AOZ13929DI

Evaluation Board User Guide

General Description

The AOZ13929DI Evaluation Board (EVB) provides a platform to evaluate the AOZ13929DI ideal diode smart protection switch. AOZ13929DI is the ideal solution for multi-port Type-C PD current sinking applications. Ideal Diode True Reverse Current Blocking (IDTRCB) to completely eliminate reverse-current from VOUT to VIN of any magnitude at any frequency (including constant VOUT > VIN blocking). AOZ13929DI also has an integrated TVS diode for surge protection and provides under-voltage lockout, start-up short circuit protection, over-voltage and over-temperature protection. FLTB pin (active low) reports RCB OVP and OTP faults.

The ideal diode voltage drop / DC current / pulsed (10 ms at 2% duty cycle) current capabilities for the AOZ13929DI are 35 mV/10 A/20 A. The EVB can operate from 3.4 V to 23 V input voltage. Figures 1 and 2 show pictures of the evaluation board.

Evaluation Board

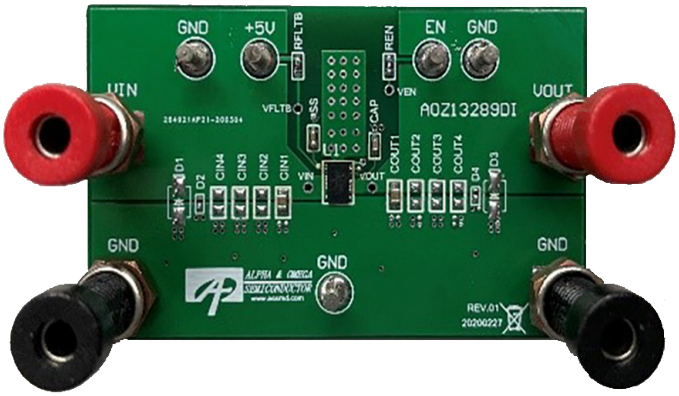


Figure 1. Top View of EVB, shares the same PCB with AOZ13289DI

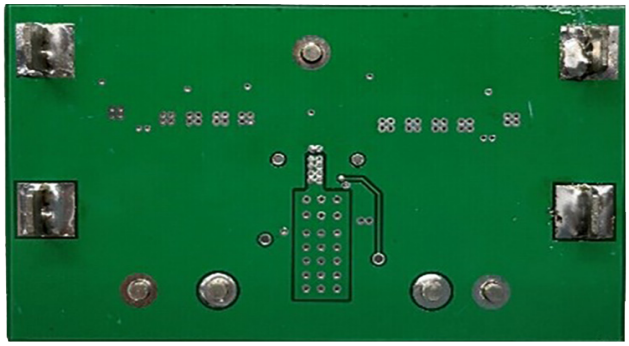


Figure 2. Bottom View of EVB AOZ13929DI

Evaluation Board Hardware

The EVB is 2oz, 2 layer board. The board schematic and the PCB layout are included in this document. The EVB has several connectors for quick input/output connections and test points for measurements. The on-board connectors and test points are listed below:

On-board Connectors and Test Points

Connectors	Descriptions
VIN	Input supply connector, connect to 3.4-23V power supply.
VOUT	Output Connector, connect an external load between this connector and the GND connector.
GND	Ground connectors.
VEN	Connector for the enable signal.
+5V	Connector for bias supply for FLTB pull up, connect to 3.3V-5.5V supply.
VFLTB	Test point for FLTB signal.

Quick Power Up Guide [1]

1. Ensure that the circuit is correctly connected to the power supply and load, refer to Figure 3 for proper setup.
2. Turn on the VIN and +5V power supplies.
3. Adjust the +5V power supply to 5V and VIN power supply to 12V. The output voltage should be approximately VIN when VIN>4V.
4. Adjust the load current, do not exceed 10A.

