User's Guide

BQ27Z561EVM-011 Single-Cell Impedance Track™ Technology

ABSTRACT

The BQ27Z561 EVM comes with the BQ27Z561 gas gauge IC and all other components necessary to measure and predict capacity of a Li-ion or Li-polymer cell. This user's guide will walk you through the following tasks:

- Connect the necessary components together to power up the EVM
- Installation of the necessary Texas Instruments software tools
- Bring up the EVM for a basic chemistry and accuracy cycle check
- Evaluate the functionality of the BQ27Z561 solution under different charge and discharge conditions

The latest Windows®-based PC software can be downloaded from the product folder on the Texas Instruments website. Use the Texas Instruments web search for Battery Management Studio on www.ti.com.

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Trademarks

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1 Features

- Complete evaluation system for the BQ27Z561 gas gauge with Impedance Track™ technology
- Populated circuit module for quick setup
- Personal computer (PC) software that allows configuring and data logging for system analysis

1.1 Kit Contents

- BQ27Z561 circuit module (BMS011B)

This EVM is used for the evaluation of BQ27Z561. Visit the product web folder at *www.ti.com* to properly configure the BQ27Z561.

2 BQ27Z561-Based Circuit Module

The BQ27Z561 based circuit module is an example solution of a BQ27Z561 circuit for battery management. The circuit module incorporates a BQ27Z561 battery gas gauge integrated circuit (IC) with external sense resistor to accurately predict the capacity of a 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): CELL+, CELL–
- Direct connection to the system connections for charging and discharging (J4): SYS+ / CELL+, SYS–
- I2C™ communications via external EV2400 to Windows-based PC USB port (J14): SDA, SCL, VSS
- Access to various signal outputs (J1): INT, PULS

2.2 Pin Description

Pin Name	Description
SYS+	System positive terminal
SYS–	System negative terminal
CELL+	Battery positive terminal
CELL–	Battery negative terminal
SDA	External I^2C communication data line
SCL	External I^2C communication clock line
VSS	Device ground
INT	General purpose output
PULS	General purpose output

3 Circuit Module Physical Layout, Bill of Materials and Schematic

This section contains the board layout, bill of materials, and schematic for the BQ27Z561 circuit module.

3.1 Board Layout

This section shows the printed-circuit board (PCB) layers (Figure 3-2 through Figure 3-4), and assembly drawing for the BQ27Z561 module.

