

bq2750xEVM System Side Single-Cell Impedance Track™ Technology Evaluation Module

This evaluation module (EVM) is a complete evaluation system for the bq2750x. The EVM includes one bq2750x circuit module, a current sense resistor, one thermistor, an EV2300 PC interface board for gas gauge interface, a PC USB cable, and Windows™-based PC software. The circuit module includes one bq27500 or bq27501 integrated circuit (IC), one TPS71525 IC, and all other onboard components necessary to monitor and predict capacity for a system side fuel gauge solution. The circuit module connects directly across the battery pack. With the EV2300 interface board and software, the user can read the bq2750x data registers, program the chipset for different pack configurations, log cycling data for further evaluation, and evaluate the overall functionality of the bq2750x solution under different charge and discharge conditions.

Contents

1	Features.....	2
2	bq2750x-Based Circuit Module	2
3	bq2750x Circuit Module Schematic	3
4	Circuit Module Physical Layouts and Bill of Materials	3
5	EVM Hardware and Software Setup	8
6	Troubleshooting Unexpected Dialog Boxes	8
7	Hardware Connection	8
8	Operation	10
9	Calibrate Screen.....	12
10	I2C Pro Screen	14
11	bqEasy.....	14
12	Related Documentation from Texas Instruments	19
13	Important Notice	20

List of Figures

1	bq27500EVM-001 Layout (Silk Screen)	4
2	Top Assembly	4
3	Top Layer	5
4	Bottom Layer	5
5	Schematic.....	7
6	bq27500 Circuit Module Connection to Cell and System Load/Charger	9
7	DataRAM Screen.....	10
8	Data Flash Screen	11
9	Calibration Screen.....	13
10	I2C Pro Screen	14
11	bqEasy Welcome Screen	15
12	bqEasy Flowchart	16
13	Load and Switch.....	19

List of Tables

1	Ordering Information	2
2	Bill of Materials.....	6

Impedance Track is a trademark of Texas Instruments.
 Windows, Microsoft are trademarks of Microsoft Corporation.

3	Performance Specification Summary	8
4	Circuit Module to EV2300 Connections.....	9

1 Features

- Complete evaluation system for the bq2750x gas gauge with Impedance Track™ Technology
- 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

- bq2750x/TPS71525 circuit module (HPA291)
- EV2300 PC interface board
- Software CD with the evaluation software
- USB connection cable to interface board
- NTC103AT Thermistor
- Set of support documentation

1.2 Ordering Information

Table 1. Ordering Information

EVM PART NUMBER	CHEMISTRY	CONFIGURATION	CAPACITY
bq27500EVM	Li-ion	1 cell	Any
bq27501EVM	Li-ion	1 cell	Any

2 bq2750x-Based Circuit Module

The bq2750x-based circuit module is a complete and compact example solution of a bq2750x circuit for battery management. The circuit module incorporates a bq2750x battery gas gauge IC, a TPS71525 LDO regulator, and all other components necessary to accurately predict the capacity of 1-series Li-Ion cell.

2.1 Circuit Module Connections

Contacts on the circuit module provide the following connections:

- Direct connection to the battery pack (J8 or J9): PACK+, PACK-, T and RID (bq27501 only)
- To the serial communications port (J4): SDA, SCL and VSS
- The system load and charger connect across charger and load (J6 and J7): CHARGER+/LOAD+ and CHARGER-/LOAD-
- Access to signal outputs (J2): BAT_LOW and /BAT_GD
- Optional 2.5V input if powering IC from actual system power (J3): 2.5V INPUT and VSS

2.2 Pin Descriptions

PIN NAME	DESCRIPTION
PACK+	Pack positive terminal
PACK-	Pack negative terminal
T	Pack thermistor input
NC/RID	Pack resistor ID input (bq27501 only)
SDA	I ² C communication data line
SCL	I ² C communication clock line
VSS	Signal return for communication line, shared with charger and ground
CHARGER+/LOAD+	High potential of load or charger connection
CHARGER-/LOAD-	Low potential of load or charger connection (System VSS)
BAT_LOW	Access to push-pull output that signals low State-of-charge
/BAT_GD	Access to open drain output that indicates that pack is ready to be connected to system

3 bq2750x Circuit Module Schematic

3.1 Schematic

The schematic follows the bill of materials in this user's guide.

4 Circuit Module Physical Layouts and Bill of Materials

This section contains the board layout, bill of materials, and assembly drawings for the bq2750x circuit module.

4.1 Board Layout

This section shows the PCB layers (Figure 1 through Figure 4), and assembly drawing for the bq2750x module.

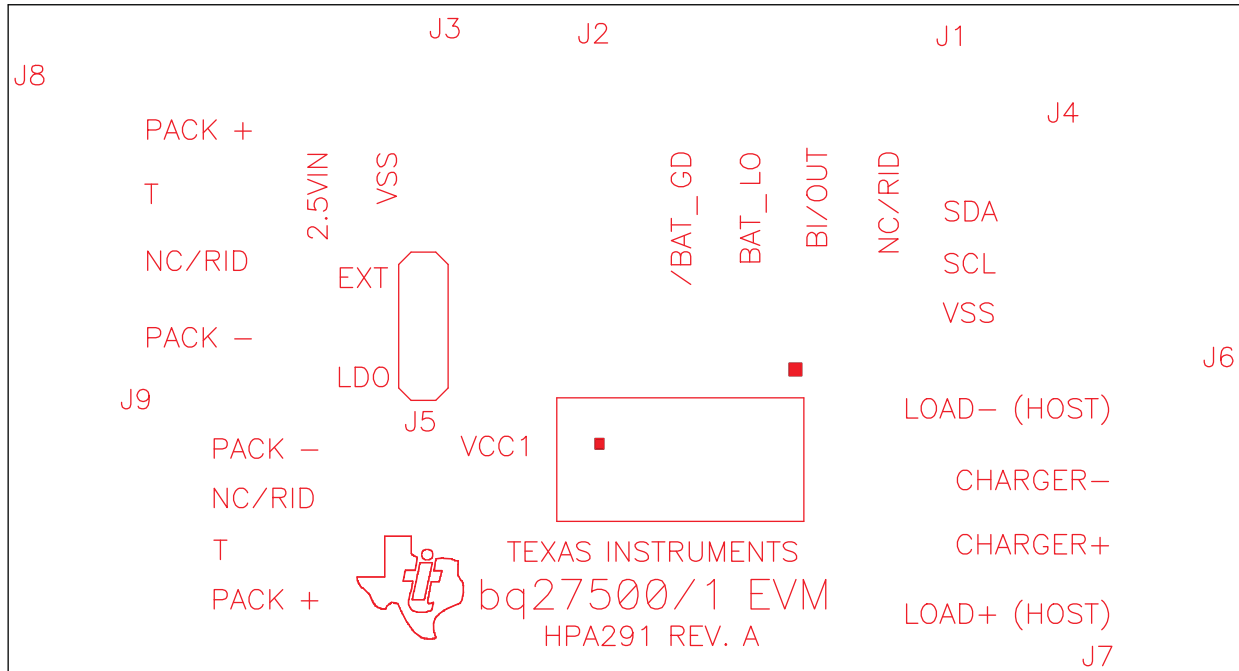


Figure 1. bq27500EVM-001 Layout (Silk Screen)

