78M6610+PSU Evaluation Kit
User Manual

April 2013
Rev 2

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1 Introduction

The 78M6610+PSU Evaluation Kit is a design example of a modular daughter card for integration into AC-DC power-supply units. The kit demonstrates the capabilities and performance of 78M6610+PSU energy measurement device in both the 16-pin and 24-pin packages.

The kit is connected to a PC through a USB cable that provides both power and data communication to the board. A Windows®-based graphical user interface (GUI) communicates with the device over the serial UART interface for simplified access to measurement data and controls.

1.1 Ordering Information

PART	TYPE
78M6610+PSU/EV#1	Evaluation Kit

#Denotes a RoHS-compliant device that may include lead that is exempt under the RoHS requirements.

1.2 Package Contents

The following are included with the 78M6610+PSU Evaluation Kit:

- 78M6610+PSU Evaluation Boards (16/24-pin)
- Shunt Adaptor Board
- USB Cable Assembly USB A-B 28/24 1.8M (Tyco/Amp 1487588-3)
- CD with Documentation, GUI Application, and USB Drivers

1.3 System Requirements

In addition to an AC source and load for measuring, the 78M6610+PSU Evaluation Kit requires use of a PC with the following features:

- 1GHz processor and 1GB RAM
- Minimum 1024 x 768 video display resolution
- Available USB port
- Microsoft Windows 7 or Windows XP®
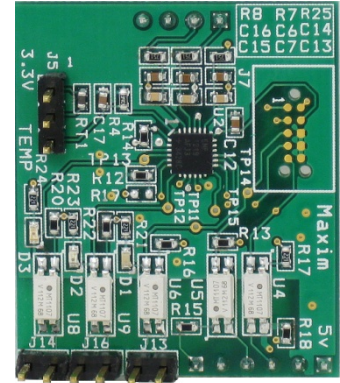
Windows and Windows XP are registered trademarks of Microsoft Corp.

Figure 1: 78M6610+PSU Evaluation Kit Application Diagram

1.4 Safety and ESD Notes

EXERCISE CAUTION WHEN LIVE AC VOLTAGES ARE PRESENT!

Standard ESD precautions must be taken when handling electronic equipment. The 78M6610+PSU contains ESD protected interfaces.

Do not connect test equipment or external development boards directly to the 78M6610+PSU hardware. Damage to the 78M6610+PSU and external equipment will occur due to the 78M6610+PSU's "high side" reference topology. The 78M6610+PSU's V3P3 supply rail (i.e., "high side") is connected directly to Neutral (Earth Ground) creating a ground reference disparity with any properly grounded external equipment.

The board components and firmware settings are designed to operate with the following nominal AC electrical ranges:

Voltage	Current	Line Frequency
10–240 VAC	10mA–20A	46–64Hz

1.5 Testing the 78M6610+PSU Boards Prior to Shipping

Before every 78M6610+PSU Kit is shipped, the following procedures have been performed at the factory:

- Full Calibration – Precise energy source equipment is used to calibrate the current, voltage, and ambient temperature for both the 16-pin and 24-pin daughter cards
- Accuracy Test – A "bench" level test ensures the energy accuracy is within ±0.5%.

2 Installation

2.1 USB Driver Installation

This Evaluation Kit includes an isolated USB interface for serial communications with a PC. The FTDI USB controller IC FT232R performs the USB functions. The FTDI Windows driver presents a virtual COM port for enabling serial communications. The FTDI Windows driver is a certified driver for Windows XP and Windows 7.

Upon attaching the 78M6610+PSU Evaluation Kit to the PC, the **Found New Hardware Wizard** should automatically launch and install the appropriate driver files. If your PC does not find the FTDI driver files on its local hard disk drive, locate and reference the FTDI USB Driver and Utilities subdirectory on the CD. The FT232R controller is powered from the USB cable and is active even when no AC power is applied to the 78M6610+PSU Evaluation Kit.

Note: If an older FTDI driver has been previously installed, it is recommended to remove the older version before installing this newer FTDI driver. Execute the **ftdiClean.exe** utility from the FTDI USB Driver and Utilities subdirectory.

For FTDI driver support on other operating systems, refer to FTDI's website at www.ftdichip.com.

2.2 Confirm COM Port Mapping

- Launch the **Control Panel** and click on the **System** icon.
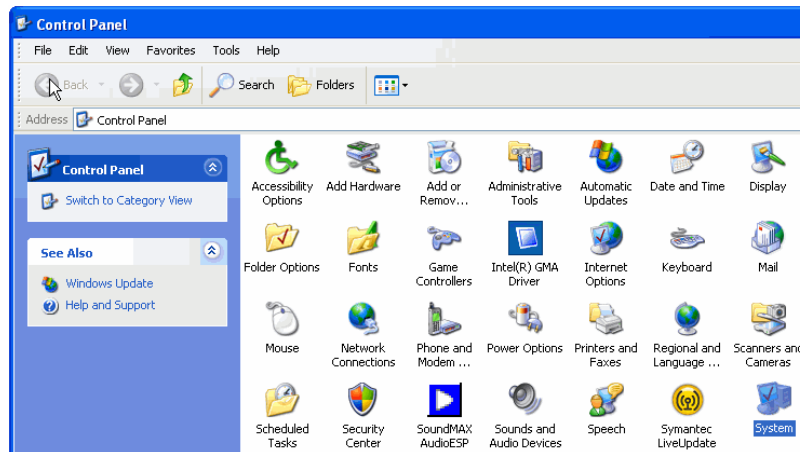
- The **System Properties** screen appears. Click on the **Hardware** tab. Click on **Device Manager**. Under **Ports (COM & LPT)**, look for the **USB Serial Port** assignment.
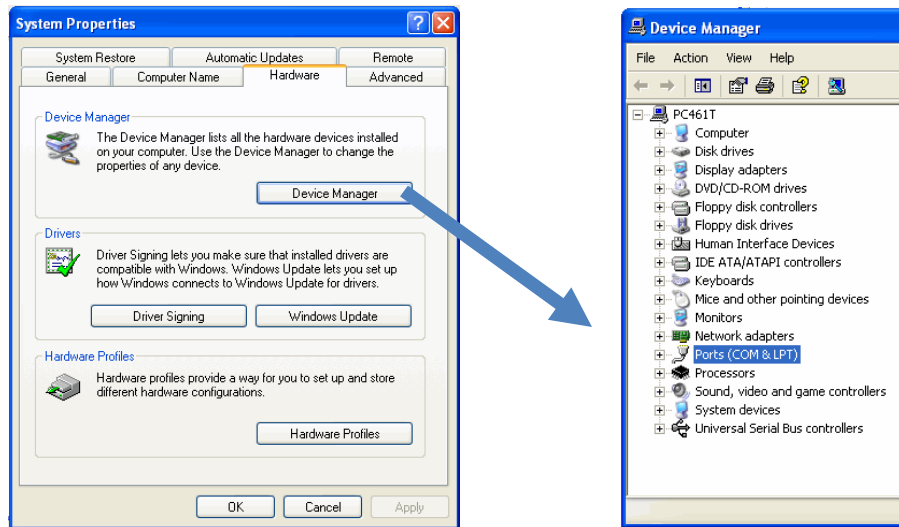
- Take note of the COM port assignment for the USB Serial Port.
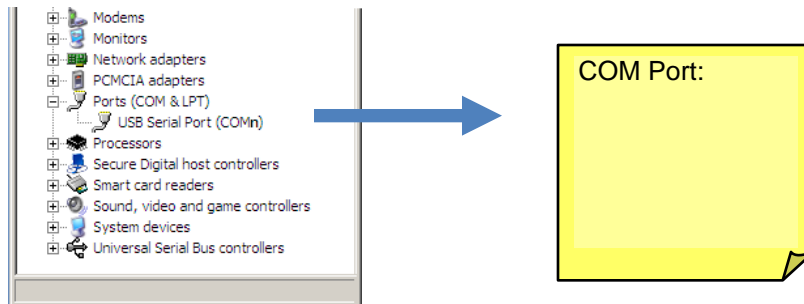
COM Port:

2.2.1   FTDI COM Port Trouble Shooting

If the FTDI device driver did not install properly, there would be no assigned COM port number for the FTDI controller. Repeat the USB Driver Installation, see Section 2.1.

