

Using the TPS23851EVM-001

User's Guide



Literature Number: SLUU492
February 2011

Using the TPS23851EVM-001

This user guide describes setup and use of the TPS23851EVM-001.

1 Introduction

It includes connection and wiring descriptions, PC installation of the user interface, schematics and layout information and a detailed section describing how to use the GUI.

2 Equipment Supplied

- HPA677 Backplane Board
- HPA676 PSE Controller Board

3 Equipment Required

- Computer
- Laptop Computer Power Supply or 20-V_{DC} to 60-V_{DC} Power Supply
- USB to Mini-USB Cable
- Valid POE Load
- National Instruments Website Download
- Texas Instrument's GUI for the TPS23851 ([TPS23851 GUI Software](#))

4 Hardware Connections

4.1 PCB Assemblies

The HPA677 is a backplane board. The HPA677 has two power supplies, the power-over-Ethernet ports and the USB to I²C interface to support the HPA676. The HPA676 connects to the backplane board. The HPA676 has the TPS23851 PSE controller and a power supply for the TPS23851. It controls port connection to a valid PD.

Plug the HPA676 PCB assembly into the HPA677 backplane by aligning the three 10-pin connectors on each board. See Board alignment photo, [Figure 1](#).



Figure 1. Board Alignment

4.2 Power Supplies

Use either a laptop computer power supply or if not available, a lab power supply. No adjustment is necessary with the laptop supply. Just plug the supply into J17.

With the lab power supply, if used, you must disconnect the output, turn on the power supply and adjust the output voltage to 24 V +/-2 V. Adjust the supply current limit to 3 A. Connect the power supply output to J9-1 and the supply GND to J9-2.

Connector J16 can be used to by-pass the 24-V to 54-V converter. This may be done if there is need to vary 54 V when injecting a voltage into J16, remove any other input power at either J17 or at J9 when using J16.

4.3 USB Cable

Turn on the power supply first and then plug the USB connector. Green LED, D1 should turn on. [Figure 2](#) shows the interconnect boards with power supply, USB, and POE load attachment.



Figure 2. Components and Interconnects

5 GUI Setup

1. Create a folder for the GUI and the National Instrument's download.
2. Go to National Instruments website and download and install the **LabView Runtime Engine** to the new folder. Follow directions on screen. The download is free but you may be asked for a registration. Use this link to get the runtime engine: <http://joule.ni.com/nidu/cds/view/p/id/1101/lang/en>. Download **LVRTE86std.exe** and install.
3. Copy the attached file, [TPS23851 GUI Software](#), to the new folder on the PC and unzip. Go to folder TPS23851GUI and Double-click TPS23851.exe.
4. The GUI should start. Power the EVM and plug in a USB cable from computer to EVM. The green LED at D1 will turn on.

6 GUI Getting Started

The I²C device address is set in the hardware for address 20h. The GUI also defaults to this address. If a different address is needed, go to the GUI's right half of the screen's **Setup Tab** and enter the new I²C address. See [Figure 3](#).

Also in the **Setup Tab** screen, the 400-kHz I²C (default) is selected.

Leave the termination set to the default setting, open.

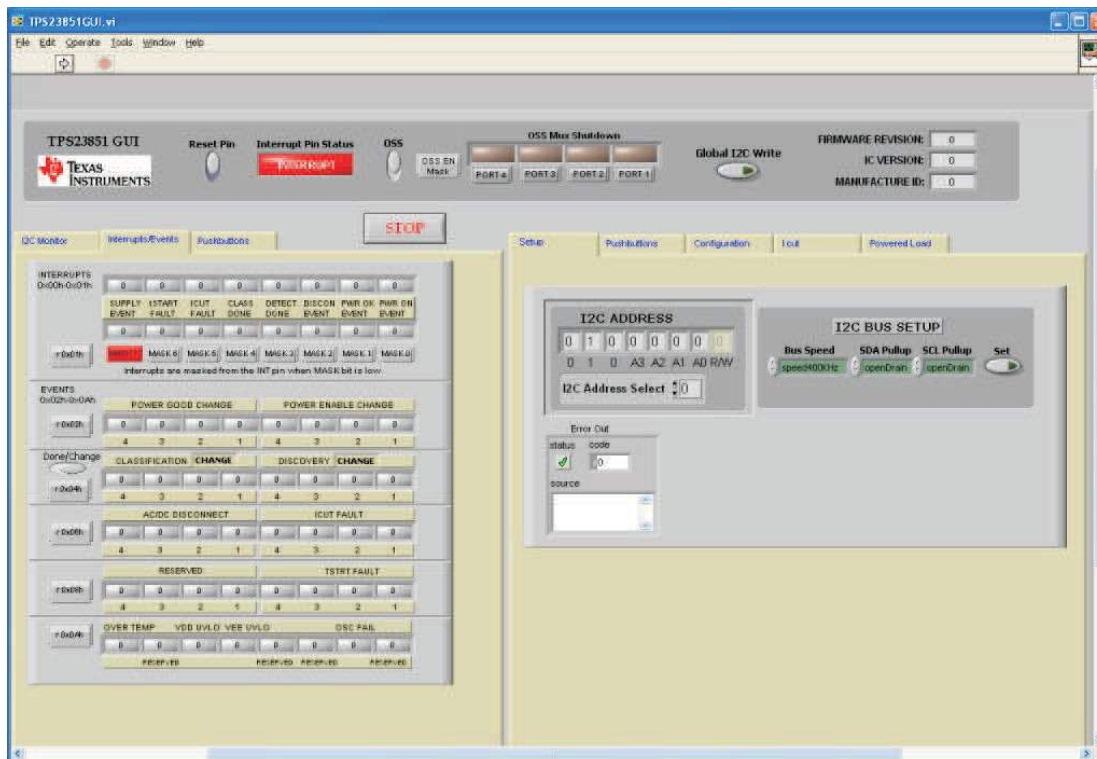


Figure 3. Interrupt/Events and Setup Tabs

Select the **Configuration Tab** (reference [Figure 4](#)). At the far right in the **Configuration Screen**, the selections are global which means they apply to all 4 ports. At the pull down that says **Manual**, select **AUTO**, and select the **r0x12h Button** just to the left of **AUTO**. The four columns to the left get set to **AUTO**.

To the left of **GLOBAL** on this same screen the window allows individual set up for each output port. Those selections are then applied using the **r0x12h Button** to the left of the four-port mode entries.

Detection and classification are initiated within the parameters of the mode already selected by either global or single port selection in the same way the mode was set. Then click the **r0x14h Button** to activate. Classification and detection can be set or cleared before initiation with the green **CLEN** and **DEN Rectangular Buttons**. The green LEDs turn on for good status indication.

Plug in a valid PD load to any of the four left-side ports and the load will be powered. The connectors are ordered Port 4 thru Port 1 where Port 4 is the leftmost connector. The right-side 4 connectors are not operational but are included for expansion. Left or right is determined by facing the port connectors plug input side.

After an operator action in the GUI, the resultant event may be checked in other GUI windows tabs such as **Events or Interrupts**. **Interrupt/Event Tabs** are shown in the left half of Figure 3. Follow the tabs to get to the proper window to check results.

RUN and STOP are in the upper left corner of the GUI screen. The GUI is running when the arrow is black filled.

Reset is not active from the GUI Button. Reset can be done through the on-board push button switch. Auto is grounded so all ports reset or power-up OFF.



Figure 4. GUI Buttons

7 HPA676 Test Points

Table 1. HPA676 Test Points

TEST POINT	SIGNAL NAME
TP1	PORT1_N
TP2	PORT1_P
TP3	GND
TP4	PSE_SDAI
TP5	GND
TP6	N48V_POE
TP7	PSE_SCL
TP8	PSE_SDAO
TP9	SDA
TP10	GND1
TP11	GND
TP12	GND
TP13	V3_3
TP14	N48V_POE
TP15	GND
TP16	OUT_P1
TP17	GATE_1
TP18	SEN_P1

8 HPA676 Test Point Connector

Table 2. HPA676 Test Point Connector

J4	SIGNAL NAME
1	GND
2	TSTA
3	Shutdown4
4	Shutdown2
5	Shutdown3
6	Shutdown1
7	INT
8	V3_3

9 Switches

- HPA676 - None
- HPA677 – S2 is a momentary **RESET** push button switch. This causes a reset to the TPS23851.

