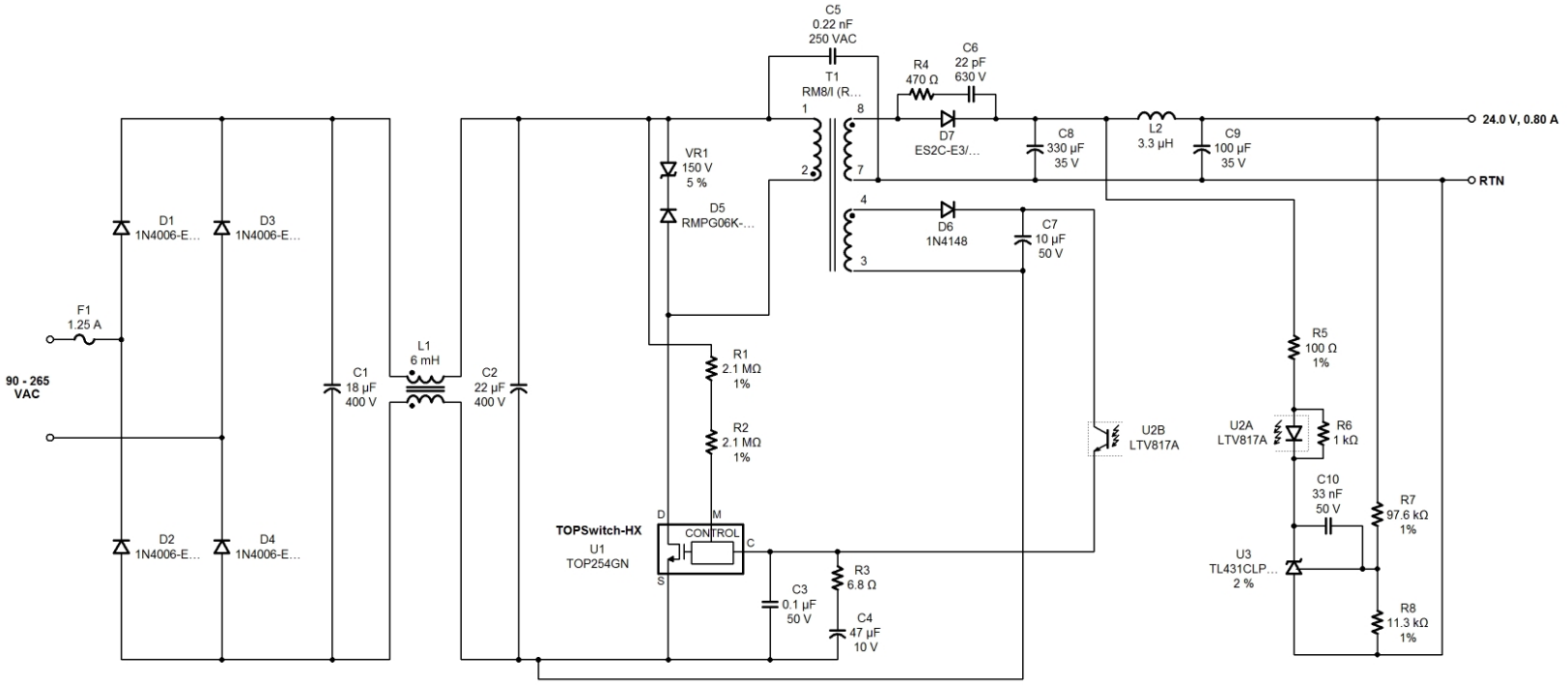


Schematic components that have been frozen by the user will appear with blue reference designators.

Power Supply Input

Var	Value	Units	Description
VACMIN	90	V	Minimum Input AC Voltage (Manual Overwrite)
VACMAX	265	V	Maximum Input AC Voltage (Manual Overwrite)
FL	50	Hz	Line Frequency (Manual Overwrite)
TC	2.63	ms	Input Rectifier Conduction Time
Z	0.48		Loss Allocation Factor
η	84.0	%	Efficiency Estimate (Target)
VMIN	88.0	V	Minimum DC Input Voltage
VMAX	374.8	V	Maximum DC Input Voltage

Input Section

Var	Value	Units	Description
Fuse	1.25	A	Input Fuse Rated Current
IAVG	0.26	A	Average Diode Bridge Current (DC Input Current)

