EVX2002-44018A-00A

120W, 2C1A Adapter Evaluation Board

PRELIMINARY SPECIFICATIONS SUBJECT TO CHANGE

DESCRIPTION

The EVX2002-44018A-00A evaluation board is a 120W, 2C1A adapter designed to demonstrate the capabilities of the MP44018A and MPX2002.

The MP44018A is a critical conduction mode (CrM)/discontinuous conduction mode (DCM), multi-mode power factor correction (PFC) controller that provides simple and high-performance active PFC using minimal external components. The switching frequency (f_{SW}) is reduced by dead time (DT) extension technology under light-load conditions, which improves light-load efficiency. The MP44018A also achieves reduced total harmonic distortion (THD) due to variable-on-time control in DCM compared to conventional constant-on-time (COT) control.

The MPX2002 is an all-in-one flyback controller with an integrated primary driving circuit, secondary controller, synchronous rectification driver, and safety-compliant feedback. The device offers the benefits of both primary-side regulation (PSR) and secondary-side regulation (SSR). A feedback circuit is not required, as a synchronous rectifier (SR) can be matched with the driving signal of the primary-side MOSFET. The SR can operate safely in continuous conduction mode (CCM), which increases the overall efficiency and design flexibility.

The MPX2002 adopts novel quasi-resonant (QR) mode switching when it runs in DCM. Due to this feature, the power supply has improved efficiency. Under very light loads, the controller enters burst mode to achieve very low standby power consumption. The MPX2002 offers frequency jittering to help dissipate the energy generated by conducted noise.

The EVX2002-44018A-00A evaluation board provides a detailed reference design. This datasheet contains the complete specification of the power supply, a detailed circuit diagram, the entire bill of materials required to build the power supply, a drawing of the transformers, and performance testing.

PERFORMANCE SUMMARY

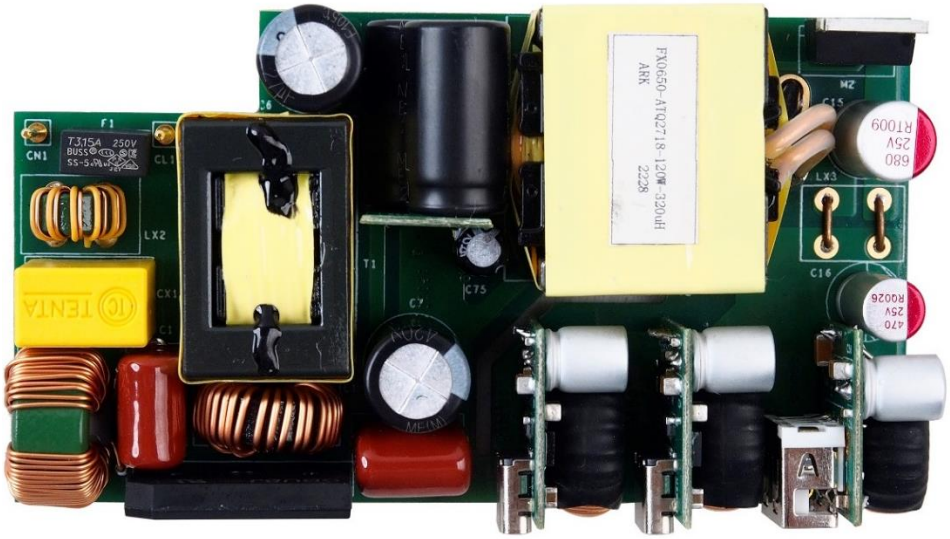
Specifications are at T_A = 25°C, unless otherwise noted.

Parameters	Conditions	Value
Input AC voltage (V_{AC})		90V_{AC} to 264V_{AC}
Input AC frequency		47Hz to 63Hz
Output voltage (V_{OUT}) / output current (I_{OUT}) (1)	USB-C1 / USB-C2	100W
	USB-C1 + USB-C2	60W + 60W
	USB-C1 / USB-C2 + USB-A	87W + 30W
	USB-C1 + USB-C2 + USB-A	60W + 30W + 30W
Maximum efficiency	USB-C1 + USB-C2: 60W + 60W	93.58%

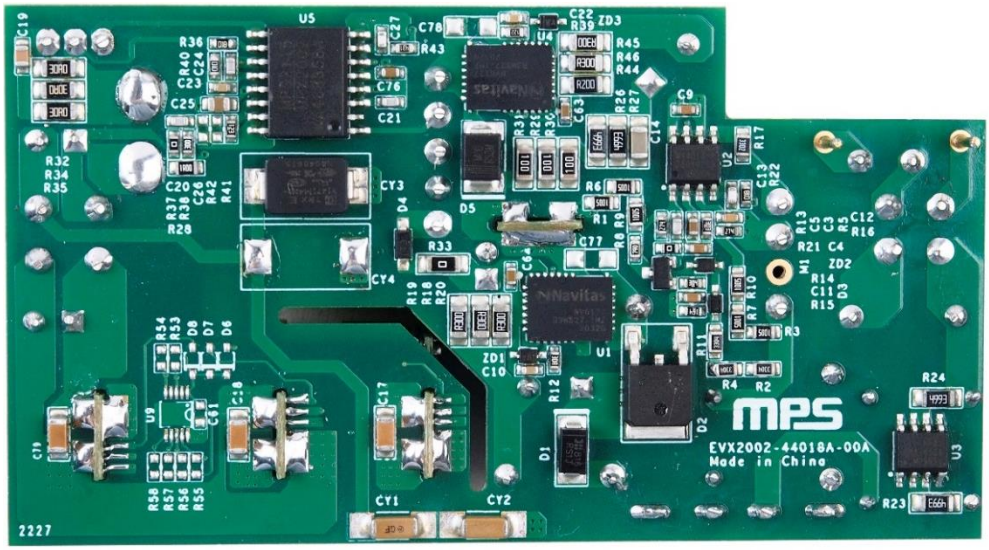
Note:

1) An additional microcontroller unit (MCU) is required to achieve power distribution.

EVX2002-44018A-00A EVALUATION BOARD



Top Layer



Bottom Layer

LxWxH (92mmx50mmx23.5mm)

Board Number	MPS IC Number
EVX2002-44018A-00A	MPX2002GY-Z
	MP44018-AGS-Z

QUICK START GUIDE

1. Preset the AC input voltage (V_{AC}) to be between $90V_{AC}$ and $264V_{AC}$.
2. Turn the AC power supply off.
3. Connect the load to the Type-C connector or Type-A connector.
4. Connect the power supply's line and neutral terminals to the AC input.
5. Turn the power supply on. The board should start up automatically.

