CY3272

Cypress High Voltage Powerline Communication Evaluation Kit Guide

Doc. # 001-55381 Rev. *D

Cypress Semiconductor
198 Champion Court
San Jose, CA 95134-1709
Phone (USA): 800.858.1810
Phone (Intnl): 408.943.2600
http://www.cypress.com

[+] Feedback

Copyrights

© Cypress Semiconductor Corporation, 2009-2011. The information contained herein is subject to change without notice. Cypress Semiconductor Corporation assumes no responsibility for the use of any circuitry other than circuitry embodied in a Cypress product. Nor does it convey or imply any license under patent or other rights. Cypress products are not warranted nor intended to be used for medical, life support, life saving, critical control or safety applications, unless pursuant to an express written agreement with Cypress. Furthermore, Cypress does not authorize its products for use as critical components in life-support systems where a malfunction or failure may reasonably be expected to result in significant injury to the user. The inclusion of Cypress products in life-support systems application implies that the manufacturer assumes all risk of such use and in doing so indemnifies Cypress against all charges.

Any Source Code (software and/or firmware) is owned by Cypress Semiconductor Corporation (Cypress) and is protected by and subject to worldwide patent protection (United States and foreign), United States copyright laws and international treaty provisions. Cypress hereby grants to licensee a personal, non-exclusive, non-transferable license to copy, use, modify, create derivative works of, and compile the Cypress Source Code and derivative works for the sole purpose of creating custom software and or firmware in support of licensee product to be used only in conjunction with a Cypress integrated circuit as specified in the applicable agreement. Any reproduction, modification, translation, compilation, or representation of this Source Code except as specified above is prohibited without the express written permission of Cypress.

Disclaimer: CYPRESS MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARD TO THIS MATERIAL, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Cypress reserves the right to make changes without further notice to the materials described herein. Cypress does not assume any liability arising out of the application or use of any product or circuit described herein. Cypress does not authorize its products for use as critical components in life-support systems where a malfunction or failure may reasonably be expected to result in significant injury to the user. The inclusion of Cypress' product in a life-support systems application implies that the manufacturer assumes all risk of such use and in doing so indemnifies Cypress against all charges.

Use may be limited by and subject to the applicable Cypress software license agreement.

PSoC® is a registered trademark of Cypress Semiconductor Corporation. All products and company names mentioned in this document may be the trademarks of their respective holders.

Purchase of I2C components from Cypress or one of its sublicensed Associated Companies conveys a license under the Philips I2C Patent Rights to use these components in an I2C system, provided that the system conforms to the I2C Standard Specification as defined by Philips. As from October 1st, 2006 Philips Semiconductors has a new trade name - NXP Semiconductors.

Flash Code Protection

Cypress products meet the specifications contained in their particular Cypress PSoC Data Sheets. Cypress believes that its family of PSoC products is one of the most secure families of its kind on the market today, regardless of how they are used. There may be methods, unknown to Cypress, that can breach the code protection features. Any of these methods, to our knowledge, would be dishonest and possibly illegal. Neither Cypress nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "unbreakable."

Cypress is willing to work with the customer who is concerned about the integrity of their code. Code protection is constantly evolving. We at Cypress are committed to continuously improving the code protection features of our products.

Contents

1. Introduction **5**

1.1 Safety Precautions....5
1.2 Introduction to the Cypress PLC Solution....5
1.3 Using the Cypress PLC Solution....6
1.4 Kit Contents....7
1.5 Additional Learning Resources....8
1.6 Additional Requirements....8
1.7 Document Revision History....9
1.8 Documentation Conventions....9

2. Getting Started **11**

2.1 Kit Installation....11
2.2 Software Installation....15
2.2.1 Before You Begin....15
2.2.2 Prerequisites....15
2.2.3 Installing PLC Control Panel Software....15

3. PLC HV Evaluation Board **17**

3.1 Features....17
3.2 Functional Overview....17
3.2.1 Operating Conditions:....17
3.3 Hardware Description....18
3.3.1 High Voltage Section with Switched Mode Power Supply (SMPS)....19
3.3.2 Transmit Amplifier and Filtering Section....20
3.3.3 Transmit and Receive Coupling Circuit....21
3.3.4 Cypress Powerline Communication Transceiver and User Controls....21
3.4 Setting Up the PLC HV Board....23
3.4.1 Setting Up Manual Addressing on PLC Boards....23
3.4.2 Setting Up I2C Address of the Node....23
3.4.3 I2C Header Settings....23
3.4.4 Jumper Settings for the PLC HV Board....24
3.5 Example Project....25
3.6 Technical Reference....25

A. Appendix **27**

A.1 Schematics....27
A.1.1 Board Overview....27
A.1.2 User Interface....28
A.1.3 Transmit and Receive Filters....29
A.1.4 Power Supply....30
A.2 Layout....31
A.2.1 Top Layer....31

A.2.2 Ground Layer 32
A.2.3 Power Layer 33
A.2.4 Bottom Layer 34
A.2.5 Top Silkscreen 35
A.2.6 Bottom Silkscreen 36
A.3 Bill of Materials 37

1. Introduction

1.1 Safety Precautions



CAUTION: High Voltage (Risk of Electric Shock)
All work in powerline communications must be done with extreme care.
Caution must be exercised when using power supplies or power related equipment.

- Use the board with expert technical supervision. There is high voltage (110 V, 240 V AC) power on the board.
- Accidental human contact with high voltage is dangerous.
- The capacitors on the board can be energized even after disconnecting the board from the main power supply. Be careful to not touch any parts on the board immediately after you disconnect the main power supply.
- Safety plastic casing is provided on the top of HV section. Do not touch the protected area during live operation for debugging, probing, or any other purpose.

Cypress bears no responsibility for any consequences that may result from the improper or hazardous use of this board.

This board is for evaluation only and should not be directly used in an end user application.

1.2 Introduction to the Cypress PLC Solution

Cypress's Powerline Communication Solution (PLC) enables transmission of command and control data over high voltage and low voltage powerlines. This solution is developed for low bandwidth powerline communication.

The CY3272 PLC High Voltage (HV) Evaluation Board demonstrates the ability of the Cypress CY8CPLC10 to transmit data at 2400 bps over high voltage (110 V to 240 V AC) powerlines.

This guide includes:

- Chapter 1 provides a brief overview of the Cypress PLC solution. It describes the contents of the CY3272 evaluation kit and lists additional requirements to run the example projects, which are included as part of the kit.
- Chapter 2 gives a detailed hardware description of the PLC HV Board. It describes features of the HV board such as manual addressing, connection of the USB-I2C bridge, and jumper settings.
- The Appendix contains the schematics, layout, and Bill of Materials.

[+] Feedback

1.3 Using the Cypress PLC Solution

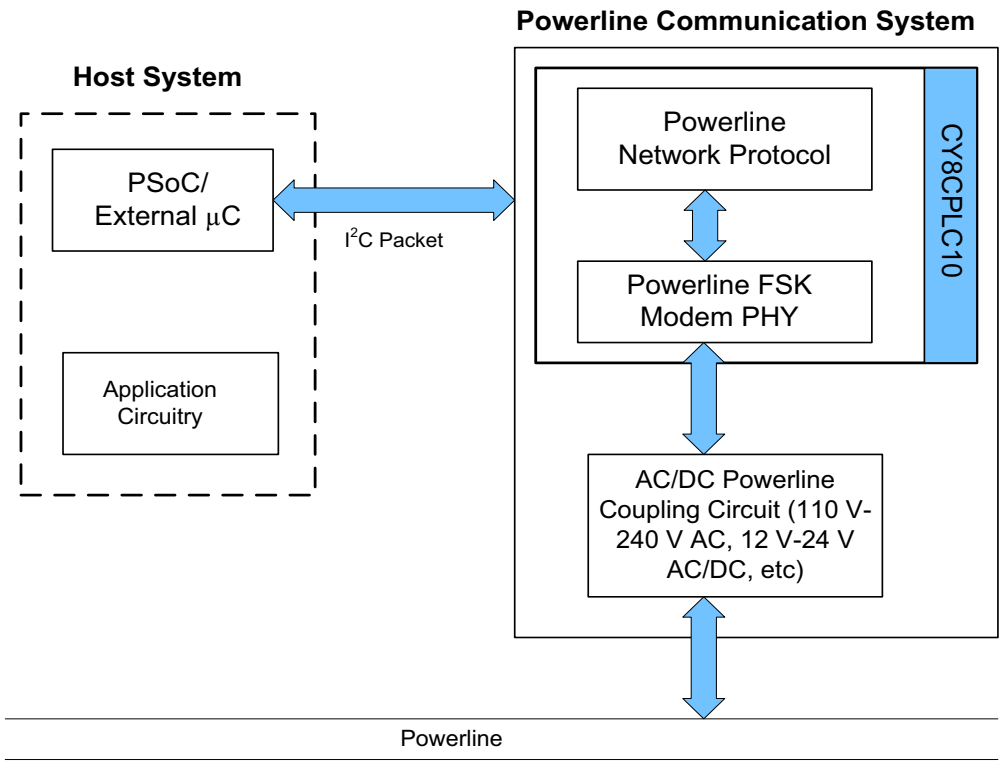
Powerlines are available everywhere in the world, which makes them one of the most widely available communication media. The pervasiveness of powerlines also makes it difficult to predict its characteristics and noise. Because of the variability of the quality of powerline, implementing robust communication over powerline has been an engineering challenge for years. With this in mind, the Cypress PLC solution is designed to enable secure, reliable, and robust communication over powerline. Some of the features of Cypress PLC are:

- Integrated powerline PHY modem with optimized filters and amplifiers to work with rugged high voltage powerlines.
- Powerline optimized network protocol that supports bidirectional communication with acknowledgement based signaling and multiple retransmit.
- Support for 8-bit packet CRC and 4-bit header CRC for error detection and data packet retransmission.
- Carrier Sense Multiple Access (CSMA) scheme that minimizes collisions between packet transmissions on the powerline.

The Cypress PLC solution contains three key elements as shown in Figure 1-1.

- Powerline Network Protocol Layer
- Physical Layer frequency shift keying (FSK) Modem
- Power Amplification and Coupling Circuits

Figure 1-1. Cypress PLC Solution Block Diagram



[+] Feedback

The powerline network protocol layer and physical layer FSK modem are implemented on the CY8CPLC10 chip. The power amplification and coupling circuits are built using discrete components. The CY3272 board contains the CY8CPLC10 device along with the power amplification and coupling circuit for communicating on high voltage (110 to 240 V AC) powerlines. For a detailed description of the design parameters for the circuit, refer to the application note "Cypress Powerline Communication Board Design Analysis - AN55427".

The CY8CPLC10 device is controlled by an external host microcontroller via an I^2C interface. To evaluate this kit, an external host must be created.

- The first option is to use a PC to install and run the Cypress PLC Control Panel GUI, which is included with this kit. The PC interfaces to the CY3272 board via the CY3240-I2USB Bridge board that is included with this kit. Steps for setting up this system are provided in the quick start guide, which is provided in the kit.
- The second option is to use an external microcontroller that is running a host application. The application note, AN52478 - Designing an External Host Application for Cypress's Powerline Communication IC CY8CPLC10, provides an example project that can be programmed on a PSoC microcontroller board (in this case, the CY3210-PSoCEVAL1) and explains how to interface it to the CY3272 board. This application note is provided with this kit.

Note To evaluate this kit, a second high voltage PLC kit is required. The compatible kits are CY3272 (this kit) and CY3274 High Voltage PLC Development Kit. For information on these kits, visit http://www.cypress.com/go/CY3272 and http://www.cypress.com/go/CY3274. For details on how to program CY3274 boards with an I2C-PLC interface, refer the Appendix A.2 of the PLC Control Panel GUI User Guide.

1.4 Kit Contents

The PLC HV evaluation kit consists of the following:

- CY3272 Quick Start Guide
- CY3272 PLC HV Evaluation Board
- Five CY8CPLC10-PVXI Samples
- CD containing:
  - Packet Test Software – PLC Control Panel Application
  - PLC Control Panel Release Notes
  - CY3272 Release Notes
  - CY8CPLC10 Datasheet
  - CY3272 Evaluation Board User Guide
  - CY3272 Board Altium Design Project
  - CY3272 Board schematics, layout, and BOM
  - Application Note – AN52478 - Designing an External Host Application for Cypress's Powerline Communication IC CY8CPLC10
- AC Power Cable
- USB-I2C Bridge
- Ribbon Cable for I2C communication, External Reset, and Powering External Board
- Retractable USB Cable

1.5 Additional Learning Resources

Visit http://www.cypress.com/go/plc for additional learning resources in the form of datasheets, technical reference manuals, and application notes.

