DEMO BOARD TEST REPORT

High Performance 12V/4A Adapter Charger with Offline Current Mode Controller KP201 and Synchronous Rectifier KP40512

FEATURES

- High Average Efficiency at Cable End Meets CoC V5 Tier2
- Standby Power Consumption <75mW
- High Precision 12V CV Regulation with Fast Dynamic Response
- Temp of Components at 45℃ Ambience Meets Derating Standard
- Ripple <120mV
- >6DB Margin for CE and RE Test
- ESD and Surge Meets IEC61000 Standard
- Stable Operation without Audio Noise

APPLICATIONS

- Chargers and Adapter

INTRODUCTION

KP201 is a high performance current mode PWM controller for offline flyback converter applications. The IC supports DCM and CCM operation mode.

KP40512 is a high efficiency and reliability secondary side synchronous rectifier switch, which supports DCM, QR, CCM operation mode and integrates 100V MOSFET.

The demo board of KP201+KP40512-D02 is typically designed for the application of 12V/4A 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	Vin	90		265	Vac	60/50Hz
Output	Vout/Iout	12V4A				
Rate Output Power	Pout		48		W	
Ripple & Noise	Vripple			109	mVp-p	1.5m #18AWG Cable end, 20MHz bandwidth
Average Efficiency	η	>88.97(Cocv5 Tie2)			%	1.5m #18AWG Cable end @115V/230Vac
Standby Power Consumption	Pst			68.19	mW	@230Vac/50Hz
Startup Time	Tst			2.69	s	Tested at 90Vac/60Hz
Conducted EMI Margin	CE		14		dB	EN55022 Class B
Radiated EMI Margin	RE		6		dB	EN55032 Class B
Surge Test (Different/Common)			±2/±1		kV	Common/Differential mode @ 230Vac/50Hz
ESD (Contact/Air Discharge)	ESD		±9/±16		kV	12V/4A Output
Operating Ambient	Ta	-5		45	℃	
Operating Humidity		5		95	%R.H.	

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

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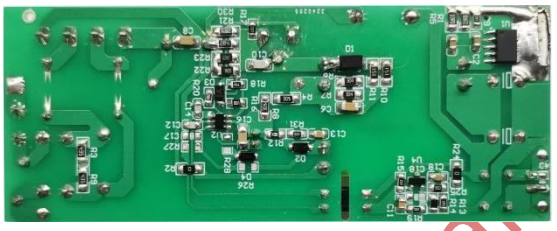
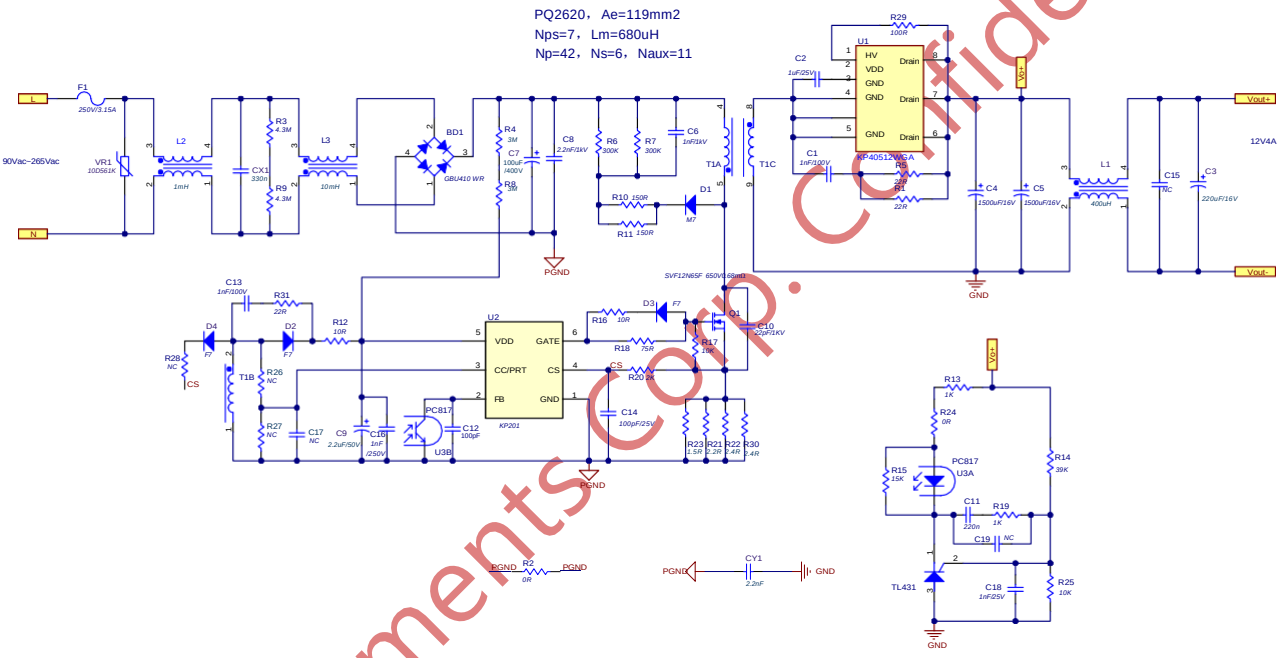
section.

Demo Board of KP201LGA+KP40512WGA-D02-REV1.0



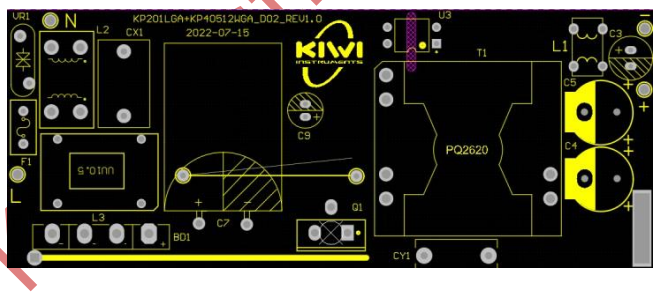
Board Size (mm): L x W x H = 101 x 40.5 x22.5

