Power over Ethernet - PD converter with 5 V 8 A output, synchronous Flyback, IEEE802.3bt standard compliant

Introduction

The STEVAL-POE002V1 power device evaluation board is equipped with a DC-DC converter stage, managed by the PM8804 controller, which provides 40 W (5 V-8 A) on the output.

The DC-DC converter stage is based on the fixed frequency Flyback topology with a secondary synchronous rectification managed by the controller via gate driver transformer.

The evaluation board embeds also the PM8805 controller, dedicated to the Ethernet interface (compliant with the Standard IEEE802.3.af/at/bt) and to the full active bridge rectification.

Figure 1. STEVAL-POE002V1 evaluation board

1 STEVAL-POE002V1 evaluation board overview

1.1 Specifications, connectors and LEDs

Table 1. STEVAL-POE002V1 specifications

Parameter	Specs
V_{IN} at RJ45 connector	From 41.2 to 57 V
I_{IN} at RJ45 connector	1.0 A max. each pair
V_{OUT}	5 V ± 5%
I_{OUT}	8 A
Max. ouput power	40 W
Efficiency overall peak DC-DC efficiency	>90% full load >91% full load
Peak to peak output ripple at full load	50 mV
Transient response ΔV pk-pk 100% to 50% load step	≈700 mV
Switching frequency	≈ 280 KHz

Table 2. STEVAL-POE002V1 connectors

Reference	Type	Specs
J1	RJ45 connector	Data and power input
J2	RJ45 connector	Data output
J9	Power jack	Front Aux
J10	Power jack	Rear Aux
J4, TP9	Banana jack/turret	Positive of V_{OUT}
J6, TP10	Banana jack/turret	Negative of V_{OUT} (Sec GND)
P1	Push button	SLEEP/WKUP
P2	Push button	SHDN

Table 3. STEVAL-POE002V1 LEDs

Reference	Type	Function	Logic
D4	Green LED	Monitor of T2 signal	LED on when T2 is low
D5	Green LED	Monitor of T1 signal	LED on when T1 is low
D6	Green LED	Monitor of T0 signal	LED on when T0 is low
D15	Green LED	Monitor of V_{OUT}	LED on when V_{OUT} is present
D39	Green LED	Monitor of FAUX signal	LED on when frontal aux is present
D40	Green LED	Monitor of STBY signal	LED on when STBY is high

Reference	Type	Function	Logic
D44	Green LED	Monitor of RAUX signal	LED on when rear aux is present

Table 4. Tx signal possible configurations

Classification	T0	T1	T2	Bridges	Finger number	Notes
Type 1 (13 W)	1	1	1	1	0 or 1	Legacy type
Type 2 (25.5 W)	0	1	1	1	2, 3	Legacy type
Type 3 (51 W)	1	0	0	2	4	New PD type
Type 4 (71 W)	0	0	0	2	≥ 5	New PD type
Type 3 on 4 pairs (13 W), or legacy 4 pairs (type 1 class)	1	1	0	2	0 or 1	New PD type
Type 3 on 4 pairs (25.5 W), or legacy 4 pairs (type 2 class)	0	1	0	2	2, 3	New PD type
Rear AUX	0	0	1	any	N.A.	Aux present
Front AUX				0		

The STEVAL-POE002V1 evaluation board is classified as type 3 and class 6. The default status of Tx signal is 000.

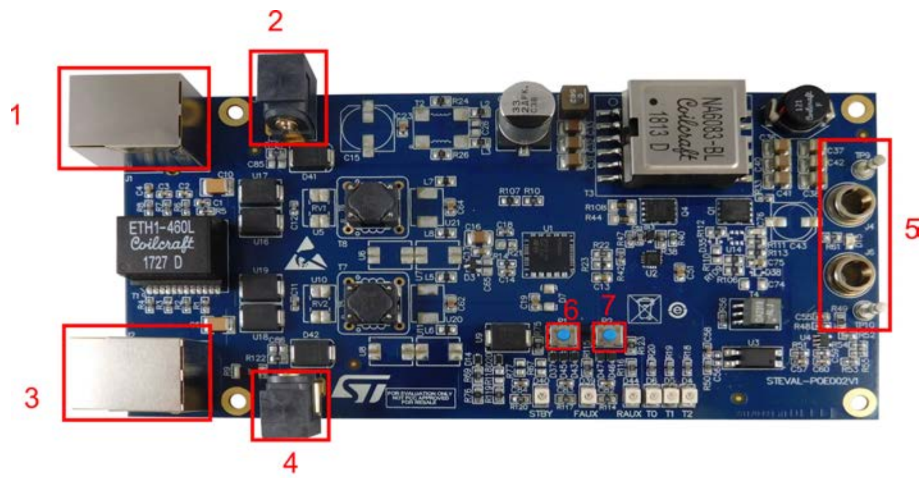
Note: Level 0 or low means the corresponding LED is on; level 1 or high means the LED is off.

1.2 Board setup

The STEVAL-POE002V1 evaluation board combines the PM8805 PD interface, compliant with the 802.3bt IEEE PoE standard, and the PM8804 PWM controller.

Figure 2. STEVAL-POE002V1 evaluation board components

- 1. POE IN
- 2. RAUX IN
- 3. DATA OUT
- 4. FAUX IN
- 5. OUTPUT
- 6. SLEEP
- 7. WAKE UP



When you use a bench power supply, follow the steps below.

Step 1. Set the power supply current limit to 50 mA

Step 2. Apply 10 V and check the input current is 350-390 µA

Step 3. Apply 20 V and check the input current is within the selected Class range (the default is Class 6, 39 mA ±2 mA)

Step 4. Apply 48 V and check the input current is <30 mA and the output voltage is 5 V (without load)

Step 5. Change the current limit to 1 A

Step 6. Connect an electronic load between V_{OUT} and the sec GND

Step 7. Turn the power supply on (48 V) and check the input current is coherent with the load current setting and the converter expected efficiency.

For example, 5 V x 8 A = 40 W→expected efficiency is 90% so P_{IN} = 40/0.90≈44.5 W, which, with 48 V as input voltage, gives input = 44.5/48 ≈930 mA

Step 8. Change the load current as needed

1.3 Configurations

1.3.1 PM8805 configurations

Table 5. **PM8805 control signal description**

PM8805 behavior,standard operations	INPUTS			OUTPUTS				
	FAUX	RAUX	STBY	PGD	Hot swap	Charge pump	Active bridge	MPS
Normal POE operation	0	0	0	1 after 85ms hot swap enabled	Closes at UVLO	On @ UVLO	Enabled	Off
Stby PoE operation	0	0	1	1 when hot swap closed	Closes at UVLO	Off	LS enabled HS OFF	On
Front Aux operation	1	0	x	1 when hot swap closed	Closed	On	Enabled	Off
Rear Aux operation	0	1	0	1	Open	Off	Off	Off
Additional non standard operations								
Sleep mode/Wake up	1	1	1	0	Open	Off	LS enabled HS OFF	On
Rear Aux with MPS	0	1	1	1	Open	Off	LS enabled HS OFF	On
Shutdown/reboot	1	1	0	0	Open	Off	Off	Off

1.3.2 PoE

The STEVAL-POE002V1 evaluation board default operation mode is the PoE (0,0,0). The selected class resistors are 36.5 ohm for CLS1 and 150 ohm for CLS2, so the board is class 6; that is, the Tx LED configuration is 100 with T0 LED in off condition.

The other classes can be adjusted using the following table.

Table 6. **PM8805 class description**

PD class	CLS1 resistor (Ω)	CLS2 resistor (Ω)	Min. (mA)	Max. (mA)
Class 0	2 K	2 K	0	4.0
Class 1	150	150	9.0	12.0
Class 2	80.6	80.6	17.0	20.0

PD class	CLS1 resistor (Ω)	CLS2 resistor (Ω)	Min. (mA)	Max. (mA)
Class 3	51.1	51.1	26.0	30.0
Class 4	36.5	36.5	36.0	44.0
Class 5	36.5	2 K	36/0	44/4
Class 6	36.5	150	36/9	44/12
Class 7	36.5	80.6	36/17	44/20
Class 8	36.5	51.1	36/26	44/30

Classification phase is valid only for PoE devices, so it is not required when connected to any non-PoE power source such as a wall adapter: in those cases, the CLS buffers are never turned on.

Depending on the PD type and class, the relevant PD electrical parameters are summarized in the table below.

Table 7. PM8805 PD main parameters

PD type	Class	CLS1 sign.	CLS2 sign.	Pin (W)	Vin min. (V)	Vin max. (V)	I_{IN} max. (mA)	P_{peak} (W) for 50 ms
1	0	0	0	13.0	37.0	57	350	14.4
	1	1	1	3.84	42.1		90	5.00
	2	2	2	6.49	40.8		160	8.36
	3	3	3	13.0	37.0		350	14.4
2	4	4	4	25.5	42.5		600	28.05
3	1	1	1	3.84	42.1		90	5.00
	2	2	2	6.49	40.8		160	8.36
	3	3	3	13.0	37.0		350	14.4
	4	4	4	25.5	42.5		600	28.05
	5	4	0	40.0	44.3		900	42
	6	4	1	51.0	42.5		1200	53.55
4	7	4	2	62.0	42.9		1440	65.10
	8	4	3	71.3	41.2		1730	74.86

1.3.3 FAUX connector

A voltage applied at J9 connector (FAUX) sets automatically the correct input configuration (FAUX=1, RAUX=0, STBY=do not care).

If the STEVAL-POE002V1 evaluation board is already powered by a PSE, the following conditions apply:

1. FAUX voltage lower than PSE voltage: the evaluation board is still powered from PSE and T0,T1,T2 signal configuration remains the same according to Table 4. Tx signal possible configurations
2. FAUX voltage is greater than PSE voltage, but the difference is less than 2 V: a current sharing occurs between PSE and FAUX to supply the evaluation board. T0,T1,T2 signal configuration remains unchanged as in the previous case
3. FAUX voltage is greater than PSE voltage and the difference is greater than 2 V: the evaluation board is powered by FAUX, PSE is disconnected as its load has significantly decreased (~3 mA) and PD does not ensure MPS condition.

   The PM8805 device works in Front aux mode (T0=0,T1=0,T2=1). When the FAUX connector (J9) is unplugged, PSE is not connected and the output voltage is interrupted as a new detection/classification procedure must be done before PSE powers the board again.

1.3.4 RAUX with MPS

A voltage applied at J10 connector (RAUX) sets automatically the correct input configuration (FAUX=0; RAUX=1; Stby=1).

The hot swap MOSFET is opened to give prevalence of the RAUX source over the PoE interface.

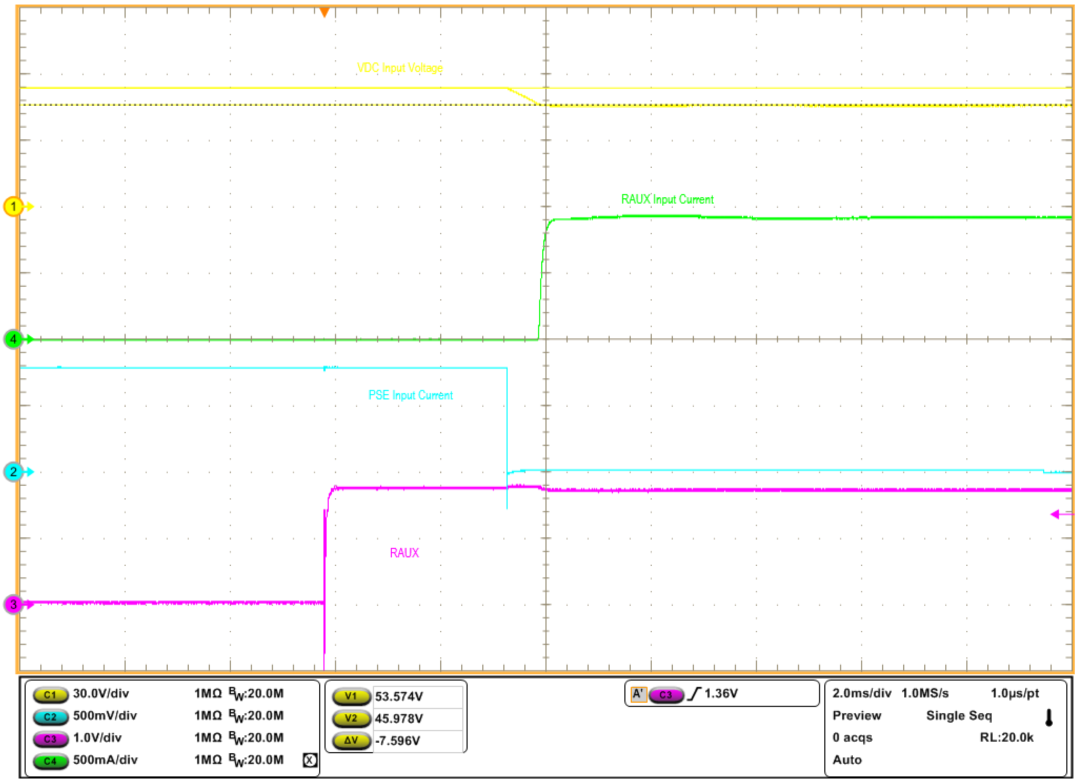
The STEVAL-POE002V1 evaluation board is configured to put the PSE in MPS mode triggering the STBY pin threshold by a proper divider (R69, R76 and R120) supplied by the RAUX input voltage, to pull the STBY pin up and enable the MPS current, drawn from the PSE.

