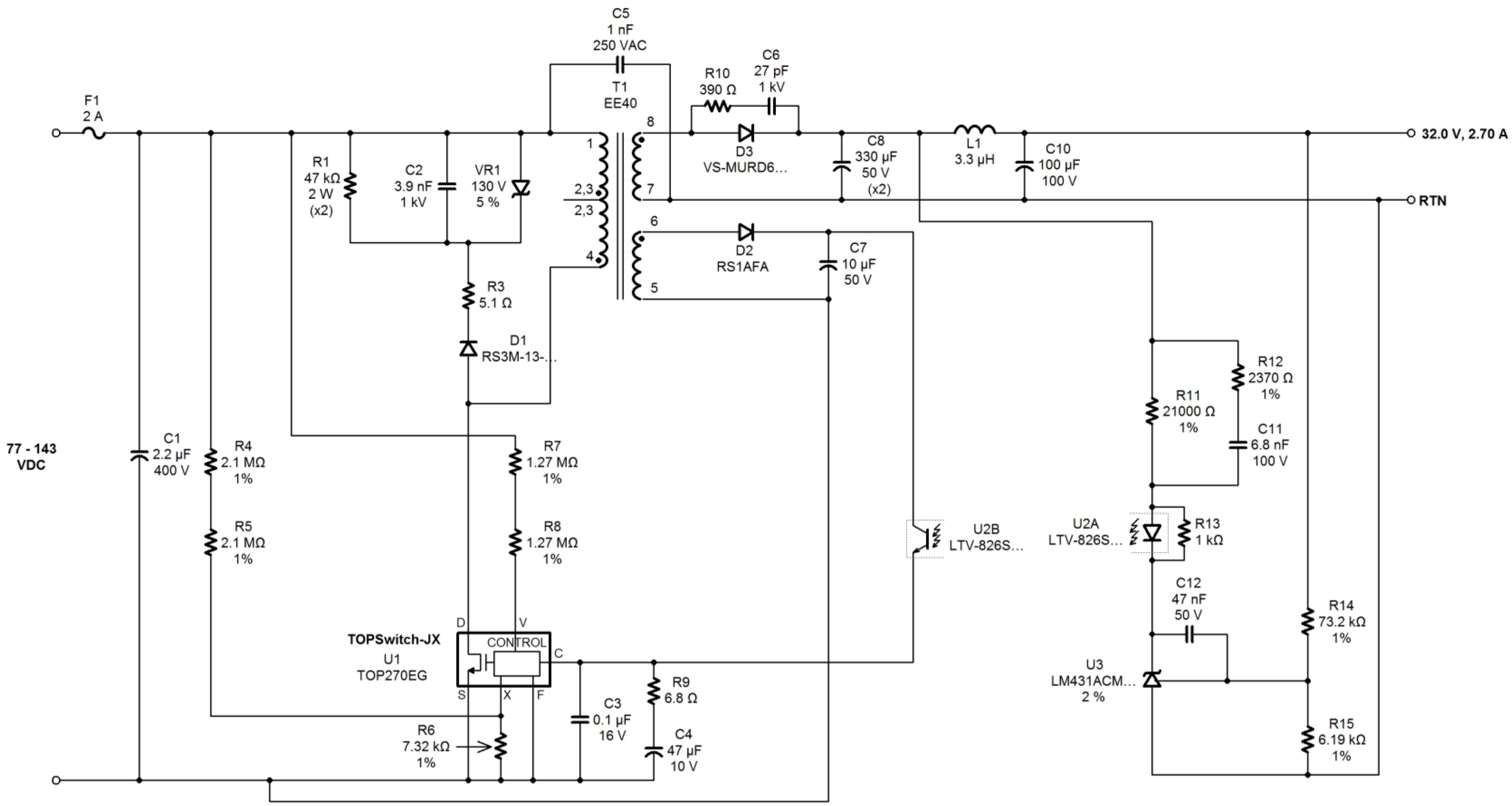


Schematic components that have been frozen by the user will appear with blue reference designators.

