bq27620 EVM: Single-Cell Impedance Track Technology

This evaluation module (EVM) is a complete evaluation system for the bq27620. The EVM includes one bq27620 circuit module, a current sense resistor, an EV2300 PC interface board for gas gauge interface, a PC USB cable, and Windows™-based PC software. The circuit module includes one bq27620 integrated circuit 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 bq27620 data registers, program the chipset for different pack configurations, log cycling data for further evaluation, and evaluate the overall functionality of the bq27620 solution under different charge and discharge conditions. The latest Windows TM – based PC software can be downloaded from the product folder on the Texas Instruments Web site.

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1 Features

- Complete evaluation system for the bq27620 gas gauge with Impedance Track™ technology
- Populated circuit module for quick setup
- Personal computer (PC) software and interface board for easy evaluation
- Software that allows data logging for system analysis
- Ability to upgrade to the latest firmware version by flash reprogramming

1.1 Kit Contents

- bq27620 circuit module (HPA735)

This EVM is used for the evaluation of bq27620-based products. Ensure that you visit the product Web folder at www.ti.com to download the latest firmware version for the associated product to be evaluated.

1.2 Ordering Information

Table 1. Ordering Information

EVM Part Number	Chemistry	Configuration	Capacity
bq27620EVM	Li-Ion	1 Cell	Any

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2 bq27620-Based Circuit Module

The bq27620-based circuit module is a complete and compact example solution of a bq27620 circuit for battery management. The circuit module incorporates a bq27620 battery gas gauge integrated circuit (IC) 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 (J2 or J3): PACK+, PACK–
- To the serial communications port (J8): 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 (J5): SOC_INT, BAT_LOW and BAT_GD

2.2 Pin Description

Pin Name	Description
PACK+	Pack positive terminal
PACK–	Pack negative terminal
SDA	I2C™ communication data line
SCL	I2C communication clock line
VSS	Signal return for communication line, shared with charger and ground
CHG+/LOAD+	High potential of load or charger connection
CHG–/LOAD–	Low potential of load or charger connection (system VSS)
BAT_LOW	Battery low output
/BAT_GD	Battery good output
SOC_INT	SOC state interrupts output

3 bq27620 Circuit Module Schematic

3.1 Schematic

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

4 Circuits Module Physical Layout and Bill of Material

This section contains the board layout, bill of materials, and assembly drawings for the bq27620 circuit module.

4.1 Board Layout

This section shows the printed-circuit board (PCB) layers (Figure 1 through Figure 4), and assembly drawing for the bq27620 module.

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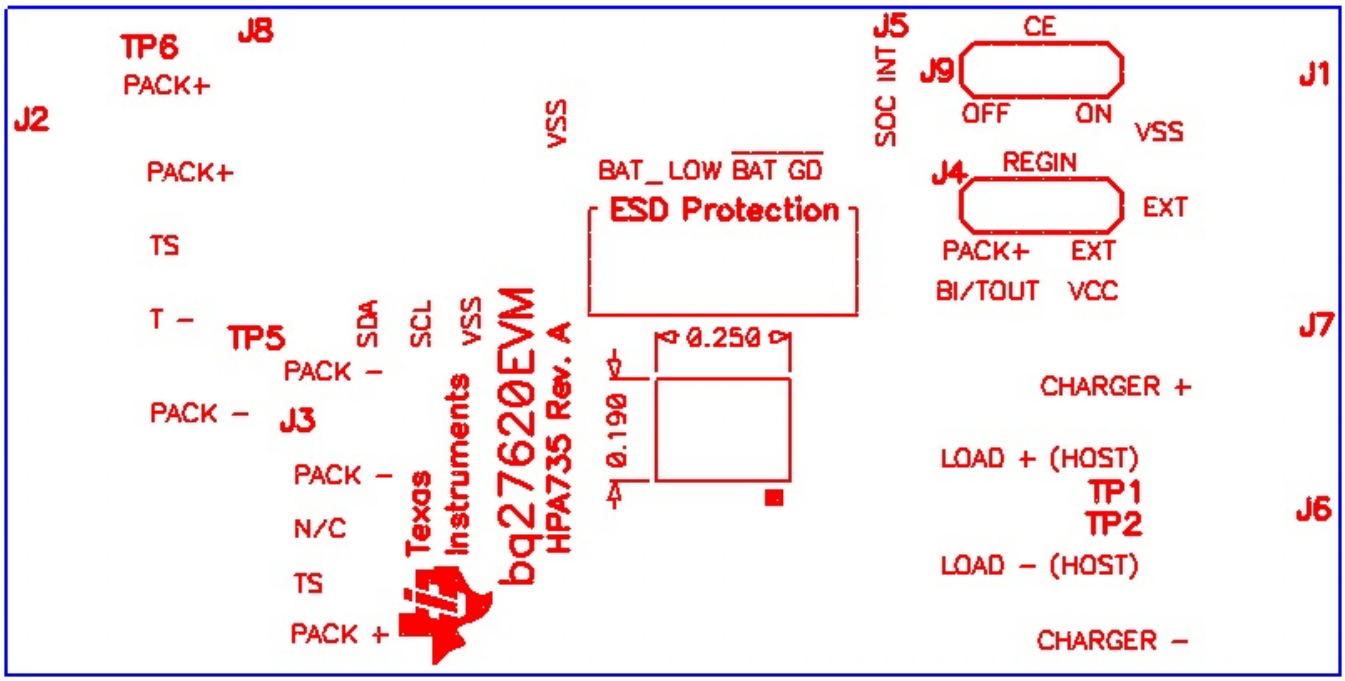


