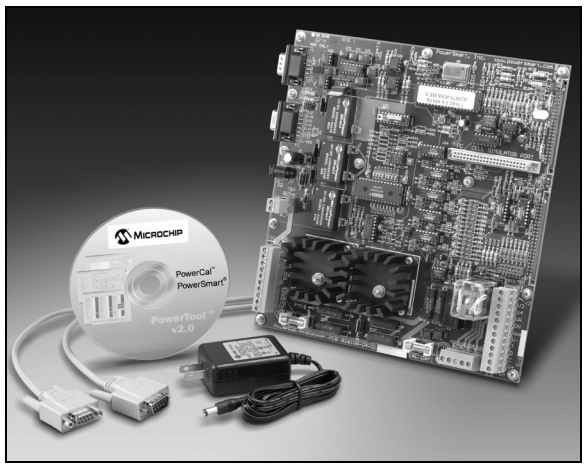
PS042

PowerCal™ Calibration Platform

Features

- Hardware platform for configuration, verification, precision calibration and production test of Microchip PowerSmart® Smart Battery systems
- Operates under control of Windows® based PowerTool™ software through COM port interface to PC
- Directly connects to assembled smart battery pack or to stand-alone PowerSmart battery electronics
- Supports loading and verification of battery configuration parameters and 3D cell models in PS40X EEPROM and OTP memory
- Precision analog hardware calibrates PowerSmart battery pack for maximum possible accuracy in current, voltage and temperature measurements
- Programmable load capable of drawing up to 36W continuous discharge power from battery pack during calibration using natural convection cooling
- Supports higher power ratings at reduced duty cycles, and/or with forced air cooling
- Powered by 24V DC external supply (included)
- Extensive safety features including production proven EMI/ESD protection, fuses for device under test and optical isolation of serial port
- Dimensions: 8.66"W x 9.13"L x 2.06"H

Board Photo



Ordering Information

Part No.	Description
PS042	PowerCal™ Calibration Board

Development/Test Software

Part No.	Description
PS040	PowerTool™ Software

1.0 PRODUCT OVERVIEW

The PowerCal calibration board is a comprehensive hardware platform that supports configuration, verification, calibration and production test of Microchip PowerSmart Smart Battery systems. It operates under the control of Microchip's PowerTool Development/Test software interfaced to a Windows PC.

The PowerCal board facilitates serial communication between the PC and the SMBus interface on smart batteries, providing a direct connection to both. Under the control of PowerTool software, the PowerCal board performs loading and verification of battery configuration parameters and 3D cell models in PS40X EEPROM and OTP memory.

In addition, the PowerCal platform provides a complete precision system for calibrating current, voltage and temperature measurements in a Smart Battery, eliminating the need for expensive meters or power supplies.

During calibration, the PowerCal board accurately measures current, voltage and temperature and compares these measured values to those reported by the Smart Battery. Calibration values are then loaded into the programmable storage and used by the chip to compensate raw measurements made during normal operation. Reported values from the PowerSmart IC are therefore corrected to eliminate known, measured errors.

The PowerCal platform accomplishes calibration with programmable load and precision measurement hardware so that a known, constant discharge current is drawn from the battery pack. The programmable load circuit is capable of drawing up 36W continuous discharge power from the battery pack during calibration using natural convection cooling. Higher discharge currents are supported at reduced duty cycles, and/or with forced air cooling. In addition, there are provisions for the user to add their own external charger or load, at up to 10A.

The PowerCal board is designed to support both development and test environments. Both RS-232 and RS-485 interfaces are present so that the board can operate with a stand-alone connection (RS-232), or with a multidrop connection (RS-485) to the host PC. The hardware supports up to 7 PowerCal boards interfaced on a multidrop link from a PC COM port. As a result, up to 28 boards can be interfaced on a single PC with 4 COM ports. PowerCal boards can fit in a DIN 6U rack (2.25" board spacing); they can also be panel mounted.

Extensive safety features include production proven EMI/ESD protection, optical isolation of the serial ports and protective fuses. Fuses protect the device under test, the PowerCal hardware and any connected external charger or load. The board is implemented using 4 layers with a dedicated ground plane. All I/Os are connected to bypass capacitors to earth ground.

2.0 GENERAL SETUP

The Microchip PowerCal platform is a very powerful, versatile calibration, test and evaluation system. It can be used in a variety of ways, as a single board in a development environment and as a multi-board system in a high volume production environment. The instructions that follow will guide you through setup for each of the features on the board. References to modules refer to PCB products not yet assembled into packs or connected to cells.

