

## Smart Battery Module with LEDs

### Features

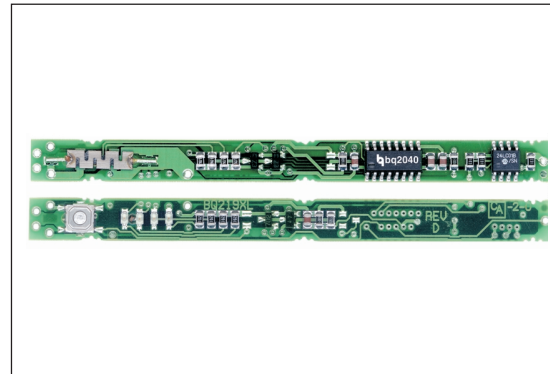
- Complete smart battery solution for NiCd, NiMH, and Li-Ion battery packs
- Based on the bq2092 or bq2040 Gas Gauge IC
- Ideal for DR35 or DR36 type packs
- Narrow board fits in the crevice formed by two adjacent battery packs
- Accurate measurement of available battery capacity
- Designed for battery pack integration:
  - Measures only 3.5 (L) x 0.3 (W) inches
  - Includes Gas Gauge IC, configuration EEPROM, and sense resistor
  - Four onboard state-of-charge LEDs with push-button activation
  - Low operating current for minimal battery drain
- Critical battery information available over two-wire serial port

### General Description

The bq219XL Smart Battery Module provides a complete solution for the design of intelligent battery packs. The bq219XL uses the SMBus protocol and supports the Smart Battery Data commands in the SMB/SBD specifications. Designed for battery pack integration, the bq219XL combines the bq2092 or bq2040 Gas Gauge IC with a serial EEPROM on a small printed circuit board. The board includes all the necessary components to accurately monitor battery capacity and communicate critical battery parameters to the host system or battery charger. The bq219XL also includes four LEDs. The push-button switch activates the LEDs to show remaining battery capacity in 25% increments.

Contacts are provided on the bq219XL for direct connection to the battery stack (B+, B-) and the two-wire interface (C, D). Please refer to the bq2092 or bq2040 data sheet for specific information on the operation of the Gas Gauge and communication interface.

Unitrode configures the bq219XL based on the information requested in Table 1. The configuration defines the pack voltage, capacity, and chemistry and charge control



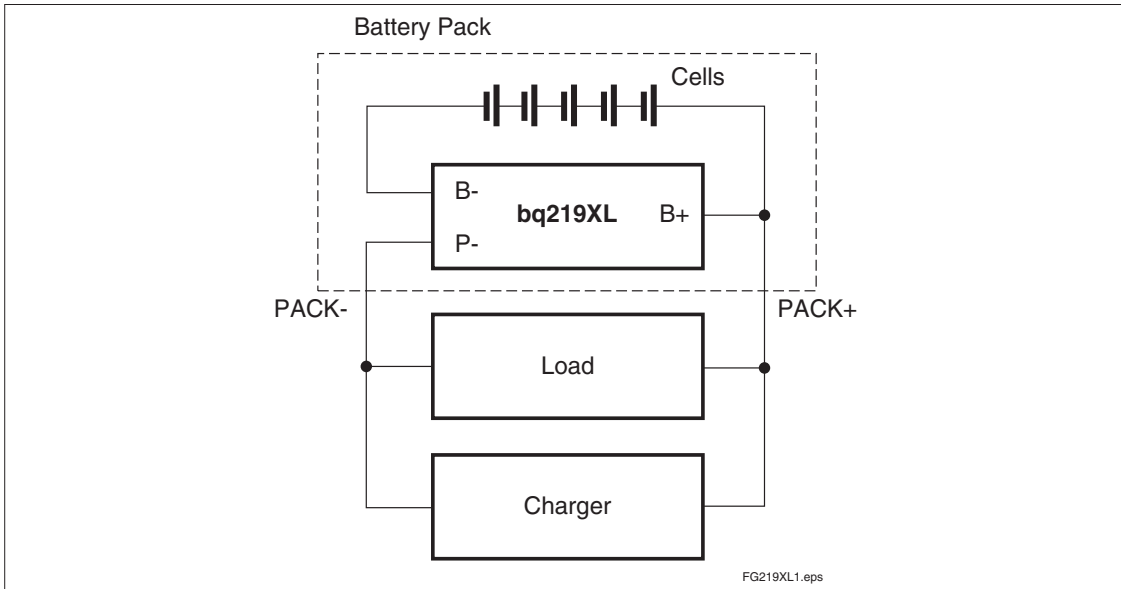
parameters. The Smart Battery Module uses the onboard sense resistor to track charge and discharge activity of the battery pack. Figure 1 shows how the module connects to the cells.