EVALUATION BOARD SCHEMATICS

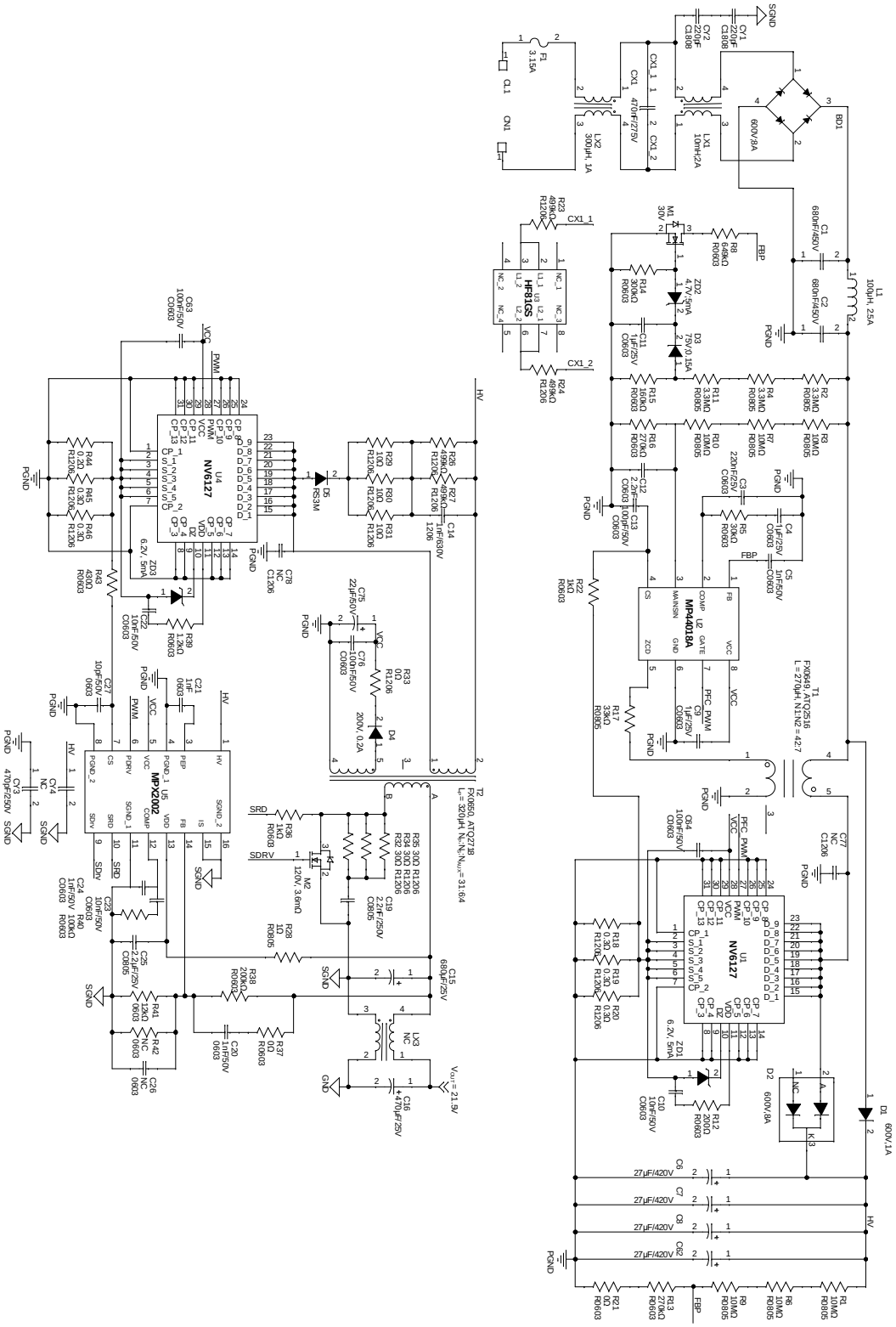


Figure 1: PFC and Flyback Controller

EVALUATION BOARD SCHEMATICS *(continued)*

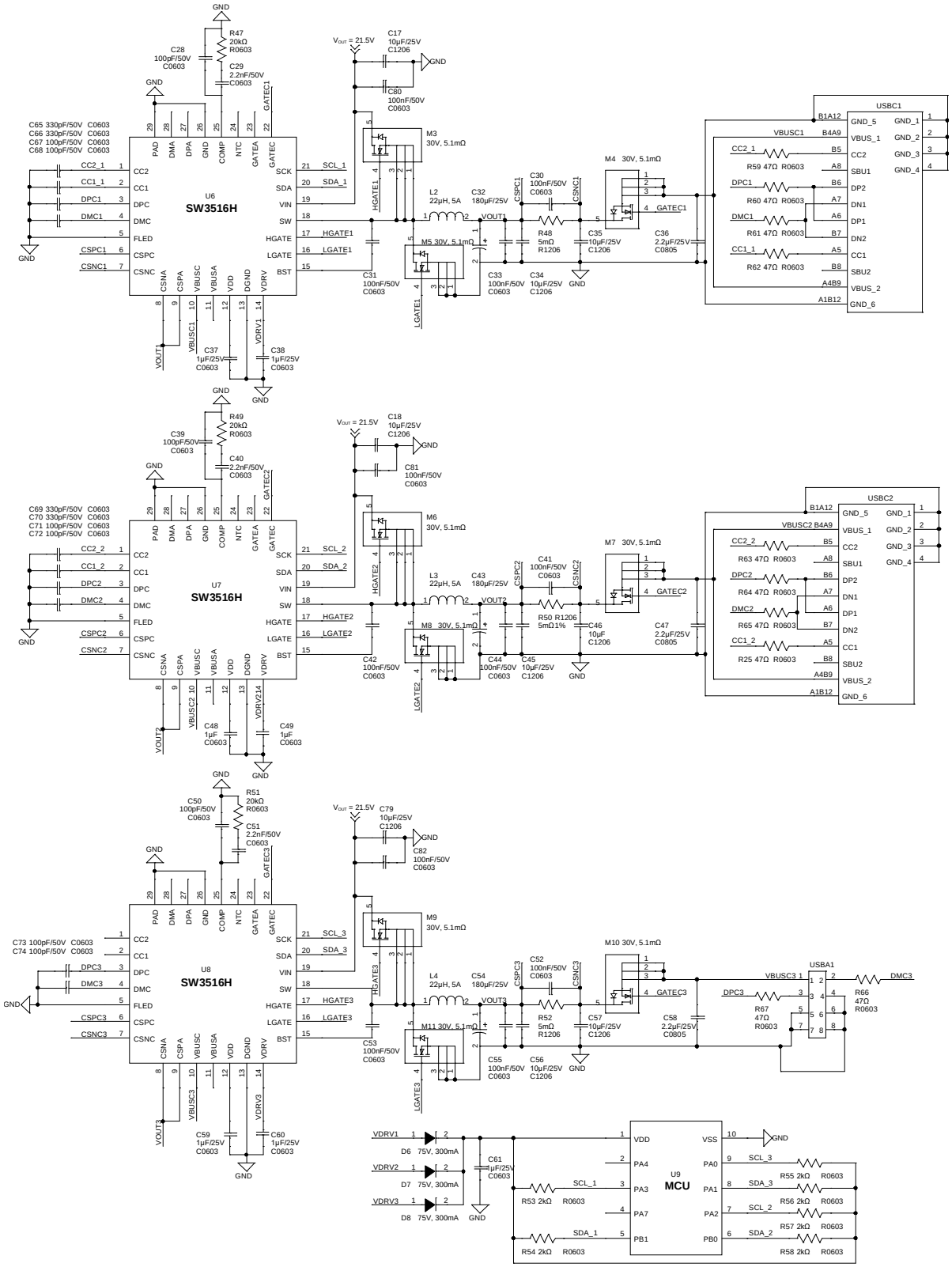


Figure 2: DC/DC and PD Controller

EVX2002-44018A-00A BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
1	BD1	600V	Bridge rectifier, 8A	DIP	FSC	GBU8J
2	C1, C2	680nF	CBB capacitor, 450V	DIP	CARLI	TF684K2Y10BL270D9R
1	C3	220nF	Ceramic capacitor, 25V, X7R	0603	Murata	GRM188R71E224KA88
9	C4, C9, C11, C37, C38, C48, C49, C59, C60	1µF	Ceramic capacitor, 25V, X7R	0603	Murata	GCM188R71E105KA64D
4	C5, C20, C21, C24	1nF	Ceramic capacitor, 25V, C0G	0603	Murata	GRM1885C1E102JA01D
4	C6, C7, C8, C62	27µF	Electrolytic capacitor, 420V	DIP	Beryl	ME 420V27uF 10X18
3	C10, C22, C23	10nF	Ceramic capacitor, 50V, X7R	0603	Murata	GRM188R71H103KA01D
4	C12, C29, C40, C51	2.2nF	Ceramic capacitor, 50V, X7R	0603	Murata	GRM188R71H222KA01D
10	C13, C28, C39, C50, C67, C68, C71, C72, C73, C74	100pF	Ceramic capacitor, 50V, C0G	0603	Murata	GRM1885C1H101JA01D
1	C14	1nF	Ceramic capacitor, 630V, U2J	1206	Murata	GRM31A7U2J102JW31D
1	C15	680µF	Electrolytic capacitor, 25V	DIP	Zhongyuan	RT681M25F160
1	C16	470µF	Electrolytic Capacitor, 25V	DIP	Zhongyuan	RQ471M025E150
9	C17, C18, C34, C35, C45, C46, C56, C57, C79	10µF	Ceramic capacitor, 25V, X7R	1206	Murata	GRM31CR71E106KA12
1	C19	2.2nF	Ceramic capacitor, 250V, X7R	0805	TDK	C2012X7R2E222K
4	C25, C36, C47, C58	2.2µF	Ceramic capacitor, 50V, X7R	0805	TDK	C2012X7R1H225K
1	C26	NC				
1	C27	10pF	Ceramic capacitor, 50V, C0G	0603	Murata	GRM1885C1H100JA01
15	C30, C31, C33, C41, C42, C44, C52, C53, C55, C63, C64, C76, C80, C81, C82	100nF	Ceramic capacitor, 50V, X7R	0603	Murata	GRM188R71H104KA93D
3	C32, C43, C54	180µF	Electrolytic capacitor, 25V	DIP	YMIN	NPXC0801E181ME
1	C61	NC				
4	C65, C66, C69, C70	330pF	Ceramic capacitor, 50V, X7R	0603	Murata	GRM188R71H331KA01D
1	C75	22µF	Electrolytic capacitor, 50V	DIP	Jianghai	CD281L-50V22
2	C77, C78	NC				
1	CX1	470nF	X capacitor, 275V_{AC}	DIP	Huajia	275V470nF 12*13*8

EVX2002-44018A-00A BILL OF MATERIALS *(continued)*

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
2	CY1, CY2	220pF	Y capacitor, 250V_{AC}	1808	Murata	GA342DR7GF221KW02
1	CY3	470pF	Y capacitor, 400V_{AC}	SMD	TRX	TMY1471M
1	CY4	NC				
1	D1	600V	Diode, 1A	SMA	Diodes, Inc.	RS1J-13-F
1	D2	600V	Diode, 8A	TO-252	WeEn	BYV29D-600P
1	D3	75V	Diode, 0.15A	SOD-323	Diodes, Inc.	1N4148WS
1	D4	200V	Diode, 0.2A	SOD-123	Diodes, Inc.	BAV21W
1	D5	1000V	Diode, 1000V,3A	SMB	Diodes, Inc.	RS3MB
3	D6, D7, D8	NC				
1	F1	3.15A	Fuse, 250V_{AC}	DIP	Cooper Bussmann	SS-5-3.15A
1	LX1	10mH	Common mode inductor, 2A	DIP	Emei	TP4M10-01
1	LX2	300µH	Common mode inductor, 1A,	DIP	Emei	TP4U300-00
1	LX3	NC				
1	L1	100µH	Inductor, 2A	DIP	SANCI	13*10*5.5
2	L2, L3	22µH	Inductor, 6A	DIP	SANCI	13*10*5
1	L4	22µH	Inductor, 5A	DIP	SANCI	12*9*4
1	M1	30V	N-channel MOSFET, 32mΩ	SOT-23	Analog Power	AM2336N
1	M2	120V	N-channel MOSFET, 3.6mΩ	TO-220	Toshiba	TK72E12N1
9	M3, M4, M5, M6, M7, M8, M9, M10, M11	30V	N-channel MOSFET, 5.1mΩ	PowerPAK -1212-8	Vishay	SISHA14DN
6	R1, R3, R6, R7, R9, R10	10MΩ	Film resistor, 1%	0805	Yageo	RC0805FR-0710ML
3	R2, R4, R11	3.3MΩ	Film resistor, 1%	0805	Yageo	RC0805FR-073M3L
1	R5	30kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0730KL
1	R8	649kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07649KL
1	R12	200Ω	Film resistor, 1%	0603	Yageo	RC0603FR-07200RL
2	R13, R16	270kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07270KL
1	R14	300kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07300KL
1	R15	160kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07160KL
1	R17	33kΩ	Film resistor, 1%	0805	Yageo	RC0805FR-0733KL
5	R18, R19, R20, R45, R46	300mΩ	Film resistor, 1%	1206	Yageo	RL1206FR-070R3L
2	R21, R37	0Ω	Film resistor, 1%	0603	Yageo	RC0603FR-070RL
2	R22, R36	1Ω	Film resistor, 1%	0603	Yageo	RC0603FR-071KL
4	R23, R24, R26, R27	499kΩ	Film resistor, 1%	1206	Yageo	RC1206FR-07499KL
1	R28	1Ω	Film resistor, 1%	0805	Yageo	RC0805FR-071RL
3	R29, R30, R31	10Ω	Film resistor, 1%	1206	Yageo	RC1206FR-0710RL
1	R33	0Ω	Film resistor, 1%	1206	Yageo	RC1206FR-070RL
3	R32, R34, R35	30Ω	Film resistor, 1%	1206	Yageo	RC1206FR-0730RL
1	R38	200kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07200KL

