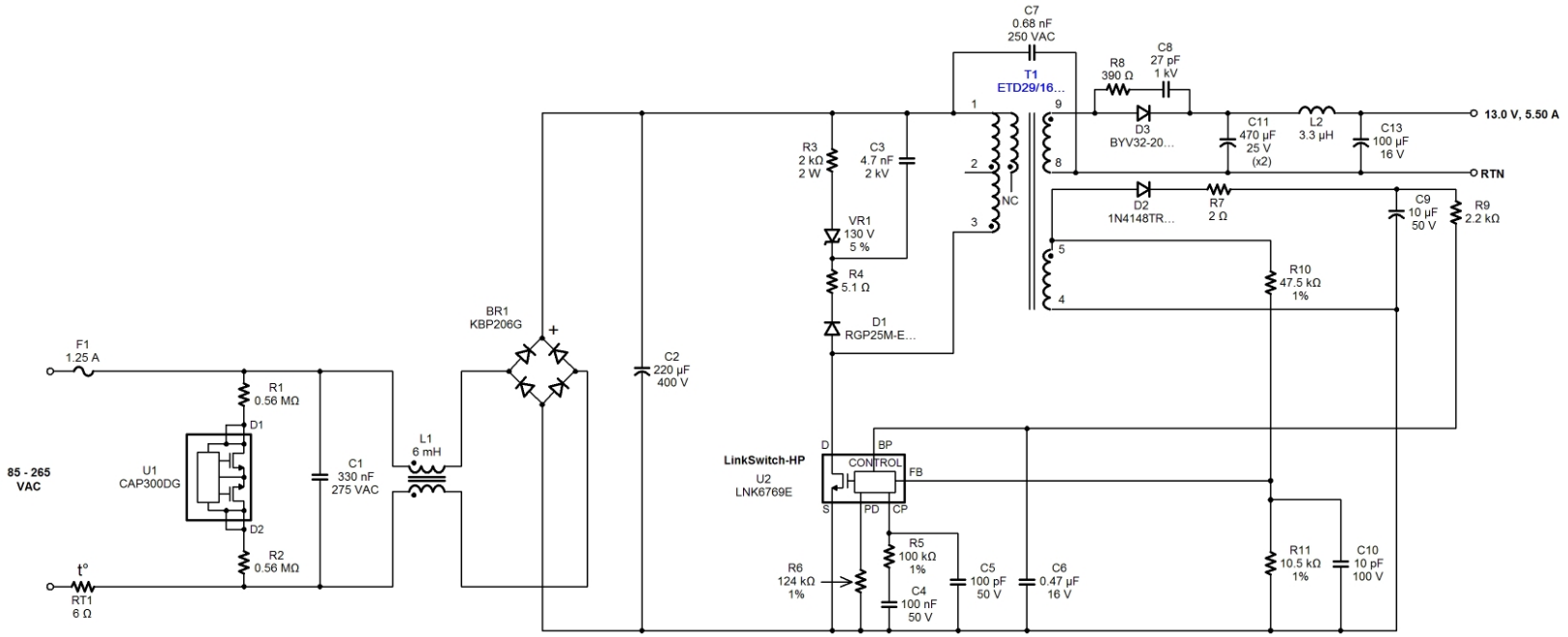


Schematic components that have been frozen by the user will appear with blue reference designators.

Power Supply Input

Var	Value	Units	Description
VACMIN	85	V	Minimum Input AC Voltage
VACMAX	265	V	Maximum Input AC Voltage
FL	50	Hz	Line Frequency
TC	2.36	ms	Input Rectifier Conduction Time
Z	0.63		Loss Allocation Factor
η	81.0	%	Efficiency Estimate (Target)
VMIN	91.2	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	0.97	A	Average Diode Bridge Current (DC Input Current)
Thermistor	6.00	Ω	Input Thermistor

