

CY8CKIT-006 PSoC[®] 3 LCD Segment Drive Evaluation Kit Guide

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1. Introduction



Thank you for purchasing the CY8CKIT-006 $PSoC^{\mathbb{R}}$ 3 LCD Segment Drive Evaluation Kit (EVK). This is an evaluation kit aimed at showcasing PSoC's LCD segment drive system. It familiarizes users with the LCD segment drive capability of Cypress's Programmable System-on-Chip (PSoC) and the LCD segment drive component in Cypress's Integrated Development Environment (PSoC[®] CreatorTM).

The kit has the following features:

- Large complex custom LCD with 448 LCD segments
- CapSense buttons
- Accelerometer
- Thermistor
- Buzzer
- Protoheaders

The kit is factory programmed for an out-of-box demonstration of PSoC's LCD segment drive capability, along with PSoC's superior ability to integrate high performance digital and analog peripherals. You can also reprogram the device and using the protoheaders, develop applications.

The CY8CKIT-006 PSoC 3 LCD Segment Drive EVK is based on the PSoC[®] 3 family of devices. PSoC is a programmable system-on-chip platform for 8, 16, and 32 bit applications. It combines precision analog and digital logic with a high performance 8051 single cycle per instruction pipelined processor, achieving ten times the performance of previous 8051 processors. With the PSoC, you can create the exact combination of peripherals and integrated proprietary IP to meet the needs of your applications. You are no longer constrained by a catalog.

1.1 Kit Contents

This kit contains:

- PSoC 3 LCD Segment Drive Evaluation Board
- 9V Battery
- 12V Wall Wart Power Supply
- Miniprog3
- USB Cable (to connect Miniprog3 to the PC)
- Kit Stand
- Quick Start Guide
- Resource CD

Inspect the contents of the kit; if you do not find any part, contact your nearest Cypress sales office for help.



1.2 **PSoC Creator**

Cypress's PSoC Creator software is a state-of-the-art, easy-to-use software development IDE that introduces a game-changing, hardware and software co-design environment based on classical schematic entry and revolutionary embedded design methodology.

With PSoC Creator, you can:

- Automatically place and route select components and integrate simple glue logic normally residing in discrete muxes.
- Trade-off hardware and software design considerations allowing you to focus on what matters and getting to market faster.

PSoC Creator also enables you to tap into an entire tools ecosystem with integrated compiler tool chains, RTOS solutions, and production programmers to support both PSoC 3 and PSoC[®] 5.

1.3 Getting Started

To get started, take a look at Chapter 3 for a description of the kit operation and how to reprogram the device through PSoC Programmer. Refer to the installation instructions that comes with the PSoC Creator software to reprogram the device directly from PSoC Creator. Chapters 4 and 5 provide details on the theory of operation of the hardware and firmware, respectively. The Appendix provides the schematics and BOM associated with the PSoC 3 LCD segment drive evaluation board.

1.4 Additional Learning Resources

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

1.5 Document History

Revision	PDF Creation Date	Origin of Change	Description of Change
**	04/29/09	TEH	Initial version of kit guide
*A	09/22/09	XKJ/TEH	Extensive content updates
*В	11/09/09	KEV	Updates to text and images for Beta3 release
*C	01/08/10	KEV	Updates to section 3 for Beta4 web release

1.6 Document Conventions

This guide uses the Courier New font to distinguish file names and file location from regular text. The keyboard commands and window selections are given in **bold** text.

2. Installation



2.1 CD Installation

Follow these steps to install the CY8CKIT-006 PSoC 3 LCD Segment Drive EVK software:

- 1. Insert the kit CD into the CD drive of your computer. The CD is designed to auto-run and PSoC 3 LCD Segment Drive EVK menu appears.
- 2. The installation allows you to install the following software:
- PSoC Creator
- PSoC Programmer
- Kit Documentation
 - Quick Start Guide
 - □ User Guide
- Firmware
 - Demonstration Firmware
 - Example Projects
- Hardware
 - Schematic
 - Layout
 - BOM

Note If auto-run does not execute, double click AutoRun in the root directory of the CD.

2.2 Hardware

WARNING: Static discharges from the human body can easily reach 20,000 volts. This can damage the PSoC 3 LCD Segment Drive Evaluation Kit hardware. Take precautions to ensure that any static is discharged before touching the hardware.

- 1. Ensure that switch SW1 is in the OFF position prior to adding or removing batteries.
- 2. Insert a battery into the appropriate terminals or connect a wall transformer to the J2 jack.
- 3. Slide SW1 to the ON position if using a battery. The wall transformer supply is not controlled by SW1 and is always ON.



2.3 Software

- CY8CKIT-006 PSoC 3 LCD Segment Drive Evaluation Kit
- PSoC Creator IDE
- PSoC Programmer 3.10
- Example Project at C:\Program Files\Cypress\CY8CKIT-006_PSoC3_LCD_Drive_Kit\1.0\Firmware
- Documents at C:\Program Files\Cypress\CY8CKIT-006_PSoC3_LCD_Drive_Kit\1.0\Documentation
- Schematic design files at: C:\Program Files\Cypress\CY8CKIT-006_PSoC3_LCD_Drive_Kit\1.0\Hardware



3.1 Introduction

The CY8CKIT-006 PSoC 3 LCD Segment Drive EVK firmware provides examples using a display with many segments (16 common lines by 28 segment lines giving 448 addressable segments).

Figure 3-1. CY8CKIT-006 Kit



Operator entries are made using the four CapSense buttons that are labeled: SEL, "+", "-", and RET. Table 3-1. CapSense Button Functionality

Button	Function
SEL (CSD4)	Enter menu levels and select items
"+" (CSD1)	Advance up through menu items
"-" (CSD3)	Advance down through menu items
RET (CSD2)	Return to previous menu levels



3.2 Main Menu

Supply power to the board either through 9V battery, 9V to 12V wall adaptor, or USB. Refer to Power Supply Options on page 22 for more information on options to power the board. On startup, the kit name is scrolled from right to left across the matrix display. When the scrolling is complete, "Push SEL" is flashed to prompt you to press the CapSense Select button. After pressing **SEL**, the first main menu selection, PUNCH is shown on the matrix display. Press the "+" or "-" CapSense buttons to select a mode from one of the main menu selections.

Option	Brief Description
PUNCH	Punch gauge
RTC/TEMP	Real Time Clock Time/Temperature Display with Set Time/Date/Alarm
CONTRAST	Set LCD contrast level
LCD DEMO	Display all icons and segment characters in sequence

Table 3-2. Main Menu Options

To select a mode, press **SEL** when the desired mode name is displayed.

3.3 PUNCH

If you select PUNCH, the project enters the Punch menu item. PUNCH automatically enters the GAUGE sub menu and prompts by scrolling "Push SEL to Start Gauge". If you press the **SEL** button, then the PUNCH Gauge continues (1:GAUGE on page 10 section). By pressing the **RET** button, the PUNCH returns to its sub menu selections. Pressing "+" or "-" allows you to select a Punch sub menu option. The sub menu options are entered by pressing **SEL**.

Option	Brief Description
1:GAUGE	Record a punch acceleration.
1:HIGH	View the current high score.
1:RECALL	View the recorded top five high scores and the average score.
1:CLEAR	Clear the saved high scores.

Table 3-3. PUNCH submenu options

After exiting a Punch sub menu option and returning to the Punch menu, you can either select another Punch sub menu or press **RET** to return to the Main Menu.

3.3.1 1:GAUGE

If you select GAUGE, the display scrolls "Push SEL to Start Gauge". When you press **SEL**, a punch recording session begins. The project automatically starts measuring the peak at rest acceleration of the LCD kit board. During this time, the project displays a three second count down ending in the phrase "PUNCH!". Then the project begins peak and hold acceleration measurements in a continuous loop. During this sampling period, the "Push SEL" prompt is flashed. You can hold the board and "throw" punches. After throwing one or more punches, press the **SEL** button. The project displays the peak acceleration that the board experienced during the punch time.

If the peak acceleration is less than 1G, then the score is displayed as 0.0G. The peak acceleration is displayed on the large 7-segment display in the form X.X with a "G" shown on the 16-segment display (for example, 4.6G). If the peak acceleration is greater than the current lowest score, then the project prompts you to enter a name. **Note** The first five scores after performing a Clear (see 1:CLEAR on page 11) are always recorded. An empty score has a 0G value in the test for lowest score.



A name is one to six alphabetic characters and is entered on the matrix display. The project flashes "Name". Press **SEL**; "A" is flashed across the display. Press "+" and "-" buttons to select a letter in the range "A" to "Z". Press the **RET** button to select a single character name or press **SEL** to enter a second letter. You can enter up to six letters. A short name can be entered by pressing **RET** twice. This enters the name for the characters currently selected and entered.

After entering a user name, the project scrolls the saved high scores along with the name for each high score, from right to left on the matrix display. Then it scrolls the final average score. If your score is the first one entered after the score structure was cleared, then that score and the average score is displayed. In this case, the average score equals user score. The recalled scores continue to scroll until you press **SEL** to start another Punch recording or **RET** to exit the Punch Gauge sub menu and return to the Punch menu.

3.3.2 1:HIGH

When the option 1:HIGH is selected, the project scrolls the name and score of the highest recorded score. The project can store up to five high scores and user entered associated names. This score data structure is stored in persistent memory on the PSoC 3 and is returned through power cycles.

The high score and name are scrolled from right to left continuously on the matrix display in the format "1:MAX SCORE - ABCDEF = X.XG", where ABCDEF is the name of the highest scorer and X.XG is the high score acceleration value.

To exit the HIGH sub menu and return to the Punch menu, press the **SEL** or **RET** buttons.

3.3.3 1:RECALL

When the 1:RECALL option is selected, the project scrolls the five stored high score values along with names. Following the high scores, the average of the high scores is scrolled from right to left across the matrix display.

The first stored high score is displayed as "1: <Name-string> =<score - string>" followed by next high score user name and score value and finally the average of the high scores as "A: AVG SCORE = <score - string>".

Example of <Name string> is JAYA and <score sting> is 5.8G

To exit this sub menu and return to the Punch menu, press the SEL or RET buttons.

3.3.4 1:CLEAR

When the option 1:CLEAR is selected, the project prompts you to either complete the Clear function or exit to the Punch menu. The Clear function scrolls the instructions "Press SEL to clear or Press RET to abort" from right to left across the matrix display continuously until you press **SEL** or **RET**.

When **SEL** is pressed, the project clears saved score records, exits the Clear sub menu, and returns to the Punch menu (this also clears the RTC alarm settings and the RTC date).

If you press **RET**, the project returns to the Punch menu without clearing the saved scores.

3.4 RTC/TEMP

The RTC/TEMP menu has five sub menus.

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Option	Brief Description
2:Clock	Show time, date, and temperature
2:SetTim	Enter time of day
2:SetDat	Enter calendar date
2:SetAlm	Enter alarm time of day
2:Alarm	Turn alarm on/off

Press "+" or "-" to select one of the sub menu items and then **SEL** button to enter the sub menu options.

If you press the **RET** button at anytime in the RTC/TEMP sub menu, the project returns to the RTC/ TEMP main menu.

3.4.1 2:Clock

This sub menu displays the current time on large 7-segment display with AM/PM displayed on the 16-segment and 14-segment displays. The colon separator in the 7-segment display flashes on/off automatically marking seconds (one second on; one second off). If the time is set, then it is displayed as 12-hour time with AM or PM. If the time is not set since the last power cycle, the time at the minute that the power was last turned off will flash on/off. Press **SEL** to stop the flashing, but verify the time is correct.

If the alarm is turned on, then the alarm time is displayed on the small 7-segment display with either the small AM or PM icons displayed along with the BELL icon. If the alarm is off, then all the alarm display elements are turned off.

Date and temperature are displayed on the matrix display. The date and temperature are flashed one after the other. The temperature display can be alternated between °C and °F by pressing the "+" or "-" buttons.

When the alarm sounds, press **SEL** to stop the alarm. Press **RET** to return to the RTC/TEMP main menu.

3.4.2 2.SetTim

This submenu allows to set the clock time of the day.

Enter H1H2:M1M2 in 12 hour AM/PM clock time. The clock time is entered and displayed on the large 7-segment displays using the four display characters to the right and the colon icon separating the H1H2 and M1M2 characters. AM and PM are displayed on the 16-segment and 14-segment display characters.

- The project displays 12:00 the first time that time is set; the left H position (H1) of the large 7-segment display is flashed.
- Press "+" or "-" button to select the higher hour digit, '0' or '1'.
- Press **SEL** to advance to the next H position (H2).
- Press "+" or "-" to select '0' '9' if H1 is '0' or to select '0' '2' if H1 is '1'.
- Press SEL to advance to the left M position (M1).
- Press "+" or "-" to select '0' '5'.
- Press **SEL** to advance to the next M position (M2).



- Press "+" or "-" to select '0' '9'.
- Press **SEL** to advance to the 16-segment display character.
- Press "+" or "-" to select 'A' 'P'. The 14-segment display character shows 'M'.
- Press **SEL** to enter the time settings. "Push SEL" is prompted on the matrix display.
- Press **SEL** to exit the SetTim sub menu.

When setting the time, pressing **RET** exits the SetTim sub menu immediately without saving the time information.

3.4.3 2:SetDat

This sub menu allows to set the date in the format DDMMM-YY.

Enter D1D2MMMABC - Y1Y2. The date is displayed on the matrix display. This application only displays the last two digits of the year, the year "00" is taken as the year 2000 which is handled as a leap century.

