TQ 012-37

EPSON

THE CRYSTALMASTER

Product Catalog

2001

SEIKO EPSON CORP.

ENERGY SAVING EPSON

THE CRYSTALMASTER

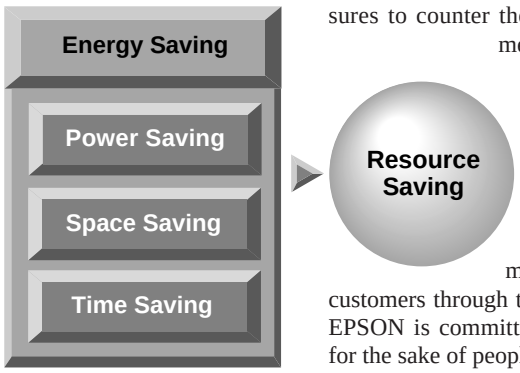
ENERGY SAVING EPSON

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.

SEIKO EPSON CORP. QUARTZ DEVICE DIVISION acquired ISO9001 and ISO14001 certification by B.V.Q.I. (Bureau Veritas Quality International) .

ISO9001 in October, 1992.

ISO14001 in November,1997.

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CONTENTS

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	Q11C001Rxxxxx00	Load Capacitance Frequency Tolerance
C-002RX	Q11C02RXxxxxx00	
C-004R	Q11C004Rxxxxx00	
C-005R	Q11C005Rxxxxx00	
FC-255	Q13FC255xxxxx00	
C-2 TYPE	Q12C2000xxxxx00	Nominal frequency Load capacitance Frequency tolerance
C-4 TYPE	Q12C4000xxxxx00	
MC-146	Q1xMC146xxxxx00	
MC-156	Q1xMC156xxxxx00	
MC-206	Q1xMC206xxxxx00	
MC-306	Q1xMC306xxxxx00	
MC-405	Q1xMC405xxxxx00	
MC-406	Q1xMC406xxxxx00	

CRYSTAL UNIT

High-frequency

Model	Product Number	Specifications for "xxxxx"
CA-301	Q21CA301xxxxx00	Nominal frequency Load capacitance Frequency tolerance Frequency temperature characteristics (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)
CA-303HS	Q23C303Sxxxxx00	
SA-315H	Q23S315Hxxxxx00	
SA-315HZ	Q24S315Zxxxxx00	
FA-238	Q22FA238xxxxx00	
FA-365	Q22FA365xxxxx00	
MA-306	Q22MA306xxxxx00	
MA-406	Q22MA406xxxxx00	
MA-406H	Q24M406Hxxxxx00	
MA-505	Q22MA505xxxxx00	
MA-506	Q22MA506xxxxx00	

CRYSTAL OSCILLATOR

Low and medium-frequency

Model	Product Number	Specifications for "xxxxx"
SG-10	Q3110000xxxxx00	Output frequency Frequency stability
SG-3032JC	Q3101JC0xxxxx00	

High-frequency

Model	Product Number	Specifications for "xxxxx"
SG-51	Q32510xxxxxxx00	Output frequency Frequency stability Operating voltage Operating temperature range Stand-by or Output enable C-MOS or TTL
SG-531	Q32531xxxxxxx00	
SG-615	Q33615xxxxxxx00	
SG-636	Q33636xxxxxxx00	
SG-710	Q33710xxxxxxx00	
SG-8002JF	Q3308JFxxxxxx00	
SG-8002CA	Q3309CAxxxxxx00	
SG-8002JC	Q3307JCxxxxxx00	
SG-8002JA	Q3306JAxxxxxx00	
SG-8002DB	Q3203DBxxxxxx00	
SG-8002DC	Q3204DCxxxxxx00	

Low jitter

Model	Product Number	Specifications for "xxxxx"
EG-2001CA	Q3801CA0xxxxx00	Output frequency

High-stability

Model	Product Number	Specifications for "xxxxx"
HG-1012JA	Q3511JA0xxxxx00	Output frequency Frequency stability Operating temperature
HG-2012JA	Q3512JA0xxxxx00	
HG-8002JA	Q3502JAxxxxxx00	Output frequency Frequency stability Operating voltage Operating temperature range Stand-by or Output enable C-MOS or TTL
HG-8002DC	Q3402DCxxxxxx00	

Voltage-controlled crystal oscillator

Model	Product Number	Specifications for "xxxxx"
VG-1011JA	Q3602JA0xxxxx00	Output frequency Frequency stability Operating temperature range Pull range
VG-4010JA	Q3611JA0xxxxx00	
VG-4030JA	Q3612JA0xxxxx00	

Multi-output

Model	Product Number	Specifications for "xxxxx"
MG-7010SA	Q33M11SAxxxxx00	Output frequency Operating voltage
MG-3020DD	Q32M12DDxxxxx00	
MG-5100SA	Q33M21SAxxxxx00	
SPG-8640	Q318640xxxxxx00	Oscillation source frequency Frequency tolerance
SPG-8650	Q318650xxxxxx00	
SPG-8651	Q318651xxxxxx00	

REAL TIME CLOCK MODULE

Serial interface

Model	Product Number	Specifications for "xxxxx"
RTC-4701JE	Q414701700002 00	Frequency Tolerance
RTC-4701NB	Q414701900002 00	
RTC-4574SA	Q414574500002 00	
RTC-4574JE	Q414574700001 00	
RTC-4553	Q4145535xxxxx00	
RTC-4543SA	Q414543500002 00	
RTC-4543SB	Q414543600002 00	
RTC-4513	Q414513500001 00	
RTC-4573SB	Q414573600002 00	
RTC-8564JE	Q418564700001 00	
RTC-8564NB	Q418564900002 00	
RTC-8563SA	Q418563500001 00	
RTC-8563JE	Q418563700002 00	
RTC-8583	Q4185835xxxxx00	
RTC-8593	Q4185935xxxxx00	
RTC-8593SB	Q4185936xxxxx00	

Parallel interface

Model	Product Number	Specifications for "xxxxx"
RTC-7301SF	Q427301800002 00	Frequency Tolerance
RTC-7301DG	Q427301100002 00	
RTC-62421	Q4262421xxxxx00	
RTC-62423	Q4262423xxxxx00	
RTC-72421	Q4272421xxxxx00	
RTC-72423	Q4272423xxxxx00	
RTC-63421	Q4263421xxxxx00	
RTC-63423	Q4263423xxxxx00	
RTC-64611	Q4264612xxxxx00	
RTC-64613	Q4264613xxxxx00	
RTC-65271	Q426527400001 00	
RTC-6593	Q426593300001 00	
RTC-58321	Q4258320xxxxx00	
RTC-58323	Q4258323xxxxx00	

TEMPERATURE SENSING CRYSTAL

Model	Product Number	Specifications for "xxxxx"
HTS-206	Q19HT206xxxxx00	Nominal freguency Operating temperature range

SURFACE ACOUSTIC WAVE DEVICE

Model	Product Number	Specifications for "xxxxx"
FS-335	Q25FS335xxxxx00	Norminal frequency Frequency Tolerance
FS-555	Q25FS555xxxxx00	

STANDARD PACKING SPECIFICATIONS

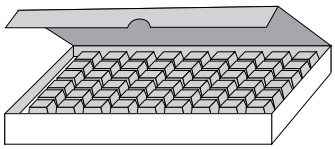
The last 2 digit of Product Number "00" means standard packing specifications.
The other packing specifications are custom,therefore, the last 2 digits of Product Number is changed.Please contact us for inguiries.
For SMD products, standard packing quantity is specified as below table.Please order in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

1. Cylinder(except SA-315HZ)

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

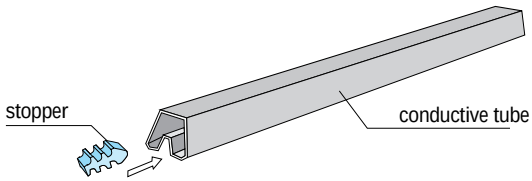
2. SIP

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



3. DIP

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



Model	Quantity
SG-531 series SG-8002DC series HG-8002DC series MG-3510DC	35 pcs/tube
SG-51 series SG-8002DB series SPG series MG-3020 RTC-58321/62421 63421/72421/7301DG	25 pcs/tube
RTC-64611	18 pcs/tube
RTC-65271	15 pcs/tube

4. SMD

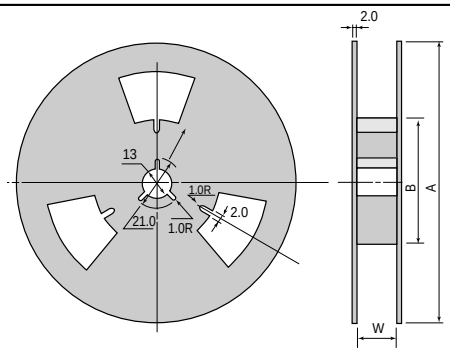
SMD products are packed in the shipping carton as below table in accordance with taping standards EIA-481A and EIAJ RC-1009B.

(Unit: mm)

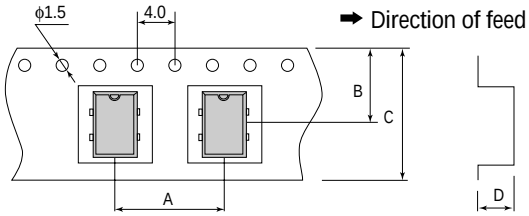
●STANDARD PACKING QUANTITY

Model	Quantity
FS-335/555	4000 pcs/reel
FC-255,MC-146/156/206/306 FA-238,MA-306,SA-315HZ	3000 pcs/reel
SG-710**K	2000 pcs/reel
The other SMD products	1000 pcs/reel

(Unit: mm)



Model	Dimension		
	A	B	W
MC-146,MC-156,MC-206,MC-306 MC-405/406,MA-306 SA-315HZ,SG-8002JC series SG-3032JC,SG-636 series,SON22-pin SOP14-pin,VSOJ20-pin,SSOP24pin	Ø330	Ø80	17.5
MA-406/406H·MA-505/506 SG-8002JA series SG-615 series HG-1012JA/2012JA VG-1011JA,SOP24-pin VG-4000 series,HG-8002JA			25.5
SOP18-pin			24.4
FC-255,FS-335/555			13.5
FA-365	Ø180	Ø60	13.0
FA-238			9.0
SG-8002JF/CA,SG-710 series,EG-2001CA	Ø255	Ø80	17.5



Model	Dimension				Tape type (L=left direction)
	A	B	C	D	
SA-315HZ	8.0	9,25	16.0	2,6	TE1608R
MC-146,MC-156				∗1	TE1608L
MC-206 MC-306 MC-405/406 MA-306 SG-3032JC SG-8002JC/JF/CA series SG-636 series SG-710 series EG-2001CA		9.25		∗2	
MA-406/406H MA-505/506 SG-8002JA series SG-615 series VG-1011JA series HG-1012JA/2012JA VG-4000 series HG-8002JA	12.0	13.25	24.0	∗3	TE2412L
VSOJ20-pin		9.25	16.0	2.0	TE1612L
SON 22-pin				1.8	
SOP14-pin			16.0	3.65	TE1612L
SSOP24-pin				2.4	
SOP18-pin		11.5	24.0	2.5	TE2412L
SOP24-pin	16.0	13.25	24.0	2.95	TE2416L
FC-255,FA-365,FS-335/555	8.0	7.25	12.0	∗4	TE1208L
FA-238	4.0	5.25	8.0	1.0	TE0804L

∗1 MC-146: 1.7; MC-156: 1.65
∗2 MC-306,MA-306: 3.0; MC-405/406: 3.9; SG-3032JC;SG-8002JC/CA; SG-636 series: 3.3; MC-206: 2.2; SG-710: 2.5;SG-8002JF:2.3
∗3 MA-406/406H: 4.0; MA-505/6, SG-8002JA, 615 series, HG-1012JA/2012JA, VG-4000 series, HG-8002JA,VG-1011JA: 4.8
∗4 FS-335:1,52;FS-555: 2.0; FA-365: 1.6;FC-255:1.1

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

HANDLING PRECAUTIONS

Common points for all products

1. Shock resistance

EPSON's crystal products are designed to endure physical shocks. (Drop tests consist of three drops onto a hard wooden board from a height of 750 mm. Alternatively, three-directional excitation tests are performed with 1/2 sine wave of 29400 m/s^2 for a duration of 0.3 ms.) Nevertheless, under some conditions, crystal products may be damaged by drops or shocks during mounting. It is important, therefore, to run mounting machines as smoothly as permissible to prevent undue shocks. Please review conditions prior to using a mounting machine.

- Products that are more sensitive to shock: SPG-8640*N series

2. Vibration resistance

Mechanical vibration of a piezo buzzer could cause frequency and amplitude change to the output frequency.
Although the affect might be minimal, Epson recommends the following product mounting guidelines.

● Mounting guideline

(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.

3. Heat resistance

Use or storage under extreme temperatures over a long period may cause the quality of the crystal products to deteriorate and affect frequency stability. It is advisable to use and store at normal temperature and humidity levels.

4. Soldering condition

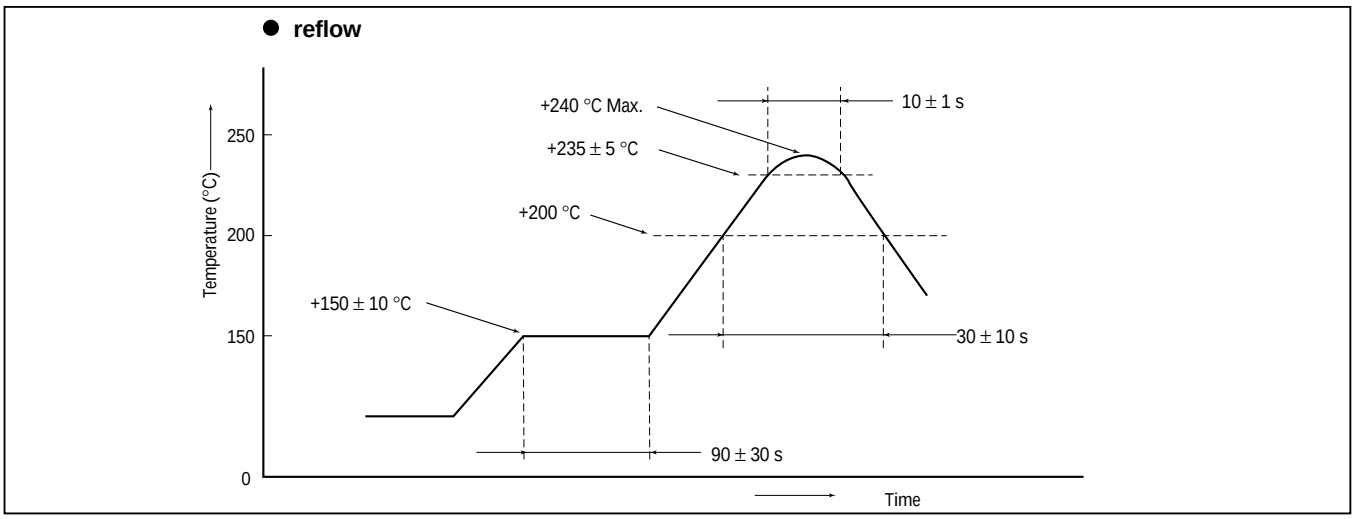
Since all crystal units except SMD products utilize solder having a +180 °C to +200 °C melting point, heating the package more than +150 °C may cause the characteristics to deteriorate or damage the product. If you are mounting at temperatures of more than +150 °C, we recommend that SMD products be used.

(1) Cylinder products, SIP products and DIP products

Model	Soldering conditions
[Cylinder] C-TYPE , C-2-TYPE , C-4-TYPE HTS-206	Under +280 °C within 5 s. Do not heat the package at more than +150 °C.
[Cylinder] CA-301 [SIP] SG-10 [DIP] SPGSG-51/531,SG-8002DB/DC,HG-8002DC , MG-3020DD RTC-58321/62421/63421/64611/65271 ,RTC-72421/7301DG	Under +260 °C within10 s. Do not heat the package at more than +150 °C.

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

Reflow profile(example)



5. Ultrasonic cleaning

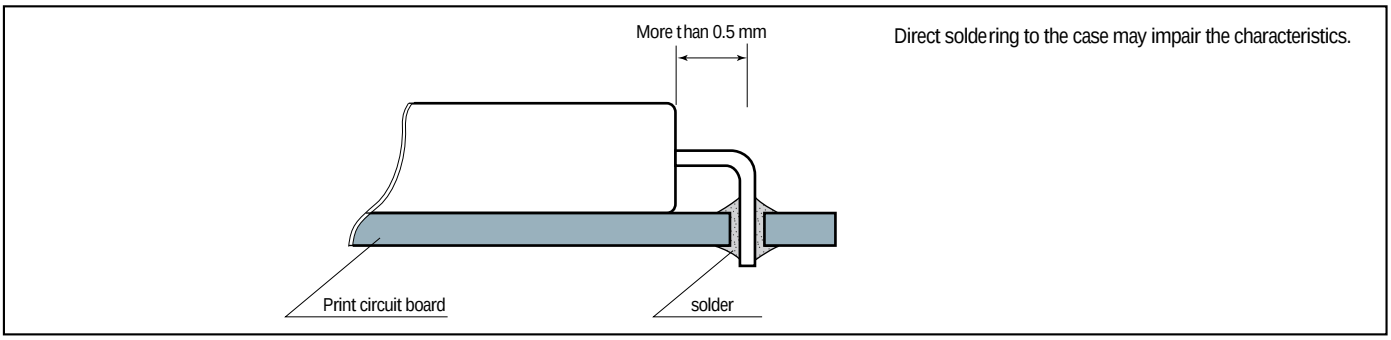
- Products using an AT-cut crystal can be cleaned ultrasonically. However, since the crystal chip may be affected under some conditions, be sure to check the suitability of your system in advance.
- Products using a tuning-fork crystal cannot be guaranteed for ultrasonic cleaning, as they are susceptible to damage by resonance vibration.

6. Handling of lead terminal

(1) Cylindrical products

Pulling the lead strongly may cause cracking of the hermetic glass seal at the root of the lead and lower the airtightness, thus deteriorating the characteristics. If it is necessary to install the product as in the figure below, leave more than 0.5 mm of lead from the case. When the lead needs to be repaired, do not pull on it, and hold the bent part to correct it.

● **Installation example**



(2) SMD products

When leads are soldered directly to the board pattern, avoid applying stress sufficient to deform the leads. Particular care must be taken with SOP products.

(3) SIP products

If leads need to be bent, bend the part beyond the stand-off (1.3 mm or more from the case).

(4) DIP products

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

7. Handling of reels

(1) Products should be stored at the normal temperature and humidity (refer to the standard conditions of test site JIS Z-8703). Avoid storing them over a long period and mount them immediately after unpacking.

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

8. Storage

We recommend storing products at +15 °C to +35 °C and 25 %RH to 85 %RH.

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 10 "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 10 "AIIowance 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 11 "Load capacitance")

Crystal oscillator and real time clock module

AII crystal oscillators and real time clock modules are provided with a C-MOS 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. AIso, 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.

PRECAUTIONS IN DESIGNING OSCILLATION CIRCUITS

1. Drive level

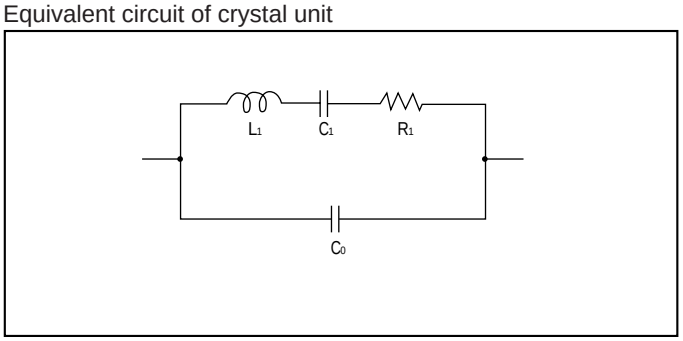
Drive level denotes electric power required to oscillate a crystal unit, which can be calculated using the following formula.

Drive level (P) = I^2Re

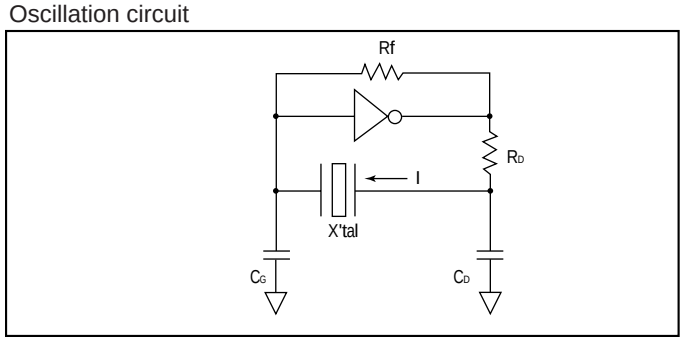
Where I stands for current to pass in the crystal unit, Re for effective resistance of crystal unit, and $Re=R_1(1+Co/C_L)^2$.

If the Drive level (P) exceeds the specified level, oscillation frequency will shift. This occurs because an excessive level of power causes stress for the crystal and 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



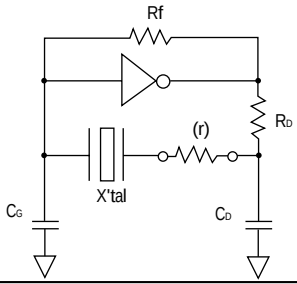
Oscillation circuit



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**



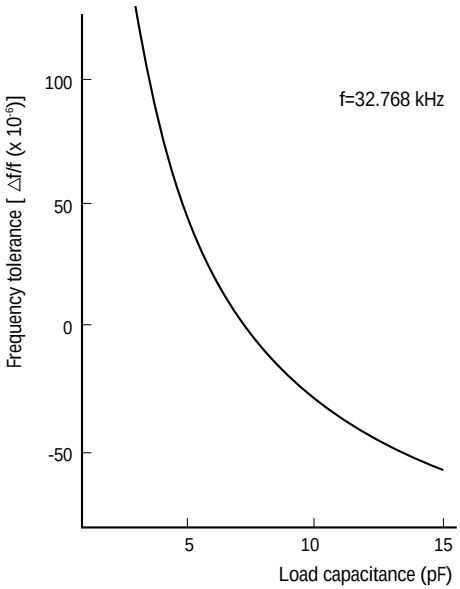
(1) Connect the resistance (r) to the circuit in series with the crystal unit.
(2) Adjust (r) so that oscillation can start (or stop).
(3) Measure (r) when oscillation just starts (or stops) in (2) above.
(4) Recommended (r)
(r) > CI x (5 to 10)

3. Load capacitance

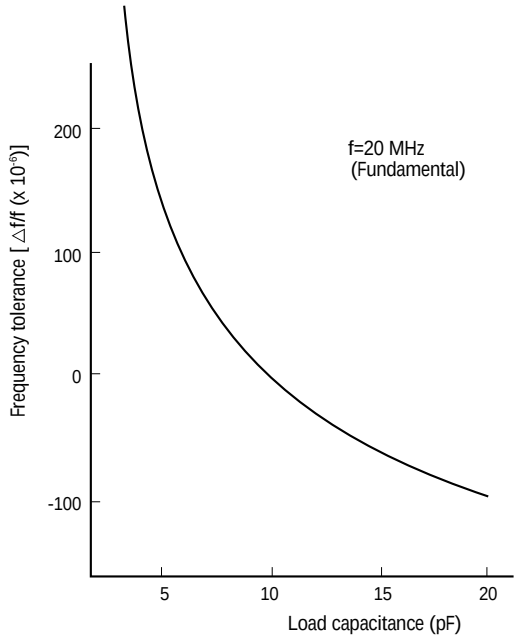
Differences in the load capacitance of the oscillation circuit may result in a different oscillation frequency from the desired one, as shown in the figure below. Approximate expression of the load capacitance of the circuit $C_L \fallingdotseq C_G \times C_D / (C_G + C_D) + C_S$.
Where C_S Stands for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

● **Frequency and load capacitance characteristics**

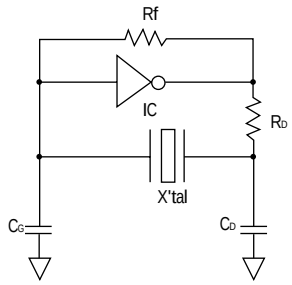
Tuning fork crystal unit (example)



AT-cut crystal unit (example)



4. Reference for setting parameters of oscillation circuit



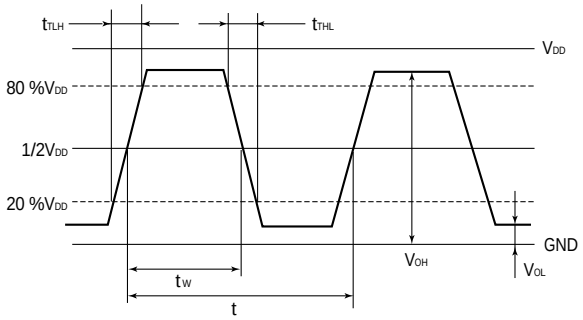
IC: equivalent to TC74HCU04AP (unbuffer)
(TC74HCU04AP is a product number of Toshiba Corp.)

Symbol / Frequency range	R_F (MΩ)	R_D (kΩ)	C_G (pF)	C_D (pF)
20 kHz to 60 kHz	20	500	10	
60 kHz to 165 kHz	10	300		
5.5 MHz to 30 MHz (Fundamental)	1	0.5	5 to 15	

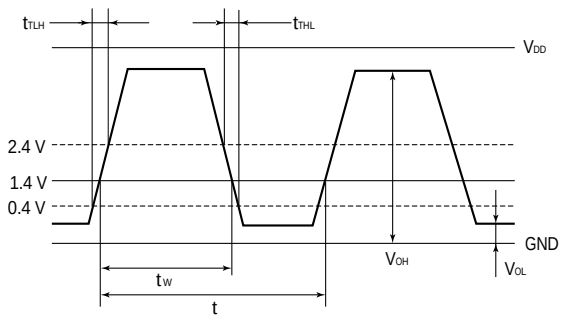
OUTPUT WAVEFORM AND TEST CIRCUIT

1. Timing chart

(1) C-MOS load



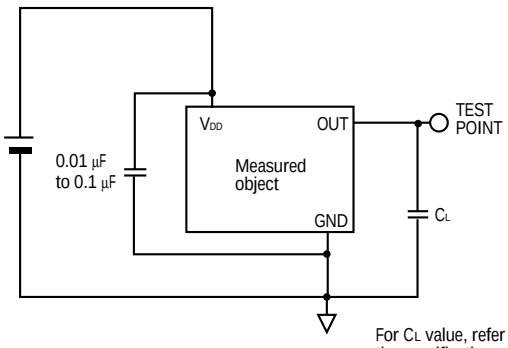
(2) TTL load



Duty[%]=t_w/t x 100

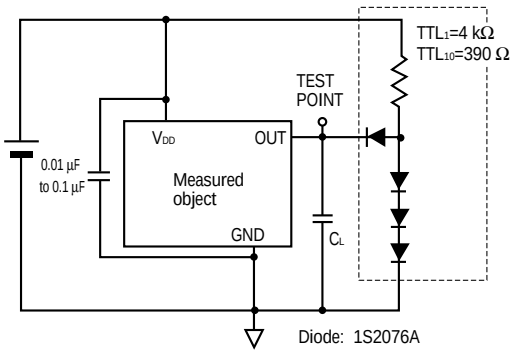
2. Test circuit

(1) C-MOS load



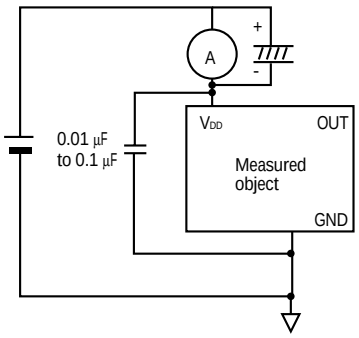
For C_L value, refer to
the specifications of each model.

(2) TTL load



Diode: 1S2076A

(3) Current consumption



3. Test conditions

(1) Supply voltage
- More than 150 µs 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 MΩ. Simultaneous measurement of waveform (frequency and waveform) is not possible; however, measurement is possible as the waveform 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

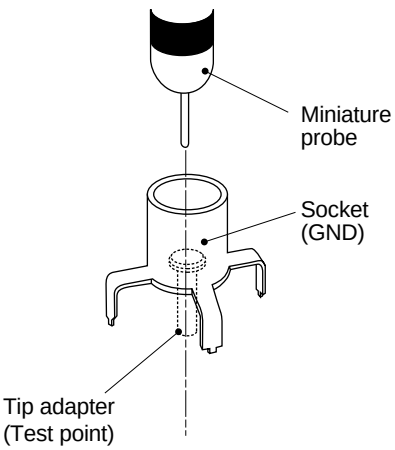


TABLE OF CRYSTAL UNITS

Frequency range

	Model	20 kHz	100 kHz	1 MHz	24 MHz	40 MHz	64 MHz
Low and medium-frequency crystal units (tuning fork crystal units)	C-001R	● 32.768 kHz					
	C-002RX	● 32.768 kHz					
	C-004R	● 32.768 kHz					
	C-005R	● 32.768 kHz					
	C-2-TYPE	20 kHz to 165 kHz, 307.2 kHz					
	C-4-TYPE	32 kHz to 120 kHz, 192 kHz ∗1					
	FC-255	● 32.768 kHz					
	MC-146	● 32.768 kHz ● 75 kHz					
	MC-156						
	MC-206	32 kHz to 100 kHz					
	MC-306	20 kHz to 165 kHz ∗1					
	MC-405/406	20 kHz to 165 kHz, 307.2 kHz ∗1					
High-frequency crystal units (AT-cut crystal units)	CA-301	4 MHz to 64 MHz ∗2					
	MA-306	17.734 MHz to 41 MHz					
	MA-406	4 MHz to 64 MHz ∗2					
	MA-505/506						
	CA-303HS	9.6 MHz to 27 MHz					
	MA-406H						
	SA-315H/HZ	10 MHz to 27 MHz					
	FA-238	16 MHz to 50 MHz					
	FA-365	12 MHz,14 MHz to 41 MHz					

∗1 Since there are unavailable frequencies, please be sure to contact your nearest distributor or please refer to the frequency list. (page 15)
∗2 8.0 MHz < f < 8.2 MHz: unavailable. For frequencies less than 5.5 MHz, please refer to the frequency list. (page21)

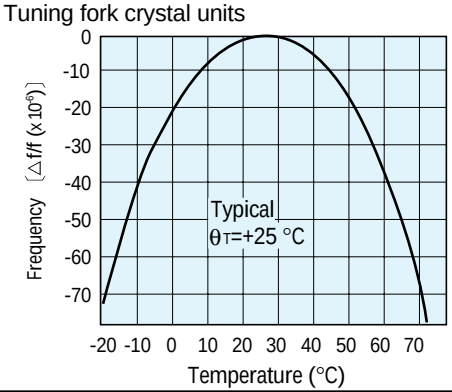
Specifications

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
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 50 kΩ			
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 55 kΩ			
FC-255	5.0 x 1.9 x 0.9	32.768 kHz	±20 x 10^{-6}	Temperature coefficient (a): -0.04 x 10^{-6}/°C^2 Max. $\Delta f/f = a(\theta_T - \theta_X)^2$	65 kΩ	7 pF, 12.5 pF	-55 °C to +125 °C	-40 °C to +85 °C
MC-146	7.0 x 1.5 x 1.4	32.768 kHz,75 kHz	±20 x 10^{-6} to ±50 x 10^{-6}		30 kΩ to 65 kΩ			
MC-156	7.1 x 3.3 x 1.5							
MC-206	7.3 x 4.1 x 2.0	32 kHz to 100 kHz	±20 x 10^{-6} to ±100 x 10^{-6}		20 kΩ to 55 kΩ			
MC-306	8.0 x 3.8 x 2.54	20 kHz to 165 kHz			6 kΩ to 55 kΩ	6 pF to ∞		
MC-405/406	10.4 x 4.1 x 3.56	20 kHz to 165 kHz 307.2 kHz						
CA-301	ø3.1 x 8.9 ø3.1 x 10.3	4 MHz to 64 MHz	±30 x 10^{-6} (±50 x 10^{-6},±100 x 10^{-6})	±30 x 10^{-6} (±50 x 10^{-6})	40 Ω to 150 Ω	Fundamental: 10 pF to ∞, 3rd overtone: 5 pF to ∞	-40 °C to +85 °C	-20 °C to +70 °C
MA-306	8.0 x 3.8 x 2.54	17.34 MHz to 41 MHz	±50 x 10^{-6}	±30 x 10^{-6}	60 Ω		-55 °C to +100 °C	
MA-406	11.7 x 4.8 x 3.7	4 MHz to 64 MHz		±30 x 10^{-6} (±50 x 10^{-6})	40 Ω to 150 Ω			
MA-505/506	13.5 x 5.1 x 4.57							
CA-303HS	ø3.1 x 8.9	9.6 MHz to 27 MHz	±10 x 10^{-6}	±3 x 10^{-6} to ±20 x 10^{-6}	25 Ω to 50 Ω	10 pF to ∞	-55 °C to +125 °C	-40 °C to +85 °C
MA-406H	11.7 x 4.8 x 3.7							
SA-315H/HZ	8.0 x 3.0 x 1.55	10 MHz to 27 MHz			30 Ω to 40 Ω			
FA-238	3.2 x 2.5 x 0.7	16 MHz to 50 MHz	±50 x 10^{-6}	±30 x 10^{-6}	100 Ω		-55 °C to +125 °C	-20 °C to +70 °C
FA-365	6.0 x 3.5 x 1.4	12 MHz,14 MHz to 41 MHz	±50 x 10^{-6} to ±100 x 10^{-6}		50 Ω			

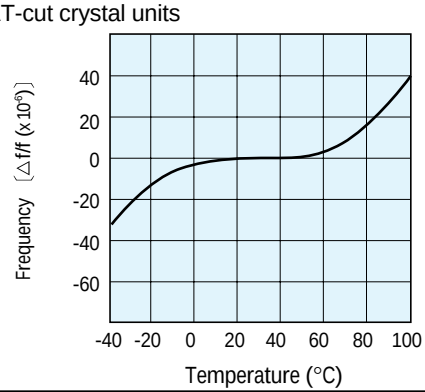
Note: For detailed specifications, refer to the individual specifications for each product.

Frequency and temperature characteristics example

● Tuning fork crystal units



● AT-cut crystal units

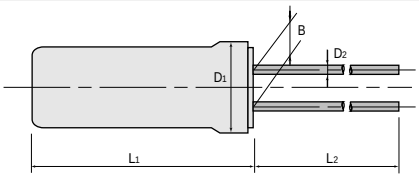


Dimensions

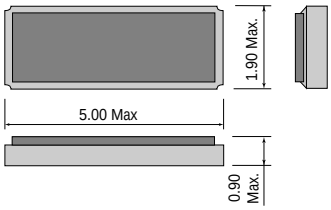
(Unit: mm)

Cylinder

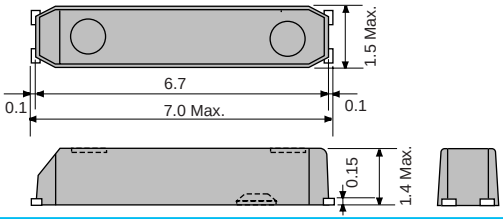
Model		L_1	L_2	D_1	D_2	B
C-001R		8.0 Max.	9.0 Min.	ø3.1 Max.	ø0.3	1.1
C-002RX/C-2-TYPE		6.0 Max.	4.0 Min.	ø2.0 Max.	ø0.2	0.7
C-004R/C-4-TYPE		5.0 Max.	4.0 Min.	ø1.5 Max.	ø0.2	0.5
C-005R		4.6 Max.	4.0 Min.	ø1.2 Max.	ø0.15	0.3
CA-301	Over 5.5 MHz	8.9 Max.	9.5 Min.	ø3.1 Max.	ø0.3	1.1
	Under 5.5 MHz	10.3 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



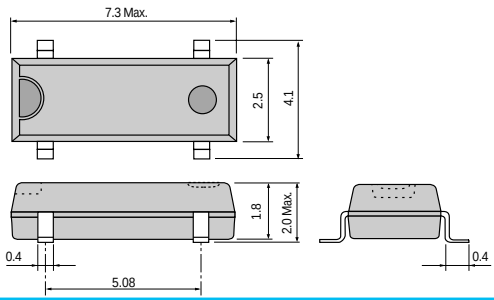
FC-255



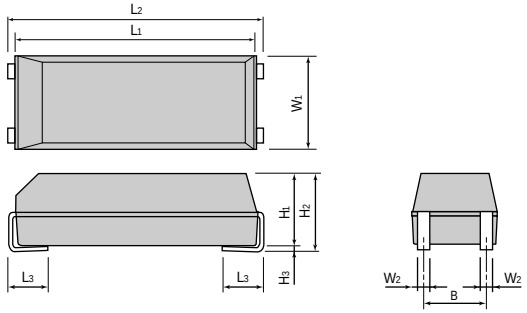
MC-146



MC-206

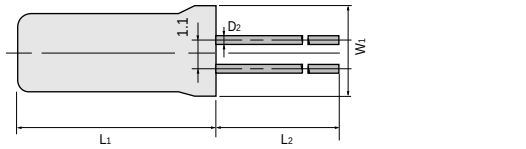


Model	L_1	L_2	L_3	W_1	W_2	B	H_1	H_2	H_3
MC-405/406	9.6	10.41 Max.	2.54	4.06 Max.	0.51	2.29	3.15	3.60 Max.	0.2 Min.
MA-505/506	12.7	13.46 Max.	2.54	5.08 Max.	1.09	3.30	4.19	4.60 Max.	0.2 Min.

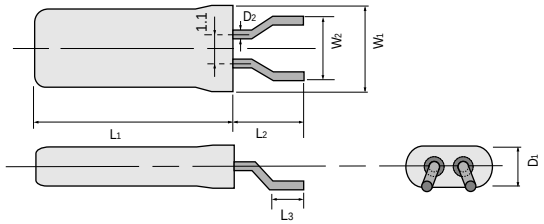


SA-315H

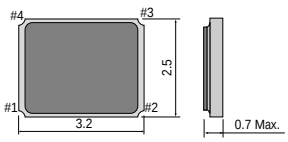
Model	L_1	L_2	L_3	W_1	W_2	D_1	D_2	B
SA-315H	8.0 Max.	7.5 Min.	–	3.0 Max.	–	1.55	ø 0.3	1.1
SA-315HZ	8.0 Max.	2.0 Min.	0.7 Min.	3.0 Max.	2.5 Max.	1.55	ø 0.3	1.1



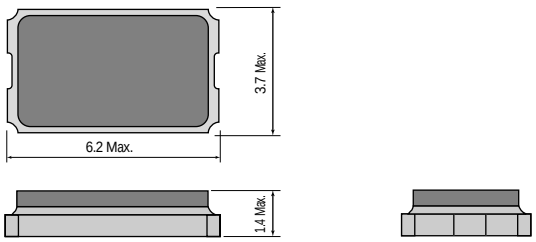
SA-315HZ



FA238



FA365



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/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

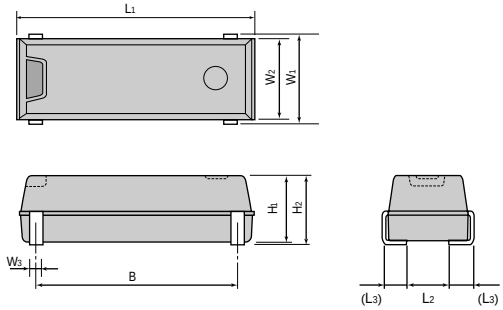


TABLE OF CRYSTAL OSCILLATORS

Frequency range

	Model	1 Hz 100 kHz 1 MHz 26 MHz 40 MHz 67 MHz 135 MHz 170 MHz
Low and medium-frequency crystal oscillators (builtin tuning fork crystal unit)	SPG-8640 series	0.005 Hz to 1 MHz
	SPG-8650 series	0.00027 Hz to 153.6 kHz
	SPG-8651 series	0.00027 Hz to 100 kHz
	SG-10	10 Hz to 153.6 kHz
	SG-3032JC	32.768 kHz
High-frequency crystal oscillators (builtin AT-cut crystal unit)	SG-51 series	1.025 MHz to 66.6667 MHz
	SG-531 series	1.025 MHz to 135 MHz
	SG-615 series	
	SG-636 series	2.2 MHz to 135 MHz
	SG-710 seriess	1.8 MHz to 135 MHz
Low jitter crystal oscillators	EG-2001CA	106.25 MHz to 170 MHz
High-stability oscillators	HG-1012JA	1.5 MHz to 28.6363 MHz
	HG-2012JA	
Voltage-controlled crystal oscillator data sheets	VG-1011JA	
	VG-4010JA	2.0 MHz to 28.6363 MHz
	VG-4030JA	
Multi-output crystal oscillators (builtin AT-cut crystal unit)	MG-3020	1.1 MHz to 40 MHz
	MG-5100SA	76.9 kHz to 100 MHz
	MG-7010	20 MHz to 120 MHz

Specifications

Item / Model	Output frequency range	Frequency stability	Current consumption	Operating temperature	Operating voltage	Output load	Output control
SPG-8640 series	0.005 MHz to 1 MHz	±100 x 10^{-6}	2 mA Max.	-10 °C to +70 °C	5 V ± 0.5 V	1TTL,15 pF	RESET
SPG-8650 series	0.00027 Hz to 153.6 kHz	±50 x 10^{-6}					
SPG-8651 series	0.00027 Hz to 100 kHz	±5 x 10^{-6}	0.5 mA Max.	-10 °C to +60 °C			
SG-10	10 Hz to 153.6 kHz	±50 x 10^{-6}		-10 °C to +70 °C			
SG-3032JC	32.768 kHz	5±23 to 5±100 x 10^{-6}	5 µA Max.	-20 °C to +70 °C	1.8 V ± 3.6 V	15 pF	—
SG-51/531/615P	1.025 MHz to 26 MHz	±100 x 10^{-6}	23 mA Max.	-20 °C to +70 °C	5 V ± 0.5 V	10 TTL,50 pF	OE
SG-51/531/615PTJ	26.0001 MHz to 66.6667 MHz		35 mA Max.			5 TTL	
SG-51/531/615PH						50 pF	
SG-531/615PTW/STW	55.0001 MHz to 135 MHz		45 mA Max.	(-40 °C to +85 °C)		15 pF	OE / ST
SG-531/615PHW/SHW							
SG-531/615PCW/SCW	26.0001 MHz to 135 MHz		28 mA Max.		3.3 V ± 0.3 V		
SG-636PTF	2.2 MHz to 41 MHz		17 mA Max.	-20 °C to +70 °C	5 V ±0.5 V	10 TTL,50 pF	OE
SG-636PH	41 MHz to 70 MHz		35 mA Max.			20 pF (<55 MHz) 15 pF (>55 MHz)	
SG-636PCE/SCE	2.2 MHz to 41 MHz	±100 x 10^{-6} (±50 x 10^{-6})	9 mA Max.		3.3 V ± 0.3 V	30 pF	OE / ST
SG-636PDE			5 mA Max.		2.5 V ± 0.25 V	15 pF	OE
SG-636PTW/STW	32.0001 MHz to 135 MHz		45 mA Max.		5 V to 0.5 V	15 pF	OE / ST
SG-636PHW/SHW							
SG-636PCW/SCW			28 mA Max.		3.3 V ± 0.3 V		
SG-710PTK	1.8 MHz to 50 MHz		24 mA Max.	-10 °C to +70 °C (-40 °C to +85 °C)	5 V to 0.5 V	10 TTL	OE
SG-710PHK	1.8 MHz to 80 MHz		40 mA Max.			50 pF	
SG-710ECK	1.8 MHz to 67 MHz		18 mA Max.		3.3 V ± 0.3 V		ST
SG-710PTW/STW	80.0001 MHz to 135 MHz		45 mA Max.	-20 °C to +70 °C (-40 °C to +85 °C)	5 V ± 0.5 V	15 pF	OE / ST
SG-710PHW/SHW							
SG-710PCW/SCW	66.6667 MHz to 135 MHz		28 mA Max.		3.3 V ±0.3 V		
EG-2001CA	106.25 MHz to 170 MHz	±100 x 10^{-6}	50mA Max.	0 °C to +70 °C			OE
HG-1012/2012JA	1.5 MHz to 28.6363 MHz	±15 x 10^{-6} to ±30 x 10^{-6}	10 mA Max.	-20 °C to +70 °C	5 V ±0.25 V		—
VG-1011JA		±15 x 10^{-6} to ±25 x 10^{-6}		-40 °C to +85 °C	5 V ±0.5 V	2 TTL 15 pF	
VG-4010JA	2.0 MHz to 28.6363 MHz	±35 x 10^{-6}	35 mA Max.	-20 °C to +70 °C	5 V ±0.25 V	2 TTL 30 pF	
VG-4030JA		±37 x 10^{-6}	18 mA Max.		3.3 V ±0.17 V	30 pF	
MG-3020	1.1 MHz to 40 MHz	±100 x 10^{-6}	20 mA Max.	-20 °C to +70 °C	5 V ± 0.25 V	15 pF	RESET
MG-5100SA	76.9 kHz to 100 MHz		100 mA Max.		5 V ± 0.5 V 3.3 V ± 0.3 V		OE
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.