Device Variables

Var	Value	Units	Description
Device	LNK6769E		PI Device Name
BVDSS	650	V	Drn-Src Bkdn Voltage
Current Limit Mode	Default		Device Current Limit Mode
PO	71.51	W	Total Output Power
VDRAIN Estimated	553.61	V	Estimated Drain Voltage
VDS	6.91	V	On state Drain to Source Voltage
FS	132000	Hz	Switching Frequency (at VMIN and Full Load)
FMIN_OTE	118528	Hz	Minimum Switching Frequency During On-Time Extension
FMAX_OTE	133822	Hz	Maximum Switching Frequency During On-Time Extension
TSAMPLE_FULL_LOAD	3.10	µs	Auxiliary Winding Sample Time at Full Load
TSAMPLE_NO_LOAD	1.47	µs	Auxiliary Winding Sample Time at No Load
KP	0.733		Continuous/Discontinuous Operating Ratio (at VMIN and Full Load)
DMAX	0.566		Maximum Duty Cycle (at VMIN and Full Load)
KI	1.00		Current Limit Reduction Factor
ILIMITEXT	3.16	A	Programmed Current Limit
ILIMITMIN	3.162	A	Minimum Current Limit
ILIMITMAX	3.638	A	Maximum Current Limit
AROTE_FLAG	NO		Auto Restart On-Time Extension Enable
AROTE_ACT	1	ms	Actual Auto Restart On-Time Extension
IP	2.700	A	Peak Primary Current (at VMIN and Full Load)
IRMS	1.357	A	Primary RMS Current (at VMIN and Full Load)
RTH_DEVICE	9.17	°C/W	PI Device Heatsink Maximum Thermal Resistance
DEV_HSINK_TYPE	Aluminum Extruded		PI Device Heatsink Type
DEV_HSINK_PN	TV35G		PI Device (Extruded) Heatsink Part Number

Clamp Circuit

Var	Value	Units	Description
Clamp Type	RCDZ Clamp		Clamp Circuit Type

VCLAMP	**68.84**	*V*	*Average Clamping Voltage*
Estimated Clamp Loss	**4.711**	*W*	*Clamp total power loss*
VC_MARGIN	**65.23**	*V*	*Clamp Voltage Safety Margin*
TPRIMARY	**0.93**	*µs*	*Primary Drain Voltage Ring Decay Time*

Primary Bias Variables

Var	*Value*	*Units*	*Description*
VB	**10.0**	*V*	*Bias Voltage*
IB	**0.001**	*A*	*Bias Current*
PIVB	**58**	*V*	*Bias Rectifier Maximum Peak Inverse Voltage*

Feedback Winding

Var	*Value*	*Units*	*Description*
NFB	**4**		*Feedback Winding Number of Turns*
VFB	**11.88**		*Feedback pin voltage*
Layers	**0.42**		*Feedback Winding Layers*

Transformer Construction Parameters

Var	*Value*	*Units*	*Description*
Core Type	**ETD29/16/10**		*Core Type (Manual Overwrite)*
Core Material	**3F3**		*Core Material*
Bobbin Reference	**Generic, 7 pri. + 7 sec.**		*Bobbin Reference*
Bobbin Orientation	**Horizontal**		*Bobbin type*
Primary Pins	**5**		*Number of Primary pins used*
Secondary Pins	**2**		*Number of Secondary pins used*
USE_SHIELDS	**YES**		*Use shield Windings*
LP_nom	**227**	*µH*	*Nominal Primary Inductance*
LP_Tol	**10.0**	*%*	*Primary Inductance Tolerance*
NP	**31.1**		*Calculated Primary Winding Total Number of Turns*
NSM	**4**		*Secondary Main Number of Turns*
CMA	**595.62**	*Cmils/A*	*Primary Winding Current Capacity*
VOR	**110.00**	*V*	*Reflected Output Voltage*
BW	**19.40**	*mm*	*Bobbin Winding Width*
ML	**0.00**	*mm*	*Safety Margin on Left Width*
MR	**0.00**	*mm*	*Safety Margin on Right Width*
FF	**74.84**	*%*	*Actual Transformer Fit Factor. 100% signifies fully utilized winding window*
TSAMPLE_FULL_LOAD	**3.10**	*µs*	*Auxiliary Winding Sample Time at Full Load*
TSAMPLE_NO_LOAD	**1.47**	*µs*	*Auxiliary Winding Sample Time at No Load*
AE	**76.00**	*mm²*	*Core Cross Sectional Area*
ALG	**235**	*nH/T²*	*Gapped Core Specific Inductance*
BM	**2597**	*Gauss*	*Maximum Flux Density*
BP	**3849**	*Gauss*	*Peak Flux Density*
BAC	**952**	*Gauss*	*AC Flux Density for Core Loss*
LG	**0.361**	*mm*	*Estimated Gap Length*
L_LKG	**4.55**	*µH*	*Estimated primary leakage inductance*
LSEC	**10**	*nH*	*Secondary Trace Inductance*