Note:

1. When testing SCP D3 (output Schottky diode) must be installed to avoid excessive negative voltage. The EVB does not come with D3 populated

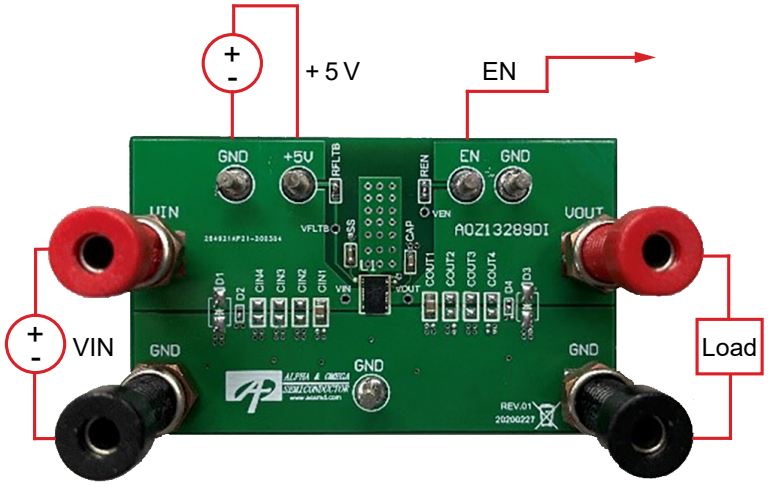
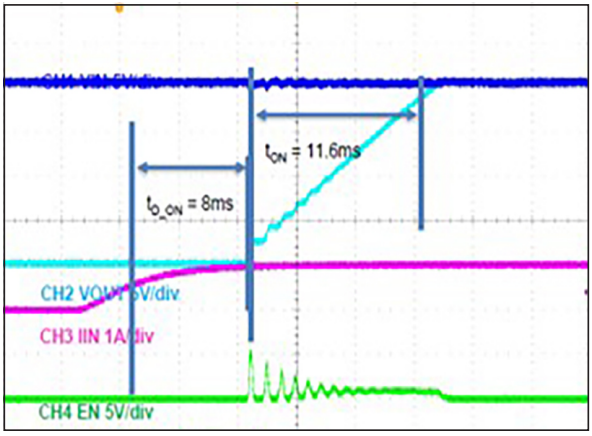


Figure 3. AOZ13929DI Evaluation Board Set Up

Typical Characteristics

VIN = 20 V, EN = 5 V, CIN = 10 µF, COUT = 560 µF, CSS = 27 nF, CCAP = 1 nF, TA = 25°C unless otherwise specified.

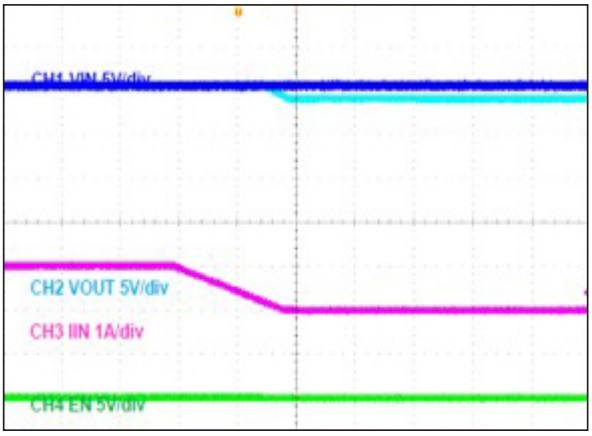
Power Up (V_{IN} = 20 V)



V_{IN} (5 V/div)
V_{OUT} (5 V/div)
IN (1A/div)
EN (5 V/div)

4 ms/div

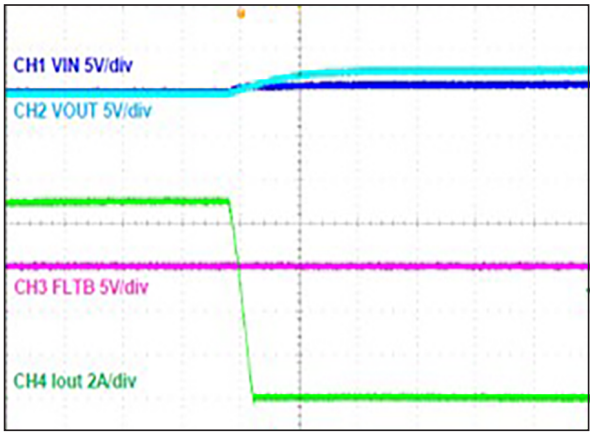
Power Down (V_{IN} = 20 V)



