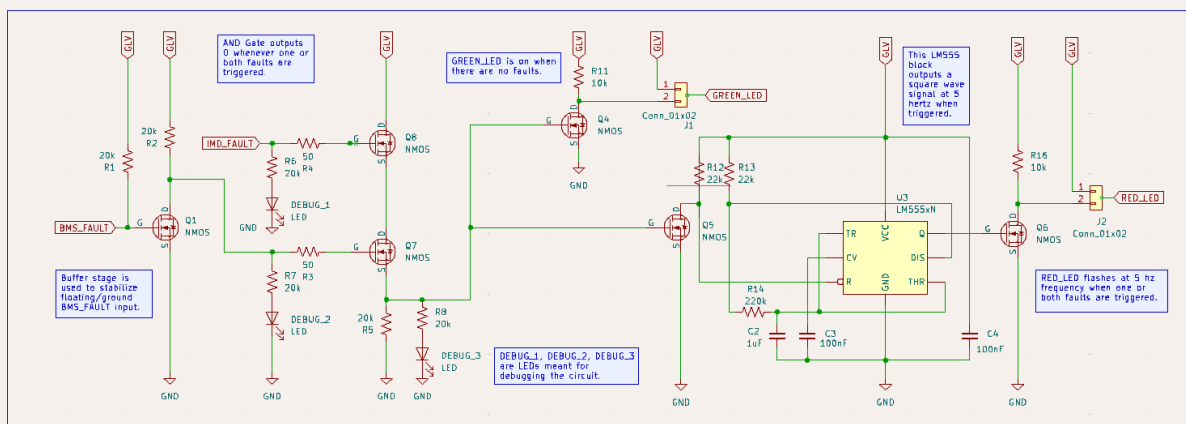
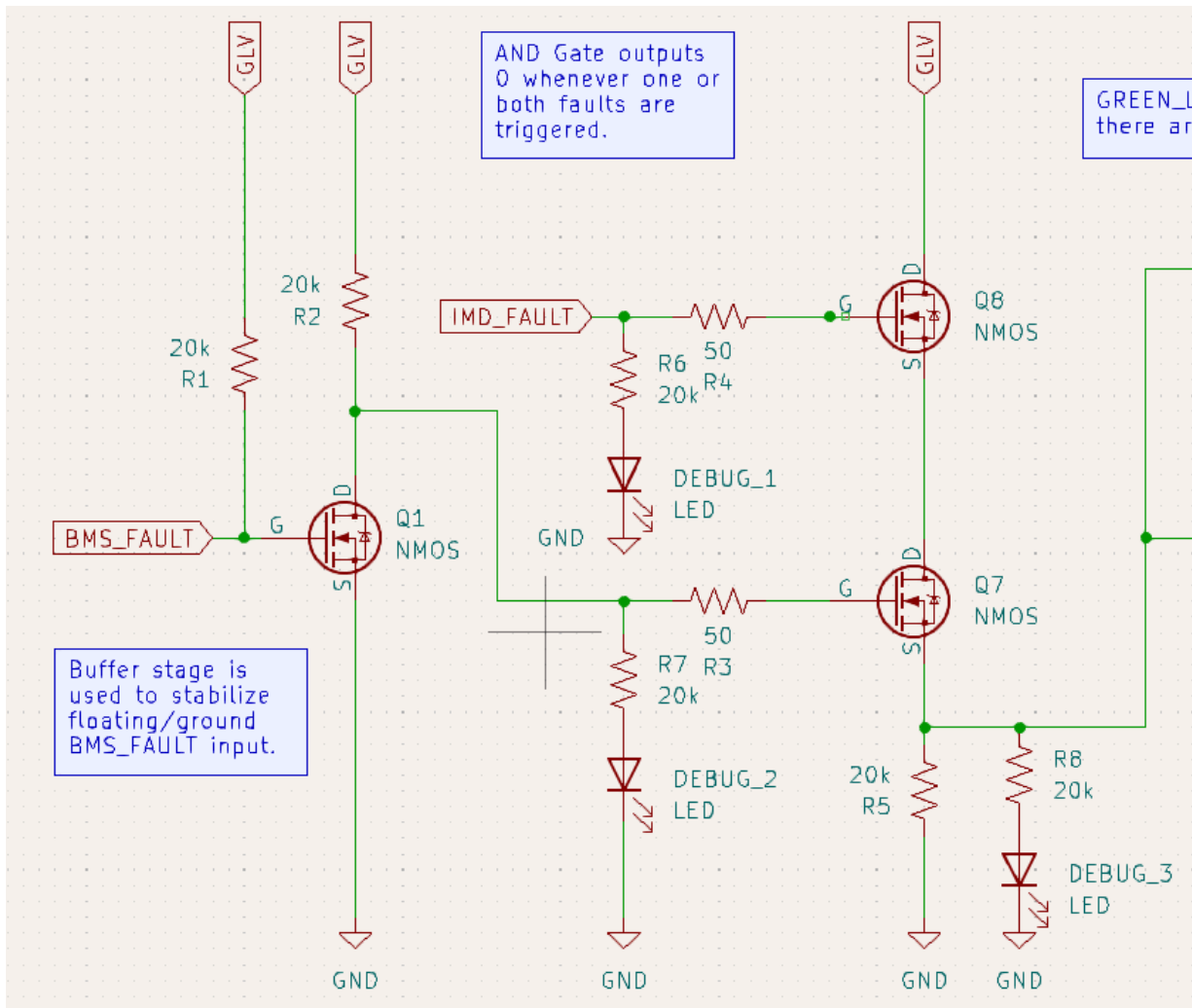


