

# CY3280-MBR2 CapSense<sup>®</sup> Express<sup>™</sup> with SmartSense<sup>™</sup> Auto-Tuning Kit Guide

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Thank you for your interest in the CY3280-MBR2 CapSense<sup>®</sup> Express<sup>™</sup> with SmartSense<sup>™</sup> Auto-Tuning Kit. This kit is designed to showcase the abilities of the CY8CMBR2110 register configurable CapSense controller. The CY8CMBR2110 controller is equipped with SmartSense, which enables engineers to go from prototyping to mass production without tuning for manufacturing variations in PCB and overlay material properties.

This guide provides details on the kit contents, installation procedure, hardware descriptions, sample configurations, schematics, and the bill of materials.

The kit package includes the EZ-Click customizer tool, which is required to configure the kit. For more information and to download the tool, visit http://www.cypress.com/go/ez-click.

## 1.1 Kit Contents

- CY3280-MBR2 kit
- Two AAA batteries (unassembled)
- Overlay (3-mm thickness)
- A to Mini-B USB cable
- Screw driver
- Five samples of CY8CMBR2110-LQXI
- CY3280-MBR2 kit CD/DVD
- Flex-PCB (with 1-mm overlay)
- Quick start guide

## **1.2 Factory Default Configuration**

The kit installation folder includes three configuration files that demonstrate several features. The Sample Configurations chapter on page 35 provides details of these configuration files. When shipped, the CY3280-MBR2 board is configured with Sample Configuration1 file.

## 1.3 Reference Documents

The following documents can be used for reference:

- CY8CMBR2110 CapSense Design Guide
- CY8CMBR2110 Datasheet
- EZ-Click Customizer Tool User Guide
- CY3280-BSM
- Getting Started with CapSense Guide



## 1.4 Acronyms

Acronym	Definition
BSM	Simple Button Module
CSD	CapSense Sigma-Delta
ESD	Electrostatic Discharge
GUI	Graphic User Interface
IIC	Inter Integrated Circuit
LED	Light Emitting Diode
MBR	Mechanical Button Replacement
NC	Not Connected
PCB	Printed Circuit Board
PC	Personal Computer
USB	Universal Serial Bus

## 1.5 Document Revision History

Table 1-1. Revision History

Revision	PDF Creation Date	Origin of Change	Description of Change
**	04/04/2012	ZINE	Initial version of kit guide
*A	11/16/2012	ZINE	Updated Getting Started chapter on page 9. Updated all images.
*B	03/04/2013	ZINE	Updated Title Updated all images in Chapter 2 Updated Procedure in Configuring CY8CMBR2110 CapSense Con- troller on page 14 Updated Configuring CY8CMBR2110 CapSense Controller on page 14 and Kit Features on page 16 Updated Table 4-1 on page 32 Updated Appendix chapter on page 39
*C	05/22/2013	ZINE	Updated Kit Operation chapter on page 13.

## 1.6 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 <i>sourcefile.hex</i> file in the <i>PSoC Designer User Guide</i> .	
[Bracketed, Bold]	Displays keyboard commands in procedures: [Enter] or [Ctrl] [C]	



Table 1-2.	Document	Conventions	for	Guides

Convention	Usage
File > Open	Represents menu paths: File > Open > New Project
Bold	Displays commands, menu paths, and icon names in procedures: Click the <b>File</b> icon and then click <b>Open</b> .
Times New Roman	Displays an equation: 2+2=4
Text in gray boxes	Describes Cautions or unique functionality of the product.

Introduction







This chapter describes the installation of the CY3280-MBR2 CapSense Express with SmartSense Auto-Tuning Kit.

## 2.1 Before you Begin

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

- 1. Shut down any Cypress software that is currently running.
- 2. Disconnect ICE-Cube or MiniProg1 devices from your computer.

### 2.2 Installation Procedure

Install the EZ-Click customizer tool to load and run the sample configurations onto the board. You can also build your own configuration file using this tool. Follow these steps to install the CY3280-MBR2 kit package:

1. Insert the kit CD/DVD into the CD/DVD drive of your PC. The CD/DVD is designed to auto-run and the kit installer startup screen appears.

**Note** You can also download the latest kit installer from http://www.cypress.com/go/CY3280-MBR2. Three different types of installers are available for download.

- a. CY3280-MBR2\_ISO: This file (ISO image) is an archive file of the optical disc provided with the kit. You can use this to create an installer CD/DVD or extract information using WinRar or similar tools.
- b. CY3280-MBR2\_ Single Package: This executable file installs the contents of the kit CD/DVD, which includes PSoC Programmer, PSoC Designer, kit code examples, kit hardware files, and user documents.
- c. CY3280-MBR2\_Single Package (without prerequisites): This executable file installs only the kit contents, which includes kit code examples, hardware files, and user documents.
- 2. Click Install CY3280-MBR2 to start the kit installation, as shown in Figure 2-1.





Figure 2-1. Kit Installer Startup Screen

**Note** If auto-run does not execute, double-click *cyautorun.exe* file on the root directory of the CD/DVD, as shown in Figure 2-2. To access the root directory, click **Start > My Computer > CY3280-MBR2 <drive:>**.

Figure 2-2. Root Directory of CD/DVD

SCY 3280-MBR2 (F:)			
<u>Fi</u> le <u>E</u> dit <u>V</u> iew F <u>a</u> vorites <u>T</u> oo	ls <u>H</u> elp		
🌀 Back 🔹 🕥 - 🏂 🔎	Search 😥 Folders 🛄 🕶		
Address 🗣 F:\			
CY3280-MBR2	Documentation	EZ-Click	Hardware
Prerequisite	PSoC Programmer	Sample Configurations	autorun Setup Inform 1 KB
Cyautorun DAT File 1 KB	Cypress Autorun Applet Cypress Semiconductor	setup 48 × 48 ICO File	

- 3. On the startup screen, click **Next** to start the installer.
- 4. The **InstallShield Wizard** screen appears. On this screen, choose the folder location to install the setup files. You can change the folder location for setup files using **Change**, as shown in Figure 2-3.
- 5. Click Next to launch the kit installer.

#### Figure 2-3. InstallShield Wizard

CY3280-MBR2 - InstallShie	eld Wizard 🛛 🔀
	Welcome to the InstallShield Wizard for CY3280-MBR2 The InstallShield Wizard will install CY3280-MBR2 on your computer. To continue, click Next.
	Select folder where setup will install files. Install CY3280-MBR2 to: C:\\CypressChange
	< Back Next > Cancel

- On the Product Installation Overview screen, select the installation type that best suits your requirement. The drop-down menu has three options: Typical, Complete, and Custom, as shown in Figure 2-4. If you are uncertain, proceed with the default setting (Typical).
- 7. Click Next to start the installation.

Figure 2-4. Installation Type Options

👶 Cyinstaller for CY3280-MBR2 1.0	? 🗙
Product Installation Overview Choose the install type that best suits your needs	
Choose the type of installation Product: CY3280-MBR2 Installation Type: Installs the most common features of CY3280-MBR2.	
Contact Us	icel

- When the installation begins, a list of all packages appear on the Installation Page. A green checkmark appears against every package that is downloaded and installed, as shown in Figure 2-5.
- 9. Wait until all the packages are downloaded and installed successfully.







10. Click Finish to complete the installation.

Figure 2-6. Installation Complete

< Cylnstaller for CY3280-MBR2 1.0	? 🛛
C2009	Contact Information   Name: *   Company:   Cypress   Email: *   * Indicates a required field   Privacy Policy    View Release Notes  Launch EZ-Click  View User Guide  Launch Update Manager  Continue Without Contact Information
All rights reserved	
Contact Us	Ejnish



The CY8CMBR2110 CapSense controller supports multiple features. The CY3280-MBR2 CapSense Express Kit package includes the hardware required to demonstrate these features. This chapter details these features along with how to use them with the kit.

To start using the kit, open the case using the screw driver and insert the two AAA batteries in the battery holder. Assemble the case using the screw driver provided with the kit. Touch the power button first and ensure the power button, LED1, and LED2 light up. Each CapSense button is mapped to an LED such that activation of a button can be verified by monitoring the LED status. The ON status of LEDs indicate that the CapSense buttons are active.

The Flex-PCB with 10 buttons can be connected to the kit via the 44-pin expansion connector (see Hardware chapter on page 31 for details). Power off the kit before connecting the Flex-PCB. When the kit is powered, a finger touch on the Flex-PCB buttons lights up the respective LED on the kit.



Figure 3-1. CY8CMBR2110 CapSense Controller Kit with Flex-PCB



#### Figure 3-2. Expansion Connector



## 3.1 CY8CMBR2110 CapSense Controller Features

The CY8CMBR2110 controller has the following features:

- SmartSense Auto-Tuning Supports auto-tuning
- Toggle (Touch ON/OFF) Allows mechanical button replacement
- Flanking sensor suppression Provides discrimination between closely spaced sensors
- LED ON time Provides better visual feedback based on button press
- Button auto reset Prevents stuck sensor, caused by placing a metal object close to the sensor
- Debounce control Prevents false button trigger
- Buzzer signal output Enables connecting the buzzer directly to the device
- Host controlled general-purpose output (GPO) Enables control by the host (I2C master)
- Power-on LED effects
- Button controlled LED effects
- System diagnostics supports production testing and debugging

See the CY8CMBR2110 datasheet for more details on these features.

The CY3280-MBR2 CapSense Express Kit can be configured using the EZ-Click customizer tool. Three configuration file projects are included with the kit. Additional configurations can be generated using the tool.