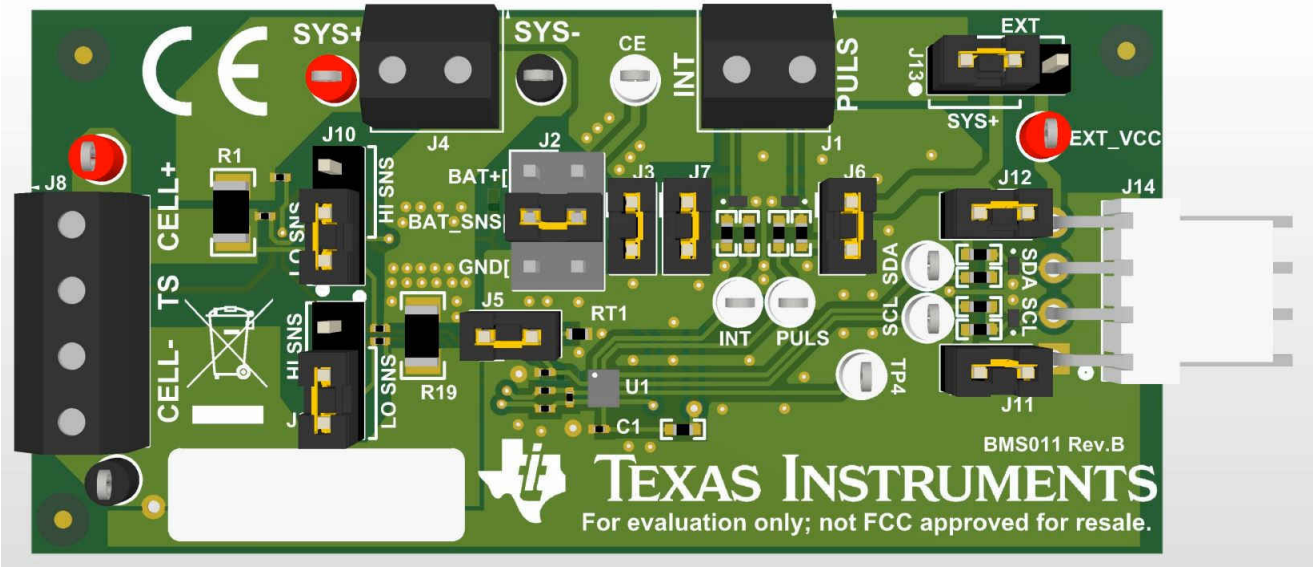

Figure 3-1. EVM Image

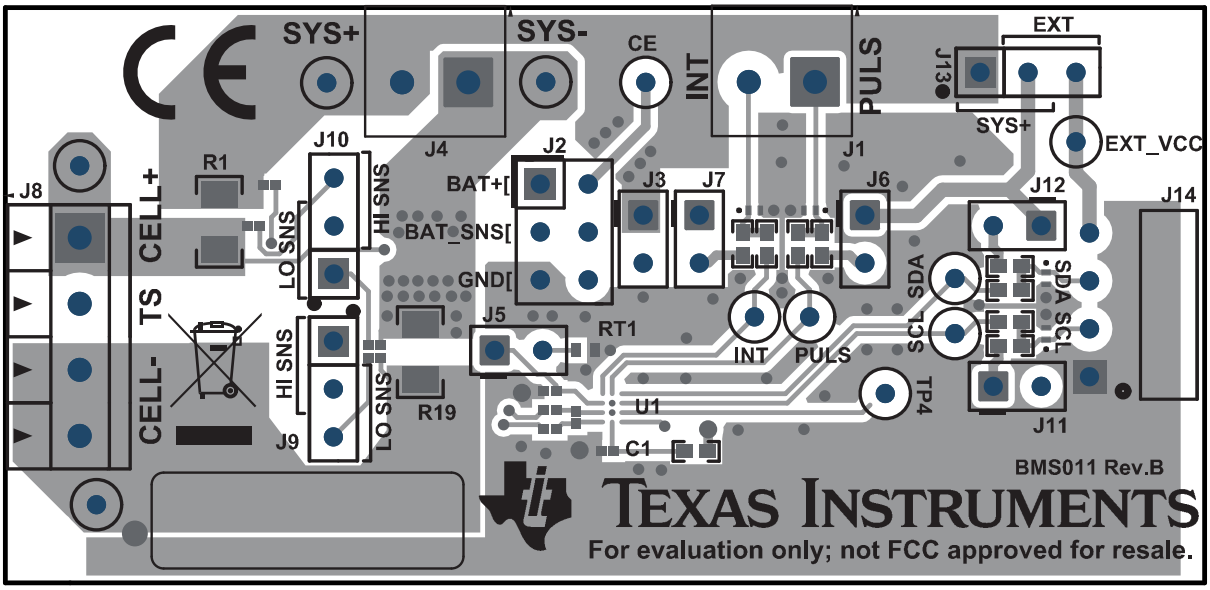

Figure 3-2. Top Layer Composite

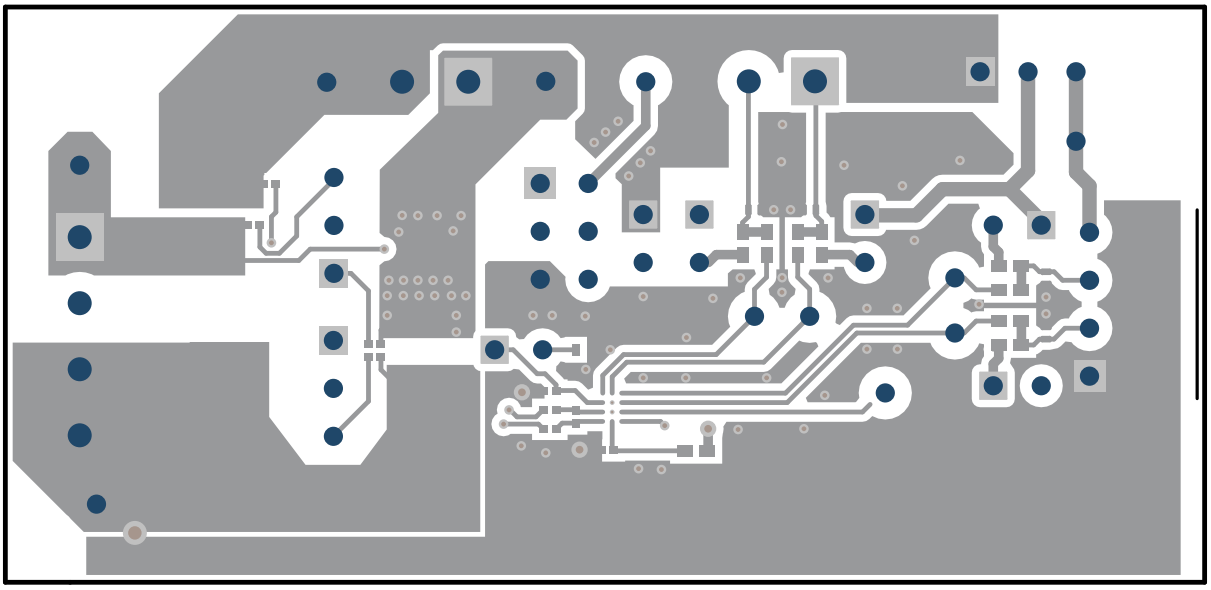

