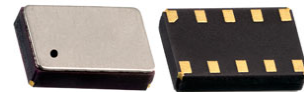


# Real Time Clock Module with I<sup>2</sup>C Bus

AB-RTCMC-32.768kHz-B5GA-S3



RoHS/RoHS II compliant



3.7 x 2.5 x 0.9 mm

Moisture Sensitivity Level: MSL=1

## FEATURES:

- With state-of-the-art RTC Technology by Micro Crystal AG
- RTC module with built-in crystal oscillating at 32.768 kHz
- 400kHz two-wire I2C interface
- Wide Interface operating voltage: 1.8 – 5.5 V
- Wide clock operating voltage: 1.2 – 5.5 V
- Low power consumption: 250 nA typ @ 3.0V / 25°C
- Provides year, month, day, weekday, hours, minutes, seconds
- Alarm and Timer functions
- Century flag
- Low voltage detector, internal power on reset
- Programmable clock output for peripheral devices (32.768 kHz, 1024 Hz, 32 Hz, 1 Hz)
- I2C slave address: read A3h, write A2h
- 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:

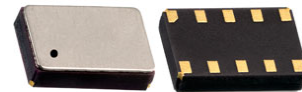
### Absolute Maximum Ratings

| Parameters                                | Min.         | Typ. | Max.         | Units | Notes                  |
|---|--------------|------|--------------|-------|------------------------|
| Supply Voltage ( $V_{DD}$ )               | -0.5         |      | +6.5         | V     | >GND / < $V_{DD}$      |
| Supply Current ( $I_{DD}$ ; $I_{SS}$ )    | -50          |      | +50          | mA    | $V_{DD}$ Pin           |
| Input Voltage ( $V_I$ )                   | $V_{SS}-0.5$ |      | $V_{DD}+0.5$ | V     | Input Pin              |
| Output Voltage ( $V_O$ )                  | $V_{SS}-0.5$ |      | $V_{DD}+0.5$ | V     | $\overline{INT}$ Pin   |
| DC Input Current ( $I_I$ )                | -10          |      | +10          | mA    |                        |
| DC Output Current ( $I_O$ )               | -10          |      | +10          | mA    |                        |
| Operating Temperature Range ( $T_{OPR}$ ) | -40          |      | +85          | °C    |                        |
| Storage Temperature ( $T_{STO}$ )         | -55          |      | +125         | °C    | Stored as bare product |

### Frequency Characteristics

| Parameters                                      | Min.  | Typ. | Max. | Units | Notes   |
|---|---|------|------|-------|---|
| Frequency Accuracy ( $\Delta F/F$ )             |   | ±10  | ±20  | ppm   | $T_{AMB}=+25^{\circ}C$ ; $V_{DD}=3.0V$            |
| Frequency vs Voltage ( $\Delta F/V$ )           |   | ±0.8 | ±1.5 | ppm/V | $T_{AMB}=+25^{\circ}C$ ;<br>$V_{DD}=1.8\sim 5.5V$ |
| Frequency vs Temperature ( $\Delta F/T_{OPR}$ ) | -0.035ppm/°C <sup>2</sup> ( $T_{OPR}-T_O$ ) <sup>2</sup> ±10% |      |      | ppm   | $T_{REF}=+25^{\circ}C$ ; $V_{DD}=3.0V$            |
| Turnover Temperature ( $T_O$ )                  | +20   | +25  | +30  | °C    |   |
| Aging (first year)                              | -3  |      | +3   | ppm   | $T_{AMB}=+25^{\circ}C$                            |
| Start-up Time ( $T_{START}$ )                   |   | 350  | 500  | ms    | $T_{AMB}=+25^{\circ}C$                            |
| CLKOUT duty cycle                               | 40  | 50   | 60   | %     | $T_{AMB}=+25^{\circ}C$                            |





