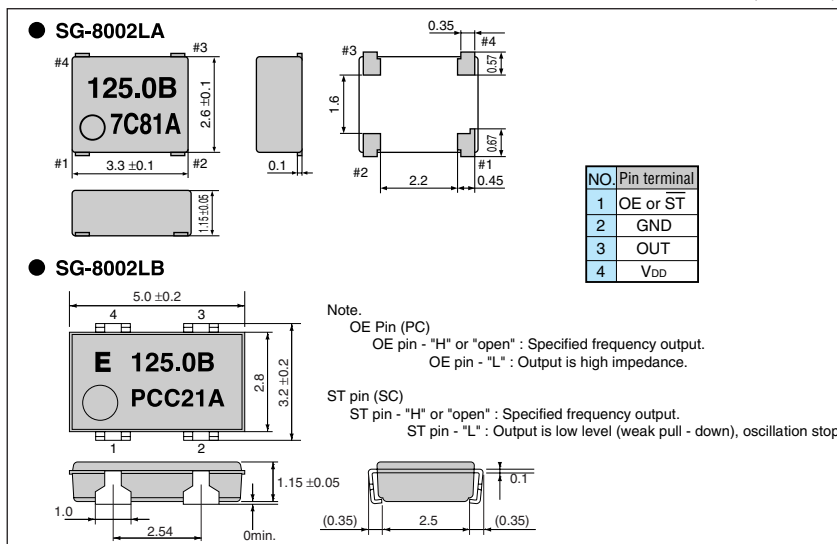
\*1 Operating temperature (-40°C to +85°C), the available frequency, duty and output load conditions, please refer to page 50, 51.

\*2 PLL-PLL connection & Jitter specification, please refer to page 52.

\*3 PH / SH for "M" stability will be available up to 27 MHz.

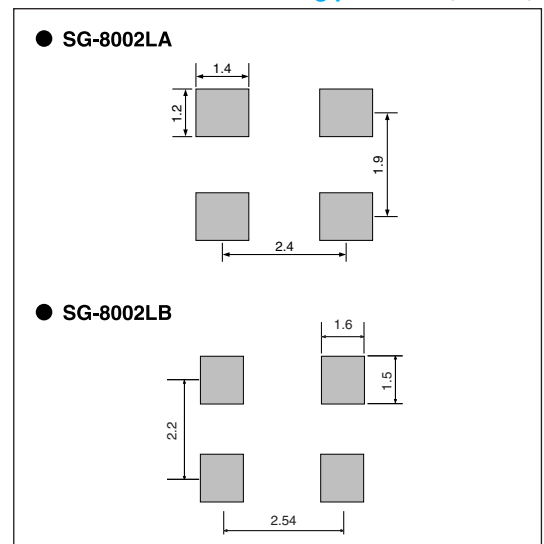
## External dimensions

(Unit: mm)



## Recommended soldering pattern

(Unit: mm)



# PROGRAMMABLE HIGH-FREQUENCY CRYSTAL OSCILLATOR

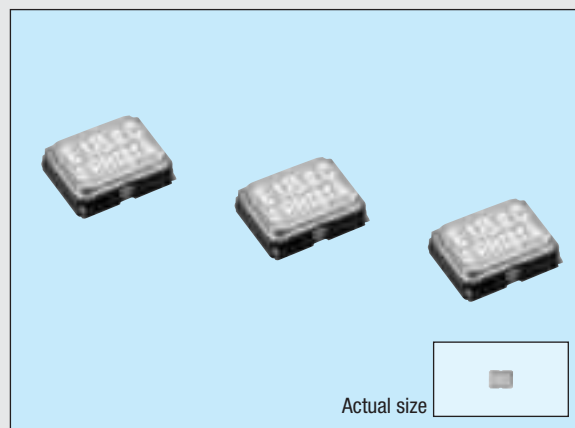
## SG-8002CE series

Product number (please refer to page 2)

**Q3321CExxxxx00**

- Wide frequency output by PLL technology.
- Short lead mass production time.
- Excellent shock resistance and environmental capability.
- Output enable function (OE) and stand-by function (ST) can be used for low current consumption applications.
- Available for lead (Pb)-free soldering.
- Complete lead (Pb)-free product.

SG-Writer available to purchase.  
Please contact EPSON or local sales representative.



### Specifications (characteristics)

Item	Symbol	Specifications *2			Remarks		
		PT / ST	PH / SH	PC / SC			
Output frequency range	f <sub>o</sub>	1.0000 MHz to 125.0000 MHz			Refer to page 50. "Frequency range"		
Power source voltage	Max. supply voltage	V <sub>DD</sub> -GND	-0.5 V to +7.0 V				
	Operating voltage	V <sub>DD</sub>	5.0 V ±0.5 V	3.3 ± 0.3 V	2.7 V to 3.6 V : f <sub>o</sub> ≤ 66.7 MHz (PC / SC)		
Temperature range	Storage temperature	T <sub>STG</sub>	-40 °C to +125 °C		Stored as bare product after unpacking		
	Operating temperature	T <sub>OPR</sub>	-20 °C to +70 °C (-40 °C to +85 °C)	-40 °C to +85 °C	Refer to page 50. "Frequency range"		
Frequency stability	Δf/f <sub>o</sub>	B: ±50 x 10 <sup>-6</sup> C: ± 100 x 10 <sup>-6</sup> M: ±100 x 10 <sup>-6</sup> *3			B, C : -20 °C to +70 °C, M : -40 °C to +85 °C		
Current consumption	I <sub>op</sub>	40 mA Max.		28 mA Max.	No load condition, Max. frequency range		
Output disable current	I <sub>oE</sub>	30 mA Max.		16 mA Max.	OE = GND (PT, PH, PC)		
Standby current	I <sub>ST</sub>	50 μA Max.			ST = GND (ST, SH, SC)		
Duty *1	tw/ t	-		40 % to 60 %	CMOS load: 1/2 V <sub>DD</sub> level		
		40 % to 60 %		-	TTL load: 1.4 V level		
High output voltage	V <sub>oH</sub>	V <sub>DD</sub> -0.4 V Min.		0.4 V Max.	I <sub>oH</sub> = -16 mA (PT / ST, PH / SH), -8 mA (PC / SC)		
Low output voltage	V <sub>oL</sub>	0.4 V Max.			I <sub>oL</sub> = 16 mA (PT / ST, PH / SH), 8 mA (PC / SC)		
Output load *1 condition (fan out)	TTL	N	5 TTL Max.	-	Max. frequency and Max. operating voltage range		
	CMOS	CL	15 pF Max.				
Output enable / disable input voltage	V <sub>IH</sub>	2.0 V Min.		0.7 V <sub>DD</sub> Min.	ST, OE terminal		
	V <sub>IL</sub>	0.8 V Max.		0.2 V <sub>DD</sub> Max.			
Output rise time *1	CMOS level	t <sub>r</sub>	-		3 ns Max.	4 ns Max.	CMOS load: 20 % → 80 % V <sub>DD</sub>
	TTL level		4 ns Max.		-		TTL load: 0.4 V → 2.4 V
Output fall time *1	CMOS level	t <sub>f</sub>	-		3 ns Max.	4 ns Max.	CMOS load: 80 % → 20 % V <sub>DD</sub>
	TTL level		4 ns Max.		-		TTL load: 2.4 V → 0.4 V
Oscillation start up time	t <sub>osc</sub>	10 ms Max.			Time at minimum operating voltage to be 0 s		
Aging	f <sub>a</sub>	±5 x 10 <sup>-6</sup> / year Max.			T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 5.0 V / 3.3 V, First year		

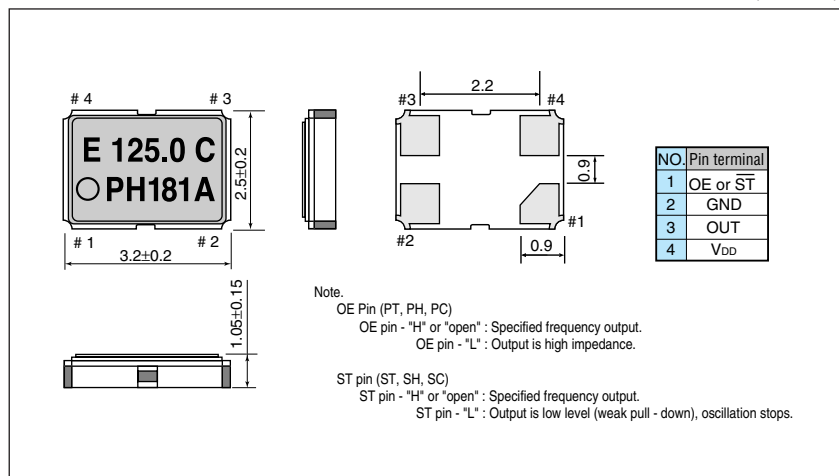
\*1 Operating temperature (-40 °C to +85 °C), the available frequency, duty and output load conditions, please refer to page 50, 51.

\*2 PLL-PLL connection & Jitter specification, please refer to page 52.

\*3 PT / ST and PH / SH for "M" stability will be available up to 27 MHz.

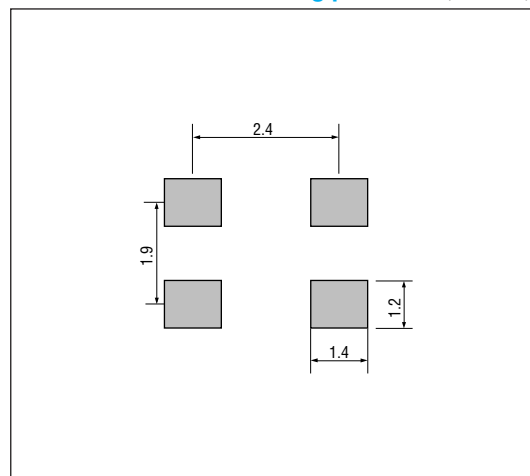
### External dimensions

(Unit: mm)



### Recommended soldering pattern

(Unit: mm)



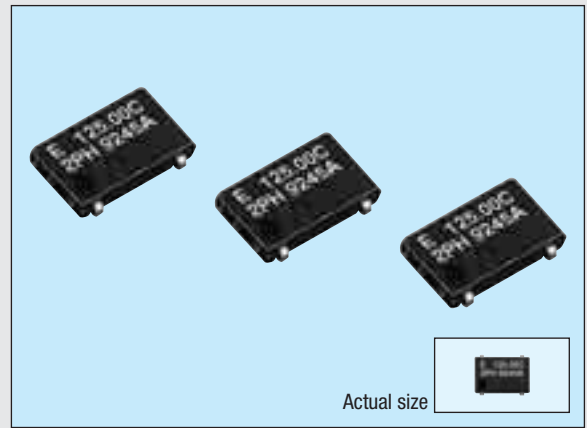
# PROGRAMMABLE HIGH-FREQUENCY CRYSTAL OSCILLATOR

## SG-8002JF series

Product number (please refer to page 2)

**Q3308JFxxxxxx00**

- Wide frequency output by PLL technology.
- Quick delivery of samples and short lead mass production time.
- Excellent environmental capability.
- Output enable function (OE) and stand-by function ( $\overline{ST}$ ) can be used for low current consumption applications.
- Pin compatible with ceramic package crystal oscillator (7 x 5)
- Available for lead (Pb)-free soldering.
- Available for lead (Pb)-free terminal.



SG-Writer available to purchase.  
Please contact EPSON or local sales representative.

### Specifications (characteristics)

Item	Symbol	Specifications *2			Remarks	
		PT / ST	PH / SH	PC / SC		
Output frequency range	$f_o$	1.0000 MHz to 125.0000 MHz			Refer to page 50. "Frequency range"	
Power source voltage	Max. supply voltage	$V_{DD-GND}$ -0.5 V to +7.0 V				
	Operating voltage	$V_{DD}$	$5.0 V \pm 0.5 V$	$3.3 \pm 0.3 V$	2.7 V to 3.6 V : $f_o \leq 66.7$ MHz (PC / SC)	
Temperature range	Storage temperature	$T_{STG}$ -55 °C to +125 °C			Stored as bare product after unpacking	
	Operating temperature	$T_{OPR}$	-20 °C to +70 °C (-40 °C to +85 °C)	-40 °C to +85 °C	Refer to page 50. "Frequency range"	
Frequency stability	$\Delta f/f_o$	B: $\pm 50 \times 10^{-6}$ C: $\pm 100 \times 10^{-6}$			B, C : -20 °C to +70 °C	
		M: $\pm 100 \times 10^{-6}$			M : -40 °C to +85 °C	
Current consumption	$I_{OP}$	45 mA Max.		28 mA Max.	No load condition, Max. frequency range	
Output disable current	$I_{OE}$	30 mA Max.		16 mA Max.	OE = GND (PT, PH, PC)	
Standby current	$I_{ST}$	50 $\mu$ A Max.			ST = GND (ST, SH, SC)	
Duty *1	$t_w/t$	-			40 % to 60 %	CMOS load: 1/2 $V_{DD}$ level
		40 % to 60 %			-	TTL load: 1.4 V level
High output voltage	$V_{OH}$	$V_{DD} - 0.4$ V Min.			$I_{OH} = -16$ mA (PT / ST, PH / SH), -8 mA (PC / SC)	
Low output voltage	$V_{OL}$	0.4 V Max.			$I_{OL} = 16$ mA (PT / ST, PH / SH), 8 mA (PC / SC)	
Output load *1 condition (fan out)	TTL	N	5 TTL Max.	-	Max. frequency and Max. operating voltage range	
	CMOS	CL	15 pF Max.			
Output enable / disable input voltage	$V_{IH}$	2.0 V Min.		0.7 $V_{DD}$ Min.	ST, OE terminal	
	$V_{IL}$	0.8 V Max.		0.2 $V_{DD}$ Max.		
Output rise time *1	CMOS level	$t_r$	-		4 ns Max.	CMOS load: 20 % $\rightarrow$ 80 % $V_{DD}$
	TTL level		4 ns Max.		-	TTL load: 0.4 V $\rightarrow$ 2.4 V
Output fall time *1	CMOS level	$t_f$	-		4 ns Max.	CMOS load: 80 % $\rightarrow$ 20 % $V_{DD}$
	TTL level		4 ns Max.		-	TTL load: 2.4 V $\rightarrow$ 0.4 V
Oscillation start up time	$t_{OSC}$	10 ms Max.			Time at minimum operating voltage to be 0 s	
Aging	$f_a$	$\pm 5 \times 10^{-6}$ / year Max.			$T_a = +25$ °C, $V_{DD} = 5.0$ V / 3.3 V, First year	
Shock resistance	S.R.	$\pm 20 \times 10^{-6}$ Max.			Three drops on a hard board from 750 mm or excitation test with 29400 m/s <sup>2</sup> x 0.3 ms x 1/2sine wave in 3 directions	

\*1 Operating temperature (-40 °C to +85 °C), the available frequency, duty and output load conditions, please refer to page 50, 51.

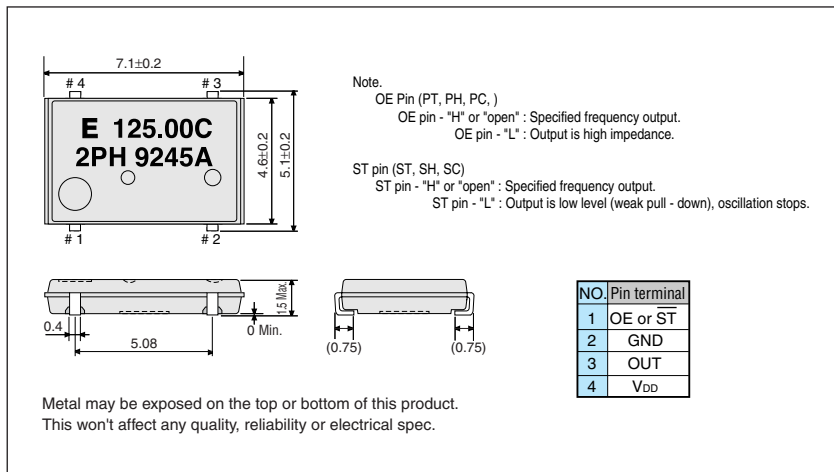
\*2 PLL - PLL connection & Jitter specification, please refer to page 52.

Checking possible by the Frequency Checking Program.

<http://www.epsondevice.com/domcfg.nsf>

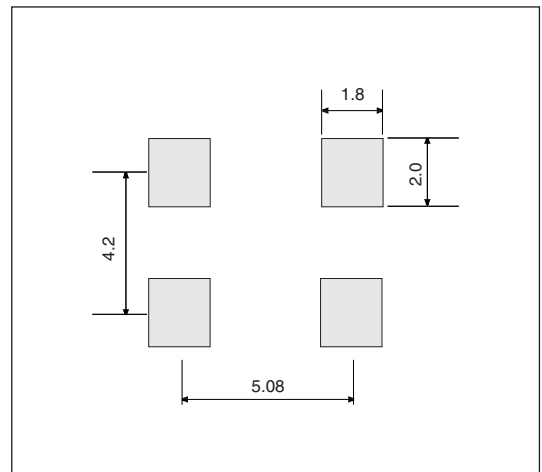
### External dimensions

(Unit: mm)



### Recommended soldering pattern

(Unit: mm)





# PROGRAMMABLE HIGH-FREQUENCY CRYSTAL OSCILLATOR

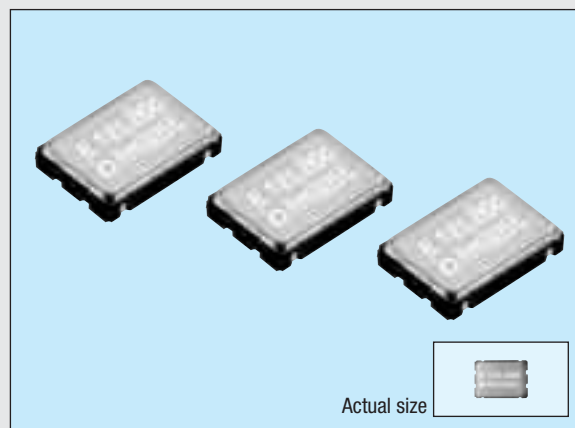
## SG-8002CA series

Product number (please refer to page 2)

**Q3309CAxxxxxx00**

- Wide frequency output by PLL technology.
- Quick delivery of samples and short lead mass production time.
- Excellent environmental capability.
- Output enable function (OE) and stand-by function ( $\overline{ST}$ ) can be used for low current consumption applications.
- Available for lead (Pb)-free soldering.
- Complete lead (Pb)-free product.

SG-Writer available to purchase.  
Please contact EPSON or local sales representative.



### Specifications (characteristics)

Item	Symbol	Specifications *2			Remarks
		PT / ST	PH / SH	PC / SC	
Output frequency range	$f_o$	1.0000 MHz to 125.0000 MHz			Refer to page 50. "Frequency range"
Power source voltage	Max. supply voltage	$V_{DD-GND}$ -0.5 V to +7.0 V			
	Operating voltage	$V_{DD}$	$5.0 V \pm 0.5 V$	$3.3 \pm 0.3 V$	2.7 V to 3.6 V : $f_o \leq 66.7$ MHz (PC / SC)
Temperature range	Storage temperature	$T_{STG}$ -55 °C to +125 °C			Stored as bare product after unpacking
	Operating temperature	$T_{OPR}$	-20 °C to +70 °C (-40 °C to +85 °C)	-40 °C to +85 °C	Refer to page 50. "Frequency range"
Frequency stability	$\Delta f/f_o$	B: $\pm 50 \times 10^{-6}$ C: $\pm 100 \times 10^{-6}$			B, C : -20 °C to +70 °C
		M: $\pm 100 \times 10^{-6}$			M : -40 °C to +85 °C
Current consumption	$I_{OP}$	45 mA Max.		28 mA Max.	No load condition, Max. frequency range
Output disable current	$I_{OE}$	30 mA Max.		16 mA Max.	OE = GND (PT, PH, PC)
Standby current	$I_{ST}$	50 $\mu$ A Max.			$\overline{ST}$ = GND (ST, SH, SC)
Duty *1	$t_w/t$	-			CMOS load: 1/2 $V_{DD}$ level
		40 % to 60 %			TTL load: 1.4 V level
High output voltage	$V_{OH}$	$V_{DD} - 0.4$ V Min.			$I_{OH} = -16$ mA (PT / ST, PH / SH), -8 mA (PC / SC)
Low output voltage	$V_{OL}$	0.4 V Max.			$I_{OL} = 16$ mA (PT / ST, PH / SH), 8 mA (PC / SC)
Output load *1 condition (fan out)	TTL	N	5 TTL Max.	-	Max. frequency and Max. operating voltage range
	CMOS	CL	15 pF Max.	25 pF Max. 15 pF Max.	
Output enable / disable input voltage	$V_{IH}$	2.0 V Min.		0.7 $V_{DD}$ Min.	ST, OE terminal
	$V_{IL}$	0.8 V Max.		0.2 $V_{DD}$ Max.	
Output rise time *1	CMOS level	$t_r$	-		CMOS load: 20 % $\rightarrow$ 80 % $V_{DD}$
	TTL level		4 ns Max.		TTL load: 0.4 V $\rightarrow$ 2.4 V
Output fall time *1	CMOS level	$t_f$	-		CMOS load: 80 % $\rightarrow$ 20 % $V_{DD}$
	TTL level		4 ns Max.		TTL load: 2.4 V $\rightarrow$ 0.4 V
Oscillation start up time	$t_{OSC}$	10 ms Max.			Time at minimum operating voltage to be 0 s
Aging	$f_a$	$\pm 5 \times 10^{-6}$ / year Max.			$T_a = +25$ °C, $V_{DD} = 5.0$ V / 3.3 V, First year
Shock resistance	S.R.	$\pm 20 \times 10^{-6}$ Max.			Three drops on a hard board from 750 mm or excitation test with 29400 m/s <sup>2</sup> x 0.3 ms x 1/2sine wave in 3 directions

\*1 Operating temperature (-40 °C to +85 °C), the available frequency, duty and output load conditions, please refer to page 50, 51.

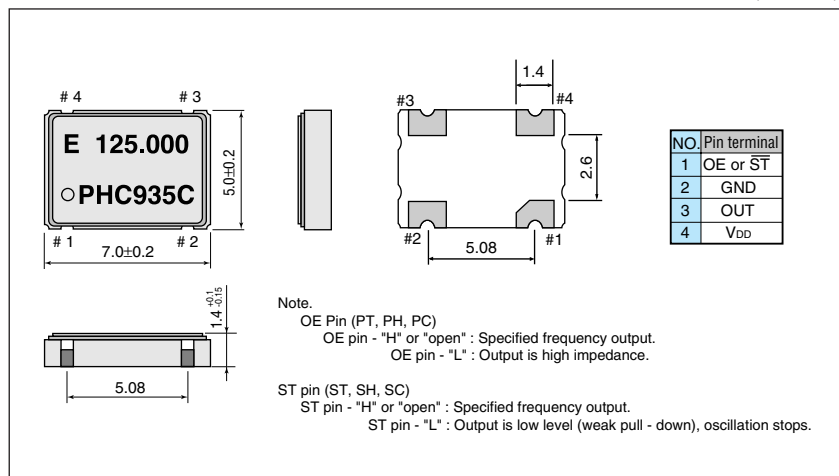
\*2 PLL - PLL connection & Jitter specification, please refer to page 52.

Checking possible by the Frequency Checking Program.

<http://www.epsondevice.com/domcfg.nsf>

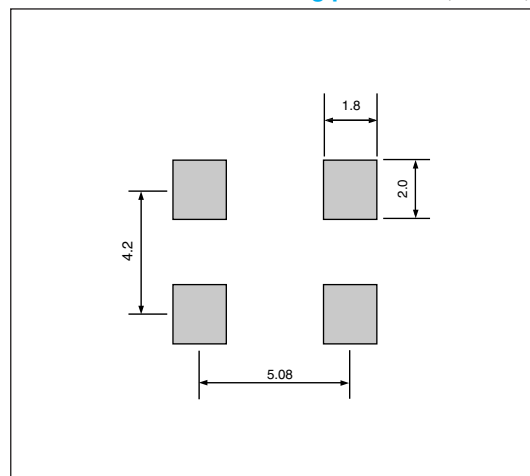
### External dimensions

(Unit: mm)



### Recommended soldering pattern

(Unit: mm)



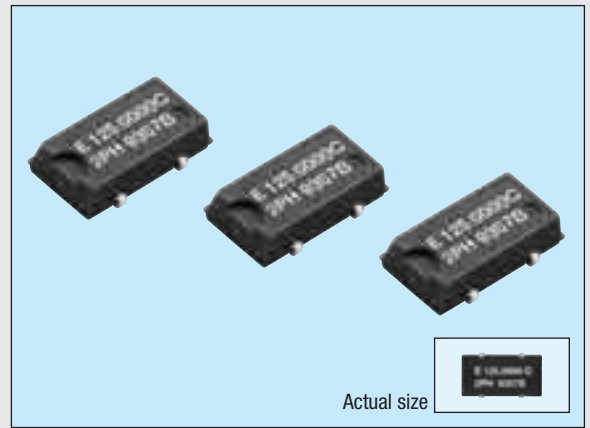
# PROGRAMMABLE HIGH-FREQUENCY CRYSTAL OSCILLATOR

## SG-8002JC series

Product number (please refer to page 2)

**Q3307JCxxxxxx00**

- Wide frequency output by PLL technology.
- Quick delivery of samples and short lead mass production time.
- Excellent environmental capability.
- Output enable function (OE) and stand-by function ( $\overline{ST}$ ) can be used for low current consumption applications.
- Package and pin compatible with SG-636.
- Available for lead (Pb)-free soldering.
- Available for lead (Pb)-free terminal.



Actual size

SG-Writer available to purchase.  
Please contact EPSON or local sales representative.

### Specifications (characteristics)

Item	Symbol	Specifications *2			Remarks
		PT / ST	PH / SH	PC / SC	
Output frequency range	$f_o$	1.0000 MHz to 125.0000 MHz			Refer to page 50. "Frequency range"
Power source voltage	Max. supply voltage	$V_{DD-GND}$			
	Operating voltage	$V_{DD}$	$5.0 V \pm 0.5 V$		$3.3 \pm 0.3 V$
Temperature range	Storage temperature	$T_{STG}$			-55 °C to +100 °C
	Operating temperature	$T_{OPR}$			-20 °C to +70 °C
Frequency stability	$\Delta f/f_o$	B: $\pm 50 \times 10^{-6}$ C: $\pm 100 \times 10^{-6}$			B, C : -20 °C to +70 °C
Current consumption	$I_{op}$	45 mA Max.		28 mA Max.	No load condition, Max. frequency range
Output disable current	$I_{oE}$	30 mA Max.		16 mA Max.	OE = GND (PT, PH, PC)
Standby current	$I_{ST}$	50 $\mu A$ Max.			$\overline{ST}$ = GND (ST, SH, SC)
Duty *1	$t_w / t$	40 % to 60 %			CMOS load: 1/2 $V_{DD}$ level
		40 % to 60 %			TTL load: 1.4 V level
High output voltage	$V_{OH}$	$V_{DD} - 0.4 V$ Min.			$I_{OH} = -16 mA$ (PT / ST, PH / SH), -8 mA (PC / SC)
Low output voltage	$V_{OL}$	0.4 V Max.			$I_{OL} = 16 mA$ (PT / ST, PH / SH), 8 mA (PC / SC)
Output load *1 condition (fan out)	TTL	N	5 TTL Max.	—	Max. frequency and Max. operating voltage range
	CMOS	CL	15 pF Max.		
Output enable / disable input voltage	$V_{IH}$	2.0 V Min.		0.7 $V_{DD}$ Min.	ST, OE terminal
	$V_{IL}$	0.8 V Max.		0.2 $V_{DD}$ Max.	
Output rise time *1	CMOS level	$t_r$	4 ns Max.		CMOS load: 20 % $\rightarrow$ 80 % $V_{DD}$
	TTL level		4 ns Max.		TTL load: 0.4 V $\rightarrow$ 2.4 V
Output fall time *1	CMOS level	$t_f$	4 ns Max.		CMOS load: 80 % $\rightarrow$ 20 % $V_{DD}$
	TTL level		4 ns Max.		TTL load: 2.4 V $\rightarrow$ 0.4 V
Oscillation start up time	$t_{osc}$	10 ms Max.			Time at minimum operating voltage to be 0 s
Aging	$f_a$	$\pm 5 \times 10^{-6}$ / year Max.			$T_a = +25 \text{ }^\circ\text{C}$ , $V_{DD} = 5.0 V / 3.3 V$ , First year
Shock resistance	S.R.	$\pm 20 \times 10^{-6}$ Max.			Three drops on a hard board from 750 mm or excitation test with 29400 m/s <sup>2</sup> x 0.3 ms x 1/2sine wave in 3 directions

\*1 Operating temperature (-40 °C to +85 °C), the available frequency, duty and output load conditions, please refer to page 50, 51.

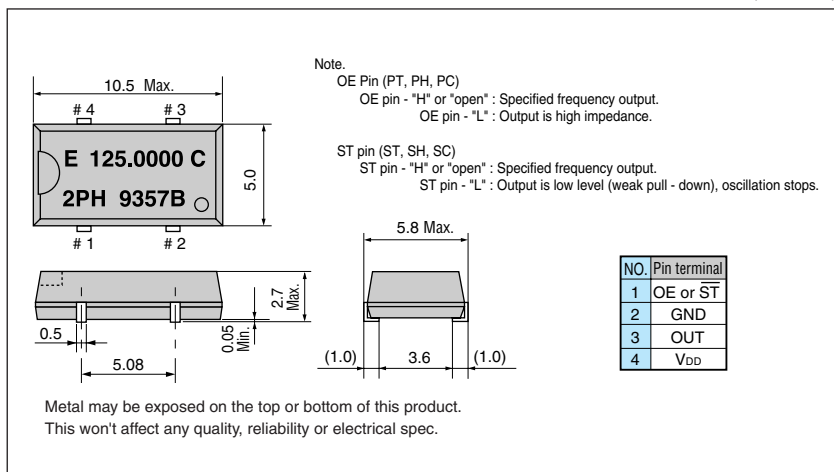
\*2 PLL - PLL connection & Jitter specification, please refer to page 52.

Checking possible by the Frequency Checking Program.

<http://www.epsondevice.com/domcfg.nsf>

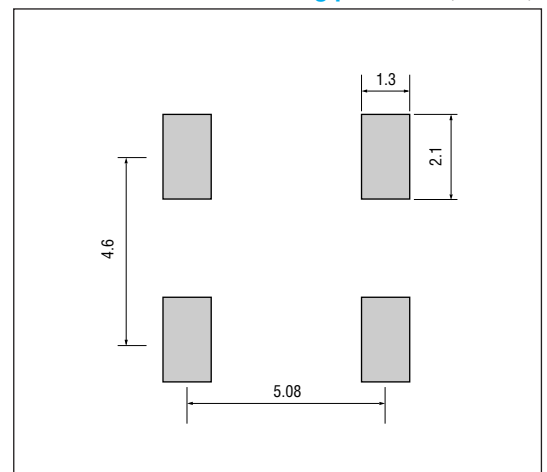
### External dimensions

(Unit: mm)



### Recommended soldering pattern

(Unit: mm)



# PROGRAMMABLE HIGH-FREQUENCY CRYSTAL OSCILLATOR

## SG-8002JA series

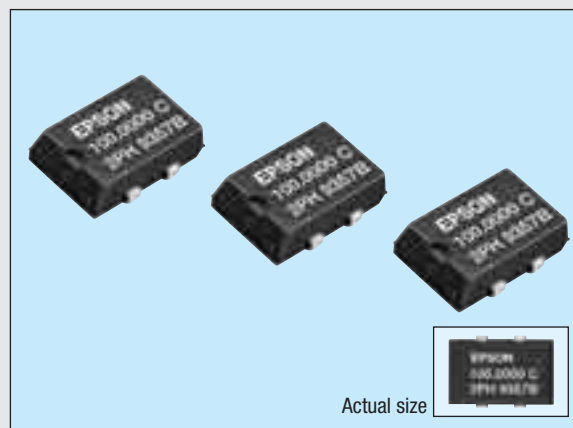
Product number (please refer to page 2)

**Q3306JAXXXXXX00**

- Wide frequency output by PLL technology.
- Quick delivery of samples and short lead mass production time.
- Excellent environmental capability.
- Output enable function (OE) and stand-by function ( $\overline{ST}$ ) can be used for low current consumption applications.
- Package and pin compatible with SG-615.
- Available for lead (Pb)-free soldering.
- Available for lead (Pb)-free terminal.

SG-Writer available to purchase.

Please contact EPSON or local sales representative.



### Specifications (characteristics)

Item	Symbol	Specifications *2			Remarks
		PT / ST	PH / SH	PC / SC	
Output frequency range	$f_o$	1.0000 MHz to 125.0000 MHz			Refer to page 50. "Frequency range"
Power source voltage	Max. supply voltage	$V_{DD-GND}$	-0.5 V to +7.0 V		
	Operating voltage	$V_{DD}$	$5.0 V \pm 0.5 V$	$3.3 \pm 0.3 V$	2.7 V to 3.6 V : $f_o \leq 66.7$ MHz (PC / SC)
Temperature range	Storage temperature	$T_{STG}$	-55 °C to +125 °C		Stored as bare product after unpacking
	Operating temperature	$T_{OPR}$	-20 °C to +70 °C (-40 °C to +85 °C)	-40 °C to +85 °C	Refer to page 50. "Frequency range"
Frequency stability	$\Delta f/f_o$	B: $\pm 50 \times 10^{-6}$ C: $\pm 100 \times 10^{-6}$			B, C : -20 °C to +70 °C
		M: $\pm 100 \times 10^{-6}$			M : -40 °C to +85 °C
Current consumption	$I_{OP}$	45 mA Max.		28 mA Max.	No load condition, Max. frequency range
Output disable current	$I_{OE}$	30 mA Max.		16 mA Max.	OE = GND (PT, PH, PC)
Standby current	$I_{ST}$	50 $\mu$ A Max.			$\overline{ST}$ = GND ( $\overline{ST}$ , SH, SC)
Duty *1	$t_w/t$	40 % to 60 %			CMOS load: 1/2 $V_{DD}$ level
		40 % to 60 %			TTL load: 1.4 V level
High output voltage	$V_{OH}$	$V_{DD} - 0.4$ V Min.		$I_{OH} = -16$ mA (PT / ST, PH / SH), -8 mA (PC / SC)	
Low output voltage	$V_{OL}$	0.4 V Max.		$I_{OL} = 16$ mA (PT / ST, PH / SH), 8 mA (PC / SC)	
Output load *1 condition (fan out)	TTL	N	5 TTL Max.	—	Max. frequency and Max. operating voltage range
	CMOS	CL	15 pF Max.	25 pF Max. / 15 pF Max.	
Output enable / disable input voltage	$V_{IH}$	2.0 V Min.		0.7 $V_{DD}$ Min.	$\overline{ST}$ , OE terminal
	$V_{IL}$	0.8 V Max.		0.2 $V_{DD}$ Max.	
Output rise time *1	CMOS level	$t_r$	4 ns Max.		CMOS load: 20 % $\rightarrow$ 80 % $V_{DD}$
	TTL level		4 ns Max.		TTL load: 0.4 V $\rightarrow$ 2.4 V
Output fall time *1	CMOS level	$t_f$	4 ns Max.		CMOS load: 80 % $\rightarrow$ 20 % $V_{DD}$
	TTL level		4 ns Max.		TTL load: 2.4 V $\rightarrow$ 0.4 V
Oscillation start up time	$t_{OSC}$	10 ms Max.		Time at minimum operating voltage to be 0 s	
Aging	$f_a$	$\pm 5 \times 10^{-6}$ / year Max.		$T_a = +25$ °C, $V_{DD} = 5.0$ V / 3.3 V, First year	
Shock resistance	S.R.	$\pm 20 \times 10^{-6}$ Max.		Three drops on a hard board from 750 mm or excitation test with 29400 m/s <sup>2</sup> x 0.3 ms x 1/2sine wave in 3 directions	

\*1 Operating temperature (-40 °C to +85 °C), the available frequency, duty and output load conditions, please refer to page 50, 51.

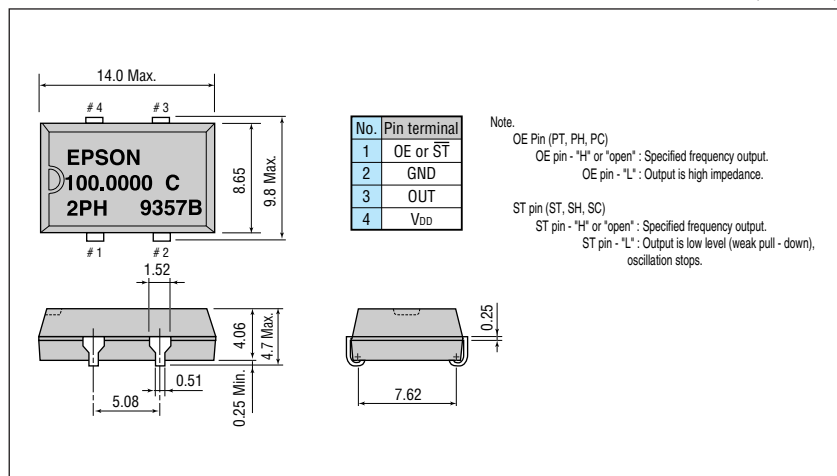
\*2 PLL - PLL connection & Jitter specification, please refer to page 52.

Checking possible by the Frequency Checking Program.

<http://www.epsondevice.com/domcfg.nsf>

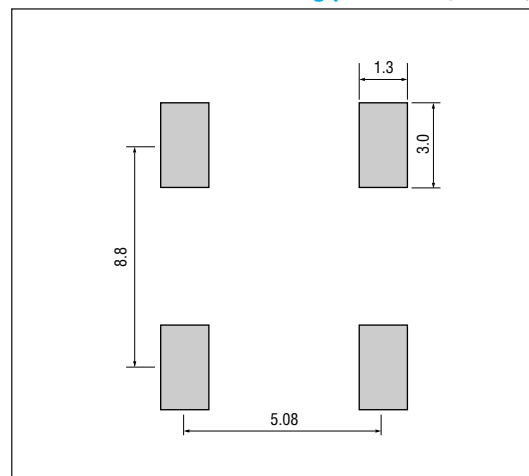
### External dimensions

(Unit: mm)



### Recommended soldering pattern

(Unit: mm)

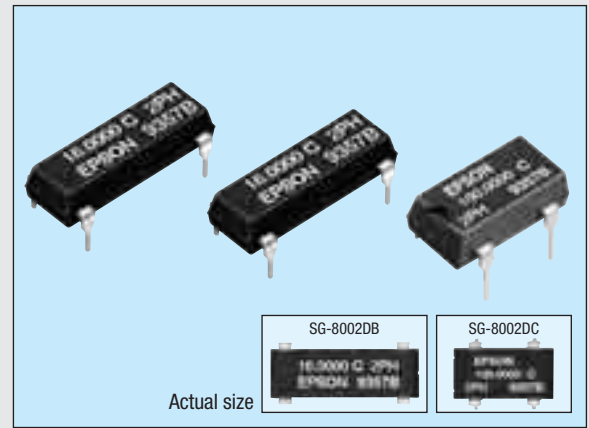


# PROGRAMMABLE HIGH-FREQUENCY CRYSTAL OSCILLATOR SG-8002DB / DC series

Product number (please refer to page 2)

**Q3203DBxxxxxx00**      **Q3204DCxxxxxx00**

- Wide frequency output by PLL technology.
- Quick delivery of samples and short lead mass production time.
- Excellent environmental capability.
- Output enable function (OE) and stand-by function ( $\overline{ST}$ ) can be used for low current consumption applications.
- Pin compatible with full size and half size.
- Available for lead (Pb)-free soldering.
- Available for lead (Pb)-free terminal.



SG-Writer available to purchase.  
Please contact EPSON or local sales representative.

## Specifications (characteristics)

Item	Symbol	Specifications *2			Remarks	
		PT / ST	PH / SH	PC / SC		
Output frequency range	$f_o$	1.0000 MHz to 125.0000 MHz			Refer to page 50. "Frequency range"	
Power source voltage	Max. supply voltage	$V_{DD-GND}$ -0.5 V to +7.0 V				
	Operating voltage	$V_{DD}$	$5.0 V \pm 0.5 V$	$3.3 \pm 0.3 V$	2.7 V to 3.6 V : $f_o \leq 66.7$ MHz (PC / SC)	
Temperature range	Storage temperature	$T_{STG}$ -55 °C to +125 °C			Stored as bare product after unpacking	
	Operating temperature	$T_{OPR}$	-20 °C to +70 °C (-40 °C to +85 °C)	-40 °C to +85 °C	Refer to page 50. "Frequency range"	
Frequency stability	$\Delta f/f_o$	B: $\pm 50 \times 10^{-6}$ C: $\pm 100 \times 10^{-6}$			B, C : -20 °C to +70 °C	
		M: $\pm 100 \times 10^{-6}$			M : -40 °C to +85 °C	
Current consumption	$I_{OP}$	45 mA Max.		28 mA Max.	No load condition, Max. frequency range	
Output disable current	$I_{OE}$	30 mA Max.		16 mA Max.	OE = GND (PT, PH, PC)	
Standby current	$I_{ST}$	50 $\mu$ A Max.			ST = GND (ST, SH, SC)	
Duty *1	$t_w / t$	-			40 % to 60 %	CMOS load: 1/2 $V_{DD}$ level
		40 % to 60 %			-	TTL load: 1.4 V level
High output voltage	$V_{OH}$	$V_{DD} - 0.4$ V Min.			$I_{OH} = -16$ mA (PT / ST, PH / SH), -8 mA (PC / SC)	
Low output voltage	$V_{OL}$	0.4 V Max.			$I_{OL} = 16$ mA (PT / ST, PH / SH), 8 mA (PC / SC)	
Output load *1 condition (fan out)	TTL	N	5 TTL Max.	-	Max. frequency and Max. operating voltage range	
	CMOS	CL	15 pF Max.	25 pF Max.      15 pF Max.		
Output enable / disable input voltage	$V_{IH}$	2.0 V Min.		0.7 $V_{DD}$ Min.	ST, OE terminal	
	$V_{IL}$	0.8 V Max.		0.2 $V_{DD}$ Max.		
Output rise time *1	CMOS level	$t_r$	-		4 ns Max.	CMOS load: 20 % $\rightarrow$ 80 % $V_{DD}$
	TTL level		4 ns Max.	-		TTL load: 0.4 V $\rightarrow$ 2.4 V
Output fall time *1	CMOS level	$t_f$	-		4 ns Max.	CMOS load: 80 % $\rightarrow$ 20 % $V_{DD}$
	TTL level		4 ns Max.	-		TTL load: 2.4 V $\rightarrow$ 0.4 V
Oscillation start up time	$t_{OSC}$	10 ms Max.			Time at minimum operating voltage to be 0 s	
Aging	$f_a$	$\pm 5 \times 10^{-6}$ / year Max.			$T_a = +25$ °C, $V_{DD} = 5.0$ V / 3.3 V, First year	
Shock resistance	S.R.	$\pm 20 \times 10^{-6}$ Max.			Three drops on a hard board from 750 mm or excitation test with 29400 m/s <sup>2</sup> x 0.3 ms x 1/2sine wave in 3 directions	

\*1 Operating temperature (-40 °C to +85 °C), the available frequency, duty and output load conditions, please refer to page 50, 51.

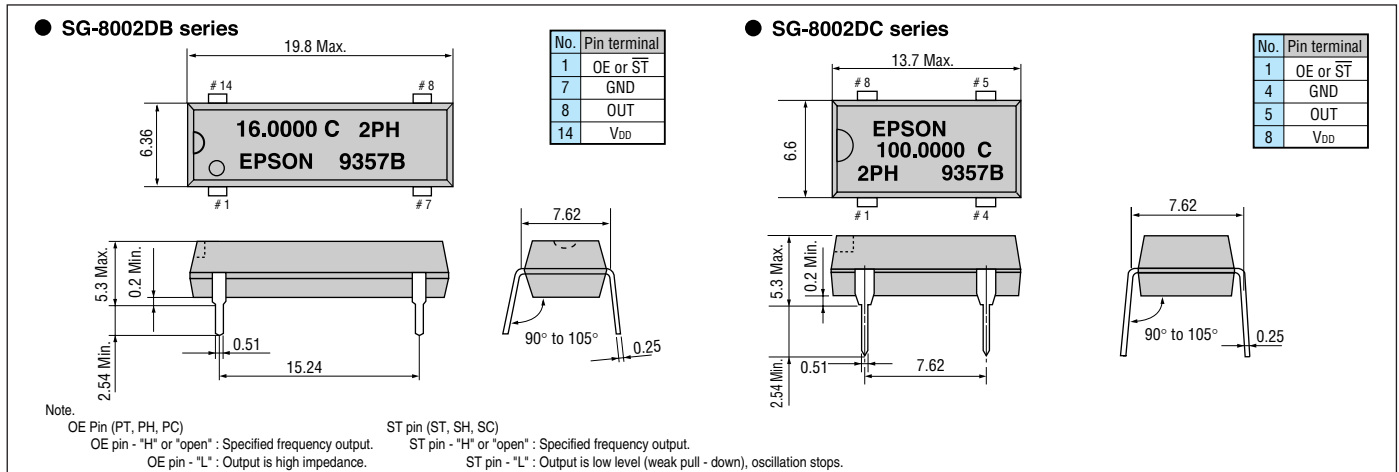
\*2 PLL - PLL connection & Jitter specification, please refer to page 52.

Checking possible by the Frequency Checking Program.

<http://www.epsondevice.com/domcfg.nsf>

## External dimensions

(Unit: mm)







# PLL oscillator (SG-8002 series and HG-8002 series)

## ■ PLL-PLL connection

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

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

## ■ Remarks on noise management for power supply line

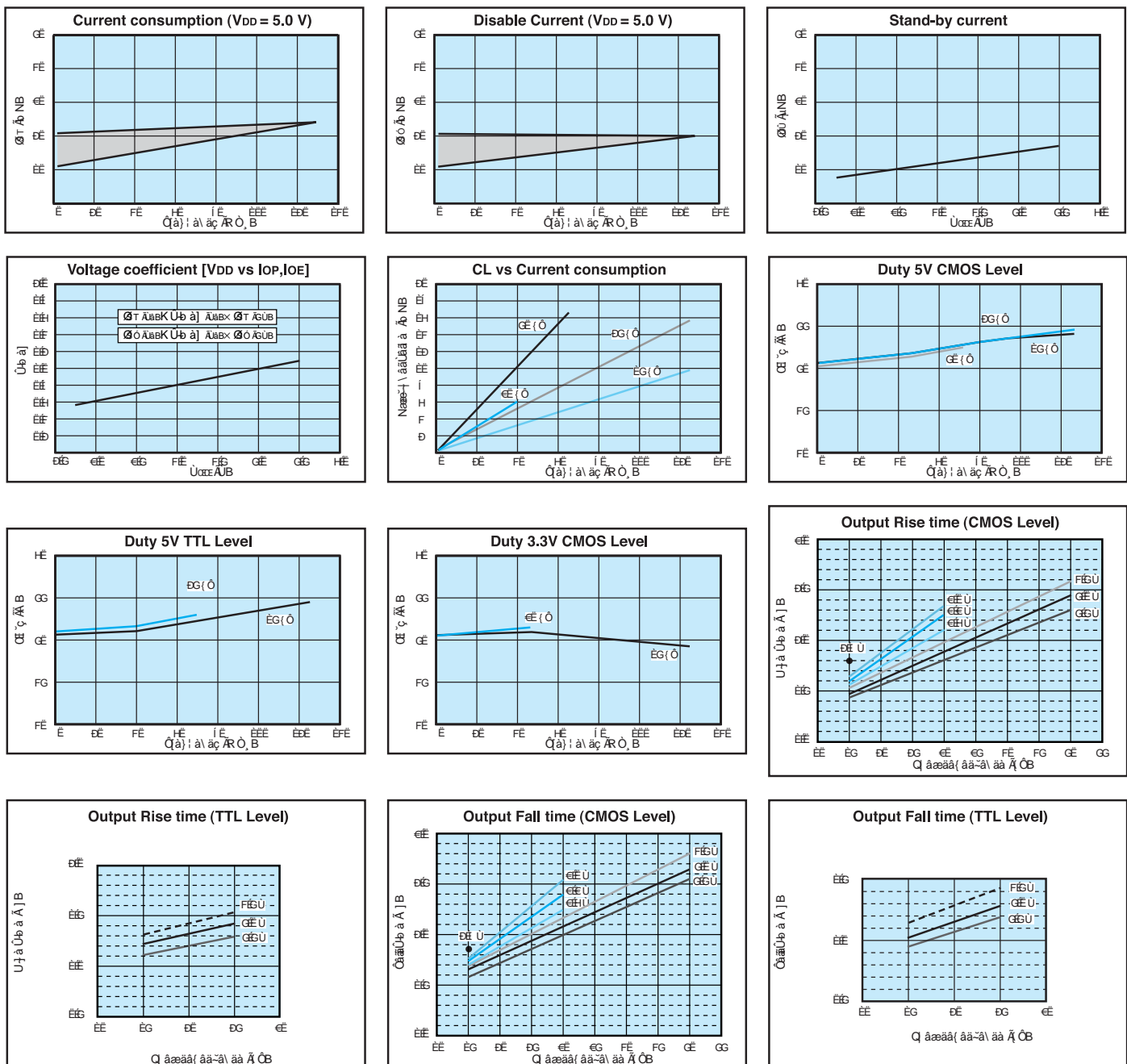
We recommend not to insert the filter and/or other devices in the power supply line as the countermeasure of EMI noise reduction. This device insertion might cause high-frequency impedance high in the power supply line and it affects oscillator stable drive.

When this measure is required, please evaluate the circuitry and device behaviour in the circuit and verify that it won't affect oscillation. And start-up time (0% VDD to 90% VDD) of power source should be more than 150 μs.

## ■ Jitter Specifications

Model	Operating Voltage	Jitter Item	Specifications	Remarks
PT / PH ST / SH	5 V ±0.5 V	Cycle to cycle	150 ps Max.	33 MHz ≤ f <sub>o</sub> ≤ 125 MHz, C <sub>L</sub> = 15 pF
			200 ps Max.	1.0 MHz ≤ f <sub>o</sub> < 33 MHz, C <sub>L</sub> = 15 pF
		Peak to peak	200 ps Max.	33 MHz ≤ f <sub>o</sub> ≤ 125 MHz, C <sub>L</sub> = 15 pF
			250 ps Max.	1.0 MHz ≤ f <sub>o</sub> < 33 MHz, C <sub>L</sub> = 15 pF
SC / PC	3.3 V ±0.3 V	Cycle to cycle	200 ps Max.	1.0 MHz ≤ f <sub>o</sub> ≤ 125 MHz, C <sub>L</sub> = 15 pF
		Peak to peak	250 ps Max.	1.0 MHz ≤ f <sub>o</sub> ≤ 125 MHz, C <sub>L</sub> = 15 pF

## ■ SG-8002 series Characteristics chart



FOR SG-8002 SERIES PROGRAMMING TOOL

# SG-WRITER

Product number

**Q91PR20W0101000**

- Easy frequency program for EPSON SG-8002 series oscillator (Blank oscillator).
- Free power supply for USB accommodate.
- Flexible PC accommodate. Windows 98SE, 2000, Me, XP (Except Windows 95, NT)
- Small body and easy carry.



