



DEMO BOARD TEST REPORT

65W High Performance PD3.0 Charger with Power Switch KP22066 and Synchronous Rectifier KP4060

FEATURES

- KP22066 Integrated with 650V GAN FET
- High System Frequency and Power Density with Quasi-Resonant Control
- High Average Efficiency Pass DoE 6
- 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

KP22066 is a high performance quasi-resonant current mode power switch for flyback converter, which integrates a 650V GAN FET and turn on speed adjustment function. The KP22066 can adaptively work in green mode, burst mode and QR mode, which can make it easy to pass DoE 6 standard.

KP4060 is a high performance secondary side synchronous rectifier controller, which supports DCM, QR CCM operation mode.

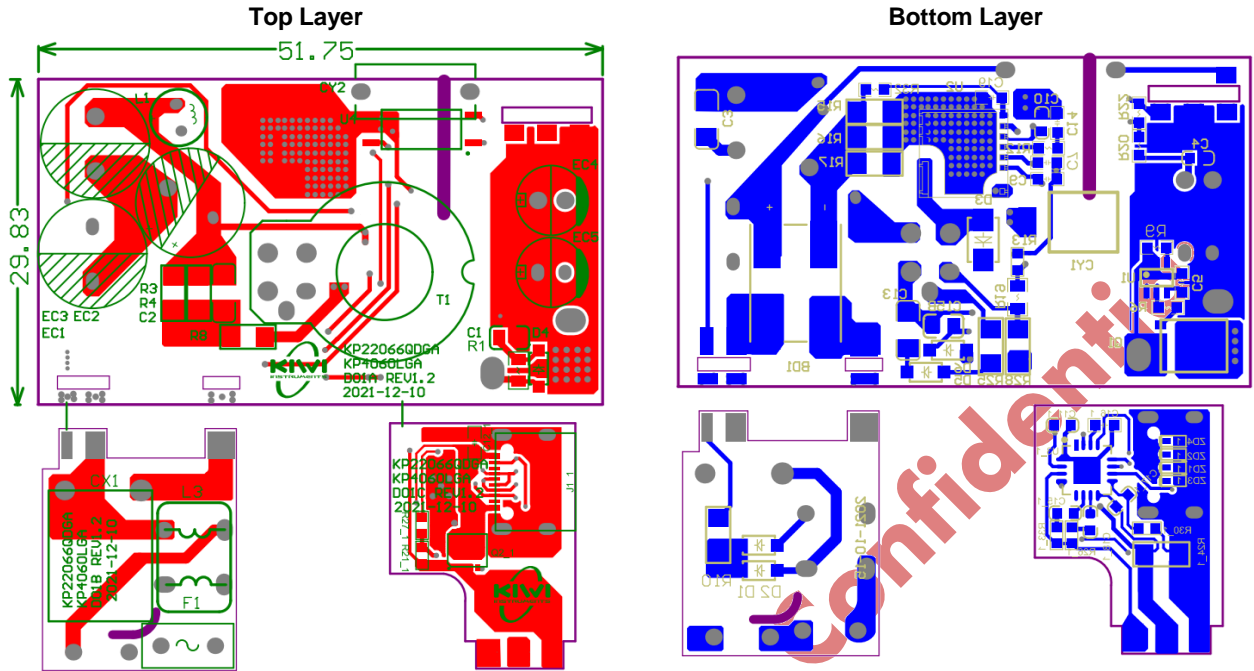
The demo board of KP22066+KP4060-D01 is typically designed for 65W PD3.0 charger with universal input (90-265Vac, 50/60Hz). The demo board can achieve high efficiency, low standby power loss and meet the EN55022B EMI standard.

DEMO BOARD SEPCIFICATION

Description	Symbol	Min	Type	Max	Unit	Note	
Input Voltage	V _{in}	90		265	Vac	50/60Hz	
Output	V _{out} /I _{out}	5V/9V/12V/15V3A; 20V3.25A					
Rate Output Power	P _{out}		65		W		
Ripple & Noise	V _{ripple}			136	mVp-p	Cable end, 20MHz bandwidth	
Maximum Full Load Efficiency	η	>93.5			%	Board end @115V/230Vac	
Standby Power Consumption	P _{st}			29	mW	@265Vac	
Startup Time	T _{st}			82.6	ms	Tested at 90Vac/60Hz	
Conducted EMI Margin	CE		6		dB	EN55022 class B	
Radiated EMI Margin	RE		6		dB	EN55015 CDN	
Surge Test (Different/Common)			±1.5/2.5		kV	Differential mode @ 230Vac/50Hz	
ESD (Contact/Air Discharge)	ESD		±18/20		kV	On max output terminal	
Operating Ambient	T _a	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.

Printed Circuit Board Layout



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Kiwi Instruments Corp.



Bill of Material

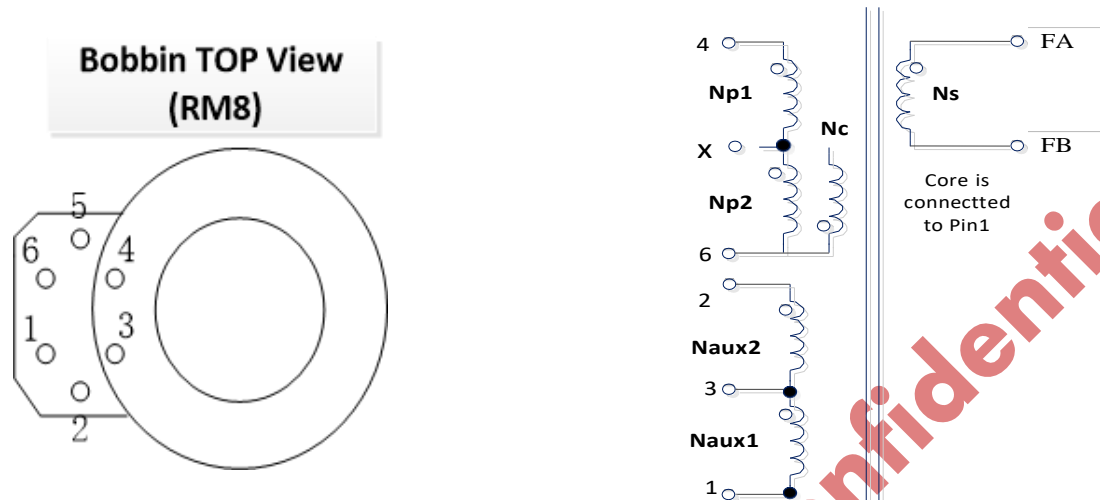
No.	Designator	Value	Description	Package	Manufacturer	Part Number
1	CN1	TYPE-C	TYPE-C female 16P	TYPE-C-16P	Kinghelm	KH-TYPE-C-16P
2	F1	3.15A/250Vac	Fuse 3.15A 250Vac 4*8	DIP	CONQUER	MST2.5A 250V
3	L1	33μH	Inductor 33uH 0.1Ω 6*8 P3.0 +/-10%	6*8 P3	Any	
4	L3	150μH	Common Mode inductor	T9*5*3	Any	
5	U1	KP4060	high-performance secondary side synchronous rectifier controller	SOT23-6	Kiwi Instruments	KP4060LGA
6	U2	KP22066	High-performance Multi-Mode PWM Controller	DFN8X8-8L	Kiwi Instruments	KP22066QDGA
7	U3	HUSB350	USB Type-C and PD Source Controller	QFN16	HyneteK	HUSB350A
8	U4	EL1019	PHOTO TR 60mA 80V SOP-4L-4P 200%-400% SMD	SOP-4L-4P	Everlight	EL1019(TA)-VG
9	Q1	79A/100V	MOSFET 79A 100V PG-TDSON-8 SMD	PG-TDSON-8	Infineon	BSC0805LS
10	Q2	-45A/-30V	MOSFET -45A -30V PDFN3333 SMD	PDFN3333	CWT	CWT3122A
11	BD1	6A/1kV	DIO BRD 6A 1kV LSB SMD	LSB	World	WRLSB60M
12	D1,D2,D5,D6	1A/1kV	DIO FRD 1A 1kV SOD123 SMD	SOD123	DIYI	FFM107-M
13	D3	1A/1kV	DIO SI 1A 1kV SMA SMD	SMA	MDD	M7
14	D4	0.2A/200V	DIO SI 0.2A 200V SOD123 SMD	SOD123	CJ	BAV21WT3
15	ZD1,ZD2,ZD3,ZD4	5V	DIO TVS 5V SOD523 SMD	SOD523	Takcheong	ESD5Z5.0VC
16	R1	5Ω	RES SMD 1/8W, 5%, 0805	0805	Any	
17	R3,R4	510kΩ	RES SMD 1/4W, 5%, 1206	1206	Any	
18	R6	0Ω	RES SMD 1/10W, 5%, 0603	0603	Any	
19	R8,R28	22Ω	RES SMD 1/4W, 5%, 1206	1206	Any	
20	R9	51kΩ	RES SMD 1/10W, 5%, 0603	0603	Any	
21	R10	22kΩ	RES SMD 1/4W, 5%, 1206	1206	Any	
22	R11	51kΩ	RES SMD 1/4W, 5%, 1206	1206	Any	
23	R12	300Ω	RES SMD 1/10W, 5%, 0603	0603	Any	
24	R13	24kΩ	RES SMD 1/10W, 5%, 0603	0603	Any	
25	R15,R16	1.1Ω	RES SMD 1/4W, 1%, 1206	1206	Any	
26	R17	0.3Ω	RES SMD 1/4W, 1%, 1206	1206	Any	
27	R19	130kΩ	RES SMD 1/8W, 5%, 0805	0805	Any	
28	R20	3kΩ	RES SMD 1/10W, 5%, 0603	0603	Any	
29	R21	100kΩ	RES SMD 1/10W, 5% 0603	0603	Any	
30	R22,R33	4.7kΩ	RES SMD 1/10W, 5%, 0603	0603	Any	
31	R24	5mΩ	RES SMD 1/4W, 1%, 1206	1206	Any	
32	R25	1Ω	RES SMD 1/4W, 5%, 1206	1206	Any	
33	R26	1kΩ	RES SMD 1/10W, 5%, 0603	0603	Any	
34	R27	10kΩ	RES SMD 1/10W, 5%, 0603	0603	Any	
35	R30	510Ω	RES SMD 1/10W, 5%, 0603	0603	Any	
36	R32	1.2kΩ	RES SMD 1/10W, 5%, 0603	0603	Any	
37	EC1,EC2,EC3	33μF	ELE CAP 400V 33μF M 10*18 P5 105°C	10*18 P5	Yongming	



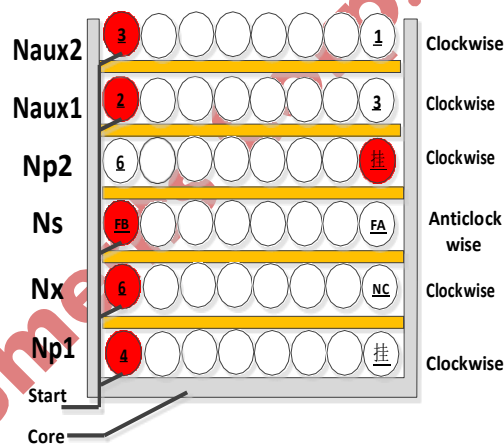
38	EC4,EC5	470 μ F	SOLID CAP 25V 470 μ F M 6.3*12 P3 105 $^{\circ}$ C	6.3*12 P3	Yongming	
39	C1	2.2nF	Ceramic CAP, 200V, X7R 0805	0805	Any	
40	C2	1nF	Ceramic CAP, 1kV, X7R 1206	1206	Any	
41	C3	10nF	Ceramic CAP, 1kV, X7R 1206	1206	Any	
42	C4	100nF	Ceramic CAP, 50V, X7R 0603	0603	Any	
43	C5,C16,C17,C12	1 μ F	Ceramic CAP, 25V, X7R 0603	0603	Any	
44	C7	1 μ F	Ceramic CAP, 50V, X7R 0603	0603	Any	
45	C9	470nF	Ceramic CAP, 100V, X7R 0805	0805	Any	
46	C10	100pF	Ceramic CAP, 25V, X7R 0603	0603	Any	
47	C11	4.7 μ F	Ceramic CAP, 25V, X7R 0603	0603	Any	
48	C13	10 μ F	Ceramic CAP, 100V, X7R 1206	1206	Any	
49	C14	100nF	Ceramic CAP, 25V, X7R 0603	0603	Any	
50	C15	22nF	Ceramic CAP, 25V, X7R 0603	0603	Any	
51	C15B	10 μ F	Ceramic CAP, 50V, X7R 0805	0805	Any	
52	C18	470nF	Ceramic CAP, 25V, X7R 0603	0603	Any	
53	C19	10pF	Ceramic CAP, 25V, X7R 0603	0603	Any	
54	CX1	220nF	X2 CAP, 310V, P7.5	P7.5	JIERONG	K224K310 VP7.5L3.5
55	CY1	680pF	Y1 CAP, 400V, SMD	SMD	TRX	MY1681K
56	CY2	470pF	Y1 CAP, 400V, P10	P10	STE	Q09B2D4 71KA5B0 S0N0
57	T1	RM8	RM8-6P-0P 175 μ H			

Transformer Manufacture Guide

1 Electrical Diagram



2 Winding Diagram



3 Winding Order

Number	Winding	Layer	Start	End	Wire Size(mm)	Turns	Note
1	Np1	Primary	Pin4	Pin 挂	0.15*9P	13Ts	Dense
2	Nx	Shield	Pin6	NC	0.12*2P	13Ts	Smooth Wound
3	Ns	Secondary	FB	FA	0.05*600P	4Ts	
4	Np2	Primary	Pin 挂	Pin6	0.15*9P	12Ts	Dense
5	Naux1	Auxiliary	Pin2	Pin3	0.2*2P	9Ts	Smooth Wound
6	Naux2	Auxiliary	Pin3	Pin1	0.2*2P	4Ts	Smooth Wound

**4 Electrical Specification**

Items	Test Pin	Specification	Test Condition
Primary Inductance	Pins 4 - 6; other windings open	175 μ H (\pm 5%)	Ta=25 $^{\circ}$ C 40kHz/1V _{rm}
Leakage Inductance	Pins 4- 6; all other windings shorted	4 μ H Max	Ta=25 $^{\circ}$ C 40kHz/1V _{rm}
Turn Ratio	N _p (4-6): N _s : N _{aux1} : N _{aux2}	25Ts: 4Ts: 9Ts: 4Ts	20kHz/1V
HI-POT HV Test	Primary to Secondary	3750 Vac	5mA, 1Min
	Pin6-1	1000 Vac	5mA, 1Min
	S-Aux	3750 Vac	5mA, 1Min
Insulation Resistance	P-A	> 100 M Ω	DC500V
DC Resistance	Pins 4 - 6	0.2R Max	

5 BOM

Number	Materials	Specifications
1	Core	RM8, PC96, AE=64
2	Bobbin	RM8, 6+0 Pin
3	Wire	Φ 0.12*2, 2UEW, Litz
4	Wire	Φ 0.2*2, 2UEW, Litz
5	Wire	Φ 0.15*9, 2UEW, Litz
6	Triple Insulation Wire	Φ 0.05*600, TIW-B, Litz
7	Duct tape	W=10mm, 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	1.284	2A	PASS

1.2 Inrush Current (Cold Start)

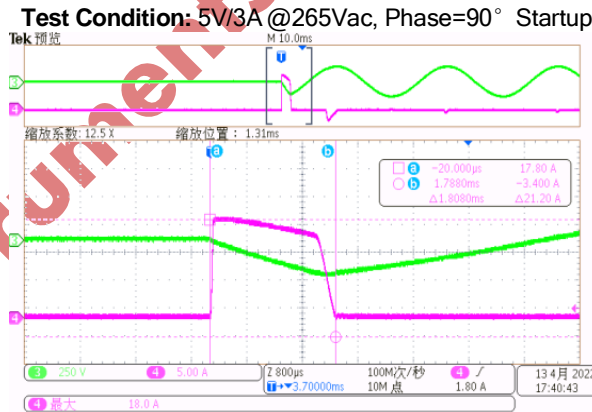
Standard: 30A max@ 265Vac input.

Result: Pass

Note: Tested @ 5V/3A

Vin (ac)	Inrush(A)	lin_max limit(A)	Result
265V	17.8	30A	PASS

Waveforms:



(CH3-Vinac, CH4-lin)

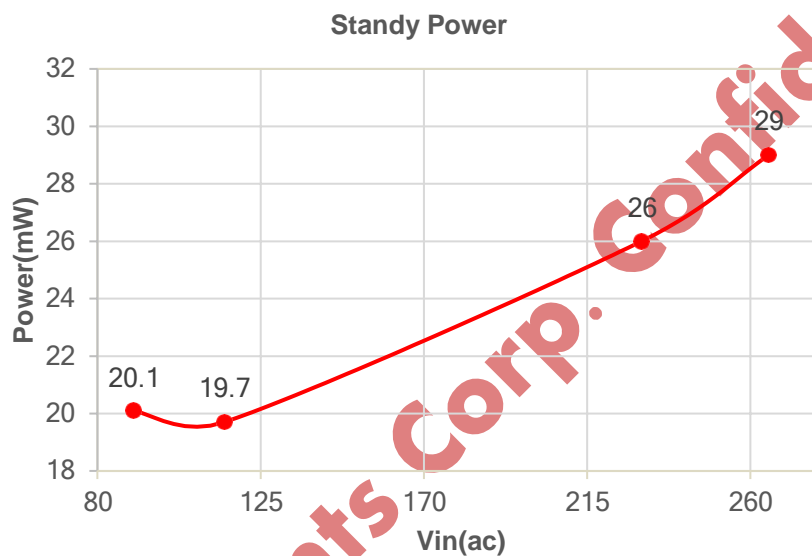
Comments: Startup Normally

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 75mW.