## Static Characteristics

| Parameters   |                              | Min.                 | Typ. | Max.                 | Units | Notes  |
|--|------------------------------|----------------------|------|----------------------|-------|--|
| <b>Supplies</b>  |                              |                      |      |                      |       |  |
| Supply Voltage (V <sub>DD</sub> )                          |                              | 1.2                  |      | 5.5                  | V     | I <sup>2</sup> C bus inactive<br>T <sub>AMB</sub> =+25°C   |
|  |                              | 1.8                  |      | 5.5                  |       | I <sup>2</sup> C bus active<br>f <sub>SCL</sub> = 400kHz   |
|  |                              | V <sub>LOW</sub>     |      | 5.5                  |       | For clock data integrity<br>T <sub>AMB</sub> =+25°C  |
| Current Consumption (I <sub>DDO</sub> )                    | f <sub>SCL</sub> = 400kHz    |                      |      | 800                  | μA    | I <sup>2</sup> C bus active  |
|  | f <sub>SCL</sub> = 100kHz    |                      |      | 200                  |       |  |
| Current Consumption (I <sub>DD</sub> ) <sup>1) 2) 3)</sup> | V <sub>DD</sub> = 5.0V       |                      | 275  | 550                  | nA    | I <sup>2</sup> C bus inactive(f <sub>SCL</sub> =0Hz)<br>CLKOUT disabled<br>T <sub>AMB</sub> =+25°C                             |
|  | V <sub>DD</sub> = 3.0V       |                      | 250  | 500                  |       |  |
|  | V <sub>DD</sub> = 2.0V       |                      | 225  | 450                  |       |  |
| Current Consumption (I <sub>DD</sub> ) <sup>1) 2) 3)</sup> | V <sub>DD</sub> = 5.0V       |                      | 500  | 750                  | nA    | I <sup>2</sup> C bus inactive(f <sub>SCL</sub> =0Hz)<br>CLKOUT disabled<br>T <sub>AMB</sub> =-40 ~ +85°C                       |
|  | V <sub>DD</sub> = 3.0V       |                      | 400  | 650                  |       |  |
|  | V <sub>DD</sub> = 2.0V       |                      | 400  | 600                  |       |  |
| Current Consumption (I <sub>DD32k</sub> ) <sup>3)</sup>    | V <sub>DD</sub> = 5.0V       |                      | 2.5  | 3.4                  | μA    | I <sup>2</sup> C bus inactive(f <sub>SCL</sub> =0Hz)<br>CLKOUT enabled<br>(32.768kHz)<br>Load=7.5pF / T <sub>AMB</sub> = +25°C |
|  | V <sub>DD</sub> = 3.0V       |                      | 1.5  | 2.2                  |       |  |
|  | V <sub>DD</sub> = 2.0V       |                      | 1.1  | 1.6                  |       |  |
| <b>Input</b>   |                              |                      |      |                      |       |  |
| LOW Level Input Voltage (V <sub>IL</sub> )                 |                              | V <sub>SS</sub> -0.5 |      | 30%* V <sub>DD</sub> | V     |  |
| HIGH Level Input Voltage (V <sub>IH</sub> )                |                              | 70%* V <sub>DD</sub> |      | V <sub>DD</sub> +0.5 | V     |  |
| Input Leakage Current (I <sub>L</sub> )                    |                              | -1                   |      | +1                   | μA    | V <sub>I</sub> =V <sub>DD</sub> or V <sub>SS</sub>   |
| Input Capacitance (C <sub>I</sub> ) <sup>4)</sup>          |                              |                      |      | 7                    | pF    |  |
| <b>Output</b>  |                              |                      |      |                      |       |  |
| HIGH Level Output Current (I <sub>OH</sub> )               | Pin: CLKOUT                  |                      |      | 1                    | mA    | V <sub>OH</sub> = 4.6V; V <sub>DD</sub> = 5.0V   |
| LOW Level Output Current (I <sub>OL</sub> )                | Pin: SDA                     |                      |      | -3                   | mA    | V <sub>OL</sub> = 0.4V; V <sub>DD</sub> = 5.0V   |
|  | Pin: $\overline{\text{INT}}$ |                      |      | -1                   |       |  |
|  | Pin: CLKOUT                  |                      |      | -1                   |       |  |
| Output Leakage Current (I <sub>LO</sub> )                  |                              | -1                   | 0    | +1                   | μA    | V <sub>O</sub> = V <sub>DD</sub> or V <sub>SS</sub>  |
| <b>Voltage Detector</b>                                    |                              |                      |      |                      |       |  |
| Low Voltage (V <sub>LOW</sub> )                            |                              |                      | 0.9  | 1.0                  | V     | T <sub>AMB</sub> =+25°C  |

