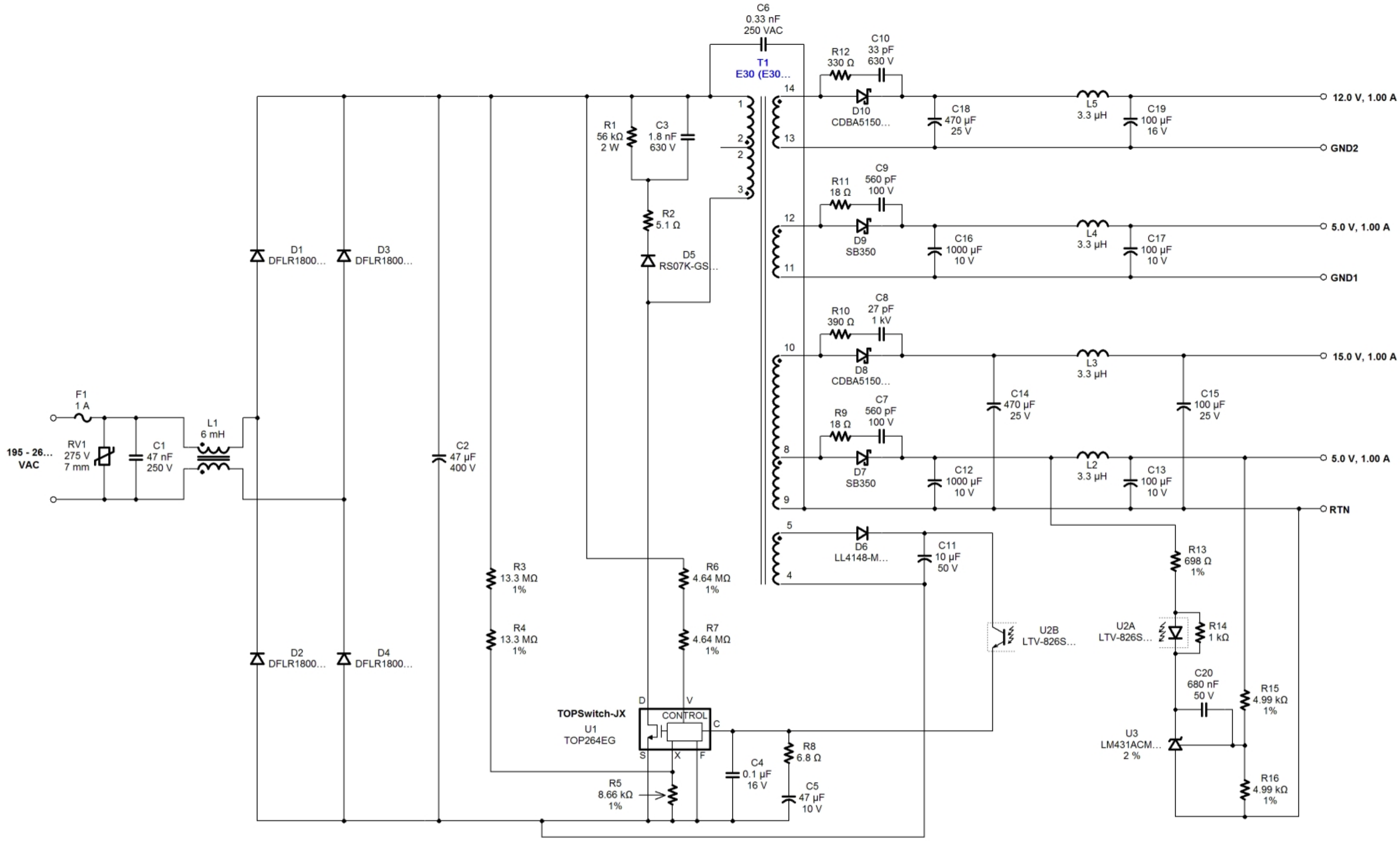


Schematic components that have been frozen by the user will appear with blue reference designators.

