

EPSON



THE CRYSTALMASTER

PRODUCT CATALOG

•
November 2002



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 CO₂, 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, 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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- The products (except for some product for automotive applications) listed up on this material are designed to be used with ordinary electronic equipment (OA equipment, AV equipment, communications equipment, measuring instruments etc). Seiko Epson does not assume any liability for the case using the products with the application required high reliability or safety extremely (such as aerospace equipment etc). When intending to use any our product with automotive application and the other application than ordinary electronic equipments as above, please contact our sales representatives in advance.

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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 3)

■ CRYSTAL UNIT

Low and medium-frequency

Model	Product Number	Specifications for "xxxxx"
C-001R	Q 11 C 001 R x x x x x 0 0	Load Capacitance Frequency Tolerance Solder-Plating (Pb-Free or not) (Except for FC-135 and FC-145)
C-002RX	Q 11 C 02 R X x x x x x 0 0	
C-004R	Q 11 C 004 R x x x x x 0 0	
C-005R	Q 11 C 005 R x x x x x 0 0	
FC-135	Q 13 F C 135 x x x x x 0 0	
FC-145	Q 13 F C 145 x x x x x 0 0	
FC-255	Q 1 x F C 255 x x x x x 0 0	Nominal frequency Load capacitance Frequency tolerance Solder-Plating (Pb-Free or not) (Except for FC-255)
C-2 TYPE	Q 12 C 2000 x x x x x 0 0	
C-4 TYPE	Q 12 C 4000 x x x x x 0 0	
MC-146	Q 1 x M C 146 x x x x x 0 0	
MC-156	Q 1 x M C 156 x x x x x 0 0	
MC-206	Q 1 x M C 206 x x x x x 0 0	
MC-306	Q 1 x M C 306 x x x x x 0 0	
MC-30A	Q 1 x M C 30 A x x x x x 0 0	
MC-405	Q 1 x M C 405 x x x x x 0 0	
MC-406	Q 1 x M C 406 x x x x x 0 0	

High-frequency

Model	Product Number	Specifications for "xxxxx"
CA-301	Q 21 C A 301 x x x x x 0 0	Nominal frequency Load capacitance Frequency tolerance Frequency temperature characteristics (FA-23H,FA-238,FA-248,CA-303HS,MA-406H,SA-315H,SA-315HZ) 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) (Except for CA-303HS,SA-315H,SA-315HZ,FA-238,FA-23H,FA-248 and FA-365)
CA-303HS	Q 23 C 303 S x x x x x 0 0	
SA-315H	Q 23 S 315 H x x x x x 0 0	
SA-315HZ	Q 24 S 315 Z x x x x x 0 0	
FA-23H	Q 24 F A 23 H x x x x x 0 0	
FA-238	Q 22 F A 238 x x x x x 0 0	
FA-248	Q 22 F A 248 x x x x x 0 0	
FA-365	Q 22 F A 365 x x x x x 0 0	
MA-306	Q 22 M A 306 x x x x x 0 0	
MA-406	Q 22 M A 406 x x x x x 0 0	
MA-406H	Q 24 M 406 H x x x x x 0 0	
MA-505	Q 22 M A 505 x x x x x 0 0	
MA-506	Q 22 M A 506 x x x x x 0 0	

Temperature sensing crystal

Model	Product Number	Specifications for "xxxxx"
HTS-206	Q 19 H T 206 x x x x x 0 0	Nominal frequency Operating temperature range Solder-Plating (Pb-Free or not)

■ CRYSTAL OSCILLATOR

Low and medium-frequency

Model	Product Number	Specifications for "xxxxx"
SG-3030JF	Q 31 02 J F 0 x x x x x 0 0	Output frequency Frequency stability Solder-Plating (Pb-Free or not)
SG-3030JC	Q 31 02 J C 0 x x x x x 0 0	
SG-3032JC	Q 31 01 J C 0 x x x x x 0 0	

High-frequency

Model	Product Number	Specifications for "xxxxx"
SG-51	Q 32510 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) (Except for SG-710,SG-730,SG-8002CA and SG-8002CE)
SG-531	Q 32531 x x x x x x 0 0	
SG-615	Q 33615 x x x x x x 0 0	
SG-636	Q 33636 x x x x x x 0 0	
SG-645	Q 33645 x x x x x x 0 0	
SG-710	Q 33710 x x x x x x 0 0	
SG-730	Q 33730 x x x x x x 0 0	
SG-8002JF	Q 3308 J F x x x x x 0 0	
SG-8002CA	Q 3309 C A x x x x x 0 0	
SG-8002CE	Q 3321 C E x x x x x 0 0	
SG-8002JC	Q 3307 J C x x x x x 0 0	
SG-8002JA	Q 3306 J A x x x x x 0 0	
SG-8002DB	Q 3203 D B x x x x x 0 0	
SG-8002DC	Q 3204 D C x x x x x 0 0	

Low jitter

Model	Product Number	Specifications for "xxxxx"
EG-2121CA	Q3805CA0xxxxx00	Output frequency Operating voltage Operating temperature range Differential LV-PECL or LV-TTL or CMOS
EG-2102CA	Q3806CA0xxxxx00	
EG-2101CA	Q3803CA0xxxxx00	
EG-2002CA	Q3802CA0xxxxx00	
EG-2001CA	Q3801CA0xxxxx00	

High-stability

Model	Product Number	Specifications for "xxxxx"
HG-1012JA	Q3511JA0xxxxx00	Output frequency Frequency stability Operating temperature Solder-Plating (Pb-Free or not)
HG-2012JA	Q3512JA0xxxxx00	
HG-2150CA	Q3514CA0xxxxx00	Output frequency Frequency stability Operating voltage Operating temperature range
HG-8002JA	Q3502JA0xxxxx00	Output frequency Frequency stability Operating voltage Operating temperature range Stand-by or Output enable CMOS or TTL Solder-Plating (Pb-Free or not)
HG-8002DC	Q3402DC0xxxxx00	

Voltage-controlled

Model	Product Number	Specifications for "xxxxx"
VG-2820CB	Q3621CB0xxxxx00	Output frequency Operating voltage Operating temperature range
EV-3101TA	Q3821TA0xxxxx00	Output frequency Operating voltage Operating temperature range APR (Absolute Pull Range)
VG-1201CA	Q3603CA0xxxxx00	Output frequency Frequency stability Operating voltage Operating temperature range Pull range Solder-Plating (Pb-Free or not) (Except for VG-1201CA and VG-4231CA)
VG-1011JA	Q3602JA0xxxxx00	
VG-4231CA	Q3614CA0xxxxx00	
VG-4010JA	Q3611JA0xxxxx00	
VG-4030JA	Q3612JA0xxxxx00	

Temperature compensated

Model	Product Number	Specifications for "xxxxx"
TG-2820CB	Q3702CB0xxxxx00	Output frequency Frequency tolerance Operating voltage Control voltage Operating temperature range Frequency control range Frequency stability vs temperature With stand-by or not (Except for TG-2820CB)
TG-2824CB	Q3703CB0xxxxx00	
TG-2825CB	Q3704CB0xxxxx00	
TG-2832CB	Q3705CB0xxxxx00	
TG-2833CB	Q3706CB0xxxxx00	

Multi-output

Model	Product Number	Specifications for "xxxxx"
MG-7010SA	Q33M11SAxxxxx00	Output frequency Operating voltage Solder-Plating (Pb-Free or not)
MG-5100SA	Q33M21SAxxxxx00	

■ REAL TIME CLOCK MODULE

Serial interface

Model	Product Number	Specifications for "xxxxx"
RX-4581NB	Q4145819x000200	Frequency tolerance Solder-Plating (Pb-Free or not) (Except for RX-4702CF and RX-8564CF)
RTC-9701JE	Q4197017x000100	
RTC-4701JE	Q4147017x000200	
RTC-4701NB	Q4147019x000200	
RX-4702CF	Q414702Ax0xxxxx00	
RTC-4574SA	Q4145745x000200	
RTC-4574JE	Q4145747x000100	
RTC-4574NB	Q4145749xxxxx00	
RTC-4553	Q4145535xxxxx00	
RTC-4543SA	Q4145435x000200	
RTC-4543SB	Q4145436x000200	
RX-8025SA	Q4180255xxxxx00	
RX-8025NB	Q4180259xxxxx00	
RX-8581SA	Q4185815xxxxx00	
RX-8581JE	Q4185817xxxxx00	
RX-8581NB	Q4185819xxxxx00	
RTC-8564JE	Q4185647x000100	
RTC-8564NB	Q4185649x000200	
RX-8564CF	Q418564Ax0xxxxx00	

Parallel interface

Model	Product Number	Specifications for "xxxxx"
RTC-7301SF	Q4273018x000200	Frequency tolerance Solder-Plating (Pb-Free or not)
RTC-7301DG	Q4273011x000200	
RTC-62421	Q4262421xxxxx00	
RTC-62423	Q4262423xxxxx00	
RTC-72421	Q4272421xxxxx00	
RTC-72423	Q4272423xxxxx00	

■ SURFACE ACOUSTIC WAVE DEVICE

Model	Product Number	Specifications for "xxxxx"
FS-305	Q25FS305xxxxx00	Nominal frequency Frequency tolerance
FS-335	Q25FS335xxxxx00	
FS-555	Q25FS555xxxxx00	
FS-585	Q25FS585xxxxx00	
FF-555	Q51FF555xxxxx00	Nominal frequency Insertion loss Pass bandwidth
FF-585	Q51FF585xxxxx00	

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

2. Soldering heat resistance

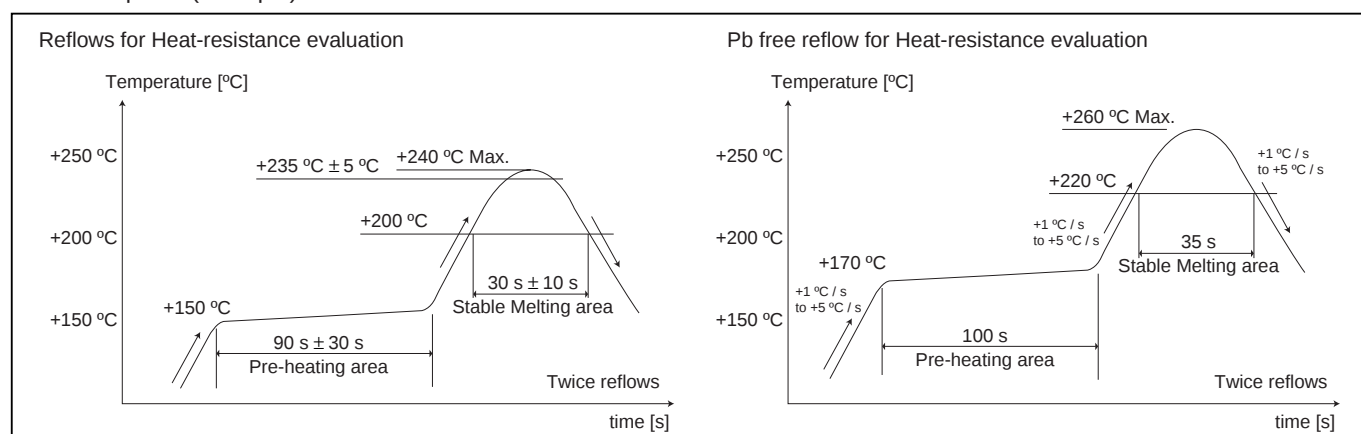
EPSON's crystal products except SMD products use solder having a $+180^{\circ}\text{C}$ to $+200^{\circ}\text{C}$ melting point. Heating up the package more than $+150^{\circ}\text{C}$ may deteriorate the characteristics or damage the products. If the crystal products need to be soldered at temperature of more than $+150^{\circ}\text{C}$, 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 $+280^{\circ}\text{C}$ within 5 s. Do not heat the package at more than $+150^{\circ}\text{C}$.
[Cylinder] CA-301 [DIP] SPG, SG-51/531, SG-8002DB/DC, HG-8002DC RTC-62421/64611, RTC-72421/7301DG	Under $+260^{\circ}\text{C}$ within 10 s. Do not heat the package at more than $+150^{\circ}\text{C}$.

(2) SMD products(include CA-303HS, SA-315H/HZ)

Reflow profile(example)



3. Mounting precautions

Shocks by auto mounting

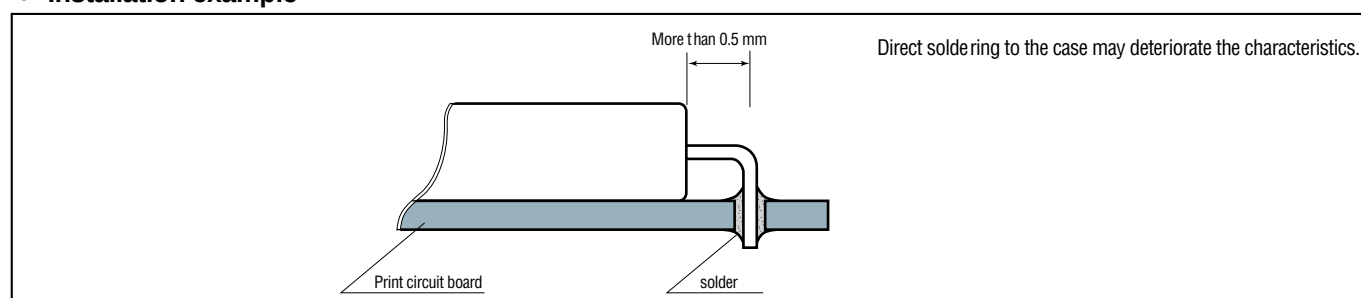
Shocks caused by auto mounting, vacuuming and chucking may deteriorate the characteristics and affect the products. Please set the mounting conditions to minimize the shocks as much as possible, and be sure that there is no effect on the characteristics before mounting. Please review the conditions after 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 package Products

Bending the board after soldering ceramic package products and SON package 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 amplitued 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 Mouting 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 μF at a location as near as possible to the power source terminal of the crystal products (between V_{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_{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.

9. Remarks on noise management for power supply line

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

When this measure is required. Please evaluate circuitry and device behaviour in the circuit and verify that won't affect oscillation.

PRECAUTIONS IN DESIGNING OSCILLATION CIRCUITS

1. Drive level

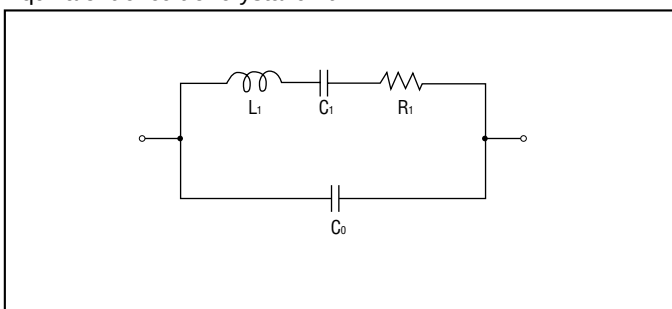
Drive level denotes electric power required to oscillate a crystal unit, which can be calculated using the following formula.

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

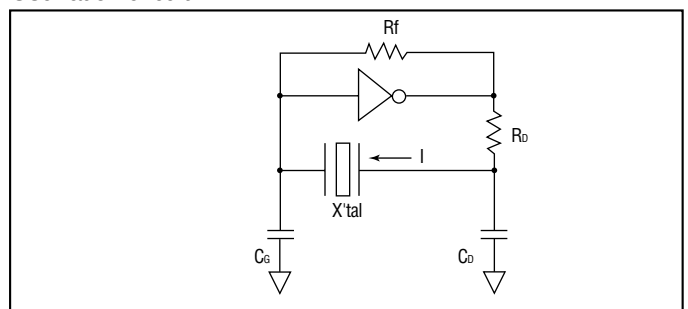
Where I stands for current to pass in the crystal unit, R_e for effective resistance of crystal unit, and $R_e = R_1 (1 + C_0/CL)^2$.

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



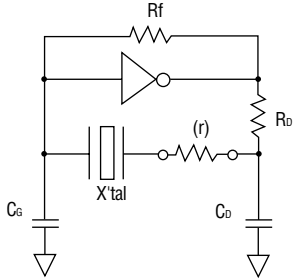
Oscillation circuit



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.

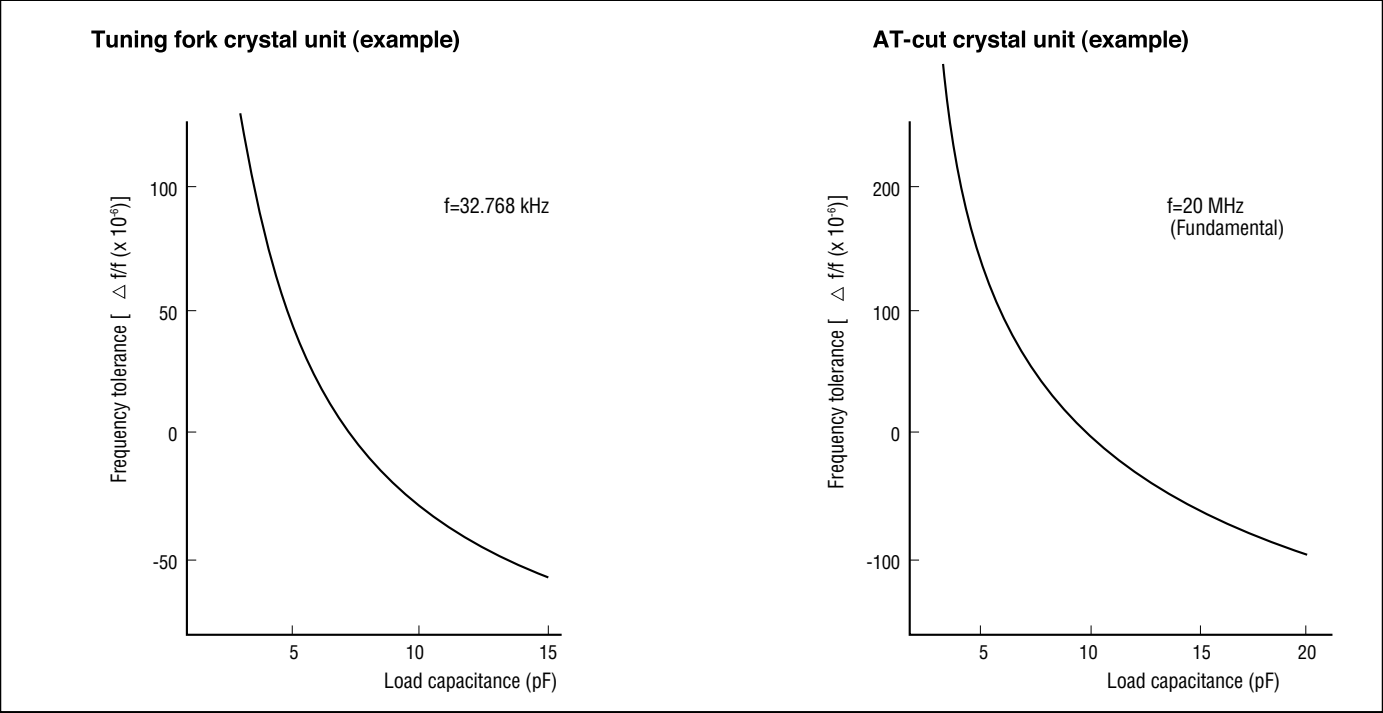
(4) Recommended (r)

(r) > CI x (5 to 10)

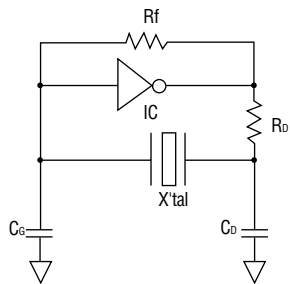
3. Load capacitance

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

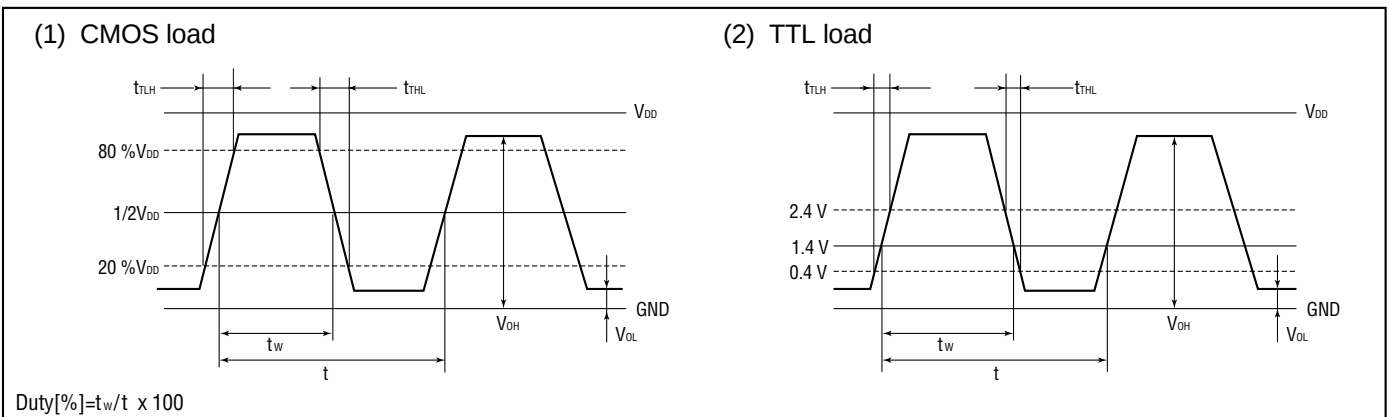


IC: equivalent to TC74HCU04 (unbuffer)
equivalent to TC74VHCU04 (unbuffer) (30 MHz to 50 MHz)
(TC74HCU04 and TC74VHCU04 are a product number of Toshiba Corp.)

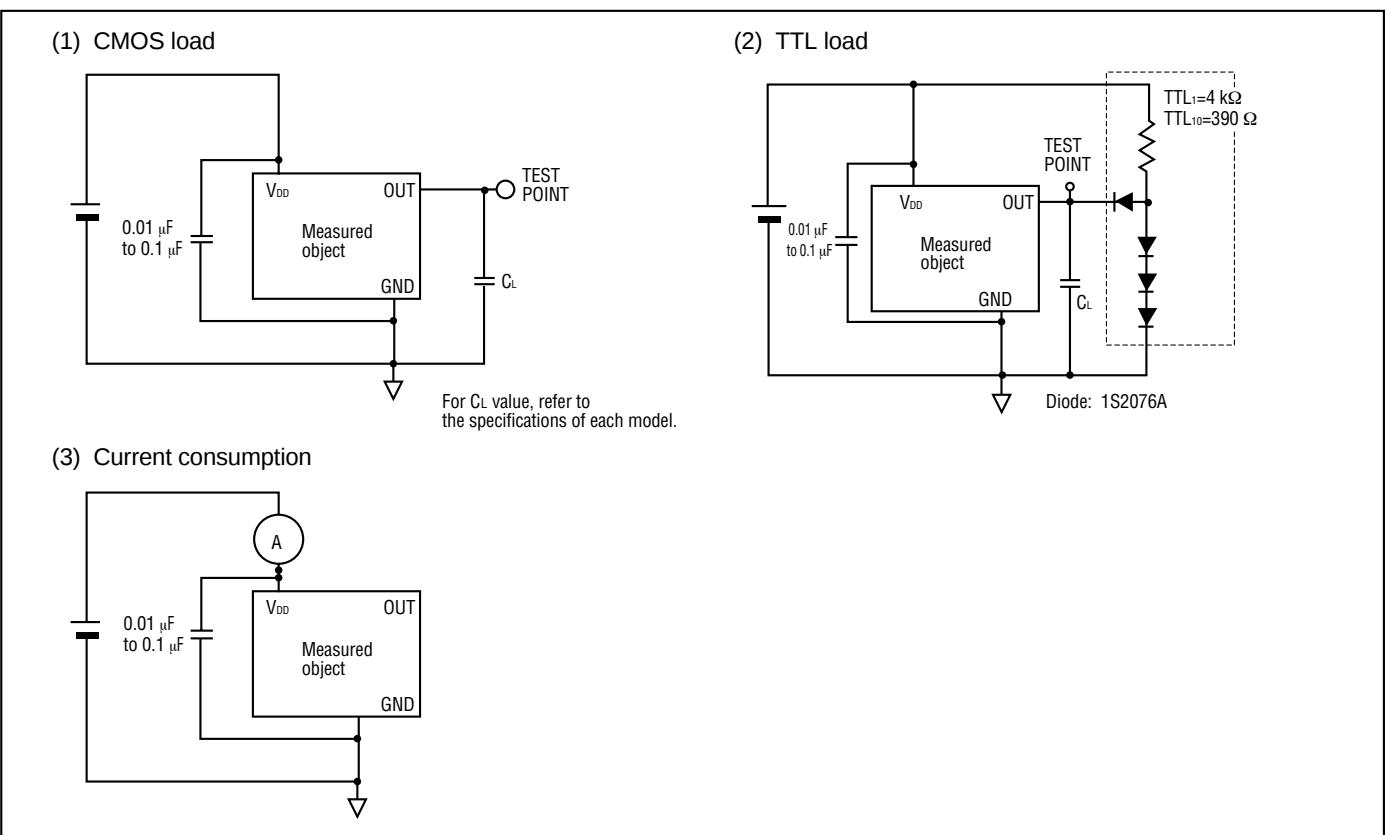
Symbol	R _F (MΩ)	R _D (kΩ)	C _G (pF)	C _D (pF)
Frequency range				
20 kHz to 60 kHz	20	500	10	
60 kHz to 165 kHz	10	300		
5.5 MHz to 30 MHz (Fundamental)	1	0.5	5 to 15	
30 MHz to 50 MHz (Fundamental)			5 to 10	

OUTPUT WAVEFORM AND TEST CIRCUIT

1. Timing chart



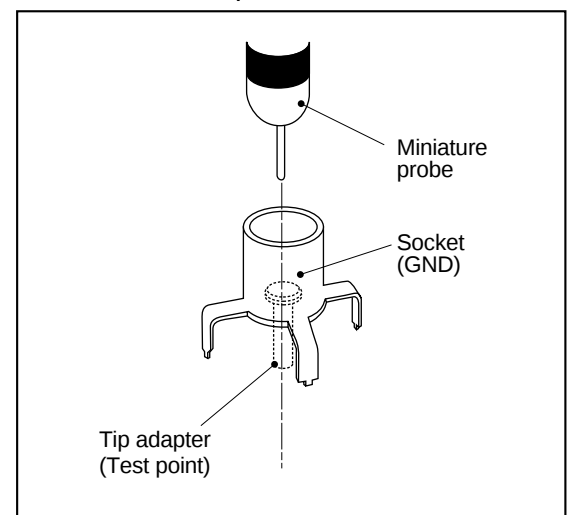
2. Test circuit



3. Test conditions

- (1) Supply voltage
 - More than 150 μ s until voltage level reaches 90 % from 0 %.
 - Supply voltage impedance is less than 2 Ω of resistance.
- (2) Oscilloscope
 - Input capacitance of less than 15 pF.
 - Frequency range of 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 Ω . Simultaneous measurement of waveform (frequency and wave from) is not possible; however, measurement is possible as the wave from 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



WORKING FOR Pb FREE

Pb Free Policy of QD products and Implementation Schedule

Implementation Schedule

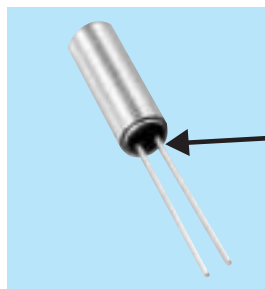
1. An announcement to our customers has been made since June, 2001.
2. Epson is ready to manufacture Pb free products in Apr., 2002.
3. For the products in mass production now, Epson will switch to Pb Free Products with customer's approval.
4. For the new products in considering now, when doesn't order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

Eliminated Pb

<Basic policy>

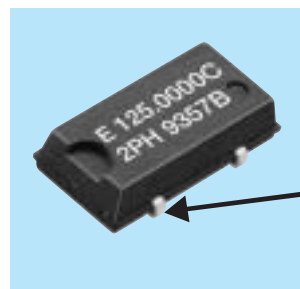
"Lead in solder" means Soldering-paste for electronic circuit board & Solder-Plating on the outer-lead of products.

•Cylinder type products (complete Pb free products) *1



Pb used in these products is eliminated.

•Plastic package type products (Pb free terminal products) *2



Pb used as Solder-Plating is eliminated.

*1. CA-303HS is currently using solder plating with heat resistance because of still under studying the alternative technology.

*2. These products includes Pb inside.

•Current Pb free terminal products *3



•Current complete Pb free products *3 *4



*3. Ceramic package products and SA-315H/315HZ are already Pb-free terminal type of product.

*4. Ceramic package products with metallic lid and SA-315H/315HZ are already complete Lead-free type of product.

Distinctions

Distinctions between current products and Pb free products. *1. *2.

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

2) Appearance

• Plastic package type products

Marking (year part lot No.) of plug 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 and SA-315H/315HZ are originally Pb free terminal designed.
So, there are no change as 1) and 2) above.

*2. CA-303HS is currently using solder plating with heat resistance because of still under studying the alternative technology.
So, there are no change as 1) and 2) above.

Pb Free materials of Seiko Epson QD products

Package	Object		Lead-flame material (No change)	Pb Free				Conventional	
				Sn-Bi	Sn-Ag ※1	Sn-Cu	Au	Sn-Pb	Au
Cylinder	Crystal unit		Fe - Ni - Co	—	—	○	○ *2	○ *3	○ *2
Plastic package	Crystal unit Crystal oscillator Real time clock module	 SON	Cu Alloy	○	○ *1	—	—	○	—
		 SOP	42Alloy *4	○	○ *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) RTC-****SA, RTC-****SB, RTC-****SF, RTC-4553, MG-5100SA, MG-7010SA

(SOJ) RTC-****JE, (SON) RX-****NB, RTC-****NB

※2.Au is applied for SA-315H/315HZ.

※3.Sn-Pb has been applied only for CA-303HS.

※4.Cu Alloy is applied only for (SOP) RTC-7301SF.

Evaluation Profile for heat-resistance

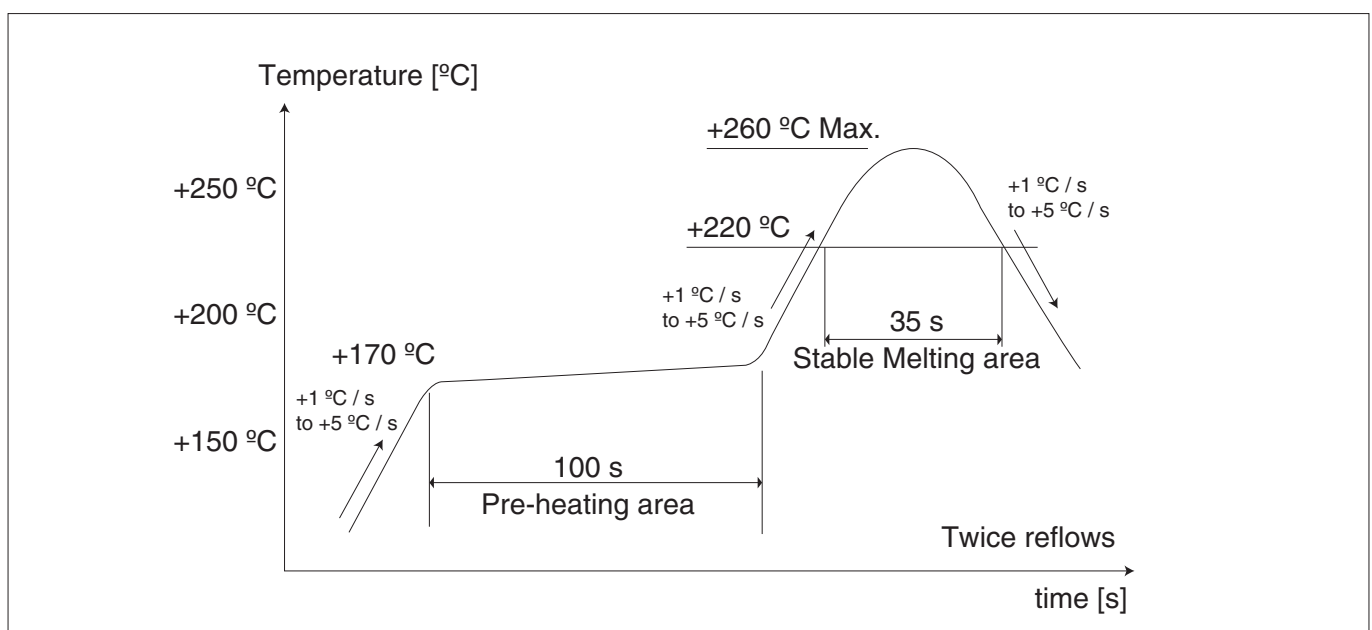


TABLE OF CRYSTAL UNITS

Frequency range

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

page	Model	20 kHz	100 kHz	1 MHz	24 MHz	40 MHz	64 MHz
13	C-001R	● 32.768 kHz					
	C-002RX						
	C-004R						
	C-005R						
	C-2-TYPE						
14	C-4-TYPE	20 kHz to 165 kHz, 307.2 kHz 32 kHz to 120 kHz, 192 kHz					
15	FC-135/145	● 32.768 kHz					
16	FC-255						
17	MC-146	32 kHz to 100 kHz					
	MC-156						
18	MC-206						
19	MC-306/30A	20 kHz to 165 kHz					
20							
21	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
22	CA-301	* 4 MHz to 64 MHz					
28	MA-306	14.31818 MHz, 17.734 MHz to 41 MHz					
29	MA-406 MA-505/506	* 4 MHz to 64 MHz					
30	CA-303HS MA-406H	9.6 MHz to 27 MHz					
23	SA-315H/HZ	10 MHz to 27 MHz					
25	FA-23H	16 MHz to 32 MHz					
24	FA-238	16 MHz to 50 MHz					
26	FA-248	12 MHz to 27 MHz					
27	FA-365	12 MHz, 14 MHz to 41 MHz					

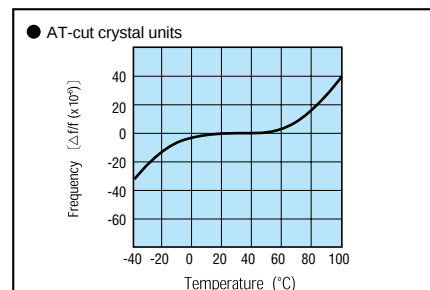
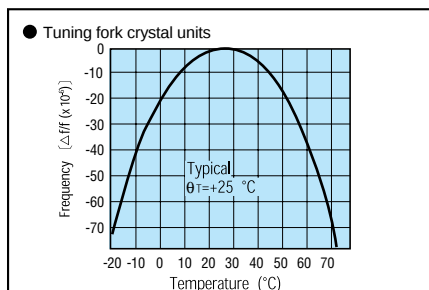
* 8.0 MHz < f < 8.2 MHz: unavailable. For frequencies less than 5.5 MHz, please refer to the frequency list. (page21)

Specifications

page	Item	Dimensions	Nominal frequency	Frequency tolerance (standard)	Frequency temperature characteristics	Series resistance	Load capacitance	Storage temperature range	Operating temperature range		
		L × W × H (mm)	f	Δf/f		R1	CL	TSTG	TOPR		
13	C-001R	ø3.1 x 8.0	32.768 kHz	±20 x 10 ⁻⁶	Peak temperature (θT): +25 °C Typ.	35 kΩ to 50 kΩ	6 pF to ∞	-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	±20 x 10 ⁻⁶ to ±100 x 10 ⁻⁶		6 kΩ to 55 kΩ					
14	C-4-TYPE	ø1.5 x 5.0	32 kHz to 120 kHz 192 kHz	±50 x 10 ⁻⁶ to ±100 x 10 ⁻⁶	10 kΩ to 50 kΩ						
15	FC-135	3.2 x 1.5 x 0.9	32.768 kHz	±20 x 10 ⁻⁶	Temperature coefficient (a): -0.04 x 10 ⁻⁶ / °C ² Max. Δf/f = a (θ T - θ X) ²	70 kΩ Max.	9.0 pF / 12.5 pF	-55 °C to +125 °C			
FC-145	4.1 x 1.5 x 0.9										
16	FC-255	5.0 x 1.9 x 0.9		25 kΩ to 70 kΩ							
17	MC-146	7.0 x 1.5 x 1.4	32 kHz to 100 kHz	±20 x 10 ⁻⁶ to ±100 x 10 ⁻⁶		25 kΩ to 65 kΩ	7 pF, 12.5 pF			-55 °C to +125 °C	-40 °C to +85 °C
MC-156	7.1 x 3.3 x 1.5										
18	MC-206	7.3 x 4.1 x 2.0									
19	MC-306/30A	8.0 x 3.8 x 2.54	20 kHz to 165 kHz				6 pF to ∞				
20											
21	MC-405/406	10.4 x 4.1 x 3.56	20 kHz to 165 kHz								
22	CA-301	ø3.1 x 8.9 ø3.1 x 9.3	4 MHz to 64 MHz	±30 x 10 ⁻⁶ (±50 x 10 ⁻⁶ to ±100 x 10 ⁻⁶)	±30 x 10 ⁻⁶ (±50 x 10 ⁻⁶)	40 Ω to 150 Ω		-40 °C to +85 °C	-20 °C to +70 °C		
28	MA-306	8.0 x 3.8 x 2.54	14.31818 MHz 17.734 MHz to 41 MHz		±30 x 10 ⁻⁶	60 Ω	Fundamental: 10 pF to ∞, 3rd overtone: 5 pF to ∞	-55 °C to +100 °C			
29	MA-406	11.7 x 4.8 x 3.7	4 MHz to 64 MHz	±50 x 10 ⁻⁶	±30 x 10 ⁻⁶ (±50 x 10 ⁻⁶)	40 Ω to 150 Ω					
	MA-505/506	13.5 x 5.1 x 4.57									
30	CA-303HS	ø3.1 x 8.9	9.6 MHz to 27 MHz	±10 x 10 ⁻⁶	±3 x 10 ⁻⁶ to ±15 x 10 ⁻⁶	25 Ω to 50 Ω		-55 °C to +125 °C		-40 °C to +85 °C	
	MA-406H	11.7 x 4.8 x 3.7									
23	SA-315H/HZ	8.0 x 3.0 x 1.55	10 MHz to 27 MHz			30 Ω to 40 Ω					
25	FA-23H	3.2 x 2.5 x 0.7	16 MHz to 32 MHz	±10 x 10 ⁻⁶	±10 x 10 ⁻⁶ to ±18 x 10 ⁻⁶	40 Ω to 80 Ω	10 pF to ∞	-40 °C to +125 °C	-20 °C to +70 °C		
24	FA-238	3.2 x 2.5 x 0.7	16 MHz to 50 MHz	±50 x 10 ⁻⁶	±30 x 10 ⁻⁶				-40 °C to +85 °C		
26	FA-248	4.0 x 2.5 x 1.0	12 MHz to 27 MHz	±10 x 10 ⁻⁶ to ±20 x 10 ⁻⁶	±10 x 10 ⁻⁶ to ±20 x 10 ⁻⁶ ±18 x 10 ⁻⁶ to ±30 x 10 ⁻⁶	40 Ω to 70 Ω		-55 °C to +125 °C	-20 °C to +70 °C -40 °C to +85 °C		
27	FA-365	6.0 x 3.5 x 1.4	12 MHz, 14 MHz to 41 MHz	±50 x 10 ⁻⁶ , ±100 x 10 ⁻⁶	±30 x 10 ⁻⁶	50 Ω			-20 °C to +70 °C		

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

Frequency and temperature characteristics example

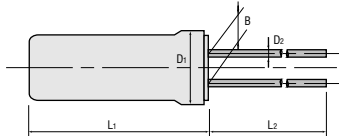


Dimensions

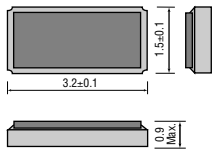
(Unit: mm)

Cylinder

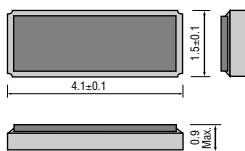
Model	L ₁	L ₂	D ₁	D ₂	B	
C-001R	8.0 Max.	9.0 Min.	ø3.1 Max.	ø0.3	1.1	
C-002RX/C-2-TYPE	6.0 Max.	4.0 Min.	ø2.0 Max.	ø0.2	0.7	
C-004R/C-4-TYPE	5.0 Max.	4.0 Min.	ø1.5 Max.	ø0.2	0.5	
C-005R	4.6 Max.	4.0 Min.	ø1.2 Max.	ø0.15	0.3	
CA-301	Over 5.5 MHz	8.9 Max.	9.5 Min.	ø3.1 Max.	ø0.3	1.1
	Under 5.5 MHz	9.3 Max.	9.5 Min.	ø3.1 Max.	ø0.3	1.1
CA-303HS	8.9 Max.	9.5 Min.	ø3.1 Max.	ø0.3	1.1	



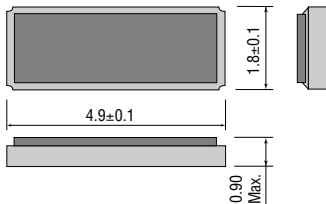
FC-135



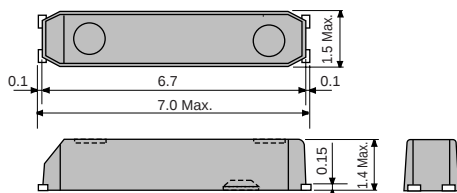
FC-145



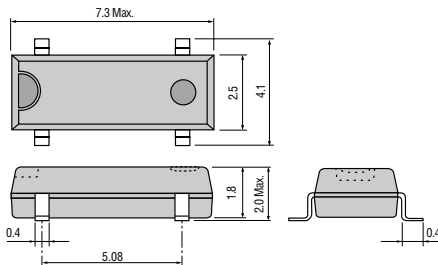
FC-255



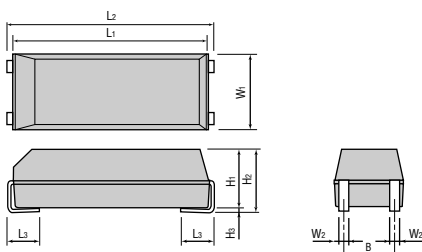
MC-146



MC-206

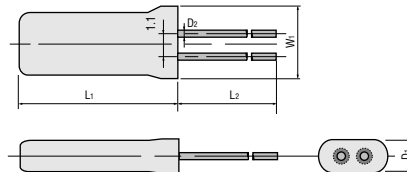


Model	L ₁	L ₂	L ₃	W ₁	W ₂	B	H ₁	H ₂	H ₃
MC-405/406	9.6	10.41 Max.	2.54	4.06 Max.	0.51	2.29	3.15	3.60 Max.	0.2 Min.
MA-505/506	12.7	13.46 Max.	2.54	5.08 Max.	1.09	3.30	4.19	4.60 Max.	0.2 Min.

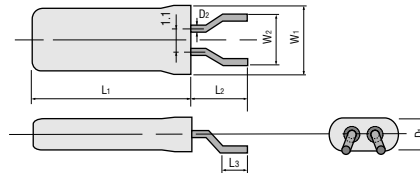


SA-315H

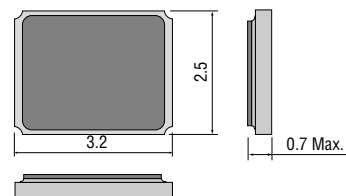
Model	L ₁	L ₂	L ₃	W ₁	W ₂	D ₁	D ₂	B
SA-315H	8.0 Max.	7.5 Min.	—	3.0 Max.	—	1.55	ø 0.3	1.1
SA-315HZ	8.0 Max.	2.0 Min.	0.7 Min.	3.0 Max.	2.5 Max.	1.55	ø 0.3	1.1



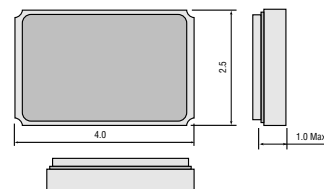
SA-315HZ



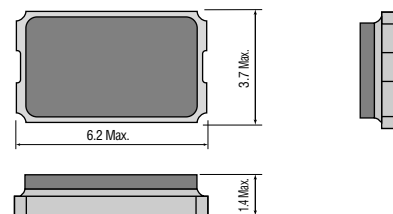
FA-238 / 23H



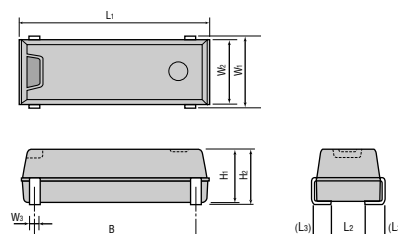
FA-248



FA-365



Model	L ₁	L ₂	L ₃	W ₁	W ₂	W ₃	H ₁	H ₂	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-406/406H	11.7 Max.	2.1	1.2	4.8 Max.	4.0	0.7	3.50	3.7 Max.	9.6



CYLINDER LOW/MEDIUM-FREQUENCY CRYSTAL UNIT

C-2-TYPE/C-TYPE

Product number (please refer to page 1)

Q12C2000xxxxxx00

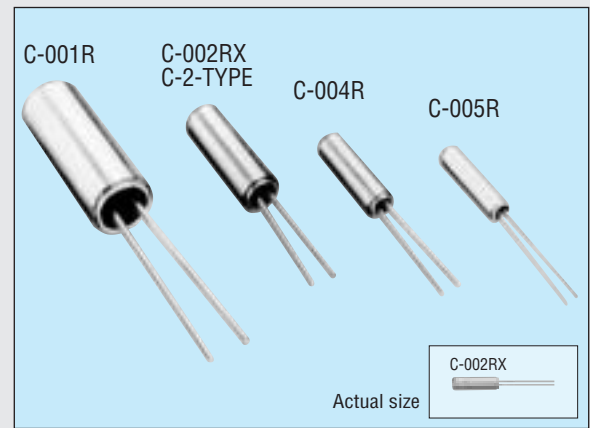
Q11C001Rxxxxxx00

Q11C02RXxxxxxx00

Q11C004Rxxxxxx00

Q11C005Rxxxxxx00

- 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.

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

Item	Symbol	Specifications	Remarks
Nominal frequency range	f	20.000 kHz to 165.000 kHz, 307.2 kHz	Please refer to frequency example page 14
Temperature range	Storage temperature	T _{STG}	-20 °C to +70 °C
	Operating temperature	T _{OPR}	-10 °C to +60 °C
Maximum drive level	GL	1.0 μW Max.	
Frequency tolerance (standard)	Δf/f	±20 x 10 ⁻⁶ ; ±50 x 10 ⁻⁶ ; ±100 x 10 ⁻⁶ (307.2 kHz: ±100 x 10 ⁻⁶)	Ta=+25 °C, DL=0.1 μW
Peak temperature (frequency)	θT	+25 °C ±5 °C	
Temperature coefficient (frequency)	a	-0.04 x 10 ⁻⁶ / °C ² Max.	
Load capacitance	C _L	6 pF to ∞	Please specify
Series resistance	R ₁	55 kΩ to 6 kΩ	As per below table
Motional capacitance	C ₁	4.0 fF Max.	
Shunt capacitance	C ₀	2.0 pF Max.	
Insulation resistance	IR	500 MΩ Min.	
Aging	fa	±5 x 10 ⁻⁶ /year Max.	Ta=+25 °C±3 °C, first year
Shock resistance	S.R.	±5 x 10 ⁻⁶ Max.	Three drops on a hard board from 750 mm or excitation test with 29400 m/s ² x 0.3 ms x 1/2 sine wave x 3 directions

- Please refer to the external dimensions on page 14.

Series resistance C-2 TYPE/MC-306/405/406

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.

Specifications for C-TYPE (characteristics)

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

- Please refer to the external dimensions on page 14.

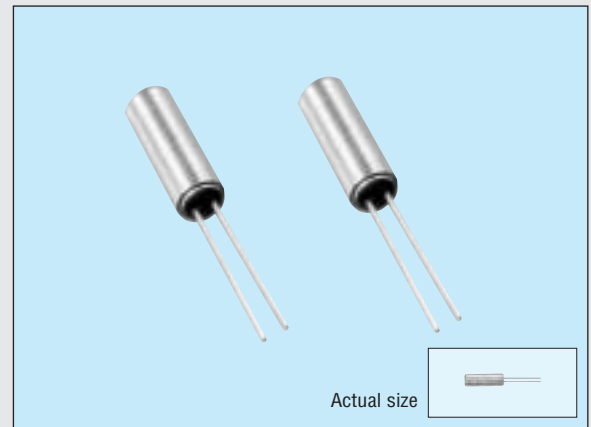
SMALL CYLINDER LOW/MEDIUM-FREQUENCY CRYSTAL UNIT

C-4-TYPE

Product number (please refer to page 1)

Q12C4000xxxxx00

- Photolithography finished allows uniform and stable performance.
- Small and light weight. (ø1.5 x 6 mm)
- Excellent environmental capability.



■ Specifications (characteristics)

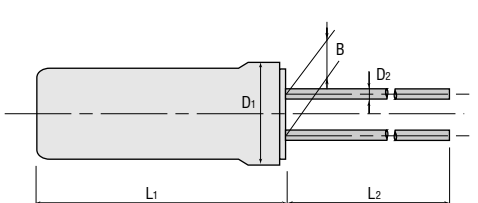
Item	Symbol	Specifications	Remarks
Nominal frequency	f	32.000 kHz to 120.000 kHz, 192 kHz	Please refer to frequency list below
Temperature range	Storage temperature T _{STG}	-20 °C to +70 °C	Stored as bare product after unpacking
	Operating temperature T _{OPR}	-10 °C to +60 °C	
Maximum drive level	GL	1.0 µW Max.	
Recommended drive level (characteristics)	DL	0.1 µW Typ.	
Frequency tolerance (standard)	Δf/f	±50 x 10 ⁻⁶ , ±100 x 10 ⁻⁶	Ta=+25 °C, DL=0.1 µW
Peak temperature (frequency)	θT	+25 °C ±5 °C	
Temperature coefficient (frequency)	a	-0.04 x 10 ⁻⁶ /°C ² Max.	
Load capacitance	C _L	6 pF to ∞	Please specify
Series resistance	R ₁	32 kHz ≤ f < 38 kHz: 50 kΩ Max. 38 kHz ≤ f < 50 kHz: 30 kΩ Max. 50 kHz ≤ f < 74 kHz: 25 kΩ Max. 74 kHz ≤ f ≤ 100 kHz: 22 kΩ Max. 100 kHz < f ≤ 120 kHz: 15 kΩ Max. 192 kHz: 10 kΩ Max.	
Motional capacitance	C ₁	3.0 fF Max.	
Shunt capacitance	C ₀	1.5 pF Max.	
Insulation resistance	IR	500 MΩ Min.	
Aging	fa	±5 x 10 ⁻⁶ /year Max.	Ta=+25 °C±3 °C, first year
Shock resistance	S.R.	±5 x 10 ⁶ Max.	Three drops on a hard board from 750 mm or excitation test with 29400 m/s ² x 0.3 ms x 1/2 sine wave x 3 directions

■ Frequency example

Type	Frequency	C _L Value
C-2-TYPE	26.6667 kHz	10.0 pF, 11.0 pF
	32.5600 kHz	7.0 pF
	36.8640 kHz	13.5 pF
	38.4000 kHz	10.0 pF
	44.7340 kHz	10.0 pF
	48.0000 kHz	15.0 pF
	75.0000 kHz	6.5 pF, 9.0 pF, 20.0 pF
	77.5030 kHz	10.0 pF, 20.0 pF
	76.8000 kHz	6.0 pF, 10.0 pF, 11.0 pF
	96.0000 kHz	6.0 pF, 8.4 pF, 11.0 pF
	153.6000 kHz	11.0 pF
	307.2000 kHz	11.0 pF
C-4-TYPE	38.4000 kHz	11.0 pF
	50.0000 kHz	9.0 pF
	76.8000 kHz	11.0 pF
	77.5030 kHz	10.0 pF
	192.0000 kHz	11.0 pF

■ External dimensions

(Unit: mm)



Model	L ₁	L ₂	D ₁	D ₂	B
C-2-TYPE	6.0 Max.	4.0 Min.	ø2.0 Max.	ø0.2	0.7
C-001R	8.0 Max.	9.0 Min.	ø3.1 Max.	ø0.3	1.1
C-002RX	6.0 Max.	4.0 Min.	ø2.0 Max.	ø0.2	0.7
C-004R	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
C-4-TYPE	5.0 Max.	4.0 Min.	ø1.5 Max.	ø0.2	0.5

(160 to 165 kHz, 307.2 kHz: D₁=ø2.2 Max.)

THIN SMD LOW FREQUENCY CRYSTAL UNIT

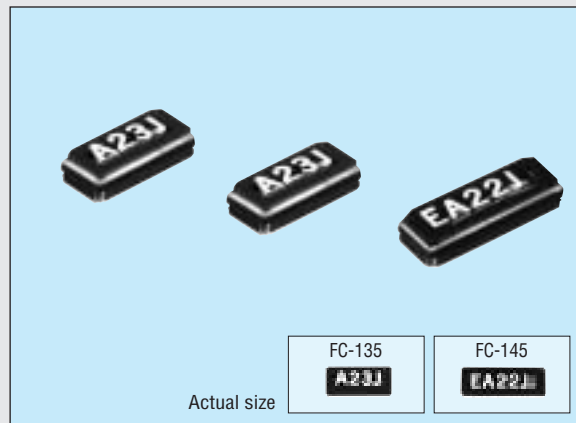
FC-135/145

Product number (please refer to page 1)

Q13FC135xxxxxx00

Q13FC145xxxxxx00

- High-density mounting-type SMD of 0.9 mm Max. thickness.
- Small packaging area and light weight.
- Excellent environmental capability.
- Most suitable for small communications devices.

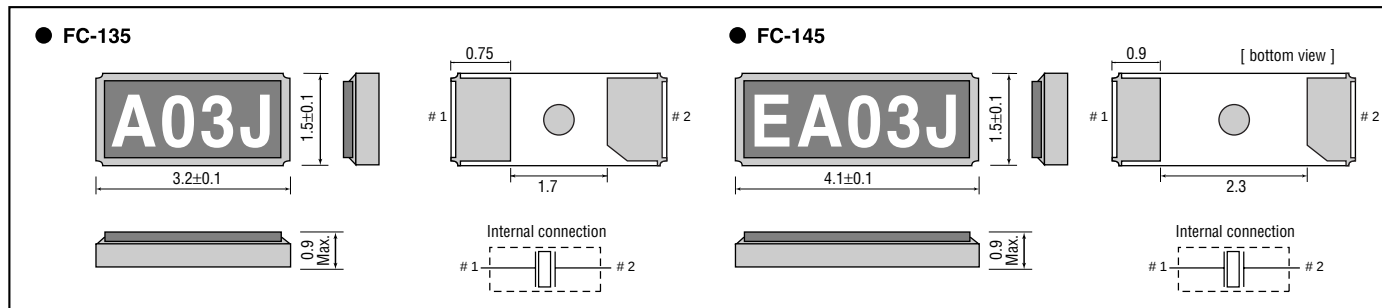


■ Specifications (characteristics)

Item		Symbol	Specifications	Remarks
Nominal frequency		f	32.768 kHz	please contact us for inquiries about the available frequency
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	
Maximum drive level		GL	0.5 μW Max.	
Recommended drive level		DL	0.1 μW	
Frequency tolerance(standard)		Δf/f	±20 x 10 ⁻⁶	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 ⁻⁶ /°C ² Max.	
Load capacitance		C _L	9.0 pF, 12.5 pF	Please specify
Series resistance		R ₁	70 kΩ Max.	
Motional capacitance		C ₁	1.7 fF Typ.	
Shunt capacitance		C ₀	1.3 pF Typ.	
Insulation resistance		IR	500 MΩ Min.	
Aging		fa	±3 x 10 ⁻⁶ /year Max.	Ta=+25 °C ±3 °C, first year
Shock resistance		S.R.	±8 x10 ⁻⁶ Max.	100 g dummy (Seiko Epson Standard) drop from 1500 mm height on to the concrete 3 directions 10 times.

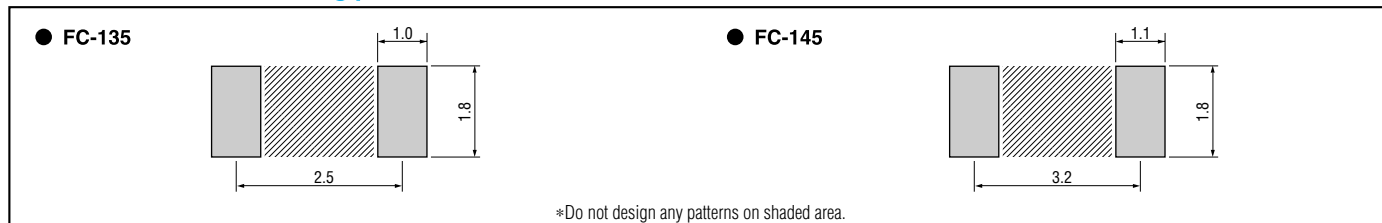
■ External dimensions

(Unit: mm)



■ Recommended soldering pattern

(Unit: mm)



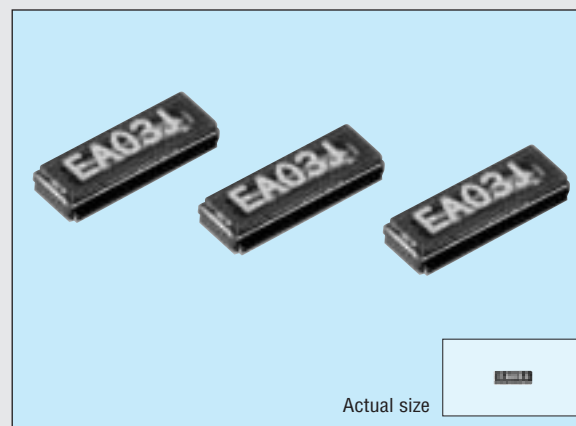
THIN SMD LOW / MEDIUM FREQUENCY CRYSTAL UNIT

FC-255

Product number (please refer to page 1)

Q1xFC255xxxxx00

- High-density mounting-type SMD of 0.9 mm Max. thickness.
- Small packaging area and light weight.
- Excellent environmental capability.
- Most suitable for small communications devices.

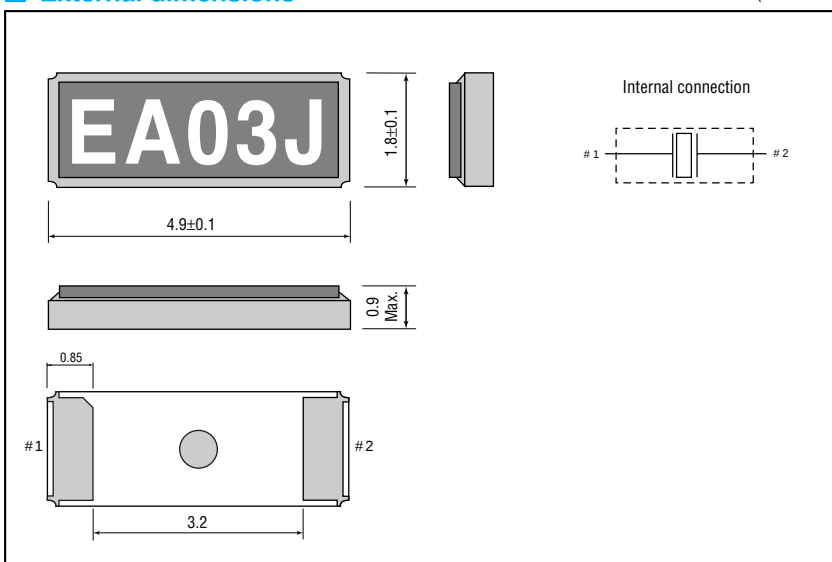


■ Specifications (characteristics)

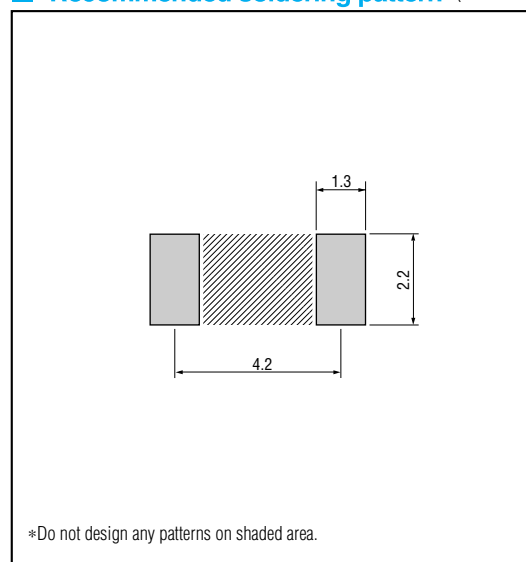
Item		Symbol	Specifications		Remarks
Nominal frequency		f	32.768 kHz	32.000 kHz to 100.000 kHz	please contact us for inquiries about the available frequency
Temperature range	Storage temperature	T _{STG}	-55 °C to +125 °C		Stored as bare product after unpacking
	Operating temperature	T _{OPR}	-40 °C to +85 °C		
Maximum drive level		GL	0.5 μW Max.		
Frequency tolerance(standard)		Δf/f	±20 x 10 ⁻⁶	±50 x 10 ⁻⁶ ,±100 x 10 ⁻⁶	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 ⁻⁶ /°C² Max.		
Load capacitance		C _L	7 pF, 12.5 pF		Please specify
Series resistance		R _i	65 kΩ Max.	70 kΩ to 25 kΩ	
Motional capacitance		C _i	1.7 fF Typ.	2.5 fF to 0.7 fF	
Shunt capacitance		C ₀	1.3 pF Typ.	1.6 pF to 0.7 pF	
Insulation resistance		IR	500 MΩ Min.		
Aging		fa	±3 x 10 ⁻⁶ /year Max.		Ta=+25 °C ±3 °C, first year
Shock resistance		S.R.	±8 x10 ⁻⁶ 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

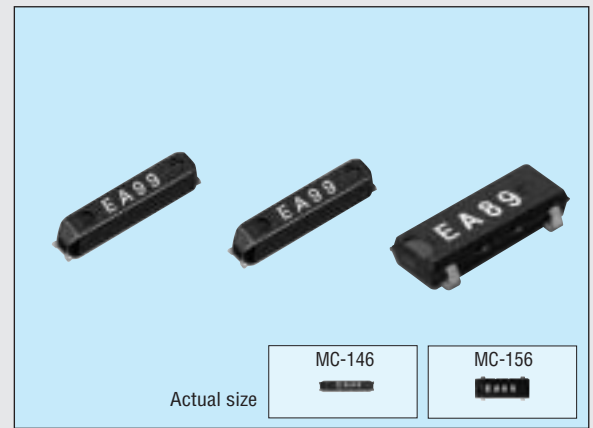
MC-146/156

Product number (please refer to page 1)

Q1xMC146xx xx x00

Q1xMC156xx xx x00

- 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.