10 LEDs

- HPA677 - Green LED D1 indicates USB attach

11 Jumpers

- HPA676 - None
- HPA677 – See [Table 3](#)

Table 3. Jumper Function

JUMPER	FUNCTION	USER NOTES
J2	Hi / Lo speed USB input	J2 1-2, HI and J2 2-3, Lo
J4	Hi / Lo speed USB output	J4 2-3, HI and J21-2, Lo
J5	Manufacturing use	J5 must be ON
J10	Enable USB interface	J10 must be ON
J14	Manufacturing use	J14 must be OFF
J18	Manufacturing use	Must be position J18 1-2

12 HPA677 Test Points

Table 4. HPA677 Test Points

TEST POINT	SIGNAL NAME
TP1	54-V, output-side feedback
TP2	18-V to 60-V input (positive)
TP3	18-V to 60-V input (negative)
TP4	54-V, input-side feedback
TP5	54-V output
TP6	54-V negative / GND
TP7	RESET
TP8	Computer GND
TP9	GND
TP10	SCL
TP11	3.3-V out
TP12	3.3-V, input-side feedback
TP13	SDA

13 HPA676 Schematics

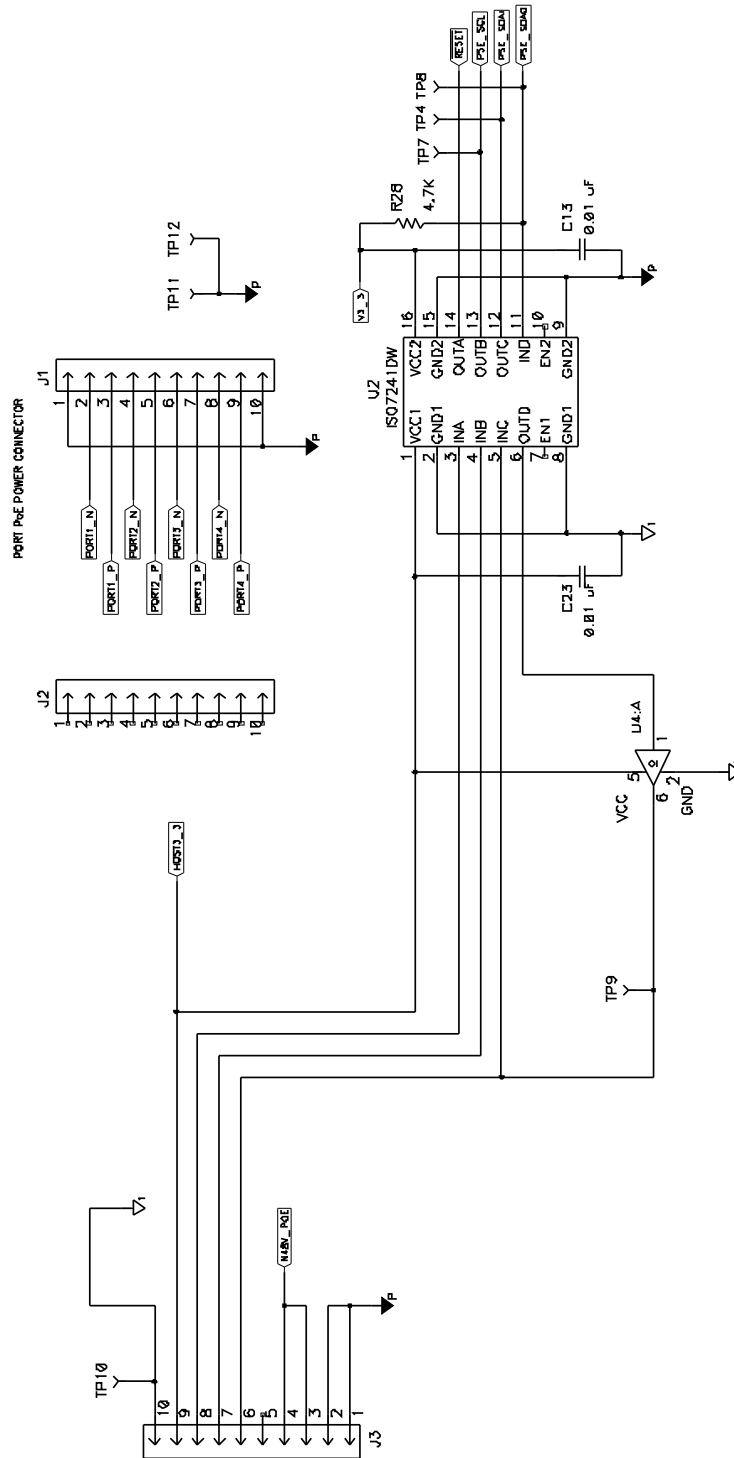


Figure 5. HPA676 Schematic 1

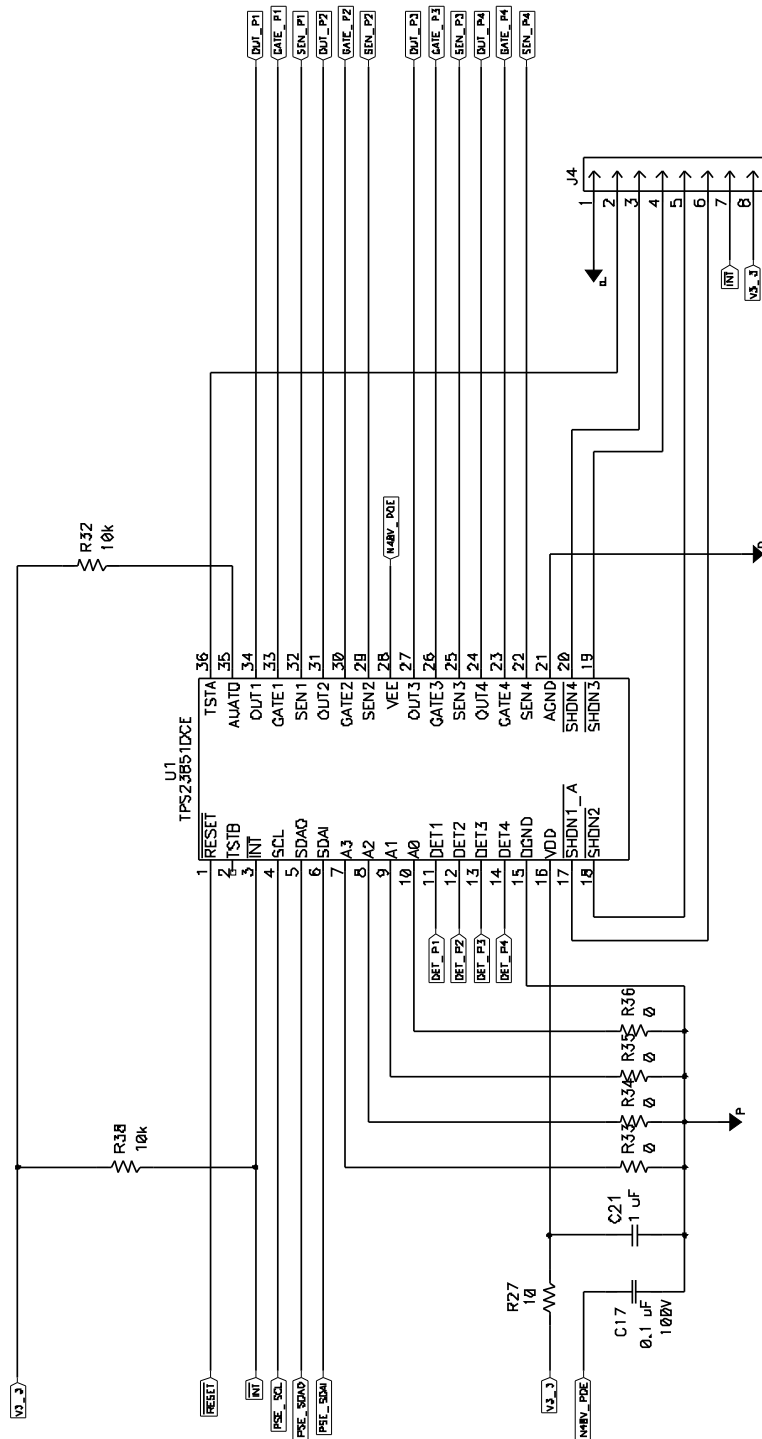


Figure 6. HPA676 Schematic 2

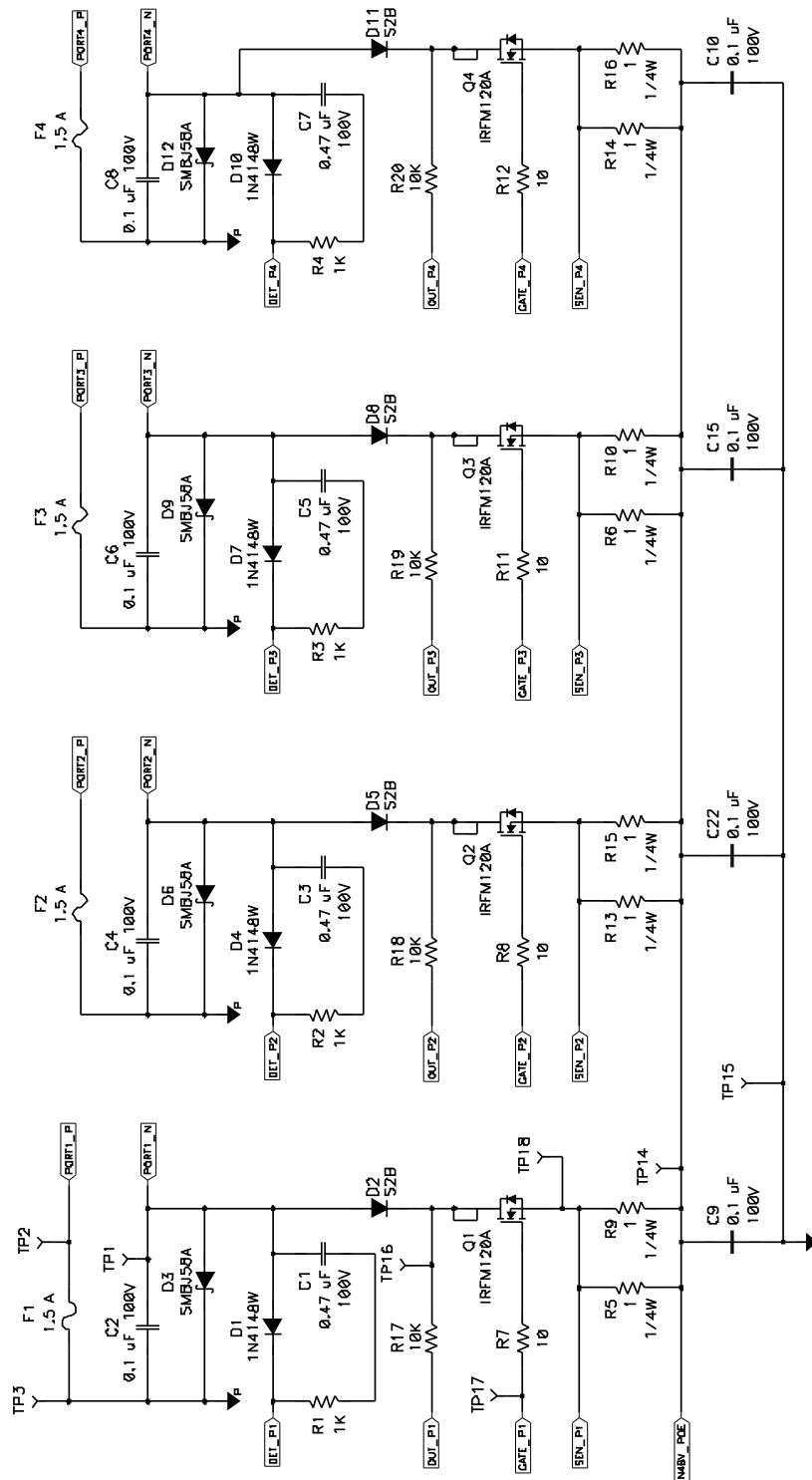


Figure 7. HPA676 Schematic 3

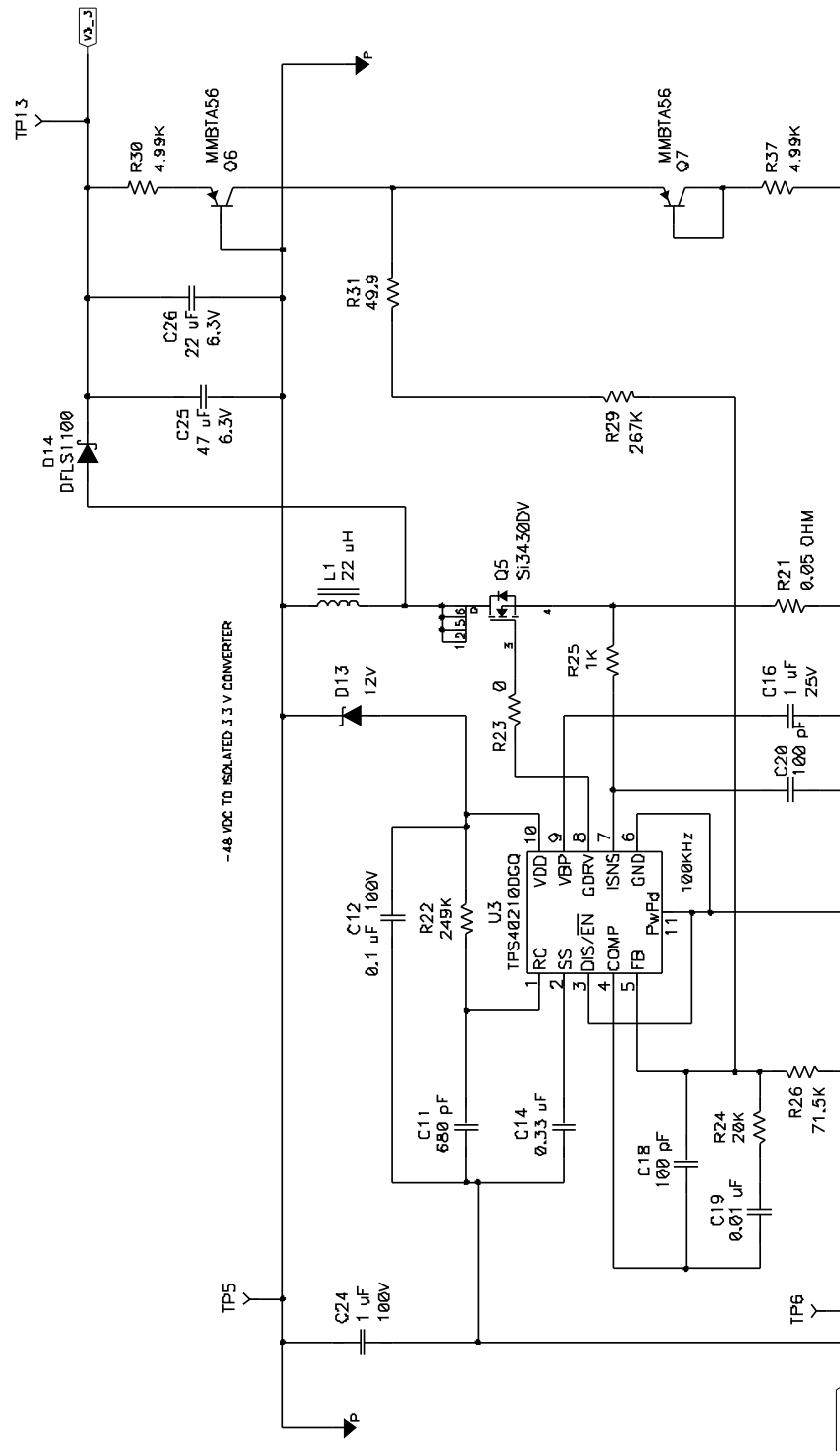


Figure 8. HPA676 Schematic 4

14 Layout HPA676

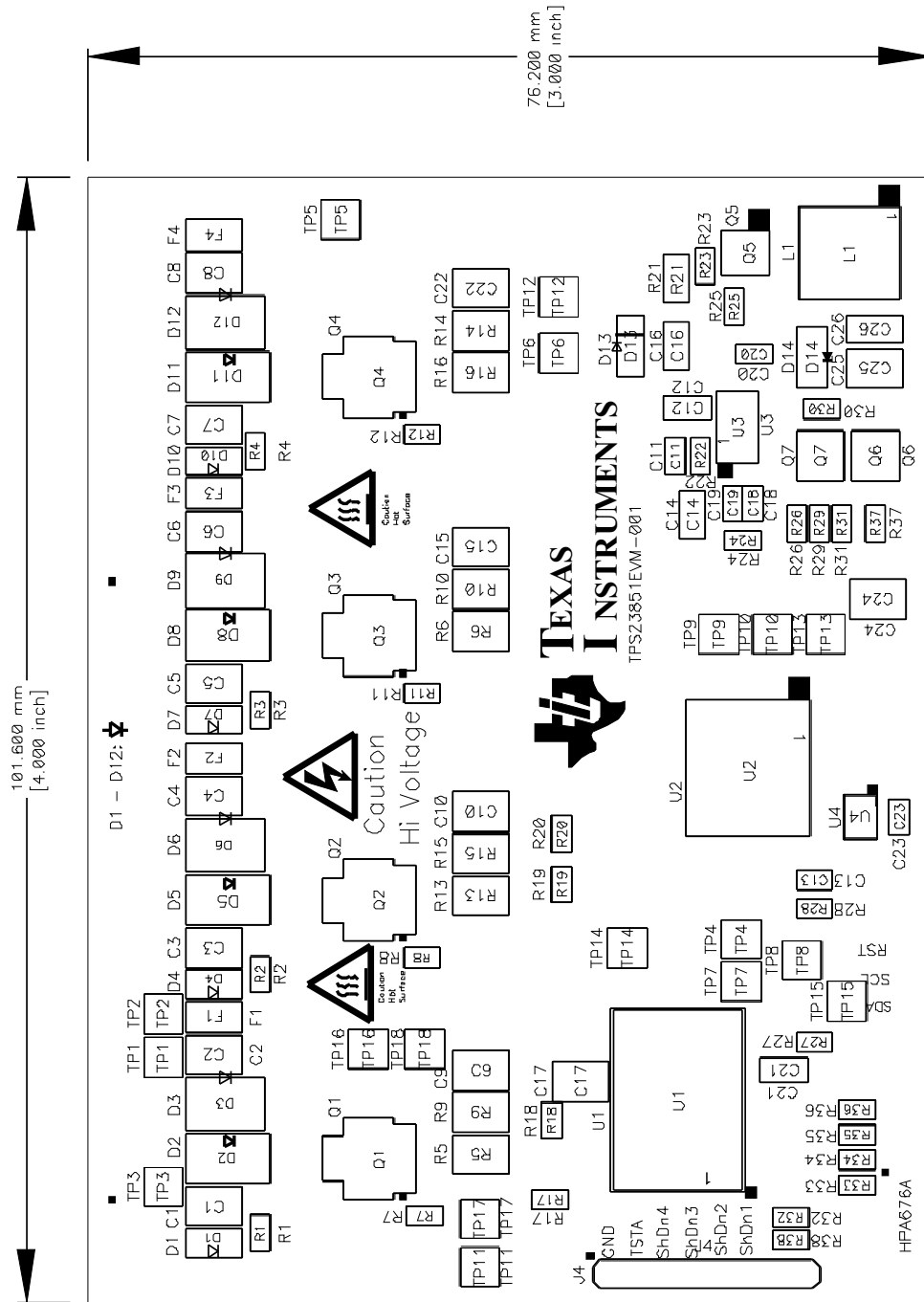


Figure 9. Board Layout (top view)

