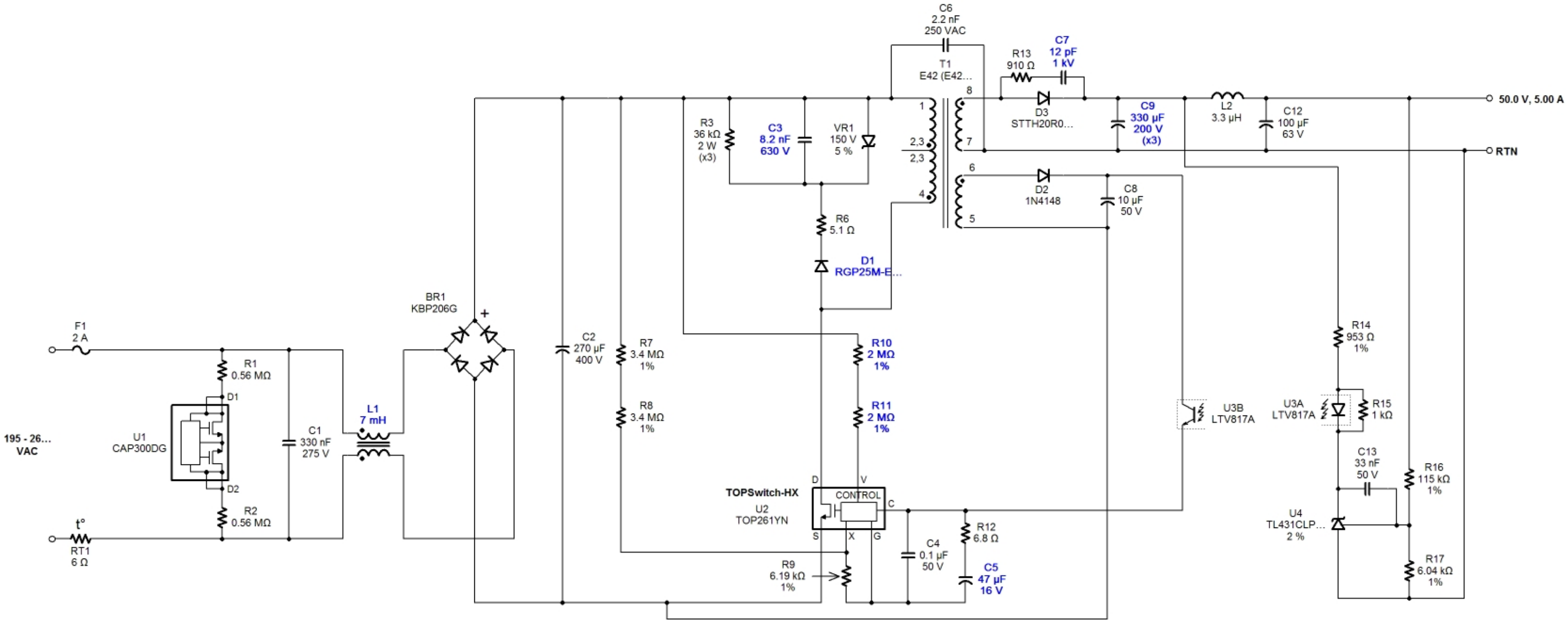


Schematic components that have been frozen by the user will appear with blue reference designators.

Power Supply Input

Var	Value	Units	Description
VACMIN	195	V	Minimum Input AC Voltage
VACMAX	265	V	Maximum Input AC Voltage
FL	50	Hz	Line Frequency
TC	1.69	ms	Input Rectifier Conduction Time
Z	0.63		Loss Allocation Factor
η	81.0	%	Efficiency Estimate (Target)
VMIN	238.8	V	Minimum DC Input Voltage
VMAX	374.8	V	Maximum DC Input Voltage

Input Section

Var	Value	Units	Description
Fuse	2.00	A	Input Fuse Rated Current
IAVG	1.29	A	Average Diode Bridge Current (DC Input Current)
Thermistor	6.00	Ω	Input Thermistor