Frequency range of SG-8002 or HG-8002 series

	Model		1 MHz	55 MHz	90 MHz	125 MHz
SG-8002 series	SG-8002DB	PT	1.0 MHz to 125 MHz (-20 °C to +70 °C)			
		ST				
		PH	1.0 MHz to 55 MHz (-40 °C to +85 °C)			
		SH				
	SG-8002DC	PC	1.0 MHz to 125 MHz (-40 °C to +85 °C)			
		SC				
	SG-8002JA	PT	1.0 MHz to 125 MHz (-20 °C to +70 °C)			
		ST				
		PH	1.0 MHz to 55 MHz (-40 °C to +85 °C)			
		SH				
	SG-8002CA	PC	1.0 MHz to 125 MHz (-40 °C to +85 °C)			
		SC				
	SG-8002JC	PT	1.0 MHz to 125 MHz (-20 °C to +70 °C)			
		ST				
		PH				
		SH				
		PC	1.0 MHz to 125 MHz (-20 °C to +70 °C)			
		SC				
	SG-8002JF	PT	1.0 MHz to 125 MHz (-20 °C to +70 °C)			
		ST				
		PH	1.0 MHz to 40 MHz (-40 °C to +85 °C)			
		SH				
		PC	1.0 MHz to 125 MHz (-40 °C to +85 °C)			
		SC				
HG-8002 series	HG-8002DC	PT	1.0 MHz to 125 MHz (-20 °C to +70 °C)			
		ST				
		PH	1.0 MHz to 55 MHz (-40 °C to +85 °C)			
		SH				
		PC	1.0 MHz to 125 MHz (-40 °C to +85 °C)			
		SC				
	HG-8002JA	PT	1.0 MHz to 125 MHz (-20 °C to +70 °C)			
		ST				
		PH	1.0 MHz to 55 MHz (-40 °C to +85 °C)			
		SH				
		PC	1.0 MHz to 125 MHz (-40 °C to +85 °C)			
		SC				

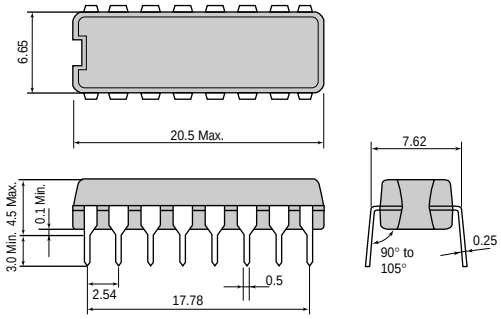
Specifications of SG-8002 or HG-8002 series

Model \ Item		Output frequency range	Frequency stability	Current consumption	Operating temperature	Operating voltage	Output load	Output control
SG-8002DB (DIP 14-pin) SG-8002DC (DIP 8-pin)	PT	1.0 MHz to 125.0 MHz	B: ± 50 x 10^{-6} (-20 °C to +70 °C) C: ± 100 x 10^{-6} (-20 °C to +70 °C) M: ± 100 x 10^{-6} (-45 °C to +85 °C)	45 mA Max.	-20 °C to +70 °C (-40 °C to +85 °C)	4.5 V to 5.5 V	5 TTL + 15 pF (-20 °C to +70 °C)	OE
	ST							ST
	PH						25 pF (-20 °C to +70 °C)	OE
	SH							ST
	PC			28 mA Max.	-40 °C to +85 °C	2.7 V to 3.6 V	15 pF (-40 °C to +85 °C/3.3 V)	OE
	SC							ST
SG-8002JA (SOJ 4-pin) SG-8002CA (Ceramic SMD)	PT			45 mA Max.	-20 °C to +70 °C (-40 °C to +85 °C)	4.5 V to 5.5 V	5 TTL + 15 pF (-20 °C to +70 °C)	OE
	ST							ST
	PH						25 pF (-20 °C to +70 °C)	OE
	SH							ST
	PC			28 mA Max.	-40 °C to +85 °C	2.7 V to 3.6 V	15 pF (-40 °C to +85 °C/3.3 V)	OE
	SC							ST
SG-8002JC (SOJ 4-pin)	PT		B: ± 50 x 10^{-6} (-20 °C to +70 °C) C: ± 100 x 10^{-6} (-20 °C to +70 °C)	45 mA Max.	-20 °C to +70 °C	4.5 V to 5.5 V	15 pF (-20 °C to +70 °C)	OE
	ST							ST
	PH						15 pF (-20 °C to +70 °C)	OE
	SH							ST
	PC			28 mA Max.		2.7 V to 3.6 V	15 pF (-20 °C to +70 °C/3.3 V)	OE
	SC							ST
SG-8002JF (SOJ 4-pin)	PT		B: ± 50 x 10^{-6} (-20 °C to +70 °C) C: ± 100 x 10^{-6} (-20 °C to +70 °C) M: ± 100 x 10^{-6} (-45 °C to +85 °C)	45 mA Max.	-20 °C to +70 °C (-40 °C to +85 °C)	4.5 V to 5.5 V	15 pF (-20 °C to +70 °C)	OE
	ST							ST
	PH						25 pF (-20 °C to +70 °C)	OE
	SH							ST
	PC			28 mA Max.	-40 °C to +85 °C	2.7 V to 3.6 V	15 pF (-40 °C to +85 °C/3.3 V)	OE
	SC							ST
HG-8002DC (DIP 8-pin)	PT		AV: ± 20 x 10^{-6} (-20 °C to +70 °C) BV: ± 25 x 10^{-6} (-20 °C to +70 °C) CX: ± 30 x 10^{-6} (-45 °C to +85 °C)	45 mA Max.	-20 °C to +70 °C (-40 °C to +85 °C)	5 V ±0.25 V	2 TTL + 15 pF (-20 °C to +70 °C)	OE
	ST							ST
	PH						15 pF (-20 °C to +70 °C)	OE
	SH							ST
	PC			28 mA Max.		3.3 V ±0.165 V	15 pF (-40 °C to +85 °C/3.3 V)	OE
	SC							ST
HG-8002JA (SOJ 4-pin)	PT		AV: ± 20 x 10^{-6} (-20 °C to +70 °C) BV: ± 25 x 10^{-6} (-20 °C to +70 °C) CX: ± 30 x 10^{-6} (-45 °C to +85 °C)	45 mA Max.	-20 °C to +70 °C (-40 °C to +85 °C)	5 V ±0.25 V	2 TTL + 15 pF (-20 °C to +70 °C)	OE
	ST							ST
	PH						15 pF (-20 °C to +70 °C)	OE
	SH							ST
	PC			28 mA Max.		3.3 V ±0.165 V	15 pF (-40 °C to +85 °C/3.3 V)	OE
	SC							ST

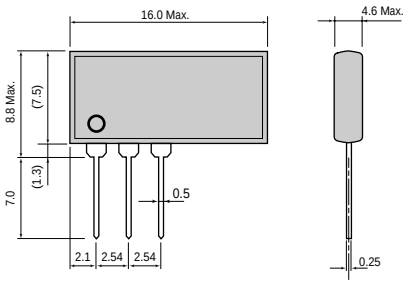
Dimensions

(Unit: mm)

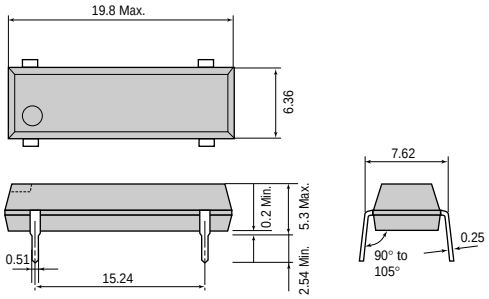
DIP 16-pin (SPG series)



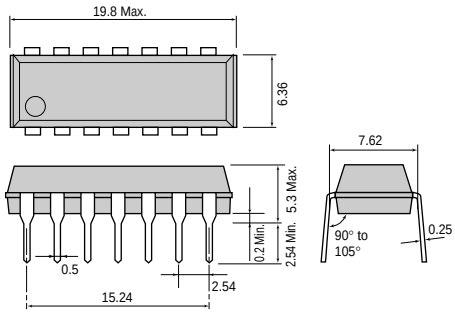
SIP 3-pin (SG-10)



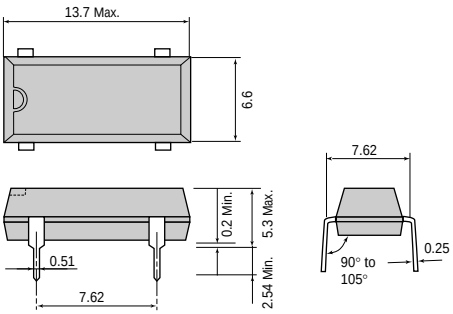
DIP 14-pin (SG-51 series, SG-8002DB series)



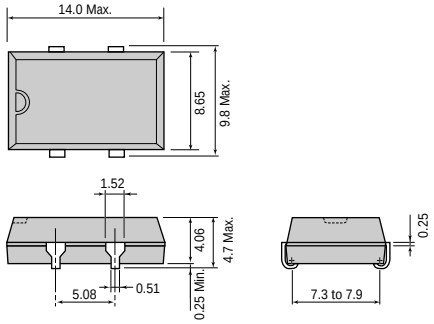
DIP 14-pin (MG-3020)



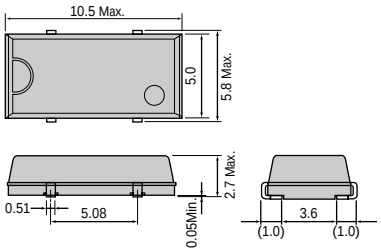
DIP 8-pin (SG-531 series, SG-8002DC series, HG-8002DC series)



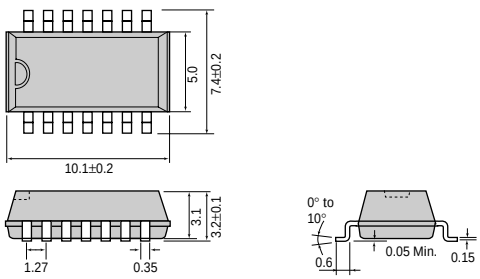
SOJ 4-pin (SG-615 series, HG-1012JA/2012JA, SG-8002JA series, HG-8002JA series, VG-1011JA series, VG-4000 series)



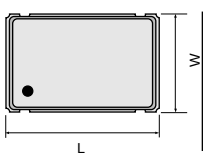
SOJ 4-pin (SG-3032JC, SG-636 series, SG-8002JC series)



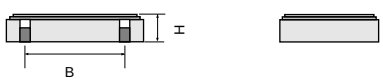
SOP 14-pin (MG-7010, MG-5100SA)



SMD (SG-710 series, SG-8002CA series, EG-2001CA)



Model	L	W	H	B
SG-710**K	7.5 Max.	5.0 Max.	1.5 Max.	5.08
SG-8002CA SG-710**W	7.2 Max.	5.2 Max.	1.5 Max.	5.08
EG-2001CA	7.2 Max.	5.2 Max.	1.4 Max.	5.08



SG-8002 JF

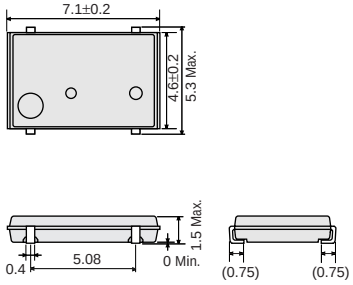


TABLE OF REAL TIME CLOCK MODULES

Characteristics

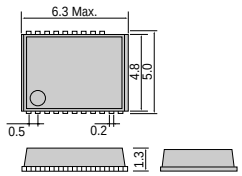
Item / Model	Package	Counter (time counting)	Access time (synchronous signal cycle)	Data bit	Address bit	Memory	Alarm	Time interval of standard pulse	Other features
RTC-4513	SOP 14-pin		(CLK: 600 ns)					64 Hz, 1 min, 1 h	
RTC-4543 SA	SOP 14-pin		(CLK: 750 ns)			—	—	32.768 kHz,1 Hz	
RTC-4543 SB	SOP 18-pin								
RTC-4553	SOP 14-pin		(CLK: 2 µs)			4 bit x 30		1024 Hz, 10 s	High stability (±5 x 10^{-6})
RTC-4573	SOP 18-pin		(CLK: 600 ns)						
RTC-4574	SOP 14-pin VSOJ20-pin	Second to year, day of the week	(CLK: 350 ns)					32.768 kHz to 1/30 Hz	
RTC-4701	VSOJ20-pin SON 22-pin			Serial		—	Second to Day and day of the week		Built-in temperature sensor
RTC-8563	SOP 14-pin VSOJ20-pin		(SCL: 2.5 µs)					32.768 kHz to 1 Hz	I²C-bus
RTC-8564	VSOJ20-pin SON 22-pin								
RTC-8583	SOP 14-pin	1/100s to year, day of the week	(SCL: 10 µs)			8 bit x 240	1/100 s to month	—	
RTC-8593/ SB	SOP 14/ 18-pin					—			
RTC-58321	DIP 16-pin		2 µs			—		1024 Hz to 1 h	I/O Connection
RTC-58323	SOP 24-pin								
RTC-7301	SSOP24-pin DIP 18-pin	Second to year and day of the week	150 ms (3.0V)			—	Second to day, day of the week	32.768 kHz to 1/30 Hz	High speed access 3.0 V operation
RTC-62421	DIP 18-pin		120 ns	4	4	—		64 Hz, 1 s, 1 min,1 h	Intel bus
RTC-62423	SOP 24-pin								
RTC-72421	DIP 18-pin								Intel bus (low current consumption)
RTC-72423	SOP 24-pin								
RTC-63421	DIP 18-pin		Intel bus:120 ns Motorola bus:220 ns			4 bit x 17 (select)	Second to month and day of the week	1024 Hz, 128 Hz, 64 Hz, 16 Hz, 2 Hz, 1 s,1 min,10 min	Intel bus
RTC-63423	SOP 24-pin								INT/MOT selectable
RTC-64611	DIP 24-pin	Second to year, day of the week, and 64 Hz to 1 Hz	85 ns			4 bit	Second to date, day of the week and 64 Hz	64 Hz, 32 Hz, 16 Hz, 8 Hz, 4 Hz, 2 Hz, 1 Hz	Same bus interface and battery backup as S-RAM
RTC-64613	SOP 24-pin								
RTC-65271	DIP 28-pin	Second to year, day of the week	325 ns	8	6	4-kBytes	Second to hour	8192 Hz to 2 Hz	Builtin battery holder
RTC-6593	SOP 24-pin					114-Bytes	Second to hour and Second to month (extended alarm)		Extended alarm

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

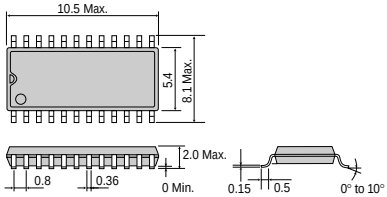
Dimensions

(Unit: mm)

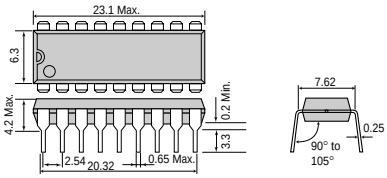
● **SON 22-pin (RTC-4701NB/8564NB)**



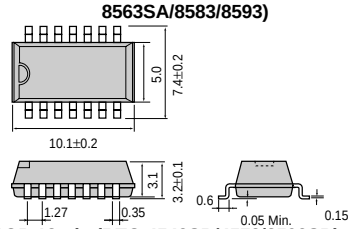
● **SSOP24-pin(RTC-7301SF)**



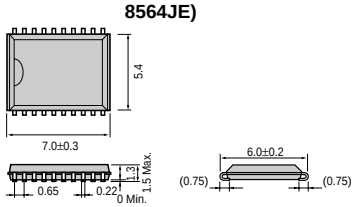
● **DIP 18-pin (RTC-7301DG/62421/72421/63421)**



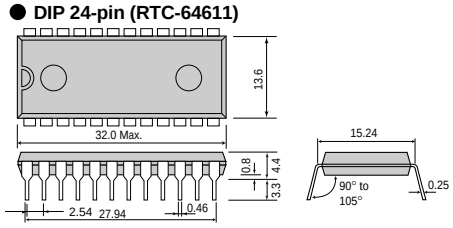
● **SOP 14-pin (RTC-4513/4543SA/4553/4574SA/8563SA/8583/8593)**



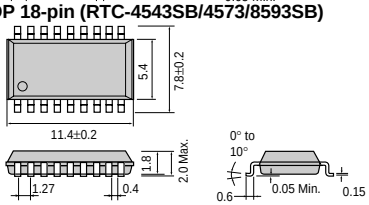
● **VSOJ 20-pin (RTC-4574JE/4701JE/8563JE/8564JE)**



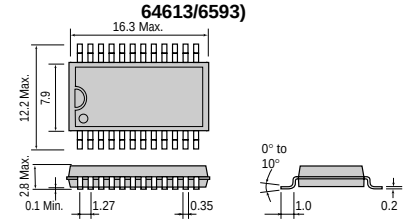
● **DIP 24-pin (RTC-64611)**



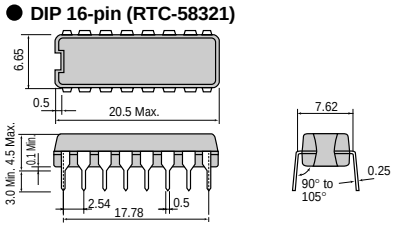
● **SOP 18-pin (RTC-4543SB/4573/8593SB)**



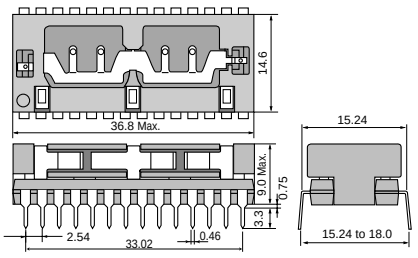
● **SOP 24-pin (RTC-58323/62423/72423/63423/64613/6593)**



● **DIP 16-pin (RTC-58321)**



● **DIP 28-pin (RTC-65271)**



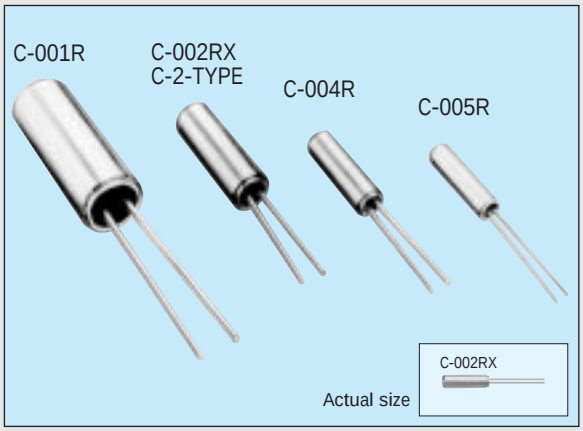
CYLINDER LOW/ MEDIUM-FREQUENCY CRYSTAL UNIT

C-2-TYPE/C-TYPE

Products number (please refer to page 1)

Q12C2000xxxxx00
Q11C001Rxxxxx00
Q11C02RXxxxxx00
Q11C004Rxxxxx00
Q11C005Rxxxxx00

- Photolithography finished allows uniform and stable performance.
- Excellent environmental capability.
- Respond to an extensive range of frequency, from 20 kHz to 165 kHz, and 307.2 kHz.



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 16
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.	
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/s² x 0.3 ms x 1/2 sine wave x 3 directions

- Please refer to the external dimensions on page 16.

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	307.2 kHz
Series resistance(Ω)	55 kΩ Max.	35 kΩ Max.	20 kΩ Max.	12 kΩ Max.	10 kΩ Max.	6 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/s² x 0.3 ms x 1/2 sine wave x 3 directions

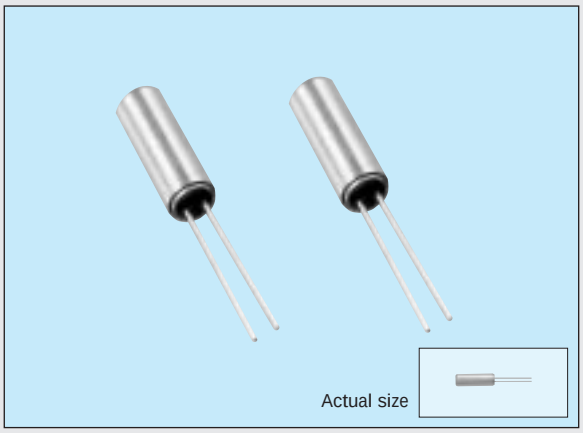
- Please refer to the external dimensions on page 16.

SMALL CYLINDER LOW/MEDIUM-FREQUENCY CRYSTAL UNIT

C-4-TYPE

Products 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.
- Most suitable for pagers and card products like PCMCIA.



Specifications (characteristics)

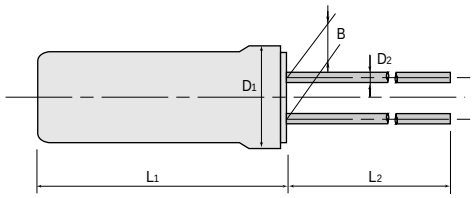
Item		Symbol	Specifications	Remarks
Nominal frequency		f	32.000 kHz to 120.000 kHz 192 kHz	Please refer to frequency list below
Temperature range	Storage temperature	T_{STG}	-20 °C to +70 °C	Stored as bare product after unpacking
	Operating temperature	T_{OPR}	-10 °C to +60 °C	
Maximum drive level		GL	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

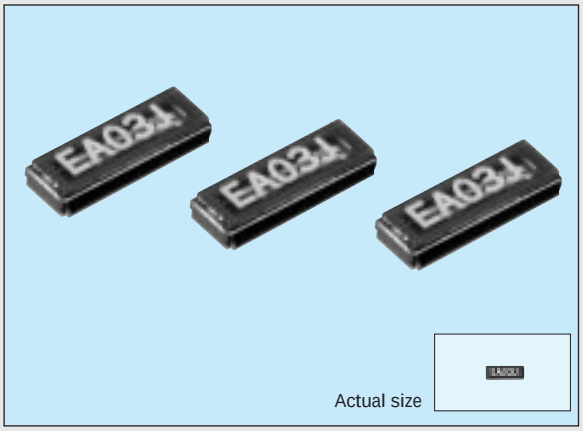
(160 to 165 kHz, 307.2 kHz: D_1=ø2.2 Max.)

THIN SMD LOW FREQUENCY CRYSTAL UNIT

FC-255

Products number (please refer to page 1)
Q13FC255xxxxx00

- 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.

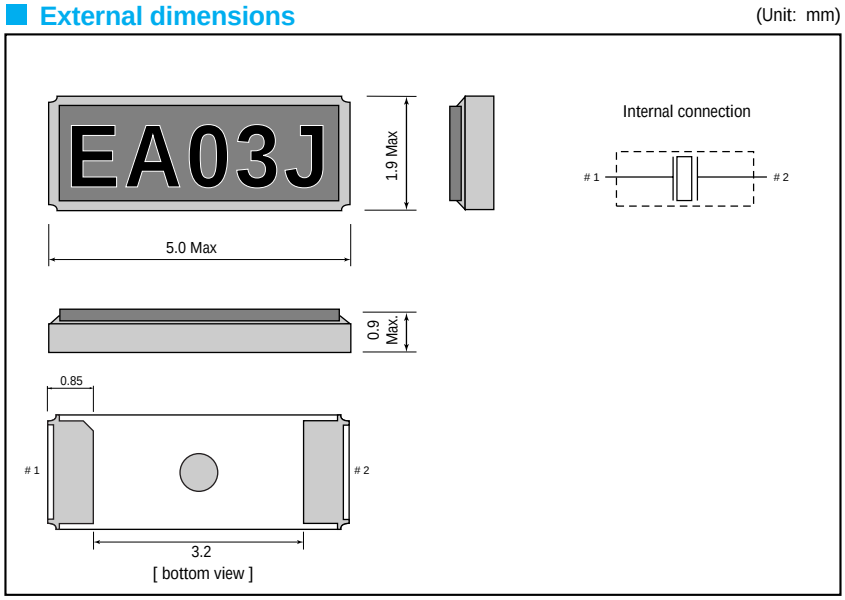


Specifications (characteristics)

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.	
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	7 pF, 12.5 pF	Please specify
Series resistance		R_1	65 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.

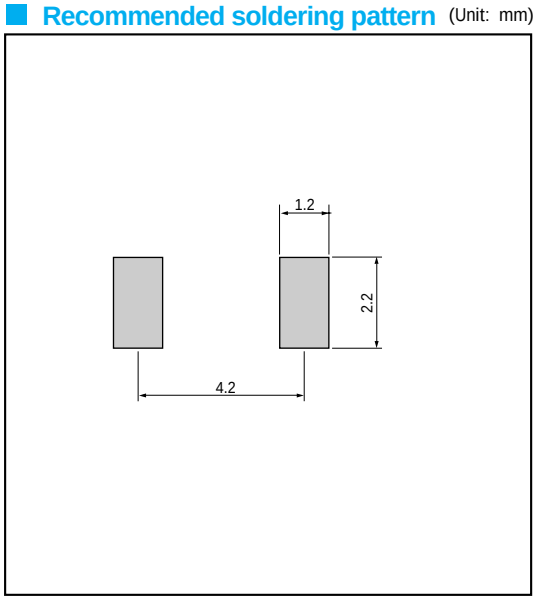
External dimensions

(Unit: mm)



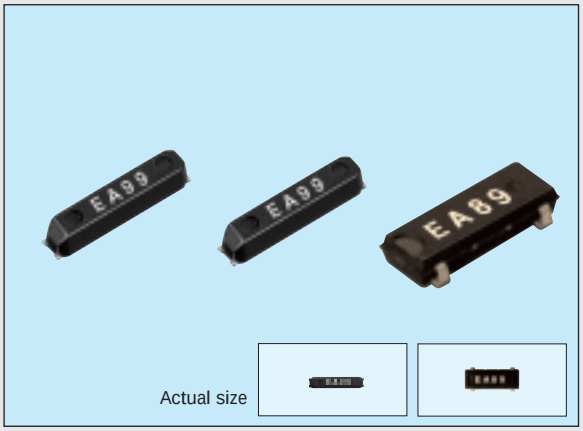
Recommended soldering pattern

(Unit: mm)



THIN SMD LOW/MEDIUM-FREQUENCY CRYSTAL UNIT

MC-146/156



Products number (please refer to page 1)

Q1xMC146xxxxx00
Q1xMC156xxxxx00

- 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.

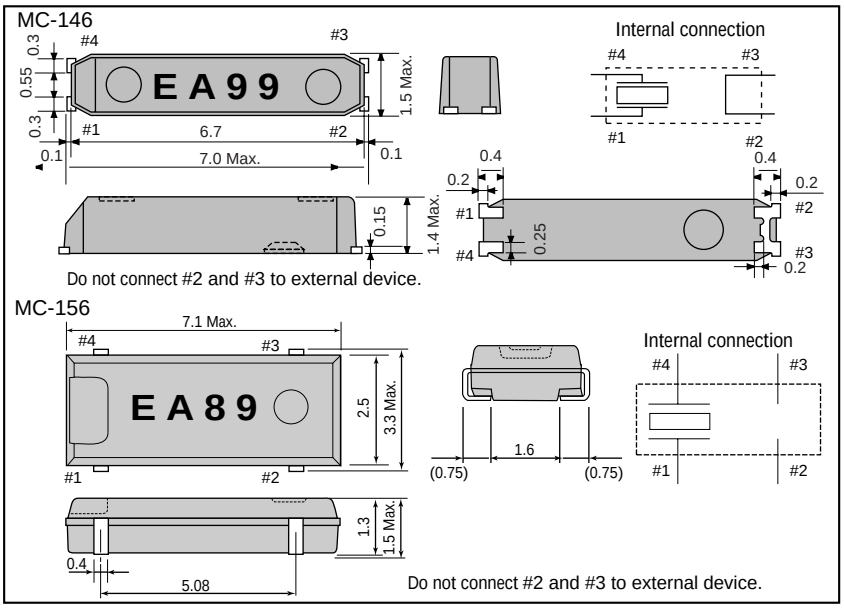
Specifications (characteristics)

Item		Symbol	Specifications		Remarks
Nominal frequency		f	32.768 kHz	75.000 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}		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.	30 kΩ Max.	
Motional capacitance		C1	1.9 fF Typ.		
Shunt capacitance		C0	0.8 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.	±5 x 10^{-6} Max.		100 g dummy (SEIKO EPSON Standard) drop from 1500 mm height on to the concrete 3 directions 10 times.

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

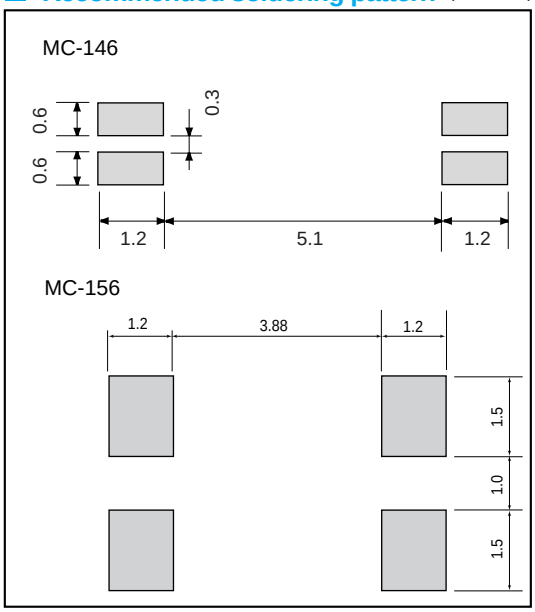
External dimensions

(Unit: mm)



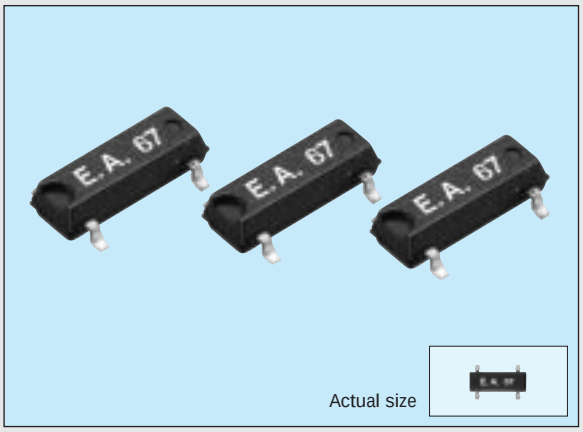
Recommended soldering pattern

(Unit: mm)



THIN SMD LOW/MEDIUM-FREQUENCY CRYSTAL UNIT

MC-206



Products number (please refer to page 1)

Q1xMC206xxxxx00

- High-density mounting-type SMD of Max. 2.0 mm thickness.
- Small packaging area and light weight.
- 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} / °C² 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/s² x 0.3 ms x 1/2 sine wave x 3 directions

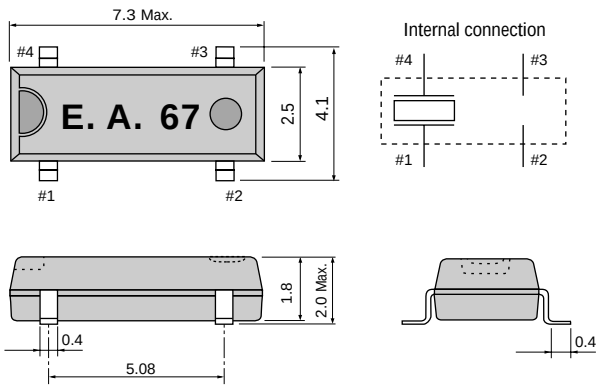
Metal may be exposed on the top of this product. This won't affect any quality, reliability or electrical spec.

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

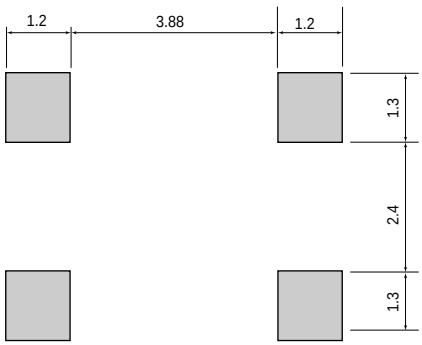
(Unit: mm)



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

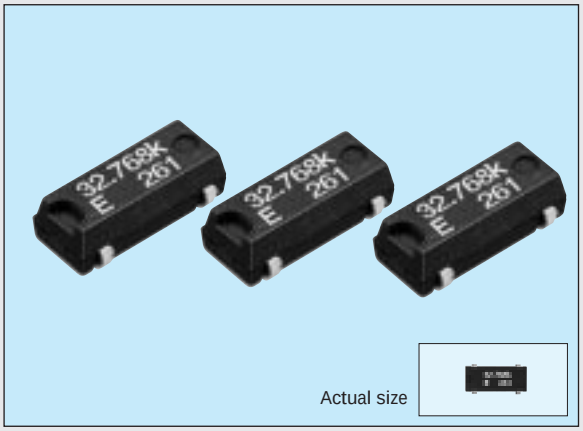
Recommended soldering pattern

(Unit: mm)



SMALL SMD LOW / MEDIUM-FREQUENCY CRYSTAL UNIT

MC-306



Products number (please refer to page 1)

Q1xMC306xxxxx00

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

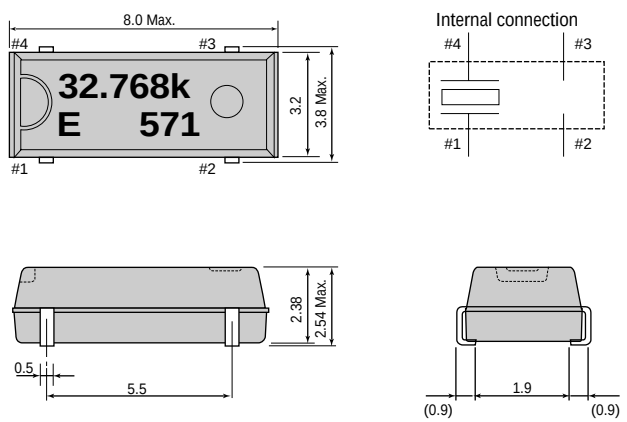
Specifications (characteristics)

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}/ °C^2 Max.		
Load capacitance		C_L	6 pF to ∞		Please specify
Series resistance		R_1	50 kΩ Max.	55 kΩ to 10 kΩ	For details, refer to page 15
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

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

External dimensions

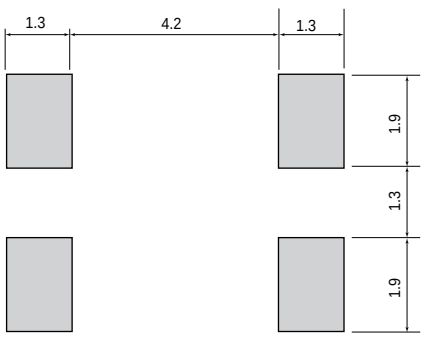
(Unit: mm)



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

Recommended soldering pattern

(Unit: mm)



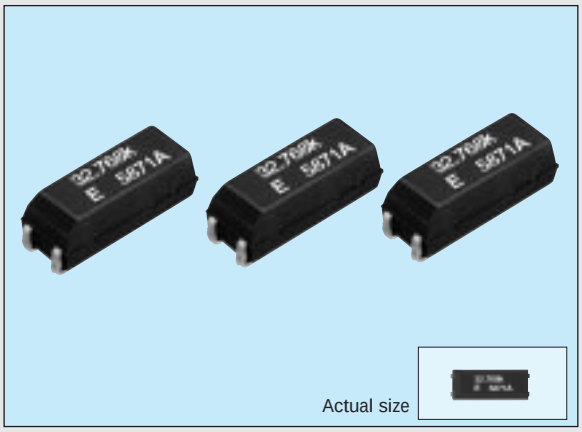
SMD LOW/ MEDIUM-FREQUENCY CRYSTAL UNIT

MC-405/406

Products 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.

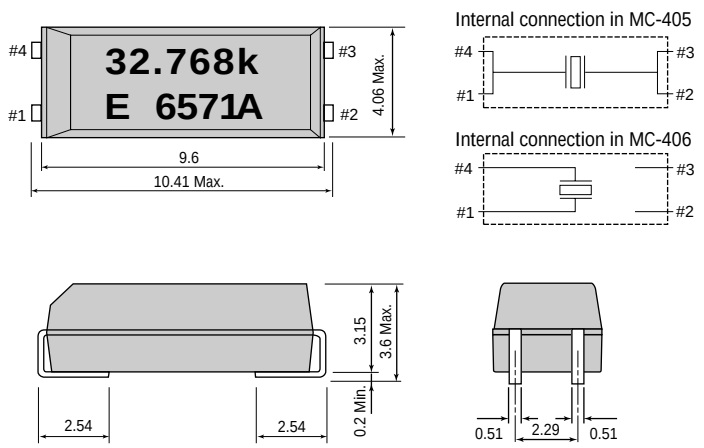


Specifications (characteristics)

Item		Symbol	Specifications		Remarks
Nominal frequency range		f	32.768 kHz	20.000 kHz to 165.000 kHz 307.2 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} (307.2 kHz: ±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}/ °C^2 Max.		
Load capacitance		C_L	6 pF to ∞		Please specify
Series resistance		R_1	50 kΩ Max.	55 kΩ to 6 kΩ	For details, refer to page 15
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/s^2 x 0.3 ms x 1/2 sine wave x 3 directions

External dimensions

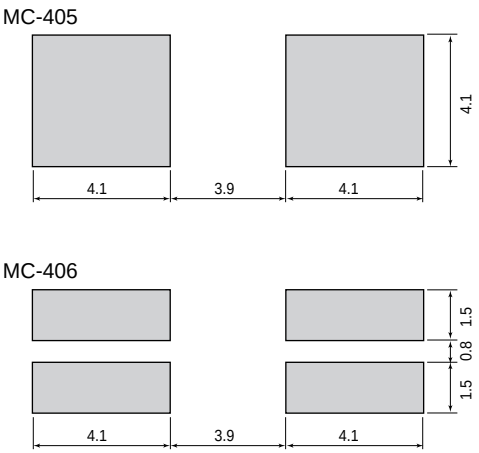
(Unit: mm)



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

Recommended soldering pattern

(Unit: mm)



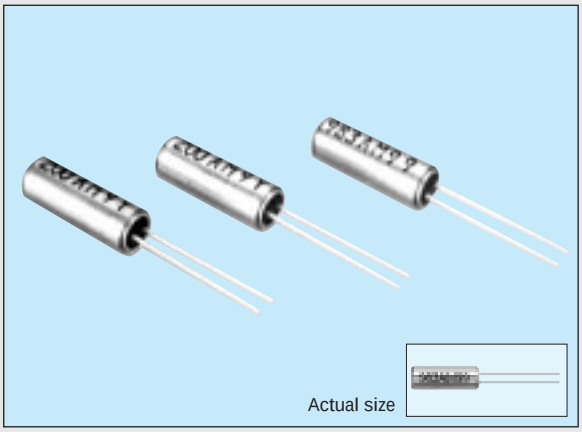
CYLINDER HIGH-FREQUENCY CRYSTAL UNIT

CA-301

Products number (please refer to page 1)

Q21CA301xxxxx00

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



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/s² 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

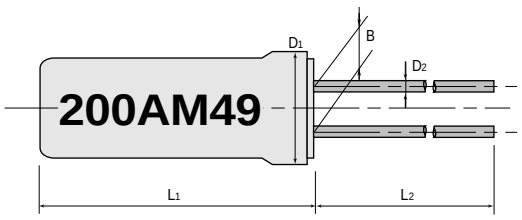
Frequency (MHz)	Series resistance (Ω)	mode
4.0 ≤ f < 5.5	150 Ω Max.	Fundamental
5.5 ≤ f < 6.0	100 Ω Max.	
6.0 ≤ f < 10.0	80 Ω Max.	
10.0 ≤ f < 12.0	60 Ω Max.	
12.0 ≤ f < 16.0	50 Ω Max.	
16.0 ≤ f < 30.0	40 Ω Max.	
26.0 ≤ f < 36.0	100 Ω Max.	3rd overtone
36.0 ≤ f ≤ 64.0	80 Ω Max.	

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	10.3 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.

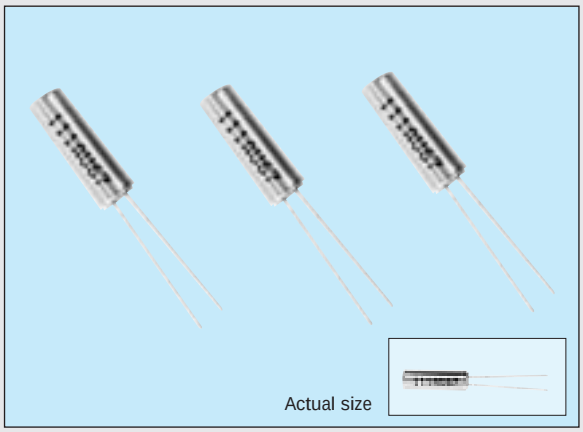
CYLINDER HIGH-STABILITY CRYSTAL UNIT

CA-303HS

Products number (please refer to page 1)

Q23C303Sxxxxx00

- High-stability in a dia.3 mm cylindrical package.
- Small package allows high-density mounting and less weight.
- Excellent environmental capability.
- High-stability with tight vacuum sealing and AT-cut single side mounting structure.
- Suitable for small telecommunication equipment.



Specifications (characteristics)

Item		Symbol	Specifications	Remarks
Nominal frequency range		f	9.600 MHz to 27.000 MHz	Fundamental mode
Temperature range	Storage temperature	T_{STG}	-55 °C to +125 °C	Stored as bare product after unpacking
	Operating temperature	T_{OPR}	-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	±10 x 10^{-6}	Ta =+25 ℃ ±3 ℃,DL=100 µW
Frequency temperature characteristics			As per below table	
Load capacitance		C_L	10 pF to ∞	Please specify
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, 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/s² 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

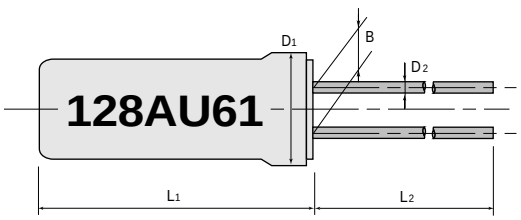
Temperature range	Frequency tolerance
0 °C to +50 °C	± 3 x 10^{-6} Min.
-10 °C to +60 °C	± 5 x 10^{-6} Min.
-20 °C to +70 °C	± 7 x 10^{-6} Min.
-30 °C to +80 °C	±10 x 10^{-6} Min.
-40 °C to +85 °C	±15 x 10^{-6} Min.

Series resistance

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)



L_1	L_2	D_1	D_2	B
8.9 Max.	9.5 Min.	ø3.1 Max.	ø0.3	1.1

Sample products are without marking.

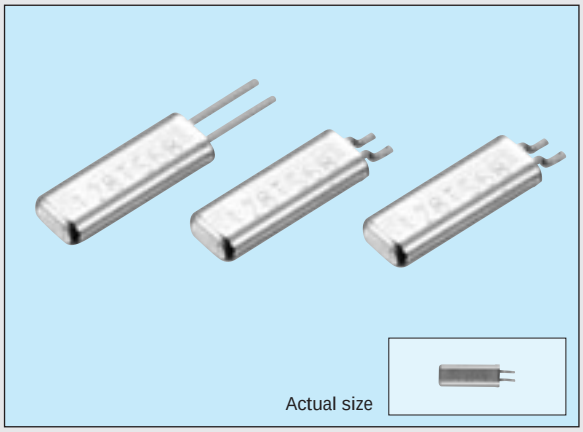
THIN CYLINDER HIGH-STABILITY CRYSTAL UNIT

SA-315H/315HZ

Products number (please refer to page 1)

Q23S315Hxxxxx00
Q24S315Zxxxxx00

- 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.



