bq35100EVM-795 Evaluation Module

This evaluation module (EVM) is a complete evaluation system for the bq35100. This EVM includes one bq35100 circuit module, an external current sense resistor. A separate orderable EV2300 or EV2400 PC interface board for gas gauge, along with a PC USB cable, and Microsoft® Windows® based PC software is needed when using this EVM. The circuit module includes one bq35100 integrated circuit and all other onboard components necessary to monitor and predict capacity for a system-side or removable battery pack fuel-gauge solution. With the EV2300 or EV2400 users can:

- Read the bq35100 data registers
- Program the chipset for different configurations
- Log cycling data for further evaluation
- Evaluate the overall functionality under different charge and discharge conditions

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1 Features

This EVM provides the following features:

- Complete evaluation system for the bq35100 end-of-service monitor gas gauge
- Populated circuit module for quick setup
- Personal computer (PC) software and interface board for easy evaluation
- Software allows data logging for system analysis

1.1 Kit Contents

The EVM kit contains the following:

- bq35100 circuit module
- Cable to connect the EVM to an EV2300 or EV2400 communications interface adapter

This EVM is used for evaluation of the bq35100. Visit the product web folder at www.ti.com to properly configure the bq35100.

1.2 Ordering Information

Table 1 contains the EVM ordering information.

Table 1. Ordering Information

Part Number	EVM Part Number	Configuration	Chemistry
bq35100	bq35100EVM-795	1 to 8 cells	Li-primary

1.3 bq35100 Circuits Module Performance Specification Summary

This section summarizes the performance specifications of the bq35100 circuit module.

Table 2. Performance Specification Summary

Specification	MIN	TYP	MAX	Units
Input Voltage BAT+ to BAT -	2.7	15	32	V
Charge and discharge current	0	0.75	1.25	A

2 bq35100EVM Quick Start Guide

This section provides the step-by-step procedures required to take a new EVM and configure it for operation in a laboratory environment.

2.1 Items Needed for EVM Setup and Evaluation

The following items are required for EVM setup and evaluation:

- bq35100 circuit module
- EV2300 or EV2400 communications interface adapter
- USB cable to the communications interface adapter to the computer
- Computer setup with Windows XP, or higher operating system
- Access to the internet to download bqStudio software setup program
- DC power supply that can supply 16.8 V and 1 A. (Constant current and constant voltage capability is desirable.)

2.2 System Requirements

The bqStudio software requires Windows XP or later. Using later versions of Windows operating system can have issues with the 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.

2.3 Software Installation

Find the latest software version of bqStudio on http://www.ti.com/tool/bqstudio. Search by part number for bq35100 to access the tool folder for the device. Use the following steps to install bq35100 bqStudio 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 bqStudio installer 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 the EV2300 is connected, wait until the 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. If the EV2300 is connected, after the previous 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.
10. For the EV2400, the driver should be installed along with software installation.

2.4 Troubleshooting Unexpected Dialog Boxes

Be sure to log in as *Administrator* before downloading the files. 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.

2.5 EVM Connections

2.5.1 Connecting the bq35100 Circuit Module to a Battery Pack

Figure 1 illustrates the EVM connections to the pack and system load.

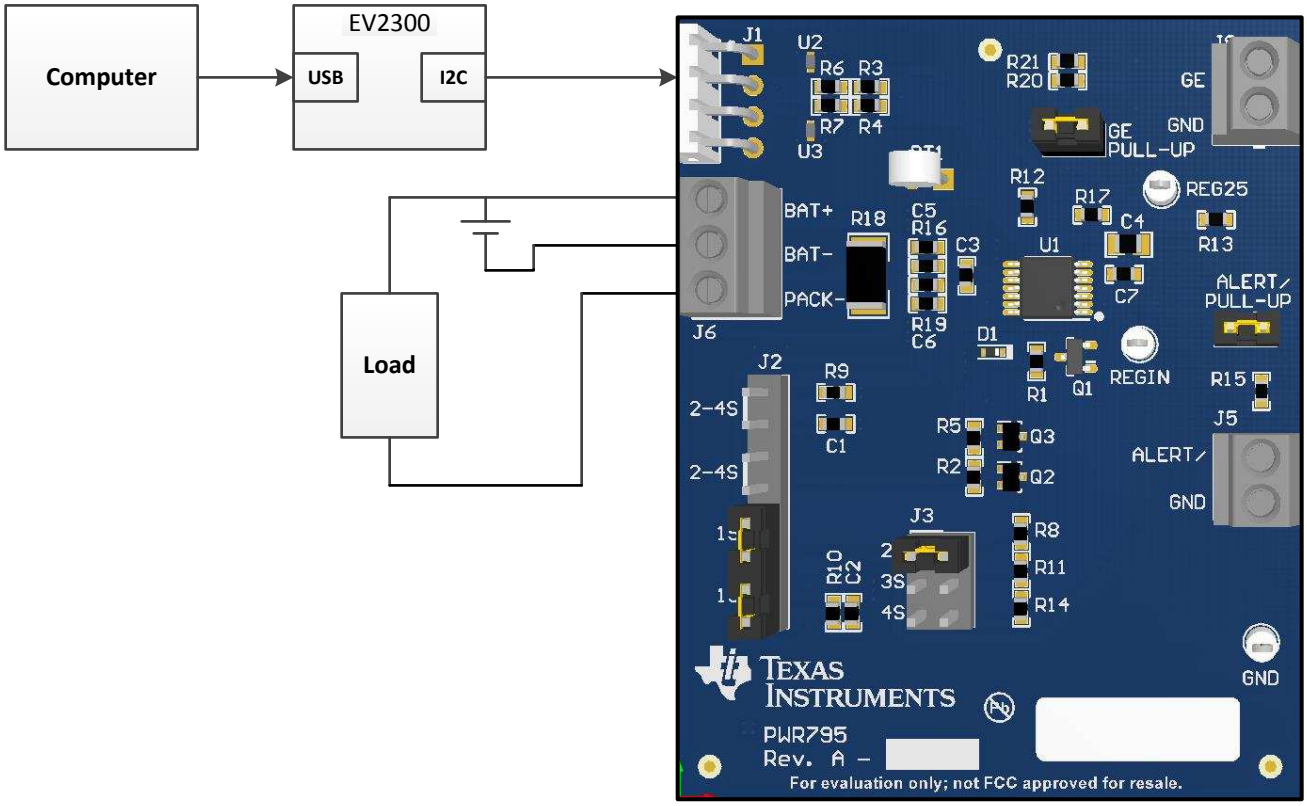


Figure 1. bq35100 Circuit Module Connection to Pack and System Load

2.5.2 Circuit Module Connections

Contacts on the circuit module provide the following connections:

- Direct connection to the battery pack (J6): BAT+ and BAT–

  Configure J2 and J3 to support the voltage range for your pack.

  Attach BAT– to the bottom of the battery stack and attach BAT+ to the top of the battery stack.
- Charger and load connection (J6): BAT+ and PACK–

  Attach the load or power supply to the J6 terminal block. The positive load or power supply wire should be connected to the terminal block position labeled BAT+. The ground wire for the load or power supply should be connected to the terminal block position labeled PACK–.
- I^2C communication port (J1): I^2C bus

  Attach the communications interface adapter cable to J1 and to the I^2C port on the EV2300.
- Chip Enable (J8): GE

  Place a jumper on GE to enable the REG25 regulator to power the bq35100. An external GE input can be applied on J8.
- ALERT/ (J5)

  Place jumpers on PULL-UP ALERT/ to apply a pull-up resistor to open drain outputs ALERT/ output. The output can be monitored on J5.

2.5.3 Pin Description

Table 3 lists the EVM pin descriptions.

Table 3. EVM Pin Descriptions

Pin Name	Description
BAT+	Battery stack positive terminal
BAT–	Battery stack negative terminal
PACK–	Pack negative terminal
ALERT/	Open drain alert output.
GE	Optional external input for gauge enable.
SDA	I^2C data signal
SCL	I^2C clock signal
GND	Ground return

2.6 PC Interface Connection

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

1. Connect the bq35100-based EVM to the EV2300 or EV2400 using wire leads as shown in Table 4.
2. Connect the PC USB cable to the EV2300 or EV2400 and the PC USB port.

Table 4. Circuit Module to EV2300 or EV2400 Connections

bq35100EVM	EV2300	EV2400
SDA	SDA	PORT2 - SDA
SCL	SCL	PORT2 - SCL
VSS	GND	PORT2 - VSS

The bq35100EVM-795 is now set up for operation.