V_{IN} (5 V/div)
V_{OUT} (5 V/div)
IN (1A/div)
EN (5 V/div)

20 ms/div

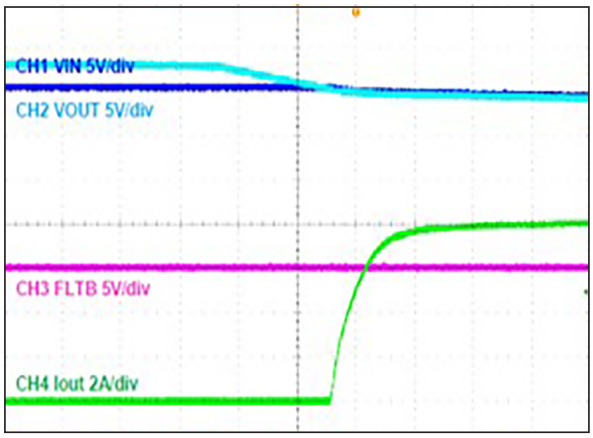
Fast RCB (V_{IN} = 20 V)



V_{OUT} (5 V/div)
V_{IN} (5 V/div)
FLTB (5 V/div)
I_{OUT} (2 A/div)

80 µs/div

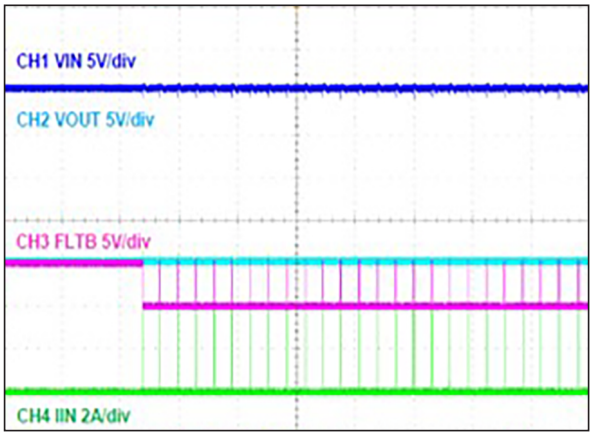
RCB Recover (V_{IN} = 20 V)



V_{IN} (5 V/div)
V_{OUT} (5 V/div)
I_{OUT} (2 A/div)
FLTB (5 V/div)

80 µs/div

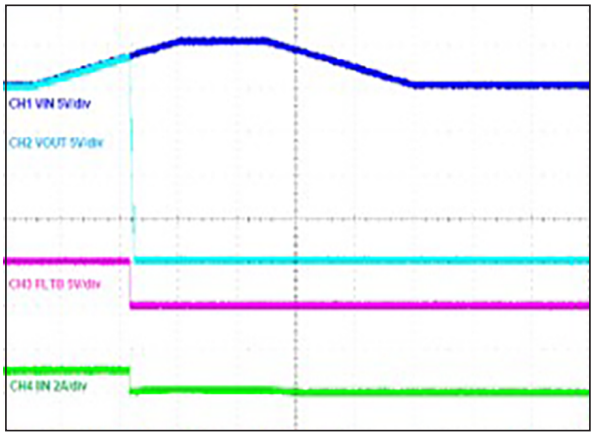
Start-up SCP (V_{IN} = 20 V)



V_{IN} (5 V/div)
V_{OUT} (5 V/div)
FLTB (5 V/div)
I_{IN} (2 A/div)

