

Quick-Start Guide for bq78PL114 With bq76PL102 Family Gas Gauges

This application report gives an overview of the implementation and testing of Texas Instruments bq78PL114 with companion bq76PL102 high-cell-count battery gas gauge and protector. It explores the hardware and software graphical user interface (GUI) setup.

This document begins with the discussion of the communication setup between the chipset and the personal computer. TI's USB Interface Adapter communications box is used with the provided bqWizard[™] software. The examples in this document show the S12 version of the firmware. The updated S12 version has programming and hardware differences from the original S8 firmware. See the *bq78PL114 and bq78PL114S12 Technical Reference Manual* (SLUU330) for those differences.

See the application report *Chemistry Selection for bq78PL114* (<u>SLUA505</u>) for additional information on configuring the gas gauge, as well as on the data collection process for defining a .AUX for your battery pack. The .AUX file is provided by Texas Instruments.

Additionally, review the application report *What is a .tmap File?* (SLUA542) to understand the nuances of the different programming files for the gas gauge. of this document includes questions on your pack configuration required by TI to create a .tmap file. Automatic .AUX file generation is now available through bqWizard[™] software version 2.5.18.

The examples used in this quick-start guide are based on the hardware implementation shown in the schematic and build of materials. Collateral on the bq78PL114 8S standard evaluation module (EVM) offered by TI is available (<u>SLUU335</u>). Note that hardware changes are required moving from the S8 firmware to S12. Do not update the firmware on the bq78PL114 8S standard EVM unless you understand the implications.

Contents

1	Getting	g Started With the bq78PL114 Graphical User Interface	. 3
2	Softwa	re Communication and Troubleshooting	. 3
3	Updati	ng the Firmware to S12 Configuration	5
4	Explor	ing the GUI Software Screens	7
5	Updati	ng the Chemistry File	. 9
6	Config	uring the Gas Gauge	10
7	Final S	Setup Steps for Evaluation	15
	7.1	To Initialize Gas Gauge and Turn On Charge and Discharge FETs	15
	7.2	To Enable PowerPump [™] Cell Balancing Feature:	17
	7.3	Initializing the Pack	19
8	Setting	Up Logging Data	19
	8.1	Setup of Dynamic Data Log Definition File	19
	8.2	Data Logging Setup	21
9	Final C	Comments Concerning Evaluation	23
Appen	dix A	.PPCSV Data-Set File Export From S12 Firmware	24
Appen	dix B	Default Data-Set Screen Captures From bqWizard™ GUI for S12 Firmware	28
Appen	dix C	Reference Design and Reference Design Bill of Materials	32

List of Figures

1	Unable to Connect to Chipset Warning	3
2	LAN is not built! Warning	3



www.ti.com

3	Proper "Loading" Percentage Start-up Screen	4
4	Proper "8 cells found" Start-up Screen	4
5	Choose Appropriate Firmware Configuration if Communication is Lost	4
6	bqWizard BootStrap Loader to Program S12 Firmware.	6
7	Progress Screen While Programming New Firmware S12	6
8	Firmware Process Completed Successfully	7
9	Click the Red X	7
10	Successful Wired Bit Toggled Message	8
11	Loading Proper TMAP File for Your Pack's Configuration	8
12	Home Screen After Loading 11s Configuration .TMAP File	8
13	Pack Parameter and Settings Tabs	9
14	Chemistry Selection Window	9
15	S12 Home Screen Showing Temperature Fault Condition	10
16	Calibration Screen. Used to Update Temperature Reading to Room Temperature	11
17	Home Screen Showing Correct Temperature Reading	11
18	Home Screen Showing Fuse Reset and no Safety Flags	12
19	Calibrating 0-mA Offset While Pack is at Rest (no Charging or Discharging)	12
20	Read All Parameters to See All Data-Set Settings	13
21	Save Data-Set Menu	13
22	GUI Indication That PPCSV File Has Been Successfully Saved	13
23	Select Read All Parameters Command After Importing a Data-Set PPCSV File	15
24	Algorithm Enable Configuration	16
25	Enabling Charge and Discharge EETs	16
26	S12 Home Screen	17
27	Zoom-in on Status Field	17
28	Enabling PowerPump TM Cell Balancing	18
20	Home Screen Showing PowerPump TM Cell Balancing Active	18
30	Default/Blank Log Definition Tool	10
31		20
32	Configured Dynamic Log Definition File	20
33	Data Logging Configuration Window in bgWizard™ Software	20
34	Choosing Poll Data From Commands Menu to Begin Logging	21
35	Entering Comments via baWizard TM Software	22
36	Example of Dynamic Log File for an 11s Battery Pack	22
37	Call Balancing Data-Set Tah	20
38	Call Chemistry Data-Set Tab	20
30	Pack Configuration Data Sat Tab	20
39 40	Safaty Lavel 1 Data Sat Tab	29
40 /1	Safety Level 7 Data-Set Tab	20
41	Selety Level 2 Data-Set Tab	29
42 12	SBData Static Data-Set Tab	20
40 44	Dada Otalio Data Soti Tab	20
44 15	Faux Dynannic Data-Set Tab	21
40	Onarye Control Data Set Tab	24
40	Fauk hisiuiy daia-del Tau	31

List of Tables

1	Data-Set Parameters to Review in Your S12 Design	14
2	.PPCSV Data-Set File Export From S12 Firmware	24
3	Bill of Materials	33



1 Getting Started With the bq78PL114 Graphical User Interface

The USB Interface Adapter box must be connected to your computer before the GUI can open. The default firmware on the standard EVM and early production product supports up to 8 cells in series (called 8s). The latest release of the bq78PL114 firmware is called S12 and supports up to 12 cells in series. The interface box used to communicate with the bq78PL114 is called USB-to-GPIO Adapter EVM. Note that it is not included with the bq78PL114EVM-001 evaluation module and must be purchased separately.

2 Software Communication and Troubleshooting

When trying to connect to the gas gauge chipset, you may see the following screen message (Figure 1) presented by the GUI software, "Unable to connect to device." Check the connections to the hardware, and try to reconnect. Additionally, the "LAN is not built!" warning message (Figure 2) appears in the lower right corner of your screen.

In some cases, everything is fine, and you need to close and open the software again. (LEDs blinking is a good sign that the part is functional.) If not, check for voltage on VLDO1, V1, and V2 pins. Also, check for shorts across the battery cell connections. A 10-second initialization period occurs after power up (POR) during which communication with the device may fail.

Proper communication is indicated by the following screen captures (Figure 3 and Figure 4).

Note that the S8 firmware may be preprogrammed into your EVM or integrated circuit when you receive it. The S8 firmware has been referred to as FW4452 throughout TI documentation. The S8 firmaware is programmed at the factory as the default firmware. Follow the process in on updating the firmware to the S12 version. Because hardware configurations are different for the different firmware versions, review the *bq78PL114 and bq78PL114S12 Technical Reference Manual* (SLUU330) for those differences.







Figure 2. LAN is not built! Warning.

bqWizard, PowerPump are trademarks of Texas Instruments. Microsoft, Excel are trademarks of Microsoft Corporation.



Software Communication and Troubleshooting

www.ti.com



Figure 3. Proper "Loading" Percentage Start-up Screen



Figure 4. Proper "8 cells found" Start-up Screen.



Figure 5. Choose Appropriate Firmware Configuration if Communication is Lost



Updating the Firmware to S12 Configuration

3 Updating the Firmware to S12 Configuration

To update the device firmware, open the Instruction README text file located at: C:\Program Files\Texas Instruments\bqWizard 2.5\Documentation\Firmware Update Procedure.txt (This folder *C:\Program Files\Texas Instruments\bqWizard 2.5* folder is the default path created by the installation of the bqWizard[™] software.)

The following excerpts and screen captures are copied beginning with Step 5 to show the process step-by-step. A detailed firmware update procedure is available on TI's E2E community Web site.

- 5) To load new firmware
 - Go to Bootstrap Loader dialog box: Main menu → Utilities → Bootstrap Loader Main menu → Commands → Read All Parameters - Turn on "Wired bit": Main Menu → Comma
 - Click on Select File button.
 - Browse to C:\Program Files\Texas Instruments\bqWizard 2.x\Configuration Files\Firmware.
 - Select FW_0001_0000_5000_0012.enc, and click on Open.
 - After returning to Bootstrap Loader dialog box, select Preserve Calibration box.
 - Click on Download button.
 - Save calibration data to a file.
 - After download is complete, approximately 50 s, close the Bootstrap Loader dialog box. Control
 returns to the bqWizard[™] software.
 - Read all parameters: Main menu \rightarrow Commands \rightarrow Read All Parameters.
 - Turn on Wired bit: Main Menu \rightarrow Commands \rightarrow Toggle Wired Bit.
- 6) Configure Target Board
 - Configure temperature sensors and cell count: Main Menu \rightarrow File \rightarrow Pack Configuration \rightarrow Load Configuration from File and Relearn.
 - Browse to C:\Program Files\Texas Instruments\bqWizard 2.x\Configuration Files\bq78PL114S12.
 - Select file that corresponds to your specific board configuration.
 - After download, the bqWizard[™] software restarts and initializes
 - Read all parameters: Main menu \rightarrow Commands \rightarrow Read All Parameters
 - Go to Pack Configuration tab and verify that the parameters Actual Number of Cells and Temperature Sensor Count match your expectations.
 - Note that the temperature sensor count includes the sensor in the bq78PL114 package.



Updating the Firmware to S12 Configuration

polication		Data		System	
ppication				System	Treve a
version:	4452	version:	5005	version:	4100
CRC:	0x0F52	CRC:	0x22A1	CRC:	0x81A1
Base Sys Version:	4100	Data CRC:	0xF66A	Status:	0x0011
Base Data Version:	5005				
e Information Naming!!! Once the d fownload failure, the P File Name: FW_0	ownload is in pr aardivare will no 001_0000_500	ogress, you must no of be operational and 0_0012.enc	t stop it from co must be reprog	mpleting. In the e rammed.	ventofa
Varning!!! Once the d lownload failure, the h File Name: FW_0 Indexes: 1 File Version: 5000	ownload is in pr aardware will no 001_0000_500	ogress, you must no it be operational and 0_0012.enc	t stop it from co must be reprog	mpleting. In the e rammed.	vent of a
Varning!!! Once the d lownload failure, the h File Name: FW_0 Indexes: 1 File Version: 5000 File Version: n/a	ownload is in pr aardware will no 001_0000_500	ogress, you must no it be operational and 0_0012.enc	t stop it from co must be reprog	mpleting. In the e rammed.	vent of a
Arning!!! Once the d ownload failure, the h File Name: FW_0 Indexes: 1 File Version: 5000 File Version: n/a Status: Down	ownload is in pr aardiware will no 001_0000_500 loading block 36	ogress, you must no it be operational and 0_0012.enc 52 of 468	t stop it from co must be reprog	mpleting. In the e rammed.	vent of a
EInformation Varning!!! Once the d ownload failure, the h File Name: FW_0 Indexes: 1 File Version: 5000 File Version: n/a Status: Down Progress:	ownload is in pr tardiware will no 001_0000_500 loading block 38	ogress, you must no it be operational and 0_0012.enc 52 of 468	t stop it from co must be reprog	mpleting. In the e rammed.	vent of a
Information JamingIII Once the d ownload failure, the h File Name: FW_0 Indexes: 1 File Version: 5000 File Version: n/a Status: Down Progress:	ownload is in pr lardware will no 001_0000_500 loading block 36	ogress, you must no it be operational and 0_0012.enc 52 of 468	t stop it from co must be reprog	mpleting. In the e rammed.	vent of a
e Information Warning!!! Once the d download failure, the h File Name: FW_0 Indexes: 1 File Version: 5000 File Version: n/a Status: Down Progress:	ownload is in pr Iardware will no 001_0000_500 loading block 36	ogress, you must no it be operational and 0_0012.enc 52 of 468 Select File	t stop it from co must be reprog	mpleting. In the e rammed.	vent of a

Figure 6. bqWizard BootStrap Loader to Program S12 Firmware.

Concerning Figure 6, be sure to choose the Preserve Calibration box as individual IC voltage readings are calibrated during assembly-test at TI.