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	0.65		Loss Allocation Factor
η	76.0	%	Efficiency Estimate (Target)
VMIN	242.5	V	Minimum DC Input Voltage
VMAX	374.8	V	Maximum DC Input Voltage

Input Section

Var	Value	Units	Description
Fuse	1.00	A	Input Fuse Rated Current
IAVG	0.20	A	Average Diode Bridge Current (DC Input Current)
MOV_VRATED	275	V	MOV Rated Voltage

Device Variables

Var	Value	Units	Description
Device	TOP264EG		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	37.07	W	Total Output Power
VDRAIN Estimated	612.61	V	Estimated Drain Voltage
VDS	10.08	V	On state Drain to Source Voltage
FS	132000	Hz	Switching Frequency (at VMIN and Full Load)
KP	0.700		Continuous/Discontinuous Operating Ratio (at VMIN and Full Load)
DMAX	0.367		Maximum Duty Cycle (at VMIN and Full Load)
KI	1.00		Current Limit Reduction Factor
ILIMITEXT	1.21	A	Programmed Current Limit
ILIMITMIN	1.209	A	Minimum Current Limit
ILIMITMAX	1.391	A	Maximum Current Limit
RPL	13.30	MΩ	Power Limit Resistor
RPL2	13.30	MΩ	2nd Power Limit Resistor
PLIM_FLAG	YES		Enable Overload Power Limiting
IP	0.842	A	Peak Primary Current (at VMIN and Full Load)
IRMS	0.348	A	Primary RMS Current (at VMIN and Full Load)
RTH_DEVICE	42.87	°C/W	PI Device Heatsink Maximum Thermal Resistance
DEV_HSINK_TYPE	Custom Aluminum		PI Device Heatsink Type
DEV_HSINK_AREA	619	mm²	PI Device Heatsink Area

Clamp Circuit

Var	Value	Units	Description
Clamp Type	**RCD Clamp**		Clamp Circuit Type
VCLAMP	**102.84**	V	Average Clamping Voltage
Estimated Clamp Loss	**1.010**	W	Clamp total power loss
VC_MARGIN	**115.23**	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	**52**	V	Bias Rectifier Maximum Peak Inverse Voltage
NB	**10**		Primary Bias Winding Number of Turns

Transformer Construction Parameters

Var	Value	Units	Description
Core Type	**E30 (E30/15/7-3F3)**		Core Type (Manual Overwrite)
Core Material	**3F3**		Core Material
Primary Pins	**5**		Number of Primary pins used
Secondary Pins	**7**		Number of Secondary pins used
USE_SHIELDS	**NO**		Use shield Windings
LP_nom	**1124**	µH	Nominal Primary Inductance
LP_Tol	**10.0**	%	Primary Inductance Tolerance
NP	**94.1**		Calculated Primary Winding Total Number of Turns
NSM	**4**		Secondary Main Number of Turns
CMA	**456.82**	Cmils/A	Primary Winding Current Capacity
VOR	**135.00**	V	Reflected Output Voltage
BW	**17.50**	mm	Bobbin Winding Width
FF	**87.32**	%	Actual Transformer Fit Factor. 100% signifies fully utilized winding window
AE	**60.00**	mm^2	Core Cross Sectional Area
ALG	**114**	nH/T^2	Gapped Core Specific Inductance
BM	**1510**	Gauss	Maximum Flux Density
BP	**2748**	Gauss	Peak Flux Density
BAC	**528**	Gauss	AC Flux Density for Core Loss
LG	**0.612**	mm	Estimated Gap Length
L_LKG	**28.10**	µH	Estimated primary leakage inductance
LSEC	**15**	nH	Secondary Trace Inductance

Primary Winding Section 1

Var	Value	Units	Description
NP1	**48**		Number of Primary Winding Turns in the First Section of Primary
L	**1.00**		Primary Winding - Number of Layers
DC Copper Loss	**0.05**	W	Primary Section 1 DC Losses

Primary Winding Section 2

Var	Value	Units	Description

NP2	**47**		*Rounded (Integer) Number of Primary winding turns in the second section of primary*
L2	**0.98**		*Primary Number of Layers in 2nd split winding*

