



Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



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DTCXO Temperature Compensated Real-Time-Clock Module with SPI bus



3.7 x 2.5 x 0.9 mm

AB-RTCMC-32.768kHz-EOA9-S3



RoHS/RoHS II compliant

Moisture Sensitivity Level: MSL=1

FEATURES:

- With state-of-the-art RTC Technology by Micro Crystal AG
- RTC module with built-in “Tuning Fork” crystal oscillating at 32.768 kHz
- Factory calibrated, all built-in Temperature Compensation circuitry Time accuracy Option A & B. See Part Identification on page 7 for details
- Ultra low power consumption: 800nA typ @ VDD = 3.0V / Tamb = 25°C
- Wide clock operating voltage: 1.3 – 5.5V
- Wide interface operating voltage: 1.4 – 5.5V
- Extended operating temperature range: -40°C to +125°C
- SPI serial interface with fast mode SCL clock frequency of 1 MHz
- Provides year, month, day, weekday, hours, minutes and seconds
- Highly versatile alarm and timer functions
- Integrated Low-Voltage Detector, Power-On Reset and Self-Recovery System
- Main Power Supply to Backup Battery switchover circuitry with Trickle Charger
- Programmable CLKOUT pins for peripheral devices (32.768 kHz / 1024 Hz / 32 Hz / 1 Hz)
- Small and compact package size: 3.7 x 2.5 x 0.9 mm. RoHS-compliant and 100% leadfree

APPLICATIONS:

- Wide range in communication & measuring equipment
- Commercial & Industrial applications
- Automotive electronics applications
- Wireless communications
- PDA and Palm Pilots
- Credit Cards with Security Technology

STANDARD SPECIFICATIONS:

Absolute Maximum Ratings

Parameters	Min.	Typ.	Max.	Units	Notes
Supply Voltage (V _{DD})	GND-0.3		+6.0	V	>GND / <V _{DD}
Supply Current (I _{DD} ; I _{SS})	-50		+50	mA	V _{DD} Pin
Input Voltage (V _I)	GND-0.3		V _{DD} +0.3	V	Input Pin
Output Voltage (V _O)	GND-0.5		V _{DD} +0.5	V	$\overline{\text{INT}} / \text{CLKOUT}$
DC Input Current (I _I)	-10		+10	mA	
DC Output Current (I _O)	-10		+10	mA	
Total Power Dissipation (P _{TOT})			300	mW	
Operating Temperature Range (T _{OPR})	-40		+125	°C	
Storage Temperature (T _{STO})	-55		+125	°C	Stored as bare product

Frequency and Time Characteristics

V_{DD}=3.0V; V_{SS}=0V; T_{AMB}=+25°C; f_{OSC}=32.768kHz

Parameters	Min.	Typ.	Max.	Units	Notes
32.768kHz Oscillator Characteristics					
Frequency Accuracy ($\Delta F/F$)		±10	±20	ppm	F _{CLKOUT} =32.768kHz; T _{AMB} =+25°C; V _{DD} =3.0V
Frequency vs Voltage ($\Delta F/V$)		±0.5	±1.0	ppm/V	T _{AMB} =+25°C; V _{DD} =1.4~5.5V
Frequency vs Temperature ($\Delta F/T_{OPR}$)	-0.035ppm/°C ² (T _{OPR} -T _O) ² ±10%			ppm	T _{OPR} =-40~+125°C; V _{DD} =3.0V
Turnover Temperature (T _O)	+20	+25	+30	°C	
Aging (first year)	-3		+3	ppm	T _{AMB} =+25°C
Start-up Time Voltage (V _{START})					
Start-up Time (T _{START})		0.5	3	s	T _{AMB} =-40 ~ +85°C
		1	3		T _{AMB} =-40 ~ +125°C
CLKOUT duty cycle	40	50	60	%	F _{CLKOUT} =32.768kHz; T _{AMB} =+25°C

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(Continued)

