



# bq4847/bq4847Y

## RTC Module With CPU Supervisor

### Features

- Real-Time Clock counts seconds through years in BCD format
- Integrated battery and crystal
- On-chip battery-backup switch-over circuit with nonvolatile control for an external SRAM
- 130mAh battery capacity
- ±1 minute per month clock accuracy
- Less than 500nA of clock operation current in backup mode
- Microprocessor reset valid to  $V_{CC} = V_{SS}$
- Independent watchdog timer with a programmable time-out period
- Power-fail interrupt warning
- Programmable clock alarm interrupt active in battery-backup mode
- Programmable periodic interrupt
- Battery-low warning

### General Description

The bq4847 Real-Time Clock Module is a low-power microprocessor peripheral that integrates a time-of-day clock, a 100-year calendar, a CPU supervisor, a battery, and a crystal in a 28-pin DIP module. The part is ideal for fax machines, copiers, industrial control systems, point-of-sale terminals, data loggers, and computers.

The bq4847 contains an internal battery and crystal. Through the use of the conditional chip enable output ( $\overline{CE}_{OUT}$ ) and battery voltage output ( $V_{OUT}$ ) pins, the bq4847 can write-protect and make nonvolatile an external SRAM. The backup cell powers the real-time clock and maintains SRAM information in the absence of system voltage.

The bq4847 contains a temperature-compensated reference and comparator circuit that monitors the status of its voltage supply. When an out-of-tolerance condition is detected, the bq4847 generates an interrupt warning and subsequently a microprocessor reset. The reset stays active for 200ms after  $V_{CC}$  rises within

tolerance to allow for power supply and processor stabilization.

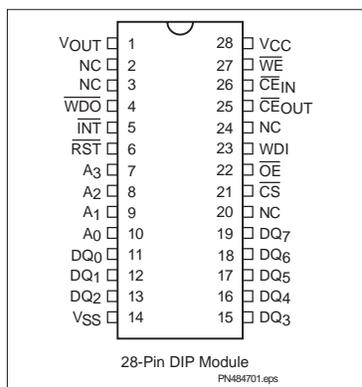
The bq4847 also has a built-in watchdog timer to monitor processor operation. If the microprocessor does not toggle the watchdog input (WDI) within the programmed time-out, the bq4847 asserts  $\overline{WDO}$  and  $\overline{RST}$ . WDI unconnected disables the watchdog timer.

The bq4847 can generate other interrupts based on a clock alarm condition or a periodic setting. The alarm interrupt can be set to occur from once per second to once per month. The alarm can be made active in the battery-backup mode to serve as a system wake-up call. For interrupts at a rate beyond once per second, the periodic interrupt can be programmed with periods of 30.5µs to 500ms.

#### Caution:

Take care to avoid inadvertent discharge through  $V_{OUT}$  and  $\overline{CE}_{OUT}$  after battery isolation has been broken.

### Pin Connections



### Pin Names

|                       |                              |                  |                        |
|-----------------------|------------------------------|------------------|------------------------|
| $A_0$ – $A_3$         | Clock/Control address inputs | NC               | No connect             |
| $DQ_0$ – $DQ_7$       | Data inputs/outputs          | $V_{OUT}$        | Back-up battery output |
| $\overline{WE}$       | Write enable                 | $\overline{INT}$ | Interrupt output       |
| $\overline{OE}$       | Output enable                | $\overline{RST}$ | Microprocessor reset   |
| $\overline{CS}$       | Chip select input            | WDI              | Watchdog input         |
| $\overline{CE}_{IN}$  | External RAM chip enable     | $\overline{WDO}$ | Watchdog output        |
| $\overline{CE}_{OUT}$ | Conditional RAM chip enable  | $V_{CC}$         | +5V supply             |
|                       |                              | $V_{SS}$         | Ground                 |

## bq4847/bq4847Y

### Functional Description

Figure 1 is a block diagram of the bq4847. The bq4847 is functionally equivalent to the bq4845 except that the battery (20, 24) and crystal (2, 3) pins are not accessible. The pins are connected internally to a coin cell and quartz crystal. The coin cell provides 130mAh of capacity. It is internally isolated from  $V_{OUT}$  and  $\overline{CE}_{OUT}$  until the initial application of  $V_{CC}$ . Once  $V_{CC}$  rises above  $V_{PFD}$ , this isolation is broken, and the backup cell provides power to  $V_{OUT}$  and  $\overline{CE}_{OUT}$  for the external SRAM. The real-time clock keeps time to within one minute per month at

room temperature. For a complete description of features, operating conditions, electrical characteristics, bus timing, and pin descriptions, see the bq4845 data sheet. Valid part types for ordering are bq4847MT (5%) and bq4847YMT (10%).