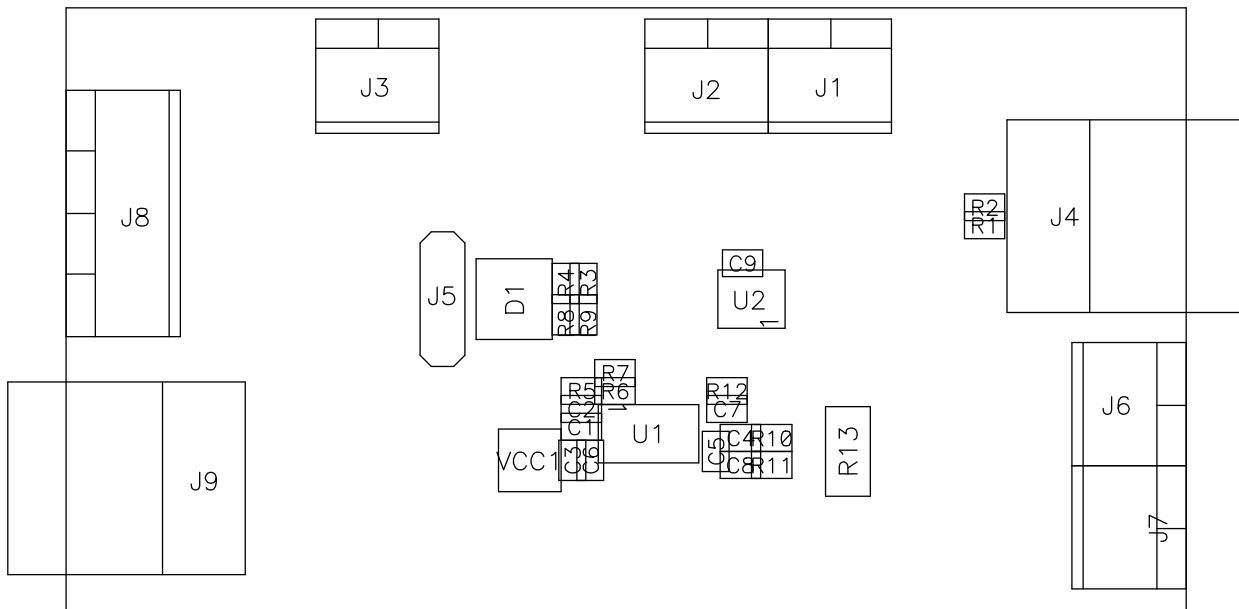


Figure 2. Top Assembly

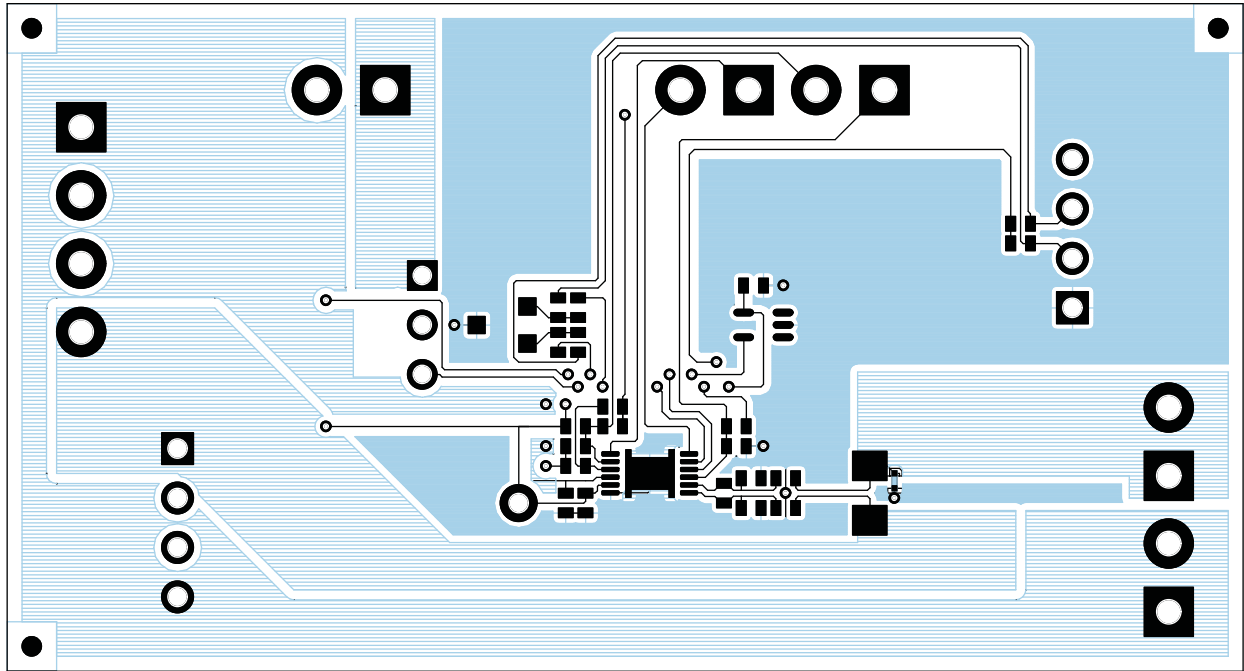


Figure 3. Top Layer

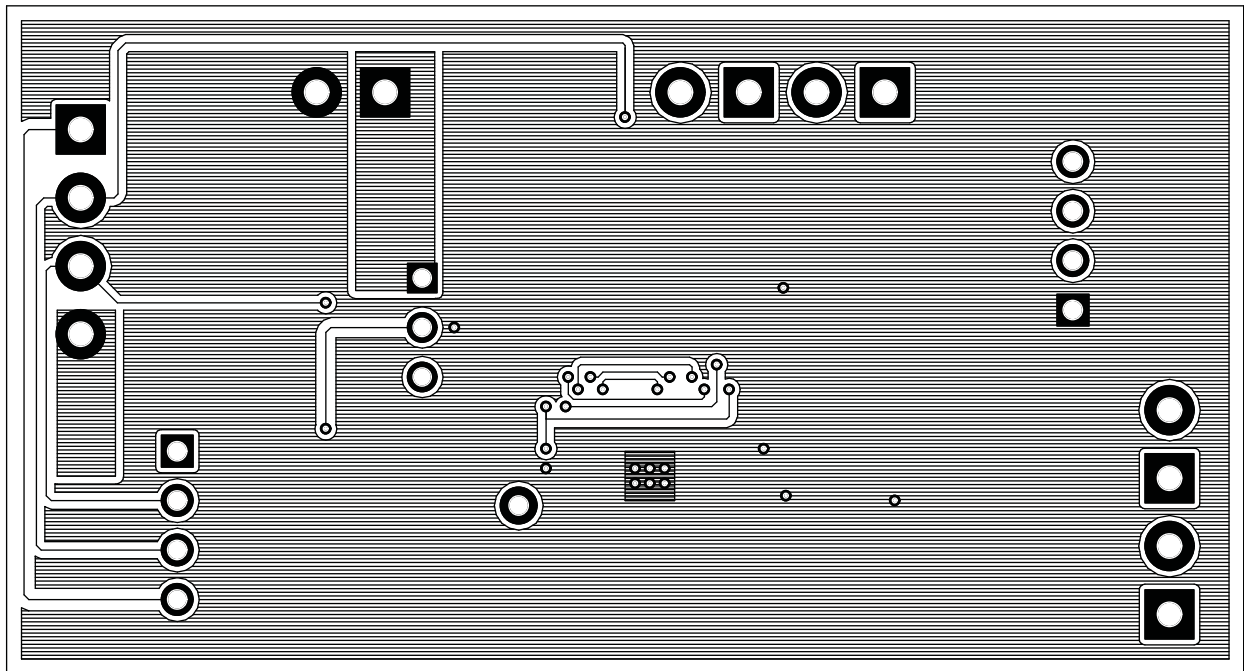


Figure 4. Bottom Layer

4.2 Bill of Materials and Schematic

Table 2. Bill of Materials

'500 Count	'501 Count	Ref Des	Description	Size	Manufacturer	Part No.
7	7	C1, C3, C4, C5, C7, C8, C9	Capacitor, Ceramic, 0.1uF, 10V, X5R	402	Murata	GRM155R61A104KA01D
1	1	C2	Capacitor, Ceramic, 0.033uF, 10V, X7R, +/-10%	402	Murata	GRM155R71A333KA01D
1	1	C6	Capacitor, Ceramic, 0.47uF, 6.3V, X5R	402	Murata	GRM155R60J474KE19D
1	1	D1	Diode, Dual, Zener, 5.6V, 300mW	SOT23	Diodes	AZ23C5V6
4	4	J2, J3, J6, J7	Terminal Block, 2-pin, 6-A, 3.5mm	0.27 x 0.25 inch	OST	ED555/2DS
0	1	J1	Terminal Block, 2-pin, 6-A, 3.5mm	0.27 x 0.25 inch	OST	ED555/2DS
2	2	J4, J9	Header, Friction Lock Assy, 4-pin Right Angle	0.400 x 0.500	Molex	22-05-3041
1	1	J5	Header, Male 3-pin, 100mil spacing, (36-pin strip)	0.100 inch x 3	Sullins	PTC36SAAN
1	1	J8	Terminal Block, 4-pin, 6-A, 3.5mm	0.55 x 0.25 inch	OST	ED555/4DS
2	2	R1, R2	Resistor, Chip, 10k-Ohms, 1/16-W, 5%	402	Std	Std
0	1	R12	Resistor, Chip, 300-Ohms, 1/16-W, 5%	402	Std	Std
1	1	R13	Resistor, Chip, 0.01-Ohms, 0.25W, 1%	1206	Vishay	WSL1206R0100FEA
6	6	R3, R4, R8, R9, R10, R11	Resistor, Chip, 100-Ohms, 1/16-W, 5%	402	STD	STD
1	1	R5	Resistor, Chip, 1.80-MOhms, 1/16-W, 5%	402	Std	Std
1	1	R6	Resistor, Chip, 18.2-kOhms, 1/16-W, 5%	402	Std	Std
1	1	R7	Resistor, Chip, 1-kOhms, 1/16-W, 5%	402	Std	Std
1	0	U1	IC, Host-Side Impedance-Track Fuel Gauge	QFN12	TI	BQ27500DRZ
0	1	U1	IC, Host-Side Impedance-Track Fuel Gauge	QFN12	TI	BQ27501DRZ
1	1	U2	IC, High Input Voltage, Micropower, 3.2 μ A @ 50 mA LDO, 2.5V	SOP-5 (DCK)	TI	TPS71525DCKR
1	1	VCC1	Test Point, Black, Thru Hole Color Keyed	0.100 x 0.100 inch	Keystone	5001
1	1	RT1 (component not part of layout. It is added to board at PCB test)	Thermistor, 10k Ohms	0.095 x 0.150 inches	Semitec	NTC103AT

