

## ***bq24180 Evaluation Module***

The bq24180 evaluation module allows for the complete evaluation of the bq24180, a switch-mode, charge-management device for single-cell Li-ion and Li-polymer batteries used in a wide range of portable applications. This document provides a test summary, equipment setup, and the procedures for using with a single-cell battery or a simulated battery load.

### **Contents**

1	Introduction .....	2
	1.1 EVM Features .....	2
	1.2 General Description .....	2
	1.3 I/O Description .....	2
	1.4 Control and Key Parameters Setting .....	3
	1.5 Recommended Operating Conditions .....	3
2	Test Summary .....	3
	2.1 Equipment .....	3
	2.2 DCOUT Load #2 .....	3
	2.3 Multimeters and Oscilloscope .....	3
	2.4 Computer .....	4
	2.5 HPA172 Communication Kit .....	4
	2.6 Software .....	4
3	Equipment Setup .....	4
4	Procedure for Use With Single-Cell Li-Ion Battery or Simulated Battery Load .....	6
	4.1 Charge Voltage and Current Regulation .....	6
5	Schematic, Board Layouts, and Bill of Materials .....	8
	5.1 bq24180EVM Schematic .....	8
	5.2 Board Layouts .....	9
	5.3 Bill of Materials .....	13

### **List of Figures**

1	Connections of HPA172 Kit.....	4
2	Evaluation Setup .....	5
3	Main Window of bq24180 Evaluation Software .....	5
4	TP9 – Switch Node at 5-Vdc Input and 1.15-A Charge With 3.3-Vdc Battery .....	7
5	Top Assembly .....	9
6	Top Copper Layer .....	10
7	Bottom Copper Layer .....	11
8	Silkscreen.....	12

## 1 Introduction

### 1.1 EVM Features

- Evaluation module for bq24180
- High-efficiency, fully integrated NMOS-NMOS synchronous buck charger with 3-MHz frequency
- Integrated power FETs for up to 1.5-A charge rate
- Programmable battery voltage, charge current, and input current via I<sup>2</sup>C interface
- Input operating range 4-V to 9.5-V normal operation and 9.5-V to 16-V limited operation
- Switched battery power, DCOUT
- LED indication for status signals
- Test points for key signals available for testing purposes. Easy probe hook-up
- Jumpers available. Easy-to-change connections.

### 1.2 General Description

The bq24180 evaluation module (EVM) is a complete charger module for evaluating a compact, flexible, high-efficiency, USB-friendly switch-mode charge-management solution for single-cell Li-ion and Li-polymer batteries used in a wide range of portable applications.

The bq24180 integrates a synchronous PWM controller, power MOSFETs, input current sensing, high-accuracy current and voltage regulation, and charge termination, into a small WCSP package.

The charge parameters can be programmed through an I<sup>2</sup>C interface.

For details, see the bq24180 data sheet ([SLUSA02](#)).

### 1.3 I/O Description

Jack	Description
J1-DC+	AC adapter or USB, positive output
J1-GND	AC adapter or USB, Ground
J2-(CSOUT)	Connect to battery positive terminal
J2-BAT- (GND)	Battery negative terminal, connect to Ground (DC-)
J5-SCL	I <sup>2</sup> C clock, connect to SCL pin
J5-SDA	I <sup>2</sup> C data, connect to SDA pin
J5-DC-	AC adapter or USB, Ground
J4-Communication Connector	Connect to 10-pin ribbon cable to USB interface adapter
J3-DCOUT	Switched battery connection
J3-GND	AC adapter or USB, Ground
J6-TS	Connect to external 4.7k NTC thermistor if JMP4 is removed.
J6-STAT	External status monitor connection; set JMP3 shunt to EXT
J6-INT	Status indication for host processor
J6-GND	Ground reference connection

## 1.4 Control and Key Parameters Setting

Jack	Description	Factory Setting
JMP1	HI 1-2: CD high (disables charge) LO 2-3: CD low (enables charge)	Jumper on LO (2-3)
JMP2	HI 1-2: high (USB source connected) LO 1-2: low (adapter source connected)	Jumper on (1-2)
JMP3	LED 1-2: Connect STAT pin to LED on EVM EXT 2-3: Connect STAT pin to J6-3	Jumper on LED (1-2)
JMP4	HI 1-2: High (charger disabled in default mode) LO 2-3: TS biased with fixed 4.7-kΩ resistor	Jumper on LED (2-3)

## 1.5 Recommended Operating Conditions

		Min	Typ	Max	Unit
Supply voltage, $V_{IN}$	Input voltage from ac adapter input	4	5	9	V
Battery voltage, $V_{BAT}$	Voltage applied at VBAT terminal of J8	0	3-4.2	4.44	V
Supply current, $I_{AC}$	Maximum input current from ac adapter input	0	0.1-0.5	1.5	A
Charge current, $I_{chg}$	Battery charge current	0.55	0.7	1.5	A
Operating junction temperature range, $T_J$		0		125	°C

