

LM5060

Reverse Polarity Protection

July 2015

TI Hot Swap Team

Goal

- To record test results of the LM5060 solution with the following features:
 - Reverse hookup/ input polarity protection
 - Gradual overcurrent protection
 - Reverse current blocking

Schematic

Figure 38 Example Circuit Specification	
Operating Voltage Range	9V to 24V
Current max	30A
OVP setting	27V typical
UVLO setting	9V typical

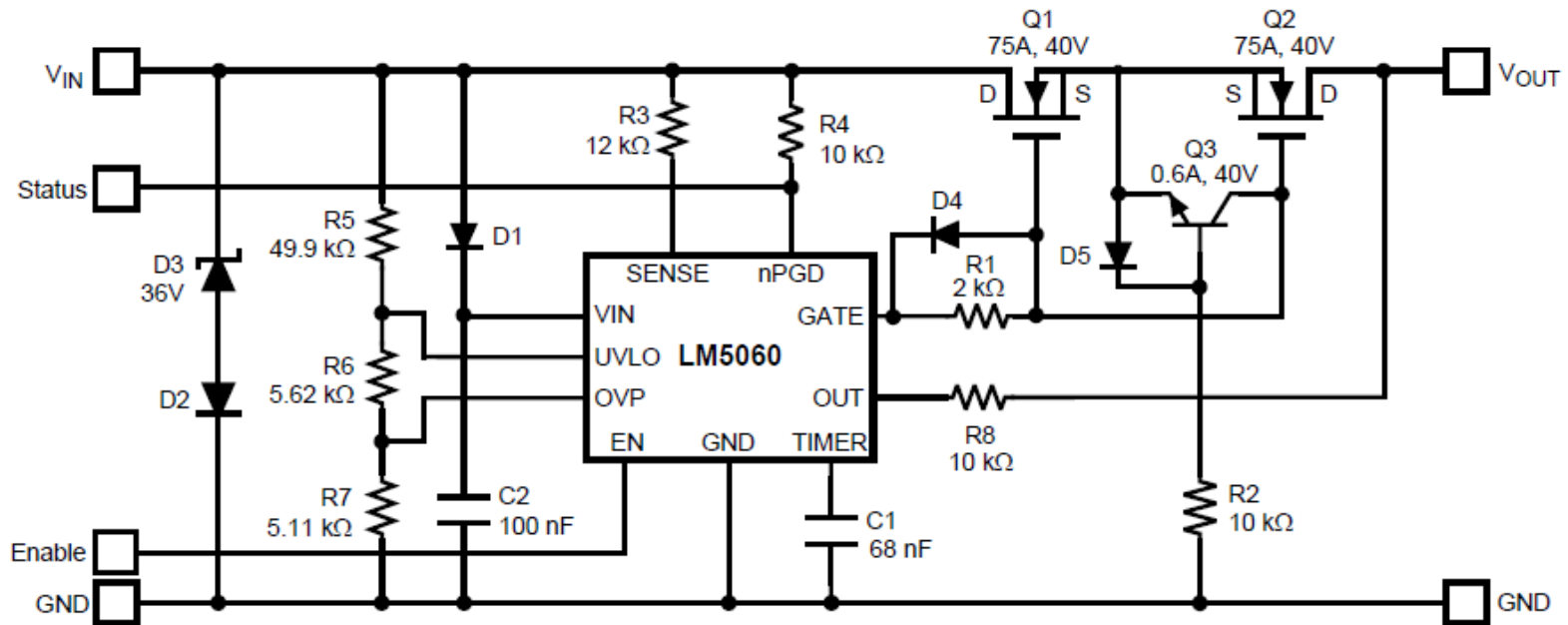
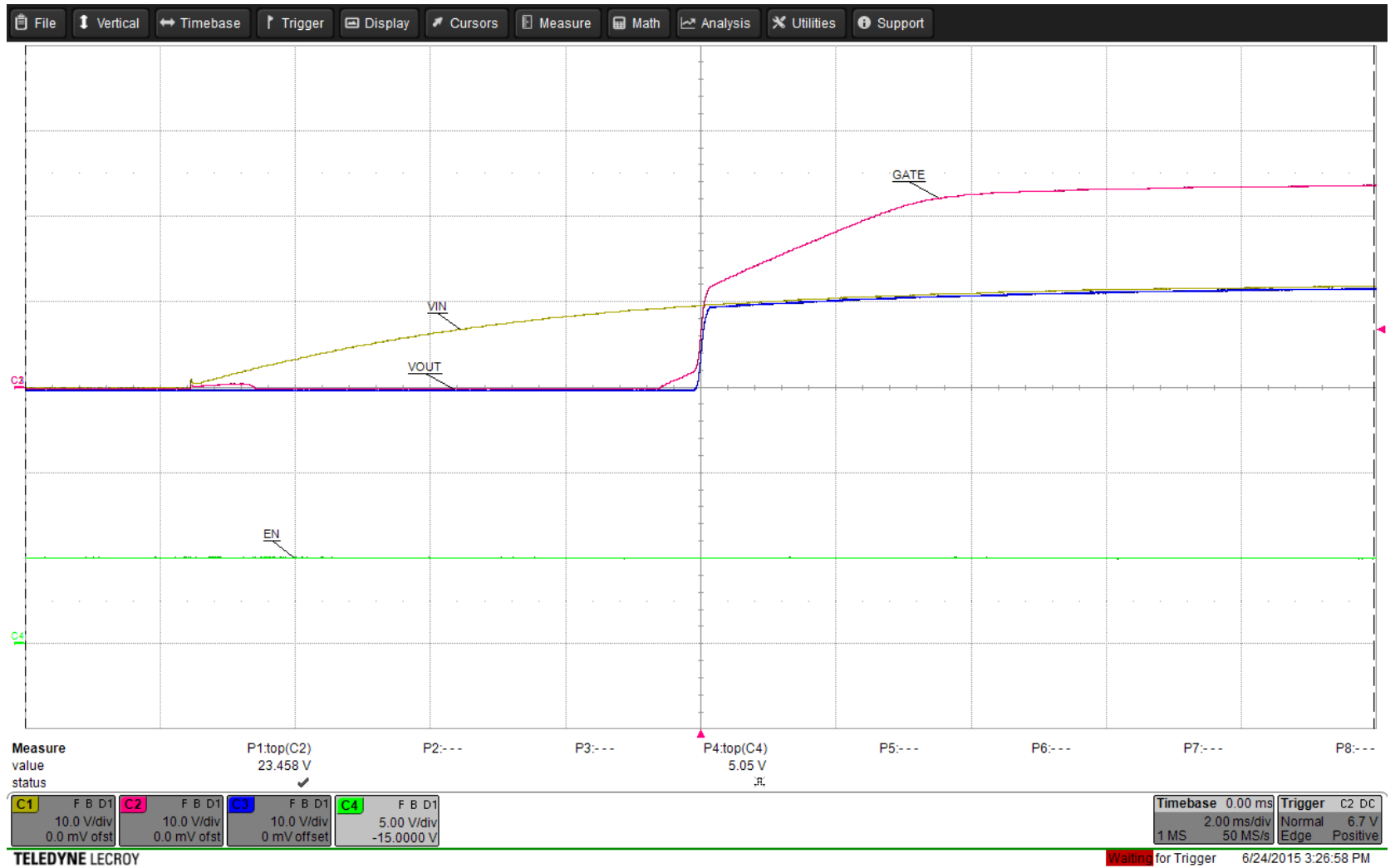