The RAUX voltage can be in one of the following ranges, depending on the PSE voltage available at RJ45 connector (J1):

- RAUX voltage lower than PSE input voltage of less than 8 V: when RAUX voltage is applied and the evaluation board is already powered by PSE, switching between the two power supply sources works properly. The PM8805 device goes in Rear auxiliary with MPS mode and PSE remains connected to the evaluation board (T0=0,T1=0, T2=1)

Figure 3. **PSE to RAUX switchover at VPSE≈53.5 V, VRAUX≈46 V, I_{OUT}=8 A**

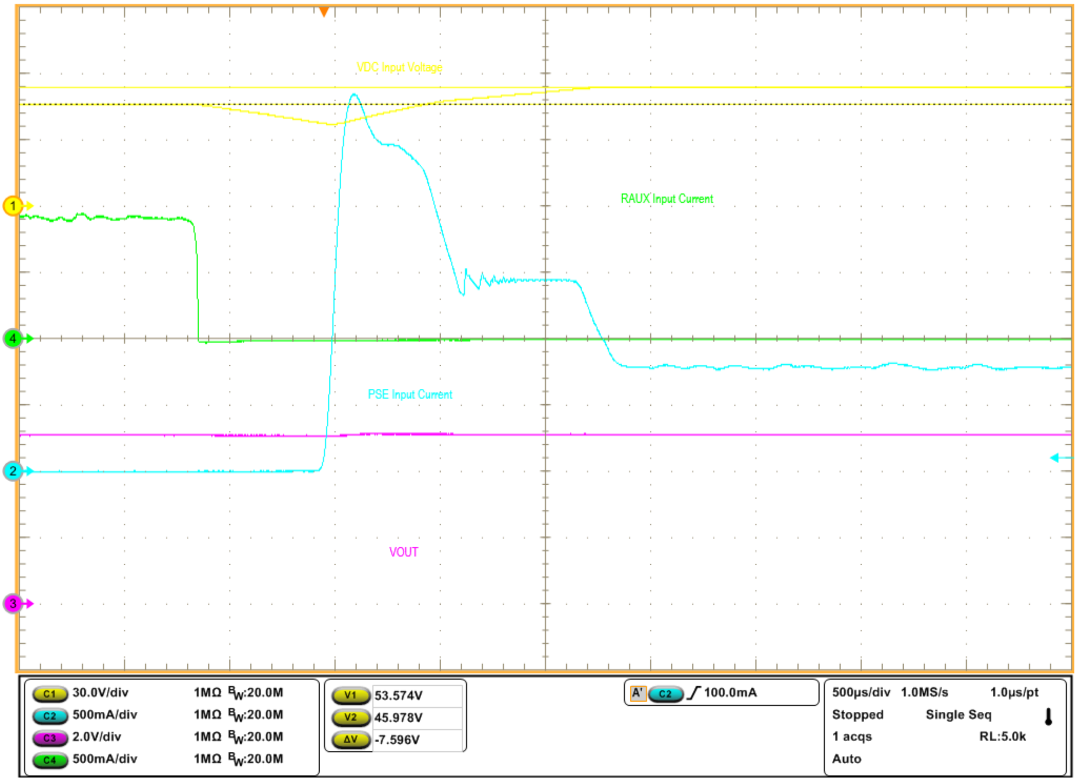
– Ch1: VDC input voltage; Ch2: PSE input current
– Ch3: RAUX signal; Ch4: RAUX input current



When RAUX power supply is unplugged from J10, PSE is immediately available to supply the evaluation board, without causing output voltage interruptions, and the PM8805 device goes back to normal operating mode.

Figure 4. **RAUX to PSE switchover at I_{OUT}=8 A, VRAUX≈46 V, PSE≈53.5 V**

– Ch1: VDC input voltage; Ch2: PSE input current
– Ch3: Vout output voltage; Ch4: RAUX input current

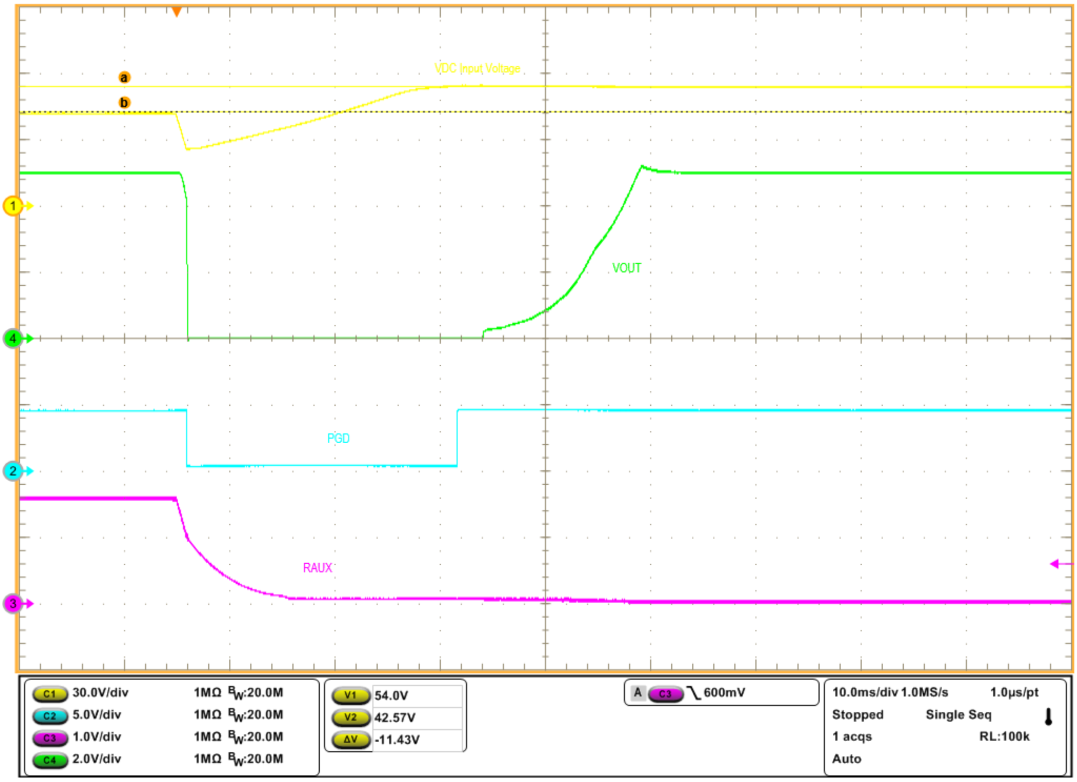


- RAUX voltage lower than PSE input voltage of more than 8 V: when RAUX voltage is applied and the evaluation board is already powered by PSE, switching between the two power supply sources works properly as in the previous case. When RAUX power supply is unplugged from J10, during the switchover, the following failures of the PM8805 hot swap MOSFET might occur:
  – hot swap MOSFET drop between drain and source is greater than the datasheet parameter **Vds_fail** (12 V min./16 V max.)
  – hot swap MOSFET current is greater than the datasheet parameter **Short** (4 A min./6 A max.)

  If one of these failures occurs, the power good signal is forced to low level according to the datasheet parameter **Tretry** (9 min./11 max. msec), stopping the Flyback converter switching, then it is released causing an output voltage interruption as shown in the following figure.

Figure 5. **RAUX to PSE switchover at I_{OUT}=8 A**

– Ch1: VDC input voltage; Ch2: PGD
– Ch3: RAUX signal; Ch4: Vout output voltage



- RAUX voltage is greater than PSE input voltage of at least a diode forward voltage: when RAUX voltage is applied and the evaluation board is already powered by PSE, switching between the two power supply sources works properly as reported in the previous cases, but in this condition MPS current is drawn by RAUX source, then PSE is no more able to stay connected to evaluation board. In this case, when RAUX source is removed, the output voltage goes to zero until PSE has successfully completed detection and classification phases, and the voltage is reapplied to the PD interface.

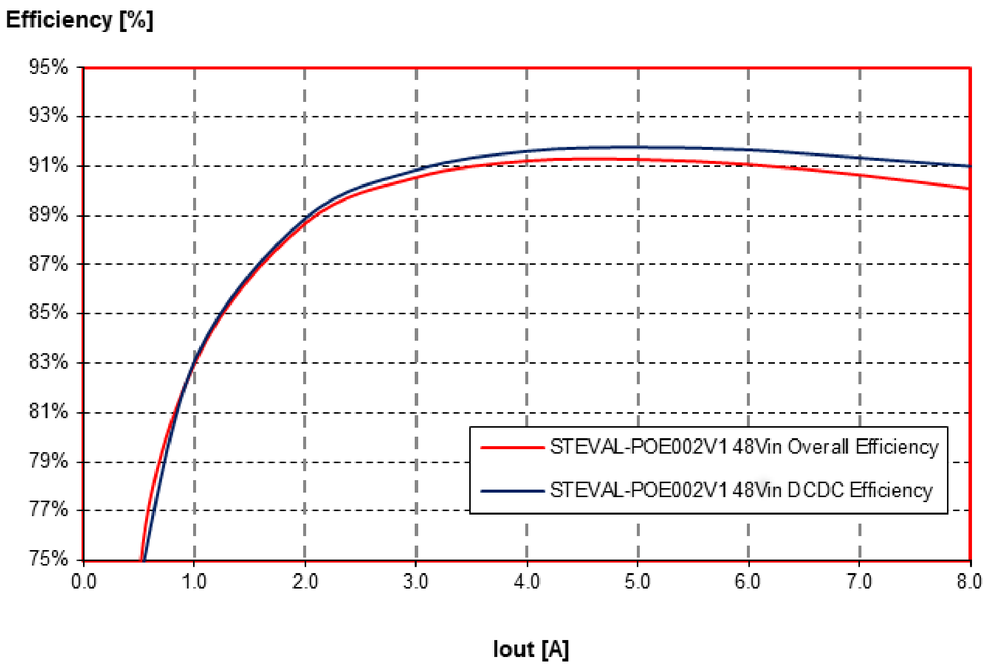
2 Measurements

2.1 Efficiency

The STEVAL-POE002V1 evaluation board is composed by a PoE interface compliant with the last standard IEEE802.3bt, thanks to the PM8805 interface and a fixed frequency Flyback topology with a secondary synchronous rectification converter that receives DC voltage from the PoE output.

The PM8805 device integrates two N-channel MOSFET bridges, one for every 2 pairs of PoE interfaces and a hot swap MOSFET placed in series to the outputs of the two bridges.

Figure 6. STEVAL-POE002V1 evaluation board efficiency measurements



The red line indicates the STEVAL-POE002V1overall efficiency at 48 VDC input voltage applied to RJ45 connector J1. The blue line indicates the DC-DC converter efficiency, that does not include the following losses of the associated POE interface section:

- RJ45 connector J1
- PoE data transformer T1
- common chokes T5,T6 placed on the two power supply pairs
- PM8805 interface that integrates the dual POWER MOS bridges and a hot swap MOSFET
- Flyback converter input filter

The DC-DC efficiency is measured between output test points TP9/TP10 and input test points across the input capacitor C28 of the DC-DC Flyback converter.

2.2 Output voltage ripple

Figure 7. Output voltage ripple: input voltage=48 V, I_{OUT} at no load

- Ch3: Vout ripple;Ch4: Iout

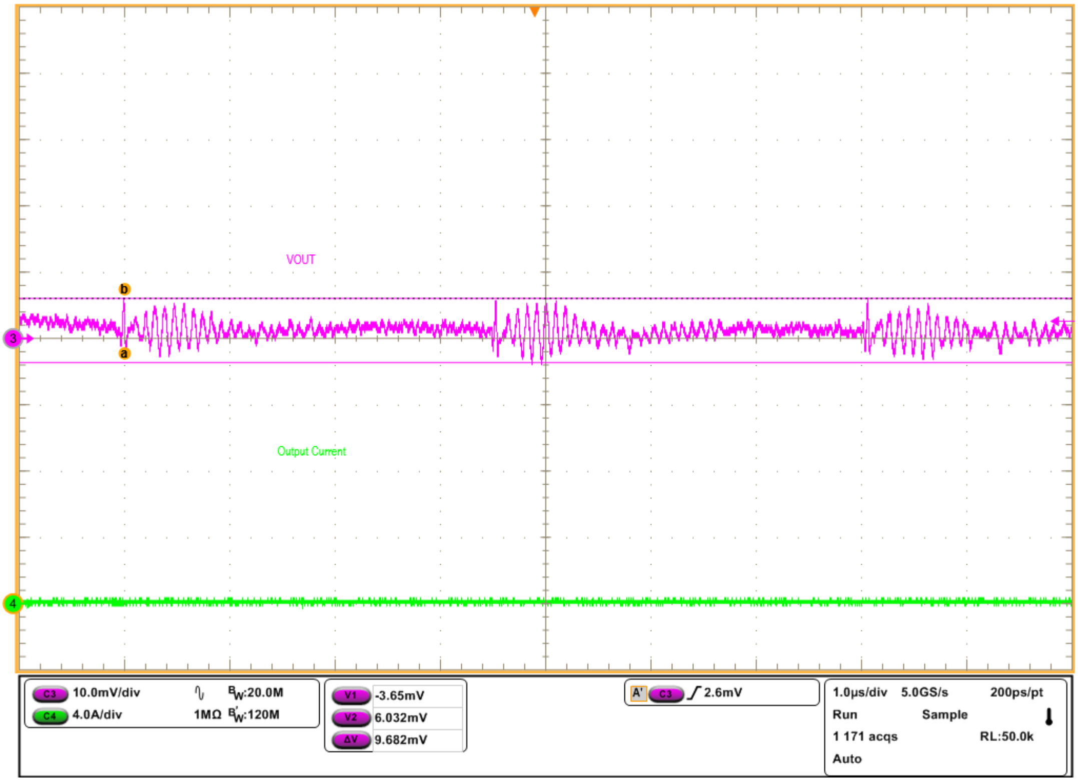
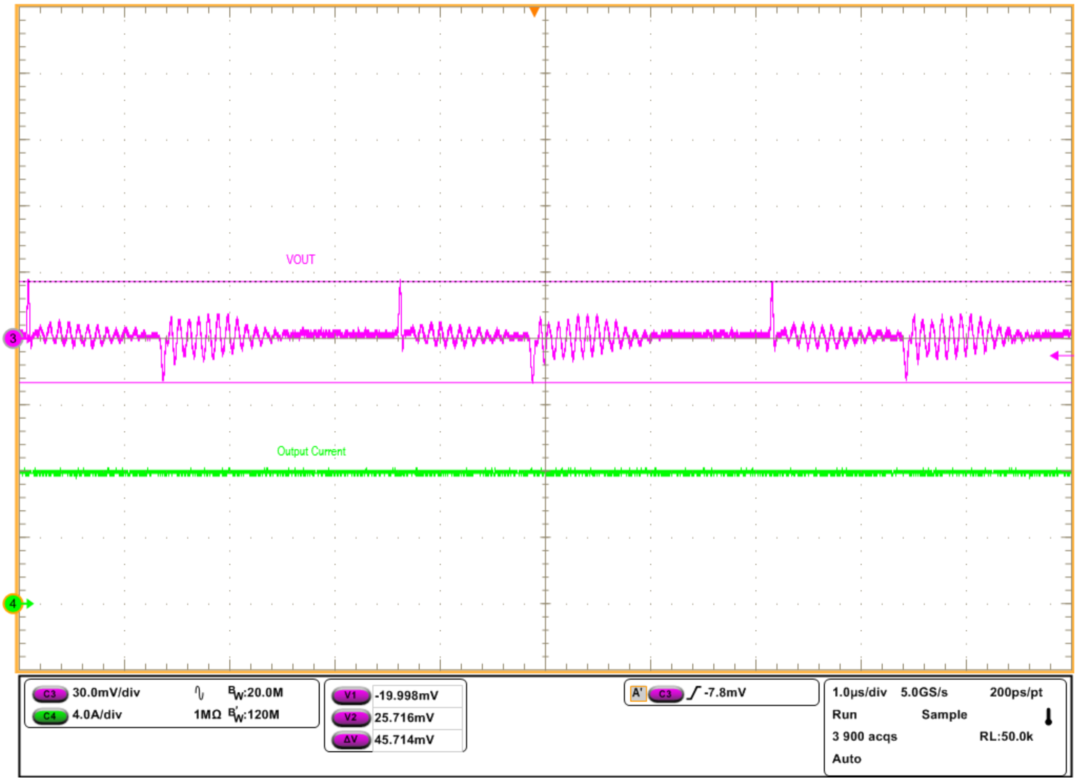


