



DEMO BOARD TEST REPORT

500W, Single Stage LLC Power Supply Reference Design with KP2591(A)

FEATURES

- Operating Frequency up to 350kHz
- VCO Control with High Accuracy
- Adaptive Dead-time Control
- Integrated Brown-out Detection and X-capacitor Discharge Function
- Support Application without PFC Stage
- Wide AC Input Range(180~265Vac/50Hz) with high efficiency up to 94.59% @230Vac/50Hz with Full Load
- Standby Power Consumption < 800mW (with Relay ON) under Standby mode
- Integrated Protection Features of Auto-Recovery Mode

APPLICATIONS

- Adapter Power Supply
- TV LCD Power Supply
- LED Applications

INTRODUCTION

The KP2591(A) is a resonant switching power controller based on half-bridge LLC resonant converter, which integrates half-bridge driver with 50% duty cycle, and the maximum operating frequency is up to 350kHz.

The demo board of KP2591(A) is a single stage LLC converter without PFC stage to converter AC input voltage (180~265Vac/50Hz) to isolated 48V DC output. The demo board has a regulated 48V output that can handle up to 10.5A of continuous output current for AC input range of 200~265Vac/50Hz (burn-in 2 hours @ open air of $T_a=25\text{ }^\circ\text{C}$ with no airflow), and 9.5A of continuous output current for 180Vac/50Hz.

And the demo board is integrated with complete protection functions, such as output OVP, output short-circuit protection, output over load protection, AC brown-out protection, and so on.

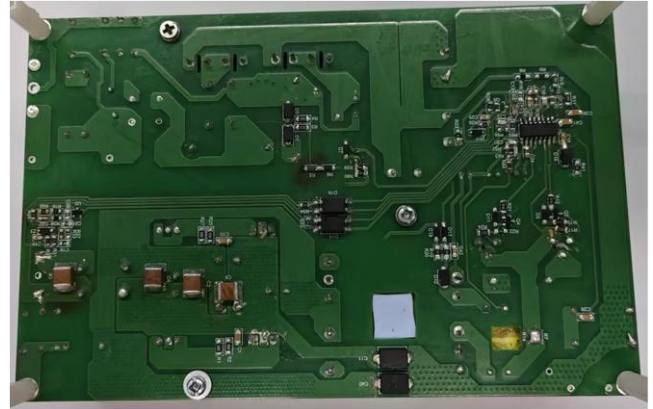
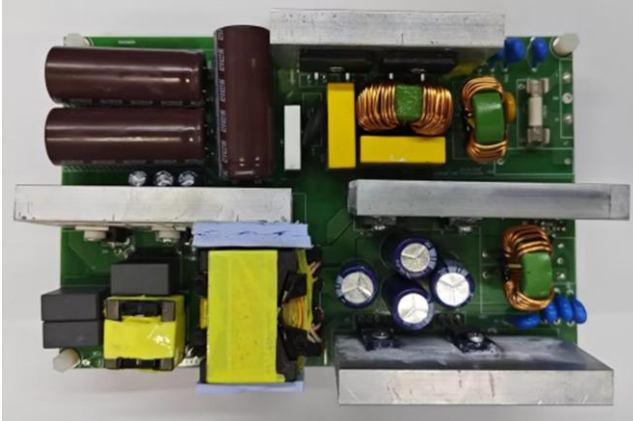
DEMO BOARD SEPCIFICATION

Description	Symbol	Min	Type	Max	Unit	Note
Input Voltage	Vin	180	230	265	Vac	
Output	Vout	48			V	
Rate Output Current	Iout	9.5	10.5	10.5	A	10.5A @200~265Vac/50Hz 9.5A @180Vac/50Hz
Rate Output Power	Pout	456	500		W	500W @200~265Vac/50Hz 456W @180Vac/50Hz
Ripple & Noise	Vripple		319		mVp-p	Board end @230Vac/50Hz Full Load
Maximum Full Load Efficiency	η	94.59			%	Board end @230Vac/50Hz
Standby Power Consumption	Ptotal			775.84	mW	@200Vac/50Hz Standby Mode with Relay ON
Startup Time	Tst			332	ms	@200Vac/50Hz Full Load
Operating Ambient	Ta	0		40	$^\circ\text{C}$	
Operating Humidity		5		95	%R.H.	

The table above shows the minimum acceptable performance of the design. Actual performance is listed in the results

section.

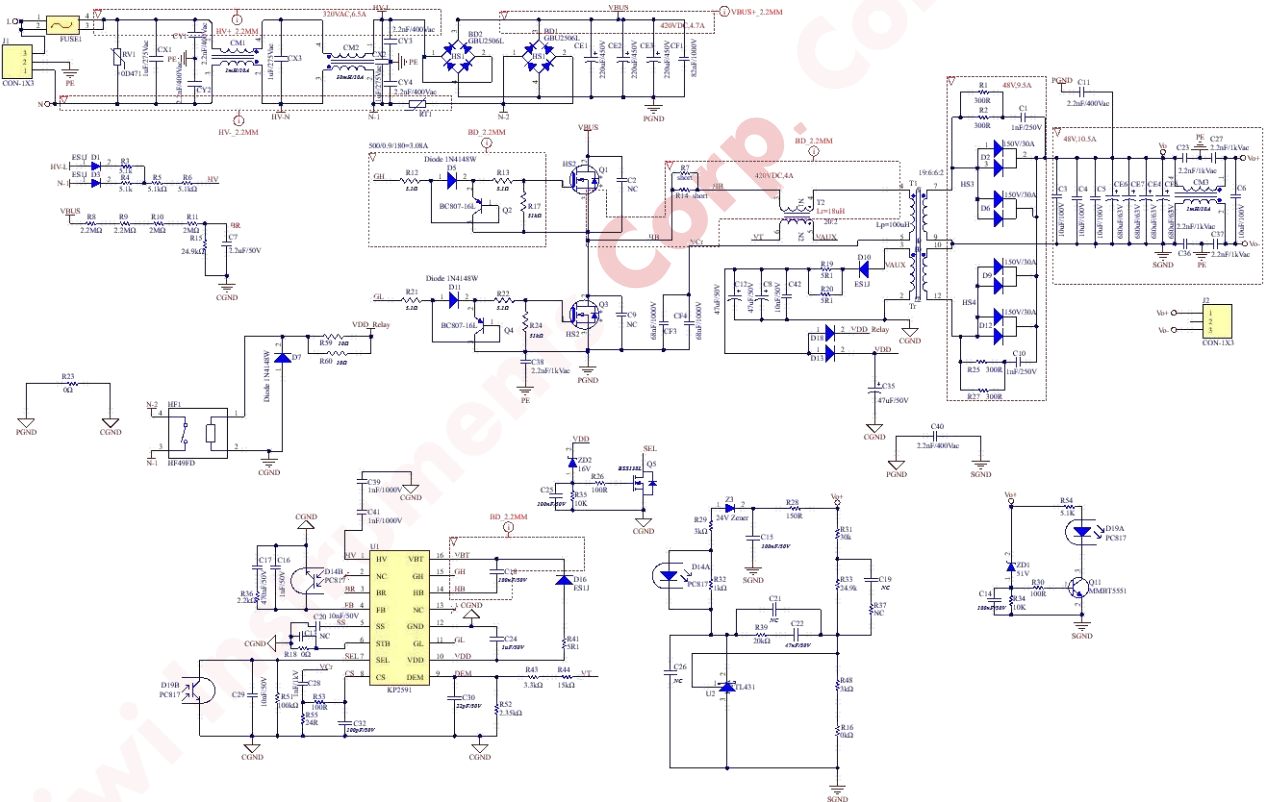
Demo Board of KP2591-D02-REV1.0



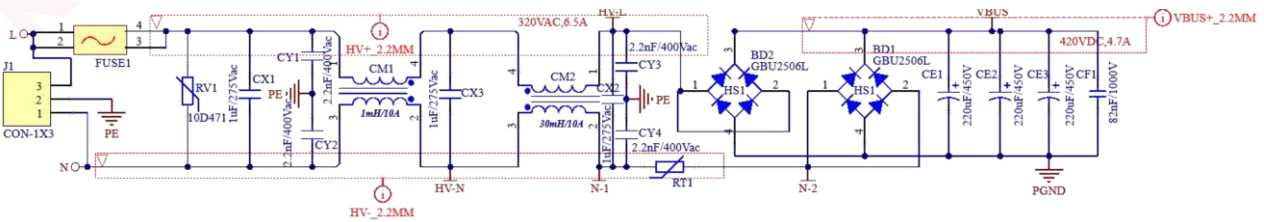
Board Size (mm): L x W x H = 171 x 110 x 42

Schematic

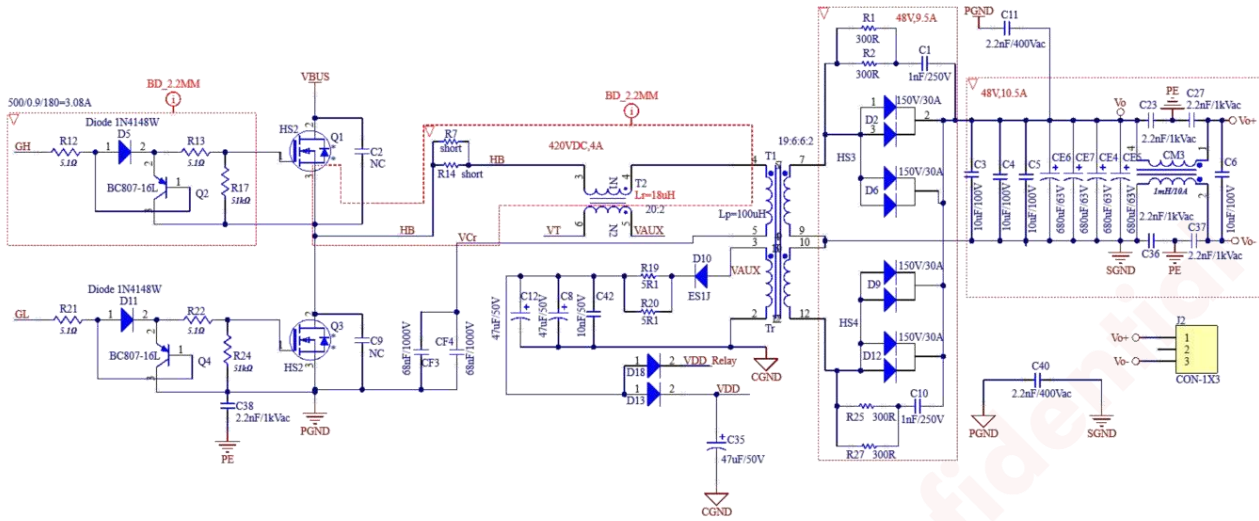
1. Overall Schematic Diagram



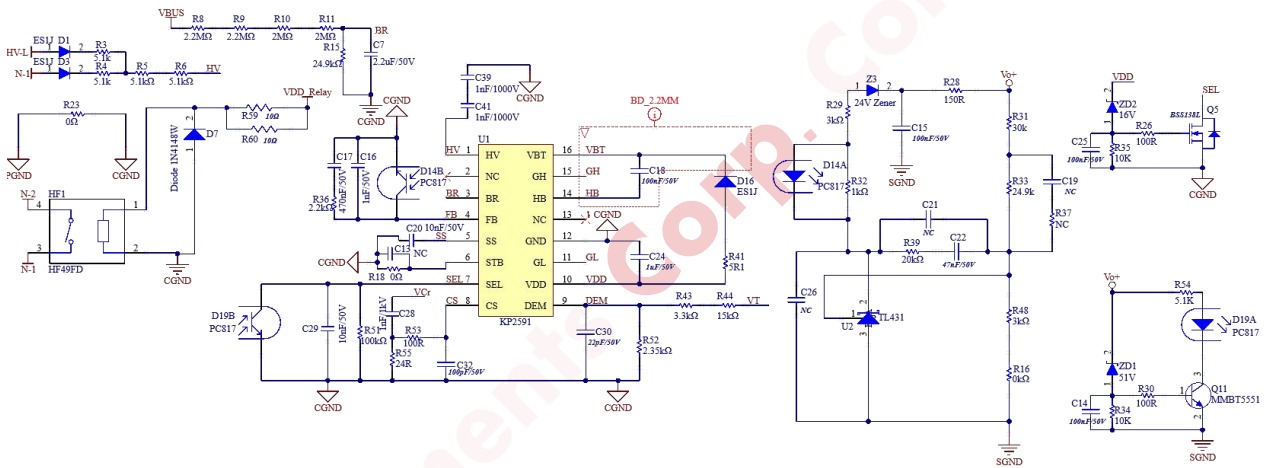
2. AC Input Loop



3. Power Transfer Loop

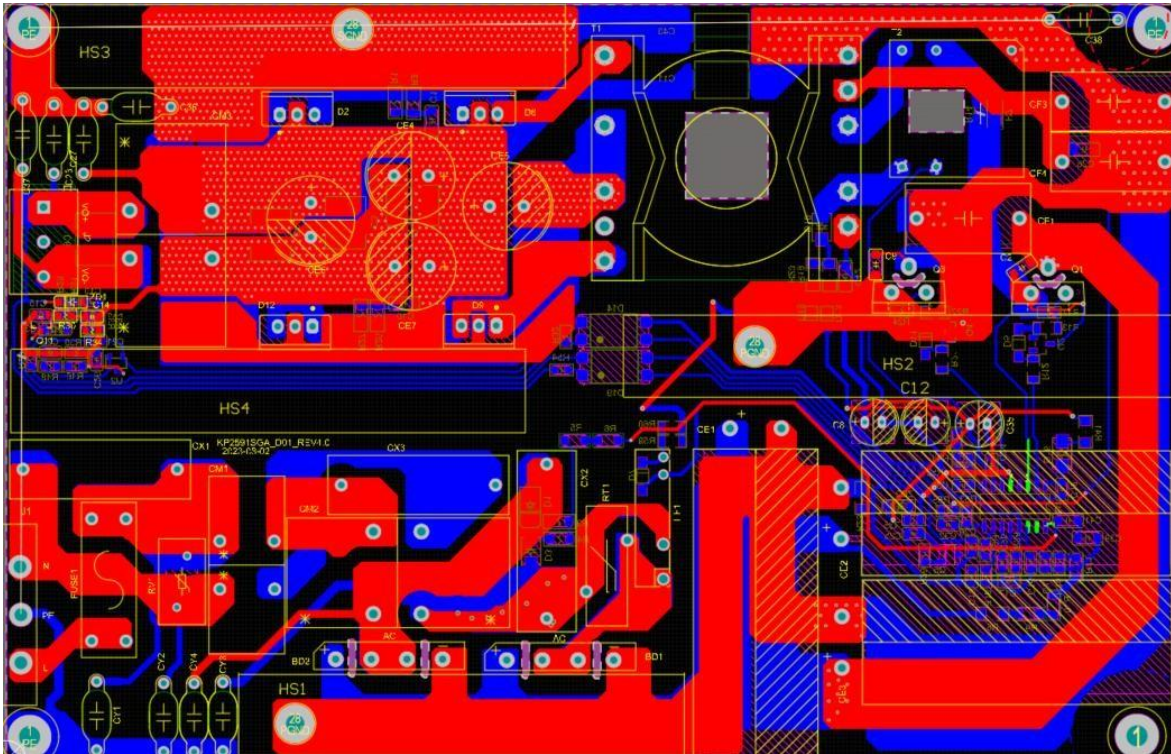


4. Control Loop

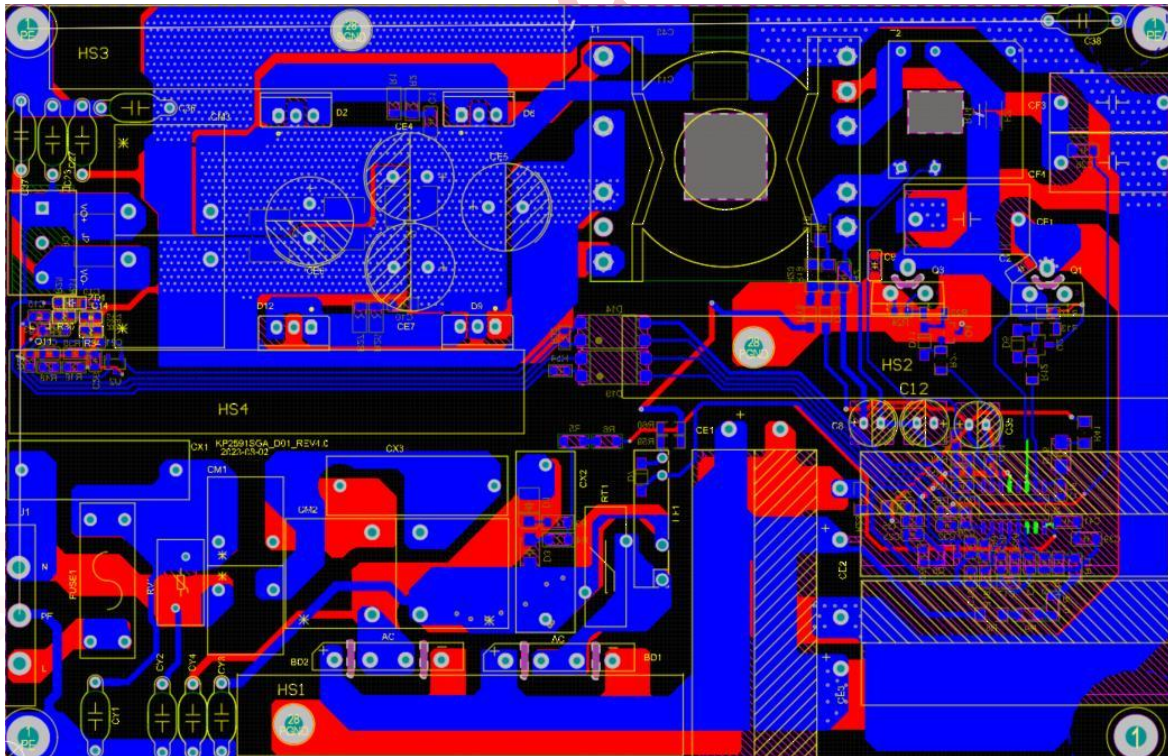


Printed Circuit Board Layout

Top Layer



Bottom Layer





Bill of Material

No	Designator	Value	Description	Package	Manufacturer	Part Number
1	HS1	/	heart sink, 65mm*10mm*30mm	TH	KEFA	DG500-5.08-03P-14-00A(H)
2	HS2, HS3, HS4	/	heart sink, 75mm*10mm*35mm	TH	KEFA	DG500-5.08-03P-14-00A(H)
3	J1 J2	/	Header, 3-Pin 5.08mm 300V 20A Green	TH	KEFA	DG500-5.08-03P-14-00A(H)
4	FUSE1	250Vac/10A	Spring Brass, Tin-plated, Ear for 5*20mm Fuses & 250Vac 10A Time-Lag Fuse	TH	Littlefuse	01110501Z
5	FUSE1	250V/10A	5*20mm Time-Lag surge withstand ceramic body cartridge fuse	TH	Littlefuse	0215010.MX P
6	HF1	30V/5A	12V SPST, 5A switching cap, Contact Rating: 5A@ 250VAC/30VDC, Rcr = 100mΩ@ 1A/6VDC	TH	HF	HF49FD/012-1H11
7	T1	100μH	Transformer, PQ35/35, Pri: Sec1: Sec2: Aux=19: 6: 6: 2, Pri: 0.1mm*40P*2 Wire Sec1: 0.1mm*200P Wire Sec2: 0.1mm*200P Wire Aux: 0.2mm Wire	TH	/	/
8	T2	18μH	Resonant Inductor, PQ20/20, Pri: Aux = 20: 2 Pri: 0.1mm*80P Wire Aux: 0.2mm Wire	TH	/	/
9	U1	KP2591ASGA	High Voltage, Half-bridge LLC Resonant Controller	SOP-16	KIWI	KP2591ASG A
10	U2	TL431	Precision adjustable shunt, VREF=2.5V 1% 37V	SOT-23	JSMSEMI	TL431
11	BD1, BD2	600V/25A	25A 600V BRIDGE RECTIFIER(VF=0.95V@IF=12.5A)	GBU	World	GBU2506L
12	C1, C10	1nF/250V	Ceramic Cap 250V ±10% X7R	1206	YAGEO	CC1206KRX 7RYBB102
13	C2, C9, C13, C19, C21, C26	NC	/	/	/	/
14	C3, C4, C5, C6	10μF/100V	Ceramic Cap 100V ±10% X7R	2220	PSA	FS55X106K1 01EHG
15	C7	2.2μF/50V	Ceramic Cap 50V ±10% X7R	0805	YAGEO	CC0805KKX 7R9BB225
16	C8, C12, C35	47μF/50V	Electrolytic Cap 50V 6.3*11 P2.5	TH	AISHI	ERS1HM470 E11OT
17	C11, C40	2.2nF/400V	Y1 Capacitor 400Vac SMD 7.8*5.4*2.38	SMD	TRX	TMY1222M
18	C14, C15, C18, C25	100nF/50V	Ceramic Cap 50V ±10% X7R	0805	WE	85012207098
19	C16	1nF/50V	Ceramic Cap 50V ±5% NPO	0805	WE	88501200706 3
20	C17	470nF/50V	Ceramic Cap 50V ±10% X7R	0805	WE	88501220710 2
21	C20, C29, C42	10nF/50V	Ceramic Cap 50V ±10% X7R	0805	WE	88501220709 2
22	C22	47nF/50V	Ceramic Cap 50V ±10% X7R	0805	WE	88501220709 6