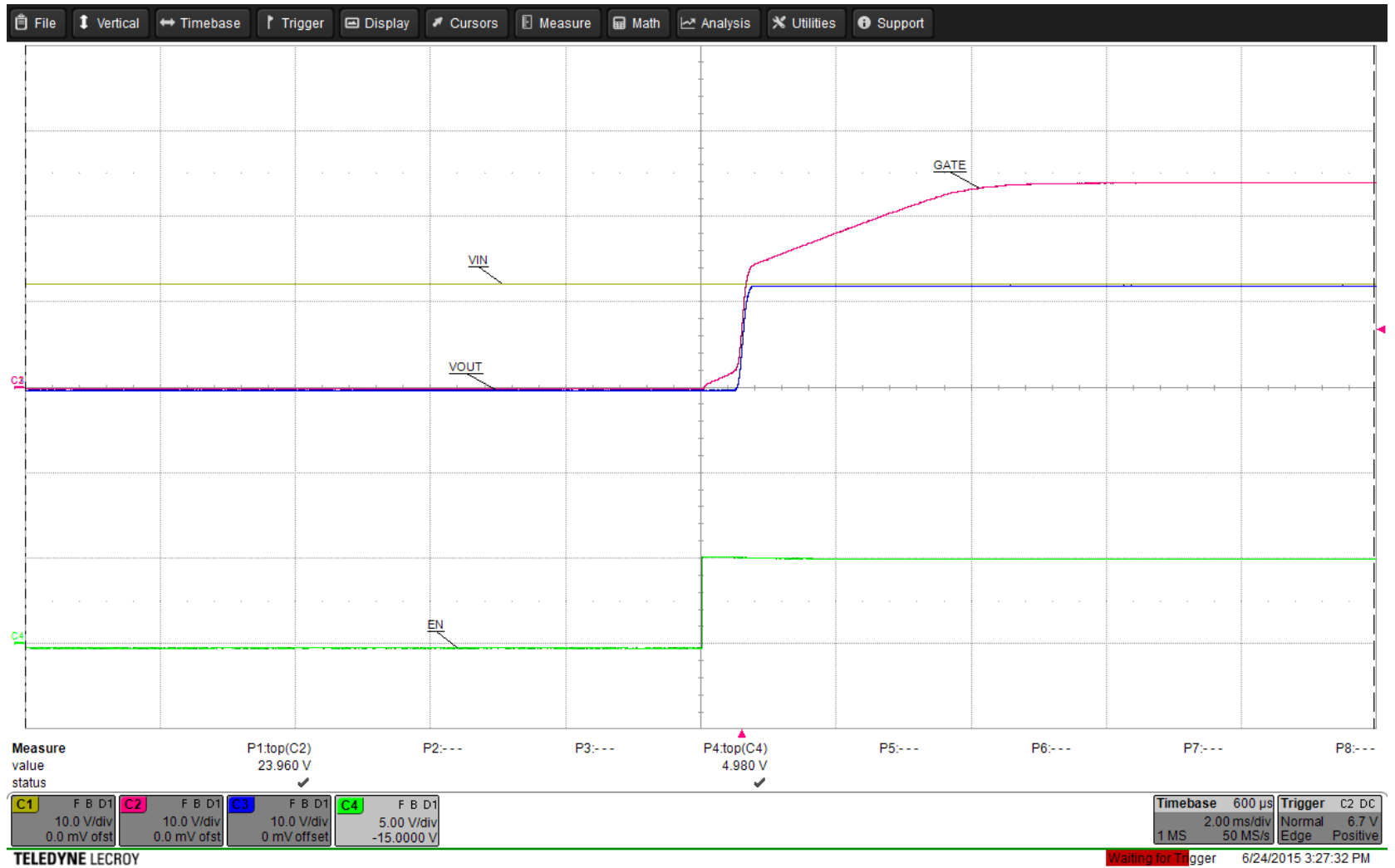
Figure 38. Application with Reverse Polarity Protection with a Resistor for OUT Pin Protection

