TIDA-00761 Test Report

Abstract

TI design TIDA-00761 is a high-performance, easy-to-use development kit for the design of a compact, flexible, high-efficiency, lower power management solution for single-cell, Li-ion and Li-polymer batteries used in wearables and low-power portable applications.

It features terminal blocks and standard headers for IN, SYS, BAT, LDO, PMID and VINLS. The battery voltage, systems output voltage, charge current, input current limit, and VIN_DPM thresholds are programmable via I^2C interface. Status signals are indicated by LEDs.

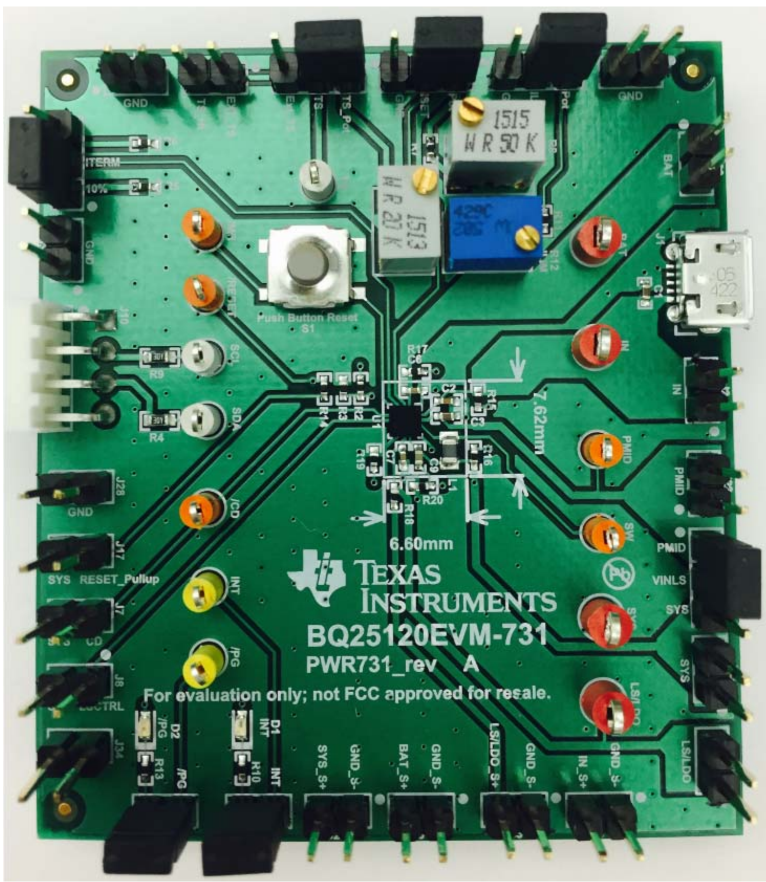


Figure 1. Board Photo

Document History

Version	Date	Author	Notes
1.0	August 28th , 2015	Wenjia Liu	First release

1. Board Setup

1.1 Schematic

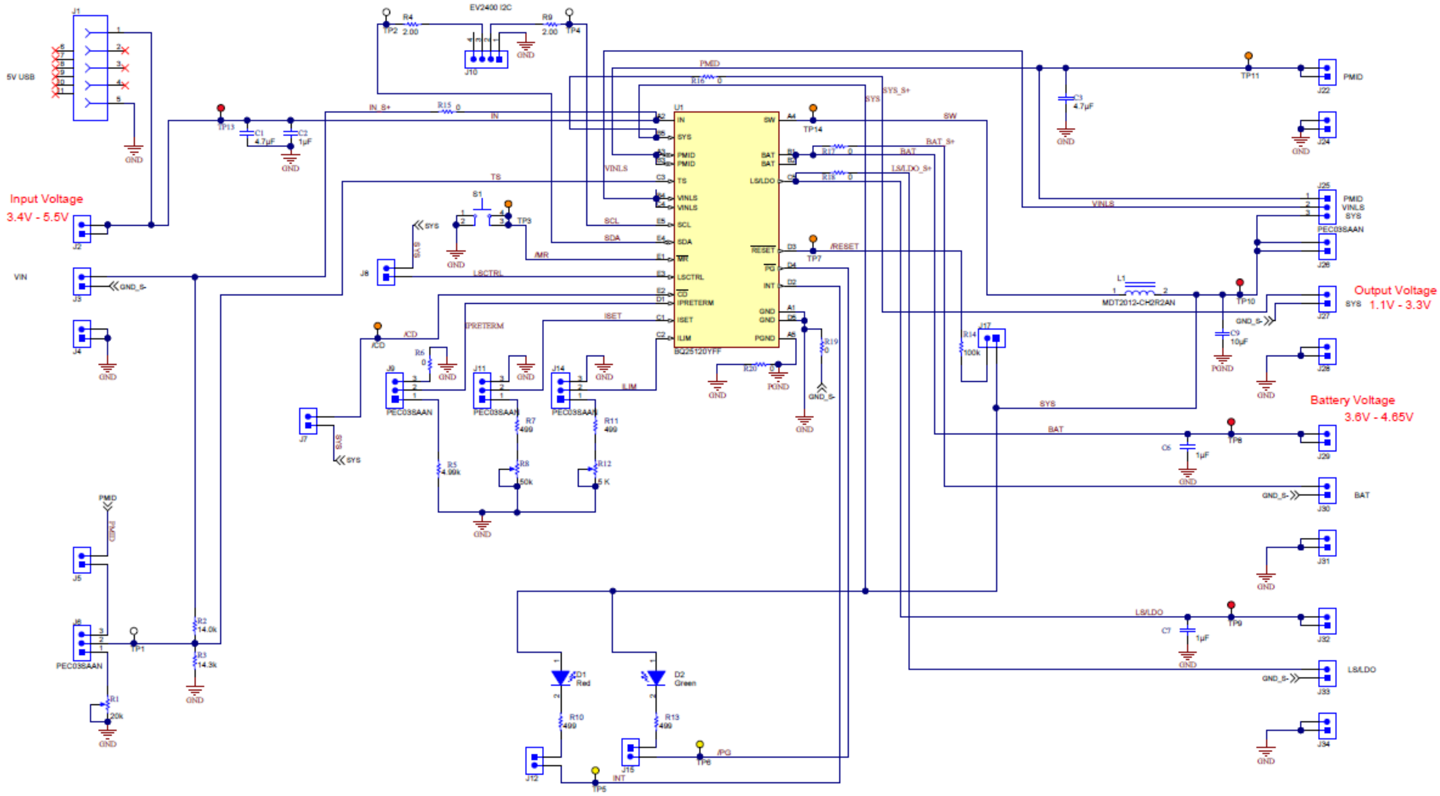


Figure 2. TIDA-00761 Schematic

1.2 I/O Description

Table 1. Description of the IO connectors on PCB

Header or Terminal Block	Description
J1 - USB Power Input	Micro USB connector for USB input power
J2 - IN (Force line)	Headers for extra connections to IN-Force
J3 - IN/GND (Sense line)	Headers for IN-Sense and GND
J4 - GND	Headers for extra connections to GND
J5 - TS to PMID	Headers for TS pin to be pulled up to PMID
J6 - TS	Headers for TS pin to be connected either to PMID or external resistor
J7 - CD	Headers for /CD pin to be pulled up to SYS pin
J8 - LS/CTRL	Headers for LS/CTRL pin to be pulled up to SYS pin
J9 - IPRETERM	Headers for IPRETERM pin to be connected to an external resistor or shorted to GND
J10 - EV2400	The 4-wire connector for EV2400 Communication interface
J11 - ISET	Headers for ISET pin to be connected to an external resistor or shorted to GND