Device Variables

Var	Value	Units	Description
Device	TOP254GN		PI Device Name
BVDSS	700	V	Drn-Src Bkdn Voltage
Current Limit Mode	Default		Device Current Limit Mode
OVP_FLAG	NO		Output Overvoltage Protection Enabled
PO	19.29	W	Total Output Power
VDRAIN Estimated	524.77	V	Estimated Drain Voltage
VDS	10.83	V	On state Drain to Source Voltage
FS	66000	Hz	Switching Frequency (at VMIN and Full Load)
KP	1.081		Continuous/Discontinuous Operating Ratio (at VMIN and Full Load)
DMAX	0.591		Maximum Duty Cycle (at VMIN and Full Load)
KI	1.00		Current Limit Reduction Factor
ILIMITEXT	0.93	A	Programmed Current Limit
ILIMITMIN	0.930	A	Minimum Current Limit
ILIMITMAX	1.070	A	Maximum Current Limit
PLIM_FLAG	NO		Enable Overload Power Limiting
IP	0.883	A	Peak Primary Current (at VMIN and Full Load)
IRMS	0.392	A	Primary RMS Current (at VMIN and Full Load)
RTH_DEVICE	43.67	°C/W	PI Device Heatsink Maximum Thermal Resistance
DEV_HSINK_TYPE	2 Oz (70 µ) 2-Sided Copper PCB		PI Device Heatsink Type
DEV_HSINK_AREA	327	mm²	PI Device Heatsink Area

Clamp Circuit

Var	Value	Units	Description
Clamp Type	Zener Clamp		Clamp Circuit Type

VCLAMP	29.34	V	Average Clamping Voltage
Estimated Clamp Loss	0.000	W	Clamp total power loss
VC_MARGIN	104.58	V	Clamp Voltage Safety Margin

Primary Bias Variables

Var	Value	Units	Description
VB	15.0	V	Bias Voltage
IB	0.006	A	Bias Current
PIVB	71	V	Bias Rectifier Maximum Peak Inverse Voltage
NB	8		Primary Bias Winding Number of Turns

Transformer Construction Parameters

Var	Value	Units	Description
Core Type	RM8/I (RM8/I-3F3)		Core Type
Core Material	3F3		Core Material
Primary Pins	4		Number of Primary pins used
Secondary Pins	2		Number of Secondary pins used
USE_SHIELDS	NO		Use shield Windings
LP_nom	874	µH	Nominal Primary Inductance
LP_Tol	10.0	%	Primary Inductance Tolerance
NP	53.3		Calculated Primary Winding Total Number of Turns
NSM	11		Secondary Main Number of Turns
Primary Current Density	7.93	A/mm²	Primary Winding Current Density
VOR	120.66	V	Reflected Output Voltage
BW	8.60	mm	Bobbin Winding Width
FF	52.76	%	Actual Transformer Fit Factor. 100% signifies fully utilized winding window
AE	63.00	mm²	Core Cross Sectional Area
ALG	277	nH/T²	Gapped Core Specific Inductance
BM	207	mT	Maximum Flux Density
BP	251	mT	Peak Flux Density
BAC	103	mT	AC Flux Density for Core Loss
LG	0.259	mm	Estimated Gap Length
L_LKG	26.23	µH	Estimated primary leakage inductance
LSEC	20	nH	Secondary Trace Inductance

Primary Winding Section 1

Var	Value	Units	Description
NP1	54		Number of Primary Winding Turns in the First Section of Primary
L	1.85		Primary Winding - Number of Layers
DC Copper Loss	0.11	W	Primary Section 1 DC Losses

Output 1

Var	Value	Units	Description
VO	24.00	V	Typical Output Voltage
IO	0.80	A	Output Current
VOUT_ACTUAL	24.00	V	Actual Output Voltage