Parameters		Min.	Typ.	Max.	Units	Notes
Time accuracy, DTCXO Digitally Temperature Compensated						
Time Accuracy Option: A ($\Delta t/t$)	$T_{AMB}=+25^{\circ}\text{C}$		± 1	± 3	ppm	
	$T_{AMB}=0 \sim +50^{\circ}\text{C}$		± 2	± 4		
	$T_{AMB}=-10 \sim +65^{\circ}\text{C}$		± 3	± 5		
	$T_{AMB}=-40 \sim +85^{\circ}\text{C}$		± 4	± 6		
	$T_{AMB}=-40 \sim +125^{\circ}\text{C}$		± 5	± 8		
Time Accuracy Option: B ($\Delta t/t$)	$T_{AMB}=+25^{\circ}\text{C}$		± 1	± 3	ppm	
	$T_{AMB}=0 \sim +50^{\circ}\text{C}$		± 3	± 5		
	$T_{AMB}=-10 \sim +65^{\circ}\text{C}$		± 5	± 10		
	$T_{AMB}=-40 \sim +85^{\circ}\text{C}$		± 10	± 25		
	$T_{AMB}=-40 \sim +125^{\circ}\text{C}$		± 15	± 30		

Static Characteristics

$V_{DD}=1.4\sim 5.5\text{V}$; $V_{SS}=0\text{V}$; $T_{AMB}=-40^{\circ}\text{C} \sim +125^{\circ}\text{C}$; $f_{OSC}=32.768\text{kHz}$

Parameters		Min.	Typ.	Max.	Units	Notes
Supplies						
Supply Voltage (V_{DD})		1.4		5.5	V	Time-keeping mode I^2C bus reduced speed
		2.1		5.5		I^2C bus full speed
Minimum Supply Voltage Detection (V_{LOW1})		1.8		2.1	V	$T_{AMB}=-40 \sim +125^{\circ}\text{C}$
Minimum Supply Voltage Detection (V_{LOW2})		1.0		1.4	V	$T_{AMB}=-40 \sim +125^{\circ}\text{C}$
Main Supply to Backup Supply Switchover Hysteresis (V_{HYST})			20		mV	V_{DD} to $V_{BACK} = 3.0\text{V}$
Supply Current I_{DD} ($V_{BACK}=0\text{V}$) or I_{BACK} ($V_{DD}=0\text{V}$)	$V_{DD}=1.4\text{V}$ $T_{AMB}=-40^{\circ}\text{C} \sim +85^{\circ}\text{C}$		0.6	1.5	μA	SPI bus inactive CLKOUT disabled $V_{BACK}=0\text{V}$ Or $V_{DD}=0\text{V}$
	$V_{DD}=1.4\text{V}$ $T_{AMB}=-40^{\circ}\text{C} \sim +125^{\circ}\text{C}$			4.6		
	$V_{DD}=3.3\text{V}$ $T_{AMB}=-40^{\circ}\text{C} \sim +85^{\circ}\text{C}$		0.8	2.0		
	$V_{DD}=3.3\text{V}$ $T_{AMB}=-40^{\circ}\text{C} \sim +125^{\circ}\text{C}$			5.2		
	$V_{DD}=5.0\text{V}$ $T_{AMB}=-40^{\circ}\text{C} \sim +85^{\circ}\text{C}$		0.9	2.2		
	$V_{DD}=5.0\text{V}$ $T_{AMB}=-40^{\circ}\text{C} \sim +125^{\circ}\text{C}$			5.5		

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Parameters		Min.	Typ.	Max.	Units	Notes
Supply Current (I_{DD})	SCL= 200kHz $V_{DD} = 1.4V$ $T_{AMB} = -40^{\circ}C \sim +85^{\circ}C$			14	μA	SPI bus active CLKOUT disabled
	SCL= 200kHz $V_{DD} = 1.4V$ $T_{AMB} = -40^{\circ}C \sim +125^{\circ}C$			18		
	SCL= 1MHz $V_{DD} = 3.3V$ $T_{AMB} = -40^{\circ}C \sim +85^{\circ}C$			50		
	SCL= 1MHz $V_{DD} = 3.3V$ $T_{AMB} = -40^{\circ}C \sim +125^{\circ}C$			55		
	SCL= 1MHz $V_{DD} = 5.0V$ $T_{AMB} = -40^{\circ}C \sim +85^{\circ}C$			65		
	SCL= 1MHz $V_{DD} = 5.0V$ $T_{AMB} = -40^{\circ}C \sim +125^{\circ}C$			75		
Current Consumption (I_{DD32K})	$V_{DD}=5.0V$		2.5	3.4	μA	SPI bus inactive CLKOUT =32.768kHz $C_{LOAD} =7.5pF$
	$V_{DD}=3.3V$		1.5	2.2		
	$V_{DD}=1.4V$		1.1	1.6		
Input						
LOW Level Input Voltage (V_{IL})				$20\% * V_{DD}$	V	$V_{DD} = 1.4 \sim 5.5V_{DD}$ Pins:SCL,SDI,CLKOE,CE
HIGH Level Input Voltage (V_{IH})		$80\% * V_{DD}$			V	
Input Leakage Current (I_L)	$T_{amb}=-40 \sim +85^{\circ}C$	-1		+1	μA	$V_{SS} > V_I < V_{DD}$
	$T_{amb}=-40 \sim +125^{\circ}C$	-1.5		+1.5		
Input Capacitance (C_I)				7	pF	

