

NCP1337 Demonstration Board 60Watt 12V5A Adapter

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ON Semiconductor (Shenzhen) Limited

Description

This design using NCP1337 offers a perfect solution for portable DVD , LCD TV or monitor and notebook etc. adapter applications. This adapter provides effective and enough protective functions such as over-load protection, over-voltage protection, short-circuit protection and brown-out protection. Thanks to the quasi-resonant operation and synchronous rectifier, this adapter has higher efficiency and better EMI performance. The standby consumption is lower because of the cycle skipping and soft ripple mode.

Features

- 1.Free-running borderline/critical mode quasi-resonant operation with 130kHz max frequency
- 2.Synchronous rectifier
- 3.Brown-out protection(AC line low voltage protections)
- 4.Over-load protection with input voltage compensation
- 5.Auto-recovery short-circuit protection
- 6.Over-voltage protection (latch-off mode)
- 7.High efficiency
- 8.Low standby consumption
- 9.Meeting EN55022 Class B limit
10. Meeting CEC and Energy Star Regulations

Typical Applications

High-power AC/DC adapters for portable DVD, LCD TV or monitors and notebook etc.



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NCP1337 60W Adapter

24 November,2005 -- Rev.2.0



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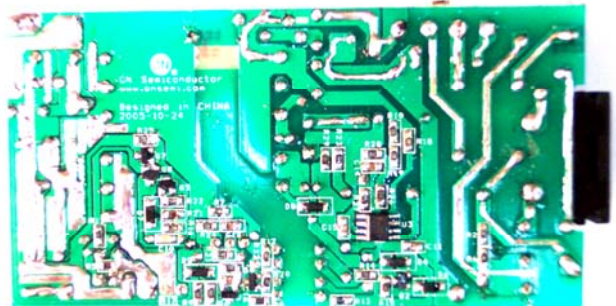
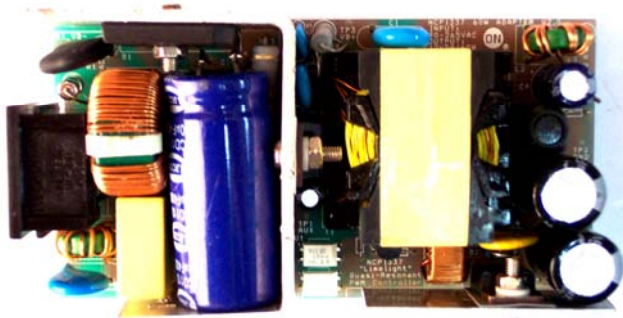
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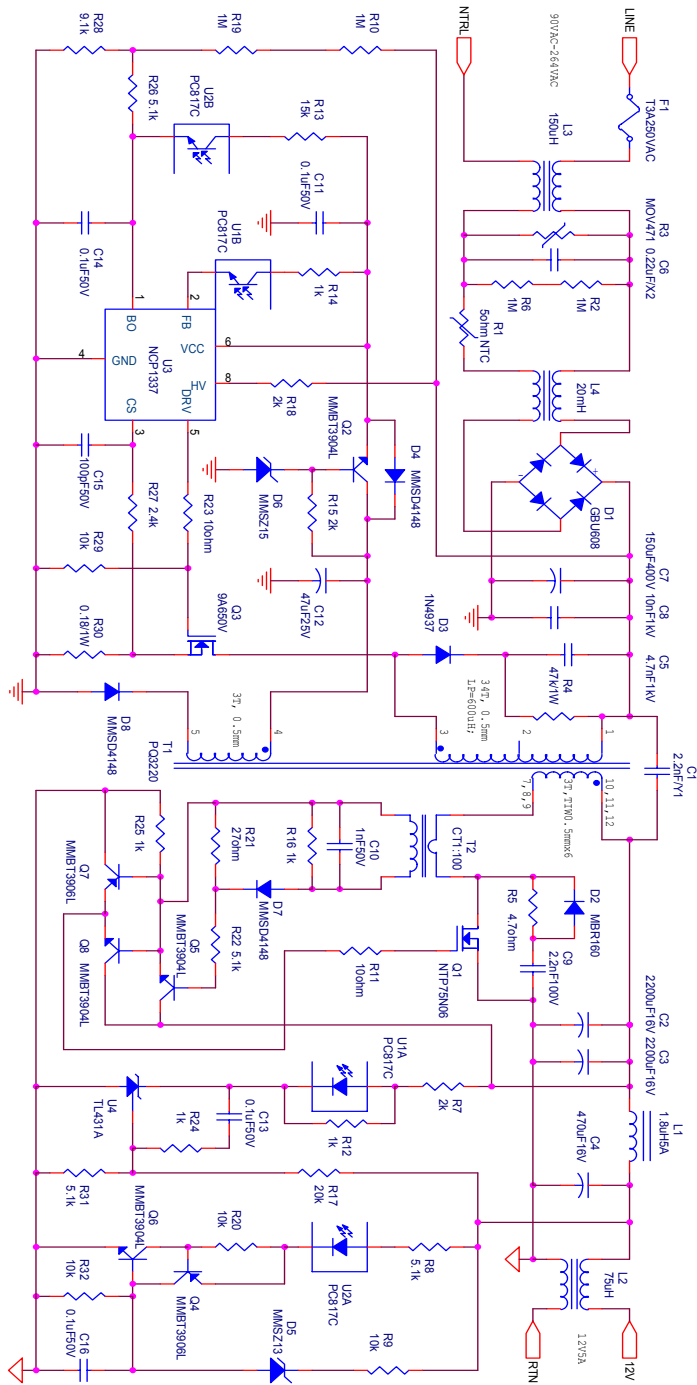
1. Specifications (T_A=25°C)