#### 3.1.1 Configuring CY8CMBR2110 CapSense Controller

Follow these steps to configure the CY8CMBR2110 controller:

To configure the kit and test the features supported by it, follow these steps:

- 1. Connect the CY3280-MBR2 kit to the PC via the USB port using the USB cable and move the switch position to GUI. Ensure USB Status LED glows.
- Open the EZ-Click customizer tool from the default location: Start > All Programs > Cypress > EZ-Click <version> > EZ-Click.
- 3. Create a new project in the EZ-Click customizer tool by clicking on **New Project** under **File** menu.
- 4. In the Main console tab, choose the Cypress device to be CY8CMBR2110.



- 5. Connect the kit to the EZ-Click tool using the following steps.
  - a. Click on the **Connect** button on the **Main Console** tab of the EZ-Click customizer tool. The EZ-Click will throw an error as shown. Click **OK** on the pop-up window. Ensure USB Power LED glows.

LED glows.		
EZ-Click - project2		
File Configuration Help		
🔄 🖬 🗗 🗃 🔐 Power 3.3V 🔹		
Start page Main console		
Cypress device:		
Port selection:		
Bridge/0914C3CC2905		
	E7.05-4	
	E2-Click	
	Failed to connect to the device.	
	OK	
		Connect Disconnect
Ready		

- b. Touch the **Power** button to turn **ON** the kit. Ensure Power button, LED1, LED2 and Attention button glows.
- c. Click the **Connect** button on the **Main Console tab** of the EZ-Click customizer tool. Ensure you see the device connected in the status window of the Main Console tab.
- 6. Select the number of buttons as desired. You can select up to 10 buttons for any configuration. The numbering starts with 0 in the EZ-Click customizer tool and is mapped to button 1 of the kit. Button 1 in the tool maps to button 2 of the kit and so on.
- 7. Modify the project to enable features as mentioned in the sections 3.2.2 to 3.2.11.
- 8. Generate the configuration file by pressing Ctrl + G.
- 9. Click on Apply Current Config under Configuration menu in the EZ-Click customizer tool.
- 10. Touch the **Power** button to turn **ON** the kit and observe the feature as explained in the respective sections.

**Note:** A sample EZ-Click configuration file Sample Configuration 1 file is pre-loaded into the kit. The kit will support the features mentioned in 5.1.1 Loading Configuration File 1 on page 35 by default. To know more about Sample configurations see Sample Configurations on page 35.



## 3.2 Kit Features

The following sections demonstrate each feature of this device.

#### 3.2.1 SmartSense Auto-Tuning

The CY8CMBR2110 CapSense controller is built with a robust CSD capacitive sensing method and patented SmartSense auto-tuning algorithm. SmartSense Auto-Tuning tunes each sensor automatically at power up; it then monitors and maintains optimum sensor performance during run time. This technology adapts for manufacturing variation in PCBs, environmental conditions, and noise sources such as LCD inverters, AC line noise, and switch-mode power supplies, and automatically tunes them out.

SmartSense auto-tuning feature does not need to be enabled using EZ-Click and is automatically enabled on power-up. This feature can be verified on all the buttons, which are enabled. This kit is pre-loaded with Sample Configuration1, which supports 10 buttons and all 10 buttons demonstrates SmartSense by default.

This feature is demonstrated as follows.

- 1. Ensure that the Power select switch is in BAT position. Power the kit by touching the Power button.
- 2. Touch any button and observe that the respective LED lights up without any manual tuning.
- 3. Power off the kit. Connect the Flex-PCB and then power the kit. When there is a finger touch on the Flex-PCB, the respective LED on the kit lights up without any tuning. The change in sensor parasitic capacitance (Cp) due to the Flex-PCB and the overlay is auto tuned by the SmartSense Auto-Tuning algorithm. Hence, no manual tuning is required.
- 4. Flex-PCB has a 1 mm overlay pasted on top of it. You can also use the 3 mm overlay provided with the kit on top of 1mm overlay in the same way as explained above to verify SmartSense auto-tuning feature.

Notes

- Button 2, Left, and Up navigation buttons on the Flex-PCB may not work with 4 mm overlay (1 mm + 3 mm). The loss of sensitivity of these buttons is due to the overlay thickness and small size of these buttons. To find the required button diameter for particular overlay thinness, refer to the CY8CMBR2110 Design Toolbox.
- It is recommended not to use the buttons on the main kit while the Flex-PCB is connected to the kit.
- The exposed Flex-PCB header pins should not be touched while the kit is powered ON. Touching these pins can act as adding the required finger capacitance. This will lead to false triggers.
- The Flex-PCB is for demonstrating SmartSense Auto-tuning feature and cannot be used for your product design.





#### Figure 3-3. Demonstration of SmartSense Auto-Tuning with Flex-PCB

SmartSense Auto-Tuning algorithm can also be tested on the Simple Button Module (BSM) board. The BSM board can be connected to the kit and tested for SmartSense Auto-Tuning in the same way as the Flex-PCB. BSM board is not provided as part of this kit. To purchase or know more about BSM board, refer to the Cypress website. The Flex-PCB needs to be disconnected from the kit to test the features mentioned in the subsequent sections.

The following sections demonstrates how to enable and verify various visual and audio features of the kit. These features require the kit to be configured using the EZ-Click customizer tool.

Follow the steps below to observe the features discussed in sections 3.2.2 to 3.2.10.

- a. Create a new project in the EZ-Click customizer tool by following the steps 1-7 in section 3.1.1.
- b. Modify the project to enable features explained in the following sections.



c. Apply the configuration to the kit by following step 7-9.

d. Verify the feature as explained in the sections 3.2.2 to 3.2.10.

Ensure that you have a new project every time you verify a different feature. Enabling two or more features may or may not work at the same time. See the CY8CMBR2110 datasheet to know about the features, which will not work together.

#### 3.2.2 Toggle (Touch ON/OFF)

#### 3.2.2.1 Enable Toggle (Touch ON/OFF)

Go to the **Device Config** tab; select the **Toggle (Touch ON/OFF)** checkbox to enable the toggle feature for the desired number of buttons. The Figure 3-4 shows toggle feature enabled in four buttons.

Figure 3-4. Toggle (Touch ON/OFF) Feature GUI

er of buttons: uto assign Caj	4 💉 pSense pins	🗹 Automa	tic thre	.shold I2Ca	iddress (hex): 37			٠	Noise imn Normal	nunity level:	
Button	CapSense pin	Sensitivity		Finger threshold (decimal)	Flanking sensor suppression	Toggle (Touch ON/OFF)	First button touch response time(ms)	Consecutive button touch response time(ms)	Host co HCG1:	ntrolled GPOs High	
Button 0	CS0 💌	High	~	50 🗸			200	200	HCG2:	High	
Button 1	CS1 🗸	High	~	50 🗸			50	50	HCG3:	High	
Button 2	CS2 🗸	High	~	50 🗸			50	50	HCG4:	High	
Button 3	CS3 🗸	High	×	50 🗸			50	50	Debour	ice (decimal)	
Button 4	CS4 · 🗠	High	~	50 🖌					CS0:	20	
Button 5	CS5 🗸 🗸	High	~	50 🗸					CS1-9:	1	
Button 6	CS6 🗸	High	V	50 🗸					Ontimizati	on:	
Button 7	CS7 🗠	High	$\sim$	50 🗸					Respons	e time	
Button 8	CS8 . 🗠	High	~	50 🗸					Auto rese	t period:	
Button 9	CS9 🗸 🗸	High	~	50 ~					5 s		
zer configurat Buzzer izer type: izer ON time (	AC buzzer-1 pin			V Ay	Frequency (kHz): 4.0 Buzzer idle state: Lo	10 W		×	Button : 25	scan rate (ms)	531

3.2.2.2 Test CapSense Buttons with Toggle (Touch ON/OFF) Enabled

- 1. Touch a CapSense button for which the Toggle (Touch ON/OFF) feature is enabled; the respective LED turns on.
- 2. Touch the same button again; the LED turns off.
- 3. On the next touch, the LED goes on again.





Button LED glows on touch



Button is "on" even after touch is removed



Button goes "off" on second touch

- 3.2.3 Flanking Sensor Suppression (FSS)
- 3.2.3.1 Enable Flanking Sensor Suppression

Go to the **Device Config** tab; select the **Flanking Sensor Suppression** checkbox to enable the FSS feature for the desired number of buttons.

#### Figure 3-6. FSS Enabled

er of buttons:			🗹 Auto	matic thre	shold	I2C ac	Idress (hex): 37			\$	Noise imr Normal	nunity levet	
Button	CapSense	e pin	Sensiti	vity	Finger	threshold	Flanking sensor	Toggle (Touch	First button touch response	Consecutive button touch	Host co HCG1:	ntrolled GPOs High	
Button ()	CSO	~	High	~	50				200	200	HCG2:	High	
Button 1	CS1	~	High	~	50	~			50	50	HCG3:	High	
Button 2	CS2	~	High	~	50	~			50	50	HCG4:	High	
Button 3	CS3	*	High	*	50	~			50	50	Debour	nce (decimal)	
Button 4	CS4	~	High	~	50	~					CS0:	20	
Button 5	CS5	Y	High	~	50	*					CS1-9	1	
Button 6	CS6	~	High	~	50	~					Ontimizat	ion:	
Button 7	CS7	~	High	~	50	~					Respons	e time	
Button 8	CS8	~	High	~	50	~					Auto rese	t period:	
Button 9	CS9	~	High	~	50	*					5 s		
er configurat Buzzer	ion	4.55					5				Button	scan rate (ms)	[
zer type:	AL DUZZEI	-i pin					Frequency (KHz): 4				25		531
zer ON time (i	ms): 25					Ŷ	Buzzer idle state:	.0W		× .			

#### 3.2.3.2 Test CapSense Buttons with FSS Enabled

- 1. Touch a FSS-enabled CapSense button; the respective LED turns on.
- 2. Without removing the touch, touch another FSS-enabled button; the LED does not glow for the second button.
- 3. Remove the touch from the first button. Now, touch any other FSS-enabled button; the respective LED glows.

