



DEMO BOARD TEST REPORT

20W High Performance PD Charger with Power Switch KP22305L and Synchronous Rectifier KP41261

FEATURES

- KP22305L Integrated with 650V Power MOS
- KP41261 Integrated with 60V Power MOS
- High Average Efficiency Pass DoE6
- Standby Power Consumption <30mW
- >6DB Margin for CE and RE Test
- Stable Operation without Audio Noise
- Integrated Protection Features of Auto-Recovery Mode

APPLICATIONS

- PD Charger

INTRODUCTION

KP22305L is a high performance quasi-resonant current mode power switch for off-line Fly-back converter. Moreover, the operating voltage of VDD can support 8V-40V to meet the PD power supply wide range output requirements.

KP41261 is a high performance secondary side synchronous rectifier, which supports High-side and Low-side in DCM and quasi-resonant topology.

The demo board is typically designed for 20W PD3.0 charger with universal input (90-265Vac, 50/60Hz). The demo board can achieve high efficiency, low standby power loss and meet the EN55022B/EN55032B EMI standards.

DEMO BOARD SEPCIFICATION

Description	Symbol	Min	Type	Max	Unit	Note
Input Voltage	Vin	90		265	Vac	50/60Hz
Output	Vout	5V3A; 9V2.22A; 12V1.67A				
Rate Output Power	Pout		20		W	
Ripple & Noise	Vripple			128	mVp-p	1m Cable end, 20MHz bandwidth
Average Efficiency	η	>88 (DoE6)			%	Output cap end @115V/230Vac
Standby Power Consumption	Pst			20.4	mW	@265Vac
Startup Time	Tst			121.8	ms	Tested at 90Vac/60Hz
Conducted EMI Margin	CE		6		dB	EN55022 class B
Radiated EMI Margin	RE		6		dB	EN55032 class B
Surge Test (Different/Common)			$\pm 1.5/2.5$		kV	@230Vin/12V1.67A
ESD (Contact/Air Discharge)	ESD		$\pm 20/20$		kV	@230Vin/12V1.67A
Operating Ambient	Ta	0		40	°C	
Operating Humidity		5		95	%R.H.	

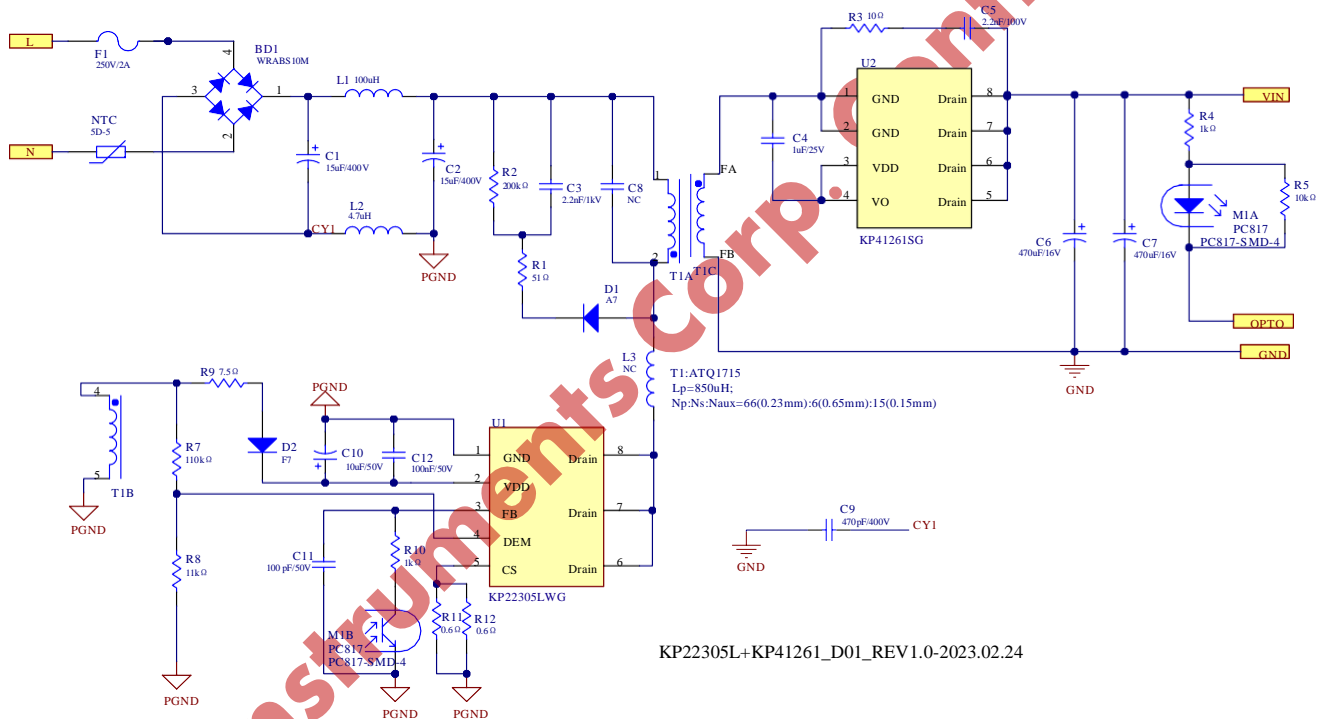
The table above shows the minimum acceptable performance of the design. Actual performance is listed in the results section.

Demo Board

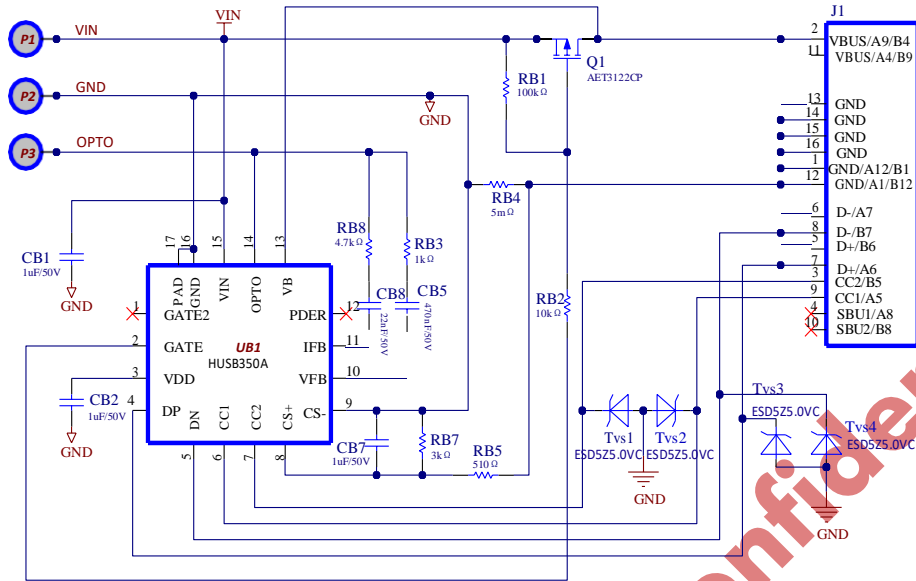


Board Size (mm): L x W x H = 39*33.2*20mm

Schematic-1

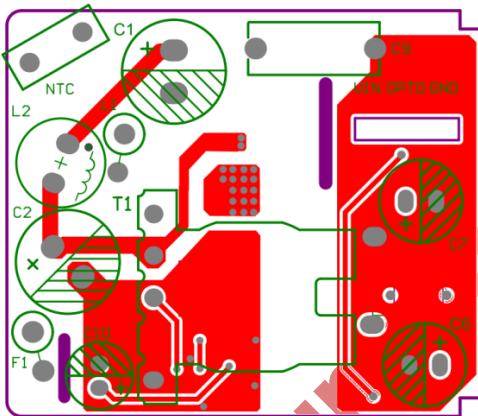


Schematic-2

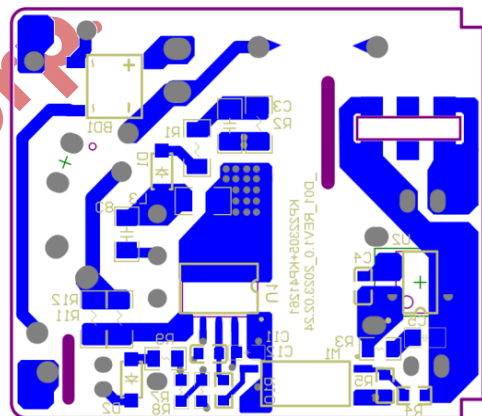


Printed Circuit Board Layout-1

Top Layer

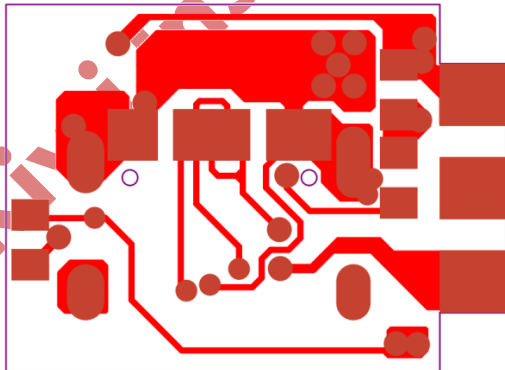


Bottom Layer

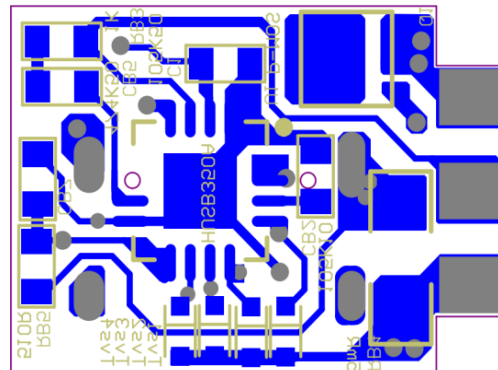


Printed Circuit Board Layout-2

Top Layer



Bottom Layer





Bill of Material

No.	Designator	Value	Description	Package	Manufacturer	Part Number
1	F1	2A/250V	Fuse 2A 250V	TH	CONQUER	PTU2A250V
2	BD1	1A/1000V	BRD 1A 1000V 1.1V	ABS	World	WRABS10M
3	L1	100μH	Inductor Isat 0.70A Rdc 0.35Ω 6*8	TH	Any	VLU0406-101KB
4	L2	4.7μH	Axial Fixed Inductor 4.7uH 0.35Ω 530mA 0410 +/-10%	TH	CENKER	AL0307-4R7K
5	L3	NC				
6	U1	KP22305L	Current Mode Power Switch	ASOP-6	Kiwi Instruments	KP22305LWGA
7	U2	KP41261	Secondary Side Synchronous Rectifier	SOP-8	Kiwi Instruments	KP41261SGA
8	R1	51R	Chip Resistor ±1% 1/4W	1206	FH	RS-06K51R0FT
9	R2	200K	Chip Resistor ±1% 1/4W	1206	FH	RS-06K2003FT
10	R3	10R	Chip Resistor ±1% 1/8W	0805	FH	RS-05K10R0FT
11	R4, R10, RB3	1K	Chip Resistor ±1% 1/10W	0603	FH	RS-03K1001FT
12	R5, RB2	10K	Chip Resistor ±1% 1/10W	0603	FH	RS-03K1002FT
13	R7	110K	Chip Resistor ±1% 1/10W	0603	FH	RS-03K1103FT
14	R8	11K	Chip Resistor ±1% 1/10W	0603	FH	RS-03K1102FT
15	R9	7.5R	Chip Resistor ±1% 1/8W	0805	FH	RS-05L7R50FT
16	R11, R12	0.6R	Chip Resistor ±1% 1/4W	1206	RALEC	RTT06R600FTP
17	RB1	100K	Chip Resistor ±1% 1/10W	0603	FH	RS-03K1002FT
18	RB4	5mR	Chip Resistor ±1% 1/4W	1206	FH	MFG06KR005FT
19	RB5	510R	Chip Resistor ±1% 1/10W	0603	FH	RS-03K5100FT
20	RB7	3K	Chip Resistor ±1% 1/10W	0603	FH	RS-03K3001FT
21	RB8	4.7K	Chip Resistor ±1% 1/10W	0603	FH	RS-03K4701FT
22	C1, C2	15μF	Electrolytic Cap 400V 8*15 P3.5	TH	Yongming	KCXD1502G150MF
23	C3	2.2nF	Ceramic Cap 1000V ±10% X7R	1206	WE	885342208019
24	C4, CB1, CB2, CB7	1μF	Ceramic Cap 50V ±10% X7R	0603	WE	885012206126
25	C5	2.2nF	Ceramic Cap 50V ±5% NPO	0805	WE	885012007065
26	C6	470μF	Solid capacitor 16V 6.3*11 P2.5	TH	AISHI	SPZ1CM471E11O00RAX XX
27	C7	470μF	Electrolytic Cap 16V 6.3*11 P2.5	TH	AISHI	ERR1AM471E11OT
28	C8	NC				
29	C10	10μF	Electrolytic Cap 50V 5*11 P2.0	TH	AISHI	EWH1HM100D11OT
30	C11	100pF	Ceramic Cap 50V ±5% NPO	0603	WE	885012006057

