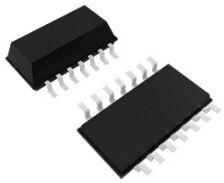
AB-RTC-TC-32.768kHz-2

Real Time Clock Module with I2C Bus

Description

Abracon's AB-RTC-TC-32.768kHz-2 Real-Time Clock (RTC) uses I2C communication interface to configure numerous features. These include an alarm function capability, a leap year autocorrection function, timer function, and build-in temperature sensor. The RTC has a broad operating power supply range of 1.6V to 5.5V with low power consumption. The RTC's integrated 32.768kHz crystal provides precise timing accuracy in a SOP 14 10.1 x 7.4 mm package.



Features

- Built-in frequency adjusted 32.768kHz crystal unit
- Built-in Temperature Sensor
- Low current consumption: 1.0uA (Typ.)
- Communication interface: I2C bus
- Leap years autocorrection
- Timer output function with adjustable period
- High stability: ±3.4ppm @ -40℃ to 85℃
- REACH/RoHS II Compliant | MSL Level 3

Typical Applications

- IoT, Wireless communication
- Medical instrumentation
- Utility meters
- Data loggers and Appliances
- Consumer electronics

Absolute Maximum Ratings

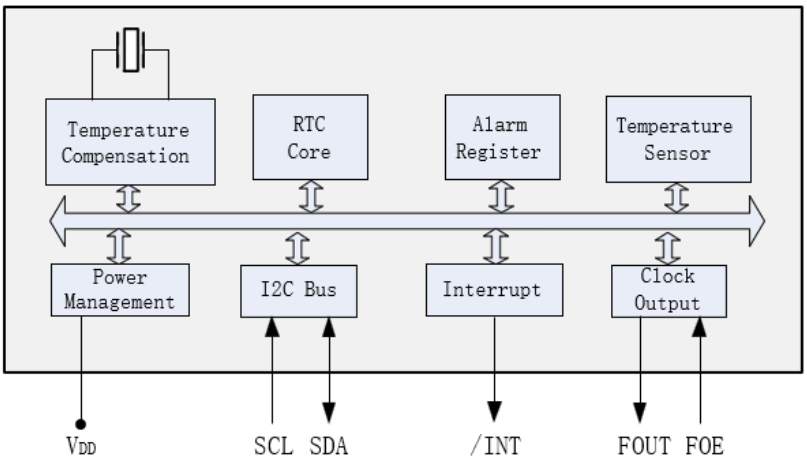
Parameters	Symbol	Min.	Typ.	Max.	Units	Notes
Supply Voltage	V_{DD}	-0.3		6.5	V	
Input Voltage	V_{IN}	GND-0.3		6.5	V	FOE, SCL,SDA input
Clock output Voltage	V_{Out1}	GND-0.3		6.5	V	FOUT output
Output Voltage	V_{Out2}	GND-0.3		6.5	V	SDA, /INT output
Operating Ambient Temperature Range	T_{OPR}	-40		85	℃	
Storage Temperature Range	T_{STO}	-55		125	℃	
Reflow Temperature				+260	℃	See Reflow Profile
ESD Protection	V_{ESD}	4kV HBM,400V MM,2kV CDM,1),2)				

1) HBM: Human Body Model, according to JESD22-A114.

2) MM: Machine Model, according to JESD22-A115.

Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operational sections of this specification is not intended. Exposure to maximum rating conditions for extended periods may affect device reliability. The data sheet limits are not guaranteed if the device is operated beyond the recommended operating conditions.

