CE218472 - PSoC 6 MCU: Comparing External Voltages Using a Low-Power Comparator

Objective

This example demonstrates the voltage comparison functionality using the LPComp Component in PSoC® 6 MCU.

Overview

This document consists of two code examples: The first code example demonstrates how to set the Low-Power Comparator (LPComp) Component options for the internal reference voltage, set the external input from a GPIO using the LPComp driver, and read comparator result using the LPComp interrupt. The second code example demonstrates how to compare two external GPIO inputs and indicate the result using LEDs.

Requirements

Tool: PSoC Creator™ 4.2

Programming Language: C (Arm® GCC 5.4-2016-q2-update, Arm MDK Generic)

Associated Parts: PSoC 6 MCU

Related Hardware: CY8CKIT-062-BLE Pioneer Kit

Design

Code Example 1

This code example features one LPComp, one Global Signal Reference (GSR) with an interrupt, one status LED, one GPIO for an external input, and one potentiometer on the V_{plus} pin, as Figure 1 shows.

Figure 1. Comparing an External Voltage and the Vref Using LPComp

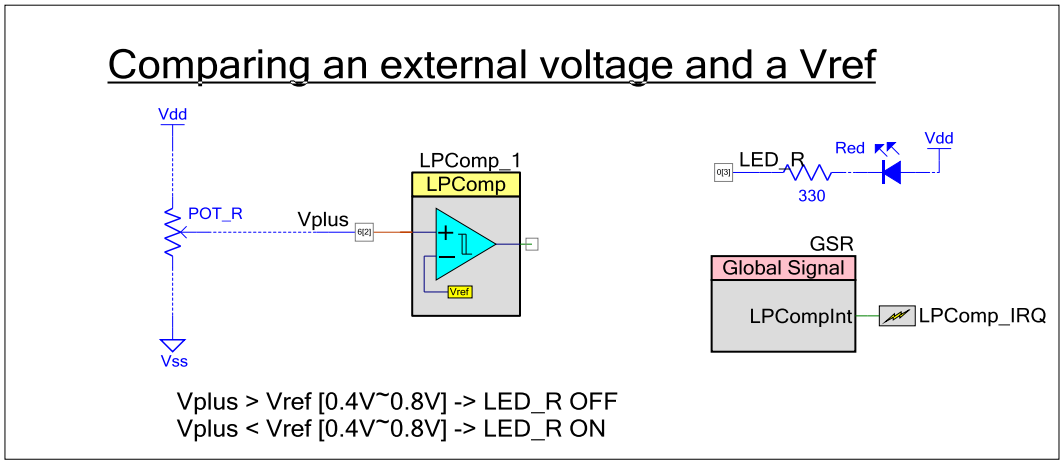
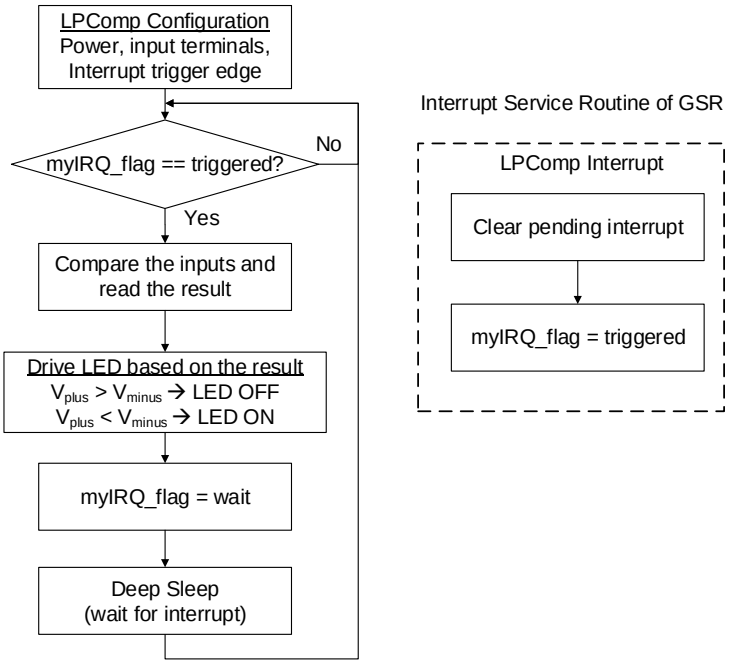