Power Supply Input

Var	Value	Units	Description
VDCMIN	77	V	Minimum Input DC Voltage (Manual Overwrite)
VDCMAX	143	V	Maximum Input DC Voltage (Manual Overwrite)
Z	0.63		Loss Allocation Factor
η	81.0	%	Efficiency Estimate (Target)

Input Section

Var	Value	Units	Description
Fuse	2.00	A	Input Fuse Rated Current
IAVG	1.39	A	Average Diode Bridge Current (DC Input Current)

Device Variables

Var	Value	Units	Description
Device	TOP270EG		PI Device Name
BVDSS	725	V	Drn-Src Bkdn Voltage
Current Limit Mode	Default		Device Current Limit Mode
OVP_FLAG	NO		Output Overvoltage Protection Enabled
PO	86.47	W	Total Output Power
VDRAIN Estimated	344.06	V	Estimated Drain Voltage
VDS	8.44	V	On state Drain to Source Voltage
FS	132000	Hz	Switching Frequency (at VMIN and Full Load)
KP	0.500		Continuous/Discontinuous Operating Ratio (at VMIN and Full Load)
DMAX	0.598		Maximum Duty Cycle (at VMIN and Full Load)
KI	1.00		Current Limit Reduction Factor
ILIMITEXT	3.91	A	Programmed Current Limit
ILIMITMIN	3.906	A	Minimum Current Limit
ILIMITMAX	4.494	A	Maximum Current Limit
RPL	2.10	MΩ	Power Limit Resistor
RPL2	2.10	MΩ	2nd Power Limit Resistor
PLIM_FLAG	YES		Enable Overload Power Limiting
IP	3.091	A	Peak Primary Current (at VMIN and Full Load)
IRMS	1.826	A	Primary RMS Current (at VMIN and Full Load)
RTH_DEVICE	8.87	°C/W	PI Device Heatsink Maximum Thermal Resistance
DEV_HSINK_TYPE	Aluminum Extruded		PI Device Heatsink Type
DEV_HSINK_PN	7025BG		PI Device (Extruded) Heatsink Part Number

Clamp Circuit

Var	Value	Units	Description
Clamp Type	RCD + Zener Clamp		Clamp Circuit Type
VCLAMP	99.01	V	Average Clamping Voltage
Estimated Clamp Loss	1.720	W	Clamp total power loss
VC_MARGIN	379.96	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	**35**	*V*	*Bias Rectifier Maximum Peak Inverse Voltage*
NB	**3**		*Primary Bias Winding Number of Turns*

Transformer Construction Parameters

Var	***Value***	***Units***	***Description***
Core Type	**EE40**		*Core Type*
Core Material	**3F3**		*Core Material*
Bobbin Reference	**Generic, 6 pri. + 6 sec.**		*Bobbin Reference*
Bobbin Orientation	**Vertical**		*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	**224**	*µH*	*Nominal Primary Inductance*
LP_Tol	**10.0**	*%*	*Primary Inductance Tolerance*
NP	**18.4**		*Calculated Primary Winding Total Number of Turns*
NSM	**6**		*Secondary Main Number of Turns*
CMA	**663.92**	*Cmils/A*	*Primary Winding Current Capacity*
VOR	**102.04**	*V*	*Reflected Output Voltage*
BW	**17.30**	*mm*	*Bobbin Winding Width*
ML	**0.00**	*mm*	*Safety Margin on Left Width*
MR	**0.00**	*mm*	*Safety Margin on Right Width*
FF	**67.50**	*%*	*Actual Transformer Fit Factor. 100% signifies fully utilized winding window*
AE	**148.00**	*mm²*	*Core Cross Sectional Area*
ALG	**593**	*nH/T²*	*Gapped Core Specific Inductance*
BM	**2285**	*Gauss*	*Maximum Flux Density*
BP	**3663**	*Gauss*	*Peak Flux Density*
BAC	**571**	*Gauss*	*AC Flux Density for Core Loss*
LG	**0.275**	*mm*	*Estimated Gap Length*
L_LKG	**3.36**	*µH*	*Estimated primary leakage inductance*
LSEC	**20**	*nH*	*Secondary Trace Inductance*