EVX2002-44018A-00A BILL OF MATERIALS *(continued)*

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
1	R39	1.2kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-071K2L
1	R40	100kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07100KL
1	R41	12kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0712KL
1	R42	NC				
1	R43	430Ω	Film resistor, 1%	0603	Yageo	RC0603FR-07430RL
1	R44	200mΩ	Film resistor, 1%	1206	Yageo	RL1206FR-070R2L
3	R47, R49, R51	20kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0720KL
3	R48, R50, R52	5mΩ	Film resistor, 1%	1206	Yageo	PA1206FRF070R005L
6	R53, R54, R55, R56, R57, R58	NC				
10	R59, R60, R61, R62, R25, R63, R64, R65, R66, R67	47Ω	Film resistor, 1%	0603	Yageo	RC0603FR-0747RL
1	T1	270µH	PFC inductor	ATQ2516	ARK	FX0649
1	T2	320µH	Flyback transformer	ATQ2718	ARK	FX0650
2	U1, U4	650V	GaNFast™ power switch, 125mΩ	QFN-30 (6mmx 8mm)	Navitas	NV6127
2	U6, U7	36V	PD controller	QFN-28	ISMARTWARE	SW3516H-C
1	U8	36V	PD controller	QFN-28	ISMARTWARE	SW3516H_A
1	U10	NC				
1	USB-A1	4-pin	Type-A connector	DIP	Jingtuo	N/A
2	USB-C1, USB-C2	16-pin	Type-C connecter	DIP	Yalian	93579102
2	ZD1, ZD3	6.2V	Zener diode, 5mA	SOD-323	Diodes, Inc.	BZT52C6V2S
1	ZD2	4.7V	Zener diode, 5mA	SOD-323	Diodes, Inc.	BZT52C4V7S
1	U2	MP44018A	CrM/DCM PFC controller	SOIC-8	MPS	MP44018-AGS-Z
1	U3	HF81	X capacitor bleeder	SOIC-8	MPS	HF81GS-Z
1	U5	MPX2002	All-in-one flyback controller	SOICW-16	MPS	MPX2002GY-Z

EVB TEST RESULTS

Performance waveforms are tested on the evaluation board. (2)

Table 1: Efficiency (USB-C1 = 100W, USB-C2 = 0W, USB-A = 0W)

V_{IN} (V_{AC}/Hz)	Load	V_{OUT1} (V)	I_{OUT1} (A)	P_{OUT} (W)	P_{IN} (W)	Efficiency
115/60	100%	20.21	5.003	101.103	109.242	92.55%
	75%	20.27	3.750	76.010	82.468	92.17%
	50%	20.33	2.500	50.823	55.014	92.38%
	25%	20.24	1.250	25.306	27.756	91.17%
	Average Efficiency (%)					92.07%
	10%	20.20	0.500	10.108	11.852	85.29%
230/50	100%	20.18	5.001	100.926	108.564	92.96%
	75%	20.24	3.751	75.910	81.930	92.65%
	50%	20.30	2.501	50.760	55.166	92.01%
	25%	20.22	1.250	25.267	28.006	90.22%
	Average Efficiency (%)					91.96%
	10%	20.17	0.500	10.087	11.910	84.69%

Table 2: Efficiency (USB-C1 = 60W, USB-C2 = 60W, USB-A = 0W)

V_{IN} (V_{AC}/Hz)	Load	V_{OUT1} (V)	I_{OUT1} (A)	V_{OUT2} (V)	I_{OUT2} (A)	P_{OUT} (W)	P_{IN} (W)	Efficiency
115/60	100%	20.27	3.0025	20.28	3.0023	121.747	131.410	92.65%
	75%	20.26	2.2504	20.24	2.2509	91.151	98.421	92.61%
	50%	20.22	1.5005	20.18	1.5005	60.620	65.693	92.28%
	25%	20.17	0.7509	20.13	0.7500	30.243	33.284	90.86%
	Average Efficiency (%)							92.10%
	10%	20.14	0.3007	20.09	0.3001	12.085	14.129	85.53%
230/50	100%	20.28	3.0004	20.28	3.0014	121.717	130.290	93.42%
	75%	20.26	2.2508	20.24	2.2503	91.147	97.855	93.15%
	50%	20.21	1.5008	20.18	1.5009	60.619	65.856	92.05%
	25%	20.17	0.7503	20.12	0.7505	30.234	33.597	89.99%
	Average Efficiency (%)							92.15%
	10%	20.14	0.3003	20.09	0.3005	12.085	14.279	84.64%

EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board. (2)

Table 3: Efficiency (USB-C1 = 60W, USB-C2 = 30W, USB-A = 30W)

V_{IN} (V_{AC}/Hz)	Load	V_{OUT1} (V)	I_{OUT1} (A)	V_{OUT2} (V)	I_{OUT2} (A)	V_{OUT3} (V)	I_{OUT3} (A)	P_{OUT} (W)	P_{IN} (W)	Efficiency
115/60	100%	20.29	3.009	20.16	1.501	20.02	1.501	121.359	130.860	92.74%
	75%	20.28	2.244	20.14	1.125	20.02	1.126	90.706	97.914	92.64%
	50%	20.23	1.511	20.11	0.751	20.03	0.751	60.705	65.780	92.28%
	25%	20.19	0.746	20.07	0.375	20.02	0.375	30.095	33.882	88.82%
	Average Efficiency (%)									91.62%
	10%	20.16	0.298	20.06	0.151	20.06	0.151	12.066	14.207	84.93%
230/50	100%	20.29	3.009	20.17	1.501	20.03	1.501	121.401	130.090	93.32%
	75%	20.28	2.246	20.14	1.125	20.03	1.125	90.740	97.615	92.96%
	50%	20.23	1.511	20.11	0.751	20.03	0.751	60.705	66.205	91.69%
	25%	20.19	0.748	20.08	0.375	20.03	0.375	30.159	33.732	89.41%
	Average Efficiency (%)									91.84%
	10%	20.15	0.298	20.05	0.1506	20.03	0.151	12.039	14.478	83.15%

Table 4: Efficiency (USB-C1 = 100W, USB-C2 = 0W, USB-A = 0W)

V_{IN} (V_{AC}/Hz)	V_{OUT1} (V)	I_{OUT1} (A)	P_{OUT} (W)	P_{IN} (W)	Efficiency
90/60	20.23	5.001	101.164	110.35	91.68%
115/60	20.21	5.003	101.103	109.24	92.55%
230/50	20.18	5.001	100.926	108.56	92.96%
264/50	20.23	5.002	101.184	108.63	93.15%

Table 5: Efficiency (USB-C1 = 60W, USB-C2 = 60W, USB-A = 0W)

V_{IN} (V_{AC}/Hz)	V_{OUT1} (V)	I_{OUT1} (A)	V_{OUT2} (V)	I_{OUT2} (A)	P_{OUT} (W)	P_{IN} (W)	Efficiency
90/60	20.13	3.002	20.15	3.002	120.927	131.74	91.79%
115/60	20.27	3.003	20.28	3.002	121.747	131.41	92.65%
230/50	20.28	3.000	20.28	3.001	121.717	130.29	93.42%
264/50	20.13	3.001	20.16	3.002	120.941	129.24	93.58%

Table 6: Efficiency (USB-C1: 60W, USB-C2: 30W, USB-A: 30W)

V_{IN} (V_{AC}/Hz)	V_{OUT1} (V)	I_{OUT1} (A)	V_{OUT2} (V)	I_{OUT2} (A)	V_{OUT3} (V)	I_{OUT3} (A)	P_{OUT} (W)	P_{IN} (W)	Efficiency
90/60	20.09	3.003	20.08	1.511	20.04	1.502	120.763	131.62	91.75%
115/60	20.29	3.009	20.16	1.501	20.02	1.501	121.359	130.86	92.74%
230/50	20.29	3.009	20.17	1.501	20.03	1.501	121.401	130.09	93.32%
264/50	20.09	3.004	20.08	1.511	20.03	1.502	120.764	129.29	93.41%

Note:

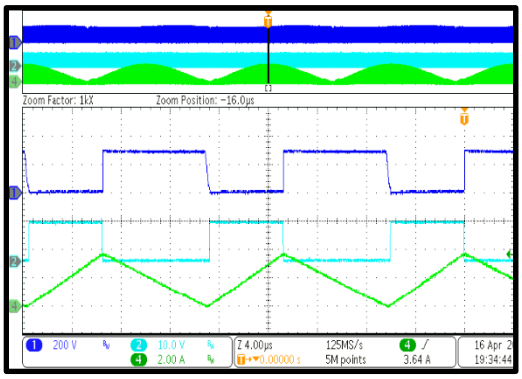
2) The measured efficiency is the board efficiency.

EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.