J12 - INT	Headers for INT pin to be pulled up to SYS pin through a LED light
J14 - ILIM	Headers for ILIM pin to be connected to an external resistor or shorted to GND
J15 - /PG	Headers for /PG pin to be pulled up to SYS pin through a LED light
J17 - /RESET	Headers for /RESET pint o be pulled up to SYS pin through a 100k resistor
J22 - PMID	Headers for extra connections to PMID
J24 - GND	Headers for extra connections to GND
J25 - PMID/VINLS/SYS	Headers for PMID/VINLS/SYS connections
J26 - SYS	Headers for extra connections to SYS-Force
J27 - SYS/GND (Sense line)	Headers for SYS-Sense and GND
J28 - GND	Headers for extra connections to GND
J29 - BAT	Headers for extra connections to BAT-Force
J30 - BAT/GND (Sense line)	Headers for BAT-Sense and GND
J31 - GND	Headers for extra connections to GND
J32 - LS/LDO	Headers for extra connections to LS/LDO-Force
J33 - LS/LDO (Sense line)	Headers for LS/LDO-Sense and GND
J34 - GND	Headers for extra connections to GND

1.3 Test points

Table 2. Test Points Description

Test Points	Description
TP1	TS pin
TP2	SDA pin
TP3	/MR pin
TP4	SCL pin
TP5	INT pin
TP6	/PG pin
TP7	/RESET pin
TP8	BAT pin
TP9	LS/LDO pin
TP10	SYS pin
TP11	PMID pin
TP13	IN pin
TP14	SW pin
TP /CD	/CD pin

1.4 Default Settings

Bq25120EVM-731 module has provided the capability of changing key parameters using I^2C and EV2400 communication interface. However, I^2C communication is not required for this device to operate. The module is programmed to the default settings as is described below. Table 3 describes the default parameter values and table 4 shows the initial jumper positions on the PCB.

