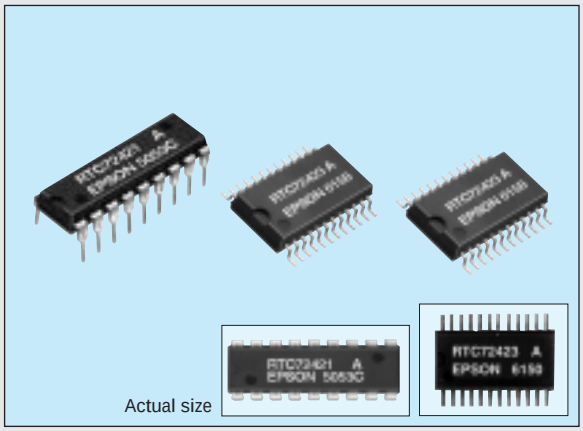
4-bit REAL TIME CLOCK MODULE

# RTC-72421/72423

Products number

**Q4272421xxxxx00**
**Q4272423xxxxx00**

- Built-in crystal unit allows adjustment-free efficient operation.
- 12/24 h clock switchover function and automatic leap year setting.
- Interrupt masking.




The details are mentioned in the application manual.

**http://www.epson.co.jp/device/**

## Specifications (characteristics)

### Absolute Max. rating

| Item | Symbol | Condition | Specifications | Unit |
|---|---|---|---|---|
| Power source voltage | $V_{DD}$ | Ta=+25 °C | -0.3 to 7.0 | V |
| Input and output voltage | $V_{I/O}$ | Ta=+25 °C | GND -0.3 to $V_{DD}$+0.3 | V |
| Storage temperature * | $T_{STG}$ | RTC-72421 | -55 to +85 | °C |
| | | RTC-72423 | -55 to +125 | °C |

*Stored as bare product after unpacking

### Operating range

| Item | Symbol | Condition | Specifications | Unit |
|---|---|---|---|---|
| Operating voltage | $V_{DD}$ | | 4.5 to 5.5 | V |
| Operating temperature * | $T_{OPR}$ | RTC-72421 | -10 to 70 | °C |
| | | RTC-72423 | -40 to 85 | °C |
| Data holding voltage | $V_{DH}$ | | 2.0 to 5.5 | V |
| $CS_1$ data holding time | $t_{CDR}$ | Refer to the data holding timing | 2.0 Min. | µs |
| Operation restoring time | $t_R$ | | | µs |

*No condensation

### Frequency characteristics and current consumption

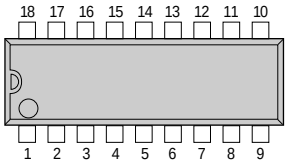
| Item | Symbol | Condition | | Specifications | Unit |
|---|---|---|---|---|---|
| Frequency tolerance | Δf/fo | Ta=+25 °C, $V_{DD}$=5 V | 72421 A | ±10 | x $10^{-6}$ |
| | | | 72421 B | ±50 | |
| | | | 72423 A | ±20 | |
| | | | 72423 | ±50 | |
| Frequency temperature characteristics | | -10 °C to +70 °C (+25 °C reference temperature) | | +10/-120 | |
| Frequency voltage characteristics | | Ta=+25 °C, $V_{DD}$=2.0 V to 5.5 V | | ±5 Max. | x $10^{-6}$/V |
| Aging | fa | $V_{DD}$=5 V, Ta=+25 °C, first year | | ±5 Max. | x $10^{-6}$ /year |
| Shock resistance | S.R. | Three drops on a hard board from 750 mm or 29400 m/s² x 0.3 ms x 1/2 sine wave x 3 directions | | ±10 Max. | x $10^{-6}$ |