## 2 Test Summary

### 2.1 Equipment

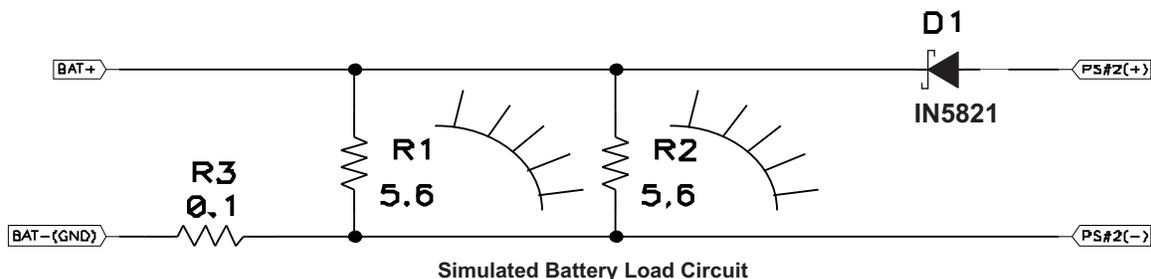
#### 2.1.1 Power Supplies

Power Supply 1 (PS#1) is a power supply capable of supplying 5 V at 2 A.

Optional Power Supply 2 is for use with optional battery simulated load (PS#2), a power supply capable of supplying 5 V at 2 A.

#### 2.1.2 Battery Pack or Simulated Load

A Li-ion, single-cell pack with capacity of at least 1200 mAh can be used or a simulated load of 2.8 Ω (two 5.6-Ω, ≥ 10-W power resistors in parallel), with a 0.1-Ω current sense in the return to the UUT and a power silicon diode (cathode) connected to the BAT+ side of the load.



### 2.2 DCOUT Load #2

A ≥ 25-Ω, ≥ 3-W power resistor

### 2.3 Multimeters and Oscilloscope

Three Fluke 75, (equivalent or better) multimeters

Oscilloscope that can capture 10-MHz waveforms

## 2.4 Computer

A computer with at least one USB port and a USB cable. The bq24180 evaluation software must be properly installed.

## 2.5 HPA172 Communication Kit

A HPA172 USB to I<sup>2</sup>C communication kit.

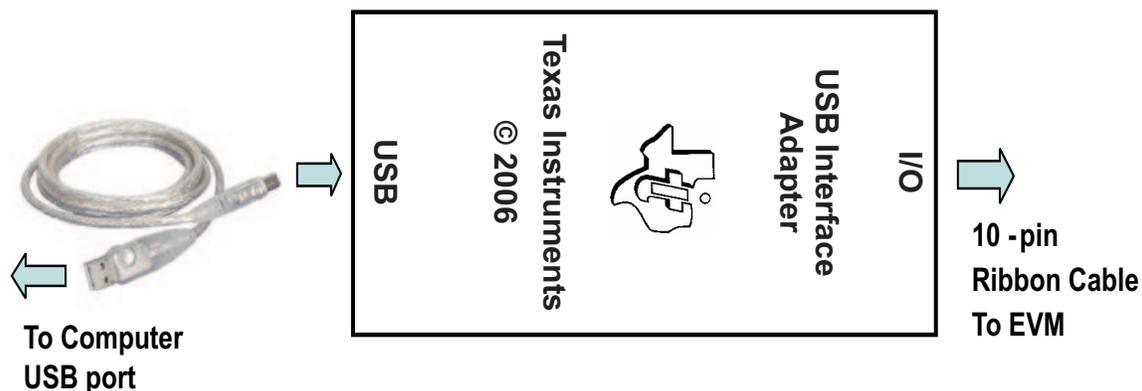
## 2.6 Software

1.0 BQ24180A\_Gui\_Software.zip

Double-click on the SETUP.EXE file. Follow the installation steps.

## 3 Equipment Setup

1. Set PS#1 for 5 V  $\pm$  100 mVdc, 1.7  $\pm$  0.1-A current limit and then turn off supply. Connect the output of PS#1 to J1 (DC+, DC-).
2. If simulated battery circuit is used in place of a battery, set the PS#2 for 3.5 V  $\pm$  100 mVdc, 1.8  $\pm$  0.1-A current limit and then turn off supply.
3. Connect the battery (discharged to  $\sim$ 3.1 V) or simulated battery load to J2 as shown in [Figure 2](#). If simulated load is used, connect the output of PS#2 (+ lead) to the anode of the simulated load and return to ground (DC-).
4. Connect the system load to J3 (DCOUT, GND).
5. Connect digital multimeter 1 (DMM#1) across J2 (BAT+, GND), and set to measure DCV (5-V range).
6. Connect DMM#2 across BAT- Sense Resistor (0.1  $\Omega$ ,  $\geq$  2 W), and set to measure mVdc (< 300-mV range).
7. Connect DMM#3 across the J3 (DCOUT, GND), and set to measure DCV (5-V range).
8. Connect J4 to HPA172 kit by 10-pin ribbon cable. Connect the USB port of the HPA172 kit to the USB port of the computer. The connections are shown in [Figure 1](#).



**Figure 1. Connections of HPA172 Kit**

9. Install jumpers JMP1-2/3 (CD, GND); JMP2-1/2 (PSEL, HI); JMP3-1/2 (LED); JMP4-2/3 (TS\_4.7k, GND)
10. Connect scope to TP9 and set to 2 V/div and 200 ns/div (not shown in setup).