Output 1

Var	*Value*	*Units*	*Description*
VO	**5.00**	*V*	*Typical Output Voltage*
IO	**1.00**	*A*	*Output Current*
VOUT_ACTUAL	**5.00**	*V*	*Actual Output Voltage*
NS	**4**		*Secondary Number of Turns*
L_S_OUT	**0.34**		*Secondary Output Winding Layers*
DC Copper Loss	**0.13**	*W*	*Secondary DC Losses*
VD	**0.74**	*V*	*Output Winding Diode Forward Voltage Drop*
VD	**0.74**	*V*	*Output Winding Diode Forward Voltage Drop*
PIVS	**20.78**	*V*	*Output Rectifier Maximum Peak Inverse Voltage*
ISP	**2.672**	*A*	*Peak Secondary Current*
ISRMS	**1.446**	*A*	*Secondary RMS Current*
ISRMS_WINDING	**2.893**	*A*	*Secondary Winding RMS Current*
CMAS	**559**	*Cmils/A*	*Secondary Winding Current Capacity*
RTH_RECTIFIER	**80.30**	*°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	**1000 x 1**	*µF*	*Output Capacitor - Capacitance*
IRIPPLE	**1.045**	*A*	*Output Capacitor - RMS Ripple Current*
Expected Lifetime	**29569**	*hr*	*Output Capacitor - Expected Lifetime*

Output 2

Var	*Value*	*Units*	*Description*
VO	**5.00**	*V*	*Typical Output Voltage*
IO	**1.00**	*A*	*Output Current*
VOUT_ACTUAL	**5.00**	*V*	*Actual Output Voltage*
NS	**4**		*Secondary Number of Turns*
L_S_OUT	**0.15**		*Secondary Output Winding Layers*
DC Copper Loss	**0.06**	*W*	*Secondary DC Losses*
VD	**0.74**	*V*	*Output Winding Diode Forward Voltage Drop*
VD	**0.74**	*V*	*Output Winding Diode Forward Voltage Drop*
PIVS	**20.78**	*V*	*Output Rectifier Maximum Peak Inverse Voltage*
ISP	**2.672**	*A*	*Peak Secondary Current*
ISRMS	**1.446**	*A*	*Secondary RMS Current*
ISRMS_WINDING	**1.446**	*A*	*Secondary Winding RMS Current*
CMAS	**222**	*Cmils/A*	*Secondary Winding Current Capacity*

RTH_RECTIFIER	**80.30**	*°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	**1000 x 1**	*µF*	*Output Capacitor - Capacitance*
IRIPPLE	**1.045**	*A*	*Output Capacitor - RMS Ripple Current*
Expected Lifetime	**29569**	*hr*	*Output Capacitor - Expected Lifetime*

Output 3

Var	*Value*	*Units*	*Description*
VO	**15.00**	*V*	*Typical Output Voltage*
IO	**1.00**	*A*	*Output Current*
VOUT_ACTUAL	**14.92**	*V*	*Actual Output Voltage*
NS	**7**		*Secondary Number of Turns*
L_S_OUT	**0.26**		*Secondary Output Winding Layers*
DC Copper Loss	**0.12**	*W*	*Secondary DC Losses*
VD	**0.87**	*V*	*Output Winding Diode Forward Voltage Drop*
VD	**0.87**	*V*	*Output Winding Diode Forward Voltage Drop*
PIVS	**58.31**	*V*	*Output Rectifier Maximum Peak Inverse Voltage*
ISP	**2.672**	*A*	*Peak Secondary Current*
ISRMS	**1.446**	*A*	*Secondary RMS Current*
ISRMS_WINDING	**1.446**	*A*	*Secondary Winding RMS Current*
CMAS	**222**	*Cmils/A*	*Secondary Winding Current Capacity*
RTH_RECTIFIER	**63.40**	*°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	**77**	*mm²*	*Output Rectifier Heatsink Area*
CO	**470 x 1**	*µF*	*Output Capacitor - Capacitance*
IRIPPLE	**1.045**	*A*	*Output Capacitor - RMS Ripple Current*
Expected Lifetime	**29569**	*hr*	*Output Capacitor - Expected Lifetime*