Microsoft Windows may associate a Ball Point device to the FTDI USB controller. When this occurs a FTDI device COM port assignment is available via HyperTerminal but there is no communications data. Verify if a Ball Point device has been added to the "Human Interface Devices" via the Device Manager. See Section 2.2 for access to the Device Manager. If a Ball Point device exists, delete it and unplug and replug the Evaluation Kit's USB cable.

2.3 Basic Connection Setup

Figure 1 shows the basic connections of the 78M6610+PSU Evaluation Kit for use with external equipment. The shunt adaptor board consists of the host side components necessary for the evaluation environment that would be replaced by the target system. This host board provides a USB serial UART controller, serial interface DC-DC power isolator, a current shunt, and AC wiring terminals.

After connecting the USB cable to J11 and installing the USB drivers, one can plug the 78M6610+PSU Evaluation Board into the Shunt Adaptor Board as shown below.

Figure 2: 78M6610+PSU Evaluation Board
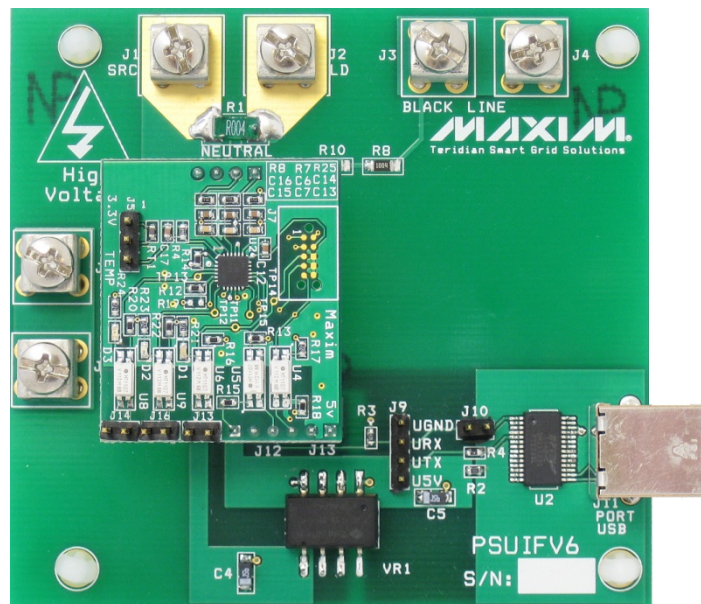
Figure 3: 78M6610+PSU Evaluation Kit Connections

Attach an AC source and AC load to the Shunt Adaptor Board as shown below. Connect J1 and J3 to an external AC power source. Connect J2 and J4 to the load to be measured. The 78M6610+PSU Evaluation Kit hardware is designed for 120 VAC and 230 VAC (nominal) up to 300 VAC (max).
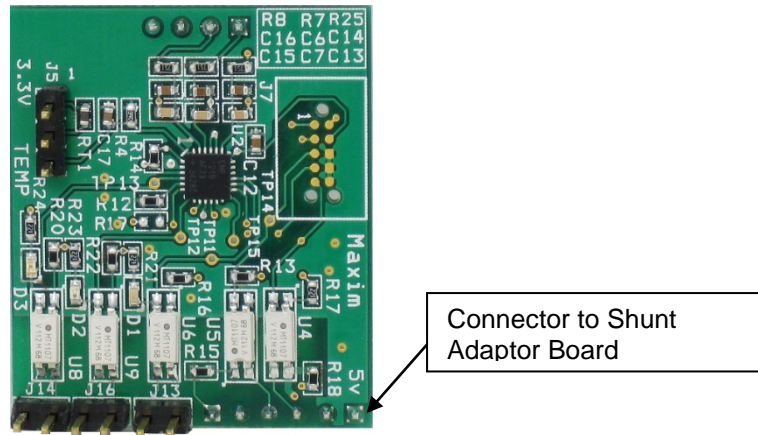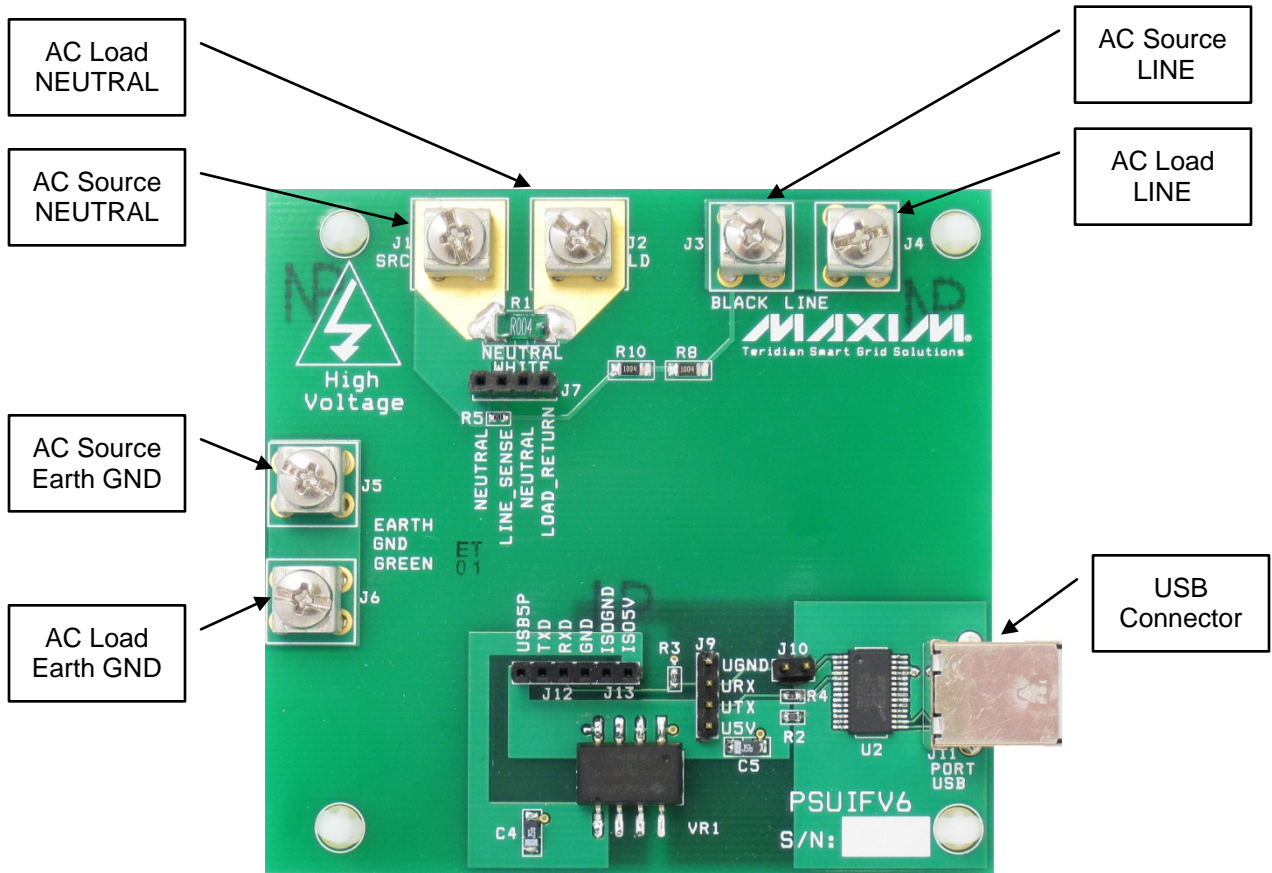

Figure 4: Shunt Adaptor Board Connections

2.4   Jumper and Switch Settings

The following tables describe the 78M6610+PSU Evaluation Kit jumpers and switches and their setting for different configurations.