## ■ Main Body Specifications

Name (Product Number)	SG-Writer for EPSON SG-8002 Series (Q91PR20W0101000)
Operating Temperature	+10 °C to +40 °C Writing (25 °C ±5 °C)
Electric Power Supply	Via USB
Standard Interface	USB Type B
External Dimensions (mm)	160 x 110 x 36 (textool top)
Wight	700 g
Accessories	SG-Writer CD-ROM (Software and Instruction Manual : Japanese, English) Documents : Japanese, English
Software, Driver	SG-Writer *1 EPSON USB Driver
Option Parts	SMD socket (JA, JC, CA, JF, CE, LA and LB type)

\*1 SG-Writer software is available only from Epson website after user registration. [http://www.epsondevice.com/qd\\_e/SG-8002CS](http://www.epsondevice.com/qd_e/SG-8002CS)

## ■ Recommend PC Specifications (Need connect PC and SG-Wrier when you Writing.)

Accommodate OS	Windows XP, Windows Me, Windows 2000, Windows 98SE (Except Windows 95, NT)
Recommend CPU	Pentium Processor 200MHz equivalent and higher
Recommend memory Capacity	Recommend Over 64MB
Recommend HDD Capacity	Need Over 40MB
Other	CD-ROM drive, USB cable (Type A ↔ Type B) Need SMD *2 socket when you write SG-8002 SMD products. (Sold individually)

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



PROGRAMMABLE HIGH-FREQUENCY CRYSTAL OSCILLATOR WITH SPREAD SPECTRUM

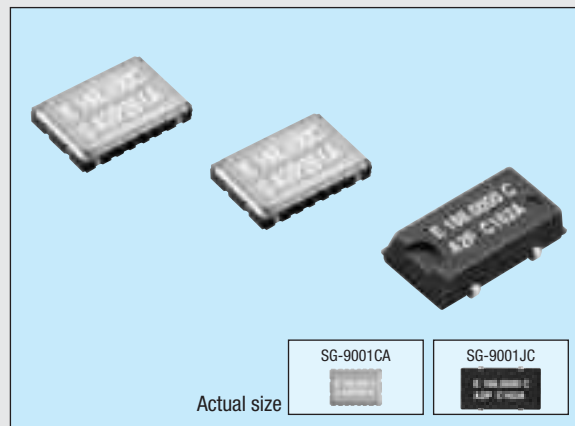
# SG-9001CA/JC

Product number (please refer to page 2)

Q3331x0xxxxxx00

Q3331x1xxxxxx00

- Output frequency is selectable from 10 MHz to 166 MHz.
- Range of spreading percentage is selectable by program (Center or Down spread, 6 Values)
- Reflowable and high density mounting type SMD package.
- Operable 3.3 V.
- Output enable (OE) function allows more low current consumption.
- Optimized Spread Spectrum profile.
- Available for lead (Pb)-free soldering.
- Lead (Pb)-free terminal product. (SG-9001JC)
- Complete lead (Pb)-free product. (SG-9001CA)



## Specifications (characteristics)

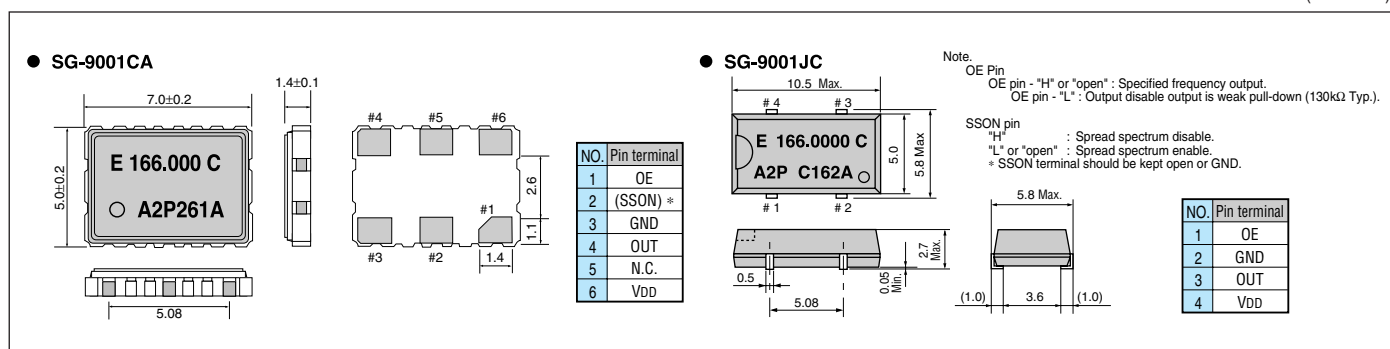
Item	Symbol	Specifications	Remarks	
Output frequency range	fo	10.0000 MHz to 166.0000 MHz	Please contact us for inquiries about the available frequency	
Power source voltage	Max. supply voltage	VDD-GND	-0.5 V to +7.0 V	
	Operating voltage	VDD	3.3 ±0.3 V	
Temperature range	Storage temperature	TSTG	-55 °C to +100 °C -40 °C to +125 °C	SG-9001JC SG-9001CA
	Operating temperature	TOPR	-20 °C to +70 °C	Stored as bare product after unpacking
Current consumption	Iop	30 mA Max.	No load condition, Max. frequency range.	
Output disable current	Ioe	20 mA Max.	OE = GND, Max. frequency range	
Duty	tw/t	45 % to 55 %	50 % VDD, CL = 15 pF	
High output voltage	VOH	VDD -0.4 V Min.	Ioh = -8 mA	
Low output voltage	VOL	0.4 V Max.	Iol = 8 mA	
Output load condition (fan out)	CMOS	15 pF Max.		
Output enable / disable input voltage	VIH	0.7 VDD Min.	Max. frequency and Max. operating voltage range	
	VIL	0.3 VDD Max.	OE terminal	
Output rise time	CMOS level	tr	2.7 ns Max.	CMOS load: 20 %→80 % VDD, CL = 15 pF
Output fall time	CMOS level	tf	2.7 ns Max.	CMOS load: 80 %→20 % VDD, CL = 15 pF
Oscillation start up time	tosc	10 ms Max.	Time at minimum operating voltage to be 0 s	
Aging	fa	±5 x 10 <sup>-6</sup> / year Max.	Ta = +25 °C First year	

## Spread Spectrum Specifications

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

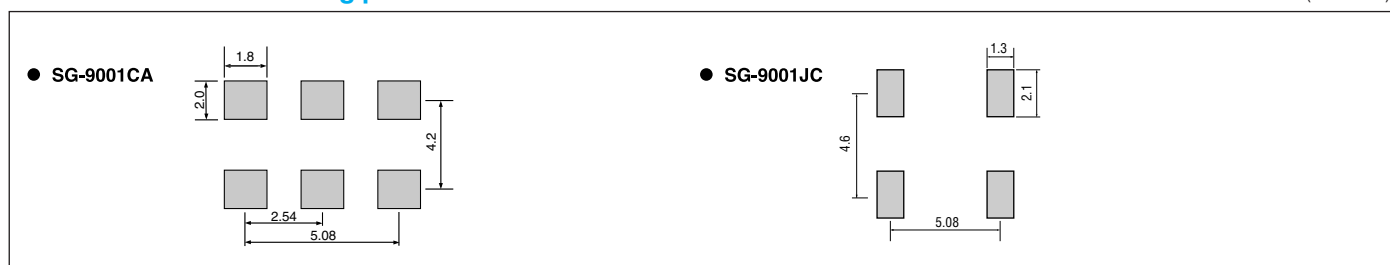
## External dimensions

(Unit: mm)



## Recommended soldering pattern

(Unit: mm)



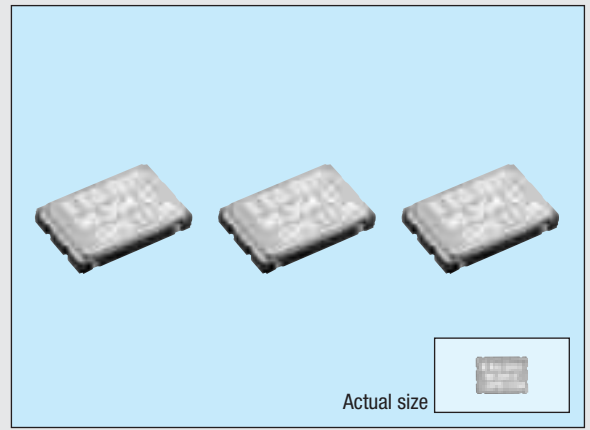
LOW-JITTER HIGH FREQUENCY CRYSTAL OSCILLATOR

# EG-2011CA

Product number (please refer to page 3)

**Q3808CA0xxxxx00**

- 1.8 V Operating voltage CMOS output.
- Generates high frequency clock with fundamental mode.
- Very low jitter and low phase noise.
- Ceramic package with 1.3 mm Typ. thickness.
- Excellent environmental capability.
- Low current consumption due to use of CMOS technology.
- Available for lead (Pb)-free soldering.
- Complete lead (Pb)-free product.



## Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Output frequency range	fo	62.5000 MHz to 170.0000 MHz	Please contact us for inquiries about the available frequency
Power source voltage	Max. supply voltage	VDD-GND	-0.5 V to +4.0 V
	Operating voltage	VDD	1.8 V Typ.
Temperature range	Storage temperature	TSTG	-40 °C to +100 °C
	Operating temperature	TOPR	P: 0 °C to +70 °C, R: -5 °C to +85 °C
Frequency stability	Δf/fo	G: ±50 x 10 <sup>-6</sup> , H: ±100 x 10 <sup>-6</sup>	P: 0 °C to +70 °C, R: -5 °C to +85 °C *1
Current consumption	I <sub>DD</sub>	15 mA Typ.	C <sub>L</sub> = 15 pF, OE = V <sub>DD</sub>
Output disable current	I <sub>OE</sub>	0.4 mA Max.	OE = GND
Duty	tw/ t	45 % to 55 %	fo ≤ 125 MHz, V <sub>TH</sub> = 1/2 V <sub>DD</sub>
		40 % to 60 %	fo > 125 MHz, V <sub>TH</sub> = 1/2 V <sub>DD</sub>
Output voltage	V <sub>OH</sub>	V <sub>DD</sub> - 0.35 V Min.	I <sub>OH</sub> = -8 mA
	V <sub>OL</sub>	0.35 V Max.	I <sub>OL</sub> = 8 mA
Output load condition (fan out)	C <sub>L</sub>	15 pF Max.	
Output enable disable input voltage	V <sub>IH</sub>	0.7 V <sub>DD</sub> Min.	
	V <sub>IL</sub>	0.3 V <sub>DD</sub> Max.	
Output rise time	t <sub>r</sub>	2 ns Max.	20 % → 80 % V <sub>DD</sub> , C <sub>L</sub> ≤ 15 pF
Output fall time	t <sub>f</sub>	2 ns Max.	80 % → 20 % V <sub>DD</sub> , C <sub>L</sub> ≤ 15 pF
Oscillation start up time	t <sub>OSC</sub>	10 ms Max.	Time at 1.7 V to be 0 s
Jitter *4	t <sub>DJ</sub>	0.2 ps Typ.	Deterministic Jitter
	t <sub>RJ</sub>	3 ps Typ.	Random Jitter
	t <sub>RMS</sub>	3 ps Typ.	σ (RMS of total distribution)
	t <sub>p-p</sub>	25 ps Typ.	Peak to Peak
	t <sub>acc</sub>	4 ps Typ.	n = 2 to 50000 cycles
Phase Jitter	t <sub>PJ</sub>	0.05 x 10 <sup>-3</sup> UI Typ.	offset frequency: 12 kHz to 20 MHz
		1 ps Max.	

\*1 As per below table.

Operating voltage		1.8 V	
Details of frequency stability *2		A	N
Frequency stability	HP : ±100 x 10 <sup>-6</sup> (0 °C to +70 °C)	CHPA	CHPN
	HR : ±100 x 10 <sup>-6</sup> (-5 °C to +85 °C)	CHRA	CHRN
	GP : ±50 x 10 <sup>-6</sup> (0 °C to +70 °C)	-	CGPN
	GR : ±50 x 10 <sup>-6</sup> (-5 °C to +85 °C)	-	CGRN *3

\*2 A : This includes initial frequency tolerance, temperature variation, supply voltage variation, load variation, reflow drift, and 10 years aging.

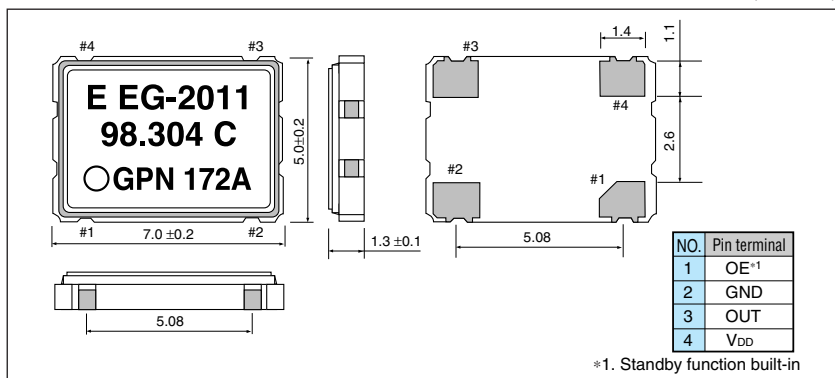
N : This includes initial frequency tolerance, temperature variation, supply voltage variation, load variation, and reflow drift.

\*3 Please contact us for inquiries.

\*4 Based on DTS-2075 Digital timing system made from WAVECREST with jitter analysis software VISI6.

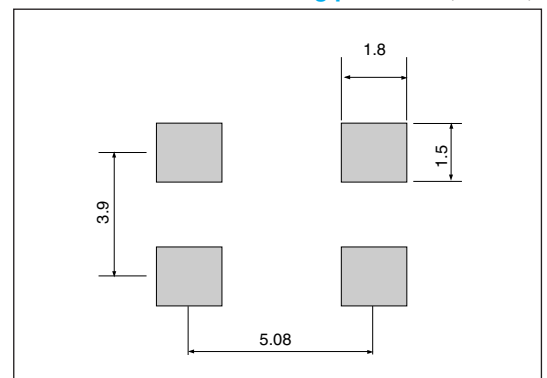
## External dimensions

(Unit: mm)



## Recommended soldering pattern

(Unit: mm)



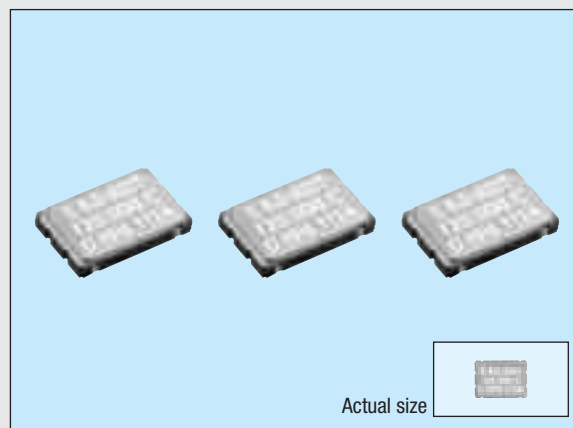
## LOW JITTER HIGH FREQUENCY CRYSTAL OSCILLATOR

**EG-2021CA**

Product number (please refer to page 3)

**Q3807CA0xxxxx00**

- 2.5 V operating voltage, CMOS output.
- Generates high frequency clock with fundamental mode.
- Very low jitter and low phase noise.
- Ceramic package with 1.3 mm Typ. thickness.
- Excellent shock resistance and environmental capability.
- Provided with output enable function (OE).
- Available for lead (Pb)-free soldering.
- Complete lead (Pb)-free product.



## ■ Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Output frequency range	fo	62.5000 MHz to 170.0000 MHz	Please contact us for inquiries about the available frequency
Power source voltage	Max. supply voltage	VDD-GND	-0.5 V to +4.0 V
	Operating voltage	VDD	2.5 V ± 0.125 V
Temperature range	Storage temperature	TSTG	-40 °C to +100 °C
	Operating temperature	TOPR	P : 0 °C to +70 °C, R : -5 °C to +85 °C
Frequency stability	Δf/fo	G : ±50 x 10 <sup>-6</sup> , H : ±100 x 10 <sup>-6</sup>	P: 0 °C to +70 °C, R: -5 °C to +85 °C *1
Current consumption	I <sub>DD</sub>	20 mA Typ.	OE = VDD, CL = 15 pF
Output disable current	I <sub>OE</sub>	0.6 mA Max.	OE = GND
Duty	tw/ t	45 % to 55 %	V <sub>TH</sub> = 50% VDD, CL ≤ 15 pF
Output voltage	V <sub>OH</sub>	VDD-0.4 V Min.	I <sub>OH</sub> = -8 mA
	V <sub>OL</sub>	0.4 V Max.	I <sub>OL</sub> = 8 mA
Output load condition (fan out)	CL	15 pF Max.	
Output enable disable input voltage	V <sub>IH</sub>	0.7 VDD Min.	
	V <sub>IL</sub>	0.3 VDD Max.	
Output rise time	t <sub>r</sub>	2.0 ns Max.	20 % → 80 % VDD, CL ≤ 15 pF
Output fall time	t <sub>f</sub>	2.0 ns Max.	80 % → 20 % VDD, CL ≤ 15 pF
Oscillation start up time	t <sub>OSC</sub>	10 ms Max.	Time at 2.375 V to be 0 s
Jitter *4	t <sub>DJ</sub>	0.2 ps Typ.	Deterministic Jitter
	t <sub>RJ</sub>	3 ps Typ.	Random Jitter
	t <sub>RMS</sub>	3 ps Typ.	σ (RMS of total distribution)
	t <sub>p-p</sub>	25 ps Typ.	Peak to Peak
	t <sub>acc</sub>	4 ps Typ.	Accumulated Jitter (σ) n = 2 to 50000 cycles
Phase Jitter	t <sub>PJ</sub>	0.05 x 10 <sup>-3</sup> UI Typ.	offset frequency: 12 kHz to 20 MHz
		1 ps Max.	

\*1 As per below table

Operating voltage		2.5 V	
Frequency range (MHz)		62.5 to 170	
Details of frequency stability *2		A	N
Frequency stability	HP : ±100 x 10 <sup>-6</sup> (0 °C to +70 °C)	CHPA	CHPN
	HR : ±100 x 10 <sup>-6</sup> (-5 °C to +85 °C)	CHRA	CHRN
	GP : ±50 x 10 <sup>-6</sup> (0 °C to +70 °C)	-	CGPN
	GR : ±50 x 10 <sup>-6</sup> (-5 °C to +85 °C)	-	CGRN *3

\*2 A : This includes initial frequency tolerance, temperature variation, supply voltage variation, load variation, reflow drift, and 10 years aging.

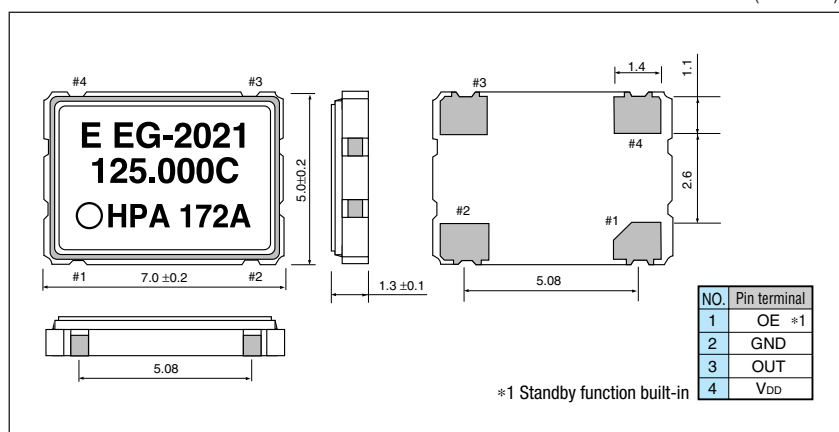
N : This includes initial frequency tolerance, temperature variation, supply voltage variation, load variation, and reflow drift.

\*3 Please contact us for inquiries.

\*4 Based on DTS-2075 Digital timing system made from WAVECREST with jitter analysis software VISI6.

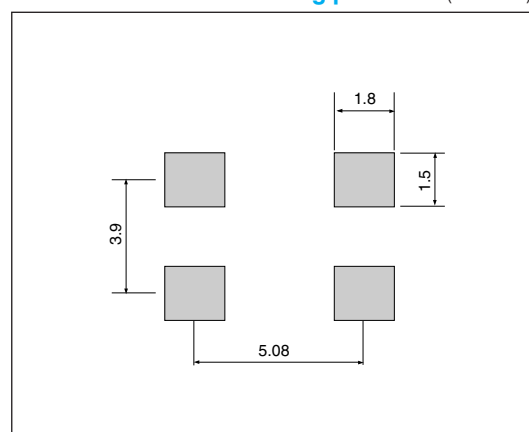
## ■ External dimensions

(Unit: mm)



## ■ Recommended soldering pattern

(Unit: mm)



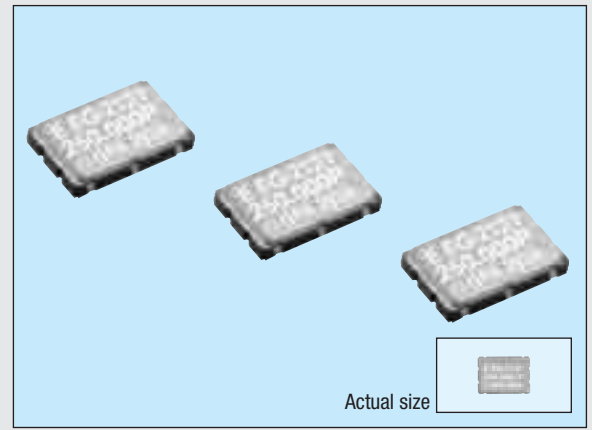
LOW JITTER HIGH FREQUENCY CRYSTAL OSCILLATOR

# EG-2121CA

Product number (please refer to page 3)

**Q3805CAxxxxxx00**

- 2.5 V operating voltage, Differential LV-PECL output / LVDS output.
- Generates high frequency clock with fundamental mode
- Very low jitter and low phase noise.
- Ceramic package with 1.3 mm Typ. thickness.
- Excellent shock resistance and environmental capability.
- Provided with output enable function (OE).
- Available for lead (Pb)-free soldering.
- Complete lead (Pb)-free product.



## Specifications (characteristics)

Item	Symbol	Specifications		Remarks
		LV-PECL	LVDS	
Output frequency range	fo	53.125 MHz to 500.0000 MHz	53.125 MHz to 700.0000 MHz	Please contact us for inquiries about the available frequency
Power source voltage	Max. supply voltage	Vcc-GND -0.5 V to +4.0 V		
	Operating voltage	Vcc 2.5 V ±0.125 V		
Temperature range	Storage temperature	TSTG -40 °C to +100 °C		Stored as bare product after unpacking
	Operating temperature	TOPR P: 0 °C to +70 °C, R: -5 °C to +85 °C		
Frequency stability	Δf/fo	G : ±50 x 10 <sup>-6</sup> , R : ±100 x 10 <sup>-6</sup>		P: 0 °C to +70 °C, R: -5 °C to +85 °C *1
Current consumption	Icc	80 mA Max.	30 mA Max.	OE = Vcc
Output disable current	Ioe	20 mA Max.		OE = GND
Duty	tw/ t	P: 40 % to 60 %	L: 40 % to 60 %	> 350 MHz
		P: 45 % to 55 %	L: 45 % to 55 %	53.125 to 350 MHz
		D: 48 % to 52 %	V: 48 % to 52 %	< 175 MHz
Output voltage	VoH	1.55 V Typ. Vcc - 1.025 to Vcc - 0.88	-	DC characteristics
	VoL	0.8 V Typ. Vcc - 1.81 to Vcc - 1.62	-	
	VoD	-	350 mV Typ. 247 mV to 454 mV	Differential output, DC characteristics
	ΔVoD	-	50 mV	Output change, DC characteristics
	Vos	-	1.25 V Typ. 1.125 V to 1.375 V	Offset
Output load condition (fan out)	RL	50 Ω	100 Ω	Offset change
				LV-PECL: Terminated to Vcc -2.0 V / LVDS: Connected between OUT - OUT
Output enable	VIH	0.7 Vcc Min.		OE
disable input voltage	ViL	0.3 Vcc Max.		OE
Output rise time	tr	400 ps Max.		LV-PECL: 20 % → 80 % of (VoH - VoL) / LVDS: 20 % → 80 % of (Voo x 2)
Output fall time	tf	400 ps Max.		LV-PECL: 80 % → 20 % of (VoH - VoL) / LVDS: 80 % → 20 % of (Voo x 2)
Oscillation start up time	tosc	10 ms Max.		Time at 2.375 V to be 0 s
Jitter *4	tDJ	0.2 ps Typ.		Deterministic Jitter
	trJ	3 ps Typ.		Random Jitter
	tRMS	3 ps Typ.		σ (RMS of total distribution)
	tP-P	25 ps Typ.		Peak to Peak
	tacc	4 ps Typ.		Accumulated Jitter(s) n = 2 to 50000 cycles
Phase Jitter	tPJ	0.05 x 10 <sup>-3</sup> UI Typ.		offset frequency: 12 kHz to 20 MHz
		1 ps Max.		

\*1 As per below table.

Frequency range (MHz)	53.125 MHz to 700 MHz		53.125 MHz to 175 MHz		53.125 MHz to 700 MHz		53.125 MHz to 175 MHz		
Output mode	P : PECL Duty ±5 %		P : PECL Duty ±2 %		L : LVDS Duty ± 5%		L : LVDS Duty ± 2%		
Frequency stability	Details of frequency stability *2		A	N	A	N	A	N	
	HP : ±100 x 10 <sup>-6</sup> (0 °C to +70 °C)	PHPA	PHPN	DHPA	DHPN	LHPA	LHPN	VHPA	VHPN
	HR : ±100 x 10 <sup>-6</sup> (-5 °C to +85 °C)	PHRA *3	PHRN *3	DHRA *3	DHRN *3	LHRA *3	LHRN *3	VHRA *3	VHRN *3
	GP : ±50 x 10 <sup>-6</sup> (0 °C to +70 °C)	PGPA *3	PGPN *3	DGPA *3	DGPN *3	LGPA *3	LGPN *3	VGPA *3	VGPN *3
GR : ±50 x 10 <sup>-6</sup> (-5 °C to +85 °C)	-	PGRN *3	-	DGRN *3	-	LGRN *3	-	VGRN *3	

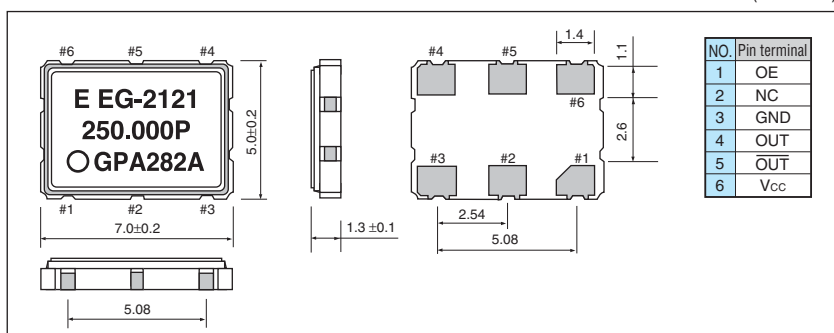
\*2 A : This includes initial frequency tolerance, temperature variation, supply voltage variation, reflow drift, and 10 years aging.

N : This includes initial frequency tolerance, temperature variation, supply voltage variation, and reflow drift.

\*3 53.125 MHz ≤ fo < 100 MHz : Unavailable \*4 Based on DTS-2075 Digital timing system made from WAVECREST with jitter analysis software VISI6.

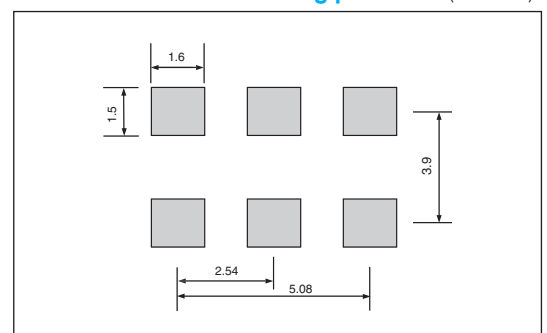
## External dimensions

(Unit: mm)



## Recommended soldering pattern

(Unit: mm)



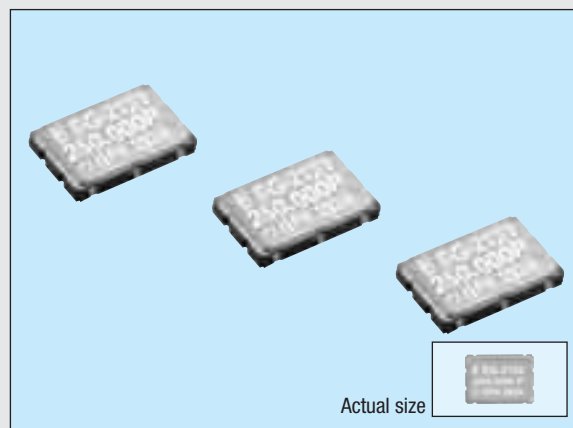
## LOW JITTER HIGH FREQUENCY CRYSTAL OSCILLATOR

## EG-2102CA

Product number (please refer to page 3)

Q3806CAxxxxxx00

- 3.3 V operating voltage, Differential LV-PECL output / LVDS output.
- Generates high frequency clock with fundamental mode
- Very low jitter and low phase noise.
- Ceramic package with 1.3 mm Typ. thickness.
- Excellent shock resistance and environmental capability.
- Provided with output enable function (OE).
- Available for lead (Pb)-free soldering.
- Complete lead (Pb)-free product.



## Specifications (characteristics)

Item	Symbol	Specifications		Remarks
		LV-PECL	LVDS	
Output frequency range	fo	100.0000 MHz to 700.0000 MHz	53.125 MHz to 700.0000 MHz	Please contact us for inquiries about the available frequency
Power source voltage	Max. supply voltage	Vcc-GND -0.5 V to +4.0 V		
	Operating voltage	Vcc 3.3 V ±0.3 V		
Temperature range	Storage temperature	Tstg -40 °C to +100 °C		Stored as bare product after unpacking
	Operating temperature	Topr P: 0 °C to +70 °C, R: -5 °C to +85 °C		
Frequency stability	Δf/fo	G: ±50 × 10 <sup>-6</sup> , H: ±100 × 10 <sup>-6</sup>		P: 0 °C to +70 °C, R: -5 °C to +85 °C *1
Current consumption	Iop	100 mA Max.	45 mA Max.	OE = Vcc
Output disable current	Ioe	32 mA Max.	30 mA Max.	OE = GND
Duty	tw/ t	—	L: 40 % to 60 %	LVDS : > 350 MHz
		P: 45 % to 55 %	L: 45 % to 55 %	LV-PECL : 100 MHz to 700 MHz LVDS : 53.125 MHz to 350 MHz
		D: 48 % to 52 %	V: 48 % to 52 %	LV-PECL : < 350 MHz / LVDS : ≤ 175 MHz
Output voltage	VoH	2.35 V Typ. Vcc - 1.025 to Vcc - 0.88	—	DC characteristics
	VoL	1.6 V Typ. Vcc - 1.81 to Vcc - 1.62	—	
	VoD	—	350 mV Typ. 247 mV to 454 mV	Differential output, DC characteristics
	ΔVoD	—	50 mV	Output change, DC characteristics
	Vos	—	1.25 V Typ. 1.125 V to 1.375 V	Offset
Output load condition (fan out)	RL	50 Ω	100 Ω	Offset change
				LV-PECL: Terminated to Vcc - 2.0 V / LVDS: Connected between OUT - OUT
Output enable	VIH	0.7 Vcc Min.		OE
disable input voltage	VIL	0.3 Vcc Max.		OE
Output rise time	tr	400 ps Max.	600 ps Max.	LV-PECL: 20 % → 80 % of (VoH - VoL) / LVDS: 20 % → 80 % of (VoD x 2)
Output fall time	tf	400 ps Max.	600 ps Max.	LV-PECL: 80 % → 20 % of (VoH - VoL) / LVDS: 80 % → 20 % of (VoD x 2)
Oscillation start up time	tosc	10 ms Max.		Time at 3.0 V to be 0 s
Jitter *4	tDJ	0.2 ps Typ.		Deterministic Jitter
	trj	3 ps Typ.		Random Jitter
	trms	3 ps Typ.		σ (RMS of total distribution)
	tp-p	25 ps Typ.		Peak to Peak
	tacc	4 ps Typ.		Accumulated Jitter(s) n = 2 to 50000 cycles
Phase Jitter	tpj	0.05 × 10 <sup>-3</sup> UI Typ.		offset frequency : 12 kHz to 20 MHz
		1 ps Max.		

\*1 As per below table.

Frequency range (MHz)	100 MHz to 700 MHz		100 MHz to 350 MHz		53.125 MHz to 700 MHz		53.125 MHz to 175 MHz	
Output mode	P : PECL Duty ±5 %		D : PECL Duty ±2 %		L : LVDS Duty ±5 %		V : LVDS Duty ±2 %	
Details of frequency stability *2	A	N	A	N	A	N	A	N
HP : ±100 × 10 <sup>-6</sup> (0 °C to +70 °C)	PHPA	PHPN	DHPA	DHPN	LHPA	LHPN	VHPA	VHPN
HR : ±100 × 10 <sup>-6</sup> (-5 °C to +85 °C)	PHRA	PHRN	DHRA	DHRN	LHRA *3	LHRN *3	VHRA *3	VHRN *3
GP : ±50 × 10 <sup>-6</sup> (0 °C to +70 °C)	PGPA	PGPN	DGPA	DGPN	LGPA *3	LGPN *3	VGPA *3	VGPN *3
GR : ±50 × 10 <sup>-6</sup> (-5 °C to +85 °C)	—	PGRN	—	DGRN	—	LGRN *3	—	VGRN *3

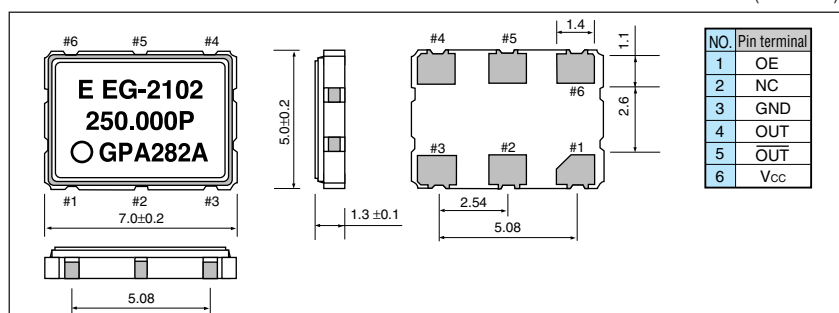
\*2 A : This includes initial frequency tolerance, temperature variation, supply voltage variation, reflow drift, and 10 years aging.

N : This includes initial frequency tolerance, temperature variation, supply voltage variation, and reflow drift.

\*3 53.125 MHz ≤ fo &lt; 100 MHz : Unavailable \*4 Based on DTS-2075 Digital timing system made from WAVECREST with jitter analysis software VISI6.

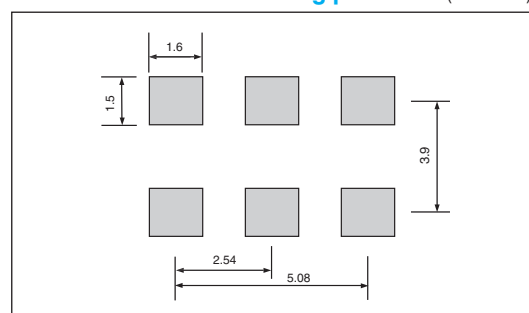
## External dimensions

(Unit: mm)



## Recommended soldering pattern

(Unit: mm)



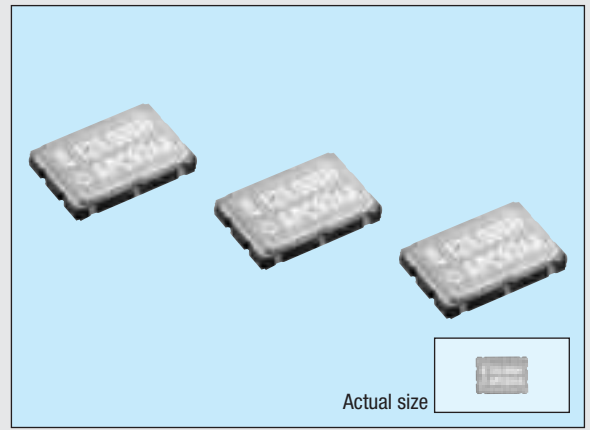
LOW JITTER HIGH FREQUENCY CRYSTAL OSCILLATOR

# EG-2101CA

Product number (please refer to page 3)

**Q3803CA0xxxxx00**

- 3.3 V operating voltage, Differential LV-PECL output.
- Generates high frequency clock with fundamental mode
- Very low jitter and low phase noise.
- Ceramic package with 1.3 mm Typ. thickness.
- Excellent shock resistance and environmental capability.
- Provided with output enable function (OE).
- Available for lead (Pb)-free soldering.
- Complete lead (Pb)-free product.



## Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Output frequency range	fo	62.5000 MHz to 400.000 MHz	Please contact us for inquiries about the available frequency
Power source voltage	Max. supply voltage	Vcc-GND	-0.5 V to +7.0 V
	Operating voltage	Vcc	C : 3.3 V±0.15 V
Temperature range	Storage temperature	TSTG	-40 °C to +100 °C
	Operating temperature	TOPR	0 °C to +70 °C
Frequency stability	Δf/fo	±50 x 10 <sup>-6</sup> , ±100 x 10 <sup>-6</sup>	0 °C to +70 °C *1
Current consumption	Iop	60 mA Max.	OE = Vcc
Output disable current	Ioe	25 mA Max.	OE = GND
Duty	tw/ t	P : 45 % to 55 %	PCH.PCY.PCZ
		D : 47.5 % to 52.5 % *3	DCH.DCY.DCZ
Output voltage	VoH	2.35 V Typ. Vcc -1.025 to Vcc -0.88	DC characteristics
	VoL	1.60 V Typ. Vcc -1.81 to Vcc -1.62	DC characteristics
Output load condition (fan out)	RL	50 Ω	Terminated to Vcc -2.0 V
Output enable	VIH	0.7 Vcc Min.	OE
disable input voltage	UIL	0.3 Vcc Max.	OE
Output rise time	tr	600 ps Max.	20 % → 80 % of (VoH - VoL)
Output fall time	tf	600 ps Max.	80 % → 20 % of (VoH - VoL)
Oscillation start up time	tosc	10 ms Max.	Time at 3.15 V to be 0 s
Jitter *2	tDJ	0.2 ps Typ.	Deterministic Jitter
	tRJ	3 ps Typ.	Random Jitter
	tRMS	3 ps Typ.	σ (RMS of total distribution)
	tP-P	25 ps Typ.	Peak to Peak
	tacc	4 ps Typ.	Accumulated Jitter(s) n = 2 to 50000 cycles
Phase Jitter	tPJ	0.05 x 10 <sup>-3</sup> UI Typ.	offset frequency: 12 kHz to 20 MHz
		1 ps Max.	

\*1 This includes initial frequency tolerance, temperature variation, supply voltage variation, reflow drift, and 10 years aging (As per below table).

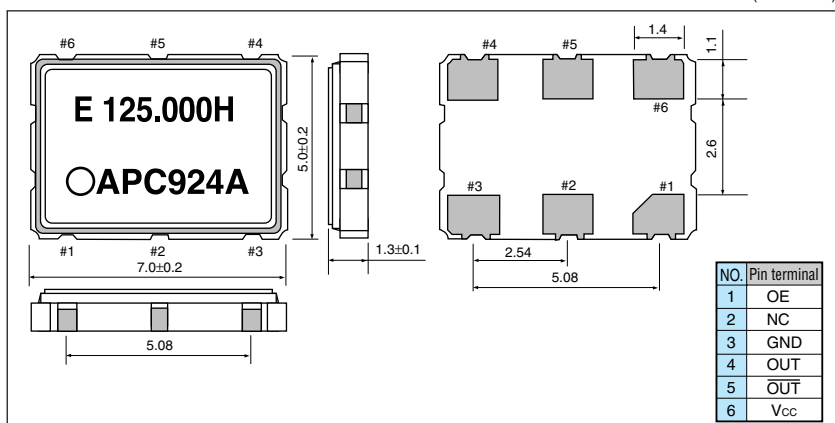
\*2 Based on DTS-2075 Digital timing system made from WAVECREST with jitter analysis software VISI6.

\*3 As per below table

Operating voltage		C : 3.3 V			
Output mode		P : Duty ± 5%		D : Duty ± 2.5%	
Frequency range (MHz)		62.5 to 318.75	318.751 to 400	62.5 to 159.375	159.376 to 200
Details of frequency stability	H : ±100 x 10 <sup>-6</sup> (0 °C to +70 °C)	PCH	-	DCH	-
	Y : ±100 x 10 <sup>-6</sup> (0 °C to +70 °C) except Aging	PCY	PCY	DCY	DCY
	Z : ±50 x 10 <sup>-6</sup> (0 °C to +70 °C) except Reflow drift, Supply voltage variation and Aging	PCZ	-	DCZ	-

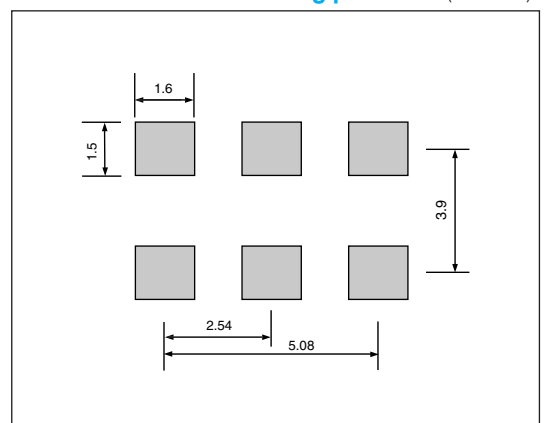
## External dimensions

(Unit: mm)



## Recommended soldering pattern

(Unit: mm)



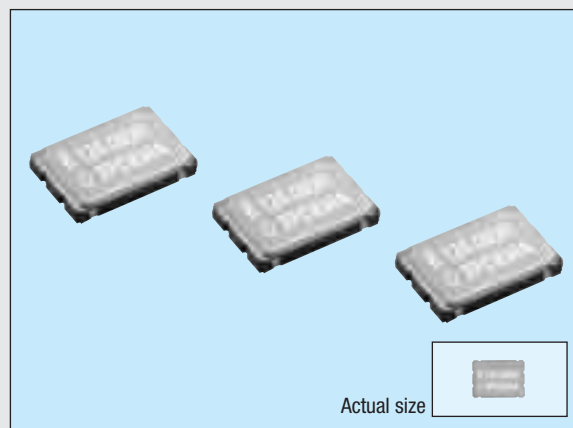
## LOW JITTER HIGH FREQUENCY CRYSTAL OSCILLATOR

## EG-2002CA

Product number (please refer to page 3)

Q3802CA0xxxxx00

- 3.3 V operating voltage, LV-TTL output.
- Generates high frequency clock with fundamental mode.
- Very low jitter and low phase noise.
- Ceramic package with 1.3 mm Typ. thickness.
- Excellent shock resistance and environmental capability.
- Provided with output enable function (OE).
- Available for lead (Pb)-free soldering.
- Complete lead (Pb)-free product.



## ■ Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Output frequency range	fo	62.5000 MHz to 170.0000 MHz	Please contact us for inquiries about the available frequency
Power source voltage	Max. supply voltage	VDD-GND	-0.5 V to +7.0 V
	Operating voltage	VDD	C : 3.3 V ±0.3 V
Temperature range	Storage temperature	TSTG	-40 °C to +100 °C
	Operating temperature	TOPR	0 °C to +70 °C
Frequency stability	Δf/fo	±50 x 10 <sup>-6</sup> , ±100 x 10 <sup>-6</sup>	0 °C to +70 °C *1
Current consumption	Iop	60 mA Max.	OE = VDD
Output disable current	Ioe	25 mA Max.	OE = GND
Duty	C-MOS level	tw/ t	45 % to 55 %
	TTL level		
Output voltage	VOH	2.4 V Min.	Ioh = -8 mA
	VOL	0.4 V Max.	Iol = 8 mA
Output load condition (fan out)	RL	25 pF Max.	fo = 62.5 MHz
		15 pF Max.	fo > 62.5 MHz
Output enable disable input voltage	VIH	0.7 VDD Min.	OE
	VIL	0.3 VDD Max.	OE
Output rise time	tr	1.5 ns Max.	0.8 V → 2.0 V, CL ≤ Max.
Output fall time	tf	1.5 ns Max.	2.0 V → 0.8 V, CL ≤ Max.
Oscillation start up time	tosc	10 ms Max.	Time at 3.0 V to be 0 s
Jitter *2	tDJ	0.2 ps Typ.	Deterministic Jitter
	tRJ	3 ps Typ.	Random Jitter
	tRMS	3 ps Typ.	σ (RMS of total distribution)
	tP-P	25 ps Typ.	Peak to Peak
	tacc	4 ps Typ.	Accumulated Jitter(s) n = 2 to 50000 cycles
Phase Jitter	tPJ	0.05 x 10 <sup>-3</sup> UI Typ.	offset frequency: 12 kHz to 20 MHz
		1 ps Max.	

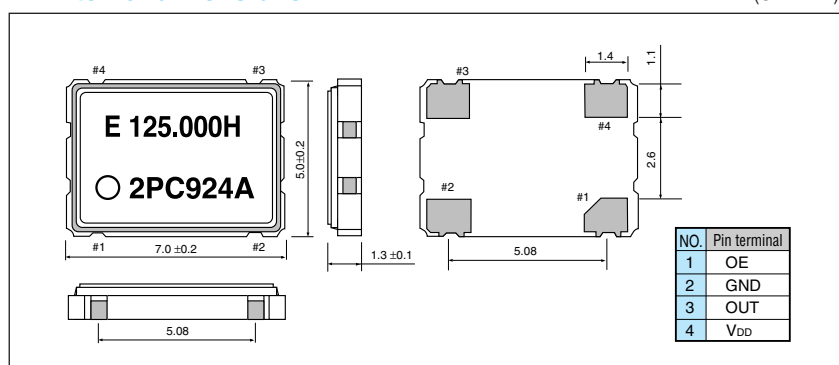
\*1 This includes initial frequency tolerance, temperature variation, supply voltage variation, load variation, reflow drift, and 10 years aging (As per below table).

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

Operating voltage		C : 3.3 V	
Frequency range (MHz)		P: 125 to 170	D: 62.5 to 124.9999
Details of frequency stability	H : ±100 x 10 <sup>-6</sup> (0 °C to +70 °C)	PCH	DCH
	Y : ±100 x 10 <sup>-6</sup> (0 °C to +70 °C) except Aging	PCY	DCY
	Z : ±50 x 10 <sup>-6</sup> (0 °C to +70 °C) except Reflow drift, Supply voltage variation, load variation and Aging	PCZ	DCZ
	F : ±50 x 10 <sup>-6</sup> (0 °C to +70 °C) except Aging	PCF	-

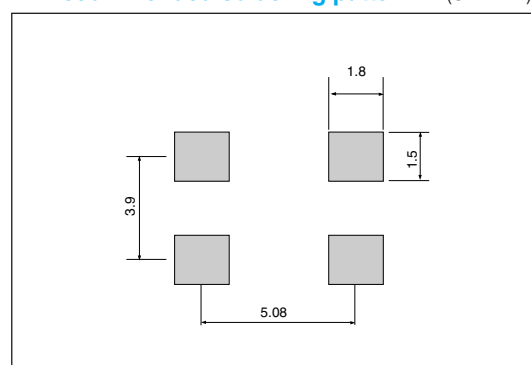
## ■ External dimensions

(Unit: mm)



## ■ Recommended soldering pattern

(Unit: mm)



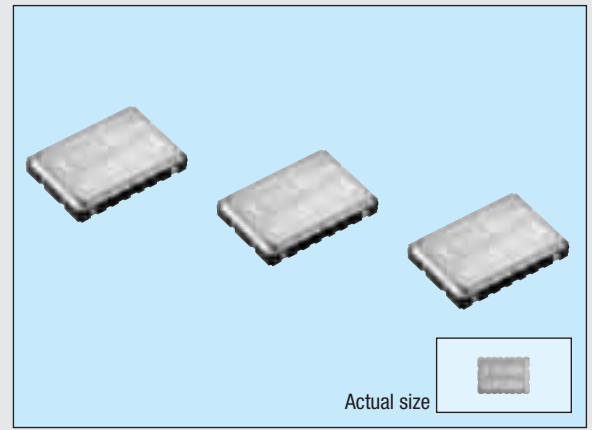
LOW-JITTER HIGH FREQUENCY CRYSTAL OSCILLATOR

# EG-2001CA

Product number (please refer to page 3)

**Q3801CA0xxxxx00**

- 3.3 V operating voltage, CMOS output.
- Generates high frequency clock with fundamental mode.
- Very low jitter and low phase noise.
- Ceramic package with 1.3 mm Typ. thickness.
- Excellent environmental capability.
- Low current consumption due to use of CMOS technology.
- Available for lead (Pb)-free soldering.
- Complete lead (Pb)-free product.



## Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Output frequency range	fo	106.2500 MHz to 170.0000 MHz	Please contact us for inquiries about the available frequency
Power source voltage	Max. supply voltage	VDD-GND	-0.5 V to +7.0 V
	Operating voltage	VDD	3.3 V ±0.3 V
Temperature range	Storage temperature	TSTG	-40 °C to +100 °C
	Operating temperature	TOPR	0 °C to +70 °C
Frequency stability	Δf/fo	±50 x 10 <sup>-6</sup> , ±100 x 10 <sup>-6</sup>	0 °C to +70 °C *1
Current consumption	I <sub>DD</sub>	50 mA Max.	OE = VDD
Output disable current	I <sub>OE</sub>	10 μA Max.	OE = GND
Duty	C-MOS level	tw/ t	45 % to 55 %
	TTL level	tw/ t	40 % to 60 %
Output voltage	V <sub>OH</sub>	VDD -0.4 V Min.	I <sub>OH</sub> = -8 mA
	V <sub>OL</sub>	0.4 V Max.	I <sub>OL</sub> = 8 mA
Output load condition (fan out)	R <sub>L</sub>	25 pF Max.	fo ≤ 135.0000 MHz
		15 pF Max.	fo > 135.0000 MHz
Output enable disable input voltage	V <sub>IH</sub>	0.7 VDD Min.	OE
	V <sub>IL</sub>	0.3 VDD Max.	OE
Output rise time	C-MOS level	tr	2 ns Max.
	TTL level	tr	1.5 ns Max.
Output fall time	C-MOS level	tf	2 ns Max.
	TTL level	tf	1.5 ns Max.
Oscillation start up time	t <sub>OSC</sub>	10 ms Max.	Time at 3.0 V to be 0 s
Jitter *2	t <sub>DJ</sub>	0.2 ps Typ.	Deterministic Jitter
	t <sub>RJ</sub>	3 ps Typ.	Random Jitter
	t <sub>RMS</sub>	3 ps Typ.	σ (RMS of total distribution)
	t <sub>p-p</sub>	25 ps Typ.	Peak to Peak
	t <sub>acc</sub>	4 ps Typ.	Accumulated Jitter(s) n = 2 to 50000 cycles
	t <sub>PJ</sub>	0.05 x 10 <sup>-3</sup> UI Typ. 1 ps Max.	offset frequency: 12 kHz to 20 MHz

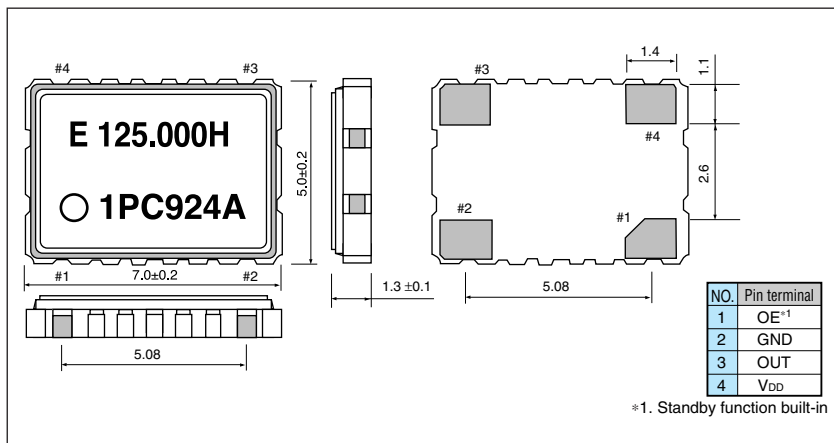
\*1 This includes initial frequency tolerance, temperature variation, supply voltage variation, load variation, reflow drift, and 10 years aging (As per below table).

