UNITRODE

bq2112

NiCd or NiMH Gas Gauge Module with Slow-Charge Control

Features

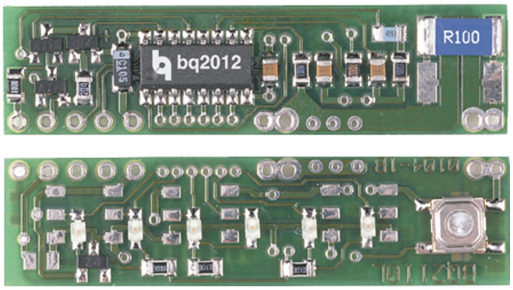
- Complete bq2012 Gas Gauge solution for NiCd or NiMH battery packs
- Output for slow-charge control of battery pack
- Battery information available over a single-wire bidirectional serial port
- Battery state-of-charge monitoring for 4- to 12-cell series applications
- On-board regulator allows direct connection to the battery
- "L" version includes push-button activated LEDs to display state-of-charge information
- Nominal capacity and cell chemistry pre-configured
- Compact size for battery pack integration

General Description

The bq2112 Gas Gauge Module provides a complete and compact solution for capacity monitoring of NiCd and NiMH battery packs. Designed for battery pack integration, the bq2112 incorporates a bq2012 Gas Gauge IC, a current sense resistor, and all other components necessary to accurately monitor and display the capacity of 3 to 12 series cells. The bq2112L includes six surface-mounted LEDs to display remaining capacity in 20% increments of the learned capacity (relative mode) or programmed capacity (absolute mode). The sixth LED is used in absolute mode to represent an overfull condition (charge above the programmed capacity). The LEDs are activated with the onboard push--button switch.

Contacts are provided on the bq2112 for direct connection to the battery stack (BAT+, BAT-), the serial communications port (DQ), the empty indicator (EMPTY), and the charge control output ($\overline{\text{CHG}}$). Please refer to the bq2012 data sheet for the specifics on the operation of the Gas Gauge.

Unitrode configures the bq2112 based on the information requested in Table 1. The configuration defines the number of series cells, the nominal battery pack capacity, the self-discharge rate, and the LED display mode.



A module development kit is also available for the bq2112. The bq2112B-KT or bq2112LB-KT includes one configured module and the following:

1) An interface board that allows connection to the serial port of an AT-compatible computer.
2) Menu-driven software with the bq2112 to display charge/discharge activity and to allow user interface to the bq2012 from any standard DOS PC.
3) Source code for the TSR.

Pin Descriptions

P1	**DQ/Serial communication port**
P2	**BAT+/Battery positive/pack positive**
P3	**$\overline{\text{CHG}}$/Charge control output**
P4	**EMPTY/Empty indicator output**
P5	**GND/Ground**
P6	**PACK-/Pack negative**
P7	**BAT-/Battery negative**

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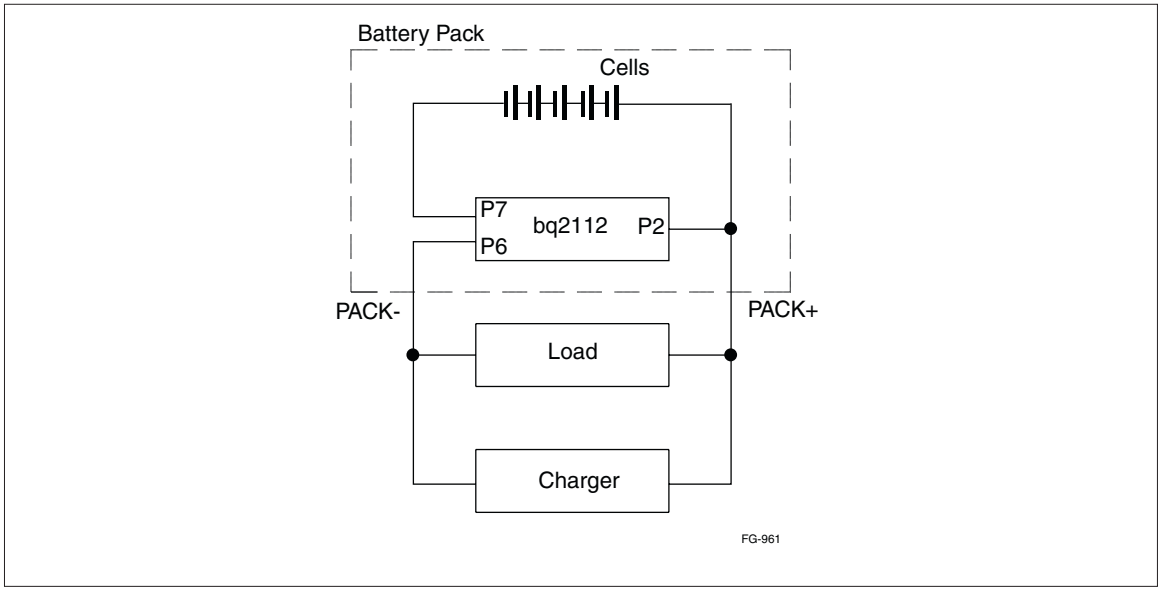