Block Diagram



Frequency Characteristics (Unless otherwise specified, GND=0V,VDD = 2.5V ~ 5.5V, Ta=-40℃~+85℃)

Parameters	Symbol	Min.	Typ.	Max.	Units	Notes
Frequency stability	Δf/f	−3.4		+3.4	ppm	-40℃ to +85℃
Oscillation start time	t_{STA}			1	s	@25℃
Year Aging	fa			±3	ppm	First year@25℃
Temperature Sensor Accuracy	T_{emp}			±5	℃	V_{DD}=3.0V
FOUT duty cycle`	$T_{w/t}$	40	50	60	%	

DC Characteristics (Unless otherwise specified, GND=0V, VBAT=VDD=1.2~5.5V, VIO=1.6V ~5.5V, Ta=-40℃~+85℃)

Parameters	Symbol	Min.	Typ.	Max.	Units	Notes
Power Supply (pad 6)[Note 1,2]	V_{DD}	1.6	3.0	5.5	V	
Operating Temperature	T_{OPR}	-40	25	85	℃	
Current consumption	I_{DD1}		1.25	5.1	uA	VDD = 5.0V, fSCL=0Hz, FOE=GND, /INT = VDD;; FOUT off (High-Z); Compensation interval 2s;
	I_{DD2}		1.0	4.9	uA	VDD = 3.0V, fSCL=0Hz, FOE=GND, /INT = VDD;; FOUT off (High-Z); Compensation interval 2s;
	I_{DD3}		5.8	20	uA	VDD= 5.0V, fSCL=0Hz, FOE=VDD, /INT = VDD; FOUT:32.768kHz, CL=0pF; Compensation interval 2s;
	I_{DD4}		3.8	19	uA	VDD= 3.0V, fSCL=0Hz, FOE=VDD, /INT = VDD; FOUT:32.768kHz, CL=0pF; Compensation interval 2s;
I^2C clock signal (pad 2)	SCL					
Input voltage high-level	V_{IH}	0.8*VDD		5.5	V	
Input voltage low-level	V_{IL}	GND-0.3		0.2*V_{DD}	V	
Input Leak Current	ILK	-0.5		0.5	uA	VIN = VDD or GND
I^2C data signal (pad 13)	SDA					
Input voltage high-level	V_{IH}	0.8*VDD		5.5	V	
Input voltage low-level	V_{IL}	GND-0.3		0.2*V_{DD}	V	
Output voltage Low-level	V_{OL}	GND		GND+0.4	V	VDD≥3.0V, IOL = 3mA
Input Leak Current	I_{LK}	-0.5		0.5	uA	VIN = VDD or GND
Output Leak Current	I_{OZ}	-0.5		0.5	uA	VIN = VDD or GND
Frequency Output (pad 3)	F_{OUT}					
Output voltage high-level	V_{OH}	4.0		5.0	V	VDD=5.0V, IOH = -1mA
		2.2		3.0		VDD=3.0V, IOH = -1mA
		2.9		3.0		VDD=3.0V, IOH = -100uA
Output voltage low-level	V_{OL}	GND		GND+0.5	V	VDD=5.0V, IOL = 1mA
		GND		GND+0.8		VDD=3.0V, IOL = 1mA
		GND		GND+0.1		VDD=3.0V, IOL = 100uA
Output Control Pin (pad 7)	FOE					
Input voltage high-level	V_{IH}	0.8*VDD		5.5	V	
Input voltage low-level	V_{IL}	GND-0.3		0.2*V_{DD}	V	
Input Leak Current	I_{LK}	-0.5		0.5	uA	VIN = VDD or GND
Output Control Pin (pad 10)	/INT					
Output voltage low-level	V_{OL}	GND		GND+0.25	V	VDD=5.0V, IOL = 1mA
		GND		GND+0.4		VDD=3.0V, IOL = 1mA
Output Leak Current	I_{OZ}	-0.5		0.5	uA	VIN = VDD or GND