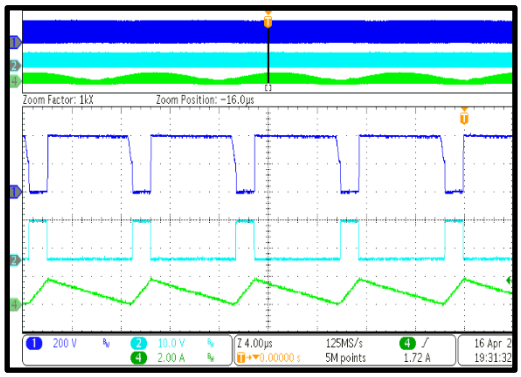
PFC Steady State

V_{IN} = 115V_{AC}/60Hz, P_{OUT} = 120W



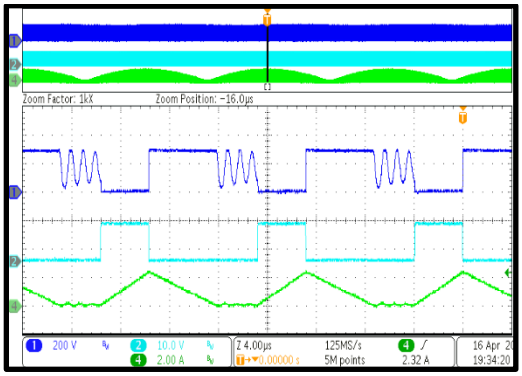
PFC Steady State

V_{IN} = 230V_{AC}/50Hz, P_{OUT} = 120W



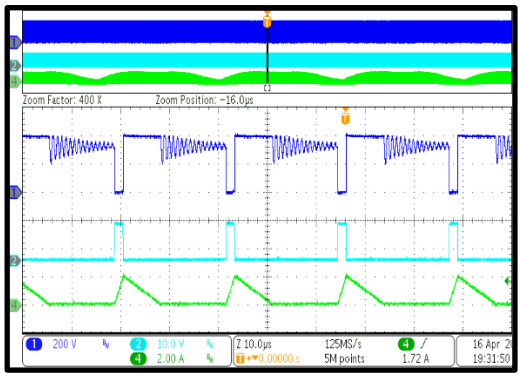
PFC Steady State

V_{IN} = 115V_{AC}/60Hz, P_{OUT} = 60W



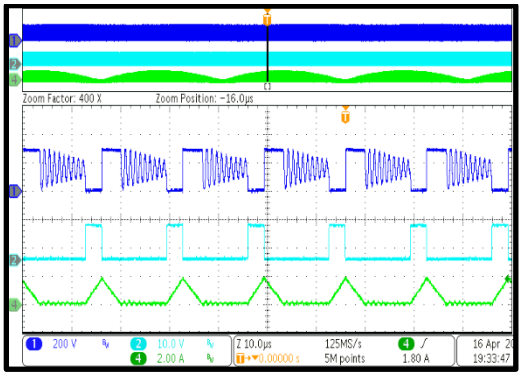
PFC Steady State

V_{IN} = 230V_{AC}/50Hz, P_{OUT} = 60W



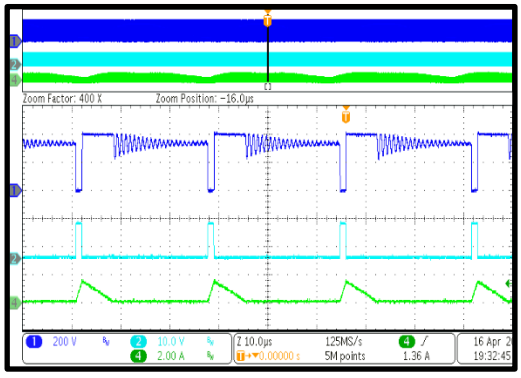
PFC Steady State

V_{IN} = 115V_{AC}/60Hz, P_{OUT} = 30W



PFC Steady State

V_{IN} = 230V_{AC}/50Hz, P_{OUT} = 30W

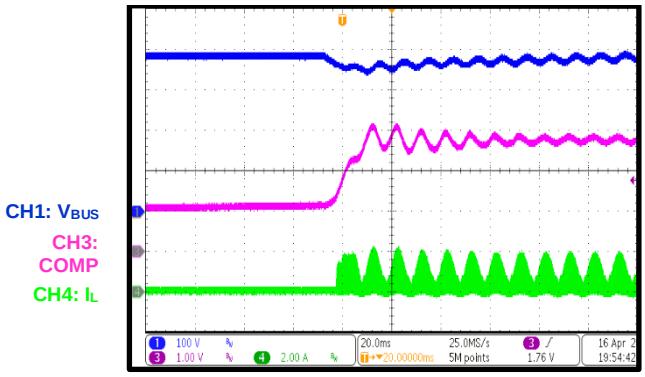


EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.

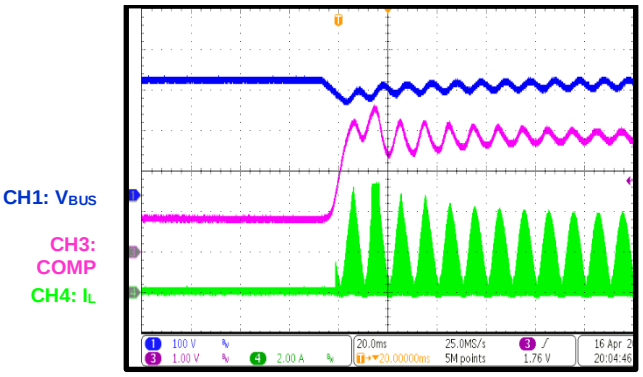
PFC Load Transient

V_{IN} = 115V_{AC}/60Hz, P_{OUT} = 0W to 120W



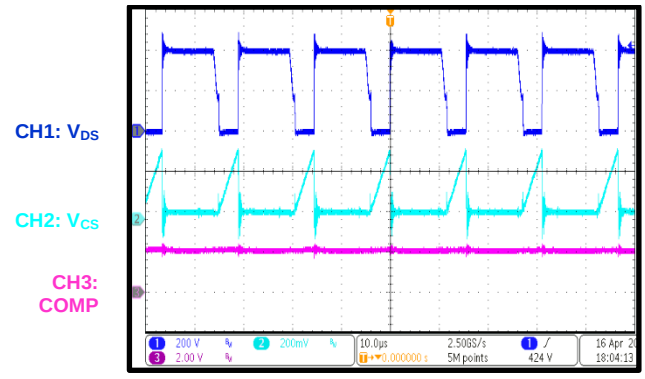
PFC Load Transient

V_{IN} = 230V_{AC}/50Hz, P_{OUT} = 0W to 120W



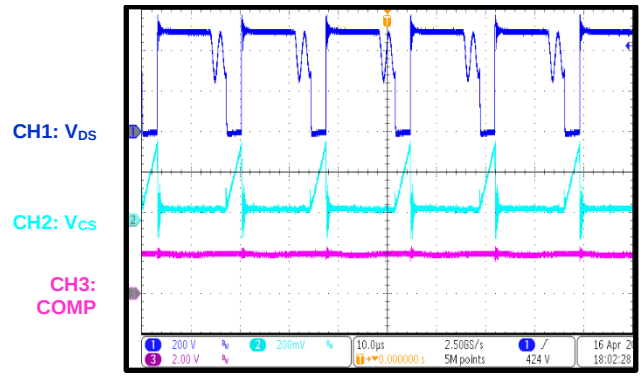
Flyback Steady State

V_{IN} = 115V_{AC}/60Hz, P_{OUT} =120W



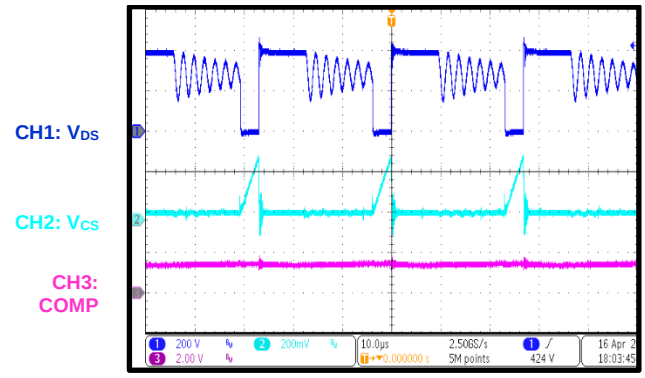
Flyback Steady State

V_{IN} = 230V_{AC}/50Hz, P_{OUT} =120W



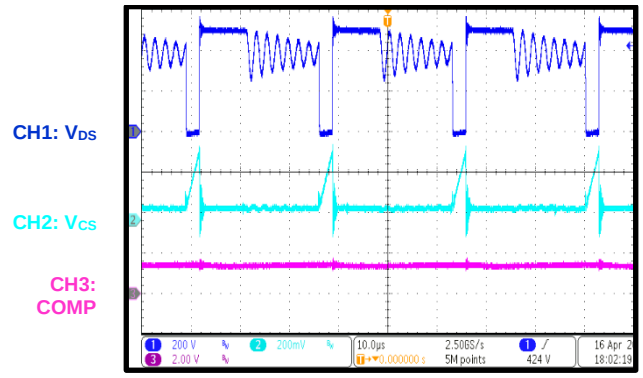
Flyback Steady State

V_{IN} = 115V_{AC}/60Hz, P_{OUT} = 60W



Flyback Steady State

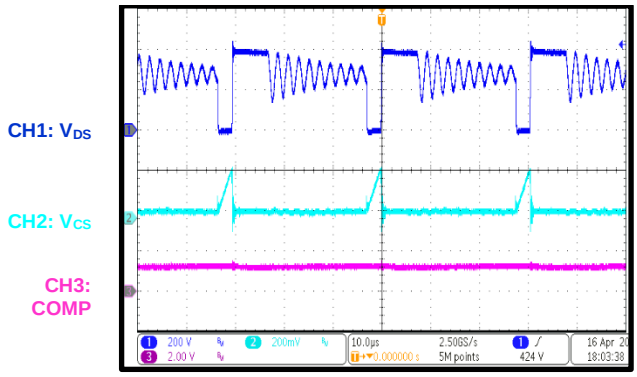
V_{IN} = 230V_{AC}/50Hz, P_{OUT} = 60W



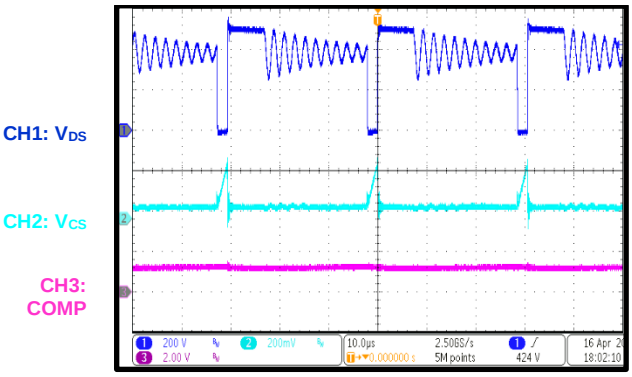
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.