Figure 3-3. Top Layer

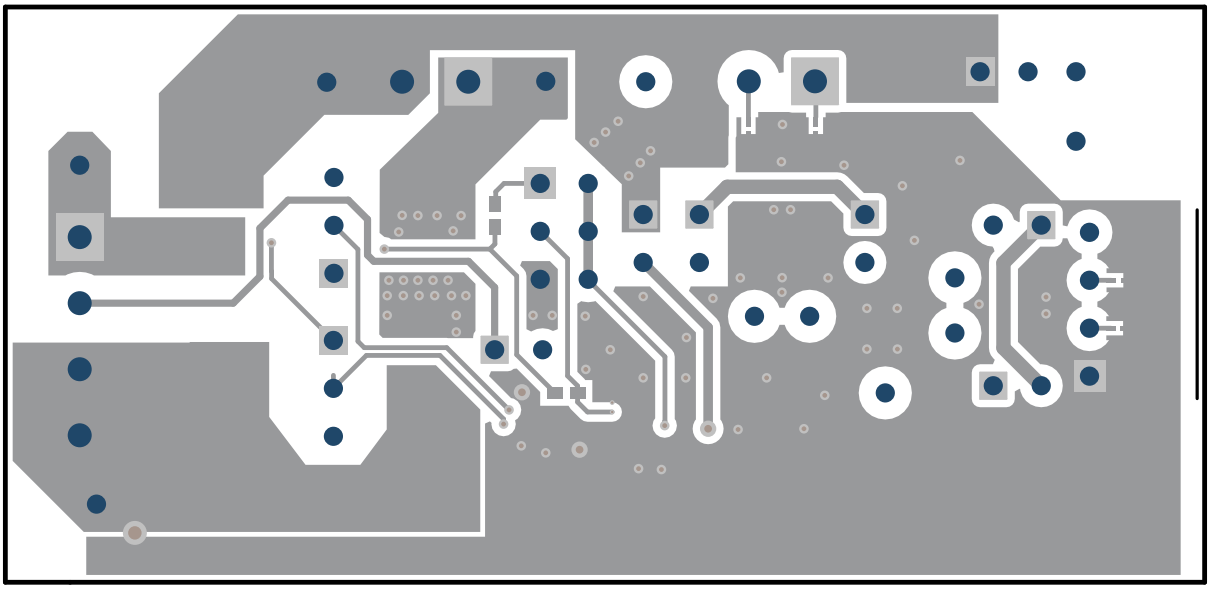

Figure 3-4. Bottom Layer

3.2 Schematic

This section contains the schematic of the PCB design.