Primary Winding Section 1

Var	***Value***	***Units***	***Description***
NP1	**10**		*Number of Primary Winding Turns in the First Section of Primary*
Wire Size	**24**	*AWG*	*Primary Winding - Wire Size*
Winding Type	**Trifilar (x3)**		*Primary Winding - Number of Parallel Wire Strands*
L	**0.98**		*Primary Winding - Number of Layers*
DC Copper Loss	**0.07**	*W*	*Primary Section 1 DC Losses*

Primary Winding Section 2

Var	***Value***	***Units***	***Description***
NP2	**9**		*Rounded (Integer) Number of Primary winding turns in the second section of primary*
Wire Size	**24**	*AWG*	*Primary Winding - Wire Size*
Winding Type	**Trifilar (x3)**		*Primary Winding - Number of Parallel Wire Strands*
L2	**0.88**		*Primary Number of Layers in 2nd split winding*

Output 1

Var	Value	Units	Description
VO	**32.00**	V	Typical Output Voltage
IO	**2.70**	A	Output Current
VOUT_ACTUAL	**32.00**	V	Actual Output Voltage
NS	**6**		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	**0.78**		Secondary Output Winding Layers
DC Copper Loss	**0.31**	W	Secondary DC Losses
VD	**1.20**	V	Output Winding Diode Forward Voltage Drop
VD	**1.20**	V	Output Winding Diode Forward Voltage Drop
PIVS	**77.16**	V	Output Rectifier Maximum Peak Inverse Voltage
ISP	**9.491**	A	Peak Secondary Current
ISRMS	**4.595**	A	Secondary RMS Current
ISRMS_WINDING	**4.595**	A	Secondary Winding RMS Current
CMAS	**264**	Cmils/A	Secondary Winding Current Capacity
RTH_RECTIFIER	**16.17**	°C/W	Output Rectifier Heatsink Maximum Thermal Resistance
OR_HSINK_TYPE	**Custom Aluminum**		Output Rectifier Heatsink Type
OR_HSINK_AREA	**5041**	mm^2	Output Rectifier Heatsink Area
CO	**330 x 2**	µF	Output Capacitor - Capacitance
IRIPPLE	**3.719**	A	Output Capacitor - RMS Ripple Current
Expected Lifetime	**32255**	hr	Output Capacitor - Expected Lifetime

