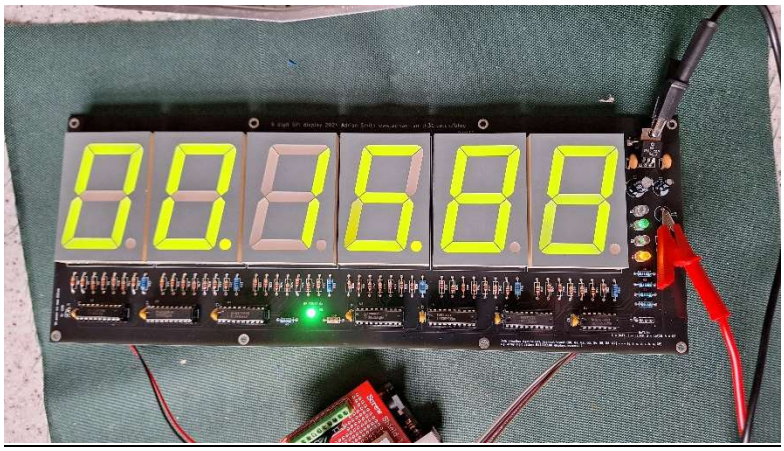
6 Digit display board with Serial Peripheral Interface



Thank you for purchasing my display board. This was designed and built at home by me when I found that such a product does not exist and I thought it would be useful for the hobbyist community. Sure there are MAX7219 based boards but they only drive displays up to 0.56". It is possible to drive larger digits with external drivers but it is cheaper to use the chain of shift register method instead.

This PCB can be used both as a development tool in conjunction with a microcontroller or could be used in a final one off project. It is built using through hole components for ease of assembly and uses high efficiency LED display modules giving a power consumption of around 700mA when all segments on all digits are lit. New, old stock displays have been used with salvaged modules on the first three PCB's to keep costs down. Diagnostic LED's on the data input lines will aid in troubleshooting code and / or connection issues.

Power input

The board should be powered from a 12V 2A regulated supply; a diode protects against reverse polarity connection and there is a 5V regulator on board which powers the IC's on the board. The LED modules are powered from 12V as they have a voltage drop of 8.4V (green) and 7.8V (red) – there are 4 LED chips per segment and two on the decimal points. The reverse polarity protection diode on the input gives approximately 11.4V on the anode pins. Segment current is between 13 and 15mA depending on the LED modules used as some are from different batches.

Data input and segment control

Data is input with the standard SPI interface and additionally the Output Enable pin is also brought out onto the data input connector. This, unlike the other inputs is active LOW so should be connected to ground to enable output or could be connected to a PWM pin on a microcontroller to control display brightness. Example code on my blog has this feature.

Data direction is right to left, that is the rightmost digit is the first shift register on the chain and the segments are connected to the shift register outputs in the following format:-

{Q0, Q1, Q2, Q3, Q4, Q5, Q6, Q7} --> {g, f, e, d, c, b, a, DP}

So, an example array for a 7 segment display would be:-

Hex {0x7e,0x30,0x6d,0x79,0x33,0x5b,0x5f,0x70,0x7f,0x7b}

Binary {B01111110, B00001100, B10110110, B10011110, B11001100, B11011010, B11111010, B01001110, B11111110, B11011110}

What you have to remember is unlike the 74HC595 which can sink and source current, the TPIC6B595 shift registers used on this PCB can only sink current as they are open drain outputs. A logic 1 will turn on a segment where a logic 0 will turn it off so if you are writing code that is designed for a 74HC595 it will work just fine but although the displays are common anode, treat them like common cathode. On a 74HC595 with a common anode display a logic 0 will turn a segment on and a 1 turn it off. This is the opposite way round as it would be for common cathode displays. This is just how the TPIC6B595 works, it is slightly different to the 74HC595.

LED indicators

The output enable pin is active LOW so should be connected to ground or a PWM pin for brightness control. The LED on the OE pin will light red if the output is disabled so if you have no display check this LED to indicate the OE pin's logic level. It will glow dimly if PWM is used to control display brightness on lower brightness settings. The other LED's will flicker or light with varying brightness levels depending on the signal duty cycle. Amber is used to indicate data is present whilst latch and clock pins will light in green. Ultra bright LED's have been used to show something even if the duty cycle of the input signal is very low. They light very bright with only 1mA of current.

Other info

Demo code can be downloaded from my blog https://www.adrian-smith31.co.uk/blog and a YouTube video can be found at https://youtu.be/eKuvKOkwBKw

If you have any questions, please comment either on the blog post or on the YouTube video.

Thanks,

Adrian