

# MD1810 DoE VI EFFICIENCY DEMO BOARD TEST

Date: 2014. 10. 20

Author: Mix-Design Application Dept.

## Power supply specification

Description	Symbol	Min	Typ	Max	Units	Comment/Condition
<b>Input</b>						
Voltage	$V_{in}$	90		264	V	2 Wire(L,N)-NO PE
Frequency	F	47		63	Hz	
Standby power				<75	mW	Open Load
<b>Output</b>						
Rating Output Voltage	$V_{out}$	4.75	5	5.25	V	
Rating load	$I_{out}$		1		A	
Output Ripple&Noise				<200	mV	See Test Detail
Dynamic load		4.5		5.5	V	See Test Detail
<b>Protection Function Item</b>						
OCP				<1.2	A	
OVP				<6	V	
OSP						Auto Recovery
<b>Efficiency(Meet DoE VI)</b>						
$V_{in}=115V_{ac}/60Hz$		77.5%				Test At The End Of PCB
$V_{in}=230V_{ac}/50Hz$		76.5%				Test At The End Of PCB

## Feature

1. High efficiency Meet DoE VI
2. No-load consumption less than 100 mW
3. SOIC-7 Package ( PWM + Power Transistor all in ONE)
4. (PSR)Tight tolerance CV/CC operation without opto-coupler

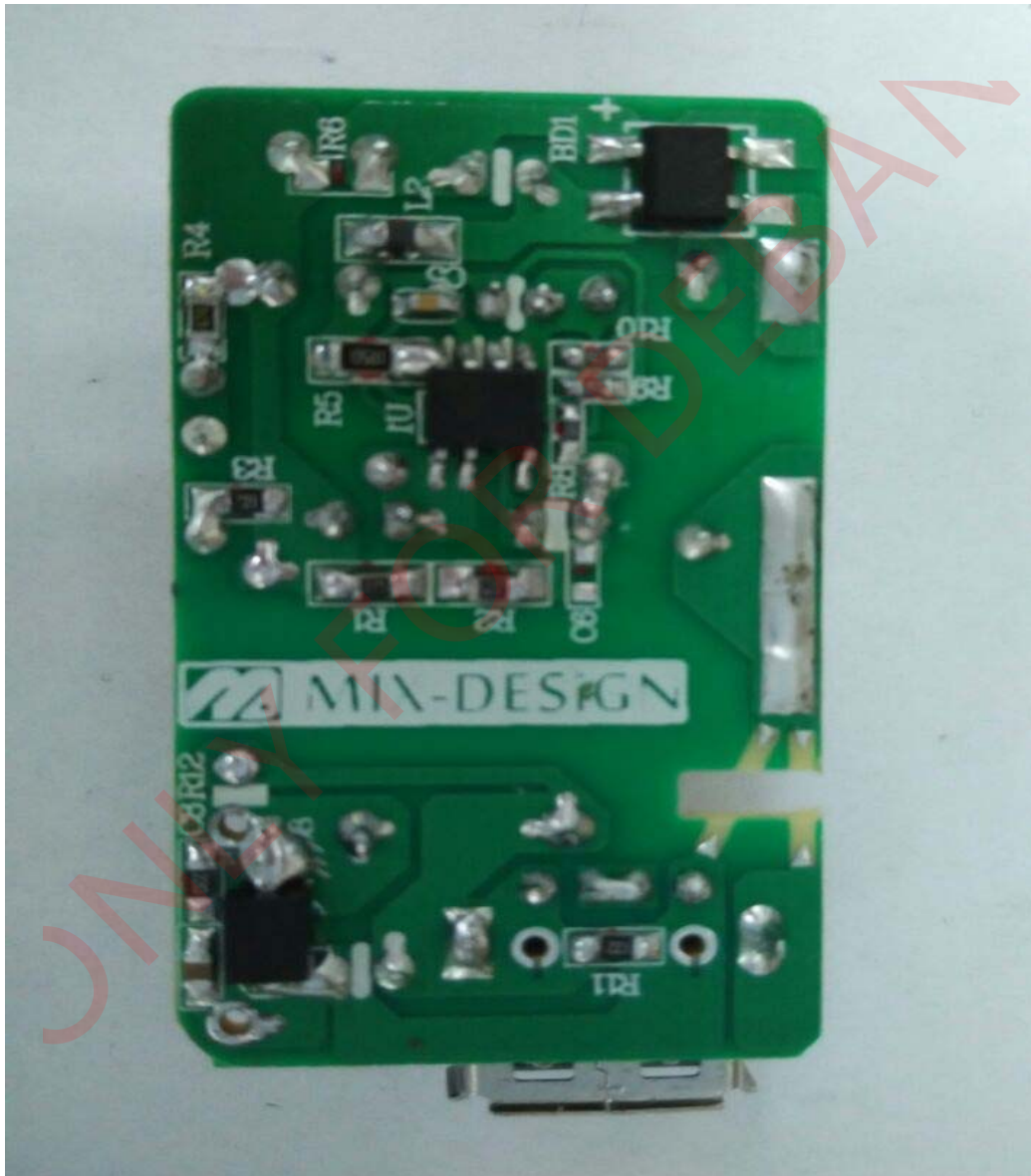
## DEMO Picture

### Top Side



## DEMO Picture

### Bottom Side

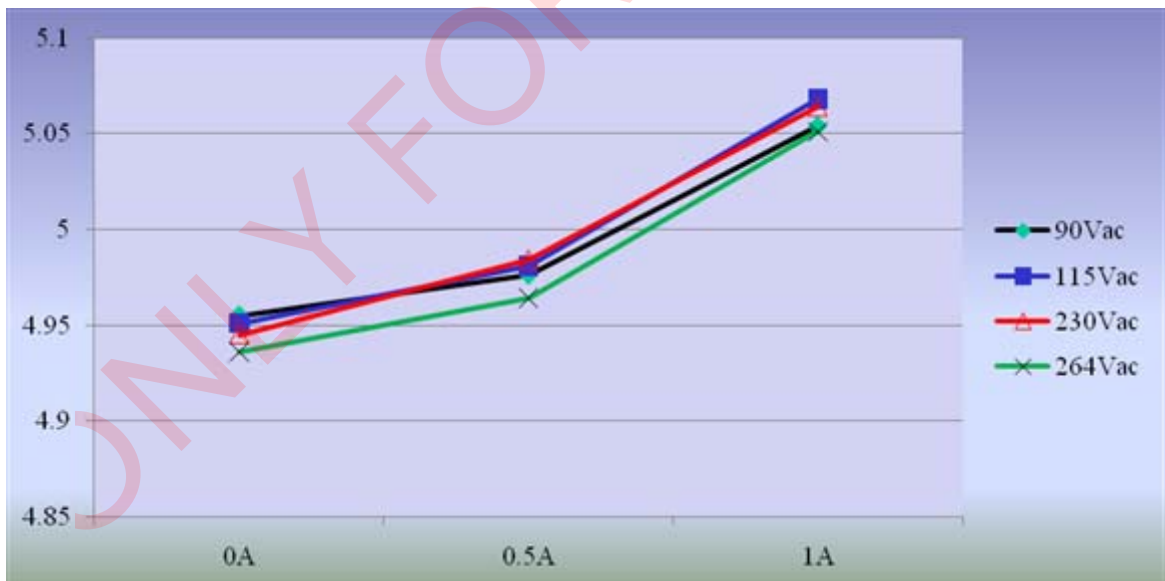


## 1. Output voltage regulation test:

### 1-1. CC mode:

Vout \ I <sub>out</sub>	Input Voltage			
	90V <sub>ac</sub>	115V <sub>ac</sub>	230V <sub>ac</sub>	264V <sub>ac</sub>
0A	4.955V	4.951V	4.945V	4.936V
0.5A	4.976V	4.981V	4.984V	4.964V
1.0A	5.054V	5.068V	5.064V	5.051V