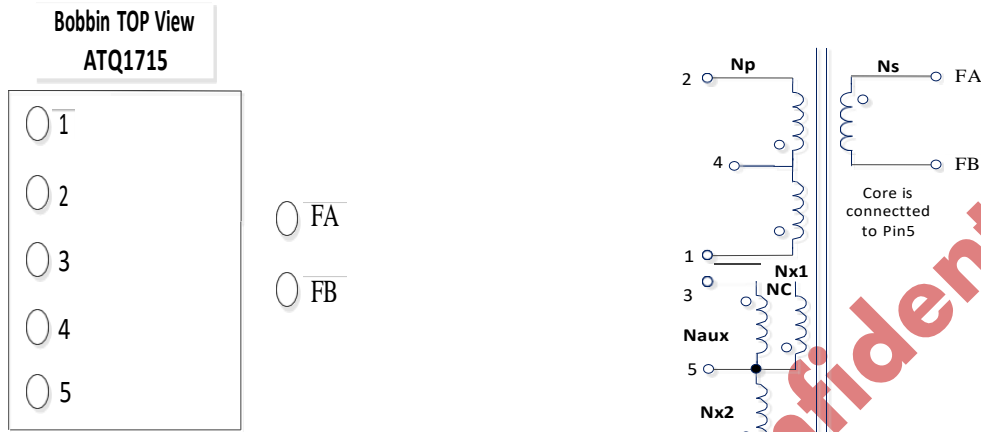


High Performance 20W PD Charger with KP22305L and KP41261

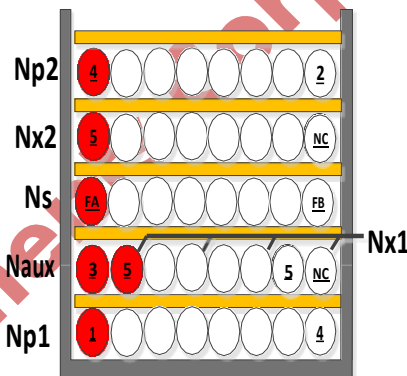
31	C12	100nF	Ceramic Cap 50V ±10% X7R	0603	WE	885012206095
32	CB5	470nF	Ceramic Cap 50V ±10% X7R	0603	YAGEO	CC0603KRX7R9BB474
33	CB8	22nF	Ceramic Cap 50V ±10% X7R	0603	WE	885012206091
34	CY1	470pF	Y1 Capacitor 400Vac ±10% T5 P10	T5 P10	STE	Q09B1D471KN0B0S0N0
35	D1	1A/1000V	DIO FRD 1A 1000V 1V	SOD- 123FL	DIYI	A7
36	D2	1A/1000V	DIO FRD 1A 1000V 500ns 1.3V	SOD- 123FL	DIYI	FFM107-M
37	M1	EL1019	EL1019 (TA) (AES)- VG, SOP- 4_P2.54_300mil, EVERLIGHT	SOP-4L- 4P	EVERLIGHT	EL1019
38	NTC	5R/1A	RES NTC 5Ω 1A	TH	HEL	5D-5
39	TVS1, TVS2, TVS3, TVS4	ESD5Z5.0V C	DIO TVS 4A 12V SOD- 523-2P SMD	SOD-523	Takcheong	ESD5Z5.0VC
40	J1	TYPE-C	TYPE-C female 16P	TYPE-C- 16P	Kinghelm	KH-TYPE-C-16P
41	Q1	-45A/-30V	MOSFET -45A -30V 8mΩ	PDFN33 33	CWT	AET3122CP
42	UB1	HUSB350A	USB Type-C and PD Source Controller	QFN16	Hynetek	HUSB350A
43	T1	850μH	ATQ1715, Vertical 5+0pins, Core Material PC44	ATQ1715		ATQ1715

Transformer Manufacture Guide

1 Electrical Diagram



2 Winding Diagram



3 Winding Order

Number	Winding	Property	Start	End	Wire Size (mm)	Turns	Note
1	Np1	Primary	Pin1	Pin4	0.23*1P	34Ts	Dense
2	Naux	Auxiliary	Pin3	Pin5	0.15*1P	15Ts	Parallel Wound
3	Nx1	Shield	Pin5	NC	0.15*1P	15Ts	
4	Ns	Secondary	FA	FB	0.25*7P	6Ts	Dense
5	Nx2	Shield	Pin5	NC	0.15*2P	13Ts	Smooth Wound
6	Np2	Primary	Pin4	Pin2	0.23*1P	32Ts	Dense



4 Electrical Specification

Items	Test Pin	Specification	Test Condition
Primary Inductance	Pins 1 - 2; Other Windings Open	850 μ H (\pm 5%)	Ta=25 $^{\circ}$ C 40kHz/1V _{rm}
Leakage Inductance	Pins 1- 2; All Other Windings Short	25 μ H Max	Ta=25 $^{\circ}$ C 40kHz/1V _{rm}
Turn Ratio	Np(1-2): Ns: Naux	66Ts: 6Ts: 15Ts	20kHz/1V
HI-POT HV Test	Primary to Secondary	3750 Vac	5mA, 1Min
	S-Aux	3750 Vac	5mA, 1Min
Insulation Resistance	P-A	> 100 M Ω	DC500V
DC Resistance	Pins 1 - 2	1R Max	

5 BOM

Number	Materials	Specifications
1	Core	ATQ1715, PC44, AE=48
2	Bobbin	ATQ1715, 5+0 Pin
3	Wire	Φ 0.23*1, 2UEW, Litz
4	Wire	Φ 0.15*1, 2UEW, Litz
5	Wire	Φ 0.15*2, 2UEW, Litz
6	Triple Insulation Wire	Φ 0.25*7, TIW-B, Litz
7	Duct Tape	W=12mm, T=0.1mm

Test Result

1 Input Characteristics

1.1 Maximum Rated Input AC Current

Standard: 2A max. @ 90Vac input & full load.

Result: Pass

Vin (ac)	lin_rms (A)	lin_max Limit (A)	Result
90V	0.402A	2A	Pass

1.2 Inrush Current (Cold Start)

Standard: 30A max@ 265Vac input.

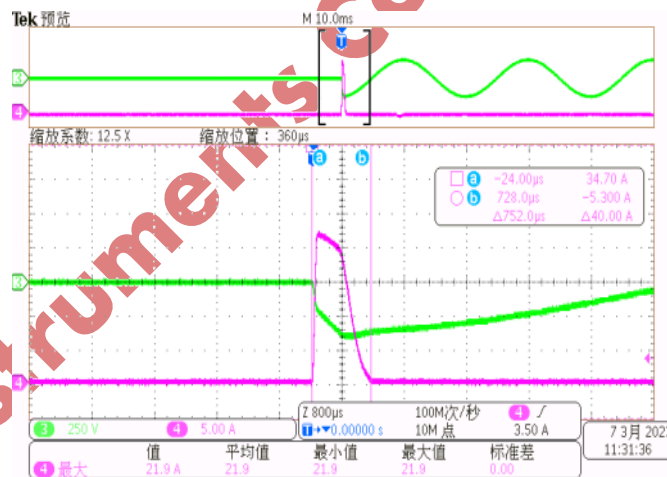
Result: Pass

Note: Tested @ 5V/3A

Vin (ac)	Inrush (A)	lin_max Limit (A)	Result
265V	21.9A	30A	Pass

Waveforms:

Test Condition: 5V/3A @265Vac, Phase=90° Startup



(CH3-Vinac, CH4-Iin)

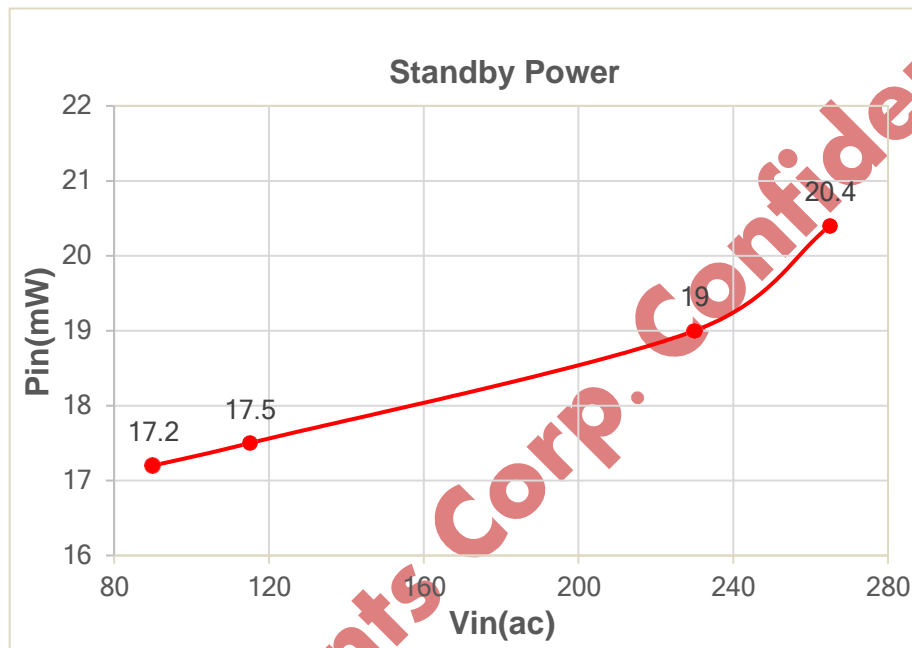
Comments: Startup Normally

1.3 No Load Input Power Dissipation

Standard: While input 90Vac~265Vac and the output is no load, the input power loss must be less than 30mW.

Result: Pass

Vin (ac)	90V	115V	230V	265V	Green Mode Limit (mW)	Result
Pin (mW)	17.2	17.5	19	20.4	30mW	Pass



1.4 Efficiency

Standard: The average efficiency tested at the output cap end should pass DoE 6 with 1-2% margin @115Vac&230Vac.

Result: Pass

Test Data:

Output	Average Eff (%)					Result
	90Vac	115Vac	230Vac	265Vac	DoE6	
12V	87.81	88.73	89.06	87.93	85.48	Pass
9V	88.11	89.22	89.62	89.19	85.47	Pass
5V	87.58	88.61	88.49	87.93	81.39	Pass



High Performance 20W PD Charger with KP22305L and KP41261

Efficiency (5V/3A):

Vin (Vac)	Fline (Hz)	Pin (W)	Vout (V)	Iout (A)	Pout (W)	Eff (%)	Eff_AVG (%)	DoE 6(%)
90	60	18.92	5.422	2.999	16.262	85.94	87.58	81.39
		13.74	5.356	2.251	12.053	87.73		
		8.99	5.286	1.501	7.935	88.27		
		4.44	5.216	0.752	3.922	88.40		
115		18.48	5.422	2.999	16.263	88.01	88.61	
		13.58	5.355	2.251	12.053	88.73		
		8.92	5.287	1.501	7.935	88.96		
		4.42	5.216	0.752	3.923	88.74		
230	50	18.25	5.423	2.999	16.267	89.14	88.49	
		13.54	5.356	2.251	12.053	89.02		
		8.96	5.286	1.501	7.935	88.59		
		4.50	5.217	0.752	3.923	87.19		
265		18.30	5.424	2.999	16.267	88.90	87.93	
		13.61	5.356	2.251	12.054	88.59		
		9.02	5.287	1.501	7.936	88.00		
		4.55	5.217	0.752	3.923	86.25		

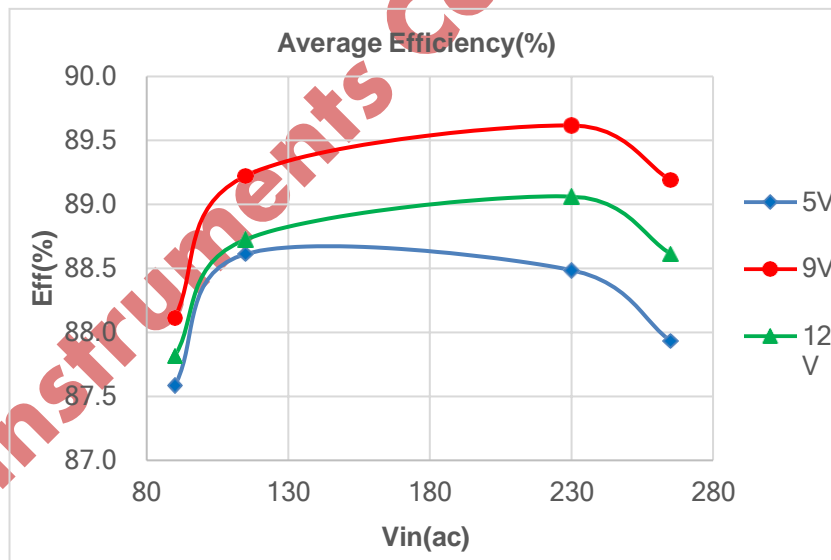
Efficiency (9V/2.22A):

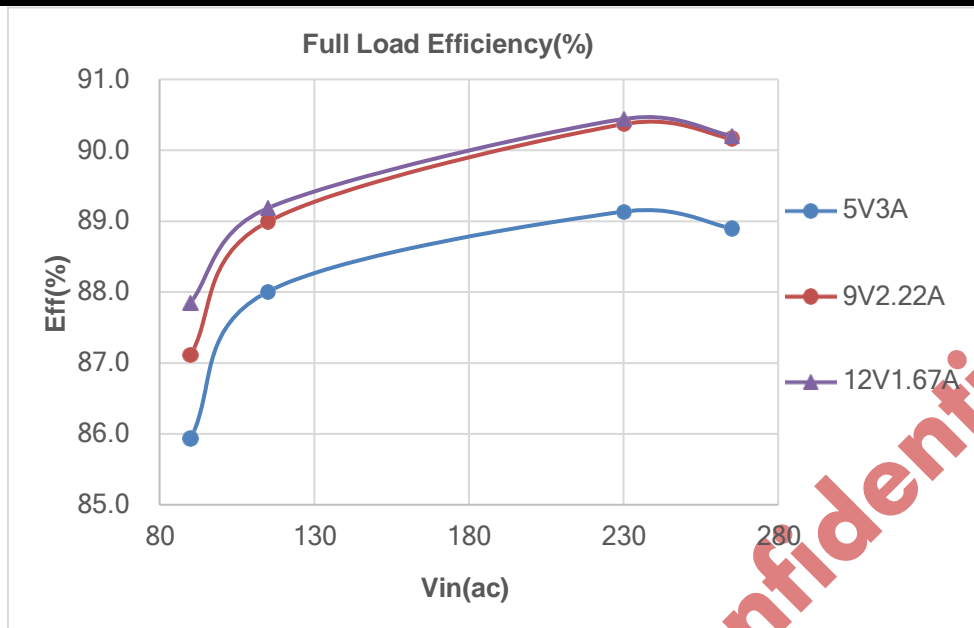
Vin (Vac)	Fline (Hz)	Pin (W)	Vout (V)	Iout (A)	Pout (W)	Eff (%)	Eff_AVG (%)	DoE 6(%)
90	60	23.57	9.250	2.220	20.534	87.11	88.11	85.47
		17.35	9.202	1.665	15.324	88.34		
		11.46	9.149	1.111	10.162	88.68		
		5.74	9.100	0.557	5.067	88.34		
115		23.07	9.250	2.220	20.535	89.00	89.22	
		17.12	9.203	1.665	15.326	89.52		
		11.35	9.149	1.111	10.162	89.53		
		5.70	9.098	0.557	5.066	88.85		
230	50	22.72	9.249	2.220	20.532	90.37	89.62	
		16.98	9.201	1.665	15.322	90.24		
		11.33	9.150	1.111	10.163	89.69		
		5.75	9.100	0.557	5.067	88.17		
265		22.77	9.251	2.220	20.536	90.17	89.19	
		17.05	9.202	1.665	15.324	89.89		
		11.39	9.151	1.111	10.165	89.24		
		5.79	9.100	0.557	5.067	87.47		



Efficiency (12V/1.67A):

Vin (Vac)	Fline(Hz)	Pin (W)	Vout (V)	Iout (A)	Pout (W)	Eff (%)	Eff_AVG (%)	DoE 6(%)
90	60	23.16	12.218	1.665	20.343	87.85	87.81	85.48
		17.17	12.181	1.245	15.166	88.34		
		11.37	12.143	0.826	10.030	88.25		
		5.66	12.104	0.406	4.916	86.82		
115		22.81	12.222	1.665	20.348	89.19	88.73	
		16.98	12.180	1.245	15.166	89.34		
		11.27	12.143	0.826	10.031	89.01		
		5.63	12.102	0.406	4.916	87.37		
230	50	22.49	12.217	1.665	20.341	90.44	89.06	
		16.84	12.178	1.245	15.163	90.04		
		11.25	12.140	0.826	10.027	89.16		
		5.67	12.099	0.406	4.913	86.60		
265		22.55	12.215	1.665	20.338	90.21	88.62	
		16.90	12.178	1.245	15.163	89.71		
		11.31	12.139	0.826	10.026	88.68		
		5.72	12.100	0.406	4.914	85.87		





