

	Ref	Value	Description	Manufacturer	Manufacturer P/N	Supplier	Supplier P/N	Unit Cost	Notes
PCB	--		PacMAN PCB Rev 0.8	Lafayette	L17-TSV-1	Advanced Circuits (4pcb.com)		\$66.00	Designed in house; Preston Bejabeng Fall 2016
Pack Voltage Sensor and Charge Sensor	U4	INA226	IC Monitor PWR/CURR BIDIR 10MSOP	Texas Instruments	INA226AIDGSR	DigiKey	296-29034-1-ND	\$3.44	
	R3	.001 Ω 1%	RES SMD 0.001 OHM 1% 1W 1206	Stackpole Electronics Inc.	CSNL1206FT1L00	DigiKey	CSNL1206FT1L00CT-ND	\$0.65	
	C23	0.1uF 0603	CAP CER 0.1UF 25V X7R 0603	Murata Electronics North America	GRM188R71E104KA01D	DigiKey	490-1524-1-ND	\$0.10	
High Voltage Power	F1	--	FUSE BLOCK BLADE PCB	MPD (Memory Protection Devices)	BK-6010	Digikey	BK-6010-ND	\$0.54	
	F1 input	1A, 250 VDC	Cartridge Fuse for PACMAN	Littelfuse Inc.	0216001.MXESPP	Mouser	576-0216001.MXESPP	\$0.62	NOT ON SCHEMATIC - be sure to put this in before powering up the board
	D5	--	DIODE SCHOTTKY 100V 3A DO214AC	Micro Commercial Co	SK310A-LTP	DigiKey	SK310A-LTPMSTR-ND	\$0.24	
	C10	220uF 20% 50V	CAP ALUM 220UF 20% 50V SMD	Nichicon	UCW1H221MNL1GS	Digikey	493-9426-1-ND	\$0.73	
	R13	1k ohm 0805	RES SMD 1K OHM 1% 1/8W 0805	Panasonic Electronic Components	ERJ-6ENF1001V	Digikey	P1.00KCT-ND	\$0.10	
	C11	1uF	CAP CER 1UF 50V X5R 0603	Samsung Electro-Mechanics America, Inc.	CL10A105KB8NNNC	Digikey	1276-1860-1-ND	\$0.14	
	U6	--	IC REG BUCK ADJ 0.25A 16MSOP	Linear Technology	LTC3638EMSE#PBF	Digikey	LTC3638EMSE#PBF-ND	\$7.79	
	D6	--	DIODE SCHOTTKY 100V 3A DO214AC	Micro Commercial Co	SK310A-LTP	DigiKey	SK310A-LTPMSTR-ND	\$0.24	
	L1	220uH	FIXED IND 220UH 500MA 1.495 OHM	TDK Corporation	VLS6045EX-221M	Digikey	445-173047-1-ND	\$0.52	
	R14	1k Ω 5% 0805	RES SMD 1K OHM 5% 1/8W 0805	Panasonic Electronic Components	ERJ-6GEYJ102V	DigiKey	P1.0KACT-ND	\$0.10	
	C15	10uF 1210 25V	CAP CER 10UF 25V X5R 1210	Samsung Electro-Mechanics America, Inc.	CL32A106KAULNNE	DigiKey	1276-1854-1-ND	\$0.24	
	C12	10uF 1210 25V	CAP CER 10UF 25V X5R 1210	Samsung Electro-Mechanics America, Inc.	CL32A106KAULNNE	DigiKey	1276-1854-1-ND	\$0.24	
ADC	C8	0.1uF 0603	CAP CER 0.1UF 25V X7R 0603	Murata Electronics North America	GRM188R71E104KA01D	DigiKey	490-1524-1-ND	\$0.10	
	U5	--	IC ADC 16BIT 860SPS LP 10MSOP	Texas Instruments	ADS1115IDGSR	Digikey	296-38849-1-ND	\$5.65	
