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CY3268

PowerPSoC[®] Lighting Starter Kit Guide

Document No. 001-67149 Rev. *D



WARNING: HIGH BRIGHTNESS LEDs CAN CAUSE PERMANENT DAMAGE!

Do not look at the HBLEDs directly. The HBLEDs illuminate at a very high intensity and can cause permanent eye damage. Use a thick white sheet of paper as diffuser if there is no optical diffuser available.

WARNING: Generally all lab work in power electronics must be done with extreme care. Caution must be exercised when using power supplies and/or power related equipment.

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1. Introduction



Thank you for your interest in the CY3268 PowerPSoC® Lighting Starter Kit. You can use this kit with the help of guides and code examples that are provided. The project 'CY3268_Example1' is programmed on the CY3268 PowerPSoC Lighting Starter Kit as the default project for demonstration purposes. For more information on this project, see Chapter 5.

The CY3268 PowerPSoC Lighting Starter Kit demonstrates the ability of PowerPSoC to create scalable HBLED management solutions and enables designers to evaluate PowerPSoC. The PowerPSoC family of devices features high-performance power electronics including 1 A, 2 MHz rated power FETs, hysteretic controllers, current sense amplifiers, and PrISM™ technology to create a complete solution for HBLED power management.

This kit also enables designers to test and evaluate preliminary prototype designs using PowerPSoC and understand the design flow using PSoC Designer™ software for the PowerPSoC device family.

Chapter 2 describes how to install and configure software. Chapter 3 explains how to program a PowerPSoC device with PSoC Programmer and use the kit with the help of a code example. Chapter 4 details the hardware operation. Chapter 5 gives a description of the code examples. The Appendix section provides the schematics and bill of materials (BOM).

1.1 Kit Contents

The CY3268 PowerPSoC Lighting Starter Kit contains:

- CY3268 PowerPSoC board
- 12 V, 1 A power supply
- Two jumper shunts
- Five PowerPSoC CY8CLED04D01-56LTXI samples
- Kit CD, which includes:
 - PSoC Designer
 - PSoC Programmer
 - Demo firmware
 - Design files
 - Related documents

Inspect the contents of the kit; if any parts are missing, contact your nearest Cypress sales office for help.

This kit does not contain the MiniProg, a device that is required to program PowerPSoC. You can purchase the MiniProg online from the Cypress web store: <http://www.cypress.com/go/CY3217-Miniprogram1>.

1.2 Additional Learning Resources

Visit www.cypress.com/go/powerpsoc for additional learning resources in the form of data sheets, technical reference manuals, and application notes.

1.2.1 References

- CY3268_PowerPSoC Lighting Starter Kit_Board Schematic.pdf
<http://www.cypress.com/?rID=36572>
- CY3268_PowerPSoC Lighting Starter Kit_Board Layout.zip
<http://www.cypress.com/?rID=36572>
- CY3268 Kit documentation
<http://www.cypress.com/go/CY3268>
- For a list of PSoC Designer-related trainings, see
<http://www.cypress.com/?rID=40543>
- PowerPSoC Intelligent LED Driver data sheet
<http://www.cypress.com/?rID=41013>
- 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
- PrISM™ Technology for LED Dimming – AN47372
<http://www.cypress.com/?rID=2922>
- Multi Channel Color Mixing Using HB LEDs – AN51188
<http://www.cypress.com/?rID=34809>
- PowerPSoC Firmware Design Guidelines – AN51012
<http://www.cypress.com/?rID=35365>
- Switching Regulators Component Design Guide – AN50099
<http://www.cypress.com/?rID=34331>
- Modulation Techniques for LED Dimming – AN49262
<http://www.cypress.com/?rID=34683>

1.3 Document History

Revision	PDF Creation Date	Origin of Change	Description of Change
**	02/02/2011	SNVN	Initial version of kit guide
*A	02/11/2011	SNVN	Updated document properties
*B	04/25/2011	SNVN	Content updates throughout the document to implement review comments
*C	05/25/2011	SNVN	Section 2.2: CD long name corrected to short name. 'CY3268 PowerPSoC'. Removed redundant step 3 in installation. Section 4.2.3.1. ISSP/I2C changed to ISSP. Section 5.2.4 : 'Example code' changed to 'code example'
*D	06/02/2011	SNVN	Corrected formatting in table of contents

1.4 Documentation Conventions

Table 1-1. Document Conventions for Guides

Convention	Usage
Courier New	Displays file locations, user entered text, and source code: C:\...cd\icc\
<i>Italics</i>	Displays file names and reference documentation: Read about the <i>sourcefile.hex</i> file in the <i>PSoC Designer User Guide</i> .
[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.

2. Getting Started



2.1 Introduction

This chapter describes how to install and configure the CY3268 PowerPSoC Lighting Starter kit.