2 Output Characteristics

2.1 Output Line Regulation and Load Regulation

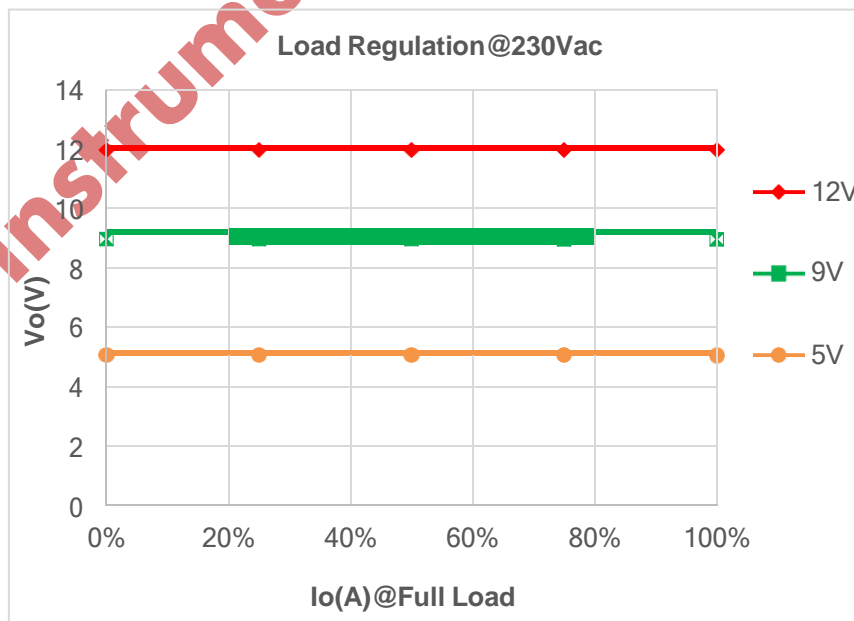
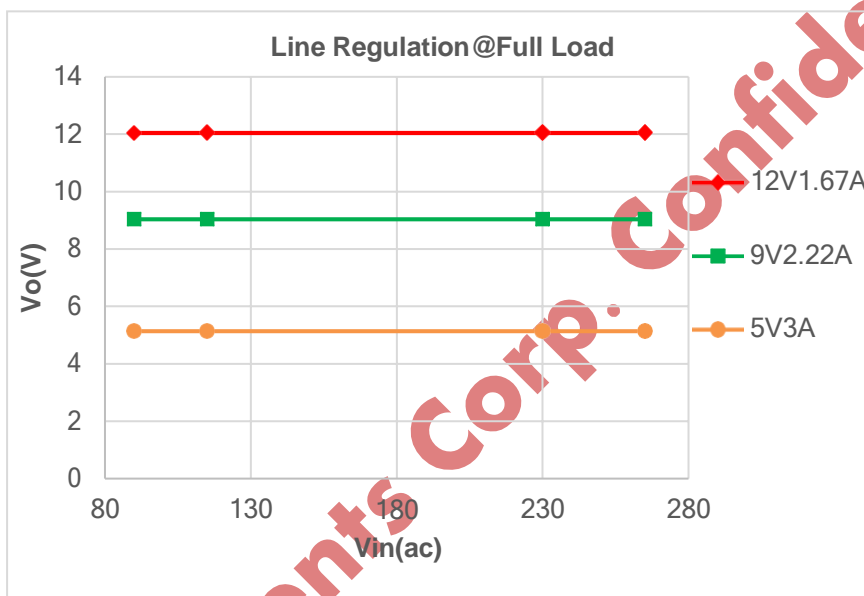
Standard: Under the input voltage 90Vac~265Vac, line regulation <6%, load regulation <6%. The output voltage tested at the output cap end.

Result: Pass

Input Voltage	For Vo=12V / Output Voltage(V)					Load Regulation
	0% Load	25% Load	50% Load	75% Load	Full Load	
90Vac/60Hz	12.048	12.046	12.044	12.042	12.04	0.07%
115Vac/60Hz	12.049	12.045	12.045	12.046	12.044	0.04%
230Vac/50Hz	12.05	12.049	12.048	12.046	12.045	0.04%
265Vac/50Hz	12.052	12.051	12.049	12.049	12.047	0.04%
Line Regulation	0.03%	0.05%	0.04%	0.06%	0.06%	
Input Voltage	For Vo=9V / Output Voltage(V)					Load Regulation
	0% Load	25% Load	50% Load	75% Load	Full Load	
90Vac/60Hz	9.041	9.038	9.036	9.036	9.033	0.09%
115Vac/60Hz	9.041	9.039	9.038	9.036	9.034	0.08%
230Vac/50Hz	9.041	9.04	9.04	9.038	9.037	0.04%
265Vac/50Hz	9.041	9.039	9.04	9.038	9.036	0.06%
Line Regulation	0.00%	0.02%	0.04%	0.02%	0.04%	



Input Voltage	For Vo=5V / Output Voltage(V)					Load Regulation
	0% Load	25% Load	50% Load	75% Load	Full Load	
90Vac/60Hz	5.142	5.14	5.138	5.136	5.134	0.16%
115Vac/60Hz	5.142	5.14	5.137	5.137	5.135	0.14%
230Vac/50Hz	5.143	5.14	5.138	5.137	5.135	0.16%
265Vac/50Hz	5.142	5.14	5.137	5.136	5.135	0.14%
Line Regulation	0.02%	0.00%	0.02%	0.02%	0.02%	



2.3 Ripple & Noise

Standard: Under the input voltage 90Vac~265Vac, Vripple_max<200mV.

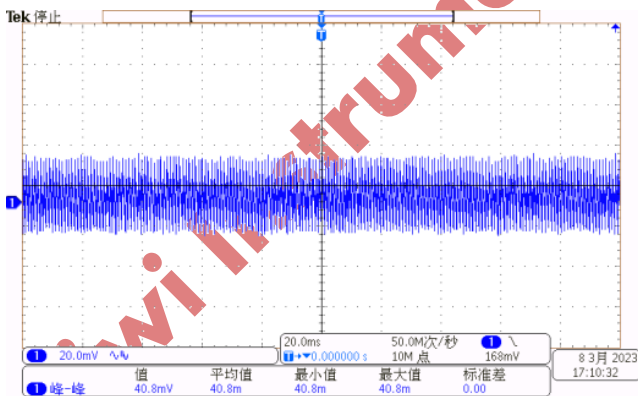
Result: Pass

Note: Ripple & noise measured at the 1 m line end with a 0.1μF/50V ceramic cap paralleled with a 10μF/50V electrolytic cap. Bandwidth is limited to 20MHz.

Input Voltage	No Load Ripple(mV)		
	5V/0A	9V/0A	12V/0A
90Vac/60Hz	40.8	46.4	43.2
115Vac/60Hz	60.8	48	39.2
230Vac/50Hz	64.8	56	47.2
265Vac/50Hz	57.6	56	53.6
Input Voltage	Full Load Ripple(mV)		
	5V/3A	9V/2.22A	12V/1.67A
90Vac/60Hz	128	118	92
115Vac/60Hz	94	80	72
230Vac/50Hz	82	76	70
265Vac/50Hz	82	72	64

Waveforms:

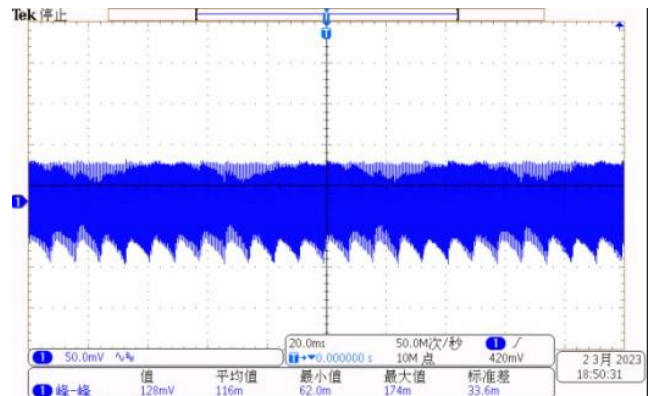
Test Condition: 90Vac/60Hz Input, 5V/0A Output



(CH1- Vripple)

Comments: Vripple=40.8mV

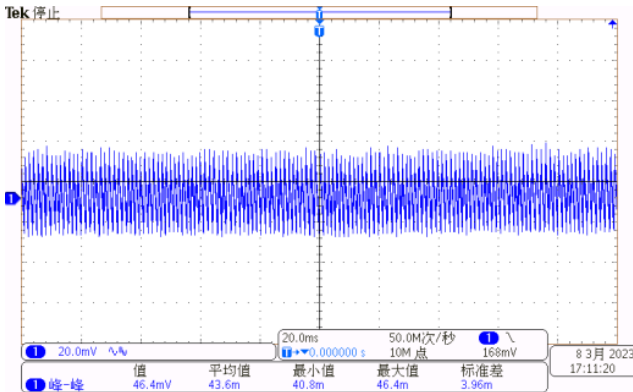
Test Condition: 90Vac/60Hz Input, 5V/3A Output



(CH1- Vripple)

Comments: Vripple=128mV

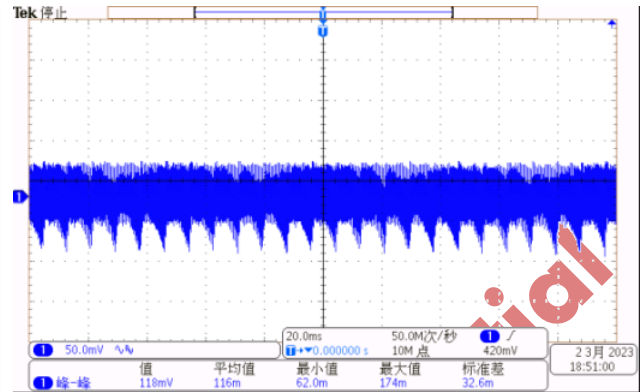
Test Condition: 90Vac/60Hz Input, 9V/0A Output



(CH1- Vripple)

Comments: Vripple=46.4mV

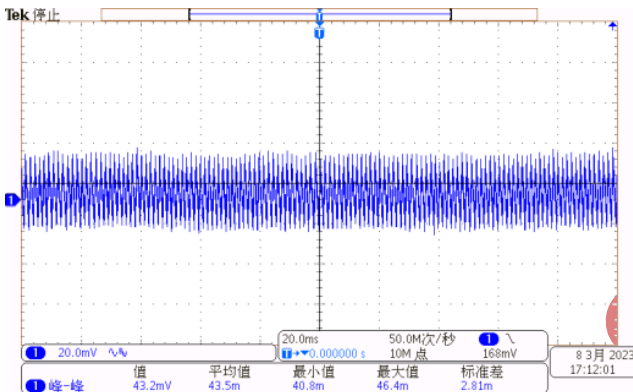
Test Condition: 90Vac/60Hz Input, 9V/2.22A Output



(CH1- Vripple)

Comments: Vripple=118mV

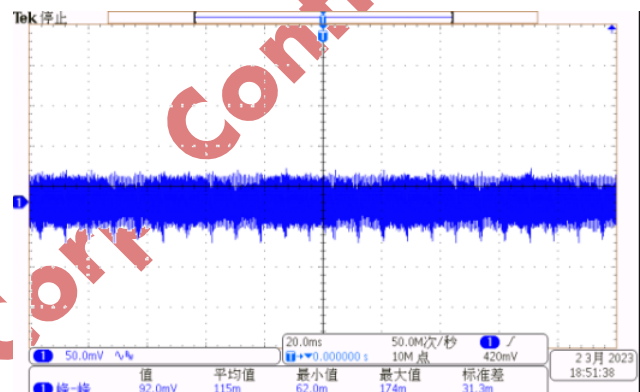
Test Condition: 90Vac/60Hz Input, 12V/0A Output



(CH1- Vripple)

Comments: Vripple=43.2mV

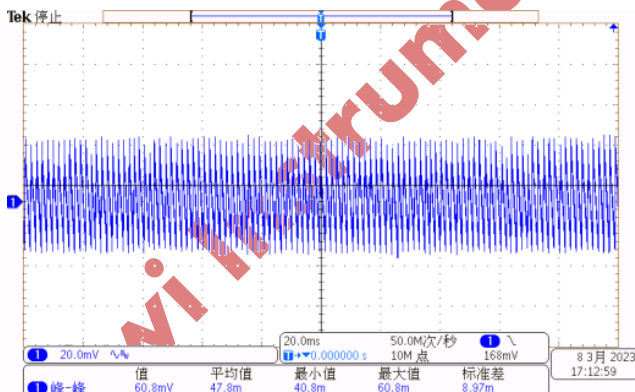
Test Condition: 90Vac/60Hz Input, 12V/1.67A Output



(CH1- Vripple)

Comments: Vripple=92mV

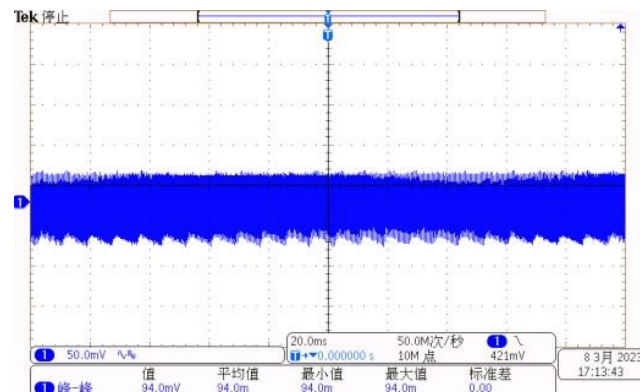
Test Condition: 115Vac/60Hz Input, 5V/0A Output



(CH1- Vripple)

Comments: Vripple=60.8mV

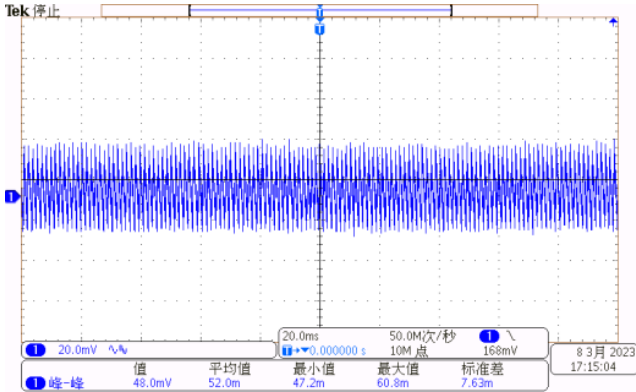
Test Condition: 115Vac/60Hz Input, 5V/3A Output



