# bq20z80EVM-001 SBS1.1 Impedance Track™ Technology Enabled Battery Management Solution Evaluation Module

This EVM is a complete evaluation system for the bq20z80/bq29312/bq29401 battery management system. The EVM includes one bq20z80/bq29312/bq29401 circuit module, a current sense resistor, two thermistors, and Windows®-based PC software. The circuit module includes one bq20z80 IC, one bq29312 IC, one bq29401 IC, and all other onboard components necessary to monitor and predict capacity, perform cell balancing, monitor critical parameters, protect the cells from overcharge, over discharge, short circuit, and overcurrent in 2-, 3- or 4-series cell Li-ion or Li-polymer battery packs. The circuit module connects directly across the cells in a battery. An EV2300 board for gas gauge interface is required to interface this EVM with the PC and can be purchased separately. With the EV2300 interface board and software, the user can read the bq20z80 data registers, program the chipset for different pack configurations, log cycling data for further evaluation, and evaluate the overall functionality of the bq20z80/bq29312/bq29401 solution under different charge and discharge conditions.

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Impedance Track is a trademark of Texas Instruments.
Windows is a registered trademark of Microsoft Corporation.

## 1 Features

- Complete evaluation system for the bq20z80 SBS 1.1-compliant advanced gas gauge with Impedance Track Technology, bq29312 analog front end (AFE) and protection IC, and bq29401 independent overvoltage protection IC
- Populated circuit module for quick setup
- PC software and interface board for easy evaluation
- Software that allows data logging for system analysis

### 1.1 Kit Contents

- bq20z80/bq29312/bq29401 circuit module
- Software CD with the evaluation software
- Set of support documentation

### 1.2 Ordering Information

**Table 1. Ordering Information**

| EVM PART NUMBER | CHEMISTRY | CONFIGURATION | CAPACITY |
|---|---|---|---|
| bq20z80EVM-001 | Li-ion | 2, 3, or 4 cell | Any |

## 2 bq20z80/bq29312-Based Circuit Module

The bq20z80/bq29312/bq29401-based circuit module is a complete and compact example solution of a bq20z80 and bq29312 circuit for battery management and protection of Li-ion or Li-polymer packs. The circuit module incorporates a bq20z80 battery monitor IC, bq29312 AFE and protection IC, bq29401 independent overvoltage protection IC, and all other components necessary to accurately predict the capacity of 2-, 3-, or 4-series cells.

### 2.1 Circuit Module Connections

Contacts on the circuit module provide the following connections:
- Direct connection to the cells: 1N (BAT-), 1P, 2P, 3P, 4P (BAT+)
- To the serial communications port (SMBC, SMBD)
- The system load and charger connect across PACK+ and PACK-
- To the *system* present pin (SYS PRES)
- To the *sleep* pin (SLEEP)

## 2.2   Pin Descriptions

| PIN NAME | DESCRIPTION |
|---|---|
| 1N | -ve connection of first (bottom) cell |
| 1P | +ve connection of first (bottom) cell |
| 2P | +ve connection of second cell |
| 3P | +ve connection of third cell |
| 4P | +ve connection of fourth (top) cell |
| SMBC | Serial communication port clock |
| SMBD | Serial communication data port |
| SYS PRES | System present pin (if low, system is present) |
| SLEEP | Sleep mode pin (if high, AFE enters sleep mode) |
| PACK- | Pack negative terminal |
| VSS | Pack negative terminal |
| PACK+ | Pack positive terminal |

## 3     bq20z80/bq29312 Circuit Module Schematic

This section contains information for modifying and choosing a precharge mode for bq20z80/bq29312/bq29401 implementation.

### 3.1   Schematic

The schematic follows the Bill of Materials in this user's guide.

### 3.2   Modifications for Choosing Particular Precharge Mode

In order to charge, the charge FET (CHG-FET) must be turned on to create a current path. When the $V_{(BAT)}$ is 0 V and CHG-FET = ON, the $V_{(PACK)}$ is as low as the battery voltage. In this case, the supply voltage for the device is too low to operate. This function has three possible configurations, and the bq29312 can be easily configured according to the application needs. The three modes are 0-V Charge FET mode, Common FET mode, and Precharge FET mode.

1.  0-V Charge FET mode - Dedicates a precharge current path using an additional FET (ZVCHG-FET) to sustain the PACK+ voltage level.
2.  Common FET mode - Does not use a dedicated precharge FET. The charge FET (CHG-FET) is set to ON state as default.
3.  Precharge FET mode - Dedicates a precharge current path using an additional open-drain (OD) pin drive FET (PCHG-FET) FET to sustain the PACK+ voltage level.

To use a particular mode of charging with the EVM, add or remove some elements shown in Table 2, and use the given settings of DF.Configuration, ZVCHG1, 0.

**Table 2. Components and Flash-Memory Settings for Different Precharge Modes**

| MODE | RESISTORS | FET | ZVCHG1 | ZVCHG0 |
|---|---|---|---|---|
| 1(default) | R19, R24 | Q3, SI4435DY | 0 | 0 |
| 2 | R17 | – | 0 | 1 |
| 3 | R19, R29 | Q3, open-drain FET | 1 | 0 |

For more details about precharge operation and mode choices, see the bq29312 data sheet (SLUS542).

### 3.3   Testing Fuse-Blowing Circuit

To prevent the loss of board functionality during the fuse-blowing test, the actual chemical fuse is not provided in the circuit. FET Q4 drives TP4 low if a fuse-blow condition occurs; so, monitoring TP4 can be used to test this condition. Fuse placement on the application board is shown in the bq20z80 data sheet reference-board schematic.

## 4    Circuit Module Physical Layouts and Bill of Materials

This section contains the board layout, bill of materials, and assembly drawings for the bq20z80/ bq29312/ bq29401 circuit module.

### 4.1    Board Layout

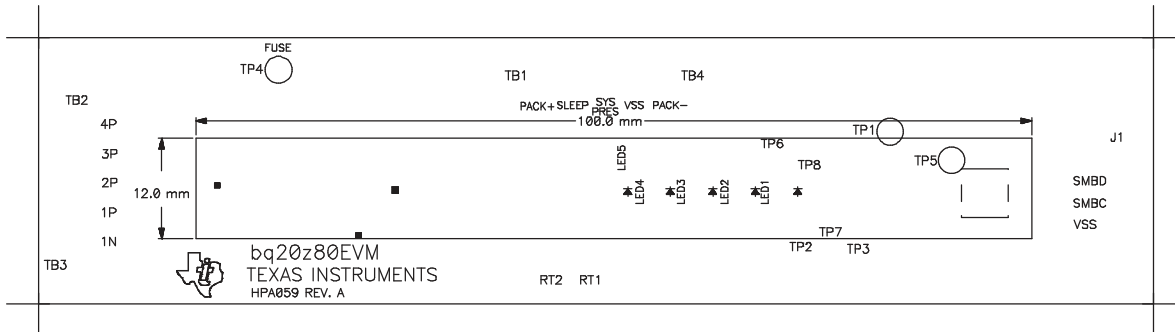This section shows the dimensions, PCB layers, and assembly drawing for the bq20z80/bq29312 module.

