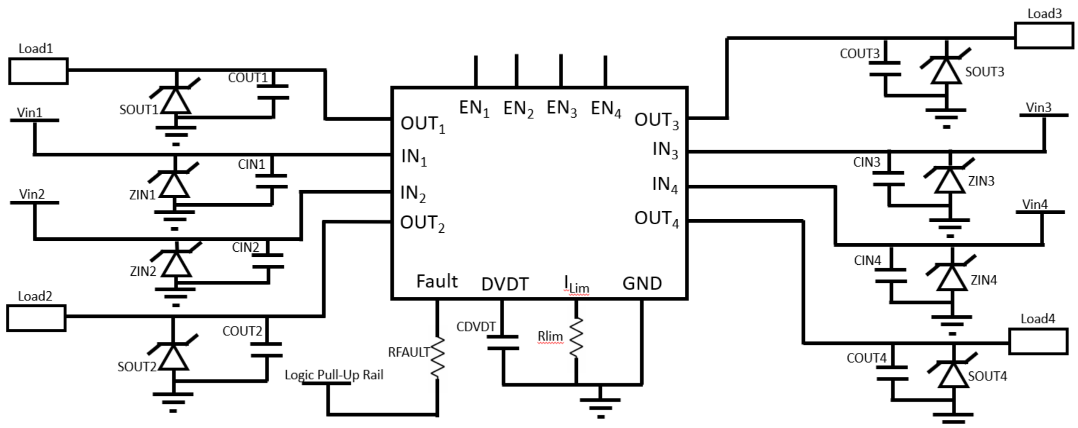
NIS(V)3071 eFuse Schematic Guide

AND90248/D

Introduction

The NIS(V)3071 is a multi−channel eFuse capable of driving 2.5 A per channel with a wide input operating range of 8 – 60 V. Channels can be paralleled to drive higher currents or can be operated independently with multiple input supplies. This document serves to help guide users on selecting the appropriate Rlim and Cdvdt values and any supporting peripheral components needed, depending on the application requirements.



Circuit Element	Name	Value	Description
Resistor	Rlim	See Section 1.1	Resistor that connects to Ilim pin to set I_{TH} and I_{CB}.
	RFAULT	15k	Resistor that connects to Fault pin to pull up to external voltage.
Capacitor	CDVDT1	See Section 2.1	Capacitor that connects to DVDT pin to control the slew rate of all outputs.
	CIN1	See Section 2.2	Capacitor connected to IN_1 pin to filter out noise at input and reduce voltage droop during a fault event.
	CIN2		Capacitor connected to IN_1 pin to filter out noise at input and reduce voltage droop during a fault event.
	CIN3		Capacitor connected to IN_1 pin to filter out noise at input and reduce voltage droop during a fault event.
	CIN4		Capacitor connected to IN_1 pin to filter out noise at input and reduce voltage droop during a fault event.
	COUT1	See Section 2.3	Capacitor connected to OUT_1 pin to help compensate for inductive loads.
	COUT2		Capacitor connected to OUT_2 pin to help compensate for inductive loads.
	COUT3		Capacitor connected to OUT_3 pin to help compensate for inductive loads.
	COUT4		Capacitor connected to OUT_4 pin to help compensate for inductive loads.

Circuit Element	Name	Value	Description
Diode	ZIN1	< 65 V	Zener Diode that protects IN_1 pin from a transient voltage higher than the 65 V maximum.
	ZIN2		Zener Diode that protects IN_2 pin from a transient voltage higher than the 65 V maximum.
	ZIN3		Zener Diode that protects IN_3 pin from a transient voltage higher than the 65 V maximum.
	ZIN4		Zener Diode that protects IN_4 pin from a transient voltage higher than the 65 V maximum.
	SOUT1	See Section 3.2	Schottky Diode that protects OUT_1 pin from falling lower than −0.3 V in the case of an inductive short to ground event.
	SOUT2		Schottky Diode that protects OUT_1 pin from falling lower than −0.3 V in the case of an inductive short to ground event.
	SOUT3		Schottky Diode that protects OUT_1 pin from falling lower than −0.3 V in the case of an inductive short to ground event.
	SOUT4		Schottky Diode that protects OUT_1 pin from falling lower than −0.3 V in the case of an inductive short to ground event.
Power Rails	Vin1	−0.3 V – 60 V	Input voltage that connects to IN_1 pin and will be seen on OUT_1 pin when device is on.
	Vin2		Input voltage that connects to IN_2 pin and will be seen on OUT_2 pin when device is on.
	Vin3		Input voltage that connects to IN_3 pin and will be seen on OUT_3 pin when device is on.
	Vin4		Input voltage that connects to IN_4 pin and will be seen on OUT_4 pin when device is on.
	Logic Pull−Up Rail	1.8 V, 3.3 V, 5 V	Voltage Rail that pulls Fault pin high