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(Continued)

Parameters		Min.	Typ.	Max.	Units	Notes
Output						
HIGH Level Output Voltage (V_{OH})	$V_{DD} = 1.4V; I_{OH} = 0.1mA$	1.0			V	
	$V_{DD} = 3.3V; I_{OH} = 1.5mA$	2.7				
	$V_{DD} = 5.0V; I_{OH} = 2.0mA$	4.5				
LOW Level Output Voltage (V_{OL})	$V_{DD} = 1.4V; I_{OL} = 0.4mA$			0.2	V	
	$V_{DD} = 3.3V; I_{OL} = 1.5mA$			0.25		
	$V_{DD} = 5.0V; I_{OL} = 5.0mA$			0.8		
HIGH Level Output Current (I_{OH})	$V_{OH} = 4.5V / V_{DD} = 5V$			2.0	mA	
LOW Level Output Current (I_{OL})	$V_{OL} = 0.8V / V_{DD} = 5V$			-5.0	mA	
Output Leakage Current (I_{LO})	$V_O = V_{DD} \text{ or } V_{SS}$ $T_{AMB} = -40^{\circ}C \sim +85^{\circ}C$	-1	0	+1	μA	
	$V_O = V_{DD} \text{ or } V_{SS}$ $T_{AMB} = -40^{\circ}C \sim +125^{\circ}C$	-1.5	0	+1.5		
Operating Temperature Range						
Operating Temperature Range (T_{OPR})		-40		+125	$^{\circ}C$	
EEPROM Characteristics						
Read Voltage (V_{Read})	$T_{AMB} = -40^{\circ}C \sim +125^{\circ}C$	1.4			V	
Programming Voltage (V_{Prog})	$T_{AMB} = -40^{\circ}C \sim +125^{\circ}C$	2.2			V	
EEPROM Programming Time (T_{Prog})	$T_{AMB} = -40^{\circ}C \sim +125^{\circ}C$ 1 Byte EEPROM User			35	ms	
	$T_{AMB} = -40^{\circ}C \sim +125^{\circ}C$ 1 Byte EEPROM Control			100		
	$T_{AMB} = -40^{\circ}C \sim +125^{\circ}C$ 2-4 Byte EEPROM Control			135		
EEPROM Write/Erase Cycles (V_{HYST})	$V_{DD} \text{ to } V_{BACK} = 3.0V$	5000			Cycles	

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(Continued)

Parameters		Min.	Typ.	Max.	Units	Notes
Trickle Charger						
Current Limiting Resistors	R80K		80		kΩ	V _{DD} = 5.0V V _{BACK} = 3.0V T _{AMB} = 25°C
	R20k		20			
	R5k		5			
	R1.5k		1.5			
Thermometer						
Thermometer Precision (T _E)	T _{AMB} = -40°C ~ +85°C		±4		°C	
	T _{AMB} = -40°C ~ +125°C		±6			

SPI Interface Dynamic Characteristics

V_{SS}=0V; T_{AMB}=-40°C ~+125°C; All timing values are valid within the operating supply voltage range and references to V_{IL} and V_{IH} with an input voltage swing from V_{SS} and V_{DD}.