- *CY3272 Schematic.pdf*
  http://www.cypress.com/?rID=38024
- *CY3272 Board Layout.zip*
  http://www.cypress.com/?rID=38024
- CY3272 Kit documentation
  http://www.cypress.com/go/CY3272
- For a list of PSoC Designer-related trainings, see
  http://www.cypress.com/?rID=40543
- CY8CPLC10 data sheet
  http://www.cypress.com/?rID=38236
- For more information regarding PSoC Designer functionality and releases, refer to the user guide and release notes on the PSoC Designer web page:
  www.cypress.com/go/psocdesigner
- For more information regarding PSoC Programmer, supported hardware, and COM layer, go to the PSoC Programmer web page:
  www.cypress.com/go/psocprogrammer
- Designing an External Host Application for Cypress's Powerline Communication IC CY8CPLC10 - AN52478
  http://www.cypress.com/?rID=37956

1.6 Additional Requirements

The following Cypress demonstration kit is used in the example applications in this user guide. This kit is available for purchase from http://www.cypress.com/go/CY3210-PSoCEVAL1.

- CY3210-PSoCEval1 Kit

This PSoC® evaluation kit features an evaluation board and MiniProg1 programming unit. The evaluation board includes an LCD module, potentiometer, LEDs, and plenty of bread boarding space to meet all your evaluation needs. The MiniProg1 programming unit is also included with the kit and programs PSoC devices directly on the evaluation board, or on other boards via a 5-pin header. This programming unit is small and compact, and connects to a PC via a provided USB 2.0 cable.

The kit includes:

- Evaluation Board with LCD Module
- MiniProg1 Programming Unit
- PSoC Designer™ Software CD
- 28-Pin CY8C29466-24PXI PDIP PSoC Device Sample
- USB 2.0 Cable
- Getting Started Guide

[+] Feedback

1.7 Document Revision History

Table 1-1. Revision History

Revision	PDF Creation Date	Origin of Change	Description of Change
**	08/13/09	IUS	New kit guide.
*A	12/10/09	RARP	Content updates
*B	09/28/10	RKPM	Added Software Installation, Example Projects, and Technical Reference sections. Added schematic in section 2.3.
*C	02/11/2011	FRE	Added references to the compatible high voltage PLC kits. Added a reference to the quick start guide for evaluation. Added clarifications to the text throughout.
*D	09/28/2011	ADIY	Removed reference to CY3276 and CY8CLED16P01. Added Getting Started Section. Modified Figure 3-7. Updated Figure 1-1. Updated hyperlinks.

1.8 Documentation Conventions

Table 1-2. Document Conventions for Guides

Convention	Usage
`Courier New`	Displays file locations, user entered text, and source code: `C:\ ...cd\icc\`
Italics	Displays file names and reference documentation: Read about the *sourcefile.hex* file in the *PSoC Designer User Guide*.
[**Bracketed, Bold**]	Displays keyboard commands in procedures: [**Enter**] or [**Ctrl**] [**C**]
File > Open	Represents menu paths: File > Open > New Project
Bold	Displays commands, menu paths, and icon names in procedures: Click the **File** icon and then click **Open**.
Times New Roman	Displays an equation: 2 + 2 = 4
Text in gray boxes	Describes Cautions or unique functionality of the product.

[+] Feedback

[+] Feedback

2. Getting Started

This chapter describes how to install and configure the CY3272 - HV PLC Evaluation Kit.

2.1 Kit Installation

To install the kit software, follow these steps:

1. Insert the kit CD in the CD drive of your PC. The CD is designed to auto-run and the Kit Installer Startup Screen appears.
2. Click **Install CY3272 High Voltage PLC Kit** to start the installation.

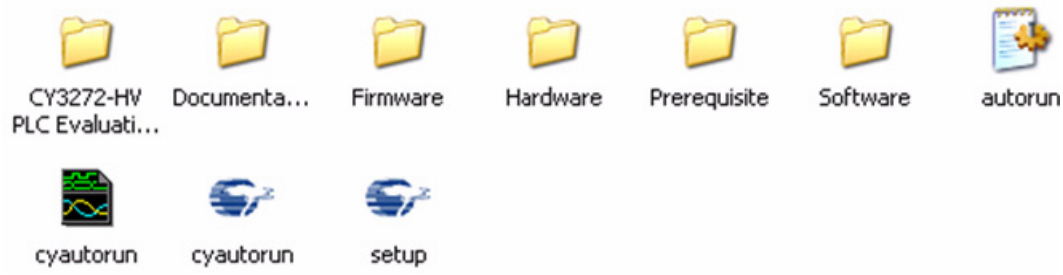
Figure 2-1. Kit Installer Startup Screen



[+] Feedback

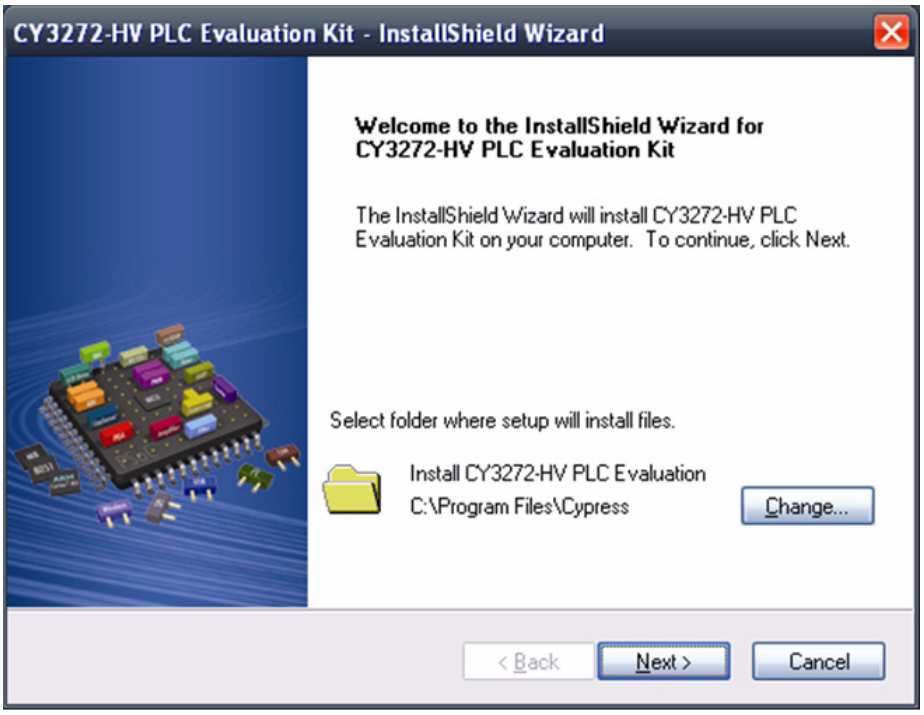
Note If auto-run does not execute, double-click the *cyautorun.exe* file on the root directory of the CD.

Figure 2-2. CD Root Directory



3. The CY3272 - HV PLC Evaluation - InstallShield Wizard screen appears. Choose the folder location to install the setup files. You can change the location of the folder using **Change**.
4. Click **Next** to launch the kit installer.

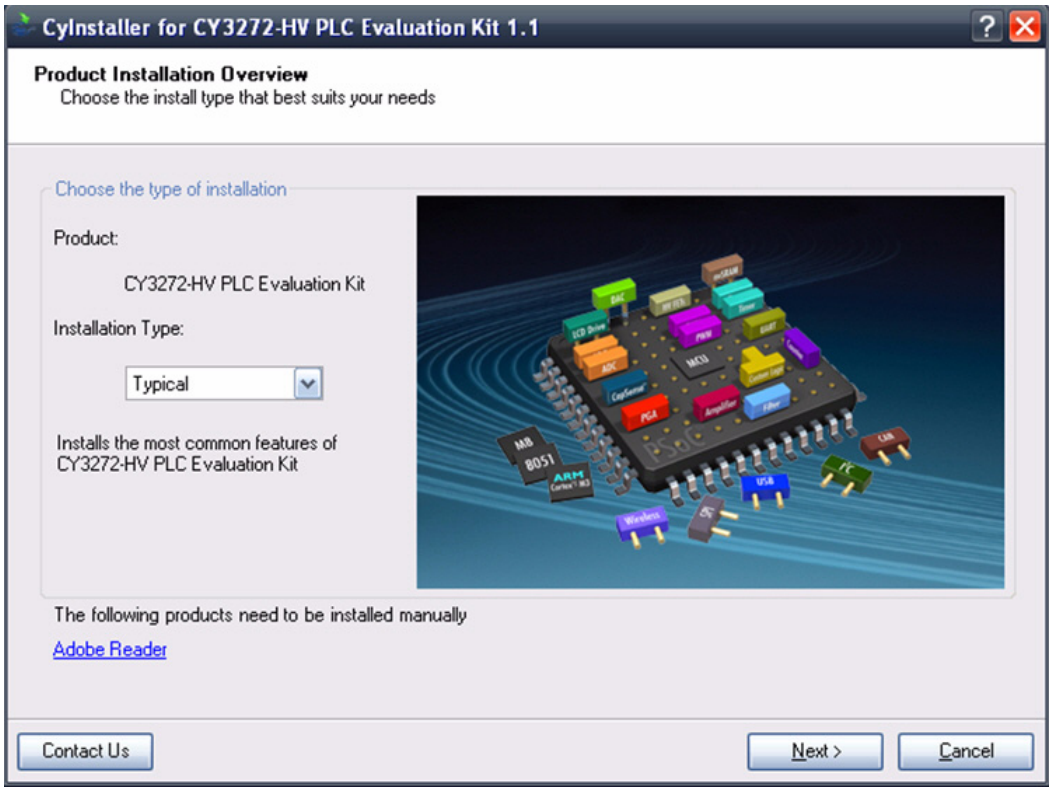
Figure 2-3. CY3272 - HV PLC Evaluation InstallShield Wizard



[+] Feedback

5. On the Product Installation Overview screen, select the installation type that best suits your requirement. The drop-down menu has the options **Typical**, **Complete**, and **Custom**.
6. Click **Next** to start the installation.

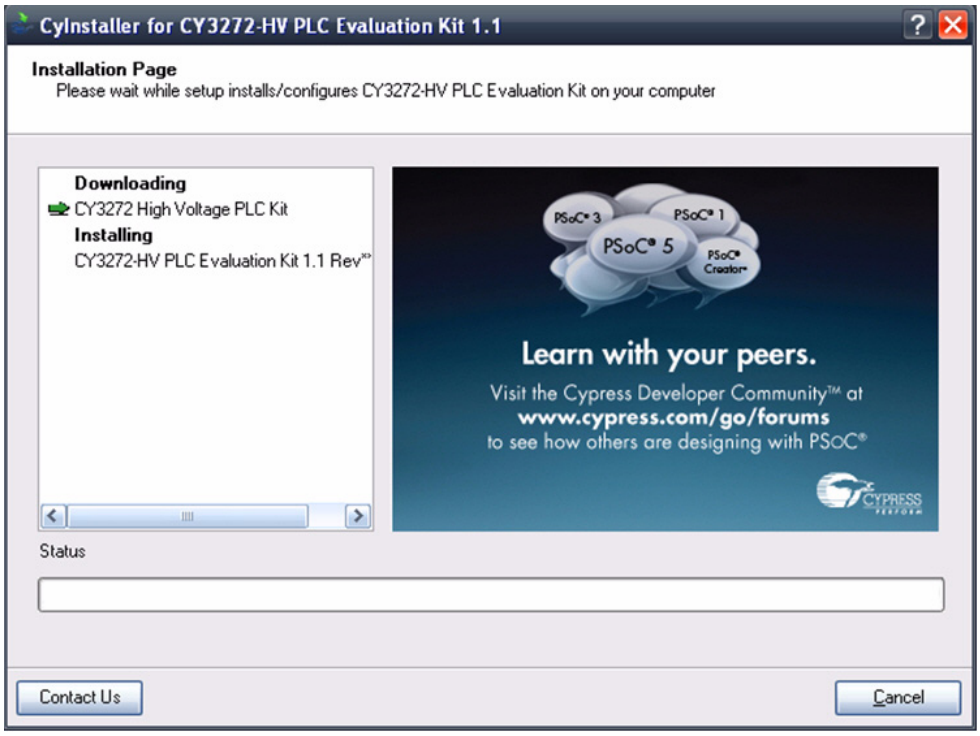
Figure 2-4. Installation Type Options



[+] Feedback

7. When the installation begins, a list of all packages appears on the Installation Page.
8. A green check mark appears next to every package that is downloaded and installed (see Figure 2-5).
9. Wait until all the packages are downloaded and installed successfully.