78PL114 Informat	ion				
Application		Data		System	
Version:	4452	Version:	5005	Version:	4100
CRC:	0x0F52	CRC:	0x22A1	CRC:	0x81A1
Base Sys Version:	4100	Data CRC:	0xF66A	Status:	0x0011
ase Data Version:	5005				
Information /aming!!! Once the d ownload failure, the h File Name: FW_0 Indexes: 1	ownload is in pr hardware will no 001_0000_500	rogress, you must no ot be operational and 0_0012.enc	t stop it from co must be reprog	mpleting. In the e rammed.	vent of a
Varning!!! Once the d ownload failure, the h File Name: FW_0 Indexes: 1 File Version: 5000	ownload is in pr aardware will no 001_0000_500	rogress, you must no ot be operational and 0_0012.enc	t stop it from co must be reprog	mpleting. In the e rammed.	vent of a
Information larning!!! Once the d www.load failure, the h File Name: FW_0 Indexes: 1 file Version: 5000 file Version: n/a	ownload is in pr aardware will no 001_0000_500	rogress, you must no ot be operational and 0_0012.enc	t stop it from co must be reprog	mpleting. In the er rammed.	vent of a
Information Varning!!! Once the d ownload failure, the h File Name: FW_0 Indexes: 1 File Version: 5000 File Version: n/a Status: Download	owinload is in pr iardiware will no 001_0000_500 loading block 38	rogress, you must no ot be operational and 0_0012.enc 52 of 468	t stap it from co must be reprog	mpleting. In the er rammed.	ventofa
Information anning!!! Once the d awnload failure, the h File Name: FW_0 Indexes: 1 File Version: 5000 File Version: n/a Status: Down Progress:	ownload is in pr nardware will no 001_0000_500 loading block 30	rogress, you must no of be operational and 0_0012.enc 52 of 468	t stap it from co must be reprog	mpleting. In the er rammed.	vent of a
Information Varning!!! Once the d ownload failure, the h File Name: FW_0 Indexes: 1 File Version: 5000 File Version: n/a Status: Down Progress:	ownload is in pr hardware will no 001_0000_500 loading block 36	ogress, you must no it be operational and 0_0012.enc 52 of 468 Select File	t stop it from co must be reprog	mpleting. In the er rammed.	vent of a

Figure 7. Progress Screen While Programming New Firmware S12

Quick-Start Guide for bq78PL114 With bq76PL102 Family Gas Gauges



	_	1212		20200	
Application		Data		System	
Version:	5000	Version:	5005	Version:	4100
CRC:	0x4104	CRC:	0xC80D	CRC:	0x81A1
Base Sys Version:	4100	Data CRC:	0x5075	Status:	0x0031
amond to unce the do	and the second se	Calibration has	haan precerva	d Non To Man	100000
ownload failure, the h File Name: FW_0 Indexes: 1 File Version: 5000 File Version: n/a	ownload ardware 001_00	Calibration has	been preserve	d. ting. In the e ned.	vent of a

Figure 8. Firmware Process Completed Successfully



Figure 9. Click the Red X

As Figure 9 shows, close the Bootstrap Loader Window by clicking the red X in the upper right corner of the window.

Some issues may occur when trying to program the firmware. These errors can manifest themselves with error messages described via the five onboard LED indicators. The *bq78PL114 and bq78PL114S12 Technical Reference Manual* (SLUU330) explains the LED indicator messages.

4 Exploring the GUI Software Screens

Once the firmware has been updated, the user can start setting up the gas gauge with the proper configuration files.

The first step is to set the Wired Bit with the software. Choose Commands from the File Menu, then choose Toggle Wired Bit or press the F7 key.

Next choose File \rightarrow Pack Configuration \rightarrow Load Configuration from File and Relearn...

In this example, a TMAP file is loaded for an 11s configuration. Figure 12 is the Home Screen after completing this operation.

shows individual screen captures of the different tabs that are selectable in the lower right portion of the screen (all tabs shown in Figure 13).



Figure 10. Successful Wired Bit Toggled Message

Texas Instruments - bqWizard 2.	5 Build	l(7) : bq78PL114 (S12)
File Logging Commands Utilities Help			
Application Settings	•		
Calibration Data	•	+	+. Q Q
Pack Configuration (.dat, .tmap, .aux)	Þ	Load Configuration fi	rom File
Data-Set (.ppcsv)	•	Load Configuration fi Save Configuration t	rom File and Relearn o File (.dat) Only
Load Chemistry Data Verify Chemistry Data		€ Pump	4100 -
Save Pack Parameters Preferences	۲	None None	3900 -
Exit Ctr	l+Q	None	≧ 3700 -

Figure 11. Loading Proper TMAP File for Your Pack's Configuration.



Figure 12. Home Screen After Loading 11s Configuration .TMAP File



Cell Balancing	Cell Chemistry	Pack Configuration	Safety Level 1	Safety Level 2
SBD ata Dynamic	SBData Static	Pack Dynamic	Charge Control	Pack History
Parameter Name	Value [Static	Data Captured @ 2/28/2010 2:59:2	23 PM) Bi	t Encoded Data
Manufacturer Access	0x55AA			
📶 Manufacturer Name	TEXAS INSTR	UMENTS		
🖉 Device Name	bq78PL114			
🖉 Device Chemistry	LION			
🛃 Manufacturer Data	0E4D616E20	4461746120202020202000000000	00000000000	
🛃 Serial Number	1			
者 Manufacture Date	14964			
Specification Info	49			
🛃 Design Voltage	33600 mV			
Design Capacity	2400 mAh/10)m/Wh		
Charging Voltage	33600 mV			
Charging Current	0 mA			
🛃 At Rate	0 mAh/10mV	/h		
🕺 Battery Mode	0x6001			
📶 Remaining Time Alarm	10 Minutes			
🛃 Remaining Capacity Alarm	560 mAh/10r	nWh		

Figure 13. Pack Parameter and Settings Tabs

5 Updating the Chemistry File

To update the pack's chemistry identification file, choose File \rightarrow Load Chemistry Data.

bqWizard - Load Chemistry Data 🛛 💈	×
Select a top level chemistry node and click OK	
🔩 Chemistry Data 🔗	
🖞 🖉 🖉 0100 - LiCoO2/graphitized carbon (default)	
🗄 🚽 🔷 0101 - Mixed Co/Ni/Mn cathode	
🗄 🛶 🤣 0102 - Mixed Co/Mn cathode	
🛨 🛶 🔷 0103 - LiCo02/Carbon 2	
🛨 🛶 🔷 0104 - Mixed Co/Mn cathode	
🚊 🌱 0105 - LiCoO2/carbon 3	
ATL:laminate 606168 (M42-V2)	
ATL:laminate 604396 (M1-V4)	
Samsung:ICR18650-26A	
🖉 🖉 🖉 🖉 🖉	
🕂 🔶 0106 - LiCoO2/carbon 4	
👳 🛶 🔶 0107 - LiCoO2/carbon 5	
🗄 🧼 0108 - Mixed Co/Mn cathode 2	
⊕ 0109 - LiCoO2/carbon 6 (2.75V cutoff)	
🗄 🛶 🔗 0110 - LiCoO2/carbon 2	
E 0200 - PSS, LiNiO2 with Co, Mn doping	
🕀 🖓 0201 - ATL LiNi02 (Co, Nn doped)/carbon	
🗉 🛶 🗘 0203 - PSS, LiNiO2 with Co, Mn doping	
The second secon	
O205 - NiCoMn/carbon high rate	
U206 - NiCoAl(NLA)/carbon	
U2U7 - NiCoMn/carbon 2	
U3UT - LIMN2U4(Co,NIJ/carbon,4.35V	
Include auxiliary chemistry data file below. Warning: this will override any learned Ra data.	
0105_12S1P.aux	
0105_12S2P.aux	
Browse	

Figure 14. Chemistry Selection Window



Configuring the Gas Gauge

6 Configuring the Gas Gauge

Initial communication with the gas gauge shows the external temperature measurements as 90°C which causes a safety fault condition. Several Safety flags are set in Figure 15. Note this home screen is for S12 version of Firmware.



Figure 15. S12 Home Screen Showing Temperature Fault Condition

To fix this issue, choose Utilities \rightarrow Calibration. Type the appropriate ambient temperature under the Calibrate Temperature section. In this example, 23°C ambient temperature has been entered. Voltage reading for the IC are calibrated during production at TI; so, do not attempt to calibrate the voltage unless necessary. The Calibrate Screen is shown in Figure 16. A relearn/initialize command overwrites any manual calibration that a user may have entered in cells 5-12 with the values stored in the bq76PL102s.

Close the calibrate screen, and then choose Read All Parameters or Poll Data. Figure 17 shows the updated home screen with proper temperature sensing.

Next, choose Commands \rightarrow Reset Fuse. Figure 18 shows the updated home screen with the Fuse Status flag set green and no Safety flags set.



Attention: The call Step 1:0 Step 2:0 Step 2:0	sation proc Calibrate Vic Calibrate Ta Calibrate Cu	acc NUST be per Rage sriperature Worl	omed in th	e foloving req	uence la encue pro	ser calibration		
			Cells			Sensors		
alibrate Voltage			Cell	Voltage	Temperature	Sensor	Temperature	Offset
and the second second	Party and the second	1000	1	3160 mV	23.4 °C	Board	22.7 °C	-305.8
select a cell to calibrate:	Cell 1	~	2	3169 mV	23.2 °C	T1	23.4 %	-361.0
			3	3167 mV	23.2 °C	T2	23.2 °C	-360.8
Supply an external mV reference	2000		4	3168 mV	23.2 °C	T3	23.1 °C	-358.9
between [2700 to 3000], then	2800	Calibrate	5	3177 mV	23.1 °C	T4	23.2 °C	-359.5
enter value:			6	3176 mV	23.2 °C	TS	23.2 °C	-357.0
			7	3176 mV	23.2 °C	T6	23.2 °C	-360.9
			8	3171 mV	23.2 °C	T7	23.2 °C	-358.4
Supply an external mV reference	4200	Calibrate	9	3175 mV	23.2 °C	T8	23.2 °C	-360.4
between [4000 to 4500], then		Comprare	10	3172 mV	23.2 °C	T9	23.2 °C	-359.9
enter value:			11	3173 mV	23.2 °C	T10	23.2 °C	-360.3
			12	3165 mV	23.2 °C	T11	23.2 °C	-358.1
alibrate Temperature						T12	23.2 °C	-358.5
Enter the ambient temperature in °C; [18 to 30]	23	Calibrate						
alibrate Current & Columb Cou	int		Current		-	Coulomb	1	
Sten 1 Zero Offset			Curre	nt Offset	Gain	Coulomb	Offset	Gain
Ensure there is no current flowing in or out of the pack.		Calibrate	-42 m/	A 0	1.000	0	0	1.000
			Informa	ation	and the second second			
Step 2 Gain Enter the applied current in mA:	0	Calibrate	Sendin	g temperature	calibration data [23	°C] success		
[-32000 to 32000] Negative = Discharging								

NOTE: Do NOT calibrate Voltage of IC unless necessary; voltage is calibrated during production.

Figure 16. Calibration Screen, Used to Update Temperature Reading to Room Temperature



Figure 17. Home Screen Showing Correct Temperature Reading





Figure 18. Home Screen Showing Fuse Reset and no Safety Flags

If the pack is at rest (not charging or discharging), the reported current is 0 mA. The Zero Offset current now can be calibrated. [Ensure that the pack is not being charged or discharged while calibrating the Zero Offset parameter.] Also, ensure that the sense resistor bits are programmed correctly for either (10 m Ω , 3 m Ω , or 1 m Ω) sense resistor. While using 1-m Ω sense resistor, all parameters are reported in tenths (i.e., a 1-A charge current is reported as 100 mA.

Click on the Calibrate button from Step 1 Zero Offset (Figure 19). Current Gain is also calibrated.

Next choose File → Read All Parameters from the Commands Menu (or Ctrl + R as the quick key.)

Calibrate Current & Columb Count —	
Step 1 Zero Offset Ensure there is no current flowing in or out of the pack.	Calibrate

Figure 19. Calibrating 0-mA Offset While Pack is at Rest (no Charging or Discharging)





🗖 Texas Ins	struments - bqWizard 2.5 B	uild(7) : bq7			
File Logging	Commands Utilities Help				
System	Connect to Pack	F2			
Pack	Safe Disconnect	Shift+F2			
	Initialize	F3			
State V	Relearn / Initialize	F4			
Online 3	Reset Fuse	F5			
Calle	Toggle Ship Bit				
Cens	Toggle Wired Bit	F7			
Cell	Cell View Safety History				
11	Poll Data	Ctrl+P			
10	Stop Polling	Ctrl+S			
9 🗎 🗹	Reset Plot	Ctrl+T			
Cell 1	Update Dynamic Data	Ctrl+U			
Cell Volta	Read All Parameters	Ctrl+R			
Cell Tem	Write Pending Changes to RAM	Ctrl+W			
Tempera	Commit Changes to Flash	Ctrl+C			

Figure 20. Read All Parameters to See All Data-Set Settings

All the Data-Set parameter settings for the gas gauge can be accessed through the .PPCSV file. Save the default .PPCSV by choosing File \rightarrow Data-Set (.ppcsv) \rightarrow Save Data-Set.

Texas Instruments - bqWizard	2.5 Buil	d(7) : bq7	8PL114 (S	512)	
File Logging Commands Utilities Hel	р				
Application Settings	•				
Calibration Data	•		÷	ι. ,	φ. (
Pack Configuration (.dat, .tmap, .aux)	•	SOC Br	rd Temp	+	¥ 4300
Data-Set (.ppcsv)	Þ	Load Dat	a-Set to Dev	ice	
Load Chamistry Data		Save Dat	ta-Set		
Verify Chemistry Data		Import Data-Set to BatteryWizard			Vizard
Save Pack Parameters	•	Pump None			3900 -
Preferences		None			1
Exit	Ctrl+Q	None None	 Image: A second s	È	3700 -

Figure 21. Save Data-Set Menu

ſ	🤃 Save Pack Parameters Summary 🗵
Į	Pack parameters has been saved.

Figure 22. GUI Indication That .PPCSV File Has Been Successfully Saved

Now, modify the data-set settings in the .PPCSV file as appropriate for your pack, and then choose File \rightarrow Load Data-Set (.ppcsv) \rightarrow Load Data-Set To Device.

Pay special attention to the following Data-Set settings. The following example is configured for 12 series cells of standard 4.2-V, Li-ion chemistry (using S12 firmware version).

An entry that is "-1" or "0 seconds" indicates that a feature is disabled. (See Table 1)

Pay special attention to the following Data-Set parameters in the .PPCSV file.



