The bq24153A/56A/57/58/59 evaluation module is a complete charger module for evaluating 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.

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1 Introduction

1.1 EVM Features

- Evaluation module (EVM) for bq24153A/56A/57/58/59
- High-efficiency fully integrated NMOS-NMOS synchronous buck charger with 3-MHz frequency
- Integrated power FETs for up to 1.55-A charge rate
- Programmable battery voltage, charge current, and input current via I²C™ interface
- Input operating range 4 V – 6 V
- Boost-mode operation for USB OTG
- 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 bq24153A/56A/57/58/59 evaluation module is a complete charger module for evaluating 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 bq24153A/56A/57/58/59 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 I²C interface.

For details, see the bq24153A/56A/58/59 data sheet (SLUSAB0) and the bq24157 datasheet (SLUSAX5).

1.3 I/O Description

<table>
<thead>
<tr>
<th>Jack</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1–DC+</td>
<td>AC adapter or USB, positive output</td>
</tr>
<tr>
<td>J1–DC–</td>
<td>AC adapter or USB, negative output</td>
</tr>
<tr>
<td>J2–BAT–</td>
<td>Battery negative terminal; connect to DC-</td>
</tr>
<tr>
<td>J2–AUXPWR/CD</td>
<td>Connect to AUXPWR pin or CD pin</td>
</tr>
<tr>
<td>J2–BAT+</td>
<td>Charger positive output; connect to CSOUT pin</td>
</tr>
<tr>
<td>J3–SCL</td>
<td>I²C clock; connect to SCL pin</td>
</tr>
<tr>
<td>J3–SDA</td>
<td>I²C data; connect to SDA pin</td>
</tr>
<tr>
<td>J3–DC–</td>
<td>AC adapter or USB, negative output</td>
</tr>
<tr>
<td>J4–STAT</td>
<td>Status output; can be connected to STAT pin by JMP1 set to EXT (2-3)</td>
</tr>
<tr>
<td>J4–OTG/SLRST</td>
<td>Connect to OTG/SLRST pin</td>
</tr>
<tr>
<td>J4–DC–</td>
<td>AC adapter or USB, negative output</td>
</tr>
</tbody>
</table>

1.4 Control and Key Parameters Setting

<table>
<thead>
<tr>
<th>Jack</th>
<th>Description</th>
<th>Factory Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>JMP1</td>
<td>LED 1-2: Connect STAT pin to LED on EVM</td>
<td>Jumper on LED (1-2)</td>
</tr>
<tr>
<td></td>
<td>EXT 2-3: Connect STAT pin to J4-1</td>
<td></td>
</tr>
<tr>
<td>JMP2</td>
<td>HI 1-2; OTG or SLRST high (input or battery voltage)</td>
<td>See Table 1</td>
</tr>
<tr>
<td></td>
<td>LO 2-3: OTG or SLRST low (ground)</td>
<td></td>
</tr>
<tr>
<td>JMP3</td>
<td>J2–BAT+ connect to J2–AUXPWR/CD</td>
<td></td>
</tr>
<tr>
<td>JMP4</td>
<td>AUXPWR/CD pin connect to high or low or float</td>
<td></td>
</tr>
<tr>
<td>JMP5</td>
<td>OTG/SLRST pin 10-kΩ resistor to ground or float</td>
<td>Jumper ON</td>
</tr>
</tbody>
</table>
1.5 Recommended Operating Conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage, ( V_\text{IN} )</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>V</td>
</tr>
<tr>
<td>Battery voltage, ( V_{\text{BAT}} )</td>
<td>0</td>
<td>3.42</td>
<td>4.44</td>
<td>V</td>
</tr>
<tr>
<td>Supply current, ( I_{\text{AC}} )</td>
<td>0.1</td>
<td>0.1–0.5</td>
<td>1.5</td>
<td>A</td>
</tr>
<tr>
<td>Charge current, ( I_{\text{chrg}} )</td>
<td>0.325</td>
<td>0.7</td>
<td>1.55</td>
<td>A</td>
</tr>
<tr>
<td>Operating junction temperature range, ( T_J )</td>
<td>0</td>
<td>125</td>
<td>°C</td>
<td></td>
</tr>
</tbody>
</table>

2 Test Summary

This procedure details how to configure the HPA697 evaluation board for bench evaluation. An electronic load is used to simulate a battery.