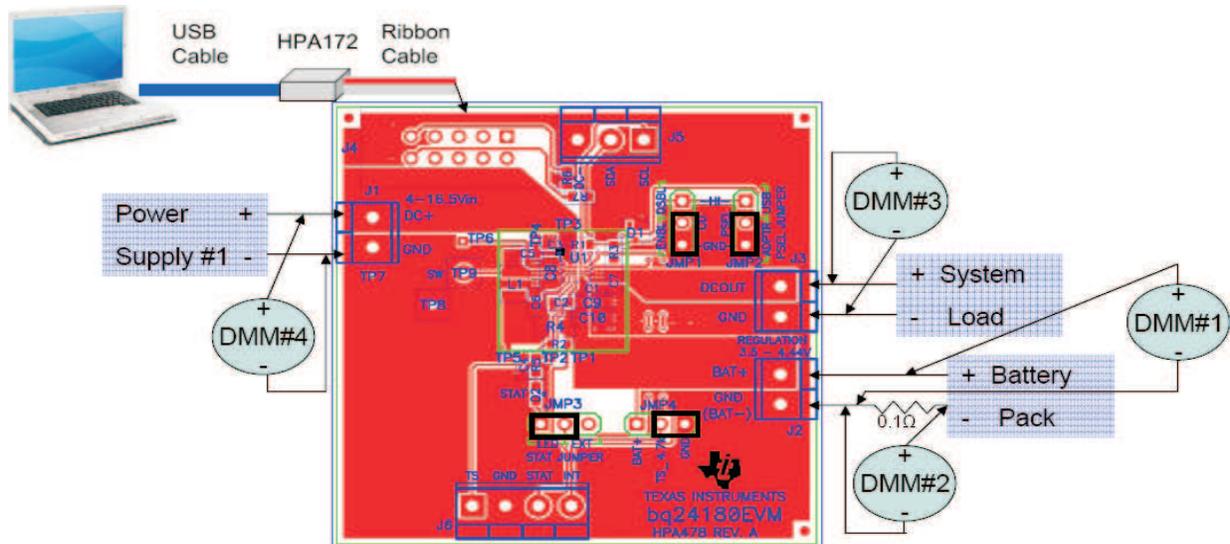


Figure 2. Evaluation Setup

11. Ensure that EQUIPMENT SETUP steps are followed. Turn on the computer. Open the bq24180 evaluation software, by double-clicking on bq24180.exe (file found in the product folder, but needs uploaded to the computer running the test). The main window of the software is shown in Figure 3.