Figure 8. Output voltage ripple: input voltage=48 V, I_{OUT} at full load 8 A

- Ch3: Vout ripple; Ch4: Iout



2.3 Input voltage ripple

Figure 9. Input voltage ripple before and after Flyback input filter I_{OUT}=0 A

- Ch1: Vin ripple before input filter; Ch2: Primary VGate
- Ch3: Vin ripple after input filter; Ch4: Input current (J1 connector pairs)

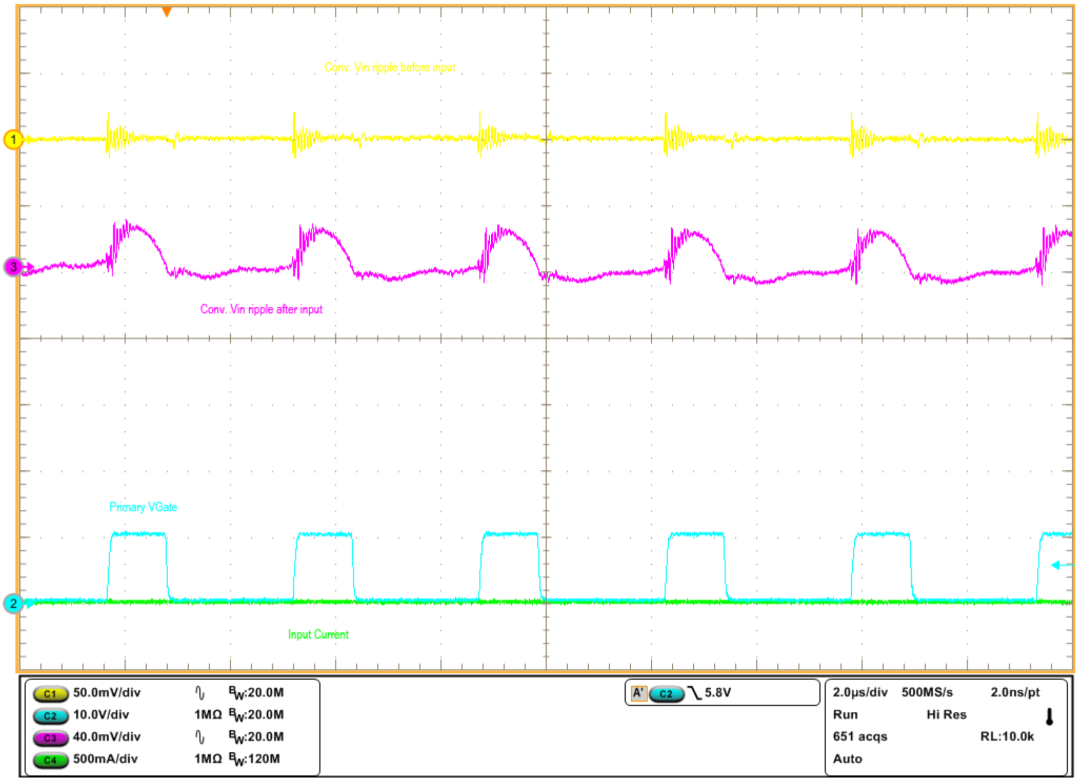
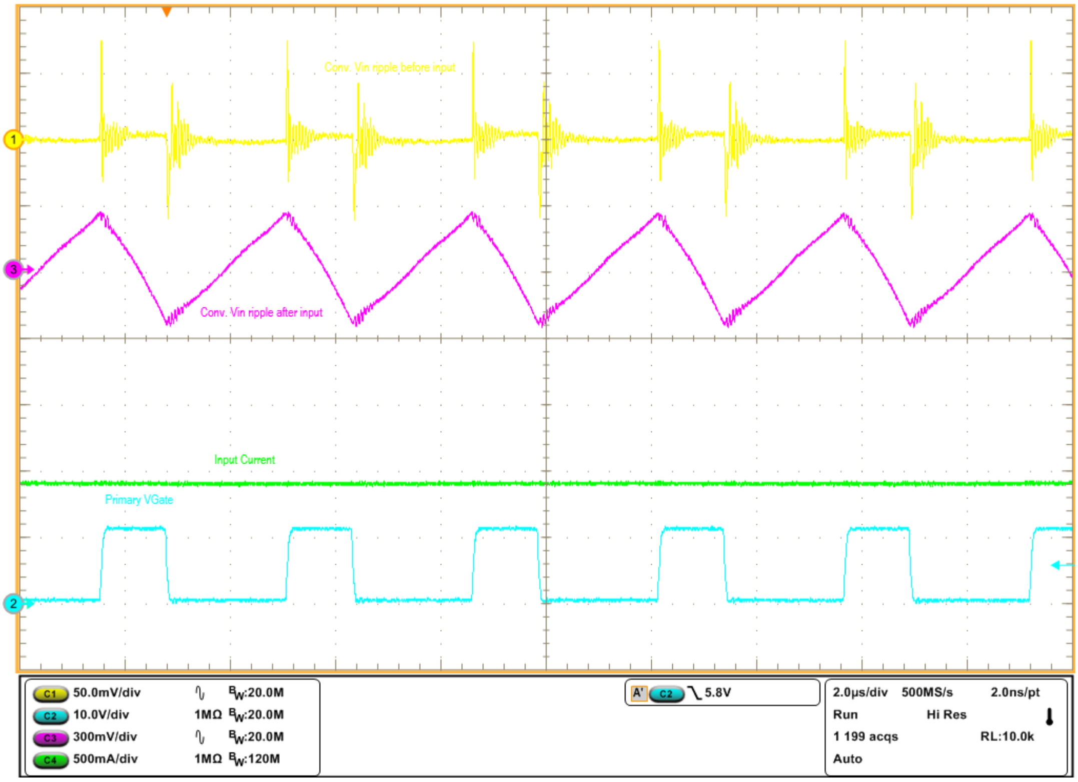


Figure 10. **Input voltage ripple before and after Flyback input filter I_{OUT}=8 A, V_{IN}=48 V**

- Ch1: Vin ripple before input filter; Ch2: Primary VGate
- Ch3: Vin ripple after input filter; Ch4: Input current (J1 connector pairs)



2.4 Startup

Figure 11. Input voltage at startup: Iout=8 A, Vin= 48 V

- Ch1: PGD; Ch2: Soft start
- Ch3: Primary VGate; Ch4: Input voltage

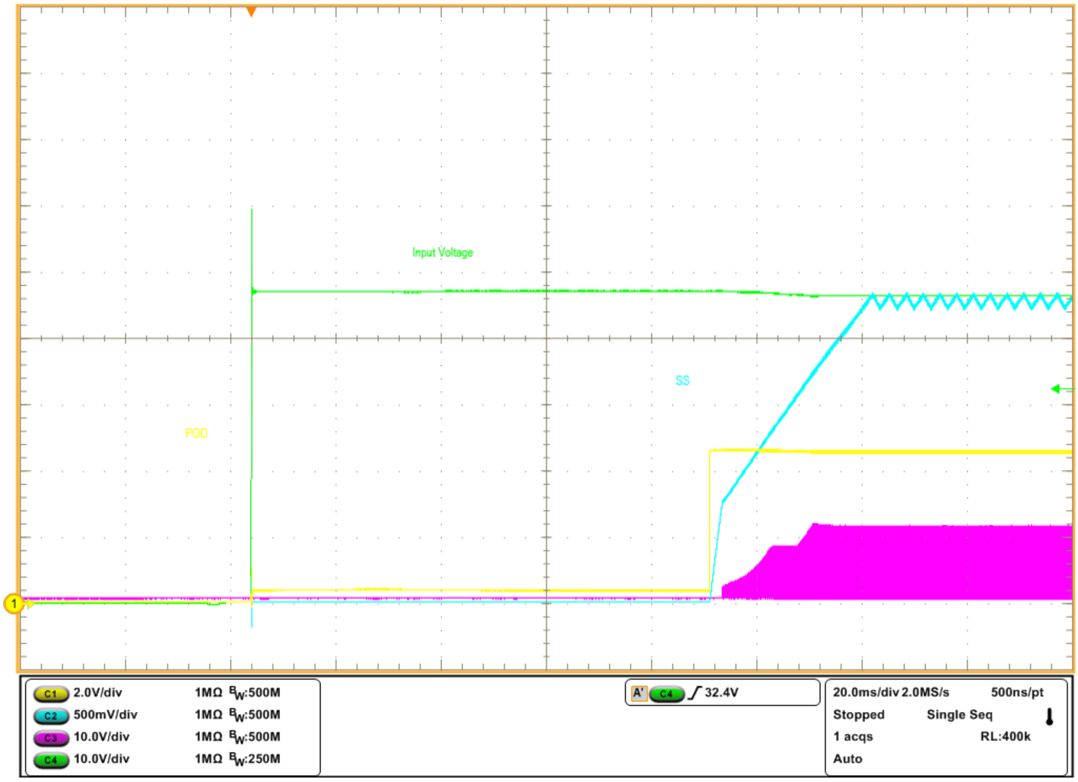
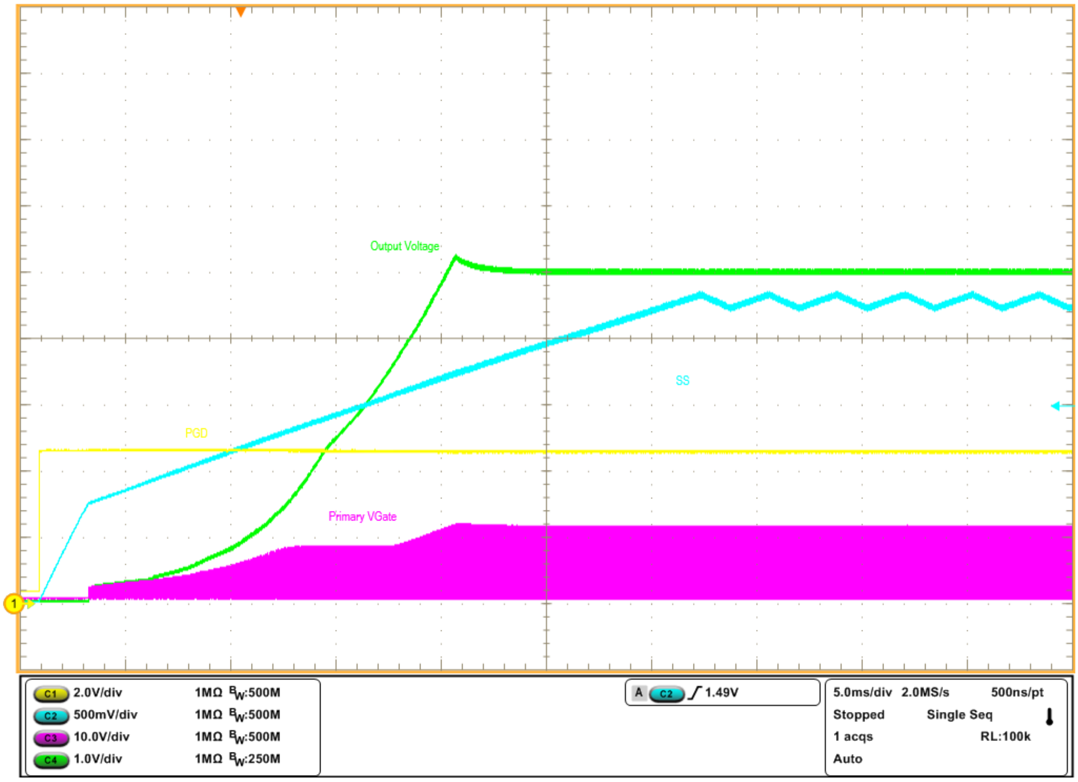


