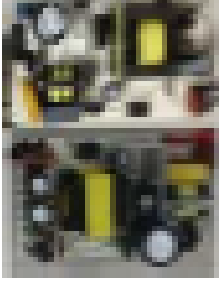


<p><b>Subject</b> NE1102 Demo Board Manual</p>	<p>Board Model: ADP12V12W1102.0</p>
	<p><b>Key Features</b></p> <ul style="list-style-type: none"> <li>➤ Meet DOE Level VI</li> <li>➤ No Y-Cap ,Cost same as Doe Level V ;</li> <li>➤ 6KV lighting surge simulation Test(L N-GND)</li> <li>➤ Peak Current Limited Burst-Cycle for Reducing Audible Noise</li> <li>➤ Various Protection Functions</li> <li>➤ Operation Frequency Down to 25KHz in No/Light Load Condition</li> <li>➤ System Open Loop / Short Circuit Protection</li> <li>➤ Internal Soft Start Time Period</li> <li>➤ Internal Leading Edge Blanking</li> <li>➤ +300mA/-500mA Gate Drive Capability</li> <li>➤ Frequency Jittering</li> <li>➤ Current Mode Control with Internal Slope Compensation</li> <li>➤ Cycle-by-Cycle Maximum Current Limit Protection</li> <li>➤ Meet Pb-Free, Halogen Free and RoHS compliant</li> </ul>

**Revision History**

Revise Date	Version	Reason/Issue
2013.05.28	00	First Issue

## Contents Index

1	Adapter Module Specification.....	3
1.1	Input Characteristics.....	3
1.2	Output Characteristics.....	3
1.3	PROTECTION.....	3
2	Adapter Module Information.....	4
2.1	Schematic.....	4
2.2	PCB Picture View.....	5
2.3	Bill of Material .....	6
2.4	Transformer Design.....	7
2.4.1	Mechanical View: .....	7
2.4.2	Schematic: .....	7
2.4.3	Transformer Winding data.....	7
3	Performance Evaluation.....	8
3.1	Input Characterization.....	8
3.1.1	Input Current/Power/Efficiency/power Factor.....	8
3.1.2	Power Consumption.....	8
3.2	Output Characterization.....	9
3.2.1	Load, line/Cross Regulation.....	9
3.2.2	Ripple and Noise (P.A.R.D) .....	9
3.2.3	Dynamic load Response.....	10
3.2.4	Output Over/Under Shoot.....	10
3.2.5	Timing Requirements.....	11
3.3	Protection.....	12
3.3.1	Short Circuit Protection.....	12
3.3.2	Over Current Protection.....	12
3.3.3	EMI Test.....	12

## Table Index

Table 01	Active Load Efficiency vs.Load.....	8
Table 02	Power Consumption @ 0 W Load.....	8
Table 03	Power Consumption @ 0.25 W Load.....	8
Table 04	Power Consumption @ 0.50 W Load.....	8
Table 05	Load, Line/Cross Regulation.....	9
Table 06	Ripple and Noise(P.A.R.D) .....	9
Table 07	Dynamic Load Response.....	10
Table 08	Output Over Shoot.....	10
Table 09	Output Under Shoot.....	10

Table 10 Rise Time.....	11
Table 11 Falling Time.....	11
Table 12 Start Up Time.....	12
Table 13 Hold Up Time.....	12
Table 14 Short Start Protection.....	13
Table 15 Short Circuit Protection.....	13
Table 16 Over Current Protection.....	13
Table 17 EMI Pass/fail Criteria.....	14

## 1. Adapter Module Specification

### 1.1 Input Characteristics

- Input Current/Power/  
Efficiency/Power Factor      Eff.> 82.96% @ 115~230Vac
- Power Consumption (Minimum  
Load Input Power)      Pin<0.1W @ No Load /230Vac  
Pin<0.5W @ 0.25W Load

