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Serial Port Interface with 8-bit Shift Register

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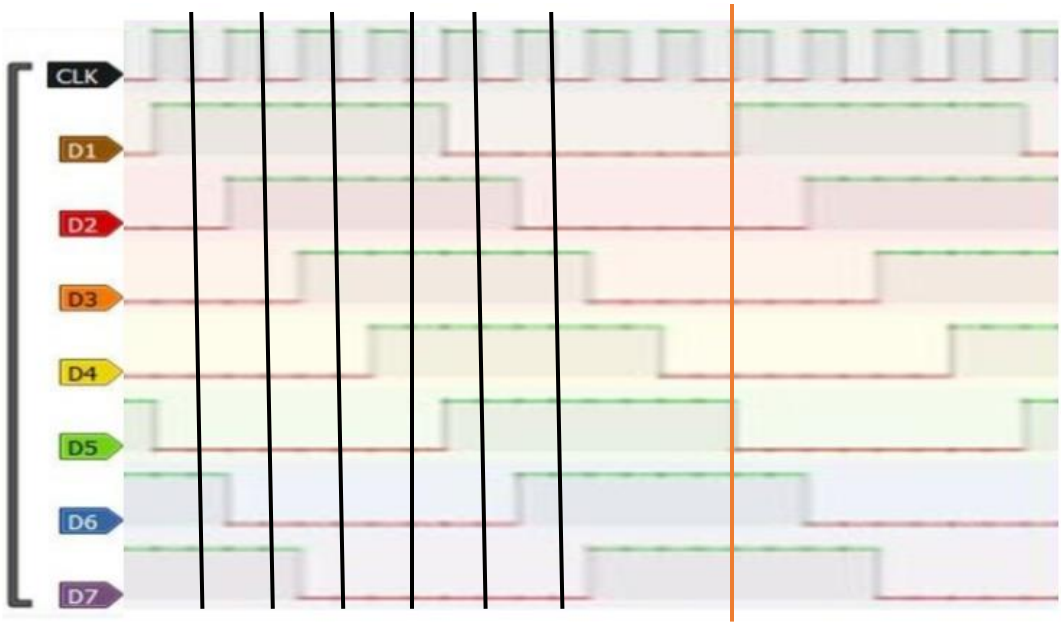

Description

Serial Port Interface (SPI) is a way for computers/devices to communicate with each other by transferring information one bit at a time. The above snapshot was taken from PulseView logic analyzer on a shift register. By connecting 1 data output pin to an 8-bit shift register, it essentially converts the 1 output pin to 8 output pins. As a part of SPI and the shift register, clock (clk) is important for coordination. The clock tells the device when to read the bits. In the picture above, there is a clock line and 7 data lines from D1 to D7 (using 7 of the 8 output pins). I used the falling edge of the clk signal (black vertical line) as a moment in time when the reading of the bit occurs. Therefore, the bits must be in a stable state when the reading happens. An example of an unstable state would be the rising edge (orange vertical line). As you can see, D1 goes from low (0) to high (1) during rising edge or where the orange vertical line is. This is because it takes time to change from 0 to 1. Therefore, the bit value should not be read until it fully converges.

The data sent out of the output pin is 0xF0 in hexadecimal or 0b11110000 in binary. As a result, in any of data lines there is 4 consecutive highs during 4 falling edges followed by 4 lows. D2, D3, D4 … is shifted to the right by 1, 2, 3 … bits respectively because it is the output of a 8-bit shift register. For example, if tried to input a bit into the shift register however storage at position 1 in the register is filled, then everything will get shifted down by 1. Consequently, all positions in the shift register is 1 bit behind its previous position.

References:

[1] *ATtiny817 Xplained Pro User Guide*, Microchip Technology, Chandler, Arizona, 2017

[2] "TDCG1050M, TDCG1060M, TDCR1050M, TDCR1060." Vishay Semiconductors, 23-Feb-2018.Data sheet for the Seven Segment Display

[3] "SNx4HC595 8-Bit Shift Registers With 3-State Output Registers." Texas Instruments, Dallas.

[4] "KSP2222A NPN General-Purpose Amplifier." Fairchild, SunnyVale, 2001.