### 1-2. CC Mode Data Curve:



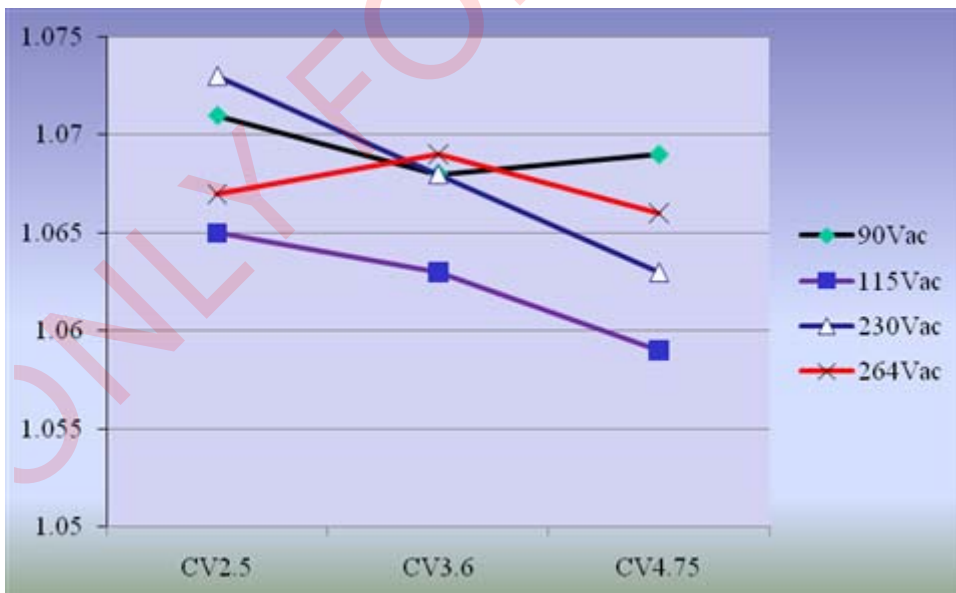
**Note :The Test Above At The End Of DC Wire(24#,1.5m)**

## 1. Output voltage regulation test:

### 1-3. CV mode:

V <sub>out</sub> \ I <sub>out</sub>	Input Voltage			
	90V <sub>ac</sub>	115V <sub>ac</sub>	230V <sub>ac</sub>	264V <sub>ac</sub>
2.5V	1.071A	1.065A	1.073A	1.067A
3.6V	1.068A	1.063A	1.068A	1.069A
4.75V	1.069A	1.059A	1.063A	1.066A

### 1-4. CV Mode Data Curve :

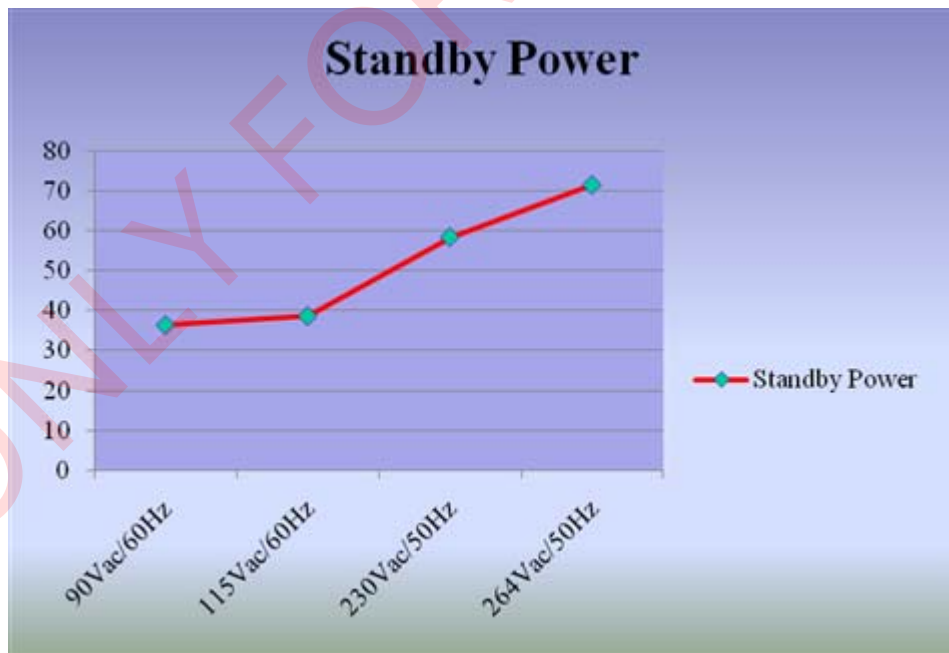


## 2. Standby power and efficiency test:

### 2-1. Standby power test:

Input voltage	Input wattage(mW)	Specification	Test result
90V <sub>ac</sub> /60Hz	36.45	<100mW	PASS
115V <sub>ac</sub> /60Hz	38.72	<100mW	PASS
230V <sub>ac</sub> /50Hz	58.40	<100mW	PASS
264V <sub>ac</sub> /50Hz	71.40	<100mW	PASS

### 2-2. Standby power Data Curve:





## 2. Standby power and efficiency test:

### 2-1. Efficiency test:

Note:

1、DC Wire Specification: 2468, 24AWG X2C, 1.5m

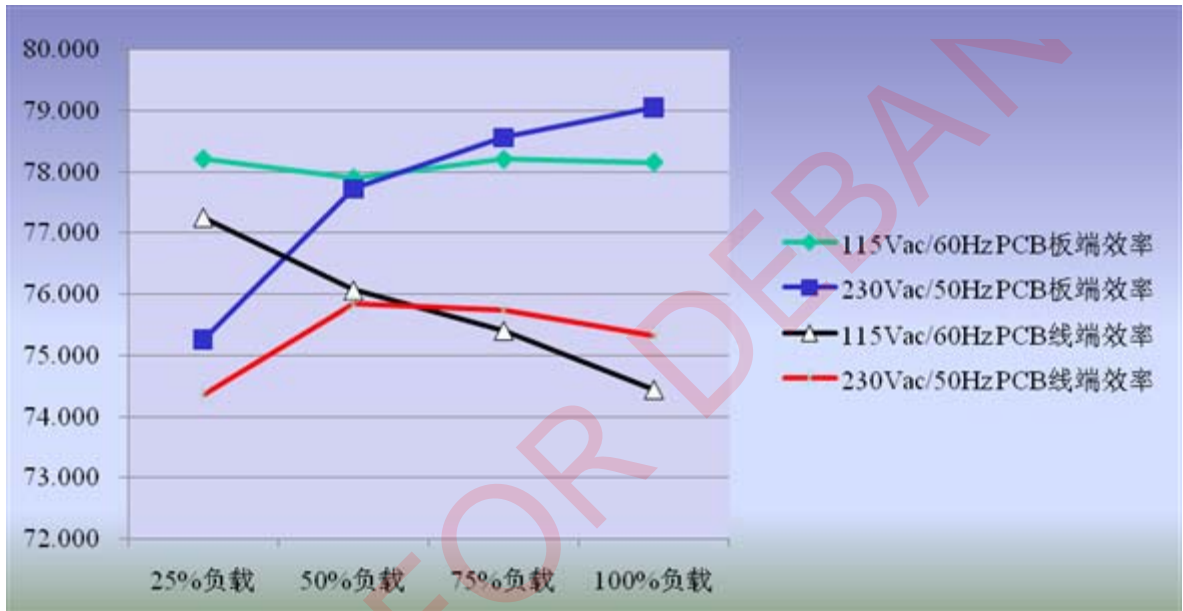
2、Room Ambient

3、 $V_{out1}$ ,  $V_{out2}$ ,  $P_{out1}$ ,  $P_{out2}$ ,  $\eta_1$ ,  $\eta_2$  Represent Output Voltage At The End Of PCB, Output Voltage At The End Of DC Wire, Output Watt At The End Of PCB, Output Watt At The End Of DC Wire, Efficiency At The End Of PCB, Efficiency At The End Of DC Wire Respectively.

$V_{in}=115V_{ac}/60Hz$	$I_{out}(A)$	$V_{out1}(V)$	$V_{out2}(V)$	$P_{out1}(W)$	$P_{out2}(W)$	$P_{in}(W)$	$\eta_1$	$\eta_2$	
	1.0	5.321	5.068	5.321	5.068	6.808	78.159	74.442	
	0.75	5.199	5.013	3.899	3.760	4.986	78.204	75.406	
	0.5	5.101	4.981	2.551	2.491	3.274	77.902	76.069	
	0.25	4.918	4.858	1.229	1.215	1.572	78.212	77.258	
	<b>Efficiency At The End Of PCB: <math>=(78.159+78.204+77.902+78.212)/4=78.119</math></b>								
	<b>Efficiency At The End Of DC Wire: <math>=(74.442+75.406+76.069+77.258)/4=75.790</math>(Be Great Than DoE VI Efficiency Standard 73.623)</b>								
$V_{in}=230V_{ac}/50Hz$	$I_{out}(A)$	$V_{out1}(V)$	$V_{out2}(V)$	$P_{out1}(W)$	$P_{out2}(W)$	$P_{in}(W)$	$\eta_1$	$\eta_2$	
	1.0	5.315	5.064	5.315	5.064	6.723	79.057	75.324	
	0.75	5.207	5.020	3.905	3.765	4.971	78.561	75.739	
	0.5	5.108	4.984	2.554	2.492	3.286	77.724	75.837	
	0.25	4.923	4.863	1.231	1.216	1.635	75.275	74.358	
	<b>Efficiency At The End Of PCB: <math>=(79.057+78.561+77.724+75.275)/4=77.654</math></b>								
	<b>Efficiency At The End Of DC Wire: <math>=(75.324+75.739+75.837+74.358)/4=75.315</math>(Be Great Than DoE VI Efficiency Standard 73.623)</b>								

