PS5163

PS501 Three-Cell Battery Manager Module with LED SOC Display for Lithium Chemistries

Features

- PS501 tested, fully populated modules for evaluation
- Designed to work with 3 series cell Lithium chemistry configurations
- Performs all major Lithium battery management functions, including:
  - Accurate capacity monitoring
  - Lithium cell protection
- SOC display with four LEDs and a switch
- Fully compliant with industry standard Smart Battery Data Specification v1.1a
- SMBus v1.1 with PEC/CRC-8 communication with system host
- High accuracy measurement of charge/discharge current, voltage and temperature with on-chip 16-bit integrating A/D
- Precise capacity reporting using Microchip patented algorithms and 3D battery cell models
- 3D models and “learned” parameters stored in integrated memory
- Complete hardware and software development tools available:
  - PS050 PC software
  - ICD (In-Circuit Debugger) port to support development of custom code
- Extremely low-power operation:
  - Run mode: 170 μA typical
  - Low-Voltage Sleep mode: 45 μA typical
  - Shelf-Sleep mode: 25 μA typical
- Overall mechanical dimensions:
  - 0.525 W x 2.500 L (inches)
  - 13.3 W x 63.5 L (millimeters)

Ordering Information

Part Number	Description
PS5163	Li Ion/Poly – 3 series cells

1.0 GENERAL DESCRIPTION

The PS5163 module is a complete smart battery controller subsystem based on the Microchip PS501 field reprogrammable battery manager with patented Accuron® technology. The module is designed to operate in a battery pack consisting of three (3) series connected Li-based cells. The module consists of the Microchip PS501 battery manager IC with a four-LED SOC display and an optional connection for an external thermistor.

1.1 Quick Start – Pack Assembly

Follow these directions to assemble a pack with the PS5163 module.

- Use standard precautions when handling static sensitive devices.
- Modules should be connected to battery cells in the order indicated below to insure proper start-up and operation. Wires should be attached to the modules first and then connected to the battery cells as instructed.
- The connection sequence is critical to successful use of the PS501 family of CMOS ASICs. The pack positive should be securely connected to the module first, followed by the intermediate cells from most positive to least positive and finally, pack negative.

Step 1) Configure the module for optional external thermistor use. PS5163 modules are shipped configured to use the internal temperature sensor only. To add an external thermistor to the board, remove resistor R16 (side 2) and connect the thermistor across via TN and TR.

Step 2) Connect wires to module. Use large diameter wire (18 AWG-20 AWG) for current carrying lines from VR, V1, B+ and BN. All others are signal only lines (24 to 22 AWG).

Step 3) Connect external connector to BN, T, C, D and B+.

Step 4) Connect V1 to the most positive point on the battery cell stack.

Step 5) Connect the negative end of the top-most cell to V2 and the negative end of the second cell to V3.

Step 6) Connect VR to the most negative point on the battery cell stack.

Step 7) Program the assembled pack using Microchip's software and PowerCal™ board or PowerInfo™ board hardware.

The memory parameters can be changed at will using the utilities on the memory page in the software.

Step 8) Calibrate the pack using the software and PowerCal™ board hardware. The pack is now ready for use.

FIGURE 1-1: CONNECTION POINTS (SIDE 1)

