



**UNITRODE**

**bq2114**

## NiCd or NiMH Gas Gauge Module with Charge-Control Output

### Features

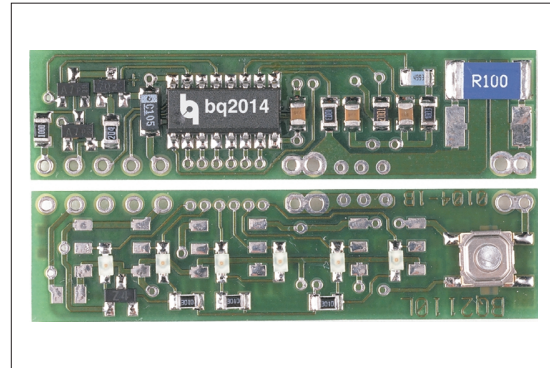
- Complete bq2014 Gas Gauge solution for NiCd or NiMH battery packs
- Charge-control output allows communication to external charge controller (bq2004)
- Battery information available over a single-wire bidirectional serial port
- Battery state-of-charge monitoring for 4- to 12-cell series applications
- 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 bq2114 Gas Gauge Module provides a complete and compact solution for capacity monitoring of NiCd and NiMH battery packs. Designed for battery pack integration, the bq2114 incorporates a bq2014 Gas Gauge IC, a current sense resistor, and all other components necessary to accurately monitor and display the capacity of 4 to 12 series cells. The bq2114L includes five surface-mounted LEDs to display remaining capacity in 20% increments of the learned capacity (relative mode). The LEDs are activated with the onboard push-button switch.

Contacts are provided on the bq2114 for direct connection to the battery stack (BAT+, BAT-), the serial communications port (DQ), the empty indicator (EMPTY), and the charge control output (CHG). Please refer to the bq2014 data sheet for the specifics on the operation of the Gas Gauge.

Unitrode configures the bq2114 based on the information requested in Table 1. The configuration defines the number of series cells, the nominal battery pack capacity, and the self-discharge rate.



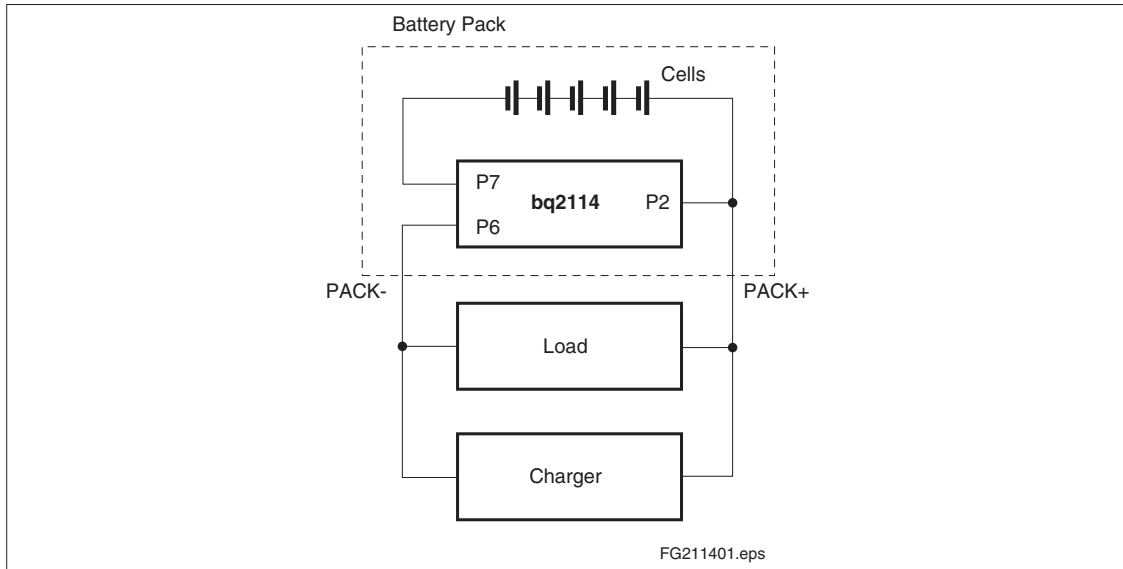
A module development kit is also available for the bq2114. The bq2114B-KT or bq2114LB-KT includes one configured module and the following:

- 1) An interface board that allows connection to the serial port of an AT-compatible computer.
- 2) Menu-driven software with the bq2114 to display charge/discharge activity and to allow user interface to the bq2014 from any standard DOS PC.
- 3) Source code for the TSR.