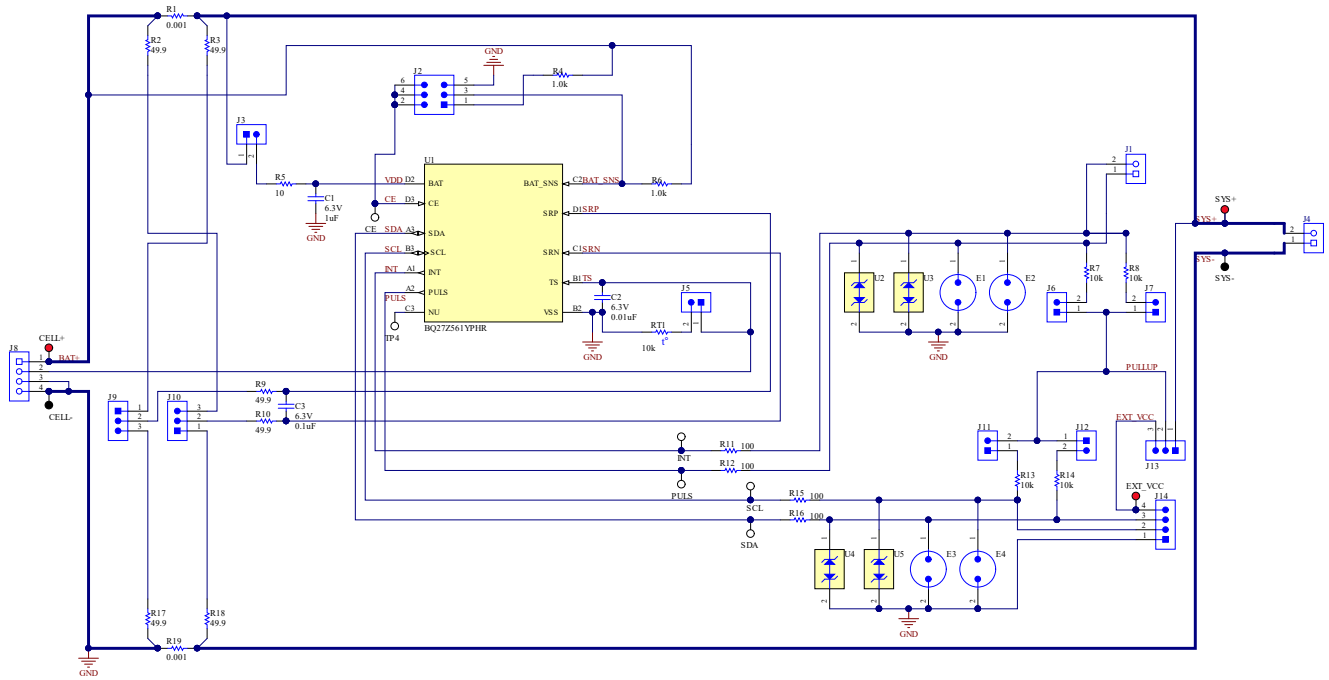

Figure 3-5. BQ27Z561 Reference Schematic

3.3 Bill of Material

Table 3-1. Bill of Materials

Designator	Quantity	Value	Description	PackageReference	PartNumber	Manufacturer
!PCB1	1		Printed Circuit Board		BMS011	Any
C1	1	1uF	CAP, CERM, 1 uF, 6.3 V, +/- 20%, X5R, 0201	201	GRM033R60J105MEA2D	MuRata
C2	1	0.01uF	CAP, CERM, 0.01 uF, 6.3 V, +/- 10%, X5R, 0201	201	GRM033R60J103KA01D	MuRata
C3	1	0.1uF	CAP, CERM, 0.1 uF, 6.3 V, +/- 10%, X5R, 0201	201	GRM033R60J104KE84D	MuRata
J1, J4	2		Terminal Block, 3.5mm Pitch, 2x1, TH	7.0x8.2x6.5mm	ED555/2DS	On-Shore Technology
J2	1		Header, 100mil, 3x2, Tin, TH	3x2 Header	PEC03DAAN	Sullins Connector Solutions
J3, J5, J6, J7, J11, J12	6		Header, 100mil, 2x1, Tin, TH	Header, 2 PIN, 100mil, Tin	PEC02SAAN	Sullins Connector Solutions
J8	1		Terminal Block, 3.5mm Pitch, 4x1, TH	14x8.2x6.5mm	ED555/4DS	On-Shore Technology
J9, J10, J13	3		Header, 100mil, 3x1, Tin, TH	Header, 3 PIN, 100mil, Tin	PEC03SAAN	Sullins Connector Solutions
J14	1		Header (friction lock), 100mil, 4x1, R/A, TH	4x1 R/A Header	22/05/3041	Molex
LBL1	1		Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650 x 0.200 inch	THT-14-423-10	Brady
R1, R19	2	0.001	RES, 0.001, 1%, 1 W, AEC-Q200 Grade 0, 1206	1206	CSNL1206FT1L00	Stackpole Electronics Inc
R2, R3, R9, R10, R17, R18	6	49.9	RES, 49.9, 1%, 0.05 W, 0201	201	CRCW020149R9FKED	Vishay-Dale
R4, R6	2	1.0k	RES, 1.0 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW04021K00JNED	Vishay-Dale
R5	1	10	RES, 10, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040210R0JNED	Vishay-Dale
R7, R8, R13, R14	4	10k	RES, 10 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040210K0JNED	Vishay-Dale
R11, R12, R15, R16	4	100	RES, 100, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW0402100RFKED	Vishay-Dale
RT1	1	10k	Thermistor NTC, 10.0k ohm, 1%, 0402	402	ERT-J0EG103FA	Panasonic
SH-J1, SH-J2, SH-J3, SH-J4, SH-J5, SH-J6, SH-J7, SH-J9, SH-J10, SH-J11	10	1x2	Shunt, 100mil, Gold plated, Black	Shunt	SNT-100-BK-G	Samtec
TP1, TP5, TP9	3		Test Point, Miniature, Red, TH	Red Miniature Testpoint	5000	Keystone Electronics
TP2, TP4, TP7, TP8, TP10, TP11	6		Test Point, Miniature, White, TH	White Miniature Testpoint	5002	Keystone Electronics
TP3, TP6	2		Test Point, Miniature, Black, TH	Black Miniature Testpoint	5001	Keystone Electronics
U1	1		Impedance Track Battery Gas Gauge Solution for 1-Series Cell Li-Ion Battery Packs, YPH0012ARAK (DSBGA-12)	YPH0012AUAM	BQ27Z561YPHR	Texas Instruments
U2, U3, U4, U5	4		Automotive 1-Channel ESD in 0402 Package With 12pF Capacitance and 6V Breakdown, DPY0002A (X1SON-2)	DPY0002A	TPD1E10B06QDPYRQ1	Texas Instruments

3.4 BQ27Z561 Circuits Module Performance Specification Summary

This section summarizes the performance specifications of the BQ27Z561 circuit module.

Table 3-2. Performance Specification Summary

BQ27Z561 Specification	Min	Typ	Max	Units
Input voltage SYS+ to SYS–	-0.3	3.6	6	V
Input voltage Bat+ to Bat–	-0.3	3.6	6	V

4 EVM Hardware and Software Setup

This section describes the installation of the BQ27Z561EVM PC software, and how to connect the different components of the EVM.

4.1 System Requirements

The bqStudio software requires Windows XP or later. Using earlier versions of Windows operating system may not work with the USB driver support.

4.2 Software Installation

Find the latest software version of bqStudio on http://www.ti.com/tool/bqstudio. Search for the BQ27Z561 part number to get to the tool folder for the device. Following these steps to install the BQ27Z561 bqStudio software.

1. Before starting this procedure, make sure the EV2400 is not connected to the personal computer (PC) through the USB cable.
2. Open the archive containing the installation package, and copy its contents into a temporary directory.
3. Open the bqStudio installer file that was downloaded from the TI website.
4. Follow the instructions on screen until completing the software installation.
5. Before starting the evaluation software, connect the EV2400's I^2C port to the board using the (J14) header.
6. Connect the EV2400 to the computer using the USB port.
7. For the EV2400, the driver should be installed along with software installation.

5 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. If using Windows 7, install the software with administrator privileges.