200 ms/div

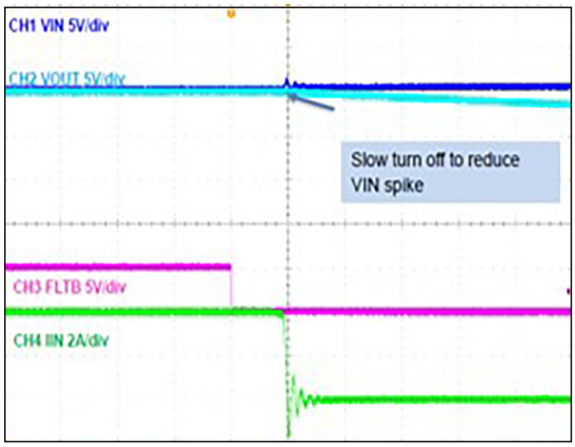
OVP (V_{IN} = 20 V)



V_{IN} (5 V/div)
V_{OUT} (5 V/div)
FLTB (5 V/div)
I_{IN} (2 A/div)

200 ms/div

OTP (V_{IN} = 20 V)



40 µs/div

Setting Soft-start Capacitor, C_{SS}

The AOZ13929DI integrates a SOA management to ensure safe operation during soft-start. During soft-start the output voltage linearly ramps up to the level of the input voltage in a controlled fashion. There are three factors to consider for a successful soft-start.

1. The current demand must not exceed the allowed current anytime during the soft-start. The current demand consists of two parts: (1) the current needed to charge the output capacitance (Cout*Vin/Soft-start-time) and (2) the load current (Vout(t)/Rout).

2. The current demand must not exceed the allowed current when the power switch closes. There is a delay from the beginning of soft-start to the closing of the power switch. The current demand when the power switch closes must not be more than the allowed current at that time

3. The device must stay within the safe operating area (SOA) during soft-start. The current demand combined with the soft-start time must not voltage the SOA. During soft-start the power switch absorbs energy. The linear start-up of a soft-start causes a significant voltage drop across the IC. This voltage drop combined with the current load causes the device to heat up.

The maximum current allowed during soft-start time increases with a decreased voltage drop from VIN to VOUT. During the soft-start time, the output capacitor, the output load and the input voltage should be considered to set the soft-start time so that the SOA management circuit doesn't interrupt the soft-start ramp.

The soft-start time can be calculated using the equation below:

$$t_{ON} = \left(\frac{VIN}{24}\right) * \{\left(\frac{C_{SS}}{0.0023}\right) - 100\}$$

where C_{SS} is in nF and t_{ON} is in µs.