Figure 2 shows the flow of the firmware. main() compares the LPComp Component inputs when the interrupt flag changes to the triggered state, and then sets the flag to the wait state and goes into Deep Sleep to wait for the next interrupt.

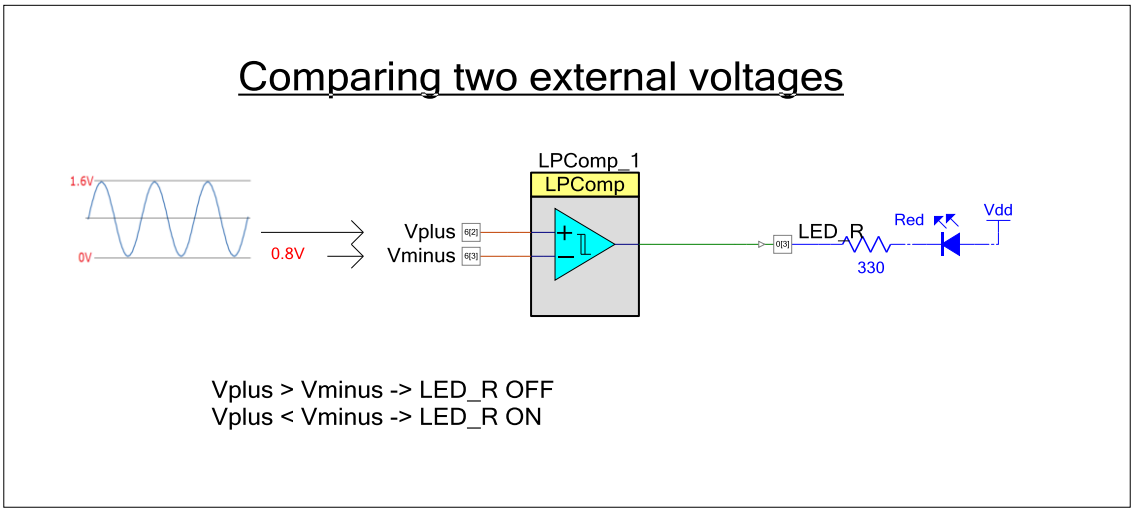
Figure 2. Interrupt-Based Voltage Comparison Flowchart



Code Example 2

This code example features the following Components: one LPComp, one GPIO for the status LED, and two GPIOs for analog inputs. The positive terminal (V_{plus}) connects to the output of a function generator to input the sine wave (in this example, the sine wave has a 0.8-V offset, 1.6-Vpp and 1-Hz frequency). The negative terminal (V_{minus}) connects the reference voltage (in this example, the voltage is 0.8 V.), as Figure 3 shows.

Figure 3. Comparing Two External Voltages Using LPComp



The comparison result from the comparator out terminal is routed directly to the LED_R pin. Because of this routing, LED_R indicates the comparison result without any additional firmware code. Therefore, main() of this example is empty.

Design Considerations

The status LED (LED_R) shows the voltage comparison result. If the positive terminal input is higher than the negative terminal input, the red LED is OFF; it is ON otherwise.

These examples place the GPIOs, LPComp, and Global Signal Reference as shown in Table 1. By placing and compiling the Component, PSoC Creator copies the necessary Peripheral Driver Library (PDL) into project folders.

Components

Table 1 lists the PSoC Creator Components used in this example, as well as the placement used by each.