NS	**11**		*Secondary Number of Turns*
L_S_OUT	**0.83**		*Secondary Output Winding Layers*
DC Copper Loss	**0.15**	*W*	*Secondary DC Losses*
VD	**0.90**	*V*	*Output Winding Diode Forward Voltage Drop*
VD	**0.90**	*V*	*Output Winding Diode Forward Voltage Drop*
PIVS	**100.34**	*V*	*Output Rectifier Maximum Peak Inverse Voltage*
ISP	**4.258**	*A*	*Peak Secondary Current*
ISRMS	**1.512**	*A*	*Secondary RMS Current*
ISRMS_WINDING	**1.512**	*A*	*Secondary Winding RMS Current*
Secondary Current Density	**9**	*A/mm²*	*Secondary Winding Current Density*
RTH_RECTIFIER	**76.27**	*°C/W*	*Output Rectifier Heatsink Maximum Thermal Resistance*
OR_HSINK_TYPE	**2 Oz (70 µ) 2-Sided Copper PCB**		*Output Rectifier Heatsink Type*
OR_HSINK_AREA	**52**	*mm²*	*Output Rectifier Heatsink Area*
CO	**330 x 1**	*µF*	*Output Capacitor - Capacitance*
IRIPPLE	**1.283**	*A*	*Output Capacitor - RMS Ripple Current*
Expected Lifetime	**36647**	*hr*	*Output Capacitor - Expected Lifetime*