Parameters	Symbol	Notes	V _{DD} =1.6V		V _{DD} =2.4V		V _{DD} =3.3V		V _{DD} =5.0V		Units
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
SCL Clock Frequency	f _{clk(SCL)}			0.2		0.6		1.0		1.0	MHz
SCL Time	t _{SCL}		5		1.7		1		1		μs
Clock HIGH Time	t _{clk(H)}		1500		700		400		400		ns
Clock LOW Time	t _{clk(L)}		1500		700		400		400		ns
Rise Time	t _r	For SCL signal		800		800		200		200	ns
Fall Time	t _f	For SCL signal		800		800		200		200	ns
CE Setup Time	t _{su(CE)}		100		100		100		100		ns
CE Hold Time	t _{h(CE)}		500		300		200		200		ns
CE Recovery Time	t _{rec(CE)}		400		300		200		200		ns
CE Pulse Width	t _{w(CE)}	Measured after valid subaddress is received		0.49		0.49		0.49		0.49	s
Setup Time	t _{su}	Setup time for SDI data	20		20		20		20		ns
Hold Time	t _h	Hold time for SDI data	500		300		200		200		ns
SDO Read Delay Time	t _{d(R)SDO}	Bus load = 50pF		1300		650		350		350	ns
SDO Disable Time	t _{dis(SDO)}	No load value; bus will be held up by bus-capacitance; use RC time constant with application values		200		100		50		50	ns
Transition Time SDI to SDO	t _{t(SDI-SDO)}	Prepare for 0s to avoid bus conflict	0		0		0		0		ns



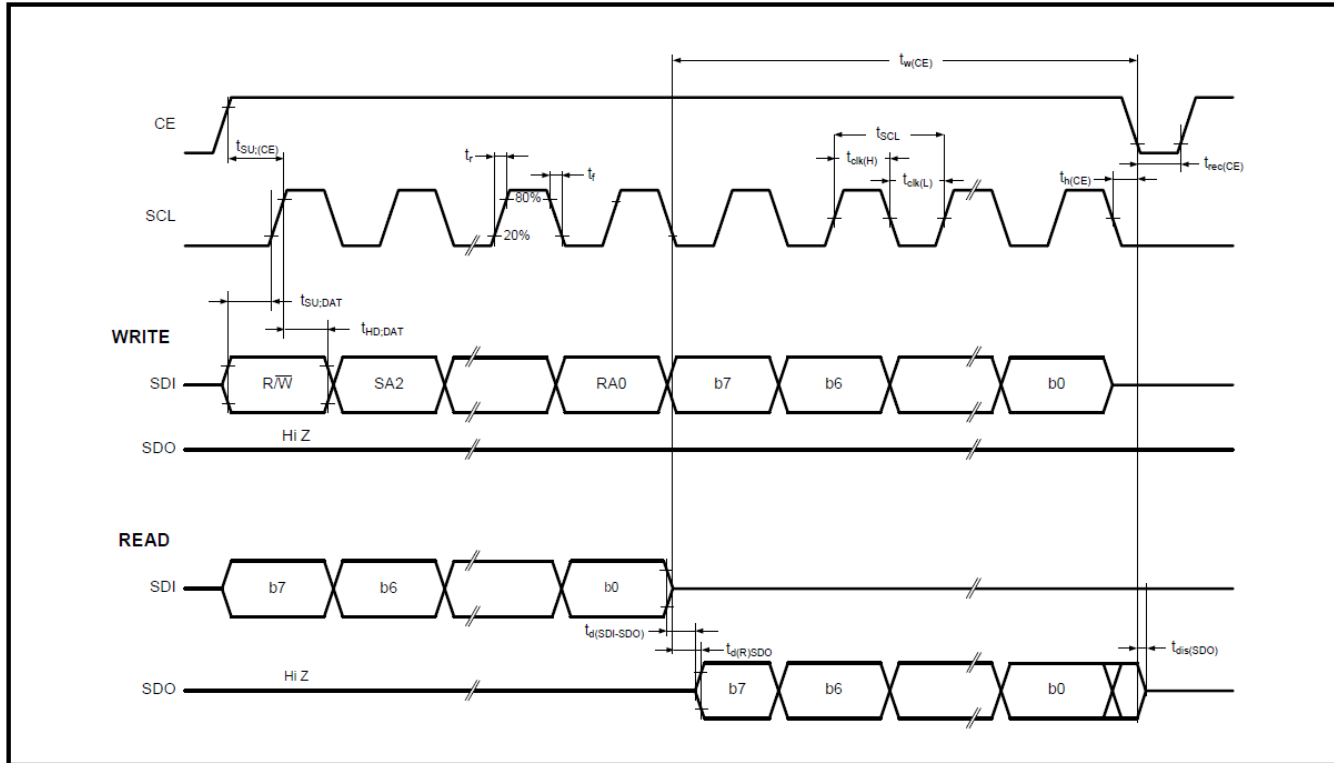
3.7 x 2.5 x 0.9 mm

AB-RTCMC-32.768kHz-EOA9-S3



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Interface Timing Characteristics



