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NIS5x2xGEVB

NIS5x2x Evaluation Board User's Manual

eFuse test board with multiple subcircuits for evaluation of overvoltage protection, overcurrent protection, controlled slew rate, and thermal shutdown features

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EVAL BOARD USER'S MANUAL

Introduction

eFuses serve a variety of purposes for electrical system designers. They may be found connected to 3.3, 5, 12, and 24 V power rails and have many interesting features.

The primary features of eFuses are:

- Current limiting (adjustable on a few models)
- Overvoltage clamping (except on NIV6124)
- Undervoltage lockout
- Enable/Fault control
- Thermal shutdown
- Controlled slew rate
- Reverse current protection on some devices such as NIS6xxx

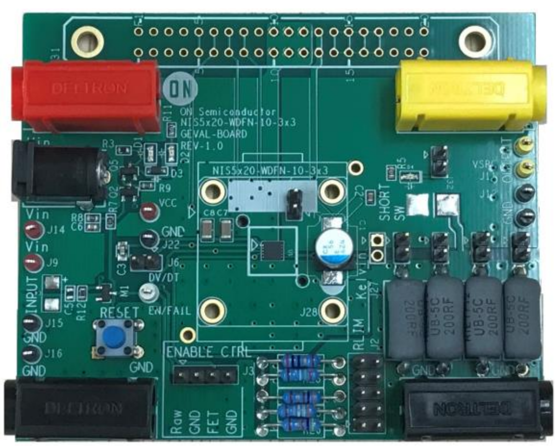

Figure 1: The NIS5x2xGEVB evaluation board

This evaluation board has many features which make it simple to observe the functionality and performance of the new 12 V NIS5x2x line of eFuses. This manual documents the use of this board with the NIS5020 latching eFuse. The properties of the NIS5x2x evaluation board include:

- Multiple connectors available for all eFuse pins (VCC, GND, SRC, enable, ILIM, dv/dt)
- Input and output capacitors
- A pushbutton switch and a MOSFET connect the enable pin to GND or float it as needed
- Green and yellow LEDs to indicate whether the eFuse enable pin voltage is high (device enabled) or low (device disabled)
- Five current limit resistor options available directly on the board (20, 25, 30, 35, 40 Ω)
- A jumper option to short circuit the load. Output and GND pads are also provided for the same purpose.
- Kelvin or direct sensing options via the jumper between pins 6 and 7
- 4x 200 Ω load option on the output

