



TNY278PN Design for 5V , 2A Adaptor (Rev-3)



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JY (PI-Shenzhen)

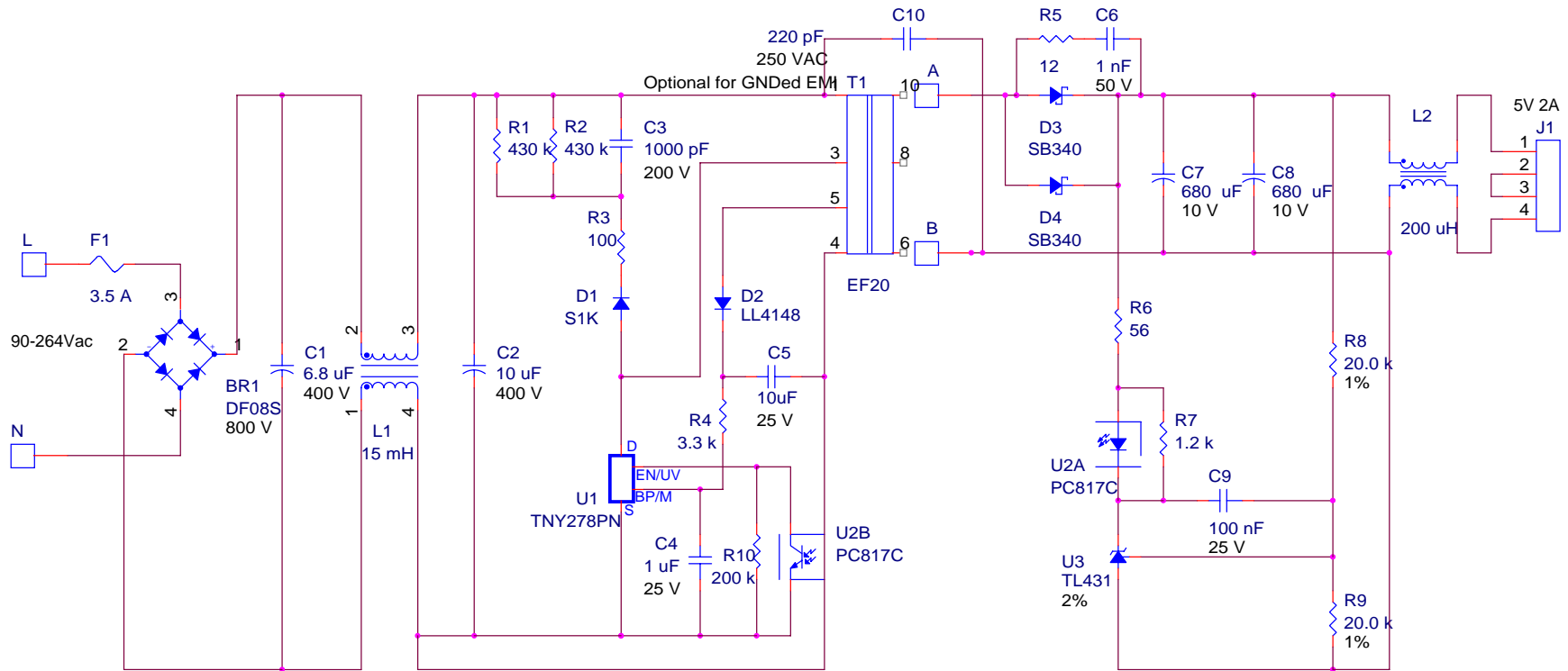
Major Features

- **No Y Cap design for 10W**
- **Very low no-load power consumption**
- **High efficiency**

1. Power Supply Specification

Description	Symbol	Min	Typ	Max	Units	Comment/Conditions
INPUT						
Voltage	V_{IN}	90		265	V_{AC}	2 Wire no P.E
Frequency	f_{LINE}	47	50/60	63	Hz	
No-load Input Power	P_{IN}			30	mW	Input 230 V_{AC}
OUTPUT						
Output Voltage	V_{OUT}	4.75	5.0	5.25	V	Measured at the End of DC cable, (24AWG,1.8m)
Output Current	I_{OUT}		2		A	
Output Ripple Voltage	V_{RIPPLE}			100	mV_{P-P}	Measured at the End of DC cable, 20 MHz Bandwidth
Total Output Power						
Continuous Output Power	P_{OUT}		10		W	
Peak Output Power	P_{OUT_PK}				W	
Conducted EMI Margin		6			dB	CISPR22B/EN55022 class B
Average Efficiency	η	73.37			%	115 and 230 V_{AC}
Ambient Temperature	T_{AMB}	-5		40	$^{\circ}C$	Free convection, sea level
Surge Test			2		kV	
Safety		Designed to meet IEC950, UL1950 Class II				