## 2.Standby power and efficiency test:

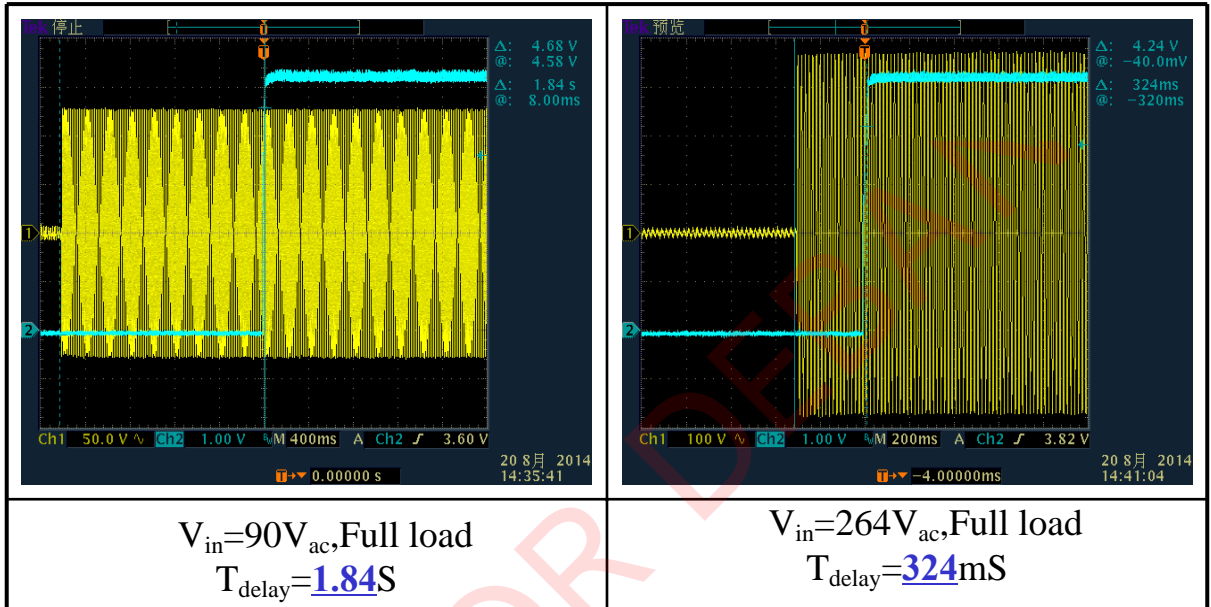
### 2-2.Efficiency Data Curve:



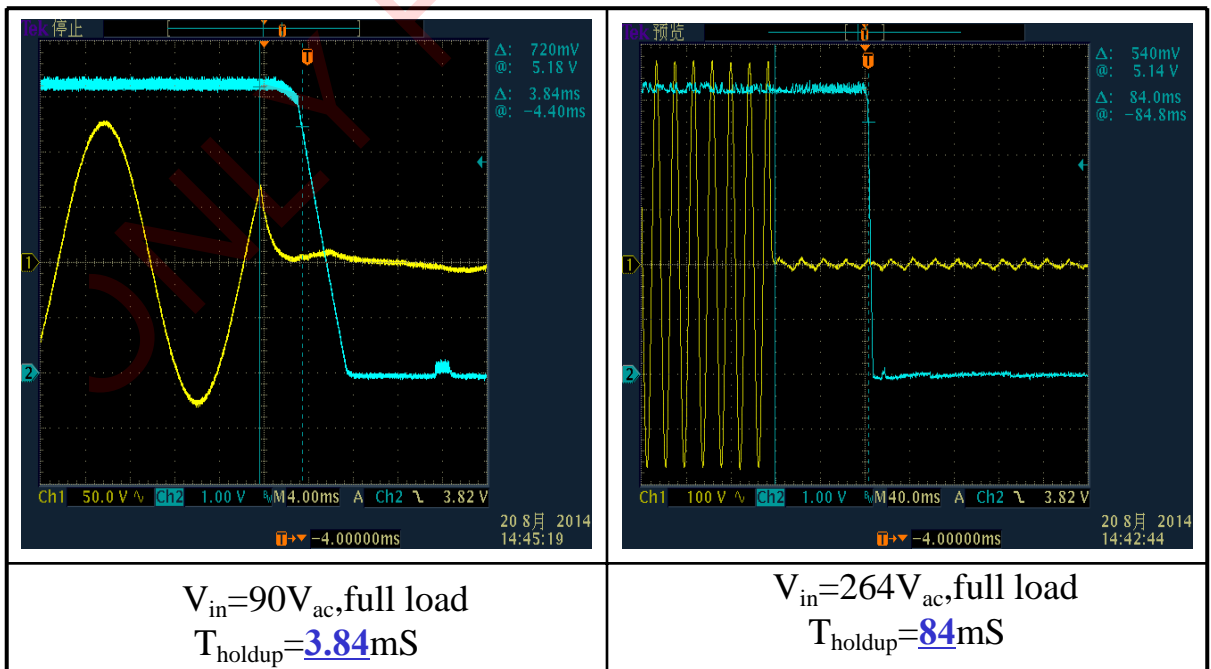


### 3. Time sequence test:

#### 3-1. Start up delay time:

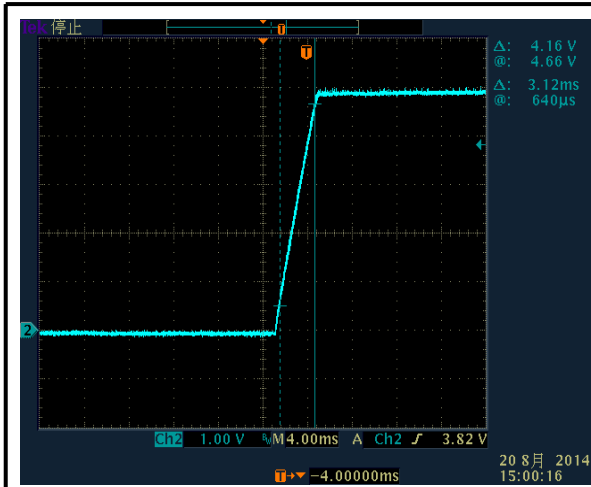


#### 3-2. Turn off hold up time:



### 3. Time sequence test:

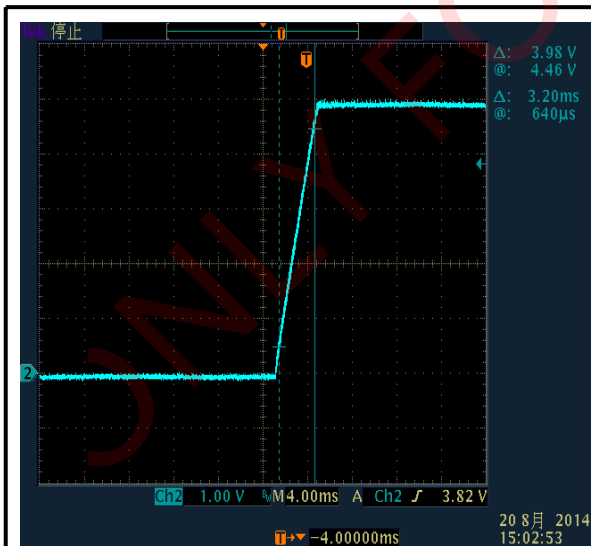
#### 3-3. Rising time at turn on:



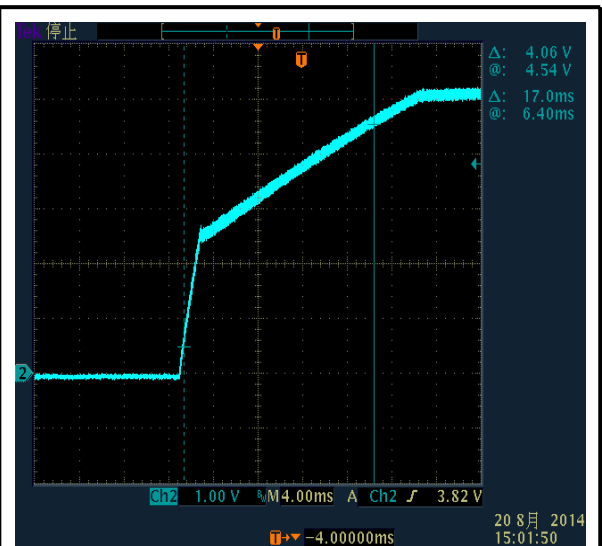
$V_{in}=90V_{ac}$ , no load  
 $T_{rising}=3.12mS$