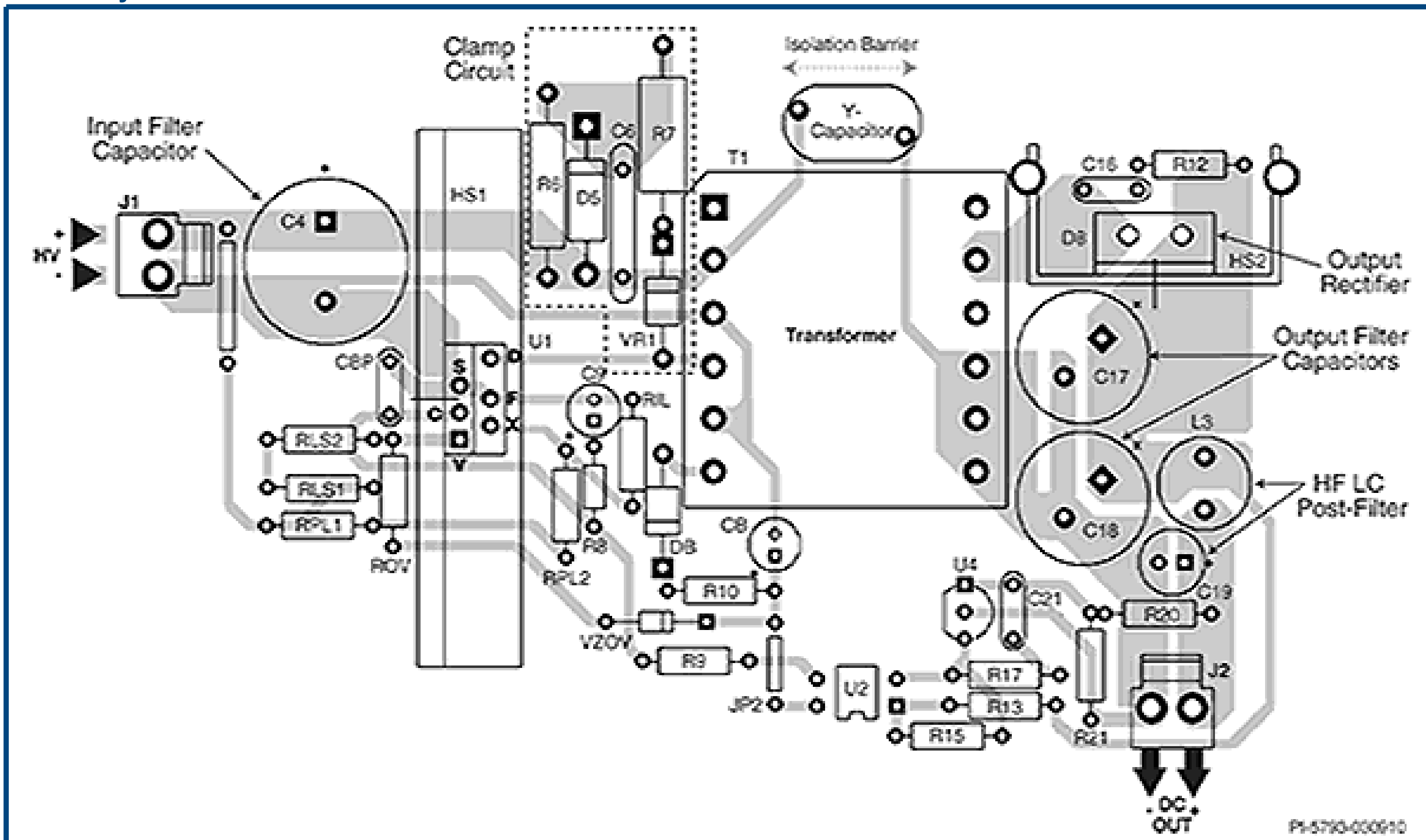
Feedback Circuit

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	**YES**		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.

