bq3287E/bq3287EA

Real-Time Clock (RTC) Module

Features

- Direct clock/calendar replacement for IBM®AT-compatible computers and other applications
- Functionally compatible with the DS1287/DS1287A and MC146818A/ MC146818B
- 242 bytes of general nonvolatile storage
- Provides a 32.768kHz output for power management
- System wake-up capability—alarm interrupt active in battery-backup mode
- Integral lithium cell and crystal
- 160 ns cycle time allows fast bus operation
- 14 bytes for clock/calendar and control
- Time of day in seconds, minutes, and hours
  - 12- or 24-hour format
  - Optional daylight saving adjustment
- Calendar in day of the week, day of the month, months, and years with automatic leap-year adjustment
- Programmable square wave output
- Three individually maskable interrupt event flags:
  - Periodic rates from 122µs to 500ms
  - Time-of-day alarm once per second to once per day
  - End-of-clock update cycle
- Better than one minute per month clock accuracy

General Description

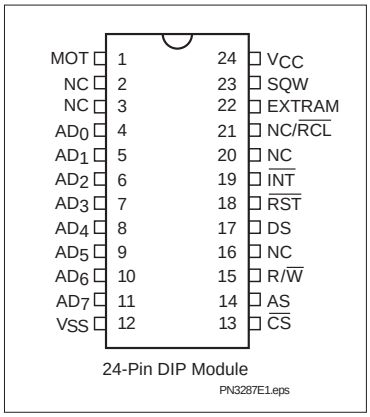
The CMOS bq3287E/bq3287EA is a low-power microprocessor peripheral providing a time-of-day clock and 100-year calendar with alarm features and battery operation. Other features include three maskable interrupt sources, square-wave output, and 242 bytes of general nonvolatile storage. A 32.768kHz output is available for sustaining power-management activities. Wake-up capability is provided by an alarm interrupt, which is active in battery-backup mode. The bq3287EA version is identical to the bq3287E, with the addition of the RAM clear input.

The bq3287E is a fully compatible real-time clock for IBM AT-compatible computers and other applications. The bq3287E write-protects the clock, calendar, and storage registers during power failure. The integral backup energy source then maintains data and operates the clock and calendar.

As shipped from Benchmarq, the real time clock is turned off to maximize battery capacity for in-system operation.

The bq3287E is functionally equivalent to the bq3285E, except the battery (16,20) and crystal pins (2,3) are not accessible. These pins are connected internally to a coin cell and quartz crystal. The coin cell is sized to provide 10 years of data retention and clock operation in the absence of power. For a complete description of features, operating conditions, electrical characteristics, bus timing, and pin descriptions, see the bq3285E data sheet.

Pin Connections



24-Pin DIP Module

PN3287E1.eps

Pin Names

AD0–AD7	Multiplex address/data input/output
MOT	
$\overline{CS}$	Chip select input
AS	Address strobe input
DS	Data strobe input
R/$\overline{W}$	Read/write input
$\overline{INT}$	Interrupt request output
$\overline{RST}$	Reset input
SQW	Square wave output
EXTRAM	Extended RAM enable
NC	No connect
$\overline{RCL}$	RAM clear input (bq3287EA only)
V_{CC}	+5V supply
V_{SS}	Ground

Sept. 1996 C

Absolute Maximum Ratings

Symbol	Parameter	Value	Unit	Conditions
V_{CC}	DC voltage applied on V_{CC} relative to V_{SS}	-0.3 to 7.0	V	
V_T	DC voltage applied on any pin excluding V_{CC} relative to V_{SS}	-0.3 to 7.0	V	$V_T \le V_{CC} + 0.3$
T_{OPR}	Operating temperature	0 to +70	°C	Commercial
T_{STG}	Storage temperature	-40 to +70	°C	Commercial
T_{BIAS}	Temperature under bias	-10 to +70	°C	Commercial
T_{SOLDER}	Soldering temperature	260	°C	For 10 seconds

Note: Permanent device damage may occur if **Absolute Maximum Ratings** are exceeded. Functional operation should be limited to the Recommended DC Operating Conditions detailed in this data sheet. Exposure to conditions beyond the operational limits for extended periods of time may affect device reliability.