- The project displays the 01JAN-00 the first time the time is set, the left D position (D1) of the matrix display is flashed.
- Press "+" or "-" button to select the higher date digit of the month, '0' '3'.
- Press **SEL** to advance to the next D position (D2).
- Press "+" or "-" to select '0' '9'.
- Press **SEL** to advance to select the month of the year.
- Press "+" or "-" to select month names, from "JAN" "DEC".
- Press **SEL** to advance to the left Y position (Y1) of the year.
- Press "+" or "-" to select '0' '9'.
- Press SEL to advance to the next Y position (Y2).
- Press "+" or "-" to select '0' '9'.
- Press **SEL** to enter the date settings and return to the "RTC/TEMP" sub menu.

If the day is set for a day greater than the number of days in the selected month, then the project automatically adjusts the day down to 30 or 31 or down to 28 or 29 for February depending on whether the entered year is a leap year.

When setting the date, pressing **RET** exits the SetDat sub menu immediately without saving the date information.

3.4.4 2:SetAlm

This sub menu allows to set the clock alarm time of the day.

Enter H1H2:M1M2 in 12 hour AM/PM alarm clock time. When setting the alarm, the alarm time is displayed on the large 7-segment display characters using the large colon icon to separate the H1H2 and M1M2 characters. AM and PM are displayed on the 16-segment and 14-segment display characters.

- The project displays the 00:00 the first time the alarm is set; the left H position (H1) of the large 7-segment display is flashed.
- Press "+" or "-" to select '0' or '1'.
- Press **SEL** to advance to the next H position (H2).
- Press "+" or "-" to select '0' '9' if H1 is '0' or '0' -'2' if H1 is '1'.
- Press SEL to advance to the left M position (M1).
- Press "+" or "-" to select '0' '5'.



- Press **SEL** to advance to the next M position (M2).
- Press "+" or "-" to select '0' '9'.
- Press **SEL** to advance to the 16-segment display character.
- Press "+' or "-" to select AM or PM.
- Press "+" or "-" to select 'A' 'P'. The 14-segment display character shows 'M'.
- Press **SEL** to enter the alarm settings. "Push SEL" is prompted on the matrix display.
- Press **SEL** to exit the "SetTim" sub menu.

The alarm time is set for the HH:MM selected and the SS is set to 00 by the code. The RTC Alarm interrupt is enabled.

When setting the alarm, pressing **RET** exits the SetAlm sub menu immediately without saving the alarm information

3.4.5 2:Alarm

This sub menu allows to turn the alarm on/off. Upon entering, either "AlarmOFF" or "AlarmON" is displayed based on the current alarm on/off settings.

- Press "+" and "-" button to select "AlarmOFF" or "Alarm ON".
- Press **SEL** to enter the ON/OFF alarm state. "PushSEL" is prompted on the matrix display.
- Press **SEL** to exit the Alarm set sub menu.

In the clock mode, alarm symbol is displayed if alarm is enabled. When the time reaches the set alarm time, the buzzer present on the board will beep. The buzzer will sound for up to 2-minutes before automatically shutting off. If the buzzer is shut off automatically, then the alarm remains on and starts the buzzer the next time the alarm time is reached again. You can manually turn off the alarm in three ways:

- 1. Press the sleep pushbutton from any state.
- 2. Press any CapSense button (for example, SEL) from any state.
- 3. Reopen the 2:Alarm sub menu item and set the Alarm state to "OFF".

3.5 CONTRAST

The project is designed for 3.3V operation and this bias level is set in the SegLCD component of the design. The CONTRAST sub menu allows the selection of a value in the range 0 to 10 to set the bias higher or lower to allow viewing the contrast effects.

Press **SEL** to enter the CONTRAST sub menu. The project displays the current contrast setting on the matrix display in the format "Level= X", where X is a value in the range 0 to 10. Press "+" or "-" to increment or decrement the value displayed. The progress bar at the bottom displays the contrast level in graphical format.

Pressing **SEL** or **RET** stores the contrast level in the persistent memory and project returns to the CONTRAST sub menu.



3.6 LCD DEMO

The LCD demonstration shows all the characters, icons, and the range of characters in an automated animation that advances through all characters and icons in sequence culminating in all characters and icons on at the same time.

You can skip sequences in the demonstration to quickly get to the end where all segments are turned on. To skip a sequence, press the **SEL** button.

After showing all the characters and icons, "Push SEL" is flashed on the matrix display. To exit the demonstration and return to the main menu, press the **RET** button.

3.7 Restore Default Firmware

This kit is delivered with the firmware already programmed onto the PSoC 3 silicon. However, if the silicon is erased or replaced, or if a new version of the project is constructed, you can reprogram the kit using PSoC Programmer and the MiniProg3. To program and debug the project interactively, refer to the instructions included with the PSoC Creator software, which is installed by this kit CD.

Here is how to program this project onto the hardware PSoC 3 silicon:

- 1. Install the kit CD software. This installs PSoC Creator and PSoC Programmer 3.10.
- 2. Open PSoC Programmer from the Program menu or the installed location on your PC.
- 3. Connect the Miniprog3 JTAG cable to the JTAG connector on the MiniProg3 and to the JTAG connector on the PSoC 3 LCD kit board. Next, connect the kit MiniProg3 to a host PC USB High Speed port using the kit USB cable.
- 4. After the MiniProg3 is automatically selected by the Programmer, verify and adjust the Programmer settings shown in Figure 3-2.
- 5. Select the File > File Load menu, and choose the demonstration project file from the example project directory: C:\Program Files\Cypress\CY8CKIT-006_PSoC_3_LCD_Drive_Kit\1.0\Firmware\SegLCD_project\SegLCD_project.cydsn\DP8051-Keil_Generic\Debug\SegLCD_project.hex

Note The MiniProg3 version numbers may be higher numbers based on release. You should include these version numbers in any request for assistance from Cypress Semiconductor.

🐱 PSoC Programmer Software Ver. 3.10.0.440 might be out of date, check Web!		
File View Help		
Port Selection IProgrammer Utilities JTAG		
■ MiniProg3/000000002E9 Programming Parameters File Path: C:\Program Files\Cypress\CY8CKIT-006_PSoC3_LCD_Drive_Kit\1.0\Firmware\SegLCD_proje ■ Programmer: MiniProg3/000000002E9 Programming Mode: Programming Mode: Image: Programming Mode: On Image: On Image: On Ima		
Actions Results		
Actions Mesuits Successfully Connecte MiniProg3 version 2.03 [2.75/1.10] Opening Port at 11:16 Connected at 11:16:54 AM MiniProg3/000000002E9 Active HEX file set a C:\Program Files\Cypress\CY8CKIT-006_PSoC3_LCD_Drive_Kit\1.0\Firm Software Ver. 3.10.0 Select Port in the PortList, then try to connect Device set to CY8C386 65536 FLASH bytes Device Family set to Active HEX file set a C:\Program Files\Cypress\PSoC3 FirstTouch Starter Kit\1.0\Firmwar Session Started at 11 PPCOM Version 3.0		
For Help, press F1 Connected		

Figure 3-2. PSoC Programmer MiniProg3 Port Selection

- 6. Power the LCD kit board using either battery connections or a wall power unit.
- 7. Verify that the Powered status is green as shown in Figure 3-3.
- 8. Select **File > Program** to download the kit project to the PSoC 3 silicon.
- 9. When the program is successfully downloaded, a "Programming Succeeded" message is displayed in the programmer window as shown in Figure 3-3.
- 10. Rest the device by plugging out and plugging in the power to the board



B DE-C December 1 Settures Ver 2 40 0 440 min	ht he suit of data sheets Waht		
Software ver. 5.10.0.440 mg	m be out of date, check web!		
Hie view Help			
📂 🗼 🔘 BB 🖉 🗎 🗅 😫 🌘			
Port Selection	G		
MinProg3/000000002E9 Programming Parameters <u>File Path:</u> C:\Programming C:\Programming Parameters	ogram Files\Cypress\CY8CKIT-006_PSoC3_LCD_Drive_Kit\1.0\Firmware\SegLCD_proje		
Programmer: Mini	Prog3/00000002E9		
Programming Mode:	Reset 🔿 Power Cycle 🔿 Power Detect		
Verification:	on ◎ Off <u>Connector:</u> O 5p ⊙ 10p		
Device Family AutoDetection:	n O Off <u>Clock Speed:</u> 1.6 MHz M		
CY8C38xx Programmer Characteristic	Status		
Protocol: O JTAG O SWI	O ISSP O I2C Execution Time: 2.9 seconds		
Voltage: 0 5.0 V 3.3	V O 2.5 V O 1.8 V Voltage: 3620 mV		
Actions Results	<u>^</u>		
Program Finished at 1			
Programming Suc	ceeded		
Doing Checksum	E		
Doing Protect			
Programming of Flash Succeeded			
Programming of	Programming of Flash Starting		
Programming of User NVL Succeeded			
WARNING!> Debug mode enabled, this should be turned off from PSoC Creato			
Device set to CY8C386 65536 FLASH byt	es		
Device Family set to			
Automatically D	etected Device: CY8C3866AXI-040		
For Help, press F1	PASS Powered Connected .:		

Figure 3-3. Program Download Succeeded

3.8 Example Projects

Refer to Application Note AN52927, *LCD Direct Drive Basics*, for steps to create a simple example project with this kit.

Kit Operation



4. Hardware



4.1 System Block Diagram

Figure 4-1. System Block Diagram



PSoC 3 LCD Segment Drive EVK showcases PSoC's LCD segment drive capability by driving a custom glass with 448 segments (16 common lines by 28 segments lines). This kit also highlights the PSoC's superior ability to integrate high performance digital and analog peripherals by integrating the accelerometer, thermistor, Real Time Clock, CapSense, and buzzer.

Refer to Functional Description on page 21 to know about functional implementation of the applications.



4.2 **Operation Theory - All Components**

SI. No.	Device Features	Description
1	Slide Switch (SW1)	This switch turns the power supplied by the battery On and Off.
		Note Switch (SW1) does not control the power supplied by sources through J1(USB) and J2(Wall Power).
2	Pushbutton Switch (S1)	This switch is used to enter (Switch - On) and exit (Switch-Off) the sleep modes.
		Note The project supports all the sleep features described with the exception that PSoC 3 device does not go to sleep; the firmware is just put in a low power mode.
з		Provides visual feedback. Custom made glass with 448 segments.
5		Refer to LCD Glass on page 21 for glass details.
	CapSense Buttons: CSD1 (Labeled as '+')	CapSense buttons are used to navigate through various modes of operation.
4	CSD2 (Labeled as 'RET') CSD3 (Labeled as '-') CSD4 (Labeled as 'SEL')	Table 3-1 on page 9, explains the function of CapSense buttons for each mode of operation.
	Accelerometer (Memsic MXR2010A (U12))	The dual axis accelerometer is used to detect the movement and calculate the force of a punch.
5		Accelerometer has a range of ±35G at 5V/25°C and can measure both static and dynamic acceleration.
	6 Buzzer(CUI CMT -1603 (LSI))	It provides audible feedback to the user.
6		A 5V, 4 kHz square wave is applied to the buzzer's input to pro- duce sound.
7	Thermistor (RT1)	It is used to detect the ambient temperature for use in the Time/ Temp demonstration mode.
/		The default firmware supports a 10k thermistor rated to $\pm 0.75\%$ at 25°C.
8	RTC Crystal (Y1)	This external crystal is used as a 32.768 kHz clock source for maintaining real-time operation in the Time/Temp demonstration mode.
	GPIO Connector(J4)	The header (J4) provides 3 SIO, 2 GPIO, XRES, VDD, and GND signals, thereby facilitating users to develop their own application.
9		Refer to Hardware Schematic and PSoC 3 data sheet for specific details regarding the SIO and GPIO pins connected to these signals.
	ITAC MiniDrog2 Connector	The J1 connector provides a programming and debugs connection between the PSoC 3 and MiniProg3 programmer.
10	(J1)	Note Miniprog3 can be used to supply the power to the board for programming, but this is not recommended for normal or debugs operation.



4.3 Functional Description

4.3.1 LCD Glass

Figure 4-2 shows the image of the LCD Glass and Table 4-1 lists the segments details.

The LCD glass provides visual feedback to the user based upon the current mode of operation. Figure 4-2. LCD Glass Image



Table 4-1. LCD Glass Segment Details

Label	Description	
А	Sleep Indicator	
В	8X5 Dot-Matrix Display Area	
С	Alarm Indicator	
D	MAX Indicator	
E	Small Seven - Segment Display	
F	AM/PM Alarm Indicator	
G	Cypress Logo	
Н	Large Seven - Segment Display Area	
J	16/14 Segment Display Area	
К	Signal Strength Bars	
L	Progress Bars	
М	Battery Level Bars	



4.3.1.1 Glass Specifications

The specifications for the LCD glass are as follows:

- Display Type: FSTN
- Viewing Direction: 6 o'clock
- Drive Method:1/16 Duty, 1/5 BIAS
- Operating Voltage: 3.3V
- Polarizer Mode: Reflective/Positive
- Operating Temperature: 0 ~ +50°C
- Storage Temperature: -10 ~ +60°C

Note Refer to Pixel Mapping Table for LCD Glass on page 73.

4.4 **Power Supply Options**

The kit can be powered by only one of the three voltage sources.

SI. No.	Description	Typical Voltage	Connection	Switch - SW1
	_			On (Up position)
1	Battery	9V	BH3, BH4	Note SW1 disconnects the 9V bat- tery from the 5V regulator.
2	Wall Power	9V to 12V (100 mA minimum)	J2	Don't care.
3	USB Power	5V	J3	Don't care.