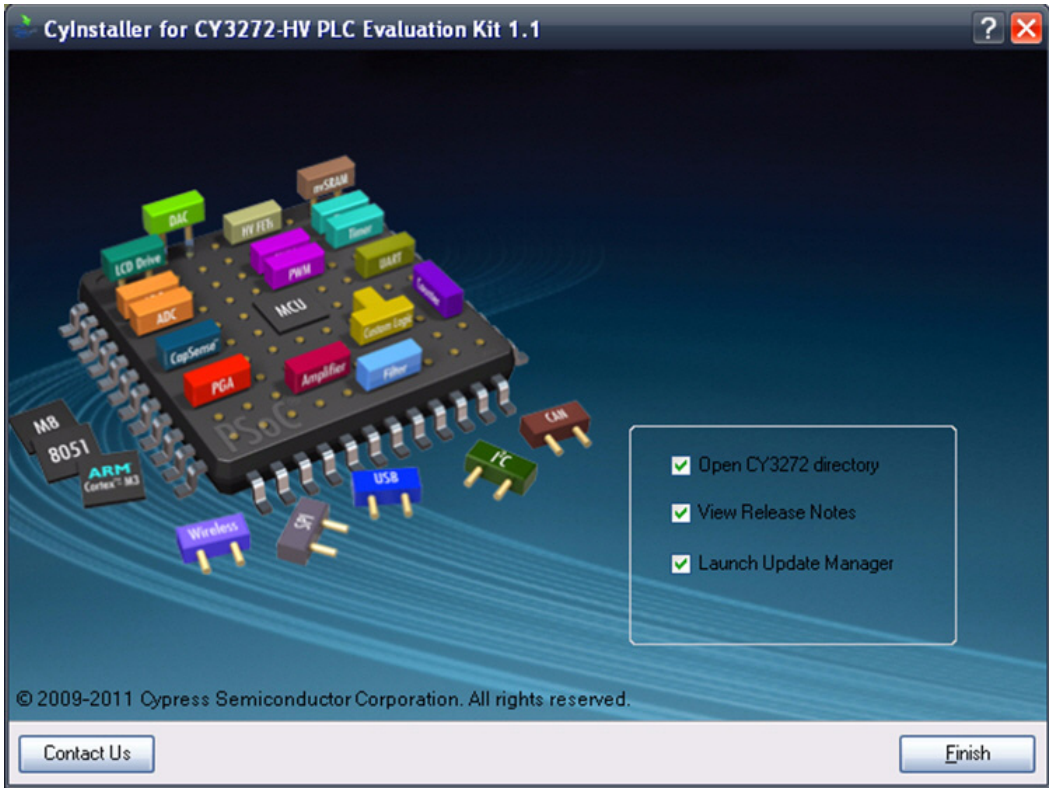
Figure 2-5. Installation Page



[+] Feedback

10. Click **Finish** to complete the installation.

Figure 2-6. Installation Completion Page



2.2 Software Installation

2.2.1 Before You Begin

All Cypress software installations require administrator privileges; however, this is not required to run the installed software.

- Shut down any Cypress software that is currently running.
- Disconnect any Cypress devices (USB-I2C bridge, ICE Cube, or MiniProg) from your computer.

2.2.2 Prerequisites

The PLC Control Panel requires the latest versions of Microsoft .NET Framework, Adobe Acrobat Reader, and a Windows Installer. If your computer does not have .NET Framework and Windows Installer, the installation automatically installs it. However, if your computer does not have Adobe Acrobat Reader, download and install it from the Adobe website.

2.2.3 Installing PLC Control Panel Software

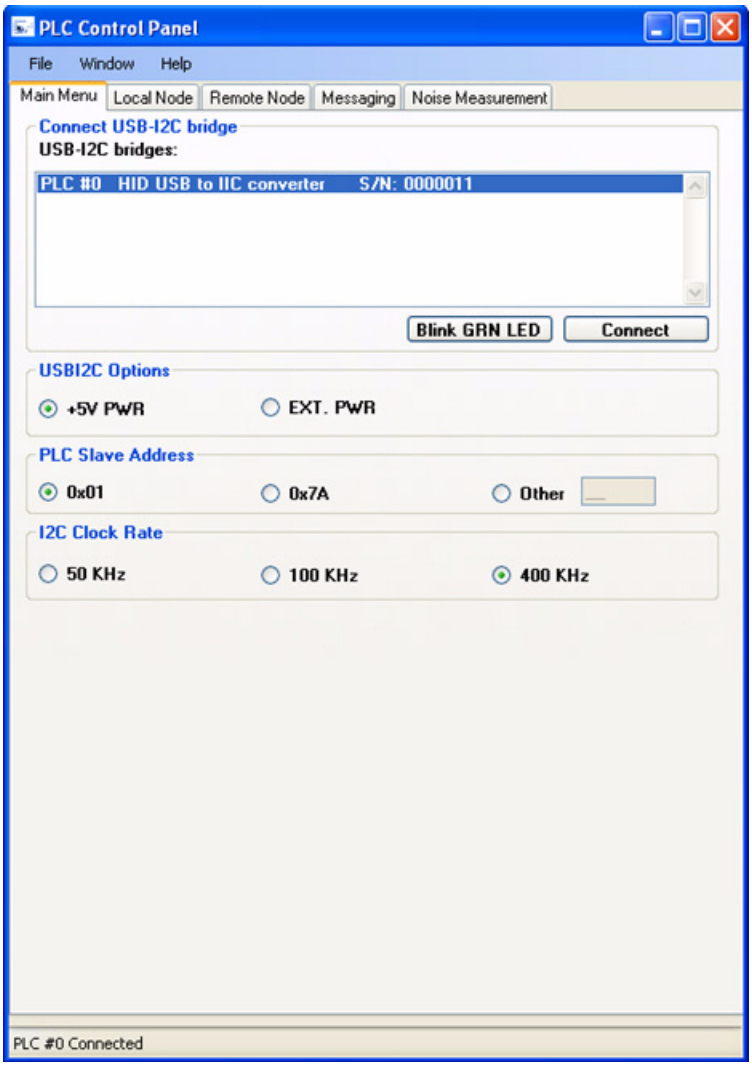
The PLC Control Panel GUI is installed as a prerequisite when you install the CY3272 PLC HV Evaluation kit. Follow the steps shown on the screen to complete the installation. If you need to reinstall this application, select **Install PLC Control Panel GUI** from the installation screen (see Figure 2-1 on page 11).

Click **Start** > **All Programs** > **Cypress** > **PLC Control Panel** > **PLC Control Panel**.

[+] Feedback

The PLC Control Panel application controls the CY3272 PLC HV Evaluation Kit over USB interface from a PC. The application's startup display, when a board is attached and operating, is shown in Figure 2-7.

Figure 2-7. PLC Control Panel Application Startup Display



After installing the PLC Control Panel, refer to the documentation as needed:

- `<CD Drive>\Software\PLC Control Panel\PLC Control Panel Release Notes.pdf`
- `<CD Drive>\Software\PLC Control Panel\User Guide for Cypress PLC Control Panel GUI.pdf`

The PLC Control Panel user guide is also available in the installation directory. It contains more information about installation and how to set up the kit to work with the GUI. It can also be accessed from the Help menu in the PLC Control Panel GUI.

[+] Feedback

3. PLC HV Evaluation Board

3.1 Features

The key features of the CY3272 evaluation board are:

- User friendly PLC Control Panel Application available on the kit CD
- Chip power supply derived from 110 V to 240 V AC
- On-chip powerline network protocol layer and physical layer FSK modem
- LED status indicators for Power, Powerline Transmit and Receive, and Band in Use.
- Five-position DIP switches
  - Three DIP switches for manual powerline node logical address selection
  - One DIP switch to configure I2C slave address
  - One DIP switch to select between external crystal and oscillator
- On board surge protection and isolation circuit
- Integrated Powerline Modem PHY

3.2 Functional Overview

The PLC evaluation board is designed as an advanced evaluation, testing, and product development platform for low bandwidth (2400 bps) powerline communication.

Data to be transmitted is sent to the CY8CPLC10 through the I^2C serial communications interface using a serial bridge driver to a PC or PSoC device. The serial bridge application on the CY8CPLC10 receives this I2C data and encapsulates it into a PLC Network packet. The on-board FSK modem modulates this packet and the coupling circuitry incorporates the resulting sinusoidal waveform onto the existing waveform on the high voltage powerline bus.

3.2.1 Operating Conditions:

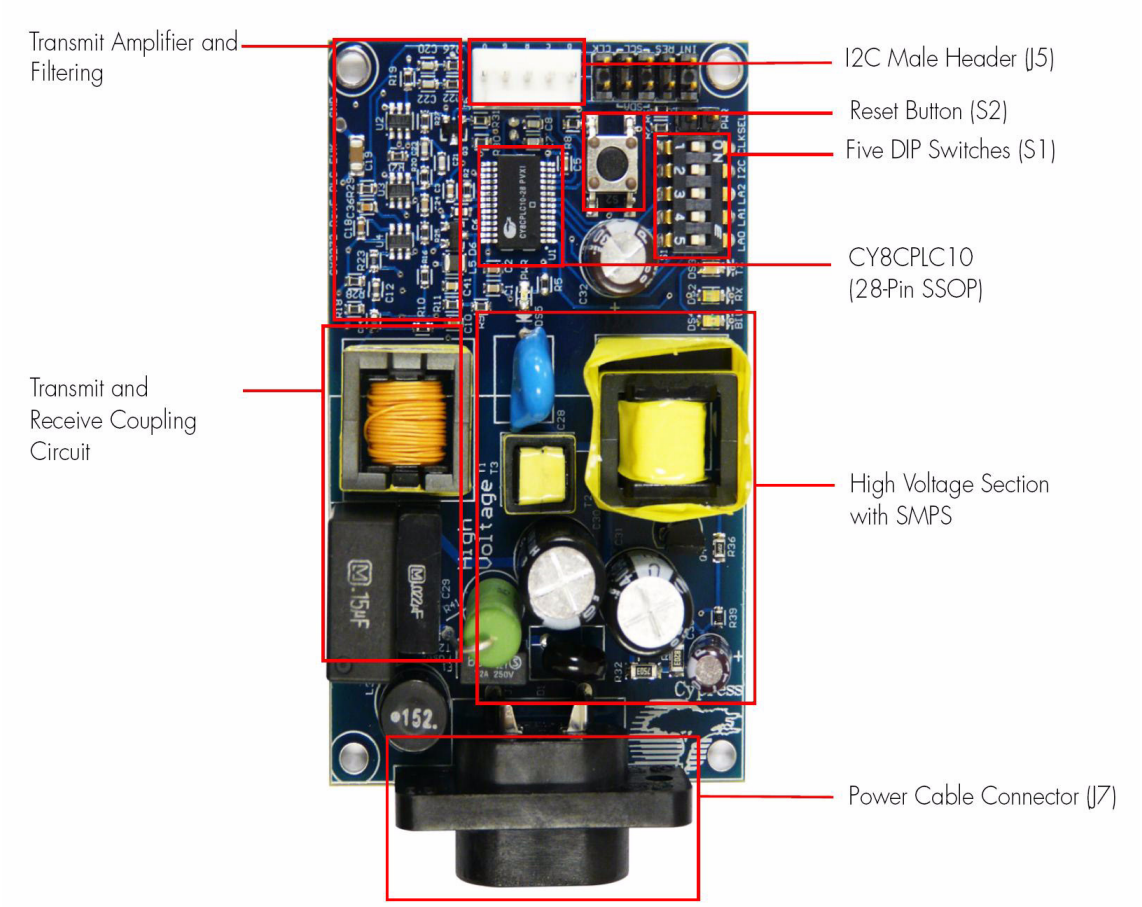
- Input Voltage: 110 VAC/240 VAC
- Input Current: 100 mA/50 mA
- Operating Temperature: 0 °C to 40 °C
- Operating Humidity Condition: 5% to 95% relative humidity (RH), non-condensing

3.3 Hardware Description

The high voltage PLC evaluation Board is shown in Figure 3-1. The key sections are highlighted. The low voltage section (top half in Figure 3-1) is isolated from the high voltage section by the PLC coupling transformer and the power supply's isolation transformer. The board is divided into four main sections:

- High voltage section with power supply
- Transmit amplifier and filter section
- Transmit and receive coupling circuit section
- Cypress powerline transceiver and user controls

Figure 3-1. Front View of Cypress PLC HV Evaluation Board



The communication signal flow on this HV board is:

Transmit: CY8CPL10 TX pin → Transmitter Filter Circuitry → Power Amplifier Circuitry → High Voltage Powerline Coupling Circuitry → High Voltage Powerline (110 V to 240 V AC)

Receive: High Voltage Powerline (110 V to 240 V AC) → High Voltage Powerline Coupling Circuitry → Passive Low Pass Filtering → Vdd/2 Biasing → CY8CPLC10 RX pin

The core of the PLC HV board is the CY8CPLC10 chip. The board contains an I2C connector, jumpers to control various functions, and a five-position DIP switch.