Table 1: 16-Pin Evaluation Board Connector Descriptions

Schematic and Silkscreen Reference	Description
J2	Power Connector to Shunt Adaptor Board
J3	Sensor Connector to Shunt Adaptor Board
J4	UART Connector to Shunt Adaptor Board
J5	External Temperature Sensor Connector
J7	SPI Connector
J13	Relay Connector
J14	AC Critical Connector
TP11	Optional Relay LED Connector
TP12	Optional AC Critical LED Connector
TP14	UART RX Test Point
TP15	UART TX Test Point

Table 2: 24-Pin Evaluation Board Connector Descriptions

Schematic and Silkscreen Reference	Description
J2	Power Connector to Shunt Adaptor Board
J3	Sensor Connector to Shunt Adaptor Board
J4	UART Connector to Shunt Adaptor Board
J5	External Temperature Sensor Connector
J7	SPI Connector
J13	Relay Connector
J14	AC Critical Connector
J16	AC Fault Connector
TP11	Optional Relay LED Connector
TP12	Optional AC Critical LED Connector
TP13	Optional AC Fault LED Connector
TP14	UART RX Test Point
TP15	UART TX Test Point

Table 3: Shunt Adaptor Board Connector Descriptions

| Schematic and Silkscreen Reference	Description
J1	AC Neutral to Source
J2	AC Neutral to Load
J3	AC Line to Source
J4	AC Line to Load
J5	AC Earth GND to Source
J6	AC Earth GND to Load
J7	Sensor connector to 78M6610+PSU Evaluation Board
J9	Optional UART communications connector
J10	USB controller TX jumper. Default = Installed Remove when using J9.
J11	USB controller connector
J12	UART connector to 78M6610+PSU Evaluation Board
J13	Power connector to 78M6610+PSU Evaluation Board

3 Graphical User Interface (GUI)

A graphical user interface (GUI) is included on the 78M6610+PSU Evaluation Kit CD to facilitate quick evaluation of the 78M6610+PSU energy measurement device. The GUI requires Microsoft.NET Framework 4 on the PC for which the GUI is to execute on. Upon invoking the GUI executable file, an installation wizard may appear if Microsoft.NET Framework 4 is not installed on the PC. Follow the installation wizard instructions, or download Microsoft.NET Framework 4 from the Microsoft web site prior to launching the GUI.

3.1 GUI Initialization

The GUI is self-explanatory when used with the *78M6610+PSU Data Sheet*. The user, however, should note the following about the evaluation kit hardware:

1. <u>Serial COM Port</u>:
   - ➢ Following the installation instructions in Section 2, launch the GUI executable and click the "Scan Ports" button to populate the drop-down menu with the available COM ports. Select the COM port assigned to the evaluation kit and leave the baud rate set to 38400 (default)
2. <u>SSI ID</u>:
   - ➢ Use SSI ID 2 for the 78M6610+PSU Evaluation Kit then click "Connect". Upon successful communication with the evaluation kit, the firmware revision field will be green and populated with the revision of the 78M6610+PSU firmware.
3. <u>Register Addresses</u>:
   - ➢ Common measurement and configuration parameters have their own labeled cells. For direct register read/writes, reference the byte-addressable registers in the data sheet for the synchronous serial interface (SSI) protocol.
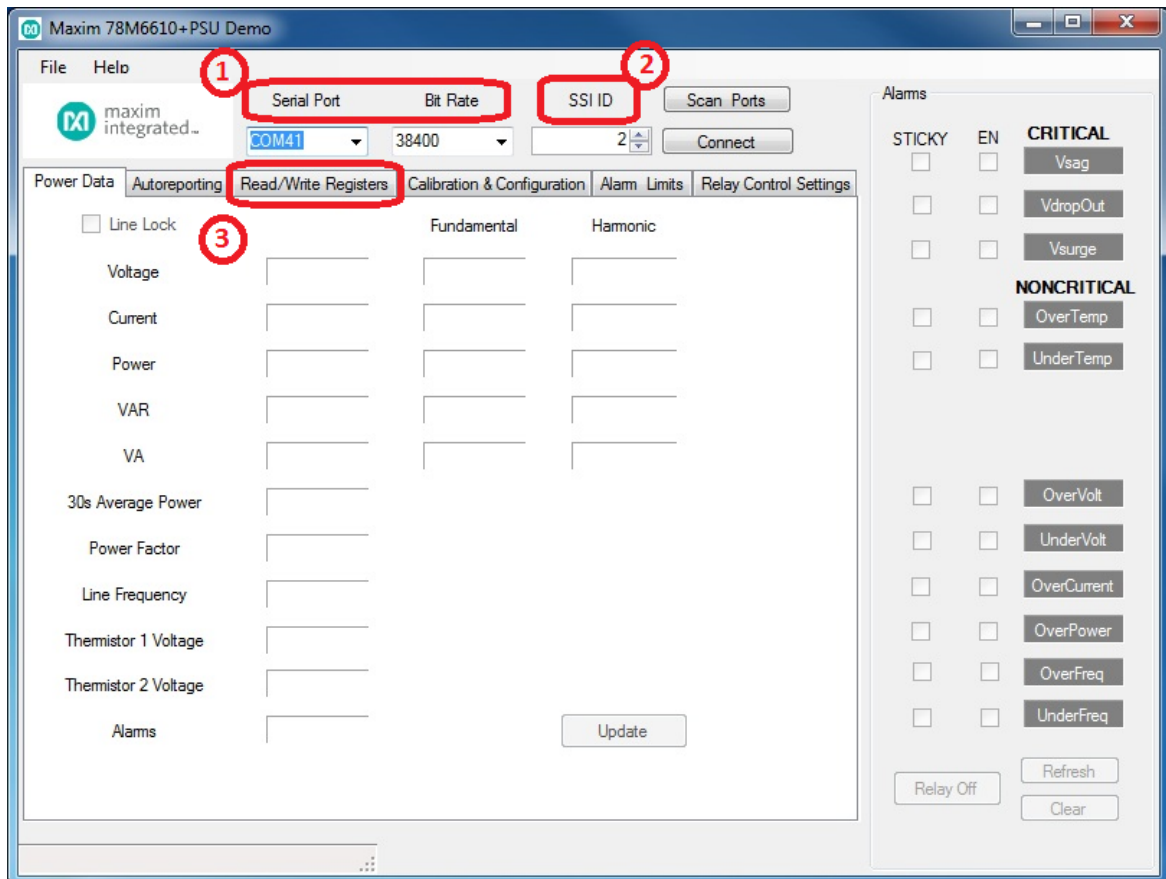
4 Schematics, Bill of Materials, and PCB Layouts

This section includes the schematics, bill of materials, and PCB layouts for the 78M6610+PSU Evaluation Boards and the
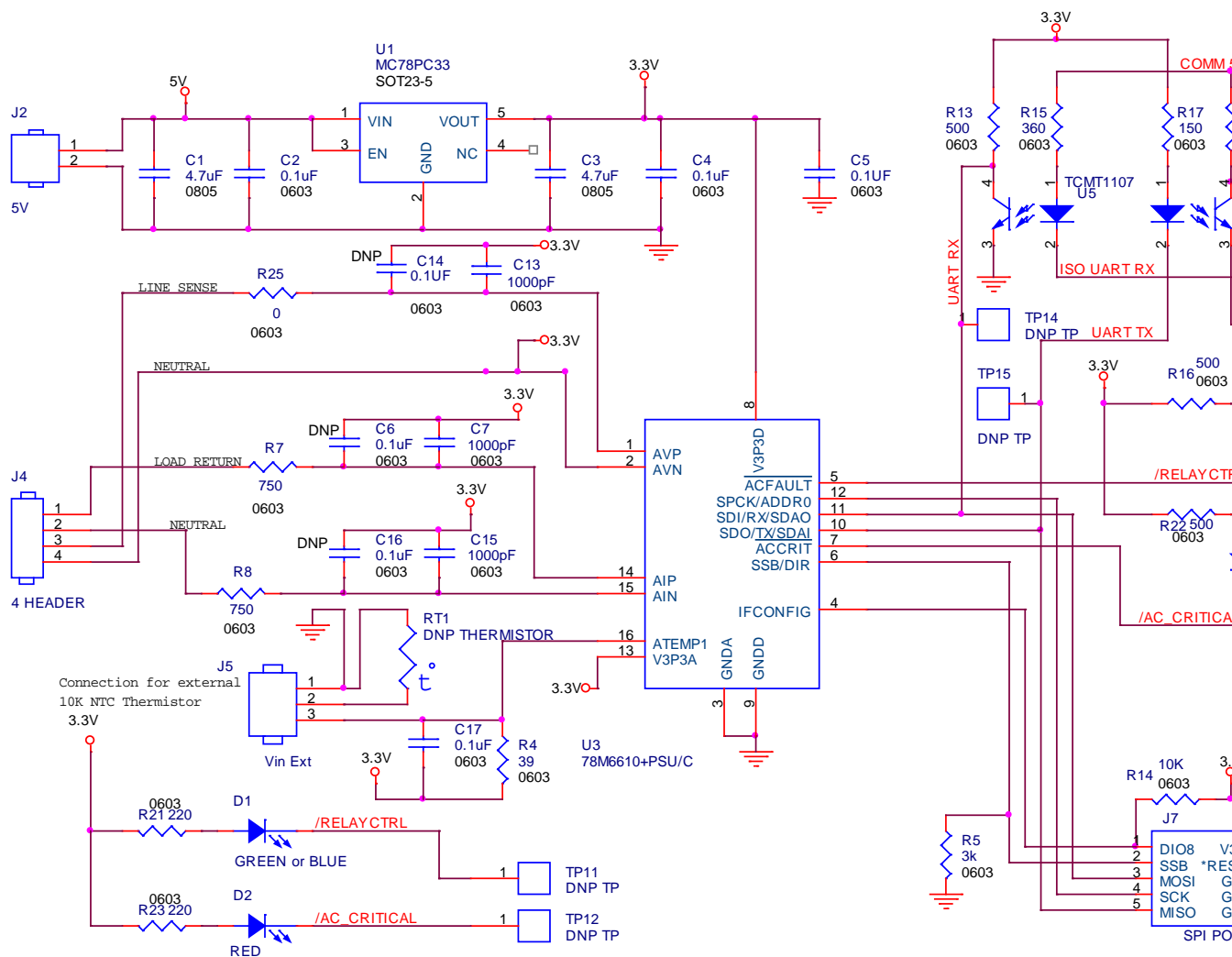
4.1 78M6610+PSU 16-Pin Evaluation Board Schematics