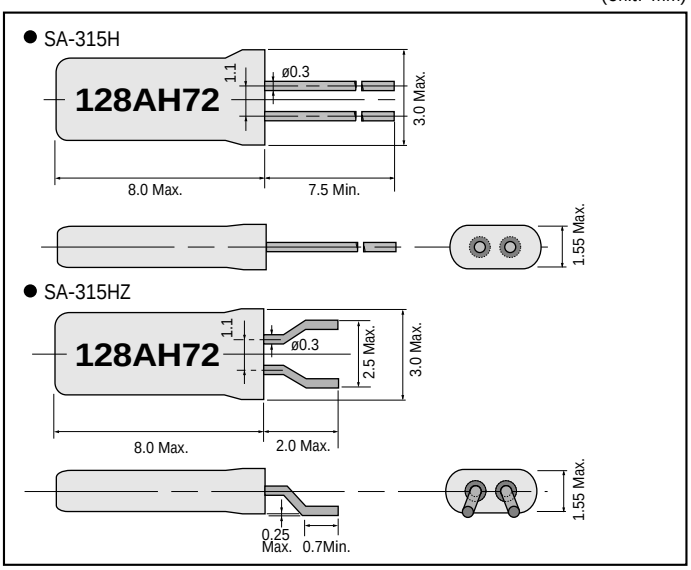
Specifications (characteristics)

Item		Symbol	Specifications	Remarks
Nominal frequency range		f	10.000 MHz to 27.000 MHz	Fundamental mode
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 x 10^{-6}	D_L=100 µW at Ta=+25 °C ±3 °C and specified load capacity.
Frequency temperature characteristics			As per below table	
Load capacitance		C_L	10 pF to ∞	Please specify
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, 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/s² 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.

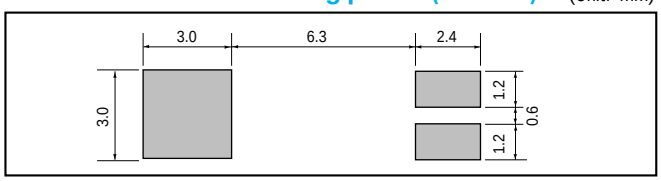
External dimensions

(Unit: mm)



Recommended soldering pattern(SA-315HZ)

(Unit: mm)



Frequency temperature characteristics

Operating temperature range	Frequency tolerance
0 °C to +50 °C	± 3 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

Frequency (MHz)	Series resistance (R_1)
10.0 ≤ f < 12.0	40 Ω Max.
12.0 ≤ f ≤ 27.0	30 Ω Max.

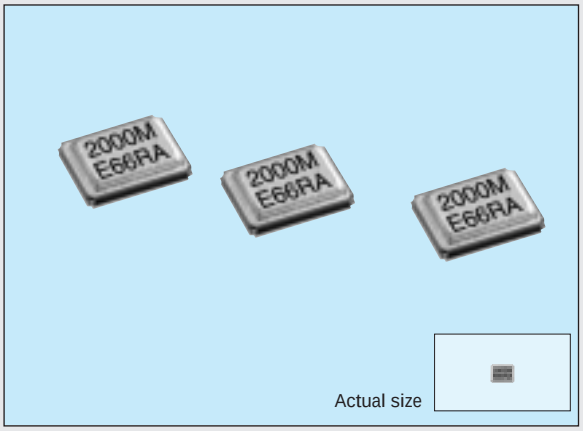
THIN SMD HIGH-FREQUENCY CRYSTAL UNIT

FA-238

Products number (please refer to page 1)

Q22FA238xxxxx00

- High-density mounting-type SMD.
- Excellent reliability and environment capability.
- Capable of covering a wide frequency range. (from 20 MHz to 50 MHz)
- 0.7 mm Max. thickness is equal to SMD-type IC.

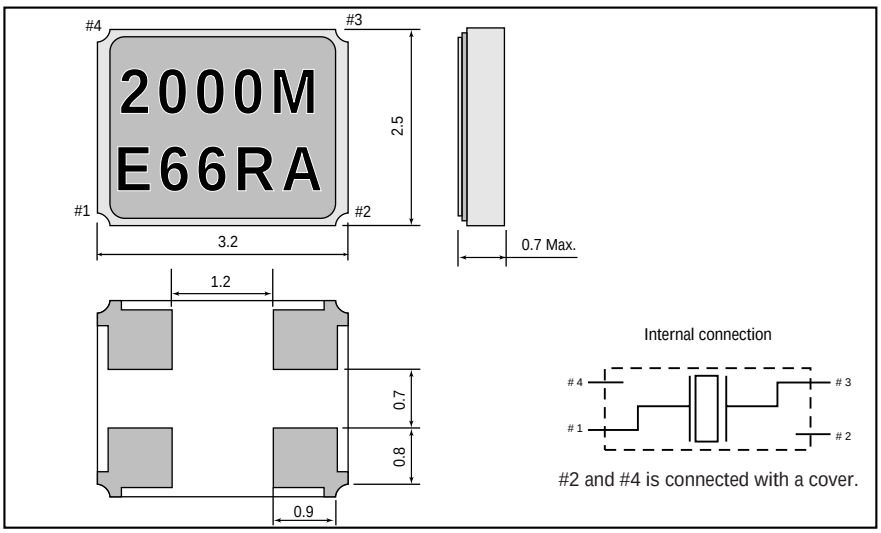


Specifications (characteristics)

Item		Symbol	Specifications	Remarks
Nominal frequency range		f	16.000 MHz to 50.000 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	
Drive level	Maximum drive level	GL	2 mW Max.	Only crystal oscillation is guaranteed
	Recommended drive level	DL	100 µW Typ.	
Frequency tolerance (standard)		Δf/f	±50 x 10^{-6}	Ta=+25 °C±3 °C Please ask tighter tolerance
Frequency temperature characteristics (standard)			±30 x 10^{-6}(STD)	-20 °C to +70 °C
			Available from ±12 x 10^{-6} (Custom)	-10 °C to +60 °C
			Available from ±15 x 10^{-6} (Custom)	-20 °C to +70 °C
Load capacitance		C_L	10 pF to ∞ (standard:12 pF)	Please specify
Series resistance		R_1	100 Ω Max. (16 MHz ≤ f < 30 MHz)	-20 °C to +70 °C,DL=100 µW
			60 Ω Max. (30 MHz ≤ f ≤ 50 MHz)	
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/s² x 0.3 ms x 1/2 sine wave x 3 directions

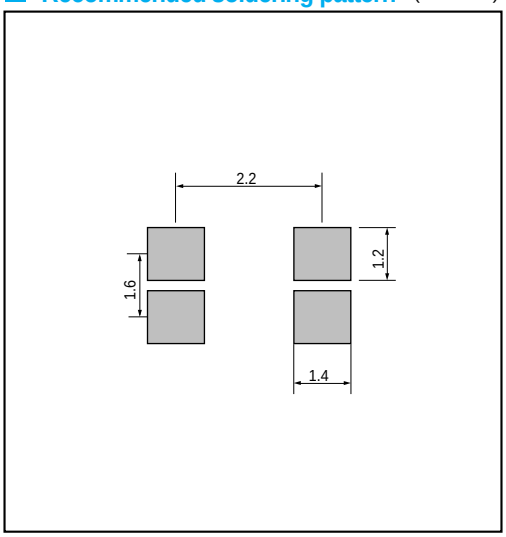
External dimensions

(Unit: mm)



Recommended soldering pattern

(Unit: mm)



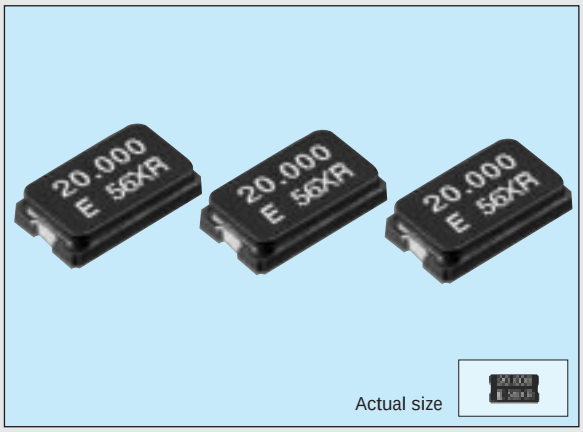
THIN SMD HIGH-FREQUENCY CRYSTAL UNIT

FA-365

Products 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.

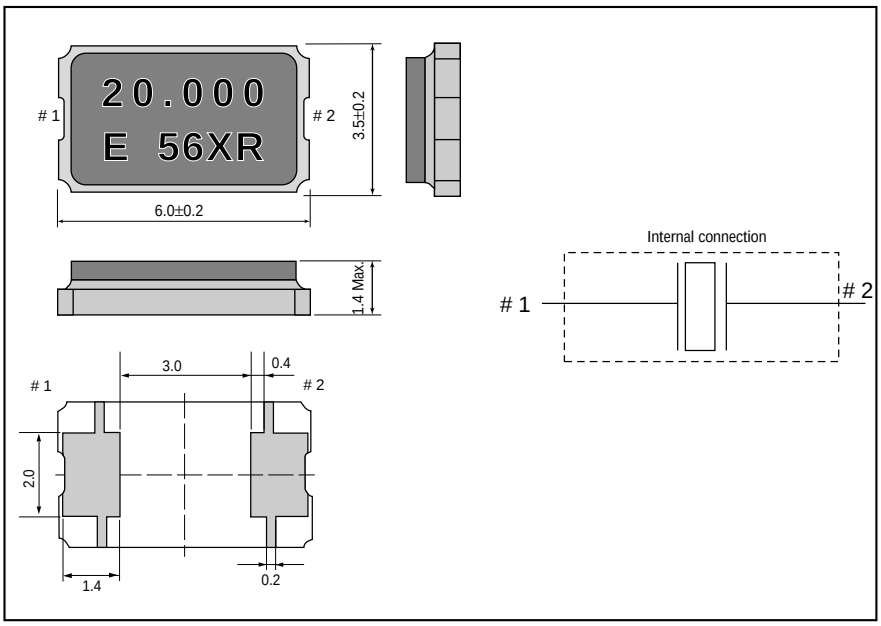


Specifications (characteristics)

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	
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
Load capacitance		C_L	10 pF to ∞	Please specify
Series resistance		R_1	60 Ω Max.(12.000 MHz) 50 Ω Max.(14.000 MHz to 41.000MHz)	-20 °C to +70 °C,DL=100 µW
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/s² x 0.3 ms x 1/2 sine wave x 3 directions

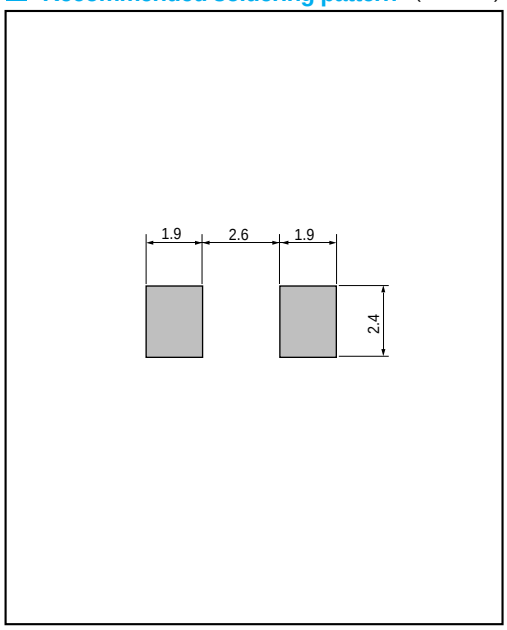
External dimensions

(Unit: mm)



Recommended soldering pattern

(Unit: mm)



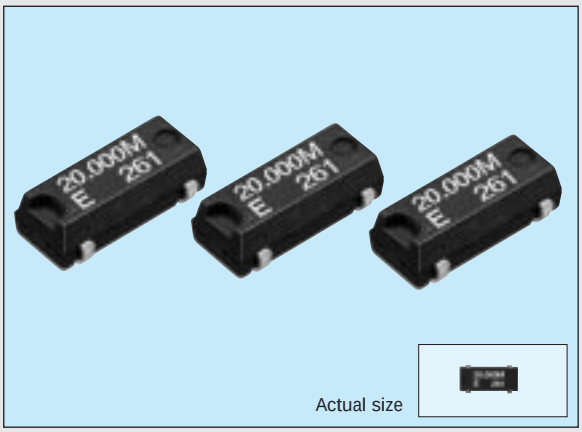
SMALL SMD HIGH - FREQUENCY CRYSTAL UNIT

MA-306

Products number (please refer to page 1)

Q22MA306xxxxx00

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



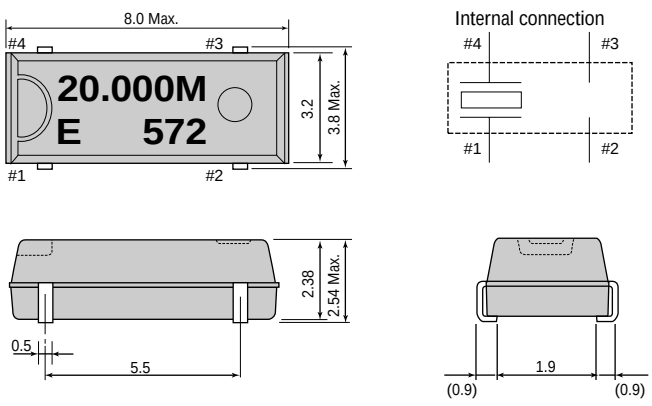
Specifications (characteristics)

Item		Symbol	Specifications	Remarks
Nominal frequency		f	17.734 MHz to 41.000 MHz	Fundamental mode
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	
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}	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/s² x 0.3 ms x 1/2 sine wave x 3 directions

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

External dimensions

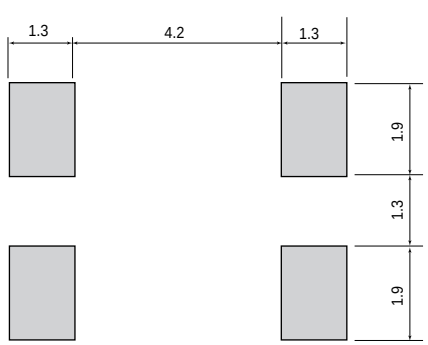
(Unit: mm)



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

Recommended soldering pattern

(Unit: mm)



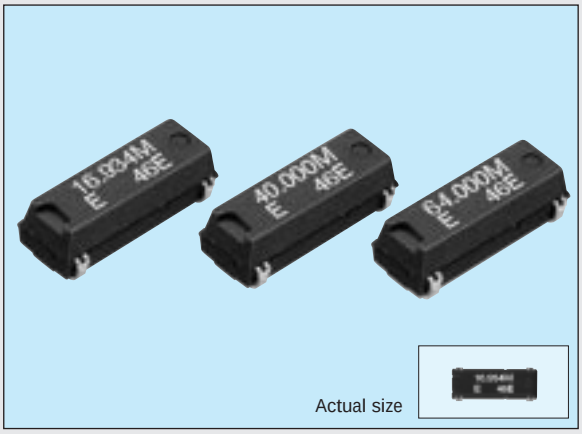
SMD HIGH-FREQUENCY CRYSTAL UNIT

MA-406

Products number (please refer to page 1)

Q22MA406xxxxx00

- High-density mounting-type SMD.
- 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		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		Only crystal oscillation is guaranteed
	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}		
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/s² x 0.3 ms x 1/2 sine wave x 3 directions

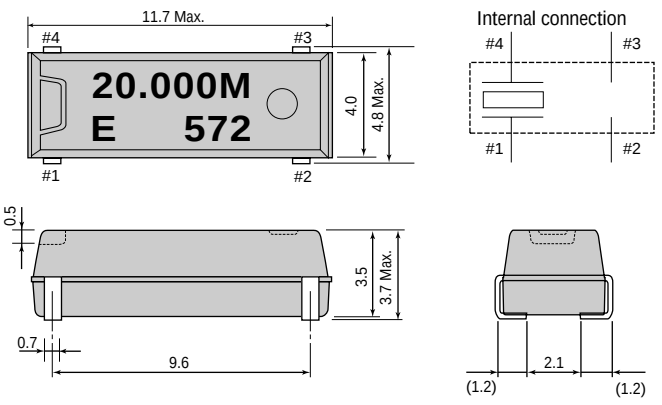
∗1 8.0 MHz < f < 8.2 MHz: Unavailable.
4.0 MHz ≦ f < 5.5 MHz : See "Available frequencies form 4.0 MHz to less than 5.5 MHz" on page 22.
∗2 26.000 MHz ≤ f <30.000 MHz :please contact us for inquiries for 3rd overtone mode.
Metal may be exposed on the top of this product. This won't affect any quality, reliability or electrical spec.

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

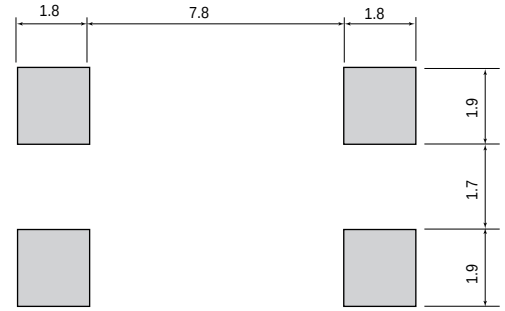
(Unit: mm)



Do not connect #2 and #3 external device.

Recommended soldering pattern

(Unit: mm)



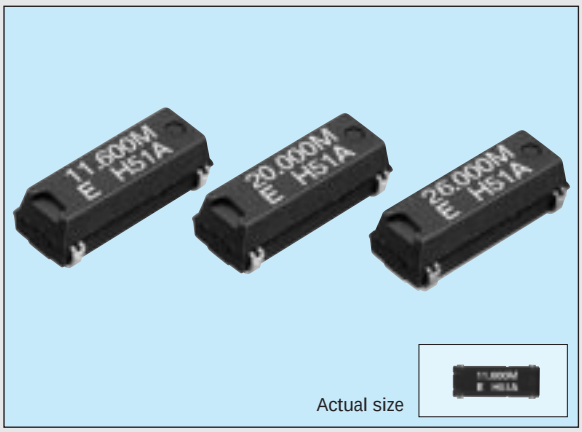
SMD HIGH-STABILITY CRYSTAL UNIT

MA-406H

Products number (please refer to page 1)

Q24M406Hxxxxx00

- High-density mounting-type SMD.
- Excellent heat-resistance and environment capability.
- 9.6 MHz to 27.0 MHz available.



Specifications (characteristics)

Item		Symbol	Specifications	Remarks
Nominal frequency range		f	9.600 MHz to 27.000 MHz	Fundamental mode
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	
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 x 10^{-6}	Ta=+25 °C ±3 °C ,DL=100 µW
Frequency temperature characteristics			As per below table	
Load capacitance		C_L	10 pF to ∞	Please specify
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/s² 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.
Metal may be exposed on the top of this product. This won't affect any quality, reliability or electrical spec.

Frequency temperature characteristics

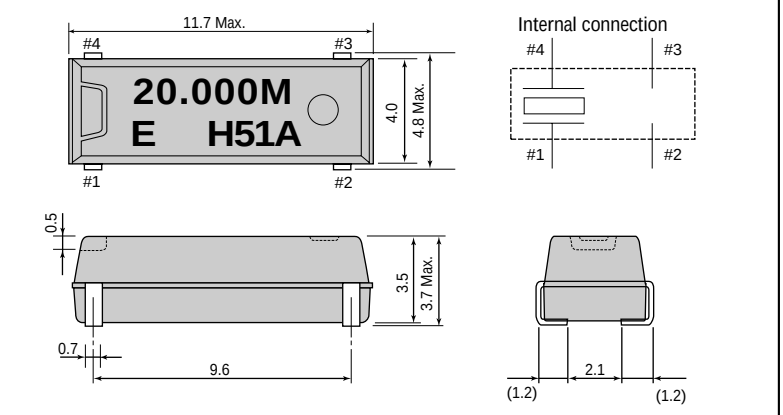
Temperature range	Frequency tolerance
0 °C to +50 °C	± 3 x 10^{-6} Min.
-10 °C to +60 °C	± 5 x 10^{-6} Min.
-20 °C to +70 °C	± 7 x 10^{-6} Min.
-30 °C to +80 °C	±10 x 10^{-6} Min.
-40 °C to +85 °C	±15 x 10^{-6} Min.

Series resistance

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

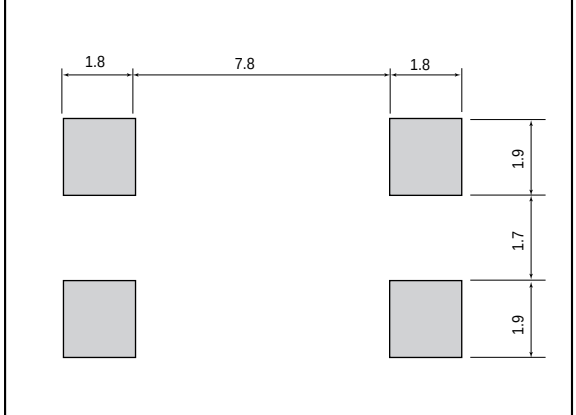
(Unit: mm)



Do not connect #2 and #3 external device.

Recommended soldering pattern

(Unit: mm)



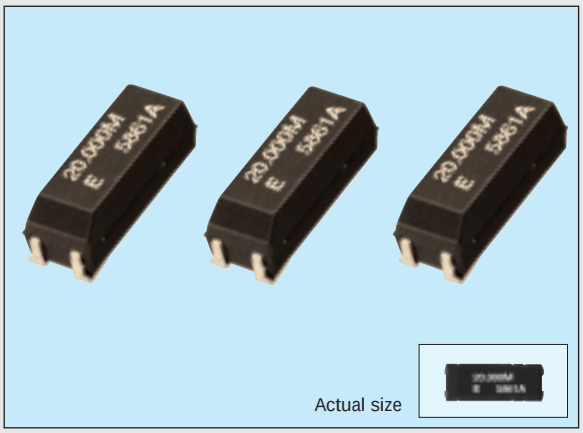
SMD HIGH-FREQUENCY CRYSTAL UNIT

MA-505/506

Products number (please refer to page 1)

Q22MA505xxxxx00
Q22MA506xxxxx00

- High-density mounting-type SMD.
- Excellent heat-resistance and environment capability.
- Capable of covering a wide range of frequency range from 4.0 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}	-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}	Ta=+25 °C±3 °C, DL=100 µW
Frequency temperature characteristics (standard)			Under 5.5 MHz: ±50 x 10^{-6}	-20 °C to +70 °C, DL=100 µW
			Over 5.5 MHz: ±30 x 10^{-6}	
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 or excitation test with 29400 m/s² x 0.3 ms x 1/2 sine wave x 3 directions

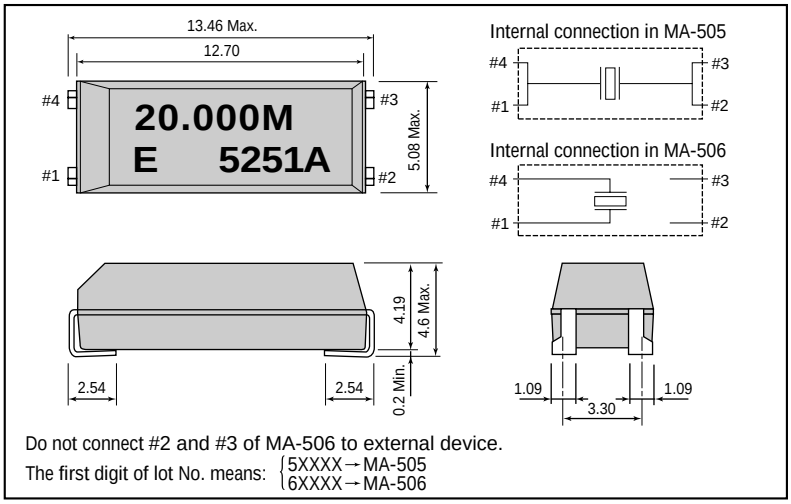
∗1 8.0 MHz < f < 8.2 MHz: Unavailable.
4.0 MHz ≦ f < 5.5MHz : See "Available frequencies from 4.0 MHz to less than 5.5 MHz" on page 22.
∗2 26.000 MHz ≤ f < 30,000 MHz : please contact us for inguiries for 3rd cvertone mode.

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	

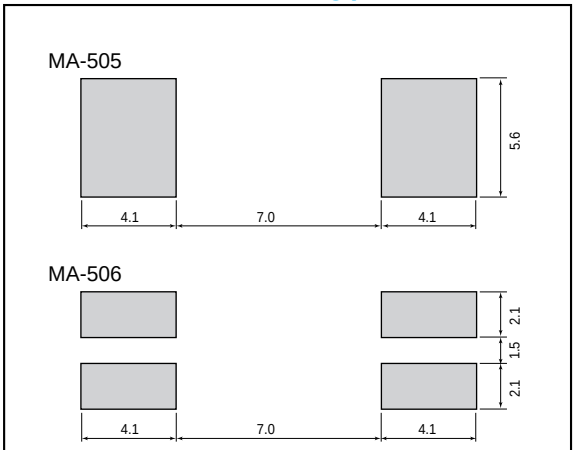
External dimensions

(Unit: mm)



Recommended soldering pattern

(Unit: mm)



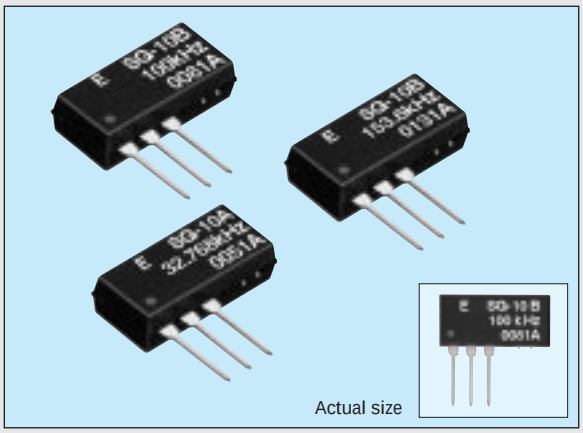
SIP LOW/MEDIUM-FREQUENCY CRYSTAL OSCILLATOR

SG-10

Products 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.



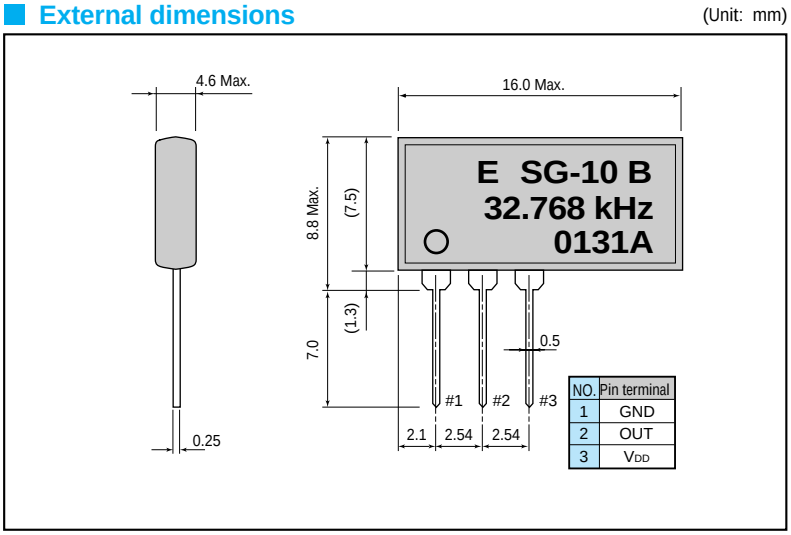
Specifications (characteristics)

Item		Symbol	Specifications	Remarks
Output frequency range		f_0	10.0000 Hz to 153.6000 kHz	For output frequency, see the table below
Power source voltage	Max. supply voltage	V_{DD}-GND	-0.3 V to +7.0 V	
	Operating voltage	V_{DD}	4.5 V to 5.5 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	
Frequency tolerance		$\Delta f/f_0$	A: ±10 x 10^{-6} B: ±50 x 10^{-6}	V_{DD}=5 V Ta=+25 °C
Frequency temperature characteristics			+10 x 10^{-6} / -120 x 10^{-6}	-10 °C to +70 °C, taking Ta=+25 °C as the reference
Frequency voltage characteristics			±10 x 10^{-6} Max.	
Current consumption		I_{OP}	0.5 mA Max..	No load condition
Duty		t_W/t	40 % to 60 % (except for cases of 1/3 and 1/5 divided frequency.)	1/2 V_{DD} or 1.4 V level
Output voltage		V_{OH}	V_{DD} -1.0 V Min.	I_{OH}= -40 µA
		V_{OL}	0.4 V Max.	I_{OL}=1.6 mA
Output load condition (fan out)		N/C_L	1 TTL Max./15 pF Max.	TTL load/C-MOS load
Output rise time		t_{TLH}	60 ns Max.	
Output fall time		t_{THL}	50 ns Max.	
Oscillation start up time		t_{OSC}	1 s Max.	For more than 1 ms until V_{DD}=0 V→4.5 V. Time at 4.5 V to be 0 s
Aging		fa	±5 x 10^{-6}/year Max.	Ta=+25 °C ±3 °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/s² x 0.3 ms x 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)



Output frequency table

Oscillation source	32.768 kHz,60.000 kHz, 96.000 kHz, 100.000 kHz, 153.600 kHz
Divided frequency output (calculation method)	Oscillation source frequency x (any arbitrary one of 1/1, 1/2, 1/3, 1/4, 1/5, 1/6, 1/12) x (any arbitrary one of 1/1, 1/10, 1/100, 1/1000). Over 10.0 Hz range.

For frequencies other than the above, please consult us. (Min. order lot 10000 pcs.)

Output frequency example

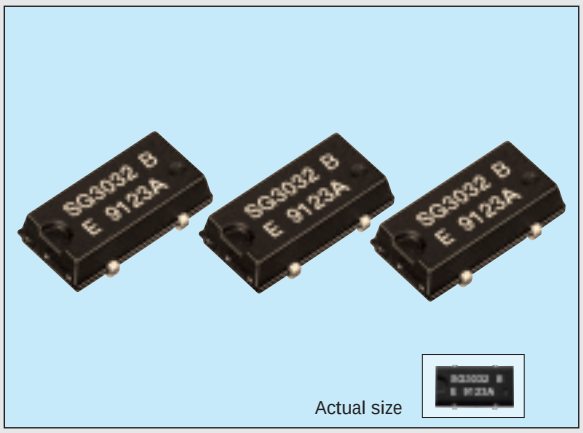
Oscillation source	32.768 kHz , 60.000 kHz , 96.000 kHz, 100.000 kHz ,153.600 kHz
Divided frequency	10.000 Hz, 50.000 Hz, 100.000 Hz, 1.000 kHz, 4.800 kHz , 9.600 kHz, 19.200 kHz , 38.400 kHz, 50.000 kHz , 76.800 kHz

32kHz CRYSTAL OSCILLATOR

SG-3032JC

Products number (please refer to page 1)
Q3101JC0xxxxx00

- No adjustment required with 32.768 kHz crystal unit built-in.
- Use of C-MOS IC enables reduction of current consumption.
- Small suited to high-density mounting.



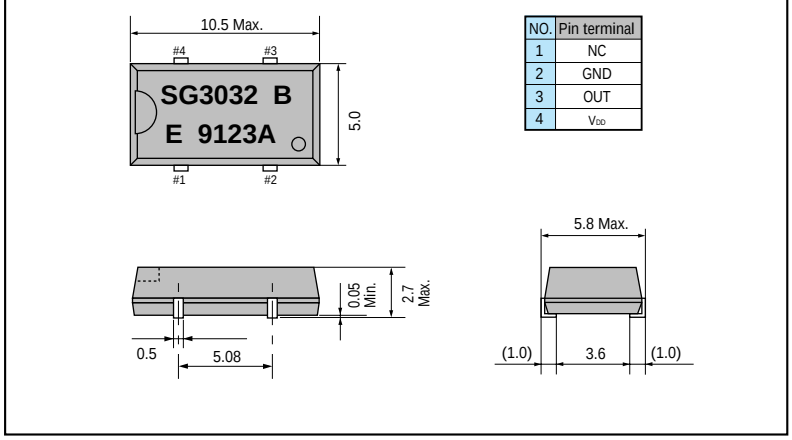
Specifications (characteristics)

Item		Symbol	Specifications	Remarks
Output frequency range		f_0	32.768 kHz	
Power source voltage	Max. supply voltage	V_{DD}-GND	-0.3 V to +4.3 V	
	Operating voltage	V_{DD}	1.8 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	
Frequency tolerance		$\Delta f/f_0$	B: 5±23 x 10^{-6} C: 5±50 x 10^{-6} D: 5±100 x 10^{-6}	V_{DD}=3.3 V Ta=+25 °C
Frequency temperature characteristics			+10 x 10^{-6} / -120 x 10^{-6}	-20 °C to +70 °C, taking Ta=+25 °C as the reference
Frequency voltage characteristics			±2 x 10^{-6} /V Max.	Ta=+25 °C
Current consumption		I_{OP}	5 µA Max.	No load condition
Duty		t_W/t	40 % to 60 %	1/2 V_{DD} level
Output voltage		V_{OH}	V_{DD} -0.4 V Min.	I_{OH}= -0.5 mA
		V_{OL}	0.4 V Max.	I_{OL}=+0.5 mA
Output load condition (fan out)		C_L	15 pF Max.	C-MOS load
Output rise time		t_{TLH}	100 ns Max.	C-MOS load:20 %→80 % V_{DD}
Output fall time		t_{THL}	100 ns Max.	C-MOS load:80 %→20 % V_{DD}
Oscillation start up time		t_{OSC}	3 s Max.	For more than 1 ms until V_{DD}=0 V→1.8 V. Time at 1.8 V to be 0 s
Aging		fa	±5 x 10^{-6} /year Max.	Ta=+25 °C, V_{DD}=3.3 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/s² x 0.3 ms x 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

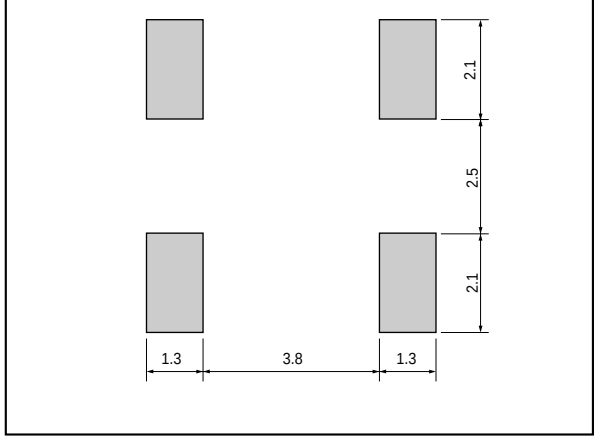
(Unit: mm)



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

Recommended soldering pattern

(Unit: mm)



FULL-SIZE DIP HIGH-FREQUENCY CRYSTAL OSCILLATOR

SG-51 series

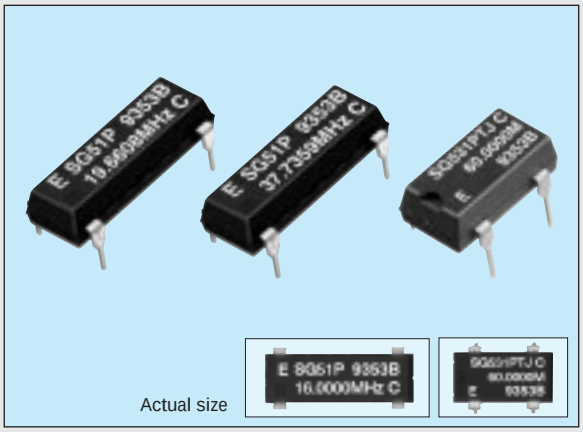
HALF-SIZE DIP HIGH-FREQUENCY CRYSTAL OSCILLATOR

SG-531 series

Products number (please refer to page 1)

Q32510xxxxxxx00
Q32531xxxxxxx00

- 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 C-MOS IC enables reduction of current consumption.



Specifications (characteristics)

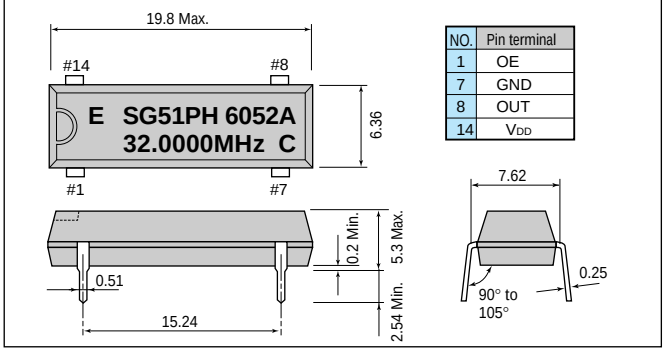
Item		Symbol	SG-51P/531P	SG-51PTJ/531PTJ	SG-51PH/531PH	Remarks
			Specifications			
Output frequency range		f_0	1.0250 MHz to 26.0000 MHz	26.0001 MHz to 66.6667 MHz		
Power source voltage	Max. supply voltage	V_{DD}-GND		-0.3 V to +7.0 V	-0.5 V to +7.0 V	
	Operating voltage	V_{DD}		5.0 V±0.5 V		
Temperature 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)			Please contact us on availability of -40 °C to +85 °C
Frequency stability		$\Delta f/f_0$		B: ± 50 x 10^{-6} C: ±100 x 10^{-6}		B type is possible up to 55.0 MHz
Current consumption		Iop	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	C-MOS 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 µA (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)	C-MOS	C_L	50 pF Max.	—	50 pF Max.	
	TTL	N	10 TTL Max.	5 TTL Max.	—	C_L≤15 pF
Output enable/disable input voltage		V_{IH}	2.0 V Min.	3.5 V Min.	2.0 V Min.	I_{IH}=1 µA Max. (OE=V_{DD})
		V_{IL}	0.8 V Max.	1.5 V Max.	0.8 V Max.	I_{IL}= -100 µA Min. (OE=GND), PTJ: -500 µA
Output rise time	C-MOS level	t_{TLH}	8 ns Max.	—	7 ns Max.	C-MOS load: 20 %→80 % V_{DD}
	TTL level			5 ns Max.	—	TTL load: 0.4 V→2.4 V
Output fall time	C-MOS level	t_{THL}	8 ns Max.	—	7 ns Max.	C-MOS 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.		More than for 1 ms until V_{DD} =0 V→4.5 V Time at 4.5 V to be 0 s
Aging		fa		±5 x 10^{-6}/year Max.		Ta=+25 °C, V_{DD} =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/s² 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

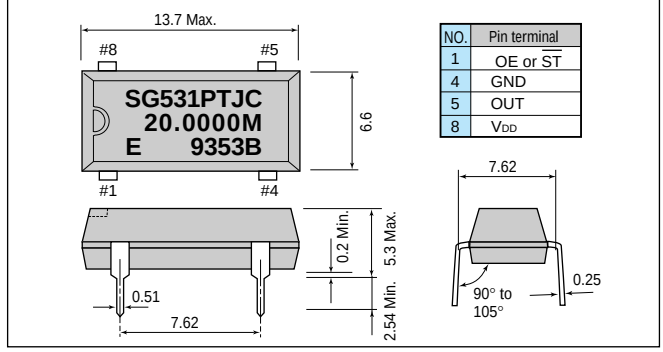
(Unit: mm)

SG-51 series



NO.	Pin terminal
1	OE
7	GND
8	OUT
14	V_{DD}

SG-531 series



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

Specifications (characteristics)

Item		Symbol	SG-531PTW/STW	SG-531PHW/SHW	SG-531PCW/SCW	Remarks
			Specifications			
Output frequency range		f_0	55.0001 MHz to 135.0000 MHz		26.0001 MHz to 135.0000 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		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	
Frequency stability		$\Delta f/f_0$	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		Iop	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.			$\overline{ST}$=GND(S*W)
Duty	C-MOS level	tw/t	—	40 % to 60 %		C-MOS 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)		C_L	15 pF Max.			
Output enable disable input voltage		V_{IH}	2.0 V Min.		0.7 V_{DD} Min.	OE,$\overline{ST}$
		V_{IL}	0.8 V Max.		0.2 V_{DD} Min.	OE,$\overline{ST}$
Output rise time	C-MOS level	t_{TLH}	—	4 ns Max.	4 ns Max.	C-MOS load: 20 %→80 % V_{DD}
	TTL level		4 ns Max.	—	—	TTL load: 0.4 V→2.4 V
Output fall time	C-MOS level	t_{THL}	—	4 ns Max.	4 ns Max.	C-MOS 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 V
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

Operating condition and Frequency band

Operating condition		1 MHz	50 MHz	100 MHz	150 MHz
5 V±0.5 V	Frequency stability:B (-20 to +70 °C)	1.025	26	55	135
		SG-51/531P	SG-51/531PTJ/PH	SG-531PTW/STW/PHW/SHW	
	Frequency stability:C (-20 to +70 °C)	1.025	26	66.6667	135
		SG-51/531P	SG-51/531PTJ/PH	SG-531PTW/STW/PHW/SHW	
3.3 V±0.3 V	Frequency stability:B (-20 to +70 °C)	26			135
		SG-531PCW/SCW			
	Frequency stability:C (-20 to +70 °C)	26			135
		SG-531PCW/SCW			
	Frequency stability:M (-40 to +85 °C)	26			135
		SG-531PCW/SCW			

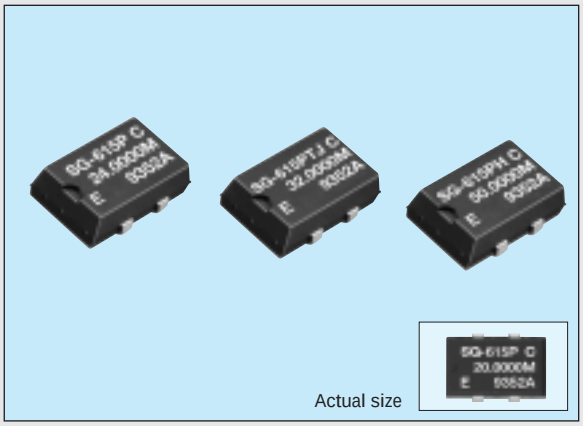
SOJ HIGH-FREQUENCY CRYSTAL OSCILLATOR

SG-615 series

Products number (Please refer to P1)

Q33615xxxxxxx00

- 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).



