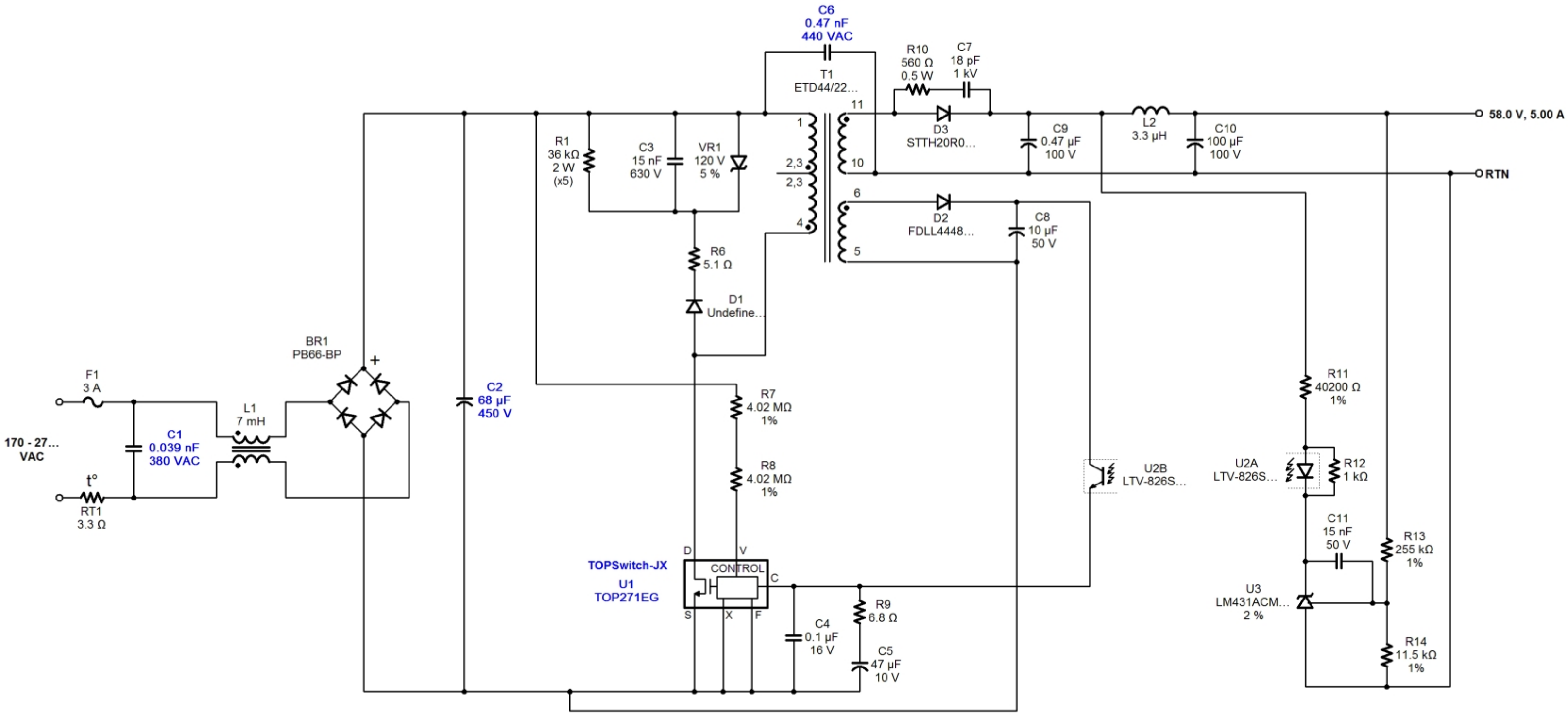


Schematic components that have been frozen by the user will appear with blue reference designators.