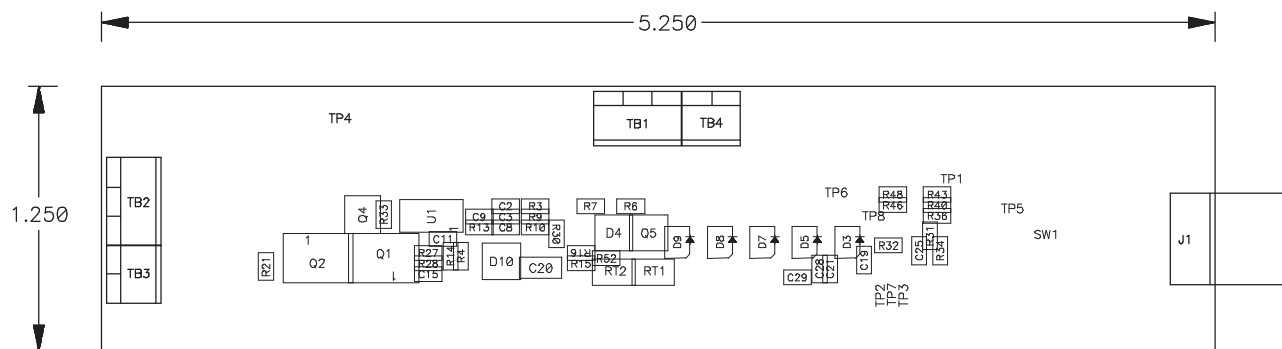

**Figure 1. bq20z80EVM-001 Layout (Silk Screen)**
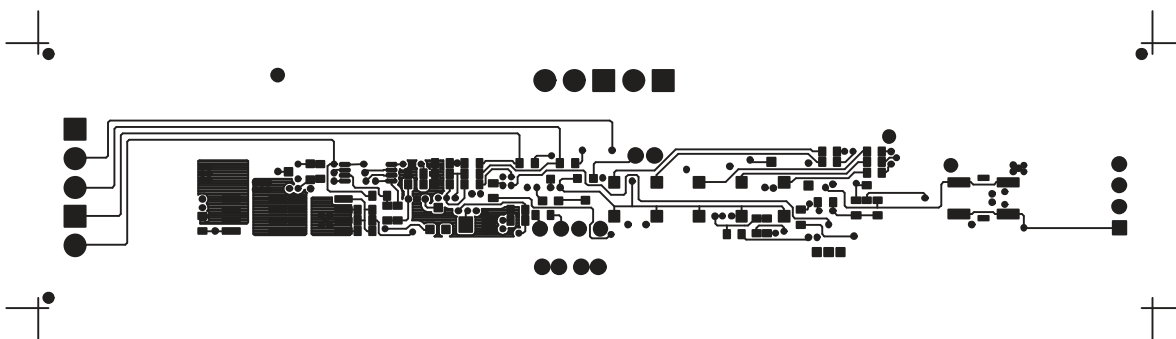


**Figure 2. Top Assembly**



**Figure 3. Layer 1**
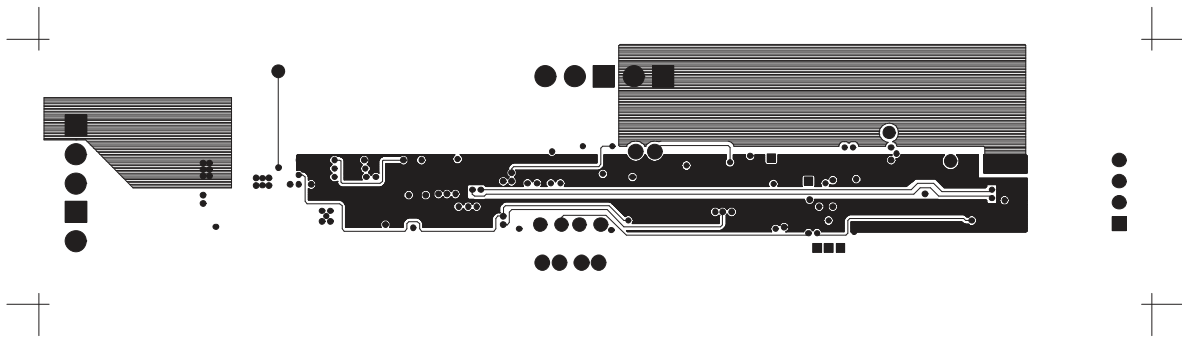
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**Figure 4. Layer 2 (Internal 1)**
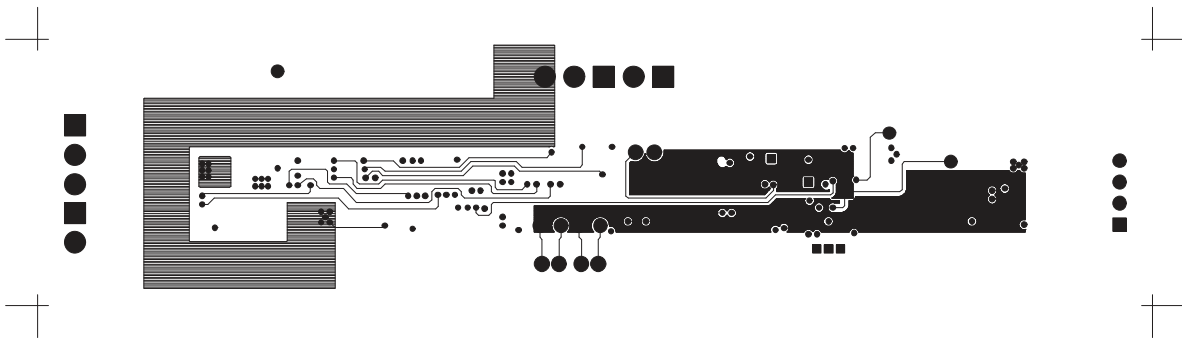
**Figure 5. Layer 3 (Internal 2)**
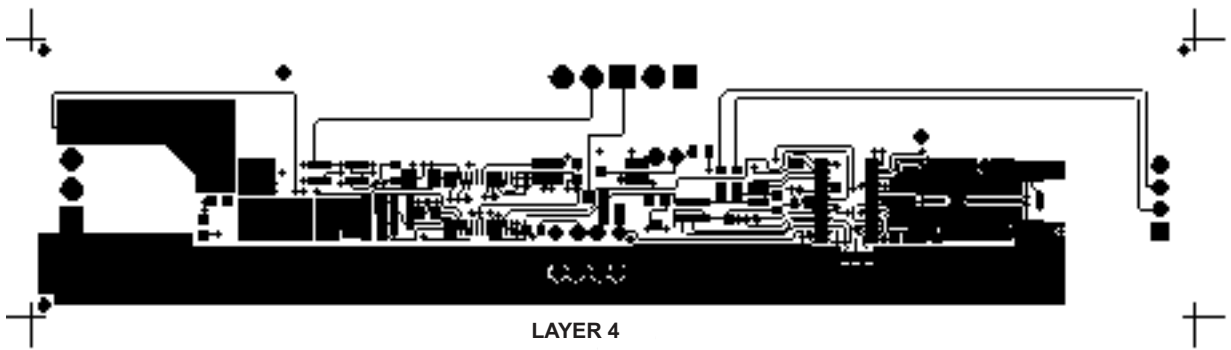
LAYER 4