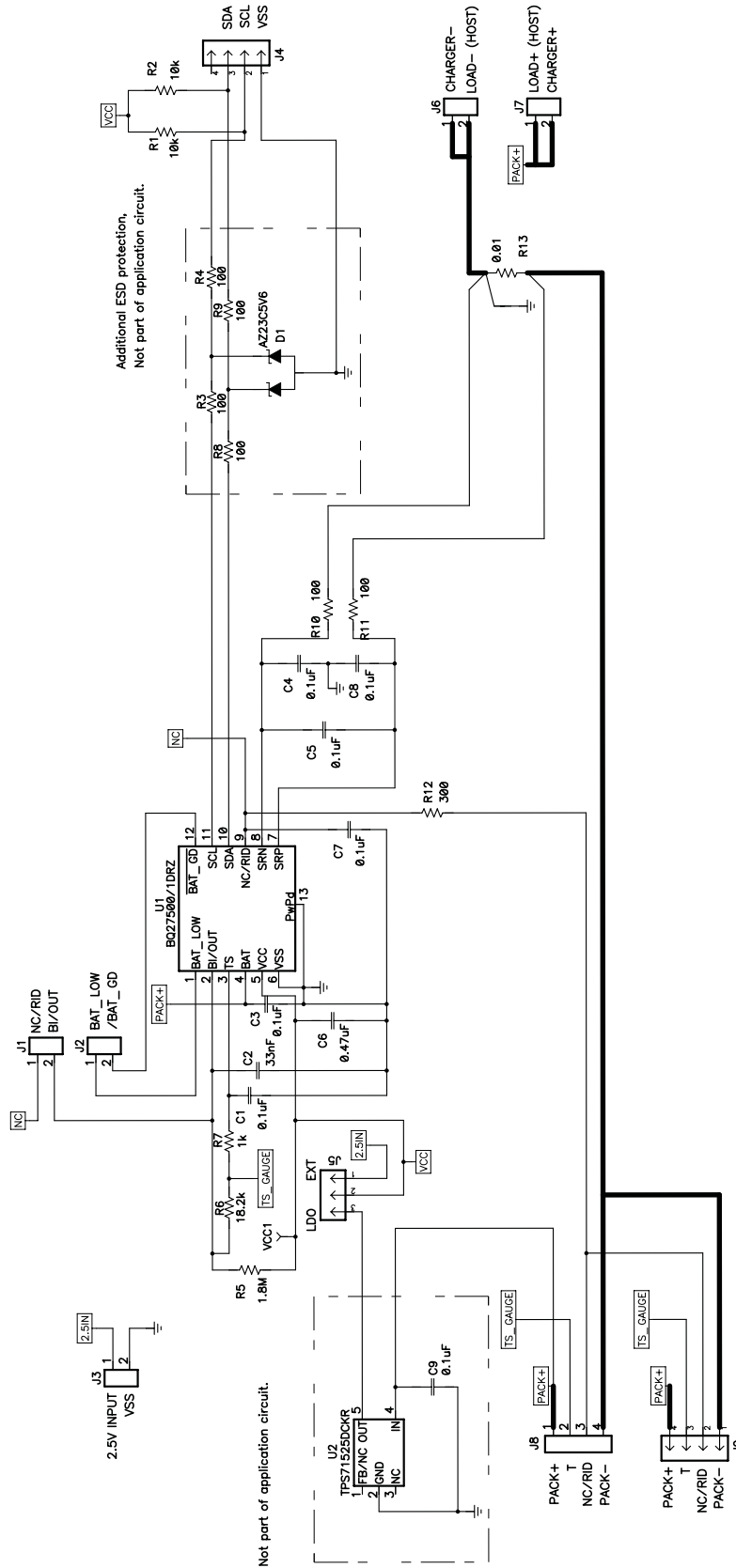


Figure 5. Schematic

4.3 **bq2750x Circuit Module Performance Specification Summary**

This section summarizes the performance specifications of the bq27500 circuit module.

Table 3. Performance Specification Summary

Specification	Min	Typ	Max	Units
Input voltage Pack+ to Pack-	2.7	3.6	4.3	V
Input voltage BAT+ to BAT-	2.7	3.6	4.3	V
Charge and discharge current	0	1	2	A

5 **EVM Hardware and Software Setup**

This section describes how to install the bq27500EVM-001 PC software and how to connect the different components of the EVM.

5.1 **System Requirements**

The bq27500EVSU software requires Windows 2000 or Windows XP. Drivers for Windows 98SE are provided, but Microsoft™ no longer supports Windows 98; 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 bq27500 or bq27501 tool folder on power.ti.com. Use the following steps to install the bq27500EVSU software:

1. Ensure that EV2300 is not connected to PC through USB cable before starting this procedure.
2. Browse the included CD and go to the Software directory, and open the bqEV-EASYSetup00.09.38_bq27500v1.00_bqEasy1.00.exe file or obtain the latest version from the TI Web site.
3. Follow the instructions on screen until completing the software installation.
4. Before starting the evaluation software, connect the EV2300 to the computer using the USB cable.
5. Wait until system prompt "new hardware found" appears. Choose "select location manually", and use the "browse" button to point to subdirectory TIUSBWin2K-XP-1.
6. Answer "continue" to the warning that drivers are not certified with Microsoft™.
7. After installation finishes, another system prompt "new hardware found" appears. Repeat steps 1 through 5, but specify the directory as TIUSBWin2K-XP-2.
8. Answer "continue" to the warning that drivers are not certified with Microsoft. Driver installation is now finished.