Device Variables

Var	Value	Units	Description
Device	TOP261YN		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	250.07	W	Total Continuous Output Power
PO_PEAK	250.07	W	Total Peak Output Power
PO_AVG	250.07	W	Total Average Output Power
VDRAIN Estimated	592.54	V	Estimated Drain Voltage
VDS	12.69	V	On state Drain to Source Voltage
FS	66000	Hz	Switching Frequency (at VMIN and Full Load)
KP	0.767		Continuous/Discontinuous Operating Ratio (at VMIN and Full Load)
DMAX	0.347		Maximum Duty Cycle (at VMIN and Full Load)
KI	0.94		Current Limit Reduction Factor
ILIMITEXT	6.47	A	Programmed Current Limit
ILIMITMIN	6.882	A	Minimum Current Limit
ILIMITMAX	7.918	A	Maximum Current Limit
RPL	3.40	MΩ	Power Limit Resistor
RPL2	3.40	MΩ	2nd Power Limit Resistor
PLIM_FLAG	YES		Enable Overload Power Limiting
IP	6.050	A	Peak Primary Current (at VMIN and Full Load)
IRMS	2.333	A	Primary RMS Current (at VMIN and Full Load)
RTH_DEVICE	6.18	°C/W	PI Device Heatsink Maximum Thermal Resistance
DEV_HSINK_TYPE	Aluminum Extruded		PI Device Heatsink Type

DEV_HSINK_PN	**532702B02500G**		*PI Device (Extruded) Heatsink Part Number*

Clamp Circuit

Var	*Value*	*Units*	*Description*
Clamp Type	**RCD + Zener Clamp**		*Clamp Circuit Type*
VCLAMP	**97.77**	*V*	*Average Clamping Voltage*
Estimated Clamp Loss	**3.952**	*W*	*Clamp total power loss*
VC_MARGIN	**105.23**	*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	**69**	*V*	*Bias Rectifier Maximum Peak Inverse Voltage*
NB	**3**		*Primary Bias Winding Number of Turns*

Transformer Construction Parameters

Var	*Value*	*Units*	*Description*
Core Type	**E42 (E42/21/20-3F3)**		*Core Type*
Core Material	**3F3**		*Core Material*
Bobbin Reference	**Generic, 6 pri. + 6 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	**268**	*µH*	*Nominal Primary Inductance*
LP_Tol	**10.0**	*%*	*Primary Inductance Tolerance*
NP	**20.9**		*Calculated Primary Winding Total Number of Turns*
NSM	**9**		*Secondary Main Number of Turns*
CMA	**519.54**	*Cmils/A*	*Primary Winding Current Capacity*
VOR	**120.00**	*V*	*Reflected Output Voltage (Manual Overwrite)*
BW	**26.30**	*mm*	*Bobbin Winding Width*
ML	**0.00**	*mm*	*Safety Margin on Left Width*
MR	**0.00**	*mm*	*Safety Margin on Right Width*
FF	**33.40**	*%*	*Actual Transformer Fit Factor. 100% signifies fully utilized winding window*
AE	**233.00**	*mm²*	*Core Cross Sectional Area*
ALG	**553**	*nH/T²*	*Gapped Core Specific Inductance*
BM	**3001**	*Gauss*	*Maximum Flux Density*
BP	**3695**	*Gauss*	*Peak Flux Density*
BAC	**1151**	*Gauss*	*AC Flux Density for Core Loss*
LG	**0.466**	*mm*	*Estimated Gap Length*
L_LKG	**4.02**	*µH*	*Estimated primary leakage inductance*
LSEC	**20**	*nH*	*Secondary Trace Inductance*

Primary Winding Section 1

Var	Value	Units	Description
NP1	**11**		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	**0.71**		Primary Winding - Number of Layers
DC Copper Loss	**0.16**	W	Primary Section 1 DC Losses

Primary Winding Section 2

Var	Value	Units	Description
NP2	**10**		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	**0.65**		Primary Number of Layers in 2nd split winding