### 1.2 Output Characteristics

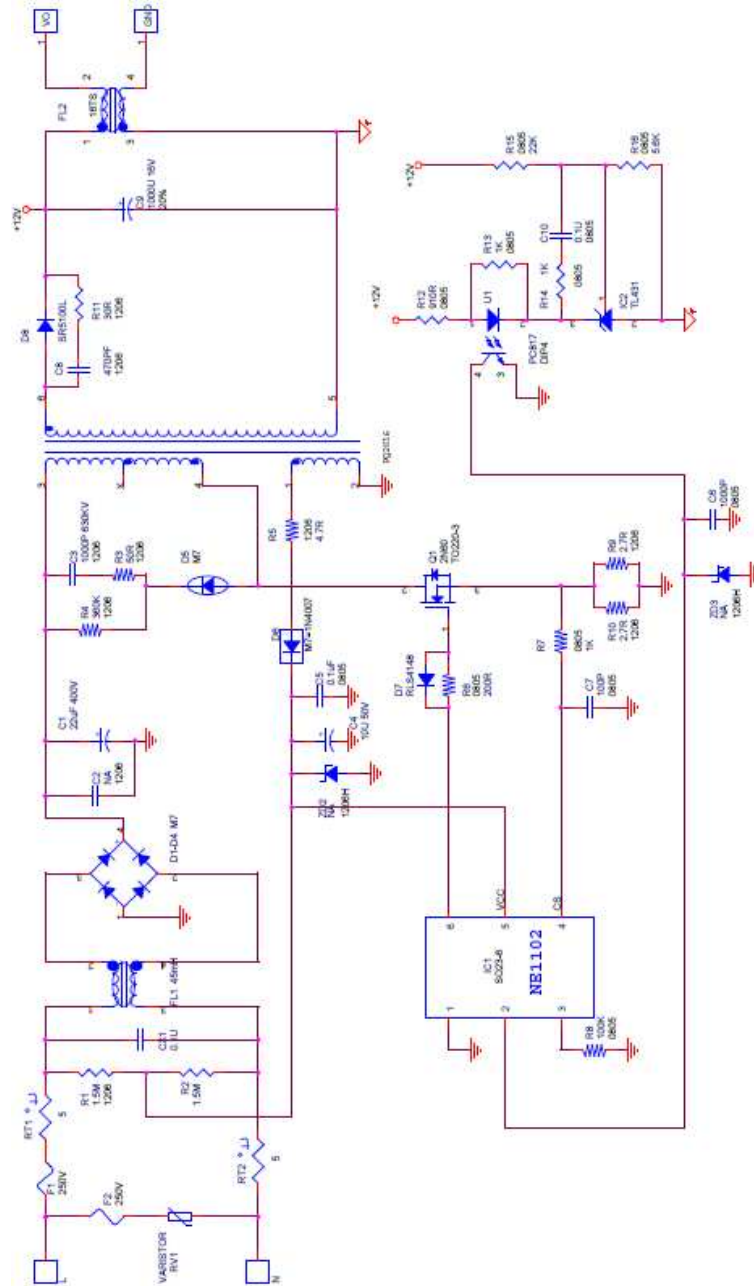
- Load, Line Cross Regulation      Vout=12.0V±5%
- Ripple and Noise      <150mVp-p
- Dynamic Loading Response      11.25V<Vout<12.75V
- Output Over / Under Shoot      < 5% Vo.
- Turn On Delay/ Hold up / DC  
Rise/Fall Time      Hold up time(>5ms) @ 115Vac/230Vac  
Rise time(<20ms)

### 1.3 PROTECTION

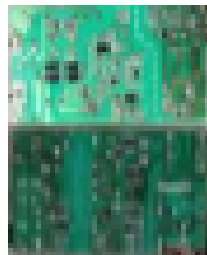
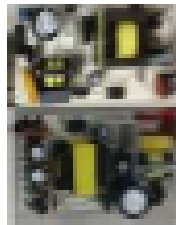
- Short Circuit Protection      No damage
- Over Current Protection      <3A