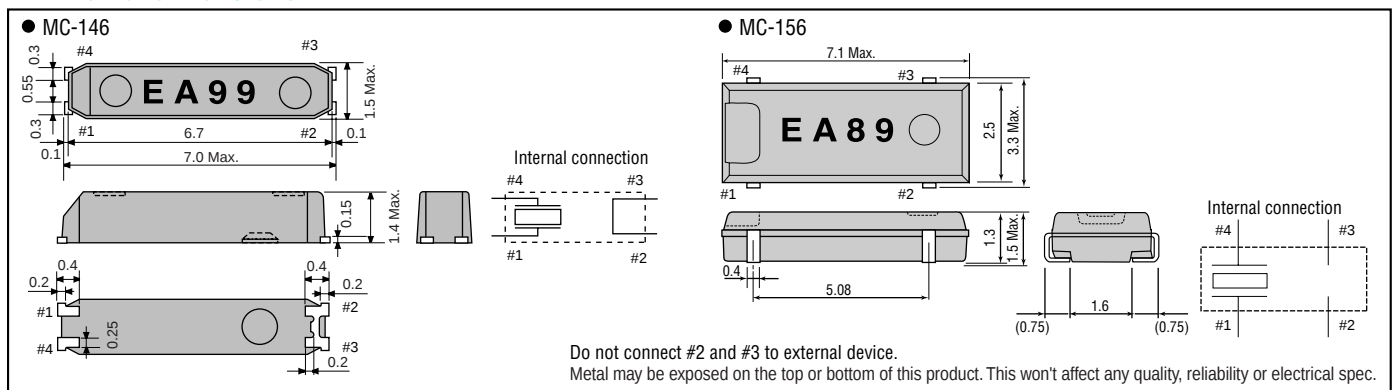


Specifications (characteristics)

Item		Symbol	Specifications		Remarks
Nominal frequency		f	32.768 kHz	32.000 kHz to 100.000 kHz	please contact us for inquiries about the available frequencies
Temperature range	Storage temperature	TSTG	-55 °C to +125 °C		Stored as bare product after unpacking
	Operating temperature	TOPR	-40 °C to +85 °C		
Maximum drive level		GL	1.0 μW Max.		Operating drive level 0.5 μW Max.
Frequency tolerance(standard)		Δf/f	±20 x 10 ⁻⁶ , ±50 x 10 ⁻⁶	±50 x 10 ⁻⁶ , ±100 x 10 ⁻⁶	Ta=+25 °C, DL=0.1 μW
Peak temperature(frequency)		θT	+25 °C ±5 °C		
Temperature coefficient(frequency)		a	-0.04 x 10 ⁻⁶ /°C ² 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 ⁻⁶ /year Max.		Ta=+25 °C ±3 °C, first year
Shock resistance		S.R.	±5 x 10 ⁻⁶ Max.		100 g dummy (Seiko Epson Standard) drop from 1500 mm height on to the concrete 3 directions 10 times.

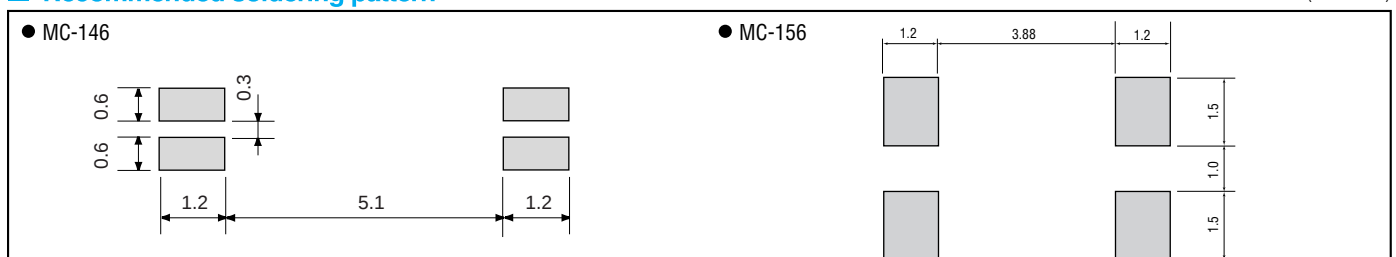
External dimensions

(Unit: mm)



Recommended soldering pattern

(Unit: mm)



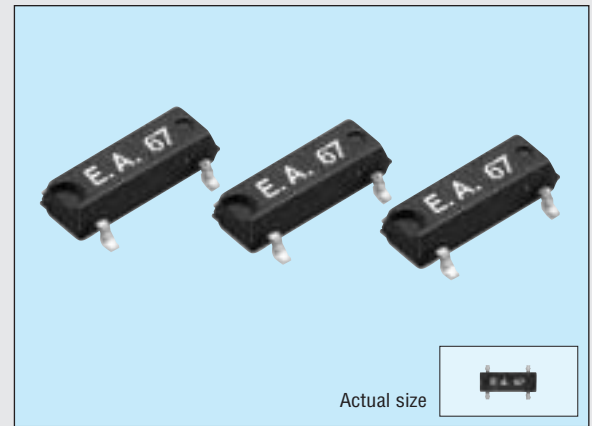
THIN SMD LOW/MEDIUM-FREQUENCY CRYSTAL UNIT

MC-206

Product number (please refer to page 1)

Q1xMC206xxxxx00

- High-density mounting-type SMD of Max. 2.0 mm thickness.
- High heat resistance allows reflow soldering.
- Excellent environmental capability.



Specifications (characteristics)

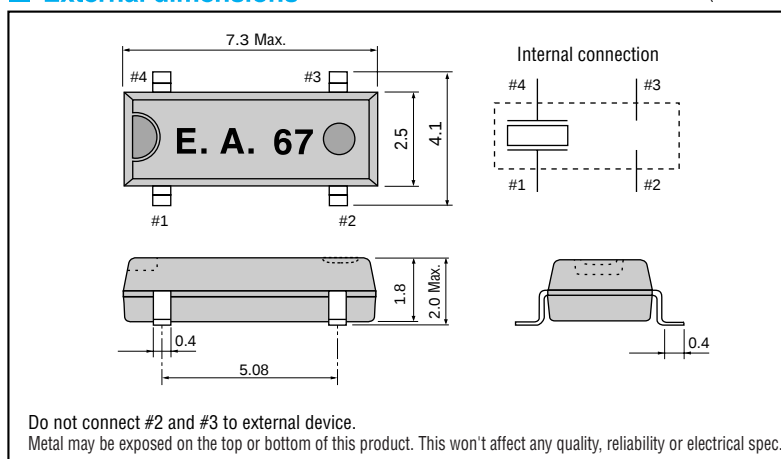
Item		Symbol	Specifications		Remarks
Nominal frequency		f	32.768 kHz	32.000 kHz to 100.000 kHz	
Temperature range	Storage temperature	T _{STG}	-55 °C to +125 °C		Stored as bare product after unpacking
	Operating temperature	T _{OPR}	-40 °C to +85 °C		
Maximum drive level		GL	1.0 μW Max.		
Frequency tolerance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

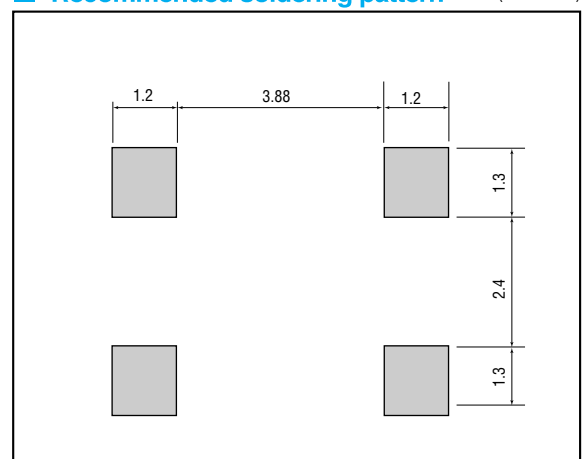
External dimensions

(Unit: mm)



Recommended soldering pattern

(Unit: mm)

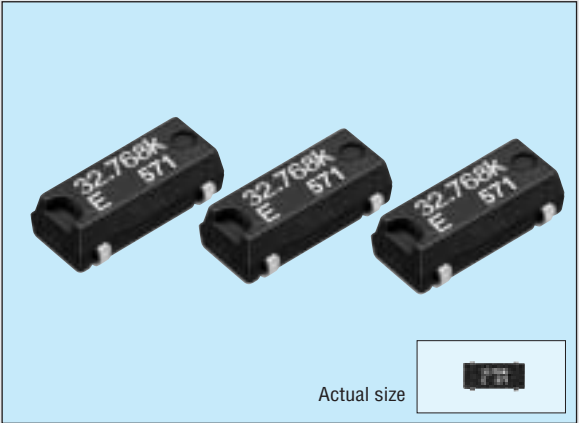


SMALL SMD LOW / MEDIUM-FREQUENCY CRYSTAL UNIT

MC-306

Product number (please refer to page 1)
Q1xMC306xxxxx00

- High-density mounting-type SMD.
- Photolithography finished allows uniform and stable performance.
- Excellent reliability and environmental capability.

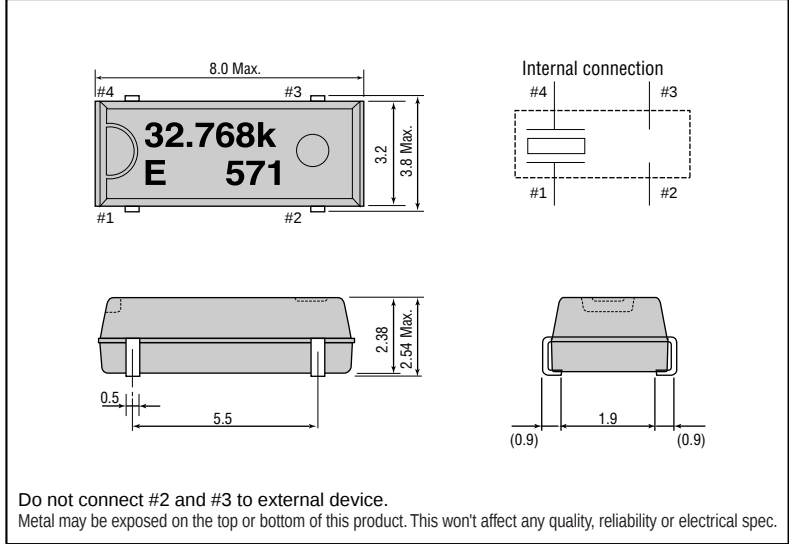


Specifications (characteristics)

Item		Symbol	Specifications		Remarks
Nominal frequency		f	32.768 kHz	20.000 kHz to 165.000 kHz	
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		
Maximum drive level		GL	1.0 μW Max.		
Frequency tolerance (standard)		Δf/f	±20 x 10 ⁻⁶ , ±50 x 10 ⁻⁶	±50 x 10 ⁻⁶ , ±100 x 10 ⁻⁶	Ta=+25 °C, DL=0.1 μW
Peak temperature (frequency)		θT	+25 °C ±5 °C		
Temperature coefficient (frequency)		a	-0.04 x 10 ⁻⁶ / °C² Max.		
Load capacitance		C _L	6 pF to ∞ (Standard : 12.5 pF)		Please specify
Series resistance		R ₁	50 kΩ Max.	55 kΩ to 10 kΩ	For details, refer to page 13
Motional capacitance		C ₁	1.8 fF Typ.	4.0 fF to 0.6 fF	
Shunt capacitance		C ₀	0.9 pF Typ.	2.0 pF to 0.6 pF	
Insulation resistance		IR	500 MΩ Min.		
Aging		fa	±3 x 10 ⁻⁶ /year Max.	±5 x 10 ⁻⁶ /year Max.	Ta=+25 °C ±3 °C, first year
Shock resistance		S.R.	±5 x 10 ⁻⁶ Max.		Three drops on a hard board from 750 mm or excitation test with 29400 m/s² x 0.3 ms x 1/2 sine wave x 3 directions

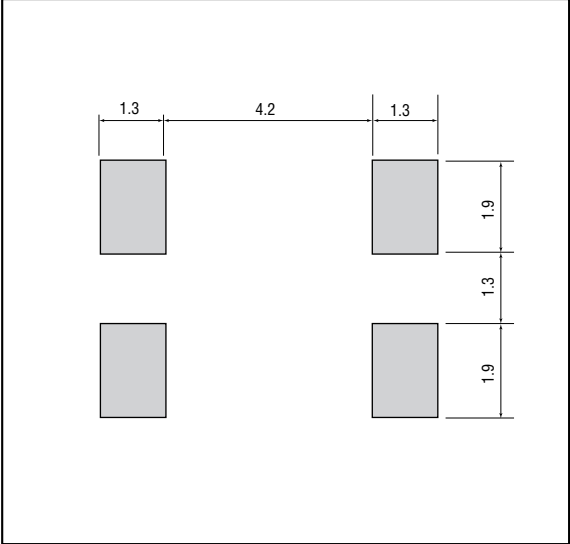
External dimensions

(Unit: mm)



Recommended soldering pattern

(Unit: mm)



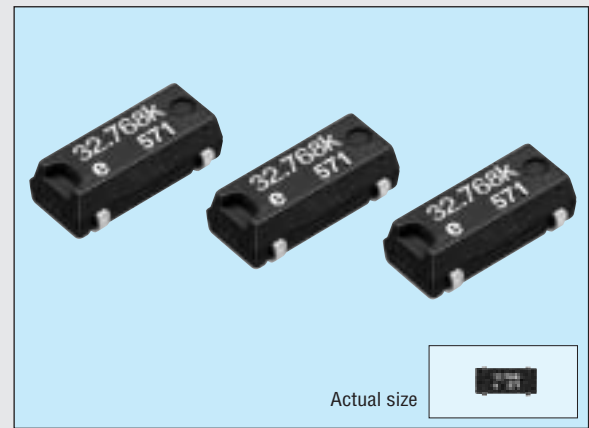
FOR AUTOMOTIVE APPLICATIONS
SMALL SMD LOW / MEDIUM-FREQUENCY CRYSTAL UNIT

MC-30A

Product number (please refer to page 1)

Q1xMC30Axxxxx00

- 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.



Actual size

Specifications (characteristics)

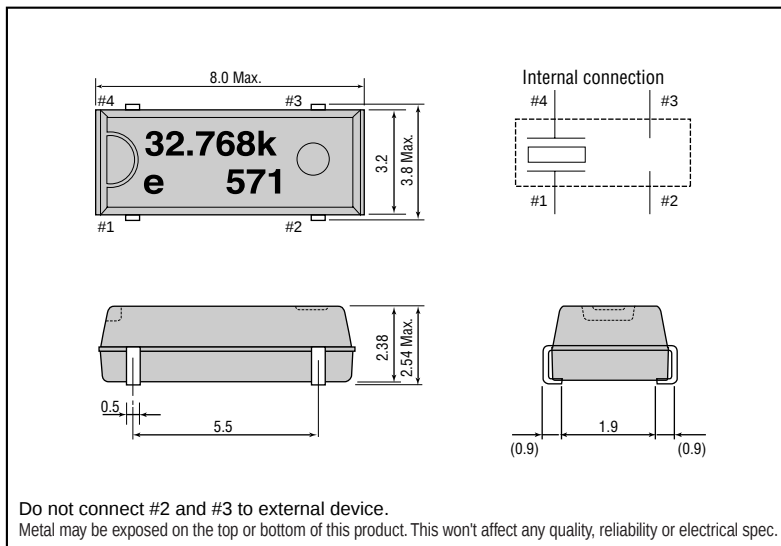
Item		Symbol	Specifications		Remarks
Nominal frequency		f	32.768 kHz	20.000 kHz to 165.000 kHz	
Temperature range	Storage temperature	T _{STG}	-55 °C to +125 °C		Stored as bare product after unpacking
	Operating temperature	T _{OPR}	-40 °C to +85 °C		
Maximum drive level		GL	1.0 μW Max.		
Frequency tolerance (standard)		Δf/f	±20 x 10 ⁻⁶ , ±50 x 10 ⁻⁶	±50 x 10 ⁻⁶ , ±100 x 10 ⁻⁶	Ta=+25 °C, DL=0.1 μW
Peak temperature (frequency)		θT	+25 °C ±5 °C		
Temperature coefficient (frequency)		a	-0.04 x 10 ⁻⁶ / °C ² Max.		
Load capacitance		C _L	6 pF to ∞		Please specify
Series resistance		R ₁	50 kΩ Max.	55 kΩ to 10 kΩ	As per below table
Motional capacitance		C ₁	1.8 fF Typ.	4.0 fF to 0.6 fF	
Shunt capacitance		C ₀	0.9 pF Typ.	2.0 pF to 0.6 pF	
Insulation resistance		IR	500 MΩ Min.		
Aging		fa	±3 x 10 ⁻⁶ /year Max.	±5 x 10 ⁻⁶ /year Max.	Ta=+25 °C ±3 °C, first year
Shock resistance		S.R.	±5 x 10 ⁻⁶ Max.		Three drops on a hard board from 100 mm

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.

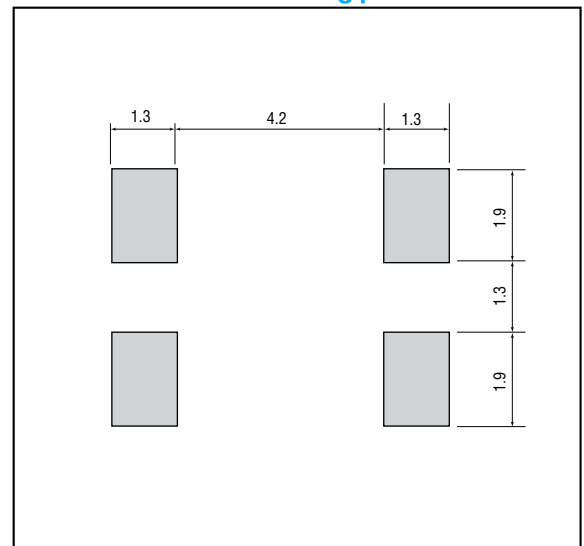
External dimensions

(Unit: mm)



Recommended soldering pattern

(Unit: mm)



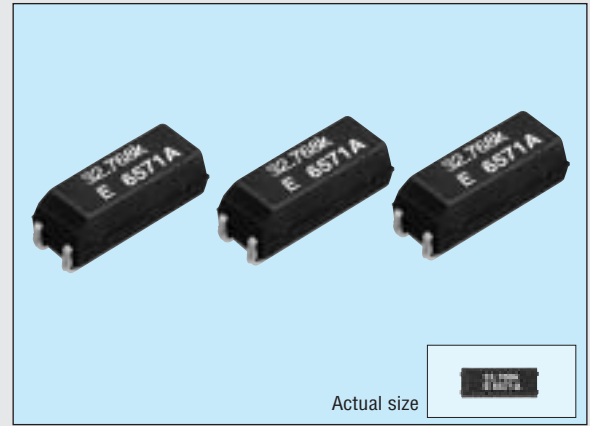
SMD LOW/MEDIUM-FREQUENCY CRYSTAL UNIT

MC-405/406

Product number (please refer to page 1)

Q1xMC405xxxxx00**Q1xMC406xxxxx00**

- 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.

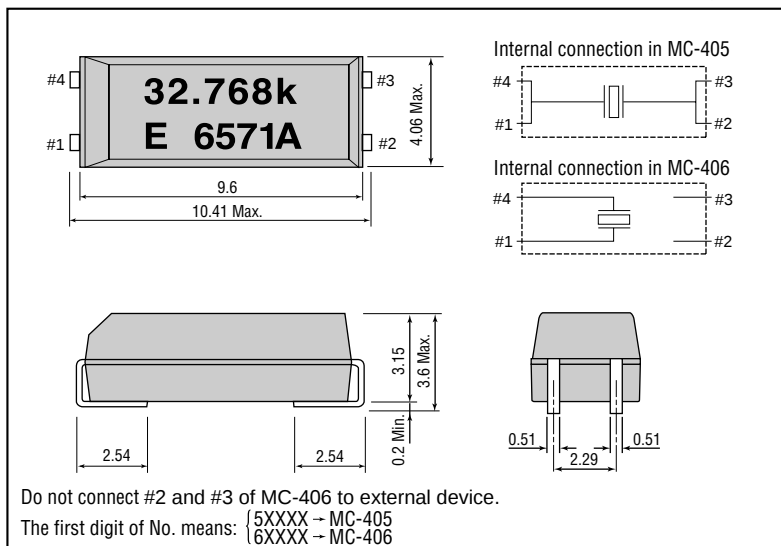


■ Specifications (characteristics)

Item		Symbol	Specifications		Remarks
Nominal frequency range		f	32.768 kHz	20.000 kHz to 165.000 kHz	
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		
Maximum drive level		GL	1.0 μW Max.		
Frequency tolerance (standard)		Δf/f	±20 x 10 ⁻⁶ , ±50 x 10 ⁻⁶	±50 x 10 ⁻⁶ , ±100 x 10 ⁻⁶	Ta=+25 °C, DL=0.1 μW
Turnover temperature (frequency)		θT	+25 °C ±5 °C		
Temperature coefficient (frequency)		a	-0.04 x 10 ⁻⁶ / °C² Max.		
Load capacitance		C _L	6 pF to ∞ (Standard : 12.5 pF)		Please specify
Series resistance		R ₁	50 kΩ Max.	55 kΩ to 10 kΩ	For details, refer to page 13
Motion capacitance		C ₁	2.0 fF Typ.	4.0 fF to 0.6 fF	
Shunt capacitance		C ₀	0.85 pF Typ.	2.0 pF to 0.6 pF	
Insulation resistance		IR	500 MΩ Min.		
Aging		fa	±3 x 10 ⁻⁶ /year Max.	±5 x 10 ⁻⁶ /year Max.	Ta=+25 °C±3 °C, first year
Shock resistance		S.R.	±5 x 10 ⁻⁶ Max.		Three drops on a hard board from 750 mm or excitation test with 29400 m/s² x 0.3 ms x 1/2 sine wave x 3 directions

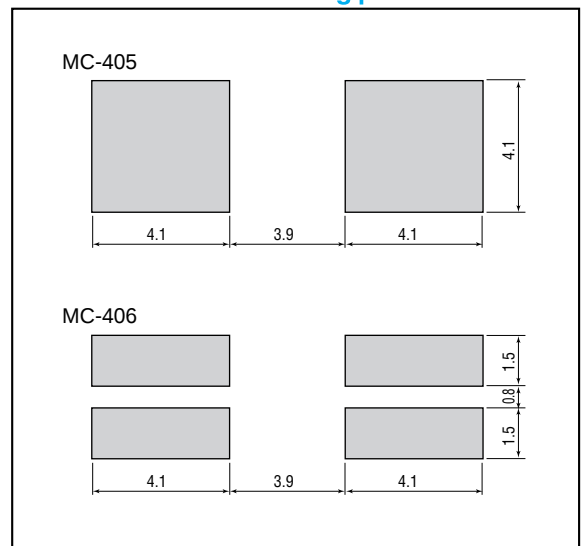
■ External dimensions

(Unit: mm)



■ Recommended soldering pattern

(Unit: mm)



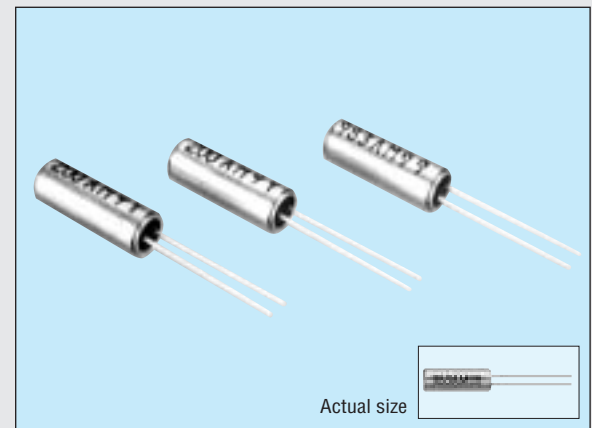
CYLINDER HIGH-FREQUENCY CRYSTAL UNIT

CA-301

Product number (please refer to page 1)

Q21CA301xxxx00

- 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.



■ 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	T _{STG}	-40 °C to +85 °C	Stored as bare product after unpacking
	Operating temperature	T _{OPR}	-20 °C to +70 °C	The operating temperature range is -10 °C to +60 °C for 5.5 MHz and below
Drive level	Maximum drive level	GL	2 mW Max.	Only crystal oscillation is guaranteed
	Recommended level	DL	10 µW to 100 µW	
Frequency tolerance (standard)		Δf/f	±30 x 10 ⁻⁶ (Under 5.5 MHz: ±50 x 10 ⁻⁶ , ±100 x 10 ⁻⁶)	Ta=+25 °C
Frequency temperature characteristics (standard)			Under 5.5 MHz: ±50 x 10 ⁻⁶	-10 °C to +60 °C
			Over 5.5 MHz: ±30 x 10 ⁻⁶	-20 °C to +70 °C
Load capacitance		C _L	Fundamental: 10 pF to ∞. Over tone: 5 pF to ∞	Please specify
Series resistance		R ₁	As per below table	-20 °C to +70 °C, DL=100 µW
Shunt capacitance		C ₀	5 pF Max.	
Insulation resistance		IR	500 MΩ Min.	
Aging		fa	±5 x 10 ⁻⁶ /year Max.	Ta=+25 °C±3 °C, first year
Shock resistance		S.R.	±10 x 10 ⁻⁶ Max.	Three drops on a hard board from 750 mm height or excitation test with 29400 m/s ² 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		L ₁	L ₂	D ₁	D ₂	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.

THIN CYLINDER HIGH-STABILITY CRYSTAL UNIT

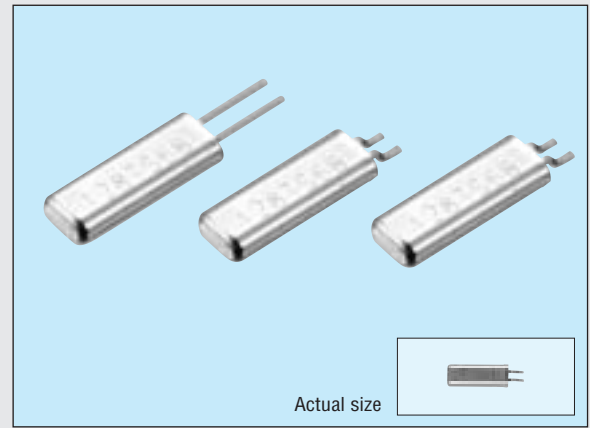
SA-315H/315HZ

Product number (please refer to page 1)

Q23S315Hxxxxxx00

Q24S315Zxxxxxx00

- Thin cylinder of 1.55 mm Max. thickness featuring high stability.
- Small and thin with small mounting area and light weight.
- High heat resistance allows reflow soldering.
- Excellent environmental capability.
- Embossed tape usable for SMD.(SA-315HZ)
- Most suitable for small communications devices.



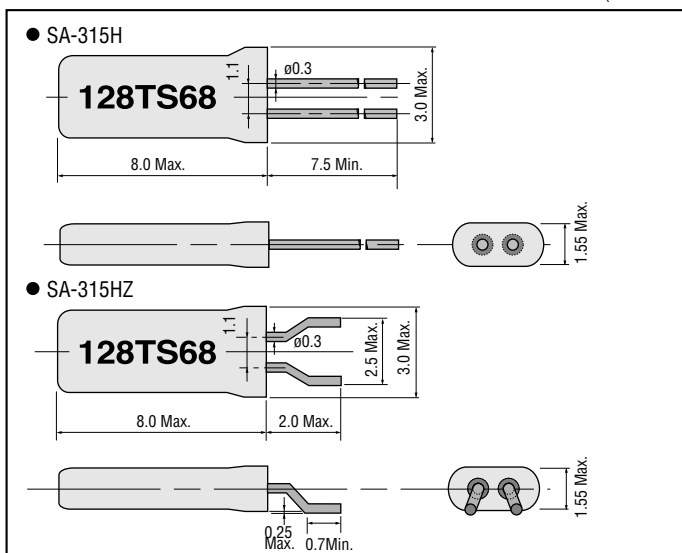
■ Specifications (characteristics)

Item		Symbol	Specifications	Remarks
Nominal frequency range		f	10.000 MHz to 27.000 MHz	Fundamental mode Please contact us for inquiries about the available frequency and Frequency temperature characteristics.
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	Specified equivalent series resistance must be satisfied.
	Operable temperature	T _{USE}	As per below table	Specified equivalent series resistance and frequency-temperature characteristics must be satisfied.
Drive level	Maximum drive level	GL	2 mW Max.	Only crystal oscillation is guaranteed
	Recommended drive level	DL	10 μW to 100 μW	
Frequency tolerance (standard)		Δf/f	±10 × 10 ⁻⁶	D _L =100 μW at Ta=+25 °C ±3 °C and specified load capacity.
Frequency temperature characteristics			As per below table	Please contact us for inquiries about the available frequency and Frequency temperature characteristics.
Load capacitance		C _L	10 pF to ∞	Please contact us for inquiries.
Series resistance		R ₁	As per below table	Operable temperature range, DL=100 μW
Shunt capacitance		C ₀	3.0 pF Max.	
Insulation resistance		IR	500 MΩ Min.	
Aging		fa	±1 × 10 ⁻⁶ / year Max.	Ta = +25 °C ±1 °C, 100 μW
Shock resistance		S.R.	±1 × 10 ⁻⁶ Max.	Three drops on a hard wooden board from 750 mm or excitation test with 29400 m/s ² x 0.3 ms x 1/2 sine wave x 3 directions

Measured values for frequency tolerance and temperature characteristics need to be brought into mutual correlation prior to the start of production.
Please check the soldering condition of plug case department before use.

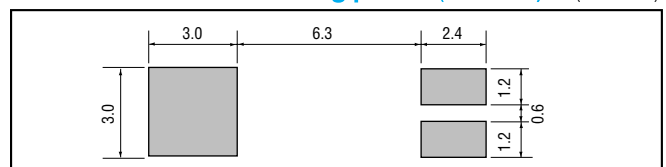
■ External dimensions

(Unit: mm)



■ Recommended soldering pattern(SA-315HZ)

(Unit: mm)



■ Frequency temperature characteristics

Operating temperature range	Frequency tolerance
0 °C to +50 °C	± 3 × 10 ⁻⁶ Min.
-10 °C to +60 °C	± 5 × 10 ⁻⁶ Min.
-20 °C to +70 °C	± 7 × 10 ⁻⁶ Min.
-30 °C to +80 °C	± 10 × 10 ⁻⁶ Min.
-40 °C to +85 °C	± 15 × 10 ⁻⁶ Min.

■ Series resistance

Frequency	Series resistance (R ₁)
10.0 MHz ≤ f < 12.0 MHz	40 Ω Max.
12.0 MHz ≤ f ≤ 27.0 MHz	30 Ω Max.

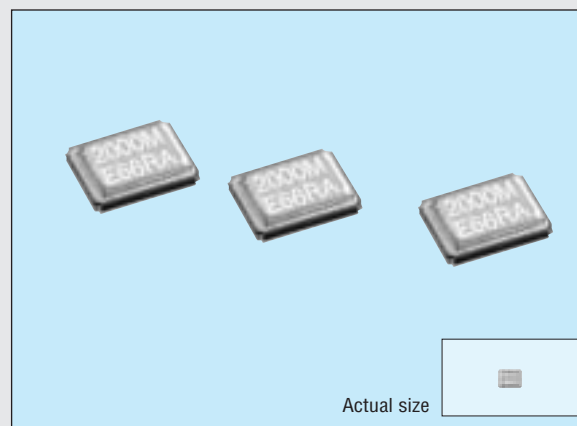
THIN SMD HIGH-FREQUENCY CRYSTAL UNIT

FA-238

Product number (please refer to page 1)

Q22FA238xxxxxx00

- High-density mounting-type SMD.
- Excellent shock resistance.
- Capable of covering a wide frequency range. (from 16 MHz to 50 MHz)
- 0.7 mm Max. thickness is equal to SMD-type IC.
- Most suitable for small communication devices.



■ Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Nominal frequency range	f	16.000 MHz to 50.000 MHz	Fundamental mode *1
Temperature range	Storage temperature	T _{STG}	-40 °C to +125 °C
	Operating temperature	T _{OPR}	-40 °C to +85 °C
	Operable temperature	T _{USE}	As per below table
Drive level	Maximum drive level	GL	2 mW Max.
	Recommended drive level	DL	10 μW to 100 μW
Frequency tolerance	Δf/f	±50 × 10 ⁻⁶ (standard) (±15 × 10 ⁻⁶ to ±50 × 10 ⁻⁶ is available)	Ta=+25 °C±3 °C For the out of standard specifications, please contact us for inquiries. *1
Frequency temperature characteristics		±30 × 10 ⁻⁶ (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 _L	7 pF to ∞ (standard:12 pF)	Please specify
Series resistance	R ₁	As per below table	Operable temperature range , DL=100 μW
Shunt capacitance	C ₀	5.0 pF Max.	
Insulation resistance	IR	500 M Ω Min.	
Aging	fa	±5 × 10 ⁻⁶ /year Max.	Ta=+25 °C ±3 °C, first year
Shock resistance	S. R.	±10 × 10 ⁻⁶ 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

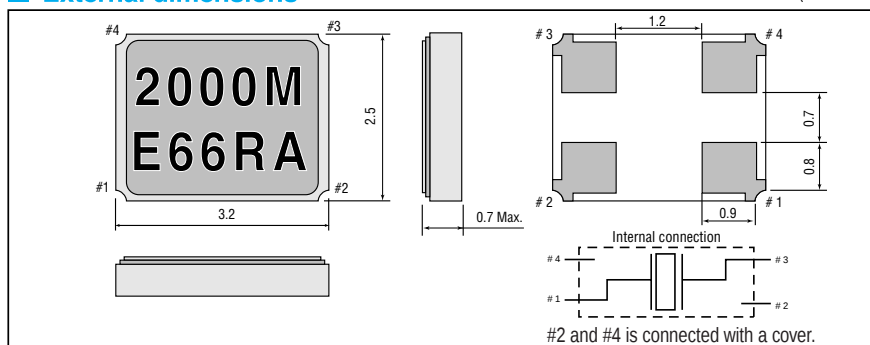
Operable temperature	Frequency tolerance
0 °C to +50 °C	± 8 × 10 ⁻⁶ Min.
-10 °C to +60 °C	± 12 × 10 ⁻⁶ Min.
-20 °C to +70 °C	± 15 × 10 ⁻⁶ Min.
-30 °C to +80 °C	± 20 × 10 ⁻⁶ Min.
-40 °C to +85 °C	± 30 × 10 ⁻⁶ Min.

■ Series resistance (R1)

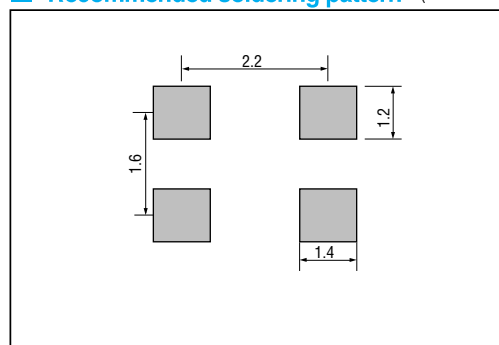
Frequency	Series resistance
16.0 MHz ≤ f < 20.0 MHz	80 Ω Max.
20.0 MHz ≤ f < 25.0 MHz	60 Ω Max.
25.0 MHz ≤ f < 30.0 MHz	50 Ω Max.
30.0 MHz ≤ f ≤ 50.0 MHz	40 Ω Max.

■ External dimensions

(Unit: mm)



■ Recommended soldering pattern (Unit: mm)



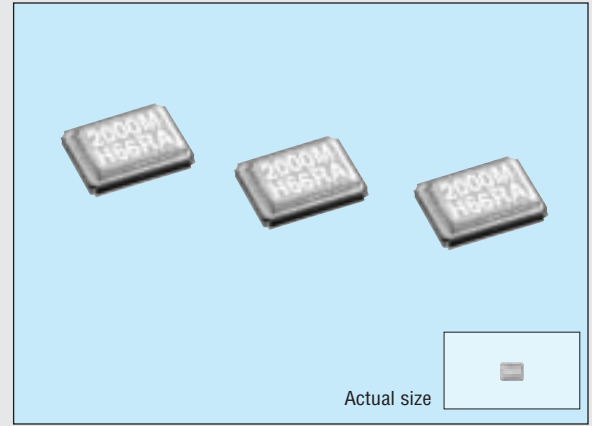
THIN SMD HIGH-STABILITY CRYSTAL UNIT

FA-23H

Product number (please refer to page 1)

Q24FA23Hxx xx 00

- 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.
- 0.7 mm Max. thickness is equal to SMD-type IC.



■ Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Nominal frequency range	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	T _{STG}	-40 °C to +125 °C
	Operating temperature	T _{OPR}	-40 °C to +85 °C
	Operable temperature	T _{USE}	As per below table
Drive level	Maximum drive level	GL	2 mW Max.
	Recommended drive level	DL	10 μW to 100 μW
Frequency tolerance (standard)	Δf/f	±10 x 10 ⁻⁶	Ta=+25 °C For the out of standard specifications, please contact us for inquiries.
Frequency temperature characteristics (standard)		±10 x 10 ⁻⁶	-20 °C to +70 °C For the out of standard specifications, please contact us for inquiries.
Load capacitance	C _L	10 pF (standard)	For the out of standard specifications, please contact us for inquiries.
Series resistance	R ₁	As per below table	Operable temperature range, DL = 100 μW
Shunt capacitance	C ₀	5 pF Max.	
Insulation resistance	IR	500 MΩ Min.	
Aging	fa	±1 x 10 ⁻⁶ / year Max.	Ta=+25 °C, first year
Shock resistance	S. R.	±2 x 10 ⁻⁶ Max.	100 g dummy (Seiko Epson Standard) drop from 1500 mm height on to the concrete 3 directions 10 times.

■ Frequency temperature characteristics

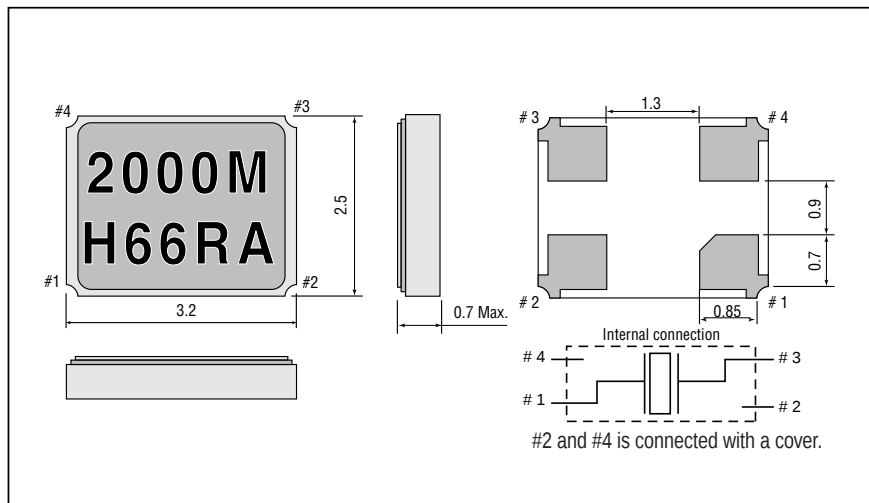
Temperature range	Series resistance
0 °C to +50 °C	±5 x 10 ⁻⁶ Min.
-10 °C to +60 °C	±7 x 10 ⁻⁶ Min.
-20 °C to +70 °C	±10 x 10 ⁻⁶ Min.
-30 °C to +80 °C	±15 x 10 ⁻⁶ Min.
-40 °C to +85 °C	±20 x 10 ⁻⁶ Min.

■ Series resistance (R1)

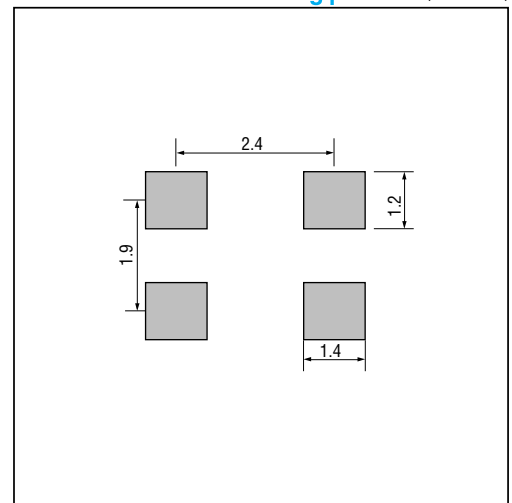
Frequency	Series resistance
16.0 MHz ≤ f < 20.0 MHz	80 Ω Max.
20.0 MHz ≤ f < 25.0 MHz	60 Ω Max.
25.0 MHz ≤ f < 30.0 MHz	50 Ω Max.
30.0 MHz ≤ f ≤ 32.0 MHz	40 Ω Max.

■ External dimensions

(Unit: mm)



■ Recommended soldering pattern (Unit: mm)



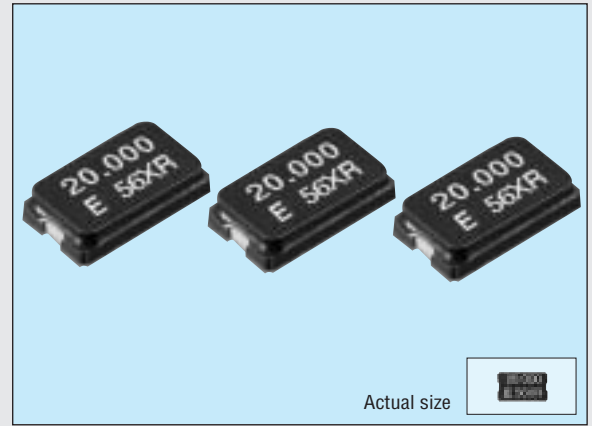
THIN SMD HIGH-FREQUENCY CRYSTAL UNIT

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.



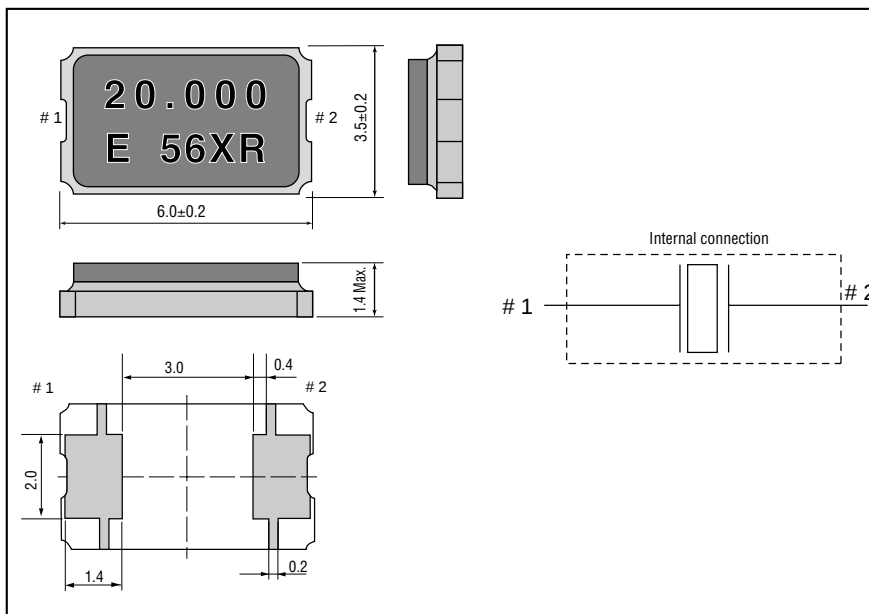
Actual size

■ Specifications (characteristics)

Item		Symbol	Specifications	Remarks
Nominal frequency range		f	12.000 MHz, 14.000 MHz to 41.000 MHz	Fundamental mode
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	Please contact us on availability of -40 °C to +85 °C
Drive level	Maximum drive level	GL	2 mW Max.	Only crystal oscillation is guaranteed
	Recommended drive level	DL	10 μW to 100 μW	
Frequency tolerance (standard)		Δf/f	±50 x 10 ⁻⁶ , ±100 x 10 ⁻⁶	Ta=+25 °C±3 °C
Frequency temperature characteristics (standard)			±30 x 10 ⁻⁶	-20 °C to +70 °C For the out of standard specifications, please contact us for inquiries
Load capacitance		C _L	10 pF to ∞	Please specify
Series resistance		R ₁	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		C ₀	5.0 pF Max.	
Insulation resistance		IR	500 MΩ Min.	
Aging		fa	±5 x 10 ⁻⁶ /year Max.	Ta=+25 °C ±3 °C, first year
Shock resistance		S. R.	±10 x 10 ⁻⁶ Max.	Three drops on a hard board from 750 mm or excitation test with 29400 m/s ² x 0.3 ms x 1/2 sine wave x 3 directions

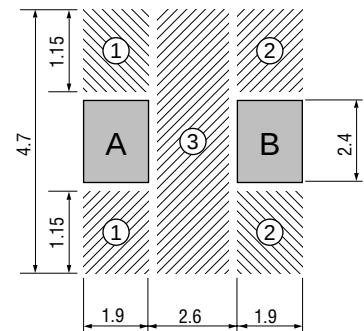
■ External dimensions

(Unit: mm)



■ Recommended soldering pattern

(Unit: mm)



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

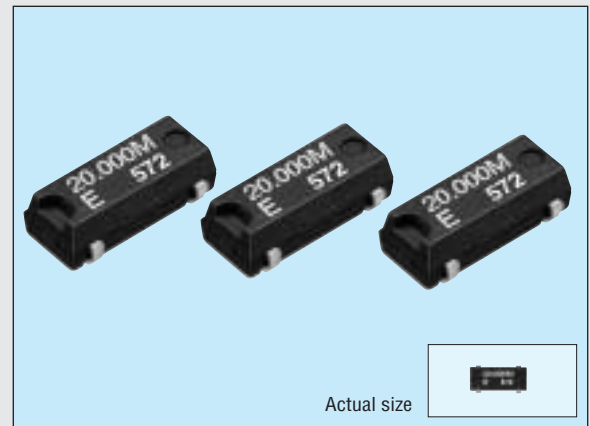
SMALL SMD HIGH - FREQUENCY CRYSTAL UNIT

MA-306

Product number (please refer to page 1)

Q22MA306xx xx 00

- High-density mounting-type SMD.
- Excellent reliability and environment capability.
- Capable of covering a wide frequency range. (from 17.734 MHz to 41 MHz)



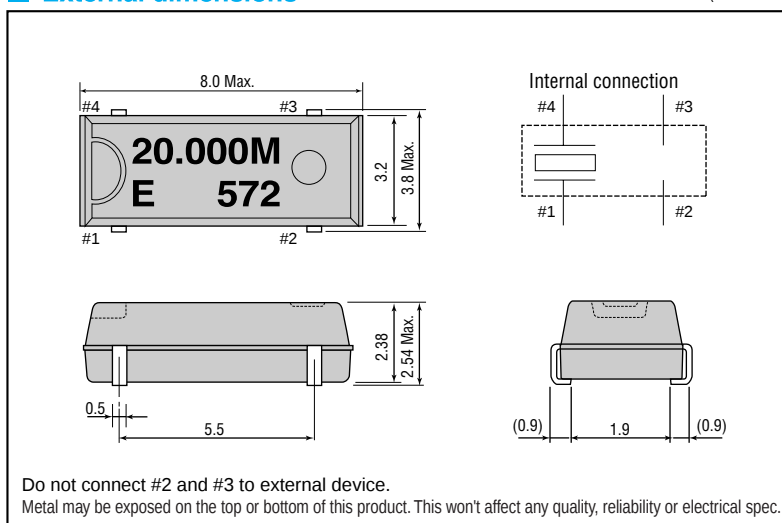
Actual size

■ 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	T _{STG}	-55 °C to +100 °C
	Operating temperature	T _{OPR}	-20 °C to +70 °C
Drive level	Maximum drive level	GL	2 mW Max.
	Recommended drive level	DL	10 µW to 100 µW
Frequency tolerance (standard)	Δf/f	±50 x 10 ⁻⁶	Ta= +25 °C ±3 °C
Frequency temperature characteristics (standard)		±30 x 10 ⁻⁶	-20 °C to +70 °C
Load capacitance	C _L	10 pF to ∞	Please specify
Series resistance	R ₁	60 Ω Max.	-20 °C to +70 °C, DL=100 µW
Shunt capacitance	C ₀	5 pF Max.	
Insulation resistance	IR	500 MΩ Min.	
Aging	fa	±5 x 10 ⁻⁶ / year Max.	Ta=+25 °C ±3 °C, first year
Shock resistance	S.R.	±10 x 10 ⁻⁶ Max.	Three drops on a hard board from 750 mm or excitation test with 29400 m/s ² x 0.3 ms x 1/2 sine wave x 3 directions

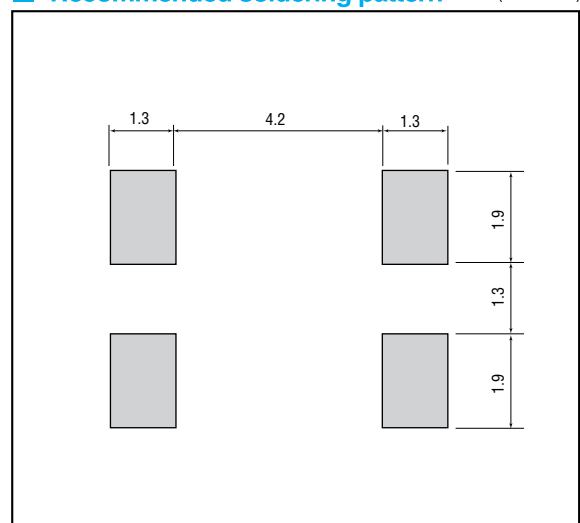
■ External dimensions

(Unit: mm)



■ Recommended soldering pattern

(Unit: mm)



SMD HIGH-FREQUENCY CRYSTAL UNIT

MA-406/505/506

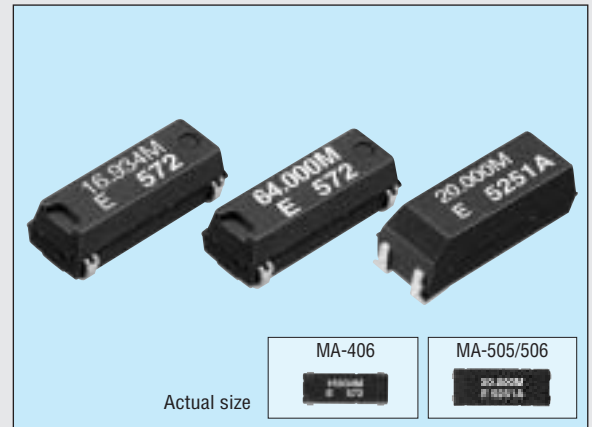
Product number (please refer to page 1)

Q22MA406xxxxx00

Q22MA505xxxxx00

Q22MA506xxxxx00

- Excellent heat-resistance and environment capability.
- Cover a wide frequency range, from 4 MHz to 64 MHz.



Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Nominal frequency	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	T _{STG}	-55 °C to +125 °C
	Operating temperature	T _{OPR}	-20 °C to +70 °C
Drive level	Maximum drive level	GL	2 mW Max.
	Recommended drive level	DL	10 µW to 100 µW
Frequency tolerance (standard)	Δf/f	±50 x 10 ⁻⁶	Ta=+25 °C±3 °C
Frequency temperature characteristics (standard)		Under 5.5 MHz: ±50 x 10 ⁻⁶	-20 °C to +70 °C
		Over 5.5 MHz: ±30 x 10 ⁻⁶	For the out of standard specifications, please contact us for inquiries
Load capacitance	C _L	Fundamental: 10 pF to ∞	Please specify
		Over tone: 5 pF to ∞	
Series resistance	R ₁	As per table below	-20 °C to +70 °C, DL=100 µW
Shunt capacitance	C ₀	5 pF Max.	
Insulation resistance	IR	500 MΩ Min.	
Aging	fa	±5 x 10 ⁻⁶ / year	Ta=+25 °C ±3 °C, first year
Shock resistance	S.R.	±10 x 10 ⁻⁶ Max.	Three drops on a hard board from 750 mm or excitation test with 29400 m/s ² 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: See "Available frequencies from 4.0 MHz to less than 5.5 MHz" on page 21.

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

Series resistance

Frequency (MHz)	4.0 ≤ f < 5.5	5.5 ≤ f < 6.0	6.0 ≤ f < 10.0	10.0 ≤ f < 12.0	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
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Recommended soldering pattern

(Unit: mm)

● MA-406	● MA-505	● MA-506
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SMD / CYLINDER HIGH-STABILITY CRYSTAL UNIT

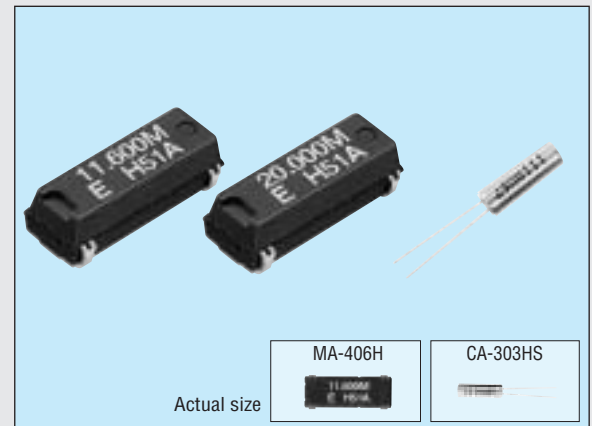
MA-406H/CA-303HS

Product number (please refer to page 1)

Q24M406Hxxxx00

Q23C303Sxxxx00

- High-density mounting-type.
- Excellent heat-resistance and environment capability.
- 9.6 MHz to 27.0 MHz available.
- Suitable for small telecommunication equipment.



■ Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Nominal frequency range	f	9.600 MHz to 27.000 MHz	Fundamental mode Please contact us for inquiries about the available frequency and Frequency temperature characteristics.
Temperature range	Storage temperature	T _{STG}	-55 °C to +125 °C
	Operable temperature	T _{OPR}	-40 °C to +85 °C
Drive level	Maximum drive level	GL	2 mW Max.
	Recommended drive level	DL	10 μW to 100 μW
Frequency tolerance (standard)	Δf/f	±10 x 10 ⁻⁶	Ta=+25 °C ±3 °C ,DL=100 μW
Frequency temperature characteristics		As per below table	Please contact us for inquiries about the available frequency and Frequency temperature characteristics.
Load capacitance	C _L	10 pF to ∞	Please contact us for inquiries
Series resistance	R ₁	As per below table	Operable temperature range, DL=100 μW
Shunt capacitance	C ₀	3.0 pF Max.	
Insulation resistance	IR	500 MΩ Min.	
Aging	fa	±1 x 10 ⁻⁶ /year Max.	Ta=+25 °C ±1 °C, DL=100 μW
Shock resistance	S. R.	±1 x 10 ⁻⁶ Max.	Three drops on a hard wooden board from 750 mm or excitation test with 29400 m/s ² x 0.3 ms x 1/2 sine wave x 3 directions

Measured values for frequency tolerance and temperature characteristics need to be brought into mutual correlation prior to the start of production.

■ Frequency temperature characteristics

Temperature range	Frequency tolerance
0 °C to +50 °C	± 3 x 10 ⁻⁶ Min.
-10 °C to +60 °C	± 5 x 10 ⁻⁶ Min.
-20 °C to +70 °C	± 7 x 10 ⁻⁶ Min.
-30 °C to +80 °C	±10 x 10 ⁻⁶ Min.
-40 °C to +85 °C	±15 x 10 ⁻⁶ Min.

■ Series resistance (R1)

Frequency (MHz)	Series resistance (Ω)
9.6 ≤ f < 10.0	50 Ω Max.
10.0 ≤ f < 12.0	40 Ω Max.
12.0 ≤ f < 16.0	30 Ω Max.
16.0 ≤ f ≤ 27.0	25 Ω Max.

