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

Doc. # 001-71857 Rev. \*C

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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.
*В	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







## 2.1 Before you Begin

**Getting Started** 

2.

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

CY 3280-MBR2 - InstallShi	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:\\Cypresshange
	<back next=""> Cancel</back>

- 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

Cylnstaller 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	ncel

- 8. 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	? 🛛
© 2009 Cypress Semiconductor Corporation All rights reserved	
Contact Us	Einish



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				= 0 2
File Configuration Help				
al of of a an Priver 3.3V				
Start page Main console				
Cyperes devices:	FZ Click	iled to connect to the device.	Core	wd Disconnet
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 Configuration1 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

to assign Ca	pSense pins									Normal	shalled CDD -	
Button	CapSen	se pin	Sensitivity	1	Finger threshold (decimal)	Flanking sensor suppression	Toggle (Touch ON/OFF)	First button touch response time(ms)	Consecutive button touch response time(ms)	HCG1:	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	ice (decimal)	
Button 4	CS4	×	High	- 50	1. N					CS0:	20	
Button 5	CS5	~	High	- 50	× .					CS1-9:	1	
Button 6	CS6	v	High	~ 50	~					Ontimizati	on	
Button 7	CS7	*	High	~ 50	~					Respons	e time	
Button 8	CS8	Y	High	- 50	×.					Auto rese	t period:	
Button 9	CS9	1	High	- 50	1					5 s		
er configura luzzer er type:	ion AC buzze	r-1 pin			~	Frequency (kHz): 4.0	10			Button :	scan rate (ms)	E21
or ON time I	mat 25				10	Rutter ide state: 1.5				20		031
	mat les						W					

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

ber of buttons:	4 🛩		🗹 Auto	matic thre	shold	I2C ac	Idress (hex): 37			0	Noise imr	nunity level:	
vuto assign Ca	pSense pins										Normal		
Button	CapSen	se pin	Sensiti	vity	Finger (de	threshold cimal)	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	~			200	200	HCG2	High	
Button 1	CS1	~	High	~	50	~			50	50	HCG3:	High	
Button 2	CS2	¥	High	~	50	Y			50	50	HCG4:	High	
Button 3	CS3	*	High	*	50	1			50	50	Debour	nce (decimal)	
Button 4	CS4	4	High	Y	50	4					CS0:	20	
Button 5	CS5	14	High	~	50	1					CS1-9:	1	
Button 6	CS6	14	High	×	50	Y			-		Ontimizat	ion:	
Button 7	CS7	X	High	.*	50	~					Respons	e time	
Button 8	CS8	4	High	Y	50	1					Auto rese	t period:	
Button 9	CS9	14	High	~	50	1					5 s		
zer configural Buzzer	ion										Button	scan rate (ms)	
The broad	AC harren	nin Lu						1.00			0-		12
	MC DUZZE	ast harr					mequency (ranz)	4:00			25		531
	mst 20					14		Low		<u> </u>			

#### 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

tt page   Main console   Device config LED configuration 2 LED ON time (Period1) LED ON time (ms): 1500 Analog voltage output	Visual config CapSense output Producti Period1 (ms): 1500 Period2 (ms): 0 Period3 (ms): 0	on line testing	tensity	aligh brig	Intraes Contract		
itandby mode LED brightness: 0%	Period4 (ms): 0			(T <sub>no</sub> ) (T <sub>n</sub>	-) (T)	T <sub>1</sub> )	
D effects It power ON On button touch							
D effects at power ON On button touch At power ON						LED effects mode:	oncurrent
D effects t power ON On button touch At power ON LED effects parameters	LED 0	LED 1,2,3		LED 4.5.6		LED effects mode: C	oncurrent
D effects power DN On button touch At power ON LED effects parameters Famp up time (T <sub>su</sub> )	LED 0 Period1	LED 1,2,3	×	LED 4.5.6 Period1	×	LED effects mode: C LED 7,8,9 Period1	oncurrent
D effects power ON Dn button touch At power ON LED effects parameters amp up time (T <sub>no</sub> ) Gight time (T <sub>no</sub> )	LED 0 Period1 Period1	LED 1.2.3 Period1	×	LED 4.5.6 Period1 Period1	×	LED effects mode: C LED 7,8.9 Period1 Period1	oncurrent
D effects (power ON On button touch) At power ON LED effects parameters dight free (T <sub>w0</sub> ) dight free (T <sub>w0</sub> ) arang down time (T <sub>w0</sub> )	LED 0 Period Period Period1	LED 12.3 Period1 Period1	× •	LED 4.5.6 Period1 Period1 Period1		LED effects mode: C LED 7,8,9 Period1 Period1 Period1	oncurrent
D effects (power DN On button touch)  At power ON LED effects parameters Ramp up time (T <sub>sp</sub> ) (sp) time (T <sub>sp</sub> ) Ramp down time (T <sub>sp</sub> ) Cover time (T <sub>sp</sub> )	LED 0 Period1 Period1 Period1	LED 1,2,3           ✓         Percol1           ✓         Percol1           ✓         Percol1           ✓         Percol1	<u>×</u> ×	LED 4.5.6 Period1 Period1 Period1	M 9 9	LED effects mode: [C LED 7.8,9 Period1 Period1 Period1 Period1	oncuirent
Deffect  Comment of the second	LED 0 Period1 Period1 Period1 Period1 Period1 100%	LED 1.2.3 Period1 Period1 Period1 Period1 Period1 V Period1 V 100%	× × ×	LED 4,5,6 Period1 Period1 Period1 100%	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	LED effects mode: C LED 7,8,3 Period1 Period1 Period1 Period1 100%	oncurrent
Deffects  Apower ON  Con button touch  Action	LED 0 Period1 Period1 Period1 100% D%	LED 1.2.3           ✓         Period1           ✓         Period1           ✓         Period1           ✓         Period1           ✓         D0%           ✓         D0%		LED 4,5,6 Period1 Period1 Period1 100% 0%	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	LED effects mode: C LED 7,9,9 Period1 Period1 Period1 100% 0%	oncultrent