Parameter	Test Conditions	Min	Typ	Max	Unit
Input					
Voltage range		90		265	Vac
Frequency range		47		63	Hz
Brown out threshold		65		75	Vac
Brown out hysteresis			10		Vac
Input inrush current	Cold start 230Vac			65	A
No-load input power	Input 240 Vac			0.3	W
Output					
Output voltage			12		V
Voltage total regulation	90Vac to 265Vac _{input} and 0 to 5A output			±2	%
Load output current	90Vac to 265Vac	0		5	A
Start-up overshoot	90Vac to 265Vac			10	%
Transient regulation	2.5A to 5A Step			300	mV
Transient recovery time	2.5A to 5A Step;Recovery to 1%			200	us
Ripple	20 MHz Bandwidth,Full Load			100	mV
Over current protection	90Vac to 265Vac	5.5		7	A
Over voltage protection	Open Voltage Feedback Loop	13.5	14	14.5	V
Total Output Power					
Continuous Output Power	Total power			60	W
Conducted EMI Margin	EN55022 class B	6			dB
Efficiency	Input 230Vac,full load	88			%
Operation Temperature	Full Load, Free Air Convection cooling	0		40	°C

2. Photo

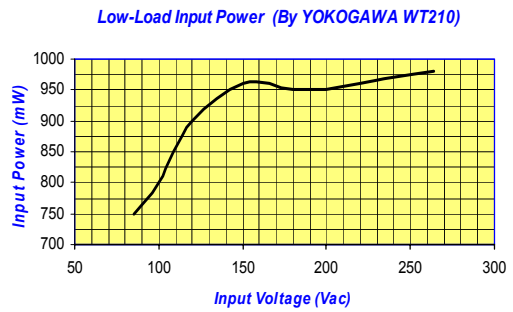
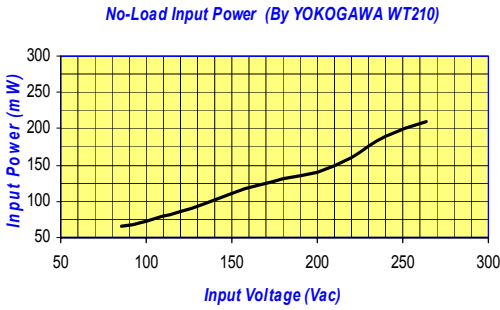


3. Circuit Schematic



5. No-load consumption

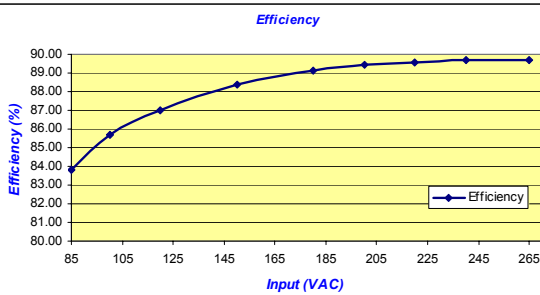
6. Low load 0.5W consumption



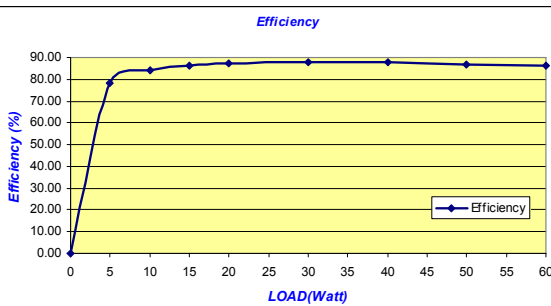
Output voltage 12.25V; output current 0A

