BENCHMARQ

bq3287/bq3287A

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
- 114 bytes of general nonvolatile storage
- Integral lithium cell and crystal
- 160 ns cycle time allows fast bus operation
- Selectable Intel or Motorola bus timing
- 14 bytes for clock/calendar and control
- BCD or binary format for clock and calendar data
- 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 122 µs to 500 ms
  - 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

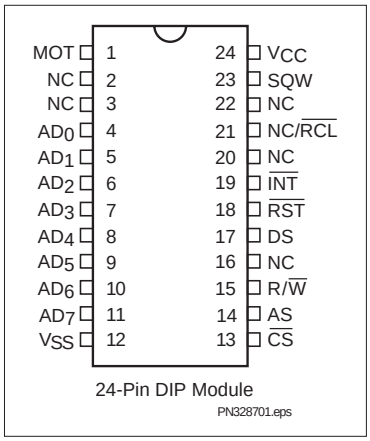
The CMOS bq3287/bq3287A is a low-power microprocessor peripheral providing a time-of-day clock and 100-year calendar with alarm features and battery operation. Other features include three maskable interrupt sources, square-wave output, and 114 bytes of general nonvolatile storage. The bq3287A version is identical to the bq3287, with the addition of the RAM clear input.

The bq3287 is a fully compatible real-time clock for IBM AT-compatible computers and other applications. The bq3287 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 bq3287 is functionally equivalent to the bq3285, except that the battery (16, 20) and crystal (2, 3) pins 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 bq3285 data sheet.

Pin Connections



24-Pin DIP Module

PN328701.eps

Pin Names

AD_0–AD_7	Multiplexed address/data input/output
MOT	Bus type select input
$\overline{CS}$	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
NC	No connect
$\overline{RCL}$	RAM clear input (bq3287A only)
V_{CC}	+5V supply
V_{SS}	Ground

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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
		-20 to +70	°C	Extended "I"
T_{STG}	Storage temperature	-40 to +70	°C	Commercial
		-40 to +70	°C	Extended "I"
T_{BIAS}	Temperature under bias	-10 to +70	°C	Commercial
		-20 to +70	°C	Extended "I"
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 (bq3287A only)
I_{MOTH}	Input current when MOT = V_{CC}	-	-	-185	µA	Internal 30K pull-down

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

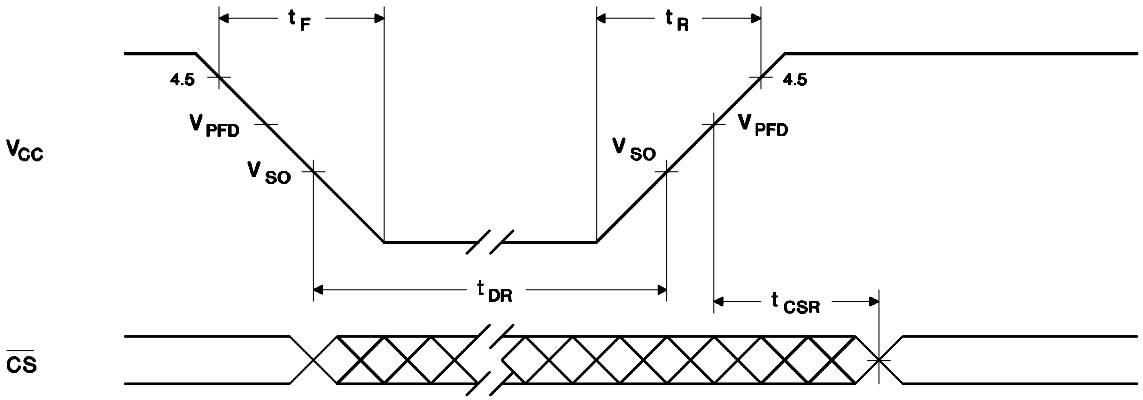
Power-Down/Power-Up Timing ($T_A = T_{OPR}$)

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}.