## 2. Adapter Module Information

### 2.1 Schematic



## 2.2 PCB Picture View



## 2.3 Bill of Material

Position	Description	Qty
F1 F2	FUSE T S 2.5A 250V L	2
RV1	VARISTOR TRV 14561*	1
RT1 RT2	NTC 5D7 DIP	2
C9	CAP AL LD 16V 1000uF M 10*16 TP P5	1
C4	CAP AL LD 50V 10uF M 5*11 TP KI5	1
C1	CAP AL 400V 22uF M	1
CX1	CAP X2 MP PC 305VAC 0.33uF K S12.5	1
D1 D2 D3 D4 D5 D6	DIO M7	6

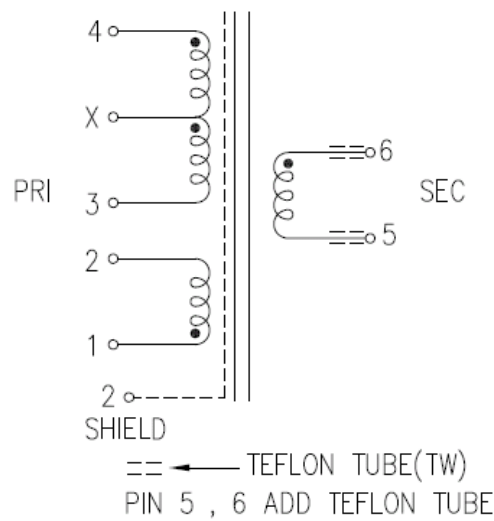
D7	DIO RLS4148	1
Q1	FET 600V 2A TO-220	1
T1	TRANSFORMER MAIN PQ2016 Horizon 3.4mH +/-5% TRANSFORMER Second Source EE19(Add wide) 2.65 +/-5%	1
FL1	LINE FILTER UU9.8 40mH MIN	1
FL2	LINE FILTER Core 100uH MIN	1
D8	SR5100L DO-201	1
R1 R2	RES SMD 1/4W 1.5Mohm J1206	2
R3	RES SMD 1/4W 30ohm J1206	1
R4	RES SMD 1/4W 360Kohm J1206	1
R5	RES SMD 1/4W 4.7Mohm J 0805	1
R6	RES SMD 1/4W 200ohm J 0805	1
R7	RES SMD 1/4W 1Kohm J 0805	1
R8	RES SMD 1/10W 100Kohm F 0805	1
R9 R10	RES SMD 1/4W 2.7ohm F 1206	2
R11	RES SMD 1/4W 30ohm F 1206	1
R12	RES SMD 1/8W 910ohm F 0805	1
R13 R14	RES SMD 1/8W 1Kohm J 0805	2
R15	RES SMD 1/8W 22Kohm J 0805	1
R16	RES SMD 1/10W 5.6Kohm J 0805	1
C2	CAP MC SMD 630V 103 J 1206	NA
C3	CAP MC SMD 200V 1000pF J 0805	1
C5 C10	CAP MC SMD 50V 0.1uF K X7R 0805	2
C6	CAP MC SMD 50V 1000pF K X7R 0805	1
C7	CAP MC SMD 50V 100pF K X7R 0805	1
C8	CAP MC SMD 100V 470pF K X7R 0805	1
U1	PHOTO TR 50mA 70V SOP-4P 100%-200% SMD	1
IC2	IC VOL REF ADJ 2.495V 200mA 0.5%	1
IC1	NE11102E	1
Wire &Case	24# 1.5M	1

## 2.4 Transformer Design

### 2.4.1 Mechanical View(EE19 add wide Or PQ2016 Horiz):



### 2.4.2 Schematic:



### 2.4.3 Transformer Winding data

TEST TERMINAL	TEST CONDITION	L (uH)	TURNS	WIRE GAUGE	HI-POT TEST 60Hz, 1s
4-X-3	40kHz,1V	3.4mH±5%(PQ2016) 2.65mH±5%(EE19)	66+32		(PRI SHORT CORE) TO SEC 3000VAC
4-X			66	Φ0.2 2UEWN	PRI TO PRI 500VAC
SHIELD1 TO PIN 2			1	T7X0.001"Cu	PRI TO CORE 500VAC
6-5			12	Φ0.45 TIW-2 OR TEX-E	
SHIELD2 TO PIN 2			1	T5.5X0.001"Cu	INDUCED VOLTAGE
X-3			32	Φ0.2 2UEWN	L(4-3) :1.0KVo-p MAX/1s
1-2			14	Φ0.2X2 2UEW	ARCING CURRENT <=10.0Ma
					LEAKAGE CURRENT <=1.0mA