A module development kit is also available for the bq219XL. The bq219XLB-KT includes one configured module and the following:

- 1) An EV2200-92 or EV2200-40 interface board that allows connection to the serial port of any AT-compatible computer.
- 2) Menu-driven software to display charge/discharge activity and to allow user interface to the Gas Gauge IC and serial E<sup>2</sup>PROM from any standard Windows 95 or 3.1x PC.

### Pin Descriptions

<b>B+</b>	<b>BAT+/Battery positive/Pack positive</b>
<b>P-</b>	<b>PACK-/Pack negative</b>
<b>C</b>	<b>SMBC/Communications clock</b>
<b>D</b>	<b>SMBD/Serial data</b>
<b>B-</b>	<b>BAT-/Battery negative</b>
<b>STAT</b>	<b>STAT/No connect</b>



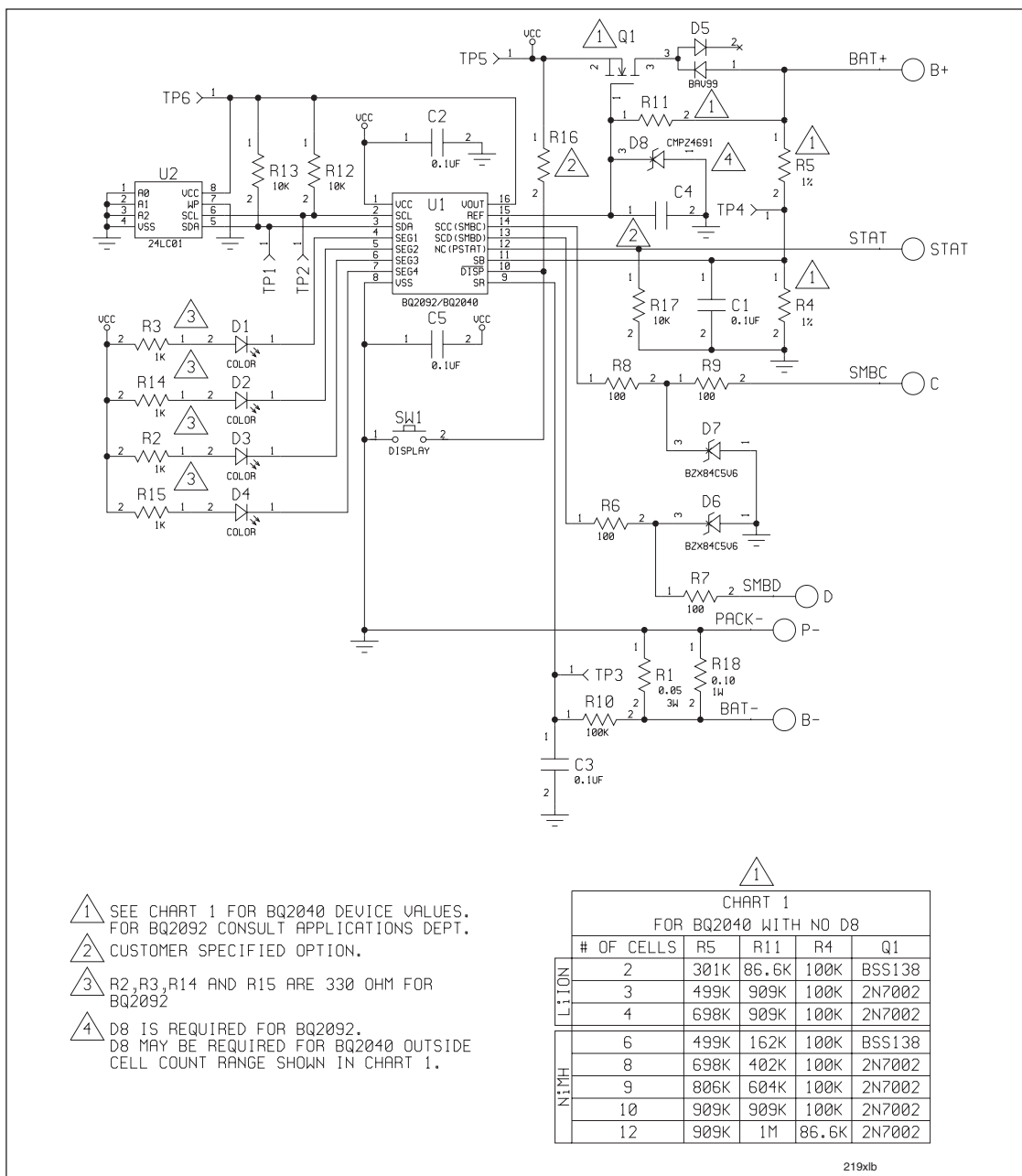
**Figure 1. Module Connection Diagram**

**Table 1. bq219XL Module Configuration**

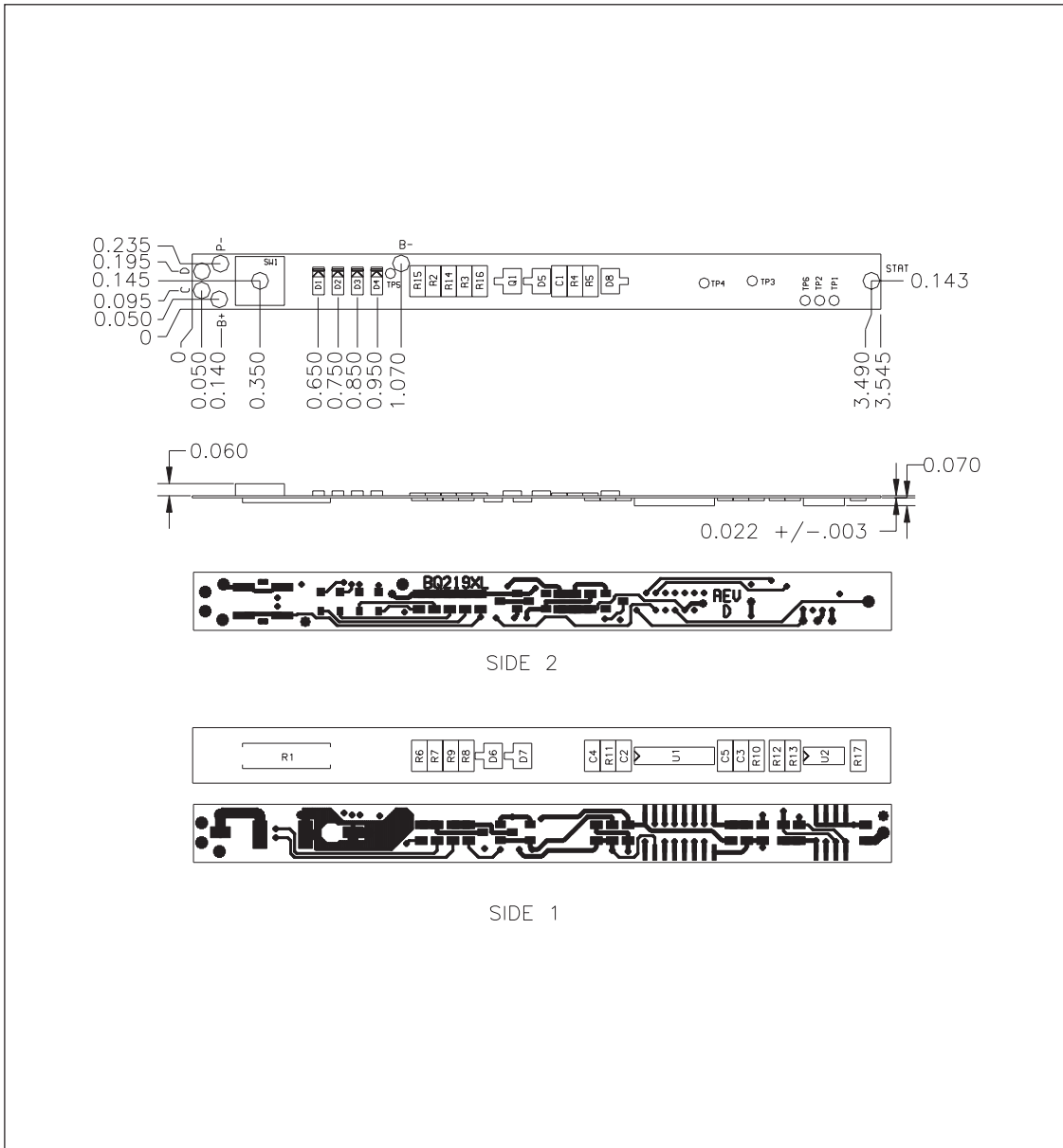
Customer Name: _____			
Contact: _____		Phone: _____	
Address: _____			
Sales Contact: _____		Phone: _____	
<b>Board Configuration</b>			
IC type	_____	bq2040 or bq2092	
LEDs and switch	_____	Yes or No	
Display mode	_____	Relative or Absolute	
Discharge rate (3.0A max.)	Min _____	Avg _____	Max _____
Duration at max. discharge	_____		
Number of series cells	_____		
<b>EEPROM Configuration</b>			
		Typical Values	
		NiMH	Li-Ion
Remaining time alarm (min)	_____	Sets the low time alarm level	
		10 min	10 min
Remaining capacity alarm (mAh)	_____	Sets the low capacity alarm level	
		C/10	C/10
Charging voltage (mV)	_____	Sets the requested charging voltage	
		65535	4.1V/cell
Design capacity (mAh)	_____	Defines the battery pack capacity	
		3000	3600