3 Operation

This section details the operation of the bq35100 bqStudio software.

3.1 Starting the Program

With the EV2300 or EV2400 and the bq35100EVM connected to the computer, run bqStudio from the Desktop or installation directory. The window consists of a tools panel at the top, and other child windows that can be hidden, docked in various positions, or allowed to float as separate windows. When bqStudio first starts up, the *DashBoard*, *Registers*, and *Commands* windows should be open. Additional windows can be added by clicking the corresponding icons in the tools panel at the top of the main window.

The **Scan** (continuous scan) or **Refresh** (single time scan) buttons can be clicked in order to update the data in the *Registers* and *Data Memory* windows.

bqStudio provides a logging function which logs selected Data Registers last received from the bq35100. To enable this function, click the **Start Log** button. The default elapsed interval is 4000 milliseconds, to change this interval, go to *Windows*, 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 gauge will not update the registers faster than 1 second.

The *Registers* section contains parameters used to monitor gauging. The *Bit Registers* section provides a bit-level picture of status and fault registers. A green flag indicates that the bit is 0 (low state) and a red flag indicates that the bit is 1 (high state). Data begins to appear once the **Refresh** (single-time scan) button is selected, or it scans continuously if the **Scan** button is selected.

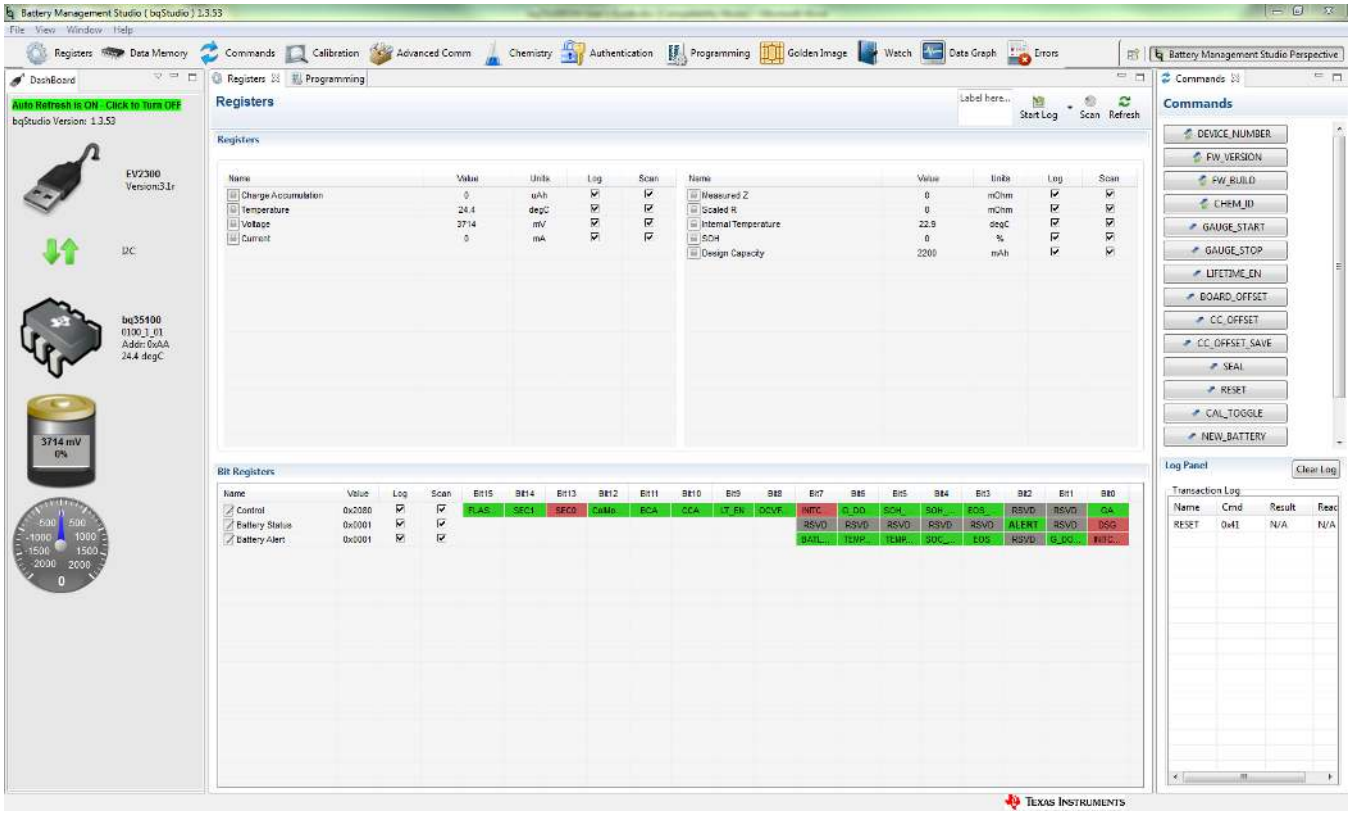


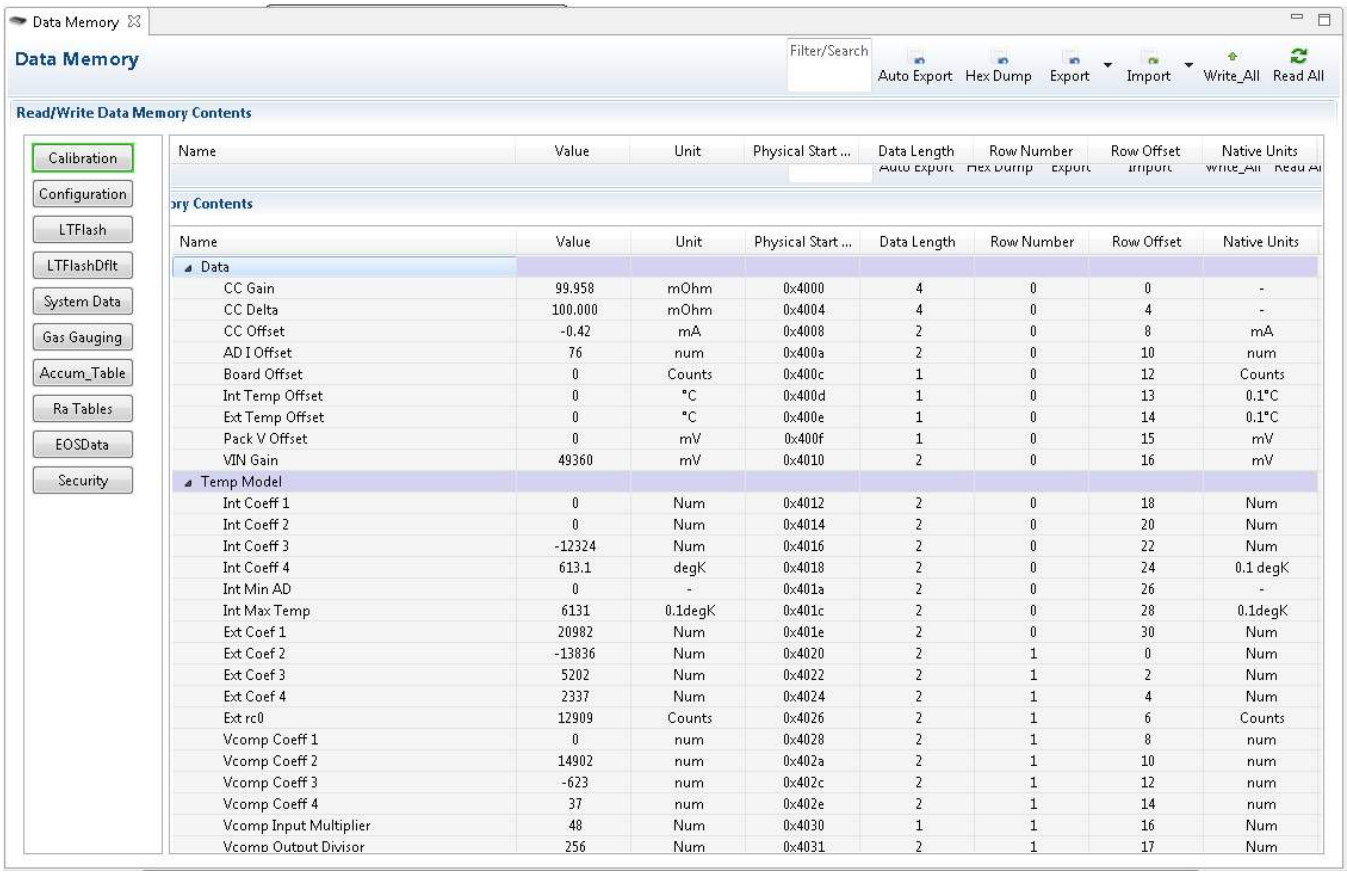
Figure 2. Registers Screen

3.2 Setting Programmable bq35100 Options

The bq35100 comes configured per the default settings detailed in the *bq35100 Technical Reference Manual* (TRM) (SLUUBH1). Ensure that the settings are correctly changed to match pack and application for the bq35100 solution being evaluated.

