



LD5523N 12V/3.0A Demo Board

General Design Specification :

- ✓Meet “DoE-6 ” Requirement
- ✓Meet “CoC V5 Tier-2” Requirement
- ✓Universal Input Range 90-264 VAC
- ✓DC Output 12V/3.0A

Oct.26, 2018
Jack_Pan

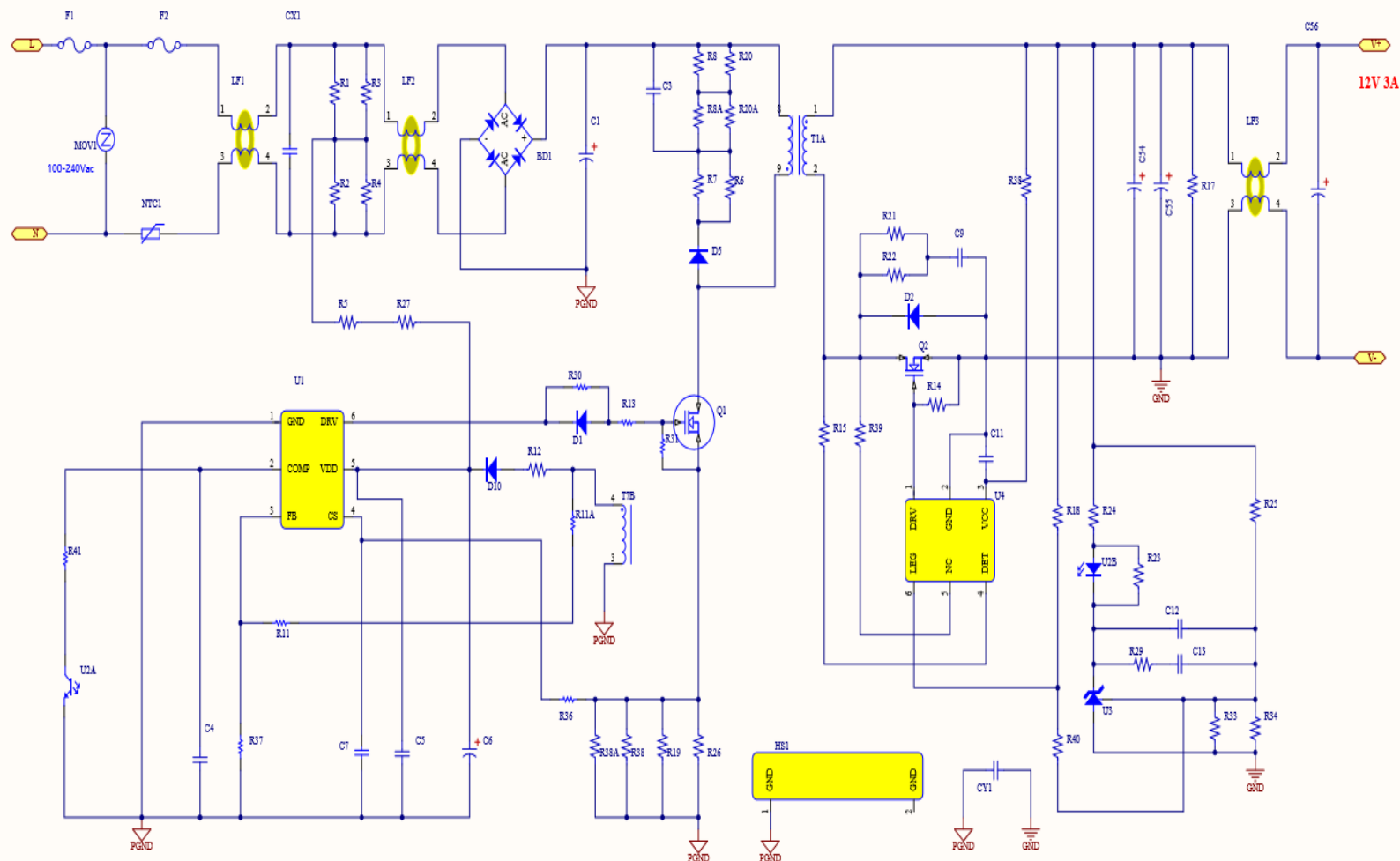
Design Check List

NO.	Test Item	Spec.	Test Result	Judgment
1	Specification			
2	Schematic			
3	Demo Board Photograph			
4	BOM List			
5	Transformer Design			
6	Efficiency Measurement @ 12V	CoC V5 Tier-2		
7	Output Ripple Voltage & Noise	<120mVp-p		
8	Over Current Protection	<4.5A		
9	Turn On Delay Time	< 3 sec		
10	Output Rise Time	<50mS		
11	Dynamic Load Response	<±10%		
12	Hold up Time	≥10mS		
13	Power Component Stress Voltage	De-rating<90%		
14	Power Component Temperature			
15	Transformer Flux Density	<3500Guass		
16	Conducted EMI	EN55022/CISPR22 class B		