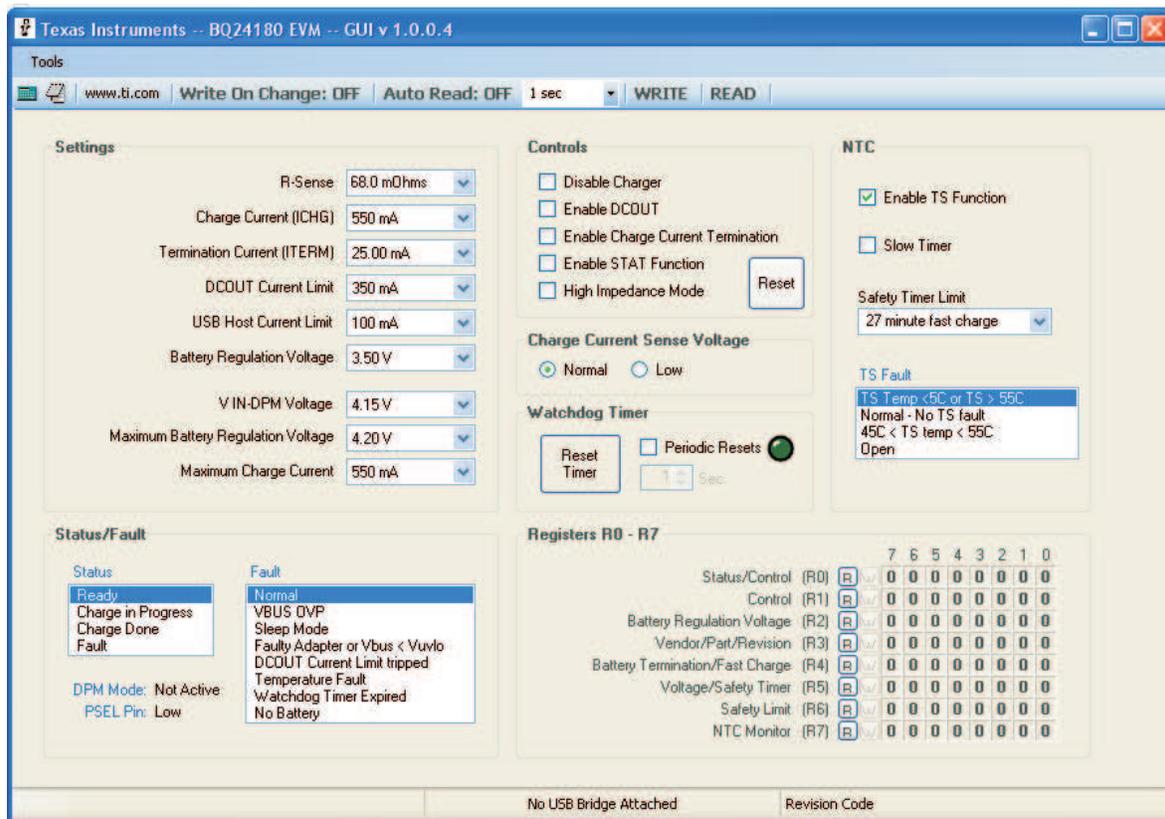


Figure 3. Main Window of bq24180 Evaluation Software

## 4 Procedure for Use With Single-Cell Li-Ion Battery or Simulated Battery Load

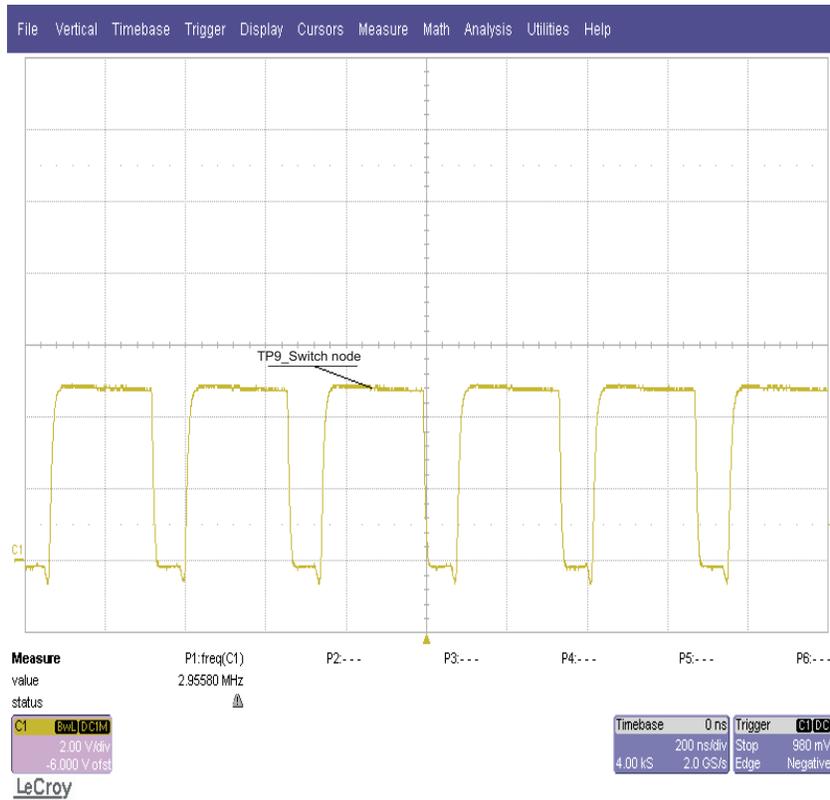
### 4.1 Charge Voltage and Current Regulation

- Turn on PS#2 if simulated battery load is used and then PS#1.
- Software setup:
  - (a) Under **Settings**: Set **Maximum Battery Regulation Voltage** to 4.3 V via the pulldown window.
  - (b) Under **Settings**: Set **Maximum Charge Current** to 1.55 A via the pulldown window.
  - (c) Under **Registers R0-R7**: Click the Write button (**W**) by the **Safety Limit (R6)** in the lower right corner. These values can only be changed on the first write command after having been powered by the battery.
  - (d) Under **Watchdog Timer**: Check the **Periodic Resets** box, and set time to 20 Sec.
  - (e) On the **Top Tool Bar**: Select the **Write On Change** button to turn to ON.
  - (f) On the **Top Tool Bar**: Select the **Auto Read** button to turn to ON, and set the time to 10 Sec via the pulldown window.
- Measure and verify the following conditions:
  - **Verify** → Meter #1 is between 3.0 and 3.4 V. (If battery is used and its voltage is over the default regulation voltage, then there is no charge current.)
  - **Verify** → Meter #2 is between 9 mV and 15 mV (90 to 150 mA)
  - **Verify** → Meter #3 is between 0.0 and 0.1 V.
  - **Verify** → Input Current of PS#1 is between 80 mA and 100 mA.
  - **Verify** → The **STAT LED**, on the UUT, is off (disabled).

This is an example of default mode where the input current limit is 100 mA, maximum, with a maximum regulation of 3.5 V. If  $V_{BAT} > 3.5$  V, then the charge current goes to zero.
- Operation Changes Via Software:
  - (a) Under **Settings**: Set **Battery Regulation Voltage** to 4.0 V via the pulldown window.
  - (b) Under **Settings**: Set **USB Host Current Limit** to **No Limit** via the pulldown window.
  - (c) Under **Settings**: Set **Charge Current (ICHG)** to 1.15 A via the pulldown window.
  - (d) Under **Controls**: Check the **Enable DCOUT** box.
  - (e) Under **Controls**: Check the **Enable STAT Function** box.
- Measure and verify the following conditions:
  - **Verify** → Meter #1 is between 3.2 V and 3.6 V.
  - **Verify** → Meter #2 is between 80 mV and 120 mV (800 mA to 1200 mA).
  - **Verify** → Meter #3 is between 3.2 V and 3.6 V.
  - **Verify** → Input Current of PS#1 is between 75 mV and 100 mV (750 mA and 1000 mA).
  - **Verify** → The **STAT LED**, on the UUT, is on (enabled).

