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## PS501 Nickel Chemistry Battery Manager Module with LED SOC Display

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- PS501 tested, fully populated modules for evaluation
- Designed to work with 6 to 12 series cell NiMH and NiCD battery packs
- Performs all major Nickel battery management functions including:
  - Accurate capacity monitoring
  - Optional external thermistor configuration for accurate temperature monitoring
  - Supports multiple full charge detection methods – dT/dt, -dV, programmable overcharge
- SOC display with four LEDs and a switch
- Fully compliant with industry standard Smart Battery Data Specification v1.1a
- SMBus v1.1 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
- Extremely low-power operation:
  - Run mode: < 170  $\mu$ A typical
  - Low-Voltage Sleep mode: < 45  $\mu$ A typical
  - Ultra Low-Power mode: < 1  $\mu$ A typical
- Complete hardware and software development tools available
- Overall mechanical dimensions:
  - 0.339 W x 1.772 L (inches)
  - 8.6 W x 45.0 L (millimeters)

Part Number	Description
PS5100	Nickel Chemistry – 6 to 12 series cells

# PS5100

## 1.0 GENERAL DESCRIPTION

The PS5100 module is a complete Smart Battery controller subsystem based on the Microchip PS501 battery manager with patented Accuron® technology. The module is designed to operate in a battery pack consisting of six (6) to twelve (12) series connected Ni-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 PS5100 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 pack negative.

**Step 1)** Configure the module for optional external thermistor use. PS5100 modules are shipped configured to use the internal temperature sensor only. To add an external thermistor to the board, remove resistor R16 and connect the thermistor across via TN and TR. A parameter change is required to enable the external thermistor measurements. Bit 5 of Flags1 must be cleared.

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

**Step 3)** Connect V1 to the most positive point on the battery cell stack.

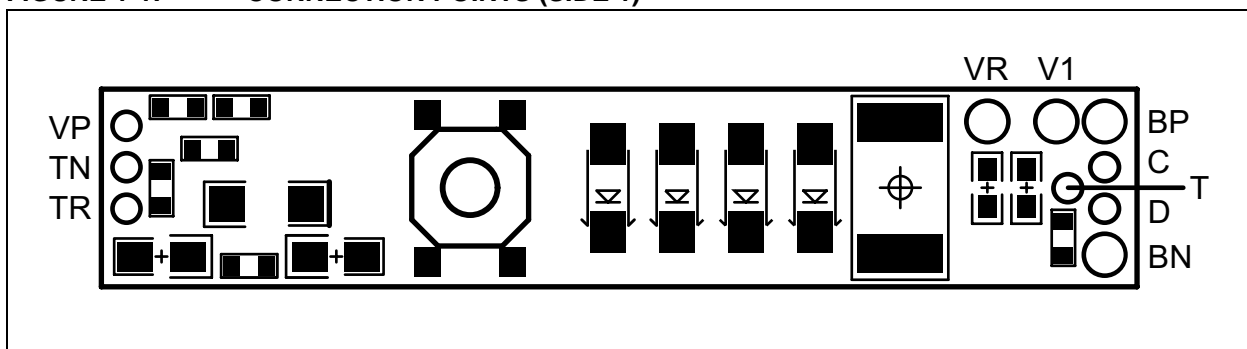
**Step 4)** Connect VR to the most negative point on the battery cell stack.

**Step 5)** Connect external connector to BN, T, C, D and BP.

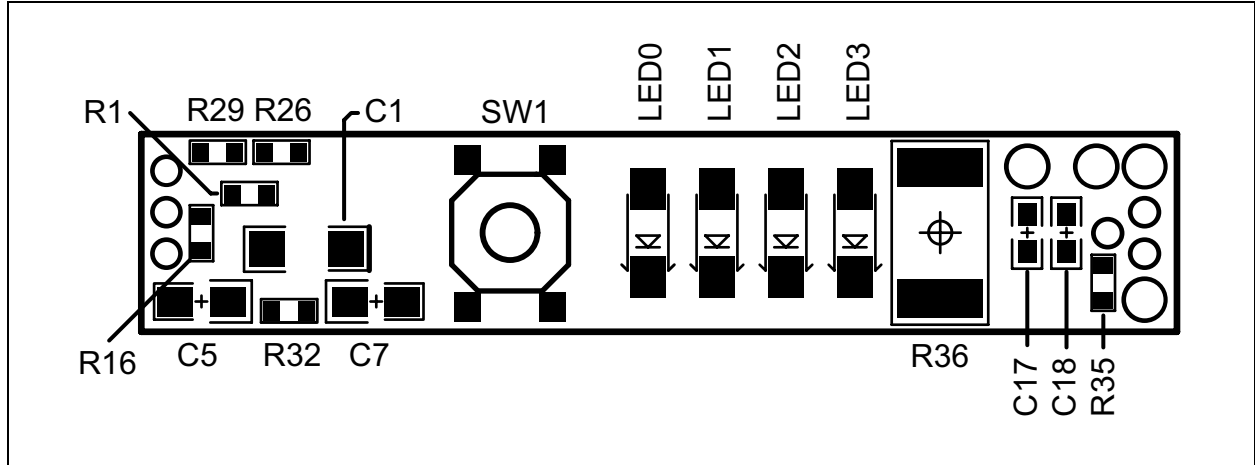
**Step 6)** Program the assembled pack using Microchip's PowerTool™ 500 software and PowerCal™ 2 board or PowerInfo™ 2 board hardware. The module is shipped with default configuration values for a six series cell pack. The Configuration Wizard guides the user through basic configuration and initial download. All of the configuration parameters can be changed at will using the utilities on the Parameters page in the PowerTool 500 software.