Output 1

Var	Value	Units	Description
VO	**50.00**	V	Typical Output Voltage
IO	**5.00**	A	Output Current (Continuous Load)
IO_PEAK	**5.00**	A	Output Current at Peak Load
VOUT_ACTUAL	**50.00**	V	Actual Output Voltage
NS	**9**		Secondary Number of Turns
Foil Thickness	**2**	mil	Wire size of secondary winding
Winding Type	**Foil**		Output winding number of parallel strands
L_S_OUT	**9.00**		Secondary Output Winding Layers
DC Copper Loss	**0.23**	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	**210.61**	V	Output Rectifier Maximum Peak Inverse Voltage
ISP	**14.038**	A	Peak Secondary Current
ISRMS	**7.431**	A	Secondary RMS Current
ISRMS_WINDING	**7.431**	A	Secondary Winding RMS Current
CDS_FOIL	**5.56**	A/mm^2	Secondary Winding Current Density
RTH_RECTIFIER	**6.41**	°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	**330 x 3**	μF	Output Capacitor - Capacitance (Manual Overwrite)
IRIPPLE	**5.498**	A	Output Capacitor - RMS Ripple Current
Expected Lifetime	**113391**	hr	Output Capacitor - Expected Lifetime (Manual Overwrite)

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*

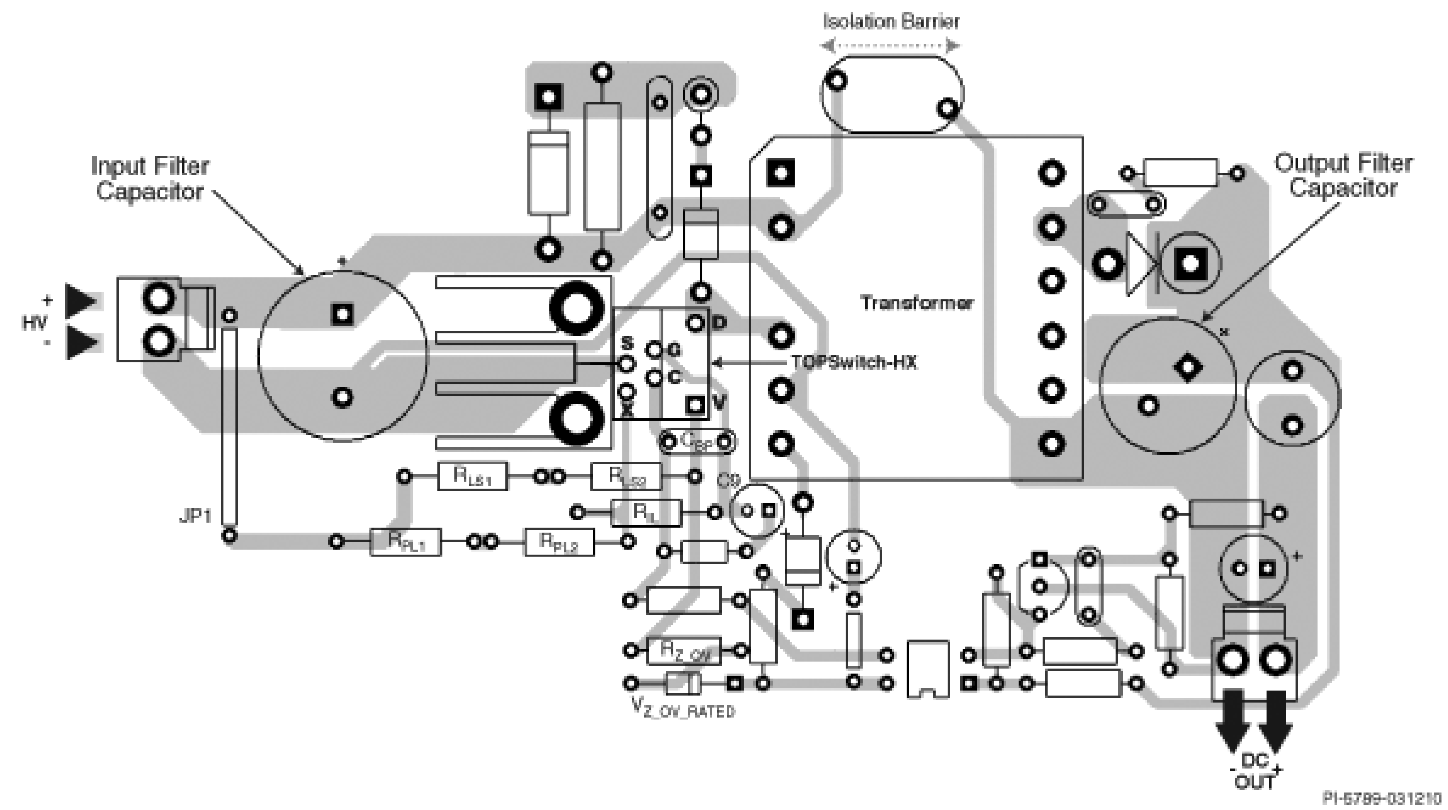
High output current Flyback design.