2. Schematic

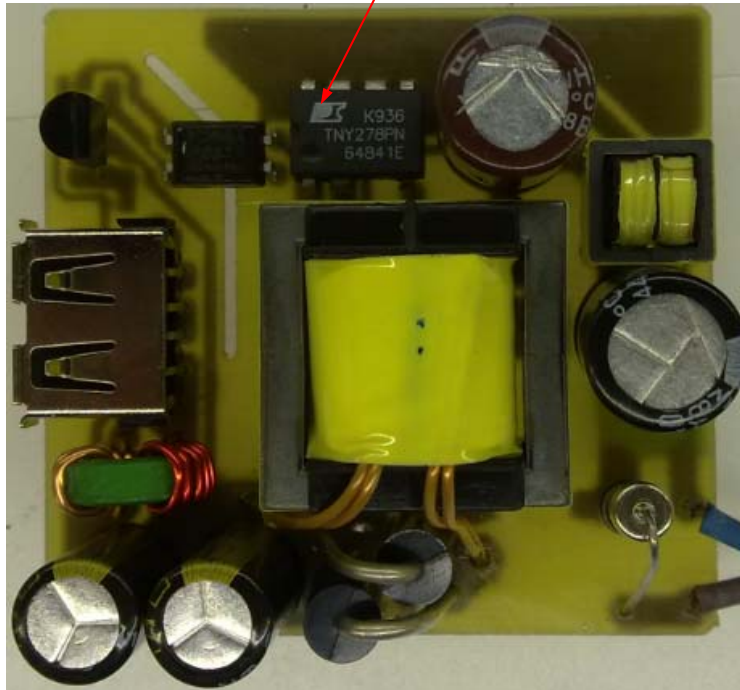


3. BOM

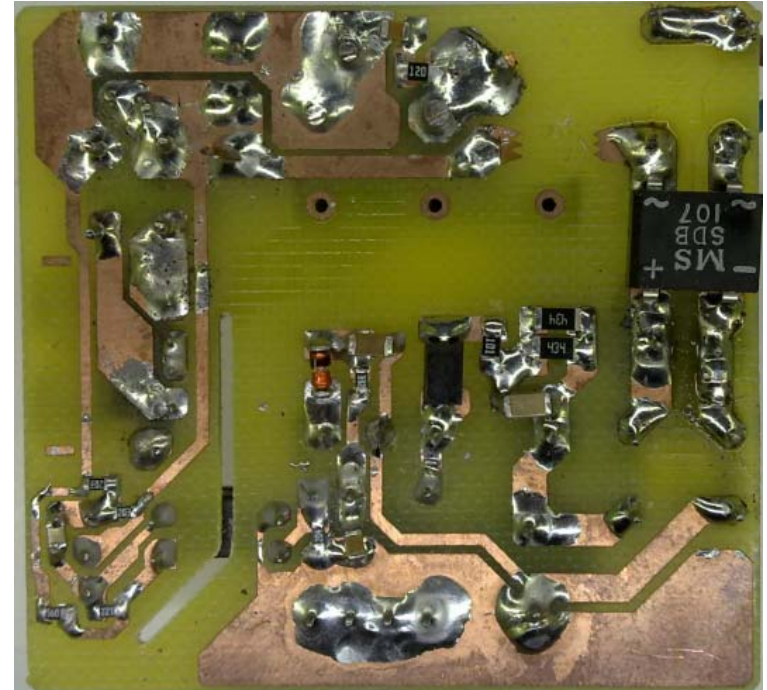
Item	Qty.	Part Ref.	Value	Description
1	1	BR1	DF08S	800 V, 1 A, Bridge Rectifier, SMD, DFS
2	1	C1	6.8 uF	6.8 uF, 400 V, Electrolytic, (10 x 16), Low ESR
3	1	C2	10 uF	10 uF, 400 V, Electrolytic, Low ESR, 90 mA, (10 x 16)
4	1	C3	1000 pF	1000 pF, 200 V, Ceramic, X7R, 1206
5	1	C4	1 uF	1 uF, 25 V, Ceramic, X7R, 0805
6	1	C5	10uF	10 uF, 25 V, Ceramic, X5R, 1206
7	1	C6	1 nF	1 nF, 50 V, Ceramic, X7R, 0805
8	2	C7 C8	680 uF	680 uF, 10 V, Electrolytic, Very Low ESR, 56 mOhm, (8 x 15)
9	1	C9	100 nF	100 nF 25 V, Ceramic, X7R, 0603
11	1	C10	220 pF	220 pF, Ceramic Y1, Optional for Grounded EMI
10	1	D1	S1K	DIODE ULTRA FAST, SW 800V, 1A, SMA
11	1	D2	LL4148	75 V, 0.15 A, Fast Switching, 4 ns, MELF
12	2	D3 D4	SB340	40 V, 3 A, Schottky, DO-201AD
13	1	F1	3.5 A	3.5 A, 250 V, Fast, 5 mm x 20 mm, Axial
14	1	J1	CON4	CONN USB, Short
15	1	L1	15 mH	Common Choke with EE8.3 core
16	1	L2	200 uH	200 uH, 2 A, Common Mode Choke
17	2	R1 R2	430 k	430 k, 5%, 1/4 W, Thick Film, 1206
18	1	R3	100	100 R, 5%, 1/8 W, Thick Film, 0805
19	1	R4	3.3 k	3.3 k, 5%, 1/10 W, Thick Film, 0603
20	1	R5	12	12 R, 5%, 1/8 W, Thick Film, 0805
21	1	R6	56	56 R, 5%, 1/10 W, Thick Film, 0603
22	1	R7	1.2 k	1.2 k, 5%, 1/8 W, Thick Film, 0805
23	2	R8 R9	20.0 k	20 k, 1%, 1/8 W, Thick Film, 0805
24	1	R10	200 k	200 k, 5%, 1/10 W, Thick Film, 0603
25	1	T1	EF20	Bobbin, EF20, Horizontal, 10 pins
26	1	U1	TNY278PN	TinySwitch-III, TNY278PN, DIP-8C
27	1	U2	PC817C	Opto coupler, 35 V, CTR 200-300%, 4-DIP
28	1	U3	TL431	2.495 V Shunt Regulator IC, 2%, 0 to 70C, TO-92

