

BOOSTXL-BATTPACK Fuel Tank BoosterPack With Rechargeable Lithium Polymer Battery for TI LaunchPad Development Kits

User's Guide



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1	BOOSTXL-BATTPACK Overview	4
1.1	Overview	4
1.2	Kit Contents	5
2	Functional Description	6
2.1	Single Cell Li-Ion Battery Charger (bq24210)	6
2.2	Fuel Gauge (bq27510-G3)	6
2.3	LEDs	6
2.4	Headers	7
2.5	Jumpers	7
3	Getting Started With BOOSTXL-BATTPACK BoosterPack	8
3.1	Hardware Preparation	8
3.2	MSP430 Value Line LaunchPad (MSP-EXP430G2)	9
3.3	TIVA C LaunchPad (EK-TM4C123GXL)	13
3.4	C2000 LaunchPad (LAUNCHXL-F28027)	18
4	ESD Precautions and Proper Handling Procedures	23
5	Battery Usage Precautions and Warnings	24
6	Troubleshooting	25
7	Schematics	28
8	PCB Layout	29

List of Tables

1	JP1 Connector.....	7
2	JP2 Connector.....	7

BOOSTXL-BATTPACK

The Fuel Tank BoosterPack (BOOSTXL-BATTPACK) is designed to provide battery power to the TI LaunchPad development kits. The BoosterPacks can be connected to the LaunchPads with two 20-pin male headers. The Fuel Tank BoosterPack is intended to be a power source to TI LaunchPads. This BoosterPack enables the portability of LaunchPads for ease of use. It comes with a rechargeable lithium polymer battery.

1 BOOSTXL-BATTPACK Overview

1.1 Overview

Figure 1 shows the Fuel Tank BoosterPack.

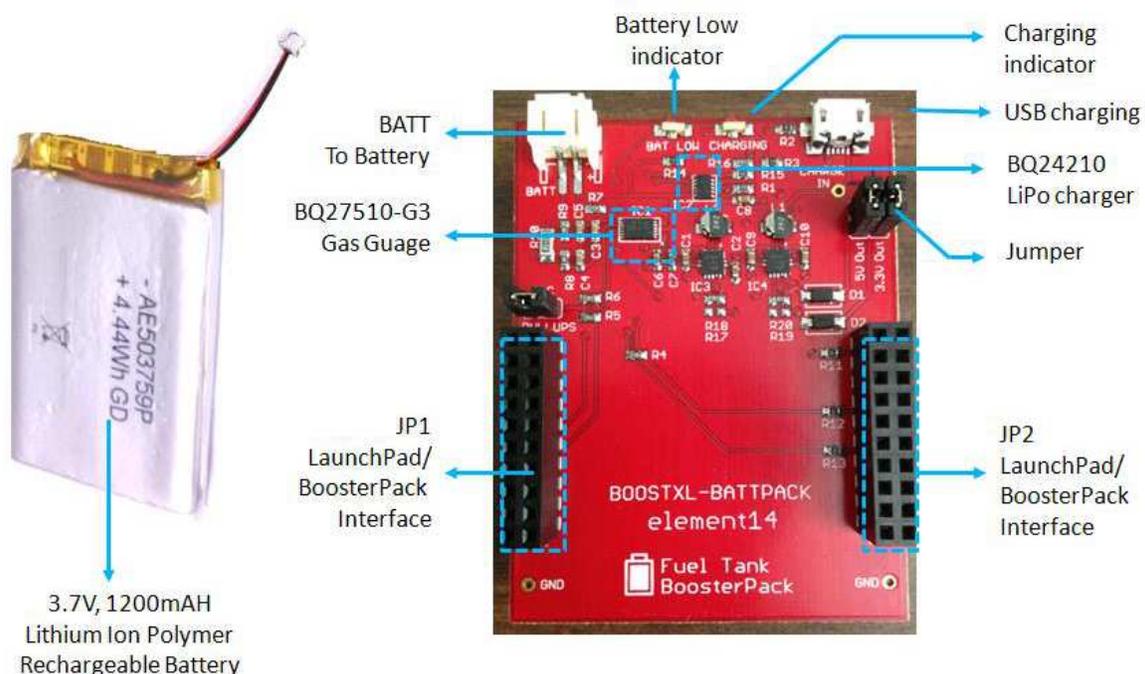


Figure 1. Fuel Tank BoosterPack

The Fuel Tank BoosterPack is available for purchase from the TI eStore, <https://estore.ti.com/>, and from element14, www.element14.com/BoosterPack.

The Fuel Tank BoosterPack features Texas Instruments lithium polymer battery charger and gas gauge devices, together with a 3.7-V 1200-mAH LiPo battery. When connected to the LaunchPad, the BoosterPack can act as a power source to the LaunchPads and provide portability and flexibility on applications.

The Fuel Tank BoosterPack features:

- TI bq24210, 800-mA, Single-Input, Single Cell Li-Ion Battery Solar Charger (see data sheet [SLUSA76](#))
- TI bq27510-G3, System-Side Impedance Track Fuel Gauge With Direct Battery Connection (see data sheet [SLUSAT1](#))
- Battery low and charging LED indicators
- 3.7-V 1200-mAH lithium polymer battery

1.2 Kit Contents

The Fuel Tank BoosterPack contains the following items:

- Fuel Tank BoosterPack Board
- 3.7-V 1200-mAH lithium polymer rechargeable battery
- Quick start guide

2 Functional Description

The Fuel Tank BoosterPack is intended to be a power source to TI LaunchPads. This BoosterPack enables the portability of LaunchPads for ease of use. It comes with a rechargeable lithium polymer battery.

2.1 Single Cell Li-Ion Battery Charger (bq24210)

The TI bq24210 device is a highly-integrated Li-ion linear charger targeted at space-limited, portable applications. The IC has a single power output that charges the battery. The battery is charged in three phases: conditioning, constant current, and constant voltage. In all charge phases, an internal control loop monitors the IC junction temperature and reduces the charge current if an internal temperature threshold is exceeded.