23	C23, C27, C36, C37, C38, CY1, CY2, CY3, CY4	2.2nF/400V	Y1 Capacitor 400Vac ±10% T5 P10	TH	STE	Q09F1D222M N0B0S0N0
24	C24	1µF/50V	Ceramic Cap 50V ±10% X7R	0805	WE	885012207103
25	C28, C39, C41	1nF/1000V	Ceramic Cap 1000V ±10% X7R	1206	WE	885342208018
26	C30	22pF/50V	Ceramic Cap 50V ±5% NPO	0805	WE	885012007053
27	C32	100pF/50V	Ceramic Cap 50V ±5% NPO	0805	WE	885012007057
28	CE1, CE2, CE3	220µF/450V	Electrolytic Cap 450V 22*46 P10	TH	AISHI	ERH2WM221 O46OT
29	CE4, CE5, CE6, CE7	680µF/63V	Electrolytic Cap 100V 12.5*25mm P5	TH	AISHI	ERR1JM681W 25OT
30	CM1, CM3	1mH/10A	Sanci Inductor, Isat=10A, Wire 1mm, Rdc=8mΩ	TH	Sanci	T18*10*7
31	CM2	30mH/10A	Sanci Inductor, Isat=10A, Wire 1mm, Rdc=38mΩ	TH	Sanci	T25*15*10
32	CF1	82nF/1000V	Film Capacitor 1000Vdc 18*16*10mm P15	TH	KYET	/
33	CF3, CF4	68nF/1000V	Film Capacitor 1000Vdc 18*14.5*8.5mm P15	TH	KYET	/
34	CX1, CX2, CX3	1µF/275Vac	X2 Capacitor 275Vac 15*8.5*14 P12.5	TH	WE	890324024003CS
35	D1, D3, D10, D16	600V/1A	DIO FRD 600V 1A 1.7V@1A	SMA	Onsemi	ES1J
36	D2, D6, D9, D12	150V/30A	DOIDE 150V 30A 1.05V@15A	TH	CJ	SBDF30150S CTB
37	D5, D7, D11, D13, D18	100V/0.15A	DIO FRD 100V 150mA 1.25V@150mA	SOD-123	CJ	1N4148W
38	D14, D19		PHOTO TR 50mA 200%-400%	SMD-4	EVERLIGHT	EL817S1(A)(TU)-F
39	Q1, Q3,	600V/31A	MOSFET 600V 31A 105mΩ@10V, 18A	TO-220	Infineon	IPP60R099CP
40	Q2, Q4	45V/500mA	PNP 45V 500mA 300mW	SOT-23	Onsemi	BC807-16LT3G
41	Q5	50V/300mA	MOSFET 50V 300mA 300mW 1.5Ω@10V, 500mA	SOT-23	ElecSuper	BSS138L
42	Q11	160V/600mA	NPN 160V 600mA 300mW	SOT-23	CJ	BD138
43	R1, R2, R25, R27	300Ω	Chip Resistor ±1% 1/4W	1206	FH	RS-06K3000FT
44	R3, R4, R5, R6	5.1kΩ	Chip Resistor ±1% 1/4W	1206	FH	RS-06K5101FT
45	R7, R14	Jump	/	/	/	/
46	R8, R9	2.2MΩ	Chip Resistor ±1% 1/4W	1206	FH	RS-06L2204FT
47	R10, R11	2MΩ	Chip Resistor ±1% 1/4W	1206	FH	RS-06L2004FT
48	R12, R13, R19, R20, R21, R22, R41	5.1Ω	Chip Resistor ±1% 1/8W	0805	FH	RS-05L5R10FT
49	R15, R33	24.9kΩ	Chip Resistor ±1% 1/8W	0805	FH	RS-05K2492FT
50	R16, R18, R23	0Ω	Chip Resistor ±1% 1/8W	0805	FH	RS-05000FT
51	R17, R24	51kΩ	Chip Resistor ±1% 1/8W	0805	FH	RS-05K5102FT

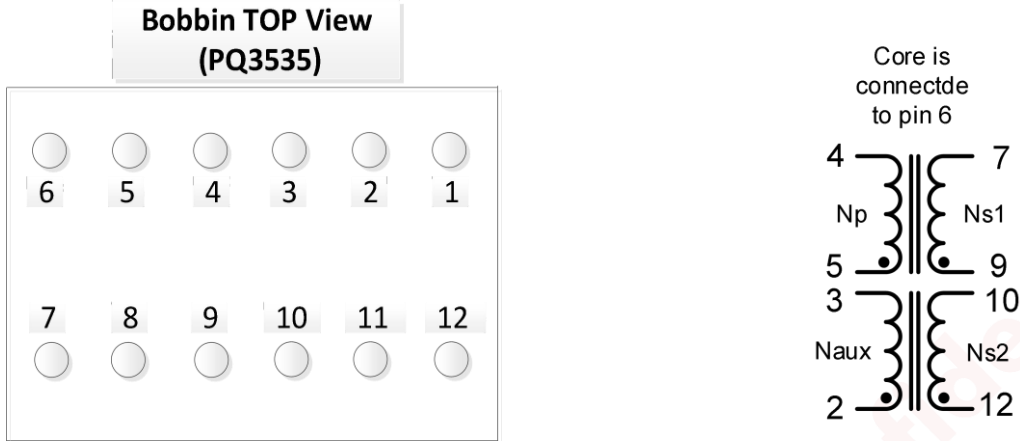


Demo Board Test Report
500W, Single Stage LLC Power Supply
Reference Design with KP2591(A)

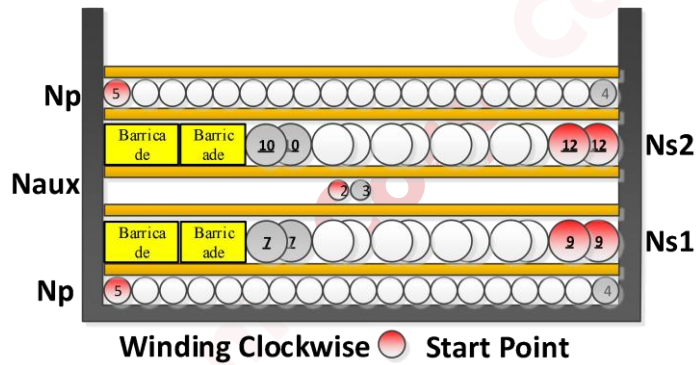
52	R26, R30, R53	100Ω	Chip Resistor ±1% 1/8W	0805	FH	RS-05K1000FT
53	R28	150Ω	Chip Resistor ±1% 1/8W	0805	FH	RS-05K1500FT
54	R29, R48	3kΩ	Chip Resistor ±1% 1/8W	0805	FH	RS-05K3001FT
55	R31	30kΩ	Chip Resistor ±1% 1/8W	0805	FH	RS-05K3002FT
56	R32	1kΩ	Chip Resistor ±1% 1/8W	0805	FH	RS-05K1001FT
57	R34, R35	10kΩ	Chip Resistor ±1% 1/8W	0805	FH	RS-05K1002FT
58	R36	2.2kΩ	Chip Resistor ±1% 1/8W	0805	FH	RS-05K2201FT
59	R37	NC	/	/	/	/
60	R39	20kΩ	Chip Resistor ±1% 1/8W	0805	FH	RS-05K2002FT
61	R43	3.3kΩ	Chip Resistor ±1% 1/8W	0805	FH	RS-05K3301FT
62	R44	15kΩ	Chip Resistor ±1% 1/8W	0805	FH	RS-05K1502FT
63	R51	100kΩ	Chip Resistor ±1% 1/8W	0805	FH	RS-05K1003FT
64	R52	2.37kΩ	Chip Resistor ±1% 1/8W	0805	FH	RS-05K2371FT
65	R54	5.1kΩ	Chip Resistor ±1% 1/8W	0805	FH	RS-05K5101FT
66	R55	24Ω	Chip Resistor ±1% 1/8W	0805	FH	RS-05K24R0FT
67	R59, R60	10Ω	Chip Resistor ±1% 1/8W	0805	FH	RS-05K10R0FT
68	RT1	MF72 3D25	NTC 3Ω @ 25°C 9A @ 25°C	TH	Shiheng	MF72 3D25
69	RV1	10D471	VARISTOR 300VAC 70J 2500A	TH	WE	820513011
70	Z3	BZT52-B24S	Diode Zener 24V 2% 200mW	SOD-123	PANJIT	BZT52-B24S
71	ZD1	51V	Diode Zener 51V 2% 500mW	SOD-123	LGE	BZT52C2V0-BZT52C51
72	ZD2	16V	Diode Zener 16V 2% 200mW	SOD-323	PANJIT	BZT52-B16S

Transformer Manufacture Guide

1 Electrical Diagram



2 Winding Diagram



3 Winding Order

Number	Winding	Layer	Start	End	Wire Size (mm)	Turns	Note
1	Npri	Primary	Pin 5	Pin 4	0.1*40P	19Ts	Dense
3	Ns1	Secondary	Pin 9	Pin 7	0.1*100Px2	6Ts	Dense
2	Naux	Auxiliary	Pin 2	Pin 3	0.2	2Ts	Dense
4	Ns2	Secondary	Pin 12	Pin 10	0.1*100Px2	6Ts	Dense
5	Npri	Primary	Pin 5	Pin 4	0.1*40P	19Ts	Dense

4 Electrical Specification

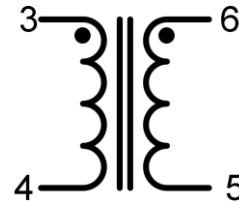
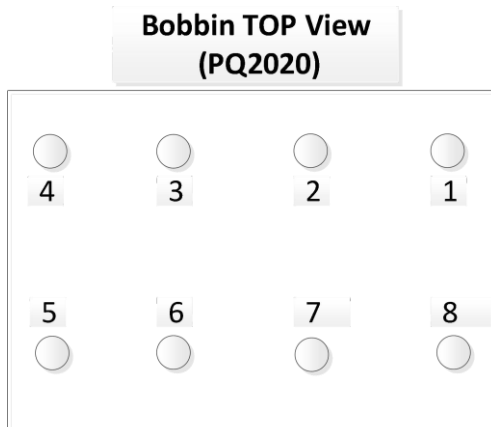
Items	Test Pin	Specification	Test Condition
Primary Inductance	100kHz, 100mVAC, Lp	Pin 5 - 4	100μH (±10%)
Leakage Inductance	100kHz, 100mVAC, Lp' (tie 7, 9, 10, 12)	Pin 5 - 4	1.7μH (±10%)
Turn Ratio	/	(5 - 4): (2 - 3)	19Ts:2Ts
S Turn Ratio	/	(5 - 4): (9 - 7): (12 - 10): (2 - 3)	19Ts: 6Ts: 6Ts: 2Ts
DC Resistance	@25°C	Pin 5 - 4	0.04R Max
DC Resistance	@25°C	Pin 9 - 7	0.01R Max
DC Resistance	@25°C	Pin 12 - 10	0.01R Max
Dielectric	3000VA, 1 second	Pin 1 - 12	/

5 BOM

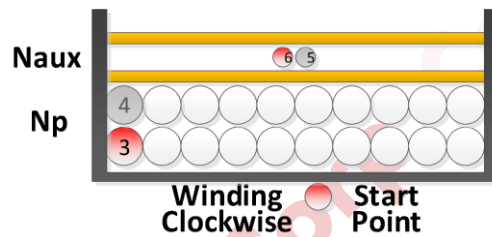
Number	Materials	Specifications
1	Bobbin	PQ35/35, 6+6 pin, Vertical
2	Core	PQ35/35, TPG33 or equivalent, AE=196mm ²
3	Wire	0.1mmΦ*100P, 2UEW, Litz, 155°C
4	Wire	0.2mmΦ, 155°C, 3000V, TIW-F
5	Wire	0.1mmΦ*40, 155°C, 3000V, TIW-F
6	Duct tape	W=18mm, T=0.1mm
7	Barricade	W=5mm, T=0.1mm

Resonant Inductor Manufacture Guide

1 Electrical Diagram



2 Winding Diagram



3 Winding Order

Number	Winding	Layer	Start	End	Wire Size (mm)	Turns	Note
1	Npri	Primary	Pin 3	Pin 4	0.1*80P	20Ts	Dense
2	Naux	Auxiliary	Pin 6	Pin 5	0.2	2Ts	Dense

4 Electrical Specification

Items	Test Pin	Specification	Test Condition
Primary Inductance	100kHz, 100mVAC, Lr	Pin 3 - 4	18μH (±10%)
Turn Ratio	/	(3 - 4): (6 - 5)	20Ts: 2Ts
DC Resistance	@25°C	Pin 3 - 4	0.034R Max
DC Resistance	@25°C	Pin 6 - 5	0.013R Max
Dielectric	3000VAC, 1 second	Pin 1 - 8	/



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5 BOM

Number	Materials	Specifications
1	Bobbin	PQ20/20, 4+4 pin, Vertical
2	Core	PQ20/20, TPG33 or equivalent, AE=62mm ²
3	Wire	0.2mm Φ , 155 $^{\circ}$ C, 3000V, TIW-F
4	Wire	0.1mm Φ *80, 2UEW, Litz, 155 $^{\circ}$ C
6	Duct tape	W=10mm, T=0.1mm

Test Result

1. Input Characteristics

1.1 No Load Input Power Dissipation

Standard: The input power loss must be less than 1W. @180~265Vac/50Hz with no load.

Result: Pass

Test Data:

Vin	180Vac/50Hz	200Vac/50Hz	230Vac/50Hz	265Vac/50Hz	Result
Standby Mode with Relay ON Ptotal (mW)	710.77	775.84	455.04	427.15	PASS
Standby Mode without Relay ON Ptotal (mW)	576.71	638.89	345.07	271.43	PASS

1.2 Efficiency

Standard: The average efficiency tested at the board end should larger than 90%. @180~265Vac/50Hz.

Result: Pass

Test Data:

Output	Average Eff (%)				Result
	180Vac/50Hz	200Vac/50Hz	230Vac/50Hz	265Vac/50Hz	
48V	91.85	92.55	93.32	93.94	PASS

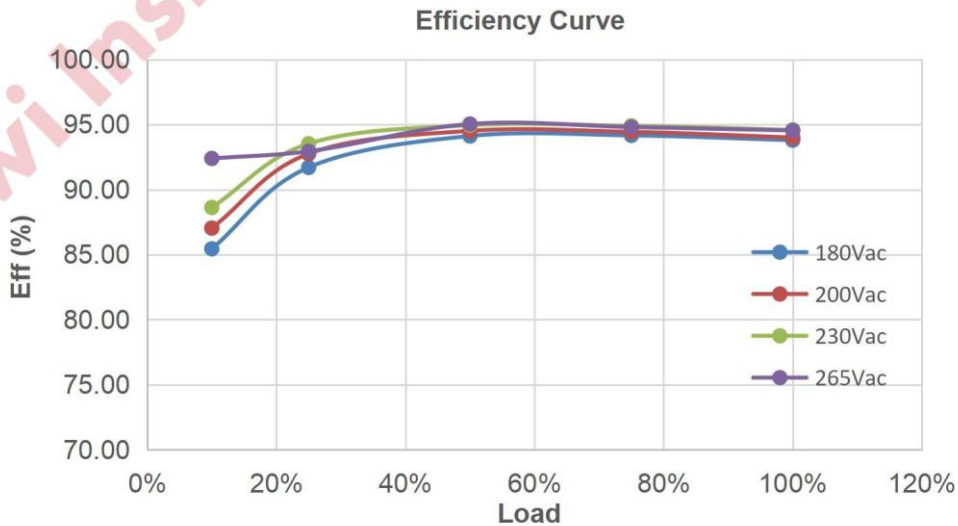
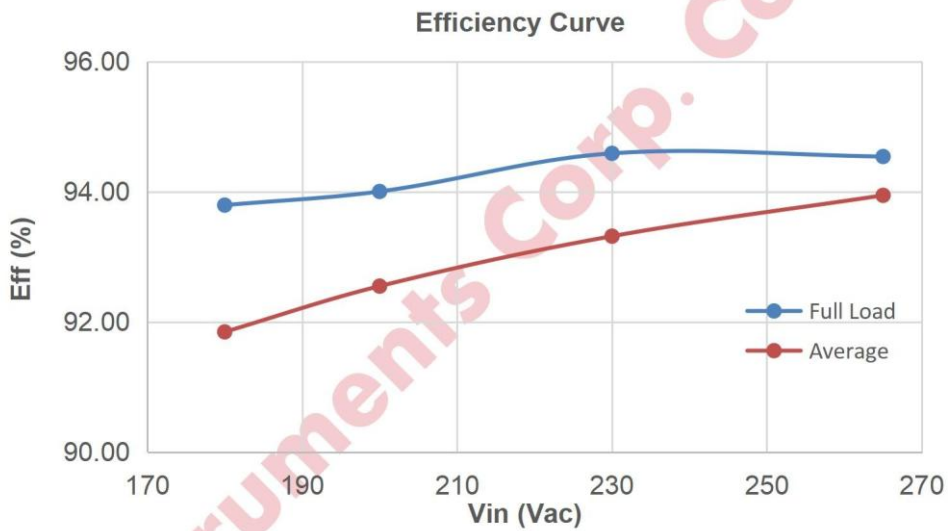
Efficiency (48V/10.5A):

Vin (Vac)	Fline (Hz)	Pin (W)	Vout (V)	Iout (A)	Pout (W)	Eff (%)	Eff_AVG (%)
180	50	489.34	48.313	9.50	458.974	93.79	91.85
		365.71	48.333	7.13	344.373	94.17	
		244.00	48.348	4.75	229.653	94.12	
		125.25	48.360	2.38	114.855	91.70	
		53.77	48.364	0.95	45.946	85.45	
200		540.00	48.345	10.50	507.623	94.00	92.55
		403.29	48.363	7.88	380.859	94.44	
		268.73	48.378	5.25	253.985	94.51	
		136.95	48.390	2.63	127.024	92.75	
		58.38	48.394	1.05	50.814	87.04	



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230	50	536.81	48.359	10.50	507.770	94.59	93.32
		401.45	48.379	7.88	380.985	94.90	
		267.59	48.391	5.25	254.053	94.94	
		135.85	48.402	2.63	127.055	93.53	
		57.35	48.406	1.05	50.826	88.62	
265		537.22	48.371	10.50	507.896	94.54	93.94
		401.94	48.389	7.88	381.063	94.81	
		267.38	48.403	5.25	254.116	95.04	
		136.74	48.416	2.63	127.092	92.94	
		55.02	48.414	1.05	50.835	92.39	



2. Output Characteristics

2.1 Output Line Regulation and Load Regulation

Standard: Under the input voltage 180~265Vac/50Hz, line regulation <6%, load regulation <6%. The output voltage is tested at the output cap end.

Result: Pass

Test Data:

Input Voltage	Output Voltage (V)					Load Regulation
	10% Load	25% Load	50% Load	75% Load	Full Load	
180Vac/50Hz	48.364	48.360	48.348	48.333	48.313	0.11%
200Vac/50Hz	48.394	48.390	48.378	48.363	48.345	0.10%
230Vac/50Hz	48.406	48.402	48.391	48.379	48.359	0.10%
265Vac/50Hz	48.414	48.416	48.403	48.389	48.371	0.09%
Line Regulation	0.10%	0.12%	0.11%	0.12%	0.12%	/

2.2 Ripple & Noise

Standard: Under the input voltage 180~265Vac/50Hz, Vripple_max < 400mVp-p.

