



Texas Instruments

PMP4450 Test Procedure

China Power Reference Design

REV A

9/23/2014

1 GENERAL

1.1 PURPOSE

To provide detailed data for evaluating and verifying the PMP4450, with the TI's new Primary Side Controller UCC28700 for 5V2A adapter, small size 47mmx34mmx15mm. The photo as below shows this demo board.



1.2 REFERENCE DOCUMENTATION

Schematic PMP4450_SCH.PDF

Assembly PMP4450_PCB.PDF

BOM

Promotion tools

1.3 TEST EQUIPMENTS

Power-meter: YOKOGAWA WT210

Multi-meter(current): Fluke 8845A

Multi-meter(voltage): Fluke 187

AC Source: Chroma 61530

Electronic load: Chroma 63105A module

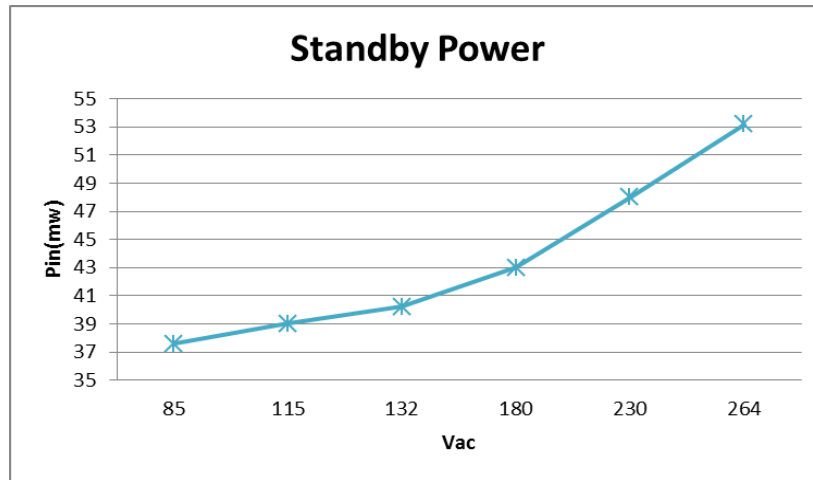
Testing demoboard

2 INPUT CHARACTERISTICS

Efficiency is tested on USB-end

Otherwise Specified, the test is under the condition with 100cm cable

2.1 STANDBY POWER



2.2 EFFICIENCY DATA

Notes: efficiency test is based USB port

Vout	Iout	Pin	Pout	η	average	
5.2187	1.9989	13.0680	10.4317	79.83%	0.807128	
5.1991	1.4990	9.6620	7.7935	80.66%		85V/60Hz
5.1875	0.9992	6.3740	5.1834	81.32%		
5.1780	0.4996	3.1920	2.5869	81.04%		
5.1777	0.1998	1.3290	1.0345	77.84%		

Vout	Iout	Pin	Pout	η	average	
5.2207	1.9989	12.8530	10.4357	81.19%	0.811424	
5.2029	1.4990	9.5590	7.7991	81.59%		115V/60Hz
5.1915	0.9993	6.3750	5.1879	81.38%		
5.1825	0.4996	3.2200	2.5892	80.41%		
5.1762	0.1998	1.3440	1.0342	76.95%		

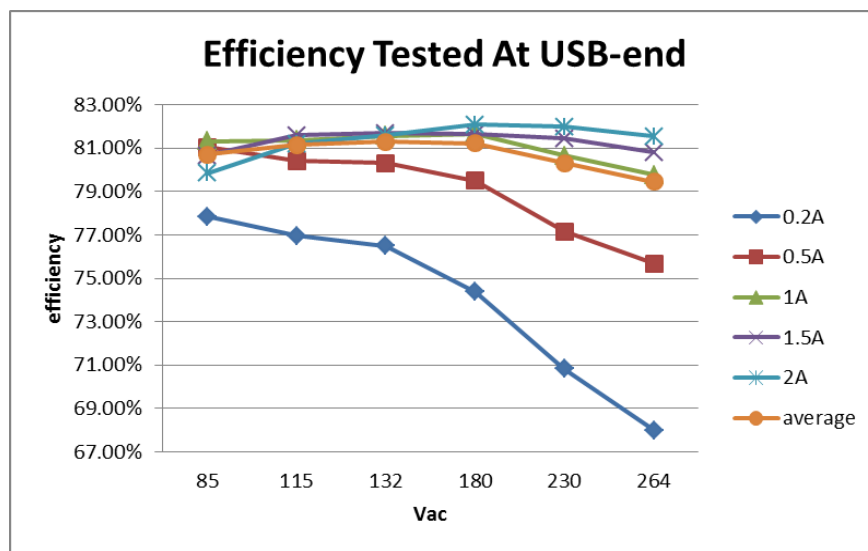
Vout	Iout	Pin	Pout	η	average	
5.2218	1.9989	12.7370	10.4379	81.95%	0.816188	
5.1985	1.4990	9.4810	7.7926	82.19%		150V/60Hz
5.1855	0.9992	6.3120	5.1814	82.09%		
5.1769	0.4996	3.2230	2.5864	80.25%		
5.1728	0.1998	1.3930	1.0335	74.19%		

Vout	Iout	Pin	Pout	η	average	
5.2200	1.9989	12.7120	10.4343	82.08%	0.812185	
5.2010	1.4990	9.5500	7.7963	81.64%		180V/50Hz
5.1868	0.9992	6.3460	5.1827	81.67%		

