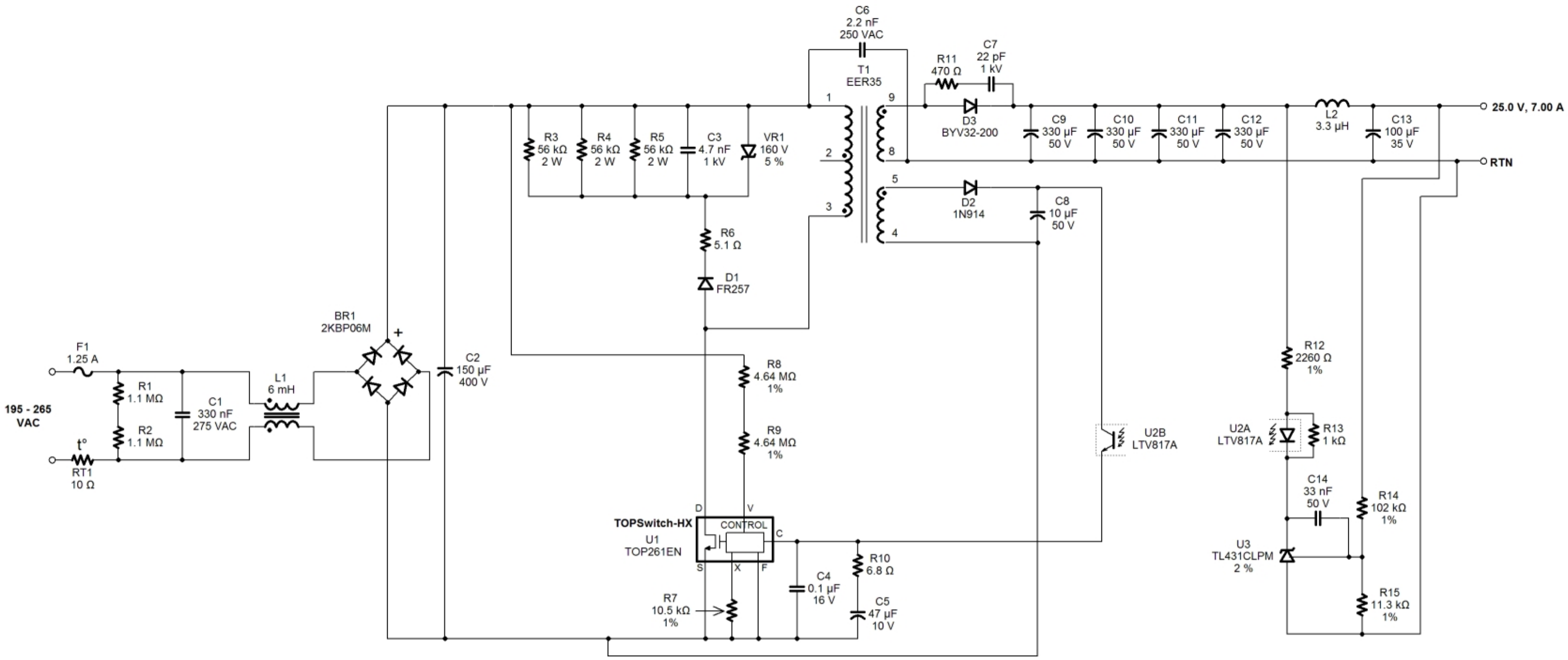

195 - 265
VAC
F1
1.25 A
RT1
10 Ω
R1
1.1 MΩ
R2
1.1 MΩ
C1
330 nF
275 VAC
L1
6 mH
BR1
2KBP06M
C2
150 µF
400 V
R3
56 kΩ
2 W
R4
56 kΩ
2 W
R5
56 kΩ
2 W
C3
4.7 nF
1 kV
VR1
160 V
5 %
R6
5.1 Ω
D1
FR257
C6
2.2 nF
250 VAC
T1
EER35
R11
470 Ω
C7
22 pF
1 kV
D3
BYV32-200
C9
330 µF
50 V
C10
330 µF
50 V
C11
330 µF
50 V
C12
330 µF
50 V
L2
3.3 µH
C13
100 µF
35 V
25.0 V, 7.00 A
RTN
D2
1N914
C8
10 µF
50 V
R8
4.64 MΩ
1%
R9
4.64 MΩ
1%
U2B
LTV817A
TOPSwitch-HX
U1
TOP261EN
CONTROL
R7
10.5 kΩ
1%
C4
0.1 µF
16 V
R10
6.8 Ω
C5
47 µF
10 V
R12
2260 Ω
1%
U2A
LTV817A
R13
1 kΩ
C14
33 nF
50 V
R14
102 kΩ
1%
U3
TL431CLPM
2 %
R15
11.3 kΩ
1%

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	**1.98**	ms	Diode Conduction Time
Z	**0.63**		Loss Allocation Factor
η	**84.0**	%	Efficiency Estimate
VMIN	**231.8**	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	**0.90**	A	Average Diode Bridge Current (DC Input Current)
Thermistor	**10.00**	Ω	Input Thermistor

Device Variables

Var	*Value*	*Units*	*Description*
Device	**TOP261EN**		PI Device Name (Manual Overwrite)
BVDSS	**700**		Drn-Src Bkdn Voltage
Device Mode	**Default**		Current Limit mode for device
OVP_FLAG	**NO**		Output Overvoltage Protection Enabled
PO	**175.09**	W	Total Output Power
VDRAIN Estimated	**604.88**	V	Actual Estimated Drain Voltage
VDS	**8.12**	V	On state Drain to Source Voltage
FS	**132000**	Hz	Switching Frequency
KP	**0.70**		Continuous/Discontinuous Operating Ratio
KI	**0.60**		Current Limit Reduction Factor (Manual Overwrite)
ILIMITEXT	**4.13**	A	Programmed Current Limit
ILIMITMIN	**6.88**	A	Minimum Current Limit
ILIMITMAX	**7.92**	A	Maximum Current Limit
PLIM_FLAG	**NO**		Enable Overload Power Limiting
IP	**3.68**	A	Peak Primary Current (at VMIN)
IRMS	**1.53**	A	Primary RMS Current (at VMIN)
DMAX	**0.38**		Maximum Duty Cycle