This shows operation in fast charge constant current.
- Measure TP9 with ground sleeve of oscilloscope probe touching TP8 (GND). Set the oscilloscope to 200 ns/div and 2 V/div. The waveform must look like [Figure 4](#) with the following boundaries: frequency must be 3 MHz  $\pm$  20%, the amplitude is +5 V  $\pm$  0.5 V and 0 V to –0.5 V and the duty cycle is 30  $\pm$  10% duty cycle.
- Uncheck the Watchdog Timer box and wait until the charge goes into default mode (less than 35 seconds), and observe that the charge current has dropped to ~125 mA (USB 100-mA input current limit).
- Ground the TS pin by placing a short between J6-TS and J6-GND. This simulates a high-temperature fault in default mode and shuts down the charge current in less than 35 seconds. To return to default mode, remove the short.
 

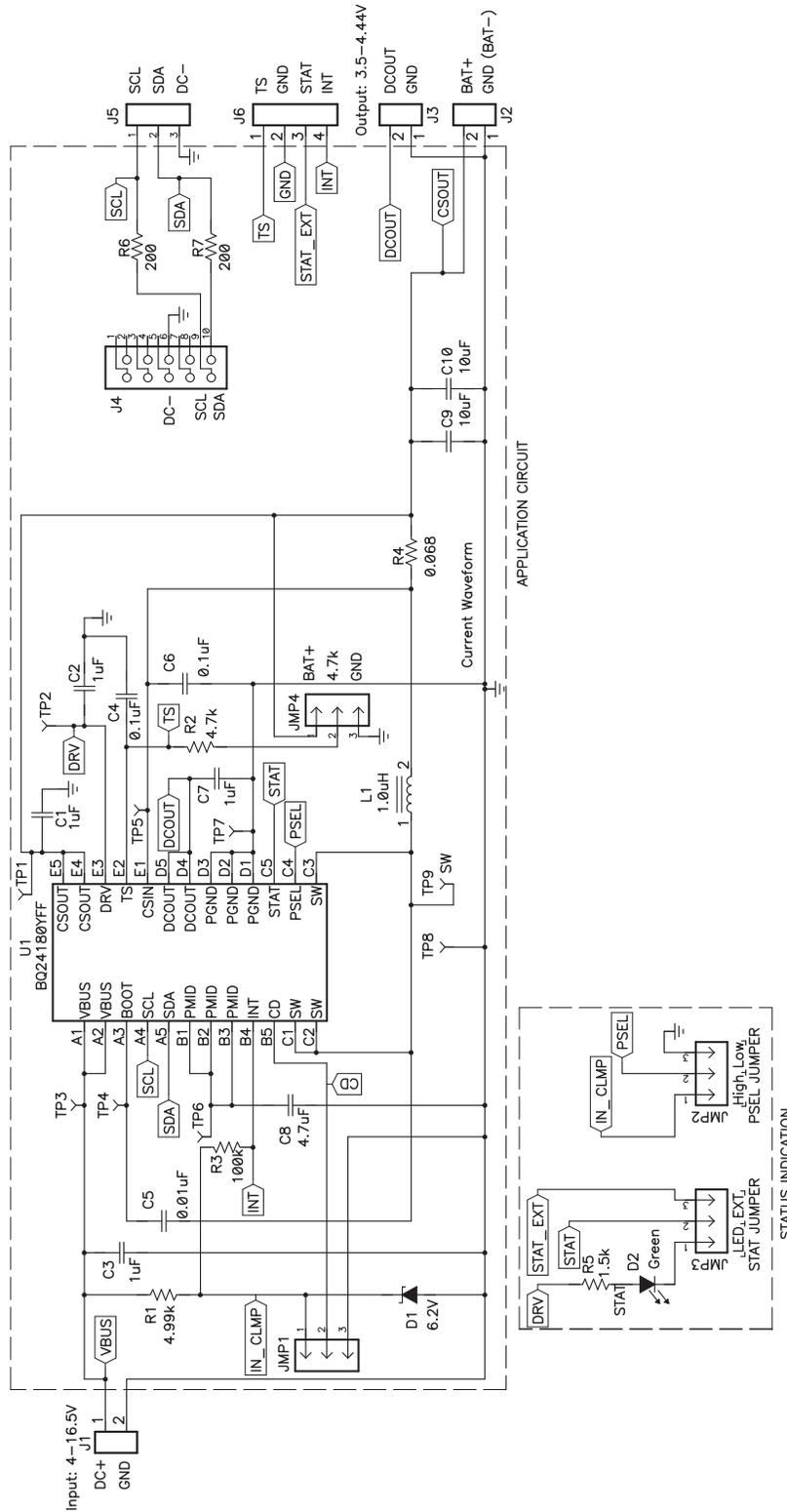
A temperature fault in default mode shuts off the charge, whereas a temperature fault in normal communication mode only notifies the host of a change in its register and does not disable the charge.
- See the data sheet for complete information on all specifications and functions.
- The software menu is intuitive and can be used to change many parameters.
- After evaluation, turn off PS#1 and then PS#2, if used.