EVB Schematic

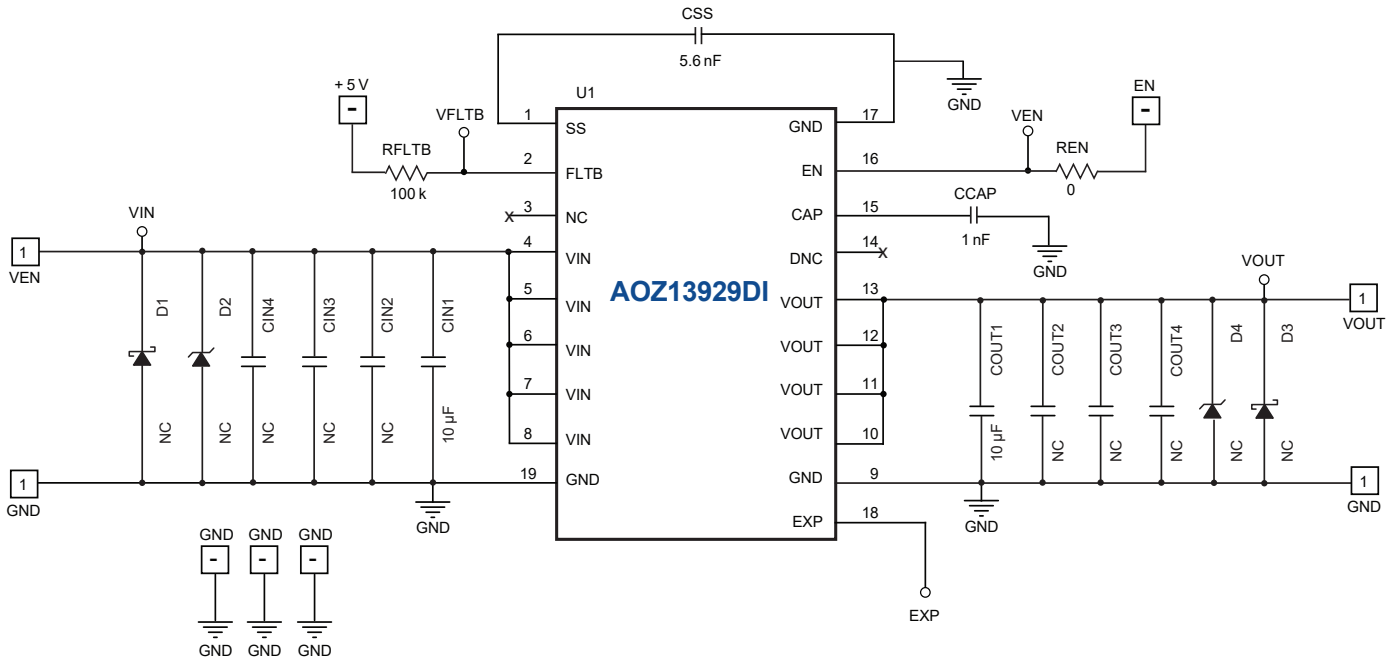


Figure 4. AOZ13929DI EVB Schematic

Bill of Materials

Designator	Type	Description	Footprint	Qty
D1, D3	Schottky Diode	NC	SMA	2
D2, D4	TVS	NC	AOZ8320DI	2
RFLTB	TVS	100k, 5%	0603	1
REN	Resistor	0, 5%	0603	1
CCAP	Capacitor, Ceramic	1 nF, 25 V, X5R	0603	1
CIN1, COUT1	Capacitor, Ceramic	10 nF, 50 V, X5R	0805	2
CSS	Capacitor, Ceramic	5.6 nF, 25 V, X5R	0603	1
CIN2, CIN3, CIN4, COUT2, COUT3, COUT4	Capacitor, Ceramic	NC	0805	6
U1	Protection Switch	AOZ13929DI	DFN3 2X5 5-17L	1