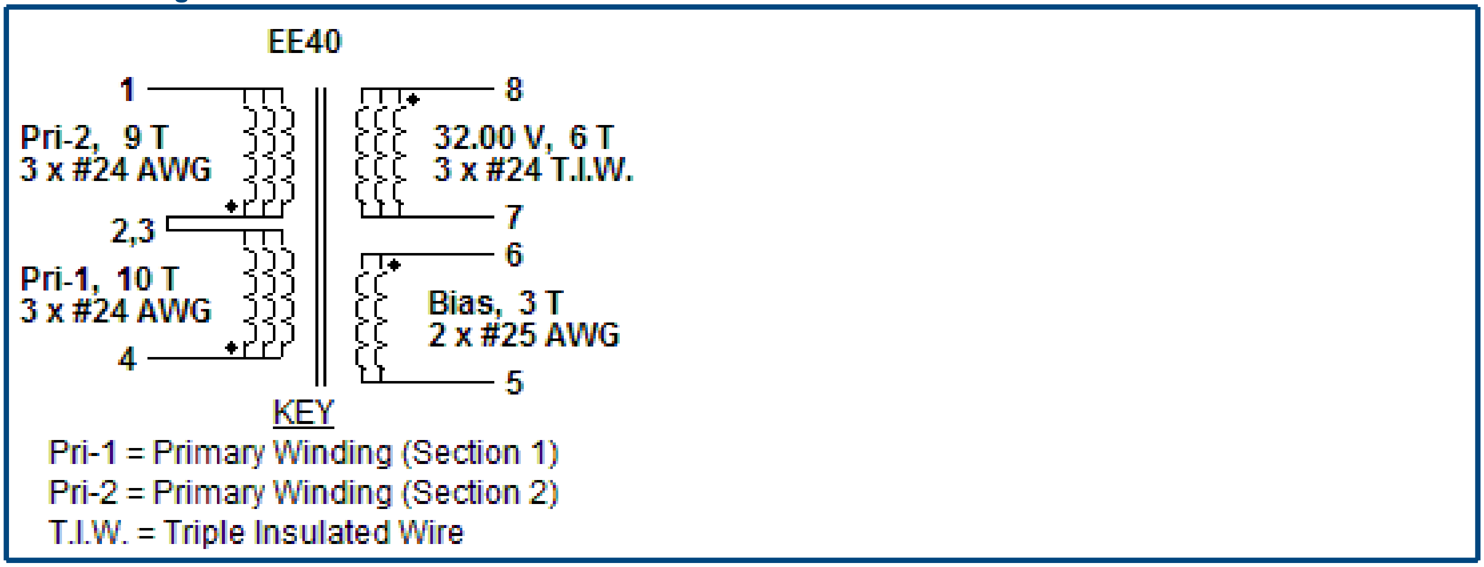
	Description	*Show Me*
1	*Minimize loop area formed by drain, clamp and transformer*	
2	*Bias winding and bias capacitor are a power connection and therefore returned to Kelvin connection at SOURCE pin*	
3	*V and X pin node areas minimized, line sensing (R1 & R2) and power limiting (R3 & R4) close to 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