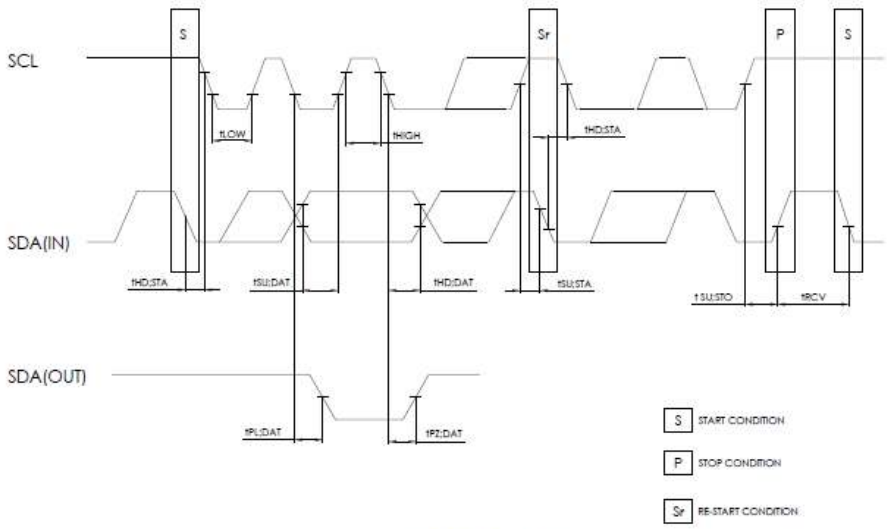
AC Characteristics (Unless otherwise specified, VDD =2.5V ~ 5.5V; Ta=-40℃ ~ +85℃)

Parameters	Symbol	Min.	Typ.	Max.	Units	Notes
Start condition setup time[Note 1]	$t_{HD;STA}$	0.6			us	
Start condition hold time[Note 1]	$t_{SU;STA}$	0.6			us	
Stop condition setup time	$t_{SU;STO}$	0.6			us	
Bus idle time between start condition and stop condition	t_{RCV}	1.3			us	
Data setup time	$t_{SU;DAT}$	100			ns	
Data hold time	$t_{HD;DAT}$	0		0.9	ns	
I^2C clock signal (pad 2)	SCL					
SCL clock frequency	f_{SCL}			400	kHz	
SCL low voltage time	t_{LOW}	1.3			us	
SCL high voltage time	t_{HIGH}	0.6			us	
SCL rising time	tr			0.3	us	
SCL falling time	tf			0.3	us	
I^2C data signal (pad 13)	SDA					
SDA rising time	tr			0.3	us	
SDA falling time	tf			0.3	us	

Note 1: VDD needs to be supplied with more than 2.5V at least for the oscillation to stabilize (oscillation start time tSTA).

Note2：After the power supply is powered off, ensure that VDD = GND for more than 10 seconds, and then power on.