PART IDENTIFICATION:

AB-RTCMC-32.768 kHz-EOA9-S3-□□□

Operating Temp. Range
D: -40 ~ +85°C
H: -40 ~ +125°C

Timing Accuracy
A: see Table 1 below
B: see Table 1 below

Packaging
Blank: Bulk
T: 1000pcs/reel

Table 1. Time accuracy, DTCXO Digitally Temperature Compensated

Parameters		Min.	Typ.	Max.	Units
Time Accuracy Option: A	T _{AMB} =+25°C		±1	±3	ppm
	T _{AMB} =0 ~ +50°C		±2	±4	
	T _{AMB} =-10 ~ +65°C		±3	±5	
	T _{AMB} =-40 ~ +85°C		±4	±6	
	T _{AMB} =-40 ~ +125°C		±5	±8	
Time Accuracy Option: B	T _{AMB} =+25°C		±1	±3	ppm
	T _{AMB} =0 ~ +50°C		±3	±5	
	T _{AMB} =-10 ~ +65°C		±5	±10	
	T _{AMB} =-40 ~ +85°C		±10	±25	
	T _{AMB} =-40 ~ +125°C		±15	±30	

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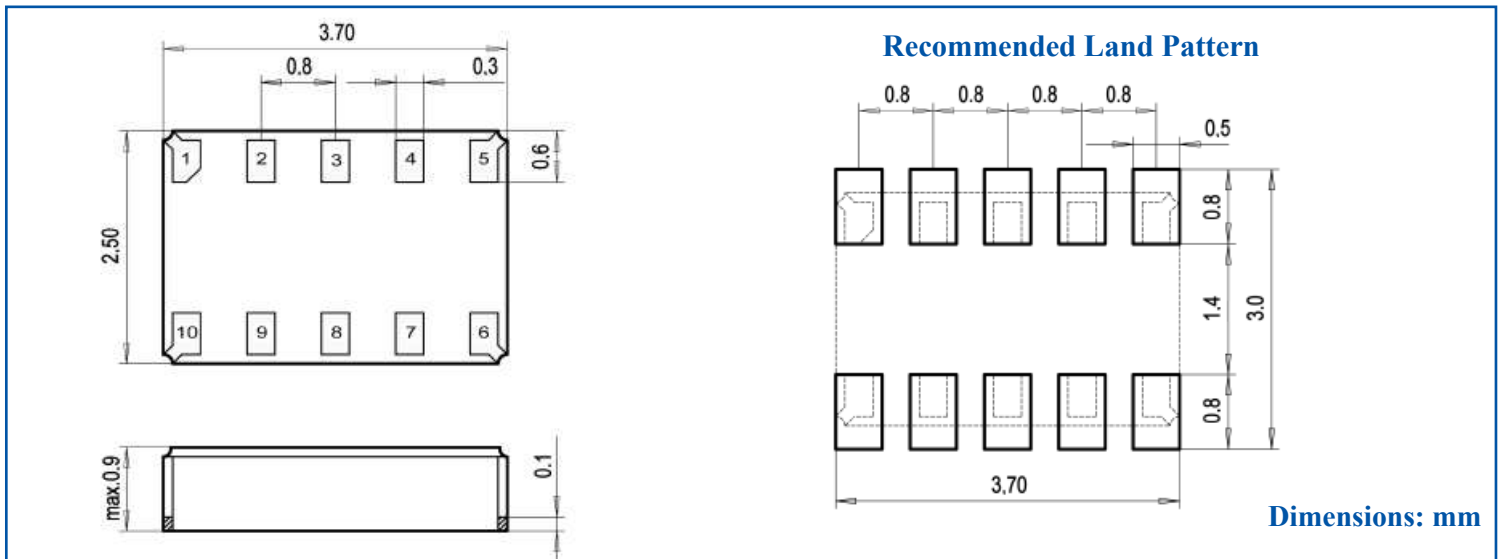


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3.7 x 2.5 x 0.9 mm

OUTLINE DIMENSIONS:



PIN DESCRIPTION:

Pin No.	Pin Name	Function
1	CLKOE	CLKOUT enable/disable pin; enable is active HIGH; tie to GND when not using CLKOUT
2	V _{DD}	Positive supply voltage; positive or negative steps in supply voltage may affect oscillator performance, recommend 10 nF decoupling capacitor close to device
3	CLKOUT	Clock Output pin; CLKOUT or $\overline{\text{INT}}$ function can be selected.(Control_1; bit7; Clk/Int) CLKOUT output push-pull / $\overline{\text{INT}}$ function open-drain requiring pull-up resistor
4	SCL	Serial Clock Input pin; may float when CE inactive
5	SDO	Serial Data Output pin; push-pull; high-impedance when not driving; can be connected to SDI for single-wire data line.
6	V _{SS}	Ground
7	$\overline{\text{INT}}$	Interrupt output pin; open-drain; active LOW
8	CE	Chip Enable input; active HIGH
9	V _{BACKUP}	Backup Supply Voltage; tie to GND when not using backup supply voltage
10	SDI	Serial Data Input pin; may float when CE inactive

DTCXO Temperature Compensated Real-Time-Clock Module with SPI bus

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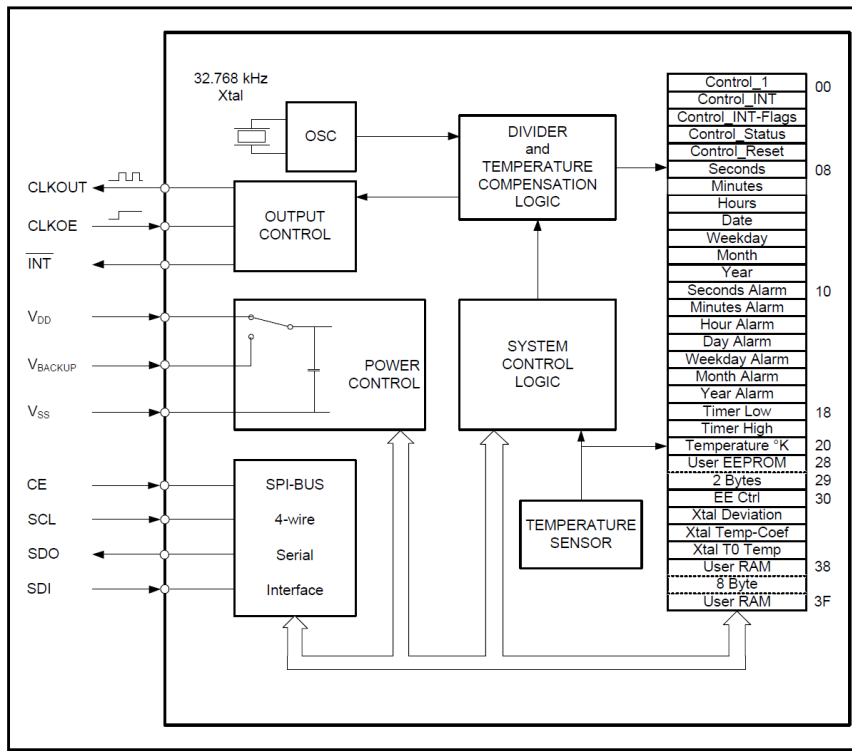


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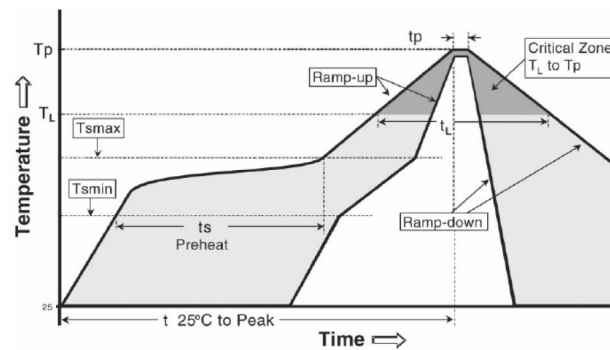
3.7 x 2.5 x 0.9 mm

BLOCK DIAGRAM:



RECOMMENDED REFLOW PROFILE:

Maximum Reflow Conditions in accordance with IPC/JEDEC J-STD-020C "Pb-free"



