

Test Report: PMP20859

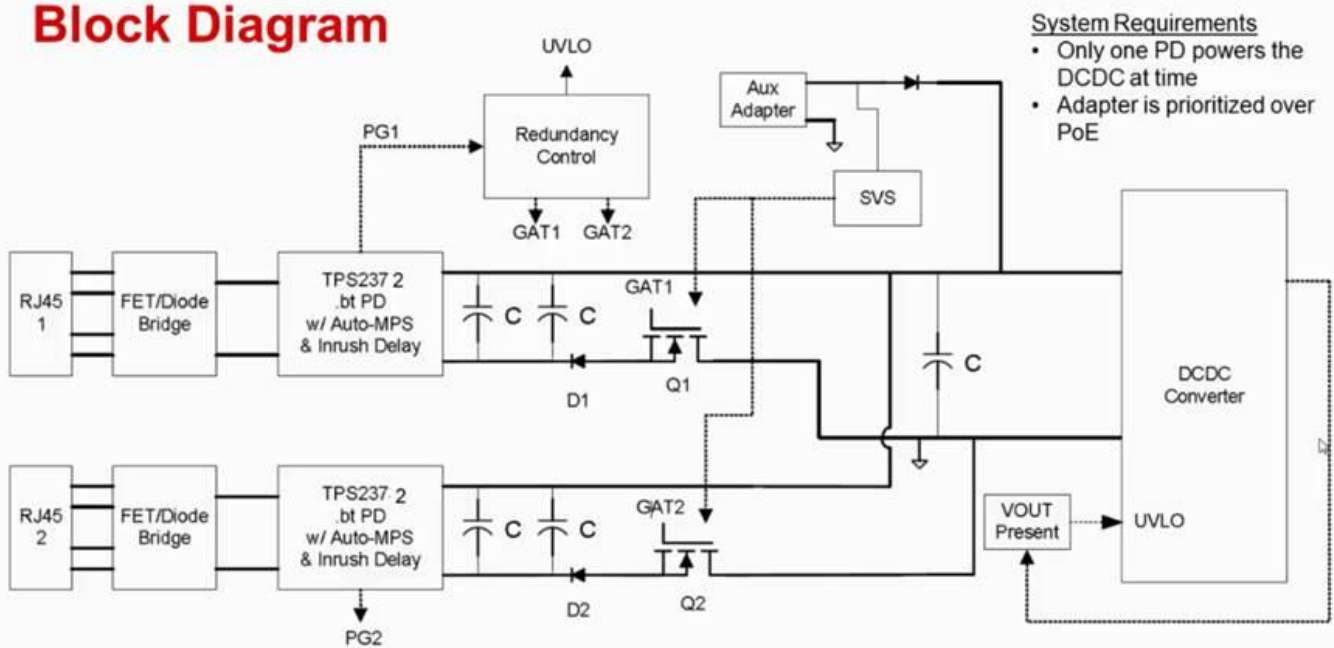
Dual-Input Redundant PoE PD with Smooth Transition Reference Design



Description

PMP20859 implements an IEEE802.3bt (draft) Power over Ethernet (PoE) Powered Device (PD) with dual redundant inputs and smooth transition between these inputs and an auxiliary input. The design consists of a 5V/6A synchronous flyback converter and allows for up to three power supplies (two PoE Power Source Equipment (PSE) supplies and one ac/dc wall adapter auxiliary supply) to be used in order to decrease the probability of power and data loss in your system. Two IEEE802.3bt (draft) TPS2372-3 PD controllers are utilized for high power PoE up to 40W. In addition, a TPS3808 delay supervisor and additional circuitry enable the PD to achieve a smooth transition between PoE to auxiliary and PoE to PoE power supply connections (in the event the main power supply is removed or fails) without an interruption in output voltage or disconnecting from the PSE.

Block Diagram



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Test Prerequisites

1.1 Voltage and Current Requirements

Table 1. Voltage and Current Requirements

PARAMETER	SPECIFICATIONS
PoE Input Voltage	42.5-57V (48V nominal)
Adapter (AUX) Input Voltage	48V+/-10%
Vout	5V
Iout	6A
Nominal Switching Frequency	250kHz

1.2 Required Equipment

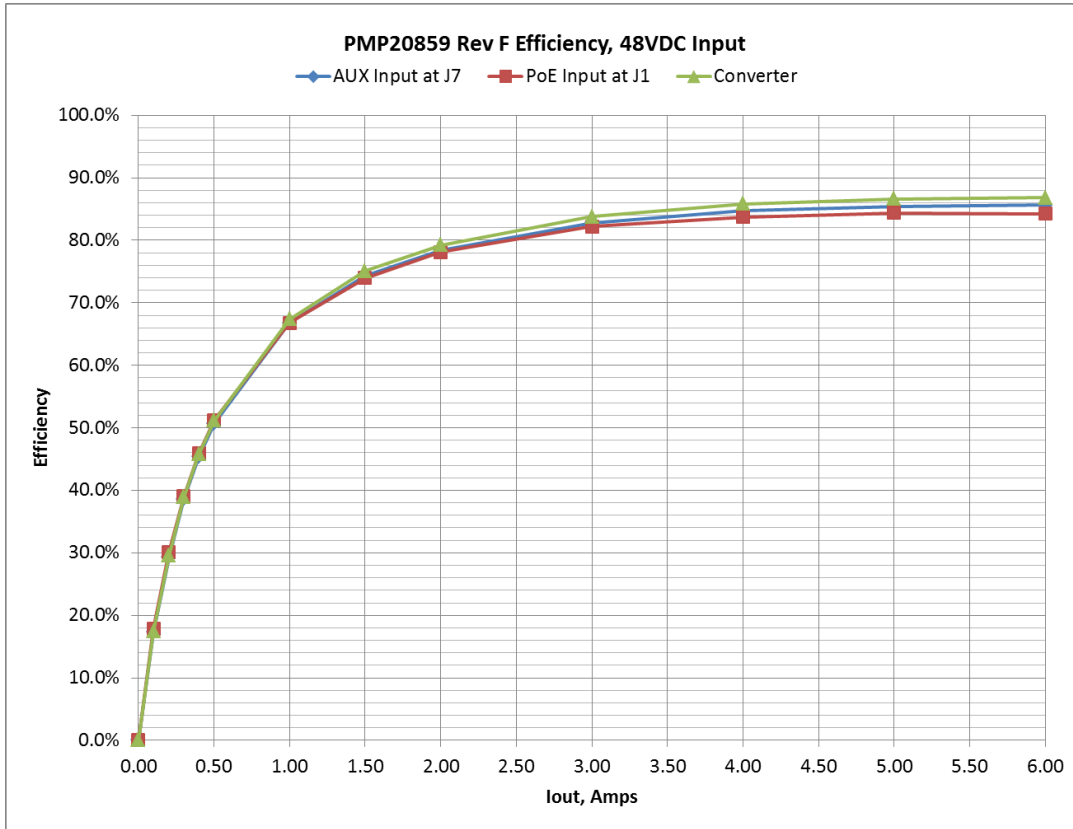
- Two IEEE802.3.bt (draft) Type 3 PSE's
- AC/DC isolated wall adapter, 48V +/-10%, 1A minimum
- CAT5e ethernet cables (<100m)
- 5V/6A load

1.3 Considerations

All testing performed with a 48V input and 6A load unless otherwise noted.