Section 1: Resistors

1.1 R_{Lim}: The current limiting resistor should be connected between the I_{Lim} pin (pin 7) and ground. The purpose of this resistor is to set the current limit value for I_{TH} and I_{CB}, which when tripped will cause the output to be disconnected from the input. Look at Figure 5 and 6 in the data sheet to choose the correct resistor value for the application.

Ex. Set I_{TH} to 2 A

R_{Lim} starting value ≅ 30k

I_{CB}, as can be seen on the figure, will always be twice the value of I_{TH}.

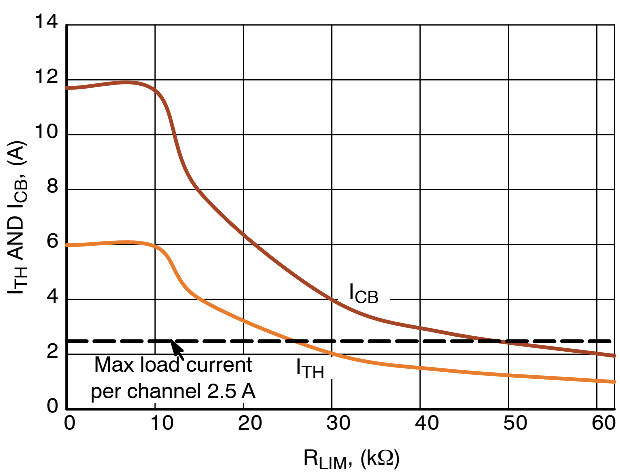


Figure 5. Current Limit Setting vs. R_{LIM}

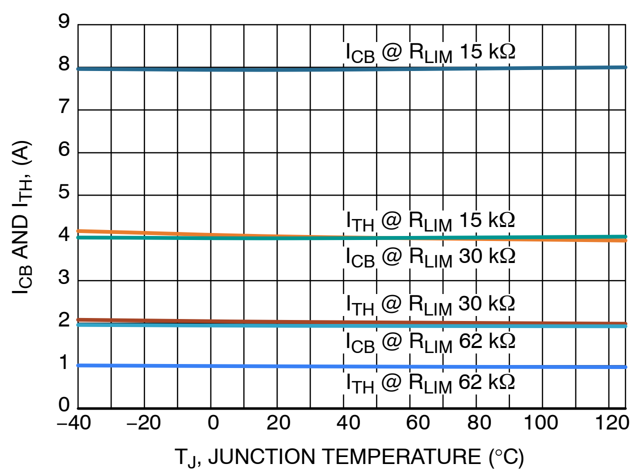


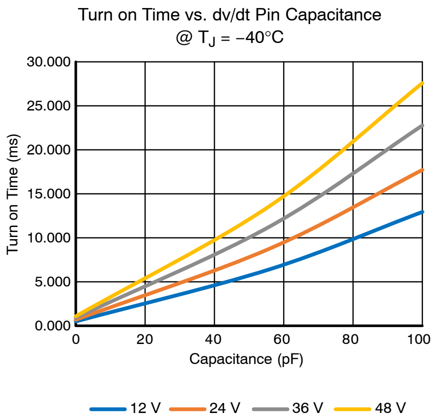
Figure 6. Junction Temperature vs. I_{TH} & I_{CB}

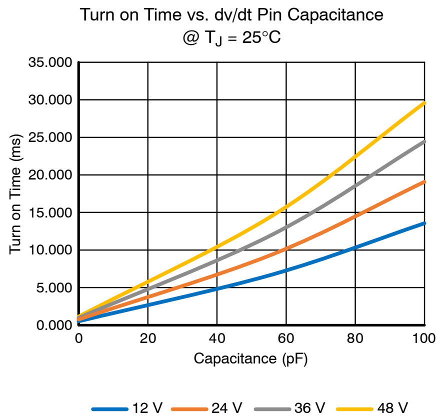
1.2 RFAULT: This resistor is connected between the Fault pin (pin 5) and Logic Pull−Up Rail. Choose this to be 15k to limit the current below the Output Sink Current max for the Fault pin.