Design voltage (mV)	_____	Defines the battery pack voltage	
		12000	10800
Manufacturer date	_____	Battery pack manufacturer date	
		mm/dd/yy	mm/dd/yy
Serial number	_____	Battery pack serial number	
		0-65535	0-65535
Fast-charging current (mA)	_____	Sets the requested charging current	
		1C	1C
Maintenance charging current (mA)	_____	Sets the requested maintenance charging current	
		C/20	0
Li-Ion taper current (mA)	_____	Sets the upper limit for charge termination	
		NA	C/10
Maximum overcharge (mAh)	_____	Sets the maximum amount of overcharge	
		256mAh	128mAh
Maximum temperature (°C)	_____	Sets the maximum charge temperature	
		61°C	61°C
$\Delta T/\Delta t$ (°C/min)	_____	Sets the termination rate	
		3°C/3min	4.6°C/20s
Fast-charge efficiency (%)	_____	Sets the fast-charge efficiency factor	
		95%	100%
Maintenance charge efficiency (%)	_____	Sets the maintenance charge efficiency factor	
		80%	100%
Self-discharge rate (%/day)	_____	Sets the battery's self-discharge rate	
		1.5%/day	0.2%/day
EDV1 (mV)	_____	Sets the initial end-of-discharge warning	
		1.05V/cell	3.0V/cell
EDVF (mV)	_____	Sets the final end-of-discharge warning	
		1.0V/cell	2.8V/cell
Hold-off timer for $\Delta T/\Delta t$ (sec.)	_____	Sets the hold off period for $\Delta T/\Delta t$ termination	
		180s	320s
Manufacturer name	_____	Programs manufacturer's name (11 char. max)	
		bq	bq
Device name	_____	Programs device name (7 char. max)	
		bq36	bq202
Chemistry	_____	Programs pack's chemistry (5 char. max)	
		NiMH	LION
Manufacturer data	_____	Open field (5 char. max)	
		2040	2040
FAE Approval: _____			Date: _____