RTH_DEVICE	**10.47**	°C/W	PI Device Maximum Thermal Resistance
DEV_HSINK_TYPE	**Aluminum Extruded**		PI Device Heatsink Type
DEV_HSINK_PN	**6032DG**		**PI Device (Extruded) Heatsink Part Number.**

Clamp Circuit

Var	*Value*	*Units*	*Description*
Clamp Type	**RCD + Zener Clamp**		Clamp Circuit Type
VCLAMP	**95**	V	Estimated average clamping voltage
Estimated Clamp Loss	**2.84**	W	Clamp Dissipation
VC_MARGIN	**90.23**	V	Clamp Voltage Safety Margin

Bias Variables

Var	Value	Units	Description
IB	**0.006**	A	Bias Current
PIVB	**63**	V	Bias Rectifier Max Peak Inverse Voltage

Transformer Construction Parameters

Var	Value	Units	Description
Core Type	**EER35**		Core Type
Core Material	**NC-2H (Nicera) or Equivalent**		Core Material
Bobbin Reference	**Generic, 7 pri. + 7 sec.**		Bobbin Reference
Bobbin Orientation	**Vertical**		Bobbin type
Primary Pins	**5**		Number of Primary pins used
Secondary Pins	**2**		Number of Secondary pins used
USE_SHIELDS	**NO**		Use shield Windings
LP_nom	**258**	µH	Nominal Primary Inductance
LP_Tol	**10.0**	%	Primary Inductance Tolerance
NP	**31.0**		Calculated Primary Winding Total Number of Turns
NSM	**6**		Secondary Main Number of Turns
Primary Current Density	**4**	A/mm²	Primary Winding Current Density
VOR	**135.0**	V	Reflected Output Voltage
BW	**26.10**	mm	Bobbin Winding Width
ML	**0.00**	mm	Safety Margin on Left Width
MR	**0.00**	mm	Safety Margin on Right Width
FF	**66**	%	Actual Transformer Fit Factor. 100% signifies fully utilized winding window
AE	**107.00**	mm²	Core Cross Sectional Area
ALG	**242**	nH/T²	Gapped Core Effective Inductance
BM	**258**	mT	Maximum Flux Density
BP	**333**	mT	Peak Flux Density
BAC	**90**	mT	AC Flux Density for Core Loss
LG	**0.507**	mm	Estimated Gap Length
L_LKG	**3.87**	µH	Estimated primary leakage inductance
LSEC	**20**	nH	Secondary Trace Inductance