2.1 Definitions

This procedure details how to configure the HPA697 evaluation board. The following naming conventions are followed. See the bq24153A/56A/57/58/59EVM (also known as HPA697) schematic for details.

- \( V_{XXX} \): External voltage supply name (VADP, VBT, VSBT)
- \( LOADW \): External load name (LOADR, LOADI)
- \( V(\text{TP}yyy) \): Voltage at internal test point TPyyy. For example, \( V(\text{TP}12) \) means the voltage at TP12.
- \( V(Jxx) \): Voltage at jack terminal Jxx
- \( V(\text{TP}(XXX)) \): Voltage at test point XXX. For example, \( V(\text{ACDET}) \) means the voltage at the test point which is marked as ACDET.
- \( V(XXX, YYY) \): Voltage across point XXX and YYY.
- \( I(JXX(YYY)) \): Current going out from the YYY terminal of jack XX.
- \( Jxx(BBB) \): Terminal or pin BBB of jack xx
- \( Jxx \text{ ON } \): Internal jumper Jxx terminals are shorted
- \( Jxx \text{ OFF } \): Internal jumper Jxx terminals are open
- \( Jxx (-YY-) \text{ ON } \): Internal jumper Jxx adjacent terminals marked as YY are shorted

Measure: \( \rightarrow A,B \) Check specified parameters A, B. If measured values are not within specified limits the unit under test has failed.

Observe: \( \rightarrow A,B \) Observe if A, B occur. If they do not occur, the unit under test has failed.

Assembly drawings have location for jumpers, test points, and individual components.

2.2 Recommended Test Equipment

2.2.1 Power Supplies

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

2.2.2 Load #1

A 10-V (or above), 2-A (or above) electronic load that can operate in constant current mode.

2.2.3 Load #2

A 10-V (or above), 2-A (or above) electronic load that can operate in constant voltage mode or a source meter to simulate a battery.
2.2.4 Meters

Two equivalent voltage meters and two equivalent current meters. The current meters must be able to measure 2-A current.

2.2.5 Computer

A computer with at least one USB port and a USB cable. The bq24153_6_8 evaluation software must be properly installed.

2.2.6 HPA172 Communication Kit (USB TO GPIO)

A HPA172 USB to I2C communication kit.

2.2.7 Software

Download BQ24153_6_8Setup.zip from the charger's product folder, unzip the file and double-click on the “SETUP.EXE” file. Follow the installation steps.

2.3 Recommended Test Equipment Setup

1. Set Power Supply #1 for 5 V ± 100 mVdc, 2-A, ±0.1-A current limit, and then turn off supply.
2. Connect the output of Power Supply #1 in series with a current meter (multimeter) to J1 (DC+, DC–).
3. Connect a voltage meter across J1 (DC+, DC–).
4. Connect the Load #2 in series with a current meter (multimeter) to J2 (BAT+, BAT–). Ensure that a voltage meter is connected across J2 (BAT+, BAT–). Turn on the Load #2. Use the constant voltage mode. Set the output voltage to 2.5 V.
5. Turn off Load #2.
6. Connect J5 to HPA172 kit by the 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

7. Install jumpers per Table 1

<table>
<thead>
<tr>
<th>Spin</th>
<th>JMP1</th>
<th>JMP2</th>
<th>JMP3</th>
<th>JMP4</th>
<th>JMP5</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPA256-001</td>
<td>(bq24153A)</td>
<td>(-LED-) ON</td>
<td>(-LO-) ON</td>
<td>OFF</td>
<td>(-LO-) ON</td>
</tr>
<tr>
<td>HPA256-002</td>
<td>(bq24156A)</td>
<td>(-LED-) ON</td>
<td>(+H-) ON</td>
<td>OFF</td>
<td>(-LO-) ON</td>
</tr>
</tbody>
</table>