4. Circuit board

TNY278PN

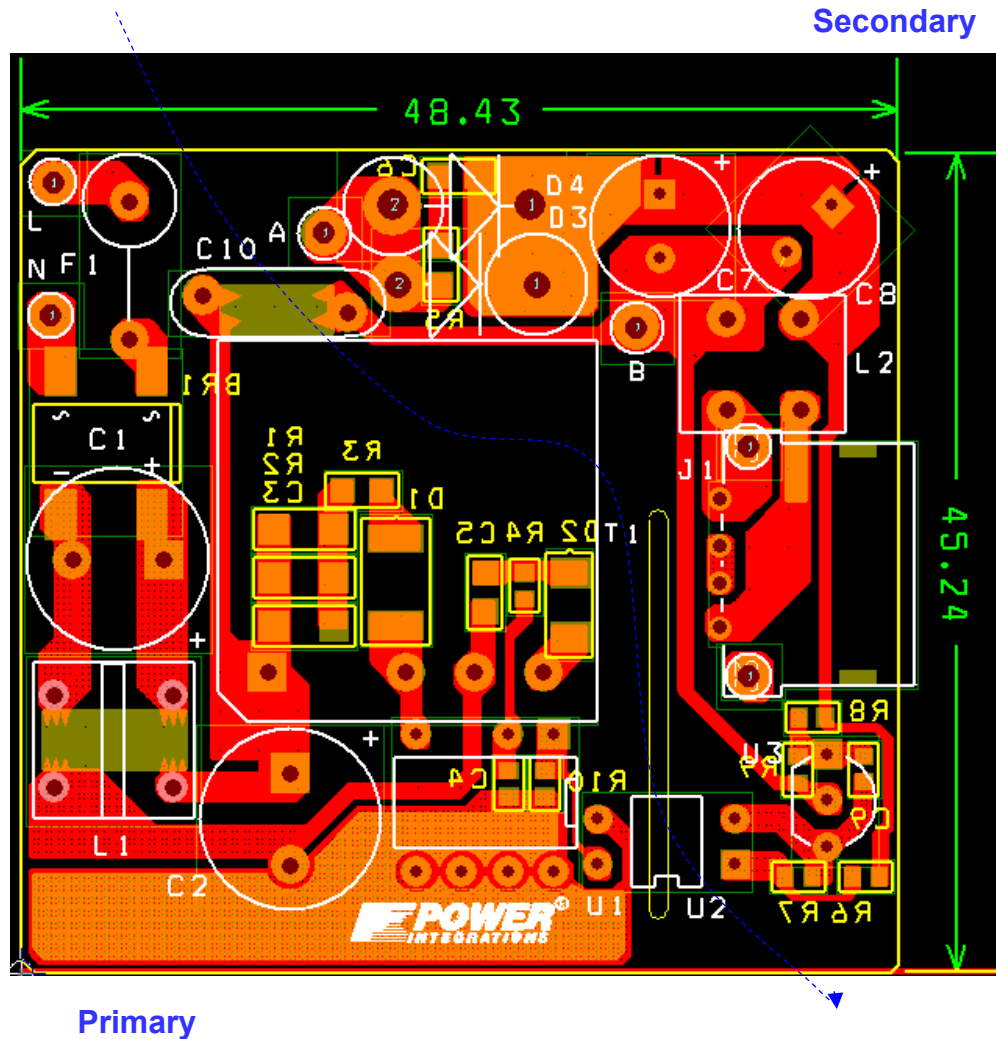


Component side



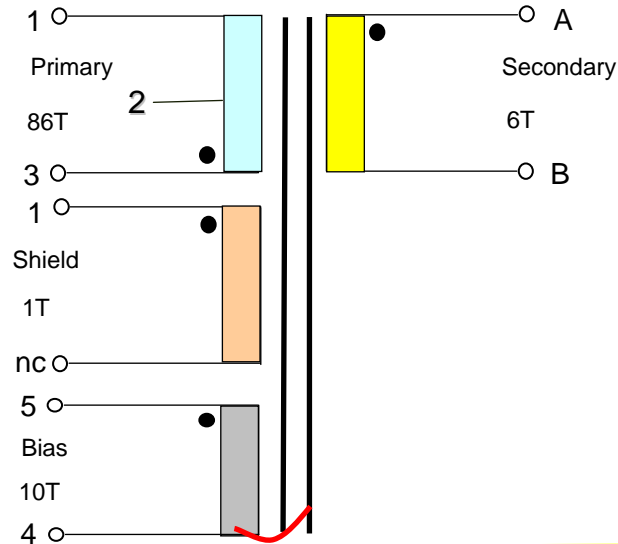
Solder side

5. Layout



6. Transformer Information

SCHEMATIC



Note: core is connected to PIN1 with 1T copper

ELECTRICAL SPECIFICATIONS:

1. Primary Inductance (L_p) = 1.56mH \pm 10% @10KHz
2. Primary Leakage Inductance 25uH
3. Electrical Strength = 3KV, 50/60Hz, 1Min

