PS052

PowerCal™ 2 Calibration Platform

Features

- Hardware platform for configuration, calibration and test of Microchip battery management products
- Operates under control of Windows® based PowerMate™ software (PS7XX) and PowerTool™ 500 software (PS5XX) through an RS-232 port or USB interface to the PC
- Directly connects to assembled PS7XX or PS5XX battery pack
- SMBus communication managed by onboard processor
- Supports loading and verification of battery configuration parameters and 3D cell models in memory
- Pluggable battery connector for convenience and flexibility
- Terminals for attachment to an external load or charger
- Powered by 12V DC external supply (included)
- Production proven EMI/ESD protection
- Overall mechanical dimensions:
  - 3.938 W x 6.300 L (inches)
  - 100.025 W x 160.020 L (millimeters)

Ordering Information

Part No.	Description
PS052	PowerCal™ 2 Calibration Board

Development/Test Software

Part No.	Description
PS070	PowerMate™ Software for use with PS7XX
PS050	PowerTool™ 500 Software for use with PS5XX

1.0 PRODUCT OVERVIEW

PowerCal 2 is a powerful, easy to use hardware platform that supports configuration, calibration and test of Microchip PS7XX and PS5XX ICs. It operates under the control of Microchip's development/test software interfaced to a Windows PC.

The PowerCal 2 board facilitates serial or USB communication between the PC and the SMBus battery interface. Whether connected to the PC's serial (RS-232) or USB port, the PowerCal 2 board must be powered through an external 12V DC power supply.

2.0 GENERAL SETUP

The Microchip PowerCal 2 platform facilitates communication between a battery containing a Microchip PS5XX or PS7XX IC and a PC running Microchip's development/test software. The information that follows will guide you through the setup of the various features available.

2.1 Connections

- P1 – Serial (RS-232)
- J1 – USB
- J2 – 12V DC power supply
- TBP – Pluggable terminal block for device under test. Looking into the connector on the board, the pins from left to right are:
  - V+: Battery pack positive
  - C: SMBus clock
  - D: SMBus data
  - T: T-pin
  - V-: Battery pack negative
- TBV – Pluggable terminal block for individual cell voltages. Use depends on the number of series cells in a Lithium pack. Looking into the connector on the board, the pins from left to right are:
  - VC4: Top of fourth series cell in pack
  - VC3: Top of third series cell in pack
  - VC2: Top of second series cell in pack
  - VC1: Battery pack positive

2.2 Jumpers

- ADR – Jumper for board address identification

TABLE 2-1: JUMPER POSITION FOR BOARD ADDRESS ID

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

2.3 USB Setup

Connect the USB cable from J1 on the PowerCal 2 board to the USB port on the PC. Connect a 12V DC power supply to J2 and plug it into the electrical outlet. The board is now powered. Attach your battery to the TBP connector and launch the Microchip development/test software on the PC.

2.4 RS-232 Setup

Connect the serial cable from P1 on the PowerCal 2 board to the RS-232 port on the PC. Connect a 12V DC power supply to J2 and plug it into the electrical outlet. The board is now powered. Attach your battery to the TBP connector and launch the Microchip development/test software on the PC.

2.5 Individual Cell Voltage Setup (Optional)

Connections from the individual cell voltages of a Lithium pack can be attached at TBV to measure and calibrate the individual cell voltages of the series cells in the pack. Unused cell voltages should be connected to V- during VC calibration.