IMPORTANT: The bq35100 comes up **UNSEALED** but **not** in **FULL ACCESS**. The keys to enter **FULL ACCESS** must be sent to the device before being able to access the data memory.

IMPORTANT: The correct setting of these options is essential to get the best performance. The settings can be configured using the *Data Memory* window (Figure 3).



Name	Value	Unit	Physical Start ...	Data Length	Row Number	Row Offset	Native Units
Data							
CC Gain	99.958	mOhm	0x4000	4	0	0	-
CC Delta	100.000	mOhm	0x4004	4	0	4	-
CC Offset	-0.42	mA	0x4008	2	0	8	mA
AD I Offset	76	num	0x400a	2	0	10	num
Board Offset	0	Counts	0x400c	1	0	12	Counts
Int Temp Offset	0	°C	0x400d	1	0	13	0.1°C
Ext Temp Offset	0	°C	0x400e	1	0	14	0.1°C
Pack V Offset	0	mV	0x400f	1	0	15	mV
VIN Gain	49360	mV	0x4010	2	0	16	mV
Temp Model							
Int Coeff 1	0	Num	0x4012	2	0	18	Num
Int Coeff 2	0	Num	0x4014	2	0	20	Num
Int Coeff 3	-12324	Num	0x4016	2	0	22	Num
Int Coeff 4	613.1	degK	0x4018	2	0	24	0.1 degK
Int Min AD	0	-	0x401a	2	0	26	-
Int Max Temp	6131	0.1degK	0x401c	2	0	28	0.1degK
Ext Coef 1	20982	Num	0x401e	2	0	30	Num
Ext Coef 2	-13836	Num	0x4020	2	1	0	Num
Ext Coef 3	5202	Num	0x4022	2	1	2	Num
Ext Coef 4	2337	Num	0x4024	2	1	4	Num
Ext rc0	12909	Counts	0x4026	2	1	6	Counts
Vcomp Coeff 1	0	num	0x4028	2	1	8	num
Vcomp Coeff 2	14902	num	0x402a	2	1	10	num
Vcomp Coeff 3	-623	num	0x402c	2	1	12	num
Vcomp Coeff 4	37	num	0x402e	2	1	14	num
Vcomp Input Multiplier	48	Num	0x4030	1	1	16	Num
Vcomp Output Divisor	256	Num	0x4031	2	1	17	Num

Figure 3. Data Memory Screen

To read all the data from the bq35100 non-volatile flash memory, click the **Read All** button on the *Data Memory* window. Make sure the device is not sealed and in full access to read/write to the data memory. To update a parameter, click on the desired parameter and a window pops-up providing details on the selected parameter. Next, enter the value in the value textbox and press *Enter*. After *Enter* has been pressed, bqStudio updates the selected parameter. The **Import** button in the *Data Memory* window can be clicked in order to import an entire configuration from a specified *.gg.csv file.

The configuration can be saved to a file by clicking the **Export** button in the *Data Memory* window and entering a file name. The configuration will be saved to a *.gg.csv file. The module calibration data is also held in the bq35100 data memory. If the Gauge Dashboard is not displaying any information, the bq35100 may not be supported by the bqStudio version being used, a bqStudio upgrade may be required.

3.2.1 Cell Configuration

The bq35100 operates in one of two modes for measuring battery voltage. Place jumpers on the J2 and J3 headers to select the mode of operation. Refer to the EVM Connections section.

For packs where the stack voltage is less than 5 V:

- Enable *Calibration Mode* on the device by pressing the **CAL_TOGGLE** button on the *Commands* panel. Verify that the CalMode flag is set in the Control register.
- Set the *Series Cell Count* parameter on the *Gas Gauging* screen to the appropriate value.
- Reset the gauge using the **RESET** button on the *Commands* panel.
- Calibrate the stack voltage. Reference the Calibration section.

NOTE: The EVM can support single cell applications where the cell voltage can drop below 2.5 V by providing an external 3.3-V supply to power REGIN. Remove the jumper from J6 – pins 3 and 4 (upper 1S jumper location) and apply a 3.3-V supply to the REGIN test point.

For packs where the stack voltage is less than 5 V:

- Enable *Calibration Mode* on the device by pressing the **CAL_TOGGLE** button on the *Commands* panel. Verify that the CalMode flag is set in the Control register.
- Set the EXTVCELL bit in the *Pack Config A* register on the *Configuration* screen.
- Set the *Series Cell Count* parameter on the Gas Gauging screen to the appropriate value.
- Reset the gauge using the **RESET** button on the *Commands* panel.
- Calibrate the stack voltage. Reference the Calibration section.

3.3 Calibration

The bq35100EVM must be calibrated to ensure accurate value reporting. This is done by going to the *Calibration* window in bqStudio (see Figure 4).