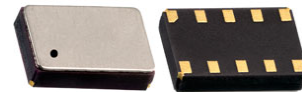
1) Timer source clock = 1/60 Hz.

2) CLKOUT disabled (FE = 0 or CLKOE = 0).

3) V<sub>IL</sub> and V<sub>IH</sub> with an input voltage swing of V<sub>SS</sub> to V<sub>DD</sub>.

4) Tested on sample basis.



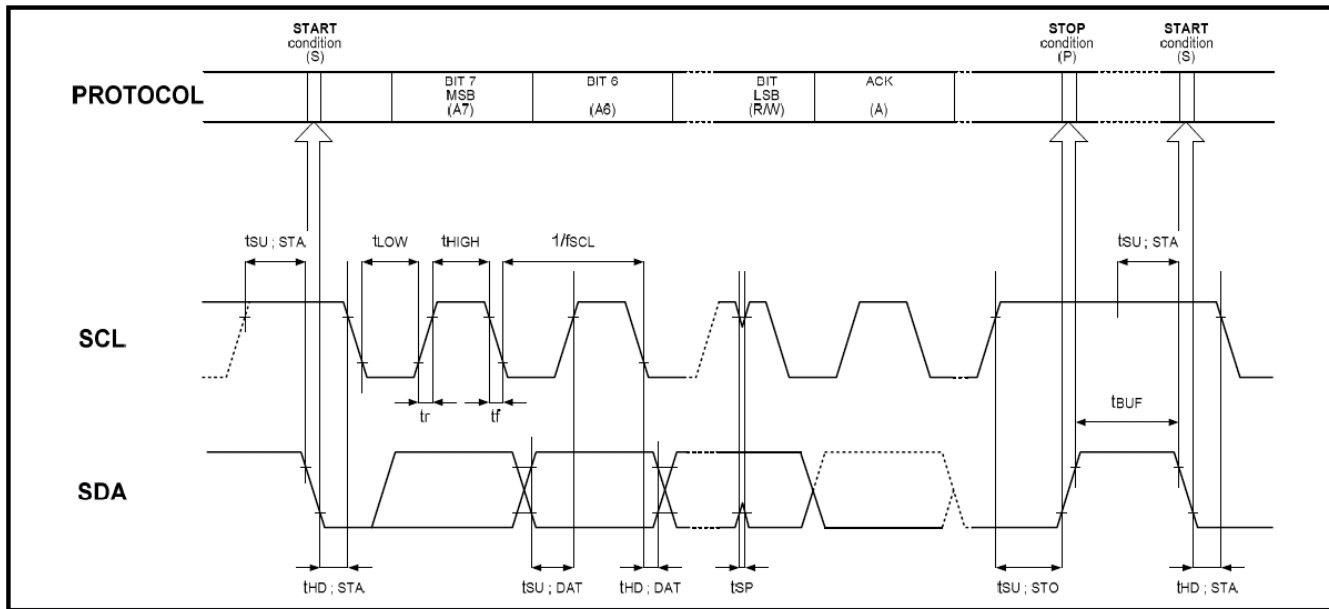


## I<sup>2</sup>C Interface Dynamic Characteristics

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   | Min. | Typ. | Max. | Units   |
|--|------|------|------|---------|
| SCL clock frequency ( $f_{SCL}$ )                            |      |      | 400  | kHz     |
| Hold time (repeated) START condition ( $t_{HD,STA}$ )        | 0.6  |      |      | $\mu$ s |
| Startup time for repeated START condition ( $t_{SU,STA}$ )   | 0.6  |      |      | $\mu$ s |
| LOW period of SCL clock ( $t_{LOW}$ )                        | 1.3  |      |      | $\mu$ s |
| HIGH period of SCL clock ( $t_{HIGH}$ )                      | 0.6  |      |      | $\mu$ s |
| Bus free time between STOP and START condition ( $t_{BUF}$ ) | 1.3  |      |      | $\mu$ s |
| Rise time of both SDA and SCL signals ( $t_r$ )              |      |      | 0.3  | $\mu$ s |
| Fall time of both SDA and SCL signals ( $t_f$ )              |      |      | 0.3  | $\mu$ s |
| Capacitive load for each bus line ( $C_b$ )                  |      |      | 400  | pF      |
| Data setup time ( $t_{SU,DAT}$ )                             | 100  |      |      | ns      |
| Data hold time ( $t_{HD,DAT}$ )                              | 0    |      |      | ns      |
| Setup time for STOP condition ( $t_{SU,STO}$ )               | 0.6  |      |      | $\mu$ s |