### DC characteristics

| Item | Symbol | Condition | | Min. | Typ. | Max. | Unit | Applicable terminal |
|---|---|---|---|---|---|---|---|---|
| "H" input voltage (1) | $V_{IH1}$ | — | | 2.2 | — | — | V | All inputs other than $CS_1$ |
| "L" input voltage (1) | $V_{IL1}$ | | | — | | 0.8 | | |
| Input leak current (1) | $I_{LK1}$ | $V_I$=$V_{DD}$/0 V | | — | — | ±1 | µA | Input other than $D_0$ to $D_3$ |
| Input leak current (2) | $I_{LK2}$ | | | | | ±10 | | $D_0$ to $D_3$ |
| "L" output voltage (1) | $V_{OL1}$ | $I_{OL}$=2.5 mA | | | | 0.4 | V | |
| "H" output voltage | $V_{OH}$ | $I_{OH}$=-400 µA | | 2.4 | | — | | |
| "L" output voltage (2) | $V_{OL2}$ | $I_{OL}$=2.5 mA | | — | | 0.4 | | STD.P |
| Off leak current | $I_{OFFLK}$ | $V_I$=$V_{DD}$/0 V | | | | 10 | µA | |
| Input capacity | $C_I$ | Input frequency 1 MHz | | | 10 | — | pF | Input other than $D_0$ to $D_3$ |
| | | | | | 20 | | | $D_0$ to $D_3$ |
| "H" input voltage (2) | $V_{IH2}$ | $V_{DD}$=2 to 5.5 V | | 4/5 $V_{DD}$ | — | — | V | $CS_1$ |
| "L" input voltage (2) | $V_{IL2}$ | | | — | | 1/5 $V_{DD}$ | | |
| Current consumption | $I_{DD1}$ | $CS_1$=0 V, Exclude input/output current | $V_{DD}$=5 V | | 1 | 10 | µA | |
| | $I_{DD2}$ | | $V_{DD}$=2 V | | 0.9 | 5 | | |

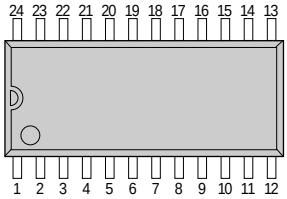
## Terminal connection

### RTC-72421




| No. | Pin terminal | No. | Pin terminal |
|---|---|---|---|
| 1 | STD. P | 18 | $V_{DD}$ |
| 2 | $\overline{CS_0}$ | 17 | ($V_{DD}$) |
| 3 | ALE | 16 | ($V_{DD}$) |
| 4 | $A_0$ | 15 | $CS_1$ |
| 5 | $A_1$ | 14 | $D_0$ |
| 6 | $A_2$ | 13 | $D_1$ |
| 7 | $A_3$ | 12 | $D_2$ |
| 8 | RD | 11 | $D_3$ |
| 9 | GND | 10 | $\overline{WR}$ |

### RTC-72423



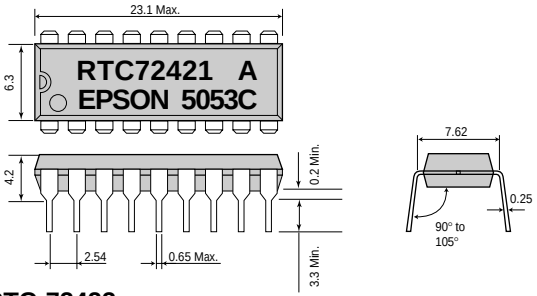

| No. | Pin terminal | No. | Pin terminal |
|---|---|---|---|
| 1 | STD. P | 24 | $V_{DD}$ |
| 2 | $\overline{CS_0}$ | 23 | ($V_{DD}$) |
| 3 | NC | 22 | ($V_{DD}$) |
| 4 | ALE | 21 | NC |
| 5 | $A_0$ | 20 | $CS_1$ |
| 6 | NC | 19 | $D_0$ |
| 7 | $A_1$ | 18 | NC |
| 8 | NC | 17 | NC |
| 9 | $A_2$ | 16 | $D_1$ |
| 10 | $A_3$ | 15 | $D_2$ |
| 11 | RD | 14 | $D_3$ |
| 12 | GND | 13 | $\overline{WR}$ |

- ($V_{DD}$) and $V_{DD}$ are to have the same level of voltage. Do not connect it to any external terminals.
- NC is not connected internally.