If files were downloaded from the TI Web site:

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

6 **Troubleshooting Unexpected Dialog Boxes**

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 bq27500EVM-001 comprises three hardware components: the bq2750x/TPS71525 circuit module, the EV2300 PC interface board, and the PC.

7.1 Connecting the bq27500 Circuit Module to a Battery Pack

Figure 6 shows how to connect the bq27500 circuit module to the cells and system load/charger.

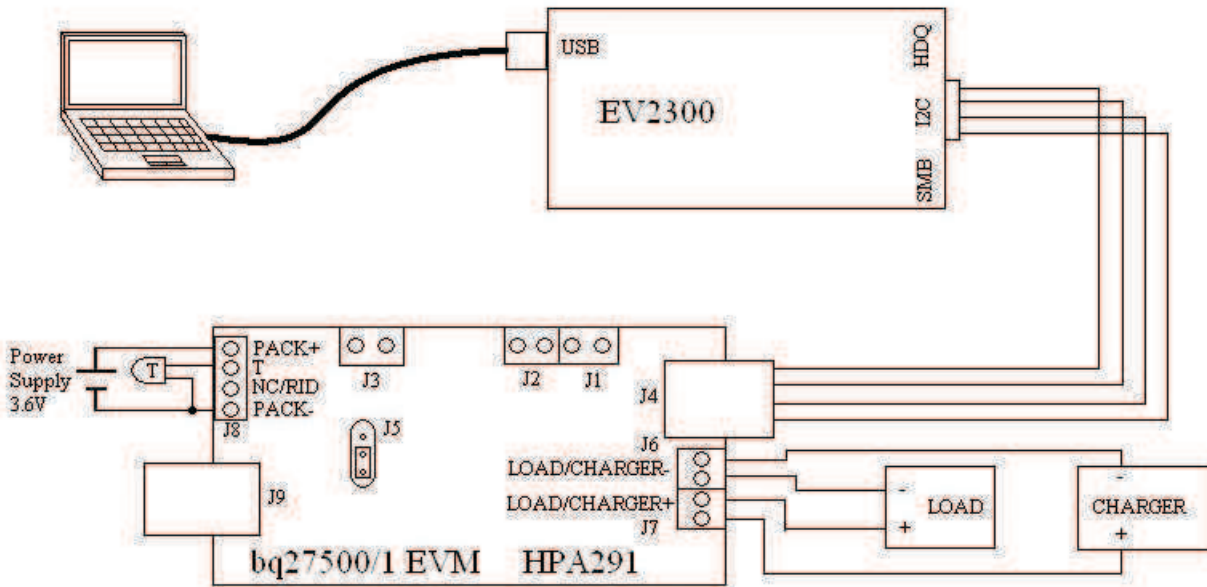


Figure 6. bq27500 Circuit Module Connection to Cell and System Load/Charger

7.2 PC Interface Connection

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

1. Connect the bq2750x-based EVM to the EV2300 using wire leads as shown in Table 4.

Table 4. Circuit Module to EV2300 Connections

bq2750x-Based Battery	EV2300
SDA	SDA
SCL	SCL
VSS	GND

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

The bq27500EVM-001 is now set up for operation.

8 Operation

This section details the operation of the bq27500 EVSW software.

8.1 Starting the Program

Run bq27500 EVSW from the Start | Programs | Texas Instruments | bq Evaluation Software menu sequence. The DataRAM screen (Figure 7) 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 65,535 ms. Only items that are selected for scanning are scanned within this period.

The bq27500 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 intervals are specified under the | Options | menu with the maximum value of 65,535 ms. The *Log* interval cannot be smaller than the scan interval because this results in the same value being logged at least twice.

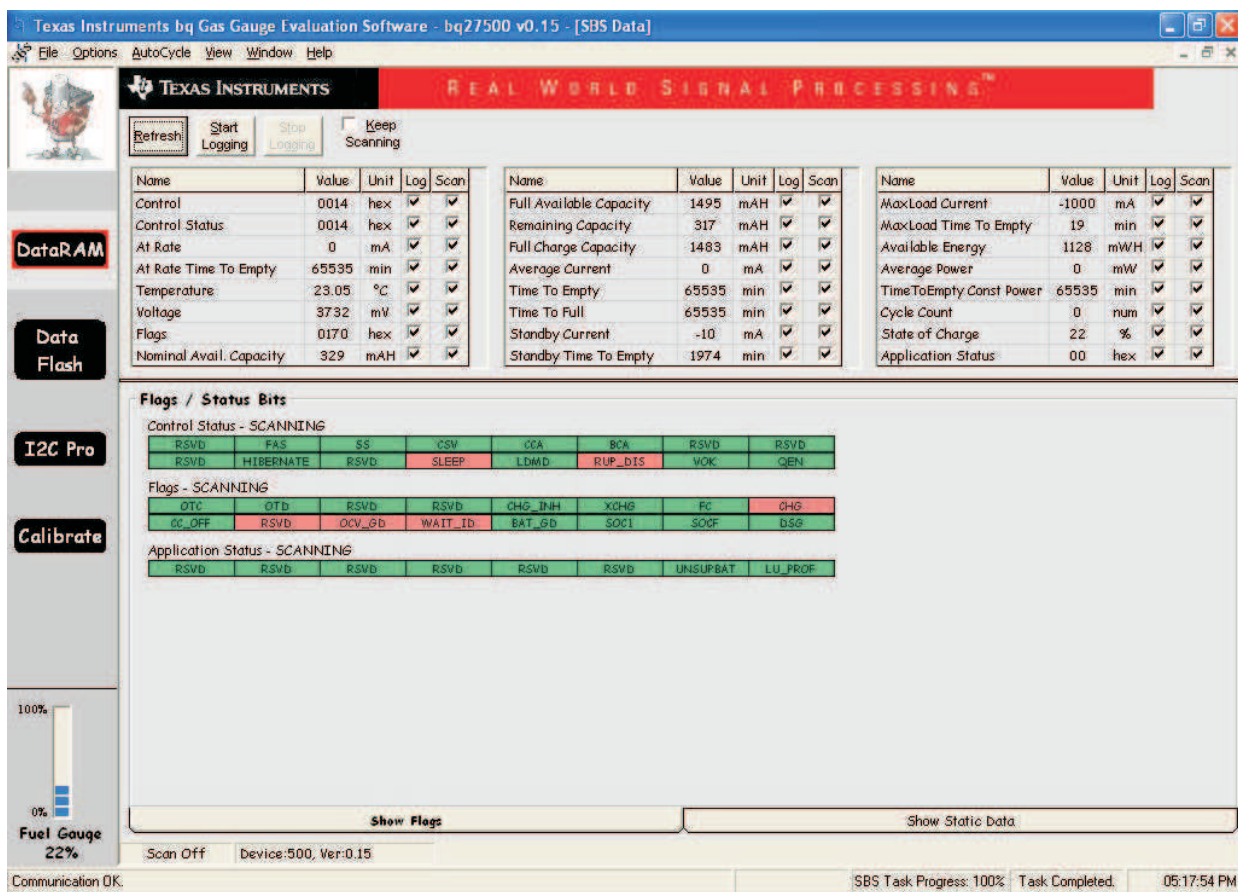


Figure 7. DataRAM Screen

This screen (Figure 7) shows the RAM data set Additional Flag and Status data can be viewed at the bottom of the DataRAM 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 bq27500 Options

The bq2750x data flash comes configured per the default settings detailed in the bq27500 data sheet. Ensure that the settings are correctly changed to match the pack and application for the bq2750x 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 8).