Result: Pass

Vin (ac)	90V	115V	230V	265V	Green mode limit(mW)	Result
Pin(mW)	20.1	19.7	26	29	75mW	PASS



1.4 Efficiency

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

Result: Pass

Test Data:

Output	Average Eff (%)					Result
	90Vac	115Vac	230Vac	265Vac	DoE 6	
20V	92.63	93.06	91.72	91.46	88	PASS
15V	92.89	93.06	91.86	91.01	87.73	PASS
12V	92.84	93.10	91.36	90.41	87.4	PASS
9V	92.74	92.92	90.67	89.35	86.62	PASS
5V	92.10	91.96	89.34	88.05	81.39	PASS



Efficiency (20V/3.25A):

Vin (Vac)	Fline(Hz)	Pin(W)	Vout(V)	Iout(A)	Pout(W)	Eff (%)	Eff_AVG(%)	DoE 6(%)
90	60	71.25	20.149	3.268	65.846	92.42	92.63	88
		53.04	20.138	2.455	49.438	93.21		
		35.45	20.094	1.64	32.954	92.96		
		18.04	20.05	0.827	16.581	91.91		
115		70.4	20.175	3.268	65.931	93.65	93.06	
		52.79	20.135	2.455	49.431	93.64		
		35.35	20.103	1.64	32.968	93.26		
		18.09	20.053	0.827	16.583	91.67		
230	50	70.59	20.184	3.268	65.961	93.44	91.72	
		53.22	20.143	2.455	49.451	92.92		
		35.8	20.091	1.64	32.949	92.04		
		18.72	20.049	0.826	16.560	88.46		
265		71.08	20.176	3.268	65.935	92.76	91.46	
		53.45	20.122	2.455	49.399	92.42		
		36.15	20.088	1.64	32.944	91.13		
		18.48	20.03	0.826	16.544	89.53		

Efficiency (15V/3A):

Vin (Vac)	Fline(Hz)	Pin(W)	Vout(V)	Iout(A)	Pout(W)	Eff (%)	Eff_AVG(%)	DoE 6(%)
90	60	49.33	15.234	3.017	45.960	93.17	92.89	87.73
		36.85	15.18	2.266	34.397	93.35		
		24.57	15.116	1.514	22.885	93.14		
		12.5	15.053	0.763	11.485	91.88		
115		49	15.246	3.017	45.997	93.87	93.06	
		36.71	15.183	2.266	34.404	93.72		
		24.54	15.118	1.514	22.888	93.27		
		12.57	15.054	0.763	11.486	91.38		
230	50	49.42	15.24	3.017	45.979	93.04	91.86	
		37.21	15.179	2.266	34.395	92.44		
		25.02	15.115	1.514	22.884	91.46		
		12.69	15.051	0.763	11.483	90.50		
265		49.79	15.233	3.017	45.957	92.30	91.01	
		37.4	15.17	2.266	34.375	91.91		
		25.34	15.116	1.514	22.885	90.31		
		12.83	15.048	0.763	11.481	89.49		



Efficiency (12V/3A):

Vin (Vac)	Fline(Hz)	Pin(W)	Vout(V)	Iout(A)	Pout(W)	Eff (%)	Eff_AVG(%)	DoE 6(%)
90	60	39.81	12.269	3.016	37.003	92.95	92.84	87.4
		29.68	12.208	2.266	27.663	93.21		
		19.75	12.14	1.513	18.367	93.00		
		9.97	12.066	0.762	9.194	92.22		
115		39.59	12.283	3.016	37.045	93.57	93.1	
		29.59	12.214	2.265	27.664	93.49		
		19.74	12.144	1.513	18.373	93.08		
		9.97	12.068	0.762	9.195	92.23		
230	50	39.93	12.279	3.016	37.033	92.75	91.36	
		30.14	12.216	2.265	27.662	91.80		
		20.28	12.146	1.513	18.376	90.62		
		10.19	12.071	0.762	9.198	90.27		
265		40.24	12.278	3.016	37.030	92.02	90.41	
		30.35	12.213	2.266	27.674	91.19		
		20.6	12.146	1.513	18.376	89.21		
		10.31	12.07	0.762	9.197	89.21		

Efficiency (9V/3A):

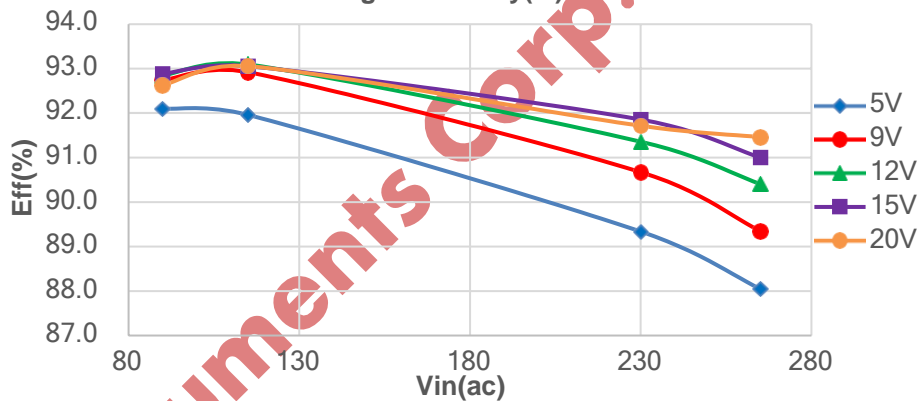
Vin (Vac)	Fline(Hz)	Pin(W)	Vout(V)	Iout(A)	Pout(W)	Eff (%)	Eff_AVG(%)	DoE 6(%)
90	60	30.24	9.295	3.016	28.033	30.24	92.74	86.62
		22.44	9.222	2.265	20.887	22.44		
		14.9	9.147	1.513	13.839	14.9		
		7.49	9.071	0.762	6.912	7.49		
115		30.03	9.299	3.015	28.036	93.36	92.92	
		22.4	9.223	2.265	20.890	93.26		
		14.92	9.147	1.513	13.839	92.76		
		7.49	9.073	0.762	6.913	92.30		
230	50	30.45	9.296	3.016	28.036	92.07	90.67	
		22.82	9.222	2.265	20.887	91.53		
		15.5	9.149	1.513	13.842	89.31		
		7.7	9.072	0.762	6.912	89.78		
265		30.76	9.297	3.016	28.039	91.16	89.35	
		23.2	9.223	2.265	20.890	90.04		
		15.8	9.149	1.513	13.842	87.61		
		7.806	9.074	0.762	6.914	88.58		



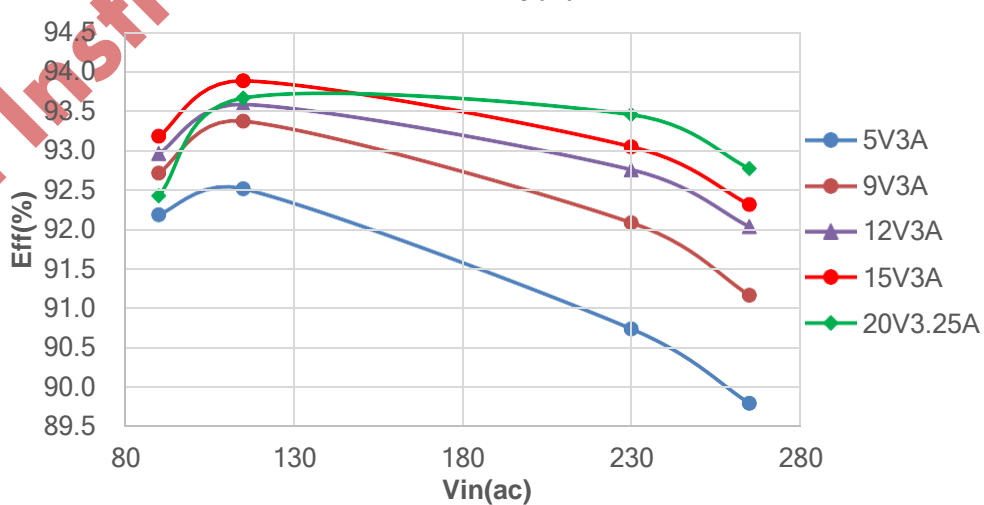
Efficiency (5V/3A):

Vin (Vac)	Fline(Hz)	Pin(W)	Vout(V)	Iout(A)	Pout(W)	Eff (%)	Eff_AVG(%)	DoE 6(%)
90	60	17.78	5.434	3.016	16.388	92.18	92.1	81.39
		13.12	5.357	2.266	12.138	92.52		
		8.67	5.281	1.513	7.990	92.16		
		4.333	5.206	0.762	3.966	91.55		
115		17.73	5.438	3.016	16.401	92.50	91.96	
		13.13	5.36	2.265	12.140	92.46		
		8.73	5.284	1.513	7.994	91.58		
		4.347	5.209	0.762	3.969	91.31		
230	50	18.08	5.439	3.016	16.404	90.73	89.34	
		13.59	5.361	2.265	12.142	89.35		
		8.89	5.286	1.513	7.997	89.96		
		4.545	5.208	0.762	3.968	87.32		
265		18.27	5.439	3.016	16.404	89.79	88.05	
		13.82	5.361	2.265	12.142	87.86		
		9	5.285	1.513	7.996	88.85		
		4.631	5.209	0.762	3.969	85.71		

Average Efficiency(%)



Full Load Efficiency(%)





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 is tested at the output cap end.

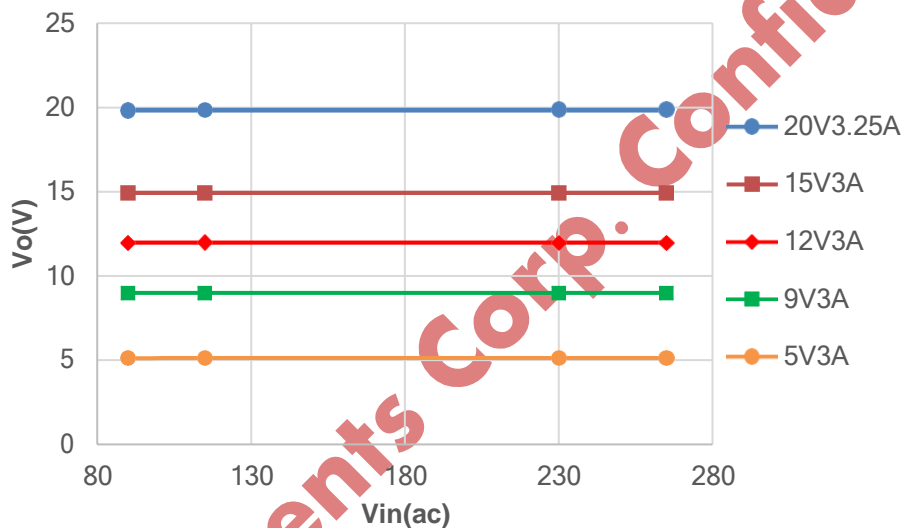
Result: Pass

Input Voltage	For Vo=20V / Output Voltage(V)					Load Regulation
	0% Load	25% Load	50% Load	75% Load	Full Load	
90Vac/60Hz	19.994	19.995	19.947	19.908	19.825	0.86%
115Vac/60Hz	19.995	19.996	19.959	19.904	19.854	0.72%
230Vac/50Hz	19.994	19.995	19.952	19.916	19.872	0.62%
264Vac/50Hz	19.99	19.994	19.943	19.901	19.872	0.61%
Line Regulation	0.03%	0.01%	0.08%	0.08%	0.24%	
Input Voltage	For Vo=15V / Output Voltage(V)					Load Regulation
	0% Load	25% Load	50% Load	75% Load	Full Load	
90Vac/60Hz	15	15.003	14.985	14.968	14.946	0.38%
115Vac/60Hz	14.998	14.999	14.989	14.965	14.941	0.39%
230Vac/50Hz	14.997	14.989	14.981	14.967	14.946	0.34%
264Vac/50Hz	14.999	14.987	14.982	14.964	14.931	0.46%
Line Regulation	0.02%	0.11%	0.05%	0.03%	0.10%	
Input Voltage	For Vo=12V / Output Voltage(V)					Load Regulation
	0% Load	25% Load	50% Load	75% Load	Full Load	
90Vac/60Hz	12.007	12.008	12.004	11.993	11.978	0.25%
115Vac/60Hz	12.008	12.005	12.004	11.997	11.987	0.18%
230Vac/50Hz	12.005	12.004	12.002	11.991	11.98	0.21%
264Vac/50Hz	12.006	12.004	12.004	11.995	11.978	0.23%
Line Regulation	0.02%	0.03%	0.02%	0.05%	0.08%	
Input Voltage	For Vo=9V / Output Voltage(V)					Load Regulation
	0% Load	25% Load	50% Load	75% Load	Full Load	
90Vac/60Hz	9.008	9.007	9.004	9.002	8.996	0.13%
115Vac/60Hz	9.008	9.007	9.006	9.003	8.996	0.13%
230Vac/50Hz	9.009	9.007	9.005	9.001	8.995	0.16%
264Vac/50Hz	9.007	9.005	9.004	9.001	8.995	0.13%

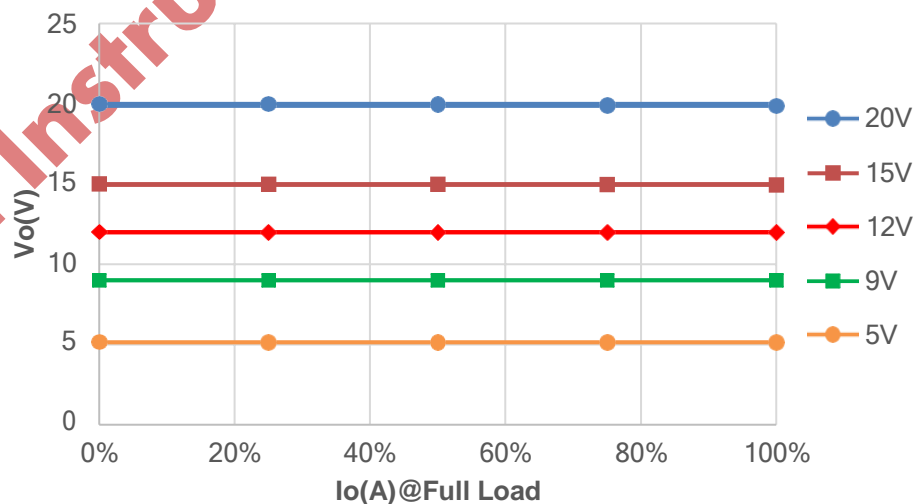


Line Regulation	0.02%	0.02%	0.02%	0.02%	0.01%	
Input Voltage	For Vo=5V / Output Voltage(V)					Load Regulation
	0% Load	25% Load	50% Load	75% Load	Full Load	
90Vac/60Hz	5.141	5.139	5.138	5.136	5.133	0.16%
115Vac/60Hz	5.141	5.139	5.137	5.135	5.134	0.14%
230Vac/50Hz	5.141	5.139	5.137	5.135	5.134	0.14%
264Vac/50Hz	5.141	5.139	5.136	5.134	5.134	0.14%
Line Regulation	0.00%	0.00%	0.04%	0.04%	0.02%	

Line Regulation@Full Load



Load Regulation@230Vac



2.3 Ripple & Noise

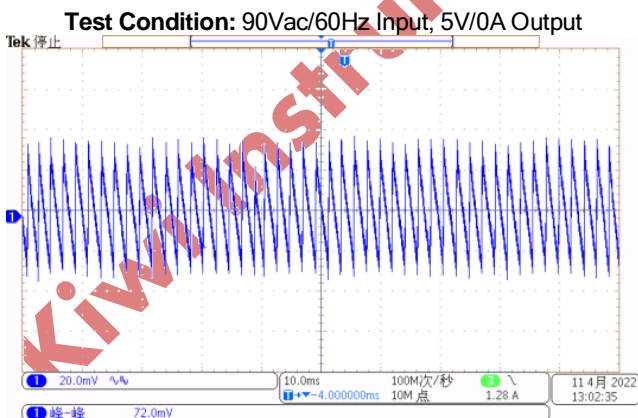
Standard: Under the input voltage 90Vac~265Vac, Vripple_max<200mV.

Result: Pass

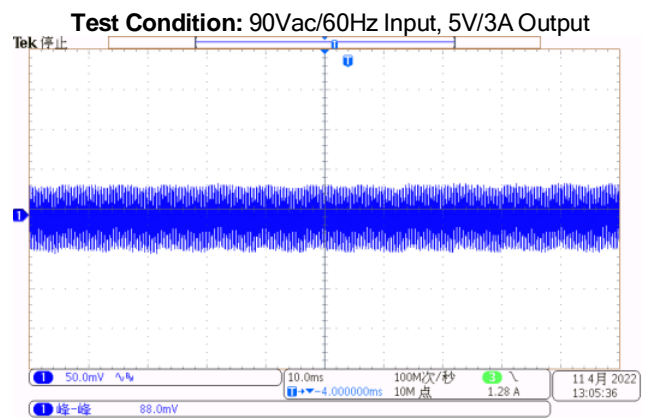
Note: Ripple & noise are measured at the 1 m line end with a 0.1μF/50V ceramic cap paralleled with a 10μF/50V electrolytic cap. Bandwidth is limited to 20Mhz.

Input Voltage	No Load Ripple(mV)				
	5V/0A	9V/0A	12V/0A	15V/0A	20V/0A
90Vac/60Hz	72	68.8	63.2	55.2	57.6
115Vac/60Hz	64	57.6	55.2	54.4	52.8
230Vac/50Hz	88.8	70.4	66.4	61.6	64
265Vac/50Hz	97.6	76.8	72.8	69.8	65.6
Input Voltage	Full Load Ripple(mV)				
	5V/3A	9V/3A	12V/3A	15V/3A	20V/3.25A
90Vac/60Hz	88	86	102	116	136
115Vac/60Hz	82	78	82	92	106
230Vac/50Hz	112	108	114	110	122
265Vac/50Hz	112	108	110	108	122

Waveforms:

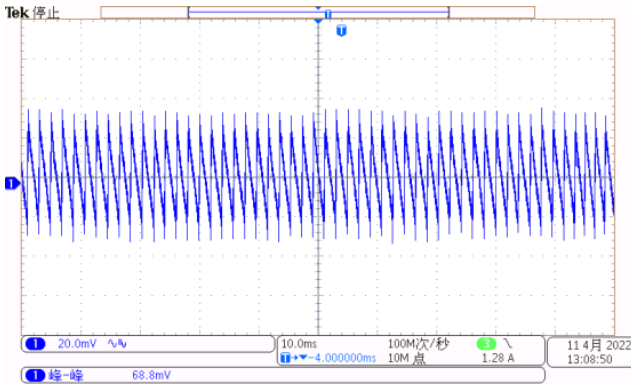


Comments: Vripple=72mV



Comments: Vripple=88mV

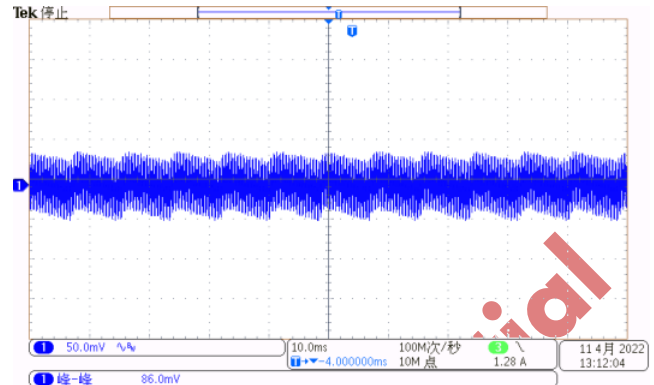
Test Condition: 90Vac/60Hz Input, 9V/0A Output



(CH1- Ripple)

Comments: Vripple=68.8mV

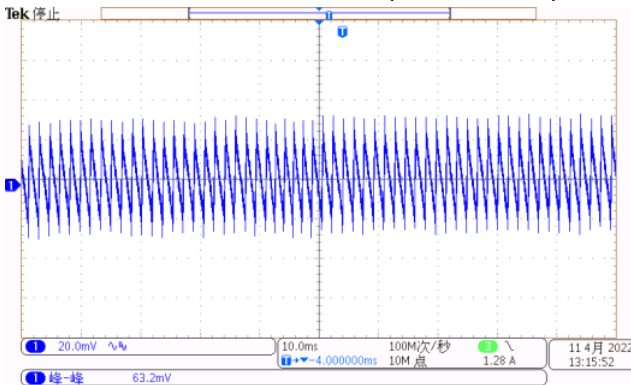
Test Condition: 90Vac/60Hz Input, 9V/3A Output



(CH1- Ripple)

Comments: Vripple=86mV

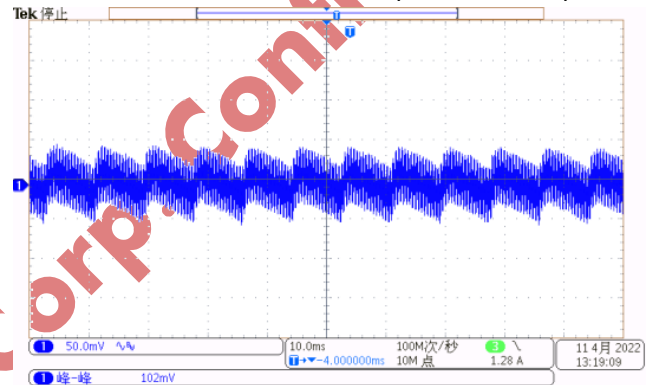
Test Condition: 90Vac/60Hz Input, 12V/0A Output