Table 1. Data-Set Parameters to Review in Your S12 Design

Design Voltage,mV,44000 Charge Completion Pack Voltage Qualifier,mV,49200 Discharge Completion Pack Voltage Qualifier,mV,39600 <Charge Control>,3, ... Charge Completion Pack Voltage Qualifier,mV,49200 ... Discharge Completion Pack Voltage Qualifier,mV,42000 FC Set SOC Threshold,%,98 FC Clear SOC Threshold,%,97 FD Set SOC Threshold,%,3 FD Clear SOC Threshold,%,4 FD Set Voltage,mV,40000 FD Clear Voltage,mV,40010 FD Set Voltage Time, Seconds, 2 TDA Set SOC Threshold,%,4 TDA Set Voltage Threshold,mV,40000 TDA Set Voltage Time, Seconds, 1 TDA Clear SOC Threshold,%,5 TDA Clear Voltage,mV,40020 TCA Set SOC Threshold,%,100 TCA Clear SOC Threshold,%,99 OCA Set Voltage,mV,51000 <Cell Chemistry>,6, Default Charging Voltage, mV, 50400 Default Charging Current,mA,2400 Capacity Algorithm,,0x0003 <Safety Level 1>,8, POV Threshold, mV, 51000 POV Recovery,mV,50400 POV Time, Seconds, 6 PUV Threshold, mV, 33600 PUV Recovery,mV,33700 PUV Time, Seconds, 1



After loading the new Data-Set file, be sure to select Read All Parameters from the Commands drop-down menu.

😐 Texas Ins	struments - bqWizard 2.5 Bu	uild(7) : bqī
File Logging	Commands Utilities Help	
System	Connect to Pack	F2
Pack	Safe Disconnect	Shift+F2
	Initialize	F3
State V	Relearn / Initialize	F4
Online 3	Reset Fuse	F5
Colle	Toggle Ship Bit	F6
Cells	Toggle Wired Bit	F7
Cell	View Safety History	F9
11	Poll Data	Ctrl+P
10	Stop Polling	Ctrl+S
9 🗎 9	Reset Plot	Ctrl+T
Cell 1	Update Dynamic Data	Ctrl+U
👔 Cell Volta	Read All Parameters	Ctrl+R
🐻 Cell Tem	Write Pending Changes to RAM	Ctrl+W
🐻 Tempera	Commit Changes to Flash	Ctrl+C

Figure 23. Select Read All Parameters Command After Importing a Data-Set .PPCSV File

7 Final Setup Steps for Evaluation

7.1 To Initialize Gas Gauge and Turn On Charge and Discharge FETs

- 1. Choose the Pack Configuration tab in the Data-Set. (Figure 24) Note: Ensure that the Wired bit is toggled on.
- 2. Double-click the Algorithm Enable line with the mouse. A secondary window opens. (Figure 25)
- 3. Uncheck the Inhibit Safety Rules box, and click OK. (Figure 25)
- 4. Next, from the Commands drop-down menu, choose Write Pending Changes to RAM CTRL+W (Choosing the Ctrl + W keys is the quick-key sequence to write changes to RAM.)
- 5. Finally, select Read All Parameters to update the home screen. (Figure 26 and Figure 27)



SBD ata Dynamic	SBData Static	Pack Dynamic	Cha	arge Control	Pack History
Cell Balancing	Cell Chemistry	Pack Configuration	Safet	y Level 1	Safety Level 2
Parameter Name		Value [Static Data Captu.		Bit Encoded I	Data
📍 Hardware Configuratio	on	0x0B31		Pump Algorit	hm [Bit 0]
Algorithm Enable		0x8186		Pump Algo	rithm [Bit 1]
🖉 System Control		0x8000		Pump Mod	e
Current Delta		100 mA		Wired	
EPD Refresh Period		10 Minutes		Reserved	
EPD Pump Time		120 Cycle Counts		Inhibit Pump	During Charge
EPD Write Time		70 Cycle Counts		Inhibit Pump	During Discharge
/ Display Driver Frequer	ncy	30 Hz		Turbo 0	
Parallel Count		1		📕 Turbo 1	
Expected Number of C	Cells	11		Turbo 2	
Actual Number of Cells	177	11		Turbo 3	
Max Number of Cells		12		Synch	
Temperature Sensor C	Count	12		Force DFET	
Max Number of Tempe	eratures	13		Force CFET	
Sense Resistor		10000 uOhms		Force PFET	
Product ID		1		Inhibit Saf	ety Rules
Product Sub ID		0			CALIFY CONTRACTORS
🐻 Format		0			
FW Build		12	*		

Figure 24. Algorithm Enable Configuration

Double-click Algorithm Enable parameter to open selection box.

bqWizard - Edit Parameter	×
Algorithm Enable	-
Pump Algorithm [Bit 0] ♥ Pump Algorithm [Bit 1] ♥ Pump Mode Wired Reserved □ Inhibit Pump During Charge □ Inhibit Pump During Discharge ♥ Turbo 0 ♥ Turbo 1 □ Turbo 2 □ Turbo 3 Synch Force OFET Force PFET ♥ Inhibit Safety Rules	
Current Value: 0x8186	
New Value:	
V Ok Cancel]

Figure 25. Enabling Charge and Discharge FETs

Uncheck Inhibit Safety Rules to enable Charge and Discharge FETs.



Figure 26. S12 Home Screen

Figure 26 shows the S12 home screen with the properly initialized gauge having the Charge and Discharge FETs turned on.



Figure 27. Zoom-in on Status Field

Figure 27 is a zoom-in on the Status field. Discharge (D-FET), Charge (C-FET) and Pre-charge (P-FET) MOSFETs are all on. Also, no FUSE error is indicated.

7.2 To Enable PowerPump[™] Cell Balancing Feature:

- 1. Choose the Pack Configuration tab in the Data-Set. (Figure 24) Note: Ensure that the Wired bit is toggled on.
- 2. Double-click the System Control line with the mouse. A secondary window opens. (Figure 28)
- 3. Un-check the "Pump Disable" box and click OK. (Figure 28)
- 4. Next choose Commands \rightarrow Write Pending Changes to RAM Ctrl + W
- 5. Select Read All Parameters to update the home screen. (Figure 26 and Figure 27)
- 6. Figure 29 shows cells 3 and 4 actively being balanced because their resting voltage is greater than Minimum Cell Differential For Balancing (default = 10 mV).





Figure 28. Enabling PowerPump[™] Cell Balancing



Uncheck Pump Disable to enable PowerPump[™] cell balancing.

Figure 29. Home Screen Showing PowerPump™ Cell Balancing Active

Figure 29 shows that the PowerPump[™] Cell Balancing is active. Cells 3 and 4 are actively balanced because their resting voltage is greater than Minimum Cell Differential For Balancing (default = 10 V).



7.3 Initializing the Pack

Setting Up Logging Data

After completing configuration settings, choose Commands \rightarrow Relearn / Initialize.

8 Setting Up Logging Data

Now that the pack is properly configured, it is time to set up the log files prior to exercising the pack.

8.1 Setup of Dynamic Data Log Definition File

This is done by choosing Logging \rightarrow Generate Log Definition File. Scroll between available Logging Parameters by clicking the left or right arrow next to Available Parameters" heading.

Figure 30 shows the default/blank Log Definition Tool. After you create this file once, it can be reused. Figure 31 highlights the scroll-through arrows in the Log File Definition Tool.

Click on Generate File after choosing the Data-Set logging parameters. Only 30 parameters can be continuously monitored during logging. The 31st parameter indicated by the tool is a tick parameter that is automatically added to each file.

ommand				
Dynamic		Max = 0/31	Reset	Generate File
ailable Parameters	• • •	Logged Parameters		
January and the set of the set o				
I Voltage(5) I Temperature(5) nperature Rise(5) - PCW(5) - OCV(5)				
mperature Rise(5) : Pumping(5) : OCV(5) ! Status(6)				

Figure 30. Default/Blank Log Definition Tool

Setting Up Logging Data

www.ti.com

bqWizard - Log Definition Tool	
File Command	
SBData Dynamic	[]
Available Parameters	• •
Pack Voltage	
Current	
Average Current	
I emperature	
Absolute State of Charge	
Full Charge Capacity	
Bemaining Capacity	
Bun Time To Empty	
Average Time To Empty	
Average Time To Full	
Battery Status	
Cycle Count	
At Rate Time To Full	
At Hate Lime To Empty	
At Hate UK May Error	
Max Elloi	

Figure 31. Available Logging Parameters

In Figure 31, scroll between available Logging Parameters by clicking the arrows highlighted by the red box.

*	Max = 31/31 Logged Parameters Epoch Hour Pack Voltage Current Average Current Temperature Absolute State of Charge Relative State of Charge Full Charge Capacity Remaining Capacity Run Time To Empty Petiter State	Reset	Generate File
•	Logged Parameters Epoch Hour Pack Voltage Current Average Current Temperature Absolute State of Charge Relative State of Charge Full Charge Capacity Remaining Capacity Run Time To Empty Putters State		^
	Epoch Hour Pack Voltage Current Average Current Temperature Absolute State of Charge Relative State of Charge Full Charge Capacity Remaining Capacity Run Time To Empty Pattern State		
	Pack Voltage Current Average Current Temperature Absolute State of Charge Relative State of Charge Full Charge Capacity Remaining Capacity Run Time To Empty Pattern State		
	Current Average Current Temperature Absolute State of Charge Relative State of Charge Full Charge Capacity Remaining Capacity Run Time To Empty Putters State		
	Average Current Temperature Absolute State of Charge Relative State of Charge Full Charge Capacity Remaining Capacity Run Time To Empty Putter State		
	Temperature Absolute State of Charge Relative State of Charge Full Charge Capacity Remaining Capacity Run Time To Empty Pattern State		
	Absolute State of Charge Relative State of Charge Full Charge Capacity Remaining Capacity Run Time To Empty Pattern State		
	Relative State of Charge Full Charge Capacity Remaining Capacity Run Time To Empty Patters Chates		
	Full Charge Capacity Remaining Capacity Run Time To Empty		
	Remaining Capacity Run Time To Empty		
	Run Time To Empty		
	Dattern Clabor		
	Dattery Status		
	Max Error		
	Cycle Count		
	Pack Passed Current		
	Battery Mode		
	Cell Voltage(1)		
	Net Pumping(1)		
	Cell Status(1)		
	Cell Voltage(5)		
	Net Pumping(5)		
	Est OCV(5)		
	Cell Status(5)		
	Cell Voltage(11)		
	Net Pumping(11)		
	Est OCV(11)		
	Cell Status(11)		
	Last Discharge Average		
			~
		Pack Passed Current Battery Mode Cell Voltage(1) Net Pumping(1) Cell Status(1) Est. OCV(1) Cell Voltage(5) Net Pumping(5) Est. OCV(5) Cell Status(5) Cell Voltage(11) Net Pumping(11) Est. OCV(11) Cell Status(11) Last Discharge Average	Pack Passed Current Battery Mode Cell Voltage(1) Net Pumping(1) Cell Status(1) Est. OCV(1) Cell Voltage(5) Net Pumping(5) Est. OCV(5) Cell Status(5) Cell Voltage(11) Net Pumping(11) Est. OCV(11) Cell Status(11) Last Discharge Average

Figure 32. Configured Dynamic Log Definition File



Click Generate File when complete. Choose up to 31 parameters to log (Figure 32).

8.2 Data Logging Setup

This is done by choosing Logging \rightarrow Configure...

Under the Dynamic Data Log Definition File section, click on the Select button and choose the .DLOG file you created in the preceding steps.

Under the Data Logging File section, click on the Select button and choose a filename with which to save your Data-Set log file.

Finally, choose Commands \rightarrow Poll Data to begin the data logging process (Figure 34). The bqWizardTM software allows you to add comments to the log file during testing. This can be done by choosing Logging \rightarrow Add Comment.

bqWizard - Loggi	ng Configuration	
Static Data Log	Definition File	
Please select a applications roo	static data log definition file (*.slog). A default (*.slog) is located in the ot directory. "\Data Logging Files\default.slog"	SC MONTE SA
Current File:	C: \Program Files\Texas Instruments\bqWizard 2.5\Data Logging Files\default.slog	Select
Dynamic Data L	og Definition File	
Please select a applications ro	dynamic data log definition file (*.dlog). A default (*.dlog) is located in the ot directory. "\Data Logging Files\default.dlog"	10-00-00
Current File:	C: \Program Files\Texas Instruments\bqWizard 2.5\Data Logging Files\ExampleCellLoggingFile.dlog	Select
Data Logging Fil		
Please select o	r create a file to collect the data.	
Current File:	C:\Documents and Settings\a0193331\Desktop\PL114training\PMP5118-RevB-Chem101-Log1.cs	Select
	Enable Auto Logging	🅻 Cancel

Figure 33. Data Logging Configuration Window in bqWizard[™] Software



🔲 Texas Ins	struments - bqWizard 2.5 Bu	uild(7) : bq
File Logging	Commands Utilities Help	
System Pack	Connect to Pack Safe Disconnect	F2 Shift+F2
State V Online 4	Relearn / Initialize Reset Fuse	F3 F4 F5
Cells	Toggle Ship Bit Toggle Wired Bit	F6 F7
Cell	View Safety History	F9
3	Poll Data	Ctrl+P
2 2 2 1	Stop Polling Reset Plot	Ctrl+S Ctrl+T
Cell 1	Update Dynamic Data Read All Parameters Write Pending Changes to RAM Commit Changes to Flash	Ctrl+U Ctrl+R Ctrl+W Ctrl+C

Figure 34. Choosing Poll Data From Commands Menu to Begin Logging

Texas Instruments - bqWizard	
Would you like to add a comment to the start of this log session?	OK Cancel
Enter Comment	

Figure 35. Entering Comments via bqWizard[™] Software

The bqWizardTM software allows the designer to enter comments throughout the log process. To add more comments, the designer chooses the Logging \rightarrow Add Comment menu during testing (Figure 35).



