

Digital I/O on the MSP430 Cont.

Ted Clifford

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0.1 Pullup/Pulldown

Only needed for inputs

Used to determine a change in input when the signal may be floating in an unknown state

0.2 Pooling

How do you monitor and use your properly configured digital I/O ports?

- By repeatedly checking if button status has changed
- Without the sw Delay main loop executes \ll 1 ms.
- First thing that happens in each loop is check the input

1 Clocks and Timers

1.1 Program control

- One or more control registers
- One or more data registers
- All are memory mapped

All register names and even control bit names are already defined in `mcp430...cmd` and `mcp430...h`

- Read from and write to register names as if they were C variables

1.2 HW Multiplier

It is used by writing operands to certain addresses (memory mapped!) reading results from different addresses

- First, write operand 1 to proper register (MPY, MPYS) to select mode
- It is a peripheral!
- Assembly has no multiply instruction
- CCS automatically uses HW multiplier to do integer multiplication

1.3 MSP430 Unified Clock System

Microcontroller and peripherals are synchronous sequential logic circuits.

- Need to be clocked

Before it can do ANYTHING, a CPU must have power and a clock signal.

1.3.1 What does a clock signal look like?

$$t_{clk} = \text{clock period} = 1 \text{ tic}$$

$$f_{clk} = \frac{1}{t_{clk}}$$

See slides for figures

Duty cycle is the percent of the cycle where the signal is 1

CPU clock provides provides the system's time reference

- Timers withing MSP430 count clock cycles to measure elapsed time
- Clock forms the time base for Whole System
- Real-time are derived from microprocessor's clock signals

1.3.2 Clocks on the MSP430

5 input clock sources to produce 3 clock sugnals to CPU and peripherals

- XT1CLK (LF Crystal) - 32768 Hz
- XT2CLK (HF Crystal) - 4 MHz
- DCOCLK (Internal Digitally controlled oscillator) - 10KHz to 25MHz
- REFOCLK (Internally generated) - 32768 Hz
- VLOCLK (Internally generated) - 10 KHz