Figure 1. bq27620EVM Layout – Silk Screen

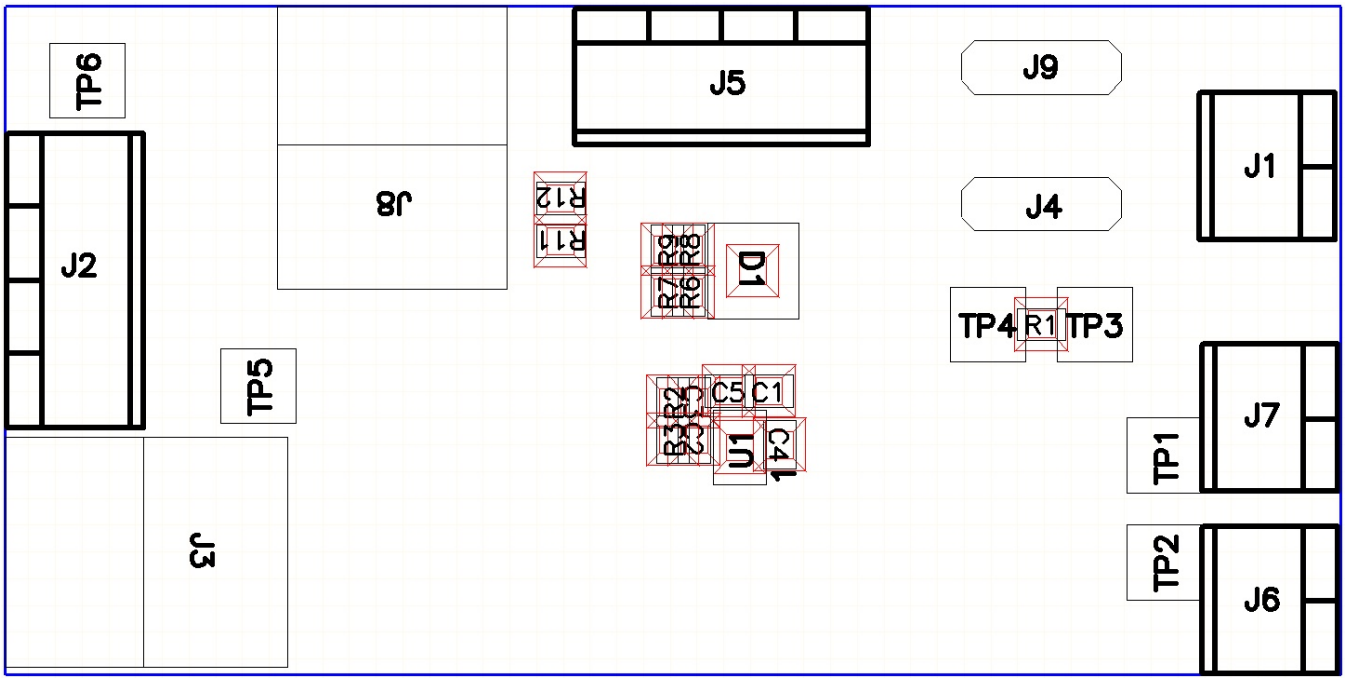


Figure 2. bq27620EVM Layout – Top Assembly

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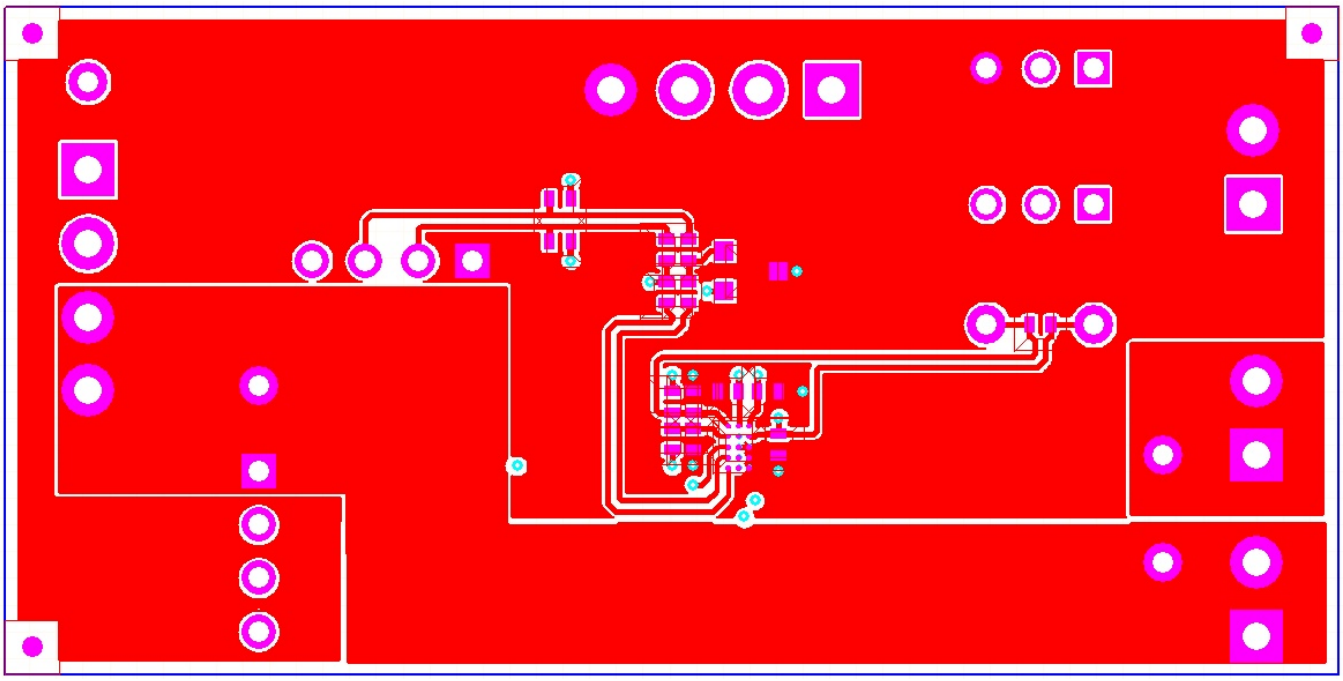


