Application Report
SLVA635–September 2015

bq76PL455A-Q1 Example Code

ABSTRACT

This application report explains the implementation of a multi-cell lithium-ion the foundation of a battery management system using an TMS570™ microcontroller and the bq76PL455A-Q1.

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Trademarks

1 Introduction

The bq76PL455A-Q1 can be stacked vertically to monitor up to 192 cells without additional isolation components between ICs. A high-speed universal asynchronous receiver/transmitter (UART) bus operates between the bottom bq76PL455A-Q1 and the TMS570LS0432 microcontroller. The differential communication interface provided by the bq76PL455A-Q1 is used to provide reliable communications through all bq76PL455A-Q1 devices in a high-voltage battery cell stack.

This firmware provided with this application note provides source code examples of the command sequences described in the bq76PL455A-Q1 Software Design Reference document (SLVA617).

Sample application code and other information associated with this application report can be downloaded from SLUC270.

2 Conventions and Acronyms

This section describes the conventions and acronyms used in this document.

2.1 Conventions

‘0’	Binary digit zero; a logic low level (a low voltage for active high logic, and a high voltage for active low logic)
‘1’	Binary digit one; a logic high level (a high voltage for active high logic, and a low voltage for active low logic)
“d…”	A binary number with more than one digit (d is 0-1)
d…	A decimal number (d is 0-9)
0xd…	A hexadecimal number (d is 0-F)
d..h	A hexadecimal number (d is 0-F)

k	kilo; 1000
K	kilo; 1024 (note: this is not official SI usage)
b	bit
B	byte

2.2 Acronyms

ADC	Analog to Digital Converter
AFE	Analog Front End
API	Application Programmers Interface
BMS	Battery Management System
BSP	Battery Stack Protection
CAN	Controller Area Network
DAC	Digital to Analog Converter
EEPROM	Electrically Erasable Programmable Read Only Memory
GPIO	General Purpose Input Output
MCU	Micro-Controller Unit
Module	Series connection of cells managed by a single bq76PL455A-Q1 in the BMS
OC	Over Current
OV	Over Voltage
OVP	Over Voltage Protection
PWM	Pulse Width Modulation
Stack	Series connection of all cells managed by the BMS
SPI	Serial Peripheral Interface
UV	Under Voltage
UVP	Under Voltage Protection

3 Hardware

The system is implemented using the TMS570LS Launchpad board (TMS570LS0432 MCU) and the BQ76PL455EVM. Figure 1 shows the system block diagram. For more information on these devices, see the device datasheets.

The evaluation modules' part numbers are LAUNCHXL-TMS57004 and BQ76PL455EVM. These boards are available from the TI eStore (https://estore.ti.com/) or from your local TI sales representative. For more details and information related to these evaluation modules (EVMs), see the specific EVM user's guide.