Figure 12. Ouput voltage at startup: Iout=8 A, Vin= 48 V

- Ch1: PGD; Ch2: Soft start
- Ch3: Primary VGate; Ch4: Output voltage



2.5 PoE connector unplugged power off

Figure 13. Power off at primary side: Iout=8 A, Vin= 48 V

- Ch1: PGD; Ch2: Soft start
- Ch3: Primary VGate; Ch4: Input voltage

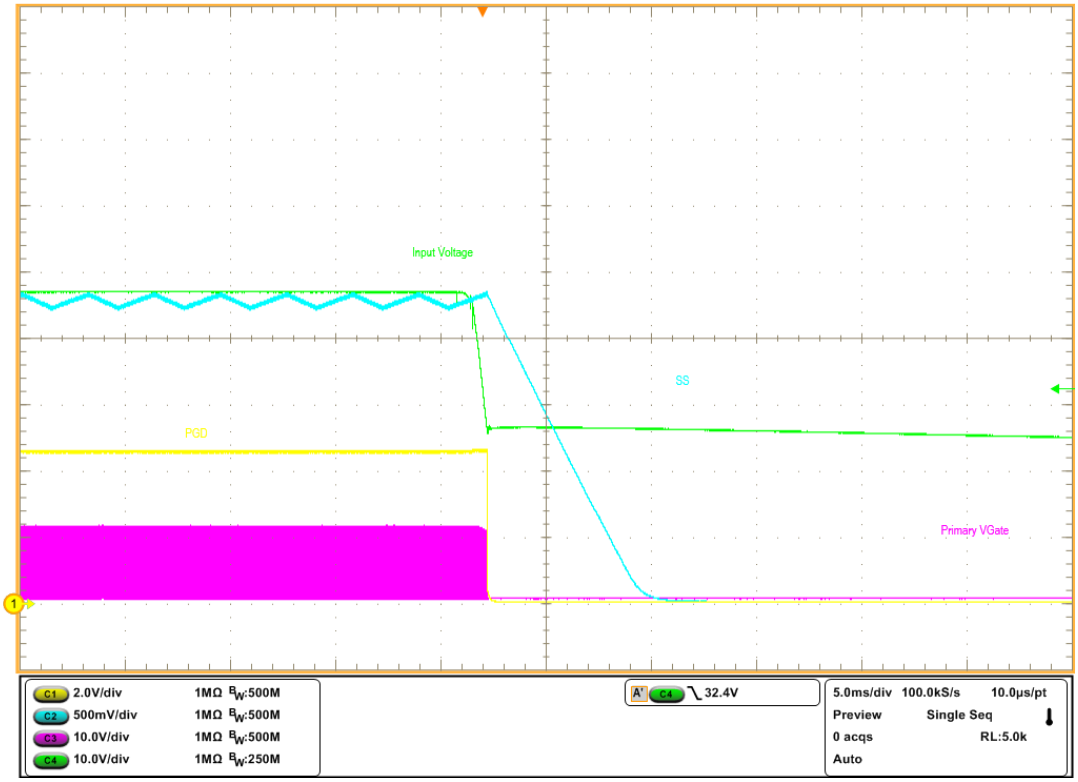
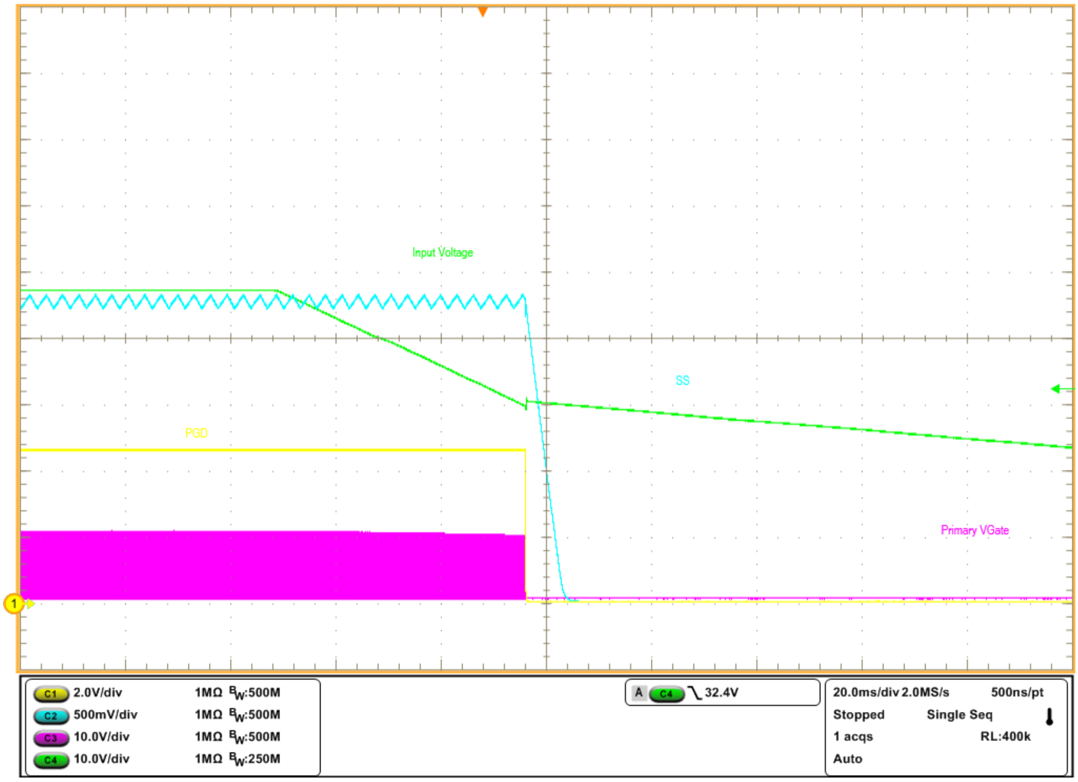


Figure 14. Power off at primary side: Iout at no load, Vin= 48 V

- Ch1: PGD; Ch2: Soft start
- Ch3: Primary VGate; Ch4: Input voltage



2.6 Primary side waveforms

Figure 15. Primary/secondary steady state: Iout at no load, Vin=48 V

- Ch1: Primary Q4 VDrain voltage; Ch2: Primary Q4 VGate voltage
- Ch3: Secondary Q1 VDrain voltage; Ch4: Secondary Q1 VGate voltage

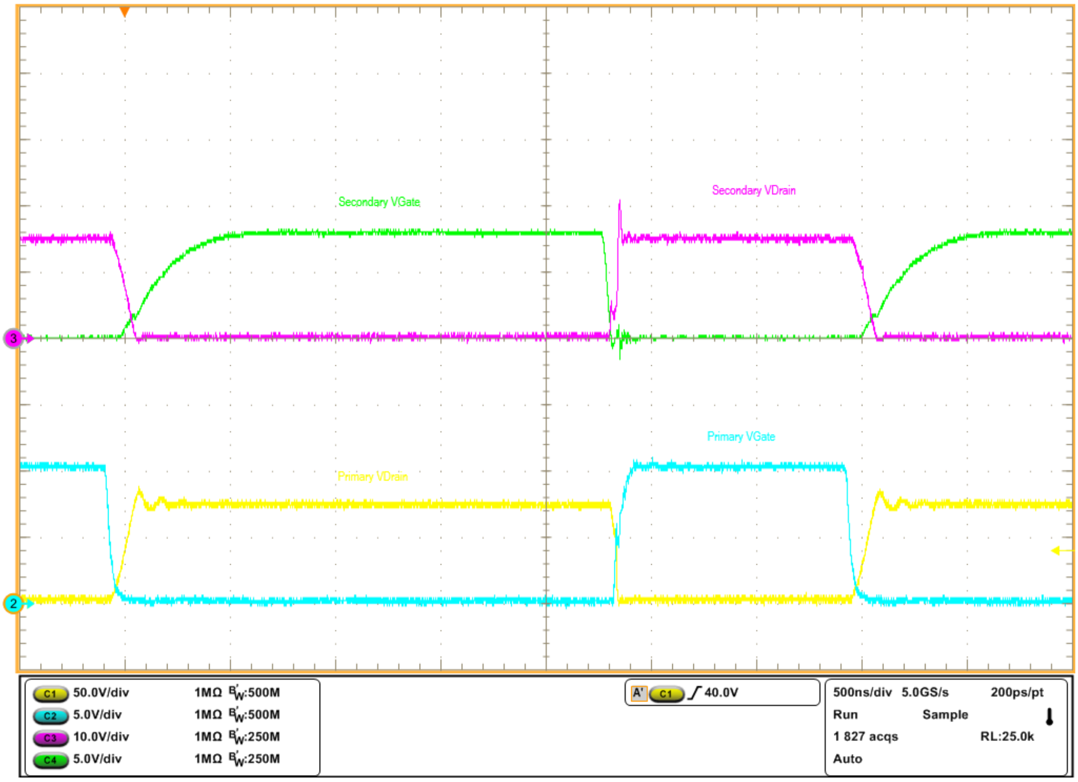
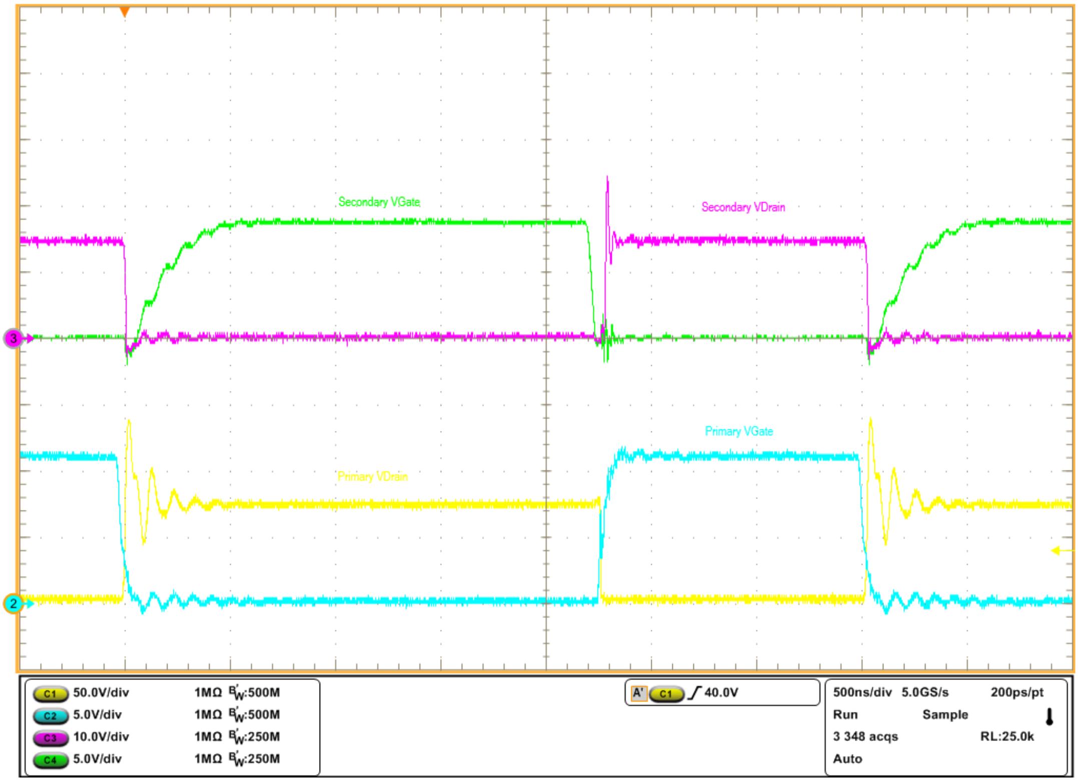


Figure 16. **Primary steady state: Iout=8 A, Vin=48 V**

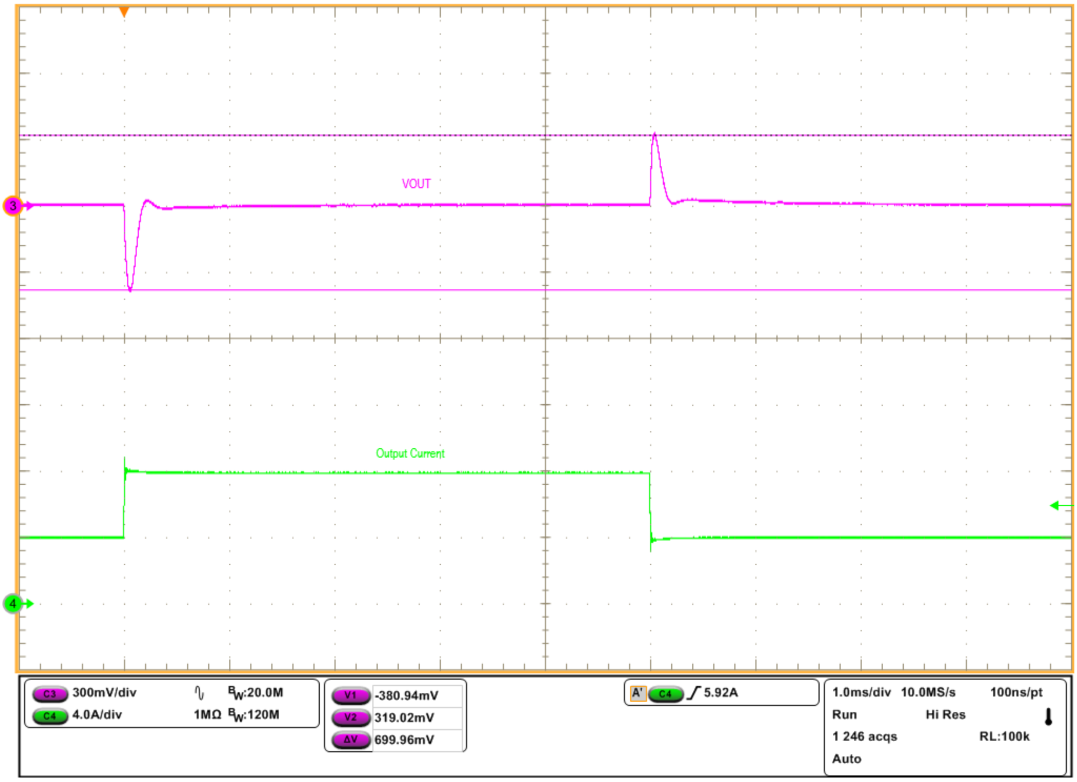
- Ch1: Primary Q4 VDrain voltage; Ch2: Primary Q4 VGate voltage
- Ch3: Secondary Q1 VDrain voltage; Ch4: Secondary Q1 VGate voltage