■ External dimensions

(Unit: mm) ■ Recommended soldering pattern (Unit: mm)

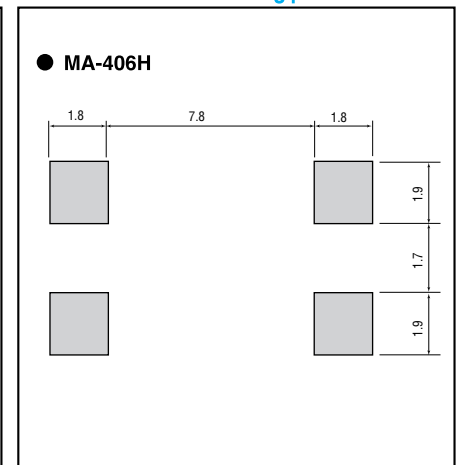
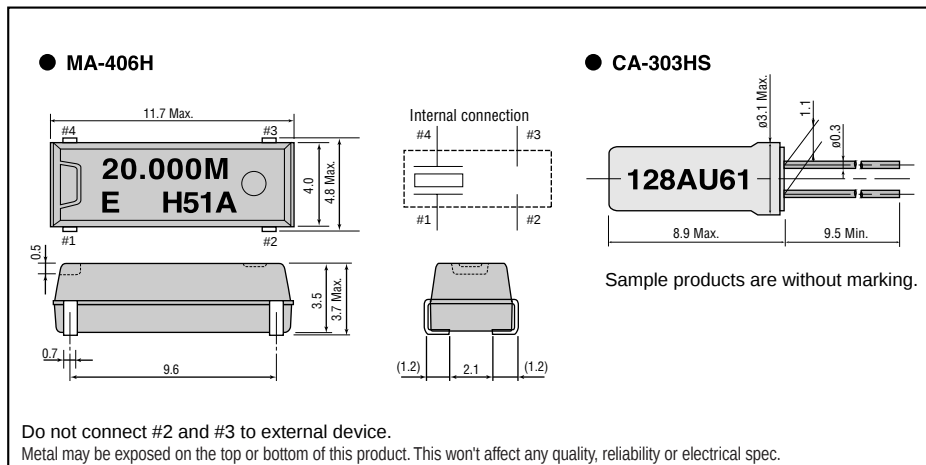


TABLE OF CRYSTAL OSCILLATORS

Frequency range

Low and medium-frequency crystal oscillators

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

High-frequency crystal oscillators

page	Model	Operating condition	Frequency stability	1 MHz	50 MHz	100 MHz	150 MHz
36	SG-730	5 V±0.5 V	S: ±25 x 10 ⁻⁶ B: ±50 x 10 ⁻⁶ C: ±100 x 10 ⁻⁶ (-20 °C to +70 °C)	1.5	67	SG-730PHN	
		3.3 V±0.3 V	L: ±50 x 10 ⁻⁶ M: ±100 x 10 ⁻⁶ (-40 °C to +85 °C)	1.5	67	80	SCN
37	SG-710 series	5 V±0.5 V	B: ±50 x 10 ⁻⁶ C: ±100 x 10 ⁻⁶ (-20 °C to +70 °C) (**K: -10 °C to +70 °C) (**W: -20 °C to +70 °C)	1.8	50	80	135
38				1.8	50	80	135
		3.3 V±0.3 V	B: ±50 x 10 ⁻⁶ C: ±100 x 10 ⁻⁶ (-20 °C to +70 °C) (**K: -10 °C to +70 °C) (**W: -20 °C to +70 °C) M: ±100 x 10 ⁻⁶ (-40 °C to +85 °C)	1.8	67	135	
39	SG-645 series	5 V±0.5 V	B: ±50 x 10 ⁻⁶ C: ±100 x 10 ⁻⁶ (-20 °C to +70 °C)	2.5	33	135	
40			M: ±100 x 10 ⁻⁶ (-40 °C to +85 °C)	2.5	33		
		3.3 V±0.3 V	B: ±50 x 10 ⁻⁶ C: ±100 x 10 ⁻⁶ (-20 °C to +70 °C) M: ±100 x 10 ⁻⁶ (-40 °C to +85 °C)	2.5	33	135	
41	SG-636 series	5 V±0.5 V	B: ±50 x 10 ⁻⁶ (-20 °C to +70 °C)	2.21675	33	135	
42			C: ±100 x 10 ⁻⁶ (-20 °C to +70 °C)	2.21675	41	70	135
		3.3 V±0.3 V	B: ±50 x 10 ⁻⁶ (-20 °C to +70 °C)	2.21675	33	135	
			C: ±100 x 10 ⁻⁶ (-20 °C to +70 °C)	2.21675	40	135	
		2.5 V±0.25 V	C: ±100 x 10 ⁻⁶ (-20 °C to +70 °C)	2.21675	40		
43	SG-615 series	5 V±0.5 V	B: ±50 x 10 ⁻⁶ (-20 °C to +70 °C)	1.025	26	55	135
44			C: ±100 x 10 ⁻⁶ (-20 °C to +70 °C)	1.025	26	66.6667	135
		3.3 V±0.3 V	B: ±50 x 10 ⁻⁶ C: ±100 x 10 ⁻⁶ (-20 °C to +70 °C) M: ±100 x 10 ⁻⁶ (-40 °C to +85 °C)	1.5	26	66.6667	135
45	SG-531 series SG-51 series	5 V±0.5 V	B: ±50 x 10 ⁻⁶ (-20 °C to +70 °C)	1.025	26	55	135
46			C: ±100 x 10 ⁻⁶ (-20 °C to +70 °C)	1.025	26	66.6667	135
		3.3 V±0.3 V	B: ±50 x 10 ⁻⁶ C: ±100 x 10 ⁻⁶ (-20 °C to +70 °C) M: ±100 x 10 ⁻⁶ (-40 °C to +85 °C)	1.5	26		135

Low jitter crystal oscillators

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

High-stability oscillators

page	Model	1 Hz	100 kHz	1 MHz	26 MHz	40 MHz	67 MHz	135 MHz	170 MHz	400 MHz	700 MHz
60	HG-2150CA						1.0 MHz to 60 MHz				
61	HG-1012JA						1.5 MHz to 28.6363 MHz				
	HG-2012JA										

Voltage-controlled crystal oscillator

page	Model	1 Hz	100 kHz	1 MHz	26 MHz	40 MHz	67 MHz	135 MHz	170 MHz	400 MHz	700 MHz
66	VG-1011JA					1.5 MHz to 28.6363 MHz					
63	EV-3101TA									600 MHz to 700 MHz	
65	VG-1201CA						1.0 MHz to 60 MHz				
64	VG-2820CB				● 13 MHz						
67	VG-4231CA						16 MHz to 41 MHz				
68	VG-4010JA										
	VG-4030JA					2.0 MHz to 28.6363 MHz					

Temperature compensated crystal oscillator

page	Model	1 Hz	100 kHz	1 MHz	26 MHz	40 MHz	67 MHz	135 MHz	170 MHz	400 MHz	700 MHz
70	TG-2824/25CB				12.5 MHz to 19.8 MHz						
69	TG-2832/33CB				19.2 MHz to 26 MHz						
71	TG-2820CB				12.5 MHz to 19.8 MHz						

Multi-output crystal oscillators

page	Model	1 Hz	100 kHz	1 MHz	26 MHz	40 MHz	67 MHz	135 MHz	170 MHz	400 MHz	700 MHz
73	MG-5100SA							76.9 kHz to 100 MHz			
72	MG-7010SA				20 MHz to 120 MHz						

Specifications

page	Model	Item	Output frequency range	Frequency stability	Current consumption	Operating temperature	Operating voltage	Output load	Output control		
35	SG-3030JC/JF		32.768 kHz	5±23 x 10 ⁻⁶	2 μA Max.	-40 °C to +85 °C	1.5 V to 5.5 V	15 pF	Vio		
	SG-3032JC				5 μA Max.	-20 °C to +70 °C	1.8 V to 3.6 V		—		
43	SG-51/531/615P		1.025 MHz to 26 MHz	±100 x 10 ⁻⁶ (±50 x 10 ⁻⁹)	23 mA Max.	-20 °C to +70 °C (-40 °C to +85 °C)	5 V ± 0.5 V	10 TTL,50 pF	OE		
44	SG-51/531/615PTJ		26.0001 MHz to		35 mA Max.			15 pF			
46	SG-51/531/615PH		66.6667 MHz							50 pF	
	SG-531/615PTW/STW		55.0001 MHz to	±50 x 10 ⁻⁶ ±100 x 10 ⁻⁶	45 mA Max.	-20 °C to +70 °C	3.3 V ± 0.3 V	15 pF (5TTL + 15 pF, 25 pF)	OE / ST		
	SG-531/615PHW/SHW		135MHz		28 mA Max.			15 pF			
	SG-531/615PCW/SCW		26.0001 MHz to 135 MHz							12 mA Max.	25 pF
	SG-531/615PCG/SCG		1.5 MHz to 26 MHz								
	SG-615PCN		26.0001 MHz to 66.6667 MHz		15 pF						
41	SG-636PTF		2.21675 MHz to 41 MHz	±100 x 10 ⁻⁶	17 mA Max.	-20 °C to +70 °C	5 V ±0.5 V	10 TTL Max.,50 pF	OE		
42	SG-636PH		41 MHz to 70 MHz		35 mA Max.			20 pF (≤55 MHz) 15 pF (>55 MHz)			
	SG-636PCE/SCE		2.21675 MHz to 40 MHz		9 mA Max.			30 pF			
	SG-636PDE		2.2 MHz to 40 MHz		5 mA Max.			15 pF			
	SG-636PTW/STW		32.0001 MHz to 135 MHz		45 mA Max.			15 pF (25 pF,50pF)			
	SG-636PHW/SHW			28 mA Max.	3.3 V ± 0.3 V	15 pF					
	SG-636PCW/SCW			25 mA Max.	4.5 V to 5.5 V	25 pF					
	SG-636PTG/PHG		2.21675 MHz to 33 MHz	12 mA Max.	2.7 V to 3.6 V		OE				
	SG-636PCG						ST				
	SG-636SCG										
39	SG-645PTG		2.5 MHz to 33 MHz	±100 x 10 ⁻⁶	25 mA Max.	-20 °C to +70 °C	4.5 V to 5.5 V	25 pF	OE		
40	SG-645PHG				12 mA Max.	-40 °C to +85 °C	2.7 V to 3.6 V				
	SG-645PCG/SCG		32.0001 MHz to 135 MHz		45 mA Max.	-20 °C to +70 °C	4.5 V to 5.5 V	15pF(25 pF, 50 pF)	OE/ST		
	SG-645PHW/SHW				28 mA Max.	-20 °C to +70 °C	3.0 V to 3.6 V	15 pF (5TTL +15 pF, 25 pF)			
	SG-645PTW/STW							15 pF			
	SG-645PCW/SCW										
37	SG-710PTK		1.8 MHz to 50 MHz	±100 x 10 ⁻⁶ (±50 x 10 ⁻⁹)	13 mA (24 mA) Max.	-10 °C to +70 °C (-40 °C to +85 °C)	5 V ± 0.5 V	10 TTL	OE		
38	SG-710PHK		1.8 MHz to 80 MHz		40 mA Max.		3.3 V ± 0.3 V	50 pF			
	SG-710ECK		1.8 MHz to 67 MHz		18 mA Max.			15 pF			
	SG-710PTW/STW		80.0001 MHz to		45 mA Max.	-20 °C to +70 °C	5 V ± 0.5 V	15 pF (5TTL + 15 pF)	OE / ST		
	SG-710PHW/SHW		135 MHz		28 mA Max.	-20 °C to +70 °C	3.3 V ±0.3 V	15 pF (25 pF)			
	SG-710PCW/SCW		67.0001 MHz to 135 MHz					15 pF			
36	SG-730PHN		1.5 MHz to 67.0 MHz	±25 x 10 ⁻⁶	12 mA (50 mA) Max.	-20 °C to +70 °C -40 °C to +85 °C	4.5 V to 5.5 V	15 pF	OE		
	SG-730PCN			±50 x 10 ⁻⁶	7 mA (20 mA) Max.		3.0 V to 3.6 V				
	SG-730SCN			67.0001 MHz to 80 MHz	±100 x 10 ⁻⁶					35 mA Max.	
55	EG-2121CA		53.125 MHz to 500 MHz		80 mA Max.	0 °C to +70 °C	2.5 V ±0.125 V				
56	EG-2102CA		100 MHz to 700 MHz		32 mA Max.	-5 °C to +85 °C	3.3 V ±0.3 V	50 Ω			
57	EG-2101CA		62.5 MHz to 400 MHz	±100 x 10 ⁻⁶	60 mA Max.		3.3 V ±0.15 V				
58	EG-2002CA		62.5 MHz to 170 MHz			0 °C to +70 °C	3.3 V ±0.3 V	25 pF(fo = 62.5 MHz) 15 pF(fo > 62.5 MHz)	OE		
59	EG-2001CA		106.25 MHz to 170 MHz		50mA Max.			25 pF(fo ≤ 135 MHz) 15 pF(fo > 135 MHz)			
60	HG-2150CA **C		1 MHz to 60 MHz	±15 x 10 ⁻⁶	25 mA Max.	-20 °C to +70 °C	3.3 V ± 0.3 V	15 pF			
	HG-2150CA **H			±25 x 10 ⁻⁶	30 mA Max.	-40 °C to +85 °C	5.0 V ± 0.5 V				
61	HG-1012/2012JA		1.5 MHz to	±15 x 10 ⁻⁶ to ±30 x 10 ⁻⁶	10 mA Max.	-40 °C to +85 °C	5 V ±0.25 V				
66	VG-1011JA		28.63636 MHz	±15 x 10 ⁻⁶ to ±25 x 10 ⁻⁶			5 V ± 0.5 V				
63	EV-3101TA		600 MHz to 700 MHz	—	60 mA Typ.	0 °C to +85 °C	3.3 V ± 0.165 V	50 Ω			
65	VG-1201CA **C		1 MHz to 60 MHz	±20 x 10 ⁻⁶	25 mA	-20 °C to +70 °C	3.3 V ± 0.3 V	15pF	OE		
	VG-1201CA **H			±25 x 10 ⁻⁶	30 mA	-40 °C to +85 °C	5.0 V ± 0.5 V				
64	VG-2820CB		13 MHz	±12 x 10 ⁻⁶	1 mA Max.	-20 °C to +75 °C	2.8 V ± 0.1 V	9 kΩ to 11 kΩ 9 pF to 11 pF	—		
67	VG-4231CA *RC		16.0000 MHz to 41 MHz	±35 x 10 ⁻⁶	10 mA	-20 °C to +70 °C	3.3 V ± 0.3 V	15 pF	OE		
	VG-4231CA *RH			±50 x 10 ⁻⁶	20 mA	-40 °C to +85 °C	5.0 V ± 0.5 V				
68	VG-4010JA		2.0 MHz to	±35 x 10 ⁻⁶	35 mA Max.	-20 °C to +70 °C	5 V ±0.25 V	2 TTL 30 pF Max.	—		
	VG-4030JA		28.63636 MHz	±37 x 10 ⁻⁶	18 mA Max.		3.3 V ±0.17 V	30 pF Max.			
70	TG-2824CB		12.5000 MHz to 19.8000 MHz	±1.5 x 10 ⁻⁶ Max.	1.8 mA (50 μA)	-30 °C to +80 °C	2.8 V ±0.14 V	9 kΩ to 11 kΩ 9 pF to 11 pF	ST		
	TG-2825CB				1.8 mA				—		
69	TG-2832CB		19.2000 MHz to 26.0000 MHz		2.0 mA (50 μA)				ST		
	TG-2833CB				2.0 mA				—		
71	TG-2820CB		12.5 MHz to 19.8 MHz						1.5 mA Max.		
73	MG-5100SA		76.9 kHz to 100 MHz	±100 x 10 ⁻⁶	100 mA Max.	-20 °C to +70 °C	5 V ± 0.5 V 3.3 V ± 0.3 V	15 pF (25pF)	OE		
72	MG-7010		20 MHz to 120 MHz		27 mA Max.		2.7 V ± 5.5 V		ST / OE		

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

page	Model		Operating voltage	Frequency stability Operating temperature	1 MHz	27 MHz	40 MHz	55 MHz	125 MHz
48 51 52	SG-8002CA SG-8002JA SG-8002DB SG-8002DC	PT ST PH SH	4.5 V to 5.5 V	B C					
				M					
		PC SC	3 V to 3.6 V (2.7 V to 3.6 V)	B C M	 *2.7 V to 3.6 V : 1.0 MHz to 66.7 MHz				
50	SG-8002JC	PT ST PH SH	4.5 V to 5.5 V	B C					
		PC SC	3 V to 3.6 V (2.7 V to 3.6 V)	B C	 *2.7 V to 3.6 V : 1.0 MHz to 66.7 MHz				
49	SG-8002JF	PT ST PH SH	4.5 V to 5.5 V	B C					
				M					
		PC SC	3 V to 3.6 V (2.7 V to 3.6 V)	B C M	 *2.7 V to 3.6 V : 1.0 MHz to 66.7 MHz				
47	SG-8002CE	PT ST PH SH	4.5 V to 5.5 V	B C					
				M					
		PC SC	3 V to 3.6 V (2.7 V to 3.6 V)	B C M	 *2.7 V to 3.6 V : 1.0 MHz to 66.7 MHz				
51 52	HG-8002JA HG-8002DC	PT ST PH SH	5 V ± 0.25 V	AV BV					
				CX					
		PC SC	3 V ± 0.165 V	AV BV CX	 *2.7 V to 3.6 V : 1.0 MHz to 66.7 MHz				

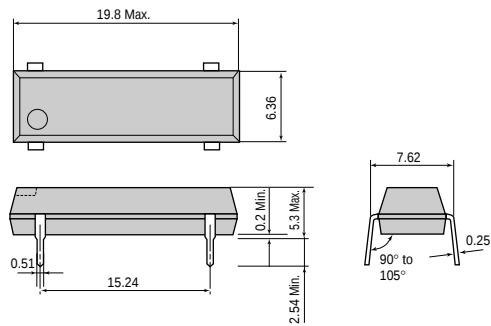
■ Specifications of SG-8002 or HG-8002 series

33

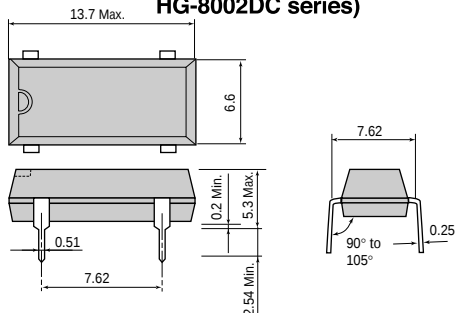
Dimensions

(Unit: mm)

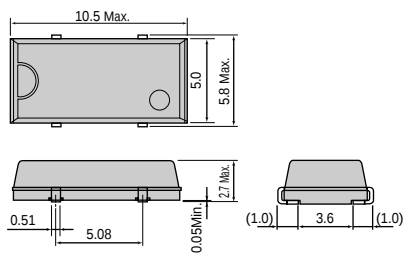
● DIP 14-pin (SG-51 series, SG-8002DB series)



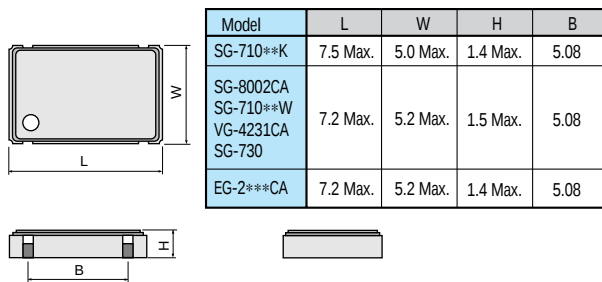
● DIP 8-pin (SG-531 series, SG-8002DC series, HG-8002DC series)



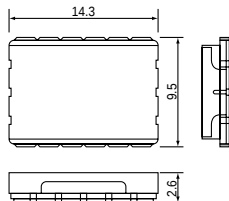
● SOJ 4-pin (SG-3032JC, SG-3030JC, SG-636 series, SG-8002JC series)



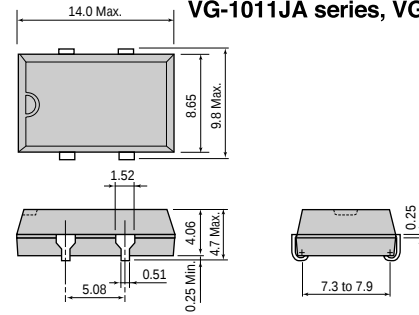
● SMD (SG-730 series, SG-710 series, SG-8002CA series, EG-2***CA, HG-2150CA, VG-1201CA/4231CA)



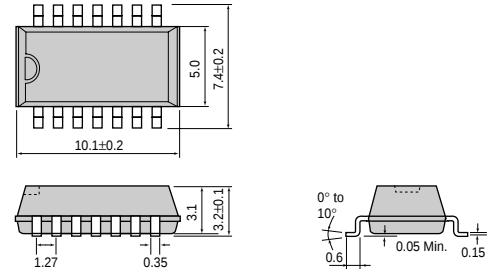
● EV-3101TA



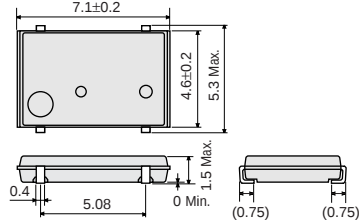
● SOJ 4-pin (SG-615 series, HG-1012JA/2012JA, SG-8002JA series, HG-8002JA series, VG-1011JA series, VG-4000 series)



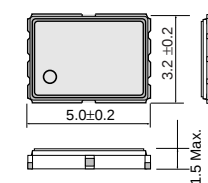
● SOP 14-pin (MG-7010, MG-5100SA)



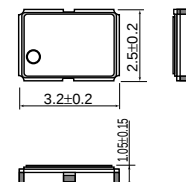
● SOJ 4-Pin (SG-645 series, SG-8002 JF, SG-3030JF)



● SMD (VG-2820CB, TG-28**CB)



● SMD (SG-8002CE)



32kHz CRYSTAL OSCILLATOR

SG-3030JC/JF

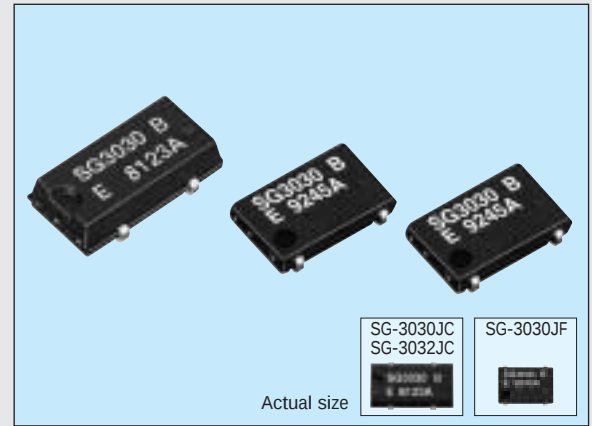
SG-3032JC

Product number (please refer to page 1)

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).



Actual size

Specifications (characteristics)

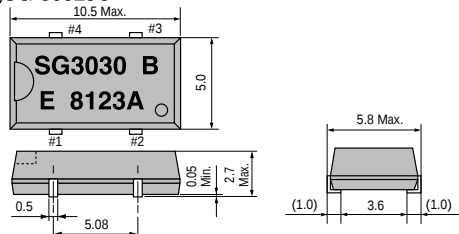
Item	Symbol	Specifications		Remarks
		SG-3030JC/JF	SG-3032JC	
Output frequency	f_0	32.768 kHz		
Power source voltage	Max. supply voltage	$V_{DD}-GND$	-0.3 V to +7.0 V	-0.3 V to +4.3 V
	Operating voltage	V_{DD}	1.5 V to 5.5 V	1.8 V to 3.6 V
	Interface power supply voltage	V_{IO}	1.5 V to 5.5 V	-
Temperature range	Storage temperature	T_{STG}	-55 °C to +125 °C	
	Operating temperature	T_{OPR}	-40 °C to +85 °C	-20 °C to +70 °C
Frequency tolerance	$\Delta f/f_0$	$5 \pm 23 \times 10^{-6}$		$V_{DD}=3.3 \text{ V}$ $T_a=+25 \text{ }^{\circ}\text{C}$
Frequency temperature characteristics	T_{OP}	$+10 \times 10^{-6} / -120 \times 10^{-6}$		-20 °C to +70 °C, taking $T_a=+25 \text{ }^{\circ}\text{C}$ as the reference
Frequency voltage characteristics	f/V	$\pm 2 \times 10^{-6} / \text{V Max.}$		$T_a=+25 \text{ }^{\circ}\text{C}$
Current consumption	I_{OP}	2 μA Max.	5 μA 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}	$V_{DD}-0.4 \text{ V Min.}$		$I_{OH}=-0.4 \text{ mA}$ (SG-3030JC/JF), -0.5 mA (SG-3032JC)
	V_{OL}	0.4 V Max.		$I_{OL}=+0.4 \text{ mA}$ (SG-3030JC/JF), +0.5 mA (SG-3032JC)
Output load condition (fan out)	C_L	15 pF Max.		CMOS load
Output rise time	t_{TLH}	200 ns Max.	100 ns Max.	CMOS load: 20 % $\rightarrow$ 80 % V_{DD}
Output fall time	t_{THL}	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	$\pm 5 \times 10^{-6} / \text{year Max.}$		$T_a=+25 \text{ }^{\circ}\text{C}$, $V_{DD}=3.3 \text{ V}$, first year
Shock resistance	S.R.	$\pm 5 \times 10^{-6} \text{ Max.}$		Three drops on a hard board from 750 mm or excitation test with 29400 $\text{m/s}^2 \times 0.3 \text{ ms} \times 1/2$ sine wave in 3 directions

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

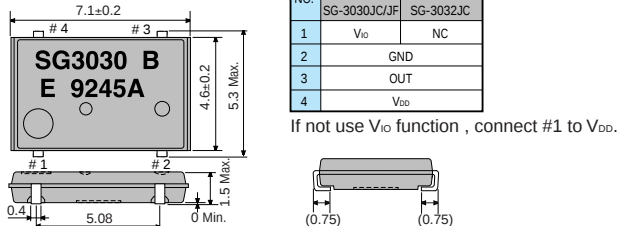
External dimensions

(Unit: mm)

SG-3030JC, SG-3032JC

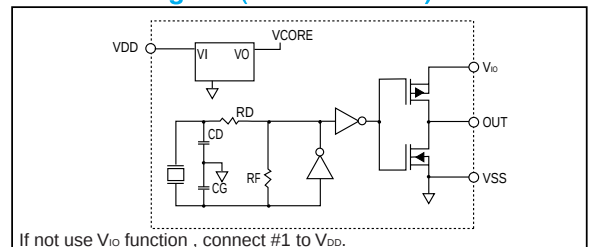


SG-3030JF



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

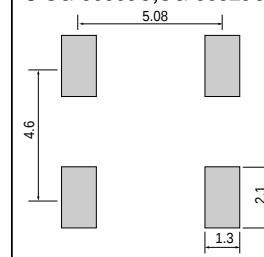
Block diagram (SG-3030JC/JF)

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

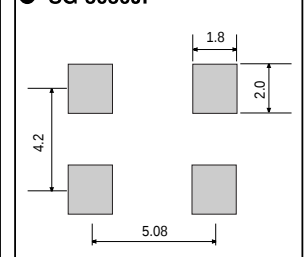
Recommended soldering pattern

(Unit: mm)

SG-3030JC, SG-3032JC



SG-3030JF



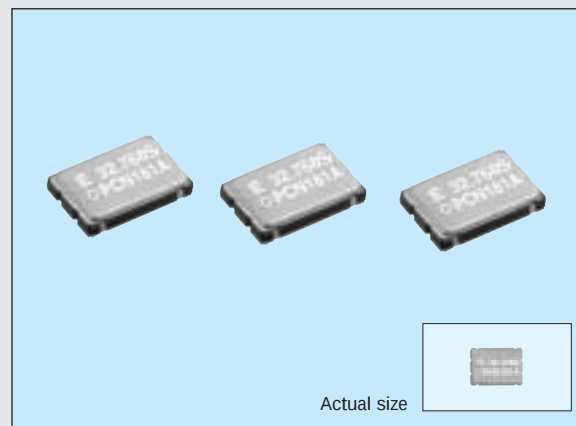
HIGH-STABILITY HIGH-FREQUENCY OSCILLATOR

SG-730 series

Products number (please refer to page 2)

Q33730xxxxxx00

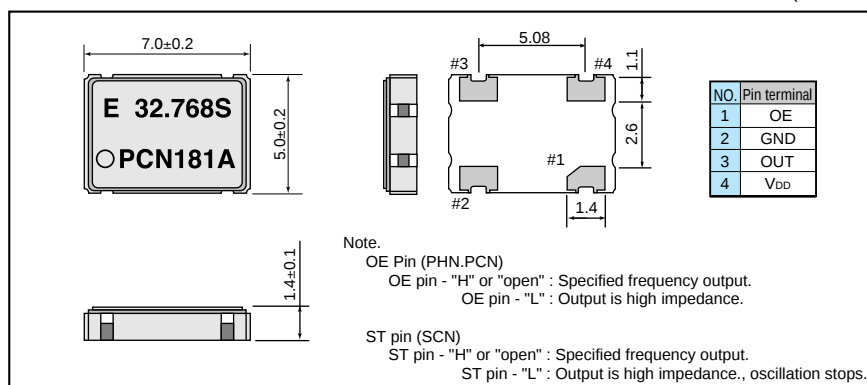
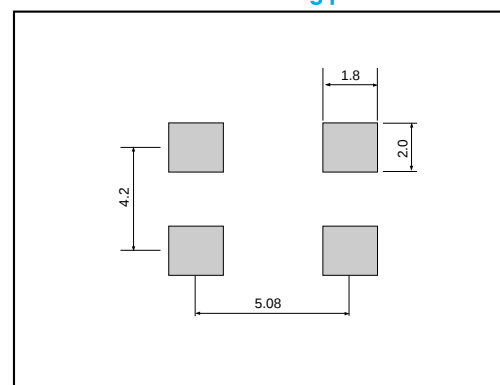
- Reflowable and high density mounting type SMD.
- Using C-MOS IC allows low current consumption.
- Operating supply voltage: 5.0 V(*H*), 3.3 V(*C*)
- Output enable function(OE) can be used for low current consumption applications.

**Specifications (characteristics)**

Item		Symbol	Specifications			Remarks
			PHN	PCN	SCN	
Output frequency range		f ₀	1.5000 MHz to 67.0000 MHz		67.0001 MHz to 80.0000 MHz	Refer to page 31. "Frequency range"
Power source voltage	Max. supply voltage	V _{DD} -GND	-0.5 V to +7.0 V			V _{DD} = GND
	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
	Operable temperature	T _{OPR}	-40 °C to +85 °C			Refer to page 31. "Frequency range"
Frequency stability		Δf/f ₀	S : ±25 × 10 ⁻⁶ Max. , B : ±50 × 10 ⁻⁶ Max. , C : ±100 × 10 ⁻⁶ Max.			-20 °C to +70 °C
			L : ±50 × 10 ⁻⁶ Max. , M : ±100 × 10 ⁻⁶ Max.			-40 °C to +85 °C
Current consumption		I _{OP}	12 mA Max.	7 mA Max.	-	f ₀ ≤ 32 MHz, No load
			30 mA Max.	12 mA Max.	-	f ₀ ≤ 40 MHz, No load
			40 mA Max.	15 mA Max.	-	f ₀ ≤ 50 MHz, No load
			50 mA Max.	20 mA Max.	-	f ₀ ≤ 67 MHz, No load
			-	-	35 mA Max.	f ₀ ≤ 80 MHz, No load
Output disable current		I _{OE}	5 mA Max.	4 mA Max.	-	f ₀ ≤ 32 MHz, OE=GND(PHN,PCN)
			25 mA Max.	10 mA Max.	-	f ₀ ≤ 40 MHz, OE=GND(PHN,PCN)
			30 mA Max.	10 mA Max.	-	f ₀ ≤ 50 MHz, OE=GND(PHN,PCN)
			40 mA Max.	10 mA Max.	-	f ₀ ≤ 67 MHz, OE=GND(PHN,PCN)
Standby current		I _{st}	-	-	15 μA Max.	ST=GND(SCN)
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} = -8 mA
Low output voltage		V _{OL}	0.4 V Max.			I _{OL} = 8 mA
Output load condition		C _L	15 pF Max.			
Output enable/ disable input voltage		V _{IH}	2.0 V Min.	2.0 V Min.	70 % V _{DD} Min.	OE terminal (PCN, PHN) ST terminal (SCN)
		V _{IL}	0.8 V Max.	0.5 V Max.	30 % V _{DD} Max.	
Output rise time		t _{TLH}	4 ns Max.			20 %→80 % V _{DD} level
Output fall time		t _{THL}	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 x 10 ⁻⁶ /year Max.			T _a =+25 °C, V _{DD} = 5.0 V / 3.3 V, 10 years

External dimensions

(Unit: mm)

**Recommended soldering pattern** (Unit: mm)

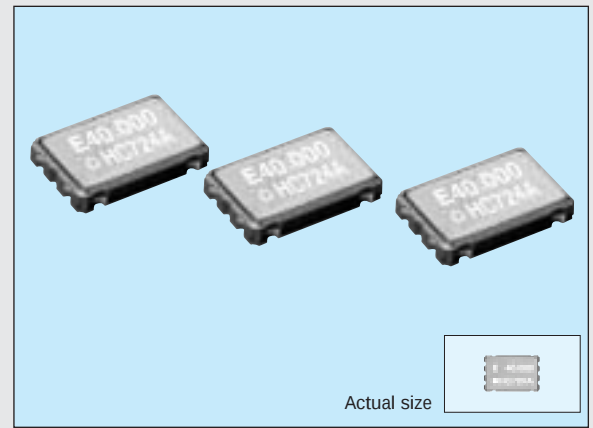
HIGH-FREQUENCY CRYSTAL OSCILLATOR

SG-710 series

Product number (please refer to page 1)

Q33710xxxxxx00

- Ceramic package with 1.5 mm thickness.
- Excellent environmental capability.
- Low current consumption due to use of C-MOS technology.
- Low current consumption by output enable function (OE) or standby function (ST).



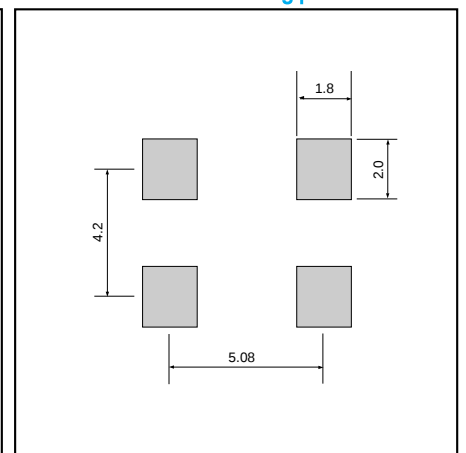
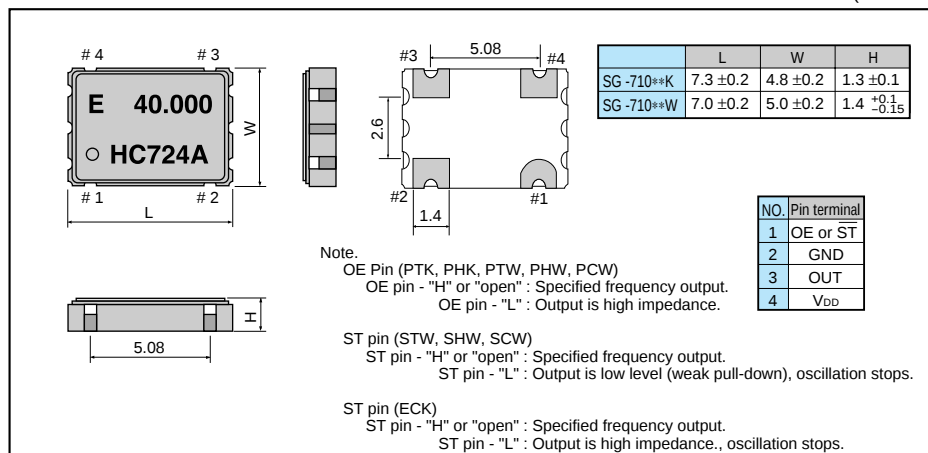
Specifications (characteristics)

Item	Symbol	Specifications			Remarks
		SG-710PTK	SG-710PHK	SG-710ECK	
Output frequency range	f_0	1.8000 MHz to 50.0000 MHz	1.8000 MHz to 80.0000 MHz	1.8000 MHz to 67.0000 MHz	Refer to page 31. "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 ± 0.5 V	3.3 V ± 0.3 V	
Temperature range	Storage temperature	T_{STG}	-55 °C to +125 °C		Stored as bare product after unpacking
	Operating temperature	T_{OPR}	-10 °C to +70 °C (-40 °C to +85 °C)		Refer to page 31. "Frequency range"
Frequency stability	$\Delta f/f_0$	B: $\pm 50 \times 10^{-6}$ C: $\pm 100 \times 10^{-6}$ M: $\pm 100 \times 10^{-6}$			B, C: -10 °C to +70 °C, M: -40 °C to +85 °C
Current consumption	I_{OP}	13 mA Max.	15 mA Max.	8 mA Max.	$F_0 \leq 25$ MHz, No load condition (ECK: $F_0 \leq 32$ MHz, No load condition)
		24 mA Max.	26 mA Max.	15 mA Max.	$F_0 \leq 50$ MHz, No load condition
		—	34 mA Max.	18 mA Max.	$F_0 \leq 67$ MHz, No load condition
		—	40 mA Max.	—	$F_0 \leq 80$ MHz, No load condition
Output disable current	I_{OE}	6 mA Max.	5 mA Max.	—	$F_0 \leq 25$ MHz, OE=GND(PTK, PHK)
		12 mA Max.	10 mA Max.	—	$F_0 \leq 50$ MHz, OE=GND(PTK, PHK)
		—	13 mA Max.	—	$F_0 \leq 67$ MHz, OE=GND(PTK, PHK)
		—	16 mA Max.	—	$F_0 \leq 80$ MHz, OE=GND(PTK, PHK)
Standby current	I_{ST}	—	—	10 μ A Max.	ST=GND(ECK)
Duty	tw/t	—	45 % to 55 %	40 % to 60 %	CMOS load: 1/2 V_{DD} level
		45 % to 55 %	40 % to 60 %	—	TTL load: 1.4 V level
High output voltage	V_{OH}	2.4 V Min.	$V_{DD} - 0.5$ V Min.	0.9 x V_{DD} Min.	$I_{OH} = -16$ mA(PTK, PHK), -2 mA(ECK)
Low output voltage	V_{OL}	0.4 V Max.	0.5 V Max.	0.1 x V_{DD} Max.	$I_{OL} = 16$ mA(PTK, PHK), 2 mA(ECK)
Output load condition (fan out)	TTL	N	10 TTL Max.	10 TTL Max.	—
	CMOS	C_L	(15 pF Max.)	50 pF Max.	15 pF Max.
Output enable/disable input voltage	V_{IH}	2.0 V Min.	2.0 V Min.	0.7 x V_{DD} Min.	OE terminal(PTK, PHK)
	V_{IL}	0.8 V Max.	0.8 V Max.	0.3 x V_{DD} Max.	ST terminal(ECK)
Output rise time	t_{LH}	—	5 ns Max.	6 ns Max.	CMOS load: 10 % $\rightarrow$ 90 % V_{DD}
		5 ns Max.	—	—	TTL load: 0.4 V $\rightarrow$ 2.4 V
Output fall time	t_{HL}	—	5 ns Max.	6 ns Max.	CMOS load: 90 % $\rightarrow$ 10 % V_{DD}
		5 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.	—	$\pm 10 \times 10^{-6}$ Max.	—	Three drops on a hard board from 750 mm or excitation test with 29400 m/s ² x 0.3 ms x 1/2sine wave in 3 directions

External dimensions

(Unit: mm)

Recommended soldering pattern (Unit: mm)



■ Specifications (characteristics)

Item		Symbol	Specifications			Remarks
			SG-710PTW/STW	SG-710PHW/SHW	SG-710PCW/SCW	
Output frequency range		f _o	80.0001 MHz to 135.0000 MHz		67.0001 MHz to 135.0000 MHz	Refer to page 31. "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 ±0.5 V		3.3 V ±0.3 V	
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	Refer to page 31. "Frequency range"
Frequency stability		Δf/f _o	B : ±50 × 10 ⁻⁶ C : ±100 × 10 ⁻⁶			-20 °C to +70 °C
					M : ±100 × 10 ⁻⁶	-40 °C to +80 °C
Current consumption		I _{OP}	45 mA Max.		28 mA Max.	No load condition (f _o = Max.)
Output disable current		I _{OE}	30 mA Max.		16 mA Max.	OE=GND(P*W)
Standby current		I _{ST}	50 μA Max.			ST=GND(S*W)
Duty	CMOS level	tw/t	—		40 % to 60 %	CMOS load: 1/2V _{DD}
	TTL level		40 % to 60 %	—		TTL load: 1.4 V
Output voltage		V _{OH}	V _{DD} -0.4 V Min.			I _{OH} = -16 mA (*TW/HW)/-8 mA(*CW)
		V _{OL}	0.4 V Max.			I _{OL} = 16 mA (*TW/HW)/8 mA(*CW)
Output load condition (fan out)		CL	15 pF	—	—	f _o ≤ 135 MHz
			5 TTL + 15 pF	—	—	f _o ≤ 90 MHz
			—	15 pF	15 pF	f _o ≤ 135 MHz
			—	25 pF	—	f _o ≤ 125 MHz
Output enable/disable input voltage		V _{IH}	2.0 V Min.		70 % V _{DD} Min.	OE, ST
		V _{IL}	0.8 V Max.		20 % V _{DD} Max.	OE, ST
Output rise time		t _{TLH}	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.
			—	3.0 ns Max.	3.0 ns Max.	CMOS load: 20 % V _{DD} →80 % V _{DD} , CL = Max.
Output fall time		t _{THL}	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.	3.0 ns Max.	CMOS load: 80 % V _{DD} →20 % V _{DD} , CL = Max.
Oscillation start up time		t _{OSC}	10 ms Max.			Time at minimum operating voltage to be 0 s
Aging		f _a	±5 × 10 ⁻⁶ /year Max.			T _a =+25 °C, V _{DD} =5.0 V / 3.0 V, First year
Shock resistance		S.R.	±20 × 10 ⁻⁶ Max.			Three drops on a hard board from 750 mm or excitation test with 29400 m/s ² × 0.3 ms × 1/2 sine wave in 3 directions

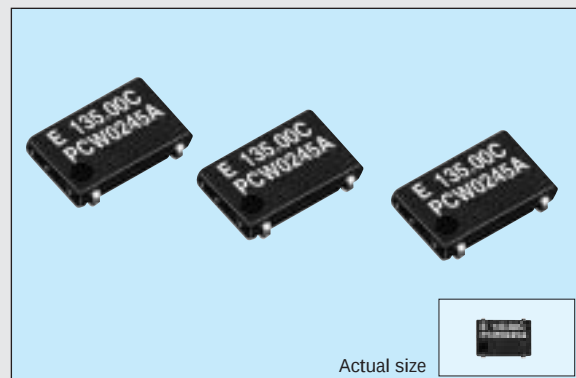
SOJ HIGH-FREQUENCY CRYSTAL OSCILLATOR

SG-645 series

Product number (Please refer to P1)

Q33645xxxxxx00

- Reflowable and high-density mounting-type SMD.
- Operable 3.3 V or 5.0 V.
- Output frequency from 2.5 MHz to 135 MHz.
- Output enable (OE:P type) or Standby (ST:S Type) function allow more low current consumption.



Actual size

■ Specifications (characteristics)

Item		Symbol	Specifications			Remarks
			SG-645PTG	SG-645PHG	SG-645PCG/SCG	
Output frequency range		f _o	2.5000 MHz to 33.0000 MHz			Refer to page 31. "Frequency range"
Power source voltage	Max. supply voltage	V _{DD} -GND	-0.5 V to +7.0 V			
	Operating voltage	V _{DD}	4.5 V to 5.5 V			2.7 V to 3.6 V
Temperature range	Storage temperature	T _{STG}	-55 °C to +125 °C			Stored as bare product after unpacking
	Operating temperature	T _{OPR}	-40 °C to +85 °C			Refer to page 31. "Frequency range"
Frequency stability		Δf/f ₀	B : ±50 x 10 ⁻⁶ C : ±100 x 10 ⁻⁶			-20 °C to +70 °C
			M : ±100 x 10 ⁻⁶			-40 °C to +85 °C
Current consumption		I _{OP}	25 mA Max.		12 mA Max.	No load condition
Output disable current		I _{OE}	20 mA Max.		10 mA Max.	OE=GND (P*G)
Standby current		I _{ST}	—		50 μA Max.	ST=GND (SCG)
Duty	CMOS level	tw/t	—	45 % to 55 %		50 % V _{DD} , CL = 25 pF
	TTL level		40 % to 60 %	—		1.4 V Level, CL = 25 pF
Output voltage		V _{OH}	2.4 V Min. —	— V _{DD} -0.4 V Min.	V _{DD} -0.4 V Min. —	I _{OH} = -8 mA I _{OH} = -16 mA
		V _{OL}	— 0.4 V Max.	0.4 V Max. —		I _{OL} = 8 mA I _{OL} = 16 mA
Output load condition (fan out)		CL	25 pF			
Output enable/disable input voltage	CMOS level	V _{IH}	2.0 V Min.		70 % V _{DD} Min.	OE,ST
	TTL level	V _{IL}	0.8 V Max.		20 % V _{DD} Max.	OE,ST
Output rise time	CMOS level	t _{TLH}	—	3.4 ns Max.	4.0 ns Max.	20 % to 80 % V _{DD} , CL ≤ 25 pF
	TTL level		1.2 ns Max. 2.4 ns Max.	— —	— —	0.8 V to 2.0 V CL ≤ 25 pF 0.4 V to 2.4 V CL ≤ 25 pF
Output fall time	CMOS level	t _{THL}	—	3.4 ns Max.	4.0 ns Max.	80 % to 20 % V _{DD} CL ≤ 25 pF
	TTL level		1.2 ns Max. 2.4 ns Max.	— —	— —	2.0 V to 0.8 V CL ≤ 25 pF 2.4 V to 0.4 V CL ≤ 25 pF
Oscillation start up time		t _{OSC}	12 ms Max.			Time at minimum operating voltage to be 0 s
Aging		fa	±5 x 10 ⁻⁶ Max.			Ta=+25 °C, VDD = 5.5 V / 3.3 V, First year
Shock resistance		S.R.	±20 x 10 ⁻⁶			Three drops on a hard board from 750 mm or excitation test with 29400 m/s ² x 0.3 ms x 1/2 sine wave in 3 directions

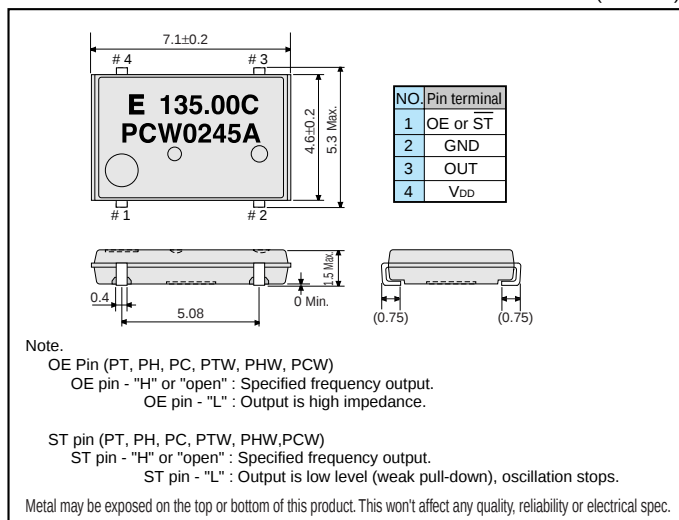
Note: • Unless otherwise stated, characteristics (specifications) shown in the above table are based on the rated operating temperature and voltage condition.
 • External by-pass capacitor is recommended.

■ Standard output frequency

2.5	3.375	3.75	5.0	6.75	7.5	10.0	13.5	15.0	20.0	27.0	30.0
2.8125	3.579545	3.84	5.625	7.15909	7.68	11.25	14.31818	15.36	22.5	28.63636	30.72
3.072	3.6864	4.0	6.144	7.3728	8.0	12.288	14.7456	16.0	24.576	29.4912	32.0
3.125	3.6873625	4.096	6.25	7.374725	8.192	12.5	14.74945	16.384	25.0	29.4989	32.768

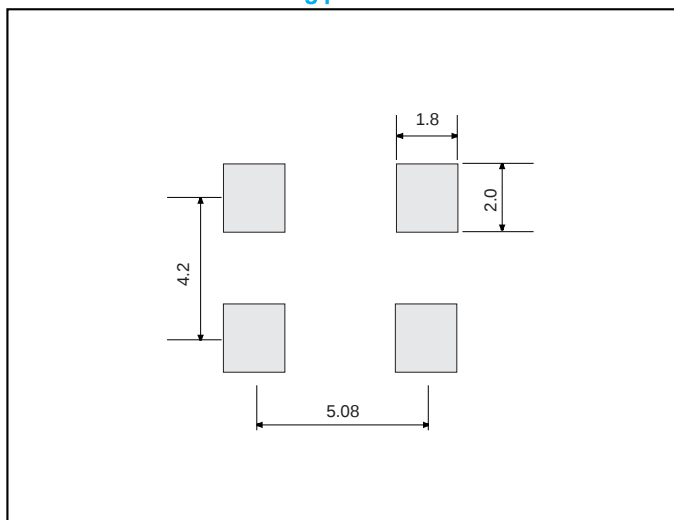
■ External dimensions

(Unit: mm)



■ Recommended soldering pattern

(Unit: mm)



■ Specifications (characteristics)

Item		Symbol	Specifications			Remarks
			SG-645PTW / STW	SG-645PHW / SHW	SG-645PCW / SCW	
Output frequency range		f _o	32.0001 MHz to 135.0000 MHz			Refer to page 31. "Frequency range"
Power source voltage	Max. supply voltage	V _{DD-GND}	-0.5 V to +7.0 V			
	Operating voltage	V _{DD}	4.5 V to 5.5 V		3.0 V to 3.6 V	
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	Refer to page 31. "Frequency range"
Frequency stability		Δf/f _o	B : ±50 x 10 ⁻⁶ C : ±100 x 10 ⁻⁶			-20 °C to +70 °C
			—		M : ±100 x 10 ⁻⁶	-40 °C to +85 °C
Current consumption		I _{OP}	45 mA Max.		28 mA Max.	No load condition (f _o = 135 MHz)
Output disable current		I _{OE}	30 mA Max.		16 mA Max.	OE=GND (P*W), f _o = 135 MHz
Standby Current		I _{ST}	50 μA Max.			ST=GND (S*W)
Duty		tw/t	—	40 % to 60 %	—	50 % V _{DD} , CL = Max.
			—	45 % to 55 %	—	50 % V _{DD} , CL = 25 pF (f _o ≤ 66.6667 MHz)
			40 % to 60 %	—	—	1.4 V, CL = Max.
			45 % to 55 %	—	—	1.4 V, 5TTL +15 pF (f _o ≤ 66.6667 MHz)
Output voltage		V _{OH} V _{OL}	V _{DD} -0.4 V		V _{DD} -0.4 V	I _{OH} = -16 mA(*TW / *HW) I _{OH} = -8 mA(*CW)
			0.4 V		0.4 V	I _{OL} = 16 mA(*TW / *HW) I _{OL} = 8 mA(*CW)
Output load condition (fan out)		CL	15 pF	—	—	(f _o ≤ 135 MHz)
			5 TTL + 15 pF	—	—	(f _o ≤ 90 MHz)
			25 pF	—	—	(f _o ≤ 66.6667 MHz)
			—	15 pF	—	(f _o ≤ 135 MHz)
			—	25 pF	—	(f _o ≤ 90 MHz)
			—	50 pF	—	(f _o ≤ 50 MHz)
Output enable disable input voltage		V _{IH} V _{IL}	2.0 V Max.		70 % V _{DD}	OE or ST
			0.8 V Max.		20 % V _{DD}	
Output rise time	CMOS level	t _{TLH}	—	4.0 ns	3.0 ns	20 % to 80 % V _{DD} CL = Max.
			—	3.0 ns	—	20 % to 80 % V _{DD} CL ≤ 25 pF
	TTL level		2.0 ns	—	—	0.8 V to 2.0 V CL = Max.
Output fall time	CMOS level	t _{THL}	4.0 ns	—	—	0.4 V to 2.4 V CL = Max.
			—	4.0 ns	3.0 ns	80 % to 20 % V _{DD} CL = Max.
	—		3.0 ns	—	80 % to 20 % V _{DD} CL ≤ 25 pF	
	TTL level		2.0 ns	—	—	2.0 V to 0.8 V CL = Max.
Oscillation start up time		t _{OSC}	10 ms Max.			2.4 V to 0.4 V CL = Max.
Aging		f _a	±5 x 10 ⁻⁶ / year Max.			Ta = +25 °C, VDD = 5.0 V / 3.3 V, First year
Shock resistance		S.R.	±20 x 10 ⁻⁶ Max.			Three drops on a hard board from 750 mm or excitation test with 29400 m/s2 x 0.3 ms x 1/2 sine wave in 3 directions

Three drops on a hard board from 750 mm or excitation test with 29400 m/s² x 0.3 ms x 1/2 sine wave in 3 directions

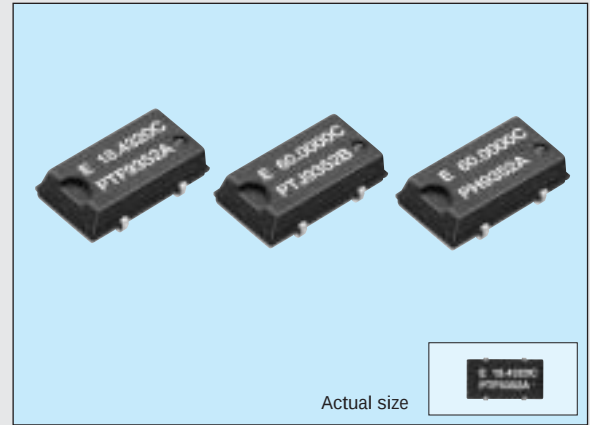
HIGH-FREQUENCY CRYSTAL OSCILLATOR

SG-636 series

Product number (please refer to page 1)

Q33636xxxxxx00

- A small SMD that enables high-density mounting.
- A general-purpose device with builtin heat-resisting cylindrical AT-cut crystal and allowing almost the same temperature condition for soldering as SMD IC.
- Low current consumption by output enable function(OE) or standby function(ST).



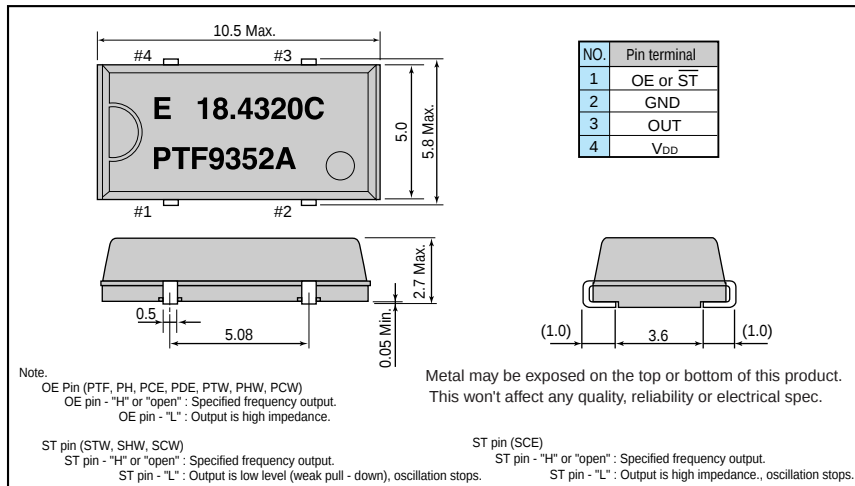
Specifications (characteristics)

Item		Symbol	Specifications				Remarks
			SG-636PTF	SG-636PH	SG-636SCE/PCE	SG-636PDE	
Output frequency range		f ₀	2.21675 MHz to 41.0000 MHz	41.0001 MHz to 70.0000 MHz	2.21675 MHz to 40.0000 MHz	2.21675MHz to 40.0000MHz	Refer to page 31. "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 ±0.5 V		3.3 V ±0.3 V	2.5 V ±0.25 V	
Temperature range	Storage temperature	T _{STG}	-55 °C to +100 °C				Stored as bare product after unpacking
	Operating temperature	T _{OPR}	-20 °C to +70 °C				Refer to page 31. "Frequency range"
Frequency stability		Δf/f ₀	C: ±100 x 10 ⁻⁶				
Current consumption		I _{OP}	17 mA Max.	35 mA Max.	9 mA Max.	5 mA Max.	No load condition
Output disable current		I _{OE}	10 mA Max.	20 mA Max.	5 mA Max.	3 mA Max.	OE=GND, $\overline{ST}$ =GND 2 μA Max.(SCE)
Duty	CMOS level	t _w /t	40 % to 60 %		45 % to 55 %		CMOS load: 1/2 V _{DD} level
	TTL level		45 % to 55 %		—		TTL load: 1.4 V level
Output voltage		V _{OH}	V _{DD} -0.4 V Min.				I _{OH} =8 mA (PTF) /-4 mA (PH / SCE / PCE / PDE)
		V _{OL}	0.4 V Max.				I _{OL} =16 mA (PTF) /4 mA (PH / SCE / PCE / PDE)
Output load condition (fan out)	CMOS level	C _L	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 _L ≤15 pF
Output enable/disable input voltage		V _{IH}	2.0 V Min.		0.8 V _{DD} Min.		OE, $\overline{ST}$ (SCE)
		V _{IL}	0.8 V Max.		0.2 V _{DD} Max.		
Output rise time	CMOS level	t _{TLH}	7 ns Max.		5 ns Max.		CMOS load: 20 %→80 % V _{DD}
	TTL level		5 ns Max.		—		TTL load: 0.4 V→2.4 V
Output fall time	CMOS level	t _{THL}	7 ns Max.		5 ns Max.		CMOS load: 80 %→20 % V _{DD}
	TTL level		5 ns Max.		—		TTL load: 2.4 V→0.4 V
Oscillation start up time		t _{OSC}	4 ms Max.	10 ms Max.	4 ms Max.		Time at minimum operating voltage to be 0 s
Aging		f _a	±5 x 10 ⁻⁶ /year Max.				T _a =+25 °C, V _{DD} =5.0 V / 3.3 V / 2.5 V, first year
Shock resistance		S.R.	±20 x 10 ⁻⁶ Max.				Three drops on a hard board from 750 mm or excitation test with 29400 m/s ² x 0.3 ms x 1/2 sine 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.

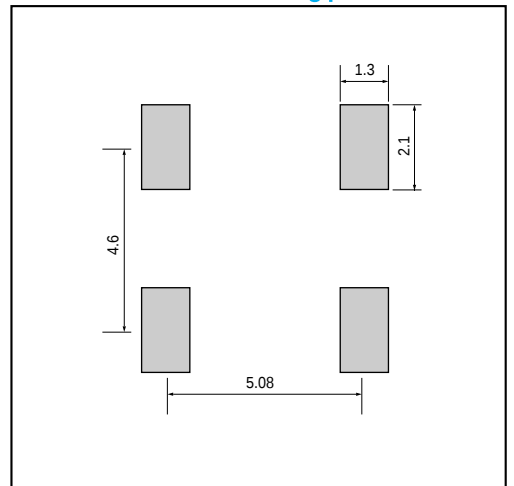
External dimensions

(Unit: mm)



Recommended soldering pattern

(Unit: mm)



■ Specifications (characteristics)

Item		Symbol	Specifications			Remarks
			SG-636PTG	SG-636PHG	SG-636PCG/SCG	
Output frequency range		f_o	2.21675 MHz to 33.0000 MHz			Refer to page 31. "Frequency range"
Power source voltage	Max. supply voltage	V_{DD-GND}	-0.5 V to +7.0 V			
	Operating voltage	V_{DD}	4.5 V to 5.5 V			2.7 V to 3.6 V
Temperature range	Storage temperature	T_{STG}	-55 °C to +100 °C			Stored as bare product after unpacking
	Operating temperature	T_{OPR}	-20 °C to +70 °C			Refer to page 31. "Frequency range"
Frequency stability		$\Delta f/f_o$	B : $\pm 50 \times 10^{-6}$ C : $\pm 100 \times 10^{-6}$			-20 °C to +70 °C
Current consumption		I_{OP}	25 mA Max.			12 mA Max.
Output disable current		I_{OE}	20 mA Max.			10 mA Max.
Standby current		I_{ST}	—			50 μ A Max.
Duty	CMOS level	tw/t	—	45 % to 55 %		50 % V_{DD} , CL = 25 pF
	TTL level		40 % to 60 %	—		1.4 V Level, CL = 25 pF
Output voltage		V_{OH}	2.4 V Min.	—	$V_{DD} - 0.4$ V Min.	$I_{OH} = -8$ mA
		V_{OL}	—	$V_{DD} - 0.4$ V Max.	—	$I_{OH} = -16$ mA
			0.4 V Max.	0.4 V Max.	—	$I_{OL} = 8$ mA
			—	—	—	$I_{OL} = 16$ mA
Output load condition (fan out)		CL	25 pF			
Output enable disable input voltage	CMOS level	V_{IH}	2.0 V Min.			70 % V_{DD} Min.
	TTL level	V_{IL}	0.8 V Max.			20 % V_{DD} Max.
Output rise time	CMOS level	t_{TLH}	—	3.4 ns Max.	4.0 ns Max.	20 % to 80 % V_{DD} , CL $\leq$ 25 pF
	TTL level		1.2 ns Max.	—	—	0.8 V to 2.0 V CL $\leq$ 25 pF
Output fall time	CMOS level	t_{THL}	—	3.4 ns Max.	4.0 ns Max.	80 % to 20 % V_{DD} CL $\leq$ 25 pF
	TTL level		1.2 ns Max.	—	—	2.0 V to 0.8 V CL $\leq$ 25 pF
Oscillation start up time		t_{OSC}	12 ms Max.			Time at minimum operating voltage to be 0 s
Aging		fa	$\pm 5 \times 10^{-6}$ /year Max.			Ta=+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 ² x 0.3 ms x 1/2 sine wave in 3 directions

■ Specifications (characteristics)

Item		Symbol	Specifications			Remarks
			SG-636PTW/STW	SG-636PHW/SHW	SG-636PCW/SCW	
Output frequency range		f _o	32.0001 MHz to 135.0000 MHz			Refer to page 31. "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 ± 0.5 V		3.3 V ± 0.3 V	
Temperature range	Storage temperature	T _{STG}	-55 °C to +100 °C			Stored as bare product after unpacking
	Operating temperature	T _{OPR}	-20 °C to +70 °C			Refer to page 31. "Frequency range"
Frequency stability		Δf/f ₀	B : ±50 x 10 ⁻⁶ C : ±100 x 10 ⁻⁶			
Current consumption		I _{OP}	45 mA Max.		28 mA Max.	No load condition
Output disable current		I _{OE}	30 mA Max.		16 mA Max.	OE=GND(P*W)
Standby current		I _{ST}	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, f _o ≤ 66.6667 MHz	
		—	40 % to 60 %	40 % to 60 %	CMOS load : 50% V _{DD} , CL = Max.	
		—	45 % to 55%	—	CMOS load : 50% V _{DD} , CL = 25 pF, f _o ≤ 66.6667 MHz	
Output voltage	V _{OH}	V _{DD} -0.4 V Min.			I _{OH} = -16 mA (*TW/HW)/-8 mA(*CW)	
	V _{OL}	0.4 V Max.			I _{OL} = 16 mA (*TW/HW)/8 mA(*CW)	
Output load condition (fan out)	CL	15 pF	—	—	f _o ≤ 135 MHz	
		5 TTL + 15 pF	—	—	f _o ≤ 90 MHz	
		25 pF	—	—	f _o ≤ 66.6667 MHz	
		—	15 pF	15 pF	f _o ≤ 135 MHz	
		—	25 pF	—	f _o ≤ 90 MHz	
		—	50 pF	—	f _o ≤ 66.6667MHz	
Output enable disable input voltage	V _{IH}	2.0 V Min.			70 % V _{DD} Min.	OE,ST
	V _{IL}	0.8 V Max.			20 % V _{DD} Max.	OE,ST
Output rise time	t _{TLH}	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.	
		—	3.0 ns Max.	—	CMOS load: 20 %→80 % V _{DD} , CL= 25 pF	
		—	4.0 ns Max.	—	CMOS load: 20 %→80 % V _{DD} , CL= 50 pF	
Output fall time	t _{THL}	—	—	3.0 ns Max.	CMOS load: 20 %→80 % V _{DD} , CL= 15 pF	
		2.0 ns Max.	—	—	TTL load: 2.0 V→0.8 V, CL = Max.	
		4.0 ns Max.	—	—	TTL load: 2.4 V→0.4V, CL = Max.	
		—	3.0 ns Max.	—	CMOS load: 80 %→20 % V _{DD} , CL= 25 pF	
		—	4.0 ns Max.	—	CMOS load: 80 %→20 % V _{DD} , CL= 50 pF	
Oscillation start up time	t _{OSC}	10 ms Max.			Time at minimum operating voltage to be 0 s	
Aging		fa	±5 x 10 ⁻⁶ /year Max.		Ta=+25 °C, VDD =5.0 V / 3.3 V, first year	
Shock resistance		S.R.	±20 x 10 ⁻⁶ Max.		Three drops on a hard board from 750 mm or excitation test with 29400 m/s2 x 0.3 ms x 1/2 sine wave in 3 directions	

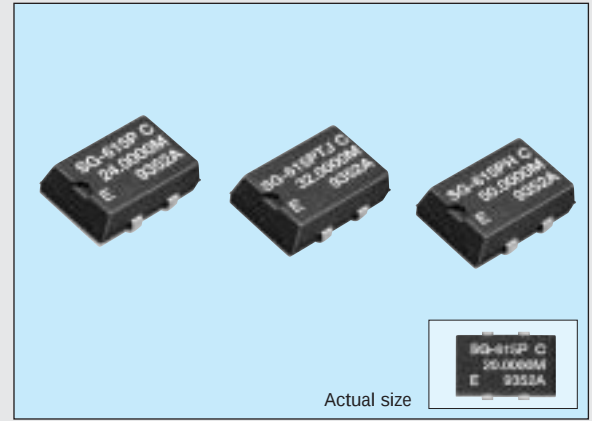
SOJ HIGH-FREQUENCY CRYSTAL OSCILLATOR

SG-615 series

Product number (Please refer to P1)

Q33615xxxxxx00

- High-density mounting-type SMD.
- A general-purpose SMD with heat-resisting cylindrical AT-cut crystal unit and allowing almost the same soldering temperature as SMD IC.
- Cylindrical AT crystal unit builtin, thus assuring high reliability.
- Low current consumption by output enable function(OE) or standby function(ST).



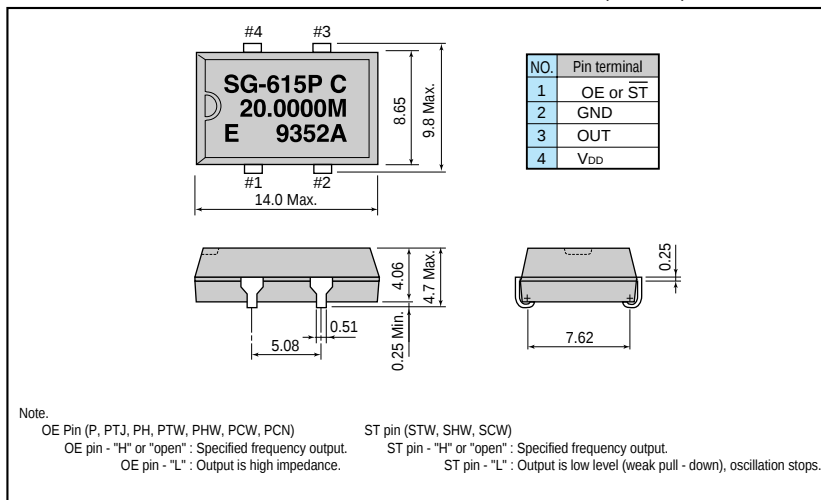
Specifications (characteristics)

Item	Symbol	Specifications			Remarks
		SG-615P	SG-615PTJ	SG-615PH	
Output frequency range	f_0	1.0250 MHz to 26.0000 MHz	26.0001 MHz to 66.6667 MHz		Refer to page 31. "Frequency range"
Power source voltage	Max. supply voltage	V_{DD-GND}	-0.3 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		Stored as bare product after unpacking
	Operating temperature	T_{OPR}	-20 °C to +70 °C (-40 °C to +85 °C)		Refer to page 31. "Frequency range"
Frequency stability	$\Delta f/f_0$		B: $\pm 50 \times 10^{-6}$ C: $\pm 100 \times 10^{-6}$		B type is possible up to 55 MHz
Current consumption	I_{OP}	23 mA Max.	35 mA Max.		No load condition
Output disable current	I_{OE}	12 mA Max.	28 mA Max.	20 mA Max.	OE=GND
Duty	t_w/t	40 % to 60 %	—	40 % to 60 %	CMOS load: $1/2V_{DD}$
		45 % to 55 %	—	—	TTL load: 1.4 V
Output voltage	V_{OH}	$V_{DD} - 0.4$ V Min.	2.4 V Min.	$V_{DD} - 0.4$ V Min.	$I_{OH} = -400 \mu A$ (P,PTJ) / -4 mA (PH)
	V_{OL}	—	0.4 V Max.	—	$I_{OL} = 16$ mA (P) / 8mA (PTJ) / 4 mA (PH)
Output load condition (fan out)	C_L	50 pF Max.	—	50 pF Max.	
	N	10 TTL Max.	5 TTL Max.	—	$C_L \leq 15$ pF
Output enable/disable input voltage	V_{IH}	2.0 V Min.	3.5 V Min.	2.0 V Min.	$I_{IH} = 1 \mu A$ Max. (OE= V_{DD})
	V_{IL}	0.8 V Max.	1.5 V Max.	0.8 V Max.	$I_{IL} = -100 \mu A$ Min. (OE=GND), PTJ: $I_{IL} = -500 \mu A$ Min. (OE=GND)
Output rise time	t_{TLH}	8 ns Max.	—	7 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_{THL}	8 ns Max.	—	7 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.	10 ms Max.		Time at 4.5 V to be 0 s
Aging	fa		$\pm 5 \times 10^{-6}$ /year Max.		Ta= +25 °C, $V_{DD} = 5$ 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 ² x 0.3 ms x 1/2sine wave in 3 directions

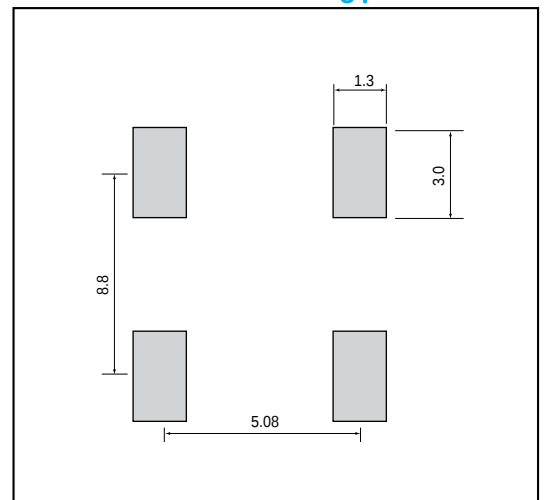
Note: • Unless otherwise stated, characteristics (specifications) shown in the above table are based on the rated operating temperature and voltage condition.
• External by-pass capacitor is recommended.