	R19	1k Ω 5% 0805	RES SMD 1K OHM 5% 1/8W 0805	Panasonic Electronic Components	ERJ-6GEYJ102V	Digikey	P1.0KACT-ND	\$0.10	
	R20	1k Ω 5% 0805	RES SMD 1K OHM 5% 1/8W 0805	Panasonic Electronic Components	ERJ-6GEYJ102V	DigiKey	P1.0KACT-ND	\$0.10	
DC/DC	U7	--	CONVERT DC/DC 6W 12VIN-5VOUT T/H	Murata Power Solutions Inc.	NCS6S1205C	Digikey	811-2109-5-ND	\$22.00	
	C9	10uF 1210 25V	CAP CER 10UF 25V X5R 1210	Samsung Electro-Mechanics America, Inc.	CL32A106KAULNNE	DigiKey	1276-1854-1-ND	\$0.24	
	C16	220uF 20% 16V	CAP ALUM 220UF 20% 16V SMD	Nichicon	UUR1C221MCL6GS	Digikey	493-6214-1-ND	\$0.34	
3.3 Linear Reg	C24	0.1uF 0603	CAP CER 0.1UF 25V X7R 0603	Murata Electronics North America	GRM188R71E104KA01D	DigiKey	490-1524-1-ND	\$0.10	
	U9	--	IC REG LDO 3.3V 1A SOT223	ON Semiconductor	NCP1117ST33T3G	Digikey	NCP1117ST33T3GOSCT-ND	\$0.46	
	C27	10uF 1210 25V	CAP CER 10UF 25V X5R 1210	Samsung Electro-Mechanics America, Inc.	CL32A106KAULNNE	DigiKey	1276-1854-1-ND	\$0.24	
System LED	R6	1k Ω 5% 0603	RES SMD 1K OHM 5% 1/10W 0603	Yageo	RC0603JR-071KL	Digikey	311-1.0KGRCT-ND	\$0.10	
	D1	Green 570nm LED	LED GREEN CLEAR 0603 SMD	Würth Electronics Inc	150060VS75000	Digikey	732-4980-1-ND	\$0.24	
HV Digital I/O	R10	10k Ohm ±5%	RES SMD 10K OHM 5% 1/10W 0603	Yageo	RC0603JR-0710KL	Digikey	311-10KGRCT-ND	\$0.10	
	C22	0.1uF 0603	CAP CER 0.1UF 25V X7R 0603	Murata Electronics North America	GRM188R71E104KA01D	DigiKey	490-1524-1-ND	\$0.10	
	U3	--	IC I/O EXPANDER I2C 8B 16SOIC	NXP USA Inc.	PCF8574AT/3,518	DigiKey	568-1074-1-ND	\$1.22	
	Q4	--	MOSFET P-CH 30V 1.5A TSMT3	Rohm Semiconductor	RRR015P03TL	Digikey	RRR015P03TLTR-ND	\$0.15	
	R11	10k Ohm ±5%	RES SMD 10K OHM 5% 1/10W 0603	Yageo	RC0603JR-0710KL	Digikey	311-10KGRCT-ND	\$0.10	
I2C Isolator	C14	0.1uF 0603	CAP CER 0.1UF 25V X7R 0603	Murata Electronics North America	GRM188R71E104KA01D	DigiKey	490-1524-1-ND	\$0.10	
	C25	0.1uF 0603	CAP CER 0.1UF 25V X7R 0603	Murata Electronics North America	GRM188R71E104KA01D	DigiKey	490-1524-1-ND	\$0.10	
	C13	0.1uF 0603	CAP CER 0.1UF 25V X7R 0603	Murata Electronics North America	GRM188R71E104KA01D	DigiKey	490-1524-1-ND	\$0.10	
	U8	--	DGTL ISO 3.75KV 2CH I2C 8SOIC	Silicon Labs	SI8600AC-B-IS	DigiKey	336-2048-5-ND	\$3.37	
	C17	0.1uF 0603	CAP CER 0.1UF 25V X7R 0603	Murata Electronics North America	GRM188R71E104KA01D	DigiKey	490-1524-1-ND	\$0.10	
