

SERIAL REAL TIME CLOCK MODULE WITH SRAM

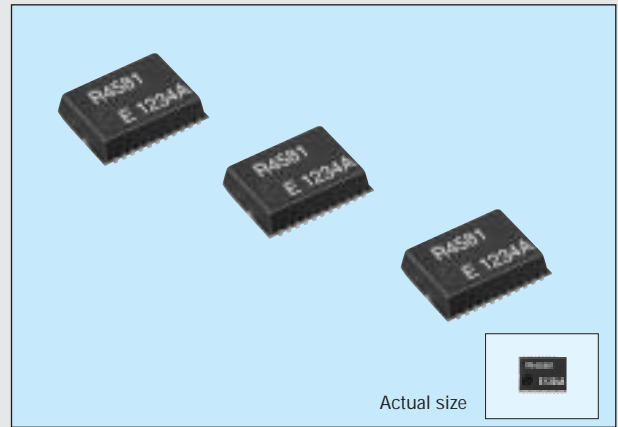
RX-4581NB

Product number (please refer to page 2)

Q4145819x000400

- Built in frequency adjusted 32.768 kHz crystal unit.
- Include 128 bit (8 bit x 16)RAM
- Serial interface which can be controlled by 4 or 3 signal lines.
- Alarm and Timer IRQ function are Available.
- 32.768 kHz clock frequency output.
- Automatic adjustment for leap year.
- Low backup current : 0.4 μ A /3 V(Typ.)
- Wide operating voltage range : 1.6 V to 5.5 V

The details are mentioned in the application manual.

<http://www.epsondevice.com>**Specifications (characteristics)****Absolute Max. rating**

| Item | Symbol | Condition | Min. | Max. | Unit |
|---------------------|------------|--|---------|--------------|--------------|
| Supply voltage | V_{DD} | V_{DD} to GND | -0.3 | +7.0 | V |
| Input voltage | V_{IN} | Input Pin | GND-0.3 | $V_{DD}+0.3$ | |
| Output voltage | V_{OUT1} | F_{OUT}, DO | | $V_{DD}+0.3$ | |
| | V_{OUT2} | $TIRQ, AIRQ$ | | +8.0 | |
| Storage temperature | T_{STG} | Stored as bare product after unpacking | -55 | +125 | $^{\circ}$ 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 | $^{\circ}$ C |

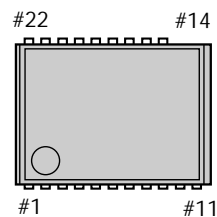
Frequency characteristics

| Item | Symbol | Condition | Range | Unit |
|---------------------------------------|----------------|---|---------------|------------------------------|
| Frequency tolerance | $\Delta f/f_0$ | $T_a=+25^{\circ}$ C, $V_{DD}=3$ V | $5\pm 23^{*}$ | $\times 10^{-6}$ |
| Oscillation start up time | t_{STA} | $T_a=+25^{\circ}$ C, $V_{DD}=3.0$ V | 3 Max. | s |
| Frequency temperature characteristics | T_{OP} | $T_a=-10$ to $+70^{\circ}$ C, Reference at $+25^{\circ}$ C | +10 -120 | $\times 10^{-6}$ |
| Frequency voltage characteristics | f/V | $T_a=+25^{\circ}$ C, $V_{DD}=2.0$ V to 5.0 V | ± 2 Max. | $\times 10^{-4}/V$ |
| Aging | f_a | $T_a=+25^{\circ}$ C, $V_{DD}=3$ V, first year | ± 5 Max. | $\times 10^{-4}/\text{year}$ |

*Please ask tighter tolerance

DC characteristics ($V_{DD}=1.6$ V to 5.5 V, $T_a=-40^{\circ}$ C to $+85^{\circ}$ C)