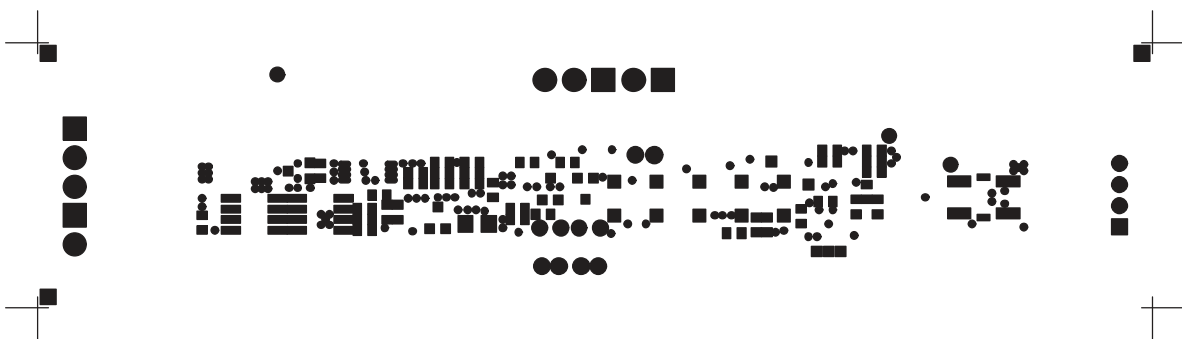**Figure 6. Layer 4**

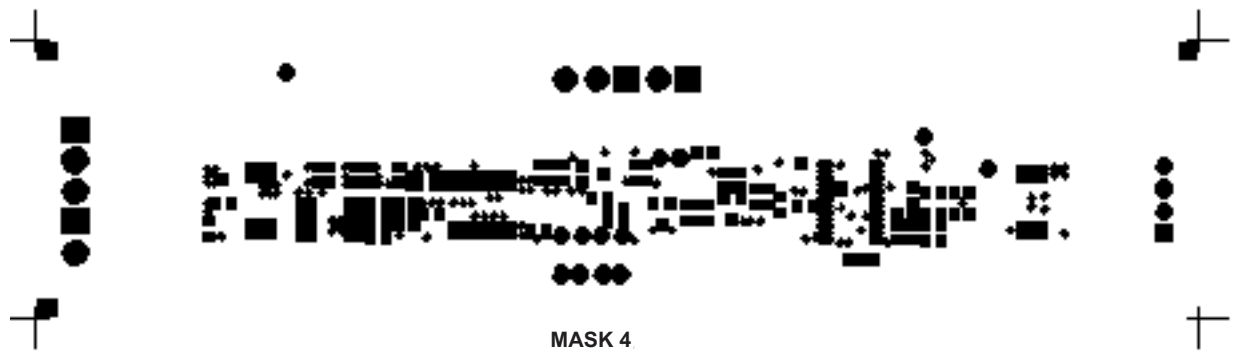**Figure 7. Mask (Layer 1)**

**MASK 4**

**Figure 8. Mask (Layer 4)**
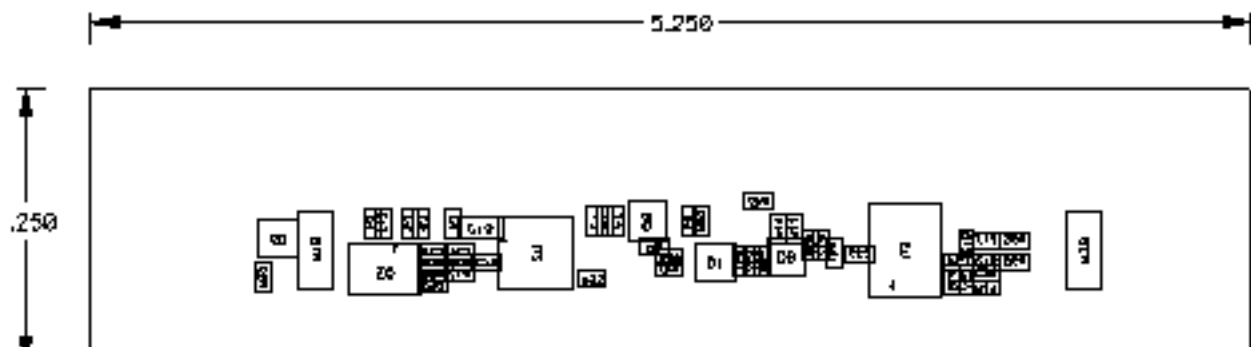


**Figure 9. Bottom Assembly**

## 4.2 Bill of Materials

### Table 3. Bill of Materials

| Count | Ref Des | Description | Size | MFG | Part No. |
|---|---|---|---|---|---|
| 18 | C1, C2, C3, C4, C5, C6, C7, C8, C9, C11, C12, C13, C14, C16, C17, C18, C19, C21 | Capacitor, ceramic, 0.1 µF 50 V, X7R, 20% | 603 | Any | STD |
| 1 | C10 | Capacitor, ceramic, 1.0 µF, 50 V, X7R, 20% | 1206 | Any | STD |
| 0 | C36 | Capacitor, ceramic, 0.1 µF, 16 V, X7R, 10% | 603 | Any | STD |
| 1 | C15 | Capacitor, ceramic, 0.047 µF, 50 V, X7R, 10% | 603 | Any | STD |
| 1 | C20 | Capacitor, ceramic, 4.7 µF, 16 V, X7R, 10% | 1206 | Any | STD |
| 5 | C19, C22, C24, C28, C29 | Capacitor, ceramic, 0.47 µF, 16 V, X7R, 10% | 603 | Any | STD |
| 1 | C26 | Capacitor, ceramic, 2200 pF, 16 V, COG, 10% | 603 | Any | STD |
| 1 | C27 | Capacitor, ceramic, 150 pF, 16 V, COG, 10% | 603 | Any | STD |
| 2 | D1, D6 | Diode, dual, Zener, 5.6 V, 300 mW | SOT23 | Vishay-Telefunken | AZ23C5V6 |
| 1 | D2 | Diode, dual ultra fast, series, 200 mA, 70 V | SOT23 | Fairchild | BAV99 |
| 5 | D3, D5, D7, D8, D9 | Diode, LED, green, Gullwing, GW type, 20 mA, 7.5 mcd Typ | Gullwing | Panasonic | LN1361C |
| 1 | D4 | Diode, dual Schottky, 200 mA, 30 V | SOT23 | Vishay-Liteon | BAT54C |
| 1 | D10 | Diode, Schottky | SOT23 | Vishay-Liteon | BAT54C |
| 1 | J1 | Header, friction lock assembly, 4-pin right angle | 0.400 × 0.500 | Molex | 22-05-3041 |
| 3 | Q1, Q2, Q3 | MOSFET, P-ch, 30 V, 8.0 A, 20 mΩ | SO8 | Vishay-Siliconix | Si4435DY |
| 2 | Q4, Q6 | MOSFET, N-ch, 60 V, 115 mA, 1.2 Ω | SOT23 | Vishay-Liteon | 2N7002DICT |
| 1 | Q5 | MOSFET, P-ch, 50 V, 130 mA, 10 Ω | SOT23 | Vishay | BSS84 |
| 16 | R1, R2, R3, R8, R9, R10, R13, R14, R15, R25, R26, R30, R37, R38, R44, R45 | Resistor, chip, 100 Ω, 1/16 W, 5% | 603 | STD | STD |
| 0 | R29 | Resistor, chip, 4.99 kΩ, 1/16 W, 1% | 603 | STD | STD |
| 5 | R11, R12, R22, R24, R28 | Resistor, chip, 4.99 kΩ, 1/16 W, 1% | 603 | STD | STD |
| 0 | R17 | Resistor, chip, 100 kΩ, 1/16 W, 5% | 603 | STD | STD |
| 7 | R16, R19, R31, R33, R34, R39, R42 | Resistor, chip, 100 kΩ, 1/16 W, 5% | 603 | STD | STD |
| 1 | R18 | Resistor, chip, 300 Ω, 1 W, 1% | 2512 | | RCW-2512-301-F |
| 1 | R20 | Resistor, chip, 0.020 Ω, 1 W, 1% | 2512 | Vishay | WSL-2512-0 |
| 5 | R21, R23, R27, R50, R51 | Resistor, chip, 1 MΩ, 1/16 W, 5% | 603 | | |
| 1 | R32 | Resistor, chip, 10 Ω, 1/16 W, 5% | 603 | STD | STD |
| 1 | R35**[1] | Resistor, chip, 100 kΩ, 1/16 W, 0.2%, 75 PPM | 603 | Vishay | TNPW06031003BT9RT1 |
| 5 | R36, R40, R43, R46, R48 | Resistor, chip, 470 Ω, 1/16 W, 5% | 603 | STD | STD |
| 4 | R4, R5, R6, R7 | Resistor, chip, 1 kΩ, 1/16 W, 5% | 603 | STD | STD |
| 2 | R41, R47 | Resistor, chip, 61.9 kΩ, 1/16 W, 1% | 603 | STD | STD |
| 2 | R49, R53 | Resistor, chip, 8.45 kΩ, 1.16 W, 1% | 603 | STD | STD |
| 2 | RT1, RT2 | Thermistor, 10 kΩ | 0.095 × 0.150 | Sematec | NTC103AT-2 |

[1] Reference designators marked with an asterisk (**) cannot be substituted. All other components can be substituted with equivalent MFG's components.