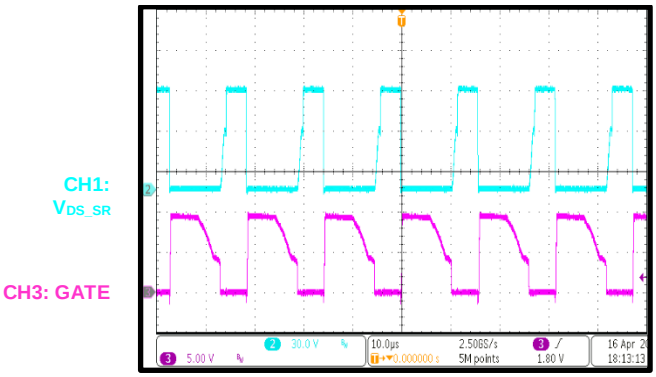
Flyback Steady State
V_{IN} = 115V_{AC}/60Hz, P_{OUT} = 30W



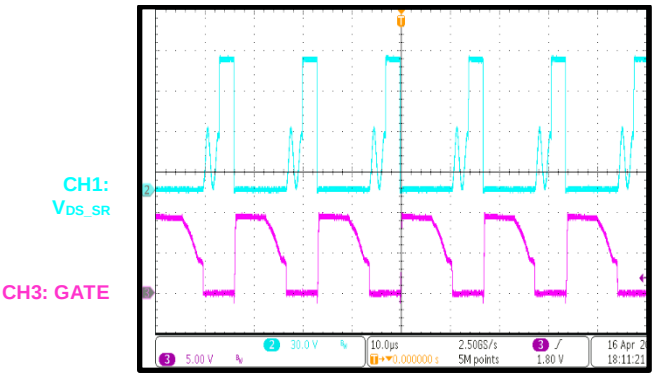
Flyback Steady State
V_{IN} = 230V_{AC}/50Hz, P_{OUT} = 30W



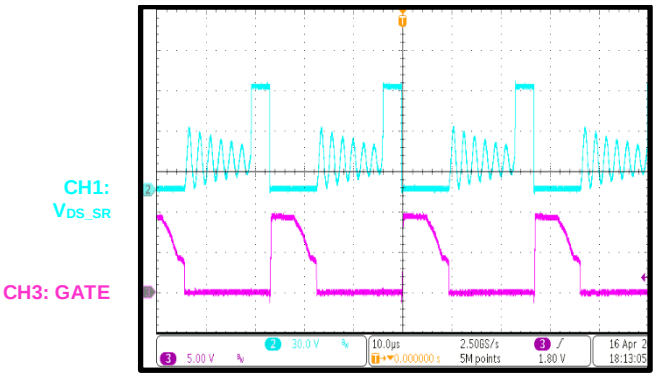
Flyback SR Steady State
V_{IN} = 115V_{AC}/60Hz, P_{OUT} = 120W



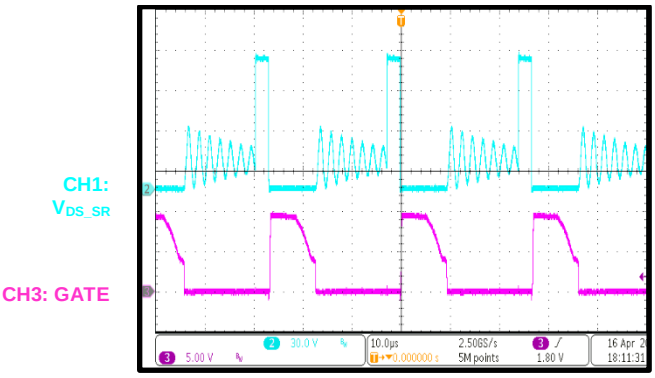
Flyback SR Steady State
V_{IN} = 230V_{AC}/50Hz, P_{OUT} = 120W



Flyback SR Steady State
V_{IN} = 115V_{AC}/60Hz, P_{OUT} = 60W



Flyback SR Steady State
V_{IN} = 230V_{AC}/50Hz, P_{OUT} = 60W

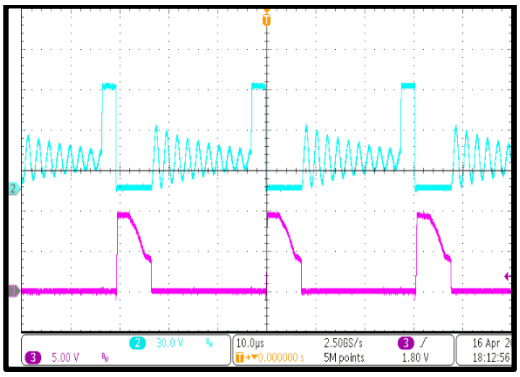


EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.

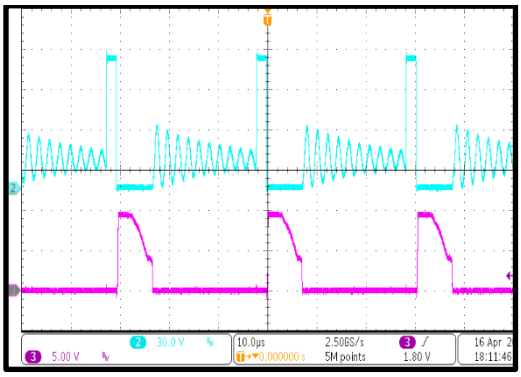
Flyback SR Steady State

V_{IN} = 115V_{AC}/60Hz, P_{OUT} = 30W



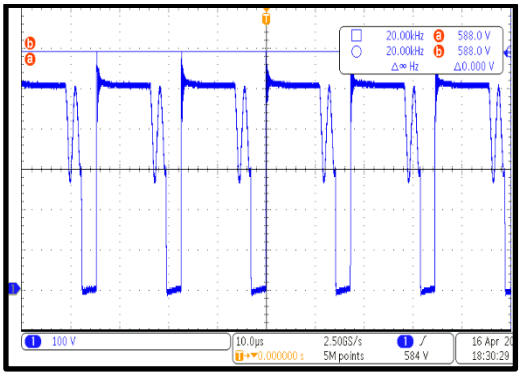
Flyback SR Steady State

V_{IN} = 230V_{AC}/50Hz, P_{OUT} = 30W



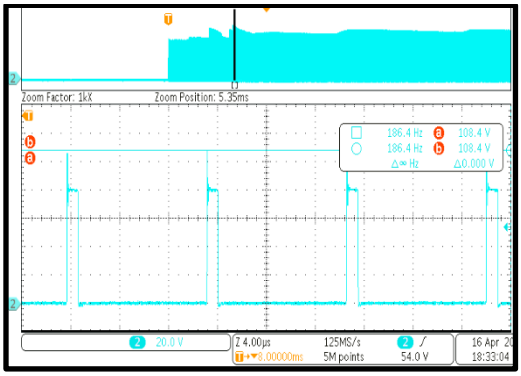
Primary MOSFET Stress

V_{IN} = 264V_{AC}, P_{OUT} = 120W, V_{MAX} = 588V



Secondary MOSFET Stress

V_{IN} = 264V_{AC}, start up, P_{OUT} = 120W,
V_{MAX} = 108.4V

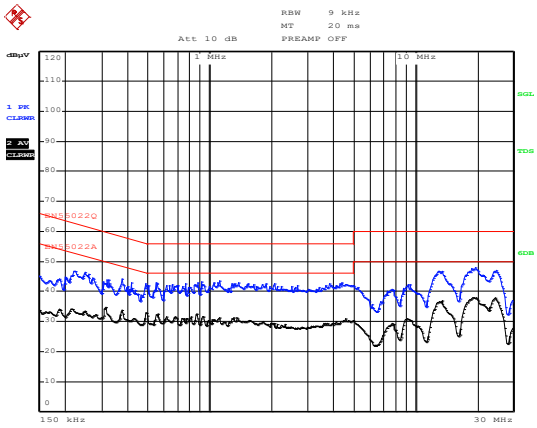


EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.

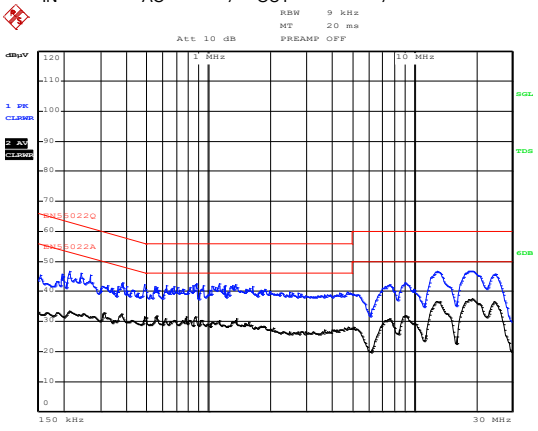
Conducted EMI

V_{IN} = 115V_{AC}/50Hz, P_{OUT} = 120W, line L



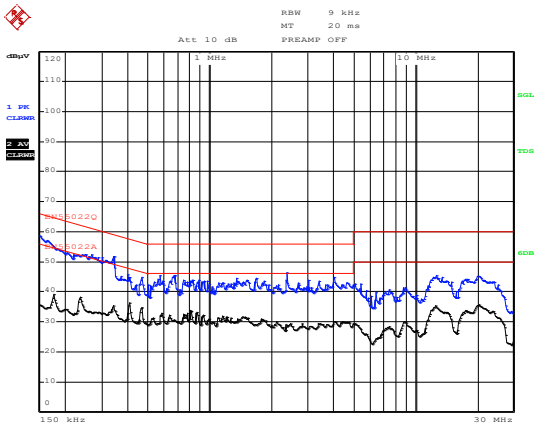
Conducted EMI

V_{IN} = 115V_{AC}/50Hz, P_{OUT} = 120W, line N



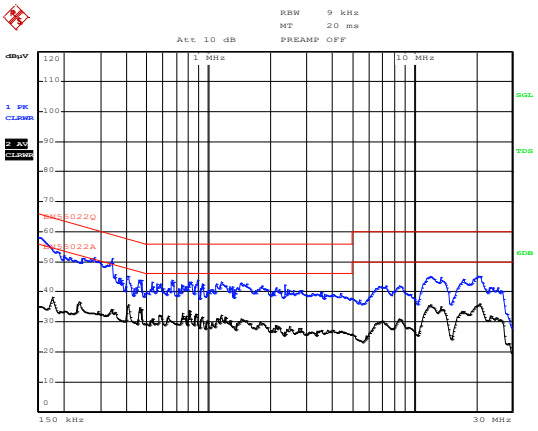
Conducted EMI

V_{IN} = 230V_{AC}/50Hz, P_{OUT} = 120W, line L



Conducted EMI

V_{IN} = 230V_{AC}/50Hz, P_{OUT} = 120W, line N

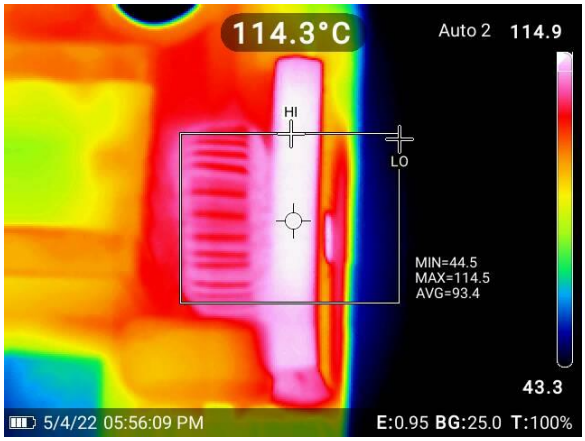


EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.