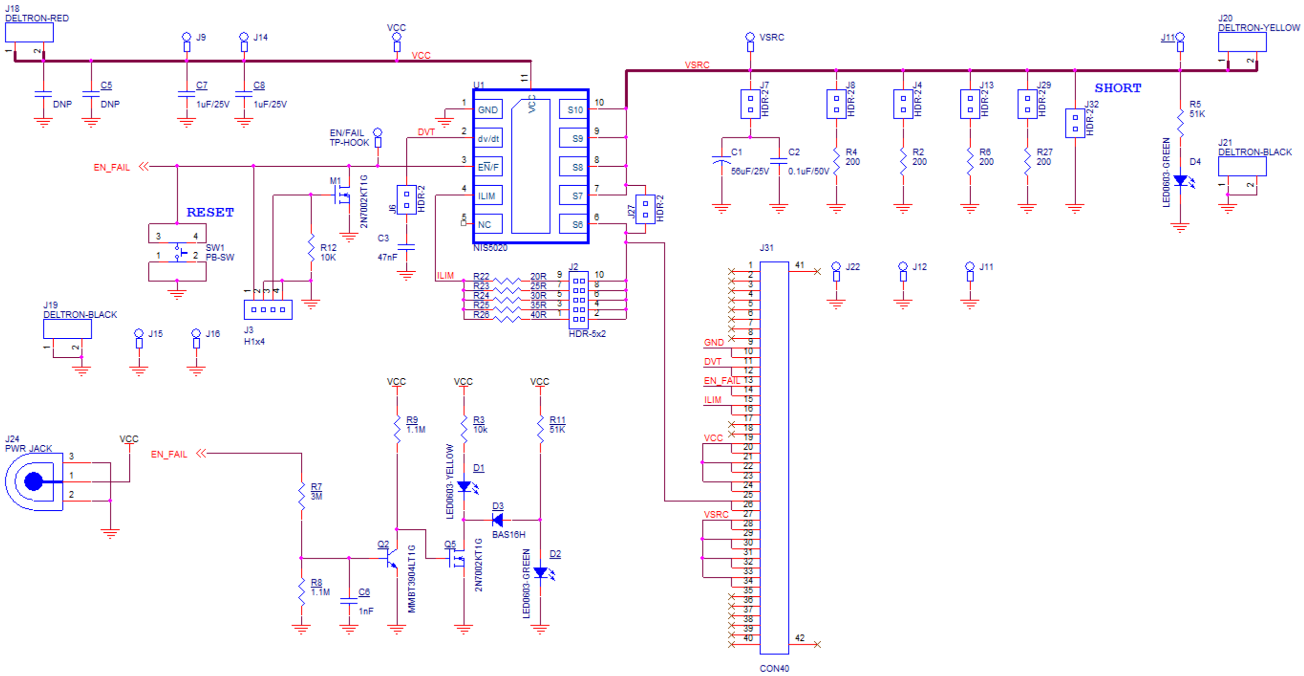

Figure 2: Schematic for the evaluation board.

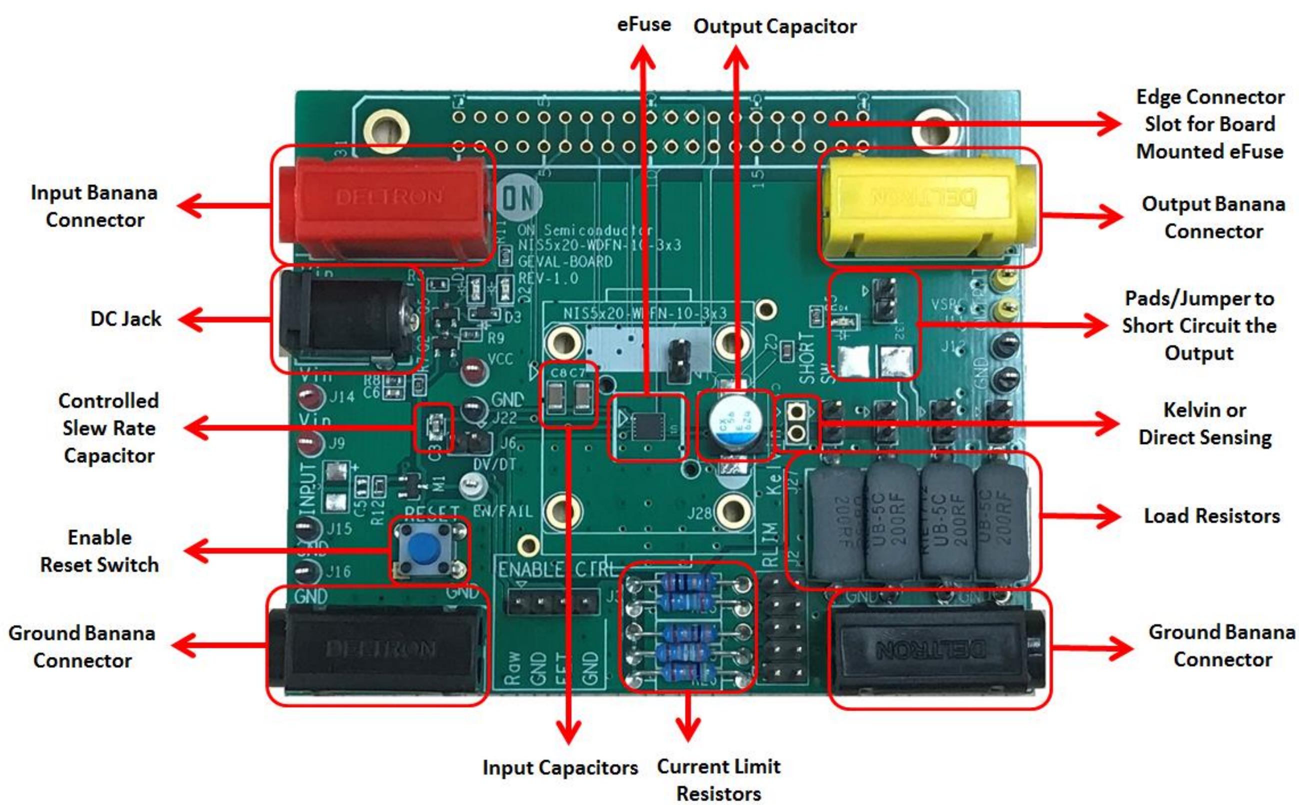

Figure 3: Features of the evaluation board.

