eFuse – Capacitor Bank Charging Demo

eFuse

eFuse – Electronic Fuses

What?
Integrated Overcurrent, thermal & Overvoltage protection solution

PowerFET
Control

Why?
Prevent damage to connectors, PCB traces and downstream components

Where?
Any *hot-swappable application* and any system requiring inrush/outrush current limiting

eFuse

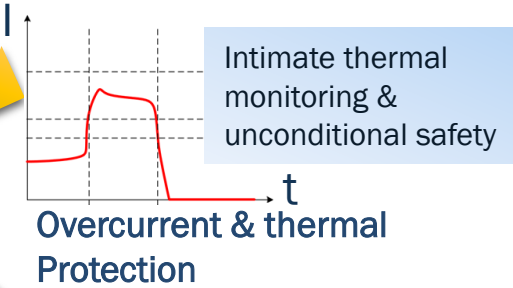Reverse Current Protection
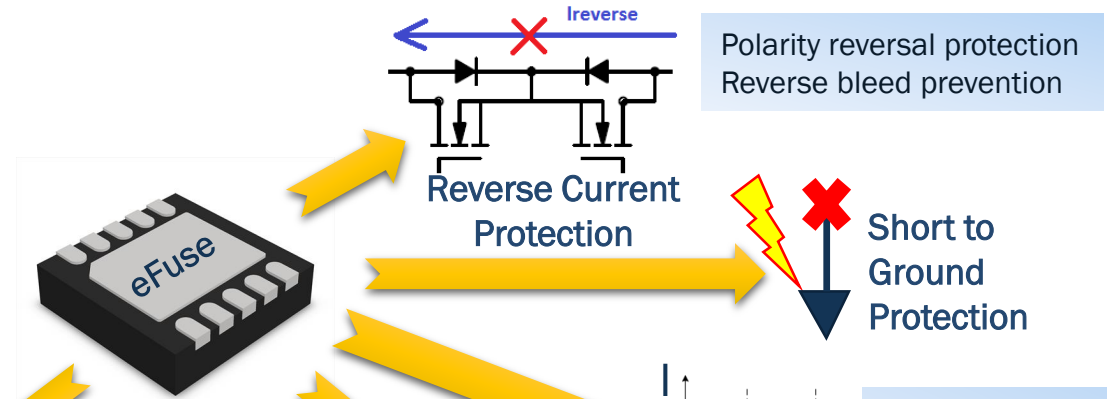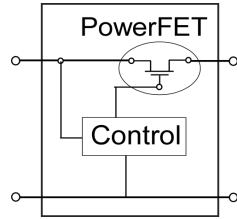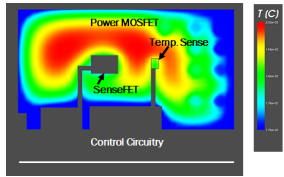
Polarity reversal protection
Reverse bleed prevention