Table 1. List of PSoC Creator Components

Component	Instance Name	Hardware Resource
Low Power Comparator	LPComp_1	1 Component
Analog Pin	Vplus	1 GPIO
Analog Pin	Vminus	1 GPIO (Code example 2 only)
Digital Output Pin	LED_R	P0_3
Global Signal Reference	GSR	1 Component (Code example 1 only)
Interrupt	LPComp_IRQ	1 Component (Code example 1 only)

LPComp

Figure 4. LPComp Component Settings for Example 1

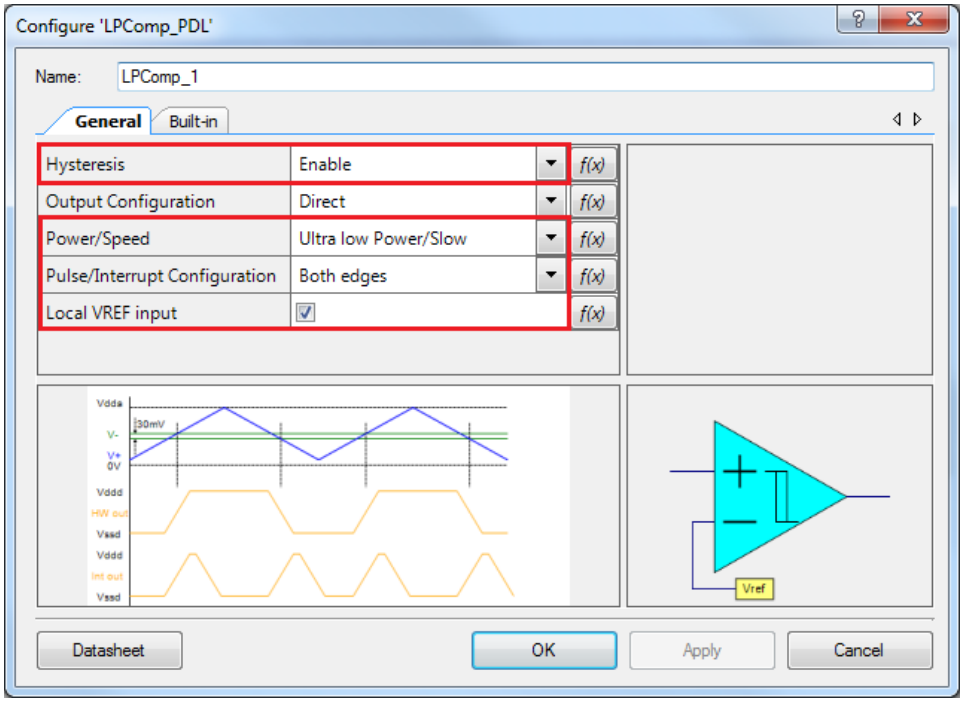
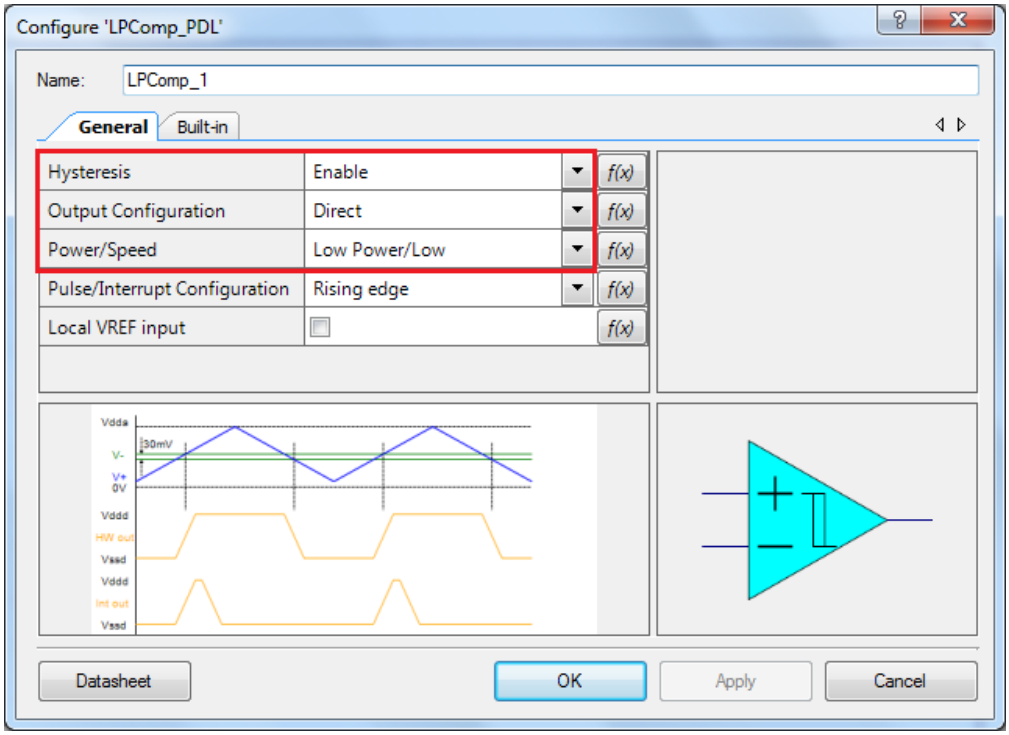