Table 3. Default Settings

Parameter	Options	BQ25120
BAT_UVLO	2.2 V to 3.4 V (200mV step)	3.0 V
VSYS	1.1 V to 3.3 V (100mV step)	1.8 V
LS/LDO	LS, 0.8 V to 3.3 V (100mV step)	LS
VBREG	3.6 V to 4.65 V (10mV step)	4.2 V
ICHG	5mA to 300mA	10 mA
IPRETERM	500uA to 50mA	2 mA
Input ILIM	50mA to 400mA (50mA step)	100 mA
VIN_DPM_ON	On or Off	On
VIN_DPM Threshold	4.2 V to 4.9 V	4.6 V
Auto Charge	On or Off	On
Safety Timer	30min, 3hr, 9hr, Disabled	3 hr

Table 4. Initial Jumper Position

J6	J9	J11	J12	J14	J15	J25
TS = TS_Pot	ITERM = GND	ISET= GND	Installed	ILIM = GND	Installed	VINLS = PMID

1.5 Recommended Operating Conditions

Table 5. Recommended Operating Conditions

		min	nom	max	unit
V_{IN}	IN voltage range	3.4	5	20	V
	IN operating voltage range, recommended	3.4	5	5.5	
V_{BAT}	V_{BAT} operating voltage range			5.5(1)	V
V_{VINLS}	VINLS voltage range for Load Switch	0.8		5.5(2)	V
V_{VINLS}	VINLS voltage range for LDO	2.2		5.5	V
I_{IN}	Input Current, IN input			400	mA
I_{SW}	Output Current from SW, DC			300	mA
I_{PMID}	Output Current from PMID, DC			300	mA
$I_{LS/LDO}$	Output Current from LS/LDO			100	mA
I_{BAT}, I_{SYS}	Charging and discharging using internal battery FET			300	mA
T_J	Operating junction temperature range	-40		125	°C

(1) Any voltage greater than shown should be a transient event.

(2) These inputs will support 6.6 V for less than 10% of the lifetime at $V_{(BAT)}$ or VIN, with a reduced current and/or performance.

2 Test Summary

This procedure describes the test configuration of the bq25120EVM-731 evaluation module for bench evaluation.

2.1 Recommended Test Equipment

2.1.1 Power Supplies

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

2.1.2 Load

Testing with an actual battery is the best way to verify operation in the system. If a battery is unavailable, then a source meter likes a Keithley 2420, capable of both sourcing and sinking current, or a circuit similar to the one shown in Figure 2 can simulate a battery when connected to PS#2.

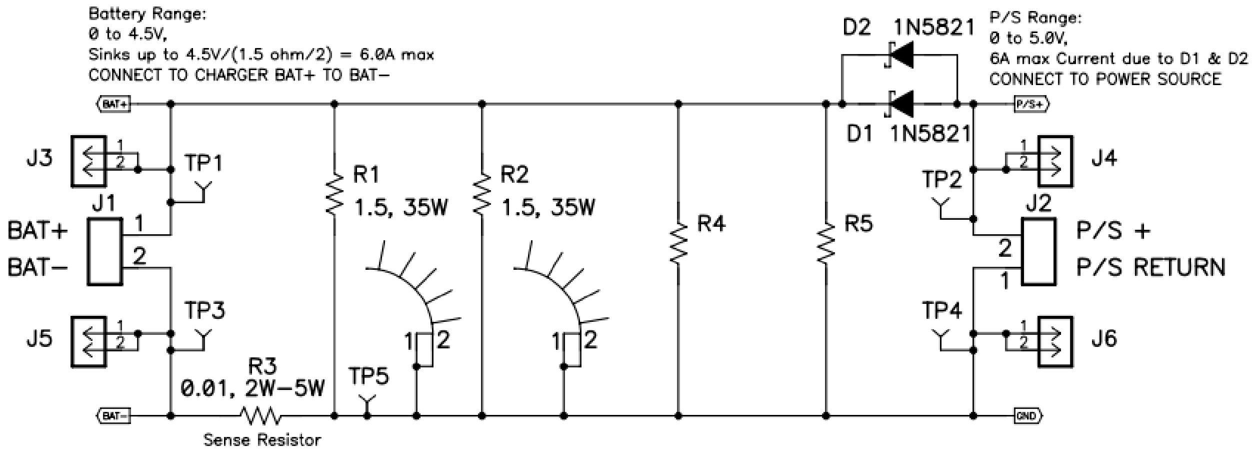


Figure 3. BAT Load (PR1010) Schematic

2.1.3 Meters

Three voltage meters and two current meters. The current meters must be able to measure at least 0.5-A current.

2.1.4 Tool/Software GUI (Optional)

1. EV2400 Communication Interface Board

   http://www.ti.com/tool/EV2400

2. BqStudio Software GUI

   http://www.ti.com/tool/BQSTUDIO

2.2 Recommended Test Equipment Setup

1. Set power supply #1 (PS#1) for 5V+/-100mV DC, 1 A current limit and then turn off supply. Set power supply #2 (PS#2) for 3.5V and then turn off supply.
2. Connect the positive output of power supply #1 (PS#1) through a current meter (CM#2) to IN (J2) and negative output to GND (J34).
3. Connect a voltage meter (VM#1) across J2 and J34.
4. Connect the PR1010 BAT+ terminal of PR1010 in series with a current meter (CM#1) to BAT (J29). Connect PR1010 BAT – to GND (J34). Connect the P/S+ and P/S return side of PR1010 to PS#2, set the voltage to 3.5V ± 50mV then disable PS#2.