### Pin Descriptions

<b>P1</b>	<b>DQ/Serial communication port</b>
<b>P2</b>	<b>BAT+/Battery positive/pack positive</b>
<b>P3</b>	<b>CHG/Charge control output</b>
<b>P4</b>	<b>EMPTY/Empty indicator output</b>
<b>P5</b>	<b>GND/Ground</b>
<b>P6</b>	<b>PACK-/Pack negative</b>
<b>P7</b>	<b>BAT-/Battery negative</b>

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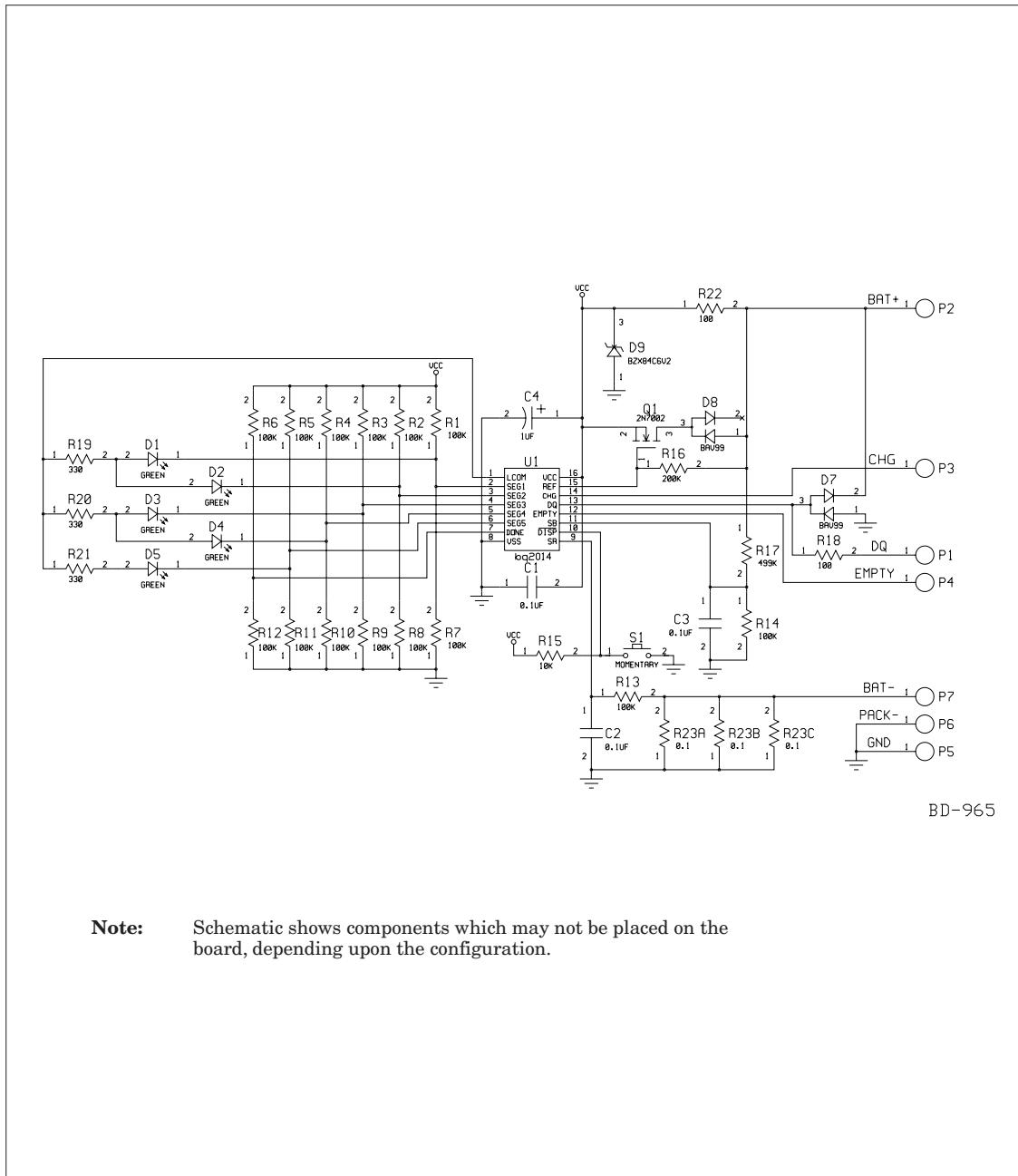