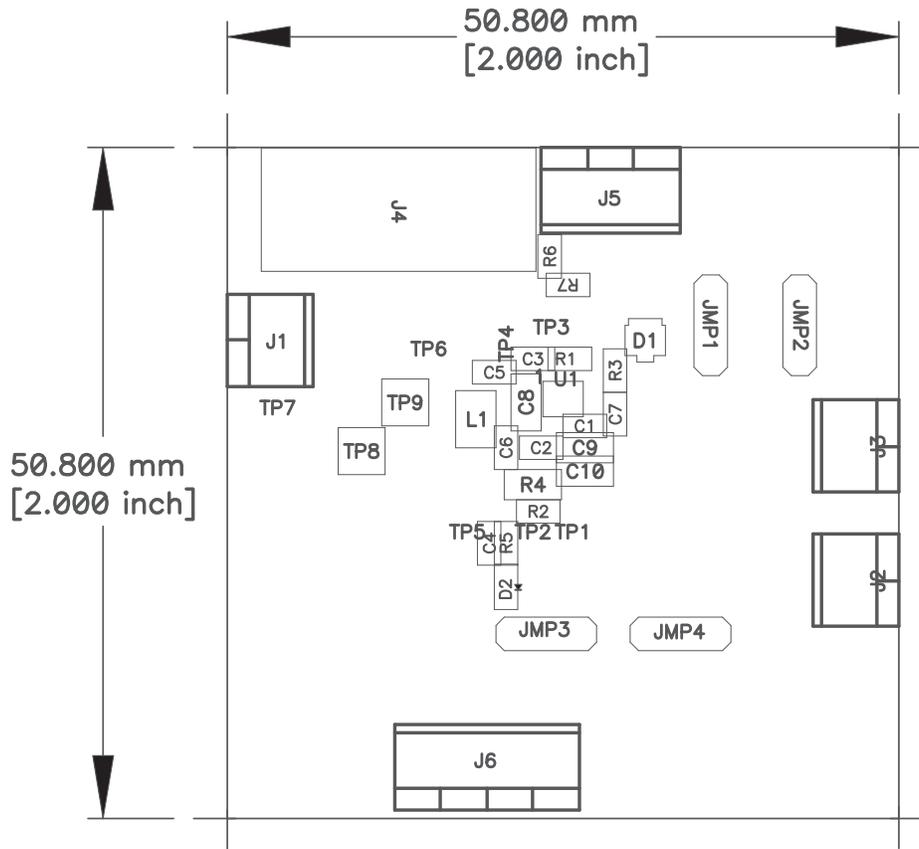
**Figure 4. TP9 – Switch Node at 5-Vdc Input and 1.15-A Charge With 3.3-Vdc Battery**