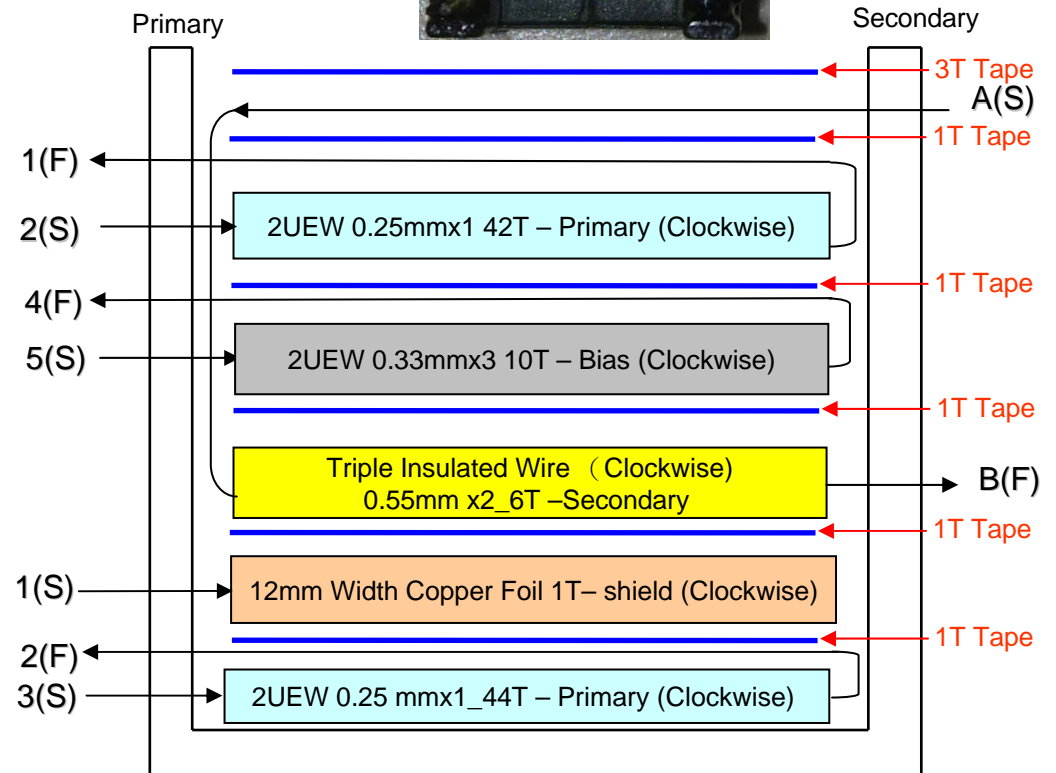
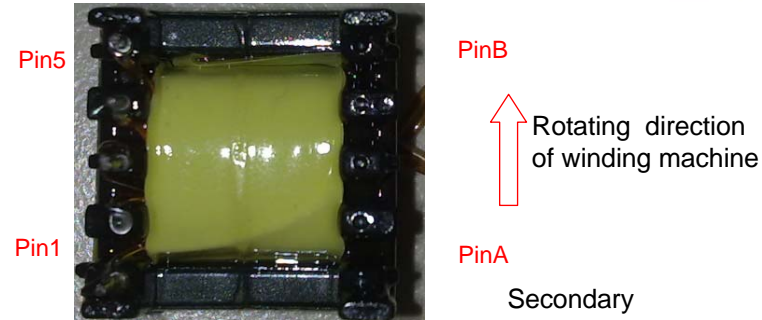
MATERIALS:

1. Core : EF20 (Ferrite Material TDK PC40 or equivalent)
2. Bobbin : EF20 **Horizontal** (5pin+5pin).
3. Magnet Wires (Pri) : Type 2-U EW
4. Magnet Wire (Sec) : Triple Insulated Wires