External dimensions

(Unit: mm)



Recommended soldering pattern (Unit: mm)



■ Specifications (characteristics)

Item		Symbol	Specifications			Remarks
			SG-615PCG	SG-615SCG	SG-615PCN	
Output frequency range		f_o	1.5000 MHz to 26.0000 MHz			Refer to page 31. "Frequency range"
Power source voltage	Max. supply voltage	V_{DD-GND}	-0.5 V to +7.0 V			
	Operating voltage	V_{DD}	2.7 V to 3.6 V			
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			Refer to page 31. "Frequency range"
Frequency stability		$\Delta f/f_o$	B : $\pm 50 \times 10^{-6}$ C : $\pm 100 \times 10^{-6}$			-20 °C to +70 °C
			M : $\pm 100 \times 10^{-6}$			-40 °C to +85 °C
Current consumption		I_{OP}	12 mA Max.			No load condition
Output disable current		I_{OE}	10 mA Max.	—	15 mA Max.	OE=GND (PCG/PCN)
Standby current		I_{ST}	—	50 μ A Max.	—	ST=GND (SCG)
Duty		tw/t	45 % to 55 %			50 % V_{DD} , CL = Max.
Output voltage		V_{OH}	V_{DD} -0.4 V Min.			I_{OH} = -8 mA
		V_{OL}	0.4 V Max.			I_{OL} = 8 mA
Output load condition (fan out)		CL	25 pF			
			15 pF			
Output enable disable input voltage	V_{IH}		70 % V_{DD} Min.			OE, ST
	V_{IL}		20 % V_{DD} Max.			OE, ST
Output rise time		t_{TLH}	4.0 ns Max.			20 % to 80 % V_{DD} , CL $\leq$ Max.
Output fall time		t_{THL}	4.0 ns Max.			80 % to 20 % V_{DD} CL $\leq$ Max.
Oscillation start up time		t_{OSC}	12 ms Max.			Time at minimum operating voltage to be 0 s
Aging		fa	$\pm 5 \times 10^{-6}$ / year Max.			Ta=+25 °C, V_{DD} =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 ² x 0.3 ms x 1/2 sine wave in 3 directions

■ Specifications (characteristics)

Item		Symbol	Specifications			Remarks
			SG-615PTW/STW	SG-615PHW/SHW	SG-615PCW/SCW	
Output frequency range		f _o	55.0001 MHz to 135.0000 MHz		26.0001 MHz to 135.0000 MHz	Refer to page 31. "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 ± 0.5 V		3.3 V ± 0.3 V	Stored as bare product after unpacking
Temperature range	Storage temperature	T _{STG}	-55 °C to +100 °C			Refer to page 31. "Frequency range"
	Operating temperature	T _{OPR}	-20 °C to +70 °C		-40 °C to +85 °C	
Frequency stability		Δf/f _o	B : ±50 x 10 ⁻⁶ °C : ±100 x 10 ⁻⁶			-20 °C to +70 °C
			—		M : ±100 x 10 ⁻⁶	-40 °C to +80 °C
Current consumption		I _{OP}	45 mA Max.		28 mA Max.	No load condition
Output disable current		I _{OE}	30 mA Max.		16 mA Max.	OE=GND(P*W)
Standby current		I _{ST}	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, f _o ≤ 66.6667 MHz
		—	40 % to 60 %	40 % to 60 %	CMOS load : 50% V _{DD} , CL = Max.	
		—	45 % to 55%	—	CMOS load : 50% V _{DD} , CL = 25 pF, f _o ≤ 66.6667 MHz	
Output voltage	V _{OH}	V _{DD} -0.4 V Min.			I _{OH} = -16 mA (*TW/*HW)/-8 mA(*CW)	
	V _{OL}	0.4 V Max.			I _{OL} = 16 mA (*TW/*HW)/8 mA(*CW)	
Output load condition (fan out)	CL	15 pF	—		—	f _o ≤ 135 MHz
		5 TTL + 15 pF	—		—	f _o ≤ 90 MHz
		25 pF	—		—	f _o ≤ 66.6667 MHz
		—	15 pF	15 pF	f _o ≤ 135 MHz	
		—	25 pF	—	f _o ≤ 125 MHz	
		—	50 pF	—	f _o ≤ 66.6667MHz	
Output enable disable input voltage	V _{IH}	2.0 V Min.		0.7 V _{DD} Min.	OE,ST	
	V _{IL}	0.8 V Max.		0.2 V _{DD} Max.	OE,ST	
Output rise time	t _{TLH}	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.
		—	3.0 ns Max.	—	CMOS load: 20 %→80 % V _{DD} , CL= 25 pF	
		—	—	3.0 ns Max.	CMOS load: 20 %→80 % V _{DD} , CL= 15 pF	
Output fall time	t _{THL}	—	4.0ns Max.	4.0ns Max.	CMOS load: 20 %→80 % V _{DD} , CL= Max.	
		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 % V _{DD} , CL= 25 pF	
Oscillation start up time	t _{OSC}	—	—		3.0 ns Max.	CMOS load: 80 %→20 % V _{DD} , CL= 15 pF
		—	—		4.0ns Max.	CMOS load: 80 %→20 % V _{DD} , CL= Max.
		—	—		4.0ns Max.	CMOS load: 80 %→20 % V _{DD} , CL= Max.
Aging		t _{OSC}	10 ms Max.			Time at minimum operating voltage to be 0 s
Shock resistance		fa	±5 x 10 ⁻⁶ /year Max.			Ta=+25 °C, VDD =5.0 V / 3.3 V, First year
Shock resistance		S.R.	±20 x 10 ⁻⁶ Max.			Three drops on a hard board from 750 mm or excitation test with 29400 m/s ² x 0.3 ms x 1/2 sine wave in 3 directions

FULL-SIZE DIP HIGH-FREQUENCY CRYSTAL OSCILLATOR

SG-51 series

HALF-SIZE DIP HIGH-FREQUENCY CRYSTAL OSCILLATOR

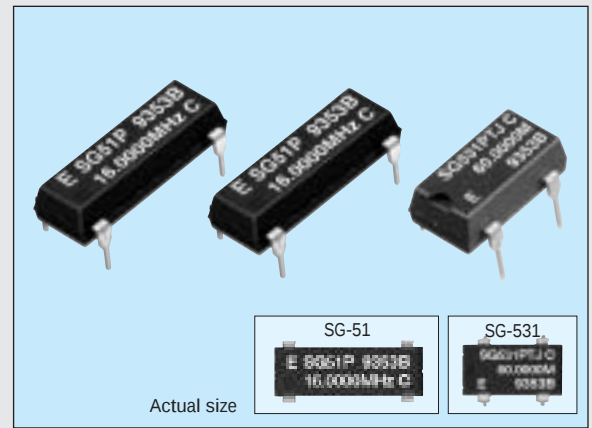
SG-531 series

Product number (please refer to page 1)

Q32510xxxxxx00

Q32531xxxxxx00

- Pin compatible with full-size metal can. (SG-51 series)
- Pin compatible with half-size metal can. (SG-531 series)
- Cylindrical AT-cut crystal unit builtin, thus assuring high reliability.
- Use of CMOS IC enables reduction of current consumption.



Specifications (characteristics)

Item	Symbol	Specifications			Remarks
		SG-51P/531P	SG-51PTJ/531PTJ	SG-51PH/531PH	
Output frequency range	f_o	1.0250 MHz to 26.0000 MHz	26.0001 MHz to 66.6667 MHz		Refer to page 31. "Frequency range"
Power source voltage	Max. supply voltage	$V_{DD}-GND$	-0.3 V to +7.0 V	-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		Stored as bare product after unpacking
	Operating temperature	T_{OPR}	-20 °C to +70 °C (-40 °C to +85 °C)		Refer to page 31. "Frequency range"
Frequency stability	$\Delta f/f_o$		B: $\pm 50 \times 10^{-6}$ C: $\pm 100 \times 10^{-6}$		B type is possible up to 55.0 MHz
Current consumption	I_{OP}	23 mA Max.	35 mA Max.		No load condition
Output disable current	I_{OE}	12 mA Max.	28 mA Max.	20 mA Max.	OE=GND
Duty	CMOS level	$t_{W/t}$	40 % to 60 %	40 % to 60 %	1/2 V_{DD} level
	TTL level		45 % to 55 %	—	1.4 V level
Output voltage	V_{OH}	$V_{DD}-0.4$ V Min.	2.4 V Min.	$V_{DD}-0.4$ V Min.	$I_{OH} = -400 \mu A$ (P,PTJ) / -4 mA (PH)
	V_{OL}		0.4 V Max.		$I_{OL} = 16$ mA (P) / 8 mA (PTJ) / 4mA (PH)
Output load condition (fan out)	CMOS	C_L	50 pF Max.	50 pF Max.	
	TTL	N	10 TTL Max.	5 TTL Max.	$C_L \leq 15$ pF
Output enable/disable input voltage	V_{IH}	2.0 V Min.	3.5 V Min.	2.0 V Min.	$I_{IH} = 1 \mu A$ Max. (OE= V_{DD})
	V_{IL}	0.8 V Max.	1.5 V Max.	0.8 V Max.	$I_{IL} = -100 \mu A$ Min. (OE=GND), PTJ: $I_{IL} = -500 \mu A$ Min. (OE=GND)
Output rise time	CMOS level	t_{TLH}	8 ns Max.	7 ns Max.	CMOS load: 20 % $\rightarrow$ 80 % V_{DD}
	TTL level		5 ns Max.	—	TTL load: 0.4 V $\rightarrow$ 2.4 V
Output fall time	CMOS level	t_{THL}	8 ns Max.	7 ns Max.	CMOS load: 80 % $\rightarrow$ 20 % V_{DD}
	TTL level		5 ns Max.	—	TTL load: 2.4 V $\rightarrow$ 0.4 V
Oscillation start up time	t_{OSC}	4 ms Max.	10 ms Max.		More than for 1 ms until $V_{DD} = 0$ V $\rightarrow$ 4.5 V Time at 4.5 V to be 0 s
Aging	f_a		$\pm 5 \times 10^{-6}$ /year Max.		$T_a = +25$ °C, $V_{DD} = 5$ 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 ² x 0.3 ms x 1/2 sine wave in 3 directions

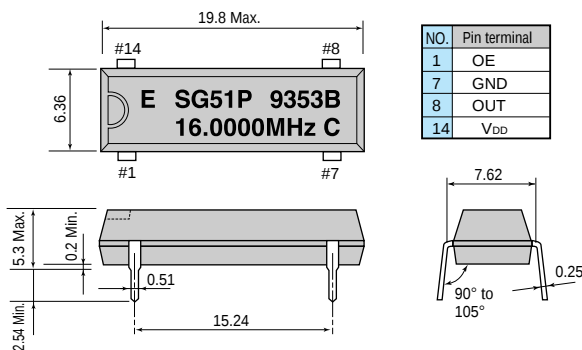
Note: • Unless otherwise stated, characteristics (specifications) shown in the above table are based on the rated operating temperature and voltage condition.

- External by-pass capacitor is recommended.

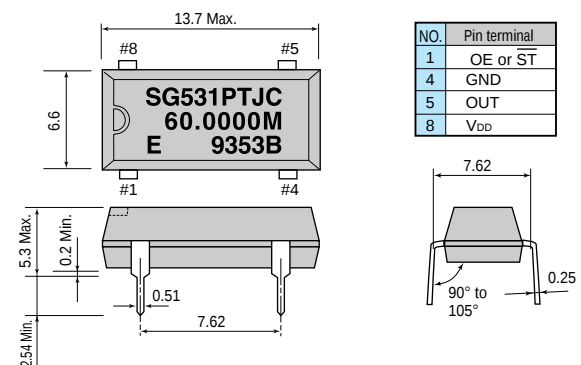
External dimensions

(Unit: mm)

SG-51 series



SG-531 series



Note.

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

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

■ Specifications (characteristics)

Item		Symbol	Specifications		Remarks
			SG-531PCG	SG-531SCG	
Output frequency range		f_o	1.5000 MHz to 26.0000 MHz		Refer to page 31. "Frequency range"
Power source voltage	Max. supply voltage	V_{DD-GND}	-0.5 V to +7.0 V		
	Operating voltage	V_{DD}	2.7 V to 3.6 V		
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		Refer to page 31. "Frequency range"
Frequency stability		$\Delta f/f_o$	B : $\pm 50 \times 10^{-6}$ C : $\pm 100 \times 10^{-6}$		-20 °C to +70 °C
			M : $\pm 100 \times 10^{-6}$		-40 °C to +85 °C
Current consumption		I_{OP}	12 mA Max.		No load condition
Output disable current		I_{OE}	10 mA Max.	—	OE=GND (PCG)
Standby current		I_{ST}	—	50 μ A Max.	ST=GND (SCG)
Duty		tw/t	45 % to 55 %		50 % V_{DD} , CL = 25 pF
Output voltage	V_{OH}		V_{DD} -0.4 V Min.		I_{OH} = -8 mA
	V_{OL}		0.4 V Max.		I_{OL} = 8 mA
Output load condition (fan out)		CL	25 pF		
Output enable disable input voltage	V_{IH}		70 % V_{DD} Min.		OE, $\overline{ST}$
	V_{IL}		20 % V_{DD} Max.		OE, $\overline{ST}$
Output rise time		t_{TLH}	4.0 ns Max.		20 % to 80 % V_{DD} , CL $\leq$ 25 pF
Output fall time		t_{THL}	4.0 ns Max.		80 % to 20 % V_{DD} CL $\leq$ 25 pF
Oscillation start up time		t_{OSC}	12 ms Max.		Time at minimum operating voltage to be 0 s
Aging		fa	$\pm 5 \times 10^{-6}$ / year Max.		Ta=+25 °C, V_{DD} =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 ² x 0.3 ms x 1/2 sine wave in 3 directions

■ Specifications (characteristics)

Item		Symbol	Specifications			Remarks
			SG-531PTW/STW	SG-531PHW/SHW	SG-531PCW/SCW	
Output frequency range		f _o	55.0001 MHz to 135.0000 MHz		26.0001 MHz to 135.0000 MHz	Refer to page 31. "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 ± 0.5 V		3.3 V ± 0.3 V	
Temperature range	Storage temperature	T _{STG}	-55 °C to +100 °C			Stored as bare product after unpacking
	Operating temperature	T _{OPR}	-20 °C to +70 °C		-40 °C to +85 °C	Refer to page 31. "Frequency range"
Frequency stability		Δf/f _o	B : ±50 x 10 ⁻⁶ C : ±100 x 10 ⁻⁶			-20 °C to +70 °C
			—		M : ±100 x 10 ⁻⁶	-40 °C to +80 °C
Current consumption		I _{OP}	45 mA Max.		28 mA Max.	No load condition
Output disable current		I _{OE}	30 mA Max.		16 mA Max.	OE=GND(P*W)
Standby current		I _{ST}	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, f _o ≤ 66.6667 MHz
		—	40 % to 60 %	40 % to 60 %	CMOS load : 50% V _{DD} , CL = Max.	
		—	45 % to 55%	—	CMOS load : 50% V _{DD} , CL = 25 pF, f _o ≤ 66.6667 MHz	
Output voltage	V _{OH}	V _{DD} -0.4 V Min.			I _{OH} = -16 mA (*TW/*HW)/-8 mA(*CW)	
	V _{OL}	0.4 V Max.			I _{OL} = 16 mA (*TW/*HW)/8 mA(*CW)	
Output load condition (fan out)	CL	15 pF	—		—	f _o ≤ 135 MHz
		5 TTL + 15 pF	—		—	f _o ≤ 90 MHz
		25 pF	—		—	f _o ≤ 66.6667 MHz
		—	15 pF	15 pF	f _o ≤ 135 MHz	
		—	25 pF	—	f _o ≤ 125 MHz	
		—	50 pF	—	f _o ≤ 66.6667MHz	
Output enable disable input voltage	V _{IH}	2.0 V Min.		0.7 V _{DD} Min.	OE,ST	
	V _{IL}	0.8 V Max.		0.2 V _{DD} Max.	OE,ST	
Output rise time	t _{TLH}	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.
		—	3.0 ns Max.	—	CMOS load: 20 %→80 % V _{DD} , CL= 25 pF	
		—	—	3.0 ns Max.	CMOS load: 20 %→80 % V _{DD} , CL= 15 pF	
Output fall time	t _{THL}	—	4.0 ns Max.	4.0 ns Max.	CMOS load: 20 %→80 % V _{DD} , CL= Max.	
		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 % V _{DD} , CL= 25 pF	
Oscillation start up time	t _{OSC}	—	—		3.0 ns Max.	CMOS load: 80 %→20 % V _{DD} , CL= 15 pF
		—	—		4.0 ns Max.	CMOS load: 80 %→20 % V _{DD} , CL= Max.
		—	—		4.0 ns Max.	CMOS load: 80 %→20 % V _{DD} , CL= Max.
Aging		t _{OSC}	10 ms Max.			Time at minimum operating voltage to be 0 s
Aging		fa	±5 x 10 ⁻⁶ /year Max.			Ta=+25 °C, VDD =5.0 V / 3.3 V, First year
Shock resistance		S.R.	±20 x 10 ⁻⁶ Max.			Three drops on a hard board from 750 mm or excitation test with 29400 m/s2 x 0.3 ms x 1/2 sine wave in 3 directions

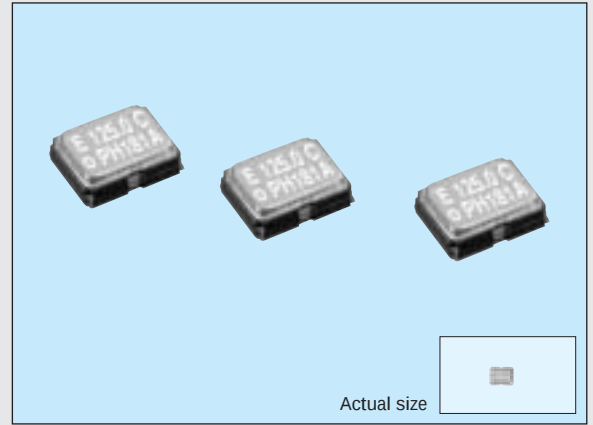
PROGRAMMABLE HIGH-FREQUENCY CRYSTAL OSCILLATOR

SG-8002CE series

Products number (please refer to page 1)

Q3321CE xxxxxx00

- 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.

**Specifications (characteristics)**

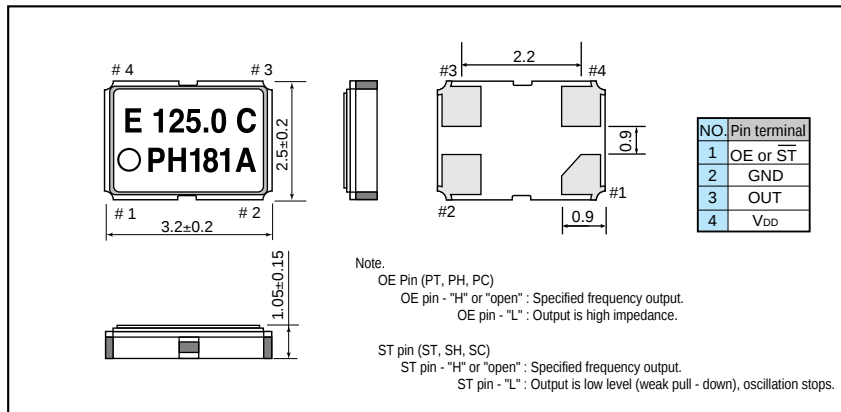
Item		Symbol	Specifications *2		Remarks	
			PT/ST	PH/SH PC/SC		
Output frequency range		f ₀	1.0000 MHz to 125.0000 MHz		Refer to page 31. "Frequency range"	
Power source voltage	Max. supply voltage	V _{DD} -GND	-0.5 V to +7.0 V			
	Operating voltage	V _{DD}	5.0 V±0.5 V	3.3 ± 0.3 V	2.7 V to 3.6 V : f ₀ ≤ 66.7 MHz (PC/SC)	
Temperature range	Storage temperature	T _{STG}	-40 °C to +125 °C		Stored as bare product after unpacking	
	Operating temperature	T _{OPR}	-20 °C to +70 °C (-40 °C to +85 °C)		Refer to page 31. "Frequency range"	
Frequency stability		Δf/f ₀	B: ±50 x 10 ⁻⁶ C: ± 100 x 10 ⁻⁶ M: ±100 x 10 ⁻⁶		B, C : -20 °C to +70 °C, M : -40 °C to +85 °C	
Current consumption		I _{OP}	40 mA Max.		No load condition, Max. frequency range	
Output disable current		I _{OE}	30 mA Max.		OE=GND (PT, PH, PC)	
Standby current		I _{ST}	50 μA Max.		ST=GND (ST, SH, SC)	
Duty *1	t _w / t	—	40 % to 60 %		CMOS load: 1/2V _{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 condition (fan out) *1	TTL	N	5 TTL Max.	—	Max. frequency and Max. operating voltage range	
	C-MOS	C _L	15 pF Max.			
Output enable/disable input voltage		V _{IH}	2.0 V Min.		ST̄, OE terminal	
		V _{IL}	0.8 V Max.			
Output rise time *1	C-MOS level	t _{TLH}	—	3 ns Max.	4 ns Max.	CMOS load: 20 %→80 % V _{DD}
	TTL level		4 ns Max.	—	TTL load: 0.4 V→2.4 V	
Output fall time *1	C-MOS level	t _{THL}	—	3 ns Max.	4 ns Max.	CMOS load: 80 %→20 % V _{DD}
	TTL level		4 ns Max.	—	TTL load: 2.4 V→0.4 V	
Oscillation start up time		t _{OSC}	10 ms Max.		Time at minimum operating voltage to be 0 s	
Aging		f _a	±5 x 10 ⁻⁶ /year Max.		T _a = +25 °C, V _{DD} = 5.0 V/3.3 V, First year	
Shock resistance		S.R.	±20 x 10 ⁻⁶ Max.		Three drops on a hard board from 750 mm or excitation test with 29400 m/s ² 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 33.

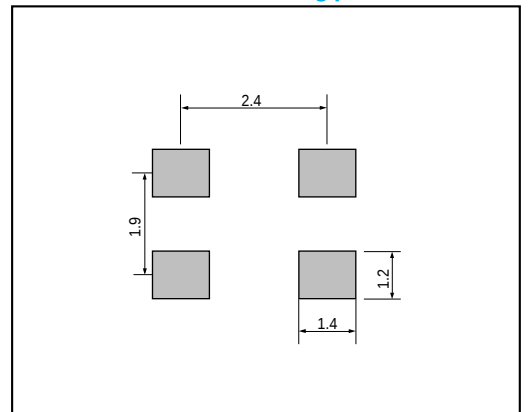
*2 PLL-PLL connection & Jitter specification, please refer to page 53, 54.

External dimensions

(Unit: mm)

**Recommended soldering pattern**

(Unit: mm)



PROGRAMMABLE HIGH-FREQUENCY CRYSTAL OSCILLATOR

SG-8002CA series

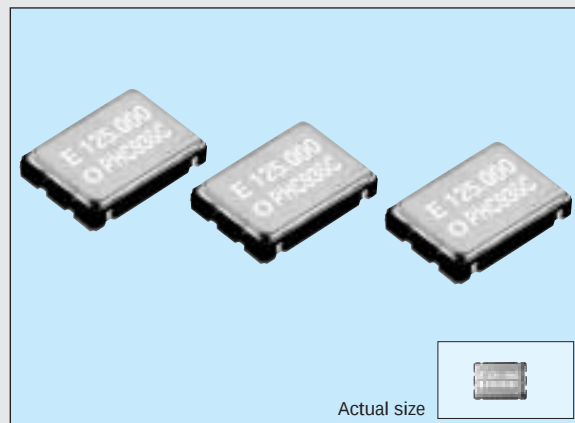
Product number (please refer to page 1)

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 (ST) can be used for low current consumption applications.

8002 PROM Writer available to purchase.

Please contact EPSON or local sales representative.



Actual size

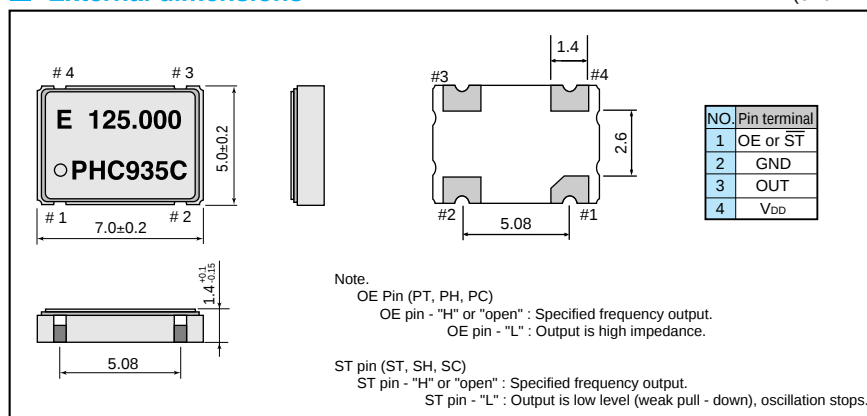
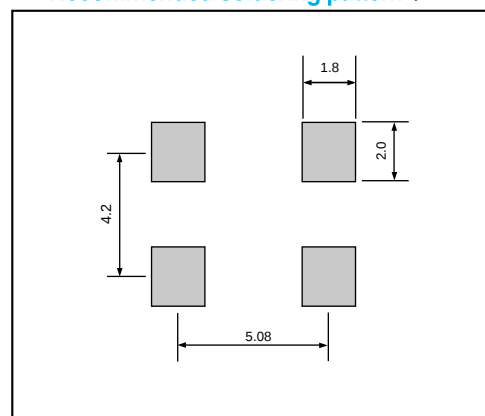
Specifications (characteristics)

Item		Symbol	Specifications *2		Remarks
			PT/ST	PH/SH	
Output frequency range		f ₀	1.0000 MHz to 125.0000 MHz		Refer to page 33. "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±0.5 V		2.7 V to 3.6 V: f ₀ ≤ 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)		Refer to page 33."Frequency range"
Frequency stability		Δf/f ₀	B: ±50 x 10 ⁻⁶ C: ± 100 x 10 ⁻⁶ M: ±100 x 10 ⁻⁶		B,C: -20 °C to +70 °C, M: -40 °C to +85 °C
Current consumption		I _{OP}	45 mA Max.		No load condition, Max. frequency range
Output disable current		I _{OE}	30 mA Max.		OE=GND (PT, PH, PC)
Standby current		I _{ST}	50 μA Max.		$\overline{ST}$ =GND (ST, SH, SC)
Duty *1	t _w / t	—	40 % to 60 %		CMOS load: 1/2V _{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	C _L	15 pF Max.	25 pF Max. 15 pF Max.	
Output enable/disable input voltage		V _{IH}	2.0 V Min.		$\overline{ST}$, OE terminal
		V _{IL}	0.8 V Max		
Output rise time *1	CMOS level	t _{TLH}	—	4 ns Max.	CMOS load: 20 %→80 % V _{DD}
	TTL level		4 ns Max.	—	TTL load: 0.4 V→2.4 V
Output fall time *1	CMOS level	t _{THL}	—	4 ns Max.	CMOS load: 80 %→20 % V _{DD}
	TTL level		4 ns Max.	—	TTL load: 2.4 V→0.4 V
Oscillation start up time		t _{OSC}	10 ms Max.		Time at minimum operating voltage to be 0 s
Aging		f _a	±5 x 10 ⁻⁶ /year Max.		T _a = +25 °C, V _{DD} = 5.0 V/3.3 V, First year
Shock resistance		S.R.	±20 x 10 ⁻⁶ Max.		Three drops on a hard board from 750 mm or excitation test with 29400 m/s ² 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 33.

*2 PLL - PLL connection & Jitter specification, please refer to page 53, 54.
Checking possible by the Frequency Checking Program.<http://www.epsondevice.com/domcfg.nsf>**External dimensions**

(Unit: mm)

**Recommended soldering pattern** (Unit: mm)

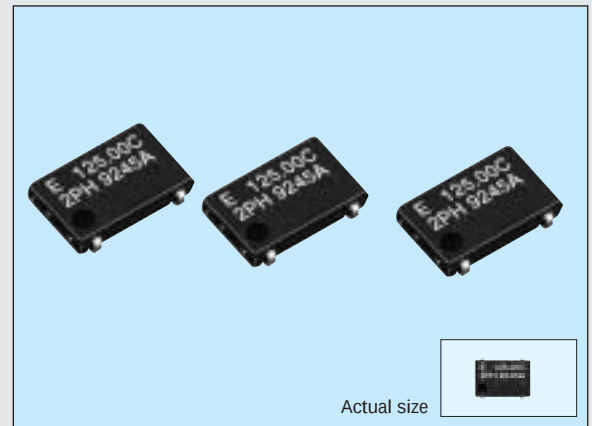
PROGRAMMABLE HIGH-FREQUENCY CRYSTAL OSCILLATOR

SG-8002JF series

Product number (please refer to page 1)

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 (ST) can be used for low current consumption applications.
- Pin compatible with ceramic package crystal oscillator (7 x 5)
8002 PROM 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 ₀	1.0000 MHz to 125.0000 MHz			Refer to page 33. "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±0.5 V		3.3 ± 0.3 V	2.7 V to 3.6 V: f ₀ ≤ 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 33."Frequency range"
Frequency stability		Δf/f ₀	B: ±50 x 10 ⁻⁶ C: ± 100 x 10 ⁻⁶ M: ±100 x 10 ⁻⁶			B, C: -20 °C to +70 °C, 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 μA Max.			ST=GND(ST,SH,SC)
Duty *1	t _w / t		—	40 % to 60 %		CMOS load: 1/2V _{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 condition (fan out) *1	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 x V _{DD} Min.	ST, OE terminal
		V _{IL}	0.8 V Max.		0.2 x V _{DD} Max.	
Output rise time *1	CMOS level	t _{TLH}	—	4 ns Max.		CMOS load: 20 %→80 % V _{DD}
	TTL level		4 ns Max.	—		TTL load: 0.4 V→2.4 V
Output fall time *1	CMOS level	t _{THL}	—	4 ns Max.		CMOS load: 80 %→20 % V _{DD}
	TTL level		4 ns Max.	—		TTL load: 2.4 V→0.4 V
Oscillation start up time		t _{OSC}	10 ms Max.			Time at minimum operating voltage to be 0 s
Aging		f _a	±5 x 10 ⁻⁶ /year Max.			T _a = +25 °C, V _{DD} = 5.0 V/3.3 V, First year
Shock resistance		S.R.	±20 x 10 ⁻⁶ Max.			Three drops on a hard board from 750 mm or excitation test with 29400 m/s ² x 0.3 ms x 1/2sine wave in 3 directions

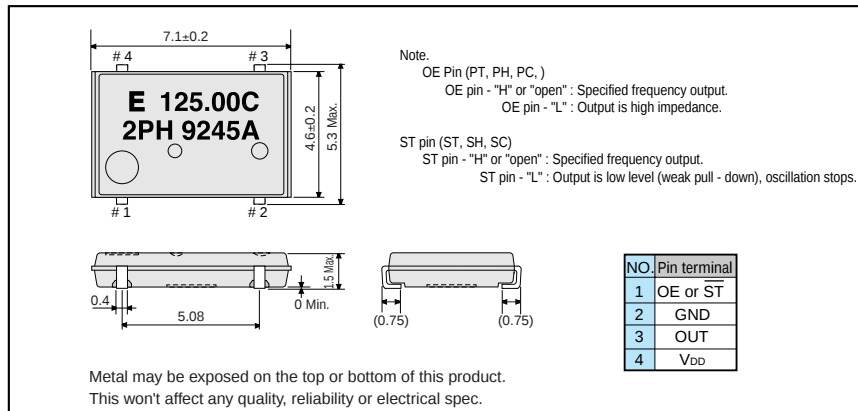
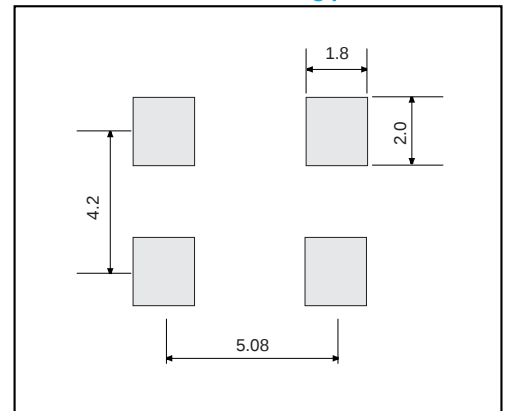
*1 Operating temperature(-40 °C to +85 °C), the available frequency, duty and output load conditions, please refer to page 33.

*2 PLL - PLL connection & Jitter specification, please refer to page 53, 54.

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

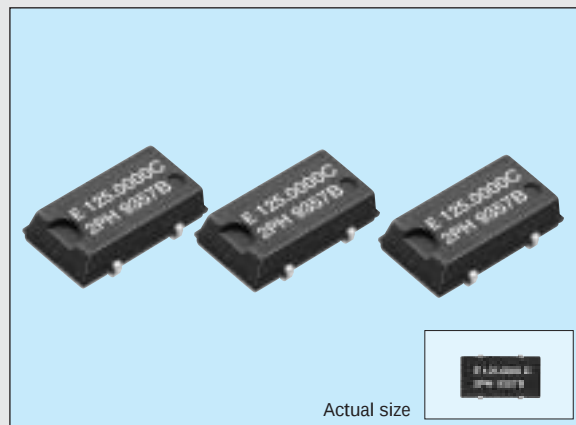
Product number (please refer to page 1)

Q3307JCxxx xxx 00

- 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 (ST) can be used for low current consumption applications.
- Package and pin compatible with SG-636.

8002 PROM Writer available to purchase.

Please contact EPSON or local sales representative.



Actual size

Specifications (characteristics)

Item		Symbol	Specifications *2			Remarks
			PT/ST	PH/SH	PC/SC	
Output frequency range		f ₀	1.0000 MHz to 125.0000 MHz			Refer to page 33. "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±0.5 V		3.3 ± 0.3 V	2.7 V to 3.6 V: f ₀ ≤ 66.7 MHz(PC/SC)
Temperature range	Storage temperature	T _{STG}	-55 °C to +100 °C			Stored as bare product after unpacking
	Operating temperature	T _{OPR}	-20 °C to +70 °C			Refer to page 33."Frequency range"
Frequency stability		Δf/f ₀	B: ±50 × 10 ⁻⁶ C: ± 100 × 10 ⁻⁶			-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 μA 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	C _L	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 _{TLH}	—	4 ns Max.		CMOS load: 20 %→80 % V _{DD}
	TTL level		4 ns Max.	—		TTL load: 0.4 V→2.4 V
Output fall time *1	CMOS level	t _{THL}	—	4 ns Max.		CMOS load: 80 %→20 % V _{DD}
	TTL level		4 ns Max.	—		TTL load: 2.4 V→0.4 V
Oscillation start up time		t _{OSC}	10 ms Max.		Time at minimum operating voltage to be 0 s	
Aging		f _a	±5 × 10 ⁻⁶ /year Max.		T _a = +25 °C, V _{DD} = 5.0 V/3.3 V, First year	
Shock resistance		S.R.	±20 × 10 ⁻⁶ Max.		Three drops on a hard board from 750 mm or excitation test with 29400 m/s ² × 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 33.

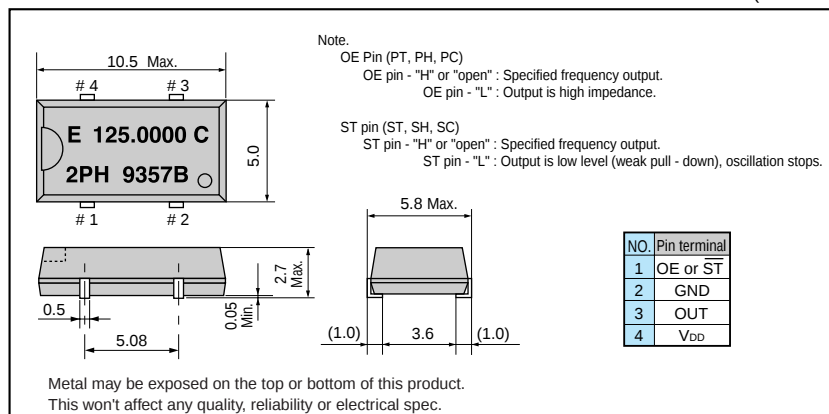
*2 PLL - PLL connection & Jitter specification, please refer to page 53, 54.

Checking possible by the Frequency Checking Program.

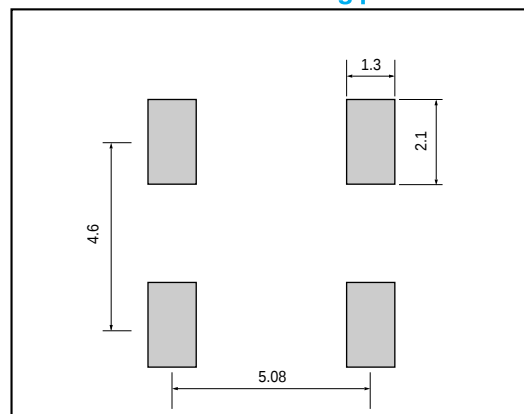
<http://www.epsondevice.com/domcfg.nsf>

External dimensions

(Unit: mm)



Recommended soldering pattern (Unit: mm)



PROGRAMMABLE HIGH-FREQUENCY CRYSTAL OSCILLATOR

SG-8002JA series

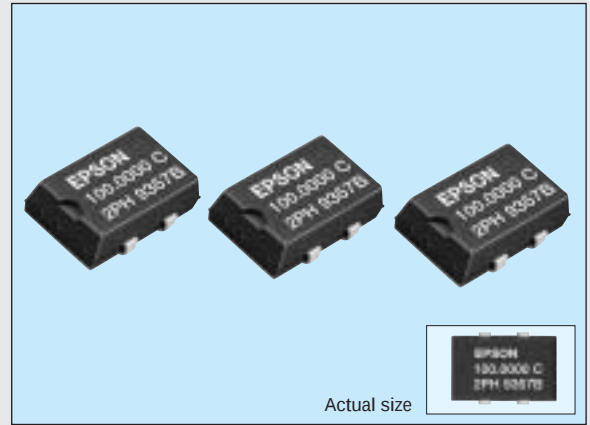
Product number (please refer to page 1)

Q3306JAXXXXX00

- 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 (ST) can be used for low current consumption applications.
- Package and pin compatible with SG-615.

8002 PROM 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 ₀	1.0000 MHz to 125.0000 MHz			Refer to page 33. "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±0.5 V		3.3 ± 0.3 V	2.7 V to 3.6 V: f ₀ ≤ 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 33."Frequency range"
Frequency stability		Δf/f ₀	B: ±50 x 10 ⁻⁶ C: ± 100 x 10 ⁻⁶ M: ±100 x 10 ⁻⁶			B,C: -20 °C to +70 °C, 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 μA Max.			ST=GND(ST, SH, SC)
Duty *1	tw/ 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	C _L	15 pF Max.	25 pF Max.	15 pF Max.	
Output enable/disable input voltage		V _{IH}	2.0 V Min.		0.7 x V _{DD} Min.	ST, OE terminal
		V _{IL}	0.8 V Max.		0.2 x V _{DD} Max.	
Output rise time *1	CMOS level	t _{TLH}	—	4 ns Max.		CMOS load: 20 %→80 % V _{DD}
	TTL level		4 ns Max.	—		TTL load: 0.4 V→2.4 V
Output fall time *1	CMOS level	t _{THL}	—	4 ns Max.		CMOS load: 80 %→20 % V _{DD}
	TTL level		4 ns Max.	—		TTL load: 2.4 V→0.4 V
Oscillation start up time		t _{OSC}	10 ms Max.			Time at minimum operating voltage to be 0 s
Aging		fa	±5 x 10 ⁻⁶ /year Max.			Ta= +25 °C, V _{DD} = 5.0 V/3.3 V, First year
Shock resistance		S.R.	±20 x 10 ⁻⁶ Max.			Three drops on a hard board from 750 mm or excitation test with 29400 m/s ² x 0.3 ms x 1/2sine wave in 3 directions

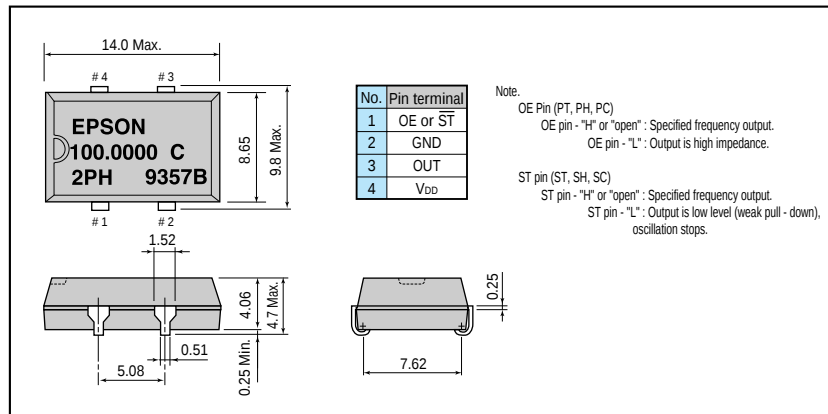
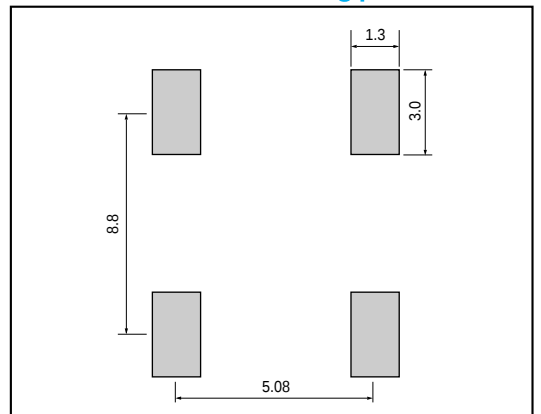
*1 Operating temperature(-40 °C to +85 °C), the available frequency, duty and output load conditions, please refer to page 33.

*2 PLL - PLL connection & Jitter specification, please refer to page 53, 54.

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

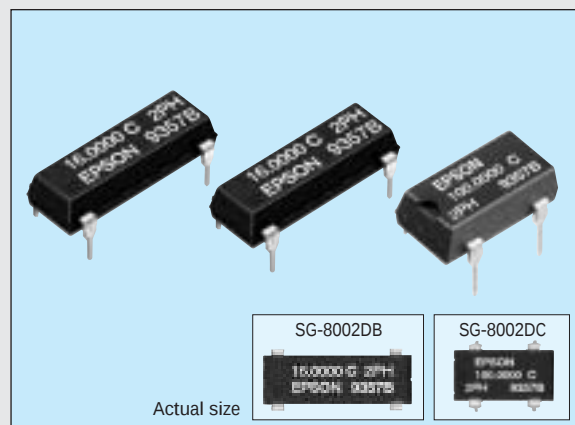
Product number (please refer to page 1)

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 (ST) can be used for low current consumption applications.
- Pin compatible with full size and half size.

8002 PROM 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 ₀	1.0000 MHz to 125.0000 MHz			Refer to page 33. "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 ±0.5 V		3.3 ± 0.3 V	2.7 V to 3.6 V: f ₀ ≤ 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 33. "Frequency range"
Frequency stability		Δf/f ₀	B: ±50 × 10 ⁻⁶ C: ± 100 × 10 ⁻⁶ M: ±100 × 10 ⁻⁶			B,C: -20 °C to +70 °C, 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 μA 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 condition (fan out) *1	TTL	N	5 TTL Max.	—		Max. frequency and Max. operating voltage range
	CMOS	C _L	15 pF Max.	25 pF Max.	15 pF Max.	
Output enable/disable input voltage		V _{IH}	2.0 V Min.		0.7 x V _{DD} Min.	ST, OE terminal
		V _{IL}	0.8 V Max.		0.2 x V _{DD} Max.	
Output rise time *1	CMOS level	t _{TLH}	—	4 ns Max.		CMOS load: 20 %→80 % V _{DD}
	TTL level		4 ns Max.	—		TTL load: 0.4 V→2.4 V
Output fall time *1	CMOS level	t _{THL}	—	4 ns Max.		CMOS load: 80 %→20 % V _{DD}
	TTL level		4 ns Max.	—		TTL load: 2.4 V→0.4 V
Oscillation start up time		t _{OSC}	10 ms Max.			Time at minimum operating voltage to be 0 s
Aging		f _a	±5 × 10 ⁻⁶ /year Max.			T _a = +25 °C, V _{DD} = 5.0 V/3.3 V, First year
Shock resistance		S.R.	±20 × 10 ⁻⁶ Max.			Three drops on a hard board from 750 mm or excitation test with 29400 m/s ² x 0.3 ms x 1/2sine wave in 3 directions

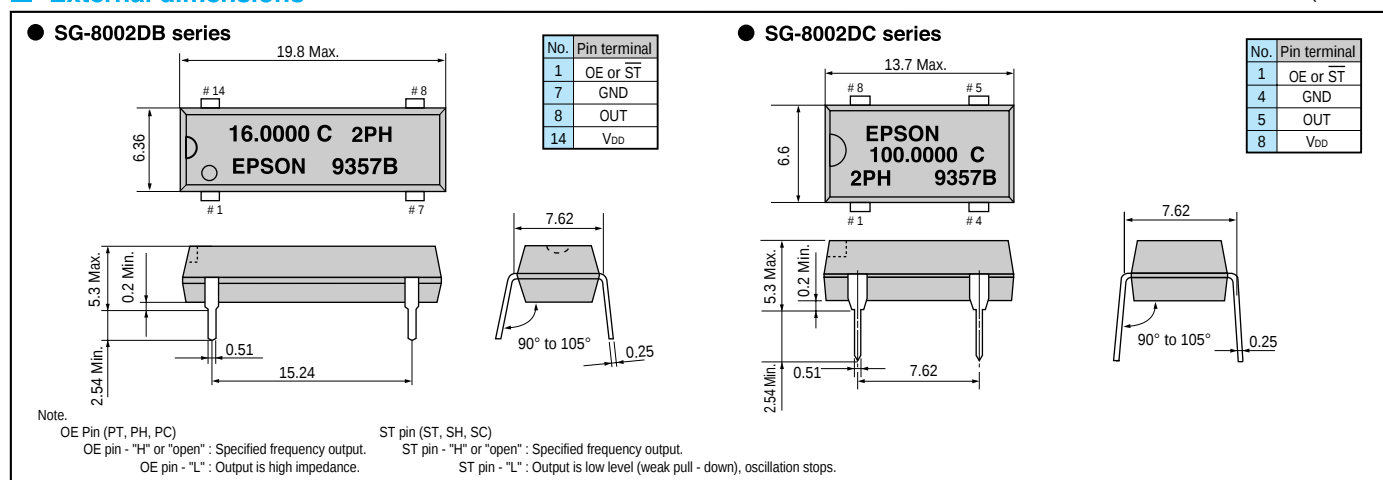
*1 Operating temperature(-40 °C to +85 °C), the available frequency, duty and output load conditions, please refer to page 33.

*2 PLL - PLL connection & Jitter specification, please refer to page 53, 54.

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 case that the jitter value will increase when SG-8002 is connected the other 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 application (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 another devices in the power supply line as the counter measure of EMI noise reduction. This device insertion might cause high-frequency impedance high in the power supply line and it affects oscillator stable drive.

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

■ Jitter Specifications

Model	Operating Voltage	Jitter Item	Specifications	Remarks
PT/PH ST/SH	5 V $\pm$ 0.5 V	Cycle to cycle	150 ps Max.	33 MHz $\leq$ f ₀ $\leq$ 125 MHz, C _L =15 pF
			200 ps Max.	1.0 MHz $\leq$ f ₀ <33 MHz, C _L =15 pF
		Peak to peak	200 ps Max.	33 MHz $\leq$ f ₀ $\leq$ 125 MHz, C _L =15 pF
			250 ps Max.	1.0 MHz $\leq$ f ₀ <33 MHz, C _L =15 pF
SC/PC	3.3 V $\pm$ 0.3 V	Cycle to cycle	200 ps Max.	1.0 MHz $\leq$ f ₀ $\leq$ 125 MHz, C _L =15 pF
		Peak to peak	250 ps Max.	1.0 MHz $\leq$ f ₀ $\leq$ 125 MHz, C _L =15 pF

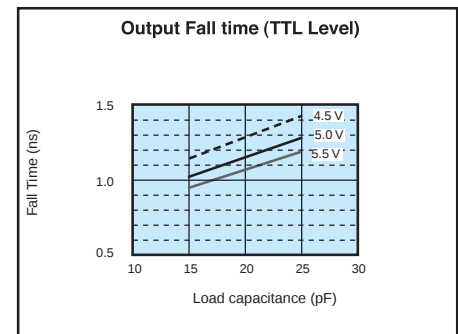
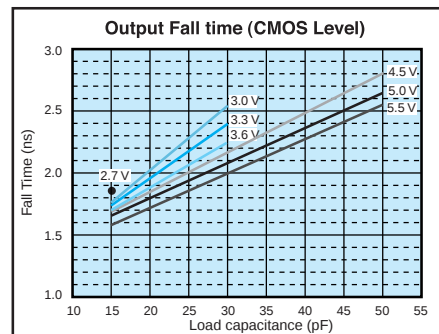
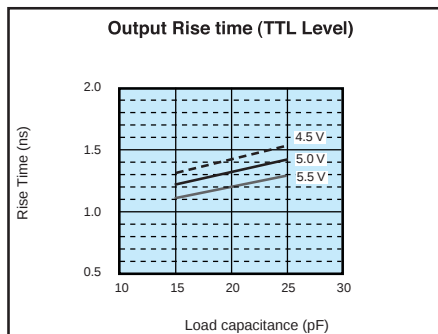
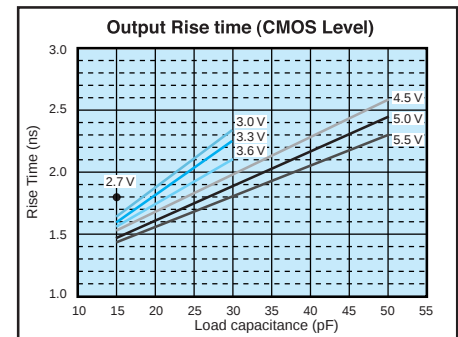
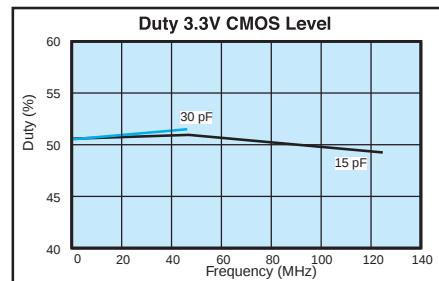
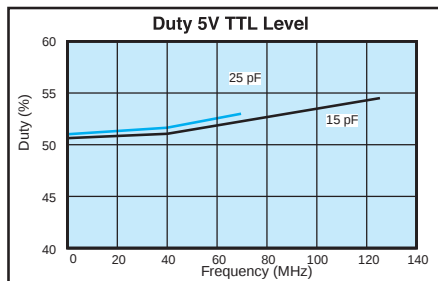
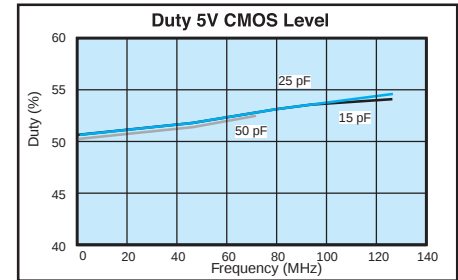
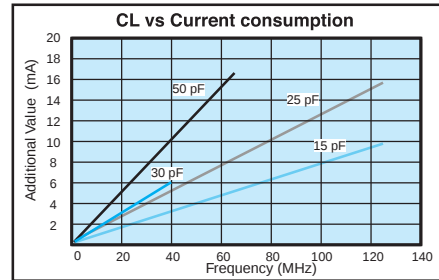
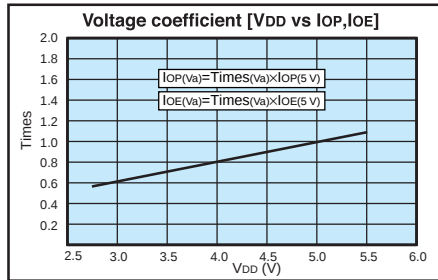
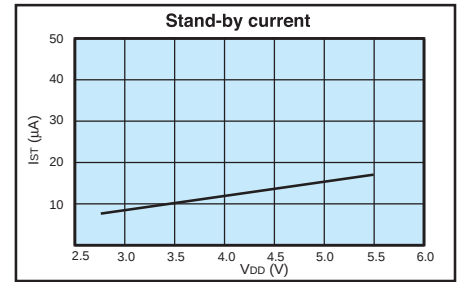
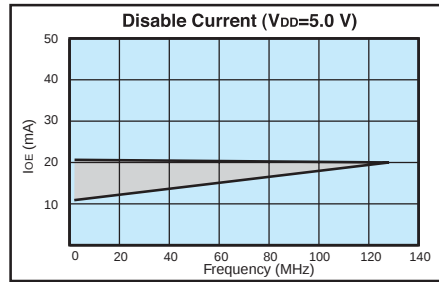
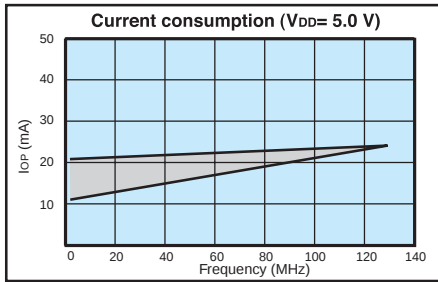
■ SG-8002Series

Function		P : Output enable			S : Standby		
Operating voltage		5.0 V $\pm$ 0.5 V		3.3 V $\pm$ 0.3 V	5.0 V $\pm$ 0.5 V		3.3 V $\pm$ 0.3 V
Output load condition		T : TTL	H : CMOS	C : CMOS	T : TTL	H : CMOS	C : CMOS
Frequency Stability	B : $\pm 50 \times 10^{-6}$ (-20 °C to +70 °C)	PTB	PHB	PCB	STB	SHB	SCB
	C : $\pm 100 \times 10^{-6}$ (-20 °C to +70 °C)	PTC	PHC	PCC	STC	SHC	SCC
	M : $\pm 100 \times 10^{-6}$ (-40 °C to +85 °C)	PTM	PHM	PCM	STM	SHM	SCM

■ HG-8002Series

Function		P : Output enable			S : Standby		
Operating voltage		5.0 V $\pm$ 0.5 V		3.3 V $\pm$ 0.3 V	5.0 V $\pm$ 0.5 V		3.3 V $\pm$ 0.3 V
Output load condition		T : TTL	H : CMOS	C : CMOS	T : TTL	H : CMOS	C : CMOS
Frequency Stability	AV : $\pm 20 \times 10^{-6}$ (-20 °C to +70 °C)	PTAV	PHAV	PCAV	STAV	SHAV	SCAV
	BV : $\pm 25 \times 10^{-6}$ (-20 °C to +70 °C)	PTBV	PHBV	PCBV	STBV	SHBV	SCBV
	CX : $\pm 30 \times 10^{-6}$ (-40 °C to +85 °C)	PTCX	PHCX	PCCX	STCX	SHCX	SCCX

■ SG-8002 series Characteristics chart



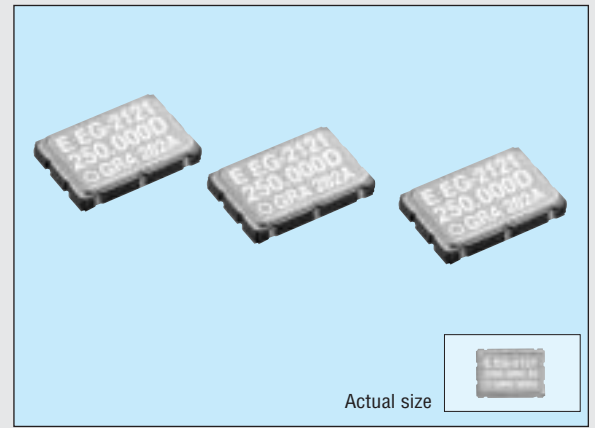
LOW JITTER HIGH FREQUENCY CRYSTAL OSCILLATOR

EG-2121CA

Product number (please refer to page 2)

Q3805CA0xxxxx00

- Generates high frequency clock with fundamental mode
- Very low jitter and low phase noise.
- Ceramic package with 1.4 mm Max. thickness.
- Excellent shock resistance and environmental capability.
- Differential LV-PECL output.
- Provided with output enable function (OE).



■ Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Output frequency range	f_0	53.125 MHz to 500.0000 MHz	Please contact us for inquiries about the available frequency
Power source voltage	Max. supply voltage	V_{CC-GND}	-0.5 V to +4.0 V
	Operating voltage	V_{CC}	2.5 V $\pm$ 0.125 V
Temperature range	Storage temperature	T_{STG}	-40 °C to +100 °C
	Operating temperature	T_{OPR}	P: 0 °C to +70 °C, R: -5 °C to +85 °C
Frequency stability	$\Delta f/f_0$	G: $\pm 50 \times 10^{-6}$, H: $\pm 100 \times 10^{-6}$ *1	P: 0 °C to +70 °C, R: -5 °C to +85 °C
Current consumption	I_{OP}	80 mA Max.	OE= V_{CC}
Output disable current	I_{OE}	20 mA Max.	OE=GND
Duty	t_w/t	40 % to 60 %	fo < 175 MHz at outputs crossing point
		48 % to 52 %	
Output voltage	V_{OH}	1.55 V Typ. $V_{CC}-1.025$ to $V_{CC}-0.88$	DC characteristics
	V_{OL}	0.8 V Typ. $V_{CC}-1.81$ to $V_{CC}-1.62$	DC characteristics
Output load condition (fan out)	R_L	50 Ω	Terminated to $V_{CC}-2.0$ V
Output enable	V_{IH}	0.7 V_{CC} Min.	OE
disable input voltage	V_{IL}	0.3 V_{CC} Max.	OE
Output rise time	t_{TLH}	400 ps Max.	20 % $\rightarrow$ 80 % of ($V_{OH} - V_{OL}$)
Output fall time	t_{THL}	400 ps Max.	80 % $\rightarrow$ 20 % of ($V_{OH} - V_{OL}$)
Oscillation start up time	t_{OSC}	10 ms Max.	Time at 2.375 V to be 0 s
Jitter	t_{DJ}	5 ps Typ.(10 ps Max.)	Deterministic Jitter
	t_{RJ}	3 ps Typ.(4 ps Max.)	Random Jitter
	t_{RMS}	3 ps Typ.(4 ps Max.)	σ
	t_{p-p}	25 ps Typ.(40 ps Max.)	Peak to Peak
	t_{acc}	4 ps Typ.(5 ps Max.)	Accumulated Jitter(σ) n= 2 to 50000 cycles

*1 Include initial frequency tolerance, reflow shift, temperature variation, supply voltage variation and aging (As per below table).

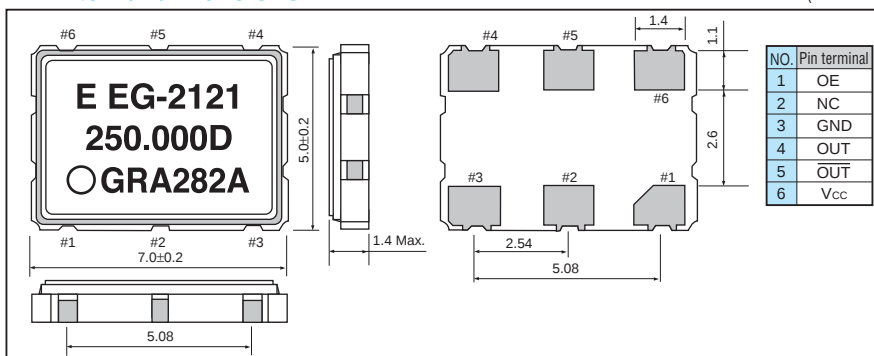
Frequency range(MHz)		53.125 MHz to 400 MHz		53.125 MHz to 200 MHz	
Output mode		P:PECL Duty ± 5 %		D:PECL Duty ± 2 %	
Details of frequency stability		A	N	A	N
Frequency stability	HP: $\pm 100 \times 10^{-6}$ (0 °C to +70 °C)	PHPA	PHPN	DHPA	DHPN
	HR: $\pm 100 \times 10^{-6}$ (-5 °C to +85 °C)	PHRA	PHRN	DHRA	DHRN
	GP: $\pm 50 \times 10^{-6}$ (0 °C to +70 °C)	PGPA	PGPN	DGPA	DGPN
	GR: $\pm 50 \times 10^{-6}$ (-5 °C to +85 °C)		PGRN		DGRN

A: Include initial frequency tolerance, reflow shift, temperature variation, supply voltage variation, load change and 10 years aging.

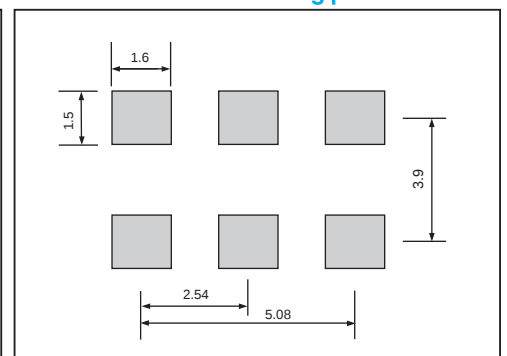
N: Include initial frequency tolerance, reflow shift, temperature variation, supply voltage variation and load change.