ExampleCellLoggingFile.dlo	g - Notepa	d		. 🗆 🖾
Eile Edit Format View Help				
Tick 0 0	U			~
Epoch Hour 5	34	U		
Pack Voltage 1	9	U		
Current 1 10	5			
Average Current 1	11	5		
Temperature 1	8	U		-
Absolute state of Charg	e	1	14	U
Relative state of Charge	e,	10	13	u
Full charge capacity	1	10	u	
Remaining Capacity	1	12	u	
Run Time To Employ	50	10	u.	
Max Freer 1	15	8		
Cycle Count 1	22	N. N		
Pack Passed Current	5	54	5	
Battery Mode 1	3	H	1 N	
cell voltage(1) 4	õ	11		
Net Pumping(1) 4	3	5		
cell status(1) 4	5	Ĥ		
Est. OCV(1) 4	4	U		
cell voltage(5) 4	24	U		
Net Pumping(5) 4	27	5		
Est. OCV(5) 4	28	U		
cell Status(5) 4	29	H		
Cell voltage(11)	4	60	U	
Net Pumping(11) 4	63	5		
Est. OCV(11) 4	64	u		
Cell Status(11) 4	65	н	122	
Last Discharge Average	8	10	S	
Hardware Configuration	9	72	н	
				~

Figure 36. Example of Dynamic Log File for an 11s Battery Pack

9 Final Comments Concerning Evaluation

Always be sure to log data during testing. Confirm that the log file content is correct by copying and pasting the .CSV file, and opening with Microsoft[™] Excel[™].

Use a standard bench power supply for charging your battery and testing functionality with the simulation resistor string on PMP5118-RevB. First, set the voltage of the bench supply using a precise digital multimeter to precisely 4.2 V/cell multiplied by the number of cells (or whatever the appropriate charge voltage is for your specific cell, 4.1 V, etc.). After you have set the appropriate charge voltage, next short-circuit the positive and negative leads from the bench power supply and limit the current to an appropriate level (usually not greater than a 1C rate determined by the packs battery cells). If the current limit is set high, you may see a spark. After this procedure, you can connect to PACK+ and GND connections (shown in PMP5118-RevB) and properly charge a Li-ion battery with constant current, followed by constant voltage profile.

See the application report *Chemistry Selection for bq78PL114* (<u>SLUA505</u>) for additional information on configuring the gas gauge, as well as the data collection process for defining a .AUX for your battery pack.



Appendix A .PPCSV Data-Set File Export From S12 Firmware

Table 2. .PPCSV Data-Set File Export From S12 Firmware

<SBData Static>,1, Manufacturer Name,, TEXAS INSTRUMENTS Device Name,,bq78PL114 Device Chemistry,,LION Serial Number.,1 Manufacture Date,,14964 Design Voltage,mV,33600 At Rate,mAh/10mWh,0 Battery Mode,,0x6001 Remaining Time Alarm, Minutes, 10 Remaining Capacity Alarm,mAh/10mWh,560 <Charge Control>,3, Pre-Charge Temperature, Kelvin, 273 Pre-Charge Voltage,mV,3000 Pre-Charge Recovery,mV,3100 Pre-Charge Current,mA,240 Charge Inhibit Temperature Low, Kelvin, 273 Charge Inhibit Temperature High, Kelvin, 318 Charge Inhibit Recovery Temperature Low, Kelvin, 278 Charge Inhibit Recovery Temperature High, Kelvin, 313 Charge Suspend Temperature Low, Kelvin, 278 Charge Suspend Recovery Temperature Low, Kelvin, 283 Charge Suspend Temperature High, Kelvin, 333 Charge Suspend Recovery Temperature High, Kelvin, 328 Charge Completion Pack Voltage Qualifier,mV,32800 Charge Completion Taper Current Qualifier,mA,240 Charge Completion Time, Seconds RDTE, 10 Charge Completion FET Activation Time, Seconds RDTE, 10 Discharge Completion Pack Voltage Qualifier, mV, 24800 Discharge Completion Time, Seconds RDTE, 4 Discharge Completion FET Activation Time, Seconds RDTE, 6 Discharge Under Temperature, Kelvin, 263 Discharge Under Temperature Recovery, Kelvin, 273 Discharge Under Temperature Time, Seconds RDTE, 2 FC Set SOC Threshold,%,-1 FC Clear SOC Threshold,%,-1 FD Set SOC Threshold,%,-1 FD Clear SOC Threshold,%,-1 FD Set Voltage,mV,24800 FD Clear Voltage, mV, 25600 FD Set Voltage Time, Seconds,0 Transition to Idle Current,mA,50 Transition to Idle Time, Seconds, 30 Transition to Discharge Current, mA, -75 Transition to Charge Current,mA,75 Cell Shutdown Voltage, mV, 2500 Design Capacity mAh,mAHrs,2400 Design Capacity 10mWh,10mWh,6912

Texas

TRUMENTS

TDA Set SOC Threshold,%,-1 TDA Set Voltage Threshold,mV,25600

Table 2. .PPCSV Data-Set File Export From S12 Firmware (continued)

TDA Set Voltage Time, Seconds, 0 TDA Clear SOC Threshold,%,-1 TDA Clear Voltage,mV,29600 TCA Set SOC Threshold,%,-1 TCA Clear SOC Threshold,%,-1 OCA Set Voltage,mV,34400 OCA Activation Time, Seconds RDTE,2 <Cell Balancing>,5, Minimum Cell Differential For Balancing,mV,10 <Cell Chemistry>,6, Chemistry ID,,105 FCC Learn Qualifier,%,30 Cycle Fade,%,0.05 Min OCV Slope,mV/% RSOC,2 OCV Idle Qualifier, Minutes, 30 Stale FCC Timeout, Minutes, 2880 Default Charging Voltage, mV, 33600 Default Charging Current, mA, 1680 Capacity Algorithm, 0x0003 User Rate,mA,1000 <Pack Configuration>,7, Hardware Configuration, 0x0731 Algorithm Enable,,0x800E System Control,,0x8000 Current Delta,mA,100 EPD Pump Time, Cycle Counts, 120 EPD Write Time, Cycle Counts, 70 Display Driver Frequency, Hz, 30 Product Sub ID,,0 <Safety Level 1>,8, COV Threshold, mV, 4250 COV Recovery, mV, 4100 COV High Temperature Threshold, mV, 4250 COV High Temperature Adjust, Kelvin, 323 COV Time, Seconds, 2 CUV Threshold, mV, 2700 CUV Recovery,mV,3000 CUV Time, Seconds, 1 POV Threshold,mV,34000 POV Recovery, mV, 32800 POV Time, Seconds, 6 PUV Threshold, mV, 22400 PUV Recovery,mV,24000 PUV Time, Seconds, 1 OC Charge Tier 1 Threshold, mA, 4800 OC Charge Tier 1 Recovery, Seconds, 2 OC Charge Tier 1 Time, Seconds, 6 OC Discharge Tier 1 Threshold,mA,-7200 OC Discharge Tier 1 Recovery, Seconds, 2 OC Discharge Tier 1 Time, Seconds, 8

TEXAS INSTRUMENTS

Appendix A

www.ti.com

Table 2. .PPCSV Data-Set File Export From S12 Firmware (continued)

OC Charge Tier 2 Recovery, Seconds, 8 OC Charge Tier 2 Time, Seconds, 2 OC Discharge Tier 2 Threshold, mA, -9600 OC Discharge Tier 2 Recovery, Seconds, 8 OC Discharge Tier 2 Time, Seconds, 1 OC Max Attempts,,3 Hardware OC Charge Threshold,,211 Hardware OC Charge Recovery, Seconds, 1 Hardware OC Charge Time,,60 Hardware OC Discharge Threshold,,98 Hardware OC Discharge Recovery, Seconds, 1 Hardware OC Discharge Time,,37 HOC Max Attempts,,3 Hardware Short Circuit Threshold,,47 Hardware Short Circuit Recovery, Seconds, 8 Hardware Short Circuit Time,,3 HSC Max Attempts,,3 EUV Threshold, mV, 2500 EUV Time, Seconds, 2 EUV Recovery, mV, 2900 OT Charge Threshold, Kelvin, 323 OT Charge Recovery, Kelvin, 318 OT Charge Time, Seconds RDTE,2 OT Discharge Threshold, Kelvin, 333 OT Discharge Recovery, Kelvin, 323 OT Discharge Time, Seconds RDTE,2 Host Watchdog Timeout, Seconds RDTE,0 Board Over Temperature, Kelvin, 358 Board Over Temperature Recovery, Kelvin, 338 Board Over Temperature Time, Seconds RDTE, 2 Hardware LP Discharge Threshold,,32 Hardware LP Discharge Duration,,127 Hardware LP Charge Threshold, 224 Hardware LP Charge Duration,,127 <Safety Level 2>,9, SOV Threshold, mV, 4350 SOV Time, Seconds RDTE,8 Cell Imbalance Current,mA,50 Cell Imbalance Fail Voltage,mV,500 Cell Imbalance Time, Seconds, 180 Cell Imbalance SOC Inhibit Threshold,%,30 SOC Charge Threshold, mA, 6000 SOC Charge Time, Seconds RDTE,2 SOC Discharge Threshold,mA,-12000 SOC Discharge Time, Seconds RDTE, 2 SOT Charge Threshold, Kelvin, 343 SOT Charge Time, Seconds RDTE,2 SOT Discharge Threshold, Kelvin, 343 SOT Discharge Time, Seconds RDTE,2 Open Temperature Sensor Threshold, Kelvin, 233 Open Temperature Sensor Time, Seconds RDTE,2 FET Fail Time, Seconds RDTE, 2

OC Charge Tier 2 Threshold,mA,5200





Table 2. .PPCSV Data-Set File Export From S12 Firmware (continued)

Fuse Fail Limit,mA,40 Fuse Fail Time,Seconds RDTE,2 VLAN Fail Time,Seconds RDTE,2 Current Measurement Fail Time,Seconds RDTE,10 Pre-Charge Voltage Timeout,Seconds RDTE,900 Charge Duration Timeout,Seconds RDTE,14400 IGR Limit,200 IGR Fail Count,255 IGR Ratio Limit,120 IGR Ratio Fail Count,255 Rate Limit Threshold,200 Rate Limit Activation Count,,100



Appendix B Default Data-Set Screen Captures From bqWizard™ GUI for S12 Firmware

Cell Balancing Cell C	hemistry	Pack Configuration	Safety Level 1	Safety Level 2
Parameter Name	Value [Static	Data Captured @ 2/28/2010 2:59:	23 PM]	Bit Encoded Data
🙆 Cell 1 Net Pump	0 Pumps		17	
Cell 2 Net Pump	0 Pumps			
🙍 Cell 3 Net Pump	0 Pumps			
Cell 4 Net Pump	0 Pumps			
🙆 Cell 5 Net Pump	0 Pumps			
Cell 6 Net Pump	0 Pumps			
🙀 Cell 7 Net Pump	0 Pumps			
Cell 8 Net Pump	0 Pumps			
Cell 9 Net Pump	0 Pumps			
💊 Cell 10 Net Pump	0 Pumps			
🙆 Cell 11 Net Pump	0 Pumps			
Cell 12 Net Pump	0 Pumps			
💋 Minimum Cell Differential For Balancing	10 mV			

Figure 37. Cell Balancing Data-Set Tab

Parameter Name	Value [Static Data Captured @ 2/28/2010 2:59:23	Bit Encoded Data
Chemistry ID	101	
Aux Chemistry Version	0	
a Tau 10	225	
Normalized Dynamic Impedance Low Temperature	20.0 °C	
Normalized Dynamic Impedance High Temperature	40.0 °C	
Normalized Dynamic Impedance SOC	15 %	
Normalized Dynamic Impedance Gain	32	
🖉 FCC Learn Qualifier	30 %	
🖉 Cyde Fade	0.05 %	
Min OCV Slope	2 mV/% RSOC	
🖉 OCV Idle Qualifier	30 Minutes	
🖉 Stale FCC Timeout	2880 Minutes	
🖉 Default Charging Voltage	33600 mV	
🖉 Default Charging Current	1680 mA	
Capacity Algorithm	0x0003	
🖊 User Rate	1000 mA	

Figure 38. Cell Chemistry Data-Set Tab



Cell Balancing	Cell Chemistry	Pack Configuration	Safety Level 1	Safety Level 2
Parameter Name	Value [S	tatic Data Captured @ 2/28/2010 2:59:23 PM]	Bit t	incoded Data
Hardware Configuration	0x0731			
🛃 Algorithm Enable	0×800E			
🖉 System Control	0x8000			
🖉 Current Delta	100 mA			
EPD Refresh Period	10 Minut	es		
🖉 EPD Pump Time	120 Cyc	le Counts		
🖉 EPD Write Time	70 Cyde	Counts		
/ Display Driver Frequency	30 Hz			
Parallel Count	1			
Expected Number of Cells	12			
Actual Number of Cells	12			
Max Number of Cells	12			
Temperature Sensor Count	13			
Max Number of Temperatures	13			
Sense Resistor	10000 u	Ohms		
Product ID	1			
Product Sub ID	0			
Format	0			
FW Build	12			
📊 Test Status	67			
Firmivare Versión	5000			
Firmware CRC	0x4104			
Data CRC	0x85F1		-	
A Cara and a				

