Texas Instruments

PWR763 Test Procedure

Rev. A

1.0 GENERAL

1.1 PURPOSE

1.1.1 To provide detailed instructions for testing EVM Modules

1.2 SCOPE

1.2.1 Correctly install the EVM jumper configuration.
1.2.2. Verify correct manufacturing of the EVM assembly.
1.2.3. Verify the basic operations of the bq76PL536APAPQ1 .Tests are indicated in red font. *The test does not validate the accuracy of the bq76PL536A-Q1 device.*

1.3 REFERENCE DOCUMENTATION

1.3.1 PWR763 Binder (Schematics and board layout documentation)
1.3.2 PWR763 Users Guide

1.4 MATERIALS

1.4.1 Test Log attached to end of this procedure.

1.5 DEFINITIONS

1.5.1 OTP – One time programmable
1.5.2 WinGUI – Windows Graphical Users Interface
1.5.3 PSx – Power Supplies numbered 1 thru 3

2.0 SAFETY

2.1 Safety Glasses are to be worn.
2.2 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 ESD precautions must be followed while handling electronic assemblies while performing this test.
2.4 Precautions should be observed to avoid touching areas of the assembly that may get hot or present a shock hazard during testing.

3.0 QUALITY

3.1 Test data shall be made available upon request by Texas Instruments.

4.0 APPAREL

4.1 Electrostatic smock
4.2 Electrostatic Gloves or finger cots
4.3 Safety Glasses
4.4 Ground ESD wrist strap.

5.0 EQUIPMENT

5.1 Aardvark USB-SPI interface adapter with 1m or 2m USB cable
5.2 PC compatible computer w/ USB port, WinXP or Windows7
5.3 TI supplied WinGUI software and Aardvark drivers, installed on PC Refer to the bq76PL536 Quick Start Guide for installation instructions.
5.4 Fluke 189 or similar/better DVM.
5.5 Thermocouple probe option for DVM (i.e. Fluke 189 & K-type thermocouple); or IR Temperature Sensor (i.e. Radio Shack IL1400BL Digital IR Thermometer); or laboratory type glass thermometer for measuring local ambient temperature to ±2C or better.
5.6 Three good quality adjustable 0-20V power supplies, capable of sourcing ~18 - 20V @500mA or more.

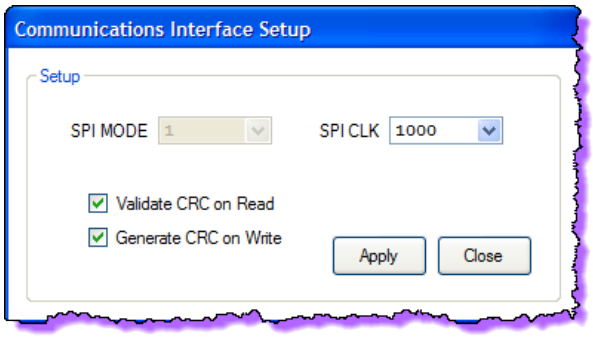
6.0 PROGRAMMING SETUP

6.1 One time Aardvark driver setup

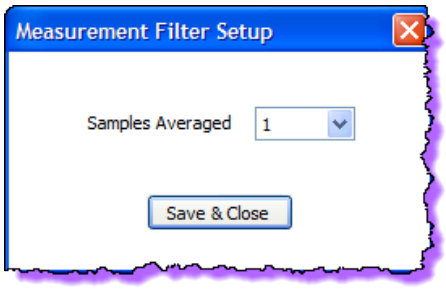
> *Caution: The Aardvark driver must be installed before attaching the adapter for the first time. The Aardvark driver should be installed prior to installing the TI supplied bq76PL536 GUI software.* Run the TotalPhaseUSB-v2.0X.exe to install the drivers. If prompted to do so, plug in the Aardvark to an available USB port using the supplied cable. The port must be a powered-port, typically directly from a PC. Using a non-powered USB hub may not provide sufficient operating current for the Aardvark or EVM to operate correctly.
> http://www.totalphase.com/downloads#aardvark.