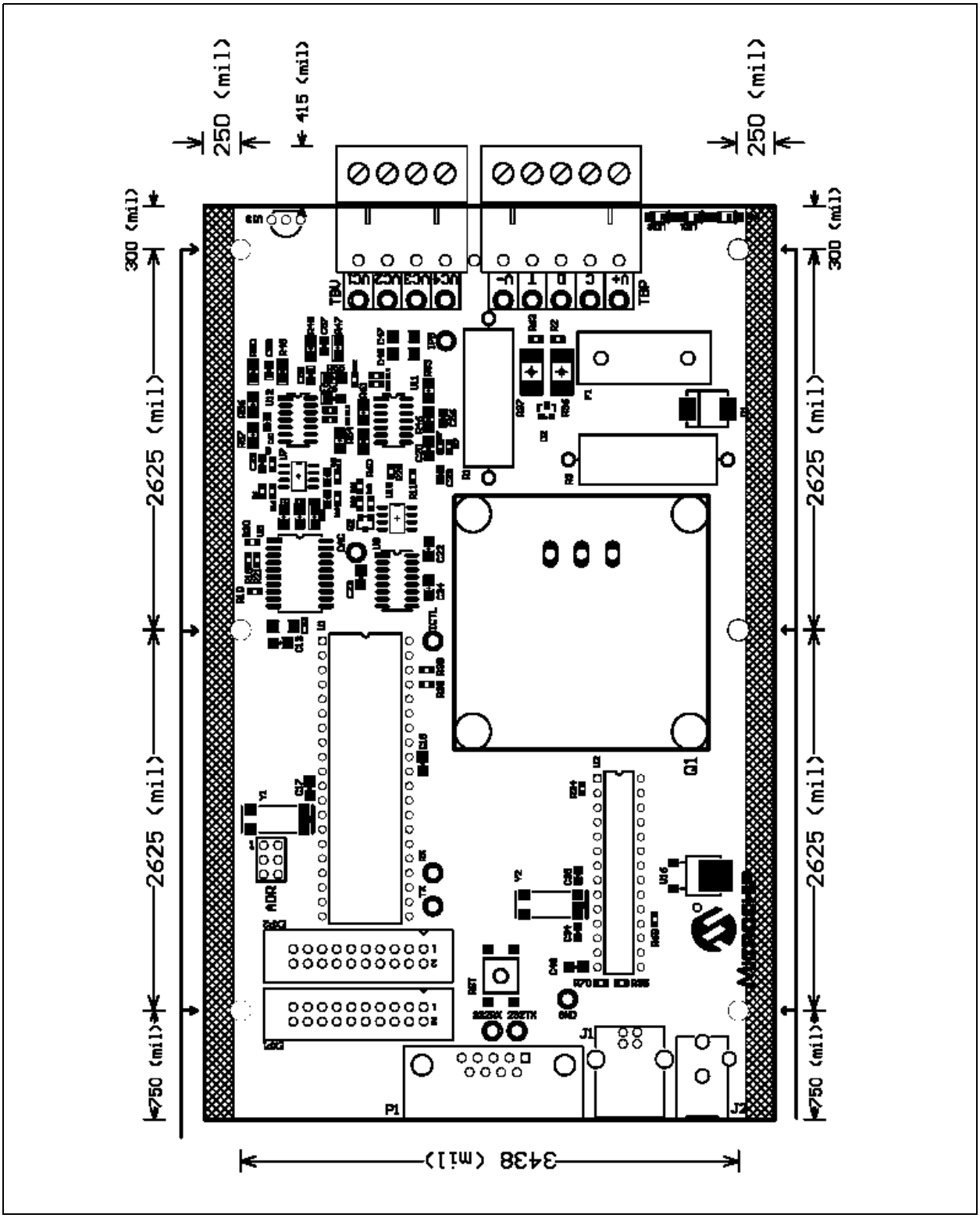
3.0 MECHANICAL DESCRIPTION

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: 3.938” x 6.300”

FIGURE 3-1: PS052 DIMENSION DETAILS



3.2 Schematic

FIGURE 3-2: PS052 BOARD SCHEMATIC (SHEET 1 OF 2)