Primary Winding Section 1

Var	Value	Units	Description
NP1	**16**		Rounded (Integer) Number of Primary winding turns in the first section of primary
Wire Size	**0.55**	mm	Primary Wire Inner Diameter Actual
Winding Type	**Bifilar (x2)**		Primary winding number of parallel wire strands
L	**0.69**		Primary Number of Layers
DC Copper Loss	**0.10**	W	Primary 1 DC Losses

Primary Winding Section 2

Var	Value	Units	Description
NP2	**15**		Rounded (Integer) Number of Primary winding turns in the second section of primary
Wire Size	**0.55**	mm	Primary Wire Inner Diameter Actual
Winding Type	**Bifilar (x2)**		Primary winding number of parallel wire strands
L2	**0.65**		Primary Number of Layers in 2nd split winding

DC Copper Loss	**0.13**	W	Primary 2 DC Losses

Output 1

Var	*Value*	*Units*	*Description*
VO	**25.00**	V	Output Voltage
IO	**7.00**	A	Output Current
VOUT_ACTUAL	**25.00**	V	Actual Output Voltage
NS	**6**		Secondary Number of Turns
Foil Thickness	**50**	µm	Secondary Wire Inner Diameter Actual
Winding Type	**Foil**		Output winding number of parallel strands
L_S_OUT	**6.00**		Secondary Output Winding Layers
DC Copper Loss	**0.20**	W	Secondary DC Losses
VD	**1.15**	V	Output Winding Diode Forward Voltage Drop
PIVS	**98**	V	Output Rectifier Maximum Peak Inverse Voltage
ISP	**18.96**	A	Peak Secondary Current
ISRMS	**10.19**	A	Secondary RMS Current
RTH_DIODE	**6.55**	°C/W	Output Diode Maximum Thermal Resistance
OD_HSINK_TYPE	**Aluminum Extruded**		Output Diode Heatsink Type
OD_HSINK_PN	**533402B02552G**		Output Diode (Extruded) Heatsink Part Number
CO	**330 x 4**	µF	Output Capacitor
IRIPPLE	**7.41**	A	Output Capacitor RMS Ripple Current
Expected Lifetime	**32410**	hr	Expected Lifetime of Output Capacitor

Feedback Circuit

Var	*Value*	*Units*	*Description*
DUAL_OUTPUT_FB_FLAG	**NO**		Dual Output Feedback regulations use flag
SF_FLAG	**NO**		Soft Finish Circuits use flag
TYPE_3CTRL_FLAG	**NO**		Phase Boost Network flag