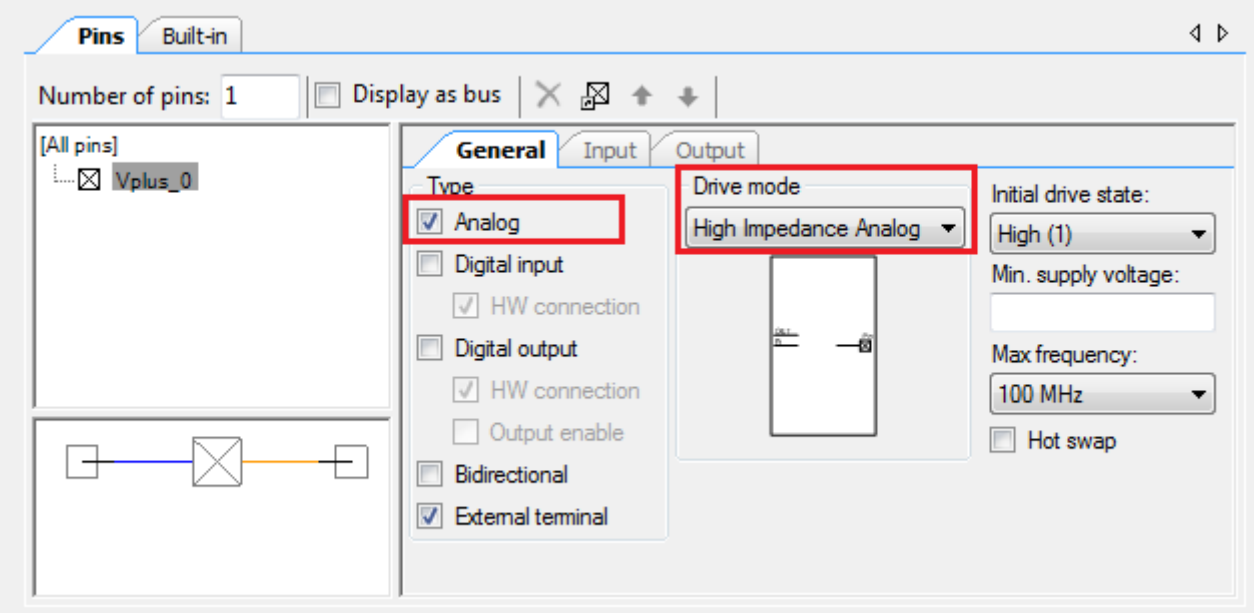
Figure 5. LPComp Component Settings for Example 2



Analog Pin

Figure 6 shows the setting for the analog input pin.