2.2 Kit Installation

To install the kit software, follow these steps:

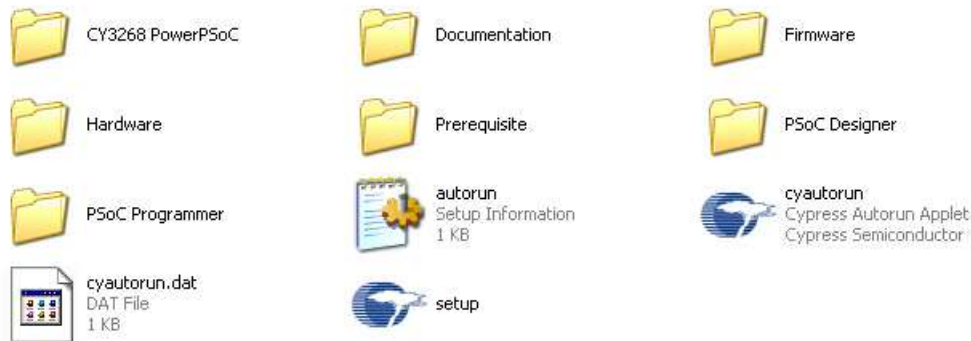
1. Insert the kit CD into the CD drive of your PC. The CD is designed to auto-run and the kit installer startup screen appears; you can also download the latest kit installer ISO file from <http://www.cypress.com/go/CY3268> and create the installer CD; the other option is to extract the ISO using WinRar and install the executables.
2. Click **Install the CY3268 PowerPSoC** to start the installation, as shown in [Figure 2-1](#).

Figure 2-1. Kit Installer Startup Screen



Note If auto-run does not execute, double-click the *cyautorun.exe* file on the root directory of the CD, as shown in [Figure 2-2](#).

Figure 2-2. Root Directory of the CD



3. The **CY3268 PowerPSoC - InstallShield Wizard** screen appears. Choose the folder location to install the setup files. You can change the location of the folder for the setup files using **Change**, as shown in [Figure 2-3](#).
4. Click **Next** to launch the kit installer.

Figure 2-3. CY3268 PowerPSoC - InstallShield Wizard



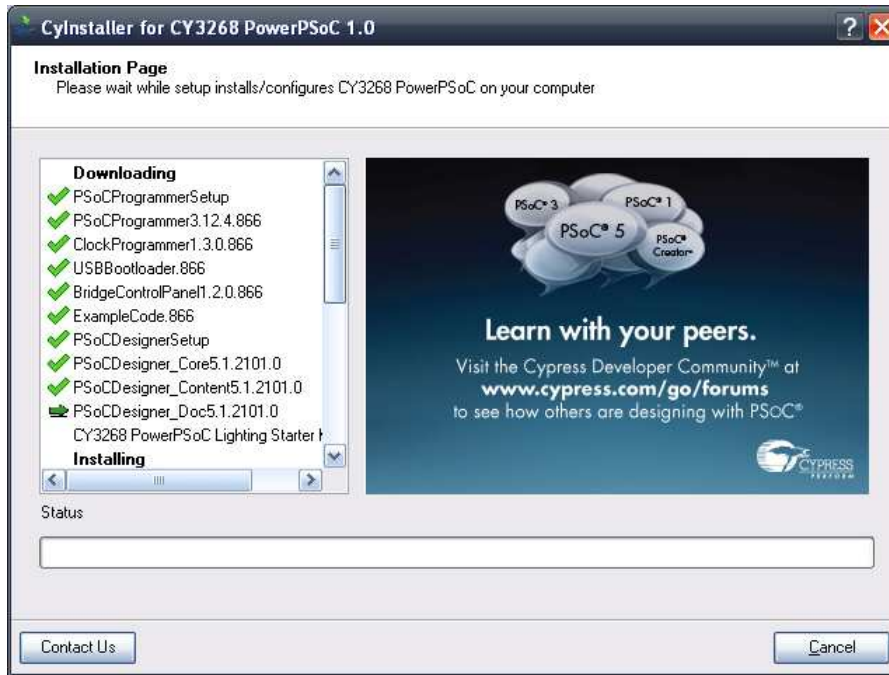
5. On the **Product Installation Overview** screen, select the installation type that best suits your requirement. The drop-down menu has the options **Typical**, **Complete**, and **Custom**, as shown in [Figure 2-4](#).
6. Click **Next** to start the installation.

Figure 2-4. Installation Type Options



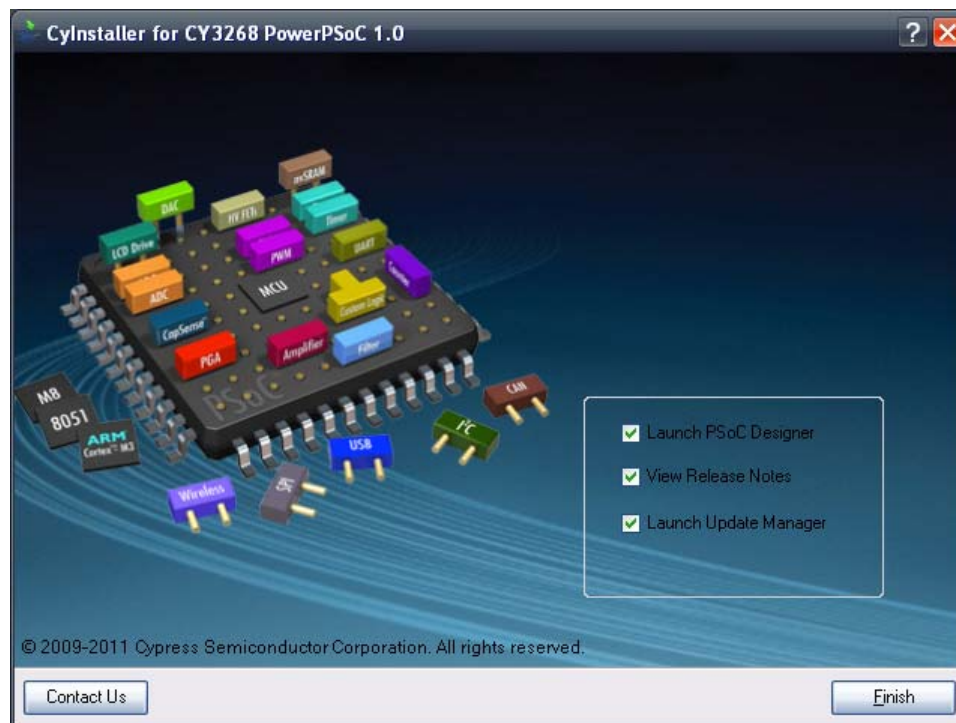
7. When the installation begins, a list of all packages appears on the **Installation Page**.
8. A green check mark appears adjacent to every package that is downloaded and installed, as shown in [Figure 2-5](#).
9. Wait until all the packages are downloaded and installed successfully.