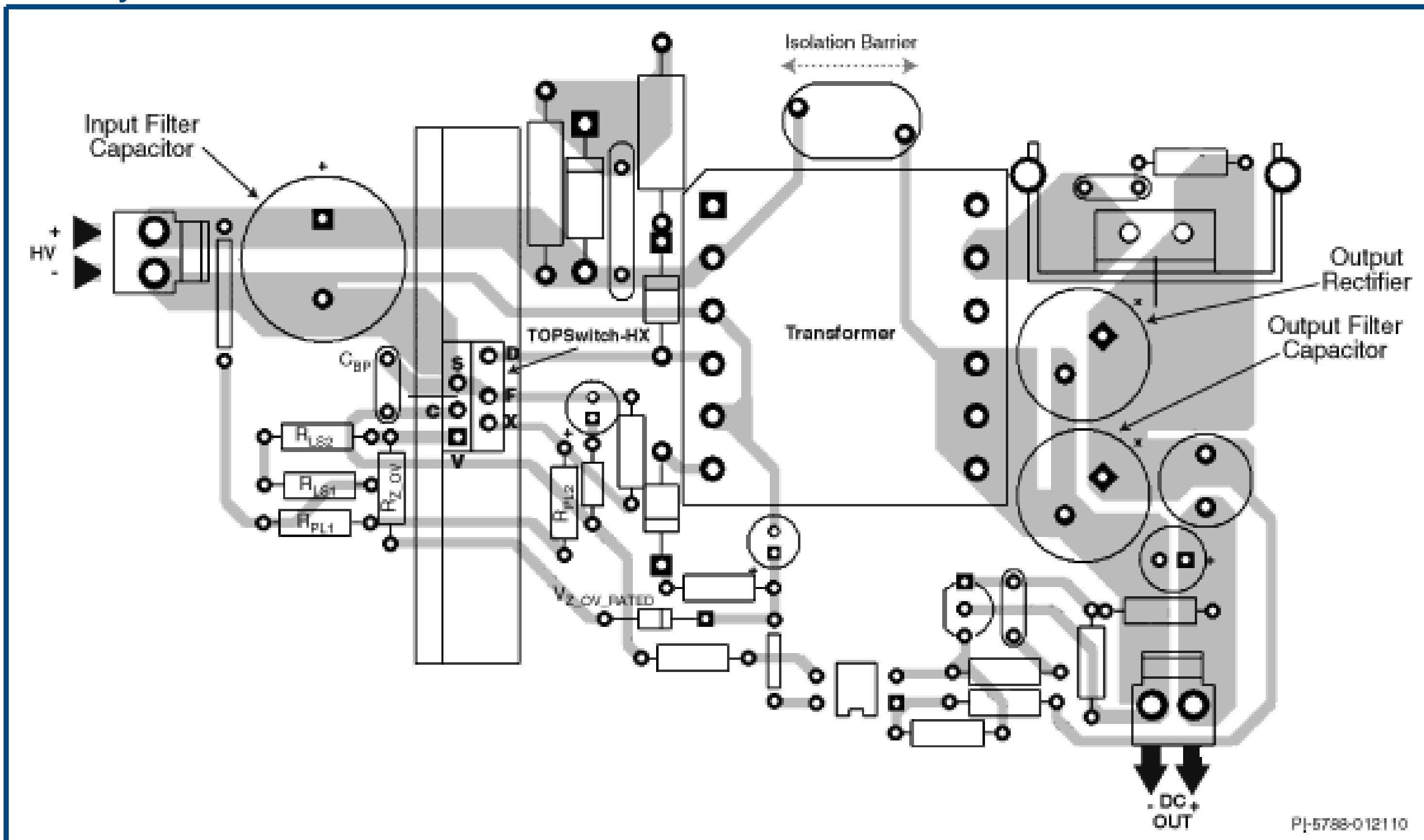
High output current flyback design.

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 diode 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	