## Table 3. Bill of Materials (continued)

| Count | Ref Des | Description | Size | MFG | Part No. |
|---|---|---|---|---|---|
| 1 | SW1 | Switch, push button, momentary, N.O. low profile | 5 mm × 5 mm | Panasonic | EVQ-PLHA15 |
| 2 | TB1, TB2 | Terminal block, 3 pin, 6 A, 3,5 mm | 0.41 × 0.25 | OST | ED1515 |
| 2 | TB3, TB4 | Terminal block, 2 pin, 6 A, 3,5 mm | 0.27 × 0.25 | OST | ED1514 |
| 3 | TP1, TP4, TP5 | Test point, cir | | Farnell | 240-333 |
| 1 | U1 | IC, voltage protection for 2, 3, or 4 cell Li-Ion, 2nd protection, x.xx | TSSOP-08 | TI | bq29400PW[2] [3] [4] |
| 1 | U2 | IC, 2, 3, or 4 cell series protection control AFE | TSSOP24 | TI | bq29312PW[2] [3] [4] |
| 1 | U3 | IC, advanced gas gauge | TSSOP38 | TI | bq20z80DBT[2] [3] [4] |
| 1 | — | PCB | | Any | HPA059 |
| | | **Connector**[5] | | | |
| 2 | J5 mate | Connector, Female, 0.100 centers | | Molex | 22-01-3407 |
| 8 | N/A | Terminals, crimp, tin | | Molex | 08-50-0114 |
| | N/A | Wire, insulated 24 awg. red, 18 inches (±3 inches) (USB_5V) | | Alpha | 1854-3 |
| | N/A | Wire, insulated 24 awg. white, 18 inches (±3 inches) (SCL) | | Alpha | 1854-1 |
| | N/A | Wire, insulated 24 awg. black, 18 inches (±3 inches) (GND) | | Alpha | 1854-2 |
| | N/A | Wire, insulated 24 awg. brown, 18 inches (±3 inches) (SDA) | | Alpha | 1854-7 |
| 1 | N/A | Heatshrink, 1 inch | | Any | Any |

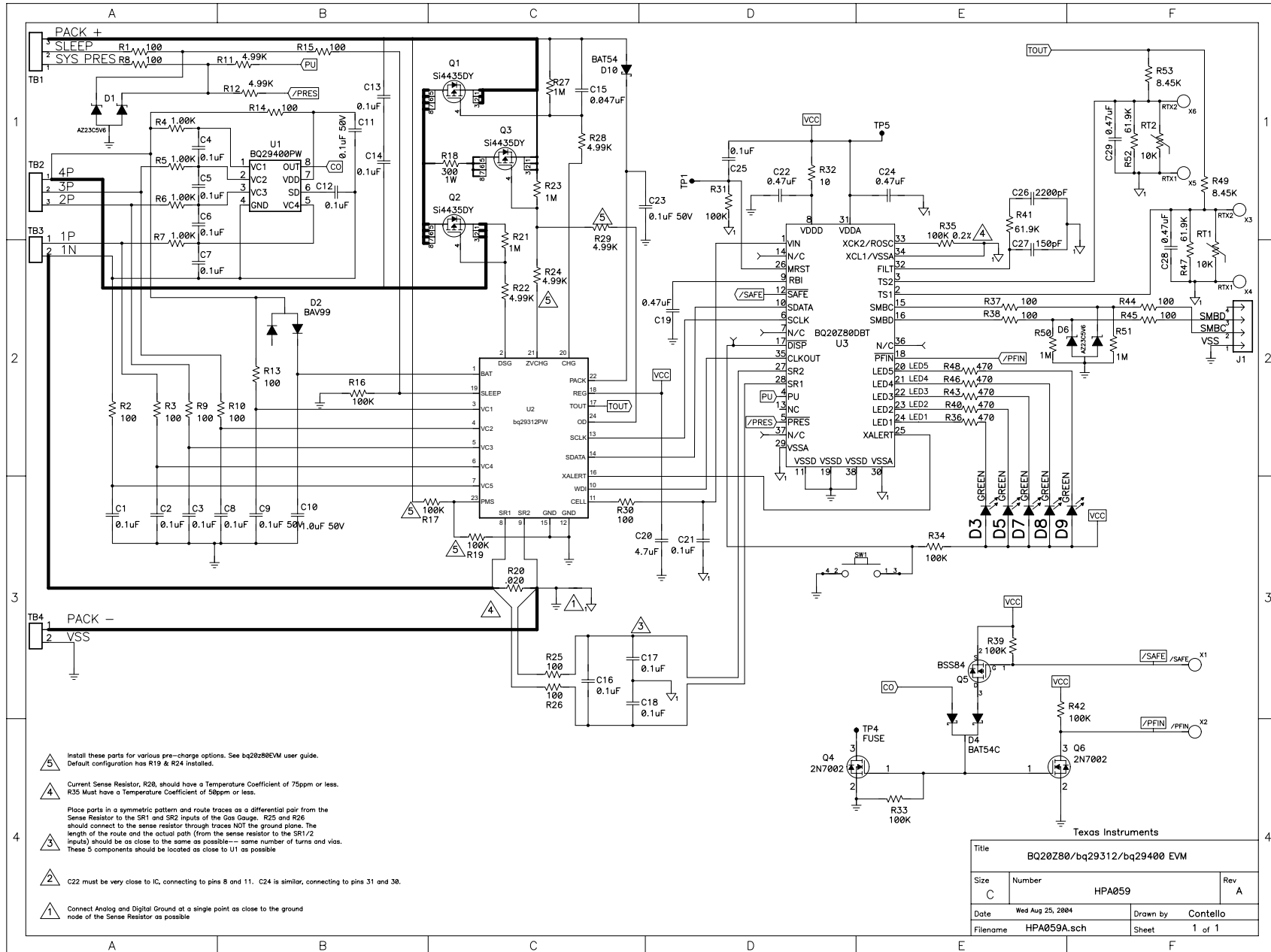[2]   This assembly is ESD sensitive.
[3]   This assembly must be clean and free from flux and all contaminants. Use of no clean flux is not acceptable.
[4]   This assembly must comply with workmanship standards IPC-A-610 Class 2.
[5]   Make one SMBus connector wire assembly for each assembly produced, from J5 mate, 4-24 awg wires, and crimp terminals.
      Wire colors for pin numbers are listed below. The wire assembly shall have a J5 mate on each end.
      •   Red - Pin #4 (Signal USB_5V)
      •   Brown - Pin #3 (Signal Data)
      •   White - Pin #2 (Signal Clock)
      •   Black - Pin #1 (GND)