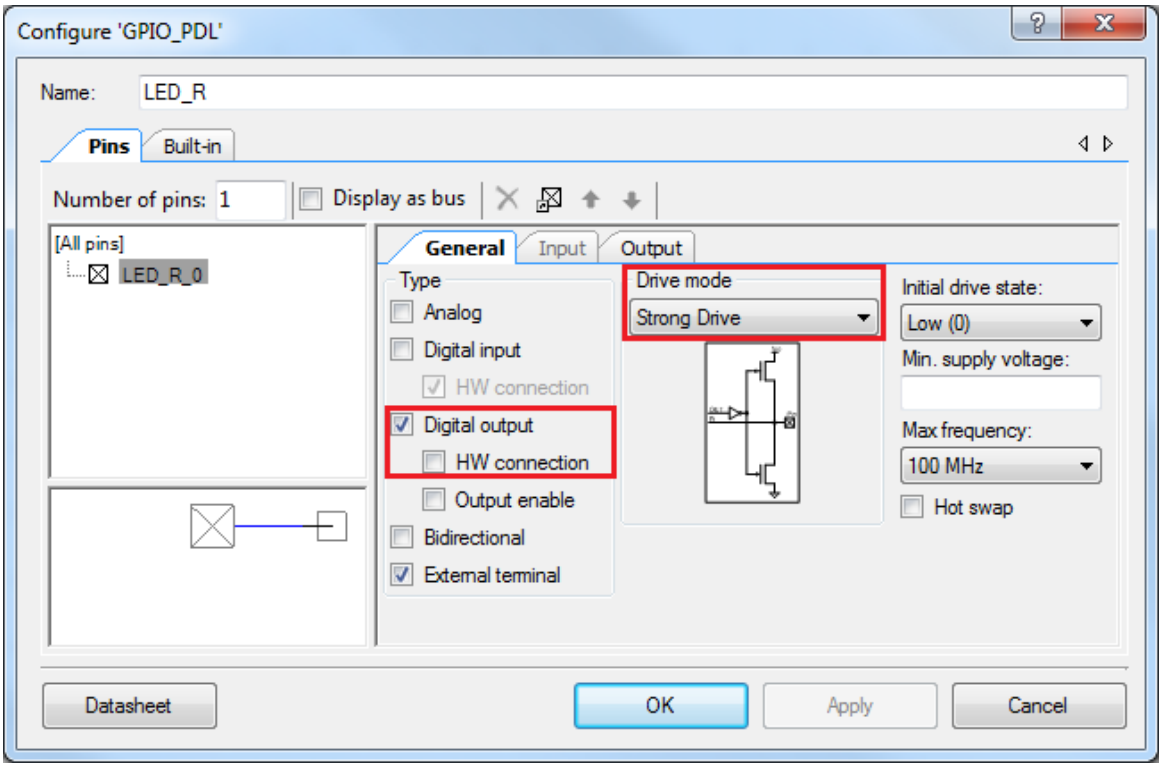
Figure 6. Analog Pin Configuration



Status LED pin

Figure 7 shows the settings for the status LED control pin. Set the drive mode as “Strong Drive” and the pin type as “Digital output”, and uncheck HW connection.