5. Connect a voltage meter (VM#2) across BAT (J29) and GND (J34).
6. Connect a DMM (VM#3) across SYS (SYS_S+ of J27) and GND (GND_S- of J27).
7. Configure jumpers as shown in Table 1.

After the preceding steps are accomplished, the test setup for PWR731 is as shown in Figure 3.

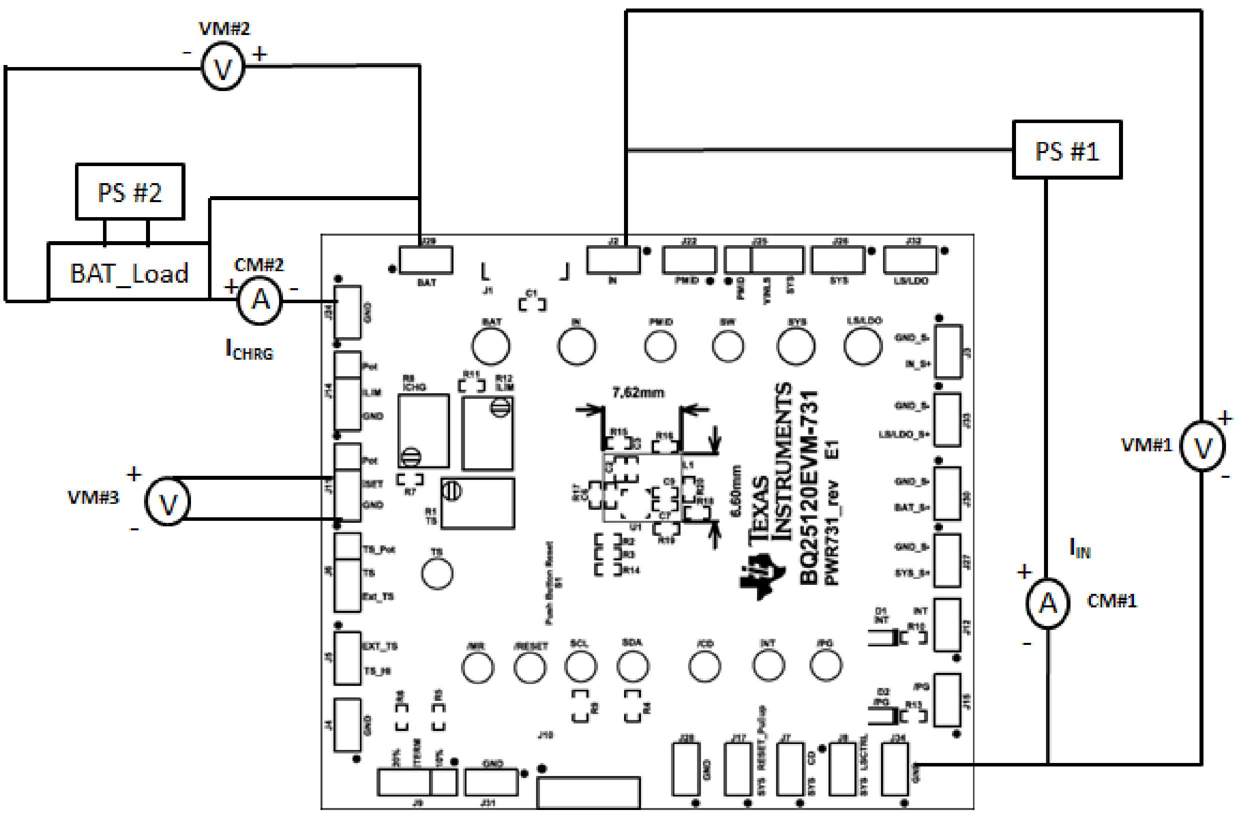


Figure 4. Test Setup for TIDA-00761 (bq25120EVM-731)