Recommended DC Operating Conditions ($T_A = T_{OPR}$)

Symbol	Parameter	Minimum	Typical	Maximum	Unit
V_{CC}	Supply voltage	4.5	5.0	5.5	V
V_{SS}	Supply voltage	0	0	0	V
V_{IL}	Input low voltage	-0.3	-	0.8	V
V_{IH}	Input high voltage	2.2	-	V_{CC} + 0.3	V

Note: Typical values indicate operation at T_A = 25°C.

DC Electrical Characteristics ($T_A = T_{OPR}$, V_{CC} = 5V ± 10%)

Symbol	Parameter	Minimum	Typical	Maximum	Unit	Conditions/Notes
I_{LI}	Input leakage current	-	-	± 1	µA	$V_{IN} = V_{SS}$ to V_{CC}
I_{LO}	Output leakage current	-	-	± 1	µA	AD_0–AD_7, $\overline{INT}$ and SQW in high impedance
V_{OH}	Output high voltage	2.4	-	-	V	I_{OH} = -1.0 mA
V_{OL}	Output low voltage	-	-	0.4	V	I_{OL} = 4.0 mA
I_{CC}	Operating supply current	-	7	15	mA	Min. cycle, duty = 100%, I_{OH} = 0mA, I_{OL} = 0mA
V_{SO}	Supply switch-over voltage	-	3.0	-	V	
V_{PFD}	Power-fail-detect voltage	4.0	4.17	4.35	V	
I_{RCL}	Input current when $\overline{RCL}$ = V_{SS}	-	-	185	µA	Internal 30K pull-up (bq3287EA only)
I_{MOTH}	Input current when MOT = V_{CC}	-	-	-185	µA	Internal 30K pull-down
I_{XTRAM}	Input current when EXTRAM = V_{CC}	-	-	-185	µA	Internal 30K pull-down

Note: Typical values indicate operation at T_A = 25°C, V_{CC} = 5V.

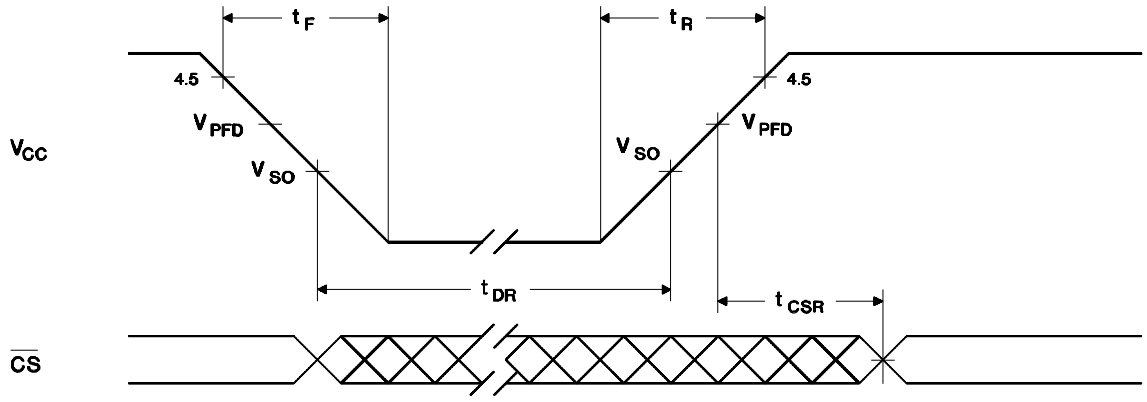
Power-Down/Power-Up Timing ($T_A = T_{OPR}$)

Symbol	Parameter	Minimum	Typical	Maximum	Unit	Conditions
t_F	V_{CC} slew from 4.5V to 0V	300	-	-	µs	
t_R	V_{CC} slew from 0V to 4.5V	100	-	-	µs	
t_{CSR}	$\overline{CS}$ at V_{IH} after power-up	20	-	200	ms	Internal write-protection period after V_{CC} passes V_{PFD} on power-up.
t_{DR}	Data-retention and time-keeping time	10	-	-	years	T_A = 25°C.