PCB Layout

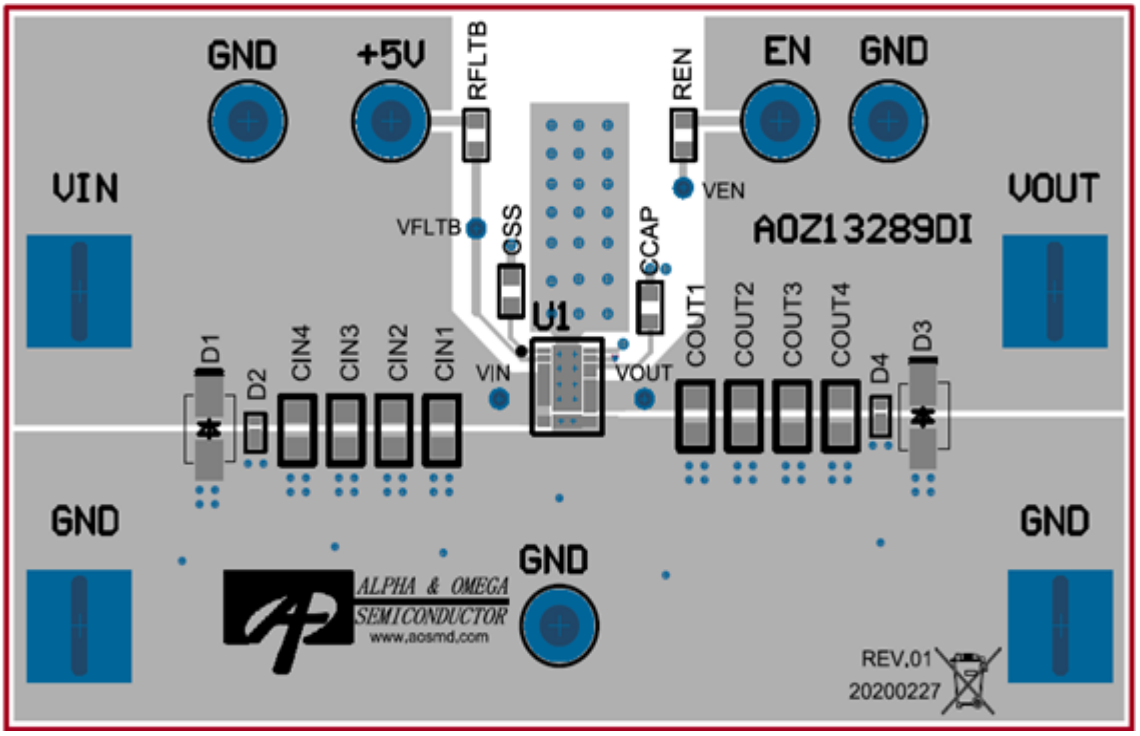


Figure 5. Top Layer of AOZ13929DI

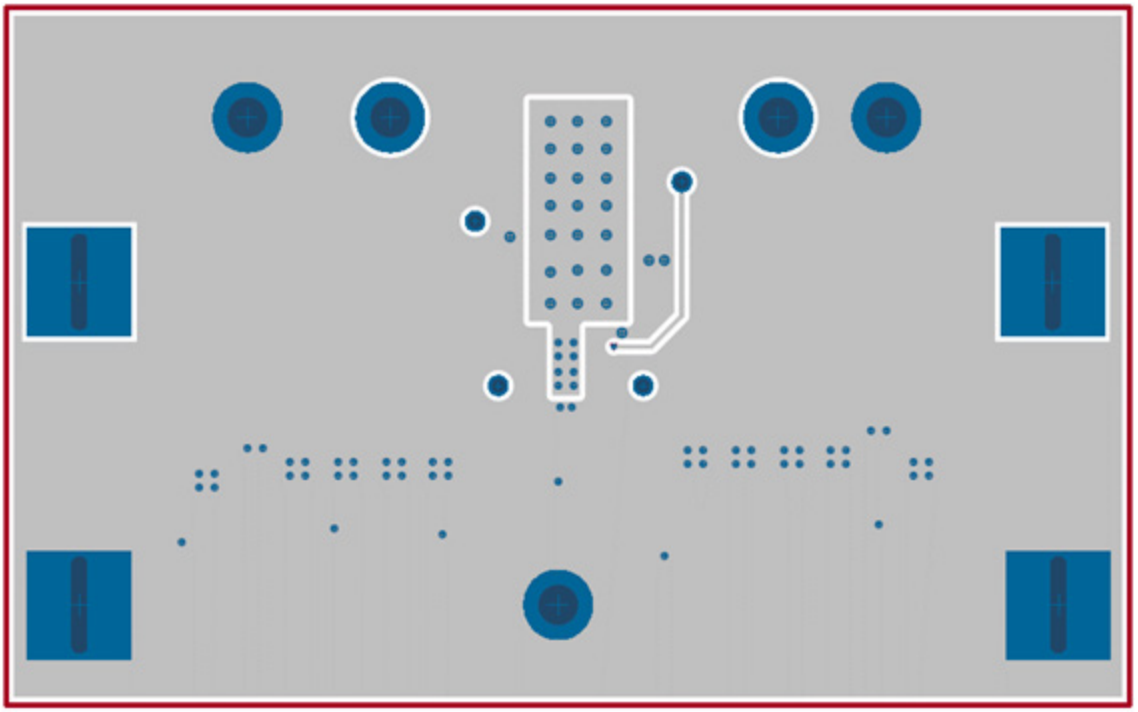


Figure 6. Bottom Layer of AOZ13929DI

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