AVR Microcontroller	U1	--	IC MCU 8BIT 128KB FLASH 64TQFP	Microchip Technology	AT90CAN128-16AUR	DigiKey	AT90CAN128-16AURCT-ND	\$7.66	
	C1	10pF ±5% 0603	CAP CER 10PF 50V NPO 0603	Murata Electronics North America	GRM1885C1H100JA01D	DigiKey	490-1403-1-ND	\$0.10	
	C4	10pF ±5% 0603	CAP CER 10PF 50V NPO 0603	Murata Electronics North America	GRM1885C1H100JA01D	DigiKey	490-1403-1-ND	\$0.10	
	C6	0.1uF 0603	CAP CER 0.1UF 25V X7R 0603	Murata Electronics North America	GRM188R71E104KA01D	DigiKey	490-1524-1-ND	\$0.10	
	X1	--	CRYSTAL 10.0000MHZ 12PF SMD	TXC CORPORATION	7A-10.000MAAE-T	DigiKey	887-1741-1-ND	\$0.66	
	C2	0.1uF 0603	CAP CER 0.1UF 25V X7R 0603	Murata Electronics North America	GRM188R71E104KA01D	DigiKey	490-1524-1-ND	\$0.10	
	C3	0.1uF 0603	CAP CER 0.1UF 25V X7R 0603	Murata Electronics North America	GRM188R71E104KA01D	DigiKey	490-1524-1-ND	\$0.10	
	C5	0.1uF 0603	CAP CER 0.1UF 25V X7R 0603	Murata Electronics North America	GRM188R71E104KA01D	DigiKey	490-1524-1-ND	\$0.10	
I2C Pullup	R1	10k Ohm ±5%	RES SMD 10K OHM 5% 1/10W 0603	Yageo	RC0603JR-0710KL	Digikey	311-10KGRCT-ND	\$0.10	
	R2	10k Ohm ±5%	RES SMD 10K OHM 5% 1/10W 0603	Yageo	RC0603JR-0710KL	Digikey	311-10KGRCT-ND	\$0.10	
External Watchdog	R34	10k Ohm ±5%	RES SMD 10K OHM 5% 1/10W 0603	Yageo	RC0603JR-0710KL	Digikey	311-10KGRCT-ND	\$0.10	
	C18	0.1uF 0603	CAP CER 0.1UF 25V X7R 0603	Murata Electronics North America	GRM188R71E104KA01D	DigiKey	490-1524-1-ND	\$0.10	
	U2	--	IC SUPERVISOR WATCHDOG SOT23-5	Analog Devices Inc.	ADM6320CY29ARJZ-R7	DigiKey	ADM6320CY29ARJZ-R7CT-ND	\$1.48	
	C26	0.1uF 0603	CAP CER 0.1UF 25V X7R 0603	Murata Electronics North America	GRM188R71E104KA01D	DigiKey	490-1524-1-ND	\$0.10	
Status LEDs	R7	1k Ω 5% 0603	RES SMD 1K OHM 5% 1/10W 0603	Yageo	RC0603JR-071KL	Digikey	311-1.0KGRCT-ND	\$0.10	
	R8	1k Ω 5% 0603	RES SMD 1K OHM 5% 1/10W 0603	Yageo	RC0603JR-071KL	Digikey	311-1.0KGRCT-ND	\$0.10	

	D2	Red 625nm LED	LED RED CLEAR 0603 SMD	Würth Electronics Inc	150060RS75000	Digikey	732-4978-1-ND	\$0.24		
	D3	Green 570nm LED	LED GREEN CLEAR 0603 SMD	Würth Electronics Inc	150060VS75000	Digikey	732-4980-1-ND	\$0.24		
Charge Control P-Fet	R23	1k Ω 5% 0603	RES SMD 1K OHM 5% 1/10W 0603	Yageo	RC0603JR-071KL	Digikey	311-1.0KGRCT-ND	\$0.10		
