TEXAS INSTRUMENTS

TI Design TIDA-00036
I2C Controlled Single Cell Charger with 5.1V 2.1A or 1A Synchronous Boost

1 GENERAL

1.1 PURPOSE

The purpose of this document is to provide detailed instructions for testing the TIDA-00036 modules (bq24195/195L EVM).

1.2 REFERENCE DOCUMENTATION

1) bq24195/195L Datasheet
2) TIDA-00036 _SCH.pdf
3) TIDA-00036 _PCB.pdf
4) TIDA-00036 _BOM.xls

1.3 DEFINITIONS

This procedure details how to configure the evaluation board. On the test procedure the following naming conventions are followed. Refer to the schematic for details.

VXXX :	External voltage supply name (VBUS, VBAT, VSYS)
LOADW:	External load name (LOAD)
V(TPyy) :	Voltage at internal test point TPyyy. For example, V(TP12) means the voltage at TP12.
V(Jxx):	Voltage at jack terminal Jxx.
V(TP(XXXXX)):	Voltage at test point “XXXXX”. For example, V(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.
Measure:→A,B	Check specified parameters A, B. If measured values are not within specified limits the unit under test has failed.
Observe → A,B	Observe if A, B occur. If they do not occur, the unit under test has failed.
Short → A,B	Connect A to B using a jumper
Jxx(BBB):	Terminal or pin BBB of jack xx

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

2 SAFETY

2.1 EYE PROTECTION

Safety Glasses are to be worn while performing all testing on the EVM.

2.2 GENERAL RISKS

This test must be performed by qualified personnel trained in electronics theory and understand the risks and hazards of the assembly to be tested.

2.3 ELECTROSTATIC DISCHARGE

ESD precautions must be followed while handling electronic assemblies.

2.4 THERMAL/SHOCK HAZARDS

Precautions should be observed to avoid touching areas of the assembly that may get hot or present a shock hazard during testing.

3 APPAREL

3.1 ELECTROSTATIC SMOCK

3.2 ELECTROSTATIC GLOVES OR FINGER COTS

3.3 SAFETY GLASSES

3.4 GROUND ESD WRIST STRAP

4 EQUIPMENT

4.1 POWER SUPPLIES

Power Supply #1 (PS#1): a power supply capable of supplying 5-V @ 2-A is required. While this part can handle larger voltage and current, it is not necessary for this procedure.

4.2 LOAD: (Constant Voltage <4.5V)

Load (BAT+ to GND): Kepco 4 quadrant Supply/Load: BOP 20-5M, DC 0 to ±20V, 0 to ±5A (or higher)

Or: A 0-20V/0-5A, >30W system DC electronic load and setting as constant voltage load mode

Load (PMID to GND; Called for in Boost Mode operation): 10 Ohm, at least 5W power resistor

4.3 METERS

Six Fluke 75 multi-meters, equivalent or better.

Or: Four equivalent voltage meters and two equivalent current meters.

The current meters must be able to measure 4A current.

4.4 Oscilloscope

Techtronic's TDS3054 or similar.

4.5 COMPUTER

A computer with at least one USB port and a USB cable. The bq2419x evaluation software must be properly installed.

4.6 HPA172 COMMUNICATION KIT

A HPA172 USB to I^2C communication kit.

4.7 SOFTWARE

Unzip bq2419xEVM_GUI.zip and double click on the "SETUP.EXE" file. Follow the installation steps. The software supports Windows XP and Window 7 operating systems.

5 EQUIPMENT SETUP

A) Set the power supply #1 for 5V DC, 1 A current limit and then turn off the supply.

B) Connect the output of power supply #1 in series with a current meter (Multi-meter) to J1 (VBUS and GND), as shown in Figure 2.

C) Connect a voltage meter across J1 (VIN) and J1 (GND).

D) Turn on the electronic load, set to constant voltage mode and output to 2.5V. Turn off (disable) the load. Connect the load in series with a current meter (multimeter), ground side, to J2 (BAT+ and GND) as shown in Figure 2. Connect a voltage meter across J2 (BAT+ and GND).

E) Connect a voltage meter across J2 (SYS and GND).

F) Connect HPA172 USB Interface Adapter to the computer with a USB mini-cable and to J3 with the 10 pin ribbon cable. The connections are shown in Figure 1.