**Step 7)** Calibrate the pack using the PowerTool 500 software and PowerCal 2 board hardware. The pack is now ready for use.

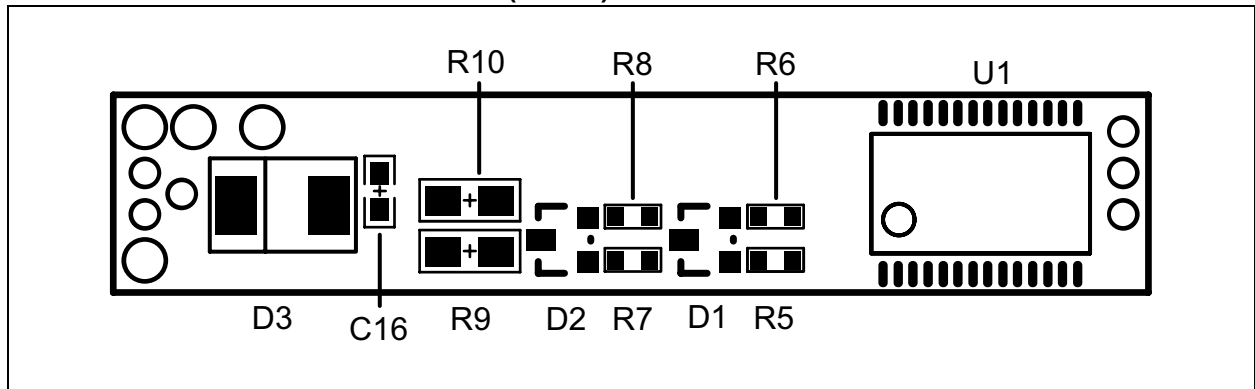
FIGURE 1-1: CONNECTION POINTS (SIDE 1)



**FIGURE 1-2: BOARD ASSEMBLY (SIDE 1)**



**FIGURE 1-3: BOARD ASSEMBLY (SIDE 2)**



## 2.0 FUNCTIONAL DESCRIPTION

### 2.1 PS501-0901 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 PS501-0901 monitors the pack voltage, battery temperature and current to determine SOC and battery status. The State-Of-Charge calculations compensate for cell self-discharge and charge acceptance. The remaining time calculation compensates 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 data sheet "PS501-0901, Single Chip Field Reprogrammable Battery Manager – Nickel Chemistries" (DS21902) for details on configuring the PS501-0901.