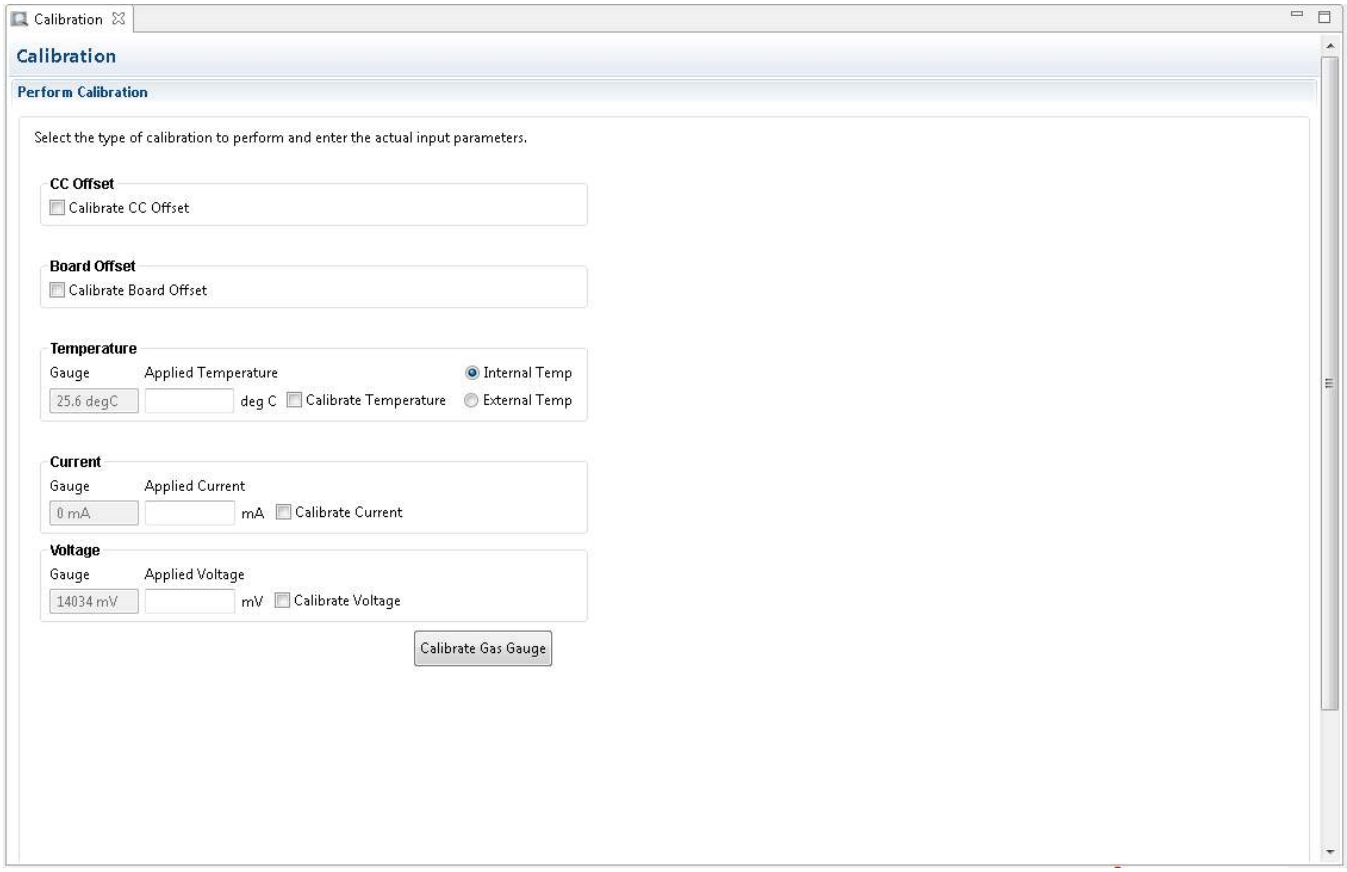


Figure 4. Calibration Screen

3.3.1 Voltage Calibration

- Measure the voltage from BAT+ to BAT– and enter this value in the *Applied Voltage* field and select the *Calibrate Voltage* box.
- Press the **Calibrate Gas Gauge** button to calibrate the voltage measurement system.
- Deselect the *Calibrate Voltage* boxes after voltage calibration has completed.

3.3.2 Temperature Calibration

- Enter the room temperature in each of the *Applied Temperature* fields and select the *Calibrate Temperature* box for the thermistor to be calibrated. The temperature values must be entered in degrees Celsius.
- Press the **Calibrate Gas Gauge** button to calibrate the temperature measurement system.
- Deselect the *Calibrate* boxes after temperature calibration has completed.

3.3.3 Current Calibration

The gauge offers *CC Offset* and *Board Offset* calibration options to zero any residual current that may be reported by the gauge. These calibrations are only required if the gauge does not report 0 mA current when no current should be present.

- Select the *CC Offset* calibration option.
- Press the **Calibrate Gas Gauge** button to calibrate.
- Verify whether the Current reports 0 mA. Proceed with the *Board Offset Current* calibration of current is reported.
- Select *CC Offset* calibration option
- Press the **Calibrate Gas Gauge** button to calibrate.
- Verify whether the *Current* reports 0 mA.
- Connect a 1-A load from BAT+ to PACK–.
- Enter '–1000' in the Applied Current field and select the *Calibrate Current* box.
- Press the **Calibrate Gas Gauge** button to calibrate.
- Deselect the *Calibrate Current* box after current calibration has completed.

3.4 Chemistry Screen

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, see Figure 5.

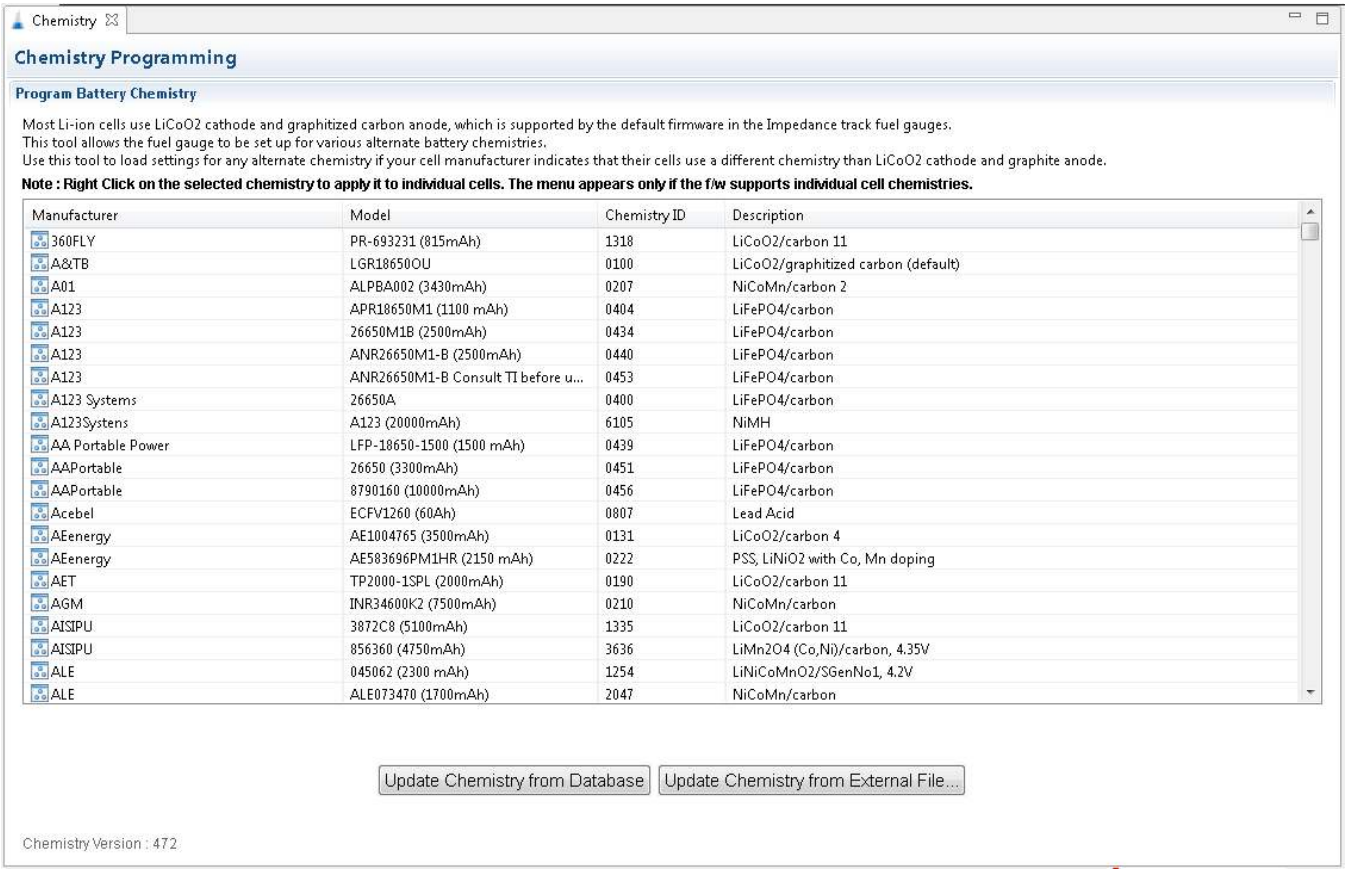


Figure 5. Chemistry Screen

- The table can be sorted by clicking the desired column. for example: Click the *Chemistry ID* column header.
- Select the *Chemistry ID* that matches your cell from the table (see Figure 5).
- Press the *Update Chemistry* in the *Data Flash* button to update the chemistry in the device.

3.5 Programming Screen

Press the **Programming** button to select the *Programming Update* window. This window allows the user to import the device firmware.

3.5.1 Programming the Flash Memory

The *Programming* screen is used to initialize the device by loading the default .srec into the flash memory, see Figure 6).