Power Supply Input

Var	Value	Units	Description
VACMIN	**170**	V	Minimum Input AC Voltage (Manual Overwrite)
VACMAX	**270**	V	Maximum Input AC Voltage (Manual Overwrite)
FL	**50**	Hz	Line Frequency (Manual Overwrite)
TC	**2.07**	ms	Input Rectifier Conduction Time
Z	**0.70**		Loss Allocation Factor
η	**80.0**	%	Efficiency Estimate (Target)
VMIN	**89.5**	V	Minimum DC Input Voltage
VMAX	**381.8**	V	Maximum DC Input Voltage

Input Section

Var	Value	Units	Description
Fuse	**3.00**	A	Input Fuse Rated Current
IAVG	**2.38**	A	Average Diode Bridge Current (DC Input Current)
Thermistor	**3.30**	Ω	Input Thermistor

Device Variables

Var	Value	Units	Description
Device	**TOP271EG**		**PI Device Name (Manual Overwrite).**
BVDSS	**725**	V	Drn-Src Bkdn Voltage
Current Limit Mode	**Default**		Device Current Limit Mode
OVP_FLAG	**NO**		Output Overvoltage Protection Enabled
PO	**295.07**	W	Total Output Power
VDRAIN Estimated	**578.93**	V	Estimated Drain Voltage
VDS	**10.00**	V	On state Drain to Source Voltage
FS	**132000**	Hz	Switching Frequency (at VMIN and Full Load)
KP	**0.655**		Continuous/Discontinuous Operating Ratio (at VMIN and Full Load)
DMAX	**0.569**		Maximum Duty Cycle (at VMIN and Full Load)
KI	**1.00**		Current Limit Reduction Factor (Manual Overwrite)
ILIMITEXT	**4.81**	A	Programmed Current Limit
ILIMITMIN	**4.808**	A	Minimum Current Limit
ILIMITMAX	**5.532**	A	Maximum Current Limit
PLIM_FLAG	**NO**		Enable Overload Power Limiting
IP	**6.219**	A	**Peak Primary Current (at VMIN and Full Load).**
IRMS	**3.280**	A	Primary RMS Current (at VMIN and Full Load)
RTH_DEVICE	**3.30**	°C/W	PI Device Heatsink Maximum Thermal Resistance
DEV_HSINK_TYPE	**Aluminum Extruded**		PI Device Heatsink Type
DEV_HSINK_PN	**530002B02500G**		PI Device (Extruded) Heatsink Part Number

Clamp Circuit

Var	Value	Units	Description
Clamp Type	**RCD + Zener Clamp**		Clamp Circuit Type
VCLAMP	**97.09**	V	Average Clamping Voltage
Estimated Clamp Loss	**5.395**	W	Clamp total power loss
VC_MARGIN	**143.16**	V	Clamp Voltage Safety Margin

Primary Bias Variables

Var	Value	Units	Description
VB	**12.0**	V	Bias Voltage
IB	**0.006**	A	Bias Current
PIVB	**60**	V	Bias Rectifier Maximum Peak Inverse Voltage
NB	**8**		Primary Bias Winding Number of Turns

Transformer Construction Parameters

Var	Value	Units	Description
Core Type	**ETD44/22/15**		Core Type
Core Material	**3F3**		Core Material
Bobbin Reference	**Generic, 9 pri. + 9 sec.**		Bobbin Reference
Bobbin Orientation	**Horizontal**		Bobbin type
Primary Pins	**6**		Number of Primary pins used
Secondary Pins	**2**		Number of Secondary pins used
USE_SHIELDS	**NO**		Use shield Windings
LP_nom	**165**	µH	Nominal Primary Inductance
LP_Tol	**10.0**	%	Primary Inductance Tolerance
NP	**63.4**		Calculated Primary Winding Total Number of Turns
NSM	**36**		Secondary Main Number of Turns
CMA	**492.76**	Cmils/A	Primary Winding Current Capacity
VOR	**100.00**	V	Reflected Output Voltage
BW	**29.50**	mm	Bobbin Winding Width
ML	**0.00**	mm	Safety Margin on Left Width
MR	**0.00**	mm	Safety Margin on Right Width
FF	**114.17**	%	**Actual Transformer Fit Factor. 100% signifies fully utilized winding window.**
AE	**173.00**	mm²	Core Cross Sectional Area
ALG	**37**	nH/T²	Gapped Core Specific Inductance
BM	**840**	Gauss	Maximum Flux Density
BP	**823**	Gauss	**Peak Flux Density.**
BAC	**275**	Gauss	AC Flux Density for Core Loss
LG	**5.838**	mm	**Estimated Gap Length.**
L_LKG	**2.47**	µH	Estimated primary leakage inductance
LSEC	**20**	nH	Secondary Trace Inductance