#### Kit Operation



#### Figure 3-7. FSS Enabled



Button LED glows on touch



Second button does not glow if the touch on the first button is continued



Second button glows after the finger from the first touched button is removed

#### 3.2.4 LED ON Time

#### 3.2.4.1 Enable LED ON Time

Go to the **Visual Config** tab; select the **LED ON time** checkbox to enable this feature. This is a global setting applicable for all CapSense buttons. To set the time, configure the **LED ON time** menu below the checkbox.

#### Figure 3-8. LED ON Time Enabled

rt page Main console Device config	Visual config CapSense output Production	on line testing				
ED configuration	Period1 (ms): 1500		1	1		
ED ON time (ma): 1500	Pariod? (ma):					
ED UN ame (ms).	Penodz (ms).	6	ity .	High bright	nosb	
Analog voltage output	Period3 (ms): 0	3	tens	58	19170 Do.	
			-	(T <sub>RU</sub> ) > < (T <sub>R</sub> )	(T <sub>RD</sub> ) (T <sub>L</sub> )	>
					Time	
D. #- I-					Time	
D effects					Time	
D effects t power ON On button touch At power ON					Time LED effects	mode: Concurrent
D effects t power DN On button touch At power DN LED effects parameters			LED	4.5.6	Time LED effects : LED 7,8,9	mode: Concurrent
D effects (power ON On button touch) At power ON LED effects parameters Ramp up time (T <sub>su</sub> )	LED 0 Period1	LED 1.2.3	LED Period	4.5.6 od1	LED effects I LED 7.8,9 Veriod1	mode: Concurrent
D effects power DN Dn button touch Dt D effects parameters lamp up time (T <sub>ps</sub> ) fight time (T <sub>ps</sub> )	LED 0 Period1 Period1	LED 1,2,3 V Period1 V Period1	LED Periode Periode P	4,5,6 od1	LED effects           LED 7.8.9           V           Period1           V	mode: Concurrent
D effects power ON On button touch touwer ON LED effects parameters Ramp up time (T <sub>su</sub> ) tigh time (T <sub>su</sub> ) Ramp down time (T <sub>su</sub> )	LED 0 Period1 Period1 Period1	LED 1.2.3           ♥           ♥           ♥           ♥           ♥           ♥           ♥           ♥           ♥	LED Peri Peri Peri	4,5,6 od1 od1	LED effects of LED 7.9.9 V Period1 V Period1 V Period1	mode: Concurrent
D effects t power ON On button touch  At power ON LED effects parameters amp up time (T <sub>mp</sub> )  High time (T <sub>m</sub> ) amp down time (T <sub>mp</sub> )	LED 0 Period1 Period1 Period1 Period1	LED 1.2.3           V         Period1           V         Period1           V         Period1           V         Period1	LED V Peri Peri V Peri V Peri	4,5,6 od1 od1 od1 od1	LED effects in           LED 78,9           V           Period1           V           Period1           V           Period1           V           Period1           V           Period1           V           Period1	node: Concurrent
D effects  (power ON On button touch  At power ON  LED effects parameters  amp up time (T <sub>ap</sub> )	LED 0 Period1 Period1 Period1 Period1 100%	LED 1.2.3           V         Period1           V         Period1           V         Period1           V         Period1           V         Period1           V         100%	↓ LE0 ▼ Peri ▼ Peri ▼ Peri ▼ Peri ▼ Peri ▼ 100	4.5.6 od1 od1 od1 od1 &	LED effects : LED 7.8.9 Period1 Period1 Period1 Period1 Period1 Piol2 Period1 Period	node: Concurrent
D effects $t$ power ON       On button touch       LED effects parameters       Rane up time ( $T_{gg}$ )       High time ( $T_{gg}$ )       Low time ( $T_{ij}$ )	LED 0 Period1 Period1 Period1 Period1 100% 0%	LED 1,2,3           ♥ Period1           ♥ Period1           ♥ Period1           ♥ Period1           ♥ 100%           ♥ 0%	LED     Peri     Peri     Peri     Peri     Peri     Peri     V     Peri     V     Peri     V     00     V     00	4.5.6 od1 od1 od1 od1 &	LED effects           LED 7.8.9           Period1           Period1           Period1           Period1           Pinod1           Period1           O2	mode: Concurrent

#### 3.2.4.2 Test CapSense Buttons with LED ON Time Enabled

Touch any CapSense button; the respective LED turns on. When the finger is released, the LED turns off after the duration specified in **LED on time** (msec) in the **Visual Config** tab.





Button LED glows on touch

Button is "on" even after touch is removed

12

 $\odot$ 

(4) (5) (6)

(3)

lacksquare



Button goes "off" after the LED On time

### 3.2.5 Button Auto Reset (ARST)

#### 3.2.5.1 Enable Button Auto Reset

Go to the **Device Config** tab; select the **Auto reset period** menu to enable this feature. The reset time can be set as either 5 or 20 seconds.

#### Figure 3-10. ARST Enabled

uto assign Ca	pSense pins										Normal		
Button	CapSer	ise pin	Sensitiv	ity	Finger th (decir	reshold nal)	Flanking sensor suppression	Toggle (Touch ON/OFF)	First button touch response time(ms)	Consecutive button touch response time(ms)	Host co HCG1:	ntrolled GPOs High	
Button 0	CSO	~	High	~	50	~			200	200	HCG2:	High	
Button 1	CS1	~	High	~	50	~			50	50	HCG3:	High	
Button 2	CS2	~	High	~	50	~			50	50	HCG4:	High	
Button 3	CS3	~	High	~	50	~			50	50	Debour	ce (decimal)	
Button 4	CS4	~	High	$\sim$	50	$\sim$					CS0:	20	
Button 5	CS5	V	High	~	50	~					CS1-9:	1	
Button 6	CS6	Y	High	~	50	~					Optimizati	on:	
Button 7	CS7	×	High	~	50	~					Respons	e time	
Button 8	CS8	×	High	~	50	~					Auto rese	t period:	
Button 9	CS9	~	High	~	50	~					5 s		
zer configura	tion										Disabled 5 s		
Buzzer											20 s		
zer type:	AC buzze	er-1 pin				*	Frequency (kHz): 4.0	0		×	25		531
zer ON time I	(ms): 25					\$	Buzzer idle state: Lo	W		~			

#### 3.2.5.2 Test CapSense Buttons with ARST Enabled

Touch any CapSense button; the respective LED turns on. Do not release the button; keep the finger pressed for 5 seconds or 20 seconds, as selected. Notice that the LED turns off automatically after 5 seconds or 20 seconds according to the setting applied. Release the buttons and touch the same buttons again, it works as usual.



Figure 3-11. ARST Enabled



Button LED glows on touch



Button goes off when continuously touched for more than the ARST

#### 3.2.6 Debounce Control

#### 3.2.6.1 Enable Debounce Control

Go to the **Device Config** tab; enter the required debounce number in the **Debounce** menu. Enter a value from 1 to 255 in the option available for CS0 and CS1-CS9.

art page   Main co	onsole Devic	e config	Visual config Ca	Sens	e output Production lin	e testing						
lumber of buttons:	4 🗸		🗹 Automati	c thre:	shold I2C a	ddress (hex): 37			*	Noise imr	nunity level:	
🛛 Auto assign Cap	oSense pins									Normal		*
Button	CapSen	se pin	Sensitivity		Finger threshold (decimal)	Flanking sensor suppression	Toggle (Touch ON/OFF)	First button touch response time(ms)	Consecutive button touch response time(ms)	Host co	ntrolled GPOs High	~
Button 0	CSO	~	High	~	50 🗸 🗸			375	375	HCG2:	High	*
Button 1	CS1	~	High	~	50 💌			400	400	HCG3:	High	*
Button 2	CS2	~	High	~	50 🗸			400	400	HCG4:	High	*
Button 3	CS3	~	High	~	50 🗸			400	400	Debour	nce (decimal)	
Button 4	CS4	$\sim$	High	$\sim$	50 🗸 🗸					CS0:	40	\$
Button 5	CS5	$\sim$	High	$\sim$	50 🗸 🗸					CS1-9:	45	\$
Button 6	CS6	~	High	~	50 🗸 🗸					Ontimizat	ion:	
Button 7	CS7	~	High	$\sim$	50 🗸					Respons	e time	~
Button 8	CS8	~	High	~	50 ~					Auto rese	t period:	
Button 9	CS9	~	High	$\sim$	50 🗸 🗸					5 s		*
Buzzer configurati	ion									Button	scan rate (ms)	[25]
Buzzer type:	AC buzze	er-1 pin			~	Frequency (kHz): 4.0	10		~	25		521
Dummer ON Second	mel: 25				6	Buzzeridle state:				2.5		551

Figure 3-12. Setting Debounce Parameter

### 3.2.6.2 Test CapSense Buttons for Debounce Control

This parameter determines the minimum duration for which the finger must be present on the button to report a "Sensor On".

For example, put 55 in the debounce parameter for CS1-CS9. To calculate the time in milliseconds, the factor 35 should be multiplied with the debounce parameter value. This factor value is only for default settings. For other settings, see the CY8CMBR2110 datasheet. In this case, any CapSense button should be touched more than  $(35 \times 55) = 1925$  ms to turn it on.