Table 1. Factory Jumper Settings
Table 1. Factory Jumper Settings (continued)

<table>
<thead>
<tr>
<th>Spin</th>
<th>JMP1</th>
<th>JMP2</th>
<th>JMP3</th>
<th>JMP4</th>
<th>JMP5</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPA256-003</td>
<td>(-LED-) ON</td>
<td>(-LO-) ON</td>
<td>OFF</td>
<td>(-LO-) ON</td>
<td>ON</td>
</tr>
<tr>
<td>(bq24158)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HPA256-003</td>
<td>(-LED-) ON</td>
<td>(-LO-) ON</td>
<td>OFF</td>
<td>(-LO-) ON</td>
<td>ON</td>
</tr>
<tr>
<td>(bq24157)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HPA256-003</td>
<td>(-LED-) ON</td>
<td>(-HI-) ON</td>
<td>OFF</td>
<td>(-LO-) ON</td>
<td>ON</td>
</tr>
<tr>
<td>(bq24159)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. After the preceding steps, the test setup for HPA697 is shown in Figure 2.

Figure 2. Charging Function Test Setup

9. Turn on the computer.
   • Open the bq24153A_9 evaluation software. Select part number and click the GO button. The main window of the software is shown in Figure 3.
2.4 **Recommended Test Procedure**

The following test procedure may be useful for evaluating the charger IC outside of a real system especially when no battery is available to connect to the output (i.e., Load#2).

### 2.4.1 Maximum Charge Current and Maximum Battery Regulation Voltage in The Safety Limit Register

The Maximum Charge Current and Maximum Battery Regulation Voltage values are stored in the Safety Limit Register. If the default values (950mA maximum charge current and 4.20V maximum charge voltage) are acceptable for your application, this step is unnecessary. If not, the Safety Limit Register bits are reset to default values and can be changed immediately after V(CSOUT) (i.e. V(BAT+)) transitions from below $V_{\text{SHORT}}$ (2.05V typ) to above $V_{\text{SHORT}}$ if the SLRST pin (bq24156A and bq24159 only) is logic high. In addition, on the bq24156A and bq24159, the Safety Limit Register bits are reset to default values and can be changed immediately after the SLRST pin transitions from logic low to logic high if V(CSOUT) is above $V_{\text{SHORT}}$ (2.05V typ). Once a change (WRITE command) to any other register is made, the safety limit registers are locked until one of the previously explained transitions occur. The following steps are recommended to modify any of the Safety Limit Register bits.

1. Ensure that Section 2.3 steps are followed.
2. Turn on PS#1. Turn on Load#2 but set its constant voltage to below 2.05V. For the bq24156A and bq24159EVMs only, move the SLRST jumper shunt to LO.
3. With the software running, disable (uncheck) the Periodic Resets and Periodic Reads feature and also...
disable the Immediate Updates button in the toolbar.
4. Increase Load#2 constant voltage to 2.5V. For the bq24156A and bq24159EVMs only, move the SLRST jumper shunt to HI.
5. Use the drop down boxes to select the desired maximum charge current and/or the maximum battery regulation voltage. The Safety Limit Register in the register bank on the bottom right of the screen will change color indicating an update is pending.
6. Press the now-highlighted W button next to the register.
7. Re-enable the Periodic Resets, Immediate Updates and Periodic Reads features as previously recommended.

The Maximum Charge Current and Maximum Battery Regulation Voltages drop down boxes now display the updated values and the charger is ready for further evaluation.