Figure 39. Pack Configuration Data-Set Tab

Cell Balancing	Cell Chemistry	Pack Configuration	Safety Level 1	Safety Level 2
Parameter Name	Value [St	tatic Data Captured @ 2/28/2010 2:5	9:23 PM] 🗾 Bit E	ncoded Data
🖉 COV Threshold	4250 mV			
COV Recovery	4100 mV			
🖉 COV High Temperature Thresh	nold 4250 mV			
🖉 COV High Temperature Adjust	50.0 °C			
COV Time	2 Second	ds 👘		
CUV Threshold	2700 mV			
CUV Recovery	3000 mV			
CUV Time	1 Second	ds		
POV Threshold	34000 m	v		
POV Recovery	32800 m	N		
POV Time	6 Second	de		
🖉 PUV Threshold	22400 m	v		
PUV Recovery	24000 m	w.		
🖉 PUV Time	1 Second	ds		
🖉 OC Charge Tier 1 Threshold	4800 mA			
OC Charge Tier 1 Recovery	2 Second	ds		
🖉 OC Charge Tier 1 Time	6 Second	de		
🖉 OC Discharge Tier 1 Threshold	-7200 m/	A		
🖉 OC Discharge Tier 1 Recovery	2 Second	de		
🖉 OC Discharge Tier 1 Time	8 Second	ds		
🖉 OC Charge Tier 2 Threshold	5200 mA	k.		
OC Charge Tier 2 Recovery	8 Second	ds		
🖉 OC Charge Tier 2 Time	2 Second	de	-	
· · · · · · · · · · · · · · · · · · ·		*		

Figure 40. Safety Level 1 Data-Set Tab

Cell Balancing	Cell Chemistry	Pack Configuration	Safety Level 1	Safety Level 2
Parameter Name	Value [Sta	tic Data Captured @ 2/28/2010 2:59:23	PM]	Bit Encoded Data
🖉 SOV Threshold	4350 mV			
🖉 SOV Time	8 Seconds	RDTE		
🗡 Cell Imbalance Current	50 mA			
🖉 Cell Imbalance Fail Voltage	500 mV			
🖉 Cell Imbalance Time	180 Secon	ds		
🖉 Cell Imbalance SOC Inhibit Threshold	30 %			
🖌 SOC Charge Threshold	6000 mA			
🖉 SOC Charge Time	2 Seconds	RDTE		
者 SOC Discharge Threshold	-12000 m/			
🖉 SOC Discharge Time	2 Seconds	RDTE		
🛃 SOT Charge Threshold	70.0 °C			
SOT Charge Time	2 Seconds	RDTE		
🖉 SOT Discharge Threshold	70.0 °C			
SOT Discharge Time	2 Seconds	RDTE		
🛃 Open Temperature Sensor Threshold	-40.0 °C			
🖉 Open Temperature Sensor Time	2 Seconds	RDTE		
👌 FET Fail Time	2 Seconds	RDTE		
者 Fuse Fail Limit	40 mA			
🞽 Fuse Fail Time	2 Seconds	RDTE		
🖉 VLAN Fail Time	2 Seconds	RDTE		
🖉 Current Measurement Fail Time	10 Second	Is RDTE		
Pre-Charge Voltage Timeout	900 Secon	ids RDTE		
🖉 Charge Duration Timeout	14400 Sec	conds RDTE		
** ** **			<u>a</u>	

Figure 41. Safety Level 2 Data-Set Tab



SBData Dynamic	SBD ata Static	Pack Dynamic	Charge Control	Pack History
Parameter Name	Value [Stati	c Data Captured @ 2/28/2010 2:59	:23 PM] Bit E	ncoded Data
Pack Voltage	38055 mV		100 A 100 A	
Current	-41 mA			
Average Current	-42 mA			
Temperature	-49.8 °C			
Absolute State of Charge	0 %			
Relative State of Charge	0 %			
Full Charge Capacity	0 mAh/10m	Wh		
Remaining Capacity	0 mAh/10m	Wh		
Run Time To Empty	65535 Minu	tes		
Average Time To Empty	65535 Minu	tes		
Average Time To Full	65535 Minu	tes		
Battery Status	0x8280			
🙀 Cycle Count	0 Cydes			
At Rate Time To Full	65535 Minu	tes		
At Rate Time To Empty	0 Minutes			
At Rate Ok	65535			
Max Error	10 %			

Figure 42. SBData Dynamic Data-Set Tab

Parameter Name	Value (Stati	c Data Captured @ 2/28/2010 2:59	9:23 PM1	Bit Encoded Data
Manufacturer Access	0x55AA			
🖉 Manufacturer Name	TEXAS INST	RUMENTS		
🖊 Device Name	bg78PL114			
🖊 Device Chemistry	LION			
🖉 Manufacturer Data	0E4D616E2	044617461202020202020000000	0000000000000	
🖉 Serial Number	1			
🛃 Manufacture Date	14964			
Specification Info	49			
者 Design Voltage	33600 mV			
Design Capacity	2400 mAh/	10mWh		
Charging Voltage	33600 mV			
Charging Current	0 mA			
At Rate	0 mAh/10m	Wh		
🖉 Battery Mode	0x6001			
🛃 Remaining Time Alarm	10 Minutes			
🛃 Remaining Capacity Alarm	560 mAh/10	DmWh		

Figure 43. SBData Static Data-Set Tab

SBData Dynamic	SBD ata Static	Pack Dynamic	Charge Control	Pack History
Parameter Name	Value [Static	Data Captured @ 2/28/2010 2:5	9:23 PM] Bit	Encoded Data
Board Temperature	55.1 °C			
Access Level	2			
Pack Passed Current	-15 mAh			
🔋 Idle Timer	0 Seconds			
Cyde Since Learn	0			
Epoch Hour	0			
Coulomb Counter Snap to Zero	21			
Temperature Voltage Trim	1.000			

Figure 44. Pack Dynamic Data-Set Tab



SBData Dynamic	SBD ata Static	Pack Dynamic	Charge Control	Pack History
Parameter Name	Value (Stati	c Data Captured @ 2/28/2010	2:59:23 PM]	Bit Encoded Data
🖉 Pre-Charge Temperature	0.0 °C	and the second s		
Pre-Charge Voltage	3000 mV			
Pre-Charge Recovery	3100 mV			
Pre-Charge Current	240 mA			
🖉 Charge Inhibit Temperature Low	0.0 °C			
🥖 Charge Inhibit Temperature High	45.0 °C			
🖉 Charge Inhibit Recovery Tempera	ature Low 5.0 °C			
🥖 Charge Inhibit Recovery Tempera	ture High 40.0 °C			
🖉 Charge Suspend Temperature Lov	v 5.0 °C			
Charge Suspend Recovery Tempe	rature Low 10.0 °C			
🥖 Charge Suspend Temperature Hig	h 60.0 ℃			
🖉 Charge Suspend Recovery Tempe	rature High 55.0 °C			
🖉 Charge Completion Pack Voltage (Qualifier 32800 mV			
Charge Completion Taper Current	Qualifier 240 mA			
Charge Completion Time	10 Seconds	RDTE		
Charge Completion FET Activation	Time 10 Seconds	RDTE		
🖉 Discharge Completion Pack Voltag	e Qualifier 24800 mV			
Discharge Completion Time	4 Seconds F	RDTE		
🖉 Discharge Completion FET Activat	ion Time 6 Seconds F	RDTE		
🖉 Discharge Under Temperature	-10.0 °C			
🖉 Discharge Under Temperature Rei	covery 0.0 °C			
🥖 Discharge Under Temperature Tim	e 2 Seconds F	RDTE		
FC Set SOC Threshold	-1 %			
18	1.21			

Figure 45. Charge Control Data-Set Tab

SBD ata Dynamic	SBD ata Static	Pack Dynamic	Charge Control	Pack History
Parameter Name	Value [St	atic Data Captured @ 2/28/2010 2:5	9:23 PM	Bit Encoded Data
Lifetime Minimum Pack Voltage	32767 m		and the second s	
Lifetime Maximum Pack Voltage	e 38055 m\			
Lifetime Maximum Charge Curr	rent 0 mA			
Lifetime Maximum Discharge C	urrent -54 mA			
Lifetime Minimum Temperature	-49.8 °C			
Lifetime Maximum Temperatur	e -49.8 ℃			
Lifetime Minimum Cell Voltage	3145 mV			
Lifetime Maximum Cell Voltage	3181 mV			
Lifetime Maximum Power	1.63 Wat	ts		
Lifetime Delivered Amp Hours	0 Ah			
Last Discharge Average	-480 mA			

Figure 46. Pack History Data-Set Tab



Appendix C Reference Design and Reference Design Bill of Materials

C.1 PMP5118-RevB Reference Design Schematic in S12 Hardware Configuration The reference design schematic is appended to the following pages.















C.2 PMP5118-Rev B Bill of Materials

Table 3. Bill of Materials

Count	RefDes	Part Number	Value	Description	Mfr	Size
4	U2	BQ76PL102RGTR	BQ76PL102RGTR	IC, Power-LAN Dual-Cell Li-Ion Batterry Monitor W/ Powerpump	ТІ	VQFN
	U3	BQ76PL102RGTR	BQ76PL102RGTR	IC, Power-LAN Dual-Cell Li-Ion Batterry Monitor W/ Powerpump	ТІ	VQFN
	U4	BQ76PL102RGTR	BQ76PL102RGTR	IC, Power-LAN Dual-Cell Li-Ion Batterry Monitor W/ Powerpump	ТІ	VQFN
	U5	BQ76PL102RGTR	BQ76PL102RGTR	IC, Power-LAN Dual-Cell Li-Ion Batterry Monitor W/ Powerpump	ТІ	VQFN
2	U10	BQ77PL157PW	BQ77PL157PW	IC, Secondary Voltage Protection for 3-6 Series Li-Ion Cells	ТІ	TSSOP-16
	U11	BQ77PL157PW	BQ77PL157PW	IC, Secondary Voltage Protection for 3-6 Series Li-Ion Cells	ТІ	TSSOP-16
1	U1	BQ78PL114RGZR	BQ78PL114	IC, PowerLAN Master Gateway Battery Management Controller With PowerPump Cell Balancing Technology	TI	VQFN
12	C46	Std	0.01 µF	Capacitor, Ceramic, 10V, X7R, 10%	Std	603
	C48	Std	0.01 µF	Capacitor, Ceramic, 10V, X7R, 10%	Std	603
	C55	Std	0.01 µF	Capacitor, Ceramic, 10V, X7R, 10%	Std	603
	C103	Std	0.01 µF	Capacitor, Ceramic, 10V, X7R, 10%	Std	603
	C110	Std	0.01 µF	Capacitor, Ceramic, 10V, X7R, 10%	Std	603
	C111	Std	0.01 µF	Capacitor, Ceramic, 10V, X7R, 10%	Std	603
	C112	Std	0.01 µF	Capacitor, Ceramic, 10V, X7R, 10%	Std	603
	C113	Std	0.01 µF	Capacitor, Ceramic, 10V, X7R, 10%	Std	603
	C114	Std	0.01 µF	Capacitor, Ceramic, 10V, X7R, 10%	Std	603
	C116	Std	0.01 µF	Capacitor, Ceramic, 10V, X7R, 10%	Std	603
	C117	Std	0.01 µF	Capacitor, Ceramic, 10V, X7R, 10%	Std	603
	C118	Std	0.01 µF	Capacitor, Ceramic, 10V, X7R, 10%	Std	603
2	C36	Std	0.1 µF	Capacitor, Ceramic, 50V, X7R, 10%	Std	603
	C109	Std	0.1 µF	Capacitor, Ceramic, 50V, X7R, 10%	Std	603
1	C58	STD	0.1 µF	Capacitor, Ceramic, Low Inductance, 6.3V, X7R, 20%	STD	603
12	C49	STD	1.0 μF	Capacitor, Ceramic, Low Inductance, 10V, X5R, 10%	STD	603
	C50	STD	1.0 μF	Capacitor, Ceramic, Low Inductance, 10V, X5R, 10%	STD	603
	C51	STD	1.0 μF	Capacitor, Ceramic, Low Inductance, 10V, X5R, 10%	STD	603
	C52	STD	1.0 μF	Capacitor, Ceramic, Low Inductance, 10V, X5R, 10%	STD	603
	C65	STD	1.0 μF	Capacitor, Ceramic, Low Inductance, 10V, X5R, 10%	STD	603
	C66	STD	1.0 μF	Capacitor, Ceramic, Low Inductance, 10V, X5R, 10%	STD	603
	C67	STD	1.0 μF	Capacitor, Ceramic, Low Inductance, 10V, X5R, 10%	STD	603
	C68	STD	1.0 μF	Capacitor, Ceramic, Low Inductance, 10V, X5R, 10%	STD	603
	C70	STD	1.0 μF	Capacitor, Ceramic, Low Inductance, 10V, X5R, 10%	STD	603



PMP5118-Rev B Bill of Materials

www.ti.com

Table 3. Bill of Materials (continued)

Count	RefDes	Part Number	Value	Description	Mfr	Size
	C71	STD	1.0 µF	Capacitor, Ceramic, Low Inductance, 10V, X5R, 10%	STD	603
	C73	STD	1.0 µF	Capacitor, Ceramic, Low Inductance, 10V, X5R, 10%	STD	603
	C74	STD	1.0 µF	Capacitor, Ceramic, Low Inductance, 10V, X5R, 10%	STD	603
2	C53	STD	1000 pF	Capacitor, Ceramic, Low Inductance, 10V, X5R, 10%	STD	603
	C56	STD	1000 pF	Capacitor, Ceramic, Low Inductance, 10V, X5R, 10%	STD	603
16	C41	STD	1000 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C44	STD	1000 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C54	STD	1000 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C59	STD	1000 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C60	STD	1000 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C69	STD	1000 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C72	STD	1000 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C75	STD	1000 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C76	STD	1000 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C77	STD	1000 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C78	STD	1000 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C79	STD	1000 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C80	STD	1000 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C81	STD	1000 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C82	STD	1000 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C83	STD	1000 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
22	C6	STD	3300 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C7	STD	3300 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C8	STD	3300 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C9	STD	3300 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C10	STD	3300 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C11	STD	3300 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C12	STD	3300 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C13	STD	3300 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C14	STD	3300 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C15	STD	3300 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C20	STD	3300 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C21	STD	3300 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C22	STD	3300 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603



