

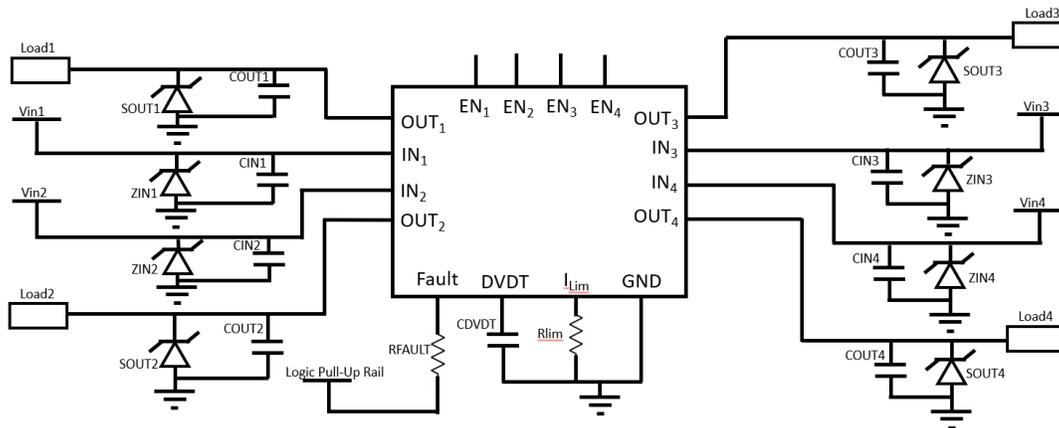
NIS(V)3071 eFuse Schematic Guide

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 ₂ pin to filter out noise at input and reduce voltage droop during a fault event. |
| | CIN3 | | Capacitor connected to IN ₃ pin to filter out noise at input and reduce voltage droop during a fault event. |
| | CIN4 | | Capacitor connected to IN ₄ 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}.

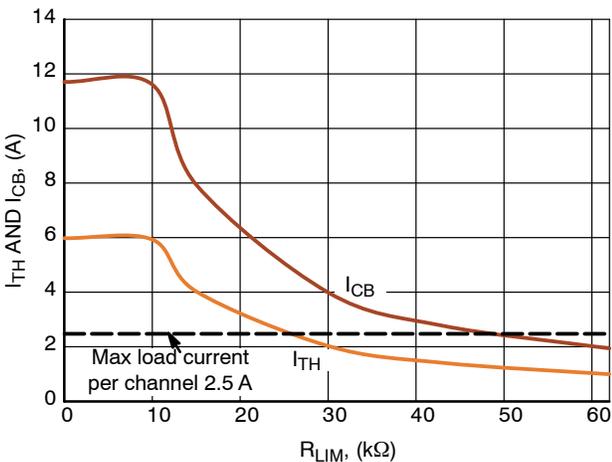


Figure 5. Current Limit Setting vs. R_{LIM}

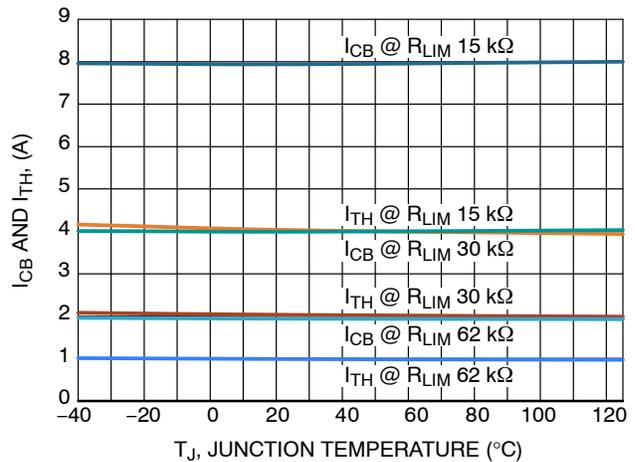


Figure 6. Junction Temperature vs. I_{TH} & I_{CB}

1.2 R_{FAULT}: This resistor is connected between the Fault pin (pin 5) and Logic Pull-Up Rail. Choose this

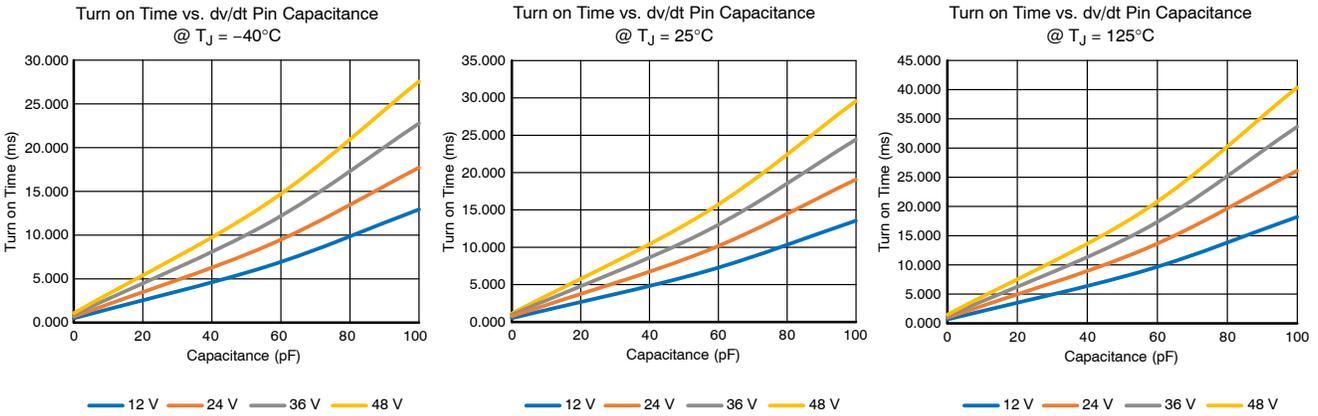
to be 15k to limit the current below the Output Sink Current max for the Fault pin.

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 \cong 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 an 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.

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