15 HPA676 List of Materials

Table 5. HPA676 List of Materials

COUNT	REF DES	DESCRIPTION	PART NUMBER	MFG
4	C1, C3, C5, C7	Capacitor, ceramic, 100 V, X7R, 10%, 0.47 μ F, 1210	STD	STD
1	C11	Capacitor, ceramic, 50 V, C0G, 5%, 680 pF, 0603	STD	STD
1	C12	Capacitor, ceramic, 100 V, X7R, 10%, 0.1 μ F, 0805	STD	STD
2	C13, C23, C19	Capacitor, ceramic, 16 V, X7R, 10%, 0.01 μ F, 0603	STD	STD
1	C14	Capacitor, Ceramic, 25 V, X7R, 10%, 0.33 μ F, 0805	STD	STD
1	C16, C21	Capacitor, ceramic, 25 V, X7R, 10%, 1 μ F, 0805	STD	STD
2	C18, C20	Capacitor, ceramic, 50 V, C0G, 5%, 100 pF, 0603	STD	STD
9	C2, C4, C6, C8, C9, C10, C15, C17, C22	Capacitor, ceramic, 100 V, X7R, 10%, 0.1 μ F, 1210	STD	STD
1	C24	Capacitor, ceramic, 100 V, X7R, 10%, 1 μ F, 1210	STD	STD
1	C25	Capacitor, ceramic, 6.3 V, X7R, 20%, 47 μ F, 1210	STD	STD
1	C26	Capacitor, ceramic, 6.3 V, X7R, 20%, 22 μ F, 1206	STD	STD
4	D1, D4, D7, D10	Diode, switch, 100 V, 400 mW, SOD-123	1N4148W-7-F	Diodes Inc
1	D13	Diode, ZENER, 12 V, 500 mW, SOD-123	MMSZ5242BT1G	On Semi
1	D14	Diode, Schottky, 100 V, 1 A, PowerDI 123	DFLS1100-7	Diodes, Inc.
4	D2, D5, D8, D11	Diode, LDO, 1.5 A, 100 V, overload, SMB	S2B-13-F	Diodes, Inc.
4	D3, D6, D9, D12	TVS unidirect, 600 W, 58 V, D0-214AA	SMBJ58A-13-F	Diodes, Inc.
4	F1, F2, F3, F4	Fuse, slim, SLO-BLO, 1.5 A, 63 V, 1.5 A, 1206	046801.5NR	Littelfuse
3	J1, J2, J3	Header, male, 10 pin, 100-mil spacing, 0.100 inch x 10 inch	PEC10SAAN	Sullins
1	J4	Header, male, 8 pin, 100-mil spacing, 0.100 inch x 8 inch	PEC08SAAN	Sullins
1	L1	Inductor shield PWR, 22 μ H, 0.300 in. sq.	DR74-220-R	Coiltronics
4	Q1, Q2, Q3, Q4	MOSFET, N-channel, 100 V 2.3 A, SOT-223	IRFM120ATF	Fairchild
1	Q5	MOSFET, N-channel, 100 V, 1.8 A, TSOP-6	SI3430DV-T1-E3	Vishay
2	Q6, Q7	Transistor, PNP, 80 V, MMBTA56, SOT23	MMBTA56-7-F	Diodes Inc.
5	R1, R2, R3, R4, R25	Resistor, 1/10 W, 1%, 1 k Ω , 0603	STD	STD
5	R17, R18, R19, R20, R32	Resistor, 1/10 W, 1%, 10 k Ω , 0603	STD	STD
0	R38	Resistor, 1/10 W, 1%, 10 k Ω , 0603	STD	STD
1	R21	Resistor, 1/8 W, 1%, 0.05 Ω , 0805	STD	STD
1	R22	Resistor, 1/10 W, 1%, 249 k Ω , 0603	STD	STD
1	R23, R33, R34, R35, R36	Resistor, 1/10 W, 0 Ω , 0603	STD	STD
1	R24	Resistor, 1/10 W, 1%, 20 k Ω , 0603	STD	STD
1	R26	Resistor, 1/10 W, 1%, 71.5 k Ω , 0603	STD	STD
1	R28	Resistor, 1/10 W, 1%, 4.7 k Ω , 0603	STD	STD
1	R29	Resistor, 1/10 W, 1%, 267 k Ω , 0603	STD	STD

Table 5. HPA676 List of Materials (continued)

COUNT	REF DES	DESCRIPTION	PART NUMBER	MFG
2	R30, R37	Resistor, 1/10 W, 1%, 4.99 k Ω , 0603	STD	STD
1	R31	Resistor, 1/10 W, 1%, 49.9 Ω , 0603	STD	STD
8	R5, R6, R9, R10, R13, R14, R15, R16	Resistor, 1/3 W, 1%, 1 Ω , 1210	STD	STD
5	R7, R8, R11, R12, R27	Resistor, 1/10 W, 1%, 10 Ω , 0603	STD	STD
18	TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12, TP13, TP14, TP15, TP16, TP17, TP18	Test point, white, thru hole, 5012, 0.125 inch x 0.125 inch	5012	Keystone
1	U1	quad IEEE 802.3 PoE PSE controller, SSOP	TPS23851DCE	TI
1	U2	1-Mbps digital isolators, SO-16	ISO7241ADW	TI
1	U3	4.5V-52V VIN Current Mode Boost Controller, MSOP-10PP	TPS40210DGQ	TI
1	U4	BUFF/DVR DL non-inv SC706, SOP-6	SN74LVC2G07DCKR	TI
1	--	PCB, 4 inch x 3 inch x 0.032 inch	Any	Any
1	Sub Assembly	PCB, 7.1 inch x 6.6 inch x 0.062 inch	HPA677	TI