Figure 2-5. Installation Page



10. Click **Finish** to complete the installation, as shown in Figure 2-6.

Figure 2-6. Installation Completion Page



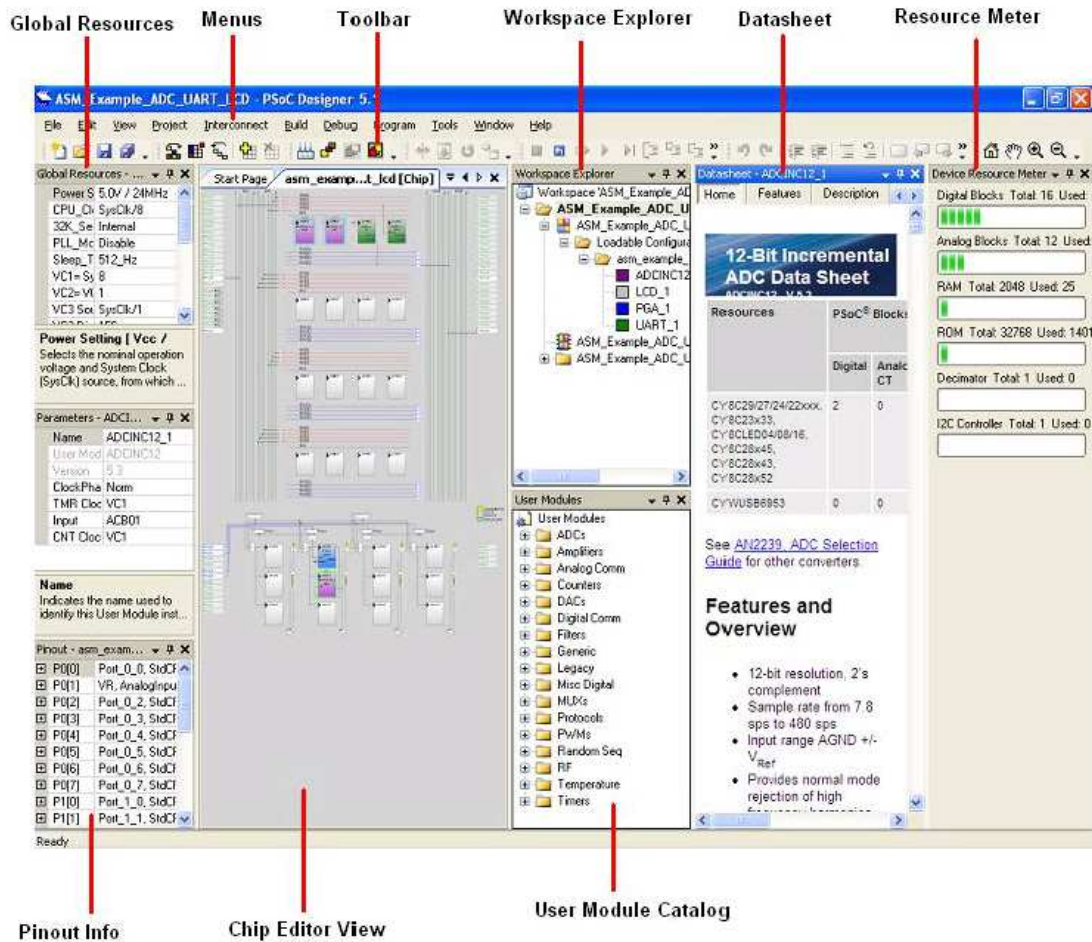
After installing the software, verify that you have all hardware and drivers set up for the MiniProg by connecting the MiniProg to your PC through its USB interface. Because this is the first time you have connected the board to this PC, initial drivers are installed. Follow the on-screen dialogs for USB detection to complete the installation process.

Verify your installation and setup by opening PSoC Designer with the MiniProg attached over USB.