[+] Feedback

The key components in all these sections are as follows.

3.3.1 High Voltage Section with Switched Mode Power Supply (SMPS)

This section takes the power from the powerline and generates necessary low DC voltage for the operation of the PLC transceiver and other components on the chip.

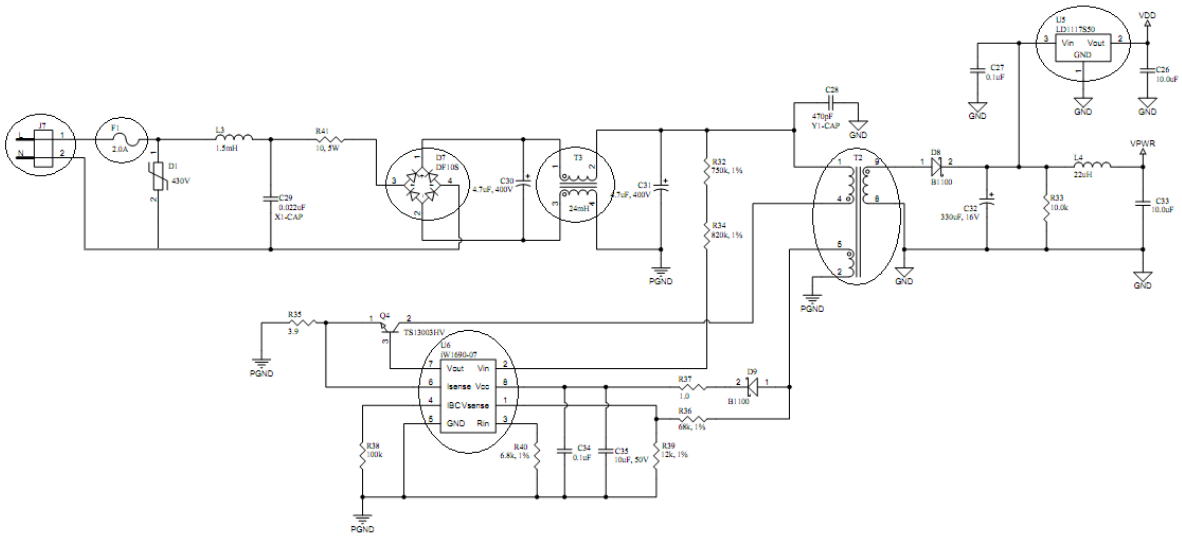
The key components in this section are as follows:

Table 3-1. SMPS Section

Component	Description
J7	This is the two pin connector where the AC cable hooks up to the powerline.
F1	Protection fuse for the circuit.
D7	Full wave bridge rectifier IC.
T3	Common mode choke.
U6	IW1690-07 – iWatt high performance AC/DC power supply controller.
T2	Flyback transformer.
U5	5-V regulator.

The key components are circled in the following schematic.

Figure 3-2. Power Supply Schematic



[+] Feedback

3.3.2 Transmit Amplifier and Filtering Section

This section takes the output signal from the transceiver chip. The circuit here amplifies the signal and filters it to make it suitable for transmission over the powerline. Filtering is done in three stages.

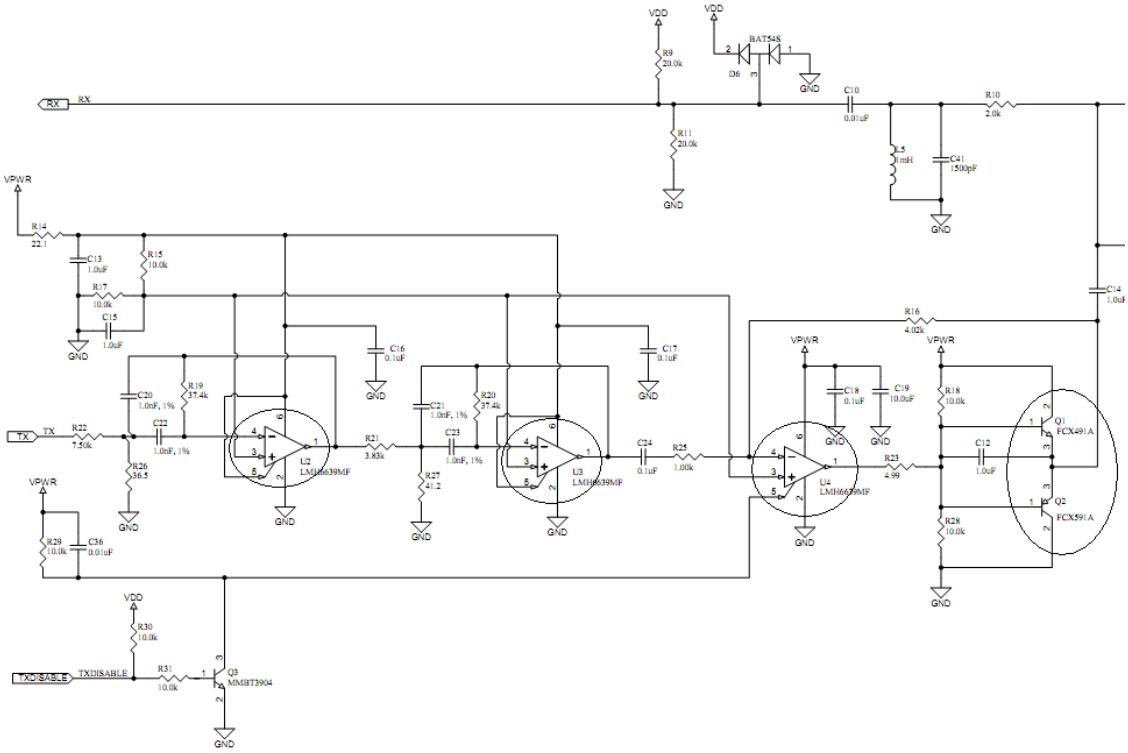
The key components in this section are as follows:

Table 3-2. Transmit Amplifier and Filtering

Component	Description
U2, U3	These opamps filter the signal from the CY8CPLC10, removing the harmonics. The filter stages are only required to meet the European CENELEC EN50065-1:2001 signaling specification. They are not required to achieve robust PLC communication
U4, Q1, Q2	This opamp and high gain transistors are used in the power amplification stage.

The key components are circled in the following schematic.

Figure 3-3. Coupling Circuit Schematic



[+] Feedback

3.3.3 Transmit and Receive Coupling Circuit

This circuit couples the signal from the board on to the powerline. On the receive side, the same circuit couples the carrier on the powerline in to the board, while filtering out the actual 50 Hz or 60 Hz power. The isolation transformer is required for safety.

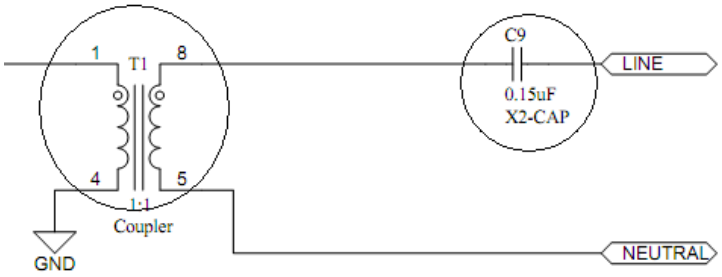
The key components in this section are as follows:

Table 3-3. Transmit and Receive Coupling Circuit

Component	Description/Comment
T1	This is the isolation transformer that isolates the HV and LV sections of the board. It has a 1:1 turns ratio.
C9	This is the coupling capacitor which couples the communication signal and filters out the low frequency noise. The voltage and X1/X2 safety ratings of this component are important parameters.

The key components are circled in the following figure.

Figure 3-4. Coupling Circuit



3.3.4 Cypress Powerline Communication Transceiver and User Controls

This section has the CY8CPLC10 chip, which has the integrated transmit and receive modem, and network protocol layer. It also has the I2C header to communicate with the external host processor. The DIP switches to control the addresses and the jumpers to control the functionality of the chip are also located in this section of the board. The red, blue, yellow, and green LEDs indicate the status of the board while functioning.

The key components and their detailed use are as follows:

Table 3-4. Transceiver and User Controls

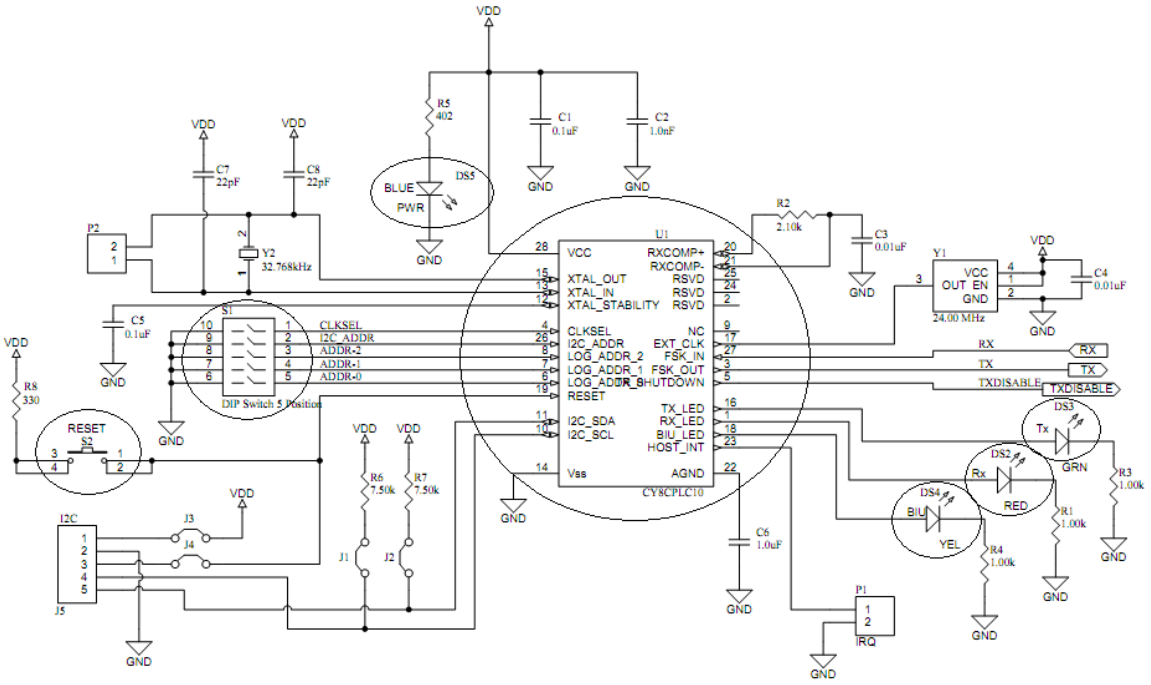
Component	Description/Comment
CY8CPLC10	This is the Cypress powerline transceiver device. It is a 28 pin SSOP device.
PWR LED[DS5]	This is a blue LED that glows when the board is powered on.
TX LED[DS3]	This is a green LED that glows when the board is transmitting data on to the powerline.
RX LED[DS2]	This is a red LED that glows when the CY8CPLC10 device is receiving data.
BIU LED[DS4]	This is a yellow LED that glows when the transmit frequency band is in use.
S1[3-5]	These dip switches set up the logical address of the node in the network. These switches provide an easy way to quickly assign an address from 0 to 7 to the board in a network. S1[3] is MSB and S1[5] is LSB for logical address assignment. If the address is modified, the board must be reset to reflect the changes.