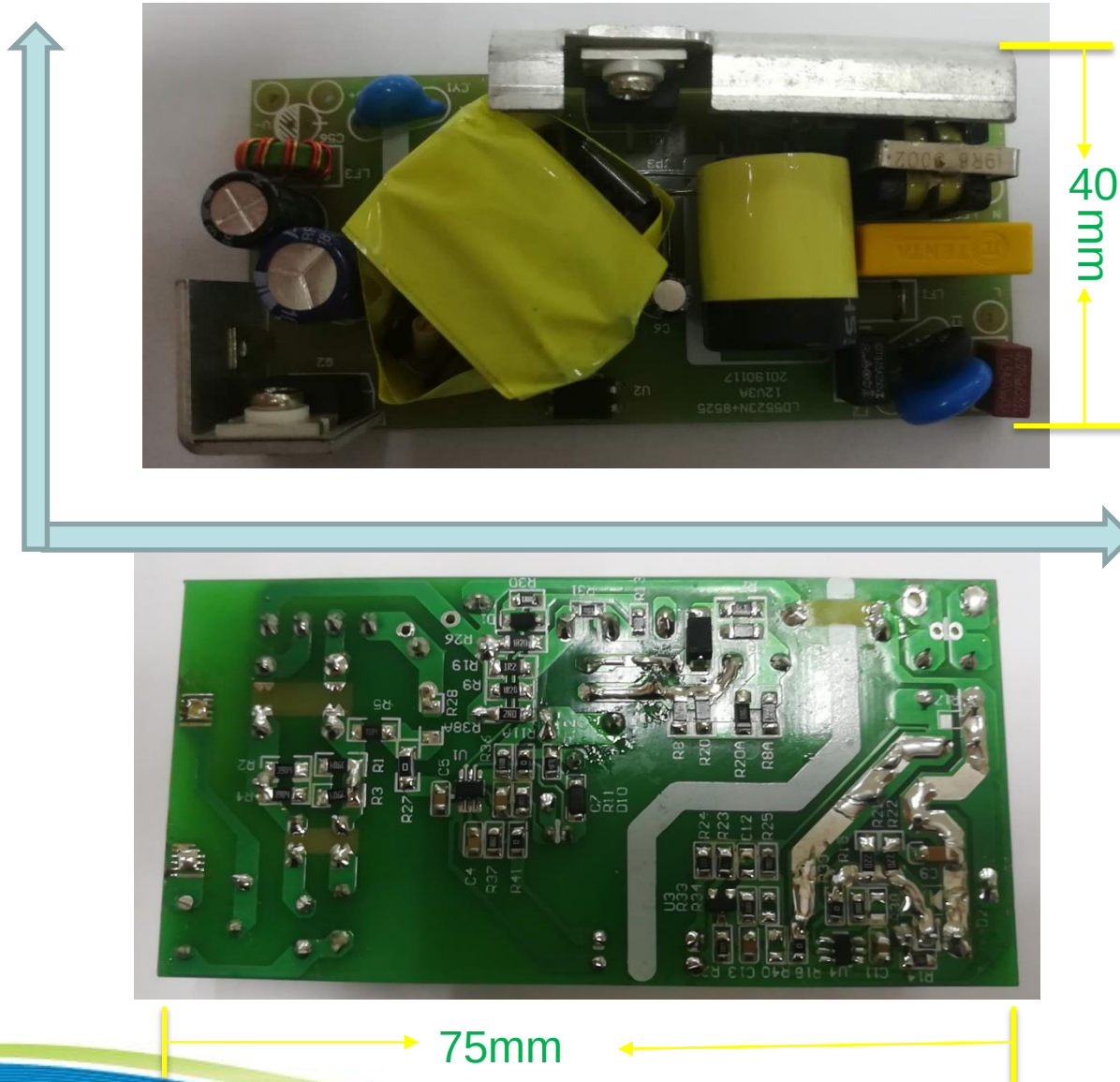
1. Specification

Description	Symbol	Min	Typ	Max	Units	Comment
Input						
Voltage	Vin	90		264	VAC	2 Wire
Frequency	f	47	50/60	63	Hz	
No-load Input Power				75	mW	Test at 230VAC
Output 12V						
Output Voltage	Vout	11.4	12	12.6	V	
Output Current	Iout	0		3.0	A	
Ripple Voltage	Vripple			120	mVpp	10uF/0.1uF &20MHz/BW
OCP	Iout			4.5	A	
Conducted EMI		Meets CISPR22B / EN55022B			Test with grounding	
Ambient Temperature	Tamp A	0	25	45	°C	Free convection, sea level