Output voltage 12.25V; output current 42mA

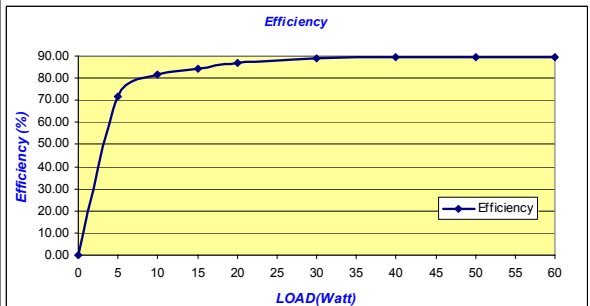
7. Efficiency



Efficiency vs input voltage at full load

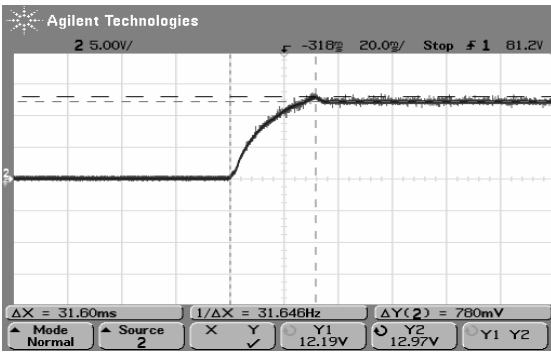


Efficiency vs Load at 110Vac input

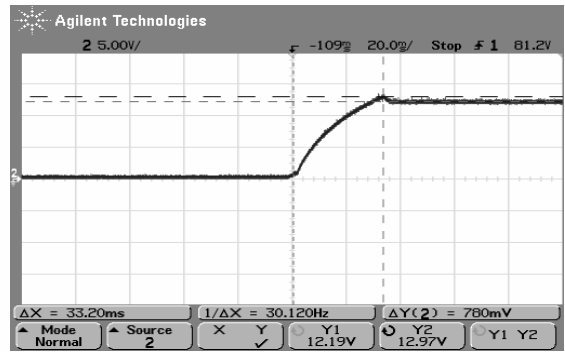


Efficiency vs Load at 220Vac input

8. Output start up profile performance @ full load

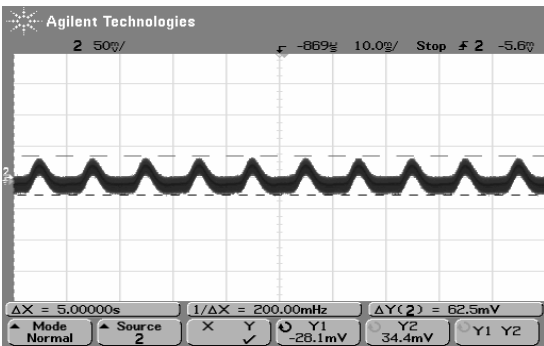


110Vac input Overshoot 0.78V,Rise time 31ms

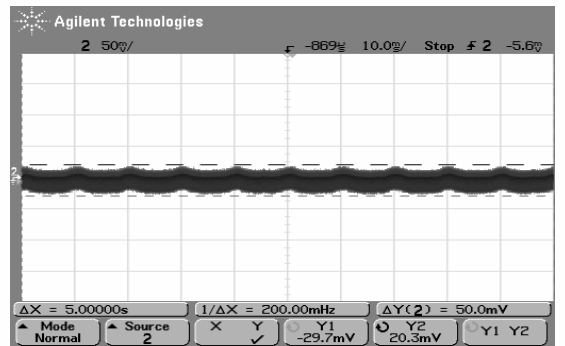


220Vac input Overshoot 0.78V,Rise time 33ms

9. Output ripple @ full load

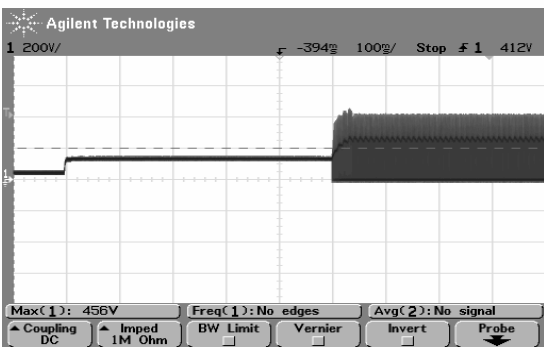