2.4.2 Charge Voltage and Current Regulation
1. Ensure that the Section 2.3 steps are followed.
2. Turn on Load#2.
3. Turn on PS#1.
4. Software setup:
   • Ensure that Immediate Updates is enabled.
   • Check Periodic Resets, and set Rate to 1 second (except for bq24157).
   • Check Periodic Reads, and set Rate to 5 seconds.
   • Ensure that Rsense is set to 68 mΩ.
   • Ensure that Operation Mode is Charger Mode (except for bq24156A and bq24159).
   • Uncheck Charge Current Termination if checked.
   • Check STAT Pin.
   • Select Charge Current Sense Voltage to Normal.
5. Change Charge Current to 950mA and change Input Current Limit to 500mA.
   $\text{Measure} \rightarrow I_{\text{chrg}} = 650\ \text{mA} - 850\text{mA}$
   $\text{Measure} \rightarrow I_{\text{in}} = 440\text{mA} - 500\text{mA}$
   $\text{Observe} \rightarrow \text{Diode D1 is on (green)}$
6. Check Disable Charger. Turn off PS#1, turn off Load #2, and disconnect.

2.4.3 Boost Function for bq24153A, bq24157 and bq24158 Versions Only
1. Adjust PS#1 output to 3.7 V, and disable the output. Connect the PS#1 in series with a current meter (multimeter) to J2 (BAT+, BAT–). Ensure that a voltage meter is connected across J2 (BAT+, BAT–).
2. Set the Load #1 current to 200 mA ±20 mA, but disable the output. Connect the output of the Load #1 in series with a current meter (multimeter) to J1 (DC+, DC–). Ensure that a voltage meter is connected across J1 (DC+, DC–). The setup is now like Figure 4 for HPA256.
3. Turn on PS#1 output.
4. Software setup: Change Operation Mode to Boost Mode.
   \[ \text{Measure} \rightarrow V(J1(DC+, DC–)) = 5 \text{ V} \pm 0.2 \text{ V} \]
5. Enable Load #1.
   \[ \text{Measure} \rightarrow V(J1(DC+, DC–)) = 5 \text{ V} \pm 0.2 \text{ V} \]
   \[ \text{Measure} \rightarrow I_{in} = 330 \text{ mA} \pm 40 \text{ mA} \]
   \[ \text{Measure} \rightarrow I_o = 200 \text{ mA} \pm 20 \text{ mA} \]

3 Printed-Circuit Board Layout Guideline

1. To obtain optimal performance, the power input capacitors, connected from input to PGND, must be placed as close as possible to the integrated circuit (IC).
2. The output inductor must be placed close to the IC and the output capacitor connected between the inductor and PGND of the IC. The intent is to minimize the current path loop area from the SW pin through the LC filter and back to the PGND pin. To prevent high-frequency oscillation problems, proper layout to minimize high-frequency current path loop is critical.
3. The sense resistor must be adjacent to the junction of the inductor and output capacitor. Route the sense leads connected across the RSNS back to the IC, close to each other (minimize loop area) or on top of each other on adjacent layers (do not route the sense leads through a high-current path).
4. Place all decoupling capacitors close to their respective IC pin and as close as to PGND (do not place components such that routing interrupts power stage currents). All small control signals must be routed away from the high current paths.
5. The PCB must have a ground plane (return) connected directly to the return of all components through vias (two vias per capacitor for power-stage capacitors, two vias for the IC PGND, one via per capacitor for small-signal components). A star ground design approach is typically used to keep circuit block currents isolated (high-power/low-power small-signal) which reduces noise-coupling and ground-bounce issues. A single ground plane for this design gives good results. No ground-bounce issue occurs with this small layout and a single ground plane. Having the components segregated minimizes coupling between signals.
6. The high-current charge paths into VBUS, PMID, and from the SW pins must be sized appropriately for the maximum charge current in order to avoid voltage drops in these traces. The PGND pins must be connected to the ground plane to return current through the internal low-side FET.
## Bill of Materials