Output 4

Var	*Value*	*Units*	*Description*
VO	**12.00**	*V*	*Typical Output Voltage*
IO	**1.00**	*A*	*Output Current*
VOUT_ACTUAL	**12.05**	*V*	*Actual Output Voltage*
NS	**9**		*Secondary Number of Turns*
L_S_OUT	**0.33**		*Secondary Output Winding Layers*
DC Copper Loss	**0.14**	*W*	*Secondary DC Losses*
VD	**0.87**	*V*	*Output Winding Diode Forward Voltage Drop*
VD	**0.87**	*V*	*Output Winding Diode Forward Voltage Drop*
PIVS	**47.55**	*V*	*Output Rectifier Maximum Peak Inverse Voltage*
ISP	**2.672**	*A*	*Peak Secondary Current*

ISRMS	**1.446**	*A*	*Secondary RMS Current*
ISRMS_WINDING	**1.446**	*A*	*Secondary Winding RMS Current*
CMAS	**222**	*Cmils/A*	*Secondary Winding Current Capacity*
RTH_RECTIFIER	**65.18**	*°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	**70**	*mm²*	*Output Rectifier Heatsink Area*
CO	**470 x 1**	*µF*	*Output Capacitor - Capacitance*
IRIPPLE	**1.045**	*A*	*Output Capacitor - RMS Ripple Current*
Expected Lifetime	**29569**	*hr*	*Output Capacitor - Expected Lifetime*