(CH1- Ripple)

Comments: Vripple=63.2mV

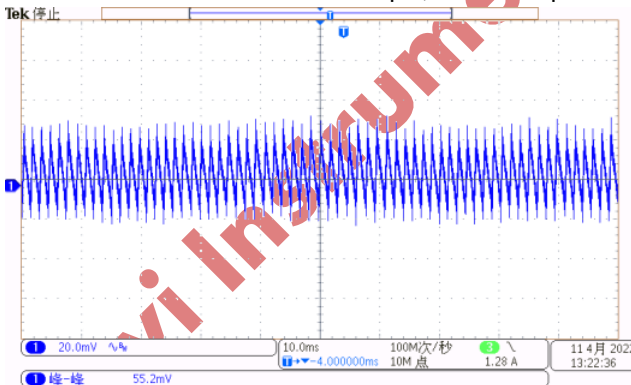
Test Condition: 90Vac/60Hz Input, 12V/3A Output



(CH1- Ripple)

Comments: Vripple=102mV

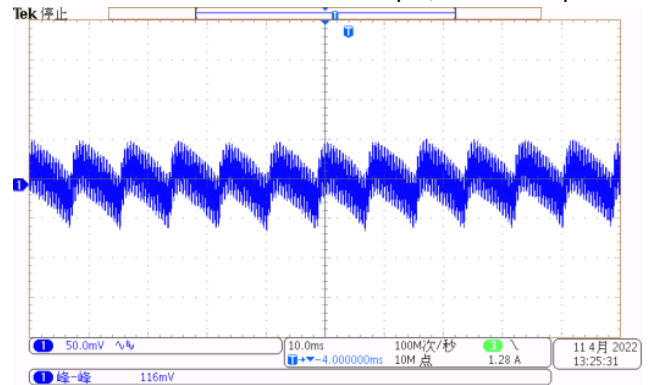
Test Condition: 90Vac/60Hz Input, 15V/0A Output



(CH1- Ripple)

Comments: Vripple=55.2mV

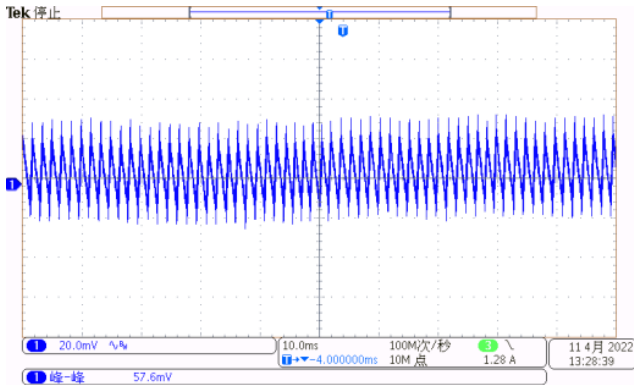
Test Condition: 90Vac/60Hz Input, 15V/3A Output



(CH1- Ripple)

Comments: Vripple=116mV

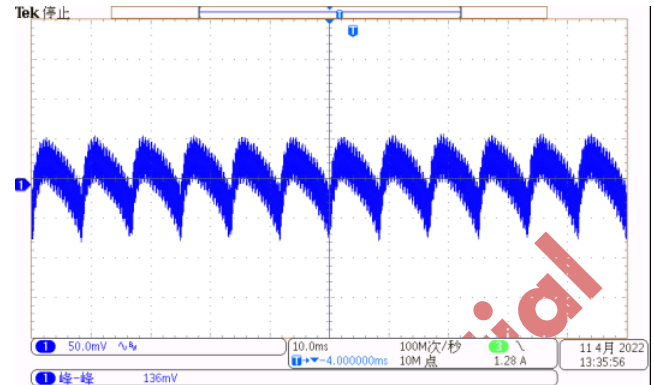
Test Condition: 90Vac/60Hz Input, 20V/0A Output



(CH1- Ripple)

Comments: Ripple=57.6mV

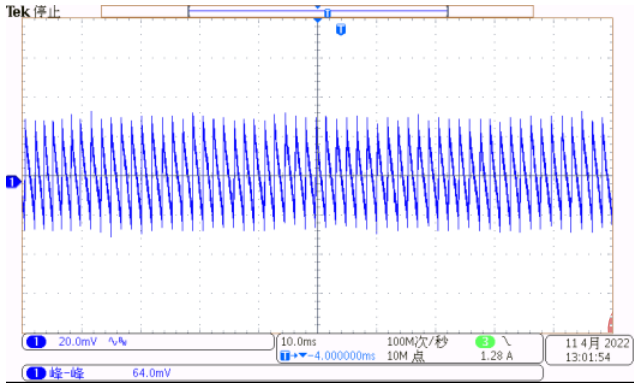
Test Condition: 90Vac/60Hz Input, 20V/3.25A Output



(CH1- Ripple)

Comments: Ripple=136mV

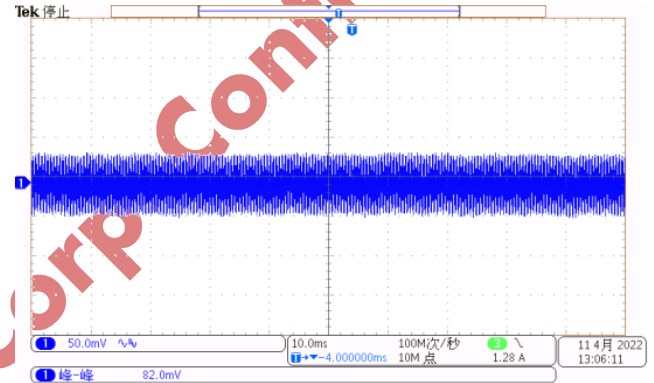
Test Condition: 115Vac/60Hz Input, 5V/0A Output



(CH1- Ripple)

Comments: Ripple=64mV

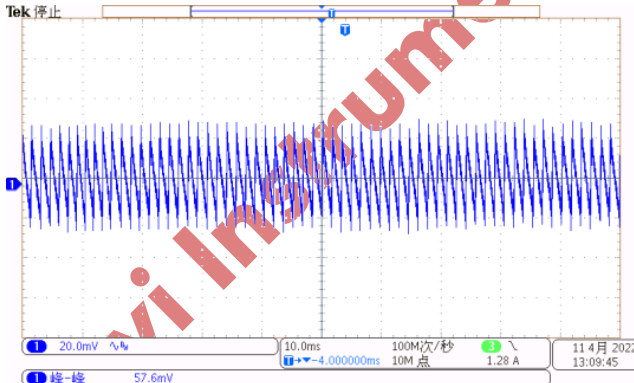
Test Condition: 115Vac/60Hz Input, 5V/3A Output



(CH1- Ripple)

Comments: Ripple=82mV

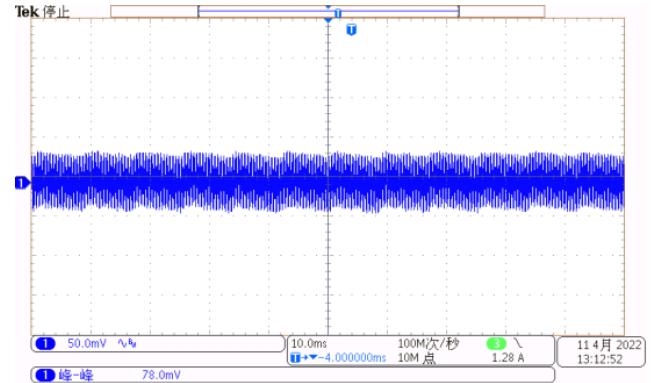
Test Condition: 115Vac/60Hz Input, 9V/0A Output



(CH1- Ripple)

Comments: Ripple=57.6mV

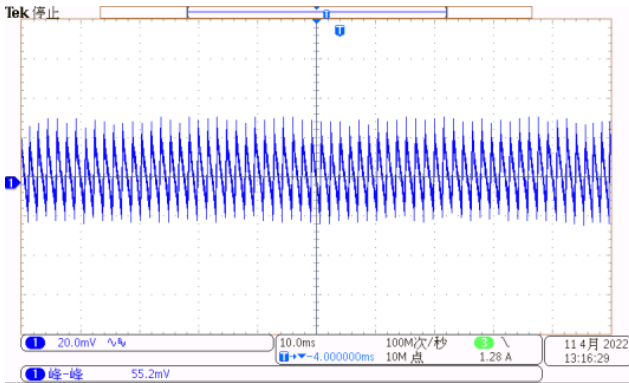
Test Condition: 115Vac/60Hz Input, 9V/3A Output



(CH1- Ripple)

Comments: Ripple=78mV

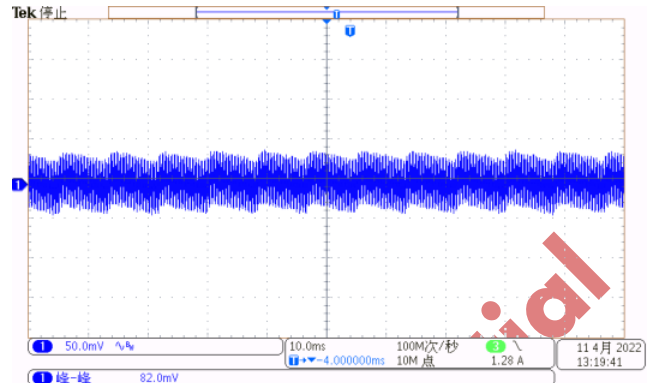
Test Condition: 115Vac/60Hz Input, 12V/0A Output



(CH1- Ripple)

Comments: Vripple=55.2mV

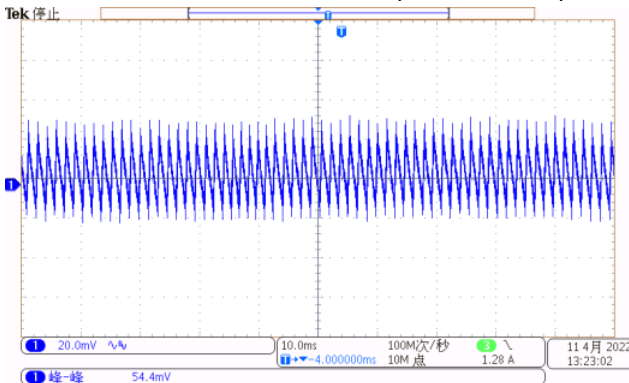
Test Condition: 115Vac/60Hz Input, 12V/3A Output



(CH1- Ripple)

Comments: Vripple=82.0mV

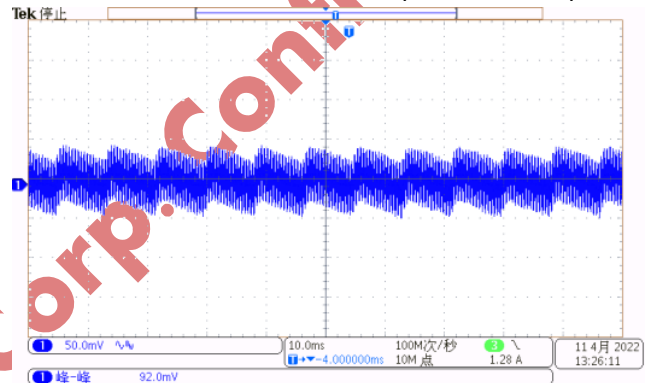
Test Condition: 115Vac/60Hz Input, 15V/0A Output



(CH1- Ripple)

Comments: Vripple=54.4mV

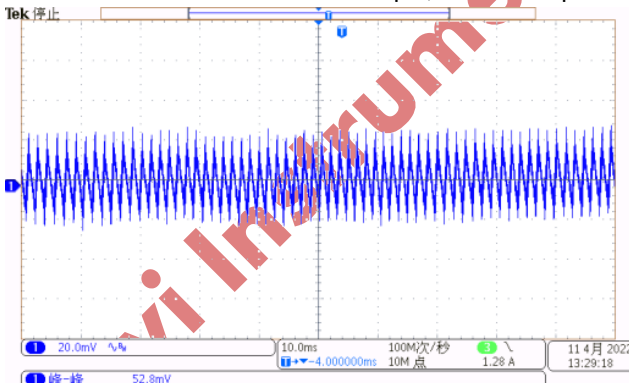
Test Condition: 115Vac/60Hz Input, 15V/3A Output



(CH1- Ripple)

Comments: Vripple=92.0mV

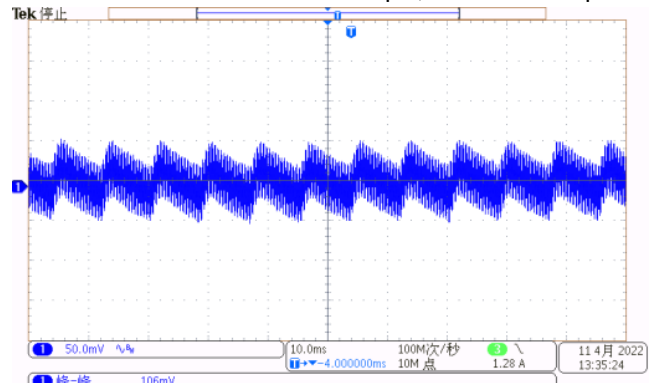
Test Condition: 115Vac/60Hz Input, 20V/0A Output



(CH1- Ripple)

Comments: Vripple=52.8mV

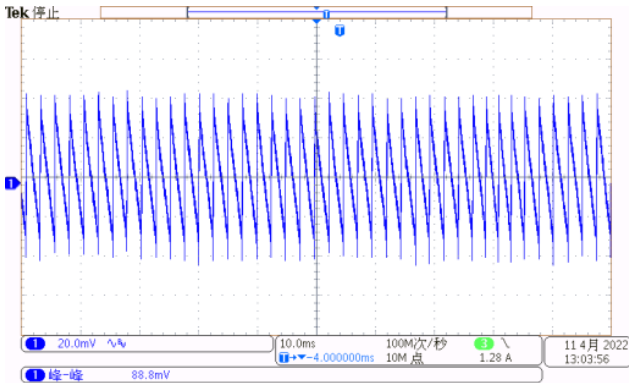
Test Condition: 115Vac/60Hz Input, 20V/3.25A Output



(CH1- Ripple)

Comments: Vripple=106mV

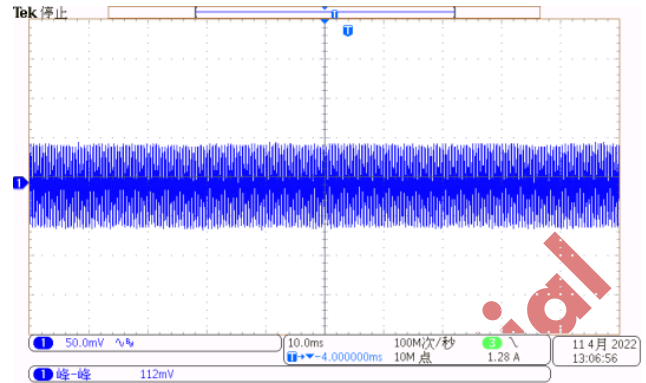
Test Condition: 230Vac/50Hz Input, 5V/0A Output



(CH1- Ripple)

Comments: Vripple=88.8mV

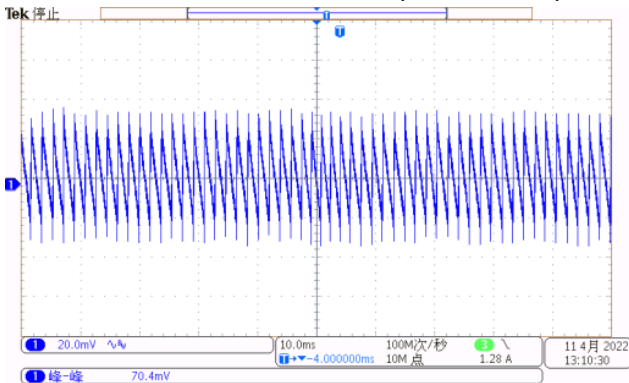
Test Condition: 230Vac/50Hz Input, 5V/3A Output



(CH1- Ripple)

Comments: Vripple=112mV

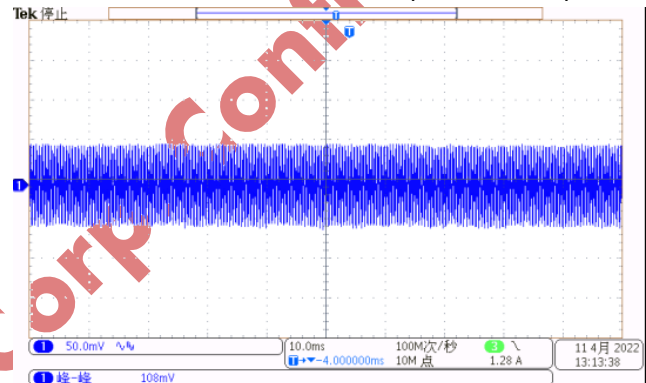
Test Condition: 230Vac/50Hz Input, 9V/0A Output



(CH1- Ripple)

Comments: Vripple=70.4mV

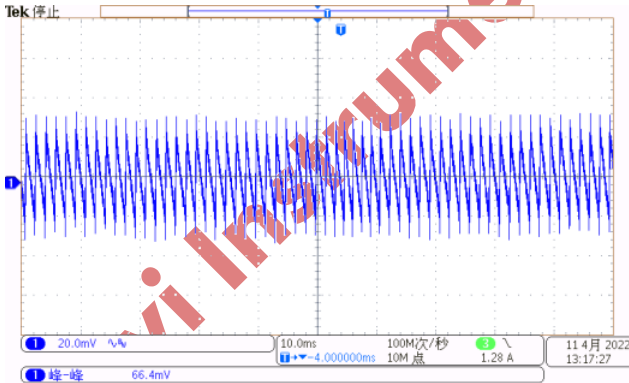
Test Condition: 230Vac/50Hz Input, 9V/3A Output



(CH1- Ripple)

Comments: Vripple=108mV

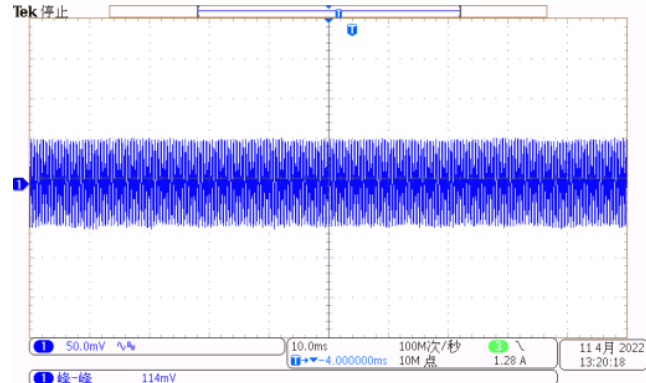
Test Condition: 230Vac/50Hz Input, 12V/0A Output



(CH1- Ripple)