■ External dimensions

(Unit: mm)



■ Recommended soldering pattern (Unit: mm)



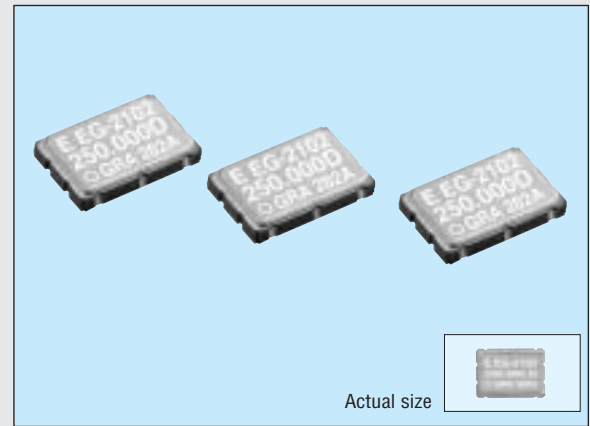
LOW JITTER HIGH FREQUENCY CRYSTAL OSCILLATOR

EG-2102CA

Product number (please refer to page 2)

Q3806CA0xxxxx00

- Generates high frequency clock with fundamental mode
- Very low jitter and low phase noise.
- Ceramic package with 1.4 mm Max. thickness.
- Excellent shock resistance and environmental capability.
- Differential LV-PECL output.
- Provided with output enable function (OE).



■ Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Output frequency range	f_0	100.0000 MHz to 700.0000 MHz	Please contact us for inquiries about the available frequency
Power source voltage	Max. supply voltage	V_{CC-GND}	-0.5 V to +4.0 V
	Operating voltage	V_{CC}	3.3 V $\pm$ 0.3 V
Temperature range	Storage temperature	T_{STG}	-40 °C to +100 °C
	Operating temperature	T_{OPR}	P : 0 °C to +70 °C, R : -5 °C to +85 °C
Frequency stability	$\Delta f/f_0$	G : $\pm 50 \times 10^{-6}$, H : $\pm 100 \times 10^{-6}$ *1	P : 0 °C to +70 °C, R : -5 °C to +85 °C
Current consumption	I_{OP}	100 mA Max.	OE = V_{CC}
Output disable current	I_{OE}	32 mA Max.	OE = GND
Duty	tw/t	45 % to 55 %	— at outputs crossing point $f_0 \leq 350\text{MHz}$
		48 % to 52 %	
Output voltage	V_{OH}	2.35 V Typ, $V_{CC}-1.025$ to $V_{CC}-0.88$	DC characteristics, $T_a < 0$ °C : $V_{CC}-1.09$ Min.
	V_{OL}	1.60 V Typ, $V_{CC}-1.81$ to $V_{CC}-1.62$	DC characteristics, $T_a < 0$ °C : $V_{CC}-1.09$ Min.
Output load condition (fan out)	R_L	50 Ω	Terminated to $V_{CC}-2.0$ V
Output enable	V_{IH}	0.7 V_{CC} Min.	OE
disable input voltage	V_{IL}	0.3 V_{CC} Max.	OE
Output rise time	t_{TLH}	400 ps Max.	20 % $\rightarrow$ 80 % of ($V_{OH} - V_{OL}$)
Output fall time	t_{THL}	400 ps Max.	80 % $\rightarrow$ 20 % of ($V_{OH} - V_{OL}$)
Oscillation start up time	t_{OSC}	10 ms Max.	Time at 3.0 V to be 0 s
Jitter	t_{DJ}	5 ps Typ.(10 ps Max.)	Deterministic Jitter
	t_{RJ}	3 ps Typ.(4 ps Max.)	Random Jitter
	t_{RMS}	3 ps Typ.(4 ps Max.)	σ
	t_{p-p}	25 ps Typ.(40 ps Max.)	Peak to Peak
	t_{acc}	4 ps Typ.(5 ps Max.)	Accumulated Jitter(σ) n= 2 to 50000 cycles

*1 Include initial frequency tolerance, reflow shift, temperature variation, supply voltage variation and aging (As per below table).

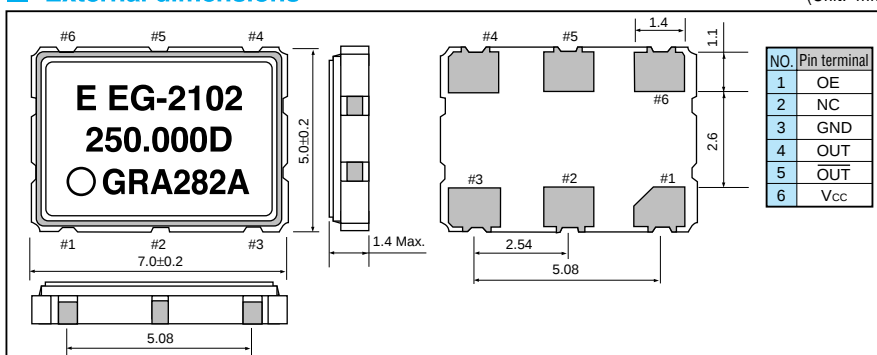
Frequency range(MHz)		100 MHz to 700 MHz		100 MHz to 350 MHz	
Output mode		P:PECL Duty ± 5 %		D:PECL Duty ± 2 %	
Details of frequency stability		A	N	A	N
Frequency stability	HP : $\pm 100 \times 10^{-6}$ (0 °C to +70 °C)	PHPA	PHPN	DHPA	DHPN
	HR : $\pm 100 \times 10^{-6}$ (-5 °C to +85 °C)	PHRA	PHRN	DHRA	DHRN
	GP : $\pm 50 \times 10^{-6}$ (0 °C to +70 °C)	PGPA	PGPN	DGPA	DGPN
	GR : $\pm 50 \times 10^{-6}$ (-5 °C to +85 °C)		PGRN		DGRN

A: Include initial frequency tolerance, reflow shift, temperature variation, supply voltage variation, load change and 10 years aging.

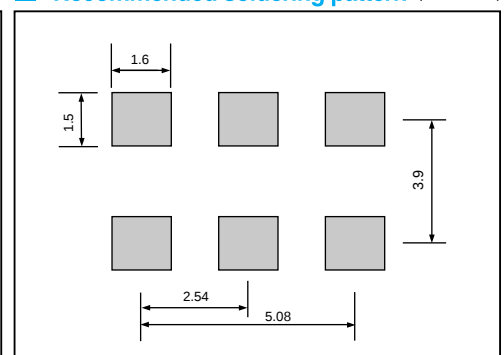
N: Include initial frequency tolerance, reflow shift, temperature variation, supply voltage variation and load change.

■ External dimensions

(Unit: mm)



■ Recommended soldering pattern (Unit: mm)



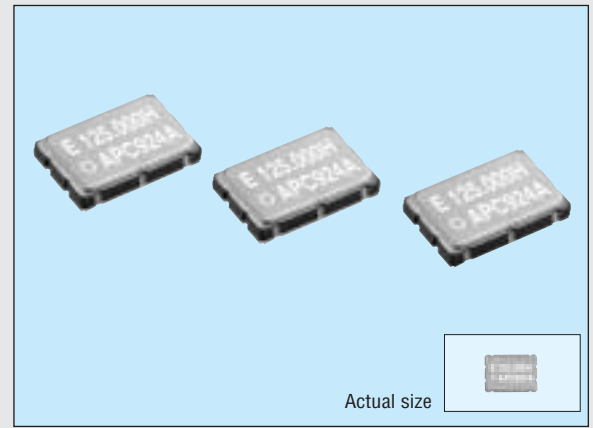
LOW JITTER HIGH FREQUENCY CRYSTAL OSCILLATOR

EG-2101CA

Product number (please refer to page 2)

Q3803CA0xxxxx00

- Generates high frequency clock with fundamental mode
- Very low jitter and low phase noise.
- Ceramic package with 1.4 mm Max. thickness.
- Excellent shock resistance and environmental capability.
- Differential LV-PECL output.
- Provided with output enable function (OE).



Specifications (characteristics)

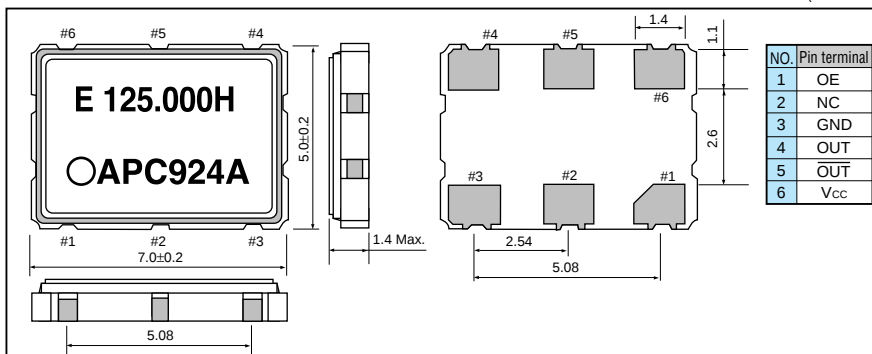
Item	Symbol	Specifications	Remarks
Output frequency range	f_0	62.5000 MHz to 400.000 MHz	Please contact us for inquiries about the available frequency
Power source voltage	Max. supply voltage	V_{CC-GND}	-0.5 V to +7.0 V
	Operating voltage	V_{CC}	3.3 V $\pm$ 0.15 V
Temperature range	Storage temperature	T_{STG}	-40 °C to +100 °C
	Operating temperature	T_{OPR}	0 °C to +70 °C
Frequency stability	$\Delta f/f_0$	$\pm 50 \times 10^{-6}$, $\pm 100 \times 10^{-6}$ *1	0 °C to +70 °C
Current consumption	I_{OP}	60 mA Max.	OE= V_{CC}
Output disable current	I_{OE}	25 mA Max.	OE=GND
Duty	t_w/t	45 % to 55 %	PCH.PCY.PCZ
		47.5 % to 52.5 %	$f_0 \leq 160$ MHz DCH.DCY.DCZ
Output voltage	V_{OH}	2.35 V Typ. $V_{CC}-1.025$ to $V_{CC}-0.88$	DC characteristics
	V_{OL}	1.60 V Typ. $V_{CC}-1.81$ to $V_{CC}-1.62$	DC characteristics
Output load condition (fan out)	R_L	50 Ω	Terminated to $V_{CC}-2.0$ V
Output enable	V_{IH}	0.7 V_{CC} Min.	OE
disable input voltage	V_{IL}	0.3 V_{CC} Max.	OE
Output rise time	t_{TLH}	600 ps Max.	20 % $\rightarrow$ 80 % of ($V_{OH} - V_{OL}$)
Output fall time	t_{THL}	600 ps Max.	80 % $\rightarrow$ 20 % of ($V_{OH} - V_{OL}$)
Oscillation start up time	t_{OSC}	10 ms Max.	Time at 3.15 V to be 0 s
Jitter	t_{DJ}	5 ps Typ.(10 ps Max.)	Deterministic Jitter
	t_{RJ}	3 ps Typ.(4 ps Max.)	Random Jitter
	t_{RMS}	3 ps Typ.(4 ps Max.)	σ
	t_{p-p}	25 ps Typ.(40 ps Max.)	Peak to Peak
	t_{acc}	4 ps Typ.(5 ps Max.)	Accumulated Jitter(σ) n= 2 to 50000 cycles

*1 Include initial frequency tolerance, reflow shift, temperature variation, supply voltage variation and aging (As per below table).

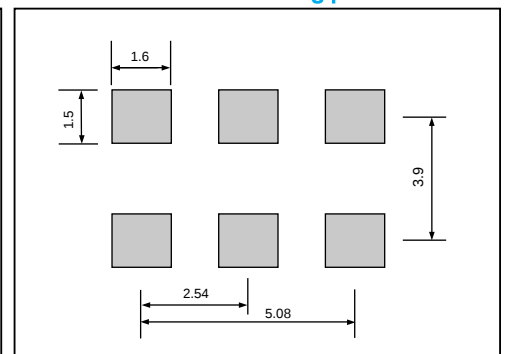
Operating voltage		C : 3.3 V		
Output mode		P : Duty $\pm$ 5%		D : Duty $\pm$ 2.5%
Frequency range(MHz)		125 to 318.75	318.751 to 400	62.5 to 160
Frequency stability	H : $\pm 100 \times 10^{-6}$ (0 °C to +70 °C)	PCH	—	DCH
	Y : $\pm 100 \times 10^{-6}$ (0 °C to +70 °C) except Aging	PCY	PCY	DCY
	Z : $\pm 50 \times 10^{-6}$ (0 °C to +70 °C) except Reflow soldering drift, Operating voltage range and Aging	PCZ	—	DCZ

External dimensions

(Unit: mm)



Recommended soldering pattern (Unit: mm)



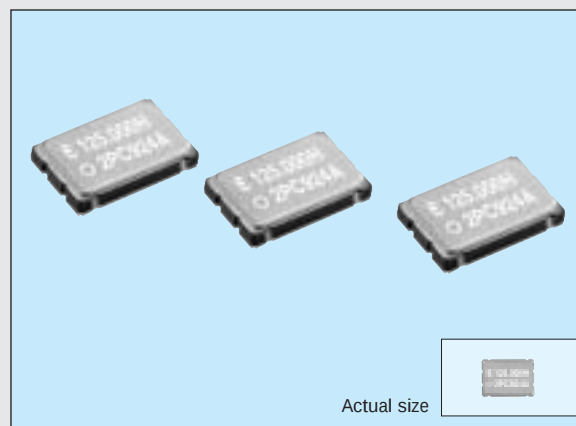
LOW JITTER HIGH FREQUENCY CRYSTAL OSCILLATOR

EG-2002CA

Product number (please refer to page 2)

Q3802CA0xxxxx00

- Generates high frequency clock with fundamental mode.
- Very low jitter and low phase noise.
- Ceramic package with 1.4 mm Max. thickness.
- Excellent shock resistance and environmental capability.
- LV TTL output
- Provided with output enable function (OE).



■ Specifications (characteristics)

Item		Symbol	Specifications	Remarks
Output frequency range		f_0	62.5000 MHz to 170.0000 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}	3.3 V $\pm$ 0.3 V	
Temperature range	Storage temperature	T_{STG}	-40 °C to +100 °C	Stored as bare product after unpacking
	Operating temperature	T_{OPR}	0 °C to +70 °C	
Frequency stability		$\Delta f/f_0$	$\pm 50 \times 10^{-6}$, $\pm 100 \times 10^{-6}$ *1	0 °C ~ +70 °C
Current consumption		I_{OP}	60 mA Max.	OE= V_{DD}
Output disable current		I_{OE}	25 mA Max.	OE=GND
Duty	C-MOS level	tw/t	45 % to 55 %	1.4 V Level, $C_L \leq$ Max.
	TTL level			
Output voltage	V_{OH}		V_{DD} -0.4 V Min.	$I_{OH} = -8$ mA
	V_{OL}		0.4 V Max.	$I_{OL} = 8$ mA
Output load condition (fan out)	C_L		25 pF Max.	$f_0 = 62.5$ MHz
			15 pF Max.	$f_0 > 62.5$ MHz
Output enable/disable input voltage	V_{IH}		0.7 V_{DD} Min.	OE
	V_{IL}		0.3 V_{DD} Max.	OE
Output rise time		t_{RLH}	1.5 ns Max.	0.8 V to 2.0 V, $C_L \leq$ Max.
Output fall time		t_{FHL}	1.5 ns Max.	2.0 V to 0.8 V, $C_L \leq$ Max.
Oscillation start up time		t_{OSC}	10 ms Max.	Time at 3.0 V to be 0 s
Jitter	t_{DJ}		5 ps Typ.(10 ps Max.)	Deterministic Jitter
	t_{RJ}		3 ps Typ.(4 ps Max.)	Random Jitter
	t_{RMS}		3 ps Typ.(4 ps Max.)	σ
	t_{p-p}		25 ps Typ.(40 ps Max.)	Peak to Peak
	t_{acc}		4 ps Typ.(5 ps Max.)	Accumulated Jitter(σ) n=2 to 50000cycles

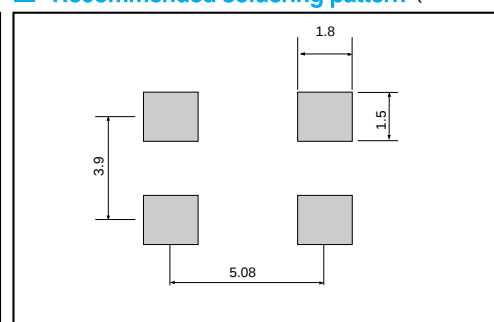
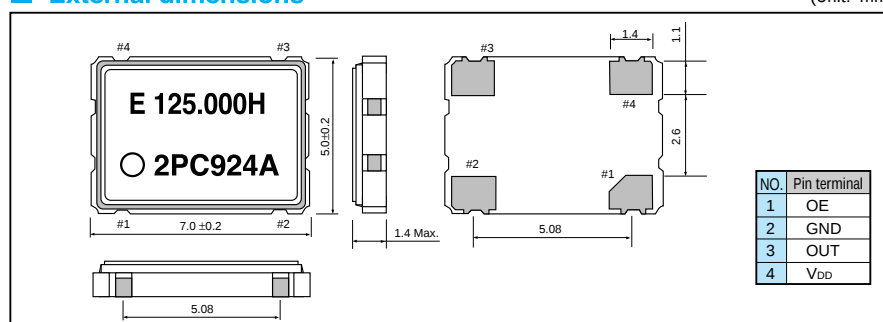
*1.Frequency stability is including variation in reflow soldering drift, operating temperature range, operating voltage range, load change and Aging (As per below table).

Operating voltage		C : 3.3 V	
Output mode		P : Fundamental frequency	D : Divided frequency
Frequency range(MHz)		125 to 170	62.5 to 124.9999
Frequency stability	H : $\pm 100 \times 10^{-6}$ (0 °C to +70 °C)	PCH	DCH
	Y : $\pm 100 \times 10^{-6}$ (0 °C to +70 °C) except Aging	PCY	DCY
	Z : $\pm 50 \times 10^{-6}$ (0 °C to +70 °C)	PCZ	DCZ
	except Reflow soldering drift, Load change, Operating voltage range and Aging		

■ External dimensions

(Unit: mm)

■ Recommended soldering pattern (Unit: mm)



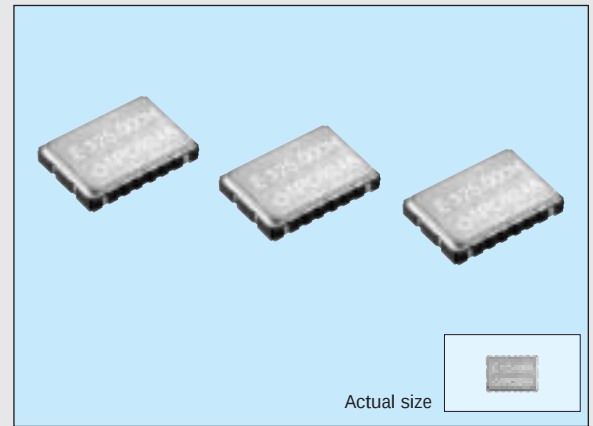
LOW-JITTER HIGH FREQUENCY CRYSTAL OSCILLATOR

EG-2001CA

Product number (please refer to page 2)

Q3801CA0xx xxx 00

- Generates high frequency clock with fundamental mode.
- Very low jitter and low phase noise.
- Ceramic package with 1.4 mm Max. thickness.
- Excellent environmental capability.
- Low current consumption due to use of CMOS technology.



■ Specifications (characteristics)

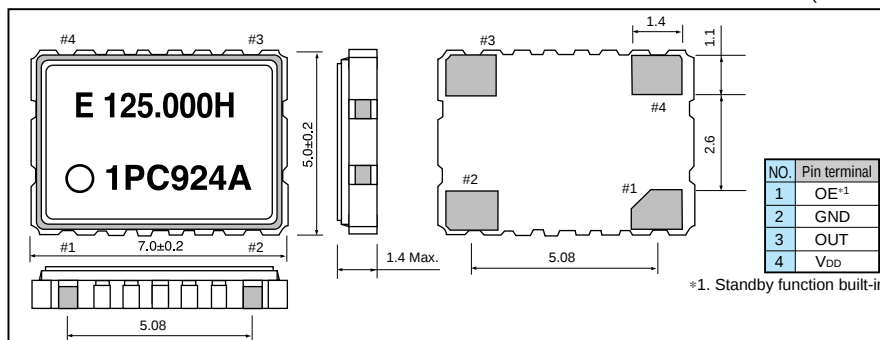
Item		Symbol	Specifications	Remarks
Output frequency range		f_0	106.2500 MHz to 170.0000 MHz	Please contact us for inquiries about the available frequency
Power source voltage	Max. supply voltage	V_{DD-GND}	-0.5 V to +7.0 V	
	Operating voltage	V_{DD}	3.3 V $\pm$ 0.3 V	
Temperature range	Storage temperature	T_{STG}	-40 °C to +100 °C	Stored as bare product after unpacking
	Operating temperature	T_{OPR}	0 °C to +70 °C	
Frequency stability		$\Delta f/f_0$	$\pm 50 \times 10^{-6}$, $\pm 100 \times 10^{-6}$ *1	0 °C to +70 °C
Current consumption		I_{OP}	50 mA Max.	$OE=V_{DD}$
Output disable current		I_{OE}	10 μ A Max.	$OE=GND$
Duty	CMOS level	tw/t	45 % to 55 %	50 % V_{DD} , $C_L \leq$ Max.
	TTL level		40 % to 60 %	1.4V Level, $C_L \leq$ Max.
Output voltage		V_{OH}	$V_{DD}-0.4$ V Min.	$I_{OH}=-8$ mA
		V_{OL}	0.4 V Max.	$I_{OL}=8$ mA
Output load condition (fan out)		C_L	25 pF Max.	$f_0 \leq 135.0000$ MHz
			15 pF Max.	$f_0 > 135.0000$ MHz
Output enable/disable input voltage		V_{IH}	0.7 V_{DD} Min.	OE
		V_{IL}	0.3 V_{DD} Max.	OE
Output rise time	CMOS level	t_{TLH}	2 ns Max.	CMOS load: 20 % $\rightarrow$ 80 % V_{DD} , $C_L \leq$ Max. pF
	TTL level		1.5 ns Max.	TTL load: 0.8 V $\rightarrow$ 2.0 V, $C_L \leq$ Max. pF
Output fall time	CMOS level	t_{THL}	2 ns Max.	CMOS load: 80 % $\rightarrow$ 20 % V_{DD} , $C_L \leq$ Max. pF
	TTL level		1.5 ns Max.	TTL load: 2.0 V $\rightarrow$ 0.8 V, $C_L \leq$ Max. pF
Oscillation start up time		t_{OSC}	10 ms Max.	Time at 3.0 V to be 0 s
Jitter		t_{DJ}	5 ps Typ.(10 ps Max.)	Deterministic Jitter
		t_{RJ}	3 ps Typ.(4 ps Max.)	Random Jitter
		t_{RMS}	3 ps Typ.(4 ps Max.)	σ
		t_{P-P}	25 ps Typ.(40 ps Max.)	Peak to Peak
		t_{acc}	4 ps Typ.(5 ps Max.)	Accumulated Jitter (σ) n = 2 to 50000 cycles

*1 Frequency stability is including variation in reflow soldering drift, operating temperature range, operating voltage range, load change and Aging.(As per below table)

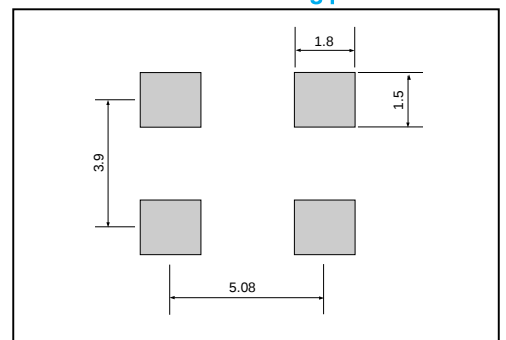
Operating voltage		C : 3.3 V
Output mode		P : Fundamental frequency
Frequency stability	H : $\pm 100 \times 10^{-6}$ (0 °C to +70 °C)	PCH
	Y : $\pm 100 \times 10^{-6}$ (0 °C to +70 °C) except Aging	PCY
	Z : $\pm 50 \times 10^{-6}$ (0 °C to +70 °C)	PCZ
	except Reflow soldering drift, Load change, Operating voltage range and Aging	

■ External dimensions

(Unit: mm)



■ Recommended soldering pattern (Unit: mm)



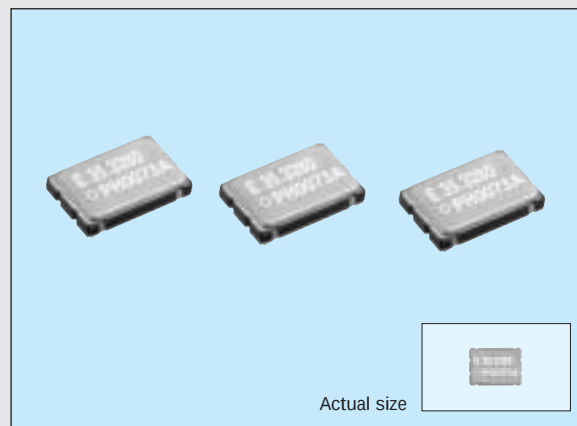
HIGH-STABILITY HIGH-FREQUENCY OSCILLATOR

HG-2150CA

Products number (please refer to page 2)

Q3514CA0xxxxx00

- Reflowable and high density mounting type SMD.
- Using the heat-resisting AT cut crystal allows almost the same heat resisting performance general purpose SMD IC.
- Using C-MOS IC allows low current consumption.
- Operating supply voltage: 5.0 V (SVH/BXH), 3.3 V (SVC/BXC)
- Provided with output enable function (OE).

**Specifications (characteristics)**

Item		Symbol	Specifications		Remarks
			SVH / BXH	SVC / BXC	
Output frequency range		f ₀	1.0000 MHz to 60.0000 MHz		60 MHz < f ₀ ≤ 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
	Operable temperature	T _{OPR}	V : -20 °C to +70 °C, X : -40 °C to +85 °C		
Frequency stability		Δf/f ₀	S : ±15 × 10 ⁻⁶ , B : ±25 × 10 ⁻⁶ *		S : -20 °C to +70 °C , B : -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		C _L	15 pF Max.		CMOS load
Output enable/		V _{IH}	0.7 V _{DD} Min.		OE terminal
disable input voltage		V _{IL}	0.3 V _{DD} Max.		
Output rise time		t _{TLH}	4 ns Max.		20 %→80 % V _{DD} level
Output fall time		t _{THL}	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 x 10 ⁻⁶ Max.		Ta=+25 °C, 10 year

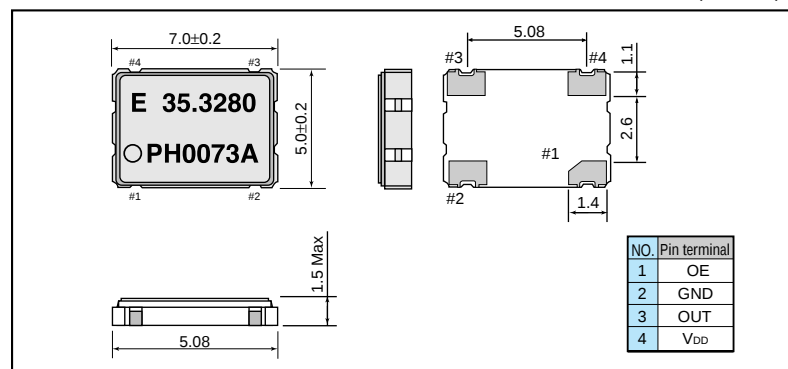
* Frequency stability is including variation in reflow soldering drift, operating temperature range, operating voltage range and load change.

Stability / Temperature range

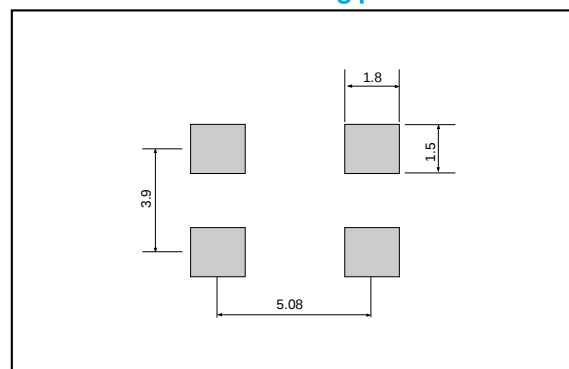
	Stability	Temperature range
SVH / SVC	±15 × 10 ⁻⁶	-20 °C to +70 °C
BXH / BXC	±25 × 10 ⁻⁶	-40 °C to +85 °C

External dimensions

(Unit: mm)

**Recommended soldering pattern**

(Unit: mm)



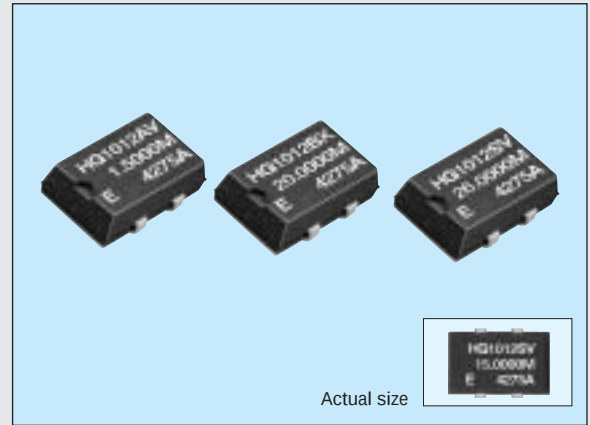
HIGH-STABILITY HIGH-FREQUENCY OSCILLATOR

HG-1012JA/2012JA

Product number (please refer to page 2)

Q3511JA0xxxxxx00**Q3512JA0xxxxxx00**

- Cylindrical AT crystal unit built-in, thus assuring high reliability.
- Excellent heat resistance.
- Low current consumption.

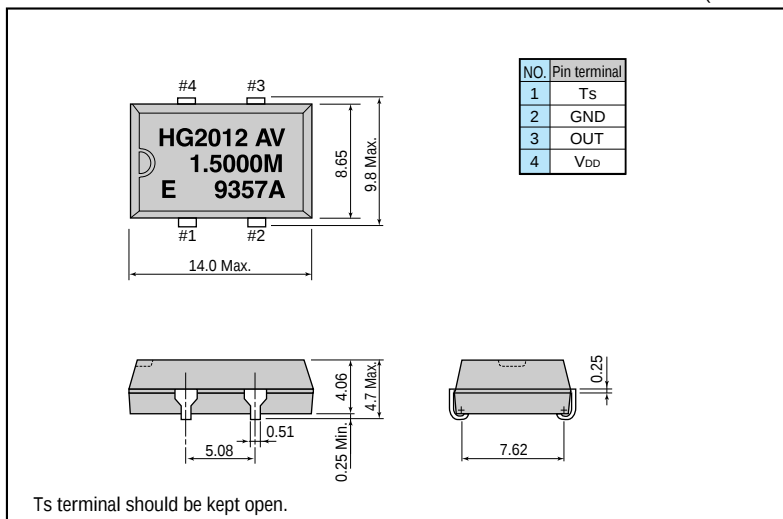


■ Specifications (characteristics)

Item	Symbol	Specifications		Remarks
		HG-1012JA	HG-2012JA	
Output frequency range	f_0	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	T_{STG} -55 °C to +125 °C		Stored as bare product after unpacking
	Operable temperature	T_{OPR} -40 °C to +85 °C		
Frequency stability	$\Delta f/f_0$	AV: $\pm 20 \times 10^{-6}$, BV: $\pm 25 \times 10^{-6}$	SV: $\pm 15 \times 10^{-6}$, AV: $\pm 20 \times 10^{-6}$	$T_a = -20 \text{ °C to } +70 \text{ °C}$
		BX: $\pm 25 \times 10^{-6}$, CX: $\pm 30 \times 10^{-6}$	BX: $\pm 25 \times 10^{-6}$	$T_a = -40 \text{ °C to } +85 \text{ °C}$
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 Max.		
Output rise time	t_{TLH}	8 ns Max.		20 % $\rightarrow$ 80 % V_{DD} level
Output fall time	t_{THL}	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	$\pm 5 \times 10^{-6}/\text{year Max.}$	$\pm 2 \times 10^{-6}/\text{year Max.}$	$T_a = +25 \text{ °C}$, first year
Shock resistance	S.R.	$\pm 10 \times 10^{-6} \text{ Max.}$	$\pm 2 \times 10^{-6} \text{ Max.}$	Three drops on a hard wooden board from 750 mm or excitation test with 29400 m/s ² x 0.3 ms x 1/2sine wave in 3 directions

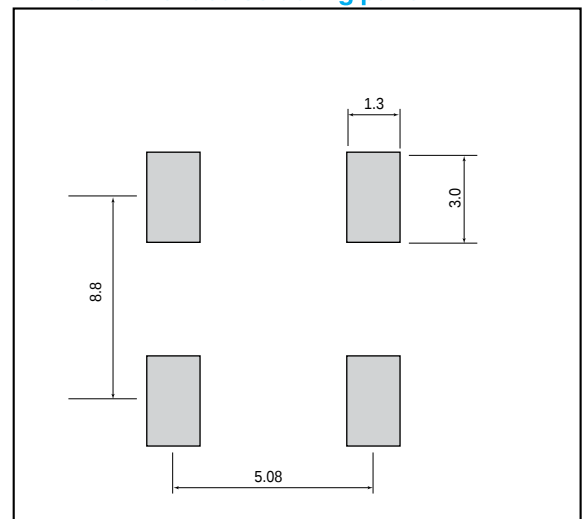
■ External dimensions

(Unit: mm)



■ Recommended soldering pattern

(Unit: mm)



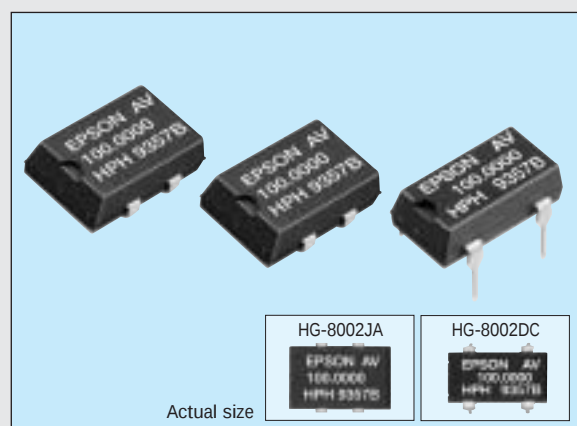
PROGRAMMABLE HIGH-STABILITY HIGH-FREQUENCY CRYSTAL OSCILLATOR

HG-8002JA/DC series

Product number (please refer to page 2)

Q3502JAXXXXXXX00**Q3402DCXXXXXX00**

- Wide frequency output by PLL technology.
- Low current consumption by output enable function (OE) or standby function (ST)
- Pin compatible with half-size oscillator SG-531.
- Package and pin compatible with SG-615.
- Low current consumption due to CMOS technology.
- Excellent environmental capability.



Actual size

Specifications (characteristics)

Item		Symbol	Specifications *2			Remarks
			PT/ST	PH/SH	PC/SC	
Output frequency range		f ₀	1.0000 MHz to 125.0000 MHz			Refer to page 33. "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 ±0.25 V		3.3 V ±0.165 V	
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)			Refer to page 33."Frequency range"
Frequency stability		Δf/f ₀	AV: ±20 x 10 ⁻⁶ BV: ±25 x 10 ⁻⁶ CX: ± 30 x 10 ⁻⁶			AV,BV: -20 °C to +70 °C, CX: -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 μA Max.			ST=GND(ST, SH, SC)
Duty *1	t _w / t		—	40 % to 60 %		CMOS load: 1/2V _{DD} level, Max. load condition
			40 % to 60 %	—		TTL load: 1.4 V level, Max. load condition
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	2 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 x V _{DD} Min.	ST, OE terminal
		V _{IL}	0.8 V Max.		0.2 x V _{DD} Max.	
Output rise time *1	CMOS level	t _{TLH}	—	3 ns Max.		CMOS load: 20 %→80 % V _{DD} level
	TTL level		4 ns Max.	—		TTL load: 0.4 V→2.4 V level
Output fall time *1	CMOS level	t _{THL}	—	3 ns Max.		CMOS load: 80 %→20 % V _{DD} level
	TTL level		4 ns Max.	—		TTL load: 2.4 V→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	±2 x 10 ⁻⁶ /year Max.		Ta= +25 °C, V _{DD} = 5.0 V/3.3 V(PC/SC)	
Shock resistance		S.R.	±2 x 10 ⁻⁶ Max.		Three drops on a hard board from 750 mm or excitation test with 29400 m/s ² x 0.3 ms x 1/2sine wave in 3 directions	

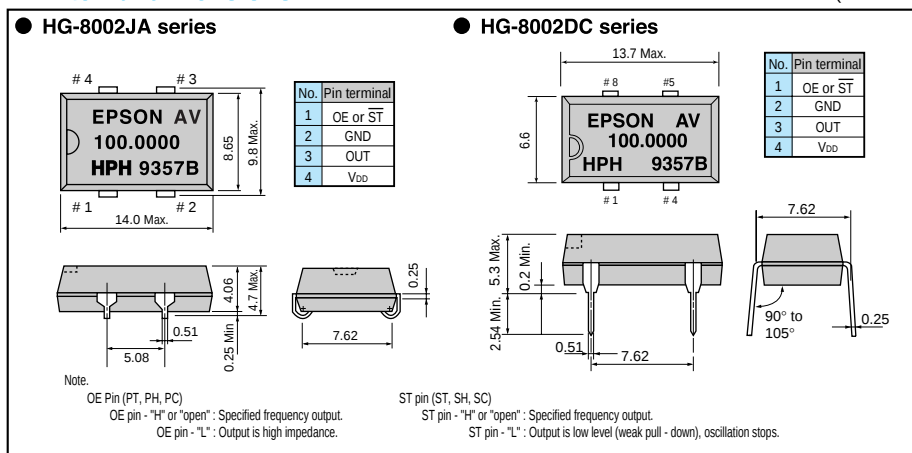
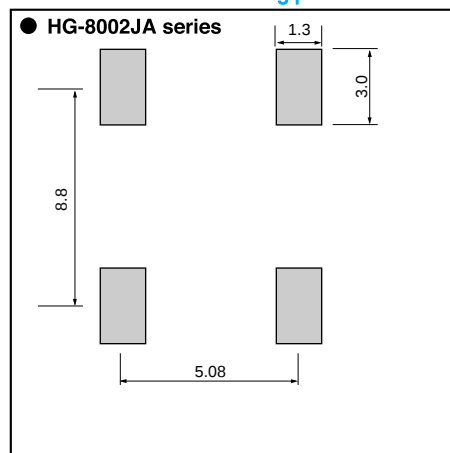
*1 Operating temperature(-40 °C to +85 °C), the available frequency, duty and output load conditions, please refer to page 33.

*2 PLL - PLL connection & Jitter specification, please refer to page 53, 54.

Checking possible by the Frequency Checking Program.

External dimensions

(Unit: mm)

**Recommended soldering pattern** (Unit: mm)

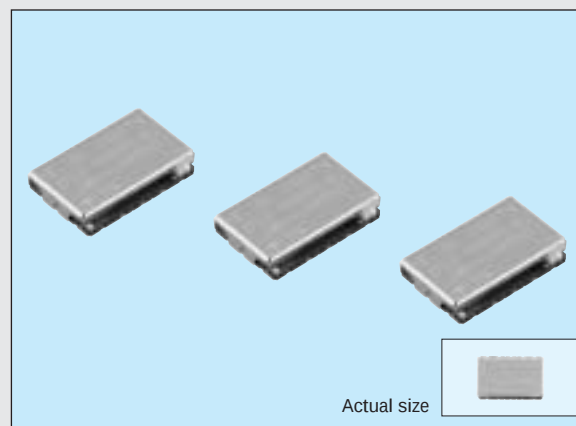
600 MHz band Voltage Controlled SAW Oscillator

EV-3101TA series

Product number (please refer to page 2)

Q3821TA0xxxxxx00

- Differential LV-PECL output.
- Very low jitter / low phase noise.
- 10 G or 2.5 G SONET / SDH clock smoothing and Frequency Translation.

**Specifications (characteristics)**

Item	Symbol	Specifications	Remarks
Output frequency range	f_0	600 MHz to 700 MHz	Please contact us for inquiries about the available frequency.
Power Source voltage	Max. Supply Voltage	$V_{CC} - GND$	0 V to 8 V
	Operating voltage	V_{CC}	3.3 V ± 0.165
	Control voltage	V_C	0.15 V to 3.15 V VC pin, 0.15 V to 3.15 V
Temperature range	Storage Temperature	T_{STG}	-40 °C to +85 °C
	Operating Temperature	T_{OPR}	0 °C to +85 °C
Current consumption	I_{OP}	60 mA Typ.	50 Ω to $V_{CC} - 2$ V
Absolute pull range	APR	G : $\pm 50 \times 10^{-6}$ Min. H : $\pm 100 \times 10^{-6}$ Min. *1	
Modulation Characteristics	BW	40 kHz Typ.	Flat to ± 2 dB typical
Input resistance		10 k Ω Typ.	V_C pin
Duty	t_w/t	45 % to 55 %	At outputs crossing point
Output Voltage	V_{OH}	2.28 V Typ.	0 °C to +85 °C
	V_{OL}	1.60 V Typ.	0 °C to +85 °C
Output load	R_L	50 Ω	
Output rise time	t_{RLH}	80 ps Min.	20 % $\rightarrow$ 80% ($V_{OH} - V_{OL}$)
Output fall time	t_{RHL}	350 ps Max.	80 % $\rightarrow$ 20% ($V_{OH} - V_{OL}$)
Phase Jitter	t_{PJ}	0.112×10^{-3} UI Typ.	offset from carrier = 12 kHz to 20 MHz
		0.218×10^{-3} UI Typ.	offset from carrier = 50 kHz to 80 MHz

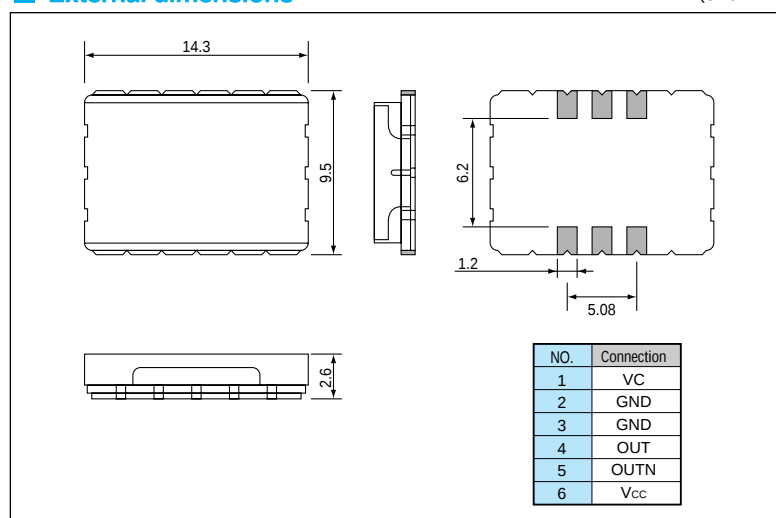
*1 This includes initial frequency tolerance, temperature, supply voltage variation, loading variation and Aging (10 years).

Typical Single Side-Band Phase Noise

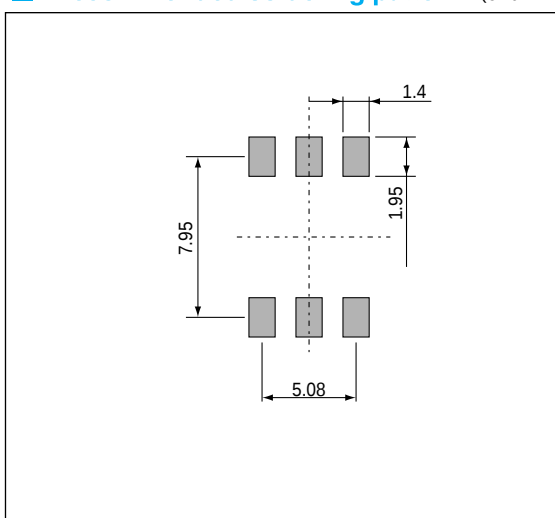
Offset from Carrier	100 Hz	1 kHz	10 kHz	100 kHz	Unit	
622.08 MHz	-70	-94	-117	-139	dBc/Hz	$V_C = 1.65$ V

External dimensions

(Unit: mm)

**Recommended soldering pattern**

(Unit: mm)



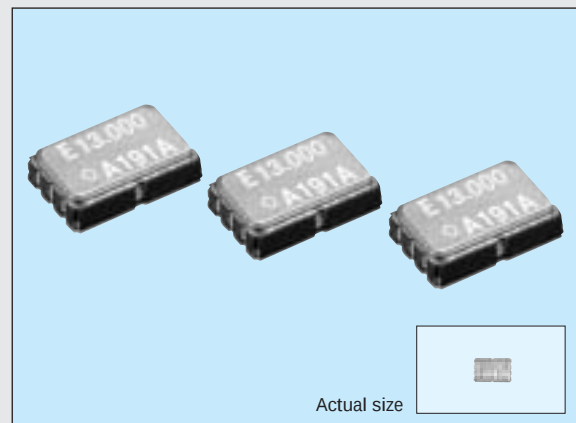
VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR

VG-2820CB

Product number (please refer to page 2)

Q3621CB0xxxxx00

- Developed for GSM.
- Reflowable and high density mounting type ultra small size SMD(5.0x3.2x1.5 mm).
- Using the heat-resisting type AT cut quartz crystal allows almost the same temperature soldering as universal SMD IC.
- Using Bi-CMOS IC allows low current consumption and low noise(-128 dBc/Hz Typ.at 100 Hz offset).
- Operating supply voltage : 2.8 V.



■ Specifications (characteristics)

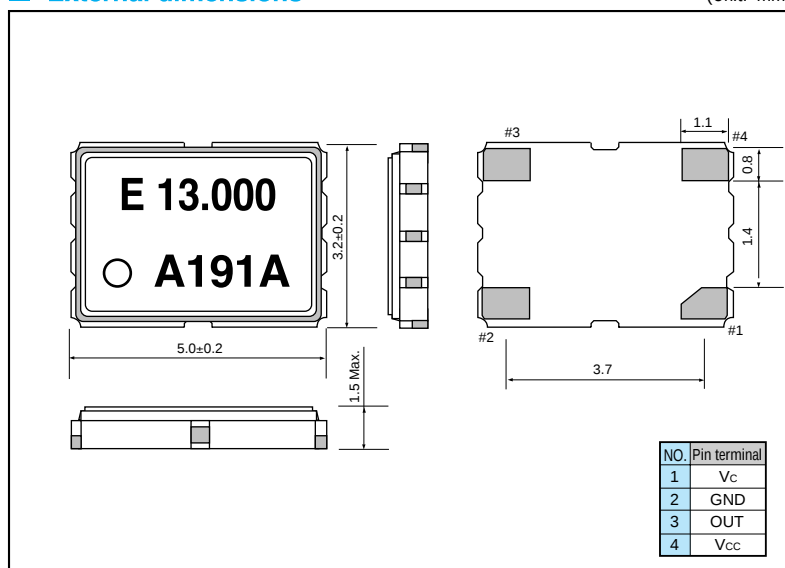
Item	Symbol	Specifications	Remarks
Output frequency	f_0	13.0000 MHz	
Power source voltage	Max. supply voltage	V_{CC-GND}	-0.3 V to +7.0 V
	Operating voltage	V_{CC}	2.8 V ± 0.1 V
Temperature range	Storage temperature	T_{STG}	-40 °C to +85 °C
	Operating temperature	T_{OPR}	-20 °C to +75 °C
Frequency stability	$\Delta f/f_0$	$\pm 12 \times 10^{-6}$ Max. *	
Frequency control range	Δf_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 Ω Min.	V_c-GND (DC)
Current consumption	I_{CC}	1.0 mA Max.	10 k Ω // 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	9 k Ω to 11 k Ω	Dc cut Capacitor=0.01 pF
	C_L	9 pF to 11 pF	

*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.

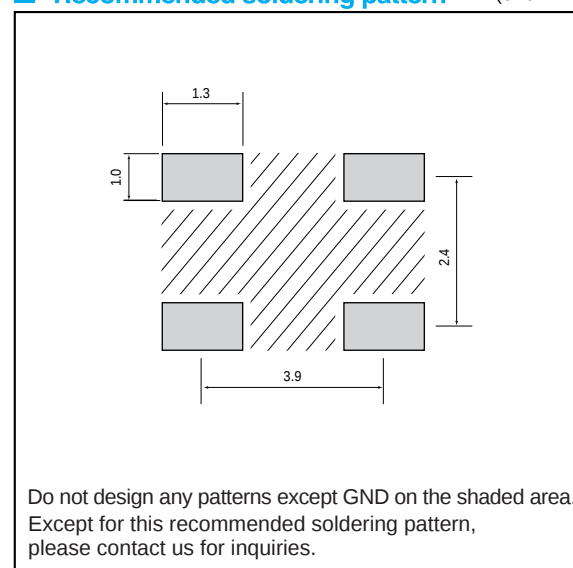
■ External dimensions

(Unit: mm)



■ Recommended soldering pattern

(Unit: mm)



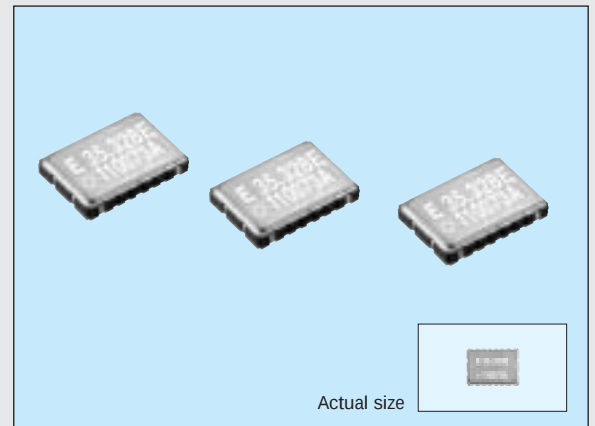
VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR

VG-1201CA

Products number (please refer to page 2)

Q3603CA0xxxxx00

- Reflowable and high density mounting type SMD.
- Well designed internal construction realizes as good as general - purpose ICs heat resistance performance.
- Use of C-MOS 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.



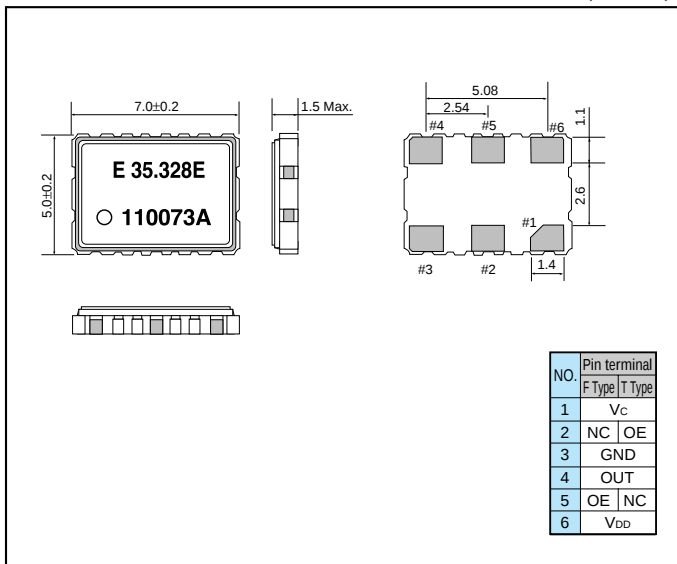
■ Specifications (characteristics)

Item		Symbol	Specifications		Remarks
			ANH / AKH / BNH / BKH	ANC / AKC / BNC / BKC	
Output frequency range		f ₀	1.0000 MHz to 60.0000 MHz		
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}	As per below table		
Frequency stability		Δf/f ₀	As per below table		
Current consumption		I _{OP}	30 mA Max.	25 mA Max.	No load condition
Output disable current		I _{OE}	25 mA Max.	20 mA Max.	OE=GND
Pull range		Δf _c	As per below table		V _c =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		Z _{IN}	5 MΩ Min.		DC Level
Frequency change polarity			Positive polarity		V _c =0.5 V to 4.5 V (**H),0.15 V to 3.15 V(**C)
Duty		t _w /t	40 % to 60 %		1/2V _{DD} level
Output voltage		V _{OH}	V _{DD} -0.4 V Min.		I _{OH} = -4 mA
		V _{OL}	0.4 V Max.		I _{OL} = 4 mA
Output load condition (fan out)		N/CL	15 pF Max.		CMOS load
Output enable / disable input voltage		V _{IH}	0.7 V _{DD} Min.		OE terminal
		V _{IL}	0.3 V _{DD} Max.		
Output rise time		t _{TLH}	4 ns Max.		CMOS load: 20 %→80 % V _{DD}
Output fall time		t _{THL}	4 ns Max.		CMOS load: 80 %→20 % V _{DD}
Oscillation start up time		t _{OSC}	10 ms Max.		Time at 0.9 V _{DD} to be 0s
Aging		f _a	±10 x 10 ⁻⁶ Max.		T _a =+25 °C,10 year

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

■ External dimensions

(Unit: mm)



■ Stability / Temperature range

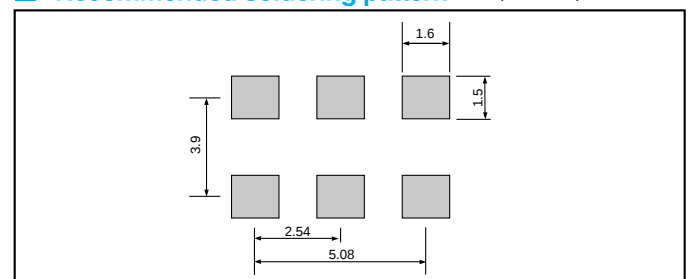
	Stability	Temperature range
A	$\pm 20 \times 10^{-6}$	-20 °C to +70 °C
B	$\pm 25 \times 10^{-6}$	-40 °C to +85 °C

■ Pull range

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

■ Recommended soldering pattern

(Unit: mm)



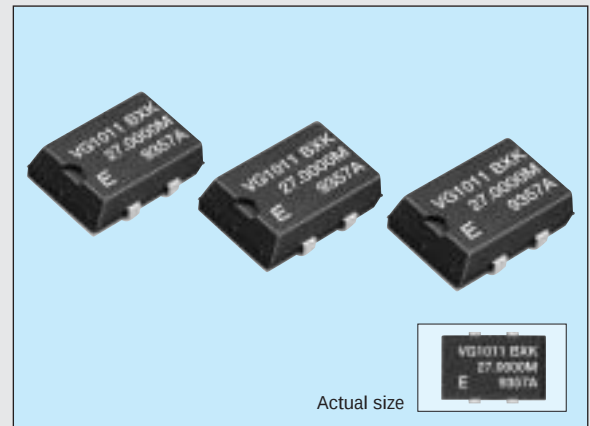
VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR

VG-1011JA

Product number (please refer to page 2)

Q3602JA0xxxxxx00

- High accuracy and high reliability due to trimmerless design.
- Built-in heat resistive AT-cut crystal provides heat resistance equivalent to that of general-purpose ICs.
- Use of CMOS IC assures low current consumption.
- Excellent environmental capability.
- Supply voltage: 5 V



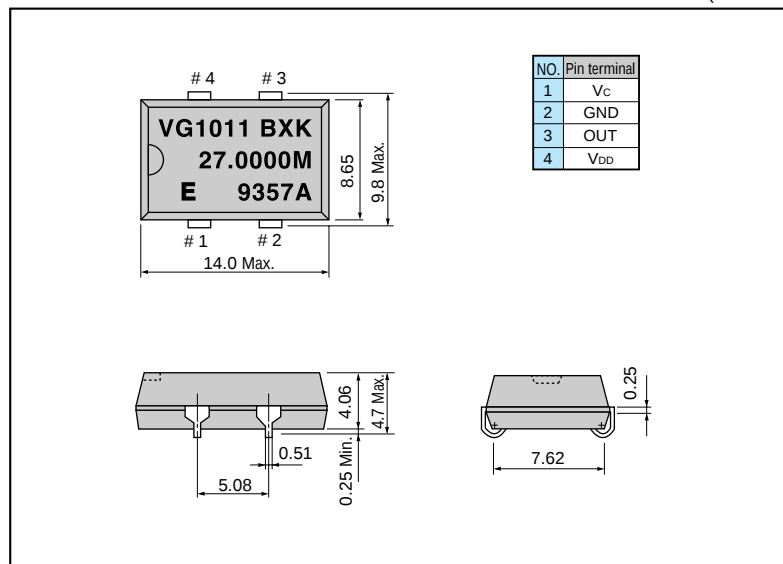
■ Specifications (characteristics)

Item		Symbol	Specifications	Remarks
Output frequency range		f ₀	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 ±0.5 V	
Temperature range	Storage temperature	T _{STG}	-55 °C to +125 °C	Stored as bare product after unpacking
	Operating temperature	T _{OPR}	As per below table *	
Frequency stability		Δf/f ₀	As per below table *	
Current consumption		I _{op}	10 mA Max.	No load condition
Pull range		Δf _c	As per below table *	V _c =2.5±2.0 V
Input resistance		Z _{IN}	10 MΩ 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 1/2V _{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)		N/C _L	2 TTL or 15 pF Max.	TTL load/CMOS load
Output rise time	t _{TLH}		8 ns Max.	CMOS load: 20 %→80 % V _{DD}
			5 ns Max.	TTL load: 0.4 V→2.4 V
Output fall time	t _{THL}		8 ns Max.	CMOS load: 80 %→20 % V _{DD}
			5 ns Max.	TTL load: 2.4 V→0.4 V
Oscillation start up time		t _{osc}	4 ms Max.	Time at 4.5 V to be 0 s
Aging		fa	±5 x 10 ⁻⁶ Max.	Ta=+25 °C, V _{DD} =5 V, first year
Shock resistance		S.R.	±5 x 10 ⁻⁶ Max.	Three drops on a hard board from 750 mm or excitation test with 29400 m/s ² 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

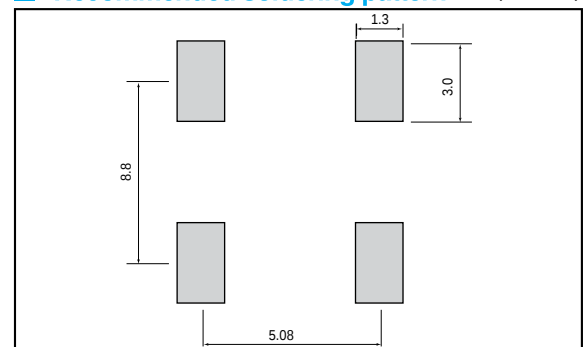
■ Pull range

Stability		Temperature range				Pull range
		-20 °C to +70 °C	-30 °C to +75 °C	-40 °C to +85 °C		
$\pm 15 \times 10^{-5}$	S	V	W	X	B	$\pm 20 \times 10^{-5}$ Min.
$\pm 20 \times 10^{-5}$	A	G, K, N	-	-	G	$\pm 50 \times 10^{-5}$ Min.
$\pm 25 \times 10^{-5}$	B	-	-	G, K, N	K	$\pm 75 \times 10^{-5}$ Min.
					N	$\pm 100 \times 10^{-5}$ Min.

*Please contact us for inquiries about the available frequency.

■ Recommended soldering pattern

(Unit: mm)



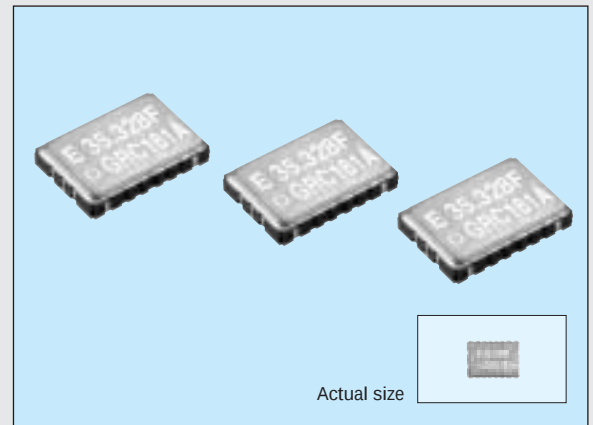
VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR

VG-4231CA

Product number (please refer to page 2)

Q3614CA0xxxxx00

- High accuracy and high reliability due to trimmerless design.
- Well designed internal construction realizes as good as general - purpose ICs heat resistance performance.
- 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.