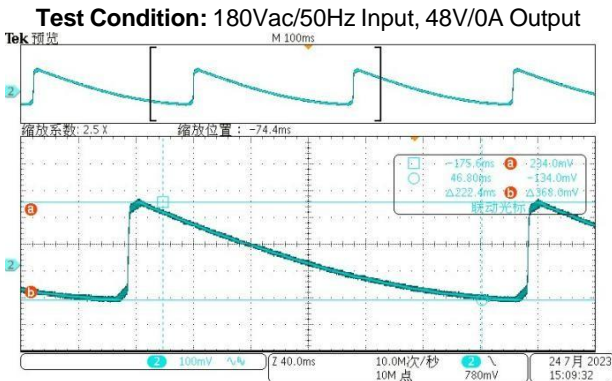
Result: Pass

Note: Generally, the ripple voltage comes from the ripple of the bus capacitors, which depends on the value of the bus capacitors. Ripple & noise are measured with minimum measurement loop. Bandwidth is limited to 20MHz.

Test Data:

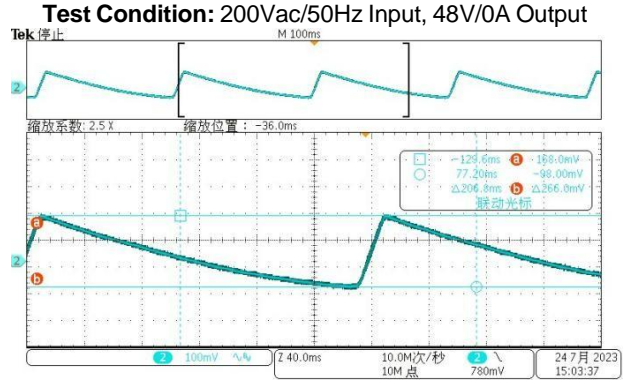
Input Voltage	No Load Ripple (mVp-p)	Full Load Ripple (mVp-p)
	48V/0A	48V/10.5A
180Vac/50Hz	368	368 (48V/9.5A)
200Vac/50Hz	266	358
230Vac/50Hz	129	319
265Vac/50Hz	231	199

Waveforms:



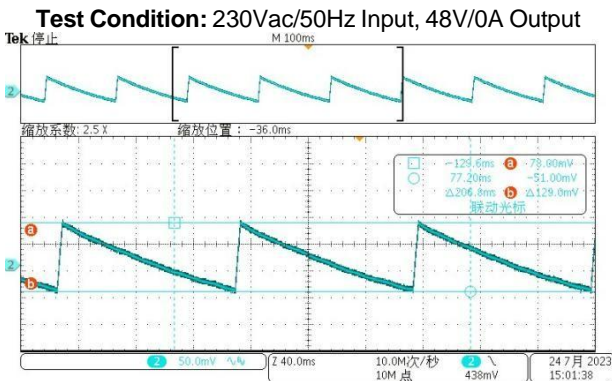
(CH2-Vripple)

Comments: Vripple = 368mVp-p



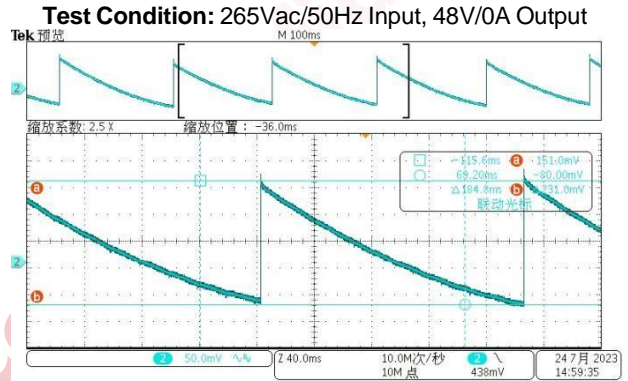
(CH2-Vripple)

Comments: Vripple = 266mVp-p



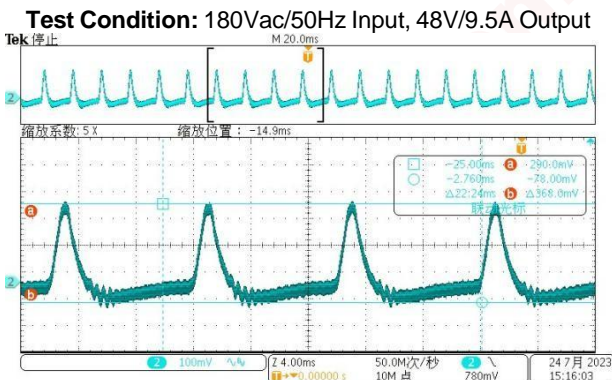
(CH2-Vripple)

Comments: Vripple = 129mVp-p



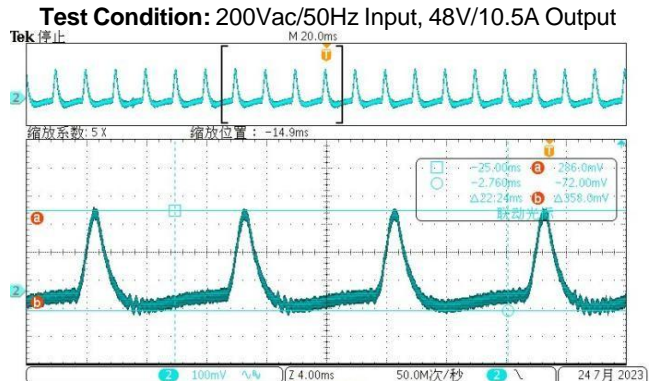
(CH2-Vripple)

Comments: Vripple = 231mVp-p



(CH2-Vripple)

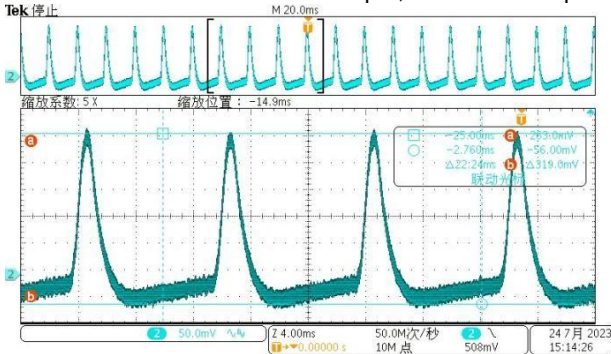
Comments: Vripple = 368mVp-p



(CH2-Vripple)

Comments: Vripple = 358mVp-p

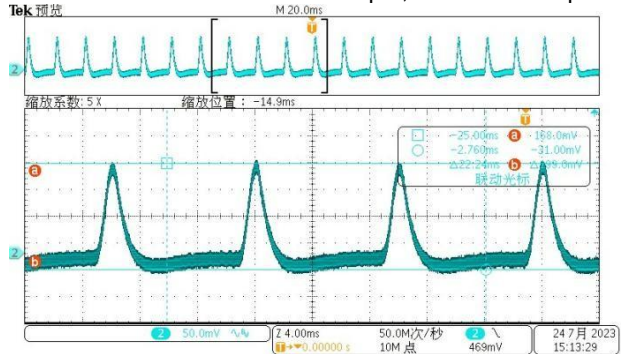
Test Condition: 230Vac/50Hz Input, 48V/10.5A Output



(CH2-Vripple)

Comments: Vripple = 319mVp-p

Test Condition: 265Vac/50Hz Input, 48V/10.5A Output



(CH2-Vripple)

Comments: Vripple = 199mVp-p

2.3 Load Transient Test

Standard: Under the input voltage 180~265Vac/50Hz, the output voltage transient response should be within $\pm 10\%$ normal voltage.

Result: Pass

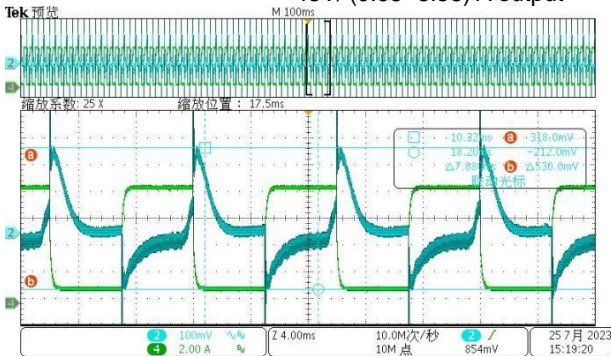
Note: 10% load shift to 90% load with 0.25A/ μ s changing ramp and 100Hz changing frequency.

Test Data:

Input Voltage	180Vac/50Hz	200Vac/50Hz	230Vac/50Hz	265Vac/50Hz
Δ Vout (Vp-p)	0.530	0.488	0.662	3.600

Waveforms:

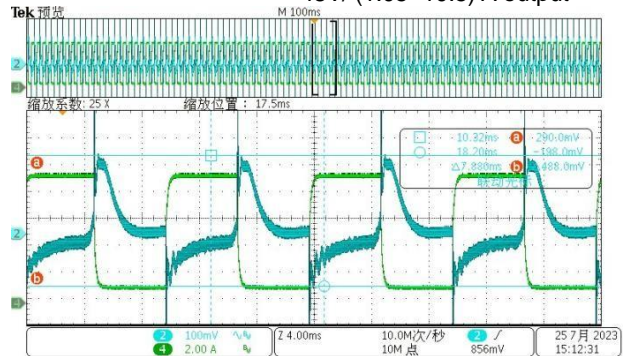
Test Condition: 180Vac/50Hz Input
48V/ (0.95~8.55) A output



(CH2-Vout (ac), CH4-Iout)

Comments: Δ Vout = 0.530Vp-p

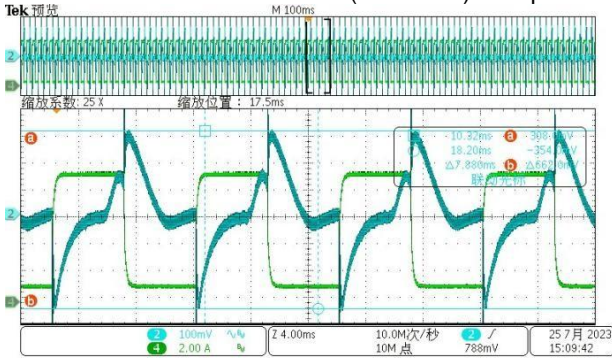
Test Condition: 200Vac/50Hz Input
48V/ (1.05~10.5) A output



(CH2-Vout (ac), CH4-Iout)

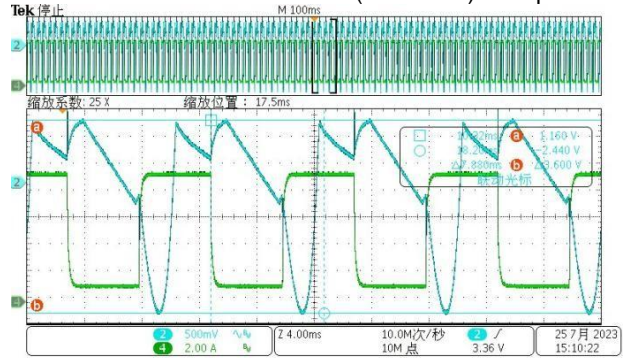
Comments: Δ Vout = 0.488Vp-p

Test Condition: 230Vac/50Hz Input
48V/ (1.05~10.5) A output



(CH2-Vout (ac), CH4-Iout)
Comments: $\Delta V_{out} = 0.662V_{p-p}$

Test Condition: 265Vac/50Hz Input
48V/ (1.05~10.5) A output



(CH2-Vout (ac), CH4-Iout)
Comments: $\Delta V_{out} = 3.600V_{p-p}$

2.4 Capacitive Load Startup Test

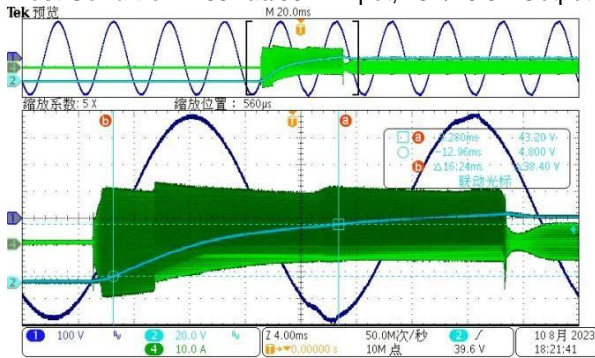
Standard: While capacitance load is 3000 μ F, the power supply can turn on normally and the output is in the rated range.

Result: Pass

Note: Tested at the output cap end.

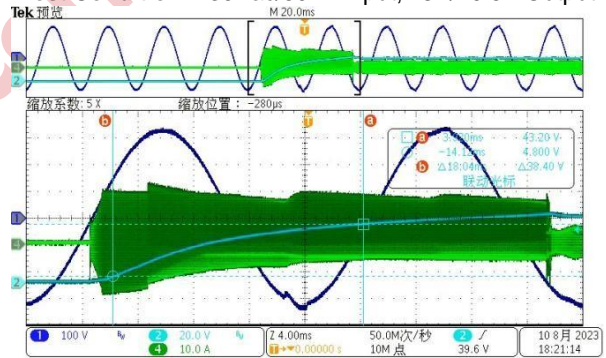
Waveforms:

Test Condition: 265Vac/50Hz Input, 48V/10.5A Output



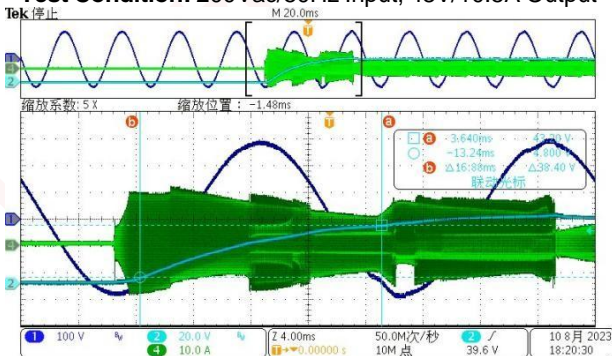
(CH1-Vin (ac), CH2-Vout, CH4-Ir)
Comments: Rise Time = 16.24ms

Test Condition: 230Vac/50Hz Input, 48V/10.5A Output



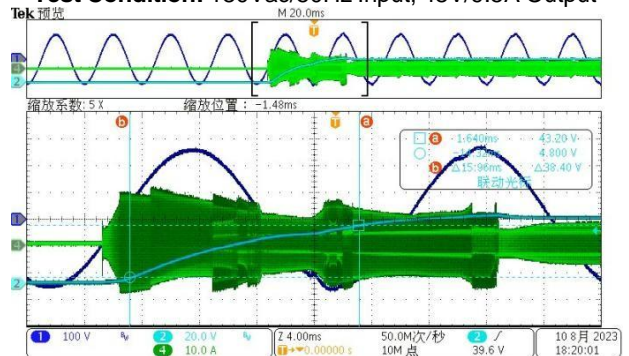
(CH1-Vin (ac), CH2-Vout, CH4-Ir)
Comments: Rise Time = 18.04ms

Test Condition: 200Vac/50Hz Input, 48V/10.5A Output

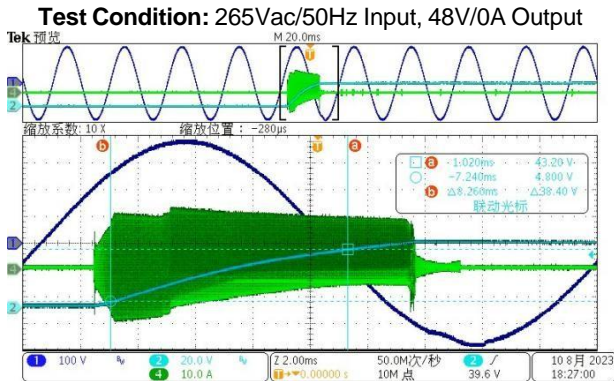


(CH1-Vin (ac), CH2-Vout, CH4-Ir)
Comments: Rise Time = 16.88ms

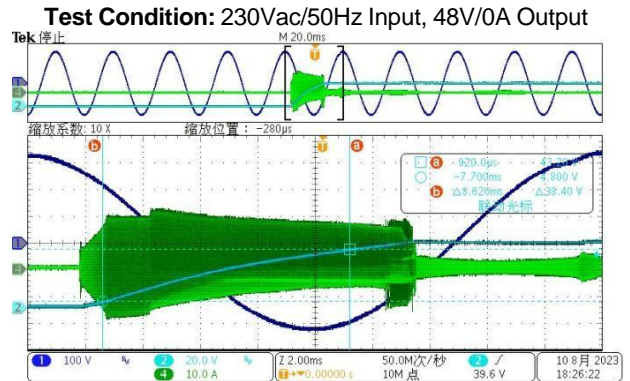
Test Condition: 180Vac/50Hz Input, 48V/9.5A Output



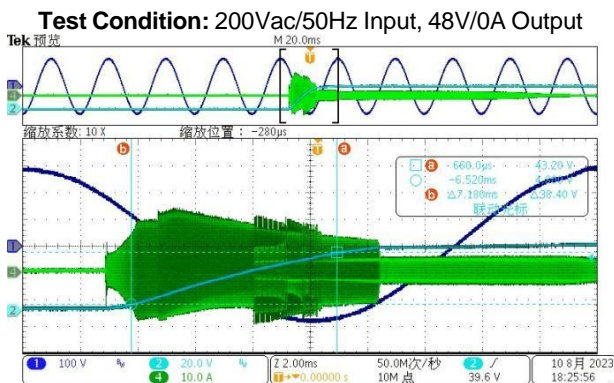
(CH1-Vin (ac), CH2-Vout, CH4-Ir)
Comments: Rise Time = 15.96ms



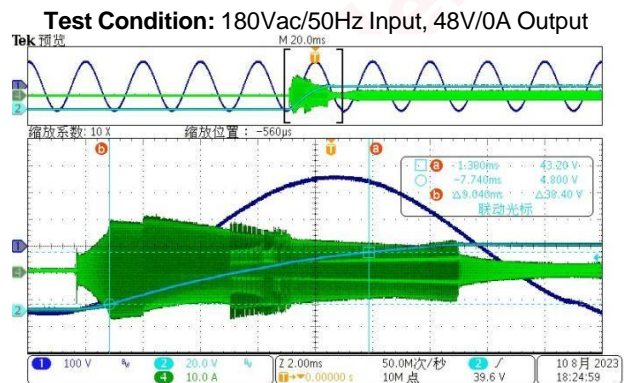
(CH1-Vin (ac), CH2-Vout, CH4-Ir)
Comments: Raise Time = 8.26ms



(CH1-Vin (ac), CH2-Vout, CH4-Ir)
Comments: Raise Time = 8.62ms



(CH1-Vin (ac), CH2-Vout, CH4-Ir)
Comments: Raise Time = 7.18ms



(CH1-Vin (ac), CH2-Vout, CH4-Ir)
Comments: Raise Time = 9.04ms

2.5 Startup Time and Raise Time

Standard: The startup time should be less than 3s. @180~265Vac/50Hz.

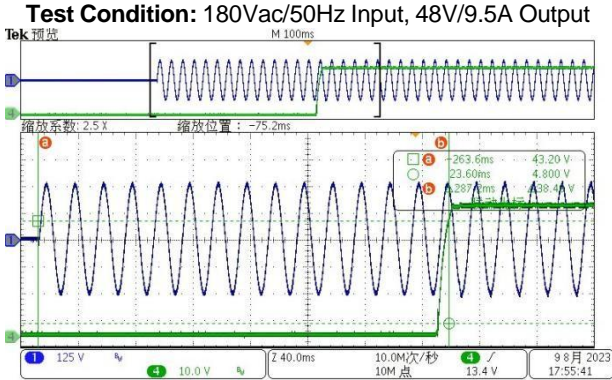
Result: Pass

Note: The output voltage is tested at the output cap end.

