TEXAS INSTRUMENTS

bq2019 EVM-001 Battery Monitoring IC Evaluation Module

User's Guide

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Chapter 1

Introduction

The bq2019 EVM is a complete evaluation system for the bq2019 FLASH-based battery-monitoring IC. The EVM includes one bq2019 circuit module, a current sense resistor, an EV2200 PC interface board for gas-gauge evaluation, a PC serial cable, and Windows-based PC software. The circuit module includes one bq2019 IC and all other components onboard necessary to monitor capacity and other critical parameters in 1 Li-Ion or 3 series NiCd or NiMH-based battery packs. The circuit module connects directly across the cells in a battery. With the EV2200 interface board and software, the user can read the bq2019 data registers and evaluate the functions of the bq2019 under different charge and discharge conditions.

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1.1 Features

- ❑ Complete evaluation system for the bq2019 gas gauge IC
- ❑ Populated circuit module for quick setup
- ❑ PC software and interface board for easy evaluation
- ❑ Software that allows data-logging for system analysis

1.2 Kit Contents

- ❑ bq2019 circuit module
- ❑ Sense resistor
- ❑ EV2200 PC interface board
- ❑ Set of evaluation software disks entitled EV2200–19
- ❑ PC serial cable
- ❑ Set of support documentation

1.3 Ordering Information

Table 1–1. Ordering Information

EVM Part Number	Additional ICs	Chemistry	Pack Voltage	Capacity
bq2019EVM–001	None	Any	2.8–5V	Any
bq2019EVM–012	UCC3952	Li–Ion	2.8–4.2V	Any

Chapter 2

bq2019-Based Circuit Module

The bq2019-based circuit module is a complete and compact example solution of a bq2019 circuit for battery monitoring of NiCd, NiMH, or Li-Ion packs. The circuit module incorporates a bq2019 battery monitor IC and all other components necessary to accurately monitor the charge and discharge of 3 series nickel or 1 Li-Ion cells.

Contacts on the circuit module provide direct connection to the battery stack (BAT+, BAT–) and the serial communications port (HDQ). The system load and charger connect across BAT+ and PACK–.

The STAT output reflects the state of the programmable STAT pin from the bq2019.

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2.1 Pin Descriptions

BAT+	BAT+/Battery positive/pack positive
HDQ	HDQ/Serial communications port
BAT–	BAT–/Battery negative
STAT	STAT/Programmable output
PACK–	PACK–/Pack negative

Chapter 3

bq2019 Circuit Module Schematic

The schematic shows the circuit for the bq2019 EVM implementation.

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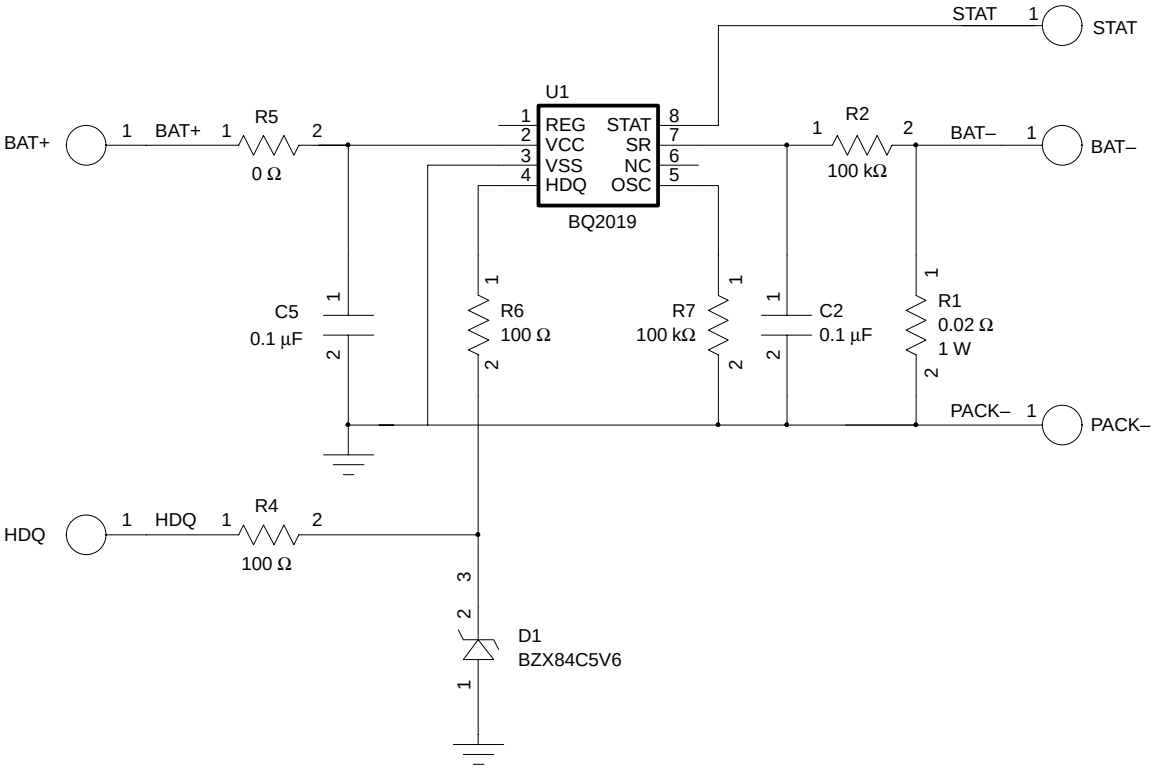
3.1 Schematic