Short to Ground Protection

Intimate thermal monitoring & unconditional safety

Overcurrent & thermal Protection

Short to Battery Protection

Current Monitor

Load diagnostics

POWER GOOD

Load Control

Report a problem

FAULT ENABLE

Overvoltage Protection

VIN
VOUT

Immunity to power supply glitches/drift

ON
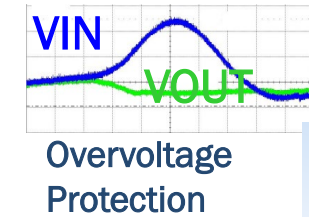
Sample Cap Charging Application – Solid State Drive
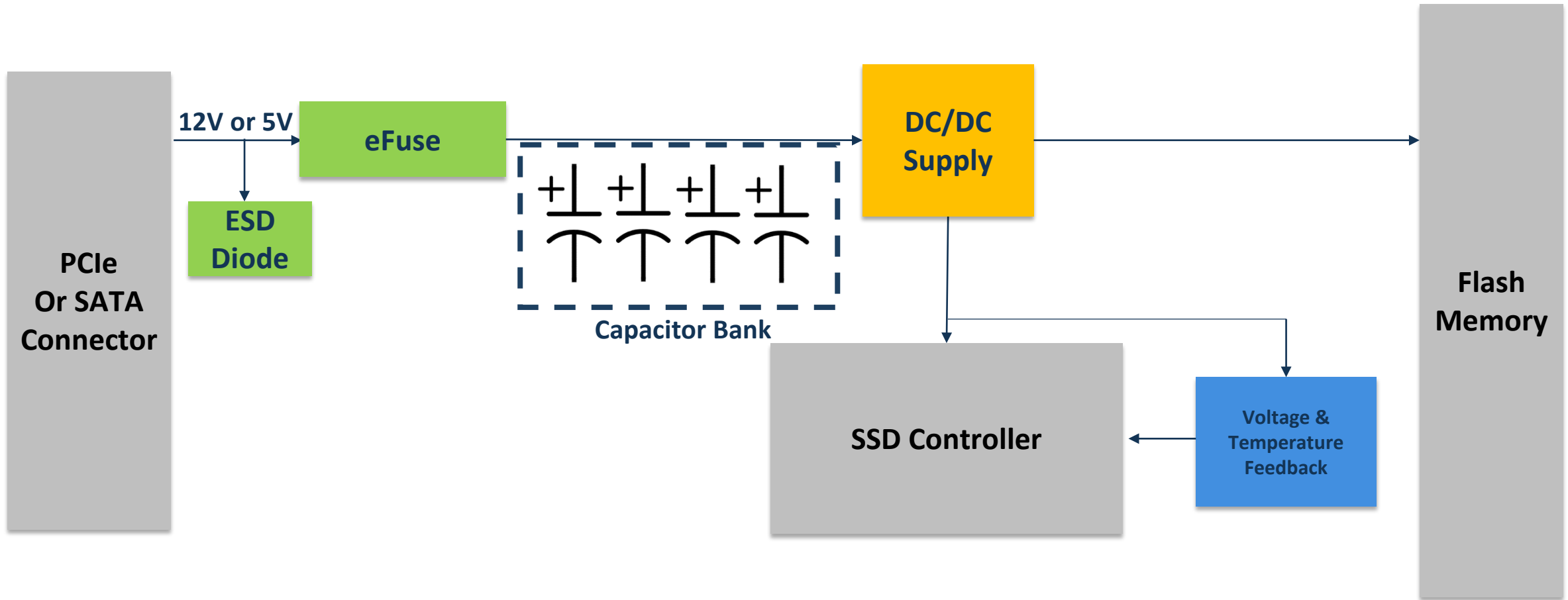
Demo description

Innovation

Showcasing the eFuse devices auto-retry mode to source the current necessary to charge a large capacitor bank while still allowing the user to protect the load from OCP and OVP events. This demo features four different eFuse devices, each with three copies allowing the user to select how many to use in parallel to change the charging current and the associated time to charge.

- NIS3320 – easy-to-use in TSOP5, fixed OCP, OVP, UVLO, and soft-start time
- NIS5420 – WDFN10 3x3, with programmable ILIM and dvdt, optional IMON
- NIS5021 – WDFN10 4x4, capable of up to 12A DC, along with ILIM and dvdt
- NIS6420 – WQFN12 2x3, featuring digital disable, IMON and reverse current blocking
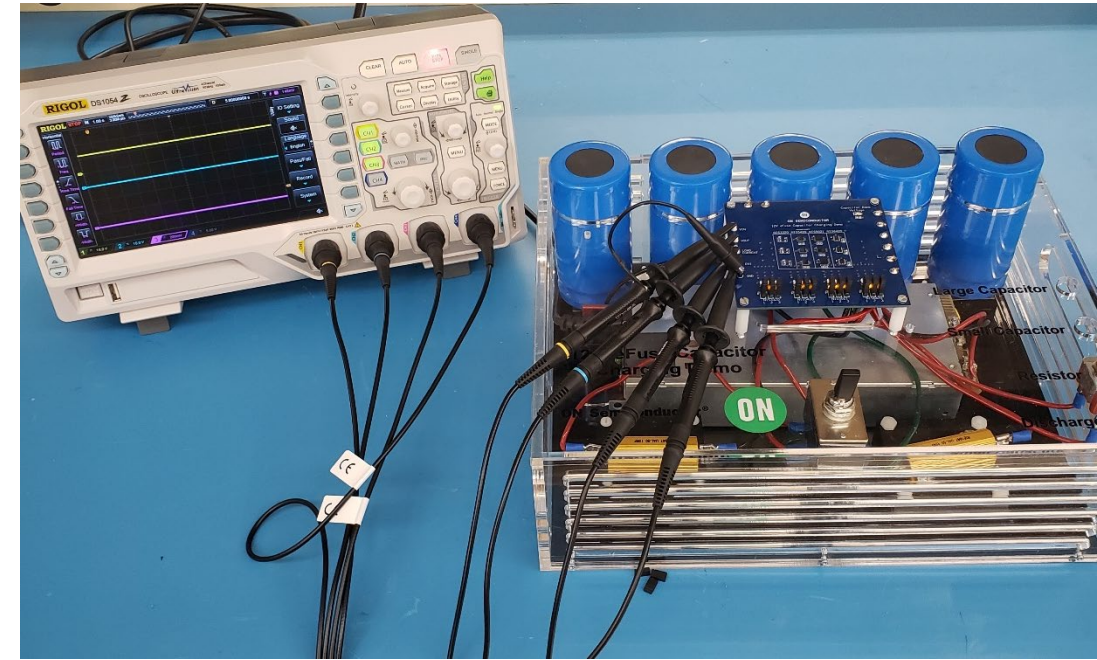
Value Proposition