$V_{in}=90V_{ac}$ , full load  
 $T_{rising}=16.2mS$



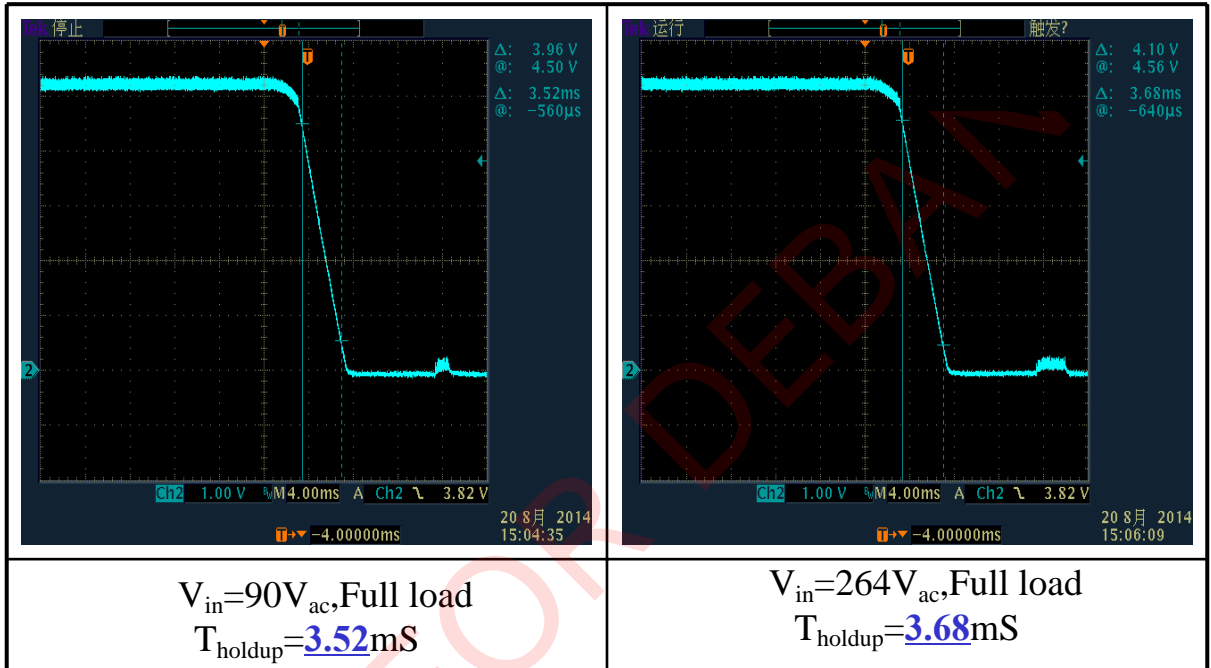
$V_{in}=264V_{ac}$ , no load  
 $T_{holdup}=3.20mS$



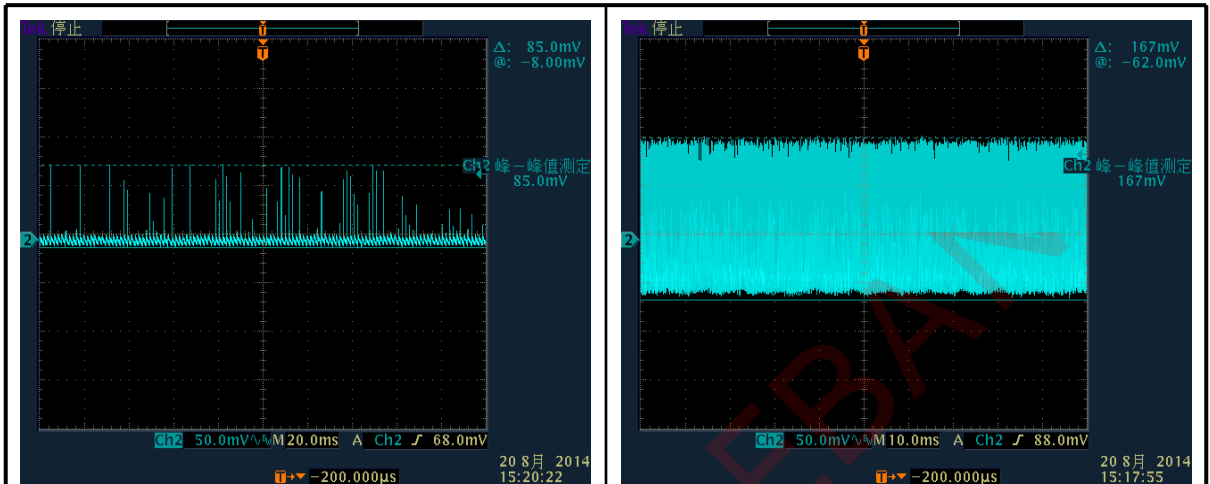
$V_{in}=264V_{ac}$ , Full load  
 $T_{holdup}=17.0mS$

### 3. Time sequence test:

#### 3-4. Falling time at turn off:

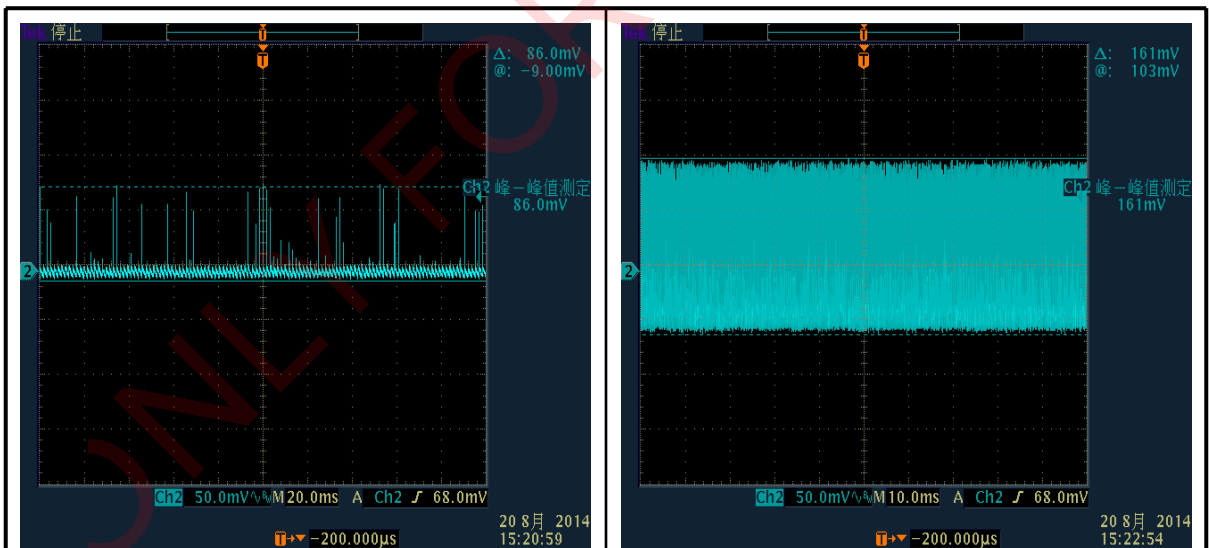


## 4. Output ripple & noise test:



$V_{in}=90V_{ac}$ , no load  
 $V_{ripple}=\underline{85mV}$

$V_{in}=264V_{ac}$ , no load  
 $V_{ripple}=\underline{167mV}$



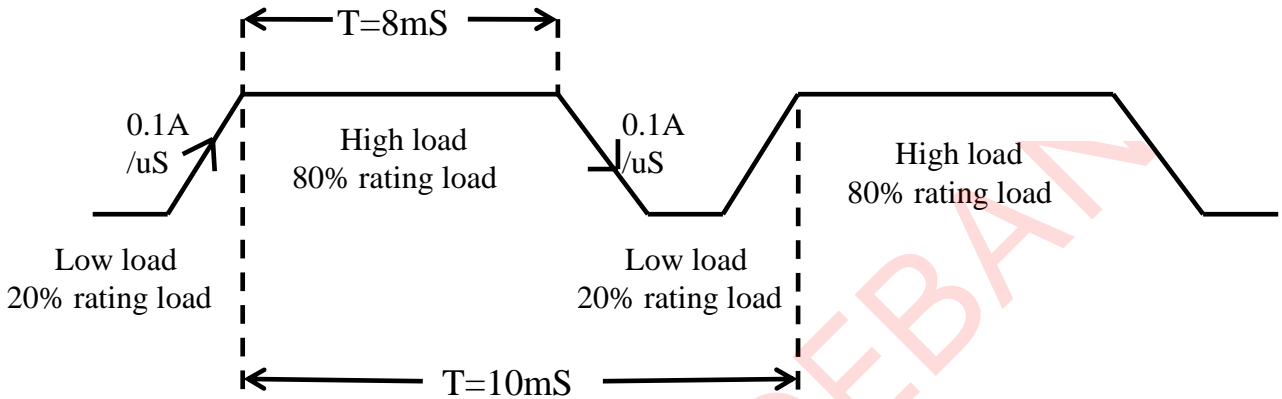
$V_{in}=90V_{ac}$ , Full load  
 $V_{ripple}=\underline{86mV}$