2. Schematic



3. Demo Board Photograph



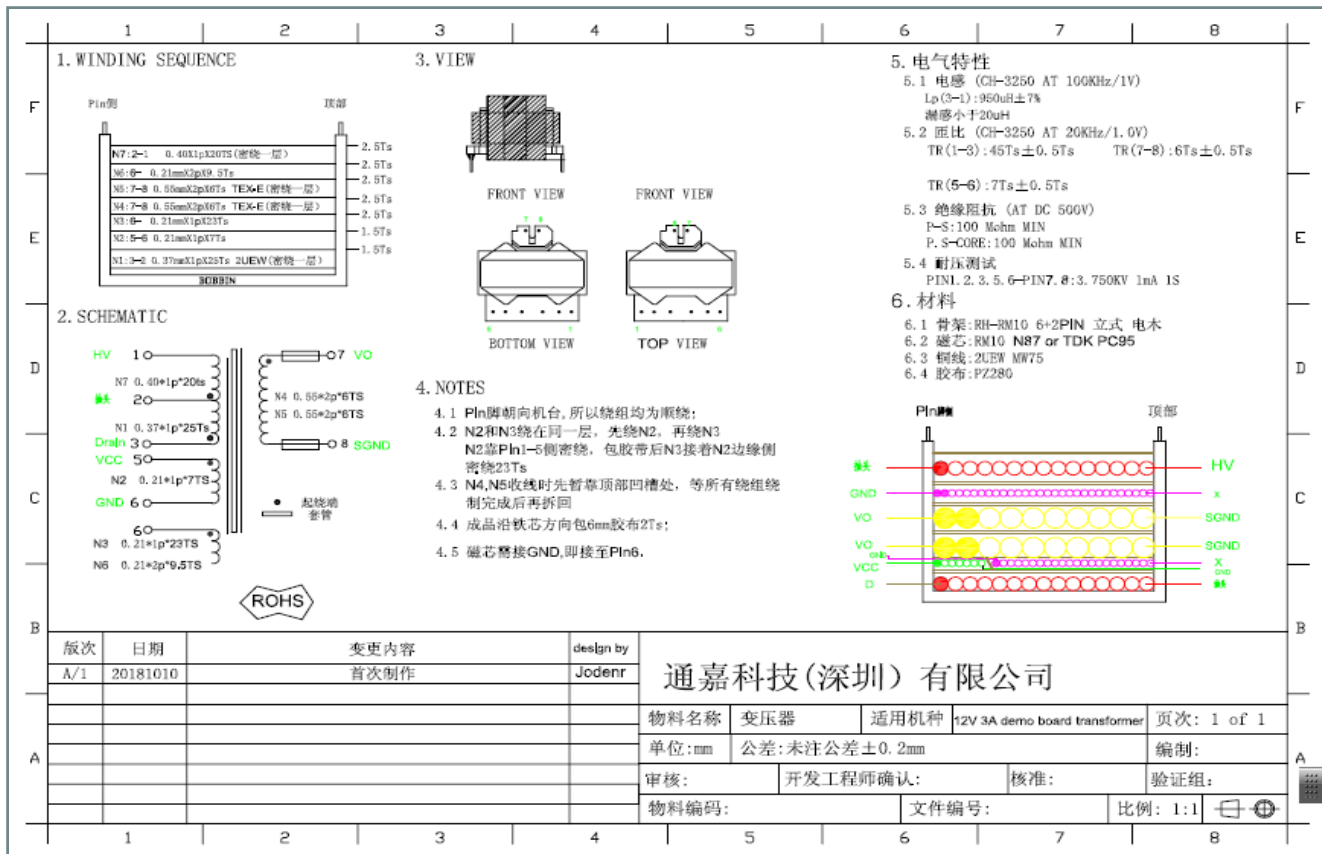
4. BOM List

1	保险丝	T6.3A250V	1	F1	30	贴片电阻	33R 0805 1%	1	R30
2	保险丝	T3.15A250V	1	F2	31	贴片电阻	22R 0805 1%	1	R13
3	热敏电阻	5d-11	1	NTC1	32	贴片电阻	10K 1206 1%	1	R31
4	压敏电阻	561KD14J	1	MOV1	33	贴片电阻	4R7 0805 1%	1	R12
5	共模电感	UU9.8	1	LF1	34	贴片电阻	NC	1	R28
6	Y电容	102 400V	1	CY1	35	贴片电阻	NC	1	JP1
7	安规电容	0.22uF/275v	1	CX1	36	贴片电阻	180K 0805 1%	1	R11
8	跳线	0.5*10mm	4	LF2,LF3	37	贴片电阻	36K 0805 1%	1	R37
9	桥堆	GPU206	1	BD1	38	贴片电阻	510R 0805 1%	1	R36
10	电解电容	68uF/450V	1	C1	39	贴片电阻	1R2 1206 1%	3	R9,R19,R26
11	电解电容	4.7uF/50V	1	C6	40	贴片电阻	22R 0805 1%	2	R21,R22
12	电解电容	680uF/16V	1	C54	41	贴片电阻	2R0 1206 1%	1	R38A
13	电解电容	1000uF/16V	1	C55	42	贴片电阻	200R 0805 1%	1	R15
14	瓷片电容	103/1KV	1	C3	43	贴片电阻	10.5K 0805 1%	1	R14
15	变压器	RM10	1	T1	44	贴片电阻	0R 0805 1%	3	R18,R39
16	光藕	PC817	1	U2	45	贴片电阻	2.2K 0805 1%	1	R24
17	MOS管	13N10M TO-220	1	Q2	46	贴片电阻	3.3K 0805 1%	2	R23,R29
18	MOS管	VS7N65 TO-220	1	Q1	47	贴片电阻	39K 0805 1%	1	R25
19	IC	LD5523N SOT23-6	1	U1	48	贴片电阻	10K 0805 1%	1	R33
20	电感	T12*8*4	1	LF3	49	贴片电阻	200K 1206 5%	2	R20,R20A
21	IC	LD8526 SOT23-6	1	U3	50	贴片电阻	150K 1206 5%	2	R8,R8A
22	IC	TL431 SOT23	1	U4	51	贴片电阻	120R 1206 5%	2	R7,R6
23	贴片二极管	1N4148	1	D1	52	贴片电容	100pF/50V 0805	2	C4,C7
24	贴片二极管	RS1M	1	D5	53	贴片电容	104 50V 0805	1	C5
25	贴片二极管	RM	1	D10	54	贴片431	TL431	1	U3
26	贴片电阻	3.9M 1206 5%	4	R1-R4	55	贴片电容	2.2uF 25V 0805	1	C11
27	贴片电阻	150K 1206 5%	2	R5	56	贴片电容	100nF 50V 0805	1	C13
28	贴片电阻	10R 1206 5%	1	J10	57	贴片电容	102PF 100V 1206	1	C9
29	贴片电阻	0R 1206 5%	1	R27	58	PCB		1	

Transformer Design

Transformer : RM10
 $A_e = 98\text{mm}^2$

- ✓ Transformer : RM10 PC44
- ✓ Inductance: 800uH @ 100KHz, 1V



6 Efficiency Measurement

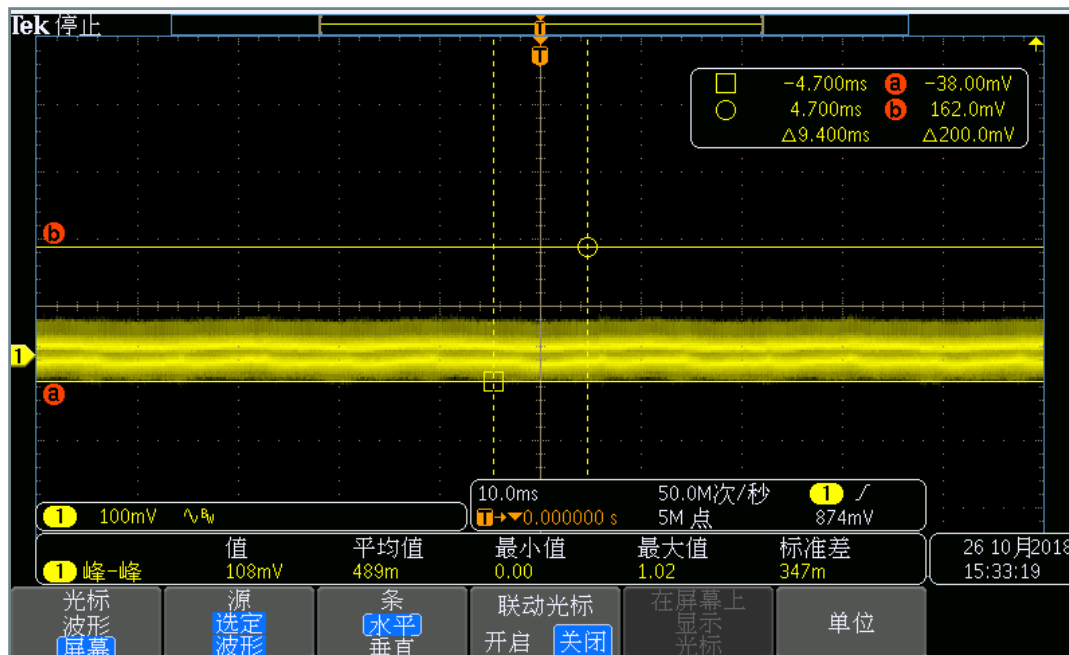
115V					230V			
Vout(V)	Iout(A)	Pin(W)	Efficiency		Vout(V)	Iout(A)	Pin(W)	Efficiency
12.17	3.0	40.79	89.5%		12.17	3.0	39.8	91.71%
12.19	2.25	30.31	90.34%		12.19	2.25	29.9	91.76%
12.22	1.5	20.18	90.98%		12.22	1.5	20.12	91.06%
12.22	0.75	10.19	90.00%		12.24	0.75	10.23	89.73%
			90.20%					91.06%

Power saving 46mW@115Vac&64mW@230Vac

➤ NOTE : CoC V5 Tier-2 spec: 12V Avg. Eff. >87.4%, 10% Eff. > 77.4%

7 Output Ripple Voltage & Noise

Input	12V3.0A ripple noise	
90VAC / 60Hz	108mV	
115VAC / 60Hz	100mV	
230VAC / 50Hz	99mV	
264VAC / 50Hz	90mV	