- Solid GREEN light when no fault is detected
- Flashes RED light when 1 or 2 fault(s) are detected

Schematic



Stage 1: Input



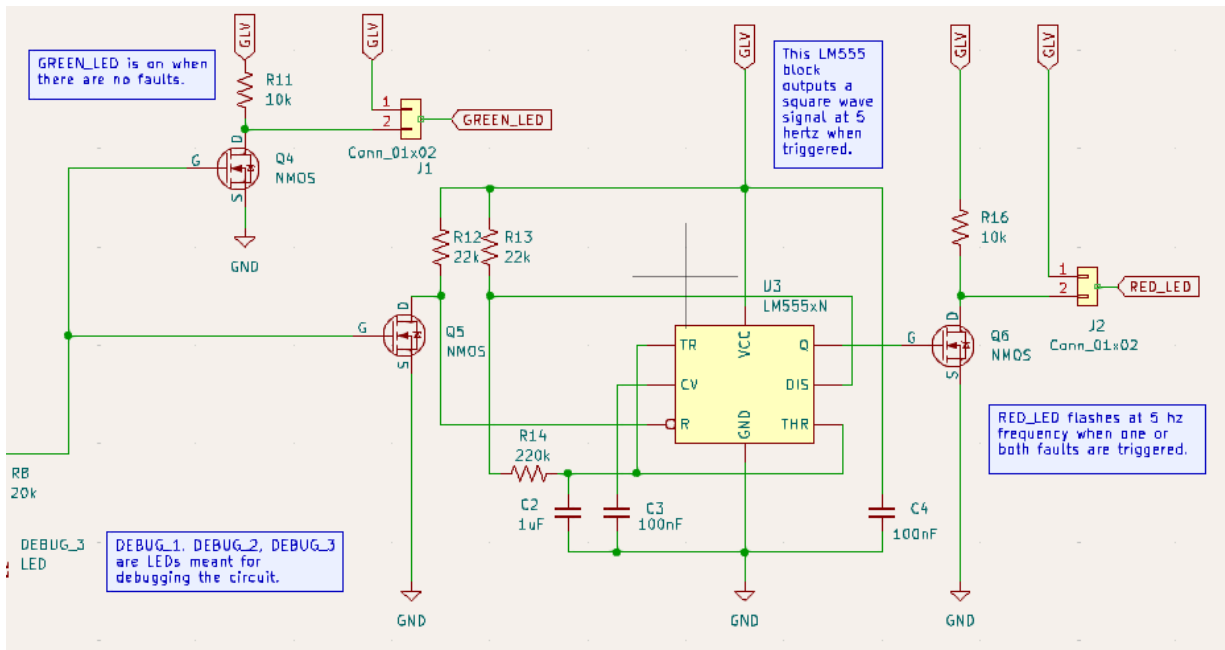
BMS_FAULT is an input with 0V or floating as its state. Thus, **R1** is used as a pullup resistor. NMOS **Q1** is used as an inverter.