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.

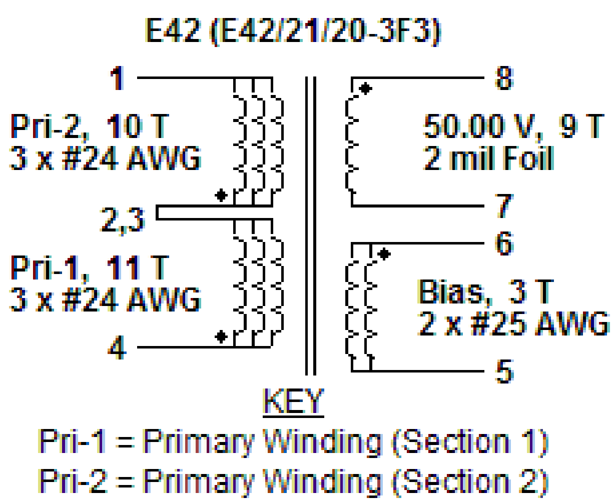
	Description	*Show Me*
1	*Minimize loop area formed by drain, clamp and transformer*	
2	*Bias winding and bias capacitor are a power connection and therefore returned to Kelvin connection at SOURCE pin*	
3	*V and X pin node areas minimized, line sensing (R1 & R2) and power limiting (R3 & R4) close to 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	*Do not connect the SOURCE (S) and GND (G) pins on the PCB. The pins are internally connected. Use S pin to return power currents and the G pin as ground for control signals*	
8	*B+ connection of RLS or RPL resistor should be on input side of capacitor to prevent switching noise injection*	