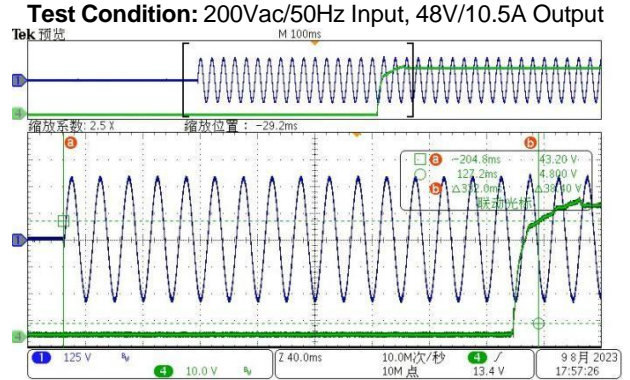
Test Data:

Input Voltage	180Vac/50Hz	200Vac/50Hz	230Vac/50Hz	265Vac/50Hz
Output	48V/9.5A	48V/10.5A	48V/10.5A	48V/10.5A
Startup Time (ms) Full Load	287.2	332.0	314.0	299.6
Raise Time (ms) Full Load	7.42	17.52	17.20	12.56
Raise Time (ms) No Load	4.94	4.74	4.36	3.96

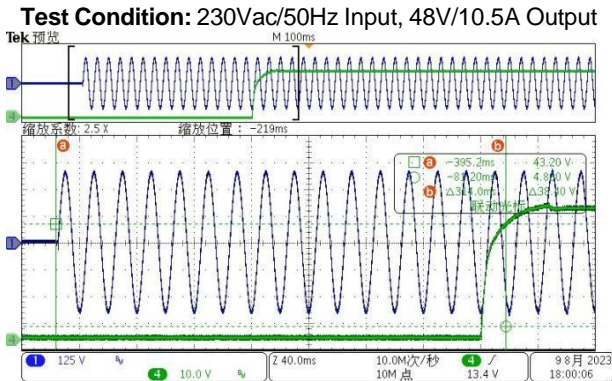
Waveforms:



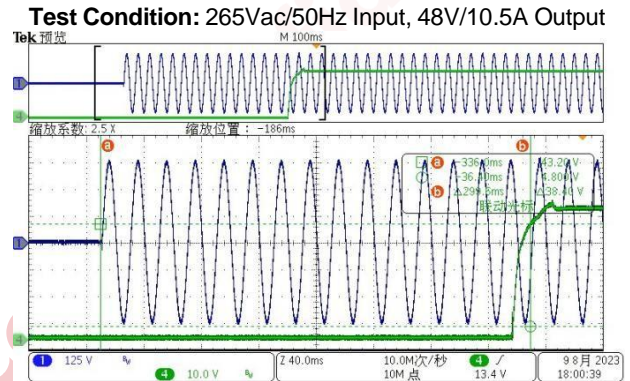
(CH1-Vin (ac), CH4-Vout)
Comments: Startup time = 287.2ms



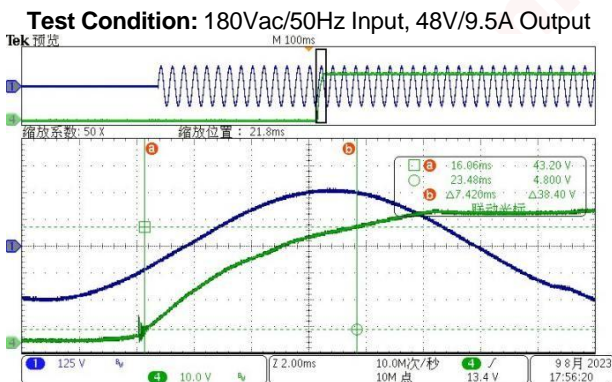
(CH1-Vin (ac), CH4-Vout)
Comments: Startup time = 332.0ms



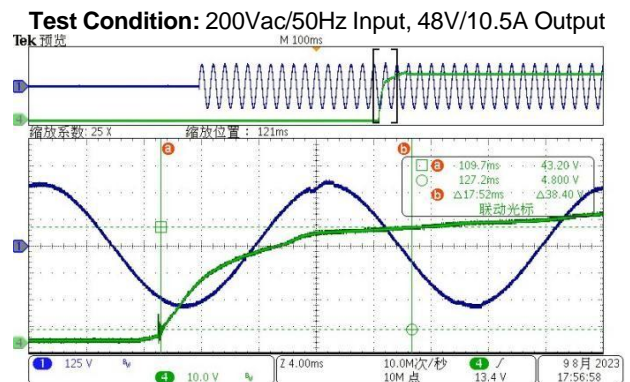
(CH1-Vin (ac), CH4-Vout)
Comments: Startup time = 314.0ms



(CH1-Vin (ac), CH4-Vout)
Comments: Startup time = 299.6ms

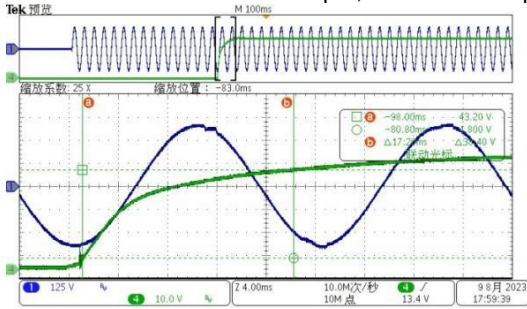


(CH1-Vin (ac), CH4-Vout)
Comments: Rise time = 7.42ms



(CH1-Vin (ac), CH4-Vout)
Comments: Rise time = 17.52ms

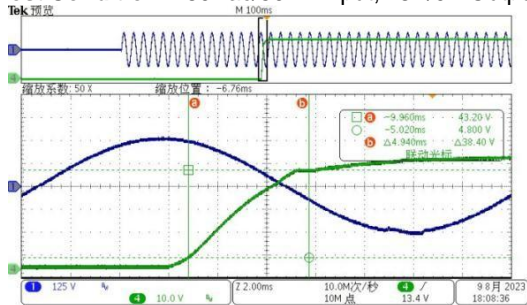
Test Condition: 230Vac/50Hz Input, 48V/10.5A Output



(CH1-Vin (ac), CH4-Vout)

Comments: Rise time = 17.20ms

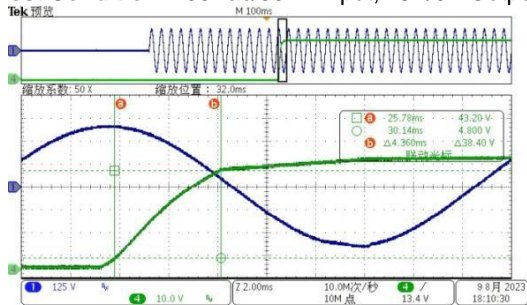
Test Condition: 180Vac/50Hz Input, 48V/0A Output



(CH1-Vin (ac), CH4-Vout)

Comments: Rise time = 4.94ms

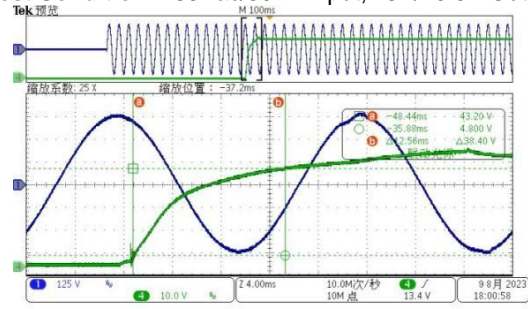
Test Condition: 230Vac/50Hz Input, 48V/0A Output



(CH1-Vin (ac), CH4-Vout)

Comments: Rise time = 4.36ms

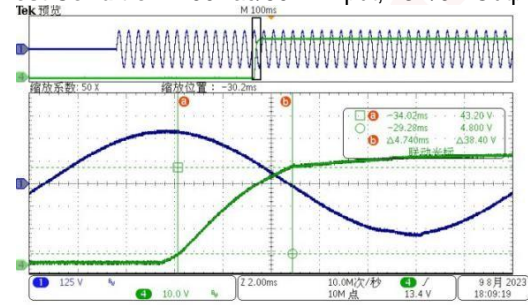
Test Condition: 265Vac/50Hz Input, 48V/10.5A Output



(CH1-Vin (ac), CH4-Vout)

Comments: Rise time = 12.56ms

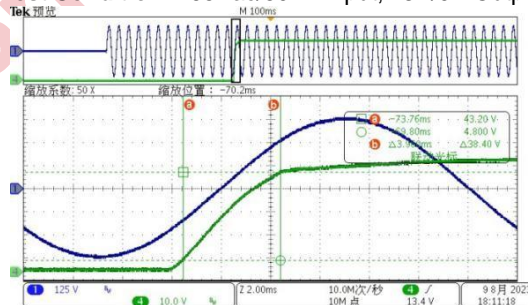
Test Condition: 200Vac/50Hz Input, 48V/0A Output



(CH1-Vin (ac), CH4-Vout)

Comments: Rise time = 4.74ms

Test Condition: 265Vac/50Hz Input, 48V/0A Output



(CH1-Vin (ac), CH4-Vout)

Comments: Rise time = 3.96ms

2.6 Holdup Time and Fall Time

Standard: The holdup time should be larger than 5ms. @180~265Vac/50Hz.

Result: Pass

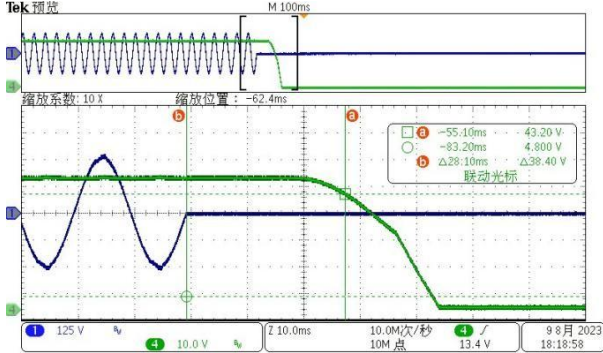
Note: The output voltage is tested at the output cap end.

Test Data:

Input Voltage	180Vac/50Hz	200Vac/50Hz	230Vac/50Hz	265Vac/50Hz
Output	48V/9.5A	48V/10.5A	48V/10.5A	48V/10.5A
Holdup Time (ms)	28.1	32.2	47.8	67.6
Fall Time (ms)	15.5	22.0	27.0	30.8

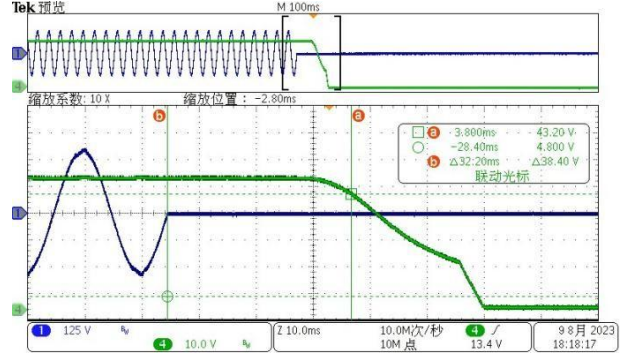
Waveforms:

Test Condition: 180Vac/50Hz Input, 48V/9.5A Output



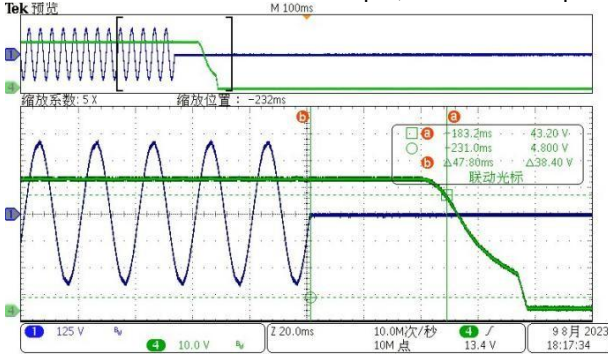
(CH1-Vin (ac), CH2-Vout)
Comments: Holdup time = 28.1ms

Test Condition: 200Vac/50Hz Input, 48V/10.5A Output



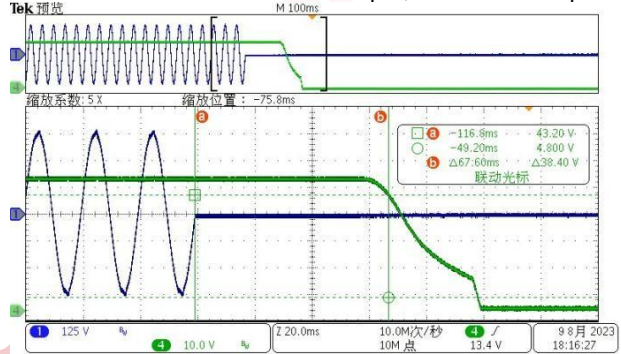
(CH1-Vin (ac), CH2-Vout)
Comments: Holdup time = 32.2ms

Test Condition: 230Vac/50Hz Input, 48V/10.5A Output



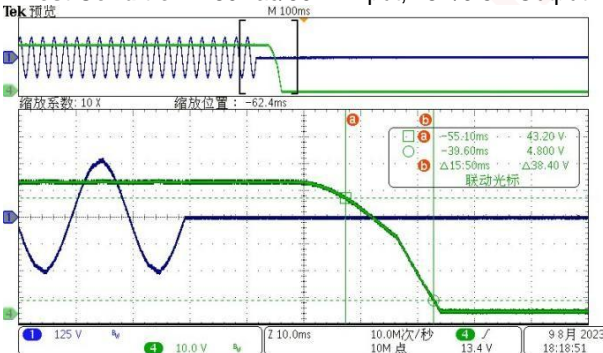
(CH1-Vin (ac), CH2-Vout)
Comments: Holdup time = 47.8ms

Test Condition: 265Vac/50Hz Input, 48V/10.5A Output



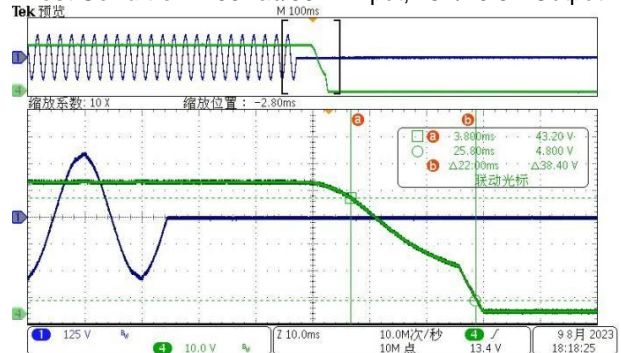
(CH1-Vin (ac), CH2-Vout)
Comments: Holdup time = 67.6ms

Test Condition: 180Vac/50Hz Input, 48V/9.5A Output



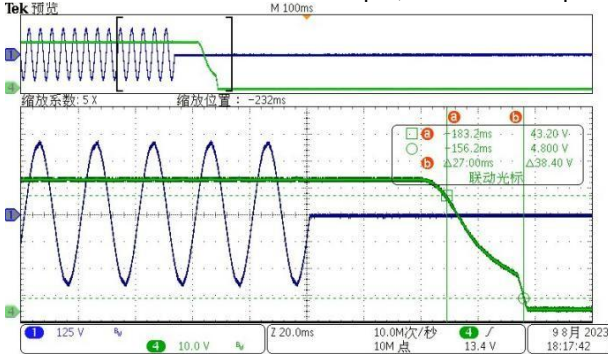
(CH1-Vin (ac), CH2-Vout)
Comments: Fall time = 15.5ms

Test Condition: 200Vac/50Hz Input, 48V/10.5A Output



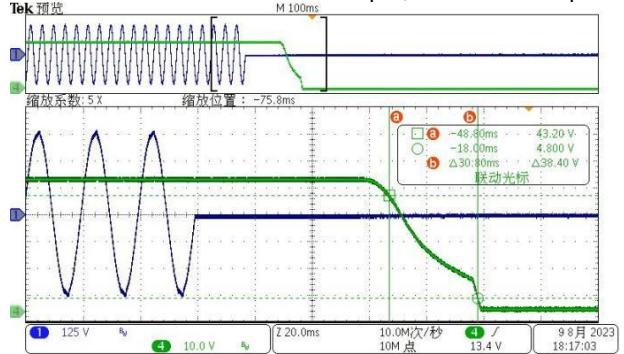
(CH1-Vin (ac), CH2-Vout)
Comments: Fall time = 22.0ms

Test Condition: 230Vac/50Hz Input, 48V/10.5A Output



(CH1-Vin (ac), CH2-Vout)
Comments: Fall time = 27.0ms

Test Condition: 265Vac/50Hz Input, 48V/10.5A Output



(CH1-Vin (ac), CH2-Vout)
Comments: Fall time = 30.8ms

2.7 Output Overshoot Test

Standard: $V_{out_peak} < \text{Rated output voltage} * 110\%$.

Result: Pass

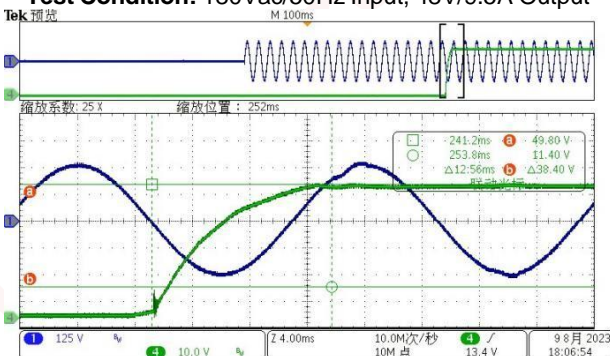
Note: The output voltage is tested at the output cap end.

Test Data:

Input Voltage	180Vac/50Hz	200Vac/50Hz	230Vac/50Hz	265Vac/50Hz
Output	48V/9.5A	48V/10.5A	48V/10.5A	48V/10.5A
Limit	52.8V			
Overshoot (V) Full Load	49.8	51.4	50.4	51.2
Overshoot (V) No Load	49.2	48.8	49.2	49.6

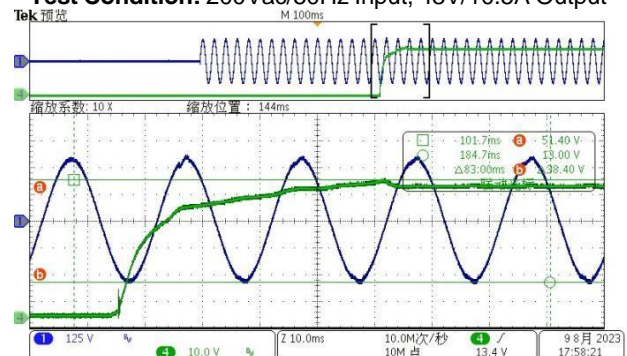
Waveforms:

Test Condition: 180Vac/50Hz Input, 48V/9.5A Output

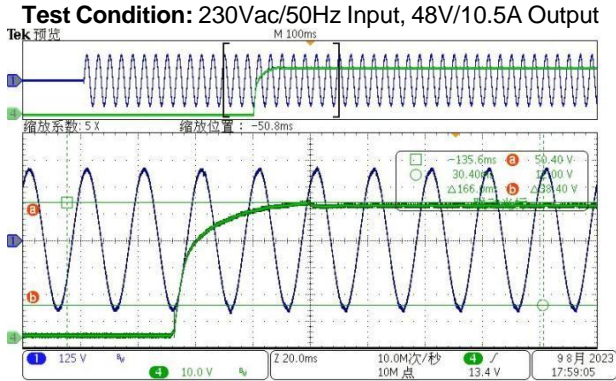


(CH1-Vin (ac), CH2-Vout)
Comments: Vout_peak = 49.8V

Test Condition: 200Vac/50Hz Input, 48V/10.5A Output

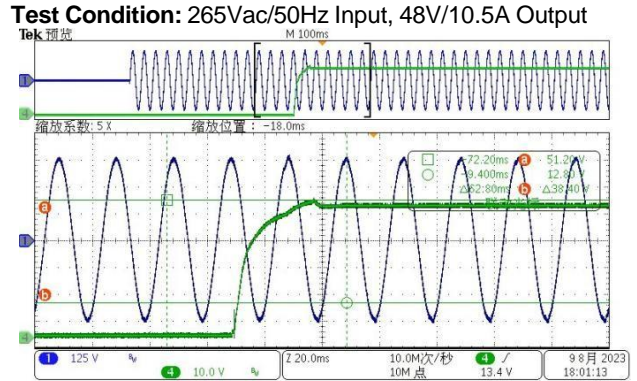


(CH1-Vin (ac), CH2-Vout)
Comments: Vout_peak = 51.4V



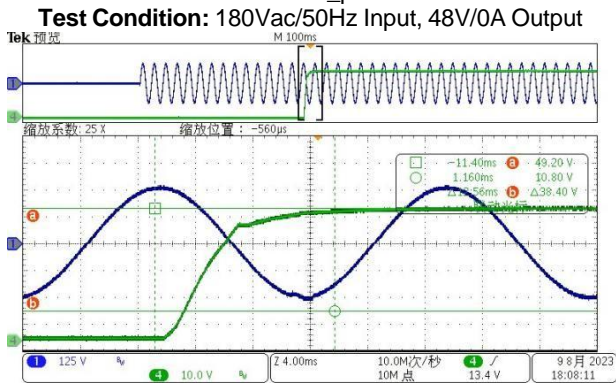
(CH1-Vin (ac), CH2-Vout)

Comments: Vout_peak = 50.4V



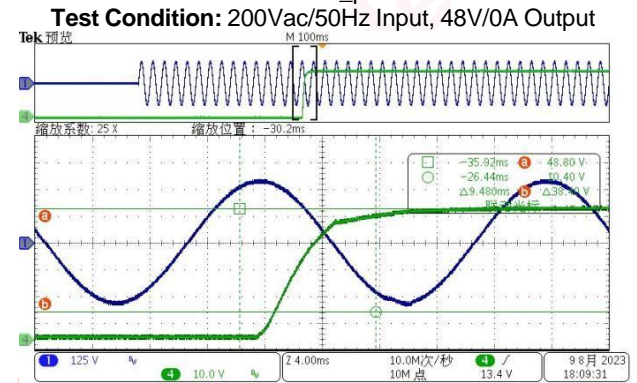
(CH1-Vin (ac), CH2-Vout)