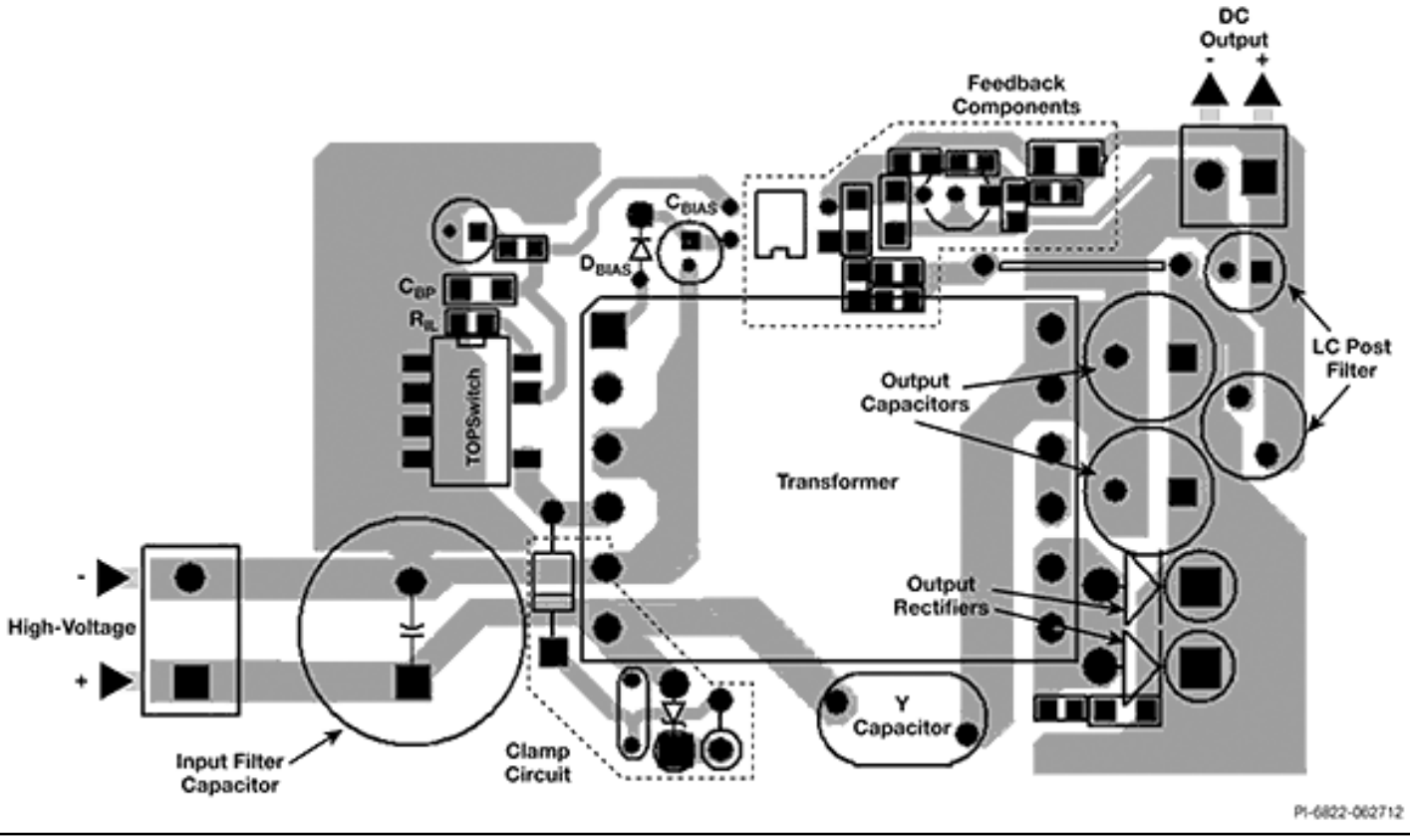
Feedback Circuit

Var	*Value*	*Units*	*Description*
DUAL_OUTPUT_FB_FLAG	**NO**		*Get feedback from 2 outputs*
SF_FLAG	**NO**		*Soft Finish Circuits use flag*
TYPE_3CTRL_FLAG	**NO**		*Phase Boost Network flag*

The regulation and tolerances do not account for thermal drifting and component tolerance of the output diode forward voltage drop and voltage drops across the LC post filter. The actual voltage values are estimated at full load only.

Please verify cross regulation performance on the bench.

Board Layout Recommendations



Click on the "Show me" icon to highlight relevant areas on the sample layout.

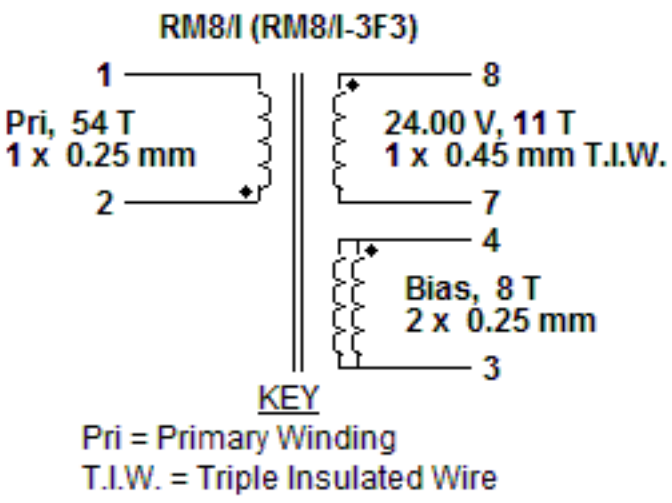
	Description	*Show Me*
1	*Maximize hatched area for heat-sinking*	
2	*Place CONTROL pin decoupling capacitor (CBP) directly across CONTROL and SOURCE pins*	
3	*Resistors connected to the M pin, should be as close as possible to the pin*	
4	*M pin node area should be minimized to prevent noise pickup*	
5	*PCB traces to M pin (V and X pin for M package) should be routed away from noisy nodes such as the Drain clamp and bias traces*	
6	*Bias winding and bias capacitor should be returned directly to input capacitor via a dedicated trace*	
7	*Y capacitor connected between output RTN and DC +*	
8	*Minimize loop area formed by secondary winding, the output rectifier and the output filter capacitor*	
9	*Minimize loop area formed by drain, clamp and transformer*	