PACK +
SLEEP
SYS PRES

TB1
TB2  4P / 3P / 2P
TB3  1P / 1N
TB4  PACK −  VSS

R1 100  R15 100
R8 100  R11 4.99K  PU
R12 4.99K  /PRES
R14 100
D1  AZ23C5V6

U1 BQ29400PW
1 VC1  OUT 8
2 VC2  VDD 7
3 VC3  SD 6
4 GND  VC4 5
CO

R4 1.00K  C4 0.1uF
R5 1.00K  C5 0.1uF
R6 1.00K  C6 0.1uF
R7 1.00K  C7 0.1uF

C13 0.1uF
C11 0.1uF 50V
C14 0.1uF
C12 0.1uF

Q1 Si4435DY
Q3 Si4435DY
Q2 Si4435DY

R18 300 1W
R23 1M
R21 1M
R22 4.99K
R24 4.99K
R29 4.99K
R27 1M
R28 4.99K

BAT54 D10
C15 0.047uF

D2 BAV99

R13 100
R16 100K

R2 100  R3 100  R9 100  R10 100
C1 0.1uF  C2 0.1uF  C3 0.1uF  C8 0.1uF  C9 0.1uF 50V  C10 1.0uF 50V

U2 bq29312PW
1 BAT
19 SLEEP
3 VC1
4 VC2
5 VC3
6 VC4
7 VC5
23 PMS
2 DSG  21 ZVCHG  20 CHG
22 PACK
18 REG
17 TOUT
24 OD
13 SCLK
14 SDATA
16 XALERT
10 WDI
11 CELL
8 SR1  9 SR2  15 GND  12 GND

TOUT
R17 100K
R19 100K
R20 .020

R25 100  R26 100
C16 0.1uF  C17 0.1uF  C18 0.1uF

VCC  TP5
TP1
R31 100K
C25 0.1uF
C22 0.47uF
R32 10
C24 0.47uF
C23 0.1uF 50V
0.47uF C19
/SAFE

C26 2200pF
R41 61.9K
C27 150pF
R35 100K 0.2%

U3 BQ20Z80DBT
8 VDDD  31 VDDA
1 VIN   33 XCK2/ROSC
14 N/C  34 XCL1/VSSA
26 MRST 32 FILT
9 RBI   3 TS2
12 SAFE 2 TS1
10 SDATA 15 SMBC
6 SCLK  16 SMBD
7 N/C   36 N/C
17 DISP 18 PFIN
35 CLKOUT 20 LED5
27 SR2  21 LED4
28 SR1  22 LED3
4 PU    23 LED2
13 NC   24 LED1
5 PRES  25 XALERT
37 N/C
29 VSSA
11 VSSD 19 VSSD 38 VSSD 30 VSSA

PU  /PRES

R48 470
R46 470
R43 470
R40 470
R36 470

R34 100K

D3 D5 D7 D8 D9 GREEN
VCC

R30 100
C20 4.7uF  C21 0.1uF

TOUT
R53 8.45K
C29 0.47uF  R52 61.9K  RT2  R51 10K  RTX2 X6  RTX1 X5
R49 8.45K
C28 0.47uF  R47 61.9K  RT1  R50 10K  RTX2 X3  RTX1 X4

R37 100  R44 100  SMBD
R38 100  R45 100  SMBC
D6 AZ23C5V6
R50 1M  R51 1M
/PFIN
VSS
J1

R39 100K
BSS84 Q5
CO
D4 BAT54C
Q4 2N7002
R33 100K
TP4 FUSE
R42 100K
Q6 2N7002
/SAFE  X1
/PFIN  X2
VCC

SW1

Notes:
5  Install these parts for various pre−charge options. See bq20z80EVM user guide. Default configuration has R19 & R24 installed.

4  Current Sense Resistor, R20, should have a Temperature Coefficient of 75ppm or less. R35 Must have a Temperature Coefficient of 50ppm or less.

3  Place parts in a symmetric pattern and route traces as a differential pair from the Sense Resistor to the SR1 and SR2 inputs of the Gas Gauge. R25 and R26 should connect to the sense resistor through traces NOT the ground plane. The length of the route and the actual path (from the sense resistor to the SR1/2 inputs) should be as close to the same as possible−− same number of turns and vias. These 5 components should be located as close to U1 as possible

2  C22 must be very close to IC, connecting to pins 8 and 11. C24 is similar, connecting to pins 31 and 30.

1  Connect Analog and Digital Ground at a single point as close to the ground node of the Sense Resistor as possible

Texas Instruments

| Title | BQ20Z80/bq29312/bq29400 EVM | | |
|---|---|---|---|
| Size C | Number HPA059 | | Rev A |
| Date Wed Aug 25, 2004 | | Drawn by Contello | |
| Filename HPA059A.sch | | Sheet 1 of 1 | |

## 4.3 *bq20z80/bq29312/bq29401 Circuit Module Performance Specification Summary*

Table 4 summarizes the performance specifications of the bq20z80/ bq29312/bq29401 circuit module.

**Table 4. Performance Specification Summary**

| Specification | Min | Typ | Max | Units |
|---|---|---|---|---|
| Input voltage Pack+ to Pack- | 6 | | 25 | V |
| Charge and discharge current | | | See [(1)] | A |

[(1)] Maximum currents are determined by the value of the sense resistor used and the short-circuit threshold setting of the bq29312. It is important to operate this EVM within the input voltage range of 6 V and 25 V, with a maximum voltage drop across the sense resistor of +2150 mV (1-W power dissipation).

## 5 EVM Hardware and Software Setup

This section describes how to install the bq20z80EVM-001 PC software, and how to connect the different components of the EVM.

### 5.1 *System Requirements*

The bq20z80EVSW requires Windows 2000 or Windows XP. Drivers for Windows 98SE are provided, but Microsoft no longer supports Windows 98; and there may be issues in Windows 98 with USB driver support. The EV2300 USB drivers have been tested for Windows 98SE, but no assurance is made for problem-free operation with specific system configurations.

### 5.2 *Software Installation*

Find the latest software version in the bq20z80 tool folder on power.ti.com. Use the following steps to install the bq20z80EVSW software:

1. Copy the files from the CD into the temporary directory you selected, open the archive TI USB DRVRS.zip, and extract its contents in a subdirectory/drivers. Choose preserve *directory structure* option when extracting. Alternatively, run SETUP.EXE from the same directory.
2. Plug the EV2300 into a USB port.
3. Wait until system prompt *new hardware found* appears. Choose *select location manually*, and use the *browse* button to point to subdirectory TIUSBWin2K-XP-1.
4. Answer *continue* to the warning that drivers are not certified with Microsoft.
5. After installation finishes, another system prompt *new hardware found* appears. Repeat procedure above, but point to subdirectory TIUSBWin2K-XP-2
6. Answer *continue* to the warning that drivers are not certified with Microsoft. Installation of drivers is now finished.
7. For Windows 98, point to directory TIUSBWin98.
8. Return to the temporary directory where you extracted files; double-click on the *Setup.exe* icon to install EV Software.

If files were downloaded from the Web:

1. Open the archive containing the installation package, and copy its contents in a temporary directory.
2. Follow the preceding steps 1 - 8.

## 6 Troubleshooting Unexpected Dialog Boxes

Ensure that the files were extracted from the zip file using the *Preserve Folder names* option.

Ensure that **ALL** the files were extracted from the zip file.

The user that is downloading the files must be logged in as the administrator.

The driver is not signed, so the administrator must allow installation of unsigned drivers in the operating system policy.

## 7    Hardware Connection

The bq20z80EVM-001 comprises three hardware components: the bq20z80/bq29312/bq29401 circuit module, the EV2300 PC interface board (purchased separately), and the PC.

### 7.1    Connecting the bq20z80/bq29312/bq29401 Circuit Module to a Battery Pack

Figure 10 shows how to connect the bq20z80/bq29312/bq29401 circuit module to the cells and system load/charger.