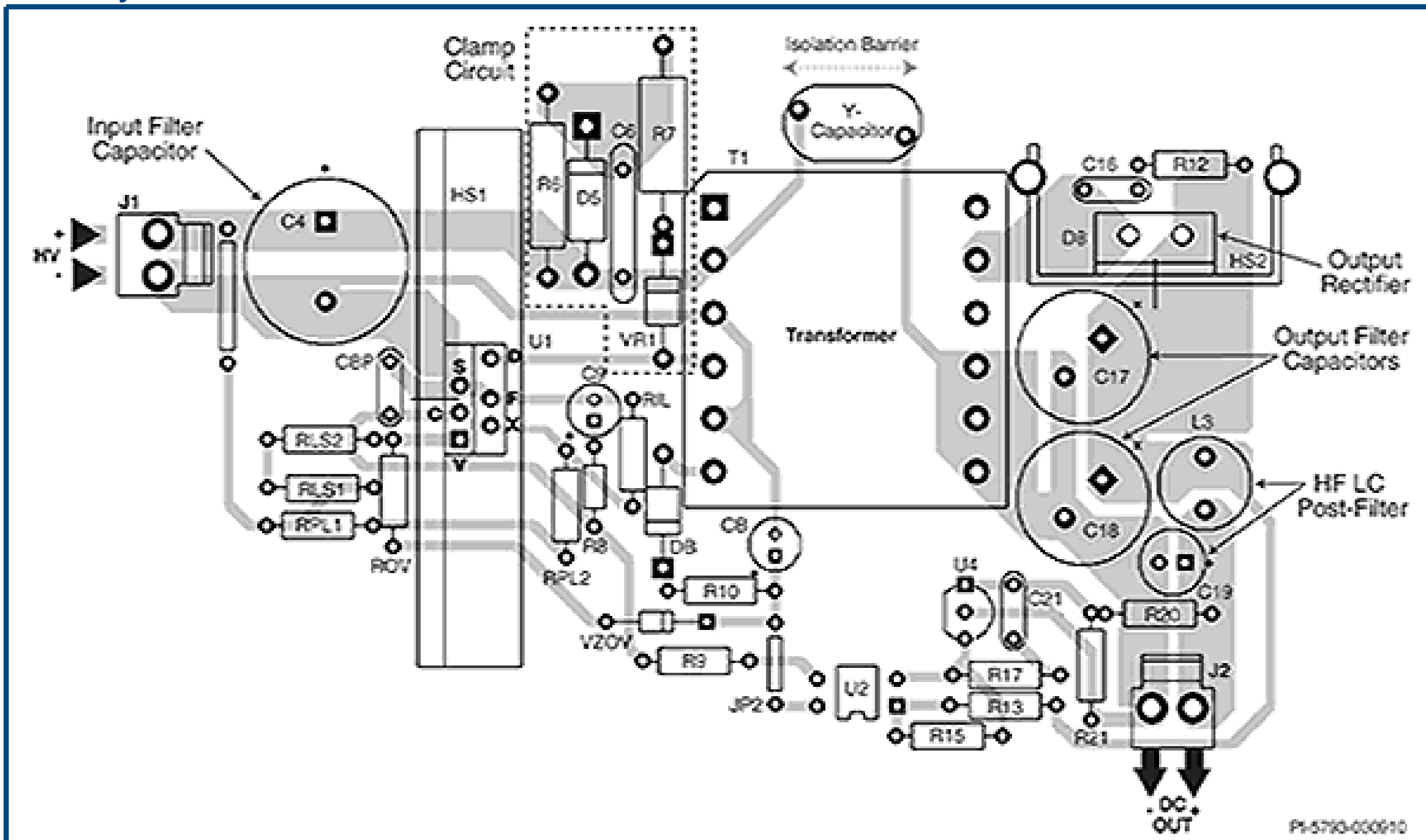
Feedback Circuit

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



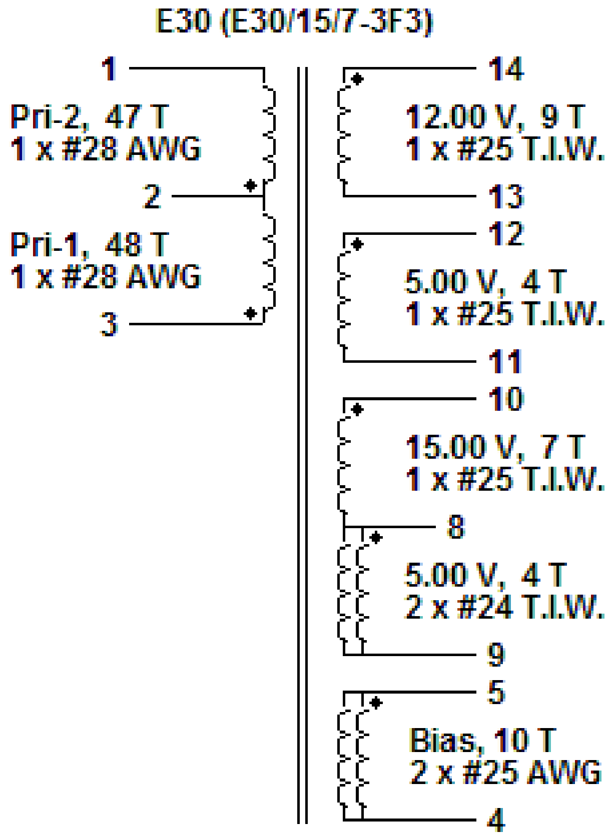
Click on the "Show me" icon to highlight relevant areas on the sample layout.		
	Description	*Show Me*
1	*Minimize loop area formed by drain, clamp and transformer*	
2	*Bias winding and bias capacitor are a power connection and therefore returned to Kelvin connection at SOURCE pin*	
3	*V and X pin node 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	47 nF	47 nF, 250 V, Film, X Class	Murata	GA355ER7GB473KW01L
2	1	C2	47 µF	47 µF, 400 V, High Voltage Al Electrolytic, (25 mm x 22 mm)	Cornell Dubilier	381LX470M400H012
3	1	C3	1.8 nF	1.8 nF, 630 V, High Voltage Ceramic	TDK	C3216C0G2J182J115AA
4	1	C4	0.1 µF	0.1 µF, 16 V, Ceramic, X7R	AVX Corp	0603YC104K4T4A
5	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
6	1	C6	0.33 nF	0.33 nF, 250 VAC, Ceramic, Y Class	Murata	GA342DR7GF331KW02L
7	2	C7, C9	560 pF	560 pF, 100 V, Ceramic, C0G	AVX Corp	08051A561JAT2A
8	1	C8	27 pF	27 pF, 1 kV, High Voltage Ceramic	Murata	GRM31A5C3A270JW01D
9	1	C10	33 pF	33 pF, 630 V, High Voltage Ceramic	Kemet	GRM31A5C2J330JW01D
10	1	C11	10 µF	10 µF, 50 V, Electrolytic, Gen Purpose, 1000 mΩ, (6.1 mm x 6.3 mm)	Rubycon	50TRV10M6.3X6.1
11	2	C12, C16	1000 µF	1000 µF, 10.0 V, Electrolytic, Super Low ESR, 41 mΩ, (20 mm x 8 mm)	United Chemi-Con	EKZE100ELL102MH20D
12	2	C13, C17	100 µF	100 µF, 10.0 V, Electrolytic, Low ESR, 500 mΩ, (3.5 mm x 2.8 mm)	Kemet	T495B107M010ATE500