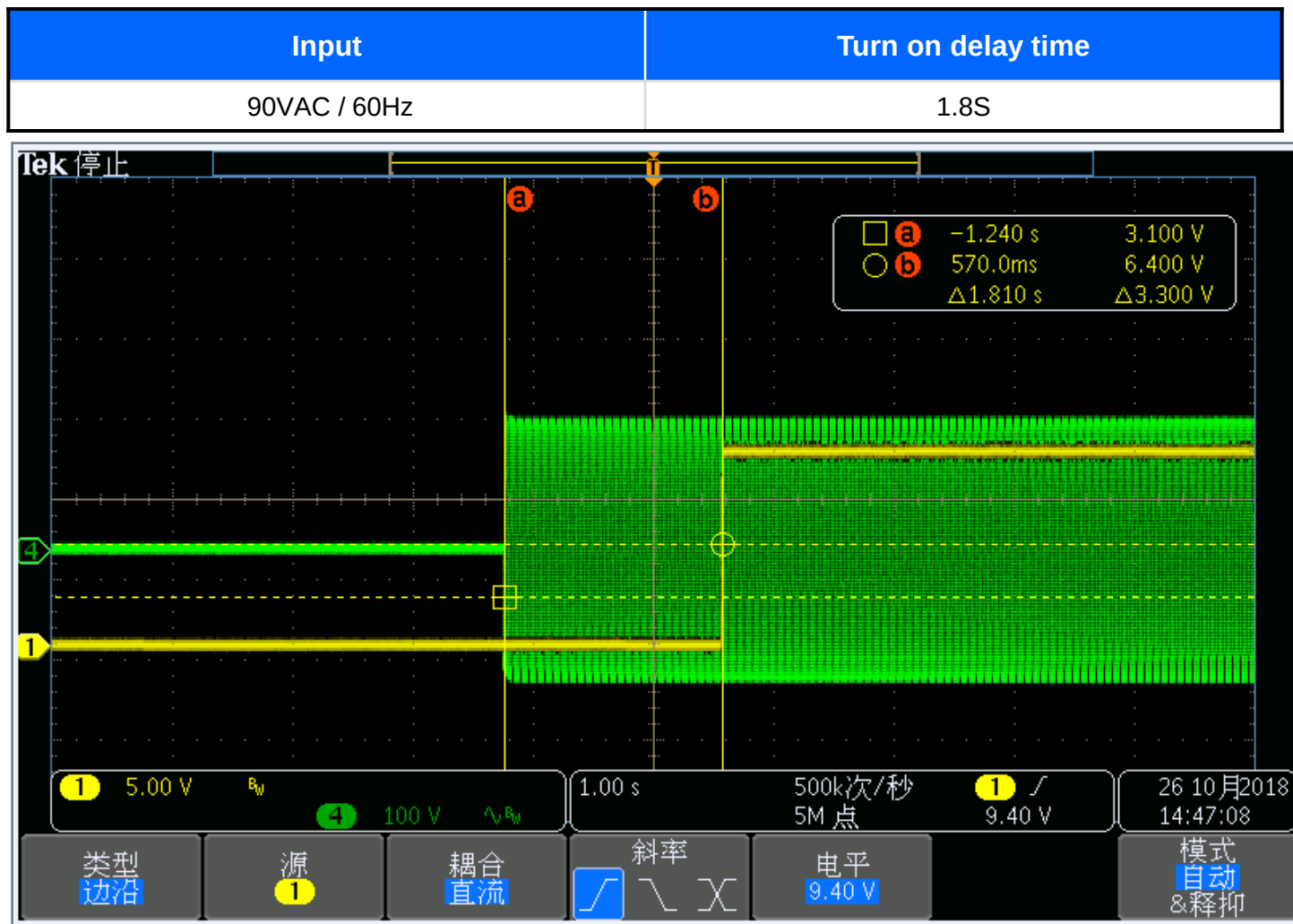


➤ **NOTE :** Output with 0.1uF ceramic // 10uF E-cap & using 20MHz BW.

8. Over Current Protection

Input	12V $I_o(\text{Max})$	
90VAC / 60Hz	3.57A	
115VAC / 60Hz	3.60A	
230VAC / 50Hz	3.63A	
264VAC / 50Hz	3.63A	