2.7 Load transient side waveforms

Figure 17. Load transient: Iout=4 to 8 A, Vin= 48 V

- Ch3: Output voltage; Ch4: Output current



2.8 Overvoltage and overcurrent protections

Figure 18. Overload protection as the first level of OCP (Vin= 48 V)

- Ch1: Primary VCS; Ch2: Primary Q4 VDrain voltage
- Ch3: Soft start;
  Ch4: Input current

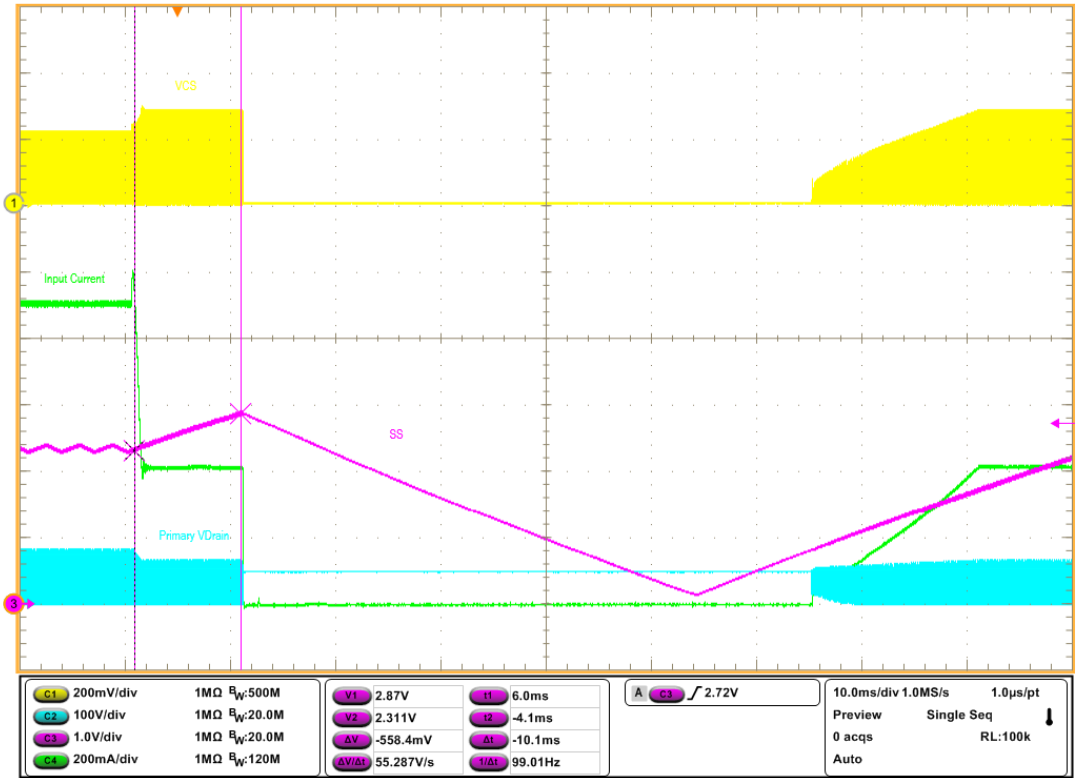


Figure 19. **Overload protection as the second level of OCP (Vin= 48 V)**

- Ch1: Primary VCS; Ch2: Output voltage
- Ch3: Primary VGate; Ch4: Output current

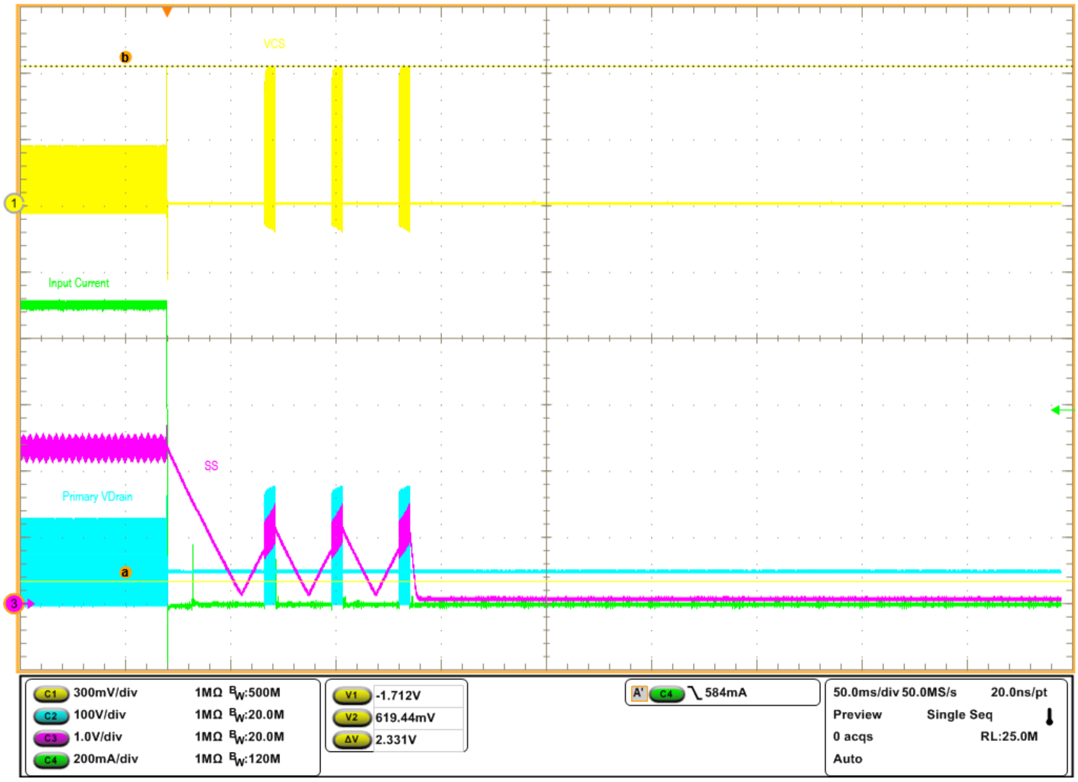
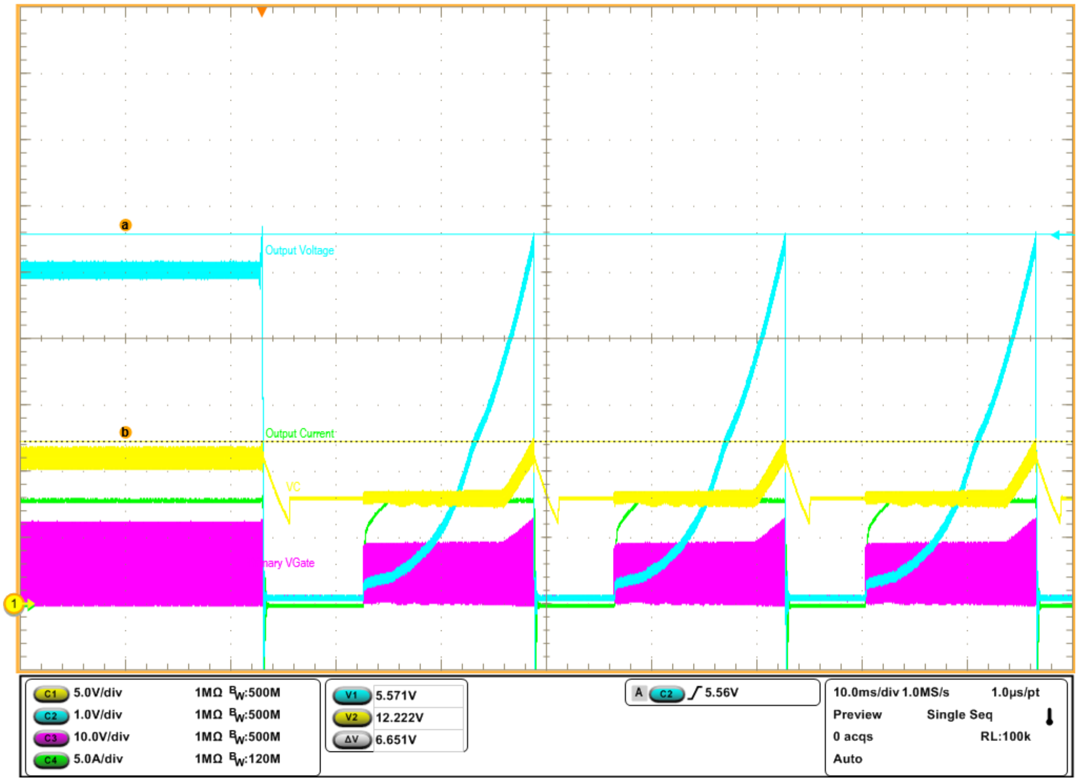


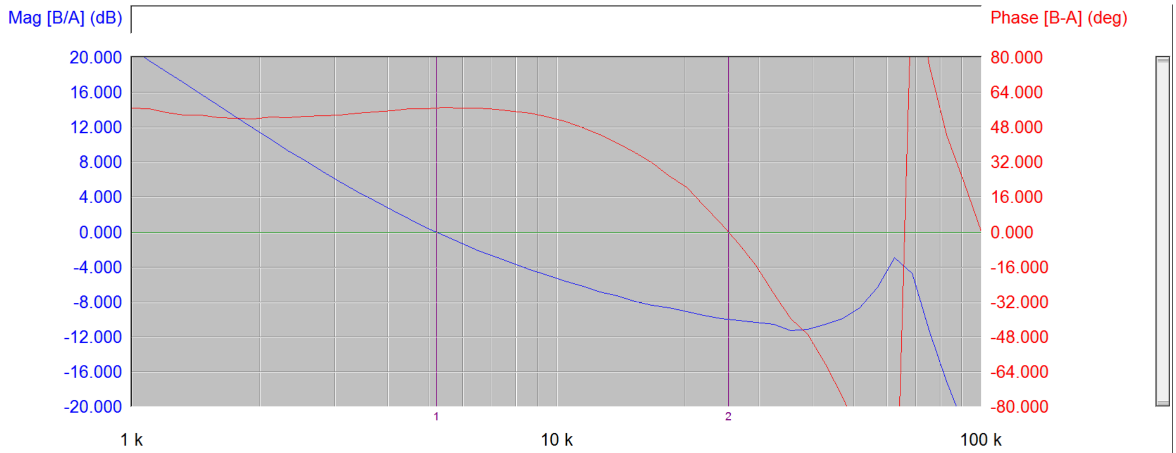
Figure 20. Overvoltage protection (Vin= 48 V, Iout=8 A)

- Ch1: Primary VCS; Ch2: Output voltage
- Ch3: Primary VGate; Ch4: Output current



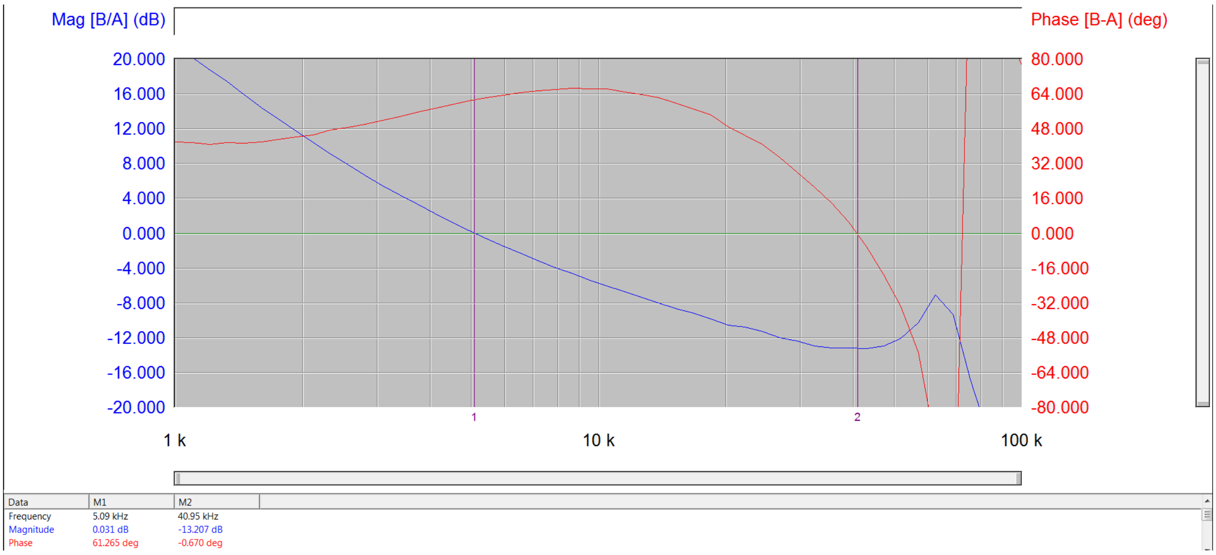
2.9 Gloop measurements

Figure 21. Gloop plot (Vin= 48 V, Iout=8 A)