IMD_FAULT is an input with 12V or 0V as its state.

NMOS pair **Q7** and **Q8** serve as an AND gate that turns off whenever either fault is triggered.

Resistor values, such as 20k and 50, can be replaced with similar values (i.e. 22k) that are more available/cheaper.

Stage 2: Indicator Lights



NMOS Q4 controls the GREEN led, while the 555 timer block produces a 5 Hz signal to trigger the RED led.

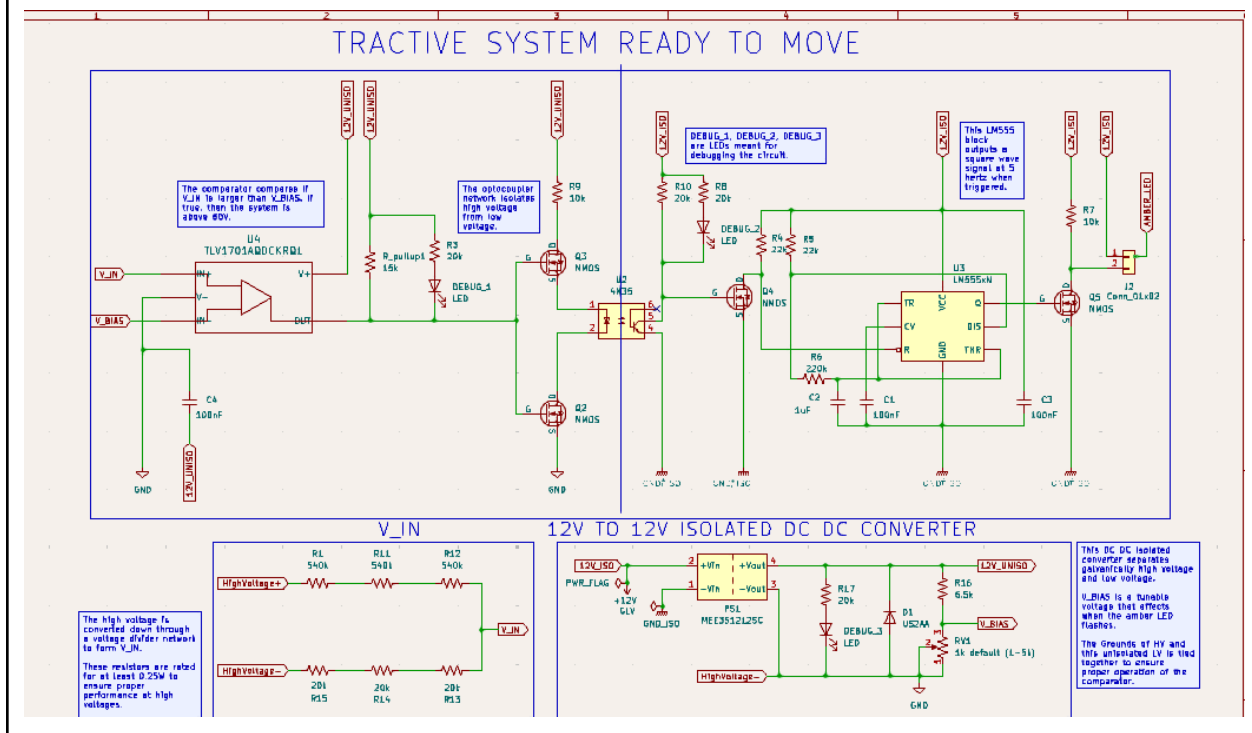
Note that both GREEN and RED leds are configured assuming the ground switching configuration.