NIS5020 Hot Plug Test

Connect jumpers J2 (position 5) and J6 (dv/dt cap). Setup a DC power supply at 12 V for this test. Connect a cable from GND on the eFuse board to GND on the power supply. Probe Vcc, source (output voltage), input current, and enable voltage. Take the positive input voltage cable and hot plug it to the eFuse board. This will turn on the eFuse. There may be noise on the input voltage but the output voltage will rise in a controlled manner. Optionally connect a 12 ohm load to the output so that current flows when the eFuse is powered up.

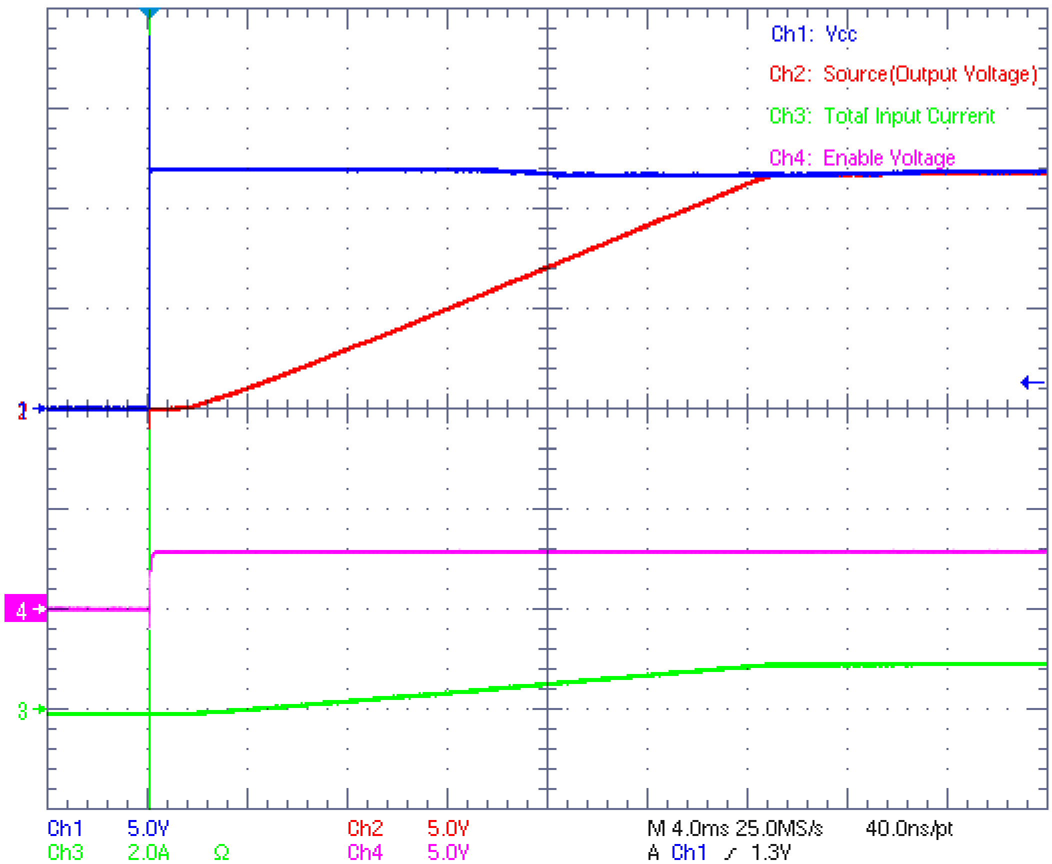

Figure 4: This shows a standard hot plug test. During this test there may be a lot of noise on the input voltage (blue waveform) from bouncing during the hot plug event, but this is normal. In this case the current (green waveform) went to 1 A because there was a 12 ohm load connected externally. Initial spike on the input current is caused by the inrush current. With J6 connected the output (red waveform) ramps slowly because there is a capacitor connected from dv/dt to ground. Remove J6 and repeat the test to observe the eFuse's built-in controlled slew rate, which will be approximately 1 ms.

NIS5020 Controlled Slew Rate

Continue with jumpers J2 and J6. With the power supply connected and set to 12 V, toggle the blue button which is the enable reset switch.