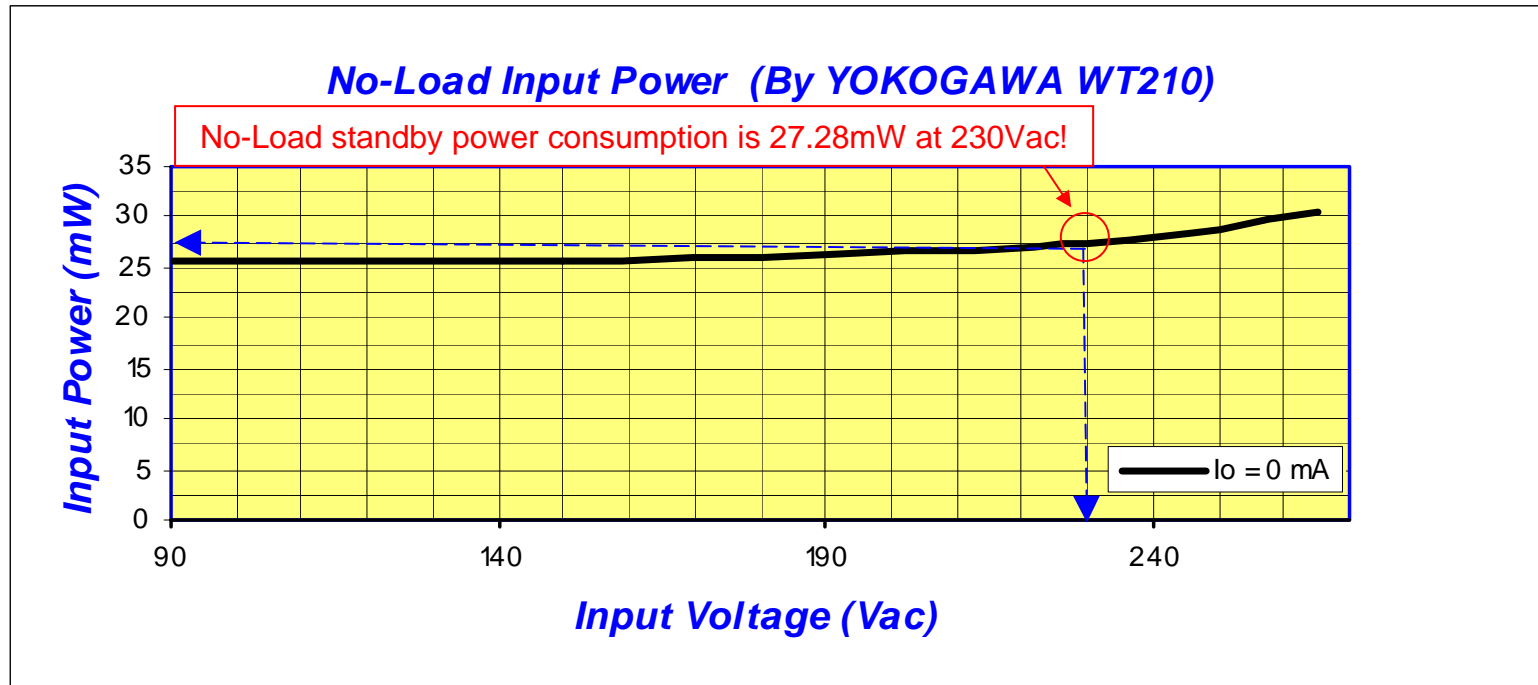
FINISHED :

1. Varnish the complete assembly

Winding Start pin-1 & Finish pin-x in "Clockwise" direction – looking from secondary side of the Bobbin.



7. No Load Power Consumption



8. Regulation, Ripple & Efficiency Measurement

*** Note: Output voltage is measured at end of PCB.**

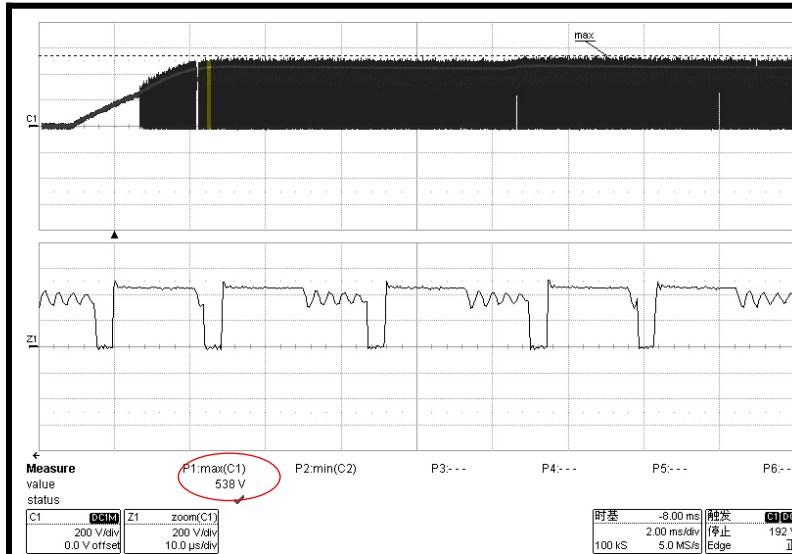
V _{IN} (V _{AC})	P _{IN} (W)	V _{OUT} (V)	I _{OUT} (mA)	V _{RIPPLE} (mV _{P-P})	P _{OUT} (W)	η (%)	Average η(%)	EPA 2.0 η (%)
90	0.0254	4.97	0	19	/	/	81.77	73.37
	3.022	4.99	498	50	2.48	82.18		
	6.020	4.98	996.9	58	4.96	82.47		
	9.134	4.97	1497.2	71	7.45	81.51		
	12.250	4.97	1996.2	75	9.91	80.92		
115	0.0252	4.97	0	18	/	/	82.62	
	3.032	4.99	498	42	2.48	81.89		
	5.952	4.98	996.9	50	4.96	83.41		
	9.010	4.97	1497.2	75	7.45	82.65		
	12.010	4.97	1996.2	71	9.91	82.54		
230	0.0272	4.97	0	21	/	/	81.31	
	3.163	4.99	498.1	46	2.48	78.52		
	6.100	4.98	996.9	58	4.96	81.39		
	9.017	4.97	1497.2	54	7.45	82.59		
	11.980	4.97	1996.2	79	9.92	82.76		
264	0.0319	4.97	0	22	/	/	81.26	
	3.180	4.99	498.1	46	2.48	78.10		
	6.042	4.98	996.9	58	4.96	82.15		
	9.062	4.97	1497.2	58	7.45	82.16		
	12.000	4.97	1996.2	83	9.92	82.63		

9. Efficiency Regulation Requirement

<i>Test Condition:</i>		<i>Measured at the end of PCB Terminals</i>				
Loading(mA)		500	1000	1500	2000	Average Eff.
V_{IN}	230Vac	78.73%	82.60%	82.77%	81.33%	81.36%
	115Vac	81.51%	83.10%	82.32%	82.47%	82.35%
Regulation	ES2	0.075*LN(J7)+0.561 (Low Voltage and High Current spec)				73.37%