6 Hardware Connection

The BQ27Z561 evaluation system requires two connections to run: the battery cells, and the I^2C connection (EV2400). In addition a system load or charger can be connected to evaluate charge and discharge.

6.1 Connecting the BQ27Z561 Circuit Module to a Battery Pack

Figure 6-1 shows how to connect the BQ27Z561 circuit module to the battery and a system load/charger.

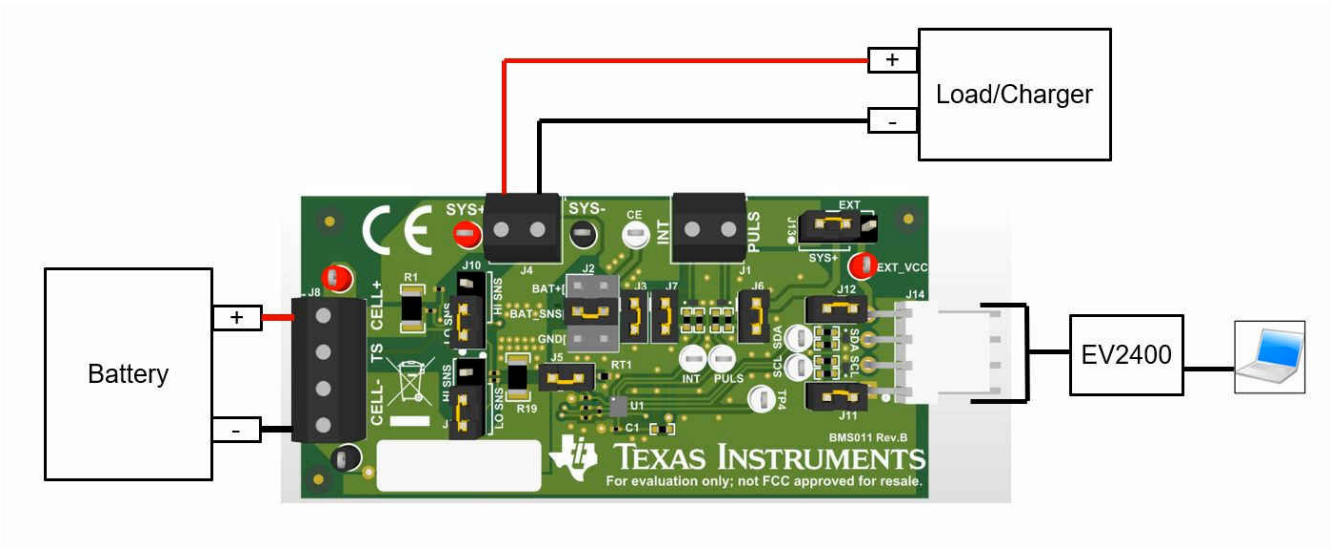

Figure 6-1. Connect the BQ27Z561 Circuit Module to a 1SxP

6.2 Description of EVM Jumpers

The following section describes the critical jumpers and their purpose on this board.

1. **J2 - Chip Enable (CE):** This jumper allows the user to connect the CE pin to ground, BAT_SNS, or directly to BAT+. Grounding or floating the CE pin will disable and reset the device. Connect the jumper across positions 4-3 or 2-1 to enable the device. Alternatively, it can be tied directly to a host system for an additional low-power state, if needed.
2. **J11 - I^2C Clock Pull-up (SCL):** This jumper applies a 10k pullup to J13 on the I^2C communication line.
3. **J12 - I^2C Data Pull-up (SDA):** This jumper applies a 10k pullup to J13 on the I^2C communication line.
4. **J6 - BQ27Z561 Pulse Pull-up (PULS):** This jumper applies a 10k pullup to J13 on the PULS pin of the BQ27Z561.
5. **J7 - BQ27Z561 Interrupt Pull-up (INT):** This jumper applies a 10k pullup to J13 on the INT pin of the BQ27Z561.
6. **J9 & J10 - Sense Resistor:** These jumpers can be configured to use either a high-side or low-side sense resistor. Set the shunt on J9 to position 2-3 and set the shunt on J10 to 1-2 to use a low-side sense. Set the shunt on J9 to position 1-2 and set the shunt on J10 to position 2-3 to use a high-side sense.
7. **J3 - BQ27Z561 VDD Connection:** This jumper ties the BQ27Z561 BAT pin to CELL+. This shunt can be removed to allow the use of another instrument to monitor the current consumption of the device under various operating conditions.
8. **J5 - BQ27Z561 TS Connection:** This jumper allows the use of the external RT1 thermistor. Removing the shunt allows the use of either the internal temperature sense or an external sense connected to pins 2-3 of J8.
9. **J13 - Pullup Level Selector:** This jumper allows the user to choose between using the SYS+ or external voltage as the pullup voltage. Set the shunt to position 1-2 to use SYS+, and set the shunt to position 3-2 to use EXT_VCC. Use caution when applying voltage to EXT_VCC as it is connected to the EV2400.

7 Operation

This section details the operation of the BQ27Z561 bqStudio software.