[+] Feedback

Component	Description/Comment
S1[2]	This dip switch sets the I2C slave address to establish the communication with a host processor. Setting the switch to OFF or ON will set the I2C address to external 0x01 or 0x7a respectively.
S1[1]	This dip switch controls the clock setting to the CY8CPLC10. Setting the switch to OFF or ON will set the FSK modem clock to external 32 kHz crystal or external 24 MHz oscillator, respectively. Note that the external crystal is always required for protocol timing.
S2	Reset switch to reset the CY8CPLC10 chip.

The key components are circled in the following schematic.

Figure 3-5. Interface Section

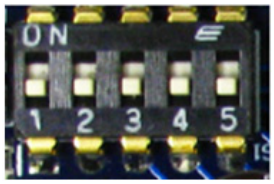


[+] Feedback

3.4 Setting Up the PLC HV Board

This section describes the components of the PLC HV Evaluation Board, the process of setting manual addresses on the PLC HV Board and the connection of USB-I2C Bridge and I2C Cable to the I2C header on the board.

Figure 3-6. DIP Switches for Manual Addressing on the PLC Evaluation Boards



3.4.1 Setting Up Manual Addressing on PLC Boards

The PLC Evaluation Board contains a five-position DIP switch (S1). The three switches S1[3-5] are used to manually set a logical address for the PLC chip. Logical Addresses for up to 8 nodes can be set up using these DIP switches.

S1[3] is the MSB. S1[5] is the LSB. Set the dip-switch to the ON position for the particular bit to be logic '1' and the OFF position for it to be logic '0'. For example, for setting logical address of 0X06:

S1[3] → ON = 1

S1[4] → ON = 1

S1[5] → OFF = 0

Note that the powerline network protocol supports 8-bit logical addressing, 16-bit extended logical addressing, and 64-bit physical addressing; all of these are supported through software. An external host microcontroller or a PSoC can talk to the CY8CPLC10 memory map to set the appropriate mode and configure a particular logical address.

Manual addressing is an easy method to quickly assign a particular address between 0 and 7 to the board which may be a node in a network.

Note After changing the address of the node, the RESET button on the board must be pressed on the PLC HV Board for the change to take effect.

3.4.2 Setting Up I2C Address of the Node

I2C DIP switch S1[2] is used to assign a specific I2C address to the node for communicating with the external microcontroller/PSoC or USB-I2C bridge. When the I2C switch S1[2] is in the OFF position, the address of the node is 0x01 and when it is in the ON position, the address of the node is 0x7A. For further details on I2C addressing, refer to the device data sheet, which is on the CD.

3.4.3 I2C Header Settings

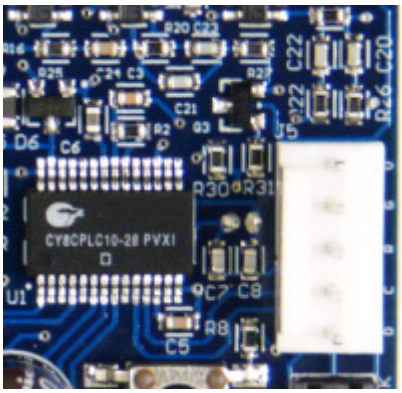
The I2C header, J5, is a five pin header that can be used for communicating with an external board, powering an external board, and resetting the CY8CPLC10 device from an external board. A five wire ribbon cable is provided with this kit for use on the J5 header. The description for J5 header pins is as follows:

[+] Feedback

Table 3-5. J5 I2C Header Pins

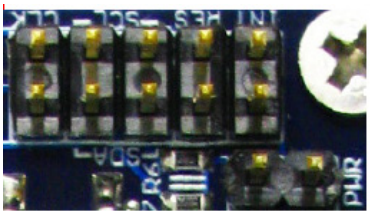
J5 Pin Name	Description
V – Vdd	The Vdd pin can provide a maximum of 50 mA at 5 V to an external board. It is only to source the current. DO NOT SUPPLY POWER TO THIS PIN FOR POWERING THE CY8CPLC10 DEVICE. Note that the PWR jumper, as explained in the next section, needs to be connected to enable this functionality.
G – Gnd	The Gnd pin can provide the ground reference to an external board. This pin connects to the ground of the CY3272 board.
D – I2C Data (SDA)	The I2C Data (SDA) pin is the data line for the I2C communication. This pin is directly connected to the I2C_SDA pin on the CY8CPLC10 device. Check the next section for appropriate jumper settings for I2C communication through this pin.
C – I2C Clock (SCL)	The I2C Clock (SCL) pin is the clock line for the I2C communication. This pin is directly connected to the I2C_SCL pin on the CY8CPLC10 device. Check the next section for appropriate jumper settings for I2C communication through this pin.
R – Reset	Connecting the reset of an external board to this pin enables the resetting of the CY8CPLC10 device via the external board. Note that RES jumper, as explained in the next section, needs to be connected to enable this functionality.

Figure 3-7. I2C Header for Communication



3.4.4 Jumper Settings for the PLC HV Board

Figure 3-8. Jumpers Available On CY3272 Board



[+] Feedback

Table 3-6. Jumper Description

Jumper Name	Use
INT	This is not a jumper. It is a 2-pin header to connect the interrupt pin of the CY8CPLC10 device to an external host. Refer to the CY3272 board schematics to determine interrupt and ground pins for this header.
PWR	This jumper should be connected if the user wants to provide power to an external board. Once this jumper has been connected, power for the external board can be derived from the V (Vdd) and G (Gnd) connectors on the I2C header (J5). For example, if we connect another PSoC EVAL1 board with this board, the PLC board can supply power to that board as well. The CY3272 board can provide a maximum of 50 mA at 5 V to an external board through the V and G pins on the I2C header (J5).
RES	This jumper is for enabling Reset of the PLC device through an external board. Once this jumper has been connected, the external board reset can be connected to the R (Reset) pin on the I2C header (J5).
SCL	This is a pull up jumper. While communicating through I2C (J5), one side has to pull up the line. When the jumper is connected, the SCL line will get pulled high. This needs to be done when the user wants the I2C link to be pulled up by the CY3272 board. This jumper does not need to be placed if the USB-I2C bridge is used for communication to the host.
SDA	This is a pull up jumper. While communicating through I2C (J5), one side has to pull up the line. When the jumper is connected, the SDA line will get pulled high. This needs to be done when the user wants the I2C link to be pulled up by the CY3272 board. This jumper does not need to be placed if the USB-I2C bridge is used for communication to the host.
CLK	This jumper is not available for use and should be left unconnected by the user.

3.5 Example Project

The CY3272 kit is designed for systems that require a communication interface over commercial high-voltage Powerlines. Typically, these systems consist of a microcontroller or processor along with other electronic components that implement the host application functionality. For more information on this interface, see AN52478 *Designing an External Host Application for Cypress's Powerline Communication IC CY8CPLC10*.

3.6 Technical Reference

For a real-time list of knowledge base articles for the CY3272 kit, refer to our Online Knowledge Base.

For any help with the installation of the Control Panel, refer to the Control Panel User Guide provided in the kit CD. You can also download the latest revision of the GUI setup and user guide from www.cypress.com/go/plc.