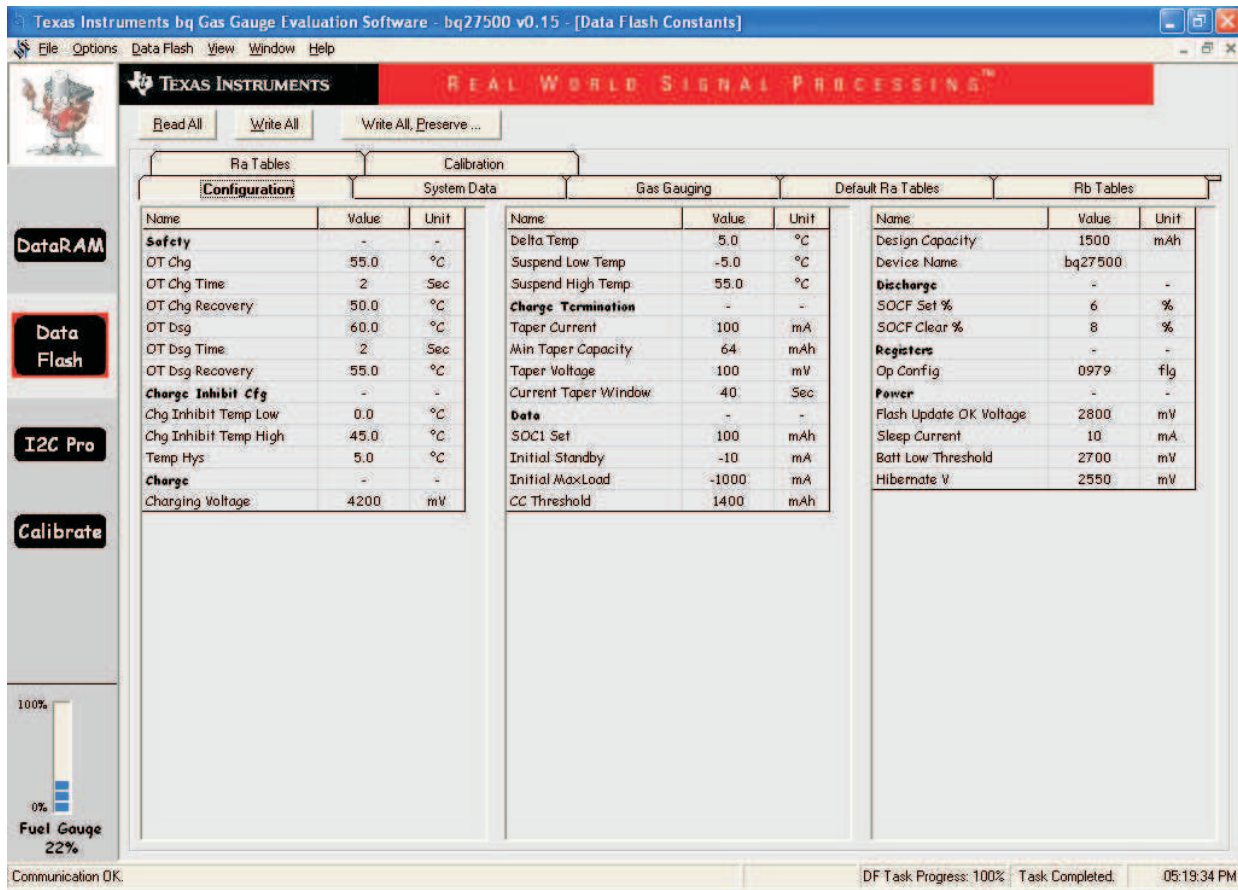


Figure 8. Data Flash Screen

To read all the data from the bq2750x 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 also can be retrieved in this way, imported, and written to the bq2750x using the | Write All | button.

The module calibration data is also held in the bq2750x data flash.

The bq2750x allows for an automatic data flash export function, similar to the DataRAM 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 s. The AutoExport filename is also set under the | Options menu |.

When a check is 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 bq2750x that is being used may not be supported by the bqEVSW version that is being used. An upgrade may be required.

9 Calibrate Screen

To ensure proper calibration follow the order described below. These steps may or may not be required, depending on the type of calibration being performed.

9.1 To Calibrate the bq2750x

Select the types of calibration to be performed (see [Figure 9](#)).

Enter the measured values for the types selected.

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

Press the *Calibrate Part as indicated below* button.

9.2 CC Offset Calibration

This performs the internal calibration of the coulomb counter input offset.

9.3 Board Offset Calibration

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

It is expected that no current is flowing through the sense resistor while performing this calibration step. Remove load and short PACK- to LOAD-.

Press the *CC Board Offset Calibration* button.

9.4 Temperature Calibration

- Measure the temperature for PACK.
- Type the temperature value into *Enter Actual Temperature*.
- Select if the temperature sensor to calibrate is the internal or external.
- Press the *Calibrate Part as indicated below* button.

9.5 Pack Current Calibration

- Connect a load to LOAD- and LOAD+ that draws approximately 1 A, or connect a current source to LOAD- and Pack-.
- Measure the current and type value into *Enter Actual Current* using (-) for current in discharge direction.
- Press the *Calibrate Part as indicated below* button.

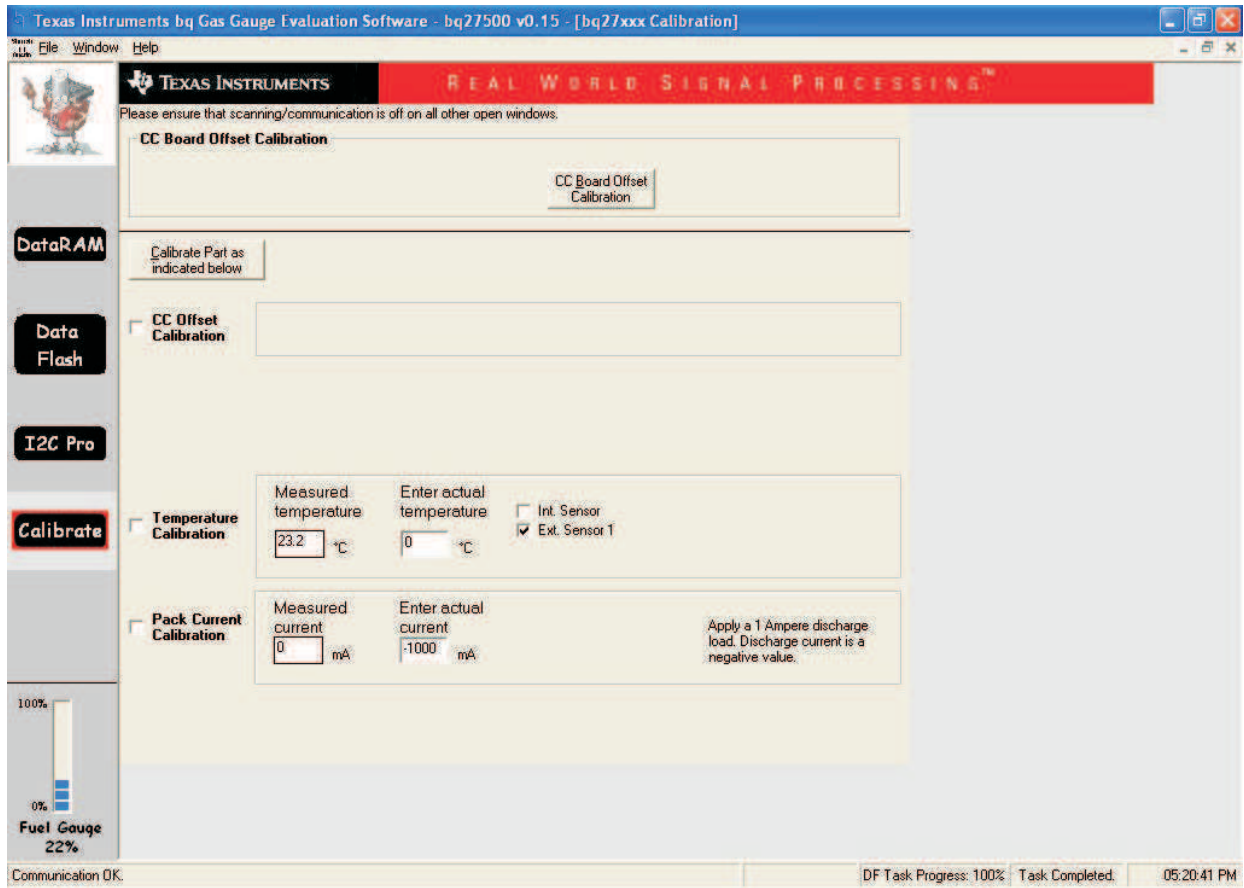


Figure 9. Calibration Screen

10 I2C Pro Screen

10.1 PC Communication

The read/write operations of the I2C Pro function is not specific to any gas gauge. These operations serve as general-purpose communication tools (Figure 10).