Bill Of Materials

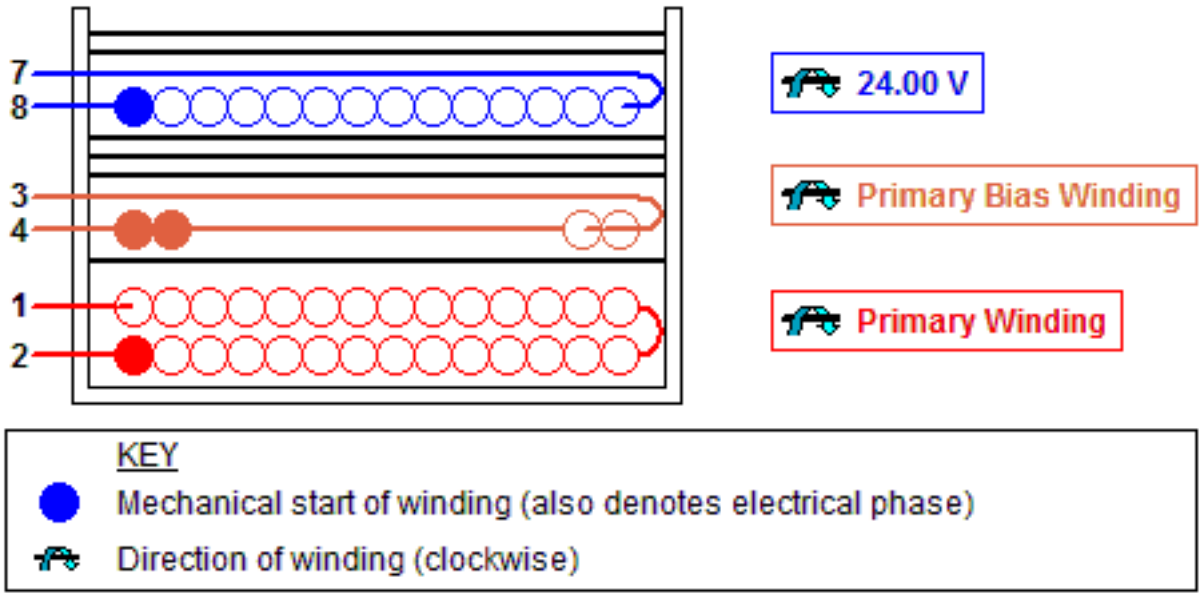
Item #	Quantity	Part Ref	Value	Description	Mfg	Mfg Part Number
1	1	C1	18 µF	18 µF, 400 V, High Voltage Al Electrolytic, (18 mm x 16 mm)	Rubycon	400BXW18MEFR16X16
2	1	C2	22 µF	22 µF, 400 V, High Voltage Al Electrolytic, (21.5 mm x 12.5 mm)	Nichicon	UCS2G220MHD
3	1	C3	0.1 µF	0.1 µF, 50 V, Ceramic, X7R	Kemet	C322C104K5R5TA
4	1	C4	47 µF	47 µF, 10.0 V, Electrolytic, Gen Purpose, 2300 mΩ, (11 mm x 4 mm)	Nichicon	UPW1A470MDD6
5	1	C5	0.22 nF	0.22 nF, 250 VAC, Ceramic, Y Class	Vishay Cera-Mite	440LT22-R
6	1	C6	22 pF	22 pF, 630 V, High Voltage Ceramic	Murata	RDE5C2J220J2M1H03A
7	1	C7	10 µF	10 µF, 50 V, Electrolytic, Gen Purpose, 1050 mΩ, (11.5 mm x 5 mm)	Panasonic	ECA-1HHG100
8	1	C8	330 µF	330 µF, 35 V, Electrolytic, Super Low ESR, 38 mΩ, (16 mm x 10 mm)	United Chemi-Con	EKZE350ELL331MJ16S
9	1	C9	100 µF	100 µF, 35 V, Electrolytic, Low ESR, 180 mΩ, (15 mm x 6.3 mm)	United Chemi-Con	ELXZ350ELL101MF15D
10	1	C10	33 nF	33 nF, 50 V, Ceramic, X7R	Kemet	C315C333K5R5TA
11	4	D1, D2, D3, D4	1N4006-E3/54	800 V, 1 A, Standard Recovery, DO-41	Vishay	1N4006-E3/54
12	1	D5	RMPG06K-E3/54	800 V, 1 A, Fast Recovery, 250 ns, MPG06	Vishay	RMPG06K-E3/54
13	1	D6	1N4148	100 V, 0.15 A, Fast Recovery, 8 ns, DO-35	Vishay	1N4148
14	1	D7	ES2C-E3/52T	150 V, 2 A, Ultrafast Recovery, 30 ns, DO-214AA	Vishay	ES2C-E3/52T
15	1	F1	1.25 A	250 VAC, 1.25 A, Radial TR5, Time Lag Fuse	Littelfuse / Wickmann(R)	37411250410
16	1	L1	6 mH	6 mH, 1.6 A	Panasonic	ELF18N016
17	1	L2	3.3 µH	3.3 µH, 2.66 A	Bourns Inc.	RL822-3R3K-RC
18	2	R1, R2	2.1 MΩ	2.1 MΩ, 1 %, 0.25 W, Metal Film	Generic	
19	1	R3	6.8 Ω	6.8 Ω, 5 %, 0.125 W, Carbon Film	Generic	
20	1	R4	470 Ω	470 Ω, 5 %, 0.25 W, Carbon Film	Generic	
21	1	R5	100 Ω	100 Ω, 1 %, 0.125 W, Metal Film	Generic	
22	1	R6	1 kΩ	1 kΩ, 5 %, 0.125 W, Carbon Film	Generic	
23	1	R7	97.6 kΩ	97.6 kΩ, 1 %, 0.125 W, Metal Film	Generic	
24	1	R8	11.3 kΩ	11.3 kΩ, 1 %, 0.125 W, Metal Film	Generic	
25	1	T1	RM8/I (RM8/I-3F3)	3F3 Core Material Refer to Manufacturer datasheet for a number of parts to purchase	Ferroxcube	RM8/I-3F3
26	1	T1 Bobbin	RM8/I - 1 (P6-S6)	Bobbin Material : Polybutyleneterephthalate (PBT)	Ferroxcube	CPV-RM8/I-1S-12PD
27	1	T1 Core Acc.1	CLI/P-RM8/I	Mounting clip with earth pin . Stainless steel (CrNi)	Ferroxcube	CLI/P-RM8/I
28	1	T1 Core Acc.2	CLI-RM8/I	Mounting clip without earth pin . Stainless steel (CrNi)	Ferroxcube	CLI-RM8/I
29	1	U1	TOP254GN	TOPSwitch-HX, TOP254GN, SMD-8	Power Integrations	TOP254GN
30	1	U2	LTV817A	Optocoupler LTV817A, 35 V, CTR 80 - 160 %, 4-DIP	Liteon	LTV817A
31	1	U3	TL431CLPM	2.495 V, Shunt Regulator IC, 2 %, TO-92	Texas Instruments	TL431CLPM