Data	M1	M2
Frequency	5.22 kHz	25.41 kHz
Magnitude	-0.011 dB	-10.014 dB
Phase	56.874 deg	-0.027 deg

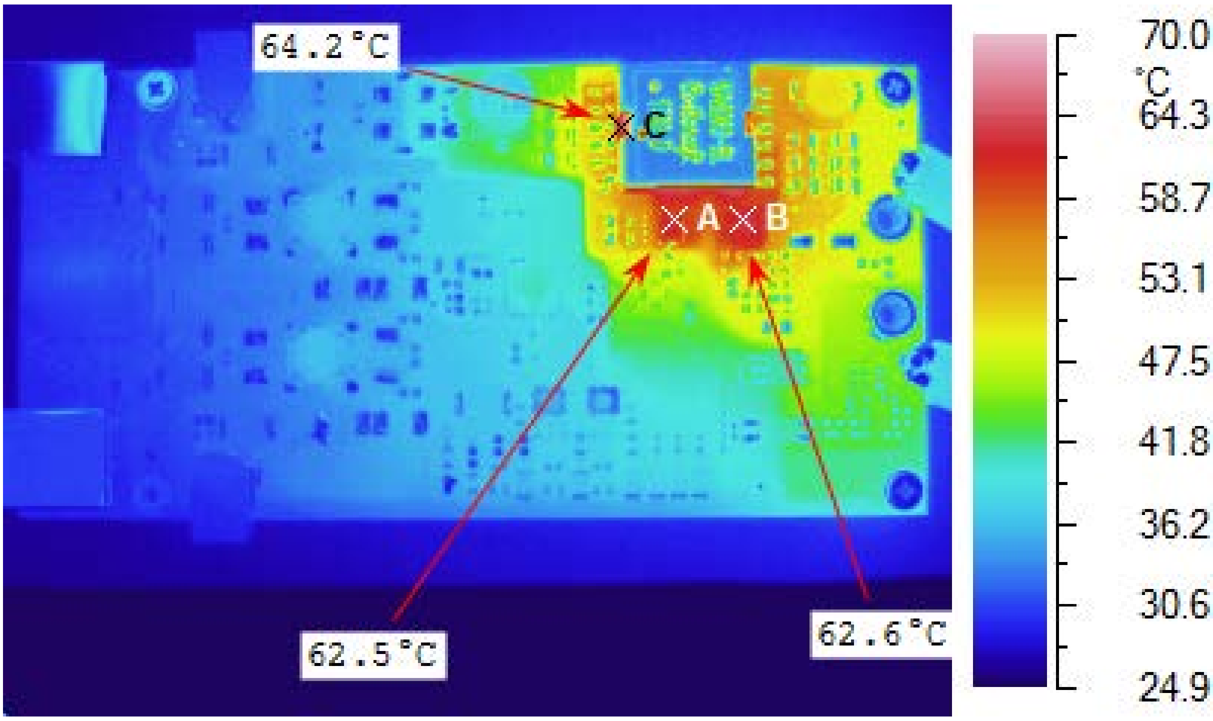
Figure 22. Gloop plot (Vin= 48 V, Iout at no load)



2.10 Board thermography

Figure 23. STEVAL-POE002V1 evaluation board thermography at Iout=8 A, Vout=48 V (top view)

A = Q4 ; B = Q1; C = T3;



A = R25/C25

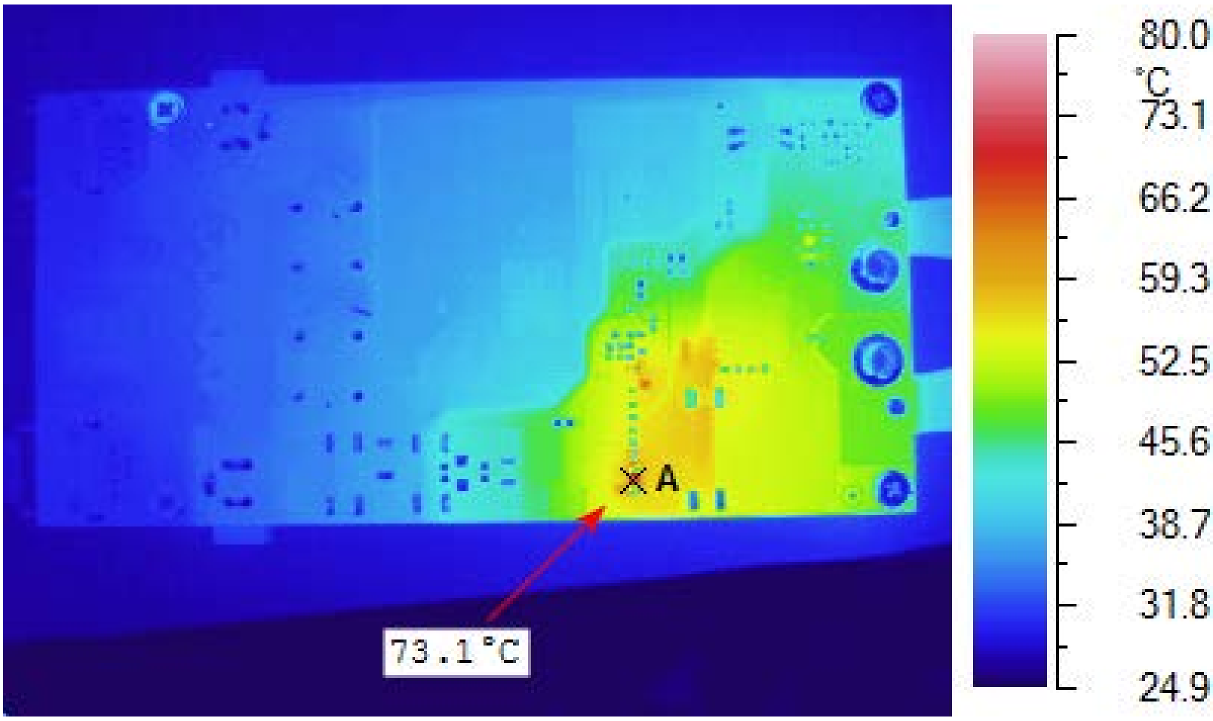


Figure 24. **STEVAL-POE002V1 evaluation board thermography at Iout=8 A, Vout=48 V (bottom view)**

3 STEVAL-POE002V1 schematic diagrams

Figure 25. STEVAL-POE002V1 circuit schematic (1 of 4)

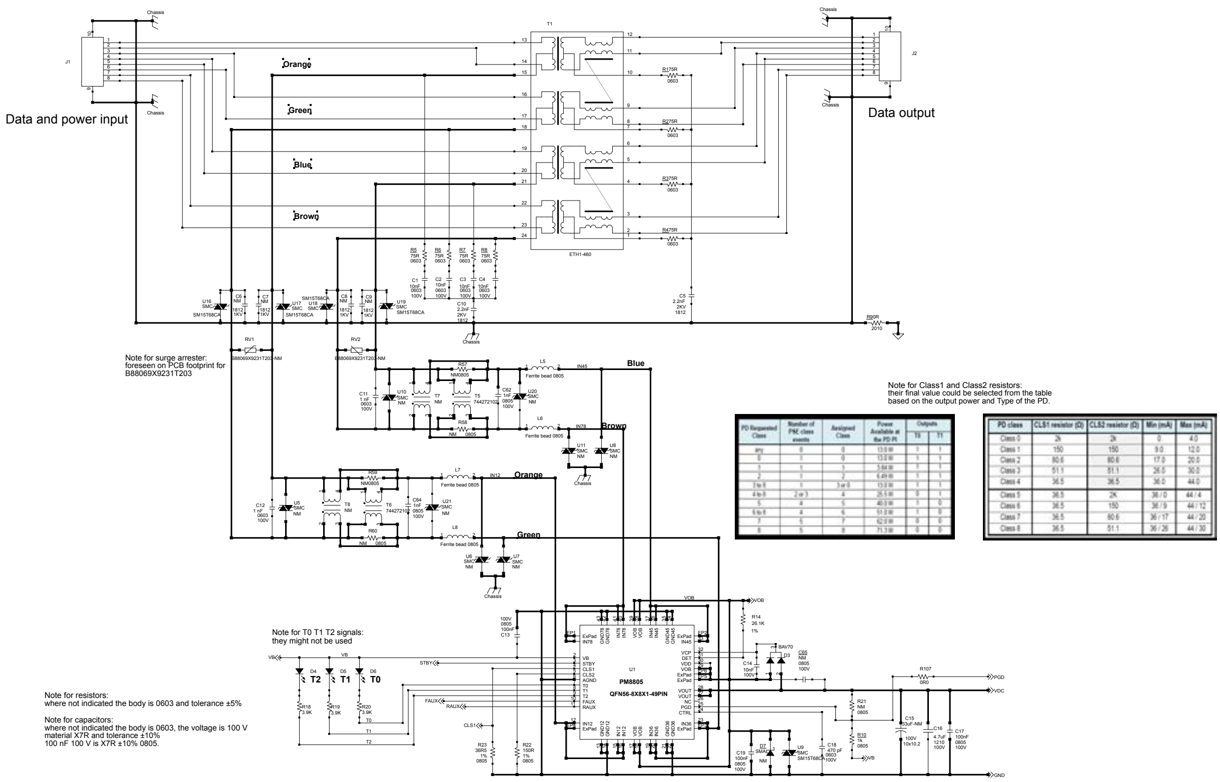
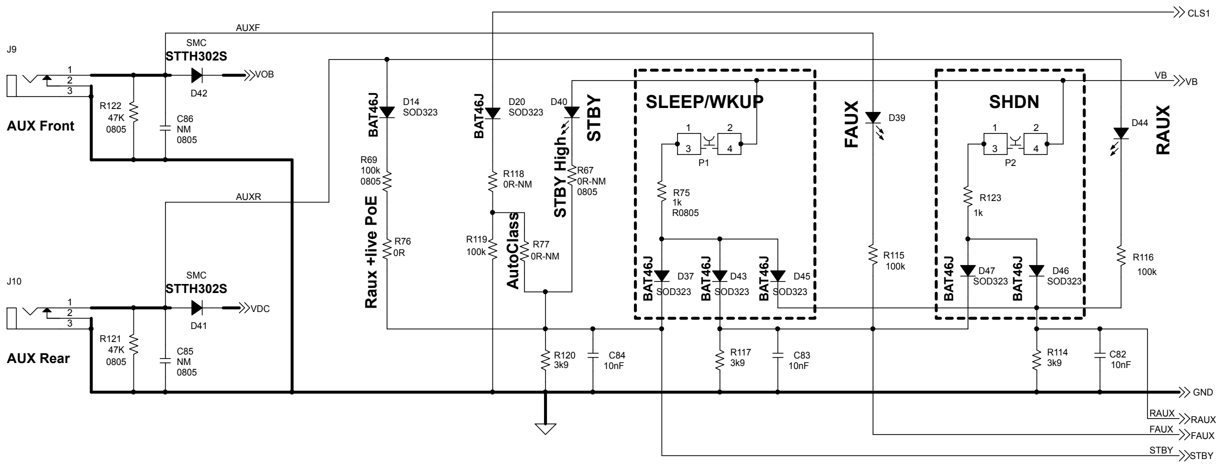


Figure 26. STEVAL-POE002V1 circuit schematic (2 of 4)



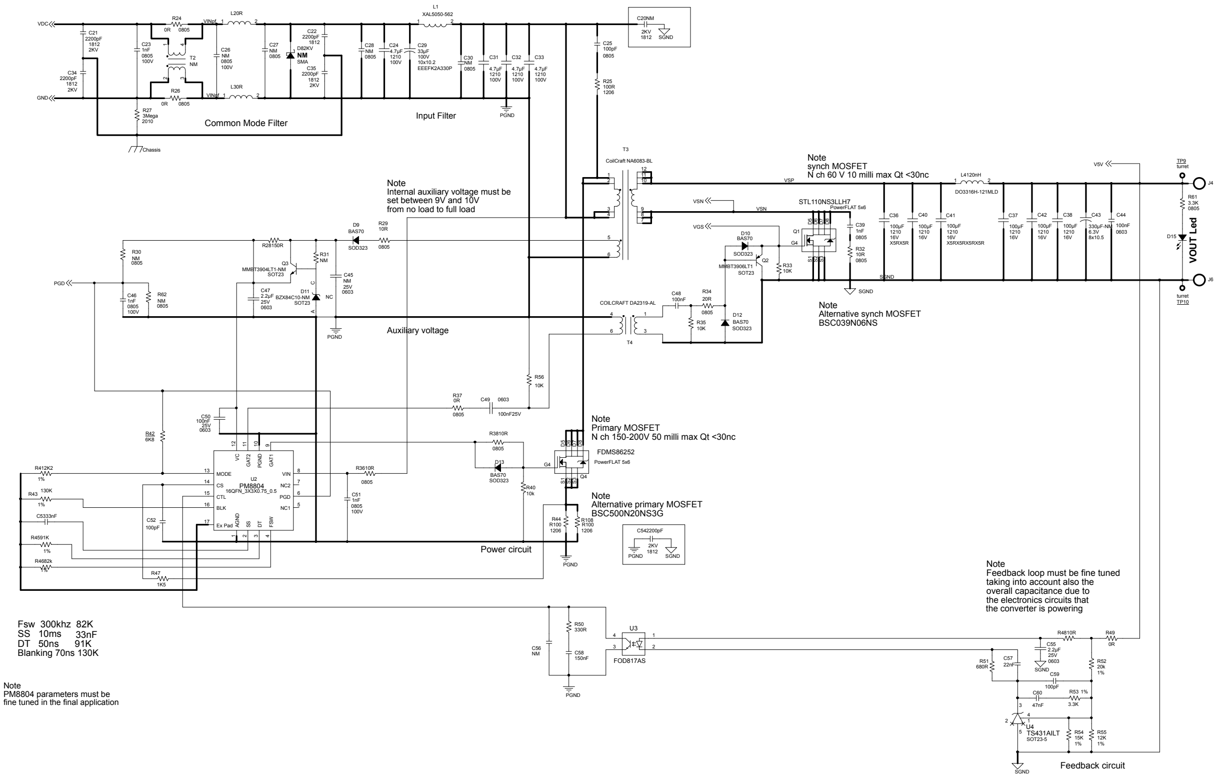


Figure 27. STEVAL-POE002V1 circuit schematic (3 of 4)