Figure 1. Module Connection Diagram

Table 1. bq2112 Module Configuration

Customer Name: _____

Contact: _____ Phone: _____

Address: _____

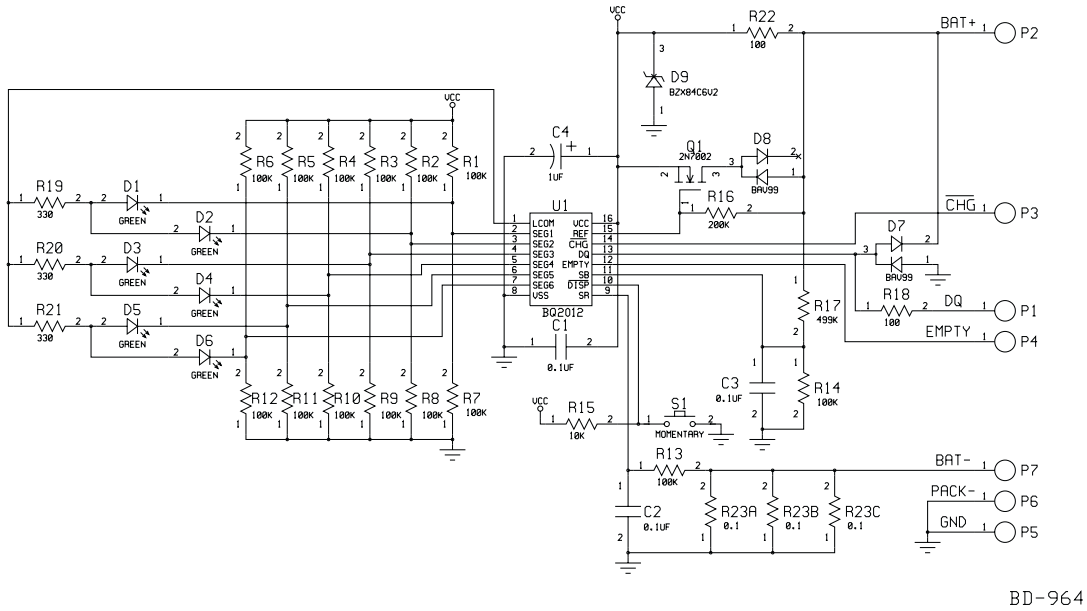
_____

Sales Contact: _____ Phone: _____

Number of series battery cells (4-12)	_____		
Battery type (NiCd or NiMH)	_____		
Battery pack capacity (mAh)	_____		
Discharge rate into load (3.0A max.)	Min._____	Avg._____	Max._____
Charge rate (3.0A max)	_____		
Display mode (absolute or relative)	_____		
LEDs and switch (Y/N)	_____		