13	2	C14, C18	470 µF	470 µF, 25 V, Electrolytic, Super Low ESR, 41 mΩ, (20 mm x 8 mm)	United Chemi-Con	EKZE250ELL471MH20D
14	1	C15	100 µF	100 µF, 25 V, Electrolytic, Low ESR, 260 mΩ, (8 mm x 6.2 mm)	Panasonic	EEEFK1E101AP
15	1	C19	100 µF	100 µF, 16 V, Electrolytic, Low ESR, 260 mΩ, (6.3 mm x 5.8 mm)	Nichicon	UCL1C101MCL1GS
16	1	C20	680 nF	680 nF, 50 V, Ceramic, X7R	Kemet	C0805C684K5RACTU
17	4	D1, D2, D3, D4	DFLR1800-7	800 V, 1 A, Standard Recovery, POWERDI123	Diodes Inc.	DFLR1800-7
18	1	D5	RS07K-GS08	800 V, 1.4 A, Fast Recovery, 300 ns, DO-219AB	Vishay	RS07K-GS08
19	1	D6	LL4148-M-08	100 V, 0.15 A, Fast Recovery, 8 ns, SOD-80	Vishay	LL4148-M-08
20	2	D7, D9	SB350	50 V, 3 A, Schottky, DO-201AD	ON Semiconductor	SB350
21	2	D8, D10	CDBA5150-HF	150 V, 5 A, Schottky, DO-214AC	Comchip Technology	CDBA5150-HF
22	1	F1	1 A	250 VAC, 1 A, Radial TR5, Time Lag Fuse	Littelfuse / Wickmann(R)	37411000410
23	1	HS1		15.5 mm x 20 mm. Aluminum Alloy (3003 OR 5052), 1.6 mm thickness. Heatsink for use with Device U1.	Custom	
24	1	L1	6 mH	6 mH, 1.6 A	Panasonic	ELF18N016
25	4	L2, L3, L4, L5	3.3 µH	3.3 µH, 2.6 A	Murata	LQH66SN3R3M03L
26	1	R1	56 kΩ	56 kΩ, 5 %, 2 W, Metal Oxide Film	Generic	
27	1	R2	5.1 Ω	5.1 Ω, 5 %, 0.25 W, Thick Film	Generic	
28	2	R3, R4	13.3 MΩ	13.3 MΩ, 1 %, 0.25 W, Thick Film	Generic	
29	1	R5	8.66 kΩ	8.66 kΩ, 1 %, 0.125 W, Thick Film	Generic	
30	2	R6, R7	4.64 MΩ	4.64 MΩ, 1 %, 0.25 W, Thick Film	Generic	
31	1	R8	6.8 Ω	6.8 Ω, 5 %, 0.125 W, Thick Film	Generic	
32	2	R9, R11	18 Ω	18 Ω, 5 %, 0.25 W, Thick Film	Generic	