Basic Tests

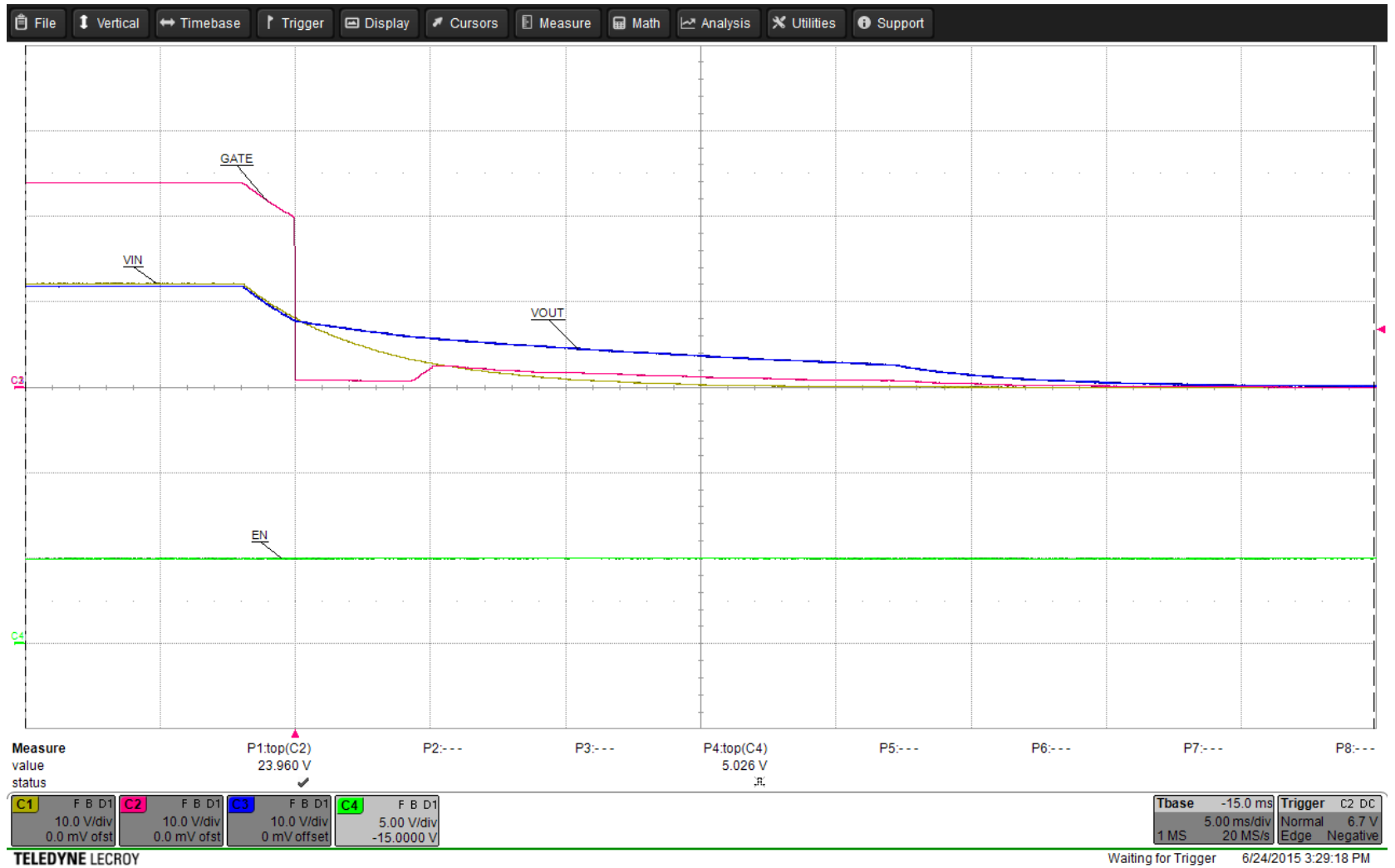
Start Up No Load – VIN