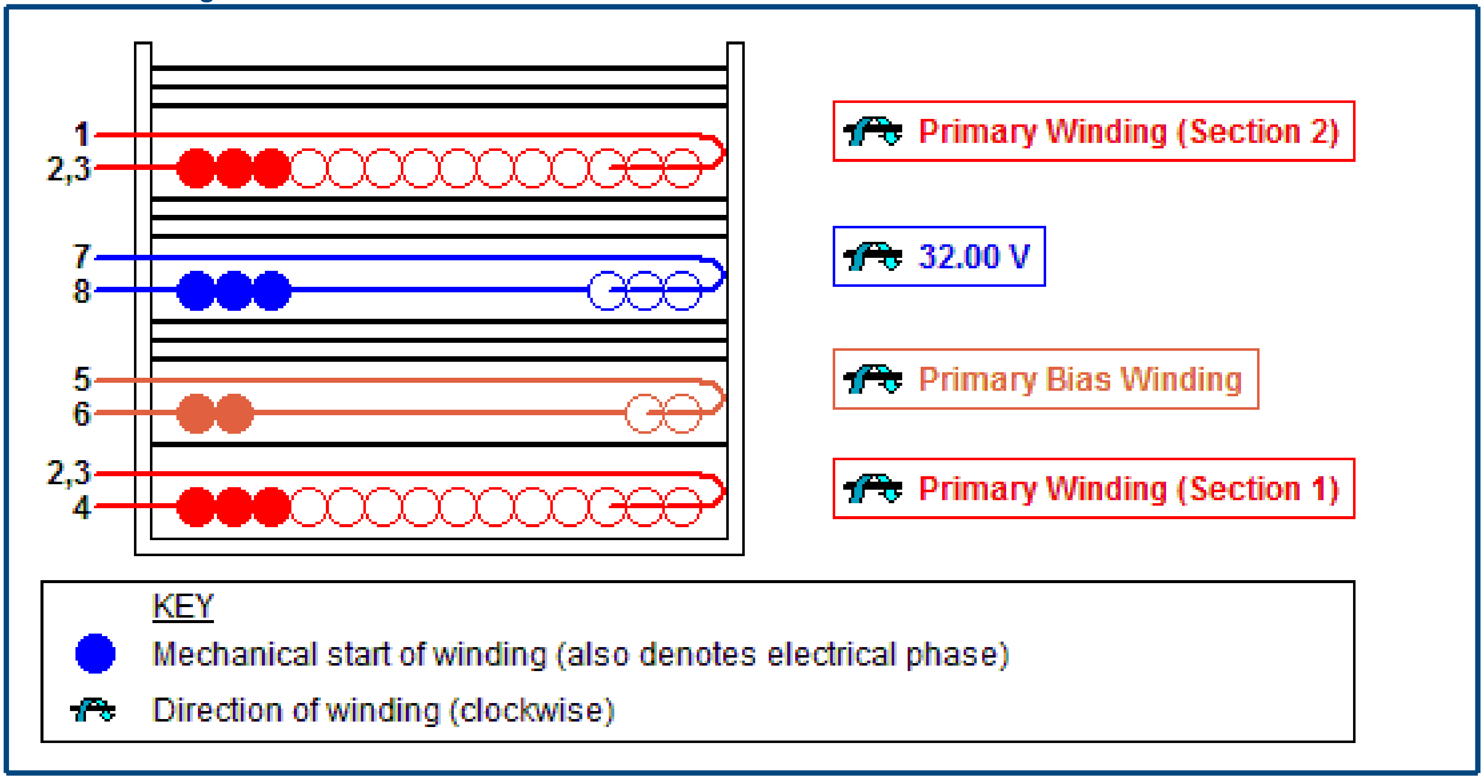
Item #	Quantity	Part Ref	Value	Description	Mfg	Mfg Part Number
1	1	C1	2.2 µF	2.2 µF, 400 V, High Voltage Al Electrolytic, (11.5 mm x 8 mm)	Nichicon	ULD2G2R2MPD1TD
2	1	C2	3.9 nF	3.9 nF, 1 kV, High Voltage Ceramic	Kemet	C1206C392KDRAC7800
3	1	C3	0.1 µF	0.1 µF, 16 V, Ceramic, X7R	AVX Corp	0603YC104K4T4A
4	1	C4	47 µF	47 µF, 10.0 V, Electrolytic, Gen Purpose, 1000 mΩ, (5.2 mm x 6.3 mm)	United Chemi-Con	EMVY100ADA470MF55G
5	1	C5	1 nF	1 nF, 250 VAC, Ceramic, Y Class	Murata	GA342DR7GF102KW02L
6	1	C6	27 pF	27 pF, 1 kV, High Voltage Ceramic	Murata	GRM31A5C3A270JW01D
7	1	C7	10 µF	10 µF, 50 V, Electrolytic, Gen Purpose, 1000 mΩ, (6.1 mm x 6.3 mm)	Rubycon	50TRV10M6.3X6.1
8	2	C8, C9	330 µF	330 µF, 50 V, Electrolytic, Super Low ESR, 28 mΩ, (25 mm x 10 mm)	United Chemi-Con	EKZE500ELL331MJ25S
9	1	C10	100 µF	100 µF, 100 V, Electrolytic, Low ESR, 170 mΩ, (16.5 mm x 16 mm)	Panasonic	EEE-FK2A101AM
10	1	C11	6.8 nF	6.8 nF, 100 V, Ceramic, X7R	AVX Corp	12061C682KAT2A
11	1	C12	47 nF	47 nF, 50 V, Ceramic, X7R	Kemet	C0805C473K5RACTU
12	1	D1	RS3M-13-F	1000 V, 3 A, Fast Recovery, 500 ns, DO-214AB	Diodes Inc.	RS3M-13-F
13	1	D2	RS1AFA	50 V, 1 A, Fast Recovery, 200 ns, SOD-123FA	ON Semiconductor	RS1AFA
14	1	D3	VS-MURD620CT-M3	200 V, 6 A, Ultrafast Recovery, 35 ns, D-PAK	Vishay	VS-MURD620CT-M3
15	1	F1	2 A	350 VAC, 2 A, Glass Cartridge, Time Lag Fuse	Bel Fuse Inc.	2JS 2-R
16	1	HS1	7025BG	6.8 °C/W TO-220. Heatsink for use with Device U1.	Aavid	7025BG
17	1	HS2		126 mm x 20 mm. Aluminum Alloy (3003 OR 5052), 1.6 mm thickness. Heatsink for use with Rectifier D3.	Custom	
18	1	L1	3.3 µH	3.3 µH, 3.94 A	Eaton	DR74-3R3-R
19	2	R1, R2	47 kΩ	47 kΩ, 5 %, 2 W, Metal Oxide Film	Generic	
20	1	R3	5.1 Ω	5.1 Ω, 5 %, 0.25 W, Thick Film	Generic	
21	2	R4, R5	2.1 MΩ	2.1 MΩ, 1 %, 0.25 W, Thick Film	Generic	
22	1	R6	7.32 kΩ	7.32 kΩ, 1 %, 0.125 W, Thick Film	Generic	
23	2	R7, R8	1.27 MΩ	1.27 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	390 Ω	390 Ω, 5 %, 0.25 W, Thick Film	Generic	
26	1	R11	21000 Ω	21000 Ω, 1 %, 0.125 W, Thick Film	Generic	
27	1	R12	2370 Ω	2370 Ω, 1 %, 0.125 W, Thick Film	Generic	
28	1	R13	1 kΩ	1 kΩ, 5 %, 0.125 W, Thick Film	Generic	
29	1	R14	73.2 kΩ	73.2 kΩ, 1 %, 0.125 W, Thick Film	Generic	
30	1	R15	6.19 kΩ	6.19 kΩ, 1 %, 0.125 W, Thick Film	Generic	
31	1	T1	EE40	3F3 Core Material See Transformer Construction's Materials List for complete information	TDK	PC40EI40-Z