Primary Winding Section 1

Var	Value	Units	Description
NP1	**39**		Number of Primary Winding Turns in the First Section of Primary
Wire Size	**24**	AWG	Primary Winding - Wire Size
Winding Type	**Quadfilar (x4)**		Primary Winding - Number of Parallel Wire Strands
L	**3.00**		Primary Winding - Number of Layers
DC Copper Loss	**0.63**	W	Primary Section 1 DC Losses

Primary Winding Section 2

Var	Value	Units	Description

NP2	**25**		*Rounded (Integer) Number of Primary winding turns in the second section of primary*
Wire Size	**24**	*AWG*	*Primary Winding - Wire Size*
Winding Type	**Quadfilar (x4)**		*Primary Winding - Number of Parallel Wire Strands*
L2	**1.92**		*Primary Number of Layers in 2nd split winding*

Output 1

Var	***Value***	***Units***	***Description***
VO	**58.00**	*V*	*Typical Output Voltage*
IO	**5.00**	*A*	*Output Current*
VOUT_ACTUAL	**58.00**	*V*	*Actual Output Voltage*
NS	**36**		*Secondary Number of Turns*
Wire Size	**24**	*AWG*	*Wire size of secondary winding*
Winding Type	**Trifilar (x3)**		*Output winding number of parallel strands*
L_S_OUT	**2.75**		*Secondary Output Winding Layers*
DC Copper Loss	**2.42**	*W*	*Secondary DC Losses*
VD	**1.70**	*V*	*Output Winding Diode Forward Voltage Drop*
VD	**1.70**	*V*	*Output Winding Diode Forward Voltage Drop*
PIVS	**272.78**	*V*	*Output Rectifier Maximum Peak Inverse Voltage*
ISP	**10.772**	*A*	*Peak Secondary Current*
ISRMS	**4.939**	*A*	*Secondary RMS Current*
ISRMS_WINDING	**4.939**	*A*	*Secondary Winding RMS Current*
CMAS	**245**	*Cmils/A*	*Secondary Winding Current Capacity*
RTH_RECTIFIER	**6.35**	*°C/W*	*Output Rectifier Heatsink Maximum Thermal Resistance*
OR_HSINK_TYPE	**Aluminum Extruded**		*Output Rectifier Heatsink Type*
OR_HSINK_PN	**533402B02552G**		*Output Rectifier (Extruded) Heatsink Part Number*
CO	**0 x 1**	*µF*	*Output Capacitor - Capacitance*
IRIPPLE	**0.000**	*A*	*Output Capacitor - RMS Ripple Current*
Expected Lifetime	**8000**	*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*