#### 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	nSense nins									•	Normal		
uto assigni ca	poense pins										Host co	ntrolled GPOs	
Button	CapSer	ise pin	Sensitiv	ity	Finger thre (decim	eshold al)	Flanking sensor suppression	l oggle (1 ouch ON/OFF)	First button touch response time(ms)	Consecutive button touch response time(ms)	HCG1:	High	
Button 0	CSO	~	High	~	50	4			200	200	HCG2:	High	
Button 1	CS1	Y	High	*	50	1			50	50	HCG3:	High	
Button 2	CS2	~	High	~	50	~			50	50	HCG4:	High	
Button 3	CS3	*	High	*	50	×			50	50	Deboun	ce (decimal)	
Button 4	CS4	4	High	Ŷ		*					CS0:	20	
Button 5	CS5	4	High	2	50	4					CS1-9:	1	
Button 6	CS6	19	High	~	50	1					Optimizati	on:	
Button 7	CS7	~	High	14	50	~					Respons	e time	
Button 8	C\$8	4	High	Y	50	*					Auto rese	t period:	
Button 9	CS9	4	High	2	50	14					5 s		
zer configural	ion										Disabled 5 s		
Buzzer											20 s		
zer type:	AC buzze	er-1 pin				14	Frequency (kHz): 4	.00		194 1	25		531
zer ON time I	ms) 25					1	Buzzer idle state	ow		*			

#### 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.

Figure 3-12.	Setting Debounce Parameter	

art page   Main co	insole Devic	e coning [	Visual config	Lapsen	se output Productio	n line testing						
umber of buttons:	4 🛩		🗹 Auto	matic thre	eshold 12	Caddress (hex):	37		\$	Noise imn	nunity level:	
Auto assign Cap	Sense pins									Normal	uballed CDD -	
Button	CapSer	nse pin	Sensitiv	rity	Finger threshold (decimal)	Flanking suppres	ensor Toggle (Touch sion 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	ce (decimal)	
Button 4	CS4	*	High	¥	50	× 🗆				CS0:	40	
Button 5	CS5		High	~	50	× 🗆				CS1-9	45	
Button 6	CS6	N.	High	×	50	Y 🗌				Ontiminati	<u></u>	
Button 7	CS7	Y	High	4	50					Respons	e time	
Button 8	CS8	4	High	Y	50	× 🗌				Auto rese	t period:	
Button 9	CS9	V	High	~	50					5 s		
Buzzer configurati	on									Button a	scan rate (ms)	
Buzzer										-		[25
Buzzer type:	AC buzz	er-1 pin			15	Frequency (	(Hz): 4.00		1 m	25		531
Buzzer ON time (n	ns) 25					Buzzer idle :	tate. Low					

#### 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.

Figure 3-14.	Buzzer	Signal	Output	Enabled
--------------	--------	--------	--------	---------

ber of buttons	4 💙		🗹 Auto	omatic thre	shold	I2C ad	ldress (hex): 37			\$	Noise imr	nunity level:	
kuto assign Ca	apSense pins										Normal		
Button	CapSer	nse pin	Sensiti	ivity	Finger th (deci	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	~			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	1			400	400	Debour	ice (decimal)	
Button 4	CS4	Y	High	1	50	~					CS0:	40	
Button 5	CS5	1.	High	~	50	1					CS1-9:	45	
Button 6	CS6	Y	High	V	50	1					Ontimizat	ion:	
Button 7	CS7	×	High	.9	50	1					Respons	e time	
Button 8	CS8	4	High	8	50	~					Auto rese	t period:	
Button 9	CS9	19	High	Y	50	(M)					5 s		
zer configura	tion										Button :	scan rate (ms)	
Buzzer											0-		[
zzer type:	AC buzz	er-2 pin				*	Frequency (kHz):	n)		×	25		531
	(ma) 25					\$	Buzzer idle state: Lo	w		¥			