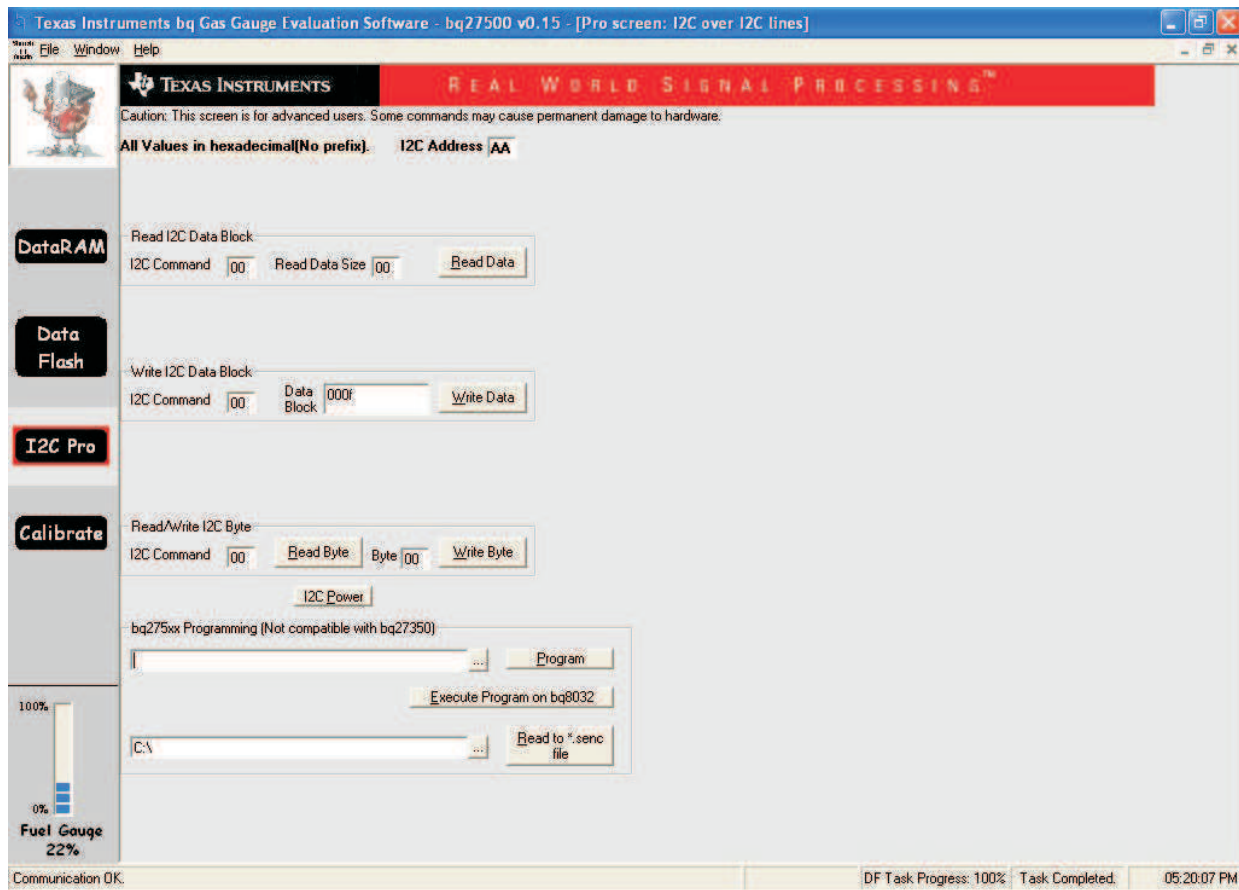


Figure 10. I2C Pro Screen

11 bqEasy

11.1 Introduction

Texas Instruments fuel gauges, employing the Impedance Track™ algorithm offer an unmatched array of features and benefits. Sometimes, however, the wide range of configuration settings can make it seem a bit challenging to get started with the evaluation process. In addition, determining the correct chemistry model and producing the 'golden image' file can be time consuming. The bqEASY program is designed to greatly simplify the process of configuring, calibrating, selecting chemistry and performing learning cycles through the step-by-step use of a wizard program.

The bqEasy software will run inside the current EV software when it is executed by clicking the bqEasy button in the left-hand column of buttons below the Calibrate button in the EV software.