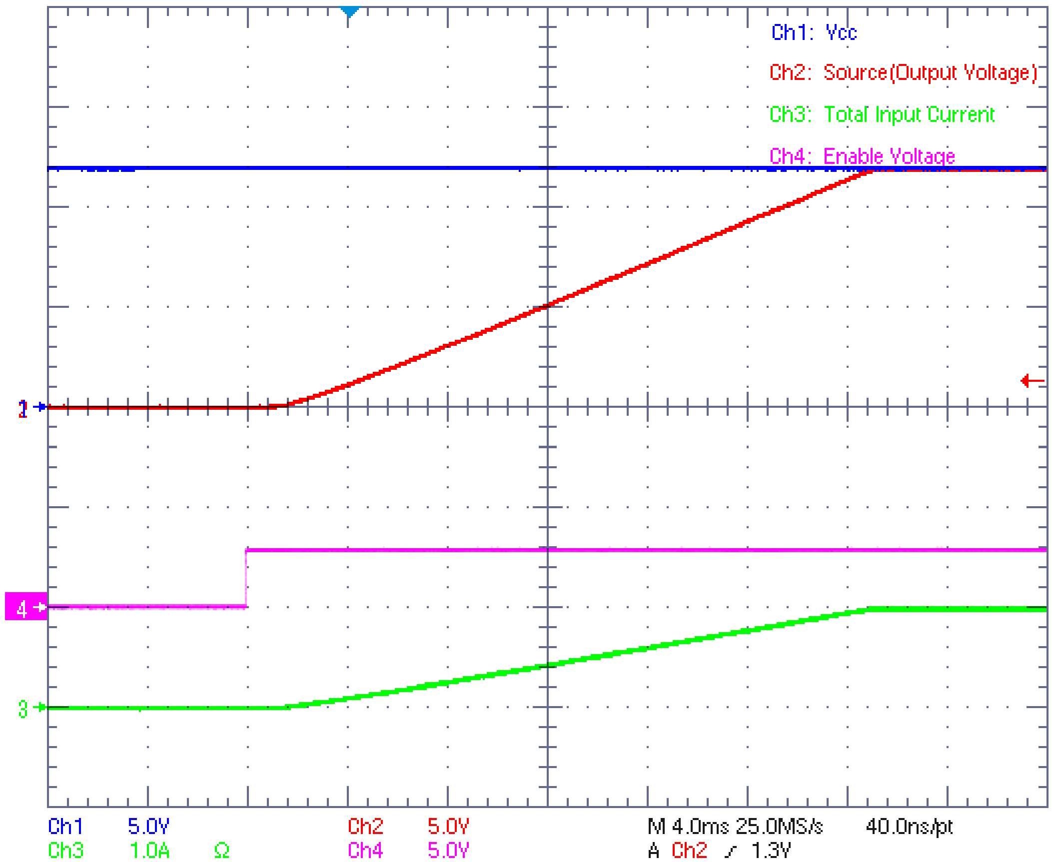

Figure 5: This shows a power-up using the enable pin (pink waveform). A 12 ohm load was connected externally. Note that Ch4 was initially 0 and then went high. Subsequently the output voltage ramped up. The eFuse has an internal pull-up mechanism that brings the enable pin high, so there is no need to ever force the enable pin high. In fact, forcing the enable pin high with something like a resistor network connected to Vcc is not recommended and could potentially interfere with the thermal shutdown mechanism.

NIS5020 Overvoltage Clamp and Thermal Shutdown

Continue with jumpers J2 and J6. Have a DC power supply connected and set to 12 V. Observe the output voltage and enable pin high. Ramp the DC input voltage from 12 to 20 V and observe the output voltage remain at the Vclamp level. If a load (such as 12 ohms) is connected, observe the eFuse enter thermal shutdown.