2.2 Fuel Gauge (bq27510-G3)

The TI bq27510-G3 device system-side Li-ion battery fuel gauge is a microcontroller peripheral that provides fuel gauging for single-cell Li-Ion battery packs. The bq27510-G3 device uses the patented Impedance Track™ algorithm for fuel gauging and provides information such as remaining battery capacity (mAh), state-of-charge (%), runtime to empty (minutes), battery voltage (mV), and temperature (°C).

It supports an I²C for connection to the system microcontroller port.

2.3 LEDs

The Fuel Tank BoosterPack has two LED indicators: one for low battery (BATT LOW) and the other to indicate the battery is charging (CHARGING).

2.4 Headers

The Fuel Tank BoosterPack features two 20-pin of headers for connection to the TI LaunchPads. [Table 1](#) and [Table 2](#) show how these header pins are connected on the BoosterPack.

Table 1. JP1 Connector

JP1 PIN	PIN FUNCTION	JP1 PIN	PIN FUNCTION
1.01	+3.3V	1.11	
1.02	+5V	1.12	
1.03	!CHARGE (bq24210)	1.13	!PG (bq24210)
1.04		1.14	
1.05		1.15	
1.06		1.16	
1.07		1.17	
1.08		1.18	
1.09	!EN (bq24210)	1.19	
1.1		1.2	

Table 2. JP2 Connector

JP2 PIN	PIN FUNCTION	JP2 PIN	PIN FUNCTION
2.01		2.11	
2.02	GND	2.12	
2.03		2.13	
2.04		2.14	SDA (bq27510)
2.05		2.15	
2.06		2.16	SCL bq27510)
2.07		2.17	
2.08		2.18	
2.09		2.19	
2.10		2.20	

2.5 Jumpers

There are two jumpers provided on the Fuel Tank BoosterPack. When inserted, they provide power to the target platform.

- Jumper 5 V out (JP4) provides 5 Vdc output
- Jumper 3.3 V out (JP5) provides 3.3 Vdc output

NOTE: These jumpers also allow for easy current measurements on the 3.3-V and 5-V rails.

3 Getting Started With BOOSTXL-BATTPACK BoosterPack

The following sections describe the preparation necessary to run the user experience application demo with the MSP430 Value Line LaunchPad (MSP-EXP430G2), Tiva C LaunchPad (EK-TM4C123GXL), and the C2000 LaunchPad (LAUNCHXL-F28027).

3.1 Hardware Preparation

To prepare the Fuel Tank BoosterPack for its use with the LaunchPads, ensure the following steps:

1. Jumpers 5 V out and 3.3 V out on the Fuel Tank BoosterPack are removed.
2. The battery is connected to the BATT connector on the Fuel Tank BoosterPack.

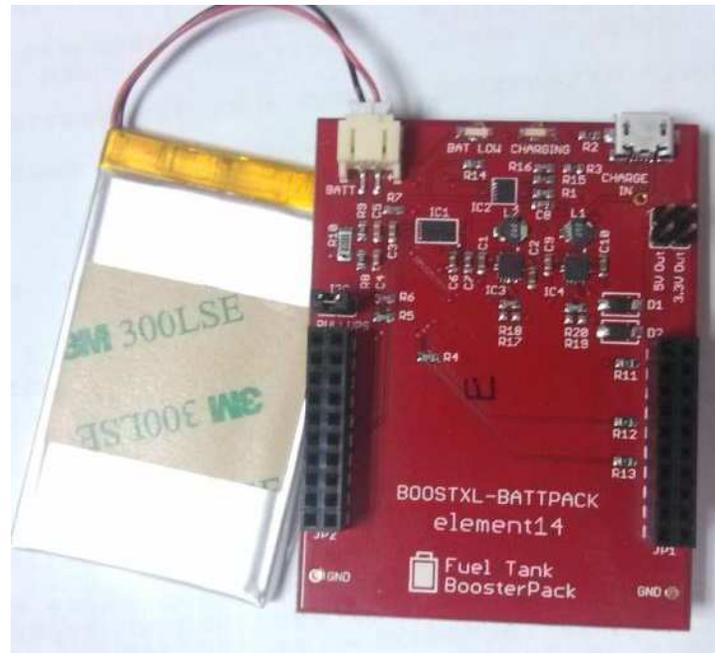


Figure 2.

3.2 MSP430 Value Line LaunchPad (MSP-EXP430G2)

3.2.1 Battery Charging

3.2.1.1 LaunchPad Jumper Settings

Ensure that jumper P1.0 is closed and P1.6 is open on the MSP430 LaunchPad.



Figure 3.

3.2.1.2 BOOSTERPACK and LaunchPad Connections

1. Connect the LaunchPad to the BoosterPack via headers JP1 and JP2.
2. Connect a mini-USB cable between the LaunchPad USB input and the host PC.
3. Connect a micro-USB cable between the Fuel Tank BoosterPack and the host PC.



Figure 4.

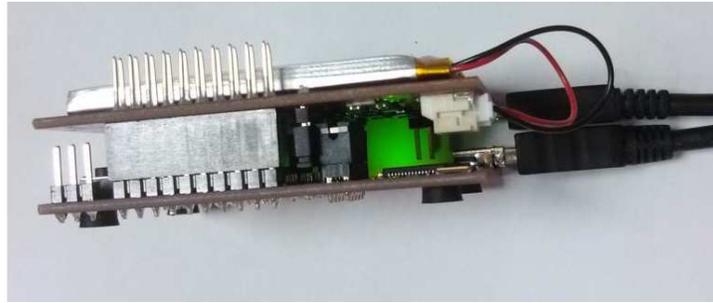


Figure 5.

