TPIC6C596 Input Interface Routing

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The TPIC6C596 is an 8-bit shift register with open-drain DMOS output structures designed to switch LEDs, relays, solenoids, and other low-current or medium-voltage loads. The device has five input pins; each input uses CMOS input structures without pull-up or pull-down terminations on the die. CMOS input structures have high-impedance characteristics that make them susceptible to noise and transients. The digital inputs are Schmitt trigger inputs, with hysteresis, to help minimize the likelihood that the device will respond to noise and transients, but the user should pay attention to the use of external components and the printed circuit board (PCB) layout to minimize the risk that noise and transients will reach the device.

Figure 1 illustrates a typical application example using the TPIC6C596.

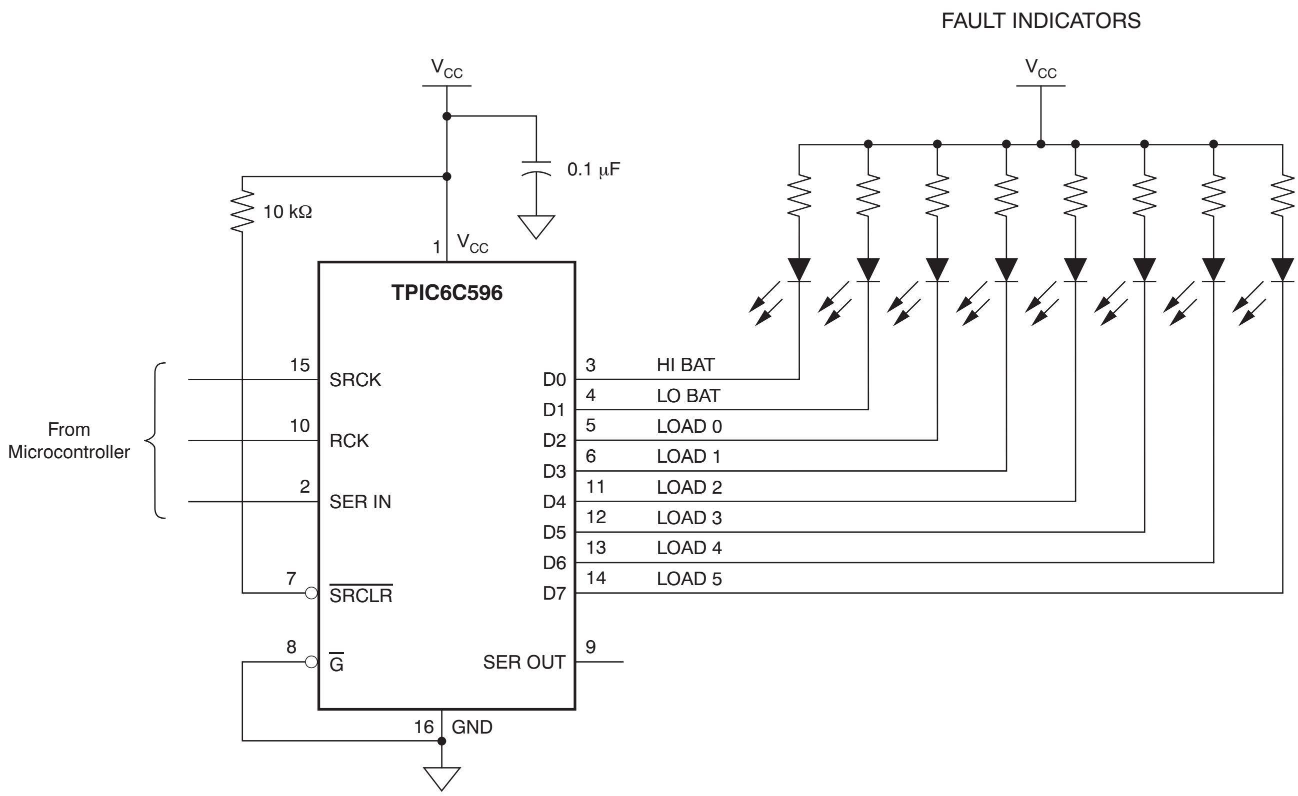

Figure 1. TPIC6C596 Used as Fault Indicator

The serial interface inputs (SRCK, RCK, and SER IN) are typically driven by a microcontroller with totem-pole output structures that provide a low-impedance signal path to the device. This routing path is generally less susceptible to false triggering from noise, but it is preferred to keep the routing away from signals with transients. The Serial Clear ($\overline{SRCLR}$) input allows the user to clear all registers on the device and initialize the device. The Output Enable, $\overline{G}$, input allows the user to disable the output stage and turn off the loads without clearing the registers or affecting serial data passing through the device. These inputs are typically driven by a microcontroller, but they can be disabled if the respective functions are not needed. The Serial Clear function can be disabled by pulling the $\overline{SRCLR}$ input pin to a logic high. This connection can be a direct short to V_{CC}, but a connection through a series resistance provides buffering from voltage and current transients. The Output Enable function can be disabled by connecting the $\overline{G}$ input to ground. A resistor should not be required if the length of the connection path to ground is minimized.