Primary Winding Section 1

Var	Value	Units	Description
NP1	**16**		Number of Primary Winding Turns in the First Section of Primary
Wire Size	**24**	AWG	Primary Winding - Wire Size
Winding Type	**Bifilar (x2)**		Primary Winding - Number of Parallel Wire Strands
L	**0.93**		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	**16**		Rounded (Integer) Number of Primary winding turns in the second section of primary
Wire Size	**24**	AWG	Primary Winding - Wire Size
Winding Type	**Bifilar (x2)**		Primary Winding - Number of Parallel Wire Strands
L2	**0.93**		Primary Number of Layers in 2nd split winding

Output 1

Var	Value	Units	Description
VO	**13.00**	V	Typical Output Voltage
IO	**5.50**	A	Output Current
VOUT_ACTUAL	**13.00**	V	Actual Output Voltage
NS	**4**		Secondary Number of Turns
Foil Thickness	**5**	mil	Wire size of secondary winding
Winding Type	**Foil**		Output winding number of parallel strands
L_S_OUT	**4.00**		Secondary Output Winding Layers
DC Copper Loss	**0.09**	W	Secondary DC Losses
VD	**1.15**	V	Output Winding Diode Forward Voltage Drop
VD	**1.15**	V	Output Winding Diode Forward Voltage Drop
PIVS	**59.85**	V	Output Rectifier Maximum Peak Inverse Voltage
ISP	**20.984**	A	Peak Secondary Current
ISRMS	**9.230**	A	Secondary RMS Current
ISRMS_WINDING	**9.230**	A	Secondary Winding RMS Current
CDS_FOIL	**3.75**	A/mm²	Secondary Winding Current Density
RTH_RECTIFIER	**6.00**	°C/W	Output Rectifier Heatsink Maximum Thermal Resistance
OR_HSINK_TYPE	**Aluminum Extruded**		Output Rectifier Heatsink Type
OR_HSINK_PN	**532702B02500G**		Output Rectifier (Extruded) Heatsink Part Number
CO	**470 x 2**	µF	Output Capacitor - Capacitance
IRIPPLE	**7.412**	A	Output Capacitor - RMS Ripple Current
Expected Lifetime	**145303**	hr	Output Capacitor - Expected Lifetime