Schematic

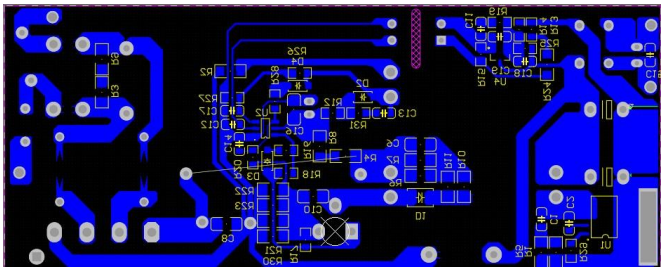


Printed Circuit Board Layout

Top Layer



Bottom Layer



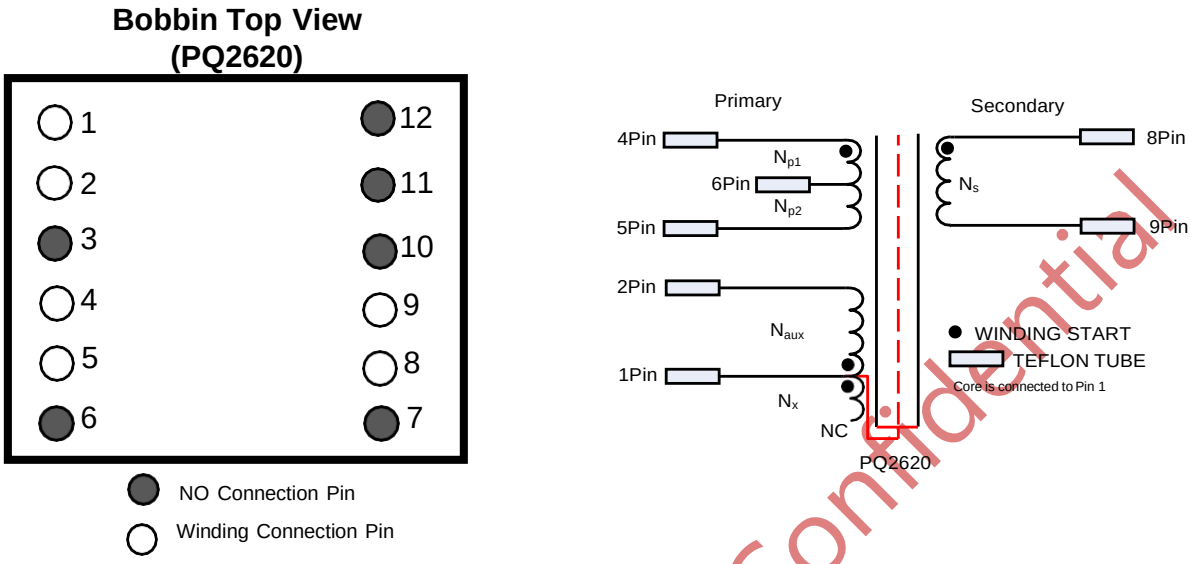
Bill of Material

No.	Designator	Value	Description	Package	Manufacturer	Part Number
1	BD1	4A/1000V	BRD 4A 1000V 1V	GBU	World	WRGBU410
2	F1	3.15A/250V	Fuse 3.15A 250V	T8.35*4.3*7.7	CONQUER	MST 3.15A 250V
3	VR1	10D561K	VARISTOR 350VAC 70J 1250A	T12.5*15.5*5.5 P7.5	STE	STE10D561K1 EN0FSB0R0
4	L1	400μH	Common Mode inductor	T10*6*5		
5	L2	1mH	Common Mode inductor	T16*7.5*17.5	WE	744821201
6	L3	10mH	Common Mode inductor	T16*12*8		
7	U1	KP40512	Secondary Side Synchronous Rectifier	ASOP6	Kiwi Instruments	KP40512WGA
8	U2	KP201	High-performance Multi-Mode PWM Controller	SOT23-6	Kiwi Instruments	KP201LGA
9	U3	EL817	PHOTO TR 50mA 200%-400%	DIP-4	EVERLIGHT	EL817(A)-F
10	U4	TL431	IC VOL REF 2.5V 100mA 1% 36V	SOT-23	MDD	TL431
11	Q1	12A/650V	MOSFET 650V 12A 680mohm	TO-220F-3L	SILAN	SVF12N65F
12	D1	1A/1kV	DIO FRD 1A 1000V 1.1V	DO-214AC (SMA)	MDD	M7
13	D2, D3, D4	1A/1kV	DIO FRD 1A 1000V 500nS 1.3V	SOD-123FL	DIYI	FFM107-M
14	CX1	330nF/275V	X2 Capacitor 275Vac	T15*8.5*14 P12.5	WE	890324024003 CS
15	CY1	2.2nF/400V	Y1 Capacitor 400Vac ±10%	T5 P10	STE	Q09F1D222M N0B0S0N0
16	R1, R5	22Ω	Chip Resistor ±5% 1/4W	1206	FH	RS-06K22R0FT
17	R2, R24	0Ω	Chip Resistor ±5% 1/4W	1206	FH	RS-06000FT
18	R3, R9	4.3MΩ	Chip Resistor ±5% 1/4W	1206	FH	RS-06L4304FT
19	R4, R8	3MΩ	Chip Resistor ±5% 1/4W	1206	FH	RS-06L3004FT
20	R6, R7	300kΩ	Chip Resistor ±5% 1/4W	1206	FH	RS-06K3003FT
21	R10, R11	150Ω	Chip Resistor ±5% 1/4W	1206	FH	RS-06K1500FT
22	R12, R16	10Ω	Chip Resistor ±5% 1/8W	0805	FH	RS-05K10R0FT
23	R13, R19	1kΩ	Chip Resistor ±5% 1/8W	0805	FH	RS-05K1001FT
24	R14	39kΩ	Chip Resistor ±1% 1/8W	0805	FH	RS-05K3902FT
25	R15	15kΩ	Chip Resistor ±5% 1/8W	0805	FH	RS-05K1502FT
26	R18	75Ω	Chip Resistor ±5% 1/8W	0805	FH	RS-05K75R0FT
27	R20	2kΩ	Chip Resistor ±5% 1/8W	0805	FH	RS-05K2001FT
28	R21	2.2Ω	Chip Resistor ±1% 1/4W	1206	FH	RS-06L2R20FT
29	R22, R30	2.4Ω	Chip Resistor ±1% 1/4W	1206	FH	RS-06L2R40FT
30	R23	1.5Ω	Chip Resistor ±1% 1/4W	1206	FH	RS-06L1R50FT
31	R17, R25	10kΩ	Chip Resistor ±1% 1/8W	0805	FH	RS-05K1002FT
32	R29	100Ω	Chip Resistor ±5% 1/8W	0805	FH	RS-05K1000FT
33	R31	22Ω	Chip Resistor ±5% 1/8W	0805	FH	RS-05K22R0FT
34	C1, C13	1nF/100V	Ceramic Cap 100V ±10% X7R	0805	WE	885012207116
35	C2	1μF/25V	Ceramic Cap 25V ±10% X7R	0805	WE	885012207078
36	C3	220μF/16V	Electrolytic Cap 16V	T6.3*11 P2.5	AISHI	ERS1CM221E 11OT

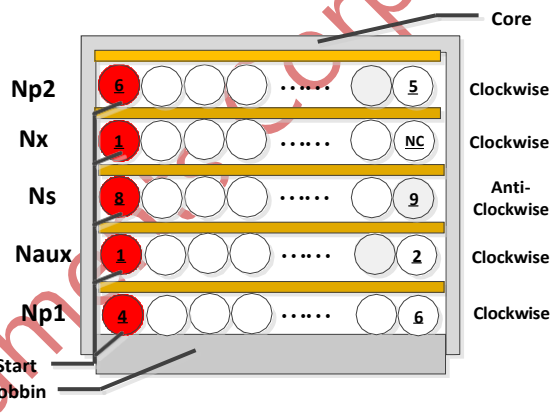
37	C4, C5	1500μF/16V	Electrolytic Cap 16V	T10*20 P5.0	AISHI	ERR1CM152G 20OT
38	C6	1nF/1KV	Ceramic Cap 1000V ±10% X7R	1206	WE	885342208018
39	C7	100μF/400V	Electrolytic Cap, 400V	T16*25 P7.5	AISHI	EWH2GM101 L25OT
40	C8	2.2nF/1KV	Ceramic Cap 1000V ±10% X7R	1206	WE	885342208019
41	C9	2.2μF/50V	Electrolytic Cap 50V	T5*11 P2.0	AISHI	ERS1HM2R2 D11OT
42	C10	22pF/1KV	Ceramic Cap 1000V ±10% X7R	1206	WE	885342008008
43	C11	220nF/50V	Ceramic Cap 50V ±10% X7R	0805	WE	885012207100
44	C12	100pF/50V	Ceramic Cap 50V ±10% X7R	0805	WE	885012007057
45	C14	100pF/25V	Ceramic Cap 25V ±10% X7R	0805	WE	885012207054
46	C16	1nF/250V	Ceramic Cap 250V ±10% X7R	1206	YAGEO	CC1206KRX7 RYBB102
47	C18	1nF/25V	Ceramic Cap 25V ±10% X7R	0805	WE	885012207060
48	T1	680μH	PQ2620, Vertical 6+6 pins, Core Material PC44	PQ2620	TDG	PQ26.5/20.4/19B

Transformer Manufacture Guide

1 Electrical Diagram



2 Winding Diagram



3 Winding Order

Number	Winding	Layer	Start	End	Wire Size(mm)	Turns	Note
1	N_{p1}	Primary	4	6	0.4mm*1P	21	Dense
2	N_{aux}	Auxiliary	1	2	0.2mm*1P	11	Smooth Wound
3	N_s	Secondary	8	9	0.9mm*2P (TIW-B)	6	Smooth Wound
4	N_x	Shield	1	NC	0.4mm*2P	8	Dense
5	N_{p2}	Primary	6	5	0.4mm*1P	21	Dense

4 Electrical Specification

Items	Test Pin	Specification	Test Condition
Primary Inductance	Pins 6 – 5; other windings open	680μH(±5%)	Ta=25℃ 40kHz/1Vrm
Leakage Inductance	Pins 6– 5; all other windings shorted	18μH	Ta=25℃ 40kHz/1Vrm
Turn Ratio	Np(6-5): Ns: Naux	42Ts:11Ts: 8Ts	20kHz/1V
HI-POT HV Test	Primary to Secondary	3750Vac	5mA, 1Min
	Pin4-1	1000Vac	5mA, 1Min
	S-Aux	3750Vac	5mA, 1Min
Insulation Resistance	P-A	> 100 MΩ	DC500V

5 BOM

Number	Materials	Specifications
1	Core	PQ2620, AE=119mm²
2	Bobbin	PQ2620,6+6 Pin
3	Wire	Φ0.2*1, 2UEW
4	Wire	Φ0.4*1, 2UEW
5	Triple Insulation Wire	Φ0.9*2, TIW-B
6	Duct Tape	W=17mm，T=0.1mm

Test Result

1 Input Characteristics

1.1 Maximum Rated Input AC Current

Standard: 1.5A max. @ 90Vac input & full load.

Result: Pass

Vin (ac)	Iin_rms (A)	Iin_max limit (A)	Result
90V	1.073	1.5A	**PASS**

1.2 Inrush Current (Cold Start)

Standard: 80A max @ 90Vac~265Vac input & full load.