CYPRESS

5.1 Top Level Architecture

5. Firmware

Figure 5-1. Top Level Architecture



5.1.1 Top Level Design

The top level schematic for the project is shown here.



The PSoC Creator project has the following components:

- Analog outputs:
 - □ Thermistor reference voltage (also an output for the reference voltage generator VDAC)
- Analog inputs:
 - □ Thermistor reference voltage output of VDAC to AMUX input
 - Thermistor signal voltage
 - Accelerometer Y-axis
 - Accelerometer X-axis
 - Battery level 9V
 - Battery level AA
- Analog mux (AMUX): 6 input
- VDAC to generate reference voltage for thermistor



- Delta-Sigma ADC to convert one of the six inputs from the AMUX
- PWM to drive the buzzer:
 - □ 6 kHz clock for PWM
 - □ Logic level High for PWM Kill
 - Logic level Low for PWM Reset
- Timer to generate 100 mS timing intervals: Timeout timers, No-activity timer, Blink timer
 - 1 kHz clock for timer
 - Logic level Low for Timer Reset
 - Timer ISR
- Segment LCD: Defines character sets and helpers to allow API access to display elements. The icon designators show the mapping to the segment symbol name applied to the segment in the FEMA Electronics drawing number S93043-0-FRPC. This drawing is included in this kit in the hardware design file 93043-602.pdf. These designators are shown on page 2 of the file.
 - □ CyLogo icon (1) (icon P6)
 - Matrix characters (8)
 - □ Large 7-segment characters (5)
 - □ Large colon icon (1) (icon COL)
 - □ Large decimal point icons (4) (icons T5, T6, T7, T8)
 - □ 16-segment character (1)
 - □ Slash icon (1) (icon T9)
 - □ 14-segment character (1)
 - □ Small 7-segment characters (4)
 - □ Small '1' icon leading 7-segment display (1) (icon Z1)
 - □ Small colon icon (1) (icon Z4)
 - □ Small decimal point icons (3) (icons Z2, Z3, Z5)
 - □ BELL icon (1) (icon Z6)
 - □ MAX icon (1) (icon MAX)
 - □ AM icon (1) (icon AM)
 - □ PM icon (1) (icon PM)
 - ZZZ sleep icon (1) (icon P1)
 - □ Signal strength icons (4) (icons P7, P8, P9, P10)
 - □ Progress bar icons (10) (icons Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q9, Q10)
 - □ Battery level icons (4):
 - Battery case icon (1) (icon T1)
 - Battery level icons (3) (icons T2, T3, T4)
- Digital Input:
 - PushButton
 - Go to sleep
 - Wake from sleep
 - Wall Supply (Vin) Detect regulated supply input voltage detect
 - VBus Detect USB VBus supply input voltage detect
- Digital Output:
 - Accelerator ON firmware control



- Buzzer hardware control
- Logic level High for Buzzer OE
- RTC: Enable 32.768 RTC clock
- CapSense:
 - CMod connection
 - RBleed connection
- EEPROM: Persistent memory storage (saved scores, contrast level, clock settings)

5.2 Application Descriptions

5.2.1 Punch Gauge Accelerometer Algorithm

The Punch Gauge code runs a peak and hold algorithm in a tight loop continuously updating until there is a change in the program state. Both the X and Y-axis accelerometer outputs are sampled separately and continuously. The higher of the two axis measurements is reported as the score.

5.2.1.1 At Rest Peak and Hold

When the operator initiates a Punch Gauge punch, the punch code begins reading the instantaneous X and Y-axis accelerometer outputs for a period of three seconds. This is to measure maximum at rest acceleration that the board experiences. This is saved as a baseline for the punch measurement.

5.2.1.2 Punch Peak and Hold

After the Punch Gauge has stored the baseline at rest acceleration, the punch code begins continuously sampling both the X and Y-axis accelerometer outputs. The code continues to sample and hold the peak values until the operator terminates the operation by pressing **SEL** button. During this sampling period the operator "throws" a punch or punches. The algorithm continues to peak and hold until the operator presses **SEL** button.

When the **SEL** button is pressed, the punch code subtracts the at rest X-axis baseline reading from the punch X-axis peak reading and subtracts the at rest Y-axis baseline from the punch Y-axis peak reading. The greater of the X and Y-axis results is reported as the punch acceleration.

5.2.2 Temperature Measurements

The temperature sensing demonstration shows how the PSoC is used to sense temperature using a thermistor. The thermistor resistance varies with temperature following a predictable non-linear curve. The temperature-resistance relationship is given by the Steinhart-Hart equation:

1/Tk = A + B.ln(R) + C.(ln(R))3

Where:

- A, B, and C are empirical constants known as Steinhart-Hart coefficients
- R is the resistance of the thermistor in Ohms
- Tk is the temperature in degree Kelvins

The same equation, when converted to Celsius scale is as follows:

Tc = Tk - 273.15; where Tc is temperature in degree Celsius.

The PSoC can measure the voltage across the thermistor but not the resistance value.



5.2.2.1 Temperature Sensing Design Principle

The device for temperature sensing uses a voltage divider with a precision resistor on one side and the thermistor on the other to estimate the thermistor resistance. This is shown in Figure 5-3. The temperature calculations are as accurate as the resistance measurement of the thermistor.





This setup significantly removes gain and offset errors from the resistance calculation.

The analog voltage output from the divider is converted to a digital signal using the ADC on the PSoC. To gain additional accuracy, the voltage at the input side of the divider is also measured. The resistor value is calculated using the ratio of the voltages across the two resistors in the resistor ladder.

Rthermistor = Rref * (V0-V1/V1-V2); where V2 = 0 (Ground voltage)

Any offset errors are removed due to subtraction of the two measured voltages. The ratio of these two values removes the measurement path gain error. The error due to the reference resistor is reduced by using a precision resistance in series with the thermistor.

Temperature is calculated using a table of 165 known points on the resistance/temperature curve using a look up table. The table holds resistance values of the thermistor from -40°C to 125°C, in 1°C increments. Linear interpolation is used between the points in the table for temperature calculation up to two places after the decimal.

Temperature is also calculated using the Steinhart-Hart equation. This project currently feeds in the Steinhart-Hart calculated temperature for display.

For more information on using PSoC family devices with a thermistor, refer to Cypress Application Note, AN2017, Sensing - A Thermistor-Based Thermometer, PSoC Style.

5.2.3 RTC Crystal and Clocking

The RTC maintains a high precision based on the application of an accurate crystal input used as the clock source. The RTC component inserted by the PSoC Creator provides API calls that can be used to set the time and date and to read the instantaneous current time and date. When the device is in the Show Time sub mode, the code simply loops on CapSense button scans and reads and displays the instantaneous time and date information. The temperature at the board thermistor is sam-



pled and displayed on alternating cycle with the date readings. Therefore, the date and temperature automatically and continuously alternates on the display. The temperature display can be alternated between °C and °F by pressing the "+" or "-".

5.2.4 Contrast Adjustments

To adjust the contrast dynamically, the project calls the adjust bias API call provided by the Segment LCD component. The higher the bias level set in the call to the API the higher the contrast. The API allows a selection between 0 and 127 with 127 corresponding to the maximum contrast level.

Enter a relative value between 0 and 10; the code maps the contrast setting into bias voltage values within the range 47 to 67 (3.23V to 3.78V).

5.2.5 LCD Demonstration

To demonstrate all the segments of LCD glass, the project sequentially demonstrates the various display sections. Refer to Figure 5-64 to know the details of sequence in which various sections of LCD glass are displayed.

5.3 **Project Design and Setup**

5.3.1 Analog I/O

5.3.1.1 Thermistor Reference Voltage

The thermistor reference voltage analog connection is configured as an input but is actually an output. The VDAC generates a fixed constant output voltage on the analog port. This reference voltage is also sent through the AMUX to be sampled by the Delta-Sigma ADC during temperature calculation periods.

The output is configured for 1-pin width mapping and Hi-Z Analog during Power-On Reset. The port pin is set for High Impedance Analog. The default Built-In settings are used.

Figure 5-4. Thermistor Reference Analog Port Configuration: General Tab

Configure 'cy_pins'		? 🛛
Name: VRefPort Pins Mapping Number of Pins: 1	Reset Built-in	۵ ۵
IAI Pins]	Type General Input Outp Drive Mode High Impedance Analog	Initial State: Low (0)
	PBPBPn	
Data Sheet	ОК Арр	y Cancel



Configure 'cy_pins'		? 🛛
Name: VRefPort Pins Mapping Re Number of Pins: 1 All Pine: VRefPort_0	set Built-in Built-in Type General Inp Canalog Digital Input HW Connection Digital Output HW Connection Duput Enable Bidirectional	4 Þ
Data Sheet	ОК	Apply Cancel

Figure 5-5. Thermistor Reference Analog Port Configuration: Pin Type Tab

5.3.1.2 Thermistor Signal Voltage

The thermistor signal voltage is sampled during temperature calculations. The circuit compares the difference in voltage drop across the thermistor and the fixed resistor. The thermistor signal voltage is sent through the AMUX to be sampled by the Delta-Sigma ADC during temperature calculation. The input is configured for 1-pin width mapping and Hi-Z Analog during Power-On Reset. The port pin is set for High Impedance Analog. The default Built-In settings are used.

Configure 'cy_pins'		? 🛛
Name: VSignalPort Pins Mapping R Number of Pins: 1	eset Built-in	4 Þ
[All Fins]	Type General Input Out Drive Mode High Impedance Analog	put Initial State: Low (0)
Data Sheet		Cancel

Figure 5-6. Thermistor Signal Analog Port Configuration: General Tab



Pins Mapping R	eset Built-in	4
Yumber of Pins: 1 [All Pins] └──⊠ VSignalPort_0	 Type General Ing Analog Digital Input HW Connection Digital Output HW Connection Ouput Enable Bidirectional 	but Output Preview:

Figure 5-7. Thermistor Signal Analog Port Configuration: Pin Type Tab

5.3.1.3 Accelerometer Y-Axis

The accelerometer Y-axis is measured during rest acceleration and thrown punch periods. The peak measurement during the measured period is retained as the sampled value. The Y-axis signal is sent through the AMUX to be sampled by the Delta-Sigma ADC during acceleration measurement.

The input is configured for 1-pin width mapping and Hi-Z Analog during Power-On Reset. The port pin is set for High Impedance Analog. The default Built-In settings are used.

Figure 5-8. Accelerometer Y-Axis Analog Port Configuration: General Tab

Configure 'cy_pins'		? 🛛
Name: YInPort		
Pins Mapping	Reset Built-in	4 ۵
Number of Pins: 1		
[All Pins]	Type General Input C	Dutput
⊠ YInPort_0	Drive Mode	Initial State:
	High Impedance Analog	🖌 Low (0) 🖌
	EBIDSI PSS	Minimum Supply Voltage:
Data Sheet		ly Cancel



Configure 'cy_pins'		? 🛛
Name: YInPort Pins Mapping Number of Pins: 1 [All Pins] YInPort_0	Reset Built-in Type General In Analog Digital Input HW Connection Digital Output HW Connection Digital Output HW Connection Digital Output Bidirectional	↓ ↓ put Output Preview:
Data Sheet	ОК	Apply Cancel

Figure 5-9. Accelerometer Y-Axis Analog Port Configuration: Pin Type Tab

5.3.1.4 Accelerometer X-Axis

The accelerometer X-axis is measured during rest acceleration and thrown punch periods. The peak measurement during the measured period is retained as the sampled value. The X-axis signal is sent through the AMUX to be sampled by the Delta-Sigma ADC during acceleration measurement.

The input is configured for 1-pin width mapping and Hi-Z Analog during Power-On Reset. The port pin is set for High Impedance Analog. The default Built-In settings are used.

Figure 5-10. Accelerometer X-Axis Analog Port Configuration: General Tab

Configure 'cy_pins'		? 🛛
Name: XInPort Pins Mapping R Number of Pins: 1	eset Built-in	4 Þ
IAI Pinsi — ⊠ XinPort_0	Type General Input Out Drive Mode High Impedance Analog	put Initial State: Low (0)
Data Sheet	OK Apply	Cancel



Pins Mapping Jumber of Pins: 1	Reset Built-in	4
IAll Finst XInPort_0	Type General Input Analog Digital Input HW Connection Digital Output HW Connection Ouput Enable Bidirectional Herein Connection	Output Preview:

Figure 5-11. Accelerometer X-Axis Analog Port Configuration: Pin Type Tab

5.3.1.5 Battery Monitor - 9V Level

On startup, the project takes a sample measurement of the 9V level. If the level is within a 9V operational range, then the project determines that a 9V battery is connected and enables continuous monitoring of the 9V level. The battery monitor port is measured periodically and the battery icons are updated to reflect the relative charge remaining. The battery monitor signal is sent through the AMUX to be sampled by the Delta-Sigma ADC during sampling periods. TThe input is configured for 1-pin width mapping and Hi-Z Analog during Power-On Reset. The port pin is set for High Impedance Analog. The default Built-In settings are used.