Comments: Vripple=66.4mV

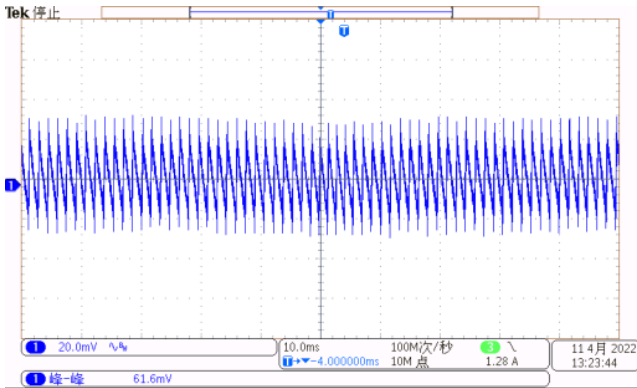
Test Condition: 230Vac/50Hz Input, 12V/3A Output



(CH1- Ripple)

Comments: Vripple=114mV

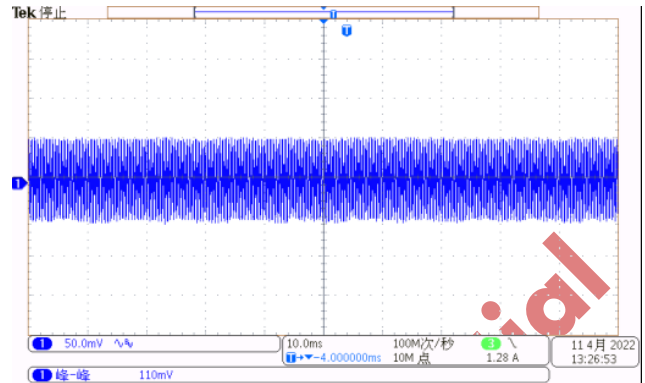
Test Condition: 230Vac/50Hz Input, 15V/0A Output



(CH1- Ripple)

Comments: Vripple=61.6mV

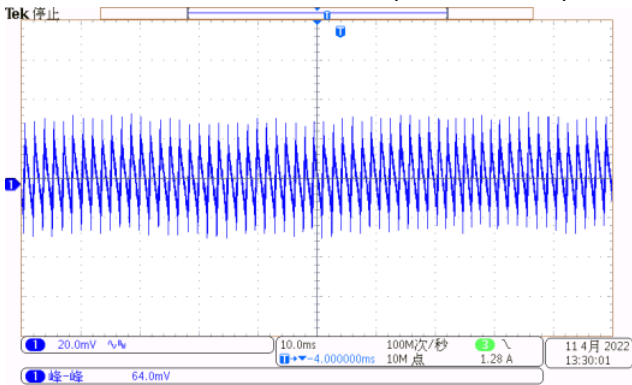
Test Condition: 230Vac/50Hz Input, 15V/3A Output



(CH1- Ripple)

Comments: Vripple=110mV

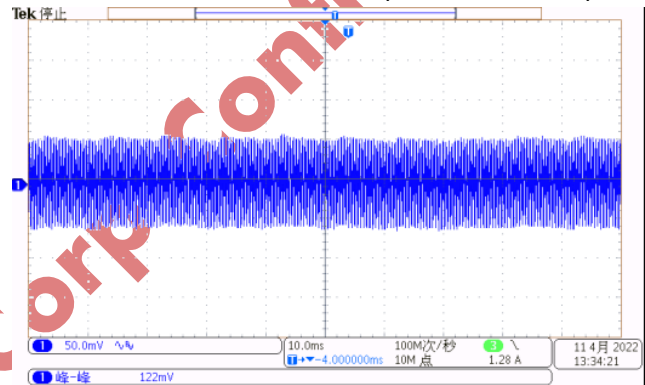
Test Condition: 230Vac/50Hz Input, 20V/0A Output



(CH1- Ripple)

Comments: Vripple=64mV

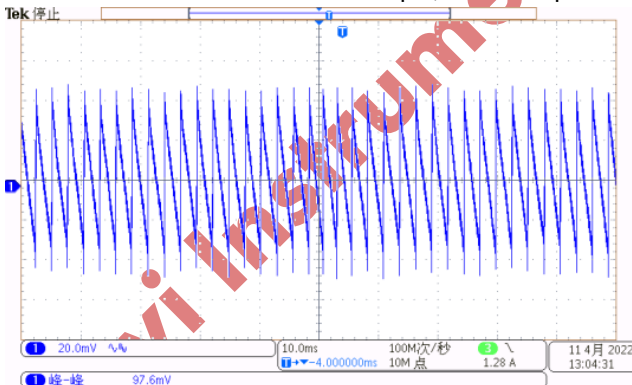
Test Condition: 230Vac/50Hz Input, 20V/3.25A Output



(CH1- Ripple)

Comments: Vripple=122mV

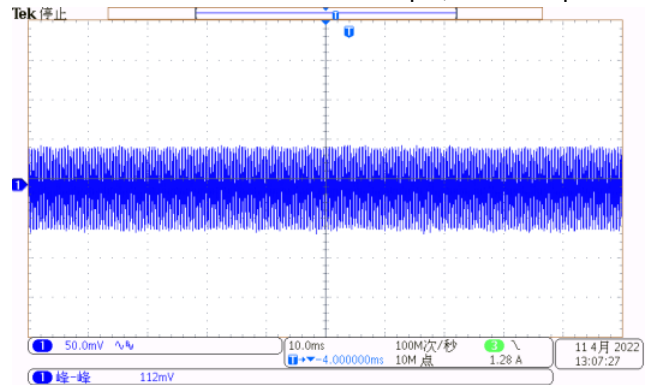
Test Condition: 265Vac/50Hz Input, 5V/0A Output



(CH1- Ripple)

Comments: Vripple=97.6mV

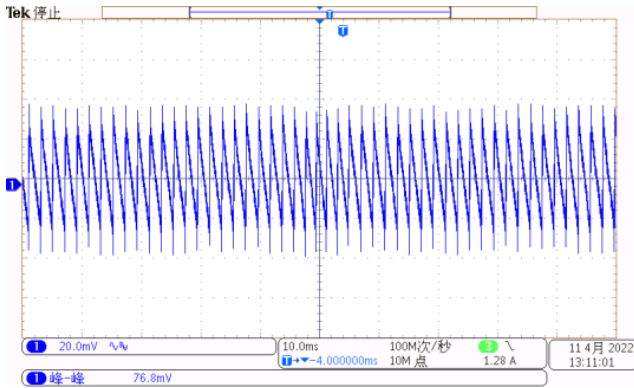
Test Condition: 265Vac/50Hz Input, 5V/3A Output



(CH1- Ripple)

Comments: Vripple=112mV

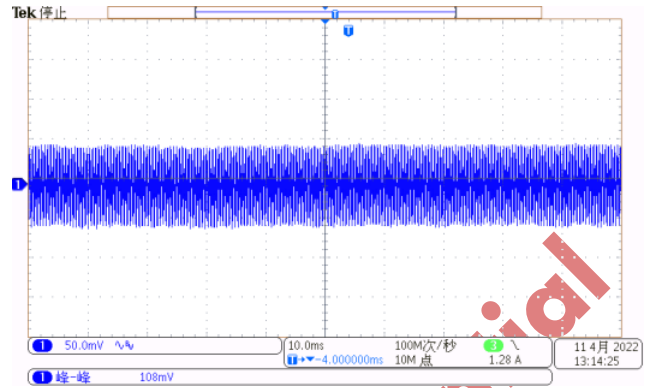
Test Condition: 265Vac/50Hz Input, 9V/0A Output



(CH1- Ripple)

Comments: Vripple=76.8mV

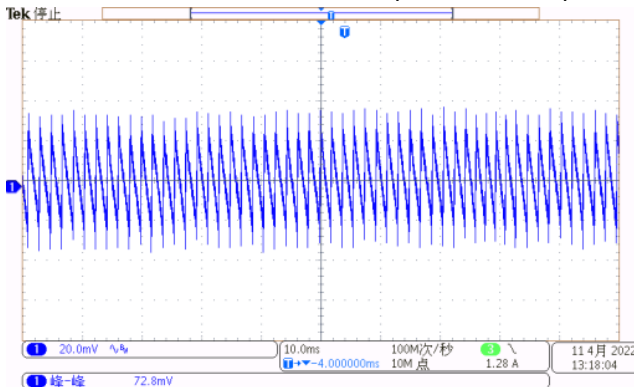
Test Condition: 265Vac/50Hz Input, 9V/3A Output



(CH1- Ripple)

Comments: Vripple=108mV

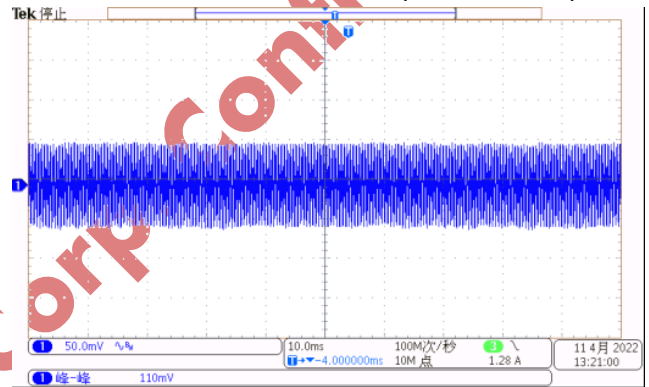
Test Condition: 265Vac/50Hz Input, 12V/0A Output



(CH1- Ripple)

Comments: Vripple=72.8mV

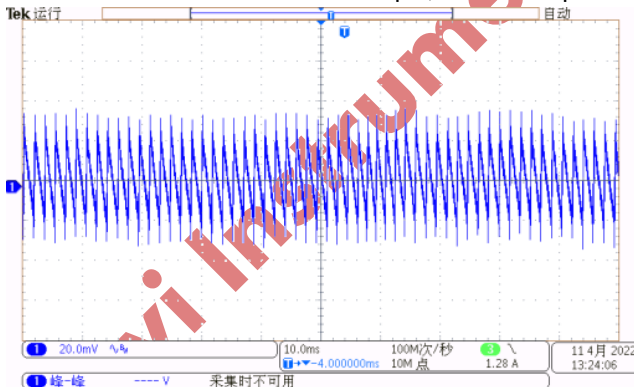
Test Condition: 265Vac/50Hz Input, 12V/3A Output



(CH1- Ripple)

Comments: Vripple=110mV

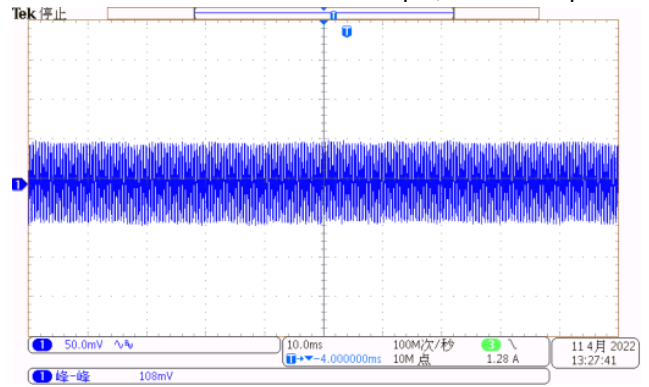
Test Condition: 265Vac/50Hz Input, 15V/0A Output



(CH1- Ripple)

Comments: Vripple=69.8mV

Test Condition: 265Vac/50Hz Input, 15V/3A Output



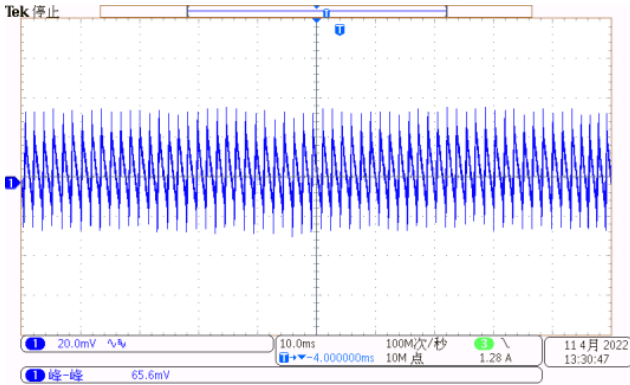
(CH1- Ripple)

Comments: Vripple=108mV



Demo Board Test Report
High Performance 65W PD Charger with KP22066 and KP4060

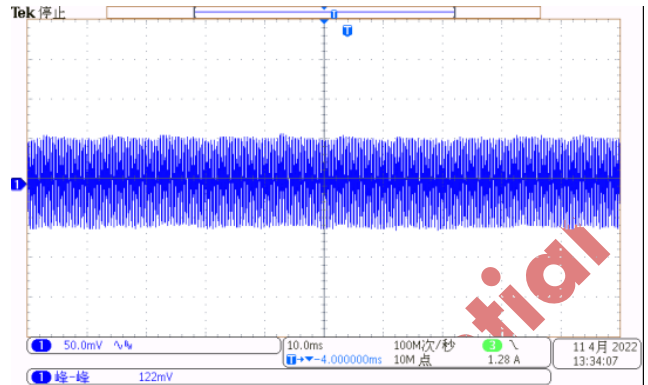
Test Condition: 265Vac/50Hz Input, 20V/0A Output



(CH1- Ripple)

Comments: Vripple=65.6mV

Test Condition: 265Vac/50Hz Input, 20V/3.25A Output



(CH1- Ripple)

Comments: Vripple=122mV

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2.4 Load Transient Test

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

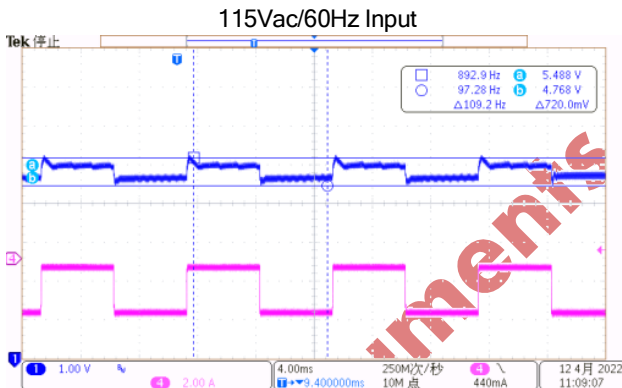
Result: Pass

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		15V		20V	
	Vo-min	Vo-max	Vo-min	Vo-max	Vo-min	Vo-max	Vo-min	Vo-max	Vo-min	Vo-max
115Vac/60Hz	4.768	5.488	8.688	9.448	11.67	12.45	14.65	15.45	19.63	20.45
230Vac/50Hz	4.748	5.488	8.688	9.468	11.69	12.49	14.67	15.51	19.63	20.69

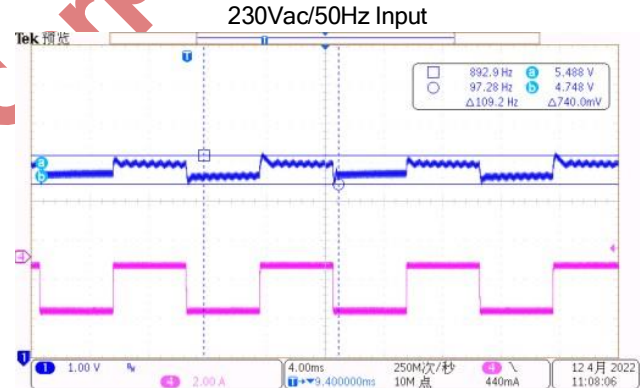
Waveforms:

Test Condition: Load 5V/(0.3-2.7)A, frequency 100Hz, duty Cycle=50%, slew rate=0.25A/ μ s



(CH1-Vo, CH4-Io)

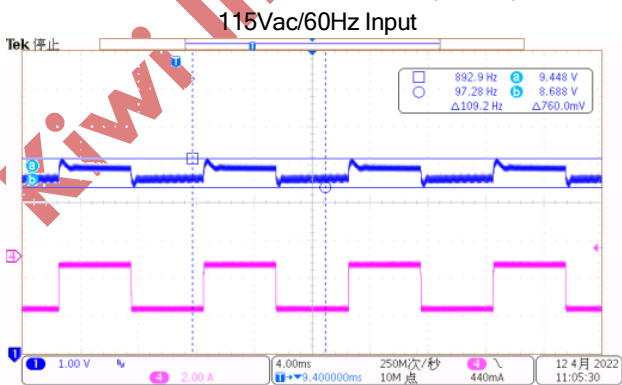
Comments: Vo-min/max=4.768V/5.488V



(CH1-Vo, CH4-Io)

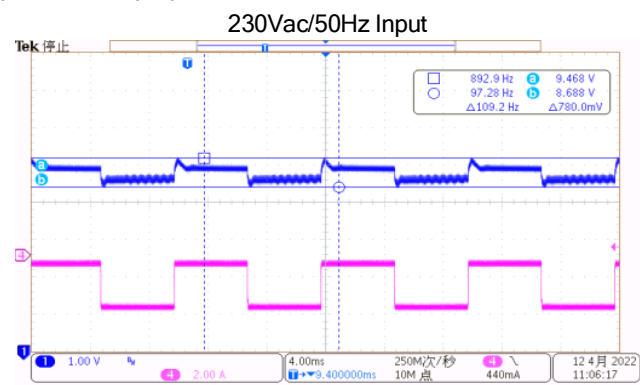
Comments: Vo-min/max=4.748V/5.488V

Test Condition: Load 9V/(0.3-2.7)A, frequency 100Hz, duty Cycle=50%, slew rate=0.25A/ μ s



(CH1-Vo, CH4-Io)

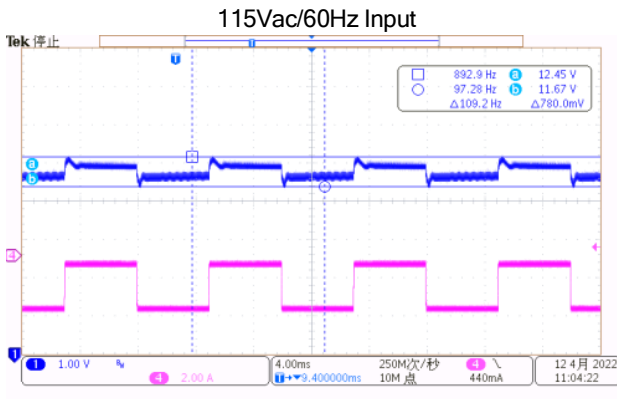
Comments: Vo-min/max=8.688V/9.448V



(CH1-Vo, CH4-Io)

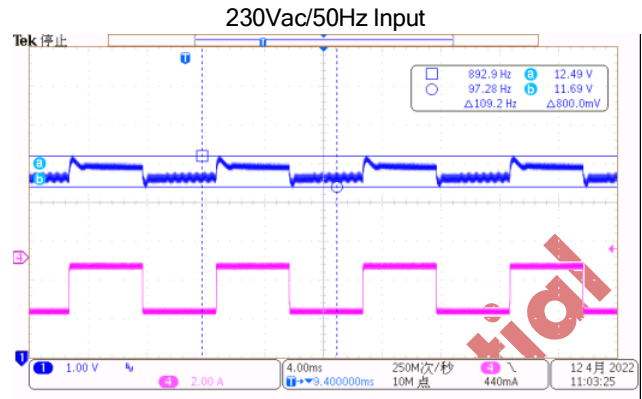
Comments: Vo-min/max=8.688V/9.468V

Test Condition: Load 12V/(0.3-2.7)A, frequency 100Hz, duty Cycle=50%, slew rate=0.25A/ μ s



(CH1-Vo, CH4-Io)