Result: Pass

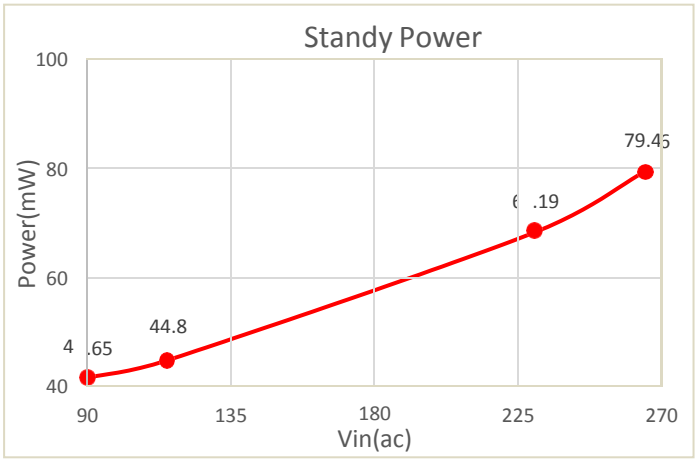
Vin (ac)	Inrush (A)	Iin_max limit (A)	Result
90V	49.2	80A	**PASS**
265V	27.6	80A	**PASS**

1.3 No Load Input Power Loss

Standard: While input 115Vac/230Vac 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)	41.65	44.8	68.19	79.46	75mW @115Vac/230Vac	**PASS**

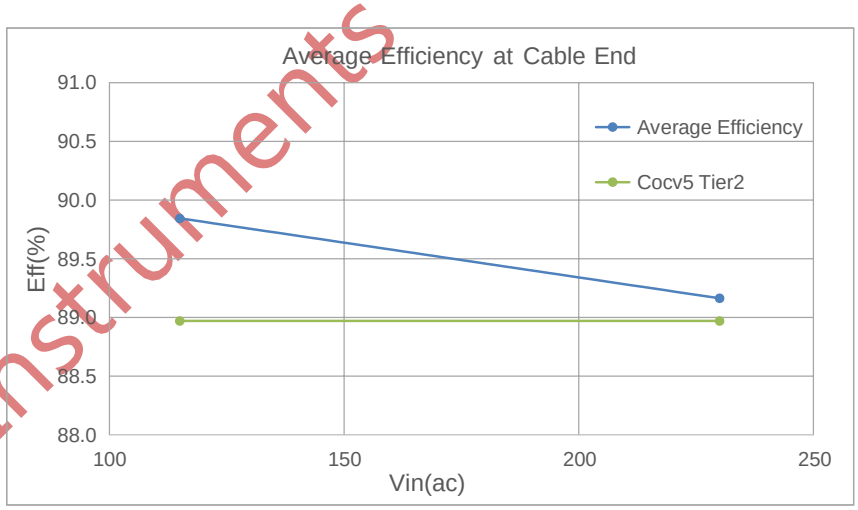


1.4 Efficiency

Standard: The average efficiency tested at 1.5m #18 AWG cable end should pass CoC_V5 Tie2 @115Vac&230Vac.

Result: Pass

Vin(Vac)	Fline(Hz)	Pin(W)	Vout(V)	Iout(A)	Pout(W)	Eff(%)	Eff_AVG (%)	CoC_V5 Tie2(%)
115	60	53.25	11.89	3.98	47.3222	88.87	89.84	88.97
		40.01	11.97	2.99	35.7903	89.45		
		26.35	12.05	1.99	23.9795	91.00		
		13.19	12.12	0.98	11.8776	90.05		
		5.30	12.17	0.38	4.6246	87.26	87.26	78.97
230	50	53.11	11.89	3.98	47.3222	89.10	89.16	88.97
		39.96	11.97	2.99	35.7903	89.57		
		26.80	12.05	1.99	23.9795	89.48		
		13.42	12.12	0.98	11.8776	88.51		
		5.60	12.17	0.38	4.6246	82.58	82.58	78.97



2 Output Characteristics

2.1 Output Line Regulation and Load Regulation

Standard: Under the input voltage 90Vac~265Vac, line regulation <±1%, load regulation <±5%. The output voltage is tested at the 1.5m #18 AWG cable end.

Result: Pass

Vo=12V	0%	25%	50%	75%	100%	Load Regulation
90Vac	12.19	12.11	12.04	11.96	11.88	2.61%
115Vac	12.19	12.11	12.04	11.96	11.88	2.61%
230Vac	12.19	12.12	12.04	11.96	11.88	2.61%
265Vac	12.19	12.12	12.04	11.96	11.89	2.52%
Line Regulation	0.00%	0.08%	0.00%	0.00%	0.08%	-

2.2 Ripple & Noise

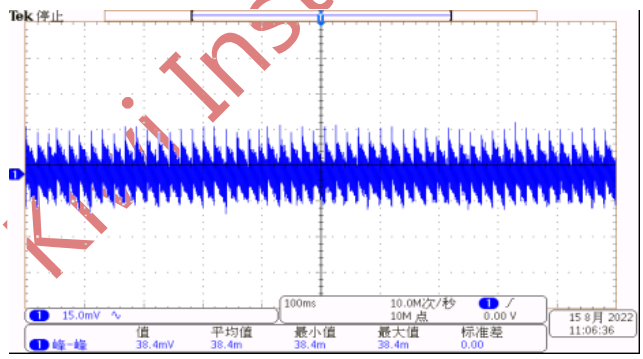
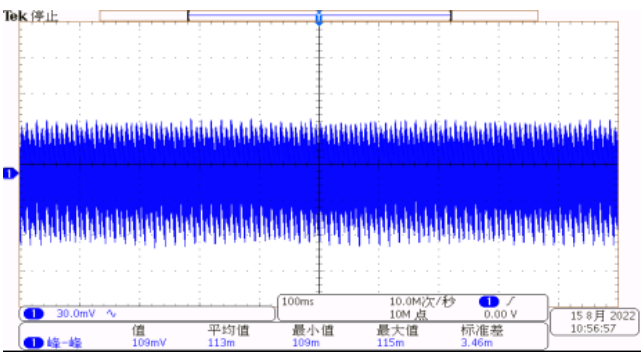
Standard: Under the input voltage 90Vac~265Vac, Vripple_max<120mV.

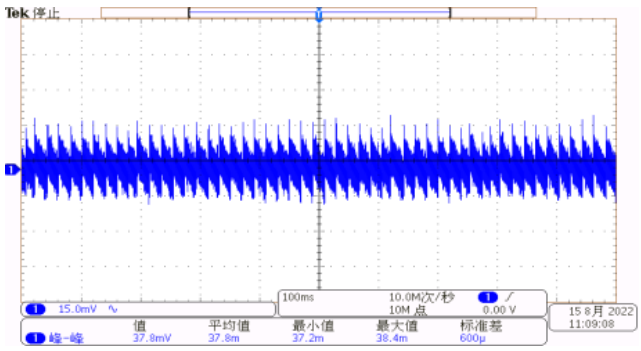
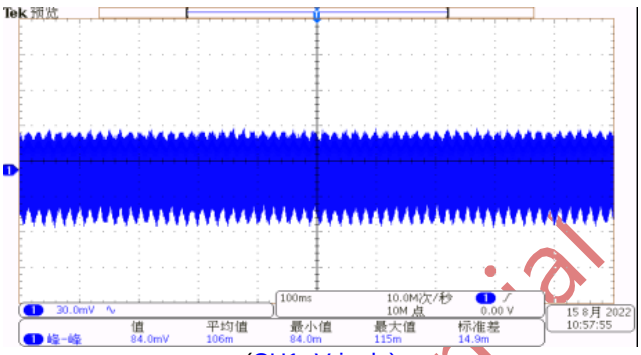
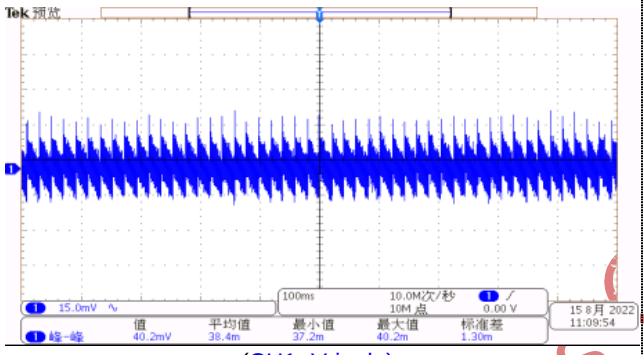
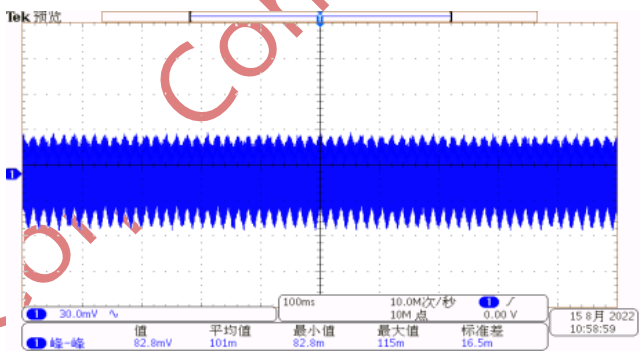
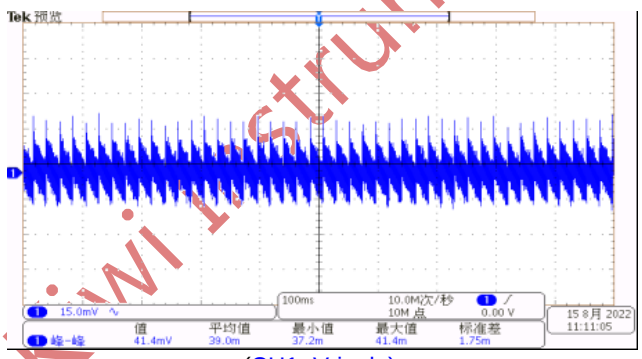
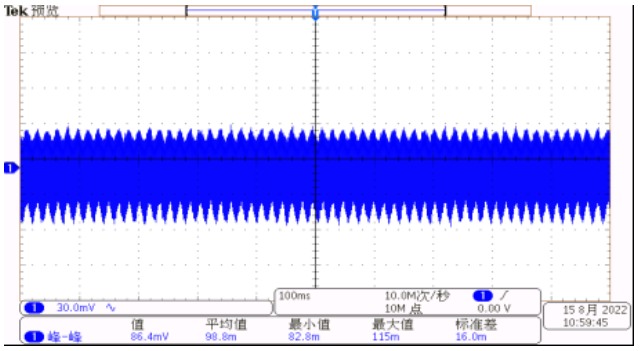
Result: Pass

Note: Ripple & noise is measured at the 1.5m #18 AWG cable end with a 0.1μF/50V ceramic cap paralleled with a 10μF/50V electrolytic cap. Bandwidth is limited to 20Mhz.