<i>Light Load Efficiency Test</i>	<i>Measured at the end of PCB Terminals (50mA Loading)</i>			
V_{IN} (Vac)	90	115	230	264
Efficiency	70.17%	70.13%	67.25%	65.88%

10. Maximum Drain voltage at start up



Test Condition:

$V_{IN}=264V_{AC}$, $I_{out}=2A$

Power ON

RESULT: $V_{drain_max} = 538V$

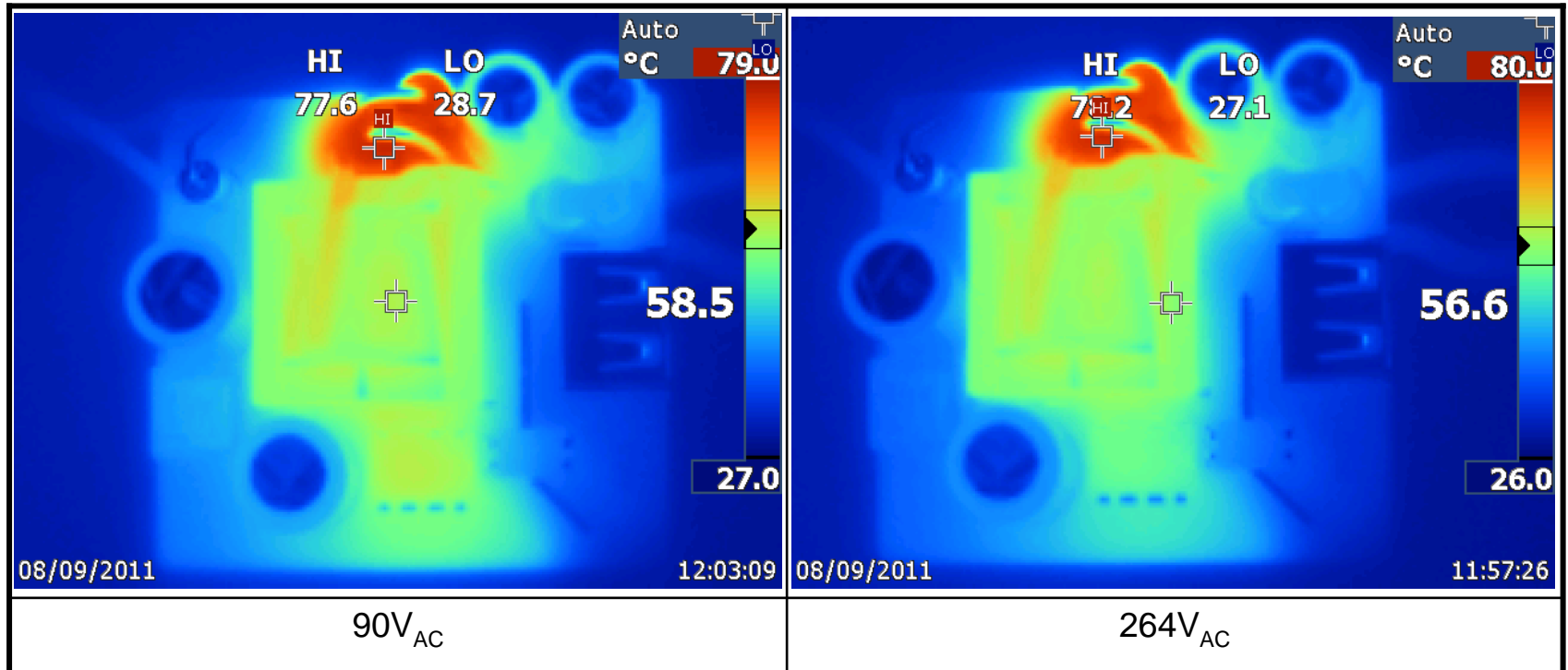
Absolute Maximum Rating from Datasheet

Absolute Maximum Ratings^(1,4)

DRAIN Voltage	-0.3 V to 700 V	Lead Temperature ⁽⁴⁾	260 °C
DRAIN Peak Current: TNY274	400 (750) mA ⁽²⁾	Notes: 1. All voltages referenced to SOURCE, $T_A = 25\text{ °C}$. 2. The higher peak DRAIN current is allowed while the DRAIN voltage is simultaneously less than 400 V. 3. Normally limited by internal circuitry. 4. 1/16 in. from case for 5 seconds. 5. Maximum ratings specified may be applied one at a time, without causing permanent damage to the product. Exposure to Absolute Rating conditions for extended periods of time may affect product reliability.	
TNY275	560 (1050) mA ⁽²⁾		
TNY276	720 (1350) mA ⁽²⁾		
TNY277	880 (1650) mA ⁽²⁾		
TNY278	1040 (1950) mA ⁽²⁾		
TNY279	1200 (2250) mA ⁽²⁾		
TNY280	1360 (2550) mA ⁽²⁾		
EN/UV Voltage	-0.3 V to 9 V		
EN/UV Current	100 mA		
BP/M Voltage	-0.3 V to 9 V		
Storage Temperature	-65 °C to 150 °C		
Operating Junction Temperature ⁽³⁾	-40 °C to 150 °C		