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

Operating voltage	C : 3.3 V	
Output mode	P : Duty ±5 %	
Frequency stability	H : ±100 x 10 <sup>-6</sup> (0 °C to +70 °C)	PCH
	Y : ±100 x 10 <sup>-6</sup> (0 °C to +70 °C) except Aging	PCY
	Z : ±50 x 10 <sup>-6</sup> (0 °C to +70 °C) except Reflow drift, Supply voltage variation, load variation and Aging	PCZ

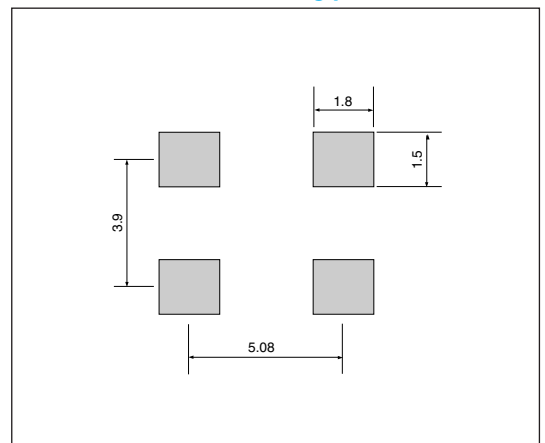
## External dimensions

(Unit: mm)



## Recommended soldering pattern

(Unit: mm)





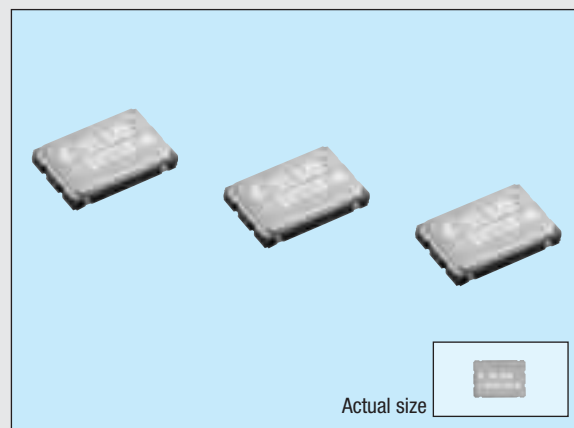
## HIGH-STABILITY HIGH-FREQUENCY OSCILLATOR

**HG-2150CA**

Product number (please refer to page 3)

**Q3514CA0xxxxx00**

- Reflowable and high density mounting type SMD.
- Using CMOS IC allows low current consumption.
- Operating supply voltage: 5.0 V (SVH / BXH), 3.3 V (SVC / BXC)
- Provided with output enable function (OE).
- Available for lead (Pb)-free soldering.
- Complete lead (Pb)-free product.



Actual size

## ■ Specifications (characteristics)

Item	Symbol	Specifications		Remarks
		SVH / BXH	SVC / BXC	
Output frequency range	$f_o$	1.0000 MHz to 80.0000 MHz		60 MHz < $f_o$ ≤ 80 MHz : Please contact us for inquiries
Power source voltage	Max. supply voltage	$V_{DD-GND}$ -0.5 V to +7.0 V		
	Operating voltage	$V_{DD}$	H : 5.0 V ±0.5 V      C : 3.3 V ±0.3 V	
Temperature range	Storage temperature	$T_{STG}$ -40 °C to +125 °C		Stored as bare product after unpacking
	Operating temperature	$T_{OPR}$ V : -20 °C to +70 °C, X : -40 °C to +85 °C		
Frequency stability	$\Delta f/f_o$	S : ±15 × 10 <sup>-6</sup> *		-20 °C to +70 °C
		B : ±25 × 10 <sup>-6</sup> *		-40 °C to +85 °C
Current consumption	$I_{OP}$	30 mA Max.	25 mA Max.	No load condition, OE = $V_{DD}$
Output disable current	$I_{OE}$	25 mA Max.	20 mA Max.	OE = GND
Duty	$t_w/t$	45 % to 55 %		1/2 $V_{DD}$ level
High output voltage	$V_{OH}$	$V_{DD}$ -0.4 V Min.		$I_{OH}$ = -4 mA
Low output voltage	$V_{OL}$	0.4 V Max.		$I_{OL}$ = 4 mA
Output load condition (fan out)	$C_L$	15 pF		CMOS load
Output enable / disable input voltage	$V_{IH}$	0.7 $V_{DD}$ Min.		OE terminal
	$V_{IL}$	0.3 $V_{DD}$ Min.		
Output rise time	$t_r$	4 ns Max.		20 % → 80 % $V_{DD}$ level
Output fall time	$t_f$	4 ns Max.		80 % → 20 % $V_{DD}$ level
Oscillation start up time	$t_{OSC}$	10 ms Max.		Time at minimum operating voltage to be 0 s
Aging	$f_a$	±10 × 10 <sup>-6</sup> / year Max.		$T_a$ = +25 °C, 10 year

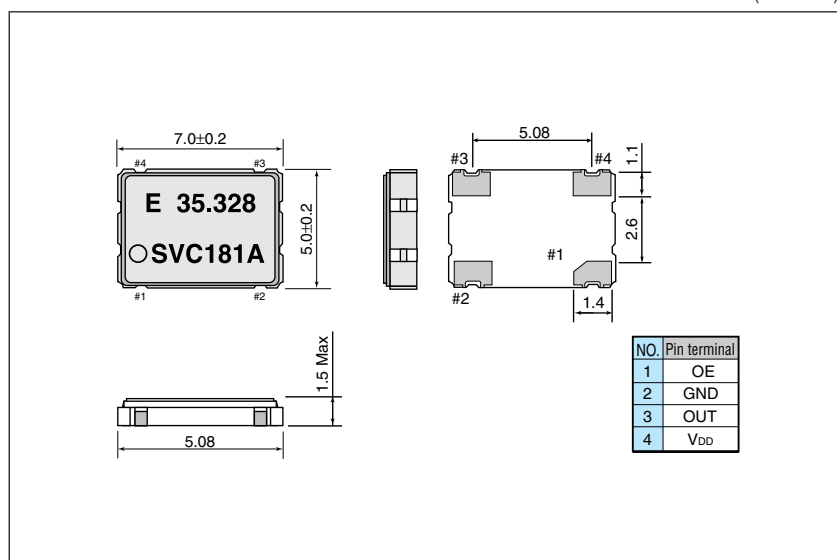
\* Frequency stability is including variation in reflow soldering drift, operating temperature range, operating voltage range and load change.

## ■ Stability / Temperature range

	Stability	Temperature range
SVH / SVC	±15 × 10 <sup>-6</sup>	-20 °C to +70 °C
BXH / BXC	±25 × 10 <sup>-6</sup>	-40 °C to +85 °C

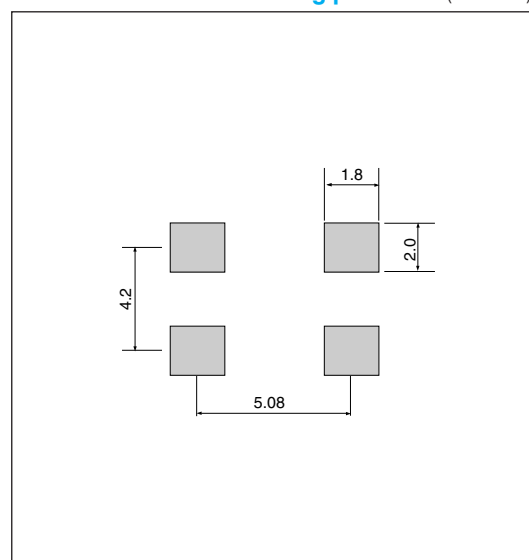
## ■ External dimensions

(Unit: mm)



## ■ Recommended soldering pattern

(Unit: mm)



HIGH-STABILITY HIGH-FREQUENCY OSCILLATOR

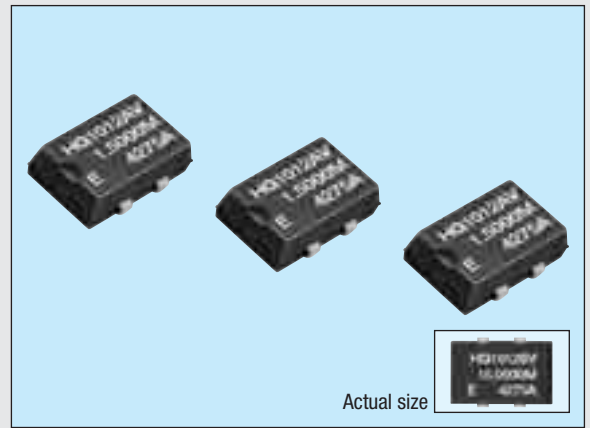
# HG-1012JA / 2012JA

Product number (please refer to page 3)

**Q3511JA0xxxxx00**

**Q3512JA0xxxxx00**

- Cylindrical AT crystal unit built-in, thus assuring high reliability.
- Excellent heat resistance.
- Low current consumption.
- Available for lead (Pb)-free soldering.
- Available for lead (Pb)-free terminal.

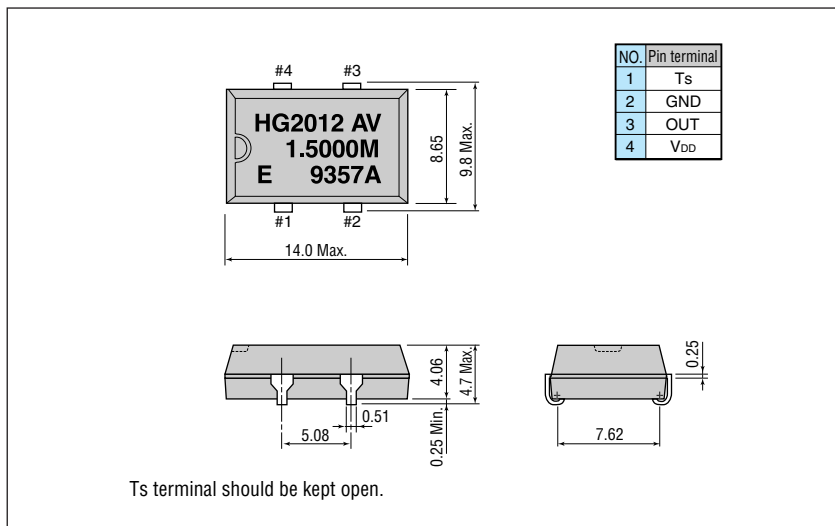


## Specifications (characteristics)

Item	Symbol	Specifications		Remarks
		HG-1012JA	HG-2012JA	
Output frequency range	$f_o$	1.5000 MHz to 28.63636 MHz		$V_{DD} = 4.75 \text{ V to } 5.25 \text{ V}$
Power source voltage	Max. supply voltage	$V_{DD-GND}$ -0.5 V to +7.0 V		
	Operating voltage	$V_{DD}$ 5.0 V $\pm 0.25 \text{ V}$		
Temperature range	Storage temperature	TSTG -55 °C to +125 °C		Stored as bare product after unpacking
	Operating temperature	TOPR -40 °C to +85 °C		
Frequency stability	$\Delta f/f_o$	AV: $\pm 20 \times 10^{-6}$ , BV: $\pm 25 \times 10^{-6}$	SV: $\pm 15 \times 10^{-6}$ , AV: $\pm 20 \times 10^{-6}$	$T_a = -20 \text{ }^\circ\text{C to } +70 \text{ }^\circ\text{C}$
		BX: $\pm 25 \times 10^{-6}$ , CX: $\pm 30 \times 10^{-6}$	BX: $\pm 25 \times 10^{-6}$	$T_a = -40 \text{ }^\circ\text{C to } +85 \text{ }^\circ\text{C}$
Current consumption	$I_{op}$	10 mA Max.		No load condition
Duty	$t_w / t$	40 % to 60 %		1/2 $V_{DD}$ level
High output voltage	$V_{OH}$	$V_{DD} - 0.4 \text{ V Min.}$		$I_{OH} = -0.8 \text{ mA}$
Low output voltage	$V_{OL}$	0.4 V Max.		$I_{OL} = 3.2 \text{ mA}$
Output load condition	$C_L$	15 pF		
Output rise time	$t_r$	8 ns Max.		20 % $\rightarrow$ 80 % $V_{DD}$ level
Output fall time	$t_f$	8 ns Max.		80 % $\rightarrow$ 20 % $V_{DD}$ level
Oscillation start up time	$t_{osc}$	4 ms Max.		Time at 4.75 V to be 0 s
Aging	$f_a$	$\pm 5 \times 10^{-6}$ / year Max.	$\pm 2 \times 10^{-6}$ / year Max.	$T_a = +25 \text{ }^\circ\text{C}$ , first year
Shock resistance	S.R.	$\pm 10 \times 10^{-6}$ Max.	$\pm 2 \times 10^{-6}$ Max.	Three drops on a hard board from 750 mm or excitation test with 29400 $\text{m/s}^2 \times 0.3 \text{ ms} \times 1/2 \text{ sine wave}$ in 3 directions

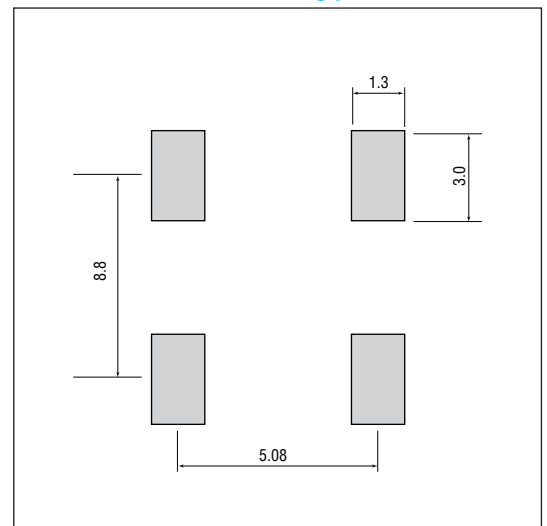
## External dimensions

(Unit: mm)



## Recommended soldering pattern

(Unit: mm)



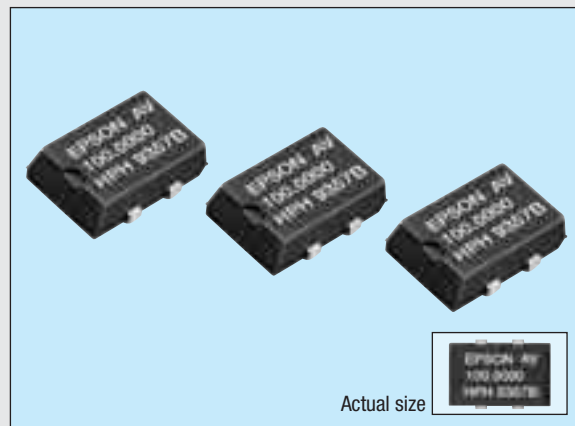
PROGRAMMABLE HIGH-STABILITY HIGH-FREQUENCY CRYSTAL OSCILLATOR

# HG-8002JA series

Product number (please refer to page 3)

**Q3502JAXXXXXX00**

- Wide frequency output by PLL technology.
- Low current consumption by output enable function (OE) or standby function (ST)
- Package and pin compatible with SG-615.
- Low current consumption due to CMOS technology.
- Excellent environmental capability.
- Available for lead (Pb)-free soldering.
- Available for lead (Pb)-free terminal.



## Specifications (characteristics)

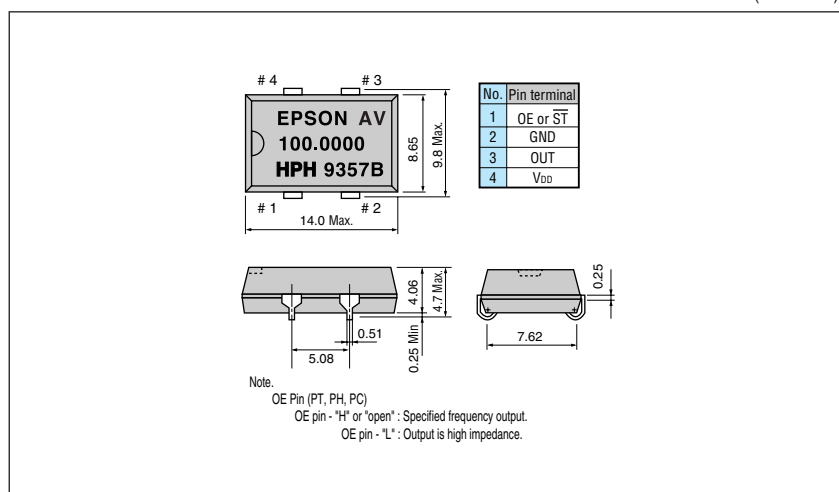
Item	Symbol	Specifications *2			Remarks		
		PT / ST	PH / SH	PC / SC			
Output frequency range	f <sub>o</sub>	1.0000 MHz to 125.0000 MHz			Refer to page 50. "Frequency range"		
Power source voltage	Max. supply voltage	V <sub>DD</sub> -GND -0.5 V to +7.0 V					
	Operating voltage	V <sub>DD</sub>	5.0 V ±0.25 V	3.3 V ±0.165 V			
Temperature range	Storage temperature	T <sub>STG</sub> -55 °C to +125 °C			Stored as bare product after unpacking		
	Operating temperature	T <sub>OPR</sub>	-20 °C to +70 °C (-40 °C to +85 °C)		Refer to page 50. "Frequency range"		
Frequency stability	Δf/f <sub>o</sub>	AV: ±20 x 10 <sup>-6</sup> BV: ±25 x 10 <sup>-6</sup>			AV, BV: -20 °C to +70 °C		
		CX: ±30 x 10 <sup>-6</sup>			CX: -40 °C to +85 °C		
Current consumption	I <sub>OP</sub>	45 mA Max.		28 mA Max.	No load condition, Max. frequency range		
Output disable current	I <sub>OE</sub>	30 mA Max.		16 mA Max.	OE = GND (PT, PH, PC)		
Standby current	I <sub>ST</sub>	50 μA Max.			ST = GND (ST, SH, SC)		
Duty *1	t <sub>w</sub> / t	-			40 % to 60 %	CMOS load: 1/2V <sub>DD</sub> level, Max. load condition	
		40 % to 60 %			-	TTL load: 1.4 V level, Max. load condition	
High output voltage	V <sub>OH</sub>	V <sub>DD</sub> -0.4 V Min.			I <sub>OH</sub> = -16 mA (PT / ST, PH / SH), -8 mA (PC / SC)		
Low output voltage	V <sub>OL</sub>	0.4 V Max.			I <sub>OL</sub> = 16 mA (PT / ST, PH / SH), 8 mA (PC / SC)		
Output load *1 condition (fan out)	TTL	N	2 TTL Max.		Max. frequency and Max. operating voltage range Refer to page 50. "Specifications"		
	CMOS	CL	15 pF Max.				
Output enable / disable input voltage	V <sub>IH</sub>	2.0 V Min.		0.7 V <sub>DD</sub> Min.	ST, OE terminal		
	V <sub>IL</sub>	0.8 V Max.		0.2 V <sub>DD</sub> Max.			
Output rise time *1	CMOS level	t <sub>r</sub>	-		3 ns Max.	4 ns Max.	CMOS load: 20 % → 80 % V <sub>DD</sub> level
	TTL level		4 ns Max.		-		TTL load: 0.4 V → 2.4 V level
Output fall time *1	CMOS level	t <sub>f</sub>	-		3 ns Max.	4 ns Max.	CMOS load: 80 % → 20 % V <sub>DD</sub> level
	TTL level		4 ns Max.		-		TTL load: 2.4 V → 0.4 V level
Oscillation start up time	t <sub>OSC</sub>	10 ms Max.			Time at minimum operating voltage to be 0 s		
Aging	f <sub>a</sub>	±5 x 10 <sup>-6</sup> / year Max.			T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 5.0 V / 3.3 V (PC / SC)		
Shock resistance	S.R.	±20 x 10 <sup>-6</sup> Max.			Three drops on a hard board from 750 mm or excitation test with 29400 m/s <sup>2</sup> x 0.3 ms x 1/2sine wave in 3 directions		

\*1 Operating temperature (-40 °C to +85 °C), the available frequency, duty and output load conditions, please refer to page 50, 51.

\*2 PLL-PLL connection & Jitter specification, please refer to page 52.

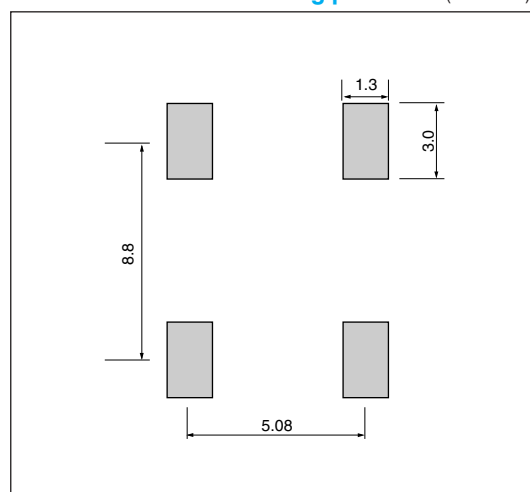
## External dimensions

(Unit: mm)



## Recommended soldering pattern

(Unit: mm)



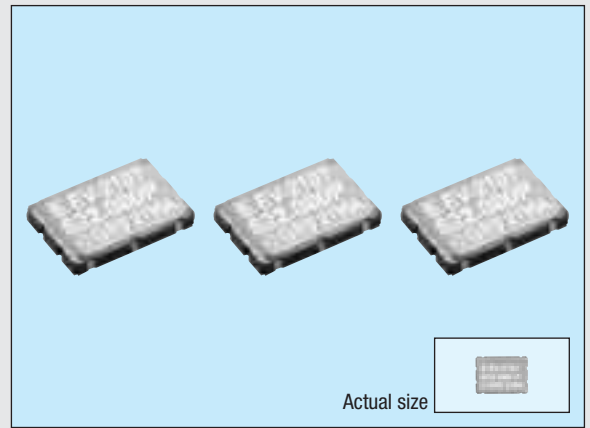
VOLTAGE CONTROLLED SAW OSCILLATOR

# EV-2101CA

Product number (please refer to page 4)

**Q3831CA0xxxxx00**

- 3.3 V operating voltage, Differential LV-PECL / LVDS output.
- Generates high frequency clock with fundamental mode.
- Very low jitter and low phase noise.
- Ceramic package with 2.0 mm Max. thickness.
- Excellent environmental capability.
- Low current consumption due to use of CMOS technology.
- Available for lead (Pb)-free soldering.
- Complete lead (Pb)-free product.



## Specifications (characteristics)

Item	Symbol	Specifications		Remarks
		LV-PECL	LVDS	
Output frequency range	fo	77.760 MHz to 700.0000 MHz		Please contact us for inquiries about the available frequency
Power source voltage	Max. supply voltage	Vcc-GND	-0.5 V to +4.0 V	
	Operating voltage	Vcc	3.3 V ±0.3 V	
Temperature range	Storage temperature	Tstg	-40 °C to +100 °C	Stored as bare product after unpacking
	Operating temperature	ToPR	R : -5 °C to +85 °C, M : -40 °C to +85 °C	
Absolute Pull Range	APR	as per below table		Vc = 0.15 V to 3.0 V *1
Modulation Bandwidth	BW	100 kHz Typ.		Flat to ±3 dB Typ.
Current consumption	Iop	70 mA Typ.	35 mA Typ.	OE = Vcc
Output disable current	Ioe	6 mA Typ.		OE = GND
Duty	tw/ t	45 % to 55 %		at outputs crossing point
Output voltage	VoH	2.35 V Typ. (Vcc -1.03 to Vcc -0.88)	-	DC characteristics
	VoL	1.60 V Typ. (Vcc -1.81 to Vcc -1.62)	-	
	VOD	-	247 mV to 454 mV	Differential output, DC characteristics
	ΔVOD	-	50 mV	Output change, DC characteristics
	Vos	-	1.125 V to 1.375 V	Offset
	ΔVos	-	150 mV	Offset change
Output load condition (fan out)	RL	50 Ω	100 Ω	LV-PECL: Terminated to Vcc -2.0V / LVDS: Connected between OUT - OUT
Output enable disable input voltage	VIH	0.7 Vcc Min.		
	UIL	0.3 Vcc Max.		
Output rise time	tr	400 ps Max.		LV-PECL: 20 % → 80 % of (VoH - VoL) / LVDS: 20 % → 80 % of (Voo x 2)
Output fall time	tf	400 ps Max.		LV-PECL: 80 % → 20 % of (VoH - VoL) / LVDS: 80 % → 20 % of (Voo x 2)
Oscillation start up time	tosc	10 ms Max.		Time at 3.0 V to be 0 s
Gain transfer	Kv	200 x 10 <sup>-6</sup> / V Typ.		APR ±50 x 10 <sup>-6</sup> , -5 °C to +85 °C *2
		250 x 10 <sup>-6</sup> / V Typ.		APR ±100 x 10 <sup>-6</sup> , -5 °C to +85 °C *2
Phase jitter	tpj	1 ps Max.		Offset frequency : 12 kHz to 20 MHz
		1 ps Max.		Offset frequency : 50 kHz to 80 MHz

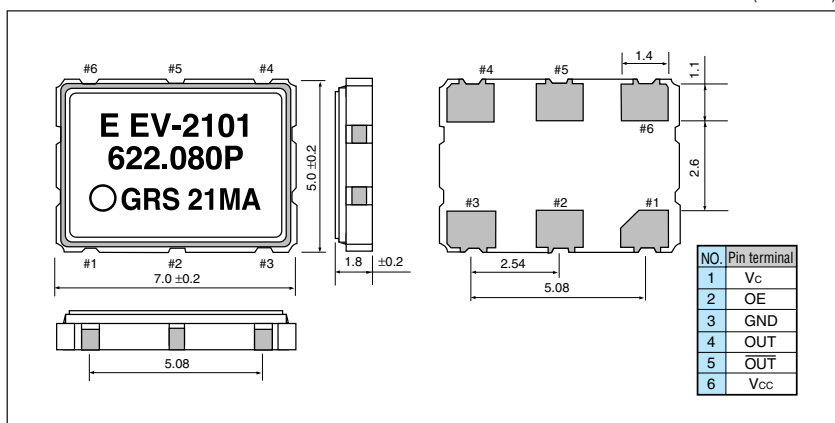
\*1 This includes initial frequency tolerance, temperature variation, supply voltage variation, reflow drift, and 10 years aging (As per below table).

\*2 For -40 °C to +85 °C, please contact us for inquiries.

Operating voltage		3.3 V	
Frequency range (MHz)		77.76 to 700	
Output mode		P : LV-PECL	L : LVDS
APR	±50 x 10 <sup>-6</sup> (-5 °C to +85 °C)	PGRS	LGRS
	±100 x 10 <sup>-6</sup> (-5 °C to +85 °C)	PHRS	LHRS
	±50 x 10 <sup>-6</sup> (-40 °C to +85 °C)	PGMS	LGMS
	±100 x 10 <sup>-6</sup> (-40 °C to +85 °C)	PHMS	LHMS

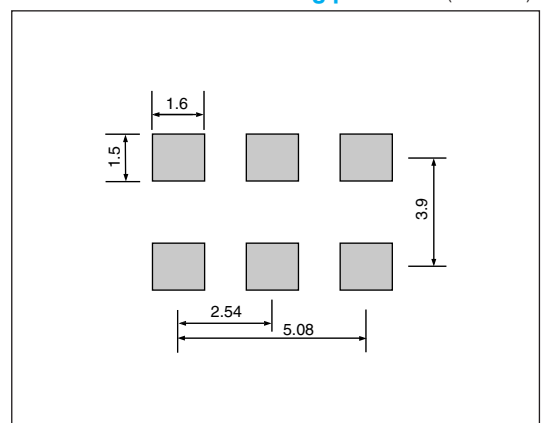
## External dimensions

(Unit: mm)



## Recommended soldering pattern

(Unit: mm)



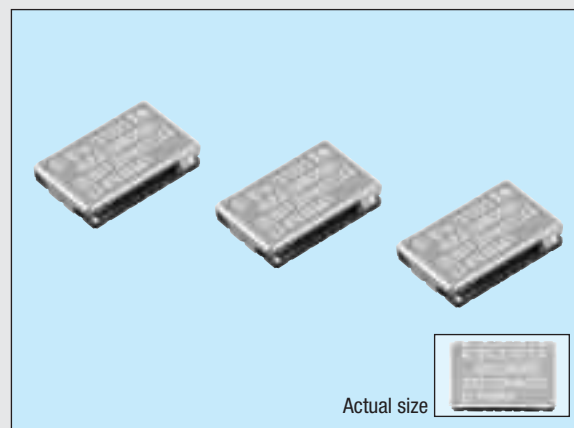
## 600 MHz band VOLTAGE CONTROLLED SAW OSCILLATOR

**EV-3101TA**

Product number (please refer to page 4)

**Q3821TA0xxxxx00**

- Differential LV-PECL output.
- Very low jitter / low phase noise.
- 10 G or 2.5 G SONET / SDH clock smoothing and Frequency Translation.
- Available for lead (Pb)-free soldering.
- Complete lead (Pb)-free product.



## ■ Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Output frequency range	$f_o$	600 MHz to 700 MHz	Please contact us for inquiries about the available frequency.
Power source voltage	Max. supply voltage	VCC-GND	0 V to 8 V
	Operating voltage	VCC	3.3 V $\pm$ 0.165
Temperature range	Storage temperature	TSTG	-40 °C to +85 °C
	Operating temperature	TOPR	0 °C to +85 °C
Absolute Pull Range	APR	G : $\pm 50 \times 10^{-6}$ Min. H : $\pm 100 \times 10^{-6}$ Min.	Vc = 0.15 V to 3.15 V *1
Modulation Characteristics	BW	40 kHz Typ.	Flat to $\pm$ 2dB Typ.
Current consumption	Iop	60 mA Typ.	50 $\Omega$ to Vcc -2 V
Input resistance	ZIN	10 k $\Omega$ Typ.	Vc pin
Duty	tw/ t	45 % to 55 %	At outputs crossing point
Output voltage	VOH	2.28 V Typ.	0 °C to +85 °C
	VOL	1.60 V Typ.	0 °C to +85 °C
Output load	RL	50 $\Omega$	
Output rise time	tr	80 ps Min.	20 % $\rightarrow$ 80 % of (VOH - VOL)
Output fall time	tf	350 ps Max.	80 % $\rightarrow$ 20 % of (VOH - VOL)
Phase jitter	tpj	1 ps Max.	offset frequency : 12 kHz to 20 MHz
		1 ps Max.	offset frequency : 50 kHz to 80 MHz

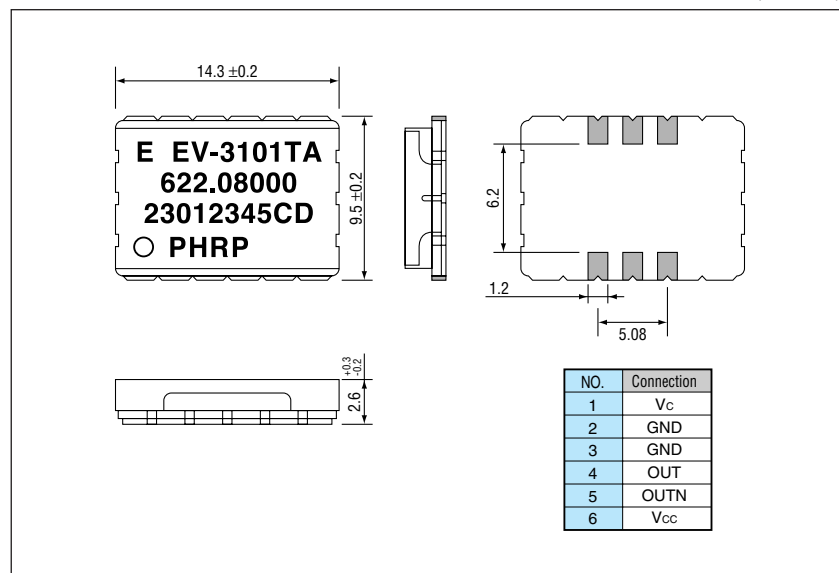
\*1 This includes initial frequency tolerance, temperature variation, supply voltage variation, reflow drift, and 10 years aging.

## ■ Single Side-Band Phase Noise

Offset from Carrier	100 Hz	1 kHz	10 kHz	100 kHz	Unit	
622.08 MHz	-70	-94	-117	-139	dBc/Hz	Vc = 1.65 V

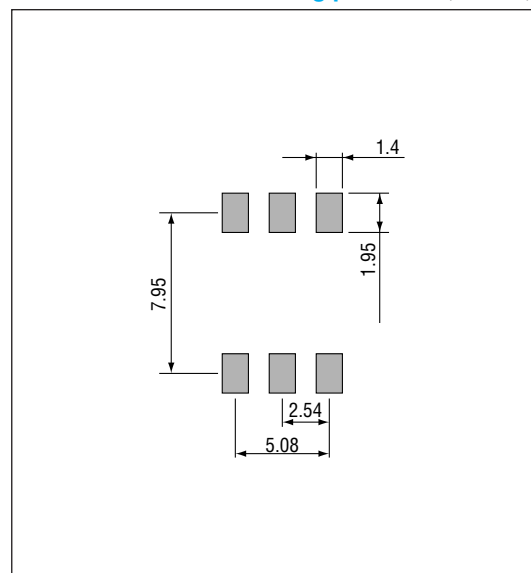
## ■ External dimensions

(Unit: mm)



## ■ Recommended soldering pattern

(Unit: mm)



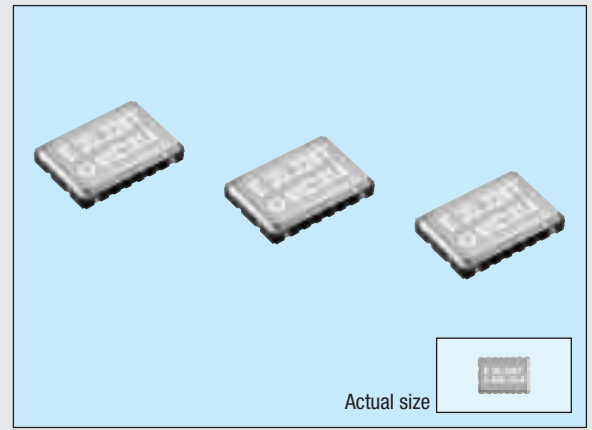
# VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR

## VG-1201CA

Product number (please refer to page 4)

**Q3603CA0xxxxx00**

- Reflowable and high density mounting type SMD.
- Use of CMOS IC assures low current consumption.
- Excellent shock resistance and environmental capability.
- Supply voltage: 5.0 V (\*\*H), 3.3 V (\*\*C)
- Output enable function (OE) can be used for low current consumption applications.
- Available for lead (Pb)-free soldering.
- Complete lead (Pb)-free product.



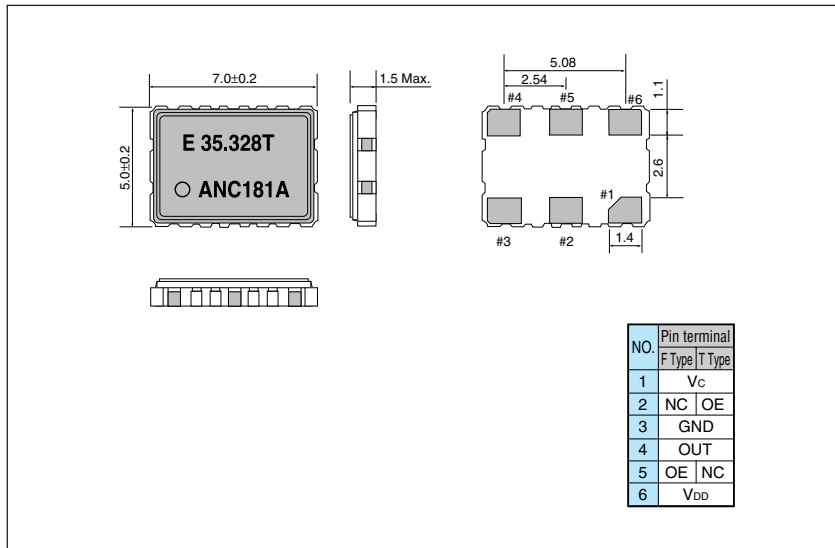
### Specifications (characteristics)

Item	Symbol	Specifications		Remarks
		ANH / AKH / BNH / BKH	ANC / AKC / BNC / BKC	
Output frequency range	fo	1.0000 MHz to 80.0000 MHz		60 MHz < fo ≤ 80 MHz : Please contact us for inquiries
Power source voltage	Max. supply voltage	VDD-GND -0.5 V to +7.0 V		
	Operating voltage	VDD	H : 5.0 V ±0.5 V      C : 3.3 V ±0.3 V	
Temperature range	Storage temperature	TSTG -40 °C to +125 °C		Stored as bare product after unpacking
	Operating temperature	TOPR As per below table		
Frequency stability	Δf/fo	As per below table		
Current consumption	Iop	30 mA Max.	25 mA Max.	No load condition
Output disable current	IoE	25 mA Max.	20 mA Max.	OE = GND
Pull range	Δfc	As per below table		VC = 2.5 V ±2.0 V (**H), 1.65 ±1.50 V (**C)
Modulation characteristics	BW	20 kHz Min.		± 3 dB at 1kHz
Input resistance	ZIN	5 MΩ Min.		DC Level
Frequency change polarity		Positive polarity		VC = 0.5 V to 4.5 V (**H), 0.15 V to 3.15 V (**C)
Duty	tw/ t	40 % to 60 %		1/2 VDD level
Output voltage	VoH	VDD -0.4 V Min.		IoH = -4 mA
	VoL	0.4 V Max.		IoL = 4 mA
Output load condition (fan out)	CL	15 pF		CMOS load
Output enable / disable input voltage	VIH	0.7 VDD Min.		OE terminal
	UIL	0.3 VDD Max.		
Output rise time	tr	4 ns Max.		CMOS load: 20 % → 80 % VDD
Output fall time	tf	4 ns Max.		CMOS load: 80 % → 20 % VDD
Oscillation start up time	tosc	10 ms Max.		Time at 0.9 VDD to be Os
Aging	fa	±10 x 10 <sup>-6</sup> / year Max.		Ta = +25 °C, 10 year

Note: Please contact us for inquiries about operating temperature, frequency stability, pull range.

### External dimensions

(Unit: mm)



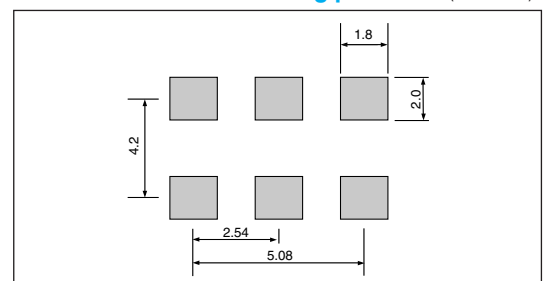
### Stability / Temperature range

	Stability	Temperature range
A	± 20 x 10 <sup>-6</sup>	-20 °C to +70 °C
B	± 25 x 10 <sup>-6</sup>	-40 °C to +85 °C

### Pull range

	Pull range	Output frequency range
K	± 75 x 10 <sup>-6</sup> Min.	41 MHz ≤ fo ≤ 60 MHz
N	± 100 x 10 <sup>-6</sup> Min.	1 MHz ≤ fo < 41 MHz

### Recommended soldering pattern (Unit: mm)



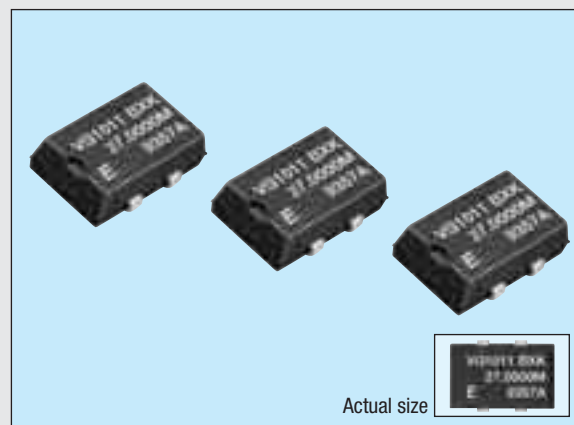
## VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR

## VG-1011JA

Product number (please refer to page 4)

Q3602JA0xxxxx00

- High accuracy and high reliability due to trimmerless design.
- Use of CMOS IC assures low current consumption.
- Excellent environmental capability.
- Supply voltage: 5 V
- Available for lead (Pb)-free soldering.
- Available for lead (Pb)-free terminal.



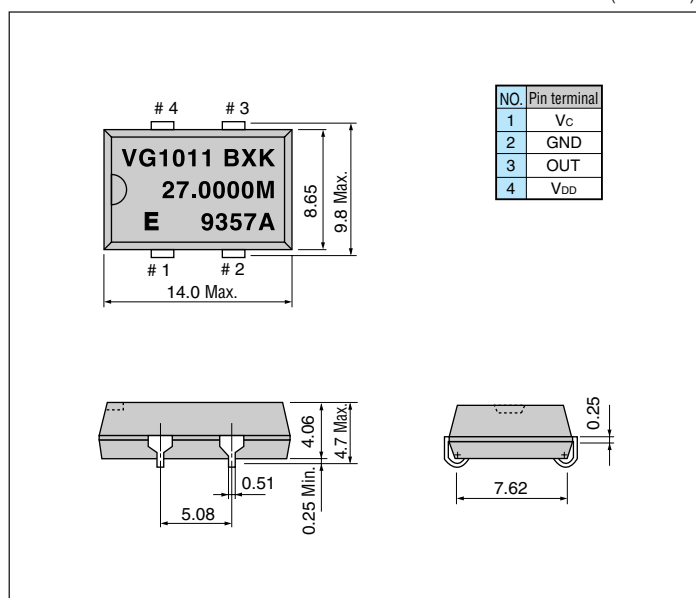
## ■ Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Output frequency range	$f_o$	1.5000 MHz to 28.63636 MHz *	
Power source voltage	Max. supply voltage	$V_{DD-GND}$	-0.5 V to +7.0 V
	Operating voltage	$V_{DD}$	5.0 V $\pm$ 0.5 V
Temperature range	Storage temperature	$T_{STG}$	-55 °C to +125 °C
	Operating temperature	$T_{OPR}$	As per below table *
Frequency stability	$\Delta f/f_o$	As per below table *	
Current consumption	$I_{OP}$	10 mA Max.	No load condition
Pull range	$\Delta f_c$	As per below table *	$V_c = 2.5 \pm 2.0$ V
Input resistance	$Z_{IN}$	10 M $\Omega$ Min.	DC Level
Frequency change polarity		Positive polarity	$V_c = 0.5$ to 4.5 V
Duty	$t_w / t$	40 % to 60 %	1.4 V or 50 % $V_{DD}$ level
Output voltage	$V_{OH}$	$V_{DD} - 0.4$ V Min.	$I_{OH} = -0.8$ mA
	$V_{OL}$	0.4 V Max.	$I_{OL} = 1.6$ mA
Output load condition (fan out)	$C_L$	2 TTL or 15 pF Max.	TTL load / CMOS load
Output rise time	$t_r$	8 ns Max.	CMOS load: 20 % $\rightarrow$ 80 % $V_{DD}$
		5 ns Max.	TTL load: 0.4 V $\rightarrow$ 2.4 V
Output fall time	$t_f$	8 ns Max.	CMOS load: 80 % $\rightarrow$ 20 % $V_{DD}$
		5 ns Max.	TTL load: 2.4 V $\rightarrow$ 0.4 V
Oscillation start up time	$t_{OSC}$	4 ms Max.	Time at 4.5 V to be 0 s
Aging	$f_a$	$\pm 5 \times 10^{-6}$ Max.	$T_a = +25$ °C, $V_{DD} = 5$ V, first year
Shock resistance	S.R.	$\pm 5 \times 10^{-6}$ Max.	Three drops on a hard board from 750 mm or excitation test with 29400 m/s <sup>2</sup> x 0.3 ms x 1/2sine wave in 3 directions

Note: \* Please contact us for inquiries about operating temperature, frequency stability, pull range.

## ■ External dimensions

(Unit: mm)



## ■ Stability / Temperature range

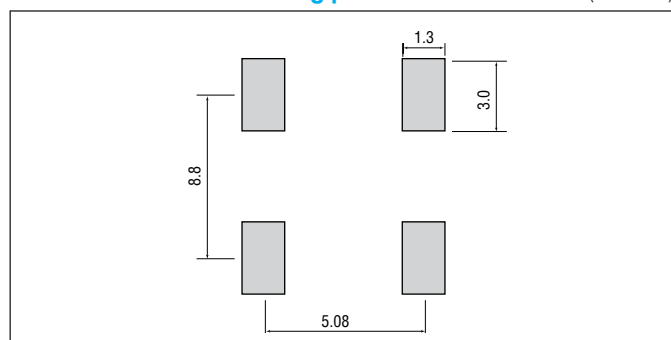
## ■ Pull range

Stability	Temperature range			Pull range
	-20 °C to +70 °C	-30 °C to +75 °C	-40 °C to +85 °C	
	V	W	X	
$\pm 15 \times 10^{-6}$	S	B	-	B
$\pm 20 \times 10^{-6}$	A	G, K, N	-	G
$\pm 25 \times 10^{-6}$	B	-	G, K, N	K
				N

\*Please contact us for inquiries about the available frequency.

## ■ Recommended soldering pattern

(Unit: mm)



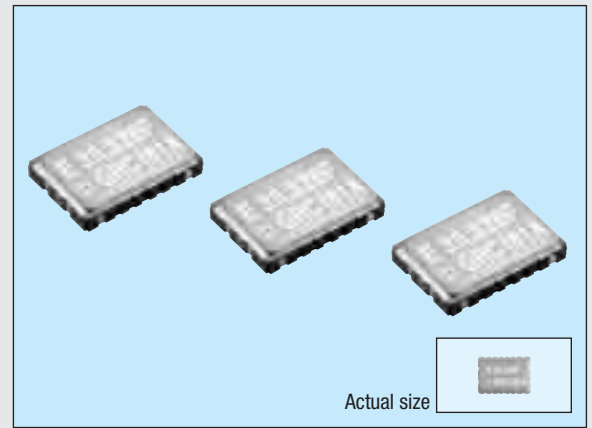
VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR

# VG-4231CA

Product number (please refer to page 4)

**Q3614CA0xxxxx00**

- High accuracy and high reliability due to trimmerless design.
- Use of CMOS IC assures low current consumption.
- Excellent shock resistance and environmental capability.
- Supply voltage: 5.0 V (DRH / GRH), 3.3 V (DRC / GRC)
- Output enable function (OE) can be used for low current consumption applications.
- Available for lead (Pb)-free soldering.
- Complete lead (Pb)-free product.



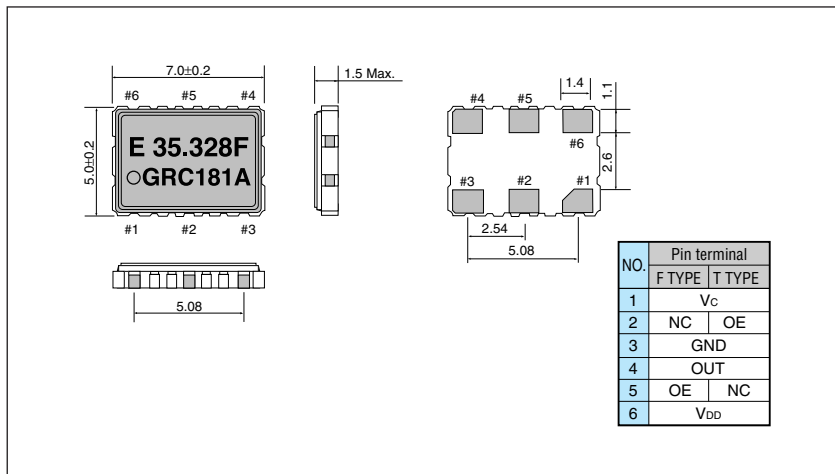
## Specifications (characteristics)

Item	Symbol	Specifications		Remarks
		DRH / GRH	DRC / GRC	
Output frequency range	f <sub>0</sub>	1.0000 MHz to 60.0000 MHz		Please contact us for inquiries about the available frequency.
Power source voltage	Max. supply voltage	V <sub>DD</sub> -GND -0.3 V to +7.0 V		
	Operating voltage	V <sub>DD</sub>	H : 5.0 V ±0.5 V      C : 3.3 V ±0.3 V	
Temperature range	Storage temperature	T <sub>STG</sub> -40 °C to +125 °C		Stored as bare product after unpacking
	Operating temperature	T <sub>OPR</sub> As per below table		
Frequency stability	Δf/f <sub>0</sub>	As per below table		VC = 2.5 V (DRH / GRH) / VC = 1.65 V (DRC / GRC)
Current consumption	I <sub>OP</sub>	20 mA Max.	10 mA Max.	No load condition
Output disable current	I <sub>OE</sub>	15 mA Max.	7 mA Max.	OE=GND
Pull range	Δf <sub>c</sub>	R : ±130 x 10 <sup>-6</sup>		VC = 2.5 ±0.2 V (DRH / GRH) / VC = 1.65 ±1.50 V (DRC / GRC)
Absolute pull range *	APR	D : ±80 x 10 <sup>-6</sup> Min		
		G : ±65 x 10 <sup>-6</sup> Min		
Modulation characteristics	BW	15 kHz Min.		± 3 dB at 1kHz
Input resistance	Z <sub>IN</sub>	50 kΩ Min.		DC Level
Frequency change polarity		Positive polarity		
Duty	tw/ t	40 % to 60 %		1/2 V <sub>DD</sub> level
Output voltage	V <sub>OH</sub>	V <sub>DD</sub> -0.4 V Min.		I <sub>OH</sub> = -0.8 mA (DRC / GRC) / I <sub>OH</sub> = -4 mA (DRH / GRH)
	V <sub>OL</sub>	0.4 V Max.		I <sub>OL</sub> = 3.2 mA (DRC / GRC) / I <sub>OL</sub> = 4 mA (DRH / GRH)
Output load condition (fan out)	C <sub>L</sub>	15 pF		CMOS load
Output enable / disable input voltage	V <sub>IH</sub>	0.7 V <sub>DD</sub> Min.		OE terminal
	V <sub>IL</sub>	0.3 V <sub>DD</sub> Max.		
Output rise time	t <sub>r</sub>	4 ns Max.		CMOS load: 20 % → 80 % V <sub>DD</sub>
Output fall time	t <sub>f</sub>	4 ns Max.		CMOS load: 80 % → 20 % V <sub>DD</sub>
Oscillation start up time	t <sub>OSC</sub>	10 ms Max.		Time at 0.9 V <sub>DD</sub> to be 0s
Aging	f <sub>a</sub>	±10 x 10 <sup>-6</sup> / year Max.		T <sub>a</sub> = +25 °C, 10 year

\* Absolute pull range = Pull range - (Frequency stability + Aging + Free fall + Vibration)

## External dimensions

(Unit: mm)

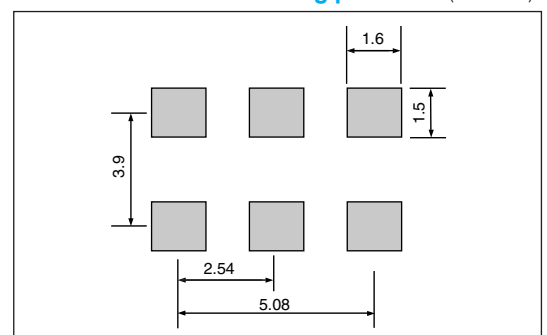


## Stability / Temperature range

	Stability	Temperature range
DRC / DRH	± 35 x 10 <sup>-6</sup>	-20 °C to +70 °C
GRC / GRH	± 50 x 10 <sup>-6</sup>	-40 °C to +85 °C

## Recommended soldering pattern

(Unit: mm)





## VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR

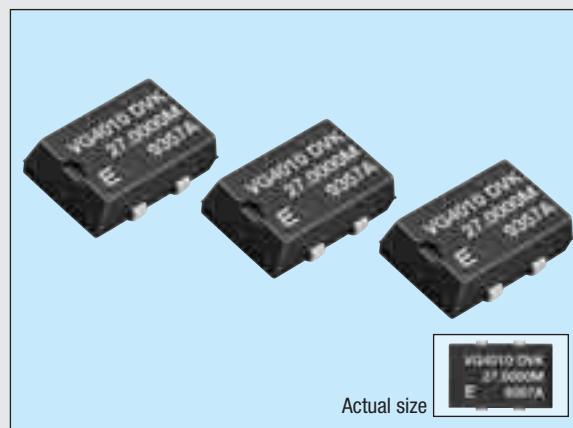
## VG-4010JA / 4030JA

Product number (please refer to page 4)

Q3611JA0xxxxx00

Q3612JA0xxxxx00

- High accuracy and high reliability due to trimmerless design.
- Use of CMOS IC assures low current consumption.
- Excellent environmental capability.
- Supply voltage: 5 V (VG-4010JA)
- Supply voltage: 3.3 V (VG-4030JA)
- Available for lead (Pb)-free soldering.
- Available for lead (Pb)-free terminal.