2.3 Software GUI (When I²C communication is used)

2.3.1 Install the bqStudio software GUI

2.3.2 Connect EV2400 Interface board to the EVM (as is shown in Figure 4)

http://www.ti.com/tool/EV2400

2.3.3 Open Software GUI and go to “Field View” page (as is shown in Figure 5)

2.3.4 Change the parameters in the pull down menu or check/uncheck the selection box.

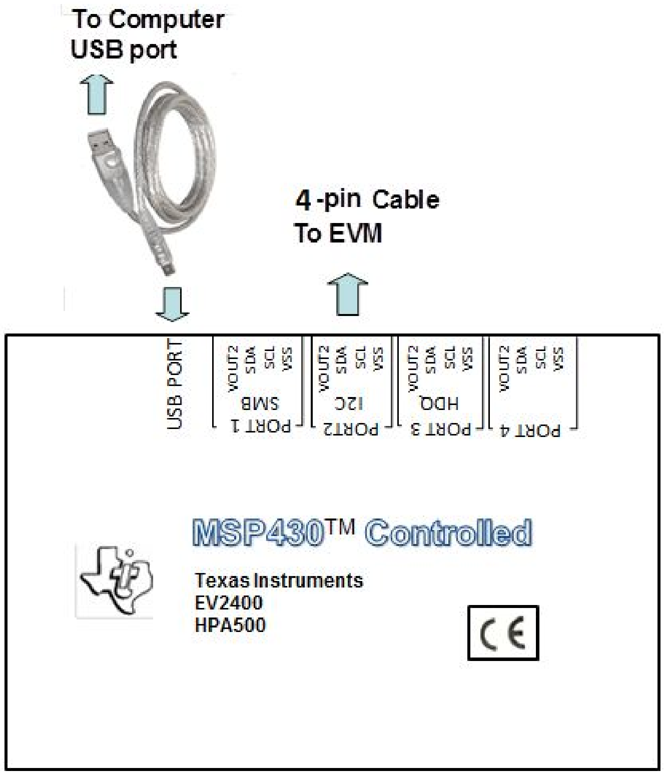


Figure 5. The Connection of EV2400 Interface Box

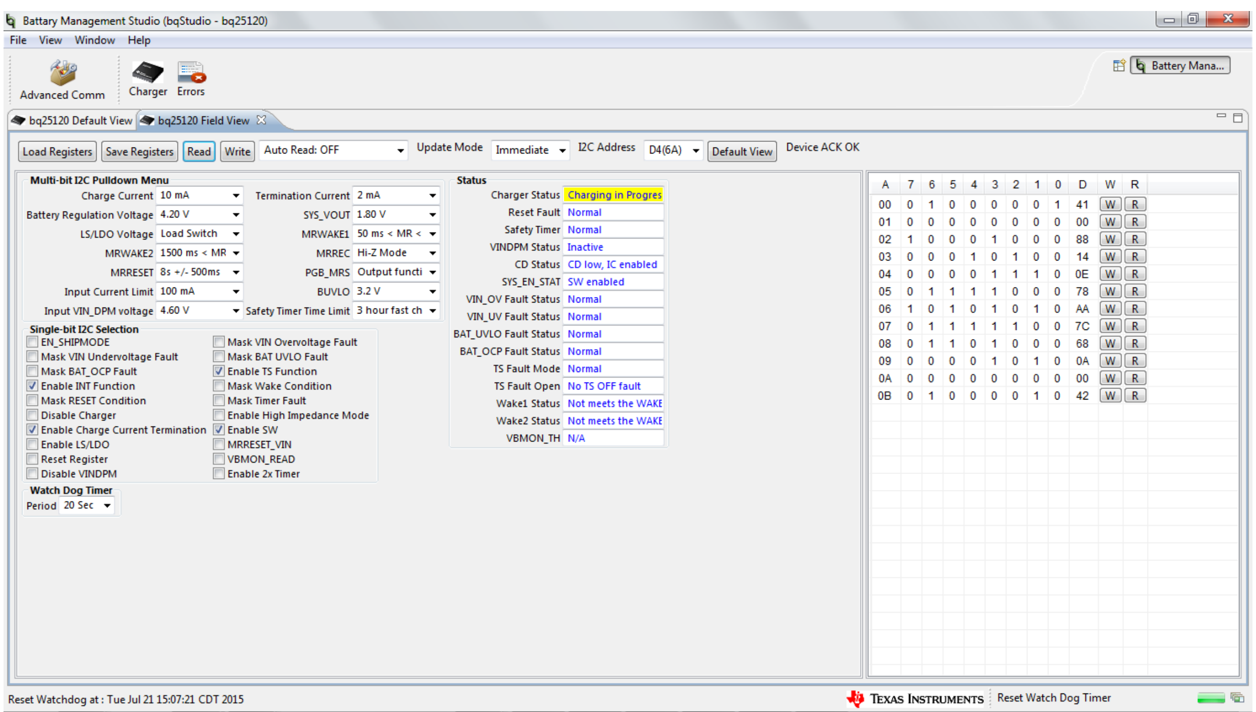


Figure 6. Software GUI of bq25120

3 Test Procedure

3.1 Set the Potentiometers

1. Set VM#3 DMM to measure resistance.
2. Install J11 to POT
3. Install J14 to POT
4. Turn the potentiometer R8 until
5. Measure on VM#3 →R[J11 (ISET), J11(GND)] = 2 kohm.
6. Move the positive side of VM#3 DMM to J14 (ILIM).
7. Turn the potentiometer R12 until
8. Measure on VM#3 →R[J14(ILIM), J14(GND)] = 499 ohm.
9. Move the positive side of VM#3 DMM to J6 (TS).
10. Turn the potentiometer R1 until
11. Measure on VM#3 →R[J6 (TS), J14(GND)] = 5.5 kohm – 6.5kohm.
12. Move the positive side of VM#3 DMM to J27 (SYS_S+)
13. Set VM#3 DMM to measure voltage.