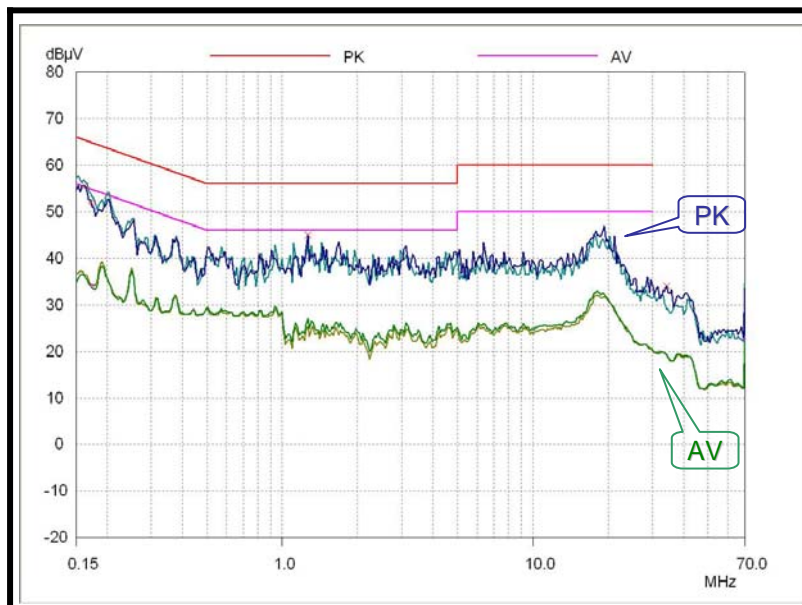
11. Thermal

(Tested under 10W loading)

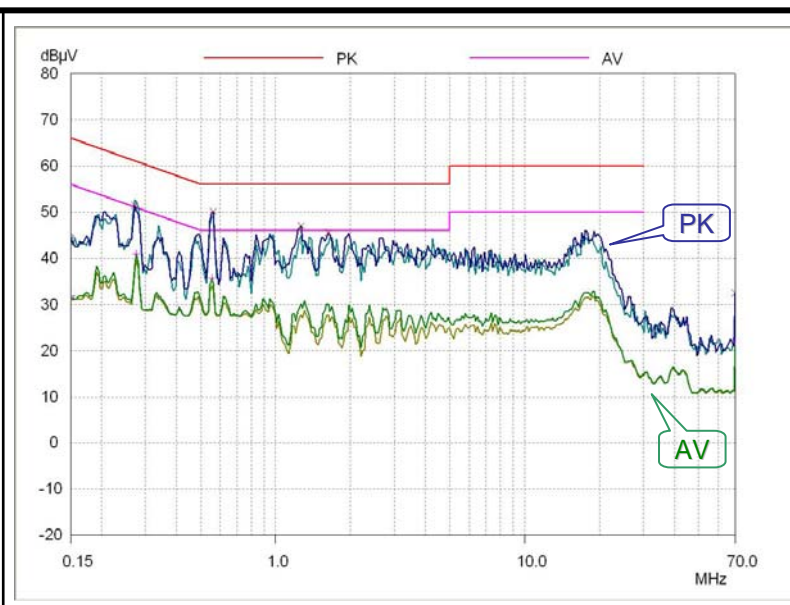


12. Conducted EMI

(Output Floating, EN55022 Class-B Limited)