Configure 'cy_pins'		? 🛛
Name: BattSense9V		
Pins Mapping R Number of Pins: 1	eset Built-in 🛛 🗡 🕅 🕅	4 Þ
All Pinst	Type General Input O Drive Mode High Impedance Analog	Dutput Initial State: Low (0)
	PE Po	Minimum Supply Voltage:
Data Sheet		ly Cancel

Figure 5-13. Battery Monitor - 9V Level: Pin Type Tab

Configure 'cy_pins'		? 🛛
Name: BattSense9V Pins Mapping R Number of Pins: 1	eset Built-in	4 Þ
IAII Pinst ■ ⊠ BattSense9V_0	Type General Ing Analog Digital Input Input HW Connection Digital Output Input HW Connection Ouput Enable Bidirectional	out Output Preview:
Data Sheet	ОК	Apply Cancel



5.3.2 Analog MUX

The analog mux (AMUX) is configured for 6-inputs. The inputs are the analog input and output signals described earlier. The default Built-In settings are used.

Figure 5-14. Configure Analog MUX: Basic Tab

Configure '	AMux'		?	×
Name:	AMux_1			
Basic	Built-in		٩	⊳
Parameter	Туре	Value		
Channels	int	6		
MuxType	AMuxType	Single		
Parameter Information				
Data Sh	ieet	OK Apply Cance	el	

5.3.3 VDAC

The Voltage DAC provides a specific voltage level at the thermistor reference voltage. Low Speed is selected to reduce power requirements. The default Built-In settings are used.

The project code calls the VDAC SetRange API to select the 4V range and the SetValue API to set the output voltage at value=250. This sets the thermistor reference level at just under 4V to allow operation at Vdda as low as 4V. The VDAC is turned off between thermistor measurements to save power.



Figure 5-15. VDAC Configuration: Basic Tab

Configure 'VDAC8'				
Name: VDA	C8_1			
Basic B	uilt-in	4 ۵		
Parameter	Туре	Value		
Data_Source	VDAC8_DataSourceType	CPU or DMA (Data Bus)		
Initial_Value	uint8	100		
Strobe_Mode	VDAC8_StrobeModeType	Register Write		
VDAC_Range	VDAC8_RangeType	0 - 1.020V (4mV/bit)		
VDAC_Speed	VDAC8_SpeedType	Low Speed		
Parameter Infor	mation			
Data Sheet		K Apply Cancel		

5.3.4 Delta-Sigma ADC

The Delta-Sigma ADC is used to convert the analog signals of the design. The resolution and conversion rate are selected to provide sufficient accuracy and speed for the accelerometer measurements and match the thermistor conversion tables used in this design. The default Built-In settings are used.

Figure 5-16. ADC Configuration

Configure 'ADC_DelSig'				
Na	ime: AccIADC			
	Configure Built-in			4 Þ
	Modes		Start of Conversion	^
	Power	Medium Power 🛛 🖌	 Software 	
	Conversion Mode	Fast Filter 🔽	 Hardware 	
	Resolution	11 🔽	Clock Source	
	Conversion Rate	1000 😂 SPS	 Internal 	
	Clock Frequency	131.000 kHz	🔘 External	
	Input Range	Vssa to Vdda (Single Ended)	~	
	Reference	Internal Ref	~	
	Input Buffer Gain	1 🗸		
	Voltage Reference	5.0500 🗘 Volts (Vdda)		~
	Data Sheet	ОК	Apply Can	icel

5.3.5 PWM

The PWM provides a signal to the buzzer to create audible alarms and cues. The frequency is selected to match the buzzer used in the design. The design uses a simple 50% duty cycle signal and does not require a high resolution. The default Built-In settings are used.

Configure 'PWM'		? 🛛
Name: PwM_1		
Configure	Advanced Built-in	4 Þ
period 4 -2	0 # 2	-0-#]
pwm		
Resolution:	● 8-Bit ● 16-Bit	
PWM Mode:	One Output	~
Period:	2 <i>Period = 500us</i>	
CMP Value 1:	1	
CMP Type 1:	Less or Equal	<u>~</u>
Data Sheet	OK Apply C	Cancel

Figure 5-17. PWM Configuration: Configure Tab

Figure 5-18. PWM Configuration: Advanced Tab

Configure 'PWM'		? ×
Name: PWM_1		
Configure Ad	vanced Built-in	۹ ۵
Implementation:	Fixed Function O UDB	^
Enable Mode:	Software Only	
Run Mode:	Continuous	
Trigger Mode:	None	
Kill Mode:	Asynchronous 💽 1	
Capture Mode:	None	
	Interrupts: None Interrupt On Terminal Count Event Interrupt On Compare 1 Event Interrupt On Compare 2 Event	
Data Sheet	OK Apply Cane	el


5.3.5.1 PWM 6 kHz Clock Source

The PWM requires a clock source to create the output frequency. The default Built-In settings are used.

Figure 5-19. PWM Clock Source Configurati	ion
---	-----

С	onfigure 'cy	_clock'	?×
I	Name: cloo	* <u>1</u>	
	Configure	e Clock Advanced Built-in	4 ۵
	Clock Type:	O New ○ Existing	
	Source:	<auto></auto>	~
	Specify:	 ● Frequency ● KHz ▼ ● Tolerance: - 5% + 5% 	
	Summary API Gene Uses Cloc	rated: Yes sk Tree Resource: Yes	
	Data Shee	t OK Apply Cano	;el;i

Figure 5-20. PWM Clock Source Configuration: Advanced Tab

Configure 'cy_clock'	?×
Name: clock_1	
Configure Clock Advanced Built-in	4 ۵
✓ Sync with BUS_CLK The clock distribution network produces a master clock, BUS_CLK, used for resunctronization	n 🖂
This clock is not intended for clocking circuitry outside of the clock distribution network. Outp clocks can be phase aligned to this clock. Normally BUS_CLK should be the highest frequen clock in the chip.	ut sy
Generally, all clocks used in the chip must be derived from the same source, or synchronized the main fast clk_sync clock (BUS_CLK).	to
By setting this parameter to false this clock becomes an unsynchronized, divided clock.	
Data Sheet OK Apply Canc	3



5.3.5.2 Logic High for PWM Kill Pin

The PWM Kill signal is not used in this design. The Kill pin is wired high to disable the function.

5.3.5.3 Logic Low for PWM Reset Pin

The PWM component requires a signal on the Reset pin to keep it out of reset after power on reset. The design does not require the application of a Reset signal on the PWM during operation.

5.3.6 Timer

The design requires period timing updates. A single timer component is used with an interrupt service. On interrupt various timer counts are updated including:

- A timeout timer for general purpose failsafe looping.
- An ADC operation timeout timer for ADC get result failsafe looping.
- A clock alarm shutoff timer to automatically stop the alarm ringing after a timeout period.
- An activity timer to automatically signal enter sleep after a period of no button presses.
- A data entry blink timer to provide blinking of characters as they are prompted for entry).

The default Built-In settings are used.

Figure 5-21. Timer Configuration

nfigure 'Timer'		?
lame: Timer_1		
Configure Buil	t-in	4 ۵
Resolution:	💿 8-Bit 🔿 16-Bit 🔿 24-Bit 🔿 32-Bit	
Implementation:	O Fixed Function O UDB	
Period:	100 Max <i>Period = 100ms</i>	
Trigger Mode:	None	~
	None	~
Capture Mode:	Enable Capture Counter 2	× ×
Enable Mode:	Software Only	~
Run Mode:	Continuous	~
Interrupts:	On TC On Capture [1-4]	\$
Data Sheet	ОК Аррју С	Cancel



5.3.7 Timer 1 kHz Clock Source

The timer requires a clock source to create the output frequency. The default Built-In settings are used.

Configure 'cy	y_clock'	?
Name: clo	ock_2	
Configu	re Clock Advanced Built-in	4 ⊳
Clock Type:	💿 New i 🔿 Existing	
Source:	<auto></auto>	*
Specify:	● Frequency 1 kHz ▼ ▼ Tolerance: - 5% + 5%	
Summary API Gen Uses Clo	erated: Yes ock Tree Resource: Yes	
Data She	et OK Apply	Cancel

Figure 5-22. Timer Clock Source Configuration

Figure 5-23. Timer Clock Source Configuration: Advanced

Configure	'cy_clock'	?	X
Name:	clock_2		
Config	gure Clock Advanced Built-in	٩	Þ
🗹 Sync w	vith BUS_CLK		
The clock This clock clocks car clock in th Generally,	distribution network produces a master clock, BUS_CLK, used for resynchronization is not intended for clocking circuitry outside of the clock distribution network. Output in be phase aligned to this clock. Normally BUS_CLK should be the highest frequency e chip. all clocks used in the chip must be derived from the same source, or synchronized to the the same slock (PUS_CLK).	r t y	
the main ra	ist circus ynd ciock (BUS_ULN).		
By setting	rnis parameter to raise this clock becomes an unsynchronized, divided clock.		
Data S	Sheet OK Apply Cancel		



5.3.7.1 Logic Level Low for Timer

The timer component requires a signal on the Reset pin to keep it out of reset after power on reset. The design does not require the application of a Reset signal on the timer during operation.

5.3.7.2 Timer ISR

The timer is implemented with the use of a Terminal Count (TC) interrupt. After adding the interrupt to the tc-pin of the timer component, PSoC Creator generates source files for the interrupt service. References to the project code interrupt service routine are added to the generated source. In the generated source file for interrupt handling, there are two places where code must be added by hand. This code is protected by source code generator statements that preserve the user added code on subsequent builds. The code that is added is a prototype for the user provided interrupt service routine and a call to the interrupt service routine (user ISR).

The Timer ISR is set for an interval of once every 100 ms. For a timeout period of 1s, the timer is initialized for a 10 count period.

The actual timer component is initialized at the start of the project. When a timing element is required, a global cont variable is added to the timer user ISR code to decrement that count variable. Code is also added for the logic to be executed when the count variable reaches zero.

Configure 'cy_isr'		?×
Name: timer_isr_1		
Built-in		4 Þ
Parameter	Туре	Value
CY_COMPONENT_NAME	string	GetComponentName()
CY_MAJOR_VERSION	string	1
CY_MINOR_VERSION	string	0
CY_REMOVE	bool	false
CY_SUPPRESS_API_GEN	bool	false
CY_VERSION	string	PSoC Creator 1.0 BETA1 Nightly Build 4248
Parameter Information Data Sheet		OK Apply Cancel

Figure 5-24. Timer ISR Default Built-In Configuration



5.3.8 Segment LCD

A single segment LCD component is selected to handle all displays on the LCD glass panel. The component is used to define all segment assignments for the glass. It presents a grid containing an entry for each addressable element in the glass. An element can be a pixel in the matrix characters, a segment of one of the segment displays, or a specific icon built into the display. Each element is considered a pixel and can be individually addressed at its mapped location and can be turned on or off using the component pixel handling API calls.

There are also helper functions that can be defined. Each helper is specifically designed to allow handling of the different types of characters in the display. Thus, segments of a segment character can be grouped and addressed collectively by a single helper. Each helper has a set of component API calls that you can place in the code for writing digits or characters to the target display areas.

Each icon is turned on or off using a write pixel API call. The matrix display characters are set using a write string API call. The segment displays are written one character at a time using a write character or write digit API call. For demonstration purposes, the large and small 7-segment characters are also written using a write number API call which writes the hex or decimal value to the entire set of large or small 7-segment characters.

In the basic configuration, the bias voltage is selected. To adjust the contrast dynamically, the project calls the adjust bias API call provided by the segment LCD component. The higher the bias level set in the call to the API the higher the contrast. The API allows a selection between 0 and 127 with 127 corresponding to the maximum contrast level (see CONTRAST on page 14). The frame rate is selected to be the maximum rate before the characters in the display begin to reduce in contrast. The Hi Drive Time is set to the maximum drive time for the Type B waveform that is selected.

The glass is of type FSTN with a 6 o'clock viewing angle. The drive method is 1/16 Duty, 1/5 Bias. The operating voltage is 3.3V. The polarizer mode is Reflective/Positive.

Configure 'SegLCD'	? 🔀
Name: SegLCD	
Basic Configuration Driver Po	ower Settings Display Helpers Built-in 4 Þ
Number of common lines	16
	Enable Ganging Commons
Number of segment lines	28
Dise have	1.15
Bias type	1/5
Waveform type	Type B Low Powe 💙
Frame rate, Hz	30 💌
Bias voltage, V	3.30
Enable Debug Mode	
Data Sheet	OK Apply Cancel

Figure 5-25. Segment LCD Configuration: Basic Tab



Basic Configuration Dr	iver Power Settings	Display Helpers	Built-in	4 ۵
Driver Power Mode	Always Active	~	da manana ana ang ba	
Hi drive time, μs	2058.9	\$		
Low drive mode	Low range			
Low drive time, µs	8.1	0		

Figure 5-26. Segment LCD Configuration: Driver Power Settings

5.3.8.1 LCD Glass Character Pixel Mapping

Refer to the component data sheet for details on mapping helper functions. Note that it is helpful to map groups of icons into single helpers to address each member of the group sequentially with the helper API calls.

In the following pixel mapping dialog, the overall mapping of all of the pixels into helper groups is shown. These mappings are used in the project design to define helpers for the matrix characters, the large 7-segment characters, the small 7-segment characters, the signal strength icons, the progress bar icons, and miscellaneous icon groupings.

Note that the matrix pixels are mapped with the HDOTX_YZ names where: X is the character number (0 to 7 with character 0 at the left of the helper area), Y is the character matrix row position, and Z is the character matrix column position. The helper allows each pixel to be mapped by clicking and dragging each pixel block in the helper area to a single segment position in the grid. The helper tool allows you to configure the number of characters in a matrix or segment character display.