Figure 3. bq27620EVM Layout – Top Layer

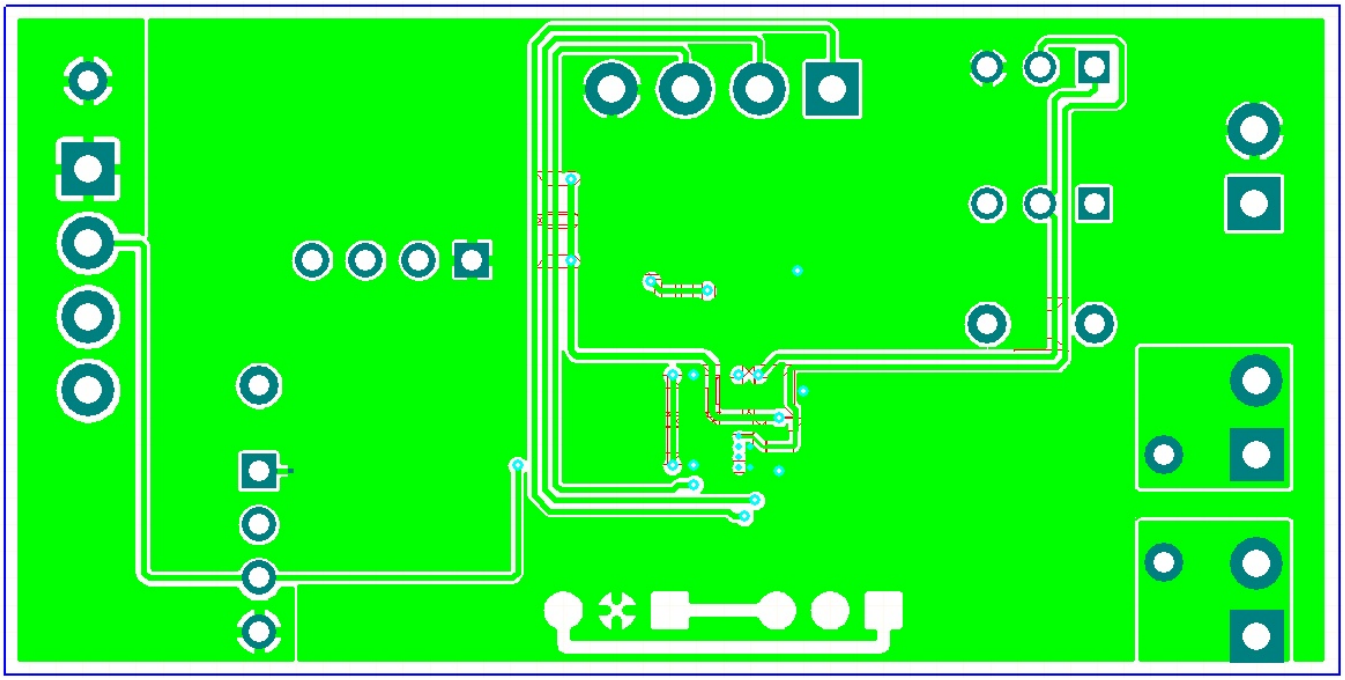


Figure 4. bq27620EVM Layout – Bottom Layer

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4.2 Bill of Material

Table 2. Bill of Materials

Count	RefDes	Value	Description	Size	Part Number	Mfr
1	C3	33nF	Capacitor, Ceramic,10V, X7R, +/-10%	402	GRM155R71A333KA01D	Murata
1	C4	1.0uF	Capacitor, Ceramic, 6.3V, X5R, 10%	402	GRM155R60J105KE19D	Murata
3	C1, C2, C5	0.1uF	Capacitor, Ceramic, 10V, X5R, 10%	402	GRM155R61A104KA01D	Murata
1	D1	AZ23C5V6-7-F	Diode, Dual, Zener, 5.6 V, 300mW	SOT23	AZ23C5V6-7-F	Diodes
3	J1, J6, J7	ED555/2DS	Terminal Block, 2-pin, 6-A, 3.5mm	0.27 x 0.25 inch	ED555/2DS	OST
2	J2, J5	ED555/4DS	Terminal Block, 4-pin, 6-A, 3.5mm	0.55 x 0.25 inch	ED555/4DS	OST
2	J3, J8	22-05-3041	Header, Friction Lock Ass'y, 4-pin Right Angle,	0.400 x 0.500	22-05-3041	Molex
2	J4, J9	PEC36SAAN	Header, Male 3-pin, 100mil spacing	0.100 inch x 3	PEC36SAAN	Sullins
1	R1	1.8M	Resistor, Chip, 1/16-W, 5%	402	Std	Std
2	R11, R12	10k	Resistor, Chip, 1/16-W, 5%	402	Std	Std
1	R2	18.2k	Resistor, Chip, 1/16-W, 1%	402	Std	Std
1	R3	1k	Resistor, Chip, 1/16-W, 5%	402	Std	Std
4	R6, R7, R4, R5	100	Resistor, Chip, 1/16-W, 5%	402	Std	Std
3	TP1, TP3, TP6	5000	Test Point, Red, Thru Hole Color Keyed	0.100 x 0.100 inch	5000	Keystone
2	TP2, TP5	5001	Test Point, Black, Thru Hole Color Keyed	0.100 x 0.100 inch	5001	Keystone
1	TP4	5002	Test Point, White, Thru Hole Color Keyed	0.100 x 0.100 inch	5002	Keystone
1	U1	BQ27620YZF	IC, System-Side Impedance Track w/ Dynamic Voltage Correlation Fuel Gauge With DSBGA		BQ27620YZF	TI