7.1 Starting the Program

Run bqStudio from the desktop. The window consists of a tools panel at the top, and other linked windows that can be hidden, docked in various positions, or allowed to float as separate windows. When bqStudio first starts up the *Gauge Dashboard* window, the Registers window,and *Data Memory* window should be seen in the main window. *Registers, Data Memory, Commands*, and other windows can be added to the main window by clicking on the corresponding icon in the tools panel at the top of the main window. Data should appear initially in the *Gauge Dashboard, Registers* and *Data Memory* sections. The **Refresh** (single time scan) or the **Scan** (continuous scan) buttons can be clicked in order to update the data in the *Registers* and *Data Memory* windows. The continuous scan is enabled when the *Scan* checkbox is highlighted green and disabled when the *Scan* checkbox is not highlighted. The continuous scanning interval can be set with the *stopwatch* icon next to the **Scan** button. When the *stopwatch* icon is clicked, a drop-down menu appears and the desired scanning interval can be selected. The scan interval value show up next to the *stopwatch* icon.

bqStudio provides a logging function which logs selected Data Registers last received from the BQ27Z561. To enable this function, click the **Start Log**. The default elapsed interval is 4000 milliseconds. To change this interval, go to Window, select Preferences, choose Registers, and change Scan/Log Interval from 4000 to 1000 milliseconds. There is no need to log faster than 1 second as the gas gauge does not update the registers faster than 1 second.

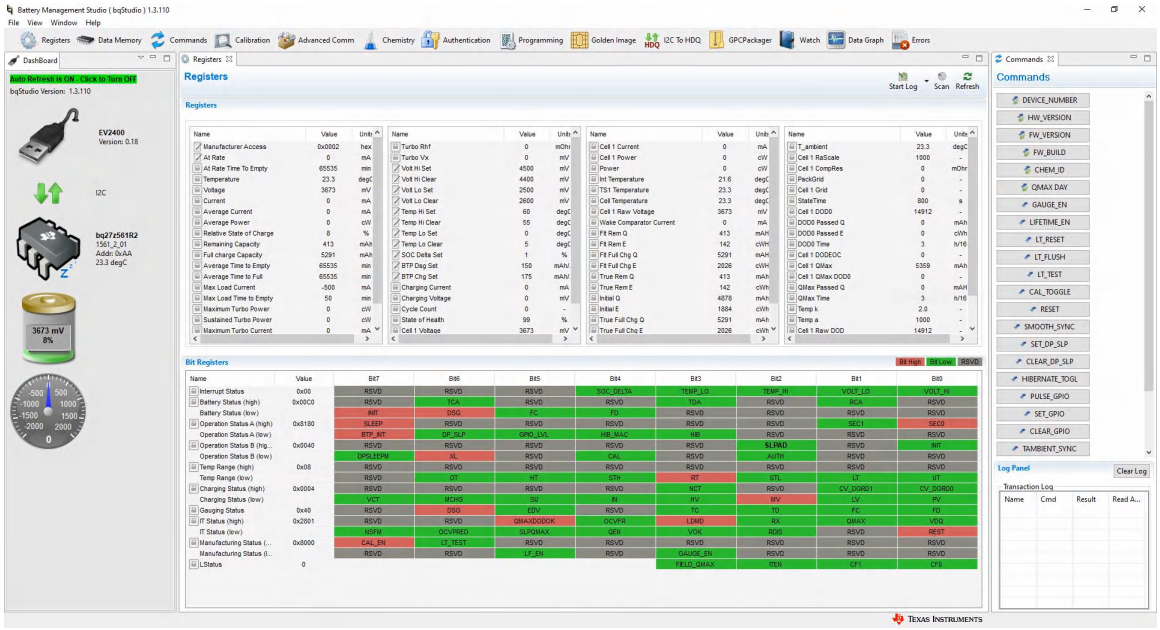

Figure 7-1. Registers Screen

Figure 7-1 shows the main bqStudio window. Additional Flag and Control Status data can be viewed at the bottom of the registers window.

7.2 Setting Programmable BQ27Z561 Options

The BQ27Z561 comes configured per the default settings detailed in the BQ27Z561 data sheet. Ensure that the settings are correctly changed to match the pack and application for the BQ27Z561 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 Memory* window seen in the main *bqStudio* window (Figure 7-2).