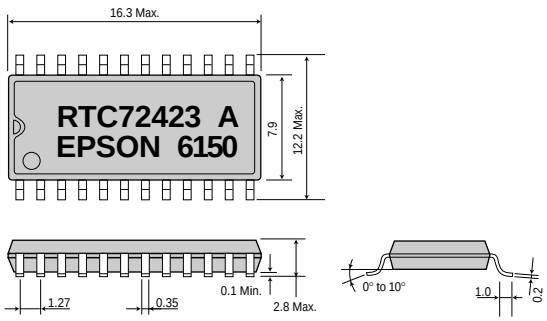
## External dimensions

(Unit: mm)

### RTC-72421 (DIP 18-pin)




### RTC-72423 (SOP 24-pin)



## Register table

| Address | $A_3$ | $A_2$ | $A_1$ | $A_0$ | Register | Data $D_3$ | Data $D_2$ | Data $D_1$ | Data $D_0$ | Count Value | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | $S_1$ | $s_8$ | $s_4$ | $s_2$ | $s_1$ | 0 to 9 | 1- second digit register |
| 1 | 0 | 0 | 0 | 1 | $S_{10}$ | * | $s_{40}$ | $s_{20}$ | $s_{10}$ | 0 to 5 | 10- second digit register |
| 2 | 0 | 0 | 1 | 0 | $MI_1$ | $mi_8$ | $mi_4$ | $mi_2$ | $mi_1$ | 0 to 9 | 1- minute digit register |
| 3 | 0 | 0 | 1 | 1 | $MI_{10}$ | * | $mi_{40}$ | $mi_{20}$ | $mi_{10}$ | 0 to 5 | 10- minute digit register |
| 4 | 0 | 1 | 0 | 0 | $H_1$ | $h_8$ | $h_4$ | $h_2$ | $h_1$ | 0 to 9 | 1- hour digit register |
| 5 | 0 | 1 | 0 | 1 | $H_{10}$ | * | PM/$\overline{AM}$ | $h_{20}$ | $h_{10}$ | 0 to 2 or 0 to 1 | PM/AM,10- hours digit register |
| 6 | 0 | 1 | 1 | 0 | $D_1$ | $d_8$ | $d_4$ | $d_2$ | $d_1$ | 0 to 9 | 1- day digit register |
| 7 | 0 | 1 | 1 | 1 | $D_{10}$ | * | * | $d_{20}$ | $d_{10}$ | 0 to 3 | 10 -day digit register |
| 8 | 1 | 0 | 0 | 0 | $MO_1$ | $mo_8$ | $mo_4$ | $mo_2$ | $mo_1$ | 0 to 9 | 1- month digit register |
| 9 | 1 | 0 | 0 | 1 | $MO_{10}$ | * | * | * | $mo_{10}$ | 0 to 1 | 10- month digit register |
| A | 1 | 0 | 1 | 0 | $Y_1$ | $y_8$ | $y_4$ | $y_2$ | $y_1$ | 0 to 9 | 1- year digit register |
| B | 1 | 0 | 1 | 1 | $Y_{10}$ | $y_{80}$ | $y_{40}$ | $y_{20}$ | $y_{10}$ | | 10- year digit register |
| C | 1 | 1 | 0 | 0 | W | * | $w_4$ | $w_2$ | $w_1$ | 0 to 6 | Week register |
| D | 1 | 1 | 0 | 1 | RegD | 30 sec. ADJ | IRQ FLAG | BUSY | HOLD | — | Control Register D |
| E | 1 | 1 | 1 | 0 | RegE | $t_1$ | $t_0$ | ITRPT /$\overline{STND}$ | MASK | | Control Register E |
| F | 1 | 1 | 1 | 1 | RegF | TEST | 24/$\overline{12}$ | STOP | REST | | Control Register F |

0="L" level,1="H" level, REST = RESET ITRPT/ $\overline{STND}$=INTERRUPT/STANDARD

1) Bit * does not exist.
2) Please mask AM/PM bit with 10's of hours operations.
3) Busy is read only. IRQ can only. IRQ can only be set low ("O").
4)

| Data Bit | PM/$\overline{AM}$ | ITRPT/$\overline{STND}$ | 24/$\overline{12}$ |
|---|---|---|---|
| 1 | PM | ITRPT | 24 |
| 0 | AM | STND | 12 |