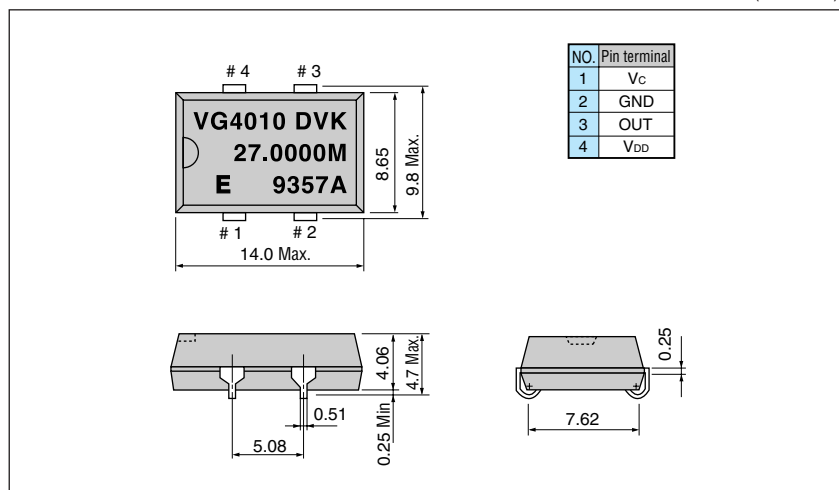


## ■ Specifications (characteristics)

Item	Symbol	Specifications		Remarks
		VG-4010JA DVK	VG-4030JA DVK	
Output frequency range	$f_o$	2.0000 MHz to 28.63636 MHz		Please contact us for inquiries about the available frequency.
Power source voltage	Max. supply voltage	$V_{DD-GND}$ -0.5 V to +7.0 V		
	Operating voltage	$V_{DD}$ 5.0 V $\pm 0.25$ V	3.3 V $\pm 0.17$ V	
Temperature range	Storage temperature	T <sub>STG</sub> -55 °C to +125 °C		Stored as bare product after unpacking
	Operating temperature	T <sub>OPR</sub> -20 °C to +70 °C		
Frequency stability	$\Delta f/f_o$	$\pm 35 \times 10^{-6}$ Max.	$\pm 37 \times 10^{-6}$ Max.	VC = 2.5 V (VG-4010JA) / VC = 1.8 V (VG-4030JA)
Current consumption	$I_{op}$	35 mA Max.	18 mA Max.	No load condition
Pull range	$\Delta f_c$	$\pm 75 \times 10^{-6}$	As per below table	VC = 0.5 to 4.5 V (VG-4010JA) / VC = 0.0 to 3.0 V (VG-4030JA)
Input resistance	$Z_{IN}$	10 M $\Omega$ Min.		DC Level
Frequency change polarity		Positive polarity		VC = 0.5 to 4.5 V (VG-4010JA) / VC = 0.0 to 3.0 V (VG-4030JA)
Duty	$t_w / t$	45 % to 55 % (40 % to 60 %)	40 % to 60 %	1/2 $V_{DD}$ level (1.4 V level)
Output voltage	$V_{OH}$	$V_{DD} - 0.4$ V Min.		$I_{OH} = -0.8$ mA
	$V_{OL}$	0.4 V Max.		$I_{OL} = 3.2$ mA
Output load condition (fan out)	N/CL	2 TTL or 30 pF Max.	30 pF Max.	TTL load / CMOS load
Output rise time	$t_r$	5 ns Max.	6 ns Max.	CMOS load: 20 % $\rightarrow$ 80 % $V_{DD}$ level
		8 ns Max.	–	TTL load: 0.4 V $\rightarrow$ 2.4 V level
Output fall time	$t_f$	5 ns Max.	6 ns Max.	CMOS load: 80 % $\rightarrow$ 20 % $V_{DD}$ level
		8 ns Max.	–	TTL load: 2.4 V $\rightarrow$ 0.4 V level
Oscillation start up time	$t_{osc}$	10 ms Max.		Time at minimum operating voltage to be 0 s
Aging	$f_a$	$\pm 5 \times 10^{-6}$ Max.		T <sub>a</sub> = +25 °C, first year
Shock resistance	S.R.	$\pm 10 \times 10^{-6}$ Max.		Three drops on a hard board from 750 mm or excitation test with 29400 m/s <sup>2</sup> x 0.3 ms x 1/2sine wave in 3 directions

## ■ External dimensions

(Unit: mm)

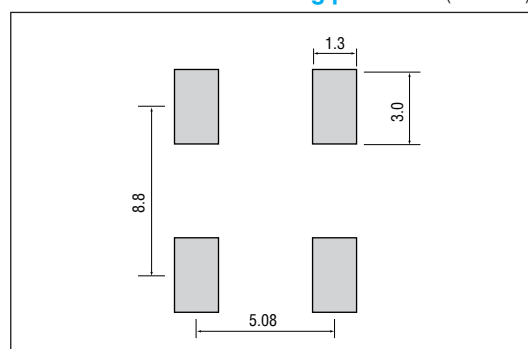


## ■ Stability / Temperature range

Pull range	Remarks
$180 \times 10^{-6}$	Crystal unit's frequency < 20 MHz, V <sub>c</sub> = 0.0 to 3.0 V
$150 \times 10^{-6}$	Crystal unit's frequency $\leq$ 20 MHz, V <sub>c</sub> = 0.0 to 3.0 V

## ■ Recommended soldering pattern

(Unit: mm)



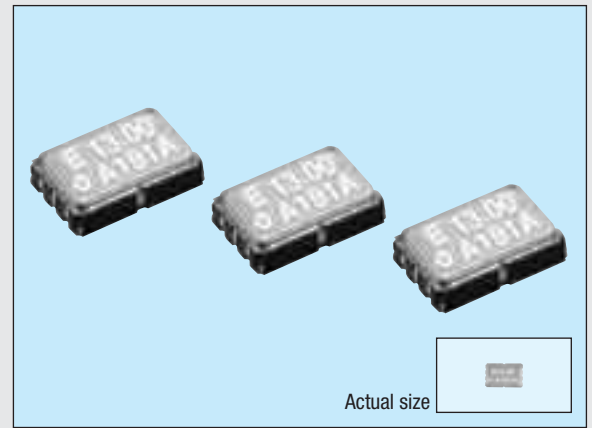
VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR

# VG-2828CB

Product number (please refer to page 4)

**Q3623CB0xxxxx00**

- Developed for GSM.
- Reflowable and high density mounting type ultra small size SMD (5.0 x 3.2 x 1.2 mm).
- Using Bi-CMOS IC allows low current consumption and low noise (-143 dBc / Hz Typ.at 100 Hz offset).
- Operating supply voltage : 2.8 V.
- Available for lead (Pb)-free soldering.
- Complete lead (Pb)-free product.



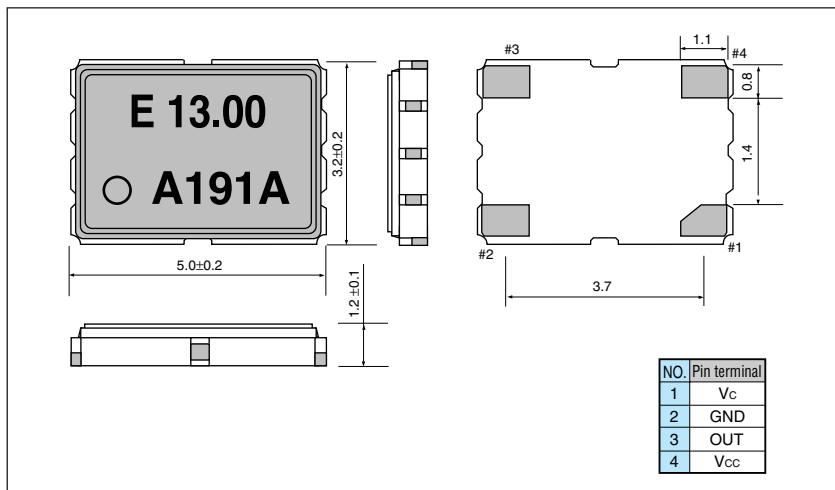
## Specifications (characteristics)

Item	Symbol	Specifications	Remarks	
Output frequency range	$f_o$	13.0000 MHz		
Power source voltage	Max. supply voltage	$V_{DD-GND}$	-0.3 V to +7.0 V	
	Operating voltage	$V_{DD}$	2.8 V $\pm$ 0.1 V	
Temperature range	Storage temperature	$T_{STG}$	-40 °C to +85 °C	Stored as bare product after unpacking
	Operating temperature	$T_{OPR}$	-20 °C to +75 °C	
Frequency stability	$\Delta f/f_o$	$\pm 12 \times 10^{-6}$ Max. *		
Frequency control range	$\Delta f_c$	$\pm 12 \times 10^{-6}$ Min.	$V_c = 1.0$ V (center), 0.06 V, 2.0 V	
Frequency change polarity		Positive polarity		
Input resistance	$Z_{IN}$	10 M $\Omega$ Min.	$V_c - GND$ (DC)	
Current consumption	$I_{CC}$	1.0 mA Max.	10 k $\Omega$ // 10 pF $V_{CC} = 2.8$ V	
Duty	Duty	30 % to 70 %	GND Level (DC cut)	
Output level	$V_{OUT}$	0.8 V Min.	Peak to Peak	
Output load	$R_L / C_L$	10 k $\Omega$ // 10 pF	Please contact us for other Output load. DC cut Capacitor = 0.01 $\mu$ F	

\* Include initial frequency tolerance, reflow shift, temperature variation, supply voltage variation and aging.  
Note: Please contact us for requiries about specifications other than the above.

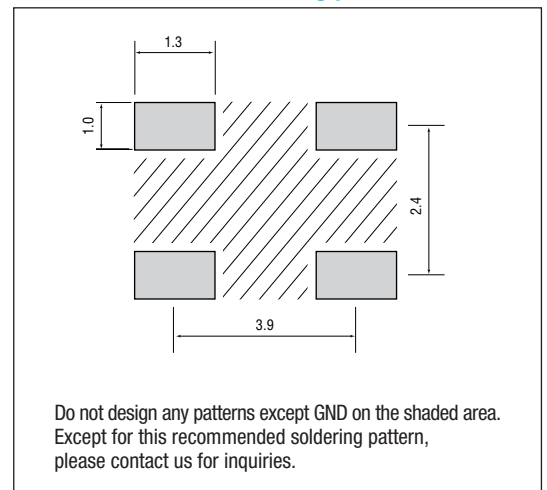
## External dimensions

(Unit: mm)



## Recommended soldering pattern

(Unit: mm)



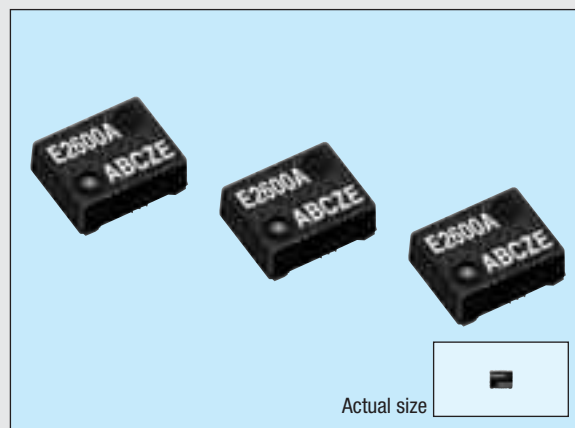
TEMPERATURE COMPENSATED CRYSTAL OSCILLATOR

# TG-5000LA

Product number (please refer to page 4)

**Q3711LAXXXXX00**

- Developed for GSM, cdma cellular phone.
- Reflowable and high density mounting type ultra small size SMD.
- Available for lead (Pb)-free soldering.
- Complete lead (Pb)-free product.
- Operating supply voltage : 2.8 V.



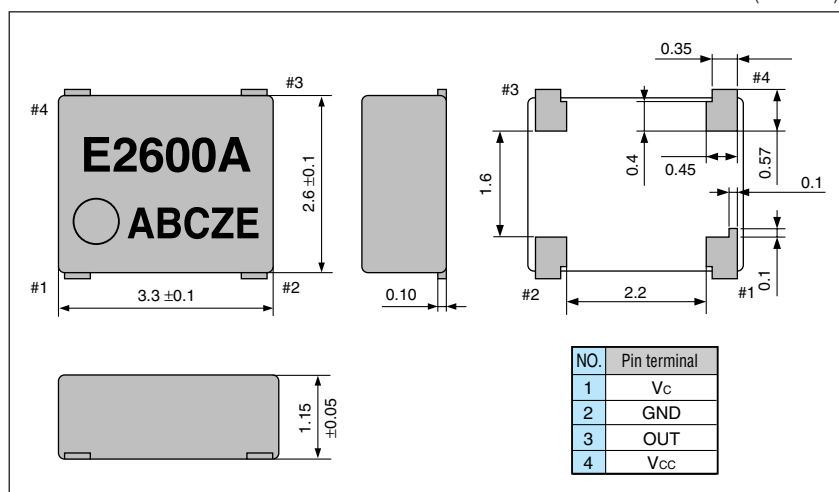
## Specifications (characteristics)

Item	Symbol	Specifications		Remarks
Output frequency	$f_o$	19.2, 19.68, 19.8 MHz	26 MHz	
Power source voltage	Max. supply voltage	$V_{CC-GND}$	-0.3 V to +4.5 V	
	Operating voltage	$V_{CC}$	2.8 V $\pm$ 0.14 V	
Temperature range	Storage temperature	$T_{STG}$	-40 °C to +85 °C	Stored as bare product after unpacking
	Operating temperature	$T_{OPR}$	-30 °C to +80 °C	-20 °C to +75 °C
Frequency tolerance	$\Delta f_o$	$\pm 2.0 \times 10^{-6}$ Max.	$\pm 2.5 \times 10^{-6}$ Max.	$V_C = 1.4$ V, +25 °C $\pm 2$ °C
Frequency stability vs. temperature	$\Delta f_r$		-	19.2, 19.68, 19.8 MHz : -30 °C to +80 °C (reference at +25 °C)
			$\pm 2.5 \times 10^{-6}$ Max.	26 MHz : -20 °C to +75 °C (reference at +25 °C)
Frequency stability vs. load	$\Delta f_L$	$\pm 0.2 \times 10^{-6}$ Max.		10 k $\Omega$ // 10 pF $\pm 10\%$
Frequency stability vs. supply voltage	$\Delta f_V$	$\pm 0.3 \times 10^{-6}$ Max.		2.8 V $\pm 5\%$
Aging	$f_a$	$\pm 1 \times 10^{-6}$ Max.		$T_a = +25$ °C, first year
Current consumption	$I_{CC}$	1.6 mA Max.	1.8 mA Max.	$V_{CC} = 2.8$ V, 10 k $\Omega$ // 10 pF
Input resistance	$Z_{IN}$	800 k $\Omega$ Min.		$V_C-GND$ (DC), $V_C = 1.4$ V
Frequency control range	$\Delta f_C$	$\pm 5.5 \times 10^{-6}$ to $\pm 9.5 \times 10^{-6}$	$\pm 5.0 \times 10^{-6}$ to $\pm 12.0 \times 10^{-6}$	$V_C = 1.4$ V $\pm 1.0$ V
Frequency change polarity		Positive polarity		
Duty	Duty	40 % to 60 %		GND level (DC cut)
Output level	$V_{OUT}$	0.8 V Min.		Peak to peak
Output load	$R_L / C_L$	10 k $\Omega$ // 10 pF		Please contact us for other Output load. DC cut capacitor = 0.01 $\mu$ F

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

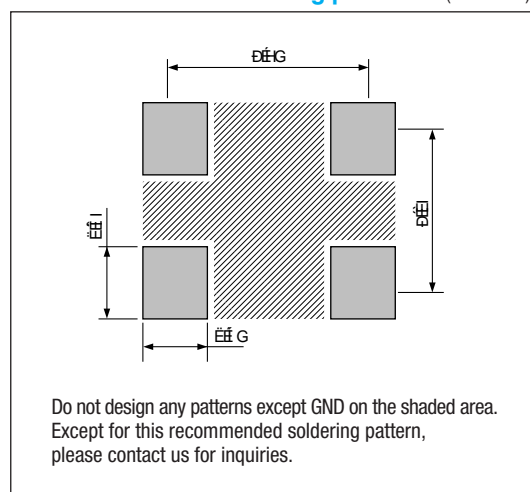
## External dimensions

(Unit: mm)



## Recommended soldering pattern

(Unit: mm)



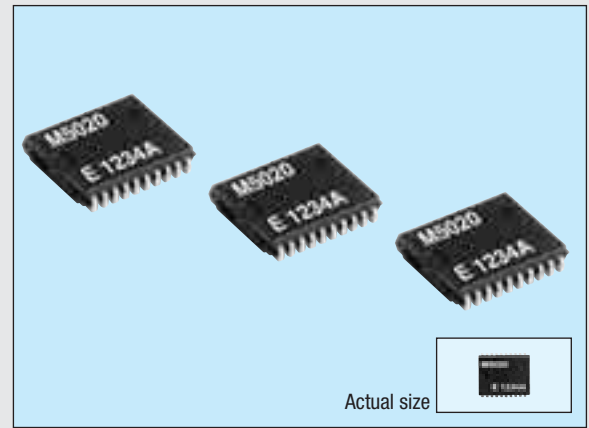
32 kHz + PLL OSCILLATOR

# MG-5020JE

Product number (please refer to page 4)

**Q33M22JExxxx00**

- Built-in 32.768 kHz crystal unit allows adjustment-free.
- 32.768 kHz clock frequency output.
- 48.005120MHz PLL oscillation frequency output.
- Support low current consumption mode by deviding power supply of 32.768 kHz and PLL oscillation circuit.
- Supply voltage : 32.768 kHz oscillation 1.8 V - 3.6 V, PLL oscillation 2.7 V - 3.6 V.
- SOJ-20pin package.
- Available for lead (Pb)-free soldering.
- Available for lead (Pb)-free terminal.



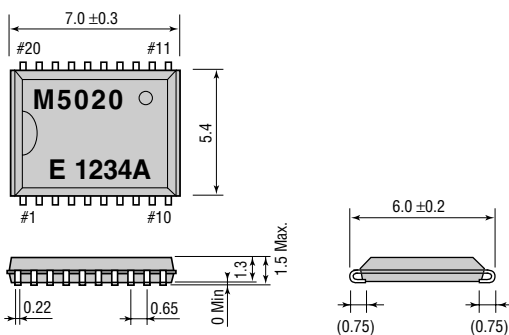
## Specifications (characteristics)

Item	Symbol	Specifications	Remarks	
Output frequency range	f <sub>o</sub>	32.768 kHz	Out 32 k pin	
	f <sub>OUT</sub>	48.005120 MHz	OUT pin	
Power source voltage	Max. supply voltage	V <sub>DD</sub> -GND	-0.3 V to +4.5 V	
	Operating voltage	V <sub>DD</sub>	2.7 V to 3.6 V	PLL Output
		V <sub>BK</sub>	1.8 V to 3.6 V	32 kHz Output
Temperature range	Storage temperature	T <sub>STG</sub>	-55 °C to +125 °C	Stored as bare product after unpacking
	Operating temperature	T <sub>OPR</sub>	-40 °C to +85 °C	No condensation
Frequency stability	Δf/0	5 ±23 x 10 <sup>-6</sup>	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 3.0 V	
Current consumption 1 (PLL Stopping)	I <sub>OP1</sub>	3 μA	V <sub>DD</sub> = 1.8 V to 3.6 V, PWD = GND, OUT 32 k = no load condition	
Current consumption 2 (PLL Working)	I <sub>OP2</sub>	15 mA	V <sub>DD</sub> = 2.7 V to 3.6 V, PWD = "H", OUT = no load condition	
Duty	t <sub>w</sub> / t	40 % to 60 %	V <sub>th</sub> = 50 % V <sub>DD</sub>	
"H" output voltage 1	V <sub>OH</sub>	V <sub>DD</sub> -0.4 V Min.	I <sub>OH</sub> = 100 μA (OUT 32 kHz), 4.0 mA (OUT)	
"L" output voltage 1	V <sub>OL</sub>	0.4 V Max.	I <sub>OL</sub> = -100 μA (OUT 32 kHz), -4.0 mA (OUT)	
condition (fan out)	CL	15 pF Max.	OUT 32 k pin, OUT pin	
"H" input voltage 1	V <sub>IH</sub>	0.8 V <sub>DD</sub> to V <sub>DD</sub> +0.2	PWD pin	
"L" input voltage 1	V <sub>IL</sub>	GND -0.2 to 0.2 V <sub>DD</sub>		
Output rise time	t <sub>r</sub>	5.0 ns Max.	20 % → 80 % V <sub>DD</sub> , OUT pin	
Output fall time	t <sub>f</sub>	5.0 ns Max.	80 % → 20 % V <sub>DD</sub> , OUT pin	
Jitter	p <sub>j</sub>	150 ps	V <sub>DD</sub> = 2.7 V to 3.6 V	
Oscillation start up time	t <sub>STA1</sub>	3 s Max.	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 0 → 1.8 V to 3.6 V	
	t <sub>STAP</sub>	0.1 s	V <sub>DD</sub> = 0 → 2.7 V to 3.6 V, PWD = LOW → High	
Aging	f <sub>a</sub>	±5 x 10 <sup>-6</sup> / year Max.	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 3.0 V, First year	

1 Please contact us for inquiries about the available frequency.

## External dimensions

(Unit: mm)



No.	Pin terminal	Function	No.	Pin terminal	Function
1	OUT 32 k	32.768 kHz output	20	N.C.	OPEN
2	N.C.	OPEN	19	N.C.	OPEN
3	V <sub>DD1</sub>	32.768 kHz oscillation power supply	18	N.C.	OPEN
4	GND	GND	17	N.C.	OPEN
5	N.C.	OPEN	16	N.C.	OPEN
6	N.C.	OPEN	15	N.C.	OPEN
7	PWD	Control PLL oscillation (STOP)	14	N.C.	OPEN
8	N.C.	OPEN	13	N.C.	OPEN
9	N.C.	OPEN	12	N.C.	OPEN
10	V <sub>DD2</sub>	supply	11	OUT	PLL output

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

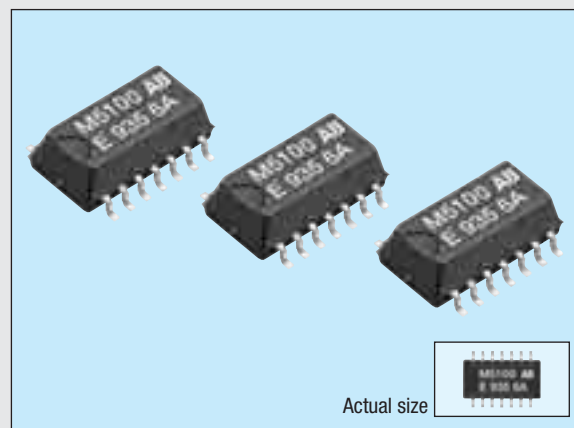
## MULTI-OUTPUT CRYSTAL OSCILLATOR

**MG-5100SA**

Product number (please refer to page 4)

**Q33M21SAxxxxx00**

- Cylindrical AT crystal unit built-in, thus assuring high reliability.
- Three-PLL circuits allowed to be programmable for output frequency.
- Available to choose output in 8 frequency by select pin for CPU CLK.
- Available for lead (Pb)-free soldering.
- Available for lead (Pb)-free terminal.



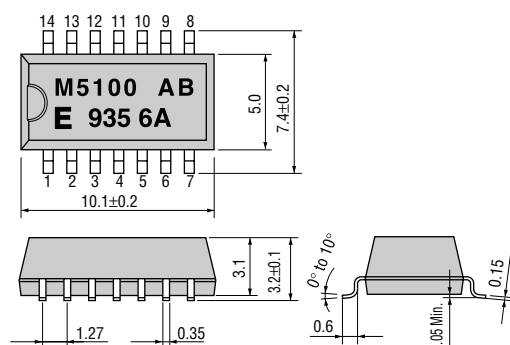
## ■ Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Output frequency range	fo	76.9 kHz to 100.0000 MHz. *1	VDD = 5.0 V ±0.5 V
		76.9 kHz to 80.0000 MHz. *1	VDD = 3.3 V ±0.3 V
Power source voltage	Max. supply voltage	VDD-GND	-0.3 V to +7.0 V
	Operating voltage	VDD	5.0 ±0.5 V 3.3 ±0.3 V
Temperature range	Storage temperature	TSTG	-55 °C to +100 °C
	Operating temperature	TOPR	-20 °C to +70 °C
Frequency stability	Δf/o	±100 x 10 <sup>-6</sup>	
Current consumption	IOP	100 mA Max.	VDD = 5.0 V ±0.5 V No load condition
		65 mA Max.	VDD = 3.3 V ±0.3 V No load condition
Duty	tw / t	40 % to 60 %	50 % VDD
"H" output voltage 1	VOH	VDD -0.4 V Min.	IOH = 4.0 mA
"L" output voltage 1	VOL	0.4 V Max.	IOL = -4.0 mA
condition (fan out)	CL	25 pF Max.	VDD = 5.0 V ±0.5 V
		15 pF Max.	VDD = 3.3 V ±0.3 V
"H" input voltage 1	VIH	0.8 VDD Min.	
"L" input voltage 1	VIL	0.2 VDD Max.	
Output rise time	tr	5.0 ns Max.	20 % → 80 % VDD
Output fall time	tf	4.0 ns Max.	80 % → 20 % VDD
Jitter	tj	450 ps Max.	Cycle to Cycle jitter
		500 ps Max.	Peak to Peak Jitter
Skew	tskw	500 ps Max.	Please contact us for inquiries about details.
Oscillation start up time	tosc	70 ms Max.	Time at minimum operating voltage to be Os.
Aging	fa	±5 x 10 <sup>-6</sup> / year Max.	Ta = +25 °C, VDD = 5.0 V / 3.0 V, First year
Shock resistance	S.R.	±20 x 10 <sup>-6</sup> Max.	Three drops on a hard board from 750 mm or excitation test with 29400 m/s <sup>2</sup> x 0.3 ms x 1/2sine wave in 3 directions

1 Please contact us for inquiries about the available frequency.

## ■ External dimensions

(Unit: mm)



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

## ■ Terminal condition

Terminal	Pin No.	Function
VDD1	14	Power supply (3.3 V or 5.0 V)
VDD1	13	
GND	9	GND
TIN	8	Do not connect anything
OE	11	Output control ("H":Enable, "L":Weak pull-down)
CLKA	3	Clock output ports.
CLKB	4	
CLKC	10	
CLKD	6	
CPUCLK	5	
XBUF	7	Reference clock output
S0	2	Select pin 0 for clock output
S1	1	Select pin 1 for clock output
S2	12	Select pin 2 for clock output

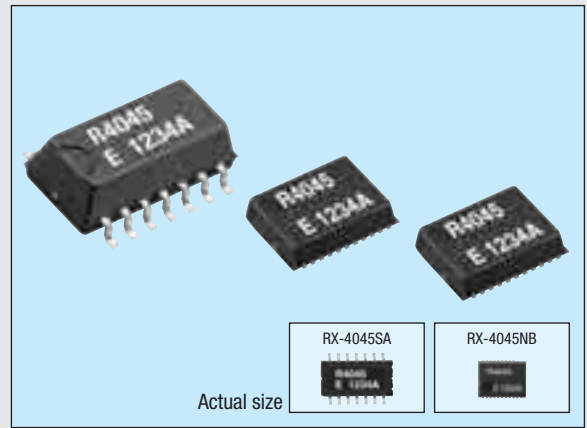
4 WIRE HIGH ACCURACY SERIAL INTERFACE REAL TIME CLOCK MODULE

# RX-4045SA / NB

Product number (please refer to page 5)

**Q4140455xxxxx00**      **Q4140459xxxxx00**

- Built-in 32.768 kHz crystal oscillator with high accuracy.
- Dual Alarm and Timer IRQ function are Available.
- 32.768 kHz clock frequency output. (Nch open drain)
- Low backup current : 0.48  $\mu$ A / 3 V (Typ.)
- Wide operating voltage range : 1.7 V to 5.5 V
- Wide timekeeper voltage range : 1.15 V to 5.5 V
- CPU interrupt generation function (cycle time range : 1 month to 0.5 seconds, includes interrupt flags and interrupt stop function)
- Oscillation stop detection function (used to determine presence of internal data)
- Power supply voltage monitoring function (with selectable detection threshold)
- Available for lead (Pb) - free soldering.
- Available for lead (Pb) - free terminal.



The details are mentioned in the application manual.

<http://www.epsondevice.com>

## ■ Specifications (characteristics)

### ■ Absolute Max. rating

Item	Symbol	Condition	Min.	Max.	Unit
Supply voltage	V <sub>DD</sub>	V <sub>DD</sub> to GND	-0.3	+6.5	V
Input voltage	V <sub>I</sub>	CE, CLK, DI pins	GND -0.3	+6.5	
Output voltage	V <sub>O1</sub>	FOUR, INT pins	GND -0.3	+6.5	
	V <sub>O2</sub>	DO pin	GND -0.3	V <sub>DD</sub> +0.3	
Storage temperature	T <sub>STG</sub>	Stored as bare product after unpacking	-55	+125	°C

### ■ Operating range

Item	Symbol	Condition	Min.	Max.	Unit
Power voltage	V <sub>DD</sub>	—	—	5.5	V
Clock voltage	V <sub>CLK</sub>	—	1.15	—	
Operating temperature	T <sub>OPR</sub>	No condensation	-40	+85	°C

### ■ Frequency characteristics

Item	Symbol	Condition	Range	Unit
Frequency tolerance	$\Delta f/f$	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 3.0 V	AA: 5 ±5 *1	x 10 <sup>-6</sup>
Oscillation start up time	t <sub>STA</sub>	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 2.0 V	1 Max.	s
Frequency temperature characteristics	T <sub>OP</sub>	T <sub>a</sub> = -20 °C to +70 °C Reference at +25 °C	+10 -120	x 10 <sup>-6</sup>
Frequency voltage characteristics	f/V	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 2.0 V to 5.5 V	±1 Max.	x 10 <sup>-6</sup>
Aging	f <sub>a</sub>	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 3.0 V, first year	±5 Max.	x 10 <sup>6</sup> / year

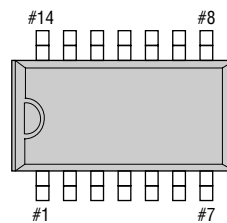
\*1 Equivalent to 13 seconds of monthly deviation (excluding offset.)

### ■ DC characteristics (GND = 0 V, V<sub>DD</sub> = 1.8 V to 5.5 V, T<sub>a</sub> = -40 °C to +85 °C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Standby current	I <sub>DD2</sub>	CE = OPEN (or GND) INT = V <sub>DD</sub> FOUR = OPEN	V <sub>DD</sub> = 5 V	0.6	1.8	$\mu$ A
		V <sub>DD</sub> = 3 V	0.48	1.20		
"H" input voltage	V <sub>IH</sub>	CE, CLK, DI pins V <sub>DD</sub> = 1.7 V to 5.5 V	0.8 V <sub>DD</sub>		5.5	V
"L" input voltage	V <sub>IL</sub>		GND -0.3		0.2 V <sub>DD</sub>	
"H" output current	I <sub>OH</sub>	FOUR pins, V <sub>OH</sub> = V <sub>DD</sub> - 0.5V			-0.5	mA
"L" output current	I <sub>OL1</sub>	FOUR pins, V <sub>OL</sub> = 0.4V	0.5			
	I <sub>OL2</sub>	INT pins, V <sub>OL</sub> = 0.4 V	2.0			
Pull down	R <sub>DNCE</sub>	CE pin	40		400	k $\Omega$
Output leakage current	I <sub>oz1</sub>	DO pin V <sub>O</sub> = 5.5 V or GND V <sub>DD</sub> = 5.5	-1		1	$\mu$ A
	I <sub>oz2</sub>	FOUR, INT pins V <sub>O</sub> = 5.5 V	-1		1	

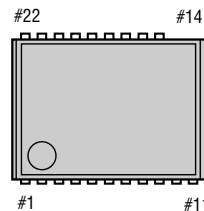
## ■ Terminal connection

### ● RX-4045SA



No.	Pin terminal	No.	Pin terminal
1	N.C	14	N.C
2	CLK	13	DO
3	FOUR	12	DI
4	N.C	11	GND
5	TEST	10	INT
6	V <sub>DD</sub>	9	N.C
7	CE	8	N.C

### ● RX-4045NB

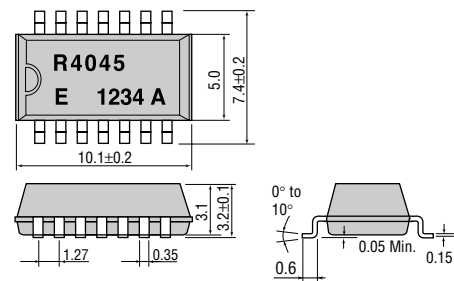


No.	Pin terminal	No.	Pin terminal
1	CE	22	N.C
2	V <sub>DD</sub>	21	N.C
3	(GND)	20	N.C
4	TEST	19	N.C
5	FOUR	18	N.C
6	CLK	17	N.C
7	DO	16	N.C
8	DI	15	N.C
9	GND	14	N.C
10	INT	13	—
11	N.C	12	—

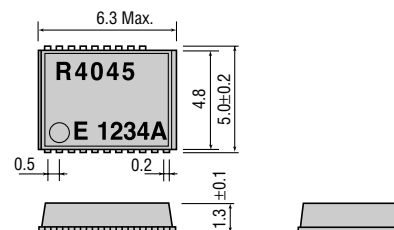
## ■ External dimensions

(Unit: mm)

### ● RX-4045SA (SOP 14-pin)



### ● RX-4045NB (SON 22-pin)



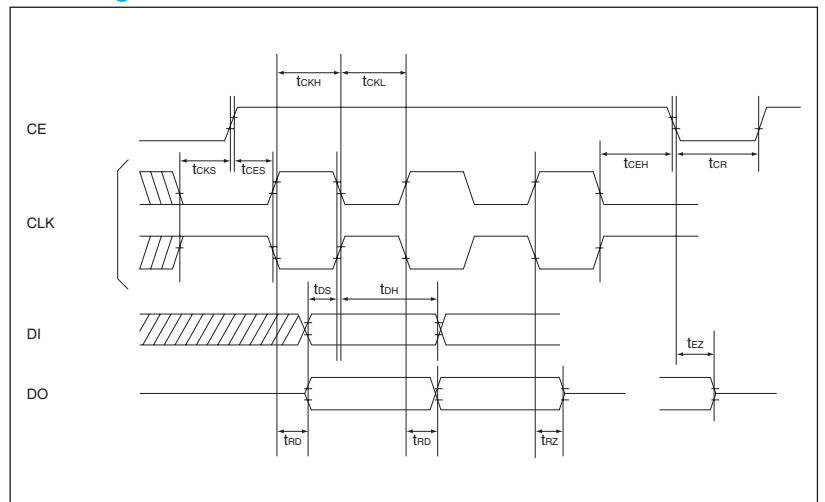
Register table

Address	Register symbol	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
0	Seconds	O	S40	S20	S10	S8	S4	S2	S1
1	Minutes	O	M40	M20	M10	M8	M4	M2	M1
2	Hours	O	O	H20 P, A	H10	H8	H4	H2	H1
3	Weekdays	O	O	O	O	O	W4	W1	W0
4	Days	O	O	D20	D10	D8	D4	D2	D1
5	Months	0	O	O	M010	M08	M04	M02	M01
6	Years	Y80	Y40	Y20	Y10	Y8	Y4	Y2	Y1
7	Digital Offset	0	F6	F5	F4	F3	F2	F1	F0
8	Alarm_W ; Minutes	O	WM40	WM20	WM10	WM8	WM4	WM2	WM1
9	Alarm_W ; Hour	O	O	WH20 WP, A	WH10	WH8	WH4	WH2	WH1
A	Alarm_W ; Weekday	O	WW6	WW5	WW4	WW3	WW2	WW1	WW0
B	Alarm_D ; Minutes	O	DM40	DM20	DM10	DM8	DM4	DM2	DM1
C	Alarm_D ; Hour	O	O	DH20 DP, A	DH10	DH8	DH4	DH2	DH1
D	Reserved	Reserved							
E	Control 1	WALE	DALE	12, 24	CLEN2	TEST	CT2	CT1	CT0
F	Control 2	VDSL	VDET	XST	PON	CLEN1	CTFG	WAFG	DAFG

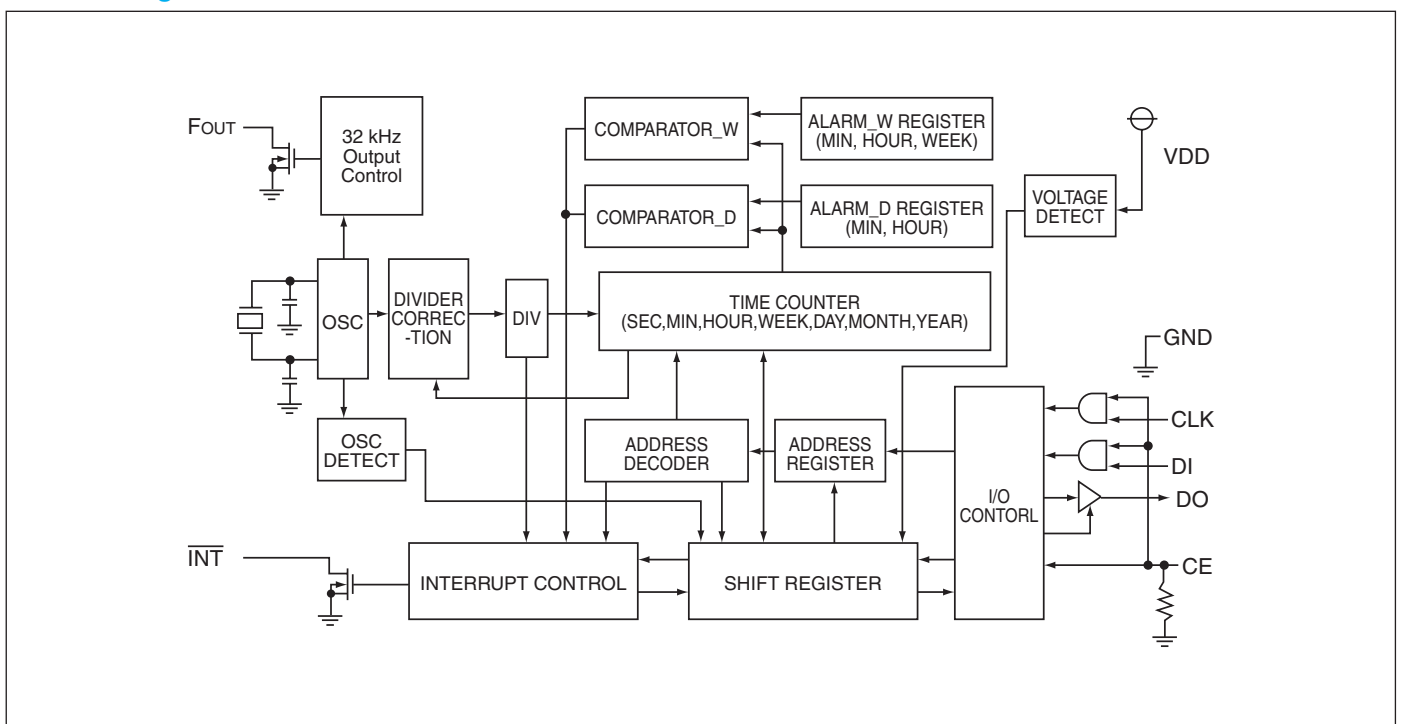
AC characteristics

Item	Symbol	Min.	Typ.	Max.	Unit
CLK clock frequency	CLK	-		1.0	MHz
CE set-up time	tCES	400			ns
CE Hold time	tCEH				
Clock "L" time	tCKL				
Clock "H" time	tCKH				
CE recovery time	tCR	61			µs
Data set-up time	tDS	200			ns
Data hold time	tDH	200			
CLK set-up time	tCKS	200			
Read data delay time	tRD			300	
Output disable time	trZ			300	

Timing chart



Block diagram



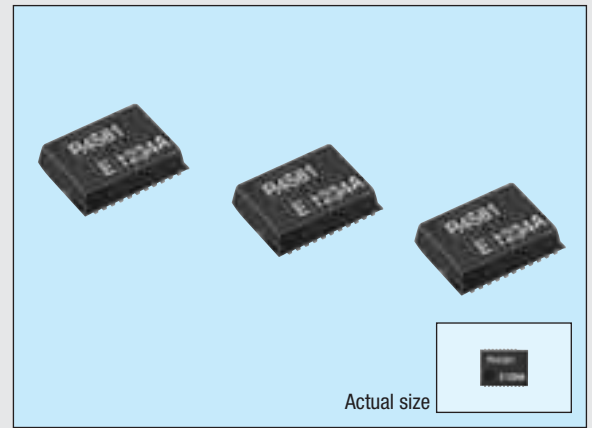
SERIAL REAL TIME CLOCK MODULE WITH SRAM

# RX-4581NB

Product number (please refer to page 5)

**Q4145819x000400**

- Built in frequency adjusted 32.768 kHz crystal unit.
- Include 128 bit (8 bit x 16) RAM
- Serial interface which can be controlled by 4 or 3 signal lines.
- Alarm and Timer IRQ function are Available.
- 32.768 kHz clock frequency output.
- Low backup current : 0.4  $\mu$ A / 3 V (Typ.)
- Wide operating voltage range : 1.6 V to 5.5 V
- Available for lead (Pb) - free soldering.
- Available for lead (Pb) - free terminal.



The details are mentioned in the application manual.

<http://www.epsondevice.com>

## ■ Specifications (characteristics)

### ■ Absolute Max. rating

Item	Symbol	Condition	Min.	Max.	Unit
Supply voltage	V <sub>DD</sub>	V <sub>DD</sub> to GND	-0.3	+7.0	V
Input voltage	V <sub>IN</sub>	Input Pin	GND -0.3	V <sub>DD</sub> +0.3	
Output voltage	V <sub>OUT1</sub>	F <sub>OUT</sub> , DO		V <sub>DD</sub> +0.3	
	V <sub>OUT2</sub>	T <sub>IRQ</sub> , A <sub>IRQ</sub>	+8.0		
Storage temperature	T <sub>STG</sub>	Stored as bare product after unpacking	-55	+125	°C

### ■ Operating range

Item	Symbol	Condition	Min.	Max.	Unit
Power voltage	V <sub>DD</sub>	—	1.6	5.5	V
Clock voltage	V <sub>CLK</sub>	—			
Operating temperature	T <sub>OPR</sub>	No condensation	-40	+85	°C

### ■ Frequency characteristics

Item	Symbol	Condition	Range	Unit
Frequency tolerance	$\Delta f/f$	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 3.0 V	B: 5 $\pm$ 23*	x 10 <sup>-6</sup>
Oscillation start up time	t <sub>STA</sub>	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 3.0 V	3 Max.	s
Frequency temperature characteristics	T <sub>op</sub>	T <sub>a</sub> = -10 to +70 °C, Reference at +25 °C	+10 -120	x 10 <sup>-6</sup>
Frequency voltage characteristics	f/V	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 2.0 V to 5.0 V	$\pm$ 2 Max.	x 10 <sup>-6</sup> / V
Aging	f <sub>a</sub>	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 3.0 V, first year	$\pm$ 5 Max.	x 10 <sup>6</sup> / year

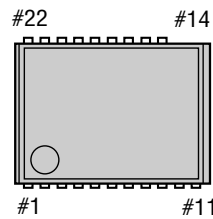
\* Please ask tighter tolerance

### ■ DC characteristics (V<sub>DD</sub> = 1.6 V to 5.5 V, T<sub>a</sub> = -40 °C to +85 °C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Standby current 1	I <sub>DD1</sub>	V <sub>DD</sub> = 5 V CEO, CE1, FOE = GND AIRQ, T <sub>IRQ</sub> = V <sub>DD</sub> 32.768 kHz output is OFF.	—	0.6	1.2	$\mu$ A
Standby current 2	I <sub>DD2</sub>	V <sub>DD</sub> = 3 V	—	0.4	0.8	
Input voltage	V <sub>IH</sub>	CEO, CE1, DI CLK, FOE	0.8 V <sub>DD</sub>	—	V <sub>DD</sub> +0.3	V
	V <sub>IL</sub>		GND-0.3	—	0.2 V <sub>DD</sub>	
Output voltage 1	V <sub>OH1</sub>	V <sub>DD</sub> = 5 V	I <sub>OH</sub> = -1 mA DO, F <sub>OUT</sub> pins	4.5	5.0	V
	V <sub>OH2</sub>			2.0	3.0	
	V <sub>OH3</sub>	V <sub>DD</sub> = 3 V	I <sub>OH</sub> = -100 $\mu$ A DO, F <sub>OUT</sub> pins	2.9		
Output voltage 2	V <sub>OL1</sub>	V <sub>DD</sub> = 5 V	I <sub>OL</sub> = 1 mA DO, F <sub>OUT</sub> pins	GND	GND+0.5	V
	V <sub>OL2</sub>				GND+0.8	
	V <sub>OL3</sub>	V <sub>DD</sub> = 3 V	I <sub>OL</sub> = 100 $\mu$ A DO, F <sub>OUT</sub> pins		GND+0.1	
					GND+0.25	
	V <sub>OL5</sub>	V <sub>DD</sub> = 3 V	A <sub>IRQ</sub> , T <sub>IRQ</sub> pins		GND+0.4	

## ■ Terminal connection

### ● RX-4581NB

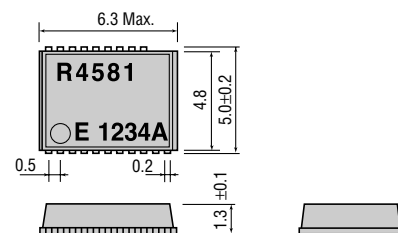


No.	Pin terminal	No.	Pin terminal
1	GND	22	N.C
2	CE1	21	N.C
3	CEO	20	N.C
4	DI	19	N.C
5	DO	18	N.C
6	CLK	17	N.C
7	T <sub>IRQ</sub>	16	N.C
8	A <sub>IRQ</sub>	15	N.C
9	FOE	14	N.C
10	F <sub>OUT</sub>	13	—
11	V <sub>DD</sub>	12	—

## ■ External dimensions

(Unit: mm)

### ● RX-4581NB (SON 22-pin)



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



Register table

BANK0

Address	Register symbol	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
0	Sec	O	40	20	10	8	4	2	1
1	Min	O	40	20	10	8	4	2	1
2	Hour	O	O	20	10	8	4	2	1
3	Day of Week	O	6	5	4	3	2	1	0
4	Day	O	O	20	10	8	4	2	1
5	Month	O	O	O	10	8	4	2	1
6	Year	80	40	20	10	8	4	2	1
7	RAM	•	•	•	•	•	•	•	•
8	Minutes Alarm	AE	40	20	10	8	4	2	1
9	Hours Alarm	AE	•	20	10	8	4	2	1
A	Day of week Alarm	AE	6	5	4	3	2	1	0
			•	20	10	8	4	2	1
B	Timer Counter 0	128	64	32	16	8	4	2	1
C	Timer Counter 1	•	•	•	•	2048	1024	512	256
D	Extension Register	TEST	WADA	USEL	TE	O	O	TSEL 1	TSEL 0
E	Frag Register	O	O	UF	TF	AF	O	VLF	O
F	Control Register	O	O	UIE	TIE	AIE	O	STOP	RESET

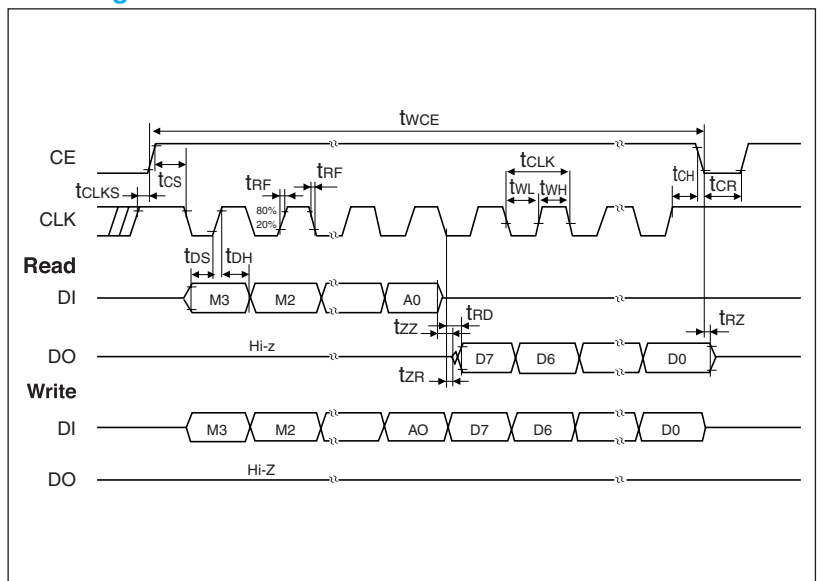
BANK1

Address	Register symbol	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
0	RAM 0	•	•	•	•	•	•	•	•
1	RAM 1	•	•	•	•	•	•	•	•
2	RAM 2	•	•	•	•	•	•	•	•
⋮	⋮								
D	RAM D	•	•	•	•	•	•	•	•
E	RAM E	•	•	•	•	•	•	•	•
F	RAM F	•	•	•	•	•	•	•	•

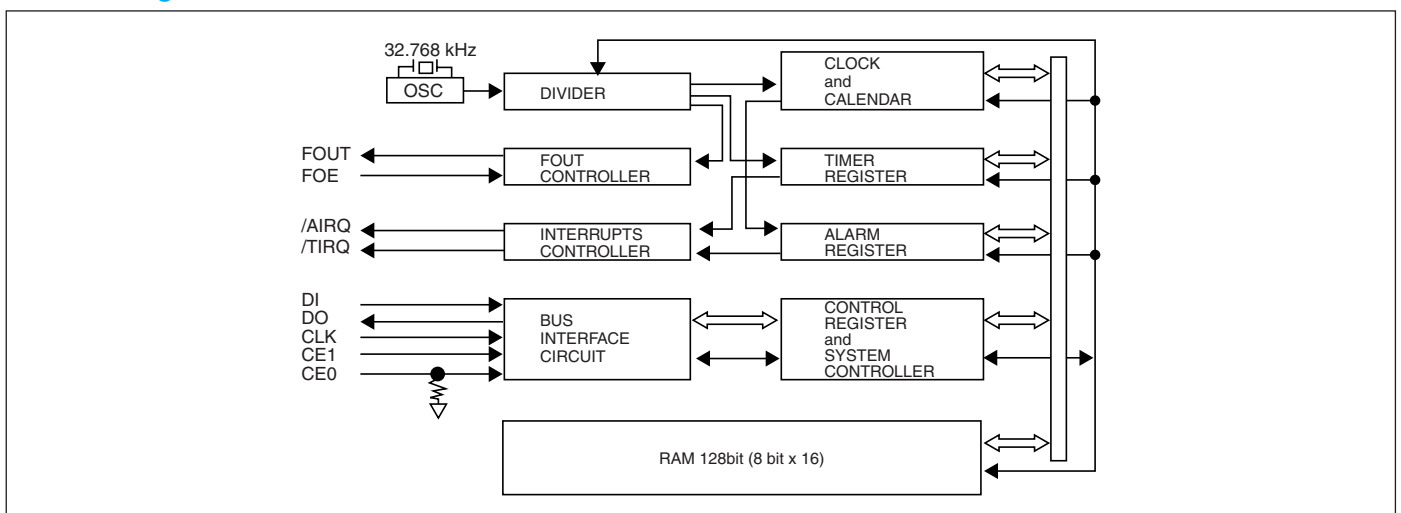
AC characteristics \*If not specifically indicated, GND = 0, Ta = -40 °C to +85 °C

Item	Symbol	Condition	VDD = 3.0 V ± 10 %		VDD = 5.0 V ± 10 %		Unit
			Min.	Max.	Min.	Max.	
CLK clock cycle	tCLK		500		350		ns
CLK H Pulse Width	tWH		250		175		ns
CLK L Pulse Width	tWL		250		175		ns
CLK L rise and fall time	trF			100		50	ns
CLK setup time	tCLKS		0		0		ns
CE setup time	tCS		200		150		ns
CE hold time	tCH		200		100		ns
CE recovery time	tCR		300		200		ns
CE enable time	twCE			0.95		0.95	s
Write data setup time	tDS		100		50		ns
Write data hold time	tDH		100		50		ns
Read data delay time	trD	CL = 50 pF		200		150	ns
DO output switching time	tZR			50		20	ns
DO output disable time	trZ	CL = 50 pF RL = 10 kΩ		200		100	ns
DI / DO conflict avoiding time	tZZ		0		0		ns
FOUT duty	tw/t	50% VDD level	40	60	40	60	ns

Timing chart



Block diagram

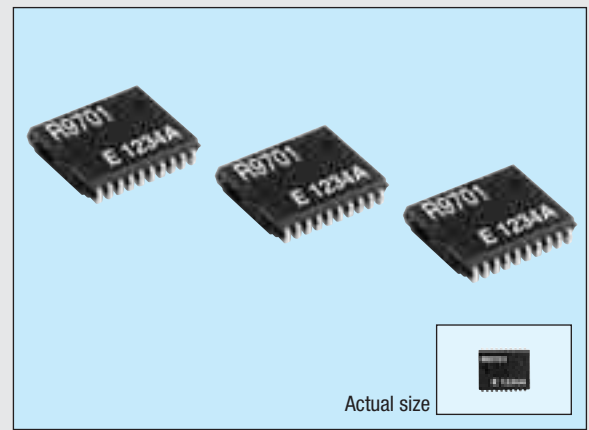


# SERIAL REAL TIME CLOCK MODULE WITH EEPROM RTC-9701JE

Product number (please refer to page 5)

**Q4197017x000100**

- Built-in frequency adjusted 32.768 kHz crystal unit.
- Include EEPROM 4 kbit (256 x 16 bit) User Memory.
- Include High Precision Voltage Detector. (2.5 V ± 0.1 V)
- Serial Interface which can be controlled by 4 or 3 signal lines.
- Timer IRQ and Alarm IRQ function available.
- 32.768 kHz clock frequency Output. (CMOS OUTPUT)
- Wide range of clock voltage between 1.8 V and 5.5 V.
- Low backup current : 0.8 μA / 3.0 V. (Typ.)
- Available for lead (Pb) - free soldering.
- Available for lead (Pb) - free terminal.