6.2 One time bq76PL536 Evaluation Software setup

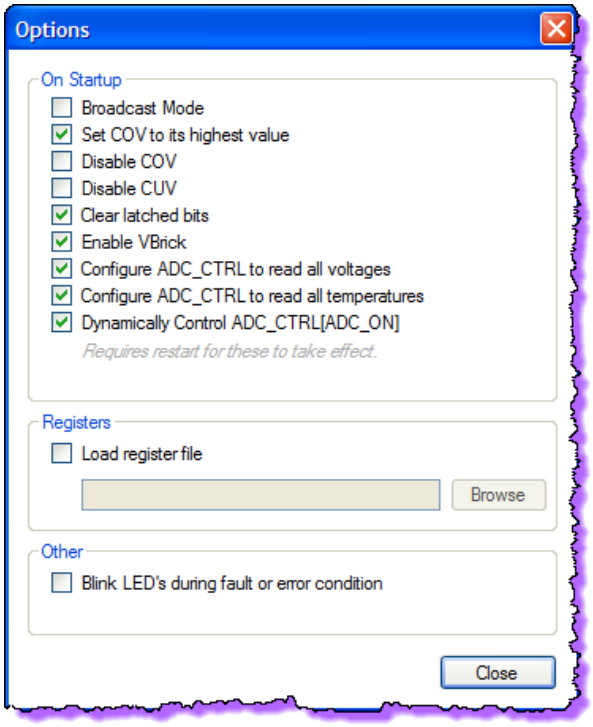
> 6.2.1 Download the bq76PL536A and bq76PL536A-Q1 Evaluation Software from the tool folder on TI.com located here: http://www.ti.com/tool/BQ76PL536EVM-3-SW .
>
> Run the file bq76PL536 Setup.msi version 2.1.21 to install the GUI (Graphical User Interface) software for Windows. *As new versions are released, they may be installed over the existing version.*
> Refer to SLUU437 for bq76PL536A and bq76PL536A-Q1 evaluation software and User's guide.
>
> 6.2.2 TOOLS | INTERFACE SETUP (default shown)



6.2.3 **TOOLS | MEASUREMENT FILTER** Setup (default shown)



6.2.4 **TOOLS | OPTION** menu recommended settings (close and restart application after changing for new settings to take effect. *It is only necessary to change the settings when the application is started the first time after installation; they are remembered on subsequent application startup.*



