Another Low Cost Isolation Amplifier for Industrial Instrumentation Applications

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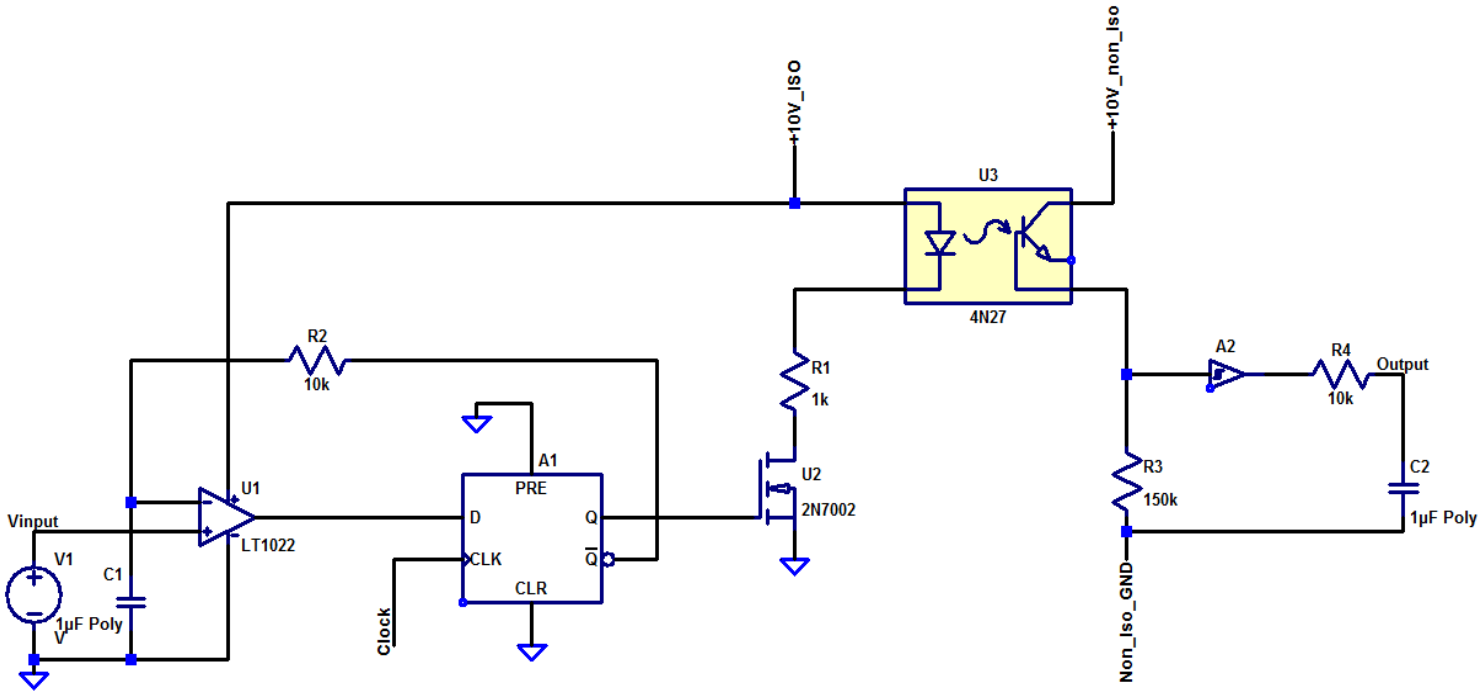

Another very simple and low cost isolation amplifer I designed about 20 years ago while working in the industrial instrumentation industry. U1 and the F/F, along with R2 and C1 form a simple delta modulator, which drives the opto, U3 via the 2N7002. The opto is configured to operate in photo diode mode, and the rise times across R3 are therefore very fast, which is critical for linearity in this design.

The output voltage across R3 (a pulse train) is buffered by the schmidt trigger (but two series inverters or buffers will also work just as well) and feeds a low pass filter consisting of R4 and C2. For an input signal of 2-10V, Vout is also 2-10V, although you can easily scale it by changing the supply voltage on the isolated side.

By offsetting the input by 20% (typical in the process instrumentation world), you can get away with a single polarity supply for the op-amp, and improve the overall linearity. Performance for this circuit:- 12mA current consumption overall with linearity over 2-10V 0.01% (100ppm). Use a FET input op-amp for best results. The clock source is not critical at anywhere between 10and 30KHz, as long as it is free from excessive jitter.

The response time for a 10-90% step change is measured in 100's of ms, but for many applications this is ok. You can dramatically imprve the response time by placing two low leakage, low capacitance diodes in an anti-parallel connection between the inverting and non-inverting input pins of the op-amp. This will only work of course if your input source can source or sink the current required to charge or discharge C1.

Note, both the iso and non-iso supply rails form the reference voltages for the modulator and demodulator. Therefore, these need to be well regulated and noise free. It is quite a simple matter to do this using some 5V references. Long term dfrift and thermal drift performance will be determined by these reference voltages, and the op-amp drift performance