**Figure 1. Module Connection Diagram**

**Table 1. bq2114 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.)	_____		
LEDs and switch (Y/N)	_____		
FAE approval:	_____	Date:	_____

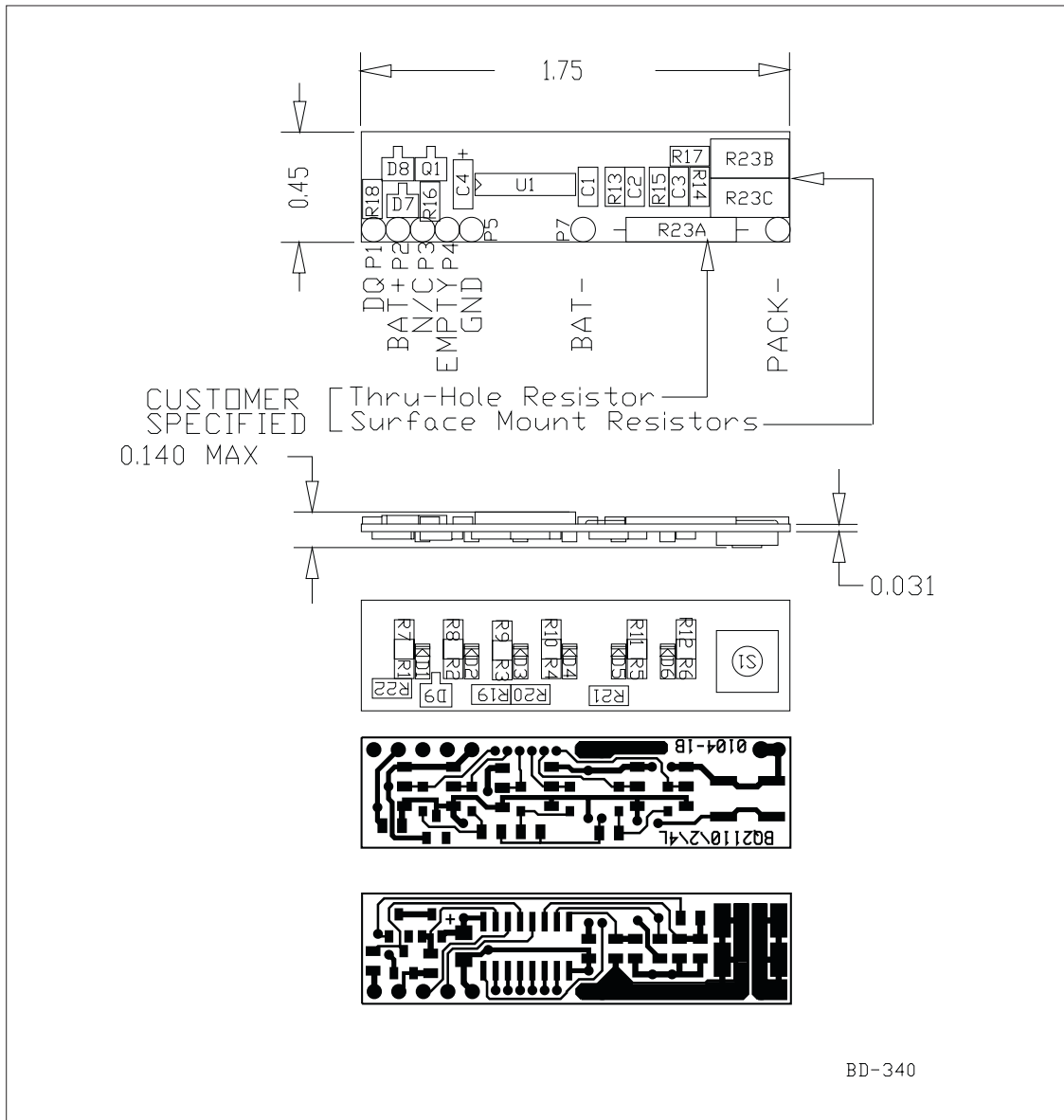
bq2114 Schematic



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

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## bq2114 Board



## Absolute Maximum Ratings

Symbol	Parameter	Minimum	Maximum	Unit	Conditions
VCC	Relative to VSS	-0.3	+7.0	V	bq2014
All other pins	Relative to VSS	-0.3	+7.0	V	bq2014
PSR	Continuous sense resistor power dissipation	-	3	W	Thru-hole sense resistor
		-	1	W	Surface-mount sense resistor
ICHG	Continuous charge/discharge current	-	3.0	A	
TOPR	Operating temperature	0	+70	°C	Commercial
TSTR	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<sub>A</sub> = TOPR)

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	
ICC	Supply current at BAT+ terminal (no external loads)	-	200	300	μA	
RDQ	Internal pull-down	500k	-	-	Ω <sup>1</sup>	
IOL	Open-drain sink current DQ, EMPTY, CHG	-	-	5.0	mA <sup>1</sup>	
VOL	Open-drain output low, DQ, EMPTY, CHG	-	-	0.5	V <sup>1</sup>	I <sub>OL</sub> < 5mA
VIHDQ	DQ input high	2.5	-	-	V <sup>1</sup>	