(CH1- Vripple)

Comments: Vripple=94mV

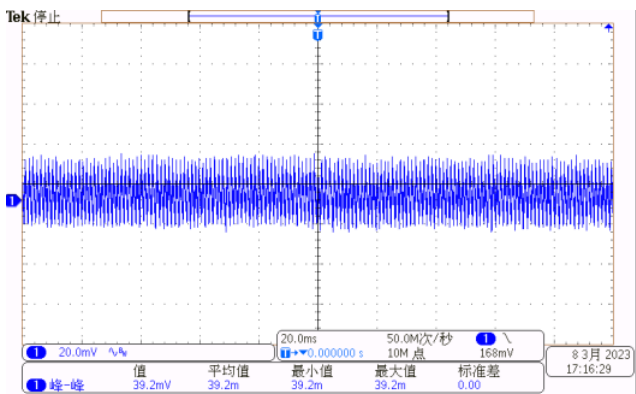
Test Condition: 115Vac/60Hz Input, 9V/0A Output



(CH1- Ripple)

Comments: Ripple=48mV

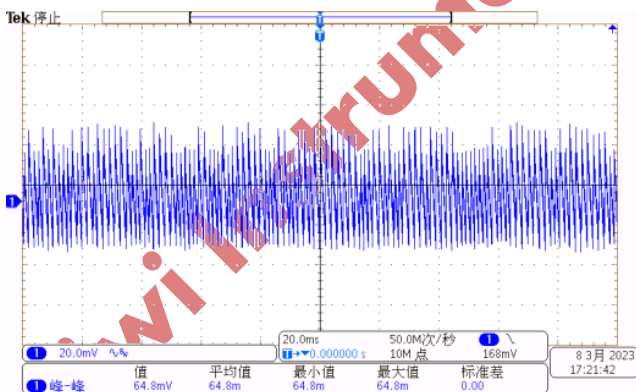
Test Condition: 115Vac/60Hz Input, 12V/0A Output



(CH1- Ripple)

Comments: Ripple=39.2mV

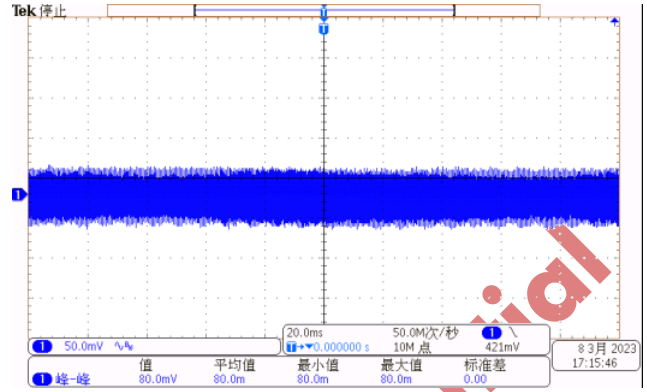
Test Condition: 230Vac/50Hz Input, 5V/0A Output



(CH1- Ripple)

Comments: Ripple=64.8mV

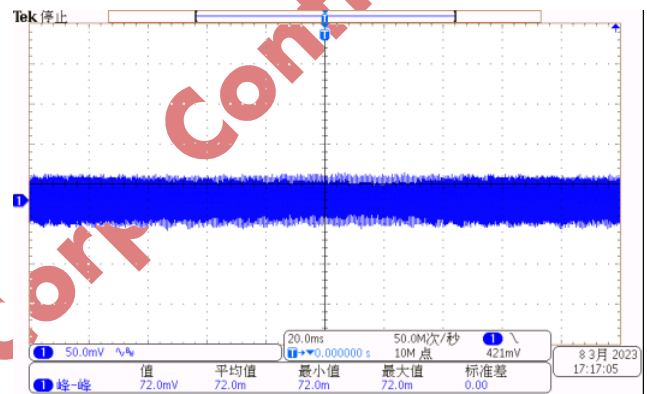
Test Condition: 115Vac/60Hz Input, 9V/2.22A Output



(CH1- Ripple)

Comments: Ripple=80mV

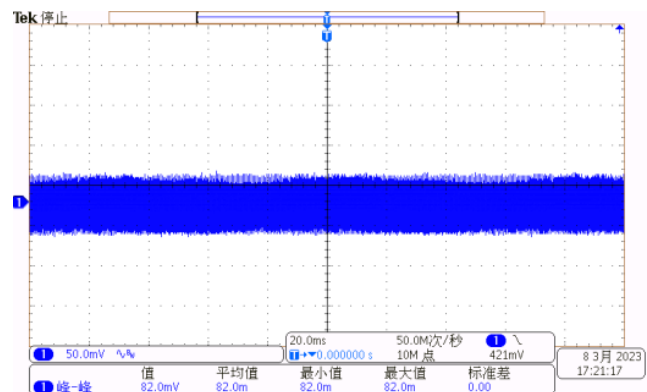
Test Condition: 115Vac/60Hz Input, 12V/1.67A Output



(CH1- Ripple)

Comments: Ripple=72mV

Test Condition: 230Vac/50Hz Input, 5V/3A Output



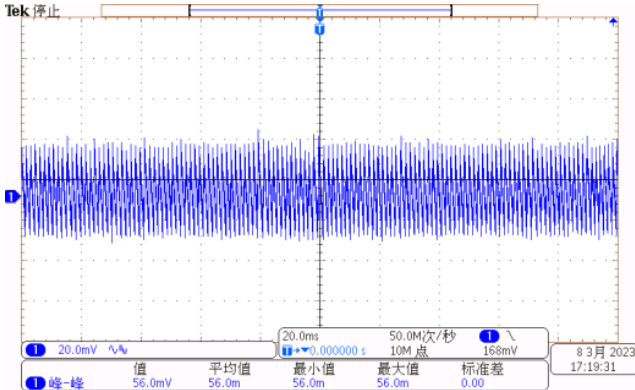
(CH1- Ripple)

Comments: Ripple=82mV



Test Condition: 230Vac/50Hz Input, 9V/0A Output

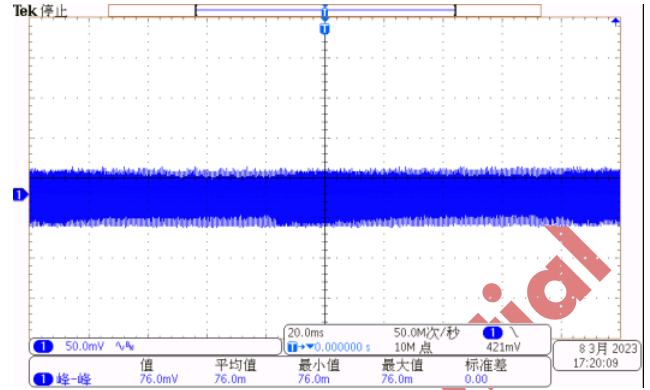
Test Condition: 230Vac/50Hz Input, 9V/2.22A Output



(CH1- Vripple)

Comments: Vripple=56mV

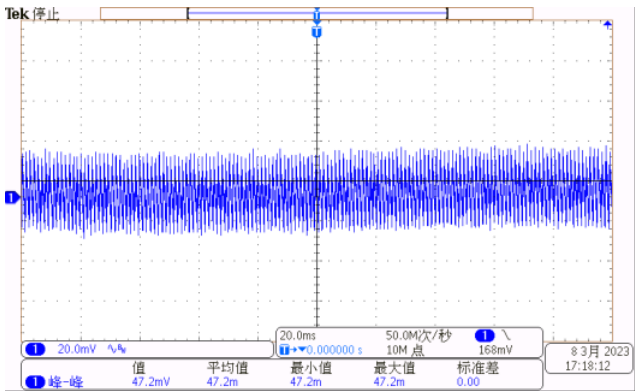
Test Condition: 230Vac/50Hz Input, 12V/0A Output



(CH1- Vripple)

Comments: Vripple=76mV

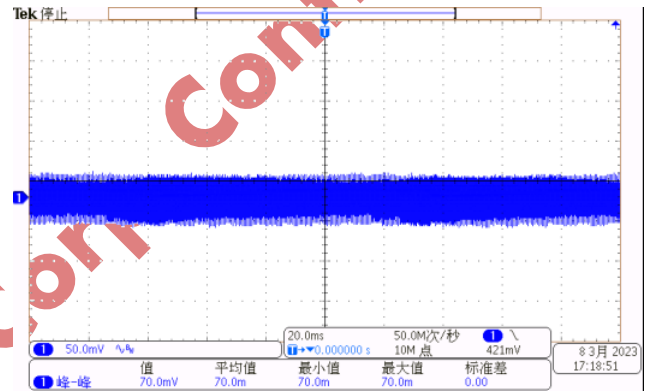
Test Condition: 230Vac/50Hz Input, 12V/1.67A Output



(CH1- Vripple)

Comments: Vripple=47.2mV

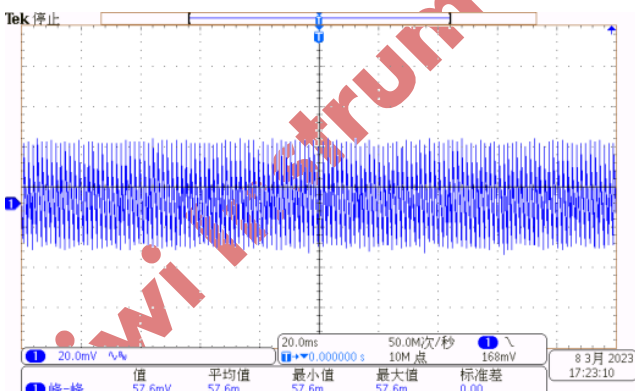
Test Condition: 265Vac/50Hz Input, 5V/0A Output



(CH1- Vripple)

Comments: Vripple=70mV

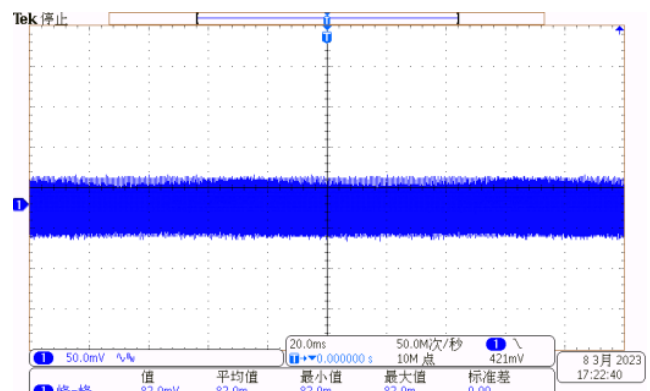
Test Condition: 265Vac/50Hz Input, 5V/3A Output



(CH1- Vripple)

Comments: Vripple=57.6mV

Test Condition: 265Vac/50Hz Input, 5V/3A Output

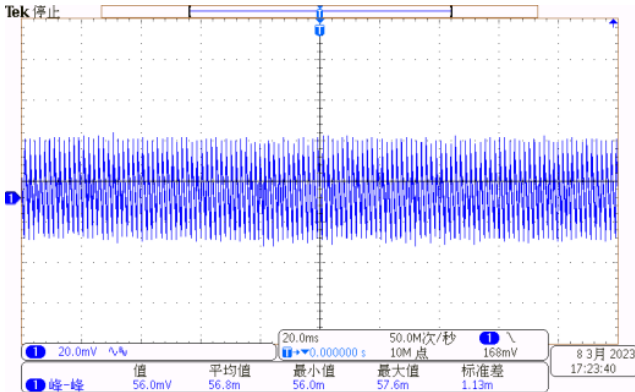


(CH1- Vripple)

Comments: Vripple=82mV

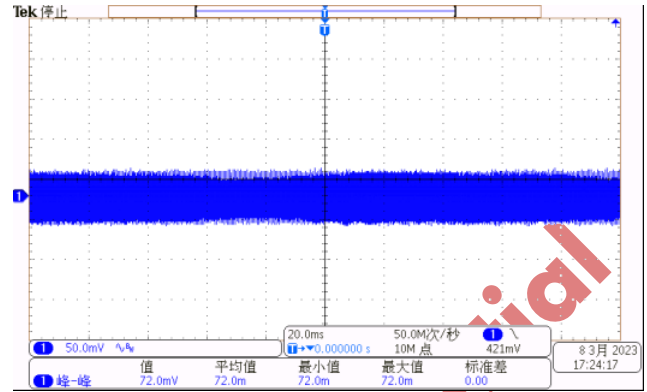
Test Condition: 265Vac/50Hz Input, 9V/0A Output

Test Condition: 265Vac/50Hz Input, 9V/2.22A Output



(CH1- Vripple)

Comments: Vripple=56mV

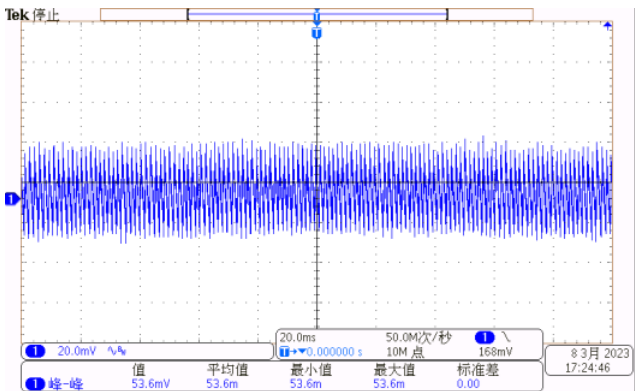


(CH1- Vripple)

Comments: Vripple=72mV

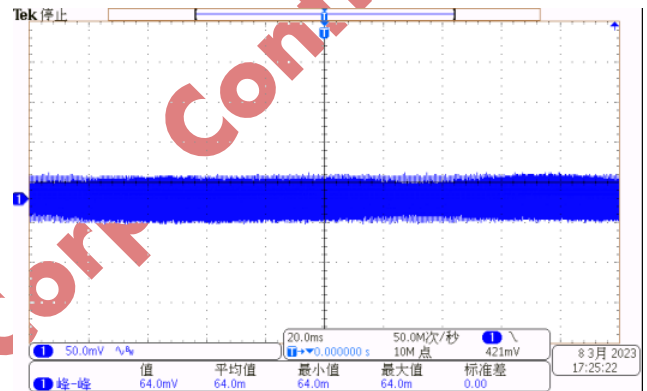
Test Condition: 265Vac/50Hz Input, 12V/0A Output

Test Condition: 265Vac/50Hz Input, 12V/1.67A Output



(CH1- Vripple)

Comments: Vripple=53.6mV



(CH1- Vripple)

Comments: Vripple=64mV

2.4 Load Transient Test

Standard: Under the input voltage 90Vac~265Vac, the output voltage transient response should be within $\pm 10\%$ normal voltage.