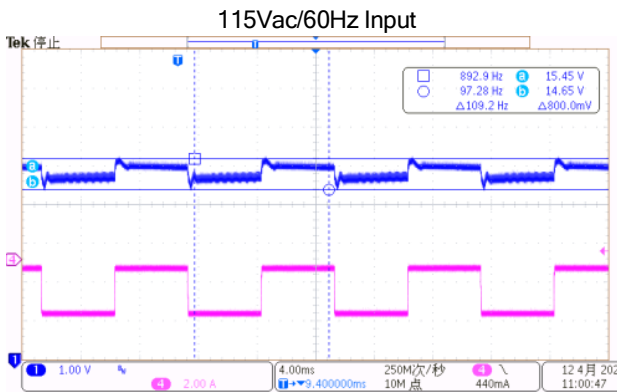
Comments: Vo-min/max=11.67V/12.45V



(CH1-Vo, CH4-Io)

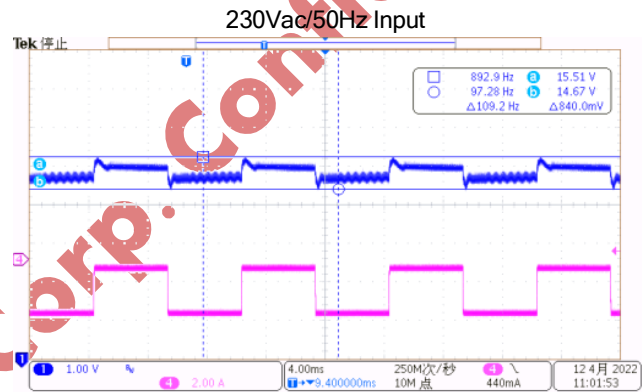
Comments: Vo-min/max=11.69V/12.49V

Test Condition: Load 15V/(0.3-2.7)A, frequency 100Hz, duty Cycle=50%, slew rate=0.25A/ μ s



(CH1-Vo, CH4-Io)

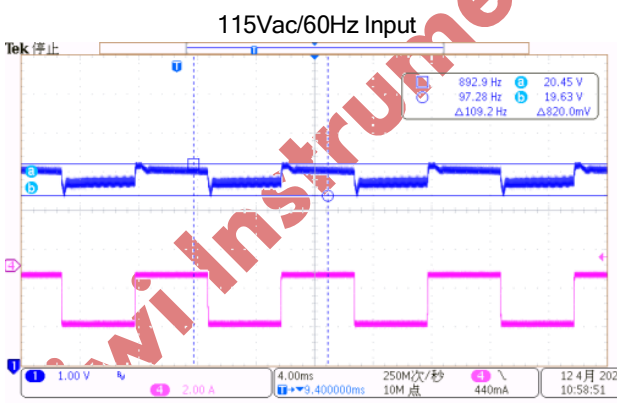
Comments: Vo-min/max=14.65V/15.45V



(CH1-Vo, CH4-Io)

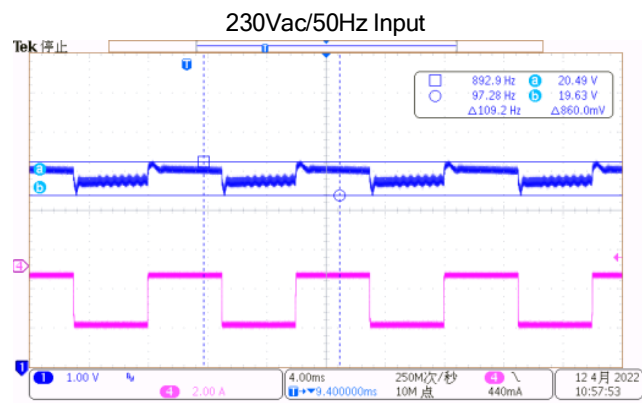
Comments: Vo-min/max=14.67V/15.51V

Test Condition: Load 20V/(0.325-2.925)A, frequency 100Hz, duty Cycle=50%, slew rate=0.25A/ μ s



(CH1-Vo, CH4-Io)

Comments: Vo-min/max=19.63V/20.45V



(CH1-Vo, CH4-Io)

Comments: Vo-min/max=19.63V/20.49V

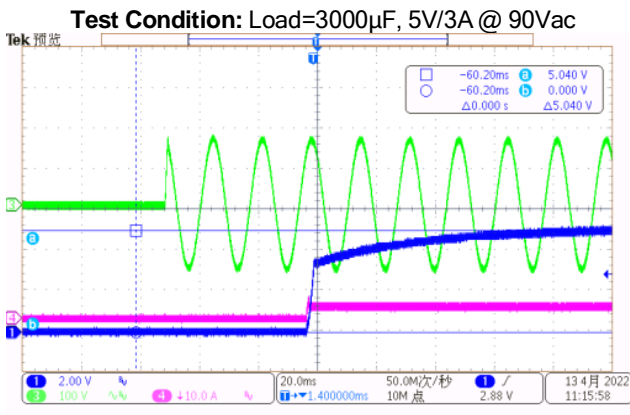
2.5 Capacitive Load Startup Test

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

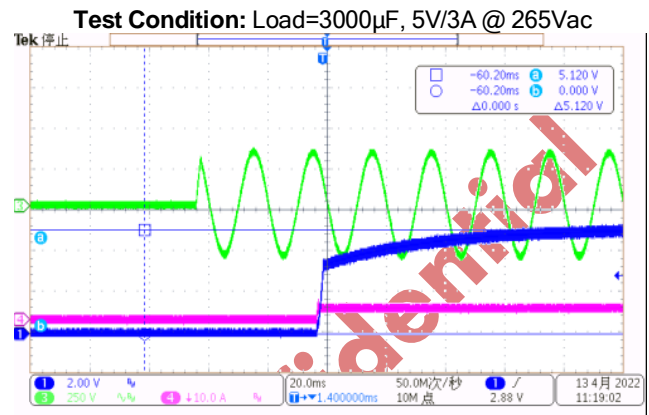
Result: Pass

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

Waveforms:



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



(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

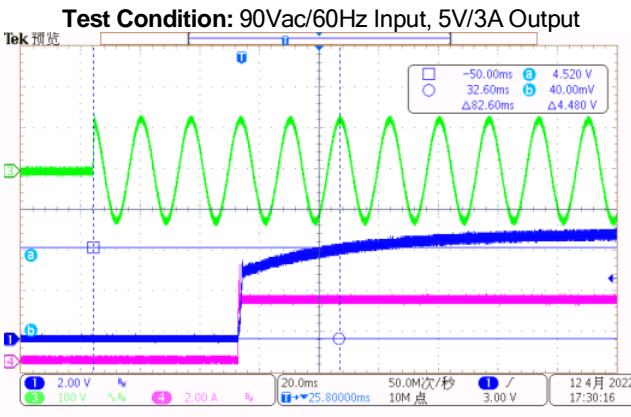
Note: The output voltage is tested at the output cap end.

Test Data:

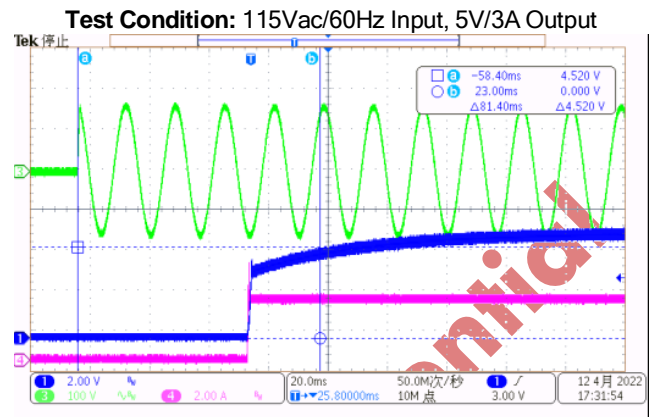
Input Voltage	90Vac/60Hz	115Vac/60Hz	230Vac/50Hz	265Vac/50Hz
Startup Time(mS)	82.6	81.4	74.2	71

Input Voltage	90Vac/60Hz		115Vac/60Hz		230Vac/50Hz		265Vac/50Hz	
Rrise Time(mS)	5V/0A	5V/3A	5V/0A	5V/3A	5V/0A	5V/3A	5V/0A	5V/3A
		28.6	29	29	29	28.6	28.8	28.6

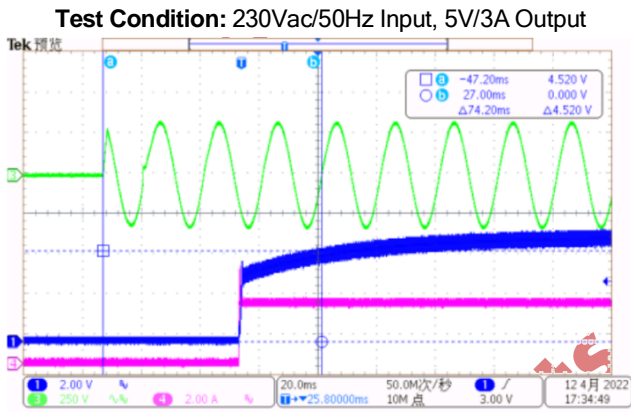
Waveforms:



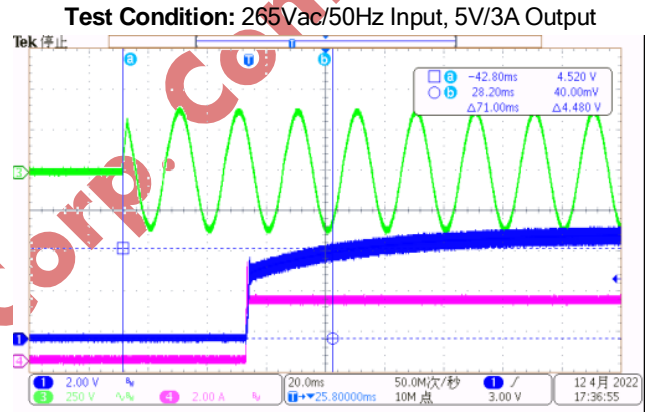
(CH1-Vo, CH3-Vinac, CH4-Io)
 Comments: Startup time=82.6ms



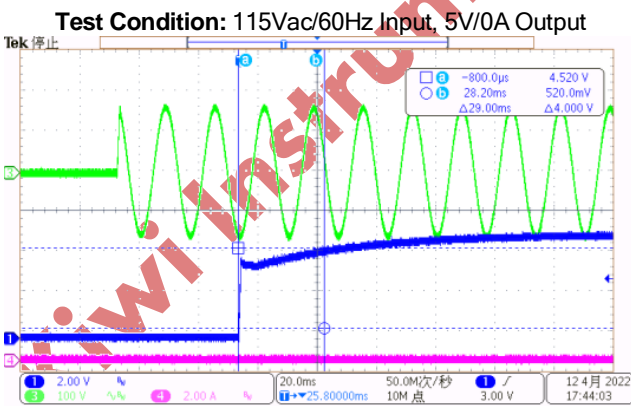
(CH1-Vo, CH3-Vinac, CH4-Io)
 Comments: Startup time=81.4ms



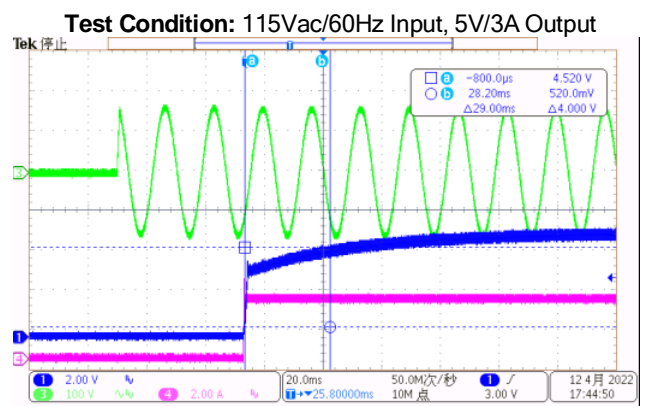
(CH1-Vo, CH3-Vinac, CH4-Io)
 Comments: Startup time=74.2ms



(CH1-Vo, CH3-Vinac, CH4-Io)
 Comments: Startup time=71ms

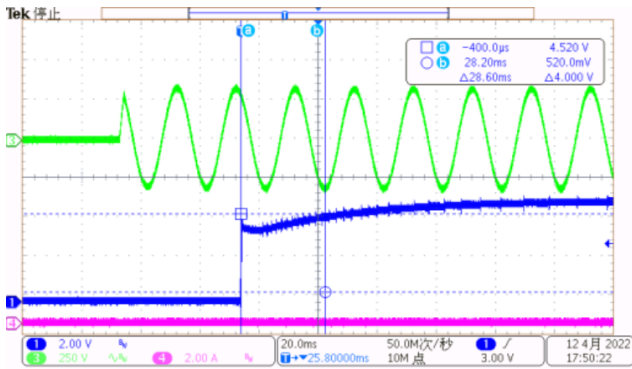


(CH1-Vo, CH3-Vinac, CH4-Io)
 Comments: Raise time=29ms



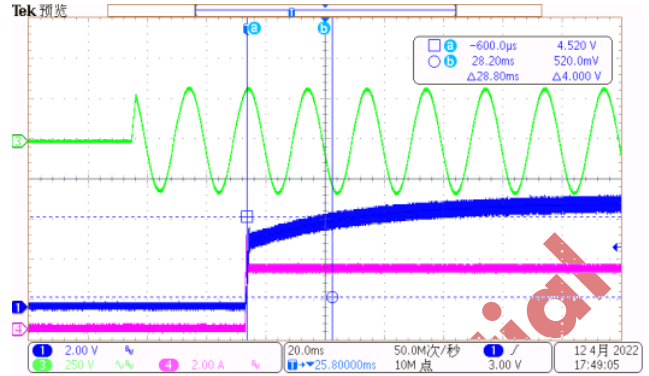
(CH1-Vo, CH3-Vinac, CH4-Io)
 Comments: Raise time=29ms

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



(CH1-Vo, CH3-Vinac, CH4-Io)
Comments: Raise time=28.6ms

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



(CH1-Vo, CH3-Vinac, CH4-Io)
Comments: Raise time=28.8ms

2.7 Holdup Time and Fall Time

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

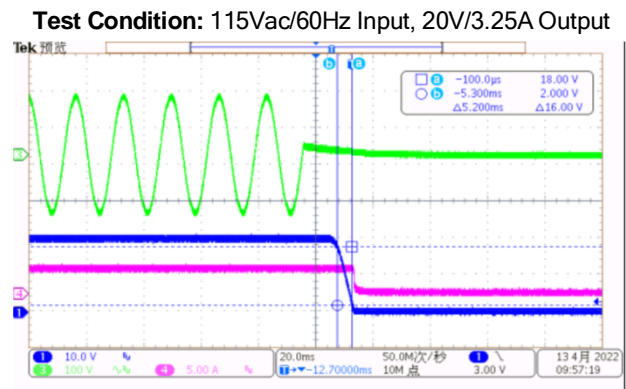
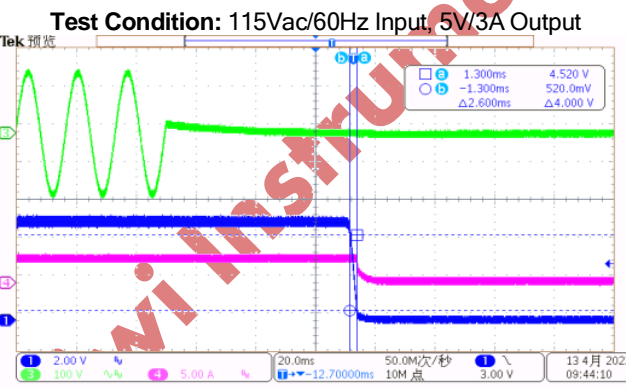
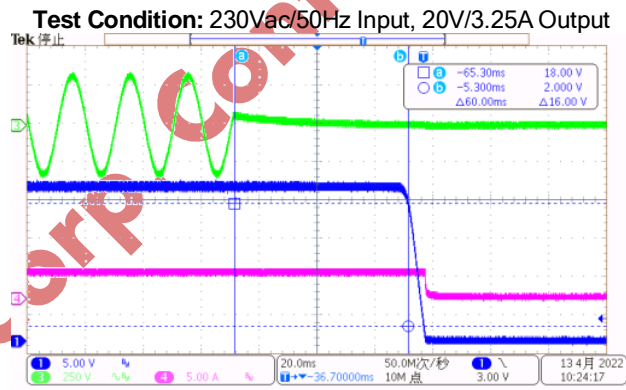
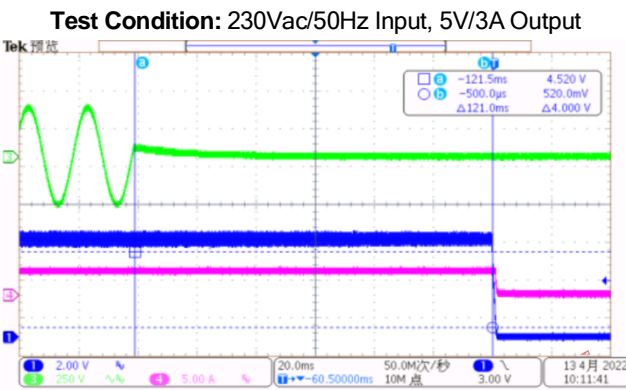
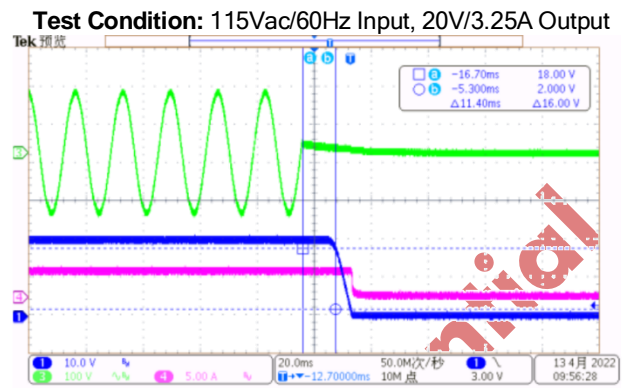
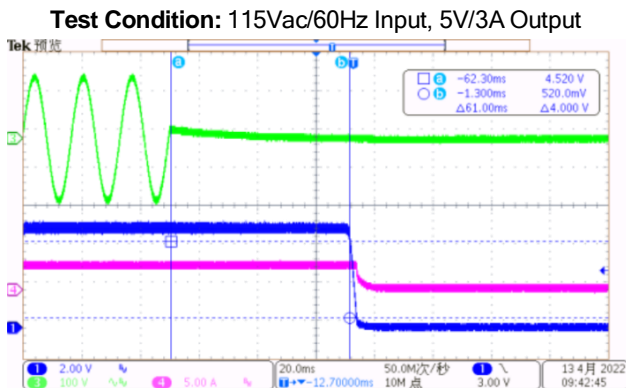
Result: Pass

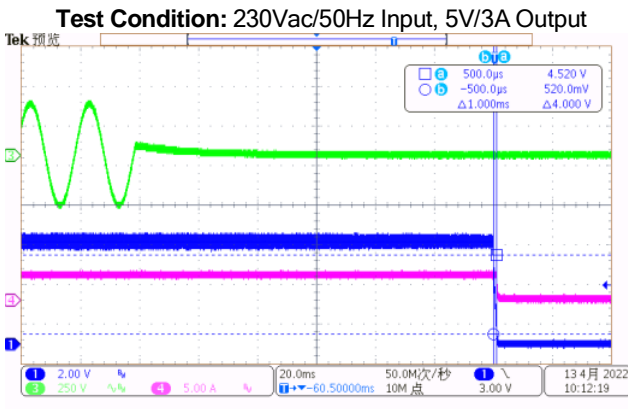
Note: The output voltage is tested at the output cap end.