2.3 PSoC Designer

1. Click **Start > All Programs > Cypress > PSoC Designer <version> > PSoC Designer <version>** (Figure 2-7)
2. Click **File > New Project** to create a new project or go to **File > Open Project/Workspace** to work with an existing project

Figure 2-7. PSoC Designer Interconnect View



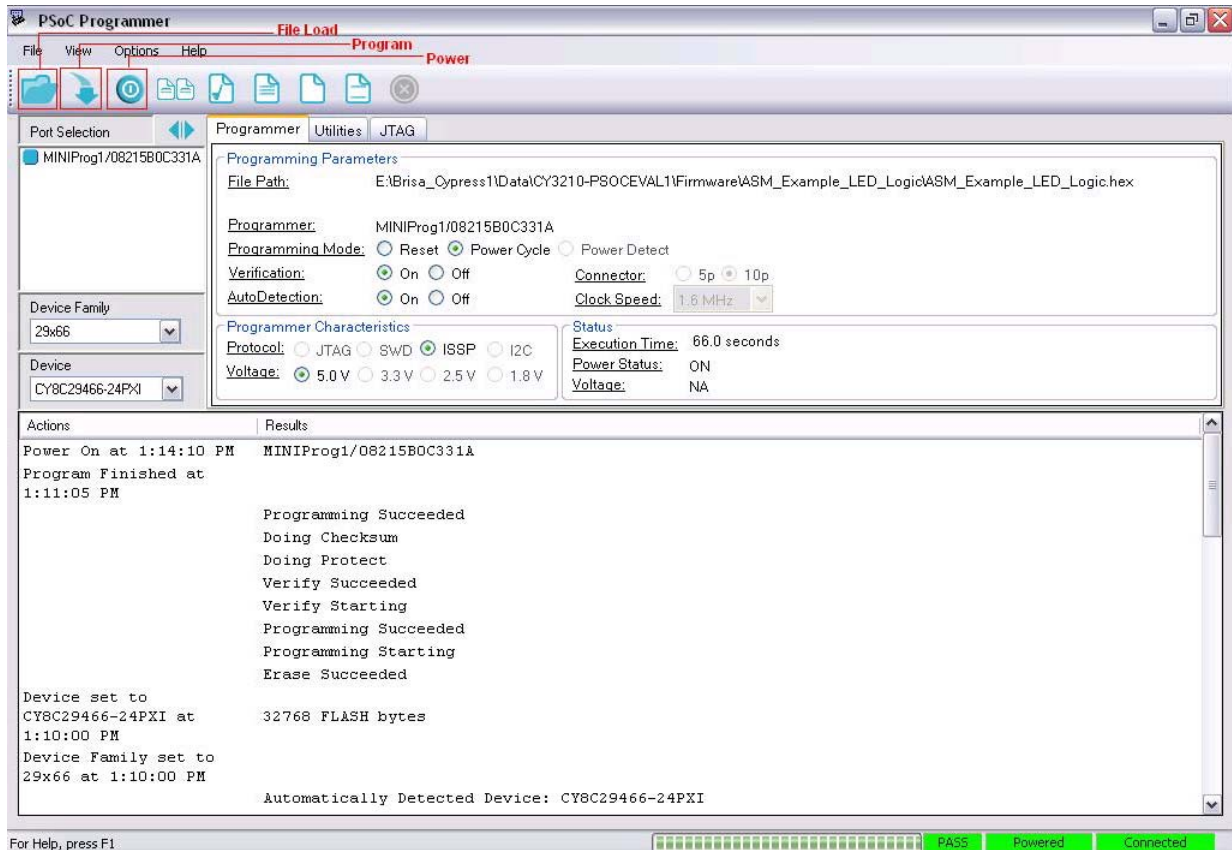
3. To experiment with the code examples, go to [Code Examples chapter on page 29](#)

Note For more details on PSoC Designer, go to **Help Topics** from the following directory:
 <Install_Dir>\Cypress\PSoC Designer\<version>\PSoC Designer 5\Help

2.4 PSoC Programmer

1. Click **Start > All Programs > Cypress > PSoC Programmer <version> > PSoC Programmer <version>** (Figure 2-8)
2. Connect to the MiniProg listed from the **Port Selection** tab of PSoC Programmer, as shown in Figure 2-8

Figure 2-8. PSoC Programmer Window



3. Click on the **File Load** button to load the hex file
4. Use the **Program** button to program the hex file on to the chip
5. When the file is successfully programmed, **Programming Succeeded** appears on the Action pane
6. Close PSoC Programmer

Note For more details on PSoC Programmer, go to **Help Topics** from the following path:
 <Install_Dir>\Cypress\Programmer\<version>\PSoc_Programmer.chm.

2.5 Install Hardware

No hardware installation is required for this kit.

3. Kit Operation



3.1 Introduction

The CY3268 PowerPSoC Lighting Starter Kit examples help you develop applications using the PowerPSoC family of devices. The kit is designed to develop lighting applications using PowerPSoC.

This chapter assists you in understanding the functionality of the kit.

3.2 Programming PowerPSoC Device

The PowerPSoC device on the board can be programmed using a MiniProg. To use MiniProg for programming, use the ISSP programming header J2 on the board, as shown in the following figure.