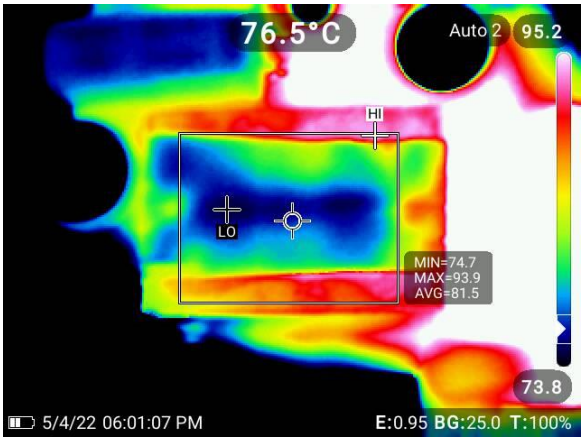
Thermal Measurements

V_{IN} = 90V_{AC}/60Hz, P_{OUT} = 120W, bridge rectifier (BD1): 114.5°C



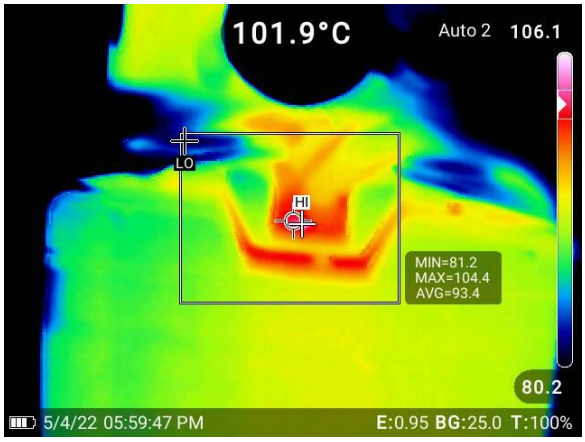
Thermal Measurements

V_{IN} = 90V_{AC}/60Hz, P_{OUT} = 120W, PFC inductor (T1): 93.9°C



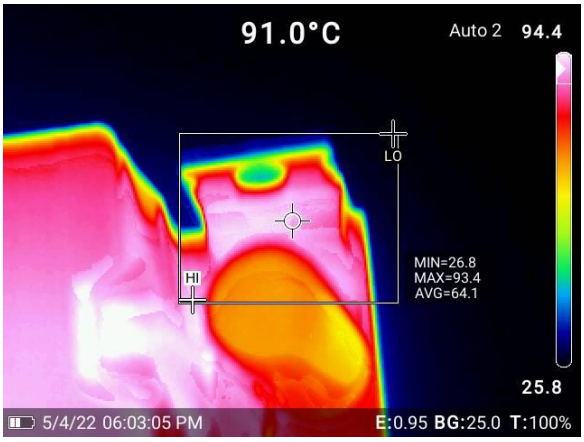
Thermal Measurements

V_{IN} = 90V_{AC}/60Hz, P_{OUT} = 120W, flyback transformer (T2): 104.4°C



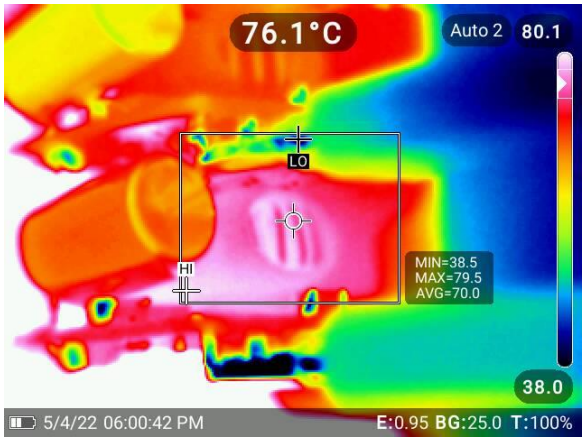
Thermal Measurements

V_{IN} = 90V_{AC}/60Hz, P_{OUT} = 120W, SR MOSFET (M2): 93.4°C



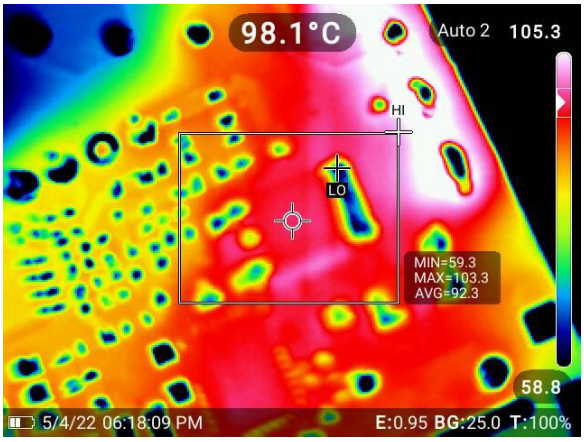
Thermal Measurements

V_{IN} = 90V_{AC}/60Hz, P_{OUT} = 120W, DC/DC inductor (L2): 79.5°C



Thermal Measurements

V_{IN} = 90V_{AC}/60Hz, P_{OUT} = 120W, PFC freewheeling diode (D1): 98.1°C

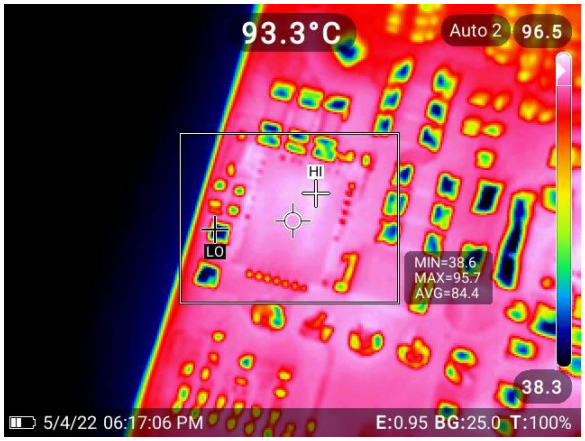


EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.

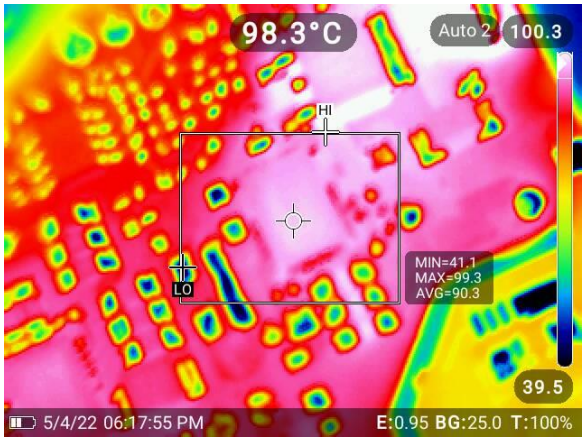
Thermal Measurements

V_{IN} = 90V_{AC}/60Hz, P_{OUT} = 120W, flyback GaN (U4): 95.7°C



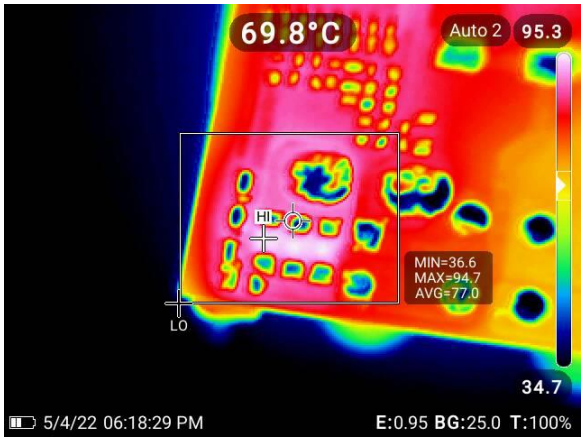
Thermal Measurements

V_{IN} = 90V_{AC}/60Hz, P_{OUT} = 120W, PFC GaN (U1): 98.3°C



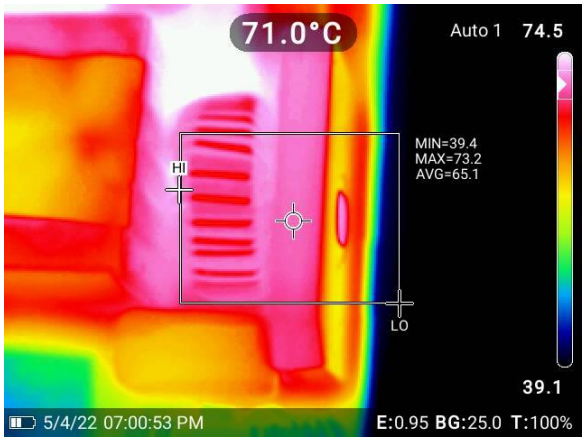
Thermal Measurements

V_{IN} = 90V_{AC}/60Hz, P_{OUT} = 120W, SR snubber (R32, R34, R35): 94.7°C



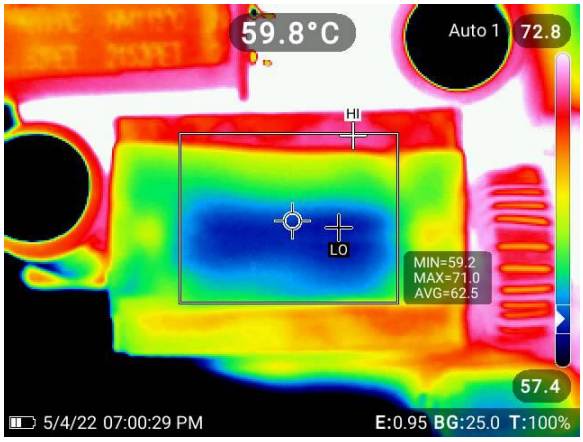
Thermal Measurements

V_{IN} = 264V_{AC}/50Hz, P_{OUT} = 120W, bridge rectifier (BD1): 73.2°C



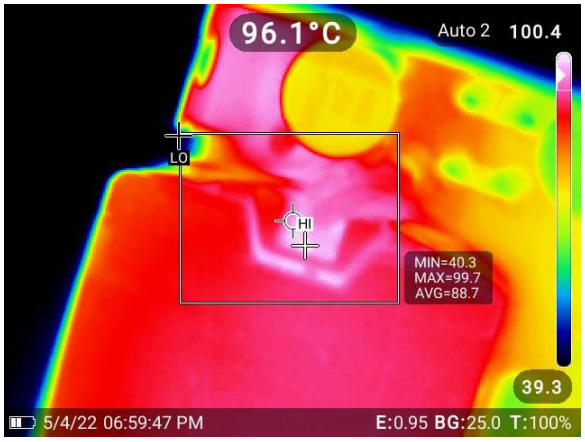
Thermal Measurements

V_{IN} = 264V_{AC}/50Hz, P_{OUT} = 120W, PFC inductor (T1): 71°C



Thermal Measurements

V_{IN} = 264V_{AC}/50Hz, P_{OUT} = 120W, flyback transformer (T2): 99.7°C

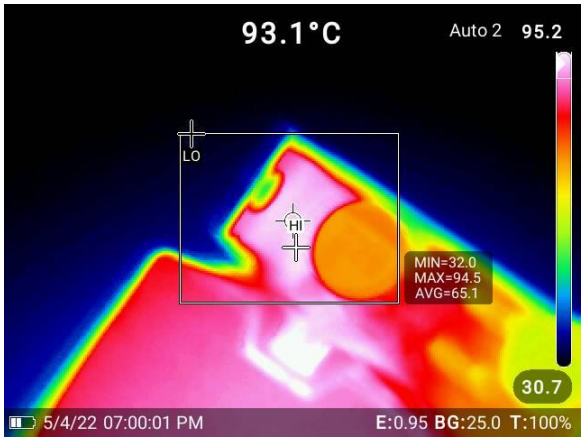


EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.