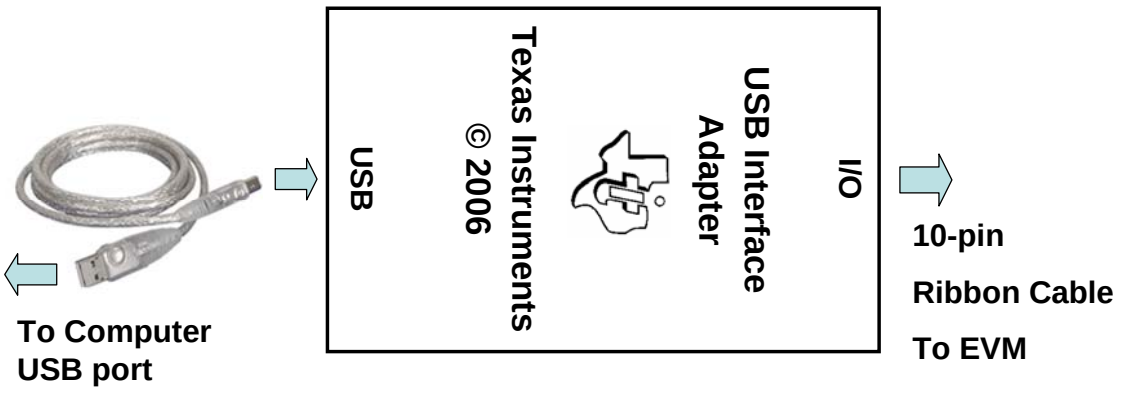


Figure 1. Connections of the HPA172 kit.

G) Install jumpers as listed below: Same for bq24195 and bq24195L

JP1: Apply Shunt: TS1 to TS2
JP2: No Shunt
JP3: Apply Shunt: PULLUP — Uses VSYS as a pull-up bias on TIDA-00036 modules
JP4: No Shunt
JP5: No Shunt
JP6: No Shunt
JP7: Apply Shunt: REGN bias for TS2
JP8: Apply Shunt**:** TS2 10k EVM pull-down
JP9: No Shunt

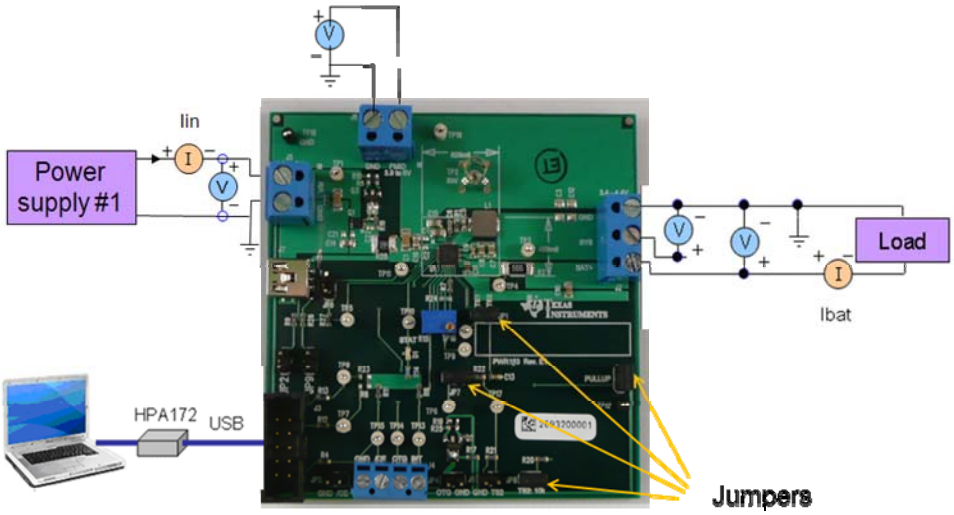


Figure 2. Original test setup for TIDA-00036 (bq2419x EVM).

H) Turn on the computer. Launch the TIDA-00036 (bq24195/195L) evaluation GUI. The main window of the GUI is shown in Figure 3.

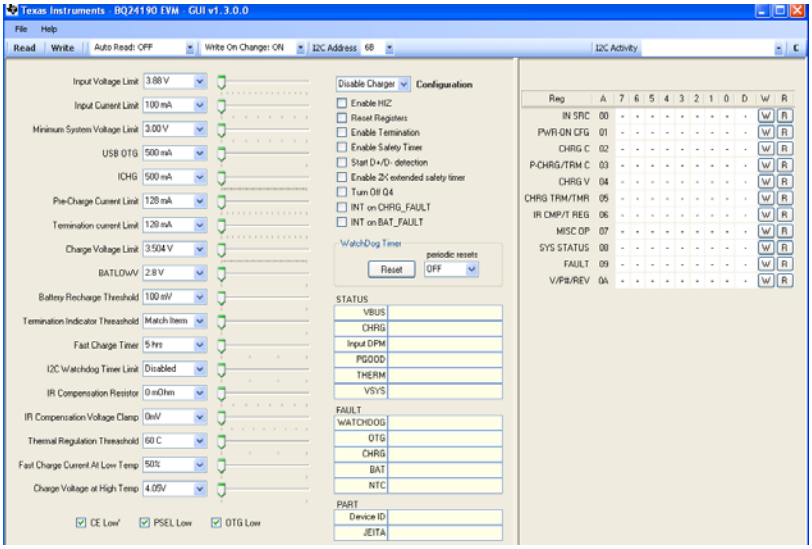


Figure 3. The main window of the GUI for TIDA-00036 module (bq24195/195L EVM).