The cells should be connected in the following order:

1.  4-Cell Pack: 1N (BAT-), 1P, and 2P (see Section 2.1 for definitions).
2.  3-Cell Pack: 1N (BAT-), 1P, 2P, and then connect 4P and 3P together.
3.  2-Cell Pack: 1N (BAT-), 1P, and then connect 4P, 3P, and 2P together

To start charge or discharge test, connect PRES pin to PACK- pin to set SYS PRES state. To test sleep mode, disconnect the PRES pin.
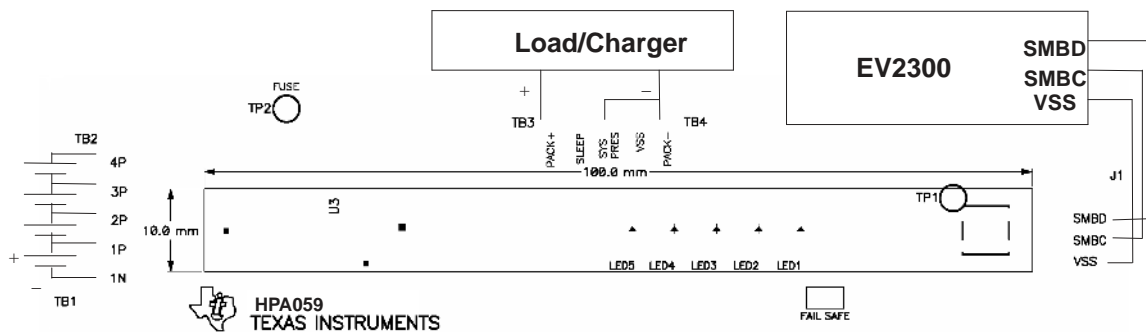


**Figure 10. bq20z80bq29312 Circuit Module Connection to Cells and System Load/Charger**

### 7.2    PC Interface Connection

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

1.  Connect the bq20z80/bq29312-based smart battery to the EV2300 using wire leads as shown in Table 5.

**Table 5. Circuit Module to EV2300 Connections**

| bq20z80/bq29312-Based Battery | EV2300 |
| --- | --- |
| SMBD | SMBD |
| SMBC | SMBC |
| VSS | GND |

2.  Connect the PC USB cable to the EV2300 and the PC USB port.

The bq20z80EVM-001 is now set up for operation.

# 8    Operation

This section details the operation of the bq20z80 EVSW software.

## 8.1    Starting the Program

Run bq20z80 EVSW from the Start | Programs | Texas Instruments | bq20z80 EVSW menu sequence. The SBS Data screen appears. Data begins to appear once the <Refresh> (single time scan) button is clicked, or when the <Keep Scanning> check box is checked. To disable the scan feature, deselect <Keep Scanning>.

The continuous scanning period can be set via the |Options| and |Set Scan Interval| menu selections. The range for this interval is 0 ms to 65535 ms. Only items that are selected for scanning are scanned within this period.

The bq20z80 EVSW provides a logging function which logs the values that were last scanned by EVSW. To enable this function, select the *Start Logging* button, this causes the *Keep Scanning* button to be selected. When logging is *Stopped*, the keep scanning button is still selected and has to be manually unchecked.

The logging interval are specified under the |Options| menu with the maximum value of 65535 milliseconds. The *Log* interval cannot be smaller than scan interval because this results in the same value being logged at least twice.
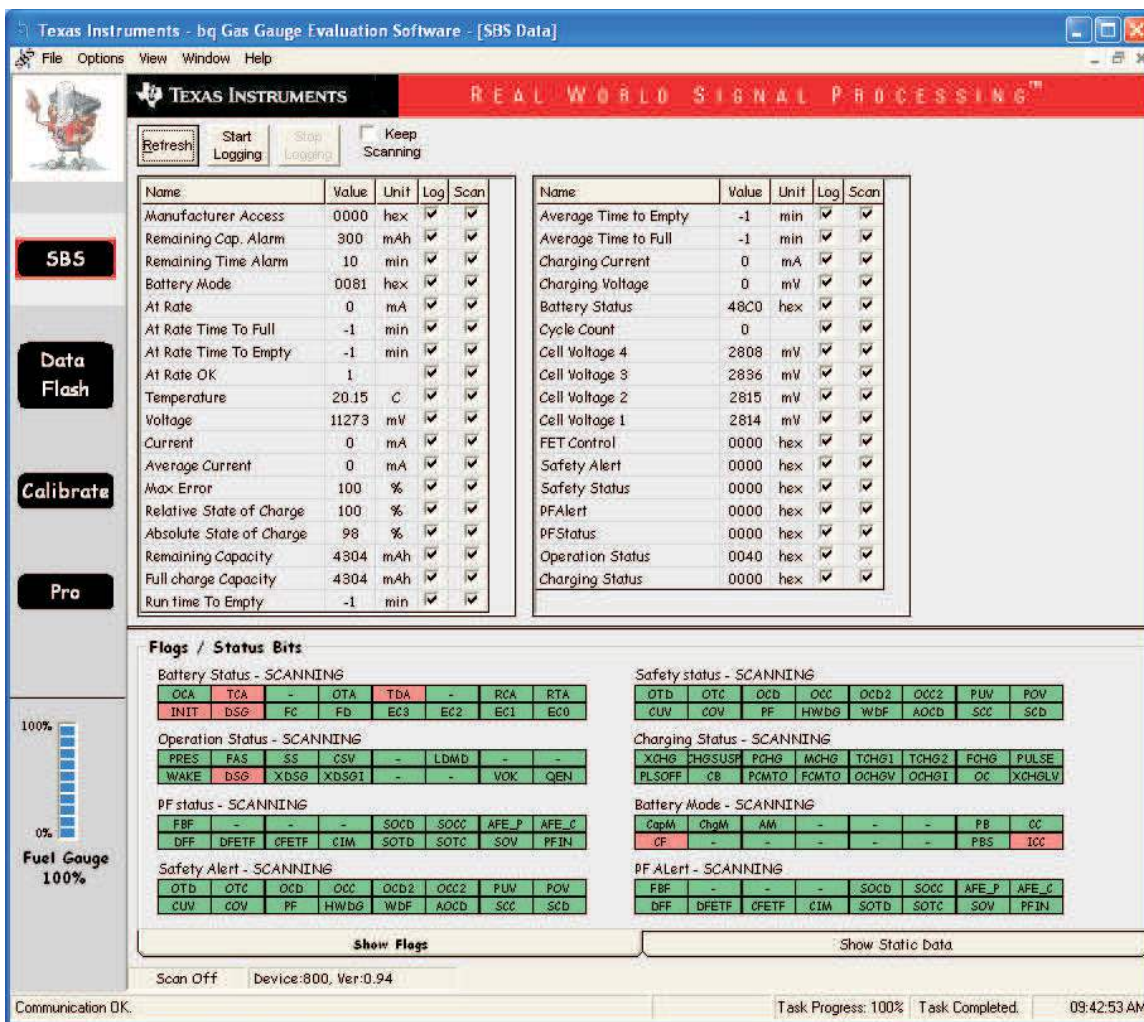


**Figure 11. SBS Data Screen**

This screen shows the SBS data set along with additional ManufacturersAccess() command information such as individual cell measurements. Additional Flag and Static data can be viewed by selecting the appropriate tab at the bottom of the SBS screen.

Data such as SBS.ManufacturerName( ) is static and does not change. This data is viewed separately using the *Static Data* tab available at the bottom of the screen.

Dragging the splitter bar (line that separates the Flags/Static data from SBS values) changes the height of the Flags/Static Data display. Selecting |View| then |Auto Arrange| returns the splitter bar to its original location.