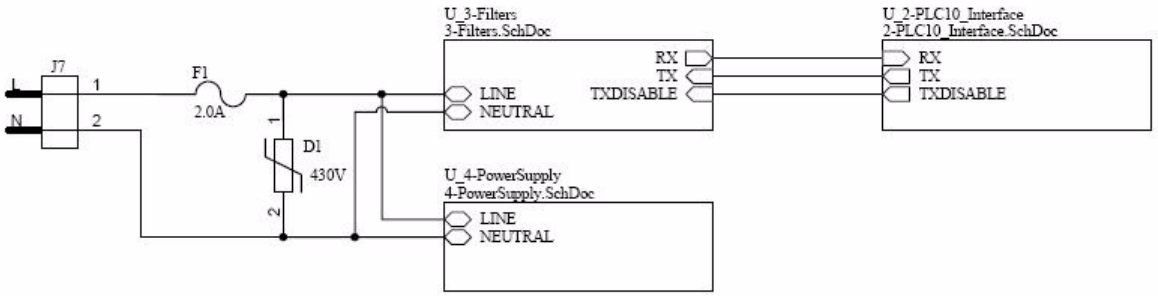
[+] Feedback

[+] Feedback

A. Appendix

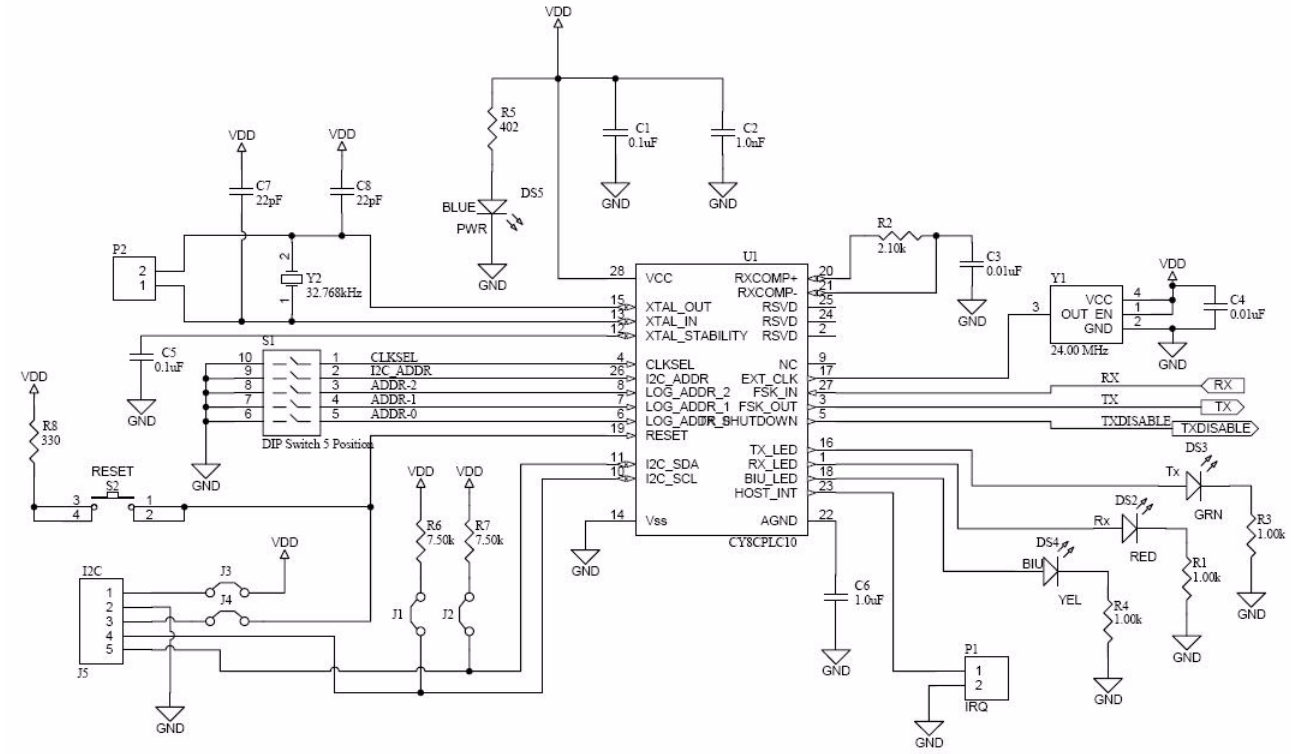
A.1 Schematics

A.1.1 Board Overview



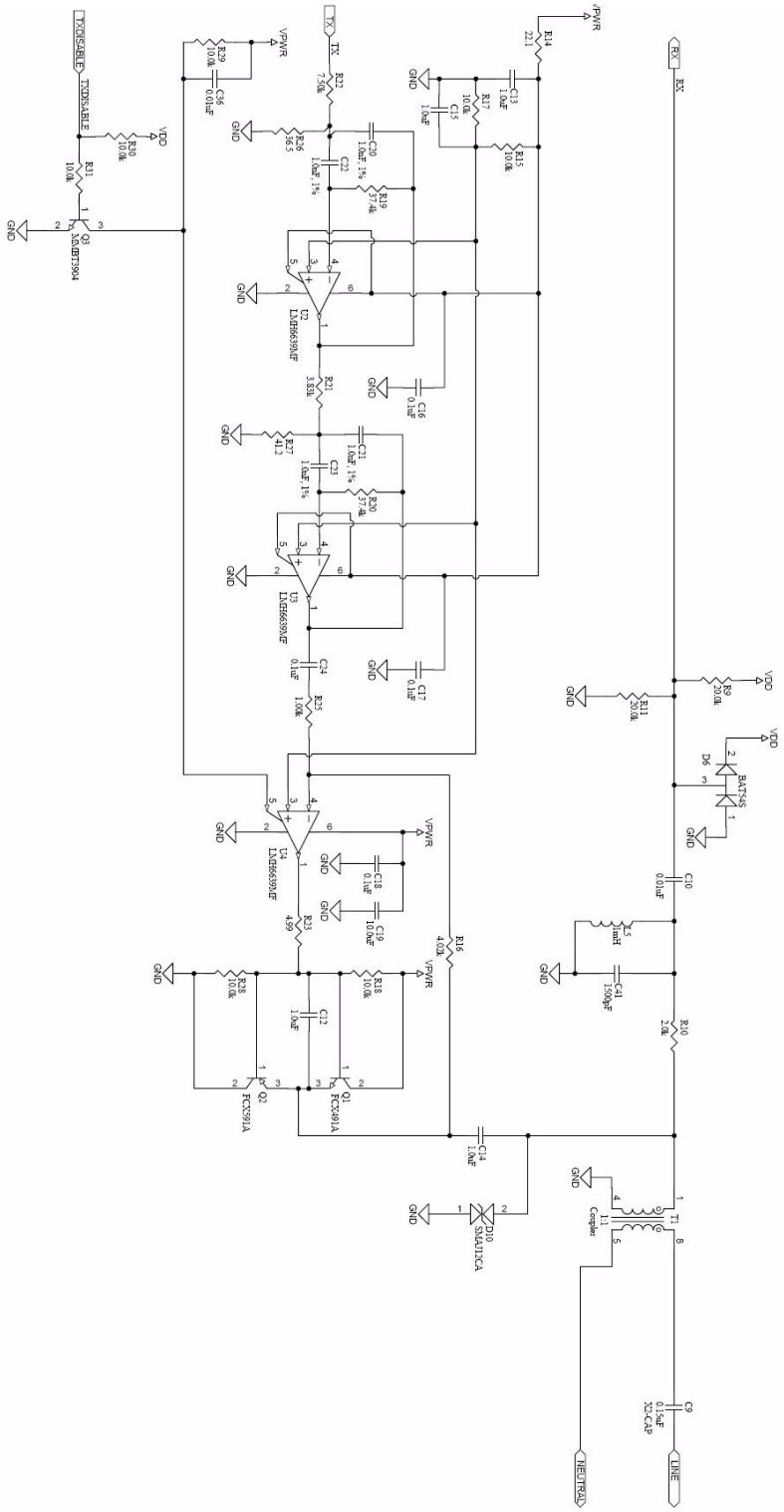
[+] Feedback

A.1.2 User Interface



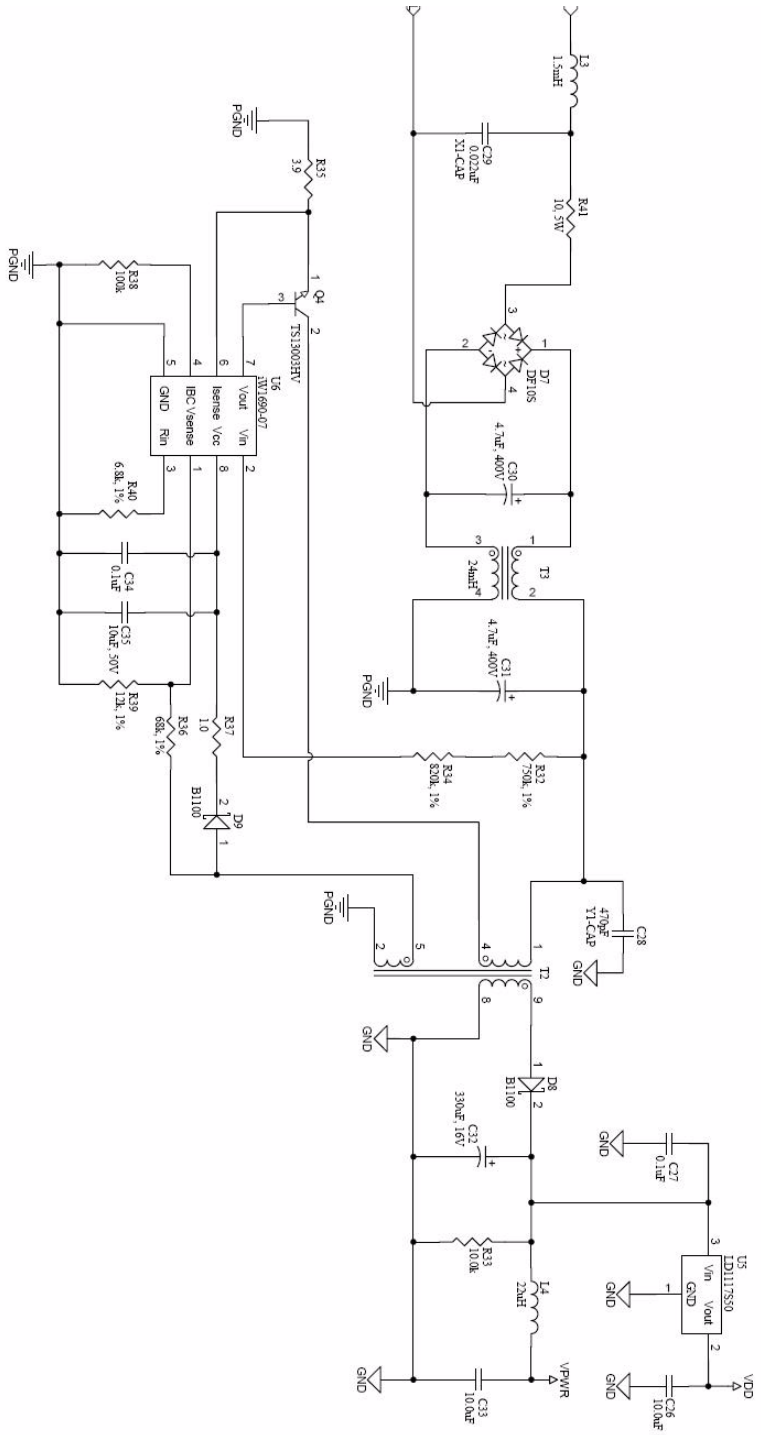
[+] Feedback

A.1.3 Transmit and Receive Filters



[+] Feedback

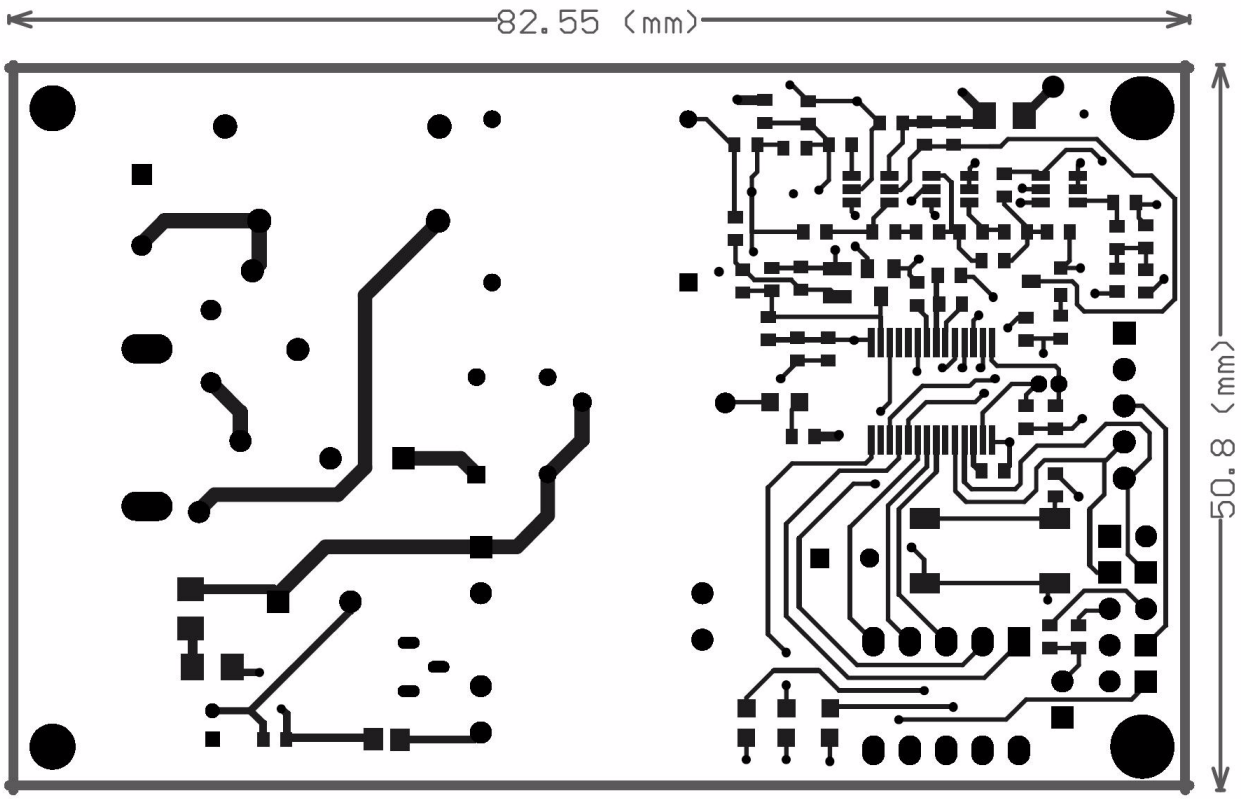
A.1.4 Power Supply



[+] Feedback

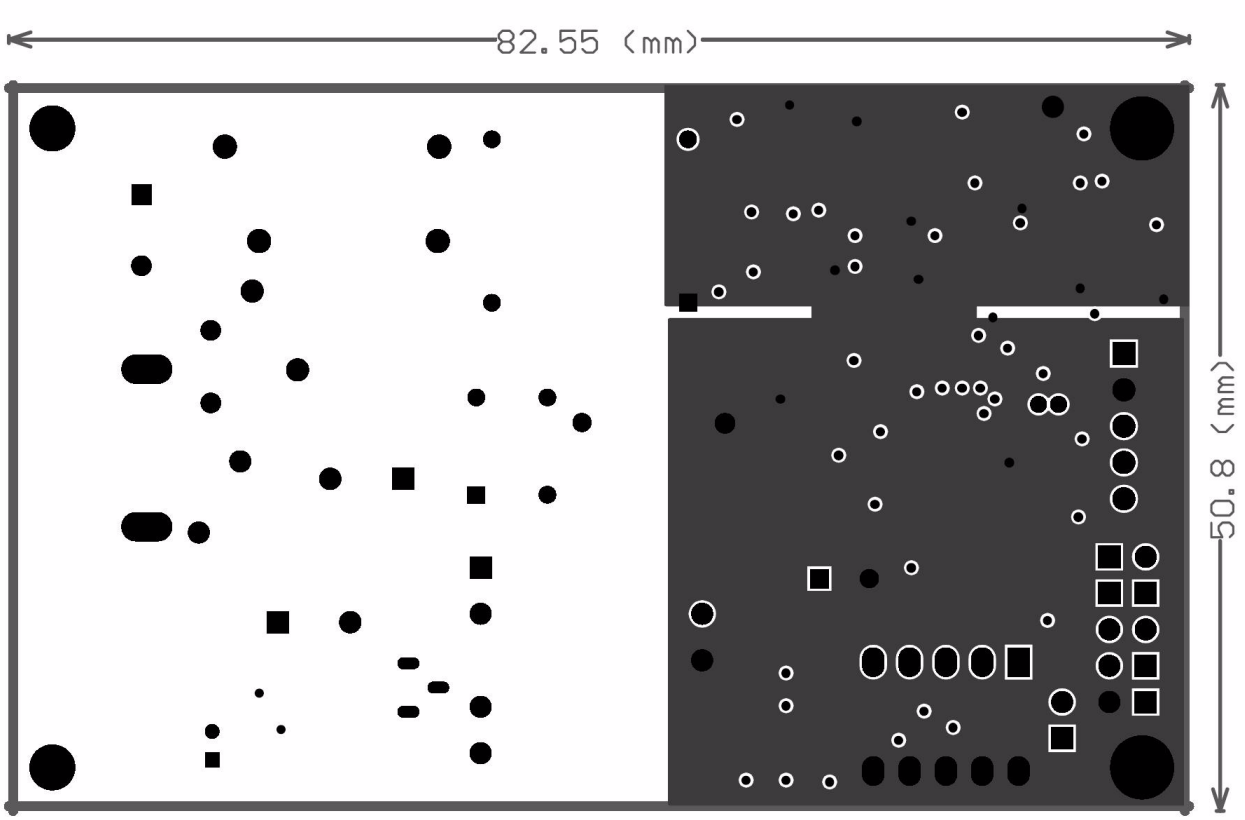
A.2 Layout

A.2.1 Top Layer



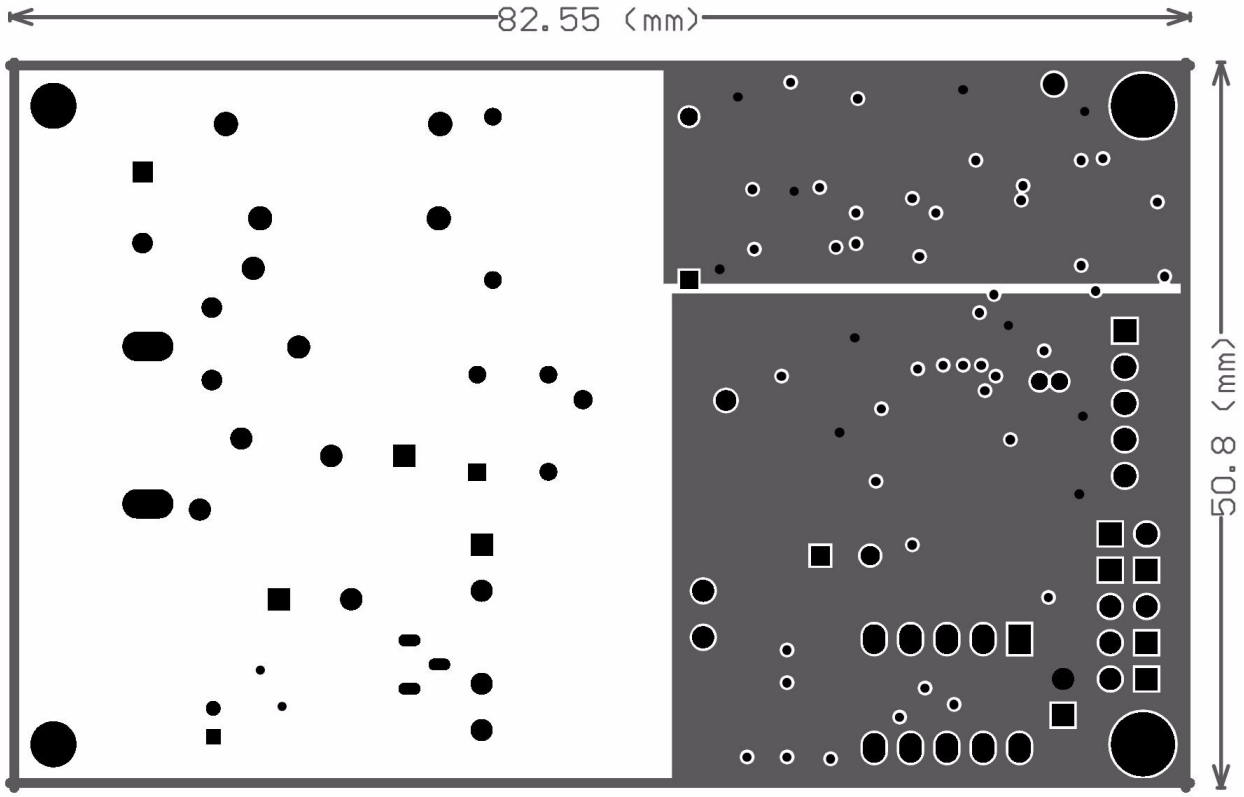
[+] Feedback

A.2.2 Ground Layer



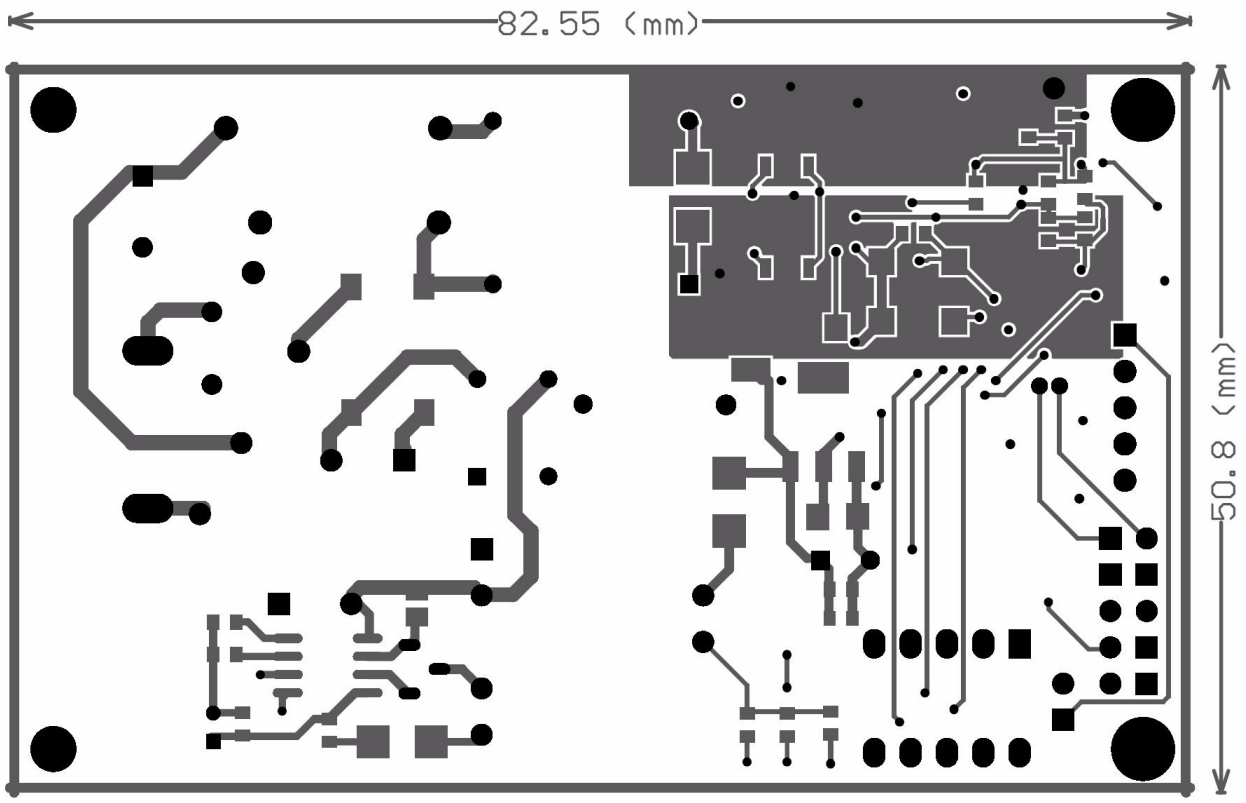
[+] Feedback

A.2.3 Power Layer



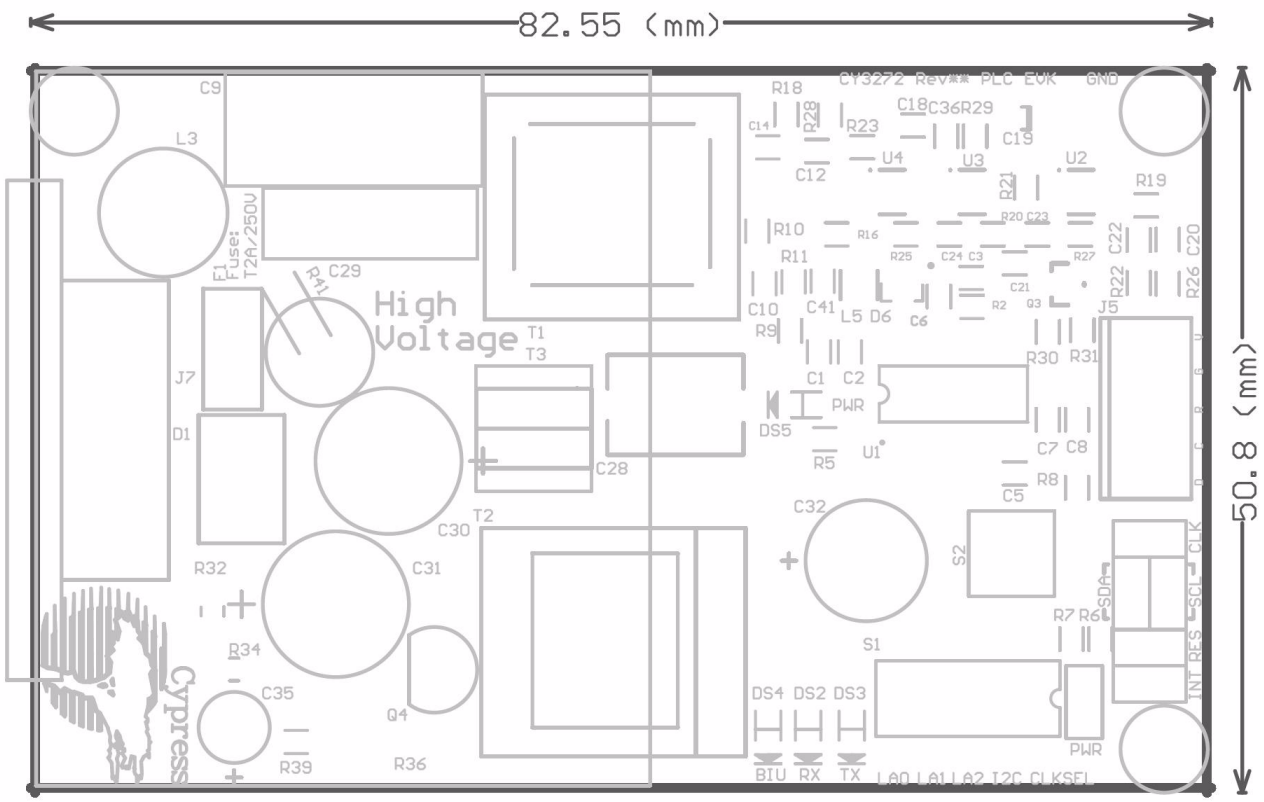
[+] Feedback

A.2.4 Bottom Layer



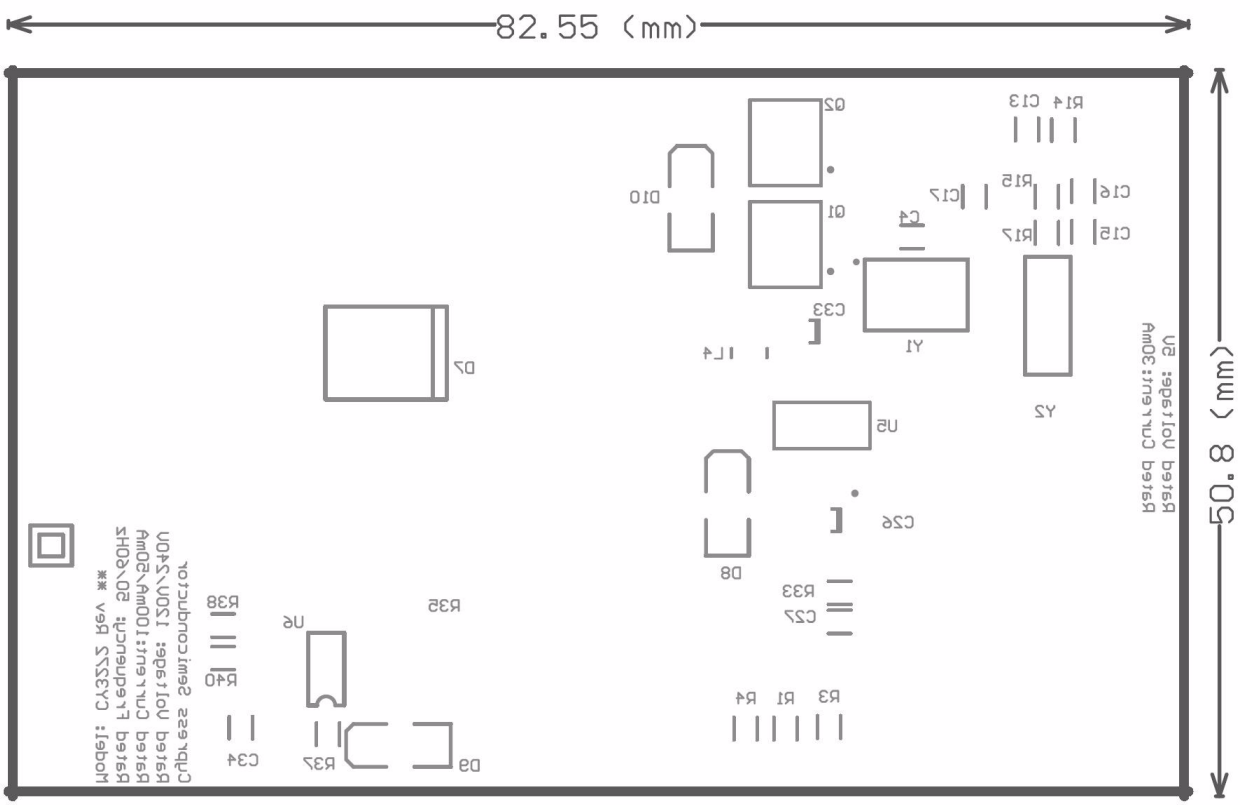
[+] Feedback

A.2.5 Top Silkscreen



[+] Feedback

A.2.6 Bottom Silkscreen



[+] Feedback

A.3 Bill of Materials

Description	Designator	Quantity	Value	Manufacturer	Manufacturer Part#	Digi-Key#
Capacitor Ceramic 0.10UF 10% 16 V X7R 0603	C1, C5, C16, C17, C18, C24, C27, C34	8	0.1 µF	Panasonic	ECJ-1VB1C104K	PCC1762CT-ND
Capacitor Ceramic 1.0nF X7R 10% 25 V C0603	C2	1	1.0nF	Murata	GRM033R71E102KA01D	490-3184-1-ND
Capacitor Ceramic 0.01 µF 25 V X7R 0603	C3, C4, C10, C36	4	0.01 µF	AVX	06033C103JAT2A	06033C103JAT2A-ND
Capacitor Ceramic 1.0 µF 16 V X7R 0603	C6, C12, C13, C14, C15	5	1.0 µF	Taiyo Yuden	EMK107B7105KA-T	587-1241-1-ND
Capacitor Ceramic 22pF 100 V C0G 0603	C7, C8	2	22pF	Murata	GRM1885C2A220JA01D	490-1335-1-ND
Capacitor .15UF 300 VAC INTER SUPP X1	C9	1	0.15 µF	Panasonic	ECQ-U3A154MG	P11117-ND
Capacitor Ceramic 10.0 µF 10% 25 V X5R 1206	C19, C26, C33	3	10.0 µF	Taiyo Yuden	TMK316BJ106KL-T	587-1337-1-ND
Capacitor Ceramic 1000PF 1% 5 V NP0 0603	C20, C21, C22, C23	4	1.0nF, 1%	AVX	06033A102FAT2A	06033A102FAT2A-ND
Capacitor Ceramic 470PF 250 VAC X1Y1 RAD	C28	1	470pF	TDK	CD95-B2GA471KYNS	445-2407-ND
Capacitor .022UF 300 VAC INTER SUPP X1	C29	1	0.022 µF	Panasonic	ECQ-U3A223MG	P11112-ND
Capacitor Electrolytic 4.7 µF, 400 V	C30, C31	2	4.7 µF, 400 V	Nichicon	UVR2G4R7MPD	493-1229-ND
	C30, C31 (2nd Source, 105C rated)		4.7 µF, 400 V	United Chemi-Con	EKMG401ELL4R7MJ16S	565-1411-ND
Capacitor Electrolytic 330 µF 16 V 20%	C32	1	330 µF, 16 V	Nichicon	UPW1C331MPD	493-1784-ND
Capacitor Electrolytic 10 µF 50 V 20%	C35	1	10 µF, 50 V	Nichicon	UPW1H100MDD	493-1890-ND