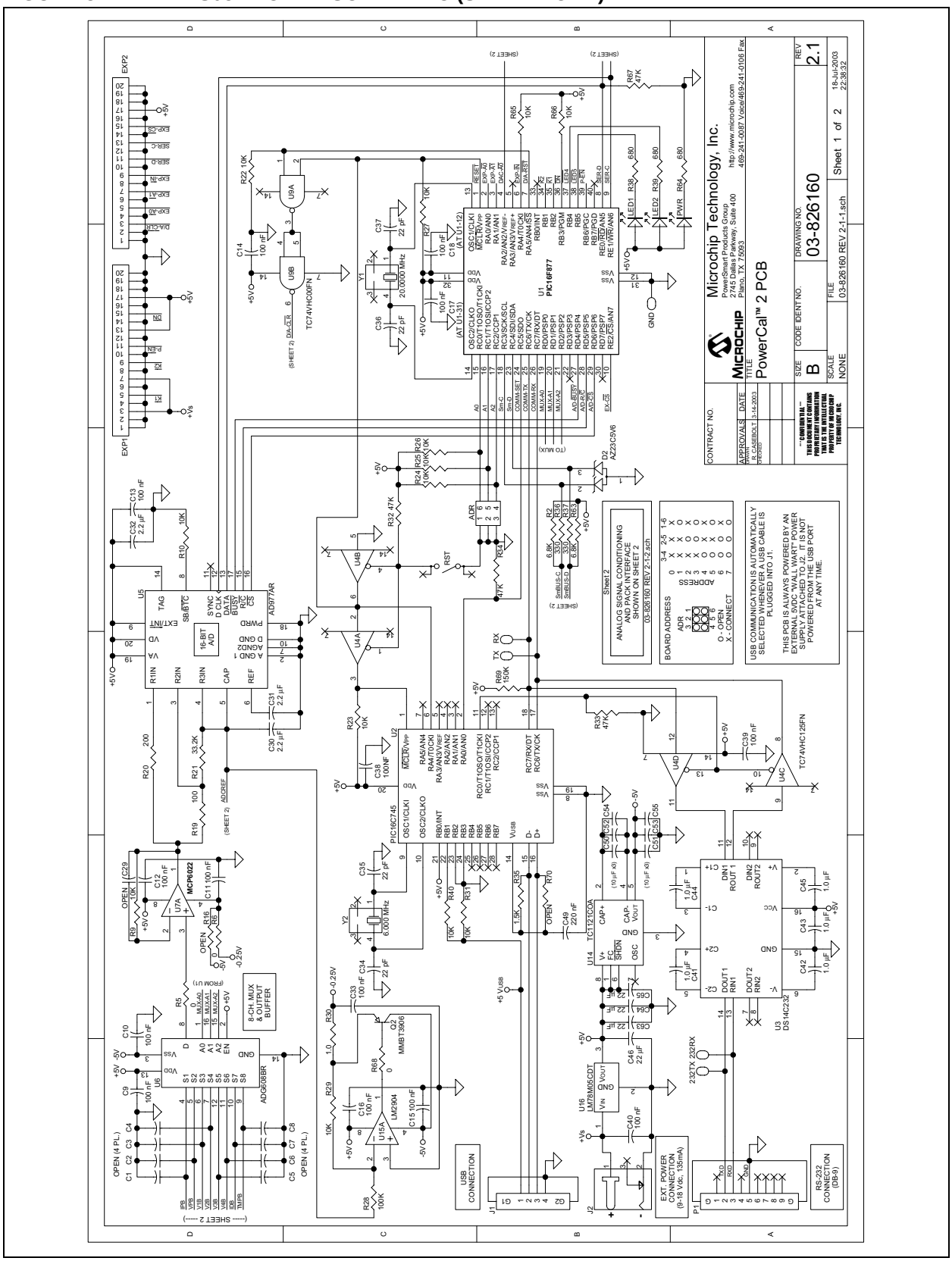