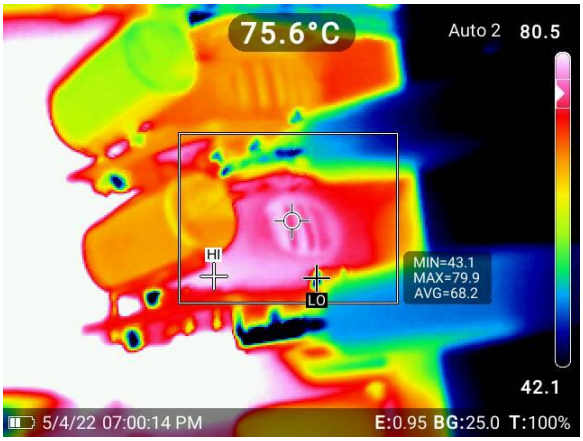
Thermal Measurements

V_{IN} = 264V_{AC}/50Hz, P_{OUT} = 120W, SR MOSFET (M2): 94.5°C



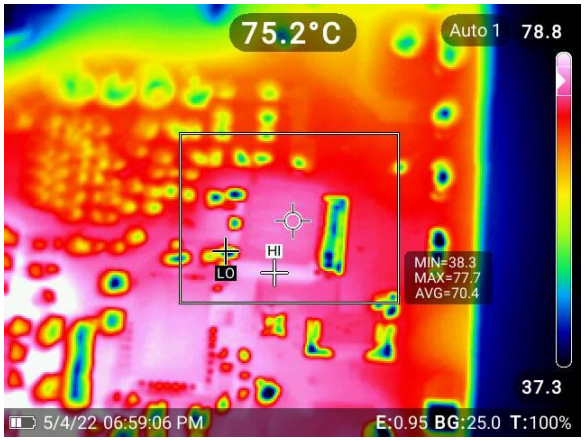
Thermal Measurements

V_{IN} = 264V_{AC}/50Hz, P_{OUT} = 120W, DC/DC inductor (L2): 79.9°C



Thermal Measurements

V_{IN} = 264V_{AC}/50Hz, P_{OUT} = 120W, PFC freewheeling diode (D1): 77.7°C



Thermal Measurements

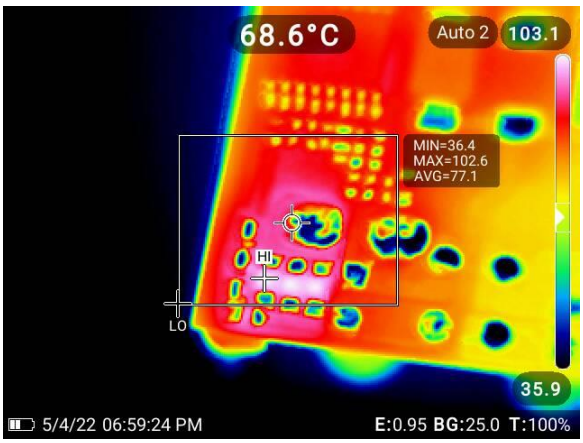
V_{IN} = 264V_{AC}/50Hz, P_{OUT} = 120W, flyback GaN (U4): 93.6°C