### 4.1 Bill of Materials

<table>
<thead>
<tr>
<th>Count</th>
<th>RefDes</th>
<th>Value</th>
<th>Description</th>
<th>Size</th>
<th>Part Number</th>
<th>MFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C1</td>
<td>1 µF</td>
<td>Capacitor, Ceramic, X5R, 16V, ±10%</td>
<td>0603</td>
<td>GRM188R61C105K</td>
<td>Murata</td>
</tr>
<tr>
<td>1</td>
<td>C2</td>
<td>4.7 µF</td>
<td>Capacitor, Ceramic, X7R, 16V, ±10%</td>
<td>0805</td>
<td>GRM21BR71C475K</td>
<td>Murata</td>
</tr>
<tr>
<td>1</td>
<td>C3</td>
<td>10 µF</td>
<td>Capacitor, Ceramic, X5R, 10V, ±10%</td>
<td>0805</td>
<td>Std</td>
<td>Std</td>
</tr>
<tr>
<td>2</td>
<td>C4, C5</td>
<td>1 µF</td>
<td>Capacitor, Ceramic, X5R, 10V, ±10%</td>
<td>0402</td>
<td>GRM155R61A105K</td>
<td>Murata</td>
</tr>
<tr>
<td>1</td>
<td>C6</td>
<td>0.033 µF</td>
<td>Capacitor, Ceramic, X7R, 16V, ±10%</td>
<td>0402</td>
<td>GRM155R71C333KA01D</td>
<td>Murata</td>
</tr>
<tr>
<td>2</td>
<td>C7, C8</td>
<td>0.1 µF</td>
<td>Capacitor, Ceramic, X7R, 16V, ±10%</td>
<td>0402</td>
<td>GRM155R71C104K</td>
<td>Murata</td>
</tr>
<tr>
<td>1</td>
<td>C9</td>
<td>47 µF</td>
<td>Capacitor, Ceramic, X5R, 10V, ±10%</td>
<td>1210</td>
<td>GRM32ER61A476KE20L</td>
<td>Murata</td>
</tr>
<tr>
<td>1</td>
<td>D1</td>
<td>Green</td>
<td>Diode, LED, Green, 2.1-V, 20-mA, 6-mcd</td>
<td>0603</td>
<td>LTST-C195GTK</td>
<td>Lite On</td>
</tr>
<tr>
<td>1</td>
<td>D2</td>
<td>BAT54C</td>
<td>Diode, Dual Schottky, 200-mA, 30-V</td>
<td>0805</td>
<td>Std</td>
<td>Std</td>
</tr>
<tr>
<td>3</td>
<td>J1</td>
<td>ED555/2DS</td>
<td>Terminal Block, 2-pin, 6-A, 3.5mm</td>
<td>0.27 x 0.25 inch</td>
<td>ED555/2DS</td>
<td>OST</td>
</tr>
<tr>
<td>3</td>
<td>J2, J3, J4</td>
<td>ED555/3DS</td>
<td>Terminal Block, 3-pin, 6-A, 3.5mm</td>
<td>0.41 x 0.25 inch</td>
<td>ED555/3DS</td>
<td>OST</td>
</tr>
<tr>
<td>1</td>
<td>J5</td>
<td>N2510-6002-RB</td>
<td>Connector, Male Straight 2x5 pin, 100mil spacing, 4 Wall</td>
<td>0.338 x 0.788 inch</td>
<td>N2510-6002-RB</td>
<td>3M</td>
</tr>
<tr>
<td>2</td>
<td>JP1, JP2, JP4</td>
<td>PEC03SAAN</td>
<td>Header, Male 3-pin, 100mil spacing</td>
<td>0.100 inch x 3</td>
<td>PEC03SAAN</td>
<td>Sullins</td>
</tr>
<tr>
<td>2</td>
<td>JP3, JP5</td>
<td>PEC02SAAN</td>
<td>Header, Male 2-pin, 100mil spacing</td>
<td>0.100 inch x 2</td>
<td>PEC02SAAN</td>
<td>Sullins</td>
</tr>
<tr>
<td>1</td>
<td>L1</td>
<td>1 µH</td>
<td>2.5mmx2mm, 1.0uH, ±30%, 1.3A</td>
<td>0.11x0.09 inch</td>
<td>LOM25-HN1R0MJ0 or CP1008</td>
<td>Murata or Inter-Technical</td>
</tr>
<tr>
<td>0</td>
<td>R1</td>
<td>0.068</td>
<td>Resistor, Chip, 125mW, 5%</td>
<td>0402</td>
<td>ERJ-2BWJR068X</td>
<td>Panasonic</td>
</tr>
<tr>
<td>1</td>
<td>R2</td>
<td>5.1k</td>
<td>Resistor, Chip, 1/16-W, 5%</td>
<td>0603</td>
<td>Std</td>
<td>Std</td>
</tr>
<tr>
<td>1</td>
<td>R3</td>
<td>10k</td>
<td>Resistor, Chip, 1/16-W, 5%</td>
<td>0603</td>
<td>Std</td>
<td>Std</td>
</tr>
<tr>
<td>2</td>
<td>R4, R5</td>
<td>200</td>
<td>Resistor, Chip, 1/16-W, 5%</td>
<td>0603</td>
<td>Std</td>
<td>Std</td>
</tr>
<tr>
<td>0</td>
<td>TP1–TP7</td>
<td>Open</td>
<td>Test Point, 0.020 Hole&quot;</td>
<td>0.05 x 0.020 Hole&quot;</td>
<td>Foolish21-A or CP1508</td>
<td>Murata or Inter-Technical</td>
</tr>
<tr>
<td>0</td>
<td>U1</td>
<td>BO24153AYFF</td>
<td>IC, Battery Charger for Single-Cell Li-Ion and Li-Polymer Battery</td>
<td>WCSP</td>
<td>BO24153AYFF</td>
<td>TI</td>
</tr>
<tr>
<td>0</td>
<td>U2</td>
<td>BO24153AYFF</td>
<td>IC, Battery Charger for Single-Cell Li-Ion and Li-Polymer Battery</td>
<td>WCSP</td>
<td>BO24153AYFF</td>
<td>TI</td>
</tr>
<tr>
<td>0</td>
<td>U3</td>
<td>BO24153AYFF</td>
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<td>4</td>
<td>U5</td>
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<td>Shorting jumper, 2-pin, 100mil spacing</td>
<td>200ohm</td>
<td>929950-00</td>
<td>3M/ESD</td>
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<tr>
<td>1</td>
<td>–</td>
<td>PCB, 2.0 In x 2.0 In x 0.031 In</td>
<td>HPA697</td>
<td>Any</td>
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(1) PCBs prior to revision C have a 0.01 µF capacitor installed.
% Table 1