Note: Clock accuracy is better than ± 1 minute per month at 25°C for the period of t_{DR}.

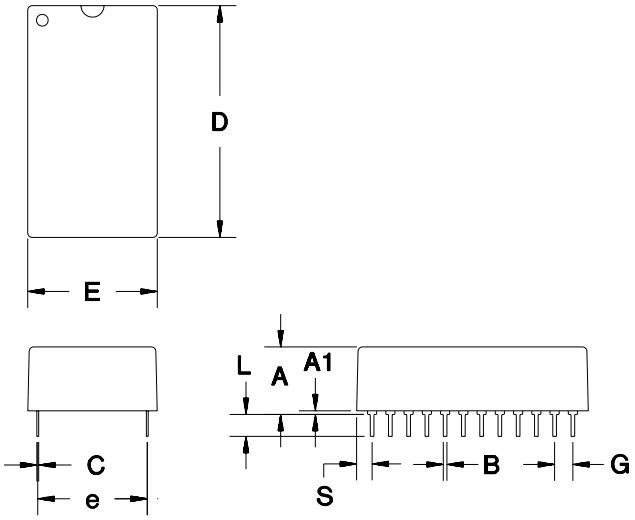
Caution: **Negative undershoots below the absolute maximum rating of -0.3V in battery-backup mode may affect data integrity.**

Power-Down/Power-Up Timing



PD-4

24-Pin MT (T-type module)



24-Pin MT (T-Type Module)

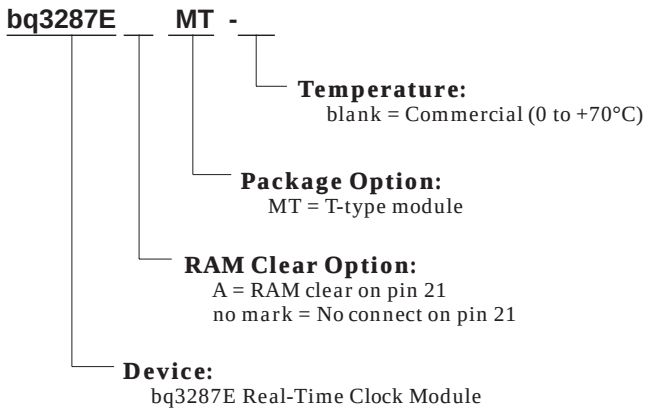
Dimension	Inches		Millimeters	
	Min.	Max.	Min.	Max.
A	0.360	0.390	9.14	9.91
A1	0.015	-	0.38	-
B	0.015	0.022	0.38	0.56
C	0.008	0.013	0.20	0.33
D	1.320	1.335	33.53	33.91
E	0.710	0.740	18.03	18.80
e	0.590	0.620	14.99	15.75
G	0.090	0.110	2.29	2.79
L	0.110	0.130	2.79	3.30
S	0.100	0.120	2.54	3.05

Data Sheet Revision History

Change No.	Page No.	Description	Nature of Change
1	8	Register C, bit 2	Was 0; is na (not affected)
2	2	I_{RCL} max. was 275; is now 185. Pull-down = 30K.	Value change
2	2	I_{XTRAM} max. was -75; is now -185.	Value change

Notes: Change 1 = Apr. 1994 B "Final" changes from Dec. 1993 A "Preliminary."
Change 2 = Sept. 1996 C changes from April 1994 B.

Ordering Information



PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
BQ3287EAMT	ACTIVE			0	1	None	Call TI	Call TI
BQ3287EMT	ACTIVE			0	1	None	Call TI	Call TI

(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 - May not be currently available - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
None: Not yet available Lead (Pb-Free).
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.
Green (RoHS & no Sb/Br): TI defines "Green" to mean "Pb-Free" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

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

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