16 HPA677 Schematics

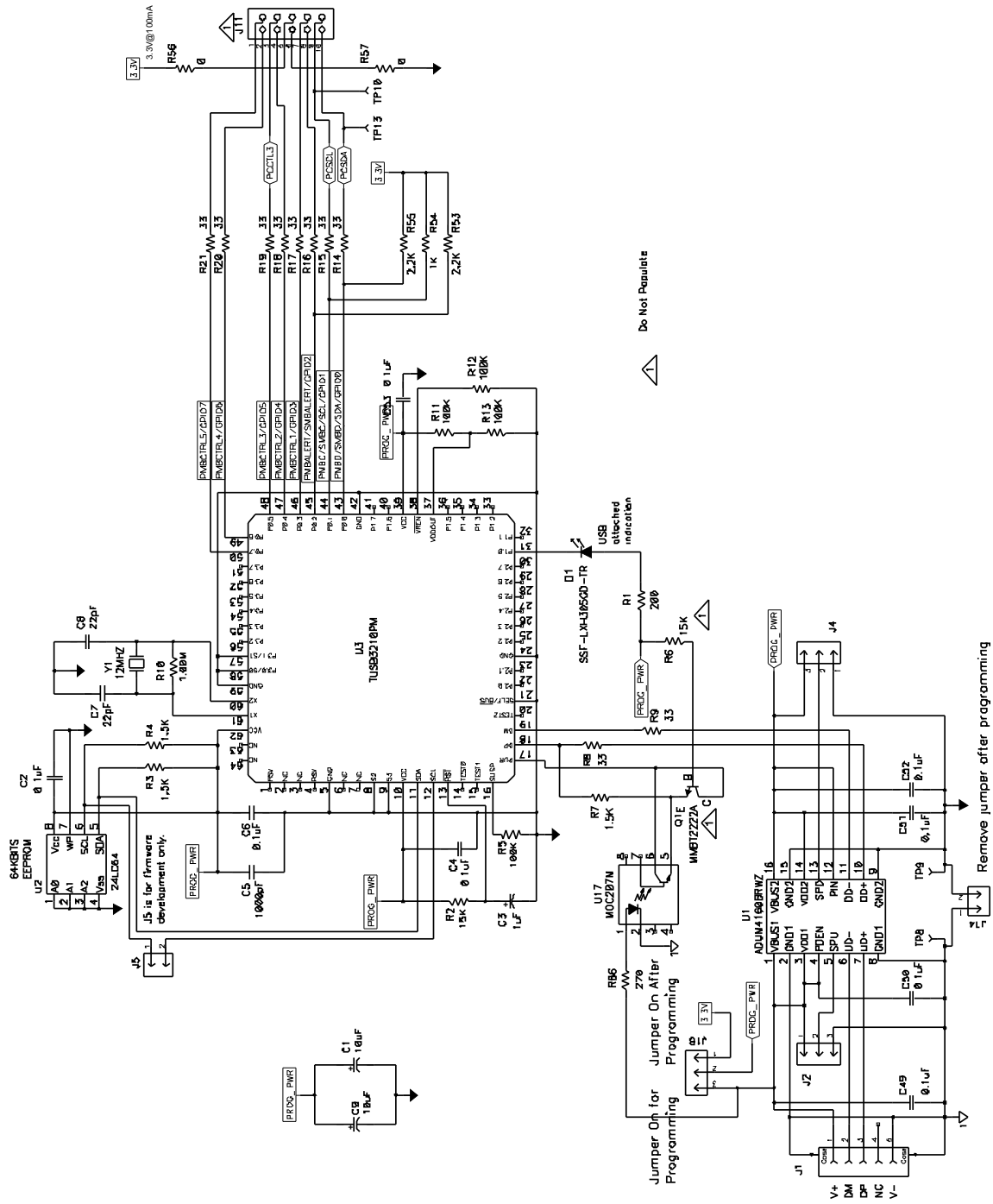


Figure 10. HPA677 Schematic 1

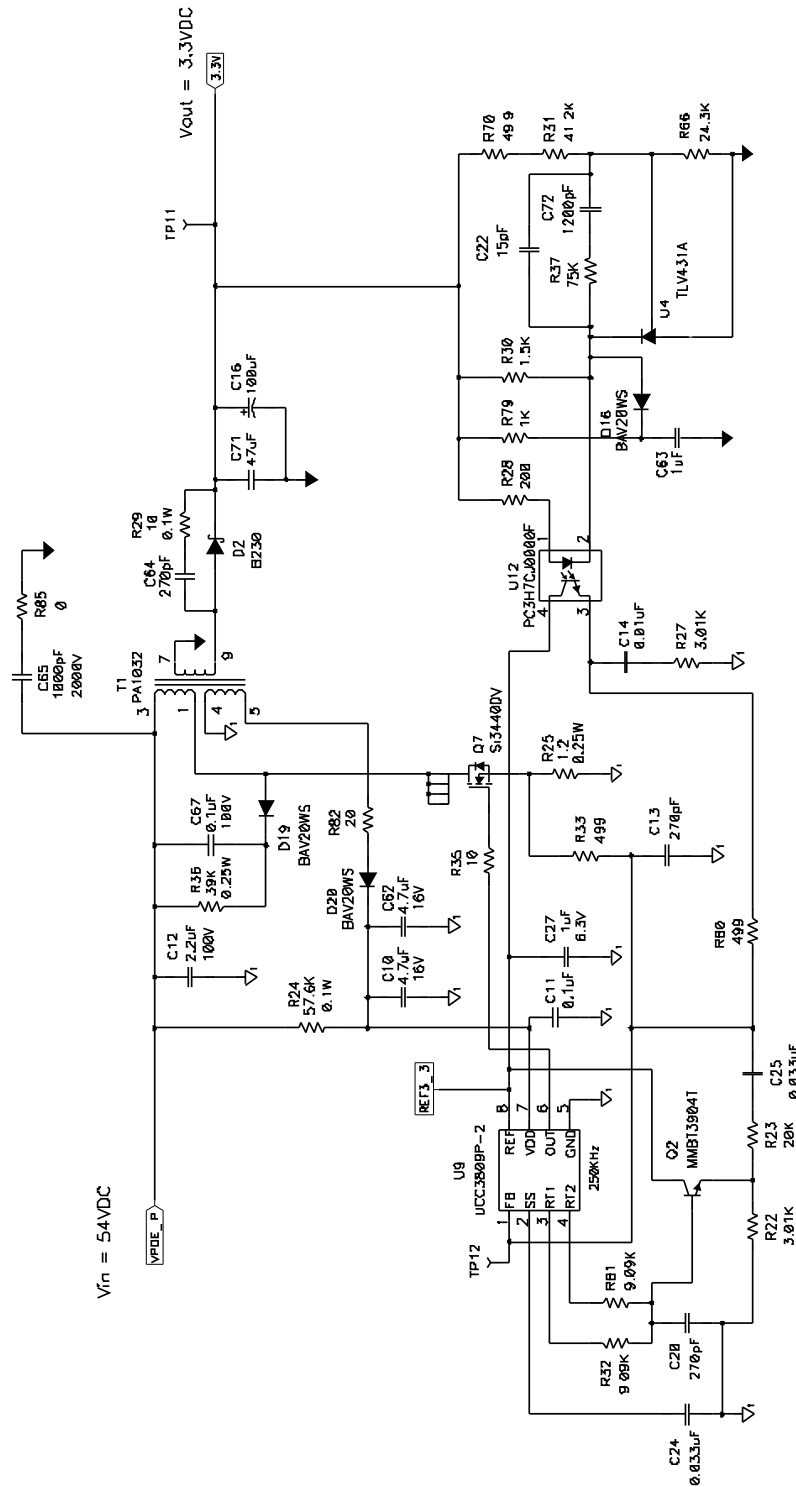


Figure 11. HPA677 Schematic 2

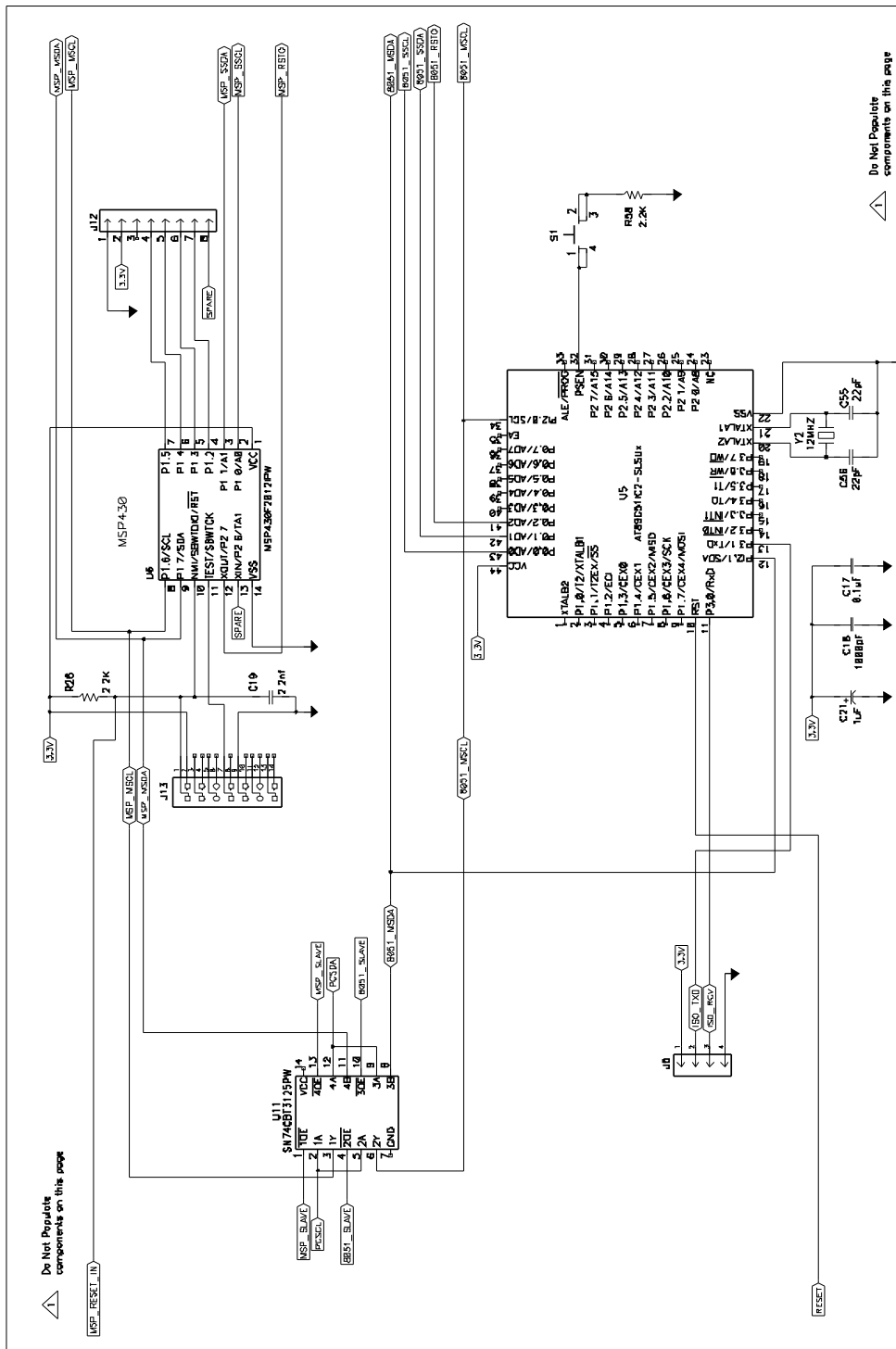


Figure 12. HPA677 Schematic 3

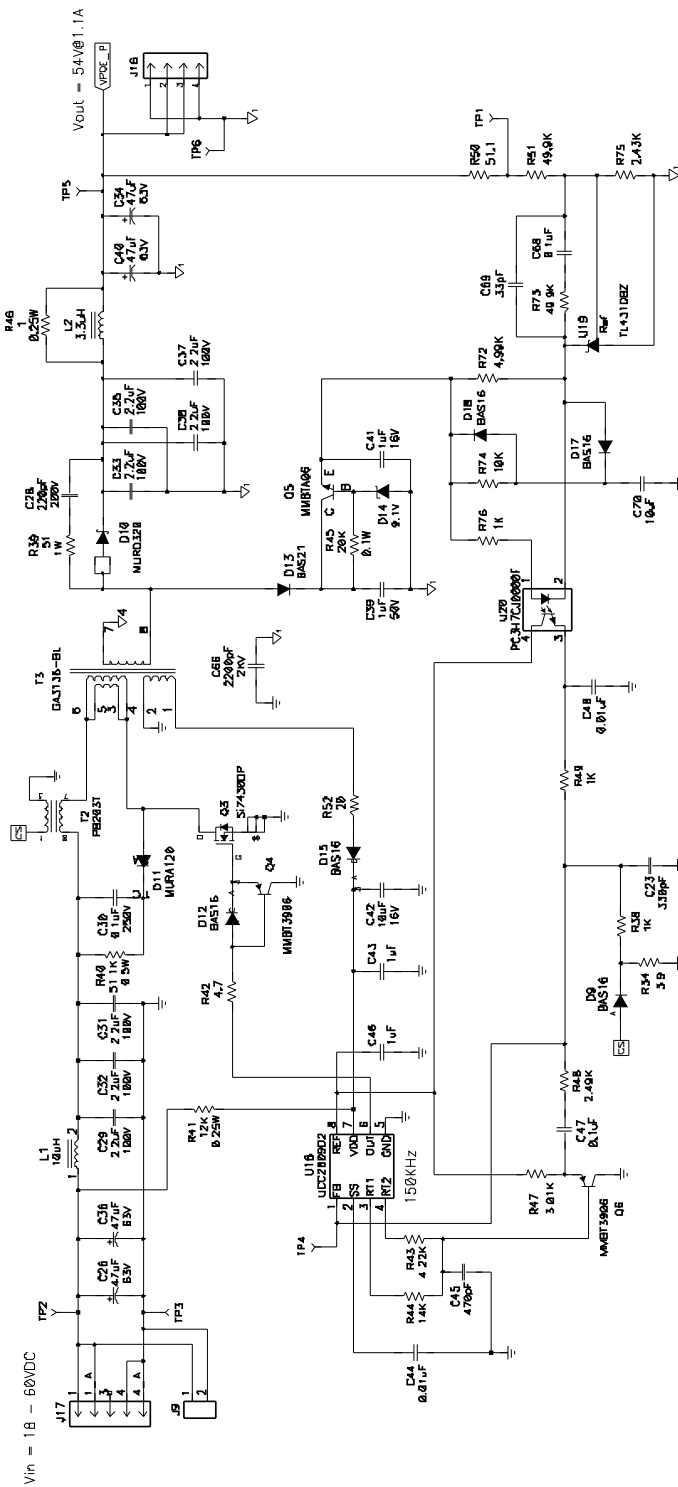


Figure 13. HPA677 Schematic 4

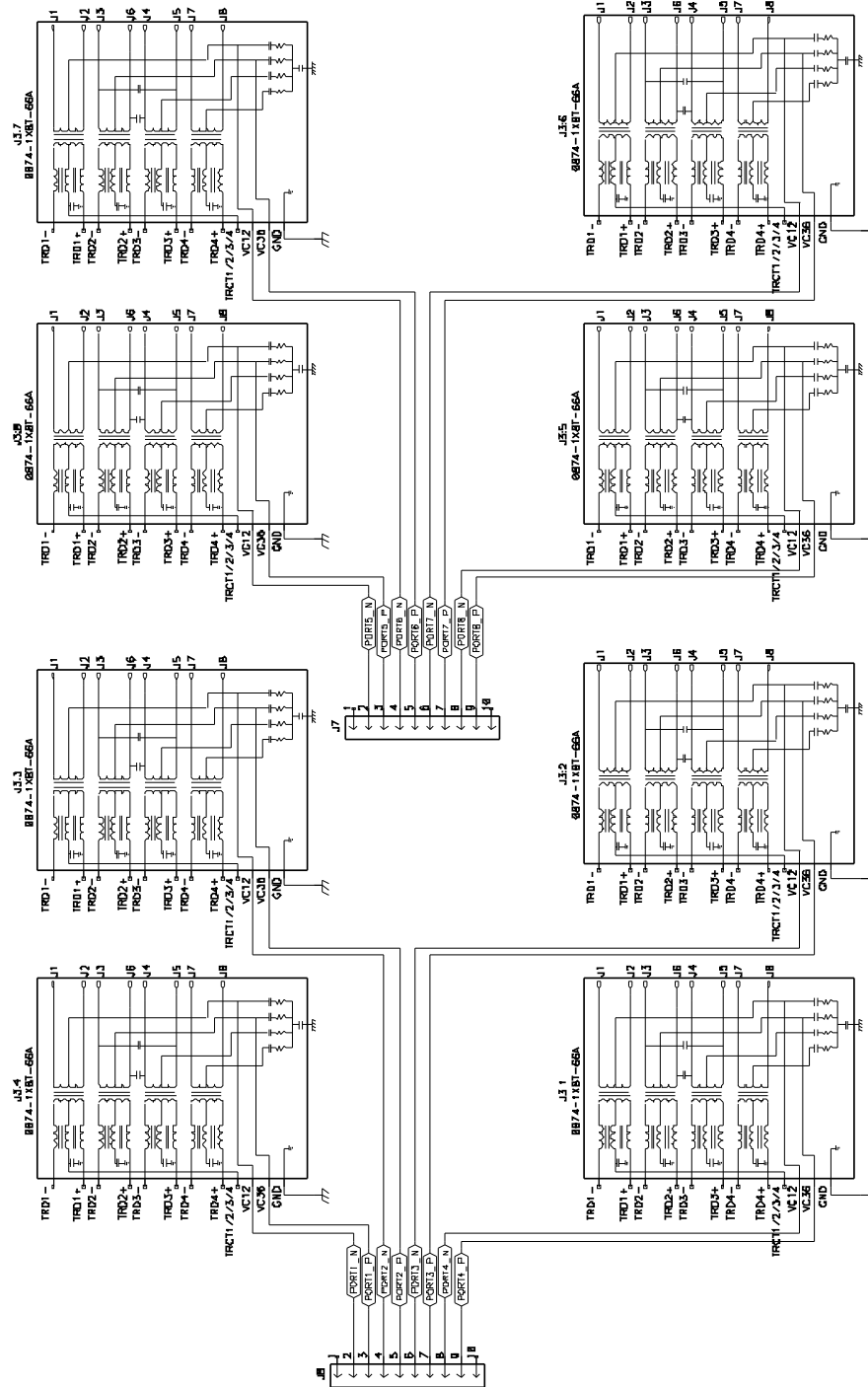


Figure 14. HPA677 Schematic 5

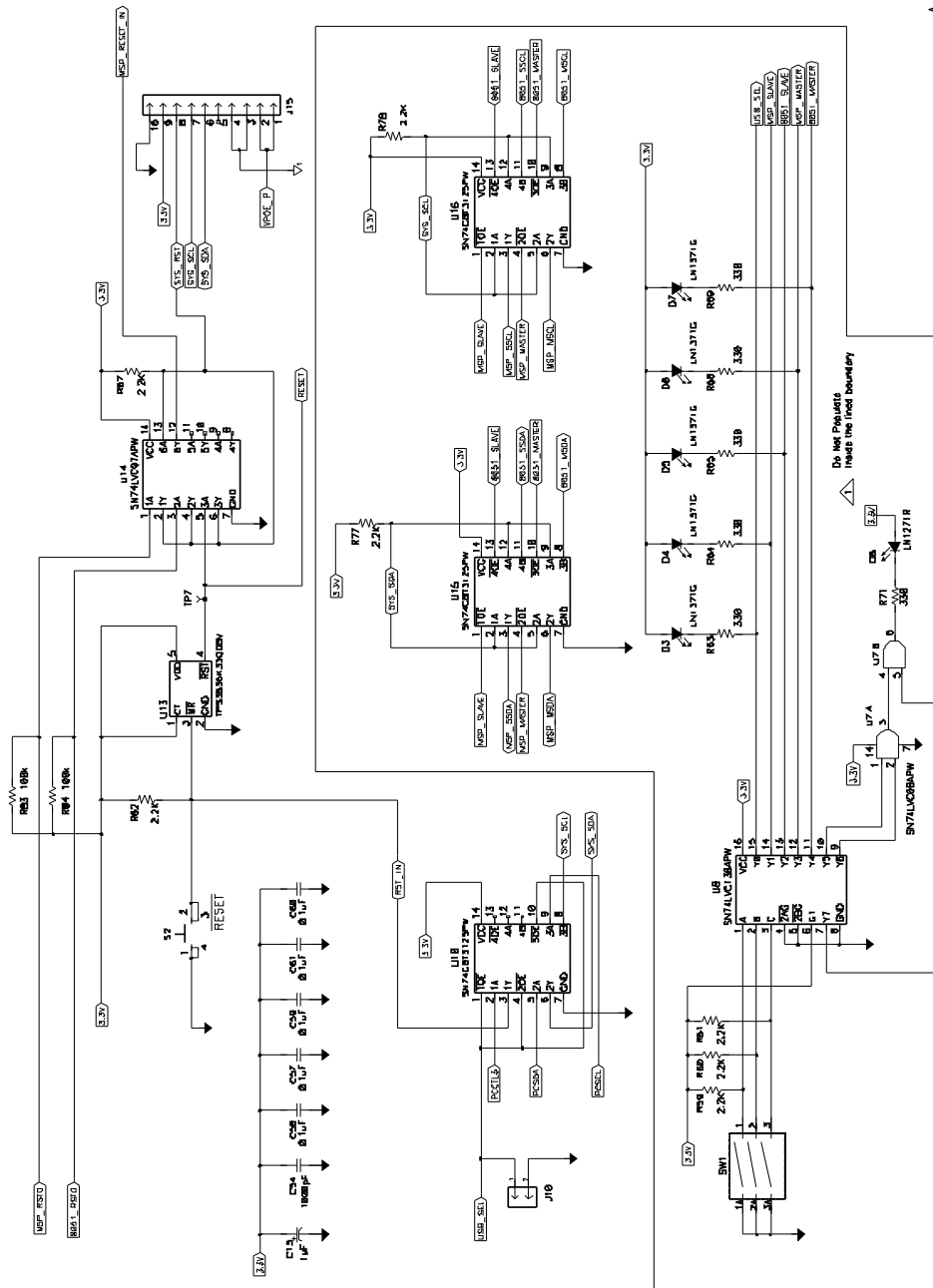


Figure 15. HPA677 Schematic 6

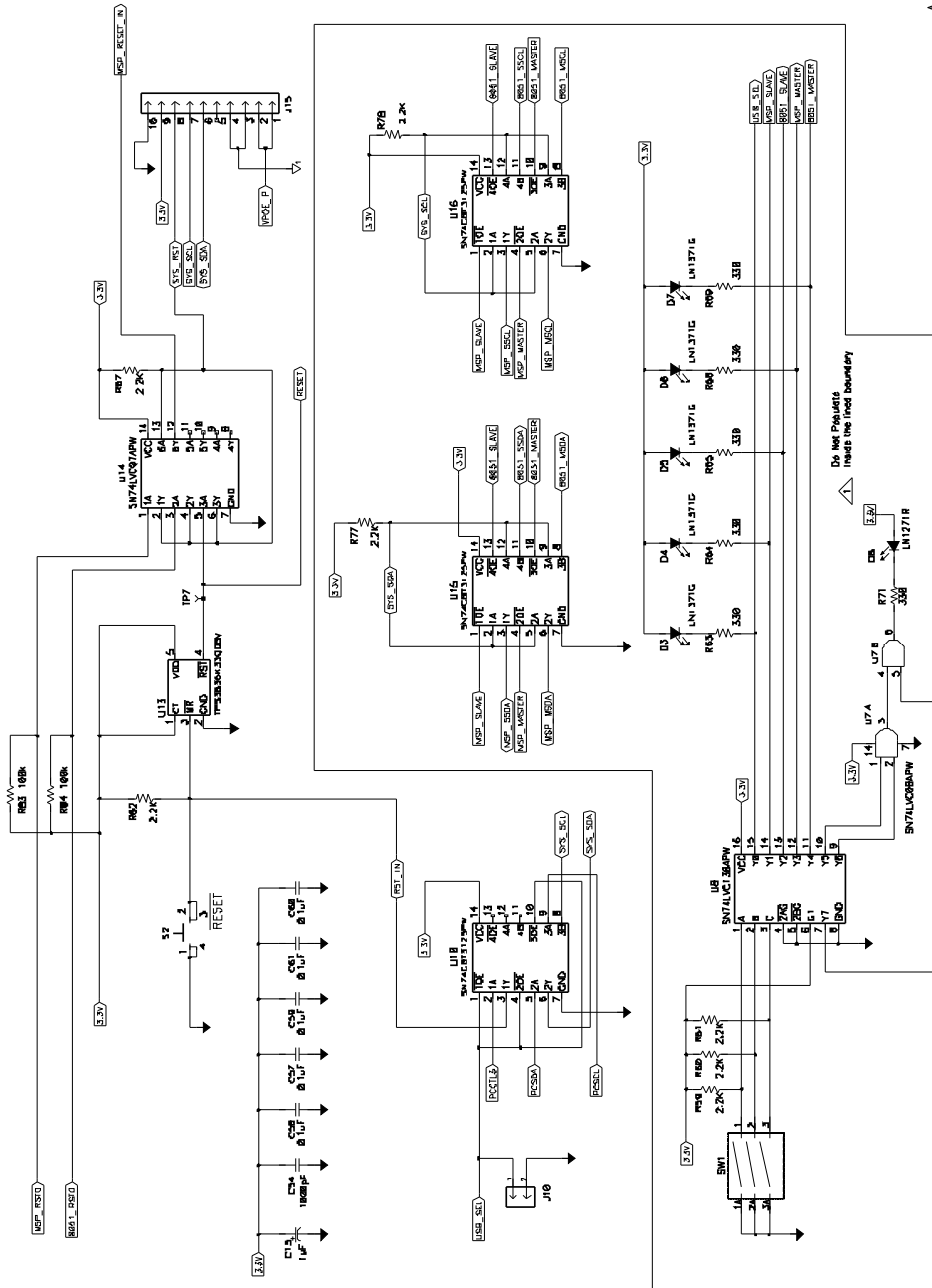


Figure 16. HPA677 Schematic 7

17 HPA677 List of Materials

Table 6. HPA677 List of Materials

COUNT	REF DES	DESCRIPTION	PART NUMBER	MFG
2	C1, C9	Capacitor, tant, 10 V, 20%, 10 μ F, 3216	293D106X0010A2TE3	Vishay
2	C10, C62	Capacitor, ceramic, 16 V, X7R, 10%, 4.7 μ F, 0805	STD	STD
8	C12, C29, C31, C32, C33, C35, C37, C38	Capacitor, ceramic, X7R, 100 V, 10%, 2.2 μ F, 1210	STD	STD
1	C13	Capacitor, ceramic, 270 pF, 50 V, C0G, 5%, 270 pF, 0402	STD	STD
1	C14	Capacitor, ceramic, 25 V, X7R, 10%, 0.01 μ F, 0402	STD	STD
1	C16	Capacitor, POSCAP, 6.3 V, 45 m Ω , 20%, 100 μ F, 6032 (C)	6TPB100MC	Sanyo
0	C19	Capacitor, ceramic, X7R, 50 V, 10%, 2.2 nf, 0603	STD	STD
13	C2, C4, C6, C11, C49, C50, C51, C52, C53, C57, C58, C59, C60, C61	Capacitor, ceramic, 25 V, X7R, 10%, 0.1 μ F, 0603	STD	STD
0	C17	Capacitor, ceramic, 25 V, X7R, 10%, 0.1 μ F, 0603	STD	STD
1	C20	Capacitor, ceramic, 50 V, C0G, 5%, 270 pF, 0402	STD	STD
1	C22	Capacitor, ceramic, 50 V, 5%, C0G, 15 pF, 0402	STD	STD
1	C23	Capacitor, ceramic, 50 V, NP0, 10%, 330 pF, 0603	STD	STD
2	C24, C25	Capacitor, Ceramic, 25 V, X7R, 10%, 0.033 μ F, 0402	STD	STD
4	C26, C34, C36, C40	Capacitor, ELECT, 63 V, FK, 47 μ F, 8 mm x 10.2 mm	EEV-FK1J470P	Panasonic
1	C27	Capacitor, ceramic, 6.3 V, X5R, 10%, 1 μ F, 0603	STD	STD
1	C28	Capacitor, ceramic, 5%, 200 V, NP0, 220 pF, 1206	STD	STD
2	C3, C15	Capacitor, TANT, 16 V, 20%, 1 μ F, 3216	293D105X0016A2TE3	Vishay
0	C21	Capacitor, TANT, 16 V, 20%, 1 μ F, 3216	293D105X0016A2TE3	Vishay