The details are mentioned in the application manual.

<http://www.epsondevice.com>

## Specifications (characteristics)

### Absolute Max. rating

Item	Symbol	Condition	Min.	Max.	Unit
Supply voltage	V <sub>DD</sub> , V <sub>DD2</sub>	V <sub>DD</sub> , V <sub>DD2</sub> to GND	-0.3	+6.0	V
Input voltage	V <sub>IN</sub>	Input Pin	GND -0.3	V <sub>DD</sub> +0.3	
Output voltage	V <sub>AIN</sub>	VEX pin	-0.3	+6.0	V
	V <sub>OUT</sub>	AIRQ, TIRQ, FOUT, DO pins	GND -0.3	V <sub>DD</sub> +0.3	
Storage temperature	T <sub>STG</sub>	Stored as bare product after unpacking	-55	+125	°C

### Operating range

Item	Symbol	Condition	Min.	Max.	Unit
Power voltage	V <sub>DD</sub>	V <sub>DD</sub>	2.7	3.6	V
Clock voltage	V <sub>DD2</sub>	V <sub>DD2</sub>	1.8	5.5	
Analog voltage	V <sub>EX</sub>	VEX	1.4	5.5	
Operating temperature	T <sub>OPR</sub>	No condensation	-40	+85	°C

### Frequency characteristics

Item	Symbol	Condition	Range	Unit
Frequency tolerance	Δf/f	T <sub>a</sub> = +25 °C, V <sub>DD2</sub> = 3.0 V	B: 5 ±23*	x 10 <sup>-6</sup>
Oscillation start up time	t <sub>STA</sub>	T <sub>a</sub> = +25 °C, V <sub>DD2</sub> = 3.0 V	3 Max.	s
Frequency temperature characteristics	T <sub>OP</sub>	T <sub>a</sub> = -10 °C to +70 °C, V <sub>DD</sub> = 3.0 V, +25 °C	+10 / -120	x 10 <sup>-6</sup>
Frequency voltage characteristics	f/V	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 1.8 V to 5.5 V	±2.0	x 10 <sup>-6</sup>
Aging	f <sub>a</sub>	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 3.0 V, first year	±5.0	x 10 <sup>-6</sup> / year

\* Please ask tighter tolerance.

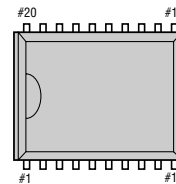
### DC characteristics

GND = 0V, V<sub>DD</sub> = 2.7 V to 3.6 V, V<sub>DD2</sub> = 1.8 V to 5.5 V, T<sub>a</sub> = -40 °C to +85 °C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
V <sub>DD</sub> current consumption	I <sub>DD1</sub>	V <sub>DD</sub> = 3.0 V, F <sub>OUT</sub> output off		0.2	3.0	μA
	I <sub>DD2</sub>	V <sub>DD</sub> = 3.0 V, CL = 0 pF, F <sub>OUT</sub> = 32.768 kHz output		1.0	3.5	
V <sub>DD2</sub> current consumption	I <sub>BK1</sub>	V <sub>DD2</sub> = 3.0 V, F <sub>OUT</sub> output off		0.8	1.0	
	I <sub>BK2</sub>	V <sub>DD2</sub> = 3.0 V, CL = 0 pF, F <sub>OUT</sub> = 32.768 kHz output		0.8	1.0	
Input voltage	V <sub>IH</sub>	CE, CLK, DI, FOE	0.8 V <sub>DD</sub>		V <sub>DD</sub>	V
	V <sub>IL</sub>		0		0.2 V <sub>DD</sub>	
Pulldown	R <sub>DWN</sub>	CE, FOE	75		600	kΩ
“H” Output voltage	V <sub>OH1</sub>	I <sub>OH</sub> = -1 mA	V <sub>DD</sub> -0.4			V
	V <sub>OL2</sub>	I <sub>OH</sub> = -1 mA	V <sub>DD</sub> -0.4			
“L” Output voltage	V <sub>OL1</sub>	I <sub>OL</sub> = 1 mA	GND		GND +0.4	V
	V <sub>OH2</sub>	I <sub>OL</sub> = 1 mA	GND		GND +0.4	
	V <sub>OL3</sub>	AIRQ, TIRQ I <sub>OL</sub> = 2 mA	GND		GND +0.4	

## Terminal connection

### RTC-9701JE

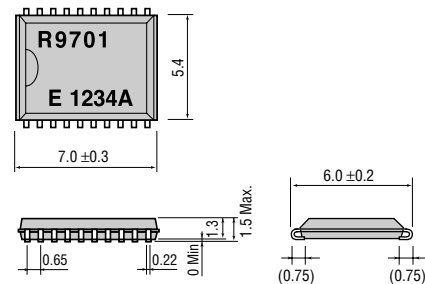


No.	Pin terminal	No.	Pin terminal
1	V <sub>DD2</sub>	20	N.C
2	VEX	19	N.C
3	FOE	18	N.C
4	AIRQ	17	N.C
5	TIRQ	16	N.C
6	CE	15	N.C
7	CLK	14	N.C
8	DI	13	GND
9	DO	12	GND
10	V <sub>DD</sub>	11	FOUT

## External dimensions

(Unit: mm)

### RTC-9701JE (VSQJ 20-pin)



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

## EEPROM Memory characteristics

GND = 0V, V<sub>DD</sub> = 2.7 V to 3.6 V, V<sub>DD2</sub> = 1.8 V to 5.5 V, T<sub>a</sub> = -40 °C to +85 °C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Memory contents				4 k (256 x 16)		bit
Program / Erase Cycle			10 <sup>5</sup>			Times
Current consumption	I <sub>DD3</sub>	EEPROM write		1	3	mA
Access time	t <sub>WV</sub>			5	10	ms

Register table

Address	Function	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
0	SEC	–	S 40	S 20	S 10	S 8	S 4	S 2	S 1
1	MIN	–	M 40	M 20	M 10	M 8	M 4	M 2	M 1
2	HOUR	–	–	H 20	H 10	H 8	H 4	H 2	H 1
3	WEEK	–	W 6	W 5	W 4	W 3	W 2	W 1	W 0
4	DAY	–	–	D 20	D 10	D 8	D 4	D 2	D 1
5	MONTH	–	–	–	C 10	C 8	C 4	C 2	C 1
6	YEAR	Y 80	Y 40	Y 20	Y 10	Y 8	Y 4	Y 2	Y 1
7	Y100	0	0	1	0	0	0	0	0
8	MIN Alarm	AE	MA 40	MA 20	MA 10	MA 8	MA 4	MA 2	MA 1
9	HOUR Alarm	AE	–	HA 20	HA 10	HA 8	HA 4	HA 2	HA 1
A	WEEK Alarm	AE	WA 6	WA 5	WA 4	WA 3	WA 2	WA 1	WA 0
	DAY Alarm		–	DA 20	DA 10	DA 8	DA 4	DA 2	DA 1
B	Reserved								
C	Interval Timer	TDUTY	CT6	CT 5	CT 4	CT3	CT 2	CT 1	CT 0
D	Extension Register	TEST	WADA	UDUTY	USEL	–	–	TSEL 1	TSEL 0
E	Flag Register	VLF2	–	UF	TF	AF	EXF	VLF	–
F	Control Register	–	–	UIE	TIE	AIE	EXIE	VLIE	–

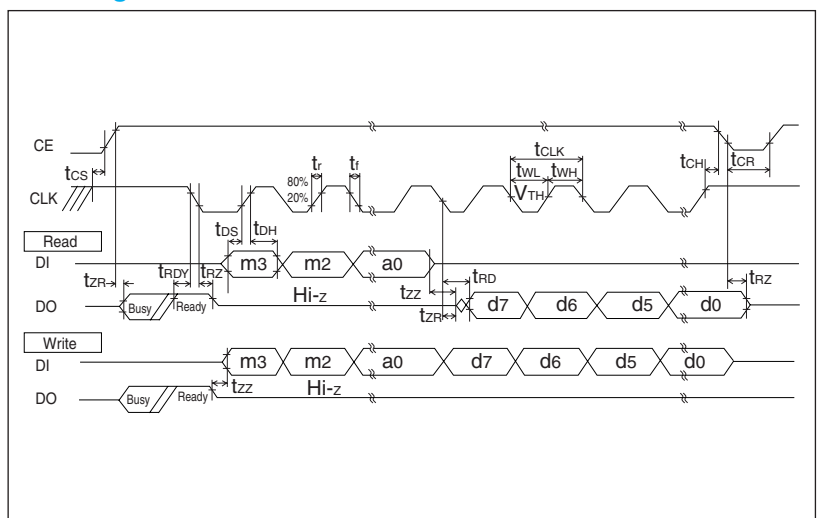
EEPROM Table

Segment	Address	Data															
		dF	dE	dD	dC	dB	dA	d9	d8	d7	d6	d5	d4	d3	d2	d1	d0
0	00	User Memory 4 kbit (256 x 16 bit)															
	⋮																
	FF																

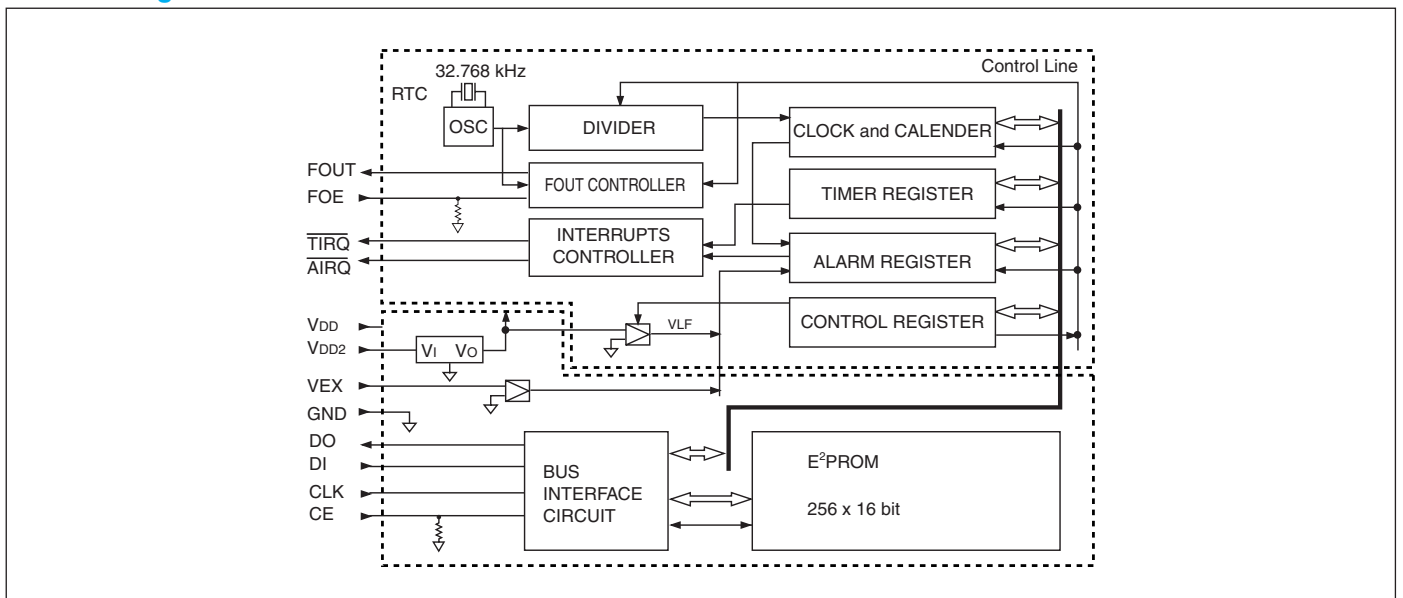
AC characteristics (GND = 0 V, VDD = 2.7 V to 3.6 V, VDD2 = 1.8 V to 5.5 V, Ta = -40 °C to +85 °C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
CLK clock cycle	tCLK	Vth = 0.5 VDD	500			ns
CLK H Pulse Width	tWH	Vth = 0.5 VDD	230			ns
CLK L Pulse Width	tWL	Vth = 0.5 VDD	230			ns
CE setup time	tCS		110			ns
CE hold time	tCH		170			ns
Write data setup time	tDS		150			ns
Write data hold time	tDH		150			ns
Read data delay time	tRD	CL = 65pF ± 10pF			240	ns
DO output mode switching time	tZR	CL = 65pF ± 10pF	170			ns
DO output disable time	trZ	CL = 65pF ± 10pF RL = 10kΩ			240	ns
Ready setup time	trDY				65	ns
Rise and fall time	trF	VDD: 20% to 80 %			30	ns
Carry busy	tcarry	Xtal = 32.768kHz			7.8125	ns
FOUT duty ratio	tw/t	Vth = 1/2 VDD VDD = 3.0V	40	50	60	%

Timing chart



Block diagram



# SERIAL REAL TIME CLOCK MODULE WITH TEMPERATURE SENSOR

## RTC-4701JE / NB RX-4702CF

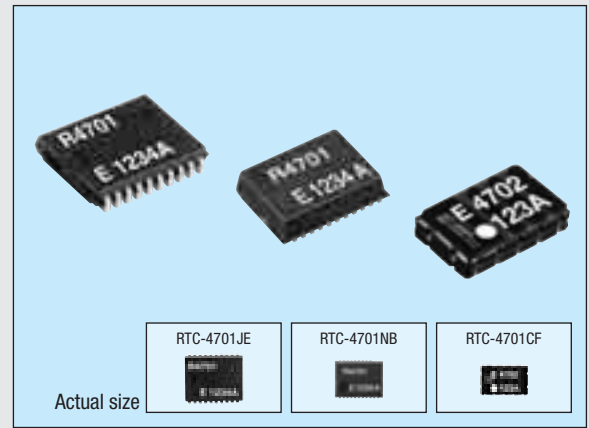
Product number (please refer to page 5)

Q4147017x000200

Q4147019x000200

Q414702Axxxxx00

- Built-in crystal unit allows adjustment-free efficient operation.
- Serial interface which can be controlled by three signal lines.
- Alarm interrupt function for day of week, day, hour, and minute.
- Timer interrupt function which can be set up between 1/4096 second and 255 minutes. (Except for RX-4702CF)
- OVF interrupt function based on 12-bit additional counter.
- Ability to detect stopping of oscillation and time update.
- Built-in temperature sensor. (voltage output RTC-4701JE / NB :7.6 mV / °C Typ. RX-4702CF : -7.8 mV / °C Typ.)
- Wide range of voltage between 1.6 V and 5.5 V.
- Low power consumption at 0.5 μA / 3 V. (Typ.)
- Available for lead (Pb) - free soldering.
- Lead (Pb) - free terminal (RX-4702CF), Available for lead (Pb) - free terminal (RTC-4701JE / NB).



The details are mentioned in the application manual.

<http://www.epsondevice.com>

### Specifications (characteristics)

#### Absolute Max. rating

Item	Symbol	Condition	Min.	Max.	Unit
Supply voltage	VDD	VDD to GND	-0.3	+7.0	V
Input voltage	VIN	Input Pin		VDD +0.3	
Output voltage	VOUT1	TIRQ, AIRQ, IRQ	GND -0.3	+8.0	
	VOUT2	FOUT, DATA		VDD +0.3	
Storage temperature	TSTG	Stored as bare product after unpacking	-55	+125	°C

#### Operating range

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

#### Frequency characteristics

Item	Symbol	Condition	Range	Unit
Frequency tolerance	$\Delta f/f$	Ta = +25 °C, VDD = 3 V	B: 5 ±23*	x 10 <sup>-6</sup>
Oscillation start up time	tSTA	Ta = +25 °C, VDD = 3.0 V	3 Max.	s
Frequency temperature characteristics	T <sub>op</sub>	Ta = -20 °C to +70 °C Reference at +25 °C	+10 -120	x 10 <sup>-6</sup>
Frequency voltage characteristics	f/V	Ta = +25 °C, VDD = 1.6 to 5.5 V	±2 Max.	x 10 <sup>-6</sup> / V
Aging	fa	Ta = +25 °C, VDD = 3.0 V	±5 Max.	x 10 <sup>9</sup> / year

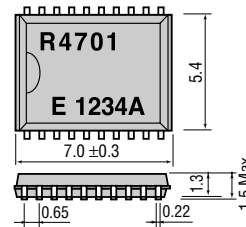
\* Please ask tighter tolerance.

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

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Standby current 1	I <sub>DD1</sub>	VDD = 5 V CE, FOE, SOFF = GND AIRQ, TIRQ, IRQ = VDD 32.768 kHz output is OFF. Sensor output is OFF.	—	1.0	2.0	μA
	I <sub>DD2</sub>	VDD = 3 V	—	0.5	1.0	
Standby current 2	V <sub>IH</sub>	CE, CLK, DATA, FOE, SOFF	0.8 VDD	—	VDD +0.3	V
Input voltage	V <sub>IL</sub>		GND -0.3	—	0.2 VDD	
Output voltage 1	V <sub>OH1</sub>	VDD = 5 V	I <sub>OH</sub> = -1 mA DATA, FOUT pins	4.5	—	5.0
	V <sub>OH2</sub>			2.0	—	3.0
	V <sub>OH3</sub>	VDD = 3 V	I <sub>OH</sub> = -100 μA DATA, FOUT pins	2.9	—	3.0
Output voltage 2	V <sub>OL1</sub>	VDD = 5 V	I <sub>OL</sub> = 1 mA DATA, FOUT pins	—	—	GND +0.5
	V <sub>OL2</sub>			—	—	GND +0.8
	V <sub>OL3</sub>	VDD = 3 V	I <sub>OL</sub> = 100 μA DATA, FOUT pins	—	—	GND +0.1
	V <sub>OL4</sub>			—	—	GND +0.25
	V <sub>OL5</sub>			—	—	GND +0.4

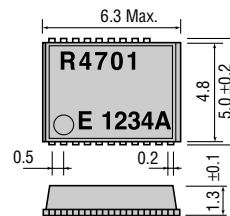
### External dimensions / Terminal connection (Unit: mm)

#### RTC-4701JE (VSOJ 20-pin)



No.	Pin terminal	No.	Pin terminal
1	VDD	20	N.C
2	FOUT	19	N.C
3	CE	18	N.C
4	AIRQ	17	N.C
5	TIRQ	16	N.C
6	CLK	15	N.C
7	DATA	14	N.C
8	FOE	13	N.C
9	VTEMP	12	N.C
10	SOFF	11	GND

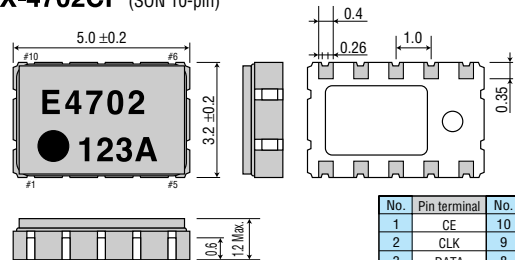
#### RTC-4701NB (SON 22-pin)



No.	Pin terminal	No.	Pin terminal
1	GND	22	N.C
2	SOFF	21	N.C
3	VTEMP	20	N.C
4	FOE	19	N.C
5	DATA	18	N.C
6	CLK	17	N.C
7	TIRQ	16	N.C
8	AIRQ	15	N.C
9	CE	14	N.C
10	FOUT	13	—
11	VDD	12	—

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

#### RX-4702CF (SON 10-pin)



No.	Pin terminal	No.	Pin terminal
1	CE	10	VDD
2	CLK	9	VTEMP
3	DATA	8	TIRQ
4	SOFF	7	FOE
5	GND	6	FOUT

### Temperature sensor characteristics

GND = 0 V, Ta = -40 °C to +85 °C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	
Temperature output voltage	VTEMP	Ta = +25 °C, GND based output voltage VTEMP pin, VDD = 2.7 V to 5.5 V		1.48		V	
Output precision	TACR	Ta = +25 °C, VDD = 2.7 V to 5.5 V			±5.0	°C	
Temperature sensitivity	VSE	-40 °C ≤ Ta ≤ +85 °C, VDD = 2.7 V to 5.5 V	RTC-4701JE /	-7.1	-7.6	-8.1	mV / °C
			RX-4702CF	-7.3	-7.8	-8.3	
Linearity	ΔNL	-40 °C ≤ Ta ≤ +85 °C, VDD = 2.7 to 5.5 V			±2.0	%	
Output resistance	Ro	Ta = +25 °C, VTEMP pin, VDD = 2.7 V to 5.5 V GND standard and VDD standard		1.0	3.0	kΩ	

■ Register table

RTC-4701 JE / NB : BANK0

Address	Register symbol	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
0	Sec	fos	S 40	S 20	S 10	S 8	S 4	S 2	S 1
1	Min	fr	Min 40	Min 20	Min 10	Min 8	Min4	Min 2	Min 1
2	Hour	fr	0	Hour 20	Hour 10	Hour 8	Hour4	Hour 2	Hour 1
3	Day of Week	fr	W 6	W 5	W 4	W 3	W 2	W 1	W 0
4	Day	fr	0	Day 20	Day 10	Day 8	Day 4	Day 2	Day 1
5	Month	fr	C	0	Month 10	Month 8	Month 4	Month 2	Month 1
6	Year	Year 80	Year 40	Year 20	Year 10	Year 8	Year 4	Year 2	Year 1
7	Minutes Alarm	AE	A-Min 40	A-Min 20	A-Min 10	A-Min 8	A-Min 4	A-Min 2	A-Min 1
8	Hours Alarm	AE	*	A-Hr 20	A-Hr 10	A-Hr 8	A-Hr 4	A-Hr 2	A-Hr 1
9	Day of week Alarm	AE	A-W 6	A-W 5	A-W 4	A-W 3	A-W 2	A-W 1	A-W 0
A	Day Alarm	AE	*	A-Day 20	A-Day 10	A-Day 8	A-Day 4	A-Day 2	A-Day 1
B	-	-	-	-	-	-	-	-	-
C	Timer setup	TE	*	TD <sub>1</sub>	TD <sub>0</sub>	*	*	*	*
D	Timer Couner	128	64	32	16	8	4	2	1
E	Control 1	0	0	0	TI / TP	AF	TF	AIE	TIE
F	Control 2	0	TEST	STOP	RESET	HOLD	0	0	0

RX-4702CF : BANK0

Address	Register symbol	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
B	Additional counter 1	128	64	32	16	8	4	2	1
C	Additional counter 2	fr	AC1	AC0	OVF	2048	1024	512	256
D	Control 3	FOES	TEST1	0	0	-	ACIE	ACE	SON
E	Control 1	0	0	0	0	AF	0	AIE	0
F	Control 2	0	TEST0	STOP	RESET	HOLD	0	0	0

RTC-4701 JE / NB : BANK1

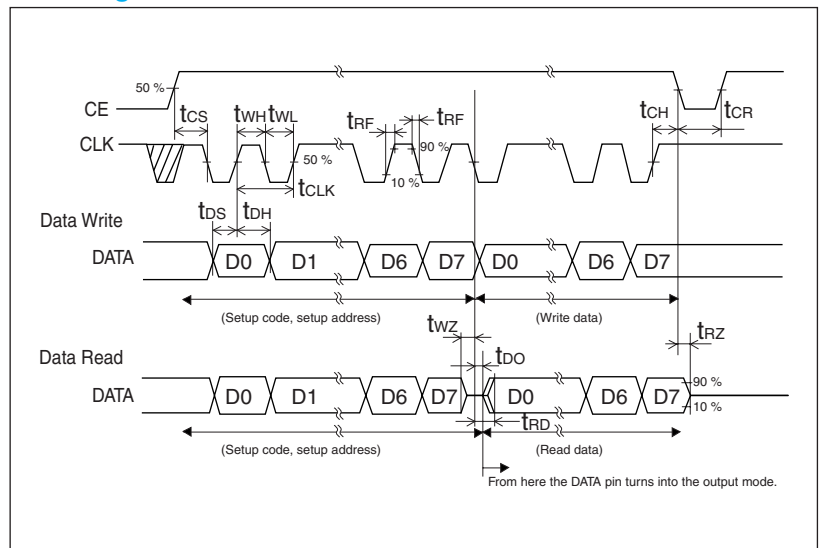
Address	Register symbol	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
B	Additional counter 1	128	64	32	16	8	4	2	1
C	Additional counter 2	fr	AC1	AC0	OVF	2048	1024	512	256
D	-	-	-	-	-	-	-	-	-
E	-	-	-	-	-	-	-	-	-
F	Control 3	FOES	TEST	-	-	-	ACIE	ACE	SON

Registers 0 to A are the same in BANK0 and BANK1.

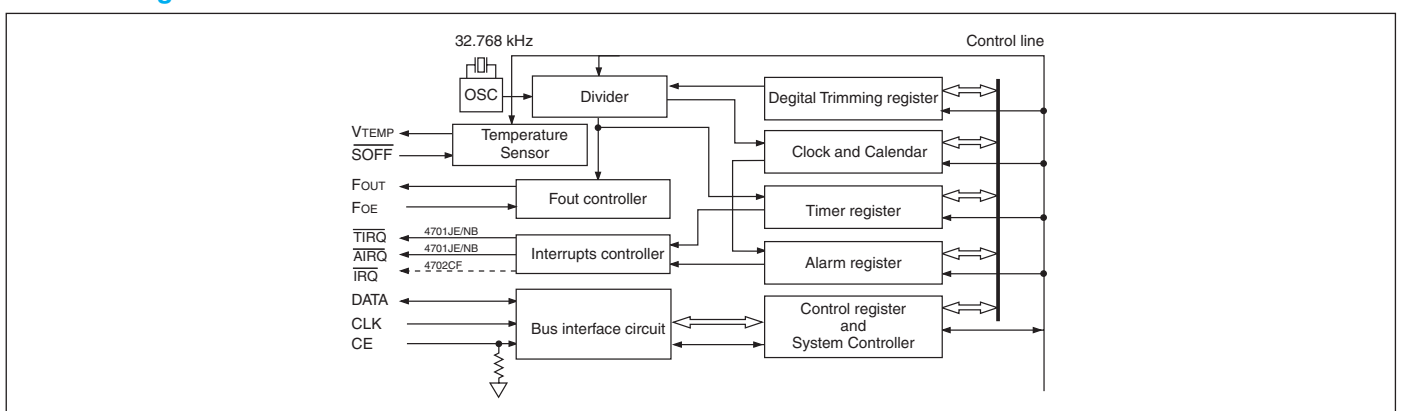
■ AC characteristics (GND = 0 V, Ta = -40 °C to +85 °C)

Item	Symbol	Control	V <sub>DD</sub> = 3.0 V ± 10 %		V <sub>DD</sub> = 5.0 V ± 10 %		Unit
			Min.	Max.	Min.	Max.	
CLK clock cycle	t <sub>CLK</sub>		600		350		ns
CLK H Pulse Width	t <sub>WH</sub>						
CLK L Pulse Width	t <sub>WL</sub>						
CE setup time	t <sub>CS</sub>		300		175		
CE hold time	t <sub>CH</sub>						
CE recovery time	t <sub>CR</sub>		400		300		
Write data setup time	t <sub>DS</sub>		75		50		
Write data hold time	t <sub>DH</sub>						
Write data disable delay time	t <sub>DZ</sub>		0		0		
Output mode switching time	t <sub>DO</sub>						
Read data delay time	t <sub>RD</sub>	C <sub>L</sub> = 50 pF	300		120		
Output disable time	t <sub>RZ</sub>	C <sub>L</sub> = 50 pF R <sub>L</sub> = 10 kΩ	200		100		
Rise and fall time	t <sub>RF</sub>		100		50		
FOUT duty ratio (32.768 kHz output)	Duty		40	60	40	60	

■ Timing chart



■ Block diagram



SERIAL REAL TIME CLOCK MODULE

# RTC-4574SA / JE / NB

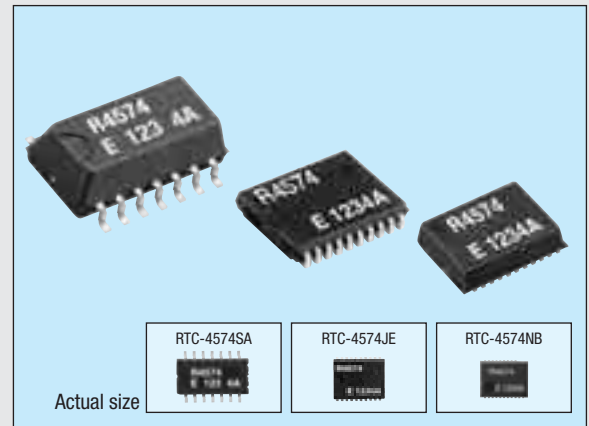
Product number (please refer to page 5)

Q4145745x000200

Q4145747x000100

Q4145749xxxxx00

- Built-in crystal unit allows adjustment-free efficient operation.
- Serial interface which can be controlled by three signal lines.
- Alarm interrupt function for day of week, day, hour, and minute.
- Timer interrupt function which can be set up between 1/4096 second and 255 minutes .
- Dedicated interrupt output of the two systems (alarm and regular cycle) which allows software masking.
- Ability to detect stopping of oscillation and time update.
- Wide range of interface voltage and clock voltage between 1.6 V and 5.5 V.
- Low power consumption at 0.5  $\mu$ A / 3 V. (Typ.)
- Available for lead (Pb) - free soldering.
- Available for lead (Pb) - free terminal.



The details are mentioned in the application manual.

<http://www.epsondevice.com>

## Specifications (characteristics)

### Absolute Max. rating

Item	Symbol	Condition	Min.	Max.	Unit
Supply voltage	V <sub>DD</sub>	V <sub>DD</sub> to GND	-0.3	+7.0	V
Input voltage	V <sub>IN</sub>	Input Pin	GND -0.3	V <sub>DD</sub> +0.3	
Output voltage	V <sub>OUT1</sub>	TIRQ, AIRQ		+8.0	
	V <sub>OUT2</sub>	FOUT, DATA		V <sub>DD</sub> +0.3	
Storage temperature	T <sub>STG</sub>	Stored as bare product after unpacking	-55	+125	°C

### Operating range

Item	Symbol	Condition	Min.	Max.	Unit
Power voltage	V <sub>DD</sub>	-	1.6	5.5	V
Clock voltage	V <sub>CLK</sub>	-			
Operating temperature	T <sub>OPR</sub>	No condensation	-40	+85	°C

### Frequency characteristics

Item	Symbol	Condition	Range	Unit
Frequency tolerance	$\Delta f/f$	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 3 V	B: 5 $\pm$ 23*	x 10 <sup>-6</sup>
Oscillation start up time	t <sub>STA</sub>	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 1.6 V	3 Max.	s
Frequency temperature characteristics	T <sub>OP</sub>	T <sub>a</sub> = -20 °C to +70 °C Reference at +25 °C	+10 -120	x 10 <sup>-6</sup>
Frequency voltage characteristics	f/V	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 1.6 V to 5.5 V	$\pm$ 2	x 10 <sup>-6</sup> / V
Aging	f <sub>a</sub>	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 3 V	$\pm$ 5	x 10 <sup>6</sup> / year

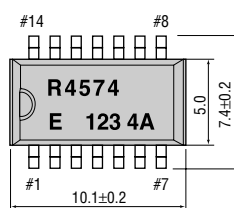
\* Please ask tighter tolerance.

### DC characteristics (GND = 0 V, V<sub>DD</sub> = 1.8 V to 5.5 V, T<sub>a</sub> = -40 °C to +85 °C)

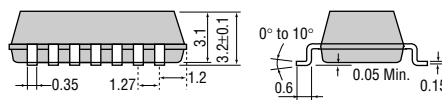
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Standby current 1	I <sub>DD2</sub>	V <sub>DD</sub> = 5 V C <sub>EO</sub> , CE <sub>1</sub> = GND	-	1.0	2.0	$\mu$ A
Standby current 2	I <sub>DD2</sub>	V <sub>DD</sub> = 3 V DATA, AIRQ, TIRQ V <sub>DD</sub>	-	0.5	1.0	
Input voltage	V <sub>IH</sub> V <sub>IL</sub>	CE <sub>0</sub> , CE <sub>1</sub> , CLK, DATA, FCON pins	0.8 V <sub>DD</sub> 0	-	V <sub>DD</sub> 0.2 V <sub>DD</sub>	V
Output voltage 1	V <sub>OH1</sub> V <sub>OH2</sub> V <sub>OH3</sub>	V <sub>DD</sub> = 5 V I <sub>OH</sub> = -1 mA DATA, FOUT pins	4.5	-	5.0	V
		V <sub>DD</sub> = 3 V I <sub>OH</sub> = -100 $\mu$ A DATA, FOUT pins	2.9	-	3.0	
Output voltage 2	V <sub>OL1</sub> V <sub>OL2</sub> V <sub>OL3</sub> V <sub>OL4</sub> V <sub>OL5</sub>	V <sub>DD</sub> = 5 V I <sub>OL</sub> = 1 mA DATA, FOUT pins	GND	-	GND +0.5	
		V <sub>DD</sub> = 3 V I <sub>OL</sub> = 100 $\mu$ A DATA, FOUT pins			GND +0.8	
		V <sub>DD</sub> = 5 V I <sub>OL</sub> = 1 mA AIRQ, TIRQ pins			GND +0.1	
		V <sub>DD</sub> = 3 V I <sub>OL</sub> = 1 mA AIRQ, TIRQ pins			GND +0.25	
		V <sub>DD</sub> = 3 V I <sub>OL</sub> = 1 mA AIRQ, TIRQ pins			GND +0.4	

## External dimensions / Terminal connection (Unit: mm)

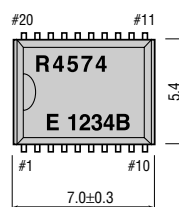
### RTC-4574SA (SOP 14-pin)



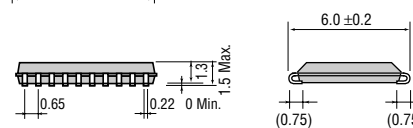
No.	Pin terminal	No.	Pin terminal
1	GND	14	FCON
2	FOUT	13	CE <sub>1</sub>
3	N.C	12	DATA
4	N.C	11	CLK
5	N.C	10	TIRQ
6	N.C	9	AIRQ
7	V <sub>DD</sub>	8	CE <sub>0</sub>



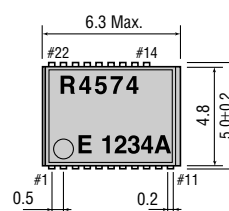
### RTC-4574JE (VSOJ 20-pin)



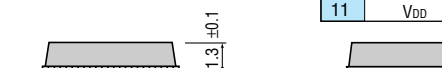
No.	Pin terminal	No.	Pin terminal
1	V <sub>DD</sub>	20	N.C
2	FOUT	19	N.C
3	CE <sub>0</sub>	18	N.C
4	AIRQ	17	N.C
5	TIRQ	16	N.C
6	CLK	15	N.C
7	DATA	14	N.C
8	CE <sub>1</sub>	13	N.C
9	FCON	12	N.C
10	GND	11	N.C



### RTC-4574NB (SON 22-pin)



No.	Pin terminal	No.	Pin terminal
1	GND	22	N.C
2	FCON	21	N.C
3	N.C	20	N.C
4	CE <sub>1</sub>	19	N.C
5	DATA	18	N.C
6	CLK	17	N.C
7	TIRQ	16	N.C
8	AIRQ	15	N.C
9	CE <sub>0</sub>	14	N.C
10	FOUT (13)	-	-
11	V <sub>DD</sub> (12)	-	-



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

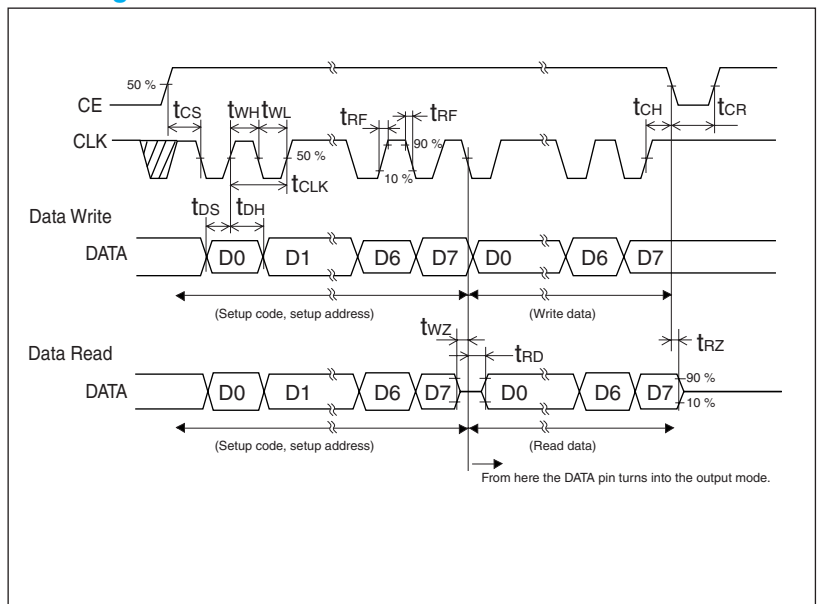
Register table

Address	Register symbol	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
0	Sec	fos	S 40	S 20	S 10	S 8	S 4	S 2	S 1
1	Min	fr	Min 40	Min 20	Min 10	Min 8	Min 4	Min 2	Min 1
2	Hour	fr	0	Hour 20	Hour 10	Hour 8	Hour 4	Hour 2	Hour 1
3	Day of Week	fr	W 6	W 5	W 4	W 3	W 2	W 1	W 0
4	Day	fr	0	Day 20	Day 10	Day 8	Day 4	Day 2	Day 1
5	Month	fr	0	0	Month 10	Month 8	Month 4	Month 2	Month 1
6	Year	Year 80	Year 40	Year 20	Year 10	Year 8	Year 4	Year 2	Year 1
7	Minutes Alarm	AE	A-Min 40	A-Min 20	A-Min 10	A-Min 8	A-Min 4	A-Min 2	A-Min 1
8	Hours Alarm	AE	*	A-Hr20	A-Hr10	A-Hr8	A-Hr4	A-Hr2	A-Hr1
9	Week Alarm	AE	A-W 6	A-W 5	A-W 4	A-W 3	A-W 2	A-W 1	A-W 0
A	Day Alarm	AE	*	A-Day 20	A-Day 10	A-Day 8	A-Day 4	A-Day 2	A-Day 1
B	Four control	FE	*	FD4	FD3	*	FD2	FD1	FD0
C	Timer interrupt control	TE	*	TD1	TD0	*	*	*	*
D	Count Down Timer	Timer 128	Timer 64	Timer 32	Timer 16	Timer 8	Timer 4	Timer 2	Timer 1
E	Control 1	0	0	0	TI / TP	AF	TF	AIE	TIE
F	Control 2	0	TEST	STOP	RESET	HOLD	0	0	0

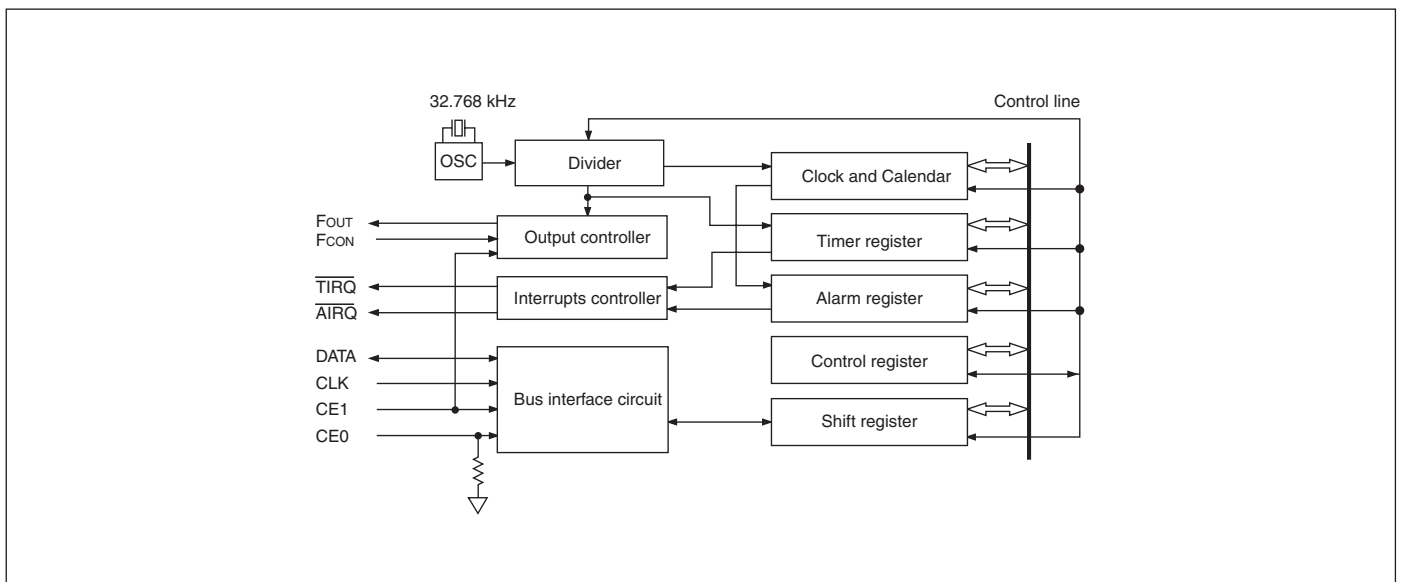
AC characteristics (GND = 0 V, Ta = -40 °C to +85 °C)

Item	Symbol	Control	VDD = 3.0 V ± 10 %		VDD = 5.0 V ± 10 %		Unit	
			Min.	Max.	Min.	Max.		
CLK clock cycle	tCLK		800		350		ns	
CLK H Pulse Width	tWH							
CLK L Pulse Width	tWL		400		175			
CE setup time	tCS							
CE hold time	tCH	-	-	-	-	-		
CE recovery time	tCR		600		300			
Write data setup time	tDS		100		50			
Write data hold time	tDH		80		50			
Write data disable delay time	twz		0		0			
Read data delay time	tRD	CL = 50 pF		300		120		
Output disable time	trZ	CL = 50 pF RL = 10 kΩ		200		100		
Rise and fall time	trF			100		50		
FOUT duty ratio (32.768 kHz output)	Duty		35	65	40	60		%

Timing chart



Block diagram



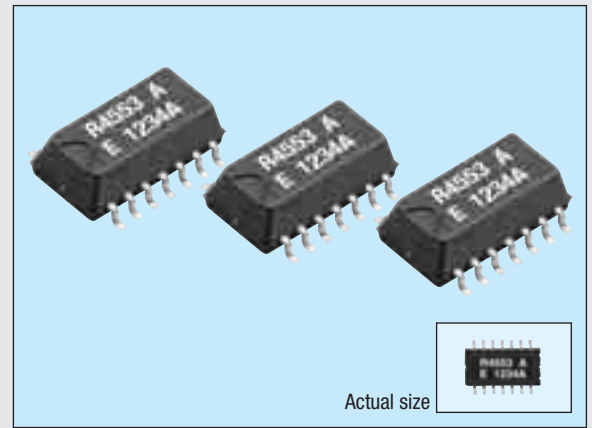
SERIAL-INTERFACE REAL TIME CLOCK MODULE WITH SRAM

# RTC-4553

Product number (please refer to page 5)

**Q4145535xxxxx00**

- Built-in 32.768 kHz crystal oscillator with high accuracy.
- Dual Alarm and Timer IRQ function are Available.
- 32.768 kHz clock frequency output. (Nch open drain)
- Low backup current : 0.48  $\mu$ A / 3 V (Typ.)
- Wide operating voltage range : 1.7 V to 5.5 V
- Wide timekeeper voltage range : 1.15 V to 5.5 V
- CPU interrupt generation function (cycle time range : 1 month to 0.5 seconds, includes interrupt flags and interrupt syop function)
- Oscillation stop detection function (used to determine presence of internal data)
- Power supply voltage monitoring function (with selectable detection threshold)
- Available for lead (Pb) - free soldering.
- Available for lead (Pb) - free treminal.



The details are mentioned in the application manual.

<http://www.epsondevice.com>

## Specifications (characteristics)

### Absolute Max. rating

Item	Symbol	Condition	Min.	Max.	Unit
Supply voltage	V <sub>DD</sub>	V <sub>DD</sub> to GND		+6.0	V
Input voltage	V <sub>IN</sub>	S <sub>IN</sub> , S <sub>CK</sub> , W <sub>R</sub> , C <sub>S0</sub> , C <sub>S1</sub>	-0.3	V <sub>DD</sub> +0.3	
Output voltage	V <sub>OUT</sub>	S <sub>OUT</sub> , T <sub>POUT</sub>			
Storage temperature	T <sub>STG</sub>	Stored as bare product after unpacking	-55	+125	°C

### Operating range

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power voltage	V <sub>DD</sub>	—	2.7	5.0	5.5	V
Clock voltage	V <sub>CLK</sub>	—	2.0	—	5.5	V
Operating temperature	V <sub>OPR</sub>	No condensation	-30	—	+70	°C

### Frequency characteristics

Item	Symbol	Condition	Range	Unit	
Frequency tolerance	$\Delta f/f$	Ta = +25 °C, V <sub>DD</sub> = 5 V	AA	5 ± 5	x 10 <sup>-6</sup>
			A	5 ± 10	
			B	5 ± 20	
Oscillation start up time	t <sub>STA</sub>	Ta = +25 °C, V <sub>DD</sub> = 3.0 V	3.0 Max.	s	
Frequency temperature characteristics	T <sub>OP</sub>	Ta = -10 °C to +70 °C, V <sub>DD</sub> = 5 V Reference at +25 °C	+10 -120	x 10 <sup>-6</sup>	
Frequency voltage characteristics	f/V	Ta = Fix, V <sub>DD</sub> = 2 V to 5.5 V Reference at 5 V	±5		
Aging	fa	Ta = +25 °C, V <sub>DD</sub> = 5 V, first year		x 10 <sup>9</sup> / year	

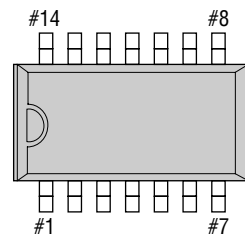
### DC characteristics

(GND = 0 V, V<sub>DD</sub> = 5 V ± 10 %, Ta = -30 °C to +70 °C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Current consumption	I <sub>DD1</sub>	SCK = 500 kHz	—	—	100	$\mu$ A
	I <sub>DD2</sub>	SCK = 0 Hz	—	1.0	3.0	
Output voltage	V <sub>OH</sub>	I <sub>OH</sub> = -400 $\mu$ A	V <sub>DD</sub> -0.4	—	—	V
	V <sub>OL</sub>	I <sub>OL</sub> = 1.6 mA	—	—	0.4	
Off leak current	I <sub>OZH</sub>	V <sub>OUT</sub> = 5.5 V	-2.0	—	2.0	$\mu$ A
	I <sub>OZL</sub>	V <sub>OUT</sub> = 0 V	—	—	—	
Input voltage	V <sub>IH</sub>	—	4/5 V <sub>DD</sub>	—	—	V
	V <sub>IL</sub>	—	—	—	1/5 V <sub>DD</sub>	
Input current	I <sub>IH</sub>	V <sub>IN</sub> = 5.5 V	-2.0	—	2.0	$\mu$ A
	I <sub>IL</sub>	V <sub>IN</sub> = 0 V	—	—	—	

## Terminal connection

### RTC-4553



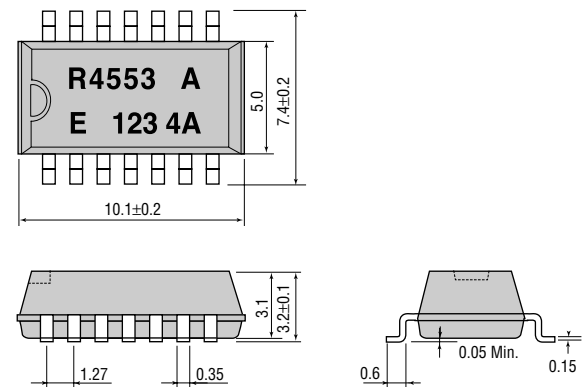
No.	Pin terminal	No.	Pin terminal
1	GND	14	T <sub>POUT</sub>
2	W <sub>R</sub>	13	S <sub>OUT</sub>
3	S <sub>IN</sub>	12	C <sub>S1</sub>
4	S <sub>CK</sub>	11	C <sub>S0</sub>
5	L1	10	L5
6	L2	9	L4
7	L3	8	V <sub>DD</sub>

L1 to L5 are test pin. Do not connect them to any terminals.