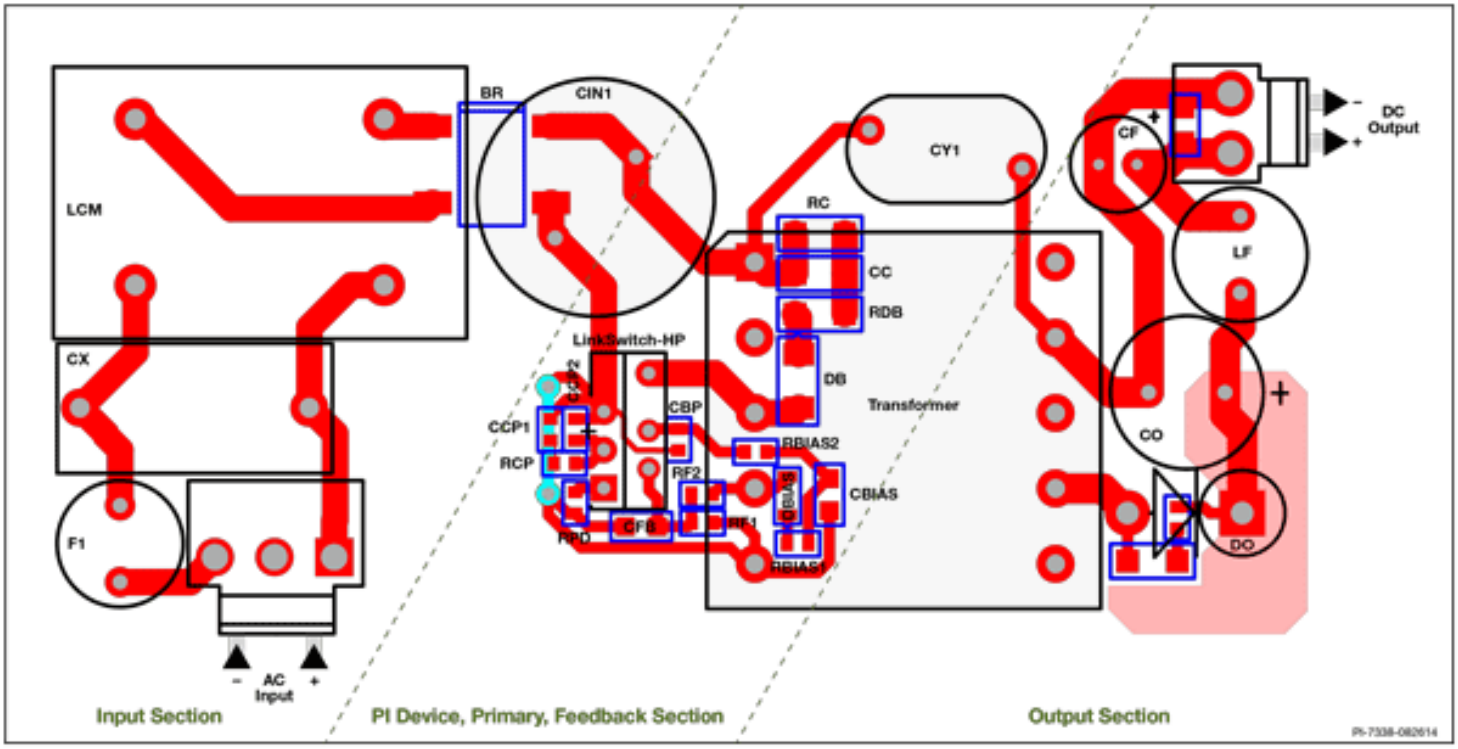
High output current Flyback design.

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.

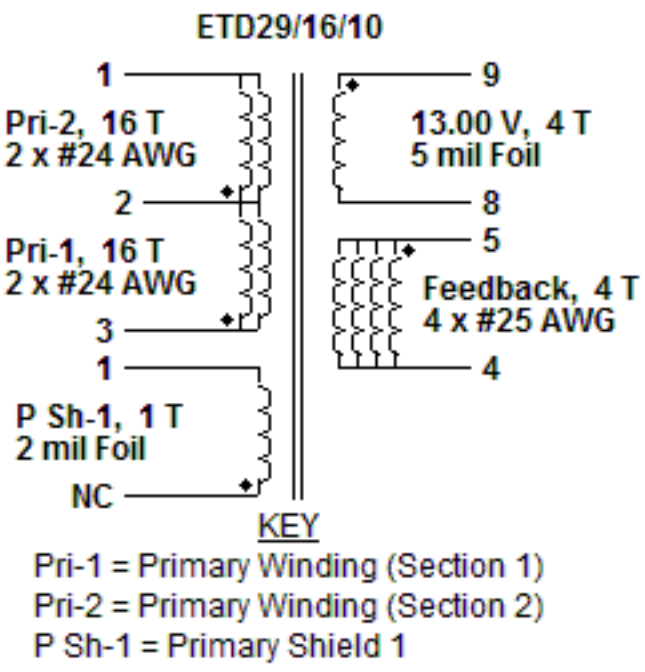
	Description	*Show Me*
1	*Minimize loop area formed by drain, input capacitor and transformer*	
2	*Minimize loop area formed by secondary winding, the output rectifier and the output filter capacitor*	
3	*Minimize the loop area formed by the clamp blocking diode, the damping resistor and the snubber capacitor*	
4	*Place the FB/BP/CP pin components as close to the pin as possible. These signal traces should be routed separately from the power traces. Use of kelvin connection for this purpose is highly recommended.*	
5	*A large copper area on the cathode of the secondary rectifier is acceptable since this is a quiet node and the larger copper area actually provides heatsinking to the rectifier*	
6	*The Y capacitor should be placed directly from the primary input filter capacitor positive terminal to the common/return terminal of the transformer secondary*	