	D12	Green 570nm LED	LED GREEN CLEAR 0603 SMD	Würth Electronics Inc	150060VS75000	Digikey	732-4980-1-ND	\$0.24		
	D9	--	DIODE SCHOTTKY 100V 3A DO214AC	Micro Commercial Co	SK310A-LTP	Digikey	SK310A-LTPMSTR-ND	\$0.24		
	R38	10k Ohm ±5%	RES SMD 10K OHM 5% 1/10W 0603	Yageo	RC0603JR-0710KL	Digikey	311-10KGRCT-ND	\$0.10		
	Q3	--	MOSFET P-CH 30V 1.5A TSM3T	Rohm Semiconductor	RRR015P03TL	Digikey	RRR015P03TLTR-ND	\$0.15		
	D19	--	DIODE SCHOTTKY 100V 3A DO214AC	Micro Commercial Co	SK310A-LTP	Digikey	SK310A-LTPMSTR-ND	\$0.24		
	Rly2	--	RELAY GEN PURPOSE SPST 30A 5V	TE Connectivity Potter & Brumfield Relays	T9A51D12-5	Digikey	PB1014-ND	\$3.78		
High Side P-Fet Driver	U10	--	IC INVERTER DUAL 1INPUT SC70-6	Texas Instruments	SN74LVC2G06DCKR	Digikey	296-13493-1-ND	\$0.54		
Fan Control P-Fet	R37	10k Ohm ±5%	RES SMD 10K OHM 5% 1/10W 0603	Yageo	RC0603JR-0710KL	Digikey	311-10KGRCT-ND	\$0.10		
	Q1	--	MOSFET P-CH 30V 1.5A TSM3T	Rohm Semiconductor	RRR015P03TL	Digikey	RRR015P03TLTR-ND	\$0.15		
	D18	--	DIODE SCHOTTKY 100V 3A DO214AC	Micro Commercial Co	SK310A-LTP	Digikey	SK310A-LTPMSTR-ND	\$0.24		
	CAN Transceiver	R24	1k Ω 5% 0603	RES SMD 1K OHM 5% 1/10W 0603	Yageo	RC0603JR-071KL	Digikey	311-1.0KGRCT-ND	\$0.10	
	C19	0.1uF 0603	CAP CER 0.1UF 25V X7R 0603	Murata Electronics North America	GRM188R71E104KA01D	Digikey	490-1524-1-ND	\$0.10		
	U11	--	IC TRANSCEIVER CAN HI-SPD 8-SOIC	Microchip Technology	MCP2551-V/SN	Digikey	MCP2551-V/SN-ND	\$1.05		
	R25	--	--	--	--	--	--	--	DO NOT PLACE	
Opto Isolator on SL_Closed Signal	R9	10k Ohm ±5%	RES SMD 10K OHM 5% 1/10W 0603	Yageo	RC0603JR-0710KL	Digikey	311-10KGRCT-ND	\$0.10		
	U13	--	OPTOISO 3.75KV PSH PULL SO6-5	Toshiba Semiconductor and Storage	TLP2361(V4-TPL.E	Digikey	TLP2361(V4-TPLECT-ND	\$1.14		
	C7	0.1uF 0603	CAP CER 0.1UF 25V X7R 0603	Murata Electronics North America	GRM188R71E104KA01D	Digikey	490-1524-1-ND	\$0.10		
Safety Loop Relay	D21	--	DIODE SCHOTTKY 100V 3A DO214AC	Micro Commercial Co	SK310A-LTP	Digikey	SK310A-LTPMSTR-ND	\$0.24		
	Rly1	--	RELAY GEN PURPOSE SPST 10A 3V	Omron Electronics Inc-EMC Div	G5LE-1A4 DC3	Digikey	Z3697-ND	\$1.43		
	Q2	--	MOSFET P-CH 30V 1.5A TSM3T	Rohm Semiconductor	RRR015P03TL	Digikey	RRR015P03TLTR-ND	\$0.15		