Power is provided to the board to the JP connector with a 24V DC, 500 mA power supply wall adapter.

2.1 Connections

- JP – 24V DC power supply.
- TBP – Pluggable terminal block alternate 24V DC power supply (parallel connections with JP).
- TBS – Pluggable terminal block for board level test I/Os (to be developed later).
- TBC – Support for future capability.
- TBB – Pluggable terminal block for device under test, module or pack (includes connections for cell voltage measurement and programming voltage).
- PC – Support for future capability.

2.2 Jumpers

- ADR – jumper for board address identification

Address	Jumper Position		
	3-4	2-5	1-6
0	X	X	X
1	X	X	O
2	X	O	X
3	X	O	O
4	O	X	X
5	O	X	O
6	O	O	X
7	O	O	O

Legend: O = open, X = connect

- COM – jumpers to select RS-232 or RS-485

	Jumper Position					
	6-7	5-8	4-9	3-10	2-11	1-12
RS-232	O	O	O	O	O	X
RS-485	X	X	X	X	X	O

Legend: O = open, X = connect

- TERM – RS-485 termination only. If several PowerCal boards are connected in series, the last board must be terminated, all others unterminated.

	Jumper Position	
	1-2	3-4
TERM	X	X
UNTERM	O	O

Legend: O = open, X = connect

- IFBSEL – jumpers for unsupported feature. Set as shown below.

	Jumper Position		
	1-6	2-5	3-4
IFBSEL	X	O	O

Legend: O = open, X = connect

- IPSEL – jumpers for unsupported feature. Set as shown below.

	Jumper Position	
	1-2	2-3
IPSEL	X	O

Legend: O = open, X = connect

- AUXCELLS – jumper for unsupported feature. Leave jumper open.

- Vx - jumpers for unsupported feature. Set as shown below.

	Jumper Position
VN	X
VR	X
V4	X
V3	X
V2	X
V1	X
VP	X

Legend: O = open, X = connect

- DFILTER – jumpers for communication filter. Set as shown below for PS3XX or PS4XX product families.

	Jumper Position	
	1-2	2-3
PS3XX	X	O
PS4XX	O	X

Legend: O = open, X = connect

3.0 FUNCTIONAL DESCRIPTION

With the current firmware, the PowerCal board can perform programming and test of packs and modules and the calibration of pack and cell voltages on packs. Apply power (24V DC) to the board at either the JP connector using an A/C wall adapter, or at TBP connector. To use a single PowerCal board connected to the serial port of a PC, configure the COM and RX jumpers for RS-232 and connect the P1 connector to the PC serial port. To use multiple boards per COM port, configure the COM and RX jumpers for RS-485 and connect the P1 connector to the RS-485 connector on the PC card. Additional PowerCal boards may be added by connecting J1 on the first board, to P1 on the next, using a standard (straight-through) PC serial cable. Up to seven boards may be added in this manner. Use the ADR jumper to give each board a unique address. Install and run Microchip's PowerTool software on the PC. The calibration platform is ready to use.

3.1 Pack Programming, Calibration and Test

Attach the external pack contacts of the Microchip Smart Battery pack (V+, C, D, T, V-) to the same terminals on the TBB connector. Using PowerTool software, the EEPROM can be programmed and the pack voltage can be calibrated. To program OTP memory, the V_{PP} contact in the pack must be connected to V_{PP} on the TBB connector. The additional connection is only necessary for OTP programming. Additional PowerTool features, such as final test, can also be performed on the pack.