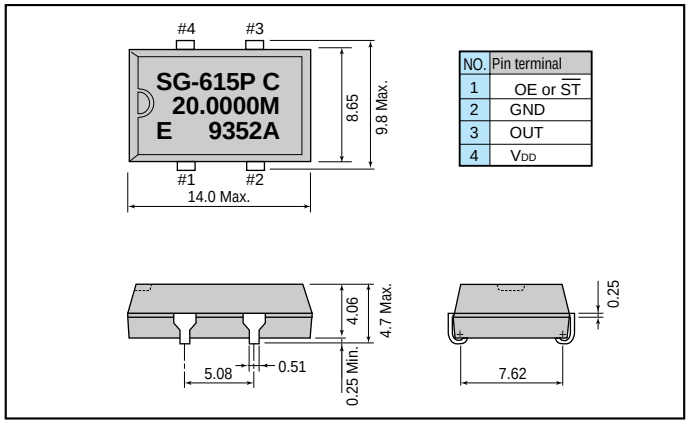
Specifications (characteristics)

Item		Symbol	SG-615P	SG-615PTJ	SG-615PH	Remarks
			Specifications			
Output frequency range		f_0	1.0250 MHz to 26.0000 MHz	26.0001 MHz to 66.6667 MHz		
Power source voltage	Max. supply voltage	V_{DD}-GND	-0.3 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}	-20 °C to +70 °C (-40 °C to +85 °C)			55 MHz Max.(-40 °C to +85 °C)
Frequency stability		$\Delta f/f_0$	B: ±50 x 10^{-6} C: ±100 x 10^{-6}			B type is possible up to 55 MHz
Current consumption		Iop	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	C-MOS level	t_w/t	40 % to 60 %	—	40 % to 60 %	C-MOS load: 1/2V_{DD}
	TTL level		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 µA (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-MOS	C_L	50 pF Max.	—	50 pF Max.	
	TTL	N	10 TTL Max.	5 TTL Max.	—	C_L≤15 pF
Output enable/disable input voltage		V_{IH}	2.0 V Min.	3.5 V Min.	2.0 V Min.	I_{IH}=1 µA Max.(OE=V_{DD})
		V_{IL}	0.8 V Max.	1.5 V Max.	0.8 V Max.	I_{IL}=-100 µA Min.(OE=GND) I_{IL}=-500 µA Min.(OE=GND) PTJ
Output rise time	C-MOS level	t_{TLH}	8 ns Max.	—	7 ns Max.	C-MOS load: 20 %→80 % V_{DD}
	TTL level			5 ns Max.	—	TTL load: 0.4 V→2.4 V
Output fall time	C-MOS level	t_{THL}	8 ns Max.	—	7 ns Max.	C-MOS 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.		Time at 4.5 V to be 0 s
Aging		fa	±5 x 10^{-6}/year Max.			Ta= +25 °C, V_{DD} = 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/s² 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

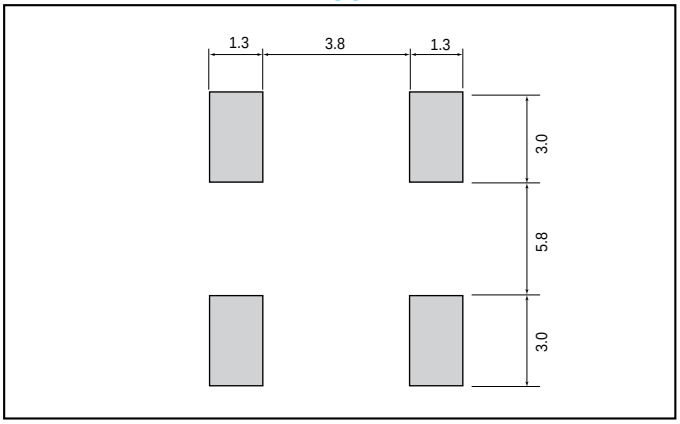
(Unit: mm)



NO.	Pin terminal
1	OE or $\overline{ST}$
2	GND
3	OUT
4	V_{DD}

Recommended soldering pattern

(Unit: mm)



Specifications (characteristics)

Item		Symbol	SG-615PTW/STW	SG-615PHW/SHW	SG-615PCW/SCW	Remarks
			Specifications			
Output frequency range		f_0	55.0001 MHz to 135.0000 MHz		26.0001 MHz to 135.0000 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		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	
Frequency stability		$\Delta f/f_0$	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		Iop	45 mA Max.		28 mA Max.	No load condition
Output disable current		I_{OE}	30 mA Max.		16 mA Max.	OE=GND
Standby current		I_{ST}	50 µA Max.			$\overline{ST}$=GND
Duty	C-MOS level	tw/t	—	40 % to 60 %		C-MOS 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)		C_L	15 pF Max.			
Output enable disable input voltage		V_{IH}	2.0 V Min.		0.7 V_{DD} Min.	OE,$\overline{ST}$
		V_{IL}	0.8 V Max.		0.2 V_{DD} Min.	OE,$\overline{ST}$
Output rise time	C-MOS level	t_{TLH}	—	4 ns Max.	4 ns Max.	C-MOS load: 20 %→80 % V_{DD}
	TTL level		4 ns Max.	—	—	TTL load: 0.4 V→2.4 V
Output fall time	C-MOS level	t_{THL}	—	4 ns Max.	4 ns Max.	C-MOS 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 V
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

Operating condition and Frequency band

Operating condition		1 MHz	50 MHz	100 MHz	150 MHz
5 V±0.5 V	Frequency stability:B (-20 to +70 °C)	1.025	26	55	135
		SG-615P	SG-615PTJ/PH	SG-615PTW/STW/PHW/SHW	
	Frequency stability:C (-20 to +70 °C)	1.025	26	66.667	135
		SG-615P	SG-615PTJ/PH	SG-615PTW/STW/PHW/SHW	
3.3 V±0.3 V	Frequency stability:B (-20 to +70 °C)	26			135
		SG-615PCW/SCW			
	Frequency stability:C (-20 to +70 °C)	26			135
		SG-615PCW/SCW			
	Frequency stability:M (-40 to +85 °C)	26			135
		SG-615PCW/SCW			

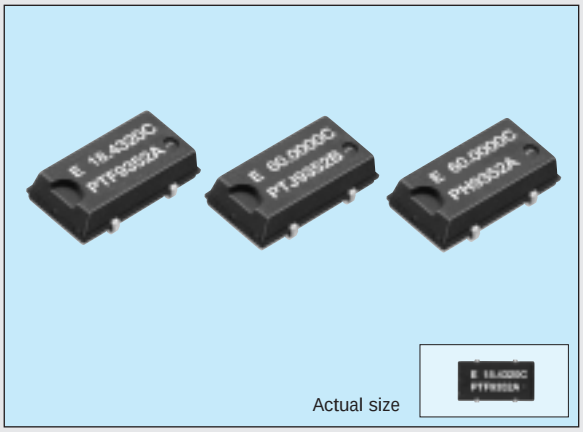
SMALL SOJ HIGH-FREQUENCY CRYSTAL OSCILLATOR

SG-636 series

Products number (please refer to page 1)

Q33636xxxxxxx00

- 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).



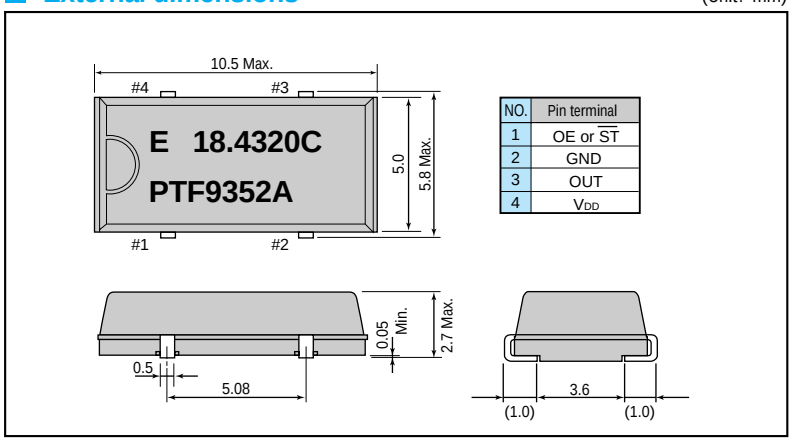
Specifications (characteristics)

Item		Symbol	SG-636PTF	SG-636PH	SG-636SCE/PCE	SG-636PDE	Remarks
			Specifications				
Output frequency range		f_0	2.21675 MHz to 41.0000 MHz	41.0001 MHz to 70.0000 MHz	2.21675 MHz to 41.0000 MHz		
Power source voltage	Max. supply voltage	V_{DD}-GND	-0.5 V to +7.0 V		-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				
Frequency stability		$\Delta f/f_0$	C: ±100 x 10^{-6}				
Current consumption		Iop	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, ST=GND 2 µA Max.(SCE)
Duty	C-MOS level	t_W/t	40 % to 60 %		45 % to 55 %		C-MOS load: 1/2 V_{DD} level
	TTL level		45 % to 55 %		—		TTL load: 1.4 V level
Output Joltage V_{OH}		V_{OL}	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)	C-MOS	C_L	50 pF Max.	20 pF Max.(≤ 55 MHz) 15 pF Max.(> 55 MHz)	30 pF Max.	15 pF Max.	
	TTL	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,ST
		V_{IL}	0.8 V Max.		0.2 V_{DD} Max.		
Output rise time	C-MOS level	t_{TLH}	7 ns Max.		5 ns Max.		C-MOS load: 20 %→80 % V_{DD}
	TTL level		5 ns Max.		—		TTL load: 0.4 V→2.4 V
Output fall time	C-MOS level	t_{THL}	7 ns Max.		5 ns Max.		C-MOS load: 80 %→20 % V_{DD}
	TTL level		5 ns Max.		—		TTL load: 2.4 V→0.4 V
Oscillation start up time		tosc	4 ms Max.	10 ms Max.	4 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 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

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

External dimensions

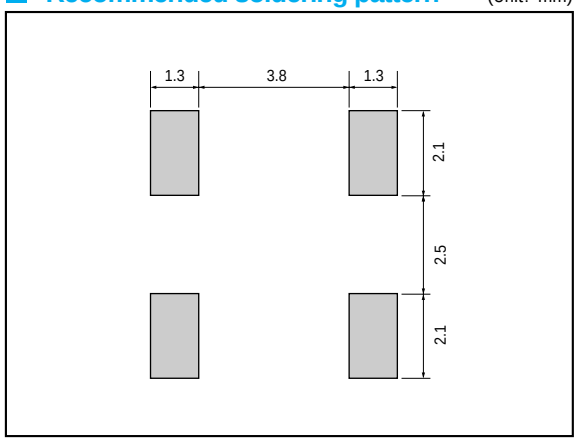
(Unit: mm)



NO.	Pin terminal
1	OE or ST
2	GND
3	OUT
4	V_{DD}

Recommended soldering pattern

(Unit: mm)



Specifications (characteristics)

Item		Symbol	SG-636PTW/STW	SG-636PHW/SHW	SG-636PCW/SCW	Remarks
			Specifications			
Output frequency range		f_0	32.0001 MHz to 135.0000 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		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			
Frequency stability		$\Delta f/f_0$	B: ±50 x 10^{-6} C: ±100 x 10^{-6}			
Current consumption		Iop	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.			$\overline{ST}$=GND(S*W)
Duty	C-MOS level	tw/t	—	40 % to 60 %		C-MOS 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)		C_L	15 pF Max.			
Output enable disable input voltage		V_{IH}	2.0 V Min.		0.7 V_{DD} Min.	OE,$\overline{ST}$
		V_{IL}	0.8 V Max.		0.2 V_{DD} Max.	OE,$\overline{ST}$
Output rise time	C-MOS level	t_{TLH}	—	4 ns Max.	4 ns Max.	C-MOS load: 20 %→80 % V_{DD}
	TTL level		4 ns Max.	—	—	TTL load: 0.4 V→2.4 V
Output fall time	C-MOS level	t_{THL}	—	4 ns Max.	4 ns Max.	C-MOS 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 V
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

Operating condition and Frequency band

Operating condition		1 MHz	50 MHz	100 MHz	150 MHz
5 V±0.5 V	Frequency stability:B (-20 to +70 °C)	32			135
		SG-636PTW/STW/PHW/SHW			
	Frequency stability:C (-20 to +70 °C)	2.21675	41	70	135
		SG-636PTF	SG-636PH	SG-636PTW/STW/PHW/SHW	
3.3 V±0.3 V	Frequency stability:B (-20 to +70 °C)	32			135
		SG-636PCW/SCW			
	Frequency stability:C (-20 to +70 °C)	2.21675	41		135
		SG-636PCE/SCE	SG-636PCW/SCW		
2.5 V±0.25 V	Frequency stability:C (-20 to +70 °C)	2.21675	41		
		SG-636PDE			

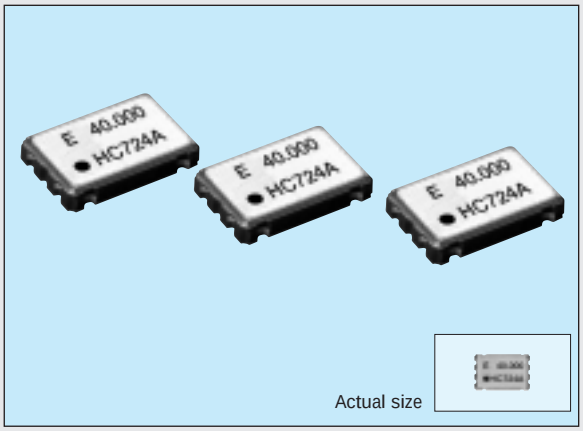
HIGH-FREQUENCY CRYSTAL OSCILLATOR

SG-710 series

Products number (please refer to page 1)

Q33710xxxxxxx00

- 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).

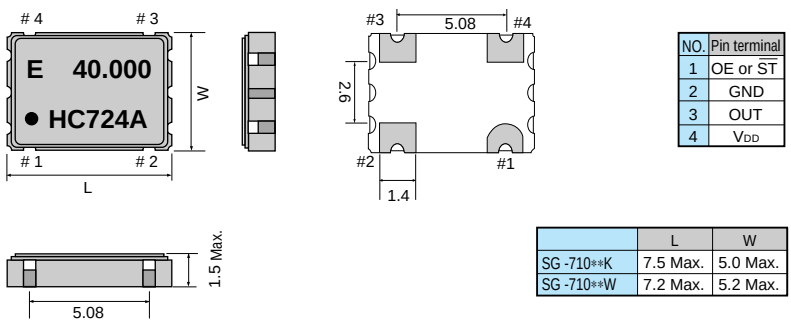


Specifications (characteristics)

Item		Symbol	SG-710PTK	SG-710PHK	SG-710ECK	Remarks
			Specifications			
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	
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)			Please contact us on availability of -40 °C to +85 °C
Frequency stability		$\Delta f/f_0$	B: ±50 x 10^{-6} C: ± 100 x 10^{-6} M: ± 100 x 10^{-6}			B,C:-10 °C to +70 °C, M:-40 °C to +85 C°
Current consumption		Iop	24 mA Max.	40 mA Max.	18 mA Max.	No load condition
Output disable current		I_{OE}	12 mA Max.	16 mA Max.	—	OE=GND(PTK, PHK)
Standby current		I_{ST}	—		10 µA Max.	$\overline{ST}$=GND(ECK)
Duty		t_w/t	—	45 % to 55 %	40 % to 60 %	C-MOS 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.	—	
	C-MOS	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) $\overline{ST}$ terminal(ECK)
		V_{IL}	0.8 V Max.	0.8 V Max.	0.3 x V_{DD} Max.	
Output rise time	C-MOS level	t_{TLH}	—	5 ns Max.	6 ns Max.	C-MOS load: 10 %→90 % V_{DD}
	TTL level		5 ns Max.	—		TTL load: 0.4 V→2.4 V
Output fall time	C-MOS level	t_{THL}	—	5 ns Max.	6 ns Max.	C-MOS load: 90 %→10 % V_{DD}
	TTL level		5 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(ECK)
Shock resistance		S.R.		±10 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 1/2sine wave in 3 directions

External dimensions

(Unit: mm)

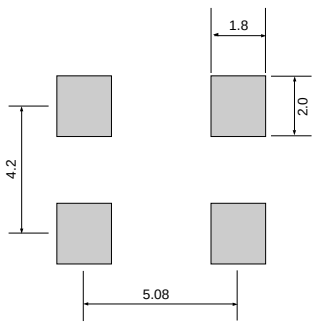


NO.	Pin terminal
1	OE or $\overline{ST}$
2	GND
3	OUT
4	V_{DD}

	L	W
SG -710**K	7.5 Max.	5.0 Max.
SG -710**W	7.2 Max.	5.2 Max.

Recommended soldering pattern

(Unit: mm)



Specifications (characteristics)

Item		Symbol	SG-710PTW/STW	SG-710PHW/SHW	SG-710PCW/SCW	Remarks
			Specifications			
Output frequency range		f_0	80.0001 MHz to 135.0000 MHz		66.6667 MHz to 135.0000 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		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	
Frequency stability		$\Delta f/f_0$	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		Iop	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.			$\overline{ST}$=GND(S*W)
Duty	C-MOS level	tw/t	—	40 % to 60 %		C-MOS 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)		C_L	15 pF Max.			
Output enable disable input voltage		V_{IH}	2.0 V Min.		0.7 V_{DD} Min.	OE,$\overline{ST}$
		V_{IL}	0.8 V Max.		0.2 V_{DD} Max.	OE,$\overline{ST}$
Output rise time	C-MOS level	t_{TLH}	—	3 ns Max.	3 ns Max.	C-MOS load: 20 %→80 % V_{DD}
	TTL level		4 ns Max.	—	—	TTL load: 0.4 V→2.4 V
Output fall time	C-MOS level	t_{THL}	—	3 ns Max.	3 ns Max.	C-MOS 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 V
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

Operating condition and Frequency band

Operating condition		1 MHz	50 MHz	100 MHz	150 MHz
5 V±0.5 V	Frequency stability:B (-20 to +70 °C)	1.8	50	80	135
		SG-710PTK	SG-710PHK	SG-710PTW/STW/PHW/SHW	
	Frequency stability:C (-20 to +70 °C)	1.8	50	80	135
		SG-710PTK	SG-710PHK	SG-710PTW/STW/PHW/SHW	
	Frequency stability:M (-40 to +85 °C)	1.8	50	80	
		SG-710PTK	SG-710PHK		
3.3 V±0.3 V	Frequency stability:B (-20 to +70 °C)	1.8	26	67	135
		SG-710ECK		SG-710PCW/SCW	
	Frequency stability:C (-20 to +70 °C)	1.8	26	67	135
		SG-710ECK		SG-710PCW/SCW	
	Frequency stability:M (-40 to +85 °C)	1.8	26	67	135
		SG-710ECK		SG-710PCW/SCW	

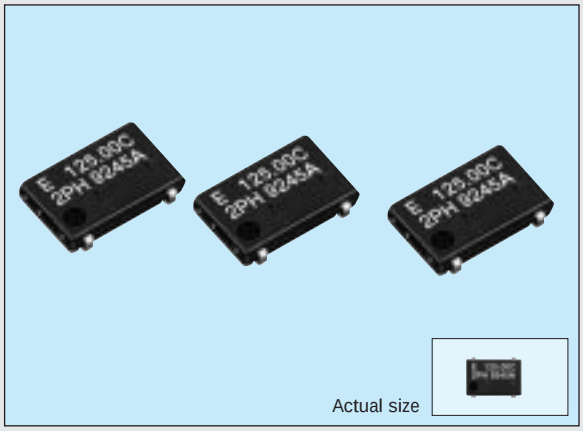
PROGRAMMABLE HIGH-FREQUENCY CRYSTAL OSCILLATOR

SG-8002JF series

Products 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.(Type:PRW-8000A3-M01)
  Please contact EPSON or local sales representative.



Specifications (characteristics)

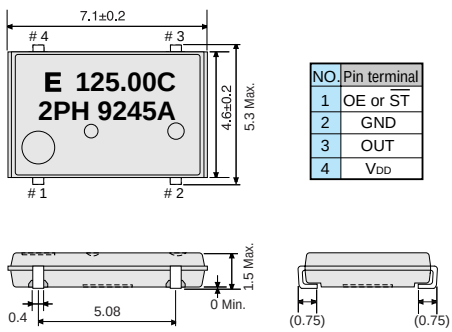
Item		Symbol	PT/ST	PH/SH	PC/SC	Remarks
			Specifications *			
Output frequency range		f_0	1.0000 MHz to 125.0000 MHz			Refer to page 12. "Frequency range".
Power source voltage	Max. supply voltage	V_{DD}-GND	-0.5 V to +7.0 V			Stored as bare product after unpacking
	Operating voltage	V_{DD}	5.0 V±0.5 V		3.3 ± 0.3 V	3.0 V ±0.3 V: $f_0 \leq$ 66.7 MHz(PC/SC)
Temperature range	Storage temperature	T_{STG}	-55 °C to +125 °C			Stored as bare product after unpacking
	Operating temperature	T_{OPR}	-20 °C to +70 °C (-40 °C to +85 °C)		-40 °C to +85 °C	Refer to page 12."Frequency range"
Frequency stability		$\Delta f/f_0$	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		Iop	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.			$\overline{ST}$=GND(ST,SH,SC)
Duty		t_w/t	—	40 % to 60 %		C-MOS 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)	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.		0.7 x V_{DD} Min.	$\overline{ST}$, OE terminal
		V_{IL}	0.8 V Max.		0.2 x V_{DD} Max.	
Output rise time	C-MOS level	t_{TLH}	—	4 ns Max.		C-MOS load: 20 %→80 % V_{DD}
	TTL level		4 ns Max.	—		TTL load: 0.4 V→2.4 V
Output fall time	C-MOS level	t_{THL}	—	4 ns Max.		C-MOS 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(PC/SC)
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 1/2sine wave in 3 directions

Note: • Please contact us for inquiries about operating temperature(-40 °C to +85 °C), the available frequency, duty and output load conditions.
Checking possible by the Frequency Checking Program. http://www.epson.co.jp/device/
Metal may be exposed on the top or bottom this product. This won't affect any quality, reliability or electrical spec.

*PLL - PLL connection & Jitter specification, please refer to page 46.

External dimensions

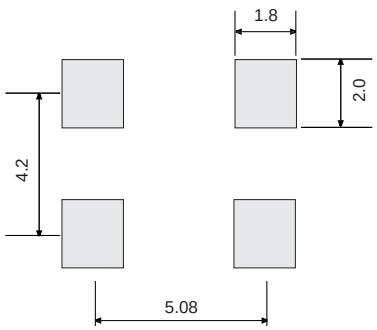
(Unit: mm)



NO.	Pin terminal
1	OE or $\overline{ST}$
2	GND
3	OUT
4	V_{DD}

Recommended soldering pattern

(Unit: mm)



PROGRAMMABLE HIGH-FREQUENCY CRYSTAL OSCILLATOR

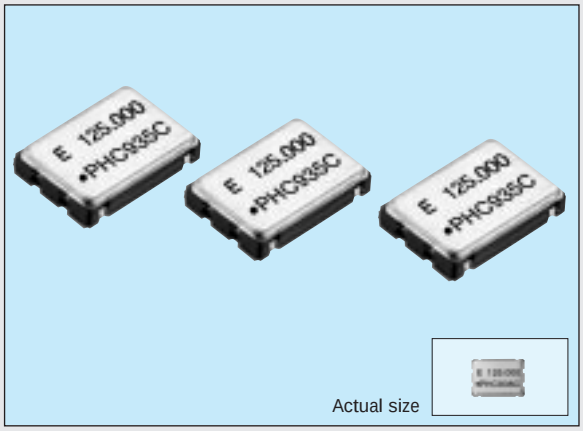
SG-8002CA series

Products 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.(Type:PRW-8000A3-M01)
Please contact EPSON or local sales representative.



Specifications (characteristics)

Item		Symbol	PT/ST	PH/SH	PC/SC	Remarks
			Specifications *			
Output frequency range		f_0	1.0000 MHz to 125.0000 MHz1			Refer to page 12. "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	3.0 V ±0.3 V: $f_0 \leq$ 66.7 MHz(PC/SC)
Temperature range	Storage temperature	T_{STG}	-55 °C to +125 °C			Stored as bare product after unpacking
	Operating temperature	T_{OPR}	-20 °C to +70 °C (-40 °C to +85 °C)		-40 °C to +85 °C	Refer to page 12."Frequency range"
Frequency stability		$\Delta f/f_0$	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		Iop	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
Standby current		I_{ST}		50 µA Max.		$\overline{ST}$=GND
Duty		t_w/t	—	40 % to 60 %		C-MOS 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)	TTL	N	5 TTL Max.	—		Max. frequency and Max. operating voltage range
	C-MOS	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.	$\overline{ST}$, OE terminal
		V_{IL}	0.8 V Max .		0.2 x V_{DD} Max.	
Output rise time	C-MOS level	t_{TLH}	—	4 ns Max.		C-MOS load: 20 %→80 % V_{DD}
	TTL level		4 ns Max.	—		TTL load: 0.4 V→2.4 V
Output fall time	C-MOS level	t_{THL}	—	4 ns Max.		C-MOS 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(PC/SC)
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 1/2sine wave in 3 directions

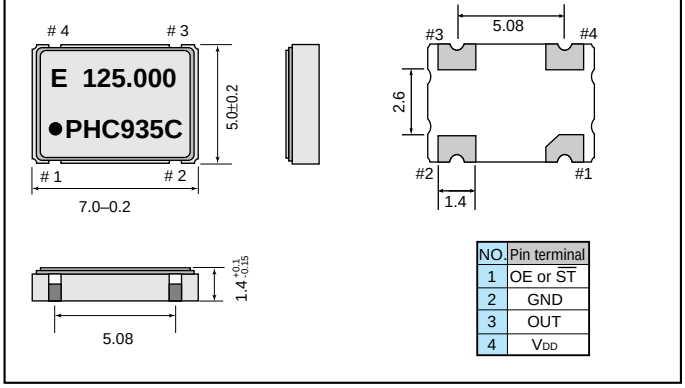
Note: • Please contact us for inquiries about operating temperature(-40 °C to +85 °C), the available frequency, duty and output load conditions. Checking possible by the Frequency Checking Program.

∗PLL - PLL connection & Jitter specification, please refer to page 46.

http://www.epson.co.jp/device/

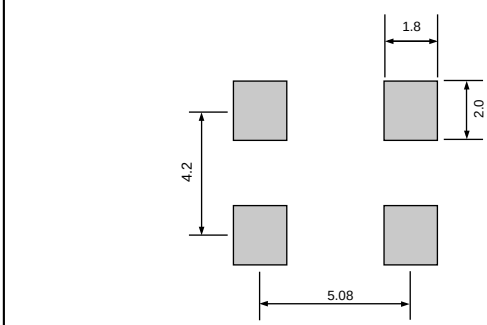
External dimensions

(Unit: mm)



Recommended soldering pattern

(Unit: mm)



PROGRAMMABLE HIGH-FREQUENCY CRYSTAL OSCILLATOR

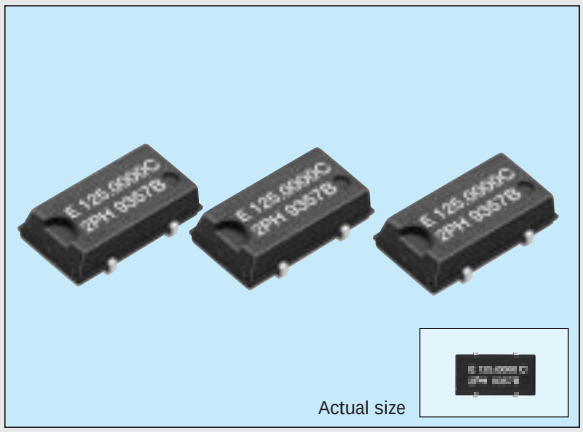
SG-8002JC series

Products number (please refer to page 1)

Q3307JCxxxxxx00

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

8002 PROM Writer available to purchase.(Type:PRW-8000A3-M01)
Please contact EPSON or local sales representative.



Specifications (characteristics)

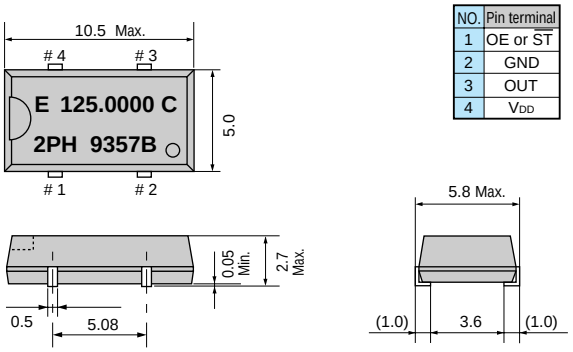
Item		Symbol	PT/ST	PH/SH	PC/SC	Remarks
			Specifications *			
Output frequency range		f_0	1.0000 MHz to 125.0000 MHz			Refer to pege 12. "Frequency range"
Power source voltage	Max. supply voltage	V_{DD}-GND	-0.5 V to +7.0 V			
	Operating voltage	V_{DD}	5.0 V±0.5 V		3.3 ± 0.3 V	3.0 V ±0.3 V: $f_0 \leq$ 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 12."Frequency range"
Frequency stability		$\Delta f/f_0$	B: ±50 x 10^{-6} C: ± 100 x 10^{-6}			-20 °C to +70 °C
Current consumption		Iop	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.			$\overline{ST}$=GND(ST, SH, SC)
Duty		t_w/t	—	40 % to 60 %		C-MOS 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)	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.		0.7 x V_{DD} Min.	$\overline{ST}$, OE terminal
		V_{IL}	0.8 V Max.		0.2 x V_{DD} Max.	
Output rise time	C-MOS level	t_{TLH}	—	4 ns Max.		C-MOS load: 20 %→80 % V_{DD}
	TTL level		4 ns Max.	—		TTL load: 0.4 V→2.4 V
Output fall time	C-MOS level	t_{THL}	—	4 ns Max.		C-MOS 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(PC/SC)
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 1/2sine wave in 3 directions

Note: • Please contact us for inquiries about operating temperature(-40 °C to +85 °C), the available frequency, duty and output load conditions.
Checking possible by the Frequency Checking Program. http://www.epson.co.jp/device/
Metal may be exposed on the top or bottom of this product. This won't affect any quality, reliability or electrical spec.

*PLL - PLL connection & Jitter specification, please refer to page 46.

External dimensions

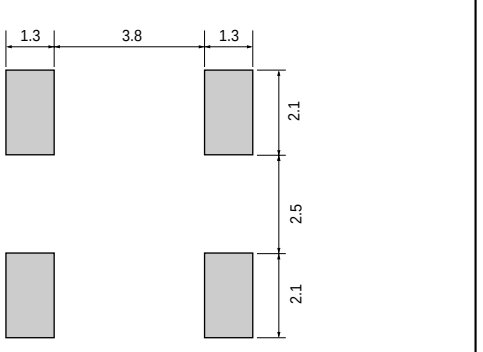
(Unit: mm)



NO.	Pin terminal
1	OE or $\overline{ST}$
2	GND
3	OUT
4	V_{DD}

Recommended soldering pattern

(Unit: mm)



PROGRAMMABLE HIGH-FREQUENCY CRYSTAL OSCILLATOR

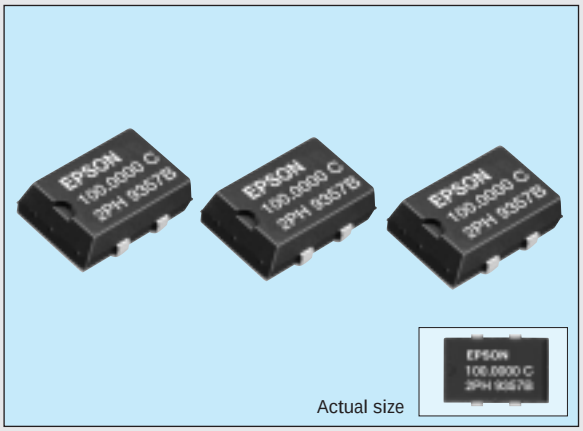
SG-8002JA series

Products number (please refer to page 1)

Q3306JAxxxxxx00

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

8002 PROM Writer available to purchase.(Type:PRW-8000A3-M01)
Please contact EPSON or local sales representative.



Specifications (characteristics)

Item		Symbol	PT/ST	PH/SH	PC/SC	Remarks
			Specifications *			
Output frequency range		f_0		1.0000 MHz to 125.0000 MHz		Refer to page 12. "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	3.0 V ±0.3 V: $f_0 \leq$ 66.7 MHz(PC/SC)
Temperature range	Storage temperature	T_{STG}		-55 °C to +125 °C		Stored as bare product after unpacking
	Operating temperature	T_{OPR}	-20 °C to +70 °C (-40 °C to +85 °C)		-40 °C to +85 °C	Refer to page 12."Frequency range"
Frequency stability		$\Delta f/f_0$	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		Iop	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.		$\overline{ST}$=GND(ST, SH, SC)
Duty		t_w/t	—	40 % to 60 %		C-MOS 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)	TTL	N	5 TTL Max.	—		Max. frequency and Max. operating voltage range
	C-MOS	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.	$\overline{ST}$, OE terminal
		V_{IL}	0.8 V Max.		0.2 x V_{DD} Max.	
Output rise time	C-MOS level	t_{TLH}	—	4 ns Max.		C-MOS load: 20 %→80 % V_{DD}
	TTL level		4 ns Max.	—		TTL load: 0.4 V→2.4 V
Output fall time	C-MOS level	t_{THL}	—	4 ns Max.		C-MOS 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(PC/SC)
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 1/2sine wave in 3 directions

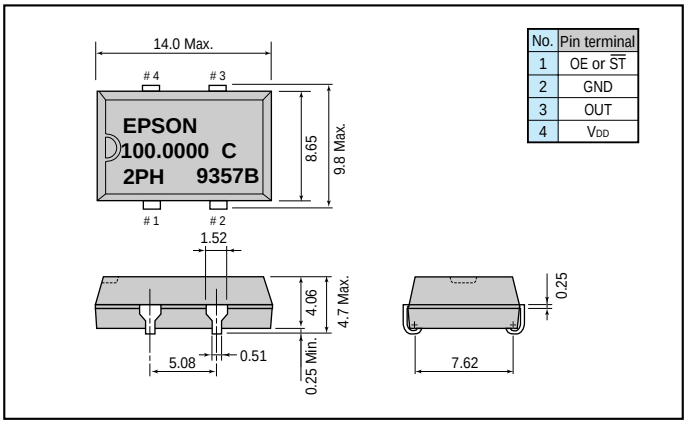
Note: • Please contact us for inquiries about operating temperature(-40 °C to +85 °C), the available frequency, duty and output load conditions. Checking possible by the Frequency Checking Program.

http://www.epson.co.jp/device/

*PLL - PLL connection & Jitter specification, please refer to page 46.

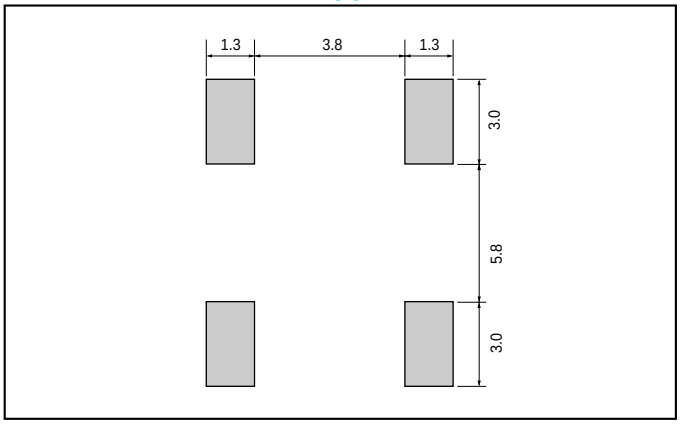
External dimensions

(Unit: mm)



Recommended soldering pattern

(Unit: mm)



PROGRAMMABLE HIGH-FREQUENCY CRYSTAL OSCILLATOR

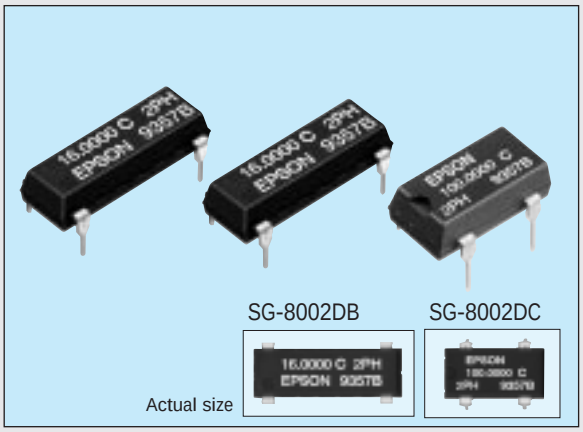
SG-8002DB/ DC series

Products 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.(Type:PRW-8000A3-M01)
Please contact EPSON or local sales representative.



Specifications (characteristics)

Item		Symbol	PT/ST	PH/SH	PC/SC	Remarks
			Specifications *			
Output frequency range		f_0	1.0000 MHz to 125.0000 MHz			Refer to page 12. "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	3.0 V ±0.3 V: $f_0 \leq$ 66.7 MHz(PC/SC)
Temperature range	Storage temperature	T_{STG}	-55 °C to +125 °C			Stored as bare product after unpacking
	Operating temperature	T_{OPR}	-20 °C to +70 °C (-40 °C to +85 °C)		-40 °C to +85 °C	Refer to page 12."Frequency range"
Frequency stability		$\Delta f/f_0$	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		Iop	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.			$\overline{ST}$=GND(ST, SH, SC)
Duty		t_w/t	—	40 % to 60 %		C-MOS 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)	TTL	N	5 TTL Max.	—		Max. frequency and Max. operating voltage range
	C-MOS	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.	$\overline{ST}$, OE terminal
		V_{IL}	0.8 V Max.		0.2 x V_{DD} Max.	
Output rise time	C-MOS level	t_{TLH}	—	4 ns Max.		C-MOS load: 20 %→80 % V_{DD}
	TTL level		4 ns Max.	—		TTL load: 0.4 V→2.4 V
Output fall time	C-MOS level	t_{THL}	—	4 ns Max.		C-MOS 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(PC/SC)
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 1/2sine wave in 3 directions

Note: • Please contact us for inquiries about operating temperature(-40 °C to +85 °C), the available frequency, duty and output load conditions. Checking possible by the Frequency Checking Program.

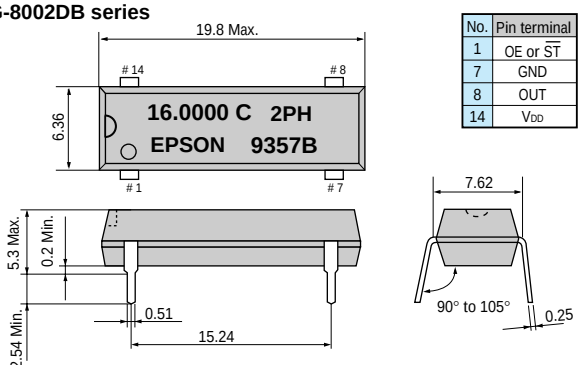
http://www.epson.co.jp/device/

*PLL - PLL connection & Jitter specification, please refer to page 46.

External dimensions

(Unit: mm)

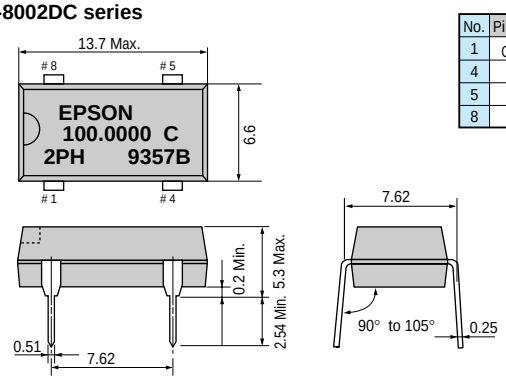
SG-8002DB series



No.	Pin terminal
1	OE or $\overline{ST}$
7	GND
8	OUT
14	V_{DD}

(Unit: mm)

SG-8002DC series



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

● (Wired-or connection & Jitter specification, please refer to page 46.)

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

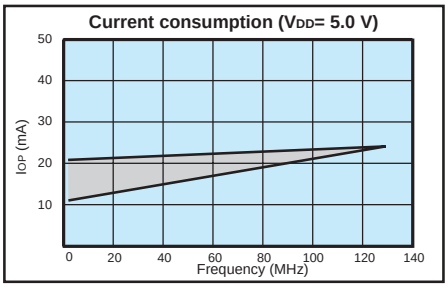
PLL-PLL connection

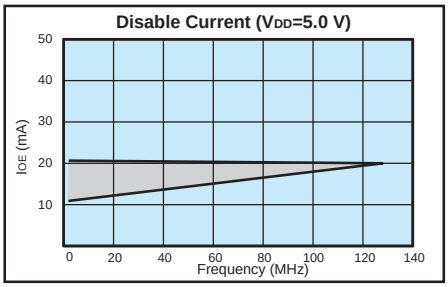
The 8002 series uses PLL technology. There are some cases where jitter will increase when connected to other PLL type devices. For application assistance, please contact Epson.

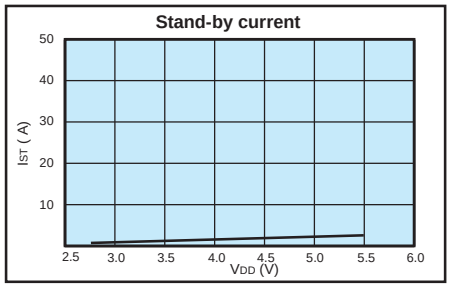
Jitter Specifications

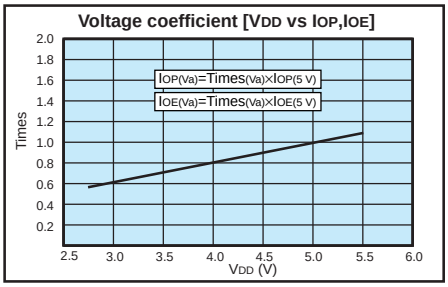
Model	Operating Voltage	Jitter Item	Specifications	Remarks
PT/PH ST/SH	5 V±0.5 V	Cycle to cycle	150 ps Max.	33 MHz≤f_O≤125 MHz,C_L=15 pF
			200 ps Max.	1.0 MHz≤f_O<33 MHz,C_L=15 pF
		Peak to peak	200 ps Max.	33 MHz≤f_O≤125 MHz,C_L=15 pF
			250 ps Max.	1.0 MHz≤f_O<33 MHz,C_L=15 pF
SC/PC	3.3 V±0.3 V	Cycle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

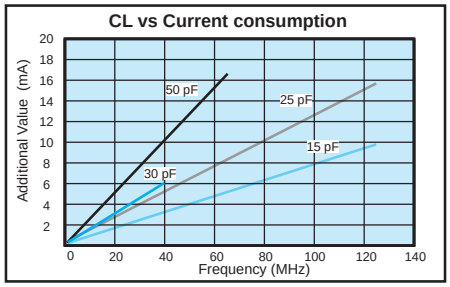
SG-8002 series Characteristics chart

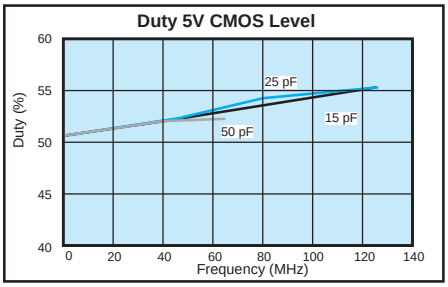


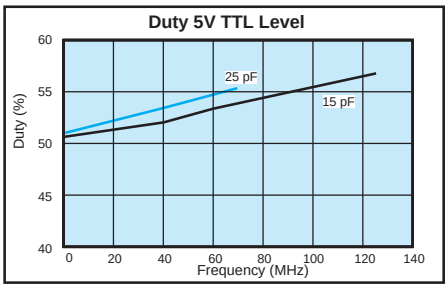


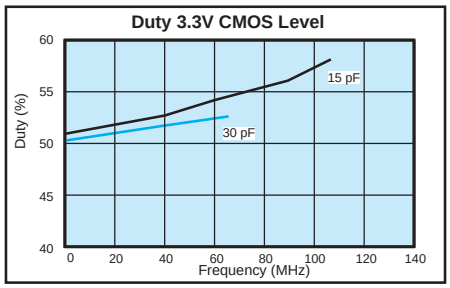


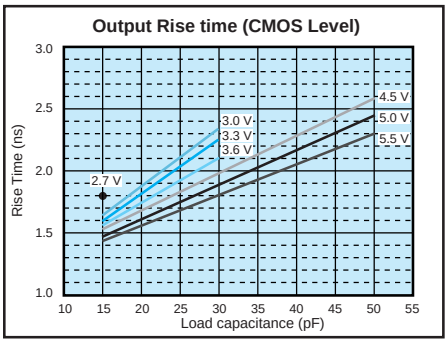


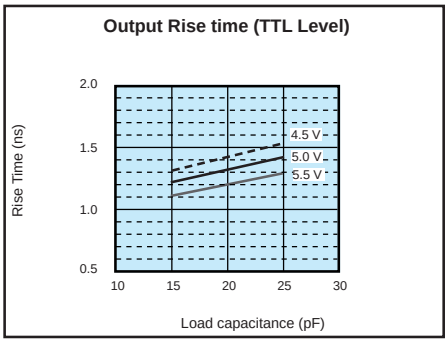


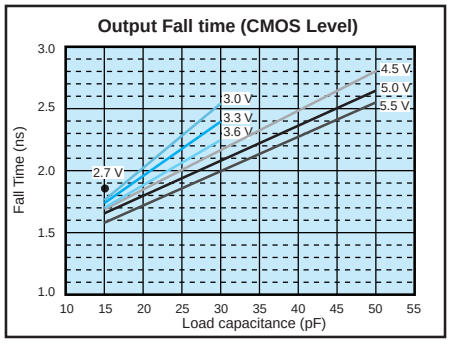


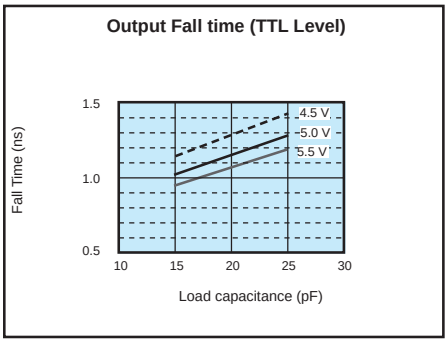












SG-8002Series

Function		P : Output enable			S : Standby		
Operating voltage		5.0 V ±0.5 V		3.3 V±0.3 V	5.0 V ±0.5 V		3.3 V±0.3 V
Output load condition		T : TTL	H : C-MOS	C : C-MOS	T : TTL	H : C-MOS	C : C-MOS
Frequency Stability	B : ±50x 10^{-6}(-20 °C to +70 °C)	PTB	PHB	PCB	STB	SHB	SCB
	C : ±100x 10^{-6}(-20 °C to +70 °C)	PTC	PHC	PCC	STC	SHC	SCC
	M : ±100x 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 ±0.5 V		3.3 V±0.3 V	5.0 V ±0.5 V		3.3 V±0.3 V
Output load condition		T : TTL	H : C-MOS	C : C-MOS	T : TTL	H : C-MOS	C : C-MOS
Frequency Stability	AV : ±20x 10^{-6}(-20 °C to +70 °C)	PTAV	PHAV	PCAV	STAV	SHAV	SCAV
	BV : ±25x 10^{-6}(-20 °C to +70 °C)	PTBV	PHBV	PCBV	STBV	SHBV	SCBV
	CX : ±30x 10^{-6}(-40 °C to +85 °C)	PTCX	PHCX	PCCX	STCX	SHCX	SCCX

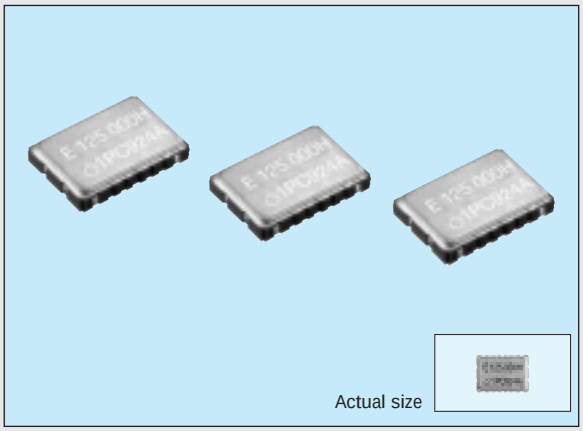
LOW-JITTER CRYSTAL OSCILLATOR

EG-2001CA

Products number (please refer to page 1)

Q3801CA0xxxxx00

- 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 C-MOS technology.
- Provided with output enable function.