$V_{in}=264V_{ac}$ , Full load  
 $V_{ripple}=\underline{161mV}$

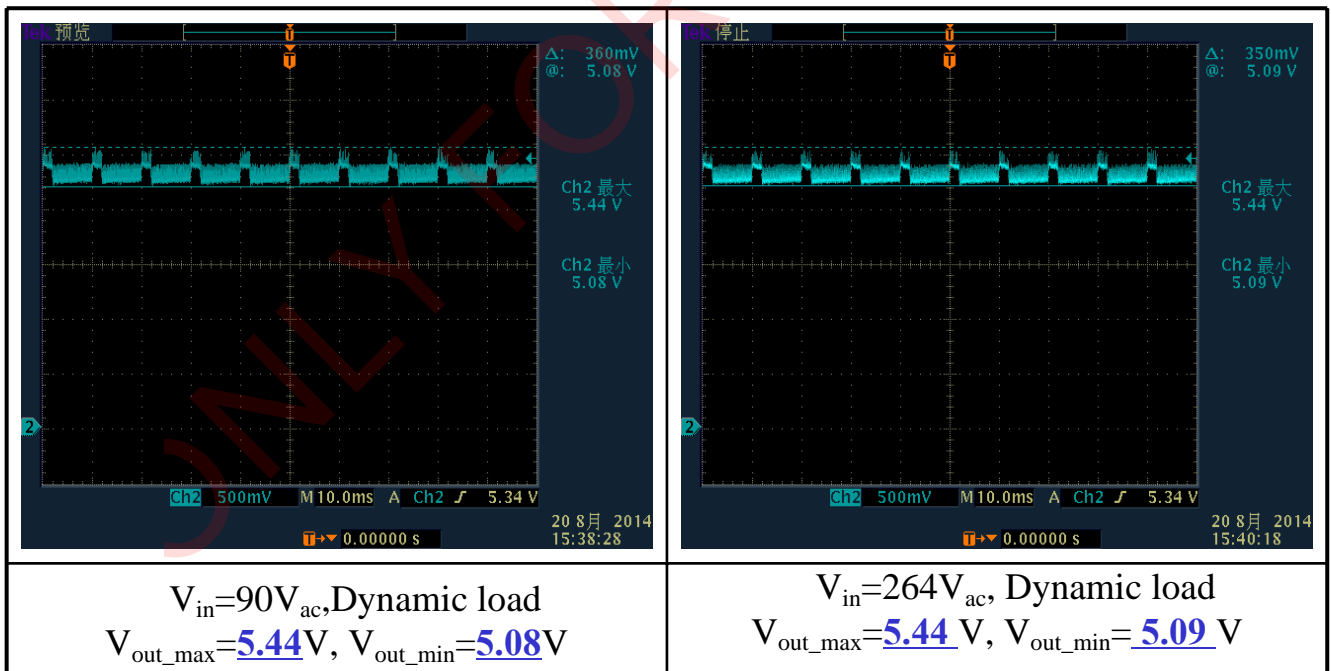
Note: Output terminal is parallel with 10uF E-cap and 0.1uF ceramic-cap.

## 5. Dynamic load test:

### 5-1. Dynamic load definition:



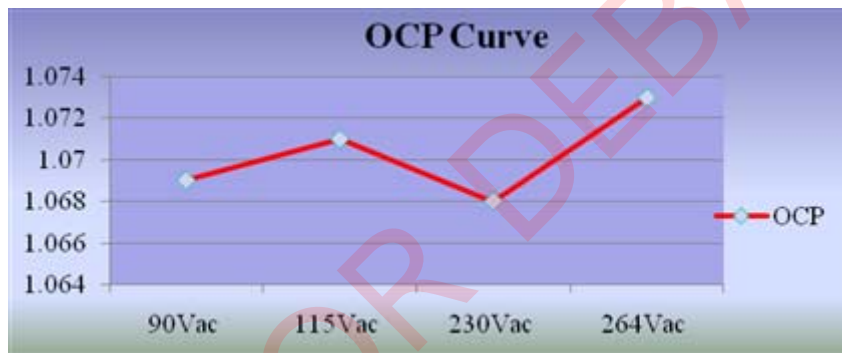
### 5-2. Waveform of output voltage under dynamic load



## 6. Protection function test:

### 6-1. Over current protection test:

OCP(A)	90V <sub>ac</sub>	115V <sub>ac</sub>	230V <sub>ac</sub>	264V <sub>ac</sub>
	<b>1.069</b>	<b>1.071</b>	<b>1.068</b>	<b>1.073</b>



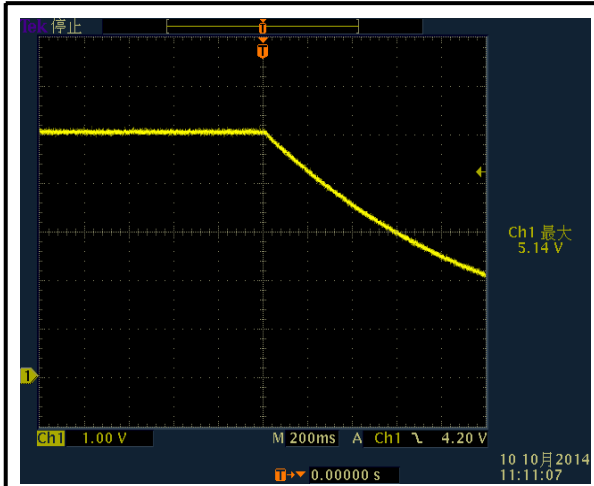
### 6-2. Short circuit protection test:

Input wattage under short output	90V <sub>ac</sub>	115V <sub>ac</sub>	230V <sub>ac</sub>	264V <sub>ac</sub>
Auto recovery /NY	<b>Y</b>	<b>Y</b>	<b>Y</b>	<b>Y</b>

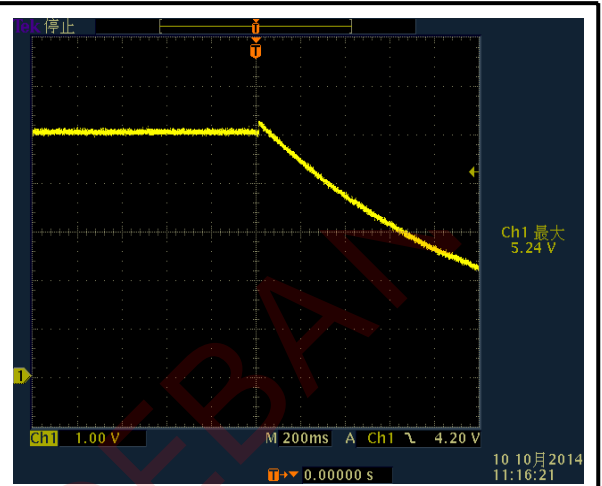
### 6-3. Over Voltage protection test:

**Short Pull Down Voltage Sample Resistor**

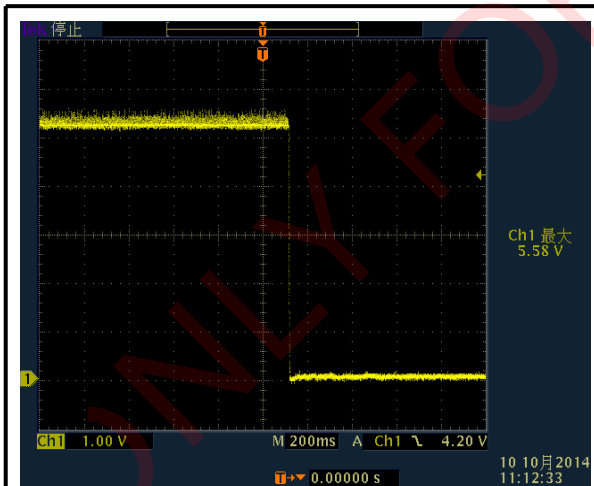




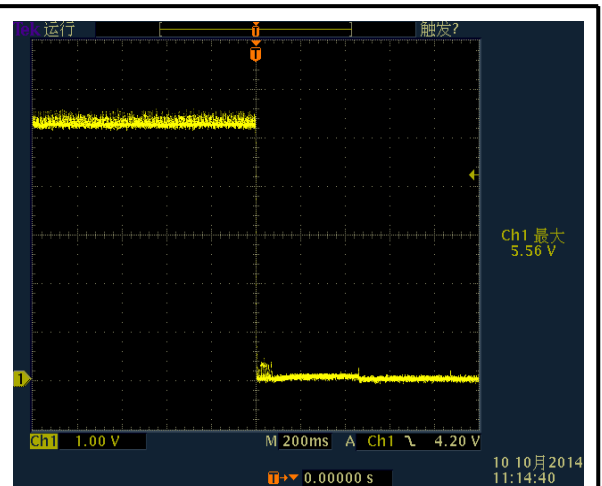
$V_{in}=90V_{ac}, No Load$   
 $V_{out\_max}=5.14V$