I2C BUS Timing Characteristics



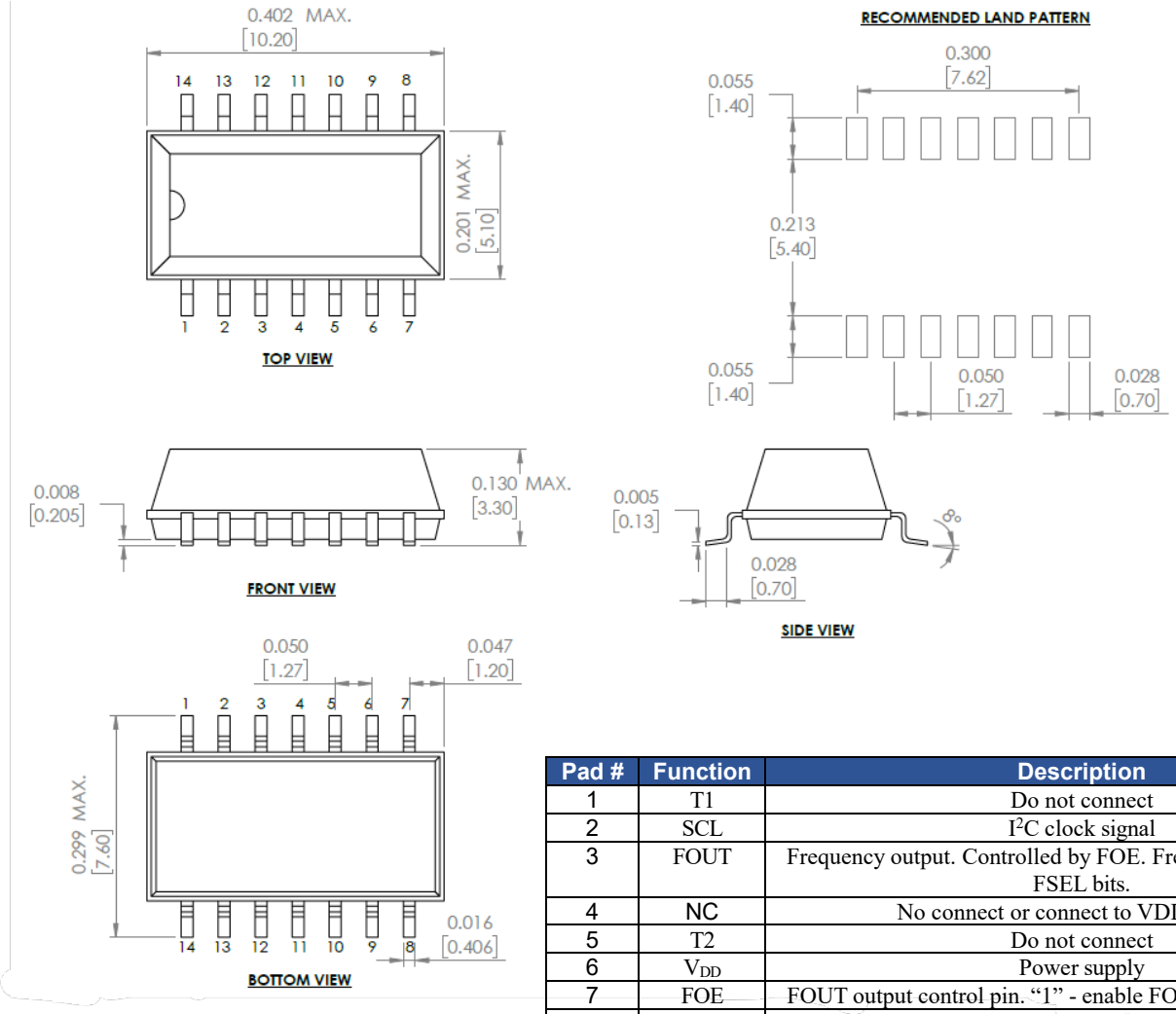
I²C BUS TIMING CHART

Part Identification

AB - RTC - TC - 32.768kHz - 2 - ☐

Packaging
Blank: Bulk
T: 1300pcs / reel

Mechanical Dimensions



Dimensions: inches[mm]

Pad #	Function	Description
1	T1	Do not connect
2	SCL	I^2C clock signal
3	FOUT	Frequency output. Controlled by FOE. Frequency can be set by FSEL bits.
4	NC	No connect or connect to VDD or GND
5	T2	Do not connect
6	V_{DD}	Power supply
7	FOE	FOUT output control pin. “1” - enable FOUT, “0”- FOUT Hi-Z
8	T5	Do not connect
9	T4	Do not connect
10	/INT	Interrupt Output, Open-Drain
11	GND	Ground
12	T3	Do not connect
13	SDA	I^2C data signal
14	NC	No connect or connect to VDD or GND

Reflow Profile [JEDEC J-STD-020]