Figure 7. Status LED Pin Configuration

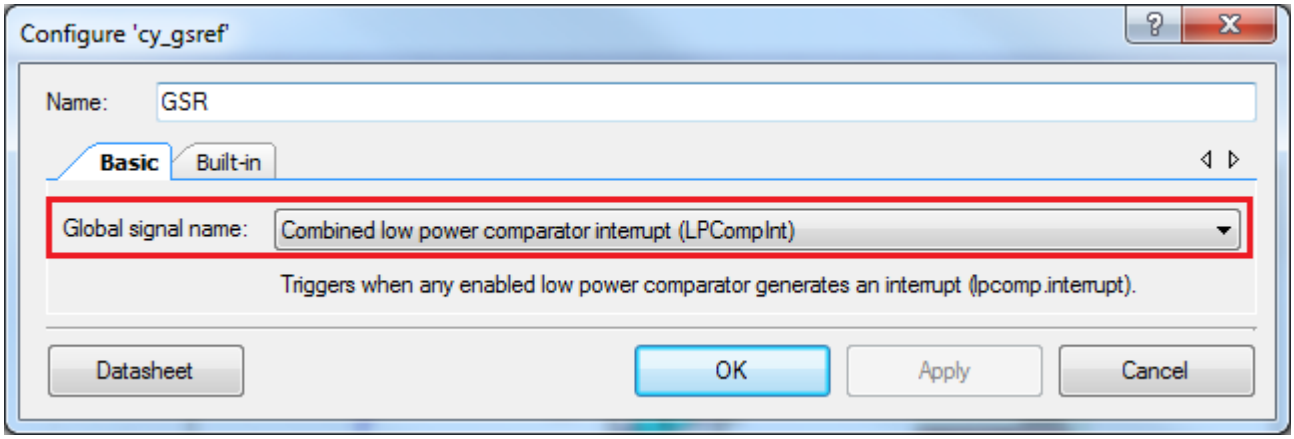


Global Signal Reference

Set the Global signal name to “Combined low power comparator interrupt (LPCompInt)”, as Figure 8 shows.

This is applicable only for code example 1.

Figure 8. Global Signal Reference Configuration



Design-Wide / Global Resources

Table 2 shows the pin assignments for the switch and LEDs of CY8CKIT-062-BLE.

Table 2. DWR Pin Assignment Table

Component	Instance Name	Pin
Digital Output Pin	LED_R	P0[3]
Analog Pin	Vplus	P6[2]
Analog Pin	Vminus	P6[3] (Code example 2 only)

Operation

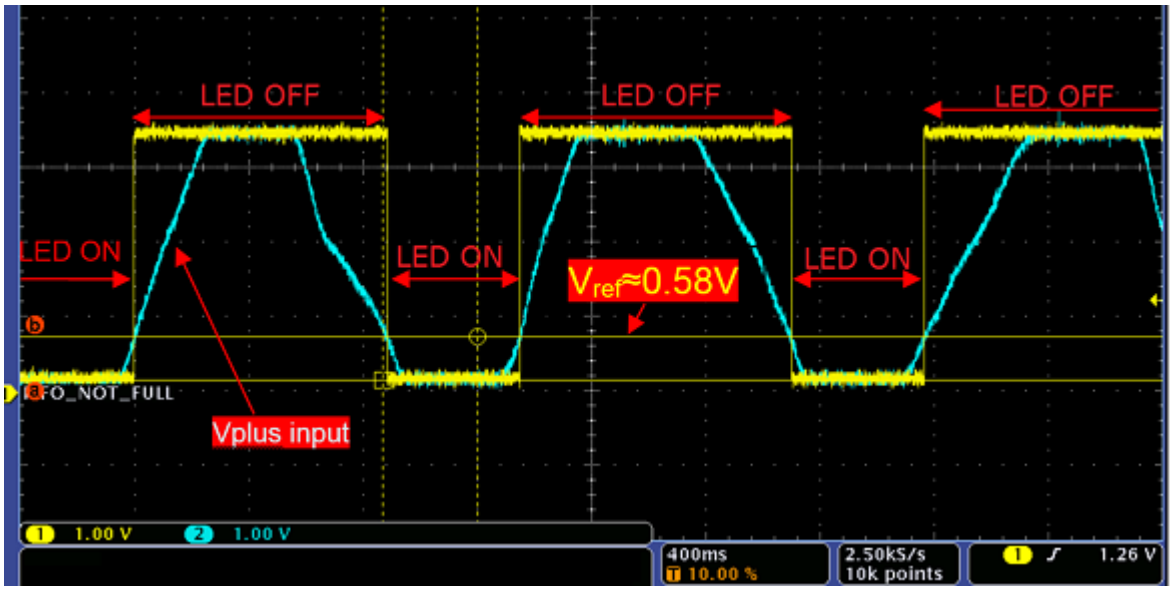
Follow the instructions that came with your kit to make sure that your kit is connected to your PC.