Button does not glow if pressed for less than the time set in the Debounce parameter settings

#### 3.2.7 Buzzer Signal Output

#### 3.2.7.1 Enable Buzzer Signal Output

Go to the **Device Config** tab; enable the feature by selecting the **Buzzer** checkbox in the **Buzzer Configuration** section of the page. Set the frequency, number of pins, type (AC buzzer-1 pin or AC buzzer-2 pin), and output duration timing using the respective menu options. Buzzer idle state indicates the state of the buzzer pins when buzzer is not ON. You can configure your buzzer to be in sinking or sourcing mode by selecting HIGH or LOW respectively as your Buzzer Idle state.

igure 3-14.	Buzzer	Signal	Output	Enable	d
igure 3-14.	Buzzer	Signal	Output	Enable	

ber of buttons:	4 💙		🗹 Auto	natic thre	eshold	I2C ad	ddress (hex): 37			~	Noise imn	nunity level:	
luto assign Ca	apSense pins										Host co	introlled GPOs	
Button	CapSens	e pin	Sensitiv	rity	Finger th (decir	reshold mal)	Flanking sensor suppression	Toggle (Touch ON/OFF)	First button touch response time(ms)	Consecutive button touch response time(ms)	HCG1:	High	
Button 0	CS0	*	High	~	50	~			375	375	HCG2:	High	
Button 1	CS1	*	High	~	50	~			400	400	HCG3:	High	
Button 2	CS2	~	High	~	50	~			400	400	HCG4:	High	
Button 3	CS3	~	High	~	50	~			400	400	Debour	nce (decimal)	
Button 4	CS4	~	High	~	50	~					CS0:	40	
Button 5	CS5	Y	High	~	50	~					CS1-9:	45	
Button 6	CS6	~	High	~	50	~					Ontimizati	ion	
Button 7	CS7	~	High	~	50	~					Respons	e time	
Button 8	CS8	~	High	~	50	~					Auto rese	t period:	
Button 9	CS9	Y	High	~	50	~					5 s		
zer configural	tion										Button :	scan rate (ms)	
Buzzer											0-		[
zzer type:	AC buzzer	-2 pin				~	Frequency (kHz):	00		×	25		531
						*	Ruzzer idle state:	ш		~			

#### 3.2.7.2 Test CapSense Buttons for Buzzer Signal Output

The button touch gives an audio feedback. The characteristics of the buzzer sound, such as frequency and duration can be observed according to the settings.



#### 3.2.8 Host Controlled GPOs

3.2.8.1 Drive Host Controlled GPOs

Go to the **Device Config** tab; drive host controlled GPOs, HCG1 and HCG2, by selecting the **Low** or **High** options in the drop-down. The kit does not have any LEDs mapped to HCG3 and HCG4. These GPOs use the same pins as the buzzer output.

By default, the LEDs light up after the device is powered.

**Note** HCG3 and HCG4 are not available when the AC buzzer-2 pin is enabled. When the AC buzzer-1 pin is enabled, HCG4 is disabled.

Start page       Main conside       Provice config       Visual config       CapSense output       Preduction line testing         Number of buttons: <ul> <li></li></ul>													Power: 2 2)	figuration Hel
Number of button:         4         C Automatic threehold         IZC address (hee):         37         Noise immunity level         Noise immunity level           Walk or ssign CapSerse pins         Earth         Finger threshold         Earth         Toggle [f ouch ON/OFF)         First button touch response threfins)         Noise immunity level         Noise immunity level           Button         CapSerse pin         Sensitivity         Finger threshold (decimal)         Toggle [f ouch ON/OFF)         First button touch response threfins)         Consecutive button touch response threfins)         HGB:								ine testing	aut Production li		Visual config CanSan	v Vi	Device config	a Main consc
Number of buttom:       4								nio tosting	Juc Troductorrin	1136 00	visual coning Capoen			6 Main Conse
Auto asign CapSence pin         Sensitivity         First threshold (decimal)         Flanking sensor (approximation)         First button touch response (memory)         Consectione button but		nunity level:	se immu	\$				address (hex): 37	12C a	reshol	<ul> <li>Automatic three</li> </ul>		~	of buttons: 4
Button         CapSense pin         Sensitivity         Finger threshold (decimal)         Flanking sensor suppression         Togde (Touch 0N/DFF)         Fits button touch response time(ms)         Consecutive button touch response time(ms)         Hold controlled UPUs (decimal)           Button 0         CS0         High         50         0         0         375         375         Hold controlled UPUs (decimal)         Hold controlled UPUs (de	*		rmal										se pins	assign CapSer
Button 0         CS0         High         S0         I         375         375         HG2         Low           Button 1         CS1         High         S0         I         A00         A00         A00         HG3         Low	<b>~</b>	I Low	ost cont CG1:	ouch :)	Consecutive button touc response time(ms)	First button touch response time(ms)	Toggle (Touch ON/OFF)	Flanking sensor suppression	nger threshold (decimal)		Sensitivity		CapSense pin	lutton
Button 1       CS1       W High       50       I       400       400       400       HCG3       Low         Button 2       CS2       W High       50       I       400       400       400       HCG3       Low         Button 2       CS2       W High       50       I       400       400       400       HCG3       HCG3 <td>~</td> <th>Low</th> <td>CG2:</td> <th></th> <td>375</td> <td>375</td> <td></td> <td></td> <td>~</td> <td>50</td> <td>High 🗸</td> <td>·</td> <td>50 🗸</td> <td>utton 0 0</td>	~	Low	CG2:		375	375			~	50	High 🗸	·	50 🗸	utton 0 0
Buton 2         CS2         High         50         I         400         400         400         HC64. Hoh           Buton 3         CS3         V         High         S0         I         A00         400         400         Deborne (decinal)           Buton 4         CS4         V         High         S0         I         I         400         400         400         Deborne (decinal)           Buton 5         CS5         V         High         S0         V         I         I         A00         400         A00         Deborne (decinal)         CS0. 40         I	~	Low	CG3:		400	400			~	50	High 🗸	ŀ	61 🗸	utton 1
Buton 3         CS3         High         50         I         400         400         400         Debounce (decina)           Buton 4         CS4         High         S0         I         I         400         400         Debounce (decina)         CS0         I         I         I         I         400         400         Edbounce (decina)         CS0         I	~	High	CG4:		400	400			~	50	High 🔽	ŀ	62 🗸	utton 2
Button 4       C54       High       D0       I		ice (decimal)	ebounc		400	400			~	50	High 🔽	ŀ	63 🔽	utton 3
Button 5       C55       W High       50       Image: C51-9       45         Button 6       C56       W High       50       Image: C51-9       45         Button 7       C57       W High       50       Image: C51-9       46         Button 8       C58       W High       50       Image: C51-9       40         Button 8       C58       W High       50       Image: C51-9       40         Button 9       C59       W High       50       Image: C51-9       40         Button 9       C59       W High       50       Image: C51-9       54         Button 9       C59       W High       50       Image: C51-9       54         Button 9       C59       W High       50       Image: C51-9       54         Buzzer configuration:       Image: C51-9       Image: C51-9       54       54	\$	40	SO: [						~	50	High 🗠	ŀ	54 🗸	utton 4
Button 6         CS6         High         90         I	÷	45	s1-9						~	50	High 🗠	ŀ	65 🗸 🗸	utton 5
Button 7         C57         High         S0         Image: Comparison of the c		ion:	imizatio						~	50	High 🔽	ŀ	66 🗸 🗸	utton 6
Button 8         CS8         High         50         Image: CS8         High         50         Image: CS8         Auto rest period         Auto rest period         Ss           Button 3         CS3         High         S0         Image: CS8         Ss	~	e time	sponse						~	50	High 🖂	ŀ	57 🔽	utton 7
Button 3         CS3         W High         50         M         5 s           Buzzer configuration         Buzzer		t period:	o reset r						~	50	High 🖌	ŀ	88	utton 8
Buzzer configuration Buzzer Buzzer Buzzer	~								~	50	High 🗸	ŀ	9 🗸	utton 9
Buzzer		scan rate (ms)	utton sc											configuration
	[ 25 ]													zzer
Buzzer type: AC buzzer 2 pin Frequency (kHz): 2.00 25	531		5		×			Frequency (kHz): 2.0	~				AC buzzer-2 pin	r type:
Buzzer ON time (ms): 25 Buzzer idle state: Low					×		N	Buzzer idle state: Lo	A V				25	r ON time (ms);

Figure 3-15. Host Controlled GPOs GUI

#### 3.2.8.2 Test Host Controlled GPO LEDs

Drive the HCG1 and HCG2 to **Low** in the EZ-Click tool to see the respective LEDs light up. Driving the HCGs **High** will turn off the LEDs.

COWER SELECT USB STATUS USB POWER

Figure 3-16. Host Controlled GPO LEDs



#### 3.2.9 Power-On LED Effects

#### 3.2.9.1 Enable Power-On LED Effects

Go to the **Visual Config** tab; select the **At Power On** checkbox under **LED Effects** to enable the feature. Select the values for different parameters such as ramp up time, ramp down time, high time, low time, high brightness, low brightness, and LED effect repeat rate in the **At Power On** tab.



e output   Production line testing   500 000 00 100	Agen	Figh brightness	
e output Production line testing 500 000 00		tigh brightness	
e output Production line testing 500 000 00 100		digh brightness	
500 000 00 100	ansity	high brightness	
500 000 00 100	¢ Aisu	High brightness	
000 00 100	sus sta	high brightness	
00	ensity		
100		Series Carro	
	<u>با</u>	and the second	*
			Low brightness
	-	(Т <sub>RU</sub> ) (Тн) (Т <sub>RD</sub> )	(TL)
			·
		Time	
			LED effects mode: Concurrent
	LED 1,2,3	LED 4,5,6	LED 7,8,9
~	Period1 🗸	Period2 🗸	Period3 💌
2	Period1 🗸	Period4 💌	Period1 💌
	Period4	Period1 🗸	Period4
~	Period1 🗸	Period2	Period2
~	100% 🗸	100% 💌	100%
~	0% 🗸	0% 🗸	0%
~	0 💌	0 🗸	0
	× × × × ×	LED 1,2.3           V         Period1           V         Period4           V         Period4           V         Period4           V         Poind1           V         V           V         V           V         V           V         V           V         V           V         V           V         V           V         V           V         V	LED 1,2.3         LED 4,5.6           V         Period1         V         Period2         V           V         Period1         V         Period2         V           V         Period1         V         Period2         V           V         Period2         V         V         V           V         Period2         V         V         V           V         Period2         V         V         V         V           V         100%         V         100%         V         V           V         0         V         0         V         V         V

3.2.9.2 Test CapSense Buttons with Power-On LED Effects Enabled

Observe the LED effects according to the configured setting at every power cycle.