Vo=12V	空载纹波 (mV)	满载纹波 (mV)
90Vac	38.4	109
115Vac	37.8	84
230Vac	40.2	82.8
264Vac	41.4	86.4

Waveforms:

Test Condition: 90Vac/60Hz Input, 12V/0A Output	**Test Condition:** 90Vac/60Hz Input, 12V/4A Output
	
(CH1- Vripple)	(CH1- Vripple)
Comments: Vripple=38.4mV	**Comments:** Vripple=109mV

Test Condition: 115Vac/60Hz Input, 12V/0A Output	**Test Condition:** 115Vac/60Hz Input, 12V/4A Output
 (CH1- Vripple) **Comments:** Vripple=37.8mV	 (CH1- Vripple) **Comments:** Vripple=84mV
Test Condition: 230Vac/60Hz Input,12V/0A Output	**Test Condition:** 230Vac/60Hz Input, 12V/4A Output
 (CH1- Vripple) **Comments:** Vripple=40.2mV	 (CH1- Vripple) **Comments:** Vripple=82.8mV
Test Condition: 265Vac/60Hz Input,12V/0A Output	**Test Condition:** 265Vac/60Hz Input, 12V/4A Output
 (CH1- Vripple) **Comments:** Vripple=41.4mV	 (CH1- Vripple) **Comments:** Vripple=86.4mV

2.3 Load Transient Test

Standard: Tested at the 1.5m #18AWG cable end and under the input voltage 90Vac~265Vac, the output voltage transient response should be within ±10% normal voltage (10.8V~13.2V).

Result: Pass

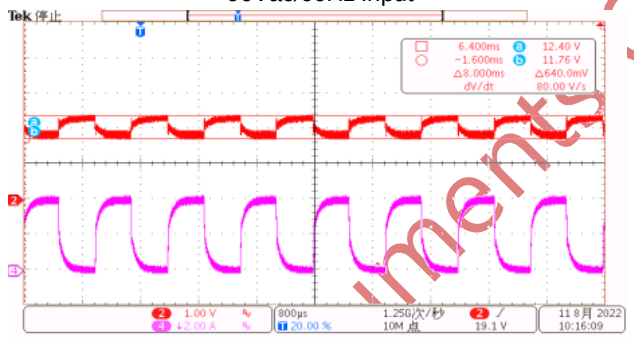
Note: 0% load shift to 100% load with 0.5A/μs changing ramp and 1kHz changing frequency.

Input Voltage	12V	
	Vo_min	Vo_max
90Vac	11.76	12.4
115Vac	11.76	12.4
230Vac	11.76	12.38
265Vac	11.76	12.4

Waveforms:

Test Condition: Load 12V/(0-4)A, Frequency 1KHz, Duty Cycle=50%, Slew Rate=0.5A/μs

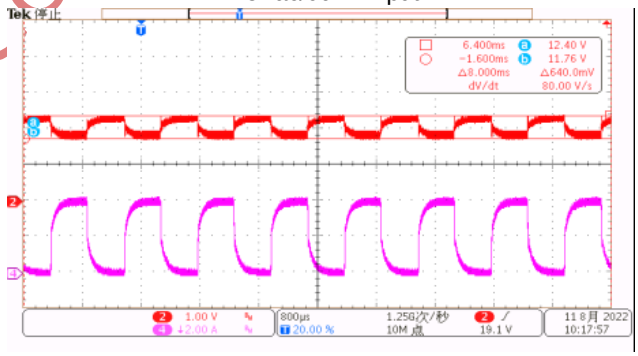
90Vac/60Hz Input



(CH2-Vo, CH4-Io)

Comments: Vo-min/max=11.76V/12.4V

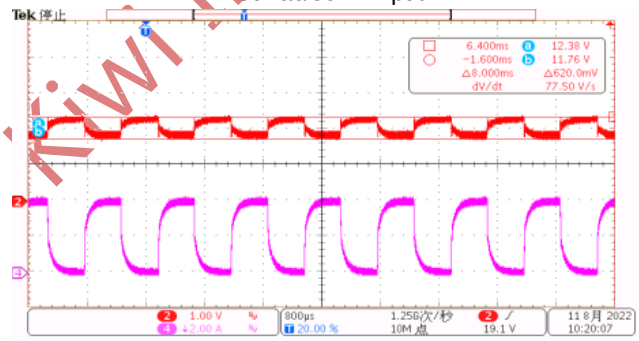
115Vac/60Hz Input



(CH2-Vo, CH4-Io)

Comments: Vo-min/max=11.76V/12.4V

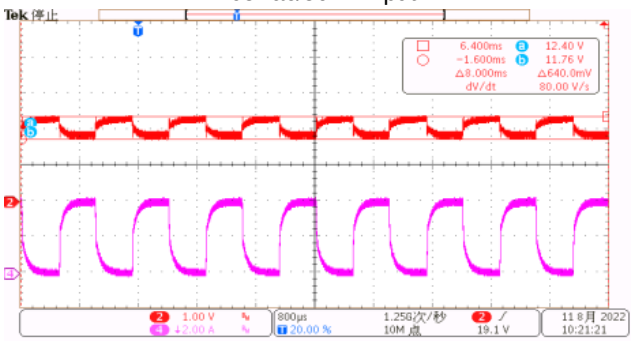
230Vac/50Hz Input



(CH2-Vo, CH4-Io)

Comments: Vo-min/max=11.76V/12.38V

265Vac/50Hz Input



(CH2-Vo, CH4-Io)

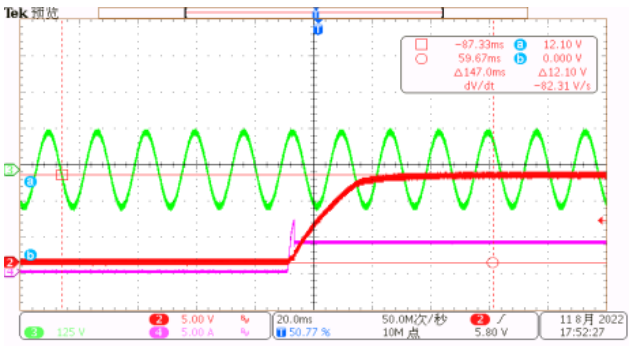
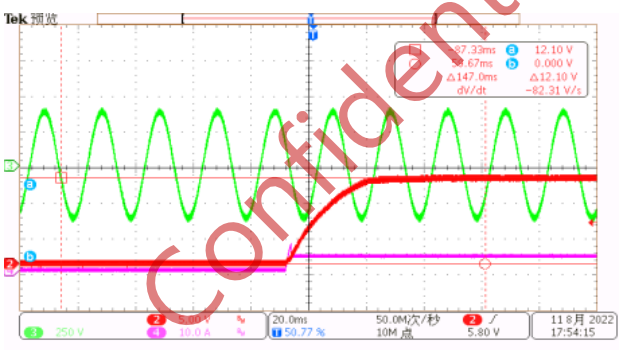
Comments: Vo-min/max=11.76V/12.4V

2.4 Capacitive Load Startup Test

Standard: While capacitance load is 5000μF, the power supply can turn on normally and the output is in the rated range.

Result: Pass

Waveforms:

Test Condition: Load=5000μF, 12V/4A @ 90Vac	**Test Condition:** Load=5000μF, 12V/4A @ 265Vac
	
(CH2-Vo, CH3-Vinac, CH4-Io)	(CH2-Vo, CH3-Vinac, CH4-Io)
Comments: Startup Normally	**Comments:** Startup Normally