110Vac input; Ripple 62mV

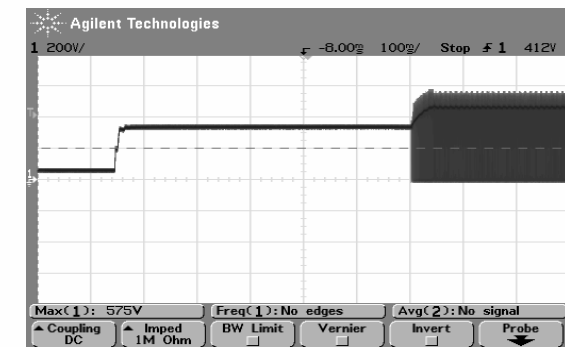


220Vac input ; Ripple 50mV

10. Start up Voltage Waveform of MOSFET Q2 @full load

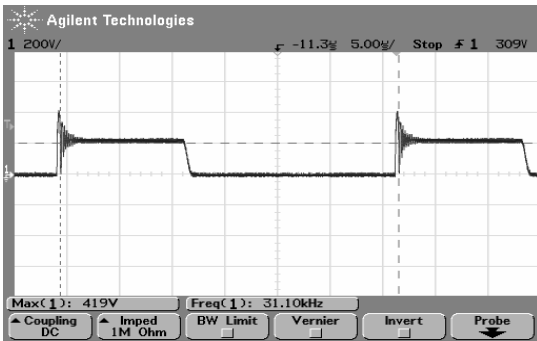


90Vac input; startup delay 500ms;Vds max 456V

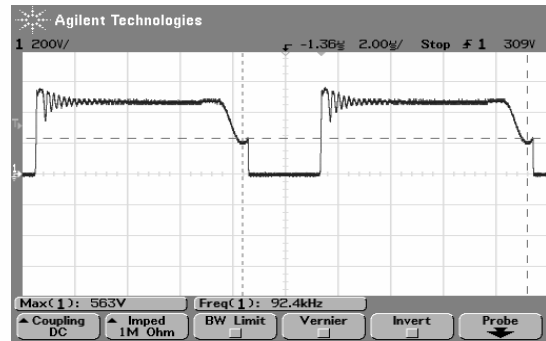


250Vac input; startup delay 550ms;Vds max 575V

11. Voltage Waveform of MOSFET Q2 Drain @full load

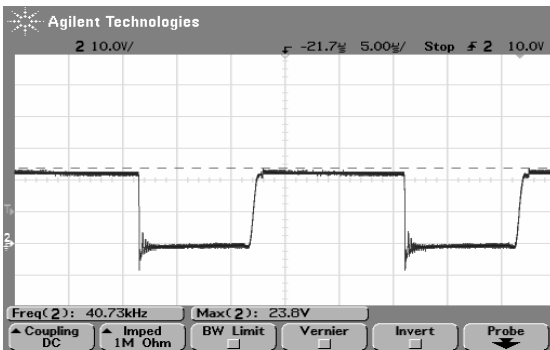


90Vac input; Switching frequency 31kHz

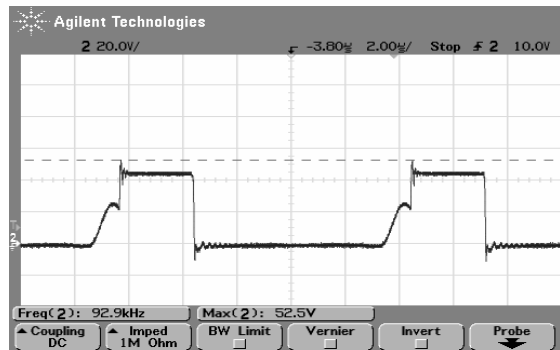


250Vac input; switching frequency 92kHz

12. Voltage Waveform of MOSFET Q1(Synchronous Rectifier) Drain @full load