Input Voltage	Holdup time(ms)				
	5V/3A	9V/3A	12V/3A	15V/3A	20V/3.25A
115Vac/60Hz	61	33.2	23.6	18.4	11.4
230Vac/50Hz	121	117.6	112.6	89.2	60
Result	PASS	PASS	PASS	PASS	PASS

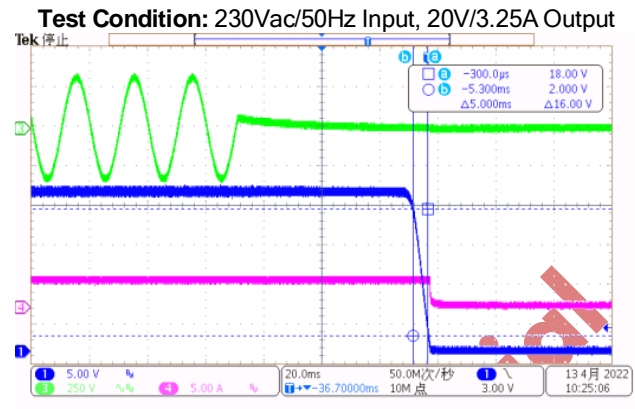
Input Voltage	Fall time (mS)				
	5V/3A	9V/3A	12V/3A	15V/3A	20V/3.25A
115Vac/60Hz	2.6	2.8	3.6	4.4	5.2
230Vac/50Hz	1	2.4	3.4	4.2	5
Result	PASS	PASS	PASS	PASS	PASS

Waveforms:





(CH1-Vo, CH3-Vinac, CH4-Io)
Comments: Comments: Fall time=1ms



(CH1-Vo, CH3-Vinac, CH4-Io)
Comments: Comments: Fall time=5ms

2.8 Output Overshoot Test

Standard: Vo-peak < output voltage*110%.

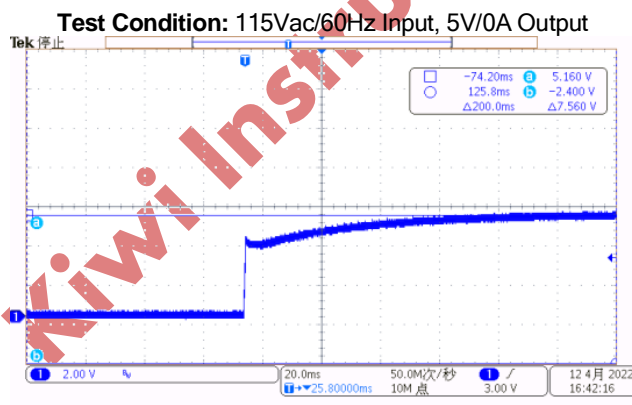
Result: Pass

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

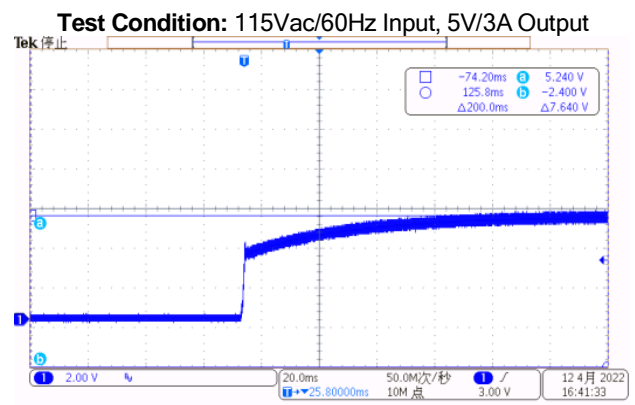
Test Data:

	90V/60Hz		115V/60Hz		230V/50Hz		265V/50Hz	
	5V/0A	5V/3A	5V/0A	5V/3A	5V/0A	5V/3A	5V/0A	5V/3A
Vo-peak(V)	5.16	5.2	5.16	5.2	5.2	5.28	5.12	5.32

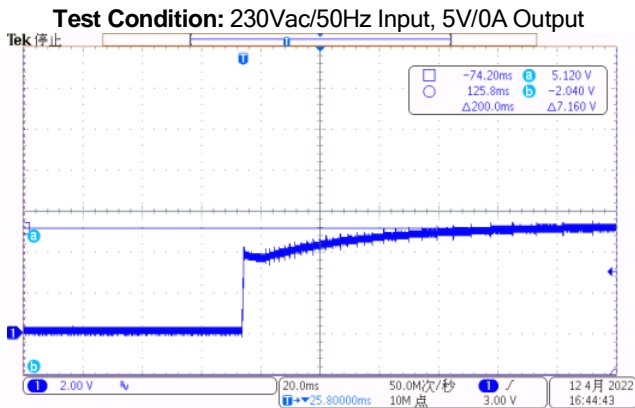
Waveforms:



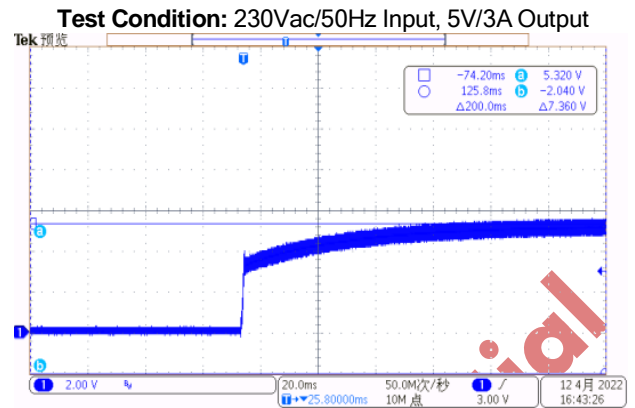
(CH1- Vo)
Comments: Vo-peak=5.16V



(CH1- Vo)
Comments: Vo-peak=5.24V



(CH1- Vo)
 Comments: Vo-peak=5.12V



(CH1- Vo)
 Comments: Vo-peak=5.32V

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. And the peak input power should be less than 5W.

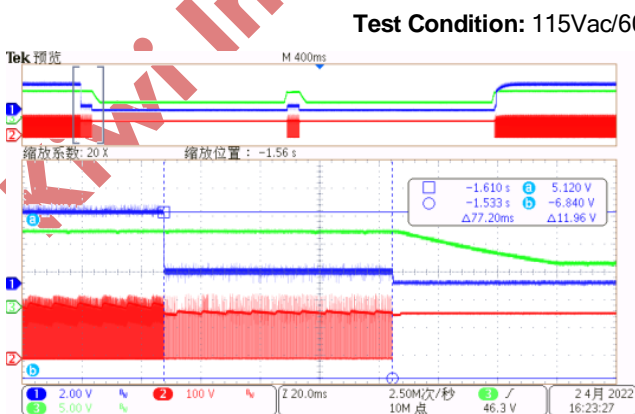
Result: Pass

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

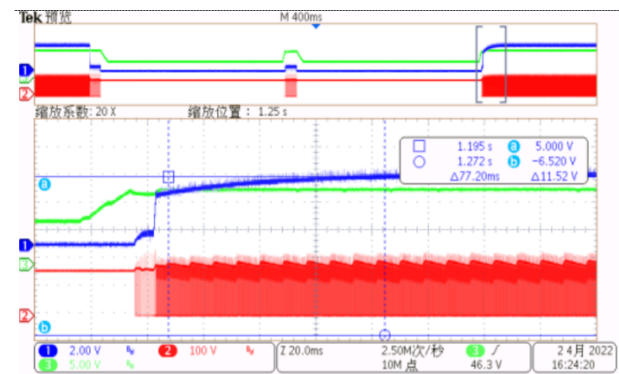
Test Data:

Input Voltage (Vac)	90V/60Hz	115V/60Hz	230V/50Hz	265V/50Hz	Result
Pin(W)	2.71	2.7	2.21	2.16	PASS

Waveforms:

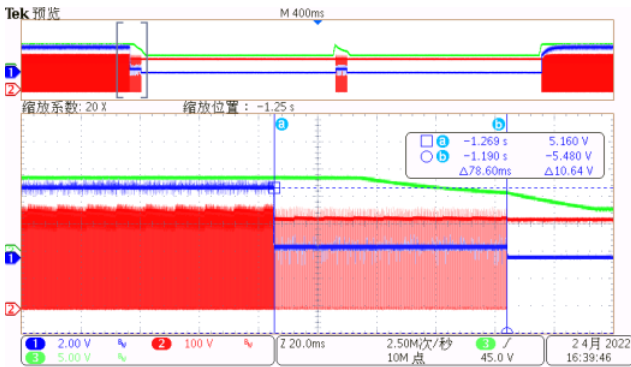


(CH1-Vo, CH2-VDrain, CH3-VDDL)
 Comments: Protection enter

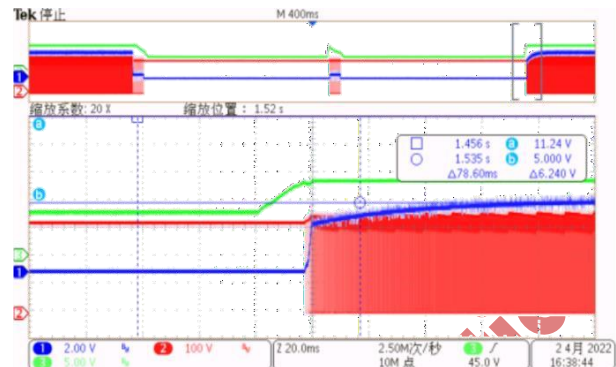


(CH1-Vo, CH2-VDrain, CH3-VDDL)
 Comments: Recover to 5V

Test Condition: 115Vac/60Hz Input, 20V3.25A Output short

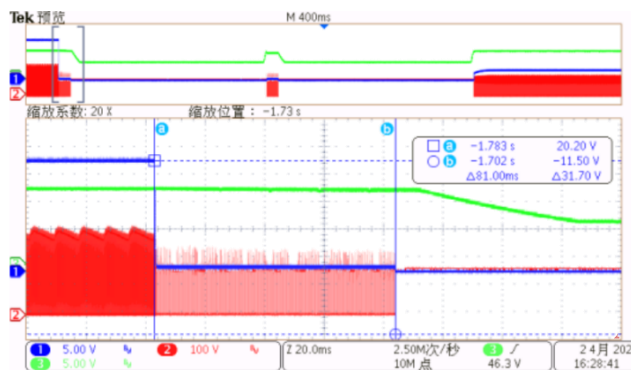


(CH1-Vo, CH2-VDrain, CH3-VDDL)
Comments: Protection enter

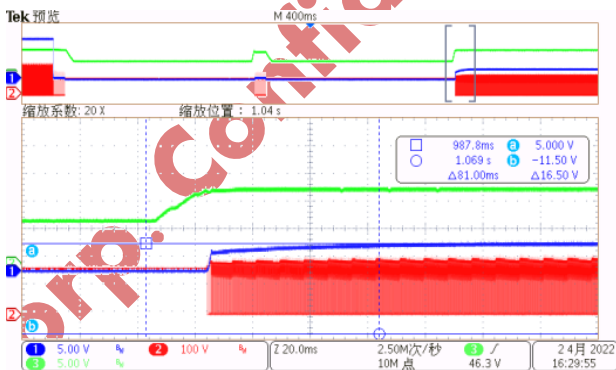


(CH1-Vo, CH2-VDrain, CH3-VDDL)
Comments: Recover to 5V

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

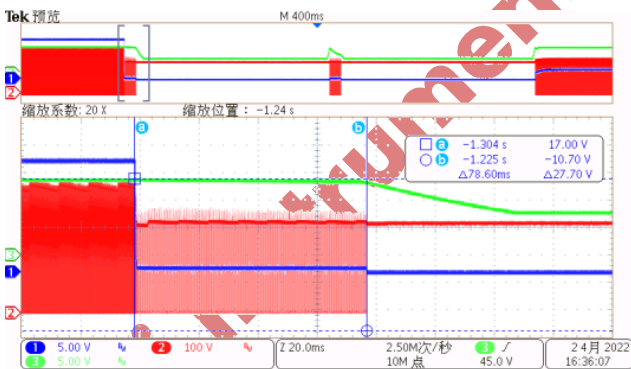


(CH1-Vo, CH2-VDrain, CH3-VDDL)
Comments: Protection enter

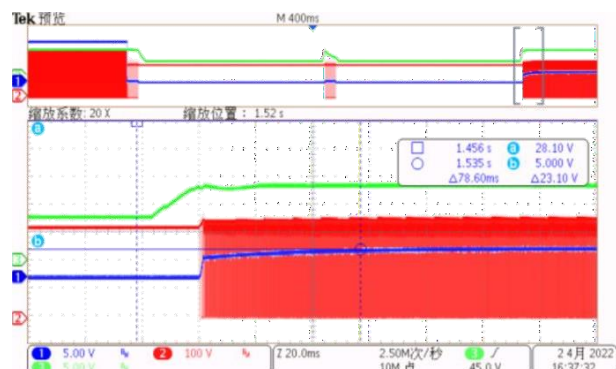


(CH1-Vo, CH2-VDrain, CH3-VDDL)
Comments: Recover to 5V

Test Condition: 230Vac/50Hz Input, 20V3.25A Output short



(CH1-Vo, CH2-VDrain, CH3-VDDL)
Comments: Protection enter



(CH1-Vo, CH2-VDrain, CH3-VDDL)
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:

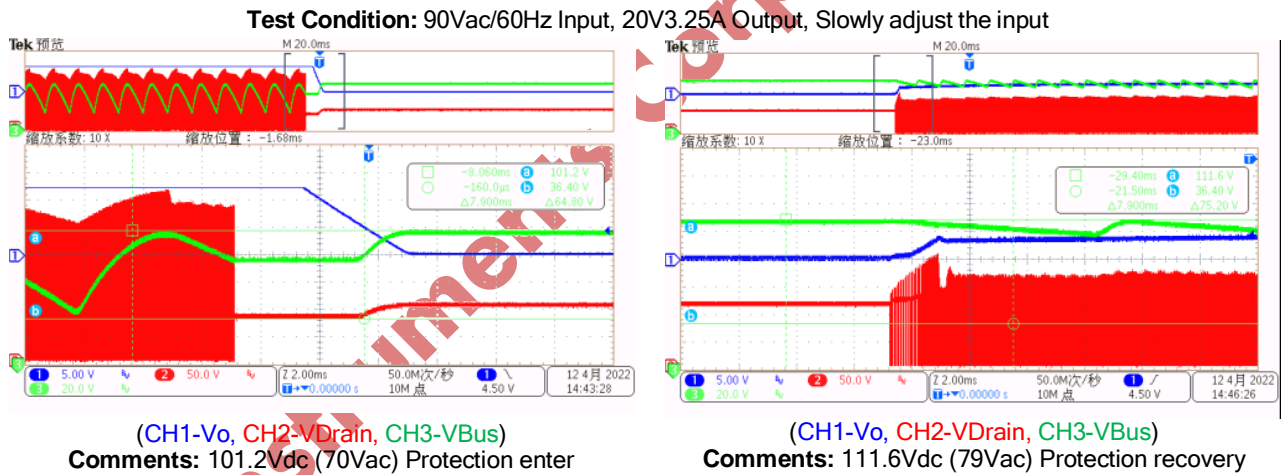
Input Voltage	OCP (A)				
	5V	9V	12V	15V	20V
90Vac/60Hz	6.41	6.25	4.21	4.13	4.02
115Vac/60Hz	6.56	6.38	4.32	4.24	4.11
230Vac/50Hz	6.87	6.82	4.58	4.55	4.22
264Vac/50Hz	6.91	6.82	4.62	4.6	4.37

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:



3.4 Output Overvoltage Protection

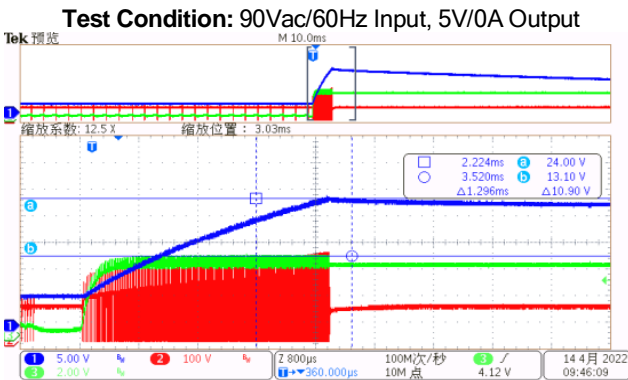
Standard: $V_{o-OVP} < 1.5 * V_{o-Max}$.

Result: Pass

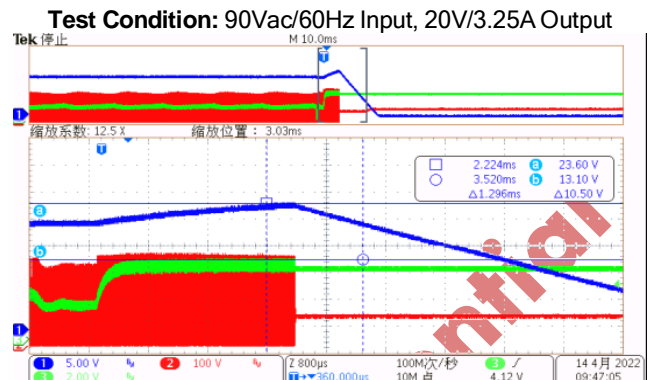
Test Data:

Vin(Vac)	Vo-OVP(V)		Result
	5V/0A	20V/3.25A	
90Vac/60Hz	24	23.6	PASS
265Vac/60Hz	23.9	23.8	

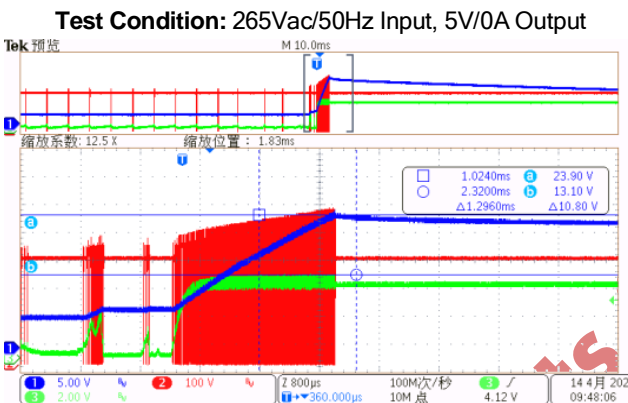
Waveforms:



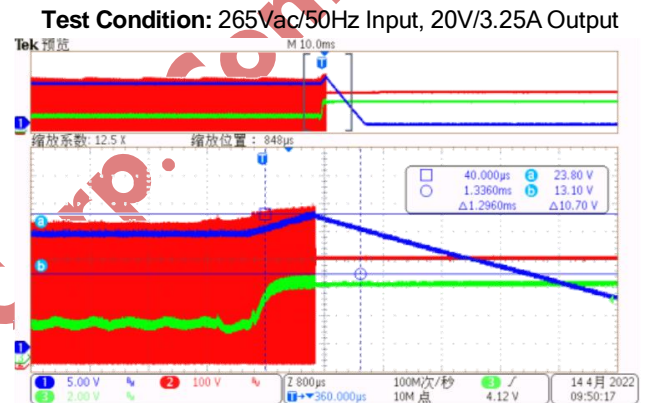
(CH1-Vo, CH2-VDrain, CH3-VFB)
Comments: Vo-OVP=24V



(CH1-Vo, CH2-VDrain, CH3-VFB)
Comments: Vo-OVP=23.6V



(CH1-Vo, CH2-VDrain, CH3-VFB)
Comments: Vo-OVP=23.9V



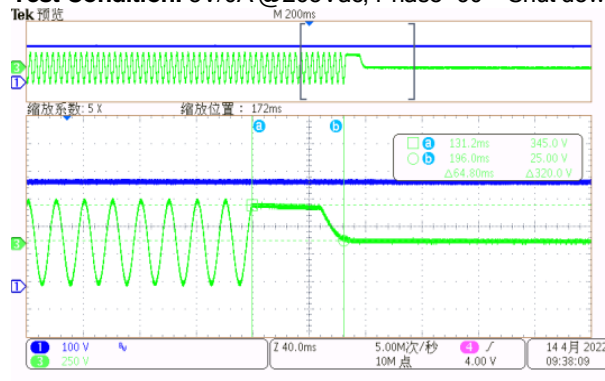
(CH1-Vo, CH2-VDrain, CH3-VFB)
Comments: Vo-OVP=23.8V

3.5 X-Cap Discharge Protection

Standard: The voltage of X-Cap decreases to less than 37% in 1s.