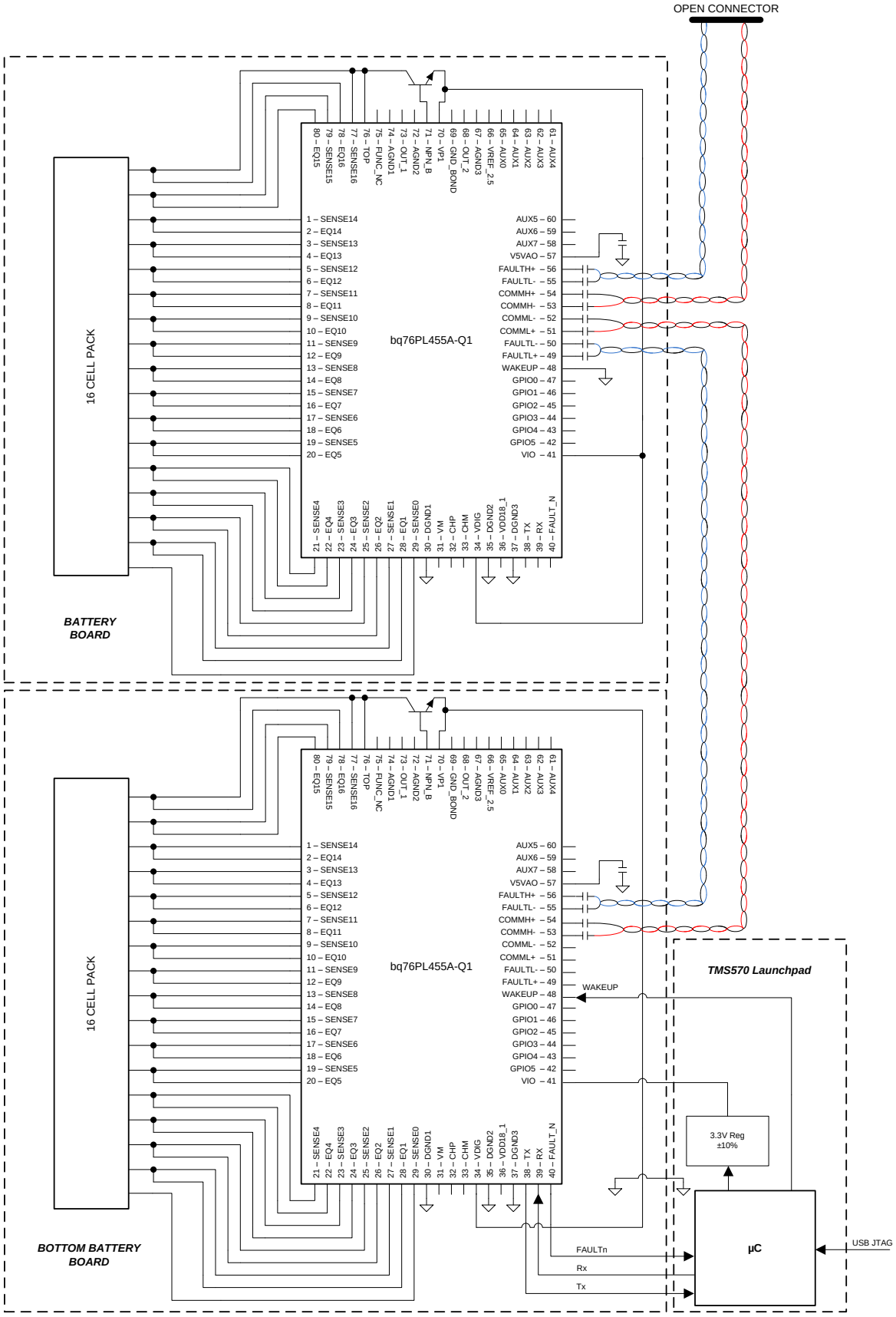

Figure 1. System Block Diagram

3.1 Connecting the Evaluation Modules

The EVMs are connected using standard wire jumper; Table 1 shows the connections between the two EVMs. By default, the TMS570 Launchpad is powered by the USB port on the host computer and the BQ76PL455EVM is powered by a 3.3-V regulator on the TMS570 Launchpad board.

NOTE: Make sure that the resistor R8 is removed on the TMS570 Launchpad board.

Table 1. Connections Between EVMs

Connection Name	BQ76PL455EVM	TMS570 Launchpad
TX	J3 pin 5	J1 pin 3 (SCI1_RX)
RX	J3 pin 4	J1 pin 4 (SCI1_TX)
nWAKE	J3 pin 6	J2 pin 3 (GIOA0)
nFAULT	J3 pin 2	J2 pin 4 (GIOA1)
VIO	J3 pin 3	J1 pin 1 (+3V3)
GND	J3 pin 1	J2 pin 1 (DGND)

3.2 Communication

The example code only provides a control interface to the bq76PL455A-Q1 and does not provide any other communications interface to the outside world. It is expected that the customer come up with their own communication implementation. Examples of communications interfaces available to the TMS570 are SPI, CAN or UART.

4 Software

The software provides command API and drivers that implement the examples provided in the bq76PL455A-Q1 Software Design Reference document. There are comments in the source code that explain the section in the bq76PL455A-Q1 Software Design Reference document the example refers to.

Importing Project into Code Composer Studio

1. Launch provided file: BQ76PL455_Example_Code_installer.exe and extract files to default path provided (C:\ti\bq76PL455A-Q1 Example Code 1.0).
2. Launch Code Composer Studio (CCS):
   Start → Programs → Texas Instruments → Code Composer Studio v5 → Code Composer Studio v5
3. When it launches, CCS will ask you to select a workspace, we will choose “C:\myWorkspace”. Once CCS loads, go to:
   File → Import → Code Composer Studio → Existing CCS Eclipse Projects
4. In Select search-directory: Browse to the folder
   C:\ti\bq76PL455A-Q1 Example Code 1.0
5. In Discovered projects: Check TMS570LS04x_455

Revision History

DATE	REVISION	NOTES
September 2015	*	Initial release.

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