



LD5530 For 12V1.5A Small-Size Adapter

General Design Specification:

- ✓ ***Meet “DOE-6 ” Requirement***
- ✓ ***Meet “COC-2016 “ Requirement***
- ✓ ***Universal Input Range 90-264 Vac***
- ✓ ***DC Output 12V, 1.5A***

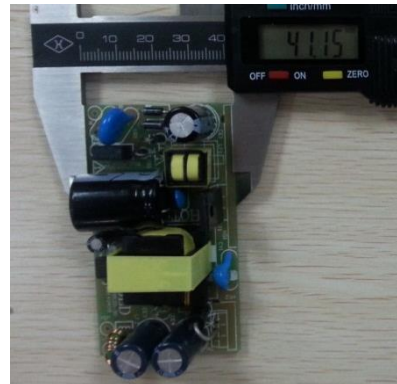
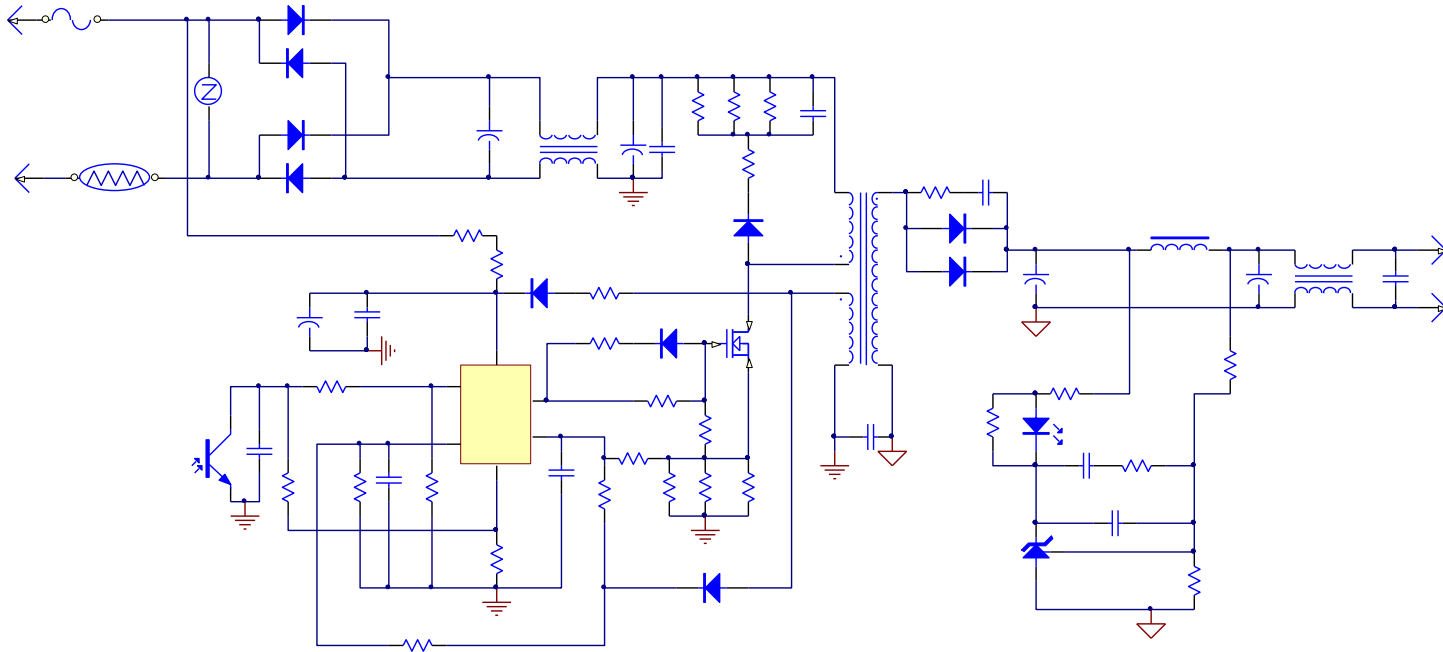
1.Specification