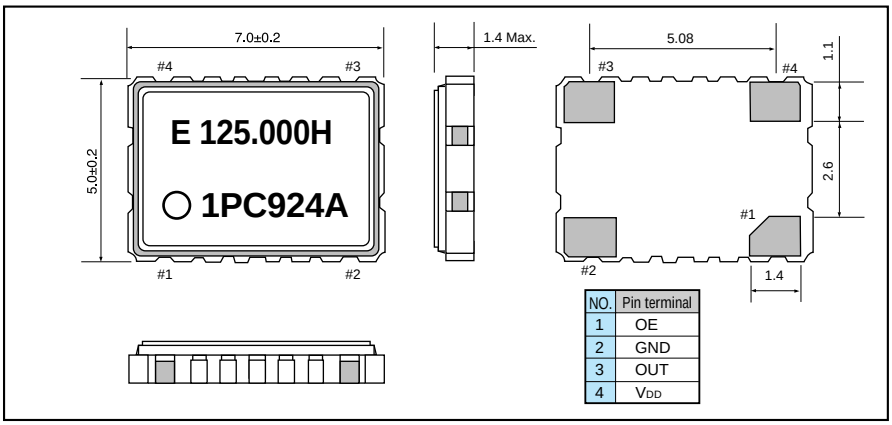
Specifications (characteristics)

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±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	
Frequency stability		$\Delta f/f_0$	±100 x 10^{-6} *	0 ˚C to +70 ˚C
Current consumption		Iop	50 mA Max.	No load condition
Output disable current		I_{OE}	10 µA Max.	OE=GND
Duty	C-MOS 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	C-MOS level	t_{TLH}	2 ns Max.	C-MOS load: 20 %→80 % V_{DD}
	TTL level		1.5 ns Max.	TTL load: 0.8 V→2.0 V
Output fall time	C-MOS level	t_{THL}	2 ns Max.	C-MOS load: 80 %→20 % V_{DD}
	TTL level		1.5 ns Max.	TTL load: 2.0 V→0.8 V
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

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

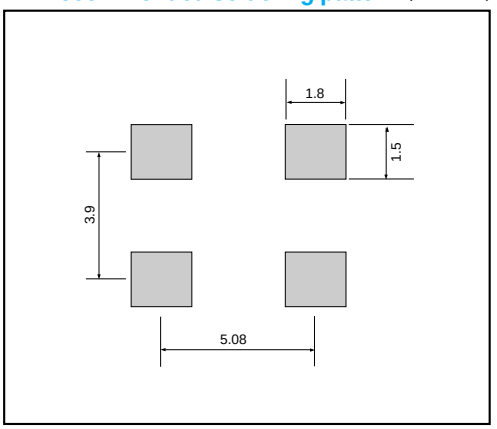
External dimensions

(Unit: mm)



Recommended soldering pattern

(Unit: mm)



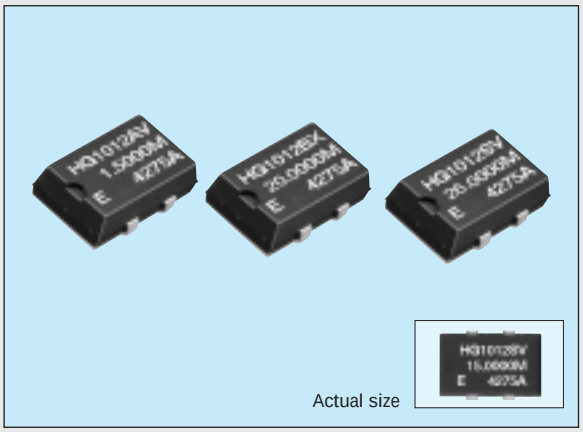
HIGH-STABILITY HIGH-FREQUENCY OSCILLATOR

HG-1000/2000 series

Products number (please refer to page 2)

Q3511JA0xxxxx00
Q3512JA0xxxxx00

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

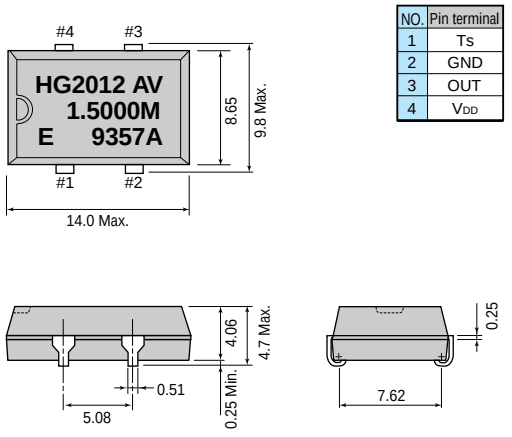


Specifications (characteristics)

Item		Symbol	HG-1012JA	HG-2012JA	Remarks
			Specifications		
Output frequency range		f_0	1.5000 MHz to 28.63636 MHz		V_{DD} =4.75 V to 5.25 V
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		
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: ±20 x 10^{-6}, BV: ±25 × 10^{-6}	SV: ±15 x 10^{-6}, AV: ±20 x 10^{-6}	Ta= -20 °C to +70 °C
			BX: ±25 x 10^{-6}, CX: ±30 × 10^{-6}	BX: ±25 x 10^{-6}	Ta= -40 °C to +85 °C
Current consumption		Iop	10 mA Max.		No load condition
Duty		tw/t	40 % to 60 %		1/2 V_{DD} level
High output voltage		V_{OH}	V_{DD} -0.4 V Min.		I_{OH}= -0.8 mA
Low output voltage		V_{OL}	0.4 V Max.		I_{OL}=3.2 mA
Output load condition		C_L	15 pF Max.		
Output rise time		t_{TLH}	8 ns Max.		20 %→80 % V_{DD} level
Output fall time		t_{THL}	8 ns Max.		80 %→20 % V_{DD} level
Oscillation start up time		t_{OSC}	4 ms Max.		Time at 4.75 V to be 0 s
Aging		fa	±5 x 10^{-6}/year Max.	±2 x 10^{-6}/year Max.	Ta=+25 °C
Shock resistance		S.R.	±10 x 10^{-6} Max.	±2 x 10^{-6} Max.	Three drops on a hard wooden board from 750 mm or excitation test with 29400 m/s² x 0.3 ms x 1/2sine wave in 3 directions

External dimensions

(Unit: mm)

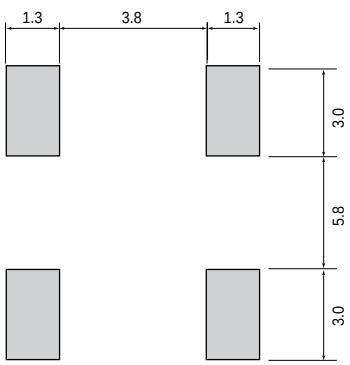


NO.	Pin terminal
1	Ts
2	GND
3	OUT
4	V_{DD}

Ts terminal should be kept open.

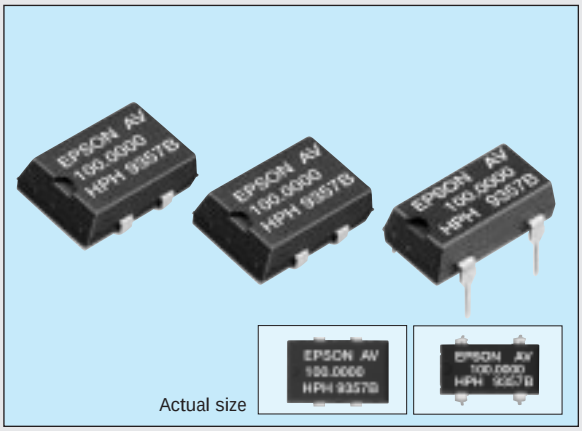
Recommended soldering pattern

(Unit: mm)



PROGRAMMABLE HIGH-STABILITY HIGH-FREQUENCY CRYSTAL OSCILLATOR

HG-8002JA/DC series



Products number (please refer to page 2)

Q3502JAxxxxxx00
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 C-MOS technology.
- Excellent environmental capability.

Specifications (characteristics)

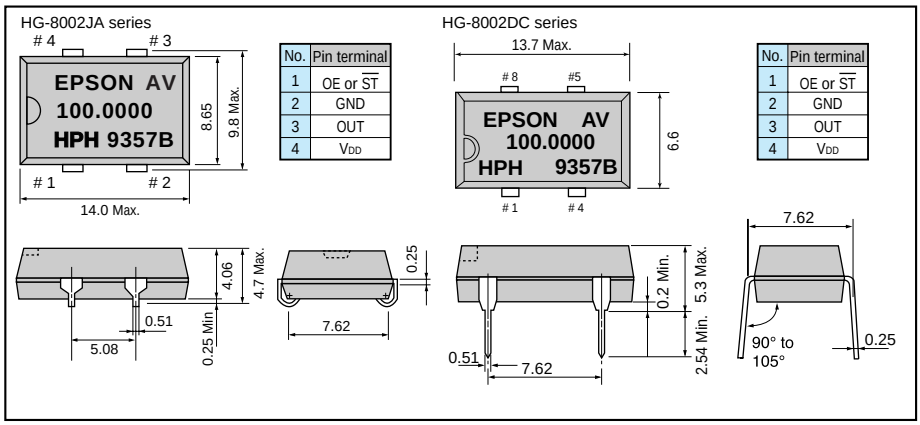
Item		Symbol	PT/ST	PH/SH	PC/SC	Remarks
			Specifications *			
Output frequency range		f_0	1.0000 MHz to 125.0000 MHz*			Refer to page 12. "Frequency range"
Power source voltage	Max. supply voltage	V_{DD}-GND	-0.5 V to +7.0 V			
	Operating voltage	V_{DD}	5.0 V ±0.25 V		3.3 V ±0.165 V	
Temperature range	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 12."Frequency range"
Frequency stability		$\Delta f/f_0$	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		Iop	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.			$\overline{ST}$=GND(ST, SH, SC)
Duty		t_w/t	—	40 % to 60 %*		C-MOS 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 condition (fan out)	TTL	N	2 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.		0.7 x V_{DD} Min.	$\overline{ST}$, OE terminal
		V_{IL}	0.8 V Max.		0.2 x V_{DD} Max.	
Output rise time	C-MOS level	t_{TLH}	—	3 ns Max.		C-MOS load: 20 %→80 % V_{DD} level
	TTL level		4 ns Max.	—		TTL load: 0.4 V→2.4 V level
Output fall time	C-MOS level	t_{THL}	—	3 ns Max.		C-MOS 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		fa	±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/s² x 0.3 ms x 1/2sine wave in 3 directions

Note: • Please contact us for inquiries about operating temperature(-40 °C to +85 °C), the available frequency, duty and output load conditions. Checking possible by the Frequency Checking Program.

*PLL - PLL connection & Jitter specification, please refer to page 46.

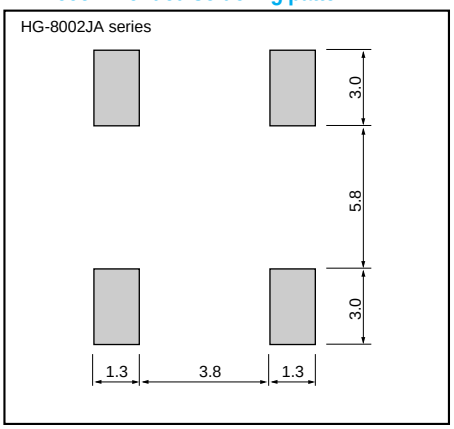
External dimensions

(Unit: mm)



Recommended soldering pattern

(Unit: mm)



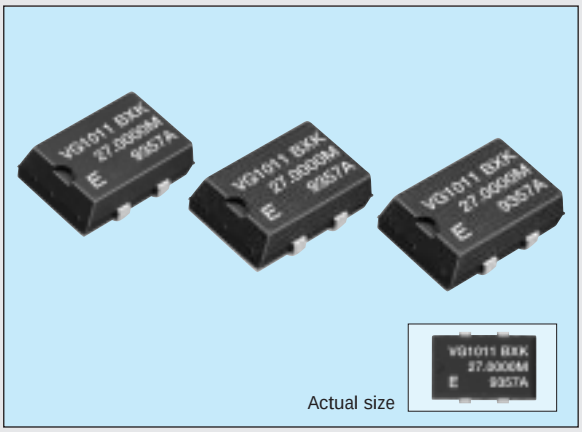
VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR

VG-1011JA series

Products number (please refer to page 2)

Q3602JA0xxxxx00

- 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 C-MOS IC assures low current consumption.
- Excellent environmental capability.
- Supply voltage: 5 V



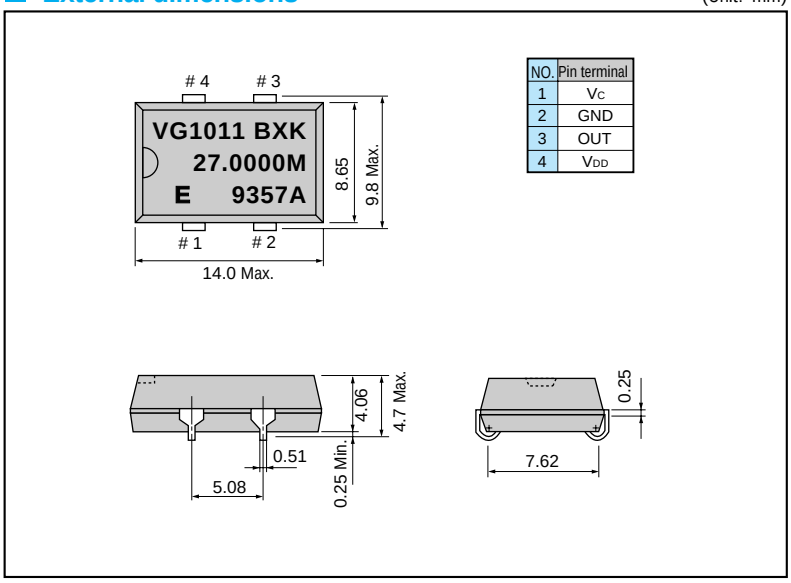
Specifications (characteristics)

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		$\Delta f/f_0$	As per below table ＊	
Current consumption		Iop	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		tw/t	40 % to 60 %	1.4 V or 1/2VDD 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/C-MOS load
Output rise time		t_{TLH}	8 ns Max.	C-MOS load: 20 %→80 % V_{DD}
			5 ns Max.	TTL load: 0.4 V→2.4 V
Output fall time		t_{THL}	8 ns Max.	C-MOS 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/s² 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

Stability	No.	Temperature range -20 °C to +70 °C	-30 °C to +75 °C	-40 °C to +85 °C
±15 x 10^{-6}	S	—	B	—
±20 x 10^{-6}	A	G, K, N	—	—
± 25 x 10^{-6}	B	—	—	G, K, N

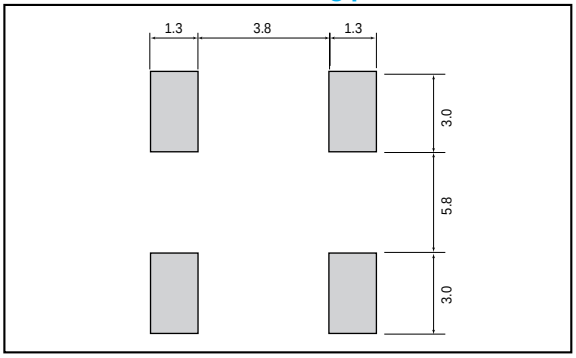
Pull range

No.	Pull range
B	± 20 x 10^{-6} Min.
G	± 50 x 10^{-6} Min.
K	± 75 x 10^{-6} Min.
N	± 100 x 10^{-6} Min.

＊Please contact us for inquiries about the available frequency.

Recommended soldering pattern

(Unit: mm)



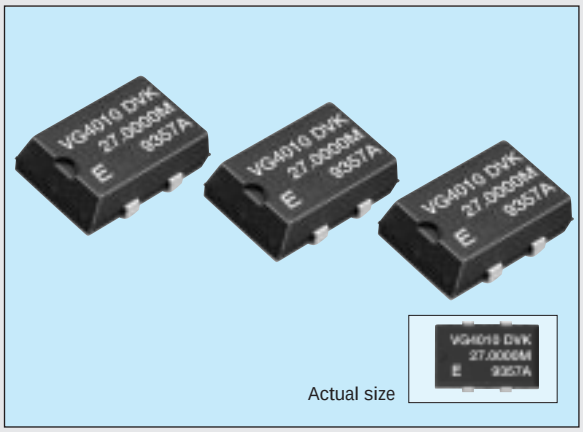
VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR

VG-4000JA series

Products number (please refer to page 2)

Q3611JA0xxxxx00
Q3612JA0xxxxx00

- 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 C-MOS IC assures low current consumption.
- Excellent environmental capability.
- Supply voltage: 5 V(VG-4010JA)
- Supply voltage: 3.3 V(VG-4030JA)



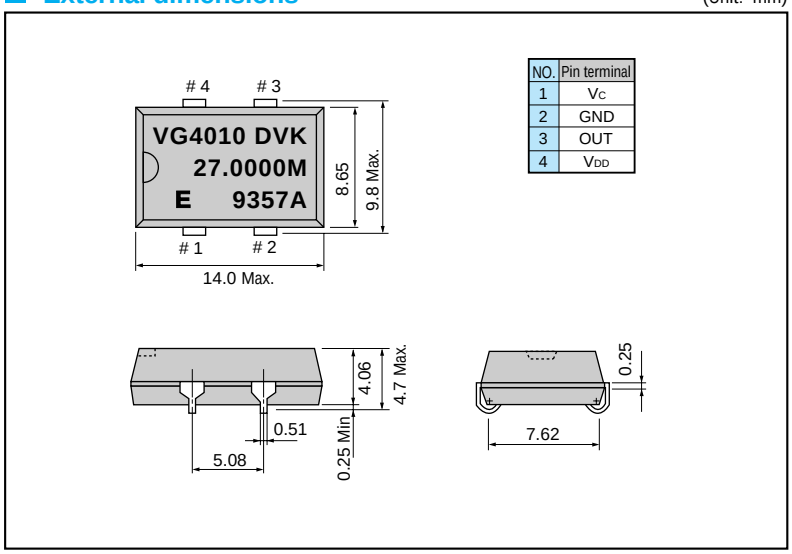
Specifications (characteristics)

Item		Symbol	VG-4010JA DVK	VG-4030JA DVK	Remarks
			Specifications		
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		$\Delta f/f_0$	±35 x 10^{-6} Max.	±37 x 10^{-6} Max.	VC=2.5 V(4010JA) / VC=1.8 V(4030JA)
Current consumption		Iop	35 mA Max.	18 mA Max.	No load condition
Pull range		Δf_C	±75 x 10^{-6}	As per below table	VC=0.5 to 4.5 V(4010JA) / VC=0.0 to 3.0 V(4030JA)
Input resistance		Z_{IN}	10 MΩ Min.		DC Level
Frequency change polarity			Positive polarity		VC=0.5 to 4.5 V(4010JA) / VC=0.0 to 3.0 V(4030JA)
Duty		tw/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/C_L	2 TTL or 30 pF Max.	30 pF Max.	TTL load/C-MOS load
Output rise time		t_{TLH}	5 ns Max.	6 ns Max.	C-MOS load: 20 %→80 % V_{DD} level
			8 ns Max.	—	TTL load: 0.4 V→2.4 V level
Output fall time		t_{THL}	5 ns Max.	6 ns Max.	C-MOS load: 80 %→20 % V_{DD} level
			8 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		fa	±5 x 10^{-6} Max.		Ta=+25 °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/s² 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)



NO.	Pin terminal
1	Vc
2	GND
3	OUT
4	V_{DD}

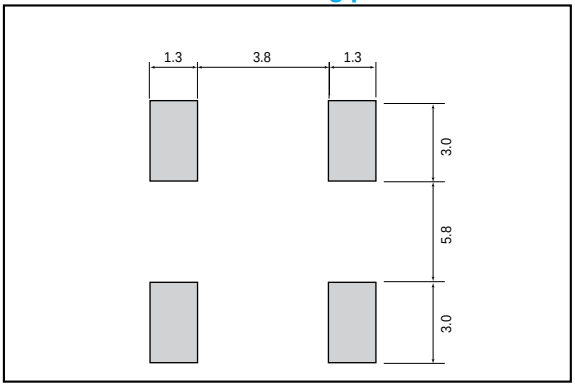
Pull range

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

Please contact us for pull range.

Recommended soldering pattern

(Unit: mm)



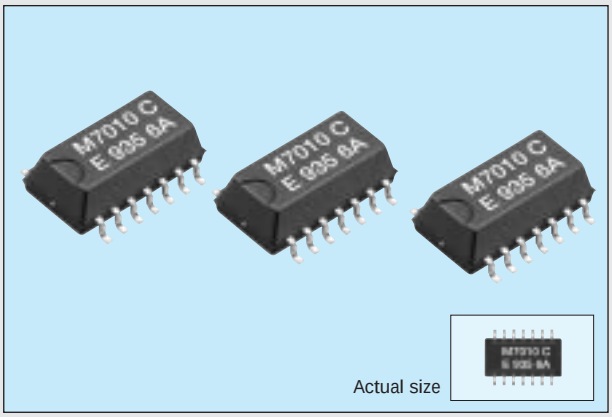
SELECTABLE-OUTPUT PLL OSCILLATOR

MG-7010SA

Products number (please refer to page 2)

Q33M11SAxxxxx00

- 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 C-MOS IC allows low current consumption and assures high reliability.



Specifications (characteristics)

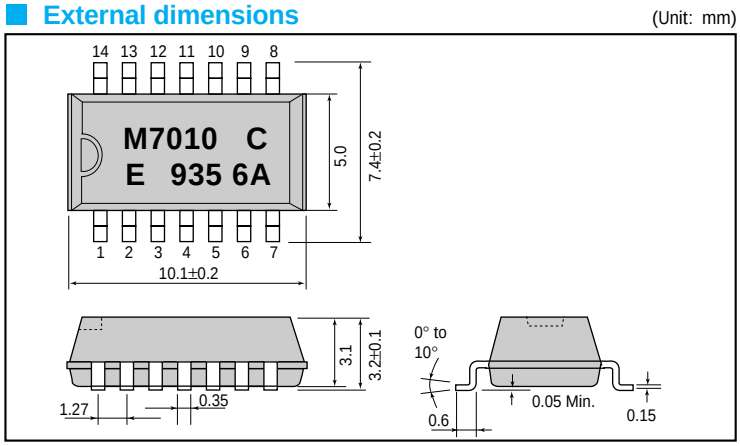
Item		Symbol	Specifications	Remark
Frequency change time		t_{ft}	10 ms Max.	S0, S1, S2, S3 changing
Output frequency range		f_0	20.0000 MHz to 120.0000 MHz	V_{DD}=4.5 V to 5.5 V
			20.0000 MHz to 80.0000 MHz	V_{DD}=2.7 V to 5.5 V
Power source voltage	Max. supply voltage	V_{DD}-GND	-0.5 V to +7.0 V	
	Operating voltage	V_{DD}	2.7 V to 5.5 V	
Temperature range	Storage temperature	T_{STG}	-55 °C to +100 °C	Stored as bare product after unpacking
	Operating temperature	T_{OPR}	-20 °C to +70 °C	
Frequency stability		$\Delta f / f_0$	C: ±100 x 10^{-6}	-20 °C to +70 °C, V_{DD}=2.7 V to 5.5 V
Current consumption		I_{op}	45 mA Max.	No load condition (fo=120 MHz)
Output disable current		I_{OE}	25 mA Max.	OE=GND, fo=120 MHz
Standby current		I_{ST}	10 µA Max.	$\overline{ST}$=GND
Duty		t_w/t	40 % to 60 %	1.4 V level
High output voltage		V_{OH}	V_{DD} -0.5 V Min.	I_{OH} = -16 mA (V_{DD}=5±0.5 V)
Low output voltage		V_{OL}	0.4 V Max.	I_{OL} = 16 mA (V_{DD}=5±0.5 V)
Output load condition		C_L	25 pF Max.	V_{DD}=4.5 V to 5.5 V($f_0 \leq$ 80 MHz)
			15 pF Max.	V_{DD}=2.7 V to 4.5 V or $f_0 >$ 80 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 %→80 %V_{DD} level
Output fall time		t_{THL}	4.0 ns Max.	80 %→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	±5 x 10^{-6}/year Max.	Ta=+25 °C, V_{DD} =3.3 V or 5.5 V
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 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"→Clock out "L"→"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

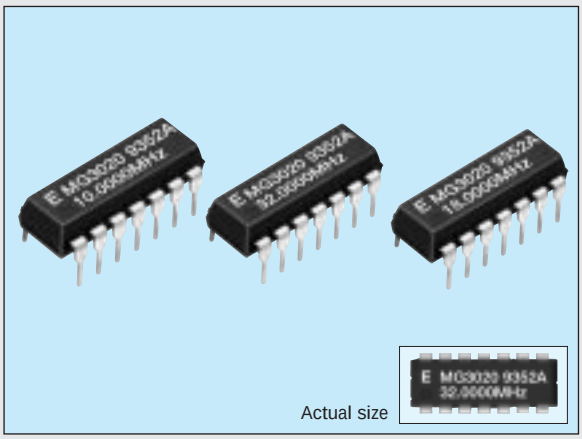
MULTI-OUTPUT CRYSTAL OSCILLATOR

MG-3020DD

Products number (please refer to page 2)

Q32M12DDxxxxx00

- Simultaneous output. (1/1, 1/2, 1/4, 1/8 and 1/16 output frequency ratio)
- Built-in cylindrical AT-cut crystal unit assures high reliability.
- DIP 14-pin plastic package allows automatic mounting.
- External clock select function, dividing circuit reset function and 1/2 divider select function.



Specifications (characteristics)

Absolute Max. rating

Item	Symbol	Rating
Supply voltage	V_{DD}	-0.5 V to +7.0 V
Input voltage	V_I	-0.5 V to V_{DD} +0.5 V
Output current	I_O	30 mA Max.
Storage temperature	T_{STG}	-55 °C to +100 °C *

*Stored as bare product after unpacking

Operating range

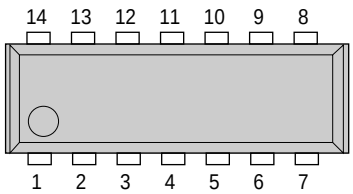
Item	Symbol	Rating			Unit
		Min.	Typ.	Max.	
Operating voltage	V_{DD}	4.5	5.0	5.5	V
Output current	I_O			1.6	mA
Operating temperature	T_{OPR}	-10	25	70	°C
Output load condition	C_L			15	pF

Frequency characteristics

oscillation source frequency is 17.7340 MHz to 40.000 MHz

Item	Symbol	Specification	Remarks
Frequency stability	$\Delta f/f_0$	±100 x 10^{-6}	-20 °C to +70 °C
Aging	fa	±5 x 10^{-6}/year	Ta=+25 °C, V_{DD} =5 V first year

Terminal connection

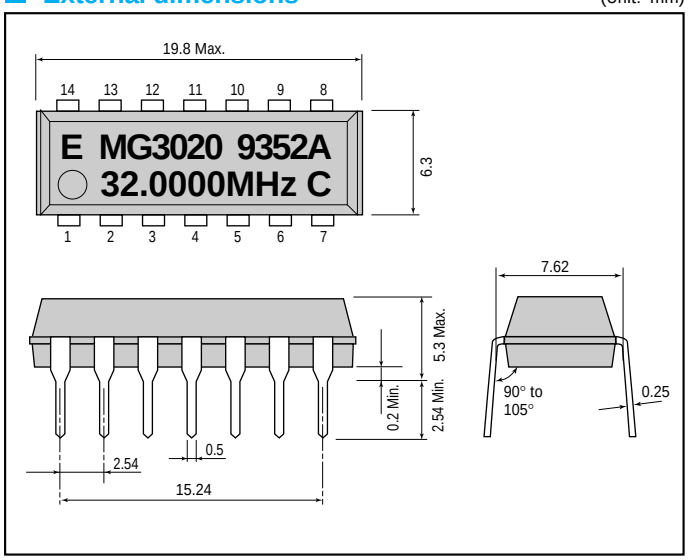


Terminal	Pin No.	Function
V_{DD}	14	+5 V power supply
GND	7	GND
OUT_1	8	1/1 source frequency
OUT_2	9	1/2 source frequency
OUT_3	10	1/4 source frequency
OUT_4	11	1/8 source frequency
OUT_5	12	1/16 source frequency
F_{OUT}	13	Source frequency
$\overline{CSEL}$	4	When this pin is made L, the external clock is selected (pull-up resistor incorporated)
EXC	5	External clock pulse input pin
$\overline{RESET}$	3	Stops output at $\overline{RESET}$=L (pull-up resistor incorporated)
$\overline{1/2\ SEL}$	6	1/2 frequency output at $\overline{1/2SEL}$=L (pull-up resistor incorporated)
NC	1 and 2	NC is not connected internally

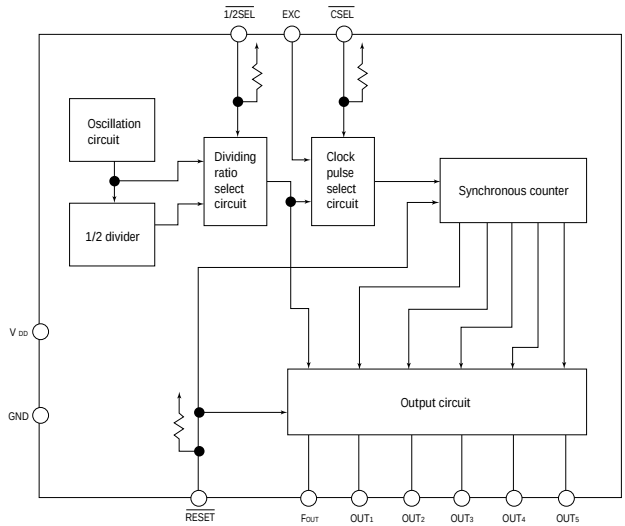
When the power switch is turned on in $\overline{RESET}$ L level mode, please note that all output becomes high impedance. To resume normal operation, disable the $\overline{RESET}$ terminal.

External dimensions

(Unit: mm)



Block diagram



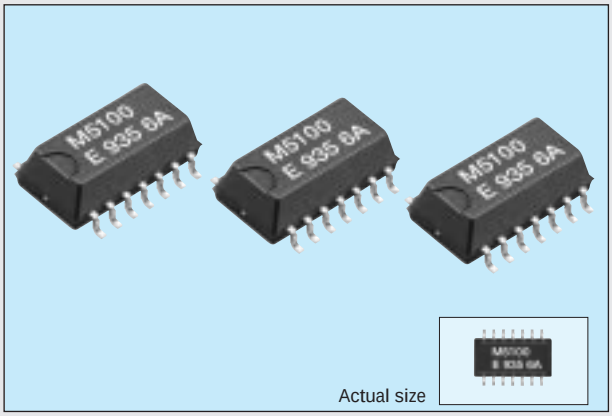
MULTI-OUTPUT CRYSTAL OSCILLATOR

MG-5100SA

Products number (please refer to page 2)

Q33M21SAxxxxx00

- 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.



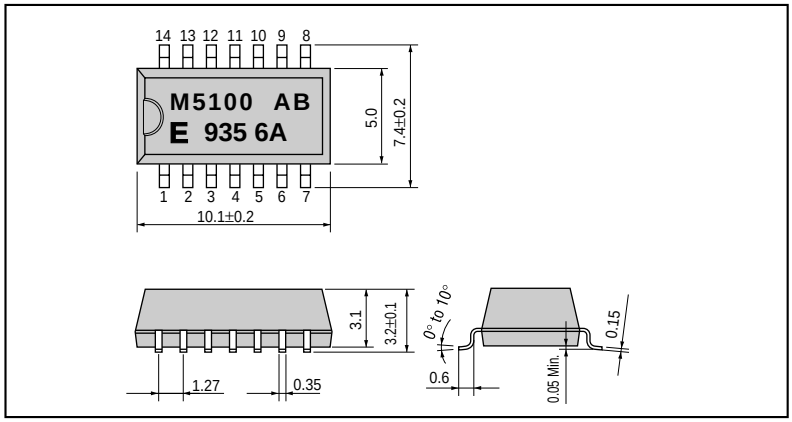
Specifications (characteristics)

Item		Symbol	Specifications	Remarks
Output frequency range		fo	76.9 kHz to 100.0 MHz.*1	V_{DD}=5.0 V ±0.5 V
			76.9 kHz to 80.0000 MHz.*1	V_{DD}=3.3 V ±0.3 V
Power source voltage	Max. supply voltage	V_{DD}-GND	-0.3 V to +7.0 V	
	Operating voltage	V_{DD}	5.0 ±0.5 V	
			3.3 ±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	
Frequency stability		Δf / fo	±100 x 10^{-6}	
Current consumption		I_{OP}	100 mA Max.	V_{DD}=5.0 V ±0.5 V
			65 mA Max.	V_{DD}=3.3 V ±0.3 V
Duty		tw / t	40 % to 60 %	50 % V_{DD}
"H" output voltage 1		V_{OH}	V_{DD}-0.4 V Min.	I_{OH}= -4.0 mA
"L" output voltage 1		V_{OL}	0.4 V Max.	I_{OL}= 4.0 mA
condition (fan out)		C_L	25 pF Max.	V_{DD}=5.0 V ±0.5 V
			15 pF Max.	V_{DD}=3.3 V ±0.3 V
"H" input voltage 1		V_{IH}	80 %V_{DD} Min.	
"L" input voltage 1		V_{IL}	20 %V_{DD} Max.	
Output rise time		t_{TLH}	5.0 ns Max.	20%→80% V_{DD}
Output fall time		t_{THL}	4.0 ns Max.	80%→20% V_{DD}
Jitter		t_j	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		t_{OSC}	70 ms Max.	Time at minimum operating voltage to be 0s.
Aging		f_a	±5 x 10^{-6} /year Max.	Ta= +25 °C, V_{DD}=3.3 V or 5.5V
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 1/2sine wave in 3 directions

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

External dimensions

(Unit: mm)



Terminal condition

Terminal	Pin No.	Function
V_{DD1}	14	Power supply (3.3V or 5.0V)
V_{DD2}	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

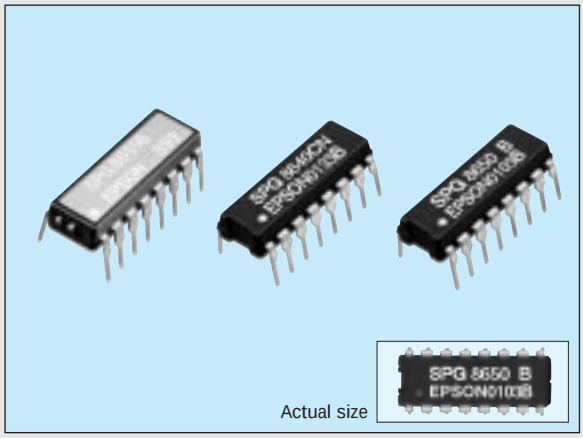
SELECTABLE-OUTPUT CRYSTAL OSCILLATOR

SPG series

Products number (please refer to page 2)

Q318640xxxxxx00
Q318650xxxxxx00
Q318651xxxxxx00

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



Specifications (characteristics)

Item		Symbol	Specifications									Remarks
Model name			8640AN	8640BN	8640CN	8650A	8650B	8650C	8650E	8651A	8651B	8651E	
Oscillation source frequency		fo	600 kHz	1 MHz	768 kHz	60 kHz	100 kHz	96 kHz	32.768 kHz	60 kHz	100 kHz	32.768 kHz	For output frequency, refer to the table in the next page
Power source voltage	Max. supply voltage	V_{DD}-GND	-0.3 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							-30 °C to +80 °C			Stored as bare product after unpacking
	Operating temperature	T_{OPR}	-10 °C to +70 °C							-10 °C to +60 °C			
Frequency tolerance		$\Delta f/f_0$	±100 x 10^{-6}			±50 x 10^{-6}				±5 x 10^{-6} *1			V_{DD}=5 V, Ta=+25 °C
Frequency temperature characteristics			+10/-120 x 10^{-6}										V_{DD}=5 V
Frequency voltage characteristics			±20 x 10^{-6}	±10 x 10^{-6}	±20 x 10^{-6}	±10 x 10^{-6}				±5 x 10^{-6}			V_{DD}=4.5 to 5.5 V
Aging		fa	±5 x 10^{-6}/year Max.							±3 x 10^{-6}/year Max.			V_{DD}=5 V, Ta=+25 °C, first year
Current consumption		Iop	1.0 mA Max.	2.0 mA Max.	1.5 mA Max.	0.5 mA Max.							No load condition
Shock resistance		S.R.	±5 x 10^{-6} Max.(From 500 mm)			±5 x 10^{-6} Max.			±10 x 10^{-6} Max.				Three drops on a hard wooden board form 750 mm

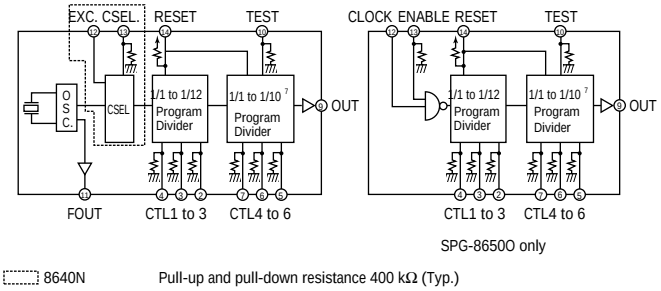
*1 Frequency tolerance of 8651 system shows the value guaranteed at the time of shipment.

Electric characteristics (V_{DD}=5 V±0.5 V, Ta=-10 to +70 °C $C_L \leq$ 15 pF)

Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
L. input voltage	V_{IL}	0		0.8	V	
H. input voltage	V_{IH}	V_{DD}-1.0		V_{DD}		
L. input current (Reset)	I_{RL}	-30		-5	μA	Reset=GND
H input current (Reset)	I_{RH}			0.5		Reset=V_{DD}
L. input current (input terminal except for Reset)	I_{IL}	-0.5				
H input current (input terminal except for Reset)	I_{IH}	5		30		I_{OL}=1.6 mA
L. output voltage	V_{OL}			0.4	V	I_{OH}= -40 μA
H. output voltage	V_{OH}	V_{DD}-1.0				V_{OL}=0.4 V
L. output current	I_{OL}	1.6			mA	V_{OH}=V_{DD}-1.0 V
H. output current	I_{OH}			-40	μA	
Output rise time	t_{TLH}		30	60	ns	
Output fall time	t_{THL}		25	50		
Duty		40		60	%	Except in the case of 1/3 and 1/5
Min. reset pulse width	t_{RW}	1.0			μs	
Reset delay time	t_R			1.0		
Reset release synchronous error	t_E	tw-* 1 1/2 to		tw * 2		
External signal input frequency	F_{IN}			1M	Hz	8640 N only
External signal input pulse width	t_{IN}	0.5			μs	
Oscillation start up time	t_{OSC}		0.2	1	s	* 3

* 1 to=oscillation source cycle. * 2 tw=1/2 cycle of preset frequency.
* 3 For more than 1 ms until V_{DD}=0→4.5 V. Time at 4.5 V is to be 0.

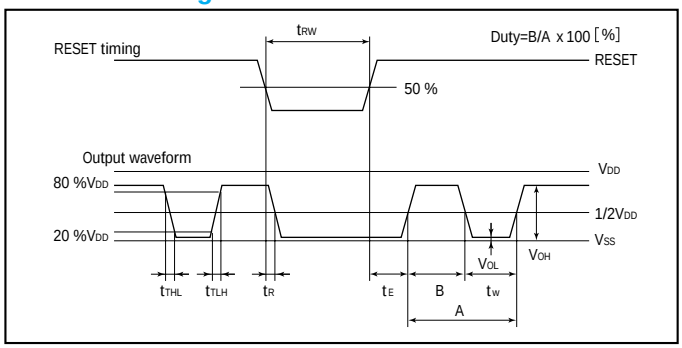
Block diagram



Divider IC (without quartz crystal)

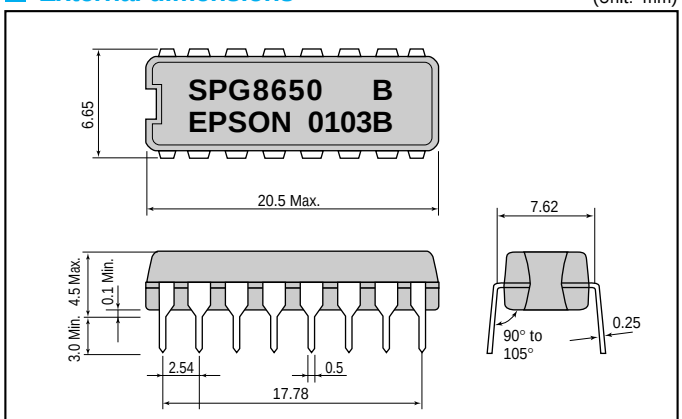
Item	Symbol	Specifications	Remarks
Model name		8650 O	
Input clock frequency		1 MHz Max.	
Current consumption	Iop	About 2 mA	No load condition

RESET timing

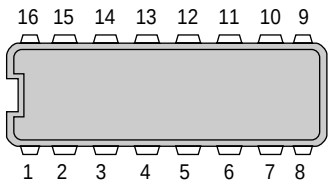


External dimensions

(Unit: mm)



Terminal connection



No.	Pin terminal	No.	Pin terminal
1	NC	16	V_{DD}
2	CTL 3	15	NC
3	CTL 2	14	RESET
4	CTL 1	13	NC (CSEL)
5	CTL 6	12	NC (EXC)
6	CTL 5	11	FOUT
7	CTL 4	10	TEST
8	GND	9	OUT

( ) shown 8640N only

For 8650 O
11. NC 12. CLOCK 13. ENABLE

NC: Do not connect to the external terminal.

Explanation of terminal

(a) CTL 1 to 6 : Programs dividing ratio. (pull-down resistor incorporated.)
(b) OUT : Output frequency preset by CTL1 to 6.
(refer to the procedure for setting output frequency.)
(c) FOUT : Constantly outputs the oscillation source frequency of builtin crystal unit.
(d) RESET : Stops output at RESET= "L".
(pull-up resistor incorporated.)
(e) TEST : Used for the input terminal for testing. When CTL4 is H, output will be 1000 times larger than the preset value at TEST= "H". (pull-down resistor incorporated.)
(f) EXC (8640N only) : Serves as input terminal when using an external clock by changing to the builtin oscillator.
Effective only when CSEL is H.
(g) CSEL (8640N only) : When this terminal is made H, the external clock is selected.
(pull-down resistor incorporated.)

(Note) Treatment of empty terminals. When RESET terminal is not used, this should be connected to V_{DD}, and when TEST terminal, CSEL terminal, and CTL 1 to 6 terminals are not used, to GND.