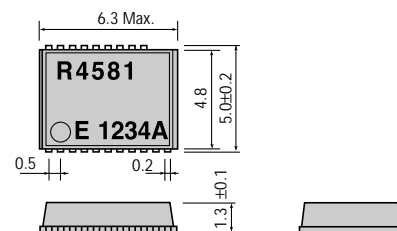
| Item | Symbol | Condition | | Min. | Typ. | Max. | Unit |
|------------------------|---------------------------|---|--|-----------------------------------|------|----------------------|----------|
| Standby current 1 | I _{DD1} | V _{DD} =5 V | CEO, CE1, FOE=GND AIRQ, TIRQ=V _{DD} 32.768 kHz output is OFF. | — | 0.6 | 1.2 | μA |
| Standby current 2 | I _{DD2} | V _{DD} =3 V | | | 0.4 | 0.8 | |
| Input voltage | V _{IH} | CEO, CE1, DI | | 0.8V _{DD} | — | V _{DD} +0.3 | V |
| | V _{IL} | CLK, FOE | | GND-0.3 | | 0.2V _{DD} | |
| Input leakage current | I _{LK} | CE1, DI, CLK, FOE V _{IN} =V _{DD} or GND | | -0.5 | | 0.5 | μA |
| Pulldown R1 | R _{DWN1} | V _{DD} =5 V | CEO 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 | 4.5 | — | 5.0 | V |
| | DO, F _{OUT} pins | | 2.0 | 3.0 | | | |
| | V _{OH2} | V _{DD} =3 V | I _{OH} =-100 μA DO, F _{OUT} pins | | | 2.9 | |
| Output voltage 2 | V _{OL1} | | V _{DD} =5 V | I _{OL} =1 mA | GND | — | |
| | V _{OL2} | DO, F _{OUT} pins | | GND+0.8 | | | |
| | V _{OL3} | V _{DD} =3 V | I _{OL} =100 μA DO, F _{OUT} pins | GND+0.1 | | | |
| | V _{OL4} | | V _{DD} =5 V | I _{OL} =1 mA | | | GND+0.25 |
| | V _{OL5} | | V _{DD} =3 V | AIRQ, TIRQ, F _{OUT} Pins | | | GND+0.4 |
| Output leakage current | I _{OZ} | V _{OUT} =GND or V _{DD} AIRQ, TIRQ, F _{OUT} Pins | | -0.5 | | 0.5 | μA |

Terminal connection**● RX-4581NB**

| No. | Pin terminal | No. | Pin terminal |
|-----|--------------|-----|--------------|
| 1 | GND | 22 | N.C |
| 2 | CE1 | 21 | N.C |
| 3 | CEO | 20 | N.C |
| 4 | DI | 19 | N.C |
| 5 | DO | 18 | N.C |
| 6 | CLK | 17 | N.C |
| 7 | TIRQ | 16 | N.C |
| 8 | AIRQ | 15 | N.C |
| 9 | FOE | 14 | N.C |
| 10 | FOUT | 13 | — |
| 11 | V_{DD} | 12 | — |

External dimensions

(Unit: mm)

● RX-4581NB (SON 22-pin)

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

Register table

BANK0

| Address | Register symbol | bit 7 | bit 6 | bit 5 | bit 4 | bit 3 | bit 2 | bit 1 | bit 0 |
|---------|--------------------|-------|-------|-------|-------|-------|-------|--------|--------|
| 0 | Sec | ○ | 40 | 20 | 10 | 8 | 4 | 2 | 1 |
| 1 | Min | ○ | 40 | 20 | 10 | 8 | 4 | 2 | 1 |
| 2 | Hour | ○ | ○ | 20 | 10 | 8 | 4 | 2 | 1 |
| 3 | Day of Week | ○ | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 4 | Day | ○ | ○ | 20 | 10 | 8 | 4 | 2 | 1 |
| 5 | Month | ○ | ○ | ○ | 10 | 8 | 4 | 2 | 1 |
| 6 | Year | 80 | 40 | 20 | 10 | 8 | 4 | 2 | 1 |
| 7 | RAM | • | • | • | • | • | • | • | • |
| 8 | Minutes Alarm | AE | 40 | 20 | 10 | 8 | 4 | 2 | 1 |
| 9 | Hours Alarm | AE | • | 20 | 10 | 8 | 4 | 2 | 1 |
| A | Day of week Alarm | AE | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| B | Timer Counter 0 | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| C | Timer Counter 1 | • | • | • | • | 2048 | 1024 | 512 | 256 |
| D | Extension Register | TEST | WADA | USEL | TE | ○ | ○ | TSEL 1 | TSEL 0 |
| E | Frag Register | ○ | ○ | UF | TF | AF | ○ | VLF | ○ |
| F | Control Register | ○ | ○ | UIE | TIE | AIE | ○ | STOP | RESET |