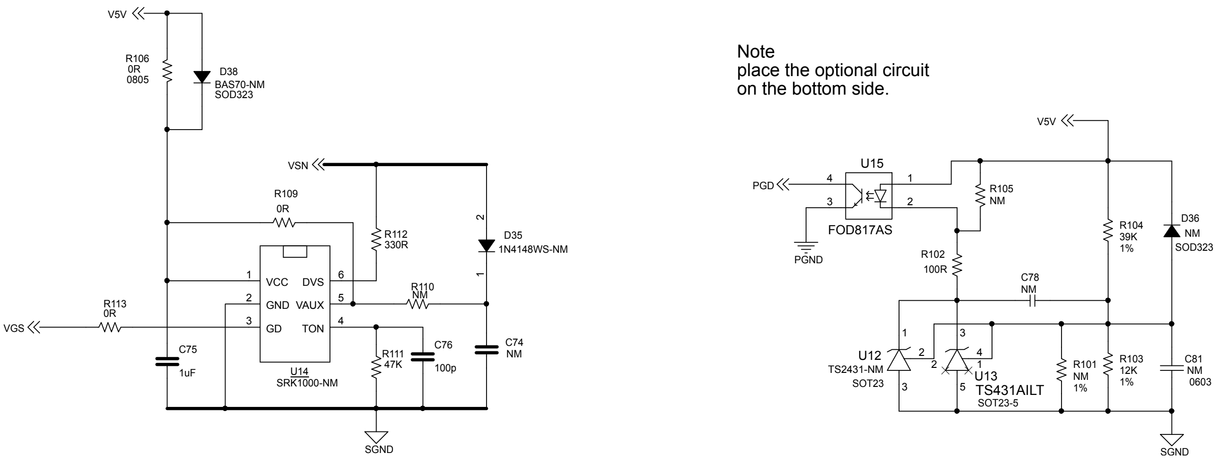


Figure 28. STEVAL-POE002V1 circuit schematic (4 of 4)

4 Bill of materials

Table 8. **STEVAL-POE002V1 bill of materials**

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
1	8	C1, C2, C3, C4, C14, C82, C83, C84	10 nF CAP-0603	Capacitor	KEMET	C0603C103K1RACTU
2	2	C5, C10	2.2 nF CAP-1812	Capacitor	TDK	C4532X7R3D222K130KA
3	5	C6, C7, C8, C9, C20	CAP-1812	Capacitor	N.M.	N.M.
4	2	C11, C12	1 nF CAP-0603	Capacitor	TDK	C1608X7R2A102K080AA
5	3	C13, C17, C19	100 nF CAP-0805	Capacitor	MURATA	GCM21BR72A104KA37L
6	1	C15	33 µF-EL-CAP-SMD-CASE-G	Electrolytic capacitor	N.M.	N.M.
7	5	C16, C24, C31, C32, C33	4.7 µF	Capacitor	TDK	C3225X7S2A475K200AB
8	1	C18	470 pF CAP-0603	Capacitor	TDK	C1608C0G1H471F080AA
9	5	C21, C22, C34, C35, C54	2200pF CAP-1812	Capacitor	TDK	C4532X7R3D222K130KA
10	6	C23, C39, C46, C51, C62, C64	1 nF CAP-0805	Capacitor	MURATA	GRM2195C2A102JA01D
11	2	C25, C76	100 pF CAP-0805	Capacitor	WALSIN	0805N101J500CT
12	7	C26, C27, C28, C30, C65, C85, C86	CAP-0805	Capacitor	N.M.	N.M.
13	1	C29	33 µF EL-CAP-SMD-CASE-G	Electrolytic capacitor	PANASONIC	EEE-FK2A330P
14	6	C36, C37, C38, C40, C41, C42	100 µF CAP-1210	Capacitor	YAGEO	CC1210MKX5R7BB107
15	1	C43	330 µF CASE-F_EL	Elcap	N.M.	N.M.
16	4	C44, C48, C49, C50	100 nF CAP-0603	Capacitor	KEMET	C0603C104M5RACTU
17	4	C45, C56, C78, C81	CAP-0603	Capacitor	N.M.	N.M.
18	2	C47, C55	2.2 µF CAP-0603	Capacitor	MURATA	GRM188R61E225KA12D
19	2	C52, C59	100 pF CAP-0603	Capacitor	TDK	C1608NP01H101J080AA
20	1	C53	33 nF CAP-0603	Capacitor	KEMET	C0603C333K5RACTU
21	1	C57	22 nF CAP-0603	Capacitor	MURATA	GCM188R72A223KA37D
22	1	C58	150 nF CAP-0603	Capacitor	MURATA	GRM188R71E154KA01D
23	1	C60	47 nF CAP-0603	Capacitor	TDK	C1608X7R1H473K080AA
24	1	C74	CAP-1206	Capacitor	N.M.	N.M.

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
25	1	C75	1 µF CAP-0805	Capacitor	MURATA	GRM21BR71H105KA12L
26	1	D3	BAV70 SOT23	Diode	ONSEMI	BAV70LT3G
27	1	D4	T2 LED-TLGE1100B	LED diode	KINGBRIGHT	AA3528CGSK
28	1	D5	T1 LED-TLGE1100B	LED diode	KINGBRIGHT	AA3528CGSK
29	1	D6	T0 LED-TLGE1100B	LED diode	KINGBRIGHT	AA3528CGSK
30	2	D7, D8	SMA	TVS diode	N.M.	N.M.
31	4	D9, D10, D12, D13	BAS70 SOD-323	Diode	ST	BAS70JFILM
32	1	D11	BZX84C10-SOT23-D	Zener diode	N.M.	N.M.
33	7	D14, D20, D37, D43, D45, D46, D47	BAT46J SOD-323	Diode	ST	BAT46JFILM
34	1	D15	VOUT SMD_0805	LED diode	KINGBRIGHT	APT2012SGC
35	1	D35	1N4148WS-SOD-323	Diode	N.M.	N.M.
36	1	D36	SOD-323	Diode	N.M.	N.M.
37	1	D38	BAS70-SOD-323	Diode	N.M.	N.M.
38	1	D39	FAUX LED-TLGE1100B	LED diode	KINGBRIGHT	AA3528CGSK
39	1	D40	STBY LED-TLGE1100B	LED diode	KINGBRIGHT	AA3528CGSK
40	2	D41, D42	STTH302S SMC	Diode	ST	STTH302S
41	1	D44	RAUX LED-TLGE1100B	LED diode	KINGBRIGHT	AA3528CGSK
42	1	J1	DATA & POWER INPUT RJ45-8PIN	Connector	STEWART	SS-7188S-A-NF
43	1	J2	DATA OUTPUT RJ45-8PIN	Connector	STEWART	SS-7188S-A-NF
44	2	J4, J6	BANANA-JACK BOC_10A	Connector	KEYSTONE	575-4
45	1	J9	AUX Front P-JACK-RAPC722	Power jack	SWITCHCRAFT	RAPC722X
46	1	J10	AUX Rear P-JACK-RAPC722	Power jack	SWITCHCRAFT	RAPC722X
47	1	L1	XAL5050-562 XAL5050-562	Inductor	COILCRAFT	XAL5050-562MEB
48	2	L2, L3	0 R 0805	Inductor	YAGEO	RC0805JR-070RL
49	1	L4	120 nH DO3316H	Inductor	COILCRAFT	DO3316H-121MLD
50	4	L5, L6, L7, L8	220 R 0805	Resistor	TDK	MPZ2012S221ATD25
51	1	P1	Sleep/Wkup push-7914-bourns	Push button	BOURNS	7914J-1-000E
52	1	P2	SHDN push-7914-bourns	Push button	BOURNS	7914J-1-000E

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
53	1	Q1	STL110NS3LLH7 POWERFLAT_5X6_SGD	Power MOSFET	ST	STL110NS3LLH7
54	1	Q2	MMBT3906LT1 SOT23_BEC_T	Power MOSFET	ON SEMI	MMBT3906LT1G
55	1	Q3	MMBT3904LT1-SOT23_BEC_T	Power MOSFET	N.M.	N.M.
56	1	Q4	FDMS86252 POWERFLAT_5X6_SGD	Power MOSFET	FAIRCHILD	FDMS86252
57	8	R1, R2, R3, R4, R5, R6, R7, R8	75R RES-0603	Resistor	MULTICOMP	MC0063W0603175R
58	1	R9	0 R RES-2010	Resistor	YAGEO	RC2010JK-070RL
59	3	R21, R62, R110	RES-0805	Resistor	N.M.	N.M.
60	1	R14	26.1 K RES-0603	Resistor	PANASONIC	ERJ3EKF2612V
61	3	R18, R19, R20	3.9 K RES-0603	Resistor	PANASONIC	ERJ-3EKF3901V
62	1	R22	150 R RES-0805	Resistor	VISHAY	CRCW0805150RFKEA
63	1	R23	36R5 RES-0805	Resistor	YAGEO	RC0805FR-0736R5L
64	9	R24, R26, R37, R49, R76, R106, R107, R109, R113	0 R RES-0805	Resistor	YAGEO	RC0805JR-070RL
65	1	R25	100 R RES-1206	Resistor	YAGEO	RC1206FR-07100RL
66	1	R27	RES-2010	Resistor	PANASONIC	ERJ-12ZYJ305U
67	1	R28	150 R RES-0603	Resistor	TE-Connectivity	CRG0603F150R
68	3	R29, R32, R36	10 R RES-0805	Resistor	YAGEO	RC0805FR-0710RL
69	1	R30	RES-0805	Resistor	N.M.	N.M.
70	3	R31, R101, R105	RES-0603	Resistor	N.M.	N.M.
71	4	R33, R35, R40, R56	10 K RES-0603	Resistor	YAGEO	RC0603FR-0710KL
72	1	R34	20 R RES-0805	Resistor	YAGEO	RC0805FR-0720RL
73	1	R38	22 R RES-0805	Resistor	YAGEO	RC0805FR-0722RL
74	1	R41	2K2 RES-0603	Resistor	YAGEO	RC0603FR-072K2L
75	1	R42	6K8 RES-0603	Resistor	YAGEO	RC0603FR-076K8L
76	1	R43	130 K RES-0603	Resistor	YAGEO	RC0603FR-07130KL
77	2	R44, R108	0.1 R RES-1206	Resistor	YAGEO	RL1206FR-7W0R1L
78	1	R45	91 K RES-0603	Resistor	YAGEO	RC0603FR-0791KL
79	1	R46	82 K RES-0603	Resistor	YAGEO	RC0603FR-0782KL
80	1	R47	1K5 RES-0603	Resistor	YAGEO	RC0603FR-071K5L
81	1	R48	10 R RES-0603	Resistor	YAGEO	RC0603FR-0710RL

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
82	1	R50	330 R RES-0603	Resistor	YAGEO	RC0603FR-07330RL
83	1	R51	680 R RES-0603	Resistor	YAGEO	RC0603FR-07680RL
84	1	R52	20 K RES-0603	Resistor	VISHAY	CRCW060320K0FKEA
85	1	R53	3.3 K RES-0603	Resistor	YAGEO	RC0603FR-073K3L
86	1	R54	15 K RES-0603	Resistor	MULTICOMP	MC0063W0603115K
87	2	R55, R103	12 K RES-0603	Resistor	MULTICOMP	MC0063W0603112K
88	7	R57, R58, R59, R60, R67, R77, R118	0 R-RES-0805	Resistor	N.M.	N.M.
89	1	R61	3.3 K RES-0805	Resistor	YAGEO	RC0805FR-073K3L
90	4	R69, R115, R116, R119	100 K RES-0805	Resistor	YAGEO	RC0805FR-07100KL
91	3	R10, R75, R123	1 K RES-0805	Resistor	YAGEO	RC0805FR-071KL
92	1	R102	100 R RES-0603	Resistor	YAGEO	RC0603FR-07100RL
93	1	R104	39 K RES-0603	Resistor	YAGEO	RC0603FR-0739KL
94	3	R111, R121, R122	47 K RES-0805	Resistor	YAGEO	RC0805FR-0747KL
95	1	R112	330 R RES-0805	Resistor	YAGEO	RC0805FR-07330RL
96	3	R114, R117, R120	3k9 RES-0805	Resistor	YAGEO	RC0805FR-073K9L
97	2	RV1, RV2	B88069X9231T203-NM 1812	Varistor	N.M.	N.M.
98	1	T1	ETH1-460 ETH1-460	Data trafo	COILCRAFT	ETH1-460LD
99	1	T2	WURTH_WE-SL5	Common choke	N.M.	N.M.
100	1	T3	CoilCraft NA6083-BL FA2709-AL	Power trafo	COILCRAFT	NA6083-BL
101	1	T4	COILCRAFT DA2319-AL DA2318-AL	Inductor	COILCRAFT	DA2319-AL
102	2	T5, T6	744272102 WURTH_WE-SL5	Common choke	WURTH	744272102
103	2	T7, T8	RN102	Common choke	N.M.	N.M.
104	2	TP9, TP10	MILLMAX_2501	Turret	MILL-MAX	2501-2-00-80-00-00-07-0
105	1	U1	QFN56-8X8X1-49PIN	Controller	ST	PM8805
106	1	U2	16QFN_3X3X0.75_0.5	Controller	ST	PM8804
107	2	U3, U15	FOD817AS FOD617	Optocoupler	FAIRCHILD	FOD817AS
108	2	U4, U13	TS431AILT SOT-23-5LEAD	Voltage Reference	ST	TS431AILT
109	6	U5, U6, U7, U8, U10, U11	SMC-BIDIR	Diode TVS	N.M.	N.M.