3.2 Charge Disabled

1. Install the jumper on J7 – Connect CD to SYS.
2. Enable PS#1 and PS#2.
3. Observe D2 is on, D1 is off.
4. Measure on VM#3→ V[J27(SYS_S+) J14(GND)] = 1.8V ± 50mV
5. Measure on CM#2 → ICHRG <= 0 – 1mA
6. Measure on CM#1 → IIN < 1 mA
7. Disable PS#1 and PS#2.
8. Charge Current Regulation
9. Remove the jumper on J7 – Disconnect CD to SYS.
10. Enable PS#1 and PS#2.
11. Observe D2 is on, D1 is on.
12. Adjust PS#2 so that the voltage measured by VM#2, across BAT and GND, measures 3.5V.
13. Adjust the PS#1 so that VM#1 still reads 5.0V + 100mV.
14. Measure on VM#3→ V[J27(SYS_S+) J14(GND)] = 1.8V ± 50mV

15. Measure on CM#2 → ICHRG = 90 – 110 mA

16. Measure on CM#1 → IIN = 93 mA - 113 mA

17. 3.3.6 Disable PS#1 and PS#2.

3.3 Ship Mode (Optional if I2C control is not used)

1. Enable PS#1 and PS#2.

2. Open the software GUI.

3. Go to Field View of the GUI and then read all the registers. All the default register values should be shown in the register map. (As shown in Figure 3)

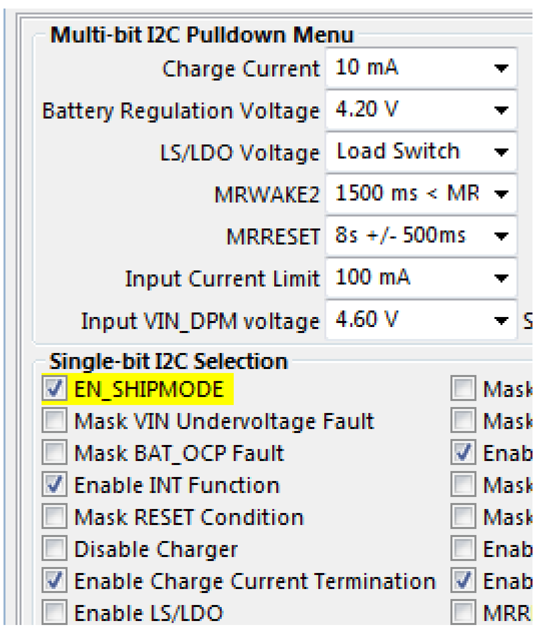
4. Measure on CM#2 → ICHRG = 9 – 11 mA

5. Install the jumper on J7 – Connect CD to SYS.

6. Disable PS#1

7. Measure on CM#2 → ICHRG = 5 - 7 uA

8. Check the box in front of “EN_SHIPMODE” in the software GUI.



9. Measure on CM#2 → ICHRG < 100 nA

10. Disable PS#2.

11. Remove the jumper on J7 – Disconnect CD to SYS.

4 Test Data

4.1 Efficiency

- Figure 7 shows the system efficiency across the different battery voltage with Vsys=1.8V.

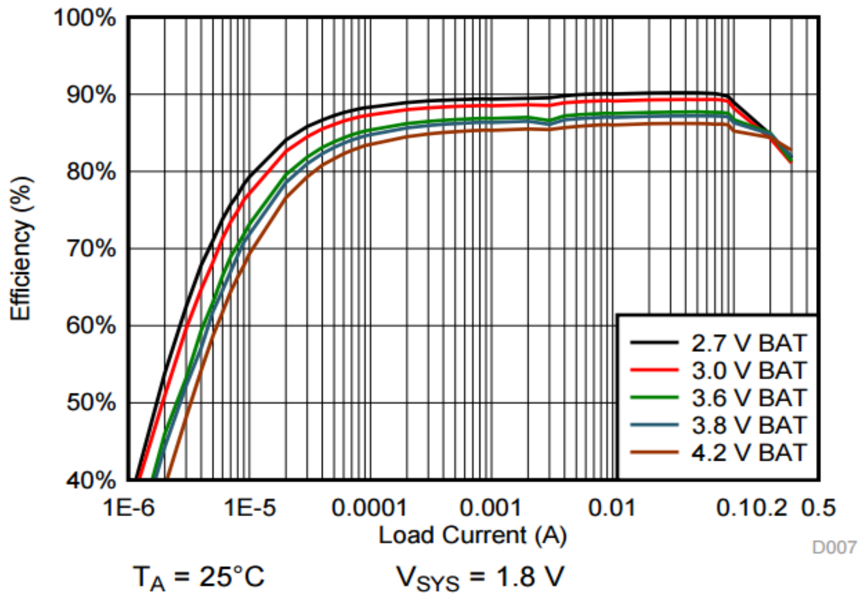


Figure 7. TIDA-00761 System Efficiency vs Battery Voltage (V_{SYS}=1.8V)

- Figure 8 shows the system efficiency across the different battery voltage with Vsys=3.3V.

