

# REAL TIME CLOCK MODULE (SPI)

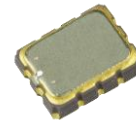
For Automotive, Built-in 32.768 kHz DTCXO,  
High Stability, +125 °C



Product Number (2,000 pcs / Reel)  
**RA4000CE YB A0 : X1B000491A00115**  
**RA4000CE YB B8 : X1B000491A00915**  
**RA4000CE YB C0 : X1B000491A01015**  
**RA4000CE YB D0 : X1B000491A01115**  
**RA4000CE YB E8 : X1B000491A01915**

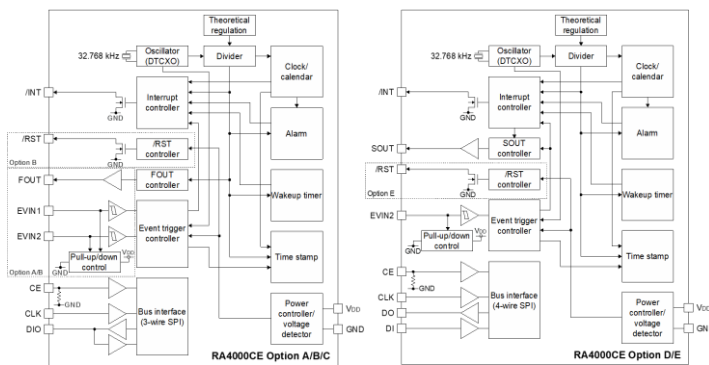
# RA4000CE

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



**RA4000CE**  
( 3.2 × 2.5 mm, t = 1.0 mm Max. )

## Block diagram



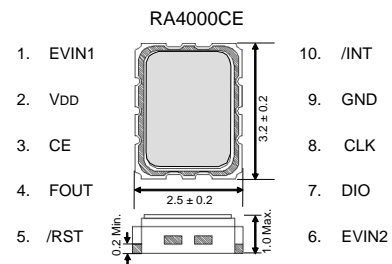
## Overview

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

## Pin Function

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

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



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

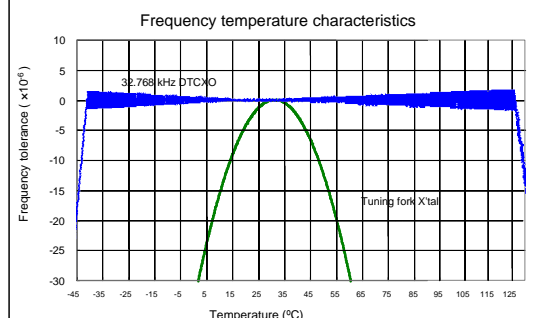
## Specifications (characteristics)

\* Refer to application manual for details

### ■ Electrical Characteristics

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

### ■ 32.768 kHz-DTCXO Frequency temperature characteristics (Example)





## Pin Option

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

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

Option A

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

Option B

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

Option C

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

Option D

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

Option E

## Product name

RA4000CE YB A 0  
 ①            ②    ③④

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

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At Seiko Epson, all environmental initiatives operate under the Plan-Do-Check-Action (PDCA) cycle designed to achieve continuous improvements. The environmental management system (EMS) operates under the ISO 14001 environmental management standard.

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ISO 14000 is an international standard for environmental management that was established by the International Standards Organization in 1996 against the background of growing concern regarding global warming, destruction of the ozone layer, and global deforestation.

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	► Designed for automotive applications such as Car Multimedia, Body Electronics, Remote Keyless Entry etc.
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