Figure 3-18. Power-On LED Effect Pattern





- T<sub>RU</sub> Ramp up time
- T<sub>H</sub> High brightness time
- T<sub>RD</sub> Ramp down time
- T<sub>L</sub> Low brightness time
- 3.2.10 Button Controlled LED Effects

#### 3.2.10.1 Enable Button Controlled LED Effects

Go to the **Visual Config** tab; select the **On Button Touch** checkbox under **LED Effects** to enable the feature. Select the values for different parameters such as ramp up time, ramp down time, high time, low time, high brightness, low brightness, and LED effect repeat rate in the **On Button Touch** tab.



Figure 3-19. Button Controlled LED Effects Enabled

#### 3.2.10.2 Test CapSense Buttons with Button Controlled LED Effects

On every button touch, the respective LED effects can be observed according to the configured setting.



#### Figure 3-20. Button Controlled LED Effects Pattern



#### 3.2.11 System Diagnostics

#### 3.2.11.1 Enable System Diagnostics

The System Diagnostics feature is enabled in the CY8CMBR2110 CapSense controller by default; no change is needed in the kit. This feature sends out a 5-ms pulse on the GPO corresponding to a faulty sensor. The GPO pins are connected via the 44-pin expansion connector, which can be probed to observe the 5-ms pulse. See Connector Details on page 34 for details of the expansion connector and to know the pin associated with each button and GPO. The pin number can be counted starting from the lower pin on the USB connector side, as shown in the following figures. Note that all odd numbered pins are at the bottom half of the connector.

The system diagnostics feature can also be observed in the EZ-Click Customizer Tool.

#### 3.2.11.2 Test System Diagnostics - CapSense Button Short to Ground

Follow these steps:

- 1. Touch the power button to turn off the kit.
- 2. Connect a wire between pin #3 and pin #5 of 44-pin expansion connector. This shorts the button #5 sensor to ground.
- 3. Touch the power button to turn on the kit.

The CapSense controller executes the System Diagnostics routine on power up and detects the sensor shorted to ground. Observe a pulse of 5 ms width on the GPO #5 pin, which is also visible on the corresponding LED. This indicates that button #5 is shorted to ground. The CapSense controller disables the button sensors that are shorted to ground. Touch button #5 and see that the corresponding LED is not turned on. Other buttons work normally.

Figure 3-21. Shorting Button #5 (pin #3) to Ground (pin #5)





To observe the feature in GUI, go to **Production line testing** tab and click on the **Start test** button. Figure 3-22. System Diagnostics GUI - Shorting Button to Ground

🚭 EZ-Click - Sample Configurati	on 1			
Eile Configuration Help				
🚽 🖬 🗊 🚰 💽 🚱 Power:	3.3V 💌			
Start page Main console Device conf	ig Visual config CapSense output Product	ion line testing		
Minimum SNR: 5	Stop test:			
Putters	Shahar		SNR	System diagnostics
Button	Status	SNR	Result	Result
Button0	Off	0		PASS
Button1	Off	0		PASS
Button2	Off	0		PASS
Button3	Off	0		PASS
Button4	Off	0		PASS
Button5	Off	0		Button short to Gnd.
Button6	Off	0		PASS
Button7	Off	0		PASS
Button8	Off	0		PASS
Button9	Off	0		PASS

#### 3.2.11.3 Test System Diagnostics - CapSense Button to Button Short

Follow these steps:

- 1. Touch the power button to turn off the kit.
- 2. Connect a wire between pin #3 and pin #9 of the 44-pin expansion connector. This shorts button #5 and button #2 sensors.
- 3. Touch the power button to turn on the kit.

**Note:** The button numbering in the Production Testing tab in the EZ-Click customizer tool starts with 0, which is linked to button 1 of the kit. Similarly, button 1 in the tab is mapped to button 2 of kit and so on.

The CapSense controller executes the System Diagnostics routine on power up and detects the sensor to sensor short. Observe a pulse of 5 ms width on the GPO #5 and GPO #2 pins, which is also visible on the corresponding LEDs. This indicates that button #5 is shorted to button #2. The CapSense controller disables the button sensors that are shorted to each other. Touch button #5 and button #2; note that the respective LEDs are not turned on.

Other buttons work normally.

Figure 3-23. Shorting Button #5 (pin #3) to Button #2 (pin #9)



To observe the feature in GUI, go to Production line testing tab and click on the Start test button.



SNR         System diagnostics           SNR         Result         Result           0         PASS         PASS           0         Bluttom to bullom short.         PASS           0         Bluttom to bullom short.         PASS           0         PASS         PASS           0         Bluttom to bullom short.         PASS           0         PASS         PASS	Main control       Vestal config       Capesane coupt       Postal         IF: Control       Sobet: Control       Sobet: Control       Sobet: Control         Buton       Shan       Result       Sobet: Control       Sobet: Contro       Sobet: Control       Sobet: Co	🗗   🛃 💽 🛃   Power:	3.3V 💌			
SNR         System diagnostics           SNR         Result         Result           0         PASS           0         PASS           0         Button to button short.           0         PASS           0         PASS           0         PASS           0         PASS           0         PASS           0         PASS	RE interview in	e Main console Device con	fig Visual config CapSense output Product	ion line testing		
SNR         System diagnostics           SNR         Result         Result           0         PASS         PASS           0         Button to button short.         Button to button short.           0         PASS         PASS           0         PASS         PASS           0         PASS         PASS	Buton         System degrostics           Buton0         Off         SNR         Result         Result           Buton0         Off         0         Result         Result           Buton1         Off         0         PASS         PASS           Buton2         Off         0         Buton3         Buton4         Result         Result         Result         Result         Buton4         Buton5         Buton4         Off         Buton5         Buton5         Off         Off         Buton5         Buton5         Off         Off         Buton5         Buton5         Off         Off         Buton5         Buton5         Off         PASS         Buton5         Buton5         Off         Off         PASS           Buton5         Off         Off         Off         Buton5         PASS         PASS           Buton5         Off         Off         Off         PASS         PASS         PASS           Buton5         Off         Off         Off         PASS         PASS           Buton5         Off         Off         Off         PASS         PASS	m SNR: 5	Stop test:			
SNR         Result         Result           0         PASS           0         PASS           0         PASS           0         Button to button short.           0         PASS           0         PASS           0         PASS           0         PASS	Button         SNR         Result         Result           Button0         Olf         O         Result           Button1         Olf         O         Result           Button2         Olf         O         Result           Button3         Olf         O         Button4           Button4         O         C         Button5           Button5         O         O         Result	2.0			SNR	System diagnostics
O         PASS           O         PASS           O         PASS           O         Buton to buton shot.           O         PASS           O         PASS           O         PASS           O         PASS           O         PASS	Buton0         Off         O         PASS           Buton1         O         O         PASS           Buton2         O         O         PASS           Buton3         O         O         Buton4         Buton5           Buton4         O         O         Buton5         Buton5         Buton5         Buton5         O         Buton5         Buton5         Buton5         O         Buton5	Button	Status	SNR	Result	Result
0         PASS           0         Button to button short.           0         PASS           0         PASS           0         PASS           0         PASS	Buton1         Off         O         PASS           Buton2         O Iff         O         Buton3         Buton4         Buton4         Buton4         Buton5         Buton4         O         Buton4         C         PASS         Buton5         G         C         PASS         C         PASS         C         PASS         Eduton4         D         Buton5         C         PASS         C         PASS         Eduton5         C         PASS         Eduton5         C         PASS         Eduton5         C         PASS         Eduton5         Eduton5         Eduton5         C         PASS         Eduton5	Button0	Off	0		PASS
0         Button to button short.           0         PASS           0         PASS	Buton2         Off         O         Buton3         Off         O           Buton3         O         O         O         PASS           Buton4         O         O         O         PASS           Buton5         O         O         O         Buton4         PASS           Buton5         O         O         O         Buton4         PASS           Buton5         O         O         O         Buton5         PASS           Buton5         O         O         O         PASS	Button1	Off	0		PASS
0 PASS 0 PASS	Buton3         Off         O         PASS           Buton4         Off         O         PASS           Buton5         Off         O         Buton4         Buton5           Buton6         Off         O         Buton5         Buton5         O         Buton5           Buton6         O         O         O         Buton5         O         Buton5         O         Buton5         Buton5         O         Buton5         D	Button2	Off	0		Button to button short.
0 PASS	Butor4         Off         O         PASS           Butor5         Off         O         Butor	Button3	Off	0		PASS
	Button5         Off         O         Button to button thot.           Button6         Off         O         PASS           Button7         Off         O         O         PASS	Button4	Off	0		PASS
U Button to button short.	Button6         Off         0         PASS           Button7         Off         O         PASS	Button5	Off	0		Button to button short.
0 PASS	Button7 Diff 0 PASS	Button6	Off	0		PASS
0 PASS		Button7	Off	0		PASS
	Button8 0// 0 PASS	Button8	Off	0		PASS
0 PASS		Button9	Olf	0		PASS
U         Button to button:           0         PASS           0         PASS	Button8 Off 0 PASS	Button3 Button4 Button5 Button6 Button7 Button8	0ff 0ff 0ff 0ff 0ff 0ff			PASS PASS Button to button : PASS PASS PASS
0 PASS	Duttion 9 Diff	Building	01	0		PMSS

Figure 3-24. System Diagnostics GUI - Shorting Button to Button

#### 3.2.11.4 Test System Diagnostics - CapSense Button to Vdd Short

Follow these steps:

- 1. Touch the power button to turn off the kit.
- 2. Connect a wire between pin #27 and pin #41 of the 44-pin expansion connector. This shorts button #6 sensor with Vdd.
- 3. Touch the power button to turn on the kit.