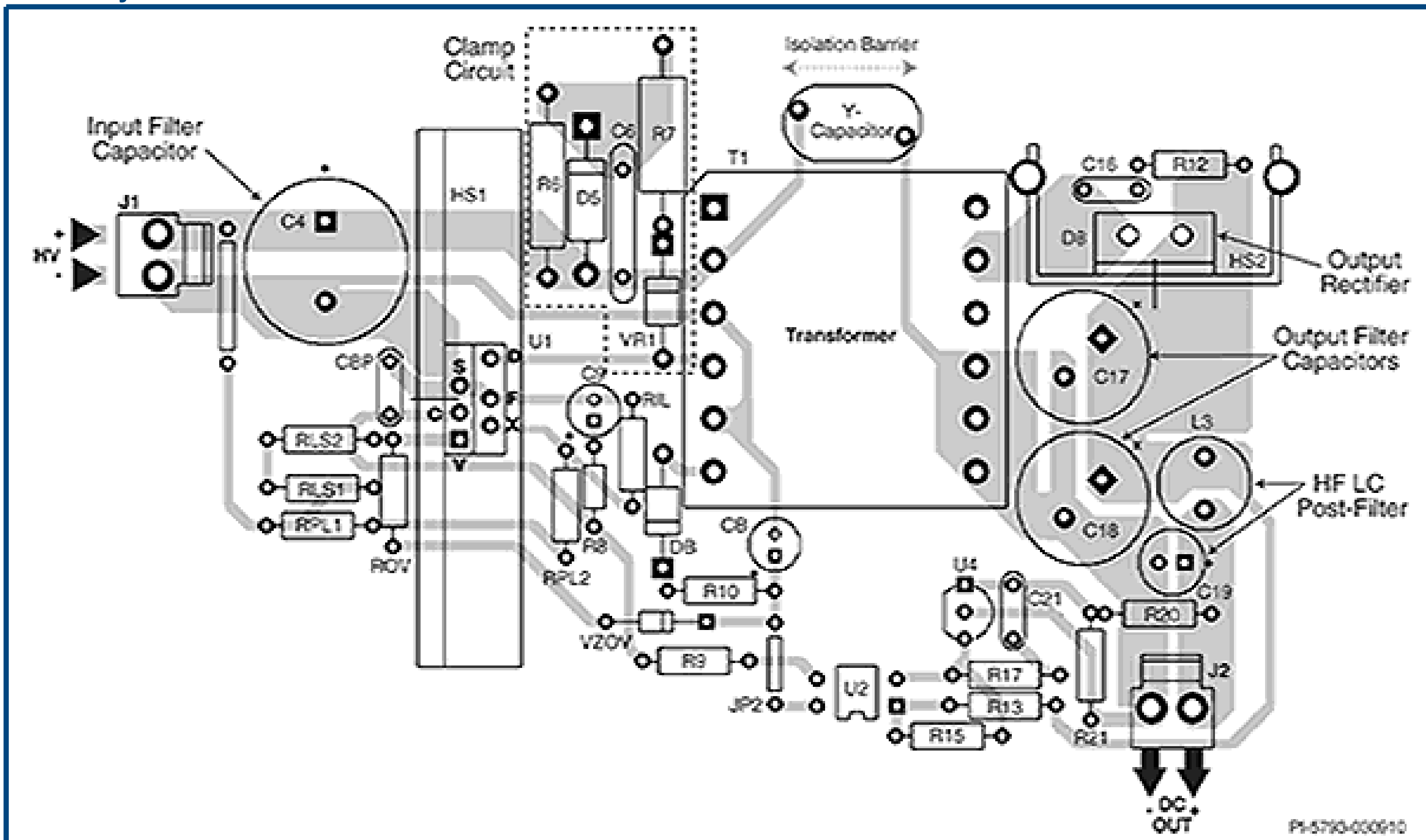
High output current Flyback design.

Use parallel low ESR output capacitors, reduce secondary ripple currents by reducing VOR and KP.

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



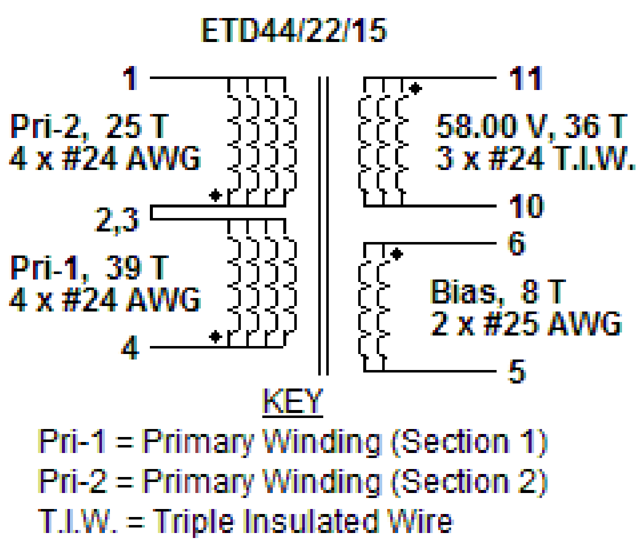
Click on the "Show me" icon to highlight relevant areas on the sample layout.		
	Description	*Show Me*
1	*Minimize loop area formed by drain, clamp and transformer*	
2	*Bias winding and bias capacitor are a power connection and therefore returned to Kelvin connection at SOURCE pin*	
3	*V and X pin node areas minimized, line sensing (R1 & R2) and power limiting (R3 & R4) close to device. Connections to V and X pin nodes should be away from noisy switching nodes (drain, clamp and bias)*	
4	*Place CONTROL pin decoupling capacitor directly across CONTROL and SOURCE pins*	
5	*Y capacitor connected between output RTN and B+*	
6	*Minimize loop area formed by secondary winding, the output rectifier and the output filter capacitor*	
7	*Kelvin connection at SOURCE pins: power and signal currents kept separate*	
8	*B+ connection of RLS or RPL resistor should be on input side of capacitor to prevent switching noise injection*	