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### 4.2 Board Layout

![Figure 5. Top Layer](image-url)
Figure 6. Bottom Layer

Figure 7. Top Assembly
Revision History

Changes from B Revision (September 2012) to C Revision

- Changed C6 in the Bill of Materials, added table note 1. ................................................................. 9
- Changed C6 in schematic ..................................................................................................................... 12

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

Revision History

Changes from A Revision (February 2012) to B Revision

- Removed device number bq24157B .................................................................................................. 1
- Added SLUSA27 and SLUS931 technical references ........................................................................ 2
- Changed From: J2–BAT+ .................................................................................................................... 2
- Changed From: J2–CSOUT .................................................................................................................. 2
- Changed From: J4–OTG ....................................................................................................................... 2
- Replaced table ...................................................................................................................................... 2
- Added SOFTWARE section ..................................................................................................................... 4
- Added Factory Jumper Settings ............................................................................................................ 4
- Changed Original Test Setup for HPA256 (bq2415x EVM) ............................................................. 5
- Updated lit item 9 ............................................................................................................................... 5
- Added New figure ............................................................................................................................... 6
- .......................................................................................................................................................... 7
- Changed title ......................................................................................................................................... 7
- Removed bq24157B from the schematic ............................................................................................. 12

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

Revision History

Changes from Original (November 2010) to A Revision

- Changed the Maximum Charge Current and Maximum Battery Regulation Voltage in The Safety Limit Register section . 6
- Changed the schematic ......................................................................................................................... 12

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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 could void the user’s authority to operate the equipment.

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- 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.

Industry Canada Compliance (English)

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

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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.
Canada Industry Canada Compliance (French)

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.

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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.

http://www.tij.co.jp

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