



ON Semiconductor

DN05090/D

Design Note – DN05090/D

NIS5452 Configuration for Low Current Limit Applications

Application	Input Voltage	Normal Load Current Max	Current Limit
Protection	5 V	< 0.75 A	~1.4 A

Schematic

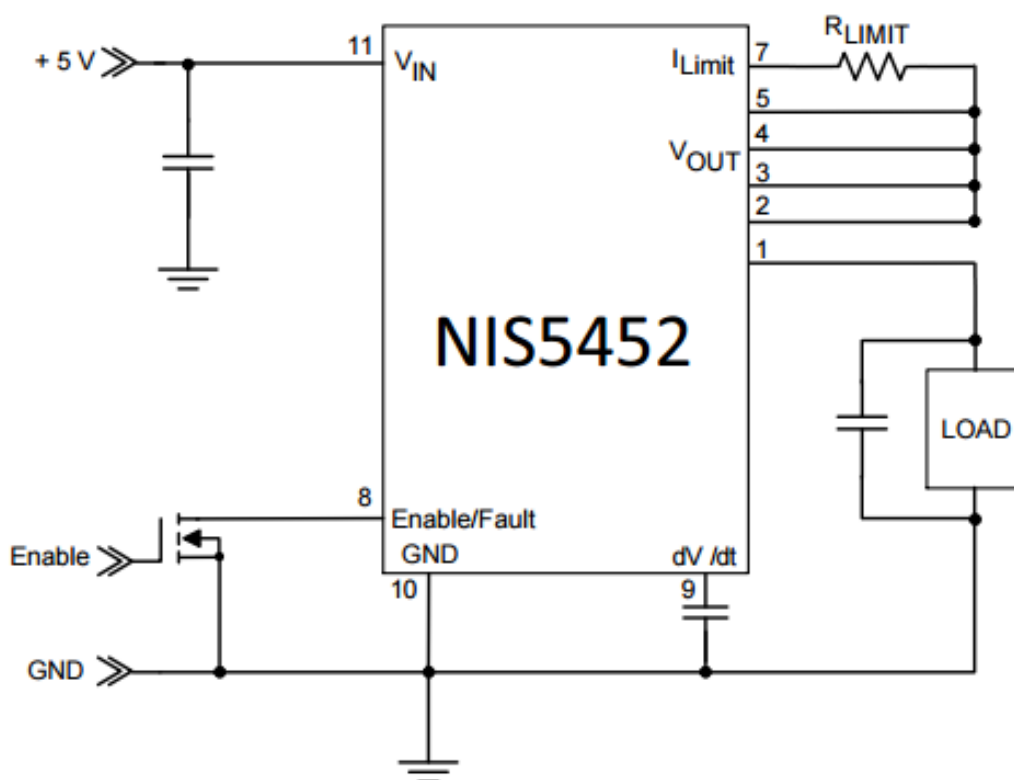


Figure 1 – NIS5452 application schematic with the device configured for low level current limiting

Circuit Operation

The circuit shown in Figure 1 is a special NIS5452 configuration designed to allow current limiting at a lower current level than that of the standard NIS5452 configuration (approximately 1.4 A vs. 4.5 A). eFuses like the NIS5452 have two current limiting levels: overload and short circuit. Whether the overload or short circuit level applies depends on the region of operation of the internal power MOSFET. Overload applies when the MOSFET is in the triode region and the output voltage is high, and short circuit applies when the MOSFET is in saturation.

The standard NIS5452 connection shown in Figure 2 allows a wide range of overload current limits but no lower than about 4.5 A. For some applications the low current configuration shown in Figure 1 will be helpful. For example if the power supply is capable of supplying only low currents it would prevent sagging of the power

supply rail. Also in some cases there is very thin cabling such as a ribbon cable that cannot support higher currents.

Some special considerations to the alternate configuration shown in Figure 1 must be noted. The maximum normal load current is 750 mA. Also this configuration only works for the NIS5452 and does not apply to other eFuses such as the NIS5135, NIS5132, or NIS5232.

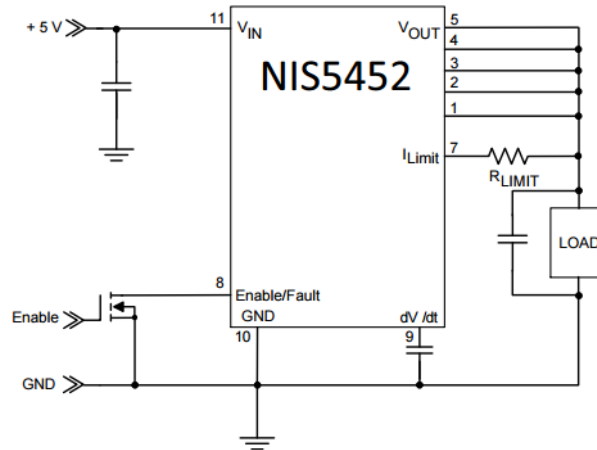


Figure 2 – NIS5452 application schematic with the device in the standard configuration. The functional characteristics of this configuration are shown in the NIS5452 datasheet.

For the configuration shown in Figure 1 a 20 ohm R_{limit} resistor is recommended for most applications. The overload current limit (which applies when the output voltage is high) will be about 1.4 A for the case when the device has been running for several milliseconds. For shorter durations the current limit may be slightly higher due to response time of the device and the device's inherent negative temperature coefficient of the current limit. The short circuit current limit (which applies when the output voltage is low such as when starting up or after hitting the overload current limit) will be approximately 1.1 A. For best design and sufficient margin it is recommended to use this circuit with normal DC operating currents less than 0.75 A.