Overcurrent, overvoltage, overtemperature and UVLO, along with programmability and fault reporting capability ensures unconditional safety with no SOA concerns.

- ✓ Unconditional safety
- ✓ Programmability
- ✓ Ultra fast response to faults
- ✓ Fault reporting and diagnostics
- ✓ Easy installation
- ✓ Small footprint
- ✓ Ability to synchronize or sequence power up/down

Public Information
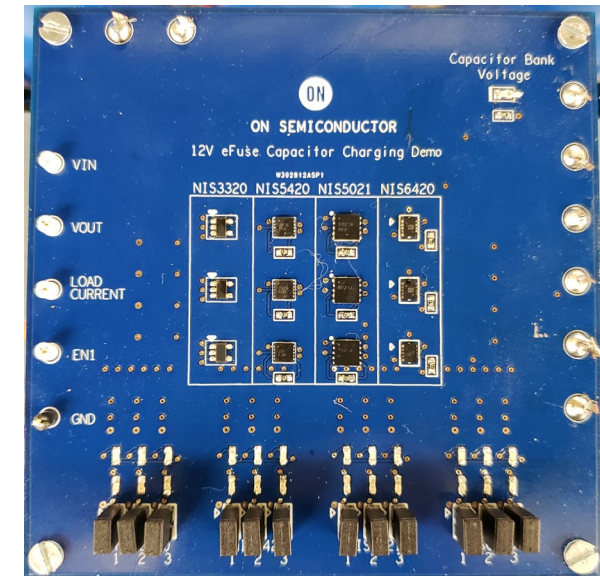
NIS3320 – 1 unit vs. 3 units in parallel
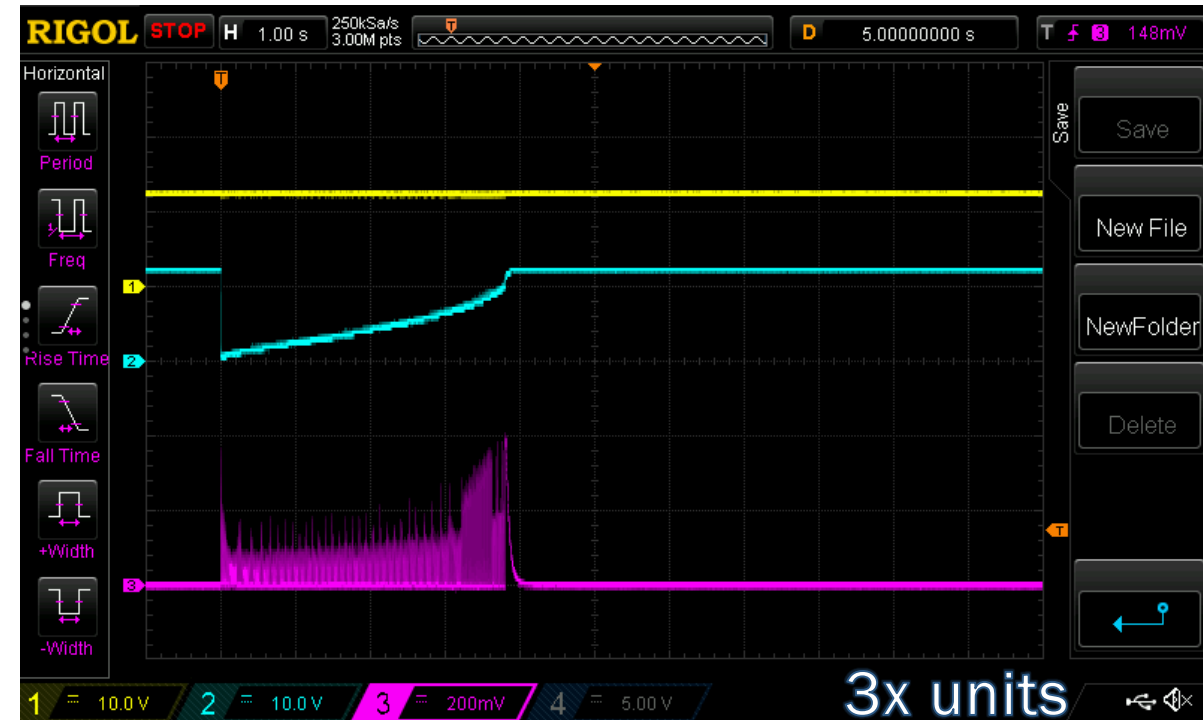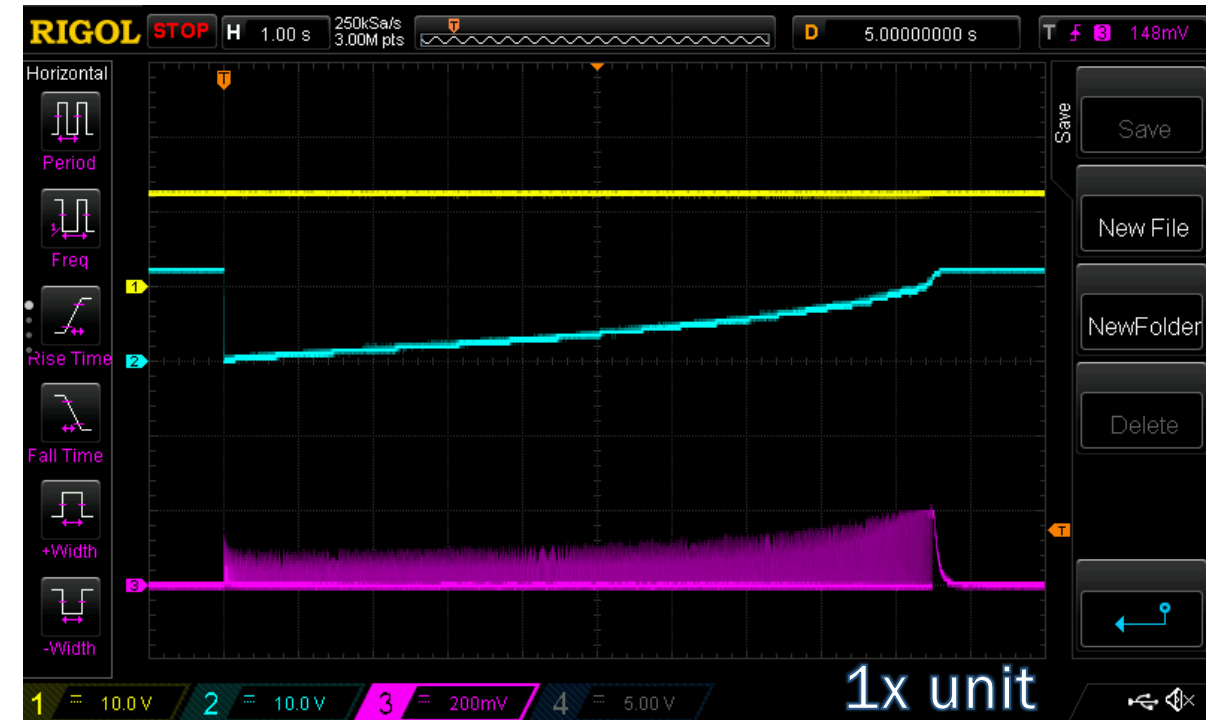
In both cases shown above, the eFuse safely charges up the capacitor bank so that until VOUT=VIN. This pulses in the current waveform are cycles of the eFuse turning on and off in auto-retry mode due to the device going into thermal protection mode. This process insures that the eFuse does not leave its safe operating area but allows the device to continue to charge the capacitors once a safe internal temperature is reached.

Depending on the applications requirements, multiple eFuses can be used in parallel to support higher charger currents – thereby reducing the overall time required to charge the capacitor bank. In the screenshots above, we show that a single NIS3320 can charge up the capacitor bank in ~10.5 seconds, while three NIS3320 devices in parallel drops the time to ~4 seconds.