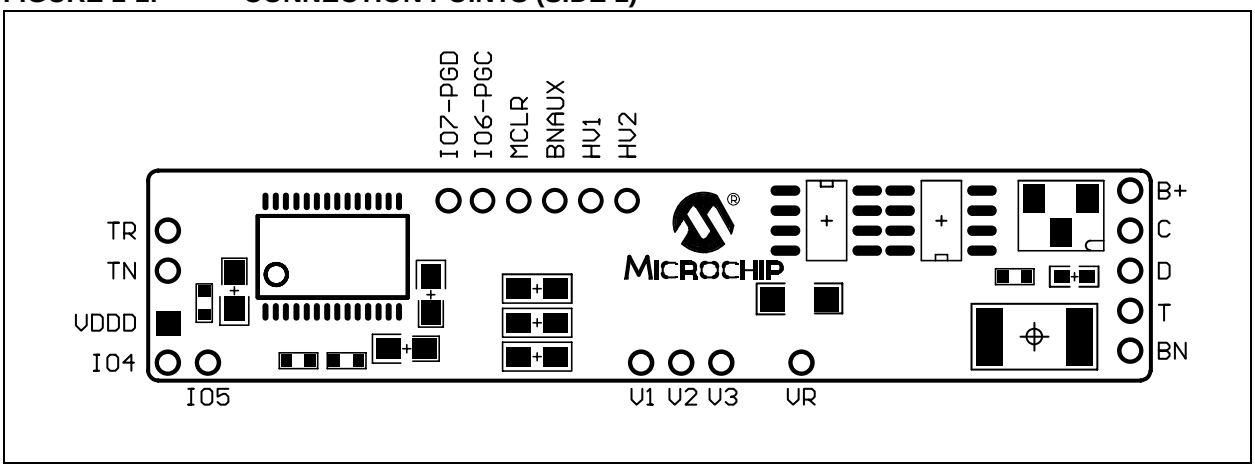


FIGURE 1-2: BOARD ASSEMBLY (SIDE 1)

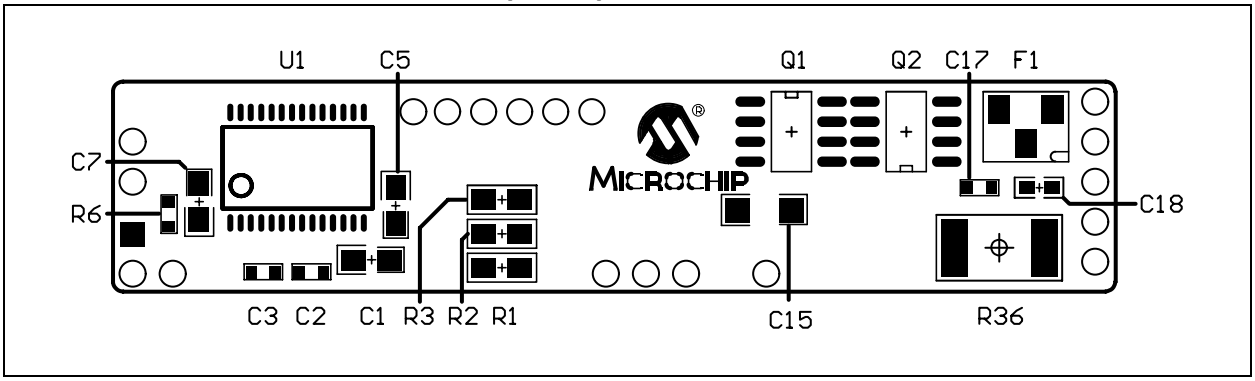
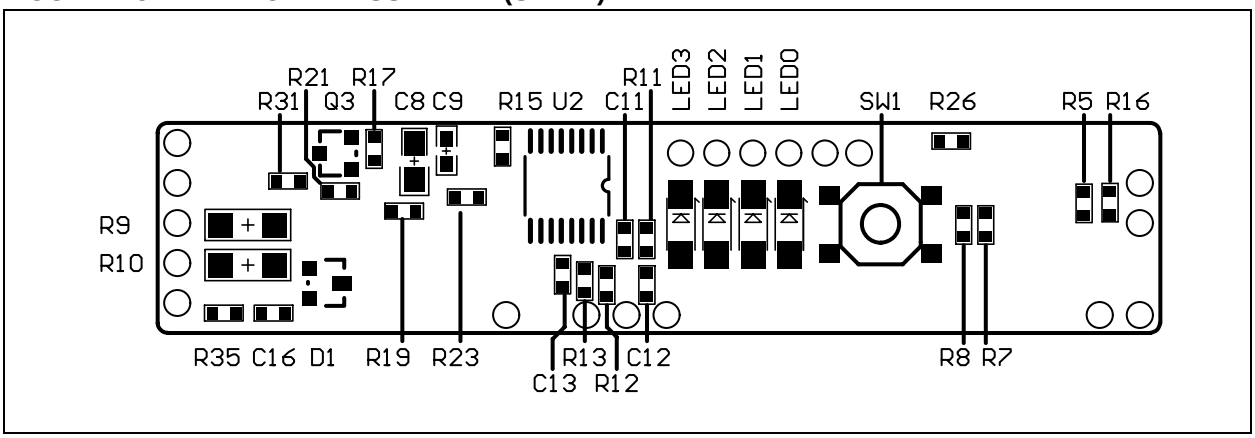