Bill Of Materials

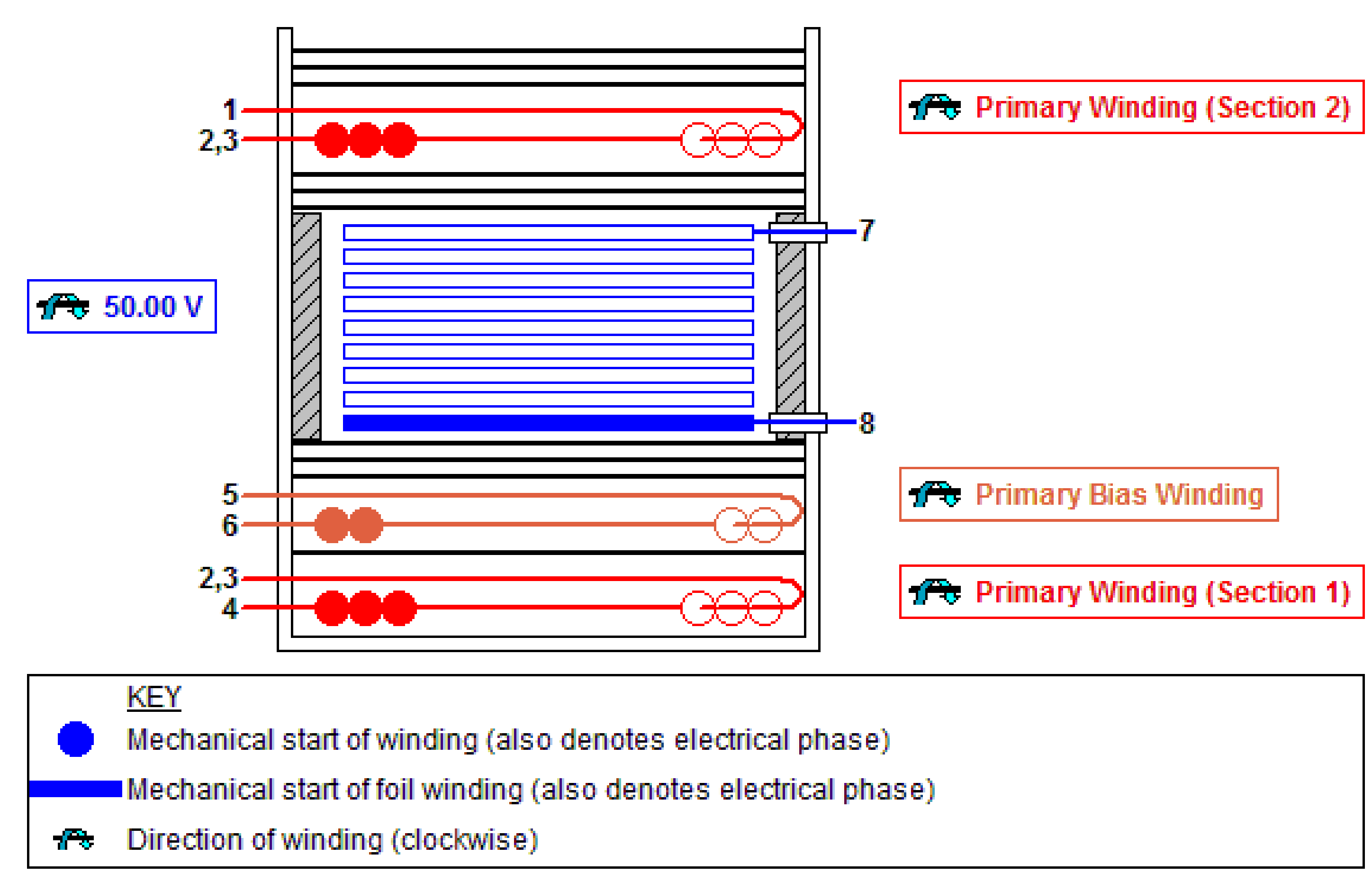
Item #	Quantity	Part Ref	Value	Description	Mfg	Mfg Part Number
1	1	BR1	KBP206G	600 V, 2 A, Standard Recovery Bridge, KBP	Diodes Inc.	KBP206G
2	1	C1	330 nF	330 nF, 275 V, Film, X Class	Panasonic	ECQ-UAAF334K
3	1	C2	270 µF	270 µF, 400 V, High Voltage Al Electrolytic, (45 mm x 25 mm)	Nichicon	LGU2G271MELA
4	1	C3	8.2 nF	8.2 nF, 630 V, High Voltage Ceramic	TDK	FA26C0G2J822JNU06
5	1	C4	0.1 µF	0.1 µF, 50 V, Ceramic, X7R	Kemet	C322C104K5R5TA
6	1	C5	47 µF	47 µF, 16 V, Electrolytic, Gen Purpose, 800 mΩ, (11 mm x 5 mm)	Panasonic	EEU-FC1C470
7	1	C6	2.2 nF	2.2 nF, 250 VAC, Ceramic, Y Class	Vishay Cera-Mite	440LD22-R
8	1	C7	12 pF	12 pF, 1 kV, High Voltage Ceramic	Vishay	S120K25SL0N63L6R
9	1	C8	10 µF	10 µF, 50 V, Electrolytic, Gen Purpose, 1050 mΩ, (11.5 mm x 5 mm)	Panasonic	ECA-1HHG100
10	3	C9, C10, C11	330 µF	330 µF, 200 V, Electrolytic, Low ESR, 600 mΩ, (40 mm x 18 mm)	Panasonic	EEUEE2D331
11	1	C12	100 µF	100 µF, 63 V, Electrolytic, Low ESR, 255 mΩ, (12.5 mm x 10 mm)	United Chemi-Con	ELXZ630ELL101MJC5S
12	1	C13	33 nF	33 nF, 50 V, Ceramic, X7R	Kemet	C315C333K5R5TA
13	1	D1	RGP25M-E3/54	1000 V, 2.5 A, Fast Recovery, 500 ns, DO-201AD	Vishay	RGP25M-E3/54
14	1	D2	1N4148	100 V, 0.15 A, Fast Recovery, 8 ns, DO-35	Vishay	1N4148
15	1	D3	STTH20R04	400 V, 20 A, Ultrafast Recovery, 45 ns, TO-220AC	STMicroelectronics	STTH20R04
16	1	F1	2 A	250 VAC, 2 A, Radial TR5, Time Lag Fuse	Littelfuse / Wickmann(R)	37412000410
17	1	HS1	532702B02500G	4.8 °C/W TO-220. Heatsink for use with Device U2.	Aavid	532702B02500G
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, 5.5 A	Bourns Inc.	RL622-3R3K-RC
21	2	R1, R2	0.56 MΩ	0.56 MΩ, 5 %, 0.25 W, Carbon Film	Generic	
22	3	R3, R4, R5	36 kΩ	36 kΩ, 5 %, 2 W, Metal Oxide Film	Generic	
23	1	R6	5.1 Ω	5.1 Ω, 5 %, 0.25 W, Carbon Film	Generic	
24	2	R7, R8	3.4 MΩ	3.4 MΩ, 1 %, 0.25 W, Metal Film	Generic	
25	1	R9	6.19 kΩ	6.19 kΩ, 1 %, 0.125 W, Metal Film	Generic	
26	2	R10, R11	2 MΩ	2 MΩ, 1 %, 0.25 W, Metal Film	Generic	
27	1	R12	6.8 Ω	6.8 Ω, 5 %, 0.125 W, Carbon Film	Generic	
28	1	R13	910 Ω	910 Ω, 5 %, 0.25 W, Carbon Film	Generic	
29	1	R14	953 Ω	953 Ω, 1 %, 0.125 W, Metal Film	Generic	
30	1	R15	1 kΩ	1 kΩ, 5 %, 0.125 W, Carbon Film	Generic	
31	1	R16	115 kΩ	115 kΩ, 1 %, 0.125 W, Metal Film	Generic	