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4.3 Schematic

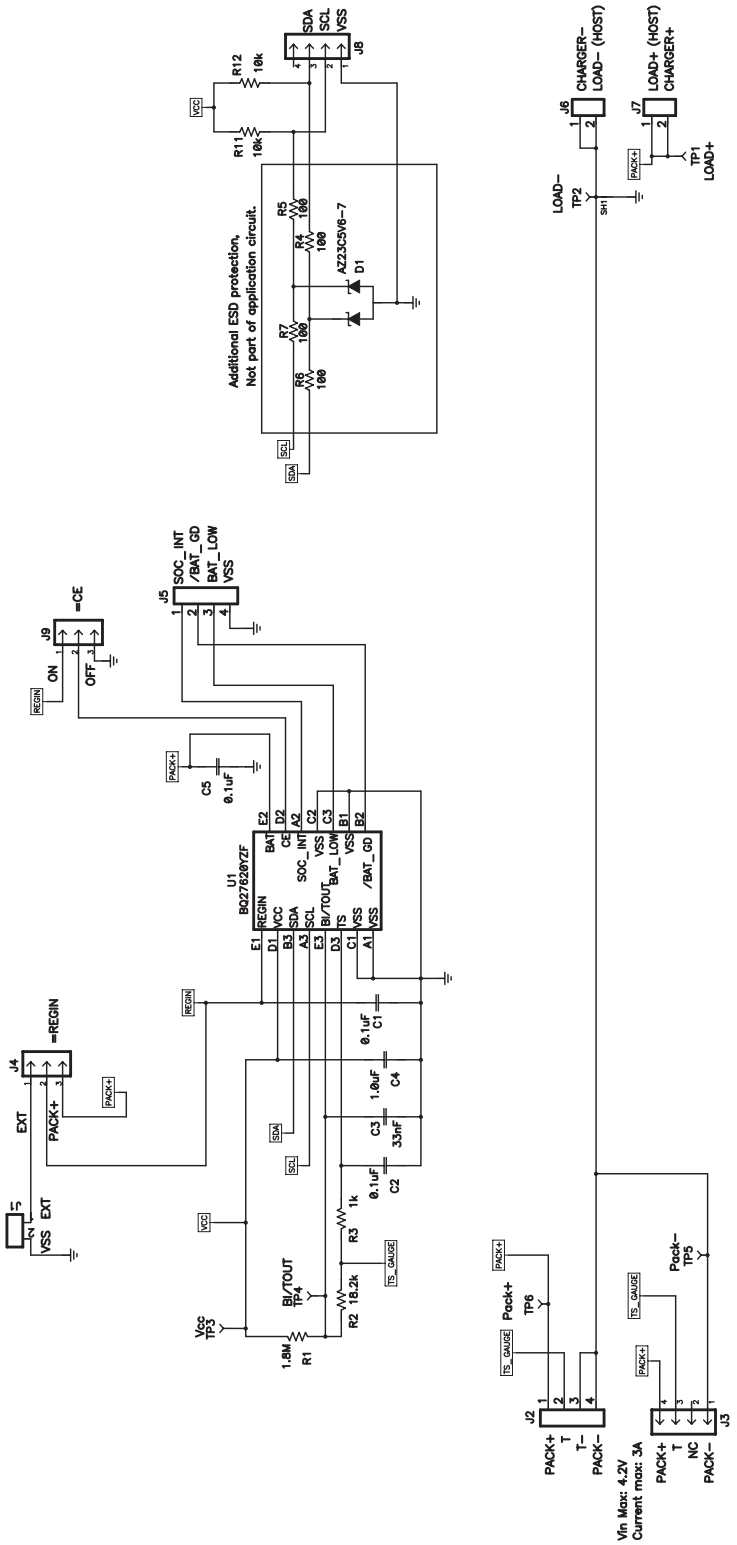


Figure 5. bq27620EVM Schematic

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4.4 bq27620 Circuits Module Performance Specification Summary

This section summarizes the performance specifications of the bq27620 circuit module.

Table 3. Performance Specification Summary

Specification	Min	Typ	Max	Units
Input voltage Pack+ to Pack–	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 bq27620EVM PC software and how to connect the different components of the EVM.