Description	Symbol	Min	Typ	Max	Units	Comment
Input						
Voltage	VIN	90		264	VAC	2 Wire
Frequency	Fline	47	50/60	63	Hz	
No-load Input Power				75	mW	Test at 230Vac
Output						
Output Voltage	Vout	11.40	12.00	12.60	V	Measured at end of Output DC-Cable
Output Current	IOUT	0		1.5	A	
Output Ripple Voltage	VRIPPLE			120	mVpp	Measured at end of Output #22AWG 1.8m DC-Cable @IOUT=1.5A , 20MHz/BW
Continuous Output Power	POUT		18		W	
Protection						
OCP	IOUT_MAX			2.5	A	
OVP	Vout_max			16	V	Open loop, R13 short
Active Mode Efficiency	η	85.45			%	
Environmental						
Conducted EMI		Meets CISPR22B / EN55022B			test with Secondary floating	
Radiation EMI						
Ambient Temperature	TAMB	0		40	°C	Free convection, sea level

Design Check List

NO.	TEST ITEM	SPEC.	Test Result	RESULT
1	Schematic			
2	Bill of Material			
3	Transformer Design			
4	Transformer Design Bmax			
5	Efficiency Measurement	>85.45%	>85.45%	PASS
6	Output Ripple Voltage And Noise	<120mV	≤70mV	PASS
7	OVER CURRENT PROTECTION	<2.5A	<2.18A	PASS
8	Turn On Delay Time	< 3 sec	2.89S	PASS
9	Power Component Stress Voltage	REF.P9		PASS
10	Output Over Voltage Protection	<18V	≤15.7V	PASS
11	OUTPUT Capacitive load	REF.P9		PASS
12	Output Dynamic Response	10.8V~13.2V	10.8V~13.2V	PASS
13	Output Rise Time	<50mS	<16mS	PASS
14	Hold up Time	≥10mS	≥20mS	PASS
15	Power Component Temperature	REF.P12		PASS
16	EMI Test-Conduction	<6dB	<6dB	PASS

1.Schematic



2. Bill of Material

2.2. BOM List

P/N	Component Value	Note
R1	300kΩ, 1206	
R2	300kΩ, 1206	
R3	200Ω, 1206	
R4	51Ω, 1206	
R5	750kΩ, 1206	
R6	620kΩ, 1206	
R7	0Ω, 1206	
R8	13kΩ, 0805	
R9	200Ω, 0805	
R11	10kΩ, 0805	
R12	47Ω, 0805	
R13	3.6kΩ, 0805	
R16	1.3KΩ, 0805	
R17	1kΩ, 0805	
R18	2.4Ω, 1206	
R19	2.4Ω, 1206	
R20	130kΩ, 0805	
R21	3.3kΩ, 0805	
R23	NC	
C1	1nF, 1kV	
C2	1nF, 1kV 1206	
C3	470pF, 500V 1206	

P/N	Component Value	Note
C4	0.1uF, 50V 0805	
C5	4.7uF, 50V	
C6	1uF, 50V 0805	
C7	1nF, 50V 0805	
C8	22pF, 50V 0805	
C9	100nF, 50V 0805	
CE1	10uF, 400V	
CE2	33uF, 400V	
CE3	1000uF 16V	
CE4	1000uF 16V	
IC1	LD5530	
IC2	PC817C	
R15	NC	
Q1	MDF4N65, TO-220F	
CY1	1000pF, 400V	
T1	EE22加宽, 3500uH	
D1	RS1M, SMA	
D3	FR107 SOD-123	
D4	FR107 SOD-123	
D6	PTS5V100 DO-201AD	
IC4	431 SOT-23	
DB1	FR107 DO-41	
DB2	FR107, DO-41	
DB3	FR107 DO-41	
DB4	FR107, DO-41	
LF1	EE10.3 20mH	
LF2	9*5*3 7Ts	
F1	2.5A250V	
RT1	0Ω	