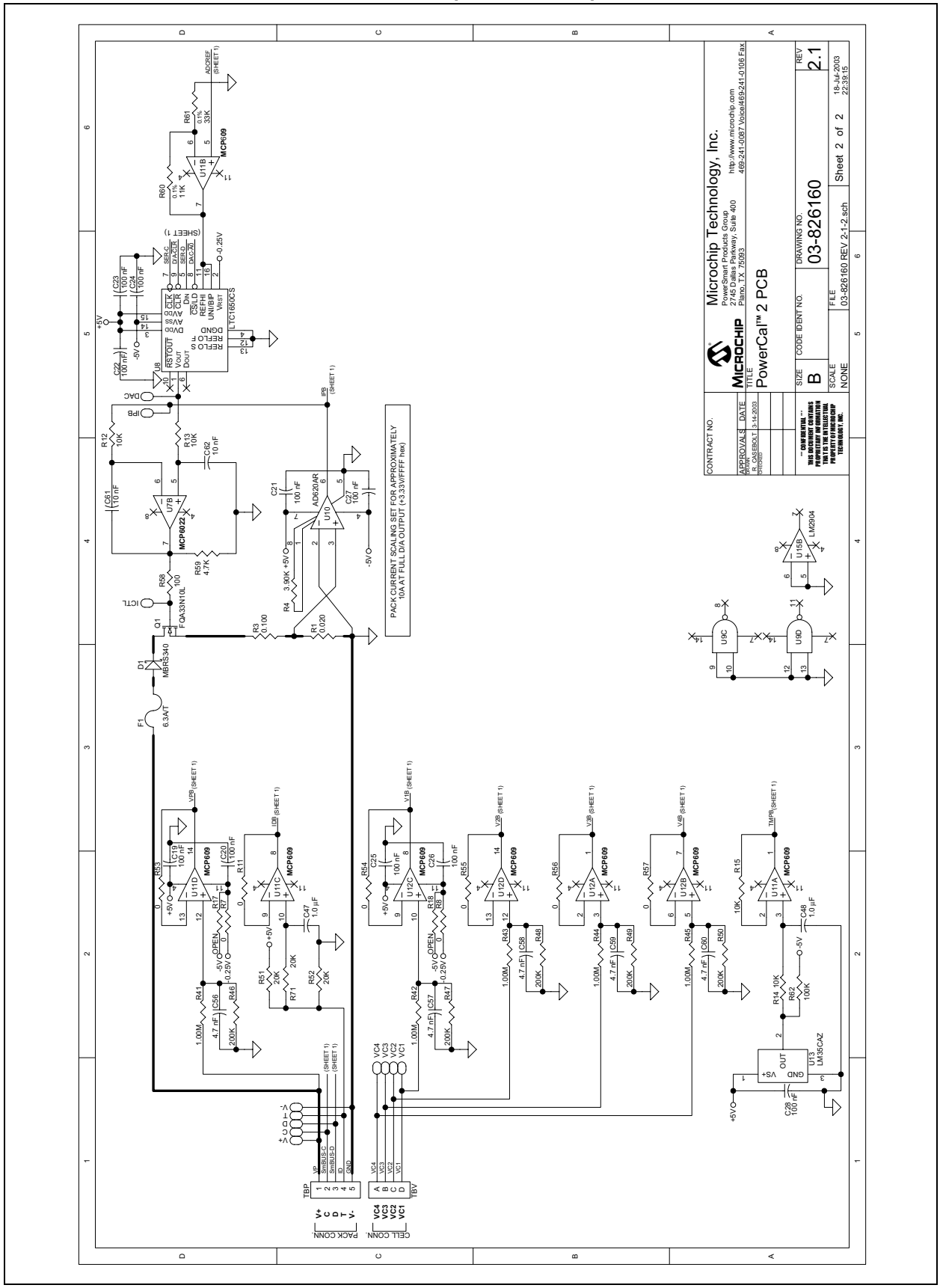