2.5 Startup Time and Raise Time

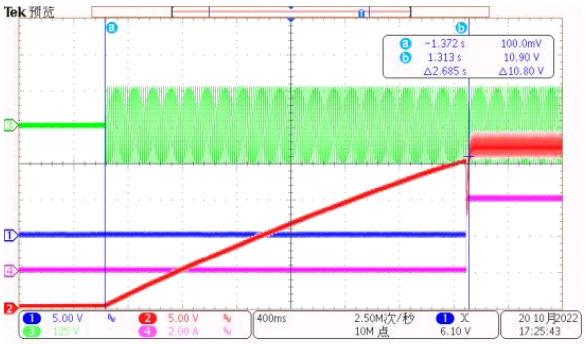
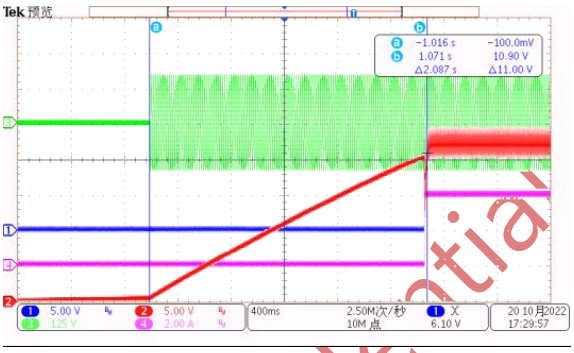
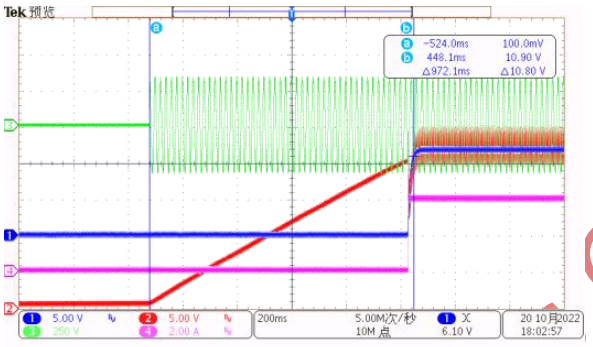
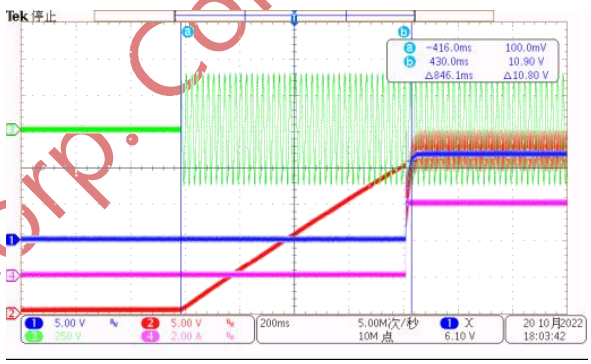
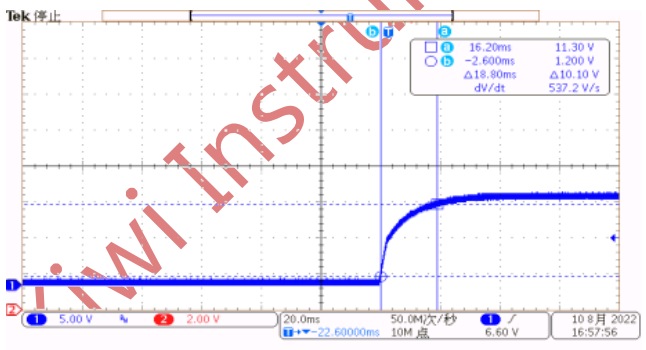
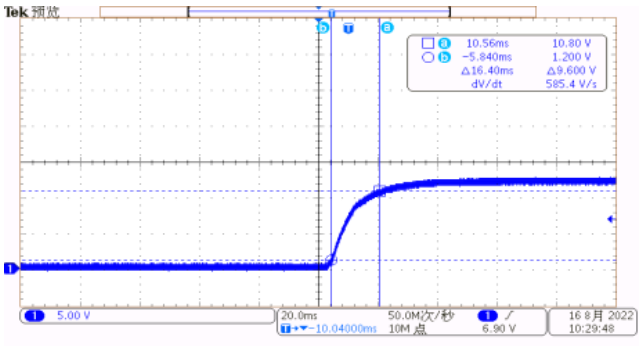
Standard: The startup time should be less than 3s@90Vac.

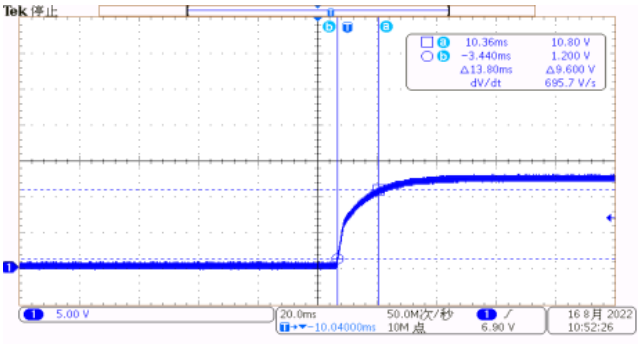
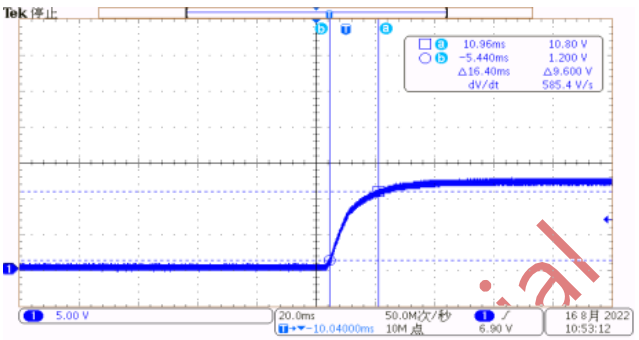
Result: Pass

Input Voltage	**90Vac/60Hz**	**115Vac/60Hz**	**230Vac/50Hz**	**265Vac/50Hz**
Turn On DelayTime(s)	2.69	2.09	0.97	0.85

Input Voltage	**90Vac/60Hz**		**115Vac/60Hz**		**230Vac/50Hz**		**265Vac/50Hz**	
Rise Time(mS)	**12V/0A**	**12V/4A**	**12V/0A**	**12V/4A**	**12V/0A**	**12V/4A**	**12V/0A**	**12V/4A**
	19.4	19.6	18.8	16.4	13.8	16.4	14.7	17.1

Waveforms:

Test Condition: 90Vac/60Hz Input, 12V/4A Output	**Test Condition:** 115Vac/60Hz Input, 12V/4A Output
	
(CH1-Vo, CH2-VDD, CH3-Vinac, CH4-Io)	(CH1-Vo, CH2-VDD, CH3-Vinac, CH4-Io)
Comments: Turn On Delay time=2.69s	**Comments:** Turn On Delay time=2.09s
Test Condition: 230Vac/50Hz Input, 12V/4A Output	**Test Condition:** 265Vac/50Hz Input, 12V/4A Output
	
(CH1-Vo, CH2-VDD, CH3-Vinac, CH4-Io)	(CH1-Vo, CH2-VDD, CH3-Vinac, CH4-Io)
Comments: Turn On Delay time=0.97s	**Comments:** Turn On Delay time=0.85s
Test Condition: 115Vac/60Hz Input, 12V/0A Output	**Test Condition:** 115Vac/60Hz Input, 12V/4A Output
	
(CH1-Vo)	(CH1-Vo)
Comments: Rise time=18.8ms	**Comments:** Rise time=16.4ms

Test Condition: 230Vac/50Hz Input, 12V/0A Output	**Test Condition:** 230Vac/50Hz Input, 12V/4A Output
	
(CH1-Vo)	(CH1-Vo)
Comments: Rise time=13.8ms	**Comments:** Rise time=16.4ms

2.6 Holdup Time and Fall Time

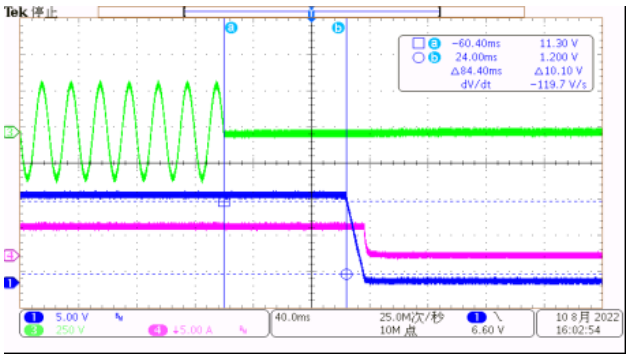
Standard: The holdup time should be larger than 10ms@115Vac and 20ms@230Vac.

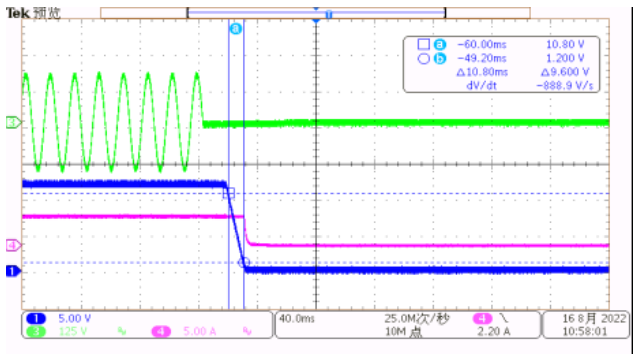
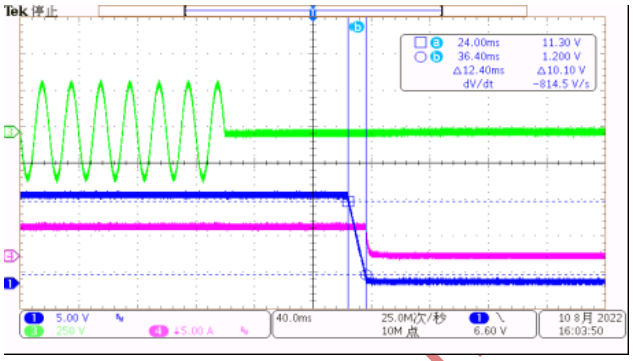
Result: Pass

Input Voltage	**115Vac/60Hz**	**230Vac/50Hz**
Hold UpTime(s)	16.4	84.4

Input Voltage	**90Vac/60Hz**	**115Vac/60Hz**	**230Vac/50Hz**	**265Vac/50Hz**
Fall Time(mS)	11.2	10.8	12.4	11.2

Waveforms:

Test Condition: 115Vac/60Hz Input, 12V/4A Output	**Test Condition:** 230Vac/50Hz Input, 12V/4A Output
	
(CH1-Vo, CH3-Vinac, CH4-Io)	(CH1-Vo, CH3-Vinac, CH4-Io)
Comments: Holdup time=16.4ms	**Comments:** Holdup time=84.4ms

Test Condition: 115Vac/60Hz Input, 12V/4A Output	**Test Condition:** 230Vac/50Hz Input, 12V/4A Output
	
(CH1-Vo, CH3-Vinac, CH4-Io)	(CH1-Vo, CH3-Vinac, CH4-Io)
Comments: Fall time=10.8ms	**Comments:** Fall time=12.4ms

2.7 Output Overshoot Test

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

Result: Pass

	90V/60Hz		115V/60Hz		230V/50Hz		265V/50Hz	
	12V/0A	12V/4A	12V/0A	12V/4A	12V/0A	12V/4A	12V/0A	12V/4A
Vo-peak(V)	12.6	12.4	12.7	12.4	12.9	12.4	12.7	12.5

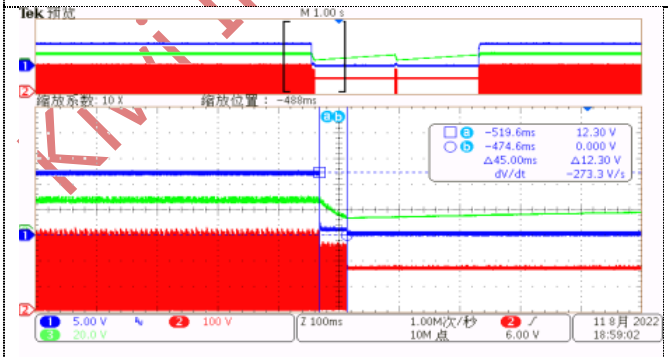
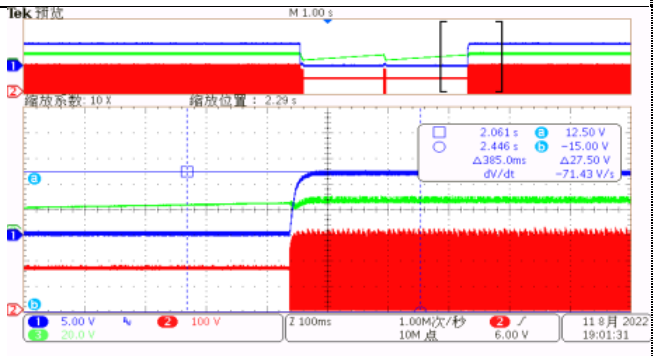
3 Protection Test

3.1 Short Circuit Protection

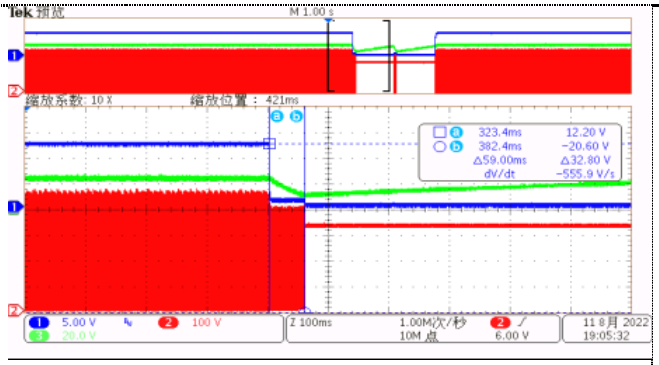
Standard: The power supply must shut down in the event of short-circuit condition and automatically return to normal operating condition once the fault condition has been removed.

Result: Pass

Waveforms:

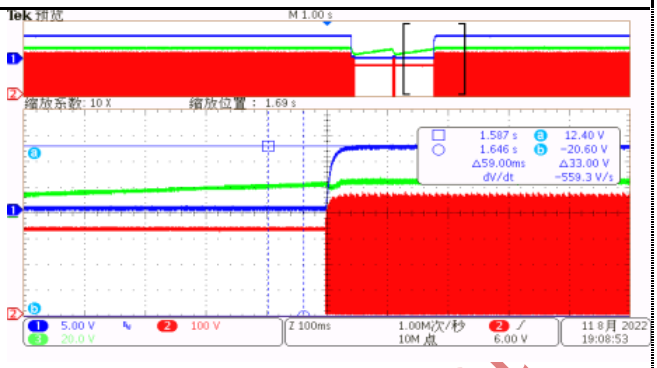
Test Condition: 115Vac/60Hz Input, 12V4A Output Short	
	
(CH1-Vo, CH2-VDrain, CH3-VDD)	(CH1-Vo, CH2-VDrain, CH3-VDD)
Comments: Protection enter	**Comments:** Recover to 12V

Test Condition: 230Vac/50Hz Input, 12V4A Output Short



(CH1-Vo, CH2-VDrain, CH3-VDD)

Comments: Protection enter



(CH1-Vo, CH2-VDrain, CH3-VDD)

Comments: Recover to 12V

3.2 Over Load Protection

Standard: The overload current should be between 120%~160% of full load current.

Result: Pass

Vin	90Vin	115Vin	230Vin	265Vin
OLP(A)	5.28	5.26	4.92	4.99

4 Reliability Requirements

4.1 Device Maximum Rating Test

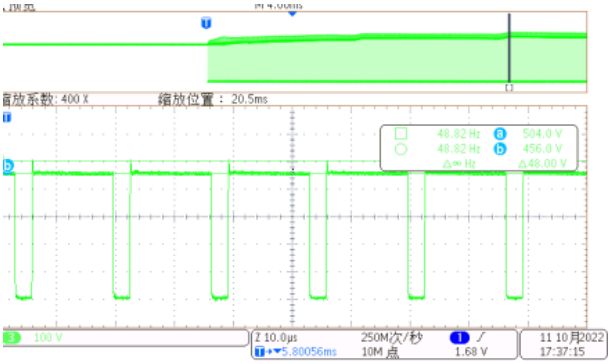
Standard: MOSFET and Diode<95% Rating

Result: Pass

Component	Rating	265Vac/50Hz						Result
		12V/0A		12V/4A			12V	
		Startup	Steady-> Short	Startup	Steady	Steady-> Short	Short (15min)	
Primary MOS	650V	476	542	504	514	542	536	PASS
KP40512WGA	100V	90.6	86.4	87	71.4	94.8	94.8	PASS

Waveforms:

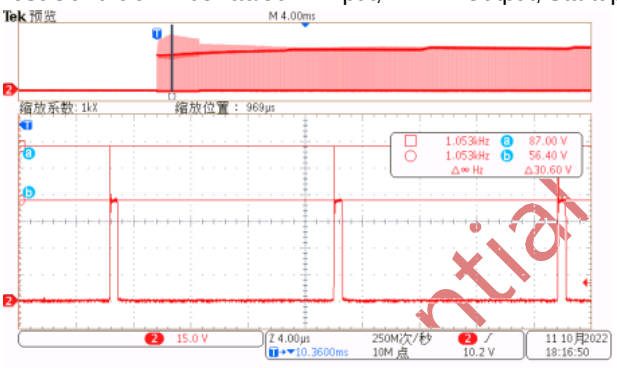
Test Condition: 265Vac/50Hz Input, 12V4A Output, Startup



(CH3-VDrain)

Comments: VDrain_peak=504V

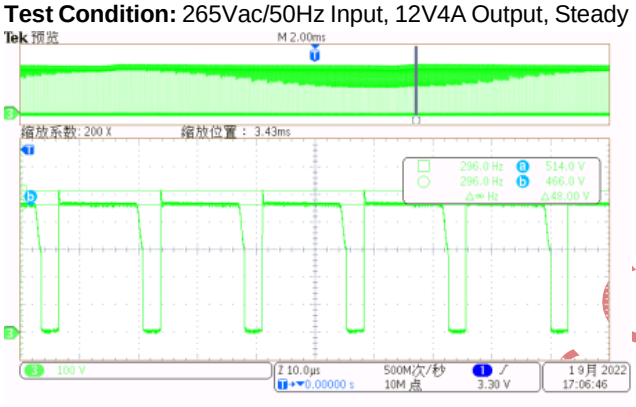
Test Condition: 265Vac/50Hz Input, 12V4A Output, Startup



(CH2-VSR)

Comments: VSR_peak=87V

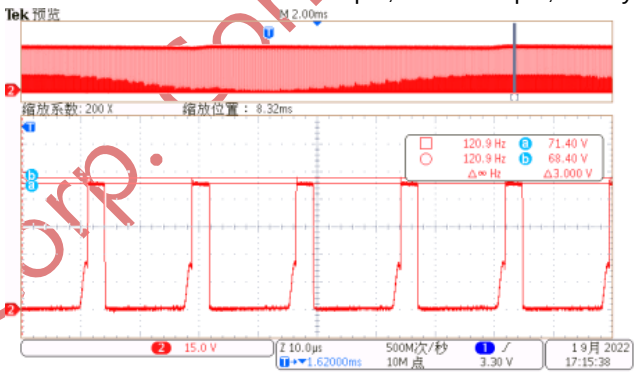
Test Condition: 265Vac/50Hz Input, 12V4A Output, Steady