FIGURE 1-3: BOARD ASSEMBLY (SIDE 2)



2.0 FUNCTIONAL DESCRIPTION

2.1 PS501 Fuel Gauge

The module fuel gauge provides State-Of-Charge (SOC) and battery status data in accordance with the SMBus standards version 1.1. The PS501 monitors the cell voltages, battery temperature and current to determine SOC and battery status. The State-Of-Charge calculations are compensated for cell self-discharge. The remaining time calculation is compensated for temperature and discharge rate. The parameters for determining battery status flags and alarm thresholds are all programmable, as is the battery design capacity and the battery performance model data. Please refer to the *"PS501 Data Sheet"* (DS21818) for details on configuring the PS501 device.

2.2 Primary Safety

The primary safety circuit provides cell protection from conditions of overcharge, overdischarge and overcurrent. The analog safety IC measures individual cell voltages, current and voltage across the safety FETs. These values are compared against internal reference values and the gates of two N-channel power MOSFETs are controlled based on the comparison results.

3.0 BOARD DESCRIPTION

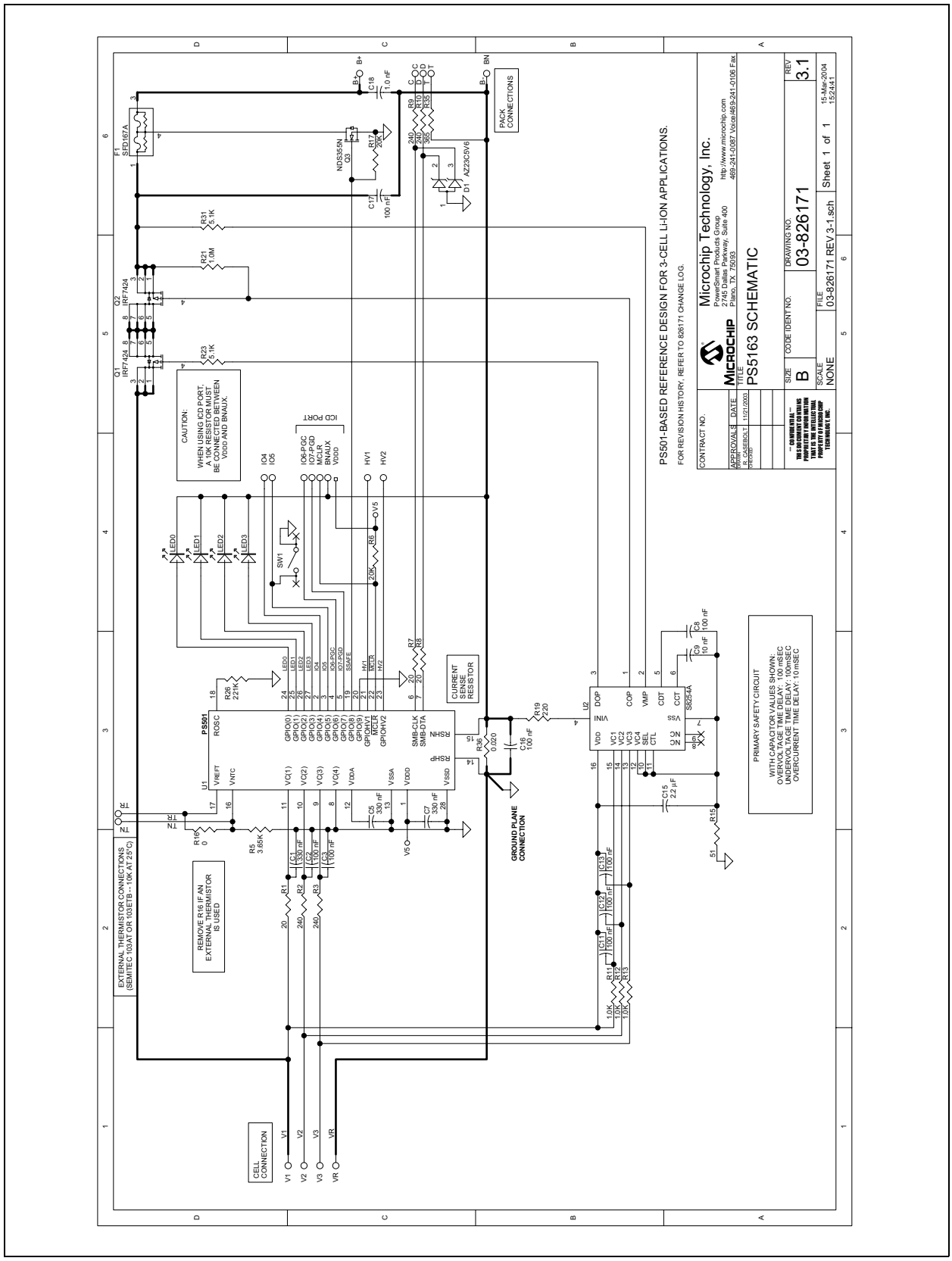
PCB schematics and bill of materials are included here for completeness. To download the full size schematic and BOM, please visit the Microchip web site.