5.1756	0.4996	3.2530	2.5857	79.49%			
5.1712	0.1998	1.3890	1.0332	74.38%			

Vout	Iout	Pin	Pout	η		average	
5.2165	1.9991	12.7200	10.4283	81.98%		0.803118	
5.1983	1.4991	9.5670	7.7928	81.45%			
5.1843	0.9994	6.4240	5.1812	80.65%			230V/50Hz
5.1756	0.4997	3.3520	2.5862	77.16%			
5.1686	0.1998	1.4580	1.0327	70.83%			

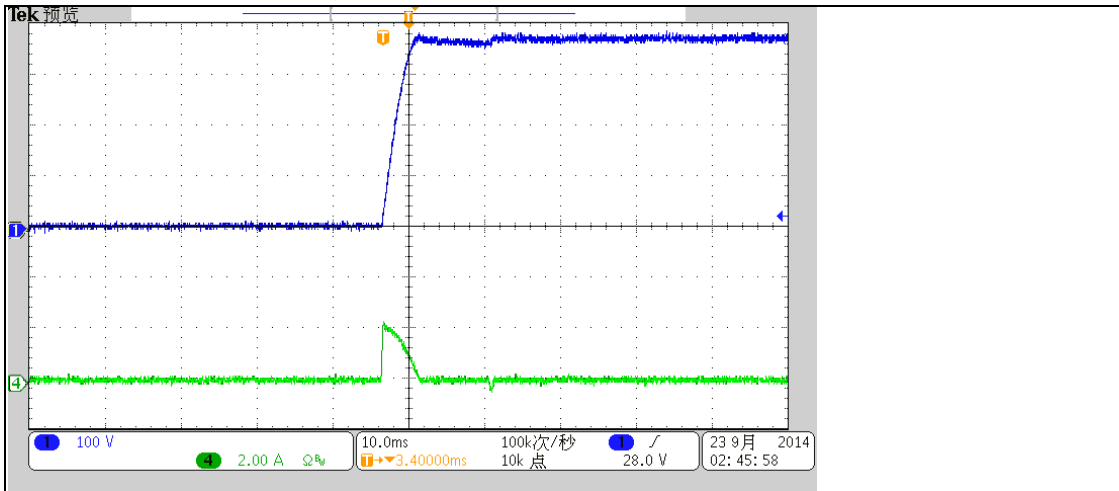
Vout	Iout	Pin	Pout	η		average	
5.2174	1.9989	12.7900	10.4291	81.54%		0.794514	
5.1967	1.4990	9.6400	7.7899	80.81%			264V/50Hz
5.1828	0.9992	6.4920	5.1787	79.77%			
5.1736	0.4996	3.4150	2.5847	75.69%			
5.1683	0.1998	1.5190	1.0326	67.98%			



2.3 INPUT CURRENT

Vin(Vac)	Freq(Hz)	Iin(Arms)	Pass/Fail
85	60	0.257	

2.4 INPUT INRUSH CURRENT

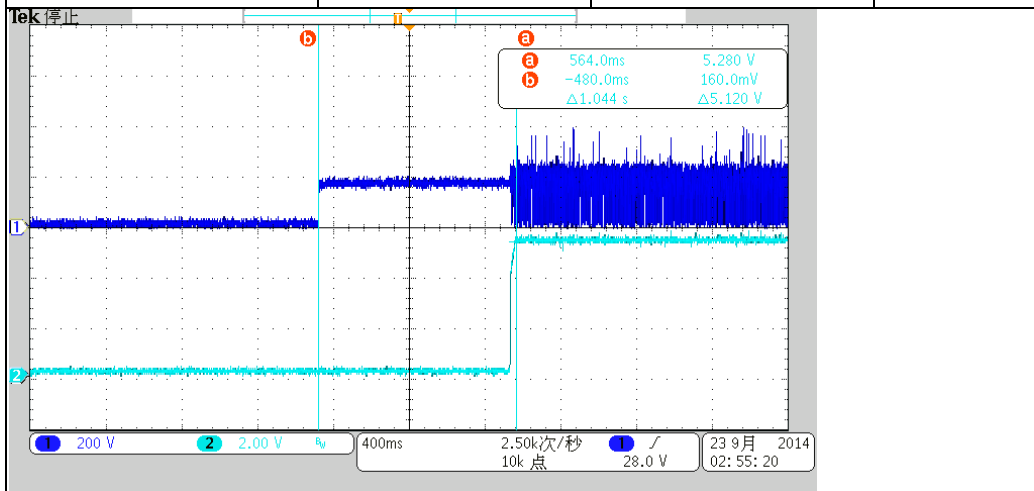


Vin:264Vac Io: 2A
 Ch1: Input bulk CAP voltage 100V/div
 Ch4: Input inrush current 2A/div