2 Testing and Results

2.1 Efficiency Graph

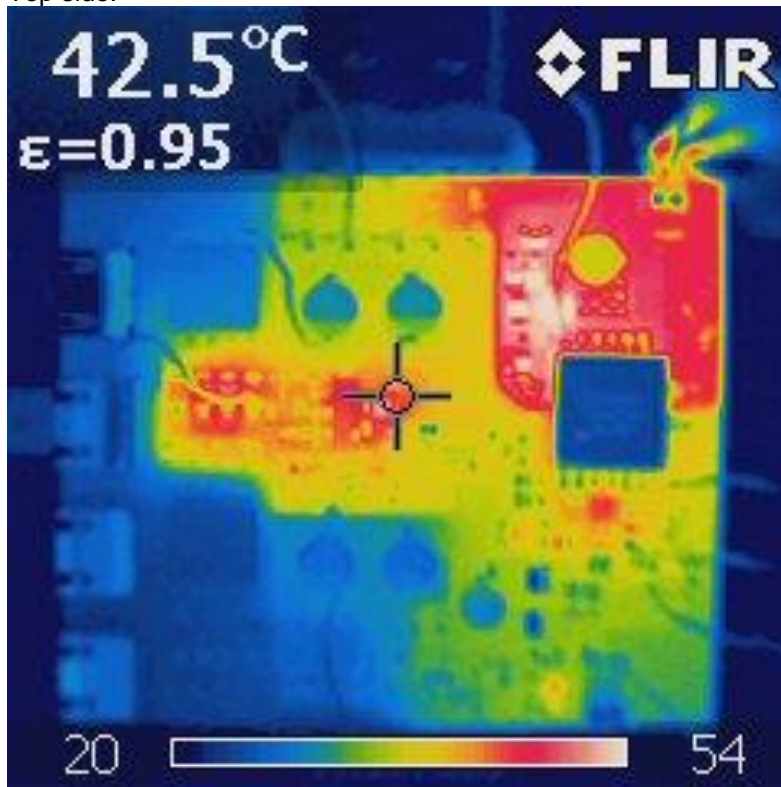


2.2 Efficiency Data

J8 Amps	J8 Volts	AUX J7 Amps	AUX J7 Volts	AUX J7 Eff	CONV Volts	CONV Eff	PoE J1 Amps	PoE J1 Volts	PoE J1 Eff
<u>Iout</u>	<u>Vout</u>	<u>Iin</u>	<u>Vin</u>	<u>Eff</u>	<u>Vin</u>	<u>Eff</u>	<u>Iin</u>	<u>Vin</u>	<u>Eff</u>
0.00	5.064	0.050	48.00	0.0%	47.61	0.0%	0.048	48.00	0.0%
0.10	5.064	0.061	48.00	17.3%	47.60	17.4%	0.059	48.00	17.9%
0.20	5.064	0.072	48.00	29.3%	47.59	29.6%	0.070	48.00	30.1%
0.30	5.064	0.082	48.01	38.6%	47.60	38.9%	0.081	48.01	39.1%
0.40	5.064	0.093	48.01	45.4%	47.59	45.8%	0.092	48.01	45.9%
0.50	5.064	0.104	48.01	50.7%	47.58	51.2%	0.103	48.01	51.2%
1.00	5.064	0.158	48.01	66.8%	47.55	67.4%	0.158	48.01	66.8%
1.50	5.064	0.213	48.00	74.3%	47.51	75.1%	0.214	48.00	73.9%
2.00	5.064	0.269	48.01	78.4%	47.50	79.3%	0.270	48.01	78.1%
3.00	5.063	0.382	48.01	82.8%	47.46	83.8%	0.385	48.01	82.2%
4.00	5.063	0.498	48.00	84.7%	47.39	85.8%	0.504	48.00	83.7%
5.00	5.063	0.617	48.01	85.5%	47.37	86.6%	0.625	48.01	84.4%
6.00	5.063	0.739	48.01	85.6%	47.33	86.9%	0.751	48.01	84.3%

2.3 Thermal Images

Top side:



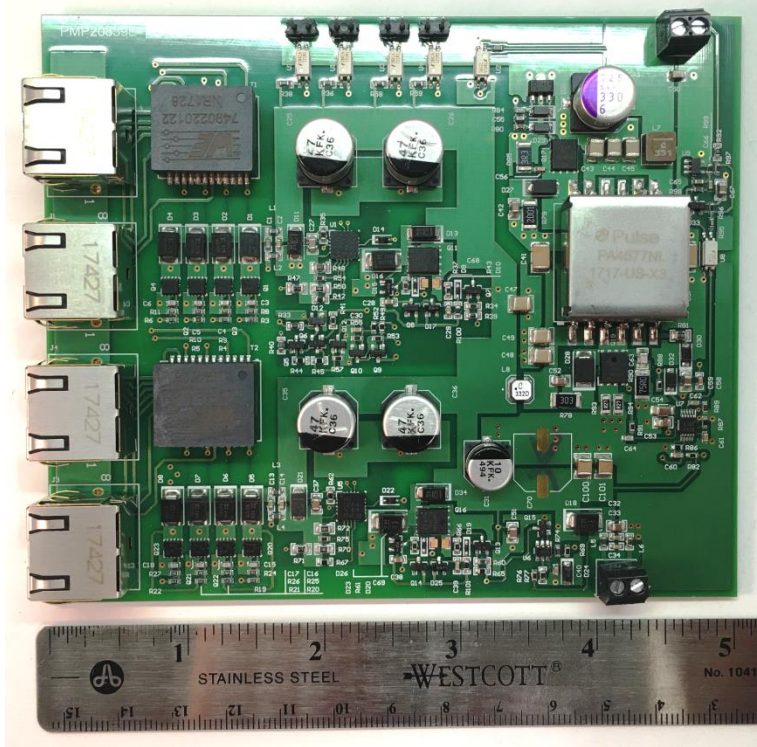
Bottom side:



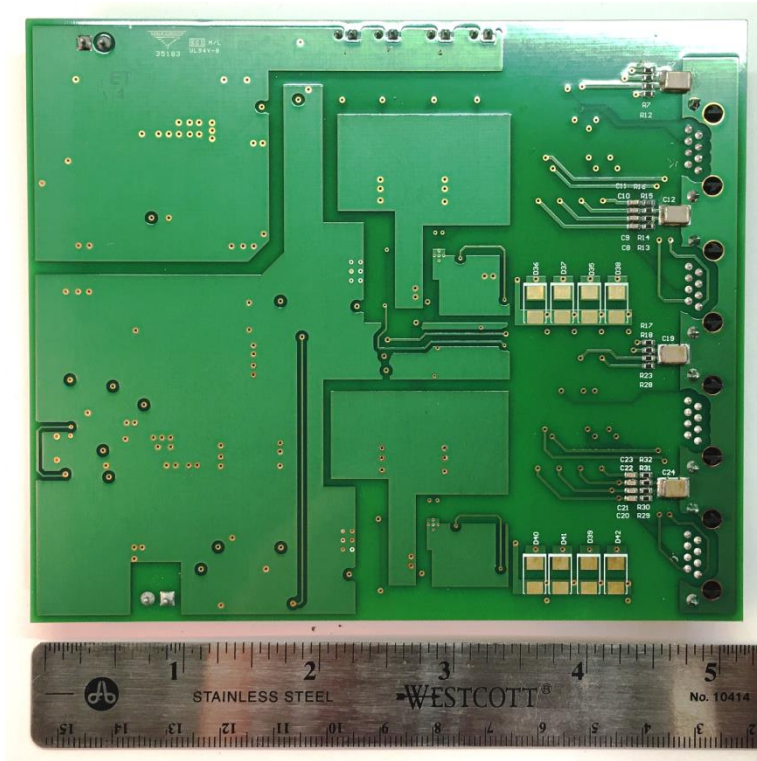
2.4 Photo

The board measures 117mm x 127mm.

Top:



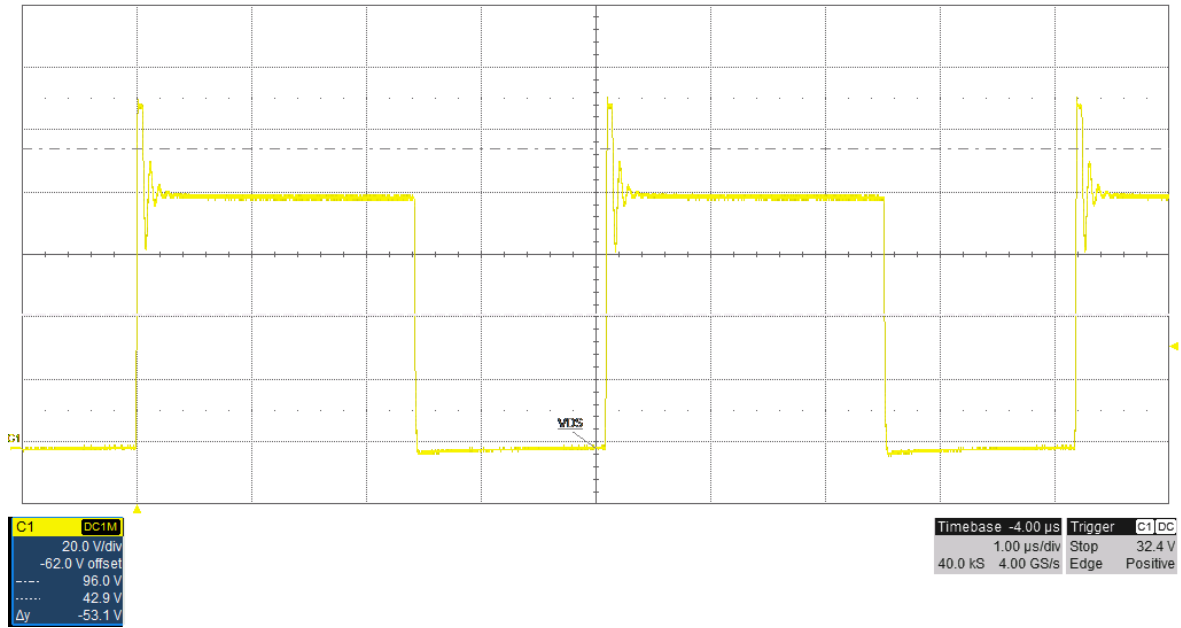
Bottom:



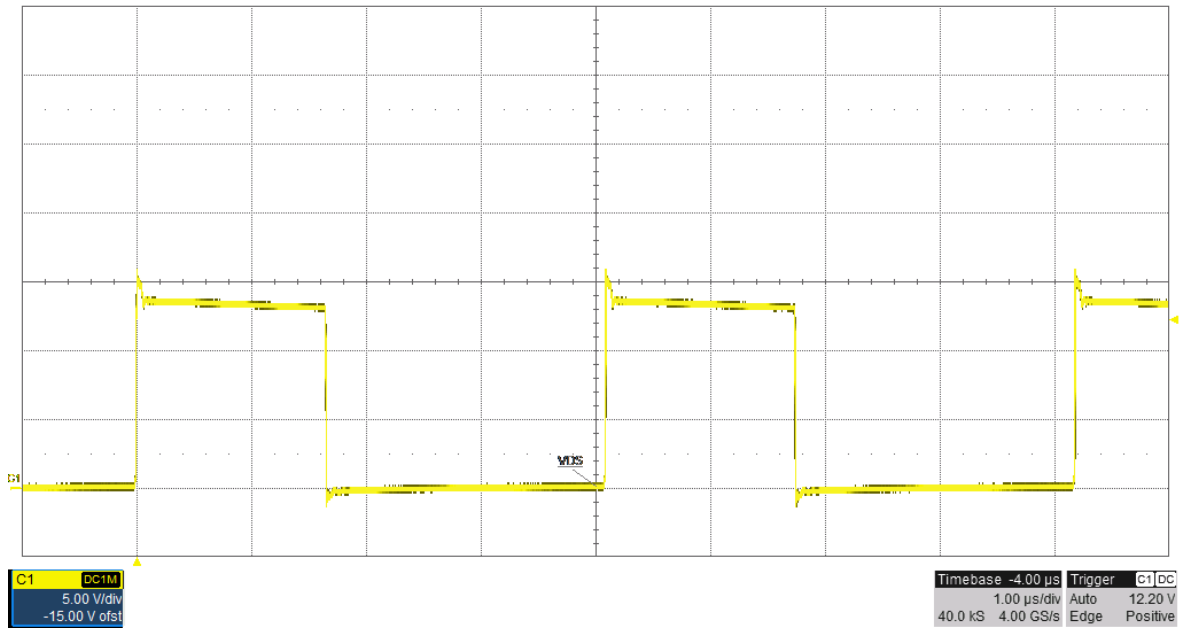
3 Waveforms

3.1 Switching

Primary FET (Q19) Drain to PWRGND:

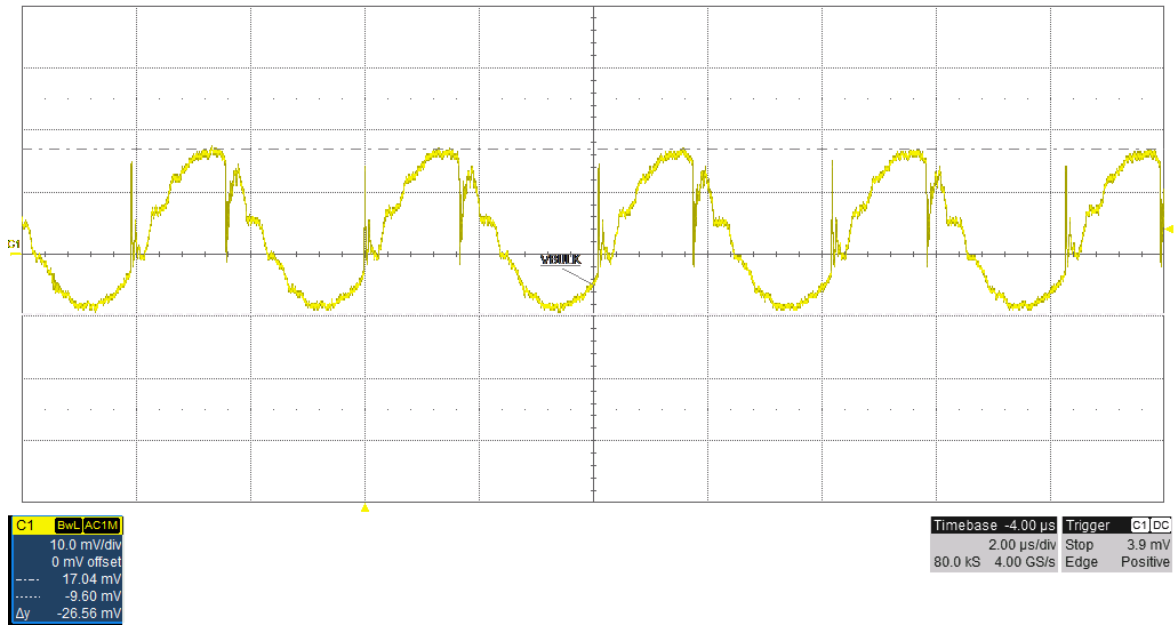


Secondary FET (Q17) Drain to GND:

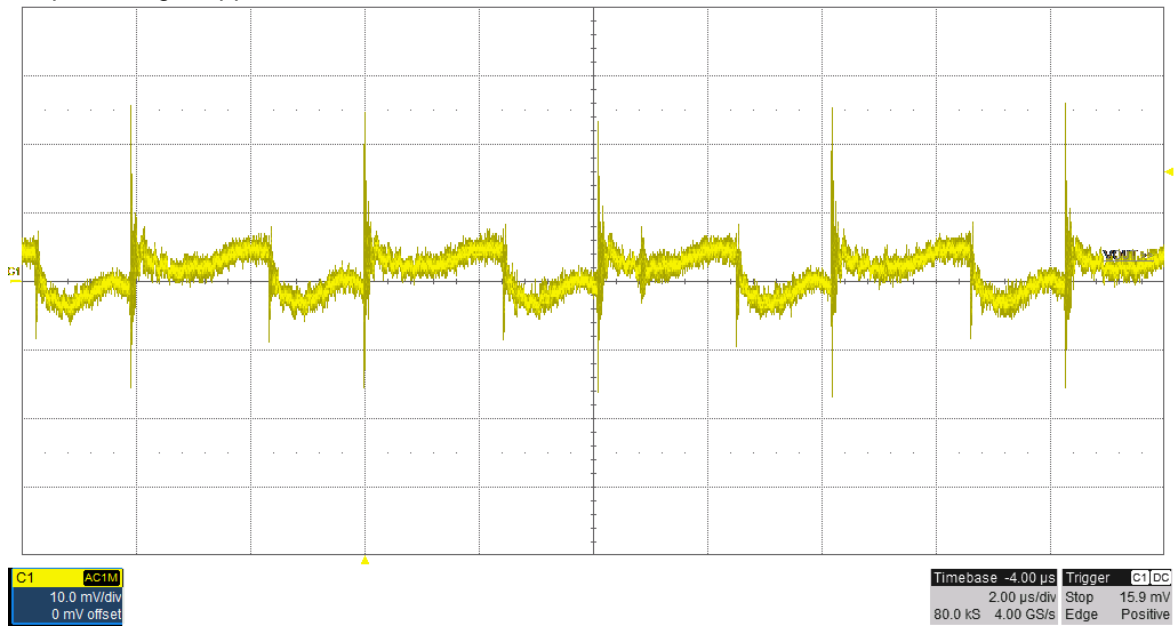


3.2 Voltage Ripple

Input Voltage Ripple:

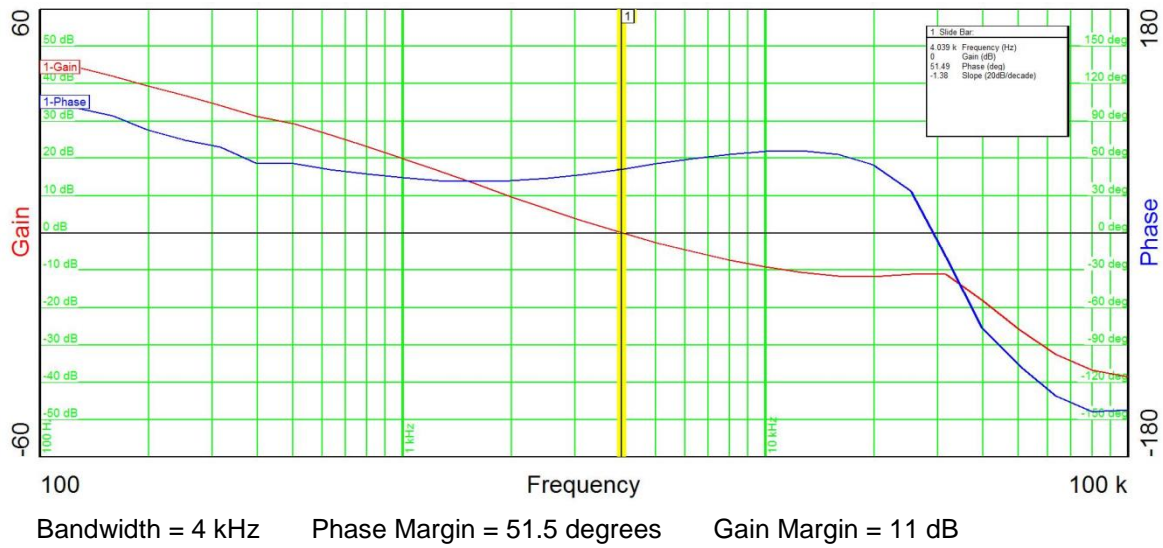


Output Voltage Ripple:

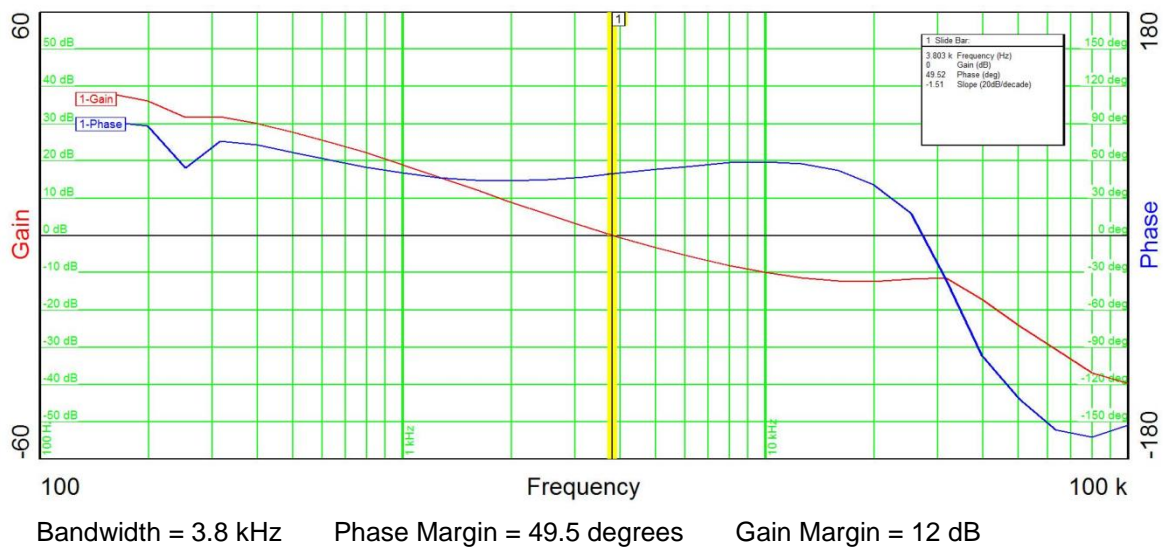


3.3 Bode Plot

0A Load:

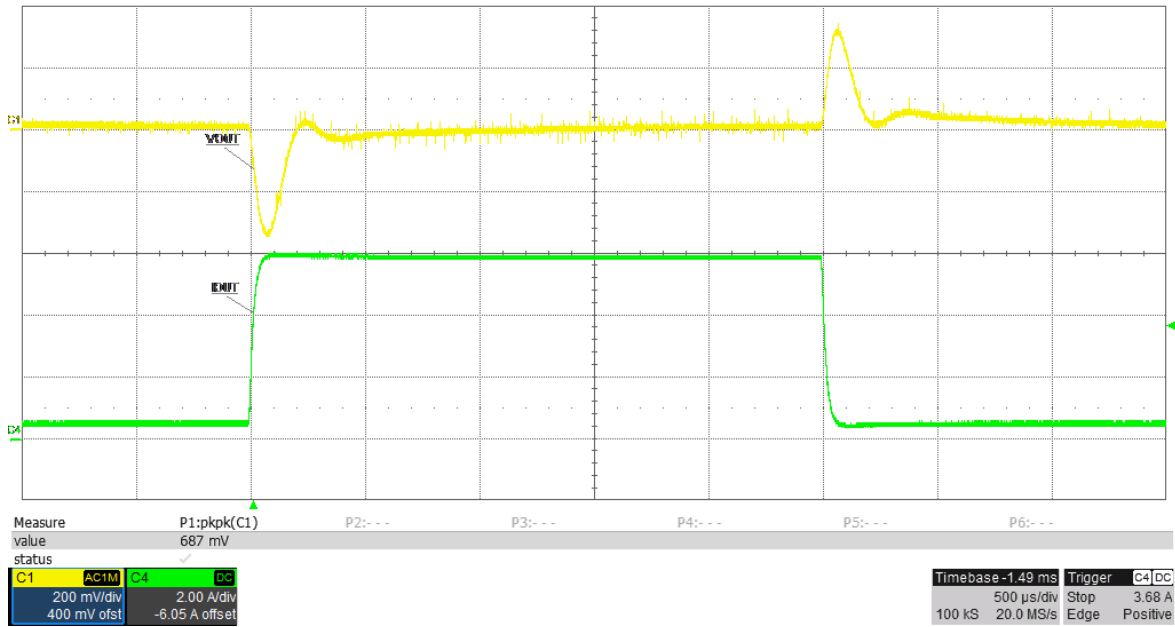


6A Load:

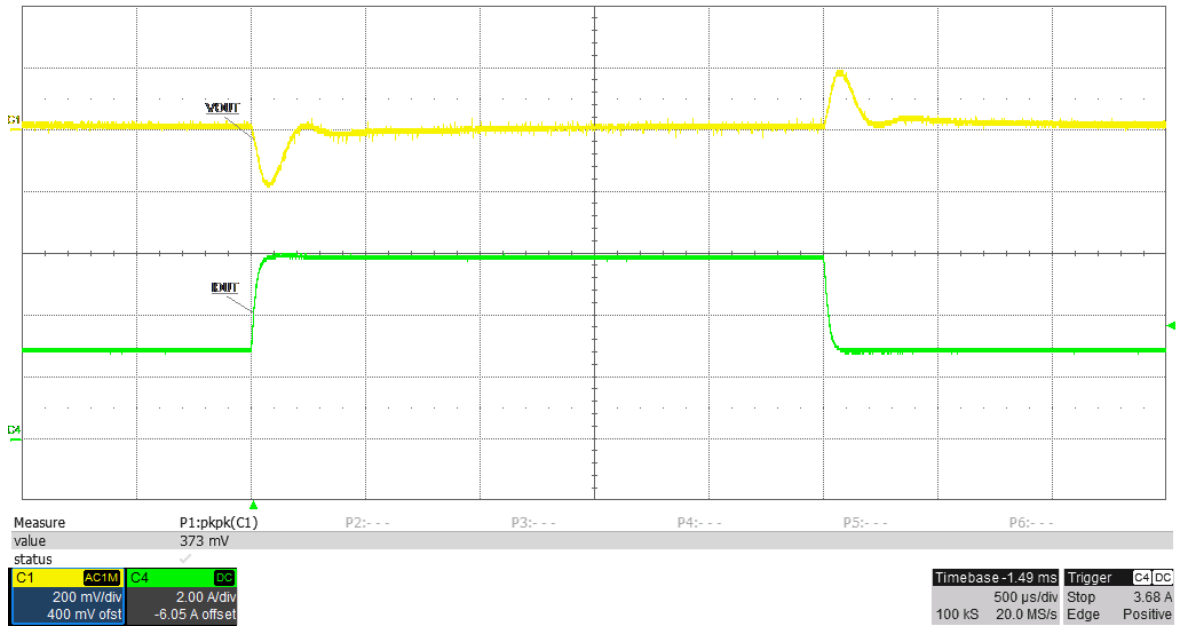


3.4 Load Transients

600mA to 6A Load Step:

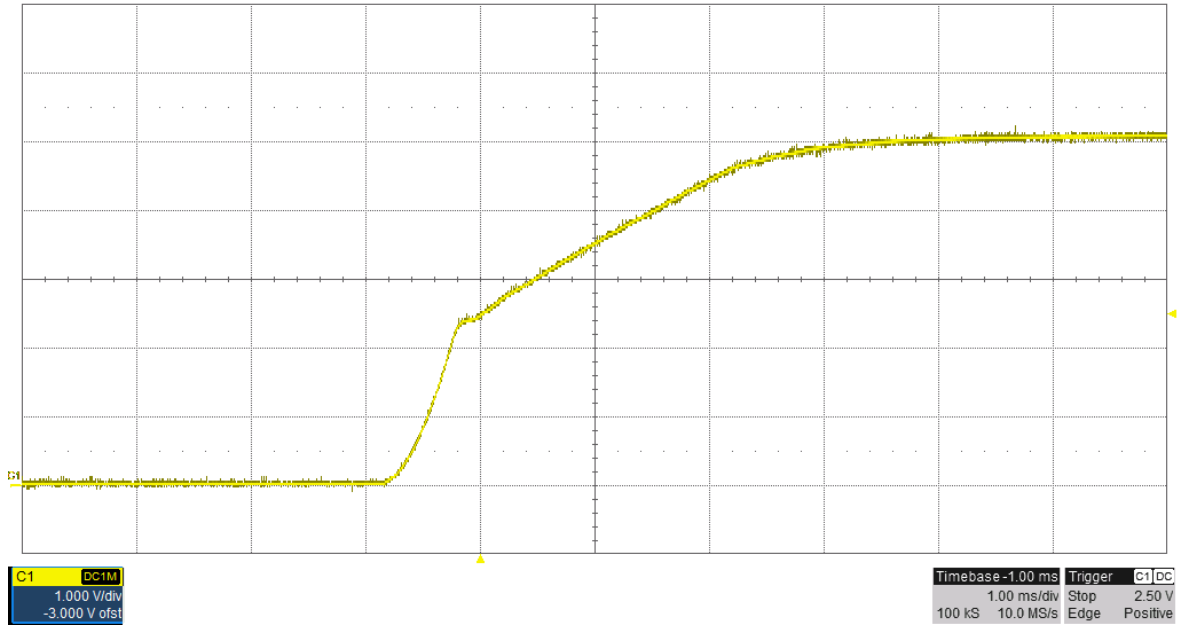


3A to 6A Load Step:

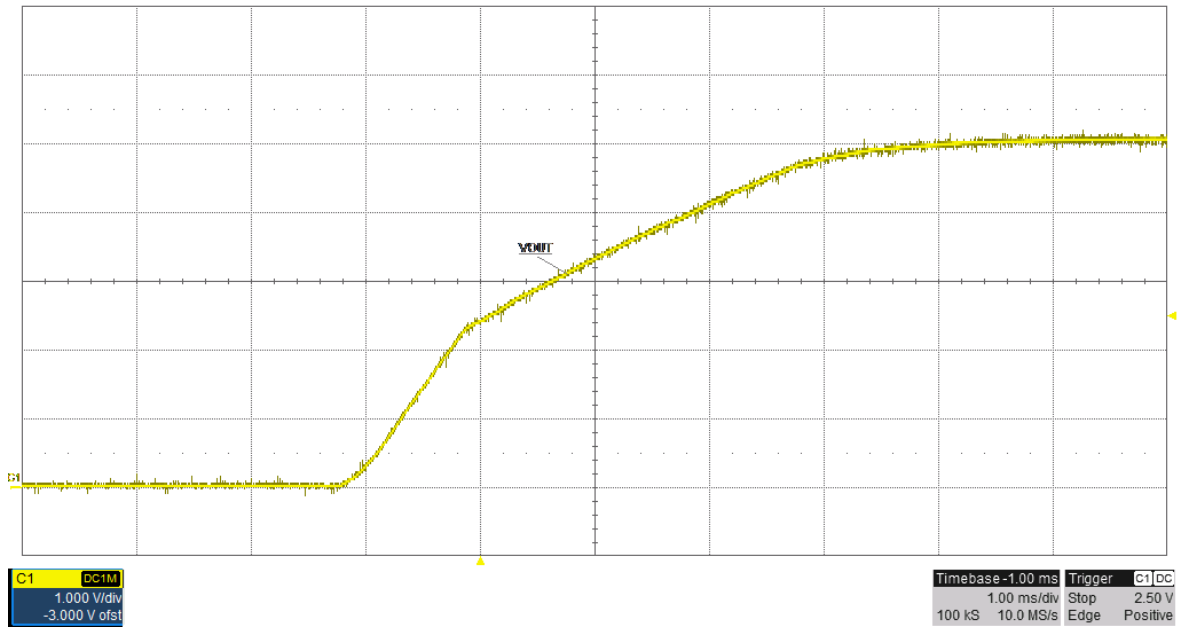


3.5 Start-up Sequence

0A Load:



6A Load:

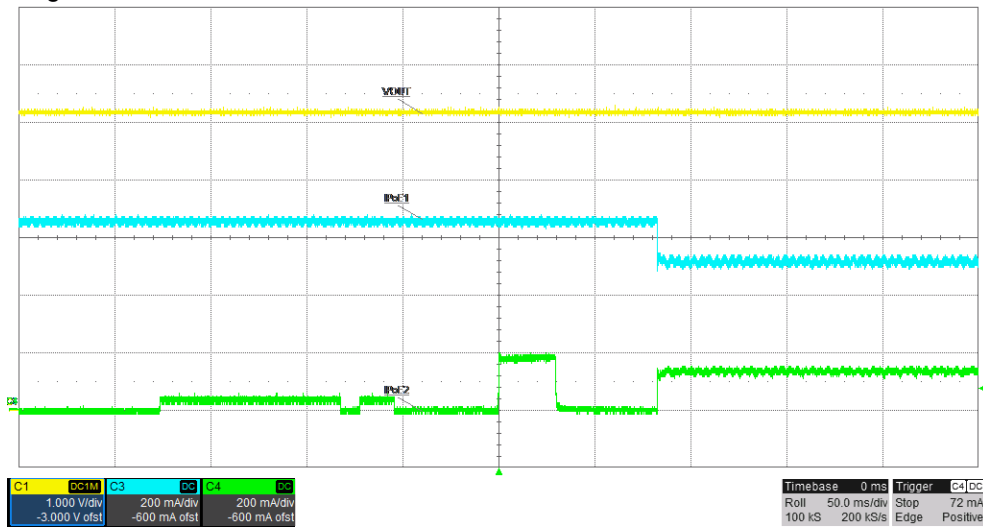


4 Smooth Transition

4.1 Transitions Between Two PoE Inputs

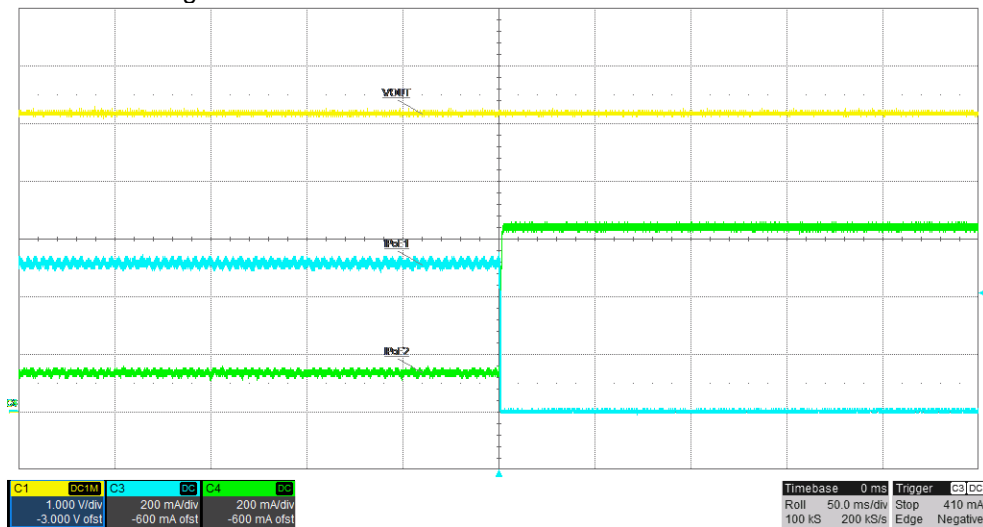
Initial State	Change	Expected Result
Single PD connected	Add second PD	Both PD's connected to PSE, one PD enters standby and one PD provides power. Output voltage remains within transient limits
Dual PD's connected	Remove one PD	PD still connected provides power. Output voltage remains within transient limits

Single PD to Dual PD:



Note: If the CAT5e cables have similar lengths/resistance and both PD circuits have similar losses, the PD circuits may share the input current. This is not typical.