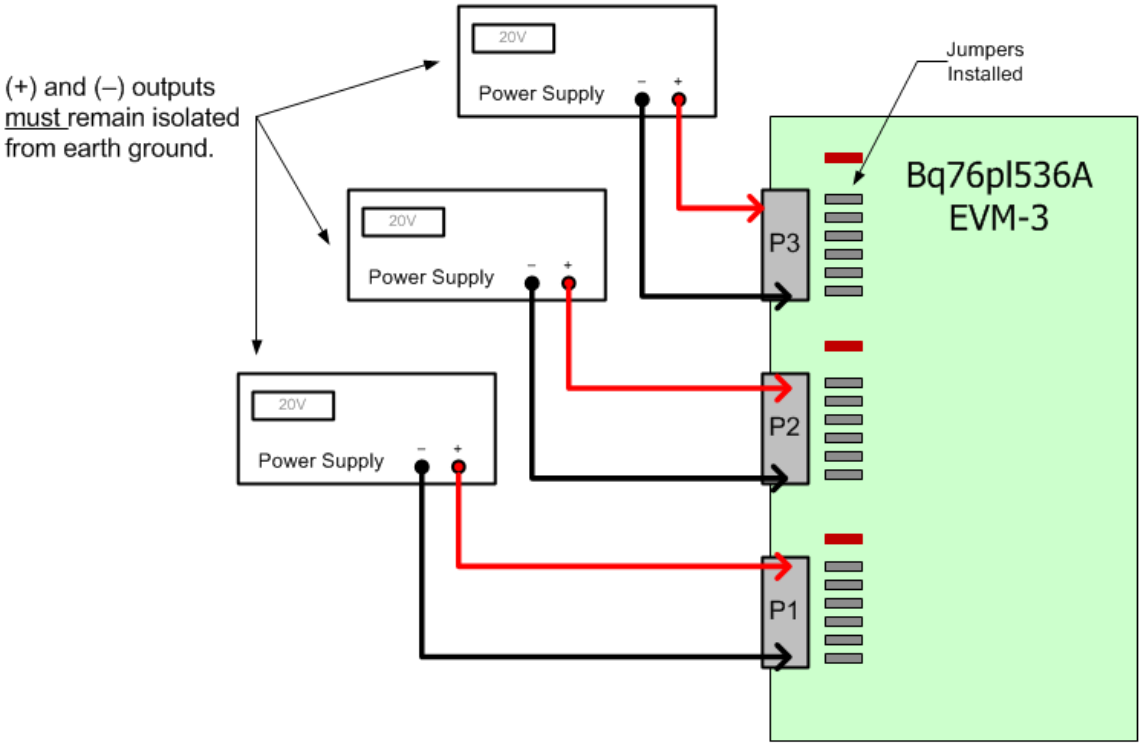
6.3 EVM Power supplies setup

6.3.1 Three isolated power supplies are connected to the EVM using the built test harness.

6.3.2 Building the test harness: Using three terminal blocks and 16gauge wire in RED and Black. Cut the wire to the desired length to facilitate a safe and ergonomically correct test setup. The wires are installed at positions 1 and 7 as shown, the red (+) lead at position 1, and the black (-) lead at position 7.

6.3.3 Set the power supplies voltage to 12Vdc and current limit to 500mA

Note: Other power schemes, such as using a single power supply will not provide correct power to the devices under test. It is important to make the connections as shown below using three ***isolated supplies****.*



6.4 EVM Test Connections

6.4.1 Move J1 through J18 shunts to the shorting position.

6.4.2 Move JP20 to B position. Select 5VDC

6.4.3 Remove the Attached terminal blocks and connect the Power Supplies connectors to the PCB. Observe the correct stack up order

6.4.4 Connect the Aardvark to the EVM using the 10 pin header to P5. Observe the correct polarity

WARNING – hazardous voltages may be present. Use proper handling precautions.

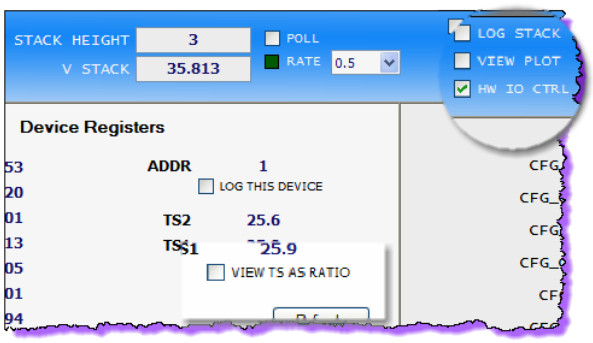
6.4.5. Connect PS1 to TP5 and TP6, PS2 to TP3 to TP4, and PS3 to TP1 and TP2.

6.4.6 Turn on the power supplies in the following order: PS1, PS2, and PS3.

6.4.7 Start the bq76PL536 WinGUI and verify that the WinGUI is configured as follows:

a. H/W I/O > box checked

b. **VIEW TS AS RATIO** should not be checked



7.0 PROCEDURE

Basic Integrity Checks (do once per EVM)

This test verifies basic connections and EVM functionality. *This section is performed once per EVM board.* The results are shown numerically and graphically for evaluation. The numeric and graphic results are equivalent.

7.1 Verify the following register values visually using the graphics below:

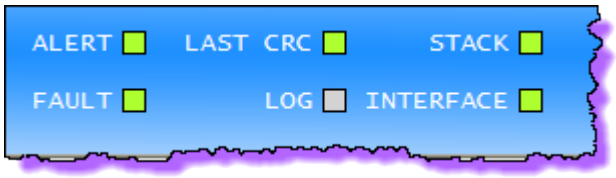
7.1.1 STACK_HEIGHT = 3

7.1.2 V_STACK ≈ 36V ± 300mV (35.7 ≤ VSTACK ≤ 36.3)

Test 1 :PASS: (35.7 ≤ VSTACK ≤ 36.3)

7.1.3 No red "LED's"

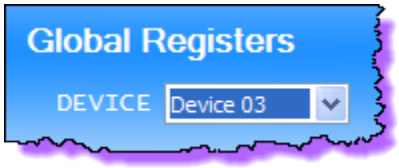
Note: These LED's should remain green (LOG LED may be brown) throughout the test unless otherwise indicated during a specific test step (i.e. step 7.2). Any exception is a test fail.