6 PROCEDURE

6.1 Current settings

6.1.1 Make sure EQUIPMENT SETUP steps are followed.

ILIM Setting: Set the potentiometer to its lowest value for max input current. To do this, connect an ohm-meter between point TP9 and ground. Turn the screw on the potentiometer counterclockwise until the resistance drops to its lowest point (this should be approximately 169 ohms which is the value of R7)

6.1.2 Launch TIDA-00036 modules (bq24195/195L EVM) GUI Application on computer, if no already done.

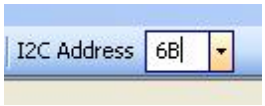
6.1.3 Turn on PS#1

Measure → V (J2(SYS), J2(GND)) = 4.10 ± 300mV

6.2 Charge Voltage and Current Regulation of VIN & Device ID Verification

6.2.1 GUI setup (all done in the GUI):

- Device address: 6B



- Click Read button
- Select “Disabled” for “I2C Watchdog Timer Limit”
- Set “Input Voltage Limit” to 4.2V
- Set “Input Current Limit” to 500mA
- Set “Charge Voltage Limit” to 4.208V
- Set Fast Charge Current, “ICHG” to 500 mA
- Set “Pre-Charge Current Limit” to 256 mA
- Deselect “Enable Termination” (See Figure 4)

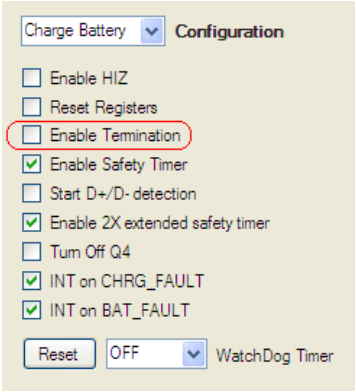


Figure 4. Termination Selection.

- Click Read button twice.

Observe → Everything normal at "FAULT" box.

Observe → D1 (STAT) is on.

6.2.2 Enable Load#1 from step 5D. Measure the voltage across J2 at two different points: V(J2(SYS), J2(GND)) and V(J2(BAT), J2(GND)).

Measure → V(J2(SYS), J2(GND)) = 3.5V ± 300 mV

Measure → V(J2(BAT), J2(GND)) = 2.5V ± 200mV

6.2.3 Increase the Load #1 voltage to 3.7V.

Measure → V(J2(SYS), J2(GND)) = 3.75V ± 200 mV

Measure → IBAT = 500mA ± 200mA

Measure → V(J2(BAT), J2(GND)) = 3.75V ± 200mV

6.2.4 In the software, select Fast Charge Current, "ICHG" to 1.012A.

Measure → Iin = 500mA ± 200mA

6.2.5 Verify Device ID and JEITA shown in software matches table below:

Assy Number	Part Number	Device ID	JEITA
TIDA-00036	bq24195 or bq24195L	100	Disabled

6.2.6 Verify Scope Measurements (See Figure 5 – 500ns/div):

Connect Channel 1, 2, 3 as listed below and verify waveforms as shown in Figure 5.

CH1 (AC coupled 20mV/div): PMID (TP19 to GND)
CH2 (5VDC/div): SW (TP2)
CH3 (AC coupled 20mV/div): SYS (TP3 to GND)

Measure → PMID (TP19) AC Ripple < 10mV excluding high frequency spikes

Measure → SW Frequency (TP2) - Frequency between 1.25MHz & 1.5MHz,
Measure → SW Duty cycle (TP2) - Duty cycle between 73 & 81%.