Capacitor Ceramic 1500pF 10% 50 V X7R 0603	C41	1	1500pF	Yageo	CC0603KRX7R9BB152	311-1184-2-ND
Transorb Voltage Suppressor 430 V 1250A ZNR	D1	1	430 V	Panasonic	ERZ-V07D431	P7251-ND
Dual Schottky Diode	D6	1		ST Micro	BAT54SFILM	497-2522-1-ND
Full Wave Diode Bridge	D7	1		Fairchild	DF10S	DF10SCT-ND
Schottky Diode 100 V 1A SMA	D8, D9	2		Diodes Inc	B1100-13-F	B1100-FDICT-ND
Transient Voltage Suppressor 400W 12 V BIDIRECT SMA	D10	1		Micro Commercial Co	SMAJ12CA-TP	SMAJ12CA-TPMSCT-ND
LED Red Clear 0805	DS2	1		Lite-On	LTST-C170KRKT	160-1415-1-ND
LED Green Clear 0805	DS3	1		Lite-On	LTST-C170KGKT	160-1414-1-ND
LED Yellow Clear 0805	DS4	1		Lite-On	LTST-C170KSKT	160-1416-1-ND
LED Blue Clear 0603	DS5	1		Rohm	SML-E12BC7TT86	511-1589-1-ND

[+] Feedback

Description	Designator	Quantity	Value	Manufacturer	Manufacturer Part#	Digi-Key#
Fuse 2A Slow Blow 250 VAC	F1	1	2.0A	Bel Fuse	RST 2	507-1179-ND
Header 2-Pin 0.1 Centers	J1, J2, J3, J4, P1, P2	6		Sullins	PEC02SAAN	S1012E-02-ND
Header 5-Pin Locking 0.1Centers	J5	1		Amp/Tyco	640456-5	A19471-ND
AC Power Connector	J7	1		Schurter	4300.0097	
Inductor 1500 µH 0.2A 5% Radial	L3	1	1.5mH	Taiyo Yuden	LHL08TB152J	LHL08TB152J-ND
Inductor 22 µH 20% 1210	L4	1	22 µH	Taiyo Yuden	CBC3225T220MR	587-1626-1-ND
Inductor 1mH 10% 1007	L5	1	1mH	Taiyo Yuden	CB2518T102K	587-2195-1-ND
Mounting Holes	MTG1, MTG2, MTG3, MTG4	4				
Transistor NPN HV 40 V 1A SOT-89	Q1	1		Zetex	FCX491ATA	FCX491ACT-ND
Transistor PNP HV 40 V 1A SOT-89	Q2	1		Zetex	FCX591A	FCX591ACT-ND
Transistor NPN SOT-23	Q3	1		Fairchild	MMBT3904LT1	MMBT3904LT1INCT-ND
NPN Silicon Planar Medium Power High-Gain Transistor	Q4	1		TSC	TS13003HVCT	
	Q4 (2nd source)			ST Micro	STX616-AP	497-7625-1-ND
Resistor 1.00k 1% 1/10W 0603	R1, R3, R4, R25	4	1.00k	Yageo	RC0603FR-071KL	311-1.00KHRTR-ND
Resistor 2.1k 1% 1/10W 0603	R2	1	2.10k	Yageo	RC0603FR-072K1L	311-2.10KHRTR-ND
Resistor 402 1% 1/10W 0603	R5	1	402	Yageo	RC0603FR-07402RL	311-402HRTR-ND
Resistor 7.50k 1% 1/10W 0603	R6, R7, R22	3	7.50k	Yageo	RC0603FR-077K5L	311-7.50KHRTR-ND
Resistor 330 1% 1/10W 0603	R8	1	330	Yageo	RC0603FR-07330RL	311-330HRCT-ND
Resistor 20.0k 1% 1/10W 0603	R9, R11	2	20.0k	Yageo	RC0603FR-0720KL	311-20.0KHRCT-ND
Resistor 2.0k 1% 1/10W 0603	R10	1	2.0k	Yageo	RC0603FR-072KL	311-2.00KHRCT-ND
Description	Designator	Quantity	Value	Manufacturer	Manufacturer Part#	Digi-Key#