Figure 2 illustrates the address map for the bq4847. Table 1 is a map of the bq4847 registers, and Table 2 describes the register bits.

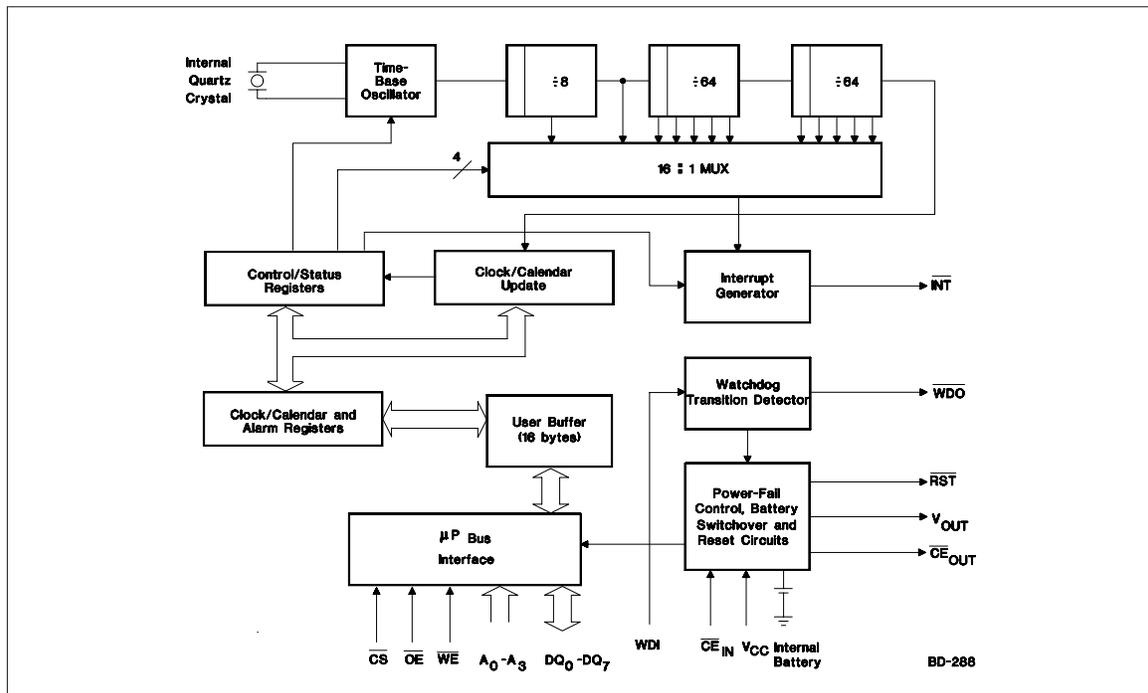


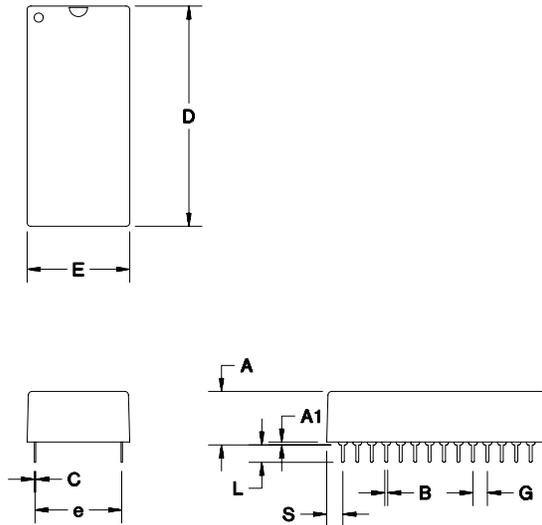
Figure 1. Block Diagram

### Truth Table

| $V_{CC}$                            | $\overline{CS}$ | $\overline{OE}$ | $\overline{WE}$ | $\overline{CE}_{OUT}$ | $V_{OUT}$  | Mode     | DQ        | Power               |
|-------------------------------------|-----------------|-----------------|-----------------|-----------------------|------------|----------|-----------|---------------------|
| $< V_{CC} \text{ (max.)}$           | $V_{IH}$        | X               | X               | $\overline{CE}_{IN}$  | $V_{OUT1}$ | Deselect | High Z    | Standby             |
|                                     | $V_{IL}$        | X               | $V_{IL}$        | $\overline{CE}_{IN}$  | $V_{OUT1}$ | Write    | $D_{IN}$  | Active              |
| $> V_{CC} \text{ (min.)}$           | $V_{IL}$        | $V_{IL}$        | $V_{IH}$        | $\overline{CE}_{IN}$  | $V_{OUT1}$ | Read     | $D_{OUT}$ | Active              |
|                                     | $V_{IL}$        | $V_{IH}$        | $V_{IH}$        | $\overline{CE}_{IN}$  | $V_{OUT1}$ | Read     | High Z    | Active              |
| $< V_{PFD} \text{ (min.)} > V_{SO}$ | X               | X               | X               | $V_{OH}$              | $V_{OUT1}$ | Deselect | High Z    | CMOS standby        |
| $\leq V_{SO}$                       | X               | X               | X               | $V_{OH}$              | $V_{OUT2}$ | Deselect | High Z    | Battery-backup mode |

Sept. 1996

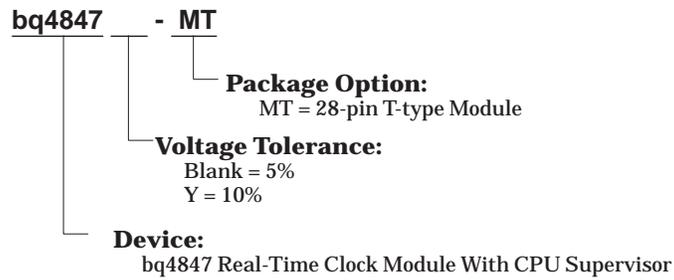