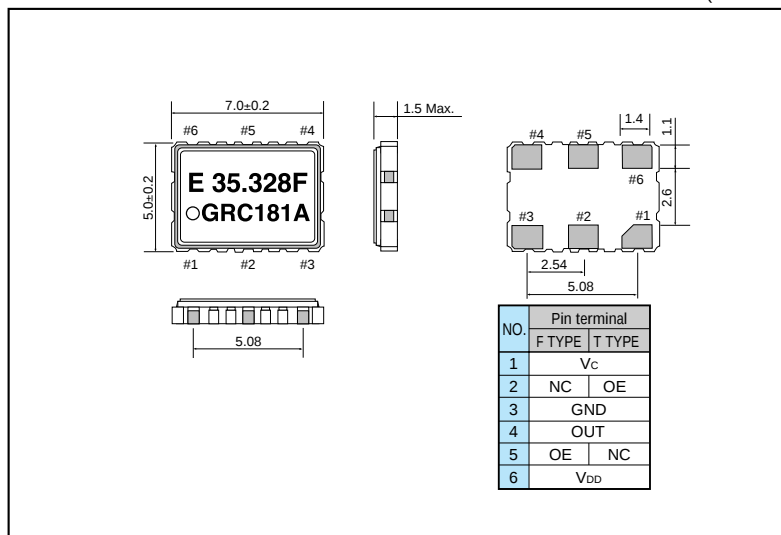


Specifications (characteristics)

Item		Symbol	Specifications		Remarks
			DRH / GRH	DRC / GRC	
Output frequency range		f ₀	16.0000 MHz to 41.0000 MHz		Please contact us for inquiries about the available frequency.
Power source voltage	Max. supply voltage	V _{DD-GND}	-0.3 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}	As per below table		
Frequency stability		Δf/f ₀	As per below table		VC=2.5 V(DRH / GRH) / VC=1.65 V(DRC / GRC)
Current consumption		I _{op}	20 mA Max.	10 mA Max.	No load condition
Output disable current		I _{OE}	15 mA Max.	7 mA Max.	OE=GND
Pull range		Δf _c	R : ±130 x 10 ⁻⁶		VC=2.5±2.0 V(DRH / GRH) / VC=1.65±1.50 V(DRC / GRC)
Modulation Characteristics		BW	± 15 kHz Min.		± 3 dB at 1kHz
Absolute pull range	APR	D : ±80 x 10 ⁻⁶ Min			
		G : ±65 x 10 ⁻⁶ Min			
Input resistance		Z _{IN}	50 kΩ Min.		DC Level
Frequency change polarity			Positive polarity		
Duty		tw/t	40 % to 60 %		1/2V _{DD} level
Output voltage	V _{OH}	V _{DD} -0.4 V Min.		I _{OH} = -0.8 mA(DRC / GRC)/I _{OH} = -4 mA(DRH / GRH)	
	V _{OL}	0.4 V Max.		I _{OL} = 3.2 mA(DRC / GRC)/I _{OL} = 4 mA(DRH / GRH)	
Output load condition (fan out)		N/CL	15 pF Max.		CMOS load
Output enable/ disable input voltage	V _{IH}	0.7 V _{DD} Min.		OE terminal	
	V _{IL}	0.3 V _{DD} Max.			
Output rise time		t _{TLH}	4 ns Max.		CMOS load: 20 %→80 % V _{DD} level
Output fall time		t _{THL}	4 ns Max.		CMOS load: 80 %→20 % V _{DD} level
Oscillation start up time		t _{OSC}	10 ms Max.		Time at 0.9 V _{DD} to be 0 s
Aging		fa	±10 x 10 ⁻⁶ Max.		Ta=+25 °C, 10 year

External dimensions

(Unit: mm)

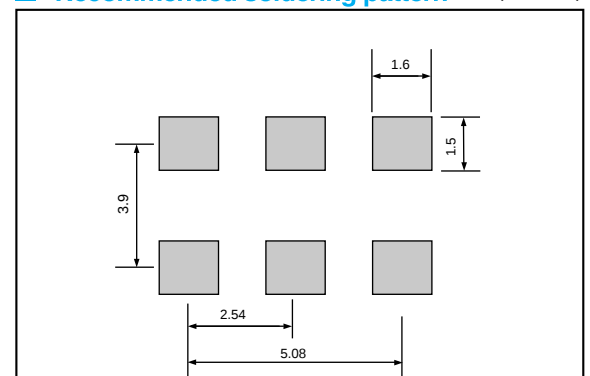


Stability / Temperature range

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

Recommended soldering pattern

(Unit: mm)



VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR

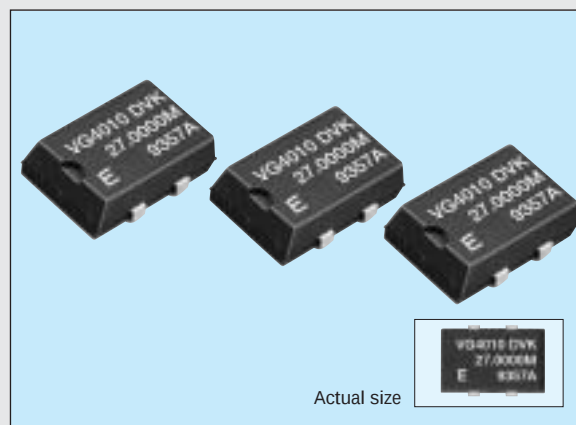
VG-4010JA / 4030JA

Product number (please refer to page 2)

Q3611JA0xxxxxx00

Q3612JA0xxxxxx00

- High accuracy and high reliability due to trimmerless design.
- Built-in heat resistive AT-cut crystal provides heat resistance equivalent to that of general-purpose ICs.
- Use of CMOS IC assures low current consumption.
- Excellent environmental capability.
- Supply voltage: 5 V(VG-4010JA)
- Supply voltage: 3.3 V(VG-4030JA)



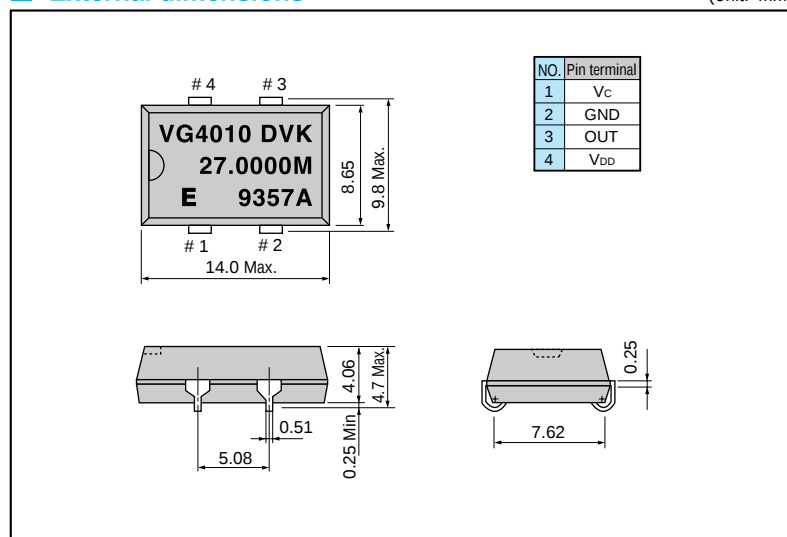
■ Specifications (characteristics)

Item	Symbol	Specifications		Remarks
		VG-4010JA DVK	VG-4030JA DVK	
Output frequency range	f_0	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 ± 0.25 V	3.3 V ± 0.17 V	
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		
Frequency stability	$\Delta f/f_0$	$\pm 35 \times 10^{-6}$ 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	Δf_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 Ω 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 %	1/2VDD 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_{RLH}	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_{THL}	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.		$T_a=+25$ °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 ² x 0.3 ms x 1/2sine wave in 3 directions

Vc should be "GND" or "OPEN" when power is on.

■ External dimensions

(Unit: mm)



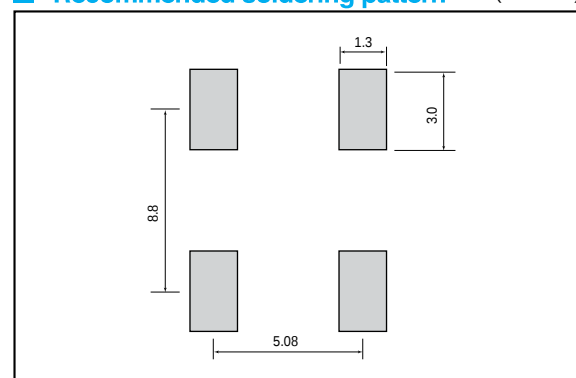
■ Pull range

Pull range	Remarks
180×10^{-6}	Crystal unit's frequency < 20 MHz, Vc=0.0 to 3.0 V
150×10^{-6}	Crystal unit's frequency $\geq$ 20 MHz, Vc=0.0 to 3.0 V

Please contact us for pull range.

■ Recommended soldering pattern

(Unit: mm)



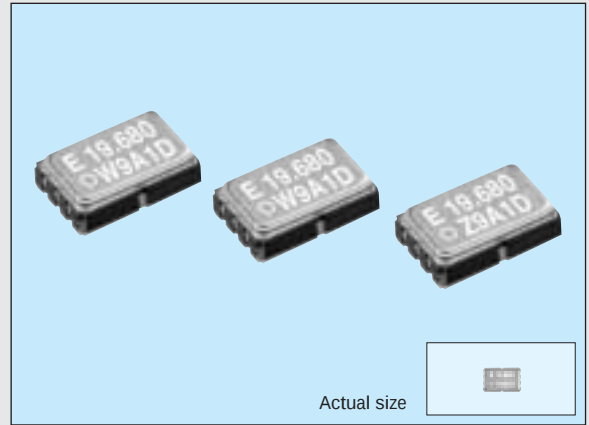
TEMPERATURE COMPENSATED CRYSTAL OSCILLATOR

TG-2832CB / 2833CB

Products number (please refer to page 2)

Q3705CB0xxxxx00**Q3706CB0xxxxx00**

- Developed for Suited for wireless communication equipment (Low noise level: -120 dBc/Hz Typ. at 100 Hz offset, $f_0 = 19.68$ MHz)
- Power saving function (standby function) built-in. (TG-2832CB)
- Reflowable and high density mounting type ultra small size SMD. (5.0x3.2x1.5 mm)
- Using the heat-resisting type AT cut quartz crystal allows almost the same temprature soldering as universal SMD IC.
- Operating supply voltage : 2.8 V.

**Specifications**

Item		Symbol	Specifications		Remarks
			TG-2832CB	TG-2833CB	
Output frequency range		f ₀	16.0000 MHz to 26.0000 MHz Standard : 16.3670, 19.2000, 19.4400, 19.6800, 19.8000, 26.000 MHz		16 MHz ≤ f ₀ ≤ 19 MHz : No frequency control function
Power source voltage	Max. supply voltage	V _{CC} -GND	-0.3 V to +6.0 V		
	Operating voltage	V _{CC}	2.8 V ±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		
Frequency toleance		Δf ₀	±1.5 x 10 ⁻⁶ Max.		V _C =1.4 V, +25 °C ±2 °C
Frequency stability vs.temperature		Δf _T	±2.5 x 10 ⁻⁶ Max.		-30 °C to +80 °C (reference at +25 °C)
Frequency stability vs.load		Δf _L	±0.2 x 10 ⁻⁶ Max.		10 kΩ//10 pF ± 10%
Frequency stability vs. supply voltage		Δf _V	±0.3 x 10 ⁻⁶ Max.		2.8 V ±5 %
Aging		f _a	±1 x 10 ⁻⁶ Max.		T _a =+25 °C,first year
Supply current		I _{CC}	2.0 mA Max.		V _{CC} =2.8 V, 10 kΩ//10 pF 19.68 MHz,STBY=V _{CC}
			50 μA Max.	—	V _{CC} =2.8 V, 10 kΩ//10 pF 19.68 MHz,STBY=GND (DC cut)
Input resistance		Z _{IN}	800 kΩ Min.		V _C -GND(DC), V _C =1.4 V
Frequency control range		Δf _C	7 x 10 ⁻⁶ Min.		V _C =1.4 V ±1.0 V, 19 MHz < f ₀ ≤ 26 MHz 16 MHz ≤ f ₀ ≤ 19 MHz : No frequency control function
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	9 kΩ to 11 kΩ		DC cut capacitor = 0.01 μF
		C _L	9 pF to 11 pF		

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

External dimensions

(Unit: mm)

● TG-2832CB <table border="1"> <thead> <tr> <th>NO.</th> <th>Pin terminal</th> </tr> </thead> <tbody> <tr><td>1</td><td>V_C</td></tr> <tr><td>2</td><td>NC</td></tr> <tr><td>3</td><td>GND</td></tr> <tr><td>4</td><td>OUT</td></tr> <tr><td>5</td><td>STBY</td></tr> <tr><td>6</td><td>V_{CC}</td></tr> </tbody> </table>	NO.	Pin terminal	1	V_C	2	NC	3	GND	4	OUT	5	STBY	6	V_{CC}	● TG-2833CB <table border="1"> <thead> <tr> <th>NO.</th> <th>Pin terminal</th> </tr> </thead> <tbody> <tr><td>1</td><td>V_C</td></tr> <tr><td>2</td><td>GND</td></tr> <tr><td>3</td><td>OUT</td></tr> <tr><td>4</td><td>V_{CC}</td></tr> </tbody> </table>	NO.	Pin terminal	1	V_C	2	GND	3	OUT	4	V_{CC}
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Recommended soldering pattern

(Unit: mm)

● TG-2832CB 	● TG-2833CB
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Do not design any patterns except GND on the shaded area. Except for this recommended soldering pattern, please contact us for inquiries.

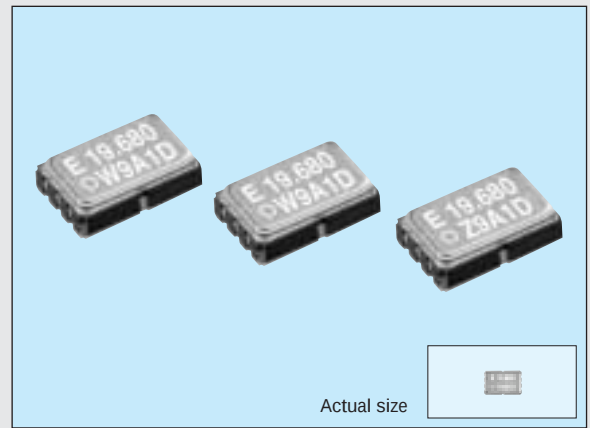
TEMPERATURE COMPENSATED CRYSTAL OSCILLATOR

TG-2824CB / 2825CB

Products number (please refer to page 2)

Q3703CB0xxxxx00**Q3704CB0xxxxx00**

- Developed for CDMA cellular phone (Low noise level: -120 dBc/Hz Typ. at 100 Hz offset, $f_0 = 19.68$ MHz)
- Power saving function (standby function) built-in. (TG-2824CB)
- Reflowable and high density mounting type ultra small size SMD. (5.0x3.2x1.5 mm)
- Using the heat-resisting type AT cut quartz crystal allows almost the same temperature soldering as universal SMD IC.
- Operating supply voltage : 2.8 V.

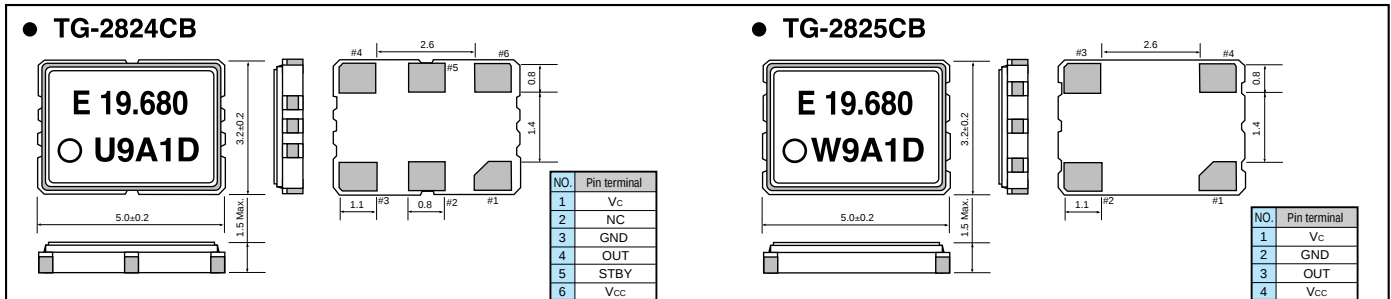
**Specifications**

Item		Symbol	Specifications		Remarks
			TG-2824CB	TG-2825CB	
Output frequency range		f ₀	12.5000 MHz to 19.8000 MHz Standard : 19.2000, 19.6800, 19.8000 MHz		12.5 MHz ≤ f ₀ ≤ 19 MHz : Please contact us for inquiries about frequency control range
Power source voltage	Max. supply voltage	V _{CC} -GND	-0.3 V to +6.0 V		
	Operating voltage	V _{CC}	2.8 V ±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		
Frequency toleance		Δf ₀	±1.5 x 10 ⁻⁶ Max.		V _C =1.4 V, +25 °C ±2 °C
Frequency stability vs.temperature		Δf _T	±2.0 x 10 ⁻⁶ Max.		-30 °C to +80 °C (reference at +25 °C)
Frequency stability vs.load		Δf _L	±0.2 x 10 ⁻⁶ Max.		10 kΩ//10 pF ± 10%
Frequency stability vs. supply voltage		Δf _V	±0.3 x 10 ⁻⁶ Max.		2.8 V ±5 %
Aging		f _a	±1 x 10 ⁻⁶ Max.		T _a =+25 °C,first year
Supply current		I _{CC}	1.8 mA Max.		V _{CC} =2.8 V, 10 kΩ//10 pF 19.68 MHz,STBY=V _{CC}
			50 μA Max.	—	V _{CC} =2.8 V, 10 kΩ//10 pF 19.68 MHz,STBY=GND (DC cut)
Input resistance		Z _{IN}	800 kΩ Min.		V _C -GND(DC), V _C =1.4 V
Frequency control range		Δf _C	±5.5 x 10 ⁻⁶ to ±11 x 10 ⁻⁶		V _C =1.4 V ±1.0 V, 19 MHz < f ₀ ≤ 19.8 MHz 12.5 MHz ≤ f ₀ ≤ 19 MHz : No voltage control function
Frequency change polarity			Positive polarity		
Duty		Duty	30 % to 70 %		GND level (DC cut)
Output level		V _{OUT}	0.8 V Min.		Peak to peak
Output load		R _L	9 kΩ to 11 kΩ		DC cut capacitor = 0.01 μF
		C _L	9 pF to 11 pF		

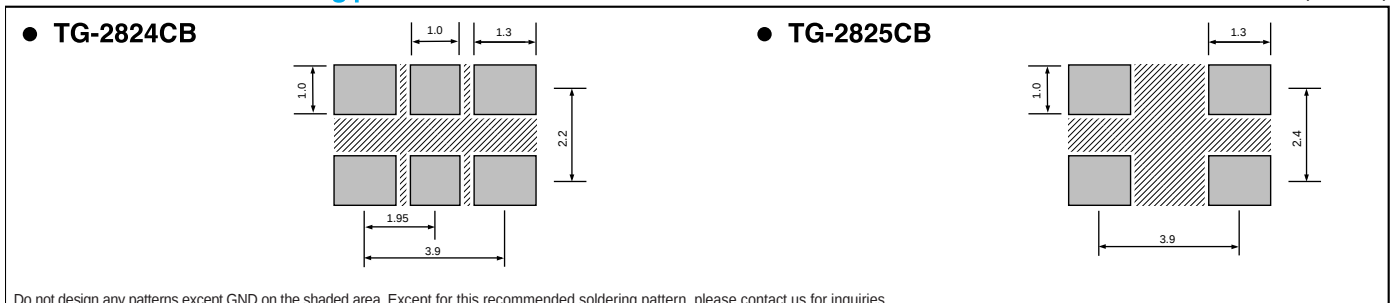
Note: Please contact us for inquiries about specifications other than the above.

External dimensions

(Unit: mm)

**Recommended soldering pattern**

(Unit: mm)



Do not design any patterns except GND on the shaded area. Except for this recommended soldering pattern, please contact us for inquiries.

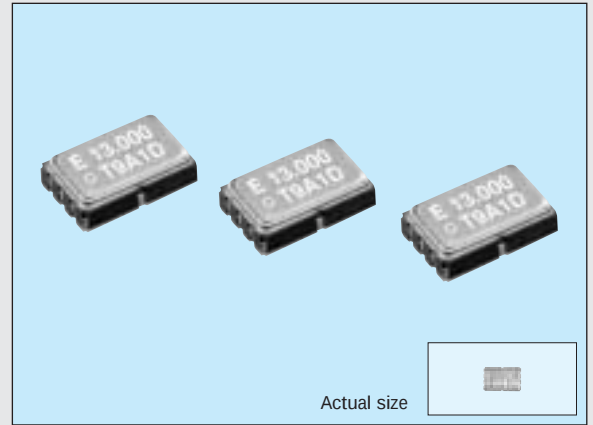
TEMPERATURE COMPENSATED CRYSTAL OSCILLATOR

TG-2820CB

Product number (please refer to page 2)

Q3702CB0xxxx00

- Developed for cellular phone.
- Reflowable and high density mounting type ultra small size SMD. (5.0x3.2x1.5 mm)
- Using the heat-resisting type AT cut quartz crystal. allows almost the same temperature soldering as universal SMD IC.
- Operating supply voltage : 2.8 V.



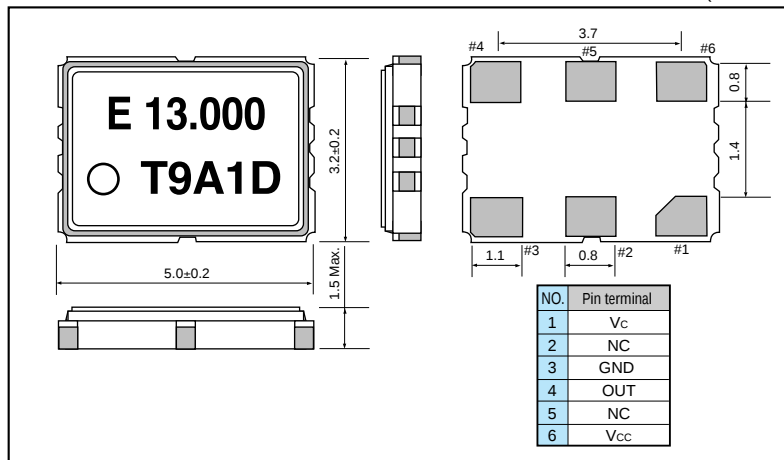
■ Specifications

Item	Symbol	Specifications	Remarks
Output frequency range	f_0	12.5000 MHz to 19.8000 MHz Standard : 12.8000, 13.0000, 16.8000, 19.2000, 19.6800, 19.8000MHz	
Power source voltage	Max. supply voltage	V_{CC-GND}	-0.3 V to +6.0 V
	Operating voltage	V_{CC}	2.8 V ± 0.14 V
Temperature range	Storage temperature	T_{STG}	-40 °C to +85 °C
	Operating temperature	T_{OPR}	-30 °C to +80 °C
Frequency tolerance	Δf_0	$\pm 1.5 \times 10^{-6}$ Max.	$V_C=1.4$ V, +25 °C ± 2 °C
Frequency stability vs. temperature	Δf_T	$\pm 2.5 \times 10^{-6}$ Max.	-30 °C to +80 °C (reference at +25 °C)
Frequency stability vs. load	Δf_L	$\pm 0.2 \times 10^{-6}$ Max.	10 k Ω /10 pF $\pm 10\%$
Frequency stability vs. supply voltage	Δf_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}	1.5 mA Max.	$V_{CC}=2.8$ V, 10 k Ω /10 pF
Input resistance	Z_{IN}	800 k Ω Min.	$V_C-GND(DC)$, $V_C=1.4$ V
Frequency control range	Δf_C	$\pm 7 \times 10^{-6}$ Min.	$V_C=1.4$ V ± 1.0 V
Frequency change polarity		Positive polarity	
Duty	Duty	30 % to 70 %	GND level (DC cut)
Output level	V_{OUT}	0.8 V Min.	Peak to peak
Output load	R_L	9 k Ω to 11 k Ω	DC cut capacitor = 0.01 μ F
	C_L	9 pF to 11 pF	

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

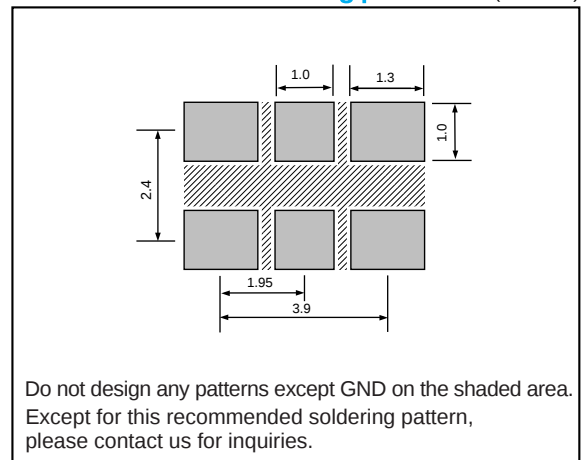
■ External dimensions

(Unit: mm)



■ Recommended soldering pattern

(Unit: mm)



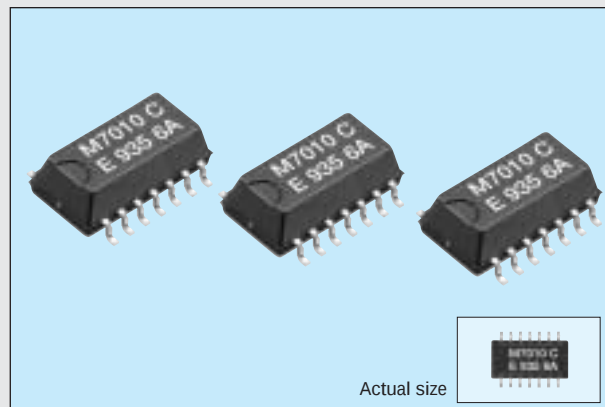
SELECTABLE-OUTPUT PLL OSCILLATOR

MG-7010SA

Product number (please refer to page 2)

Q33M11SAxxxx00

- Can output one CPU frequency among 15 selections.
- Reflow able, high-density mounting-type SMD.
- Provided with output enable and stand-by function to allow low current consumption.
- Using CMOS IC allows low current consumption and assures high reliability.



Specifications (characteristics)

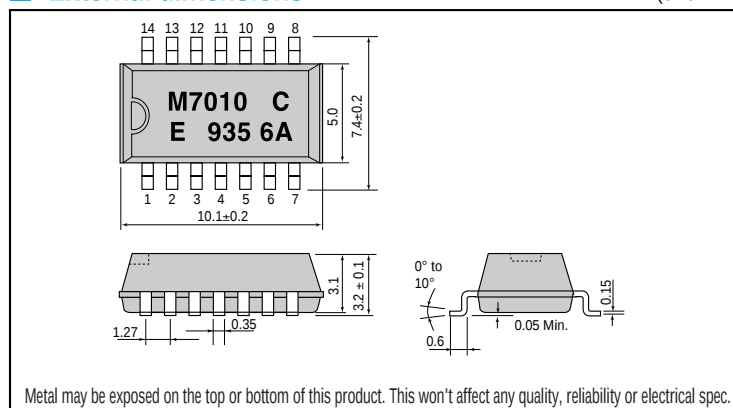
Item	Symbol	Specifications	Remark
Frequency change time	t_{ft}	10 ms Max.	S0, S1, S2, S3 changing
Output frequency range	f_0	20.0000 MHz to 120.0000 MHz	$V_{DD}=4.5\text{ V to }5.5\text{ V}$
		20.0000 MHz to 80.0000 MHz	$V_{DD}=2.7\text{ V to }5.5\text{ V}$
Power source voltage	Max. supply voltage	$V_{DD}-GND$	-0.5 V to +7.0 V
	Operating voltage	V_{DD}	2.7 V to 5.5 V
Temperature range	Storage temperature	T_{STG}	-55 °C to +100 °C
	Operating temperature	T_{OPR}	-20 °C to +70 °C
Frequency stability	$\Delta f / f_0$	C: $\pm 100 \times 10^{-6}$	-20 °C to +70 °C, $V_{DD}=2.7\text{ V to }5.5\text{ V}$
Current consumption	I_{OP}	45 mA Max.	No load condition ($f_0=120\text{ MHz}$)
Output disable current	I_{OE}	25 mA Max.	$OE=GND$, $f_0=120\text{ MHz}$
Standby current	I_{ST}	10 μ A Max.	$\overline{ST}=GND$
Duty	t_w/t	40 % to 60 %	1.4 V level
High output voltage	V_{OH}	$V_{DD}-0.5\text{ V Min.}$	$I_{OH} = -16\text{ mA}$ ($V_{DD}=5\pm 0.5\text{ V}$)
Low output voltage	V_{OL}	0.4 V Max.	$I_{OL} = 16\text{ mA}$ ($V_{DD}=5\pm 0.5\text{ V}$)
Output load condition	C_L	25 pF Max.	$V_{DD}=4.5\text{ V to }5.5\text{ V}$ ($f_0 \leq 80\text{ MHz}$)
		15 pF Max.	$V_{DD}=2.7\text{ V to }4.5\text{ V}$ or $f_0 > 80\text{ MHz}$
High input voltage	V_{IH}	2.0 V Min.	$\overline{ST}, OE$ terminal
Low input voltage	V_{IL}	0.8 V Max.	$\overline{ST}, OE$ terminal
Output rise time	t_{TLH}	4.0 ns Max.	20 % $\rightarrow$ 80 % V_{DD} level
Output fall time	t_{THL}	4.0 ns Max.	80 % $\rightarrow$ 20 % V_{DD} level
Oscillation start up time	t_{OSC}	10 ms Max.	Time at 4.5 V to be 0 s
Aging	f_a	$\pm 5 \times 10^{-6}$ /year Max.	$T_a=+25\text{ °C}$, $V_{DD}=5.0\text{ V} / 3.0\text{ V}$, 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 ² x 0.3 ms 1/2 sine wave in 3 directions

Output frequency

Select bit	Output frequency (MHz)															
	100.0	33.33	30.0	120.0	25.0	20.0	70.0	80.0	75.0	66.66	60.0	60.0	50.0	45.0	90.0	40.0
S3	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
S2	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
S1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
S0	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1

External dimensions

(Unit: mm)



Terminal connection

Terminal No.	Terminal symbol	Function
1	S3	Frequency select bit 3
2	GND	Ground
4	S0	Frequency select bit 0
5	S1	Frequency select bit 1
6	OE	Output Enable control Clock out at "H" high-impedance at "L"
7	$\overline{ST}$	Stand by control "H" $\rightarrow$ Clock out "L" $\rightarrow$ "Level"
8	V_{DD}	Power supply
13	OUT	Clock output
14	S2	Frequency select bit 2
3, 9, 10, 11, 12	N.C	No connection

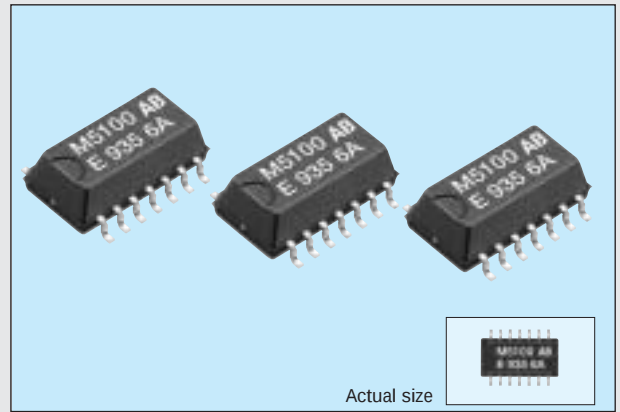
MULTI-OUTPUT CRYSTAL OSCILLATOR

MG-5100SA

Product number (please refer to page 2)

Q33M21SAxxxxxx00

- High density mounting type SMD, SOP-14pin package.
- 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 frequencies by select pin for CPU CLK.



Actual size

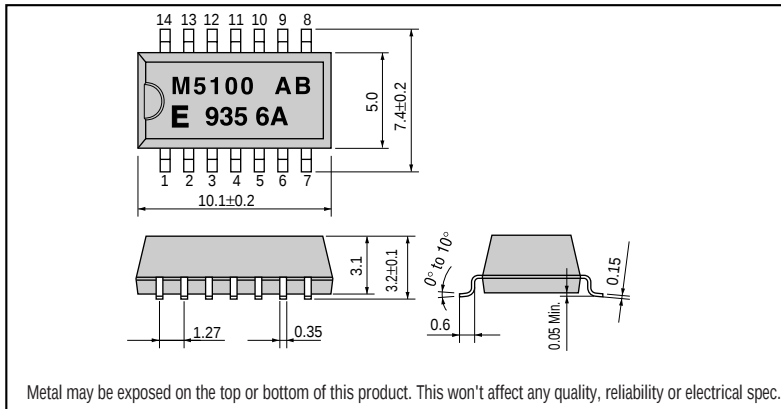
■ Specifications (characteristics)

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 / fo	±100 × 10 ⁻⁶	Stored as bare product after unpacking
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	80 %VDD Min.	
"L" input voltage 1	VIL	20 %VDD Max.	
Output rise time	tRLH	5.0 ns Max.	20%→80% VDD
Output fall time	tRHL	4.0 ns Max.	80%→20% VDD
Jitter	tj	450 ps Max.	Cycle to Cycle jitter
		500 ps Max.	Peak to Peak Jitter
Skew	t _{skw}	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 × 10 ⁻⁶ /year Max.	Ta= +25 °C, VDD=5.0 V / 3.0 V, First year
Shock resistance	S.R.	±20 × 10 ⁻⁶ Max.	Three drops on a hard board from 750 mm or excitation test with 29400 m/s ² 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)



■ Terminal condition

Terminal	Pin No.	Function
VDD1	14	Power supply (3.3V or 5.0V)
VDD2	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

TABLE OF REAL TIME CLOCK MODULES

Characteristics

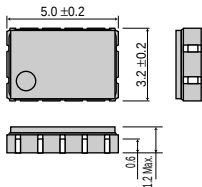
page	Item Model	Package	Counter (time counting)	Access time (synchronous signal cycle)	Data bit	Address bit	Memory	Alarm	Time interval of standard pulse	Other features
75 76	RX-4581	SON 22-Pin		(CLK: 350 ns)			128 bit (SRAM)	Minute to Day and day of the week	32.768 kHz to 1/60 Hz	
77 78	RTC-9701	VSOJ 20-Pin		(CLK: 500 ns)		4-Wire Serial	4 kbit (EEPROM)		32.768 kHz	SPI bus
83	RTC-4553	SOP 14-Pin		(CLK: 2 μ s)			4 bit x 30 (SRAM)	—	1024 Hz, 10 s	
79 80	RX-4702	SON 10-Pin						Minute to Day and day of the week		
81 82	RTC-4701	VSOJ20-pin SON 22-pin		(CLK: 350 ns)			—		32.768 kHz to 1/30 Hz	Built-in temperature sensor
81 82	RTC-4574	SOP 14-pin VSOJ20-pin SON 22-Pin				3-Wire Serial				
84	RTC-4543	SOP 14-pin SOP 18-pin		(CLK: 750 ns)					32.768 kHz, 1 Hz	
85 86	RX-8025	SOP 14-Pin SON 22-Pin	Second to year day of the week					Second to Hour	32.768 kHz	High stability ($\pm 5 \times 10^{-6}$)
87 88	RX-8581	SOP 14-Pin VSOJ20-Pin SON 22-Pin		(SCL: 2.5 μ s)		I ² C Bus				High Quality 32.768 kHz output
89 90	RX-8564	SON 10-Pin					—	Minute to Day and day of the week	32.768 kHz to 1 Hz	
89 90	RTC-8564	VSOJ20-pin SON 22-pin								
91 92	RTC-7301	DIP 18-pin SSOP24-pin		85 ns				Second to day, day of the week	32.768 kHz to 1/30 Hz	High speed access 3.0 V operation
93	RTC-62421	DIP 18-pin			4	4			64 Hz, 1 s, 1 min, 1 h	
94	RTC-62423	SOP 24-pin		120 ns						Intel bus

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

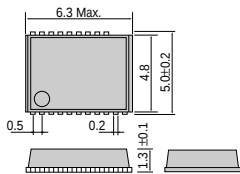
Dimensions

(Unit: mm)

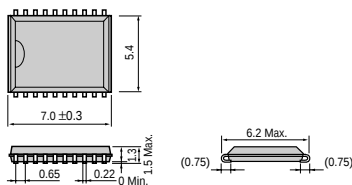
● SON 10-pin (RX-4702CF/8564CF)



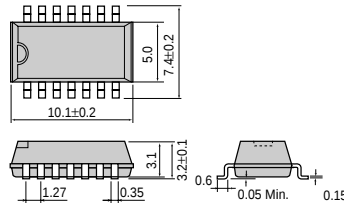
● SON 22-pin (RX-8025NB/8581NB/4581NB RTC-4574NB/4701NB/8564NB)



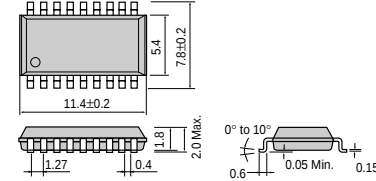
● VSOJ 20-pin (RTC-9701JE/4574JE/4701JE/8564JE RX-8581JE)



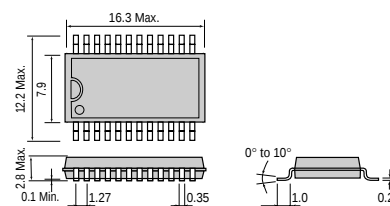
● SOP 14-pin (RX-8025SA/8581SA RTC-4543SA/4553/4574SA)



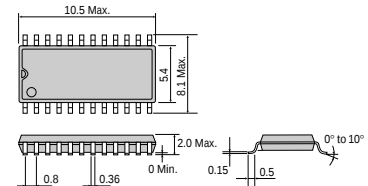
● SOP 18-pin (RTC-4543SB)



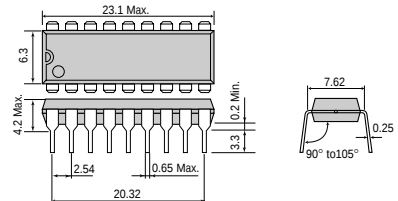
● SOP 24-pin (RTC-62423/72423)



● SSOP24-pin(RTC-7301SF)



● DIP 18-pin (RTC-7301DG/62421/72421)



SERIAL REAL TIME CLOCK MODULE WITH SRAM

RX-4581NB

Product number (please refer to page 2)

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.
- Automatic adjustment for leap year.
- Low backup current : 0.4 μ A /3 V(Typ.)
- Wide operating voltage range : 1.6 V to 5.5 V

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_{DD}	V_{DD} to GND	-0.3	+7.0	V
Input voltage	V_{IN}	Input Pin	GND-0.3	$V_{DD}+0.3$	
Output voltage	V_{OUT1}	F_{OUT}, DO		$V_{DD}+0.3$	
	V_{OUT2}	$TIRQ, AIRQ$		+8.0	
Storage temperature	T_{STG}	Stored as bare product after unpacking	-55	+125	$^{\circ}$ C

■ Operating range

Item	Symbol	Condition	Min.	Max.	Unit
Power voltage	V_{DD}	—	1.6	5.5	V
Clock voltage	V_{CLK}	—			
Operating temperature	V_{OPR}	No condensation	-40	+85	$^{\circ}$ C

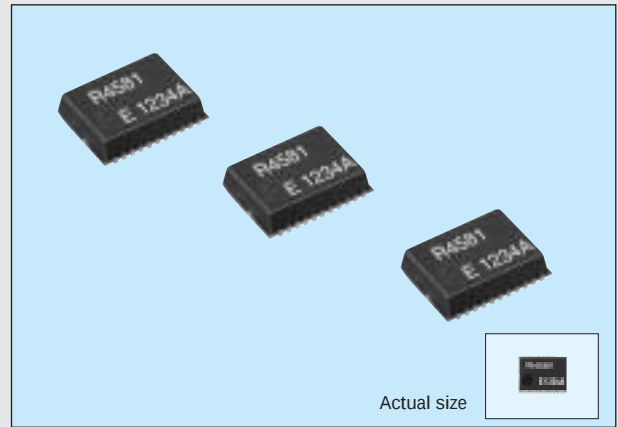
■ Frequency characteristics

Item	Symbol	Condition	Range	Unit
Frequency tolerance	$\Delta f/f_0$	$T_a=+25^{\circ}\text{C}$, $V_{DD}=3\text{ V}$	$5\pm 23^{*}$	$\times 10^{-6}$
Oscillation start up time	t_{STA}	$T_a=+25^{\circ}\text{C}$, $V_{DD}=3.0\text{ V}$	3 Max.	s
Frequency temperature characteristics	T_{OP}	$T_a=-10$ to $+70^{\circ}\text{C}$, Reference at $+25^{\circ}\text{C}$	+10 -120	$\times 10^{-6}$
Frequency voltage characteristics	f/V	$T_a=+25^{\circ}\text{C}$, $V_{DD}=2.0\text{ V}$ to 5.0 V	± 2 Max.	$\times 10^{-6}/\text{V}$
Aging	f_a	$T_a=+25^{\circ}\text{C}$, $V_{DD}=3\text{ V}$, first year	± 5 Max.	$\times 10^{-6}/\text{year}$

*Please ask tighter tolerance

■ DC characteristics ($V_{DD}=1.6\text{ V}$ to 5.5 V , $T_a=-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$)

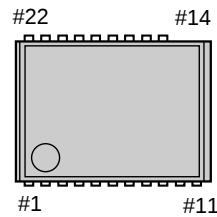
Item	Symbol	Condition		Min.	Typ.	Max.	Unit	
Standby current 1	I _{DD1}	V _{DD} =5 V	CEO, CE1, FOE=GND AIRQ, TIRQ=V _{DD} 32.768 kHz output is OFF.	—	0.6	1.2	μA	
Standby current 2	I _{DD2}	V _{DD} =3 V			0.4	0.8		
Input voltage	V _{IH}	CEO , CE1 , DI		0.8V _{DD}	—	V _{DD} +0.3	V	
	V _{IL}	CLK , FOE		GND-0.3		0.2V _{DD}		
Input leakage current	I _{LK}	CE1 , DI , CLK , FOE V _{IN} =V _{DD} or GND		-0.5		0.5	μA	
Pulldown R1	R _{DWN1}	V _{DD} =5 V	CEO pins V _{IN} =V _{DD}	75	150	300	kΩ	
Pulldown R2	R _{DWN2}	V _{DD} =3 V		150	300	600		
Output voltage 1	V _{OH1}	V _{DD} =5 V	I _{OH} =-1 mA	4.5	—	5.0	V	
	V _{OH2}	V _{DD} =3 V	DO, FOUT pins	2.0		3.0		
	V _{OH3}		I _{OH} =-100 μA DO, FOUT pins	2.9				
Output voltage 2	V _{OL1}	V _{DD} =5 V	I _{OL} =1 mA	GND	—	GND+0.5		
	V _{OL2}	V _{DD} =3 V	DO, FOUT pins			GND+0.8		
	V _{OL3}		I _{OL} =100 μA DO, FOUT pins			GND+0.1		
	V _{OL4}		V _{DD} =5 V			I _{OL} =1 mA		GND+0.25
	V _{OL5}		V _{DD} =3 V			AIRQ, TIRQ pins		
Output leakage current	I _{OZ}	V _{OUT} =GND or V _{DD} AIRQ, TIRQ, FOUT Pins		-0.5		0.5	μA	



Actual size

■ Terminal connection

● RX-4581NB

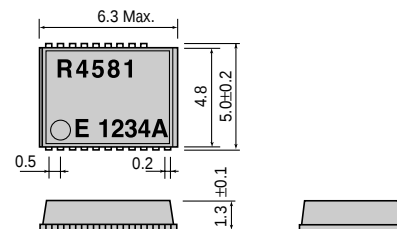


No.	Pin terminal	No.	Pin terminal
1	GND	22	N.C
2	CE1	21	N.C
3	CEO	20	N.C
4	DI	19	N.C
5	DO	18	N.C
6	CLK	17	N.C
7	TIRQ	16	N.C
8	AIRQ	15	N.C
9	FOE	14	N.C
10	FOUT	13	—
11	V_{DD}	12	—

■ 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	○	40	20	10	8	4	2	1
1	Min	○	40	20	10	8	4	2	1
2	Hour	○	○	20	10	8	4	2	1
3	Day of Week	○	6	5	4	3	2	1	0
4	Day	○	○	20	10	8	4	2	1
5	Month	○	○	○	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	○	○	TSEL 1	TSEL 0
E	Frag Register	○	○	UF	TF	○	○	VLF	○
F	Control Register	○	○	UIE	TIE	AIE	○	STOP	RESET

BANK1

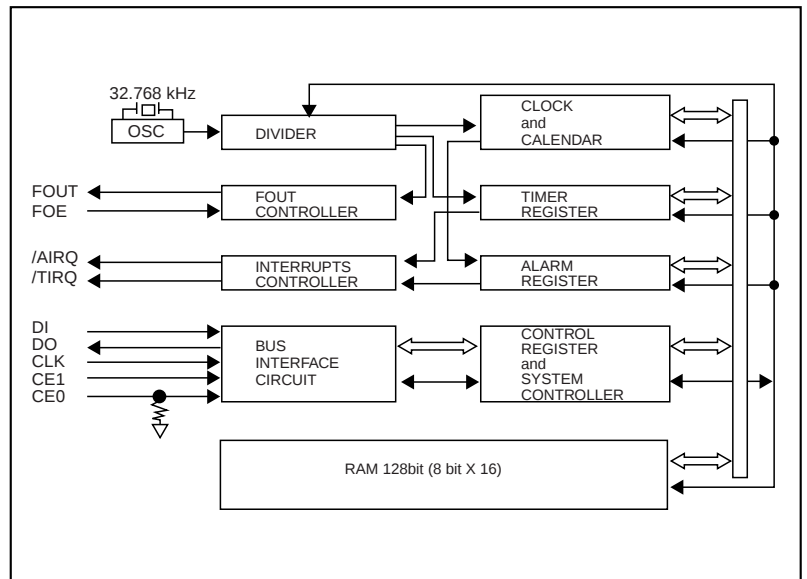
Address	Register symbol	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
0	RAM 0	•	•	•	•	•	•	•	•
1	RAM 1	•	•	•	•	•	•	•	•
2	RAM 2	•	•	•	•	•	•	•	•
⋮	⋮	⋮							
D	RAM D	•	•	•	•	•	•	•	•
E	RAM E	•	•	•	•	•	•	•	•
F	RAM F	•	•	•	•	•	•	•	•

■ AC characteristics

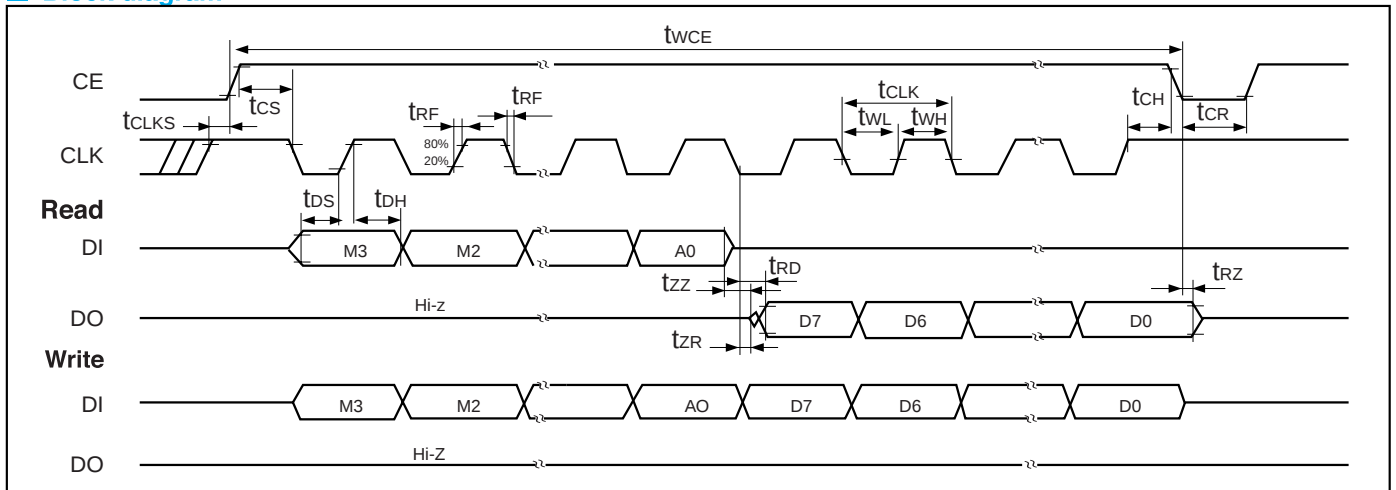
*If not specifically indicated, GND=0, Ta=-40 °C to +85 °C

Item	Symbol	Condition	V _{DD} =3.0 V±10 %		V _{DD} =5.0 V±10 %		Unit
			Min.	Max.	Min.	Max.	
CLK clock cycle	t _{CLK}		500		350		ns
CLK H Pulse Width	t _{WH}		250		175		ns
CLK L Pulse Width	t _{WL}		250		175		ns
CLK L rise and fall time	t _{RF}			100		50	ns
CLK setup time	t _{CLKS}		0		0		ns
CE setup time	t _{CS}		200		150		ns
CE hold time	t _{CH}		200		100		ns
CE recovery time	t _{CR}		300		200		ns
CE enable time	t _{WCE}			0.95		0.95	s
Write data setup time	t _{DS}		100		50		ns
Write data hold time	t _{DH}		100		50		ns
Read data delay time	t _{RD}	C _I =50 pF		200		150	ns
DO output switching time	t _{ZR}			50		20	ns
DO output disable time	t _{RZ}	C _I =50 pF R _I =10 kΩ		200		100	ns
DI/DO conflict avoiding time	t _{ZZ}		0		0		ns
FOUT duty	t _{Wt}	50% V _{DD} level	40	60	40	60	%

■ Timing chart



■ Block diagram



SERIAL REAL TIME CLOCK MODULE WITH EEPROM

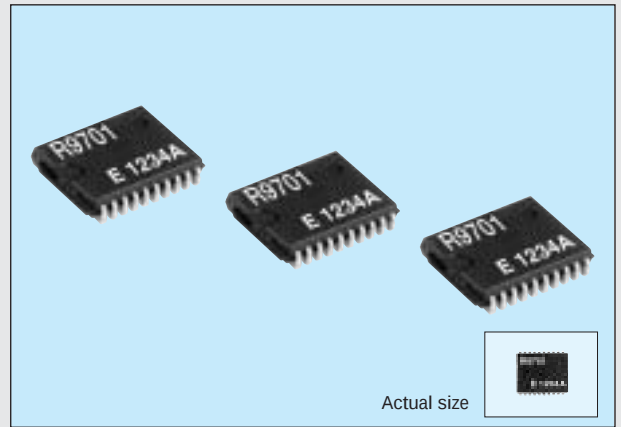
RTC-9701JE

Product number (please refer to page 1)

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 $\pm$ 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)
- Automatic adjustment for leap year.
- Wide range of clock voltage between 1.8 V and 5.5 V.
- Low backup current : 0.8 μ A / 3.0 V. (Typ.)

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_{DD}, V_{DD2}	V_{DD}, V_{DD2} to GND	-0.3	+6.0	V
Input voltage	V_{IN}	Input Pin	GND-0.3	$V_{DD}+0.3$	
	V_{AIN}	VEX pin	-0.3	+6.0	
Output voltage	V_{OUT}	AIRQ, TIRQ, FOUT, DO pins	GND-0.3	$V_{DD}+0.3$	
Storage temperature	T_{STG}	Stored as bare product after unpacking	-55	+125	$^{\circ}$ C

■ Operating range

Item	Symbol	Condition	Min.	Max.	Unit
Power voltage	V_{DD}	V_{DD}	2.7	3.6	V
Clock voltage	V_{DD2}	V_{DD2}	1.8	5.5	
Analog voltage	V_{EX}	VEX	1.4	5.5	
Operating temperature	T_{OPR}	No condensation	-40	+85	$^{\circ}$ C

■ Frequency characteristics

Item	Symbol	Condition	Range	Unit
Frequency tolerance	$\Delta f/f_0$	$T_a = +25^{\circ}$ C, $V_{DD2} = 3.0$ V	$5 \pm 23^{*}$	$\times 10^{-6}$
Oscillation start up time	t_{STA}	$T_a = +25^{\circ}$ C, $V_{DD} = 3.0$ V	3 Max.	s
Frequency temperature characteristics	T_{OP}	$T_a = -10^{\circ}$ C to $+70^{\circ}$ C, $V_{DD} = 3.0$ V, $+25^{\circ}$ C	$\pm 10/-120$	$\times 10^{-6}$
Frequency voltage characteristics	f/V	$T_a = +25^{\circ}$ C, $V_{DD} = 1.8$ V to 5.5 V	± 2.0	$\times 10^{-6}/V$
Aging	f_a	$T_a = +25^{\circ}$ C, $V_{DD} = 3.0$ V, first year	± 5.0	$\times 10^{-6}/\text{year}$

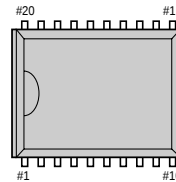
* Please ask tighter tolerance.

■ DC characteristics $GND=0$ V, $V_{DD}=2.7$ V to 3.6 V, $V_{DD2}=1.8$ V to 5.5 V, $T_a=-40^{\circ}$ C to $+85^{\circ}$ C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
V_{DD} current consumption	I_{DD1}	$V_{DD} = 3.0$ V, F_{OUT} output off		0.2	3.0	μ A
	I_{DD2}	$V_{DD} = 3.0$ V, $CL=0$ pF, $F_{OUT}=32.768$ kHz output		1.0	3.5	
V_{DD2} current consumption	I_{BK1}	$V_{DD2} = 3.0$ V, F_{OUT} output off		0.8	1.0	μ A
	I_{BK2}	$V_{DD2} = 3.0$ V, $CL=0$ pF, $F_{OUT}=32.768$ kHz output		0.8	1.0	
Input voltage	V_{IH}	CE, CLK, DI, FOE	$0.8V_{DD}$		V_{DD}	V
	V_{IL}		0		$0.2V_{DD}$	
Input leakage current	I_{LK}	CE, CLK, DI, FOE $V_{IN}=V_{DD}$ or GND	-0.5		0.5	μ A
Pulldown	R_{DWN}	CE, FOE	75		600	k Ω
"H" Output voltage	$VOH1$	$I_{OH}=-1$ mA	$V_{DD}-0.4$			V
	$VOH2$	$I_{OH}=-1$ mA	$V_{DD}-0.4$			
"L" Output voltage	$VOL1$	$I_{OL}=1$ mA	GND		$GND+0.4$	
	$VOL2$	$I_{OL}=1$ mA	GND		$GND+0.4$	
	$VOL3$	AIRQ, TIRQ $I_{OL}=2$ mA	GND		$GND+0.4$	
Leakage current	I_{OZ}	DO, AIRQ, TIRQ, F_{OUT} $V_{OUT}=V_{DD}$ or GND	-0.5		0.5	μ A

■ Terminal connection

● RTC-9701JE

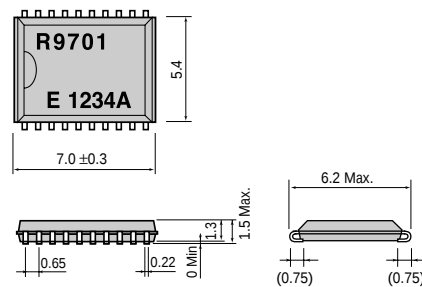


No.	Pin terminal	No.	Pin terminal
1	V_{DD2}	20	N.C
2	VEX	19	N.C
3	FOE	18	N.C
4	AIRQ	17	N.C
5	TIRQ	16	N.C
6	CE	15	N.C
7	CLK	14	N.C
8	DI	13	GND
9	DO	12	GND
10	V_{DD}	11	FOUT

■ External dimensions

(Unit: mm)

● RTC-9701JE (VSOJ 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

 $GND=0$ V, $V_{DD}=2.7$ V to 3.6 V, $V_{DD2}=1.8$ V to 5.5 V, $T_a=-40^{\circ}$ C to $+85^{\circ}$ C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Memory contents			4 k (256 x 16)			bit
Program/Erase Cycle			10^5			Times
Current consumption	I_{DD3}	EEPROM write		1	3	mA
Access time	t_{WNV}			5	10	ms

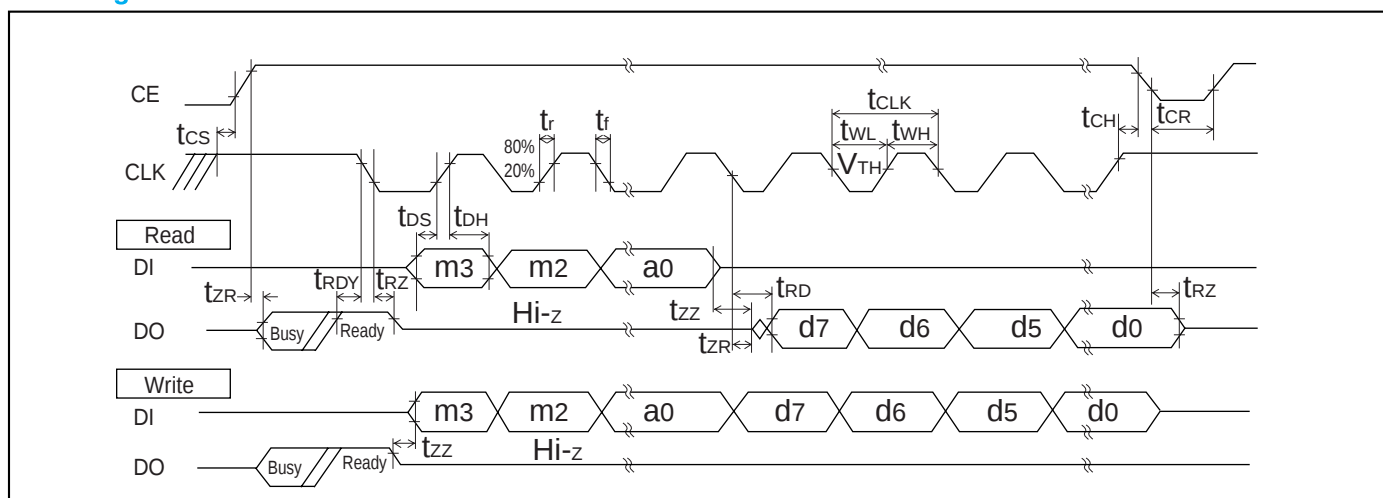
■ RC Register table

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																

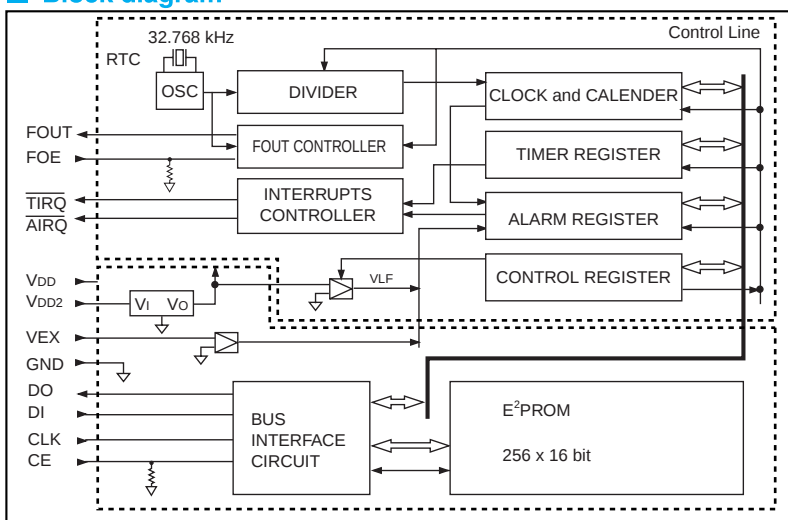
■ Timing chart



■ AC characteristics (GND=0 V, $V_{DD}=2.7$ V to 3.6 V, $V_{DDQ}=1.8$ V to 5.5 V, $T_a=-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$)

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=65 pF±10pF RL=10 k			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	ms
FOUT duty ratio	tw/t	Vth=1/2 VDD VDD=3.0 V	40	50	60	%

■ Block diagram



SERIAL REAL TIME CLOCK MODULE WITH TEMPERATURE SENSOR

RTC-4701JE/NB RX-4702CF

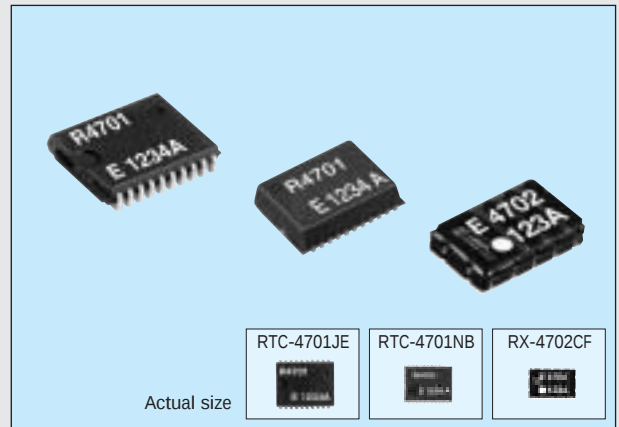
Product number (please refer to page 2)

Q4147017x000200 Q4147019x000200

Q414702Axxxxxx00

- 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.
- Automatic adjustment for leap year.
- 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.)

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 _{DD}	V _{DD} to GND	-0.3	+7.0	V
Input voltage	V _{IN}	Input Pin	GND-0.3	V _{DD} +0.3	
Output voltage	V _{OUT1}	TIRQ, AIRQ, IRQ		+8.0	
	V _{OUT2}	FOUT, DATA		V _{DD} +0.3	
Storage temperature	T _{STG}	Stored as bare product after unpacking	-55	+125	°C

Operating range

Item	Symbol	Condition	Min.	Max.	Unit
Power voltage	V _{DD}	—	1.6	5.5	V
Clock voltage	V _{CLK}	—			
Operating temperature	V _{OPR}	No condensation	-40	+85	°C

Frequency characteristics

Item	Symbol	Condition	Range	Unit
Frequency tolerance	Δf/f ₀	Ta=+25 °C, V _{DD} =3 V	5±23*	x 10 ⁻⁶
Oscillation start up time	t _{STA}	Ta=+25 °C, V _{DD} =3.0 V	3 Max.	s
Frequency temperature characteristics	T _{OP}	Ta=-10 to +70 °C, Reference at +25 °C	+10 -120	x 10 ⁻⁶
Frequency voltage characteristics	f/V	Ta=+25 °C, V _{DD} =1.6 to 5.5 V	±2 Max.	x 10 ⁻⁶ /V
Aging	fa	Ta=+25 °C, V _{DD} =3 V	±5 Max.	x 10 ⁻⁶ /year

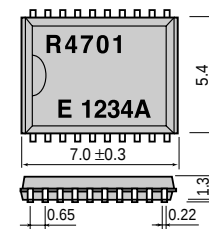
* Please ask tighter tolerance.

DC characteristics (GND=0 V, V_{DD}=1.6 V to 5.5 V, Ta=-40 °C to +85 °C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Standby current 1	I _{DD1}	V _{DD} =5 V CE, FOE, SOFF=GND AIRQ, TIRQ, IRQ=V _{DD} 32.768 kHz output is OFF. Sensor output is OFF.	—	1.0	2.0	μA
Standby current 2	I _{DD2}	V _{DD} =3 V	—	0.5	1.0	
Input voltage	V _{IH}	CE, CLK, DATA, FOE, SOFF	0.8V _{DD}	—	V _{DD} +0.3	V
	V _{IL}	—	GND-0.3	—	0.2V _{DD}	
Input leakage current	I _{LK}	CLK, DATA, FOE, SOFF V _{IN} =V _{DD} or GND	-0.5	—	0.5	μA
Pulldown R1	R _{DWN1}	V _{DD} =5 V CE pins	75	150	300	kΩ
Pulldown R2	R _{DWN2}	V _{DD} =3 V V _{IN} =V _{DD}	150	300	600	
Output voltage 1	V _{OH1}	V _{DD} =5 V I _{OH} =-1 mA	4.5	—	5.0	V
	V _{OH2}	V _{DD} =5 V DATA, FOUT pins	2.0	—	3.0	
	V _{OH3}	V _{DD} =3 V I _{OH} =-100 μA DATA, FOUT pins	2.9	—	3.0	
Output voltage 2	V _{OL1}	V _{DD} =5 V I _{OL} =1 mA	—	—	GND+0.5	
	V _{OL2}	V _{DD} =5 V DATA, FOUT pins	—	—	GND+0.8	
	V _{OL3}	V _{DD} =3 V I _{OL} =100 μA DATA, FOUT pins	—	—	GND+0.1	
	V _{OL4}	V _{DD} =5 V I _{OL} =1 mA	—	—	GND+0.25	
	V _{OL5}	V _{DD} =3 V AIRQ, TIRQ, IRQ pins	—	—	GND+0.4	
Leakage current	I _{oz}	V _{OUT} =GND or V _{DD} , FOUT, DATA, AIRQ, TIRQ, IRQ pins	-0.5	—	0.5	μA

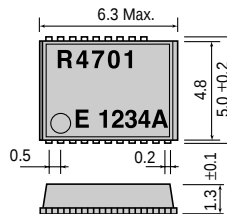
External dimensions/Terminal connection (Unit: mm)

● RTC-4701JE (VSQJ 20-pin)



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

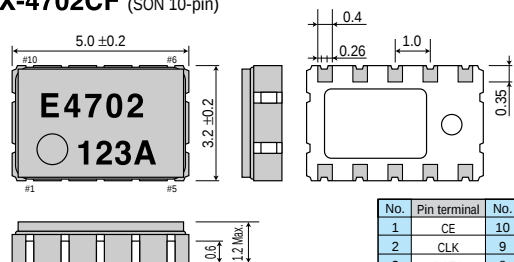
● RTC-4701NB (SON 22-pin)



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	V _{DD}	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	V _{DD}
2	CLK	9	VTEMP
3	DATA	8	IRQ
4	SOFF	7	FOE
5	GND	6	FOUT

Temperature sensor characteristics

GND=0 V, Ta=-40 °C to +85 °C

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Temperature output voltage	V _{TEMP}	Ta=+25 °C, GND based output voltage V _{TEMP} pin, V _{DD} =2.7 V to 5.5 V	—	1.48	—	V
Output precision	T _{ACR}	Ta=+25 °C, V _{DD} =2.7 V to 5.5 V	—	—	±5.0	°C
Temperature sensitivity	V _{SE}	-40 °C ≤ Ta ≤ +85 °C, V _{DD} =2.7 V to 5.5 V	-7.1	-7.6	-8.1	mV/°C
		RX-4702CF	-7.3	-7.8	-8.3	
Linearity	ΔNL	-40 °C ≤ Ta ≤ +85 °C, V _{DD} =2.7 to 5.5 V	—	—	±2.0	%
Output resistance	R _O	Ta=+25 °C, VTEMP pin, V _{DD} =2.7 V to 5.5 V GND standard and V _{DD} 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	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	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 ₁	TD ₀	*	*	*	*
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

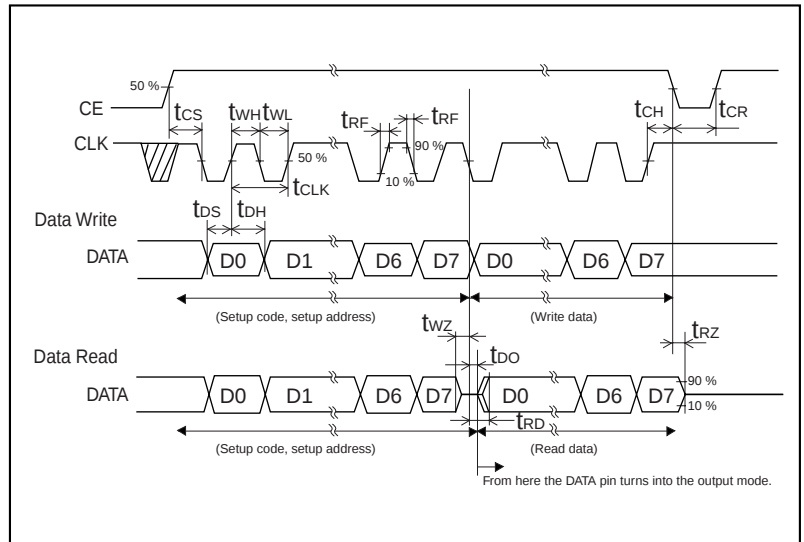
0 : Always set this bit to "0". Registers 0 to A are the same in BANK0 and BANK1.