$V_{in}=90V_{ac}, No Load$   
 $V_{out\_max}=5.14V$



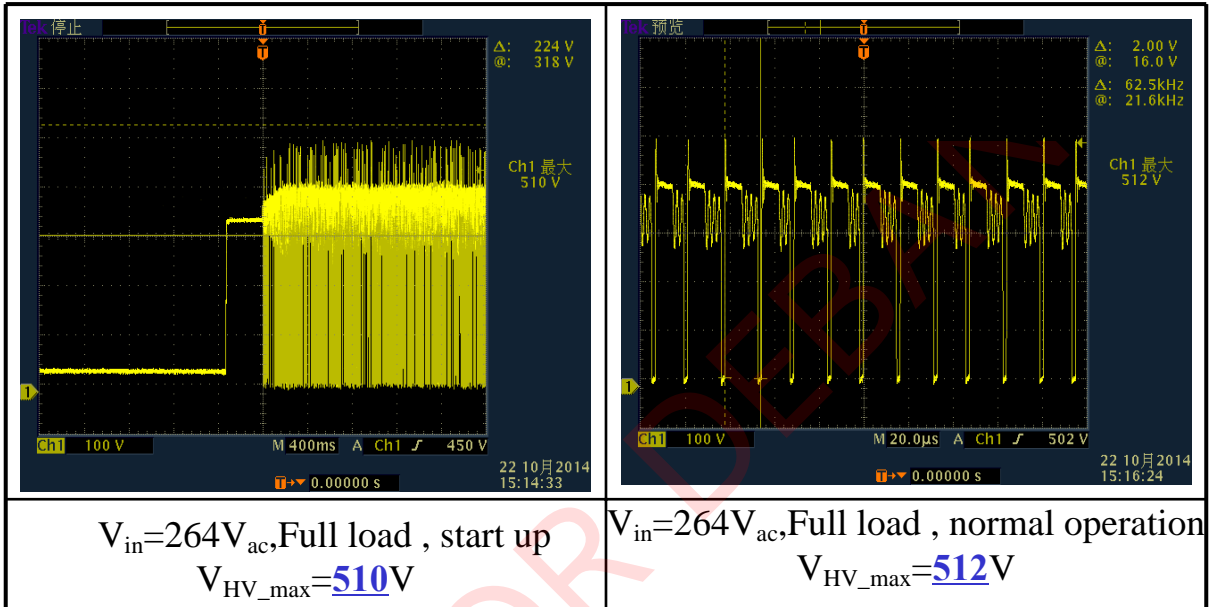
$V_{in}=264V_{ac}, Full Load$   
 $V_{out\_max}=5.58V$



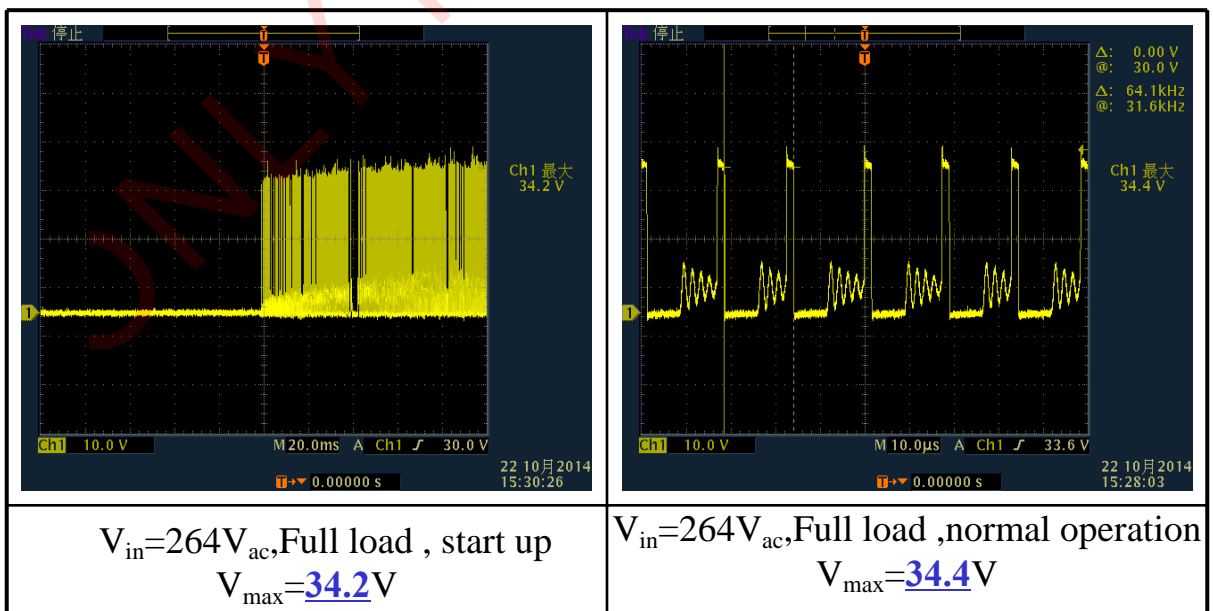
$V_{in}=264V_{ac}, Full Load$   
 $V_{out\_max}=5.56V$

## 7.Key component derating test:

### 7-1.Switching transistor voltage stress test:



### 7-2.Schokkty voltage stress test:



## 8.EMI test: performance @EN55022 class B Limited

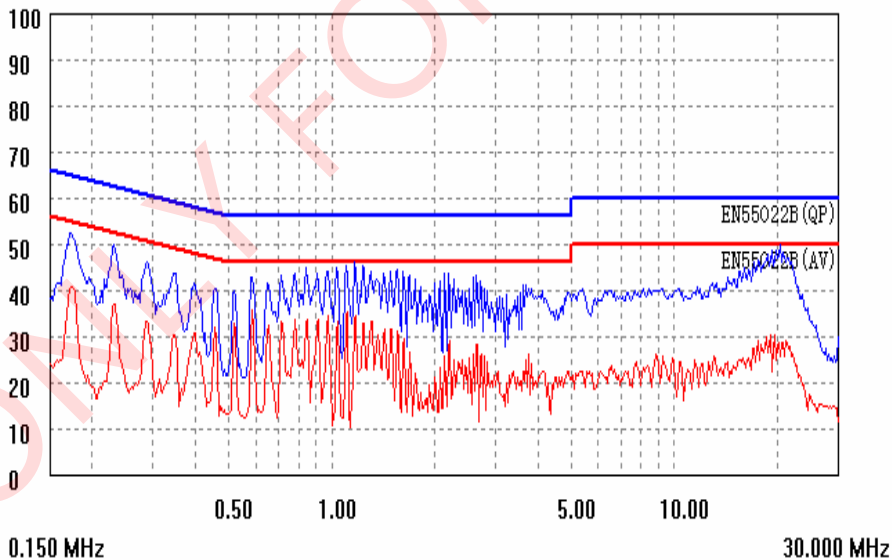
### 8-1.EMI-conduction emission test: L Line

#### EMI TEST REPORT

Organization:	Operator:	EUT:	parameter
Place:	Time: 2014/10/22/12:15	Test equipment:KH3932	
Detector: PK+AV	Test-time(ms): 30	SN: 1332408	
Limit: EN55022B	Transductor(PK/AV): PK / AV	JZ: 2,14,1093	
Remark:			

Start(MHz)	End(MHz)	Step(MHz)	freq, step
0.150	2.000	0.002	
2.000	10.000	0.010	
10.000	30.000	0.025	

dBuV scan result



## 8.EMI test: performance @EN55022 class B Limited

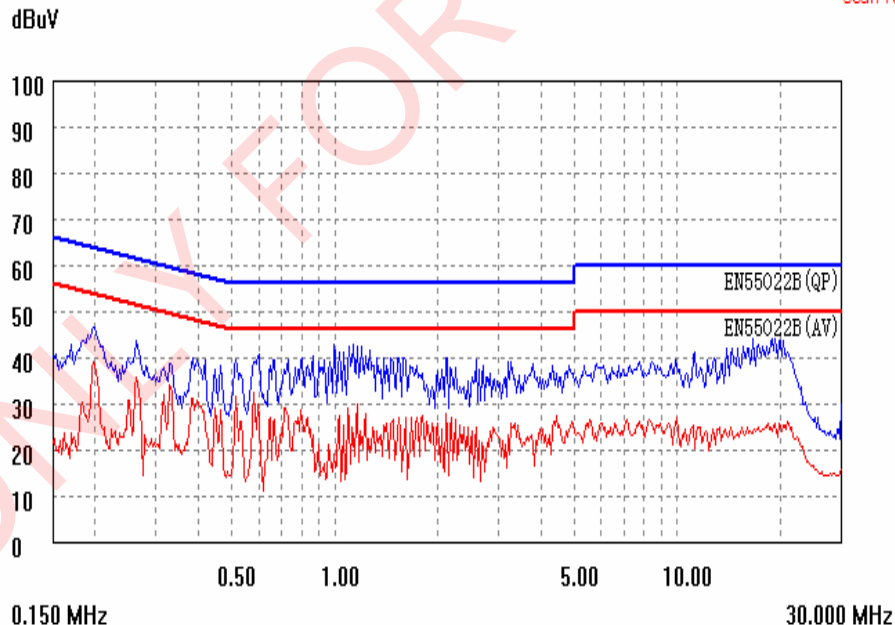
### 8-1.EMI-conduction emission test: N Line