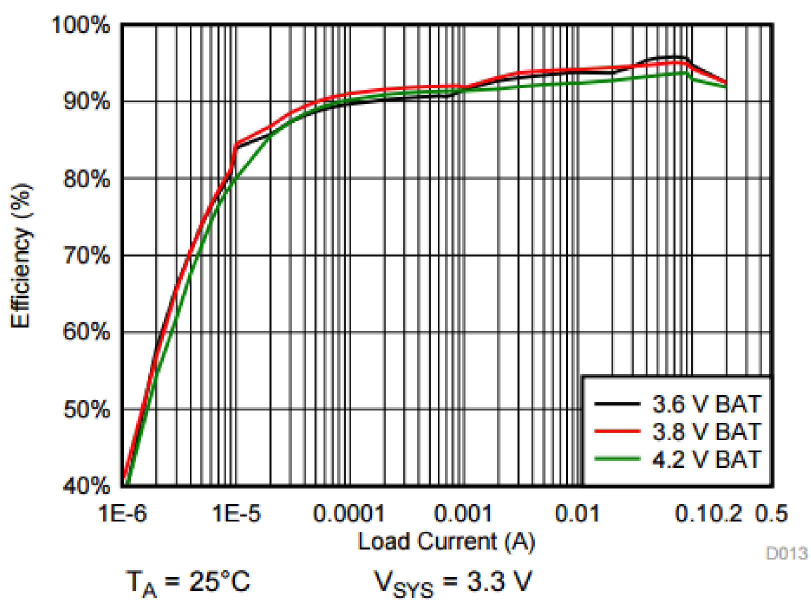


Figure 8. TIDA-00761 System Efficiency vs Battery Voltage (V_{SYS}=3.3V)

4.2 Load Transient

- Figure 9 shows the load transient of V_{LSLDO} from 0 to 100 mA. V_{LSLDO} =3.3V.

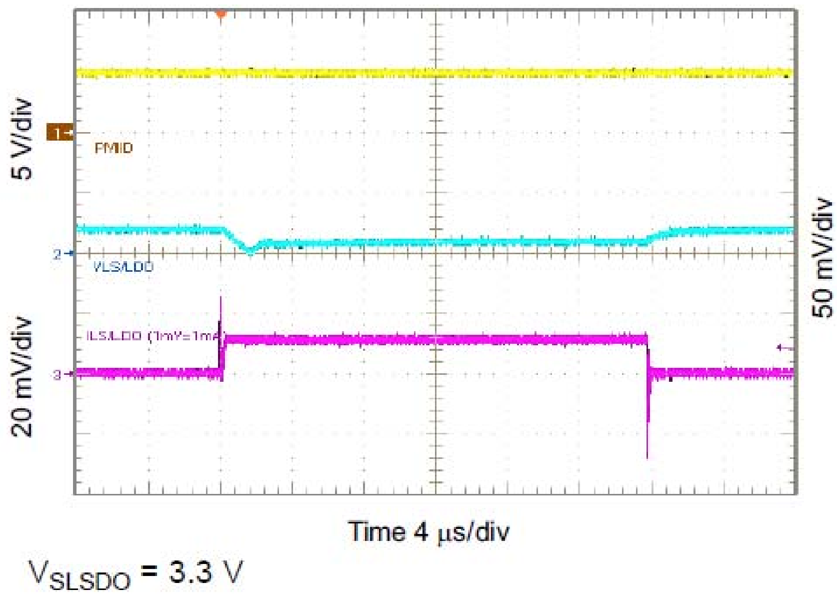


Figure 9. 3.3V VLSLDO Load Transient from 0 to 100mA

- Figure 10 shows the load transient of VLSLDO from 0 to 100 mA. VLSLDO =1.2V.