1	C30	Capacitor, ceramic, X7R, 250 V, 10%, 0.1 μ F, 1206	STD	STD
1	C39	Capacitor, ceramic, 50 V, X7R, 10%, 1 μ F, 1206	STD	STD
1	C41	Capacitor, ceramic, 16 V, X7R, 10%, 1 μ F, 0603	STD	STD
1	C42	Capacitor, ceramic, 16 V, X7R, 10%, 10 μ F, 1210	STD	STD
2	C43, C46, C63	Capacitor, ceramic, 25 V, X7R, 10%, 1 μ F, 0805	STD	STD
2	C44, C48	Capacitor, ceramic, 50 V, 10%, X7R, 0.01 μ F, 0603	STD	STD
1	C45	Capacitor, ceramic, 50 V, X7R, 10%, 470 pF, 0603	STD	STD
2	C47, C68	Capacitor, ceramic, 25 V, X7R, 10%, 0.1 μ F, 0603	STD	STD
2	C5, C54	Capacitor, ceramic, 100 V, C0G, 5%, 1000 pF, 0805	STD	STD
0	C18	Capacitor, ceramic, 100 V, C0G, 5%, 1000 pF, 0805	STD	STD
1	C64	Capacitor, ceramic, 50 V, C0G, 5%, 270 pF, 0603	STD	STD
1	C65	Capacitor, ceramic, 2000 V, X7R, 10%, 1000 pF, 1206	STD	STD
1	C66	Capacitor, ceramic, 2000 V, X7R, 10%, 2200 pF, 1812	STD	STD
1	C67	Capacitor, ceramic, 100 V, X7R, 10%, 0.1 μ F, 0805	STD	STD
1	C69	Capacitor, ceramic, 50 V, C0G, 5%, 33 pF, 0603	STD	STD
2	C7, C8	Capacitor, ceramic, 50 V, C0G, 5%, 22 pF, 0603	STD	STD
0	C55, C56	Capacitor, ceramic, 50 V, C0G, 5%, 22 pF, 0603	STD	STD
1	C70	Capacitor, ceramic, 16 V, X7R, 10%, 10 μ F, 0805	STD	STD
1	C71	Capacitor, ceramic, 6.3 V, X5R, 20%, 47 μ F, 1206	STD	STD

Table 6. HPA677 List of Materials (continued)

COUNT	REF DES	DESCRIPTION	PART NUMBER	MFG
1	C72	Capacitor, ceramic, 50 V, 10%, X7R, 1200 pF, 0402	STD	STD
1	D1	LED, ALINGAP, RA, green, DIF, 565 NM, 0.250 inch x 0.250 inch	SSF-LXH305SGD-TR	Lumex
1	D10	Diode, ultra fast, 3 A, 200 V, TO-252AA	MURD320	On Semi
1	D11	Diode, ultra fast, 1 A, 200 V, SMA	MURA120T3G	On Semi
1	D13	Diode, GP, 250 V, SOT23	BAS21	Fairchild
1	D14	Diode, ZENER, 9.1 V, 225 mW, 9.1 V, SOT-23	BZX84C9V1LT1G	On Semi
3	D16, D19, D20	Diode, GP, 200 V, 200 mA, SOD-323	BAV20WS-TP	Micro Commercial
1	D2	Diode, SCHOTTKY, 2 A, 30 V, SMB	MBRS230LT3G	On Semi
0	D3, D4, D5, D6, D7	LED, GRN, S-TYPE, GULL WING, 0.068 inch x 0.049 inch	LNJ306G5TR02	Panasonic
0	D8	LED, red, S-GW type, SMD, 0.068 inch x 0.049 inch	LN1271RALTRP	Panasonic