3.2.1.3 Software Preparation

The steps described in the following sections are not required to use the Fuel Tank BoosterPack with the LaunchPad. These steps demonstrate the monitoring and battery management features of the BoosterPack using the LaunchPads. For this purpose, proper installation of the hardware driver and the software is required. This includes the installation of:

- Code Composer Studio (CCS v5.4.0 or higher)
- USB serial COM port driver – for the PC to communicate with the LaunchPad hardware, the LaunchPad USB driver must be installed. The LaunchPad USB drivers are integrated into the IDE installer packages from Code Composer Studio
- Software packages for each of the LaunchPads are available for download from www.element14.com/community/docs/DOC-55618 in source code

3.2.1.4 Import Project in CCS

To import the project into CCS:

1. Open CCS.
2. Select a new project workspace outside of the project folder (1).
3. Select Project → Import Existing Project.
4. Browse to the [PROJECT_ROOT]\CCS folder.
5. Make sure that "Copy projects into workspace" is not checked.
6. Click Finish.

NOTE: All projects are available for download in a zip file from www.element14.com/community/docs/DOC-55618.

Location: MSP430G2_FuelTank_BoostPack

3.2.1.4.1 Debug the Project

Open a terminal window with the following settings for the detected COM port:

- Baud rate: 9600
- Data bits: 8
- Parity: None
- Stop bits: 1
- Flow control: none
- Press F11 on the PC to enter into debug mode. After the image downloads in the board, stop the running project.
- Reset the LaunchPad. The following message will display on the terminal window:

```
*****
This is a battery demo !
Press:
1. To see the battery main parameter
2. To see the battery State of charge!
*****
```

- Enter 1, and the battery's current state will display:

```
The battery is charging!
Current Temperature :32°C
Current Voltage :3958mV
AverageCurrent :283mA
State of Charge :65%
DesignCapacity :1200mAH
RemainingCapacity :750mAH
```

- Enter 2. The LaunchPad terminal prompts the user to input a time interval:

```
Please set the show time interval(units = s)
30
```

- Subsequently, the terminal displays the state of charge at the frequency set in the time interval. The following example shows the state of charge is displayed every 30 s:

```
Please set the show time interval(units = s)
30
State of Charge :67%
State of Charge :68%
State of Charge :69%
```

3.2.2 Discharging the Battery

3.2.2.1 LaunchPad Jumper Settings

For the jumper settings for respective LaunchPads, refer to [Section 3.2.1.1](#).

3.2.2.2 **BOOSTERPACK and LaunchPad Connections**

1. Connect the LaunchPad to the BoosterPack via headers JP1 and JP2.
2. Connect a mini-USB cable between the LaunchPad USB input and the host PC.



Figure 6.

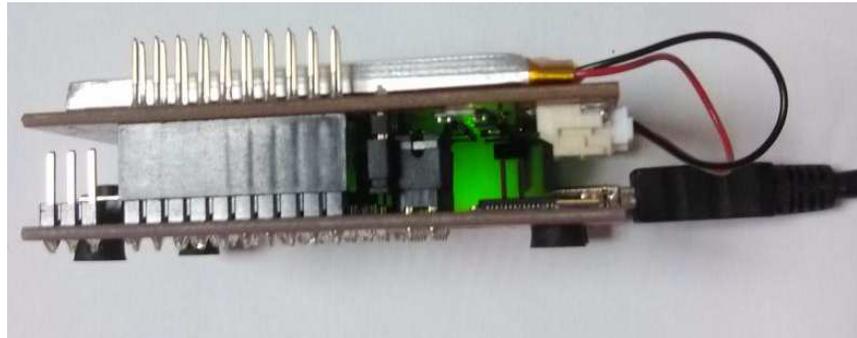


Figure 7.

Reset the board. The following message will display on the terminal:

```
The battery is discharging!
Current Temperature :28°C
Current Voltage :4180mV
AverageCurrent :-28mA
State of Charge :100%
DesignCapacity :1200mAH
RemainingCapacity :1304mAH
█
```

3.2.2.3 **Capacity Low**

If the battery capacity is lower than 10% of the full charging capacity, the terminal will prompt the user to charge the battery:

```
There is no battery or the battery's capacity is too low
Please plugin a battery or charge the battery
█
```

3.3 TIVA C LaunchPad (EK-TM4C123GXL)

3.3.1 Battery Charging

3.3.1.1 LaunchPad Jumper Settings

Ensure that jumper P1.0 is closed and P1.6 is open on the MSP430 LaunchPad.

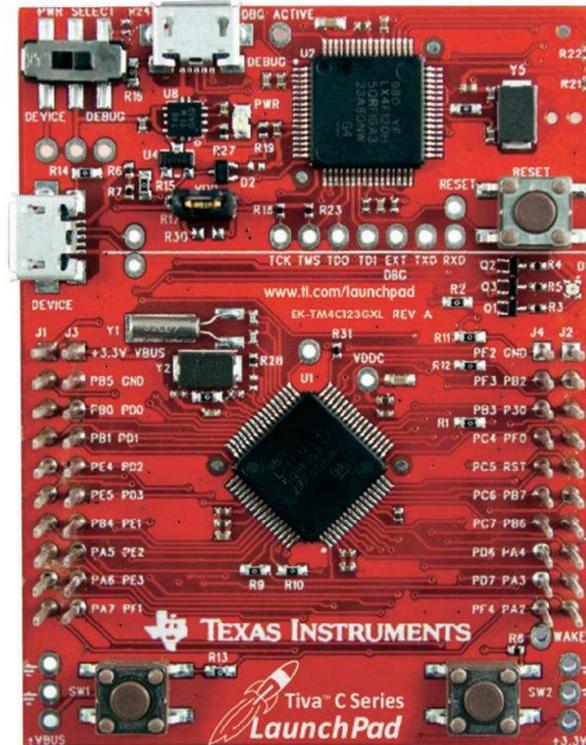


Figure 8.