## 8.2   Setting Programmable bq20z80 and bq29312 Options

The bq20z80 data flash comes configured per the default settings detailed in the bq20z80 data sheet. Ensure that the settings are correctly changed to match the pack and application for the bq20z80/bq29312 solution being evaluated.

**IMPORTANT:** The correct setting of these options is essential to get the best performance.

The settings can be configured using the Data Flash screen.
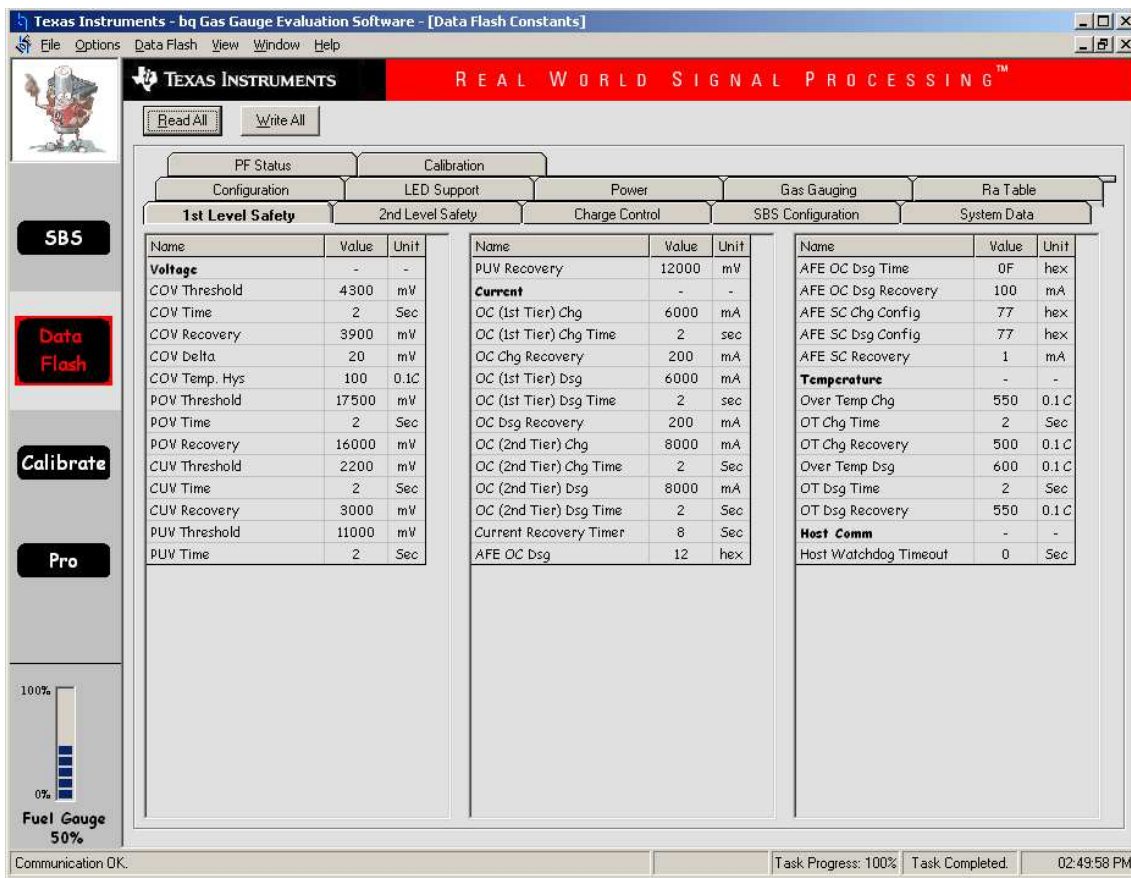


**Figure 12. Data Flash Screen, 1st Level Safety Class**

To read all the data from the bq20z80 data flash, click on menu option | Data Flash | Read All |.

To write to a data flash location, click on the desired location, enter the data and press <Enter>, which writes the entire tab of flash data, or select menu option |Data Flash|Write All|. The data flash **MUST** be read before any writes are performed to avoid any incorrect data being written to the device.

The | File | Special Export | menu options allows the data flash to be exported, but it configures the exported data flash to a learned state ready for mass production use.

The data flash configuration can be saved to a file by selecting | File | Export |, and entering a file name. A data flash file can also be retrieved in this way, imported, and written to the bq20z80 using the | Write All | button.

The configuration information of the bq29312 and module calibration data is also held in the bq20z80 data flash.

The bq20z80 allows for an automatic data flash export function, similar to the SBS Data logging function. This feature, when selected via | Options | Auto Export |, exports Data Flash to a sequential series of files named as *FilenameNNNNN.gg* where N = a decimal number from 0 to 9.

The AutoExport interval is set under the | Options menu | with a minimum value of 15 seconds. The AutoExport filename is also set under the | Options menu |.

When there is a check next to | AutoExport |, the AutoExport is in progress. The same menu selection is used to turn on / off AutoExport.

If the data flash screen is blank, then the bq20z80 that is being used may not be supported by the bqEVSW version that is being used. An upgrade may be required.

# 9    Calibration Screen

## 9.1    How to Calibrate

Before the bq20z80 is calibrated:

- Connect a load to Pack- and Pack+ that draws approximately 2 A and measures discharge current to use the FETs.
- Connect a current source to Batt- and Pack- to calibrate without using the FETs.
- Measure the pack voltage from Batt+ to Batt- (Total of Cell voltages).
- Measure the temperature of the pack.
- These steps may or may not be required, depending on the type of calibration being performed.

## 9.2    To Calibrate the bq20z80

Select the types of calibration to be performed.

Enter the measured values for the types selected.

If *Voltage Calibration* is selected, then enter the number of cells on the pack.

If *Temperature Calibration* is selected, then select the sensor that is to be calibrated.

If the load is connected between Pack+ and Pack-, then select the *Use FETs* checkbox.

Press the *Calibrate Part* button.

## 9.3    Board Offset Calibration

This performs the offset calibration for the current offset of the board.

Remove load/external voltage and short Pack- to Batt-.

Press the *CC Board Offset* button.

## 9.4    Pack Voltage Calibration

This calibrates the voltage at the AFE Pack pin.

Make sure *Voltage Calibration* has been performed for the pack. If *Voltage Calibration* is not performed, then *Pack Voltage Calibration* calibrates incorrectly.

Remove load/external voltage applied between Pack+ and Pack-.