5	D9, D12, D15, D17, D18	Diode, switch, 75 V, 200 mA, SOT-23	BAS16LT3G	On Semi
1	J1	Connector, recpt, USB-B, mini, 5 pins, SMT, 0.354 inch x 0.303 inch	UX60-MB-5ST	Hiroise Electrical Co
2	J10, J14	Header, male, 2 pin, 100-mil spacing, 0.100 inch x 2 inch	PEC02SAAN	Sullins
0	J11	Connector, male, right angle, 2 x 5 pin, 100-mil spacing, 4 wall, 0.607 inch x 0.484 inch	9-146257-0-05	Tyco
0	J12	Header, male, 8 pin, 100-mil spacing, 0.100 inch x 8	PEC08SAAN	Sullins
0	J13	Header, male, 2 x 7 pin, 100-mil spacing, 0.100 inch x 2 inch x 7 inch	PEC07DAAN	Sullins
1	J16	Term, blk, hdr, PCB, 4POS, 3.81 mm, green, 0.280 inch x 1.000 inch	1793810000	Weidmuller
1	J17	Connector, DC power jack, ra, 3 position, 0.394 inch x 0.433 inch	JPD1135-509-7F	Foxconn
1	J3	Connector, PoE, 1 x 8 gigabit Magjack, 1.550 inch x 4.550 inch	0874-1X8T-66A	Bell
2	J4, J18	Header, male, 3 pin, 100-mil spacing, 0.100 inch x 3 inch	PEC03SAAN	Sullins
0	J6	Header, male, 4 pin, 100-mil spacing, 0.100 inch x 4 inch	PEC04SAAN	Sullins
3	J7, J8, J15	Header, female 10 pin, 100-mil spacing, 0.100 inch x 10 inch	PPTC101LFBN-RC	Sullins
1	J9	Terminal block, 5.08 mm, vertical, 2 position, 0.40 inch x 0.35 inch	ED120/2DS	On Shore Technology
1	L1	Inductor, SMT, 3.8 A, 38 mΩ, 10 μH, 9.4 mm x 12.95 mm	DO3316P-103ML	Coilcraft
1	L2	Inductor, SMT, 2 A, 80 mΩ, 3.3 μH, 0.26 inch x 0.09 inch	DO1608C-332ML	Coilcraft
0	Q1	Transistor, NPN, GP, 40 V, SOT-23	MMBT2222A-TP	Micro Commercial
1	Q2	Transistor, GP, SS, NPN, 40 V, SC-75	MMBT3904TT1G	On Semi
1	Q3	MOSFETs, 150 V, 26 A, 64 W, 45 mΩ at 10 V, PWRPAK S0-8	Si7430DP-T1-E3	Vishay
2	Q4, Q6	Transistor, SS, PNP, 40 V, 300 mW, SOT23	MMBT3906-TP	Micro Commercial
1	Q5	Transistor, NPN, 80 V, SOT23	MMBTA06-7-F	Diodes Inc
1	Q7	MOSFET, N-channel, 150 V, 1.2 A, TSOP-6	SI3440DV-T1-E3	Vishay
1	R1	Resistor, 1/10 W, 1%, 200, 603	STD	STD
1	R10	Resistor, 1/10 W, 1%, 1.00M, 603	STD	STD
4	R11, R5, R12, R13	Resistor, 1/10 W, 1%, 100K, 603	STD	STD
1	R2	Resistor, 1/10 W, 1%, 15K, 603	STD	STD
0	R6	Resistor, 1/10 W, 1%, 15K, 603	STD	STD