3. Transformer Design

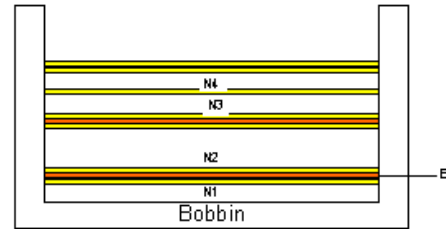
Test Condition:

DC out line: AWG 22 1.8m;

Schottky:PTS5V100;

Transformer:EE22加宽,Ae=49.5mm;

MOS:MDF4N65 ;



Winding order	Pin No.		Winding types	Number turns		Remarks
	Start	Finish		Winding	MYLAR tape	
N1	1	2	0.3mm ϕ x 1	74	1	NA
E1	5		0.1mm ϕ x 1	60	1	NA
N2	6	7	TIW 0.4mm ϕ x 2	13	1	NA
N3	2	3	0.3mm ϕ x 1	40	1	NA
N4	4	5	0.1mm ϕ x 2	15	1	NA
Pin 1-3 3500 μ H \pm 5%						NA

4. Transformer Design Bmax

Input	+12Vout(V)/1.5A	+12Vout(V)/2.03A
	Bmax	Bmax
90Vac /60Hz	3307Gauss	3491Gauss

$$\Delta B = (I_p * L_p) / (N_p * A_e)$$

5. Efficiency Measurement

Rated Output Power (P_{no})	Minimum Four Point Average Efficiency in Active Mode		Minimum Efficiency in Active Mode at 10 % load of full rated output current	
	Tier 1	Tier 2	Tier 1	Tier 2
$0.3 \leq W \leq 1$	$\geq 0.500 * P_{no} + 0.146$	$\geq 0.500 * P_{no} + 0.169$	$\geq 0.500 * P_{no} + 0.046$	$\geq 0.500 * P_{no} + 0.060$
$1 < W \leq 49$	$\geq 0.0626 * \ln(P_{no}) + 0.646$	$\geq 0.071 * \ln(P_{no}) - 0.00115 * P_{no} + 0.670$	$\geq 0.0626 * \ln(P_{no}) + 0.546$	$\geq 0.071 * \ln(P_{no}) - 0.00115 * P_{no} + 0.570$
$49 < W \leq 250$	≥ 0.890	≥ 0.890	≥ 0.790	≥ 0.790

Specification	Result
COC V5 Tier2 spec:平均效率85.45%;10%效率75.45%,待机0.075W;	PASS

Note: Measure P_o , V_o , I_o with DC 1.8M 22AWG Line

AC Input	P_{in} (W)	P_o (W)	V_o (V)	I_o (A)	Efficiency	Average Eff.	No Load (W)
115 Vac 60 Hz	21.05	18	12	1.5	85.51%	86.62%	0.023
	15.69	13.59	12.08	1.125	86.62%		
	10.49	9.12	12.16	0.75	86.94%		
	5.25	4.59	12.24	0.375	87.43%		
	2.17	1.84	12.28	0.15	84.88%	10% Efficiency	
230 Vac 50 Hz	20.94	18	12	1.5	85.96%	86.71%	0.041
	15.56	13.59	12.08	1.125	87.34%		
	10.51	9.12	12.16	0.75	86.77%		
	5.29	4.59	12.24	0.375	86.77%		
	2.23	1.84	12.28	0.15	82.60%	10% Efficiency	

6. Output Ripple Voltage And Noise

Input	Ripple voltage and noise
90Vac /60Hz	70mV
115Vac/ 60Hz	66mV
230Vac/ 50Hz	64mV
264Vac/ 50Hz	68mV