Press the *Pack Voltage* button to calibrate.
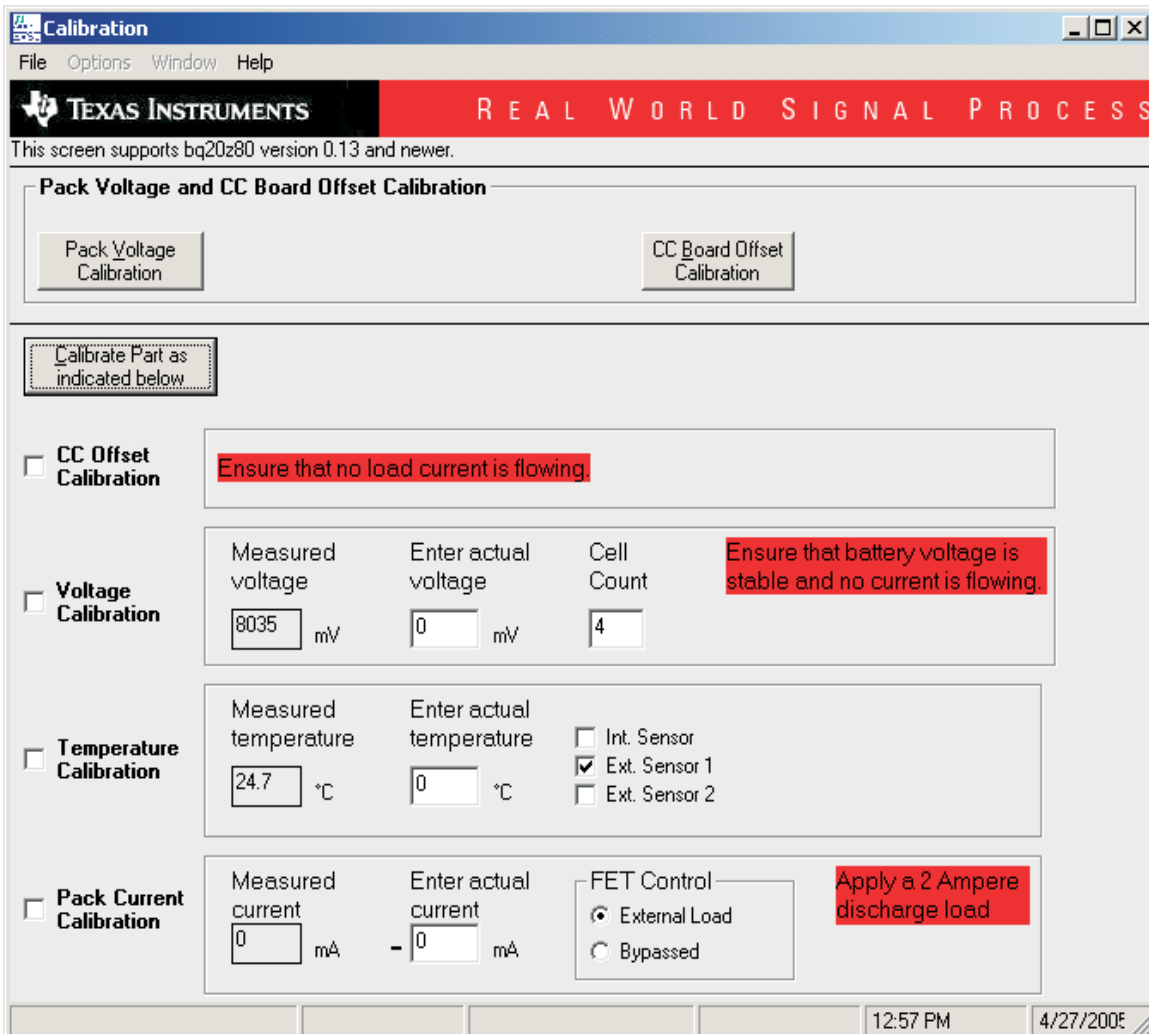
**Figure 13. Calibration Screen**

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# 10    Pro (Advanced) Screen

## 10.1   SMB Communication

The set of read/write operations over SMBus are not specific to any gas gauge. These are provided as general-purpose communication tools.

## 10.2   Hex / Decimal Converter

These two boxes convert between hex and decimal as soon as values are typed into the boxes. Invalid values may cause erroneous results.

When scaling converted hex values to a higher number of bytes, follow these rules:

• When unsigned is selected, the left pad contains zeroes.

• When signed is selected, the left pad contains zeroes for a positive number, or the left pad contains *F* for negative numbers.

## 10.3   Programming

Allows for device reprogramming from unencrypted and encrypted files.
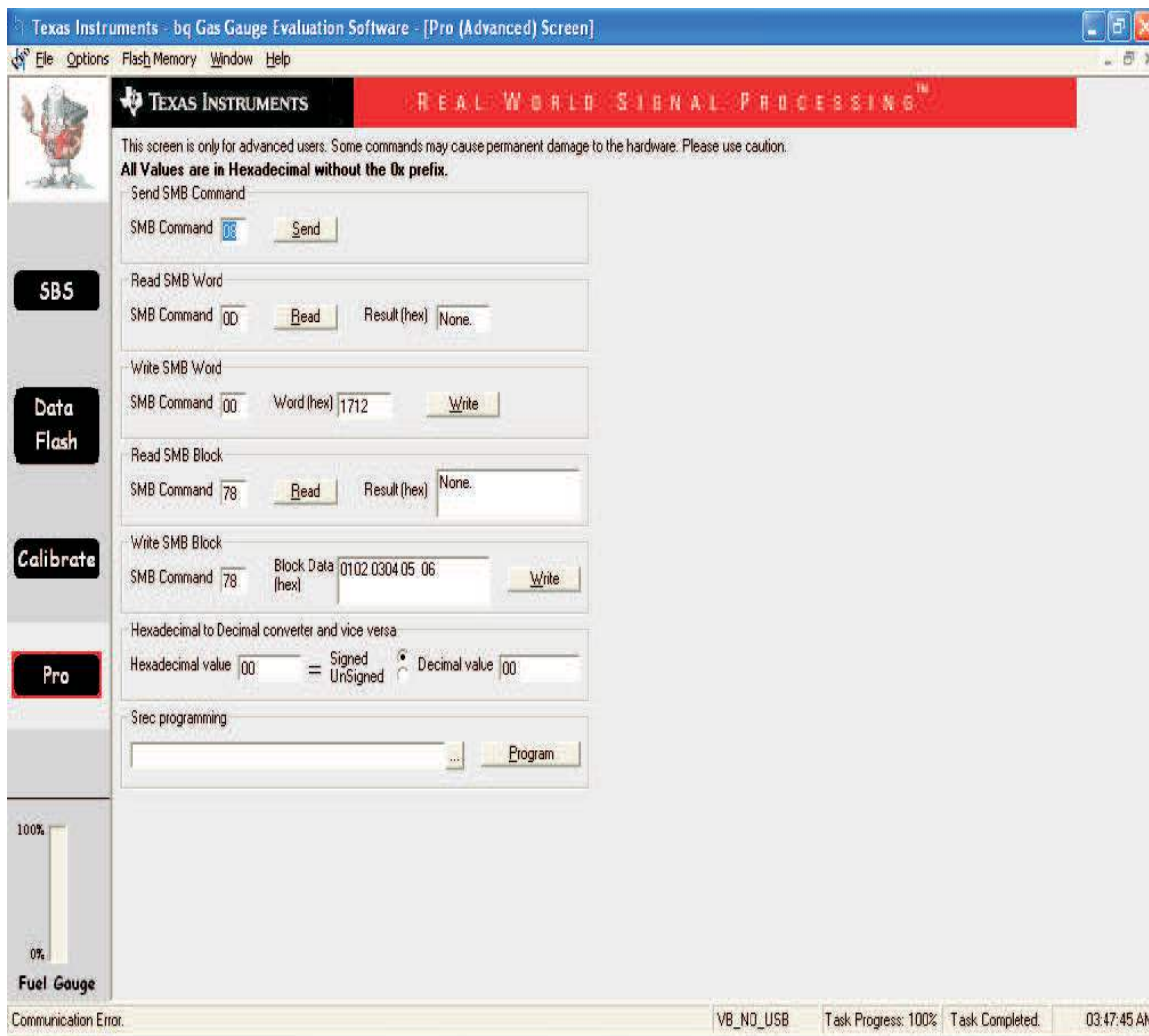


**Figure 14. Pro (Advanced) Screen**

## Related Documentation from Texas Instruments

To obtain a copy of any of the following TI document, call the Texas Instruments Literature Response Center at (800) 477-8924 or the Product Information Center (PIC) at (972) 644-5580. When ordering, identify this document by its title and literature number. Updated documents can also be obtained through the TI web site at www.ti.com

| Data Sheets: | Literature Number: |
|---|---|
| bq20z80 | SLUS625 |
| bq29312 | SLUS546 |

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