3.1 Mechanical Dimensions

Overall Dimensions: 2500 mils x 525 mils

3.2 Schematic

FIGURE 3-1: PS5163 BOARD SCHEMATIC



3.3 Bill of Materials

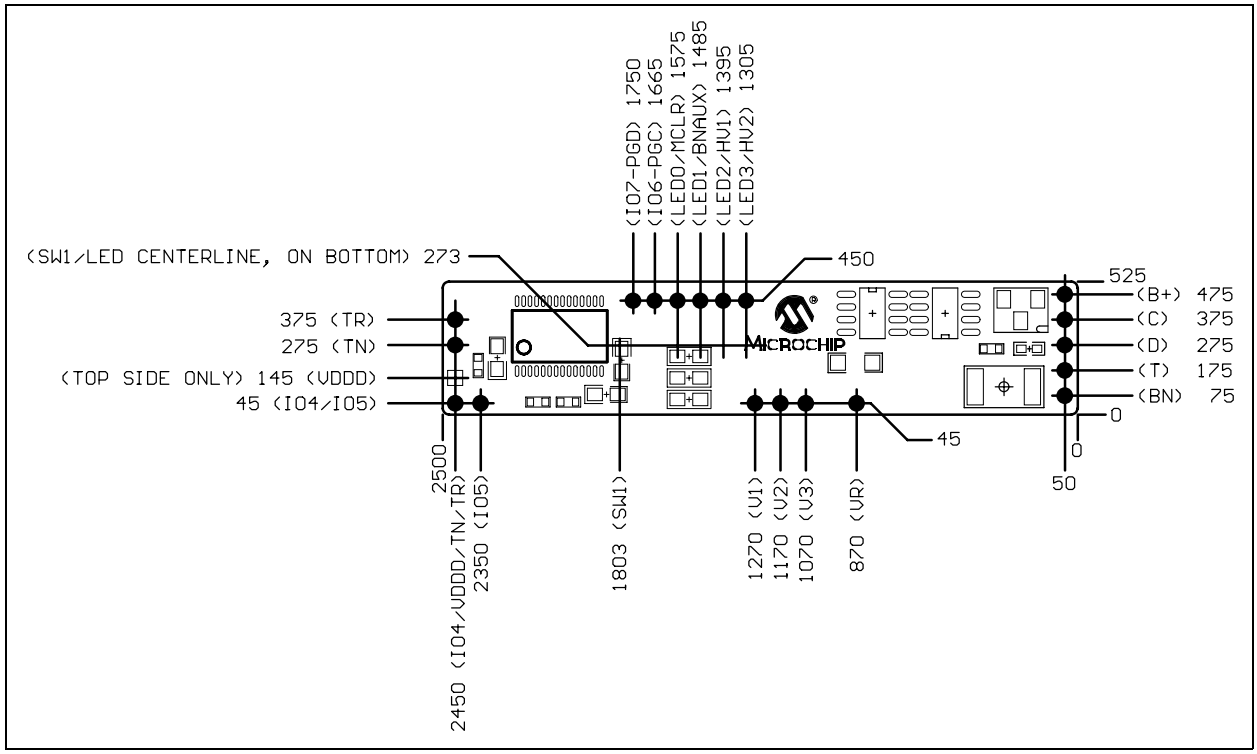
TABLE 3-1: PS5163 BILL OF MATERIALS

Symbols	Description	Manufacturer	Manufacturer PN	Qty.
	Raw PCB, PS5163	Microchip	04-826171 REV. 3.1	1
C9	Capacitor, Ceramic, 10 nF, 25V, +/-10%, X7R dielectric, 0603	Panasonic	ECJ-1VB1E103K	1
C18	Capacitor, Ceramic, 1.0 nF, 50V, +/-10%, X7R dielectric, 0603	Panasonic	ECJ-1VB1H102K	1
C2-C3, C11-C13, C16-C17	Capacitor, Ceramic, 100 nF, 25V, +80%/-20%, Y5V dielectric, 0603	Panasonic	ECJ-1VF1E104Z	7
C8	Capacitor, Ceramic, 100 nF, 25V, +/-10%, X7R dielectric, 0805	Panasonic	ECJ-2VB1E104K	1
C1, C5, C7	Capacitor, Ceramic, 330 nF, 25V, +80%/-20%, Y5V dielectric, 1206	Panasonic	ECJ-2YF1E334Z	3
C15	Capacitor, Ceramic, 2.2 µF, 25V, +/-10%, X7R dielectric, 1206	Panasonic	ECJ-3YF1E225Z	1
LED0-LED3	LED, clear green, 1206 package	Lumex	SML-LX1206GC-TR	4
D1	Dual Zener Diode, 5.6V, +/-5%, 300 mW, common anode, SOT-23	Diodes Inc. General Semi.	AZ23C5V6-7 AZ23-C5V6	1
F1	Fuse, battery pack protector, 7A, 36 VDC, 50A breaking capacity, 5 +/- 1.5 mOhm resistance, 31.6 +/- 3.2 ohms heater resistance, 11.1-25.0V heater operating voltage range, UL248-14, 3-terminal surface mount package	Sony Chemicals	SFD-167A	1
Q1-Q2	MOSFET, P-channel Enhancement mode, -30V, 11A, 13.5 mOhms, 1.9W, SO-8	Int. Rectifier Toshiba	IRF7424 TPC8108	2
Q3	MOSFET, N-channel Enhancement mode, 30V, 1.6A, 0.125 ohms, 500 mW, SOT-23	Fairchild Semi. Fairchild Semi.	NDS355N NDS355AN	1