## 3.0 BOARD DESCRIPTION

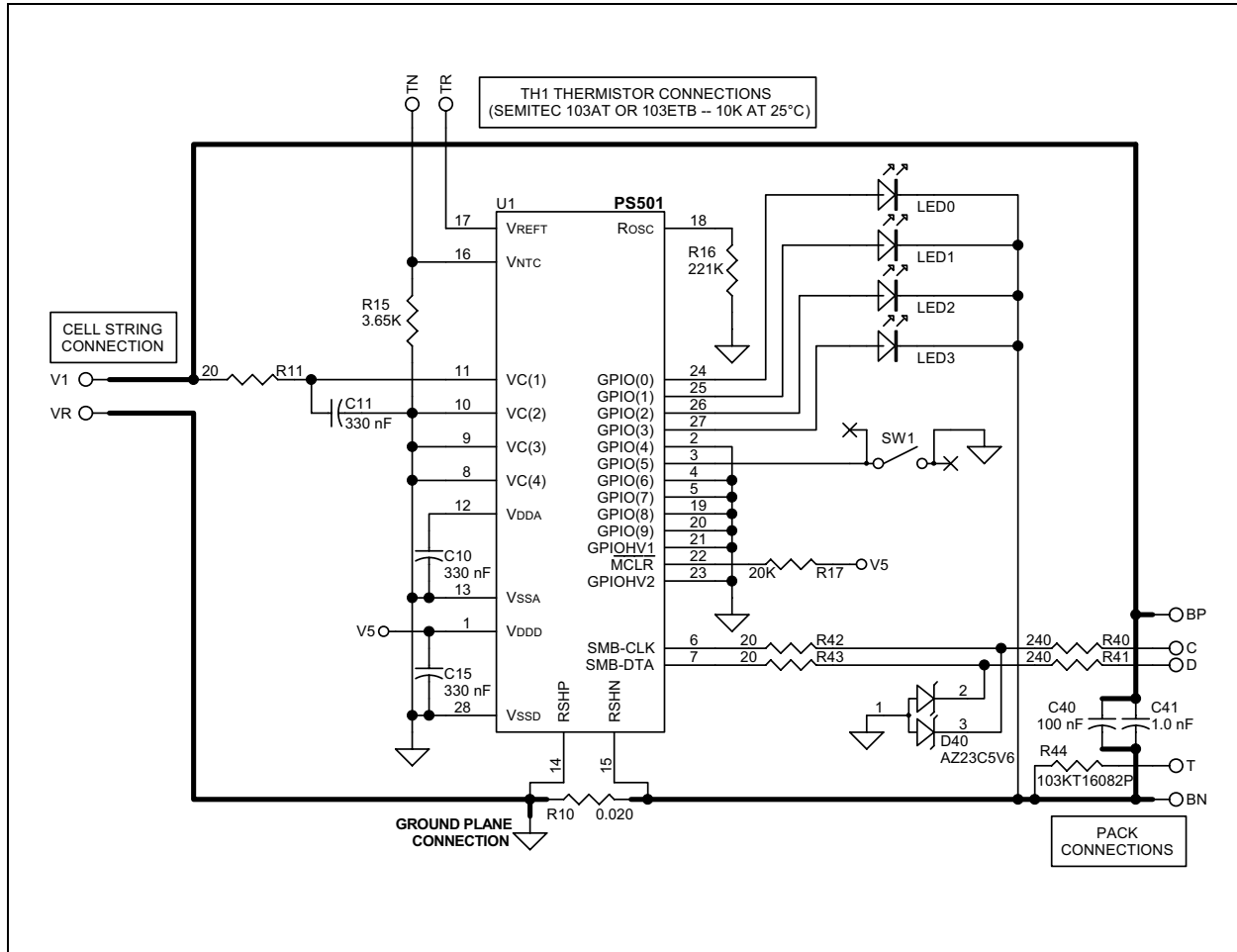
PCB schematics and bill of materials are included here for completeness. To download full size schematic and BOM, please visit the Microchip web site ([www.microchip.com](http://www.microchip.com)).

### 3.1 Mechanical Dimensions

Overall Dimensions: 1772 mils (L) x 339 mils (W).