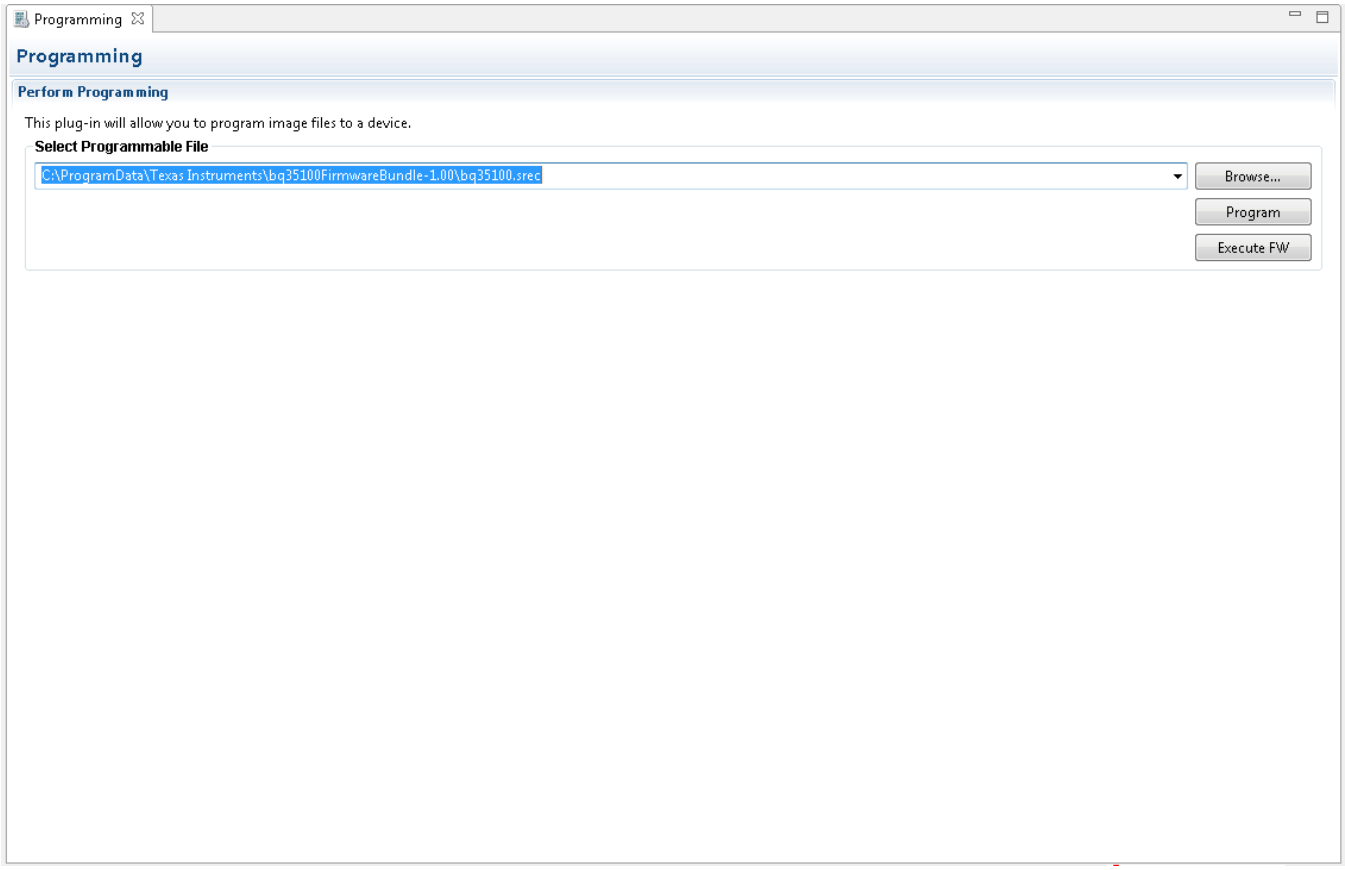


Figure 6. Programming Screen

- Search for the .srec file using the **Browse** button.
- Press the **Program** button and wait for the download to complete.
- Press the **Execute** FW button after the programming is completed.

3.6 Advanced Comm SMB Screen

Press the **Advanced Comm SMB** button to select the *Advanced SMB Comm* window. This tool provides access to parameters using *SMB and Manufacturing Access* commands, see Figure 7.

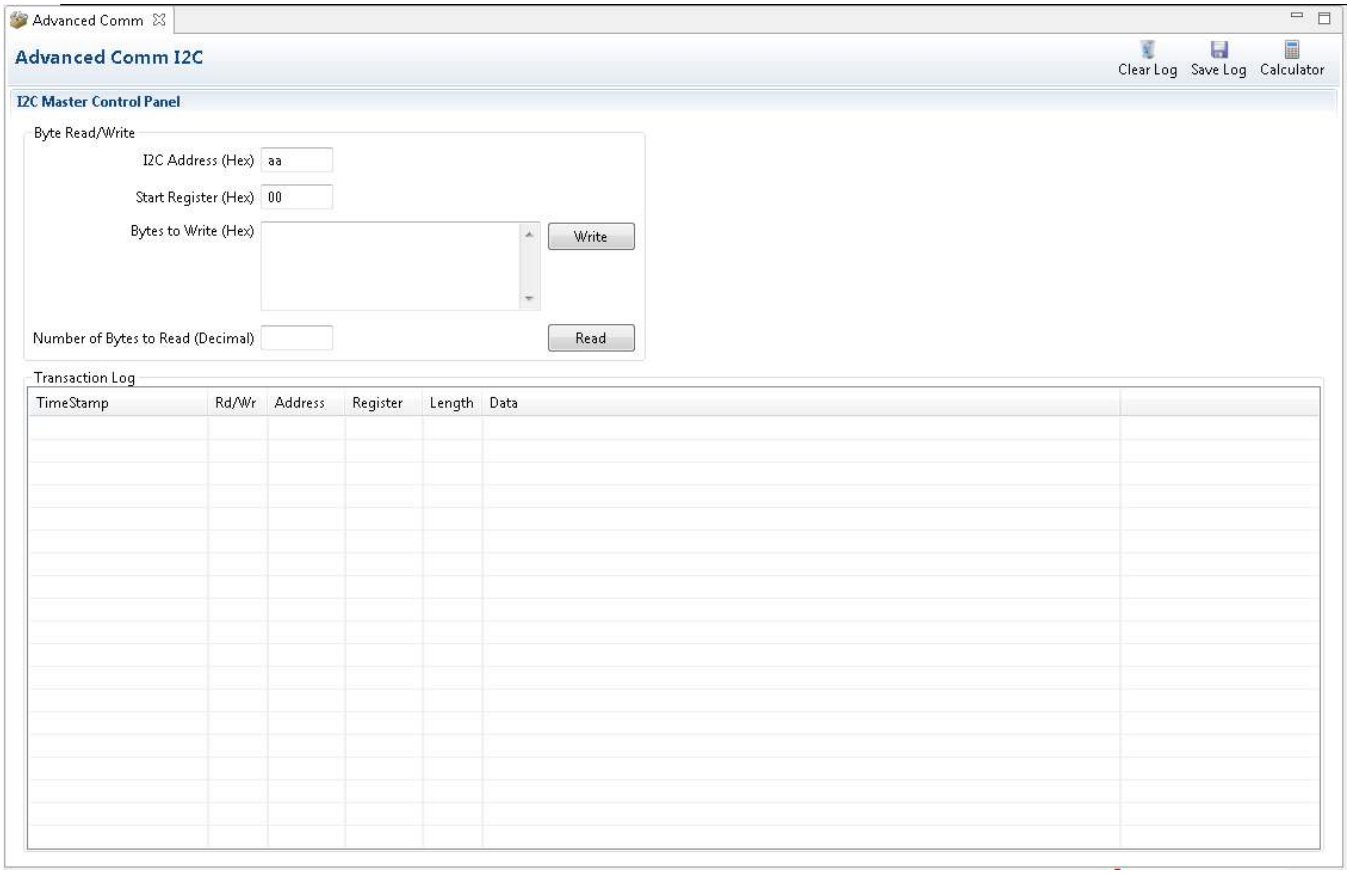


Figure 7. Advanced Comm SMB Screen

Examples:

Reading an SMB Command.

- Read SBData Voltage (0x08)
  - SMBus Read Word. Command = 0x00=08, 2 bytes
  - Word = 0x840E, which is hexadecimal for 3716 mV

Sending a MAC GAUGE_START to start gauging via ManufacturerAccess().

- Send GAUGE_START() (0x11) to ManufacturerAccess().
  - SMBus Write Word. Command = 0x00. Data = 11 00

3.7 Golden Image Screen

Press the **Golden Image** button to select the *Golden Image* window. This window allows the user to export the device firmware as an .srec, .bq.fs and .df.fs files.

3.7.1 Exporting the Flash Memory

The .srec file contains the full flash memory. The .bq.fs contains the program memory portion for the flash memory and the .df.fs contains the data flash portion of the flash memory, see Figure 8.

- Select the directory location to export the files.
- Enter the file name for the files.
- Select the files types to export.
- Press the **Create Image Files** button to export the memory and create the files.