## 3. Performance Evaluation

### 3.1 INPUT CHARACTERIZATION

### 3.1.1 INPUT CURRENT/POWER/EFFICIENCY/POWER FACTOR

■ **Test conditions:**

The unit is set at maximum load and the input voltage is varied from the minimum to the maximum value. Efficiency is computed and Power Factor is either computed or measured after 2 minutes warm up at least. Output voltage is measured at the end of 24AWG cable with 1.5m long.

Table 01 Active Load Efficiency vs. Load

Vin (Vac)	Fin (Hz)	Iin (mA)	Pin (W)	Iout (A)	Vout (V)	Pout (W)	Pd(W)	P.F	Eff(%)	Avg-Eff(%)	Result
115	60	217.7	14.43	1.006	12.08	12.15	2.28	0.578	84.19%	84.44%	PASS (DoE level 6)
		170.1	10.74	0.75	12.128	9.09	1.65	0.552	84.63%		
		120	7.11	0.495	12.178	6.02	1.09	0.516	84.46%		
		70.1	3.68	0.255	12.22	3.11	0.57	0.461	84.51%		
230	50	133.6	14.15	1.006	12.08	12.15	2.0	0.46	85.8%	84.31%	PASS (DoE level 6)
		107.6	10.8	0.75	12.128	9.09	1.71	0.436	84.16%		
		76.8	7.1	0.495	12.178	6.02	1.08	0.401	84.78%		
		47	3.77	0.255	12.224	3.11	0.66	0.35	82.50%		

### 3.1.2 Power Consumption

■ **Test conditions:**

The unit is set at no load and light load and the rated input voltage for at least 15 minutes. The ambient temperature is set between 15 Deg C to 35 Deg C

Table 02 Power Consumption @ 0 W Load

Vin (Vac)	Fin (Hz)	Iin (mA)	Pin (W)	Vout (V)	Result
90	47	6.07	0.042	12.28	PASS
115	60	9.65	0.045	12.28	PASS (DoE level 6)
230	50	19.1	0.075	12.28	PASS (DoE level 6)
264	63	23.08	0.098	12.28	PASS

Table 03 Power Consumption @ 0.25 W Load

Vin (Vac)	Fin (Hz)	Iin (mA)	Pin (W)	Vout (V)	Efficiency (%)
90	47	13.27	0.397	12.28	62.9%
115	60	13.98	0.404	12.28	61.88%
230	50	17.17	0.43	12.28	58.13%
264	63	23.72	0.46	12.28	54.34%

Table 04 Power Consumption @ 0.5 W Load

Vin (Vac)	Fin (Hz)	Iin (mA)	Pin (W)	Vout (V)	Efficiency (%)
90	47	20.23	0.7	12.28	71.4%
115	60	19.14	0.71	12.28	70.42%
230	50	19.01	0.73	12.28	68.49%



264	63	24.81	0.76	12.28	65.78%
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### 3.2 OUTPUT CHARACTERIZATION

#### 3.2.1 LOAD, LINE/CROSS REGULATION

■ **Test condition:**

Test is repeated from different input voltages. The output is at maximum load then at minimum.

Table 05 LOAD, LINE/CROSS REGULATION

Vin (Vac)	Fin (Hz)	Loading (A)	Vout (V)	Result
90	47	1	12.09	PASS
90	47	0	12.28	PASS
115	60	1	12.09	PASS
115	60	0	12.28	PASS
230	50	1	12.09	PASS
230	50	0	12.28	PASS
264	63	1	12.09	PASS
264	63	0	12.28	PASS

#### 3.2.2 RIPPLE AND NOISE (P.A.R.D.)

■ **Test conditions:**

Rated input voltage shall be applied to the primary circuit and rated load to the secondary voltage.