Result: Pass

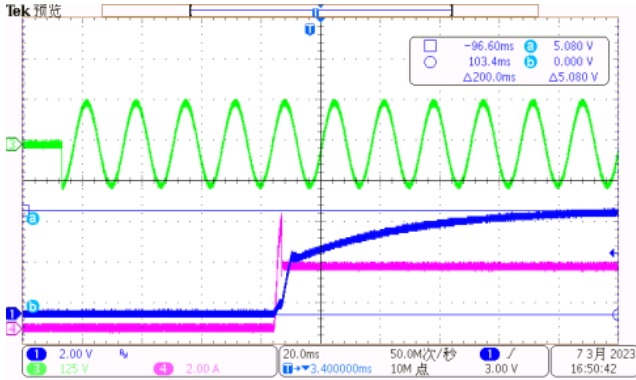
Note: 10% load shift to 90% load with 0.25A/ μ s changing ramp and 100Hz changing frequency.

Input Voltage	Output Voltage(V)					
	5V		9V		12V	
	Vo-min	Vo-max	Vo-min	Vo-max	Vo-min	Vo-max
115Vac/60Hz	4.94	5.3	8.9	9.2	11.94	12.22
230Vac/50Hz	4.92	5.3	8.84	9.24	11.94	12.24

Note: Tested at the output cap end@5V/3A.

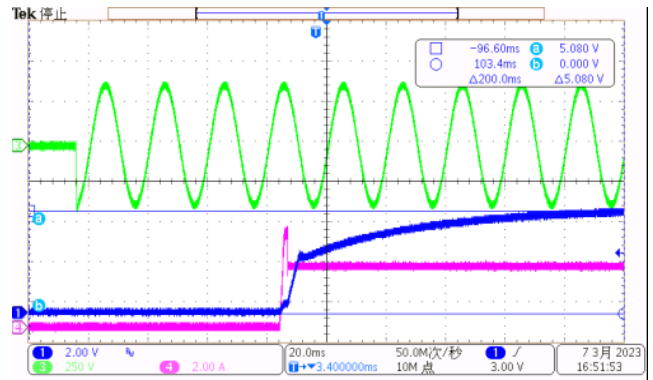
Waveforms:

Test Condition: Load=3000μF, 5V/3A @90Vac



(CH1-Vo, CH3-Vinac, CH4-Io)
Comments: Startup Normally

Test Condition: Load=3000μF, 5V/3A @265Vac



(CH1-Vo, CH3-Vinac, CH4-Io)
Comments: Startup Normally

2.6 Startup Time and Raise Time

Standard: The startup time should be less than 3s@90Vac.

Result: Pass

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

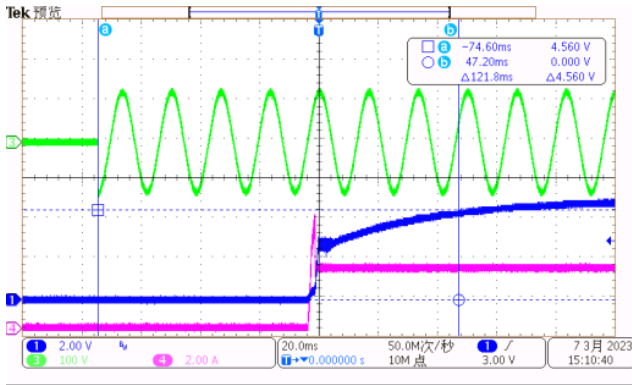
Test Data:

Input Voltage	90Vac/60Hz	115Vac/60Hz	230Vac/50Hz	265Vac/50Hz
Startup Time (mS)	121.8	117	115.2	114.8

Input Voltage	90Vac/60Hz		115Vac/60Hz		230Vac/50Hz		265Vac/50Hz	
Raise Time (mS)	5V/0A	5V/3A	5V/0A	5V/3A	5V/0A	5V/3A	5V/0A	5V/3A
		52.4	52.4	52.6	43.8	50.2	43.4	50.8

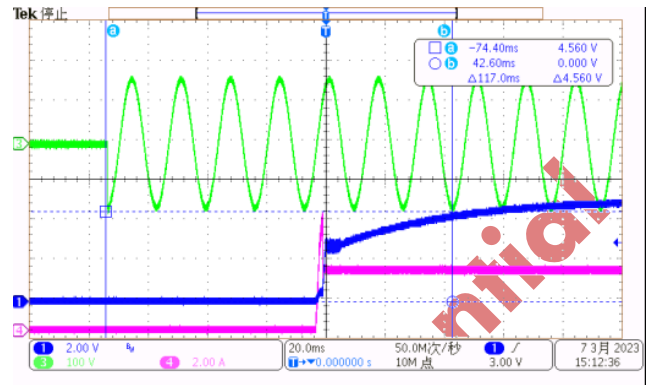
Waveforms:

Test Condition: 90Vac/60Hz Input, 5V/3A Output



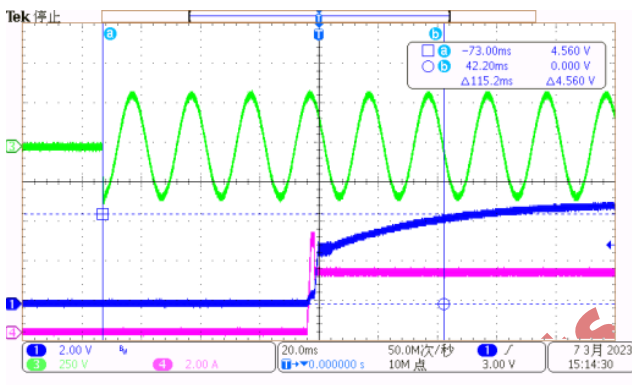
(CH1-Vo, CH3-Vinac, CH4-Io)
Comments: Startup Time=121.8ms

Test Condition: 115Vac/60Hz Input, 5V/3A Output



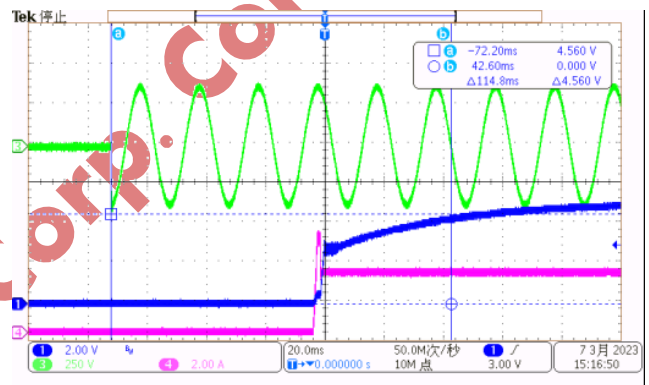
(CH1-Vo, CH3-Vinac, CH4-Io)
Comments: Startup Time=117ms

Test Condition: 230Vac/50Hz Input, 5V/3A Output



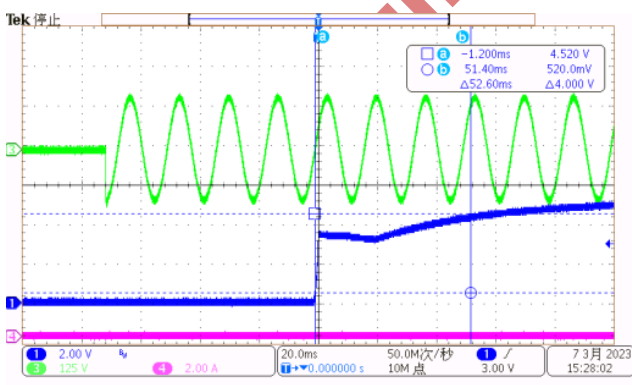
(CH1-Vo, CH3-Vinac, CH4-Io)
Comments: Startup Time=115.2ms

Test Condition: 265Vac/50Hz Input, 5V/3A Output



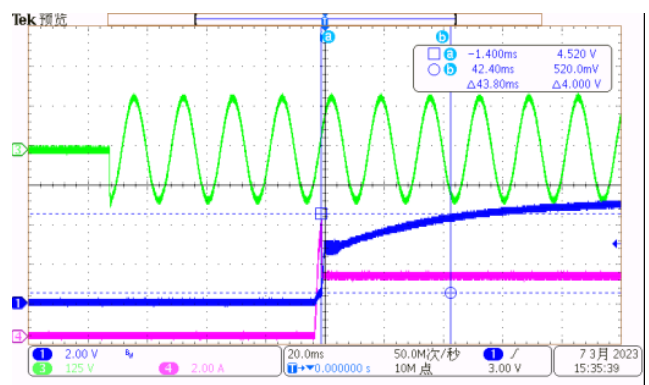
(CH1-Vo, CH3-Vinac, CH4-Io)
Comments: Startup Time=114.8ms

Test Condition: 115Vac/60Hz Input, 5V/0A Output



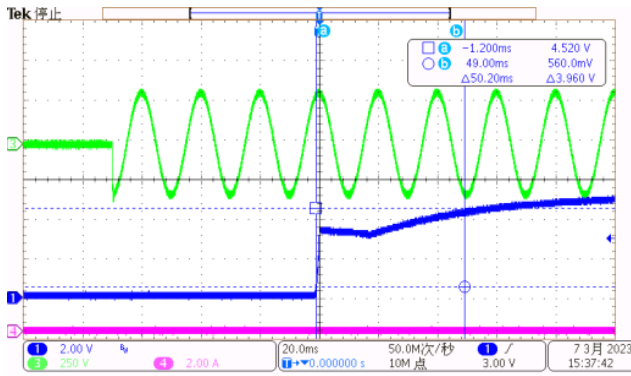
(CH1-Vo, CH3-Vinac, CH4-Io)
Comments: Raise Time=52.6ms

Test Condition: 115Vac/60Hz Input, 5V/3A Output



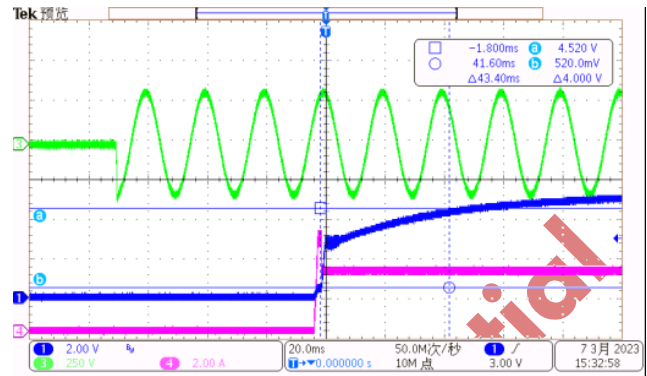
(CH1-Vo, CH3-Vinac, CH4-Io)
Comments: Raise Time=43.8ms

Test Condition: 230Vac/50Hz Input, 5V/0A Output



(CH1-Vo, CH3-Vinac, CH4-Io)
Comments: Raise Time=50.2ms

Test Condition: 230Vac/50Hz Input, 5V/3A Output



(CH1-Vo, CH3-Vinac, CH4-Io)
Comments: Raise Time=43.4ms

2.7 Holdup Time and Fall Time

Standard: The holdup time should be larger than 10ms@115/230Vac.

Result: Pass

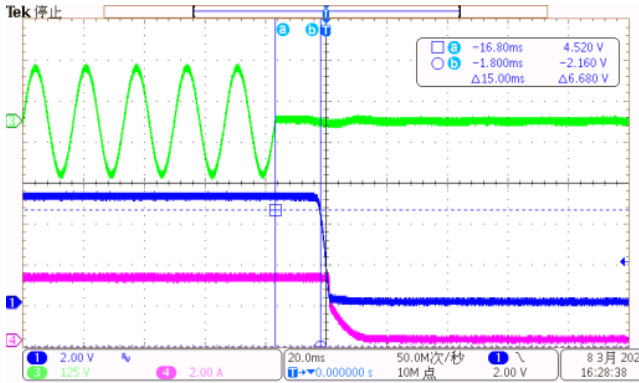
Note: The output voltage tested at the output cap end.

Input Voltage	Holdup Time (mS)		
	5V/3A	9V/2.22A	12V/1.67A
115Vac/60Hz	15	11	12
230Vac/50Hz	77.6	59.4	60
Result	Pass	Pass	Pass

Input Voltage	Fall Time (mS)		
	5V/3A	9V/2.22A	12V/1.67A
115Vac/60Hz	3	4.6	6.8
230Vac/50Hz	3	4.6	6.4
Result	Pass	Pass	Pass

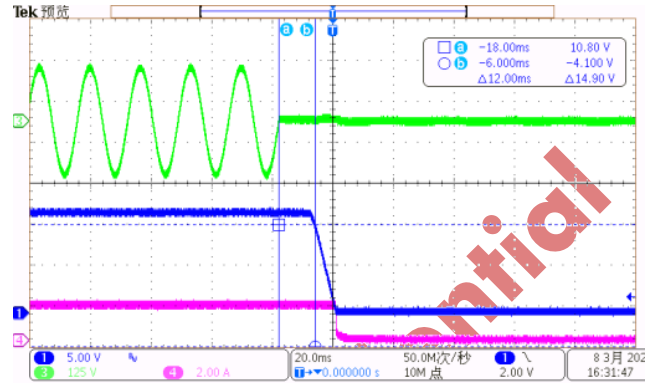
Waveforms:

Test Condition: 115Vac/60Hz Input, 5V/3A Output



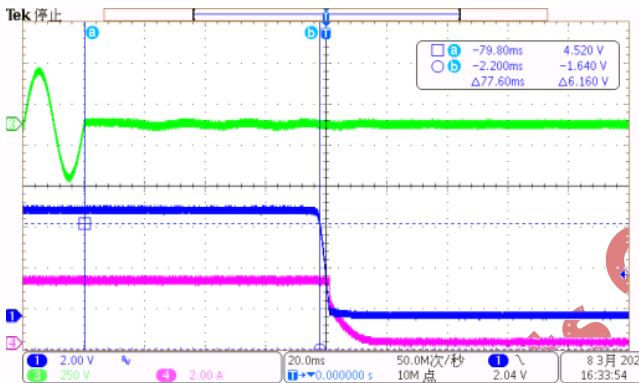
(CH1-Vo, CH3-Vinac, CH4-Io)
Comments: Holdup Time=15ms

Test Condition: 115Vac/60Hz Input, 12V/1.67A Output



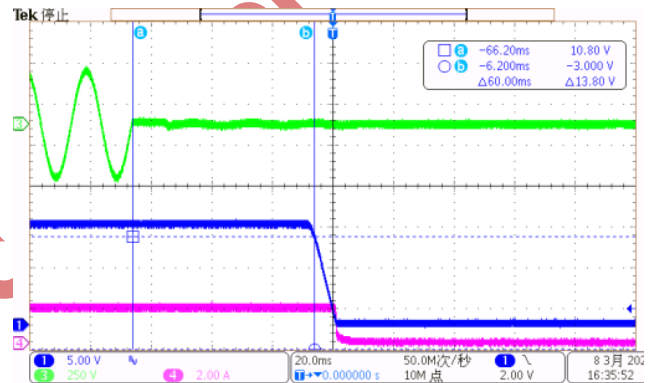
(CH1-Vo, CH3-Vinac, CH4-Io)
Comments: Holdup Time=12ms