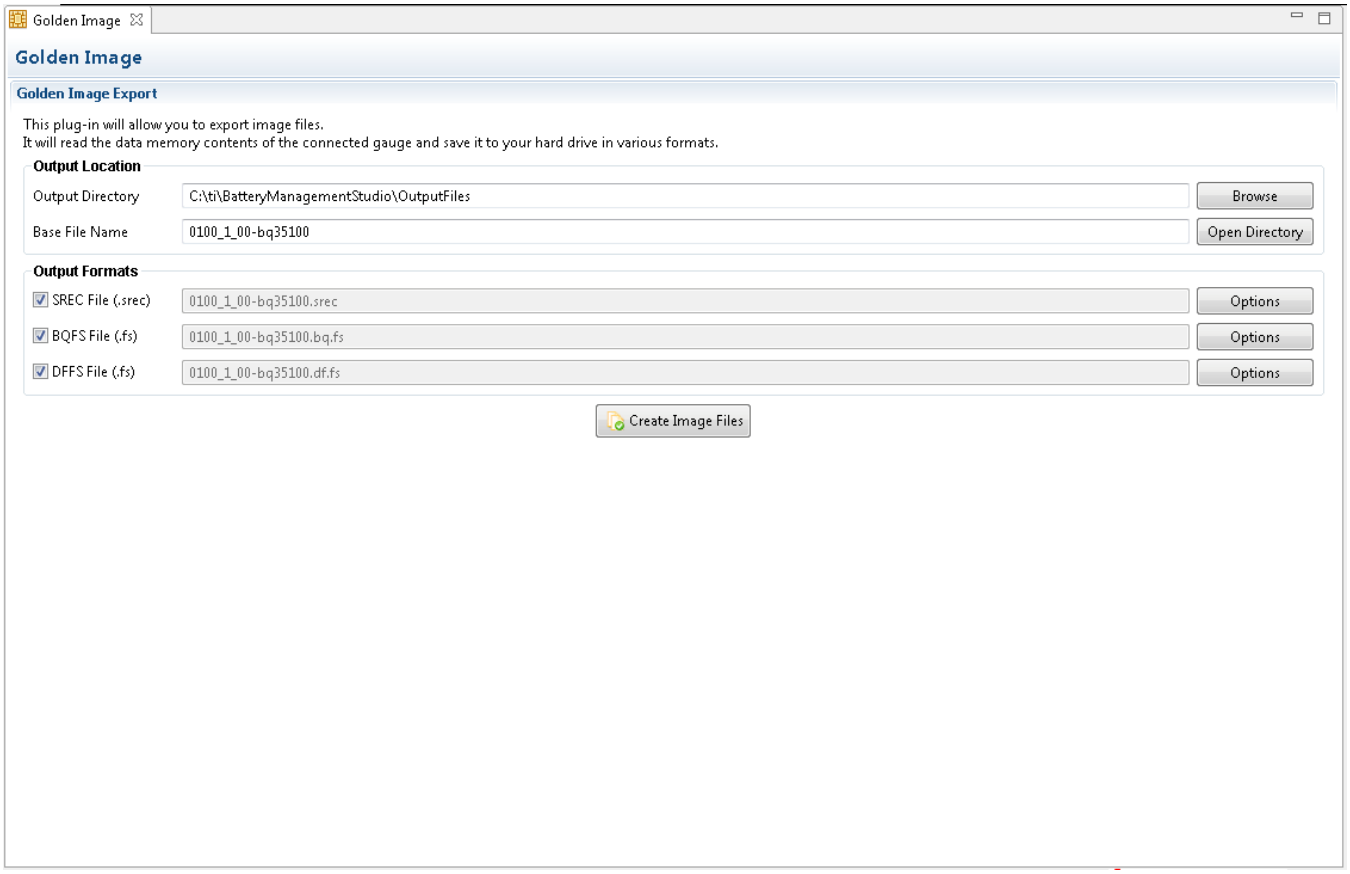


Figure 8. Golden Image Screen

4 Circuit Module Physical Layout, Bill of Materials, and Schematic

This section contains the board layout, bill of materials, and schematic for the bq35100 circuit module.

4.1 Board Layout

This section shows the printed circuit board (PCB) layers, and assembly drawing for the bq35100 module (Figure 9 through Figure 12).