## 3.2 Schematic

FIGURE 3-1: PS5100 BOARD SCHEMATIC



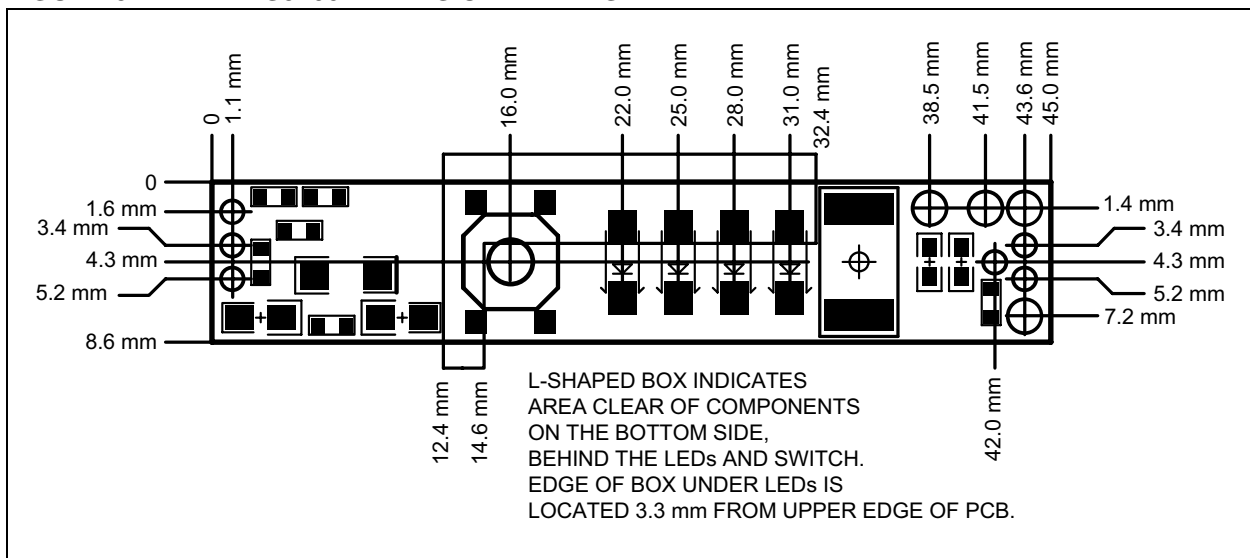
# PS5100

## 3.3 Bill of Materials

TABLE 3-1: PS5100 BILL OF MATERIALS

Symbols	Description	Manufacturer	Manufacturer PN	Qty.
	Raw PCB, PS5210	Microchip	04-826192 Rev. 1.1	1
C41	Capacitor, Ceramic, 1.0 nF, 50V, +/-10%, X7R dielectric, 0603	Panasonic	ECJ-1VB1H102K	1
C40	Capacitor, Ceramic, 100 nF, 25V, +80%/-20%, Y5V dielectric, 0603	Panasonic	ECJ-1VF1E104Z	1
C10, C11, C15	Capacitor, Ceramic, 330 nF, 25V, +80%/-20%, Y5V dielectric, 0805	Panasonic	ECJ-2YF1E334Z	3
LED0-LED3	LED, clear green, 1206 package	Lumex	SML-LX1206GC-TR	4
D40	Dual Zener Diode, 5.6V, +/-5%, 300 mW, common-anode, SOT-23	Diodes Inc. General Semiconductor	AZ23C5V6-7 AZ23-C5V6	1
R15	Resistor, film, 0603, 1%, 3.65 kOhms	Panasonic	ERJ-3EKF3651V	1
R16	Resistor, film, 0603, 1%, 221 kOhms, 25 ppm TC	Susumu Co. Ltd.	RR0816P-2213-D-34D	1
R42-R43	Resistor, film, 0603, 5%, 20 Ohms	Panasonic	ERJ-3GEYJ200V	2
R17	Resistor, film, 0603, 5%, 20 kOhms	Panasonic	ERJ-3GEYJ203V	1
R11	Resistor, film, 0805, 5%, 20 Ohms	Panasonic	ERJ-6GEYJ200V	1
R40-R41	Resistor, film, 0805, 5%, 240 Ohms	Panasonic	ERJ-6GEYJ241V	2
R10	Resistor, metal strip, 2512, 1%, 0.020 Ohms	Vishay	WSL2512-0.020-1%-R86	1
R44	Thermistor, 10 kOhms at 25°C, B value 3435, -40°C to +125°C operating temperature range, 0603 SMT package	Semitec	103KT1608-2P	1
SW1	Switch, SPST-momentary, push button, surface mount	ALPS Fuk Hing Ind.	SKQGADE010 11871501	1
U1	IC, single chip Battery Manager, programmable, -20°C to +85°C, SSOP-28	Microchip	PS501-I/ST	1

FIGURE 3-2: PS5100 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 PS5100. Please refer to the Microchip web site for ordering information and design documentation (including schematics) at [www.microchip.com](http://www.microchip.com).

## 4.1 Reference Documents

This data sheet provides an overview of the PS5100 Battery Manager module. For further information on the PS501-0901 and development tool operations, please refer to the following documents available for download at [www.microchip.com](http://www.microchip.com).

**TABLE 4-1: MICROCHIP DEVELOPMENT TOOL SUMMARY**

Development Tool	Use
PowerInfo™ 2 hardware with PowerTool™ 500 software (PS051)	Read and write Smart Battery data values, memory programming
PowerCal™ 2 hardware with PowerTool™ 500 software (PS052)	Read and write Smart Battery data values, memory programming, pack calibration, pack test

**TABLE 4-2: MICROCHIP REFERENCE DOCUMENTS**

Document Number	Documents Available
DS21902	PS501-0901 Single Chip Field Reprogrammable Battery Manager – Nickel Chemistries Data Sheet (IC Products)
DS21815	PS051 PowerInfo™ 2 Configuration Interface Data Sheet
DS21817	PS052 PowerCal™ 2 Calibration Platform Data Sheet

# PS5100

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NOTES:



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