Test Condition: 230Vac/50Hz Input, 5V/3A Output



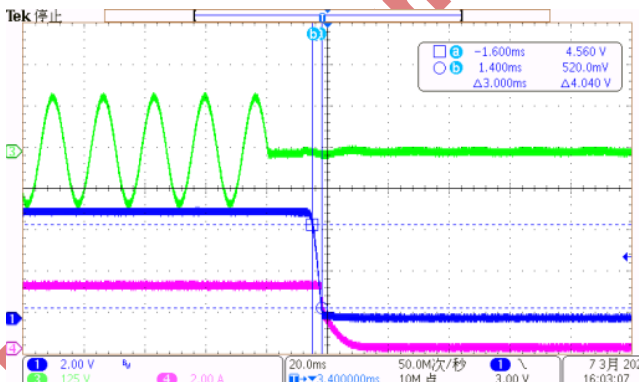
(CH1-Vo, CH3-Vinac, CH4-Io)
Comments: Holdup Time=77.6ms

Test Condition: 230Vac/50Hz Input, 12V/1.67A Output



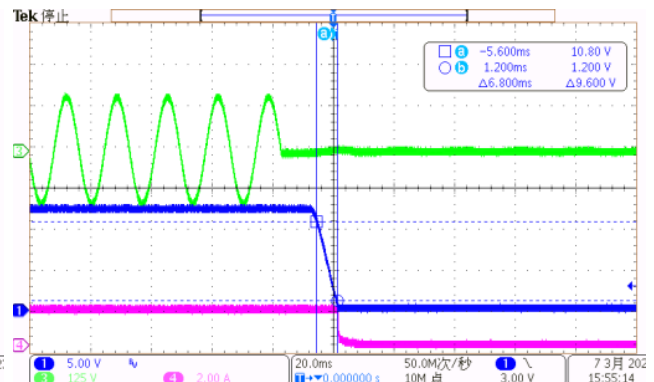
(CH1-Vo, CH3-Vinac, CH4-Io)
Comments: Holdup Time=60ms

Test Condition: 115Vac/60Hz Input, 5V/3A Output



(CH1-Vo, CH3-Vinac, CH4-Io)
Comments: Fall Time=3ms

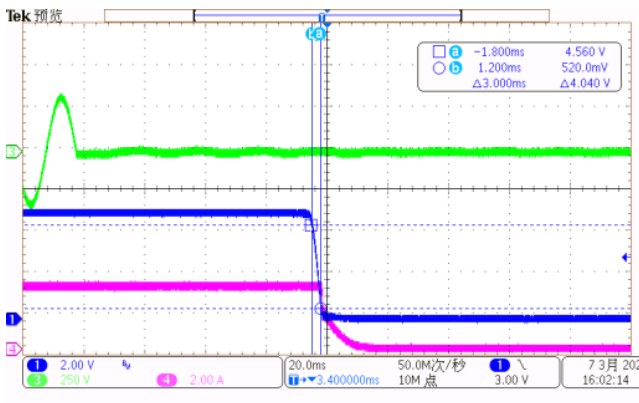
Test Condition: 115Vac/60Hz Input, 12V/1.67A Output



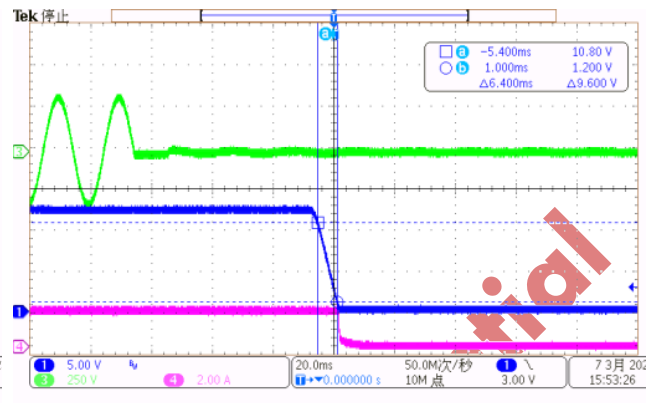
(CH1-Vo, CH3-Vinac, CH4-Io)
Comments: Fall Time=6.8ms

Test Condition: 230Vac/50Hz Input, 5V/3A Output

Test Condition: 230Vac/50Hz Input, 12V/1.67A Output



(CH1-Vo, CH3-Vinac, CH4-Io)
Comments: Comments: Fall Time=3ms



(CH1-Vo, CH3-Vinac, CH4-Io)
Comments: Comments: Fall Time=6.4ms

3 Protection Test

3.1 Short Circuit Protection

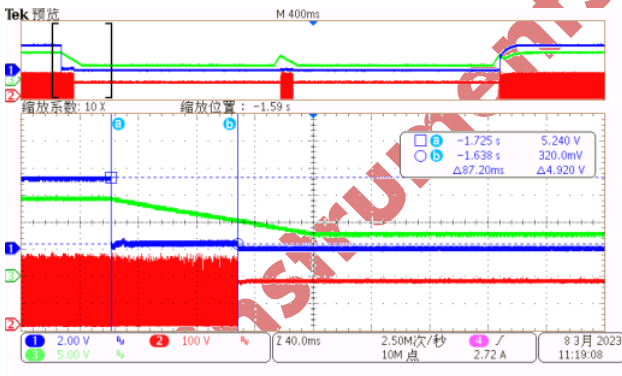
Standard: The power supply must shut down in the event of short-circuit condition and automatically return to normal operating condition once the fault condition has been removed.

Result: Pass

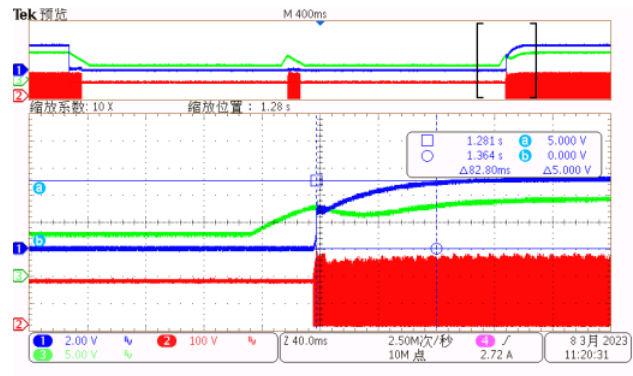
Note: The short circuit protection tested at the output cap end.

Waveforms:

Test Condition: 115Vac/60Hz Input, 5V3A Output Short

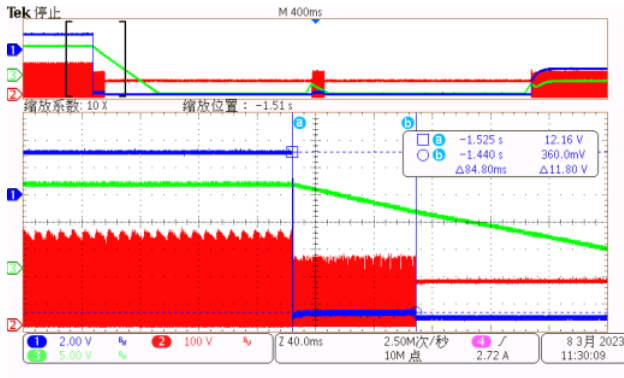


(CH1-Vo, CH2-VDrain, CH3-VDD)
Comments: Protection Enter

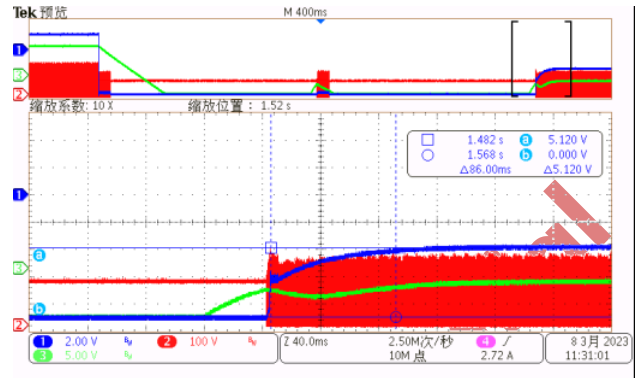


(CH1-Vo, CH2-VDrain, CH3-VDD)
Comments: Recover to 5V

Test Condition: 115Vac/60Hz Input, 12V1.67A Output Short

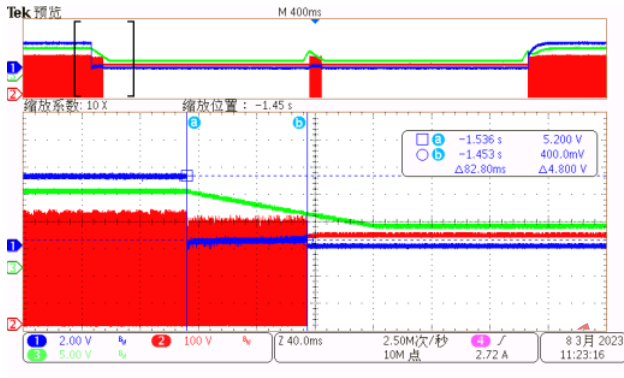


(CH1-Vo, CH2-VDrain, CH3-VDL)
Comments: Protection Enter

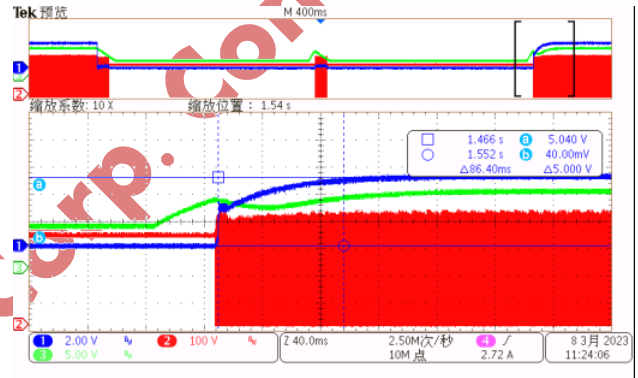


(CH1-Vo, CH2-VDrain, CH3-VDD)
Comments: Recover to 5V

Test Condition: 230Vac/50Hz Input, 5V3A Output short



(CH1-Vo, CH2-VDrain, CH3-VDD)
Comments: Protection Enter

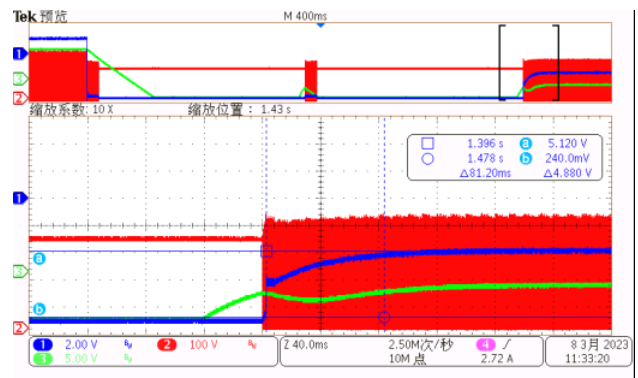


(CH1-Vo, CH2-VDrain, CH3-VDD)
Comments: Recover to 5V

Test Condition: 230Vac/50Hz Input, 12V1.67A Output short



(CH1-Vo, CH2-VDrain, CH3-VDD)
Comments: Protection Enter



(CH1-Vo, CH2-VDrain, CH3-VDD)
Comments: Recover to 5V

3.2 Over Current Protection

Standard: The overload current should be larger than 110% of full load current and meet LPS requirements.

Result: Pass

Note: Tested at the output cap end.

Test Data:

Input Voltage	OCP (A)		
	5V	9V	12V
90Vac/60Hz	3.78	2.9	2.15
115Vac/60Hz	3.85	2.89	2.15
230Vac/50Hz	3.82	2.81	2.15
265Vac/50Hz	3.84	2.9	2.2

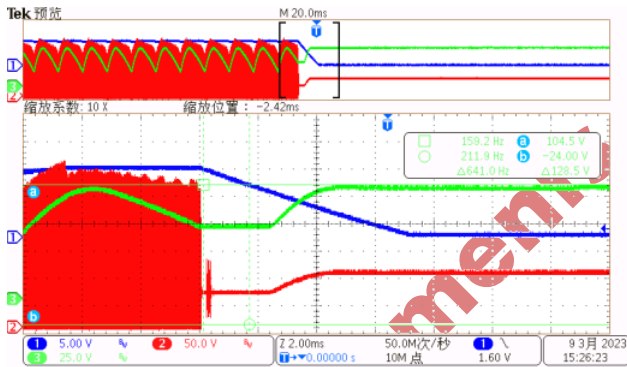
3.3 Input Brown-out Protection

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.

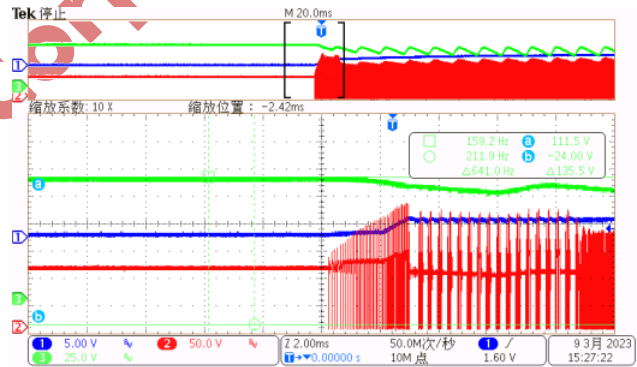
Result: Pass

Waveforms:

Test Condition: 90Vac/60Hz Input, 12V1.67A Output, Slowly Adjust the Input



(CH1-Vo, CH2-VDrain, CH3-VBus)
Comments: 101.2Vdc (70Vac) Protection Enter



(CH1-Vo, CH2-VDrain, CH3-VBus)
Comments: 111.6Vdc (79Vac) Protection Recovery

3.4 Output Over Voltage Protection

Standard: $V_{o_OVP} < 1.5 * V_{o_max}$.