Table 3. Bill of Materials (continued)

Count	RefDes	Part Number	Value	Description	Mfr	Size
	C23	STD	3300 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C24	STD	3300 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C25	STD	3300 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C26	STD	3300 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C27	STD	3300 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C31	STD	3300 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C32	STD	3300 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C33	STD	3300 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
	C34	STD	3300 pF	Capacitor, Ceramic, Low Inductance, 50V, X7R, 10%	STD	603
1	C105	ECJ-ZVF1C104Z	0.047 µF	Capacitor, Ceramic, 0 .047-uF, 16-V, Y5V, +80/-20%	Panasonic	805
2	C39	Std	0.1 µF	Capacitor, Ceramic, 50V, X7R, 10%	Std	805
	C120	Std	0.1 µF	Capacitor, Ceramic, 50V, X7R, 10%	Std	805
1	C35	100V	0.1 µF	Capacitor, Ceramic, 100V, X7R, 10%	STD	805
2	C37	C0805C104K1RACTU	0.1 µF	Capacitor, Ceramic, 100V, X7R, 10%	KEMET	805
	C38	C0805C104K1RACTU	0.1 µF	Capacitor, Ceramic, 100V, X7R, 10%	KEMET	805
1	C43	STD	0.1 µF	Capacitor, Ceramic, 6.3V, X5R, 10%	STD	805
2	C104	Std	0.22 µF	Capacitor, Ceramic, 16V, X7R, 10%	Std	805
	C115	Std	0.22 μF	Capacitor, Ceramic, 16V, X7R, 10%	Std	805
1	C45	STD	1 µF	Capacitor, Ceramic, 6.3V, X5R, 10%	STD	805
1	C57	STD	10 µF	Capacitor, Ceramic, 6.3V, X5R, 10%	STD	805
5	C42	STD	10 µF	Capacitor, Ceramic, 10V, X5R, 10%	STD	805
	C61	STD	10 µF	Capacitor, Ceramic, 10V, X5R, 10%	STD	805
	C62	STD	10 µF	Capacitor, Ceramic, 10V, X5R, 10%	STD	805
	C63	STD	10 µF	Capacitor, Ceramic, 10V, X5R, 10%	STD	805
	C64	STD	10 µF	Capacitor, Ceramic, 10V, X5R, 10%	STD	805
12	C1	STD	22 µF	Capacitor, Ceramic, 6.3V, X5R, 10%	STD	805
	C2	STD	22 µF	Capacitor, Ceramic, 6.3V, X5R, 10%	STD	805
	C3	STD	22 µF	Capacitor, Ceramic, 6.3V, X5R, 10%	STD	805
	C4	STD	22 µF	Capacitor, Ceramic, 6.3V, X5R, 10%	STD	805
	C5	STD	22 µF	Capacitor, Ceramic, 6.3V, X5R, 10%	STD	805
	C16	STD	22 µF	Capacitor, Ceramic, 6.3V, X5R, 10%	STD	805
	C17	STD	22 µF	Capacitor, Ceramic, 6.3V, X5R, 10%	STD	805
	C18	STD	22 µF	Capacitor, Ceramic, 6.3V, X5R, 10%	STD	805
	C19	STD	22 µF	Capacitor, Ceramic, 6.3V, X5R, 10%	STD	805



PMP5118-Rev B Bill of Materials

www.ti.com

Table 3. Bill of Materials (continued)

Count	RefDes	Part Number	Value	Description	Mfr	Size
	C28	STD	22 µF	Capacitor, Ceramic, 6.3V, X5R, 10%	STD	805
	C29	STD	22 µF	Capacitor, Ceramic, 6.3V, X5R, 10%	STD	805
	C30	STD	22 µF	Capacitor, Ceramic, 6.3V, X5R, 10%	STD	805
1	C47	STD	10000 pF	Capacitor, Ceramic, 6.3V, X5R, 10%	STD	805
1	C106	ECJ-3YBZA104K	0.1 µF	Capacitor, Ceramic, 0.1-uF, 100-V, X7R, +-10%	Panasonic	1206
1	C40	B32529C1104J	0.1 µF	Capacitor, Leaded, 100V, [temp], [tol]	Epcos	0.177 x 0.287 in.
1	C107	ECA-ZAM101	100 µF	Capacitor, Panasonic, 100-uF, 100-V, , 20%	Panasonic	0.315
1	J14	3267	BATT+	Connector, Banana Jack, Uninsulated	Pomona	0.500 dia
1	J15	3267	BATT–	Connector, Banana Jack, Uninsulated	Pomona	0.500 dia
1	J16	3267	GND	Connector, Banana Jack, Uninsulated	Pomona	0.500 dia
1	J20	3267	PACK+	Connector, Banana Jack, Uninsulated	Pomona	0.500 dia
1	J43	3267	PACK+PROT	Connector, Banana Jack, Uninsulated	Pomona	0.500 dia
1	J44	3267	PACK-PROT	Connector, Banana Jack, Uninsulated	Pomona	0.500 dia
2	J54	3267	unconnected	Connector, Banana Jack, Uninsulated	Pomona	0.500 dia
	J55	3267	unconnected	Connector, Banana Jack, Uninsulated	Pomona	0.500 dia
12	D38	MMBD4148SE	MMBD4148SE	Diode, Dual Ultra Fast, Series, 200-mA, 100-V	Fairchild	SOT23
	D39	MMBD4148SE	MMBD4148SE	Diode, Dual Ultra Fast, Series, 200-mA, 100-V	Fairchild	SOT23
	D40	MMBD4148SE	MMBD4148SE	Diode, Dual Ultra Fast, Series, 200-mA, 100-V	Fairchild	SOT23
	D42	MMBD4148SE	MMBD4148SE	Diode, Dual Ultra Fast, Series, 200-mA, 100-V	Fairchild	SOT23
	D46	MMBD4148SE	MMBD4148SE	Diode, Dual Ultra Fast, Series, 200-mA, 100-V	Fairchild	SOT23
	D47	MMBD4148SE	MMBD4148SE	Diode, Dual Ultra Fast, Series, 200-mA, 100-V	Fairchild	SOT23
	D48	MMBD4148SE	MMBD4148SE	Diode, Dual Ultra Fast, Series, 200-mA, 100-V	Fairchild	SOT23
	D49	MMBD4148SE	MMBD4148SE	Diode, Dual Ultra Fast, Series, 200-mA, 100-V	Fairchild	SOT23
	D50	MMBD4148SE	MMBD4148SE	Diode, Dual Ultra Fast, Series, 200-mA, 100-V	Fairchild	SOT23
	D51	MMBD4148SE	MMBD4148SE	Diode, Dual Ultra Fast, Series, 200-mA, 100-V	Fairchild	SOT23
	D52	MMBD4148SE	MMBD4148SE	Diode, Dual Ultra Fast, Series, 200-mA, 100-V	Fairchild	SOT23
	D53	MMBD4148SE	MMBD4148SE	Diode, Dual Ultra Fast, Series, 200-mA, 100-V	Fairchild	SOT23
22	D6	MA21D3800L	MA21D3800L	Diode, Switching, 1A, 30-V	Panasonic	0.067 x 0.049 in.
	D7	MA21D3800L	MA21D3800L	Diode, Switching, 1A, 30-V	Panasonic	0.067 x 0.049 in.
	D8	MA21D3800L	MA21D3800L	Diode, Switching, 1A, 30-V	Panasonic	0.067 x 0.049 in.
	D9	MA21D3800L	MA21D3800L	Diode, Switching, 1A, 30-V	Panasonic	0.067 x 0.049 in.
	D10	MA21D3800L	MA21D3800L	Diode, Switching, 1A, 30-V	Panasonic	0.067 x 0.049 in.
	D11	MA21D3800L	MA21D3800L	Diode, Switching, 1A, 30-V	Panasonic	0.067 x 0.049 in.
	D12	MA21D3800L	MA21D3800L	Diode, Switching, 1A, 30-V	Panasonic	0.067 x 0.049 in.



Table 3. Bill of Materials (continued)

Count	RefDes	Part Number	Value	Description	Mfr	Size
	D13	MA21D3800L	MA21D3800L	Diode, Switching, 1A, 30-V	Panasonic	0.067 x 0.049 in.
	D14	MA21D3800L	MA21D3800L	Diode, Switching, 1A, 30-V	Panasonic	0.067 x 0.049 in.
	D15	MA21D3800L	MA21D3800L	Diode, Switching, 1A, 30-V	Panasonic	0.067 x 0.049 in.
	D20	MA21D3800L	MA21D3800L	Diode, Switching, 1A, 30-V	Panasonic	0.067 x 0.049 in.
	D21	MA21D3800L	MA21D3800L	Diode, Switching, 1A, 30-V	Panasonic	0.067 x 0.049 in.
	D22	MA21D3800L	MA21D3800L	Diode, Switching, 1A, 30-V	Panasonic	0.067 x 0.049 in.
	D23	MA21D3800L	MA21D3800L	Diode, Switching, 1A, 30-V	Panasonic	0.067 x 0.049 in.
	D24	MA21D3800L	MA21D3800L	Diode, Switching, 1A, 30-V	Panasonic	0.067 x 0.049 in.
	D25	MA21D3800L	MA21D3800L	Diode, Switching, 1A, 30-V	Panasonic	0.067 x 0.049 in.
	D26	MA21D3800L	MA21D3800L	Diode, Switching, 1A, 30-V	Panasonic	0.067 x 0.049 in.
	D27	MA21D3800L	MA21D3800L	Diode, Switching, 1A, 30-V	Panasonic	0.067 x 0.049 in.
	D31	MA21D3800L	MA21D3800L	Diode, Switching, 1A, 30-V	Panasonic	0.067 x 0.049 in.
	D32	MA21D3800L	MA21D3800L	Diode, Switching, 1A, 30-V	Panasonic	0.067 x 0.049 in.
	D33	MA21D3800L	MA21D3800L	Diode, Switching, 1A, 30-V	Panasonic	0.067 x 0.049 in.
	D34	MA21D3800L	MA21D3800L	Diode, Switching, 1A, 30-V	Panasonic	0.067 x 0.049 in.
5	D59	160-1183-1-ND	Green	Diode, LED, Green, 2.1-V, 20-mA, 6-mcd	Liteon	603
	D60	160-1183-1-ND	Green	Diode, LED, Green, 2.1-V, 20-mA, 6-mcd	Liteon	603
	D61	160-1183-1-ND	Green	Diode, LED, Green, 2.1-V, 20-mA, 6-mcd	Liteon	603
	D62	160-1183-1-ND	Green	Diode, LED, Green, 2.1-V, 20-mA, 6-mcd	Liteon	603
	D63	160-1183-1-ND	Green	Diode, LED, Green, 2.1-V, 20-mA, 6-mcd	Liteon	603
4	D35	BZT52C12	BZT52C12-7-F	Diode, Zener, 12V	Diodes Inc.	SOD-123
	D37	BZT52C12	BZT52C12-7-F	Diode, Zener, 12V	Diodes Inc.	SOD-123
	D58	BZT52C12	BZT52C12-7-F	Diode, Zener, 12V	Diodes Inc.	SOD-123
	D64	BZT52C12	BZT52C12-7-F	Diode, Zener, 12V	Diodes Inc.	SOD-123
1	D16	5.1V	SMAZ5V1	Diode, Zener 100-mA, 5.1-V	Diodes Inc	SMA
11	D1	5.1V	SMAZ5V1	Diode, Zener, 100-mA, 5.1-V	Diodes Inc	SMA
	D2	5.1V	SMAZ5V1	Diode, Zener, 100-mA, 5.1-V	Diodes Inc	SMA
	D3	5.1V	SMAZ5V1	Diode, Zener, 100-mA, 5.1-V	Diodes Inc	SMA
	D4	5.1V	SMAZ5V1	Diode, Zener, 100-mA, 5.1-V	Diodes Inc	SMA
	D5	5.1V	SMAZ5V1	Diode, Zener, 100-mA, 5.1-V	Diodes Inc	SMA
	D17	5.1V	SMAZ5V1	Diode, Zener, 100-mA, 5.1-V	Diodes Inc	SMA
	D18	5.1V	SMAZ5V1	Diode, Zener, 100-mA, 5.1-V	Diodes Inc	SMA
	D19	5.1V	SMAZ5V1	Diode, Zener, 100-mA, 5.1-V	Diodes Inc	SMA
	D28	5.1V	SMAZ5V1	Diode, Zener, 100-mA, 5.1-V	Diodes Inc	SMA



PMP5118-Rev B Bill of Materials

www.ti.com

Table 3. Bill of Materials (continued)