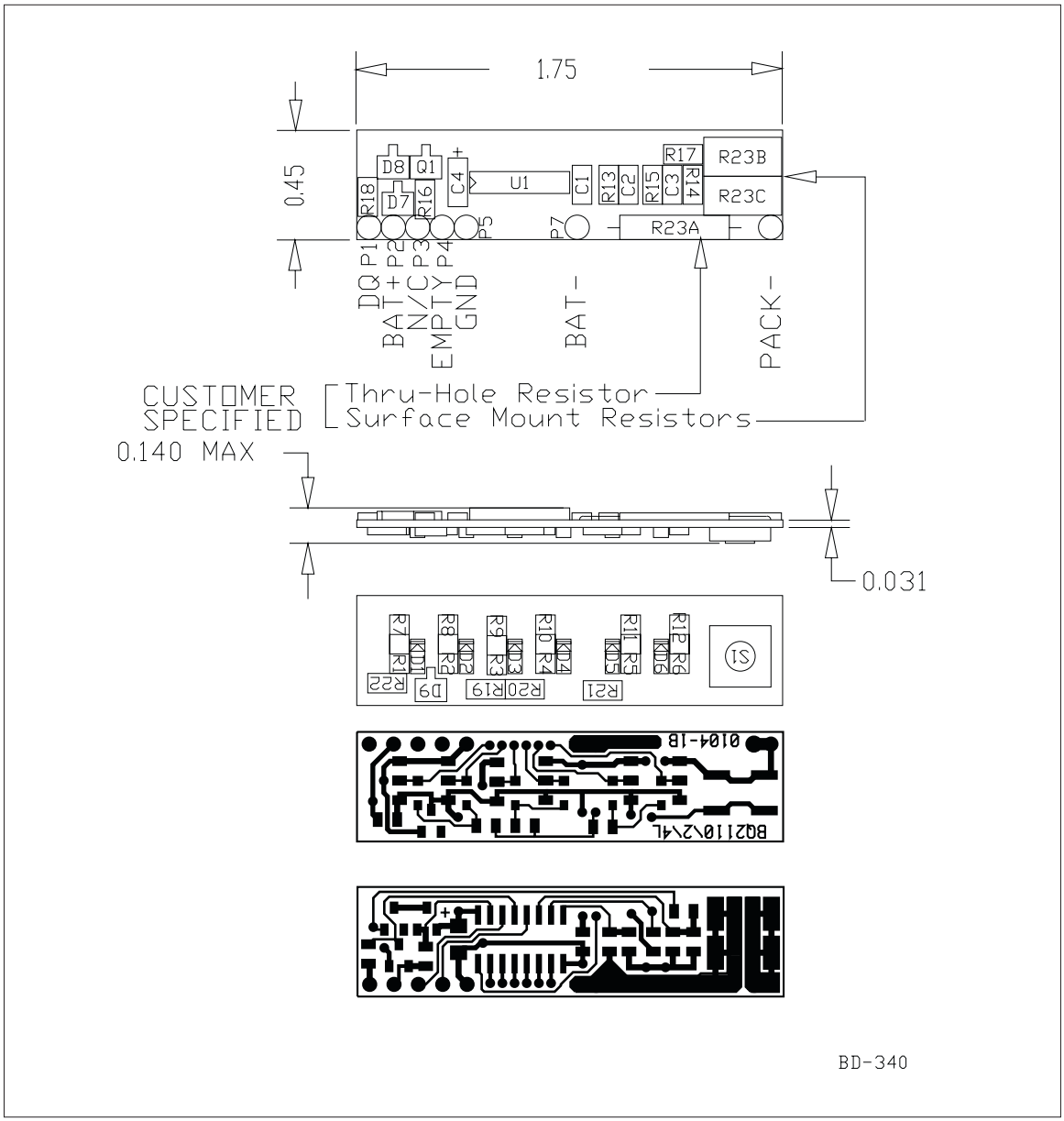
FAE approval: _____ Date:_____

bq2112 Schematic



Note: Schematic shows components which may not be placed on the board, depending upon the configuration.

bq2112 Board



Absolute Maximum Ratings

Symbol	Parameter	Minimum	Maximum	Unit	Conditions
V_{CC}	Relative to V_{SS}	-0.3	+7.0	V	bq2012
All other pins	Relative to V_{SS}	-0.3	+7.0	V	bq2012
P_{SR}	Continuous sense resistor power dissipation	-	3	W	Thru-hole sense resistor
		-	1	W	Surface mount sense resistor
I_{CHG}	Continuous charge/ discharge current	-	3.0	A	
T_{OPR}	Operating temperature	0	+70	°C	Commercial
T_{STR}	Storage temperature	-40	+85	°C	

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.