Bill Of Materials

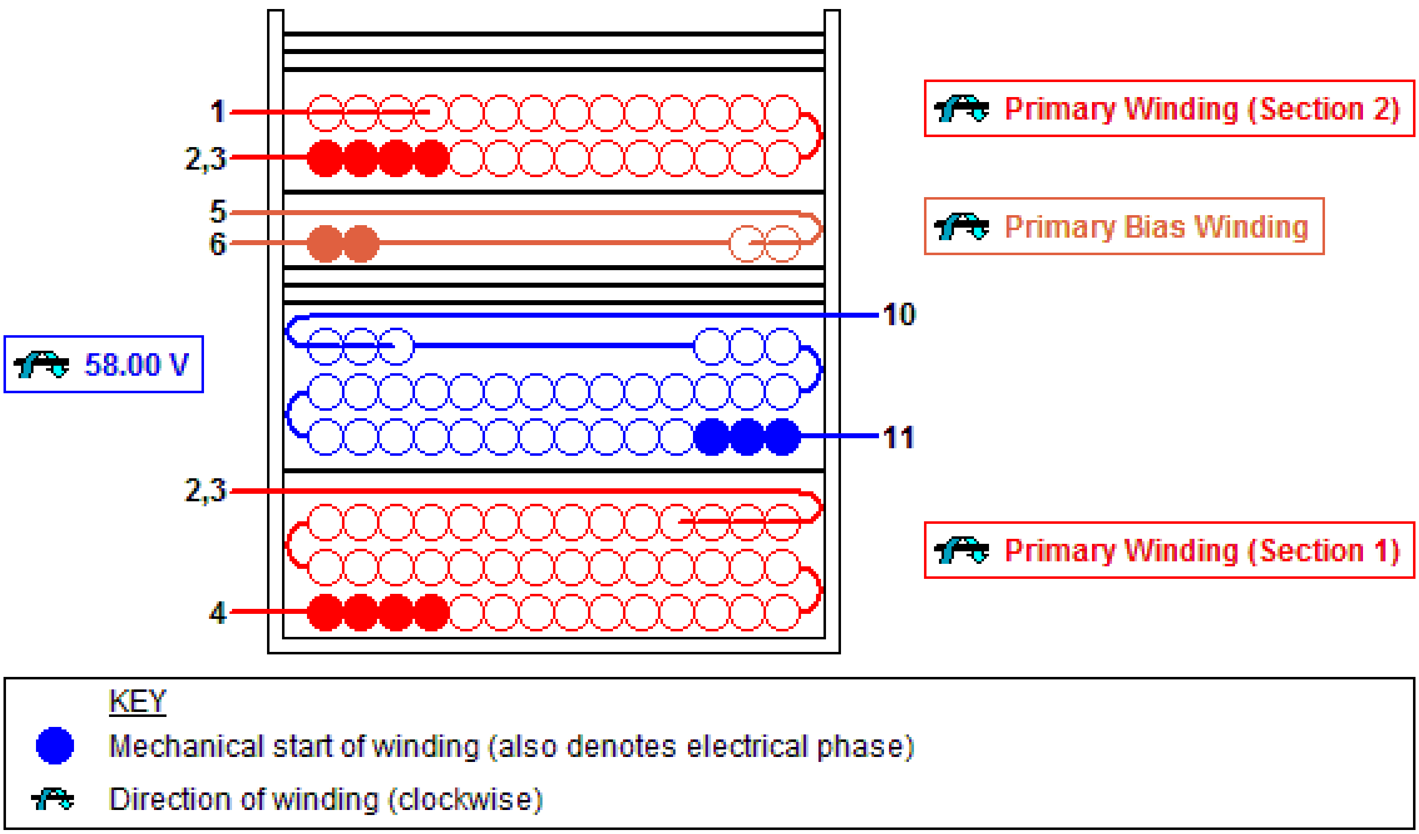
Item #	Quantity	Part Ref	Value	Description	Mfg	Mfg Part Number
1	1	BR1	PB66-BP	600 V, 6 A, Standard Recovery Bridge, PB-6	MCC	PB66-BP
2	1	C1	0.039 nF	0.039 nF, 380 VAC, Film, X Class	Vishay BCcomponents	VY1471K31Y5UQ63V0
3	1	C2	68 µF	68 µF, 450 V, High Voltage Al Electrolytic, (25 mm x 22 mm)	Epcos	B43644A5686M000
4	1	C3	15 nF	15 nF, 630 V, High Voltage Ceramic	TDK	CGA6L4NP02J153J160AA
5	1	C4	0.1 µF	0.1 µF, 16 V, Ceramic, X7R	AVX Corp	0603YC104K4T4A
6	1	C5	47 µF	47 µF, 10.0 V, Electrolytic, Gen Purpose, 1000 mΩ, (5.2 mm x 6.3 mm)	United Chemi-Con	EMVY100ADA470MF55G
7	1	C6	0.47 nF	0.47 nF, 440 VAC, Ceramic, Y Class	Vishay BCcomponents	VY2471K29Y5SS63V7
8	1	C7	18 pF	18 pF, 1 kV, High Voltage Ceramic	Murata	GRM31A7U3A180JW31D
9	1	C8	10 µF	10 µF, 50 V, Electrolytic, Gen Purpose, 1000 mΩ, (6.1 mm x 6.3 mm)	Rubycon	50TRV10M6.3X6.1
10	1	C9	0.47 µF	0.47 µF, 100 V, Electrolytic, Low ESR, 270 mΩ, (11 mm x 5 mm)	Nichicon	UVR2AR47MDD
11	1	C10	100 µF	100 µF, 100 V, Electrolytic, Low ESR, 170 mΩ, (16.5 mm x 16 mm)	Panasonic	EEE-FK2A101AM
12	1	C11	15 nF	15 nF, 50 V, Ceramic, X7R	Kemet	C0805C153K5RACTU