Bill Of Materials

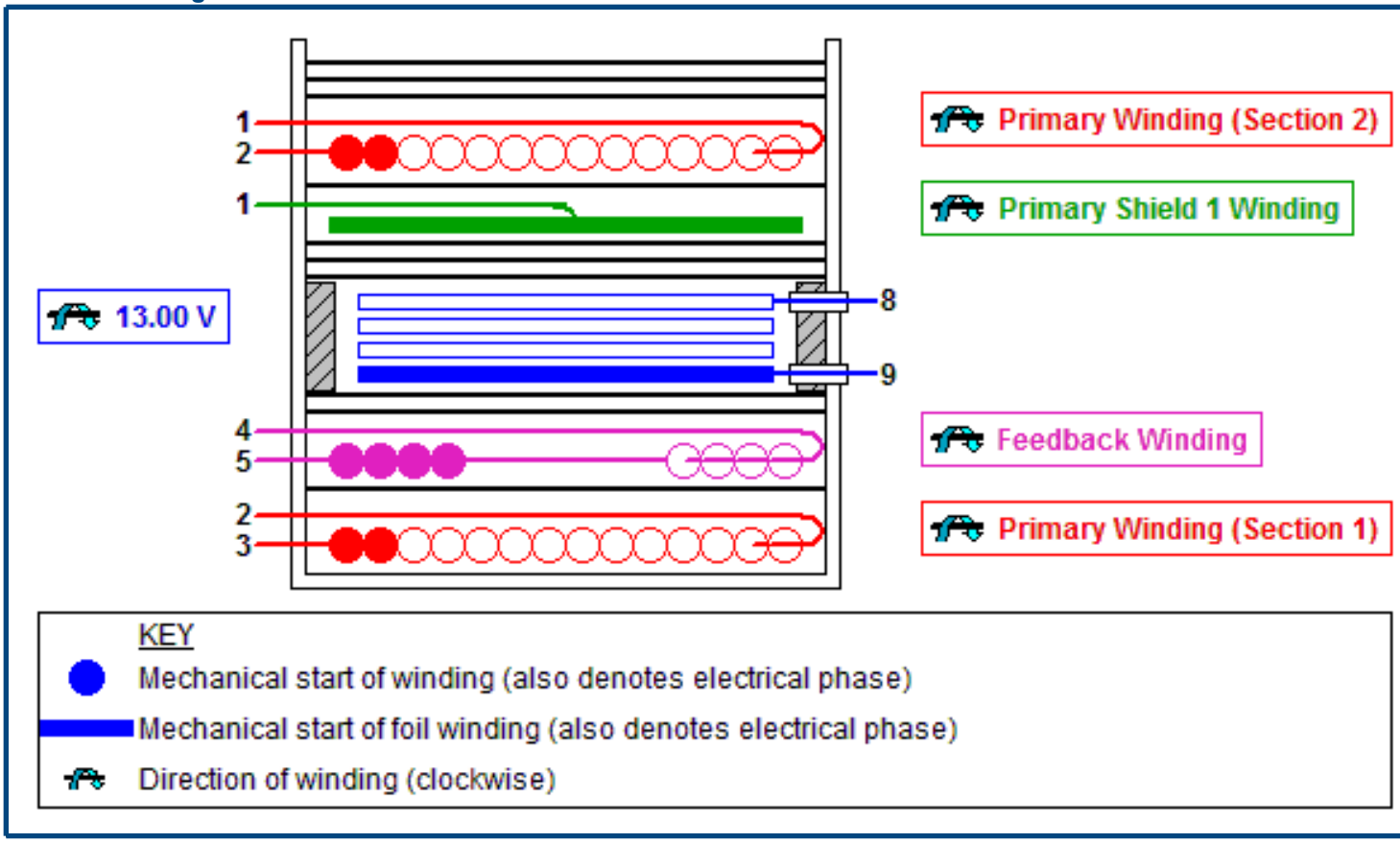
Item #	Quantity	Part Ref	Value	Description	Mfg	Mfg Part Number
1	1	BR1	KBP206G	600 V, 2 A, Standard Recovery Bridge, KBP	Diodes Inc.	KBP206G
2	1	C1	330 nF	330 nF, 275 VAC, Film, X Class	Panasonic	ECQ-UAAF334K
3	1	C2	220 µF	220 µF, 400 V, High Voltage Al Electrolytic, (25 mm x 35 mm)	Nichicon	LGU2G221MELC
4	1	C3	4.7 nF	4.7 nF, 2 kV, High Voltage Ceramic	Vishay	564R20TSD47
5	1	C4	100 nF	100 nF, 50 V, Ceramic, X7R	Kemet	C322C104K5R5TA
6	1	C5	100 pF	100 pF, 50 V, Ceramic, C0G	Kemet	C317C101J5G5TA
7	1	C6	0.47 µF	0.47 µF, 16 V, Ceramic, X7R	TDK	FK18X7R1C474K
8	1	C7	0.68 nF	0.68 nF, 250 VAC, Ceramic, Y Class	Vishay Cera-Mite	440LT68-R
9	1	C8	27 pF	27 pF, 1 kV, High Voltage Ceramic	Vishay	S270K25SL0N63L6R
10	1	C9	10 µF	10 µF, 50 V, Electrolytic, Gen Purpose, 1050 mΩ, (11.5 mm x 5 mm)	Panasonic	ECA-1HHG100
11	1	C10	10 pF	10 pF, 100 V, Ceramic, C0G	Kemet	C0603C100J1GACTU
12	2	C11, C12	470 µF	470 µF, 25 V, Electrolytic, Super Low ESR, 15 mΩ, (12.7 mm x 10 mm)	Nichicon	PCR1E471MCL1GS
13	1	C13	100 µF	100 µF, 16 V, Electrolytic, Low ESR, 250 mΩ, (11.5 mm x 6.3 mm)	United Chemi-Con	ELXZ160ELL101MFB5D