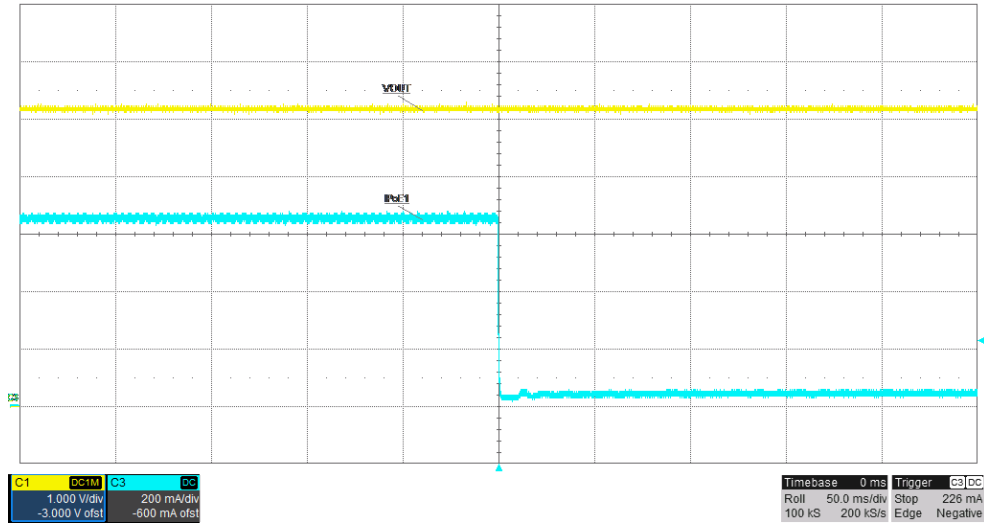
Dual PD to Single PD:



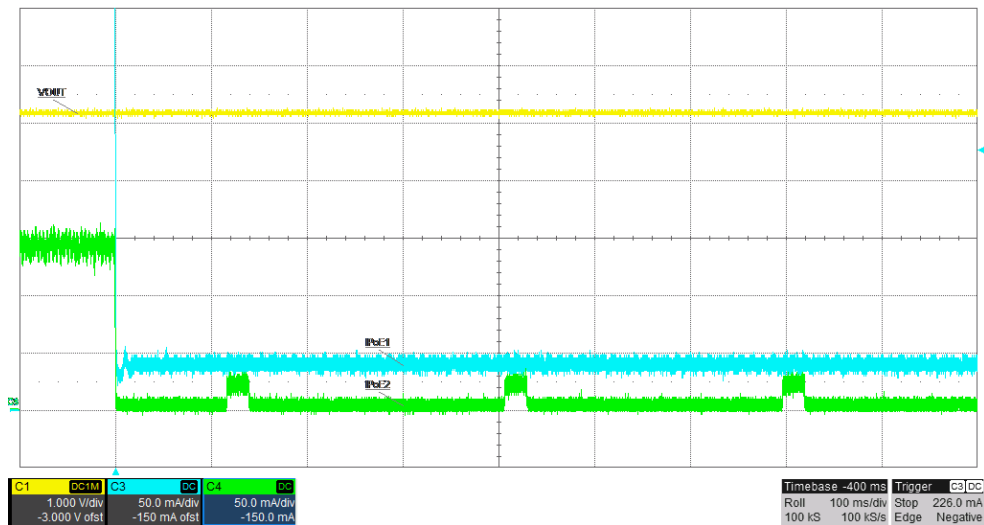
4.2 Transitions Between PoE Inputs and AUX

Initial State	Change	Expected Result
Single PD connected	Add AUX	AUX provides power and PD enters standby. Output voltage remains within transient limits.
Dual PDs connected	Add AUX	AUX provides power and PD's enter standby. Output voltage remains within transient limits.

Single PD to AUX:



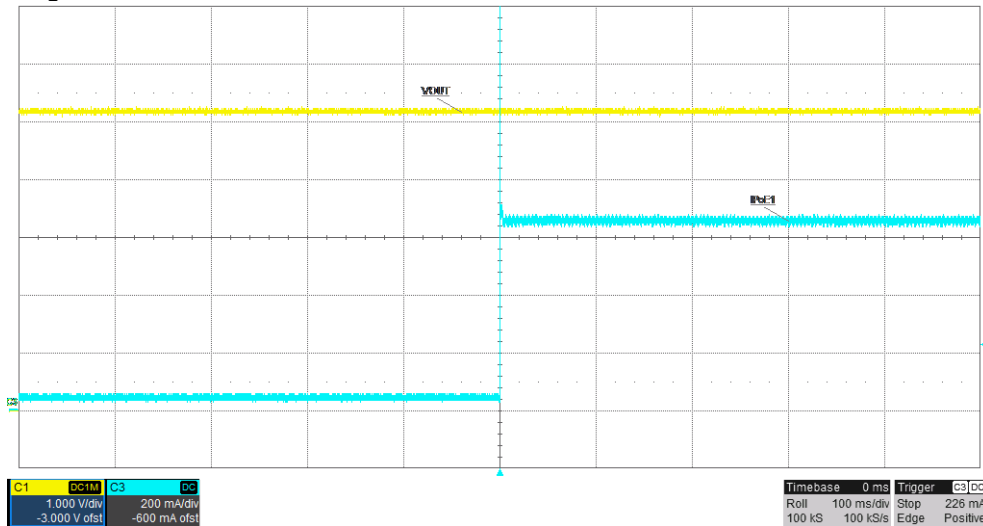
Dual PD to AUX:



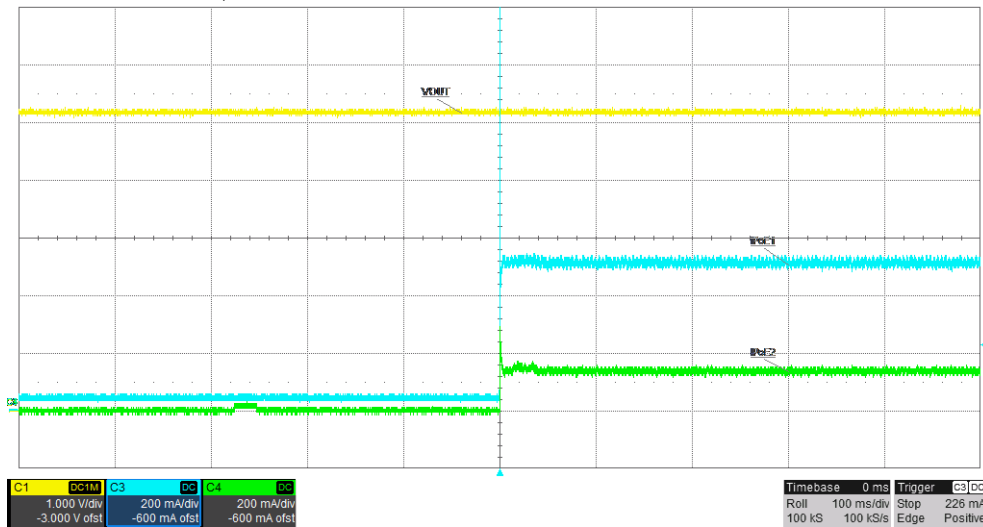
4.3 Transitions From AUX to PD

Initial State	Change	Expected Result
Single PD and AUX connected	Remove AUX	PD continues to provide power. Output voltage remains within transient limits.
Dual PD's and AUX connected	Remove AUX	One PD continues to provide power and the second enters standby. Output voltage remains within transient limits.

Single PD and AUX, Remove AUX:



Dual PD and AUX, Remove AUX:

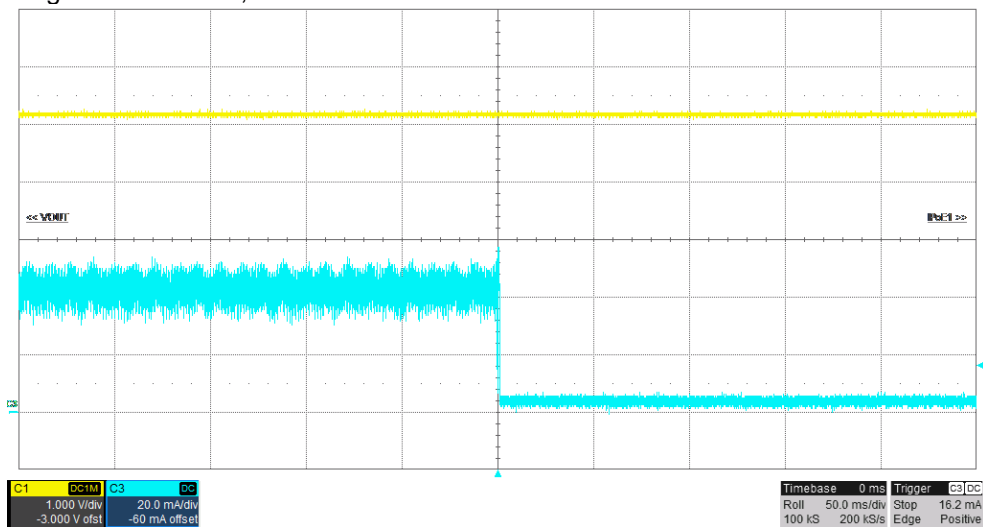


Note: If the CAT5e cables have similar lengths/resistance and both PD circuits have similar losses, the PD circuits may share the input current. This is not typical.

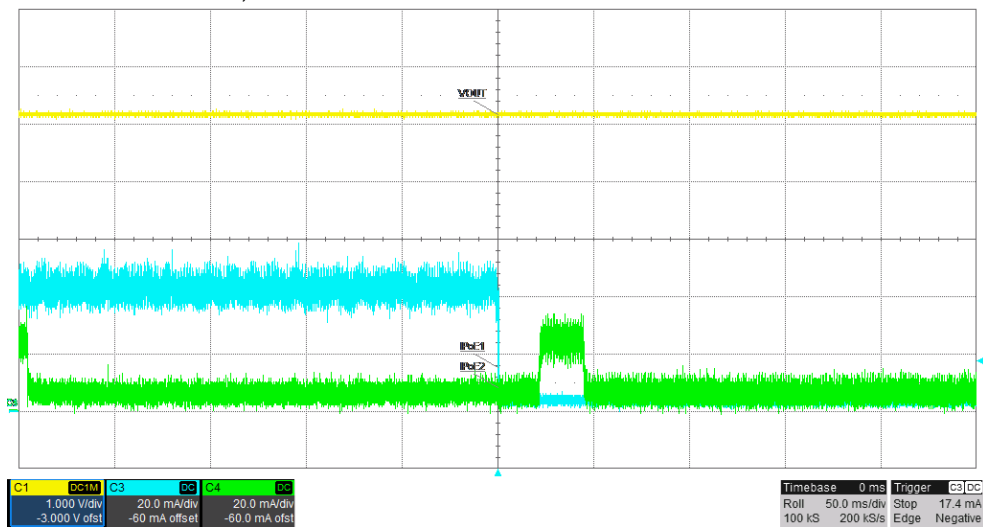
4.4 Transitions Between AUX and Single/Dual PD Inputs

Initial State	Change	Expected Result
Single PD and AUX connected	Remove PD	AUX continues to provide power. Output voltage remains within transient limits.
Dual PD's and AUX connected	Remove one PD	AUX continues to provide power and remaining PD enters standby. Output voltage remains within transient limits.
Single PD and AUX connected	Add second PD	AUX continues to provide power and PD's enter standby. Output voltage remains within transient limits.

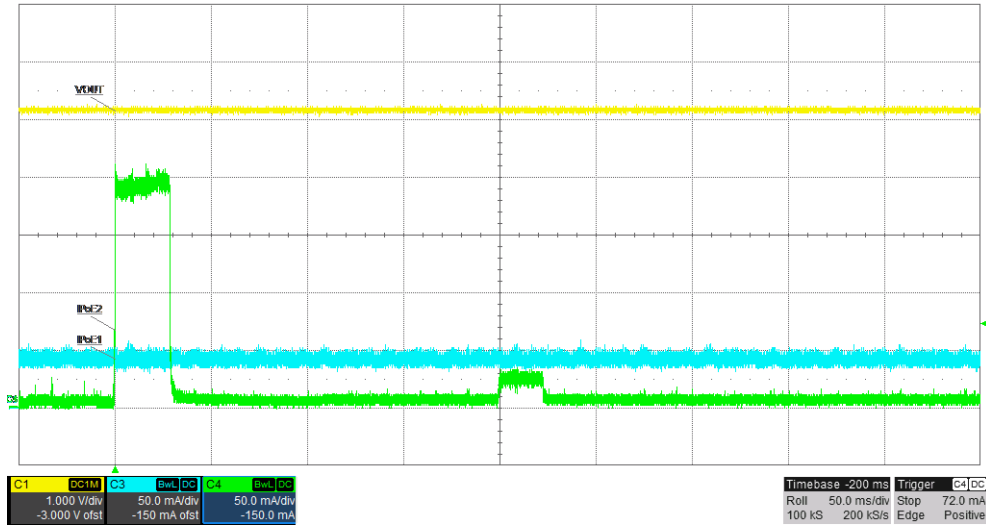
Single PD and AUX, Remove PD:



Dual PD's and AUX, Remove one PD:



Single PD and AUX, add second PD:



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