Figure 3–1 shows the bq2019 circuit module schematic diagram.

Figure 3–1. bq2019EVM Schematic



Chapter 4

Circuit Module Physical Layouts

This chapter contains the board layout and assembly drawings for the bq2019 circuit module.

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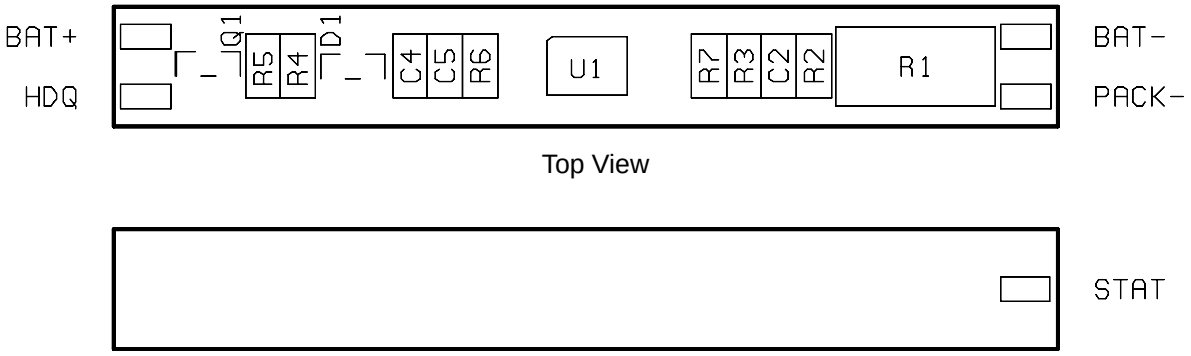
4.1 Board Layout

Figure 4–1 shows the dimensions, PCB layers, and assembly drawing for the bq2019A.

Figure 4–1. bq2019 Dimensions and Layout



Top View

Bottom View

Chapter 5

bq2019 Circuit Module Bill of Materials

This chapter contains the bill of materials required for the bq2019 circuit module.

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5.1 Bill of Materials

Table 5–1 lists materials required for the bq2019 circuit module.

Table 5–1. Bill of Materials

Reference Designator	Qty	Description	Mfg.	MFG Part No.	Size
PCB	1	Printed-circuit board, 0.031, FR4, SMOBC, HASL	Any	bq2119 Rev. A	See FAB DWG
C1,C4,R3 reference designator not used					
C2, C5	2	Capacitor, ceramic, 0.1 µF, 16 V, ±10%, X7R	Panasonic	ECJ-1VB1C104K	603
R1	1	Resistor, 0.020 Ω, 1 W 1%	IRC	LR2512-01-R020-G	2512
R2,R7	2	Resistor, 100 kΩ, 1/16 W, 5%	Panasonic	ERJ-3GSYJ104	603
R3	1	Resistor, 0 Ω, 1/16 W, 5%	Venkel	CR0603-16W000J	603
R4,R6	2	Resistor, 100 Ω, 1/16 W, 5%	Venkel	ERJ-3GSYJ101	603
D1	1	Diode, Zener, 5.6 V	Zetex	BZX84C5V6	SOT-23
U1	1	Integrated circuit, gas gauge, bq2019	Benchmarq/ TI	BQ2019TS	TSSOP-8
Component count	11				

Notes: 1) This assembly is ESD sensitive.
2) This assembly must comply with IPC-A-610 class 2 or better.
3) This assembly must be clean of flux residues and contaminants.
4) Use of no clean flux is not acceptable.