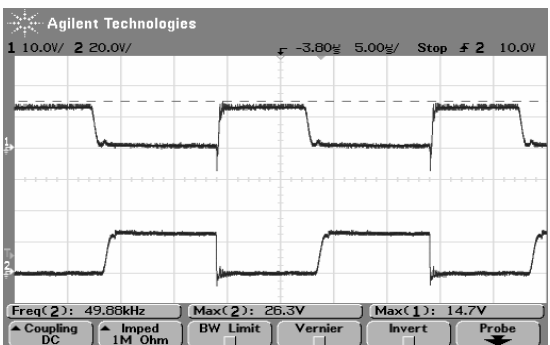


90Vac input; Vds Max 23.8V

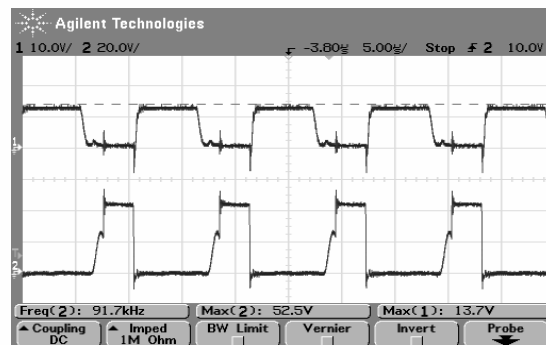


250Vac input; Vds Max 52.5V

13. Drive Waveform of MOSFET Q1(Synchronous Rectifier) @full load

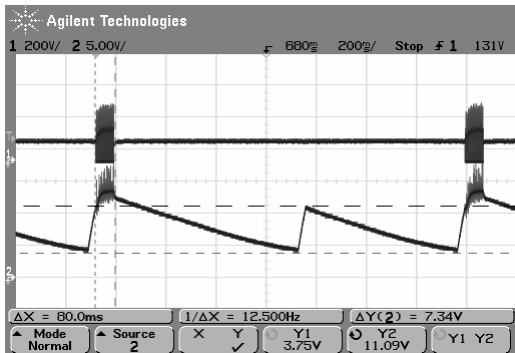


90Vac input; CH1 Vgs; CH2 Vds

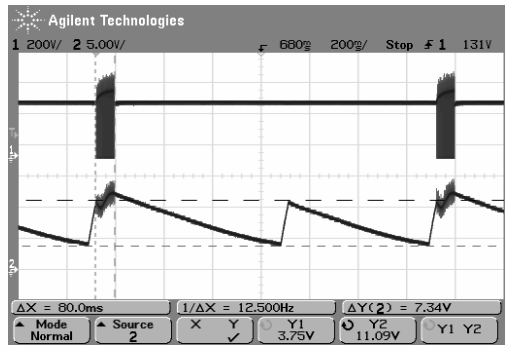


250Vac input; CH1 Vgs; CH2 Vds

14. VDS of Q2 and Vcc Waveform @Over load

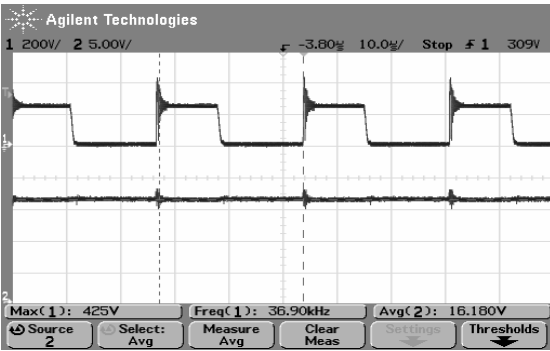


90Vac input; Over load at 5.5A; CH1 Vds; CH2 Vcc;

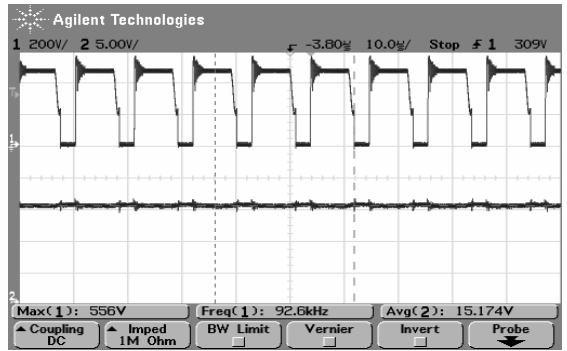


250Vac input; Over load at 5.9A; CH1 Vds; CH2 Vcc;