The CapSense controller executes the System Diagnostics routine on power up and detects the sensor to Vdd short. Observe a pulse of 5 ms width on the GPO #6 pin, which is also visible on the corresponding LED. This indicates that button #6 is shorted to Vdd. The CapSense controller disables the button sensors that are shorted to ground. Touch button #6; note that the corresponding LED is not turned on.

Other buttons work normally.

Figure 3-25. Shorting Button #6 (pin #27) to Vdd (pin #41)



To observe the feature in GUI, go to Production line testing tab and click on the Start test button.



Figure 3-26. System Diagnostics GUI - Shorting Button to Vdd

num SNR: 5	Stop test:			
Button	Status		SNR	System diagnostics
		SNR	Result	Result
Button0	Off	0		PASS
Button1	Off	0		PASS
Button2	Off	0		PASS
Button3	Off	0		PASS
Button4	Off	0		PASS
Button5	Off	0		PASS
Button6	Off	0		Button short to Vdd.
Button7	Off	0		PASS
Button8	Off	0		PASS
Button9	Off	0		PASS



The CY3280-MBR2 CapSense Express Kit is designed to demonstrate the features of the CY8CMBR2110 register configurable CapSense controller. Figure 3-1 on page 13 illustrates ten CapSense buttons and CapSense-based power and attention buttons. The kit has two status LEDs to demonstrate the direct LED control feature. The CY8CMBR2110 controller supports multiple features, which are discussed in the Kit Operation chapter on page 13.

The CY3280-MBR2 kit has two connectors: a 44-pin expansion connector and a USB-IIC connector. The expansion connector is used to demonstrate the SmartSense Auto-Tuning feature. The USB-IIC connector helps to power and configure the kit using the GUI.



Figure 4-1. CY3280-MBR2 Kit



Figure 4-2 shows the block diagram of the CY3280-MBR kit. The block diagram can be classified into four sections: Power, CY8CMBR2110 functional blocks, I2C to USB, and Connectors (USB-IIC and 44-pin expansion connector). Each section is explained in detail here.



## 4.1 **Power Block**

This block consists of the power source, series pass switch, power LED, and the CY8CMBR2044 CapSense controller. The kit supports three power sources.

No.	Power Source	Voltage Levels (Volts)	Power Select Switch Position
1	AAA batteries provided with the kit <sup>a</sup>	3.0	BAT
2	GUI when connected to PC via USB-IIC connector <sup>b</sup>	3.3	GUI
3	External source <sup>c</sup>	3.0	EXT

Table 4-1. Power Source

a. An estimated battery life of ~40hrs can be achieved on an AAA pack when all blocks are turned on. An estimated battery life of one year can be achieved on an AAA pack when the unit is in standby/sleep.

b. GUI has four power options - 1.8 V, 2.5 V, 3.3 V, and 5 V; however, it only supports 3.3 V for this kit. The USB status LED glows when the kit is connected to PC. USB power LED indicates that the kit is powered through USB.

c. To power the kit in this mode change the switch position to EXT and connect the external voltage source and ground to the VDD\_EXT (pin 43) and GND (pin 40) pins respectively of the 44-pin connector.

The series pass switch, which is controlled by the CY8CMBR2044 CapSense controller is responsible for the power supplied to the CY8CMBR2110 functional block. To power the kit, at least one of the above sources should be active. Touch the CapSense-based **Power** button to see the LED glowing and ensure that the kit is powered.

The kit has various protection circuits driven by the CY8CMBR2044 chip:

- A fuse is present in the power block to limit the external consumption to 200 mA.
- A diode is present at VDD-Ext to limit the input voltage to 6 V.
- ESD protection is enabled for USB lines.



Figure 4-3. Power Supply System Structure Schematic



Capsense(CY8CMBR2044) Based Power Button and I2C Attn. control section

## 4.2 CY8CMBR2110 Functional Block

This block demonstrates the features mentioned in 3.2 Kit Features on page 16. It consists of:

- CY8CMBR2110 CapSense controller
- 10 CapSense buttons as input
- 10 output LEDs that are directly mapped to CapSense buttons
- A single line buzzer for audio output
- Two host-controlled configurable LEDs
- 22×2 connector to bring out all I/Os and power line of the CY8CMBR2110 chip
- Flex-PCB/BSM board, which can be connected via the 44-pin expansion connector and demonstrates the SmartSense Auto-Tuning feature of the device

## 4.3 I2C to USB Bridge Block

This block functions as a bridge between the USB (PC) and I2C communication on the CY8CMBR2110 chip. The kit can be configured using this bridge with the help of the GUI. To configure the kit, either use the sample configuration files provided with the kit package or use the GUI via the USB-IIC bridge. In addition to the I2C to USB protocol conversion, the block also controls power to the CY8CMBR2110 chip via the GUI and USB. The block consists of the CY8C24894 chip, which is responsible for the USB-IIC protocol conversion and power control.



## 4.4 Connector Details

#### 4.4.1 USB-IIC Connector

This kit is configurable through the IIC interface. The USB-IIC connector enables the kit to connect to the PC via the USB cable provided with the kit. This connector serves two main purposes:

- Enables powering the kit from the GUI
- Enables configuring the kit by connecting to the GUI via the USB-IIC header

#### 4.4.2 Expansion Connector

Table 4-2 shows various signals connected to the 44-pin expansion connector. The CS inputs (CS0-CS9) and GPOs linked to each CapSense button are brought to the 44-pin expansion connector. This is used to verify SmartSense Auto-Tuning by connecting the Flex-PCB, BSM, or any other connecting board. The kit can be powered from an external power supply using the VDD and GND signals available in the connector. The kit also has output lines for host control and buzzer. The IIC clock and data lines from the CY8CMBR2110 chip are also brought to this connector.

Pin	Connected to	Pin	Connected to
P1-1	CS8	P1-23	Wake
P1-2	GPO8	P1-24	GPO 1
P1-3	CS5	P1-25	GND
P1-4	XRES	P1-26	GND
P1-5	GPO5	P1-27	CS6
P1-6	GND	P1-28	GPO6
P1-7	GPO5	P1-29	GPO3
P1-8	GPO2	P1-30	CS3
P1-9	CS2	P1-31	GPO3
P1-10	CS9	P1-32	NC
P1-11	GPO9	P1-33	CS0
P1-12	GP07	P1-34	GND
P1-13	CS7	P1-35	GND
P1-14	CS4	P1-36	GND
P1-15	GND	P1-37	I2C SDA
P1-16	GND	P1-38	I2C SCL
P1-17	CS1	P1-39	GND
P1-18	Host Cntl 0	P1-40	GND
P1-19	Host Cntl 1	P1-41	VDD Dev
P1-20	GPO4	P1-42	NC
P1-21	Buzzer Out 0	P1-43	VDD Ext
P1-22	Buzzer Out 1	P1-44	NC

Table 4-2. 44-Pin Expansion Connector

**Note:** There are two pins assigned to each of GPO3 and GPO5. This is done to make expansion connector compatible to CY3280 Universal CapSense Module Boards.

## 5. Sample Configurations



This section discusses the high-level design process to open, build, configure, and run sample configurations using the CY3280-MBR2 CapSense Express Kit.

There are three Sample configurations provided with this kit. Each sample configuration file has different configuration settings demonstrating various kit features. By default, the kit is configured with Sample Configuration 1.

To use the Sample Configuration files, EZ-Click customizer tool is required. The installation details for EZ-Click customizer tool is explained in Getting Started chapter on page 9.

## 5.1 Demonstration of Features using Sample Configuration Files

Follow the steps to run the configuration files and test the features.

#### 5.1.1 Loading Configuration File 1

- 1. Connect the CY3280-MBR2 kit to the PC via the USB port using the USB cable and move the switch position to GUI. Ensure USB Status LED glows.
- Open the EZ-Click customizer tool from the default location: Start > All Programs > Cypress > EZ-Click <version> > EZ-Click.
- Click on Load Project under File menu. Figure 5-1 shows the default location of Load Project action.

Figure 5-1. Load Project

File Configuration Help III III IIII IIII IIIIIIIIIIIIIIIIIII	r: Off		
EZ-Click	S Open Project-Select Project Location		PRES
Recent Projects	() Wy Documents + Cypress Projects + 47	Search Cypress Projects	
Sample Configuration 7 Sample Configuration 3	Organize   New folder	al configuration options for Cypress devices. This tool currently	,
Sample Configuration 1 Sample Configuration 1	Favorites     Favorites     Arrow Paces     Recent Places     Documents     Music     Fictures     Tideos	Date modified Type search.	
	n Computer	•	
	File name:	ypress Solution Project File	
New Project   Browse		Open Cancel	



- 4. Navigate to the project directory <Install\_Directory>:\Program Files\Cypress\ CY3280-MBR2\<version>\Sample Configurations\Sample Configuration 1 in the Open Project - Select Project Location window.
- 5. Double-click on the **Sample Configuration 1** file to open.