Figure 3-1. ISSP (J2) Programming Header

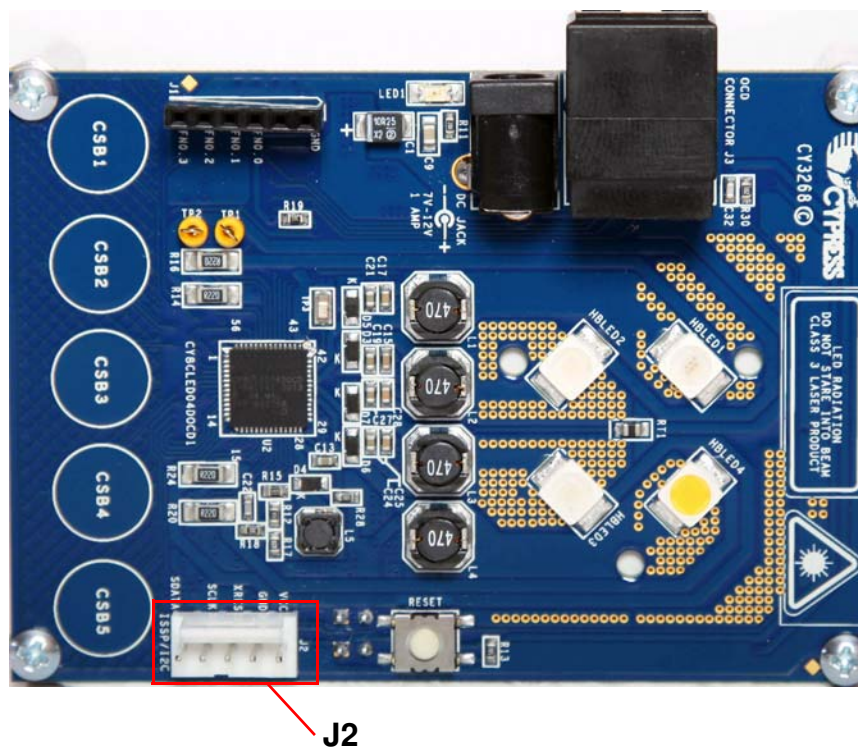


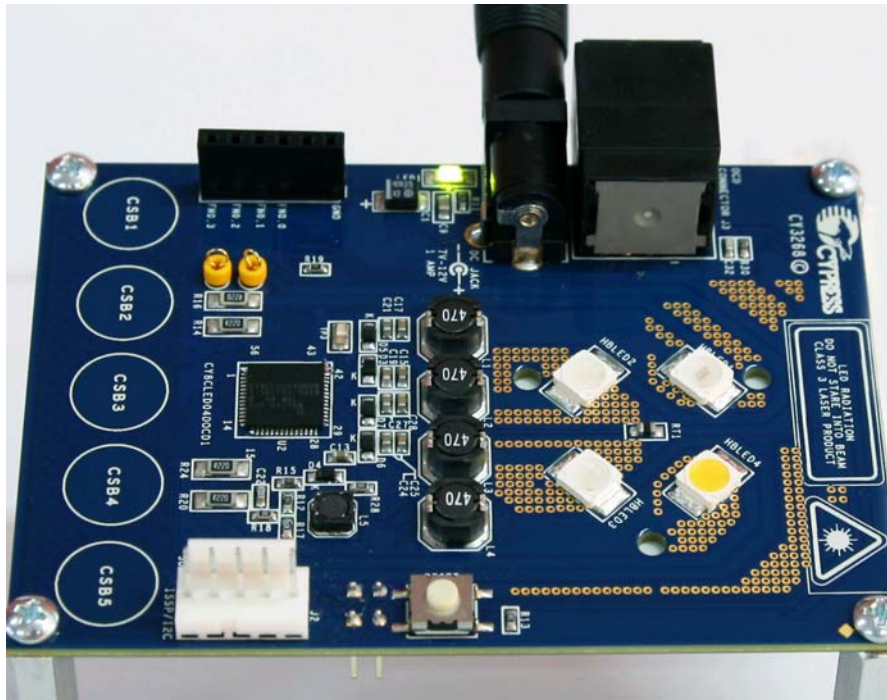
Figure 3-2. Connect MiniProg



Connect the MiniProg, as shown in the [Figure 3-2](#) and program the board using PSoC Programmer.

3.3 CY3268 PowerPSoC Lighting Starter Kit Operation

Figure 3-3. Kit Board



The code example 1 is pre-loaded in the kit, when shipped.

1. Connect the power supply to a wall outlet and to the board.
2. Touch the CapSense[®] buttons CSB1 to CSB4 to turn on the HBLEDs initially.
3. Touch the CapSense buttons CSB1 to CSB4 to select/deselect corresponding HBLEDs. The HBLEDs blink when selected.
4. Touch the CapSense button CSB5 to increase/decrease the brightness of the selected HBLED. Touching CSB5 repeatedly increases the brightness of the selected HBLED. When the maximum brightness is reached, further touching CSB5 decreases the brightness.
5. Turn off the board by removing the power supply from the wall outlet.



WARNING: HIGH BRIGHTNESS LEDs CAN CAUSE PERMANENT DAMAGE!

Do not look at the HBLEDs directly. The HBLEDs illuminate at a very high intensity and can cause permanent eye damage. Use a thick white sheet of paper as diffuser if there is no optical diffuser available.

WARNING: Generally all lab work in power electronics must be done with extreme care. Caution must be exercised when using power supplies and/or power related equipment.

