

## Experiment #2

### Software Tools and Pulse-Width Modulator

#### Getting Started with the TMS320F28027 LaunchPad and the Analog Discovery 2

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The objectives of this short experiment are:

- To install the Code Composer Suite development system on your local computer, and produce an open-loop PWM output signal with the LaunchPad board, having a desired switching frequency and duty cycle.
- To install the Waveforms software on your local computer, and capture oscilloscope waveforms using it and the Analog Discovery 2 USB device.
- To begin construction of your prototype on the perfboard, including installation of the LaunchPad.

This experiment requires the following components and equipment from your parts kit:

- LaunchPad containing a TMS320F28027 microcontroller, with USB interface to your computer
- The Analog Discovery 2 device, including oscilloscope probes and USB interface to your computer (on loan from ECEE department)
- Perf board, binding posts (4), standoffs (4), superglue, soldering iron and solder

You will need your own computer, running either the Windows or the Mac operating system, with two USB ports.

Refer to the reference material and lectures for details related to the experimental procedure below.

### Experimental Procedure

1. See the course page “Microcontroller and Launchpad Documentation.” Follow the link at the bottom of this page to the Code Composer Studio (CCS) download site, then download and install CCS on your local computer. Connect the LaunchPad to your computer using the USB cable.
2. Follow the steps in the slides, “Setting Up the PWM Generator Project in CCS” to load the PWM Generator project, build code, and load onto the Launchpad target processor.
3. See the course page “AD2 Documentation.” Follow the link to the [store.digilentinc.com](http://store.digilentinc.com) site, and download the *Waveforms* software. Install on your local computer. Connect the Digilent AD2

device to your computer through a USB cable.

4. Follow the steps in the slides to use the oscilloscope probes to observe the PWM outputs on the Launchpad connector J6, pins 1-4.

## **Begin Perfboard Construction**

5. Install the large hardware on your perfboard: install the standoff legs in the four corners of the board. Install the binding posts for the converter input and output terminals.

6. Install header strips to connect the Launchpad connectors J1, J2, J3, J5, and J6 to your perfboard, and to mount the Launchpad on one side of the perfboard. Specifically, cut four header strips into ten-pin lengths, for connectors J1, J2, J5, and J6. Also cut a three-pin header strip for connector J3. You will need to align these on the perfboard so that the Launchpad connectors plug into these header strips.

Use the superglue (DAP RapidFuse Plastic Primer Adhesive Kit) in your parts kit to glue the header strips in place on the perfboard. Place primer on the bottom side of the header strips (where they will contact the perfboard), then place superglue and press onto the perfboard. Work quickly, and be careful to avoid getting superglue on your skin or in your eyes.

7. Solder wires to connect the ground terminals of the input and output binding posts, and the Launchpad ground (J3 pin 1).

## **PWM Setup and Report**

8. Take photographs of the top side and bottom side of your perfboard with the above steps completed.

9. Modify the PWM Generator Project code, so that the output on J6 pin 1 is a PWM signal having duty cycle of 40% and a switching period of  $14\mu\text{sec} \pm 0.1\mu\text{sec}$ . Measure this signal using your oscilloscope, and capture the waveform to document the result.

10. Submit a brief report documenting completion of the above steps. Your report should include your perfboard photos of step 8, your waveform of step 9, and the segment of C code where you set the switching period and duty cycle. Upload this very short report to the course site, to complete Experiment 2.

## Experiment 2 Grading Rubric

### Software Tools and Pulse-Width Modulator

1. Photographs of the top side and bottom side of perfboard show that binding posts and standoff legs have been installed, LaunchPad XL board has been mounted, and wires soldered to connect grounds of input, output, and LaunchPad. (10 points)
2. From *Code Composer Studio*, screen capture that includes the lines of C code used to set the PWM duty cycle to 40% and the switching period to 14  $\mu\text{sec}$ . (10 points)
3. From *Waveforms*, screen capture of oscilloscope waveform showing PWM output on header J2 pin 1, with switching period of 14  $\mu\text{sec}$  and duty cycle of 40%. (10 points)