MT: 28-Pin T-Type Module



28-Pin MT (T-Type Module)

| Dimension | Inches |       | Millimeters |       |
|-----------|--------|-------|-------------|-------|
|           | Min.   | Max.  | Min.        | Max.  |
| A         | 0.360  | 0.390 | 9.14        | 9.91  |
| A1        | 0.015  | -     | 0.38        | -     |
| B         | 0.015  | 0.022 | 0.38        | 0.56  |
| C         | 0.008  | 0.013 | 0.20        | 0.33  |
| D         | 1.520  | 1.535 | 38.61       | 38.99 |
| E         | 0.710  | 0.740 | 18.03       | 18.80 |
| e         | 0.590  | 0.620 | 14.99       | 15.75 |
| G         | 0.090  | 0.110 | 2.29        | 2.79  |
| L         | 0.110  | 0.130 | 2.79        | 3.30  |
| S         | 0.100  | 0.120 | 2.54        | 3.05  |

Ordering Information



**PACKAGING INFORMATION**

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)   | Lead/Ball Finish | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples |
|------------------|---------------|--------------|--------------------|------|----------------|-------------------|------------------|----------------------|--------------|-------------------------|---------|
| BQ4847MT         | LIFEBUY       | DIP MODULE   | MT                 | 28   | 13             | Pb-Free<br>(RoHS) | Call TI          | N / A for Pkg Type   | 0 to 70      |                         |         |
| BQ4847YMT        | LIFEBUY       | DIP MODULE   | MT                 | 28   | 13             | Pb-Free<br>(RoHS) | Call TI          | N / A for Pkg Type   | 0 to 70      |                         |         |

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

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(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