Comments: Vout_peak = 51.2V



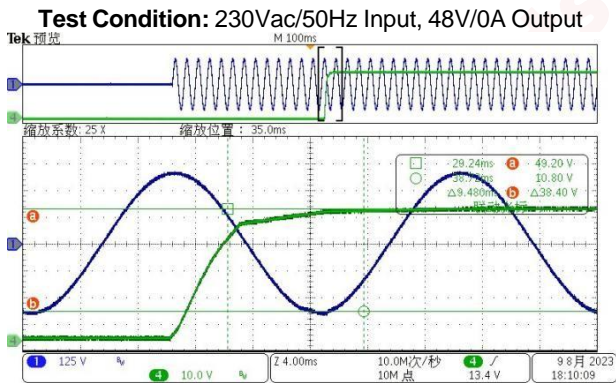
(CH1-Vin (ac), CH2-Vout)

Comments: Vout_peak = 49.2V



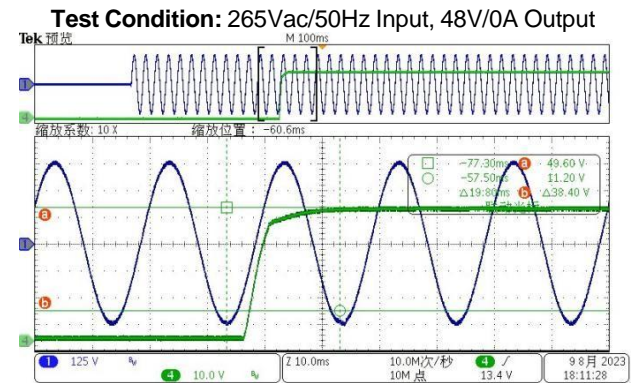
(CH1-Vin (ac), CH2-Vout)

Comments: Vout_peak = 48.8V



(CH1-Vin (ac), CH2-Vout)

Comments: Vout_peak = 49.2V



(CH1-Vin (ac), CH2-Vout)

Comments: Vout_peak = 49.6V

3. Protection Test
3.1 Over Load Protection

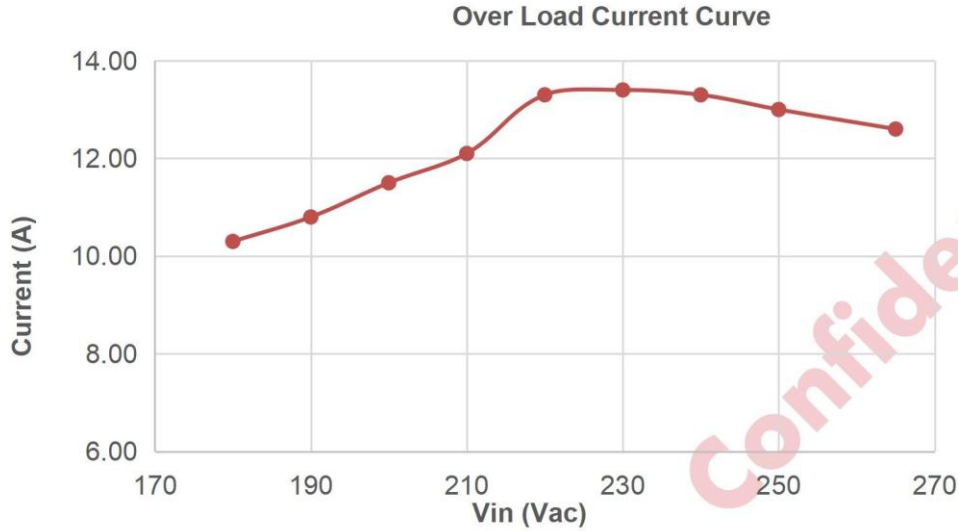
Standard: The overload current should not differ too much within the range of AC input voltage.

Result: Pass

Note: Tested at the output cap end.

Test Data:

Input Voltage	180Vac /50Hz	190Vac /50Hz	200Vac/ 50Hz	210Vac/ 50Hz	220Vac /50Hz	230Vac /50Hz	240Vac /50Hz	250Vac /50Hz	265Vac /50Hz
OLP (A)	10.3	10.8	11.5	12.1	13.3	13.4	13.3	13.0	12.6



3.2 Output Over Voltage Protection

Standard: The output over voltage should be within the voltage rating of output capacitor.

Result: Pass

Note: Tested at the output cap end with secondary side of opto-coupler for FB shorted.

Test Data:

Input Voltage	180Vac/50Hz	200Vac/50Hz	230Vac/50Hz	265Vac/50Hz	Output Capacitor Voltage Rating
Output	9.5A	10.5A	10.5A	10.5A	63V
OVP (V) No Load	54.25	53.75	53.75	54.00	
OVP (V) Full Load	52.25	52.75	52.50	52.75	

3.3 Output Short Circuit Protection

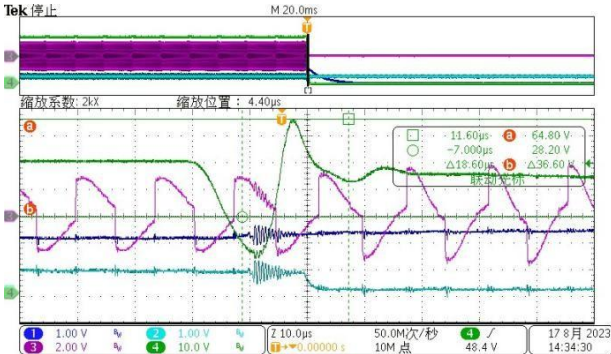
Standard: The power supply must shut down in the event of short circuit condition and automatically return to normal operating condition once the fault condition has been removed.

Result: Pass

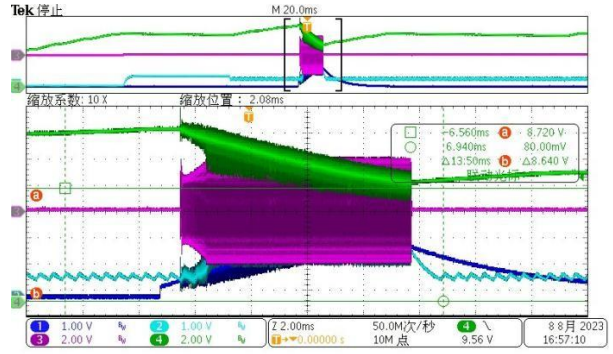
Note: The short circuit protection is tested at the output cap end.

Waveforms:

Test Condition: 180Vac/50Hz Input, 48V/9.5A Output. Full Load to Short and Restart at Short Circuit Condition.

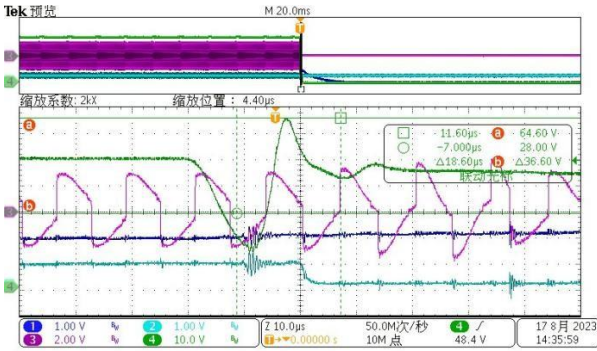


(CH1-VFB, CH2-VSEL, CH3-VDEM, CH4-Vout)
Comments: Protection Enter (OVP)

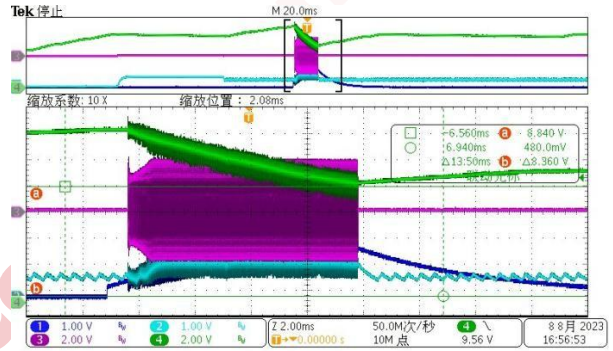


(CH1-VFB, CH2-VSEL, CH3-VDEM, CH4-VDD)
Comments: Restart at Short Circuit Condition (UVLO)

Test Condition: 200Vac/50Hz Input, 48V/10.5A Output. Full Load to Short and Restart at Short Circuit Condition.

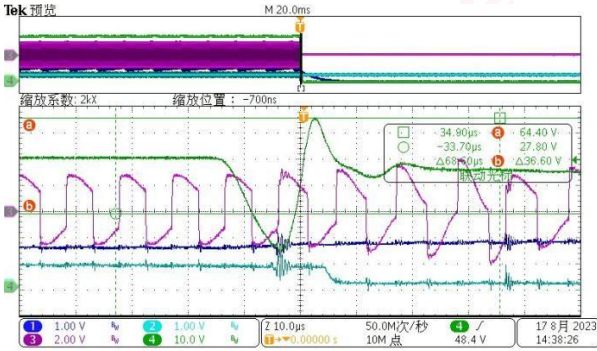


(CH1-VFB, CH2-VSEL, CH3-VDEM, CH4-Vout)
Comments: Protection Enter (OVP)

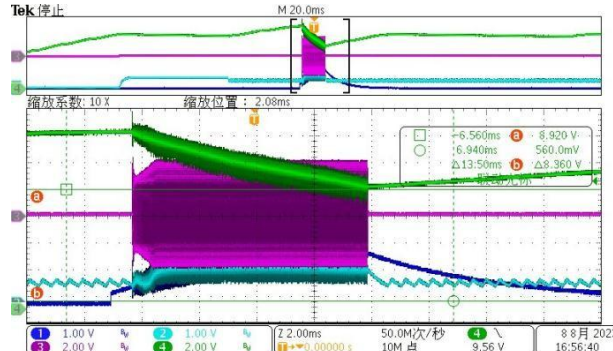


(CH1-VFB, CH2-VSEL, CH3-VDEM, CH4-VDD)
Comments: Restart at Short Circuit Condition (UVLO)

Test Condition: 230Vac/50Hz Input, 48V/10.5A Output. Full Load to Short and Restart at Short Circuit Condition.

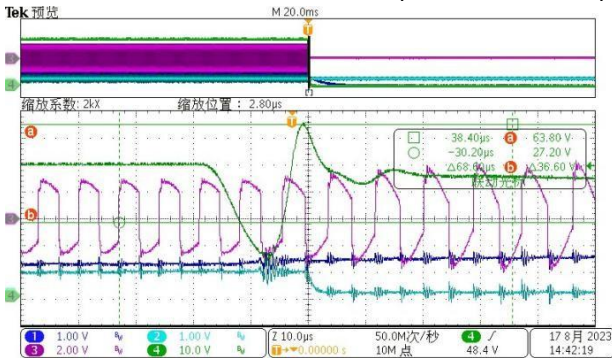


(CH1-VFB, CH2-VSEL, CH3-VDEM, CH4-Vout)
Comments: Protection Enter (OVP)

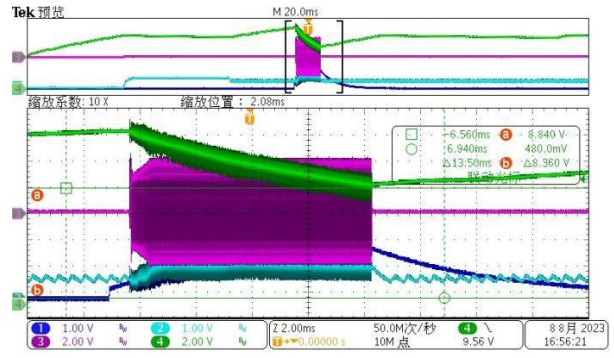


(CH1-VFB, CH2-VSEL, CH3-VDEM, CH4-VDD)
Comments: Restart at Short Circuit Condition (UVLO)

Test Condition: 265Vac/50Hz Input, 48V/10.5A Output. Full Load to Short and Restart at Short Circuit Condition.



(CH1-VFB, CH2-VSEL, CH3-VDEM, CH4-Vout)
Comments: Protection Enter (OVP)



(CH1-VFB, CH2-VSEL, CH3-VDEM, CH4-Vout)
Comments: Restart at Short Circuit Condition (UVLO)

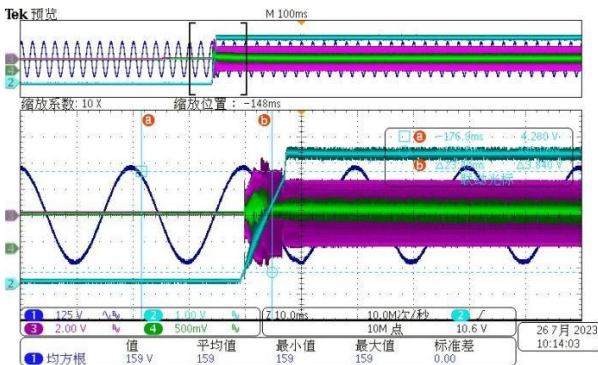
3.4 Input Brown-out Protection

Standard: The power supply should shut down when the input voltage is lower than the Brown-out protection value and return to normal operating condition when the input in the range of normal operating voltage.

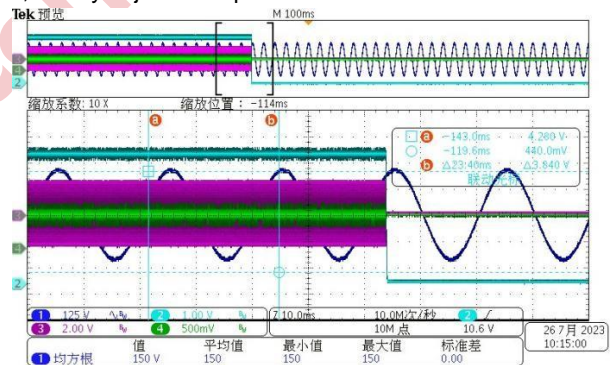
Result: Pass

Waveforms:

Test Condition: 48V/1A Output, Slowly adjust the input

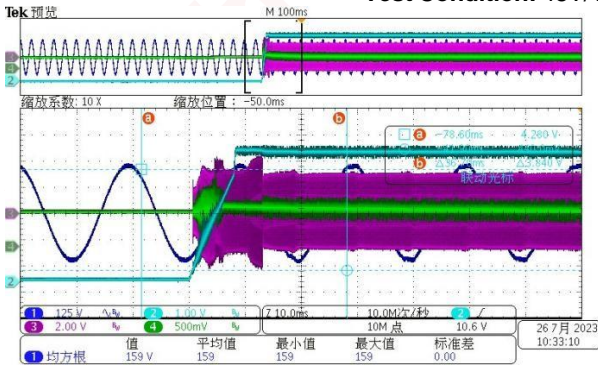


(CH1-Vin (ac), CH2-VSS, CH3-VDEM, CH4-VBR)
Comments: 159Vac Protection recovery

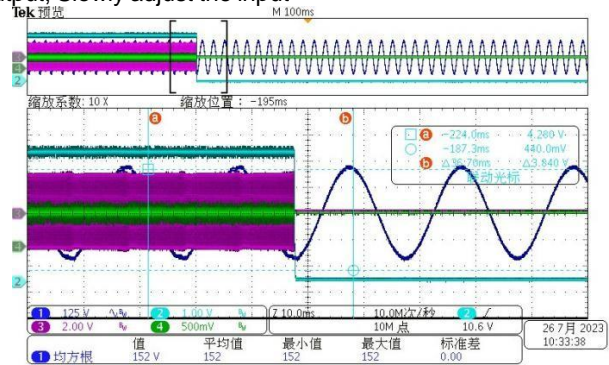


(CH1-Vin (ac), CH2-VSS, CH3-VDEM, CH4-VBR)
Comments: 150Vac Protection enter

Test Condition: 48V/1A Output, Slowly adjust the input



(CH1-Vin (ac), CH2-VSS, CH3-VDEM, CH4-VBR)
Comments: 159Vac Protection recovery



(CH1-Vin (ac), CH2-VSS, CH3-VDEM, CH4-VBR)
Comments: 152Vac Protection enter

4 Reliability Requirements

4.1 Device Maximum Rating Test

Standard: Capacitor, MOSFET and Diode < 95% Rating.

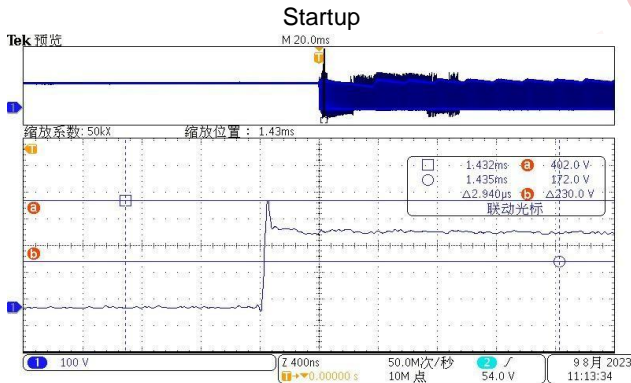
Result: Pass

Test Data:

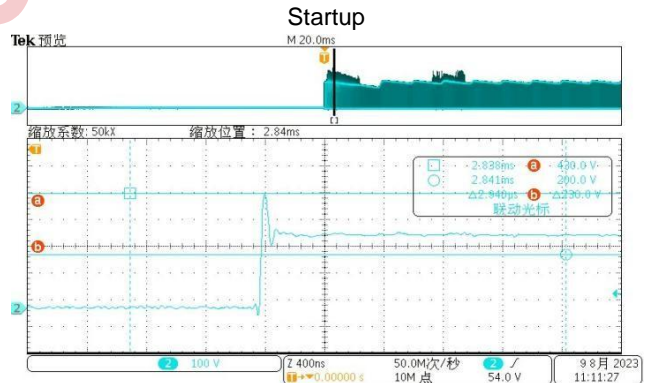
Component	Rating	200Vac/50Hz Input 48V/10.5A Output				265Vac/50Hz Input 48V/10.5A Output				Result
		Startup	Steady	Short	Short Start	Startup	Steady	Short	Short Start	
MOSFET H	650V	402.0V	310.0V	370.0V	400.0V	502.0V	406.0V	484.0V	502.0V	PASS
MOSFET L	650V	430.0V	298.0V	378.0V	410.0V	506.0V	388.0V	490.0V	524.0V	PASS
Resonant Capacitor Voltage	1kV	398.0V	256.0V	344.0V	496.0V	440.0V	241.0V	380.0V	634.0V	PASS
Resonant Current		19.6A	8.3A	16.4A	21.6A	21.4A	6.7A	19.0A	23.0A	PASS
DIODE1 (D9&D12)	150V	108.0V	103.6V	104.0V	21.1V	124.8V	111.6V	116.0V	20.5V	PASS
DIODE2 (D2&D6)	150V	110.4V	104.0V	104.8V	24.9V	122.8V	116.0V	117.6V	23.8V	PASS

Waveforms:

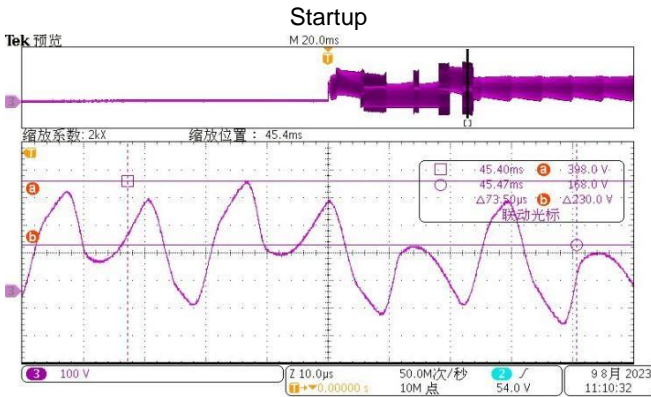
Test Condition: 200Vac/50Hz Input, 48V/10.5A Output,



Test Condition: 200Vac/50Hz Input, 48V/10.5A Output,



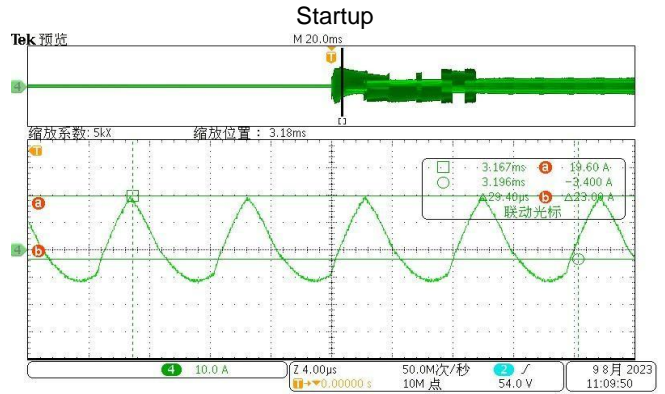
Test Condition: 200Vac/50Hz Input, 48V/10.5A Output,