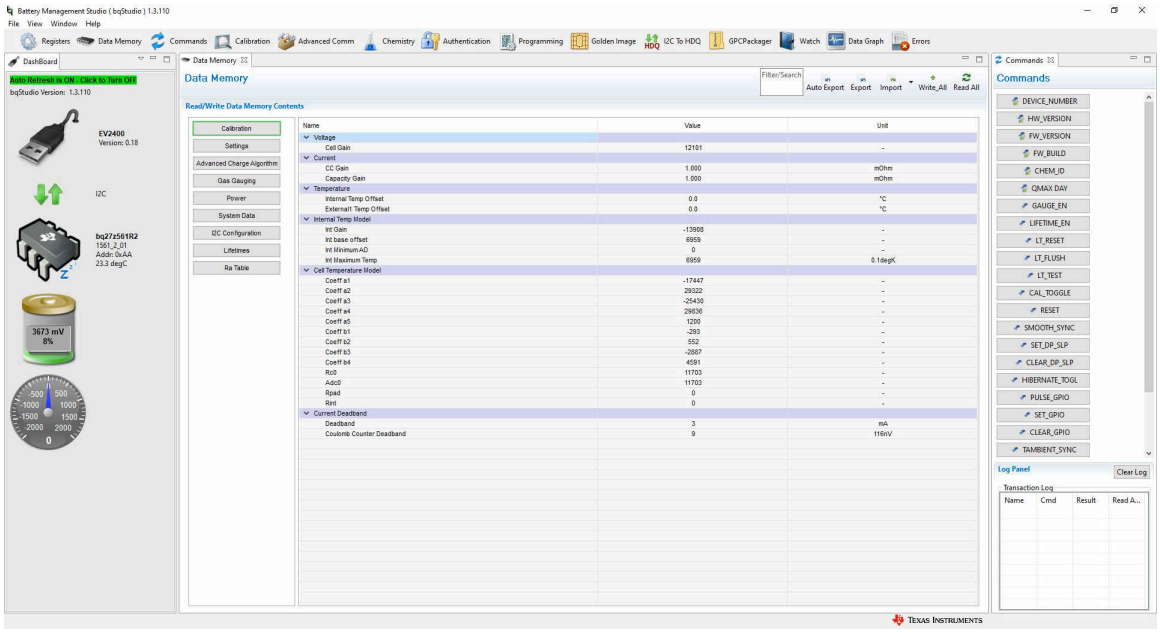

Figure 7-2. Data Memory Screen

To read all the data from the BQ27Z561, click on the **Read All** button in the *Data Memory* window. For ease of configuration, a text file with a .gg.csv extension can be extracted, modified, and imported back on the device. Use the export and import buttons as seen in Figure 7-2 to export and import .gg.csv files. The auto export button enables .gg.csv files to be exported periodically at intervals. This is useful when debugging issues with the gauge. A write command is necessary if a .gg.csv file is imported to ensure that all changes made on the .gg.csv file are effected on the gauge. The read command is used to read back all of the data written to the gauge so that the changes made can be verified. The filter/search field enables the user to search for a particular parameter in the data memory content.

IMPORTANT: Do not make modifications to the .gg.csv file using Microsoft® Excel® as it makes changes to the file, which bqStudio rejects. Make sure to use a text editor like notepad or similar to edit a .gg.csv file.

7.2.1 Important Data Memory Parameters to Change

This section outlines the minimal critical settings that should be changed for even the basic evaluation. A short description is included which can be used as a recommendation how to set the parameter value. Additional updates are needed for a production setting.

1. ***[Gas Gauging][State][Qmax Cell 1]:*** This value should be updated to be the default design capacity of the battery being used. It represents the full unloaded chemical capacity of the cell. This value is updated by the gauge when proper learning is performed and in the field over the life of the battery.
2. ***[Gas Gauging][IT Cfg][Term Voltage]:*** This value should be set to the minimum value of the end system when absolute 0% state of charge should be reported. For normal Li-ion cells this value should range between 3.2 V to 2.75 V. It is recommended this value is not set to above 3.4 V.
3. ***[Advanced Charge Algorithm][Termination Config][Charge Term Taper Current]:*** This value should be set slightly above the capabilities of your charger to taper to. A recommended value is C/20 where C is the default capacity of the cell. For example a battery with 1000 mAh capacity should have a taper current of around 50 mA.
4. ***[Advanced Charge Algorithm][Low/Standard/High/Rec Temp Charging][Voltage]:*** This parameter should be updated to the maximum charging voltage of the battery to be used. For a typical Li-Ion battery this value is between 4.4 V to 4.2 V.
5. **ChemID:** It is important that the correct ChemID is updated to give the best accuracy. Refer to Section 7.3 on how to update the chemistry in the device. If your cell is not included in the chemistry list, it is possible to run a match on the battery by following the steps here: http://www.ti.com/tool/gpcchem. For basic testing if the correct chemistry is unknown it is important to chose a chemistry ID with the same maximum charging voltage as the intended cell. Our recommended ID's for common charging voltages are as follows:
   - 4.2 V (ID 1202)
   - 4.35 V (ID 3230)
   - 4.4 V (ID 3142)

7.3 Setting the Chemistry

The chemistry file contains parameters that the simulations use to model the cell and its operating profile. It is critical to program a Chemistry ID that matches the cell into the device. Some of these parameters can be viewed in the Data Flash section of the Battery Management Studio.

Press the **Chemistry** button to select the **Chemistry** window.

1. The table can be sorted by clicking the desired column. For example: Click the *Chemistry ID* column header.
2. Select the ChemID that matches your cell from the table.
3. Press **Program Selected Chemistry** to update the chemistry in the device.