VILDQ	DQ input low	-	-	0.8	V <sup>1</sup>	
VOS	Voltage offset	-	-	150	μV <sup>1</sup>	

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

## bq2114

### DC Voltage Thresholds (T<sub>A</sub> = T<sub>OPR</sub>)

Symbol	Parameter	Minimum	Typical	Maximum	Unit	Notes
VEDVF	Final empty warning	0.93	0.95	0.97	V	BAT+/NumCell <sup>1</sup>
VEDV1	First empty warning	1.03	1.05	1.07	V	BAT+/NumCell <sup>1</sup>
V <sub>MCV</sub>	Maximum single-cell voltage	2.20	2.25	2.30	V	BAT+/NumCell <sup>1</sup>
V <sub>SRO</sub>	Sense resistor range	-300	-	+2000	mV	V <sub>SR</sub> + V <sub>OS</sub> <sup>2</sup>
V <sub>SRQ</sub>	Valid charge	375	-	-	μV	V <sub>SR</sub> + V <sub>OS</sub> <sup>2, 3</sup>
V <sub>SRD</sub>	Valid discharge	-	-	-300	μV	V <sub>SR</sub> + V <sub>OS</sub> <sup>2, 3</sup>

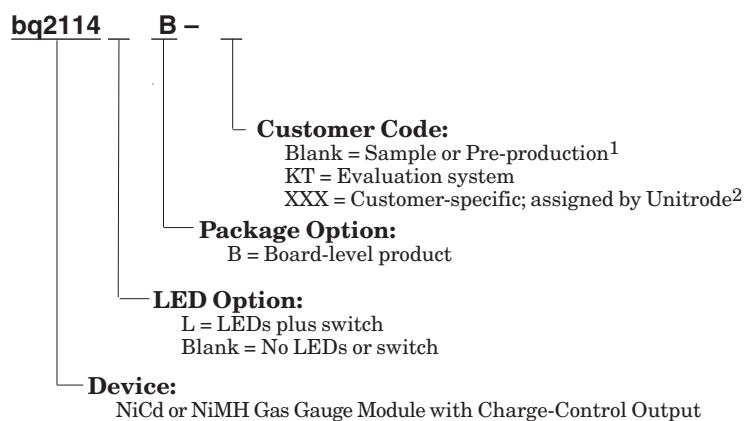
- Notes:**
1. At SB input of bq2014.
  2. At SR input of bq2014.
  3. Default value; value set in DMF register.

### 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 Sept. 1996.

### Ordering Information



- Notes:**
1. Requires configuration sheet (see Table 1)
  2. Example production part number: bq2114LB-003

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