15. VDS of Q2 and Vcc Waveform @full load

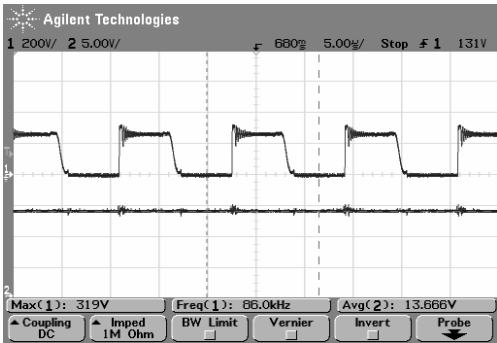


90Vac input; CH1 Vds; CH2 Vcc;

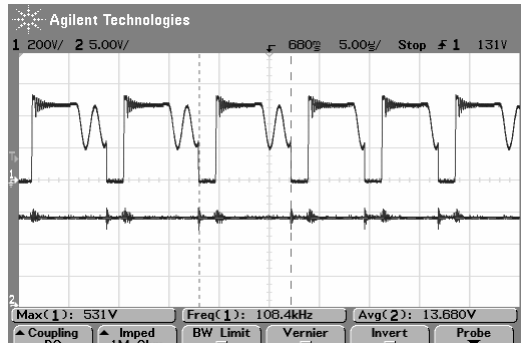


250Vac input; CH1 Vds; CH2 Vcc;

16. VDS of Q2 and Vcc Waveform @half load, 2.5A

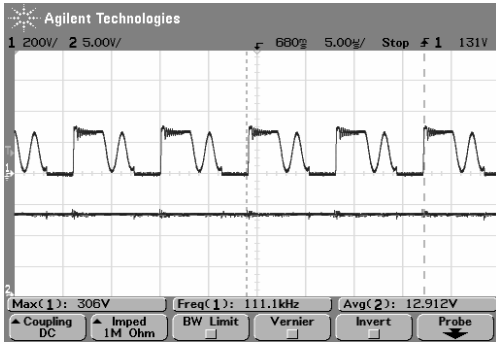


90Vac input; CH1 Vds; CH2 Vcc;

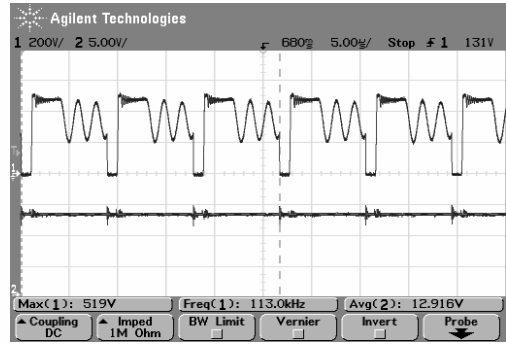


250Vac input; CH1 Vds; CH2 Vcc;

17.VDS of Q2 and Vcc Waveform @low load, 1A

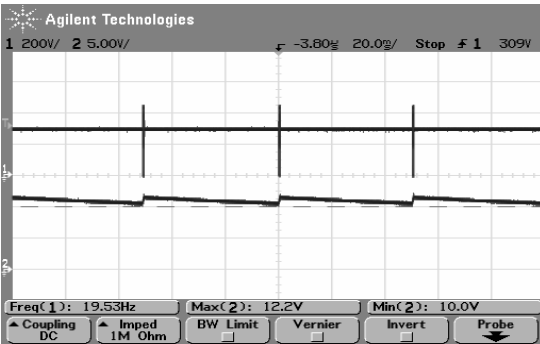


90Vac input;CH1 Vds; CH2 Vcc;

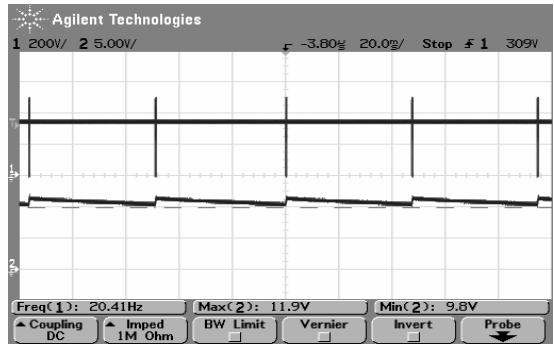


250Vac input;CH1 Vds; CH2 Vcc;