TS Ready to Move

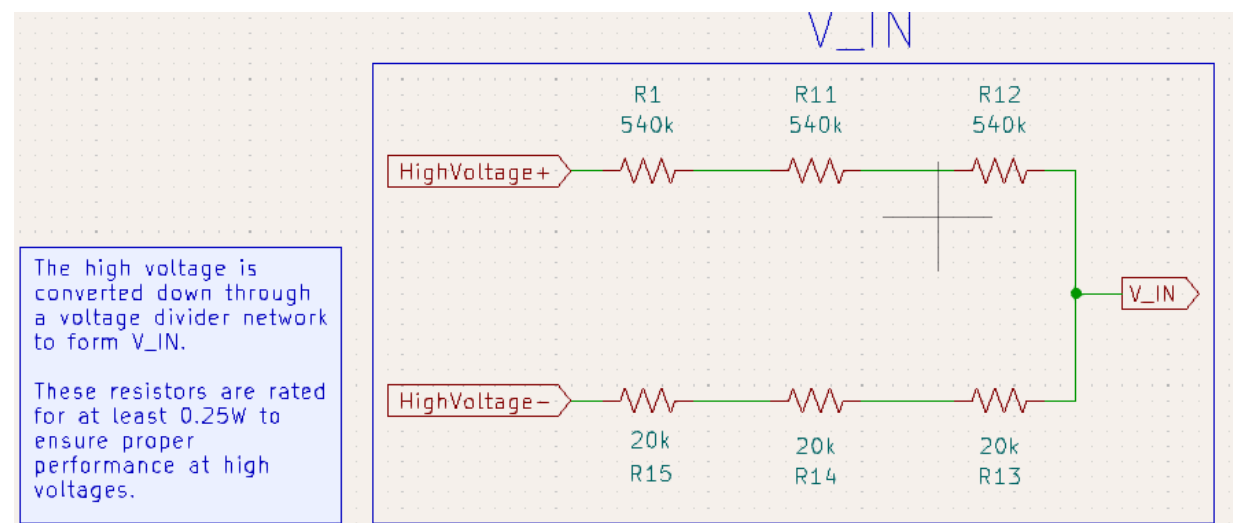
Purpose

- If the High Voltage is more than 60V, flash the AMBER LED.
- Ensure proper isolation between high-voltage and low-voltage systems.

Schematic



High Voltage Input

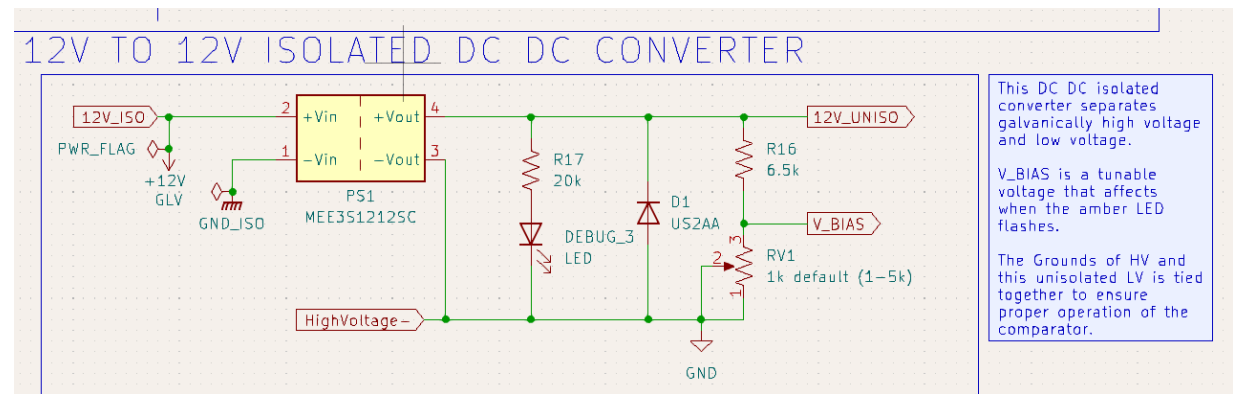


This is a voltage divider network that converts high voltage (up to around 460V) to around

12V.

Make sure the resistors chosen are rated for at least 0.25W or higher.