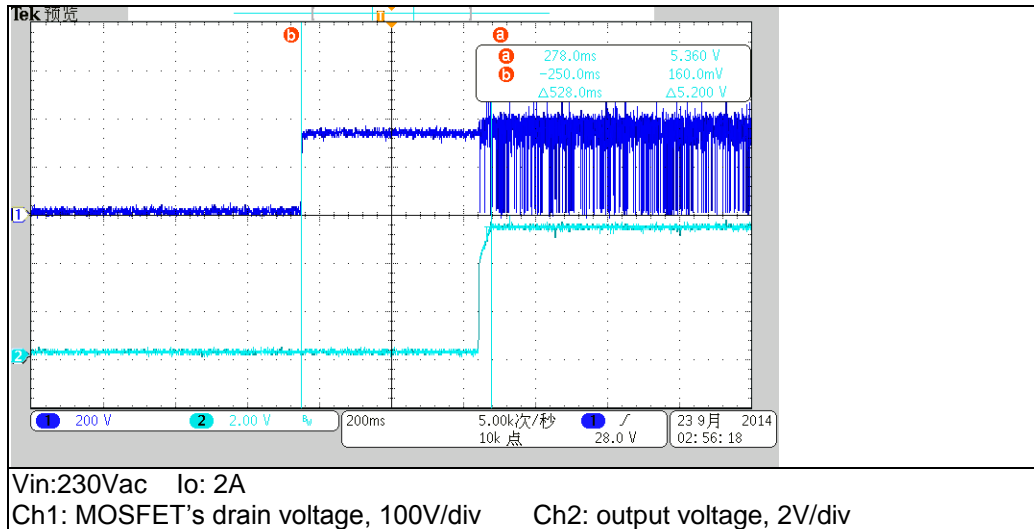
3 OUTPUT CHARACTERISTICS

3.1 STARTUP TIME

Input voltage	Output current	Startup time	Pass/Fail
115Vac	2A	1.044S	
230Vac	2A	528mS	



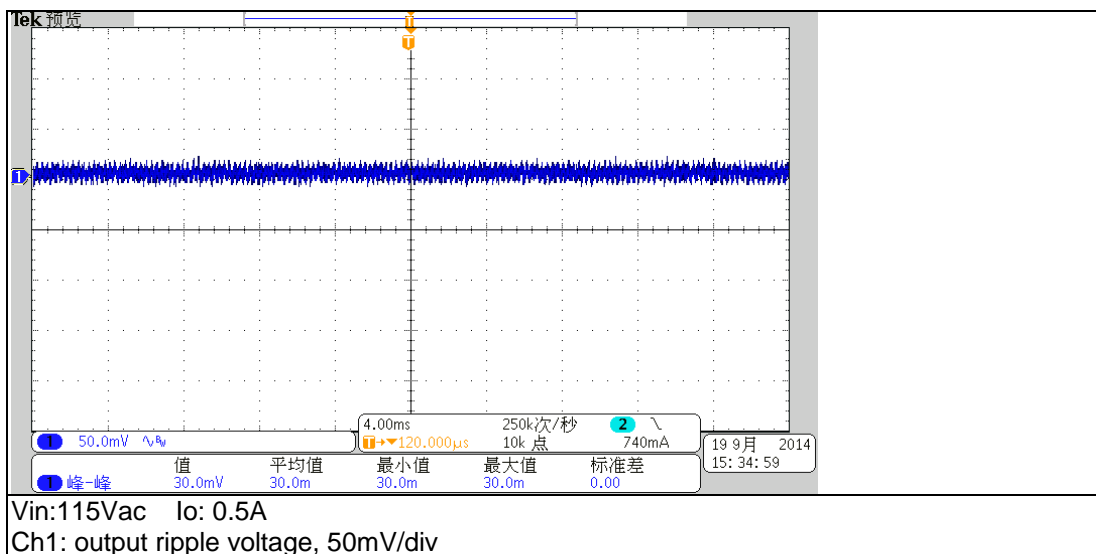
Vin:115Vac Io: 2A
 Ch1: MOSFET's drain voltage, 100V/div Ch2: output voltage, 2V/div