| Spike pulse width ( $t_{w(spike)}$ )                         |      |      | 50   | ns      |

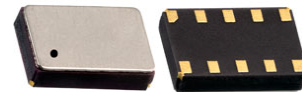
## I<sup>2</sup>C Interface Timing Characteristics



Note:

The I<sup>2</sup>C BUS 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.





3.7 x 2.5 x 0.9 mm

AB-RTCMC-32.768kHz-B5GA-S3



RoHS/RoHS II compliant

## PART IDENTIFICATIONS:

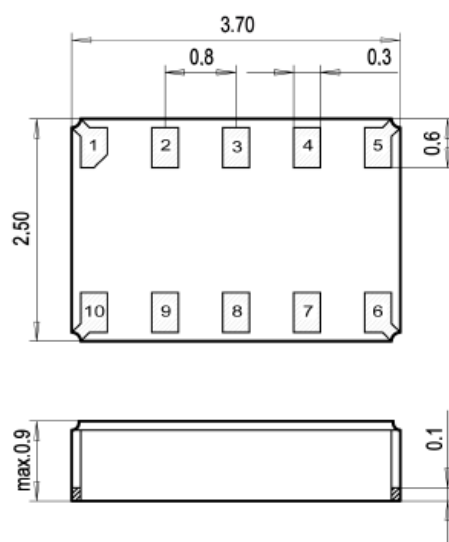
AB-RTCMC-32.768 kHz-B5GA-S3-

### Packaging

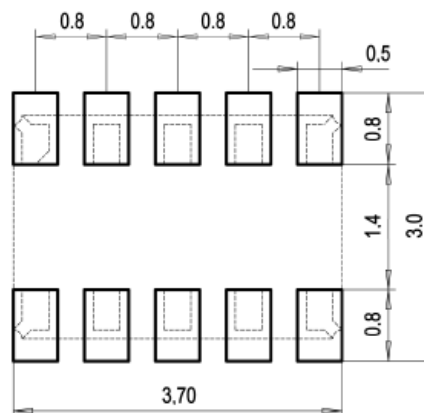
Blank: Bulk

T: 1000pcs/reel

## OUTLINE DIMENSIONS:



### Recommended Land Pattern



Dimensions: mm

## PIN DESCRIPTIONS:

| Pin No. | Pin Name                | Function   |
|---------|-------------------------|--|
| 1       | CLKOE                   | CLKOUT enable/disable pin; enable is active HIGH; tie to GND when not using CLKOUT |
| 2       | V <sub>DD</sub>         | Positive supply voltage  |
| 3       | CLKOUT                  | Clock Output pin; push-pull  |
| 4       | SCL                     | Serial Clock Input pin; requires pull-up resistor                                  |
| 5       | SDA                     | Serial Data Input-Output pin; open-drain; requires pull-up resistor                |
| 6       | $\overline{\text{INT}}$ | Interrupt Output pin; open-drain; active LOW                                       |
| 7       | V <sub>SS</sub>         | Ground   |
| 8       | N.C.                    | Not Connected  |
| 9       | N.C.                    | Not Connected  |
| 10      | N.C.                    | Not Connected  |