Chapter 6

bq2019 Circuit Module Performance Specification Summary

This section summarizes the performance specifications of the bq2019 circuit module. Table 6–1 gives the performance specifications of the circuit.

Table 6–1. Performance Specification Summary

Specification	Min	Typ	Max	Units
Input voltage BAT+/BAT–	2.8		4.2	V
Charge and discharge current			3	A

Note: Charge and discharge maximum is limited by the PCB design and power dissipation of the 20-mΩ 1-W sense resistor included in the kit.

Chapter 7

EVM Hardware and Software Setup

This section describes how to install the bq2019 EVM PC software and how to connect the components of the EVM.

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7.1 Software Installation

The following steps install the EV2200–19 software:

1) Insert disk 1 into a 3 1/2 inch floppy drive.
2) Select the 3 1/2 inch drive using My Computer or File Manager.
3) Double-click on the Setup.exe icon.

The setup program prompts for the remaining disks and installs a Windows application group.

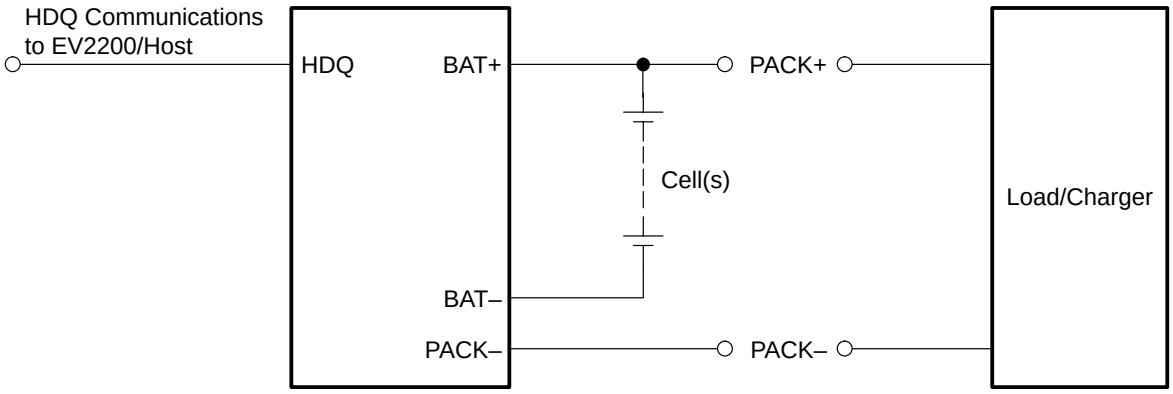
7.2 Hardware Connection

There are three hardware components to the bq2019 EVM: the bq2019 circuit module, the EV2200 PC interface board, and the PC.

7.2.1 Connecting the bq2019 Circuit Module to a Battery Pack

Figure 7–1 shows how to connect the bq2019 circuit module to a stack of cells, the sense resistor, and the system load/charger.

Figure 7–1. bq2019 Circuit Module Connection to Cells and System Load/Charger



7.2.2 PC Interface Connection

The following steps configure the hardware for interface to the PC:

1) Connect the bq2019–based smart battery to the EV2200 using wire leads as in Table 7–1.

Table 7–1. Circuit Module-to-EV2200 Connection

bq2019-Based Battery	EV2200
HDQ	SMBD/HDQ1 or SMBC/HDQ2
PACK–	VSS

2) Connect the PC serial cable to the EV2200 and the PC COM port.

The bq2019 EVM is now set up for operation.

Chapter 8

Operation

This section details the operation of the bq2019 EVM software.