7. OVER CURRENT PROTECTION

Input	Io(Max)
90Vac /60Hz	2.03A
115Vac/ 60Hz	2.18A
230Vac/ 50Hz	2.18A
264Vac/ 50Hz	2.18A

8. Turn On Delay Time

Input	Turn on delay
90Vac /60Hz	2,89S

9. Power Component Stress Voltage

Input	Location	Work normal	Output short	OCP	RESULT
		Measurement	Measurement	Measurement	
264Vac/ 50Hz	Q1	564V	556V	578V	PASS
	D6	70V	57.2V	70V	PASS

10. Output Over Voltage Protection

Input	Second-side	Second-side
	+12Vout(V)/0A	+12Vout(V)/1.5A
90Vac /60Hz	15.7V	15.3V
264Vac/ 50Hz	15.4V	15.3V

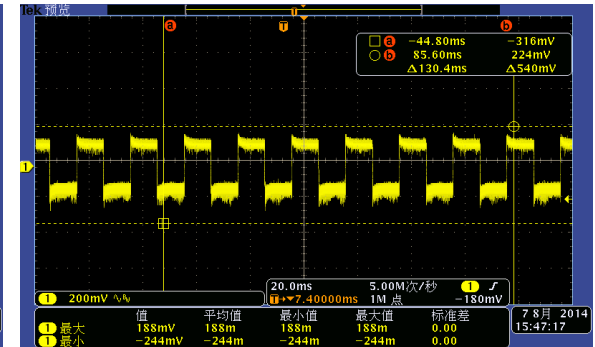
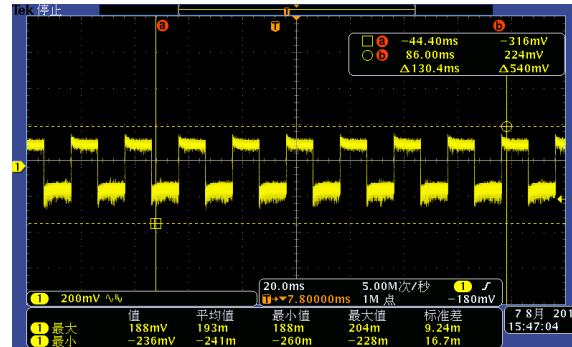
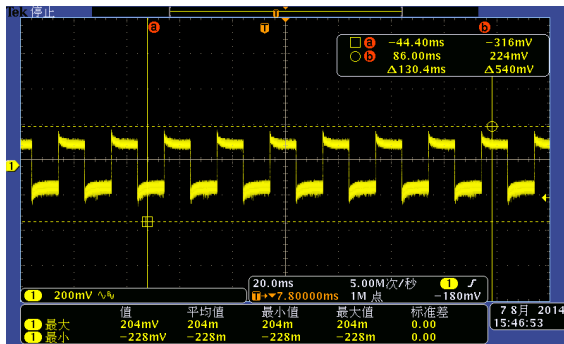
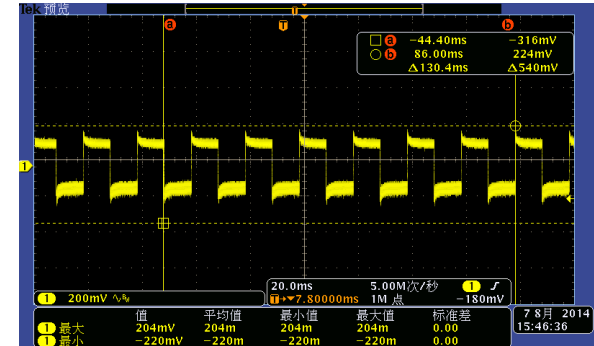
11. OUTPUT Capacitive load

Input	Capacitive load	RESULT
90Vac /60Hz	2200uF	PASS

12. Dynamic Load Response

- **Test Condition:**
- **Output:** 10-90%, T1=T2=10ms, Slew Rate: 0.25A/us
- **Ambient Temperature:** 25°C