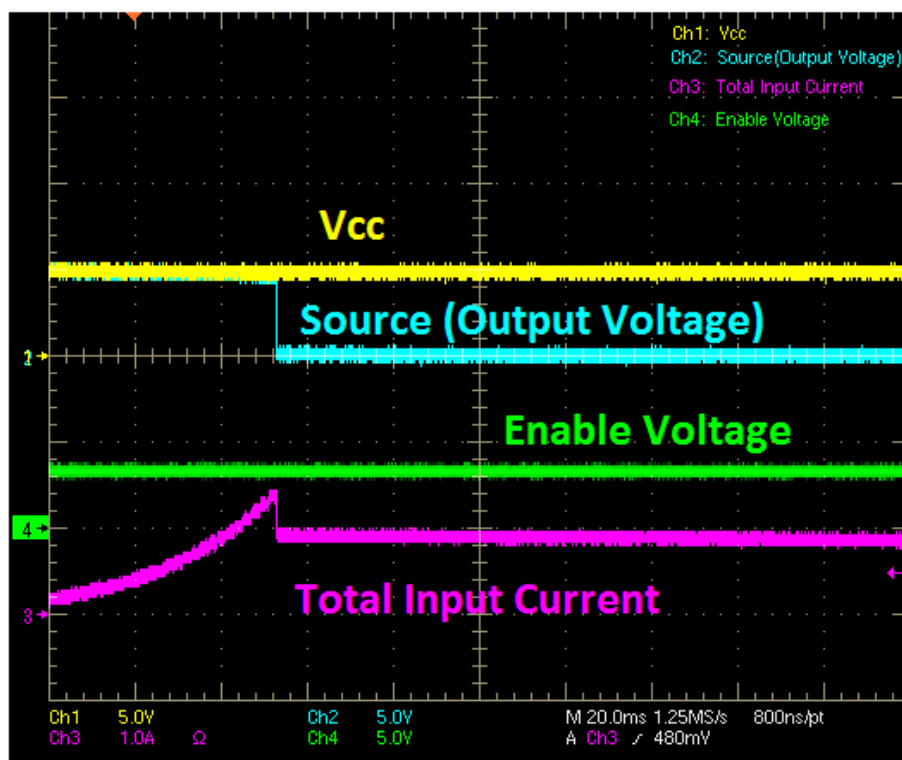


Figure 3 – Here the NIS5452, set up in the low level current limiting configuration is operating with $V_{CC} = 5\text{ V}$ and a $20\ \Omega$ R_{LIMIT} connected as shown in Figure 1. The load resistance is slowly decreased until the overload current limit is reached at 1.4 A. The device then falls to its short circuit current limit. Time is 20 ms/div, voltage scales are 5 V/div, and current scale is 1 A/div.

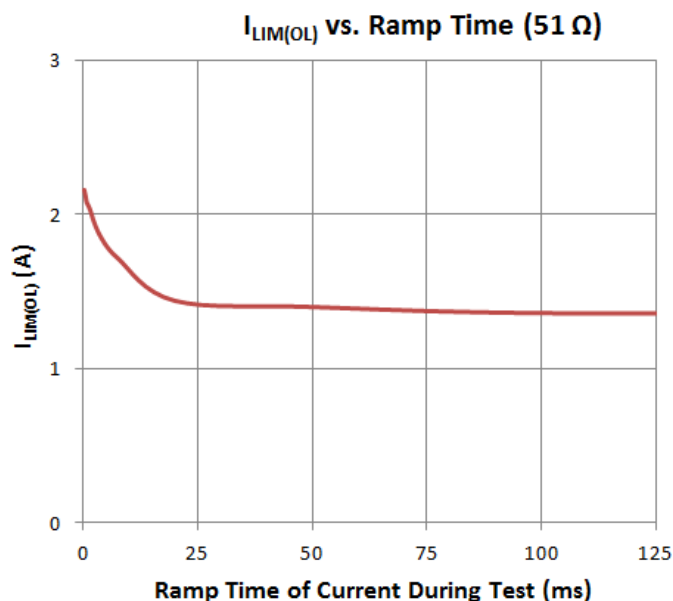


Figure 4 – NIS5452 overload current limit in low level current limit configuration depends on the ramp time of the current during the test.

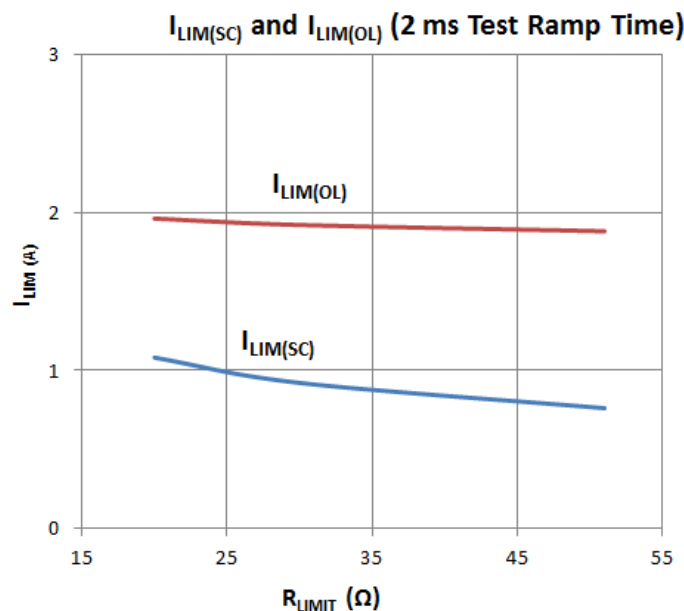


Figure 5– NIS5452 overload current limit and short circuit current limit in low overload current configuration versus current limit resistor value.

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