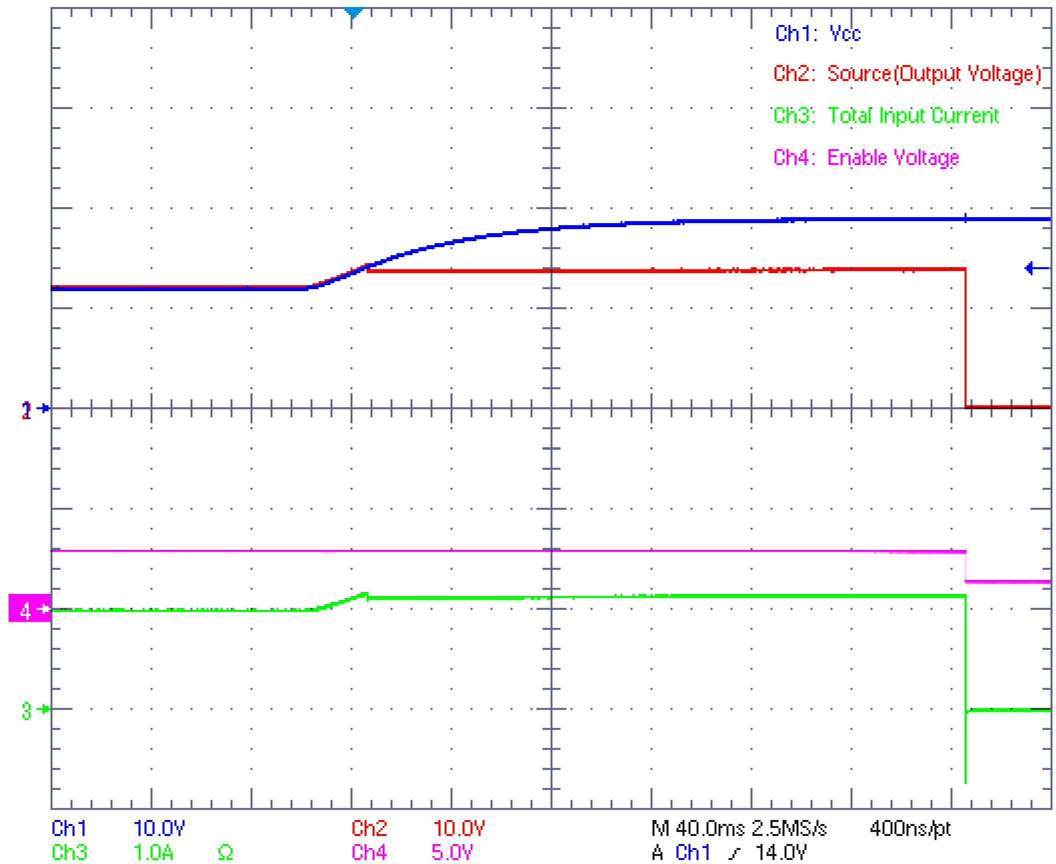

Figure 6: This shows how the eFuse limits the output voltage and subsequently enters into thermal shutdown. A 12 ohm load was connected externally.

NIS5020 Reset from Thermal Shutdown

Continue with jumpers J2 and J6. Have a DC power supply connected and set to 12 V. Observe the output voltage and enable pin in thermal shutdown. Push the blue button to toggle the enable pin. This will reset the device.