The 7-segment character segments are shown in the map with the H7SEGX_A names where X is the character position in the group and A is the Alpha name of the segment within the character. The small 7-segment helper maps are shown in a group of 4-character helpers and the large 7-segment helper maps are shown in a group of 5-character helpers. The 16-segment character is mapped with the H16SEG0... symbols and the 14-character is mapped with the H14SEG0... symbols.





Configure	onligure 'Segl CD'							2 🛛									
Name:	SegLCD																1
		1000		V													
v basic caniguration univer settings / useptay Helpers But-in 4 P										9 P							
Helpers Selected Helpers																	
1 Segment Histor Magan D																	
16 Seg	16 Segment Helper 75 general Helper 15 general H																
Matrix	Bargah and Dial Heber, 155 agrinert, O																
Hebe	Heber function configuration																
	A W Mada darber 9 Schenderderer W0010 00																
	(None	Der of symbols	0 36	ecieu pivoi na	sie neoro	-00											
Diall	denning Table																
P.Mer	Com15	Com14	Com13	Com12	Com11	Com 10	Com9	Com8	Com7	Com6	ComS	Com4	Com3	Com2	Com1	Com0	
Sec0	HDOTT 47	HDOT7 46	HDOTT 45	HDOTT 44	HDDT7 43	HDOT7 42	HDOTT 41	HDOTT 40	HDOTD 07	HDOTO 06	HDOTO 05	HDOTO 04	HDOTE 63	HDOTO 02	HDOTO 01	HD OTO OO	
Seg1	HDOT7_37	HDOTT_36	HD017_35	HD017_34	HDDT7_33	HD017_32	HDOTT_31	HDOT7_30	HDOTO_17	HDOTO_16	HDOTO_15	HDOTO_14	HDOTD_13	HDOTO_12	HDOTO_11	HDOTO_10	
Seg2	HDOT7_27	HD017_26	HD017_25	HD017_24	HD017_23	HDOT7_22	HDOTT_21	HD017_20	HDOTO_27	HD/010_26	HD010_25	HDOTO_24	HDOTO_23	HD0T0_22	HDOTO_21	HDOTO_20	
Seg3	HD017_17	HD017_16	HD017_15	HD017_14	HD0T7_13	HD017_12	HDOT7_11	HDOT7_10	HD0T0_37	HDOT0_36	HD070_35	HDOT0_34	HDOTD_33	HD0T0_32	HD0T0_31	HDOTO_30	
Segi	HDOT7_07	HD017_06	HD017_05	HDOT7_04	HD DT7_03	HD017_02	HDOT7_01	HDOT7_00	HDOTD_47	HD-010_46	HDOTO_45	HDOT0_44	HDOTO_43	HDOT0_42	HDOTO_41	HD OTO_40	
Seg5	HD076_47	HDOTE_46	HDOT6_45	HDOT6_44	HDOTE_43	HDOT6_42	HDOT6_41	HDOT6_40	HDOT1_07	HD0T1_06	HD:011_05	HDOT1_04	HD0T1_03	HD0T1_02	HD0T1_01	HDOT1_00	
Seg6	HDDT6_37	HDOT5_36	HDOTE_35	HDOTE_34	HD DT6_33	HDOTE_32	HDOT6_31	HDOT6_30	HDOT1_17	HDOT1_16	HDOT1_15	HDOT1_14	HDOT1_13	HD0T1_12	HDOT1_11	HDOT1_10	
Seg7	HDOTE_27	HDOT5_26	HDOTE_25	HDOTE_24	HD OTE_23	HDOT6_22	HDOTE_21	HDOT6_20	HDOT1_27	HDOT1_26	HDOT1_25	HDDT1_24	HD0T1_23	HDOT1_22	HD0T1_21	HDOT1_20	
Seg8	HDOT6_17	HDOT6_16	HDOT6_15	HDOT6_14	HDOTE_13	HDOT6_12	HDOT6_11	HDOT6_10	HDOT1_37	HDOT1_36	HDOT1_35	HDOT1_34	HDOT1_33	HDOT1_32	HDOT1_31	HDOT1_30	
Seg9	HDOT6_07	HDOTE_06	HDOTE_05	HDOTE_04	HD OTE_03	HDOTE_02	HDOTE_01	HDOTE_00	HDOT1_47	HDOT1_46	HDOT1_45	HDOT1_44	HDOT1_43	HDOT1_42	HDOT1_41	HDOT1_40	
Seg10	HDOTS_47	HDOTS_46	HDOTS_45	HDOTS 44	HDUI5_43	HD015_42	HDOTS_41	HDOTS_40	HD012_07	HD012_06	HDOT2_05	HDOT2_04	HD012_03	HD012_02	HD0T2_01	HD 0T2_00	
Seg11	HDUIS_3/	HDOTE 36	HDOTE 25	HOOTE 24	HDOTE 23	HDOTE 22	HDOTE 31	HDOTE 20	HD012_17	HD012_16	HD012_15	HDOT2 34	HD012_13	HD012_12	HD012_11	HD012_10	
Seg12	HD015_27	HDOTS 16	HDOTS 15	HOOTS 14	HDOTE 13	HDOTS_22	HDOIS_21	HD075_20	HD012_27	HD012_26	HD012_25	HDOT2_24	HD012_23	HD012_22	HD012_21	HD012_20	
Sea14	HDOTS 07	HDOTS 06	HDOTS OS	HDOTS 04	HDDT5 03	HDOTS 02	HDOTS 01	HDOTS 00	HDOT2 47	HDDT2 46	HDOT2 45	HDOT2 44	HDOTZ 43	HDOT2 42	HDOT2 41	HDOT2 40	
Seg15	HDOT4 47	HDOT4 46	HDOT4 45	HDOT4 44	HDDT4 43	HDOT4 42	HDOT4 41	HDOT4 40	HDOTS 07	HDDT3 06	HDOTS 05	HDOT3 04	HDOT3 03	HDOTS 02	HDOTS 01	HDOT3 00	
Seg16	HDOT4_37	HDOT4_36	HDOT4_35	HDOT4_34	HDOT4_33	HDOT4_32	HDOT4_31	HDOT4_30	HDOT3_17	HDOT3_16	HDOT3_15	HDOT3_14	HDOT3_13	HDOT3_12	HDOT3_11	HDOT3_10	
Seg17	HDOT4_27	HDOT4_26	HD0T4_25	HD0T4_24	HDOT4_23	HDOT4_22	HDOT4_21	HD0T4_20	HD0T3_27	HD0T3_26	HD0T3_25	HDOT3_24	HD0T3_23	HD0T3_22	HD0T3_21	HD 0T3_20	
Seg18	HDOT4_17	HD0T4_16	HDOT4_15	HDOT4_14	HD 014_13	HD0T4_12	HDOT4_11	HD014_10	HDOT3_37	HDOT3_36	HDOT3_35	HDOT3_34	HDOT3_33	HD0T3_32	HDOT3_31	HDOT3_30	
Seg19	HDOT4_07	HDOT4_06	HDOT4_05	HDOT4_04	HD0T4_03	HDOT4_02	HDOT4_01	HDOT4_00	HD013_47	HD0T3_46	HD013_45	HDOT3_44	HD0T3_43	HD0T3_42	HD0T3_41	HDOT3_40	
Seg20	H14SEG0	H14SEGO	H14SEG0	H14SEGO	H14SEG0	H14SEG0_I	H14SEG0	PM	H16SEGO	H16SEG0	H165EG0	HIGSEGO	H16SEGO	H165EG0	H16SEG0_I	H16SEGO	
Seg21	H14SEG0	H14SEG0	H14SEG0	H145EG0	H14SEGO	H145EG0	H14SEG0	19	H16SEGO	H16SEG0	H165EG0	HIGSEGO	H16SEG0.	HI6SEGO	H16SEG0	H16SEG0	
Seg22	14	13	12	11	24	MAX	26	21	02	Q1	P10	P9	P8	P7	P6	P1	
Seg23	414	WISECO D	UD UTCERO F	US POSSEL	W70000 0	UTCECO D	UTCEPP E	UTO A	10	H7SEU4_D	H75EU4_C	HISELALE	HISEU4_G	H/SEGA_B	HISEUA_F	HISECS A	
Sec.25	75	H7SEG7 D	H7SEG7_C	H7SEG0_E	H7SEG7_C	H7SEG7 P	H7SEG7 F	H7SEG7 A	0	H7SEG2 D	HZSEG2 C	H7SEG2 E	H7SEG2 G	H7SEG2 B	HTSEGO_F	HTSEGO A	
Sec26	23	H7SEG6 D	H7SEG6 C	H7SEG6 F	HTSEGS G	H7SEG6 A	H7SEGS F	H7SEGS A	16	H7SEG1 D	H7SEG1 C	H7SEG1 F	HISEGI G	H7SEG1 A	H7SEG1 F	H7SEG1 A	
Seg27	22	H7SEGS D	H7SEG5 C	H7SEGS E	H7SEG5 G	H7SEG5 B	H7SEGS F	H7SEGS A	T5	H7SEG0 D	H7SEG0 C	H7SEG0 E	H7SEG0 G	H7SEG0 B	H7SEGO F	H7SEGO A	
P	nt																
	_												-			10	
Data	Sheet													OK	A	oply .	Cancel
															1000	1.1	



Configure 'SegLCD'		? 🗙					
Name: SegLCD							
Basic Configuration Dri	iver Power Settings Display Helpers Built-in	4 Þ					
Helpers	Selected Helpers	^					
7 Segment 14 Segment 16 Segment Bargraph and Dial Matrix 4 Helper_7Segment_0 Helper_7Segment_0 Helper_16Segment_0 Helper_14Segment_0							
Helper function configuratio	n						
📳 🔀 Number of sy	ymbols: 5 Selected pixel name H7SEG0_A						
F B F B G G G E C E C D D	A A A F B F B F B G G G E C E C E C D D D D						
Pixel Mapping Table		- •					
Data Sheet	OK Apply Can	xel					

Figure 5-28. Five Character Helper for Large Seven Segment Display

Figure 5-29. Four Character Helper for Small Seven Segment Display

Configure 'SegLCD'		? 🗙
Name: SegLCD		
Basic Configuration Driver Pov	wer Settings Display Helpers Built-in	4 Þ
Helpers	Selected Helpers	^
7 Segment 14 Segment 16 Segment Bargraph and Dial Matrix	Helper_Matrix_0 Helper_7Segment_0 Helper_7Segment_1 Helper_16Segment_0 Helper_14Segment_0	
Helper function configuration		
		_
	BFB	
G G G	G	
	C E C	
Pixel Mapping Table		
Data Sheet	OK Apply Cano	;el



Configure 'SegLCD'	? 🛛
Name: SegLCD	
Basic Configuration Driver Power Settings Dis	splay Helpers Built-in 4 🕨
Helpers	Selected Helpers
7 Segment 14 Segment 16 Segment Bargraph and Dial Matrix	Helper_Matrix_0
Helper function configuration Number of symbols: 1 Selected F H I J B	pixel name H16SEG0_A
G K E N M L C D D	
Pixel Mapping Table	
Data Sheet OK	Apply Cancel

Figure 5-30. One Character Helper for 16-Segment Display

Figure 5-31. One Character Helper for 14-Segment Display

Configure	'SegLCD'	? 🔀
Name:	SegLCD	nlay Helpers Built-in d b
Helper 7 Segm 14 Segr 16 Segr Bargrap Matrix Helper F H G E N N	s ent nent h and Dial function configuration Number of symbols: 1 Selected p K K L C	Selected Helpers
Pixel M	apping Table	Apply Cancel



5.3.8.2 LCD Glass Icon Pixel Mapping

Refer to the hardware design document included in this package for the glass segment icon mapping and symbol names (*LCD Layout s93043-602.pdf*, page 2). Icons can be grouped together for ease of control, such as signal strength, progress, and battery level bars or they can be individually controlled by direct pixel access.

The icon bar graph helpers allow to specify the number of icon elements in the bar. This information is used by the helper to provide the bar element pixel segment selection and allows you to specify the element position in the graph in the parameters in the API calls for the bar graph.