Temperature	Conditions	Units
Average Ramp-up Rate (T_{Smax} to T_p)	3°C/second max	°C/s
Ramp Down Rate (T_{cool})	6°C/second max	°C/s
Time 25°C to Peak Temperature ($T_{to-peak}$)	8 minutes max	m
Preheat		
Temperature Min (T_{Smin})	150	°C
Temperature Max (T_{Smax})	200	°C
Time T_{Smin} to T_{Smax} (t_s)	60 ~ 180	sec
Time Above Liquidus		
Temperature Liquidus (T_l)	217	°C
Time above Liquidus (t_l)	60 ~ 150	sec
Peak Temperature		
Peak Temperature (T_p)	260	°C
Time within 5°C of Peak Temperature (t_p)	20 ~ 40	sec

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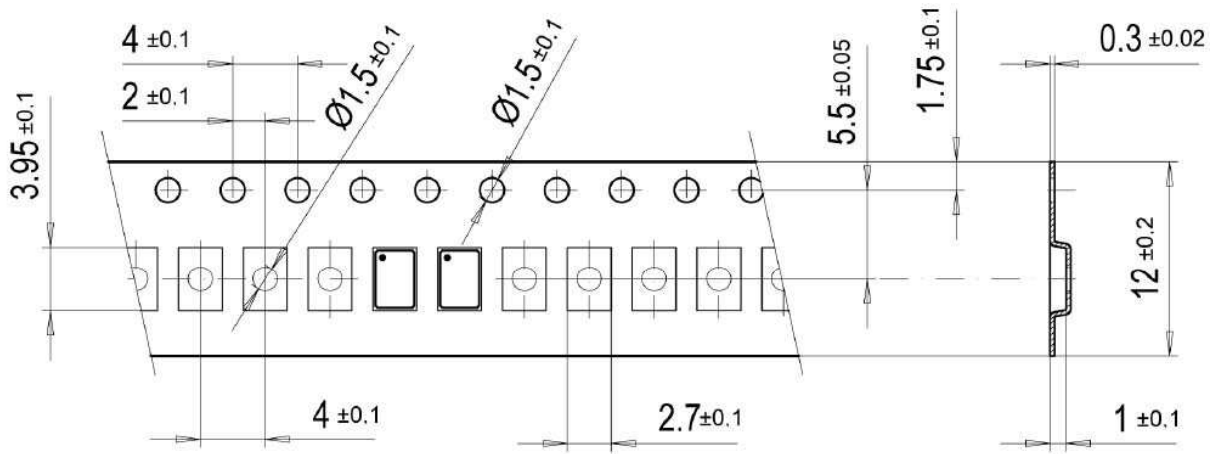
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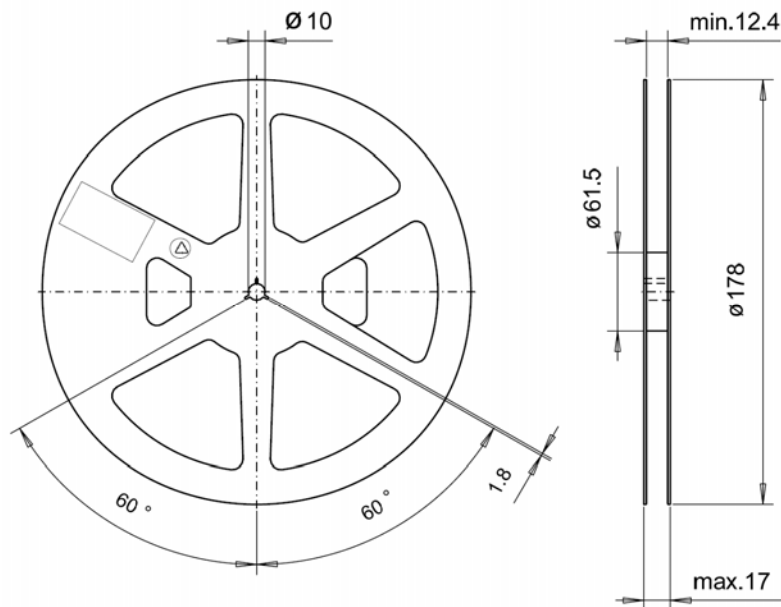
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TAPE & REEL:

T = 1000pcs/reel



User Direction of Feed



Dimension: mm

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