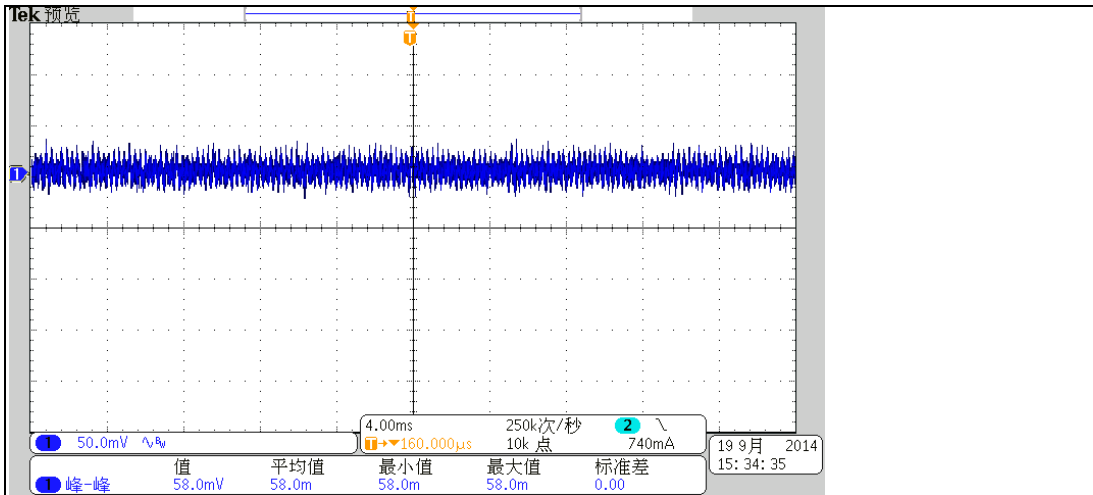


3.2 RIPPLE VOLTAGE

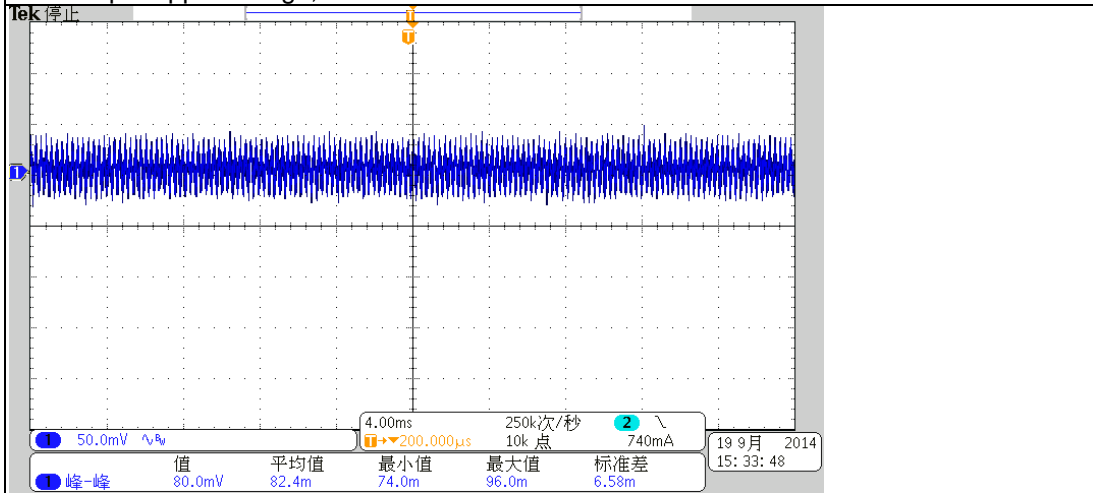
Input voltage	Output current	Ripple voltage	Pass/Fail
115Vac	0.5A	30mV	
115Vac	1A	58mV	
115Vac	1.5A	80mV	
115Vac	2A	78mV	
230Vac	0.5A	30mV	
230Vac	1A	50mV	
230Vac	1.5A	72mV	
230Vac	2A	96mV	

Test with 60cm cable and 1uf capacitor

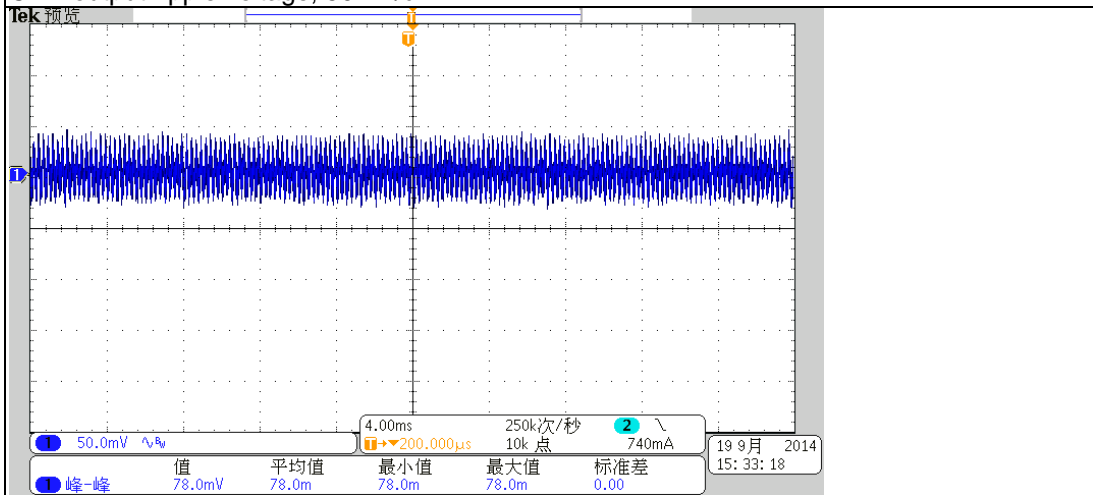




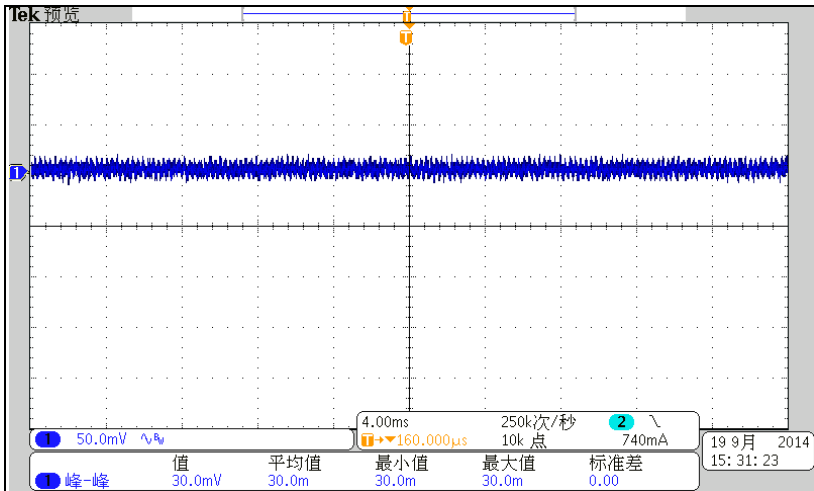
Vin:115Vac Io: 1A
 Ch1: output ripple voltage, 50mV/div



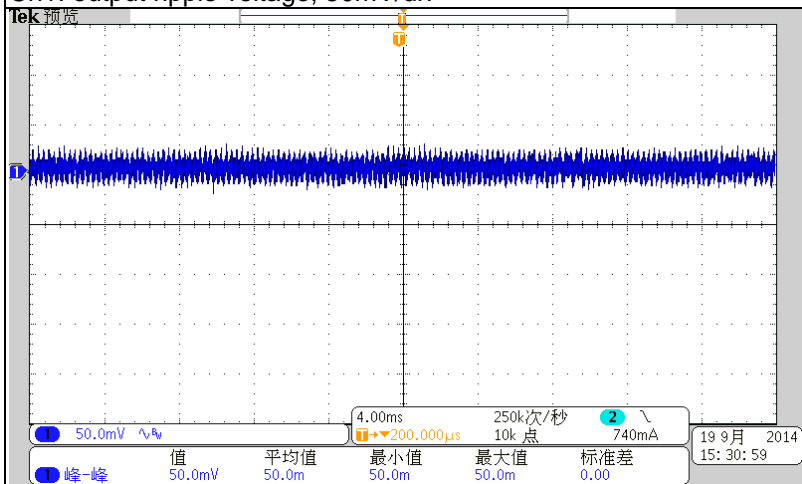
Vin:115Vac Io: 1.5A
 Ch1: output ripple voltage, 50mV/div