Result: Pass

Test Condition: 5V/0A @265Vac, Phase=90° Shut down



(CH3-Vinac, CH4-Vin)
Comments: Normally

4 Reliability Requirements

4.1 Device Maximum Rating Test

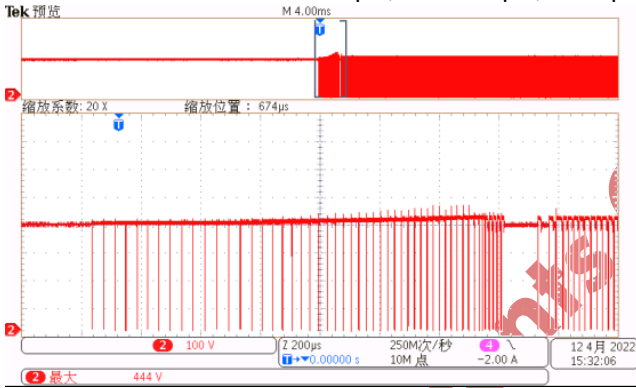
Standard: MOSFET and Diode<95% Rating.

Result: Pass

Component	Rating	265Vac/50Hz			Result
		5V/3A	20V/3.25A		
		Startup	Steady	Short	
KP22066QDGA	650V	444V	524V	546V	PASS
Q1 Mos	100V	77.2V	90V	88.4V	PASS

Waveforms:

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



(CH2-VDrain)

Comments: VDrain_peak=444V

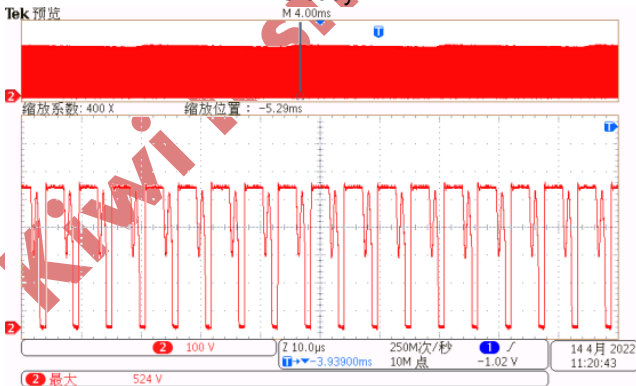
Test Condition: 265Vac/50Hz Input, 5V3A Output, Startup



(CH3-VSR)

Comments: VSR_peak=77.2V

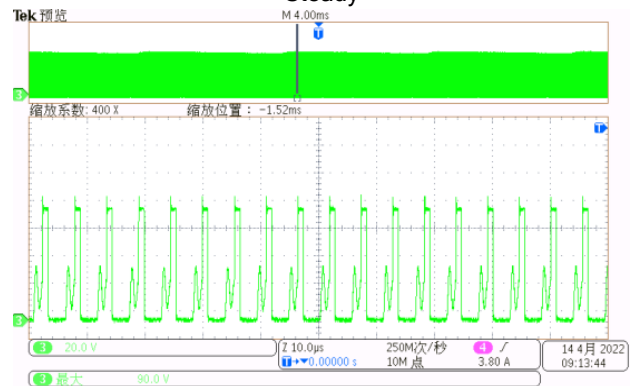
Test Condition: 265Vac/50Hz Input, 20V3.25A Output, Steady



(CH2-VDrain)

Comments: VDrain_peak=524V

Test Condition: 265Vac/50Hz Input, 20V3.25A Output, Steady

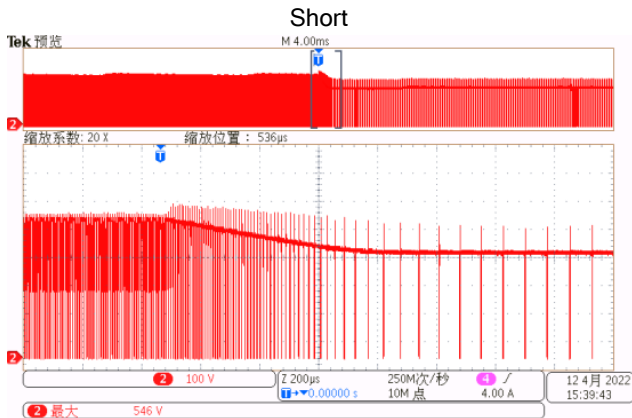


(CH3-VSR)

Comments: VSR_peak=90V

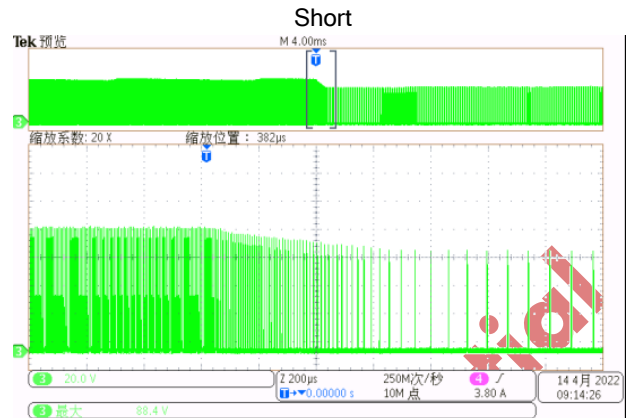
Test Condition: 265Vac/50Hz Input, 20V/3.25A Output,

Test Condition: 265Vac/50Hz Input, 20V/3.25A Output,



(CH2-VDrain)

Comments: VDrain_peak=546V



(CH3-VSR)

Comments: VSR_peak=88.4V

4.2 Bmax Test

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

Transient and its peak load: $B_{max} \leq 0.38T$.

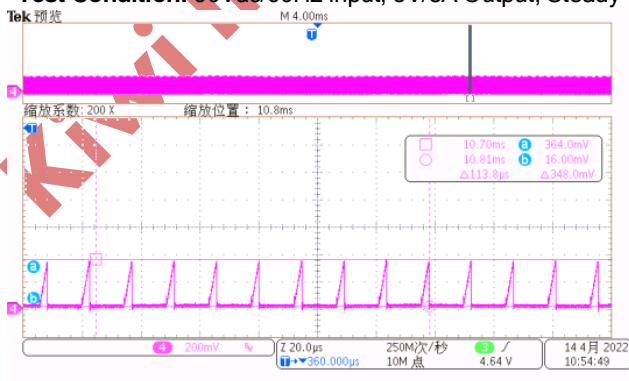
Result: Pass

Note: The turn numbers of the transform is 25, and the sectional area is 64mm², Lp is 175µH, Rcs=0.194R.

Bmax(T)	90Vac/60Hz					Bmax_Limit(T)	Result
	5V	9V	12V	15V	20V		
Steady	0.205	0.239	0.261	0.241	0.318	0.32T	PASS
OverLoad	0.33	0.365	0.313	0.32	0.35	0.38T	PASS

Waveforms:

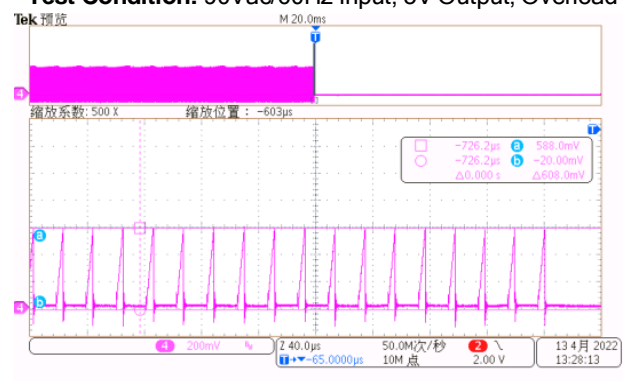
Test Condition: 90Vac/60Hz Input, 5V/3A Output, Steady



(CH4-Vcs)

Comments: Vcs=364mV, Rcs=0.194R, Ics=1.876A

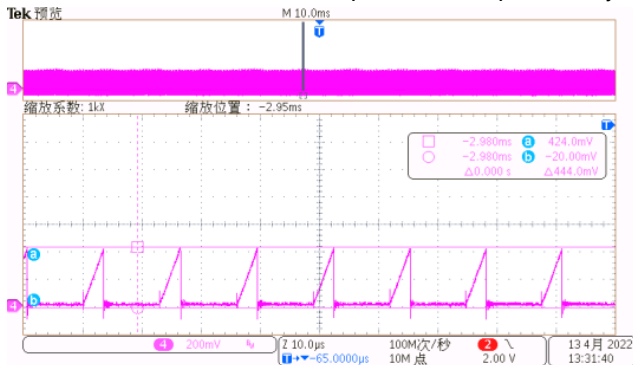
Test Condition: 90Vac/60Hz Input, 5V Output, Overload



(CH4-Vcs)

Comments: Vcs=588mV, Rcs=0.194R, Ics=3.03A

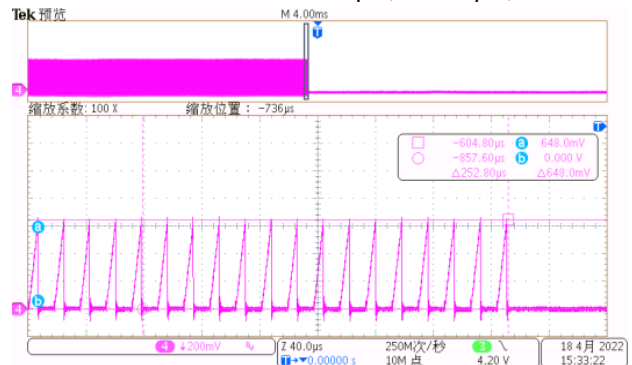
Test Condition: 90Vac/60Hz Input, 9V3A Output, Steady



(CH4-Vcs)

Comments: Vcs=424mV, Rcs=0.194R, Ics=2.185A

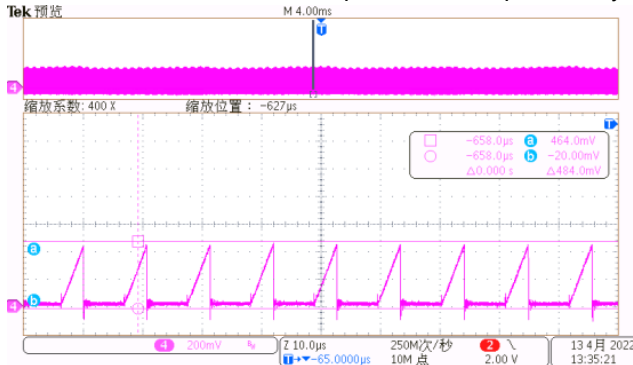
Test Condition: 90Vac/60Hz Input, 9V Output, Overload



(CH4-Vcs)

Comments: Vcs=648mV, Rcs=0.194R, Ics=3.34A

Test Condition: 90Vac/60Hz Input, 12V3A Output, Steady



(CH4-Vcs)

Comments: Vcs=464mV, Rcs=0.194R, Ics=2.391A

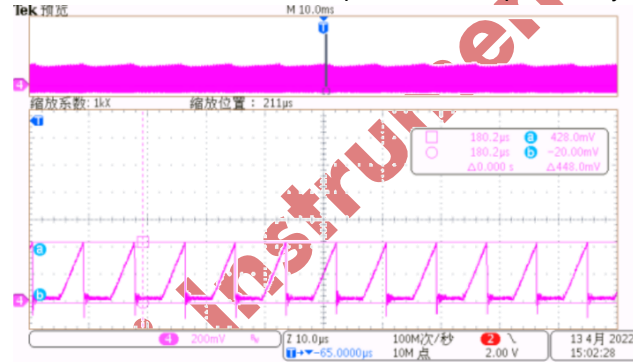
Test Condition: 90Vac/60Hz Input, 12V Output, Overload



(CH4-Vcs)

Comments: Vcs=556mV, Rcs=0.194R, Ics=2.865A

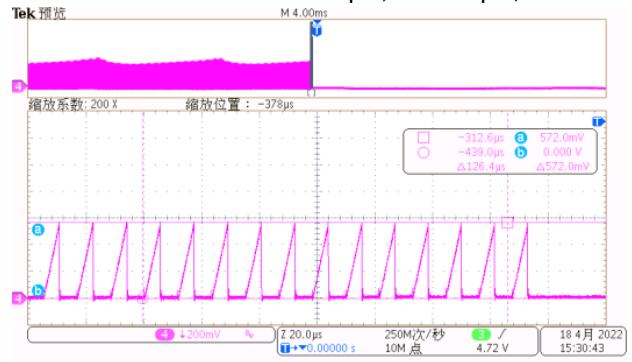
Test Condition: 90Vac/60Hz Input, 15V3A Output, Steady



(CH4-Vcs)

Comments: Vcs=428mV, Rcs=0.194R, Ics=2.206A

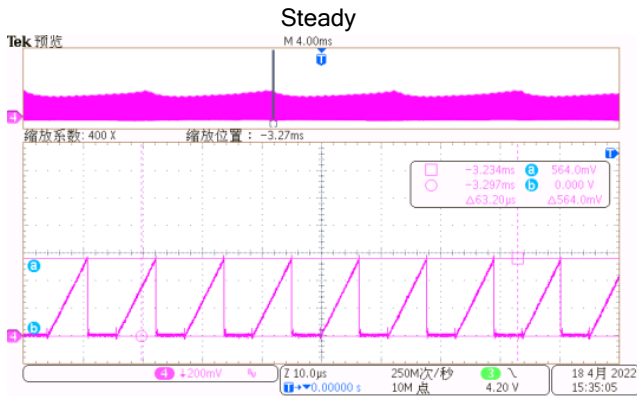
Test Condition: 90Vac/60Hz Input, 15V Output, Overload



(CH4-Vcs)

Comments: Vcs=572mV, Rcs=0.194R, Ics=2.948A

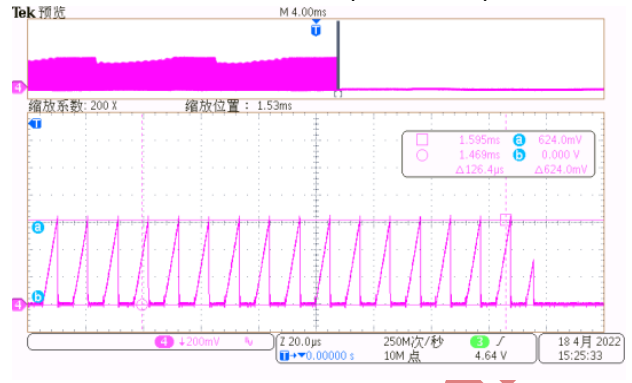
Test Condition: 90Vac/60Hz Input, 20V/3.25A Output,



(CH4-Vcs)

Comments: Vcs=564mV, Rcs=0.194R, Ics=2.907A

Test Condition: 90Vac/60Hz Input, 20V Output, Overload



(CH4-Vcs)

Comments: Vcs=624mV, Rcs=0.194R, Ics=3.216A

4.3 Thermal Test

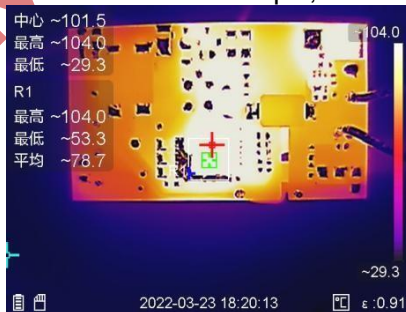
Test Condition: 90Vac/60Hz, 265Vac/50Hz input; 20V/3.25A output; Burn-in 1Hour @ confined container (30cm*30cm*30cm acrylic box) and steady environment with no airflow, Ta is the temperature inside the acrylic box.

Standard: MOS, IC and Diode: Ta=25°C, Trise<90°C. Transformer: Ta=25°C, Trise<85°C.

Result: Pass

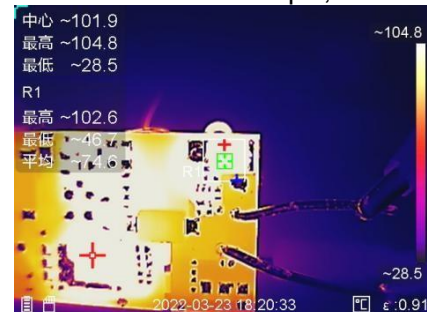
Trise(°C)	20V/3.25A			
	Ta: 27.3°C			
Location	90V/60Hz		265V/50Hz	
	T(°C)	Trise(°C)	T(°C)	Trise(°C)
KP22066QDGA	100	72.7	104	76.7
KP4060LGA	78.8	51.5	96.5	69.2
Q1 Mos	82.7	55.4	102.6	75.3
Transformer	93.4	66.1	106.7	79.4
Bridge	102.4	75.1	77.3	50

Test Condition: 265Vac/50Hz Input, 20V/3.25A Output



Comments: T-KP22066=104°C

Test Condition: 265Vac/50Hz Input, 20V/3.25A Output



Comments: T-Q1 Mos=102.6°C

5 EMC/EMS Test Result

5.1 Conducted and Radiation Emissions

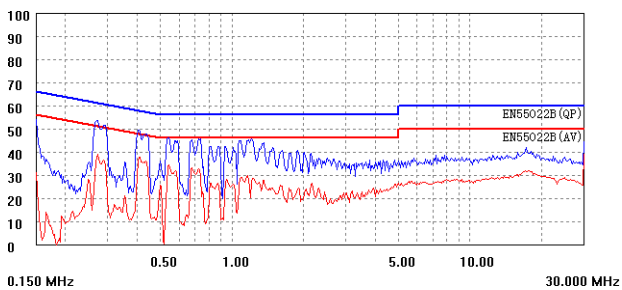
Standard:

standard	EN55022B/EN55015CDN
content	CE & RE
requirement	6dB margin

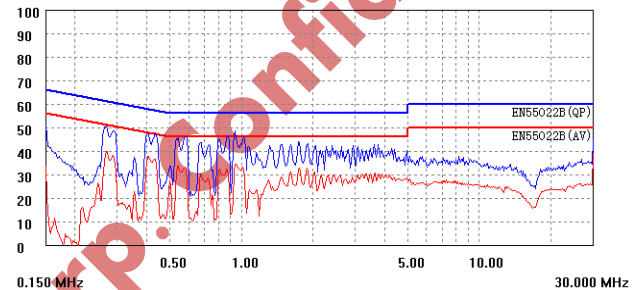
Result: Pass

Note: The resistor load is connected at the 1m Line end.