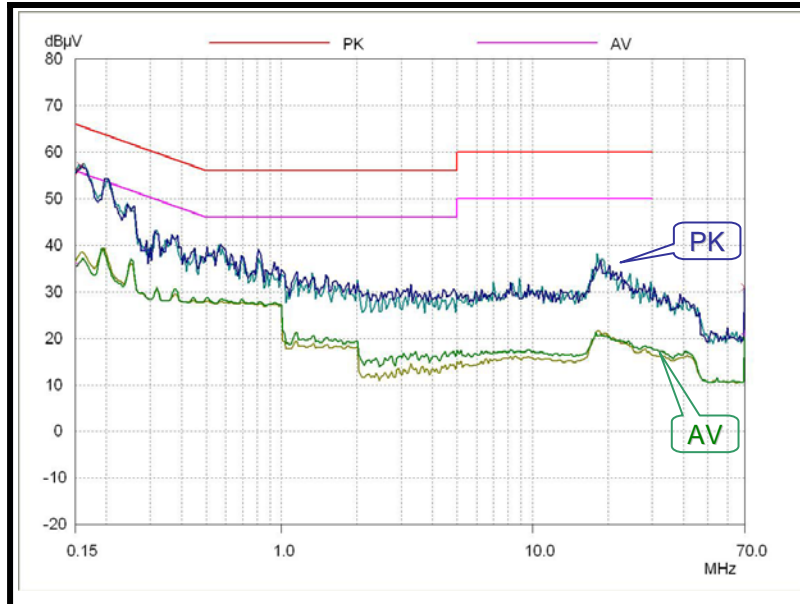
115V_{AC}, LIVE and NEUTRAL



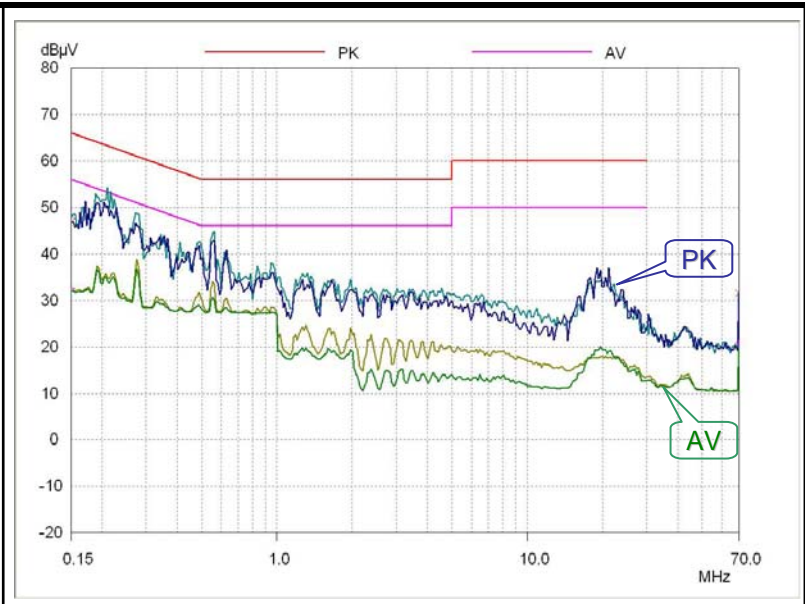
230V_{AC}, LIVE and NEUTRAL

13. Conducted EMI

(Output Grounded with 220pF Y cap connected, EN55022 Class-B Limited)

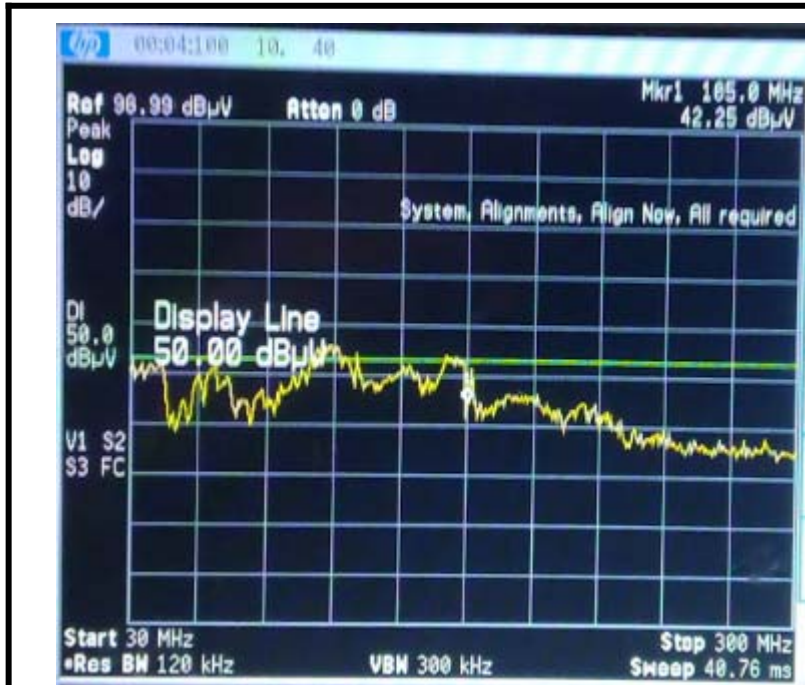


115V_{AC}, LIVE and NEUTRAL

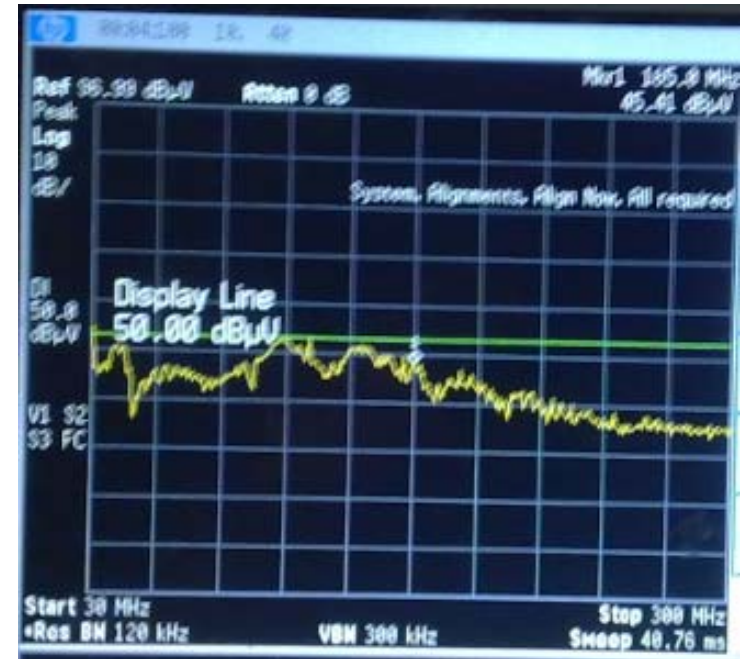


230V_{AC}, LIVE and NEUTRAL

14. Simulated Radiated EMI (Output Floating, EN55022 Class-B Limited)



1150V_{AC}



230V_{AC}

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Important note

Although this board is designed to satisfy safety isolation requirements, the engineering prototype has not been agency approved. Therefore, all testing should be performed using an isolation transformer to provide the AC input to the prototype board.

The products and applications illustrated herein (including circuits external to the products and transformer construction) may be covered by one or more U.S. and foreign patents or potentially by pending U.S. and foreign patent applications assigned to Power Integrations. A complete list of Power Integrations' patents may be found at www.powerint.com.