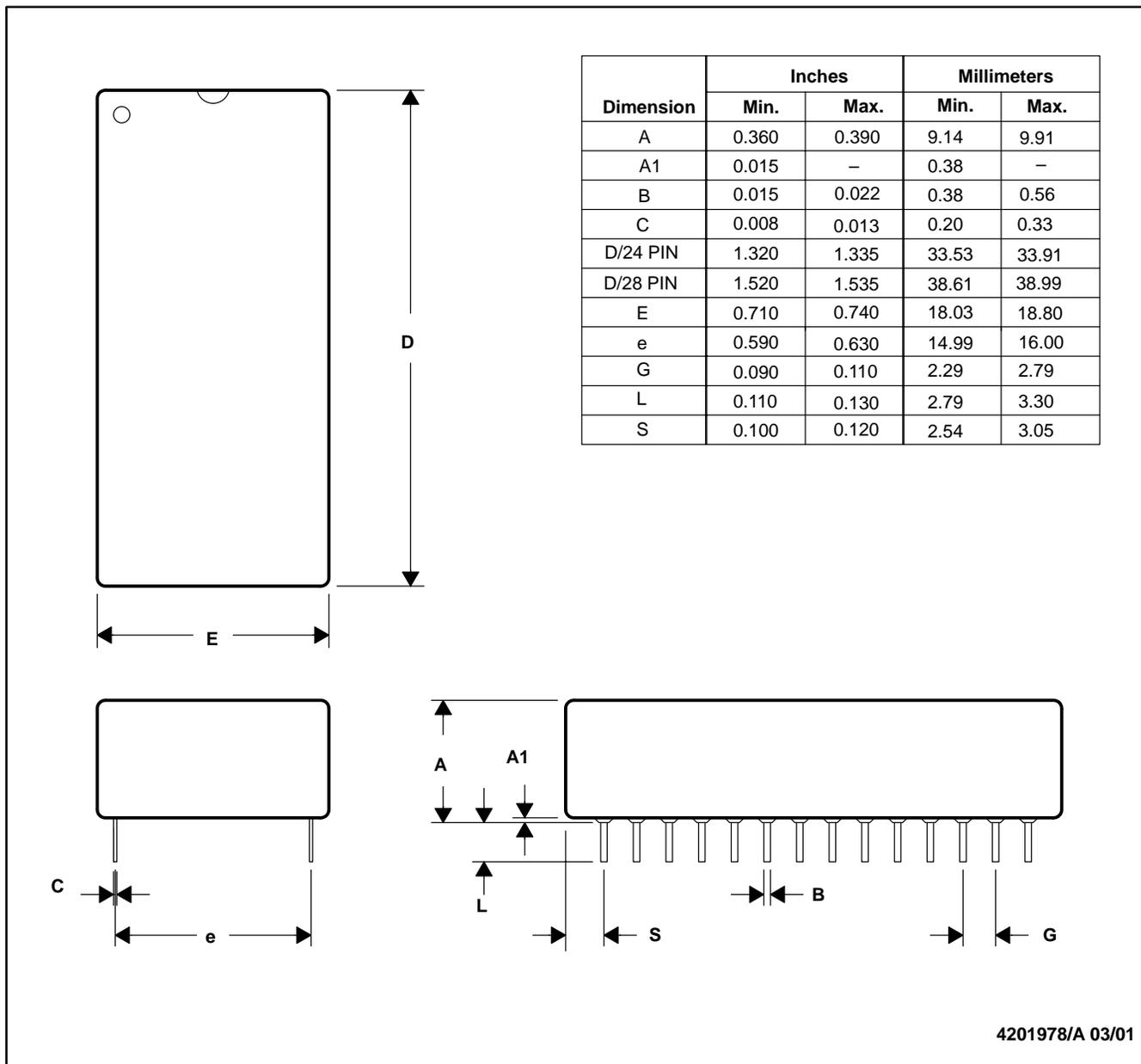
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MT (R-PDIP-T\*\*)

PLASTIC DUAL-IN-LINE

28 PINS SHOWN



4201978/A 03/01

NOTES: A. All linear dimensions are in inches (mm).  
 B. This drawing is subject to change without notice.

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|                               |  |
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