Ripple voltage and noise are measured at the pins of the mating connector of which each output is decoupled by a high frequency 0.1 $\mu$ F and a 10 $\mu$ F capacitor. Bandwidth is set at 20MHz.

Table 06 RIPPLE AND NOISE(P.A.R.D)

Vin (Vac)	Fin (Hz)	Initial Load(A)	Vpp max (mV)	Vpp Reading (mV)	Result
90	47	0	150	74	Pass
90	47	1	150	114	Pass
115	60	0	150	81	Pass
115	60	1	150	81	Pass
230	50	0	150	95	Pass
230	50	1	150	94	Pass
265	63	0	150	106	Pass
265	63	1	150	106	Pass

#### 3.2.3 DYNAMIC LOAD RESPONSE

■ **Test conditions:**

The PSU is subjected to a specified load changes (100% ~ 0% Load and 50% ~ 0% Load) at rate of 2.5A/μsec. The frequency of change is set to give the best readability of the deviation and setting frequency to 100Hz.

Table 07 DYNAMIC LOAD RESPONSE

Condition	Vo_max (V)	Vo_min (V)	Vpk_H (V)	Vpk_L (V)	Vp-p (V)	Result
Dynamic_90V_47Hz_1.0A to 0.0A	12.6	11.4	12.3	12.2	0.1	Pass
Dynamic_90V_47Hz_0.5A to 0.00A	12.6	11.4	12.3	12.25	0.05	Pass
Dynamic_265V_63Hz_1A to 0.00A	12.6	11.4	12.3	12.05	0.25	Pass
Dynamic_265V_63Hz_0.5A to 0.00A	12.6	11.4	12.3	12.2	0.1	Pass

3.2.4 OUTPUT OVER/UNDER SHOOT

■ **Test conditions:**

The power adapter unit was tested either at Turn On/Off or from Full Load to No Load.

Table 08 OUTPUT OVERSHOOT

Condition	Output Overshoot Max.(%)	Output Overshoot Reading.(%)	Output Voltage Max.(V)	Output Voltage Reading.(V)	Test Result (V)
Turnon_90V_47Hz_1.0A	5.00	1%	13.5	12.3	PASS
Turnon_90V_47Hz_0.0A	5.00	0	12.3	12.3	PASS
Turnon_265V_63Hz_1.0A	5.00	0	12.3	12.3	PASS
Turnon_265V_63Hz_0.0A	5.00	0	12.3	12.3	PASS

Table 09 OUTPUT UNDERSHOOT

Condition	Output Overshoot Max.(%)	Output Overshoot Reading.(%)	Output Voltage Max.(V)	Output Voltage Reading.(V)	Test Result (V)
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Turnoff_90V_47Hz_1.0A	5.00	0	12.3	12.3	PASS
Turnoff_90V_47Hz_0.0A	5.00	0	12.3	12.3	PASS
Turnoff_265V_63Hz_1.0A	5.00	0	12.3	12.3	PASS
Turnoff_265V_63Hz_0.0A	5.00	0	12.3	12.3	PASS

### 3.2.5 TIMING REQUIREMENTS

#### ■ Test conditions:

The following timings are measured:

- AC Turn-on delay: Output voltage shall reach its nominal setting within 3 seconds after turning AC power on at 115Vac.
- AC Hold-up time: The output voltage shall remain regulation large then 5mS at full load at 115Vac and 230Vac.
- DC Rise/Fall time: 10% ~ 90% of Vout < 20mS.