#### EMI TEST REPORT

parameter		
Organization:	Operator:	EUT:
Place:	Time: 2014/10/22/12:21	Test equipment:KH3932
Detector: PK+AV	Test-time(ms): 30	SN: 1332408
Limit: EN55022B	Transductor(PK/AV): PK / AV	JZ: 2,14,1089
Remark:		

freq, step		
Start(MHz)	End(MHz)	Step(MHz)
0.150	2.000	0.002
2.000	10.000	0.010
10.000	30.000	0.025

scan result



## 8.EMI test: performance @EN55013 class B Limited

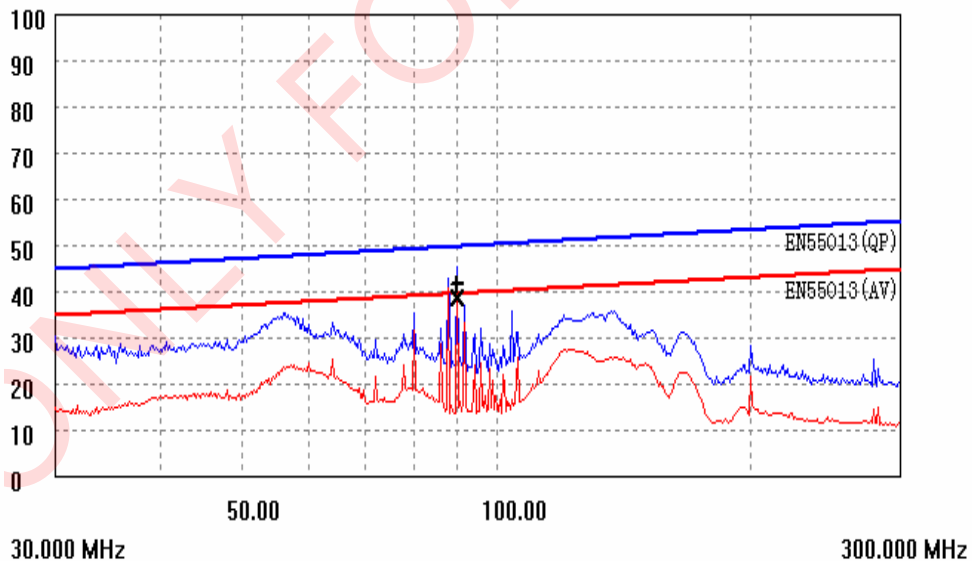
### 8-2. EMI-radiation emission test : L Line

#### EMI TEST REPORT

parameter	
Organization:	Operator:
Place:	Time: 2014/10/22/13:1
Detector: PK+AV	Test-time(ms): 30
Limit: EN55013	Transductor(PK/AV): PK / AV
Remark:	EUT:
	Test equipment:KH3932
	SN: 1332408
	JZ: 2,14,1079

freq, step		
Start(MHz)	End(MHz)	Step(MHz)
30.000	100.000	0.100
100.000	230.000	0.200
230.000	300.000	0.200

scan result



## 8.EMI test: performance @EN55013 class B Limited

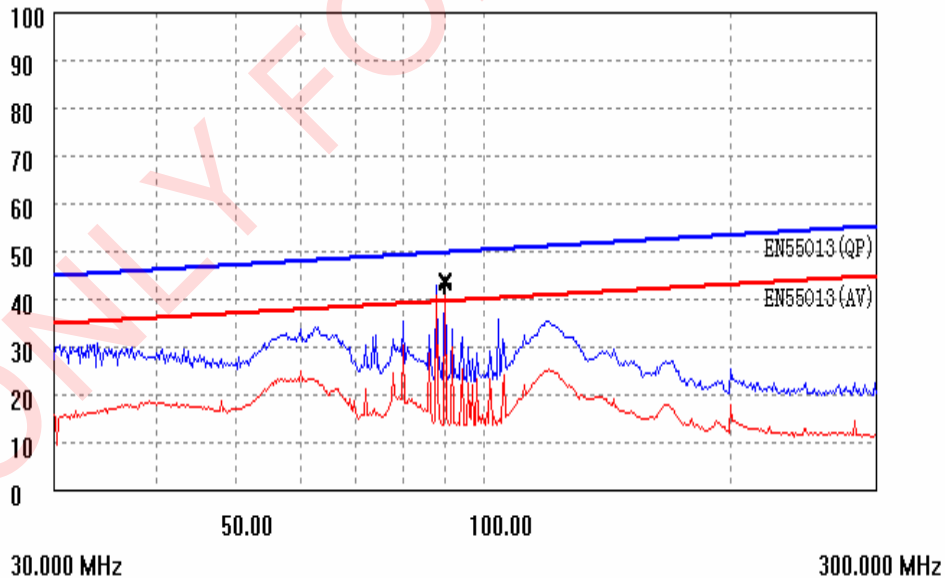
### 8-2. EMI-radiation emission test : N Line

#### EMI TEST REPORT

Organization:	Operator:	EUT:	parameter
Place:	Time: 2014/10/22/13:5	Test equipment:KH3932	
Detector: PK+AV	Test-time(ms): 30	SN: 1332408	
Limit: EN55013	Transducer(PK/AV): PK / AV	JZ: 2,14,1084	
Remark:			

Start(MHz)	End(MHz)	Step(MHz)	freq, step
30.000	100.000	0.100	
100.000	230.000	0.200	
230.000	300.000	0.200	

dBuV scan result



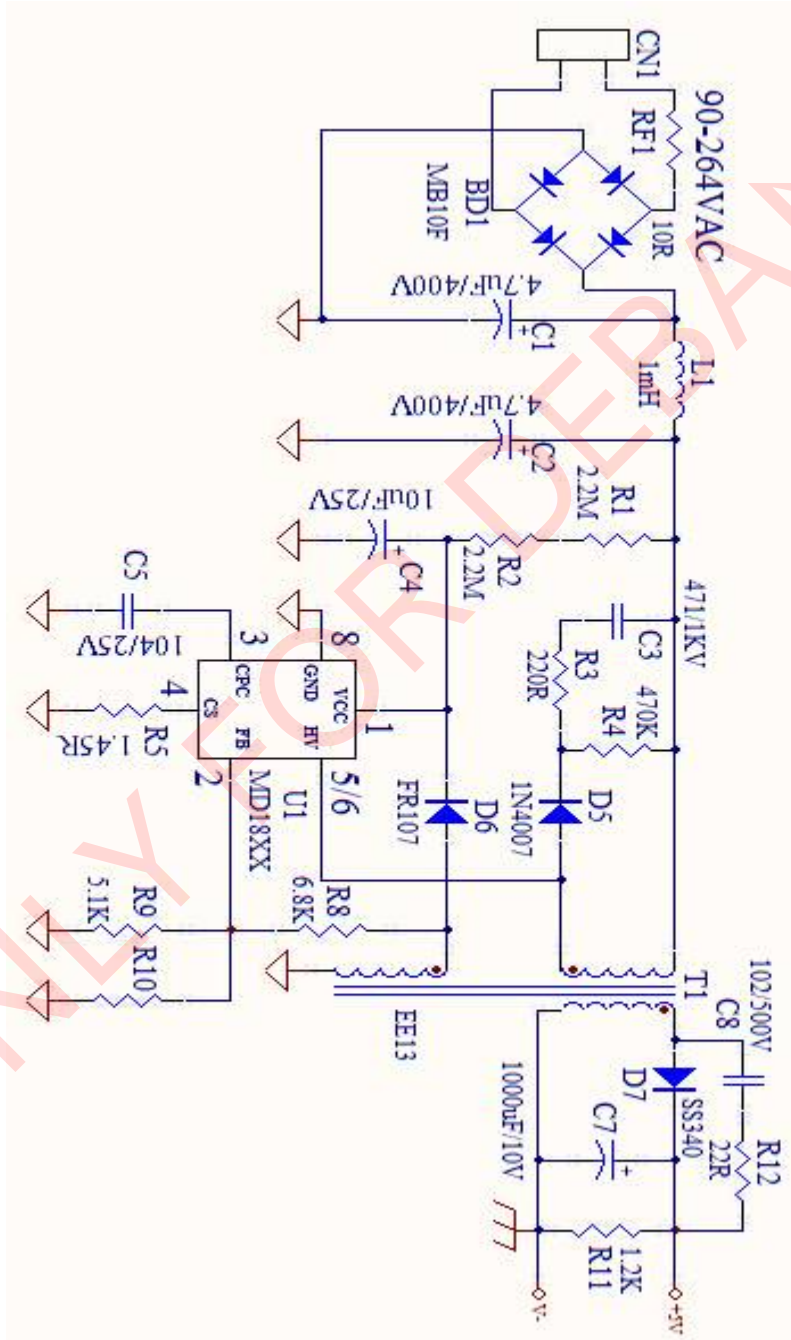


## 9.Key Component Temperature Rise Test:

**Test Condition : Ambient Temperature Is 40 °C, Load Is Full Load**

NO	Component	Temperature(°C)	
		$V_{in}=90V_{ac}$	$V_{in}=264V_{ac}$
1	IC1(MD1810)	87.5	88.4
2	T1-Winding	80.9	82
3	T1-Core	82	90.0
4	BD1(Rectifier Bridge)	92	84
5	D6(1N4007,Snubber Diode)	89	95
6	D7(SS340,Schottky)	84.2	82.7
7			