32	*1*	*U1*	*TOP270EG*	*TOPSwitch-JX, TOP270EG, eSIP-7C*	*Power Integrations*	*TOP270EG*
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*	*P6SMB130CA-E3/52*	*130 V, 5 W, 5 %, DO-214AA, TVS*	*Vishay*	*P6SMB130CA-E3/52*

Electrical Diagram



Mechanical Diagram



Winding Instruction

Primary Winding (Section 1)

Start on pin(s) 4 and wind 10 turns (x 3 filar) of item [5]. in 1 layer(s) from left to right. Winding direction is clockwise. 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.

Primary Bias Winding

Start on pin(s) 6 and wind 3 turns (x 2 filar) of item [6]. Winding direction is clockwise. Spread the winding evenly across entire bobbin. Finish this winding on pin(s) 5.

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

Secondary Winding

Start on pin(s) 8 and wind 6 turns (x 3 filar) of item [7]. Spread the winding evenly across entire bobbin. Winding direction is clockwise. Finish this winding on pin(s) 7.

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

Primary Winding (Section 2)

Start on pin(s) 2,3 and wind 9 turns (x 3 filar) of item [5]. in 1 layer(s) from left to right. Winding direction is clockwise. 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: EE40, 3F3, gapped for ALG of 593 nH/T²**
[2]	**Bobbin: Generic, 6 pri. + 6 sec.**
[3]	**Barrier Tape: Polyester film [1 mil (25 µm) base thickness], 17.30 mm wide**
[4]	**Varnish**
[5]	**Magnet Wire: 24 AWG, Solderable Double Coated**
[6]	**Magnet Wire: 25 AWG, Solderable Double Coated**
[7]	**Triple Insulated Wire: 24 AWG**

Electrical Test Specifications

Parameter	*Condition*	*Spec*
Electrical Strength, VAC	**60 Hz 1 second, from pins 1,2,3,4,5,6 to pins 7,8.**	**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.**	**224**
Tolerance, ±%	**Tolerance of Primary Inductance**	**10.0**
Maximum Primary Leakage, µH	**Measured between Pin 1 to Pin 4, with all other Windings shorted.**	**3.36**

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.