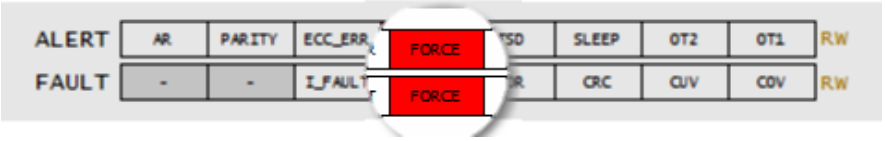
Test 2: Pass if No red "LED".

7.2 FAULT & ALERT Hardware Tests

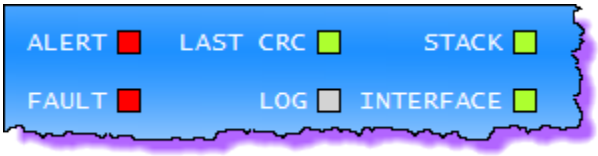
7.2.1 Select Device 3



7.2.2 Click on each of the FAULT[FORCE] and ALERT[FORCE] bits to set to '1', each will turn red.



7.2.3 Verify that the ALERT and FAULT LEDs are each solid red or blinking red.



Test3: Pass If ALERT and FAULT has solid or blinking Red.

7.2.4 Click on each of the FAULT[FORCE] and ALERT[FORCE] bits from step 0 to reset them back to ‘0’, each will return to white. The ALERT and FAULT LEDs in step 0 will return to their original green color.

7.3 LED Test

7.3.1 Set Broadcast mode

7.3.2 In Broadcast mode, click on the IO_CTRL[GPIO_OUT] bit. It will change color to green, indicating it is set to 1.

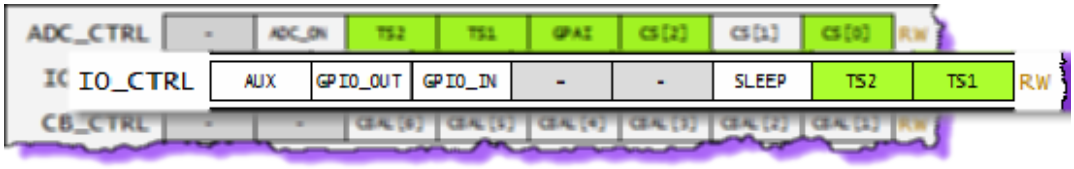
7.3.3 Check that the three LEDs on the EVM are all ON.

Test4: Pass if all three yellow LEDs on the EVM are all ON.

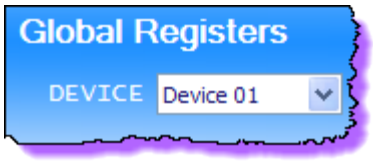
7.3.4 Click on the IO_CTRL [GPIO_OUT] bit. It will change color from green back to white, indicating it is set to a 0.

7.3.5 Check that the three LEDs are all OFF.

7.3.6 Return the IO_CTRL[TSn] bits to the correct state by clicking on each one while in BROADCAST mode, turning each one green as shown below.