FIGURE 3-3: PS052 BOARD SCHEMATIC (SHEET 2 OF 2)



3.3 Bill of Materials

TABLE 3-1: PS052 BILL OF MATERIALS

Symbols	Description	Manufacturer	Manufacturer PN	Qty
PCB	Raw PCB, PowerCal™ 2	Microchip	04-826160 Rev. 2.1	1
U1	Firmware Specification, PowerCal™ 2 Main MCU	None	Document	Doc.
U2	Firmware Specification, PowerInfo™/PowerCal™ USB MCU	None	Document	Doc.
C61-C62	Capacitor, Ceramic, 10 nF, 50V, +/-10%, X7R dielectric, 0603	Panasonic	ECJ-1VB1H103K	2
C56-C60	Capacitor, Ceramic, 4.7 nF, 50V, +/-10%, X7R dielectric, 0603	Panasonic	ECJ-1VB1H472K	5
C34-C37	Capacitor, Ceramic, 22 pF, 50V, +/-5%, C0G dielectric, 0603	Panasonic	ECJ-1VC1H220J	4
C33, C38-C39	Capacitor, Ceramic, 100 nF, 25V, +80%/-20%, Y5V dielectric, 0603	Panasonic	ECJ-1VF1E104Z	3
C9-C28	Capacitor, Ceramic, 100 nF, 25V, +/-10%, X7R dielectric, 0805	Panasonic	ECJ-2VB1E104K	20
C49	Capacitor, Ceramic, 220 nF, 25V, +/-10%, X7R dielectric, 0805	Panasonic	ECJ-2YB1E224K	1
C41-C45, C47-C48	Capacitor, Ceramic, 1.0 µF, 25V, +/-10%, X7R dielectric, 1206	Panasonic	ECJ-3YB1E105K	7
C40	Capacitor, Ceramic, 100 nF, 50V, +/-10%, X7R dielectric, 1206	BC Components	1206B104K500BT	1
C50-C55	Capacitor, Ceramic, 10 µF, 6.3V, +/-20%, X5R dielectric, 1206	Panasonic	ECJ-HVB0J106M	6
C46, C63-C65	Capacitor, Ceramic, 22 µF, 6.3V, +/-20%, X5R dielectric, 1206	Panasonic	ECJ-3YB0J226M	4
C30-C32	Capacitor, Ceramic, 2.2 µF, 25V, +80%/-20%, Y5V dielectric, 1206	Panasonic	ECJ-3YF1E225Z	3
LED1-LED2, PWR	LED, clear green, 1206 package	Lumex	SML-LX1206GC-TR	3
D1	Schottky Diode, 40V, 3A, SMC package	International Rct. Central Semi. Central Semi.	MBRS340TR CMSH3-40-PST CMSH3-40L-PST	1
D2	Dual Zener Diode, 5.6V +/- 5%, 300 mW, common anode, SOT-23	Diodes Inc. General Semiconductor	AZ23C5V6-7 AZ23-C5V6	1
F1	Fuse, 6.3A, 250V, Time delay, 5X20 mm	Littelfuse	021806.3H	1
ADR	Connector, shorting jumper, female, 2-position, 100 mil spacing, mates with 25 mil square pins, 15-microinch gold over nickel	AMP	382811-6	3
TBV	Header, pluggable terminal block, 5.08 mm pitch x 4 positions, 12A/250V, right-angle, closed end	Phoenix	1757268	1
TBP	Header, pluggable terminal block, 5.08 mm pitch x 5 positions, 12A/250V, right-angle, closed end	Phoenix	1757271	1
U2	IC socket, 28-pin DIP, 300 mil width	Mill-max	110-99-328-41-001	1
U1	DIP socket, 40-pin, 600 mil width, BeCu/Sn	AMP	2-641268-1	1
J2	Connector, coaxial power, female, 2.0 mm center pin x 6.5mm sleeve, right-angle PCB mount	Cui Stack	PJ-102A	1
V-, GND	Test point, 0.125" OD, for 0.062" hole, black	Keystone	5011	2
VC1-VC4, V+	Test point, 0.125" OD, for 0.062" hole, red	Keystone	5010	5
232RX, 232TX, C, D, DAC, ICTL, IPB, RX, T, TX	Test point, 0.125" OD, for 0.062" hole, white	Keystone	5012	10

Note 1: See schematic for jumper configuration details.

2: The header used for ADR is a break-apart component – one 2 x 36 header can be broken apart to provide up to 12 of the 2 x 3 headers used for ADR.

3: The following components are left open: C1-C8, C29, EXP1, EXP2, R16, R17, R18, R70.

TABLE 3-1: PS052 BILL OF MATERIALS (CONTINUED)