33	*1*	*R10*	*390 Ω*	*390 Ω, 5 %, 0.25 W, Thick Film*	*Generic*	
34	*1*	*R12*	*330 Ω*	*330 Ω, 5 %, 0.25 W, Thick Film*	*Generic*	
35	*1*	*R13*	*698 Ω*	*698 Ω, 1 %, 0.125 W, Thick Film*	*Generic*	
36	*1*	*R14*	*1 kΩ*	*1 kΩ, 5 %, 0.125 W, Thick Film*	*Generic*	
37	*2*	*R15, R16*	*4.99 kΩ*	*4.99 kΩ, 1 %, 0.125 W, Thick Film*	*Generic*	
38	*1*	*RV1*	*V275LA4P*	*275 V, 23 J, 7 mm, RADIAL, MOV*	*Littelfuse*	*V275LA4P*
39	*1*	*T1*	*E30 (E30/15/7-3F3)*	*3F3 Core Material See Transformer Construction's Materials List for complete information*	*Ferroxcube*	*E30/15/7-3F3*
40	*1*	*T1 Bobbin*	*E30/15/7 - 1 (P7-S7)*	*Bobbin Material : GFR polyterephthalate*	*EPCOS (TDK)*	*B66232*
41	*1*	*T1 Core Acc.1*	*B66232*	*Yoke . Stainless spring steel (0.4mm)*	*EPCOS (TDK)*	*B66232*
42	*1*	*T1 Core Acc.2*	*CLA-E30/15/7*	*Clasp . CuZn Alloy, Ni plated*	*Ferroxcube*	*CLA-E30/15/7*
43	*1*	*T1 Core Acc.3*	*SPR-E30/15/7*	*Spring . Stainless steel (CrNi)*	*Ferroxcube*	*SPR-E30/15/7*
44	*1*	*U1*	*TOP264EG*	*TOPSwitch-JX, TOP264EG, eSIP-7C*	*Power Integrations*	*TOP264EG*
45	*1*	*U2*	*LTV-826S*	*Optocoupler LTV-826S , 80 V, CTR 300 - 600 %, 4-SMD*	*Liteon*	*LTV-826S*
46	*1*	*U3*	*LM431ACM/NOPB*	*2.495 V, Shunt Regulator IC, 2 %, SOIC-8*	*Texas Instruments*	*LM431ACM/NOPB*
47	*1*			*52 mm² area on Copper PCB. 2 oz (70 µm) thickness. Heatsink for use with Rectifier D7.*	*Custom*	
48	*1*			*52 mm² area on Copper PCB. 2 oz (70 µm) thickness. Heatsink for use with Rectifier D9.*	*Custom*	
49	*1*			*70 mm² area on Copper PCB. 2 oz (70 µm) thickness. Heatsink for use with Rectifier D10.*	*Custom*	
50	*1*			*77 mm² area on Copper PCB. 2 oz (70 µm) thickness. Heatsink for use with Rectifier D8.*	*Custom*	