7.5 Device Tests (repeat each test for Device 1, 2, 3)

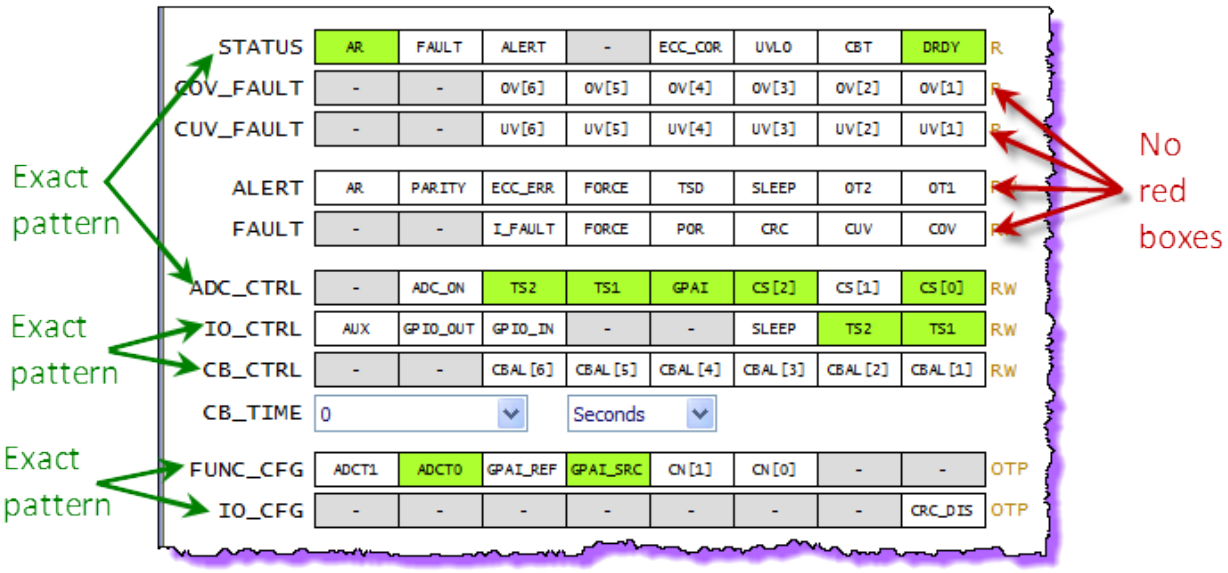


This section (0.x) of tests is performed three times, once per ‘536 device installed on the board. Device selection is made using the device list box. Four settings are possible**, BROADCAST, DEVICE 1, DEVICE 2, AND DEVICE 3**. *It is a test failure if any of these selections is not available (indicating a wiring or IC defect). The Broadcast setting is not used in this section of tests.*

Note: Select device 1, 2, or 3 in turn as shown, repeat this section for each.

7.5.1 Verify registers using the graphics below

Test5: Passed if device 1,2, and 3 shows graphics below.



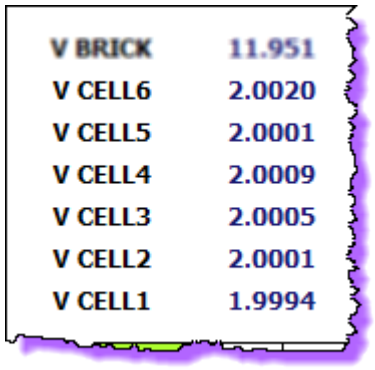
Note: The STATUS[ECC_COR], ALERT[ECC_ERR], and FAULT[I_FAULT] bits should never be red for any part of the test. A red indicator in these positions indicates a memory fail and is a test failure.

7.6 ADC Results - Voltage Measurement Tests

To successfully test the ADC inputs using the constants below, it is important that each power supply be adjusted to 12.000V ±20mV. This test does *not* verify the accuracy of the '536 part, only that the part is correctly installed and connected without significant shorts or opens in the signal path.

7.6.1 Vcell

Each V_{CELL} register VCELL1-VCELL6 (6) should report nominally 2.00VDC ±10mV ($1.90 \leq V \leq 2.10$)



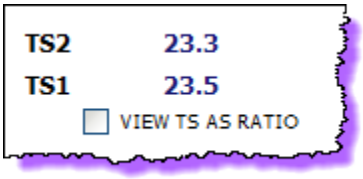
Test6 : Passed if Vcell1-Vcell6 are $1.90 \leq V \leq 2.10$ and Vbrick is $11.90 \leq V \leq 12.10$

7.6.3 Temperatures

The temperature readings should be equal to the local room environment temperature, usually 23C to 27C. Since this varies by location and time, the local temperature should be measured with an electronic or lab-type thermometer accurate to ±2°C. The measurement should be made at the time the test is performed.