(CH3-VCr)

Comments: VCr_peak = 398.0V

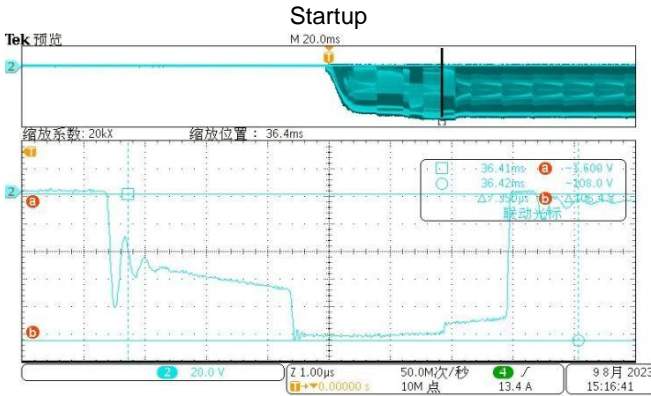
Test Condition: 200Vac/50Hz Input, 48V/10.5A Output,



(CH4-Ir)

Comments: Ir_peak = 19.6A

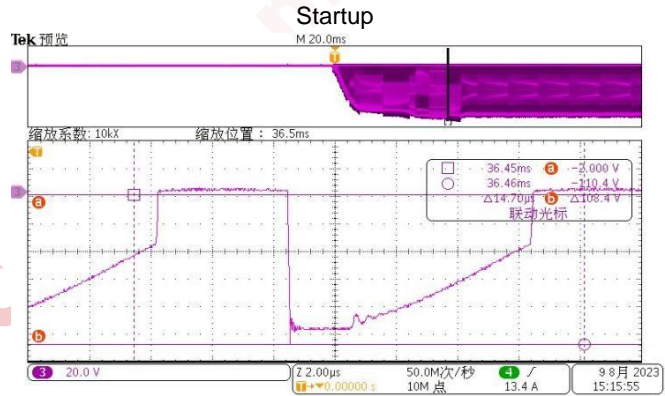
Test Condition: 200Vac/50Hz Input, 48V/10.5A Output,



(CH2-VDiode1)

Comments: VDiode1 = 108.0V

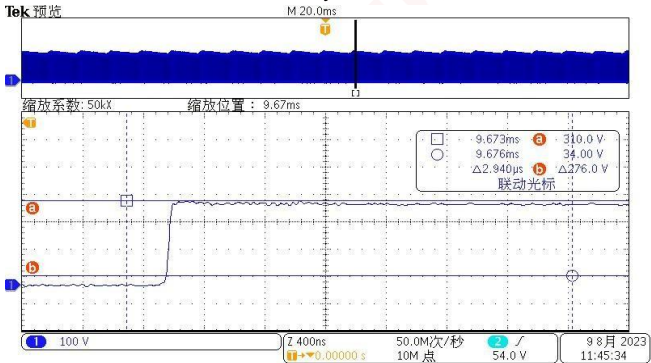
Test Condition: 200Vac/50Hz Input, 48V/10.5A Output,



(CH3-VDiode2)

Comments: VDiode2 = 110.4V

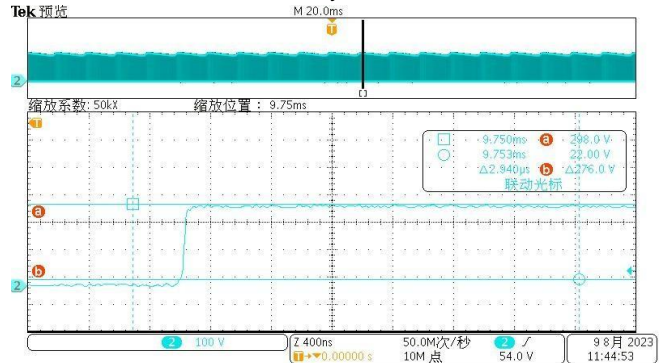
Test Condition: 200Vac/50Hz Input, 48V/10.5A Output,
Steady State



(CH1-VDrain_H)

Comments: VDrain_H_peak = 310.0V

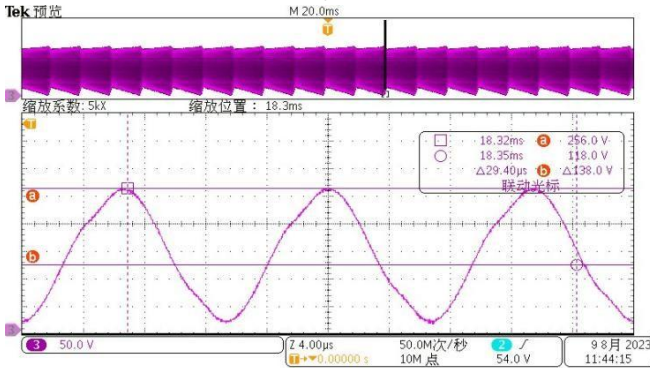
Test Condition: 200Vac/50Hz Input, 48V/10.5A Output,
Steady State



(CH2-VDrain_L)

Comments: VDrain_L_peak = 298.0V

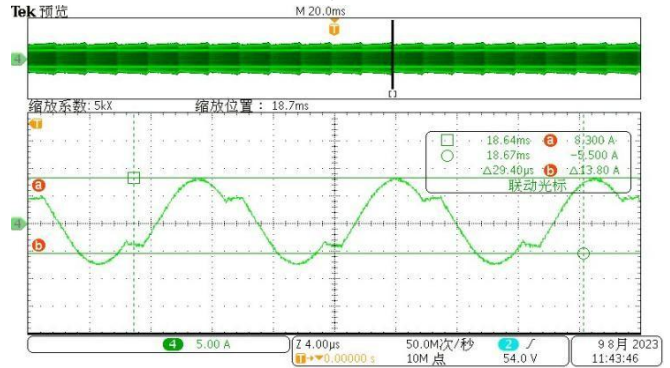
Test Condition: 200Vac/50Hz Input, 48V/10.5A Output, Steady State



(CH3-VCr)

Comments: VCr_peak = 256.0V

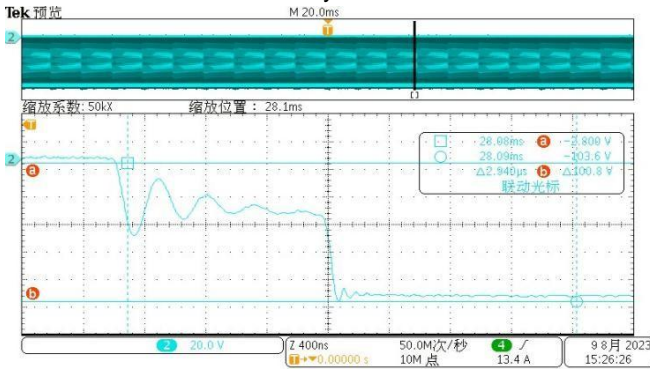
Test Condition: 200Vac/50Hz Input, 48V/10.5A Output t, Steady State



(CH4-Ir)

Comments: Ir_peak = 8.3A

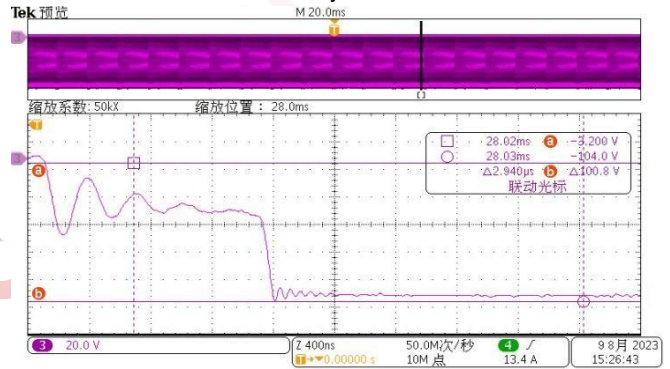
Test Condition: 200Vac/50Hz Input, 48V/10.5A Output, Steady State



(CH2-VDiode1)

Comments: VDiode1 = 103.6V

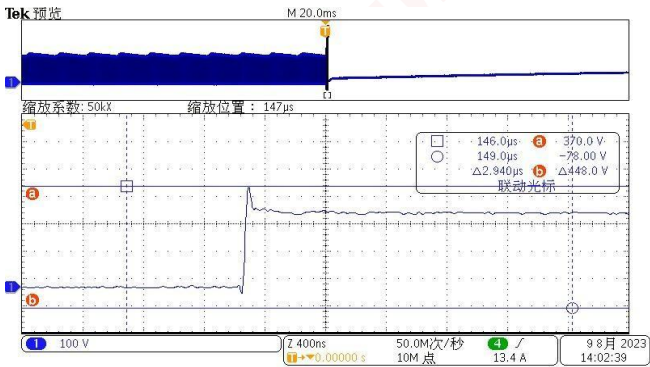
Test Condition: 200Vac/50Hz Input, 48V/10.5A Output, Steady State



(CH3-VDiode2)

Comments: VDiode2=104.0V

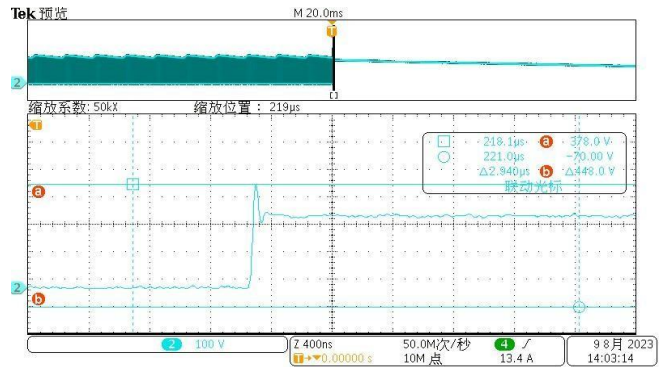
Test Condition: 200Vac/50Hz Input, 48V/10.5A Output, Full Load to Short



(CH1-VDrain_H)

Comments: VDrain_H_peak = 370.0V

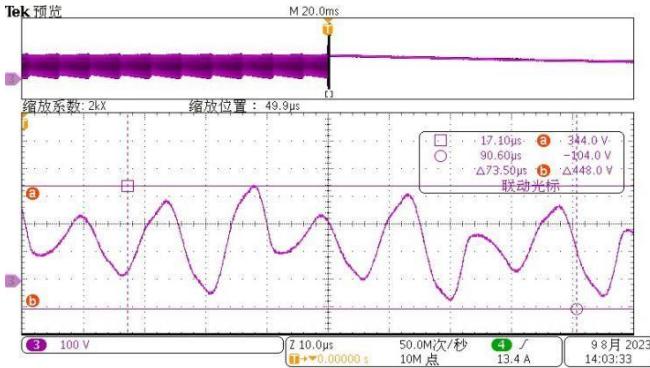
Test Condition: 200Vac/50Hz Input, 48V/10.5A Output, Full Load to Short



(CH2-VDrain_L)

Comments: VDrain_L_peak = 378.0V

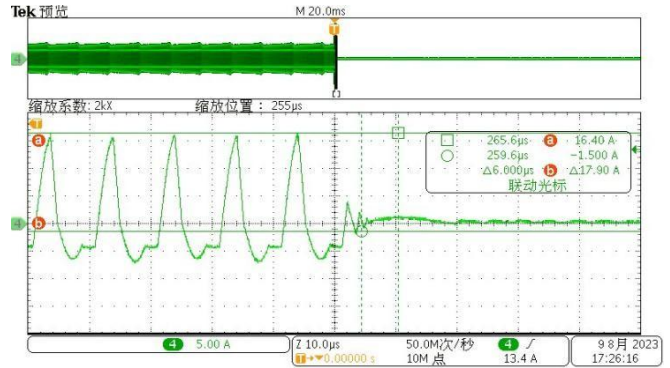
**Test Condition: 200Vac/50Hz Input, 48V/10.5A Output,
Full Load to Short**



(CH3-VCr)

Comments: VCr_peak = 344.0V

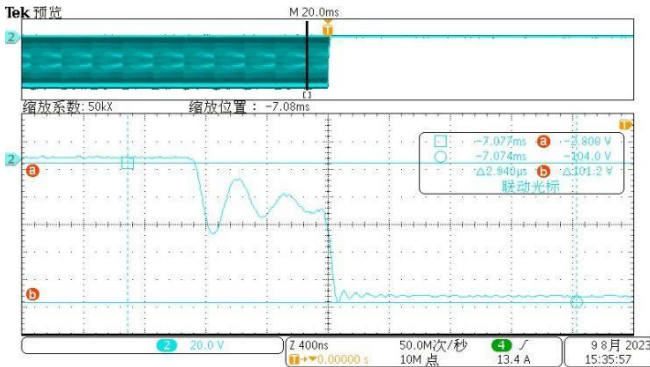
**Test Condition: 200Vac/50Hz Input, 48V/10.5A Output,
Full Load to Short**



(CH4-Ir)

Comments: Ir_peak = 16.4A

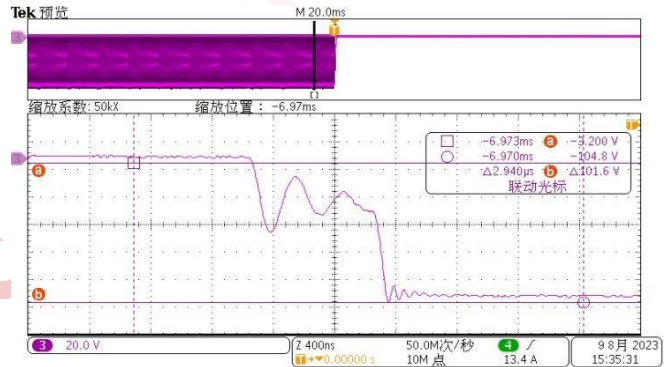
**Test Condition: 200Vac/50Hz Input, 48V/10.5A Output,
Full Load to Short**



(CH2-VDiode1)

Comments: VDiode1 = 104.0V

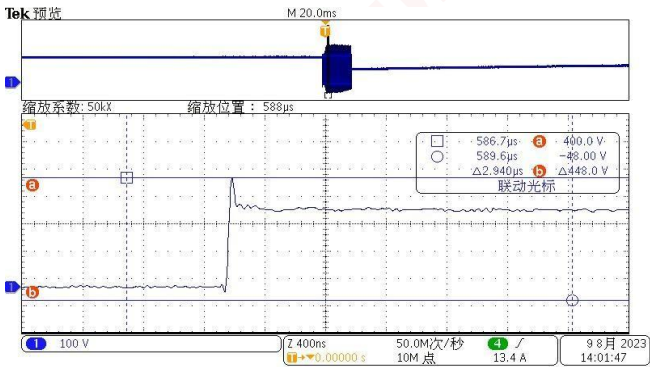
**Test Condition: 200Vac/50Hz Input, 48V/10.5A Output,
Full Load to Short**



(CH3-VDiode2)

Comments: VDiode2 = 104.8V

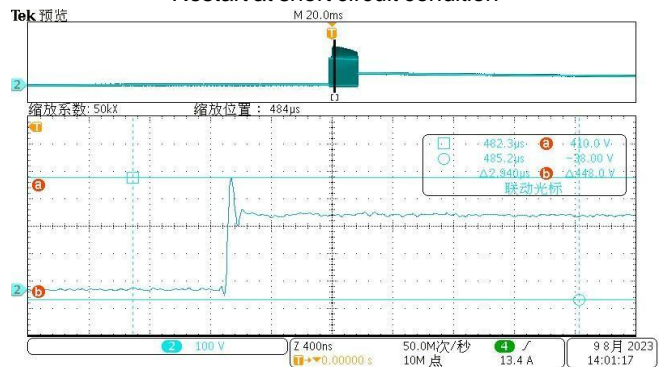
**Test Condition: 200Vac/50Hz Input, 48V/10.5A Output,
Restart at short circuit condition**



(CH1-VDrain_H)

Comments: VDrain_H_peak = 400.0V

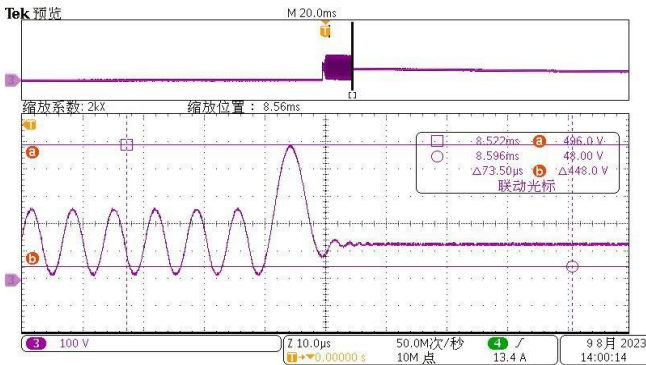
**Test Condition: 200Vac/50Hz Input, 48V/10.5A Output,
Restart at short circuit condition**



(CH2-VDrain_L)

Comments: VDrain_L_peak = 410.0V

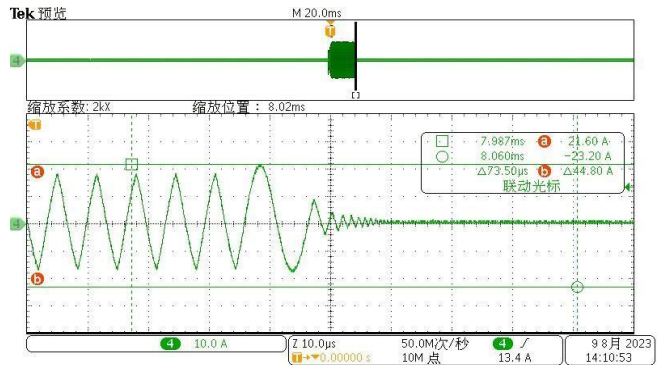
**Test Condition: 200Vac/50Hz Input, 48V/10.5A Output,
Restart at short circuit condition**



(CH3-VCr)

Comments: VDiode_peak = 496.0V

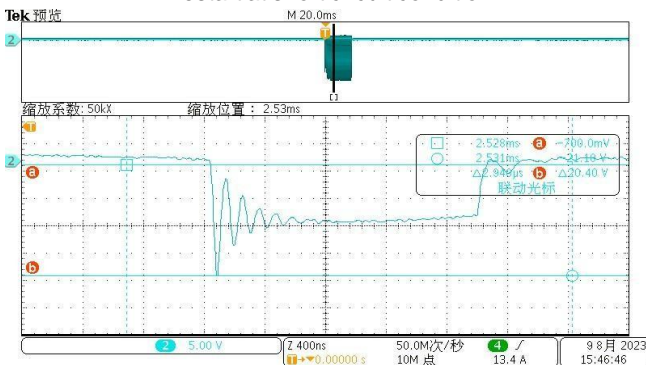
**Test Condition: 200Vac/50Hz Input, 48V/10.5A Output,
Restart at short circuit condition**



(CH4-Ir)

Comments: Ir_peak = 21.6A

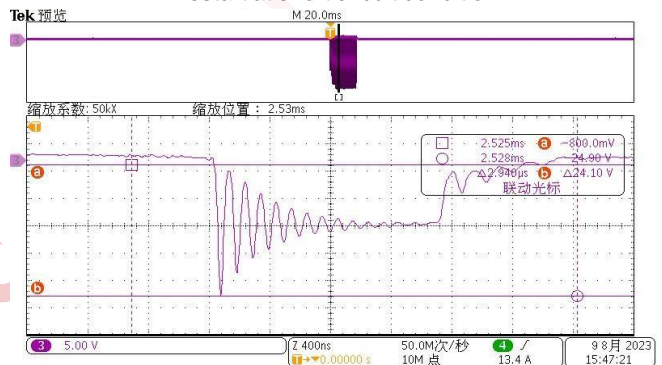
**Test Condition: 200Vac/50Hz Input, 48V/10.5A Output,
Restart at short circuit condition**



(CH2-VDiode1)