Explanation of terminal (8650 O)

(a) CLOCK: Clock input (Max. 1 MHz) (b) ENABLE: Be sure to connect to V_{DD}

Setting of divider output

CTL1	CTL2	CTL3	Dividing ratio
0	0	0	1/1
0	0	1	1/10
0	1	0	1/2
0	1	1	1/3
1	0	0	1/4
1	0	1	1/5
1	1	0	1/6
1	1	1	1/12

CTL4	CTL5	CTL6	Dividing ratio
0	0	0	1/1
0	0	1	1/10
0	1	0	$1/10^2$
0	1	1	$1/10^3$
1	0	0	$1/10^4$
1	0	1	$1/10^5$
1	1	0	$1/10^6$
1	1	1	$1/10^7$

0= "L" 1="H"

Setting of output frequency

8640AN

(Unit: Hz)

Set terminal		CTL4	0	0	0	0	1	1	1	1
		CTL5	0	0	1	1	0	0	1	1
CTL1	CTL2	CTL3 \ CTL6	0	1	0	1	0	1	0	1
0	0	0	600k	60k	6k	600	60	6.0	0.6	0.06
0	0	1	60k	6k	600	60	6	0.6	0.06	0.006
0	1	0	300k	30k	3k	300	30	3.0	0.3	0.03
0	1	1	200k	20k	2k	200	20	2.0	0.2	0.02
1	0	0	150k	15k	1.5k	150	15	1.5	0.15	0.015
1	0	1	120k	12k	1.2k	120	12	1.2	0.12	0.012
1	1	0	100k	10k	1k	100	10	1.0	0.1	0.01
1	1	1	50k	5k	500	50	5	0.5	0.05	0.005

8640BN

Set terminal		CTL4	0	0	0	0	1	1	1	1
		CTL5	0	0	1	1	0	0	1	1
CTL1	CTL2	CTL3 \ CTL6	0	1	0	1	0	1	0	1
0	0	0	1M	100k	10k	1k	100	10	1	1/10
0	0	1	100k	10k	1k	100	10	1	1/10	1/100
0	1	0	500k	50k	5k	500	50	5	1/2	1/20
0	1	1	333.3k	33.3k	3.3k	333.3	33.3	3.33	1/3	1/30
1	0	0	250k	25k	2.5k	250	25	2.5	1/4	1/40
1	0	1	200k	20k	2k	200	20	2	1/5	1/50
1	1	0	166.6k	16.6k	1.6k	166.6	16.6	1.6	1/6	1/60
1	1	1	83.3k	8.3k	833.3	83.3	8.3	0.83	1/12	1/120

8650A 8651A

Set terminal		CTL4	0	0	0	0	1	1	1	1
		CTL5	0	0	1	1	0	0	1	1
CTL1	CTL2	CTL3 \ CTL6	0	1	0	1	0	1	0	1
0	0	0	60k	6.0k	600	60	6.0	0.6	0.06	0.006
0	0	1	6k	600	60	6	0.6	0.06	0.006	0.0006
0	1	0	30k	3.0k	300	30	3.0	0.3	0.03	0.003
0	1	1	20k	2.0k	200	20	2.0	0.2	0.02	0.002
1	0	0	15k	1.5k	150	15	1.5	0.15	0.015	0.0015
1	0	1	12k	1.2k	120	12	1.2	0.12	0.012	0.0012
1	1	0	10k	1.0k	100	10	1.0	0.1	0.01	0.001
1	1	1	5k	500	50	5	0.5	0.05	0.005	0.0005

8650B 8651B

Set terminal		CTL4	0	0	0	0	1	1	1	1
		CTL5	0	0	1	1	0	0	1	1
CTL1	CTL2	CTL3 \ CTL6	0	1	0	1	0	1	0	1
0	0	0	100k	10k	1k	100	10	1	1/10	1/100
0	0	1	10k	1k	100	10	1	1/10	1/100	1/1000
0	1	0	50k	5k	500	50	5	1/2	1/20	1/200
0	1	1	33.3k	3.3k	333.3	33.3	3.33	1/3	1/30	1/300
1	0	0	25k	2.5k	250	25	2.5	1/4	1/40	1/400
1	0	1	20k	2k	200	20	2	1/5	1/50	1/500
1	1	0	16.6k	1.6k	166.6	16.6	1.6	1/6	1/60	1/600
1	1	1	8.3k	833.3	83.3	8.3	0.83	1/12	1/120	1/1200

8650E 8651E

Set terminal		CTL4	0	0	0	0	1	1	1	1
		CTL5	0	0	1	1	0	0	1	1
CTL1	CTL2	CTL3 \ CTL6	0	1	0	1	0	1	0	1
0	0	0	32768	3276.8	327.68	32.768	3.276	0.3276	0.03276	0.00327
0	0	1	3276.8	327.68	32.768	3.276	0.327	0.0327	0.00327	0.00032
0	1	0	16384	1638.4	163.84	16.384	1.638	0.1638	0.01638	0.00163
0	1	1	10922.6	1092.26	109.226	10.922	1.092	0.1092	0.01092	0.00109
1	0	0	8192	819.2	81.92	8.192	0.819	0.0819	0.00819	0.00081
1	0	1	6553.6	655.36	65.536	6.553	0.655	0.0655	0.00655	0.00065
1	1	0	5461.3	546.13	54.613	5.461	0.546	0.0546	0.00546	0.00054
1	1	1	2730.6	273.06	27.306	2.730	0.273	0.0273	0.00273	0.00027

Note: Lower digits are omitted.

Baud rate generator

8640CN

CTL1	CTL2	CTL3	CTL4	CTL5	CTL6	Output frequency	Baud rate output example (fo/16)
0	0	0	0	0	0	768 kHz	48000 bits/s
1	0	1	0	0	0	153.6	9600
0	0	1	0	0	0	76.8	4800
0	1	0	0	0	1	38.4	2400
1	0	0	0	0	1	19.2	1200

8650C

CTL1	CTL2	CTL3	CTL4	CTL5	CTL6	Output frequency	Baud rate output example (fo/16)
0	0	0	0	0	0	96.0 kHz	6000 bits/s
1	0	1	0	0	0	19.2	1200
0	0	1	0	0	0	9.6	600
0	1	0	0	0	1	4.8	300
0	1	1	0	0	1	3.2	200
1	0	0	0	0	1	2.4	150
1	1	0	0	0	1	1.6	100
1	1	1	0	0	1	0.8	50

SERIAL RTC MODULE WITH ALARM AND TIMER FUNCTIONS

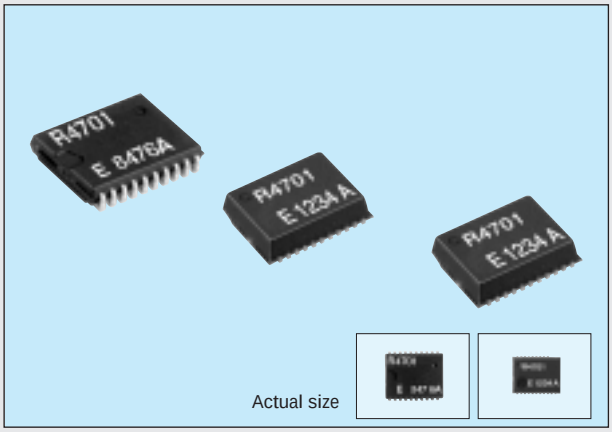
RTC-4701JE/NB

Products number (please refer to page 2)

Q4147017000020 0
Q4147019000020 0

- 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 .
- 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 :-7.6 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.epson.co.jp/device/

Specifications (characteristics)

Absolute Max. rating

Item	Symbol	Condition	Min.	Max.	Unit
Supply voltage	V_{DD}	—	-0.3	+7.0	V
Input voltage	V_{IN}	Input Pin	GND-0.3	V_{DD}+0.3 V	
Output voltage	V_{OUT1}	$\overline{TIRQ}$,$\overline{AIRQ}$		+8.0	
	V_{OUT2}	FOUT,DATA		V_{DD}+0.3 V	
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/fo	Ta=+25 °C, V_{DD}=3 V	5±23	x 10^{-6}
Frequency temperature characteristics	T_{op}	Ta=-10 to +70 °C, Reference at +25 °C	+10 -120	
Frequency voltage characteristics	f/v	Ta=+25 °C,V_{DD}=1.6 to 5.5 V	±2	x 10^{-6}/V
Oscillation start up time	t_{STA}	Ta=+25 °C,V_{DD}=3.0 V	3	s
Aging	fa	Ta=+25 °C, V_{DD}=3 V	±5	x 10^{-6}/year

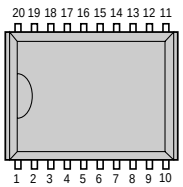
DC characteristics

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

Item	Symbol	Condition		Min.	Typ.	Max.	Unit
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,$\overline{SOFF}$ V_{IN}=V_{DD} or GND		-0.5		0.5	µA
Pulldown R1	R_{DWN1}	V_{DD}=5 V	CE 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 DATA,FOUT pins	4.5	—	5.0	V
	V_{OH2}	V_{DD}=3 V		2.0		3.0	
	V_{OH3}		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}	V_{DD}=3 V				GND+0.8	
	V_{OL3}		I_{OL}=100 µA DATA,FOUT pins			GND+0.1	
	V_{OL4}	V_{DD}=5 V	I_{OL}=1 mA AIRQ, TIRQ pins			GND+0.25	
	V_{OL5}	V_{DD}=3 V				GND+0.4	
Leakage current	I_{OZ}	V_O=GND or V_{DD}, FOUT,DATA , $\overline{AIRQ}$, $\overline{TIRQ}$ pins		-0.5		0.5	µA
Standby current 1	I_{DD1}	V_{DD}=5 V	CE,FOE,$\overline{SOFF}$=GND AIRQ,TIRQ=V_{DD} 32.768 kHz output is OFF. Sensor output is OFF.	—	1.0	2.0	
Standby current 2	I_{DD2}	V_{DD}=3 V			0.5	1.0	

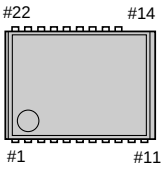
Terminal connection

● **RTC-4701JE**



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

● **RTC-4701NB**

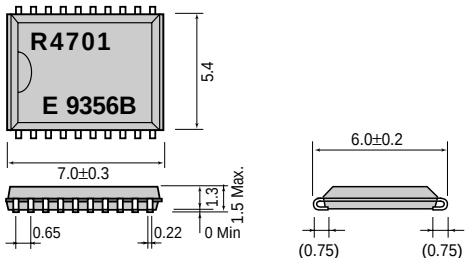


No.	Pin terminal	No.	Pin terminal
1	GND	22	N.C
2	$\overline{SOFF}$	21	N.C
3	VTEMP	20	N.C
4	FOE	19	N.C
5	DATA	18	N.C
6	CLK	17	N.C
7	$\overline{TIRQ}$	16	N.C
8	$\overline{AIRQ}$	15	N.C
9	$\overline{CE}$	14	N.C
10	FOUT	13	—
11	V_{DD}	12	—

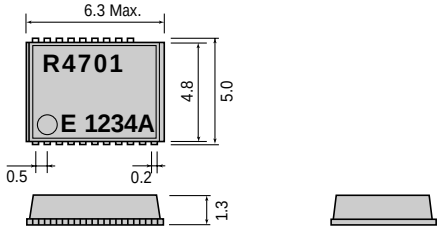
External dimensions

(Unit: mm)

● **RTC-4701JE** (VSOJ 20-pin)



● **RTC-4701NB** (SON 22-pin)



Temperature sensor characteristics

GND=0 V,Ta=-40 °C to +85 °C

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Temperature output voltage	Vtemp	Ta=+25 °C, GND based output voltage VTEMP 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
Linearity	ΔNL	-40 °C ≤ Ta ≤ +85 °C,VDD=2.7 to 5.5 V			±2.0	%
Output resistance	Ro	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

BANK0

Address	Register symbol	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
0	Sec	fos	S 40	S 20	S 10	S 8	S 4	S 2	S 1
1	Min	fr	Min 40	Min 20	Min 10	Min 8	Min4	Min 2	Min 1
2	Hour	fr	0	Hour 20	Hour 10	Hour 8	Hour4	Hour 2	Hour 1
3	Day of Week	fr	W 6	W 5	W 4	W 3	W 2	W 1	W 0
4	Day	fr	0	Day 20	Day 10	Day 8	Day 4	Day 2	Day 1
5	Month	fr	C	0	Month 10	Month 8	Month 4	Month 2	Month 1
6	Year	Year 80	Year 40	Year 20	Year 10	Year 8	Year 4	Year 2	Year 1
7	Minutes Alarm	AE	A-Min 40	A-Min 20	A-Min 10	A-Min 8	A-Min 4	A-Min 2	A-Min 1
8	Hours Alarm	AE	*	A-Hr 20	A-Hr 10	A-Hr 8	A-Hr 4	A-Hr 2	A-Hr 1
9	Day of week Alarm	AE	A-W 6	A-W 5	A-W 4	A-W 3	A-W 2	A-W 1	A-W 0
A	Day Alarm	AE	*	A-Day 20	A-Day 10	A-Day 8	A-Day 4	A-Day 2	A-Day 1
B	–	–	–	–	–	–	–	–	–
C	Timer setup	TE	*	TD_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

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

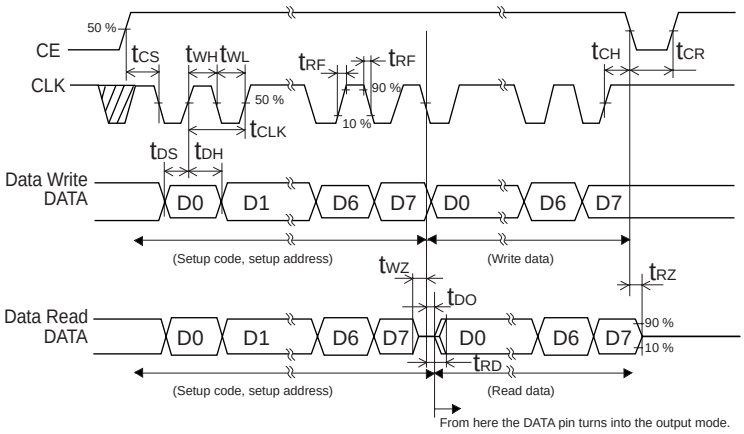
0 : Always set this bit to 0 .
Registers 0 to A are the same in BANK0 and BANK1.

AC characteristics

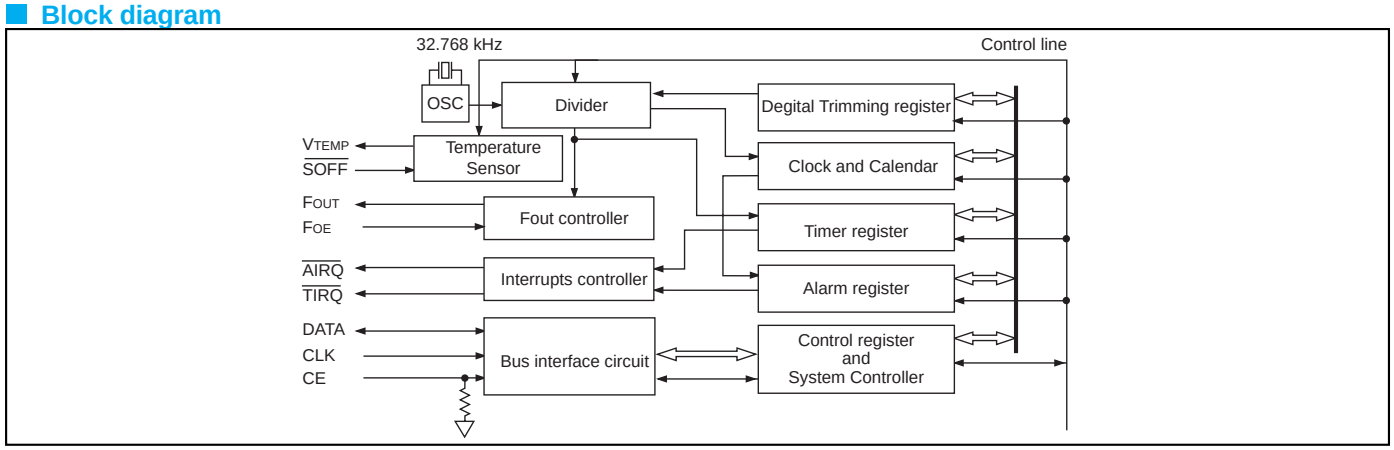
(GND=0 V,Ta=-40 ˚C to +85 ˚C)

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		
CLK H Pulse Width	t_{WH}						
CLK L Pulse Width	t_{WL}		300		175		
CE setup time	t_{CS}						
CE hold time	t_{CH}	—		—		—	
CE recovery time	t_{CR}		400		300		ns
Write data setup time	t_{DS}		75		50		
Write data hold time	t_{DH}						
Write data disable delay time	t_{WZ}		0		0		
Output mode switching time	t_{DO}						
Read data delay time	t_{RD}	C_L=50 pF		300		120	
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	%
Oscillation stop detection time	t_{OSC}		10	—	10	—	ms

Timing chart



Block diagram



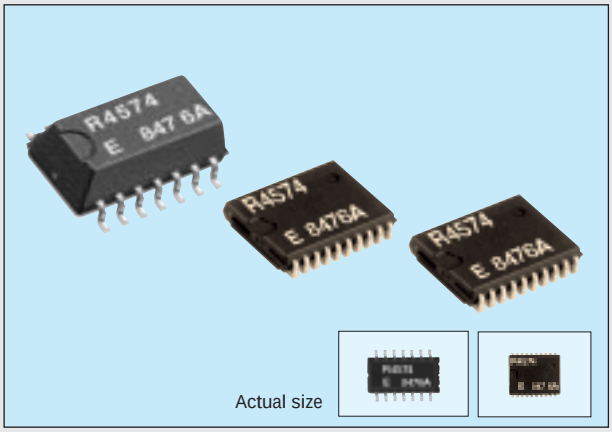
SERIAL RTC MODULE WITH ALARM AND TIMER FUNCTIONS

RTC-4574SA/JE

Products number (please refer to page 2)

Q4145745000020 0
Q4145747000010 0

- 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 µA/3 V. (Typ.)



The details are mentioned in the application manual.

http://www.epson.co.jp/device/

Specifications (characteristics)

Absolute Max. rating

Item	Symbol	Condition	Min.	Max.	Unit
Supply voltage	V_{DD}	—	-0.3	+7.0	V
Input voltage	V_{IN}	Input Pin	GND-0.3	V_{DD}+0.3 V	
Output voltage	V_{OUT1}	$\overline{TIRQ}$,$\overline{AIRQ}$		+8.0	
	V_{OUT2}	F_{OUT},DATA		V_{DD}+0.3 V	
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/fo	Ta=+25 °C, V_{DD}=3 V	5±23	x 10^{-6}
Frequency temperature characteristics	T_{op}	Ta=-10 °C to +70 °C, Reference at +25 °C	+10 -120	
Frequency voltage characteristics	f/v	Ta=+25 °C,V_{DD}=1.6 to 5.5 V	±2	x 10^{-6}/ V
Oscillation start up time	t_{STA}	Ta=+25 °C,V_{DD}=1.6 V	3	s
Aging	fa	Ta=+25 °C, V_{DD}=3 V	±5	x 10^{-6}/year

*Equivalent to 1 minute of monthly deviation

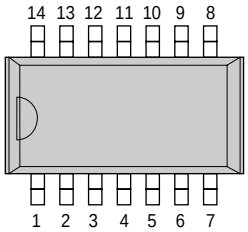
DC characteristics

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

Item	Symbol	Condition		Min.	Typ.	Max.	Unit
Input voltage	V_{IH}	CE_0,CE_1,CLK, DATA,F_{CON} 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 F_{CON} pins		-0.5		0.5	µA
Pulldown R1	R_{DWN1}	V_{DD}=5 V	CE_0 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 DATA,F_{OUT} pins	4.5		5.0	V
	V_{OH2}	V_{DD}=3 V		2.0		3.0	
	V_{OH3}		I_{OH}=-100 µA DATA,F_{OUT} pins	2.9			
Output voltage 2	V_{OL1}	V_{DD}=5 V	I_{OL}=1 mA DATA,F_{OUT} pins	GND		GND+0.5	
	V_{OL2}	V_{DD}=3 V				GND+0.8	
	V_{OL3}		I_{OL}=100 µA DATA,F_{OUT} pins			GND+0.1	
	V_{OL4}	V_{DD}=5 V	I_{OL}=1 mA $\overline{AIRQ}$, $\overline{TIRQ}$ pins			GND+0.25	
	V_{OL5}	V_{DD}=3 V				GND+0.4	
Output leakage current	I_{OZ}	V_{OUT}=GND or V_{DD}, DATA , $\overline{AIRQ}$, $\overline{TIRQ}$ pins		-0.5		0.5	µA
Standby current 1	I_{DD1}	V_{DD}=5 V	CE_0,CE_1=GND DATA , $\overline{AIRQ}$, $\overline{TIRQ}$ pins		1.0	2.0	
Standby current 2	I_{DD2}	V_{DD}=3 V		—	0.5	1.0	

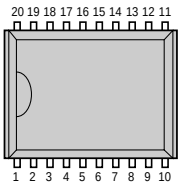
Terminal connection

RTC-4574SA



No.	Pin terminal	No.	Pin terminal
1	GND	14	F_{CON}
2	F_{OUT}	13	CE_1
3	N.C	12	DATA
4	N.C	11	CLK
5	N.C	10	$\overline{TIRQ}$
6	N.C	9	$\overline{AIRQ}$
7	V_{DD}	8	CE_0

RTC-4574JE

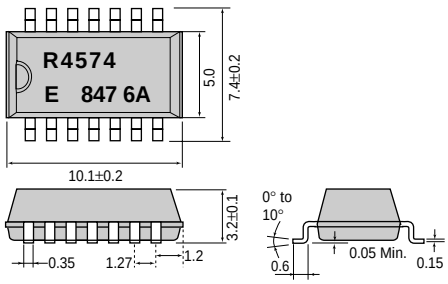


No.	Pin terminal	No.	Pin terminal
1	V_{DD}	20	N.C
2	F_{OUT}	19	N.C
3	CE_0	18	N.C
4	$\overline{AIRQ}$	17	N.C
5	$\overline{TIRQ}$	16	N.C
6	CLK	15	N.C
7	DATA	14	N.C
8	CE_1	13	N.C
9	F_{CON}	12	N.C
10	GND	11	N.C

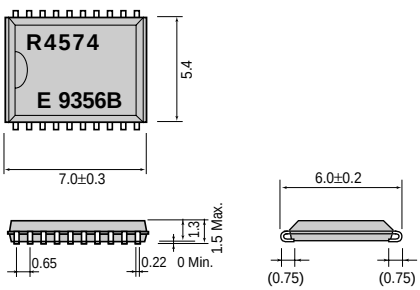
External dimensions

(Unit: mm)

RTC-4574SA (SOP 14-pin)



RTC-4574JE (VSOJ 20-pin)



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	*	FD_4	FD_3	*	FD_2	FD_1	FD_0
C	Timer interrupt control	TE	*	TD_1	TD_0	*	*	*	*
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

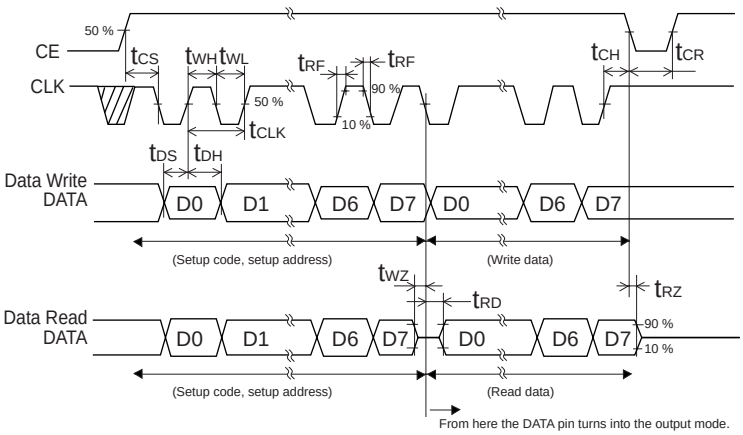
0 : Always set this bit to 0 .

AC characteristics

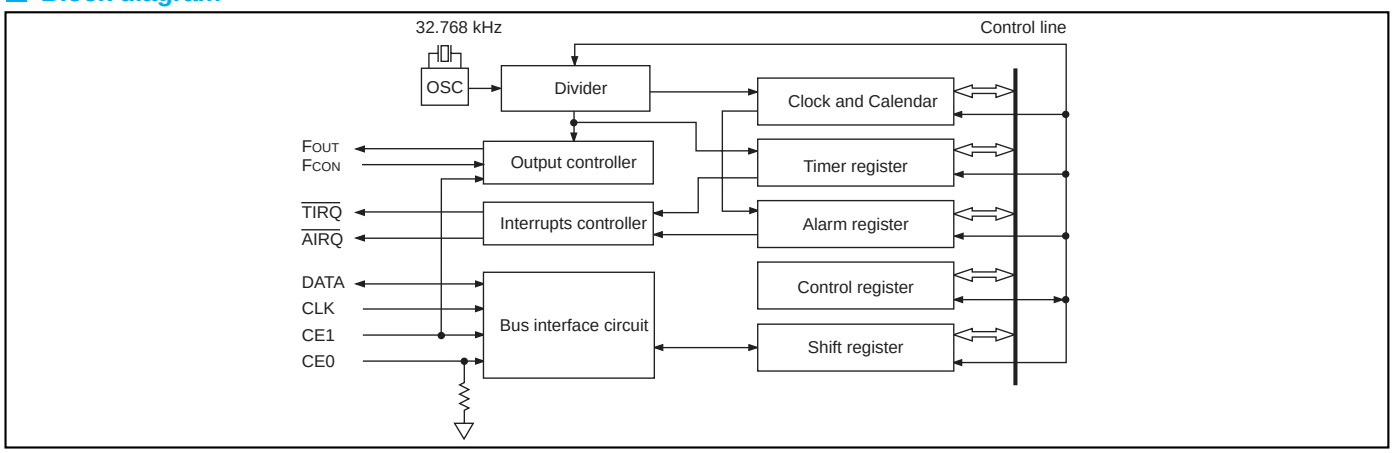
(GND=0 V,Ta=-40 °C to +85 °C)

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}		800		350		
CLK H Pulse Width	t_{WH}						
CLK L Pulse Width	t_{WL}		400		175		
CE setup time	t_{CS}	—		—		—	
CE hold time	t_{CH}						ns
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_L=50 pF		300		120	
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	—	35	65	40	60	%
Oscillation stop detection time	t_{OSC}		10	—	10	—	ms

Timing chart



Block diagram



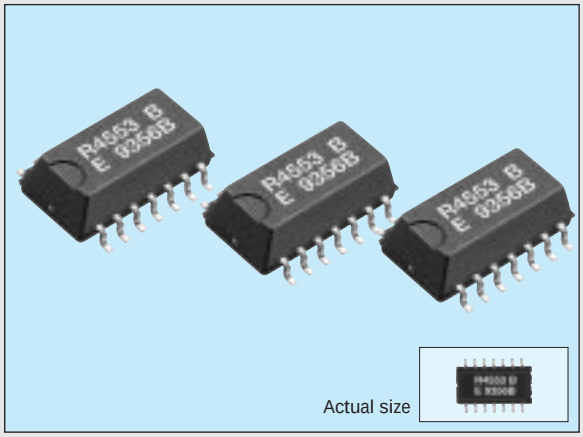
SERIAL-INTERFACE REAL TIME CLOCK MODULE

RTC-4553

Products number (please refer to page 2)

Q4145535xxxxx00

- 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.
- Builtin 30 x 4-bit S-RAM.
- Reference pulse output. (1024 Hz, 1/10 Hz)



The details are mentioned in the application manual.

http://www.epson.co.jp/device/

Specifications (characteristics)

Absolute Max. rating

Item	Symbol	Condition	Min.	Max.	Unit
Supply voltage	V_{DD}	V_{DD}-GND	-0.3	+6.0	V
Input voltage	V_{IN}	S_{IN}, $\overline{SCK}$, $\overline{WR}$, $\overline{CS_0}$, CS_1		V_{DD}+0.3	
Output voltage	V_{OUT}	S_{OUT}, $\overline{TP_{OUT}}$			
Storage temperature	T_{STG}	Stored as bare product after unpacking	-55	+125	°C

Operating range

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating voltage	V_{DD}	—	2.7	5.0	5.5	V
Operating temperature	T_{OPR}	No conden sation	-30	—	+70	˚C

Frequency characteristics

Item	Symbol	Condition		Range	Unit
Frequency tolerance	Δf/fo	Ta=+25 °C, V_{DD}=5 V	AA	5±5	x 10^{-6}
			A	5±10	
			B	5±20	
Frequency temperature characteristics	T_{op}	Ta=-10 °C to +70 °C, V_{DD}=5 V Reference at +25 °C		+10 -120	
Frequency voltage characteristics	f/v	Ta=Fix, V_{DD}=2 V to 5.5 V Reference at 5 V		±5	
Aging	fa	Ta=+25 °C, V_{DD}=5 V, first year			x 10^{-6}/ year

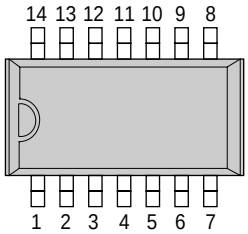
DC characteristics

● V_{DD}=5 V±10 %

(GND=O V, Ta=-30 °C to +70 °C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Data holding voltage	V_{DH}	—	2.0	—	5.5	V
Current consumption	I_{DD1}	$\overline{SCK}$=500 kHz	—		100	µA
	I_{DD2}	$\overline{SCK}$=O Hz		1.0	3.0	
Output voltage	V_{OH}	I_{OH}=-400 µA	V_{DD}-04		—	V
	V_{OL}	I_{OL}=1.6 mA	—		0.4	
Off leak current	I_{OZH}	V_{OUT}=5.5 V	-2.0		2.0	µA
	I_{OZL}	V_{OUT}=0 V				
Input voltage	V_{IH}	—	4/5 V_{DD}	—	—	V
	V_{IL}		—		1/5 V_{DD}	
Input current	I_{IH}	V_{IN}=5.5 V	-2.0		2.0	µA
	I_{IL}	V_{IN}=0 V				
Oscillation start-up time	T_{osc}	Ta=+25 °C	—		3.0	s

Terminal connection



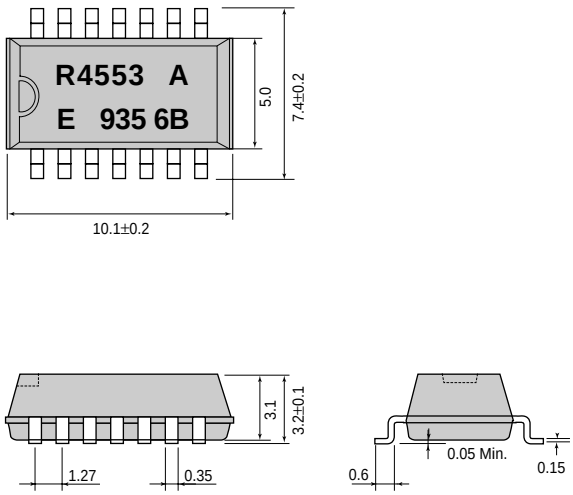
No.	Pin terminal	No.	Pin terminal
1	GND	14	$\overline{TP_{OUT}}$
2	$\overline{WR}$	13	S_{OUT}
3	S_{IN}	12	CS_1
4	$\overline{SCK}$	11	$\overline{CS_0}$
5	L1	10	L5
6	L2	9	L4
7	L3	8	V_{DD}

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

External dimensions

(Unit: mm)

● **RTC-4553** (SOP 14-pin)



Register table

Address					Register symbol	MODE 0					MODE 1				MODE 2			
						Counter control register					User RAM Domain 1				User RAM Domain 2			
	A_3	A_2	A_1	A_0		D_3	D_2	D_1	D_0	Register name	D_3	D_2	D_1	D_0	D_3	D_2	D_1	D_0
0	0	0	0	0	S_1	S_8	S_4	S_2	S_1	1-second digit register	RA_3	RA_2	RA_1	RA_0	RA_{63}	RA_{62}	RA_{61}	RA_{60}
1	0	0	0	1	S_{10}	0	S_{40}	S_{20}	S_{10}	10-second digit register	RA_7	RA_6	RA_5	RA_4	RA_{67}	RA_{66}	RA_{65}	RA_{64}
2	0	0	1	0	MI_1	mi_8	mi_4	mi_2	mi_1	1-minute digit register	RA_{11}	RA_{10}	RA_9	RA_8	RA_{71}	RA_{70}	RA_{69}	RA_{68}
3	0	0	1	1	MI_{10}	0	mi_{40}	mi_{20}	mi_{10}	10-minute digit register	RA_{15}	RA_{14}	RA_{13}	RA_{12}	RA_{75}	RA_{74}	RA_{73}	RA_{72}
4	0	1	0	0	H_1	h_8	h_4	h_2	h_1	1-hour digit register	RA_{19}	RA_{18}	RA_{17}	RA_{16}	RA_{79}	RA_{78}	RA_{77}	RA_{76}
5	0	1	0	1	H_{10}	PM/AM	0	h_{20}	h_{10}	10-hour digit register	RA_{23}	RA_{22}	RA_{21}	RA_{20}	RA_{83}	RA_{82}	RA_{81}	RA_{80}
6	0	1	1	0	W	0	w_4	w_2	w_1	Day of the week digit register	RA_{27}	RA_{26}	RA_{25}	RA_{24}	RA_{87}	RA_{86}	RA_{85}	RA_{84}
7	0	1	1	1	D_1	d_8	d_4	d_2	d_1	1-day digit register	RA_{31}	RA_{30}	RA_{29}	RA_{28}	RA_{91}	RA_{90}	RA_{89}	RA_{88}
8	1	0	0	0	D_{10}	0	0	d_{20}	d_{10}	10-day digit register	RA_{35}	RA_{34}	RA_{33}	RA_{32}	RA_{95}	RA_{94}	RA_{93}	RA_{92}
9	1	0	0	1	MO_1	mo_8	mo_4	mo_2	mo_1	1-month digit register	RA_{39}	RA_{38}	RA_{37}	RA_{36}	RA_{99}	RA_{98}	RA_{97}	RA_{96}
A	1	0	1	0	MO_{10}	0	0	0	mo_{10}	10-month digit register	RA_{43}	RA_{42}	RA_{41}	RA_{40}	RA_{103}	RA_{102}	RA_{101}	RA_{100}
B	1	0	1	1	Y_1	y_8	y_4	y_2	y_1	1-year digit register	RA_{47}	RA_{46}	RA_{45}	RA_{44}	RA_{107}	RA_{106}	RA_{105}	RA_{104}
C	1	1	0	0	Y_{10}	y_{80}	y_{40}	y_{20}	y_{10}	10-year digit register	RA_{51}	RA_{50}	RA_{49}	RA_{48}	RA_{111}	RA_{110}	RA_{109}	RA_{108}
D	1	1	0	1	C_1	TPS	30ADJ	CNTR	24/12	Control register 1	RA_{55}	RA_{54}	RA_{53}	RA_{52}	RA_{115}	RA_{114}	RA_{113}	RA_{112}
E	1	1	1	0	C_2	BUSY	PONC	—	*	Control register 2	RA_{59}	RA_{58}	RA_{57}	RA_{56}	RA_{119}	RA_{118}	RA_{117}	RA_{116}
F	1	1	1	1	C_3	SYSR	TEST	MS_1	MS_0	Control register 3	Same as MODE 0				Same as MODE 0			

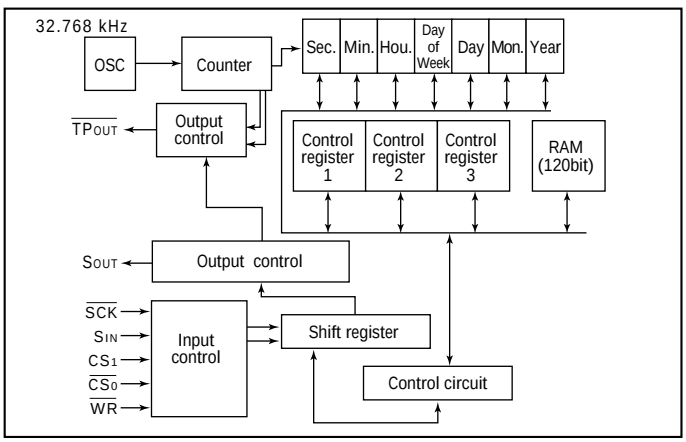
Note: * TEST bit should be "0".

AC characteristics

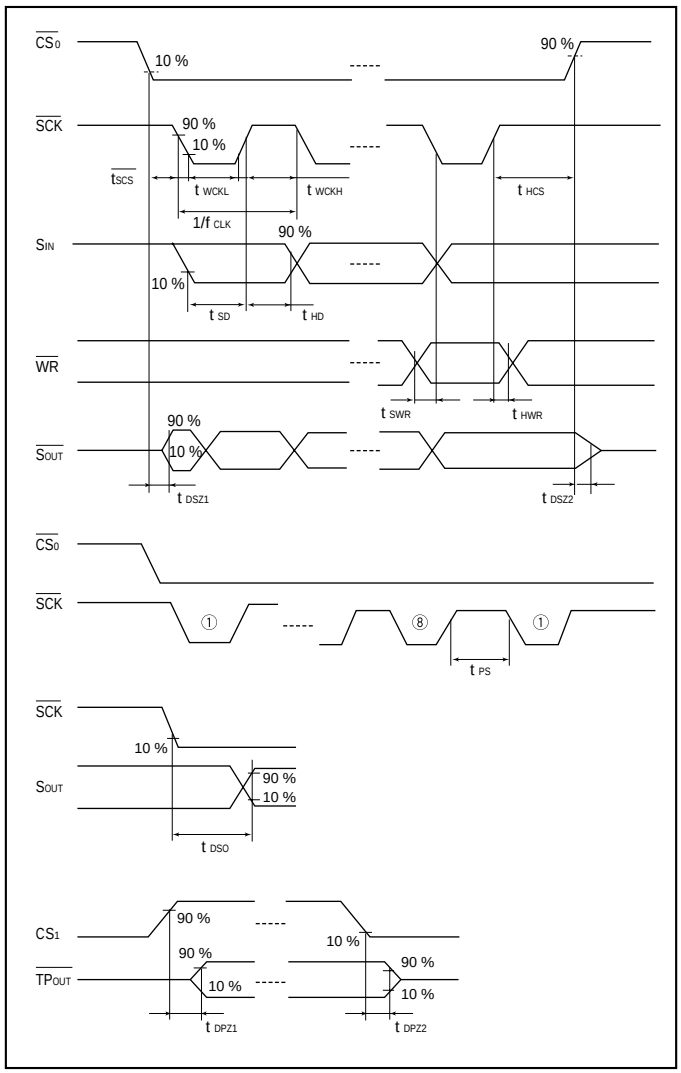
(Ta=-30 °C to +70 °C, V_{DD}=5 V±10 %, GND=0 V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
$\overline{SCK}$ input frequency	f_{CLK}		—		500	kHz
$\overline{SCK}$ "L" time	t_{WCKL}	—		—	—	
$\overline{SCK}$ "H" time	t_{WCKH}		1.0			
$\overline{SCK}$ pause time	t_{PS}					
$\overline{CS_0}$ setup time	t_{SCS}		0			
$\overline{CS_0}$ hold time	t_{HCS}		0.5			µs
S_{IN} data setup time	t_{SD}	—	0.2	—	—	
S_{IN} data Hold time	t_{HD}					
$\overline{WR}$ setup time	t_{SWR}		1.0			
$\overline{WR}$ hold time	t_{HWR}		0.5			
S_{OUT} delay time	t_{DSO}			150	500	
$\overline{CS_0}$, and CS_1 enable to S_{OUT} output	t_{DSZ1}					
$\overline{CS_0}$ disable to S_{OUT} high Z	t_{DSZ2}	C_L=100 pF	—	—	100	ns
CS_1 enable to S_{OUT} output	t_{DPZ1}					
CS_1 enable to S_{OUT} high Z	t_{DPZ2}					

Block diagram



Timing chart



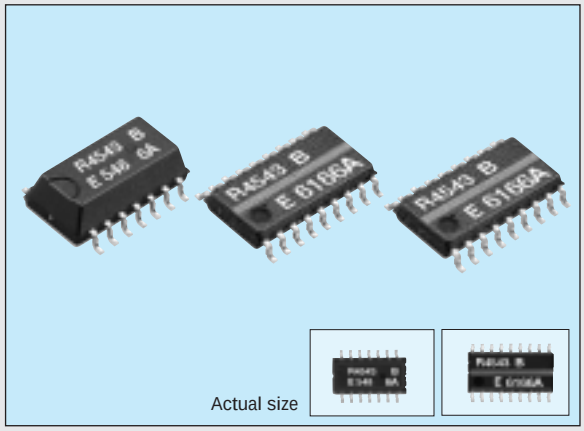
SERIAL-INTERFACE REAL TIME CLOCK MODULE

RTC-4543SA/SB

Products number (please refer to page 2)

Q4145435000020 0
Q4145436000020 0

- Built-in crystal unit allows adjustment-free efficient operation.
- Automatic leap year correction.
- Output selectable between 32.768 kHz/1 Hz.
- Supply voltage detection voltage: 1.7 V ±0.3 V.



The details are mentioned in the application manual.

http://www.epson.co.jp/device/

Specifications (characteristics)

Absolute Max. rating

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

Frequency characteristics

Item	Symbol	Condition	Range	Unit
Frequency tolerance	Δf/fo	Ta=+25 °C, V_{DD}=5 V	5±23	x 10^{-6}
Frequency temperature characteristics	Top	-10 to +70 °C	+10/-120	
Frequency voltage characteristics	f/V	Ta=+25 °C, V_{DD}=2.0 to 5.5 V	±2 Max.	x 10^{-6}/V
Oscillation start time	tosc	Ta=+ 25 °C, V_{DD}=2.5 V	3 Max.	s
Aging	fa	First year Ta=+25 °C, V_{DD}=5 V	±5 Max.	x 10^{-6}/year

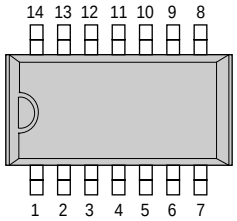
DC characteristics

(V_{DD}=5 V±0.5 V, Ta=-40 °C to +85 °C)

Item		Symbol	Condition		Min.	Typ.	Max.	Unit
"H" input voltage		V_{IH}	WR, DATA, CE, CLK, FOE,FSEL pins		0.8V_{DD}		—	V
"L" input voltage		V_{IL}			—		0.2V_{DD}	
Input off-leak current		I_{OFF}	WR, CE, CLK, FOE,FSEL pins				0.5	µA
"H" output voltage		V_{OH1}	V_{DD}=5.0 V	I_{OH}=-1.0 mA	4.5	—	—	V
		V_{OH2}	V_{DD}=3.0 V	DATA, FOUT pins	2.5			
"L" output voltage		V_{OL1}	V_{DD}=5.0 V	I_{OL}=1.0 mA	—		0.5	
		V_{OL2}	V_{DD}=3.0 V	DATA, FOUT pins			0.8	
Output leak current		I_{OZH}	V_{OUT}=5.5 V	DATA, FOUT pins	-1.0		1.0	µA
		I_{OZL}	V_{OUT}=0 V					
Supply detection voltage		V_{DT}	—		1.4	1.7	2.0	V
Output load conditions		C_L	FOUT pin		30 pF(Max.)			
		N			2LS-TTL			
Current consumption	1	I_{DD1}	V_{DD}=5.0 V	CE="L", FOE="L" FSEL="H"	—	1.5	3.0	µA
	2	I_{DD2}	V_{DD}=3.0 V			1.0	2.0	
	3	I_{DD3}	V_{DD}=2.0 V			0.5	1.0	
	4	I_{DD4}	V_{DD}=5.0 V	CE="L", FOE="H" FSEL="L" No load on the FOUT pin		4.0	10.0	
	5	I_{DD5}	V_{DD}=3.0 V			2.5	6.5	
	6	I_{DD6}	V_{DD}=2.0 V			1.5	4.0	

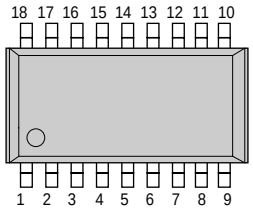
Terminal connection

● **RTC-4543SA**



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

● **RTC-4543SB**

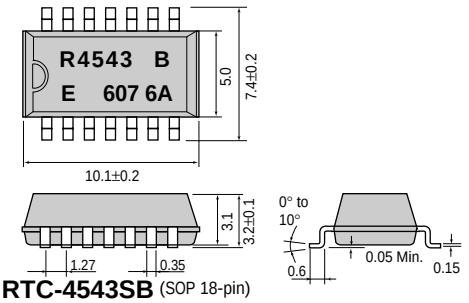


No.	Pin terminal	No.	Pin terminal
1	N.C	18	N.C
2	N.C	17	N.C
3	N.C	16	N.C
4	N.C	15	N.C
5	FOE	14	VDD
6	WR	13	N.C
7	FSEL	12	CLK
8	CE	11	DATA
9	GND	10	FOUT

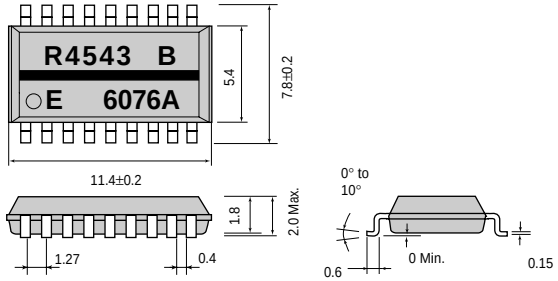
External dimensions

(Unit: mm)

● **RTC-4543SA** (SOP 14-pin)



● **RTC-4543SB** (SOP 18-pin)



Register table

	MSB							LSB
Seconds (0 to 59)	FDT	s 40	s 20	s 10	s 8	s 4	s 2	s 1
Minutes (0 to 59)	*	mi 40	mi 20	mi 10	mi 8	mi 4	mi 2	mi 1
Hour (0 to 23)	*	*	h 20	h 10	h 8	h 4	h 2	h 1
Day of the week (1 to 7)					*	w 4	w 2	w 1
Day (1 to 31)	*	*	d 20	d 10	d 8	d 4	d 2	d 1
Month (1 to 12)	TM	*	*	mo 10	mo 8	mo 4	mo 2	mo 1
year (0 to 99)	y 80	y 40	y 20	y 10	y 8	y 4	y 2	y 1

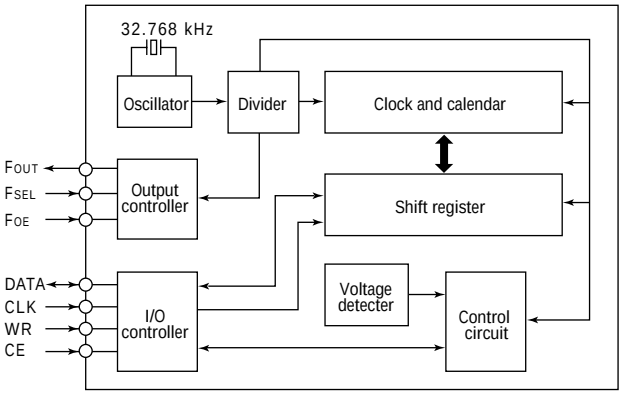
FDT bit: Supply voltage detection bit. TM bit: Test bit always set this bit to "0".