Count	RefDes	Part Number	Value	Description	Mfr	Size
	D29	5.1V	SMAZ5V1	Diode, Zener, 100-mA, 5.1-V	Diodes Inc	SMA
	D30	5.1V	SMAZ5V1	Diode, Zener, 100-mA, 5.1-V	Diodes Inc	SMA
1	D36	IRF	10BQ0100	Diode, Schottky, 1-A, 100-V	STD	SMB
1	D41	AZ23C5V6	AZ23C5V6	Diode, Dual, Zener, 5.6 V, 300mW	Diodes	SOT23
1	D57	SMAT70A	SMAT70A	Diode, 100V transient voltage supressor	Diodes Inc.	SMA
1	J42	PTC36SAAN	Enable	Header, 2-pin, 100mil spacing, (36-pin strip)	Sullins	0.100 x 2
1	J24	PTC36SAAN	Reset (active low)	Header, 2-pin, 100mil spacing, (36-pin strip)	Sullins	0.100 x 2
12	J2	PTC36SAAN	Simulate	Header, 2-pin, 100mil spacing, (36-pin strip)	Sullins	0.100 x 2
	J3	PTC36SAAN	Simulate	Header, 2-pin, 100mil spacing, (36-pin strip)	Sullins	0.100 x 2
	J4	PTC36SAAN	Simulate	Header, 2-pin, 100mil spacing, (36-pin strip)	Sullins	0.100 x 2
	J5	PTC36SAAN	Simulate	Header, 2-pin, 100mil spacing, (36-pin strip)	Sullins	0.100 x 2
	J6	PTC36SAAN	Simulate	Header, 2-pin, 100mil spacing, (36-pin strip)	Sullins	0.100 x 2
	J7	PTC36SAAN	Simulate	Header, 2-pin, 100mil spacing, (36-pin strip)	Sullins	0.100 x 2
	J8	PTC36SAAN	Simulate	Header, 2-pin, 100mil spacing, (36-pin strip)	Sullins	0.100 x 2
	J9	PTC36SAAN	Simulate	Header, 2-pin, 100mil spacing, (36-pin strip)	Sullins	0.100 x 2
	J10	PTC36SAAN	Simulate	Header, 2-pin, 100mil spacing, (36-pin strip)	Sullins	0.100 x 2
	J11	PTC36SAAN	Simulate	Header, 2-pin, 100mil spacing, (36-pin strip)	Sullins	0.100 x 2
	J12	PTC36SAAN	Simulate	Header, 2-pin, 100mil spacing, (36-pin strip)	Sullins	0.100 x 2
	J13	PTC36SAAN	Simulate	Header, 2-pin, 100mil spacing, (36-pin strip)	Sullins	0.100 x 2
2	J18	PTC36SAAN	XT2	Header, 2-pin, 100mil spacing, (36-pin strip)	Sullins	0.100 x 2
	J22	PTC36SAAN	XT2	Header, 2-pin, 100mil spacing, (36-pin strip)	Sullins	0.100 x 2
1	J28	PTC36SAAN	XT6	Header, 2-pin, 100mil spacing, (36-pin strip)	Sullins	0.100 x 2
1	J36	PTC36SAAN	XT8	Header, 2-pin, 100mil spacing, (36-pin strip)	Sullins	0.100 x 2
1	J29	PTC36SAAN	XT10	Header, 2-pin, 100mil spacing, (36-pin strip)	Sullins	0.100 x 2
1	J37	PTC36SAAN	XT12	Header, 2-pin, 100mil spacing, (36-pin strip)	Sullins	0.100 x 2
2	J52	PTC36SAAN		Header, 2-pin, 100mil spacing, (36-pin strip)	Sullins	0.100 x 2
	J53	PTC36SAAN		Header, 2-pin, 100mil spacing, (36-pin strip)	Sullins	0.100 x 2
1	J461	PEC03SAAN	PEC03SAAN	Header, Male 3-pin, 100mil spacing,	Sullins	0.100 in. x 3
1	J1	PEC36SAAN	PEC36SAAN	Header, Male 20-pin, 100mil spacing, (36-pin strip)	STD	0.100 in. x 20
6	J45	640454-4	640454-4	Header, Polarized Notched, 4 Pin 100 mil Pitch	Тусо	0.400 x 0.225 in.
	J47	640454-4	640454-4	Header, Polarized Notched, 4 Pin 100 mil Pitch	Тусо	0.400 x 0.225 in.
	J48	640454-4	640454-4	Header, Polarized Notched, 4 Pin 100 mil Pitch	Тусо	0.400 x 0.225 in.
	J49	640454-4	640454-4	Header, Polarized Notched, 4 Pin 100 mil Pitch	Тусо	0.400 x 0.225 in.
	J50	640454-4	640454-4	Header, Polarized Notched, 4 Pin 100 mil Pitch	Тусо	0.400 x 0.225 in.



Table 3. Bill of Materials (continued)

Count	RefDes	Part Number	Value	Description	Mfr	Size
	J51	640454-4	640454-4	Header, Polarized Notched, 4 Pin 100 mil Pitch	Тусо	0.400 x 0.225 in.
1	J46	C-5103309-1	C-5103309-1	Connector, 10 pin Shrouded Vertical	Тусо	0.388 x 0.400 in.
11	L1	LPS4012-472ML	4.7 µH	Inductor, SMT, 1.8A, 175 mΩ	Coilcraft	0.153 x 0.153 in.
	L2	LPS4012-472ML	4.7 µH	Inductor, SMT, 1.8A, 175 mΩ	Coilcraft	0.153 x 0.153 in.
	L3	LPS4012-472ML	4.7 µH	Inductor, SMT, 1.8A, 175 mΩ	Coilcraft	0.153 x 0.153 in.
	L4	LPS4012-472ML	4.7 µH	Inductor, SMT, 1.8A, 175 mΩ	Coilcraft	0.153 x 0.153 in.
	L5	LPS4012-472ML	4.7 µH	Inductor, SMT, 1.8A, 175 mΩ	Coilcraft	0.153 x 0.153 in.
	L6	LPS4012-472ML	4.7 µH	Inductor, SMT, 1.8A, 175 mΩ	Coilcraft	0.153 x 0.153 in.
	L7	LPS4012-472ML	4.7 µH	Inductor, SMT, 1.8A, 175 mΩ	Coilcraft	0.153 x 0.153 in.
	L8	LPS4012-472ML	4.7 µH	Inductor, SMT, 1.8A, 175 mΩ	Coilcraft	0.153 x 0.153 in.
	L9	LPS4012-472ML	4.7 µH	Inductor, SMT, 1.8A, 175 m	Coilcraft	0.153 x 0.153 in.
	L10	LPS4012-472ML	4.7 µH	Inductor, SMT, 1.8A, 175 m	Coilcraft	0.153 x 0.153 in.
	L11	LPS4012-472ML	4.7 µH	Inductor, SMT, 1.8A, 175 m	Coilcraft	0.153 x 0.153 in.
10	R71	Std	1M	Resistor, Chip, 1/16W, 5%	Std	603
	R80	Std	1M	Resistor, Chip, 1/16W, 5%	Std	603
	R82	Std	1M	Resistor, Chip, 1/16W, 5%	Std	603
	R88	Std	1M	Resistor, Chip, 1/16W, 5%	Std	603
	R92	Std	1M	Resistor, Chip, 1/16W, 5%	Std	603
	R93	Std	1M	Resistor, Chip, 1/16W, 5%	Std	603
	R105	Std	1M	Resistor, Chip, 1/16W, 5%	Std	603
	R106	Std	1M	Resistor, Chip, 1/16W, 5%	Std	603
	R144	Std	1M	Resistor, Chip, 1/16W, 5%	Std	603
	R145	Std	1M	Resistor, Chip, 1/16W, 5%	Std	603
11	R16	Std	2K	Resistor, Chip, 1/16W, 5%	Std	603
	R17	Std	2K	Resistor, Chip, 1/16W, 5%	Std	603
	R18	Std	2K	Resistor, Chip, 1/16W, 5%	Std	603
	R19	Std	2K	Resistor, Chip, 1/16W, 5%	Std	603
	R20	Std	2K	Resistor, Chip, 1/16W, 5%	Std	603
	R43	Std	2K	Resistor, Chip, 1/16W, 5%	Std	603
	R44	Std	2K	Resistor, Chip, 1/16W, 5%	Std	603
	R45	Std	2K	Resistor, Chip, 1/16W, 5%	Std	603
	R46	Std	2K	Resistor, Chip, 1/16W, 5%	Std	603
	R64	Std	2K	Resistor, Chip, 1/16W, 5%	Std	603
	R65	Std	2K	Resistor, Chip, 1/16W, 5%	Std	603



PMP5118-Rev B Bill of Materials

www.ti.com

Table 3. Bill of Materials (continued)

Count	RefDes	Part Number	Value	Description	Mfr	Size
2	R96	Std	4.7K	Resistor, Chip, 1/16W, 5%	Std	603
	R98	Std	4.7K	Resistor, Chip, 1/16W, 5%	Std	603
1	R107	Std	10K	Resistor, Chip, 1/16W, 5%	Std	603
22	R21	Std	20K	Resistor, Chip, 1/16W, 5%	Std	603
	R22	Std	20K	Resistor, Chip, 1/16W, 5%	Std	603
	R23	Std	20K	Resistor, Chip, 1/16W, 5%	Std	603
	R24	Std	20K	Resistor, Chip, 1/16W, 5%	Std	603
	R25	Std	20K	Resistor, Chip, 1/16W, 5%	Std	603
	R26	Std	20K	Resistor, Chip, 1/16W, 5%	Std	603
	R27	Std	20K	Resistor, Chip, 1/16W, 5%	Std	603
	R28	Std	20K	Resistor, Chip, 1/16W, 5%	Std	603
	R29	Std	20K	Resistor, Chip, 1/16W, 5%	Std	603
	R30	Std	20K	Resistor, Chip, 1/16W, 5%	Std	603
	R47	Std	20K	Resistor, Chip, 1/16W, 5%	Std	603
	R48	Std	20K	Resistor, Chip, 1/16W, 5%	Std	603
	R49	Std	20K	Resistor, Chip, 1/16W, 5%	Std	603
	R50	Std	20K	Resistor, Chip, 1/16W, 5%	Std	603
	R51	Std	20K	Resistor, Chip, 1/16W, 5%	Std	603
	R52	Std	20K	Resistor, Chip, 1/16W, 5%	Std	603
	R53	Std	20K	Resistor, Chip, 1/16W, 5%	Std	603
	R54	Std	20K	Resistor, Chip, 1/16W, 5%	Std	603
	R66	Std	20K	Resistor, Chip, 1/16W, 5%	Std	603
	R67	Std	20K	Resistor, Chip, 1/16W, 5%	Std	603
	R68	Std	20K	Resistor, Chip, 1/16W, 5%	Std	603
	R69	Std	20K	Resistor, Chip, 1/16W, 5%	Std	603
2	R76	Std	30K	Resistor, Chip, 1/16W, 5%	Std	603
	R84	Std	30K	Resistor, Chip, 1/16W, 5%	Std	603
9	R95	Std	100	Resistor, Chip, 1/16W, 5%	Std	603
	R97	Std	100	Resistor, Chip, 1/16W, 5%	Std	603
	R99	Std	100	Resistor, Chip, 1/16W, 5%	Std	603
	R103	Std	100	Resistor, Chip, 1/16W, 5%	Std	603
	R104	Std	100	Resistor, Chip, 1/16W, 5%	Std	603
	R108	Std	100	Resistor, Chip, 1/16W, 5%	Std	603
	R109	Std	100	Resistor, Chip, 1/16W, 5%	Std	603



Table 3. Bill of Materials (continued)

Count	RefDes	Part Number	Value	Description	Mfr	Size
	R110	Std	100	Resistor, Chip, 1/16W, 5%	Std	603
	R143	Std	100	Resistor, Chip, 1/16W, 5%	Std	603
4	R72	Std	100K	Resistor, Chip, 1/16W, 5%	Std	603
	R81	Std	100K	Resistor, Chip, 1/16W, 5%	Std	603
	R85	Std	100K	Resistor, Chip, 1/16W, 5%	Std	603
	R94	Std	100K	Resistor, Chip, 1/16W, 5%	Std	603
3	R75	Std	200K	Resistor, Chip, 1/16W, 5%	Std	603
	R83	Std	200K	Resistor, Chip, 1/16W, 5%	Std	603
	R87	Std	200K	Resistor, Chip, 1/16W, 5%	Std	603
2	R70	Std	560K	Resistor, Chip, 1/16W, 5%	Std	603
	R86	Std	560K	Resistor, Chip, 1/16W, 5%	Std	603
1	R152	Std	0 Ω	Resistor, Chip, 1/16W, 5%	Any	603
2	R149	Std	0 Ω	Resistor, Chip, 1/16W, 5%	Any	603
	R166	Std	0 Ω	Resistor, Chip, 1/16W, 5%	Any	603
15	R140	Std	1K	Resistor, Chip, 1/16W, 5%	Any	603
	R147	Std	1K	Resistor, Chip, 1/16W, 5%	Any	603
	R148	Std	1K	Resistor, Chip, 1/16W, 5%	Any	603
	R150	Std	1K	Resistor, Chip, 1/16W, 5%	Any	603
	R151	Std	1K	Resistor, Chip, 1/16W, 5%	Any	603
	R155	Std	1K	Resistor, Chip, 1/16W, 5%	Any	603
	R156	Std	1K	Resistor, Chip, 1/16W, 5%	Any	603
	R157	Std	1K	Resistor, Chip, 1/16W, 5%	Any	603
	R158	Std	1K	Resistor, Chip, 1/16W, 5%	Any	603
	R159	Std	1K	Resistor, Chip, 1/16W, 5%	Any	603
	R160	Std	1K	Resistor, Chip, 1/16W, 5%	Any	603
	R161	Std	1K	Resistor, Chip, 1/16W, 5%	Any	603
	R162	Std	1K	Resistor, Chip, 1/16W, 5%	Any	603
	R163	Std	1K	Resistor, Chip, 1/16W, 5%	Any	603
	R164	Std	1K	Resistor, Chip, 1/16W, 5%	Any	603
1	R153	STD	5.1M	Resistor, Chip, 1/16W, 5%	Std	603
1	R74	Std	100	Resistor, Chip, 1/16W, 5%	Any	603
1	R139	Std	6K	Resistor, Chip, 6 kΩ, 1/10-W, 1%	Std	805
1	R137	Std	10K	Resistor, Chip, 10 kΩ, 1/10-W,1%	Std	805
1	R138	Std	100K	Resistor, Chip, 100 kΩ, 1/10-W,1%	Std	805