32	*1*	*VR1*	*P6KE150A-E3/54*	*150 V, 5 W, 5 %, DO-204AC, TVS*	*Littelfuse*	*P6KE150A-E3/54*
33	*1*			*327 mm² area on Copper PCB. 2 oz (70 µm) thickness. Heatsink for use with Device U1.*	*Custom*	
34	*1*			*52 mm² area on Copper PCB. 2 oz (70 µm) thickness. Heatsink for use with Rectifier D7.*	*Custom*	

Electrical Diagram



Mechanical Diagram



Winding Instruction

Primary Winding

Start on pin(s) 2 and wind 54 turns (x 1 filar) of item [5]. in 2 layer(s) from left to right. Winding direction is clockwise. At the end of 1st layer, continue to wind the next layer from right to left. On the final layer, spread the winding evenly across entire bobbin. Finish this winding on pin(s) 1.

Add 1 layer of tape, item [3], for insulation.

Primary Bias Winding

Start on pin(s) 4 and wind 8 turns (x 2 filar) of item [5]. Winding direction is clockwise. Spread the winding evenly across entire bobbin. Finish this winding on pin(s) 3.

Add 3 layers of tape, item [3], for insulation.

Secondary Winding

Start on pin(s) 8 and wind 11 turns (x 1 filar) of item [6]. Spread the winding evenly across entire bobbin. Winding direction is clockwise. Finish this winding on pin(s) 7.

Add 2 layers of tape, item [3], for insulation.

Core Assembly

Assemble and secure core halves. Item [1].

Varnish

Dip varnish uniformly in item [4]. Do not vacuum impregnate.

Comments

1. For non margin wound transformers use triple insulated wire for all secondary windings.

Materials

Item	*Description*
[1]	**Core: RM8/I (RM8/I-3F3), 3F3, gapped for ALG of 277 nH/T²**
[2]	**Bobbin: Generic, 6 pri. + 6 sec.**
[3]	**Barrier Tape: Polyester film [1 mil (25 µm) base thickness], 8.60 mm wide**
[4]	**Varnish**
[5]	**Magnet Wire: 0.25 mm, Solderable Double Coated**
[6]	**Triple Insulated Wire: 0.45 mm**

Electrical Test Specifications

Parameter	*Condition*	*Spec*
Electrical Strength, VAC	**60 Hz 1 second, from pins 1,2,3,4 to pins 7,8.**	**3000**
Nominal Primary Inductance, µH	**Measured at 1 V pk-pk, typical switching frequency, between pin 1 to pin 2, with all other Windings open.**	**874**
Tolerance, ±%	**Tolerance of Primary Inductance**	**10.0**
Maximum Primary Leakage, µH	**Measured between Pin 1 to Pin 2, with all other Windings shorted.**	**26.23**

Although the design of the software considered safety guidelines, it is the user's responsibility to ensure that the user's power supply design meets all applicable safety requirements of user's product.