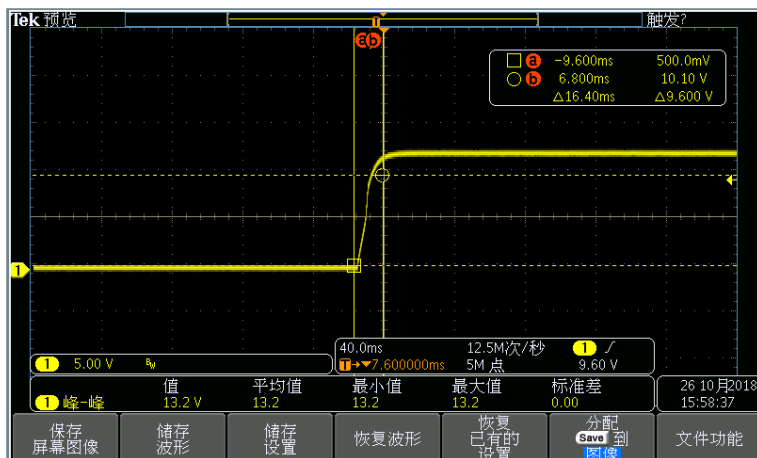
9. Turn On Delay Time



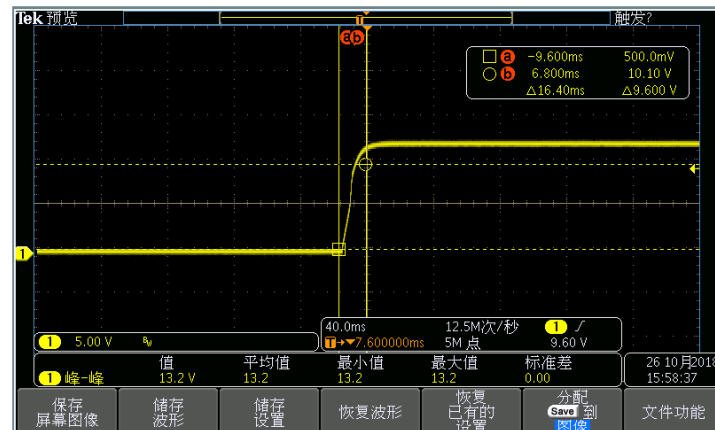
CH1: Vout, CH2: Input voltage

10. Output Rise Time

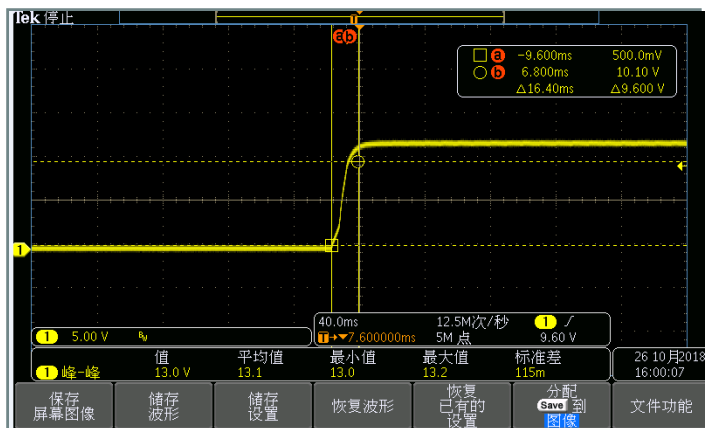
90VAC, No load
Trise = 16.4mS



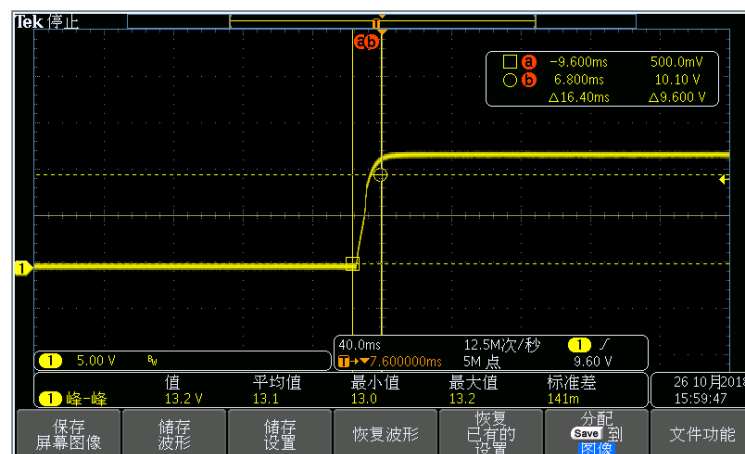
90VAC, Full load
Trise = 16.4mS



264VAC, No load
Trise = 16.4mS



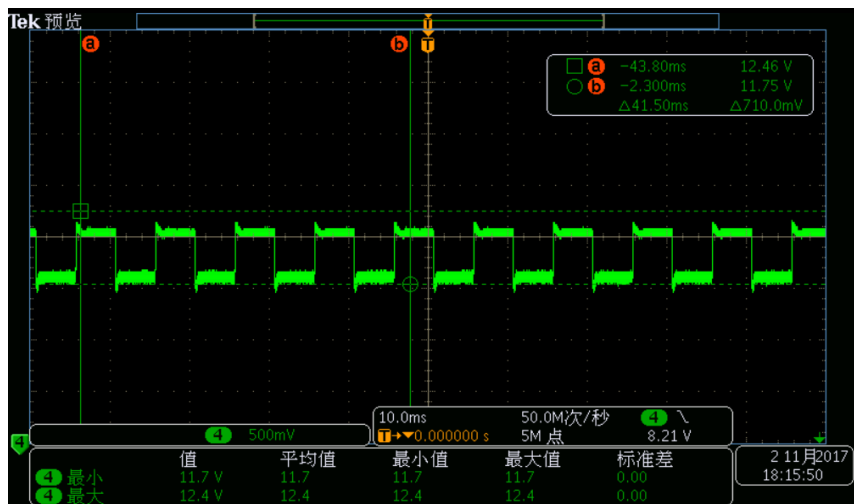
264VAC, Full load
Trise = 16.4mS



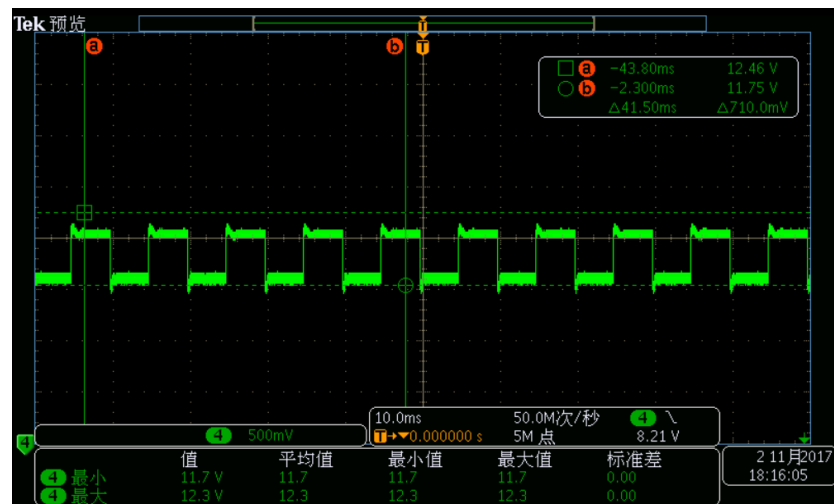
11. Dynamic Load Response

Input	Output Dynamic	Reading		+/-%
		Vmax(V)	Vmin(V)	
90VAC / 60Hz	0.3A→2.7A	12.4	11.7	
115VAC / 60Hz	0.3A→2.7A	12.3	11.7	
230VAC / 50Hz	0.3A→2.7A	12.3	11.7	
264VAC / 50Hz	0.3A→2.7A	12.3	11.7	
SPEC	12V ±1.2V			
Result		PASS		

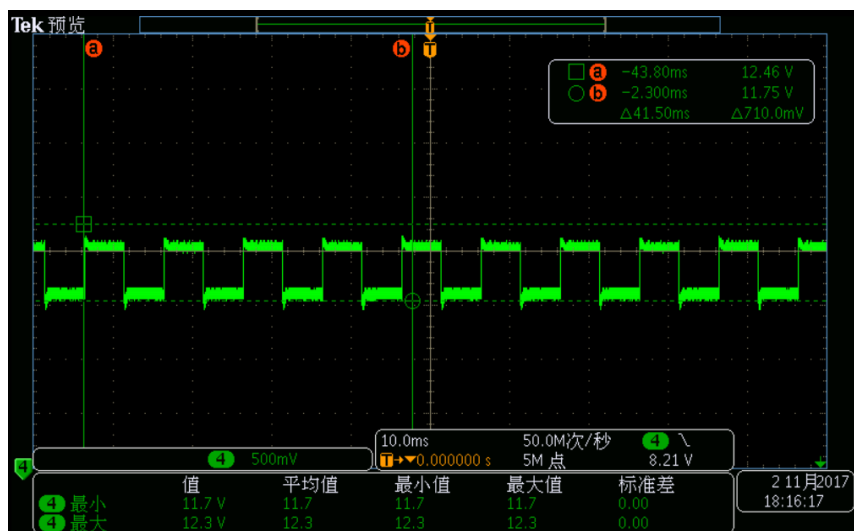
- Output Load : 10%-90%, T1=T2=5ms, Slew Rate: 0.25A/us
- Note : Measured at wire end 20# 1.5M