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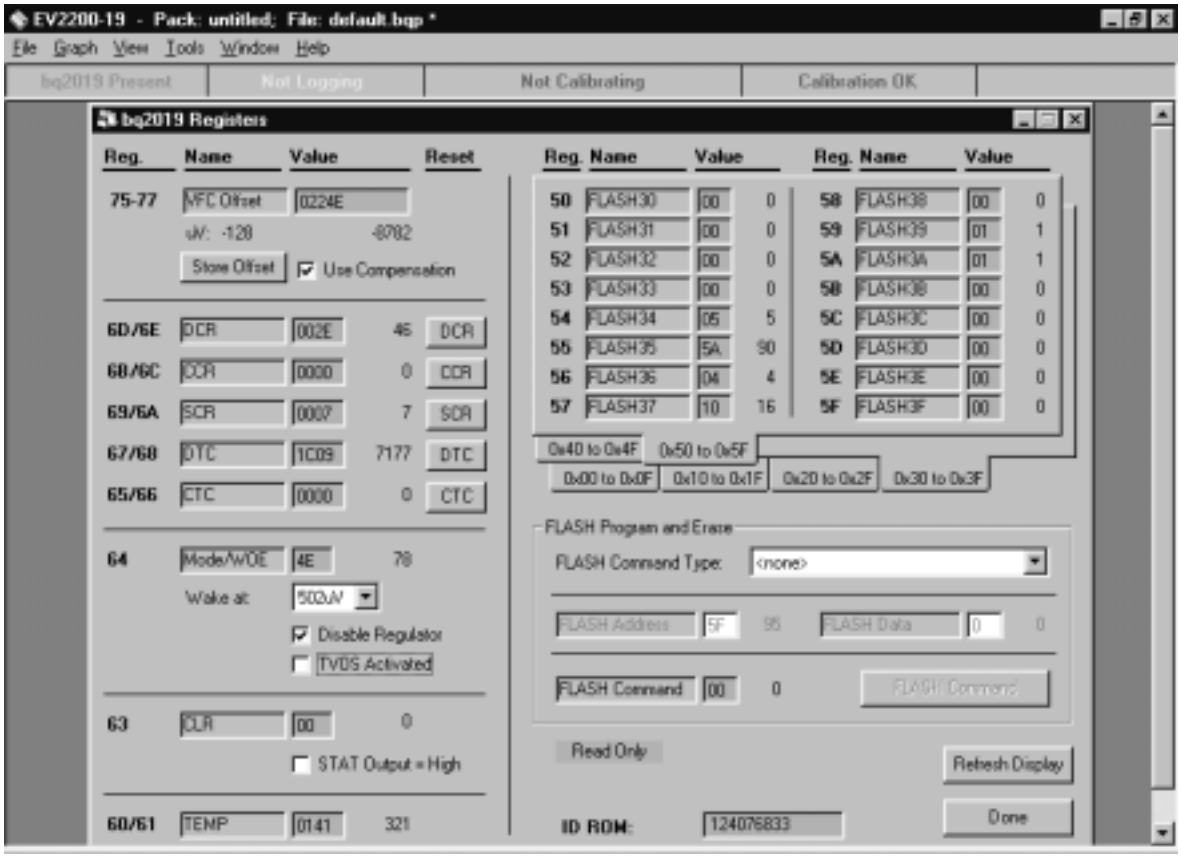
8.1 Starting the Program

Run EV2200–19 from the Start|Programs|EV2200–19 menu sequence. The software requests the PC communications port the first time it is run after installation. Choose the Retry Auto-detection button for automatic port configuration. After the port is detected, the software loads the bq2019 registers and displays the bq2019 Registers screen.

Figure 8–1. Initial Register Screen



8.2 Initialization

This section describes the settings that must be made before the bq2019 is evaluated.

8.2.1 Offset Compensation

For accurate charge and discharge counting, the bq2019 should be calibrated. To calibrate the VFC of the bq2019:

- ❑ Ensure that there is no charge or discharge current flowing.
- ❑ Select Tools|Calibrate VFC from the pulldown menu.
- ❑ Click OK in the Calibrate bq2019 VFC pop-up box.

Note:

Use of TVOS for the VFC offset calibration is not recommended; therefore, do not check the TVOS box in the Calibrate bq2019 VFC pop-up box.

The top bar in the Registers screen should indicate Calibration in Progress. Once completed, the top bar should indicate Calibration OK and the measured offset should be indicated on the Registers screen.

- ❑ Store the offset value in FLASH by clicking the Store Offset button.
- ❑ Click the Use Compensation box to instruct the bq2019 to perform automatic compensation.

8.2.2 Setting Programmable bq2019 Options

Wake-Up Threshold
Select the wake-up threshold with the Wake at: pull down tab. This designates the potential across the sense resistor below which the bq2019 goes to sleep.

Regulator Operation
The circuit module in this EVM does not use the regulator output. Check the Disable Regulator box to turn this function off.

TVOS Activation
The TVOS bit should never be set. Make sure the TVOS Activation box is not checked.

Note:

The TVOS bit must be set to 0 for normal bq2019 operation.