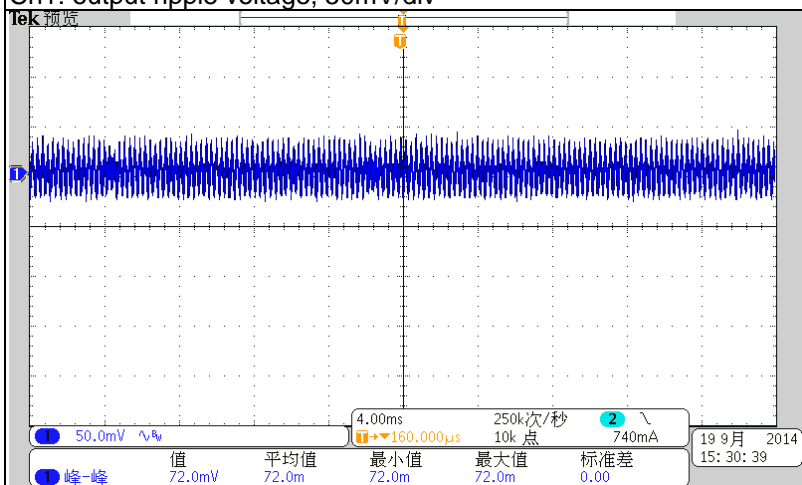
Vin:115Vac Io: 2A
 Ch1: output ripple voltage, 50mV/div



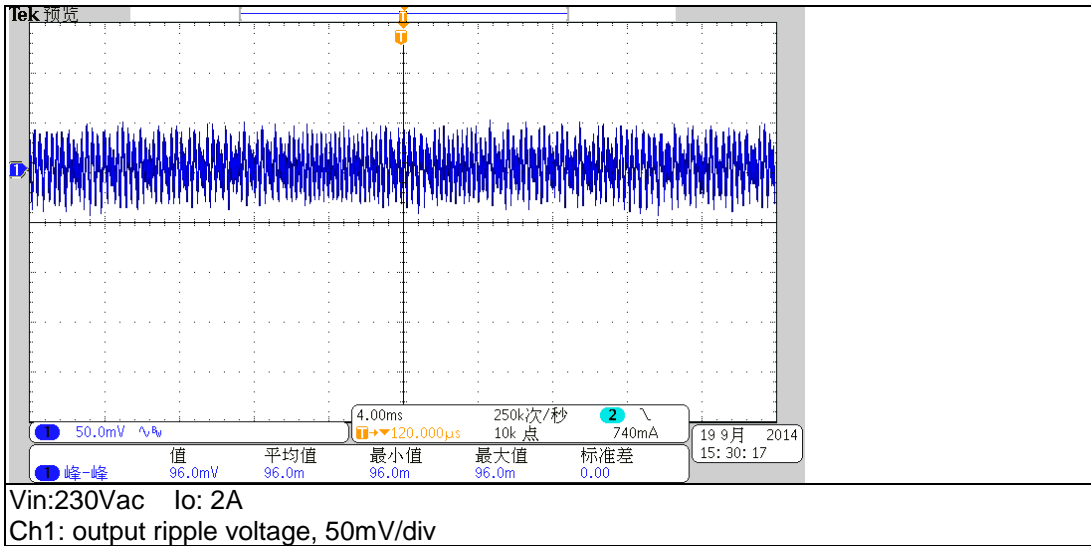
Vin:230Vac Io: 0.5A
Ch1: output ripple voltage, 50mV/div