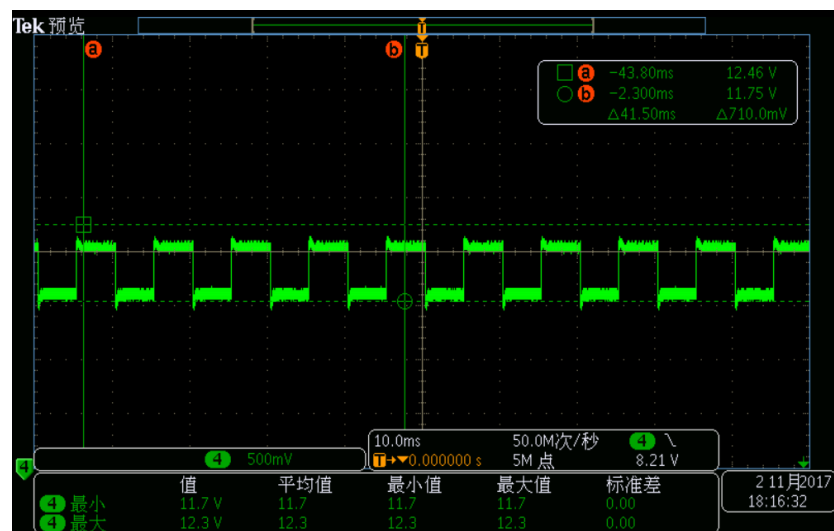
90V



115V



230V

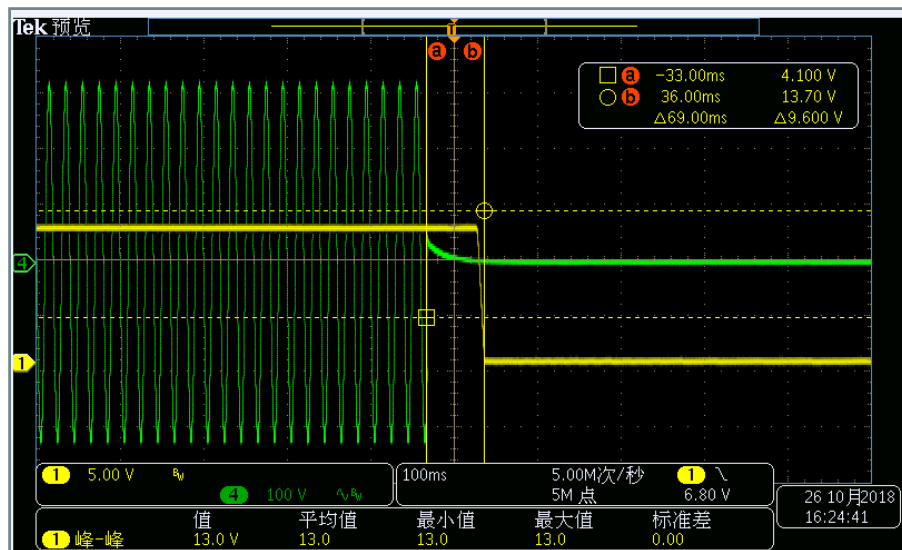


264V

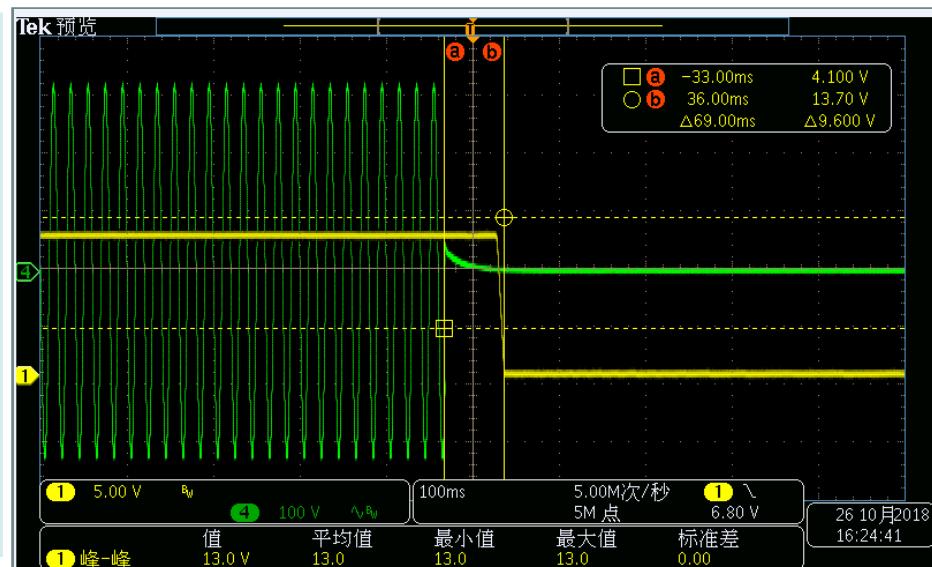
12. Hold Up Time

Input	Load	SPEC.	Measured (ms)	RESULT
115VAC / 60Hz	12V/3.0A	$\geq 10\text{ms}$	69	PASS
230VAC / 50Hz	12V/3.0A	$\geq 10\text{ms}$	69	PASS

115VAC



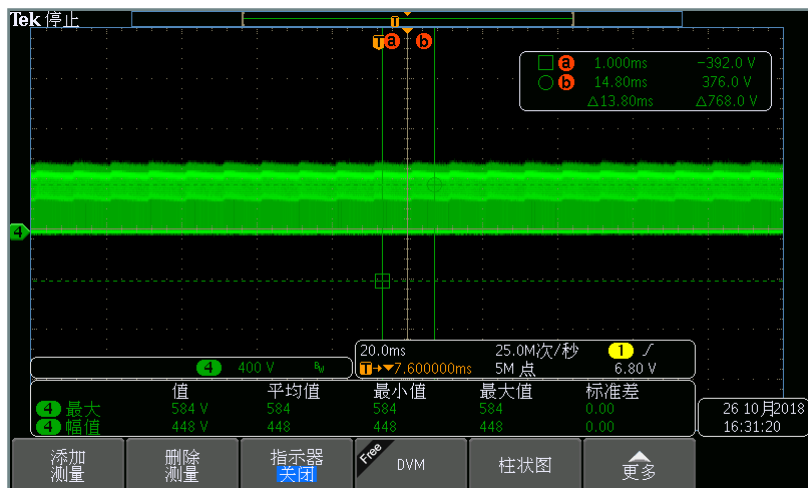
230VAC



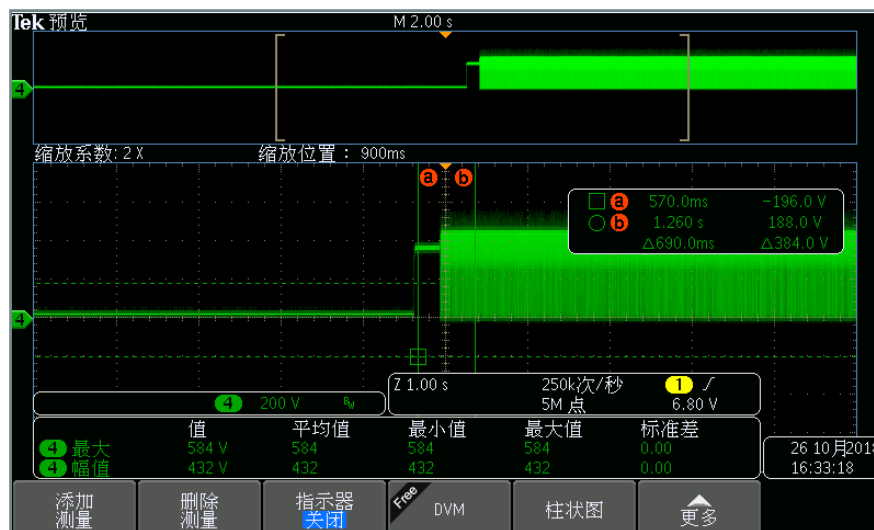
CH1: Vout, CH2: Input voltage

13. Power Component Stress Voltage

Input	Location	Max Rating	Stable	AC Turn-On	Output short circuit	De-rating
			Measurement @12V & 3.0A load	Measurement @12V & 3.0A load	Measurement @12V & 3.0A load	
264VAC / 50Hz	IC1 LD5523E (Combine MOSFET)	650V	584V	584V	524V	89%