Figure 5-32. Bar Graph Helper for 10-Element Progress Bar Icons

Conf	igu	re	'Se	gL (D'														?	×
Nam	ne:		Seg	JLCI)															1
	Ba	sic (Conf	figu	ratio	n	D	rive	r Po	wer Set	tings	Dis	splay	Help	ers	Bu	ilt-in	η.	4 Þ	
Н	lelp	ers	:										Se	ecte	d H	elper	\$		^	ļ
7	Seg 4 Se	gme egm	int ient										He He	lper_ lper	16Se 14Se	gmen gmen	t_0 t 0	^		
1 B	6 Se largi	egm aph	ient 1 an	d Di	al					-	4	-	He He	lper_ lper_	Bar_(Bar_1) I	-			
M	Matrix Helper_Bar_2												≣							
ſ	Helper function configuration																			
	Number of symbols: 10 Selected pixel name																			
			0		0					Q										
	1	2	3	4	5	6	7	8	9	1 0										
0	Pixel Mapping Table											~								
	Dat	a S	hee	t	٦			Г		ОК			Ap	ply		_	Ca	ancel	_	
													1			_				



Conf	igu	re	'Se	gLC	D'											?	
Nam	ne:		Seg	JLCI)												
	Ba	sic (Conl	figu	ratio	n	Driv	er Po	wer Se	ettings	Dis	splay H	elpers	Bu	ilt-in	4	⊳
Н	lelp	ers	:									Sele	cted I	lelper	s		^
7 1 B M	'Se 4S 6S largi 1atri	gme egm egm rapł x	ent ient ient n an	d Di	al					•		Help Help Help Help	er_169 er_149 er_Bar er_Bar er_Bar	iegmen iegmen _0 _1 _2	10 10		=
	Helper function configuration Image: Selected pixel name										=						
	P 1	Р 6	Р 7	Р 8	Р 9	P 1 0											
c	Pixe	I M	appi	ng '	ГаЫ	е											~
	Da	ta S	hee	ł]		(OK			Appl	į		Car	ncel	

Figure 5-33. Bar Graph Helper for Four Elements Signal Strength Icons (include ZZZ and CyLogo)

Figure 5-34. Bar Graph Helper for Four Element Battery Level Icons

Сол	ıfigu	re	'Se	gLC	CD'																?	X
Na	ame:		Seg	JLCI	D																	
2	Basic Configuration Driver Power Settings Display Helpers Built-in 4													⊳								
	Helpers Selected Helpers													^								
	7 Segment 14 Segment 16 Segment Bargraph and Dial Matrix																					
-	Helper function configuration																					
	Number of symbols: 19 Selected pixel name																					
	Т Т Т Т Т Т Т Т Т Т Т С Р А ^М Z Z Z Z Z Z 1 2 3 4 5 6 7 8 9 ^С М М ^A 1 2 3 4 5 6																					
1	Pixe	el M	appi	ng '	Tab	e																*
C	Da	ta S	hee	t				C		0	K				Ap	ply			Ca	ncel		

It includes remaining icon pixels: four large decimal points, large colon, slash, bell, MAX, AM, PM, small decimal points, and small colon).



5.3.8.3 Pixel Only Mapped Icons

The following icons are only mapped for use as direct pixels:

- BELL (Z6)
- MAX (MAX)
- AM (AM)
- PM (PM)
- Small '1' Icon (Z1)
- Small decimal point 1 (Z2)
- Small decimal point 2 (Z3)
- Small decimal point 3 (Z5)
- Small colon (Z4)

These icons can be turned on and off directly by using the pixel writing API calls.

5.3.9 Digital I/O

5.3.9.1 Sleep Button

The sleep button is configured to generate an interrupt on both edges of a button press. The default Built-In settings are used.

If the project is in wake mode, when the button is pressed and released, the button ISR signals a go to sleep command.

If the project is in sleep mode, when the button is pressed, a wake signal is sent and the code returns to normal flow just after the sleep entry point.

Note In sleep mode, the PSoC 3 device does not go into sleep; the firmware is just put in a lower power mode. In the low power mode, only RTC component is left running and all other components are powered off. It periodically wakes up the PSoC enough to strobe the ZZZ icon on and off to indicate that the device is in low power mode. To know details on low power operation mode refer to Low Power Entry on page 64.

When the project is powered from a wall supply and the operator is in the RTC/TEMP submenu, then the sleep entry is blocked. If the project is battery powered, there is no sleep blocking.



Pins Mapping	Reset Built-in	4 1
umber of Pins: 1		
Sleep_Btn_0	Drive Mode High Impedance Digital	Initial State:

Figure 5-36.	Sleep Button	Configuration: Pin	Туре	Tab (includes	dual-edge	interrupt	configuration	٦)
--------------	--------------	--------------------	------	---------------	-----------	-----------	---------------	----

Name: Sleep_Btn		
Pins Mapping Number of Pins: 1	Reset Built-in	4 Þ
IAI Fins1	Type General Input Output Analog Preview Digital Input Input Input HW Connection Input Input HW Connection Input Input HW Connection Input Input Input Input Input Input Input Input Input Input Input Input Input Input Input Input Input Input Input <th></th>	



Configure 'cy_	pins'	? 🛛
Name: Slee	p_Btn	
Pins Ma	apping Reset Built-in	4 Þ
IAI Pinsi	Btn_0 Type General Input Threshold: CMOS Interrupt: Both Edges Hot Swap Input Buffer Enabled Input Synchronized	utput
Data Sheet		Dly Cancel

Figure 5-37. Sleep Button Configuration: Input Tab (includes dual edge interrupt configuration)

5.3.9.2 Sleep Button ISR

The PSoC Creator generates source files for the Sleep Button ISR. The project Sleep Button code includes project specific code for interrupt handling. References to the project Sleep Button code interrupt service routine are added to the generated source. In the generated source file for the interrupt handling, there are two places where code must be added manually. This code is protected by source code generator statements that preserve the user entered code during subsequent builds. The code added is a prototype for the user provided ISR and a call to the user ISR in the generated source.



Figure 5-38. Sleep Button ISR

Name: Sleep_Btn_ISR Built-in		4 Þ
Parameter	Туре	Value
CY_COMPONENT_NAME	string	GetComponentName()
CY_MAJOR_VERSION	string	1
CY_MINOR_VERSION	string	10
CY_REMOVE	bool	false
CY_SUPPRESS_API_GEN	bool	false
CY_VERSION	string	PSoC Creator 1.0 Beta 3.1
Parameter Information	_	

5.3.9.3 Wall Supply (Vin) Detect

The Wall Supply (Vin) Detect is configured to allow firmware to poll the port with the Read API call. This signal is used in conjunction with the battery sense pins to communicate the current power configuration to the project. The default Built-In settings are used.

Figure 5-39.	Wall Supply	(Vin)	Detect	Configuration:	General	Tab
. igaio 0 00.	man Cappij	、•···/	201001	ooringaraaorii	00110101	100

Configure 'cy_pins'		? 🛛
Name: WallSupplyDetect		
Pins Mapping Res	et Built-in X	4 Þ
IAIL Pins1	Type General Input Outp	ut Initial State:
	High Impedance Digital	Low (0)
Data Sheet	OK Apply	Cancel



Pins Mapping Reset Built-in 4 Number of Pins: 1 Image: Section and the section andi	lame: MallSuppluDetect			
Pins Mapping Reset Built-in 4 Number of Pins: 1 Image: Second Se	valie. vvalisupplybeleci	·		
Number of Pins: 1 Type General Input Output Analog Preview: Digital Input HW Connection Digital Output HW Connection Duput Enable Bidirectional	Pins Mapping Re	set Built-in		41
IAIL Final Type General Input Output Image: Supply Detect_0 Analog Preview: Image: Digital Input Image: Digital Input Image: Digital Input Image: HW Connection Image: Digital Output Image: Digital Output Image: HW Connection Image: Digital Output Image: Digital Output Image: HW Connection Image: Digital Output Image: Digital Output Image: HW Connection Image: Digital Output Image: Digital Output Image: Bidirectional Image: Digital Output Image: Digital Output	Number of Pins: 1			
WallSupplyDetect_0 Analog Preview: Digital Input HW Connection Digital Output HW Connection Duput Enable Bidirectional	[All Fins]	Type General Inp	out Output	
 Digital Input HW Connection Digital Output HW Connection Ouput Enable 	WallSupplyDetect_0	Analog	Preview:	
HW Connection Digital Output HW Connection Ouput Enable Bidirectional		Digital Input		
		HW Connection		e
HW Connection Ouput Enable		Digital Output		
Ouput Enable				
Ouput Enable Bidirectional		HW Connection		
Bidirectional		Ouput Enable		
		Bidirectional		
× × ×				
			10	

Figure 5-40. Wall Supply (Vin) Detect Configuration: Pin Type Tab

Figure 5-41. Wall Supply (Vin) Detect Configuration Input Tab

Configure 'cy_pins'			? 🔀
Name: WallSupplyDetect			
Pins Mapping Re Number of Pins: 1	set Built-ii	in) • X X	4 Þ
IAII Pinsi	Type Threshold:	General Input Output	
	Interrupt:	None	
		 Hot Swap Input Buffer Enabled 	
		Input Synchronized	
	47		
Data Sheet		OK Apply Cance	



5.3.9.4 VBus Detect

The VBus Detect is configured to allow the firmware to poll the port with the Read API call. The VBus Detect signal is used in conjunction with the battery sense pins to help communicate the current power configuration to the project. The default Built-In settings are used.

Configure 'cy_pins' Name: VBUSDetect Pins Mapping R	eset Built-in	? X 4 Þ
Number of Pins: 1	Type General Input Drive Mode High Impedance Digital	Dutput Initial State: Low (0)
Data Sheet		Dly Cancel

Figure 5-42. VBus Detect Configuration: General Tab

Figure 5-43. VBus Detect Configuration: Pin Type Tab

Configure 'cy_pins'		? 🛛
Name: VBUSDetect Pins Mapping R Number of Pins: 1 IAIL Pinst VBUSDetect_0	eset Built-in Digital Input HW Connection	tput
Data Sheet	Digital Output HW Connection Ouput Enable Bidirectional OK Apple	Cancel



5.3.9.5 Digital Outputs

5.3.9.6 Accelerometer On

The firmware uses API to write to this port to turn on the accelerometer, enabling measurements. The default Built-In settings are used.

Figure 5-44. Accelerometer On Configuration: General Tab

Configure 'cy_pins'		? 🛛
Name: Acc_On		
Number of Pins: 1		<u> </u>
IAII Enst	Type General Input Drive Mode Strong Drive	Output Initial State: Low (0)
Data Sheet	OK A	pply Cancel

Figure 5-45. Accelerometer On Configuration: Pin Type Tab

Configure 'cy_pins'		? 🛛
Pins Mapping Number of Pins: 1	Reset Built-in	4 Þ
IAJI Fins1	Type General Input Output Analog Preview: Digital Input Imput Imput HW Connection Imput Imput Digital Output Imput Imput HW Connection Imput Imput Imput Imput Imput Imput <td></td>	
Data Sheet	ОК Арру (Cancel



Configure 'cy_pins'			? 🛛
Name: Acc_On Pins Mapping R Number of Pins: 1	eset Built-in		4 Þ
IAU Pinst	Type Slew Rate: Drive Level: Current:	General Input Output Fast Vddio 4mA source, 8mA sink Output Synchronized	
Data Sheet		DK Apply C	ancel

Figure 5-46. Accelerometer on Configuration: Output Tab

5.3.9.7 Buzzer In

This digital port provides a hardware path from PWM to the buzzer. It is configured to use hardware configuration and therefore does not require firmware code to activate it. Because the component is hardware configured, the output pin is exposed in the top level design, which allows a connection from the PWM to the digital port for output mapping. The default Built-In settings are used.

Figure 5-47. Buzzer In Configuration: General Tab

Configure 'cy_pins'		? 🛛
Name: Buzzer_In		
Pins Mapping Re	set Built-in	4 ۵
Number of Pins: 1		
IAI Pinst	Type General Input Outp	put
Buzzer_In_0	Drive Mode	Initial State:
	Strong Drive 🔽	Low (0) 🖌
		Minimum Supply Voltage:
Data Sheet	ОК Арріу	Cancel



Pins Mapping Jumber of Pins: 1	Reset Built-in	4
IAII Finst Buzzer_In_0	Type General Input Output Analog Preview Digital Input Imput HW Connection Digital Output HW Connection Ouput Enable Bidirectional	

Figure 5-48. Buzzer In Configuration: Pin Type Tab

Figure 5-49. Buzzer In Configuration: Output Tab

Pins Mapping Jumber of Pins: 1	Reset Built-in	4
[All Pins]	Type General Input	Output
Buzzer_In_0	Slew Rate: Fast 🗸	
	Drive Level: Vddio 🗸	
	Current: 4mA source, 8mA s	sink 🔽
	🔲 Output Synchro	nized

5.3.9.8 Logic Level High for Buzzer In Output Enable

The Buzzer In digital output component requires a signal on the OE pin to enable the output.



5.3.10 Real Time Clock (RTC)

The RTC is minimally configured to use Sunday as the start day of the week. The firmware enables the RTC with hours, minutes, and seconds set to zero and the date set to January 1, 2000. After the clock is set, as long as power is provided to the PSoC 3 part, the real time is maintained with high accuracy. For the RTC to function, the 32 kHz crystal must be enabled in the System Clocks dialog.

The RTC function also has complete Alarm Clock settings. The project allows you to set an alarm for any time of the day. The project also provides options to enable or turn off an alarm that has started ringing. The alarm automatically stops ringing after five minutes.

The default Built-In settings are used.

Configure 'RTC'	? 🗙
Name: RTC_1	
Basic Configuration Built-in	4 Þ
Enable Daylight Savings Time Functionality	
Start of week Sunday	
Data Sheet OK Apply Cancel	

Figure 5-50. Real Time Clock (RTC) Configuration: Basic Tab

5.3.10.1 CapSense Buttons

There are four CapSense button capacitive pickup points on the LCD board. The silkscreen identifies each pickup point as a button in the range "+", "-", "SEL", and "RET". These buttons are used for menu navigation and data input.

This design uses the CapSense IDAC enabled as source method. The hardware is wired with an RBleed resistor to allow the IDAC disabled CapSense implementation. The hardware is wired for only one CMod circuit, so the serial CapSense method is used. For this implementation, the CapSense inputs are mapped to button functions. All the buttons are similarly configured.

CapSense button detection is performed using polling method. This requires the firmware to provide button sampling at each user loop in the code flow. The Timer user ISR can be enhanced to provided button sense events.

Note The CapSense CPS clock must not be greater than one half the projects bus clock selection (see System Clocks on page 61).