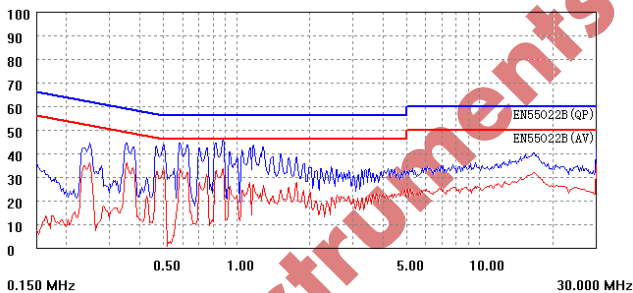
Test Condition: 220Vac/50Hz-L Input, 20V/3.25A Output



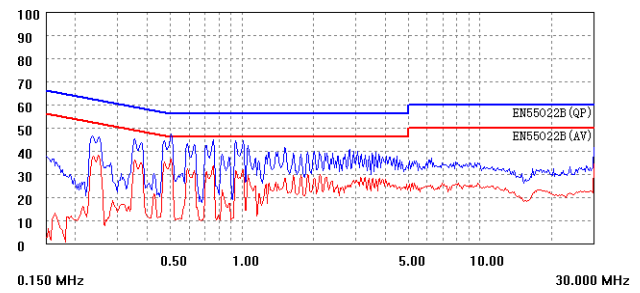
Test Condition: 220Vac/50Hz-N Input, 20V/3.25A Output



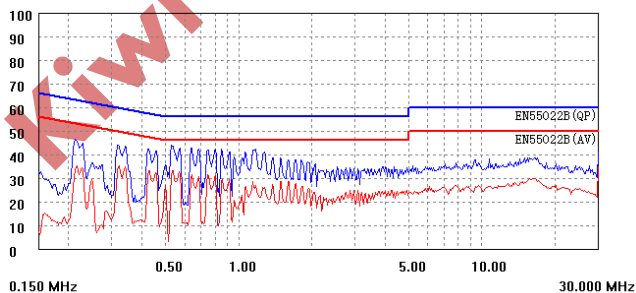
Test Condition: 220Vac/50Hz-L Input, 15V/3A Output



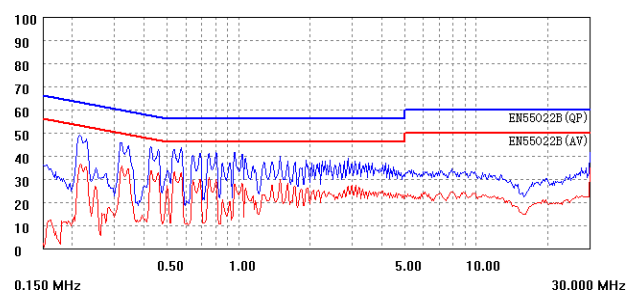
Test Condition: 220Vac/50Hz-N Input, 15V/3A Output



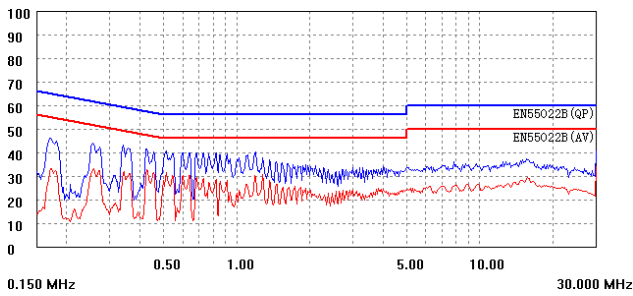
Test Condition: 220Vac/50Hz-L Input, 12V/3A Output



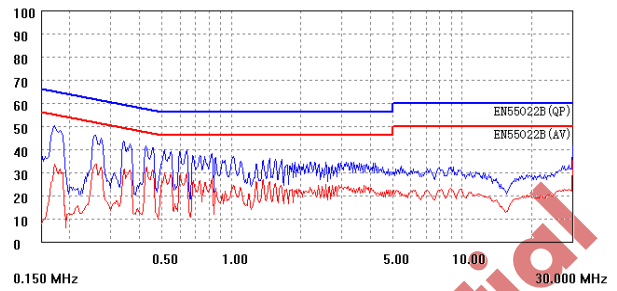
Test Condition: 220Vac/50Hz-N Input, 12V/3A Output



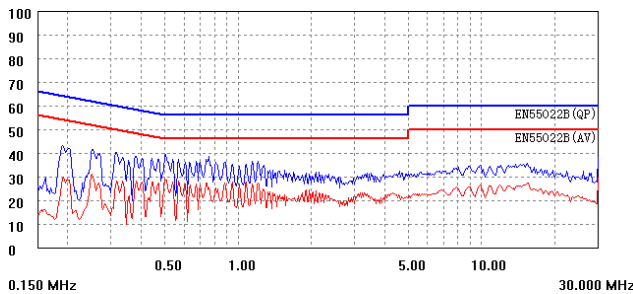
Test Condition: 220Vac/50Hz-L Input, 9V/3A Output



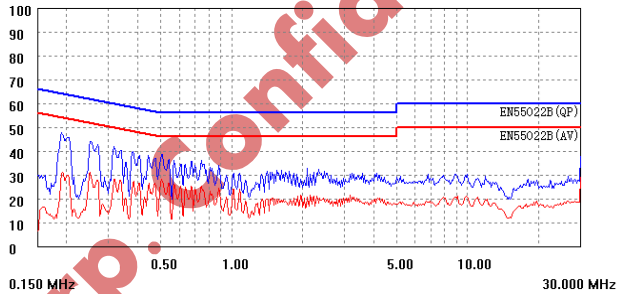
Test Condition: 220Vac/50Hz-N Input, 9V/3A Output



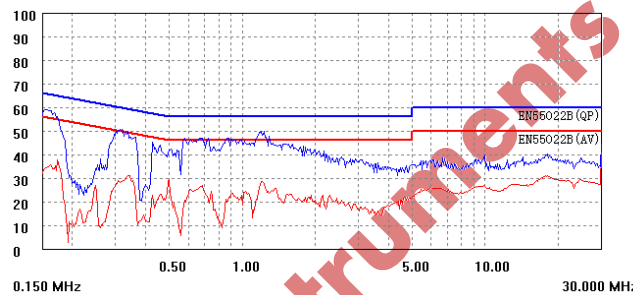
Test Condition: 220Vac/50Hz-L Input, 5V/3A Output



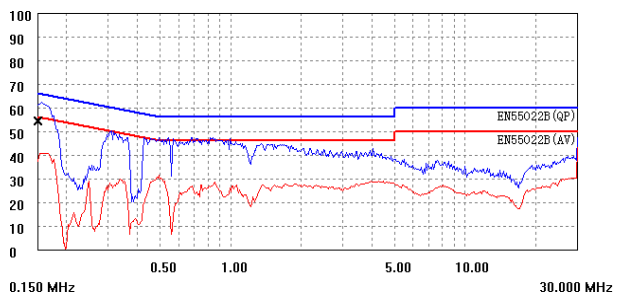
Test Condition: 220Vac/50Hz-N Input, 5V/3A Output



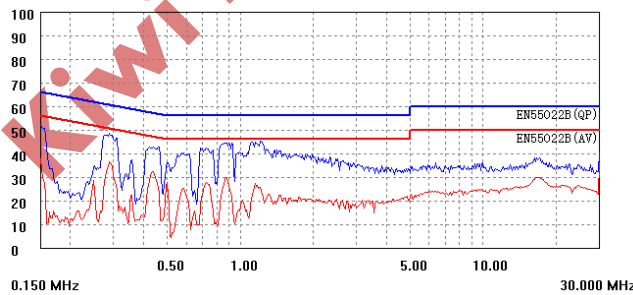
Test Condition: 110Vac/60Hz-L Input, 20V/3.25A Output



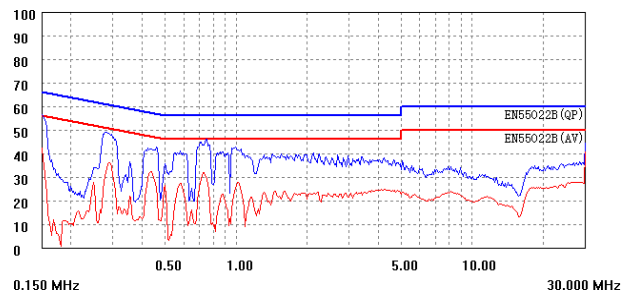
Test Condition: 110Vac/60Hz-N Input, 20V/3.25A Output



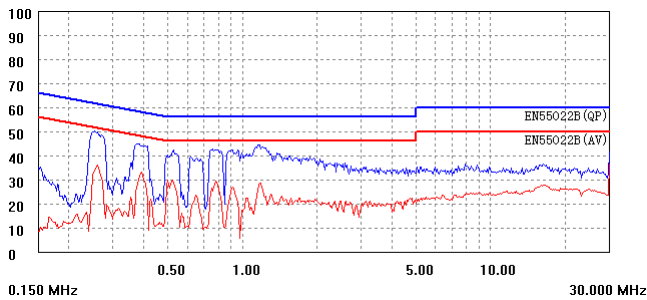
Test Condition: 110Vac/60Hz-L Input, 15V/3A Output



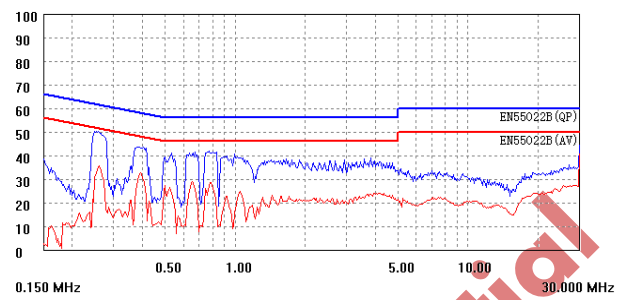
Test Condition: 110Vac/60Hz-N Input, 15V/3A Output



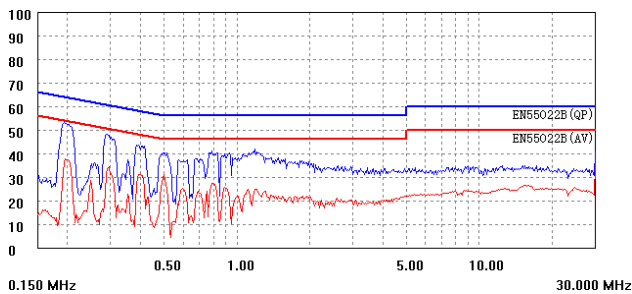
Test Condition: 110Vac/60Hz-L Input, 12V/3A Output



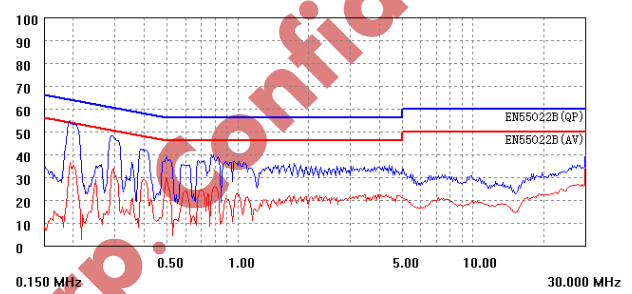
Test Condition: 110Vac/60Hz-N Input, 12V/3A Output



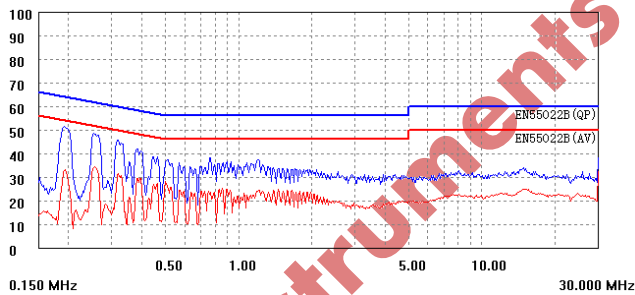
Test Condition: 110Vac/60Hz-L Input, 9V/3A Output



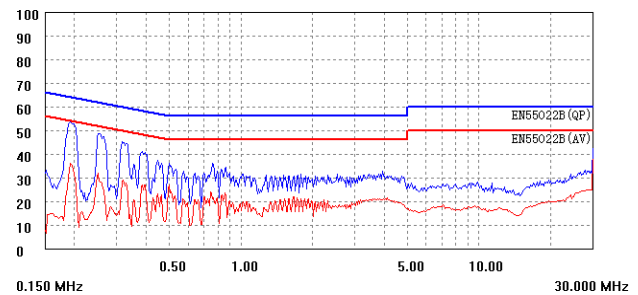
Test Condition: 110Vac/60Hz-N Input, 9V/3A Output



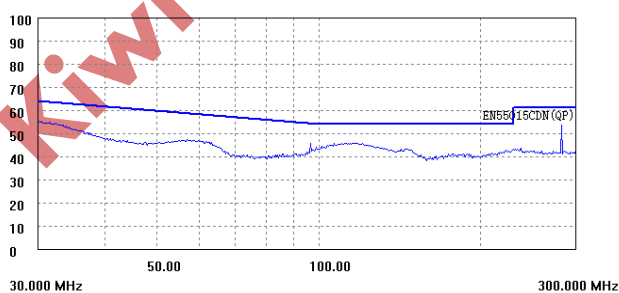
Test Condition: 110Vac/60Hz-L Input, 5V/3A Output



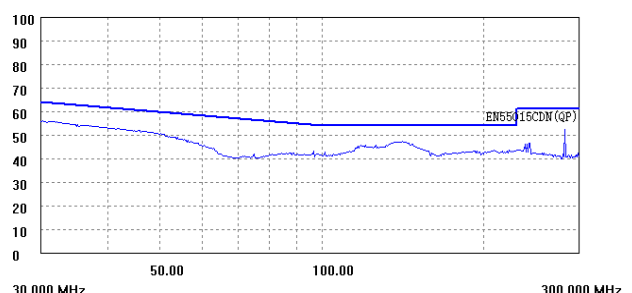
Test Condition: 110Vac/60Hz-N Input, 5V/3A Output



Test Condition: 220Vac/50Hz Input, 20V/3.25A Output

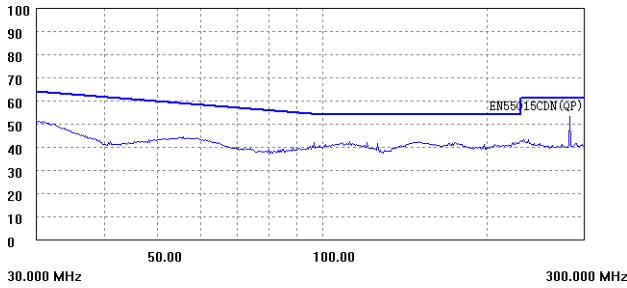


Test Condition: 110Vac/60Hz Input, 20V/3.25A Output

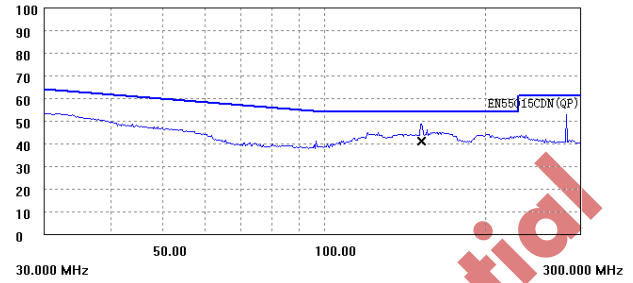




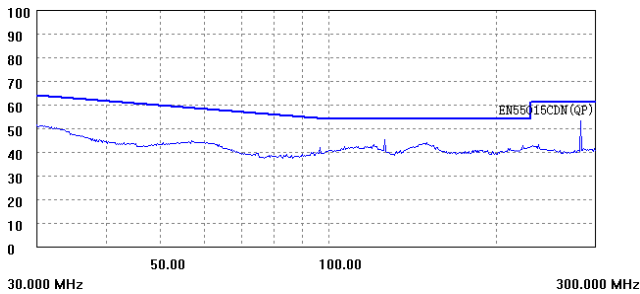
Test Condition: 220Vac/50Hz Input, 15V/3A Output



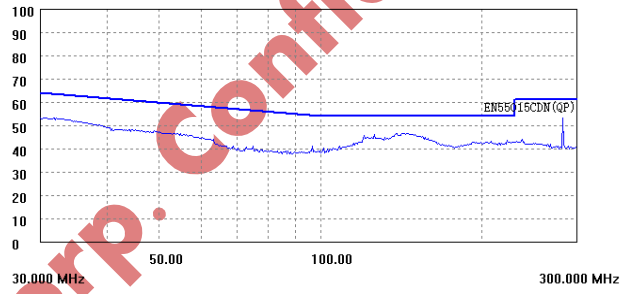
Test Condition: 110Vac/60Hz Input, 15V/3A Output



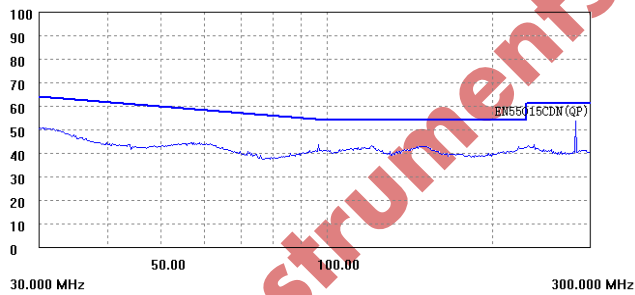
Test Condition: 220Vac/50Hz Input, 12V/3A Output



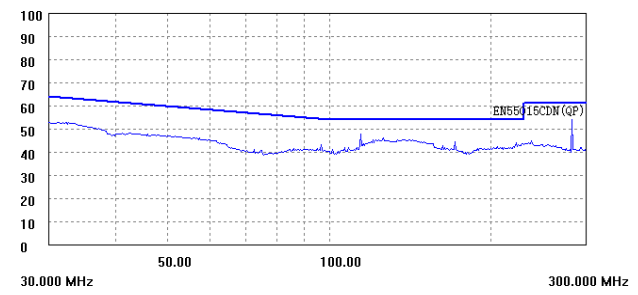
Test Condition: 110Vac/60Hz Input, 12V/3A Output



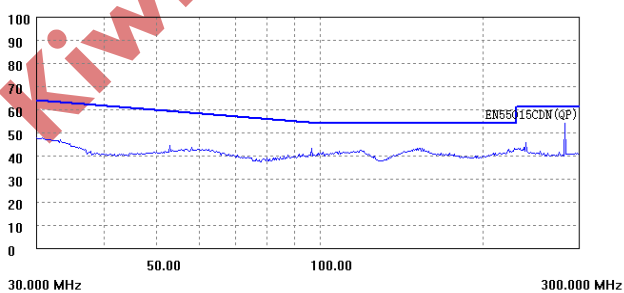
Test Condition: 220Vac/50Hz Input, 9V/3A Output



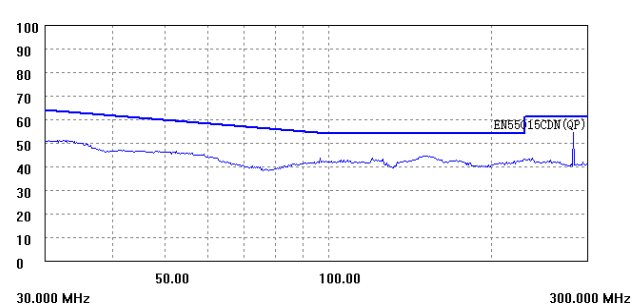
Test Condition: 110Vac/60Hz Input, 9V/3A Output



Test Condition: 220Vac/50Hz Input, 5V/3A Output



Test Condition: 110Vac/60Hz Input, 5V/3A Output





5.2 Surge Test

Test Condition: Input 220Vac/50Hz, output 20V/3.25A. 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 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
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
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 20V/3.25A. 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
18	Pass	20	Pass
-18	Pass	-20	Pass

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DATE	REV	DESCRIPTION
2022/04/20	1.0	First Release

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