Input	Output Dynamic	Reading	
		V _H (mv)	V _L (mv)
90Vac/60Hz	0.15→1.35A	204	-220
115Vac/60Hz	0.15→1.35A	204	-228
230Vac/50Hz	0.15→1.35A	188	-236
264Vac/50Hz	0.15→1.35A	188	-244
SPEC	±1.2V		
Result		PASS	



13. Output Rise Time

INPUT	Load	SPEC.	MEASURED (ms)	RESULT
90Vac/60Hz	1.5A	<50ms	24	PASS
115Vac/60Hz	1.5A	<50ms	18	PASS
230Vac/50Hz	1.5A	<50ms	16	PASS
264Vac/50Hz	1.5A	<50ms	16	PASS

14. Hold up Time

INPUT	Load	SPEC.	MEASURED (ms)	RESULT
115Vac/60Hz	1.5A	$\geq 10\text{mS}$	20	PASS
230Vac/50Hz	1.5A	$\geq 10\text{mS}$	22	PASS

15. Power Component thermal

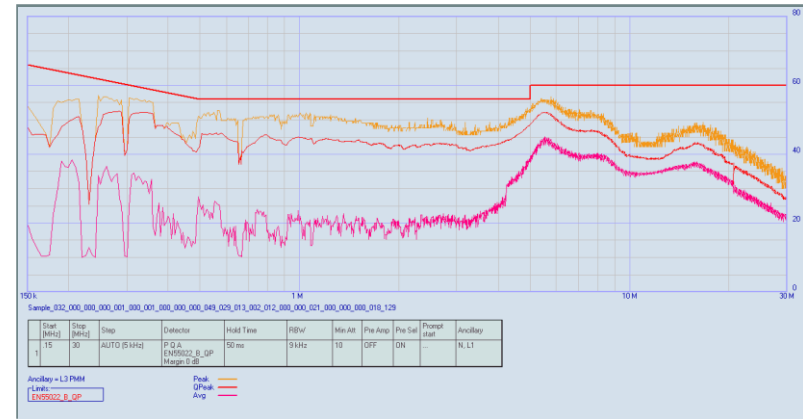
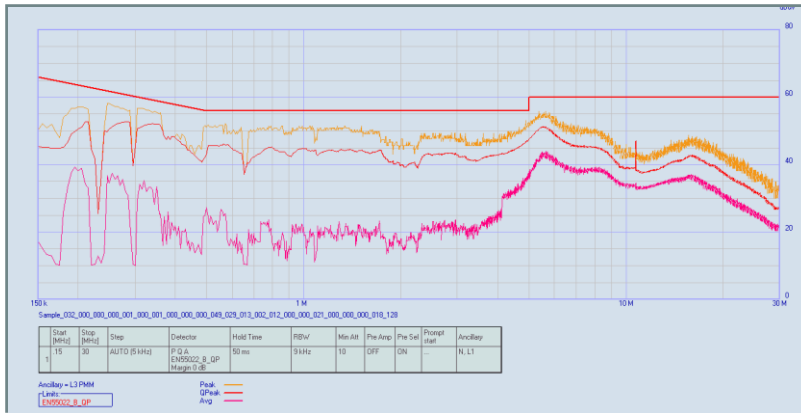
Location	Io=1.5A			
	Vin=90Vac/60Hz		Vin=264Vac/50Hz	
	T(°C)	Tr(°C)	T(°C)	Tr(°C)
CE1	58	31	58	31
CE2	56	41	62	35
LF1	72	45	65	38
Q1	62	35	60	33
T1 wire	68	41	64	37
T1 core	72	45	70	43
CE4	62	35	67	35
CE3	57	30	59	32
DB1	64	37	48	21
Ambient Temperature	27		27	

16. Conducted EMI

Test Condition:

AC INPUT:230V/50Hz

OUTPUT:full load





End & Thank You