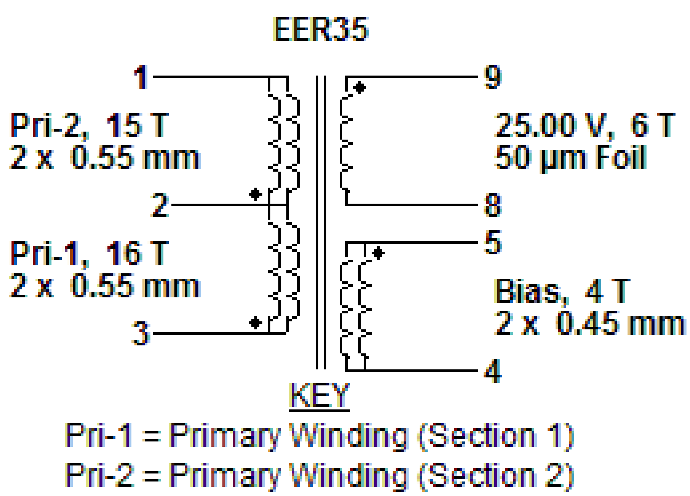
Bill Of Materials

Item #	Quantity	Part Ref	Value	Description	Mfg	Mfg Part Number
1	1	BR1	2KBP06M	600 V, 2 A, Standard Recovery Bridge, KBPM	Fairchild Semiconductor	2KBP06M
2	1	C1	330 nF	330 nF, 275 VAC, Film, X Class	Panasonic	ECQ-UAAF334K
3	1	C2	150 µF	150 µF, 400 V, High Voltage Al Electrolytic, (35 mm x 18 mm)	United Chemi-Con	EPAG400VB151M18X35LL
4	1	C3	4.7 nF	4.7 nF, 1 kV, High Voltage Ceramic	Panasonic	ECK-D3A472KBN
5	1	C4	0.1 µF	0.1 µF, 16 V, Ceramic, X7R	TDK	C1005X7R1C104K
6	1	C5	47 µF	47 µF, 10 V, Electrolytic, Gen Purpose, 1040 mΩ, (11 mm x 5 mm)	United Chemi-Con	KME10VB47RM5X11LL
7	1	C6	2.2 nF	2.2 nF, 250 VAC, Ceramic, Y Class	TDK	CD12-E2GA222MYNS
8	1	C7	22 pF	22 pF, 1 kV, High Voltage Ceramic	Panasonic	ECC-D3A220JGE
9	1	C8	10 µF	10 µF, 50 V, Electrolytic, Gen Purpose, 1050 mΩ, (11.5 mm x 5 mm)	Panasonic	ECA-1HHG100
10	4	C9, C10, C11, C12	330 µF	330 µF, 50 V, Electrolytic, Super Low ESR, 28 mΩ, (25 mm x 10 mm)	United Chemi-Con	EKZE500ELL331MJ25S
11	1	C13	100 µF	100 µF, 35 V, Electrolytic, Low ESR, 180 mΩ, (15 mm x 6.3 mm)	United Chemi-Con	ELXZ350ELL101MF15D
12	1	C14	33 nF	33 nF, 50 V, Ceramic, X7R	Murata	RPER71H333K2P1A03B
13	1	D1	FR257	1000 V, 2.5 A, Fast Recovery, 500 ns, R-3	Rectron	FR257
14	1	D2	1N914	100 V, 0.3 A, Fast Recovery, 4 ns, DO-35	Vishay	1N914
15	1	D3	BYV32-200	200 V, 18 A, Ultrafast Recovery, 25 ns, TO-220AC	Vishay	BYV32-200
16	1	F1	1.25 A	250 VAC, 1.25 A, Radial TR5, Time Lag Fuse	Littelfuse / Wickmann(R)	37411250410
17	1	HS1	6032DG	8.3 °C/W TO-220. Heatsink for use with Device U1.	Aavid	6032DG
18	1	HS2	533402B02552G	5 °C/W TO-220. Heatsink for use with Diode D3.	Aavid	533402B02552G
19	1	L1	6 mH	6 mH, 1.6 A	Panasonic	ELF18N016
20	1	L2	3.3 µH	3.3 µH, 7.5 A	Wurth Elektronik	7447471033
21	2	R1, R2	1.1 MΩ	1.1 MΩ, 5 %, 0.25 W, Thick Film	Generic	
22	3	R3, R4, R5	56 kΩ	56 kΩ, 5 %, 2 W, Metal Oxide Film	Generic	
23	1	R6	5.1 Ω	5.1 Ω, 5 %, 0.25 W, Thick Film	Generic	
24	1	R7	10.5 kΩ	10.5 kΩ, 1 %, 0.125 W, Thick Film	Generic	
25	2	R8, R9	4.64 MΩ	4.64 MΩ, 1 %, 0.25 W, Thick Film	Generic	
26	1	R10	6.8 Ω	6.8 Ω, 5 %, 0.125 W, Thick Film	Generic	
27	1	R11	470 Ω	470 Ω, 5 %, 0.25 W, Thick Film	Generic	
28	1	R12	2260 Ω	2260 Ω, 1 %, 0.125 W, Thick Film	Generic	
29	1	R13	1 kΩ	1 kΩ, 5 %, 0.125 W, Thick Film	Generic	
30	1	R14	102 kΩ	102 kΩ, 1 %, 0.125 W, Thick Film	Generic	
31	1	R15	11.3 kΩ	11.3 kΩ, 1 %, 0.125 W, Thick Film	Generic	