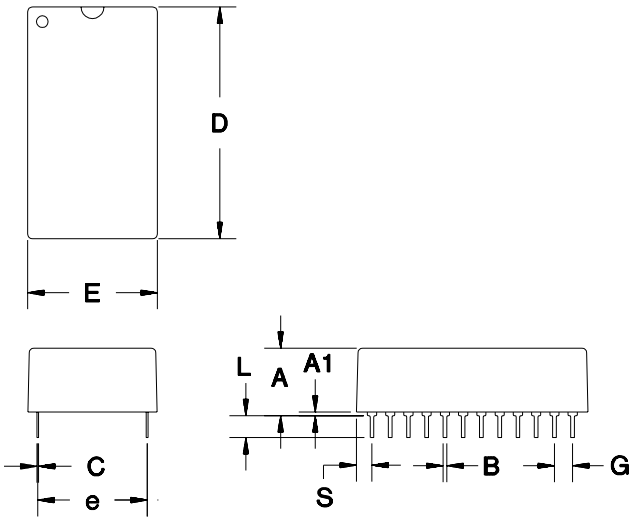
Caution: **Negative undershoots below the absolute maximum rating of -0.3V in battery-backup mode may affect data integrity.**

Power-Down/Power-Up Timing



PD-4

24-Pin MT (T-type module)



24-Pin MT (T-type module)

Dimension	Minimum	Maximum
A	0.360	0.375
A1	0.015	-
B	0.015	0.022
C	0.008	0.013
D	1.320	1.335
E	0.685	0.700
e	0.590	0.620
G	0.090	0.110
L	0.120	0.130
S	0.100	0.120

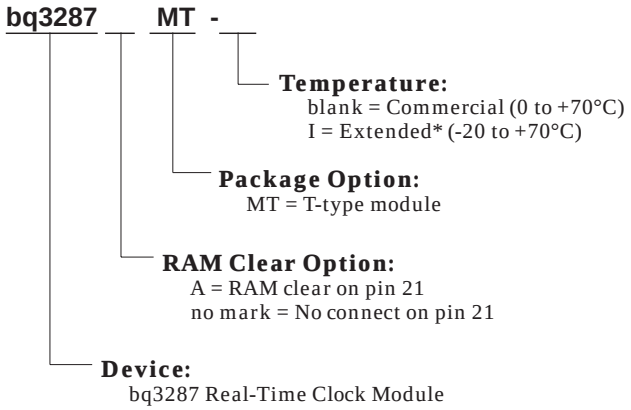
All dimensions are in inches.

Data Sheet Revision History

Change No.	Page No.	Description	Nature of Change
1	1	Address strobe input	Clarification
1	2	Power-fail detect voltage V_{PFD}	Was 4.1 min, 4.25 max; is 4.0 min, 4.35 max
2	1	Was : "As shipped from Benchmarq, the backup cell is electrically isolated from the memory." Is: "As shipped from Benchmarq, the backup cell is electrically isolated from the active circuitry."	Clarification
2	2, 4	Changed temperature from N (industrial, -40 to +85°C) to I (extended, -20 to +70°C)	Specification change
3	2	I_{RCL} max. was 275; is now 185. Pull-up = 30K I_{MOTH} max. was -275; is now -185. Pull-down = 30K	Changed values

Notes: Change 1 = Nov. 1992 B changes from June 1991 A.
Change 2 = Nov. 1995 C changes from Nov. 1992 B.
Change 3 = Sept. 1996 D changes from Nov. 1995 C.

Ordering Information



*Contact factory for availability.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
BQ3287AMT-I	LIFEBUY	DIP MODULE	MT	24		TBD	Call TI	Call TI	-20 to 70		
BQ3287AMT-SB2	OBSOLETE	DIP MODULE	MT	24		TBD	Call TI	Call TI	0 to 70		
BQ3287MT-I	OBSOLETE	DIP MODULE	MT	24		TBD	Call TI	Call TI	-20 to 70		
BQ3287MT-SB2	OBSOLETE	DIP MODULE	MT	24		TBD	Call TI	Call TI	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.
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Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(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.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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