#### 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.

Lesas Mais a	annels Devic	e config	Gu cal annifa	CanCana	e entent Drede	ntine li	es textica						
r page   Main c	Unsue   Done	o coning [	visual coning [	Capsens	e output ji riodu	cuorin	ne tesung						
mber of buttons:	. 4 💌		🗹 Autor	natic thre	shold	12C a	address (hex): 37			٥	Noise imn	nunity level:	
Auto assign Ca	pSense pins										Normal		
Button	CapSer	nse pin	Sensitiv	ity	Finger thresh (decimal)	old	Flanking sensor suppression	Toggle (Touch ON/OFF)	First button touch response time(ms)	Consecutive button touch response time(ms)	Host co HCG1:	Itrolled GPUs	
Button 0	CS0	~	High	~	50	4			375	375	HCG2:	Low	
Button 1	CS1	¥	High	*	50	14			400	400	HCG3:	Low	
Button 2	CS2	×	High	~	50	1			400	400	HCG4:	High	
Button 3	CS3	*	High	~	50	1			400	400	Debour	ce (decimal)	
Button 4	CS4	8	High	4	50	1					CS0:	40	
Button 5	CS5	1	High	-	50	1					CS1-9:	45	
Button 6	CS6	1	High	19	50	1					Ontimizati		
Button 7	CS7	4	High	~	50	4					Respons	e time	
Button 8	CS8	8	High	2	50	1					Auto rese	t period:	
Button 9	CS9	1	High	4	50	14					5 s		
uzzer configural	tion										Button	can rate (ms)	
Buzzer													[ 25 ]
uzzer type:	AC buzz	er-2 pin				1	Frequency (kHz):	2.00		×	25		531
uzzer ON time (	ms): 25					4.5	Buzzer idle state:	Low		*			

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.

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.



⊆onfiguration Help							
🛯 🖬 🛃 💽 💽 Power: 3.3V	¥						
art page Main console Device config Visua	al config CapSense output Producti	on line testing					
LED configuration					-	1	
LED ON time (Period1)	Period1 (ms): 1500		<b>\$</b>				
LED ON time (ms): 1500 🛟	Period2 (ms): 1000		-	High brightne			
Analog voltage output	Period3 (ms): 800		ensity		Parns		
Standby mode LED brightness	Period4 (mst 1100		P Inte	amp	200	*7	
						Low brightness	
				(тки) (тн)	(TRD)	(TL)	
					8	·	
					Time	55	
ED effects							
ED effects At power ON On button touch							
ED effects At power ON At power ON At power ON						LED effects mode: Concurrer	it 💌
ED effects At power ON On button touch At power ON LED effects parameters	LED 0	LED 1.2.3		LED 4.5.6		LED effects mode: Concurren	t 💌
ED effects At 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 4.5.6 Period2	×	LED effects mode: Concurrer LED 7,8,9 Period3	t 💌
ED effects At power ON On button touch ✓ At power ON LED effects parameters Rane up time (T <sub>au</sub> ) High time (T <sub>au</sub> )	LED 0 Period1 Period2	LED 1,2,3 Period1 Period1	<u>v</u>	LED 4.5.6 Period2 Period4	~	LED effects mode: Concurrer LED 7.8,9 Period3 Period1	it 💌
ED effects At power ON On button touch ↓ At power ON LED effects parameters Ramo up time (T <sub>su</sub> ) High time (T <sub>su</sub> ) Ramp down time (T <sub>su</sub> )	LED 0 Period1 Period2 Period3	LED 1,2,3 • Period1 • Period1 • Period4	× × ×	LED 4.5.6 Period2 Period4 Period1	~ ~ ~	LED effects mode: Concurrer LED 7.8.9 Period3 Period1 Period4	it 💌
ED effects D on button touch D on button touch D of button touch D	LED 0 Period1 Period2 Period3 Period1	LED 1.2.3 Period1     Period1     Period4     Period1	v v	LED 4.5.6 Period2 Period4 Period2	× × ×	LED effects mode: Concurrer LED 7.8.9 Period3 Period1 Period2	t 💌
ED effects At power ON CP At power ON LED effects parameters Ramp up time (T <sub>au</sub> ) High time (T <sub>au</sub> ) Ramp down time (T <sub>au</sub> ) Lex without (T <sub>a</sub> ) High brightness	LED 0 Period1 Period2 Period3 Period1 100%	LED 1.2.3 Period1 Period1 Period4 Period1 100%	× × × ×	LED 4.5.6 Period2 Period4 Period1 Period2 100%	× × ×	LED effects mode: Concurrer LED 7.8,9 Period3 Period4 Period4 Period2 100%	t 🗸
ED effects At power ON On button touch At power ON LED effects parameters Ramp up time (T <sub>wp</sub> ) High time (T <sub>w</sub> ) Cow time (T <sub>w</sub> ) Low time (T <sub>s</sub> ) Low time to the set of t	LED 0 Period1 Period2 Period3 Period1 100% 0%	LED 1.2.3 Period1 Period1 Period4 Period4 Period1 00% 00%	× × × ×	LED 4.5.6 Period2 Period2 Period2 100% 0%	× • •	LED effects mode: Concurrer LED 78,9 Period3 Period4 Period2 100% 0%	t 🗸

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