Comments: VDiode1 = 21.1V

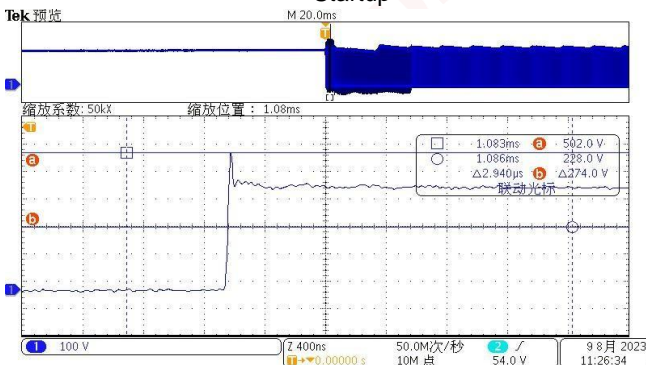
**Test Condition: 200Vac/50Hz Input, 48V/10.5A Output,
Restart at short circuit condition**



(CH3-VDiode2)

Comments: VDiode2 = 24.9V

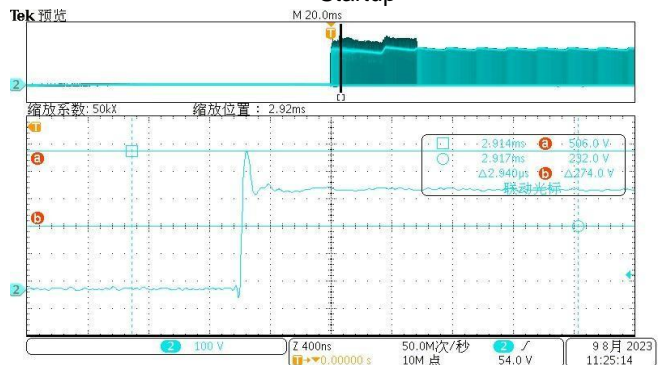
**Test Condition: 265Vac/50Hz Input, 48V/10.5A Output,
Startup**



(CH1-VDrain_H)

Comments: VDrain_H_peak = 502.0V

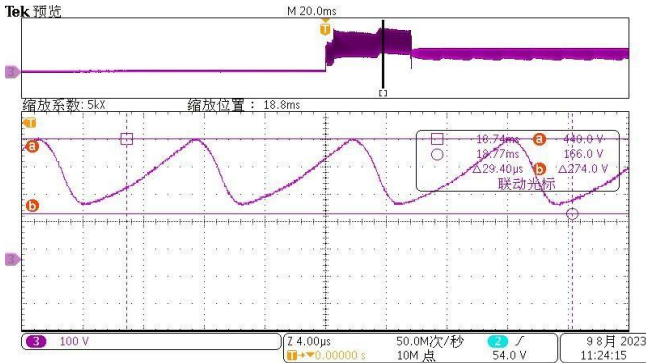
**Test Condition: 265Vac/50Hz Input, 48V/10.5A Output,
Startup**



(CH2-VDrain_L)

Comments: VDrain_L_peak = 506.0V

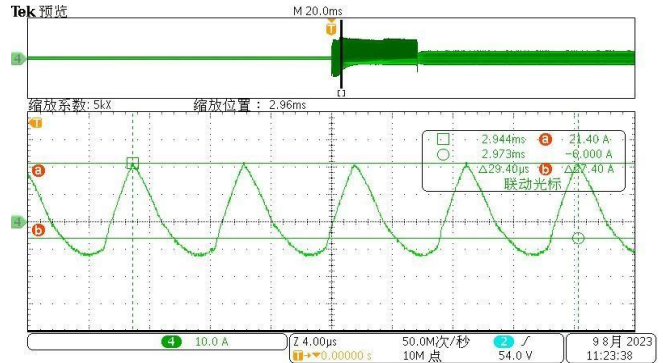
Test Condition: 265Vac/50Hz Input, 48V/10.5A Output, Startup



(CH3-VCr)

Comments: VCr_peak = 440.0V

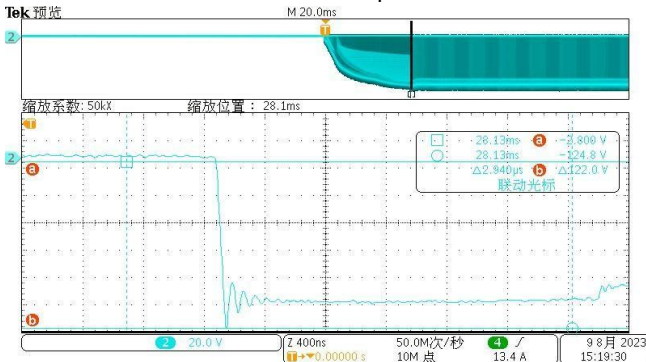
Test Condition: 265Vac/50Hz Input, 48V/10.5A Output, Startup



(CH4-Ir)

Comments: Ir_peak = 21.4A

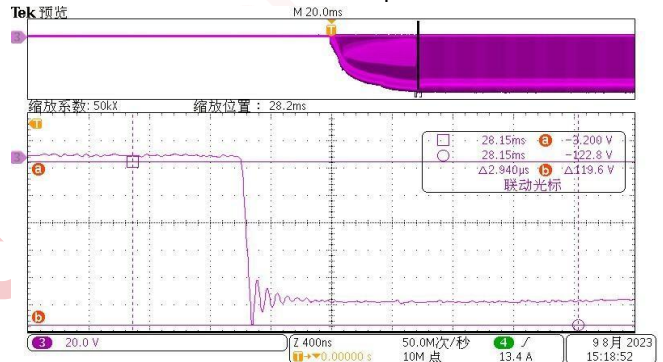
Test Condition: 265Vac/50Hz Input, 48V/10.5A Output, Startup



(CH2-VDiode1)

Comments: VDiode1 = 124.8V

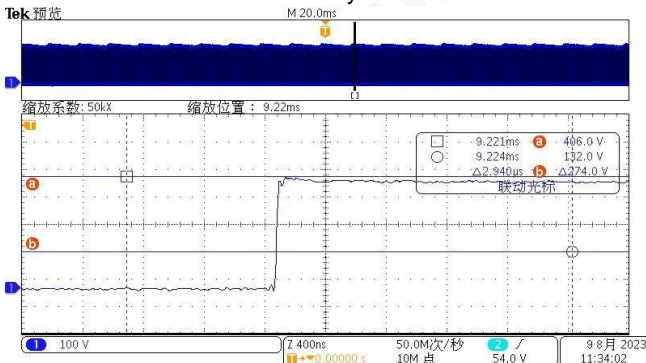
Test Condition: 265Vac/50Hz Input, 48V/10.5A Output, Startup



(CH3-VDiode2)

Comments: VDiode2 = 122.8V

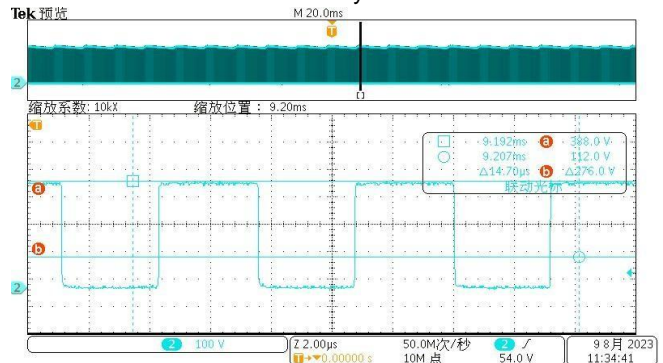
Test Condition: 265Vac/50Hz Input, 48V/10.5A Output, Steady State



(CH1-VDrain_H)

Comments: VDrain_H_peak = 406.0V

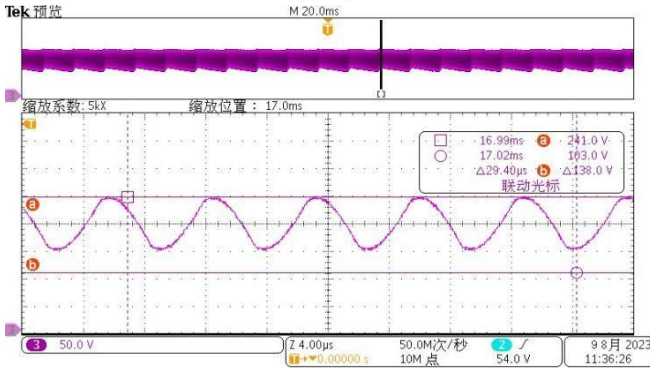
Test Condition: 265Vac/50Hz Input, 48V/10.5A Output, Steady State



(CH2-VDrain_L)

Comments: VDrain_L_peak = 388.0V

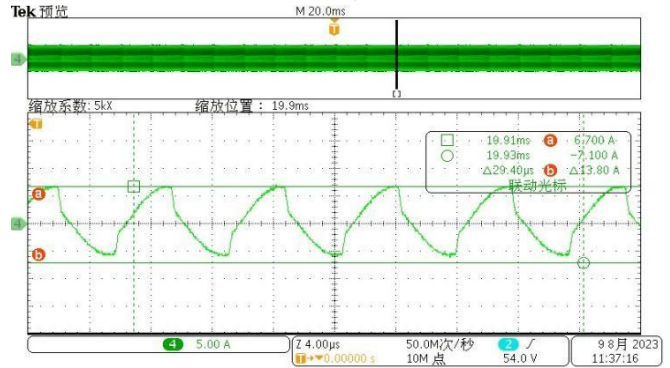
Test Condition: 265Vac/50Hz Input, 48V/10.5A Output, Steady State



(CH3-VCr)

Comments: VCr_peak = 241.0V

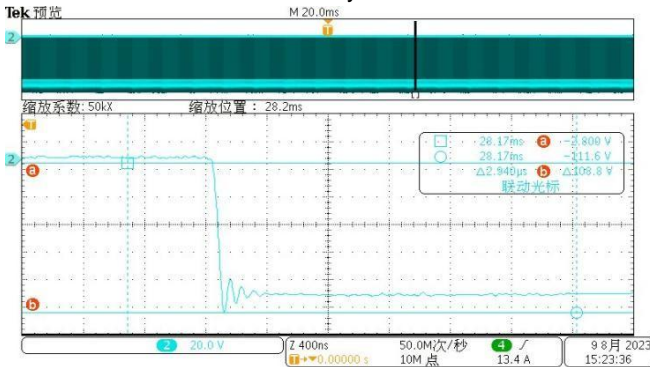
Test Condition: 265Vac/50Hz Input, 48V/10.5A Output, Steady State



(CH4-Ir)

Comments: Ir_peak = 6.7A

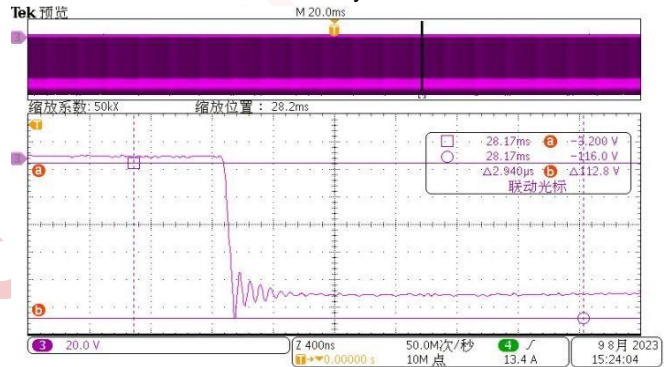
Test Condition: 265Vac/50Hz Input, 48V/10.5A Output, Steady State



(CH2-VDiode1)

Comments: VDiode1 = 111.6V

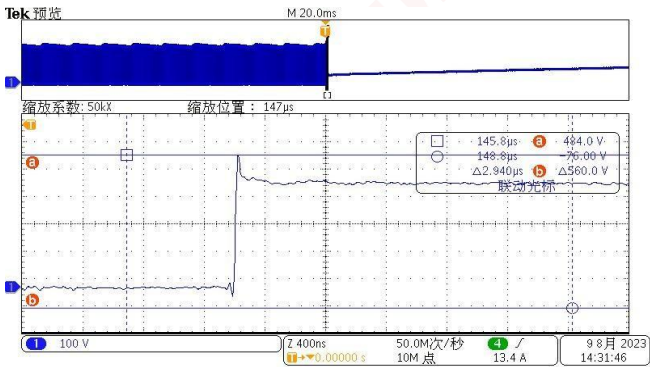
Test Condition: 265Vac/50Hz Input, 48V/10.5A Output, Steady State



(CH3-VDiode2)

Comments: VDiode2 = 116.0V

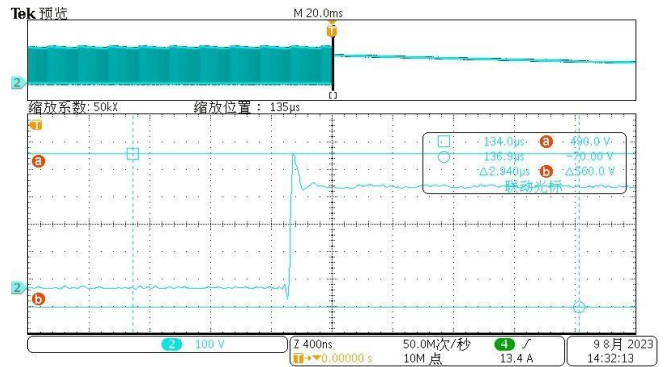
Test Condition: 265Vac/50Hz Input, 48V/10.5A Output, Full Load to Short



(CH1-VDrain_H)

Comments: VDrain_H_peak = 484.0V

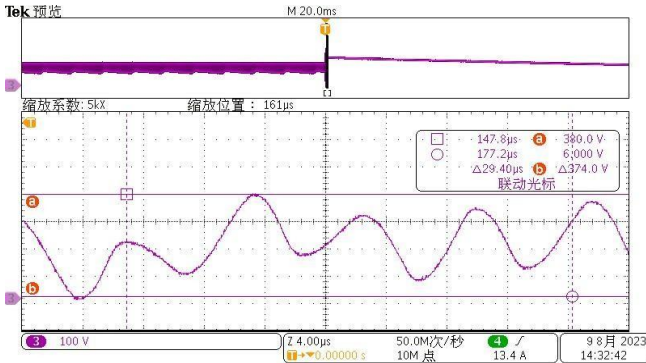
Test Condition: 265Vac/50Hz Input, 48V/10.5A Output, Full Load to Short



(CH2-VDrain_L)

Comments: VDrain_L_peak = 490.0V

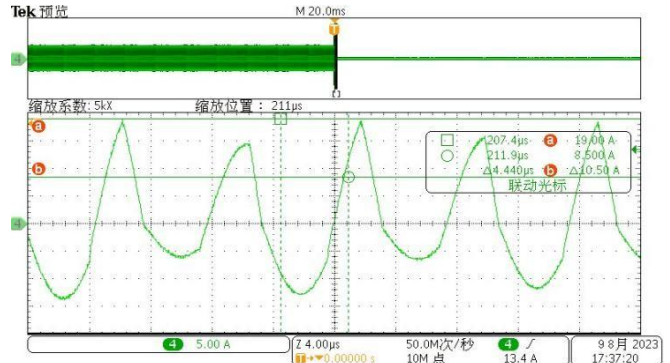
**Test Condition: 265Vac/50Hz Input, 48V/10.5A Output,
Full Load to Short**



(CH3-VCr)

Comments: VCr_peak = 380.0V

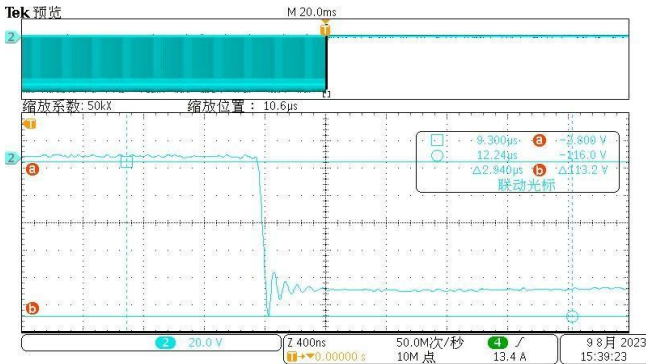
**Test Condition: 265Vac/50Hz Input, 48V/10.5A Output,
Full Load to Short**



(CH4-Ir)

Comments: Ir_peak = 19.0A

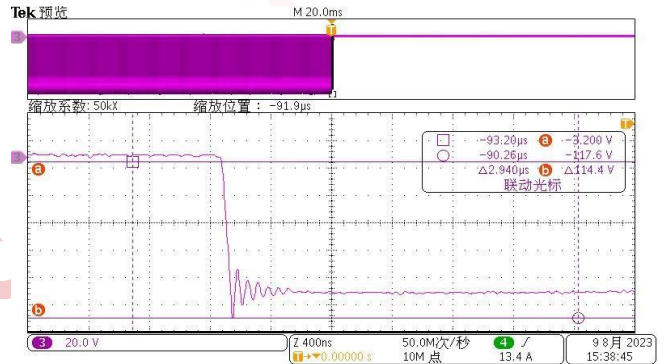
**Test Condition: 265Vac/50Hz Input, 48V/10.5A Output,
Full Load to Short**



(CH2-VDiode1)

Comments: VDiode1 = 116.0V

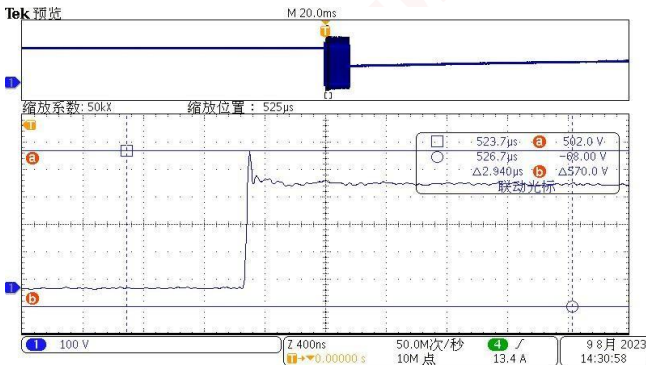
**Test Condition: 265Vac/50Hz Input, 48V/10.5A Output,
Full Load to Short**



(CH3-VDiode2)

Comments: VDiode2 = 117.6V

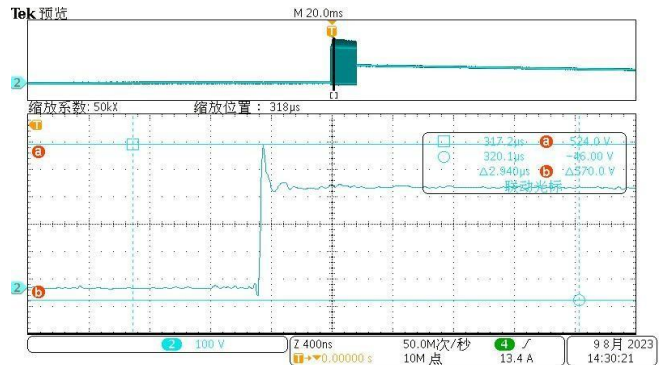
**Test Condition: 265Vac/50Hz Input, 48V/10.5A Output,
Restart at short circuit condition**



(CH1-VDrain_H)

Comments: VDrain_H_peak = 502.0V

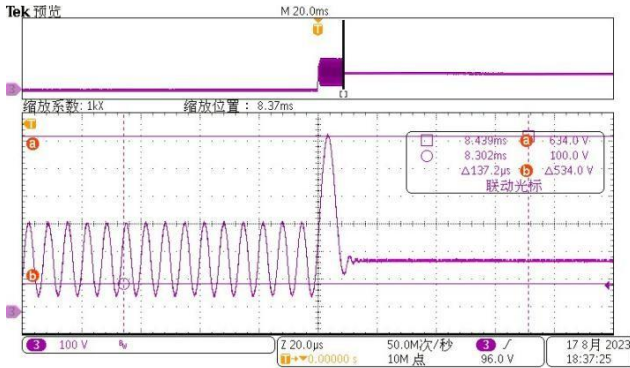
**Test Condition: 265Vac/50Hz Input, 48V/10.5A Output,
Restart at short circuit condition**



(CH2-VDrain_L)

Comments: VDrain_peak = 524.0V

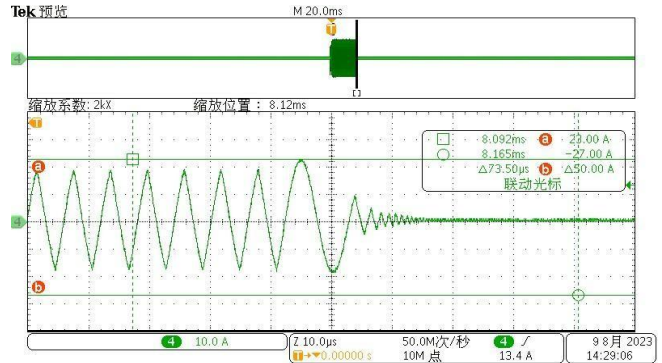
Test Condition: 265Vac/50Hz Input, 48V/10.5A Output,
Restart at short circuit condition



(CH3-VCr)

Comments: VCr_peak = 634.0V

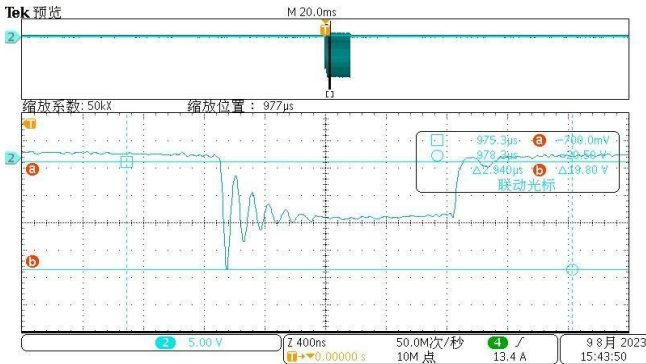
Test Condition: 265Vac/50Hz Input, 48V/10.5A Output,
Restart at short circuit condition



(CH4-Ir)

Comments: Ir_peak=23.0A

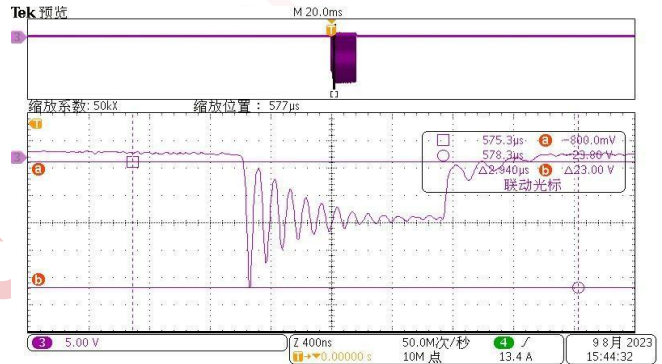
Test Condition: 265Vac/50Hz Input, 48V/10.5A Output,
Restart at short circuit condition



(CH2-VDiode1)

Comments: VDiode1 = 20.5V

Test Condition: 265Vac/50Hz Input, 48V/10.5A Output,
Restart at short circuit condition



(CH3-VDiode2)

Comments: VDiode2 = 23.8V

4.2 Bmax Test

Standard: Steady state rated load: $B_{max} \leq 0.32T$; Transient and its peak load: $B_{max} \leq 0.38T$.