13	1	D1	Undefined	1000 V, 200 A, Fast Recovery, 75 ns, Undefined	-	Undefined
14	1	D2	FDLL4448	100 V, 0.3 A, Fast Recovery, 4 ns, SOD-80	ON Semiconductor	FDLL4448
15	1	D3	STTH20R04G-TR	400 V, 20 A, Ultrafast Recovery, 45 ns, D2PAK	STMicroelectronics	STTH20R04G-TR
16	1	F1	3 A	350 VAC, 3 A, Glass Cartridge, Time Lag Fuse	Bel Fuse Inc.	2JS 3-R
17	1	HS1	530002B02500G	2.6 °C/W TO-220. Heatsink for use with Device U1.	Aavid	530002B02500G
18	1	HS2	533402B02552G	5 °C/W TO-220. Heatsink for use with Rectifier D3.	Aavid	533402B02552G
19	1	L1	7 mH	7 mH, 3.5 A	Wurth Elektronik	744834407
20	1	L2	3.3 µH	3.3 µH, 7.6 A	Bourns Inc.	PM5022-3R3M-RC
21	5	R1, R2, R3, R4, R5	36 kΩ	36 kΩ, 5 %, 2 W, Metal Oxide Film	Generic	
22	1	R6	5.1 Ω	5.1 Ω, 5 %, 0.25 W, Thick Film	Generic	
23	2	R7, R8	4.02 MΩ	4.02 MΩ, 1 %, 0.25 W, Thick Film	Generic	
24	1	R9	6.8 Ω	6.8 Ω, 5 %, 0.125 W, Thick Film	Generic	
25	1	R10	560 Ω	560 Ω, 5 %, 0.5 W, Thick Film	Generic	
26	1	R11	40200 Ω	40200 Ω, 1 %, 0.125 W, Thick Film	Generic	
27	1	R12	1 kΩ	1 kΩ, 5 %, 0.125 W, Thick Film	Generic	
28	1	R13	255 kΩ	255 kΩ, 1 %, 0.125 W, Thick Film	Generic	
29	1	R14	11.5 kΩ	11.5 kΩ, 1 %, 0.125 W, Thick Film	Generic	
30	1	RT1	3.3 Ω	NTC Thermistor 3.3 Ω, 4.5 A	Murata	PRG18BC3R3MM1RB