Thermal Measurements

V_{IN} = 264V_{AC}/50Hz, P_{OUT} = 120W, PFC GaN (U1): 78.2°C

Thermal Measurements

V_{IN} = 264V_{AC}/50Hz, P_{OUT} = 120W, SR snubber (R32, R34, R35): 102.6°C



PCB LAYOUT

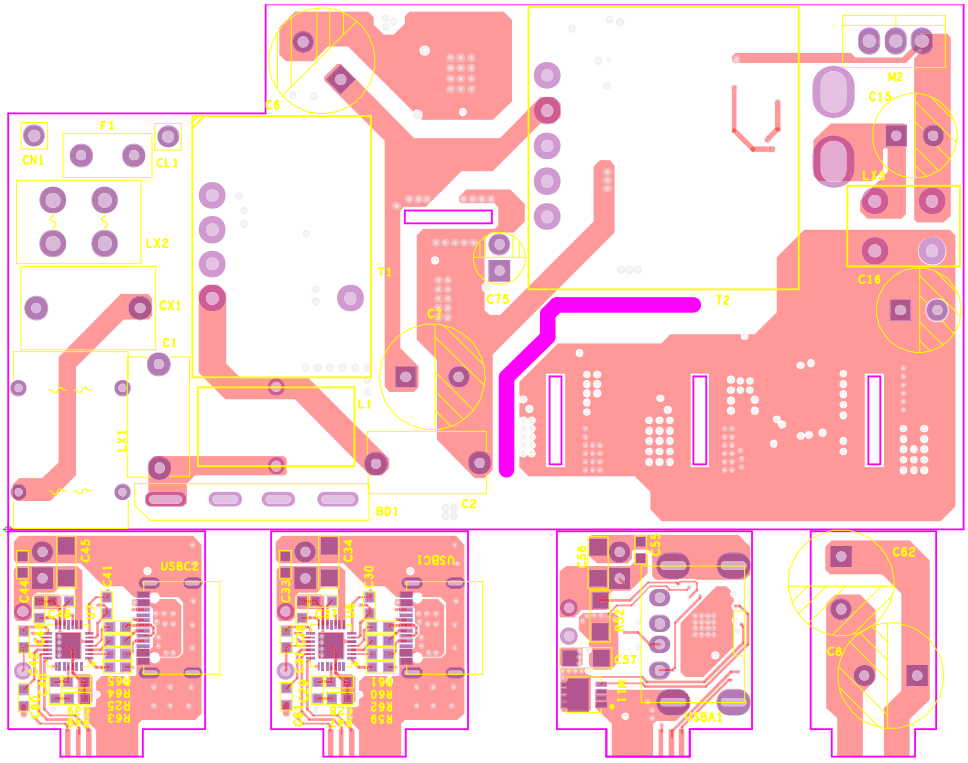


Figure 3: Top Layer

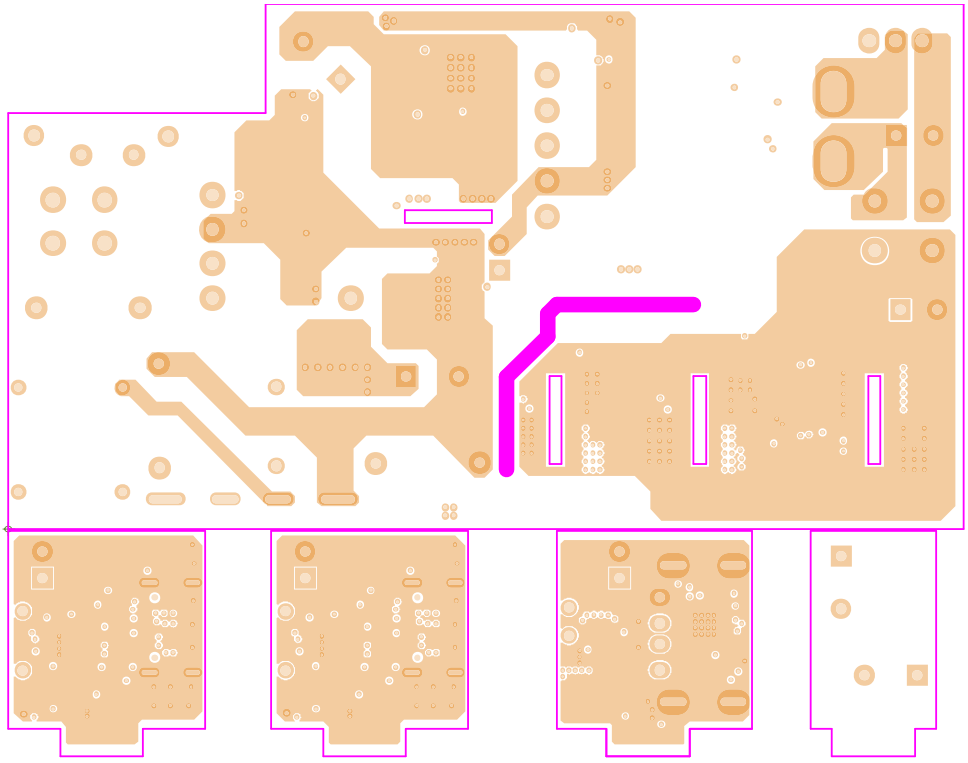


Figure 4: Mid-Layer 1

PCB LAYOUT *(continued)*

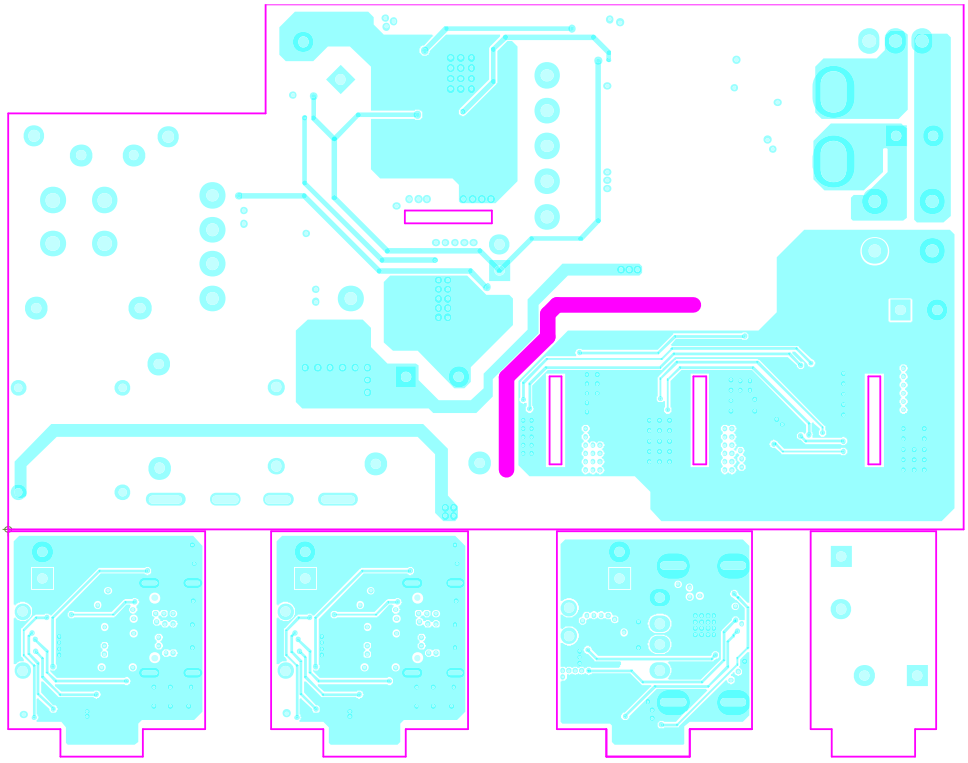


Figure 5: Mid-Layer 2

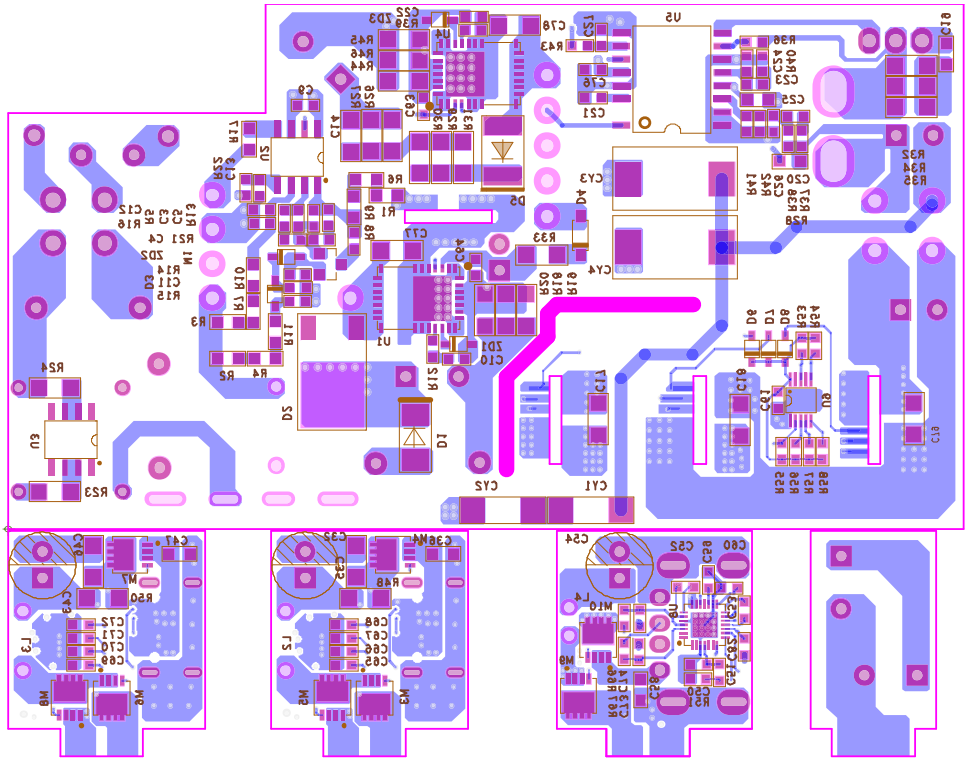


Figure 6: Bottom Layer

APPENDIX 1: PFC INDUCTOR T1 SPECIFICATION

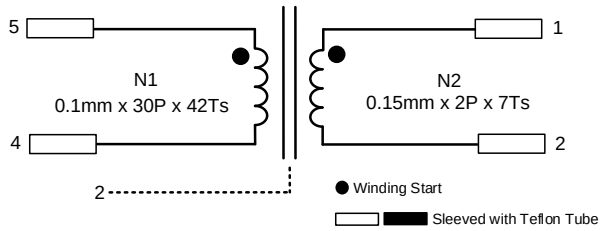


Figure 7: Electrical Diagram

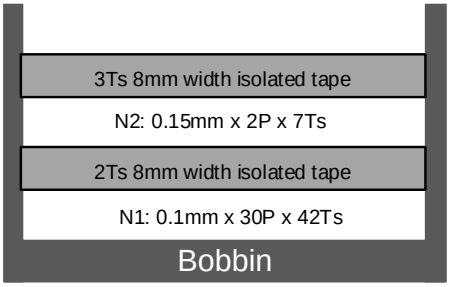


Figure 9: Winding Diagram

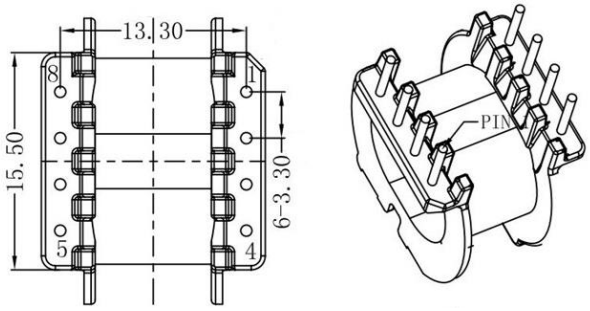


Figure 8: Pin Definition of Bobbin

Table 7: Electrical Characteristic

Parameter	Condition	Value
Inductance	L_P (4-5)	270μH ±3%
Core	-	ATQ2516
Bobbin	-	ATQ2516 (4 + 4) pin
Core material	-	N95
Turn ratio	N1:N2	42:7

Table 8: Winding Specification

Tape Turns	Winding No.	Start to End	Wire Diameter (φ)	Turns	Winding	Tube
	N1	5 to 4	0.1mm x 30P	42Ts	5 layers	Yes
2Ts						
3Ts	N2	1 to 2	0.15mm x 2P	7Ts	1 layer	Yes
Connect the core to GND (pin 2) via copper. The core center column is fixed with epoxy resin.						

APPENDIX 2: FLYBACK TRANSFORMER T2 SPECIFICATION

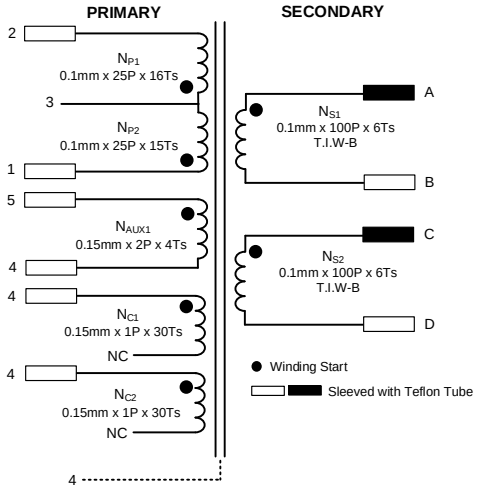


Figure 10: Electrical Diagram

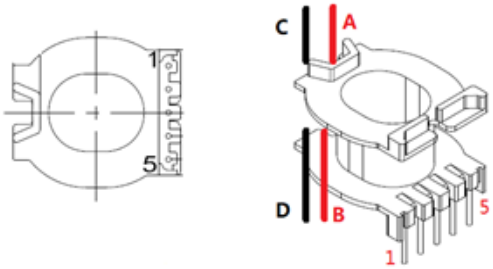


Figure 11: Pin Definition of Bobbin (View from Top)

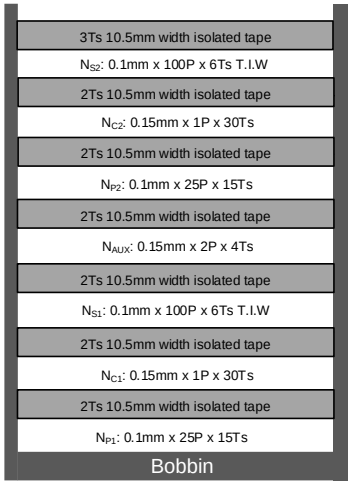


Figure 12: Winding Diagram

Table 9: Electrical Characteristic

Parameter	Condition	Value
Primary inductance	L_P (1-2)	320μH ±3%
Leakage inductance	L_{LK} (1-2)	4μH max
Core	-	ATQ2718
Bobbin	-	ATQ2718 (5 + 0) pin
Core material	-	N95
Turn ratio	N_P:N_S:N_{AUX}	31:6:4

Table 10: Winding Specification

Tape Turns	Winding No.	Start to End	Wire Diameter (φ)	Turns	Winding	Tube
2Ts	N_{P1}	1 to 3	0.1mm x 25P	16Ts	1 layer	Yes
2Ts	N_{C1}	4 to NC	0.15mm x 1P	30Ts	1 layer	Yes
2Ts	N_{S1}	A to B	0.1mm x 100P (T.I.W)	6Ts	1 layer	Yes
2Ts	N_{AUX}	5 to 4	0.15mm x 2P	4Ts	1 layer	Yes
2Ts	N_{P2}	3 to 2	0.1mm x 25P	15Ts	1 layer	Yes
2Ts	N_{C2}	4 to NC	0.15mm x 1P	30Ts	1 layer	Yes
3Ts	N_{S2}	C to D	0.1mm x 100P (T.I.W)	6Ts	1 layer	Yes
Connect the core to GND (pin 4) via copper. The core center column is fixed with epoxy resin.						

REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	10/19/2022	Initial Release	-