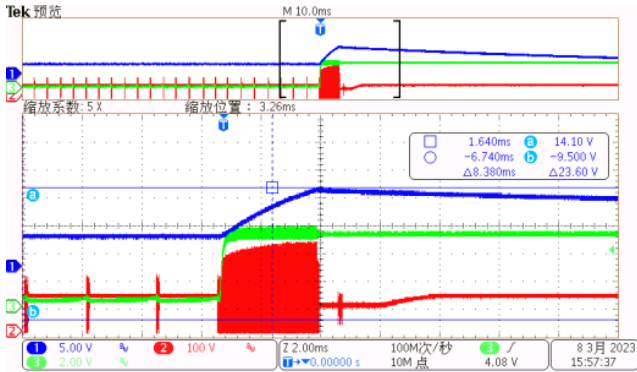
Result: Pass

Test Data:

Vin(Vac)	Vo_OVP (V)		Result
	5V/0A	12V/1.67A	
90Vac/60Hz	14.1	14.1	Pass
265Vac/50Hz	14.3	14	

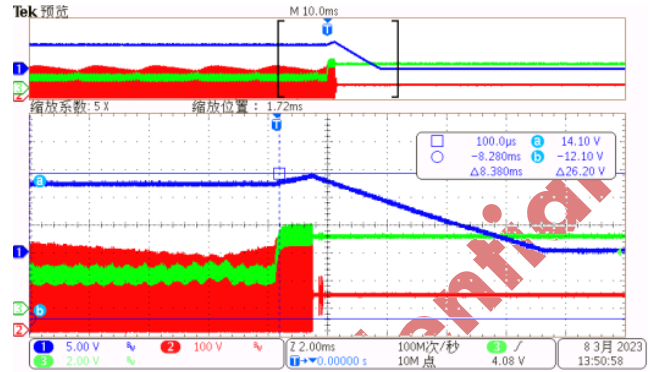
Waveforms:

Test Condition: 90Vac/60Hz Input, 5V/0A Output



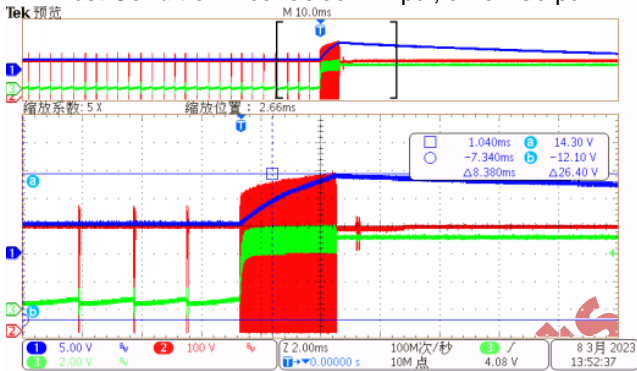
(CH1-Vo, CH2-VDrain, CH3-VFB)
Comments: Vo_OVP=14.1V

Test Condition: 90Vac/60Hz Input, 12V/1.67A Output



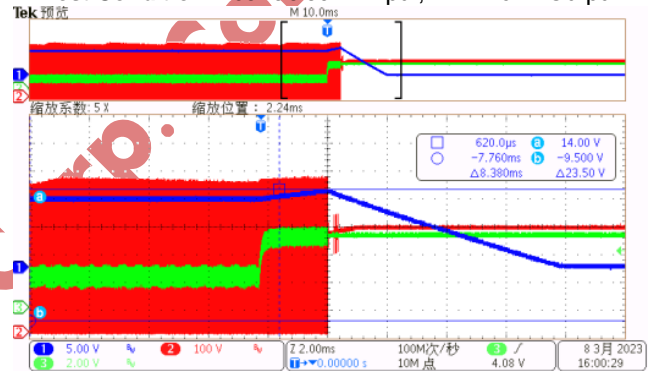
(CH1-Vo, CH2-VDrain, CH3-VFB)
Comments: Vo_OVP=14.1V

Test Condition: 265Vac/50Hz Input, 5V/0A Output



(CH1-Vo, CH2-VDrain, CH3-VFB)
Comments: Vo_OVP=14.3V

Test Condition: 265Vac/50Hz Input, 12V/1.67A Output



(CH1-Vo, CH2-VDrain, CH3-VFB)
Comments: Vo_OVP=14V

4 Reliability Requirements

4.1 Device Maximum Rating Test

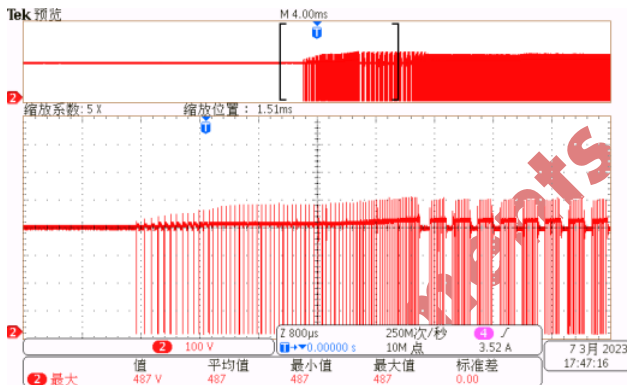
Standard: MOSFET and Diode < 95% Rating.

Result: Pass

Component		265Vac/50Hz				Rating	Result
		5V/0A	12V/0A	5V/3A	12V/1.67A		
KP22305LWG	Startup	487V	/	487V	/	650V	Pass
	Steady	/	527V	/	555V	650V	Pass
	Short	/	527V	/	539V	650V	Pass
KP41261SG	Startup	39.4V	/	39.4V	/	60V	Pass
	Steady	/	47.8V	/	48.2V	60V	Pass
	Short	/	48.6V	/	48.6V	60V	Pass

Waveforms:

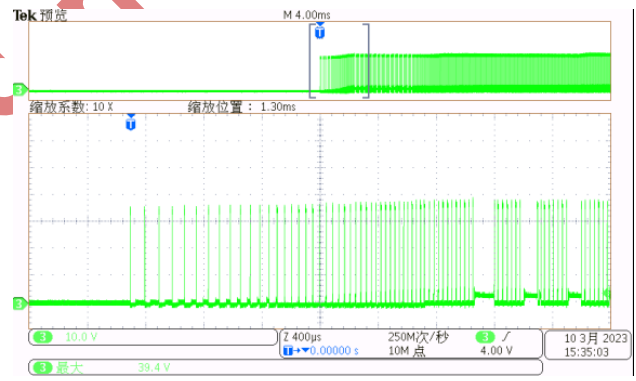
Test Condition: 265Vac/50Hz Input, 5V3A Output, Startup



(CH2-VDrain)

Comments: VDrain_peak=487V

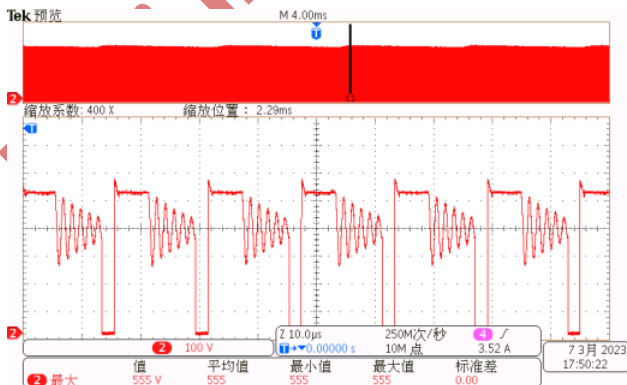
Test Condition: 265Vac/50Hz Input, 5V3A Output, Startup



(CH3-VSR)

Comments: VSR_peak=39.4V

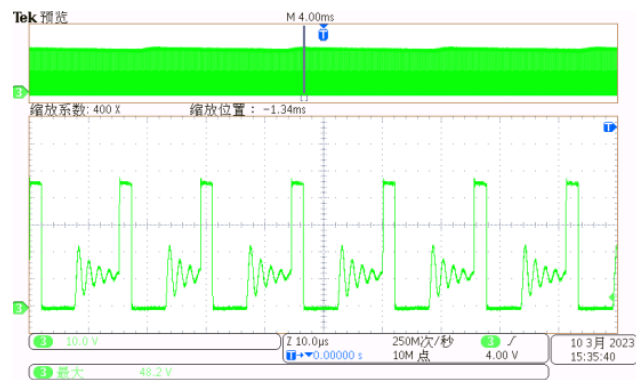
Test Condition: 265Vac/50Hz Input, 12V1.67A Output, Steady



(CH2-VDrain)

Comments: VDrain_peak=555V

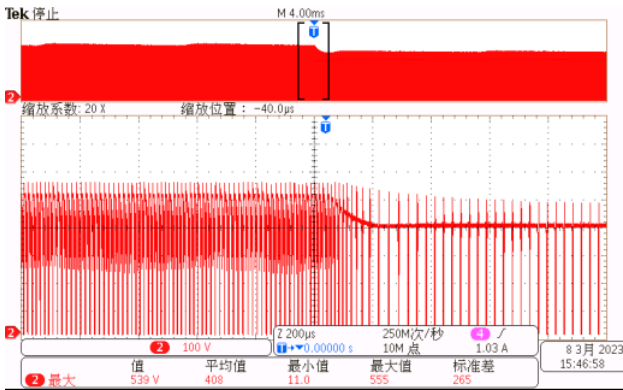
Test Condition: 265Vac/50Hz Input, 12V1.67A Output, Steady



(CH3-VSR)

Comments: VSR_peak=48.2V

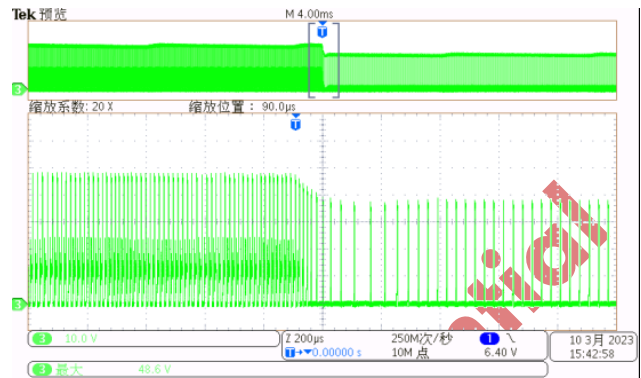
Test Condition: 265Vac/50Hz Input, 12V1.67A Output, Short



(CH2-VDrain)

Comments: VDrain_peak=539V

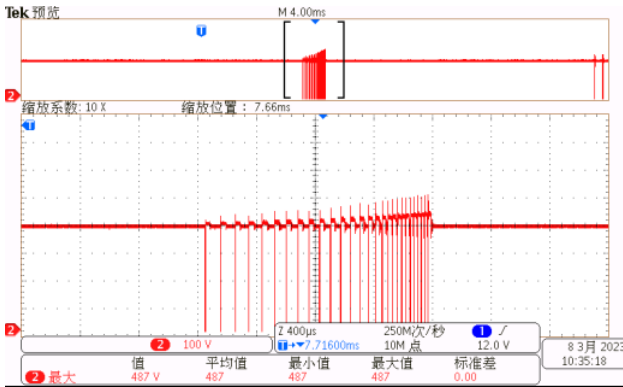
Test Condition: 265Vac/50Hz Input, 12V1.67A Output, Short



(CH3-VSR)

Comments: VSR_peak=48.6V

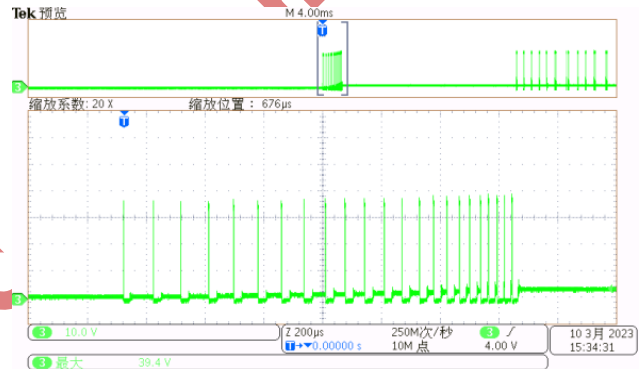
Test Condition: 265Vac/50Hz Input, 5V0A Output, Startup



(CH2-VDrain)

Comments: VDrain_peak=487V

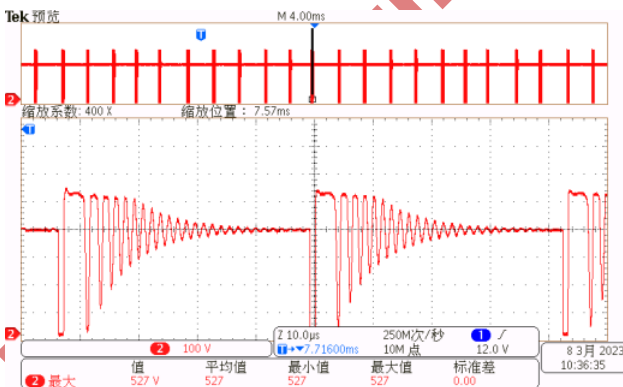
Test Condition: 265Vac/50Hz Input, 5V0A Output, Startup



(CH3-VSR)

Comments: VSR_peak=39.4V

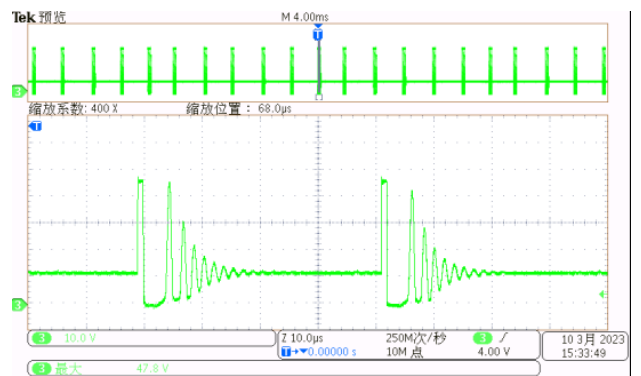
Test Condition: 265Vac/50Hz Input, 12V0A Output, Steady



(CH2-VDrain)

Comments: VDrain_peak=527V

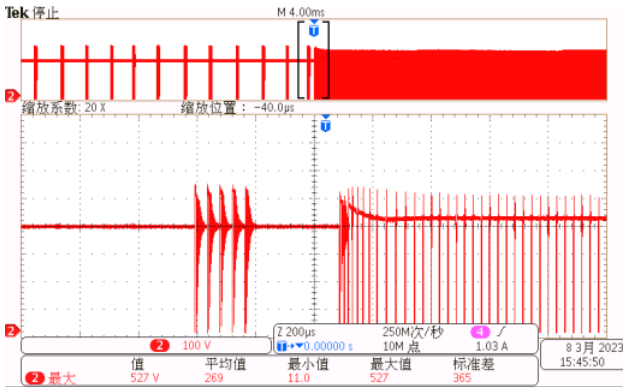
Test Condition: 265Vac/50Hz Input, 12V0A Output, Steady



(CH3-VSR)

Comments: VSR_peak=47.8V

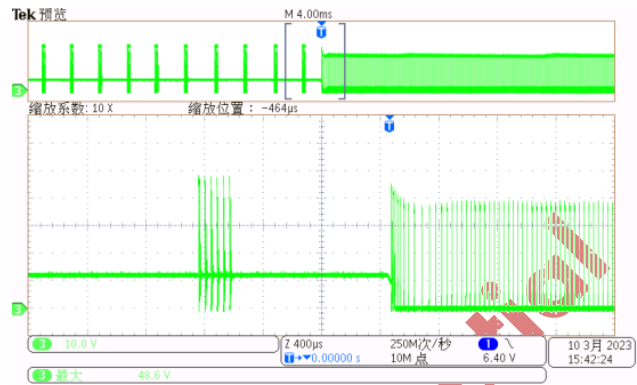
Test Condition: 265Vac/50Hz Input, 12V0A Output, Short



(CH2-VDrain)

Comments: VDrain_peak=527V

Test Condition: 265Vac/50Hz Input, 12V0A Output, Short



(CH3-VSR)

Comments: VSR_peak=48.6V

4.2 Bmax Test

Standard: Steady-state rated load: $B_{max} \leq 0.32T$;

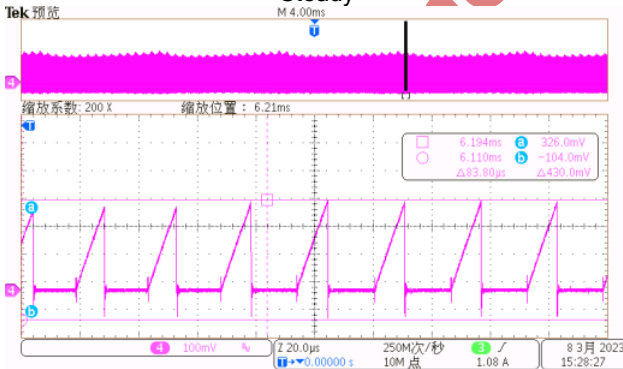
Result: Pass

Note: The turn numbers of the transform is 66, and the sectional area is 48mm², Lp is 850μH, Rcs=0.3R.