## External dimensions

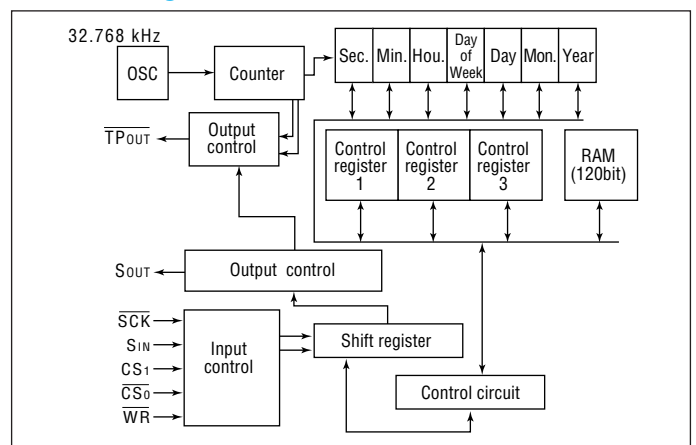
(Unit: mm)

### RTC-4553 (SOP 14-pin)



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

## Block diagram





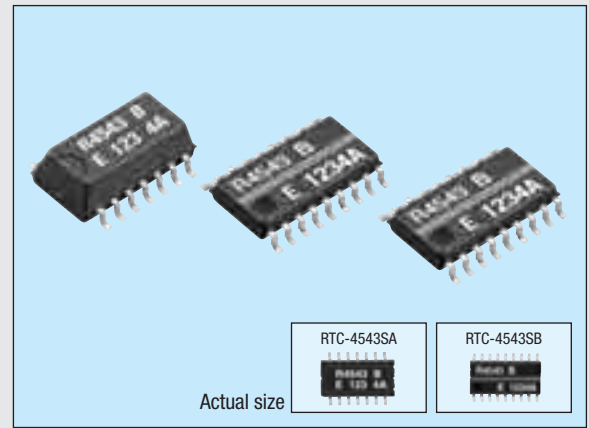
SERIAL-INTERFACE REAL TIME CLOCK MODULE

# RTC-4543SA / SB

Product number (please refer to page 5)

**Q4145435x000200**      **Q4145436x000200**

- Built-in crystal unit allows adjustment-free efficient operation.
- Automatic leap year correction.
- Output selectable between 32.768 kHz / 1 Hz.
- Supply voltage detection voltage: 1.7 V ±0.3 V.
- Available for lead (Pb) - free soldering.
- Available for lead (Pb) - free terminal.



The details are mentioned in the application manual.

<http://www.epsondevice.com>

## Specifications (characteristics)

### Absolute Max. rating

Item	Symbol	Condition	Min.	Max.	Unit
Supply voltage	V <sub>DD</sub>	V <sub>DD</sub> to GND	-0.3	7.0	V
Input voltage	V <sub>IN</sub>	—		V <sub>DD</sub> +0.3	
Output voltage	V <sub>OUT</sub>	—			
Storage temperature	T <sub>STG</sub>	Stored as bare product after unpacking	-55	+125	°C

### Operating range

Item	Symbol	Condition	Min.	Max.	Unit
Power voltage	V <sub>DD</sub>	—	2.5	5.5	V
Clock voltage	V <sub>CLK</sub>	—	1.4		
Operating temperature	V <sub>OPR</sub>	No condensation	-40	+85	°C

### Frequency characteristics

Item	Symbol	Condition	Range	Unit
Frequency tolerance	Δf/f	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 5 V	B: 5 ±23*	x 10 <sup>-6</sup>
Oscillation start-up time	t <sub>STA</sub>	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 2.5	3 Max.	s
Frequency temperature characteristics	T <sub>OP</sub>	T <sub>a</sub> = -10 °C to +70 °C Reference at +25 °C	+10 / -120	x 10 <sup>-6</sup>
Frequency voltage characteristics	f/V	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 2.0 V to 5.5 V	±2.0	x 10 <sup>-6</sup> / V
Aging	f <sub>a</sub>	First year T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 5 V	±5.0	x 10 <sup>6</sup> / year

\* Please ask tighter tolerance.

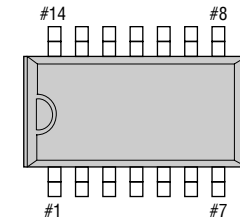
### DC characteristics

(V<sub>DD</sub> = 5 V ±0.5 V, T<sub>a</sub> = -40 °C to +85 °C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Current consumption	1	I <sub>DD1</sub> V <sub>DD</sub> = 5.0 V	—	1.5	3.0	μA
	2	I <sub>DD2</sub> V <sub>DD</sub> = 3.0 V		1.0	2.0	
	3	I <sub>DD3</sub> V <sub>DD</sub> = 2.0 V		0.5	1.0	
	4	I <sub>DD4</sub> V <sub>DD</sub> = 5.0 V		4.0	10.0	
	5	I <sub>DD5</sub> V <sub>DD</sub> = 3.0 V		2.5	6.5	
	6	I <sub>DD6</sub> V <sub>DD</sub> = 2.0 V		1.5	4.0	
"H" input voltage	V <sub>IH</sub>	WR, DATA, CE, CLK, FOE, FSEL pins	0.8V <sub>DD</sub>		—	V
"L" input voltage	V <sub>IL</sub>		—		0.2V <sub>DD</sub>	
"H" output voltage	V <sub>OH1</sub>	V <sub>DD</sub> = 5.0 V	I <sub>OH</sub> = -1.0 mA	4.5		V
	V <sub>OH2</sub>	V <sub>DD</sub> = 3.0 V	DATA, FOUT pins	2.5		
"L" output voltage	V <sub>OL1</sub>	V <sub>DD</sub> = 5.0 V	I <sub>OL</sub> = 1.0 mA		0.5	V
	V <sub>OL2</sub>	V <sub>DD</sub> = 3.0 V	DATA, FOUT pins		0.8	
Supply detection voltage	V <sub>DT</sub>		1.4	1.7	2.0	V
Output load conditions	C <sub>L</sub>	FOUT pin			30	pF
	N				2LS-TTL	

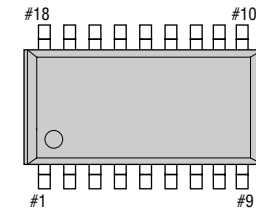
## Terminal connection

### RTC-4543SA



No.	Pin terminal	No.	Pin terminal
1	GND	14	FOUT
2	N.C	13	N.C
3	CE	12	N.C
4	FSEL	11	DATA
5	WR	10	CLK
6	FOE	9	V <sub>DD</sub>
7	N.C	8	N.C

### RTC-4543SB

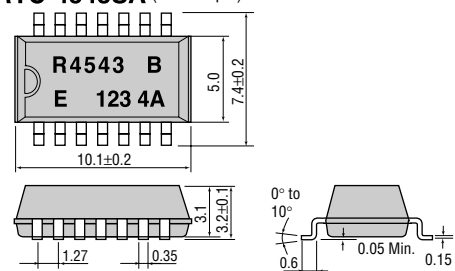


No.	Pin terminal	No.	Pin terminal
1	N.C	18	N.C
2	N.C	17	N.C
3	N.C	16	N.C
4	N.C	15	N.C
5	FOE	14	V <sub>DD</sub>
6	WR	13	N.C
7	FSEL	12	CLK
8	CE	11	DATA
9	GND	10	FOUT

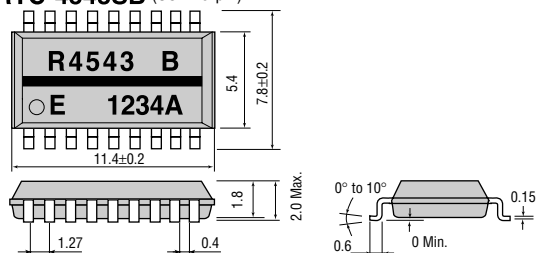
## External dimensions

(Unit: mm)

### RTC-4543SA (SOP 14-pin)



### RTC-4543SB (SOP 18-pin)



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

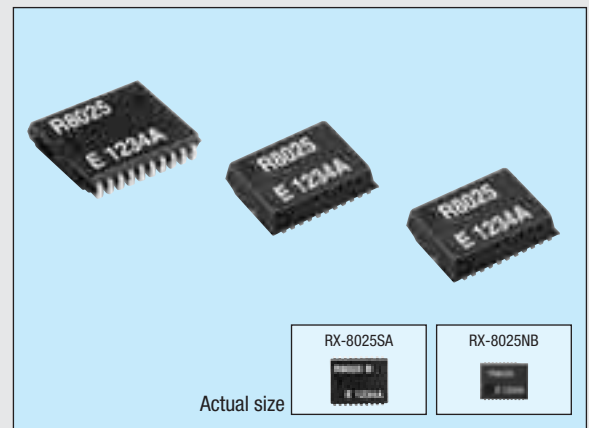
# I2C-BUS INTERFACE REAL TIME CLOCK MODULE

# RX-8025SA / NB

Product number (please refer to page 5)

**Q4180255xxxxx00**      **Q4180255xxxxx00**

- Built-in frequency adjusted 32.768 kHz crystal unit.
- Compliant with I2 C high-speed bus specifications. (400 kHz)
- Dual Alarm and Timer IRQ function are Available.
- 32.768 kHz clock frequency output. (FOE, FOUT)
- Low backup current : 0.48  $\mu$ A / 3 V (Typ.)
- Wide operating voltage range : 1.7 V to 5.5 V
- CPU interrupt generation function (cycle time range : 1 month to 0.5 seconds, includes interrupt flags and interrupt stop function)
- Oscillation stop detection function (used to determine presence of internal data)
- Power supply voltage monitoring function (with selectable detection threshold)
- Available for lead (Pb) - free soldering.
- Available for lead (Pb) - free terminal.



The details are mentioned in the application manual.

<http://www.epsondevice.com>

The I<sup>2</sup>C-Bus is a trademark of Philips Electronics N.V.

## Specifications (characteristics)

### Absolute Max. rating

GND = 0V

Item	Symbol	Condition	Min.	Max.	Unit
Supply voltage	V <sub>DD</sub>	V <sub>DD</sub> to GND	-0.3	+6.5	V
Input voltage	V <sub>I</sub>	SCL, SDA, FOE pins	GND -0.3	+6.5	
Output voltage	V <sub>O1</sub> V <sub>O2</sub>	SDA, INT, INTB pins FOUT pin	GND -0.3 GND -0.5	+6.5 V <sub>DD</sub> +0.3	
Storage temperature Range	T <sub>STG</sub>	Stored as bare product after unpacking	-55	+125	°C

### Operating range

GND = 0V

Item	Symbol	Condition	Min.	Max.	Unit
Power voltage	V <sub>DD</sub>	—	1.7	5.5	V
Clock voltage	V <sub>CLK</sub>	—	1.15		
Operating temperature	T <sub>OPR</sub>	No condensation	-40	+85	°C

### Frequency characteristics

GND = 0V

Item	Symbol	Condition	Range	Unit
Frequency tolerance	$\Delta f/f$	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 3.0 V	AA : 5 $\pm$ 5 *	x 10 <sup>-6</sup>
Oscillation start-up time	t <sub>STA</sub>	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 2.0 V	1 Max.	s
Frequency temperature characteristics	T <sub>OP</sub>	T <sub>a</sub> = -10 °C to +70 °C, V <sub>DD</sub> = 3.0 V ; Reference at +25 °C	+10 -120	x 10 <sup>-6</sup>
Frequency voltage characteristics	f/V	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 2.0 V to 5.5 V	$\pm$ 1 Max.	x 10 <sup>-6</sup>
Aging	f <sub>a</sub>	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 3.0 V, first year	$\pm$ 5 Max.	x 10 <sup>6</sup> / year

\*1 Equivalent to 15 seconds of monthly deviation (excluding offset.)

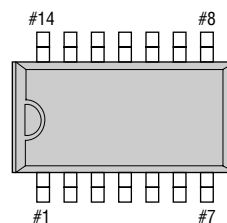
### DC characteristics

(GND = 0 V, V<sub>DD</sub> = 1.8 V to 5.5 V, T<sub>a</sub> = -40 °C to +85 °C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Standby current	I <sub>DD2</sub>	f <sub>SCL</sub> = 0 Hz, FOE = GND INTA, INTB = V <sub>DD</sub> FOUT ; output off ("L" level)		0.48	1.20	$\mu$ A
"H" input voltage	V <sub>IH</sub>	SCL, SDA, FOE pins	0.8 V <sub>DD</sub>		5.5	V
"L" input voltage	V <sub>IL</sub>		GND -0.3		0.2 V <sub>DD</sub>	
"H" output current	I <sub>OH</sub>	FOUT pins, V <sub>OH</sub> = V <sub>DD</sub> -0.5 V			-0.5	mA
"L" output current	I <sub>OL1</sub>	FOUT pins, V <sub>OL</sub> = 0.4 V	0.5			
	I <sub>OL2</sub> I <sub>OL3</sub>	INTA, INTB pins, V <sub>OL</sub> = 0.4 V SDA pin, V <sub>OL</sub> = 0.4 V	1.0 4.0			

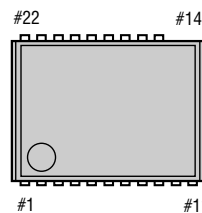
## Terminal connection

### RX-8025SA



No.	Pin terminal	No.	Pin terminal
1	N.C	14	N.C
2	SCL	13	SDA
3	FOUT	12	INTB
4	N.C	11	GND
5	TEST	10	INTA
6	V <sub>DD</sub>	9	N.C
7	FOE	8	N.C

### RX-8025NB

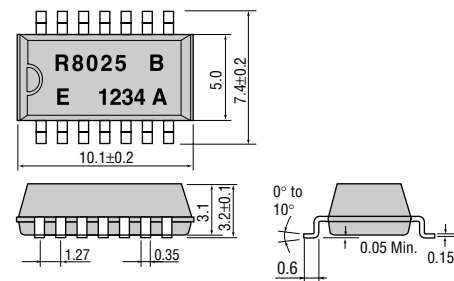


No.	Pin terminal	No.	Pin terminal
1	FOE	22	N.C
2	V <sub>DD</sub>	21	N.C
3	(GND)	20	N.C
4	TEST	19	N.C
5	FOUT	18	N.C
6	SCL	17	N.C
7	SDA	16	N.C
8	INTB	15	N.C
9	GND	14	N.C
10	INTA	13	—
11	N.C	12	—

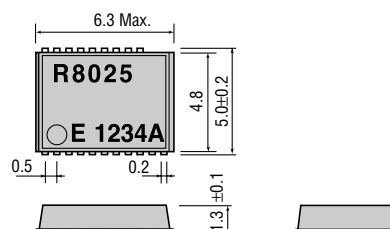
## External dimensions

(Unit: mm)

### RX-8025SA (SOP 14-pin)



### RX-8025NB (SON 22-pin)



Register table

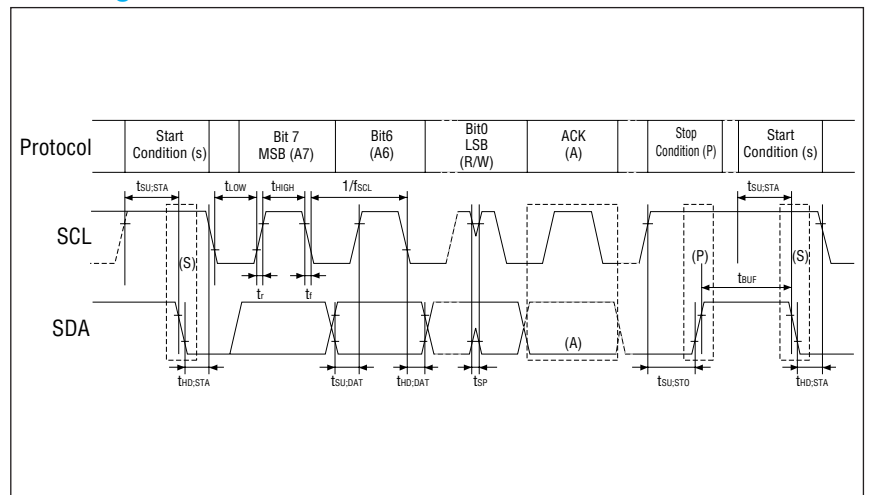
Address	Register symbol	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
0	Seconds	0	S 40	S 20	S 10	S 8	S 4	S 2	S 1
1	Minutes	0	M 40	M 20	M 10	M 8	M 4	M 2	M 1
2	Hours	0	0	H 20 P, $\bar{A}$	H 10	H 8	H 4	H 2	H 1
3	Weekdays	0	0	0	0	0	W 4	W 2	W 1
4	Days	0	0	D 20	D 10	D 8	D 4	D 2	D 1
5	Months	0	0	0	MO 10	MO 8	MO 4	MO 2	MO 1
6	Years	Y 80	Y 40	Y 20	Y 10	Y 8	Y 4	Y 2	Y 1
7	Digital Offset	0	F 6	F 5	F 4	F 3	F 2	F 1	F 0
8	Alarm_W ; Minutes	0	WM 40	WM 20	WM 10	WM 8	WM 4	WM 2	WM 1
9	Alarm_W ; Hour	0	0	WH 20 WP, A	WH 10	WH 8	WH 4	WH 2	WH 1
A	Alarm_W ; Weekday	0	WW 6	WW 5	WW 4	WW 3	WW 2	WW 1	WW 0
B	Alarm_D ; Minutes	0	DM 40	DM 20	DM 10	DM 8	DM 4	DM 2	DM 1
C	Alarm_D ; Hour	0	0	DH 20 DP, $\bar{A}$	DH 10	DH 8	DH 4	DH 2	DH 1
D	Reserved	Reserved							
E	Control 1	WALE	DALE	$\bar{12}$ , 24	CLEN 2	TEST	CT 2	CT 1	CT 0
F	Control 2	VDSL	VDET	$\bar{XST}$	PON	CLEN 1	CTFG	WAFG	DAFG

0 : Always set this bit to "0".

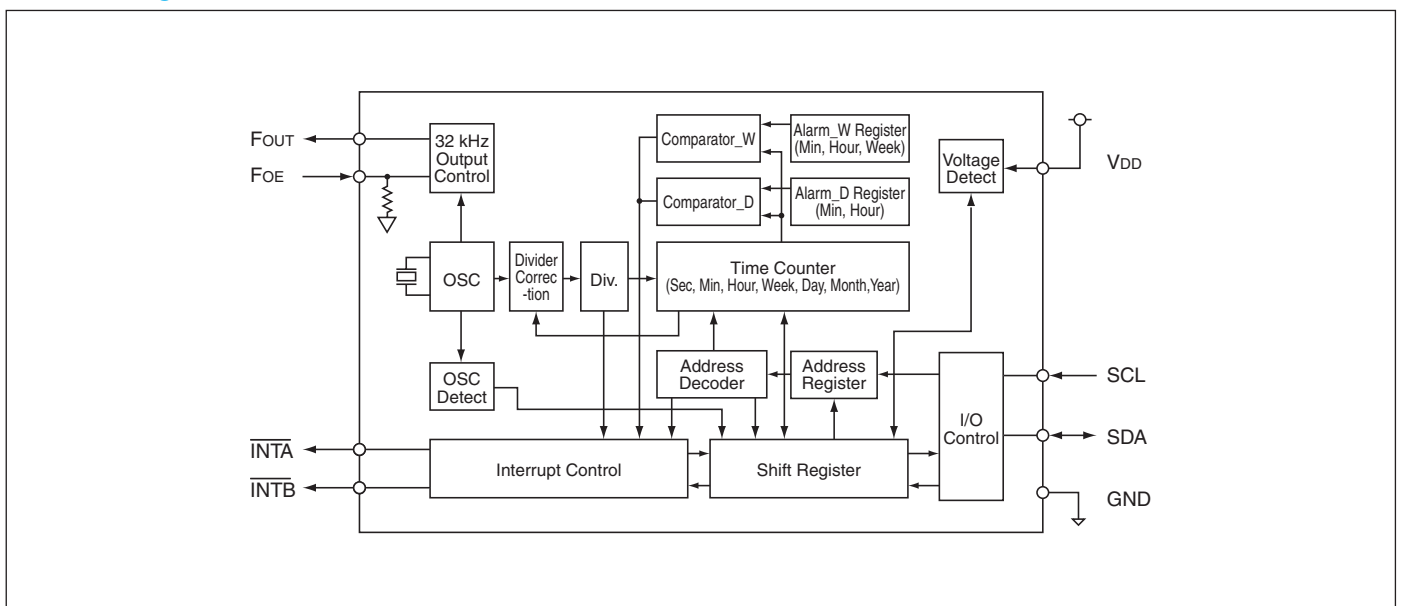
AC characteristics

Item	Symbol	Min.	Typ.	Max.	Unit
SCL clock frequency	f <sub>SCL</sub>			400	kHz
Tolerance spike time on bus	t <sub>SP</sub>			50	ns
Start condition set-up time	t <sub>SU; STA</sub>	0.6			μs
Start condition Hold time	t <sub>HD; STA</sub>				
SCL "L" time	t <sub>LOW</sub>				
SCL "H" time	t <sub>HIGH</sub>	0.3			μs
SCL and SDA rise time	t <sub>r</sub>				
SCL and SDA fall time	t <sub>f</sub>				
Data set-up time	t <sub>SU; DAT</sub>			200	ns
Data hold time	t <sub>HD; DAT</sub>			0	
Stop condition set-up time	t <sub>SU; STO</sub>			0.6	μs
Bus free time	t <sub>BUF</sub>			2.0	μs

Timing chart



Block diagram



I2C-BUS INTERFACE REAL TIME CLOCK MODULE

# RX-8581SA / JE / NB

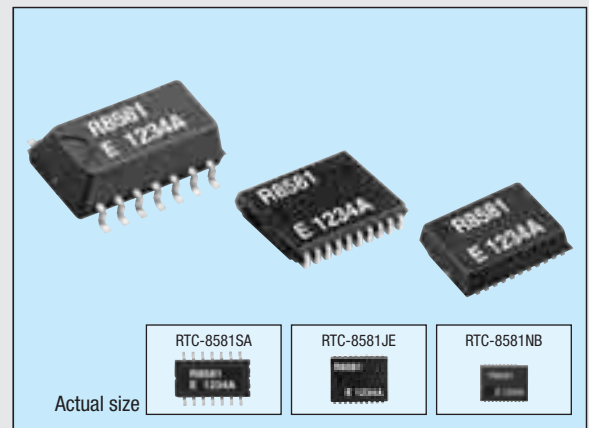
Product number (please refer to page 5)

Q4185815xxxxx00

Q4185817xxxxx00

Q4185819x000200

- Built-in frequency adjusted 32.768 kHz crystal unit.
- Compliant with I2C high-speed bus specifications. (400 kHz)
- Alarm and Timer IRQ function are Available.
- 32.768 kHz clock frequency output. (Duty 50 ± 5%)
- Low backup current : 0.5 µA / 3 V (Typ.)
- Wide operating voltage range : 1.8 V to 5.5 V
- Wide timekeeper voltage range : 1.6 V to 5.5 V
- Available as small package. (SON 22-pin)
- Available for lead (Pb) - free soldering.
- Available for lead (Pb) - free terminal.



The details are mentioned in the application manual.

<http://www.epsondevice.com>

The I<sup>2</sup>C-Bus is a trademark of Philips Electronics N.V.

## ■ Specifications (characteristics)

### ■ Absolute Max. rating

GND = 0V

Item	Symbol	Condition	Min.	Max.	Unit
Supply voltage	V <sub>DD</sub>	V <sub>DD</sub> to GND	-0.3	+7.0	V
Input voltage 1	V <sub>IN1</sub>	FOE pin	GND -0.3	V <sub>DD</sub> +0.3	V
Input voltage 2	V <sub>IN2</sub>	SCL, SDA pins		+8.0	
Output voltage 1	V <sub>OUT1</sub>	FOUT pin		V <sub>DD</sub> +0.3	
Output voltage 2	V <sub>OUT1</sub>	SDA, INT pins		+8.0	
Storage temperature	T <sub>STG</sub>	Stored as bare product after unpacking	-55	+125	°C

### ■ Operating range

GND = 0V

Item	Symbol	Condition	Min.	Max.	Unit
Power voltage	V <sub>DD</sub>	—	1.8	5.5	V
Clock voltage	V <sub>CLK</sub>	—	1.6		
Operating temperature	T <sub>OPR</sub>	No condensation	-40	+85	°C

### ■ Frequency characteristics

GND = 0V

Item	Symbol	Condition	Range	Unit
Frequency tolerance	Δf/f	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 3.0 V	B: 5 ± 23 <sup>*1</sup> <sub>*2</sub>	x 10 <sup>-6</sup>
Oscillation start-up time	t <sub>STA</sub>	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 3.0 V	3 Max.	s
Frequency temperature characteristics	T <sub>OP</sub>	T <sub>a</sub> = -10 °C to +70 °C, V <sub>DD</sub> = 3.0 V; Reference at +25 °C	+10 -120	x 10 <sup>-6</sup>
Frequency voltage characteristics	f/V	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 2.0 V to 5.5 V	±2 Max.	x 10 <sup>-6</sup> / V
Aging	f <sub>a</sub>	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 3.0 V	±5 Max.	x 10 <sup>6</sup> / year

\*1 Equivalent to 1 minute of monthly deviation (excluding offset).

\*2 Please ask tighter tolerance

### ■ DC characteristics

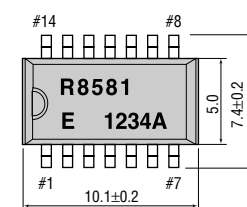
(GND = 0 V, V<sub>DD</sub> = 1.8 V to 5.5 V, T<sub>a</sub> = -40 °C to +85 °C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power current 1	I <sub>DD1</sub>	f <sub>SCL</sub> = 0 Hz INT = V <sub>DD</sub> , FOE = GND	V <sub>DD</sub> = 5 V	0.65	1.2	µA
Power current 2	I <sub>DD2</sub>	FOUT; output off ("L" level)	V <sub>DD</sub> = 3 V	0.45	0.8	
Power current 3	I <sub>DD3</sub>	f <sub>SCL</sub> = 0 Hz INT, FOE = V <sub>DD</sub>	V <sub>DD</sub> = 5 V	3.0	7.5	
Power current 4	I <sub>DD4</sub>	FOUT; 32.768 kHz output ON, CL = 0 pF	V <sub>DD</sub> = 3 V	1.7	4.5	
Power current 5	I <sub>DD5</sub>	f <sub>SCL</sub> = 0 Hz INT, FOE = V <sub>DD</sub>	V <sub>DD</sub> = 5 V	8.0	20.0	
Power current 6	I <sub>DD6</sub>	FOUT; 32.768 kHz output ON, CL = 30 pF	V <sub>DD</sub> = 3 V	5.0	12.0	
"H" input voltage	V <sub>IH1</sub>	FOE pin	0.7 V <sub>DD</sub>		V <sub>DD</sub> +0.3	V
	V <sub>IH2</sub>	SCL, SDA pins	0.7 V <sub>DD</sub>		6.0	
"L" input voltage	V <sub>IL</sub>	Input pin	GND -0.3		0.3 V <sub>DD</sub>	
"H" output current	V <sub>OH1</sub>	FOUT pin	V <sub>DD</sub> = 5 V, I <sub>OH</sub> = -1 mA	4.5	5.0	V
	V <sub>OH2</sub>		V <sub>DD</sub> = 3 V, I <sub>OH</sub> = -1 mA	2.2	3.0	
	V <sub>OH3</sub>		V <sub>DD</sub> = 3 V, I <sub>OH</sub> = -100 µA	2.9	3.0	
"L" output current	V <sub>OL1</sub>	FOUT pin	V <sub>DD</sub> = 5 V, I <sub>OL</sub> = 1 mA	GND	GND +0.5	V
	V <sub>OL2</sub>		V <sub>DD</sub> = 3 V, I <sub>OL</sub> = 1 mA	GND	GND +0.8	
	V <sub>OL3</sub>		V <sub>DD</sub> = 3 V, I <sub>OL</sub> = 100 µA	GND	GND +0.1	
	V <sub>OL4</sub>	INT pin	V <sub>DD</sub> = 5 V, I <sub>OL</sub> = 1 mA	GND	GND +0.25	
	V <sub>OL5</sub>		V <sub>DD</sub> = 3 V, I <sub>OL</sub> = 1 mA	GND	GND +0.4	
	V <sub>OL6</sub>		SDA pin	V <sub>DD</sub> > 2 V, I <sub>OL</sub> = 3 mA	GND	

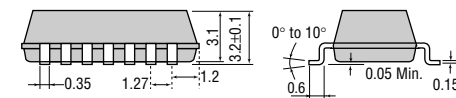
## ■ External dimensions / Terminal connection

(Unit: mm)

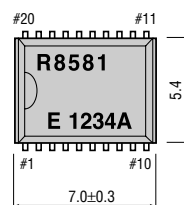
### ● RX-8581SA (SOP 14-pin)



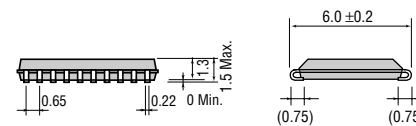
No.	Pin terminal	No.	Pin terminal
1	N.C	14	Four
2	SCL	13	N.C
3	SDA	12	N.C
4	N.C	11	V <sub>DD</sub>
5	GND	10	FOE
6	N.C	9	N.C
7	INT	8	N.C



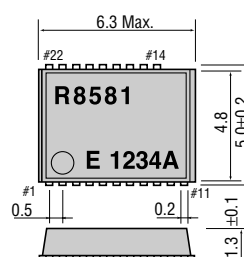
### ● RX-8581JE (VSOJ 20-pin)



No.	Pin terminal	No.	Pin terminal
1	N.C	20	N.C
2	N.C	19	N.C
3	FOE	18	N.C
4	V <sub>DD</sub>	17	N.C
5	FOUT	16	N.C
6	SCL	15	N.C
7	SDAT	14	N.C
8	(V <sub>DD</sub> )	13	N.C
9	GND	12	N.C
10	INT	11	N.C



### ● RX-8581NB (SON 22-pin)



No.	Pin terminal	No.	Pin terminal
1	INT	22	N.C
2	GND	21	N.C
3	(V <sub>DD</sub> )	20	N.C
4	N.C	19	N.C
5	SDA	18	N.C
6	SCL	17	N.C
7	FOUT	16	N.C
8	V <sub>DD</sub>	15	N.C
9	FOE	14	N.C
10	N.C	13	—
11	N.C	12	—

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

Register table

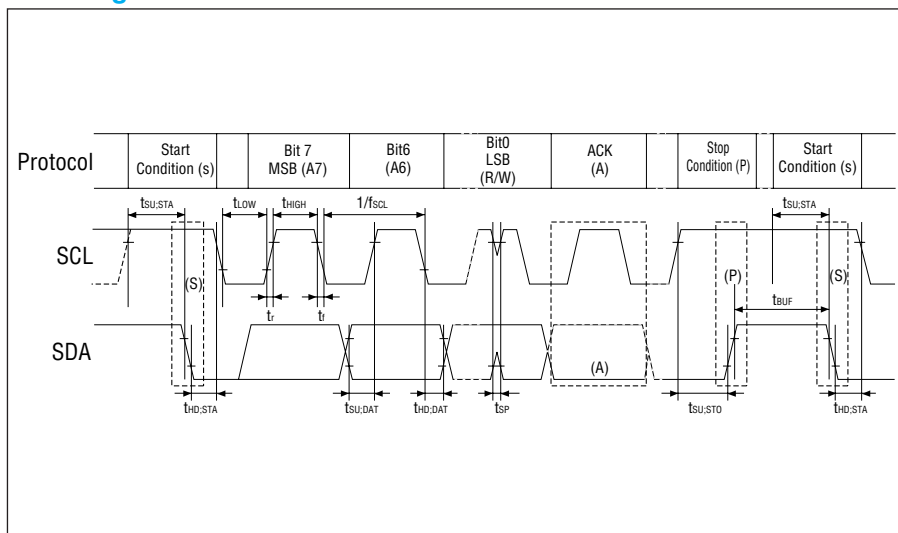
Address	Register symbol	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
0	SEC	0	40	20	10	8	4	2	1
1	MIN	0	40	20	10	8	4	2	1
2	HOUR	0	0	20	10	8	4	2	1
3	WEEK	0	6	5	4	3	2	1	0
4	DAY	0	0	20	10	8	4	2	1
5	MONTH	0	0	0	10	8	4	2	1
6	YEAR	80	40	20	10	8	4	2	1
7	RAM	•	•	•	•	•	•	•	•
8	MIN Alarm	AE	40	20	10	8	4	2	1
9	HOUR Alarm	AE	•	20	10	8	4	2	1
A	WEEK Alarm	AE	6	5	4	3	2	1	0
	DAY Alarm		•	20	10	8	4	2	1
B	Timer Counter 0	128	64	32	16	8	4	2	1
C	Timer Counter 1	•	•	•	•	2048	1024	512	256
D	Extension Register	TEST	WADA	USEL	TE	0	0	TSEL1	TSEL0
E	Flag Register	0	0	UF	TF	AF	0	VLF	0
F	Control Register	0	0	UIE	TIE	AIE	0	STOP	RESET

0 : Always set this bit to "0".

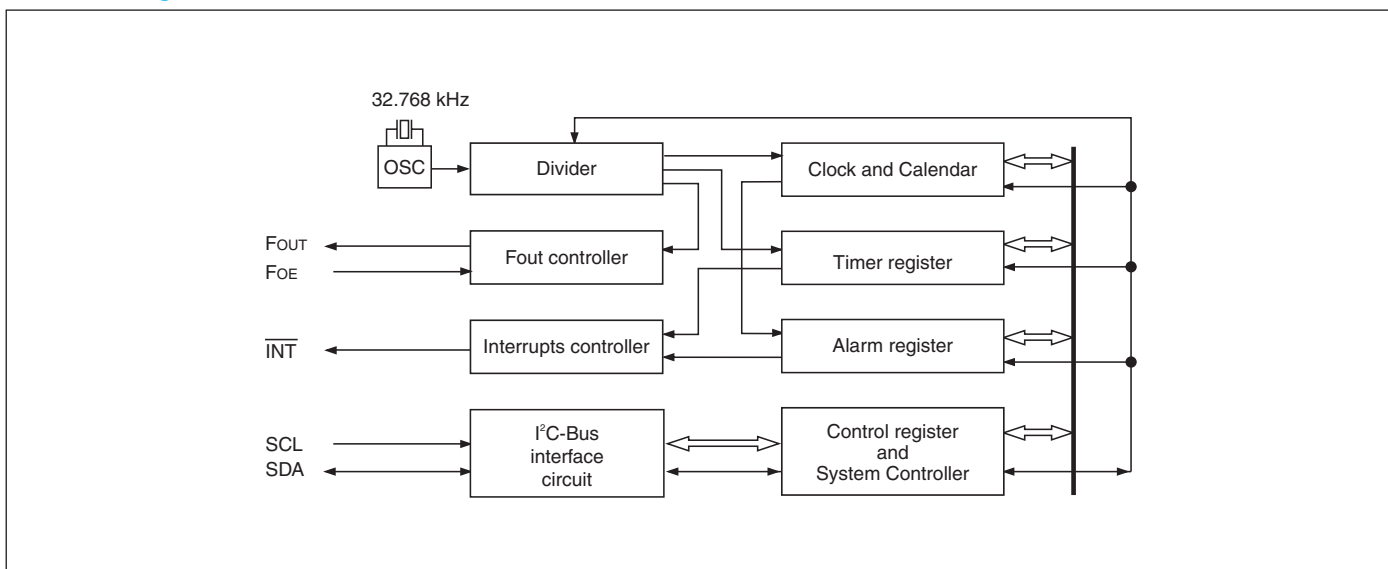
AC characteristics

Item	Symbol	Min.	Max.	Unit
SCL clock frequency	f <sub>SCL</sub>	-	400	kHz
Tolerance spike time on bus	t <sub>SP</sub>	-	50	ns
Start condition set-up time	t <sub>SU; STA</sub>	0.6	0.3	μs
Start condition Hold time	t <sub>HD; STA</sub>			
SCL "L" time	t <sub>LOW</sub>			
SCL "H" time	t <sub>HIGH</sub>			
SCL and SDA rise time	t <sub>r</sub>	-	0.3	ns
SCL and SDA fall time	t <sub>f</sub>			
Data set-up time	t <sub>SU; DAT</sub>	100	-	ns
Data hold time	t <sub>HD; DAT</sub>	0		
Stop condition set-up time	t <sub>SU; STO</sub>	0.6		
Bus free time	t <sub>BUF</sub>	1.3	-	μs
Fout Duty	t <sub>w</sub> /t	45	55	%

Timing chart



Block diagram



I2C-BUS INTERFACE REAL TIME CLOCK MODULE

# RTC-8564JE / NB RX-8564CF

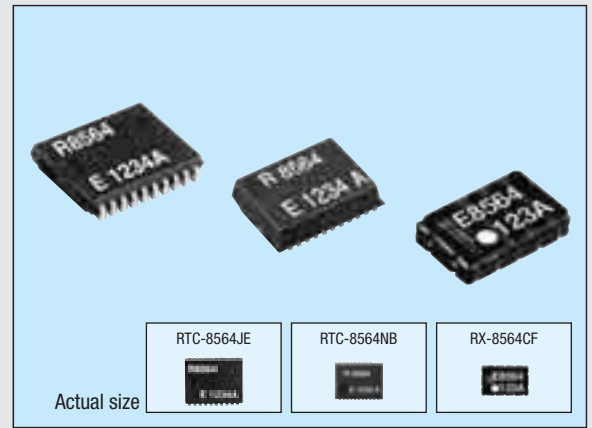
Product number (please refer to page 5)

Q4185647x000100

Q4185649x0000200

Q418564Ax000100

- Built-in crystal unit allows adjustment-free efficient operation.
- Compliant with I2C high-speed bus specifications. (400 kHz)
- Equipped with alarm, timer, and frequency output (32.768 kHz, 1024 Hz, 32 Hz, 1 Hz) features.
- Operating in wide voltage range from 1.8 V to 5.5 V, and in wide range of clock voltage from 1.0 V to 5.5 V. (RTC-8564JE / NB : -20 °C to +70 °C / RX-8564CF: +25 °C)
- Low power consumption at 275 nA / 3.0 V. (Typ.)
- Available for lead (Pb) - free soldering.
- Lead (Pb) - free terminal (RX-8564CF), Available for lead (Pb) - free terminal. (RTC-8564JE / NB)



The details are mentioned in the application manual.

<http://www.epsondevice.com>

The I<sup>2</sup>C-Bus is a trademark of Philips Electronics N.V.

## Specifications (characteristics)

### Absolute Max. rating

Item	Symbol	Condition	Min.	Max.	Unit
Supply voltage	V <sub>DD</sub>	V <sub>DD</sub> to GND	-0.5	+6.5	V
Input voltage	V <sub>I</sub>	Input pin	GND -0.5	V <sub>DD</sub> +0.5	V
Output voltage	V <sub>O</sub>	INT pins			
DC Input current	I <sub>I</sub>	—	-10	10	mA
DC Output current	I <sub>O</sub>	—	-10	10	mA
Storage temperature	T <sub>STG</sub>	Stored as bare product after unpacking	-55	+125	°C

### Operating range

Item	Symbol	Condition	Min.	Max.	Unit
Power voltage	V <sub>DD</sub>	I <sup>2</sup> C-BUS access at 400 kHz	1.8	5.5	V
Clock voltage	V <sub>CLK</sub>	—	V <sub>LOW</sub>	—	V
Operating temperature	T <sub>OPR</sub>	No condensation	-40	+85	°C

### Frequency characteristics

Item	Symbol	Condition	Range	Unit
Frequency tolerance	Δf/f	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 3.0 V	B: 5 ±23*	x 10 <sup>-6</sup>
Oscillation start up time	t <sub>STA</sub>	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 1.8 V	3 Max.	s
Frequency temperature characteristics	T <sub>OP</sub>	Reference at +25 °C, T <sub>a</sub> = -10 °C to +70 °C, V <sub>DD</sub> = 3.0 V	+10 -120	x 10 <sup>-6</sup>
Frequency voltage characteristics	f/V	RTC-8564JE / NB: T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 1.0 V to 5.5 V RX-8564CF: T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 1.8 V to 5.5 V	±2 Max.	x 10 <sup>-6</sup> / V
Aging	f <sub>a</sub>	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 3.0 V	±5	x 10 <sup>6</sup> / year

\* Please ask tighter tolerance

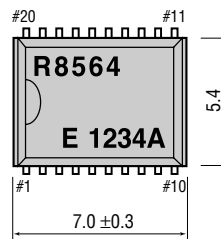
### DC characteristics (GND = 0 V, V<sub>DD</sub> = 1.8 V to 5.5 V, T<sub>a</sub> = -40 °C to +85 °C)

Item	Pin	Symbol	Condition	Min.	Typ.	Max.	Unit
Power current (not during access) (CLKOUT = 0 Hz)	—	I <sub>DD</sub>	f <sub>SCL</sub> = 0 Hz, V <sub>DD</sub> = 5.0 V	—	0.33	0.80	μA
			f <sub>SCL</sub> = 0 Hz, V <sub>DD</sub> = 3.0 V	—	0.275	0.70	
			f <sub>SCL</sub> = 0 Hz, V <sub>DD</sub> = 2.0 V	—	0.25	0.65	
Power current (not during access) (CLKOUT = 32.768 kHz)	—	I <sub>DD32k</sub>	f <sub>SCL</sub> = 0 Hz, V <sub>DD</sub> = 5.0 V	—	2.5	3.4	μA
			f <sub>SCL</sub> = 0 Hz, V <sub>DD</sub> = 3.0 V	—	1.5	2.2	
			f <sub>SCL</sub> = 0 Hz, V <sub>DD</sub> = 2.0 V	—	1.1	1.6	
"L" input voltage	—	V <sub>IL</sub>	—	-0.5	0.3 V <sub>DD</sub>	V	
"H" input voltage	—	V <sub>IH</sub>	—	0.7 V <sub>DD</sub>	V <sub>DD</sub> +0.5	V	
"L" output current	SDA	I <sub>OL</sub>	—	-3	—	mA	
"L" output current	INT	I <sub>OL</sub>	V <sub>OL</sub> = 0.4 V, V <sub>DD</sub> = 5 V	-1	—	—	
							I <sub>OL</sub>
"H" output current	CLKOUT	I <sub>OH</sub>	—	—	1	mA	
Low voltage detection RTC-8564JE / NB	—	V <sub>LOW</sub>	T <sub>a</sub> = -40 °C to +85 °C	—	1.1	—	V
			T <sub>a</sub> = -20 °C to +70 °C	—	1.0	—	
			T <sub>a</sub> = -40 °C to +85 °C	—	1.2	—	
Low voltage detection RX-8564CF	—	V <sub>LOW</sub>	T <sub>a</sub> = +25 °C	—	1.0	—	V

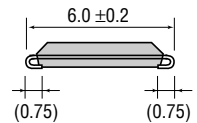
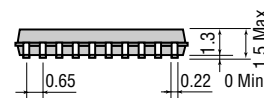
## External dimensions / Terminal connection

(Unit: mm)

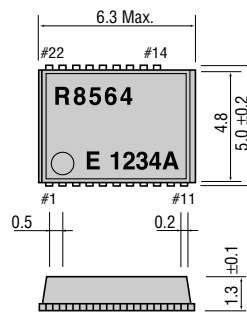
### RTC-8564JE (VSOJ 20-pin)



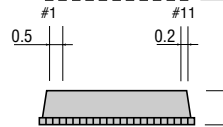
No.	Pin terminal	No.	Pin terminal
1	N.C	20	N.C
2	N.C	19	N.C
3	CLKOE	18	N.C
4	V <sub>DD</sub>	17	N.C
5	CLKOUT	16	N.C
6	SCL	15	N.C
7	SDA	14	N.C
8	(GND)	13	N.C
9	GND	12	N.C
10	INT	11	N.C



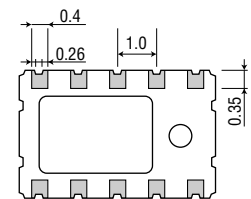
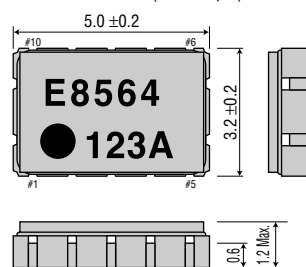
### RTC-8564NB (SON 22-pin)



No.	Pin terminal	No.	Pin terminal
1	INT	21	N.C
2	GND	22	N.C
3	(GND)	20	N.C
4	N.C	19	N.C
5	SDA	18	N.C
6	SCL	17	N.C
7	CLKOUT	16	N.C
8	V <sub>DD</sub>	15	N.C
9	CLKOE	14	N.C
10	N.C	13	—
11	N.C	12	—



### RX-8564CF (SON 10-pin)



No.	Pin terminal	No.	Pin terminal
1	V <sub>DD</sub>	10	CLKOE
2	CLKOUT	9	N.C
3	N.C	8	N.C
4	SCL	7	INT
5	SDA	6	GND

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

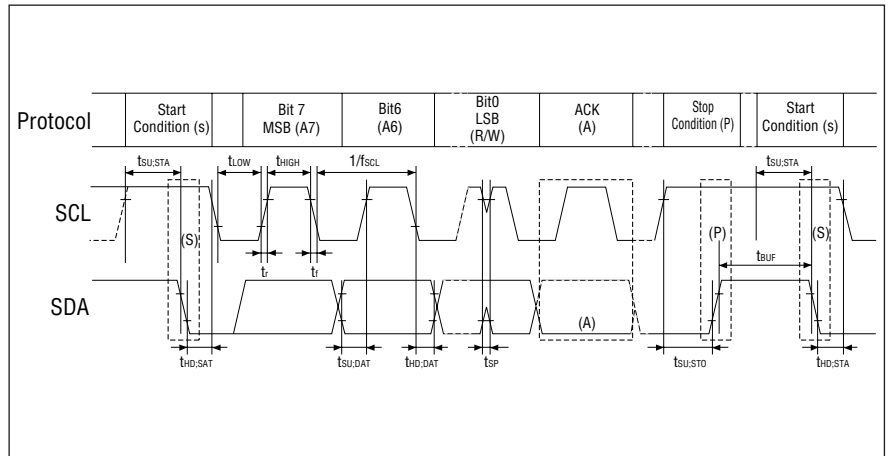
Register table

Address	Register symbol	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
0	Control 1	TEST	0	STOP	0	TEST	0	0	0
1	Control 2	0	0	0	TI / TP	AF	TF	AIE	TIE
2	Sec	VL	S 40	S 20	S 10	S 8	S 4	S 2	S 1
3	Min	*	Min 40	Min 20	Min 10	Min 8	Min 4	Min 2	Min 1
4	Hour	*	*	Hour 20	Hour 10	Hour 8	Hour 4	Hour 2	Hour 1
5	Day	*	*	Day 20	Day 10	Day 8	Day 4	Day 2	Day 1
6	Day of Week	*	*	*	*	*	W 4	W 2	W 1
7	Month / Century	C	*	*	Month 10	Month 8	Month 4	Month 2	Month 1
8	Year	Year 80	Year 40	Year 20	Year 10	Year 8	Year 4	Year 2	Year 1
9	Minutes Alarm	AE	A-Min 40	A-Min 20	A-Min 10	A-Min 8	A-Min 4	A-Min 2	A-Min 1
A	Hours Alarm	AE	*	A-Hr 20	A-Hr 10	A-Hr 8	A-Hr 4	A-Hr 2	A-Hr 1
B	Day Alarm	AE	*	A-Day 20	A-Day 10	A-Day 8	A-Day 4	A-Day 2	A-Day 1
C	Week Alarm	AE	*	*	*	*	A-W 4	A-W 2	A-W 1
D	CLKOUT frequency	FE	*	*	*	*	*	FD1	FD0
E	Timer control	TE	*	*	*	*	*	TD1	TD0
F	Timer	128	64	32	16	8	4	2	1

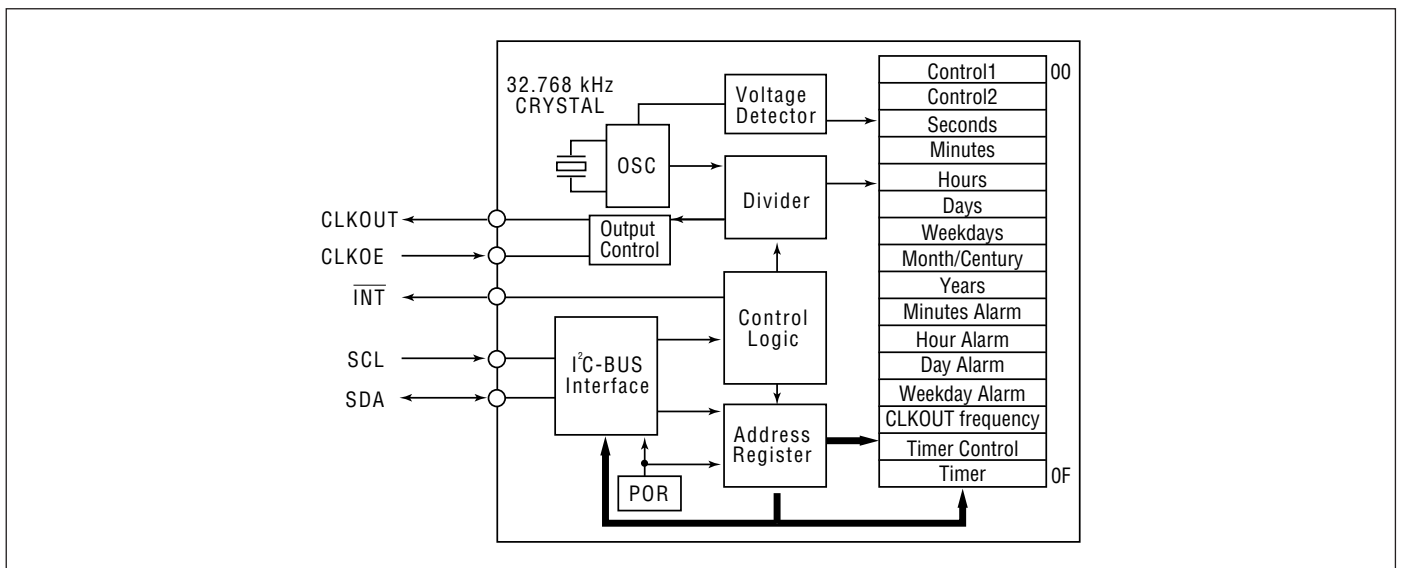
AC characteristics (V<sub>DD</sub> = 1.8 V to 5.5 V, T<sub>a</sub> = -40 °C to +85 °C)

Item	Symbol	Min.	Max.	Unit
SCL clock frequency	f <sub>SCL</sub>	-	400	kHz
Tolerance spike time on bus	t <sub>SP</sub>	-	50	ns
Start condition set-up time	t <sub>SU; STA</sub>	0.6	-	μs
Start condition Hold time	t <sub>HD; STA</sub>			
SCL "L" time	t <sub>LOW</sub>	1.3	-	μs
SCL "H" time	t <sub>HIGH</sub>	0.6		
SCL and SDA rise time	t <sub>r</sub>	-	0.3	μs
SCL and SDA fall time	t <sub>f</sub>			
Data set-up time	t <sub>SU; DAT</sub>	100	-	ns
Data hold time	t <sub>HD; DAT</sub>	0	-	ns
Stop condition set-up time	t <sub>SU; STO</sub>	0.6	-	μs

Timing chart



Block diagram



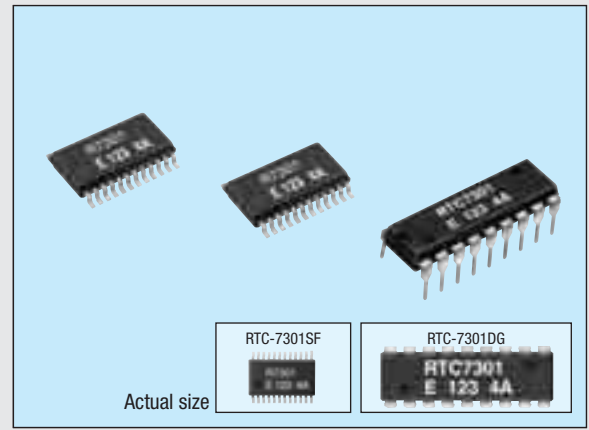
4-bit REAL TIME CLOCK MODULE

# RTC-7301SF / DG

Product number (please refer to page 5)

**Q4273018x000200**      **Q4273011x000200**

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



The details are mentioned in the application manual.