Electrical Diagram



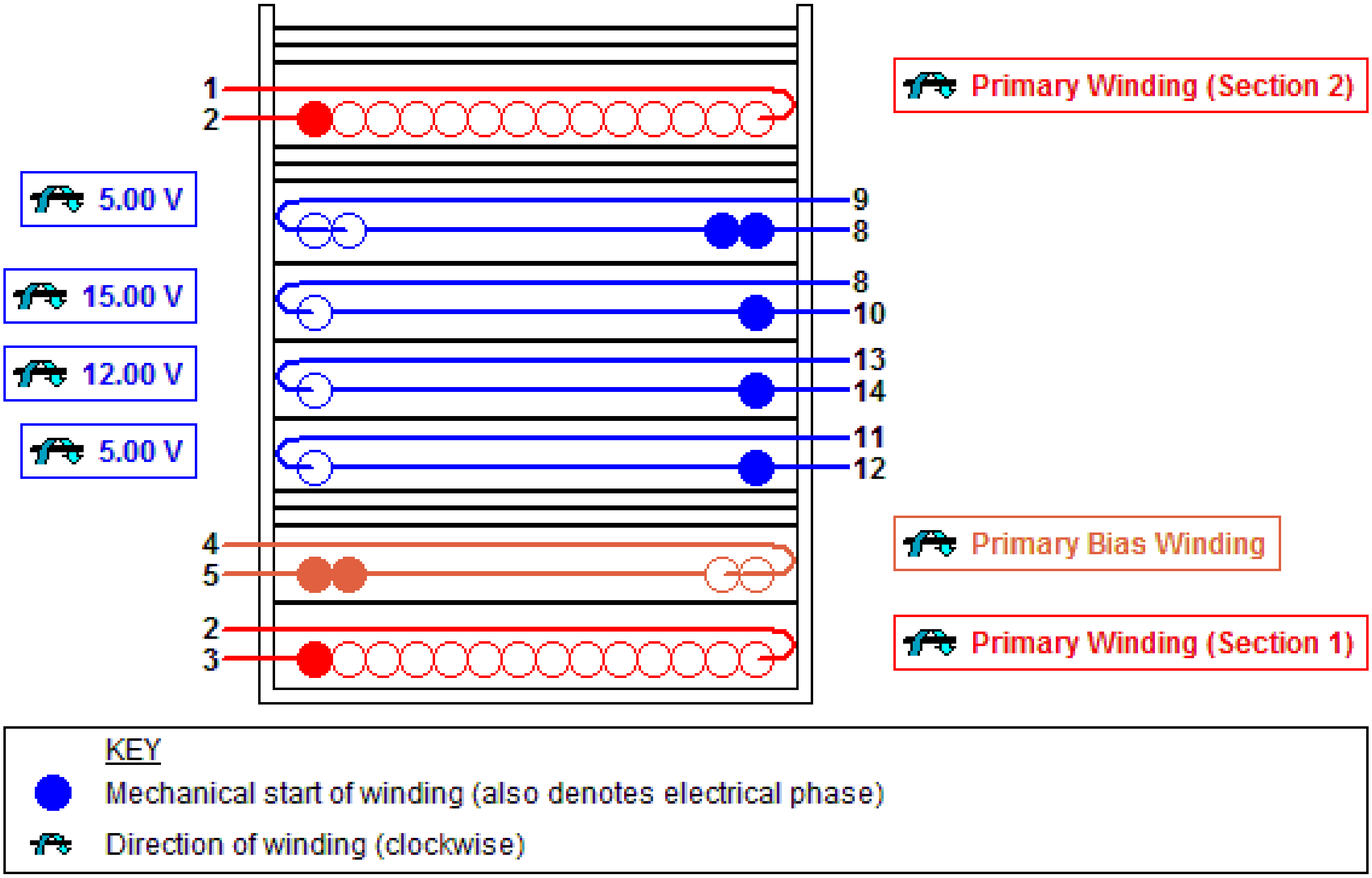
KEY

Pri-1 = Primary Winding (Section 1)

Pri-2 = Primary Winding (Section 2)

T.I.W. = Triple Insulated Wire

Mechanical Diagram



Winding Instruction

Primary Winding (Section 1)

Start on pin(s) 3 and wind 48 turns (x 1 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.

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

Primary Bias Winding

Start on pin(s) 5 and wind 10 turns (x 2 filar) of item [6]. Winding direction is clockwise. 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

Start on pin(s) 12 and wind 4 turns (x 1 filar) of item [7]. Spread the winding evenly across entire bobbin. Winding direction is clockwise. Finish this winding on pin(s) 11.

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

Start on pin(s) 14 and wind 9 turns (x 1 filar) of item [7]. Spread the winding evenly across entire bobbin. Winding direction is clockwise. Finish this winding on pin(s) 13.

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

Start on pin(s) 10 and wind 7 turns (x 1 filar) of item [7]. Spread the winding evenly across entire bobbin. Winding direction is clockwise. Finish this winding on pin(s) 8.

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

Start on pin(s) 8 and wind 4 turns (x 2 filar) of item [8]. Spread the winding evenly across entire bobbin. Winding direction is clockwise. Finish this winding on pin(s) 9.

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

Primary Winding (Section 2)

Start on pin(s) 2 and wind 47 turns (x 1 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. 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: E30 (E30/15/7-3F3), 3F3, gapped for ALG of 114 nH/T²
[2]	Bobbin: Generic, 7 pri. + 7 sec.
[3]	Barrier Tape: Polyester film [1 mil (25 µm) base thickness], 17.50 mm wide
[4]	Varnish
[5]	Magnet Wire: 28 AWG (0.32 mm), Solderable Double Coated
[6]	Magnet Wire: 25 AWG (0.45 mm), Solderable Double Coated
[7]	Triple Insulated Wire: 25 AWG (0.45 mm)
[8]	Triple Insulated Wire: 24 AWG (0.55 mm)

Electrical Test Specifications

Parameter	*Condition*	*Spec*
Electrical Strength, VAC	60 Hz 1 second, from pins 1,2,3,4,5 to pins 8,9,10,11,12,13,14.	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.	1124
Tolerance, ±%	Tolerance of Primary Inductance	10.0
Maximum Primary Leakage, µH	Measured between Pin 1 to Pin 3, with all other Windings shorted.	28.10

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.

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*