The device has the capability to switch inductive loads, so transients will be present on the PCB traces around the device. The best approach to minimize the risk of inducing transients onto digital signals is to provide adequate spacing between the input signals and the noisy output signals. The recommended spacing is two to three times the width of the trace. Additional protection can be provided by placing grounded copper between the digital traces and noisy traces. Digital traces should not be placed in parallel with noisy traces on the opposite side of the PCB. Noise coupling can be minimized by crossing traces at a 90º angle. Figure 2 shows the recommended PCB layout.

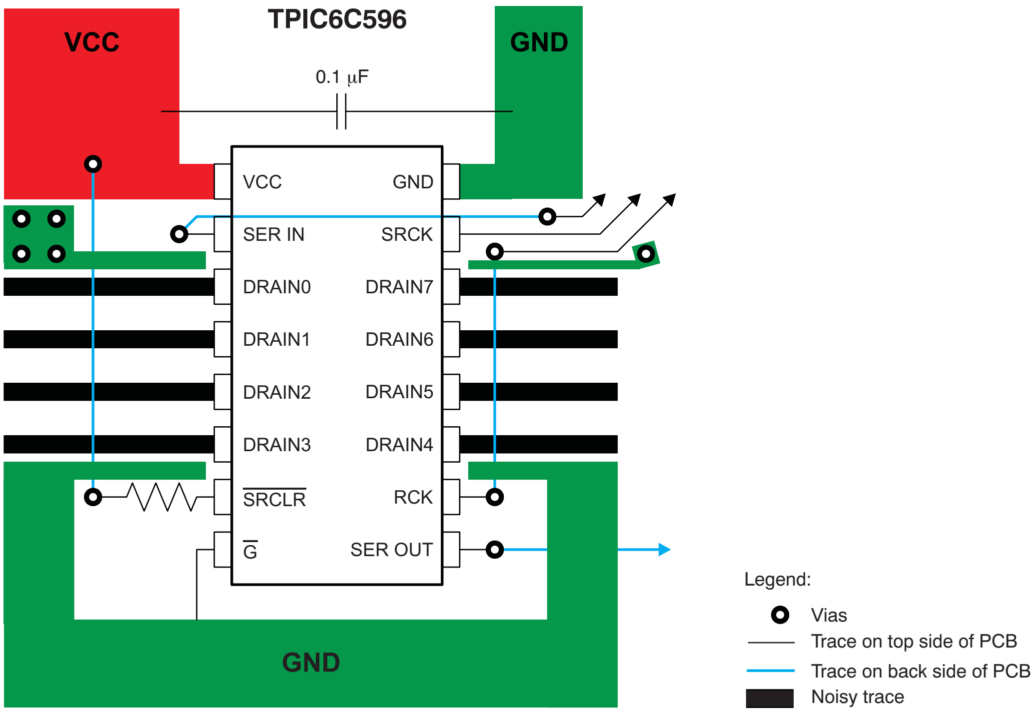

Figure 2. Optimized Layout

Follow these guidelines to achieve an optimized PCB layout for this device:

- Route digital signals away from power signals.
- Provide adequate spacing between signals.
- Place grounded copper fill between digital signals and noisy signals.
- Route sensitive signals at 90° from noisy signals.
- Place pull-up components close to the device to minimize the exposed high-impedance trace.
- Keep grounded connections short.

Some PCB layouts may not have the space to place wide gaps between signals, so care must be taken to minimize coupling onto sensitive signals. This coupling issue should not be a problem for the serial interface and $\overline{G}$ signals because they are connected directly to low-impedance nodes.

The SRCLR input may be pulled high through a resistor, so the value and placement of this resistor should be managed to minimize noise coupling into the device. The trace is low impedance between the resistor and voltage source, but it is high impedance between the resistor and the SRCLR input to the device. The resistor should be placed as close as possible to the device to minimize the length of the high impedance trace, and the user should place as much gap as possible between this trace and traces where noise and transients may be present. The value of the series resistance can also be reduced in order to lower the impedance of the circuit and reduce the susceptibility to transients coupling into the device. A capacitor can be placed from SRCLR to ground to help filter the transient, if the series resistor cannot be placed close to the device.

If the load conditions result in a very noisy operating environment that cannot be managed with board layout, then additional filtering can be added to inputs and outputs, as needed. Capacitors placed from pins-to-GND on inputs and the DRAIN(0:7) outputs help to filter out voltage transients that could potentially cause false triggers in the device.

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