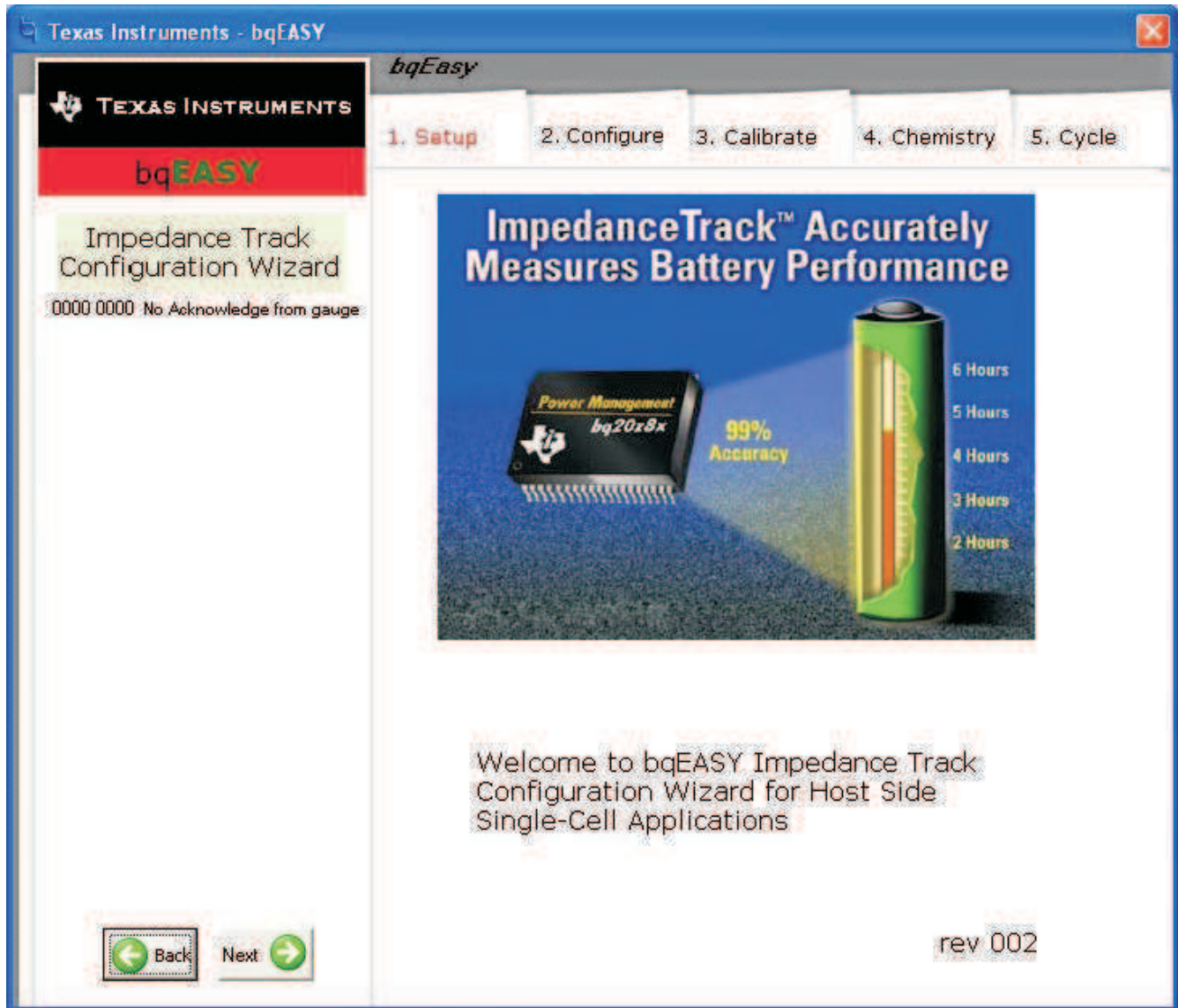


Figure 11. bqEasy Welcome Screen

11.2 Program Navigation and Flowchart

The sequence of operation of bqEASY can be understood by reviewing the basic flowchart in [Figure 12](#). Using the program is simple – just start a new project and follow the steps sequentially from 1A to 5C. You can use the Next button, or click on the top tabs and left subsection labels to move to any desired page. Some operations must be completed in sequence due to data dependencies, or to implement the proper flow. Therefore it is recommended that the prescribed sequence be followed, at least at first.

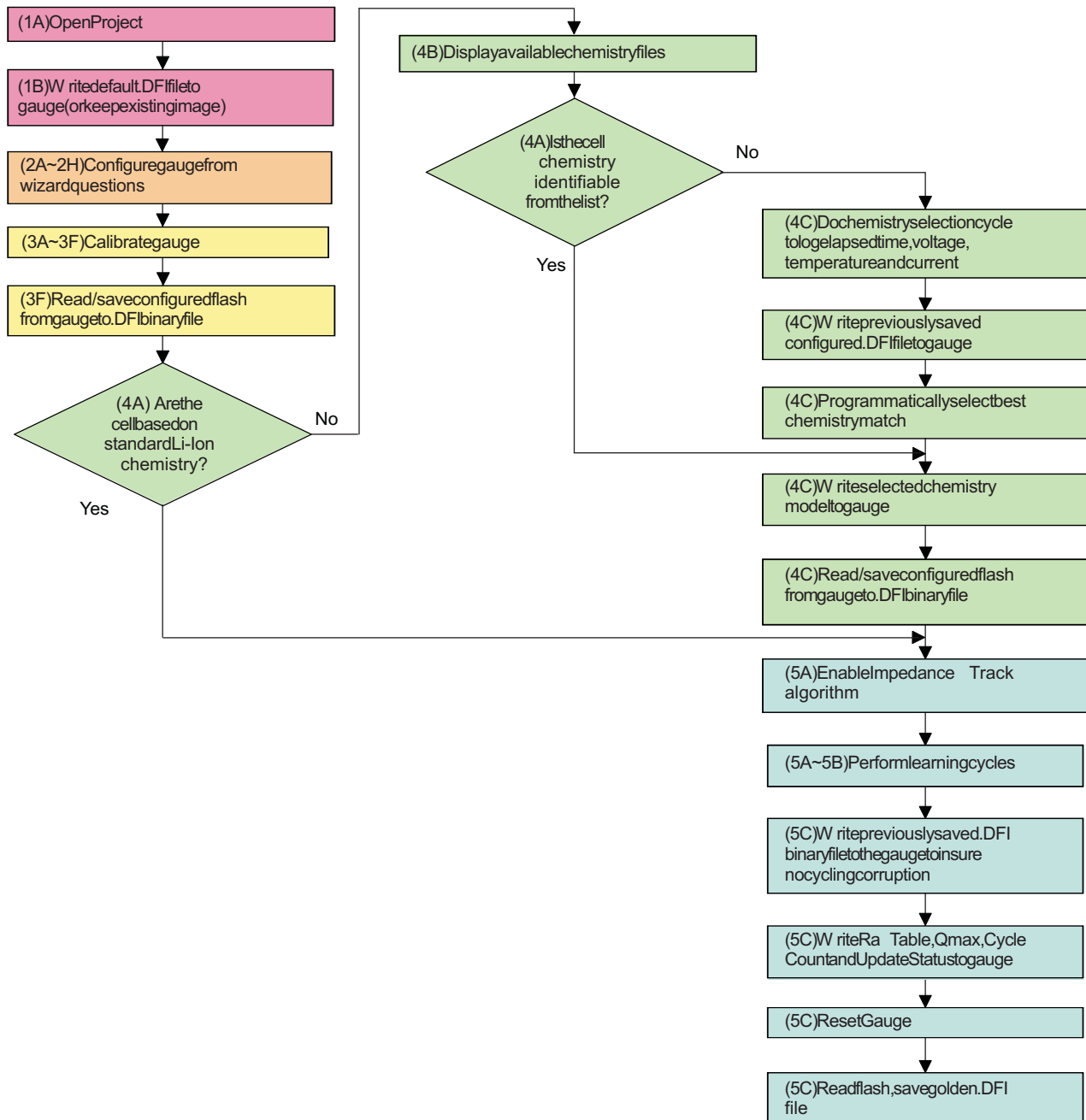


Figure 12. bqEasy Flowchart

11.3 Simplified Configuration Procedures

These simplified configuration procedures can be used to quickly set up the parameters without navigating through the entire user interface.

1. Simple configuration of the Gas Gauge with default or custom data:
 - a. Open the current EV software and click the bqEasy button in the left-hand column of buttons below the "Calibrate" button in the EV software.
 - b. Click the "2. Configure" tab at the top row of bqEASY tabs. (Note: You can skip the 1st tab)
 - c. Answer all questions or leave defaults for all of tab "2", but be sure to click the ok button at the bottom of each tab "2" page to ensure that a Completion Checkmark appears for each page.

- d. On page 2H, when you click the "OK" button, the software will ask you to write to the data flash memory. Click "Yes" for OK to write to the data flash.
Your Gas Gauge Module now has the data flash configured as you declared with all the information entered in tab "2. Configure".
2. Simple installation of the Chemistry data using bqEASY if the chemistry is a known chemistry available in the bqEASY software:
 - a. Open the current EV software and click the bqEasy button in the left-hand column of buttons below the "Calibrate" button in the EV software.
 - b. Click the "4. Chemistry" tab at the top row of bqEASY tabs. (Note: You can skip all tabs prior to this)
 - c. Either select "Use Default Chemistry", or click "Enable Chemistry Selection" and select the correct chemistry from the list.
 - d. If you cannot find the proper chemistry, check the device EVM tool folder on the TI Web site for any new bqChemistry file updates. These are updated more frequently than the EV software, so between EV software updates, we will create a self-extracting installer and post it in the EVM tool folder for the part being used. Install these updates if they are in the folder.
The software will now configure all data flash locations on Your Gas Gauge Module that deal with chemistry functions. No other data flash locations will be modified.

11.4 Files

bqEASY uses four types of files to configure a fuel gauge.