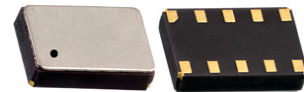


# Real Time Clock Module with I<sup>2</sup>C Bus

AB-RTCMC-32.768kHz-B5GA-S3

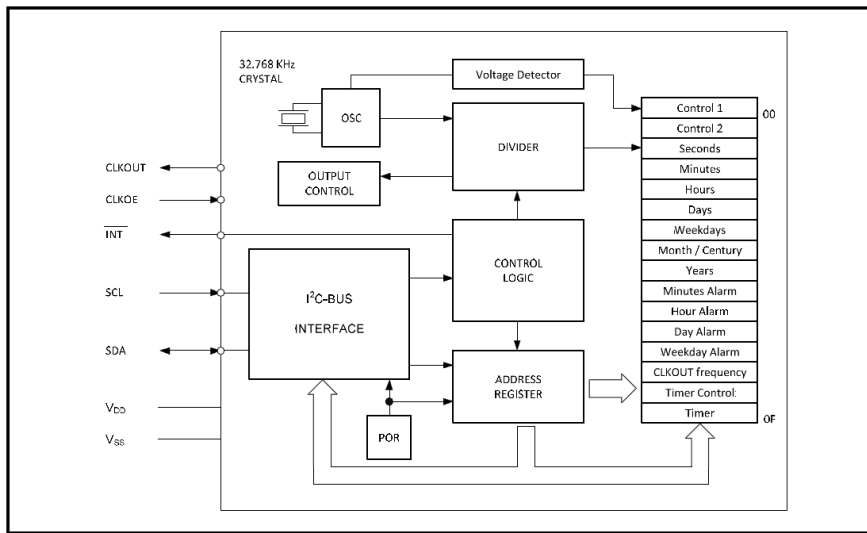


RoHS/RoHS II compliant



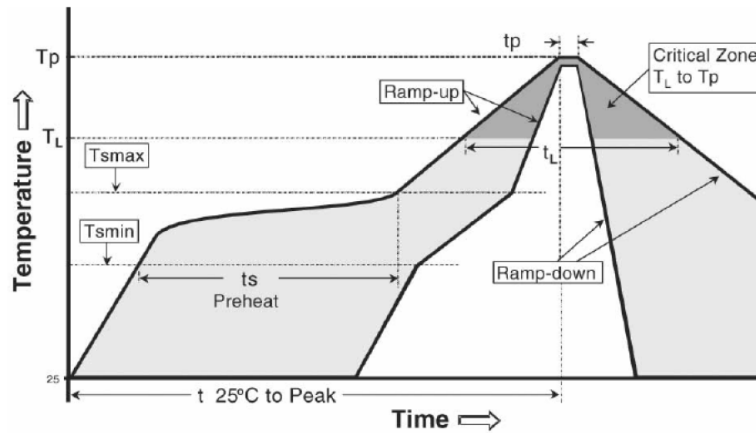
3.7 x 2.5 x 0.9 mm

## 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     |
| <b>Preheat</b>                                  |                |       |
| Temperature Min ( $T_{Smin}$ )                  | 150            | °C    |
| Temperature Max ( $T_{Smax}$ )                  | 200            | °C    |
| Time $T_{Smin}$ to $T_{Smax}$ ( $t_s$ )         | 60 ~ 180       | sec   |
| <b>Time Above Liquidus</b>                      |                |       |
| Temperature Liquidus ( $T_L$ )                  | 217            | °C    |
| Time above Liquidus ( $t_L$ )                   | 60 ~ 150       | sec   |
| <b>Peak Temperature</b>                         |                |       |
| Peak Temperature ( $T_p$ )                      | 260            | °C    |
| Time within 5°C of Peak Temperature ( $t_p$ )   | 20 ~ 40        | sec   |



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- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
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- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



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