Bmax (T)	90Vac/60Hz			Bmax Limit (T)	Result
	5V	9V	12V		
Steady	0.291	0.307	0.28	0.32T	Pass

Waveforms:

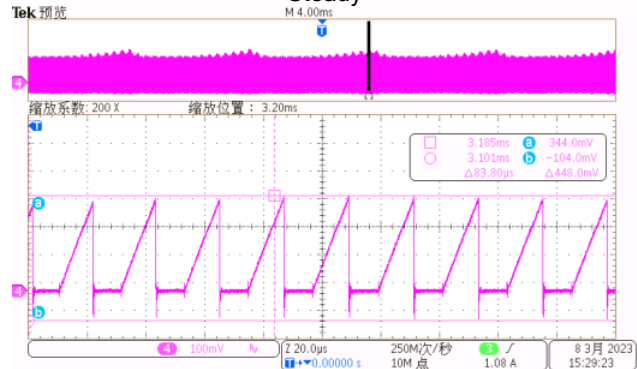
Test Condition: 90Vac/60Hz Input, 5V/3A Output, Steady



(CH4-Vcs)

Comments: Vcs=326mV, Rcs=0.3R, Ics=1.086A

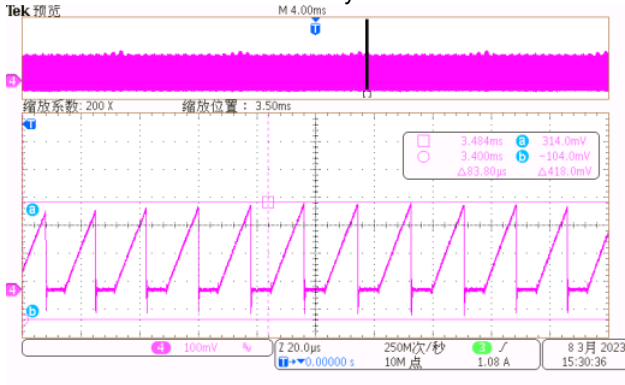
Test Condition: 90Vac/60Hz Input, 9V2.22A Output, Steady



(CH4-Vcs)

Comments: Vcs=344mV, Rcs=0.3R, Ics=1.146A

Test Condition: 90Vac/60Hz Input, 12V1.67A Output, Steady



(CH4-Vcs)

Comments: Vcs=314mV, Rcs=0.3R, Ics=1.046A

4.3 Thermal Test

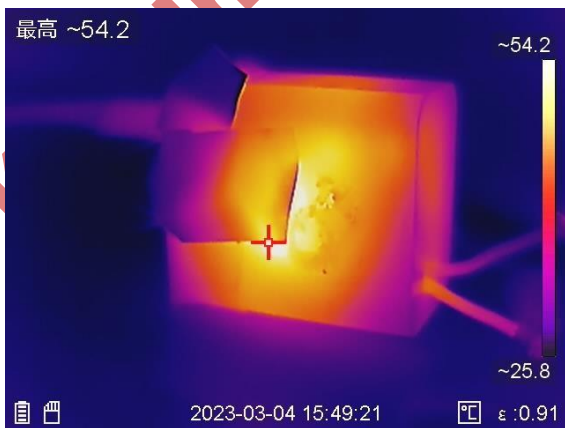
Test Condition: 90Vac/60Hz, 265Vac/50Hz input; 5V/3A, 12V/1.67A output; Demo board in an Incubator, Burn-in until the temperature is stable @ 25°C ambience without airflow.

Standard: MOS, IC and Diode: Trise <90°C. Transformer: Trise <85°C. Nylon box: T <77°C.

Result: Pass

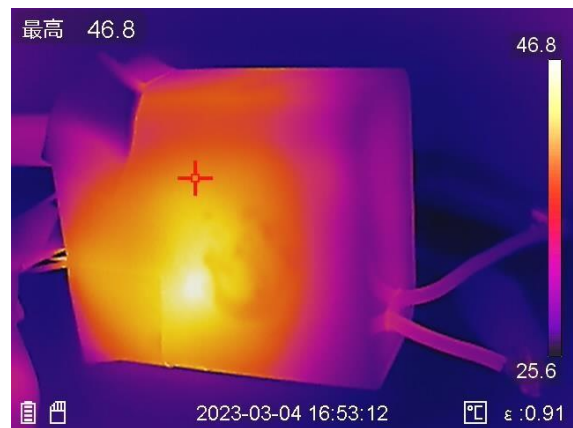
Location	Temp in Box @ 25°C Ambience							
	90V/60Hz				265V/50Hz			
	5V/3A		12V/1.67A		5V/3A		12V/1.67A	
	T (°C)	Trise (°C)	T (°C)	Trise (°C)	T (°C)	Trise (°C)	T (°C)	Trise (°C)
KP22305LWG	98.1	73.1	105.9	80.9	81.8	56.8	79.1	54.1
KP41261SG	78.1	53.1	65.3	40.3	76.1	51.1	62.8	37.8
Bridge	83.8	58.8	93.3	68.3	57.6	22.6	59.8	34.8
Transformer	82.3	57.3	79.8	54.8	73.9	48.9	67	42

Test Condition: 90Vac/60Hz Input, 12V/1.67A Output



Comments: T_Box=54.4°C

Test Condition: 265Vac/50Hz Input, 12V/1.67A Output



Comments: T_Box=46.8°C

5 EMC/EMS Test Result

5.1 Conducted and Radiation Emissions

Standard:

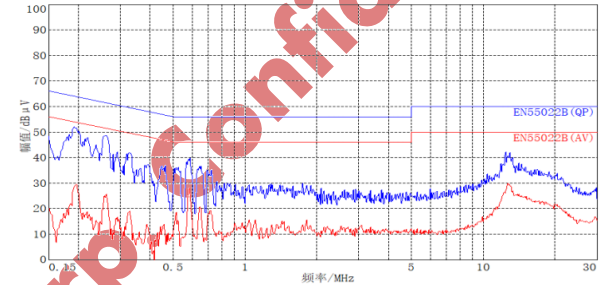
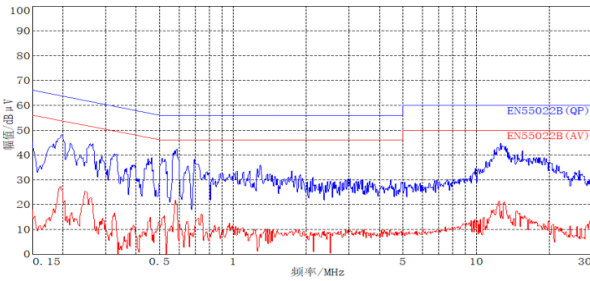
Standard	EN55022B/EN55032B
Content	CE & RE
Requirement	6dB Margin

Result: Pass

Note: Tested at the 1m Line end.

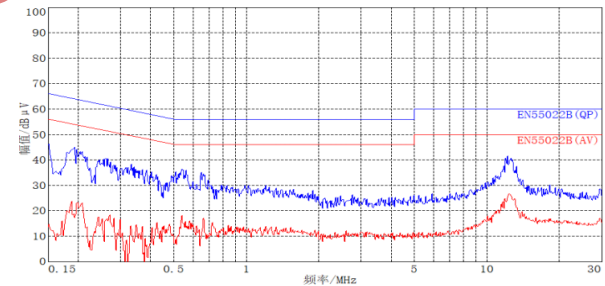
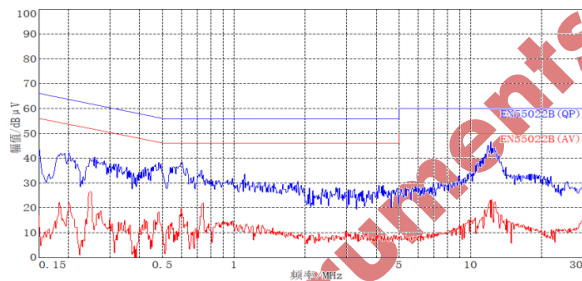
Test Condition: 220Vac/50Hz-L Input, 12V/1.67A Output

Test Condition: 220Vac/50Hz-N Input, 12V/1.67A Output



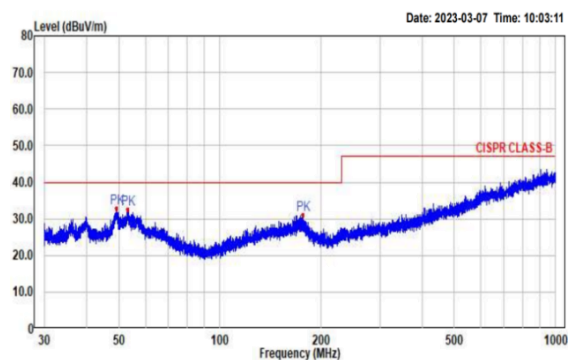
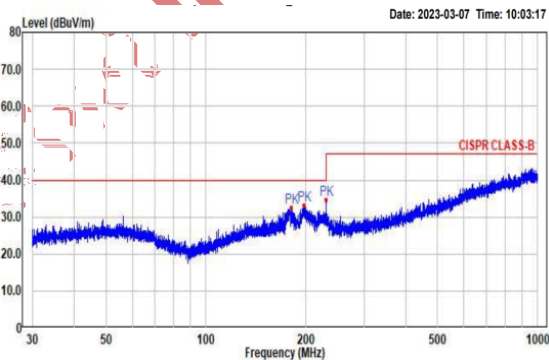
Test Condition: 110Vac/60Hz-L Input, 12V/1.67A Output

Test Condition: 110Vac/60Hz-N Input, 12V/1.67A Output

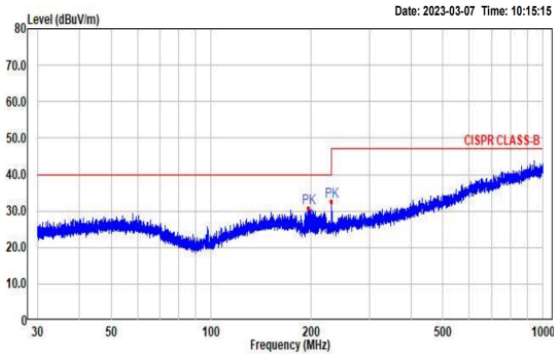


Test Condition: 220Vac/50Hz Input, 12V/1.67A Output, Horizontal

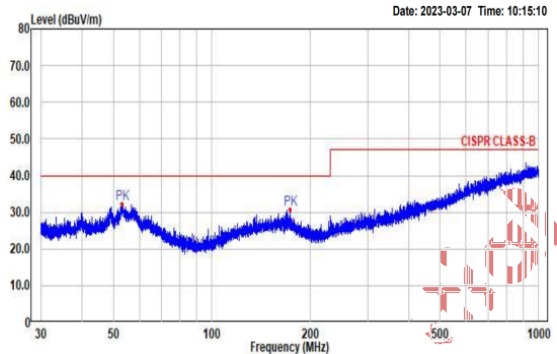
Test Condition: 220Vac/50Hz Input, 12V/1.67A Output, Vertical



Test Condition: 110Vac/60Hz Input, 12V/1.67A Output, Horizontal



Test Condition: 110Vac/60Hz Input, 12V/1.67A Output, Vertical



5.2 Surge Test

Test Condition: Input 220Vac/50Hz, output 12V/1.67A. Surge testing is completed according to IEC61000-4-5 each injection phase below is tested with 5 times and hold for 60 seconds before next one.

Standard: Level3, common mode voltage 2kV, difference mode voltage 1kV.

Result: Pass

Injection Location	Surge Level(V)	Injection Phase (°)	Test Result (Pass/Fail)
L to N	+1500	0	Pass
	+1500	90	Pass
	+1500	180	Pass
	+1500	270	Pass
	-1500	0	Pass
	-1500	90	Pass
	-1500	180	Pass
	-1500	270	Pass
L+N to PE	+2500	0	Pass
	+2500	90	Pass
	+2500	180	Pass
	+2500	270	Pass
	-2500	0	Pass
	-2500	90	Pass
	-2500	180	Pass
	-2500	270	Pass



5.3 ESD Test

Test Condition: Input 220Vac/50Hz, output 12V/1.67A. Discharge 10 times on each output terminals at each test voltage according to IEC61000-4-2.

Standard: Level4, air discharge 15kV, contact discharge 8kV.

Result: Pass

Air Discharge		Contact Discharge	
Test Voltage(kV)	Result	Test Voltage(kV)	Result
20	Pass	20	Pass
-20	Pass	-20	Pass

Kiwi Instruments Corp. Confidential

Disclaimer

Kiwi reserves the right to make any change to its product, datasheet or specification without any notice. Users shall obtain the latest information before placing an order. Kiwi herein makes no guarantee or warranty, expressed or implied, including without limitation the warranties of merchantability, fitness for any purpose or non-infringement of third party rights, nor does Kiwi convey any license or permission including without limitation the intellectual property rights of Kiwi or any third party. Users should warrant that third party intellectual property right or other right is not infringed when integrating Kiwi products into any application or in use. Kiwi will not assume any liability arising from any said application or use, and especially disclaim any liability including without limitation any consequential or incidental damage. Without written declaration, Kiwi products are not designed for use in surgical device implant into the body or other life sustain systems. This disclaimer supersedes the disclaimers in previous versions.