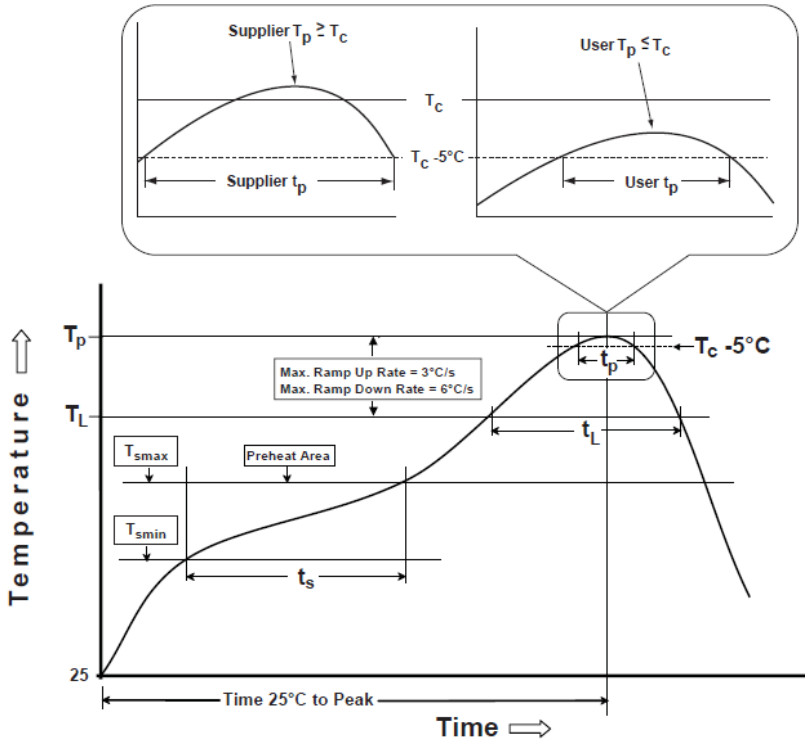


Table 1

SnPb Eutectic Process Classification Temperatures (T_c)		
Package Thickness	**Volume mm³ <350**	**Volume mm³ ≥350**
<2.5 mm	235 °C	220 °C
≥2.5 mm	220 °C	220 °C

Table 2

Pb-Free Process Classification Temperatures (T_c)			
Package Thickness	**Volume mm³ <350**	**Volume mm³ 350-2000**	**Volume mm³ >2000**
<1.6 mm	260 °C	260 °C	260 °C
1.6 mm - 2.5 mm	260 °C	250 °C	245 °C
>2.5 mm	250 °C	245 °C	245 °C

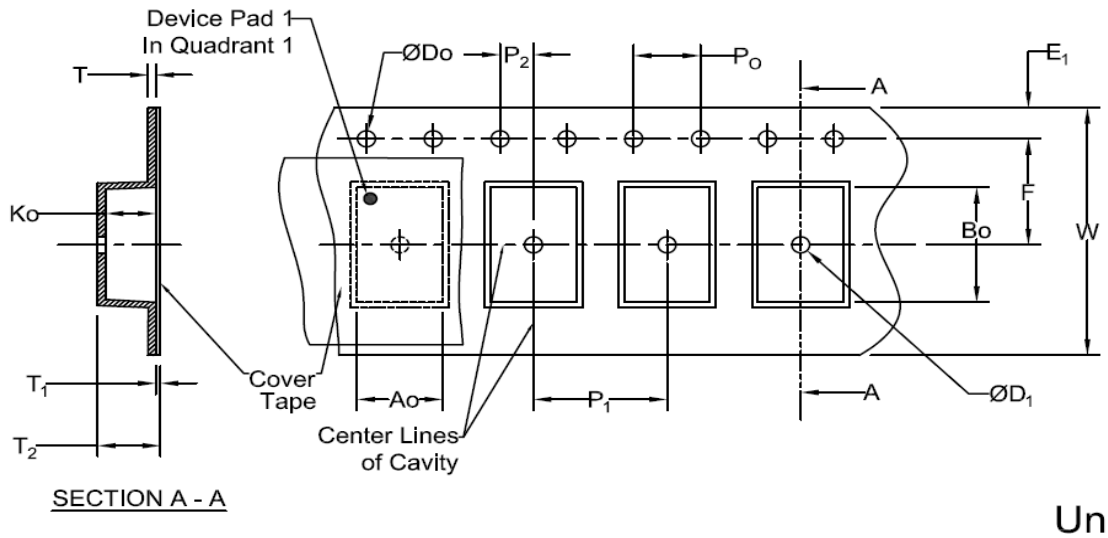
Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat / soak		
Temperature minimum (T_{smin})	100°C	150°C
Temperature maximum (T_{smax})	150°C	200°C
Time (T_{smin} to T_{smax}) (t_s)	60 - 120 sec.	60 - 120 sec.
Average ramp-up rate (T_{smax} to T_P)	3°C/sec. max	3°C/sec. max
Liquidous temperature (T_L)	183°C	217°C
Time at liquidous (t_L)	60 - 150 sec.	60 - 150 sec.
Peak package body temperature (T_P)*	**see Table 1**	**see Table 2**
Time (t_p)** within 5°C of the specified classification temperature (T_C)	20 sec.	30 sec.
Ramp-down rate (T_p to T_{smax})	6°C/sec. max	6°C/sec. max
Time 25°C to peak temperature	6 min. max	8 min. max
Reflow cycles	2 max	2 max