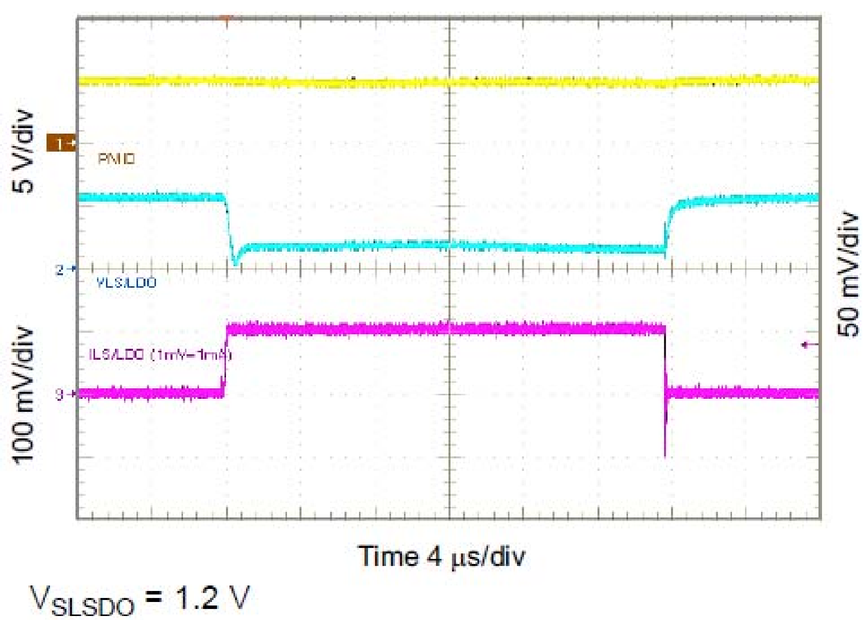
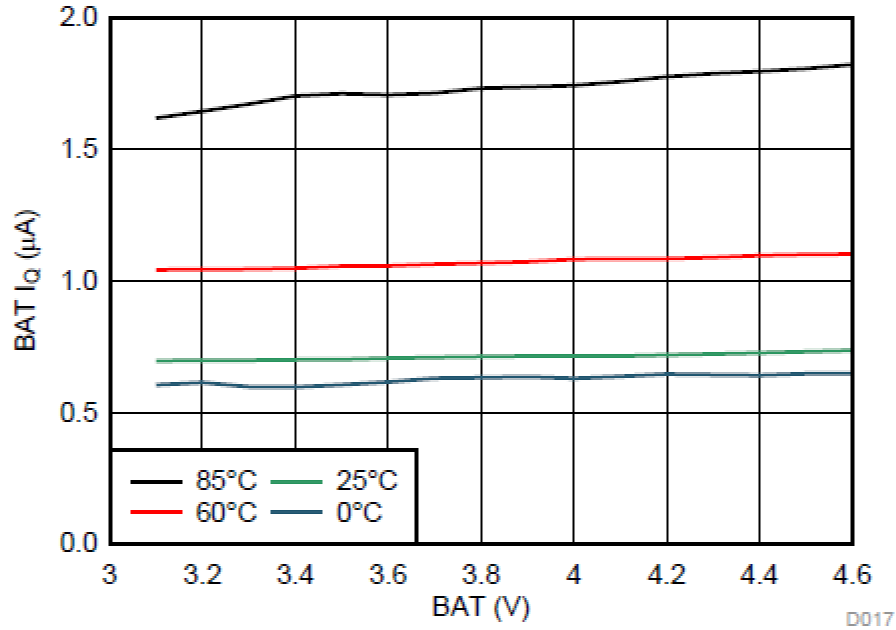


Figure 10. 1.2V VLSLDO Load Transient from 0 to 100mA

4.3 Battery Leakage Current

- Figure 11 shows the battery leakage current in HiZ mode.



1.8 V System Enabled (No Load)

Figure 11. Hi-Z BAT, I_Q

- Figure 12 shows the battery leakage current in ship mode.

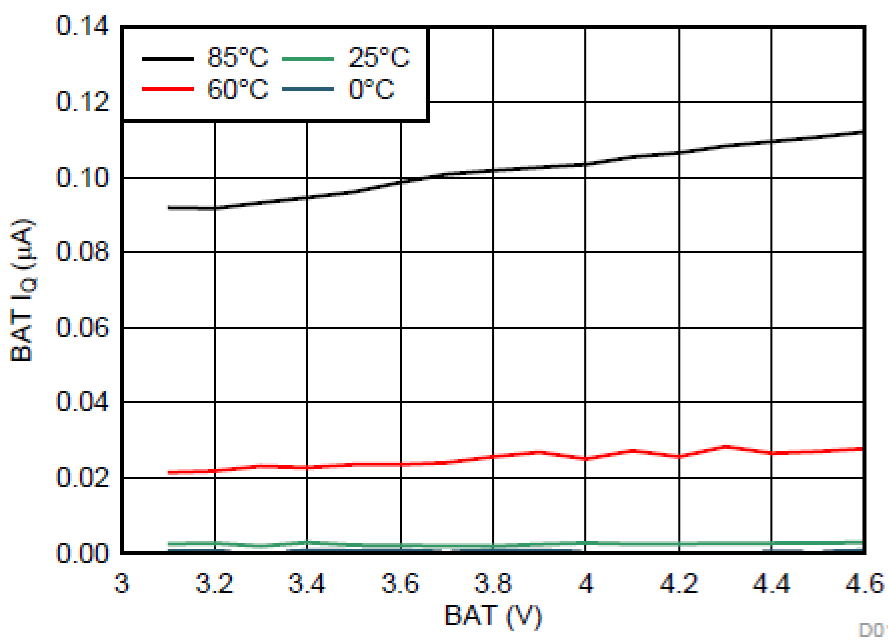


Figure 12. Ship Mode BAT, I_Q

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265