4. Hardware

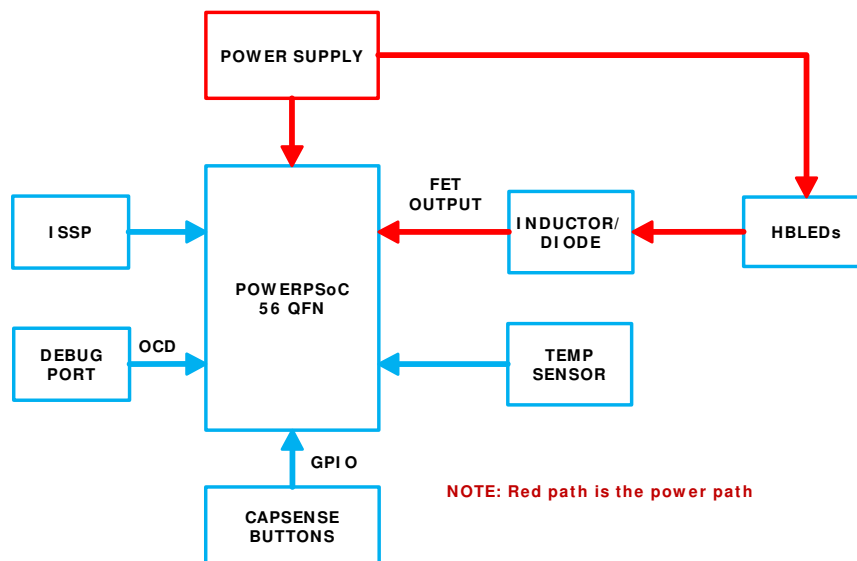


4.1 System Block Diagram

The CY3268 PowerPSoC Lighting Starter Kit has the following sections:

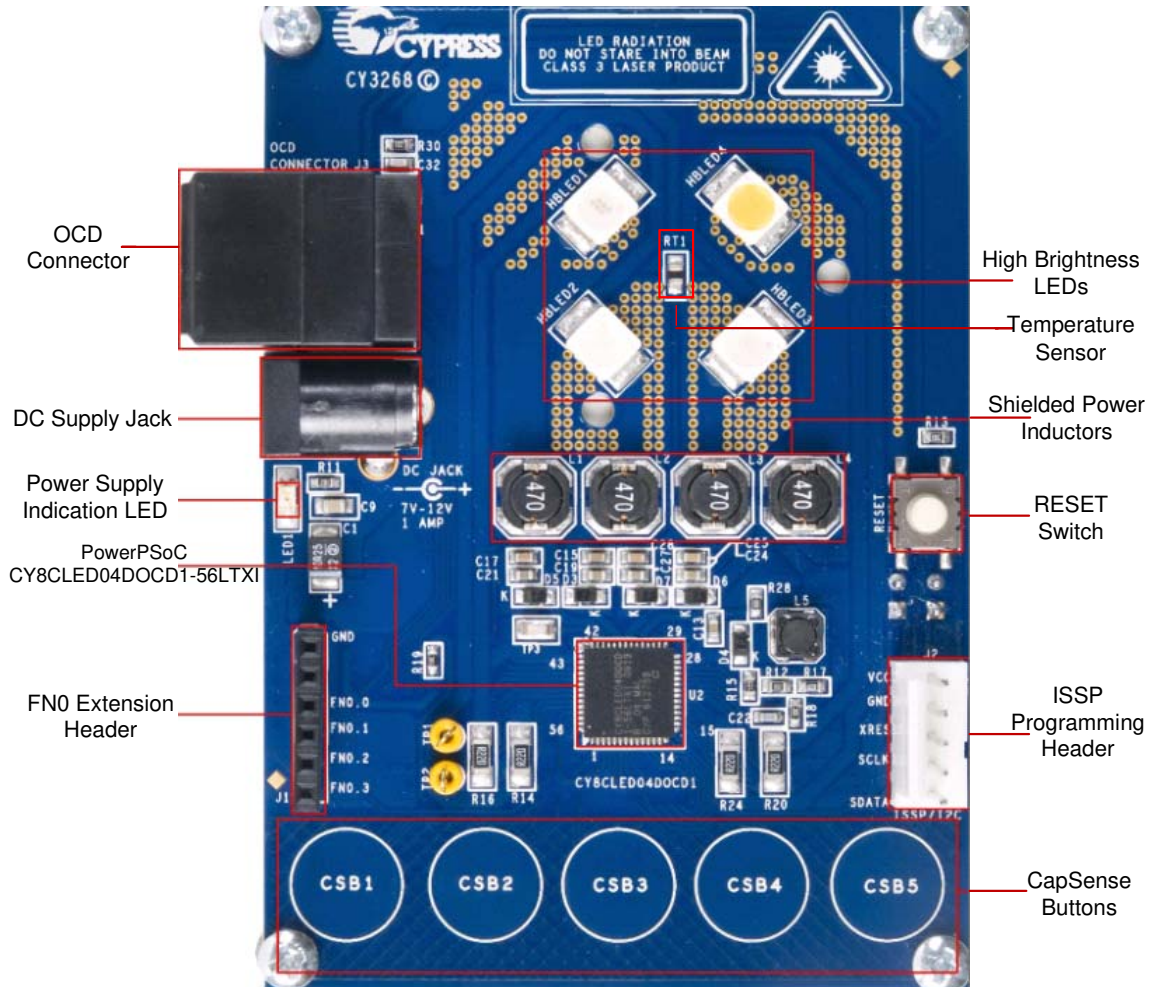
- Power supply system
 - Power on indicator LED (green)
- Programming interface
 - ISSP/I²C header
- Four HBLEDs (300 mA rating)
- Five CapSense buttons
- One reset switch
- Debug port
- Temperature sensor