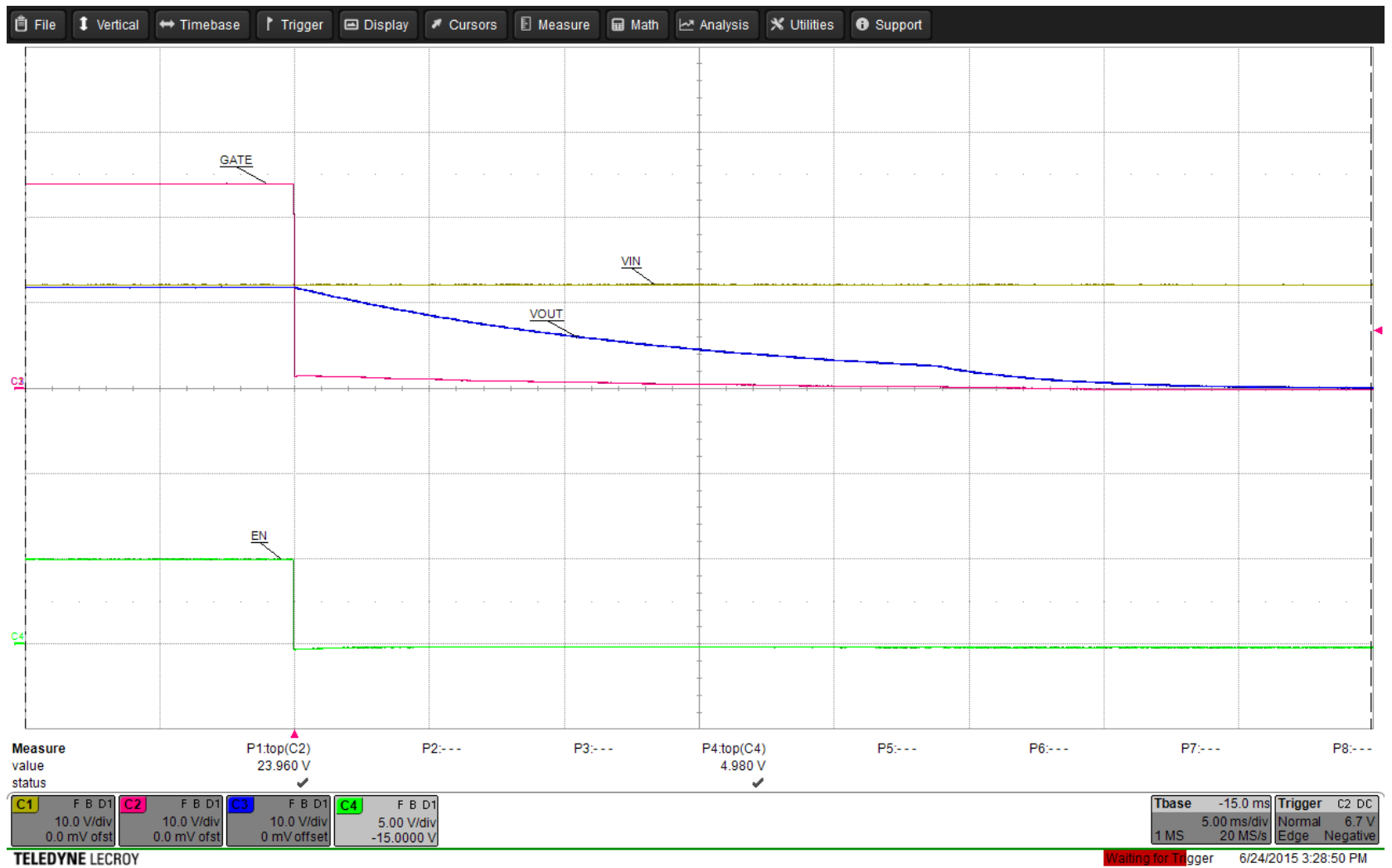
Start Up No Load – EN



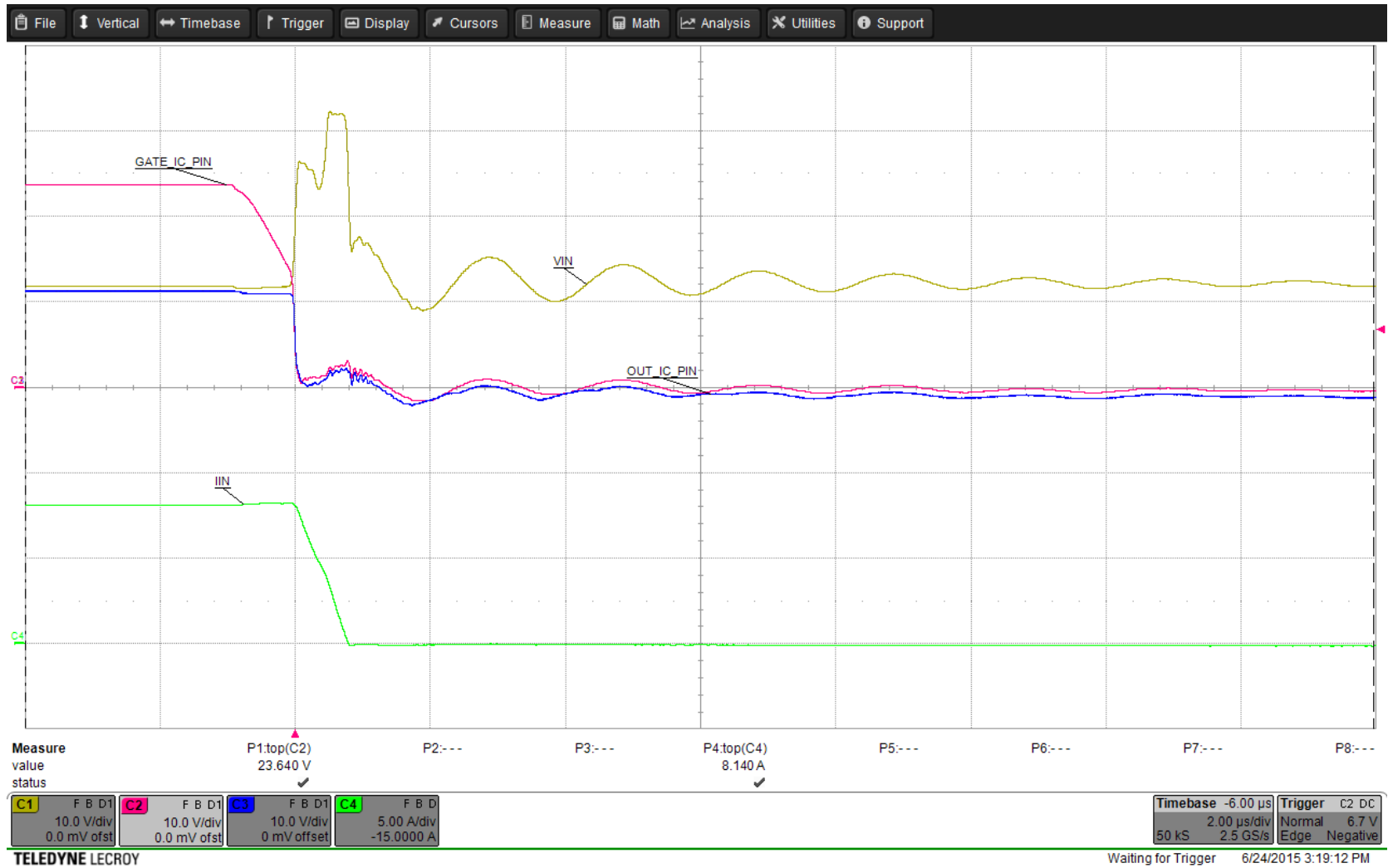