3.3.1.2 BOOSTERPACK and LaunchPad Connections

1. Connect the LaunchPad to the BoosterPack via headers JP1 and JP2.
2. Connect a mini-USB cable between the LaunchPad USB input and the host PC.
3. Connect a micro-USB cable between the Fuel Tank BoosterPack and the host PC.



Figure 9.



Figure 10.

3.3.1.3 Software Preparation

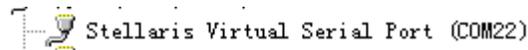
The steps described in the following sections are not required to use the Fuel Tank BoosterPack with the LaunchPad. These steps demonstrate the monitoring and battery management features of the BoosterPack using the LaunchPads. For this purpose, proper installation of the hardware driver and the software is required. This includes the installation of:

- Code Composer Studio (CCS v5.4.0 or higher)
- USB serial COM port driver – for the PC to communicate with the LaunchPad hardware, the LaunchPad USB driver must be installed. The LaunchPad USB drivers are integrated into the IDE installer packages from Code Composer Studio
- Install the Tiva C library (version 1.1). Download it from www.ti.com/tool/sw-ek-tm4c123gx1, and install it in the default directory C:\



SW-TM4C-1.1

- Copy the project into Tiva C software/ (location: C:\ti\TivaWare_C_Series-1.1\examples\boards\ek-tm4c123gx1)
- Software packages for each of the LaunchPads are available for download from www.element14.com/community/docs/DOC-55618 in source code
- Reset the Tiva C LaunchPad, the board's driver will install automatically. Then, the user can see a UART device added in device manager (for example, COM22)



3.3.1.4 Import Project in CCS

To import the project into CCS:

1. Open CCS.
2. Select a new project workspace outside of the project folder (1).
3. Select Project → Import Existing Project.
4. Browse to the [PROJECT_ROOT]\CCS folder.
5. Make sure that "Copy projects into workspace" is not checked.
6. Click Finish.

NOTE: All projects are available for download in a zip file from www.element14.com/community/docs/DOC-55618.

Location: TivaWare_C_Series-1.1\examples\boards\ek-tm4c123gx\FuelTank_BoosterPack

3.3.1.5 Debug the Project

Open a terminal window with the following settings for the detected COM (COM22) port:

- Baud rate: 115200
- Data bits: 8
- Parity: None
- Stop bits: 1
- Flow control: none
- Press F11 on the PC to enter into debug mode. After the image downloads in the board, stop the running project.
- Reset the LaunchPad. The following message will display on the terminal window:

```
*****
This is a battery demo !
Press:
1. To see the battery main parameter
2. To see the battery State of charge!
*****
```

- Enter 1, and the battery's current state will display:

```
The battery is charging!
Current Temperature :32°C
Current Voltage :3958mV
AverageCurrent :283mA
State of Charge :65%
DesignCapacity :1200mAH
RemainingCapacity :750mAH
```

- Enter 2. The LaunchPad terminal prompts the user to input a time interval:

```
Please set the show time interval(units = s)
30
```

- Subsequently, the terminal displays the state of charge at the frequency set in the time interval. The following example shows that the state of charge is displayed every 30 s:

```

Please set the show time interval(units = s)
30
State of Charge :67%
State of Charge :68%
State of Charge :69%

```

3.3.2 Discharging the Battery

3.3.2.1 LaunchPad Jumper Settings

For the jumper settings for respective LaunchPads, refer to [Section 3.3.1.1](#).

3.3.2.2 BOOSTERPACK and LaunchPad Connections

1. Connect the LaunchPad to the BoosterPack via headers JP1 and JP2 4.
2. Connect a mini USB cable between the LaunchPad USB input and the host PC.



Figure 11.



Figure 12.

Reset the board. The following message will display on the terminal:

```
The battery is discharging!  
Current Temperature :28°C  
Current Voltage :4180mV  
AverageCurrent :-28mA  
State of Charge :100%  
DesignCapacity :1200mAH  
RemainingCapacity :1304mAH  
■
```

3.3.2.3 Capacity Low

If the battery capacity is lower than 10% of the full charging capacity, the terminal will prompt the user to charge the battery:

```
There is no battery or the battery's capacity is too low  
Please plugin a battery or charge the battery  
■
```

3.4 C2000 LaunchPad (LAUNCHXL-F28027)

3.4.1 Battery Charging

3.4.1.1 LaunchPad Jumper Settings

Ensure that jumpers JP1, JP2, JP3, JP9, and JP11 are closed on the C2000 LaunchPad.

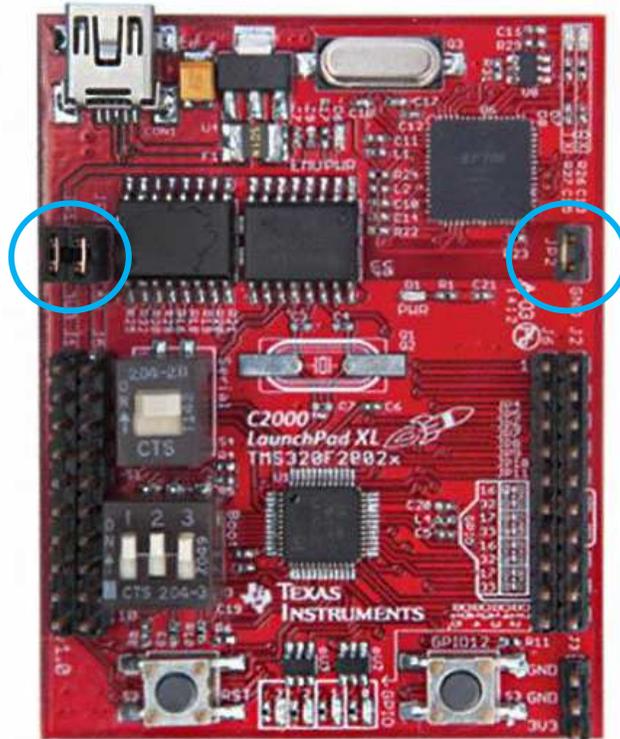


Figure 13.