Resistor 22.1 1% 1/10W 0603	R14	1	22.1	Yageo	RC0603FR-0722R1L	311-22.1HRCT-ND
Resistor 10.0k 1% 1/10W 0603	R15, R17, R18, R28, R29, R30, R31, R33	8	10.0k	Yageo	RC0603FR-0710KL	311-10.0KHRTR-ND
Resistor 4.02k 1% 1/10W 0603	R16	1	4.02k	Yageo	RC0603FR-072K02L	311-4.02KHRTR-ND
Resistor 37.4k 1% 1/10W 0603	R19, R20	2	37.4k	Yageo	RC0603FR-0737K4L	311-37.4KHRCT-ND

Description	Designator	Quantity	Value	Manufacturer	Manufacturer Part#	Digi-Key#
Resistor 3.83k 1% 1/10W 0603	R21	1	3.83k	Yageo	RC0603FR-073K83L	311-3.83KHRCT-ND
Resistor 4.99 1% 1/10W 0603	R23	1	4.99	Yageo	RC0603FR-074R99L	311-4.99HRCT-ND
Resistor 36.5 1% 1/10W 0603	R26	1	36.5	Yageo	RC0603FR-0736R5L	311-36.5HRCT-ND
Resistor 41.2 1% 1/10W 0603	R27	1	41.2	Yageo	RC0603FR-0741R2L	311-41.2HRCT-ND
Resistor 750k 1% 1206	R32	1	750k, 1%	Yageo	RC1206FR-07750KL	311-750KFRCT-ND
Resistor 820k 1% 1206	R34	1	820k, 1%	Yageo	RC1206FR-07820KL	311-820KFRCT-ND
Resistor 3.9 Ohm 1% 0805	R35	1	3.9	Yageo	RC0805FR-073R9L	311-3.90CRCT-ND
Resistor 68.0K OHM 1/8W 1% 0805 SMD	R36	1	68k, 1%	Yageo	RC0805FR-0768KL	311-68.0KCRTR-ND
Resistor 1.00 OHM 1/10W 1% 0603 SMD	R37	1	1.0	Yageo	RC0603FR-071RL	311-1.00HRCT-ND
Resistor 100k OHM 1/10W 1% 0603 SMD	R38	1	100k	Yageo	RC0603FR-07100KL	311-100KHRTR-ND
Resistor 12.0K OHM 1/10W 1% 0603 SMD	R39	1	12k, 1%	Yageo	RC0603FR-0712KL	311-12.0KHRCT-ND
Resistor6.8k, 1% 0603	R40	1	6.8k, 1%	Yageo	RC0603FR-076K8L	311-6.80KHRTR-ND
Resistor 10.0 OHM 5W 5% WIREWND	R41	1	10, 5W	Vishay	AC05000001009JAC00	PPC5W10.0CT-ND
DIP Switch 5 Position DIP-5	S1	1		E-Switch	KAJ05LAGT	EG4429-ND
Pushbutton N.O.	S2	1		E-Switch	TL3301AF160QG	EG2526CT-ND
Isolation Transformer	T1	1		Precision Components	0505-0821G	
Power Trasnsformer EE-16	T2	1	3.2mH	Shenzen Goldenway	EE-16 (5+5) (rev-A)	
	T2 (2nd Source)	1		Renco Electronics	RLCY-1014	
24mH Common Mode Choke	T3	1	24mH	Shenzen Goldenway	EE8.3(2+2)-hori, (rev-A)	
	T3 (2nd Source)	1		Renco Electronics	RLCY-101	
CY8CPLC10 Part	U1	1		Cypress	CY8CPLC10-28PVXI	
Op-Amp 190MHz	U2, U3, U4	3		National Semiconductor	LMH6639MF/NOPB	LMH6639MFCT-ND
Voltage Regulator 5 Volt	U5	1		ST Micro	LD1117S50CTR	497-1243-1-ND
Off-Line Switcher	U6	1		iWatt	iW1690-07	
Oscillator	Y1	1	24.00 MHz	Crystek	C3290-24.000	C3290-24.000-ND
	Y1 (2nd source)			Citizen	CSX750FCC24.000M-UT	300-7214-2-ND
Crystal 32.768kHz 12.5pF	Y2	1	32.768 kHz	ECS Inc.	ECS-3X8X	X1123-ND

[+] Feedback