Shutdown – Vin



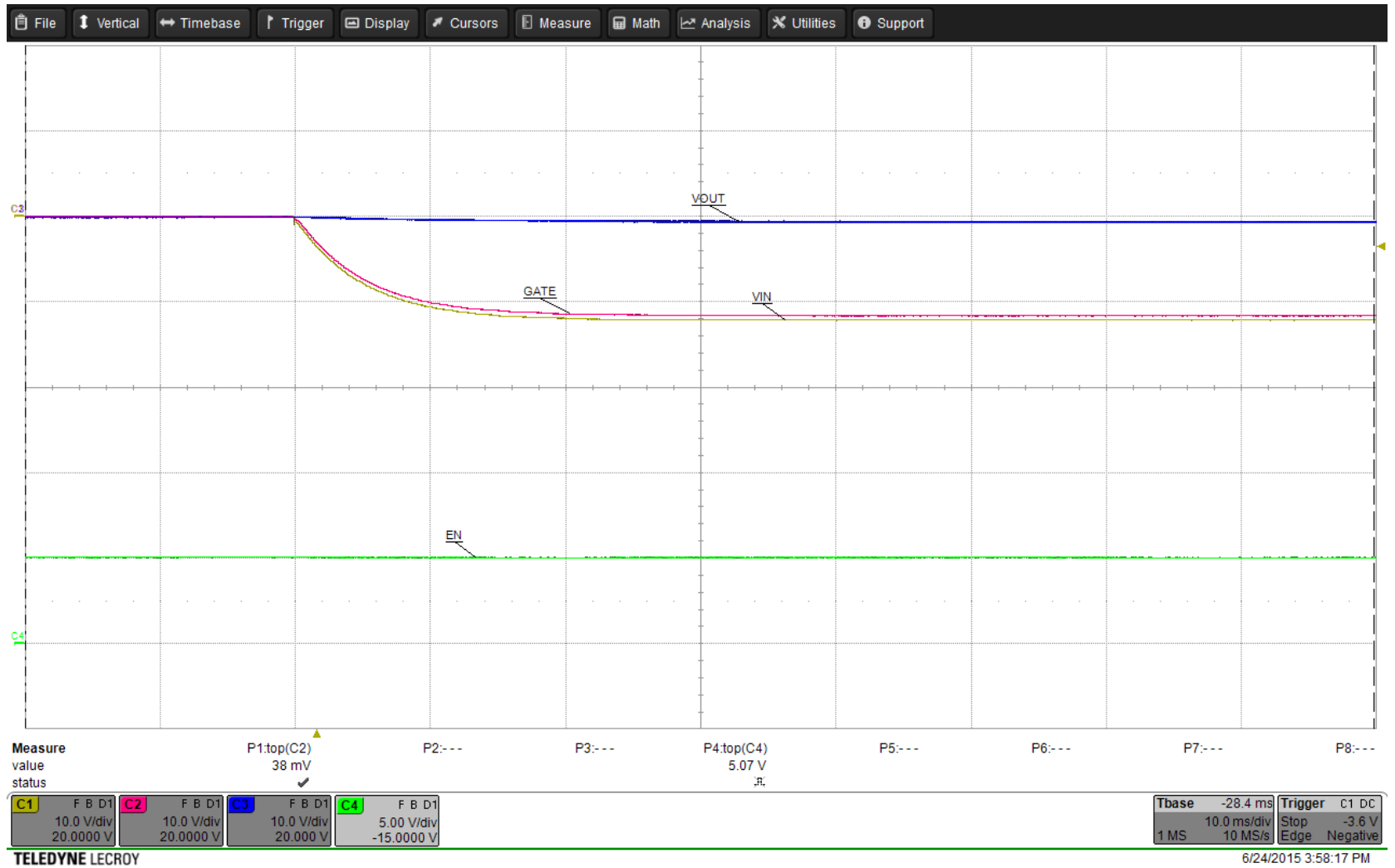
Shutdown – EN



Gradual Overcurrent Shutdown