Figure 5: 78M6610+PSU 16-Pin Evaluation Board Electrical Schematic

4.2   78M6610+PSU 16-Pin Evaluation Board Bill of Materials

Table 4: 78M6610+PSU 16-Pin Evaluation Board Bill of Materials

Item	Q	Reference	Part	PCB Footprint	Part Number	Manufact
1	2	C1,C3	4.7uF	805	C2012Y5V1C475Z/0.85	TDK
2	7	C2,C4,C5,C17	0.1uF	603	C1608Y5V1H104Z	TDK
3	3	C7,C13,C15	1000pF	603	C1608X7R2A102K	TDK
4	1	D1	Green	603	LG Q971-KN-1	OSRAM
5	1	D2	Red	603	LTST-C190CKT	Lite-On
6	1	J2	5V	Through hole	PBC36SAAN	Sullins
7	1	J3	CON4- FEMALE	Through hole	SSA-132-S-G	Samtec
8	1	J4	UART	Through hole	PBC36SAAN	Sullins
9	1	J5	SIP100P3	Through hole	PBC36SAAN	Sullins
10	1	J7	SPI port	Through hole	PBC36SAAN	Sullins
11	2	J13,J16	CON2	Through hole	PBC36SAAN	Sullins
12	1	RT1	THERMISTOR	603	NCP18XH103F03RB	Murata
13	1	R4	39	603	ERJ-3GEYJ390V	Panasonic
14	2	R7,R8	750 0.1%	603	ERA-3YEB751V	Panasonic
15	1	R5	3K	603	ERJ-3EKF3001V	Panasonic
16	1	R14	10K	603	ERJ-3EKF1002V	Panasonic
17	1	R15	360	603	ERJ-3EKF3600V	Panasonic
18	1	R17	150	603	ERJ-3EKF1500V	Panasonic
19	4	R13,R16,R18,R22	499	603	ERJ-3EKF4990V	Panasonic
20	2	R21,R23	220	603	RC0603FR-07220RL	Yageo
21	1	R25	0	603	ERJ-3GEY0R00V	Panasonic
22	1	U1	MC78PC33	SOT 23-5	MC78PC33NTRG	ON Semi
23	1	U3	78M6610+PSU	TSSOP16	78M6610+PSU/C00	Maxim
24	4	U4,U5,U6,U9	TCMT1107	SOP-4	TCMT1107	Vishay

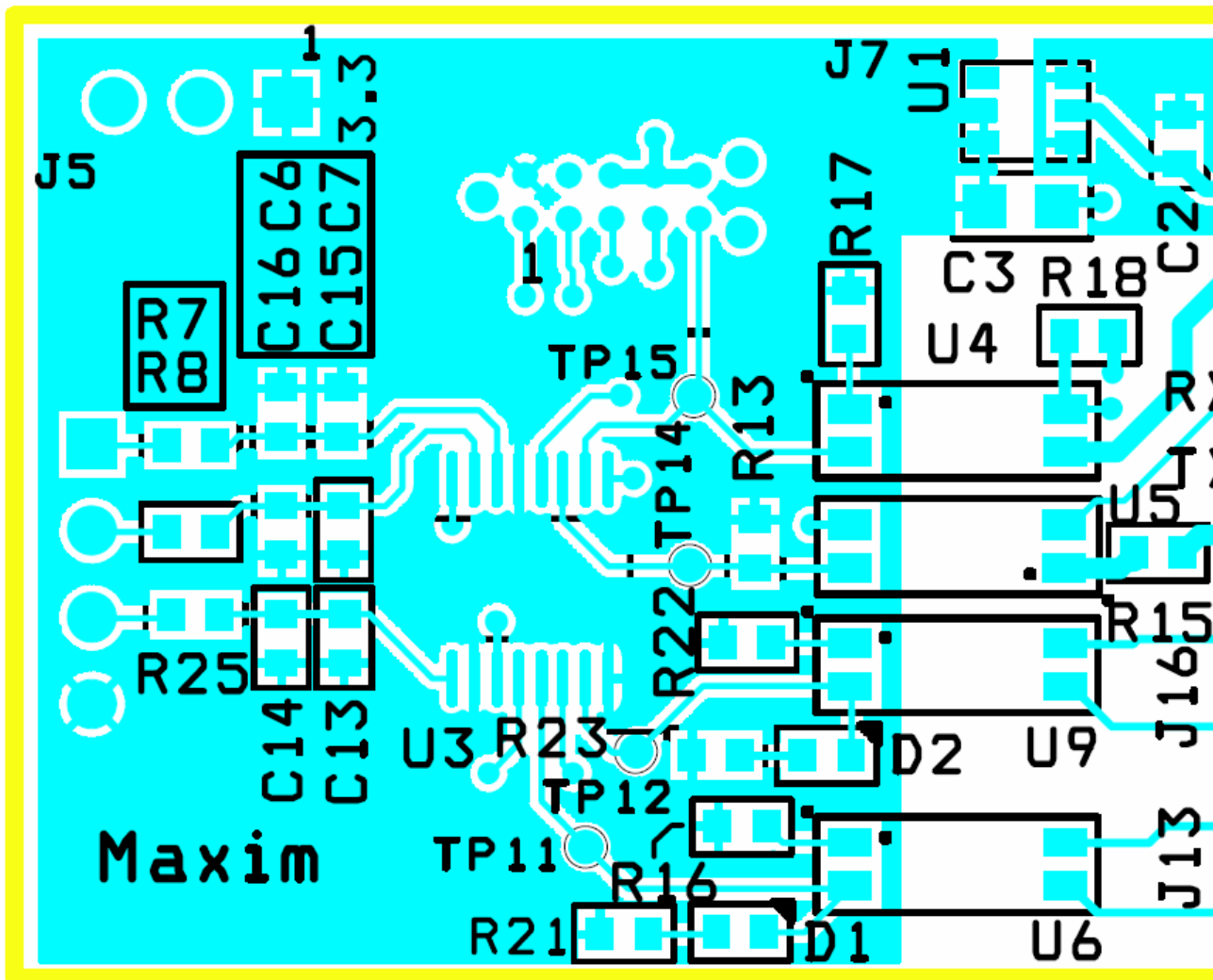## 4.3 78M6610+PSU 16-Pin Evaluation Board PCB Layouts