14	1	D1	RGP25M-E3/54	1000 V, 2.5 A, Fast Recovery, 500 ns, DO-201AD	Vishay	RGP25M-E3/54
15	1	D2	1N4148TR	100 V, 0.3 A, Fast Recovery, 8 ns, DO-35	Vishay	1N4148TR
16	1	D3	BYV32-200G	200 V, 18 A, Ultrafast Recovery, 25 ns, TO-220AB	Vishay	BYV32-200G
17	1	F1	1.25 A	250 VAC, 1.25 A, Radial TR5, Time Lag Fuse	Littelfuse / Wickmann(R)	37411250410
18	1	HS1	TV35G	7.2 °C/W TO-220. Heatsink for use with Device U2.	Aavid	TV35G
19	1	HS2	532702B02500G	4.8 °C/W TO-220. Heatsink for use with Rectifier D3.	Aavid	532702B02500G
20	1	L1	6 mH	6 mH, 1.6 A	Panasonic	ELF18N016
21	1	L2	3.3 µH	3.3 µH, 7.5 A	Wurth Elektronik	7447471033
22	2	R1, R2	0.56 MΩ	0.56 MΩ, 5 %, 0.25 W, Carbon Film	Generic	
23	1	R3	2 kΩ	2 kΩ, 5 %, 2 W, Metal Oxide Film	Generic	
24	1	R4	5.1 Ω	5.1 Ω, 5 %, 0.25 W, Carbon Film	Generic	
25	1	R5	100 kΩ	100 kΩ, 1 %, 0.25 W, Metal Film	Generic	
26	1	R6	124 kΩ	124 kΩ, 1 %, 0.125 W, Metal Film	Generic	
27	1	R7	2 Ω	2 Ω, 5 %, 0.125 W, Carbon Film	Generic	
28	1	R8	390 Ω	390 Ω, 5 %, 0.25 W, Carbon Film	Generic	
29	1	R9	2.2 kΩ	2.2 kΩ, 5 %, 0.125 W, Carbon Film	Generic	
30	1	R10	47.5 kΩ	47.5 kΩ, 1 %, 0.25 W, Metal Film	Generic	
31	1	R11	10.5 kΩ	10.5 kΩ, 1 %, 0.125 W, Metal Film	Generic	
32	1	RT1	6 Ω	NTC Thermistor 6 Ω, 4 A	TDK	B57235S0609M000V9