(CH3-VDrain)

Comments: VDrain_peak=514V

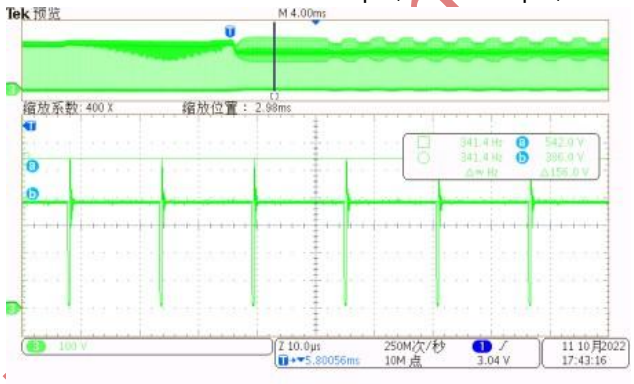
Test Condition: 265Vac/50Hz Input, 12V4A Output, Steady



(CH2-VSR)

Comments: VSR_peak=71.4V

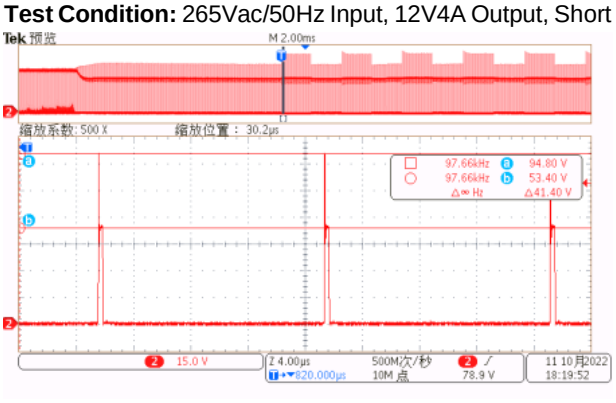
Test Condition: 265Vac/50Hz Input, 12V4A Output, Short



(CH3-VDrain)

Comments: VDrain_peak=542V

Test Condition: 265Vac/50Hz Input, 12V4A Output, Short



(CH2-VSR)

Comments: VSR_peak=94.8V

4.2 Bmax Test

Standard: Steady state rated load: Bmax≤0.3T.

Transient and its peak load: Bmax≤0.32T.

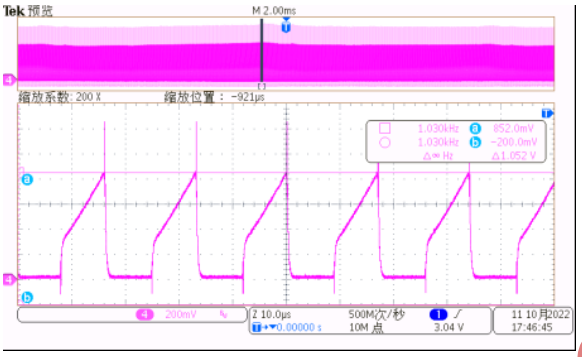
Result: Pass

Note: The turn numbers of the transform are 42, and the sectional area is 119mm^2, Lp is 680μH, Rcs=0.51R.

Bmax(T)	90Vac/60Hz	Bmax_Limit(T)	Result
Steady	0.227	0.3T	**PASS**
OverLoad	0.273	0.32T	**PASS**

Waveforms:

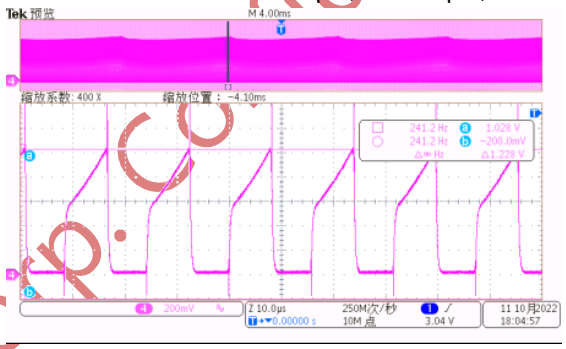
Test Condition: 90Vac/60Hz Input, 12V/4A Output, Steady



(CH4-Vcs)

Comments: Vcs=0.852V, Rcs=0.51R, Ics=1.67A

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



(CH4-Vcs)

Comments: Vcs=1.028V, Rcs=0.51R, Ics=2.02A

4.3 Thermal Test

Test Condition: 90Vac/60Hz, 265Vac/50Hz input; 12V/4A output; Demo board in a 106.5mm*46mm*34.3mm nylon box; Burn-in until the temperature is stable @ 45℃ ambience without airflow.

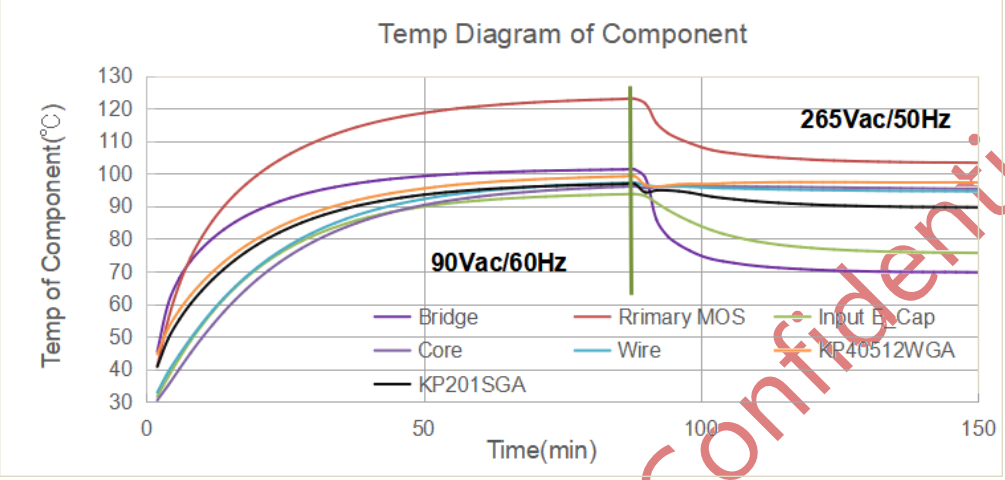
Standard: Temp of MOS, IC, Diode. Bridge, E-Cap, Core, Wire and Nylon Box < safe temp (showed below).

Result: Pass

Test Data:

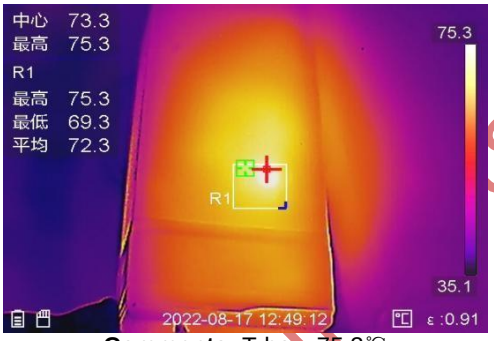
T(℃)	Temp in box @ 45℃ ambience				Safety Temp
	90Vac	115Vac	230Vac	265Vac	
KP201	96.86	90.73	91.4	89.64	120
Primary MOS	122.97	109.6	109.5	103.29	125
KP40512WGA	99.21	92.74	94.98	97.27	125
Input E-Cap	93.72	84.89	78.65	75.67	100
Core of Transformer	96.05	90.76	94.55	95.34	110

Wire of Transformer	97.26	91.39	94.19	94.56	110
Bridge	101.28	89.78	73.41	69.7	125
Nylon Box	75.3	68.5	70.9	64.8	77



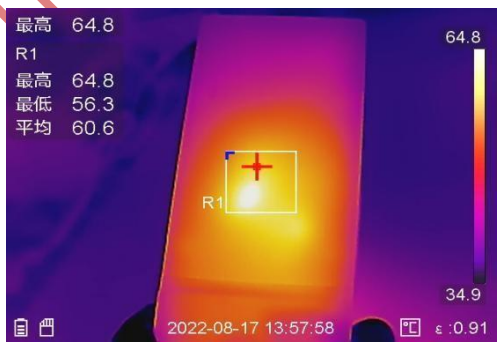
Temp of Nylon Box @ 90Vac/265Vac

Test Condition: 90Vac/60Hz Input, 12V/4A Output



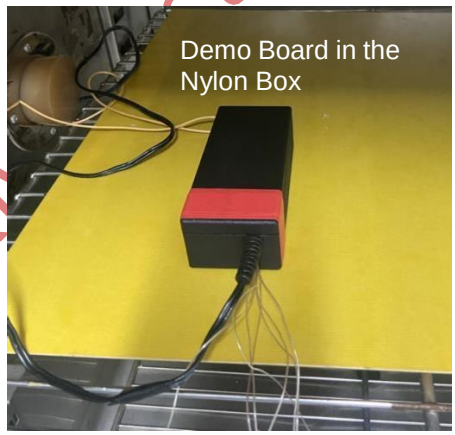
Comments: T-box=75.3℃

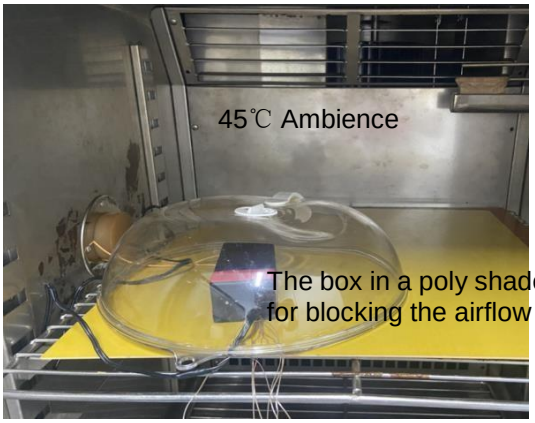
Test Condition: 90Vac/60Hz Input, 12V/4A Output