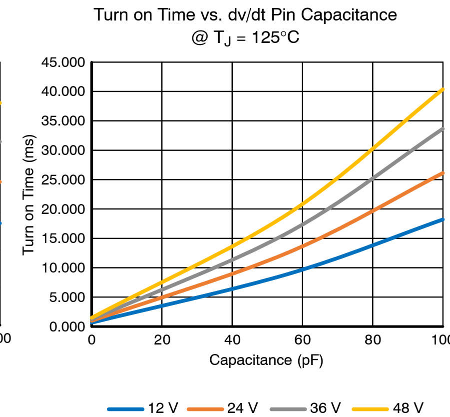
Section 2: Capacitors

2.1 CDVDT: This capacitor is connected between the DVDT pin (pin 6) and ground. The purpose of the capacitor is to increase the Turn−on Time of the output. There are 3 important metrics to consider when choosing the DVDT capacitor: typical junction temperature, output voltage, and desired Turn on Time. Look at Figures 7−9 in the datasheet to choose the appropriate capacitor for the application.

Ex. 25°C Junction Temperature, 24 V Output Voltage, 11 ms Turn on Time
CDVDT Starting Value ≅ 65 pF







2.2 Input Capacitors: These capacitors are connected between the input pins (pin 2, 3, 10, and 11) and ground. They are used mainly to filter out any unwanted noise at the input but has the added benefit of reducing voltage droop at in input during an inrush or fault event at the output. Choose a capacitor that is rated for the max system voltage and has a capacitance large enough for desired filtering applications. Only one filtering capacitor is needed per independent rail, meaning that if all inputs are paralleled only one capacitor is recommended.

2.3 Output Capacitors: These capacitors are connected between the output pins (pin 1, 4, 9, and 12) and ground. They are intended to compensate for any inductive loads that are connected to the outputs. Choose a capacitor that is rated for the max system voltage and can handle inductive kick back during a fault event. Only one capacitor is needed per independent output, meaning that if all outputs are paralleled only one capacitor is recommended.

Section 3: Diodes:

3.1 Input Diodes: These are Zener diodes that have their anode connected to ground and their cathode connected to the input pins (pin 2, 3, 10, and 11). They are used to protect the input from a transient voltage higher than the maximum transient voltage of the device. For this reason, it is recommended to use a Zener with a voltage equal to or lower than 65 V, but higher than the maximum system voltage during normal operation. Only one Zener is needed per independent rail, meaning that if all inputs are paralleled only one Zener is required.

3.2 Output Diodes: These are Schottky diodes that have their anode connected to ground and their cathode connected to the output pins (pin 1, 4, 9, and 12). They are used to protect the output from falling below minimum output voltage of −0.3 V during a inductive short to ground event. Only one Schottky is needed per independent output, meaning that if all outputs are paralleled only one Schottky is required.

Section 4: Power Rails

4.1 Input Rails: These are voltage supplies that connect directly to the input pins (pin 2, 3, 10, and 11). Each rail is independent of the others unless purposefully connected, and the input pins can all handle voltages between −0.3 and 60 V, with each input able to be set to a different voltage. When a channel is turned on with its corresponding enable pin (pins 16, 15, 14, and 13 respectively), the output will be pulled up to the same voltage at the input.

4.2 Logic Pull−Up Rail: This is a voltage supply that is connected to the Fault pin (pin 5) through a pull up resistor. This rail is responsible for pulling the fault pin high when there is fault detected on any of the outputs. Because this is a logic−high signal, it can be set to 1.8 V, 3.3 V, or 5 V depending on the desired application. If the fault pin does not need to be used, it can be left floating.

◊