PMP5118-Rev B Bill of Materials

www.ti.com

Table 3. Bill of Materials (continued)

Count	RefDes	Part Number	Value	Description	Mfr	Size
1	R136	Std	232K	Resistor, Chip, 232 kΩ, 1/10-W,1%	Std	805
1	R142	Std	10 Ω	Resistor, Chip, 10-Ω, 1/8-W, 5%	Std	1206
1	R141	Std	100K	Resistor, Chip, 100 kΩ, 1/8-W, 5%	Std	1206
9	R1	STD	2.7 Ω	Resistor, 2.7 mΩ, 1W, 5%	STD	2512
	R2	STD	2.7 Ω	Resistor, 2.7 mΩ, 1W, 5%	STD	2512
	R3	STD	2.7 Ω	Resistor, 2.7 mΩ, 1W, 5%	STD	2512
	R4	STD	2.7 Ω	Resistor, 2.7 mΩ, 1W, 5%	STD	2512
	R5	STD	2.7 Ω	Resistor, 2.7 mΩ, 1W, 5%	STD	2512
	R31	STD	2.7 Ω	Resistor, 2.7 mΩ, 1W, 5%	STD	2512
	R32	STD	2.7 Ω	Resistor, 2.7 mΩ, 1W, 5%	STD	2512
	R33	STD	2.7 Ω	Resistor, 2.7 mΩ, 1W, 5%	STD	2512
	R34	STD	2.7 Ω	Resistor, 2.7 mΩ, 1W, 5%	STD	2512
27	R6	STD	2.7 Ω	Resistor, 2.7 mΩ, 2W, 5%	STD	2512
	R7	STD	2.7 Ω	Resistor, 2.7 mΩ, 2W, 5%	STD	2512
	R8	STD	2.7 Ω	Resistor, 2.7 mΩ, 2W, 5%	STD	2512
	R9	STD	2.7 Ω	Resistor, 2.7 mΩ, 2W, 5%	STD	2512
	R10	STD	2.7 Ω	Resistor, 2.7 mΩ, 2W, 5%	STD	2512
	R11	STD	2.7 Ω	Resistor, 2.7 mΩ, 2W, 5%	STD	2512
	R12	STD	2.7 Ω	Resistor, 2.7 mΩ, 2W, 5%	STD	2512
	R13	STD	2.7 Ω	Resistor, 2.7 mΩ, 2W, 5%	STD	2512
	R14	STD	2.7 Ω	Resistor, 2.7 mΩ, 2W, 5%	STD	2512
	R15	STD	2.7 Ω	Resistor, 2.7 mΩ, 2W, 5%	STD	2512
	R35	STD	2.7 Ω	Resistor, 2.7 mΩ, 2W, 5%	STD	2512
	R36	STD	2.7 Ω	Resistor, 2.7 mΩ, 2W, 5%	STD	2512
	R37	STD	2.7 Ω	Resistor, 2.7 mΩ, 2W, 5%	STD	2512
	R38	STD	2.7 Ω	Resistor, 2.7 mΩ, 2W, 5%	STD	2512
	R39	STD	2.7 Ω	Resistor, 2.7 mΩ, 2W, 5%	STD	2512
	R40	STD	2.7 Ω	Resistor, 2.7 mΩ, 2W, 5%	STD	2512
	R41	STD	2.7 Ω	Resistor, 2.7 mΩ, 2W, 5%	STD	2512
	R42	STD	2.7 Ω	Resistor, 2.7 mΩ, 2W, 5%	STD	2512
	R55	STD	2.7 Ω	Resistor, 2.7 mΩ, 2W, 5%	STD	2512
	R56	STD	2.7 Ω	Resistor, 2.7 mΩ, 2W, 5%	STD	2512
	R57	STD	2.7 Ω	Resistor, 2.7 mΩ, 2W, 5%	STD	2512
	R58	STD	2.7 Ω	Resistor, 2.7 mΩ, 2W, 5%	STD	2512



Table 3. Bill of Materials (continued)

Count	RefDes	Part Number	Value	Description	Mfr	Size
	R59	STD	2.7 Ω	Resistor, 2.7 mΩ, 2W, 5%	STD	2512
	R60	STD	2.7 Ω	Resistor, 2.7 mΩ, 2W, 5%	STD	2512
	R61	STD	2.7 Ω	Resistor, 2.7 mΩ, 2W, 5%	STD	2512
	R62	STD	2.7 Ω	Resistor, 2.7 mΩ, 2W, 5%	STD	2512
	R63	STD	2.7 Ω	Resistor, 2.7 mΩ, 2W, 5%	STD	2512
3	R89	STD	100	Resistor, 100 Ω, 1W, 5%	STD	2512
	R90	STD	100	Resistor, 100 Ω, 1W, 5%	STD	2512
	R91	STD	100	Resistor, 100 Ω, 1W, 5%	STD	2512
1	R100	ERJ-M1WSF3M0U	0.003R	Resistor, Chip, 1W, 1%, 350ppm	Panasonic	2512
3	R77	PR2512FKF070R003L (Digikey 311-0.003AGCT-ND)	0.003R	Resistor, Chip, 0.003 Ω, 1W, 1%, 100ppm	Yageo	2512
	R78	PR2512FKF070R003L (Digikey 311-0.003AGCT-ND)	0.003R	Resistor, Chip, 0.003 Ω, 1W, 1%, 100ppm	Yageo	2512
	R79	PR2512FKF070R003L (Digikey 311-0.003AGCT-ND)	0.003R	Resistor, Chip, 0.003 Ω, 1W, 1%, 100ppm	Yageo	2512
1	R101	ERJ-M1WSF3M0U	DNP	Resistor, Chip, 1W, 1%, 350ppm	Panasonic	2512
6	J17	8196	8196	Terminal, PC Screw #10-32, 30A	Keystone	0.470 x 0.470 in.
	J19	8196	8196	Terminal, PC Screw #10-32, 30A	Keystone	0.470 x 0.470 in.
	J21	8196	8196	Terminal, PC Screw #10-32, 30A	Keystone	0.470 x 0.470 in.
	J23	8196	8196	Terminal, PC Screw #10-32, 30A	Keystone	0.470 x 0.470 in.
	J26	8196	8196	Terminal, PC Screw #10-32, 30A	Keystone	0.470 x 0.470 in.
	J27	8196	8196	Terminal, PC Screw #10-32, 30A	Keystone	0.470 x 0.470 in.
2	SPK1	Spark Gap	{Value}	Spark Gap, 0.010 inch space	mfg	0.050 x 0.070 in.
	SPK2	Spark Gap	{Value}	Spark Gap, 0.010 inch space	mfg	0.050 x 0.070 in.
1	S2	FSM4JSMA	FSM4JSMA	Switch, Micro Push Button xxV, xxA	ITT	0.394 x 0.200 in.
3	TP8	STD	STD	Test Point, O.032 Hole	STD	
	TP17	STD	STD	Test Point, O.032 Hole	STD	
	TP22	STD	STD	Test Point, O.032 Hole	STD	
2	TP11	5000	5000	Test Point, Red, Thru Hole Color Keyed	Keystone	0.100 x 0.100 in.
	TP12	5000	5000	Test Point, Red, Thru Hole Color Keyed	Keystone	0.100 x 0.100 in.
6	TP1	5001	5001	Test Point, Black, Thru Hole Color Keyed	Keystone	0.100 x 0.100 in.
	TP2	5001	5001	Test Point, Black, Thru Hole Color Keyed	Keystone	0.100 x 0.100 in.
	TP3	5001	5001	Test Point, Black, Thru Hole Color Keyed	Keystone	0.100 x 0.100 in.
	TP4	5001	5001	Test Point, Black, Thru Hole Color Keyed	Keystone	0.100 x 0.100 in.
	TP5	5001	5001	Test Point, Black, Thru Hole Color Keyed	Keystone	0.100 x 0.100 in.



PMP5118-Rev B Bill of Materials

www.ti.com

Table 3. Bill of Materials (continued)

Count	RefDes	Part Number	Value	Description	Mfr	Size
	TP6	5001	5001	Test Point, Black, Thru Hole Color Keyed	Keystone	0.100 x 0.100 in.
2	TP13	STD	STD	Test Point, 0.020 Hole	STD	
	TP27	STD	STD	Test Point, 0.020 Hole	STD	
1	U9	TPS2490DGS	TPS2490DGSR	IC,	ТІ	DGS10
11	Q1	FDC6327C	FDC6327C	Transistor, Dual N&P-Channel 2.5V Specified PowerTrench	Fairchild	SuperSOT-6
	Q2	FDC6327C	FDC6327C	Transistor, Dual N&P-Channel 2.5V Specified PowerTrench	Fairchild	SuperSOT-6
	Q3	FDC6327C	FDC6327C	Transistor, Dual N&P-Channel 2.5V Specified PowerTrench	Fairchild	SuperSOT-6
	Q4	FDC6327C	FDC6327C	Transistor, Dual N&P-Channel 2.5V Specified PowerTrench	Fairchild	SuperSOT-6
	Q5	FDC6327C	FDC6327C	Transistor, Dual N&P-Channel 2.5V Specified PowerTrench	Fairchild	SuperSOT-6
	Q6	FDC6327C	FDC6327C	Transistor, Dual N&P-Channel 2.5V Specified PowerTrench	Fairchild	SuperSOT-6
	Q7	FDC6327C	FDC6327C	Transistor, Dual N&P-Channel 2.5V Specified PowerTrench	Fairchild	SuperSOT-6
	Q8	FDC6327C	FDC6327C	Transistor, Dual N&P-Channel 2.5V Specified PowerTrench	Fairchild	SuperSOT-6
	Q9	FDC6327C	FDC6327C	Transistor, Dual N&P-Channel 2.5V Specified PowerTrench	Fairchild	SuperSOT-6
	Q10	FDC6327C	FDC6327C	Transistor, Dual N&P-Channel 2.5V Specified PowerTrench	Fairchild	SuperSOT-6
	Q11	FDC6327C	FDC6327C	Transistor, Dual N&P-Channel 2.5V Specified PowerTrench	Fairchild	SuperSOT-6
1	Q30	SUM90N10-8m2P	SUM90N10-8m2P	Transistor, NFET, 100V, 97A, 8 mΩ	Vishay	D2PAK
1	Q28	SUM90N10-8m2P	SUM90N10-8m2P	Transistor, NFET, 100V, 97A, 8 mΩ	Vishay	D2PAK
1	Q29	SUM90N10-8m2P	SUM90N10-8m2P	Transistor, NFET, 100V, 97A, 8 mΩ	Vishay	D2PAK
1	Q27	SUM90N10-8m2P	SUM90N10-8m2P	Transistor, NFET, 100V, 97A, 8 mΩ	Vishay	D2PAK
2	Q12	MMBFJ201	MMBFJ201	JFET, NChan -40V, 50mA	Fairchild	SOT-23
	Q21	MMBFJ201	MMBFJ201	JFET, NChan -40V, 50mA	Fairchild	SOT-23
1	Q20	FDS3682	FDS3682	MOSFET, N-ch, 100-V, 6-A, 35-mΩ	Fairchild	SO8
3	Q13	BC846ALT1G	BC846ALT1G	Bipolar, NPN, -65-V, 100-mA, 100-mW	Vishay	SOT23
	Q17	BC846ALT1G	BC846ALT1G	Bipolar, NPN, -65-V, 100-mA, 100-mW	Vishay	SOT23
	Q19	BC846ALT1G	BC846ALT1G	Bipolar, NPN, -65-V, 100-mA, 100-mW	Vishay	SOT23
4	Q14	SUM110P08-11L	SUM110P08-11L	MOSFET, Pch, -80V, 109 A, 11m Ω (Vgs=-10V), 14.5m Ω (Vgs=-4.5V)	Vishay	D2PAK
	Q15	SUM110P08-11L	SUM110P08-11L	MOSFET, Pch, -80V, 109 A, 11mΩ (Vgs=-10V), 14.5mΩ (Vgs=-4.5V)	Vishay	D2PAK
	Q16	SUM110P08-11L	SUM110P08-11L	MOSFET, Pch, -80V, 109 A, 11mΩ (Vgs=-10V), 14.5mΩ (Vgs=-4.5V)	Vishay	D2PAK
	Q18	SUM110P08-11L	SUM110P08-11L	MOSFET, Pch, -80V, 109 A, 11m Ω (Vgs=-10V), 14.5m Ω (Vgs=-4.5V)	Vishay	D2PAK

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DLP® Products	www.dlp.com	Communications and Telecom	www.ti.com/communications
DSP	dsp.ti.com	Computers and Peripherals	www.ti.com/computers
Clocks and Timers	www.ti.com/clocks	Consumer Electronics	www.ti.com/consumer-apps
Interface	interface.ti.com	Energy	www.ti.com/energy
Logic	logic.ti.com	Industrial	www.ti.com/industrial
Power Mgmt	power.ti.com	Medical	www.ti.com/medical
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
RFID	www.ti-rfid.com	Space, Avionics & Defense	www.ti.com/space-avionics-defense
RF/IF and ZigBee® Solutions	www.ti.com/lprf	Video and Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless-apps

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265 Copyright © 2010, Texas Instruments Incorporated