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
110	5	U9, U16, U17, U18, U19	SM15T68CA SMC-BIDIR	Diode TVS	ST	SM15T68CA
111	1	U12	TS2431-SOT23	Voltage Reference	N.M.	N.M.
112	1	U14	SRK1000 SOT-23-6LEAD	Controller	N.M.	N.M.
113	2	U20, U21	SMC-BIDIR	Diode TVS	N.M.	N.M.

5 Board layout

Figure 29. **STEVAL-POE002V1 evaluation board: PCB top assembly**

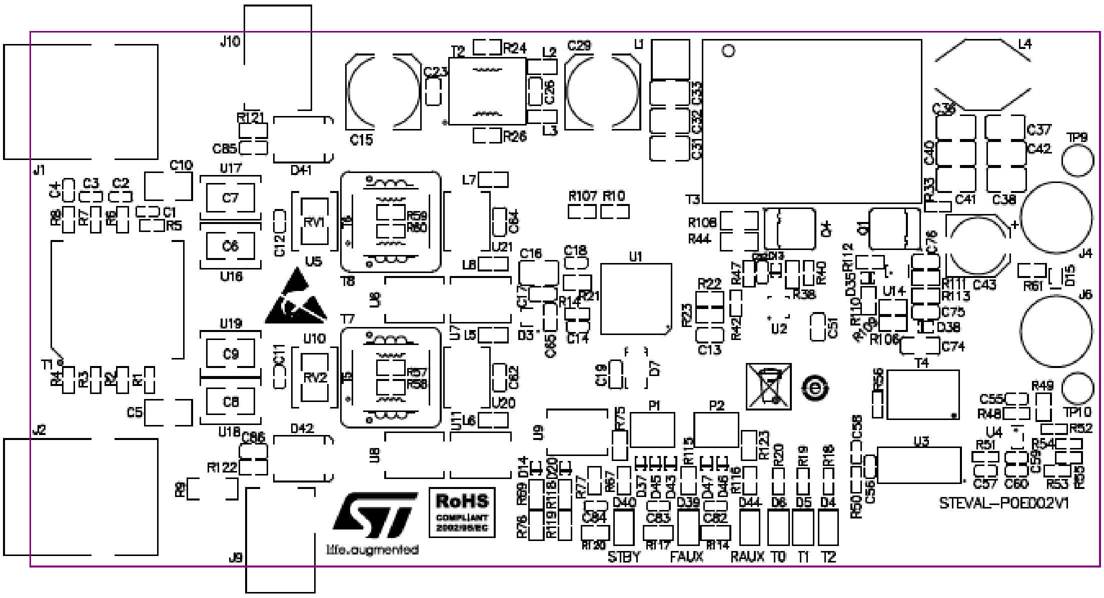


Figure 30. **STEVAL-POE002V1 evaluation board: PCB bottom assembly**

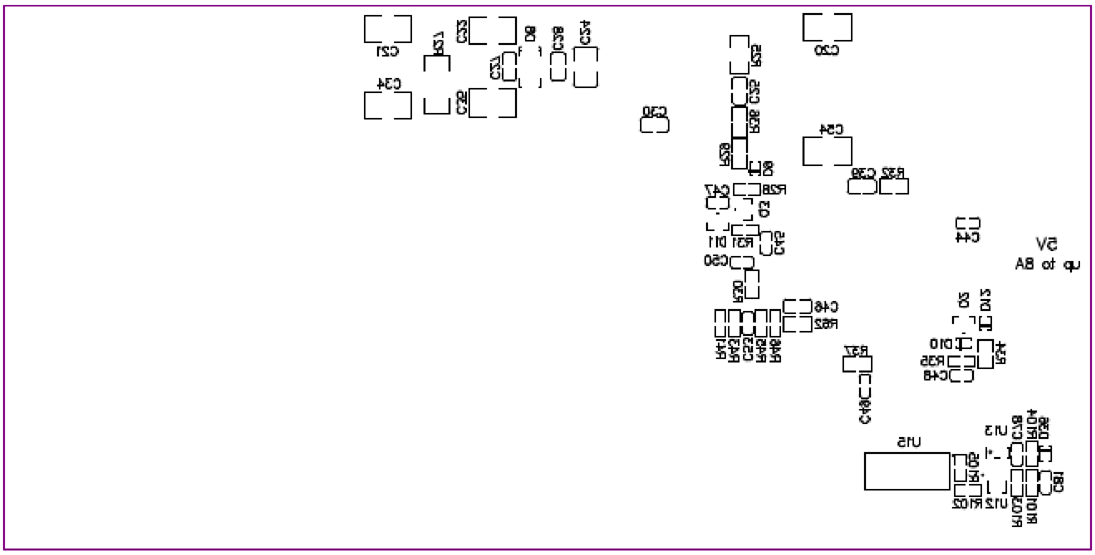


Figure 31. STEVAL-POE002V1 evaluation board: PCB layer 1

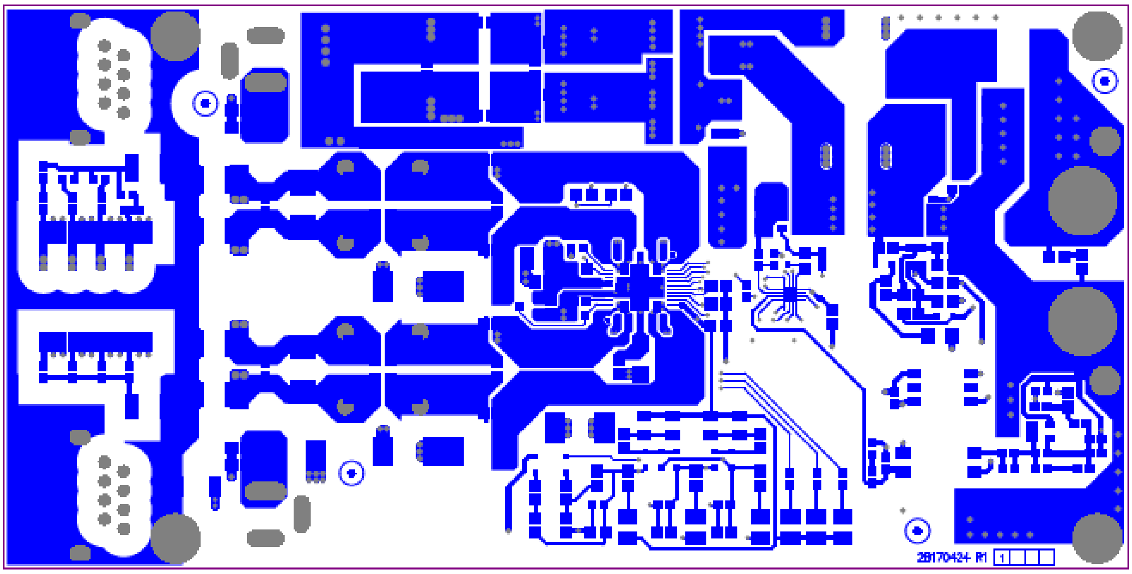
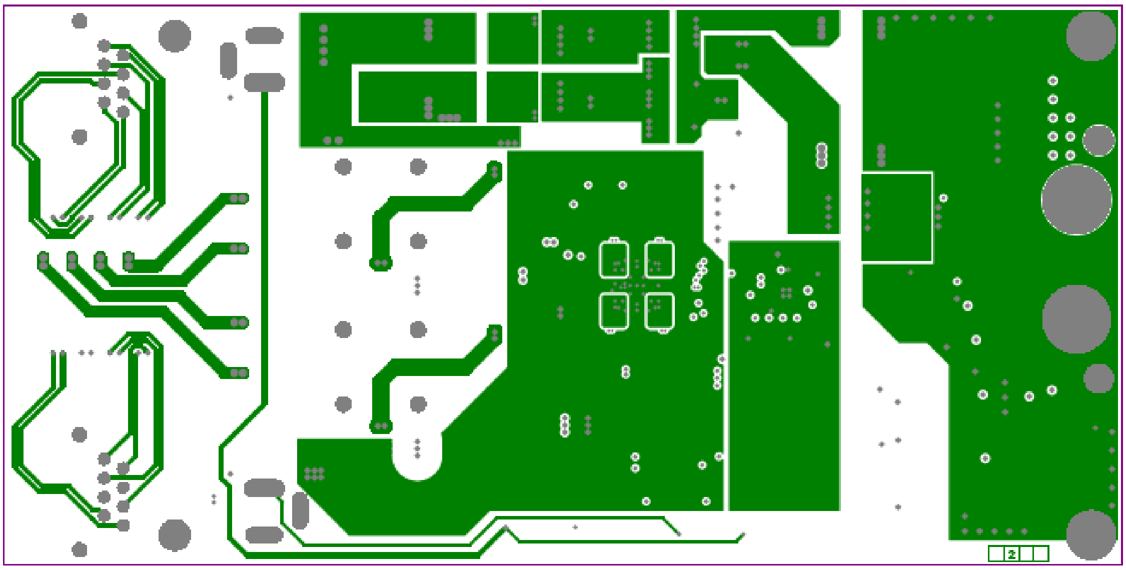


Figure 32. STEVAL-POE002V1 evaluation board: PCB layer 2



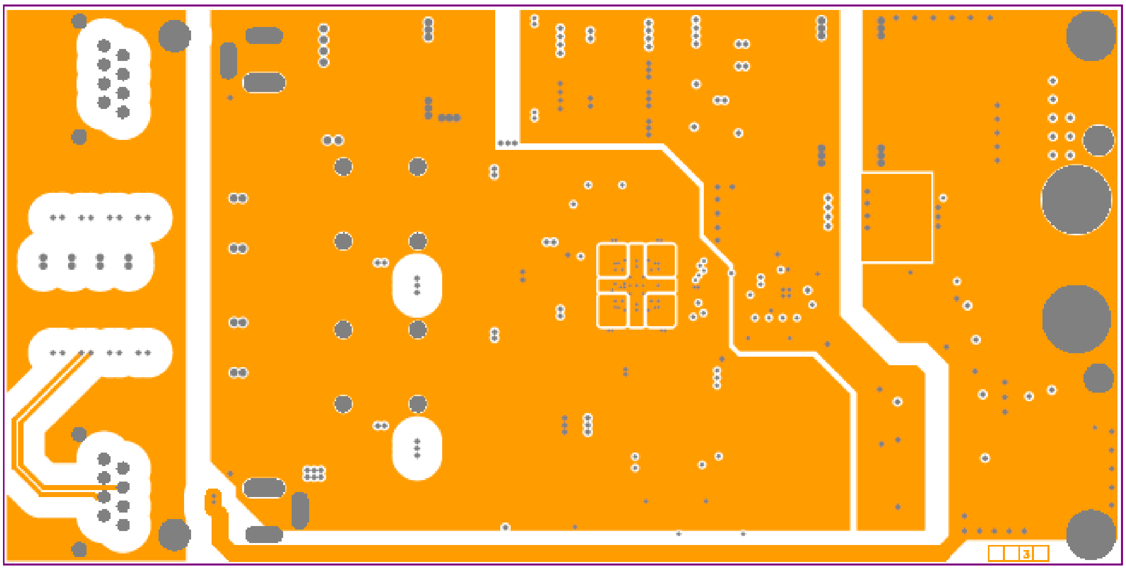


Figure 33. STEVAL-POE002V1 evaluation board: PCB layer 3

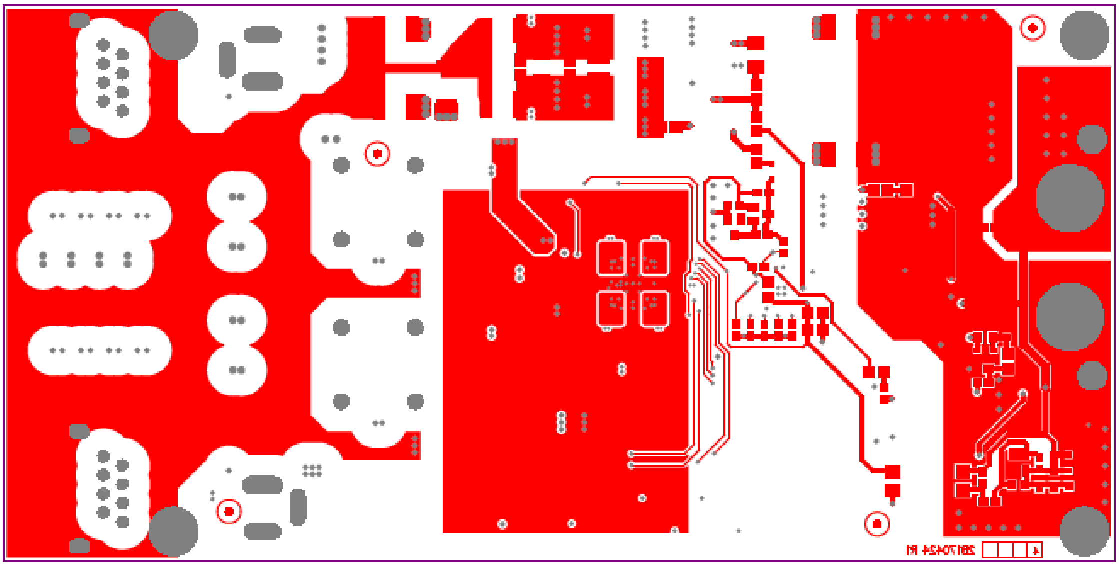


Figure 34. STEVAL-POE002V1 evaluation board: PCB layer 4

A References

Freely available on www.st.com:

1. PM8804 datasheet
2. PM8805 datasheet

Revision history

Table 9. Document revision history

Date	Version	Changes
16-Oct-2018	1	Initial release.

Contents

List of figures

List of tables