Code Example 1

1. Build the “CE218472_LPComp_Ext_Vref” project and program the CY8CKIT-062-BLE kit.
2. Place a potentiometer on P6[2] to change the V_{plus} input voltage.
3. Turn the knob of the potentiometer until the V_{plus} input is high (=V_{dd}).
4. Confirm that LED_R is OFF.
5. Turn the knob of the potentiometer until the V_{plus} input is low (=GND).
6. Confirm that LED_R is ON.

Figure 9 shows the plots of LED_R and Vplus. It shows that LED_R turns ON when Vplus goes lower than 0.58 V; otherwise it turns OFF.

Figure 9. Plots of LED_R and the External Input (Vplus)



Code Example 2

1. Build the “CE218472_LPComp_Two_Ext” project and program the CY8CKIT-062-BLE kit.
2. Connect a function generator output to P6[2].
3. Configure the function generator output for generating a sine wave.

   The sine wave should be equal or higher than 0 V. (In this code example, it uses 0 V – 1.6 V and 1 Hz)

4. Connect a reference voltage (V_{minus}) to P6[3].

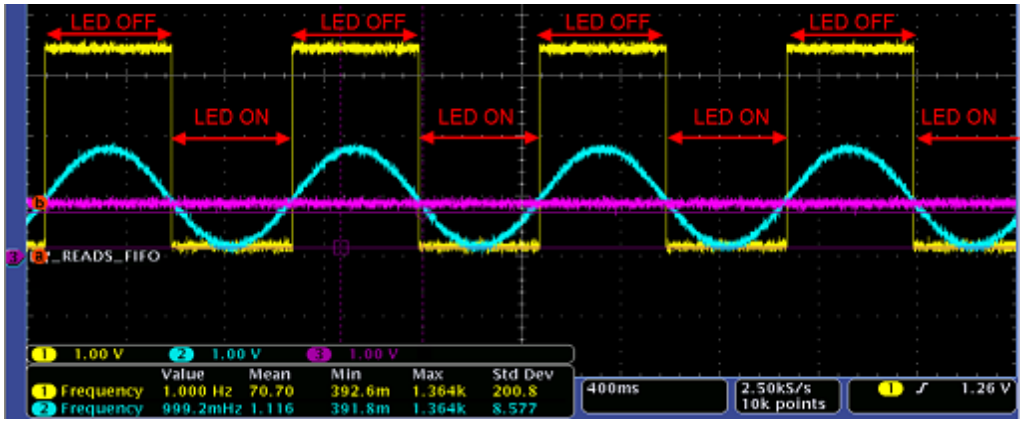
   This voltage should be higher than the minimum voltage of the sine wave and lower than the maximum voltage of the sine wave. (In this code example, it uses 0.8 V)

5. Enable the output of the function generator.

6. Confirm that LED_R toggles following the sine wave frequency.

Figure 10 shows plots of LED_R, Vplus and V_{minus}. It shows that LED_R turns ON when Vplus is lower than V_{minus}; otherwise it turns OFF.

Figure 10. Plots of LED_R and Two External Inputs (Vplus and Vminus)



Related Documents

Application Notes	
AN210781 – Getting Started with PSoC 6 MCU with Bluetooth Low Energy (BLE) Connectivity	Introduction of PSoC 6 MCU with Bluetooth Low Energy (BLE)
PSoC Creator Component Datasheets	
Pins	Supports connection of hardware resources to physical pins
Low Power Comparator	Supports low power comparators
SysInt	Provides SysInt component settings
Device Documentation	
PSoC 6 MCU: PSoC 63 with BLE Datasheet	PSoC 6 MCU: PSoC 63 with BLE Architecture Technical Reference Manual PSoC 6 MCU: PSoC 63 with BLE Registers Technical Reference Manual
Development Kit (DVK) Documentation	
CY8CKIT-062-BLE Pioneer Kit	

Document History

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*A	5975021	AJYA	11/24/2017	Initial Public Release

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