5.1 System Requirements

The bq27620EVSW software requires Windows 2000 or Windows XP. Drivers for Windows 98SE are provided, but Microsoft™ no longer supports Windows 98; therefore, Windows 98 can have issues 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 bq27620 tool folder on power.ti.com. Make a search by Part Number for bq27620 to access the tool folder. Use the following steps to install the bq27620EVSW software:

1. Ensure that the EV2300 or EV2400 is not connected to the personal computer (PC) through the USB cable before starting this procedure.
2. Open the archive containing the installation package, and copy its contents into a temporary directory.
3. Open the software file that was downloaded from the TI Web site.
4. Follow the instructions on screen until completing the software installation.
5. Before starting the evaluation software, connect the EV2300 or EV2400 to the computer using the USB cable.
6. If EV2300 is connected, wait until system prompt “new hardware found” appears. Choose “select location manually”, and use the “browse” button to point to subdirectory TIUSBWin2K-XP-1.
7. Answer “continue” to the warning that drivers are not certified with Microsoft™.
8. After installation finishes, another system prompt "new hardware found" appears. Repeat steps 1 through 5, but specify the directory as TIUSBWin2K-XP-2.
9. Answer "continue" to the warning that drivers are not certified with Microsoft. Driver installation is now finished.

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 bq27620EVM comprises three hardware components: the bq27620 circuit module, the EV2300 PC interface board, and the PC.

7.1 Connecting the bq27620 Circuit Module to a Battery Pack

Figure 6 shows how to connect the bq27620 circuit module to the cells and system load/charger.

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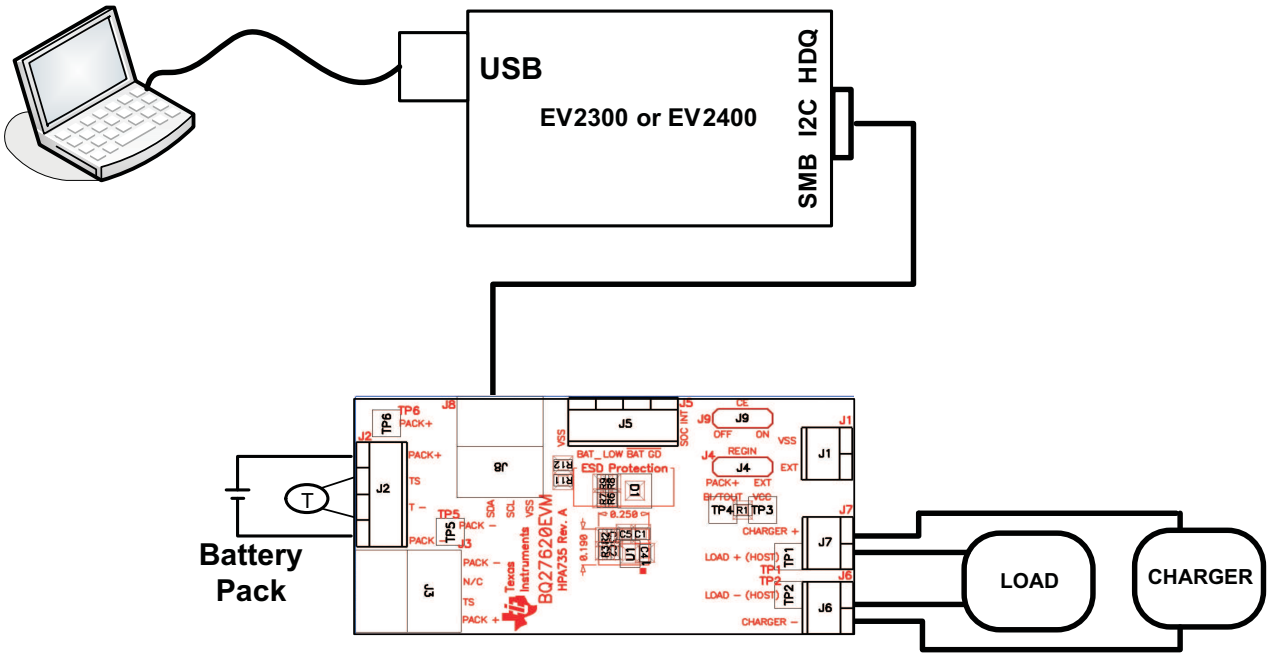


Figure 6. bq27620 Circuit Module Connection to Pack and System Load/Charger

7.2 PC Interface Connection

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

1. Connect the bq27620-based EVM to the EV2300 using wire leads as shown in Table 4.
2. Connect the PC USB cable to the EV2300 and the PC USB port.

Table 4. Circuit Module to EV2300/EV2400 Connections

bq27620EVM	EV2300
SDA	SDA
SCL	SCL
VSS	GND

The bq27620EVM is now set up for operation.

8 Operation

This section details the operation of the bq27620 EVSW software.

8.1 Starting the Program

Run bq27620 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 with 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.

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The bq27620 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.

