Control Register

My name is Alan Hawse and this is PSoC 101. The status register lesson shows how to get information out of the hardware. The control register works the other way. It allows firmware to generate control signals in the hardware. We are going to use a control register to pick channels in a digital multiplexer and control the brightness of an LED without changing the PWM compare value.

Make a copy of the PWM project we did a while back. It has the PWM and red LED set up the way we need them. Edit the period and compare values for the PWM so the duty cycle is 25%. Use the full range of the 16-bit PWM by setting the period to 65535 and the compare to 16383.

You may have noticed that the PWM has two outputs – line and line_n –so far we have just been using line. Line_n is the complement output. If line has a 25% duty cycle, line_n has a 75% duty cycle. From one PWM you can drive an LED at two intensities.

What you need to do now is add a multiplexer component that will let you control which of the signals goes to the LED pin. Add a digital mux and edit it to have just two inputs. Connect the wires to the line and line_n of the pwm to the inputs of the mux. Then connect mux output to the pin

Now grab a control register and add it to the schematic. It only needs to be a one-bit register. Wire it to the select input on the mux and you have a design that will switch LED brightness under the control of firmware.

In C, create a NUM_CHANNELS #define and a variable to remember the current mux channel. In the main loop simply increment the channel number and write it to the register. Once you reach the maximum, cycle back to 0, which corresponds to the first channel.

You should be able to reproduce this design without too many difficulties. To make it more interesting, extend it to cycle between 4 brightness levels by adding states for fully on and fully off. Make the mux 4-bits wide and put a logic low and a logic high on the zeroth and third inputs. The tricky part, compared to the example we just did, is that you will have to use a bus to control the mux.

As always you are welcome to email me at alan_hawse@cypress.com.