Symbols	Description	Manufacturer	Manufacturer PN	Qty
J1	Connector, USB type B, right-angle PCB mount, shielded	Mill-max Molex	897-30-004-90-000000 67068-0000	1
F1	Fuse holder, PCB mount, for 5X20 mm fuse	Wickmann	6490000100	1
Q1	Heatsink, TO-247, PCB mount, omnidirectional, 1.81 in. W x 1.81 in. D x 1.25 in. H, modified version of Wakefield 680-125K heatsink	Microchip	MM-825052-01	1
	Flat Washer, #4, zinc-plated steel	Various	See Description	11
Q1	Hex Nut, 4-40, zinc-plated steel	Various	See Description	1
	Hex standoff, 4-40, 0.375" length, 0.187" across flats, female, zinc-plated brass	Keystone	1803	10
	Internal-tooth lockwasher, #4, zinc-plated steel	Building Fasteners	INT LWZ 004	10
	Screw, pan head Phillips, 4-40 x 1/4", zinc-plated steel	Building Fasteners	PMS 440 0025 PH	10
Q1	Screw, pan head Phillips, 4-40 x 5/16", zinc-plated steel	Various	See Description	4
Q1	Screw, pan head Phillips, 4-40 x 3/4", zinc-plated steel	Various	See Description	1
Q1	Split lock washer, #4, spring steel	Various	See Description	1
ADR	Connector, break-apart PCB header, straight, 2-row x 36-pin, 100 x 100 mil spacing, 235 mil/100 mil/ 145 mil length, 25 mil square pins, 10-microinch gold	3M	929665-09-36-I	1
TBV	Pluggable terminal block, 5.08 mm pitch x 4 positions, 12A/250V	Phoenix	1757035	1
TBP	Pluggable terminal block, 5.08 mm pitch x 5 positions, 12A/250V	Phoenix	1757048	1
P1	Connector, DB9 right-angle PCB mount, female sockets	Norcomp	182-009-212-531	1
Q2	Transistor, PNP, -40V, 350 mW SOT-23	Diodes Inc. Central Semi.	MMBT3906-7 CMPT3906-PST	1
Q1	MOSFET, N-channel enhancement mode, logic-level gate drive, 36A, 100V, TO-3P package	Fairchild Semi. Toshiba	FQA33N10L 2SK1381	1
R19, R58	Resistor, film, 0603, 1%, 100 ohms	Panasonic	ERJ-3EKF1000V	2
R28, R62	Resistor, film, 0603, 1%, 100 kOhms	Panasonic	ERJ-3EKF1003V	2
R9-10, R12-R15, R22-R27, R29, R31, R40, R65-R66	Resistor, film, 0603, 1%, 10 kOhms	Panasonic	ERJ-3EKF1002V	17
R20	Resistor, film, 0603, 1%, 200 ohms	Panasonic	ERJ-3EKF2000V	1
R51-R52, R71	Resistor, film, 0603, 1%, 20 kOhms	Panasonic	ERJ-3EKF2002V	3
R21	Resistor, film, 0603, 1%, 33.2 kOhms	Panasonic	ERJ-3EKF3322V	1
R5-R8, R11, R68	Resistor, zero ohm, 0603	Panasonic	ERJ-3GEY0R00V	6
R30	Resistor, film, 0603, 5%, 1.0 ohms	Panasonic	ERJ-3GEYJ1R0V	1
R35	Resistor, film, 0603, 5%, 1.5 kOhms	Panasonic	ERJ-3GEYJ152V	1
R69	Resistor, film, 0603, 5%, 150 kOhms	Panasonic	ERJ-3GEYJ154V	1
R32-R34, R67	Resistor, film, 0603, 5%, 47 kOhms	Panasonic	ERJ-3GEYJ473V	4
R2, R63	Resistor, film, 0603, 5%, 6.8 kOhms	Panasonic	ERJ-3GEYJ682V	2
R38-R39, R64	Resistor, film, 0603, 5%, 680 ohms	Panasonic	ERJ-3GEYJ681V	3
R4	Resistor, film, 0603, 0.5%, 3.90 kOhms, 25 ppm TC	Susumu	RR0816P-392-D	1
R53-R57	Resistor, zero ohm, 0805	Panasonic	ERJ-6GEY0R00V	5
R59	Resistor, film, 0805, 5%, 4.7 kOhms	Panasonic	ERJ-6GEYJ472V	1
R60	Resistor, film, 0805, 0.1%, 25 ppm TC, 11.0 kOhms	Panasonic	ERA-6YEB113V	1
R61	Resistor, film, 0805, 0.1%, 25 ppm TC, 33.0 kOhms	Panasonic	ERA-6YEB333V	1
R41-R45	Resistor, film, 0805, 0.5%, 1.00 mOhms, 25 ppm TC	Susumu	RR1220P-105-D	5

Note 1: See schematic for jumper configuration details.

2: The header used for ADR is a break-apart component – one 2 x 36 header can be broken apart to provide up to 12 of the 2 x 3 headers used for ADR.

3: The following components are left open: C1-C8, C29, EXP1, EXP2, R16, R17, R18, R70.