Vin:230Vac Io: 1A
Ch1: output ripple voltage, 50mV/div

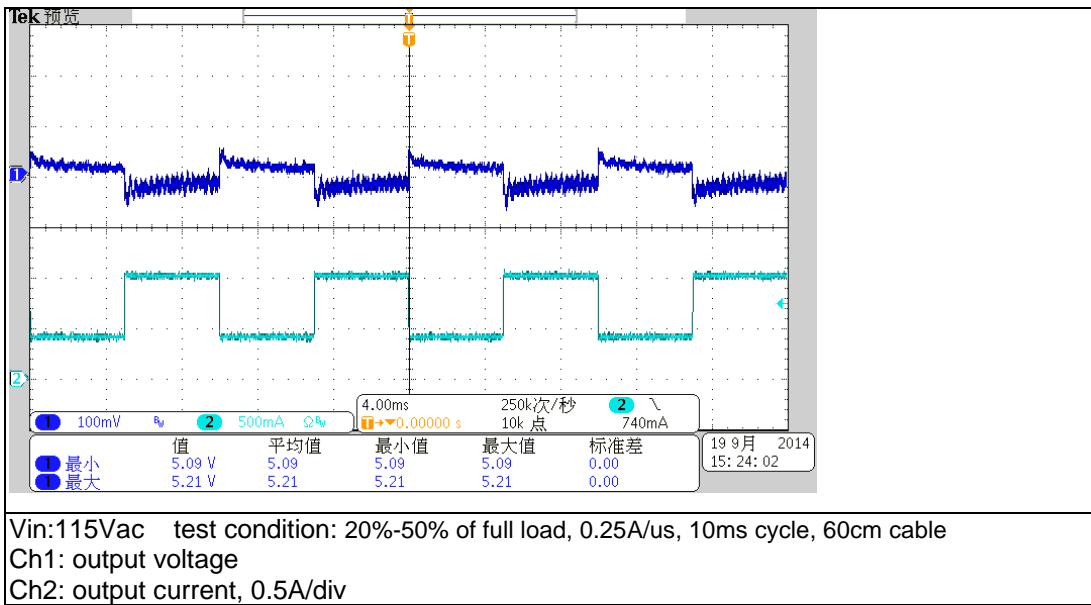


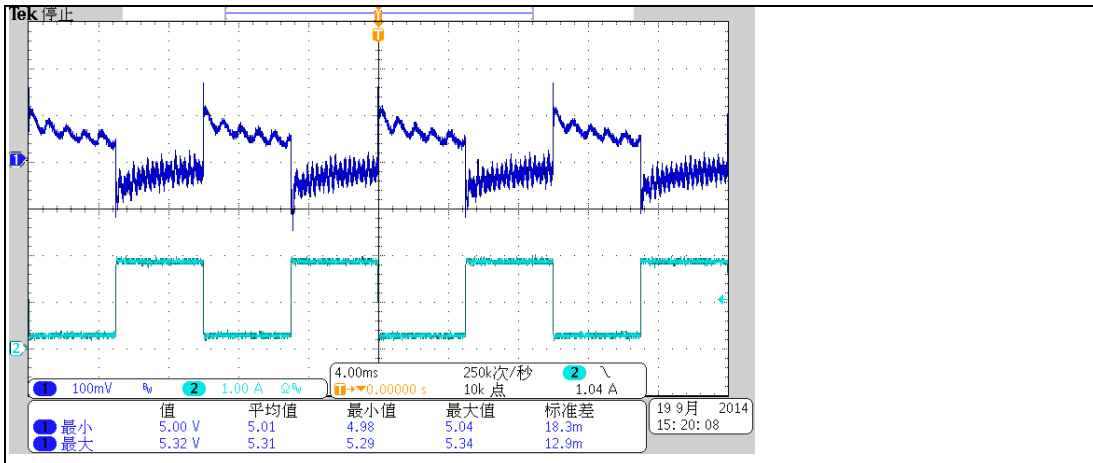
Vin:230Vac Io: 1.5A
Ch1: output ripple voltage, 50mV/div



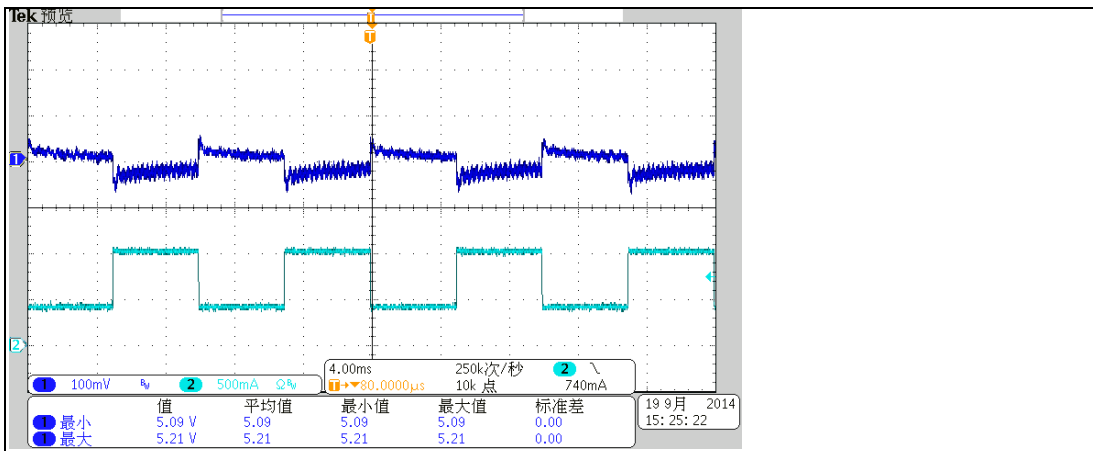
3.3 DYNAMIC RESPONSE

Input voltage	Output current	Max voltage	Min voltage
115Vac	20%-50% of full load	5.21V	5.09V
115Vac	10%-90% of full load	5.32V	5.00V
230Vac	20%-50% of full load	5.21V	5.09V
230Vac	10%-90% of full load	5.3V	4.98V

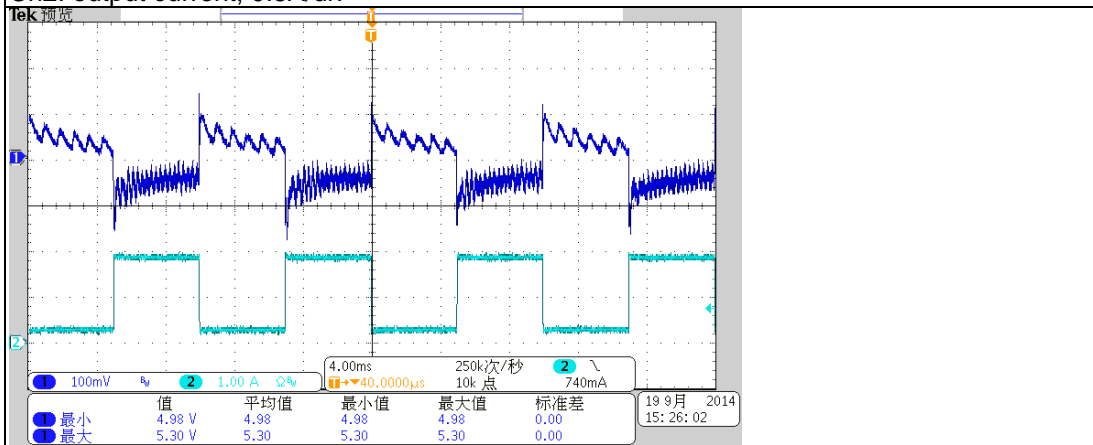




Vin:115Vac test condition: 10%-90% of full load, 0.25A/us, 10ms cycle, 60cm cable
 Ch1: output voltage
 Ch2: output current, 1A/div