Measure → SYS AC Ripple (TP3 to GND) < 15mV excluding high frequency spikes

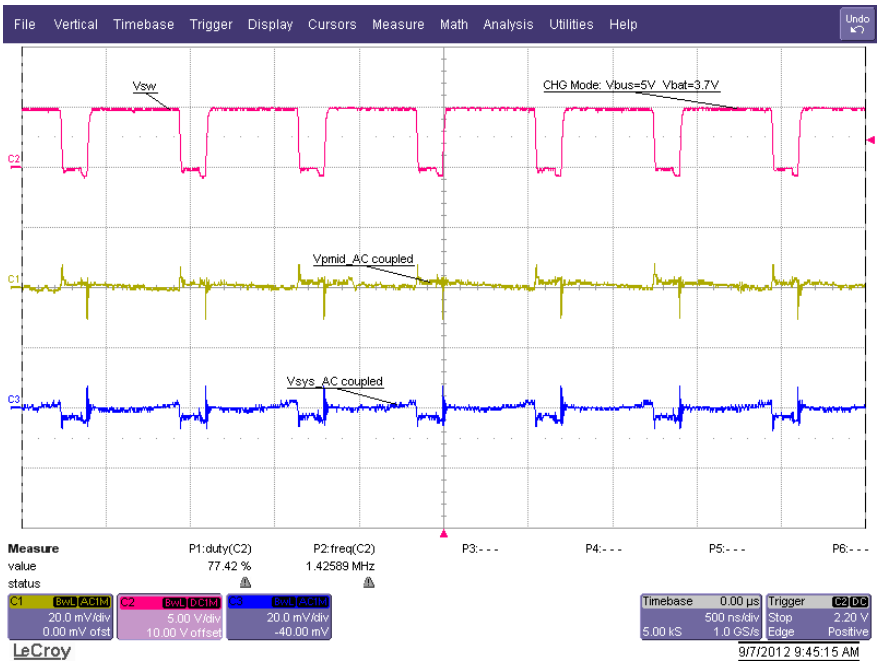


Figure 5. CHG mode ripple and duty cycle; VBUS = 5V and VBAT = 3.7V.

6.2.7 Switch to Boost Mode

a) Turn off and Disconnect Power Supply #1
b) If the Constant voltage supply connected between BAT+ and GND, form above, is not a 4 quadrant supply (can source current) then this needs to be replaced with a power source set to 3.7VDC that can source current.
c) c) Apply 10 ohms (5W or greater) across J5 (PMID(+) to GND(-))
d) d) Uncheck the “OTG Low” box in the GUI.
e) f) Select OTG in the “Configuration” drop down window.
f) g) Verify PMID to GND on J5 is between 4.9V and 5.3V
g) h) Verify scope measurement (See Figure 6).

CH1 (AC coupled 20mV/div): PMID (TP19 to GND)
CH2 (5V/div): SW (TP2)

Measure → PMID (TP19 to GND) AC Ripple < 10mV excluding high frequency spikes

Measure → SW Frequency (TP2) - Frequency between 1.2MHz & 1.7MHz,
Measure → SW Duty cycle (TP2) - Duty cycle between 67 & 74%.

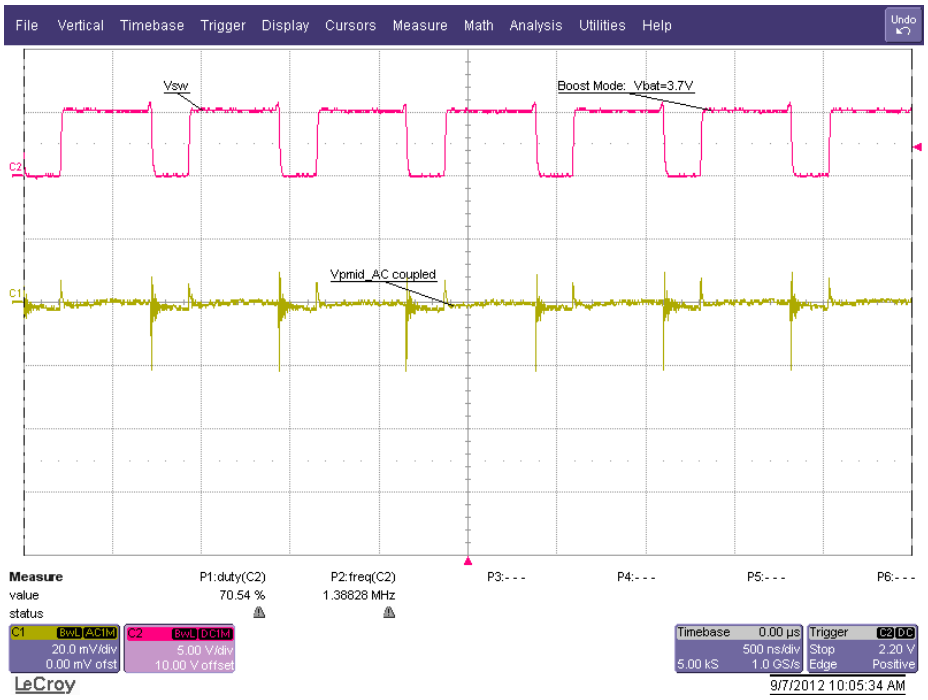


Figure 6. Boost mode Ripple and Duty Cycle; VBAT = 3.7V.

6.2.8 Turn off Power Source connected to BAT+ and GND after the test is done.

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