<http://www.epsondevice.com>

## Specifications (characteristics)

### Absolute Max. rating

GND = 0V

Item	Symbol	Condition	Min.	Max.	Unit
Supply voltage	V <sub>DD</sub>	V <sub>DD</sub> to GND	-0.3	+7.0	V
Input voltage	V <sub>IN</sub>	Input terminal, D0 to D3 pins	GND -0.3	V <sub>DD</sub> +0.3	
Output voltage (1)	V <sub>OUT1</sub>	IRQ pin	GND -0.3	+8.0	
Output voltage (2)	V <sub>OUT2</sub>	FOUT, D0-D3 pins, VTEMP pin	GND -0.3	V <sub>DD</sub> +0.3	
Storage temperature	T <sub>STG</sub>	Stored as bare product after unpacking	-55	+125	°C

### Operating range

GND = 0V

Item	Symbol	Condition	Min.	Max.	Unit
Power voltage	V <sub>DD</sub>	—	2.4	5.5	V
Clock voltage	V <sub>CLK</sub>	—	1.6	5.5	V
Operating temperature	T <sub>OPR</sub>	No condensation	-40	+85	°C

### Frequency characteristics

Item	Symbol	Condition	Range	Unit
Frequency precision	$\Delta f/f$	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 3.0 V	B: 5 ±23 *    x 10 <sup>-6</sup>	
Oscillation start-up time	t <sub>STA</sub>	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 2.4 V	3 Max.	s
Frequency temperature characteristics	T <sub>OP</sub>	T <sub>a</sub> = -10 °C to +70 °C V <sub>DD</sub> = 3.0 V	+10 / -120	x 10 <sup>-6</sup>
Frequency voltage characteristics	f/V	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 1.6 V to 5.5V	±2	x 10 <sup>-6</sup> / V
Aging	f <sub>a</sub>	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 3.0 V	±5	x 10 <sup>6</sup> / year

\* Please ask tighter tolerance

### DC characteristics

GND = 0 V, V<sub>DD</sub> = 1.6 V to 5.5 V, T<sub>a</sub> = -40 °C to +85 °C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Current consumption (When non-accessed) FOUT = Output OFF VTEMP = Output OFF	I <sub>DD1</sub>	V <sub>DD</sub> = 5 V CS <sub>0</sub> , RD, WR = V <sub>DD</sub> A <sub>0</sub> -A <sub>3</sub> , CS <sub>1</sub> = GND D <sub>0</sub> -D <sub>3</sub> , IRQ = Hi-Z	—	1.0	2.0	μA
	I <sub>DD2</sub>	V <sub>DD</sub> = 3 V FOUT = Hi-Z (OFF) VTEMP = Hi-Z (OFF)	—	0.6	1.0	μA

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

### Temperature sensor characteristics

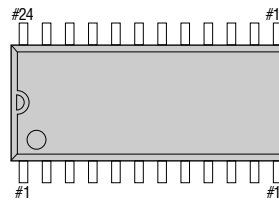
GND = 0 V, T<sub>a</sub> = -40 °C to +85 °C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Temperature output voltage	VTEMP	T <sub>a</sub> = +25 °C, GND based output voltage VTEMP pins, V <sub>DD</sub> = 2.7 V to 5.5 V		1.470		V
Output precision	T <sub>ACR</sub>	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 2.7 V to 5.5 V			±5.0	°C
Temperature sensitivity	V <sub>SE</sub>	-40 °C ≤ T <sub>a</sub> ≤ +85 °C, V <sub>DD</sub> = 2.7 V to 5.5 V	-7.3	-7.8	-8.3	mV/°C
Linearity	ΔNL	-40 °C ≤ T <sub>a</sub> ≤ +85 °C, V <sub>DD</sub> = 2.7 V to 5.5 V			±2.0	%
Temperature detection range	T <sub>SOP</sub>	ΔNL ≤ ±2.0 %, V <sub>DD</sub> = 2.7 V to 5.5 V	-40		+85	°C
Output resistance	R <sub>o</sub>	T <sub>a</sub> = +25 °C, VTEMP pins, V <sub>DD</sub> = 2.7 V to 5.5 V GND standard and V <sub>DD</sub> standard		1.0	3.0	kΩ
Load condition	C <sub>L</sub>	V <sub>DD</sub> = 2.7 V to 5.5 V			100	pF
	R <sub>L</sub>	V <sub>DD</sub> = 2.7 V to 5.5 V	500			kΩ
Response time	t <sub>rsp</sub>	V <sub>DD</sub> = 3.3 V C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 kΩ, Max. ±1 °C			200	μs

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

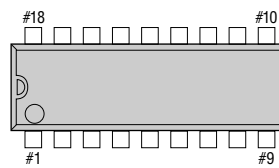
## Terminal connection

### RTC-7301SF



No.	Pin terminal	No.	Pin terminal
1	CS <sub>0</sub>	24	V <sub>DD</sub>
2	F <sub>OUT</sub>	23	(V <sub>DD</sub> )
3	F <sub>OUT</sub>	22	(V <sub>DD</sub> )
4	VTEMP	21	(V <sub>DD</sub> )
5	(V <sub>DD</sub> )	20	(V <sub>DD</sub> )
6	IRQ	19	(V <sub>DD</sub> )
7	A <sub>0</sub>	18	CS <sub>1</sub>
8	A <sub>1</sub>	17	D <sub>0</sub>
9	A <sub>2</sub>	16	D <sub>1</sub>
10	A <sub>3</sub>	15	D <sub>2</sub>
11	RD	14	D <sub>3</sub>
12	GND	13	WR

### RTC-7301DG

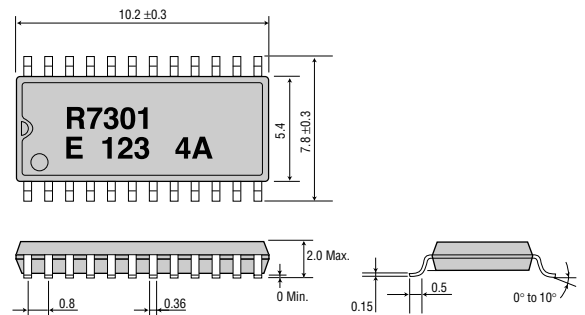


No.	Pin terminal	No.	Pin terminal
1	CS <sub>0</sub>	18	V <sub>DD</sub>
2	F <sub>OUT</sub>	17	(V <sub>DD</sub> )
3	IRQ	16	(V <sub>DD</sub> )
4	A <sub>0</sub>	15	CS <sub>1</sub>
5	A <sub>1</sub>	14	D <sub>0</sub>
6	A <sub>2</sub>	13	D <sub>1</sub>
7	A <sub>3</sub>	12	D <sub>2</sub>
8	RD	11	D <sub>3</sub>
9	GND	10	WR

## External dimensions

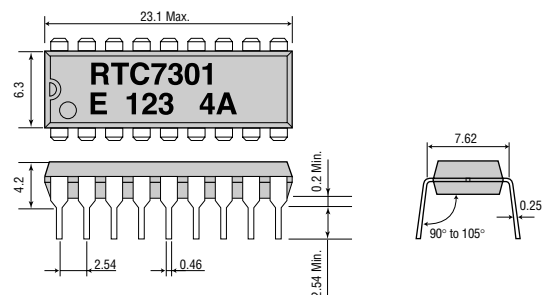
(Unit: mm)

### RTC-7301SF (SSOP 24-pin)



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

### RTC-7301DG (DIP 18-pin)





Register table

Bank0 Clock and calendar registers

Bank1 Alarms and FOUT registers

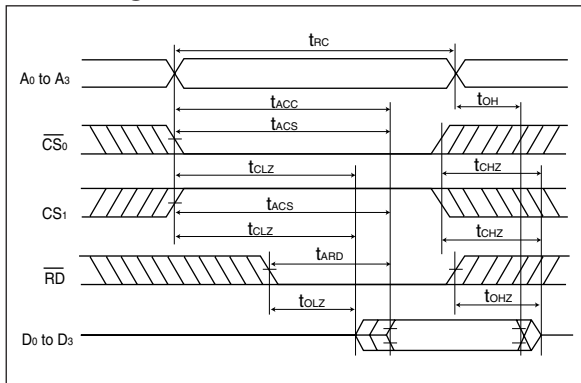
Bank2 Digital offset and timer registers

Address	Register	bit 3	bit 2	bit 1	bit 0
0	1 second digit	8	4	2	1
1	10 second digit	FOS	40	20	10
2	1 minute digit	8	4	2	1
3	10 minute digit	0	40	20	10
4	1 hour digit	8	4	2	1
5	10 hour digit	0	0	20	10
6	Day digit	0	4	2	1
7	1 day digit	8	4	2	1
8	10 day digit	0	0	20	10
9	1 month digit	8	4	2	1
A	10 month digit	0	0	0	10
B	1 year digit	8	4	2	1
C	10 year digit	80	40	20	10
D	100 year digit	800	400	200	100
E	1000 year digit	TEST	TEMP	2000	1000
F	Control registers	Bank Sel 1	Bank Sel 0	STOP	BUSY / ADJ

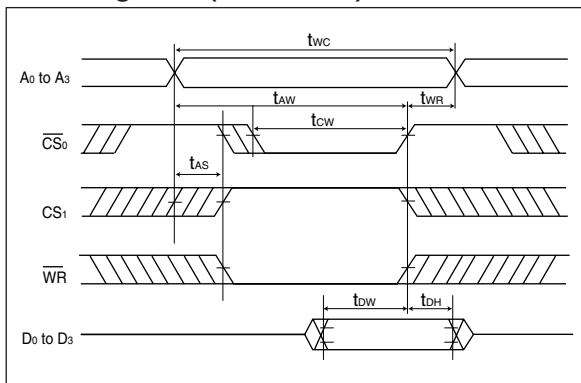
Address	Register	bit 3	bit 2	bit 1	bit 0
0	1 second digit	8	4	2	1
1	10 second digit	AE	40	20	10
2	1 minute digit	8	4	2	1
3	10 minute digit	AE	40	20	10
4	1 hour digit	8	4	2	1
5	10 hour digit	AE	•	20	10
6	Day digit	AE	4	2	1
7	1 day digit	8	4	2	1
8	10 day digit	AE	•	20	10
9	–	•	•	•	•
A	–	•	•	•	•
B	CS1 Controller	CTEMP	CDT_ON	•	•
C	FOUT divider ratio setting register	0	FD2	FD1	FDO
D	FOUT divider ratio setting register	FE	0	FD4	FD3
E	Alarm control	TEST	TEMP	AF	AIE
F	Control register	Bank Sel 1	Bank Sel 0	STOP	BUSY / ADJ

Address	Register	bit 3	bit 2	bit 1	bit 0
0	Digital offset	DT3	DT2	DT1	DT0
1	Digital offset	DT_ON	DT6	DT5	DT4
2	–	0	0	0	0
3	–	0	0	0	0
4	Timer counter preset value	8	4	2	1
5	Timer counter preset value	128	64	32	16
6	Timer counter data	8	4	2	1
7	Timer counter data	128	64	32	16
8	Timer settings	TE	TI /	TD1	TDO
9	–	0	0	0	0
A	–	0	0	0	0
B	–	0	0	0	0
C	–	0	0	0	0
D	–	0	0	0	0
E	Timer control	TEST	TEMP	TF	TIE
F	Control register	Bank Sel 1	Bank Sel 0	STOP	BUSY / ADJ

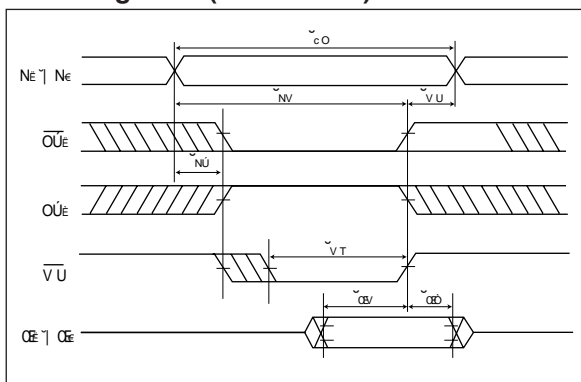
Reading data



Writing data (CS Control)



Writing data (WR Control)

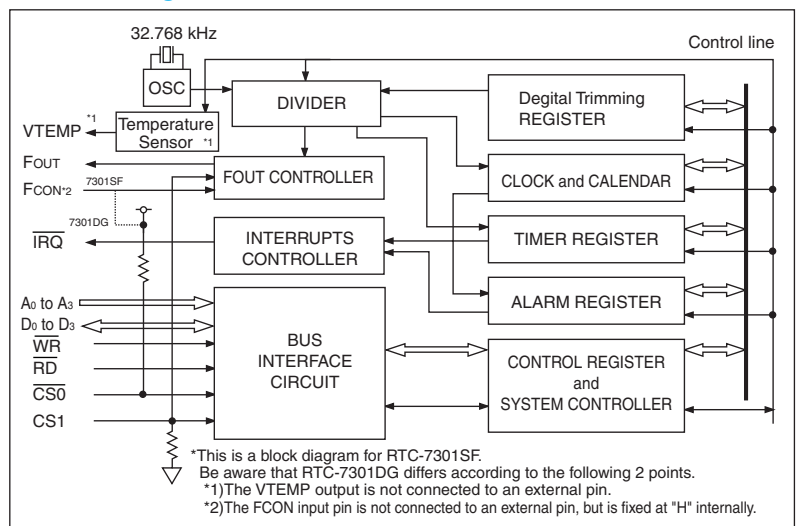


AC characteristics

•GND = 0V, Ta = -40 °C to +85 °C •Input conditions: VI = 0.5 x VDD, VO = 0.5 x VDD •Output load : CL = 100 pF (tACC, tACS, tARD)

Item	Symbol	Control	VDD = 2.4 to 3.6V		VDD = 4.5 to 5.5V		Unit
			Min.	Max.	Min.	Max.	
Read cycle time	tRC	–	150	–	85	–	ns
Address access time	tACC	–	–	150	–	85	ns
CE access time	tACS	–	–	150	–	85	ns
RD access time	tARD	–	–	100	–	45	ns
CE output set time	tCLZ	–	5	–	3	–	ns
CE output floating	tCHZ	–	–	60	–	30	ns
RD output set time	tOLZ	–	5	–	3	–	ns
RD output floating	tOHZ	–	–	60	–	30	ns
Output hold time	tOH	–	10	–	5	–	ns
Write cycle time	tWC	–	150	–	85	–	ns
Chip select time	tCW	–	140	–	70	–	ns
Address valid end of write	tAW	–	140	–	70	–	ns
Address setup time	tAS	–	0	–	0	–	ns
Address hold time	tWR	–	0	–	0	–	ns
Write pulse width	tWP	–	130	–	65	–	ns
Input data set time	tDW	–	80	–	35	–	ns
Input data hold time	tDH	–	0	–	0	–	ns
FOUT output frequency duty	DUTY	FOUT = 32.768 kHz	40	60	40	60	%

Block diagram



4-bit REAL TIME CLOCK MODULE

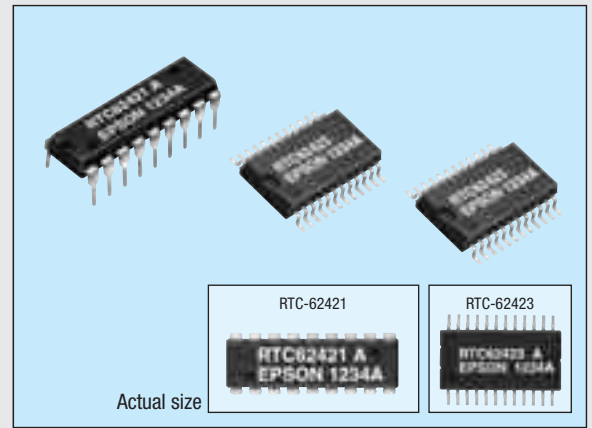
# RTC-62421 / 62423

Product number (please refer to page 5)

**Q4262421XXXXX00**

**Q4262423XXXXX00**

- Built-in crystal unit allows adjustment-free efficient operation.
- 24 h /12 h changeable and leap year automatically adjustable (gregorian calendar).
- Pins and functions are compatible with the MSM6242 series.
- Available for lead (Pb) - free soldering.
- Available for lead (Pb) - free terminal.



The details are mentioned in the application manual.

<http://www.epsondevice.com>

## Specifications (characteristics)

### Absolute Max. rating

Item	Symbol	Condition	Min.	Max.	Unit
Supply voltage	V <sub>DD</sub>	Ta = +25 °C	-0.3	+7.0	V
Input and output voltage	V <sub>I/O</sub>		GND -0.3	V <sub>DD</sub> +0.3	
Storage temperature *	T <sub>STG</sub>	RTC-62421	-55	+85	°C
		RTC-62423	-55	+125	

\* Stored as bare product after unpacking

### Operating range

Item	Symbol	Condition	Min.	Max.	Unit
Power voltage	V <sub>DD</sub>	—	4.5	5.5	V
Clock voltage	V <sub>CLK</sub>	—	2.0	5.5	V
Operating temperature	T <sub>OPR</sub>	No condensation	-40	+85	°C

### Frequency characteristics

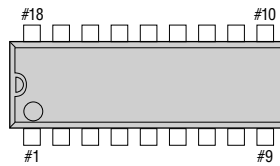
Item	Symbol	Condition	Range	Unit	
Frequency tolerance	Δf/f	Ta = +25 °C, V <sub>DD</sub> = 5 V	62421 A	±10	x 10 <sup>-6</sup>
			62421 B	±50	
			62423 A	±20	
			62423	±50	
Frequency temperature characteristics	T <sub>OP</sub>	-10 °C to +70 °C (Reference at +25 °C)	+10 / -120	x 10 <sup>-6</sup> / V	
		-40 °C to +85 °C (Reference at +25 °C)	+10 / -220		
Frequency voltage characteristics	f/V	Ta = +25 °C V <sub>DD</sub> = 4.5 V to 5.5V	±5	x 10 <sup>-6</sup> / V	
Aging	fa	V <sub>DD</sub> = 5 V, Ta = +25 °C, first year	±5	x 10 <sup>-6</sup> / year	

### DC characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Applicable terminal
Current consumption	I <sub>DD1</sub>	CS <sub>1</sub> = 0 V	—	15	30	μA	—
	I <sub>DD2</sub>				1.8		
"H" input voltage (1)	V <sub>IH1</sub>	—	2.2	—	—	V	All inputs other than CS <sub>1</sub>
"L" input voltage (1)	V <sub>IL1</sub>						
Input leak current (1)	I <sub>LK1</sub>	V <sub>1</sub> = V <sub>DD</sub> / 0 V	—	—	1 / -1	μA	Input other than Do to D <sub>3</sub>
Input leak current (2)	I <sub>LK2</sub>				10 / -10		
"L" output voltage (1)	V <sub>OL1</sub>	I <sub>OL</sub> = 2.5 mA	—	—	0.4	V	Do to D <sub>3</sub>
"H" output voltage	V <sub>OH</sub>				I <sub>OH</sub> = -400 μA		
"L" output voltage (2)	V <sub>OL2</sub>	I <sub>OL</sub> = 2.5 mA	—	—	0.4	V	STD.P
OFF leak current	I <sub>OFFLK</sub>				V <sub>1</sub> = V <sub>DD</sub> / 0 V		
Input capacity	C <sub>1</sub>	Input frequency 1 MHz	—	5	—	pF	Input Pins
"H" input voltage (2)	V <sub>IH2</sub>	V <sub>DD</sub> = 2 V to 5.5 V	—	—	4/5 V <sub>DD</sub>	V	CS <sub>1</sub>
"L" input voltage (2)	V <sub>IL2</sub>				1/5 V <sub>DD</sub>		

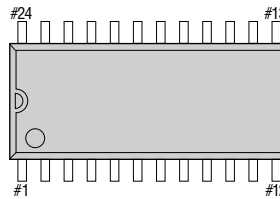
## Terminal connection

### RTC-62421



No.	Pin terminal	No.	Pin terminal
1	STD.P	18	V <sub>DD</sub>
2	CS <sub>0</sub>	17	(V <sub>DD</sub> )
3	ALE	16	(V <sub>DD</sub> )
4	A <sub>0</sub>	15	CS <sub>1</sub>
5	A <sub>1</sub>	14	D <sub>0</sub>
6	A <sub>2</sub>	13	D <sub>1</sub>
7	A <sub>3</sub>	12	D <sub>2</sub>
8	RD	11	D <sub>3</sub>
9	GND	10	WR

### RTC-62423

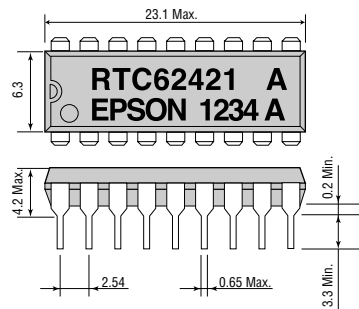


No.	Pin terminal	No.	Pin terminal
1	STD.P	24	V <sub>DD</sub>
2	CS <sub>0</sub>	23	(V <sub>DD</sub> )
3	NC	22	(V <sub>DD</sub> )
4	ALE	21	NC
5	A <sub>0</sub>	20	CS <sub>1</sub>
6	NC	19	D <sub>0</sub>
7	A <sub>1</sub>	18	NC
8	NC	17	NC
9	A <sub>2</sub>	16	D <sub>1</sub>
10	NC	15	D <sub>2</sub>
11	RD	14	D <sub>3</sub>
12	GND	13	WR

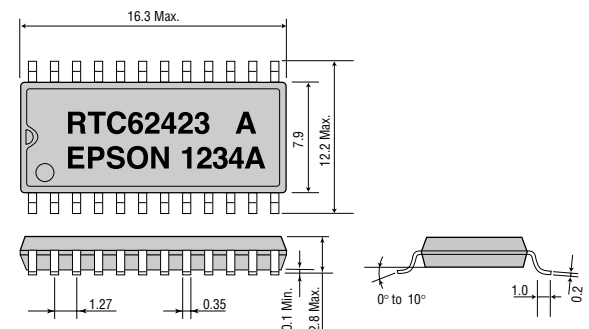
## External dimensions

(Unit: mm)

### RTC-62421 (DIP 18-pin)



### RTC-62423 (SOP 24-pin)



4-bit REAL TIME CLOCK MODULE

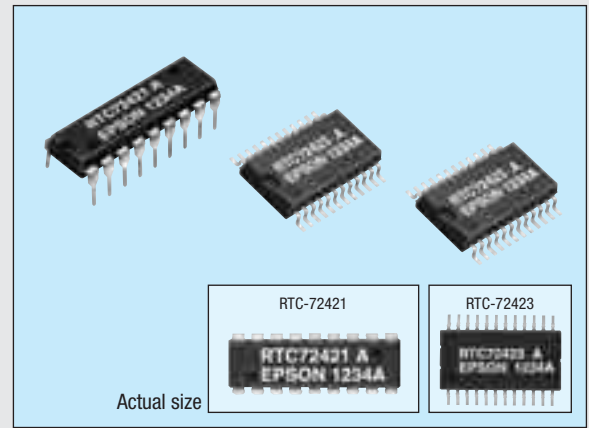
# RTC-72421 / 72423

Product number (please refer to page 5)

**Q4272421xxxxx00**

**Q4272423xxxxx00**

- Built-in crystal unit allows adjustment-free efficient operation.
- 12/24 h clock switchover function and automatic leap year setting.
- Interrupt masking.
- Available for lead (Pb) - free soldering.
- Available for lead (Pb) - free terminal.



The details are mentioned in the application manual.

<http://www.epsondevice.com>

## ■ Specifications (characteristics)

### ■ Absolute Max. rating

Item	Symbol	Condition	Min.	Max.	Unit
Supply voltage	V <sub>DD</sub>	T <sub>a</sub> = +25 °C	-0.3	7.0	V
Input and output voltage	V <sub>I/O</sub>	T <sub>a</sub> = +25 °C	GND -0.3	V <sub>DD</sub> +0.3	
Storage temperature *	T <sub>STG</sub>	RTC-72421	-55	+85	°C
		RTC-72423	-55	+125	

\* Stored as bare product after unpacking

### ■ Operating range

Item	Symbol	Condition	Min.	Max.	Unit
Power voltage	V <sub>DD</sub>	—	4.5	5.5	V
Supply voltage	V <sub>CLK</sub>	—	2.0	5.5	V
Operating temperature *	T <sub>OPR</sub>	RTC-72421	-10	70	°C
		RTC-72423	-40	85	

\* No condensation

### ■ Frequency characteristics

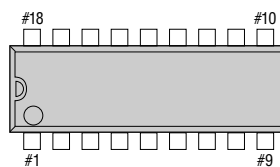
Item	Symbol	Condition	Range	Unit
Frequency tolerance	Δf/f	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 5 V	72421 A	±10
			72421 B	±50
			72423 A	±20
			72423	±50
Frequency temperature characteristics	T <sub>OP</sub>	-10 °C to +70 °C (Reference at +25 °C)	+10 / -120	x 10 <sup>-6</sup>
		-40 °C to +85 °C (Reference at +25 °C)	+10 / -220	
Frequency voltage characteristics	f/V	T <sub>a</sub> = +25 °C V <sub>DD</sub> = 2.0 V to 5.5 V	±5 Max.	x 10 <sup>-6</sup> / V
Aging	f <sub>a</sub>	V <sub>DD</sub> = 5 V, T <sub>a</sub> = +25 °C, first year	±5 Max.	x 10 <sup>6</sup> / year

### ■ DC characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Applicable terminal
Current consumption	I <sub>DD1</sub>	CS <sub>1</sub> = 0 V Exclude input/output current	—	1	10	μA	—
	I <sub>DD2</sub>						
"H" input voltage (1)	V <sub>IH1</sub>	—	2.2	—	—	V	All inputs other than CS <sub>1</sub>
"L" input voltage (1)	V <sub>IL1</sub>						
Input leak current (1)	I <sub>LK1</sub>	V <sub>1</sub> = V <sub>DD</sub> / 0 V	—	—	±1	μA	Input other than Do to D <sub>3</sub>
Input leak current (2)	I <sub>LK2</sub>						
"L" output voltage (1)	V <sub>OL1</sub>	I <sub>oL</sub> = 2.5 mA	—	—	±10	V	Do to D <sub>3</sub>
"H" output voltage (2)	V <sub>OH</sub>						
"L" output voltage (2)	V <sub>OL2</sub>	I <sub>oL</sub> = 2.5 mA	2.4	—	—	V	STD.P
Off leak current	I <sub>OFFLK</sub>	V <sub>1</sub> = V <sub>DD</sub> /0 V					
Input capacity	C <sub>1</sub>	Input frequency 1 MHz	—	10	—	pF	Input other than Do to D <sub>3</sub>
"H" input voltage (2)	V <sub>IH2</sub>	V <sub>DD</sub> = 2 V to 5.5 V	4/5 V <sub>DD</sub>	—	—	V	CS <sub>1</sub>
"L" input voltage (2)	V <sub>IL2</sub>						

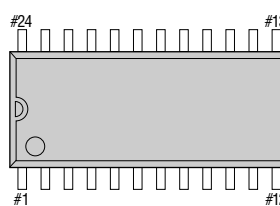
## ■ Terminal connection

### ● RTC-72421



No.	Pin terminal	No.	Pin terminal
1	STD_P	18	V <sub>DD</sub>
2	CS <sub>1</sub>	17	(V <sub>DD</sub> )
3	ALE	16	(V <sub>DD</sub> )
4	A <sub>0</sub>	15	CS <sub>1</sub>
5	A <sub>1</sub>	14	D <sub>0</sub>
6	A <sub>2</sub>	13	D <sub>1</sub>
7	A <sub>3</sub>	12	D <sub>2</sub>
8	RD	11	D <sub>3</sub>
9	GND	10	WR

### ● RTC-72423

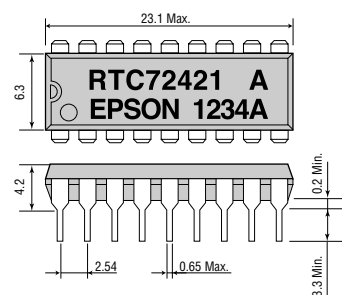


No.	Pin terminal	No.	Pin terminal
1	STD_P	24	V <sub>DD</sub>
2	CS <sub>1</sub>	23	(V <sub>DD</sub> )
3	NC	22	(V <sub>DD</sub> )
4	ALE	21	NC
5	A <sub>0</sub>	20	CS <sub>1</sub>
6	NC	19	D <sub>0</sub>
7	A <sub>1</sub>	18	NC
8	NC	17	NC
9	A <sub>2</sub>	16	D <sub>1</sub>
10	A <sub>3</sub>	15	D <sub>2</sub>
11	RD	14	D <sub>3</sub>
12	GND	13	WR

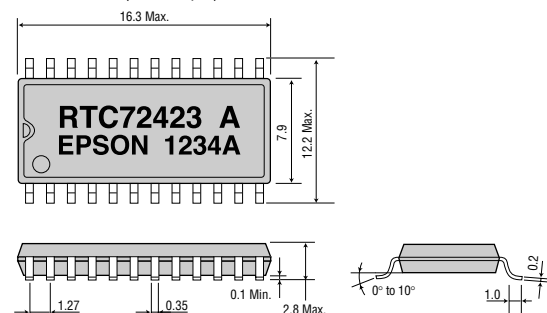
## ■ External dimensions

(Unit: mm)

### ● RTC-72421 (DIP 18-pin)



### ● RTC-72423 (SOP 24-pin)

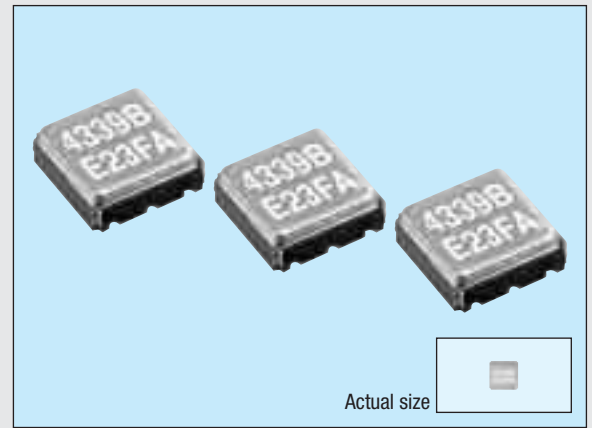


# SAW RESONATOR NS-32R

Product number (please refer to page 5)

**Q25NS32Rxxxx00**

- Improved the Temp characteristics by new simulation technology.
- Reflow solderable SMD ceramic package.
- Capable of covering a wide frequency range, from 312 MHz to 1 GHz.
- 1.45 mm Max. thickness is equal to SMD-type IC.
- Perfect for small wireless equipment.
- Excellent shock resistance and enviromental capability (prevention for contamination)
- Available for lead (Pb) - free soldering.
- Complete lead (Pb) - free product.

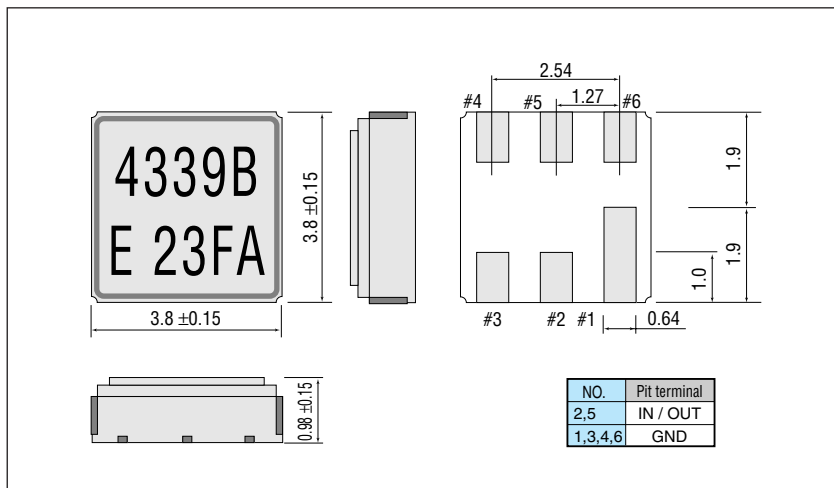


## Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Nominal frequency range	fo	312 MHz to 1.0 GHz	fundamental mode, Please contact us for inquiries about available frequency
Temperature range	Storage temperature	TSTG	-40 °C to +85 °C
	Operating temperature	TOPR	-40 °C to +85 °C
Maximum drive level	GL	10 mW Max. 2 mW Max.	400 MHz ≤ fo ≤ 500 MHz 500 MHz < fo ≤ 1 GHz
Recommended drive level	DL	1 mW Typ.	
Frequency tolerance (standard)	Δf/fo	±50 x 10 <sup>-6</sup> , ±100 x 10 <sup>-6</sup>	Ta = +25 °C ± 3 °C
Peak temperature	θT	+20 °C ± 15 °C	Please contact us for inquires about Peak temperature
Temperature coefficient	α	- (1.6±0.4) x 10 <sup>-8</sup> / °C <sup>2</sup>	
Harmonic ratio	Rs/R1	2 Min.	
Series resistance	R1	35 Ω Max.	
Aging	fa	±10 x 10 <sup>-6</sup> / year Max.	Ta = +25 °C ± 3 °C
Shock resistance	S.R.	±10 x 10 <sup>-6</sup> Max.	Nine drops on a concrete from 1500 mm

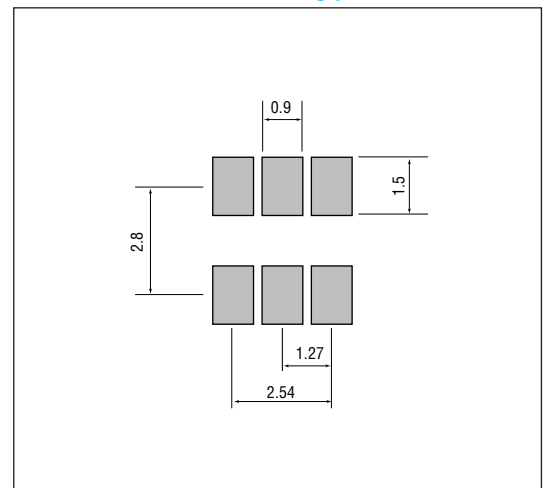
## External dimensions

(Unit: mm)



## Recommended soldering pattern

(Unit: mm)



## SAW RESONATOR

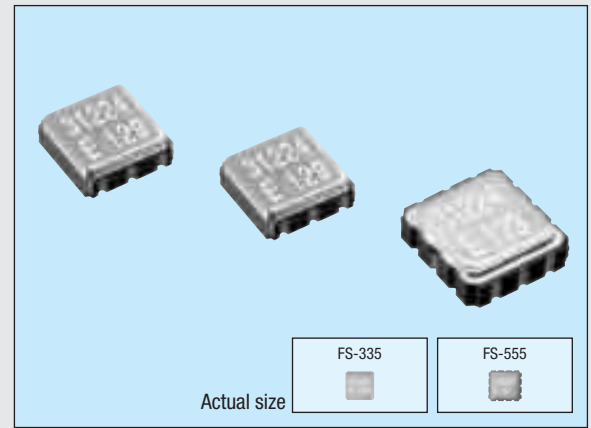
## FS-335 / 555

Product number (please refer to page 5)

Q25FS335xxxx00

Q25FS555xxxx00

- Reflow solderable SMD ceramic package.
- Capable of covering a wide frequency range,  
FS-335 : 300 MHz to 870 MHz      FS-555 : 230 MHz to 500 MHz.
- Perfect for small wireless equipment.
- Excellent shock resistance and enviromental capability (prevention for contamination)
- Available for lead (Pb) - free soldering.
- Complete lead (Pb) - free product.

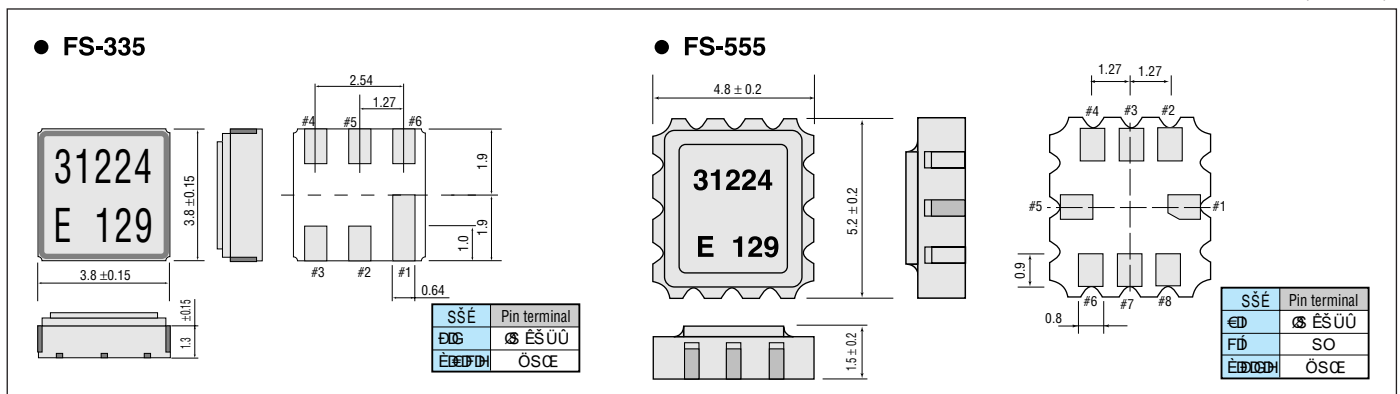


## ■ Specifications (characteristics)

Item	Symbol	Specifications		Remarks
		FS-335	FS-555	
Nominal frequency range	$f_0$	300 MHz to 870 MHz	230 MHz to 500 MHz	fundamental mode, Please contact us for inquiries about the available frequency.
Temperature range	Storage temperature	-40 °C to +85 °C		Stored as bare product after unpacking
	Operating temperature	-40 °C to +85 °C		
Maximum drive level	GL	10 mW Max.	10 mW Max.	300 MHz $\leq f_0 \leq$ 500 MHz
		2 mW Max.		500 MHz $< f_0 \leq$ 870 MHz
Recommended drive level	DL	1 mW Typ.	2 mW Typ.	
Frequency tolerance(standard)	$\Delta f/f_0$	$\pm 25 \times 10^{-6}$ , $\pm 50 \times 10^{-6}$ , $\pm 100 \times 10^{-6}$	$\pm 25 \times 10^{-6}$ , $\pm 50 \times 10^{-6}$ , $\pm 100 \times 10^{-6}$	300 MHz $\leq f_0 \leq$ 500 MHz, $T_a = +25 \text{ °C} \pm 3 \text{ °C}$
		$\pm 100 \times 10^{-6}$		500 MHz $< f_0 \leq$ 870 MHz, $T_a = +25 \text{ °C} \pm 3 \text{ °C}$
Peak temperature	$\theta T$	+25 °C $\pm$ 15 °C		
Temperature coefficient	$\alpha$	$-(3.4 \pm 0.8) \times 10^{-8} / \text{°C}^2$		
Harmonic ratio	$R_s/R_1$	2 Min.		
Series resistance	$R_1$	25 $\Omega$ Max.	40 $\Omega$ Max.	300 MHz $\leq f_0 \leq$ 500 MHz
		40 $\Omega$ Max.		500 MHz $< f_0 \leq$ 870 MHz
				230 MHz $\leq f_0 \leq$ 250 MHz
				250 MHz $< f_0 \leq$ 500 MHz
Aging	$f_a$	$\pm 10 \times 10^{-6} / \text{year Max.}$		$T_a = +25 \text{ °C} \pm 3 \text{ °C}$
Shock resistance	S.R.	$\pm 10 \times 10^{-6} \text{ Max.}$		Nine drops on a concrete from 1500 mm

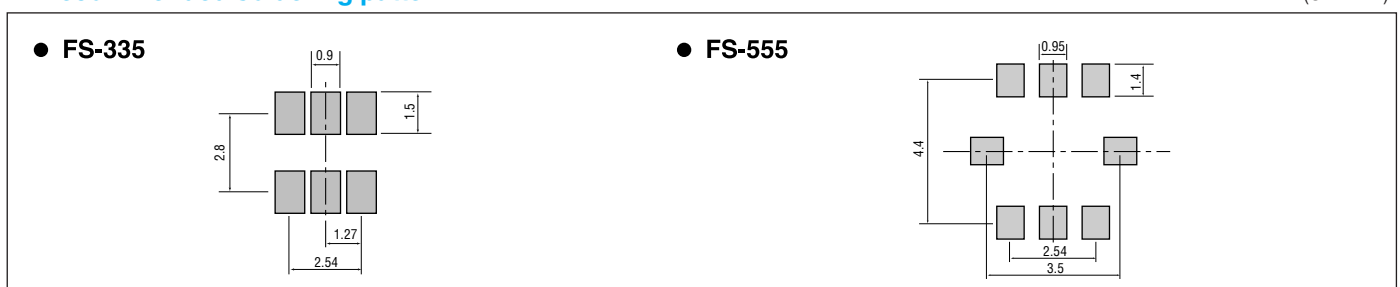
## ■ External dimensions

(Unit: mm)



## ■ Recommended soldering pattern

(Unit: mm)



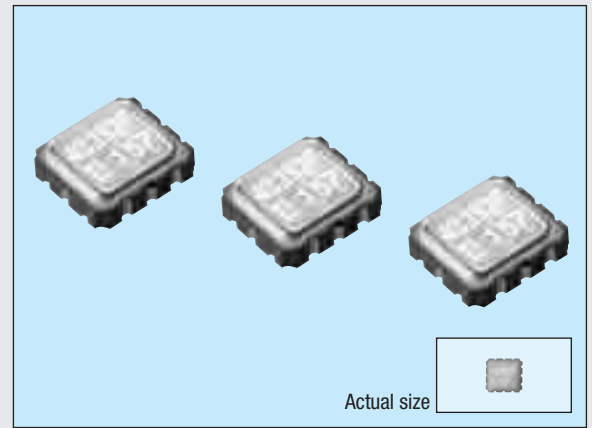
## SAW Filter

## FF-555

Product number (please refer to page 5)

Q51FF555XXXXX00

- Low-loss, Narrow Pass bandwidth, High stability by using crystal plate.
- Reflow solderable Surface-Mount ceramic package.
- Applications: Wireless remote-control, Security (Automotive keyless entry)
- Front-end filter for wireless receivers.
- Excellent shock resistance and environmental capability (prevention for contamination)
- Available for lead (Pb) - free soldering.
- Complete lead (Pb) - free product.

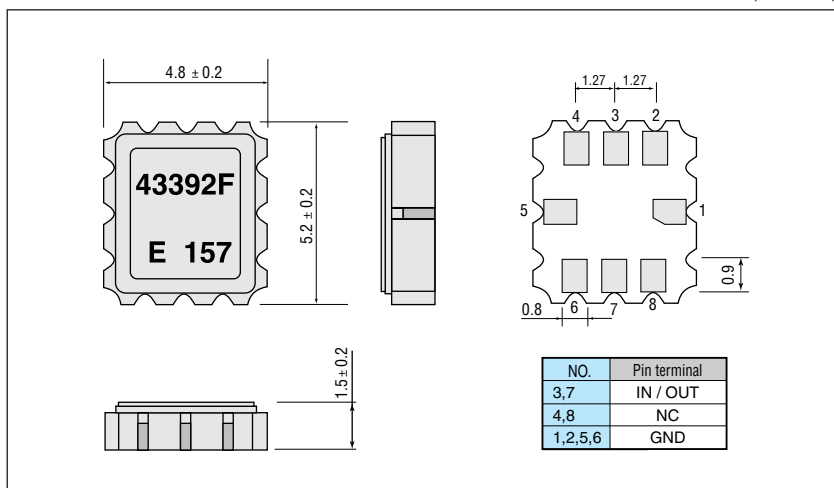


## ■ Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Nominal frequency range	$f_0$	300 MHz to 500 MHz	
Insertion Loss	IL	3.5 dB Max.	Minimum Loss
Pass bandwidth	BW3.5	$f_0 \pm 100$ kHz Min.	Reference to Through level (0 dB)
Attenuation	ATT	At $f_0 - 21.4$ MHz 40 dB Min. At $f_0 - 10.7$ MHz 40 dB Min.	Reference to Through level (0 dB)
Peak temperature	$\theta T$	$+25^\circ\text{C} \pm 15^\circ\text{C}$	
Temperature coefficient	$\alpha$	$-(3.4 \pm 0.8) \times 10^{-6} / ^\circ\text{C}^2$	
Operable temperature	$T_{OPR}$	$-40^\circ\text{C}$ to $+85^\circ\text{C}$	
Storage temperature range	$T_{STG}$	$-55^\circ\text{C}$ to $+125^\circ\text{C}$	
Terminal impedance	Z	370 $\Omega$ Typ.	Ex : 315 MHz
		260 $\Omega$ Typ.	Ex : 433.92 MHz
Test fixture			Ex : 315 MHz Series Capacitance 4 pF Parallel Inductance 33 nH Ex : 433.92 MHz Series Capacitance 5 pF parallel Inductance 18 nH

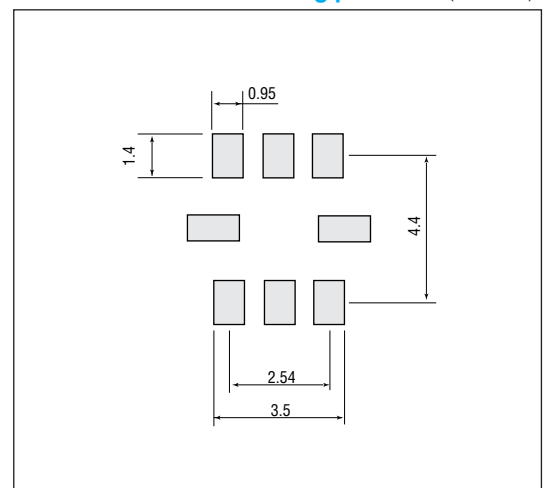
## ■ External dimensions

(Unit: mm)



## ■ Recommended soldering pattern

(Unit: mm)



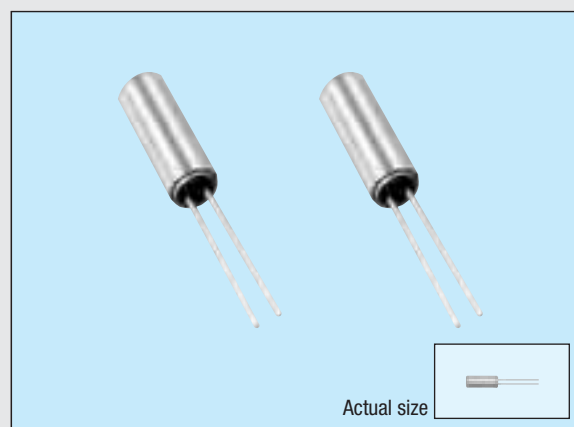
## TEMPERATURE SENSING CRYSTAL

# HTS-206

Product number (please refer to page 1)

**Q19HT206XXXXX00**

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

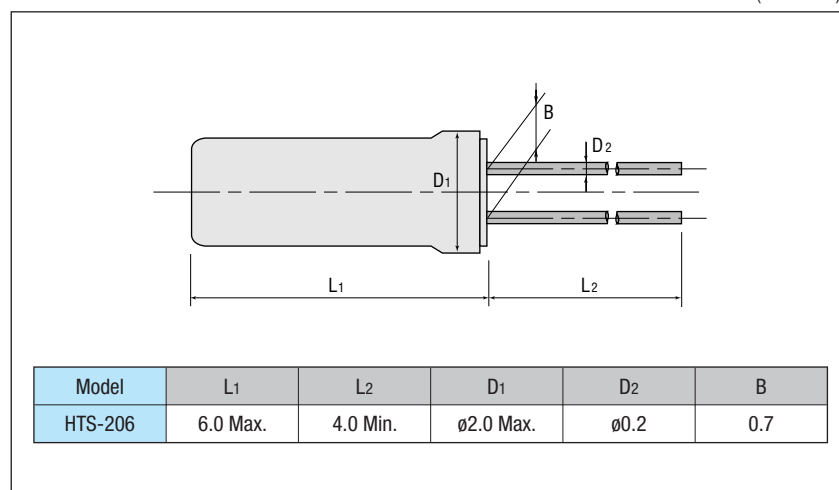


### ■ Specifications (characteristics)

Item	Symbol	Specifications	Remarks	
Nominal frequency	$f_0$	40 kHz		
Temperature range	Storage temperature	TSTG	-55 °C to +120 °C	Stored as bare product after unpacking
	Operating temperature	TOPR	-40 °C to +85 °C	
Drive level	Maximum	GL	1.0 $\mu$ W Max.	
	Recommended	DL	0.1 $\mu$ W Typ.	
Frequency tolerance (standard)	$\Delta f/f$	$\pm 2\%$	$T_a = +25\text{ }^\circ\text{C}$ , DL = 0.1 $\mu$ W	
Temperature coefficient	1st	$\alpha$	$-29.6 \times 10^{-6} / ^\circ\text{C}$ [ $\pm 2\%$ ]	
	2nd	$\beta$	$-6.4 \times 10^{-6} / ^\circ\text{C}^2$ [ $\pm 8\%$ ]	
	3rd	$\gamma$	$-1.5 \times 10^{-6} / ^\circ\text{C}^3$ Max.	
Series resistance	$R_1$	30 k $\Omega$ Max.	$T_a = +25\text{ }^\circ\text{C}$ , DL = 0.1 $\mu$ W	
Motion capacitance	$C_1$	2.0 fF Typ.		
Shunt capacitance	$C_0$	0.9 pF Typ.		
Insulation resistance	IR	500 M $\Omega$ Min.		
Aging	$f_a$	$\pm 3 \times 10^{-6} / \text{year}$ Max.	$T_a = +25\text{ }^\circ\text{C} \pm 3\text{ }^\circ\text{C}$	
Shock resistance	S.R.	$\pm 3 \times 10^{-6}$ Max.	Three drops on a hard board from 500 mm	

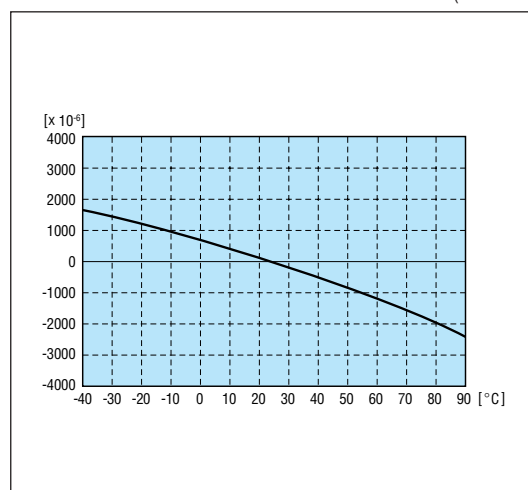
### ■ External dimensions

(Unit: mm)



### ■ External dimensions

(Unit: mm)

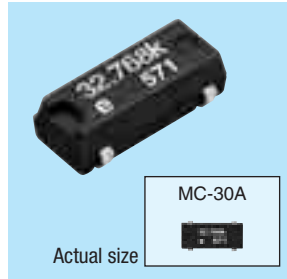


# QUARTZ DEVICE FOR AUTOMOTIVE

## Low-medium frequency crystal unit MC-30A

● **Target application**

- ECU sub clock (Power window / seat, Key-less entry, Immobilizer etc.)
- Clock
- Instrument panel display
- Bluetooth sub clock
- ITS (Telematics, VICS, ETC), Clock / sub clock

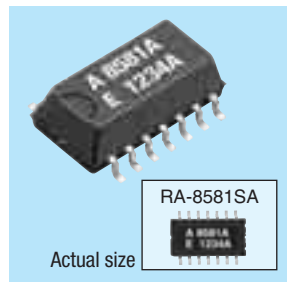
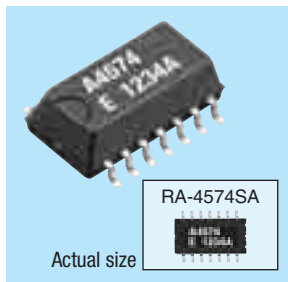


## Real time clock module Serial Interface 3-Wire RA-4574SA

● **Target application**

- ITS (Telematics, VICS, ETC), Clock / sub clock / Timing control

I<sup>2</sup>C bus RA-8581SA



## Saw device

	<b>Saw resonator</b>	<p><b>FS-585</b></p> <ul style="list-style-type: none"> <li>● <b>Target application</b> TPMS transmitter</li> </ul> <p><b>FS-335 / 555, NS-32R</b></p> <ul style="list-style-type: none"> <li>● <b>Target application</b> Key-less entry transmitter Smart key transmitter</li> </ul>
	<b>Saw filter</b>	<p><b>FF-585</b></p> <ul style="list-style-type: none"> <li>● <b>Target application</b> TPMS receiver</li> </ul> <p><b>FF-555</b></p> <ul style="list-style-type: none"> <li>● <b>Target application</b> Key-less entry receiver Smart key receiver</li> </ul>





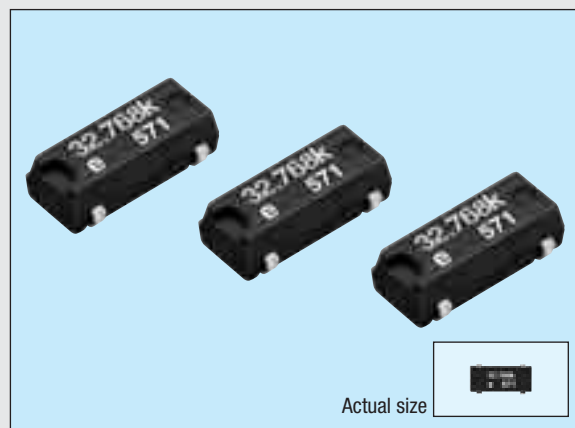
FOR AUTOMOTIVE APPLICATIONS  
SMALL SMD LOW / MEDIUM-FREQUENCY CRYSTAL UNIT

# MC-30A

Product number (please refer to page 1)

**Q1 x MC30Axxxxx00**

- Most suitable for accessories and ECU sub clock for automotive applications.
- High-density mounting-type SMD.
- Photolithography finished allows uniform and stable performance.
- Excellent reliability and environmental capability.
- Available for lead (Pb) - free soldering.
- Available for lead (Pb) - free terminal.