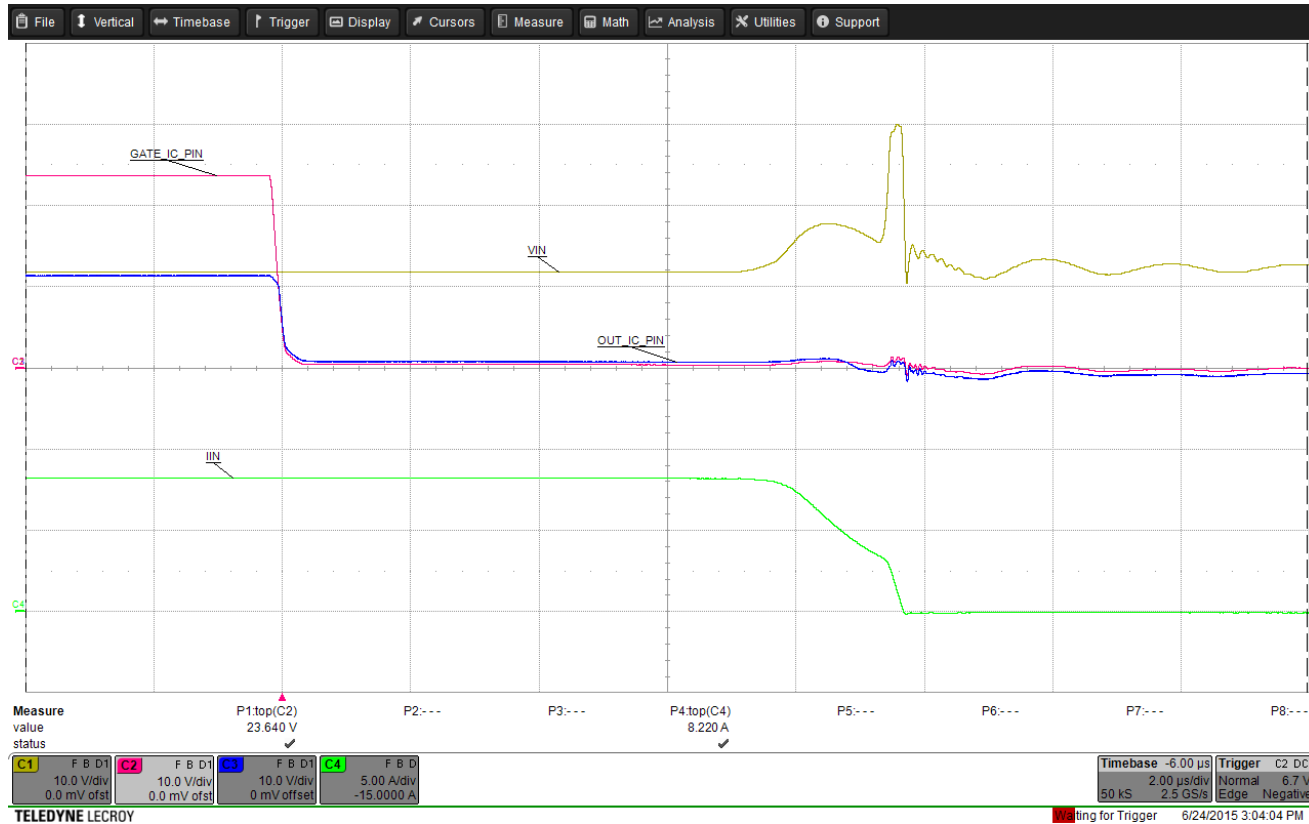
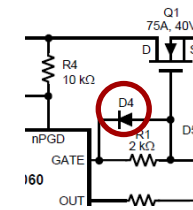