# bq219XL Preliminary

## bq219XL Schematic



bq219XL Board

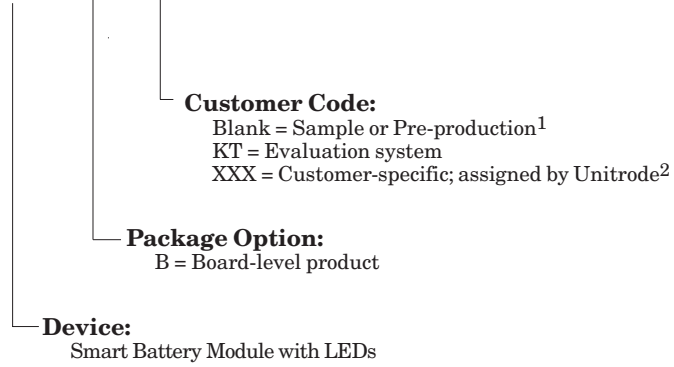


## **bq219XL** *Preliminary*

---

### **Ordering Information**

**bq219XL B – XXX**



- Notes:**
1. Requires configuration sheet (see Table 1)
  2. Example production part number: bq219XLB-001

## **IMPORTANT NOTICE**

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its semiconductor products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

CERTAIN APPLICATIONS USING SEMICONDUCTOR PRODUCTS MAY INVOLVE POTENTIAL RISKS OF DEATH, PERSONAL INJURY, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE ("CRITICAL APPLICATIONS"). TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF TI PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE FULLY AT THE CUSTOMER'S RISK.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.