TABLE 3-1: PS052 BILL OF MATERIALS (CONTINUED)

Symbols	Description	Manufacturer	Manufacturer PN	Qty
R46-R50	Resistor, film, 0805, 0.5%, 200 kOhms, 25 ppm TC	Susumu	RR1220P-204-D	5
R36-R37	Resistor, film, 2512, 5%, 330 ohms	Panasonic	ERJ-1TYJ331U	2
R1	Resistor, metal strip, 20 milliohms, 1%, 5W, 925 mil L x 330 mil D axial package	Vishay Ohmite	LVR-5-0.020OHMS-1% 15FR020	1
R3	Resistor, metal strip, 100 milliohms, 5%, 5W, 925 mil L x 330mil D axial package	Huntington Elec.	ALSR-5-.10	1
RST	Switch, SPST momentary tact, surface mount, 6 mm square, 4.3 mm high, 260 g-force	E-Switch	TL3301NF260QG	1
U11, U12	IC, operational amplifier, precision low-voltage/micropower, quad, SO-14, -40°C to +85°C	Microchip	MCP609-I/SL	2
U10	IC, instrumentation amplifier, SO-8, -40°C to +85°C	Analog Devices	AD620AR	1
U15	IC, dual operational amplifier, SO-8	National Semi. Fairchild Semi.	LM2904M LM2904M	1
U7	IC, dual low-voltage operational amplifier, SO-8	Microchip	MCP6022-I/SN	1
U13	IC, Linear Temperature Sensor, TO-92, -40°C to +110°C	National Semiconductor	LM35CAZ	1
U2	IC, Microcontroller, 24 MHz, with USB Interface, 28-pin/300 mil DIP, -40°C to +85°C	Microchip	PIC16C745-I/SP	1
U1	IC, Microcontroller, 20 MHz, 40-pin DIP, 0°C to +70°C	Microchip	PIC16F877-20/P	1
U9	IC, Quad 2-input NAND gate, VHCMOS, SO-14, -40°C to +85°C	Toshiba	TC74VHC00FN	1
U4	IC, quad buffer with tri-state outputs, VHCMOS, SO-14, -40°C to +85°C	Toshiba	TC74VHC125FN	1
U3	IC, RS-232 transceiver, SO-16, 0°C to +70°C	National Semiconductor	DS14C232CM	1
U8	IC, D/A converter, 16-bit, serial input, SO-16, 0°C to +70°C	Linear Technology	LTC1650CS	1
U6	IC, Analog multiplexer, 8-channel, single-ended, SO-16, -40°C to +85°C	Analog Devices	ADG608BR	1
U5	IC, A/D converter, 16-bit, serial-output, 7.5 mm wide SO-20, -40°C to +85°C	Analog Devices	AD977AR	1
U14	IC, charge pump DC/DC converter, 2.4 to 5.5 VDC input, -2.4 to -5.5 VDC or 4.8 to 11 VDC output, 100 mA, SO8, 0°C to +70°C	Microchip	TC1121COA	1
U16	IC, Linear Voltage Regulator, 5V, 500 mA, TO-252, 0°C to +125°C	National Semiconductor	LM78M05CDT	1
Y1	Crystal, 20.0000 MHz, 18 pF load capacitance, surface-mount.	Citizen	CM309S20.000MABJTR	1
Y2	Crystal, 6.0000 MHz, 18 pF load capacitance, surface-mount.	Citizen	CM309S6.000MABJTR	1

Note 1: See schematic for jumper configuration details.

2: The header used for ADR is a break-apart component – one 2 x 36 header can be broken apart to provide up to 12 of the 2 x 3 headers used for ADR.

3: The following components are left open: C1-C8, C29, EXP1, EXP2, R16, R17, R18, R70.

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 PS5XX and PS7XX products. 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 PS052 Calibration Platform. For further information on other products 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™ 2 hardware with development/ test software (PS051)	Read and write battery registers and memory, pack test
PowerCal™ 2 hardware with development/ test software (PS052)	Read and write battery registers and memory, pack calibration, pack test

TABLE 4-2: MICROCHIP REFERENCE DOCUMENTS

Document Number	Documents Available
DS21774	PS070 PowerMate™ Development Software Data Sheet
DS21885	PS050 PowerTool™ 500 Development Software User's Guide

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