12V-12V Isolated DC-DC Converter

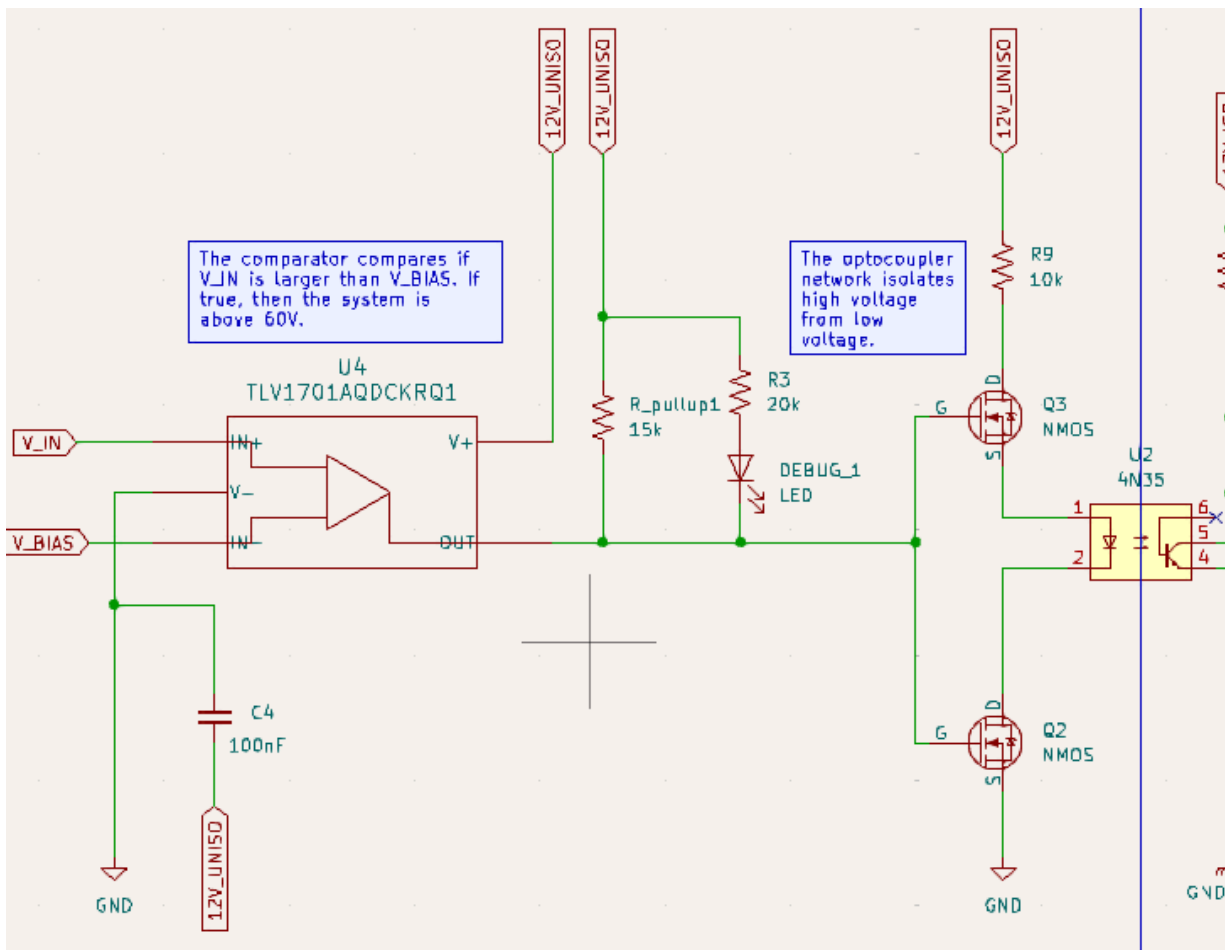


A 12V to 12V Isolated DC-DC Converter ensures that high voltage and low voltage are sufficiently isolated. Make sure to choose one with a voltage isolation of over 500V.

The Zener diode D1 is used as an ESD protection diode. Make sure it triggers at 15V to prevent excessive voltage.

There is a potentiometer (from 1 to 5k) that will be used to vary the bias voltage.