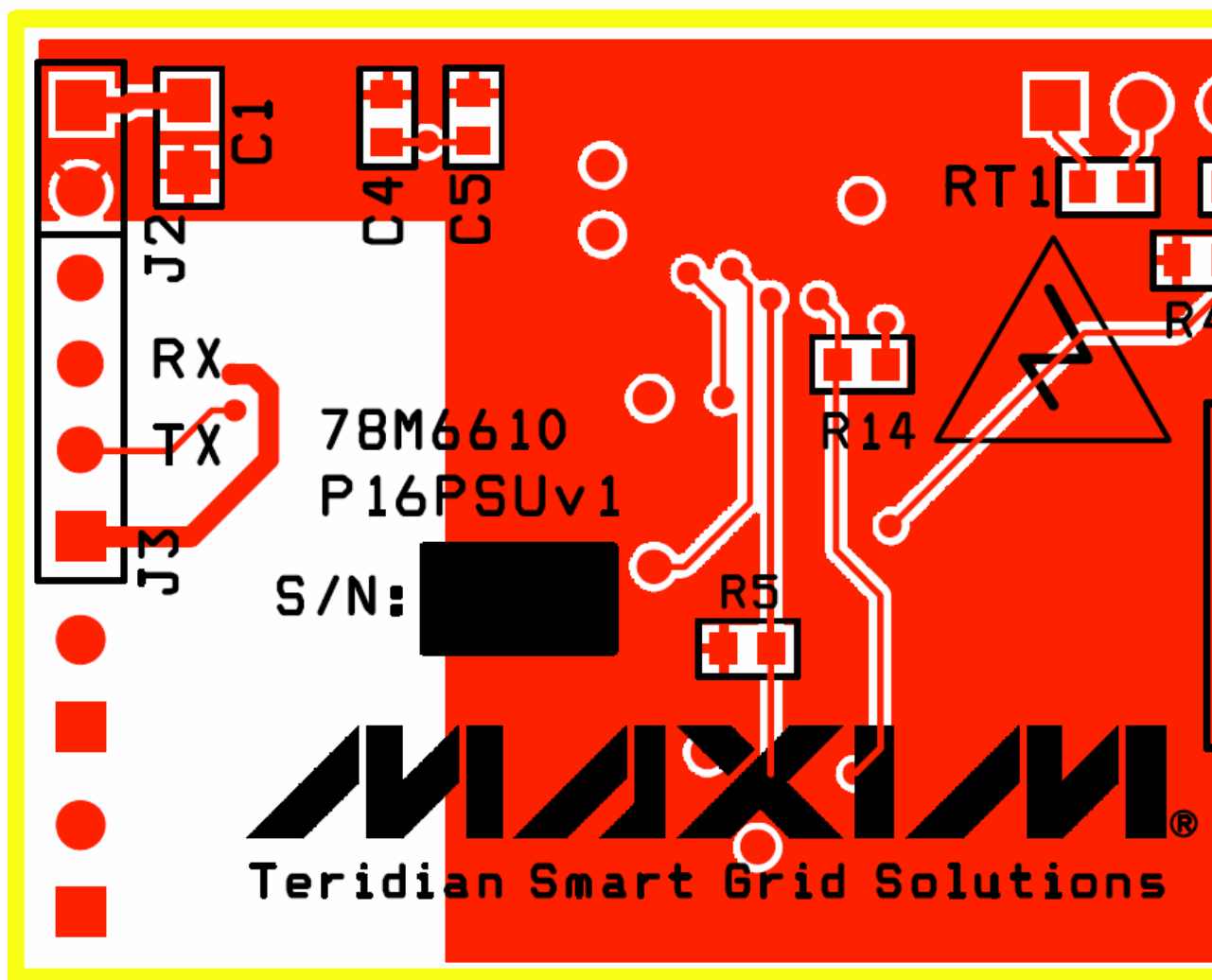**Figure 6: 78M6610+PSU 16-Pin Evaluation Board PCB Top View**

Figure 7: 78M6610+PSU 16-Pin Evaluation Board PCB Bottom View

4.4   78M6610+PSU 24-Pin Evaluation Board Schematics
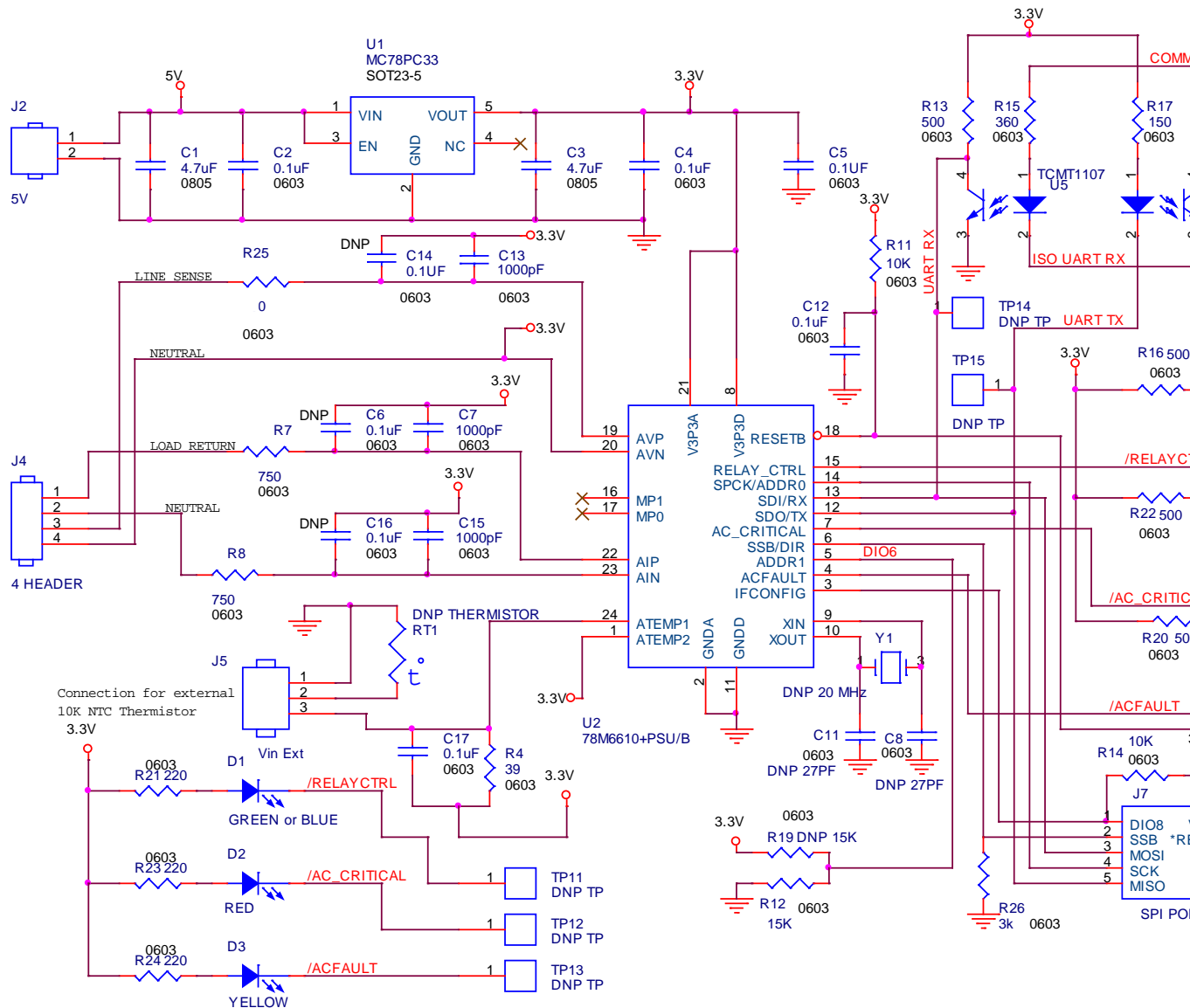