AC characteristics

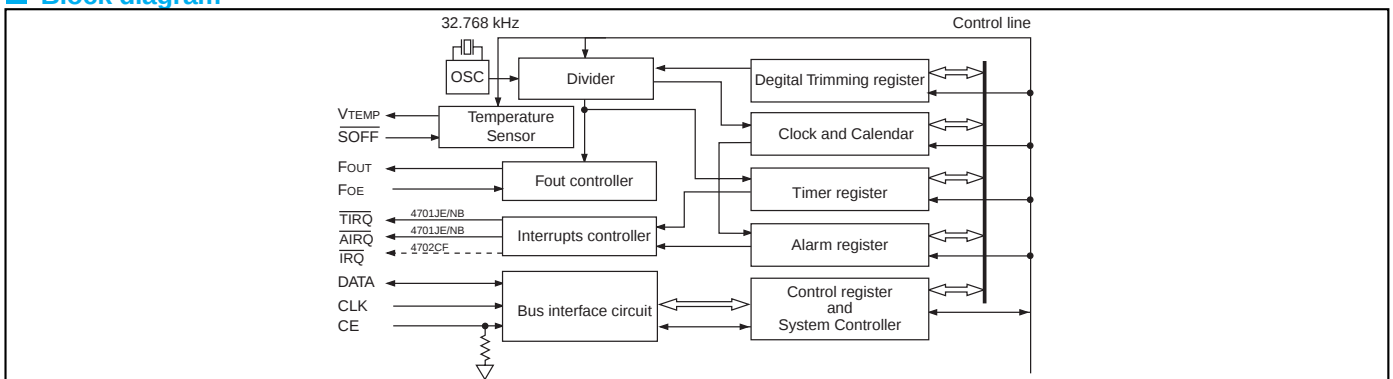
(GND=0 V, Ta=-40 °C to +85 °C)

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

Timing chart



Block diagram



SERIAL REAL TIME CLOCK MODULE

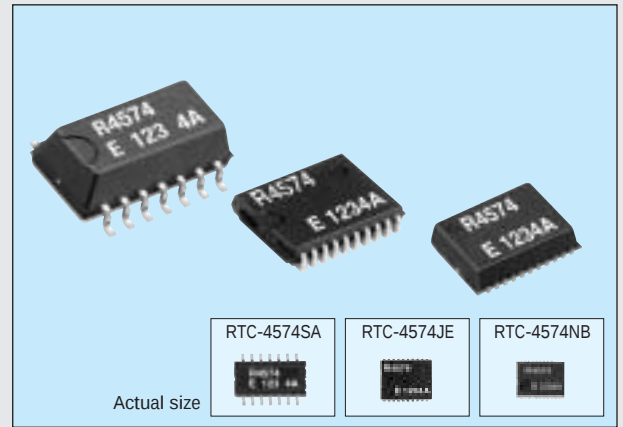
RTC-4574SA/JE/NB

Product number (please refer to page 2)

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.
- 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 μ A/3 V. (Typ.)



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 _{DD}	V _{DD} to GND	-0.3	+7.0	V
Input voltage	V _{IN}	Input Pin	GND-0.3	V _{DD} +0.3	
Output voltage	V _{OUT1} V _{OUT2}	TIRQ, AIRQ FOUT, DATA		+8.0 V _{DD} +0.3	
Storage temperature	T _{STG}	Stored as bare product after unpacking	-55	+125	°C

■ Operating range

Item	Symbol	Condition	Min.	Max.	Unit
Power voltage	V _{DD}	—	1.6	5.5	V
Clock voltage	V _{CLK}	—			
Operating temperature	V _{OPR}	No condensation	-40	+85	°C

■ Frequency characteristics

Item	Symbol	Condition	Range	Unit
Frequency tolerance	$\Delta f/f_0$	T _a =+25 °C, V _{DD} =3 V	5 $\pm$ 23*	x 10 ⁻⁶
Oscillation start up time	t _{STA}	T _a =+25 °C, V _{DD} =1.6 V	3 Max.	s
Frequency temperature characteristics	T _{OP}	T _a =-10 °C to +70 °C, Reference at +25 °C	+10 -120	x 10 ⁻⁶
Frequency voltage characteristics	f/V	T _a =+25 °C, V _{DD} =1.6 to 5.5 V	$\pm$ 2	x 10 ⁻⁶ /V
Aging	f _a	T _a =+25 °C, V _{DD} =3 V	$\pm$ 5	x 10 ⁻⁶ /year

* Please ask tighter tolerance.

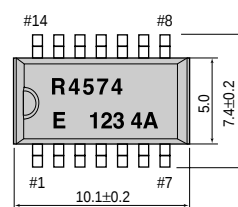
■ DC characteristics (GND=0 V, V_{DD}=1.6 V to 5.5 V, T_a=-40 °C to +85 °C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Standby current 1	I _{DD1}	V _{DD} =5 V CE ₀ , CE ₁ =GND DATA, AIRQ, TIRQ V _{DD}	—	1.0	2.0	μA
Standby current 2	I _{DD2}	V _{DD} =3 V		0.5	1.0	
Input voltage	V _{IH}	CE ₀ , CE ₁ , CLK, DATA, FCON pins	0.8V _{DD}	—	V _{DD} +0.3	V
	V _{IL}		GND-0.3		0.2V _{DD}	
Input leakage current	I _{LK}	V _{IN} =GND or V _{DD} CE ₁ , CLK FCON pins	-0.5		0.5	μA
Pulldown R1	R _{DOWN1}	V _{DD} =5 V CE ₀ pins V _{IN} =V _{DD}	75	150	300	kΩ
Pulldown R2	R _{DOWN2}	V _{DD} =3 V	150	300	600	
Output voltage 1	V _{OH1}	V _{DD} =5 V I _{OH} =-1 mA DATA, FOUT pins	4.5	—	5.0	V
	V _{OH2}		2.0		3.0	
	V _{OH3}	V _{DD} =3 V I _{OH} =-100 μA DATA, FOUT pins	2.9			
Output voltage 2	V _{OL1}	V _{DD} =5 V I _{OL} =1 mA DATA, FOUT pins	GND	—	GND+0.5	
	V _{OL2}				GND+0.8	
	V _{OL3}	V _{DD} =3 V I _{OL} =100 μA DATA, FOUT pins			GND+0.1	
	V _{OL4}	V _{DD} =5 V I _{OL} =1 mA			GND+0.25	
	V _{OL5}	V _{DD} =3 V AIRQ, TIRQ pins			GND+0.4	
Output leakage current	I _{OZ}	V _{OUT} =GND or V _{DD} , DATA, AIRQ, TIRQ pins	-0.5		0.5	μA

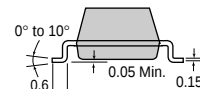
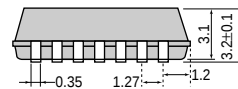
■ External dimensions/Terminal connection

(Unit: mm)

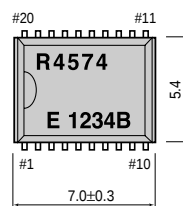
● RTC-4574SA (SOP 14-pin)



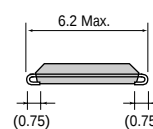
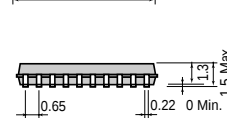
No.	Pin terminal	No.	Pin terminal
1	GND	14	FCON
2	FOUT	13	CE ₁
3	N.C	12	DATA
4	N.C	11	CLK
5	N.C	10	TIRQ
6	N.C	9	AIRQ
7	V _{DD}	8	CE ₀



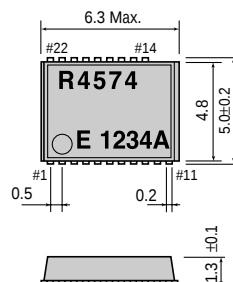
● RTC-4574JE (VSQJ 20-pin)



No.	Pin terminal	No.	Pin terminal
1	V _{DD}	20	N.C
2	FOUT	19	N.C
3	CE ₀	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 ₁	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 ₁	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 ₀	14	N.C
10	FOUT	(13)	-
11	V _{DD}	(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	S40	S20	S10	S8	S4	S2	S1
1	Min	fr	Min40	Min20	Min10	Min8	Min4	Min2	Min1
2	Hour	fr	0	Hour20	Hour10	Hour8	Hour4	Hour2	Hour1
3	Day of Week	fr	W6	W5	W4	W3	W2	W1	W0
4	Day	fr	0	Day20	Day10	Day8	Day4	Day2	Day1
5	Month	fr	0	0	Month10	Month8	Month4	Month2	Month1
6	Year	Year80	Year40	Year20	Year10	Year8	Year4	Year2	Year1
7	Minutes Alarm	AE	A-Min40	A-Min20	A-Min10	A-Min8	A-Min4	A-Min2	A-Min1
8	Hours Alarm	AE	*	A-Hr20	A-Hr10	A-Hr8	A-Hr4	A-Hr2	A-Hr1
9	Week Alarm	AE	A-W6	A-W5	A-W4	A-W3	A-W2	A-W1	A-W0
A	Day Alarm	AE	*	A-Day20	A-Day10	A-Day8	A-Day4	A-Day2	A-Day1
B	FOUT control	FE	*	FD4	FD3	*	FD2	FD1	FD0
C	Timer interrupt control	TE	*	TD1	TD0	*	*	*	*
D	Count Down Timer	Timer128	Timer64	Timer32	Timer16	Timer8	Timer4	Timer2	Timer1
E	Control 1	0	0	0	TI/TP	AF	TF	AIE	TIE
F	Control 2	0	TEST	STOP	RESET	HOLD	0	0	0

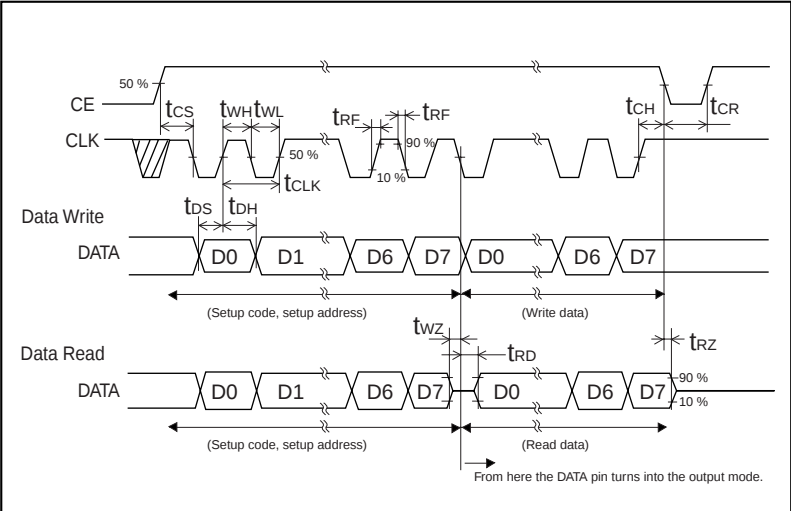
0 : Always set this bit to“0”.

■ AC characteristics

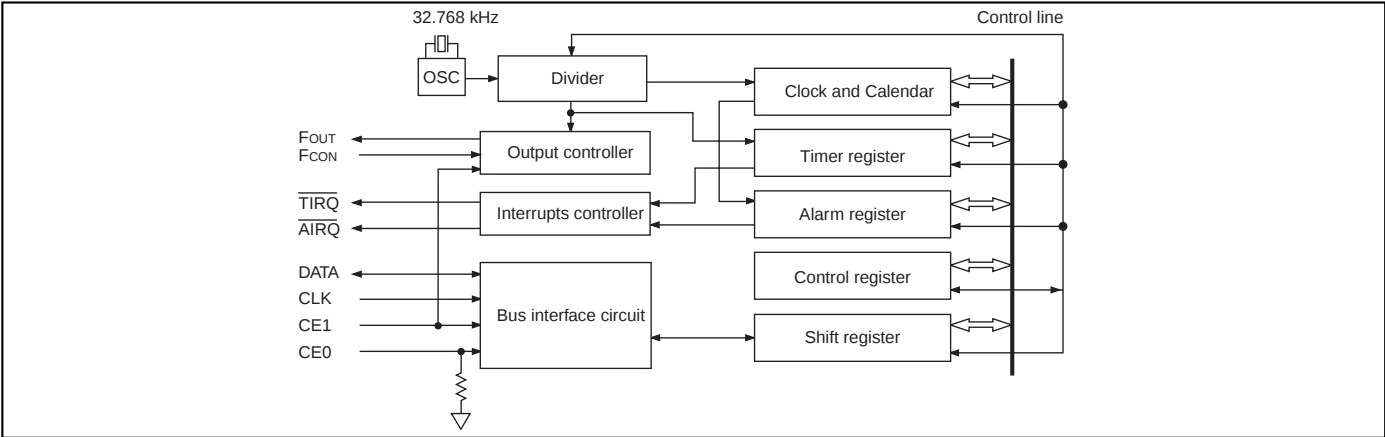
(GND=0 V, T_a =-40 °C to +85 °C)

Item	Symbol	Control	V _{DD} =3.0 V±10 %		V _{DD} =5.0 V±10 %		Unit
			Min.	Max.	Min.	Max.	
CLK clock cycle	t _{CLK}	—	800	—	350	—	ns
CLK H Pulse Width	t _{WH}		400		175		
CLK L Pulse Width	t _{WL}						
CE setup time	t _{CS}						
CE hold time	t _{CH}						
CE recovery time	t _{CR}		600		300		
Write data setup time	t _{DS}		100		50		
Write data hold time	t _{DH}		80				
Write data disable delay time	t _{WZ}		0		0		
Read data delay time	t _{RD}	C _I =50 pF	—	300	—	120	
Output disable time	t _{TRZ}	C _I =50 pF		200		100	
		R _I =10 kΩ					
Rise and fall time	t _{RF}	—	100	50			
FOUT duty ratio (32.768 kHz output)	Duty		35	65	40	60	%

■ Timing chart



■ Block diagram



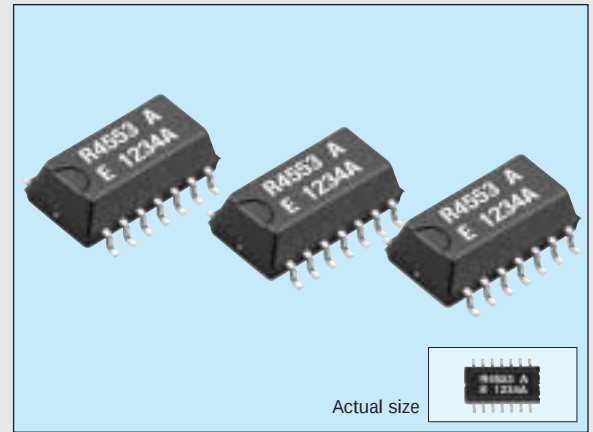
SERIAL-INTERFACE REAL TIME CLOCK MODULE WITH SRAM

RTC-4553

Product number (please refer to page 2)

Q4145535xx xx 00

- Built-in crystal unit allows adjustment-free efficient operation.
- Automatic calendar function (year, month, day, day of the week, hour, minute, second).
- Automatic leap year correction.
- Built-in 30 x 4-bit S-RAM.
- Reference pulse output. (1024 Hz, 1/10 Hz)



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 _{DD}	V _{DD} to GND	-0.3	+6.0	V
Input voltage	V _{IN}	S _{IN} , S _{CK} , WR, CS ₀ , CS ₁		V _{DD} +0.3	
Output voltage	V _{OUT}	S _{OUT} , T _{POINT}			
Storage temperature	T _{STG}	Stored as bare product after unpacking	-55	+125	°C

Operating range

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power voltage	V_{DD}	—	2.7	5.0	5.5	V
Clock voltage	V_{CLK}	—	2.0	—	5.5	V
Operating temperature	T_{OPR}	No condensation	-30	—	+70	°C

Frequency characteristics

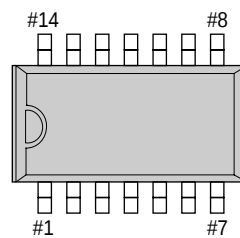
Item	Symbol	Condition		Range	Unit
Frequency tolerance	$\Delta f/f_0$	$T_a=+25\text{ }^{\circ}\text{C}$, $V_{DD}=5\text{ V}$	AA	5±5	$\times 10^{-6}$
			A	5±10	
			B	5±20	
Oscillation start-up time	t_{STA}	$T_a=+25\text{ }^{\circ}\text{C}$, $V_{DD}=3.0\text{ V}$		3.0 Max.	s
Frequency temperature characteristics	T_{op}	$T_a=-10\text{ }^{\circ}\text{C}$ to $+70\text{ }^{\circ}\text{C}$, $V_{DD}=5\text{ V}$ Reference at $+25\text{ }^{\circ}\text{C}$		+10 -120	$\times 10^{-6}$
Frequency voltage characteristics	f/V	$T_a=Fix$, $V_{DD}=2\text{ V}$ to 5.5 V Reference at 5 V		±5	
Aging	f_a	$T_a=+25\text{ }^{\circ}\text{C}$, $V_{DD}=5\text{ V}$, first year			$\times 10^{-9}/\text{year}$

DC characteristics (GND=0 V, $V_{DD}=5\text{ V} \pm 10\%$, $T_a=-30^\circ\text{C}$ to $+70^\circ\text{C}$)

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

Terminal connection

● RTC-4553



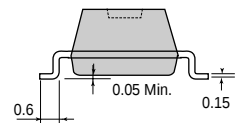
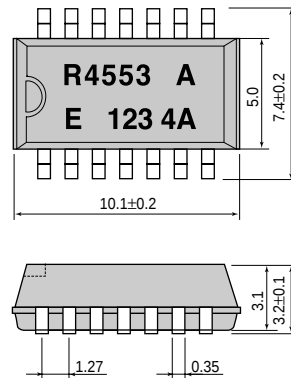
No.	Pin terminal	No.	Pin terminal
1	GND	14	TP_{OUT}
2	$\overline{WR}$	13	S_{OUT}
3	S_{IN}	12	CS_1
4	$\overline{SCK}$	11	$\overline{CS}_0$
5	L1	10	L5
6	L2	9	L4
7	L3	8	V_{DD}

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

External dimensions

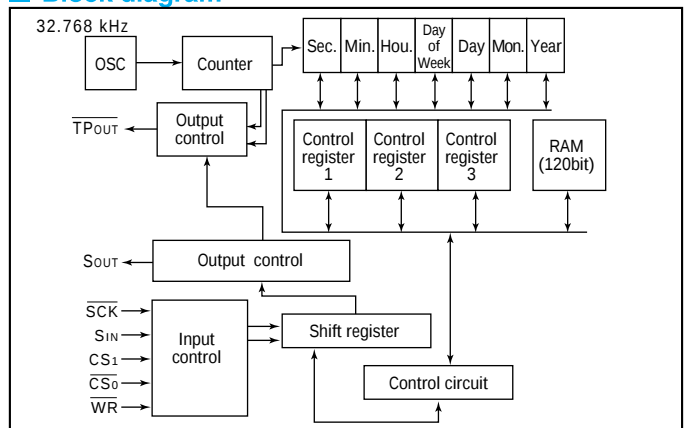
(Unit: mm)

● 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

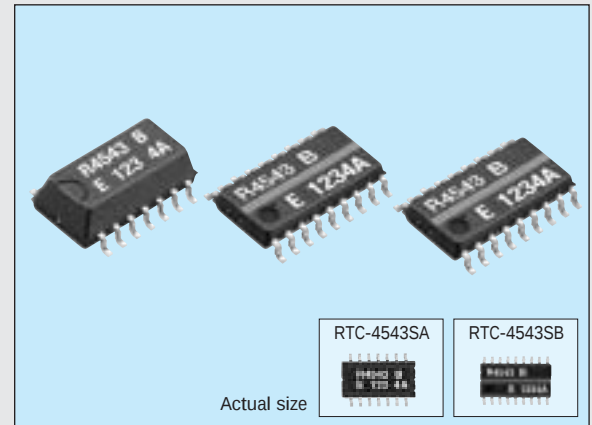
RTC-4543SA/SB

Product number (please refer to page 2)

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 $\pm$ 0.3 V.



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 _{DD}	V _{DD} to GND	-0.3	7.0	V
Input voltage	V _{IN}	—		V _{DD} +0.3	
Output voltage	V _{OUT}	—			
Storage temperature	T _{STG}	Stored as bare product after unpacking	-55	+125	°C

■ Operating range

Item	Symbol	Condition	Min.	Max.	Unit
Power voltage	V_{DD}	—	2.5	5.5	V
Clock voltage	V_{CLK}	—	1.4		
Operating temperature	T_{OPR}	No condensation	-40	+85	°C

■ Frequency characteristics

Item	Symbol	Condition	Range	Unit
Frequency tolerance	$\Delta f/f_0$	$T_a=+25^\circ\text{C}$, $V_{DD}=5\text{ V}$	$5\pm 23^*$	$\times 10^{-6}$
Oscillation start-up time	t_{STA}	$T_a=+25^\circ\text{C}$, $V_{DD}=2.5$	3 Max.	s
Frequency temperature characteristics	T_{OP}	$T_a=-10$ to $+70^\circ\text{C}$ Reference at $+25^\circ\text{C}$	$\pm 10/-120$	$\times 10^{-6}$
Frequency voltage characteristics	f/V	$T_a=+25^\circ\text{C}$, $V_{DD}=2.0$ to 5.5 V	± 2.0	$\times 10^{-6}/\text{V}$
Aging	f_a	First year $T_a=+25^\circ\text{C}$, $V_{DD}=5\text{ V}$	± 5.0	$\times 10^{-6}/\text{year}$

* Please ask tighter tolerance.

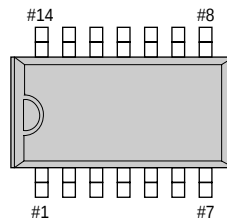
■ DC characteristics

 $(V_{DD}=5\text{ V}\pm 0.5\text{ V}, T_a=-40^\circ\text{C}$ to $+85^\circ\text{C})$

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Current consumption	1 I_{DD1}	$V_{DD}=5.0\text{ V}$	—	1.5	3.0	μA
	2 I_{DD2}	$V_{DD}=3.0\text{ V}$		1.0	2.0	
	3 I_{DD3}	$V_{DD}=2.0\text{ V}$		0.5	1.0	
	4 I_{DD4}	$V_{DD}=5.0\text{ V}$		4.0	10.0	
	5 I_{DD5}	$V_{DD}=3.0\text{ V}$		2.5	6.5	
	6 I_{DD6}	$V_{DD}=2.0\text{ V}$		1.5	4.0	
"H" input voltage	V_{IH}	WR, DATA, CE, CLK, F_{OE}, F_{SEL} pins	$0.8V_{DD}$	—	—	V
"L" input voltage	V_{IL}		—	$0.2V_{DD}$	0.5	
Input off-leak current	I_{OFF}	WR, CE, CLK, F_{OE}, F_{SEL} pins	—	—	0.5	μA
"H" output voltage	V_{OH1}	$V_{DD}=5.0\text{ V}$	$I_{OH}=-1.0\text{ mA}$	4.5	—	V
	V_{OH2}	$V_{DD}=3.0\text{ V}$	DATA, F_{OUT} pins	2.5	—	
"L" output voltage	V_{OL1}	$V_{DD}=5.0\text{ V}$	$I_{OL}=1.0\text{ mA}$	—	0.5	
	V_{OL2}	$V_{DD}=3.0\text{ V}$	DATA, F_{OUT} pins	—	0.8	
Output leak current	I_{OZH}	$V_{OUT}=5.5\text{ V}$	DATA, F_{OUT} pins	—	1.0	μA
	I_{OZL}	$V_{OUT}=0\text{ V}$		—	—	
Supply detection voltage	V_{DT}		1.4	1.7	2.0	V
Output load conditions	CL		—	—	30	pF
	N	F_{OUT} pin	2LS-TTL			

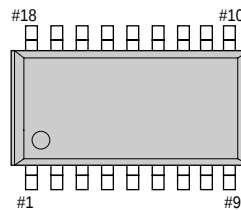
■ Terminal connection

● RTC-4543SA



No.	Pin terminal	No.	Pin terminal
1	GND	14	F_{OUT}
2	N.C	13	N.C
3	CE	12	N.C
4	F_{SEL}	11	DATA
5	WR	10	CLK
6	F_{OE}	9	V_{DD}
7	N.C	8	N.C

● RTC-4543SB

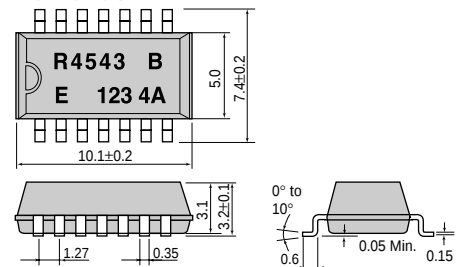


No.	Pin terminal	No.	Pin terminal
1	N.C	18	N.C
2	N.C	17	N.C
3	N.C	16	N.C
4	N.C	15	N.C
5	F_{OE}	14	V_{DD}
6	WR	13	N.C
7	F_{SEL}	12	CLK
8	CE	11	DATA
9	GND	10	F_{OUT}

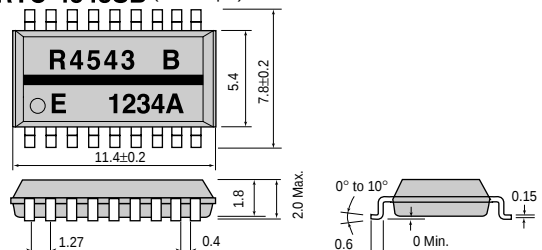
■ External dimensions

(Unit: mm)

● RTC-4543SA (SOP 14-pin)



● RTC-4543SB (SOP 18-pin)



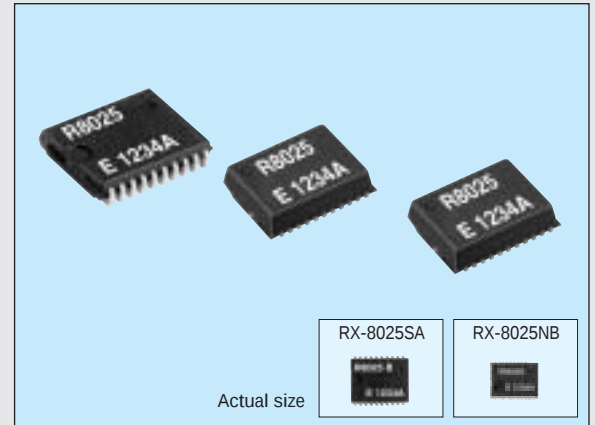
Metal may be exposed on the top or bottom of this product. This won't affect any quality, reliability or electrical spec.

I²C-BUS INTERFACE REAL TIME CLOCK MODULE**RX-8025SA/NB**

Product number (please refer to page 2)

Q4180255xxxxx00**Q4180259xxxxx00**

- Built-in frequency adjusted 32.768 kHz crystal unit.
- Compliant with I²C 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 μ 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



The details are mentioned in the application manual.

<http://www.epsondevice.com>The I²C-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 _{DD}	VDD to GND	-0.3	+6.5	V
Input voltage	V _I	SCL, SDA, FOE pins	GND-0.3	+6.5	
Output voltage	V _{O1}	SDA, INT, INTB pins	GND-0.3	+6.5	
	V _{O2}	FOUT pin	GND-0.5	V _{DD} +0.3	
Storage temperature Range	T _{STG}	Stored as bare product after unpacking	-55	+125	°C

■ Operating range

GND=0V

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

■ Frequency characteristics

GND=0V

Item	Symbol	Condition	Range	Unit
Frequency tolerance	$\Delta f/f$	Ta=+25 °C, VDD=3.0 V	AA : 5 $\pm$ 1	$\times 10^{-6}$
Oscillation start-up time	t _{STA}	Ta=+25 °C, VDD=3.0 V	3 Max.	s
Frequency temperature characteristics	T _{OP}	Ta=-10°C to +70°C, VDD=3.0 V ; Reference at +25°C	+10 -120	$\times 10^{-6}$
Frequency voltage characteristics	f/V	Ta=+25 °C, VDD=2.0 V to 5.5 V	± 1 Max.	$\times 10^{-6}$
Aging	fa	Ta=+25 °C, VDD=3.0 V, first year	± 5 Max.	$\times 10^{-6}$ /year

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

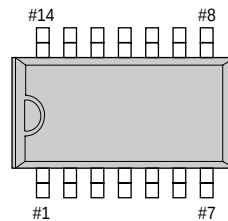
■ DC characteristics

(GND=0 V, VDD = 1.8 V to 5.5 V, Ta = -40 °C to +85 °C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Standby current	I _{DD2}	fSCL=0 Hz, FOE = GND INTA, INTB = VDD FOUT ; output off ("L" level) VDD = 3 V		0.48	1.20	μ A
"H" input voltage	V _{IH}	SCL, SDA, FOE pins	0.8 VDD		5.5	V
"L" input voltage	V _{IL}		GND -0.3		0.2 VDD	
"H" output current	I _{OH}	FOUT pins, V _{OH} = VDD-0.5 V			-0.5	mA
"L" output current	I _{OL1}	FOUT pins, V _{OL} = 0.4 V	0.5			
	I _{OL2}	INTA, INTB pins, V _{OL} = 0.4 V	1.0			
	I _{OL3}	SDA pin, V _{OL} = 0.4 V	4.0			
Input leakage current	I _{IL}	SCL pins, V _I = 5.5 V or GND VDD = 5.5 V	-1		1	μ A

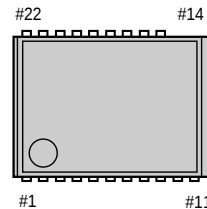
■ Terminal connection

● 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	VDD	9	N.C
7	FOE	8	N.C

● RX-8025NB

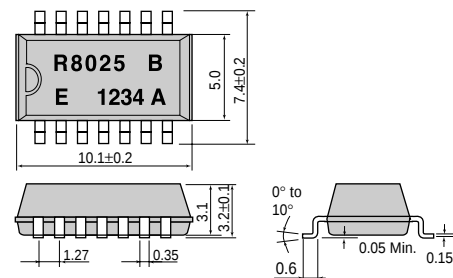


No.	Pin terminal	No.	Pin terminal
1	FOE	22	N.C
2	VDD	21	N.C
3	N.C	20	N.C
4	TEST	19	N.C
5	FOUT	18	N.C
6	SCL	17	N.C
7	SDA	16	N.C
8	INTB	15	N.C
9	GND	14	N.C
10	INTA	13	—
11	N.C	12	—

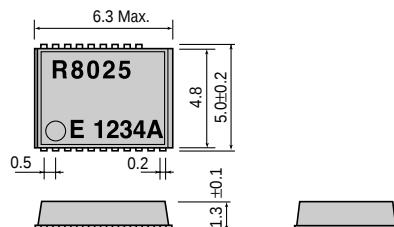
■ External dimensions

(Unit: mm)

● RX-8025SA (SOP 14-pin)



● RX-8025NB (SON 22-pin)



Register table

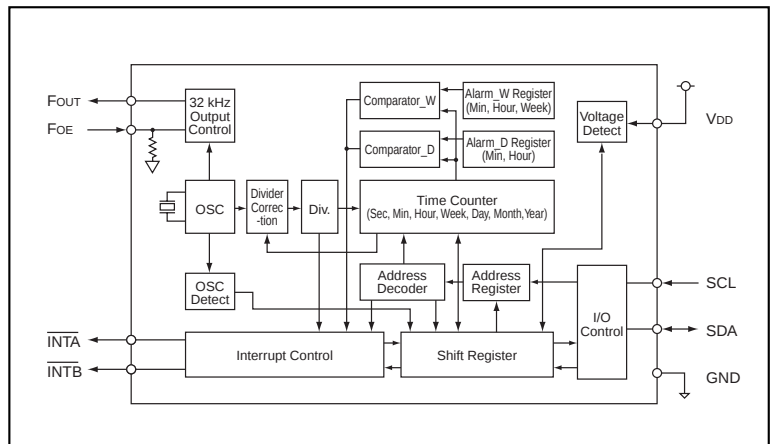
Address	Register symbol	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
0	Seconds	0	S40	S20	S10	S8	S4	S2	S1
1	Minutes	0	M40	M20	M10	M8	M4	M2	M1
2	Hours	0	0	H20 P, $\bar{A}$	H10	H8	H4	H2	H1
3	Weekdays	0	0	0	0	0	W4	W2	W1
4	Days	0	0	D20	D10	D8	D4	D2	D1
5	Months	0	0	0	MO10	MO8	MO4	MO2	MO1
6	Years	Y80	Y40	Y20	Y10	Y8	Y4	Y2	Y1
7	Digital Offset	0	F6	F5	F4	F3	F2	F1	F0
8	Alarm_W; Minutes	0	WM40	WM20	WM10	WM8	WM4	WM2	WM1
9	Alarm_W; Hour	0	0	WH20 WP, $\bar{A}$	WH10	WH8	WH4	WH2	WH1
A	Alarm_W; Weekday	0	WW6	WW5	WW4	WW3	WW2	WW1	WW0
B	Alarm_D; Minutes	0	DM40	DM20	DM10	DM8	DM4	DM2	DM1
C	Alarm_D; Hour	0	0	DH20 DP, $\bar{A}$	DH10	DH8	DH4	DH2	DH1
D	Reserved	Reserved							
E	Control 1	WALE	DALE	$\bar{12}, 24$	•	TEST	CT2	CT1	CT0
F	Control 2	VDSL	VDET	XST	PON *1	•	CTFG	WAFG	DAFG

0 : Always set this bit to "0".

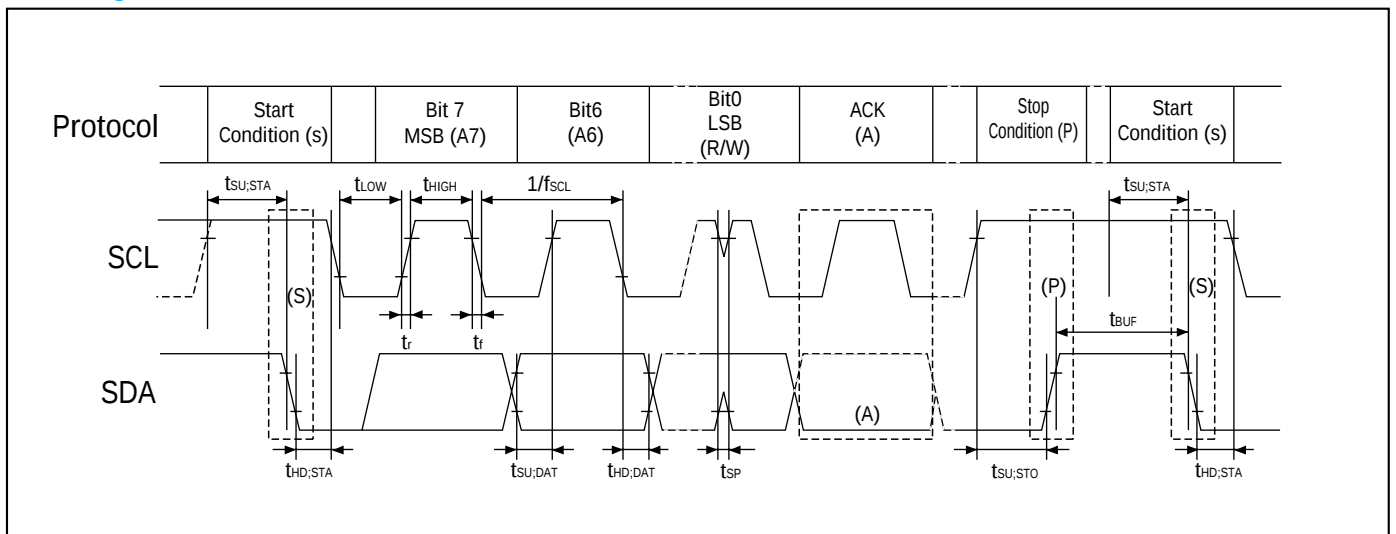
AC characteristics

Item	Symbol	Min.	Typ.	Max.	Unit
SCL clock frequency	f_{SCL}	—		400	kHz
Tolerance spike time on bus	t_{SP}	—		50	ns
Start condition set-up time	$t_{SU;STA}$	0.6			μs
Start condition Hold time	$t_{HD;STA}$				
SCL "L" time	t_{LOW}	1.3			μs
SCL "H" time	t_{HIGH}	0.6			μs
SCL and SDA rise time	t_r	—			
SCL and SDA fall time	t_f	—			
Data set-up time	$t_{SU;DAT}$	200			ns
Data hold time	$t_{HD;DAT}$	0			
Stop condition set-up time	$t_{SU;STO}$	0.6			μs
Bus free time	t_{BUF}	1.3			μs

Block diagram



Timing chart



I²C-BUS INTERFACE REAL TIME CLOCK MODULE

RX-8581SA/JE/NB

Product number (please refer to page 2)

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%)
- 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 as small package. (SON-22pin)

The details are mentioned in the application manual.

<http://www.epsondevice.com>The I²C-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 _{DD}	VDD to GND	-0.3	+7.0	V
Input voltage 1	V _{IN1}	FOE pin	GND-0.3	VDD+0.3	V
Input voltage 2	V _{IN2}	SCL, SDA pins		+8.0	
Output voltage 1	V _{OUT1}	FOUT pin		VDD+0.3	
Output voltage 2	V _{OUT1}	SDA, INT pins		+8.0	
Storage temperature	T _{STG}	Stored as bare product after unpacking	-55	+125	°C

Operating range

GND=0V

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

Frequency characteristics

GND=0V

Item	Symbol	Condition	Range	Unit
Frequency tolerance	Δf/f	Ta=+25 °C, VDD=3.0 V	5 ±23 ⁺¹ / ₋₂	x 10 ⁻⁶
Oscillation start-up time	t _{STA}	Ta=+25 °C, VDD=3.0 V	3 Max.	s
Frequency temperature characteristics	Top	Ta=-10°C to +70°C, VDD=3.0 V; Reference at +25°C	+10 -120	x 10 ⁻⁶
Frequency voltage characteristics	f/V	Ta=+25 °C, VDD=2.0 V to 5.0 V	±2 Max.	x 10 ⁻⁶ /V
Aging	fa	Ta=+25 °C, VDD=3.0 V	±5 Max.	x 10 ⁻⁶ /year

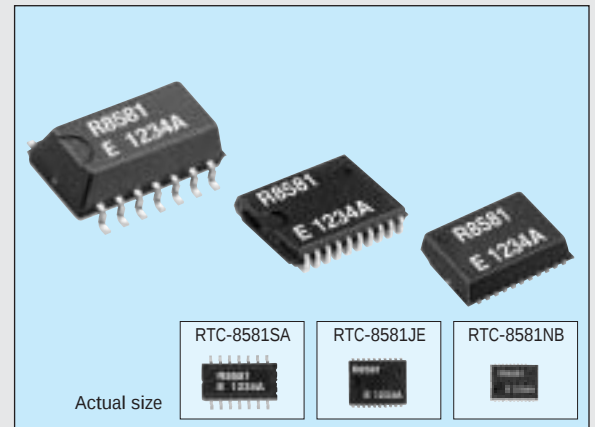
*1 Equivalent to 1 minute of monthly deviation (excluding offset.)

*2 Please ask tighter tolerance

DC characteristics

(GND=0 V, VDD = 1.8 V to 5.5 V, Ta = -40°C to +85°C)

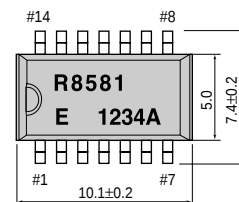
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power current 1	I _{DD1}	f _{osc} =0 Hz INT = V _{DD} , FOE = GND	V _{DD} = 5 V	0.65	1.2	μA
Power current 2	I _{DD2}	FOUT = V _{DD} ; output off ("L" level)	V _{DD} = 3 V	0.45	0.8	
Power current 3	I _{DD3}	f _{osc} =0 Hz INT, FOE = V _{DD}	V _{DD} = 5 V	3.0	7.5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



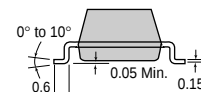
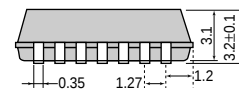
External dimensions / Terminal connection

(Unit: mm)

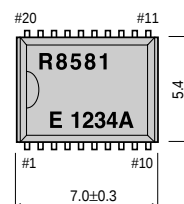
● RX-8581SA (SOP 14-pin)



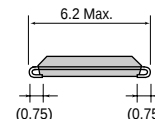
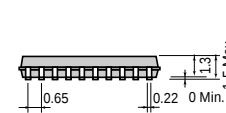
No.	Pin terminal	No.	Pin terminal
1	N.C	14	FOUT
2	SCL	13	N.C
3	SDA	12	N.C
4	N.C	11	VDD
5	GND	10	FOE
6	N.C	9	N.C
7	INT	8	N.C



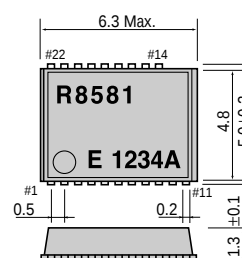
● RX-8581JE (VSOJ 20-pin)



No.	Pin terminal	No.	Pin terminal
1	N.C	20	N.C
2	N.C	19	N.C
3	FOE	18	N.C
4	VDD	17	N.C
5	FOUT	16	N.C
6	SCL	15	N.C
7	SDAT	14	N.C
8	(VDD)	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	(VDD)	20	N.C
4	N.C	19	N.C
5	SDA	18	N.C
6	SCL	17	N.C
7	FOUT	16	N.C
8	VDD	15	N.C
9	FOE	14	N.C
10	N.C	13	—
11	N.C	12	—

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

Register table

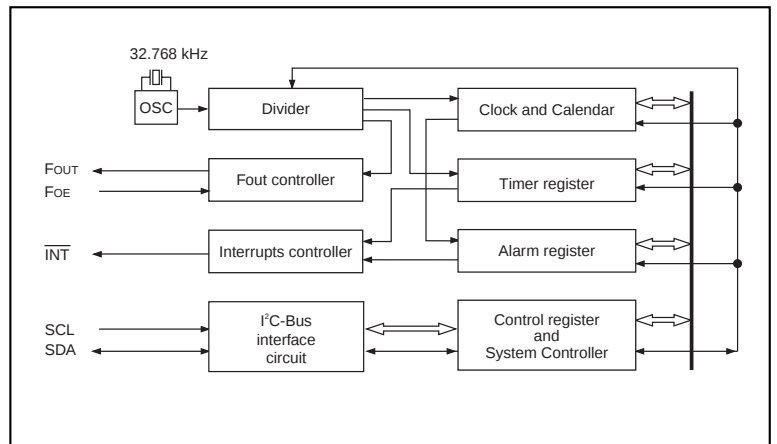
Address	Register symbol	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
0	SEC	0	40	20	10	8	4	2	1
1	MIN	0	40	20	10	8	4	2	1
2	HOURL	0	0	20	10	8	4	2	1
3	WEEK	0	6	5	4	3	2	1	0
4	DAY	0	0	20	10	8	4	2	1
5	MONTH	0	0	0	10	8	4	2	1
6	YEAR	80	40	20	10	8	4	2	1
7	RAM	•	•	•	•	•	•	•	•
8	MIN Alarm	AE	40	20	10	8	4	2	1
9	HOURL 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".

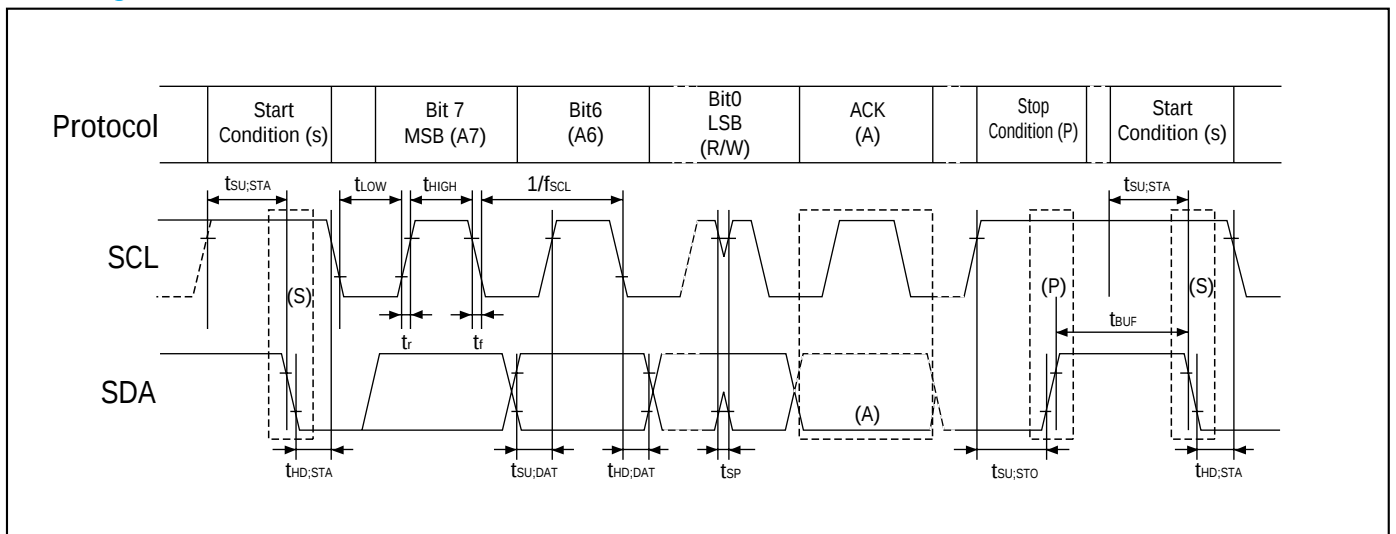
AC characteristics

Item	Symbol	Min.	Max.	Unit
SCL clock frequency	f _{SCL}	—	400	kHz
Tolerance spike time on bus	t _{SP}		50	ns
Start condition set-up time	t _{SU,STA}	0.6	0.3	μs
Start condition Hold time	t _{HD,STA}			
SCL “L” time	t _{LOW}	1.3		
SCL “H” time	t _{HIGH}	0.6		
SCL and SDA rise time	t _r	—		
SCL and SDA fall time	t _f			
Date set-up time	t _{SU,DAT}	100	ns	
Date hold time	t _{HD,DAT}	0		
Stop condition set-up time	t _{SU,STO}	0.6		μs
Bus free time	t _{BUF}	1.3		
Fout Duty	t _w /t	45	55	%

Block diagram



Timing chart



I²C-BUS INTERFACE REAL TIME CLOCK MODULE

RTC-8564JE/NB

RX-8564CF

Product number (please refer to page 2)

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.)

The details are mentioned in the application manual.

<http://www.epsondevice.com>The I²C-Bus is a trademark of Philips Electronics N.V.

Specifications (characteristics)

Absolute Max. rating

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

Operating range

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

Frequency characteristics

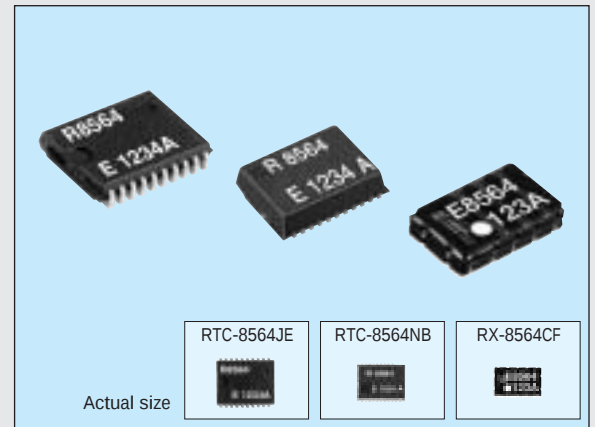
Item	Symbol	Condition	Range	Unit
Frequency tolerance	Δf/f ₀	T _a =+25 °C, V _{DD} =3.0 V	5±23*	× 10 ⁻⁶
Oscillation start-up time	t _{STA}	T _a =+25 °C, V _{DD} =1.8 V	3 Max.	s
Frequency temperature characteristics	T _{OP}	Reference at +25 °C, T _a =-10 °C to +70 °C, V _{DD} =3.0 V	+10 -120	× 10 ⁻⁶
Frequency voltage characteristics	f/V	RTC-8564JE/NB Ta=+25 °C, V _{DD} =1.0 V to 5.5 V RX-8564CF Ta=+25 °C, V _{DD} =1.8 V to 5.5 V	±2 Max.	× 10 ⁻⁶ /V
Aging	f _a	T _a =+25 °C, V _{DD} =3.0 V	±5	× 10 ⁻⁶ /year

* Please ask tighter tolerance

DC characteristics

(GND=0 V, V_{DD}=1.8 V to 5.5 V, T_a=-40 °C to +85 °C)

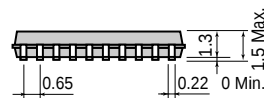
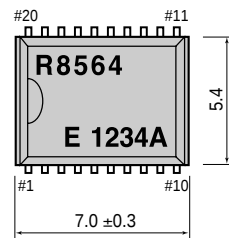
Item	Pin	Symbol	Condition	Min.	Typ.	Max.	Unit
Power current (during access)	—	I _{DD0}	f _{SCL} =400 kHz f _{SCL} =100 kHz	—	—	800 200	μA
Power current (not during access) (CLKOUT=0 Hz)		I _{DD}	f _{SCL} =0 Hz, V _{DD} =5.0 V f _{SCL} =0 Hz, V _{DD} =3.0 V f _{SCL} =0 Hz, V _{DD} =2.0 V	—	0.33 0.275 0.25	0.80 0.70 0.65	
Power current (not during access) (CLKOUT=32.768 kHz)		I _{DD32k}	f _{SCL} =0 Hz, V _{DD} =5.0 V f _{SCL} =0 Hz, V _{DD} =3.0 V f _{SCL} =0 Hz, V _{DD} =2.0 V	—	2.5 1.5 1.1	3.4 2.2 1.6	
"L" input voltage		V _{IL}	—	-0.5	—	0.3 V _{DD}	
"H" input voltage	SDA	V _{IH}	—	0.7 V _{DD}	—	V _{DD} +0.5	V
"L" output current		I _{OL}	—	-3	—	—	
"L" output current	INT	I _{OL}	V _{OL} =0.4 V, V _{DD} =5 V	-1	—	—	mA
"H" output current	CLKOUT	I _{OH}	—	—	—	1	
Leakage current	—	I _{LO}	V _{OUT} =V _{DD} or GND	-1	—	1	μA
Low voltage detection	—	V _{LOW}	T _a =-40 °C to +85 °C	—	—	1.1	V
RTC-8564JE/NB			T _a =-20 °C to +70 °C	—	—	1.0	
Low voltage detection			T _a =-40 °C to +85 °C	—	—	1.2	
RX-8564CF			T _a =+25 °C	—	—	1.0	



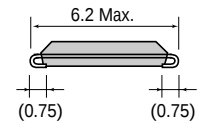
External dimensions/Terminal connection

(Unit: mm)

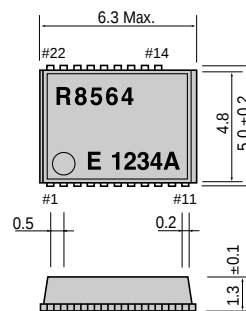
● RTC-8564JE (VSOJ 20-pin)



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 _{DD}	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



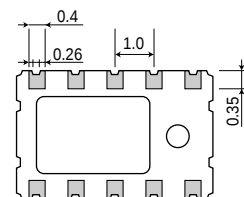
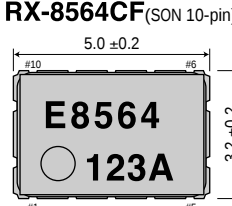
● RTC-8564NB (SON 22-pin)



No.	Pin terminal	No.	Pin terminal
1	INT	22	N.C
2	GND	21	N.C
3	(GND)	20	N.C
4	N.C	19	N.C
5	SDA	18	N.C
6	SCL	17	N.C
7	CLKOUT	16	N.C
8	V _{DD}	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 _{DD}	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

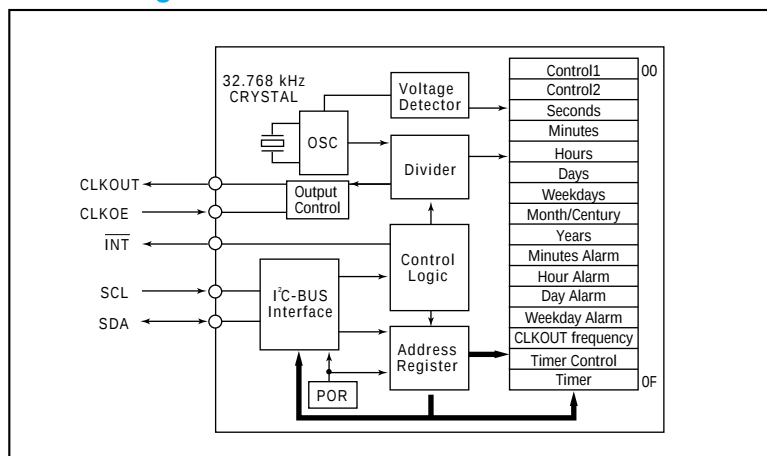
0 : Always set this bit to "0".

■ AC characteristics

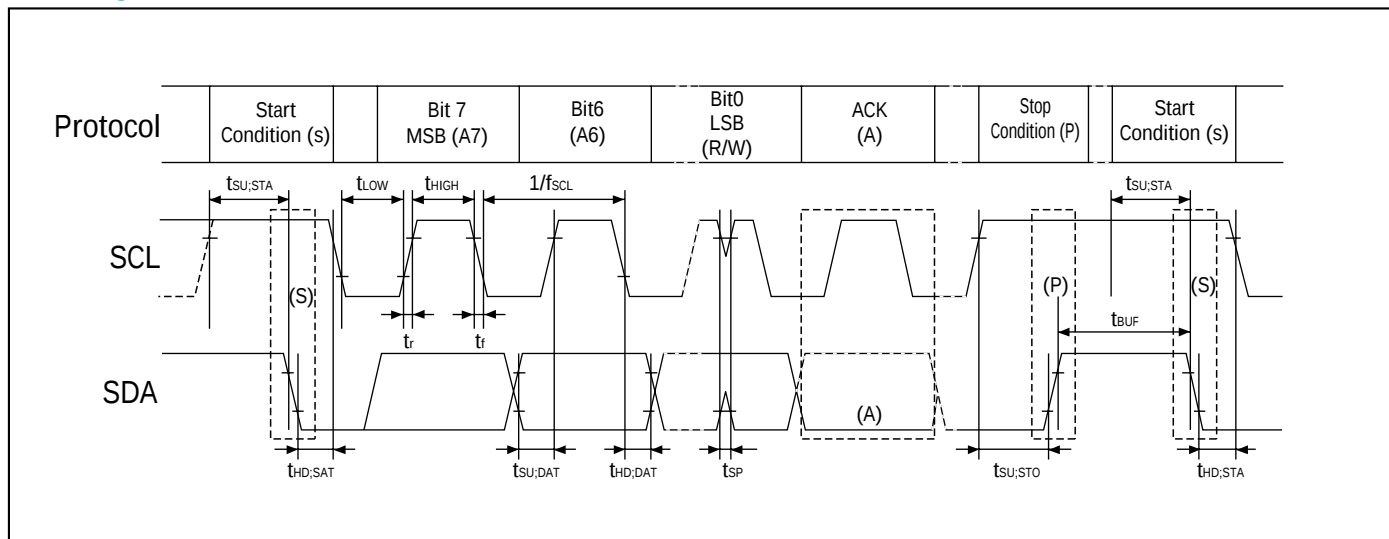
(V_{DD}=1.8 V to 5.5 V, T_a=-40 °C to +85 °C)

Block diagram

Item	Symbol	Min.	Max.	Unit	
SCL clock frequency	f _{SCL}	—	400	kHz	
Tolerance spike time on bus	t _{SP}		50	ns	
Start condition set-up time	t _{SU;STA}	0.6	—	μs	
Start condition Hold time	t _{HD;STA}				
SCL “L” time	t _{LOW}	1.3			
SCL “H” time	t _{HIGH}	0.6			
SCL and SDA rise time	t _r	—	0.3		
SCL and SDA fall time	t _f				
Data set-up time	t _{SU;DAT}	100	—	ns	
Data hold time	t _{HD;DAT}	0			
Stop condition set-up time	t _{SU;STO}	0.6			μs



■ Timing chart



4-bit REAL TIME CLOCK MODULE

RTC-7301SF/DG

Product number (please refer to page 2)

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 mV / °C, RTC-7301SF)
- Operating voltage range: 2.4 V to 5.5 V, time keeping voltage range: 1.6 V to 5.5 V
- Low current consumption (0.6 μ A / 3 V Typ.)
- High speed parallel interface compatible with SRAM

The details are mentioned in the application manual.

<http://www.epsondevice.com>

Specifications (characteristics)

Absolute Max. ratings

GND=0V

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

Operating conditions

GND=0V

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

Frequency characteristics

Item	Symbol	Condition	Range	Unit
Frequency precision	$\Delta f/f_0$	T _a =+25 °C, V _{DD} =3.0 V	5 ± 23 *	x 10 ⁻⁶
Oscillation start-up time	t _{STA}	T _a =+25 °C, V _{DD} =2.4 V	3 Max.	s
Frequency temperature characteristics	T _{OP}	T _a =-10 °C to +70 °C, V _{DD} =3.0 V	+10/-120	x 10 ⁻⁶
Frequency voltage characteristics	f/V	T _a =+25 °C, V _{DD} =1.6 V to 5.5 V	±2	x 10 ⁻⁴ /V
Aging	f _a	T _a =+25 °C, V _{DD} =3.0 V	±5	x 10 ⁻⁴ /year

* Please ask tighter tolerance

DC characteristics

GND=0 V, V_{DD}=1.6 V to 5.5 V, T_a= -40 °C to +85 °C

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

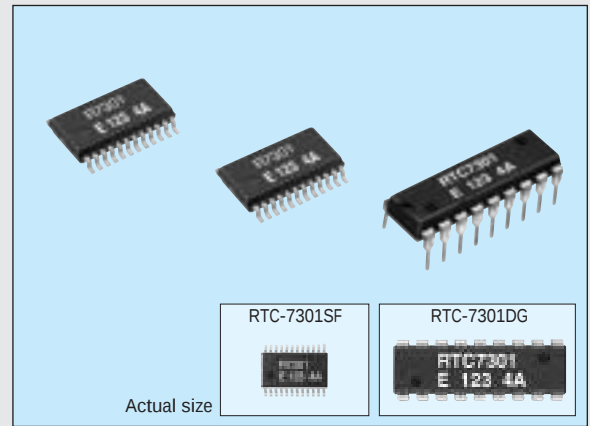
Note) There is no VTEMP pin on the RTC-7301DG so standards for the VTEMP pin within the conditions described above do not apply.

Temperature sensor characteristics

GND=0 V, T_a= -40 °C to +85 °C

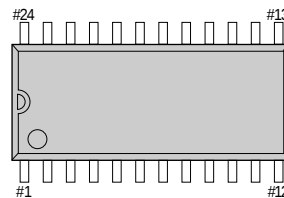
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Temperature output voltage	VTEMP	T _a =+25 °C, GND based output voltage VTEMP pins, V _{DD} =2.7 V to 5.5 V		1.470		V
Output precision	T _{ACR}	T _a =+25 °C, V _{DD} =2.7 V to 5.5 V			±5.0	°C
Temperature sensitivity	V _{SE}	-40 °C ≤ T _a ≤ +85 °C, V _{DD} =2.7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

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



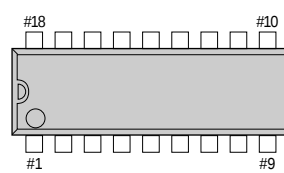
Terminal connection

RTC-7301SF



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

RTC-7301DG



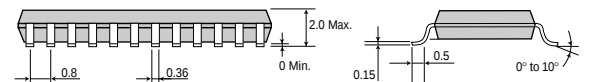
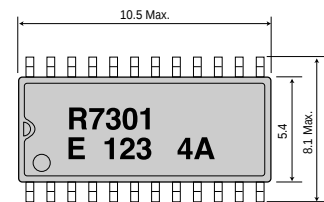
No.	Pin terminal	No.	Pin terminal
1	CS ₀	18	V _{DD}
2	FOUT	17	(V _{DD})
3	IRQ	16	(V _{DD})
4	A ₀	15	CS ₁
5	A ₁	14	D ₀
6	A ₂	13	D ₁
7	A ₃	12	D ₂
8	RD	11	D ₃
9	GND	10	WR

• (V_{DD}) and V_{DD} are to have the same level of voltage. Do not connect it to any external terminals.