Test7 : Passed if TS1 and TS2 are 20C to 25C.

Typical values are shown.

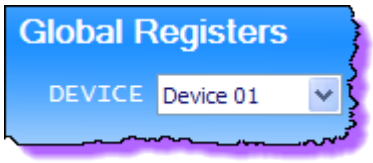


7.7 Balancing FET Tests

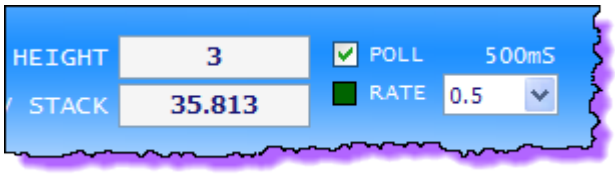
These tests verify the integrity of the balancing FETs installed on each cell channel, six per brick.

7.7.1 Change the CFG_CUVT (Under Voltage Timer) to 300ms for this test.

7.7.2 Make sure the "Poll" checkbox is unchecked, and select Device 1 to test.

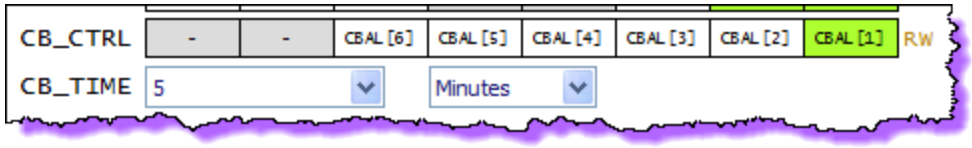


7.7.3 Set the polling rate to 0.5s, and click on the "Poll" checkbox (a checkmark will appear as shown). The green LED will flash each time the EVM is asked for a reading (polled) at ½ second intervals.



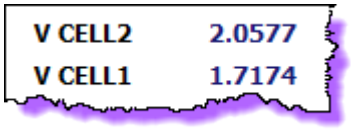
7.7.4 Set the balancing units to minutes, and the time interval in the CB time register to 5. The test must now be completed in the number of minutes set, counting from the moment the value is clicked upon. Other timer values can be used, and the timer may be restarted depending on test personnel requirements and familiarity. To restart the timer, select a different numerical value and click. Note: selecting the same value may not restart the timer.

7.7.5 Click on the bit CBAL[1] (turns green, indicating set to '1')



7.7.6 Verify that VCELL1 is between 1.3 and 1.6V

7.7.7 Verify that other VCELLs readings are ~2.00V ($1.8 \leq VCn \leq 2.2$)



Test8 : Pass if $1.2V < Vcell1 < 1.6V$ and $1.8V < Vcell\ 2\text{- }Vcell6 < 2.2$.

Test 9: Repeat for device 2.

Test 10: Repeat for device 3.

7.8 Test completion

7.8.1 Go to section “9.0 Equipment shut down” Replace the terminal blocks that were removed earlier, then repeat from “6.4 EVM Test Connections” with a new board.

8.0 Test Results

8.1 All areas must be verified as working according to this document.

9.0 EQUIPMENT SHUTDOWN

9.1 Turn off the power supplies in the following order: PS3, PS2, and PS1.

WARNING – Hazardous voltages may be present.

Allow the power supplies to fully discharge before handling the wires or connectors.

9.2 Disconnect the Power Supplies wiring harness and connectors from the PCB

9.3 Remove the Aardvark 10-pin ribbon connector from the EVM at P4.

10.0 MATERIAL DISPOSITION & TRANSFER

10.1 CONFORMING MATERIAL
Units that have passed this test procedure shall be packaged into anti-static ESD approved bags, labeled with two labels according to the table below, and shipped per the P.O.

Label 1 Assembly Number+Dash Number if Applicable	Label 2 IC Number – bq76PL536A-Q1PAP
PWR763	Bq76PL536A-Q1PAP

10.2 NON-CONFORMING MATERIAL
If yield loss is 2% or less, scrap non-conforming units and adjust P.O. to reflect total amount shipped. If yield loss approaches or exceeds 5%, contact EVM coordinator for assistance.