R5	Resistor, film, 0603, 1%, 3.65 KOhms	Panasonic	ERJ-3EKF3651V	1
R35	Resistor, film, 0603, 1%, 365 ohms	Panasonic	ERJ-3EKF3650V	1
R26	Resistor, film, 0603, 1%, 221 KOhms, 25 ppm, TC	Susumu Co. Ltd.	RR0816P-2213-D-34D	1
R16	Resistor, zero ohm, 0603	Panasonic	ERJ-3GEY0R00V	1
R11-R13	Resistor, film, 0603, 5%, 1.0 KOhms	Panasonic	ERJ-3GEYJ102V	3
R21	Resistor, film, 0603, 5%, 1.0 Megohms	Panasonic	ERJ-3GEYJ105V	1
R7-R8	Resistor, film, 0603, 5%, 20 ohms	Panasonic	ERJ-3GEYJ200V	2
R6, R17	Resistor, film, 0603, 5%, 20 KOhms	Panasonic	ERJ-3GEYJ203V **(Note 2)**	2
R19	Resistor, film, 0603, 5%, 220 ohms	Panasonic	ERJ-3GEYJ221V	1
R23, R31	Resistor, film, 0603, 5%, 5.1 KOhms	Panasonic	ERJ-3GEYJ512V	2
R15	Resistor, film, 0603, 5%, 51 ohms	Panasonic	ERJ-3GEYJ510V	1
R1	Resistor, film, 0805, 5%, 20 ohms	Panasonic	ERJ-6GEYJ200V	1
R2-R3	Resistor, film, 0805, 5%, 240 ohms	Panasonic	ERJ-6GEYJ241V	2
R9-R10	Resistor, film, 1206, 5%, 240 ohms	Panasonic	ERJ-8GEYJ241V	2
R36	Resistor, metal strip, 2512, 1%, 0.020 ohms	Vishay	WSL2512-0.020-1%-R86	1
SW1	Switch, SPST-momentary, push button, surface mount	ALPS	SKQGADE010	1
U1	IC, Single chip Battery Manager, programmable, 25°C to 85°C, SSOP-28	Microchip	PS501-I/ST	1
U2	IC, Battery Protection Circuit, Li Ion, 3 or 4-cell, 40°C to 85°C, 4.4 mm body width TSSOP-16 package	Seiko Instruments	S-8254AAJFT-TB **(Note 1)**	1

Note 1: Other variants of the S-8254A series, with different trip points, are also available. Consult the S-8254A series data sheet.