18.VDS of Q2 and Vcc Waveform @no load

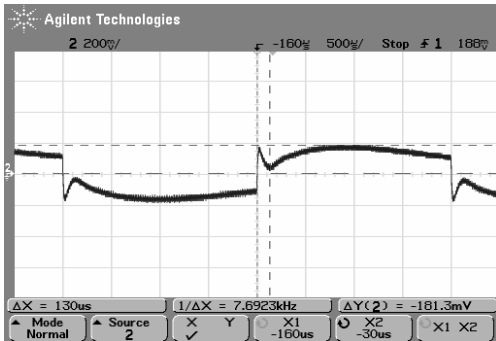


90Vac input; CH1 Vds; CH2 Vcc;

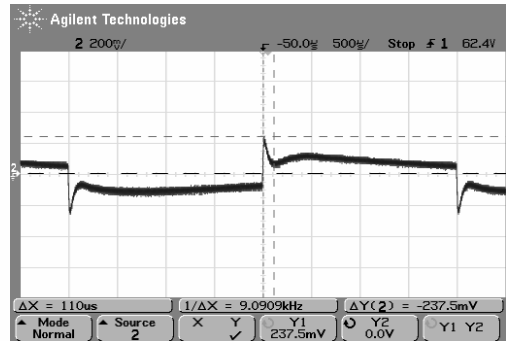


250Vac input; CH1 Vds; CH2 Vcc;

19. Dynamic Load transient response @Step load 2.5A to 5A to 2.5A

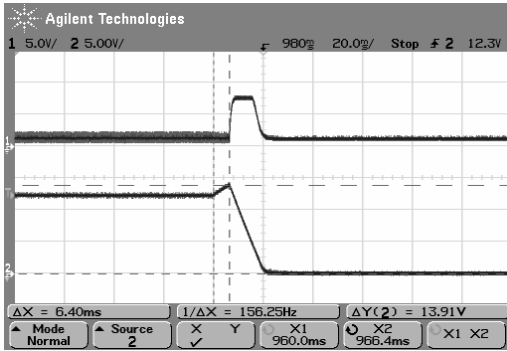


Input voltage 90Vac



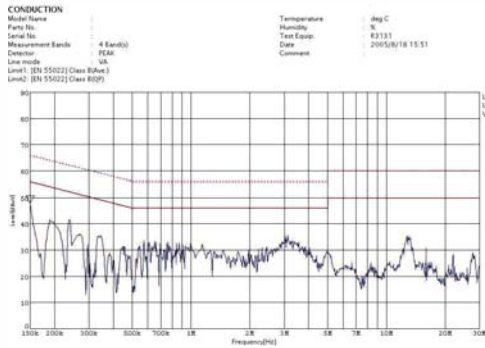
Input voltage 250Vac

20. Over Voltage Protection (Voltage feedback open circuit mode) @full load

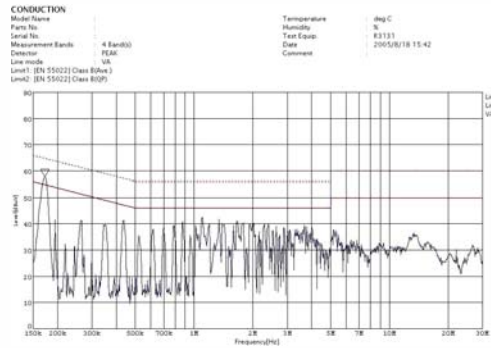


CH1: BO pin; CH2:Output (OVP 13.91V)