Reverse Polarity



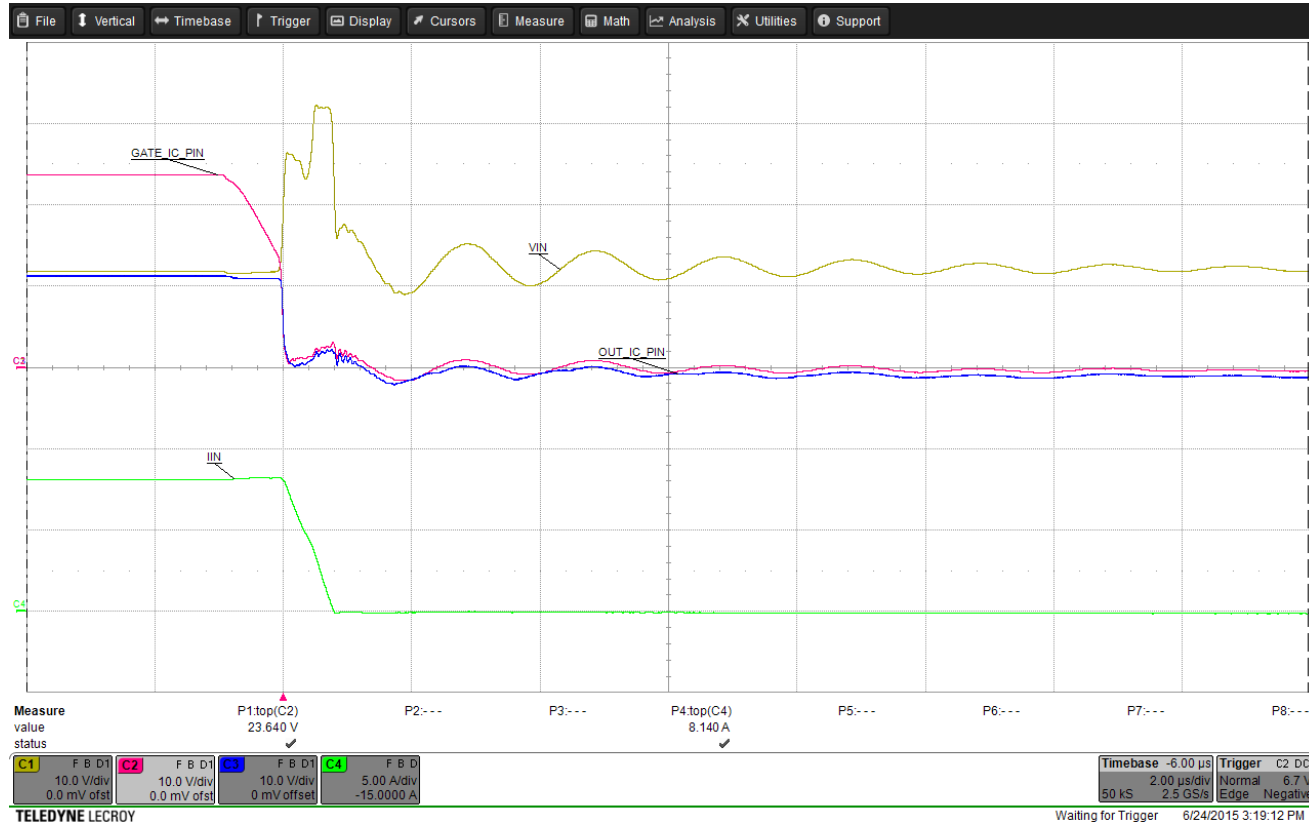
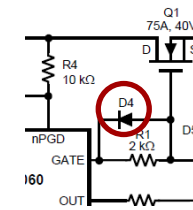
Advanced Tests