31	1	T1	ETD44/22/15	3F3 Core Material See Transformer Construction's Materials List for complete information	Epcos	B66365-G-X127
32	1	U1	TOP271EG	TOPSwitch-JX, TOP271EG, eSIP-7C	Power Integrations	TOP271EG
33	1	U2	LTV-826S	Optocoupler LTV-826S , 80 V, CTR 300 - 600 %, 4-SMD	Liteon	LTV-826S
34	1	U3	LM431ACM/NOPB	2.495 V, Shunt Regulator IC, 2 %, SOIC-8	Texas Instruments	LM431ACM/NOPB
35	1	VR1	P6SMB120CA	120 V, 5 W, 5 %, DO-214AA, TVS	Vishay	P6SMB120CA

Electrical Diagram



Mechanical Diagram



Winding Instruction

Primary Winding (Section 1)

Start on pin(s) 4 and wind 39 turns (x 4 filar) of item [5]. in 3 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. At the end of 2nd layer, continue to wind the next layer from left to right. On the final layer, spread the winding evenly across entire bobbin. Finish this winding on pin(s) 2,3.

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

Secondary Winding

Start on pin(s) 11 and wind 36 turns (x 3 filar) of item [6]. Spread the winding evenly across entire bobbin. Winding direction is clockwise. Finish this winding on pin(s) 10.

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

Primary Bias Winding

Start on pin(s) 6 and wind 8 turns (x 2 filar) of item [7]. Winding direction is clockwise. Spread the winding evenly across entire bobbin. Finish this winding on pin(s) 5.

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

Primary Winding (Section 2)

Start on pin(s) 2,3 and wind 25 turns (x 4 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. At the end of 2nd layer, continue to wind the next layer from left to right. On the final layer, spread the winding evenly across entire bobbin. Finish this winding on pin(s) 1.

Add 3 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. Pins 2 and 3 are electrically shorted to each other on the PCB via a copper trace.
2. Use of a grounded flux-band around the core may improve the EMI performance.
3. For non margin wound transformers use triple insulated wire for all secondary windings.

Materials

Item	*Description*
[1]	**Core: ETD44/22/15, 3F3, gapped for ALG of 37 nH/T²**
[2]	**Bobbin: Generic, 9 pri. + 9 sec.**
[3]	**Barrier Tape: Polyester film [1 mil (25 µm) base thickness], 29.50 mm wide**
[4]	**Varnish**
[5]	**Magnet Wire: 24 AWG (0.55 mm), Solderable Double Coated**
[6]	**Triple Insulated Wire: 24 AWG (0.55 mm)**
[7]	**Magnet Wire: 25 AWG (0.45 mm), Solderable Double Coated**

Electrical Test Specifications

Parameter	*Condition*	*Spec*
Electrical Strength, VAC	**60 Hz 1 second, from pins 1,2,3,4,5,6 to pins 10,11.**	**3000**
Nominal Primary Inductance, µH	**Measured at 1 V pk-pk, typical switching frequency, between pin 1 to pin 4, with all other Windings open.**	**165**
Tolerance, ±%	**Tolerance of Primary Inductance**	**10.0**
Maximum Primary Leakage, µH	**Measured between Pin 1 to Pin 4, with all other Windings shorted.**	**2.47**

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.

	Description	Fix	Ref. #
	Peak primary current exceeds device current limit.	*Select larger PI device, increase minimum input voltage (VACMIN or VDCMIN), increase reflected output voltage (VOR), decrease KP, increase input capacitor (CIN) if applicable.*	*210*
	Transformer windings do not fit in the winding window	*Use a larger transformer*	*712*
	Gap length too big.	*Decrease transformer size, decrease secondary turns (NS), decrease KP.*	*217*
	PI device may be too small for continuous output power.	*Select larger PI device.*	*207*
	Drain voltage close to BVDSS at maximum OV threshold.	*Verify BVDSS during line surge, decrease VUVON_MAX or reduce VOR.*	*237*
	Resistor value of RF2 is too large and may not provide enough bias for error amplifier.	*Decrease RF2*	*606*
	Peak flux density is low but design will work.	*Choose smaller core size, decrease secondary turns (NS), decrease reflected output voltage (VOR), decrease KP.*	*220*