AC characteristics

(Ta=-40 °C to +85 °C, C_L=50 pF)

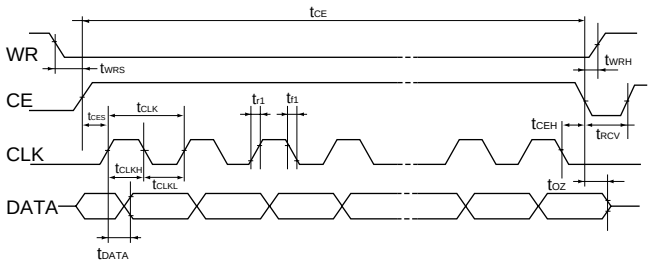
Item		Symbol	V_{DD}= 5 V± 10 %		V_{DD}= 3 V± 10 %		Unit
			Min.	Max.	Min.	Max.	
CLK clock cycle		t CLK	0.75	7800	1.5	7800	µs
CLK high pulse width		t CLKH	0.375	3900	0.75	3900	
CLK low pulse width		t CLKL					
CE setup time		t CES					
CE hold time		t CEH		—		—	
CE enable time		t CE	—	0.9	—	0.9	s
Write data setup time		t SD	0.1	—	0.2	—	µs
Write data hold time		t HD			0.1		
WR setup time		t WRS	100		100		ns
WR hold time		t WRH					
DATA output delay time		t DATA	—	0.2	—	0.4	µs
DATA output floating time		t DZ		0.1		0.2	
Clock input rise time		t r1		50		100	ns
Clock input fall time		t f1					
FOUT rise time	C_L= 30 pF	t r2		100		200	
FOUT fall time		t f2					
Disable time		t XZ					
Enable time		t ZX					
FOUT duty ratio		Duty	40	60	40	60	%
Wait time		t rcv	0.95	—	1.9	—	µs

Block diagram

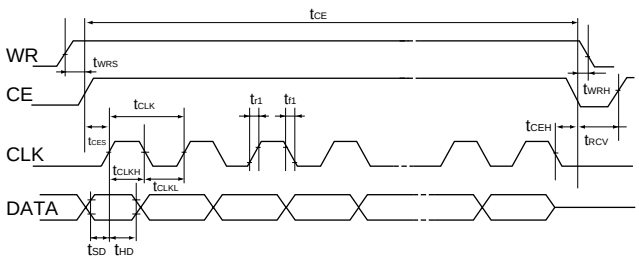


Timing chart

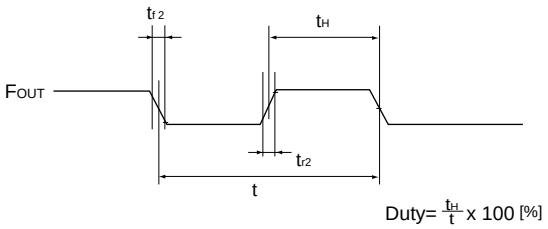
Data read



Data write

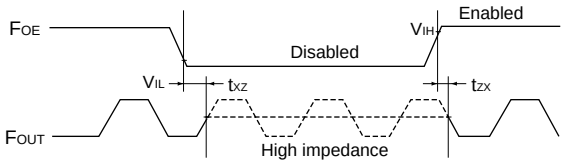


FOUT



Duty= $\frac{t_H}{t}$ x 100 [%]

Disabled and Enabled

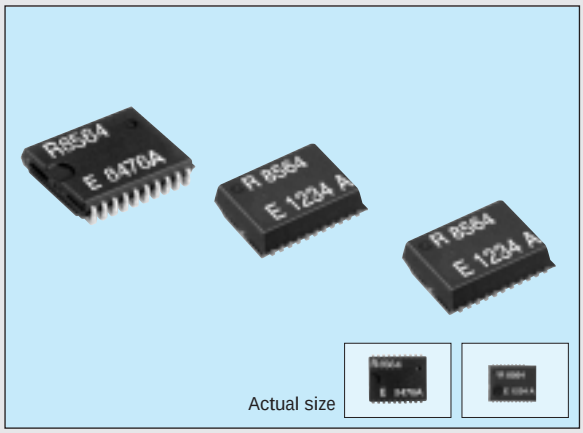


I²C-BUS INTERFACE REAL TIME CLOCK MODULE

RTC-8564JE/NB

Products number (please refer to page 2)

Q4185647000010 0
Q4185649000020 0



- 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.(-20 °C to +70 °C)
- Low power consumption at 275 nA/3.0 V. (Typ.)

The details are mentioned in the application manual.

http://www.epson.co.jp/device/

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}	Between V_{DD} and GND	-0.5	+6.5	V
	I_{DD}	V_{DD} pin	-50	50	mA
Input voltage	Vi	Input pin	GND-0.5	V_{DD}+0.5	V
Output voltage	Vo	$\overline{INT}$ pins			
DC Input current	Ii	—	-10	10	mA
DC Output current	Io				
Storage temperature Range	T_{STG}	Stored as bare product after unpacking	-55	+125	˚C

Operating range

Item	Symbol	Condition	Min.	Max.	Unit
Supply voltage range	V_{DD}	I²C-BUS access at 400 kHz	1.8	5.5	V
Clock voltage range		—	V_{LOW}		
Operating temperature range	T_{OPR}	No condensation	-40	+85	˚C

Frequency characteristics

Item	Symbol	Condition	Max.	Unit
Frequency precision	Δf/fo	Ta=+25 ˚C, V_{DD}=3.0 V	5±23	× 10⁻⁶
Frequency temperature characteristics	T_{op}	Ta=+25˚C, -10 ˚C to +70 ˚C,V_{DD}=3.0 V	+10 -120	
Frequency voltage characteristics	f/v	Ta=+25 ˚C, V_{DD}=1.2 V to 5.5 V	±2	× 10⁻⁶/V
Oscillation start-up time	t_{STA}	Ta=+25 ˚C, V_{DD}=1.8 V	3	s
Aging	fa	Ta=+25 ˚C, V_{DD}=3.0 V	±5	× 10⁻⁶/year

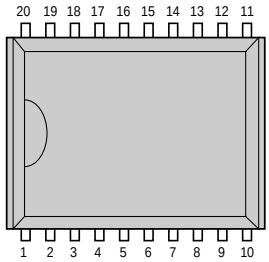
DC characteristics

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

Item	Pin	Symbol	Condition	Min.	Typ.	Max.	Unit
Power current (during access)	—	I_{DD0}	f_{SCL}=400 kHz	—	—	800	µA
			f_{SCL}=100 kHz			200	
Power current (not during access) (CLKOUT=0 Hz)		I_{DD}	f_{SCL}=0 Hz, V_{DD}=5.0 V	—	0.33	0.80	
			f_{SCL}=0 Hz, V_{DD}=3.0 V		0.275	0.70	
			f_{SCL}=0 Hz, V_{DD}=2.0 V		0.25	0.65	
Power current (not during access) (CLKOUT=32.768 kHz)		I_{DD32k}	f_{SCL}=0 Hz, V_{DD}=5.0 V		2.5	3.4	
			f_{SCL}=0 Hz, V_{DD}=3.0 V		1.5	2.2	
			f_{SCL}=0 Hz, V_{DD}=2.0 V		1.1	1.6	
"L" input voltage		V_{IL}	—	-0.5	—	0.3xV_{DD}	V
"H" input voltage		V_{IH}		0.7xV_{DD}		V_{DD}+0.5	
"L" output current	SDA	I_{OL}(SDA)	V_{OL}=0.4 V, V_{DD}=5 V	-3	—	—	mA
"L" output current	$\overline{INT}$	I_{OL}($\overline{INT}$)		-1			
	CLKOUT	I_{OL}(CLKOUT)					
"H" output current		I_{OH}(CLKOUT)		—		1	
Leakage current	—	I_{LO}	V_O=V_{DD} or GND	-1		1	µA
Low voltage detection		V_{LOW}	Ta=-40 °C to +85 °C	—	0.9	1.1	V
			Ta=-20 °C to +70 °C		0.9	1.0	

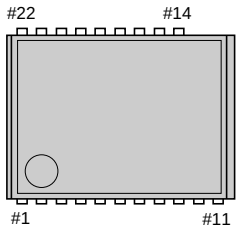
Terminal connection

RTC-8564JE



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	$\overline{INT}$	11	N.C

RTC-8564NB

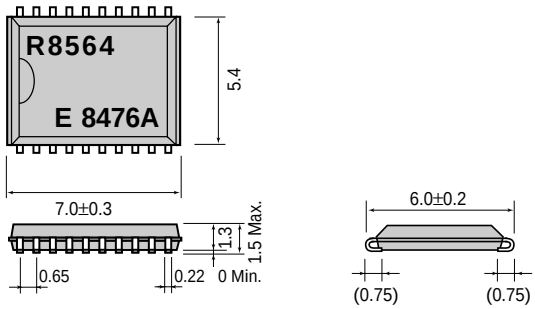


No.	Pin terminal	No.	Pin terminal
1	$\overline{INT}$	22	N.C
2	GND	21	N.C
3	(GND)	20	N.C
4	N.C	19	N.C
5	SDA	18	N.C
6	SCL	17	N.C
7	CLKOUT	16	N.C
8	V_{DD}	15	N.C
9	CLKOE	14	N.C
10	N.C	13	—
11	N.C	12	—

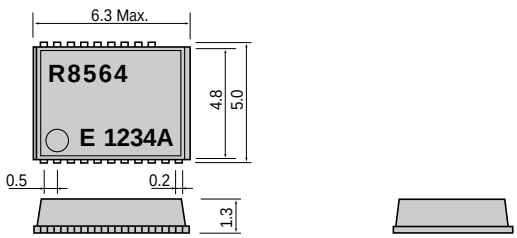
External dimensions

(Unit: mm)

RTC-8564JE (VSOJ 20-pin)



RTC-8564NB (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	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

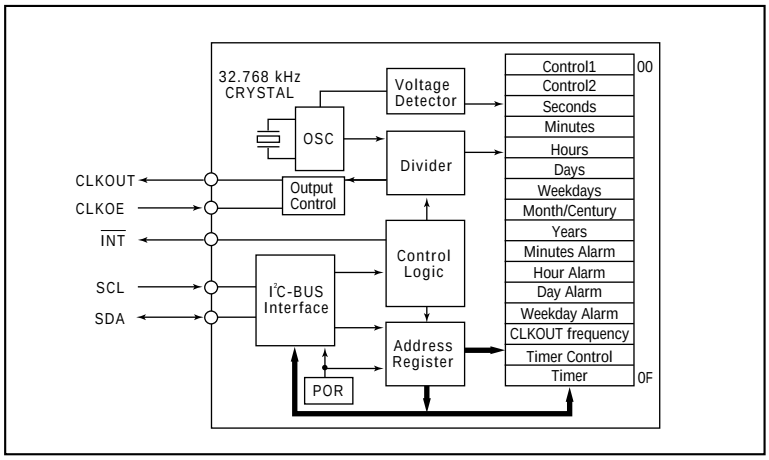
0 : Always set this bit to 0 .

AC characteristics

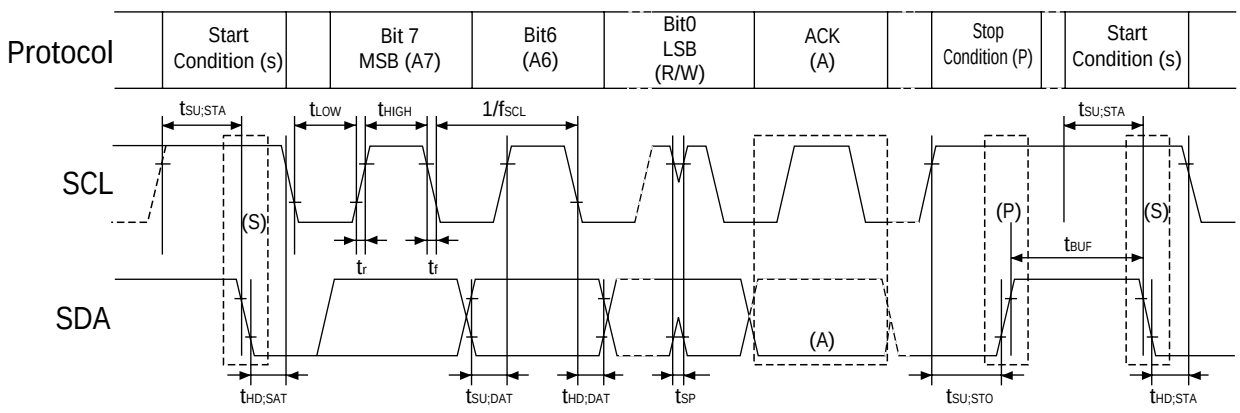
(V_{DD}=1.8 V to 5.5 V, Ta=-40 °C to +85 °C)

Item	Symbol	Min.	Max.	Unit
SCL clock frequency	f_{SCL}	—	400	kHz
Tolerance spike time on bus	t_{SW}		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			
Date set-up time	$t_{SU;DAT}$	100	—	ns
Date hold time	$t_{HD;DAT}$	0		
Stop condition set-up time	$t_{SU;STO}$	4.0		µs

Block diagram



Timing chart



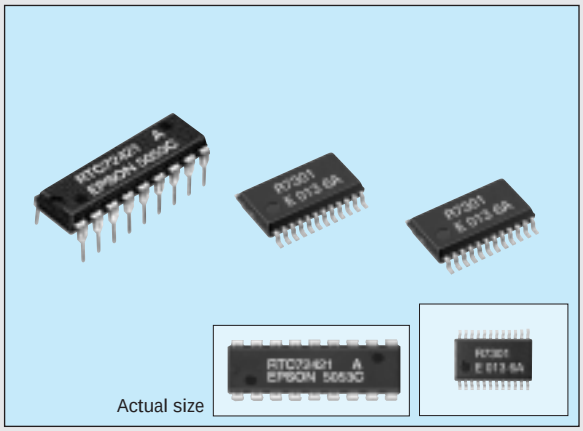
Note : I²C access time between a START and a START condition or between a START and a STOP condition to this device must be less than one second.

4-bit REAL TIME CLOCK MODULE

RTC-7301SF/DG

Products number (please refer to page 2)

Q4273018000200
Q4273011000200



- Built-in liquid 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: ±192 x 10^{-6})
- Built-in alarm and timer interrupt functions.
- Built-in semiconductor temperature sensor (Voltage output: -7.8 mV / °C, RTC-7301SF)
- Operating voltage range:2.4 V to 5.5 V, time keeping voltage range: 1.6 V to 5.5 V
- Low current consumption (0.6 µA / 3 V Typ.)
- High speed parallel interface compatible with S-RAM

The details are mentioned in the application manual.

http://www.epson.co.jp/device/

Specifications (characteristics)

Absolute Max. ratings

GND=0V

Item	Symbol	Condition	Min.	Max.	Unit
Power supply voltage	V_{DD}	———	-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	°C

Operating conditions

GND=0V

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

Frequency characteristics

Item	Symbol	Condition	Specifications	Unit
Frequency precision	Δf/fo	Ta=+25 °C, V_{DD}= 3.0 V	5 ± 23	x 10^{-6}
Frequency voltage characteristics	f/V	Ta=+25 °C, V_{DD}= 1.6 V to 5.5V	±2 Max.	x 10^{-6}/V
Frequency temperature characteristics	T_{OP}	Ta=-10 °C to +70 °C, V_{DD}= 3.0 V	+10/-120	x 10^{-6}
Oscillating starting time	t_{STA}	Ta=+25 °C, V_{DD}= 2.4 V	3 (Max.)	s
Aging amount	fa	Ta=+25 °C, V_{DD}= 3.0 V	±5 Max.	x 10^{-6}/Y

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
Current consumption (When non-accessed) FOUT =Output OFF VTEMP =Output OFF	I_{DD1}	V_{DD}= 5 V	$\overline{CS0}$,$\overline{RD}$,$\overline{WR}$=V_{DD} A0-A3,CS1=GND D0-D3,IRQ=Hi-z FOUT=Hi-z(OFF) V_{TEMP} (Temperature voltage output)=Hi-z(OFF)	—	1.0	2.0	µA
	I_{DD2}	V_{DD}= 3 V		—	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

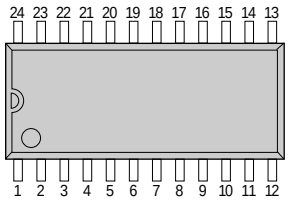
GND=0 V,Ta= - 40 °C to + 85 °C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Temperature output voltage	VTEMP	Ta= +25 °C, GND based output voltage VTEMP pins, V_{DD}=2.7 V to 5.5 V		1.470		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	-7.3	-7.8	-8.3	mV/°C
Linearity	ΔNL	-40 °C ≤ Ta ≤ +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_O	Ta= +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	C_L	V_{DD}=2.7 V to 5.5 V			100	pF
	R_L	V_{DD}=2.7 V to 5.5 V	500			kΩ
Response time	t_{RSP}	V_{DD}=3.3 V C_L=50 pF, R_L= 500 kΩ, Max. ±1 °C			200	µs

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

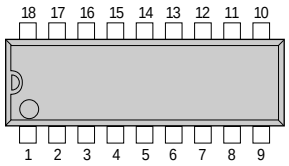
Terminal connection

RTC-7301SF



No.	Pin terminal	No.	Pin terminal
1	$\overline{CS_0}$	24	V_{DD}
2	F_{CON}	23	(V_{DD})
3	F_{OUT}	22	(V_{DD})
4	VTEMP	21	(V_{DD})
5	(V_{DD})	20	(V_{DD})
6	$\overline{IRQ}$	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	$\overline{RD}$	14	D_3
12	GND	13	$\overline{WR}$

RTC-7301DG



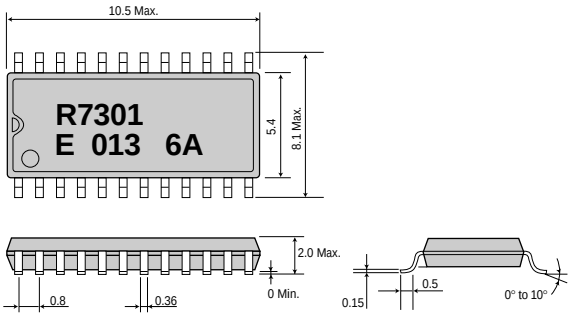
No.	Pin terminal	No.	Pin terminal
1	$\overline{CS_0}$	18	V_{DD}
2	FOUT	17	(V_{DD})
3	$\overline{IRQ}$	16	(V_{DD})
4	A_0	15	CS_1
5	A_1	14	D_0
6	A_2	13	D_1
7	A_3	12	D_2
8	$\overline{RD}$	11	D_3
9	GND	10	$\overline{WR}$

- (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.

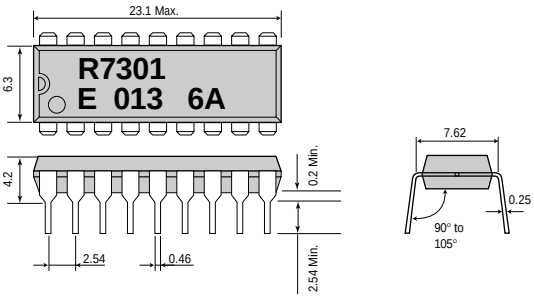
External dimensions

(Unit: mm)

RTC-7301SF



RTC-7301DG



Register table

Bank0 Clock and calendar registers

Address	Register	bit 3	bit 2	bit 1	bit 0
0	1 second digit	8	4	2	1
1	10 second digit	Fos	40	20	10
2	1 minute digit	8	4	2	1
3	10 minute digit	o	40	20	10
4	1hour digit	8	4	2	1
5	10 hour digit	o	o	20	10
6	Day digit	o	4	2	1
7	1 day digit	8	4	2	1
8	10 day digit	o	o	20	10
9	1 month digit	8	4	2	1
A	10 month digit	o	o	o	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

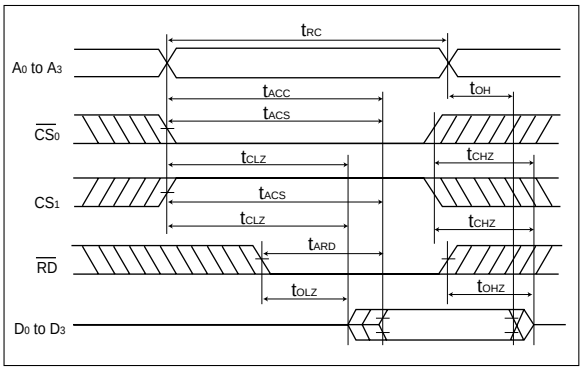
Bank1 Alarms and FOUT registers

Address	Register	bit 3	bit 2	bit 1	bit 0
0	1 second digit	8	4	2	1
1	10 second digit	AE	40	20	10
2	1 minute digit	8	4	2	1
3	10 minute digit	AE	40	20	10
4	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	o	FD2	FD1	FD0
D	FOUT divider ratio setting register	FE	o	FD4	FD3
E	Alarm control	TEST	TEMP	AF	AIE
F	Control register	Bank Sel 1	Bank Sel 0	STOP	BUSY/ADJ

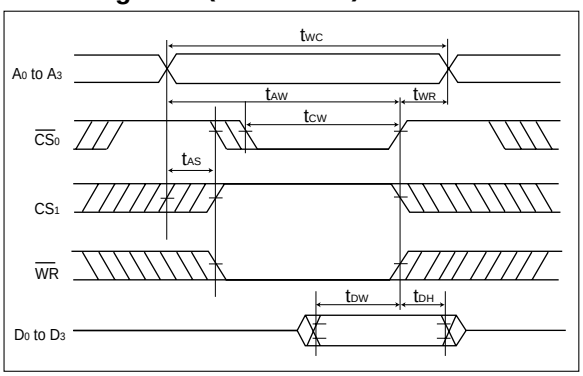
Bank2 Digital offset and timer registers

Address	Registers	bit 3	bit 2	bit 1	bit 0
0	Digital offset	DT3	DT2	DT1	DT0
1		DT_ON	DT6	DT5	DT4
2	—	o	o	o	o
3	—	o	o	o	o
4	Timer counter	8	4	2	1
5	preset value	128	64	32	16
6	Timer counter	8	4	2	1
7	data	128	64	32	16
8	Timer settings	TE	TI/TP	TD1	TD0
9	—	o	o	o	o
A	—	o	o	o	o
B	—	o	o	o	o
C	—	o	o	o	o
D	—	o	o	o	o
E	Timer control	TEST	TEMP	TF	TIE
F	Control register	Bank Sel 1	Bank Sel 0	STOP	BUSY/ADJ

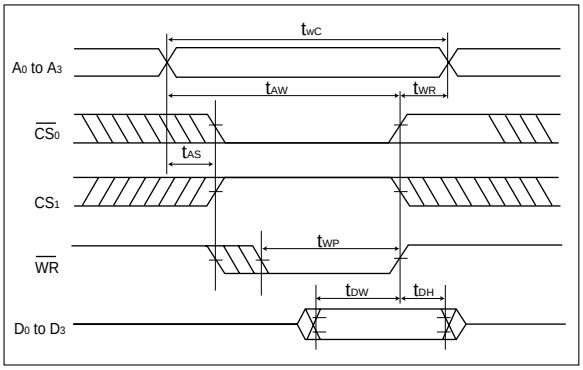
Reading data



Writing data (CS Control)



Writing data (WR Control)

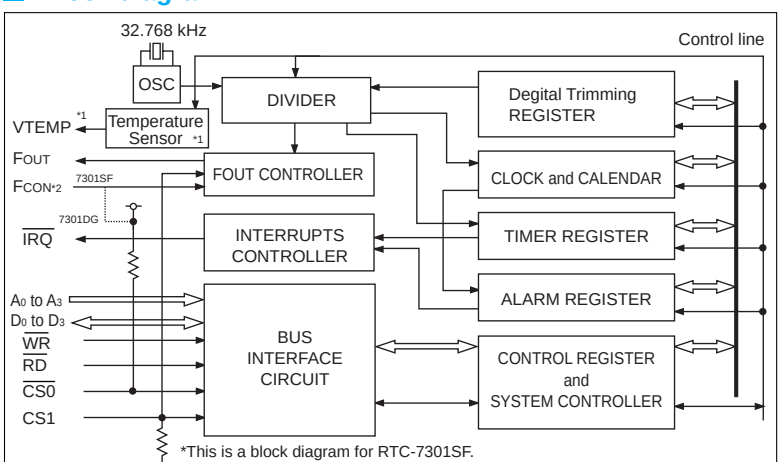


AC characteristics

•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	tRC	—	150	—	85	—	ns
Address access time	tACC	—	—	150	—	85	ns
CE access time	tACS	—	—	150	—	85	ns
RD access time	tARD	—	—	100	—	45	ns
CE output set time	tCLZ	—	5	—	3	—	ns
CE output floating	tCHZ	—	—	60	—	30	ns
RD output set time	tOLZ	—	5	—	3	—	ns
RD output floating	tOHZ	—	—	60	—	30	ns
Output hold time	tOH	—	10	—	5	—	ns
Write cycle time	tWC	—	150	—	85	—	ns
Chip select time	tCW	—	140	—	70	—	ns
Address valid end of write	tAW	—	140	—	70	—	ns
Address setup time	tAS	—	0	—	0	—	ns
Address hold time	tWR	—	0	—	0	—	ns
Write pulse width	tWP	—	130	—	65	—	ns
Input data set time	tDW	—	80	—	35	—	ns
Input data hold time	tDH	—	0	—	0	—	ns
FOUT output frequency duty	DUTY	FOUT= 32.768 kHz	40	60	40	60	%

Block diagram



*This is a block diagram for RTC-7301SF.
Be aware that RTC-7301DG differs according to the following 2 points.
*1)The VTEMP output is not connected to an external pin.
*2)The FCON input pin is not connected to an external pin, but is fixed at "H" internally.

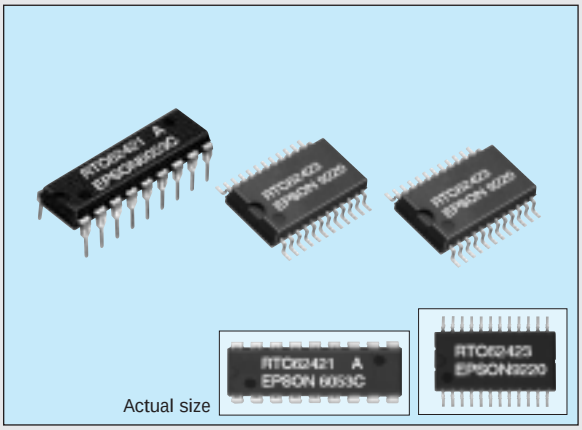
4-bit REAL TIME CLOCK MODULE

RTC-62421/62423

Products number (please refer to page 2)

Q4262421xxxxx00
Q4262423xxxxx00

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



The details are mentioned in the application manual.

http://www.epson.co.jp/device/

Specifications (characteristics)

Absolute Max. rating

Item	Symbol	Condition	Specifications	Unit
Power source voltage	V_{DD}	Ta=+25 °C	-0.3 to 7.0	V
Input and output voltage	$V_{I/O}$		-0.3 to V_{DD}+0.3	
Storage temperature *	T_{STG}	RTC-62421	-55 to +85	°C
		RTC-62423	-55 to +125	

*Stored as bare product after unpacking

Operating range

Item	Symbol	Condition	Specifications	Unit
Operating voltage	V_{DD}		4.5 to 5.5	V
Operating temperature	T_{OPR}	No condensation	-40 to +85	°C
Data holding voltage	V_{DH}		2.0 to 5.5	V
CS_1 data holding time	t_{CDR}	Refer to the data holding timing	2.0 Min.	µs
Operation restoring time	t_R			

Frequency characteristics

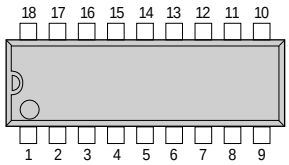
Item	Symbol	Condition		Specifications	Unit
Frequency tolerance	Δf/fo	Ta=+25 °C, V_{DD}=5 V	62421 A	±10	x 10^{-6}
			62421 B	±50	
			62423 A	±20	
			62423	±50	
Frequency temperature characteristics		-10 °C to +70 °C (+25 °C reference temperature)		+10/-120	
		-40 °C to +85 °C (+25 °C reference temperature)		+10/-220	
Frequency voltage characteristics		Ta=+25 °C, V_{DD}=4.5 V to 5.5V		±5 Max.	x 10^{-6}/V
Aging	fa	V_{DD}=5 V, Ta=+25 °C, first year		±5 Max.	x 10^{-6}/year
Shock resistance	S.R.	Three drops on a hard board from 750 mm or 29400 m/s² x 0.3 ms x 1/2 sine wave x 3 directions		±10 Max.	x 10^{-6}

DC characteristics

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

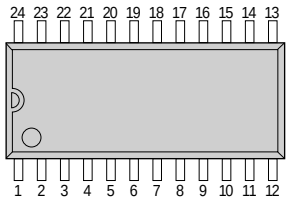
Terminal connection

RTC-62421



No.	Pin terminal	No.	Pin terminal
1	STD. P	18	V_{DD}
2	$\overline{CS_0}$	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	$\overline{WR}$

RTC-62423



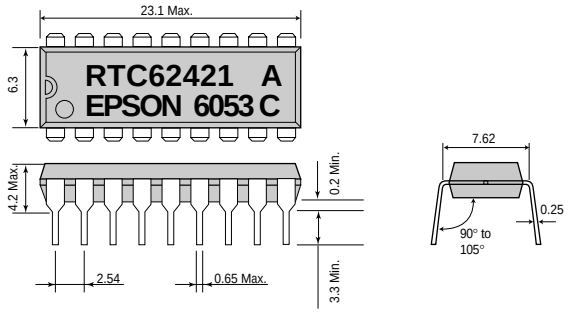
No.	Pin terminal	No.	Pin terminal
1	STD. P	24	V_{DD}
2	$\overline{CS_0}$	23	(V_{DD})
3	NC	22	(V_{DD})
4	ALE	21	NC
5	A_0	20	CS_1
6	NC	19	D_0
7	A_1	18	NC
8	NC	17	NC
9	A_2	16	D_1
10	A_3	15	D_2
11	RD	14	D_3
12	GND	13	$\overline{WR}$

- (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.

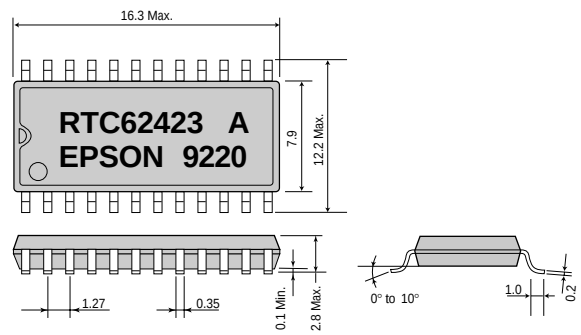
External dimensions

(Unit: mm)

RTC-62421 (DIP 18-pin)



RTC-62423 (SOP 24-pin)



Register table

Address	A_3	A_2	A_1	A_0	Name of register	D_3	D_2	D_1	D_0	Count	Note
0	0	0	0	0	S_1	s_8	s_4	s_2	s_1	0 to 9	1 - sec. digit register
1	0	0	0	1	S_{10}	*	s_{40}	s_{20}	s_{10}	0 to 5	10 - sec. digit register
2	0	0	1	0	MI_1	mi_8	mi_4	mi_2	mi_1	0 to 9	1 - min. digit register
3	0	0	1	1	MI_{10}	*	mi_{40}	mi_{20}	mi_{10}	0 to 5	10 - min. digit register
4	0	1	0	0	H_1	h_8	h_4	h_2	h_1	0 to 9	1 - hour digit register
5	0	1	0	1	H_{10}	*	PM/$\overline{AM}$	h_{20}	H_{10}	0 to 2 or 0 to 1	10 - hour digit register
6	0	1	1	0	D_1	d_8	d_4	d_2	d_1	0 to 9	1 - day digit register
7	0	1	1	1	D_{10}	*		d_{20}	d_{10}	0 to 3	10 - day digit register
8	1	0	0	0	MO_1	mo_8	mo_4	mo_2	mo_1	0 to 9	1 - month digit register
9	1	0	0	1	MO_{10}	*			mo_{10}	0 to 1	10 - month digit register
A	1	0	1	0	Y_1	y_8	y_4	y_2	y_1	0 to 9	1 - year digit register
B	1	0	1	1	Y_{10}	y_{80}	y_{40}	y_{20}	y_{10}		10 - year digit register
C	1	1	0	0	W	*	w_4	w_2	w_1	0 to 6	Week register
D	1	1	0	1	C_D	30 sec. ADJ	IRQ FLAG	BUSY	HOLD		Control register D
E	1	1	1	0	C_E	t_1	t_0	ITRPT /STND	MASK		Control register E
F	1	1	1	1	C_F	TEST	24/$\overline{12}$	STOP	RESET		Control register F

Supplement

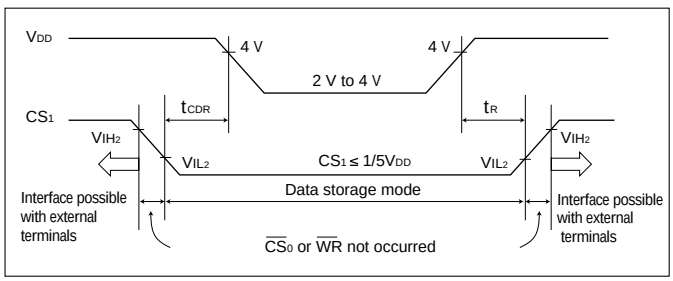
0="L" level. 1="H" level

	PM/$\overline{AM}$	24/$\overline{12}$	ITRPT/$\overline{STND}$
1	PM	24	ITRPT
0	$\overline{AM}$	$\overline{12}$	$\overline{STND}$

Bit name	Description
* mark	Writable. Recognized as 0 while in read mode.
BUSY	Read only (effective only when HOLD=1)
IRQ FLAG	Enter "0" only when clearing interruption. Enter "1" otherwise.
24/$\overline{12}$	Set able only when RESET=1
TEST	For our company's testing. TEST should be "0" in normal use.

Note: Do not enter erroneous data for clock. This may result in time keeping error.

Data holding timing



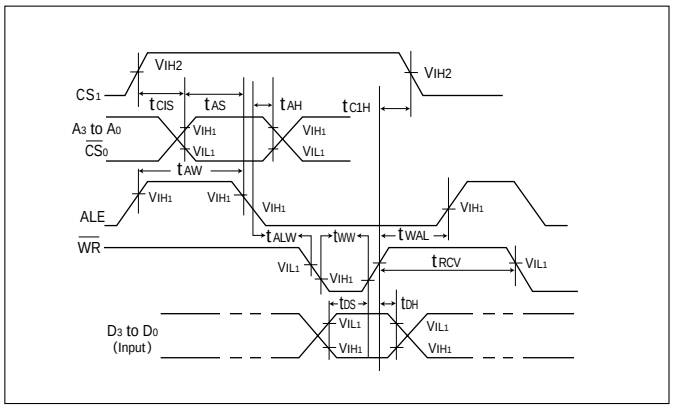
AC characteristics

(ALE = While in use)

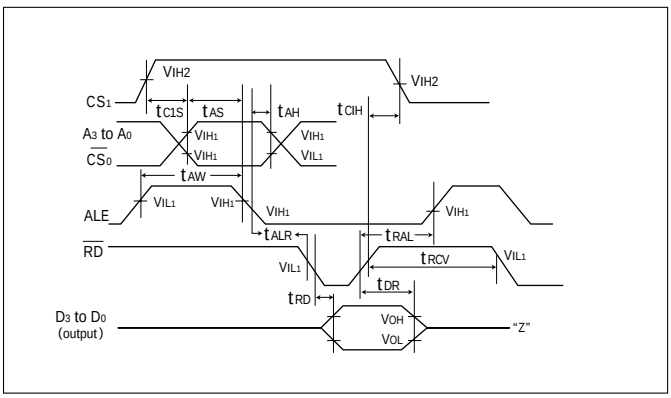
(V_{DD} = 5 V ± 0.5 V, Ta = -40 °C to + 85 °C)

Item	Symbol	Condition	Min.	Max.	Unit
CS_1 setup time	t_{CIS}		1000		
CS_1 hold time	t_{CIH}		1000		
Address setup time	t_{AS}		25		
Address hold time	t_{AH}		25		
ALE pulse width	t_{AW}	—	40	—	
ALE before WRITE	t_{ALW}		10		
ALE before READ	t_{ALR}		10		
ALE after WRITE	t_{WAL}		20		ns
ALE after READ	t_{RAL}		10		
WRITE pulse width	t_{WW}		120		
$\overline{RD}$ to data	t_{RD}	C_L=150 pF		120	
DATA hold	t_{DR}		0	45	
DATA setup time	t_{DS}	—	100		
DATA hold time	t_{DH}		10	—	
$\overline{RD}$/$\overline{WR}$ recovery time	t_{RCV}		60		

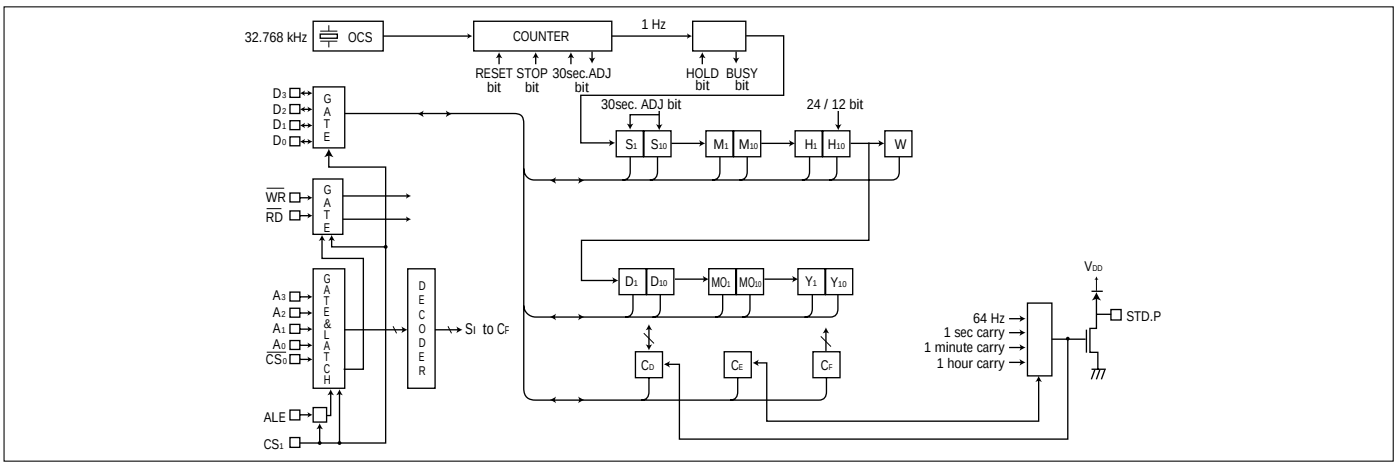
Write mode



Read mode



Block diagram



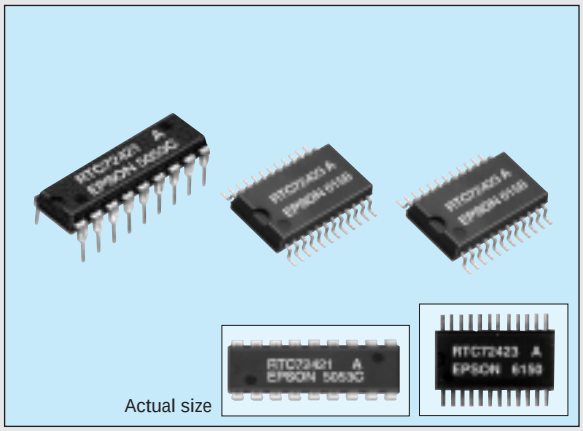
4-bit REAL TIME CLOCK MODULE

RTC-72421/72423

Products number (please refer to page 2)

Q4272421xxxxx00
Q4272423xxxxx00

- 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.epson.co.jp/device/

Specifications (characteristics)

Absolute Max. rating

Item	Symbol	Condition	Specifications	Unit
Power source voltage	V_{DD}	Ta=+25 °C	-0.3 to 7.0	V
Input and output voltage	$V_{I/O}$	Ta=+25 °C	GND -0.3 to V_{DD}+0.3	V
Storage temperature *	T_{STG}	RTC-72421	-55 to +85	°C
		RTC-72423	-55 to +125	°C

*Stored as bare product after unpacking

Operating range

Item	Symbol	Condition	Specifications	Unit
Operating voltage	V_{DD}		4.5 to 5.5	V
Operating temperature *	T_{OPR}	RTC-72421	-10 to 70	°C
		RTC-72423	-40 to 85	°C
Data holding voltage	V_{DH}		2.0 to 5.5	V
CS_1 data holding time	t_{CDR}	Refer to the data holding timing	2.0 Min.	µs
Operation restoring time	t_R			µs

*No condensation

Frequency characteristics and current consumption

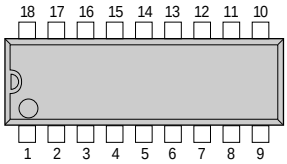
Item	Symbol	Condition		Specifications	Unit
Frequency tolerance	Δf/fo	Ta=+25 °C, V_{DD}=5 V	72421 A	±10	x 10^{-6}
			72421 B	±50	
			72423 A	±20	
			72423	±50	
Frequency temperature characteristics		-10 °C to +70 °C (+25 °C reference temperature)		+10/-120	
Frequency voltage characteristics		Ta=+25 °C, V_{DD}=2.0 V to 5.5 V		±5 Max.	x 10^{-6}/V
Aging	fa	V_{DD}=5 V, Ta=+25 °C, first year		±5 Max.	x 10^{-6} /year
Shock resistance	S.R.	Three drops on a hard board from 750 mm or 29400 m/s² x 0.3 ms x 1/2 sine wave x 3 directions		±10 Max.	x 10^{-6}

DC characteristics

Item	Symbol	Condition		Min.	Typ.	Max.	Unit	Applicable terminal
"H" input voltage (1)	V_{IH1}	—		2.2	—	—	V	All inputs other than CS_1
"L" input voltage (1)	V_{IL1}			—	—	0.8		
Input leak current (1)	I_{LK1}	V_I=V_{DD}/0 V		—	—	±1	µA	Input other than D_0 to D_3
Input leak current (2)	I_{LK2}					±10		D_0 to D_3
"L" output voltage (1)	V_{OL1}	I_{OL}=2.5 mA				0.4	V	
"H" output voltage	V_{OH}	I_{OH}=-400 µA		2.4		—		
"L" output voltage (2)	V_{OL2}	I_{OL}=2.5 mA		—		0.4		STD.P
Off leak current	I_{OFFLK}	V_I=V_{DD}/0 V				10	µA	
Input capacity	C_I	Input frequency 1 MHz			10	—	pF	Input other than D_0 to D_3
					20			D_0 to D_3
"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}		
Current consumption	I_{DD1}	CS_1=0 V, Exclude input/output current	V_{DD}=5 V		1	10	µA	
	I_{DD2}		V_{DD}=2 V		0.9	5		

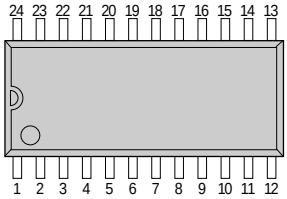
Terminal connection

RTC-72421



No.	Pin terminal	No.	Pin terminal
1	STD. P	18	V_{DD}
2	$\overline{CS_0}$	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	$\overline{WR}$

RTC-72423



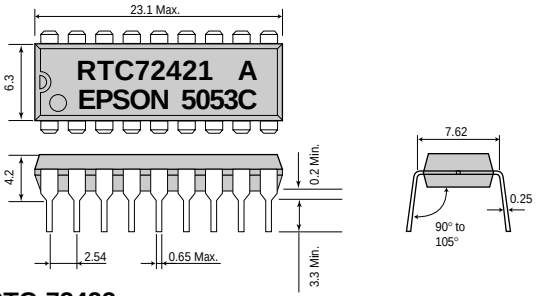
No.	Pin terminal	No.	Pin terminal
1	STD. P	24	V_{DD}
2	$\overline{CS_0}$	23	(V_{DD})
3	NC	22	(V_{DD})
4	ALE	21	NC
5	A_0	20	CS_1
6	NC	19	D_0
7	A_1	18	NC
8	NC	17	NC
9	A_2	16	D_1
10	A_3	15	D_2
11	RD	14	D_3
12	GND	13	$\overline{WR}$

- (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.