Comments: T-box=64.8℃

Test Ambience





5 EMC/EMS Test Result

5.1 Conducted and Radiation Emissions

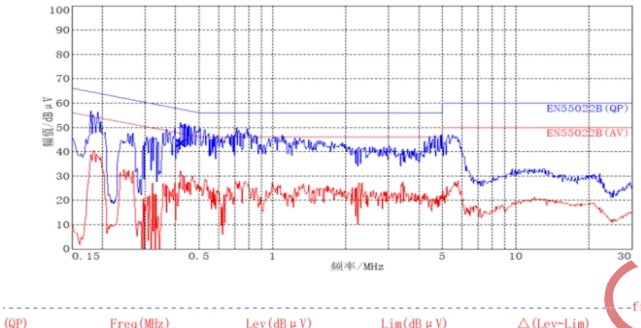
Standard:

standard	EN55022 ClassB/EN55032 ClassB
content	CE & RE
requirement	6dB margin

Result: Pass

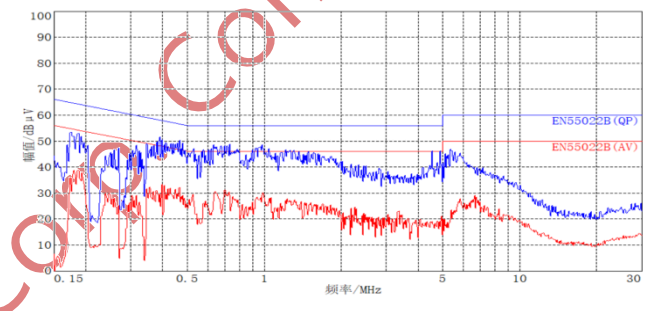
Note: Tested in the nylon box with 1.5m #18 AWG cable and the resister load is connected to the earth.

Test Condition: 220Vac/50Hz-L Input, 12V/4A Output

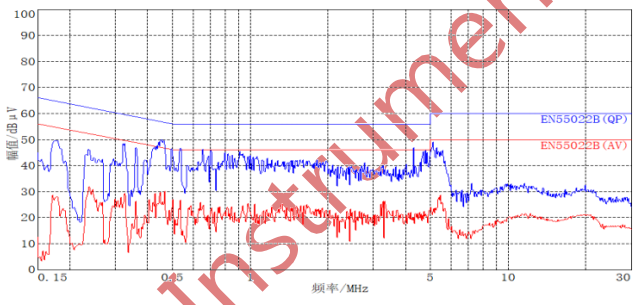


(QP)	Freq(MHz)	Lev(dBμV)	Lim(dBμV)	△(Lev-Lim)
	0.420	43.420	57.448	-14.028

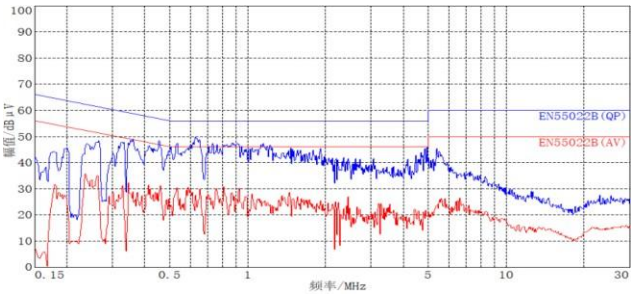
Test Condition: 220Vac/50Hz-N Input, 12V/4A Output



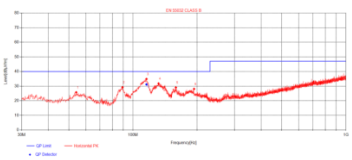
Test Condition: 110Vac/60Hz-L Input, 12V/4A Output



Test Condition: 110Vac/60Hz-N Input, 12V/4A Output



Test Condition: 220Vac/50Hz Input, 12V/4A Output, Horizontal



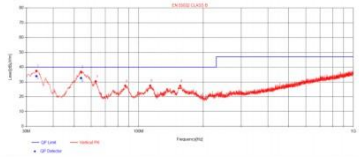
Suspected Data List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Verdict
1	54.1318	25.73	20.28	40.00	14.27	200	108	Horizontal	PASS
2	89.2987	29.20	14.68	40.00	10.80	200	92	Horizontal	PASS
3	115.734	34.86	17.56	40.00	5.14	200	246	Horizontal	PASS
4	131.862	31.78	19.29	40.00	8.22	200	276	Horizontal	PASS
5	159.026	29.01	20.47	40.00	10.99	200	306	Horizontal	PASS
6	193.586	28.05	17.40	40.00	11.95	100	237	Horizontal	PASS

Final Data List

NO.	Freq. [MHz]	Factor [dB]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity	Verdict
1	115.734	17.56	31.14	40.00	8.86	200	246	Horizontal	PASS

Test Condition: 220Vac/60Hz Input, 12V/4A Output, Vertical



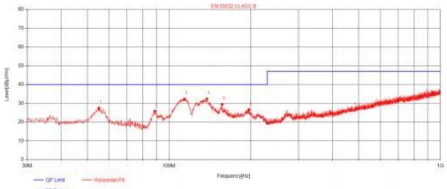
Suspected Data List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Verdict
1	33.3954	37.43	19.20	40.00	2.57	100	216	Vertical	PASS
2	53.8892	36.82	20.30	40.00	3.18	100	201	Vertical	PASS
3	63.1054	30.42	19.38	40.00	9.58	100	113	Vertical	PASS
4	86.6308	27.41	14.88	40.00	12.59	100	18	Vertical	PASS
5	113.187	27.49	17.31	40.00	12.51	100	288	Vertical	PASS
6	156.115	27.35	20.47	40.00	12.65	100	113	Vertical	PASS

Final Data List

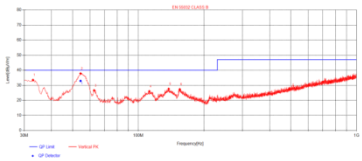
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity	Verdict
1	33.3954	19.21	33.89	40.00	6.11	100	216	Vertical	PASS
2	53.8892	20.30	32.60	40.00	7.40	100	201	Vertical	PASS

Test Condition: 110Vac/50Hz Input, 12V/4A Output, Horizontal	**Test Condition:** 110Vac/60Hz Input, 12V/4A Output, Vertical



Suspected Data List

NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Verdict
1	55.1019	27.41	20.23	40.00	12.59	200	259	Horizontal	PASS
2	88.5711	25.82	14.71	40.00	14.18	200	237	Horizontal	PASS
3	113.915	32.28	17.37	40.00	7.72	200	82	Horizontal	PASS
4	137.804	32.37	19.89	40.00	7.63	200	252	Horizontal	PASS
5	156.843	29.42	20.48	40.00	10.58	200	305	Horizontal	PASS
6	196.860	26.58	17.24	40.00	13.42	100	276	Horizontal	PASS



Suspected Data List

NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Verdict
1	32.9104	33.48	19.16	40.00	6.52	100	167	Vertical	PASS
2	54.3743	37.81	20.27	40.00	2.19	100	71	Vertical	PASS
3	62.7416	26.58	19.43	40.00	13.42	100	49	Vertical	PASS
4	112.339	25.98	17.23	40.00	14.02	100	247	Vertical	PASS
5	137.804	27.57	19.89	40.00	12.43	200	32	Vertical	PASS
6	154.903	27.31	20.47	40.00	12.69	100	269	Vertical	PASS

Final Data List

NO.	Freq. [MHz]	Factor [dB]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity	Verdict
1	54.3743	20.27	32.88	40.00	7.12	100	71	Vertical	PASS

5.2 Surge Test

Test Condition: Input 220Vac/50Hz, output 12V/4A. 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	+1000	0	Pass
	+1000	90	Pass
	+1000	180	Pass
	+1000	270	Pass
	-1000	0	Pass
	-1000	90	Pass
	-1000	180	Pass
	-1000	270	Pass
L to PE	+2000	0	Pass
	+2000	90	Pass
	+2000	180	Pass
	+2000	270	Pass
	-2000	0	Pass
	-2000	90	Pass
	-2000	180	Pass
	-2000	270	Pass
N to PE	+2000	0	Pass
	+2000	90	Pass
	+2000	180	Pass
	+2000	270	Pass
	-2000	0	Pass
	-2000	90	Pass
	-2000	180	Pass
	-2000	270	Pass

L+N to PE	+2000	0	Pass
	+2000	90	Pass
	+2000	180	Pass
	+2000	270	Pass
	-2000	0	Pass
	-2000	90	Pass
	-2000	180	Pass
	-2000	270	Pass

5.3 ESD Test

Test Condition: Input 220Vac/50Hz, output 12V/4A. 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**
16	Pass	9	Pass
-16	Pass	-9	Pass

Revision History

DATE	REV	DESCRIPTION
2022/11/21	1.0	First Release

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