Result: Pass

Note: The number of turns on the transform primary side is 19, and the sectional area is $196mm^2$, L_p is $100\mu H$, leakage inductance L_p' is $1.7\mu H$. The number of turns on the resonant inductor is 20 and the sectional area is $62mm^2$, L_r is $18\mu H$. If the primary current of transformer cannot be measured, resonant current and leakage inductance L_p' are used instead.

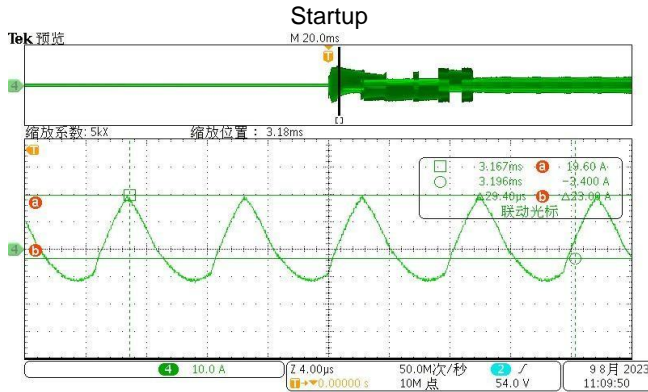
Test Data:

Comment	Resonant Inductor		Transformer		Bmax-limit (T)	Result
	200Vac/50Hz	265Vac/50Hz	200Vac/50Hz	265Vac/50Hz		
Output	48V/10.5A					
Startup	0.285T	0.311T	0.009T	0.010T	0.32	PASS
Steady	0.120T	0.097T	0.134T	0.046T	0.38	PASS

Short	0.238T	0.276T	0.105T	0.009T	0.38	PASS
Short Start	0.314T	0.334T	0.010T	0.010T	0.38	PASS

Waveforms:

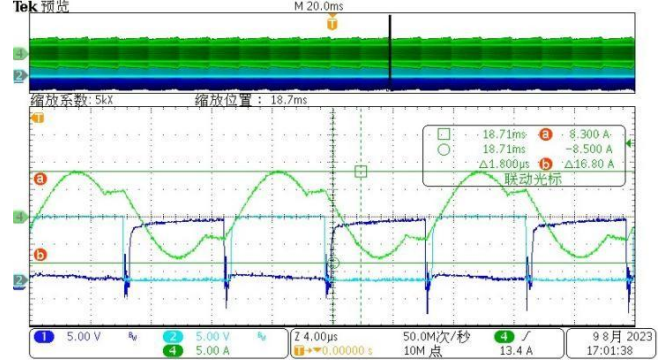
Test Condition: 200Vac/50Hz Input, 48V/10.5A Output,



(CH4-Ir)

Comments: Ir_peak = 19.6A

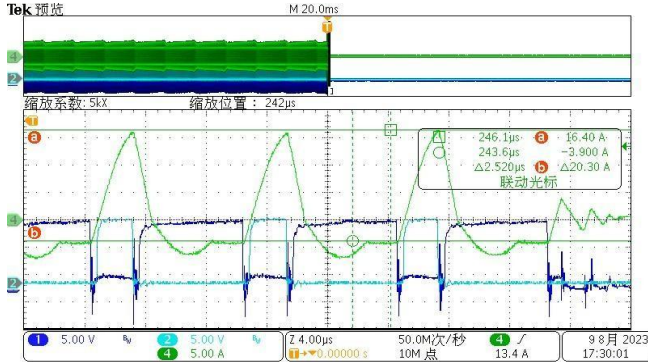
Test Condition: 200Vac/50Hz Input, 48V/10.5A Output,



(CH1-VGH, CH2-VGL, CH4-Ir)

Comments: Ir_peak = 8.3A

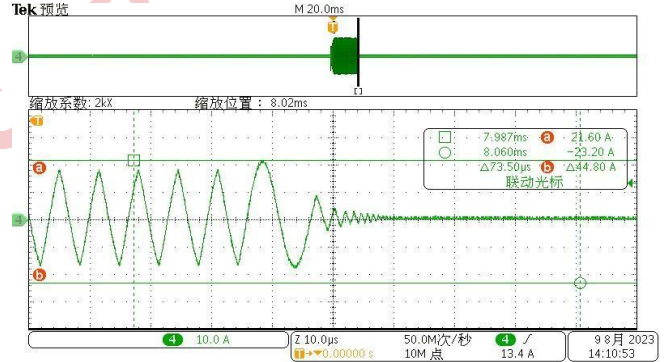
Test Condition: 200Vac/50Hz Input, 48V/10.5A Output,



(CH1-VGH, CH2-VGL, CH4-Ir)

Comments: Ir_peak = 16.4A

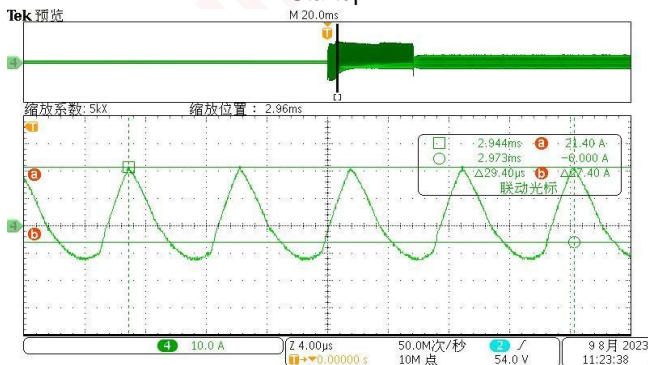
Test Condition: 200Vac/50Hz Input, 48V/10.5A Output,



(CH4-Ir)

Comments: Ir_peak = 21.6A

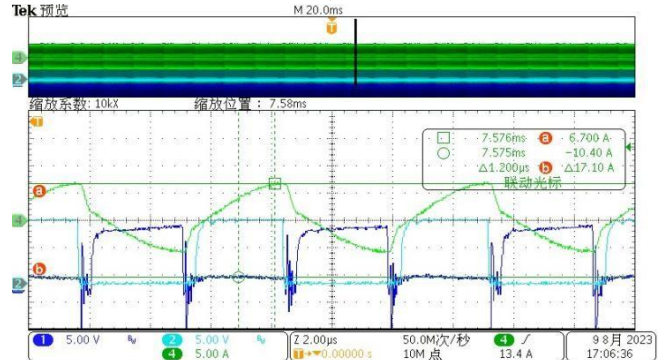
Test Condition: 265Vac/50Hz Input, 48V/10.5A Output,



(CH4-Ir)

Comments: Ir_peak = 21.4A

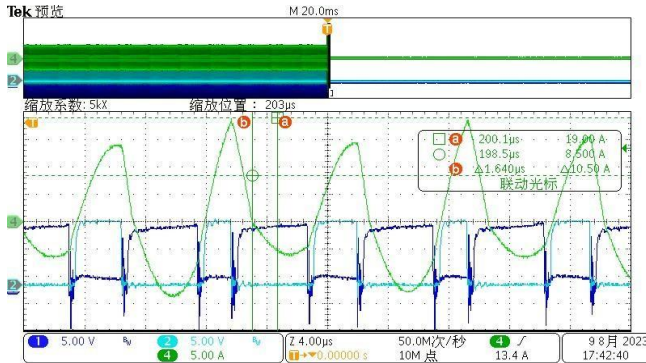
Test Condition: 265Vac/50Hz Input, 48V/10.5A Output



(CH1-VGH, CH2-VGL, CH4-Ir)

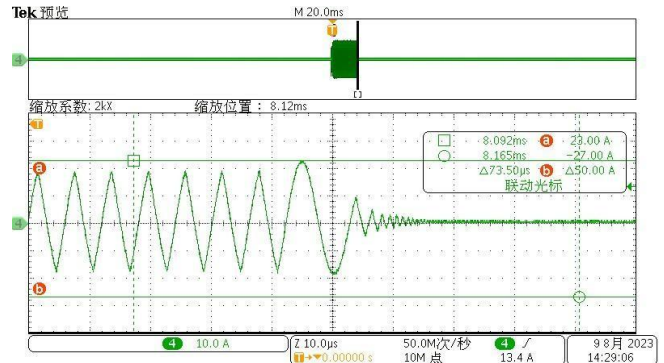
Comments: Ir_peak = 6.7A

**Test Condition: 265Vac/50Hz Input, 48V/10.5A Output,
Full Load to Short**



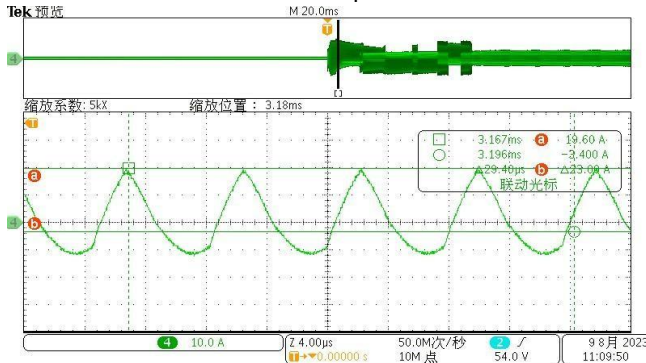
(CH1-VGH, CH2-VGL, CH4-Ir)
Comments: Ir_peak = 19.0A

**Test Condition: 265Vac/50Hz Input, 48V/10.5A Output
Restart at Short Circuit Condition**



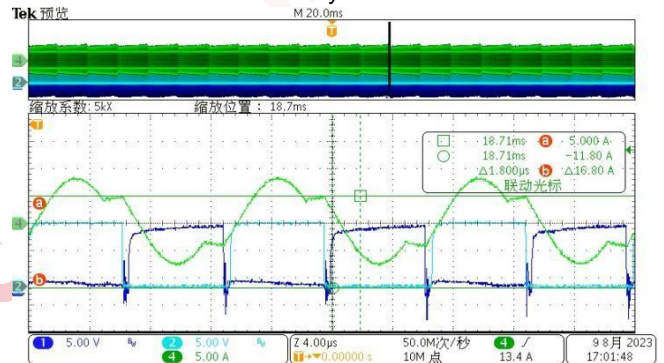
(CH4-Ir)
Comments: Ir_peak = 23.0A

**Test Condition: 200Vac/50Hz Input, 48V/10.5A Output,
Startup**



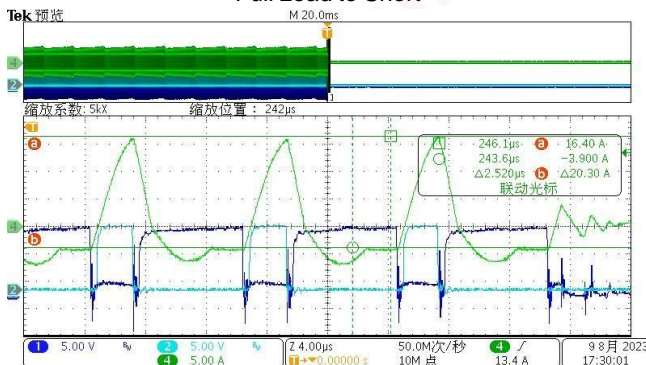
(CH4-Ir)
Comments: Ip'_peak = 19.6A

**Test Condition: 200Vac/50Hz Input, 48V/10.5A Output,
Steady State**



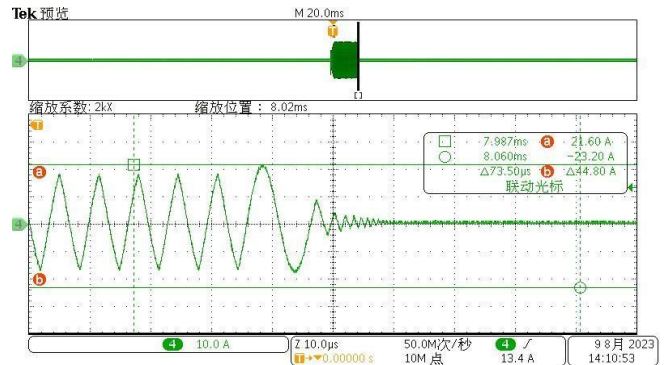
(CH1-VGH, CH2-VGL, CH4-Ir)
Comments: Ip_peak = 5.0A

**Test Condition: 200Vac/50Hz Input, 48V/10.5A Output,
Full Load to Short**



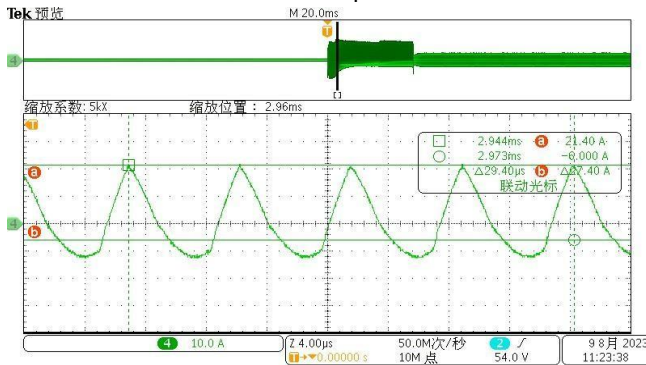
(CH1-VGH, CH2-VGL, CH4-Ir)
Comments: Ip_peak = 3.9A

**Test Condition: 200Vac/50Hz Input, 48V/10.5A Output,
Restart at Short Circuit Condition**



(CH4-Ir)
Comments: Ip'_peak = 21.6A

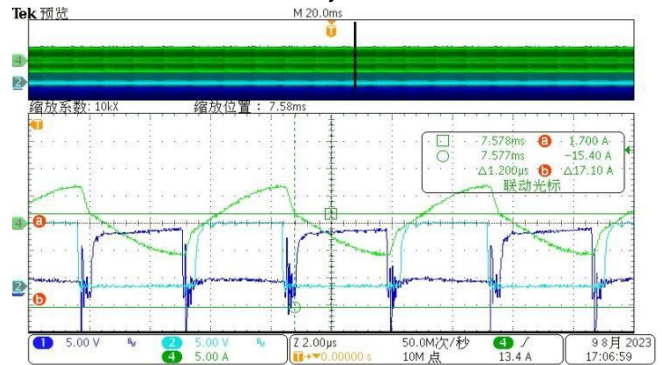
Test Condition: 265Vac/50Hz Input, 48V/10.5A Output,
Startup



(CH4-Ir)

Comments: Ip' _peak = 21.4A

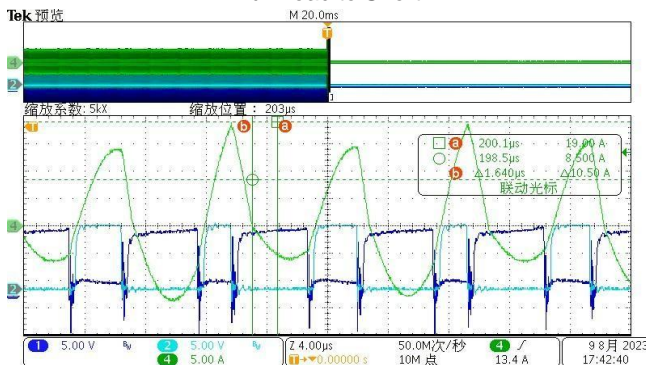
Test Condition: 265Vac/50Hz Input, 48V/10.5A Output,
Steady State



(CH1-VGH, CH2-VGL, CH4-Ir)

Comments: Ip' _peak = 1.7A

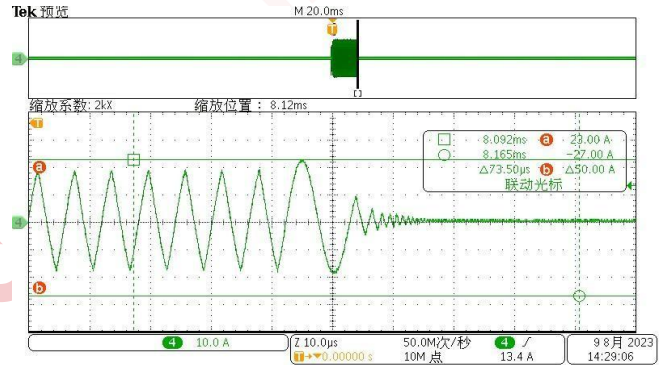
Test Condition: 265Vac/50Hz Input, 48V/10.5A Output,
Full Load to Short



(CH1-VGH, CH2-VGL, CH4-Ir)

Comments: Ip' _peak = 19.0A

Test Condition: 265Vac/50Hz Input, 48V/10.5A Output,
Restart at Short Circuit Condition



(CH4-Ir)

Comments: Ip' _peak = 23.0A

4.3 Thermal Test

Test Condition: 200Vac/50Hz input; 48V/10.5A output; Burn-in 2 Hours @ Open Air with no airflow, Ta is the ambient temperature.

Standard: MOS, IC and Diode: Ta=30.3 °C, Trise<90 °C. Transformer and Resonant Inductor: Ta=30.3 °C, Trise<120 °C.

Result: Pass

Test Data:

Trise(°C)	48V/10.5A	
	Ta: 30.3°C	
Location	200V/50Hz	
	T(°C)	Trise(°C)
KP2591	58.1	27.8

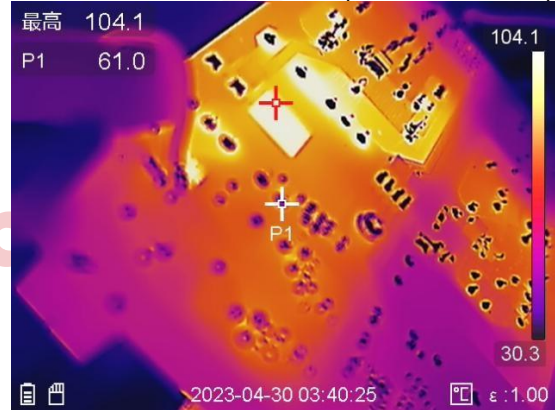
MOSFET H	90.8	60.5
MOSFET L	89.6	59.3
DIODE1 &2	92.3	62.0
DIODE 3 & 4	95.7	65.4
Rectifier 1 & 2	83.4	53.1
CM1 Inductor	54.7	24.4
CM2 Inductor	102.0	71.7
Output Inductor	79.2	48.9
Transformer	119.6	89.3
Resonant Inductor	73.4	43.1

Test Condition: 200Vac/50Hz Input, 48V/10.5A Output



Comments: TOP Side Tmax=119.6°C(Transformer)

Test Condition: 200Vac/50Hz Input, 48V/10.5A Output



Comments: Bottom Side Tmax=104.1°C



Revision History

DATE	REV	DESCRIPTION
2023/08/18	1.0	First Release

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