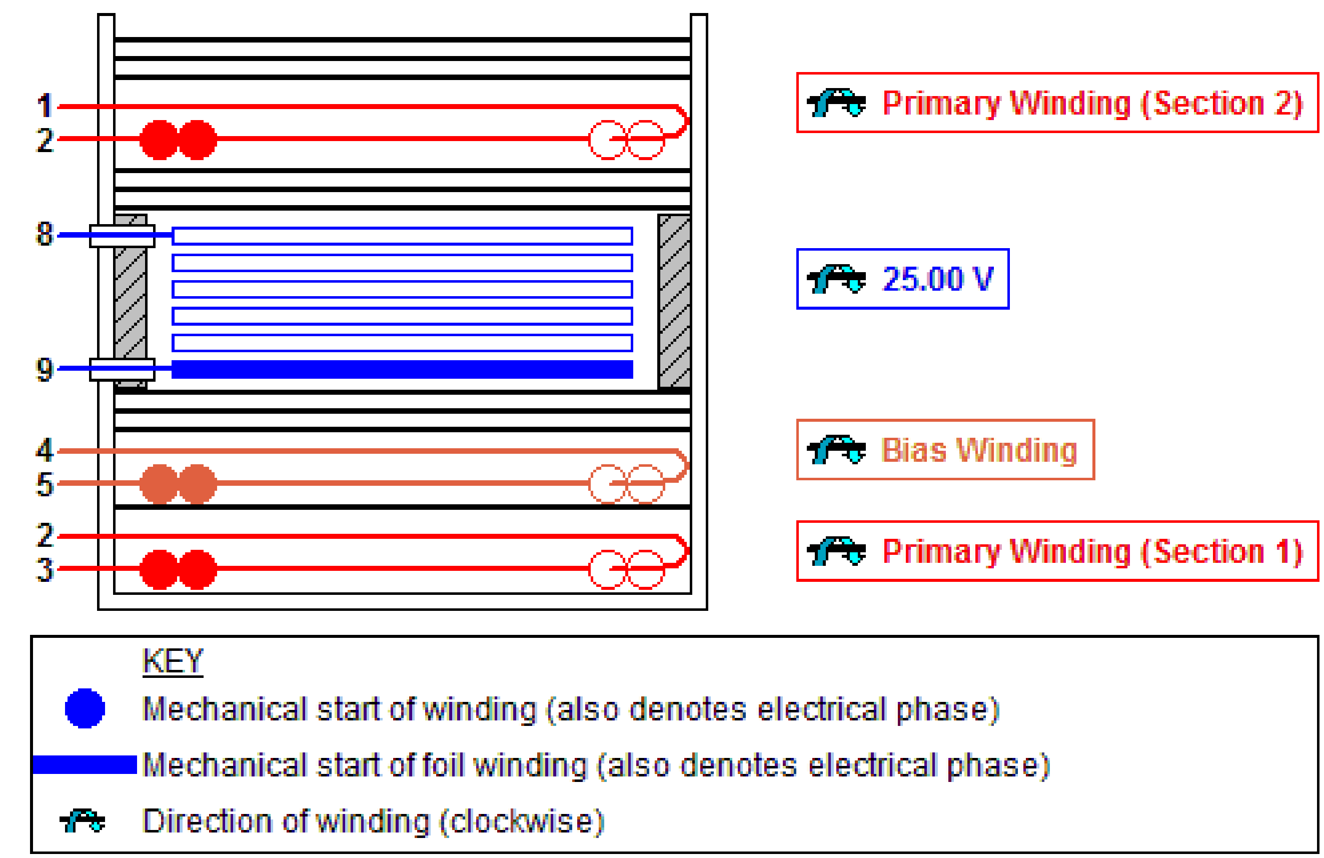
32	1	RT1	10 Ω	NTC Thermistor 10 Ω, 1.7 A	Thermometrics	CL-120
33	1	T1	EER35	NC-2H (Nicera) or Equivalent Core Material See Transformer Construction’s Materials List for complete information	TDK	PC40EER35-Z
34	1	U1	TOP261EN	TOPSwitch-HX, TOP261EN, eSIP-7C	Power Integrations	TOP261EN
35	1	U2	LTV817A	Optocoupler LTV817A, 35 V, CTR 80 - 160 %, 4-DIP	Liteon	LTV817A
36	1	U3	TL431CLPM	2.495 V, Shunt Regulator IC, 2 %, TO-92	Texas Instruments	TL431CLPM
37	1	VR1	P6KE160A	160 V, 5 W, 5 %, DO-204AC, TVS	Vishay	P6KE160A