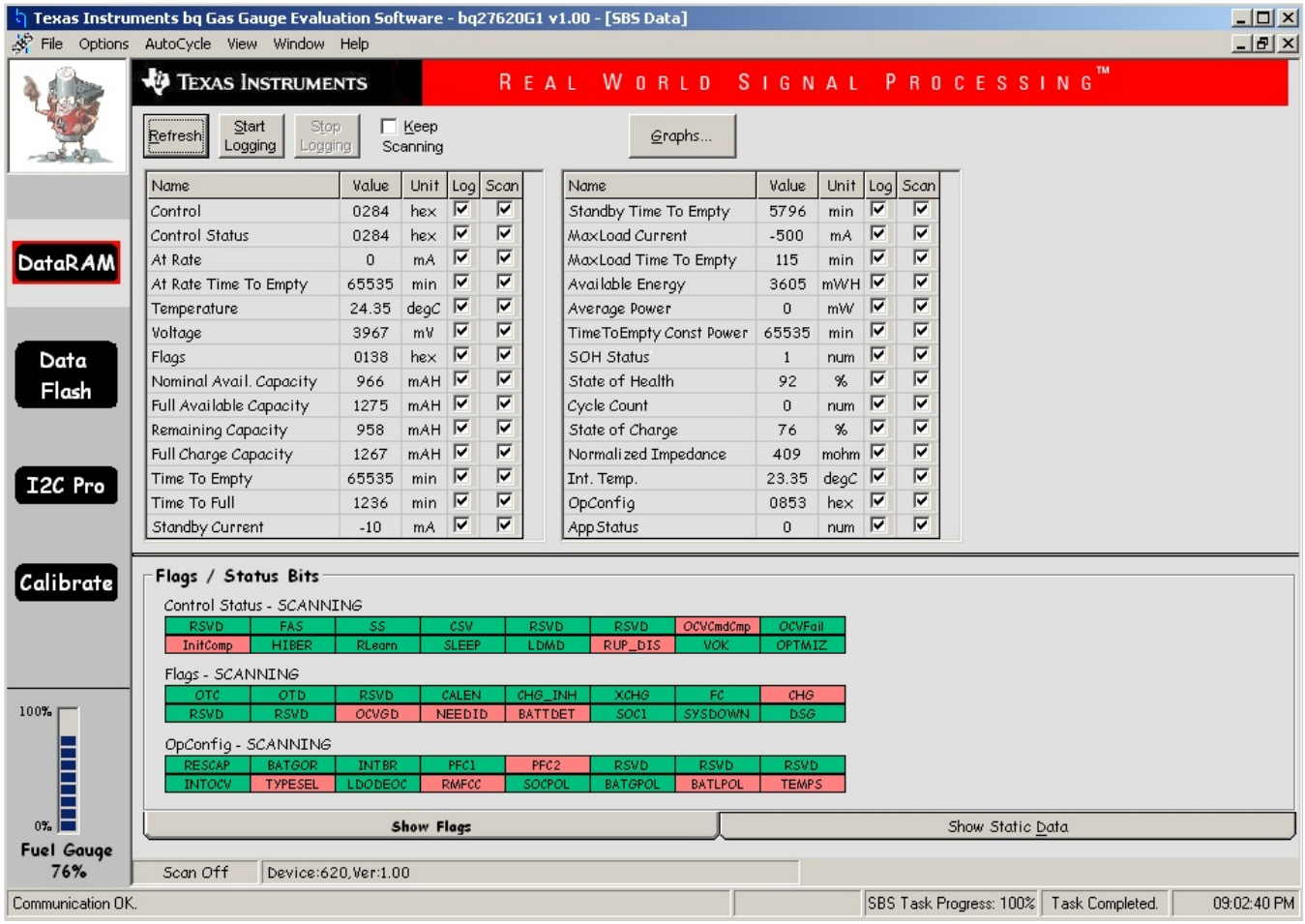


Figure 7. DataRAM Screen

This screen (Figure 2) 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/Status data from Data Ram register values) changes the height of the Flags/Status Data display. Selecting | View |, then | Auto Arrange | returns the splitter bar to its original location.

8.2 Setting Programmable bq27620 Options

The bq27620 data flash comes configured per the default settings detailed in the bq27620 data sheet. Ensure that the settings are correctly changed to match the pack and application for the bq27620 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).

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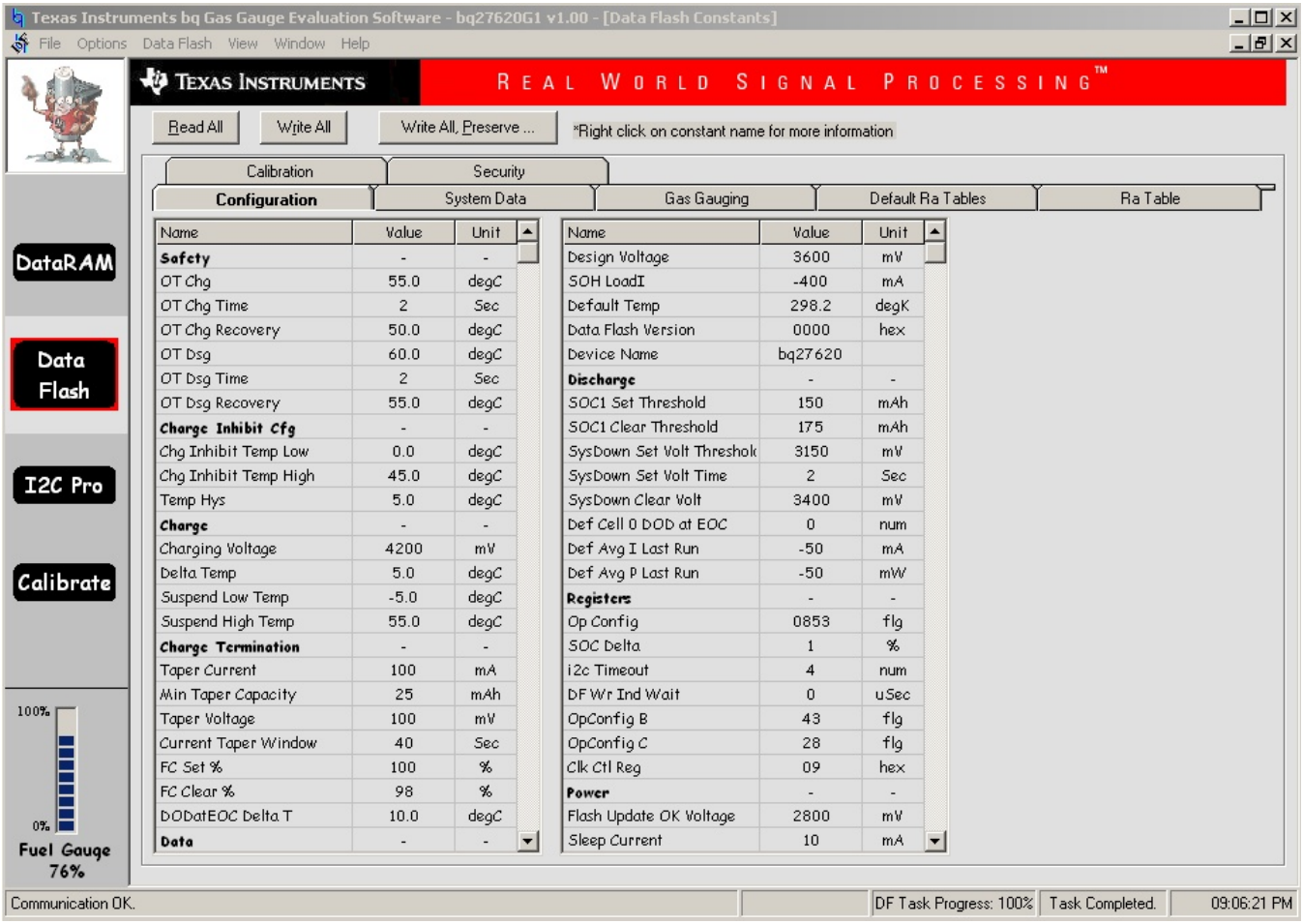