32	1	R17	6.04 kΩ	6.04 kΩ, 1 %, 0.125 W, Metal Film	Generic	
33	1	RT1	6 Ω	NTC Thermistor 6 Ω, 4 A	TDK	B57235S0609M000V9
34	1	T1	E42 (E42/21/20-3F3)	3F3 Core Material See Transformer Construction's Materials List for complete information	Ferroxcube	E42/21/20-3F3
35	1	T1 Bobbin	E42/21/20 - 3 (P6-S6)	Bobbin Material : Polyamide	Ferroxcube	CPH-E42/20-1S-12PD-Z
36	1	U1	CAP300DG	CAPZero-3, 1000 V, SOIC-8	Power Integrations	CAP300DG
37	1	U2	TOP261YN	TOPSwitch-HX, TOP261YN, TO-220	Power Integrations	TOP261YN
38	1	U3	LTV817A	Optocoupler LTV817A, 35 V, CTR 80 - 160 %, 4-DIP	Liteon	LTV817A
39	1	U4	TL431CLPM	2.495 V, Shunt Regulator IC, 2 %, TO-92	Texas Instruments	TL431CLPM
40	1	VR1	P6KE150A-E3/54	150 V, 5 W, 5 %, DO-204AC, TVS	Littelfuse	P6KE150A-E3/54

Electrical Diagram



Mechanical Diagram



Winding Instruction

Primary Winding (Section 1)

Start on pin(s) 4 and wind 11 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

Use 3 mm margin (item [8]) on the left side and 3 mm margin on the right side. Use 3 layers of tape for the foil insulation both sides around the edges which together with the margins are providing a total of 6.40 mm minimum of creepage and clearance to any primary part.

Start on pin(s) 8 and wind 9 turns of item [7]. 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 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) 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.
4. The sleeving length must comply with 6.40 mm safety margins required.

Materials

Item	*Description*
[1]	Core: E42 (E42/21/20-3F3), 3F3, gapped for ALG of 553 nH/T²
[2]	Bobbin: Generic, 6 pri. + 6 sec.
[3]	Barrier Tape: Polyester film [1 mil (25 µm) base thickness], 26.30 mm wide
[4]	Varnish
[5]	Magnet Wire: 24 AWG (0.55 mm), Solderable Double Coated
[6]	Magnet Wire: 25 AWG (0.45 mm), Solderable Double Coated
[7]	Copper Foil: 2 mil thick, 20.30 mm wide, covered with 1 layer of lapped tape. Terminations to foil: 2 x 23 AWG (0.6 mm) magnet wire with sleeving
[8]	Tape: Polyester web 3 mm wide

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.	268
Tolerance, ±%	Tolerance of Primary Inductance	10.0
Maximum Primary Leakage, µH	Measured between Pin 1 to Pin 4, with all other Windings shorted.	4.02

Design Notepad

Through Hole