This design will use SMD components wherever available. Use Design Setting/Defaults dialog to change this selection

Electrical Diagram



Mechanical Diagram



Winding Instruction

Primary Winding (Section 1)

Start on pin(s) 3 and wind 16 turns (x 2 filar) of item [5]. in 1 layer(s) from left to right. On the final layer, spread the winding evenly across entire bobbin. Finish this winding on pin(s) 2.

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

Bias Winding

Start on pin(s) 5 and wind 4 turns (x 2 filar) of item [6]. Wind in same rotational direction as primary winding. Spread the winding evenly across entire bobbin. Finish this winding on pin(s) 4.

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

Secondary Winding

Use 3 mm margin (item [8]) on the top and 3 mm margin on the bottom (to meet safety). Start on pin(s) 9 and wind 6 turns of item [7]. Wind in same rotational direction as primary winding. Finish this winding on pin(s) 8.

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

Primary Winding (Section 2)

Start on pin(s) 2 and wind 15 turns (x 2 filar) of item [5]. in 1 layer(s) 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. Use of a grounded flux-band around the core may improve the EMI performance.
2. For non margin wound transformers use triple insulated wire for all secondary windings.

Materials

Item	*Description*
[1]	**Core: EER35, NC-2H (Nicera) or Equivalent, gapped for ALG of 242 nH/T²**
[2]	**Bobbin: Generic, 7 pri. + 7 sec.**
[3]	**Barrier Tape: Polyester film [1 mil (25 µm) base thickness], 26.10 mm wide**
[4]	**Varnish**
[5]	**Magnet Wire: 0.55 mm, Solderable Double Coated**
[6]	**Magnet Wire: 0.45 mm, Solderable Double Coated**
[7]	**Copper Foil: 50 µm thick, 20.10 mm wide, covered with 1 layer of lapped tape. Terminations to foil: 2 x 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 to pins 8,9.**	**3000**
Nominal Primary Inductance, µH	**Measured at 1 V pk-pk, typical switching frequency, between pin 1 to pin 3, with all other Windings open.**	**258**
Tolerance, ±%	**Tolerance of Primary Inductance**	**10.0**
Maximum Primary Leakage, µH	**Measured between Pin 1 to Pin 3, with all other Windings shorted.**	**3.87**

1 Design Passed (No Optimization)

	Description	***Fix***	***Ref. #***
	Drain voltage close to BVDSS at maximum OV threshold.	Verify BVDSS during line surge, decrease VUVON_MAX or reduce VOR.	237
	The Copper thickness is not recommended at this level of output power.	Change board thickness to 2 oz (70 µm).	179