## 10. Schematic:

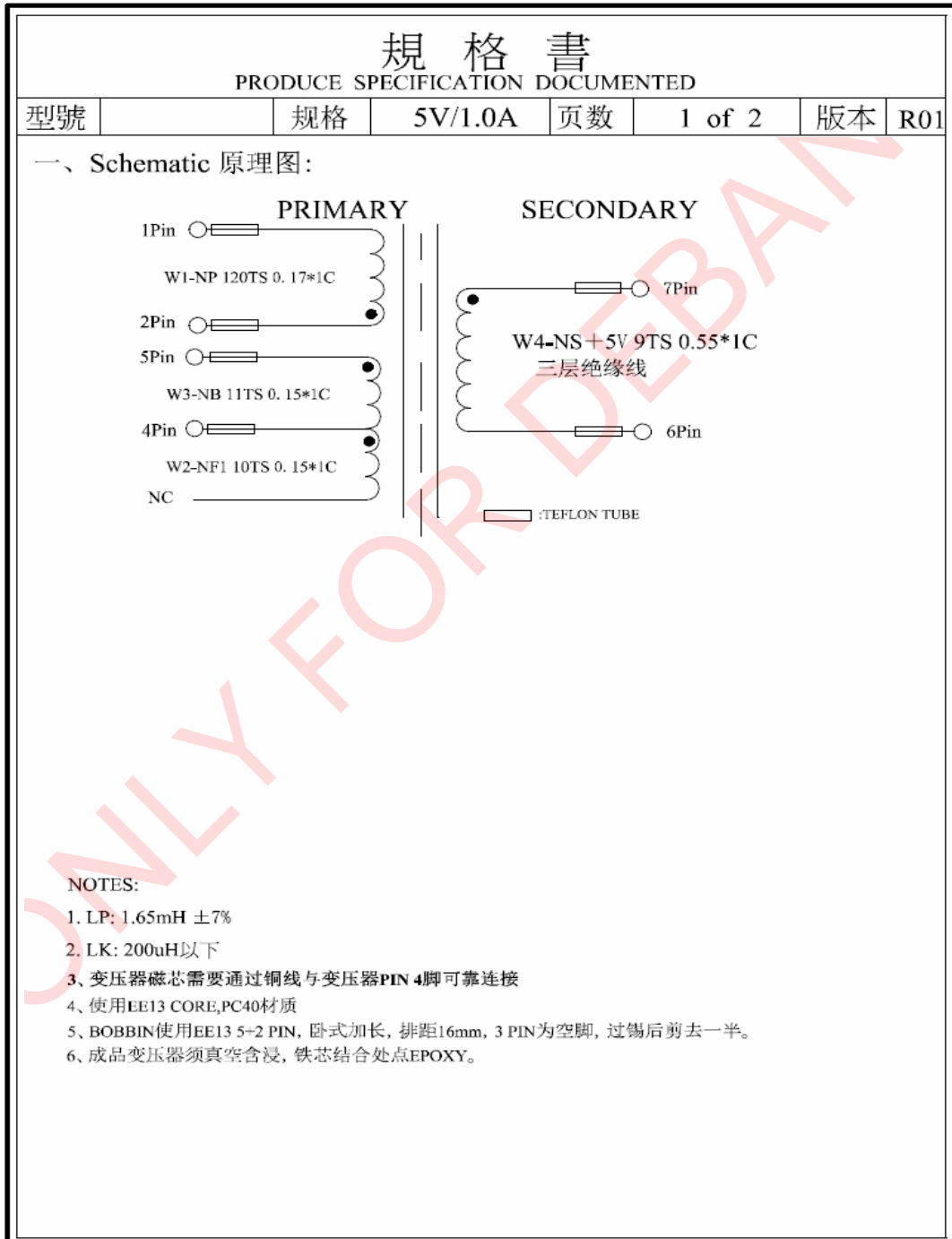


## 11. Bill Of Material:

产品规格		Input : 90~264Vac ; Output : 5V1A ( 安规产品 )			
<b>初级</b>					
No.	Q'ty	Location	Discription	Pacakge	Remark
1	2	C1 C2	4.7uF, 400V, Electrolytic 105°C	Φ8*12	
2	1	C4	10uF, 25V, Electrolytic ,Low ESR 105°C	Φ5*11	
3	1	C3	470pF, 1000V, Disc Ceramic	Rad	
4	1	D5	1N4007 1000V/1A, Rectifier	DO-41	
5	1	D6	FR107 1000V/1A, Rectifier	DO-41	
6	1	L1	Choke coil 1mH 1W	Axial	
7	1	RF1	10R, 1W Wire-Wound Resistor	Axial	
8	1	T1	Transformer, EE13, 5+2 pins,	EE13	
9	1	U1	MD1810SCG	SOIC-7	
10	1	BD1	MB10F 1000V/1A Bridge	SO-4	
11	2	R1 R2	Resistor SMD 2.2M 1206 5%	1206	
12	1	R3	Resistor SMD 220R 0805 5%	0805	
13	1	R4	Resistor SMD 470K 0805 5%	0805	
14	1	R5	Resistor SMD 1.45R 1206 1%	1206	
15	1	R8	Resistor SMD 6.8K 0603 1%	0603	
16	1	R9	Resistor SMD 5.1K 0603 1%	0603	
17	1	R10	Resistor SMD 82K 0603 1%	0603	
18	1	L2	Inductor SMD 3.3uH 0805	0805	
19	1	C5	Capactor SMD 104, 25V 0603 10%	0603	
<b>次级</b>					
No.	Q'ty	Location	Discription	Pacakge	Remark
20	1	C7	1000 uF, 10 V, Electrolytic,Low ESR, 105°C	Φ8*12	
21	1	USB	USB	DIP	
22	1	D7	SS340 40V/3A, Schottky, SMB	DO-15	
23	1	R11	Resistor SMD 1.2K 0805 5%	0805	
24	1	R12	Resistor SMD 22R 0805 5%	0805	
25	1	C8	Capactor SMD 102,500V 0805 10%	0805	

## 12. Transformer Structure:

### 12-1. Schematic:



## 12. Transformer Structure:

### 12-2. Transformer winding process:

No.	绕组	线径(材质)	起绕点	端点	圈数	胶带层数	备注
1.	W1 - NP	2UE Ø 0.17*1C	2 Pin	1 Pin	120 TS	3 TS	密绕三层
*此绕组平滑密绕三层, 如果超出可稍微调整线径。							
2.	W2 - NF1	2UE Ø 0.15*1C	4 Pin	NC	10 TS	1 TS	疏绕一层
*此绕组须均匀疏绕一层							
3.	W3 - NB	2UE Ø 0.15*1C	5 Pin	4 Pin	11 TS	3 TS	疏绕一层
*此绕组须均匀疏绕一层。							
4.	W4 - NB	TEX-E Ø 0.55*1C	6 Pin	7 Pin	9 TS	3 TS	密绕一层
此绕组须逆绕							

### 12-3. Transformer Test Item:

No.	测试项目	测试条件	测试Pin脚	规格	备注
1.	INDUCTANCE (电感量)	10KHz/1V	1Pin — 2Pin	1.65mH ±7%	
2.	L K (漏感)	10KHz/1V 4-5 and Sec Short	1Pin — 2Pin	200uH Max	
3.	HI-POR 高压测试	3500Vac 5mA One Minute	Primary—Secondary	3500Vac 5mA	
		1500Vac 5mA	Primary to Core	1500Vac 5mA	
		1500Vac 5mA	Secondary to Core	1500Vac 5mA	
4.	Insulation Resistance 绝缘电阻	500Vdc	All Windings to Core	>100 Mohms	
		500Vdc	Between windings	>100 Mohms	
5.	DC Resistance DC阻抗		1Pin —2Pin	< 3 Ohms	

**13. PCB LAYOUT:**