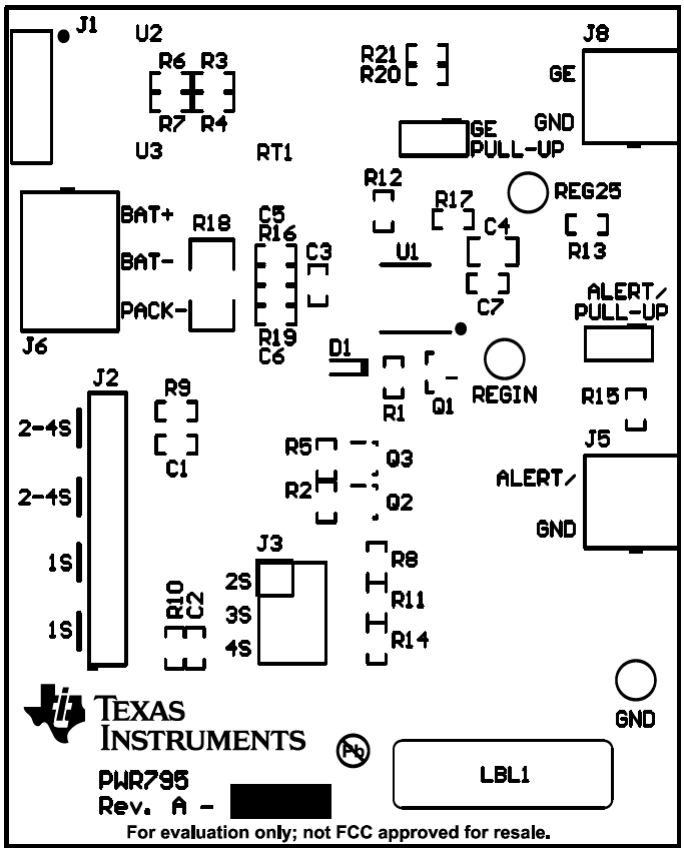


Figure 9. Top Silk Screen

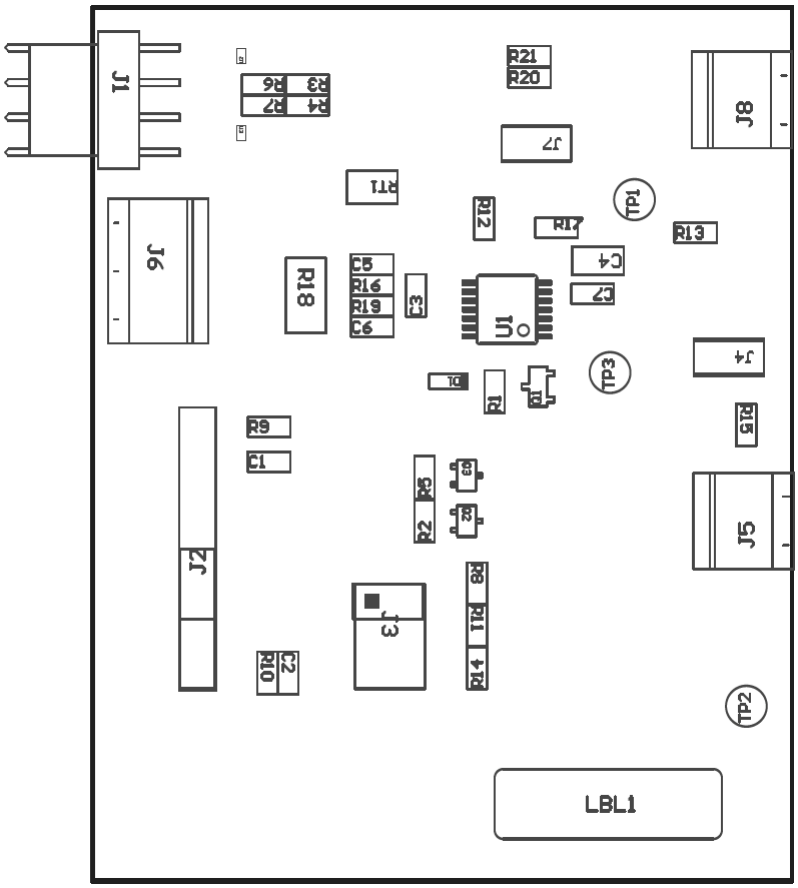


Figure 10. Top Assembly

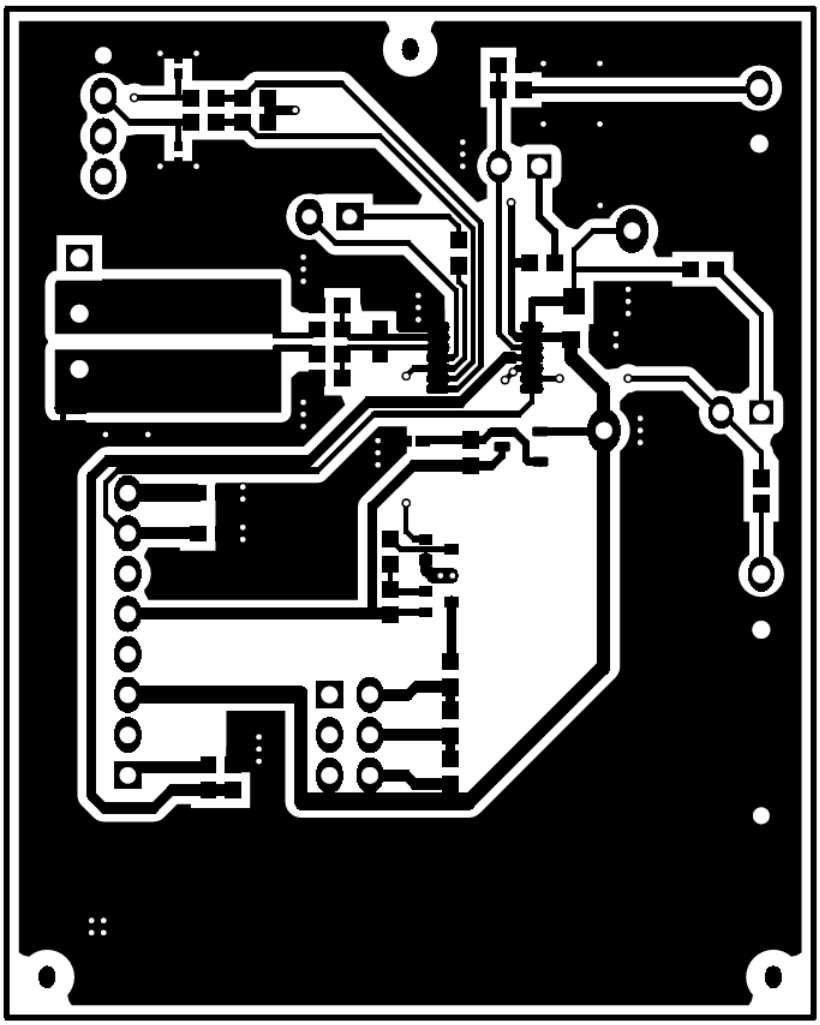


Figure 11. Top Layer

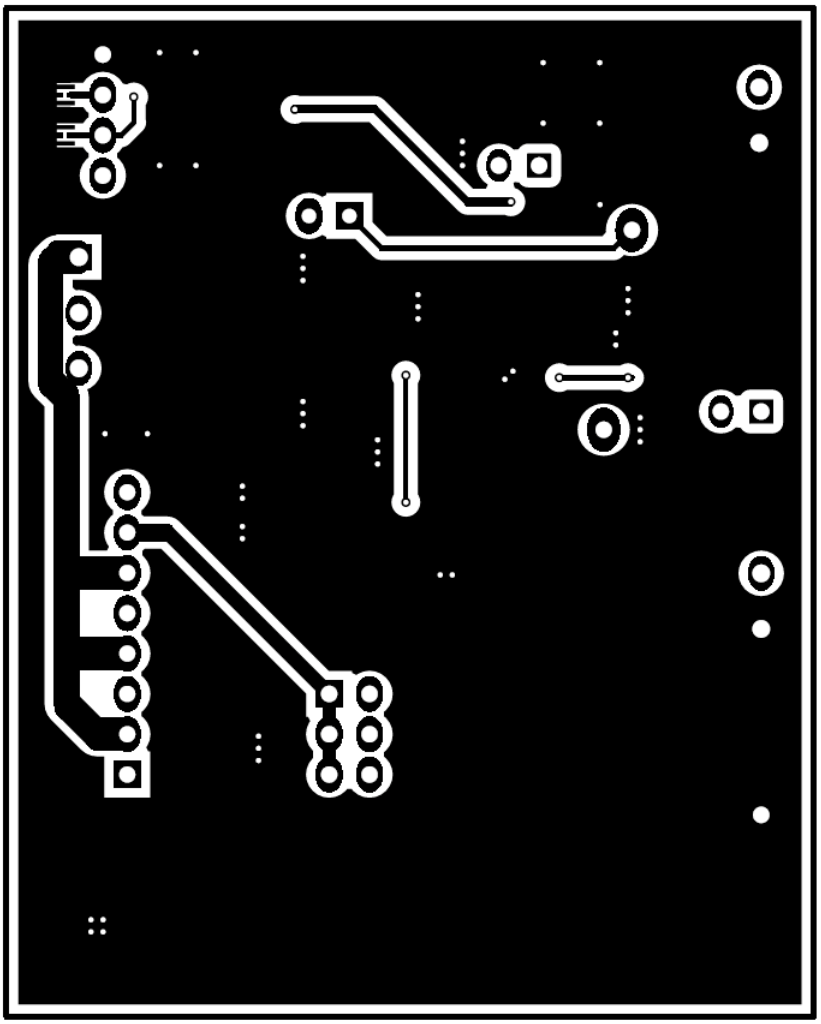


Figure 12. Bottom Layer

4.2 Bill of Materials

Table 5 lists the BOM for this EVM.

Table 5. Bill of Materials

Qty	RefDes	Value	Description	Size	Part Number	Manufacturer
1	C1	3300pF	CAP, CERM, 3300 pF, 50 V, +/- 10%, X7R, 0603	0603	GRM188R71H332KA01D	Murata
5	C2, C3, C5, C6, C7	0.1uF	CAP, CERM, 0.1 µF, 50 V, +/- 10%, X7R, 0603	0603	GRM188R71H104KA93D	Murata
1	C4	1uF	CAP, CERM, 1 µF, 50 V, +/- 10%, X7R, 0805	0805	GRM21BR71H105KA12L	Murata
1	D1	5.6V	Diode, Zener, 5.6 V, 300 mW, SOD-523	SOD-523	BZT52C5V6T-7	Diodes Inc.
1	J1		Header (friction lock), 100mil, 4x1, R/A, TH	4x1 R/A Header	22-05-3041	Molex
1	J2		Header, 100mil, 8x1, Tin, TH	100mil	PEC08SAAN	Sullins Connector Solutions
1	J3		Header, 100mil, 3x2, Tin, TH	3x2 Header	PEC03DAAN	Sullins Connector Solutions
2	J4, J7		Header, 100mil, 2x1, Tin, TH	100mil	PEC02SAAN	Sullins Connector Solutions
2	J5, J8		Terminal Block, 3.5 mm, 2x1, Tin, TH	3.5 mm, 2x1	39357-0002	Molex
1	J6		Terminal Block, 3.5 mm, 3x1, Tin, TH	3.5 mm, 3x1	39357-0003	Molex
1	Q1	60V	MOSFET, N-CH, 60 V, 0.17 A, SOT-23	SOT-23	2N7002-7-F	Diodes Inc.
1	Q2	-50V	MOSFET, P-CH, -50 V, -0.13 A, SOT-323	SOT-323	BSS84W-7-F	Diodes Inc.
1	Q3	50V	MOSFET, N-CH, 50 V, 0.2 A, SOT-323	SOT-323	BSS138W-7-F	Diodes Inc.
1	R1	10k	RES, 10k ohm, 5%, 0.1W, 0603	0603	CRCW060310K0JNEA	Vishay-Dale
3	R2, R12, R13	100k	RES, 100 k, 1%, 0.1 W, 0603	0603	CRCW0603100KFKEA	Vishay-Dale
3	R3, R4, R17	10.0k	RES, 10.0 k, 1%, 0.1 W, 0603	0603	CRCW060310K0FKEA	Vishay-Dale
1	R5	165k	RES, 165 k, 1%, 0.1 W, 0603	0603	CRCW0603165KFKEA	Vishay-Dale
5	R6, R7, R10, R16, R19	100	RES, 100, 1%, 0.1 W, 0603	0603	CRCW0603100RFKEA	Vishay-Dale
1	R8	160k	RES, 160 k, 0.1%, 0.1 W, 0603	0603	RG1608P-164-B-T5	Susumu Co Ltd
1	R9	16.5k	RES, 16.5 k, 0.1%, 0.1 W, 0603	0603	RG1608P-1652-B-T5	Susumu Co Ltd
2	R11, R14	90.9k	RES, 90.9 k, 0.1%, 0.1 W, 0603	0603	RG1608P-9092-B-T5	Susumu Co Ltd
2	R15, R20	1.0k	RES, 1.0k ohm, 5%, 0.1W, 0603	0603	CRCW06031K00JNEA	Vishay-Dale
1	R18	0.1	RES, 0.1, 1%, 0.5 W, 2010	2010	WSL2010R1000FEA	Vishay-Dale
1	R21	1.0Meg	RES, 1.0 M, 5%, 0.1 W, 0603	0603	CRCW06031M00JNEA	Vishay-Dale
1	RT1	10.0k	Thermistor NTC, 10.0k ohm, 1%, Disc, 5x8.4 mm	5x8.4 mm	103AT-2	SEMITEC Corporation
3	TP1, TP2, TP3	White	Test Point, Miniature, White, TH		5002	Keystone
1	U1		Single Lithium Primary State-of-Health and End-of-Service Monitor, PW0014A	PW0014A	BQ35100PWR	Texas Instruments
2	U2, U3		ESD in 0402 Package with 10 pF Capacitance and 6 V Breakdown, 1 Channel, -40 to +125 degC, 2-pin X2SON (DPY), Green (RoHS & no Sb/Br)	DPY0002A	TPD1E10B06DPYR	Texas Instruments

4.3 Schematic

Figure 13 illustrates the EVM schematic.