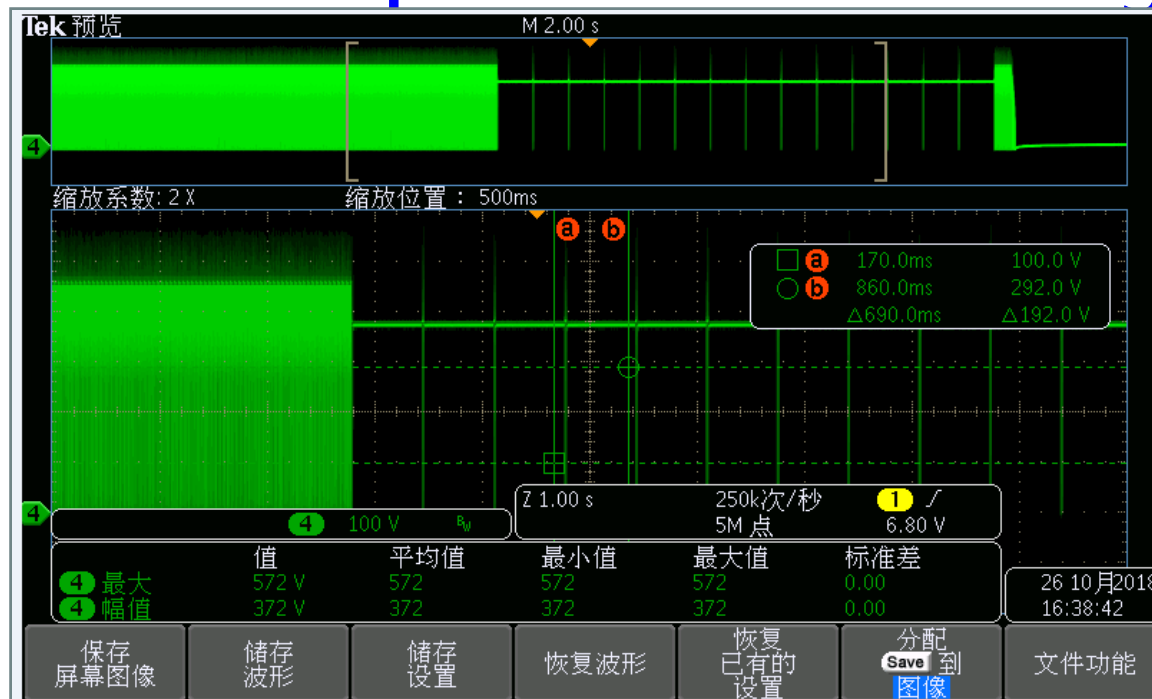


Steady state



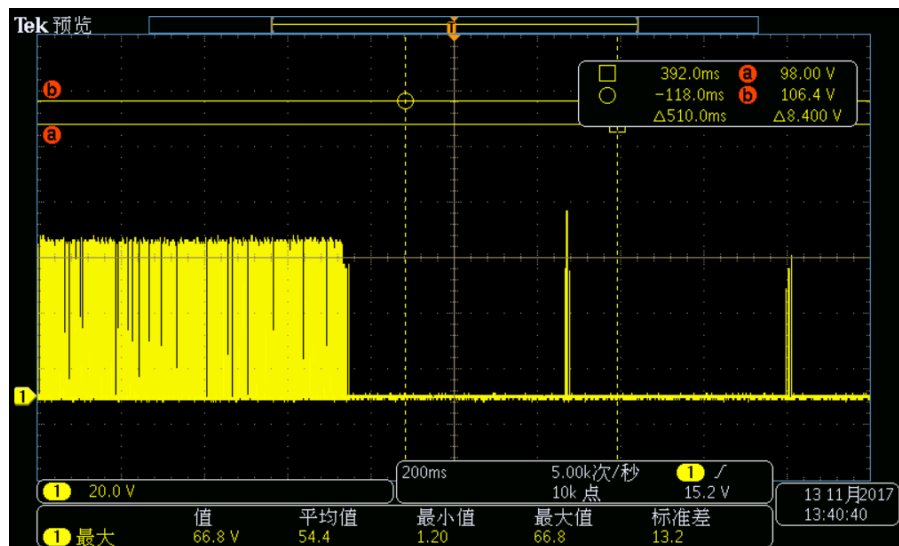
AC Turn-on

• 13. Power Component Stress Voltage



Output short circuit

13. Power Component Stress Voltage

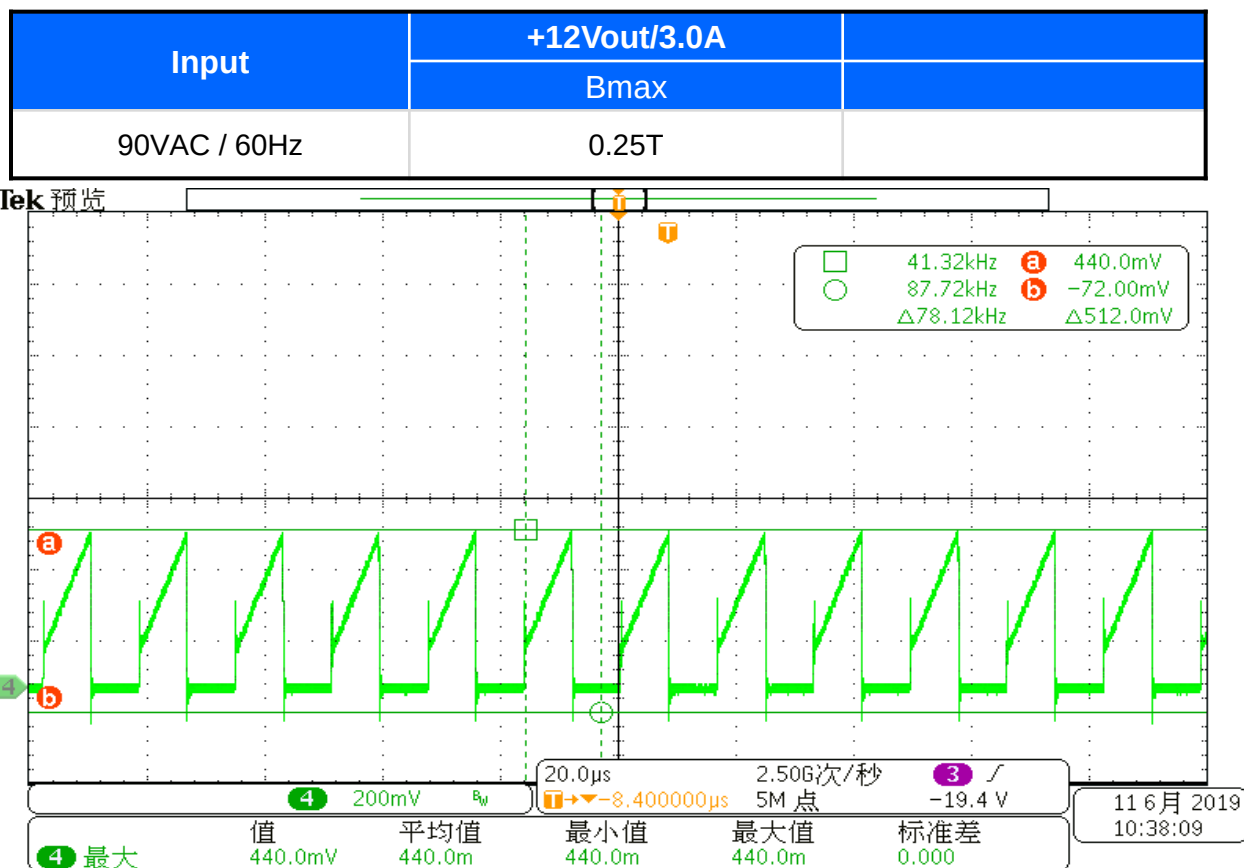


Output short circuit

14. Power Component Temperature

		LD5523N (90V)	LD5523N(264V)
测试条件	元件位置	温度(°C)	温度(°C)
Measurement @12Vo & Full load (密封环境中老化2小时)	LF1	90	62.9
	C3	86.4	67.1
	Q1	94.7	74.3
	T磁芯	85.3	74.9
	T线包	83.4	75.5
	D6	91.3	87.8
	C5	75.3	67.1
	LF2	67.2	64.9
	BD1	90.3	66.8
	环境温度	40	40