2: R6 is left open (not placed).

FIGURE 3-2: PS5163 DIMENSION DETAILS



4.0 DEVELOPMENT TOOL SUMMARY

Microchip provides all the necessary hardware and software to enable easy tailoring of battery control algorithm parameters and cell performance models to meet specific application requirements and attain the highest accuracy available anywhere. Table 4-1 summarizes the development tool offering from Microchip to support the PS5163. Please refer to the Microchip web site for ordering information and design documentation (including schematics) at www.microchip.com.

4.1 Reference Documents

This data sheet provides an overview of the PS5163 Battery Manager module. For further information on the PS501 and development tool operations, please refer to the following documents available for download at www.microchip.com.

TABLE 4-1: MICROCHIP DEVELOPMENT TOOL SUMMARY

Development Tool	Use
PowerInfo™ hardware with PC software (PS041)	Read and write Smart Battery data values, memory programming
PowerCal™ hardware with PC software (PS042)	Read and write Smart Battery data values, memory programming, pack calibration, pack test

TABLE 4-2: MICROCHIP REFERENCE DOCUMENTS

Document Number	Documents Available
DS21818	PS501 Single Chip Field Reprogrammable Battery Manager Data Sheet (IC Products)
DS40234	PS041 PowerInfo™ Configuration Interface Product Brief
DS40237	PS042 PowerCal™ Calibration Platform Data Sheet

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