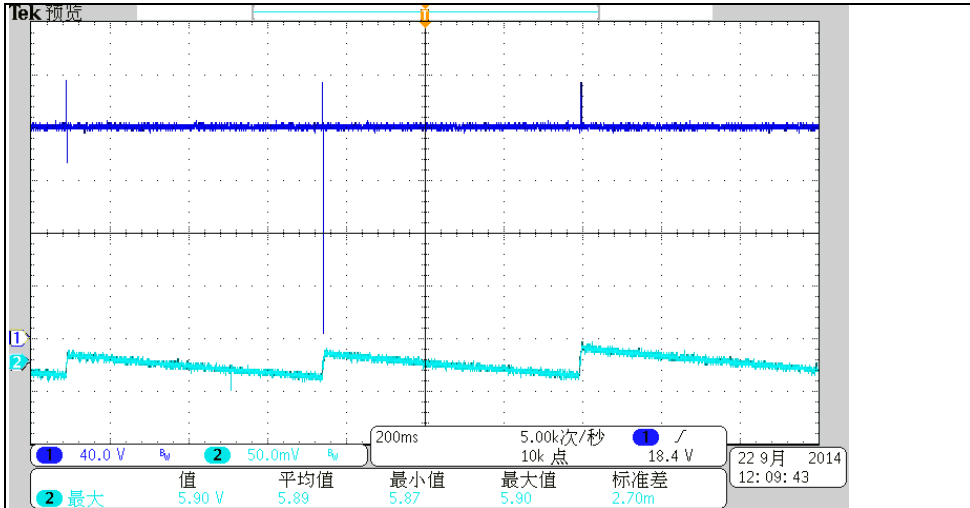
Vin:230Vac test condition: 20%-50% of full load, 0.25A/us, 10ms cycle, 60cm cable
 Ch1: output voltage
 Ch2: output current, 0.5A/div



Vin:230Vac test condition: 10%-90% of full load, 0.25A/us, 30ms cycle, 60cm cable
 Ch1: output voltage
 Ch2: output current, 1A/div

3.4 OUTPUT VOLTAGE PROTECTION

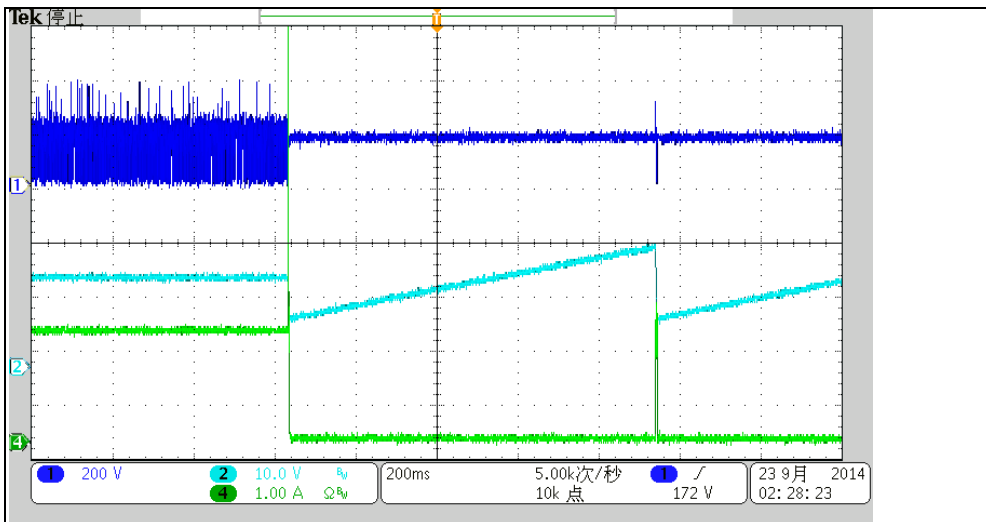
CONDITIONS	Protection voltage (V)	Pass/Fail
Vin (Vac)		
115&230	5.90	



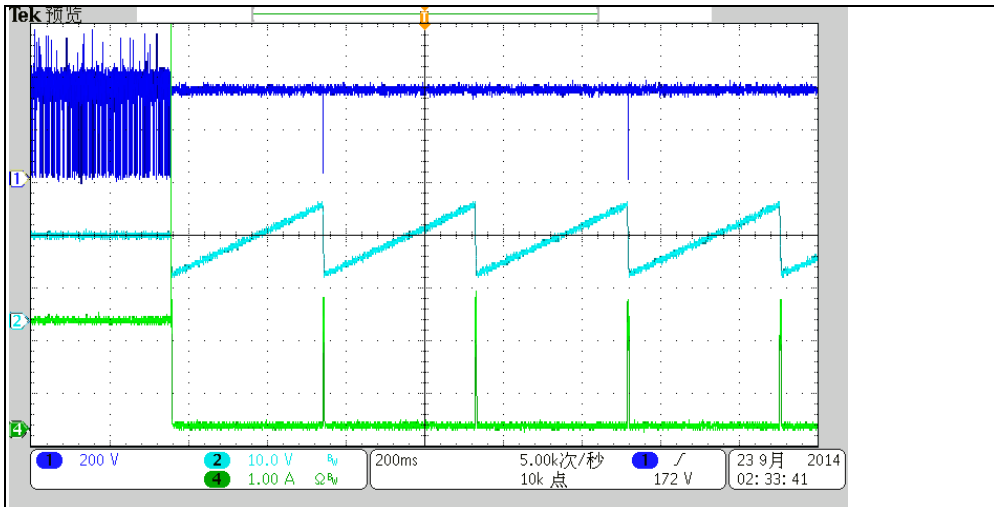
Vin: 115Vac OVP: 5.90 V
 CH1: Vds voltage of MOSFET, 100V/div
 CH2: output voltage, 50mV/div