Table 6. HPA677 List of Materials (continued)

COUNT	REF DES	DESCRIPTION	PART NUMBER	MFG
2	R22, R27	Resistor, 1/16 W, 1%, 3.01K, 402	STD	STD
1	R23	Resistor, 1/16 W, 1%, 20K, 402	STD	STD
1	R24	Resistor, 1/8 W, 1%, 57.6K, 805	STD	STD
1	R25	Resistor, 1/4 W, 1%, 1.2, 1206	STD	STD
6	R53, R55, R62, R67, R77, R78	Resistor, 1/10 W, 1%, 2.2K, 603	STD	STD
0	R26, R58, R59, R60, R61	Resistor, 1/10 W, 1%, 2.2K, 603	STD	STD
1	R28	Resistor, 1/16 W, 1%, 200, 402	STD	STD
1	R29	Resistor, 1/8 W, 1%, 10, 805	STD	STD
3	R3, R4, R7	Resistor, 1/10 W, 1%, 1.5K, 603	STD	STD
1	R30	Resistor, 1/16 W, 1%, 1.5K, 402	STD	STD
1	R31	Resistor, 1/16 W, 1%, 41.2K, 402	STD	STD
2	R32, R81	Resistor, 1/16 W, 1%, 9.09K, 402	STD	STD
2	R33, R80	Resistor, 1/16 W, 1%, 499, 402	STD	STD
1	R34	Resistor, 1/8 W, 1%, 3.9, 805	STD	STD
1	R35	Resistor, 1/10 W, 1%, 10, 603	STD	STD
1	R36	Resistor, 1/4 W, 1%, 39K, 1206	STD	STD
1	R37	Resistor, 1/16 W, 1%, 75K, 402	STD	STD
4	R38, R49, R76, R54	Resistor, 1/10 W, 1%, 1K, 603	STD	STD
1	R39	Resistor, 1 W, 1%, 51, 2512	STD	STD
1	R40	Resistor, 1/2 W, 1%, 51.1K, 2010	STD	STD
1	R41	Resistor, 1/4 W, 1%, 12K, 1206	STD	STD
1	R42	Resistor, 1/10 W, 1%, 4.7, 603	STD	STD
1	R43	Resistor, 1/10 W, 1%, 4.22K, 603	STD	STD
1	R44	Resistor, 1/10 W, 1%, 14K, 603	STD	STD
1	R45	Resistor, 1/8 W, 1%, 20K, 805	STD	STD
1	R46	Resistor, 1/4 W, 1%, 1, 1206	STD	STD
1	R47	Resistor, 1/10 W, 1%, 3.01K, 603	STD	STD
1	R48	Resistor, 1/10 W, 1%, 2.49K, 603	STD	STD
1	R50	Resistor, 1/10 W, 1%, 51.1, 603	STD	STD
2	R51, R73	Resistor, 1/10 W, 1%, 49.9K, 603	STD	STD
2	R52, R82	Resistor, 1/10 W, 1%, 20, 603	STD	STD
2	R56, R57	Resistor, 1/10 W, 0, 603	STD	STD
0	R63, R64, R65, R68, R69, R71	Resistor, 1/8 W, 1%, 330, 805	STD	STD
1	R66	Resistor, 1/16 W, 1%, 24.3K, 402	STD	STD
1	R70	Resistor, 1/16 W, 1%, 49.9, 402	STD	STD
1	R72	Resistor, 1/10 W, 1%, 4.99K, 603	STD	STD
1	R74	Resistor, 1/10 W, 1%, 10K, 603	STD	STD
1	R75	Resistor, 1/10 W, 1%, 2.43K, 603	STD	STD
1	R79	Resistor, 1/16 W, 1%, 1K, 402	STD	STD

Table 6. HPA677 List of Materials (continued)

COUNT	REF DES	DESCRIPTION	PART NUMBER	MFG
10	R8, R9, R14, R15, R16, R17, R18, R19, R20, R21	Resistor, 1/10 W, 1%, 33, 603	STD	STD
2	R83, R84	Resistor, 1/10 W, 1%, 100k, 603	STD	STD
1	R85	Resistor, metal film, 1/4 watt, \pm 5%, 0, 1206	STD	STD
1	R86	Resistor, 1/10W, 1%, 270, 603	STD	STD
0	S1	SWITCH, TACT, 2.36MM, SILV J-LEAD, 0.245 inch x 0.251 inch	KT11P2JM34LFS	STD
1	S2	SWITCH, TACT, 2.36MM, SILV J-LEAD, Reset, 0.245 inch x 0.251 inch	KT11P2JM34LFS	STD
0	SW1	SWITCH, SPST, GOLD, 3 SEC, Mode Select, 0.380 inch x 0.385 inch	206-3	STD
1	T1	Transformer, Flyback, 0.490 inch X 0.450 inch	PA1032	PULSE
1	T2	Transformer, Current Sense, 6A, 100Khz, 30:1, 0.330 inch x 0.360 inch	P8203T	Pulse
1	T3	Transformer, 1.053 inch x 1.285 inch	GA3136-BL	Coilcraft
13	TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12, TP13	Test Point, White, Thru Hole, 5012, 0.125 inch x 0.125 inch	5012	Keystone
1	U1	USB, ISOLATOR, FULL/LOW, SO-16	ADUM4160BRWZ	AD
0	U11, U15, U16	QUAD, FET, BUS, SW, TSSOP-14	SN74CBT3125PW	TI
2	U12, U20	PHOTOCOUPLER, TRAN OUT, MF4	PC3H7CJ0000F	STD
1	U13	Nanopower, Supervisory Circuits, SOT23-5	TPS3833QDBV	TI
1	U14	Hex Buffers/Drivers With Open-Drain Outputs, TSSOP-14	SN74LVC07APW	TI
1	U17	Optocoupler Trans Output, 60mA, 70V, SO	MOC207M	Fairchild
1	U18	Economy Primary-Side Controller, SO8	UCC2809D-2	TI
1	U19	PREC SHUNT, REG ADJ, SOT23-3	TL431IDBZR	TI
1	U2	SRL EEPROM, 8KX8, 2.5V, SO8	24LC64F-I/SN	TI
1	U3	USB CNTRLR STORAGE, TUSB3210PM, 0.480 inch x 0.480 inch	24LC64F-I/SN	TI
1	U4	Shunt Regulator, 1.24V, Ref, 6V, 10mA, 1%, SOT23-5	TLV431ACDBVR	TI
0	U5	MCU FLASH 32K, PLCC, 8051	AT89C51IC2-SLSUL	TI
0	U6	MCU 16BIT, 2K, FLASH, TSSOP-14	MSP430F2012IPWR	TI
1	U7	QUAD, 2-IN AND GATE, TSSOP-14	SN74LVC08APWR	TI
0	U8	3-8 DECODER/DEMUX, TSSOP-16	SN74LVC138APWR	TI
1	U9	PRIMARY-SIDE CTRLR, MSOP-8	UCC3809P-2	TI
1	Y1	Crystal, 20pF, +/- 50PPM at 25°C, 12MHZ, 0.185 inch x 0.532 inch	CY12BPSMD	Cypress
0	Y2	Crystal, 20pF, +/- 50PPM at 25°C, 12MHZ, 0.185 inch x 0.532 inch	CY12BPSMD	Cypress
1	--	PCB, 7 inch x 6.5 inch x 0.032 inch		
4	--	Shunt, 100 mil, black, 0.100		
5	-REF-	Bumper, rubber	2566	SPC Tech

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