Input Stage: Comparator

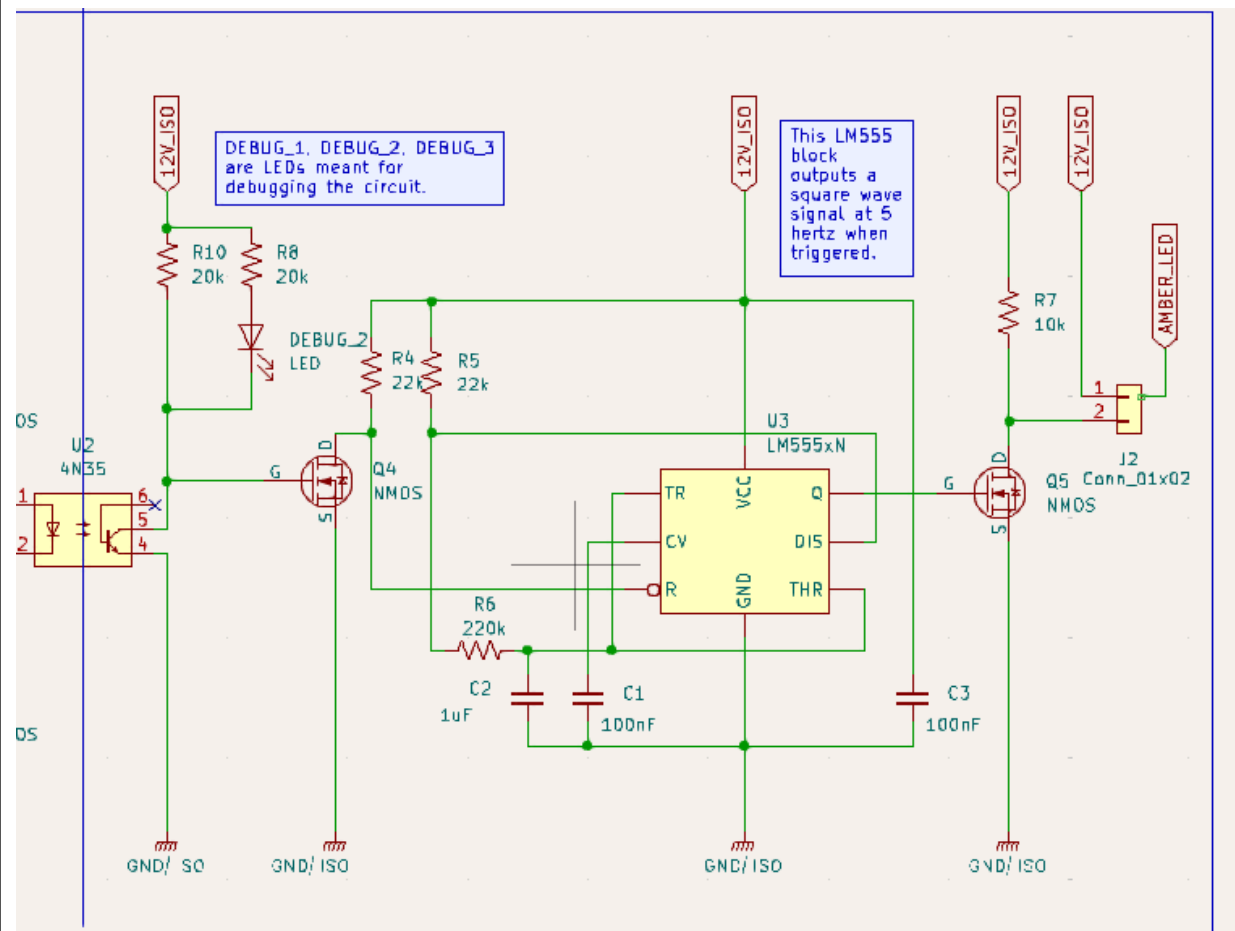


If V_{IN} is higher than V_{BIAS} , then it means that the high voltage is larger than 60 volts. Thus, this comparator will produce a high signal and turn on NMOS Q3 and NMOS Q2, which will turn on the optocoupler.

This NMOS Q2 and Q3 network helps to isolate the optocoupler when HV is floating, off, and on.

Resistor values (10k, 15k, 20k) can all be set to 22k (or any other **larger value**) for convenience.

Output Stage: Amber LED



The 555 timer block produces a 5 Hz signal to trigger the AMBER LED.

Note that the AMBER LED is configured assuming the ground switching configuration.

Capacitor values must be EXACT to produce a 5 Hz signal.