*Tolerance for peak profile temperature (T_p) is defined as a supplier minimum and a user maximum.

**Tolerance for time at peak profile temperature (t_p) is defined as supplier minimum and a user maximum.

Packaging

T: 1,300pcs/reel

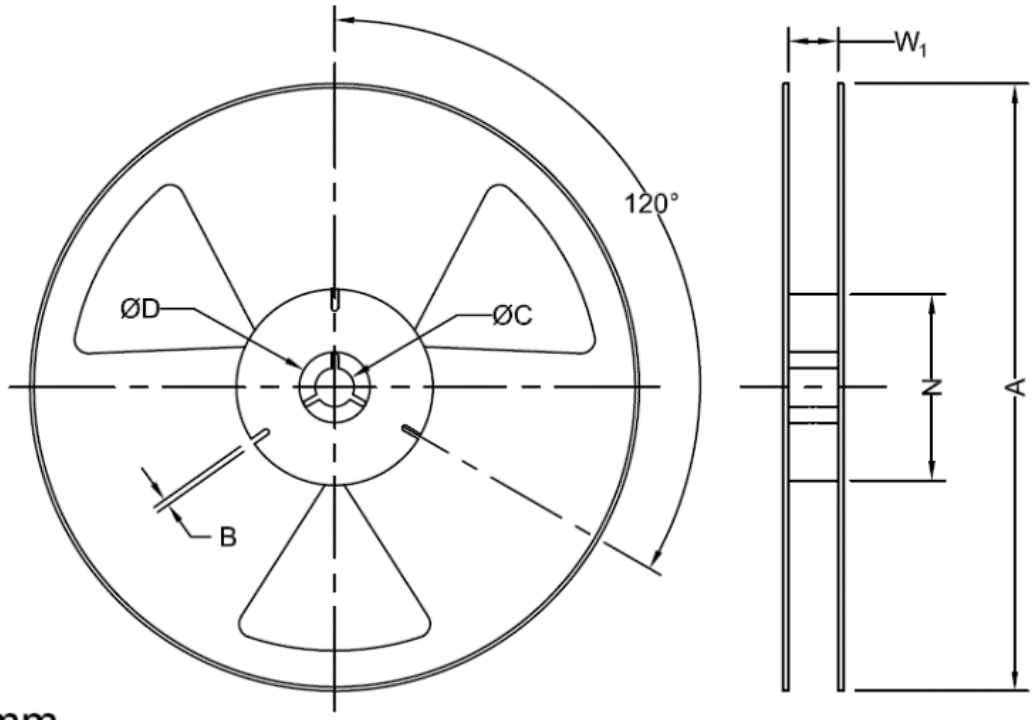


Unit: mm

Tape Specifications (mm)							
Width	Ao	Bo	Do	D_1 (Min)	E_1	F	Ko
16mm	*	*	1.5+0.1/-0.0	1.0	1.75±0.1	7.5±0.10	*

Tape Specifications (mm)							
Width	P_1	P_2	P_0	T (Max)	T_1 (Max)	T_2 (Max)	W (Max)
16mm	4.0±0.1	2.0±0.1	4.0±0.1	0.6	0.1	8.0	16.3

*Note: Compliant to EIA-481



Unit: mm

Tape Specifications (mm)							
Width	Qty/Reel	A (Nom)	B (Min)	C (Min)	D (Min)	N (Min)	*W_1
16mm	1300	330	1.5	13.0+0.5/-0.2	20.2	60	24.4+2.0/-0.0