Table 10 RISE TIME

Vin(Vac)	Freq(Hz)	Loading (A)	Spec Max. (mS)	Spec Min. (mS)	Reading (ms)	Result
Risetime_90V_47Hz_1.0A	47	1	20.00	--	8.25mS	PASS
Risetime_115V_60Hz_1.0A	60	1	20.00	--	8.02mS	PASS
Risetime_230V_50Hz_1.0A	50	1	20.00	--	8.18mS	PASS
Risetime_265V_63Hz_1.0A	63	1	20.00	--	8.15mS	PASS

Table 11 FALLING TIME

Condition	Vin(Vac)	Freq(Hz)	Loading (A)	Spec Max. (mS)	Spec Min. (mS)	Reading (ms)	Result
Falltime_90V_47Hz_1.0A	90	47	1	--	--	5.60	PASS
Falltime_115V_60Hz_1.0A	265	60	1	--	--	5.64	PASS
Falltime_230V_50Hz_1.0A	90	50	1	--	--	5.63	PASS

50Hz_1.0A							
Falltime_265V_63Hz_1.0A	265	63	1	--	--	5.62	PASS

Table 12 START UP TIME

Condition	Vin(Vac)	Freq(Hz)	Loading (A)	Spec Max. (mS)	Spec Min. (mS)	Reading (ms)	Result
Turnontime_90V_47Hz_1.0A	90	47	1.0	--	--	1820	PASS
Turnontime_115V_60Hz_1.0A	115	60	1.0	--	--	1420	PASS
Turnontime_230V_50Hz_1.0A	230	50	1.0	--	--	660	PASS
Turnontime_265V_63Hz_1.0A	265	63	1.0	--	--	520	PASS

Table 13 HOLD UP TIME

Vin(Vac)	Turn on angle (degree)	Freq(Hz)	Loading (A)	Spec Max. (mS)	Spec Min. (mS)	Reading (ms)	Result
Holdup_90V_47Hz_1.0A	180	47	1.0	--	--	12	PASS
Holdup_115V_60Hz_1.0A	180	60	1.0	--	--	14	PASS
Holdup_230V_50Hz_1.0A	180	50	1.0	--	--	58	PASS
Holdup_265V_63Hz_1.0A	180	63	1.0	--	--	96	PASS

### 3.3 PROTECTION

#### 3.3.1 SHORT CIRCUIT PROTECTION

■ **Test conditions:**

Output short circuit (output load less than 0.1 ohm).

**Pass/Fail criteria:**

The unit test shall meet the specification requirements.

**Test result: Pass**

Table 14 Short Start Protection

Vin(Vac)	Freq(Hz)	Loading (A)	Vrecovery max.(V) 5%	Vrecovery min.(V)	Vrecovery(V)	Test Result
90	47	0.00	12.6	11.4	12.28	PASS
90	47	1.0	12.6	11.4	12.08	PASS
265	63	0.00	12.6	11.4	12.28	PASS
265	63	1.0	12.6	11.4	12.08	PASS

Table 15 Short Circuit Protection

Vin(Vac)	Freq(Hz)	Loading (A)	Vrecovery max.(V)	Vrecovery min.(V)	Vrecovery(V)	Test Result
90	47	0.00	12.6	11.4	12.28	PASS
90	47	1.00	12.6	11.4	12.08	PASS
265	63	0.00	12.6	11.4	12.28	PASS
265	63	1.00	12.6	11.4	12.08	PASS

### 3.3.2 OVER CURRENT PROTECTION

■ **Test conditions:**

The load is increased to an estimated over current value in several steps. The test is repeated at different input voltages.

OCP Spec: <3A under AC full range condition

Table 16 OVER CURRENT PROTECTION

Vin (Vac)	Fin (Hz)	OCP Max.(A)	OCP Min.(A)	OCP Reading(A)	Result / OCP Ratio
90	47	3.0	1.2	1.31	PASS
115	60	3.0	1.2	1.69	PASS
230	50	3.0	1.2	2.35	PASS
264	63	3.0	1.2	2.45	PASS

### 3.3.3 EMI Conduction Scan Test

Test conditions:

Input Voltage: 115Vac/230Vac.

Frequency: 50Hz.

Load Condition: Full load.

Ambient Temperature: 25°C.

Test Quantity:2 Sets

Table 17 EMI Pass/fail Criteria: Test result shall be within specification

Item	12V dc 1A load	Spec EN55022 (CISPR 22)-CLASS B	Result
INPUT LOLTAGE			
115Vac Wall socket	1A	Under 6dB average-limit	PASS
230Vac Wall socket	1A	Under 6dB average-limit	PASS

**Test result: Pass**