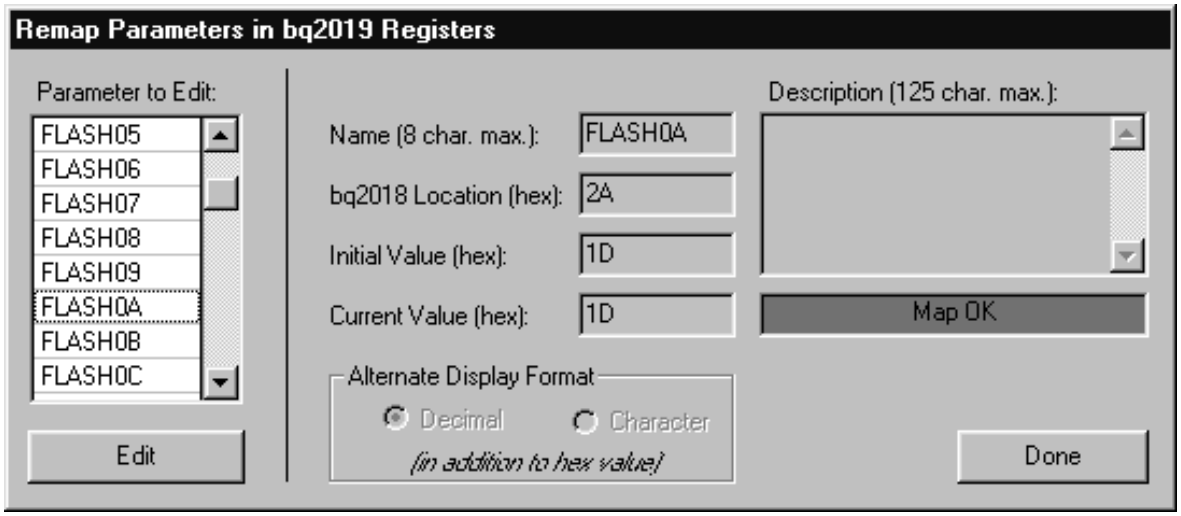
8.2.3 Creating a FLASH Initialization File

The FLASH memory on the bq2019 can be used to store battery pack specific parameters that can be used by the host system in its capacity monitoring algorithm. A configuration file in the evaluation program stores the initial values for all FLASH memory locations when the program is run. The configuration file can be changed to initialize the FLASH locations to different values.

To change the initial FLASH values in configuration file, select Tools| Parameter Mapping from the main pulldown menu.

Select the parameter to change and click the Edit button. The initial FLASH value and the name of the location can be changed by clicking on the appropriate box and overwriting the data. After the data is changed, click on the Done button. Repeat the process for each location to be changed.

Figure 8–2. FLASH Memory Initialization Programming



To save the initialization file, select File|Save Battery Pack As from the main pulldown menu and name the file. Click on the Save button to save the new initialization file.

To program the FLASH locations with the new initialization file, select Tools|Initialize Pack from the main pulldown menu.

8.3 FLASH Memory Commands

The software provides the ability to initiate each bq2019 FLASH Command Code described in the bq2019 data sheet through the pulldown menu in the FLASH Program and Erase box of the bq2019 Registers screen. To initiate a FLASH command, select the command from the pulldown menu and click on the FLASH command button. If the FLASH command is Program Byte, make sure to enter the address and data of the byte to be programmed.

8.4 Data Logging

The bq2019 registers can be logged by using the data log function. To log the data and create a log file:

1) Select Tools|Logging from the pulldown menu.

2) Check the bq2019 registers to be logged in the Log File Setup box.

3) Enter the name of the data log file.

4) Click on the Save button.

5) To stop the data logging, select Tools|Logging from the pulldown menu.

The file can be imported into a text editor, spreadsheet, or word processor program.

Example data log:

```
”Interval:”,”21”,” Seconds.”
”Pack ID:”,”124076833”
”Start Date: ”,”10/4/00”,”Start Time: ”,”1:34:01 PM”
SampleNumber, DCR, DTC
152, 39, 3703
153, 40, 3726
154, 40, 3748
155, 40, 3771
156, 40, 3793
157, 40, 3816
158, 41, 3838
159, 41, 3861
160, 41, 3883
161, 41, 3906
162, 42, 3929
163, 42, 3951
164, 42, 3974
165, 42, 3996
166, 43, 4019
167, 43, 4041
168, 43, 4064
169, 43, 4086
170, 44, 4109
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