## Specifications (characteristics)

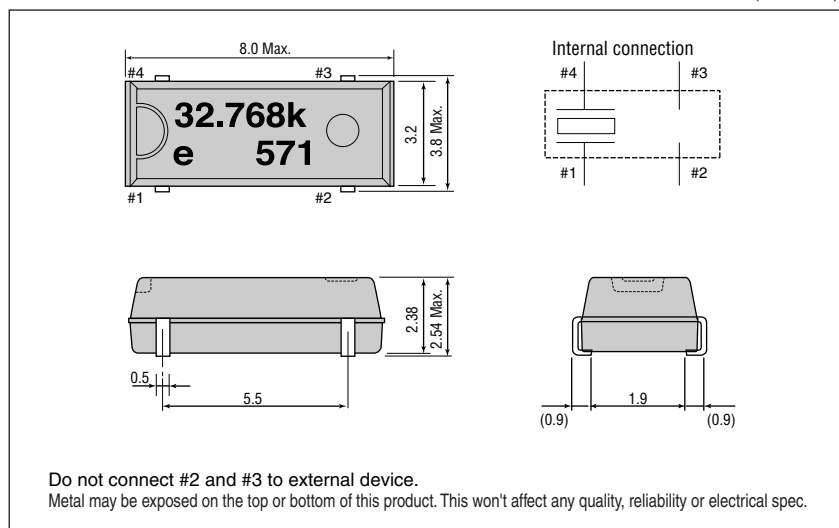
Item	Symbol	Specifications		Remarks
Nominal frequency range	f	32.768 kHz	20.000 kHz to 165.000 kHz	
Temperature range	Storage temperature	-55 °C to +125 °C		Stored as bare product after unpacking
	Operating temperature	-40 °C to +85 °C		
Maximum drive level	GL	1.0 μW Max.		
Frequency tolerance (standard)	$\Delta f/f$	$\pm 20 \times 10^{-6}$ , $\pm 50 \times 10^{-6}$	$\pm 50 \times 10^{-6}$ , $\pm 100 \times 10^{-6}$	Ta = +25 °C, DL = 0.1 μW
Peak temperature (frequency)	$\theta T$	+25 °C $\pm 5$ °C		
Temperature coefficient (frequency)	a	-0.04 x 10 <sup>-6</sup> / °C <sup>2</sup> Max.		
Load capacitance	CL	6 pF to $\infty$		Please specify
Series resistance	R <sub>1</sub>	50 k $\Omega$ Max.	55 k $\Omega$ to 10 k $\Omega$	As per below table
Motional capacitance	C <sub>1</sub>	1.8 fF Typ.	4.0 fF to 0.6 fF	
Shunt capacitance	C <sub>0</sub>	0.9 pF Typ.	2.0 pF to 0.6 pF	
Insulation resistance	IR	500 M $\Omega$ Min.		
Aging	fa	$\pm 3 \times 10^{-6}$ / year Max.	$\pm 5 \times 10^{-6}$ / year Max.	Ta = +25 °C $\pm 3$ °C, first year
Shock resistance	S.R.	$\pm 5 \times 10^{-6}$ Max.		Three drops on a hard board from 100 mm

## Series resistance

Frequency (kHz)	20 kHz $\leq$ f < 31.2 kHz	31.2 kHz $\leq$ f < 40 kHz	40 kHz $\leq$ f < 90 kHz	90 kHz $\leq$ f < 130 kHz	130 kHz $\leq$ f $\leq$ 165 kHz
Series resistance ( $\Omega$ )	55 k $\Omega$ Max.	35 k $\Omega$ Max.	20 k $\Omega$ Max.	12 k $\Omega$ Max.	10 k $\Omega$ Max.

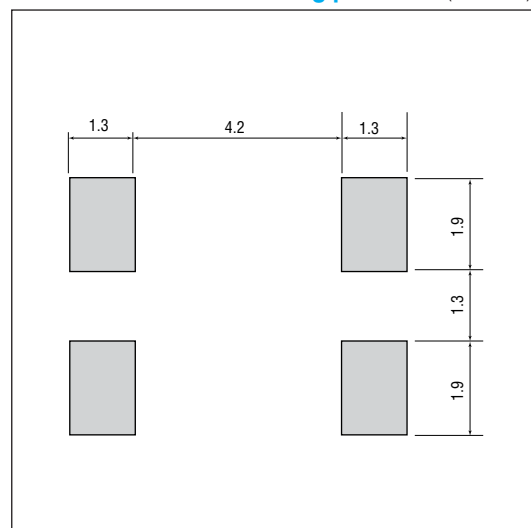
## External dimensions

(Unit: mm)



## Recommended soldering pattern

(Unit: mm)



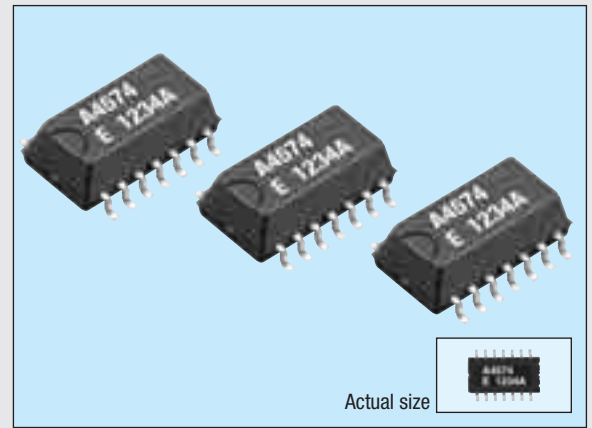
FOR AUTOMOTIVE APPLICATIONS

# RA-4574SA

Product number (please refer to page 5)

**Q41A4745xxxxx00**

- It is suitable for the car accessories.
- Built-in frequency adjusted 32.768kHz crystal oscillator.
- Serial interface which can be controlled by three signal lines.
- Alarm interrupt function for day of week, day, hour, and minute.
- Timer interrupt function which can be set up between 1/4096 second and 255 minutes.
- Dedicated interrupt output of the two systems (alarm and regular cycle) which allows software masking.
- Ability to detect stopping of oscillation and time update.
- Automatic adjustment for leap year.
- Wide range of interface voltage and clock voltage between 1.6 V and 5.5 V.
- Low power consumption at 0.5  $\mu$ A / 3 V. (Typ.)
- Selectable frequency outputs function.
- Available for lead (Pb) - free soldering.
- Available for lead (Pb) - free terminal.



The details are mentioned in the application manual.

<http://www.epsondevice.com>

## Specifications (characteristics)

### Absolute Max. rating

Item	Symbol	Condition	Min.	Max.	Unit
Supply voltage	V <sub>DD</sub>	V <sub>DD</sub> to GND	-0.3	+7.0	V
Input voltage	V <sub>IN</sub>	Input Pin		V <sub>DD</sub> +0.3	
Output voltage	V <sub>OUT1</sub> V <sub>OUT2</sub>	T <sub>IRQ</sub> , AIRQ F <sub>OUT</sub> , DATA	GND -0.3	+8.0 V <sub>DD</sub> +0.3	
Storage temperature	T <sub>STG</sub>	Stored as bare product after unpacking	-55	+125	°C

### Operating range

Item	Symbol	Condition	Min.	Max.	Unit
Power voltage	V <sub>DD</sub>	—	1.6	5.5	V
Clock voltage	V <sub>CLK</sub>	—			
Operating temperature	V <sub>OPR</sub>	No condensation	-40	+85	°C

### Frequency characteristics

Item	Symbol	Condition	Range	Unit
Frequency tolerance	$\Delta f/f_0$	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 3 V	5 ±23 *1	x 10 <sup>-6</sup>
Oscillation start up time	t <sub>STA</sub>	T <sub>a</sub> = -40 °C to +85 °C, V <sub>DD</sub> = 3.0 V *2	3 Max.	s
Frequency temperature characteristics	T <sub>OP</sub>	T <sub>a</sub> = -20 °C to +70 °C, V <sub>DD</sub> = 3.0 V	+10 -120	x 10 <sup>-6</sup>
Frequency voltage characteristics	f/V	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 1.6 V to 5.5 V	±2	x 10 <sup>-6</sup> / V
Aging	f <sub>a</sub>	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 5 V, first year	±5	x 10 <sup>6</sup> / year

\*1 Please ask tighter tolerance.

\*2 V<sub>DD</sub> Power Supply rise up time ≤ 1 ms. (0 % V<sub>DD</sub> - 90 % V<sub>DD</sub>)

### DC characteristics (GND = 0 V, V<sub>DD</sub> = 1.6 V to 5.5 V, T<sub>a</sub> = -40 °C to +85 °C)

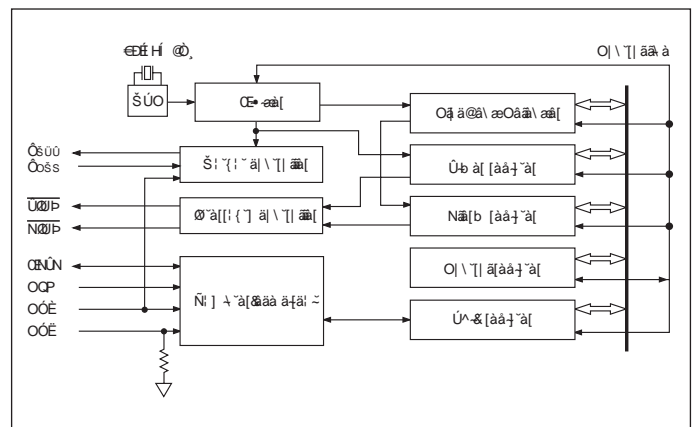
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Standby current 1	I <sub>DD1</sub>	V <sub>DD</sub> = 5 V CE <sub>0</sub> , CE <sub>1</sub> = GND	—	1.0	2.0	$\mu$ A
Standby current 2	I <sub>DD2</sub>	V <sub>DD</sub> = 3 V DATA, AIRQ, T <sub>IRQ</sub> = V <sub>DD</sub>	—	0.5	1.0	
Input voltage	V <sub>IH</sub> V <sub>IL</sub>	CE <sub>0</sub> , CE <sub>1</sub> , CLK, DATA, FCON pins	0.8 V <sub>DD</sub> GND -0.3	—	V <sub>DD</sub> +0.3 0.2 V <sub>DD</sub>	V
Input leakage current	I <sub>LK</sub>	V <sub>IN</sub> = GND or V <sub>DD</sub> CE <sub>1</sub> , CLK FCON pins CE <sub>0</sub>	-0.5	—	0.5	$\mu$ A
Pulldown R1	R <sub>DWN1</sub>	V <sub>DD</sub> = 5 V CE <sub>0</sub> pins	75	150	300	k $\Omega$
Pulldown R2	R <sub>DWN2</sub>	V <sub>DD</sub> = 3 V V <sub>IN</sub> = V <sub>DD</sub>	150	300	600	
Output voltage 1	V <sub>OH1</sub>	V <sub>DD</sub> = 5 V I <sub>OH</sub> = -1 mA	4.5	—	5.0	V
	V <sub>OH2</sub>	V <sub>DD</sub> = 3 V DATA, F <sub>OUT</sub> pins	2.0	—	3.0	
	V <sub>OH3</sub>	V <sub>DD</sub> = 3 V I <sub>OH</sub> = -100 $\mu$ A DATA, F <sub>OUT</sub> pins	2.9	—	3.0	
Output voltage 2	V <sub>OL1</sub>	V <sub>DD</sub> = 5 V I <sub>OL</sub> = 1 mA	GND	—	GND +0.5	V
	V <sub>OL2</sub>	V <sub>DD</sub> = 3 V DATA, F <sub>OUT</sub> pins			GND +0.8	
	V <sub>OL3</sub>	V <sub>DD</sub> = 3 V I <sub>OL</sub> = 100 $\mu$ A DATA, F <sub>OUT</sub> pins			GND +0.1	
	V <sub>OL4</sub>	V <sub>DD</sub> = 5 V I <sub>OL</sub> = 1 mA			GND +0.25	
	V <sub>OL5</sub>	V <sub>DD</sub> = 3 V AIRQ, T <sub>IRQ</sub> pins			GND +0.4	
Output leakage current	I <sub>OZ</sub>	V <sub>OUT</sub> = GND or V <sub>DD</sub> , DATA, AIRQ, T <sub>IRQ</sub> pins	-0.5	—	0.5	$\mu$ A

## External dimensions / Terminal connection (Unit: mm)

● RA-4574SA (SOP 14-pin)

No.	Pin terminal	No.	Pin terminal
1	GND	14	FCON
2	FOUT	13	CE <sub>1</sub>
3	N.C	12	DATA
4	N.C	11	CLK
5	N.C	10	T <sub>IRQ</sub>
6	N.C	9	AIRQ
7	V <sub>DD</sub>	8	CE <sub>0</sub>

## Block diagram



## AC characteristics (GND = 0 V, T<sub>a</sub> = -40 °C to +85 °C)

Item	Symbol	Control	V <sub>DD</sub> = 3 V ±10%		V <sub>DD</sub> = 5 V ±10%		Unit
			Min.	Max.	Min.	Max.	
CLK clock cycle	t <sub>CLK</sub>	—	800	—	350	ns	
CLK H pulse width	t <sub>WH</sub>	—	—	—	—		
CLK L pulse width	t <sub>WL</sub>	—	—	—	—		
CE setup time	t <sub>CS</sub>	—	400	—	175		
CE hold time	t <sub>CH</sub>	—	—	—	—		
CE recovery time	t <sub>CR</sub>	—	600	—	300		
Write data setup time	t <sub>DS</sub>	—	100	—	50		
Write data hold time	t <sub>DH</sub>	—	80	—	—		
Write data disable delay time	t <sub>DZ</sub>	—	0	—	0		
Read data delay time	t <sub>RD</sub>	C <sub>L</sub> = 50 pF	—	300	120		
Output disable time	t <sub>RZ</sub>	C <sub>L</sub> = 50 pF R <sub>L</sub> = 10 k $\Omega$	—	200	100		
Rise and fall time	t <sub>RF</sub>	—	—	100	50		
FOUT duty ratio (32.768 kHz output)	Duty	—	35	65	40	60	%

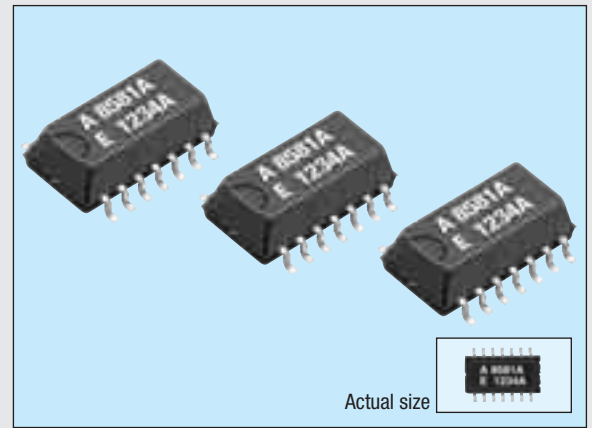
FOR AUTOMOTIVE APPLICATIONS I<sup>2</sup>C-BUS INTERFACE REAL TIME CLOCK MODULE

# RA-8581SA

Product number (please refer to page 5)

**Q41A8815XXXX00**

- It is suitable for the car accessories.
- Built-in frequency adjusted 32.768 kHz crystal unit.
- Compliant with I<sup>2</sup>C high-speed bus specifications. (400 kHz)
- Alarm and Timer IRQ function are Available.
- 32.768 kHz clock frequency output. (Duty 50 ± 5%)
- Automatic adjustment for leap year.
- Low backup current : 0.5 μA / 3 V (Typ.)
- Wide operating voltage range : 1.8 V to 5.5 V
- Wide timekeeper voltage range : 1.6 V to 5.5 V
- Available for lead (Pb) - free soldering.
- Available for lead (Pb) - free terminal.



The details are mentioned in the application manual.

<http://www.epsondevice.com>

The I<sup>2</sup>C-Bus is a trademark of Philips Electronics N.V.

## Specifications (characteristics)

### Absolute Max. rating

GND = 0V

Item	Symbol	Condition	Min.	Max.	Unit
Supply voltage	V <sub>DD</sub>	V <sub>DD</sub> to GND	-0.3	+7.0	V
Input voltage 1	V <sub>IN1</sub>	FOE pin	GND -0.3	V <sub>DD</sub> +0.3	V
Input voltage 2	V <sub>IN2</sub>	SCL, SDA pins		+8.0	
Output voltage 1	V <sub>OUT1</sub>	F <sub>OUT</sub> pin		V <sub>DD</sub> +0.3	
Output voltage 2	V <sub>OUT1</sub>	SDA, INT pins		+8.0	
Storage temperature	T <sub>STG</sub>	Stored as bare product after unpacking	-55	+125	°C

### Operating range

GND = 0V

Item	Symbol	Condition	Min.	Max.	Unit
Power voltage	V <sub>DD</sub>	—	1.8	5.5	V
Clock voltage	V <sub>CLK</sub>	—	1.6		V
Operating temperature	T <sub>OPR</sub>	No condensation	-40	+85	°C

### Frequency characteristics

GND = 0V

Item	Symbol	Condition	Range	Unit
Frequency tolerance	Δf/f	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 3.0 V	5 ±23 ±1 *2	x 10 <sup>-6</sup>
Oscillation start-up time	t <sub>STA</sub>	T <sub>a</sub> = -40 °C to +85°C, V <sub>DD</sub> = 3.0 V	3 Max.	s
Frequency temperature characteristics	T <sub>OP</sub>	T <sub>a</sub> = -20 °C to +70 °C, V <sub>DD</sub> = 3.0 V	+10 -120	x 10 <sup>-6</sup>
Frequency voltage characteristics	f/V	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 2.0 V to 5.0 V	±2 Max.	x 10 <sup>-6</sup> / V
Aging	f <sub>a</sub>	T <sub>a</sub> = +25 °C, V <sub>DD</sub> = 3.0 V, first year	±5 Max.	x 10 <sup>6</sup> / year

\*1 Equivalent to 1 minute of monthly deviation (excluding offset).

\*2 Please ask tighter tolerance

### DC characteristics

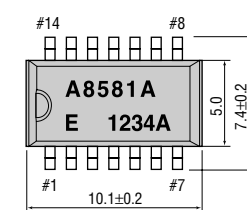
(GND = 0 V, V<sub>DD</sub> = 1.8 V to 5.5 V, T<sub>a</sub> = -40°C to +85°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	
Power current 1	I <sub>DD1</sub>	f <sub>SCL</sub> = 0 Hz INT = V <sub>DD</sub> , FOE = GND F <sub>OUT</sub> ; output off ("L" level)	V <sub>DD</sub> = 5 V	0.65	1.2	μA	
Power current 2	I <sub>DD2</sub>		V <sub>DD</sub> = 3 V	0.45	0.8		
Power current 3	I <sub>DD3</sub>	f <sub>SCL</sub> = 0 Hz INT, FOE = V <sub>DD</sub>	V <sub>DD</sub> = 5 V	3.0	7.5		
Power current 4	I <sub>DD4</sub>	F <sub>OUT</sub> ; 32.768 kHz output ON, Q <sub>L</sub> = 0 pF	V <sub>DD</sub> = 3 V	1.7	4.5		
Power current 5	I <sub>DD5</sub>	f <sub>SCL</sub> = 0 Hz INT, FOE = V <sub>DD</sub>	V <sub>DD</sub> = 5 V	8.0	20.0		
Power current 6	I <sub>DD6</sub>	F <sub>OUT</sub> ; 32.768 kHz output ON, Q <sub>L</sub> = 30 pF	V <sub>DD</sub> = 3 V	5.0	12.0		
"H" input voltage	V <sub>IH1</sub>	FOE pin	0.7 V <sub>DD</sub>		V <sub>DD</sub> +0.3	V	
	V <sub>IH2</sub>	SCL, SDA pins	0.7 V <sub>DD</sub>		6.0		
"L" input voltage	V <sub>IL</sub>	Input pin	GND-0.3		0.3 V <sub>DD</sub>		
"H" output voltage	V <sub>OH1</sub>	F <sub>OUT</sub> pin	V <sub>DD</sub> = 5 V, I <sub>OH</sub> = -1 mA	4.5	5.0	V	
	V <sub>OH2</sub>		V <sub>DD</sub> = 3 V, I <sub>OH</sub> = -1 mA	2.2	3.0		
	V <sub>OH3</sub>		V <sub>DD</sub> = 3 V, I <sub>OH</sub> = -100 μA	2.9	3.0		
"L" output voltage	V <sub>OL1</sub>	F <sub>OUT</sub> pin	V <sub>DD</sub> = 5 V, I <sub>OL</sub> = 1 mA	GND	GND+0.5		V
	V <sub>OL2</sub>		V <sub>DD</sub> = 3 V, I <sub>OL</sub> = 1 mA	GND	GND+0.8		
	V <sub>OL3</sub>		V <sub>DD</sub> = 3 V, I <sub>OL</sub> = 100 μA	GND	GND+0.1		
	V <sub>OL4</sub>	INT pin	V <sub>DD</sub> = 5 V, I <sub>OL</sub> = 1 mA	GND	GND+0.25		
	V <sub>OL5</sub>		V <sub>DD</sub> = 3 V, I <sub>OL</sub> = 1 mA	GND	GND+0.4		
	V <sub>OL6</sub>		SDA pin	V <sub>DD</sub> > 2 V, I <sub>OL</sub> = 3mA	GND	GND+0.4	
Leakage current	I <sub>LK</sub>	Input pin, V <sub>IN</sub> = V <sub>DD</sub> or GND	-0.5	0.5	μA		
Low voltage detection	I <sub>OZ</sub>	INT, SDA, F <sub>OUT</sub> pins, V <sub>OUT</sub> = V <sub>DD</sub> or GND	-0.5	0.5			

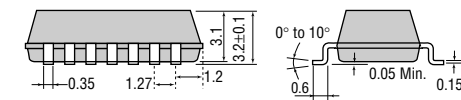
## External dimensions / Terminal connection

(Unit: mm)

### RA-8581SA (SOP 14-pin)

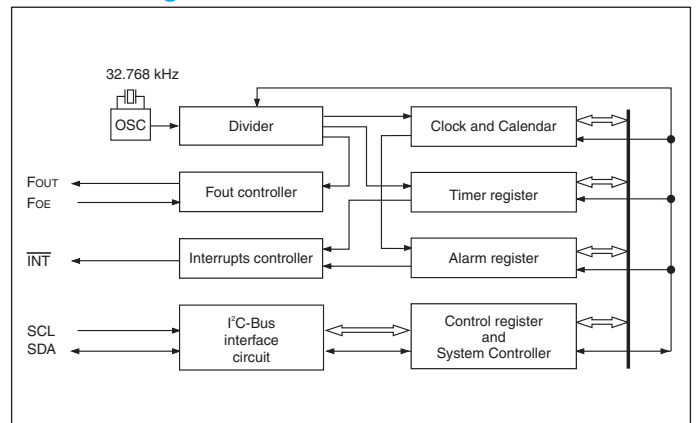


No.	Pin terminal	No.	Pin terminal
1	N.C	14	F <sub>OUT</sub>
2	SCL	13	N.C
3	SDA	12	N.C
4	N.C	11	V <sub>DD</sub>
5	GND	10	FOE
6	N.C	9	N.C
7	INT	8	N.C



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

## Block diagram



## AC characteristics

Item	Symbol	Min.	Max.	Unit
SCL clock frequency	f <sub>SCL</sub>	—	400	kHz
Allowable spike time on bus	t <sub>SP</sub>	—	50	ns
Start condition set-up time	t <sub>SU;STA</sub>	0.6	0.3	μs
Start condition Hold time	t <sub>HD;STA</sub>			
SCL "L" time	t <sub>LOW</sub>	1.3		
SCL "H" time	t <sub>HIGH</sub>	0.6		
SCL and SDA rise time	t <sub>r</sub>	—	0.3	μs
SCL and SDA fall time	t <sub>f</sub>			
Date set-up time	t <sub>SU;DAT</sub>	100	ns	
Date hold time	t <sub>HD;DAT</sub>	0		
Stop condition set-up time	t <sub>SU;STO</sub>	0.6	μs	
Bus free time	t <sub>BUF</sub>	1.3		
Fout Duty	t <sub>w/t</sub>	45	55	%

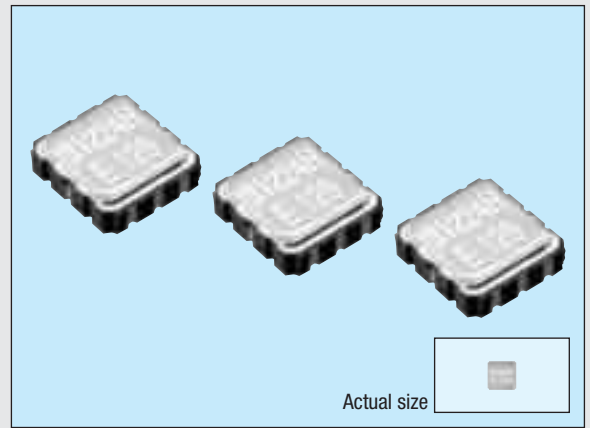
SAW RESONATOR (THE TYPE OF HIGH ENVIRONMENTAL PROCESS) FOR TPMS

# FS-585

Product number (please refer to page 5)

**Q25FS585XXXXX00**

- Be able to operate up to + 120 °C.
- Perfect for small wireless equipment.
- Reflow solderable SMD ceramic package.
- Excellent enviromental capability
- Available for lead (Pb) - free soldering.
- Complete lead (Pb) - free product.

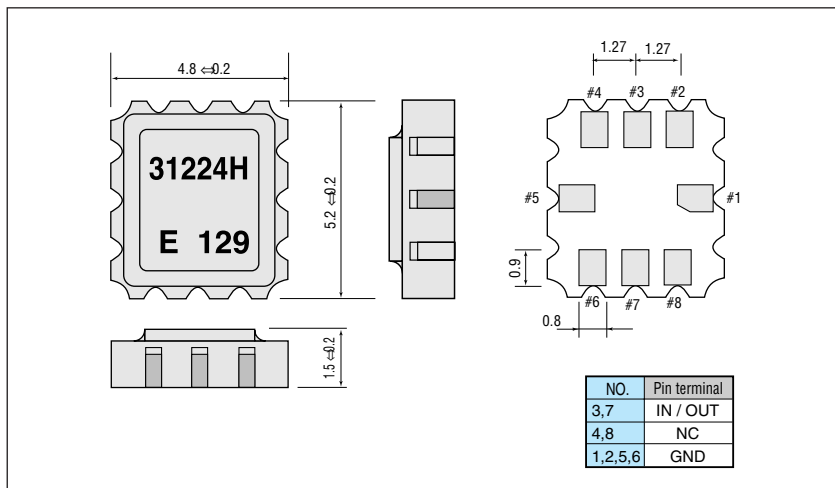


## Specifications (characteristics)

Item	Symbol	Specifications	Remarks	
Nominal frequency range	$f_0$	300 MHz to 500 MHz	fundamental mode, Please contact us for inquiries about the available frequency.	
Temperature range	Storage temperature	TSTG	-40 °C to +125 °C	Stored as bare product after unpacking
	Operating temperature	TOPR	-40 °C to +120 °C	
Maximum drive level	GL	10 mW Max.		
Recommended drive level	DL	2 mW Typ.		
Frequency tolerance (standard)	$\Delta f/f_0$	$\pm 50 \times 10^{-6}$ , $\pm 100 \times 10^{-6}$	$T_a = +25 \text{ °C} \pm 3 \text{ °C}$	
Peak temperature	$\theta T$	+40 °C $\pm$ 10 °C	Please contact us for inquires about Peak temperature	
Temperature coefficient	$\alpha$	$-3.4^{+0.8}_{-0.6} \times 10^{-8} / \text{°C}^2$		
Harmonic ratio	$R_s/R_1$	2 Min.		
Series resistance	$R_1$	18 $\Omega$ Max.		
Aging	$f_a$	$\pm 10 \times 10^{-6}$ / year Max.	$T_a = +25 \text{ °C} \pm 3 \text{ °C}$	
Shock resistance	S.R.	$\pm 10 \times 10^{-6}$ Max.	Nine drops on a concrete from 1500 mm	

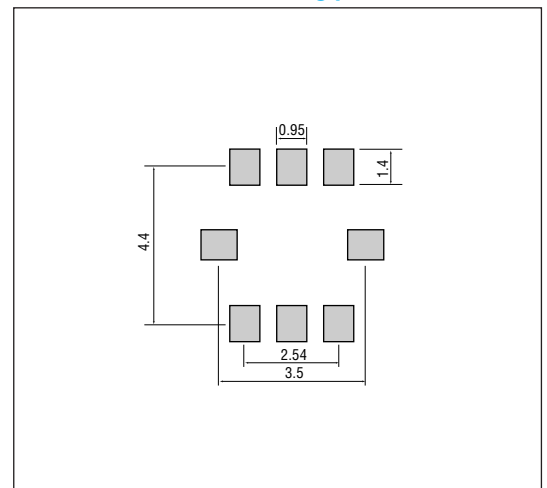
## External dimensions

(Unit: mm)



## Recommended soldering pattern

(Unit: mm)



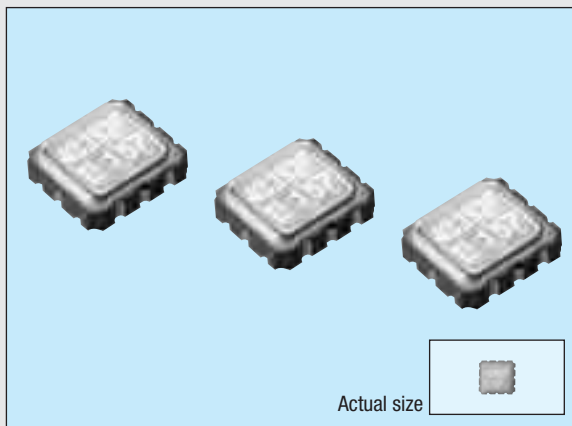
SAW FILTER (THE TYPE OF HIGH ENVIRONMENTAL PROCESS) FOR TPMS

# FF-585

Product number (please refer to page 5)

**Q51FF585XXXXX00**

- Low-loss, High stability by using Quartz crystal substrate.
- Reflow solderable Surface-Mount ceramic package.
- Applications: Wireless remote-control, Safety system (Automotive TPMS)
- Available for lead (Pb) - free soldering.
- Complete lead (Pb) - free product.

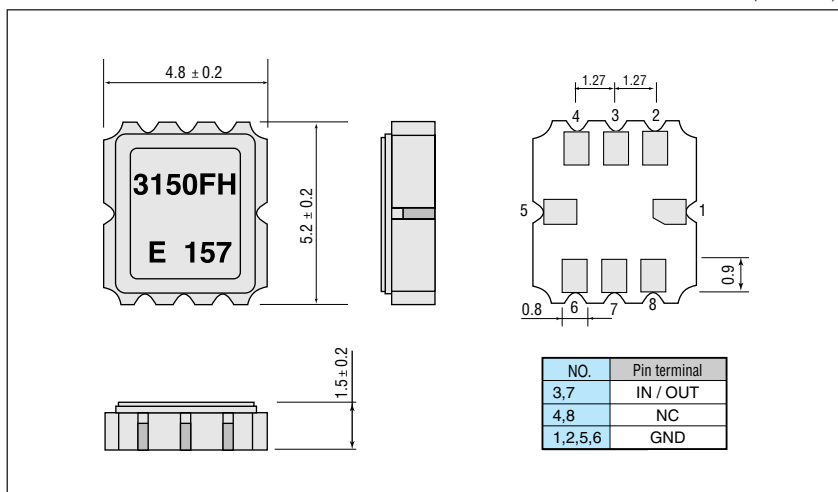


## Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Nominal frequency range	f <sub>0</sub>	300 MHz to 500 MHz	
Insertion Loss	IL	3.5 dB Max.	Minimum Loss
Pass bandwidth	BW3.5	f <sub>0</sub> ±200 kHz Min.	Reference to Minimum Loss
Rejection band	ATT	At f <sub>0</sub> +21.4 MHz 40 dB Min. At f <sub>0</sub> -21.4 MHz 40 dB Min.	Reference to Through level (0 dB)
Peak temperature	θT	+25 °C ± 15 °C	
Temperature coefficient	α	-(3.4 ±0.8) × 10 <sup>-8</sup> / °C <sup>2</sup>	
Operable temperature	T <sub>OPR</sub>	-40 °C to +85 °C	
Storage temperature range	T <sub>STG</sub>	-55 °C to +125 °C	
Terminal impedance	Z	370 Ω Typ.	Ex : 315 MHz
		260 Ω Typ.	Ex : 433.92 MHz
Test fixture			EX : 315 MHz Series Capacitance 4 pF Parallel Inductance 33 nH Ex : 433.92 MHz Series Capacitance 5 pF parallel Inductance 18 nH

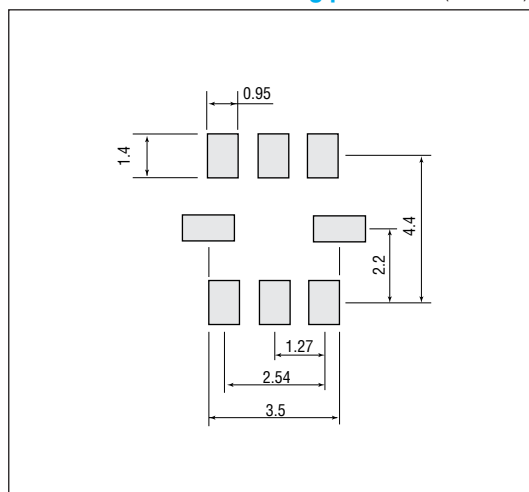
## External dimensions

(Unit: mm)

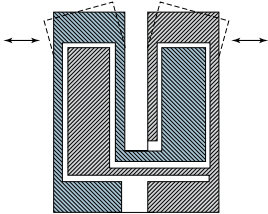
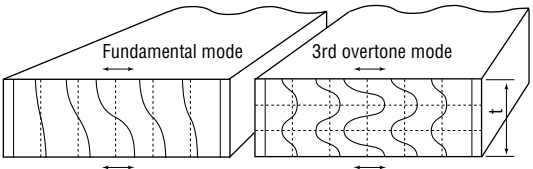
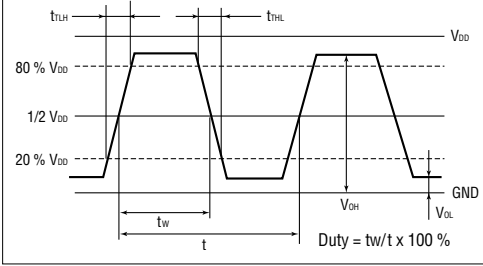
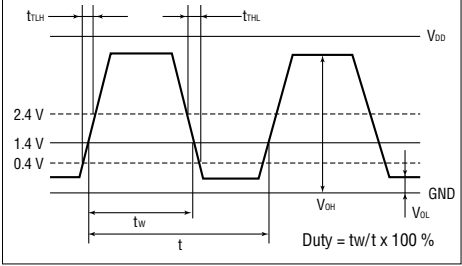


## Recommended soldering pattern

(Unit: mm)

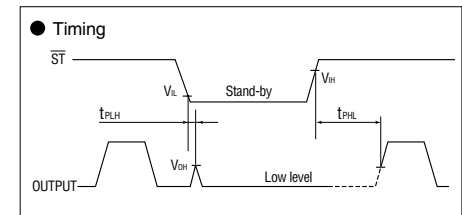
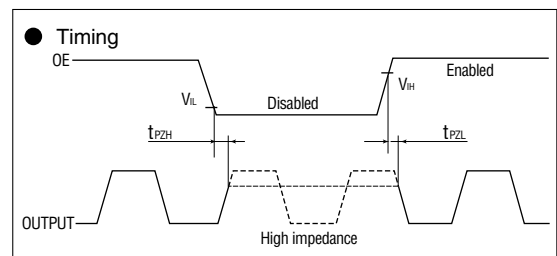
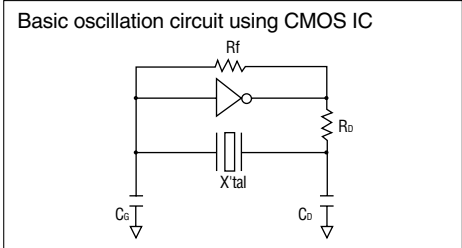


■ Glossary

Item	Content	Object
<p>Fundamental mode</p>	<p>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.</p> <p style="text-align: right;"><b>AT fundamental mode</b></p> $f \text{ (MHz)} = \frac{1670}{t \text{ (\mu m)}}$ <p style="text-align: right;">( t : Thickness )</p> <div style="display: flex; justify-content: space-around;"> <div> <p style="text-align: center;">Tuning fork crystal unit</p> <p style="text-align: center;">Fundamental mode</p>  </div> <div> <p style="text-align: center;">AT crystal unit</p>  </div> </div>	<p>X'tal, OSC</p>
<p>Baud rate</p>	<p>The rate of data transmission, i.e. how many data can be transmitted in one second.</p>	<p>OSC</p>
<p>Divided frequency</p>	<p>The output frequency that is divided by the internal IC.</p>	<p>OSC</p>
<p>Duty (tw/t) (symmetry)</p>	<p>Ratio of full and half cycles. For CMOS loading duty is rated at 1/2 V<sub>DD</sub>, and for TTL loading at 1.4 V.</p> <div style="display: flex; justify-content: space-around;"> <div> <p>● CMOS loading</p>  </div> <div> <p>● TTL loading</p>  </div> </div>	<p>OSC</p>
<p>(Equivalent) series capacitance (C1) (motional capacitance)</p>	<p>Energy distortion to the (equivalent) internal charge capacitance component of the crystal unit, at the series resonant frequency.</p>	<p>X'tal</p>
<p>(Equivalent) series resonant resistance (R1)</p>	<p>Vibration loss to the (equivalent) internal resistance component of the crystal resonator, at the series resonant frequency. A measure of the easiness of oscillation.</p>	<p>X'tal</p>
<p>Drive level (DL)</p>	<p>Current or voltage level in the oscillating (operating) state. (Drive power = power required to oscillate crystal unit.)</p>	<p>X'tal</p>
<p>Frequency (f)</p>	<p>Number of waves (cycles) per second. The relation between frequency and cycle is f (Hz) = 1/t (s).</p>	<p>ALL</p>
<p>(Frequency) aging (fa)</p>	<p>Amount of frequency drift when operated under the specified conditions for a specified term.</p>	<p>ALL</p>
<p>Frequency tolerance precision (Δf/f)</p>	<p>Under specified conditions at an ambient temperature of +25 °C, the difference in actual (measured) frequency from the nominal frequency.</p>	<p>ALL</p>
<p>Frequency stability (Δf/fo)</p>	<p>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.</p>	<p>OSC</p>

Item	Content	Object
Frequency temperature characteristics	<p>Taking the frequency at 25 degrees Centigrade as the reference, the change in frequency in response to ambient temperature.</p> <ul style="list-style-type: none"> <li>Tuning fork crystal unit. SAW Resonator.  <math display="block">\Delta f/f = a (\theta_T - \theta_x)^2, \quad \theta_x : \text{specified temperature}</math> </li> <li>AT crystal unit.  <math display="block">\Delta f/f = \alpha (\theta - 25) + \beta (\theta - 25)^2 + \gamma (\theta - 25)^3</math> </li> </ul> <p>Examples of frequency temperature characteristics</p>	ALL
Frequency voltage characteristics	<p>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 RTC. The effects of the ICs are larger.</p>	OSC,RTC
Insulation resistance (IR)	Resistance between lead and lead, or between lead and case package. (conductive package)	ALL
Load capacitance (CL)	<p>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: <math>C_L \cong C_G \times C_D / (C_G + C_D) + C_s</math>  (C<sub>s</sub> = stray capacitance)</p>	X'tal
Max. drive level (GL)	Rating for the drive level. Current or power input over this level may result in characteristic degradation or destruction.	X'tal
Max. supply voltage (V <sub>DD</sub> -GND)	Maximum rated value for power input to the power supply pin. Input over this value may result in characteristic degradation or destruction.	OSC,RTC
Nominal frequency (f)	Nominal value of frequency of crystal unit.	X'tal
Operating temperature range (T <sub>OPR</sub> )	Temperature range where specification characteristics are fulfilled, unless otherwise specified.	ALL
Operating voltage (V <sub>DD</sub> )	Voltage input to V <sub>DD</sub> pin which will support continuous operation with specification characteristics.	OSC,RTC
Origin frequency (f <sub>0</sub> )	Oscillation source frequency of oscillator inside oscillation system.	OSC

Item	Content	Object
Oscillation circuit	Circuit needed to oscillate crystal unit. Circuit constants will differ with type of crystal unit and frequency.	X'tal
Oscillation start up time (tOSC)	The time from power on until the wave from stabilizes. However, voltage rise times depend on the power supply, therefore the time is measured from a specific set of initial conditions.	OSC,RTC
Output enable (OE)	<p>Output is switched to high impedance, and wired OR connection can be used to select multiple outputs (frequency).</p> <p>OE pin : High or open. Specified frequency output = enabled.</p> <p>OE pin : Low. Output is high impedance = disabled.</p> <p>Oscillation is not stopped, so the clock after disabled is cleared is not synchronized with OE (clock is continuous).</p>	OSC
Output fall time (tTHL)	The time it takes for the output wave from to change from the high voltage (high level) to the low voltage (low level). Also called wave from fall time. See wave from diagram under duty.	OSC
Output frequency (fo)	The frequency output from the oscillator circuit or the crystal oscillator system.	OSC,RTC
Output load conditions (N or CL)	The types and quantities (power) of the loads that can be connected to the oscillator. Calculated for 1 TTL as $I_{OH} = -40 \mu A$ , $I_{OL} = 1.6 mA$ and for LS-TTL as $I_{OH} = -20 \mu A$ , $I_{OL} = 0.4 mA$ , 1 C-MOS = 5 pF.	OSC
Output rise time (tTLH)	The time it takes for the output wave from to change from the low voltage (low level) to the high voltage (high level). Also called wave from rise time. See wave from diagram under duty.	OSC
Overtone	Vibration state when crystal in 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
Shunt capacitance (Co)	Charge capacitance between the two electrodes in the crystal unit.	X'tal
Recommended drive level (DL)	Excitation level for optimum oscillation characteristics.	X'tal
Soldering conditions (Tsol)	Soldering conditions that can be assured at mounting. Temperatures or times over these limits may result in characteristic degradation or destruction.	ALL
Stand-by (ST)	<p>Function that halts crystal unit oscillation and frequency division. Cuts the current consumed by the oscillators circuit and the frequency division stage.</p> <p><math>\overline{ST}</math> pin - high or open: Specified frequency output.</p> <p><math>\overline{ST}</math> pin - low : Output is low level, oscillation stops.</p> <p style="padding-left: 20px;">: Output is low level (weak pull-down), oscillation stops.</p> <p style="padding-left: 20px;">: Output is high impedance, oscillation stops.</p> <p>Please refer to each data sheet.</p>	OSC
Storage temperature range (Tstg)	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





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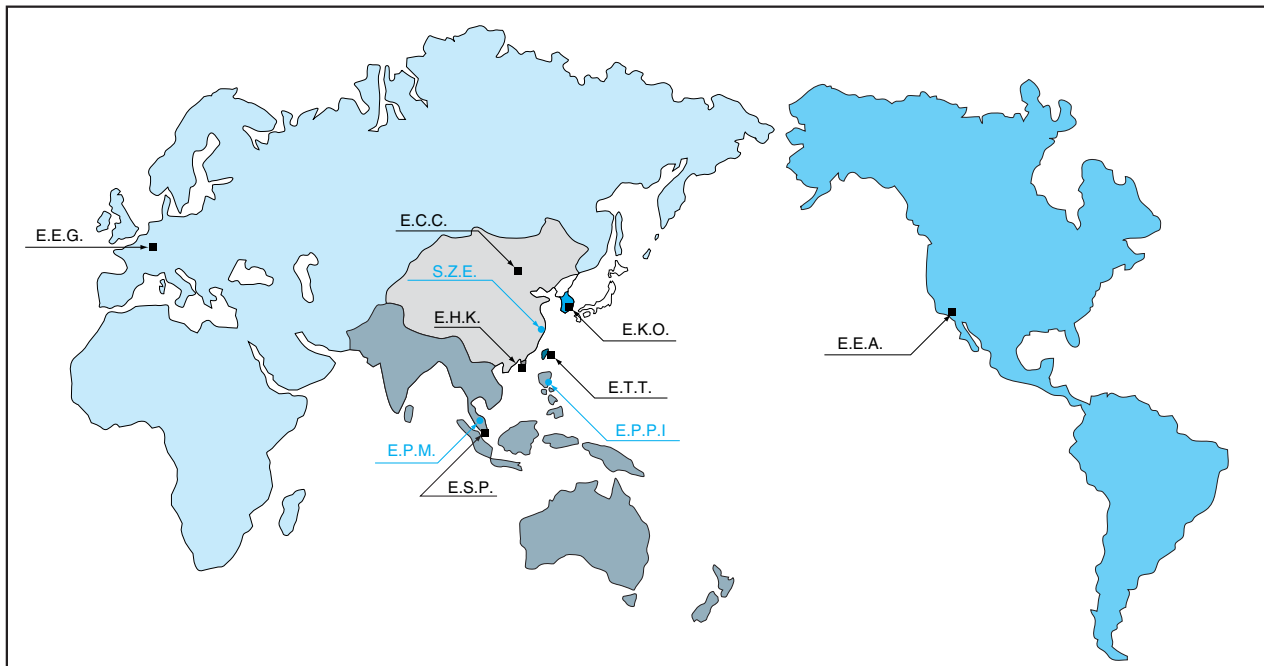
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## Manufacturing Plant

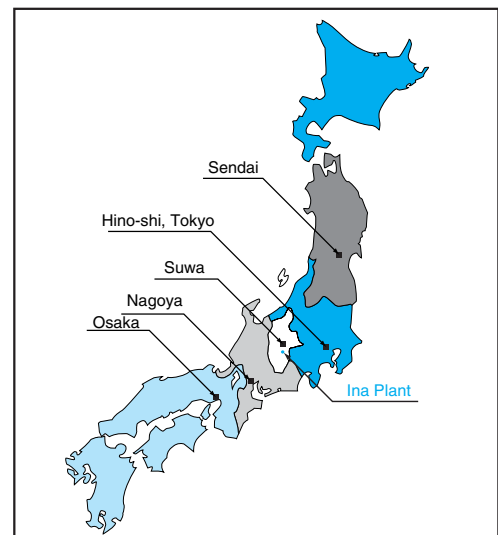
- Ina Plant
- E.P.M.: Epson Precision (Malaysia) SDN. BHD. Plant
- S.Z.E.: Suzhou Epson CO.,LTD.Plant
- E.P.P.I: Epson Precision (Philippines) Inc. Plant

Plant	Date Operations Commenced	Products
Ina Plant	Jun. 1959	Crystal unit Crystal oscillator Real time clock module Surface acoustic wave device
E.P.M. Plant	Dec. 1974	Crystal unit Crystal oscillator Real time clock module
S.Z.E. Plant	Mar. 1997	Crystal unit
E.P.P.I Plant	Feb. 2002	Crystal unit

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