Figure 8: 78M6610+PSU 24-Pin Evaluation Board Electrical Schematic

4.5   78M6610+PSU 24-Pin Evaluation Board Bill of Materials

Table 5: 78M6610+PSU 24-Pin Evaluation Board Bill of Materials

| Item	Q	Reference	Part	PCB Footprint	Part Number	Ma
1	2	C1,C3	4.7uF	805	C2012Y5V1C475Z/0.85	TDK
2	8	C2,C4,C5,C12,C17	0.1uF	603	C1608Y5V1H104Z	TDK
3	3	C7,C13,C15	1000pF	603	C1608X7R2A102K	TDK
4	2	C8,C11	27PF	603	CC0603JRNP09BN270	Yage
5	1	D1	Green	603	LG Q971-KN-1	OSR
6	1	D2	Red	603	LTST-C190CKT	Lite-C
7	1	D3	Yellow	603	LTST-C190YKT	Lite-C
8	1	J2	5V	Through hole	PBC36SAAN	Sullir
9	1	J3	CON4	Through hole	PBC36SAAN	Samt
10	1	J4	UART	Through hole	PBC36SAAN	Sullir
11	1	J5	SIP100P3	Through hole	PBC36SAAN	Sullir
12	1	J7	SPI port	Through hole	PBC36SAAN	Sullir
13	3	J13,J14,J16	CON2	Through hole	PBC36SAAN	Sullir
14	1	RT1	THERMISTOR	603	NCP18XH103F03RB	Mura
15	1	R4	39	603	ERJ-3GEYJ390V	Pana
16	2	R7,R8	750 0.1%	603	ERA-3YEB751V	Pana
17	2	R11,R14	10K	603	ERJ-3EKF1002V	Pana
18	1	R15	360	603	ERJ-3EKF3600V	Pana
19	1	R17	150	603	ERJ-3EKF1500V	Pana
20	1	R12	15K	603	ERJ-3EKF1502V	Pana
21	5	R13,R16,R18,R20,R22	499	603	ERJ-3EKF4990V	Pana
22	4	R21,R23,R24	220	603	RC0603FR-07220RL	Yage
23	1	R25	0	603	ERJ-3GEY0R00V	Pana
24	1	R26	3K	603	ERJ-3GEYJ302V	Pana
25	1	U1	MC78PC33	SOT 23-5	MC78PC33NTRG	ON S
26	1	U2	78M6610+PSU	QFN24	78M6610+PSU/B00	Maxi
27	5	U4,U5,U6,U8,U9	TCMT1107	SOP-4	TCMT1107	Visha
28	1	Y1	887-1143-1-ND 20MHz	4-SMD	8Z-20.000MAAJ-T	TXC
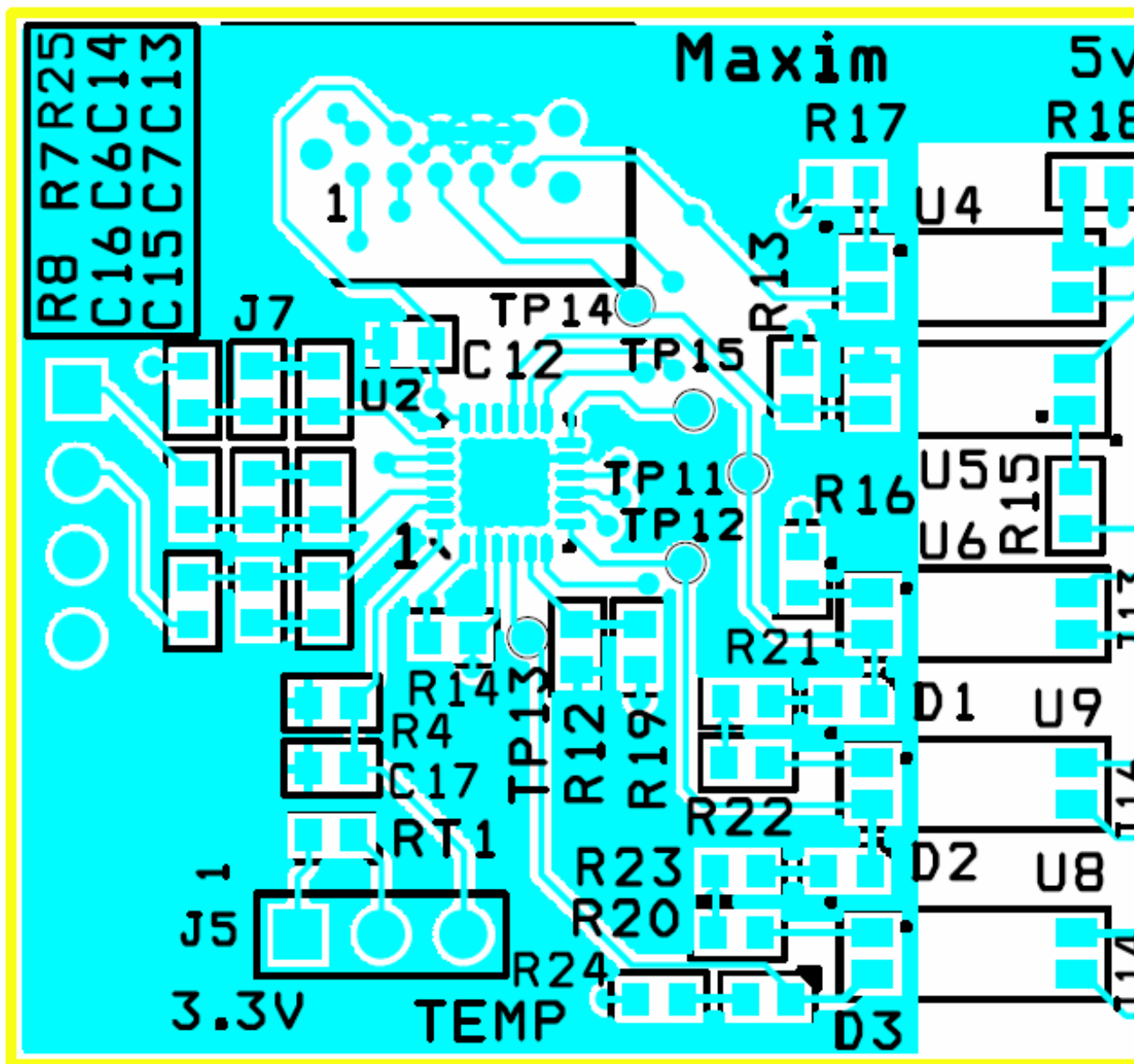
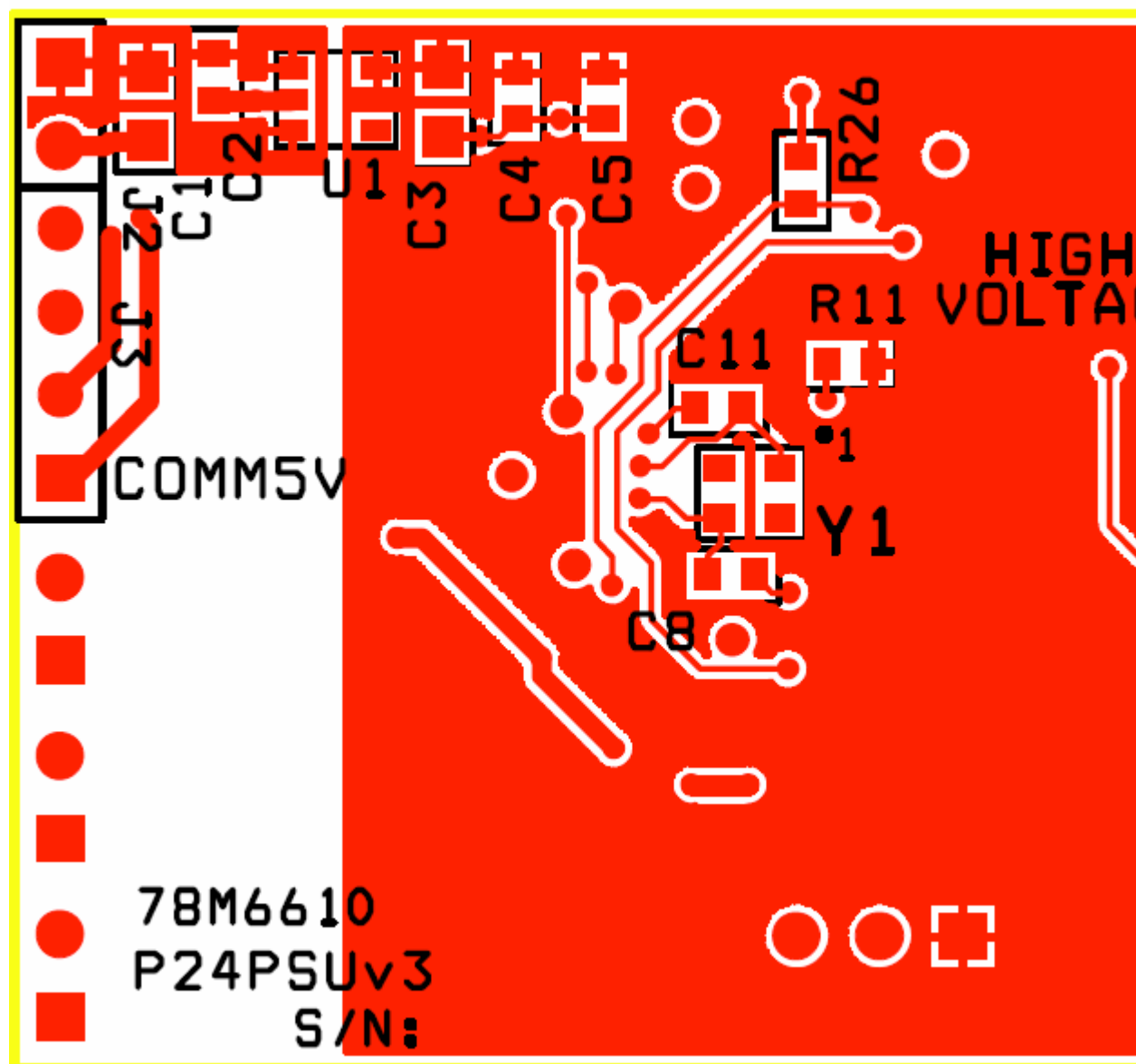**Figure 9: 78M6610+PSU 24-Pin Evaluation Board PCB Top View**