Effect of D4 diode



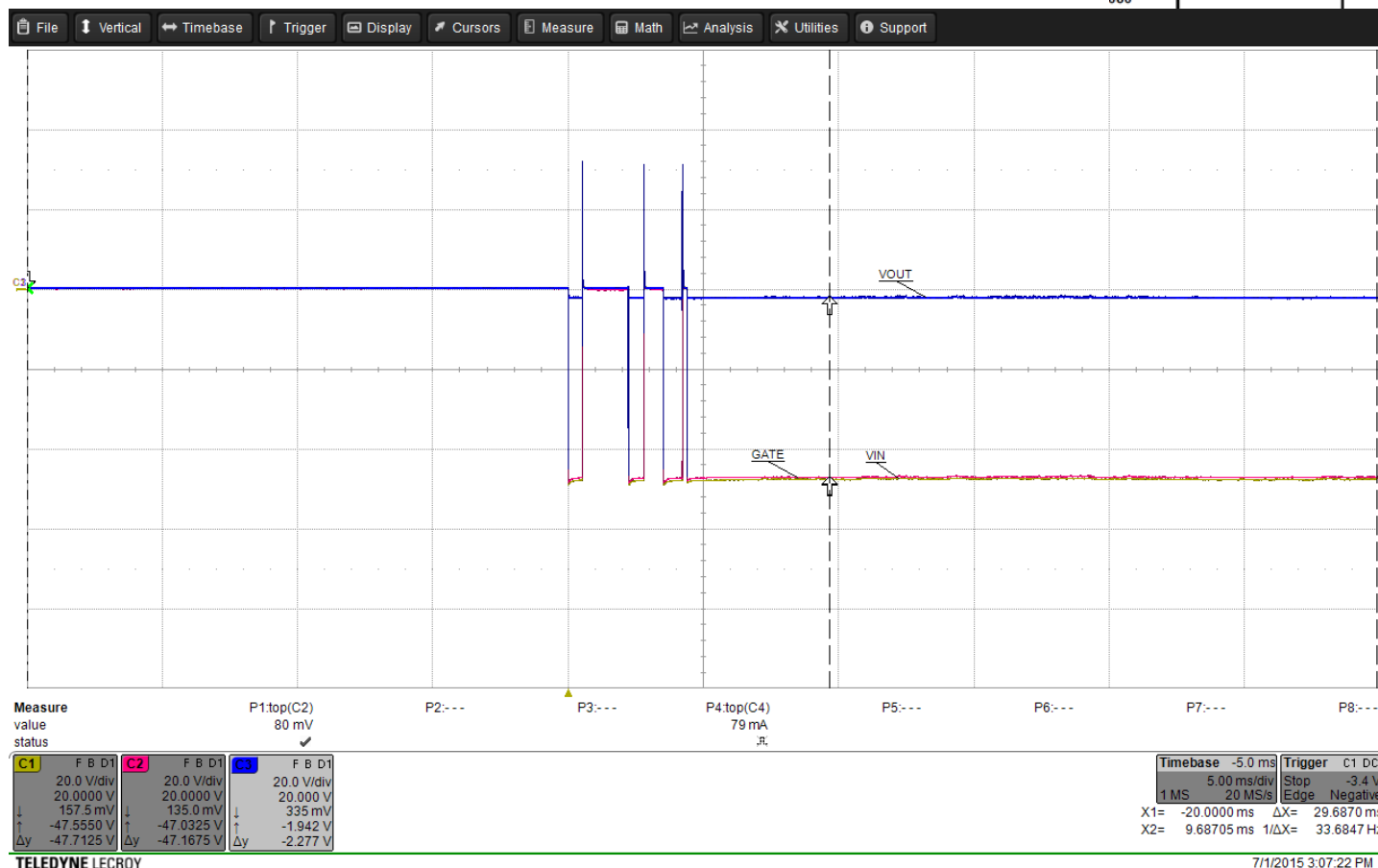
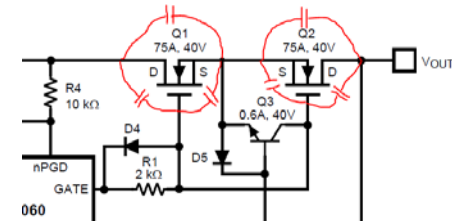
Without D4, gate pull down current is limited by gate resistance. The GATE_IC_PIN pulled low, but current (IIN) did not stop until 10us later. With higher gate resistances this time can be longer.

Effect of D4 diode (cont'd)



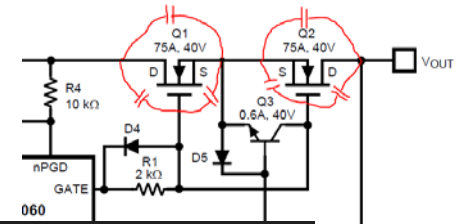
With D4, gate pull down current is **NOT** limited by gate resistance.
The GATE_IC_PIN pulled low, and current (IIN) was reduced with it.

VOUT vs VOUT_IC_PIN



Instead of a gradual reverse polarity voltage, this waveform shows a hot-plugged reverse polarity input. Note the voltage spikes on VOUT occur because there is no load and because of the large dv/dt of VIN and GATE.

VOUT vs VOUT_IC_PIN (cont'd)



If we perform the same test but look at the IC_PINS for VIN, GATE and OUT, then we don't see those spikes.

Summary

- The LM5060 solution (Figure 38 in current datasheet) has passed tests for:
 - Startup
 - Shutdown
 - Reverse Polarity Input
 - Gradual Overcurrent Shutdown