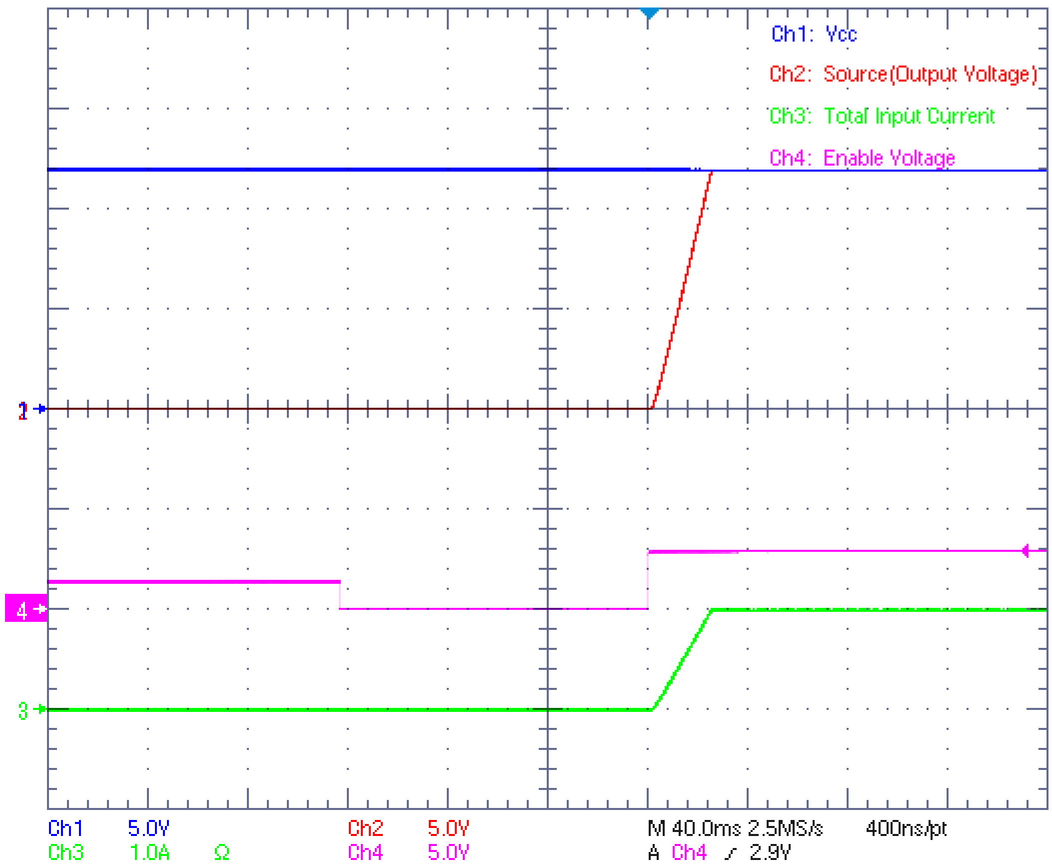

Figure 7: This shows the eFuse reset from thermal shutdown. The enable pin is at the 1.4 V thermal shutdown level, then it is toggled low and released. The internal mechanism pulls the enable pin high, then the output voltage and current ramp. A 12 ohm load was connected externally.

NIS5020 Crowbar Short Circuit Test

Continue with jumpers J2 and J6. Connect Cout using jumper J7 which is located above and slightly to the right of the eFuse. Have a DC power supply connected and set to 12 V. Observe the output voltage and enable pin high. Use jumper J32 to short circuit the output. The oscilloscope may inadvertently trigger early on bouncing from the jumper connection. If this happens, make a few more shorting attempts to get a clear screenshot like the one shown below. The device will be in thermal shutdown after the test.