External dimensions

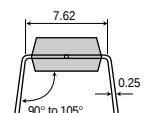
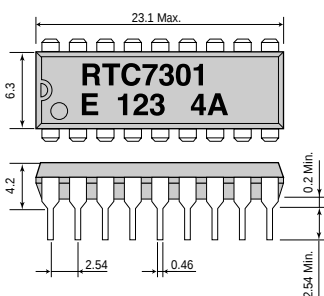
(Unit: mm)

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

Address	Register	bit3	bit2	bit1	bit0
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	1hour 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

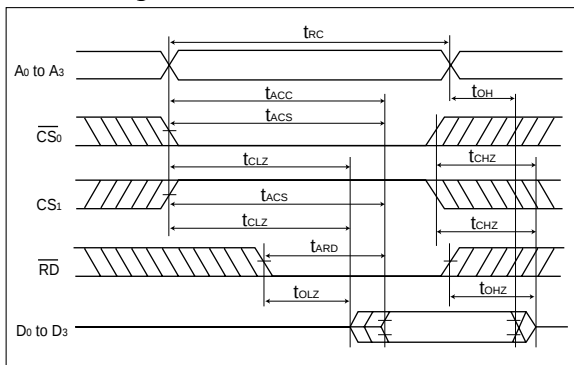
Bank1 Alarms and FOUT registers

Address	Register	bit3	bit2	bit1	bit0
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	1hour 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	FD0
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

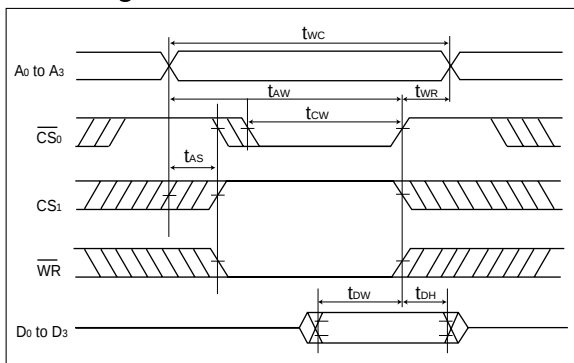
Bank2 Digital offset and timer registers

Address	Registers	bit3	bit2	bit1	bit0
0	Digital offset	DT3	DT2	DT1	DT0
1		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		128	64	32	16
6	Timer counter data	8	4	2	1
7		128	64	32	16
8	Timer settings	TE	TI/TP	TD1	TD0
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

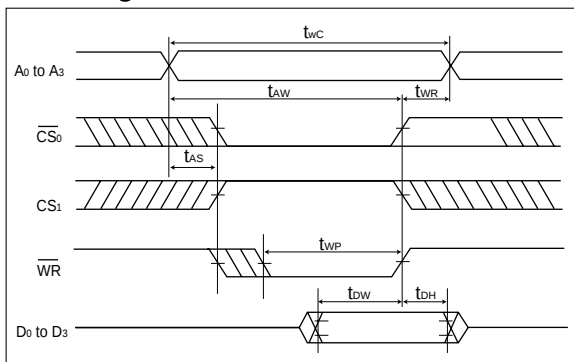
Reading data



Writing data (CS Control)



Writing data (WR Control)

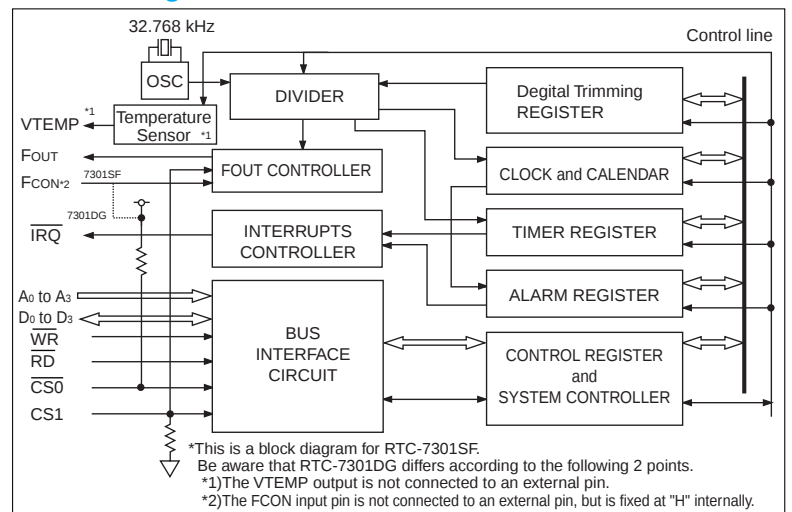


AC characteristics

•GND=0 V, 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	Condition	VDD=2.4 to 3.6 V		VDD=4.5 to 5.5 V		Unit
			Min.	Max.	Min.	Max.	
Read cycle time	t _{RC}	—	150	—	85	—	ns
Address access time	t _{ACC}	—	—	150	—	85	ns
CE access time	t _{ACS}	—	—	150	—	85	ns
RD access time	t _{ARD}	—	—	100	—	45	ns
CE output set time	t _{CLZ}	—	5	—	3	—	ns
CE output floating	t _{CHZ}	—	—	60	—	30	ns
RD output set time	t _{OLZ}	—	5	—	3	—	ns
RD output floating	t _{OHZ}	—	—	60	—	30	ns
Output hold time	t _{OH}	—	10	—	5	—	ns
Write cycle time	t _{WC}	—	150	—	85	—	ns
Chip select time	t _{CW}	—	140	—	70	—	ns
Address valid end of write	t _{AW}	—	140	—	70	—	ns
Address setup time	t _{AS}	—	0	—	0	—	ns
Address hold time	t _{WR}	—	0	—	0	—	ns
Write pulse width	t _{WP}	—	130	—	65	—	ns
Input data set time	t _{DW}	—	80	—	35	—	ns
Input data hold time	t _{DH}	—	0	—	0	—	ns
FOUT output frequency duty	DUTY	FOUT= 32.768 kHz	40	60	40	60	%

Block diagram



4-bit REAL TIME CLOCK MODULE

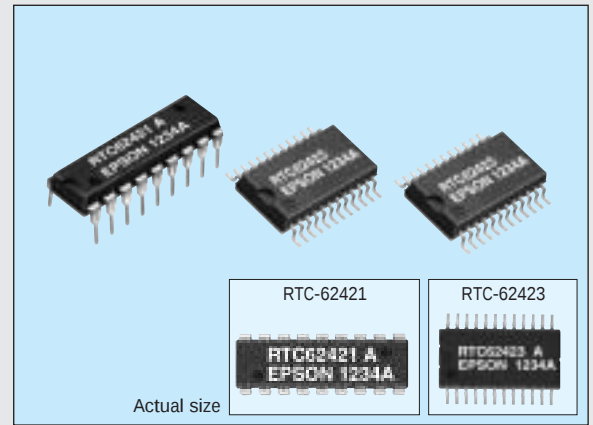
RTC-62421/62423

Product number (please refer to page 2)

Q4262421xxxxxx00

Q4262423xxxxxx00

- 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.



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_{DD}	$T_a = +25^\circ\text{C}$	-0.3	+7.0	V
Input and output voltage	$V_{I/O}$		GND-0.3	$V_{DD}+0.3$	
Storage temperature *	T_{STG}	RTC-62421	-55	+85	$^\circ\text{C}$
		RTC-62423	-55	+125	

*Stored as bare product after unpacking

■ Operating range

Item	Symbol	Condition	Min.	Max.	Unit
Power voltage	V_{DD}	—	4.5	5.5	V
Clock voltage	V_{CLK}	—	2.0	5.5	V
Operating temperature	T_{OPR}	No condensation	-40	+85	$^\circ\text{C}$

■ Frequency characteristics

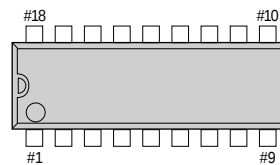
Item	Symbol	Condition	Range	Unit
Frequency tolerance	$\Delta f/f_0$	$T_a = +25^\circ\text{C}$ $V_{DD} = 5\text{ V}$	62421 A	± 10
			62421 B	± 50
			62423 A	± 20
			62423	± 50
Frequency temperature characteristics	T_{OP}	-10 $^\circ\text{C}$ to +70 $^\circ\text{C}$ (Reference at +25 $^\circ\text{C}$)	$\pm 10/-120$	
		-40 $^\circ\text{C}$ to +85 $^\circ\text{C}$ (Reference at +25 $^\circ\text{C}$)	$\pm 10/-220$	
Frequency voltage characteristics	f/V	$T_a = +25^\circ\text{C}$ $V_{DD} = 4.5\text{ V}$ to 5.5 V	± 5	$\times 10^{-6}/\text{V}$
Aging	f_a	$V_{DD} = 5\text{ V}$, $T_a = +25^\circ\text{C}$, first year	± 5	$\times 10^{-6}/\text{year}$

■ DC characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Applicable terminal
Current consumption	I_{DD1}	$CS_1 = 0\text{ V}$ $V_{DD} = 5\text{ V}$	—	15	30	μA	—
	I_{DD2}		—	1	1.8		
"H" input voltage (1)	V_{IH1}	$V_1 = V_{DD}/0\text{ V}$	2.2	—	—	V	All inputs other than CS_1
"L" input voltage (1)	V_{IL1}			—	0.8		
Input leak current (1)	I_{LK1}			—	1/-1	μA	Input other than D_0 to D_3
Input leak current (2)	I_{LK2}			—	10/-10		
"L" output voltage (1)	V_{OL1}	$I_{OL} = 2.5\text{ mA}$	2.4	—	0.4	V	D_0 to D_3
"H" output voltage	V_{OH}	$I_{OH} = -400\text{ }\mu\text{A}$		—	—		
"L" output voltage (2)	V_{OL2}	$I_{OL} = 2.5\text{ mA}$		—	0.4		
OFF leak current	I_{OFFLK}	$V_1 = V_{DD}/0\text{ V}$		—	10	μA	STD.P
Input capacity	C_1	Input frequency 1 MHz	—	5	—	pF	Input Pins
"H" input voltage (2)	V_{IH2}	$V_{DD} = 2\text{ V}$ to 5.5 V	4/5 V_{DD}	—	—	V	CS_1
"L" input voltage (2)	V_{IL2}		—	1/5 V_{DD}	—		

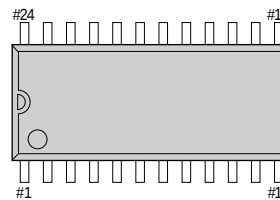
■ Terminal connection

● RTC-62421



No.	Pin terminal	No.	Pin terminal
1	STD.P	17	V_{DD}
2	CS_1	18	(V_{DD})
3	ALE	16	(V_{DD})
4	A_0	15	CS_1
5	A_1	14	D_0
6	A_2	13	D_1
7	A_3	12	D_2
8	$\overline{RD}$	11	D_3
9	GND	10	$\overline{WR}$

● RTC-62423



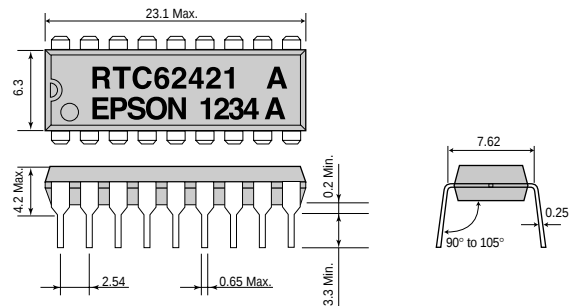
No.	Pin terminal	No.	Pin terminal
1	STD.P	24	V_{DD}
2	CS_1	23	(V_{DD})
3	NC	22	(V_{DD})
4	ALE	21	NC
5	A_0	20	CS_1
6	NC	19	D_0
7	A_1	18	NC
8	NC	17	NC
9	A_2	16	D_1
10	A_3	15	D_2
11	$\overline{RD}$	14	D_3
12	GND	13	$\overline{WR}$

- (V_{DD}) and (V_{DD}) are to have the same level of voltage. Do not connect it to any external terminals.
- NC is not connected internally.

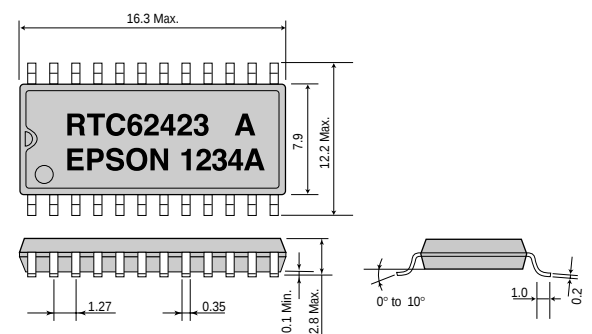
■ External dimensions

(Unit: mm)

● RTC-62421 (DIP 18-pin)



● RTC-62423 (SOP 24-pin)



4-bit REAL TIME CLOCK MODULE

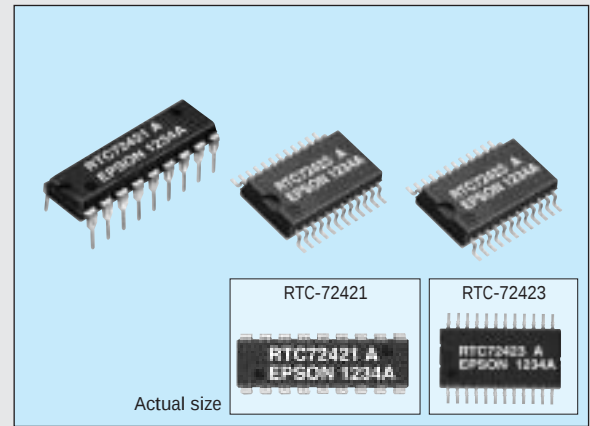
RTC-72421/72423

Product number (please refer to page 2)

Q4272421xx xx x00

Q4272423xx xx x00

- Built-in crystal unit allows adjustment-free efficient operation.
- 12/24 h clock switchover function and automatic leap year setting.
- Interrupt masking.



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 _{DD}	Ta=+25 °C	-0.3	7.0	V
Input and output voltage	V _{I/O}	Ta=+25 °C	GND -0.3	V _{DD} +0.3	
Storage temperature *	T _{STG}	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 _{DD}	—	4.5	5.5	V
Supply voltage	V _{CLK}	—	2.0	5.5	V
Operating temperature *	T _{OPR}	RTC-72421	-10	70	°C
		RTC-72423	-40	85	

*No condensation

■ Frequency characteristics

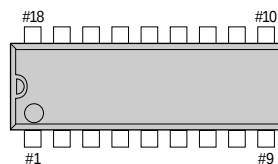
Item	Symbol	Condition		Range	Unit
Frequency tolerance	$\Delta f/f_0$	Ta=+25 °C VDD=5 V	72421 A	±10	x 10 ⁻⁶
			72421 B	±50	
			72423 A	±20	
			72423	±50	
Frequency temperature characteristics	T _{OP}	-10 °C to +70 °C (Reference at +25 °C)		+10/-120	x 10 ⁻⁶
		-40 °C to +85 °C (Reference at +25 °C)		+10/-220	
Frequency voltage characteristics	f/V	Ta=+25 °C VDD=2.0 V to 5.5 V		±5 Max.	x 10 ⁻⁵ /V
Aging	fa	VDD=5 V, Ta=+25 °C, first year		±5 Max.	x 10 ⁻⁶ /year

■ DC characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Applicable terminal
Current consumption	I _{DD1}	CS ₁ =0 V	—	1	10	μA	—
	I _{DD2}	Exclude input/output current V _{DD} =5 V V _{IO} =2 V	—	0.9	5		
"H" input voltage (1)	V _{IH1}	—	2.2	—	—	V	All inputs other than CS ₁
"L" input voltage (1)	V _{IL1}	—	—	0.8	—	V	
Input leak current (1)	I _{LK1}	V _I =V _{DD} /0 V	—	±1	—	μA	Input other than Do to D ₃
Input leak current (2)	I _{LK2}			±10	—	μA	
"L" output voltage (1)	V _{OL1}	I _{OL} =2.5 mA	2.4	0.4	—	V	Do to D ₃
"H" output voltage	V _{OH}	I _{OH} =-400 μA		—	—	V	
"L" output voltage (2)	V _{OL2}	I _{OL} =2.5 mA	—	0.4	—	V	STD.P
Off leak current	I _{OFFLK}	V _I =V _{DD} /0 V		10	—	μA	
Input capacity	C ₁	Input frequency 1 MHz	—	10	—	pF	Input other than Do to D ₃
				20	—		
"H" input voltage (2)	V _{IH2}	V _{DD} =2 to 5.5 V	4/5 V _{DD}	—	—	V	CS ₁
"L" input voltage (2)	V _{IL2}			—	1/5 V _{DD}		

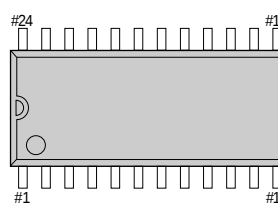
■ Terminal connection

● RTC-72421



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

● RTC-72423



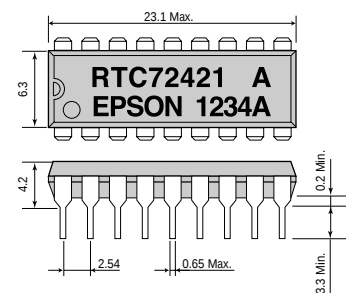
No.	Pin terminal	No.	Pin terminal
1	STD. P	24	V _{DD}
2	CS ₁	23	(V _{DD})
3	NC	22	(V _{DD})
4	ALE	21	NC
5	A ₀	20	CS ₁
6	NC	19	D ₀
7	A ₁	18	NC
8	NC	17	NC
9	A ₂	16	D ₁
10	A ₃	15	D ₂
11	RD	14	D ₃
12	GND	13	WR

- (V_{DD}) and V_{DD} are to have the same level of voltage. Do not connect it to any external terminals.
- NC is not connected internally.

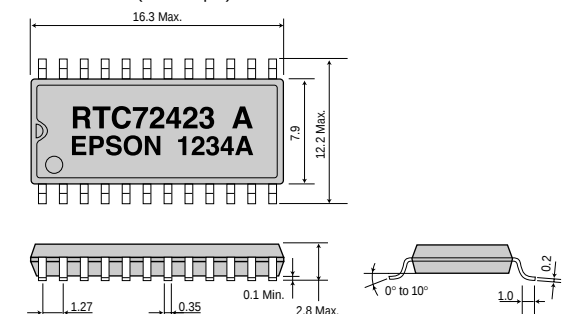
■ External dimensions

(Unit: mm)

● RTC-72421 (DIP 18-pin)



● RTC-72423 (SOP 24-pin)

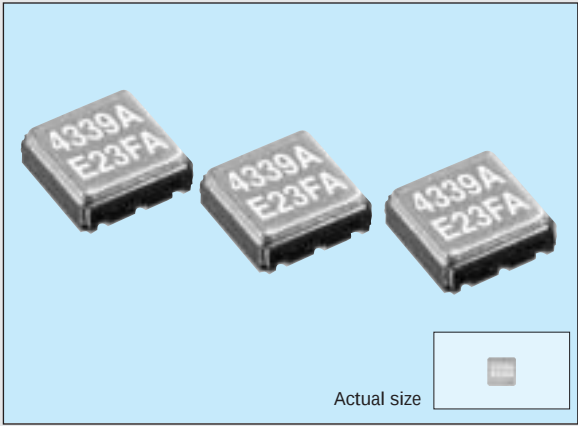


SAW RESONATOR

FS-305

Product number (please refer to page 2)
Q25FS305xxxxx00

- Improved the Temp characteristics by new simulation technology.
- Reflow solderable SMD ceramic package.
- Capable of covering a wide frequency range, from 300 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)

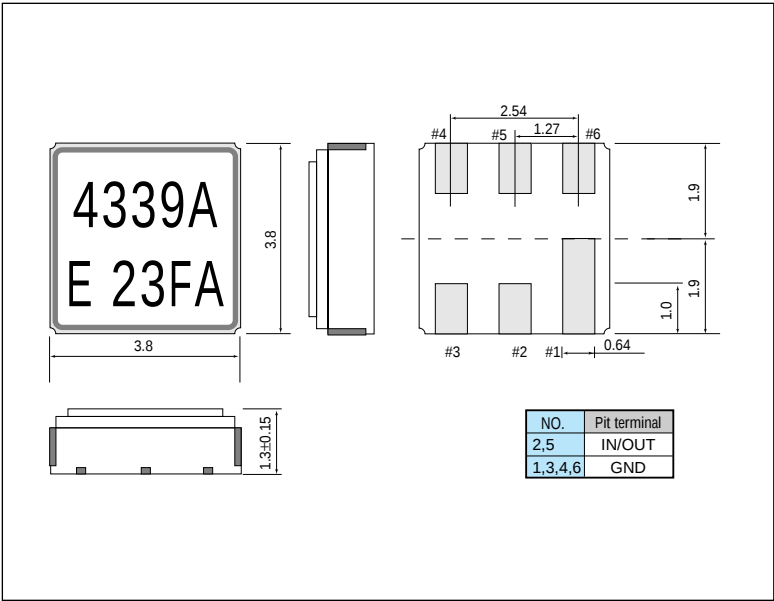


Specifications (characteristics)

Item		Symbol	Specifications	Remarks
Nominal frequency range		fo	400 MHz to 1.0 GHz	fundamental mode, Please contact us for inquiries about available frequency
Temperature range	Storage temperature	T _{STG}	-40 °C to +85 °C	
	Operating temperature	T _{OPR}	-40 °C to +85 °C	
Maximum drive level		GL	10 mW Max. 2 mW Max.	400 MHz ≤ fo ≤ 500 MHz, Ta = +25 °C ± 3 °C 500 MHz < fo ≤ 1 GHz, Ta = +25 °C ± 3 °C
Recommended drive level		DL	1 mW Typ.	
Frequency tolerance (standard)		Δf/f	±50 x 10 ⁻⁶ , ±100 x 10 ⁻⁶	Ta = +25 °C ± 3 °C
Peak temperature		θT	+20 °C ± 15 °C	
Temperature coefficient		α	(-1.6±0.4) x 10 ⁻⁹ / °C ²	
Harmonic ratio		Rs/R ₁	2 Min.	
Series resistance		R ₁	35 Ω Max.	400 MHz ≤ fo ≤ 1 GHz, Ta = +25 °C ± 3 °C
Aging		fa	±10 x 10 ⁻⁶ /year Max.	Ta = +25 °C ± 3 °C
Shock resistance		S.R.	±10 x 10 ⁻⁶ Max.	Nine drops on a concrete from 1500 mm

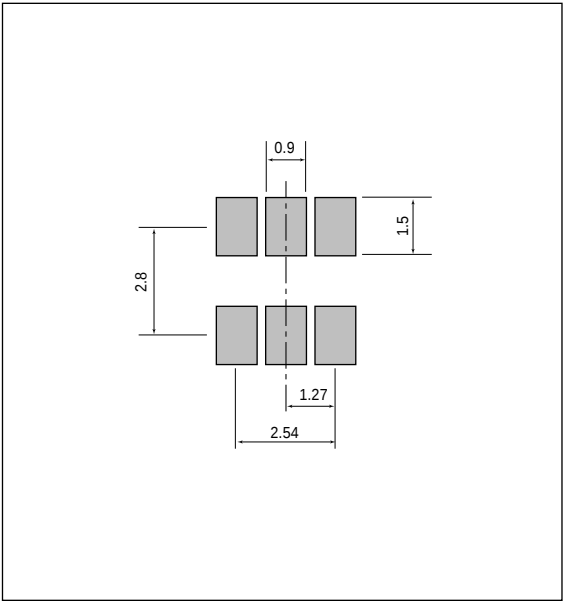
External dimensions

(Unit: mm)



Recommended soldering pattern

(Unit: mm)



SAW RESONATOR

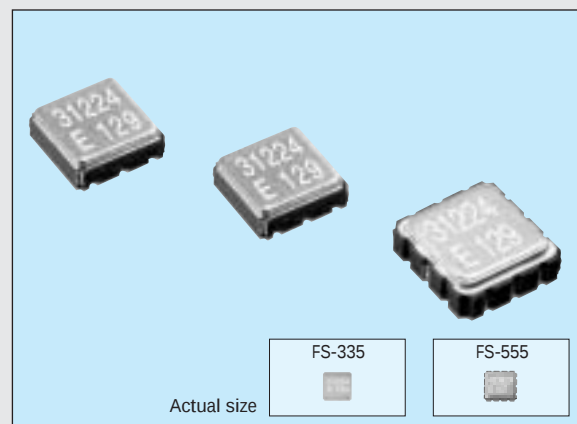
FS-335/FS-555

Product number (please refer to page 2)

Q25FS335xxxxx00

Q25FS555xxxxx00

- 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)

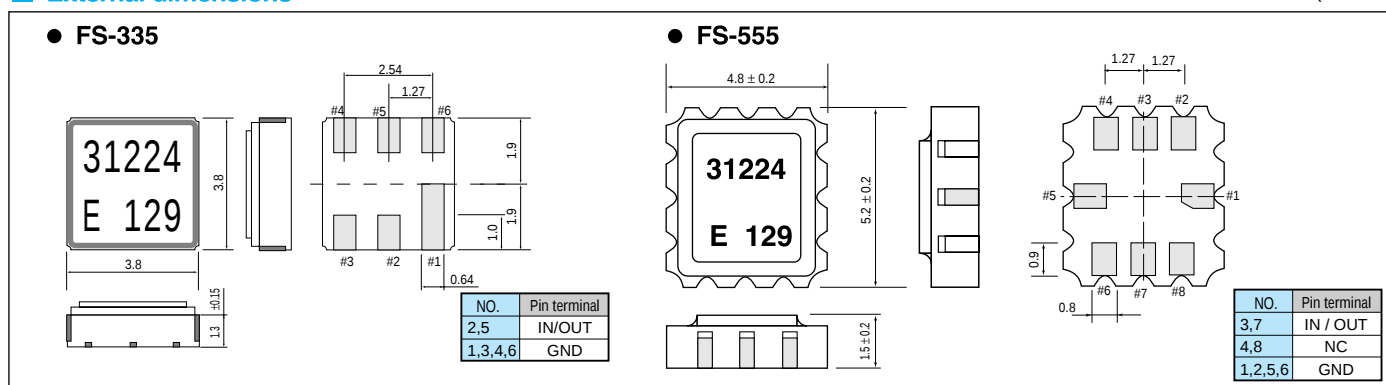


■ Specifications (characteristics)

Item		Symbol	Specifications		Remarks
			FS-355	FS-555	
Nominal frequency range		f ₀	300 MHz to 870 MHz	—	Please contact us for inquiries about the available frequency.
			—	230 MHz to 500 MHz	
Temperature range	Storage temperature	T _{STG}	-40 °C to +85 °C		Stored as bare product after unpacking
	Operating temperature	T _{OPR}	-40 °C to +85 °C		
Maximum drive level		GL	10 mW Max.	—	300 MHz ≤ f ₀ ≤ 500 MHz, Ta=+25 °C ± 3 °C
			2 mW Max.	—	500 MHz < f ₀ ≤ 870 MHz, Ta=+25 °C ± 3 °C
			—	10 mW Max.	
Recommended drive level		DL	1 mW Typ.	2 mW Typ.	
Frequency tolerance (standard)		Δf/f	±25 x 10 ⁻⁶ , ±50 x 10 ⁻⁶ , ±100 x 10 ⁻⁶	—	300 MHz ≤ f ₀ ≤ 500 MHz, Ta=+25 °C ± 3 °C
			±100 x 10 ⁻⁶	—	500 MHz < f ₀ ≤ 870 MHz, Ta=+25 °C ± 3 °C
			—	±25 x 10 ⁻⁶ , ±50 x 10 ⁻⁶ , ±100 x 10 ⁻⁶	Ta=+25 °C ± 3 °C
Peak temperature		θT	+25 °C ± 15 °C		
Temperature coefficient		α	(-3.4±0.8) x 10 ⁻⁸ / °C ²		
Harmonic ratio		R _S /R ₁	2 Min.		
Series resistance		R ₁	25 Ω Max.	—	300 MHz ≤ f ₀ ≤ 500 MHz, Ta=+25 °C
			30 Ω Max.	—	500 MHz < f ₀ ≤ 870 MHz, Ta=+25 °C
			—	40 Ω Max.	230 MHz to ≤ f ₀ < 250 MHz, Ta=+25 °C
			—	25 Ω Max.	250 MHz ≤ f ₀ ≤ 500 MHz, Ta=+25 °C
Aging		f _a	±10 x 10 ⁻⁶ /year Max.		Ta=+25 °C ±3 °C
Shock resistance		S.R.	±10 x 10 ⁻⁶ Max.		Nine drops on a concrete from 1500 mm

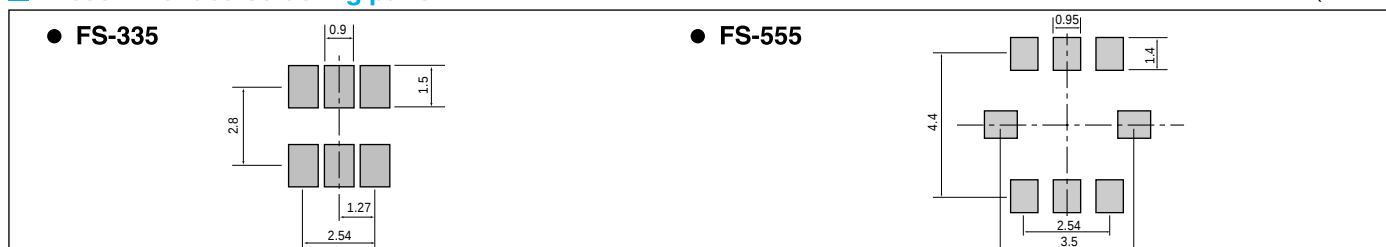
■ External dimensions

(Unit: mm)



■ Recommended soldering pattern

(Unit: mm)

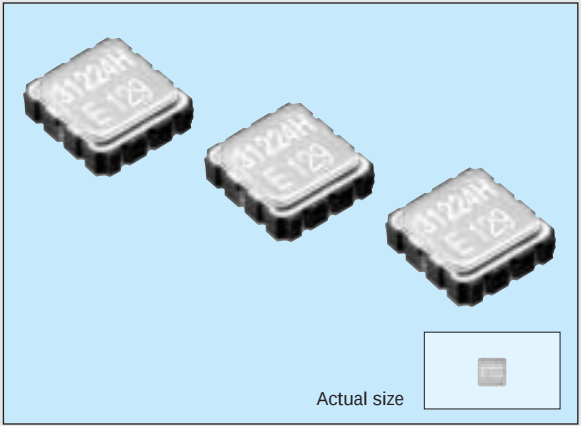


SAW RESONATOR (THE TYPE OF HIGH ENVILONMENTAL PROCESS) FOR TPMS

FS-585

Product number (please refer to page 2)
Q25FS585xxxxx00

- Be able to operate up to + 120°C.
- Perfect for small wireless equipment.
- Reflow solderable SMD ceramic package.
- Excellent enviromental capability

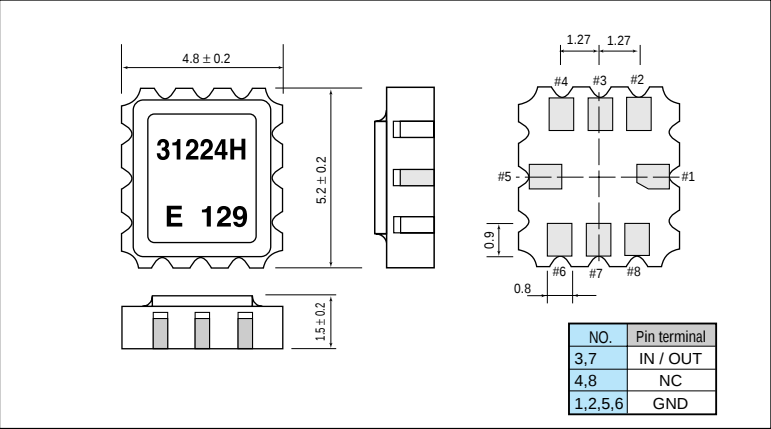


Specifications (characteristics)

Item		Symbol	Specifications	Remarks
Nominal frequency range		f ₀	315 MHz, 433 MHz	Please contact us for inquiries about the available frequency.
Temperature range	Storage temperature	T _{STG}	-40 °C to +125 °C	Stored as bare product after unpacking
	Operating temperature	T _{OPR}	-40 °C to +120 °C	
Maximum drive level		GL	10 mW Max.	
Recommended drive level		DL	2 mW Typ.	
Frequency tolerance (standard)		Δf/f	±50 x 10 ⁻⁶ , ±100 x 10 ⁻⁶	300 MHz to 500 MHz, Ta=+25 °C ± 3 °C
Peak temperature		θT	+40 °C ± 10 °C	
Temperature coefficient		α	-3.4(+0.8/-0.6) x 10 ⁻⁹ / °C ²	
Harmonic ratio		R _s /R ₁	2 Min.	
Series resistance		R ₁	18 Ω Max.	
Aging		fa	±10 x 10 ⁻⁶ /year Max.	Ta=+25 °C ±3 °C
Shock resistance		S.R.	±10 x 10 ⁻⁶ Max.	Nine drops on a concrete from 1500 mm

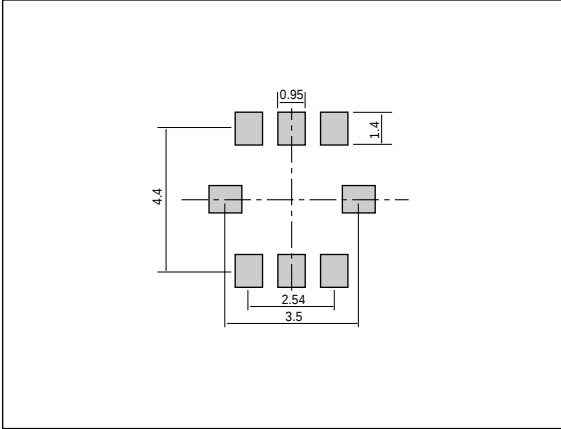
External dimensions

(Unit: mm)



Recommended soldering pattern

(Unit: mm)



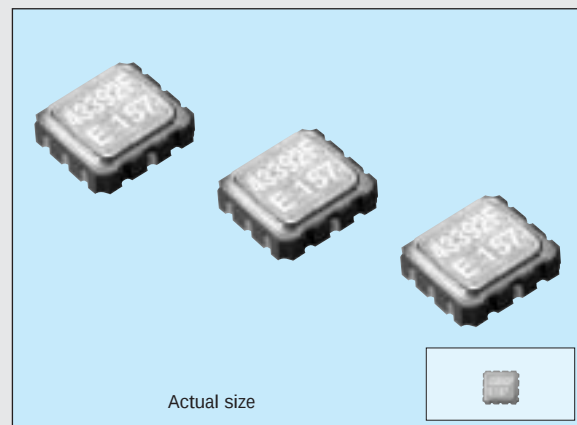
SAW Filter

FF-555

Product number (please refer to page 2)

Q51FF555x x x x x 00

- 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)



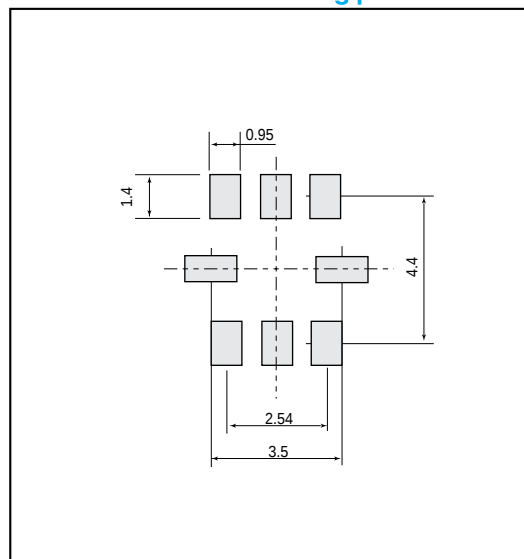
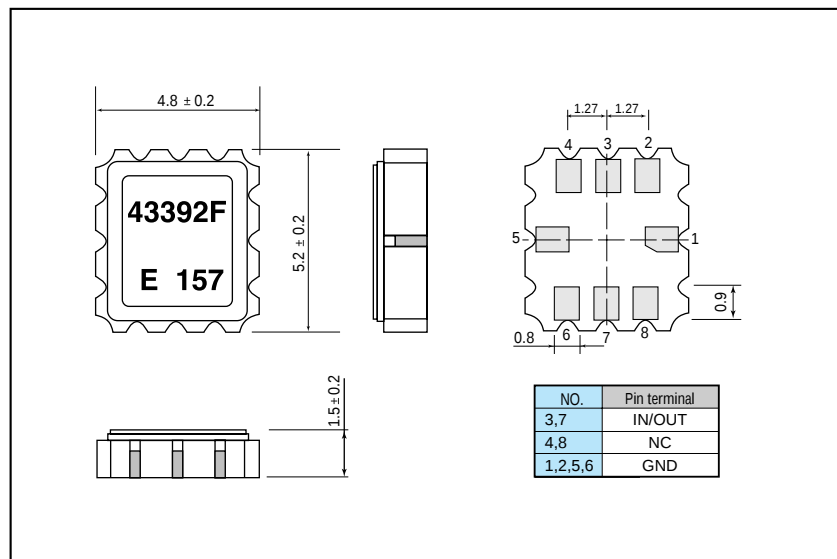
■ Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Nominal frequency range	f_0	300 MHz to 500 MHz	
Insertion Loss	IL	- 3.5 dB Min.	Minimum Loss
Pass bandwidth	BW	$f_0 \pm 200$ kHz Min.	Reference to Minimum Loss
Attenuation	ATT	40 dB Min. ($f_0 \pm 21.4$ MHz)	Reference to Through level (0 dB)
Peak Temperature	θT	+25 °C $\pm$ 15 °C	
Temperature Coefficient	α	$(-3.4 \pm 0.8) \times 10^{-8} / ^\circ\text{C}^2$	
Operable temperature	T _{OPR}	-40 °C to +85 °C	
Storage temperature range	T _{STG}	-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)

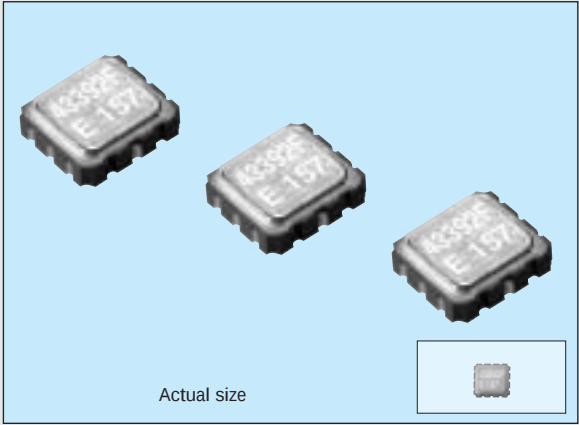


FRONT-END FILTER FOR TPMS AND WIRELESS RECEIVERS

FF-585

Product number (please refer to page 2)
Q51FF585x x x x x 00

- Low-loss, High stability by using Quartz crystal substrate.
- Reflow solderable Surface-Mount ceramic package.
- Applications:Wireless remote-control, Safety system (Automotive TPMS)

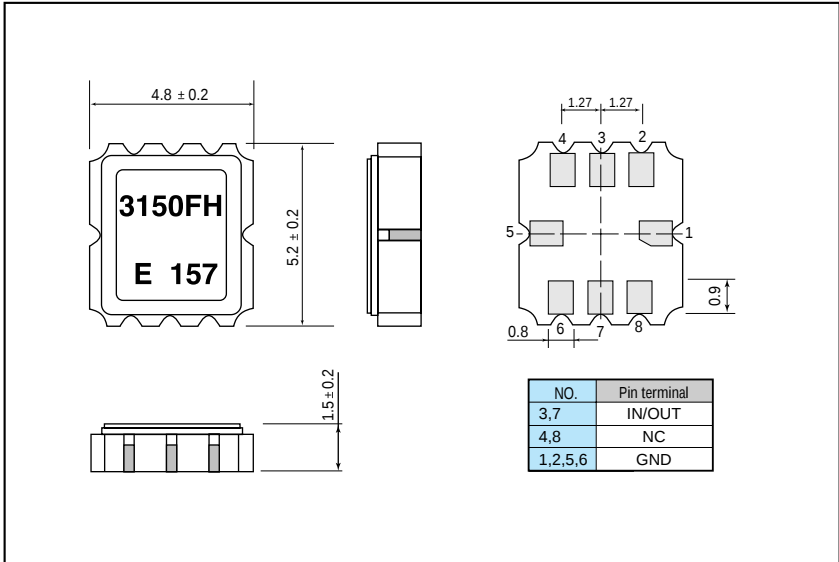


Specifications (characteristics)

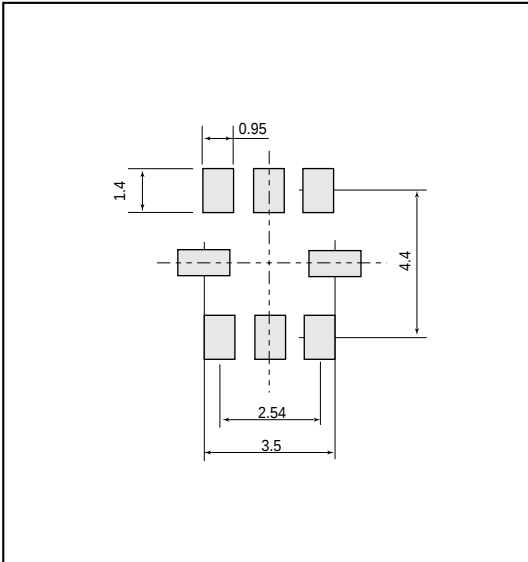
Item	Symbol	Specifications	Remarks
Nominal frequency range	f ₀	300 MHz to 500 MHz	
Insertion Loss	IL	- 3.5 dB Min.	Minimum Loss
Pass bandwidth	BW	f ₀ ±200 kHz Min.	Reference to Minimum Loss
Rejection band		At F _c -21.4 MHz -40 dB Min. At F _c +21.4 MHz -40 dB Min.	Reference to Through level (0 dB)
Peak Temperature	θT	+30 °C ±15 °C	
Temperature Coefficient	α	(-3.4±0.8) x 10 ⁻⁸ / °C ²	
Operable temperature	T _{OPR}	-40 °C to +85 °C	
Storage temperature range	T _{STG}	-55 °C to +125 °C	
Terminal impedance	Z	370 Ω Typ.	Ex : 315 MHz
		260 Ω Typ.	Ex : 433.92 MHz
Test fixture			EX:314.98 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



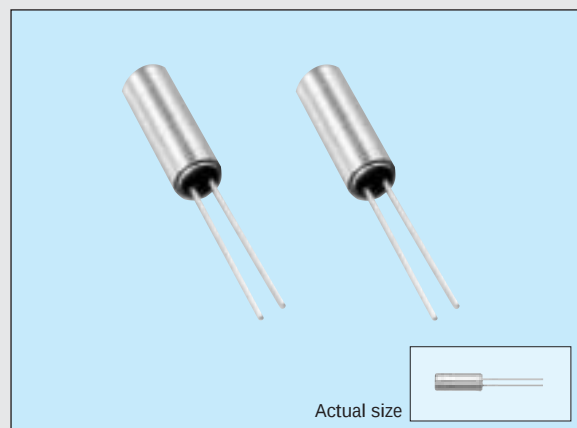
TEMPERATURE SENSING CRYSTAL

HTS-206

Product number (please refer to page 2)

Q19HT206xxxx00

- 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.

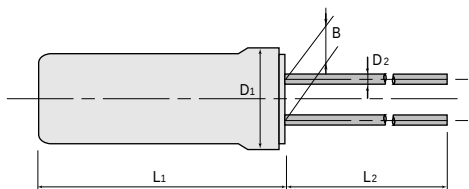


■ Specifications (characteristics)

Item		Symbol	Specifications	Remarks
Nominal frequency		f_0	40 kHz	
Temperature range	Storage temperature	T_{STG}	-55 °C to +125 °C	Stored as bare product after unpacking
	Operating temperature	T_{OPR}	-40 °C to +85 °C	
Drive level	Maximum	GL	1.0 μ W Max.	
	Recommended	DL	0.1 μ W Typ.	
Frequency tolerance (standard)		$\Delta f/f$	± 2 %	$T_a = +25$ °C, DL=0.1 μ W
Temperature coefficient	1st	α	$-29.6 \times 10^{-6}/^{\circ}\text{C}$ [± 2 %]	
	2nd	β	$-6.4 \times 10^{-8}/^{\circ}\text{C}^2$ [± 8 %]	
	3rd	γ	$-1.5 \times 10^{-10}/^{\circ}\text{C}^3$ Max.	
Series resistance		R_1	30 k Ω Max.	$T_a = +25$ °C, DL=0.1 μ W
Motion capacitance		C_1	2.0 fF Typ.	
Shunt capacitance		C_0	0.9 pF Typ.	
Insulation resistance		IR	500 M Ω Min.	
Aging		f_a	$\pm 3 \times 10^{-6}$ /year Max.	$T_a = +25$ °C ± 3 °C
Shock resistance		S.R.	$\pm 3 \times 10^{-6}$ Max.	Three drops on a hard board from 500 mm

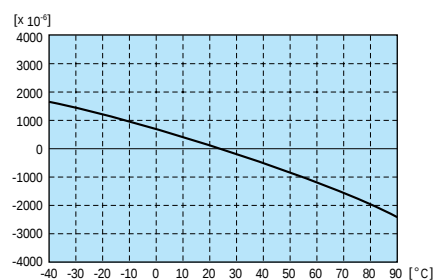
■ External dimensions

(Unit: mm)



Model	L_1	L_2	D_1	D_2	B
HTS-206	6.0 Max.	4.0 Min.	$\phi 2.0$ Max.	$\phi 0.2$	0.7

■ Temperature characteristic



SIP LOW/MEDIUM-FREQUENCY CRYSTAL OSCILLATOR

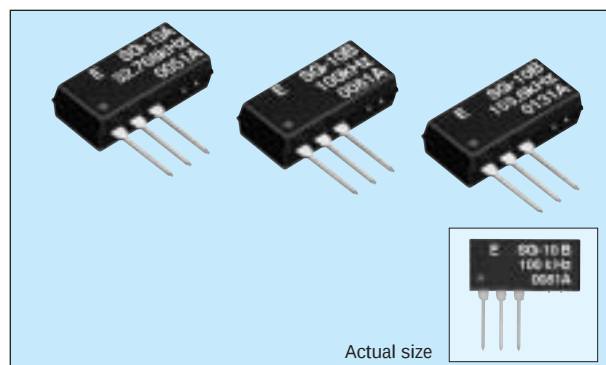
SG-10

obsolete

Product number (please refer to page 1)

Q3110000xxxxx00

- Low current consumption.
- Small suited to high-density mounting.
- Mountable on a standard printed circuit board.
- Cylindrical low/medium-frequency crystal unit builtin, thus assuring high reliability.



SELECTABLE-OUTPUT CRYSTAL OSCILLATOR

SPG series

obsolete

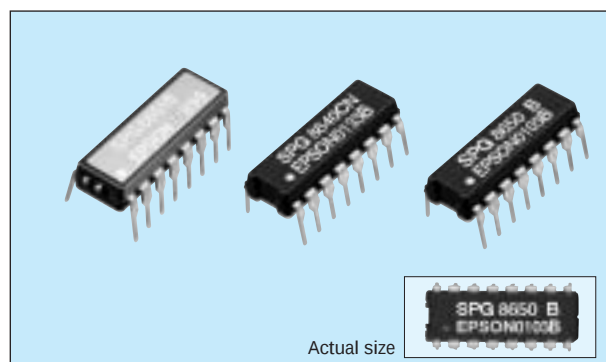
Product number (please refer to page 2)

Q318640xxxxxxxx00

Q318650xxxxxxxx00

Q318651xxxxxxxx00

- Capable of selecting 57 varieties of frequency output.
- Low current consumption.
- Easy to mount DIP 16-pin package.



SERIAL-INTERFACE REAL TIME CLOCK MODULE

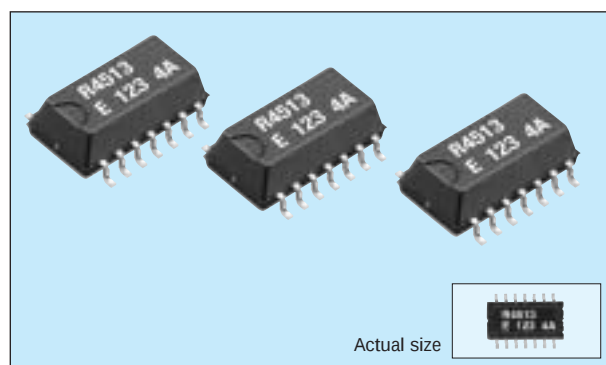
RTC-4513

obsolete

Products number (please refer to page 2)

Q4145135x000100

- Using a serial interface, controllable only three signal lines.
- 30 second adjustment, available.



SERIAL INTERFACE REAL TIME CLOCK MODULE

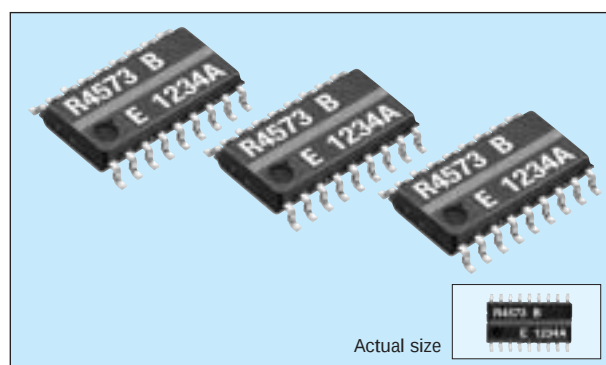
RTC-4573SB

obsolete

Products number (please refer to page 2)

Q4145736x000200

- Using a serial interface, controllable only three signal lines.
- Alarm interruption of sec. to month and day of week possible.
- Interval timer interrupt function that can be set with an interval ranging from 1/4096 of a second to 255 minutes.
- Low current consumption. (0.5 μ A/3 V Typ.)



REAL TIME CLOCK MODULE FOR PC/AT^{*1}

RTC-6593

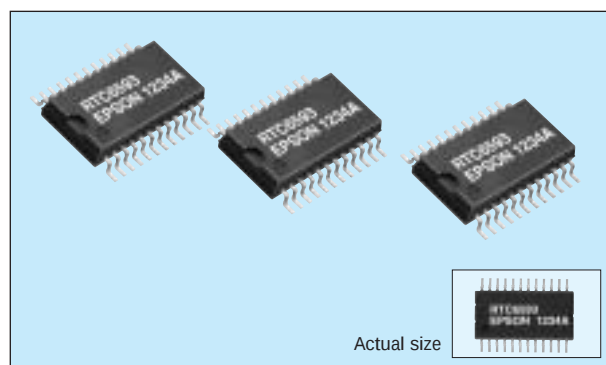
obsolete

Products number (please refer to page 2)

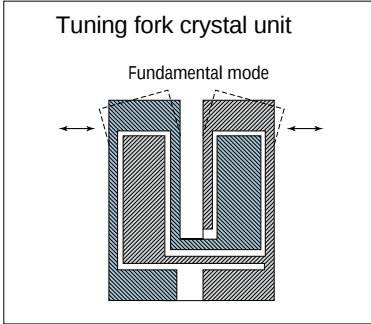
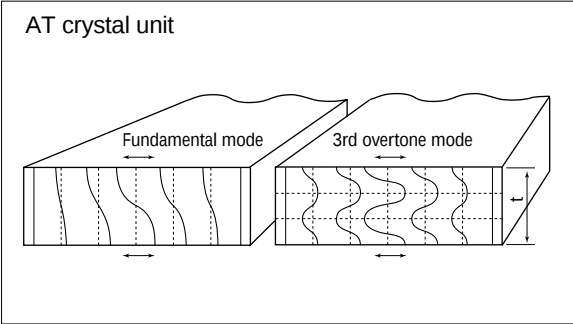
Q4265933x000100

- Provides 114-bytes of backed-up RAM.
- Extended alarm function.

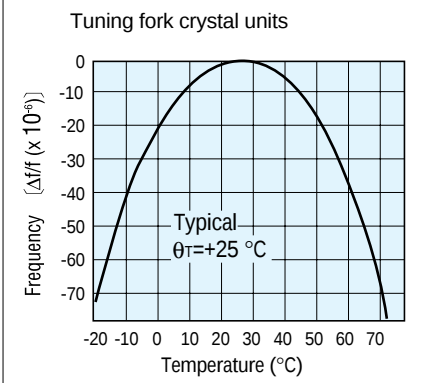
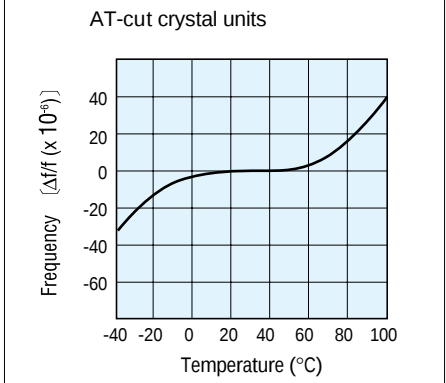
^{*1} PC / AT is a trademark of international Business Machines Corporation.



Glossary

Item	Content	Object
Fundamental mode	First harmonic crystal vibration mode. The AT resonance frequency is determined by the thickness of the crystal, but even with the same thickness the third overtone will be about three times the frequency of the fundamental. With tuning fork crystal unit, the second overtone is about six times the fundamental. AT fundamental mode $f \text{ (MHz)} = \frac{1670}{t \text{ (}\mu\text{m)}}$ (t : Thickness)  	X'tal, OSC
Baud rate	The rate of data transmission, i.e. how many data can be transmitted in one second.	OSC
Divided frequency	The output frequency that is divided by the internal IC.	OSC
Duty (tw/t) (symmetry)	Ratio of full and half cycles. For CMOS loading duty is rated at 1/2V _{DD} , and for TTL loading at 1.4 V.	OSC
(Equivalent) series capacitance (C ₁) (motional capacitance)	Energy distortion to the (equivalent) internal charge capacitance component of the crystal unit, at the series resonant frequency.	X'tal
(Equivalent) series resonant resistance (R ₁)	Vibration loss to the (equivalent) internal resistance component of the crystal resonator, at the series resonant frequency. A measure of the easiness of oscillation.	X'tal
Drive level (DL)	Current or voltage level in the oscillating (operating) state. (Drive power=power required to oscillate crystal unit.)	X'tal
Frequency (f)	Number of waves (cycles) per second. The relation between frequency and cycle is f (Hz) =1/t (s).	ALL
(Frequency) aging (fa)	Amount of frequency drift when operated under the specified conditions for a specified term.	ALL
Frequency tolerance precision (Δf/f)	Under specified conditions at an ambient temperature of +25 °C, the difference in actual (measured) frequency from the nominal frequency.	ALL
Frequency stability (Δf/f ₀)	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.	OSC

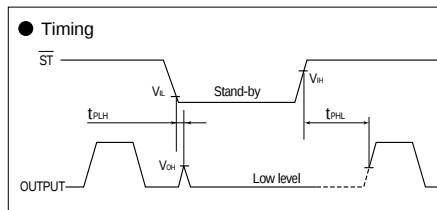
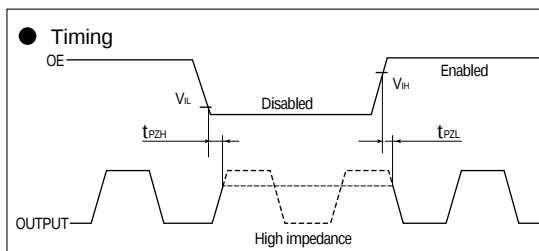
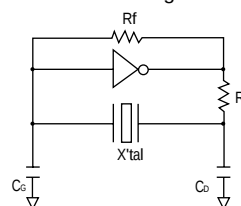
X'tal: Crystal unit, OSC: Crystal oscillator, RTC: Real time clock module

Item	Content	Object
Frequency temperature characteristics	Taking the frequency at 25 degrees Centigrade as the reference, the change in frequency in response to ambient temperature. - Tuning fork crystal unit. SAW Resonator. $\Delta f/f = a(\theta - \theta_x)^2$ θ_x: specified temperature - AT crystal unit. $\Delta f/f = \alpha(\theta - 25) + \beta(\theta - 25)^2 + \gamma(\theta - 25)^3$ Examples of frequency temperature characteristics  	ALL
Frequency voltage characteristics	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.	OSC,RTC
Insulation resistance (IR)	Resistance between lead and lead, or between lead and case package. (conductive package)	ALL
Load capacitance(CL)	Effective capacitance (series equivalent charge capacitance) of the oscillation circuit as seen from the pins of the crystal unit. This capacitance is determined as a condition when the crystal unit is connected to the oscillation circuit and will determine the output frequency. Load capacitance approximation: $CL \approx C_G \times C_D / (C_G + C_D) + C_s$ (Cs=stray capacitance)	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 (VDD-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 (TOPR)	Temperature range where specification characteristics are fulfilled, unless otherwise specified.	ALL
Operating voltage (VDD)	Voltage input to VDD pin which will support continuous operation with specification characteristics.	OSC,RTC
Origin frequency (f0)	Oscillation source frequency of oscillator inside oscillation system.	OSC

X'tal: Crystal unit, OSC: Crystal oscillator, RTC: Real time clock module

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 (t _{osc})	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)	Output is switched to high impedance, and wired OR connection can be used to select multiple outputs (frequency). OE pin: High or open. Specified frequency output = enabled. OE pin: Low. Output is high impedance = disabled. Oscillation is not stopped, so the clock after disabled is cleared is not synchronized with OE (clock is continuous).	OSC
Output fall time (t _{THL})	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 (f _o)	The frequency output from the oscillator circuit or the crystal oscillator system.	OSC,RTC
Output load conditions (N or C _L)	The types and quantities (power) of the loads that can be connected to the oscillator. Calculated for 1 TTL as I _{OH} =-40 μA, I _{OL} =1.6 mA and for LS-TTL as I _{OH} =-20 μA, I _{OL} =0.4 mA, 1 C-MOS=5 pF.	OSC
Output rise time (t _{TLH})	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 (C ₀)	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 (T _{sol})	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)	Function that halts crystal unit oscillation and frequency division. Cuts the current consumed by the oscillators circuit and the frequency division stage. ST pin - high or open: Specified frequency output. ST pin - low: Output is low level, oscillation stops. : Output is low level (weak pull-down), oscillation stops. : Output is high impedance, oscillation stops. Please refer to each data sheet.	OSC
Storage temperature range (T _{STG})	Maximum absolute rating for the discharged state (no input of voltage, current or power). Exposure to temperatures over this level may result in characteristic degradation or destruction. To assure precision, store at room temperature whenever possible.	ALL

Basic oscillation circuit using CMOS IC



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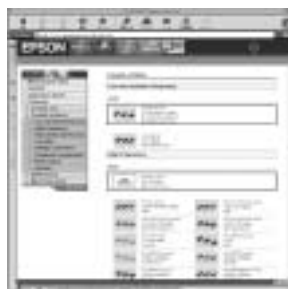
Entrance of Electronic Devices Information



click!



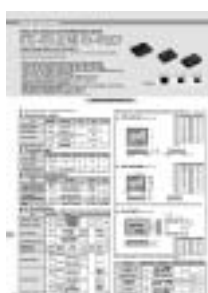
Lineup Page for each device



Introduce the lineup of each device.



Catalog & Data Sheet Page



Catalogs and Data sheets for each devices are available.

[NOTE]

Handwriting practice lines consisting of 24 horizontal dashed lines.

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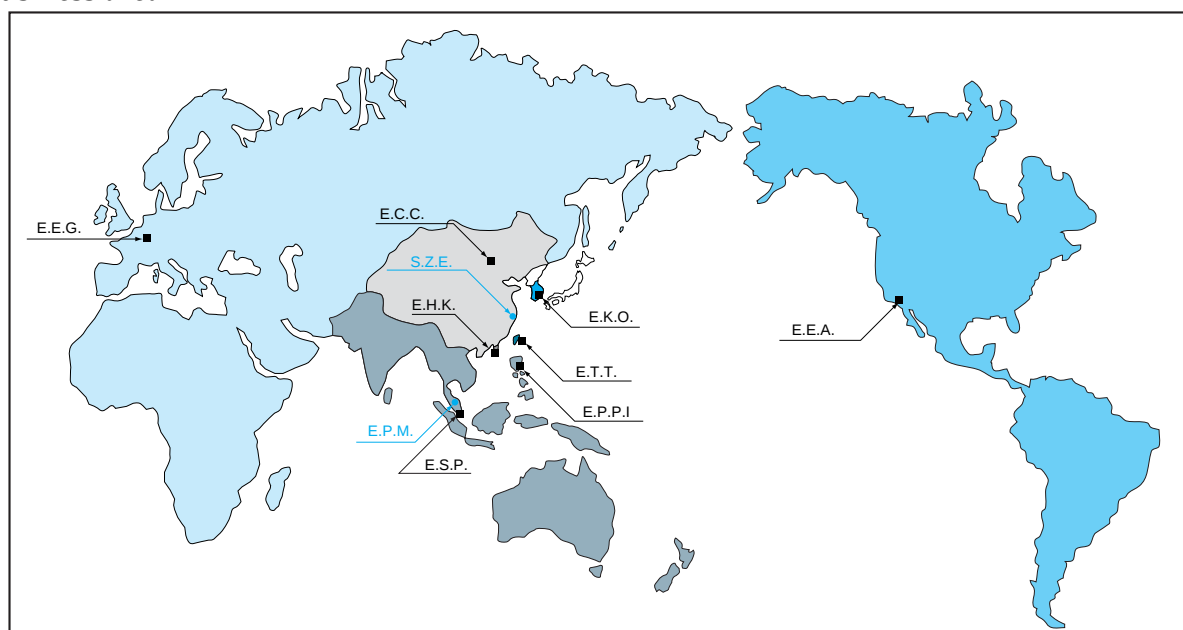
edevice@epson.co.jp

Manufacturing Plant

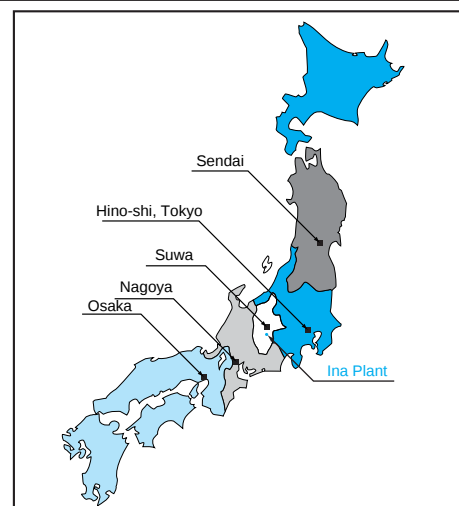
- Ina Plant
- E.P.M.: Epson Precision (Malaysia) SDN. BHD. Plant
- S.Z.E.: Suzhou Epson CO.,LTD.Plant
- E.P.P.I: Epson Precision (Philippines) Inc. Plant

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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