1. **.ENCR** – These are default data-flash definition files found in the `\bq_Evaluation_Software` folder. The ENCR file is basically a copy of the entire data-flash from a fresh Gas Gauge prior to any data-flash updates either by the user or the Gas Gauge. They are unique for each version of each TI fuel gauge product. If you should be working with a new version fuel gauge and an older version of bqEASY, the correct file may not be present. This will require a new version of the EV software with bqEASY. Navigate to the TI Web site in the EVM tool folder for the device being used, and download the latest version, or contact TI. For bqEASY, the ENCR files act mainly as a dictionary to look up the address for a given data-flash location. For bqEVSU, they define screen parameters including address, display formulas and data type. An error message will appear if the correct .ENCR file cannot be found.
2. **.CHEM (Chemistry Files)** – These are read-only files found in the `..\bq_Evaluation_Software\Plugins\Chemistry` folder of the application. When a new Li-Ion battery chemistry is developed, a new Impedance Track model is required to define the chemical model. During automated chemistry selection, each of these files is scanned in order to select the best match with the recorded data. If you are working with a newly developed chemistry, it is possible that an acceptable match will not be found. If this is the case, please check for updated bqEasy software or bqChemistry files on the TI Web site in the EVM tool folder for the part being used.
3. **.DFI (Data-Flash Image Files)** – These are binary images of the fuel gauge data-flash with modified values based on the application. Because of the binary format, it is quick and easy to transfer them to and from a gauge. Each fuel gauge model and firmware version has a unique read-only .DFI which is found in the `..\bq_Evaluation_Software\Plugins\Device_Defaults` folder of the application. During the bqEASY process, intermediate versions of .DFI files are recorded with current updated data in order to prevent the possibility of corruption. Then, the final output of bqEASY is also a .DFI file which is the 'golden image' that will be programmed into each production unit. This output file will be placed in the `..\bq_Evaluation_Software\Plugins\Projects` folder.
4. **.EZY (bqEASY Project Files)**– These are read-write text files which record header information regarding a project, answers to the wizard questions, and status regarding the stage of completion (the red check marks). They are kept in the `..\bq_Evaluation_Software\Plugins\Projects` folder.

11.5 Completion Checkmarks

As the wizard questions and tasks are completed, completion checkmarks appear in two places – along the task list on the left and on the category tabs on top. A checkmark on a top tab will only appear after all tasks in the category have been completed. For example, in **Figure 3** all of the Setup tasks and all of the Configure tasks have been completed. Completion marks are saved in the .EZY project text file. When a completed or partially-completed project file is opened, the user is given the chance to erase the checkmarks.

11.6 Device Detection

BqEASY is designed to work with a fuel gauge present and already communicating with the bqEVSU evaluation software through the EV2300 USB interface. When the Evaluation software is started, it reads the device type and displays it on the upper title block. This information is used by bqEASY to select the correct default data-flash image (.DFI) and data-flash configuration file (.ENCR) for this particular device. To ensure that the device has not changed, bqEASY also checks the device type when the bqEASY button is pressed. If the correct files are not found, first check the TI Web site in the EVM tool folder for the part being used, and download the latest version of EV software with bqEASY support. If that does not help, then contact TI.

1. Setup

As the wizard questions and tasks are completed, completion checkmarks appear in two places – along the task list on the left and on the category tabs on top. A checkmark on a top tab will only appear after all tasks in the category have been completed. Completion marks are saved in the .EZY project text file. When a completed or partially-completed project file is opened, the user is given the chance to erase the checkmarks.

2. Configure

A series of eight screens is used to collect information about the battery pack application to enable automatic configuration of the most critical data-flash parameters.

3. Calibrate

If you wish to proceed with either automatic chemistry selection or 'golden' unit learning cycles, the Impedance Track fuel gauge must be accurately calibrated. The bqEASY screens simply ask the user to use the calibration screen of the bqEVSU for this purpose.

4. Chemistry

The chemistry choices presented in section 4B are based on files in the \Chemistry folder of the bqEASY application. The latest files are available for downloading from the ti.com Web site. Automation of the chemistry-selection cycle is made possible using a simple load and switch as depicted in **Figure 13**. The switch can be implemented with either a low VGS-threshold FET or a small relay such as the OMICRON G6RN-1 with a 5-VDC coil. Multiple 2N7000 FETs can be paralleled if nothing else is available. The load can be either a power resistor or an electronic load set to a discharge rate of C/5. Hint: Follow the instructions exactly, or errors may result.

5. Cycle

When preparing for mass production, cell learning is required, but only on one 'golden' pack. The chemical information learned from one pack will be quickly transferred to all production units prior to calibration. Doing this correctly requires a series of charge and discharge cycles. The discharge part can be automated with bqEASY if the simple load circuit for the chemistry selection is available. Follow the screen instructions.

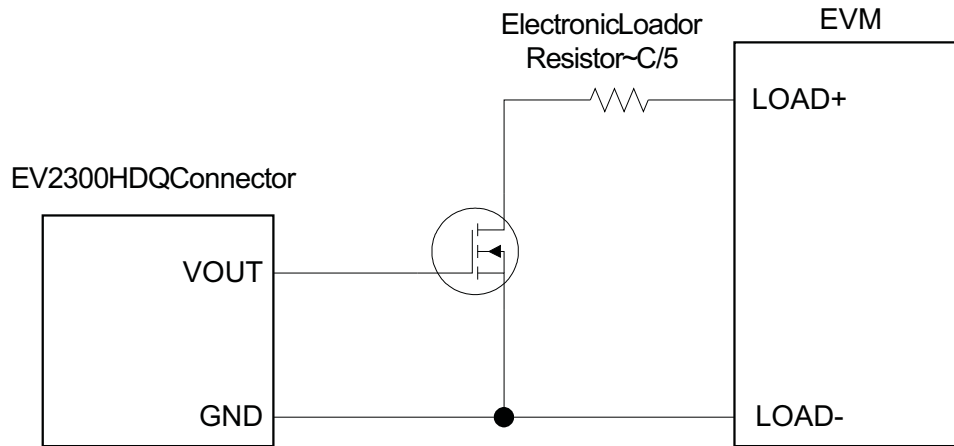


Figure 13. Load and Switch

12 Related Documentation from Texas Instruments

To obtain a copy of any of the following TI documents, 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.

13 Important Notice

EVALUATION BOARD/KIT IMPORTANT NOTICE

Texas Instruments (TI) provides the enclosed product(s) under the following conditions:

This evaluation board/kits is intended for use for **ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY** and is not considered by TI to be a finished end-product fit for general consumer use. Persons handling the product(s) must have electronics training and observe good engineering practice standards. As such, the goods being provided are not intended to be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including product safety and environmental measures typically found in end products that incorporate such semiconductor components or circuit boards. This evaluation board/kits does not fall within the scope of the European Union directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE or UL, and therefore may not meet the technical requirements of these directives or other related directives.

Should this evaluation board/kits not meet the specifications indicated in the User's Guide, the board/kits may be returned within 30 days from the date of delivery for a full refund. **THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.**

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge.

EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

TI currently deals with a variety of customers for products, and therefore our arrangement with the user **is not exclusive**.

TI assumes **no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein.**

Please read the User's Guide and, specifically, the Warnings and Restrictions notice in the User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For additional information on TI's environmental and/or safety programs, please contact the TI application engineer or visit www.ti.com/esh.

No license is granted under any patent right or other intellectual property right of TI covering or relating to any machine, process, or combination in which such TI products or services might be or are used.

FCC Warning

This evaluation board/kits is intended for use for **ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY** and is not considered by TI to be a finished end-product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of 6 V to 25 V and the output voltage range of 0 V to 16.4 V.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

During normal operation, some circuit components may have case temperatures greater than 60°C. The EVM is designed to operate properly with certain components above 60°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright 2007, Texas Instruments Incorporated

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

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

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products

Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
RF/IF and ZigBee® Solutions	www.ti.com/lprf

Applications

Audio	www.ti.com/audio
Automotive	www.ti.com/automotive
Broadband	www.ti.com/broadband
Digital Control	www.ti.com/digitalcontrol
Medical	www.ti.com/medical
Military	www.ti.com/military
Optical Networking	www.ti.com/opticalnetwork
Security	www.ti.com/security
Telephony	www.ti.com/telephony
Video & Imaging	www.ti.com/video
Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2009, Texas Instruments Incorporated