Figure 10: 78M6610+PSU 24-Pin Evaluation Board PCB Bottom View
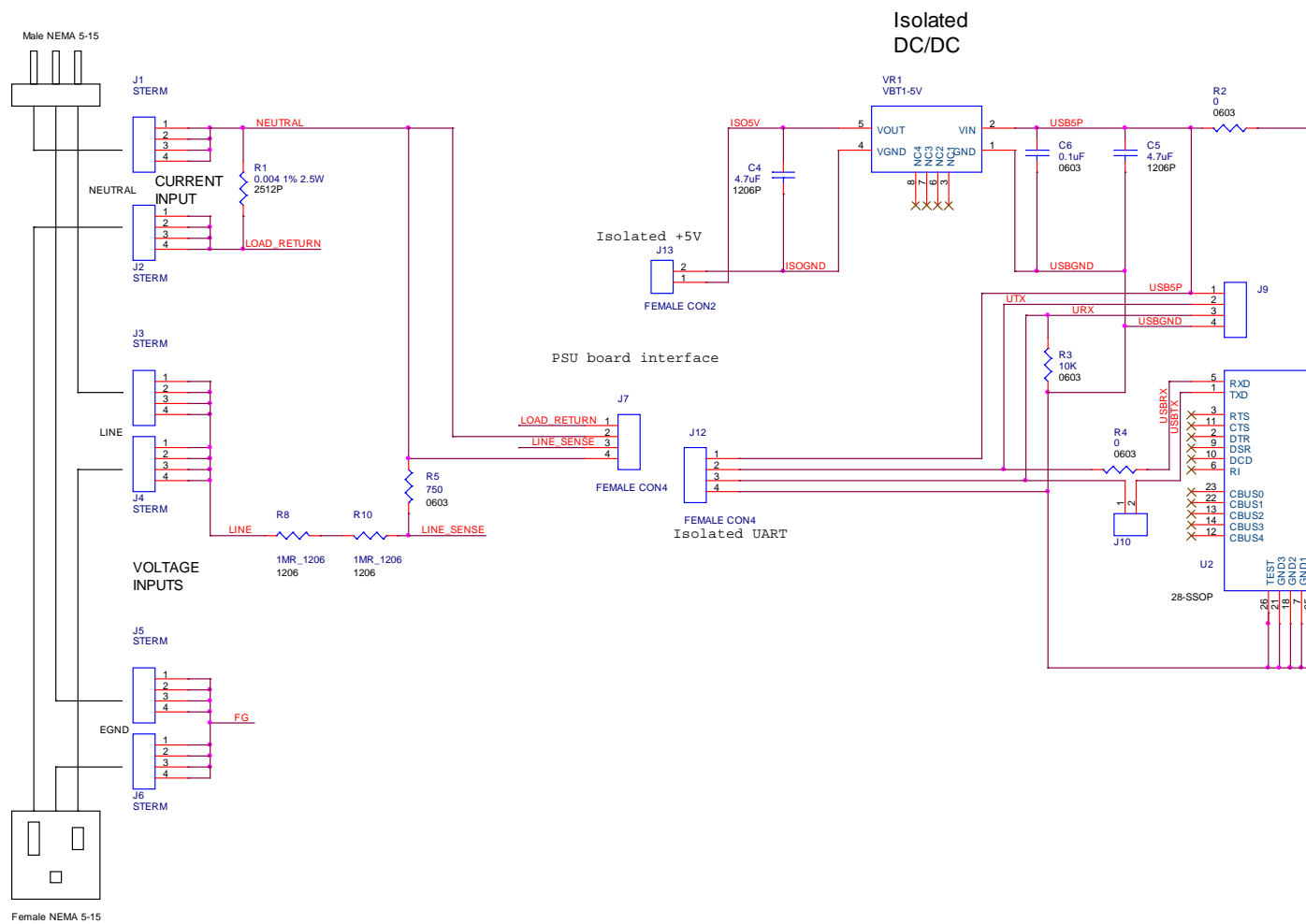
4.6   Shunt Adaptor Board Schematics

Figure 11: Shunt Adaptor Board Electrical Schematic

4.7 Shunt Adaptor Board Bill of Materials

Table 6: Shunt Adaptor Board Bill of Materials

| Item	Q	Reference	Part	PCB Footprint	Part Number	Manufact
1	2	C2,C6	0.1uF	0603	C0603C104K5RACTU	Kemet
2	3	C3,C4,C5	4.7uF	1206P	C3216Y5V1C475Z/0.85	TDK
3	4	G1,G2,G3,G4	MTHOLE	MTGPS.PRT	561-PS500A	Eagle Plas Devices
4	6	J1,J2,J3,J4,J5,J6	STERM	STERM VERTICAL	8191	Keystone Electronics
5	1	J7	CON4 FEMALE	Through hole	SSA-132-S-G	Samtec
6	1	J9	CON4	Through hole	PBC36SAAN	Sullins
7	1	J12	CON4 FEMALE	Through hole	SSA-132-S-G	Samtec
8	2	J10	CON2	Through hole	PBC36SAAN	Sullins
9	1	J11	USB-B	USBB	154-2442-E	Kobiconn
10	1	J13	CON2 FEMALE	Through hole	SSA-132-S-G	Samtec
11	1	R1	0.004 1% 2.5W	2512P	ULR25R004FLFTR	IRC
12	2	R2,R4	0	0603	ERJ-3GEY0R00V	Panasonic
13	1	R3	10K	0603	ERJ-3EKF1002V	Panasonic
14	1	R5	750 0.1%	603	ERA-3YEB751V	Panasonic
15	2	R8,R10	1M	1206	RNCS1206BKE1M00	Stackpole
16	1	U2	FT232QFN32	28-SSOP	FT232RL-REEL	FTDI
17	1	VR1	VBT1-5V	VBT1	VBT1-S5-S5-SMT	CUI Inc