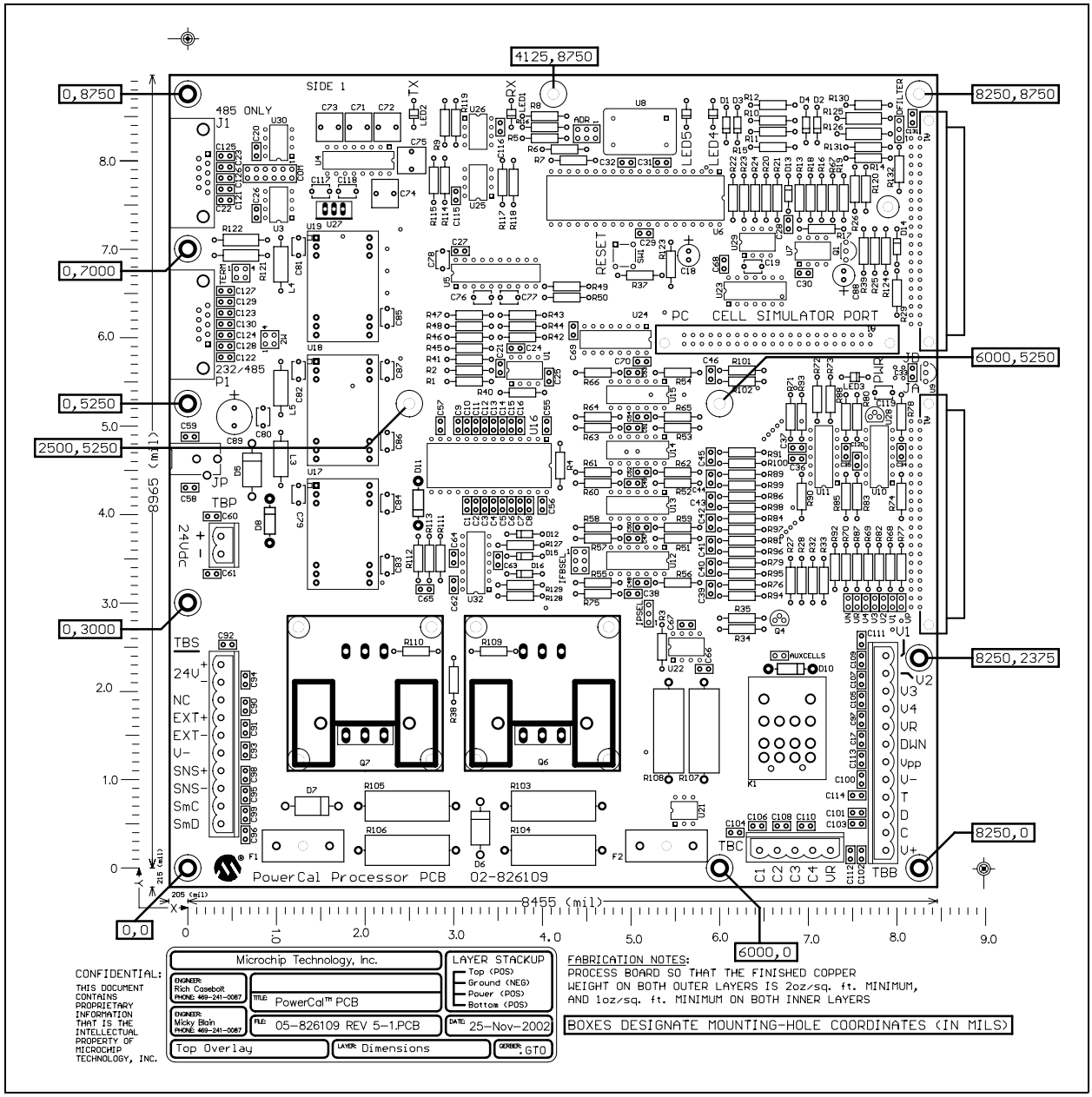
3.2 V_{CELL} Calibration

Additional connections to the TBB connector are necessary for the calibration of individual cell voltages. The bottom of the cell stack is connected to V_R, the top of the cell stack is connected to V1, and the intermediate cell connections are made from the top-down. In other words, V2 is connected to the next cell below V1, V3 below V2, and V4 below V3. For 3-cell packs, short V4 to VR. For 2-cell packs, short V3 and V4 to VR. PowerTool software is used to calibrate the cell voltages.

4.0 MECHANICAL DIMENSIONS (units are inches)

8.66"W x 9.13"L x 2.06"H (height does not include stand-offs)

FIGURE 4-1: PowerCal™ BOARD TOP LAYER AND CONNECTIONS



5.0 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 5-1 summarizes the development tool offering from Microchip to support the P3 and P4 families. Please refer to the Microchip web site for ordering information and design documentation (including schematics) at www.microchip.com.

TABLE 5-1: MICROCHIP DEVELOPMENT TOOL SUMMARY

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

5.1 Reference Documents

This data sheet provides an overview of the PowerCal Calibration Board. For further information on the PS401 and development tool operations, please refer to the following documents available for download at www.microchip.com.

TABLE 5-2: MICROCHIP REFERENCE DOCUMENTS

Document Number	Documents Available
DS40239	PS401 Smart Battery IC User's Guide
DS40238	PS401 Single Chip Battery Manager Data Sheet (IC Products)
DS40234	PS041 PowerInfo Configuration Interface Product Brief

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