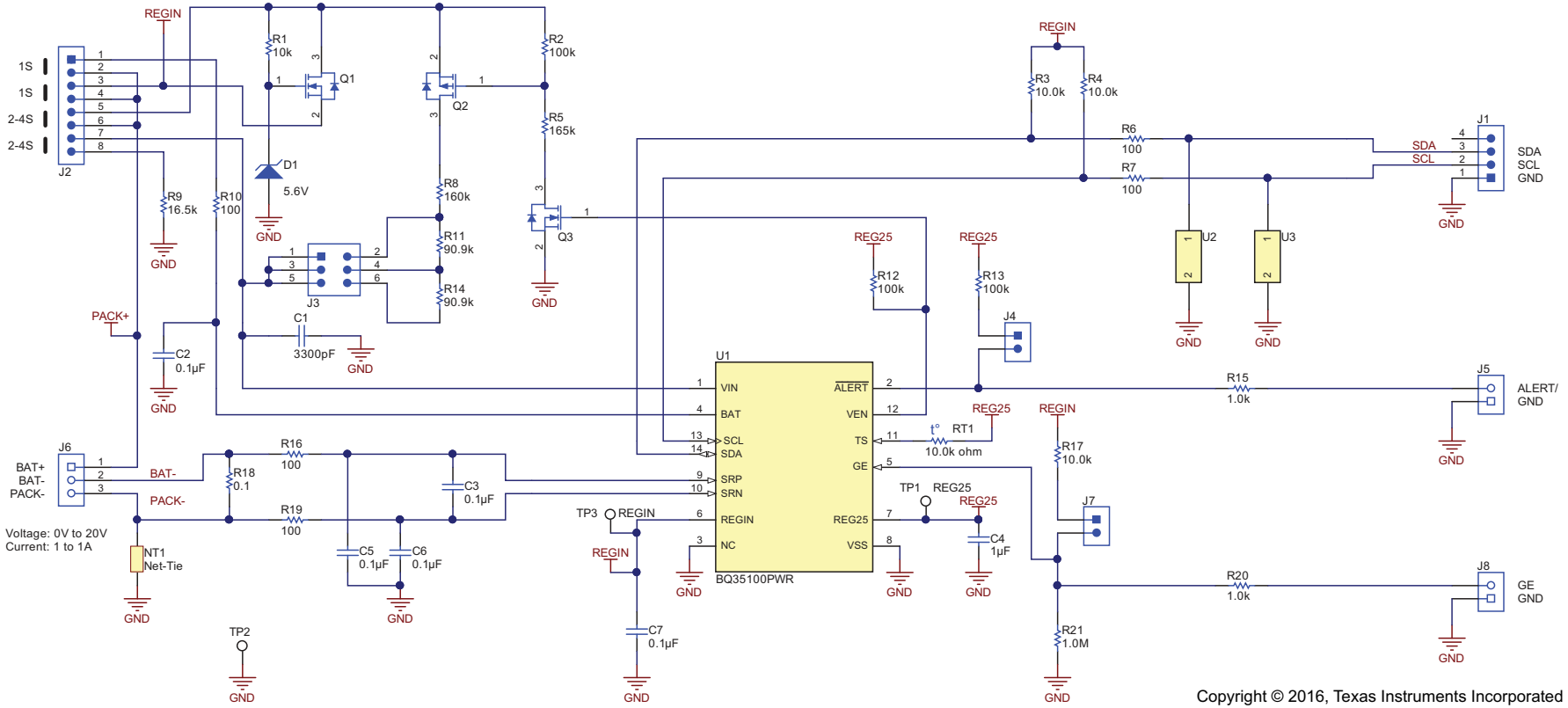


Figure 13. bq35100EVM Schematic

5 Related Documentation from Texas Instruments

Please contact the Texas Instruments Literature Response Center at (800) 477-8924 or the Product Information Center (PIC) at (972) 644-5580 for additional support. 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.

STANDARD TERMS AND CONDITIONS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, or documentation (collectively, an “EVM” or “EVMs”) to the User (“User”) in accordance with the terms and conditions set forth herein. Acceptance of the EVM is expressly subject to the following terms and conditions.

   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 and conditions 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 and conditions 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 any defects that are 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. Moreover, TI shall not be liable for any defects that result from User's design, specifications or instructions for such EVMs. Testing and other quality control techniques are used to the extent TI deems necessary or as mandated by government requirements. TI does not test all parameters of each EVM.

   2.3 If any EVM fails to conform to the warranty set forth above, TI's sole liability shall be at its option to repair or replace such EVM, 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.

3 *Regulatory Notices:*

   3.1 *United States*

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

      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*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSS standard(s). 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 by Radio Law of Japan to follow the instructions below with respect to EVMs:

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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2. 実験局の免許を取得後ご使用いただく。
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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 WRITTEN DESIGN MATERIALS PROVIDED WITH THE EVM (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 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 AND CONDITIONS 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 MADE, CONCEIVED OR ACQUIRED PRIOR TO OR AFTER DELIVERY OF THE EVM.

7. *USER'S INDEMNITY OBLIGATIONS AND REPRESENTATIONS.* USER WILL DEFEND, INDEMNIFY AND HOLD TI, ITS LICENSORS AND THEIR REPRESENTATIVES HARMLESS FROM AND AGAINST ANY AND ALL CLAIMS, DAMAGES, LOSSES, EXPENSES, COSTS AND LIABILITIES (COLLECTIVELY, "CLAIMS") ARISING OUT OF OR IN CONNECTION WITH ANY HANDLING OR USE OF THE EVM THAT IS NOT IN ACCORDANCE WITH THESE TERMS AND CONDITIONS. THIS OBLIGATION SHALL APPLY WHETHER CLAIMS ARISE UNDER STATUTE, REGULATION, OR THE LAW OF TORT, CONTRACT OR ANY OTHER LEGAL THEORY, AND EVEN IF THE EVM FAILS TO PERFORM AS DESCRIBED OR EXPECTED.

8. *Limitations on Damages and Liability:*

   8.1 *General Limitations*. IN NO EVENT SHALL TI BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF THESE TERMS ANDCONDITIONS OR THE USE OF THE EVMS PROVIDED HEREUNDER, REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCLUDED DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, COST OF REMOVAL OR REINSTALLATION, ANCILLARY COSTS TO THE PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, RETESTING, OUTSIDE COMPUTER TIME, LABOR COSTS, LOSS OF GOODWILL, LOSS OF PROFITS, LOSS OF SAVINGS, LOSS OF USE, LOSS OF DATA, OR BUSINESS INTERRUPTION. NO CLAIM, SUIT OR ACTION SHALL BE BROUGHT AGAINST TI MORE THAN ONE YEAR AFTER THE RELATED CAUSE OF ACTION HAS OCCURRED.

   8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY WARRANTY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS AND CONDITIONS, OR ANY USE OF ANY TI EVM PROVIDED HEREUNDER, EXCEED THE TOTAL AMOUNT PAID TO TI FOR THE PARTICULAR UNITS SOLD UNDER THESE TERMS AND CONDITIONS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM AGAINST THE PARTICULAR UNITS SOLD TO USER UNDER THESE TERMS AND CONDITIONS SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

9. *Return Policy*. Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

10. *Governing Law:* These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.

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No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or “enhanced plastic” are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have ***not*** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

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