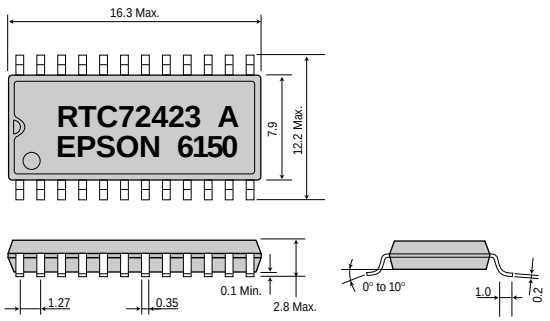
External dimensions

(Unit: mm)

RTC-72421 (DIP 18-pin)



RTC-72423 (SOP 24-pin)



Register table

Address	A_3	A_2	A_1	A_0	Register	Data D_3	Data D_2	Data D_1	Data D_0	Count Value	Remarks
0	0	0	0	0	S_1	s_8	s_4	s_2	s_1	0 to 9	1- second digit register
1	0	0	0	1	S_{10}	*	s_{40}	s_{20}	s_{10}	0 to 5	10- second digit register
2	0	0	1	0	MI_1	mi_8	mi_4	mi_2	mi_1	0 to 9	1- minute digit register
3	0	0	1	1	MI_{10}	*	mi_{40}	mi_{20}	mi_{10}	0 to 5	10- minute digit register
4	0	1	0	0	H_1	h_8	h_4	h_2	h_1	0 to 9	1- hour digit register
5	0	1	0	1	H_{10}	*	PM/$\overline{AM}$	h_{20}	h_{10}	0 to 2 or 0 to 1	PM/AM,10- hours digit register
6	0	1	1	0	D_1	d_8	d_4	d_2	d_1	0 to 9	1- day digit register
7	0	1	1	1	D_{10}	*	*	d_{20}	d_{10}	0 to 3	10 -day digit register
8	1	0	0	0	MO_1	mo_8	mo_4	mo_2	mo_1	0 to 9	1- month digit register
9	1	0	0	1	MO_{10}	*	*	*	mo_{10}	0 to 1	10- month digit register
A	1	0	1	0	Y_1	y_8	y_4	y_2	y_1	0 to 9	1- year digit register
B	1	0	1	1	Y_{10}	y_{80}	y_{40}	y_{20}	y_{10}		10- year digit register
C	1	1	0	0	W	*	w_4	w_2	w_1	0 to 6	Week register
D	1	1	0	1	RegD	30 sec. ADJ	IRQ FLAG	BUSY	HOLD	—	Control Register D
E	1	1	1	0	RegE	t_1	t_0	ITRPT /$\overline{STND}$	MASK		Control Register E
F	1	1	1	1	RegF	TEST	24/$\overline{12}$	STOP	REST		Control Register F

0="L" level,1="H" level, REST = RESET ITRPT/ $\overline{STND}$=INTERRUPT/STANDARD

1) Bit * does not exist.
2) Please mask AM/PM bit with 10's of hours operations.
3) Busy is read only. IRQ can only. IRQ can only be set low ("O").
4)

Data Bit	PM/$\overline{AM}$	ITRPT/$\overline{STND}$	24/$\overline{12}$
1	PM	ITRPT	24
0	AM	STND	12

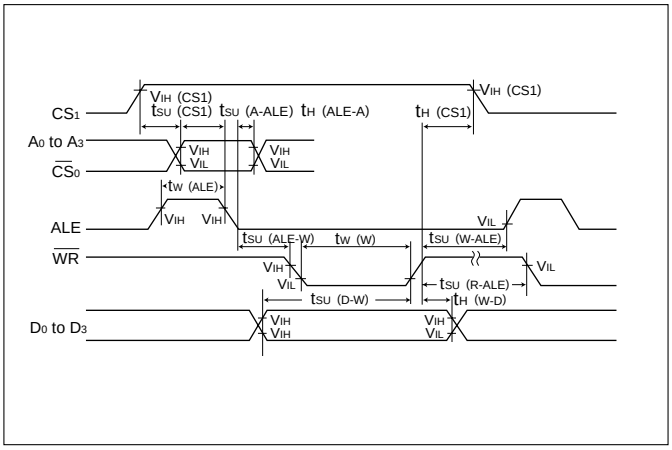
5) TEST bit should be "O".

AC characteristics (with ALE)

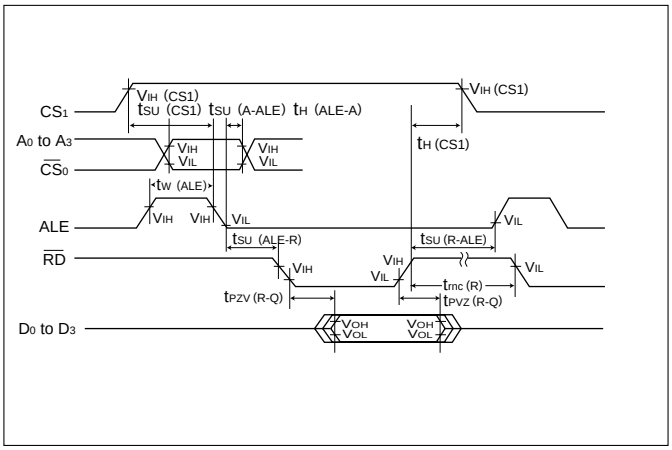
(Please connect ALE to V_{DD} if the microprocessor does not have an ALE output.)
(V_{DD} = 5 V ± 0.5 V)

Item	Symbol	Condition	Min.	Max.	Unit
CS_1 setup time	$t_{SU\ (CS1)}$		1000	—	ns
Address setup time before ALE	$t_{SU\ (A-ALE)}$		50		
Address hold time after ALE	$t_{H\ (ALE-A)}$		50		
ALE pulse width	$t_{W\ (ALE)}$		80		
ALE setup time before WRITE	$t_{SU\ (ALE-W)}$		0		
ALE setup time before READ	$t_{SU\ (ALE-R)}$		0		
ALE setup time after WRITE	$t_{SU\ (W-ALE)}$		50		
ALE setup time after READ	$t_{SU\ (R-ALE)}$		50		
WRITE pulse width	$t_{W\ (W)}$		120		
DATA delay time after READ	$t_{PZV\ (R-Q)}$	C_L=150 pF	—	120	
DATA Hold time after READ	$t_{PVZ\ (R-Q)}$		0	70	
DATA setup time before WRITE	$t_{SU\ (D-W)}$		80	—	
DATA hold time after WRITE	$t_{H\ (W-D)}$		10		
CS_1 hold time	$t_{H\ (CS1)}$		1000		
READ/WRITE recovery time	$t_{REC\ (R/W)}$		200		

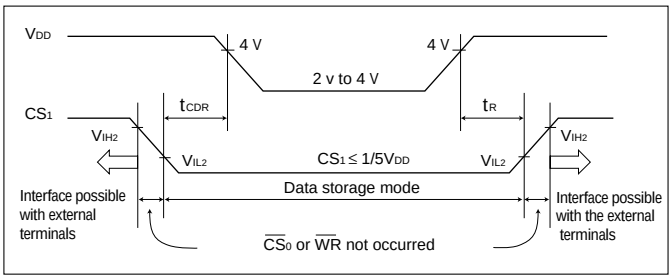
Write mode (with ALE)



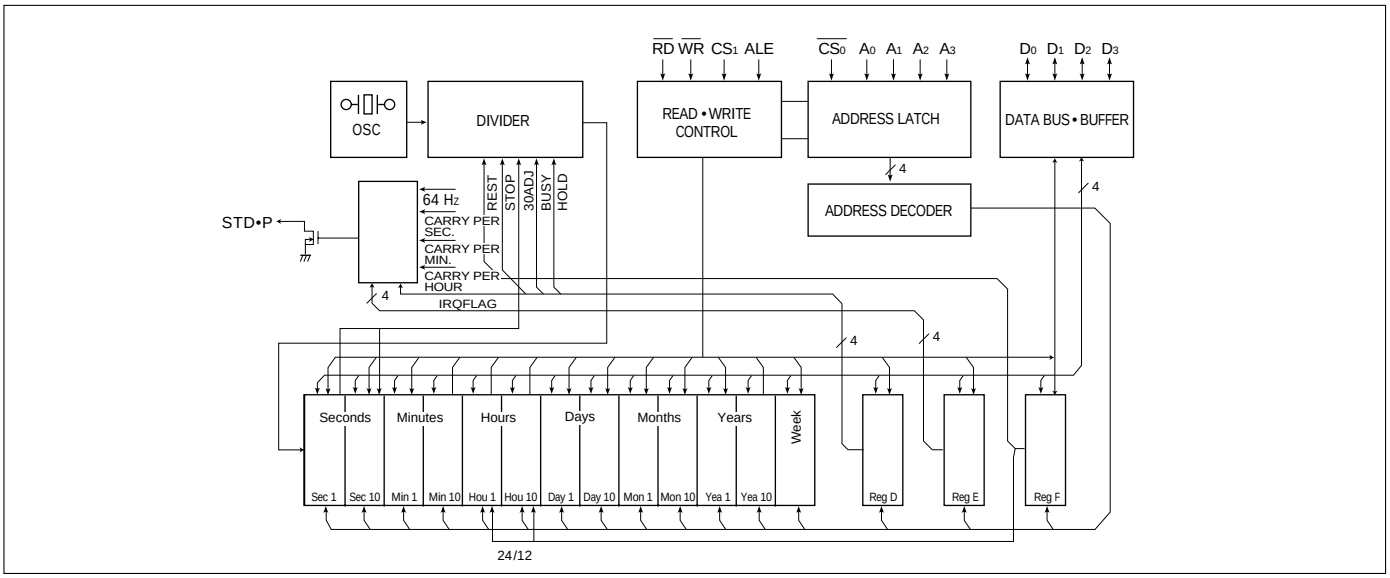
Read mode (with ALE)



Data holding timing



Block diagram

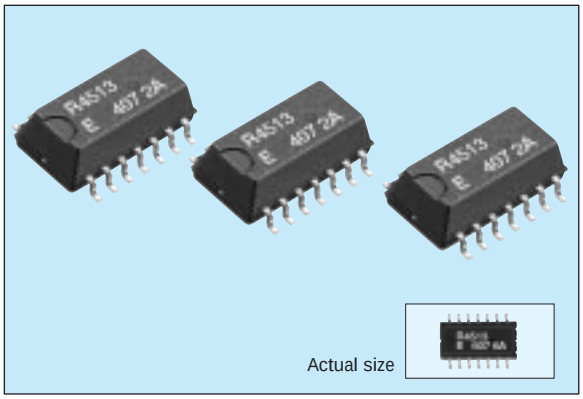


SERIAL-INTERFACE REAL TIME CLOCK MODULE

RTC-4513

Products number (please refer to page 2)
Q4145135000010 0

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

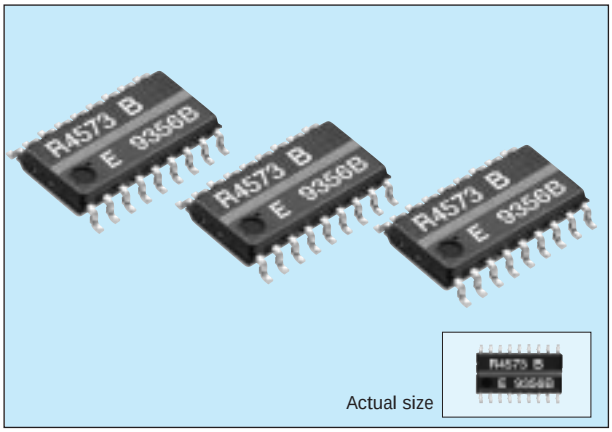


SERIAL INTERFACE RTC WITH AN ALARM TIMER

RTC-4573SB

Products number (please refer to page 2)
Q4145736000020 0

- 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 µA/3 V Typ.)



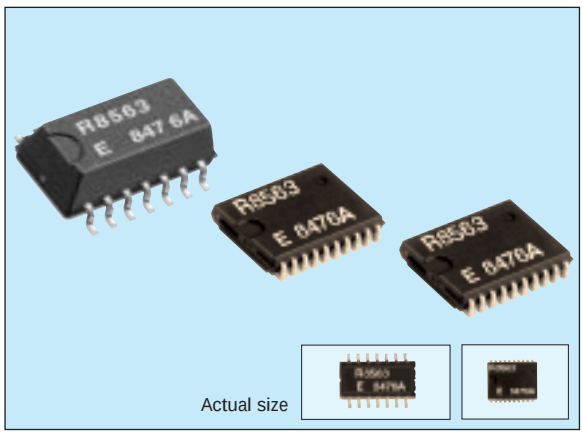
I²C-BUS INTERFACE REAL TIME CLOCK MODULE

RTC-8563SA/JE

Products number (please refer to page 2)
Q4185635000010 0
Q4185637000020 0

- 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 1.2 V to 5.5 V.
- Low power consumption at 250 nA/2.0 V. (Typ.)

The I²C - Bus is a trademark of Philips Electronics N.V.



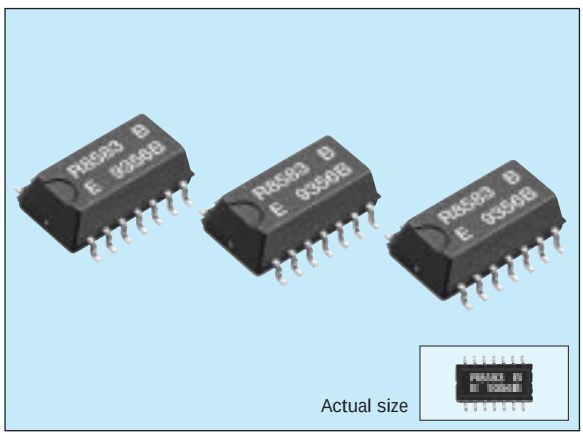
I²C-BUS COMPATIBLE REAL TIME CLOCK MODULE

RTC-8583/8593/8593SB

Products number (please refer to page 2)
Q4185835xxxxx00
Q4185935xxxxx00
Q4185936xxxxx00

- Three mode operations: internal crystal oscillation, external 50 Hz clock and event counter.
- Builtin 240 x 8 bit S-RAM available (RTC8583).
- Alarm and timer functions available.

The I²C - Bus is a trademark of Philips Electronics N.V.



These products on this page are still on production and orderable.
But we would like to recommend the following products for new dosigns.
RTC-4701,RTC-4574,RTC-8564

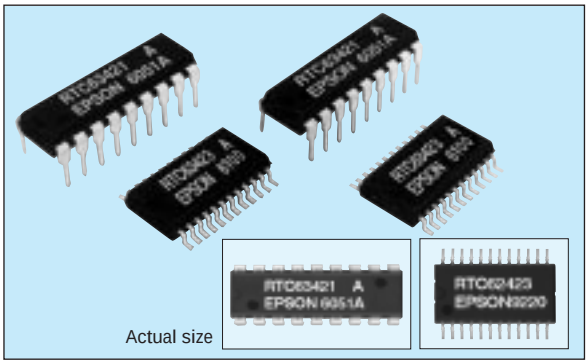
4-bit MULTIFUNCTIONAL REAL TIME CLOCK MODULE

RTC-63421/63423

Products number (please refer to page 2)

Q4263421xxxxx00
Q4263423xxxxx00

- Alarm interruption of sec. to month and day of week possible.
- Standard signal output selectable in a range of 10 min to 1024 Hz.
- Either sec. to hour and day of week or sec. to year and day of week is selectable.
- Provided with START/STOP 30 second adjusting function.



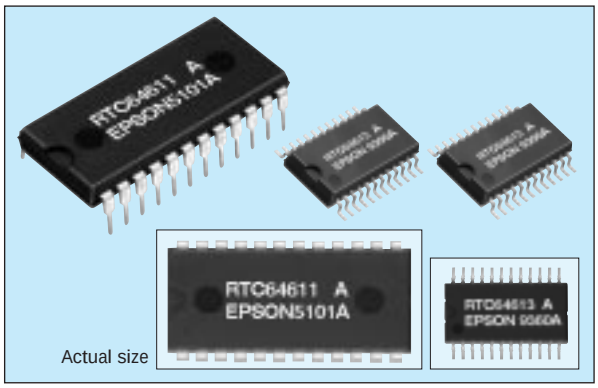
8-bit REAL TIME CLOCK MODULE

RTC-64611/64613

Products number (please refer to page 2)

Q4264612xxxxx00
Q4264613xxxxx00

- Provided with the same interface as S-RAM and battery backup function.
- Interruption of alarm of sec. to day and day of week and carry interruption.
- Reference signal selectable in a range of 1 Hz to 64 Hz (binary).
- Provided with START/STOP, 30 second adjust function.



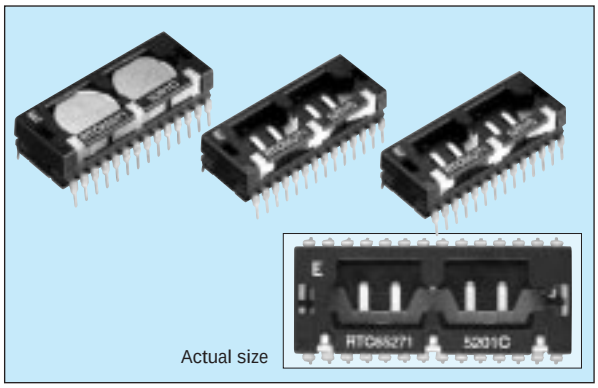
8-bit REAL TIME CLOCK MODULE

RTC-65271

Products number (please refer to page 2)

Q4265274000O100

- A builtin power supply switching circuit makes it possible to provide automatic power supply backup to both the RTC and extended RAM.
- Extended RAM: 4k-bytes of builtin S-RAM
  Page register: 1-byte Configuration: 32-bytes x 128 pages
- The package is a 28-pin DIP IC with a battery holder that makes battery replacement possible.



REAL TIME CLOCK MODULE FOR PC/AT *1

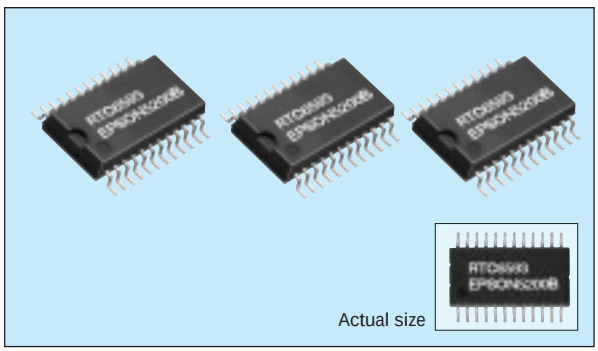
RTC-6593

Products number (please refer to page 2)

Q4265933000O100

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

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



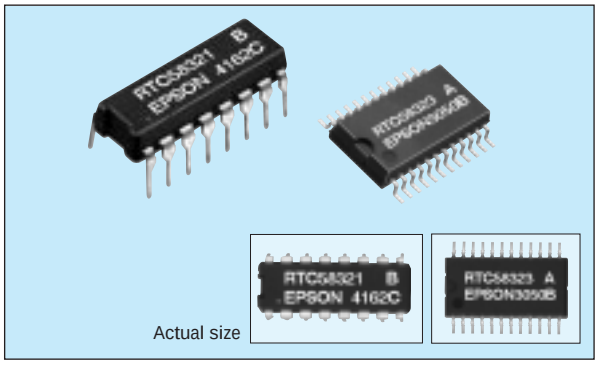
4-bit I/O CONNECTION REAL TIME CLOCK MODULE

RTC-58321/58323

Products number (please refer to page 2)

Q4258320xxxxx00
Q4258323xxxxx00

- Incorporating time counter (hour, minute, sec.) and calendar counter (year, month, day of week).
- Standard signal output selectable among a choice of 1024 Hz, 1 sec., 60 sec., and 1 hour.



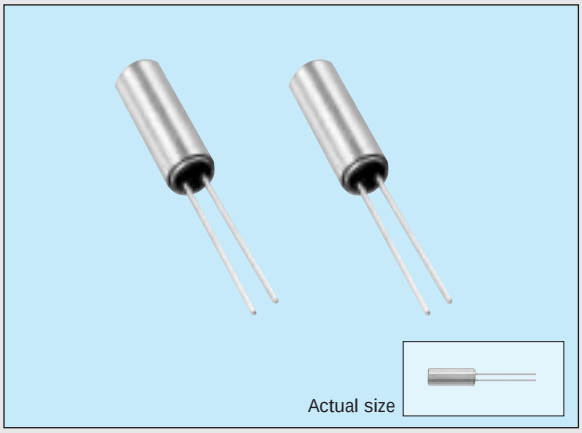
These products on this page are still on production and orderable.
But we would like to recommend RTC-7301 for new designs.

TEMPERATURE SENSING CRYSTAL

HTS-206

Products number (please refer to page 2)
Q19HT206xxxxx00

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

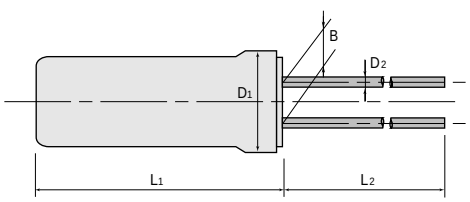


Specifications (characteristics)

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

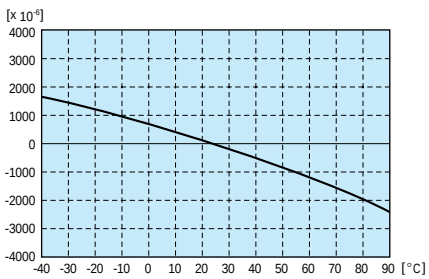
External dimensions

(Unit: mm)



Model	L_1	L_2	D_1	D_2	B
HTS-206	6.0 Max.	4.0 Min.	ø2.0 Max.	ø0.2	0.7

Temperature characteristic

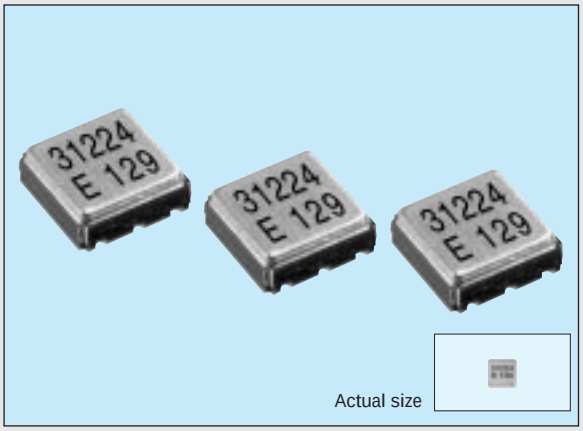


SAW RESONATOR

FS-335

Products number (please refer to page 2)

Q25FS335xxxxx00



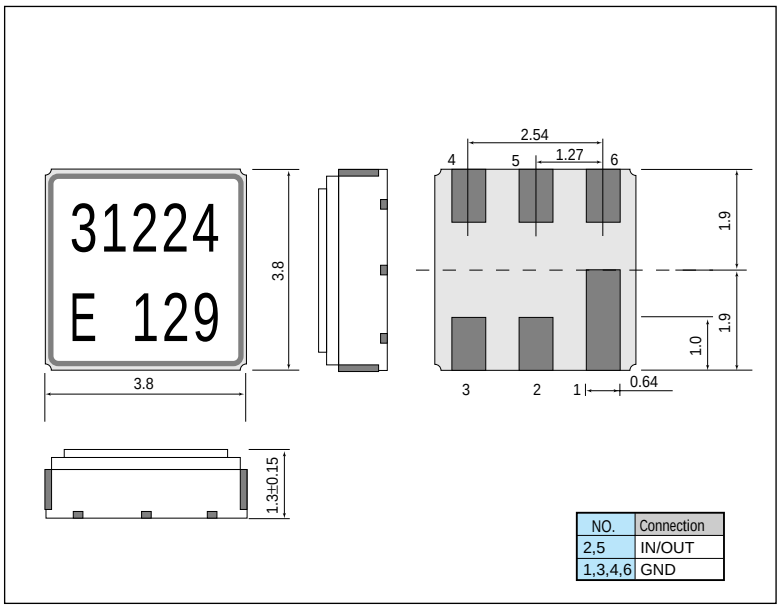
- Reflow solderable SMD ceramic package.
- Capable of covering a wide frequency range, from 300 MHz to 805 MHz.
- 1.45 mm Max. thickness is equal to SMD-type IC.
- Perfect for small wireless equipment.
- Excellent shock resistance and enviromental capability (prevention for contamination)

Specifications (characteristics)

Item		Symbol	Specifications	Remarks
Nominal frequency range		f_0	300 MHz to 805 MHz	Please contact us for inquiries about the available frequency.
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
			2 mW Max.	500 MHz < f_0 ≤ 805 MHz
Recommended drive level		DL	1 mW Typ.	
Frequency tolerance (standard)		Δf/f	±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 ≤ 805 MHz, 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 ≤ 805 MHz, Ta=+25 °C
Motional capacitance		C_1	2.6 fF Typ.	(f_0=312.24 MHz)
Shunt capacitance		C_0	4.0 pF Typ.	(f_0=312.24 MHz)
Insulation resistance		IR	500 M Ω Min.	
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

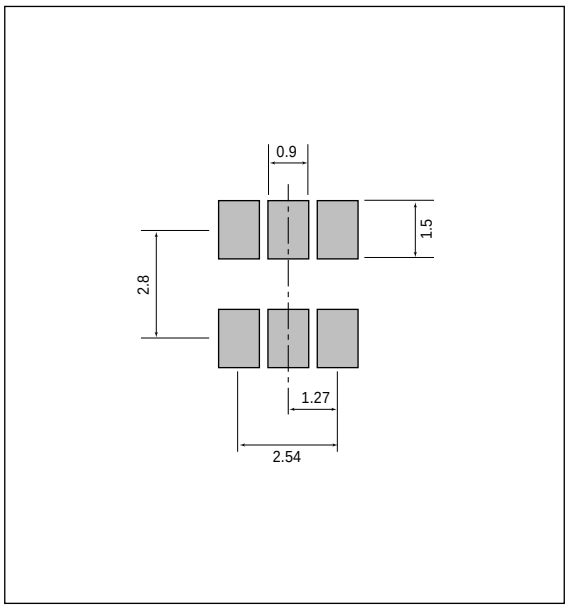
External dimensions

(Unit: mm)



Recommended soldering pattern

(Unit: mm)



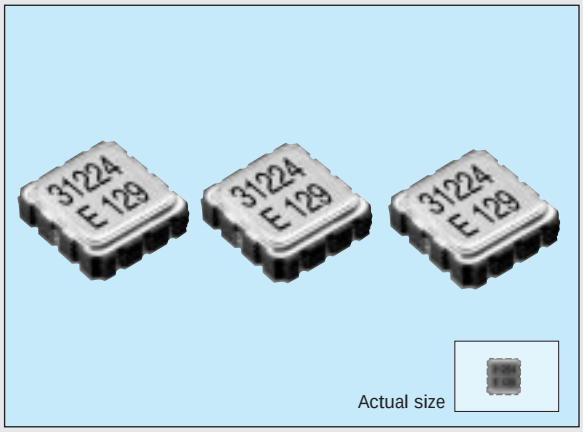
SAW RESONATOR

FS-555

Products number (please refer to page 2)

Q25FS555xxxxx00

- Reflow solderable SMD ceramic package.
- Capable of covering a wide frequency range, from 230 MHz to 500 MHz.
- 1.7 mm Max. thickness is equal to SMD-type IC.
- Perfect for small wireless equipment.

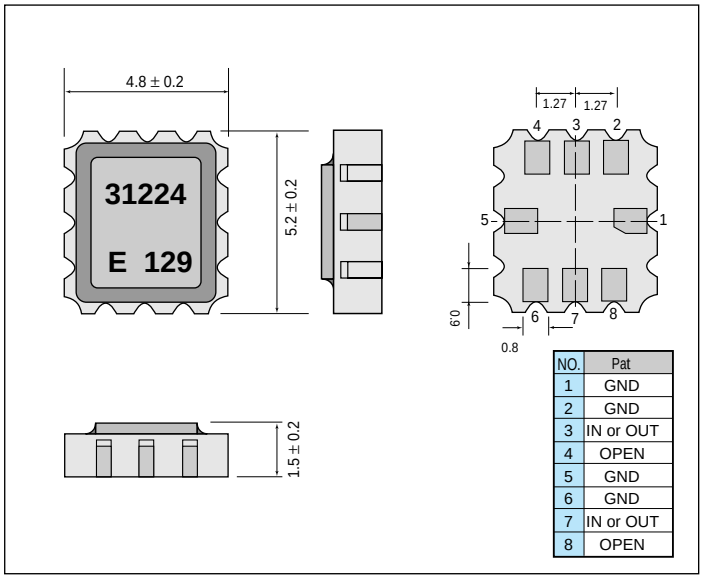


Specifications (characteristics)

Item		Symbol	Specifications	Remarks
Nominal frequency range		f_0	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.	
Recommended drive level		DL	2 mW Typ.	
Frequency tolerance (standard)		Δf/f	±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	40 Ω Max.	230 MHz to 249.9 MHz, Ta=+25 °C
			25 Ω Max.	250 MHz to 500 MHz, Ta=+25 °C
Motional capacitance		C_1	2.6 fF Typ.	(f_0=312.24 MHz)
Shunt capacitance		C_0	4.0 pF Typ.	(f_0=312.24 MHz)
Insulation resistance		IR	500 M Ω Min.	
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

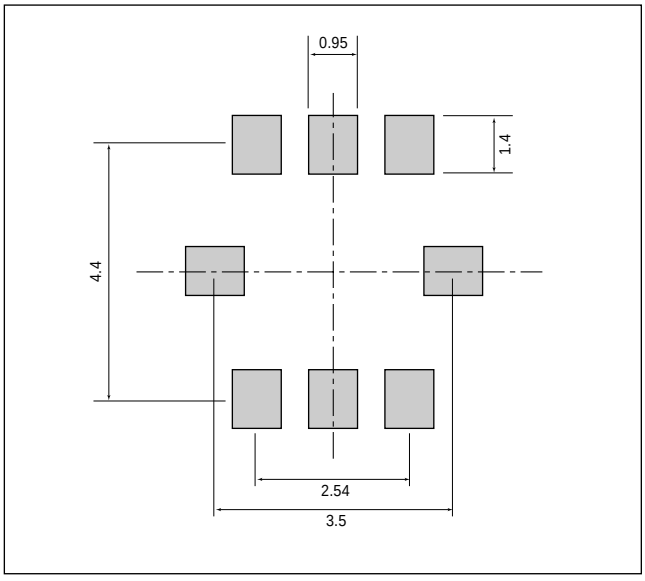
(Unit: mm)



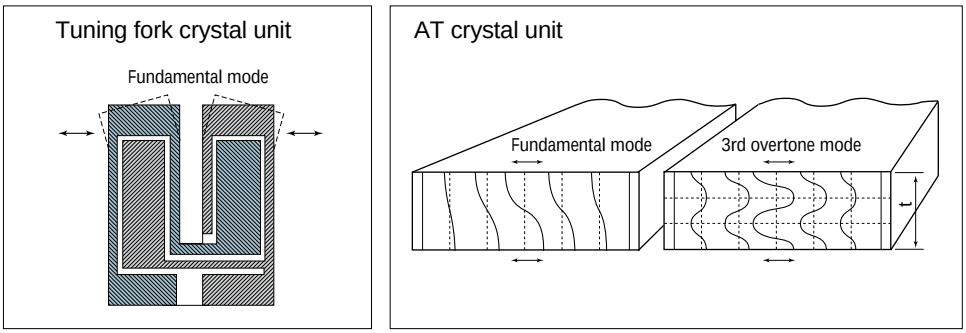
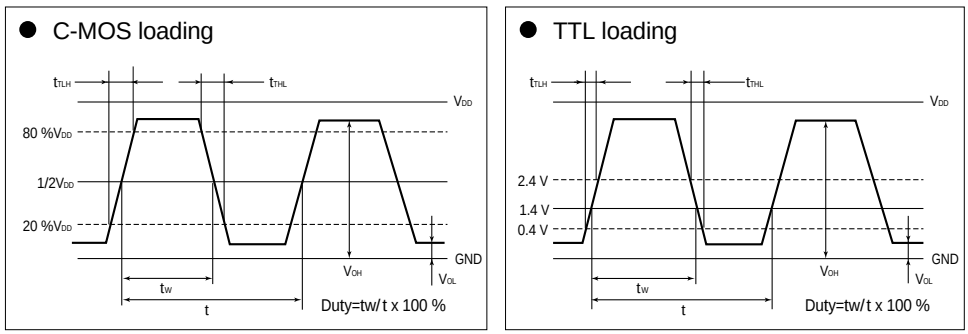
NO.	Pat
1	GND
2	GND
3	IN or OUT
4	OPEN
5	GND
6	GND
7	IN or OUT
8	OPEN

Recommended soldering pattern

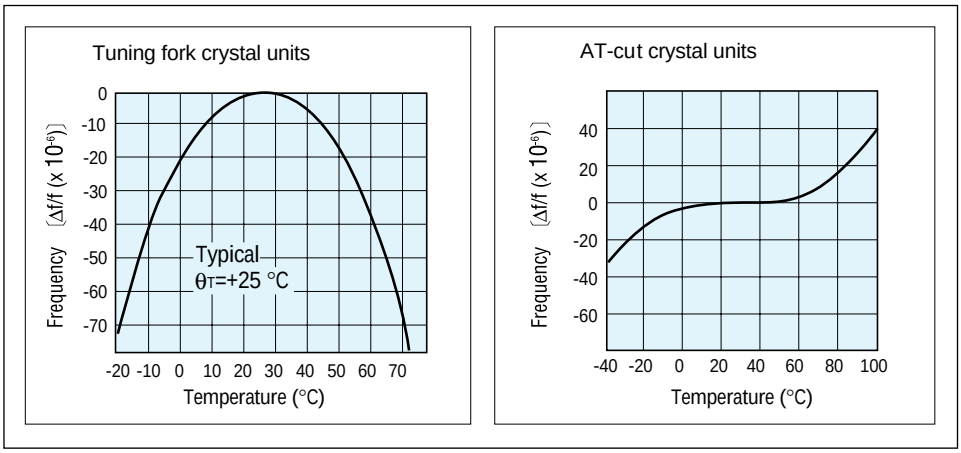
(Unit: mm)



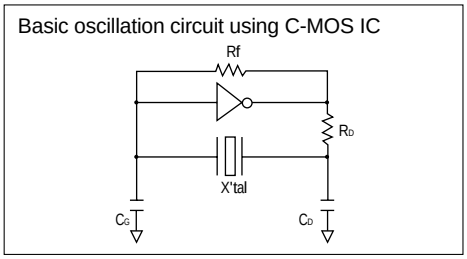
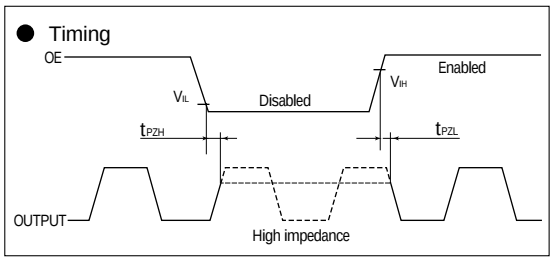
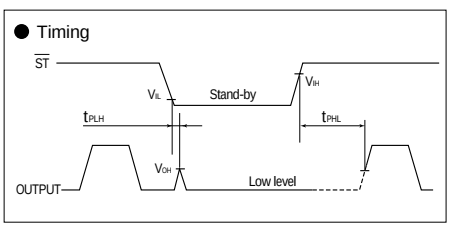
Glossary

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 $f\ (MHz) = \frac{1670}{t\ (\mu m)}$ (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 C-MOS 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 (f_a)	Amount of frequency drift when operated under the specified conditions for a specified term.	ALL
Frequency tolerance precision ($\Delta f/f$)	Under specified conditions at an ambient temperature of +25 ˚C, the difference in actual (measured) frequency from the nominal frequency.	ALL
Frequency stability ($\Delta f/fo$)	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. $\Delta f/f = a(\theta_T - \theta_X)^2$, 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(C_L)	Effective capacitance (series equivalent charge capacitance) of the oscillation circuit as seen from the pins of the crystal unit. This capacitance is determined as a condition when the crystal unit is connected to the oscillation circuit and will determine the output frequency. Load capacitance approximation: $C_L \fallingdotseq C_G \times C_D/(C_G+C_D) + C_S$ (C_S=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 (V_{DD}-GND)	Maximum rated value for power input to the power supply pin. Input over this value may result in characteristic degradation or destruction.	OSC,RTC
Nominal frequency (f)	Nominal value of frequency of crystal unit.	X'tal
Operating temperature range (T_{OPR})	Temperature range where specification characteristics are fulfilled, unless otherwise specified.	ALL
Operating voltage (V_{DD})	Voltage input to V_{DD} pin which will support continuous operation with specification characteristics.	OSC,RTC
Origin frequency (f_0)	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 waveform 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 waveform to change from the high voltage (high level) to the low voltage (low level). Also called waveform fall time. See waveform diagram under duty.	OSC
Output frequency (fo)	The frequency output from the oscillator circuit or the crystal oscillator system.	OSC,RTC
Output load conditions (N or 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 waveform to change from the low voltage (low level) to the high voltage (high level). Also called waveform rise time. See waveform 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. $\overline{ST}$ pin - high or open: Specified frequency output. $\overline{ST}$ Pin - low: Output is low level, oscillation stops. SG-8002 series • MG-5100: $\overline{ST}$-Pin-low:Output is low level (weak pull-down) ,oscillation stops. 	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

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

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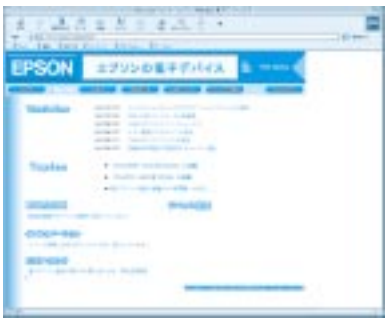

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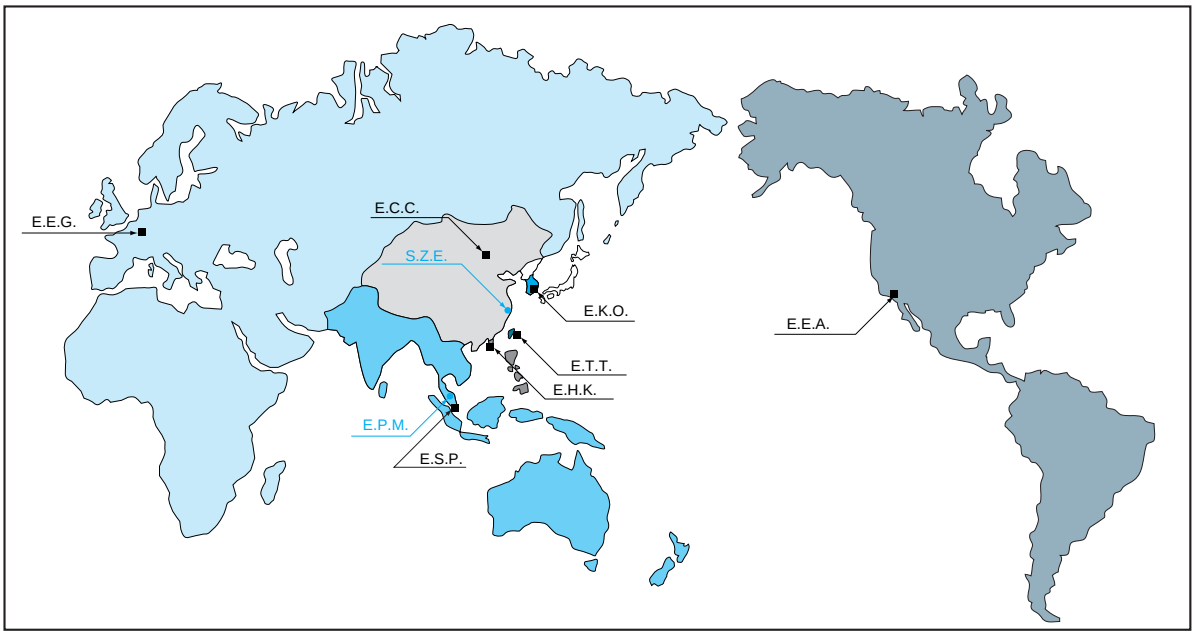
- Ina Plant
- E.P.M.: Epson Precision (Malaysia) SDN. BHD. Plant
- S.Z.E.: Suzhou Epson CO.,LTD.Plant

Plant	Date Operations Commenced	Products
Ina Plant	Jun. 1959	Crystal unit Crystal oscillator Real time clock module
E.P.M. Plant1	Dec. 1974	Crystal unit Crystal oscillator Real time clock module
E.P.M. Plant2	Apr. 1995	Crystal unit Crystal oscillator
S.Z.E. Plant	Mar. 1997	Crystal unit

Business area



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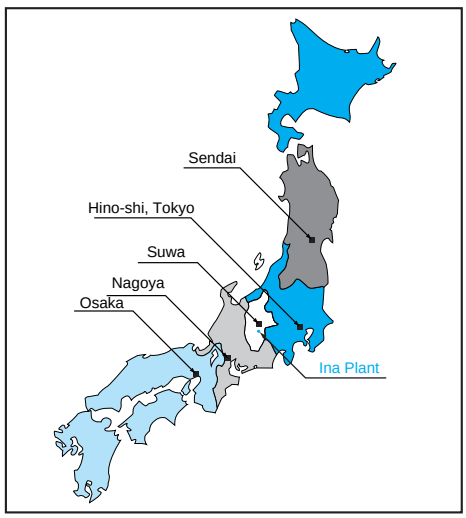

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