3.4.1.2 BOOSTERPACK and LaunchPad Connections

1. Connect the LaunchPad to the BoosterPack via headers JP1 and JP2.
2. Connect a mini-USB cable between the LaunchPad USB input and the host PC.
3. Connect a micro-USB cable between the Fuel Tank BoosterPack and the host PC.



Figure 14.



Figure 15.

3.4.1.3 Software Preparation

The steps described in the following sections are not required to use the Fuel Tank BoosterPack with the LaunchPad. These steps demonstrate the monitoring and battery management features of the BoosterPack using the LaunchPads. For this purpose, proper installation of the hardware driver and the software is required. This includes the installation of:

- Code Composer Studio (CCS v5.4.0 or higher)
- USB serial COM port driver – for the PC to communicate with the LaunchPad hardware, the LaunchPad USB driver must be installed. The LaunchPad USB drivers are integrated into the IDE installer packages from Code Composer Studio
- Copy the project into f2802x_examples/FuelTank_BoosterPack
- Software packages for each of the LaunchPads are available for download from www.element14.com/battpack in source code
- Reset the C2000 LaunchPad. The board's driver will install automatically. Then, the user can see a UART device added in the device manager (for example, COM22)

3.4.1.4 Import Project in CCS

To import the project into CCS:

1. Open CCS.
2. Select a new project workspace outside of the project folder (1).
3. Select Project → Import Existing Project.
4. Browse to the [PROJECT_ROOT]\CCS folder.

5. Make sure that "Copy projects into workspace" is not checked.
6. Click Finish.

NOTE: All projects are available for download in a zip file from www.element14.com/community/docs/DOC-55618.

Location: f2802x_examples/FuelTank_BoosterPack

3.4.1.5 Debug the Project

Open a terminal window with the following settings for the detected COM port:

- Baud rate: 9600
- Data bits: 8
- Parity: None
- Stop bits: 1
- Flow control: none
- Press F11 on the PC to enter into debug mode. After the image downloads in the board, stop the running project.
- Reset the LaunchPad. The following message will display on the terminal window:

```
*****
This is a battery demo !
Press:
1. To see the battery main parameter
2. To see the battery State of charge!
*****
```

- Enter 1, and the battery's current state will display:

```
The battery is charging!
Current Temperature :32°C
Current Voltage :3958mV
AverageCurrent :283mA
State of Charge :65%
DesignCapacity :1200mAH
RemainingCapacity :750mAH
```

- Enter 2. The LaunchPad terminal prompts the user to input a time interval:

```
Please set the show time interval(units = s)
30█
```

- Subsequently, the terminal displays the state of charge at the frequency set in the time interval. The following example shows that the state of charge is displayed every 30 s:

```

Please set the show time interval(units = s)
30
State of Charge :67%
State of Charge :68%
State of Charge :69%
    
```

3.4.2 Discharging the Battery

3.4.2.1 LaunchPad JUMPER SETTINGS

For the jumper settings for respective LaunchPads, refer to [Section 3.4.1.1](#).

3.4.2.2 BOOSTERPACK and LaunchPad Connections

1. Connect the LaunchPad to the BoosterPack via headers JP1 and JP2.
2. Connect a mini-USB cable between the LaunchPad USB input and the host PC.



Figure 16.

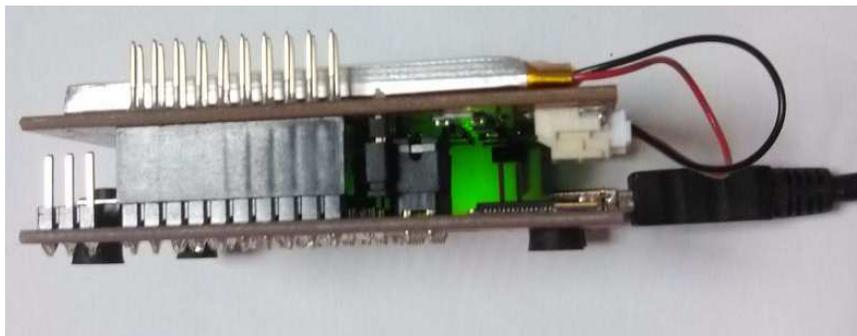


Figure 17.

Reset the board and the following message will display on the terminal:

```
The battery is discharging!  
Current Temperature :28°C  
Current Voltage :4180mV  
AverageCurrent :-28mA  
State of Charge :100%  
DesignCapacity :1200mAH  
RemainingCapacity :1304mAH  
■
```

3.4.2.3 Capacity Low

If the battery capacity is lower than 10% of the full charging capacity, the terminal will prompt the user to charge the battery:

```
There is no battery or the battery's capacity is too low  
Please plugin a battery or charge the battery  
■
```

4 ESD Precautions and Proper Handling Procedures

This section includes precautions to take for mechanical handling and static to avoid ESD damage:

- Avoid carpets in cool, dry areas. Leave development kits in their anti-static packaging until they are ready to be installed.
- Dissipate static electricity before handling any system components (development kits) by touching a grounded metal object, such as the system unit unpainted metal chassis.
- If possible, use antistatic devices, such as wrist straps and floor mats.
- Always hold an evaluation board by its edges. Avoid touching the contacts and components on the board.
- Take care when connecting or disconnecting cables. A damaged cable can cause a short in the electrical circuit.
- Prevent damage to the connectors by aligning connector pins before the user connects the cable. Misaligned connector pins can cause damage to system components at power-on.
- When disconnecting a cable, always pull on the cable connector or a strain-relief loop, not on the cable itself.