Figure 4-1. Block Diagram



4.2 Functional Description

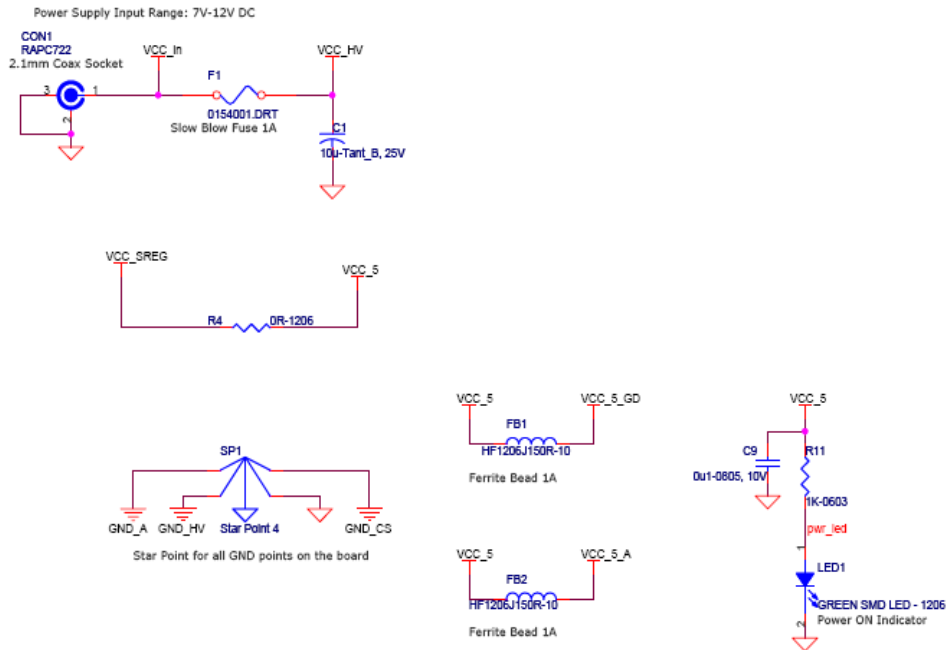
Figure 4-2. Components on the CY3268 PowerPSoC Board



4.2.1 Power Supply

The power supply system on this board is versatile. It takes input supply from the following source:
7 V - 12 V wall wart supply using connector CON1

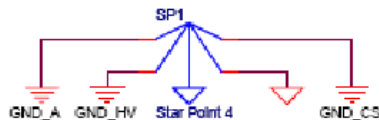
Figure 4-3. Power System Structure



4.2.1.1 Grounding Scheme

Star Point for all GND points on the board.

Figure 4-4. Star Grounding Scheme

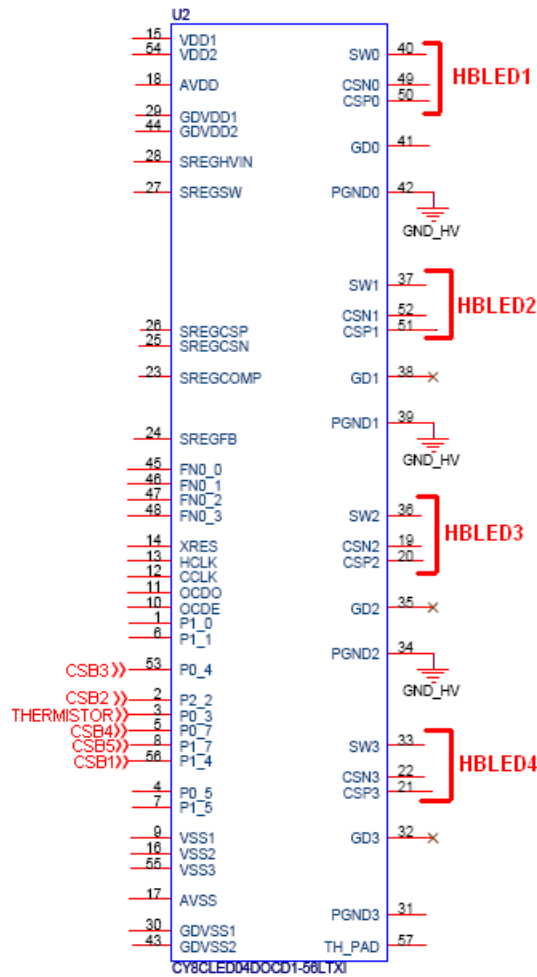


4.2.2 PowerPSoC

The CY3268 PowerPSoC Lighting Starter Kit is designed as the HBLEDD driver circuit. The specifications of the driver circuit in this design are:

- Input voltage: 7 V minimum and 12 V maximum
- HBLEDD output current per channel: 300 mA maximum
- Expected efficiency: > 90%
- Expected switching frequency: 800 kHz
- Inductor current ripple: 30% of load current, that is, 30% of 300 mA = 90 mA

Figure 4-5. PowerPSoC Connections



Thermistor should be placed on the same side of the board as the LEDs and should be placed in the center among the four LEDs

4.2.2.1 Applications of PowerPSoC

- Stage lighting
- Architectural lighting
- General purpose lighting
- Automotive and emergency vehicle lighting
- Landscape lighting
- Display lighting
- Effects lighting
- Signage lighting