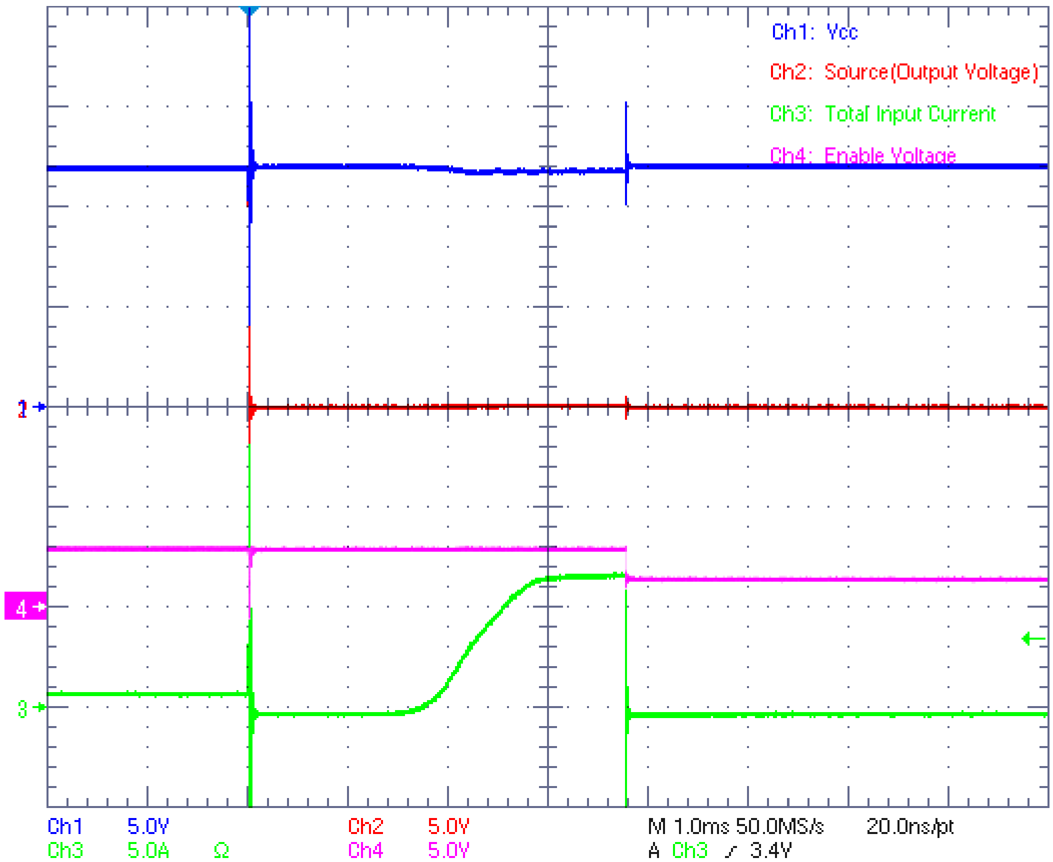

Figure 8: The eFuse is operating and everything is normal until a fault suddenly occurs from source (output) to ground. The current rises but is quickly limited by the eFuse. The device conducts at its short circuit current limit (ILIM SC) until it enters into thermal shutdown. To reset, disconnect the jumper J32 and press the blue button.

NIS5020 Power-up into a Short Circuit Test

Continue with jumpers J2, J6, and J7. Have a DC power supply connected and set to 12 V. Engage the jumper J32 and make sure that output is connected to GND. Press and release the enable pin to observe the device conduct current at the short circuit current limit level and then subsequently enter thermal shutdown.

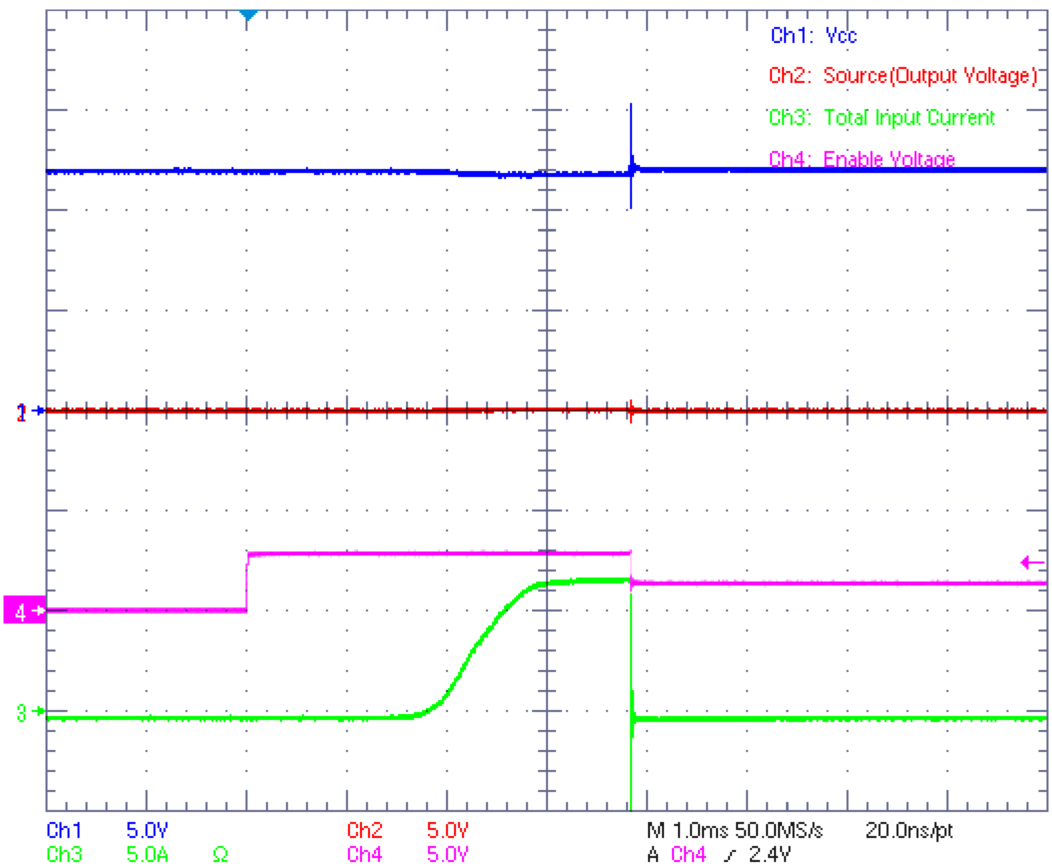

Figure 9: The eFuse begins the test with the J32 engaged to short the output. The blue enable pin reset button is toggled to observe the short circuit current and the device subsequently enters thermal shutdown.

NIS5x2x General Evaluation Board Rev 1.0 - Schematic