21.EMI@full load



110Vac input

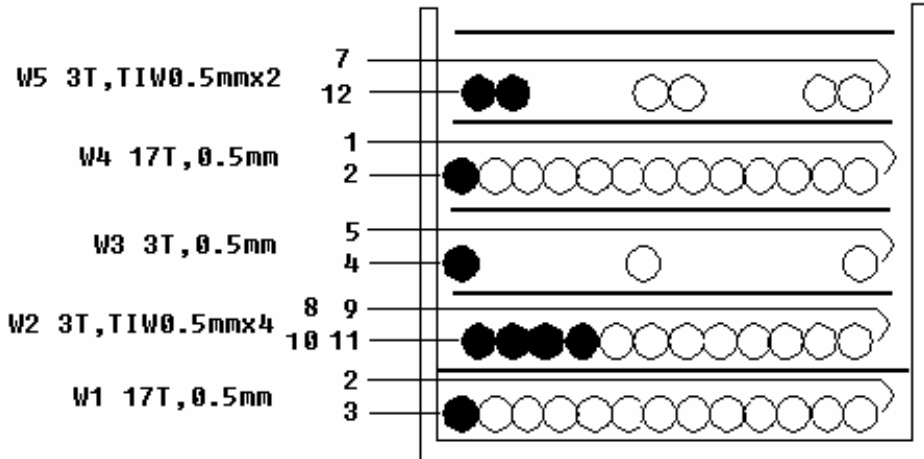
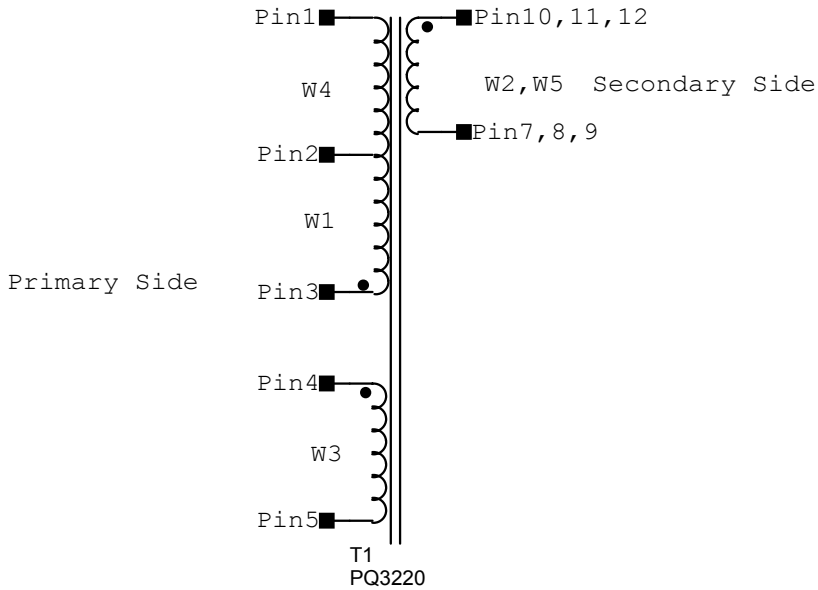


220Vac input

22. Transformer Specification

$L_p(W1+W4)=600\mu H \pm 7\% @ 10KHz 1V$ *Leaking induction: 60uH max*

CORE: PQ32-20



23. Bill of materials

Item	Quantity	Reference	Part	Manufactory
1	1	C1	2.2nF/Y1	
2	2	C3,C2	2200uF16V	
3	1	C4	470uF16V	
4	1	C5	4.7nF1kV	
5	1	C6	0.22uF/X2	
6	1	C7	150uF400V	
7	1	C8	10nF1kV	
8	1	C9	2.2nF100V	
9	1	C10	1nF50V	
10	4	C11,C13,C14,C16	0.1uF50V	
11	1	C12	47uF25V	
12	1	C15	100pF50V	
13	1	D1	GBU608	
14	1	D2	MBR160	ON Semiconductor
15	1	D3	1N4937	ON Semiconductor
16	3	D4,D7,D8	MMSD4148	ON Semiconductor
17	1	D5	MMSZ13	ON Semiconductor
18	1	D6	MMSZ15	ON Semiconductor
19	1	F1	T3A250VAC	
20	1	L1	1.8uH5A	
21	1	L2	75uH	
22	1	L3	150uH	
23	1	L4	20mH	
24	1	Q1	NTP75N06	ON Semiconductor
25	4	Q2,Q5,Q6,Q8	MMBT3904L	ON Semiconductor
26	1	Q3	9A650V	
27	2	Q4,Q7	MMBT3906L	ON Semiconductor
28	1	R1	5ohm NTC	
29	4	R2,R6,R10,R19	1M	
30	1	R3	MOV471	
31	1	R4	47k/1W	
32	1	R5	4.7ohm	
33	3	R7,R15,R18	2k	
34	4	R8,R22,R26,R31	5.1k	
35	4	R9,R20,R29,R32	10k	
36	2	R23,R11	10ohm	
37	5	R12,R14,R16,R24,R25	1k	
38	1	R13	15k	
39	1	R17	20k	
40	1	R21	27ohm	
41	1	R27	2.4k	
42	1	R28	9.1k	
43	1	R30	0.18/1W	
44	1	T1	PQ3220	
45	1	T2	CT1:100 Toroid or UU9.8	
46	2	U1,U2	PC817C	
47	1	U3	NCP1337	ON Semiconductor
48	1	U4	TL431A	ON Semiconductor
49	1	PCB	PCB5.2*10	