## 5 Schematic, Board Layouts, and Bill of Materials

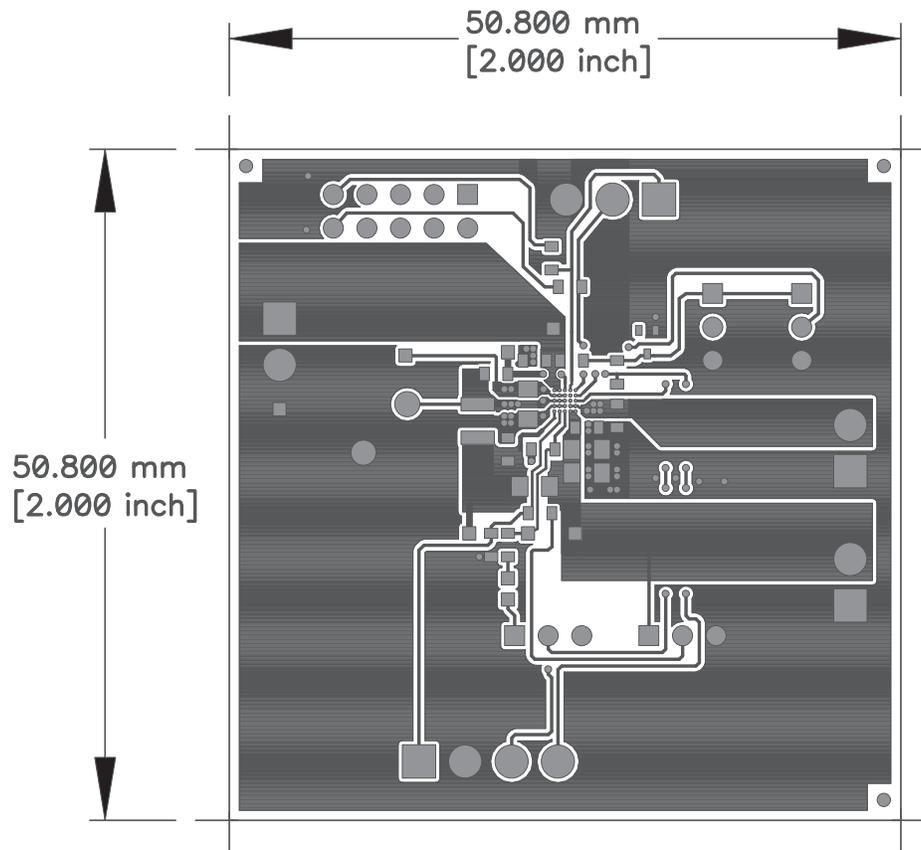
### 5.1 bq24180EVM Schematic



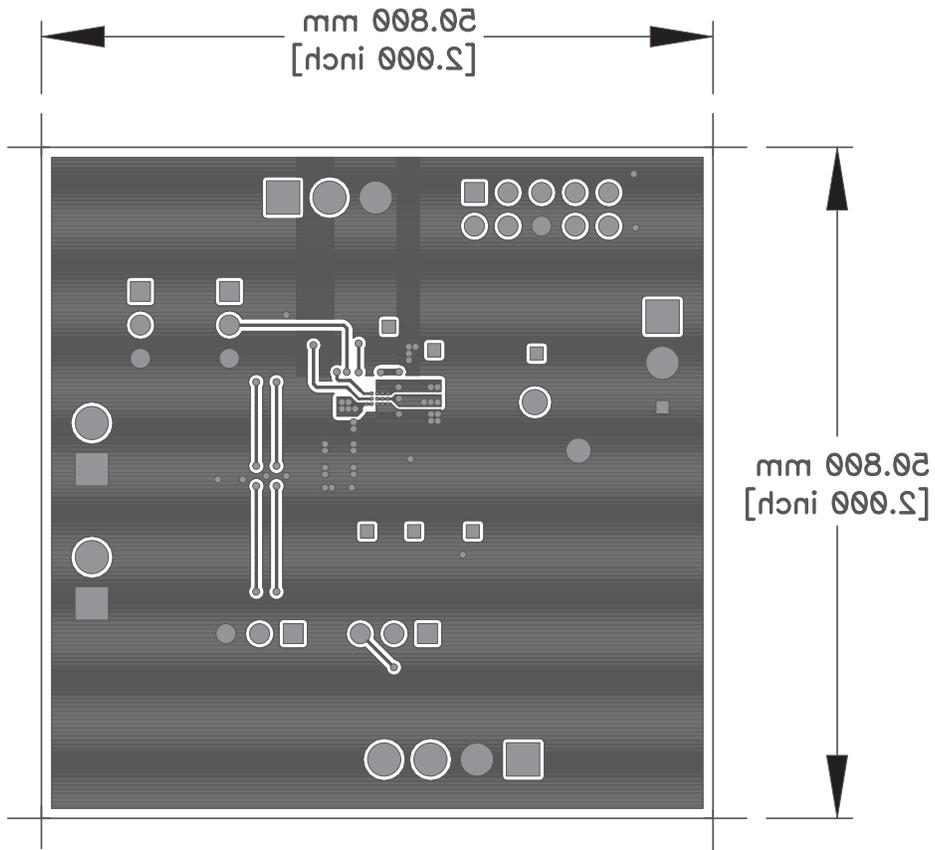
## 5.2 Board Layouts



**Figure 5. Top Assembly**



**Figure 6. Top Copper Layer**



**Figure 7. Bottom Copper Layer**

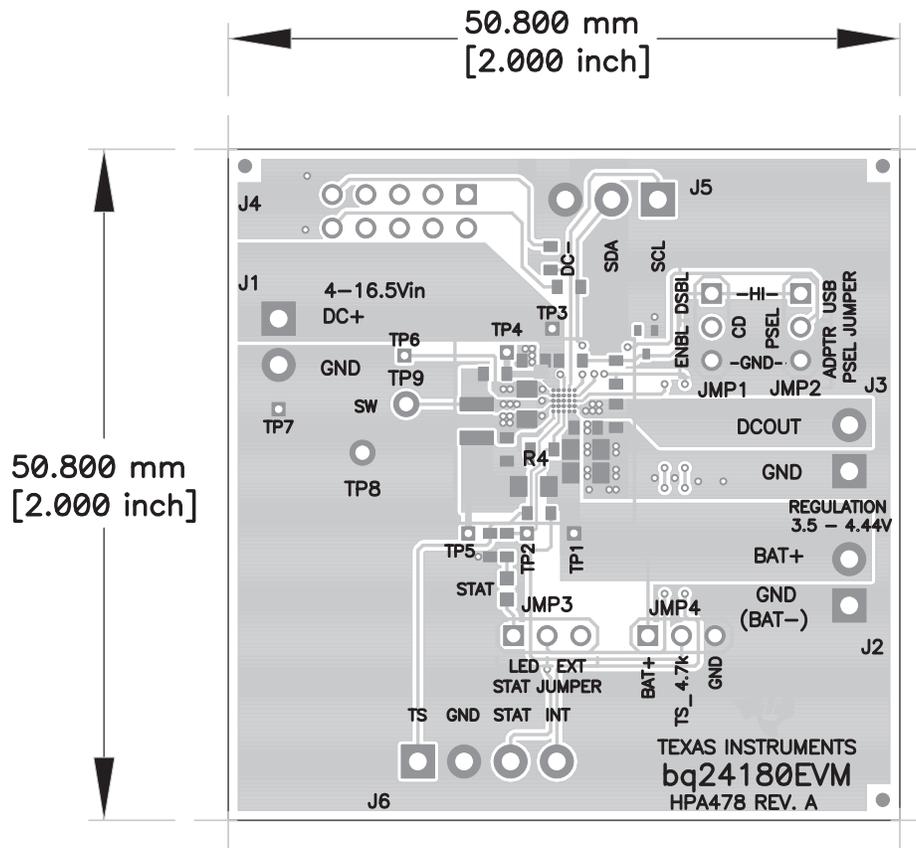


Figure 8. Silkscreen

### 5.3 Bill of Materials

**Table 1. Bill of Materials for bq24180EVM**

Count	RefDes	Value	Description	Size	Part Number	MFR
3	C1, C2, C7	1 µF	Capacitor, Ceramic, Low Inductance, 10V, X5R, 10%	0603	ECJ-1VB1A105K	Panasonic
2	C9, C10	10 µF	Capacitor, Ceramic, 10V, X5R, 10%	0805	ECJ-2FB1A106K	Panasonic
1	C3	1 µF	Capacitor, Ceramic, X5R, 16V, ±10%	0603	ECJ-1VB1C105K	Panasonic
2	C4, C6	0.1 µF	Capacitor, Ceramic, Low Inductance, 16V, X7R, 10%	0603	ECJ-1VB1C104K	Panasonic
1	C5	0.01 µF	Capacitor, Ceramic, Low Inductance, 25V, X7R, 10%	0603	ECJ-1VB1E103K	Panasonic
1	C8	4.7 µF	Capacitor, Ceramic, 16V, X5R, 10%	0805	ECJ-2FB1C475K	Panasonic
1	D1	BZX84C6V2W	Diode, Zener, 6.2-V, 200-mW	SOT-323	BZX84C6V2W	Diodes
1	D2	Green	Diode, LED, Green, 2.1-V, 20-mA, 6-mcd	0603	LTST-C190GKT-7-F	Lite On
3	J1, J2, J3	ED555/2DS	Terminal Block, 2-pin, 6-A, 3.5mm	0.27 x 0.25 inch	ED555/2DS	OST
1	J4		Connector, Male Straight 2x5 pin, 100mil spacing, 4 Wall	0.338 x 0.788 inch	N2510-6002-RB	3M
1	J5	ED555/3DS	Terminal Block, 3-pin, 6-A, 3.5mm	0.41 x 0.25 inch	ED555/3DS	OST
1	J6	ED555/4DS	Terminal Block, 4-pin, 6-A, 3.5mm	0.55 x 0.25 inch	ED555/4DS	OST
4	JMP1, JMP2, JMP3, JMP4	PEC03SAAN	Header, Male 3-pin, 100mil spacing,	0.100 inch x 3	PEC03SAAN	Sullins
1	L1	1.0 µH	Inductor, SMT, 1.5A, 80milliohm, ±30%	2.5 x 2.0 mm	LQM2HPN1R0MJO or MIPS2520D1R0 or MDT2520-CN1R0M or CP1008	Murata or FDK or TOKO or Inter-Technical
1	R1	4.99k	Resistor, Chip, 1/16W, 1%	0603	Std	Std
1	R2	4.7k	Resistor, Chip, 1/16W, 1%	0603	Std	Std
1	R3	100k	Resistor, Chip, 1/16W, 1%	0603	Std	Std
1	R4	0.068	Resistor, Chip, 1/10W, 1%	0805	Std	Std
1	R5	1.5k	Resistor, Chip, 1/16-W, 5%	0603	Std	Std
2	R6, R7	200	Resistor, Chip, 1/16W, 1%	0603	Std	Std
0	TP1 thru TP7	STD	Test Point, 0.020 Hole"			
1	TP8	5001	Test Point, Black, Thru Hole Color Keyed	0.100 x 0.100 inch	5001	Keystone
1	TP9	5000	Test Point, Red, Thru Hole Color Keyed	0.100 x 0.100 inch	5000	Keystone
1	U1	BQ24180YFF	IC, Fully Integrated Switch-Mode One-Cell Li-Ion Charger with Full USB Compliance	WCSP	BQ24180YFF	TI
1	—		PCB, 2 In x 2 In x 0.031 In		HPA478	Any
4		929950-00	Shunts	100 mill	929950-00	3M

Notes: 1. These assemblies are ESD sensitive, ESD precautions shall be observed.  
2. These assemblies must be clean and free from flux and all contaminants. Use of no clean flux is not acceptable.  