15. Transformer Flux Density



- ✓ Lp: 800uH
- ✓ Np: 45Ts
- ✓ Ae: 98mm² RM8
- ✓ Rcs: 0.33ohm

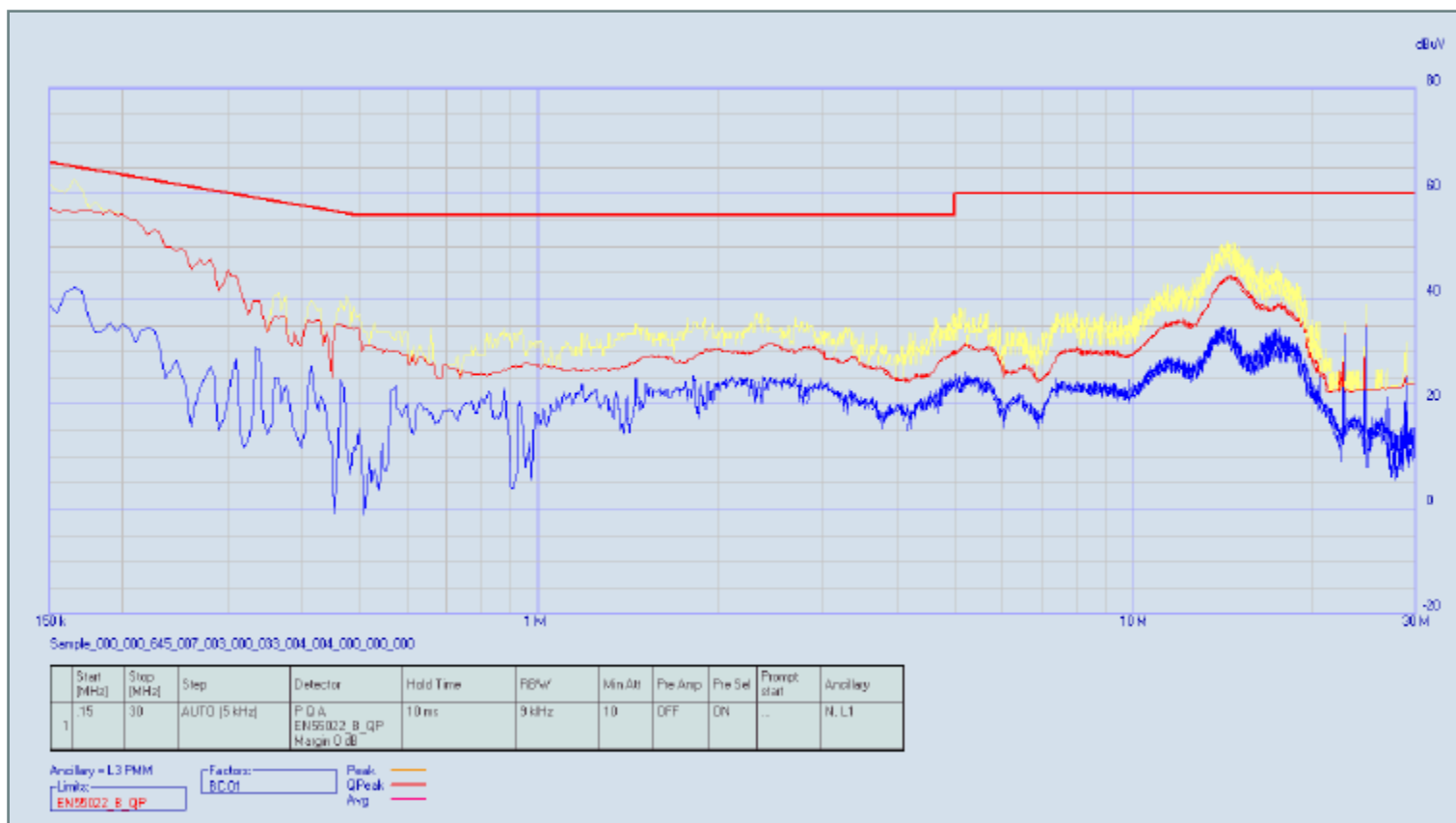
CH4: Voltage of current sense resistor @ 90VAC & 3.0A load

$$\begin{aligned}
 \Delta B &= (I_p \cdot L_p) / (N_p \cdot A_e) \\
 &= [(V_{cs} / R_{cs}) \cdot L_p] / (N_p \cdot A_e) \\
 &= [(0.44 / 0.33) \cdot 0.8] / (45 \cdot 98) \cdot 10^3 \\
 &= 0.24(T)
 \end{aligned}$$

16 Conducted EMI@12V3A

115V-L/N

12V/3.0A Resistive Load, Output Floating



Thank you

Green your power,
Green the **World**