DC Electrical Characteristics ($T_A = T_{OPR}$)

Symbol	Parameter	Minimum	Typical	Maximum	Unit	Conditions/Notes
NumCell	Number of series cells in battery pack	4	-	12	-	
BAT+	Positive terminal of pack	GND	NumCell * 1.2V	NumCell * 1.8V	V	
BAT-	Negative terminal of pack	GND - 0.3	-	GND+2.0	V	
I_{CC}	Supply current at BAT+ terminal (no external loads)	-	200	300	µA	
R_{DQ}	Internal pull-down	500k	-	-	Ω[1]	
I_{OL}	Open-drain sink current DQ, EMPTY, $\overline{CHG}$	-	-	5.0	mA[1]	
V_{OL}	Open-drain output low, DQ, EMPTY, $\overline{CHG}$	-	-	0.5	V[1]	I_{OL} < 5mA
V_{IHDQ}	DQ input high	2.5	-	-	V[1]	
V_{ILDQ}	DQ input low	-	-	0.8	V[1]	
V_{OS}	Voltage offset	-	-	150	µV[1]	

Note: 1. Characterized on PCB, IC 100% tested.

DC Voltage Thresholds ($T_A = T_{OPR}$)

Symbol	Parameter	Minimum	Typical	Maximum	Unit	Notes
V_{EDVF}	Final empty warning	0.93	0.95	0.97	V	BAT+/NumCell[1]
V_{EDV1}	First empty warning	1.03	1.05	1.07	V	BAT+/NumCell[1]
V_{MCV}	Maximum single-cell voltage	2.20	2.25	2.30	V	BAT+/NumCell[1]
V_{SRO}	Sense resistor range	-300	-	+2000	mV	$V_{SR} + V_{OS}$[2]
V_{SRQ}	Valid charge	375	-	-	µV	$V_{SR} + V_{OS}$ [2, 3]
V_{SRD}	Valid discharge	-	-	-300	µV	$V_{SR} + V_{OS}$ [2, 3]

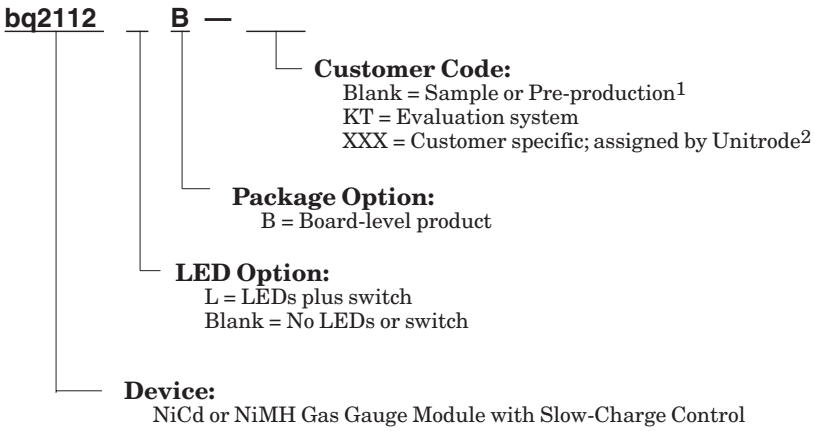
Notes: 1. At SB input of bq2012.
2. At SR input of bq2012.
3. Default value; value set in DMF register.

Data Sheet Revision History

Change No.	Page No.	Description
1	2	Updated Table 1 to include 3.0A limit
1	5	Added 3.0A maximum continuous charge/discharge current specification

Note: Change 1 = May 1999 B changes from Nov. 1997.

Ordering Information



Notes: 1. Requires configuration sheet (see Table 1)
2. Example production part number: bq2112LB-002

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