4.8 Shunt Adaptor Board PCB Layouts
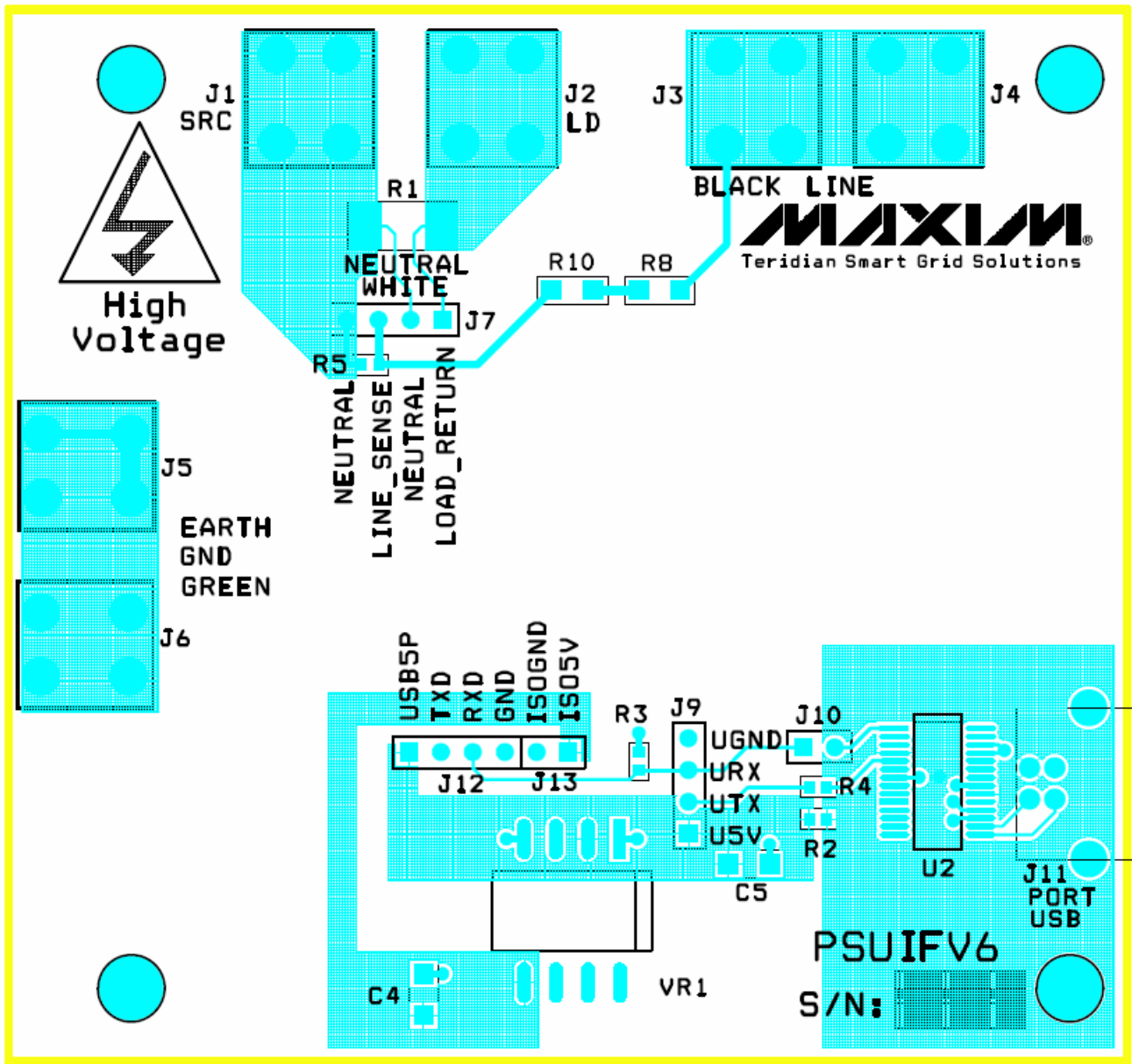
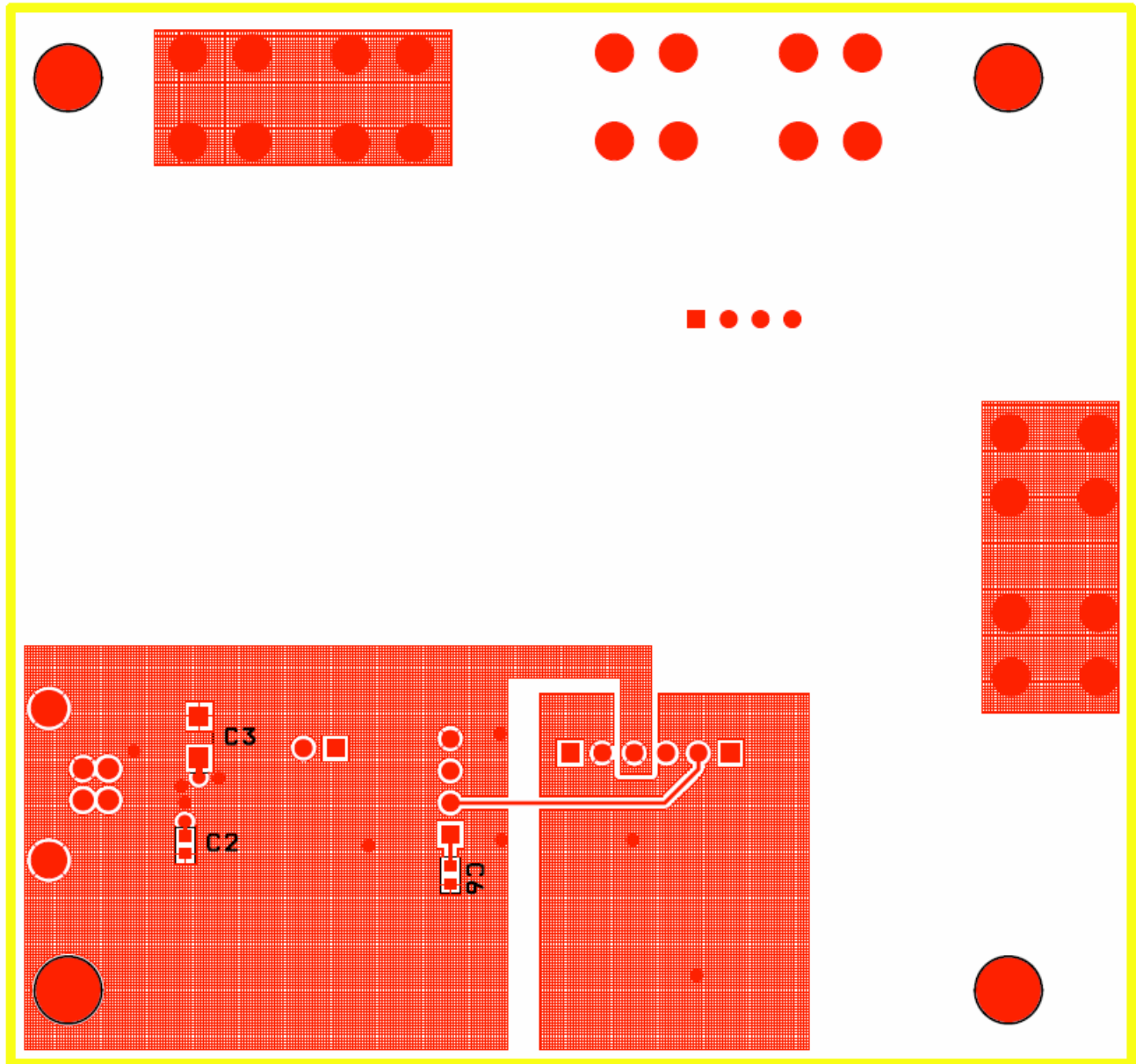**Figure 12: Shunt Adaptor Board PCB Top View**

Figure 13: Shunt Adaptor Board PCB Bottom View

5   Included Documentation

The following 78M6610+PSU documents are included on the CD:

78M6610+PSU Data Sheet
78M6610+PSU Evaluation Kit User Manual

6   Contact Information

For more information about Maxim products or to check the availability of the 78M6610+PSU, contact technical support at **www.maximintegrated.com/support**.

Revision History

Revision	Date	Description
0	7/25/2012	First publication.
1	8/17/2012	Expanded GUI initialization instructions.
1.1	11/30/2012	Modified Schematics, BOM, and GUI screenshot.
2.0	4/9/2013	Corrected ordering part number, removed legacy Teridian doc#

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