Figure 5-2. Open Configuration1 File

	EZ-Click - Sample_Config	uration1						- 2 2
We Deck     We Deck     Veloce     Veloce <th>le Configuration Help</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th>	le Configuration Help							
Name conde       Device conde       Visual conde       Open Draject Select Project Location       Image: Condepartion         Recent Projects       Supports CapSense Expension       Image: Condepartion       Image: Condeparti       Image: Condepartion       Image	🔒   🖾 🗗   🚰 🕘 🔛   Pov	ver: Off 🖌						
EZ-Click       Open Project Sense Configuration1       Image: Configuration2       Image: Configurati	Start page Main console Device	e config Visual config CapSense ou	put Production line	e testing				
Recent Projects       Welcome to EZ-Click       Configuration1       Image: Configuration1	EZ-Click		Open Project-	Select Project	Location		? 🛛	CYPRESS
New Project., IBrowse.       New Project., IBrowse.         New Project., IBrowse.       Step 3: Click on the Connect button to connect to the target device.         Step 3: Click on the Connect to USB-1 <sup>2</sup> C bridge and MiniProg3 is configuration > Apply Current Con	Depart Depinete		Look in:	Sample_Co	nfiguration1	O Ø P D		
sparing       Use E2-Click to take your supports CapSense Expression       Image: CapSense Expression	Sample Configuration1	Welcome to EZ-Click		Sample_Conf	iguration1			
Design flow       Image: Configuration 1       Design flow         Step 1: Create a new proposed       Step 1: Create a new proposed       Step 2: Select a target Cy         Step 2: Select a target Cy       Step 3: Modify the paran       My Computer         Step 4: Click on (Configuration 1       Image: Configuration 1       Image: Configuration 1         Step 4: Click on (Configuration 1       Image: Configuration 1       Image: Configuration 1         Step 1: Connect and configuration 1       Image: Configuration 1       Image: Configuration 1         Step 1: Connect a CV3240 USB-1-C Bridge or MiniProgs to the PC: This naroware will appear in the port selection list.       Step 1: Connect the bridge or MiniProgs to the target device.         Step 2: Connect the bridge or MiniProgs 3 is connected to the PC, you must select the one to which the target device is connected.       Step 3: If more than one USB-1 <sup>2</sup> C bridge and MiniProg3 is connected to the PC, you must select the one to which the target device is connected.         Step 3: Click on the Connect button to connect to the target device.       Step 5: Click on (Configuration > Apply Current Config) to configure the target device.	spirit ug	Use EZ-Click to take your supports CapSense Expre	My Recent Documents					options for Cypress devices. This tool currently
New ProtedIBrowse.         Hortcuts		Design flow	Desktop					
New Project.       Biomet.         New Project.       Biomet.         Step 3: Modify the parameter       Step 4: Click on (Configure         Step 4: Click on (Configure       Step 6: Connect and configure         My Decomposition       My Decomposition         Step 1: Connect a CV3240 USB-1 C Broge or NumProget to the PC. This hardware Will appear in the port selection Ist.         Step 1: Connect a CV3240 USB-1 C Broge or NumProget to the PC. This hardware Will appear in the port selection Ist.         Step 2: Connect the bridge or MiniProgra to the target device.         Step 3: If more than one USB-1 <sup>2</sup> C bridge and MiniProgra is connected to the PC, you must select the one to which the target device is connected.         Step 3: Click on (Configuration > Apply Current Config) to configure the target device.         Step 5: Click on (Configuration > Apply Current Config) to configure the target device.		The tool supports the fol						
New Project [Browse]       Step 3: Modify the param         New Project		Step 1: Create a new proj	My Documents					
New Project.       Blowse.         New Project.       Blowse.         Step 3: Modify the parameters       Step 4: Click on (Configured on MiniProgs to the PC., Ints naroware will appear in the port selection list.         Step 1: Connect the bridge or MiniProgs to the target device.       Step 2: Connect the bridge or MiniProgs to the target device.         Step 2: Connect the bridge or MiniProgs to the target device.       Step 3: If more than one USB-1 <sup>2</sup> C bridge and MiniProgs is connected to the PC, you must select the one to which the target device is connected.         Step 3: Click on the Connect button to connect to the target device.       Step 5: Click on (Configuration > Apply Current Config) to configure the target device.		Step 2: Select a target Cy						
New Project.       Biowse.         Step 4: Click on (Configuration Configuration Configuration Project File       Image: Configuration Project File         Step 1: Connect a CV3240 USB-1-C Bridge of NumProgs to the PC. This hardware will appear in the port selection list.         Step 2: Connect the bridge or MiniProg3 to the target device.         Step 3: If more than one USB-1 <sup>2</sup> C bridge and MiniProg3 is connected to the PC, you must select the one to which the target device is connected.         Step 5: Click on (Configuration > Apply Current Config) to configure the target device.		Step 3: Modify the param	My Computer					
New ProjectIBIOWSE         Step 1: Connect a CV3240 USB-1*C Bridge or MiniProg3 to the PC This naroware will appear in the port selection list.         Step 2: Connect the bridge or MiniProg3 to the target device.         Step 3: If more than one USB-1 <sup>2</sup> C bridge and MiniProg3 is connected to the PC, you must select the one to which the target device is connected.         Step 4: Click on the Connect button to connect to the target device.         Step 5: Click on (Configuration > Apply Current Config) to configure the target device.		Step 4: Click on (Configur	1000	-	-			
New Project.       Istore that one USB-1 <sup>2</sup> Connect a CY3240 USB-1 <sup>2</sup> Erroge of MiniProg3 to the PC. Inits hardware will appear in the port selection list.         Step 1: Connect a CY3240 USB-1 <sup>2</sup> Erroge of MiniProg3 to the target device.         Step 2: Connect the bridge or MiniProg3 to the target device.         Step 3: If more than one USB-1 <sup>2</sup> Coridge and MiniProg3 is connected to the PC, you must select the one to which the target device is connected.         Step 4: Click on the Connect button to connect to the target device.         Step 5: Click on (Configuration > Apply Current Config) to configure the target device.		Step to connect and conf		File name:	Sample_Configuration1	~	Open	
New ProjectIBitwese       Step 1: Connect a CV3240 USE-I C Bridge or MiniProgs to the PC. This hardware will appear in the port selection list.         Step 2: Connect the bridge or MiniProgs to the target device.       Step 3: If more than one USB-I <sup>2</sup> C bridge and MiniProgs is connected to the PC, you must select the one to which the target device is connected.         Step 4: Click on the Connect button to connect to the target device.       Step 5: Click on (Configuration > Apply Current Config) to configure the target device.			My Network	Files of type:	Cypress Solution Project File	~	Cancel	
New Project., [Biowse.]       Step 2: Connect the bridge or MiniProg3 to the target device.         ihortcuts       Step 3: If more than one USB-1 <sup>2</sup> C bridge and MiniProg3 is connected to the PC, you must select the one to which the target device is connected.         Step 4: Click on the Connect button to connect to the target device.       Step 5: Click on (Configuration > Apply Current Config) to configure the target device.		Step 1: Connect a CY3240	USB-ITC Bridge	or WiniProgs to	o the PC. This hardware will a	ppear in the po	ort selection list.	
New Project [Browse] Step 3: If more than one USB-1 <sup>2</sup> C bridge and MiniProg3 is connected to the PC, you must select the one to which the target device is connected. Step 4: Click on the Connect button to connect to the target device. Step 5: Click on (Configuration > Apply Current Config) to configure the target device.		Step 2: Connect the bridg	e or MiniProgr3	to the target o	device.			
Step 3: If more than one USB-I <sup>+C</sup> bridge and MiniProg3 is connected to the PC, you must select the one to which the target device is connected. Step 4: Click on the Connect button to connect to the target device. Step 5: Click on (Configuration > Apply Current Config) to configure the target device.	New Project   Browse		2					
Step 4: Click on the Connect button to connect to the target device. Step 5: Click on (Configuration > Apply Current Config) to configure the target device.	Shortcuts	Step 3: If more than one U	JSB-I <sup>+</sup> C bridge a	nd MiniProg3	is connected to the PC, you m	ust select the o	one to which the	target device is connected.
Step 5: Click on (Configuration > Apply Current Config) to configure the target device.		Step 4: Click on the Conne	ect button to co	nnect to the ta	rget device.			
		Step 5: Click on (Configur	ation > Apply C	urrent Config)	to configure the target device			
		step st click on (comgar	acion - Apply Cl	aren comigj	to configure the target device			
								~

- 6. Connect the kit to the EZ-Click tool using the following steps.
  - a. Click on the Connect button on the Main Console tab of the EZ-Click customizer tool. The EZ-Click will throw an error as shown. Click OK on the pop-up window. Ensure USB Power LED glows.

EZ-Click - project2			2
File Configuration Help			
🔄 🖬 🗗 🗿 😥 Power 3.3V 🔹			
Start page Main console			
Cypress device:			
Port selection:			
Bridge-/0914C3CC2905			
	EZ-Click		
	Failed to connect to the device.		
	-		
	OK		
		Connec	t Disconnect



- b. Touch the **Power** button to turn **ON** the kit. Ensure Power button, LED1, LED2 and Attention button glows.
- c. Click the **Connect** button on the **Main Console tab** of the EZ-Click customizer tool. Ensure you see the device connected in the status window of the Main Console tab.
- 7. Click on Apply Current Config under Configuration menu to apply the configuration to the kit.

Figure 5-3. Apply Current Configuration

le	Configuration Help	
	🛃 Generate Config File Ctrl+G	✓
itar	Apply Current Config	ual config CapSense output Production line testing
Cy	Apply Default Config Read Config	
Dev	evice connected:	

- 8. Touch the **Power** button to power the kit.
- 9. Verify the following features:
  - □ LED ON time (1.5 sec): Touch any CapSense button; the respective LED turns on. When the finger is released, the LED turns off after 1.5 seconds.
  - Button auto reset (5 sec): Touch any CapSense button; the respective LED turns on. Do not release the finger; the button will go off automatically after 5 seconds.
  - Automatic threshold: This feature automatically keeps an optimum finger threshold value for all the buttons.