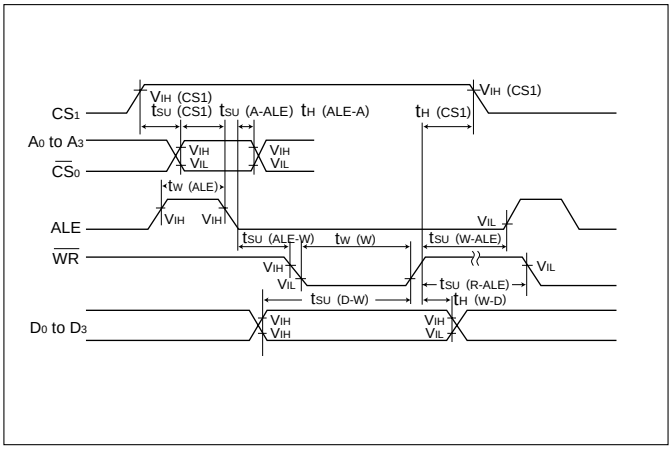
5) TEST bit should be "O".

## AC characteristics (with ALE)

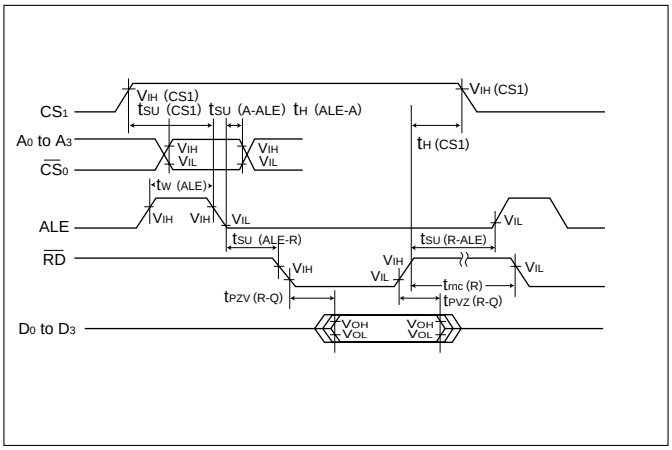
(Please connect ALE to $V_{DD}$ if the microprocessor does not have an ALE output.)
($V_{DD}$ = 5 V ± 0.5 V)

| Item | Symbol | Condition | Min. | Max. | Unit |
|---|---|---|---|---|---|
| $CS_1$ setup time | $t_{SU\ (CS1)}$ | | 1000 | — | ns |
| Address setup time before ALE | $t_{SU\ (A-ALE)}$ | | 50 | | |
| Address hold time after ALE | $t_{H\ (ALE-A)}$ | | 50 | | |
| ALE pulse width | $t_{W\ (ALE)}$ | | 80 | | |
| ALE setup time before WRITE | $t_{SU\ (ALE-W)}$ | | 0 | | |
| ALE setup time before READ | $t_{SU\ (ALE-R)}$ | | 0 | | |
| ALE setup time after WRITE | $t_{SU\ (W-ALE)}$ | | 50 | | |
| ALE setup time after READ | $t_{SU\ (R-ALE)}$ | | 50 | | |
| WRITE pulse width | $t_{W\ (W)}$ | | 120 | | |
| DATA delay time after READ | $t_{PZV\ (R-Q)}$ | $C_L$=150 pF | — | 120 | |
| DATA Hold time after READ | $t_{PVZ\ (R-Q)}$ | | 0 | 70 | |
| DATA setup time before WRITE | $t_{SU\ (D-W)}$ | | 80 | — | |
| DATA hold time after WRITE | $t_{H\ (W-D)}$ | | 10 | | |
| $CS_1$ hold time | $t_{H\ (CS1)}$ | | 1000 | | |
| READ/WRITE recovery time | $t_{REC\ (R/W)}$ | | 200 | | |

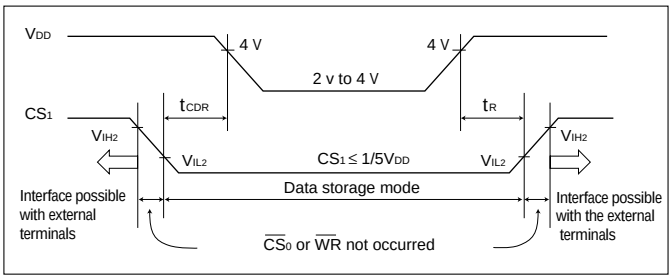
## Write mode (with ALE)




## Read mode (with ALE)




## Data holding timing




## Block diagram