Public Information

NIS5420 – Load Delay Circuit
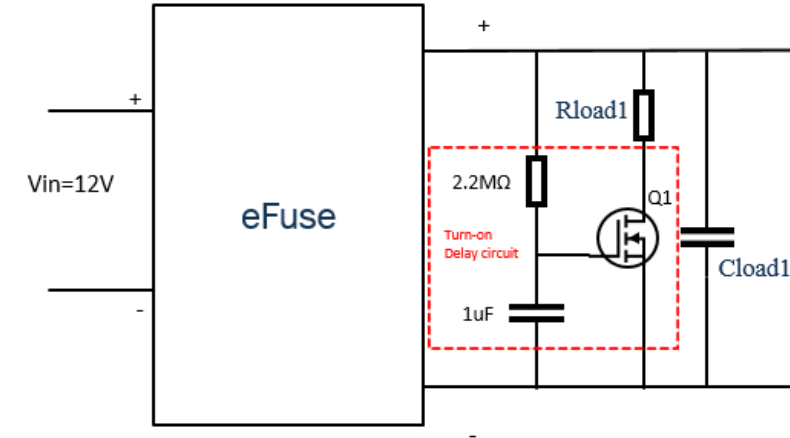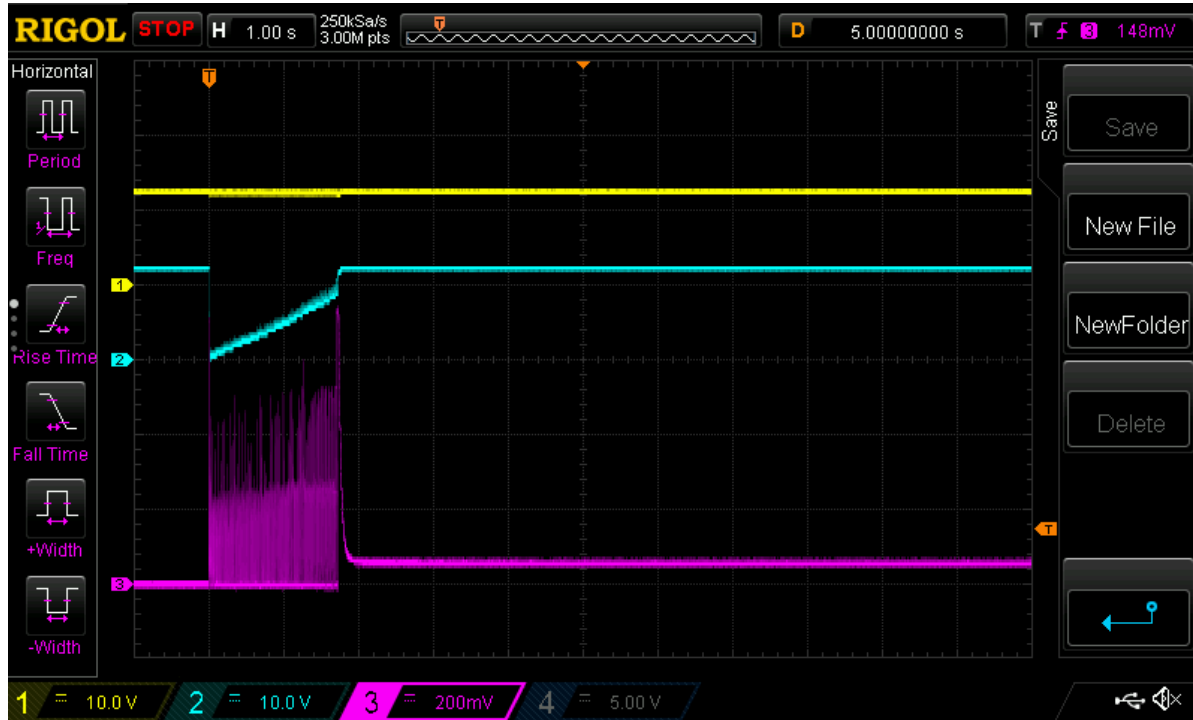
In some applications, it may be beneficial to wait to turn on certain portions of the load until after the capacitor bank is fully charged. Some reasons to do this are: 1) If the rail needs to be fully charged for the load to be safely started, 2) If the charging current + load current is too close to the ILIM level of the eFuse.

In this portion of the demo, we show how the auto-retry mode displayed previously can be used in combination with a delay circuit in order to: 1) Fully charge the output capacitor bank until VOUT=12V, 2) Turn on a resistor load only when a certain threshold is reached on the output rail.

Public Information

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