#### 5.1.2 Loading Configuration File 2

The GUI images for the following steps are similar to 5.1.1 Loading Configuration File 1 on page 35:

- 1. Steps 1 to 3 remains the same as mentioned 5.1.1.
- 2. Navigate to the project directory <Install\_Directory>:\Program Files\Cypress\ CY3280-MBR2\<version>\Sample Configurations\Sample Configuration 2 in the Open Project - Select Project Location window.
- 3. Double-click on the Sample Configuration 2 file to open.
- 4. Follow the steps 4 to 6 mentioned in section 5.1.1 to continue.
- 5. Verify the following features:
  - **Buzzer:** Touch any button; the respective LED turns ON along with an audio feedback.
  - **Power-on LED effects:** Observe LED effects on all the buttons upon power up.
  - **Button controlled LED effects:** Observe LED effects on touching any CapSense button.
  - Automatic threshold: This feature automatically keeps an optimum finger threshold value for all the buttons.
  - Debounce control on Button 1: Observe that button 1 is activated only after you touch the button for approximately 1 second.



#### 5.1.3 Loading Configuration File 3

The GUI images for the following steps are similar to 5.1.1 Loading Configuration File 1 on page 35:

- 1. Steps 1 to 3 remains the same as mentioned 5.1.1.
- 2. Navigate to the project directory <Install\_Directory>:\Program Files\Cypress\ CY3280-MBR2\<version>\Sample Configurations\Sample Configuration 3 in the Open Project - Select Project Location window.
- 3. Double-click on the Sample Configuration 3 file to open.
- 4. Follow the steps 4 to 6 mentioned in section 5.1.1 to continue.
- 5. Verify the following features:
  - Button auto reset (5 sec): Touch any CapSense button; the respective LED turns on. Do not release the finger; the button will go off automatically after 5 seconds.
  - **Power-on LED effects:** Observe LED effects on all the buttons upon power up.
  - □ **Toggle + Button controlled LED effects:** Touch any of the buttons 1, 2, 3, 4, 5, 6; the corresponding LED lights up showing a ramp in LED brightness. The button will remain lit till the next touch. The LED brightness ramps down to 0 on the second touch.
  - FSS + Button LED effects: Touch any of the buttons 7, 8, 9, 10; the corresponding LED lights up showing LED effects. Keep the finger on the button and touch any of these buttons; the second button does not glow. Remove the finger from the first button and then touch any of these button; the button glows displaying LED effects.

**Note:** You can use Sample configurations 1 and 2 with the Flex-PCB in the same way as explained in the SmartSense auto-tuning feature in Kit Operation chapter on page 13. It is not recommended to use Sample configuration 3 for Flex-PCB.

# A. Appendix



## A.1 Schematics







Test Points



Capsense(CY8CMBR2044) Based Power Button and I2C Attn. control section













## A.1.2 Flex-PCB







## A.2 Board Layouts

A.2.1 CY3280-MBR2 Board Primary Side





A.2.2 CY3280-MBR2 Board Secondary Side





## A.2.3 Power Layer





## A.2.4 Ground Layer





## A.2.5 Flex-PCB Primary Side



A.2.6 Flex-PCB Secondary Side





## A.3 Bill of Materials (BOM)

Item	Qty	Reference	Description	Manufacturer	Mfr Part Number
1	5	C2,C1,C6,C12,C7	CAP .10UF 10V CERAMIC X7R 0603	Kemet	C0603C104K8RACTU
2	2	C3,C4	CAP CERAMIC 10.0UF 16V X5R 1206	Kemet	C1206C106K4PACTU
3	1	C5	CAP CER 2200PF 50V 5% C0G 0805	Murata Electronics North America	GRM2165C1H222JA01D
4	1	C8	CAP 1.0UF 16V CERAMIC Y5V 0805	Murata Electronics North America	GRM219F51C105ZA01D
5	1	C9	CAP CER 2.2UF 10V 10% X7R 0805	Murata Electronics North America	GRM21BR71A225KA01L
6	1	C10,C11	CAP 10000PF 16V CERAMIC X7R 0402	Yageo America	CC0402KRX7R7BB103
7	1	C13	CAP CERM 2200PF 1% 50V NP0 1206	AVX Corporation	12065A222FAT2A
8	16	D2,D3,D6,D7, D8,D9,D10,D11, D12,D13,D14, D15,D16,D17, D18,D19	LED RED CLEAR 1206 REAR MNT SMD	Stanley Electric Co	BR1111R-TR
9	2	D4,D5	TVS 5.0 VOLT 600 WATT BI- DIR SMB	Littelfuse Inc	SMBJ5.0CA
10	1	TVS3	IC TVS UNI-DIR 5V 350W	Semtech	SD05.TCT
11	1	F1	POLYSWITCH 1.10A RESET FUSE SMD	TE Connectivity	MICROSMD110F-2
12	1	F2	POLYSWITCH .20A RESET FUSE SMD	TE Connectivity	MINISMDC020F-2
13	2	J1,J2	CLIP BATTERY AAA/N .375X.460" SS	Keystone Electronics	55TR
14	1	J3	CONN USB MINI B SMT RIGHT ANGLE	ТҮСО	1734035-2
15	1	LS1	BUZZER AUDIO PIEZO 25V SMD	CUI Inc	CMT-1603
16	1	P1	CONN FMALE 44POS DL .1" R/ A GOLD	Sullins Electronics Corp.	PPPC222LJBN-RC
17	3	R2,R3,R51	RES CHIP 0.0 OHM 1/10 1/8W 5% 0805 SMD	Panasonic - ECG	ERJ-6GEY0R00V
18	3	R4,R5,R7	RES 5.1K OHM 1/16 1/10W 1% 0603 SMD	Yageo Corporation	RC0603FR-075K1L
19	1	R6	RES 0.0 OHM 1/10W 0603 SMD	Yageo Corporation	RC0603JR-070RL
20	12	R9,R10,R33,R34,R 35,R36,R37, R39,R40,R42, R43, R44	RES 560 OHM 1/16W 1% 0402 SMD	Vishay/Dale	CRCW0402560RFKED
21	1	R11	RES 52.3K OHM 1/10W 1% 0603 SMD	Yageo	RC0603FR-0752K3L
22	1	R12	RES 5.1K OHM 1/10W 5% 0603 SMD	Yageo	RC0603JR-075K1L
23	1	R14, R13	RES 51K OHM 1/10W 5% 0603 SMD	Yageo	RC0603JR-0751KL
24	1	R15	RES 24.0K OHM 1/10W 1% 0603 SMD	Yageo	RC0603FR-0724KL
25	1	R16	RES 10K OHM 1/10W 5% 0603 SMD	Yageo	RC0603JR-0710KL



Item	Qty	Reference	Description	Manufacturer	Mfr Part Number
26	1	R17	RES 30.1K OHM 1/10W 1% 0603 SMD	Yageo	RC0603FR-0730K1L
27	1	R18	RES 6.8K OHM 1/10W 5% 0603 SMD	Yageo	RC0603JR-076K8L
28	2	R19,R21	RES 7.5K OHM 1/10W 5% 0603 SMD	Yageo	RC0603JR-077K5L
29	3	R22,R23,R24	RES 47 OHM 1/10W 5% 0603 SMD	Yageo	RC0603JR-0747RL
30	2	R25,R26	RES 22 OHM 1/8W 5% 0805 SMD	Panasonic - ECG	ERJ-6GEYJ220V
31	1	R28	RES 100K OHM 1/10W 5% 0603 SMD	Rohm	MCR03EZPJ104
32	1	SW1	SWITCH MINI SLIDE SP4T	APEM Components, LLC	SLB1470R
33	1	U1	IC LOAD SW HGH SIDE 1.2A SC70-6	Micrel Inc	MIC94090YC6 TR
34	1	U2	IC SINGLE INVERTER GATE SOT-23-5	Texas Instruments	SN74LVC1GU04DBVR
35	1	U3	IC MCU CAPSENSE QFN16	Cypress Semiconductor	CY8CMBR2044-24LKXI
36	1	U4A	IC LDO REG 1A SOT223-6	Texas Instruments	TPS73701DCQ
37	1	U5	IC PSOC 16KB FLASH 56QFN	Cypress Semiconductor	CY8C24894-24LFXA
38	1	U6	IC SINGLE USB PORT TVS SOT-23-6	Texas Instruments	SN65220DBVR
39	1	U7	IC MCU CAPSENSE QFN32	Cypress Semiconductor	CY8CMBR2110-24LQXI
40	16	R1,R8,R20,R27, R29,R30,R31, R32,R38,R41, R45,R46,R47, R48,R49,R50	RES 665 OHM 1/8W 1% 0805 SMD	Panasonic-ECG	ERJ-6ENF6650V
41	1	РСВ	FLEXIBLE PRINTED CIRCUIT BOARD	Open Source	PDC-09807 Rev03
42	1	D1	DIODE SCHOTTKY 0.5A 20V SOD-123	Fairchild Semiconductor	MBR0520L
43	10	R52,R53,R55, R56,R57,R58, R59,R60,R61, R62	RES CHIP 0.0 OHM 1/10 1/8W 5% 0805 SMD	Panasonic - ECG	ERJ-6GEY0R00V
44	1	J4	CONN HEADER 5POS 0.1 VERT KEYED	Molex	22-23-2051
45	1	D1	DIODE SCHOTTKY 0.5A 20V SOD-123	Fairchild Semiconductor	MBR0520L
46	10	R52,R53,R55, R56,R57,R58, R59,R60,R61, R62	RES CHIP 0.0 OHM 1/10 1/8W 5% 0805 SMD	Panasonic - ECG	ERJ-6GEY0R00V
47	1	J4	CONN HEADER 5POS 0.1 VERT KEYED	Molex	22-23-2051
48	1	J6	CONN HEADER .100 DUAL R/A 44POS	Sullins Electronics Corp.	PBC22DBAN