General Configuration	lock Source Buttons Sliders Touch Pad	s Matrix Buttons P 4
	eriai O Farailei Synchronized O Para	
CapSense Method	CSD 💌	
	$\mathbf{r}^{\mathbf{r}}$, $\mathbf{r}^{\mathbf{r}}$, \mathbf{r}	
 IDAC sourcing IDAC sinking IDAC disable, u 	se external Rb	
PRS Shield Electrode Count	None 🔽	

Figure 5-51. CapSense Configuration: General Tab

Figure 5-52. CapSense Configuration: Clock Source Tab





ame:	CapSense	
G	ieneral Clock Source Buttons	Sliders Touch Pads Matrix Buttons P 4
	Button Name	
•	B1	
	B2	
	P2	
-	84	
*		
		B1
3 Fil	Iters Configuration	B1
3 Fil Av	Iters Configuration reraging Filter for Raw Data	B1 Disabled
3 Fil Av Fir:	I ters Configuration eraging Filter for Raw Data st Order IIR Filter for Raw Data	B1 Disabled Disabled
∃ Fil Av Fir: Jitt	I ters Configuration eraging Filter for Raw Data st Order IIR Filter for Raw Data er Filter for Raw Data	B1 Disabled Disabled Disabled
E Fil Av Fir Jitt Me	I ters Configuration eraging Filter for Raw Data st Order IIR Filter for Raw Data er Filter for Raw Data edian Filter for Raw Data	B1 Disabled Disabled Disabled Disabled
E Fil Av Fir Jitt Me	I ters Configuration eraging Filter for Raw Data st Order IIR Filter for Raw Data er Filter for Raw Data edian Filter for Raw Data i sc	B1 Disabled Disabled Disabled Disabled
∃ Fil Av Fir Jitt Me ∃ Mi De	Iters Configuration eraging Filter for Raw Data st Order IIR Filter for Raw Data er Filter for Raw Data edian Filter for Raw Data isc	B1 Disabled Disabled Disabled 5
∃ Fil Av Fir: Jitt Me ∃ Mi De Hy	Iters Configuration reraging Filter for Raw Data st Order IIR Filter for Raw Data er Filter for Raw Data edian Filter for Raw Data isc ebounce rsteresis	B1 Disabled Disabled Disabled 5 5
Fin Av Fin Jitt Me Mi De Hy Th	Iters Configuration eraging Filter for Raw Data st Order IIR Filter for Raw Data er Filter for Raw Data edian Filter for Raw Data isc ebounce esteresis tresholds	B1 Disabled Disabled Disabled 5 5 5
Fill Av Fils Jitt Me Mi De Hy Fin	Iters Configuration eraging Filter for Raw Data st Order IIR Filter for Raw Data er Filter for Raw Data dian Filter for Raw Data isc ebounce esteresis mesholds nger Threshold	B1 Disabled Disabled Disabled 5 5 5

Figure 5-53. CapSense Configuration: Buttons Tab

Figure 5-54. CapSense Configuration: Scan Slots Tab

С	onfigu	re 'Ca	pSense'		? 🛛
	Name:	Сар	Sense		
	Pads 1	Matrix B	Buttons Pro	ximity Sensors	Generic Sensors Scan Slots Built-in
		Scan Order	Associated Terminal(s)		
	۲.	0	BTN_B1		
		1	BTN_B2		
		2	BTN_B3		
		3	BTN_B4		
	BTN_B CapSer	1 hse Met	hod: CSD	🗹 Cu	ustom
	Prescal Period	ler 8		Connect Inactive Senso	ors Ground 🗸
	Resolut	tion 1	0 bits 🛛 🔽	Scan Speed	Normal 💌
	IDAC ra	ange 2	*	IDAC Setting	127
	Data	a Sheel		0	DK Apply Cancel



5.3.11 EEPROM

This project uses the default Built-In settings. The EEPROM is 2 KB in two sectors [0, 1]. The project uses Sector 0 starting at the beginning of the sector. Each sector is addressed by 16-byte rows. The API provides a Write function to write data to the EEPROM and simple pointer code is used to provide read access row by row.

The project uses the following organization of the EEPROM for storing Punch saved high scores, display contrast level, and clock alarm settings.

Row	Data	Description		
0	"0123456789ABCDEF"	Initialization String – if this string is missing then automatically re-initialize the EEPROM project data		
1	High Score #1:Name, Score	Name is String Score is Long		
2	High Score #2:Name, Score	Name is String Score is Long		
3	High Score #3:Name, Score	Name is String Score is Long		
4	High Score #4:Name, Score	Name is String Score is Long		
5	High Score #5:Name, Score	Name is String Score is Long		
6	Number of saved high scores	Byte (range [0 5])		
7	Accumulated score for averaging	Long		
8	Average Score	Long		
9	Current High Score Index	Byte (range [0 4])		
10	Clock Alarm	Hour Byte (range [0 23])		
10	(Hour, Minute)	Minute Byte (range [0 59])		
11	Display Contrast Level Byte (range [0 10])			
	Clock Data	Day Byte (range [1 31])		
12	(Day Month Index Year)	Month Index Byte (range [011] \rightarrow [JAN DEC)		
	(Day, Month Index, Tear)	Year Byte (range [0 99] \rightarrow [2000 2099])		
13	Clock Alarm OFF/ON	Byte (range $[0 1] \rightarrow [OFF, ON]$)		
14	Clock Time	Hour Byte (range [0 23])		
	(Hour, Minute)	Minute Byte (range [0 59])		

Table 5-1. EEPROM Row Contents



Figure 5-55. EEPROM Default Settings

Configure 'EEPI	ROM'		? 🔀		
Name: EEPF	ROM_1				
Built-in			4 Þ		
Param	eter	Туре	Value		
CY_COMPONE	NT_NAME	string	EEPROM_v1_10		
CY_MAJOR_VE	RSION	string	1		
CY_MINOR_VE	CY_MINOR_VERSION		10		
CY_REMOVE	CY_REMOVE		false		
CY_SUPPRESS	CY_SUPPRESS_API_GEN		false		
CY_VERSION		string	PSoC Creator 1.0 Beta 3.1		
Parameter Inform	nation	C	OK Apply Cancel		

5.3.12 System Clocks

There are two system clocks to be enabled: the 32 kHz crystal clock for the RTC component and the PLL. The PLL is created from the IMO clock and is set high enough to allow CapSense operations. These clocks are enabled in the Configure Built In Clocks dialog.

To get to this dialog, select *SegLCD_project.cydwr* in the Workspace Explorer. Select the Clocks tab at the bottom of the workspace and then click **Edit Clock** on top of the workspace.





Figure 5-56. Enable XTAL 32 kHz for RTC and PLL

5.3.13 Pin Mapping

For the design to work, the PSoC3 pins internal connections must be mapped to the corresponding output connections. This is done using the Pins dialog.

To get to this dialog, select the *SegLCD_project.cydwr* file in the Workspace Explorer. Select the Pins tab at the bottom of the workspace. To connect a pin grab and drop one of the unassigned pins from the pin list panel on the right side onto an unassigned target pin stub on the PSoC3 block in the center panel. To remove a connection, right click the assigned target pin stub and unlock the signal name.





Figure 5-57. Pin Connection Mapping Page 1



C	Start Page *TopDesign cysch Segl CD project cydwr				-
Γ	Startrage Toplesignicital Segree_projecticydwi	Alex Mana	En	-	Ī,
	edited edited 1110 11		F III	100	ľ
		(SegucD: Seguini)	P4[4]	Y	
	3 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	\SegLCD: Seg\[10]	P4[5]	~	
8	88 88 88 88 88 88 88 88 88 88 88 88 88	2 3 5 8 8 8 8 8 8 8 8 9 19 19	P4[6]	Ť	
	Convin		P4[7]	~	
		\SegLCD: Seg\[7]	P6[0]	~	
	Sed CD Con(1) 1 P2(9)	Viol 23 19/ SegLCD: SegL[6]	P6[1]	~	
	VsepLCD Com(0) 3 P2(7)	Pi[2] 73 UseLCD:Com(11] \SegLCD:Seg\[5]	P6[2]	~	
	34,5,N 4 P124 00 SCL	P0[1] 72 SegLCD:Com(12] \SegLCD:Seg\[4]	P6[3]	*	
	14.6.0UT 5 P125 00 IDA	Pqq 71 \SegLCD:Com(13] \SegLCD:Seg\[3]	P15[4]	*	
L	SegLCD:Com(4) 6 P(4)	P4[1] 70 \SegLCD: Seg\[2]	P15[5]	~	
L	SegLD.Com/6] 8 P(6)	P123 6 VBUSDenct \SegLCD: Seg\[1]	P2[0]	*	
	UsedLCD.Com(1) 9 Pt(7)	P122 67 Acc.On \SegLCD: Seg\[0]	P2[1]	~	
	Visit Visit	Visid Acc_On	P12[2]	*	
		Vata 65 55W J4_5_IN	P12[4]	~	
		Voca 61 J4_3_0UT	P12[1]	¥	
L	Visid CV9C2966AVL0	nt SCmod \CapSense:sbCSD:cCmod	A P4(0)	~	
L	xres_N 100-TQFP	NV BTN_B4 \CapSense:sbCSD:cPort	\[3] P3[3]	~	
	15ogl.CD.Sog(27) 16 P3(0	NC BTN_B3 \CapSense:sbCSD:cPort	\[2] P3[2]	~	
L	SegLCD SegL29 17 P3(1) VSegLCD SegL29 18 P52	nt BTN_B2 \CapSense:sbCSD:cPort	\[1] P3[1]	~	
L	1SegLCD.Seg(24) 19 PS[3]	NV 57 BTN_B1 \CapSense:sbCSD:cPort	\[0] P3[0]	*	
	DEBUG 20 PRO SWD. ID, JTAG. TWS	XTAL_32Hz X P193 2 XTAL32Ntz J4 6 OUT	P12[5]	~	
	DEBIG TI PUT SWD CK JTAG TCK	XTAL 320H: Xe P152 TAL 320H: Buzzer In	P12[6]	~	
	21 PTE 6V0 /TAG TDO 9 5	C SU PIZO 51 WalSandyGenera XInPort	P3(7)	~	
L	34.8.IN 34 P1(4 JTAG: TO)	Pil(7) 2 XinPart YInPort	P3(6)	~	
L	ButSenedV 25 PISI JTAG STRST	P3(0 51 YiHPart USi ma I Part	P2(5)	~	
L			P2(4)	~	
	S E E E E E E E E E E E E E E E E E E E		P12(2)	~	
			P12(3)		
	State		P12(7)		
	2 2 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	a b b b > a b b b > a b b b > a b b b > a b b > a b b > a b b b > a b b b > a b b b > a b b b > a b b b > a b b b > a b b b > a b b b > a b b b > a b b b > a b b b > a b b b > a b b b > a b b b > a b b b b	P12(0)		
	** ***	J4_8_IN	P1(4)	~	
		BattSense9V	P1[5]	~	
		9 9 9 9 BattSenseAA	P1[2]	~	

Figure 5-58. Pin Connection Mapping Page 2

5.3.14 Low Power Operation

The design also includes the ability to go to low power operation. When the device goes to low power operation, only the RTC component is left running. It periodically wakes up the PSoC enough to strobe the ZZZ icon on and off to indicate that the device is in low power mode. To bring the device out of low power mode, press and hold the push button switch. When the device wakes up at the next ZZZ strobe interval, it samples the push button and return to normal operations if the button is pressed.

5.3.15 Low Power Entry

The following tasks must be performed prior to entering low power:

- 1. Set 32 kHz clock to low power mode (API call).
- 2. Set trim registers (sleep and wake trims).
- 3. Stop timer components (except RTC).
- 4. Disable component clocks.
- 5. Deactivate accelerometer.
- 6. Deactivate thermistor VDAC reference generator.



- 7. Stop CapSense.
- 8. Set segment LCD to low power mode (API call).
- 9. Call CySleep library API.

5.3.16 Automatic Low Power Entry

The firmware automatically puts the device into low power mode after 10 minutes of no user activity (no CapSense button presses). The exception is when you are in the RTC/TEMP mode. If the device is powered by a wall supply, then the RTC/TEMP mode blocks entering low power.

However, if the device is powered by a battery source, then the project goes into automatic low power mode even if user is in the RTC/TEMP mode. The automatic low power mode is a sleep operation.

5.3.17 Manual Low Power Entry

When the device is in normal operation, if the push button is pressed and the device is not in the RTC/TEMP mode, then the device enters the low power operation. If the device is powered by a wall supply, the RTC/TEMP mode blocks entering low power.

However, if the device is powered by a battery source, then the project goes into manual low power mode even if the clock is displayed. The pushbutton low power mode is a sleep operation.

5.3.18 Periodic Wake and Return to Sleep

The RTC clocking continues during the sleep low power mode. This allows the RTC clock to continue interrupting the PSoC 3 every second. The PSoC 3 RTC interrupt calls the project interrupt service code which counts RTC interrupt events. Normally, the interrupt service simply returns without action and the device automatically re-enters sleep mode.

However, on every fourth RTC interrupt, the interrupt service reactivates the LCD segment component, turns on the ZZZ icon for three-fourths of a second, and deactivates the LCD segment component. The device then re-enters the sleep mode.

5.3.19 Wake from Sleep

Press the pushbutton to wake from sleep. The pushbutton interrupt wakes up the PSoC 3 device, which resumes processing from the point it went into low power mode. The clock time is preserved during automatic sleep.

5.3.20 Low Power Exit

The following tasks must be performed after waking from low power to continue normal operations:

- 1. Set segment LCD to low power mode (API call).
- 2. Restart CapSense.
- 3. Reactivate component clocks.
- 4. Restart timer components.
- 5. Restart ADC component.