33	1	T1	ETD29/16/10	3F3 Core Material See Transformer Construction’s Materials List for complete information	Epcos	B66358-G-X127
34	1	U1	CAP300DG	CAPZero-3, 1000 V, SOIC-8	Power Integrations	CAP300DG
35	1	U2	LNK6769E	LinkSwitch-HP, LNK6769E, eSIP-7C	Power Integrations	LNK6769E
36	1	VR1	P6KE130A-E3/54	130 V, 5 W, 5 %, DO-204AC, TVS	Vishay	P6KE130A-E3/54

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. 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.

Feedback Winding

Start on any (temp) pin on the secondary side and wind 4 turns (x 4 filar) of item [6]. Winding direction is clockwise. Spread the winding evenly across entire bobbin. Finish this winding on pin(s) 4. Move end of wire from temp pin and terminate it on pin 5.

Add 2 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 (to meet safety). Start on pin(s) 9 and wind 4 turns of item [7]. Winding direction is clockwise. Finish this winding on pin(s) 8.

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

Primary Shield 1 Winding

Leaving the start of this winding unconnected, wind 1 turn of item [9]. Winding direction is clockwise. Finish this winding on pin(s) 1.

Add 1 layer of tape, item [3], to secure the winding in place.

Primary Winding (Section 2)

Start on pin(s) 2 and wind 16 turns (x 2 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: ETD29/16/10, 3F3, gapped for ALG of 235 nH/T²**
[2]	**Bobbin: Generic, 7 pri. + 7 sec.**
[3]	**Barrier Tape: Polyester film [1 mil (25 µm) base thickness], 19.40 mm wide**
[4]	**Varnish**
[5]	**Magnet Wire: 24 AWG, Solderable Double Coated**
[6]	**Magnet Wire: 25 AWG, Solderable Double Coated**
[7]	**Copper Foil: 5 mil thick, mm wide, covered with 1 layer of lapped tape. Terminations to foil: 2 x 23 AWG magnet wire with sleeving**
[8]	**Tape: Polyester web 3 mm wide**
[9]	**Copper Foil: 2 mil thick, 19.40 mm wide, covered with 1 layer of lapped tape. Terminations to foil: 1 x 24 AWG magnet wire**

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.**	**227**
Tolerance, ±%	**Tolerance of Primary Inductance**	**10.0**
Maximum Primary Leakage, µH	**Measured between Pin 1 to Pin 3, with all other Windings shorted.**	**4.55**

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.