BANK1

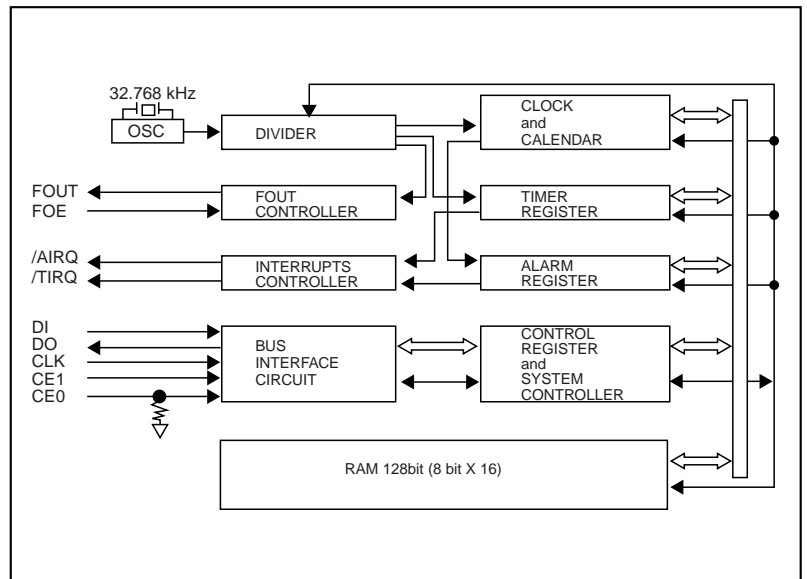
| Address | Register symbol | bit 7 | bit 6 | bit 5 | bit 4 | bit 3 | bit 2 | bit 1 | bit 0 |
|---------|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|
| 0 | RAM 0 | • | • | • | • | • | • | • | • |
| 1 | RAM 1 | • | • | • | • | • | • | • | • |
| 2 | RAM 2 | • | • | • | • | • | • | • | • |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ |
| D | RAM D | • | • | • | • | • | • | • | • |
| E | RAM E | • | • | • | • | • | • | • | • |
| F | RAM F | • | • | • | • | • | • | • | • |

AC characteristics

*If not specifically indicated, GND=0, Ta=-40 °C to +85 °C

| Item | Symbol | Condition | V _{DD} =3.0 V±10 % | | V _{DD} =5.0 V±10 % | | Unit |
|------------------------------|-------------------|--|-----------------------------|------|-----------------------------|------|------|
| | | | Min. | Max. | Min. | Max. | |
| CLK clock cycle | t _{CLK} | | 500 | | 350 | | ns |
| CLK H Pulse Width | t _{WH} | | 250 | | 175 | | ns |
| CLK L Pulse Width | t _{WL} | | 250 | | 175 | | ns |
| CLK L rise and fall time | t _{RF} | | | 100 | | 50 | ns |
| CLK setup time | t _{CLKS} | | 0 | | 0 | | ns |
| CE setup time | t _{CS} | | 200 | | 150 | | ns |
| CE hold time | t _{CH} | | 200 | | 100 | | ns |
| CE recovery time | t _{CR} | | 300 | | 200 | | ns |
| CE enable time | t _{WCE} | | | 0.95 | | 0.95 | s |
| Write data setup time | t _{DS} | | 100 | | 50 | | ns |
| Write data hold time | t _{DH} | | 100 | | 50 | | ns |
| Read data delay time | t _{RD} | C _L =50 pF | | 200 | | 150 | ns |
| DO output switching time | t _{ZR} | | | 50 | | 20 | ns |
| DO output disable time | t _{RZ} | C _L =50 pF R _L =10 kΩ | | 200 | | 100 | ns |
| DI/DO conflict avoiding time | t _{ZZ} | | 0 | | 0 | | ns |
| FOUT duty | t _{W/t} | 50% V _{DD} level | 40 | 60 | 40 | 60 | % |

Timing chart



Block diagram