Figure 8. Data Flash Screen

To read all the data from the bq27620 data flash, click on menu option | Data Flash | Read All |.

To read all the data from the bq27620 data flash, click on menu option | Data Flash | Read All |. <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 bq27620 using the | Write All |button.

The module calibration data is also held in the bq27620 data flash.

The bq27620 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 also is 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 bq27620 that is being used may not be supported by the bqEVSW version that is being used. An upgrade may be required.

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9 Calibrate Screen

To ensure proper calibration, perform the following steps. These steps may or may not be required, depending on the type of calibration being performed. Only one calibration item can be selected and calibrated at once.

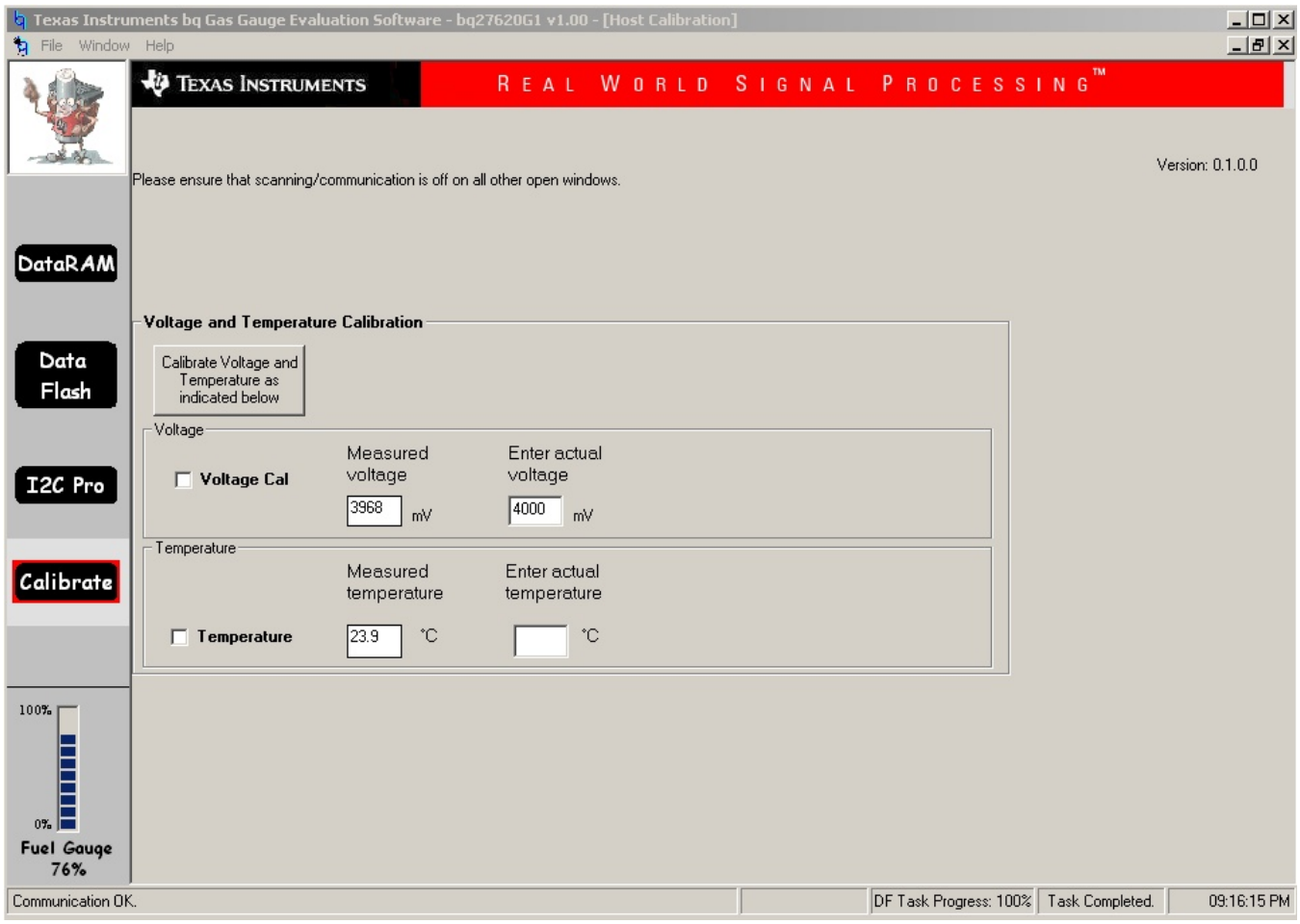


Figure 9. Calibration Screen

9.1 To Calibrate the bq27620

1. Select the types of calibration to be performed (see Figure 9).
2. Enter the measured values for the types selected.
3. Press the button to calibrate.