	R4	510 Ohm 5% 0805	RES SMD 510 OHM 5% 1/8W 0805	Stackpole Electronics Inc.	RMCF0805JT510R	Digikey	RMCF0805JT510RCT-ND	\$0.10		
	R5	510 Ohm 5% 0805	RES SMD 510 OHM 5% 1/8W 0805	Stackpole Electronics Inc.	RMCF0805JT510R	Digikey	RMCF0805JT510RCT-ND	\$0.10		
			10uF 1210 25V 120K-160K ohm Resistor	CAP CER 10UF 25V X5R 1210	Samsung Electro-Mechanics America, Inc.	CL32A106KAULNNE	Digikey	1276-1854-1-ND	\$0.24	NOT ON SCHEM put this in before
		C28	0.1uF 0603	CAP CER 0.1UF 25V X7R 0603	Murata Electronics North America	GRM188R71E104KA01D	Digikey	490-1524-1-ND	\$0.10	
	C29	0.1uF 0603	CAP CER 0.1UF 25V X7R 0603	Murata Electronics North America	GRM188R71E104KA01D	Digikey	490-1524-1-ND	\$0.10		
UART	U12	--	IC USB FS SERIAL UART 28-SSOP	FTDI, Future Technology Devices International Ltd	FT232RL-REEL	Digikey	768-1007-1-ND	\$4.50		
	D15	--	DIODE SCHOTTKY 100V 3A DO214AC	Micro Commercial Co	SK310A-LCT	Digikey	SK310A-LTPMSCT-ND	\$0.24		
	C20	0.1uF 0603	CAP CER 0.1UF 25V X7R 0603	Murata Electronics North America	GRM188R71E104KA01D	Digikey	490-1524-1-ND	\$0.10		
	C21	0.1uF 0603	CAP CER 0.1UF 25V X7R 0603	Murata Electronics North America	GRM188R71E104KA01D	Digikey	490-1524-1-ND	\$0.10		
R15	510 Ohm ±5%	RES SMD 510 OHM 5% 1/4W 0603	Panasonic Electronic Components	ERJ-PA3J511V	Digikey	P510BZCT-ND	\$0.10			
R16	510 Ohm ±5%	RES SMD 510 OHM 5% 1/4W 0603	Panasonic Electronic Components	ERJ-PA3J511V	Digikey	P510BZCT-ND	\$0.10			
R17	510 Ohm ±5%	RES SMD 510 OHM 5% 1/4W 0603	Panasonic Electronic Components	ERJ-PA3J511V	Digikey	P510BZCT-ND	\$0.10			
R18	510 Ohm ±5%	RES SMD 510 OHM 5% 1/4W 0603	Panasonic Electronic Components	ERJ-PA3J511V	Digikey	P510BZCT-ND	\$0.10			
C30	10uF 0805 6.3V	CAP CER 10UF 6.3V X5R 0805	Samsung Electro-Mechanics America, Inc.	CL21A106KQCLRNC	Digikey	1276-2405-1-ND	\$0.10			
C31	10uF 0805 6.3V	CAP CER 10UF 6.3V X5R 0805	Samsung Electro-Mechanics America, Inc.	CL21A106KQCLRNC	Digikey	1276-2405-1-ND	\$0.10			
C32	10uF 0805 6.3V	CAP CER 10UF 6.3V X5R 0805	Samsung Electro-Mechanics America, Inc.	CL21A106KQCLRNC	Digikey	1276-2405-1-ND	\$0.10			
C33	10uF 0805 6.3V	CAP CER 10UF 6.3V X5R 0805	Samsung Electro-Mechanics America, Inc.	CL21A106KQCLRNC	Digikey	1276-2405-1-ND	\$0.10			
C34	0.1uF 0603	CAP CER 0.1UF 25V X7R 0603	Murata Electronics North America	GRM188R71E104KA01D	Digikey	490-1524-1-ND	\$0.10			
