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## New Tri-Color LED Driver Minimizes Control Lines on MCU

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### APPLICATION NOTE

When it comes to driving LEDs, a serial bus connection eliminates the need for many connections to the MCU. The SPI—Serial Peripheral Interface was introduced in the '80s by Motorola and been around for many years. It is still very popular, and the purpose of this note is to show how to use a two standard new open drain shift register to interface an MCU. ON Semiconductor is introducing a new shift register especially aimed at driving the newly available tri-color LEDs (red, green, blue). The NLSF595 may be used as an SPI peripheral, or with standard I/O.

#### Circuit

The design calls for driving 5 tri-color displays from either an SPI (data, clock, enable) bus or simply from 3 I/O pins. Only 1 pin needs to be dedicated to the display, the Enable (bar) pin. Operating voltage is assumed to be +2.7 V, with the LEDs operating from +5.0 V. The MCU is providing the data to the 5 tri-color LEDs via this new device. The MCU writes the 16 data bits as two 8 bit words (one extra bit), in serial form, and latches the data. The display is driven and can be ignored until it needs to be changed. The NLSF595 includes a shift register, a latch and 8–12 mA drivers in one inexpensive 16-pin package. The outputs are open drain, so they may be operated at a different voltage from the main supply. Two or more devices may be cascaded together to drive many multiple LEDs. Although

the diagram shows 15 total segments, a larger number of drivers may be used for more LEDs. In all cases just one data line and one clock line are needed, and one or more Enable lines depending upon the circuit requirements. The NLSF595 is an 8 bit device. It is capable of sinking 12 mA or more. Resistor values should be calculated assuming the part will have about a 0.5 V drop under normal usage. The microcontroller (any with an SPI output) is assumed to be in the MISO mode, Master IN Slave OUT. The 595 is a slave peripheral, or 3 I/O lines of the MCU may be used.

Figure 1 shows two NLSF595s in cascade. The LEDs are connected common anode, to a 5.0 V supply. The diagram shows 220  $\Omega$  resistors series limiting resistor which will allow  $\sim$ 12 mA of current. The two devices are cascaded, with the serial out pin feeding the serial in pin of the second device. Connections to the MCU are simply Data, Clock, Enable (low). If there are more SPI devices, the only pin dedicated to the function, is the EN pin, which is a negative going latch enable.

#### Conclusion

The NLSF595 makes interfacing multiple tri-color LEDs easy and trouble-free. Two devices can drive 5 independent tri-color displays. If needed, any unused outputs may be paralleled for increased drive output.

# AND8091/D

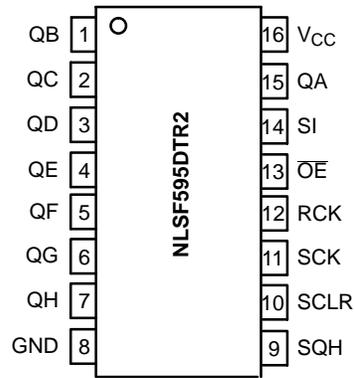
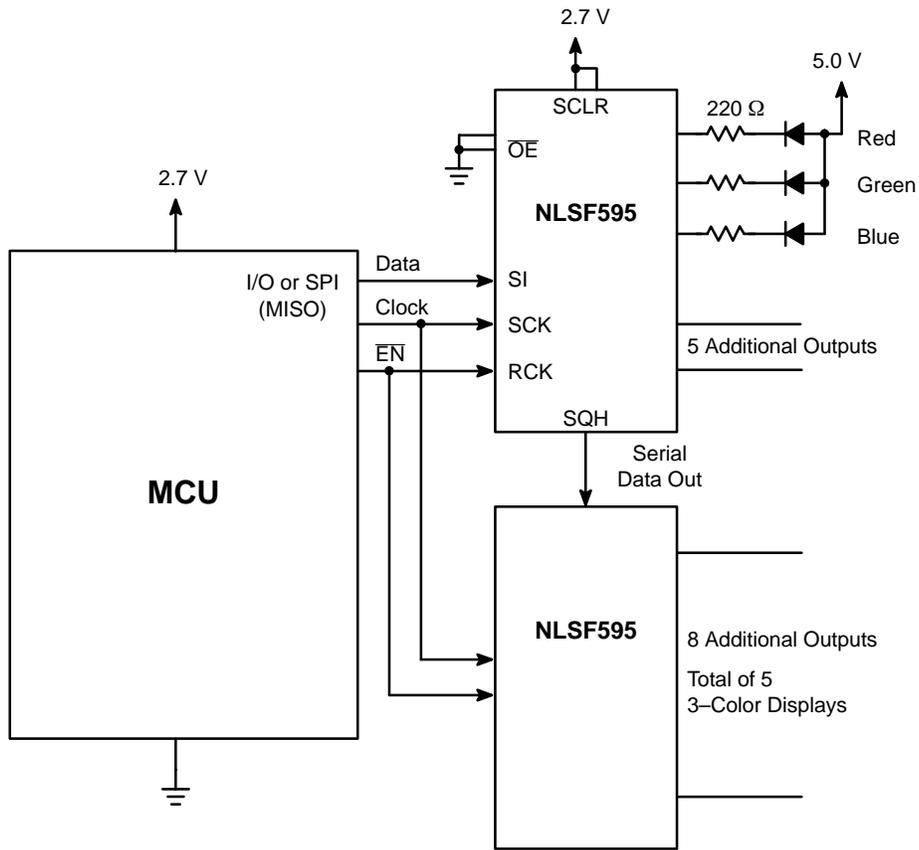


Figure 1. NLSF595 Shown Driving 5 3-Color LEDs

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