4.2.2.2 Pin Details

Table 4-1. Pin Description

Pin No.	Name	Description	Connected To
1	P1[0]	GPIO/I2C SDA (Secondary)/ISSP SDATA	ISSP SDATA (J2)
2	P2[2]	GPIO/Direct Switch Cap connection	CSB2
3	P0[3]	GPIO/Analog Input (Column 0)/ Analog Output (Column 0)	Thermistor
4	P0[5]	GPIO/Analog Input (Column 0)/ Analog Output (Column 1) / CapSense Ref Cap	GND
5	P0[7]	GPIO/Analog Input (Column 0)/CapSense Ref Cap	CSB4
6	P1[1]	GPIO/I2C SCL (Secondary)/ISSP SCLK	ISSP_SCK (J2)
7	P1[5]	GPIO/I2C SDA (Primary)	GND
8	P1[7]	GPIO/I2C SCL (Primary)	CSB5
9	VSS	Digital Ground	
10	OCDE	On Chip Debugger Port	J3 (Used to interface with the ICE for debugging)
11	OCDO	On Chip Debugger Port	J3 (Used to interface with the ICE for debugging)
12	CCLK	On Chip Debugger Port	J3 (Used to interface with the ICE for debugging)
13	HCLK	On Chip Debugger Port	J3 (Used to interface with the ICE for debugging)
14	XRES	External Reset	ISSP_XRES(J2, J3, Reset push button)
15	VDD	Digital Power Supply	
16	VSS	Digital Ground	
17	AVSS	Analog Ground	
18	AVDD	Analog Power Supply	
19	CSN2	Current Sense Negative Input 2	
20	CSP2	Current Sense Positive Input and Power Supply - CSA2	
21	CSP3	Current Sense Positive Input and Power Supply - CSA3	
22	CSN3	Current Sense Negative Input 3	
23	SREGCOMP	Voltage Regulator Error Amp Comp	
24	SREGFB	Regulator Voltage Mode Feedback Node	
25	SREGCSN	Current Mode Feedback Negative	
26	SREGCSP	Current Mode Feedback Positive	
27	SREGSW	Switch Mode Regulator OUT	
28	SREGHVIN	Switch Mode Regulator IN	
29	GDVDD	Gate Driver Power Supply	
30	GDVSS	Gate Driver Ground	
31	PGND3[2]	Power FET Ground 3	

Table 4-1. Pin Description

Pin No.	Name	Description	Connected To
32	GD3	External Low Side Gate Driver 3	
33	SW3	Power Switch 3	
34	PGND2[2]	Power FET Ground 2	
35	GD2	External Low Side Gate Driver 2	
36	SW2	Power Switch 2	
37	SW1	Power Switch 1	
38	GD1	External Low Side Gate Driver 1	
39	PGND1[2]	Power FET Ground 1	
40	SW0	Power Switch 0	
41	GD0	External Low Side Gate Driver 0	
42	PGND0[2]	Power FET Ground 0	
43	GDVSS	Gate Driver Ground	
44	GDVDD	Gate Driver Power Supply	
45	FN0[0]	Function I/O	J1 (GPIO 6x1 TH Header (F))
46	FN0[1]	Function I/O	J1 (GPIO 6x1 TH Header (F))
47	FN0[2]	Function I/O	J1 (GPIO 6x1 TH Header (F))
48	FN0[3]	Function I/O	J1 (GPIO 6x1 TH Header (F))
49	CSN0	Current Sense Negative Input 0	
50	CSP0	Current Sense Positive Input and Power Supply - CSA0	
51	CSP1	Current Sense Positive Input and Power Supply - CSA1	
52	CSN1	Current Sense Negative Input 1	
53	P0[4]	GPIO/Analog Input (Column 1) / Bandgap Output	CSB3
54	VDD	Digital Power Supply	
55	VSS	Digital Ground	
56	P1[4]	GPIO / External Clock Input	CSB1

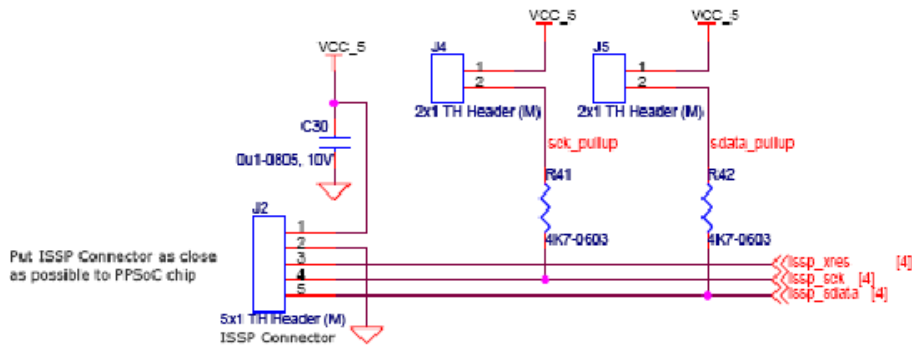
4.2.3 Programming Interface

This kit allows programming using the ISSP/I²C programming interface that uses a MiniProg.

4.2.3.1 ISSP Programming

The board also provides the option of using the MiniProg. This interface is faster and the ISSP programming is done through the 5-pin connector, J2.

Figure 4-6. ISSP Programming



The ISSP programming using J2 requires a programmer that can be purchased from [here](#).

Connector	Functionality
J4	Used with issp_sck pin for programming; short pins 1 and 2 to enable pull-ups on I ² C
J5	Used with issp_sdata pin for programming; short pins 1 and 2 to enable pull-ups on I ² C

4.2.4 CapSense Sensors

The board has five CapSense buttons. The board layout has considered the special requirements for CapSense. The CapSense button (CSB1) is connected to pin P1[4], CapSense button (CSB2) is connected to P2[2], CapSense button (CSB3) is connected to P0[4], CapSense button (CSB4) is connected to P0[7], and CapSense button (CSB5) is connected to P1[7].

CSB 1	LED 1	ON/OFF
CSB 2	LED 2	ON/OFF
CSB 3	LED 3	ON/OFF
CSB 4	LED 4	ON/OFF
CSB 5	DIM	CYCLE COLORS