5.4 Source Code Description

5.4.1 Top Level Functional Description

On startup, the main process starts the necessary components that operate the main program menu. This includes the LCD segment display component and CapSense buttons. The main function then enters the continuous Main Loop.

5.4.1.1 Main Loop

Figure 5-59 shows the flow of the main code. The Main Loop displays the top level modes of operation in sequential order. These modes are:

- Punch Gauge (PUNCH)
- Time/Temperature (RTC/TEMP)
- Contrast Control (CONTRAST)
- LCD Demo (LCD DEMO).

Press the "+" and "-" buttons to select from one of the modes. A mode is entered when you press the **SEL** button while that mode name is displayed. On selecting a mode of operation, the main process transfers control to a sub mode control level with sub mode menus and controls.

Figure 5-59. Main Code Flow





5.4.1.2 Punch Gauge Mode

Figure 5-60 shows the flow of the Punch Gauge sub mode code. On entering the Punch Gauge mode, the Punch process enters a continuous loop that displays in sequential order the sub modes. These sub modes are

- Throw Punch (1:GAUGE)
- Show High Score (1:HIGH)
- Recall Highest Scores (1:RECALL)
- Clear the saved high scores (1:CLEAR)

Use the "+" and" -" buttons to select from one of the Punch Gauge sub modes. A sub mode is entered when you press **SEL** while that sub mode name is displayed. Pressing **RET**, exits the Punch Gauge sub mode and re-enters the Main Flow.

All the Punch processes display characters on the matrix display.

Figure 5-60. Punch Code Flow





5.4.1.3 RTC/TEMP

Figure 5-61 shows the RTC code flow and Figure 5-62 shows the Date/Temperature code flow. On entering the Time/Temperature mode, the RTC process displays the Time/Temperature sub modes in sequential order. The sub modes are:

- Show Time (2:Clock)
- Set Time (2:SetClk)
- Set Date(2:SetDat)
- Set Alarm (2:SetAlm)
- Turn Alarm On/Off (2:Alarm).

Press the "+" and "-" buttons to select from one of the sub modes. A sub mode is entered when you press **SEL** button while that sub mode name is displayed. Upon selecting a sub mode operation, the Time/Temperature mode transfers control to a sub mode control level with sub mode menus and controls.

Figure 5-61. RTC Code Flow







Figure 5-62. Clock Show Time and Date/Temperature Flow



5.4.1.4 Contrast Control Mode

Refer to Figure 5-63 for the contrast control code flow. On entering the Contrast Control mode, the contrast process displays "Level = X" in the matrix display. The X is the current contrast level, which is a number in the range 0 to 10. The Progress Bar icons are turned on from left to right to display the contrast level. The "+' and "-" buttons control the increment and decrement of the contrast level.



Figure 5-63. Contrast Control Flow



5.4.1.5 LCD Demonstration Mode

Figure 5-64. LCD Demonstration Code Flow





5.4.1.6 Register Descriptions

There are several low power handling registers in PSoC 3 that must be directly set by the project code to allow proper sleep entry and wakeup exit. All other register activity is performed by the component the API calls.

Table 5-2.	Register	Descriptions
------------	----------	--------------

Register Component Name	Register Silicon Name	Register Address	Write Value	Description
CYDEV_MFGCFG_P WRSYS_SLP_TR	PWR- SYS.SLP_TR	0x4683	0x03	Sleep regulator trim: 1. Regulator trim = 3
CYDEV_MFGCFG_P WRSYS_WAKE_TR0	PWR- SYS.WAKE_TR0	0x4685	0xFF	Wake trim: 1. Wake holdoff interval multiplier=16 2. Wake timeout interval multiplier=16
CYDEV_MFGCFG_P WRSYS_WAKE_TR1	PWR- SYS.WAKE_TR1	0x4686	0x38	Wake trim: 1. Wake precount=7 2. Wake IMO frequency = 12 MHz
A. Appendix



A.1 Pixel Mapping Table for LCD Glass





Segment Lettering Information A.2









A.3 Schematic





A.4 BOM

CY8CKIT-006 PSoC3/5 LCD Driver

121R-49500 Revision: 5

REF-14890 Revision: 5

ltem	Qty.	Reference	Part	Manufacturer	Mfrg. Part No.	RoHS	Sub
1	1	BH3	BATTERY HOLDER 9V Female PC MT	Keystone Elec- tronics	594	Y	Y
2	1	BH4	BATTERY HOLDER 9V Male PC MT	Keystone Elec- tronics	593	Y	Υ
3	1	C1	CAP .10UF 16V CERAMIC X7R 0603	Kemet	C0603C104J 4RACTU	Y	Y
4	6	C2,C3,C4,C 8,C11,C12	CAP CERAMIC 1.0UF 10V X5R 0603	Kemet	C0603C105K 8PACTU	Y	Y
5	1	C6	CAP 10UF 16V TANTA- LUM 10% 3216	AVX	TAJA106K01 6R	Y	Y
6	2	C13,C14	CAP CER 10UF 16V X5R 0805	Murata Electron- ics North Amer- ica	GRM21BR61 C106KE15L	Y	Υ
7	4	C15,C16,C1 7,C22	CAP .10UF 10V CERAMIC X5R 0402	Kemet	C0402C104K 8PACTU	Y	Y
8	2	C18,C19	CAP 6PF 50V CERAMIC NPO 0603	Panasonic - ECG	ECJ- 1VC1H060D	Y	Y
9	1	C20	CAP ELECT 100UF 25V FK SMD	Panasonic - ECG	EEE- FK1E101P	Y	Y
10	1	C21	CAP 0.01UF 50V CERAMIC X7R 0603	Panasonic	ECJ- 1VB1H103K	Y	Y
11	1	C23	CAP 220UF 16V TANTA- LUM 20% 7343H	AVX	TAJE227M01 6R	Y	Υ
12	2	C24,C25	CAP .1UF 16V CERAMIC Y5V 0402	Panasonic - ECG	ECJ- 0EF1C104Z	Y	Y
13	2	D11,D13	DIODE SCHOTTKY 40V 1.5A SMA	Vishay IR	10MQ040NT RPBF	Y	Υ
14	1	J1	CONN HEADER 10 PIN 50MIL KEYED SMD	Samtec	FTSH-105- 01-L-DV-K	Y	Y
15	1	J2	CONN JACK POWER 2.1mm PCB RA	CUI	PJ-102A	Y	Y



Item	Qty.	Reference	Part	Manufacturer	Mfrg. Part No.	RoHS	Sub
16	1	J4	CONN HEADER 4x2POS .100 VERT AU	Molex/Waldom Electronics Corp	WM26808- ND	Y	Y
17	1	LS1	BUZZER AUDIO PIEZO 25V SMD	CUI Inc	CMT-1603	Y	Y
18	1	P1	LCD FEMA Custom 60 Pin, 16 Commons, 28 Seg Lines	FEMA	593043-527	Y	Y
19	1	RT1	THERMISTOR NTC 10K OHM LEADED	BC Components	2381 640 66103	Y	Y
20	1	R1	RES 10.0K OHM 1/16W 1% 0603 SMD	Yageo Corpora- tion	RC0603FR- 0710KL	Y	Y
21	4	R23,R25,R5 2,R53	RES 100K OHM 1/16W 5% 0402 SMD	Panasonic - ECG	ERJ- 2GEJ104X	Y	Y
22	4	R14,R15,R1 6,R17	RES 560 OHM 1/16W 5% 0402 SMD	Yageo Corpora- tion	RC0402JR- 07560RL	Y	Y
23	1	R19	RES 4.7K OHM 1/10W 5% 0805 SMD	Panasonic - ECG	ERJ- 6GEYJ472V	Y	Y
24	3	R20,R39,R4 0	RES 10 OHM 1/16W 5% 0402 SMD	Yageo	RC0402JR- 0710RL	Y	Y
25	1	R22	RES 300K OHM 1/10W 5% 0402 SMD	Panasonic - ECG	ERJ- 2GEJ304X	Y	Y
26	2	R24,R51	RES 1.50K OHM 1/16W 1% 0402 SMD	Panasonic - ECG	ERJ- 2RKF1501X	Y	Y
27	2	R37,R38	RES ZERO OHM 1/16W 5% 0603 SMD	Panasonic - ECG	ERJ- 3GEY0R00V	Y	Y
28	3	R41,R57,R5 8	RES ZERO OHM 1/16W 0402 SMD	Panasonic - ECG	ERJ- 2GE0R00X	Y	Y
29	1	R42	RES 100 OHM 1/16W 5% 0402 SMD	Rohm	MCR01MZPJ 101	Y	Y
30	1	R45	RES 39K OHM 1/16W 5% 0402 SMD	Panasonic - ECG	ERJ- 2GEJ393X	Y	Y
31	1	R46	RES 62K OHM 1/10W 5% 0402 SMD	Panasonic - ECG	ERJ- 2GEJ623X	Y	Y
32	3	R49,R50,R5 9	RES 0.0 OHM 1/10W 5% 0805 SMD	Panasonic-ECG	ERJ- 6GEY0R00V	Y	Y



ltem	Qty.	Reference	Part	Manufacturer	Mfrg. Part No.	RoHS	Sub	
33	1	SW1	SWITCH SLIDE MINI SPDT PCMNT SLV	ITT Industries, C&K Div	1101M2S3C QE2	Y	Y	
34	1	S1	LT SWITCH 6MM 100GF H=7MM TH	Panasonic - ECG	EVQ- PAC07K	Y	Y	
35	3	TP3,TP4,TP 6	TEST POINT 43 HOLE 65 PLATED RED	Keystone Elec- tronics	5000	Y	Y	
36	1	TP5	TEST POINT 43 HOLE 65 PLATED BLACK	Keystone Elec- tronics	5001	Y	Y	
37	1	U1	PSoC3 Mixed-Signal Array	Cypress Semi- conductor	CY8C3866A XI-040	Y	Y	
38	1	U12	IC Accelerometer Mem- sic 2-axis 3.3V-5V	Memsic	MXR2010A	Y	Y	
39	1	U14	IC REG 5.0V 800MA LDO SOT-223	National Semi- conductor	LM1117MPX- 5.0	Y	Y	
40	1	Y1	CRYSTAL 32.768 kHz CYL 12.5PF	Citizen America Corporation	CFS206 32.768KDZF- UB	Y	Y	
Do No	Do Not Load							
41	1	C5	CAP 10000PF 16V CERAMIC X7R 0402	Yageo America	04022R103K 7B20D	Y	Y	
42	2	C9,C29	CAP .10UF 16V CERAMIC X7R 0603	Kemet	C0603C104J 4RACTU	Y	Y	
43	2	C10,C28	CAP CER 22UF 10V 10% X5R 1210	Kemet	C1210C226K 8PACTU	Y	Y	
44	2	C26,C27	CAP 0402 NO LOAD	NA	NA	Y	Y	
45	1	C30	CAPACITOR TANT 22UF 10V 20% SMD	Kemet	T491A226M0 10AS	Y	Y	
46	4	CSD1,CSD2 ,CSD3,CSD 4	CapSense Touch Element F	Manufacturing Process		Y	Y	
47	1	D1	DIODE SCHOTTKY 40V 1A SOT23	Zetex	ZHCS1000T A	Y	Y	
48	1	D12	DIODE SCHOTTKY 40V 1.5A SMA	Vishay IR	10MQ040NT RPBF	Y	Y	
49	1	D10	Diode, Zener, 3W, 5.6V, SMB	ON Semiconduc- tor	1SMB5919B T3	Y	Y	



Item	Qty.	Reference	Part	Manufacturer	Mfrg. Part No.	RoHS	Sub
50	1	J3	CONN USB MINI AB SMT RIGHT ANGLE	ТҮСО	1734035-2	Y	Υ
51	1	L1	COIL PWR CHOKE 10UH 1A SMD	Panasonic - ECG	ELL- 6PM100M	Y	Υ
52	1	L2	FERRITE CHIP BEAD 120 OHM SMD	TDK Corporation	MMZ1005S1 21C	Y	Υ
53	2	BH1,BH2	CLIP BATTERY AA PC MNT	Keystone Elec- tronics	92	Y	Y
54	2	R11,R12	RES 22 OHM 1/16W 1% 0402 SMD	Panasonic - ECG	ERJ- 2RKF22R0X	Y	Y
55	1	R13	RES 100K OHM 1/16W 5% 0402 SMD	Panasonic - ECG	ERJ- 2GEJ104X	Y	Y
56	1	R44	RES 3.00K OHM 1/8W 1% 0805 SMD	Yageo America	RC0805FR- 073KL	Y	Y
57	2	R47,R48	RES NO LOAD 0805 SMD	NA	NA	Y	Y
58	1	R18	RES NO LOAD 0603 SMD	NA	NA	Y	Y
59	4	R54,R55,R6 0,R61	RES NO LOAD 0402 SMD	NA	NA	Y	Υ
60	1	R56	RES ZERO OHM 1/16W 0402 SMD	Panasonic - ECG	ERJ- 2GE0R00X	Y	Υ
61	1	TP1	TEST POINT 43 HOLE 65 PLATED RED	Keystone Elec- tronics	5000	Y	Υ
62	1	TP2	TEST POINT 43 HOLE 65 PLATED BLACK	Keystone Elec- tronics	5001	Y	Υ
Install On Bottom of PCB Near Rounded Corners As Noted On SASSY assembly drawing.							
63	4	n/a	BUMPER CLEAR.370X.19" CYLIN-	Richco Plastic Co	RBS-35	Y	Y

DER



A.5 PCB Layout and Silkscreen