9.2 Voltage Calibration

1. Measure the voltage across Pack+ and Pack–.
2. Type the voltage value in mV into *Enter Actual Voltage*.
3. Press the *Calibrate Part as indicated below* button.

9.3 Temperature Calibration

1. Measure the temperature for PACK.
2. Type the temperature value into *Enter Actual Temperature*.
3. Select if the temperature sensor to calibrate is the internal or external.

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4. Press the *Calibrate Voltage and Current as indicated below* button.

10 I2C Pro Screen

10.1 I2C Communication

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

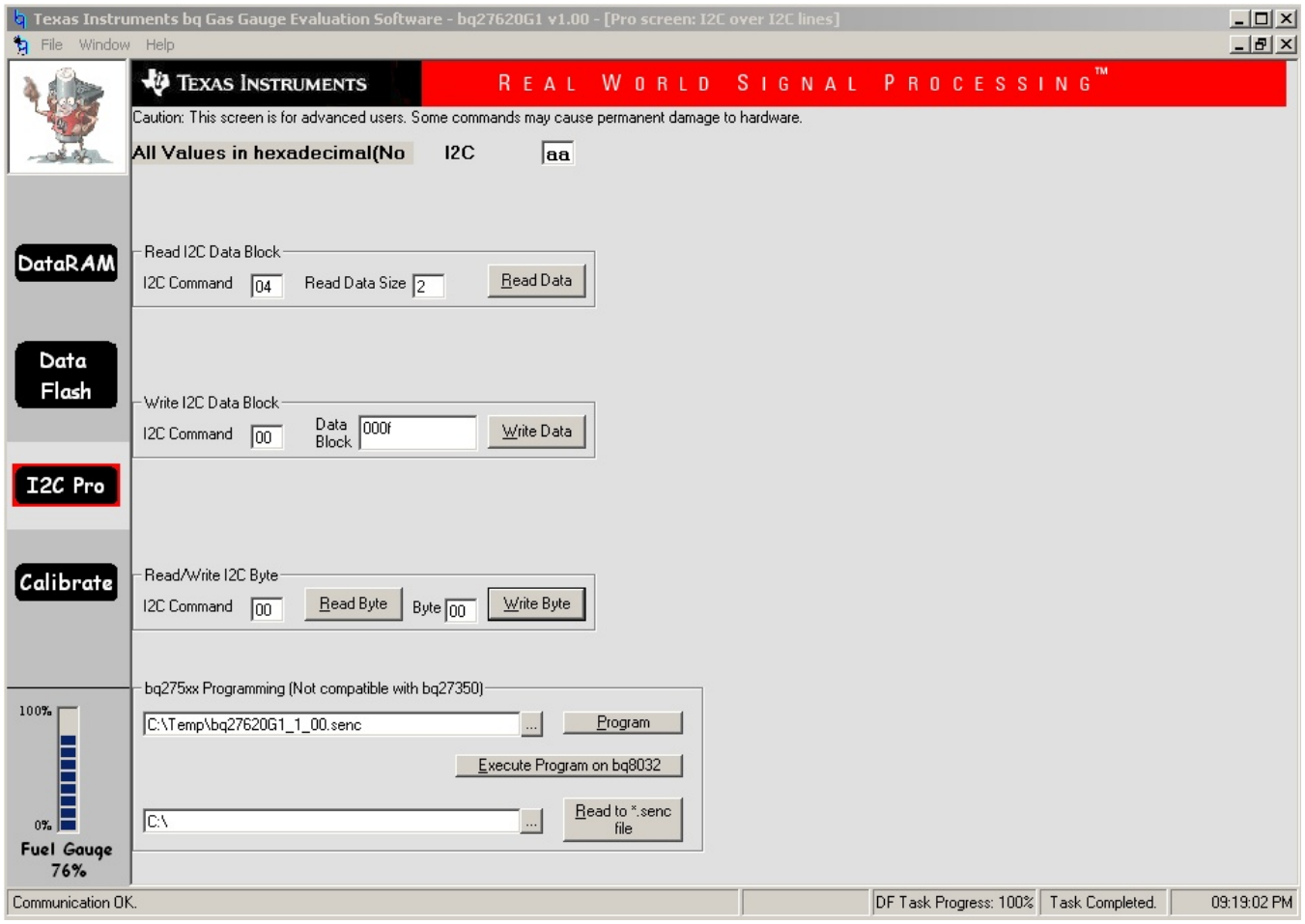


Figure 10. I2C Pro Screen

11 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 also can be obtained through the TI Web site at www.ti.com .

1. *bq27620, System-Side Impedance Track™ Dynamic Voltage Correlation Fuel Gauge with Integrated LDO* data sheet (SLUSAE3)

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EVM Warnings and Restrictions

It is important to operate this EVM within the input voltage range of 0 V to 5V and the output voltage range of 0 V to 5V .

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.

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