3. These assemblies must comply with workmanship standards IPC-A-610 Class 2.  
4. Ref designators marked with an asterisk (\*\*\*) cannot be substituted. All other components can be substituted with equivalent MFG's components.  
5. Installed jumpers JMP1-2/3 (CD, GND); JMP2-1/2 (PSEL, HI); JMP3-1/2 (LED); JMP4-2/3 (TS\_4.7k, GND)

## Evaluation Board/Kit Important Notice

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

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

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

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

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

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

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

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

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

## FCC Warning

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

## EVM Warnings and Restrictions

It is important to operate this EVM within the input voltage range of 0 V to 16 V and the output voltage range of 0 V to 4.5 V .

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

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

During normal operation, some circuit components may have case temperatures greater than 75° C. The EVM is designed to operate properly with certain components above 75° C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2011, Texas Instruments Incorporated

## IMPORTANT NOTICE

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

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

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

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

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

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

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

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

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

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

### Products

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
RF/IF and ZigBee® Solutions	<a href="http://www.ti.com/lprf">www.ti.com/lprf</a>

### Applications

Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Space, Avionics and Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
Transportation and Automotive	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>
Wireless	<a href="http://www.ti.com/wireless-apps">www.ti.com/wireless-apps</a>

TI E2E Community Home Page

[e2e.ti.com](http://e2e.ti.com)

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2011, Texas Instruments Incorporated