3.5 OUTPUT SHORT PROTECTION

Input voltage	Output short protection
115&230Vac	Hiccup up mode

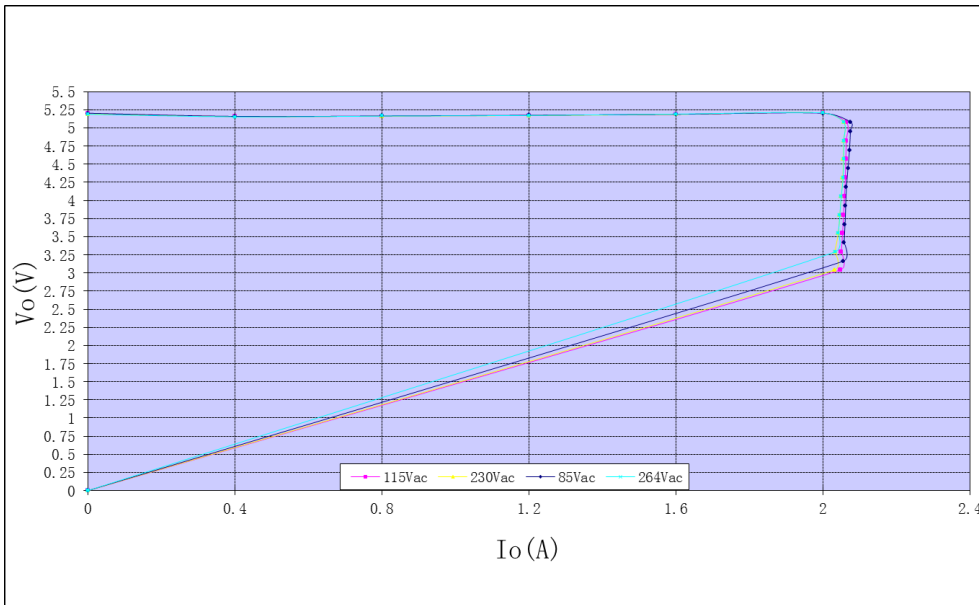


Vin: 115Vac
 CH1: Vds of MOSFET, 200V/div CH2: Vdd, 10V/div
 CH4: output current, 1A/div



Vin:230Vac
 CH1: Vds of MOSFET, 200V/div CH2: Vdd, 10V/div
 CH4: output current, 1A/div

4 IV CURVE



5 THERMAL TEST

5.1. Thermal test with case at $T_a=25^\circ\text{C}$

Temp record						
Thermal Coupler Channel	Name	Pos	90VAC 50Hz, Ambient:25°C		264VAC 60Hz, Ambient:25°C	
			Record Time	CV5V	Record Time	CV5V
			15:00~16:40	2.4A	16:40~17:40	2.4A
11	Input cap	C1	62.7° C		57.6° C	
15	Input cap	C2	66.7° C		61.6° C	
3	Input inductor	L1	65.9° C		57.8° C	
8	Schonounous MOSFET	Q2	53.1° C		53.1° C	
9	Transformer	T1 Core	72.2° C		70.6° C	
1	Transformer	T1 Winding	79.1° C		76.1° C	
17	Power Switch	Q1	70.9° C		71.1° C	
5	Output cap	C5	56.4° C		55.7° C	
7	Output cap	C3	60.9° C		60.3° C	
13	Output rectifier	D2	58.6° C		58.4° C	
16	Rect. Bridge diode	DB1	68.7° C		59.9° C	
10	UCC28713	U1	67.4° C		66° C	
4	UCC24610	U2	55.8° C		55.3° C	
actual T_a			$T_a=25^\circ\text{C}$		$T_a=25^\circ\text{C}$	

5.2. Thermal test with case at $T_a=45^\circ\text{C}$

Temp record						
Thermal Coupler Channel	Name	Pos	90VAC 50Hz, Ambient:45°C		264VAC 60Hz, Ambient:45°C	
			Record Time	CV5V	Record Time	CV5V
			14:00~15:00	2.4A	16:10~17:10	2.4A
11	Input cap	C1	67.5 °C		63.2 °C	
15	Input cap	C2	71 °C		66.3 °C	
3	Input inductor	L1	71.9 °C		63.5 °C	
8	Schonounous MOSFET	Q2	68.4 °C		68 °C	
9	Transformer	T1 Core	79.4 °C		76.7 °C	
1	Transformer	T1 Winding	85.1 °C		77 °C	
17	Power Switch	Q1	73 °C		73 °C	
5	Output cap	C5	63.9 °C		63.7 °C	
7	Output cap	C3	67.8 °C		67.2 °C	
13	Output rectifier	D2	66.4 °C		66.2 °C	
16	Rect. Bridge diode	DB1	73.1 °C		64.9 °C	
10	UCC28713	U1	71.9 °C		70.2 °C	
4	UCC24610	U2	64.7 °C		64.3 °C	
actual T_a			$T_a=45.5^\circ\text{C}$		$T_a=46.8^\circ\text{C}$	

6 EMI Test

6.1 Conduction emission



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