5 Battery Usage Precautions and Warnings

- Use a charger that is clearly specified to be compatible for charging the battery and has appropriate charging protection (voltage, current, and temperature).
- Lithium batteries should only be used with proper voltage, current, and temperature protection circuitry and protection.
- In case the battery terminals are dirty, clean the terminals with a dry cloth before use. Otherwise, poor performance may occur due to the poor connection with the instrument or device.
- Keep or store the battery in a cool and dry place or environment.
- Do not immerse the battery in water or other liquids.
- Do not use or store the battery near any source of heat.
- Do not install the battery in reverse polarity.
- Do not connect the battery to an electrical outlet or other incompatible power source.
- Do not discard the battery in fire.
- Do not short circuit the battery. Do not connect the positive and negative terminals to each other with a metallic object or other conductive material.
- Do not transport or store the battery together with metal objects, such as hairpins, necklaces, or any other conductive object or material.
- Do not strike, crush, puncture, disassemble, or throw the battery.
- Do not directly solder the battery or battery terminals. Do not pierce the battery.
- Do not use or leave the battery in a high temperature environment (for example, under direct sunlight or in a vehicle in hot weather). Failure to take this precaution can lead to overheating the battery, fire, or explosion. Also, performance of battery will degrade and lifetime will be reduced.
- Do not use the battery in a location where there is high static-electricity or magnetic fields, otherwise safety devices may be damaged which cannot be visible.
- If the battery gives off an odor, generates heat, becomes discolored or deformed, or in any way appears abnormal during use, recharging, or storage, immediately remove it from the device or battery charger and stop using it.

WARNING

- If the battery leaks and the electrolyte get into the eyes, do not rub eyes. Instead, rinse and wash eyes with clean water, and immediately seek medical attention.
- Be aware that discarded batteries may cause fire or explosion. Therefore, apply a non-conductive tape to the battery terminals to insulate them before discarding.

6 Troubleshooting

Discharging the battery below a certain threshold triggers the protection circuit inside the battery. The battery charger IC detects the low threshold and responds as if no battery is connected and is unable to power the battery.

There are reminders in the software to not over-discharge. When the battery power is lower than 10%, the DC/DC turns off, and the battery does not supply power. The red light turns on, which reminds the user that the power is low and needs to be recharged.

In the event that the battery is discharged to a level lower than the threshold, try the following steps to reactivate the charging of the battery.

1. Remove the positive terminal from the connector on the battery pack as shown in [Figure 18](#):

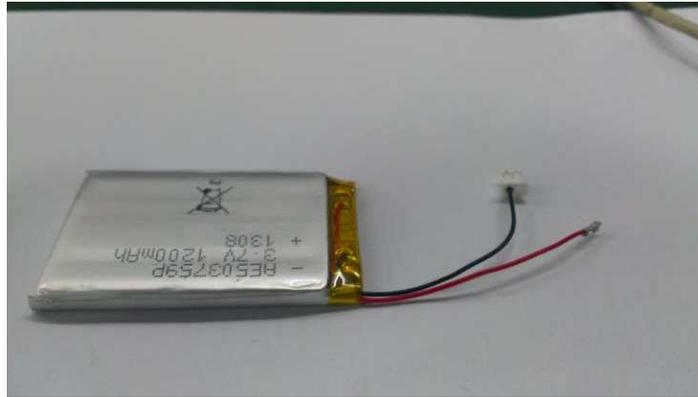


Figure 18.

CAUTION

Do not remove, puncture, or open the battery pack. For precautions in handling the battery, refer to [Section 5](#).

2. Connect a resistor to the positive terminal of the battery. The recommended value of the resistor is 56 Ω , .5 W:

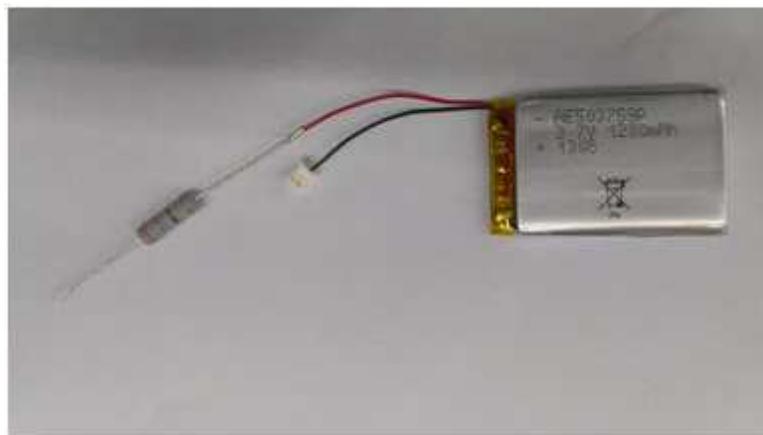


Figure 19.

3. Connect the BoosterPack with a USB cable to the PC as shown in [Figure 20](#):



Figure 20.

4. Connect the negative terminal of the battery to the BoosterPack “BATT” terminal and the resistor to the “CHARGE IN” testpoint as shown in Figure 21:

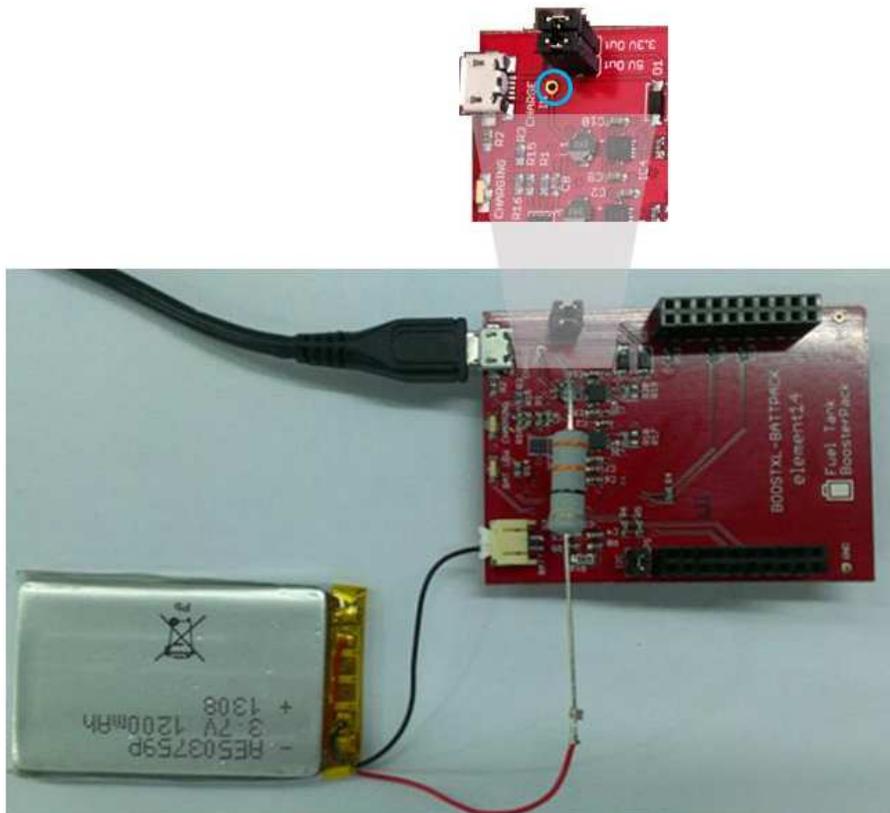


Figure 21.

The battery should now start charging. Keep the resistor connected for only about 3 to 5 s.

CAUTION

- (a) Do not connect the positive terminal of the battery directly to the CHARGE IN testpoint. This will have a serious impact on the battery life.
- (b) Do not connect the battery's positive terminal longer than recommended, as this will have a serious impact on the battery life.
- (c) Adhere to the safety precautions outlined in [Section 5](#).

The charging current can be determined as:

$$I = \frac{5.0 - V_{\text{batt}}}{R}$$

where $R = 56 \Omega$

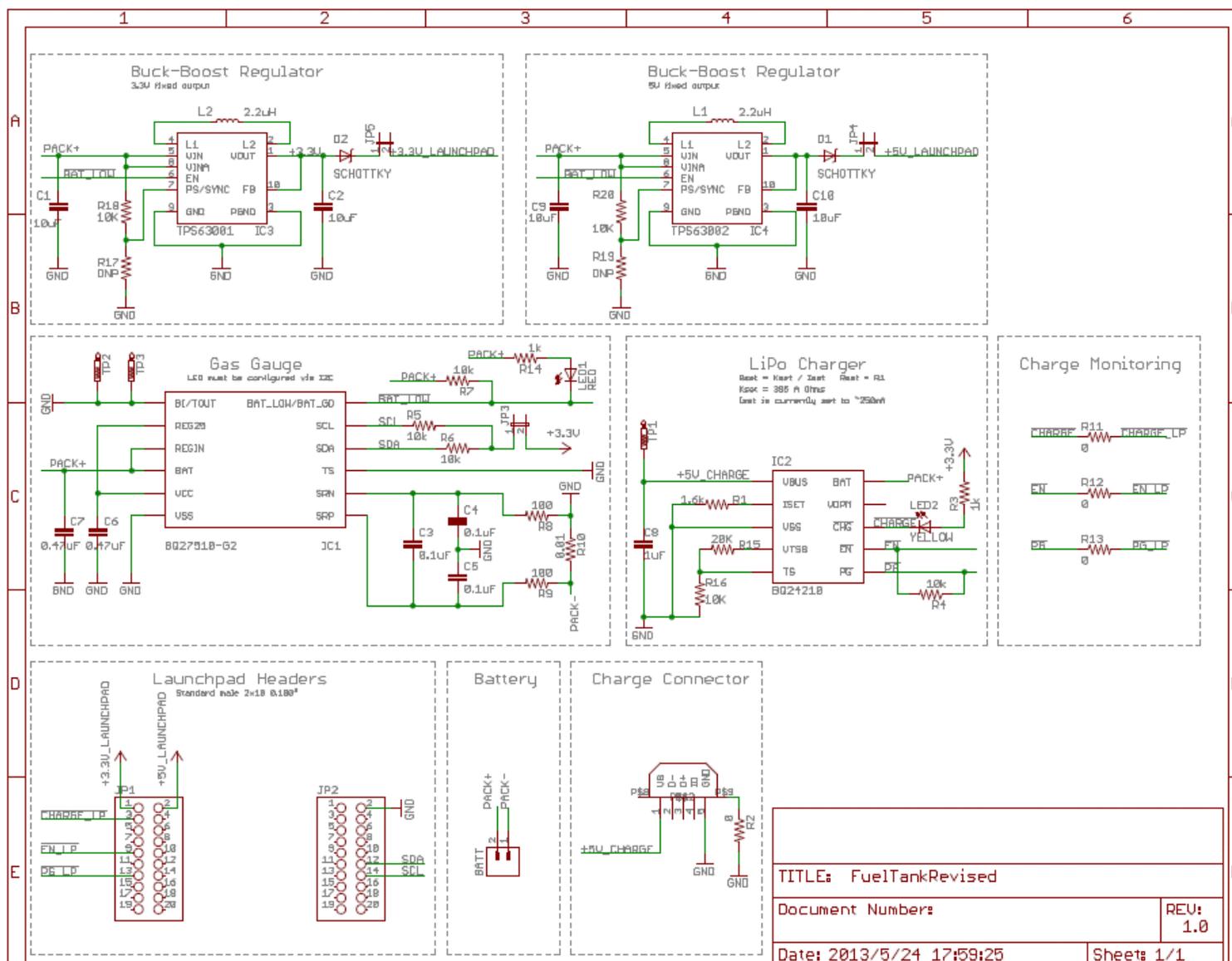
(1)

The charging time is related to the value of the resistor. The value for the resistor can be between 10 to 60 Ω , but the power rating needs to be considered accordingly. (Use at least a 1 W rating for a 10- Ω resistor).