C35	10uF 0805 6.3V	CAP CER 10UF 6.3V X5R 0805	Samsung Electro-Mechanics America, Inc.	CL21A106KQCLRNC	Digikey	1276-2405-1-ND	\$0.10			
C36	10uF 0805 6.3V	CAP CER 10UF 6.3V X5R 0805	Samsung Electro-Mechanics America, Inc.	CL21A106KQCLRNC	Digikey	1276-2405-1-ND	\$0.10			
R22	510 Ohm ±5%	RES SMD 510 OHM 5% 1/4W 0603	Panasonic Electronic Components	ERJ-PA3J511V	Digikey	P510BZCT-ND	\$0.10			
R26	510 Ohm ±5%	RES SMD 510 OHM 5% 1/4W 0603	Panasonic Electronic Components	ERJ-PA3J511V	Digikey	P510BZCT-ND	\$0.10			
C37	0.1uF 0603	CAP CER 0.1UF 25V X7R 0603	Murata Electronics North America	GRM188R71E104KA01D	Digikey	490-1524-1-ND	\$0.10			
U14	--	IC V-LEVEL XLATR FM+ I2C 8VSSOP	Texas Instruments	TCA9617BDGKR	Digikey	296-40579-1-ND	\$1.01			
R27	10k Ohm ±5%	RES SMD 10K OHM 5% 1/10W 0603	Yageo	RC0603JR-0710KL	Digikey	311-10KGRCT-ND	\$0.10			
R28	10k Ohm ±5%	RES SMD 10K OHM 5% 1/10W 0603	Yageo	RC0603JR-0710KL	Digikey	311-10KGRCT-ND	\$0.10			
Connectors	P1	--	CONN RCPT 4POS 11.18MM PCB SLDR	TE Connectivity AMP Connectors	556881-4	Digikey	A113982-ND	\$8.30		
	P6	--	CONN HEADER 2POS .100 R/A SMD	Molex, LLC	15912025	Digikey	WM1340-ND	\$2.61		
	P2	--	CONN HEADER 2POS .100 R/A SMD	Molex, LLC	15912025	Digikey	WM1340-ND	\$2.61		
	P3	--	CONN HEADER 6POS .100 R/A SMD	Molex, LLC	15912065	Digikey	WM1344-ND	\$4.20		
	J3	--	CONN MOD JACK 6P6C VERT UNSHLD	Molex, LLC	855135002	Digikey	WM3789CT-ND	\$1.16		
	J1	--	CONN USB TYPE B R/A BLACK	On Shore Technology Inc.	USB-B1HSB6	Digikey	ED2983-ND	\$0.58		
	P4	--	CONN HEADER 16POS DL STR GOLD	3M	30316-6002HB	Digikey	3M11931-ND	\$0.78		
	P5	--	CONN HEADER 10POS DUAL SHRD SMD	Amphenol FCI	20021521-00010T1LF	Digikey	609-4054-ND	\$1.11		
	J2	--	CONN D-SUB RCPT 37POS R/A SOLDER	Norcomp Inc.	182-037-213R531	Digikey	182-37FE-ND	\$3.28		
	R12	100 Ohm ±5%	RES SMD 100 OHM 5% 1/10W 0603	Panasonic Electronic Components	ERJ-3GEYJ101V	Digikey	P100GCT-ND	\$0.10		
	R21	100 Ohm ±5%	RES SMD 100 OHM 5% 1/10W 0603	Panasonic Electronic Components	ERJ-3GEYJ101V	Digikey	P100GCT-ND	\$0.10		
	R35	100 Ohm ±5%	RES SMD 100 OHM 5% 1/10W 0603	Panasonic Electronic Components	ERJ-3GEYJ101V	Digikey	P100GCT-ND	\$0.10		
	R36	100 Ohm ±5%	RES SMD 100 OHM 5% 1/10W 0603	Panasonic Electronic Components	ERJ-3GEYJ101V	Digikey	P100GCT-ND	\$0.10		