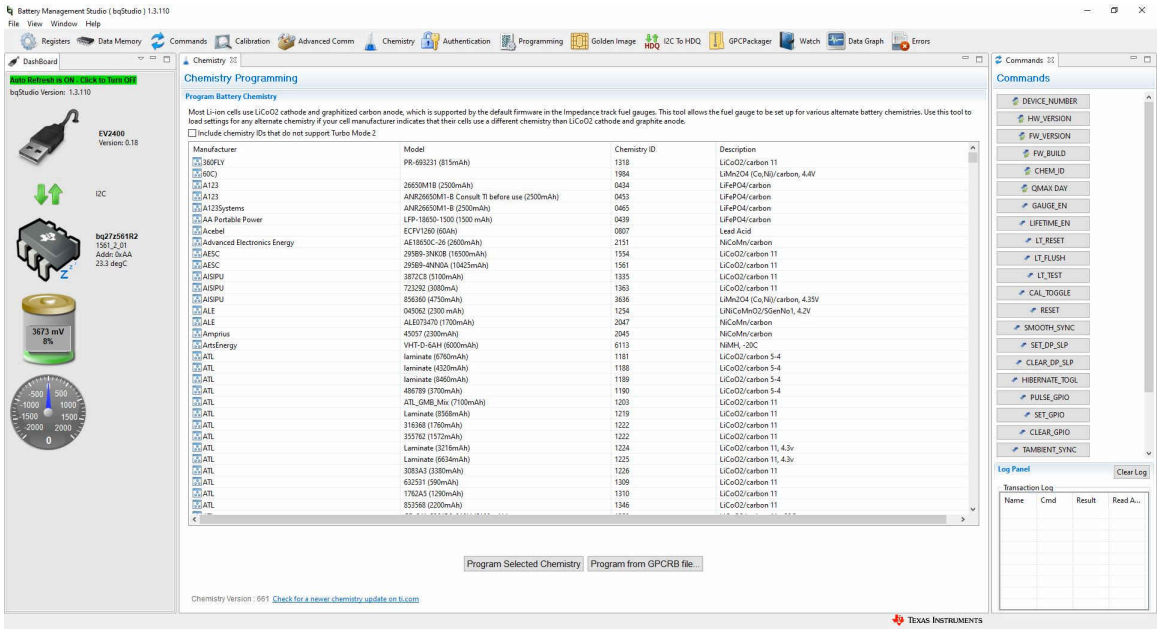

Figure 7-3. Chemistry Screen

8 Related Documentation from Texas Instruments

Updated documents also can be obtained through the TI website at www.ti.com.

1. Data sheet: *BQ27Z561-R2 Impedance Track™ Battery Gas Gauge Solution for 1-Series Cell Li-Ion Battery Packs*, SLUSE22A
2. Technical Reference Manual: *BQ27Z561-R2 Technical Reference Manual (REV. B)*, SLUUC54B

9 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision * (June 2018) to Revision A (July 2022)	Page
• Revised abstract	1
• Combined redundant bullets	3
• Changed board name	3
• Updated section	4
• Updated names and jumpers	4
• Renamed system pins	4
• Replaced board images	5
• Updated schematic	7
• Updated Bill of Materials	8
• Updated table	9
• Updated for new ports	10
• Updated for new connections	12
• Updated for revised board	12
• Added descriptions for new jumpers	13
• Updated bqStudio picture	14
• Fixed paths to match bqStudio	16
• Updated bqStudio picture	16
• Changed data sheet and TRM links to newer versions	18

STANDARD TERMS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an “EVM” or “EVMs”) to the User (“User”) in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.

   1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM (“Software”) shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms that accompany such Software

   1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.

2 *Limited Warranty and Related Remedies/Disclaimers*:

   2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.

   2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.

   2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

WARNING

Evaluation Kits are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems.

User shall operate the Evaluation Kit within TI’s recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI’s recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI’s instructions for electrical ratings of interface circuits such as input, output and electrical loads.

NOTE:

EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGREDATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

3 *Regulatory Notices:*

3.1 *United States*

3.1.1 *Notice applicable to EVMs not FCC-Approved:*

FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

3.1.2 *For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:*

CAUTION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer or an experienced radio/TV technician for help.*

3.2 *Canada*

3.2.1 *For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur

3.3 *Japan*

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。
http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

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3.4 *European Union*

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive)*:

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

4 *EVM Use Restrictions and Warnings:*

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

4.3 *Safety-Related Warnings and Restrictions:*

4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user 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, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.

6. *Disclaimers:*

6.1 EXCEPT AS SET FORTH ABOVE, EVMS AND ANY MATERIALS PROVIDED WITH THE EVM (INCLUDING, BUT NOT LIMITED TO, REFERENCE DESIGNS AND THE DESIGN OF THE EVM ITSELF) ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." TI DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING SUCH ITEMS, INCLUDING BUT NOT LIMITED TO ANY EPIDEMIC FAILURE WARRANTY OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADE SECRETS OR OTHER INTELLECTUAL PROPERTY RIGHTS.

6.2 EXCEPT FOR THE LIMITED RIGHT TO USE THE EVM SET FORTH HEREIN, NOTHING IN THESE TERMS SHALL BE CONSTRUED AS GRANTING OR CONFERRING ANY RIGHTS BY LICENSE, PATENT, OR ANY OTHER INDUSTRIAL OR INTELLECTUAL PROPERTY RIGHT OF TI, ITS SUPPLIERS/LICENSORS OR ANY OTHER THIRD PARTY, TO USE THE EVM IN ANY FINISHED END-USER OR READY-TO-USE FINAL PRODUCT, OR FOR ANY INVENTION, DISCOVERY OR IMPROVEMENT, REGARDLESS OF WHEN MADE, CONCEIVED OR ACQUIRED.

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