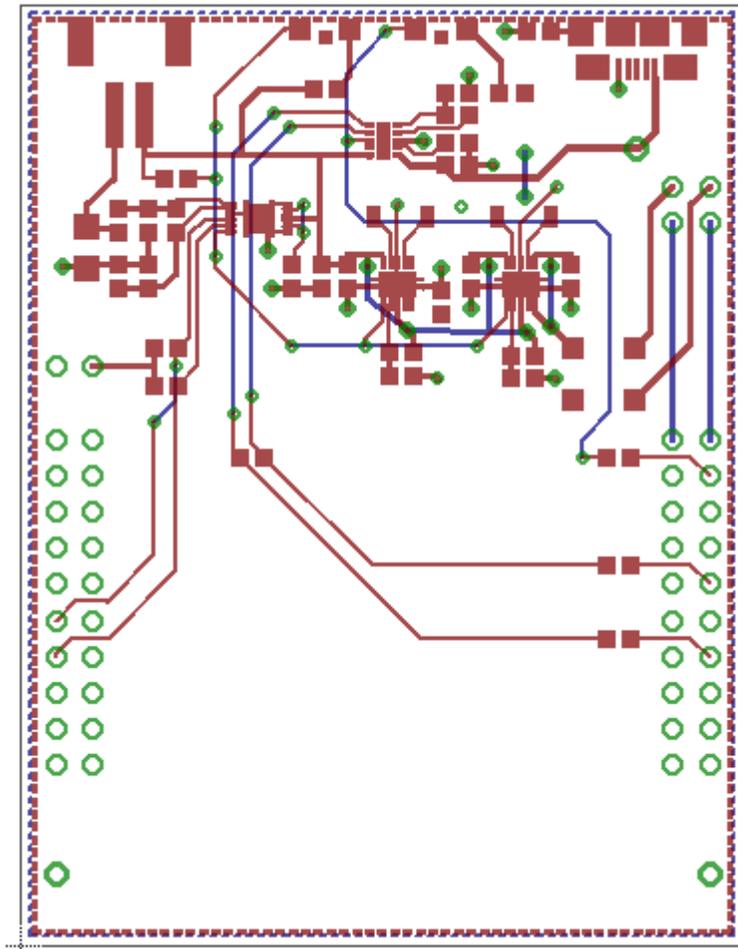
When the battery voltage, V_{batt} voltage, reaches 3.5 V, the battery will recover and be ready to discharge with voltage out.

5. Disconnect the resistor and the USB from the BoosterPack. Remove the resistor from the positive terminal and insert the positive terminal back into the connector on the battery. The battery pack can now be connected to the BoosterPack BATT terminal and is ready for typical operation.

7 Schematics



8 PCB Layout



EVALUATION BOARD/KIT/MODULE (EVM) ADDITIONAL TERMS

Texas Instruments (TI) provides the enclosed Evaluation Board/Kit/Module (EVM) under the following conditions:

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.

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 LIMITED 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. 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.

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 visit www.ti.com/esh or contact TI.

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REGULATORY COMPLIANCE INFORMATION

As noted in the EVM User's Guide and/or EVM itself, this EVM and/or accompanying hardware may or may not be subject to the Federal Communications Commission (FCC) and Industry Canada (IC) rules.

For EVMs **not** subject to the above rules, this evaluation board/kit/module 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 or ICES-003 rules, which are designed to provide reasonable protection against radio frequency interference. Operation of the equipment 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.

General Statement for EVMs including a radio

User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

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

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

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.

For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

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

Concerning EVMs including radio transmitters

This device complies with Industry Canada licence-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.

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.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

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.

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.

【Important Notice for Users of EVMs for RF Products in Japan】

This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product 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 this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

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EVALUATION BOARD/KIT/MODULE (EVM) WARNINGS, RESTRICTIONS AND DISCLAIMERS

For Feasibility Evaluation Only, in Laboratory/Development Environments. Unless otherwise indicated, this EVM is not a finished electrical equipment and not intended for consumer use. It is intended solely for use for preliminary feasibility evaluation in laboratory/development environments by technically qualified electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems and subsystems. It should not be used as all or part of a finished end product.

Your Sole Responsibility and Risk. You acknowledge, represent and agree that:

1. You have unique knowledge concerning Federal, State and local regulatory requirements (including but not limited to Food and Drug Administration regulations, if applicable) which relate to your products and which relate to your use (and/or that of your employees, affiliates, contractors or designees) of the EVM for evaluation, testing and other purposes.
2. You have full and exclusive responsibility to assure the safety and compliance of your products with all such laws and other applicable regulatory requirements, and also to assure the safety of any activities to be conducted by you and/or your employees, affiliates, contractors or designees, using the EVM. Further, you are responsible to assure 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.
3. Since the EVM is not a completed product, it may not meet all applicable regulatory and safety compliance standards (such as UL, CSA, VDE, CE, RoHS and WEEE) which may normally be associated with similar items. You assume full responsibility to determine and/or assure compliance with any such standards and related certifications as may be applicable. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.
4. You will take care of proper disposal and recycling of the EVM's electronic components and packing materials.

Certain Instructions. It is important to operate this EVM within TI's recommended specifications and environmental considerations per the user guidelines. Exceeding the specified EVM ratings (including but not limited to input and output voltage, current, power, and environmental ranges) may cause property damage, personal injury or death. If there are questions concerning these ratings please 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 result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. 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 as long as the input and output are maintained at a normal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during normal operation, please be aware that these devices may be very warm to the touch. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use these EVMs.

Agreement to Defend, Indemnify and Hold Harmless. You agree to 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 use of the EVM that is not in accordance with the terms of the agreement. This obligation shall apply whether Claims arise under law of tort or contract or any other legal theory, and even if the EVM fails to perform as described or expected.

Safety-Critical or Life-Critical Applications. If you intend to evaluate the components for possible 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, such as devices which are classified as FDA Class III or similar classification, then you must specifically notify TI of such intent and enter into a separate Assurance and Indemnity Agreement.

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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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