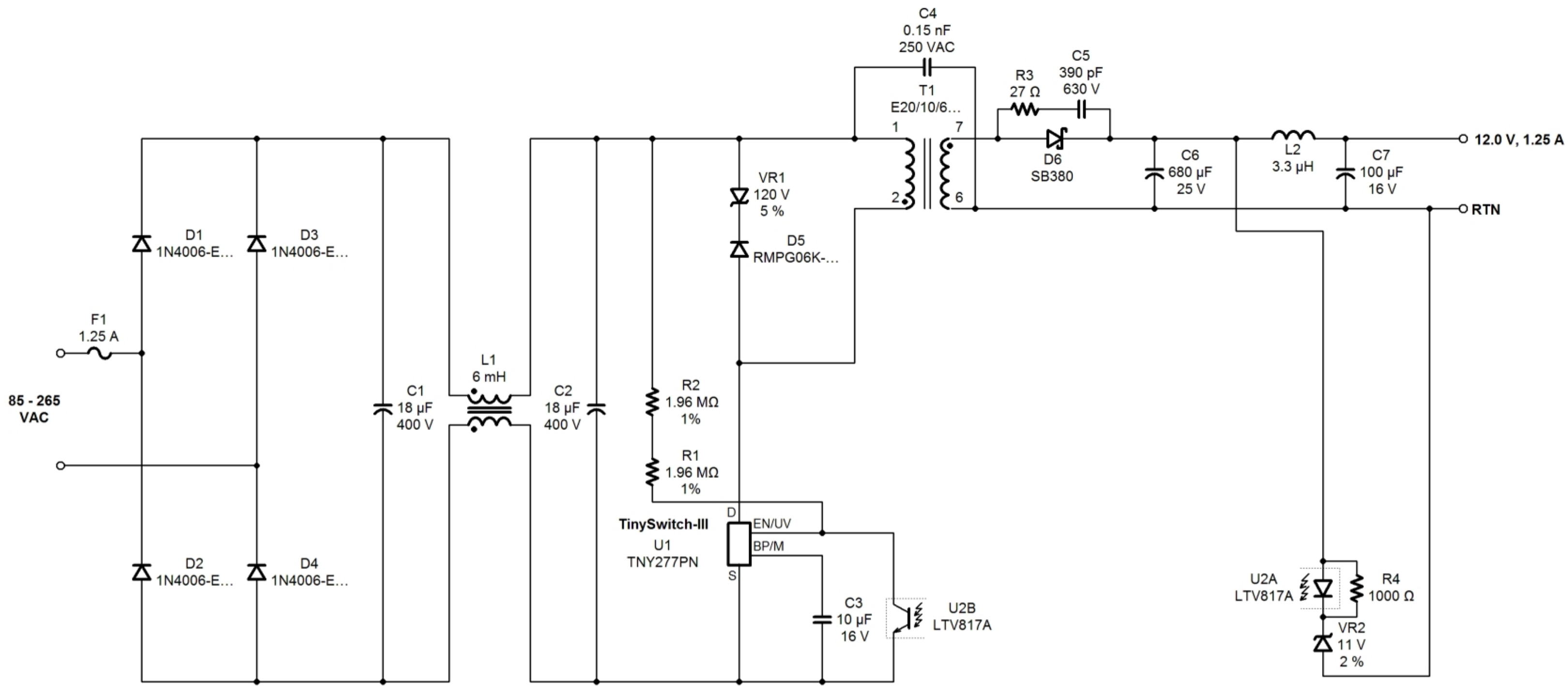


Schematic components that have been frozen by the user will appear with blue reference designators.

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	2.69	ms	Input Rectifier Conduction Time
Z	0.47		Loss Allocation Factor
η	78.0	%	Efficiency Estimate (Target)
VMIN	81.5	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	0.24	A	Average Diode Bridge Current (DC Input Current)

Device Variables

Var	Value	Units	Description
Device	TNY277PN		PI Device Name
BVDSS	700	V	Drn-Src Bkdn Voltage
Current Limit Mode	Increased		Device Current Limit Mode
PO	15.00	W	Total Output Power
VDRAIN Estimated	494.77	V	Estimated Drain Voltage
VDS	11.08	V	On state Drain to Source Voltage
I2F_MIN	35.94	A^2kHz	Minimum I2F
I2F_MAX	46.32	A^2kHz	Maximum I2F
FS_AT_ILIMMIN	137088	Hz	Switching Frequency at Current Limit Minimum
KP	0.404		Continuous/Discontinuous Operating Ratio (at VMIN and Full Load)
KP_TRANSIENT	0.27		Transient Ripple to Peak Current Ratio
DMAX	0.590		Maximum Duty Cycle (at VMIN and Full Load)
ILIMITMIN	0.512	A	Minimum Current Limit
ILIMITMAX	0.610	A	Maximum Current Limit
IRMS	0.324	A	Primary RMS Current (at VMIN and Full Load)
RTH_DEVICE	43.02	°C/W	PI Device Heatsink Maximum Thermal Resistance
DEV_HSINK_TYPE	2 Oz (70 µ) 2-Sided Copper PCB		PI Device Heatsink Type
DEV_HSINK_AREA	346	mm^2	PI Device Heatsink Area

Clamp Circuit

Var	Value	Units	Description
Clamp Type	Zener Clamp		Clamp Circuit Type
VCLAMP	18.51	V	Average Clamping Voltage
Estimated Clamp Loss	0.585	W	Clamp total power loss

Transformer Construction Parameters

Var	Value	Units	Description
Core Type	E20/10/6 (EF20)		Core Type
Core Material	3F3		Core Material
Bobbin Reference	Generic, 5 pri. + 5 sec.		Bobbin Reference

Bobbin Orientation	**Horizontal**		Bobbin type
Primary Pins	**2**		Number of Primary pins used
Secondary Pins	**2**		Number of Secondary pins used
USE_SHIELDS	**NO**		Use shield Windings
LP_nom	**1664**	µH	Nominal Primary Inductance
LP_Tol	**12.0**	%	Primary Inductance Tolerance
NP	**102.7**		Calculated Primary Winding Total Number of Turns
NSM	**13**		Secondary Main Number of Turns
CMA	**393.84**	Cmils/A	Primary Winding Current Capacity
VOR	**101.49**	V	Reflected Output Voltage
BW	**12.50**	mm	Bobbin Winding Width
ML	**0.00**	mm	Safety Margin on Left Width
MR	**0.00**	mm	Safety Margin on Right Width
FF	**93.55**	%	Actual Transformer Fit Factor. 100% signifies fully utilized winding window
AE	**32.10**	mm²	Core Cross Sectional Area
ALG	**139**	nH/T²	Gapped Core Specific Inductance
BM	**2782**	Gauss	Maximum Flux Density
BAC	**470**	Gauss	AC Flux Density for Core Loss
LG	**0.259**	mm	Estimated Gap Length
L_LKG	**49.92**	µH	Estimated primary leakage inductance
LSEC	**15**	nH	Secondary Trace Inductance

Primary Winding Section 1

Var	Value	Units	Description
NP1	**103**		Number of Primary Winding Turns in the First Section of Primary
Wire Size	**29**	AWG	Primary Winding - Wire Size
Winding Type	**Single (x1)**		Primary Winding - Number of Parallel Wire Strands
L	**2.72**		Primary Winding - Number of Layers
DC Copper Loss	**0.11**	W	Primary Section 1 DC Losses

Output 1

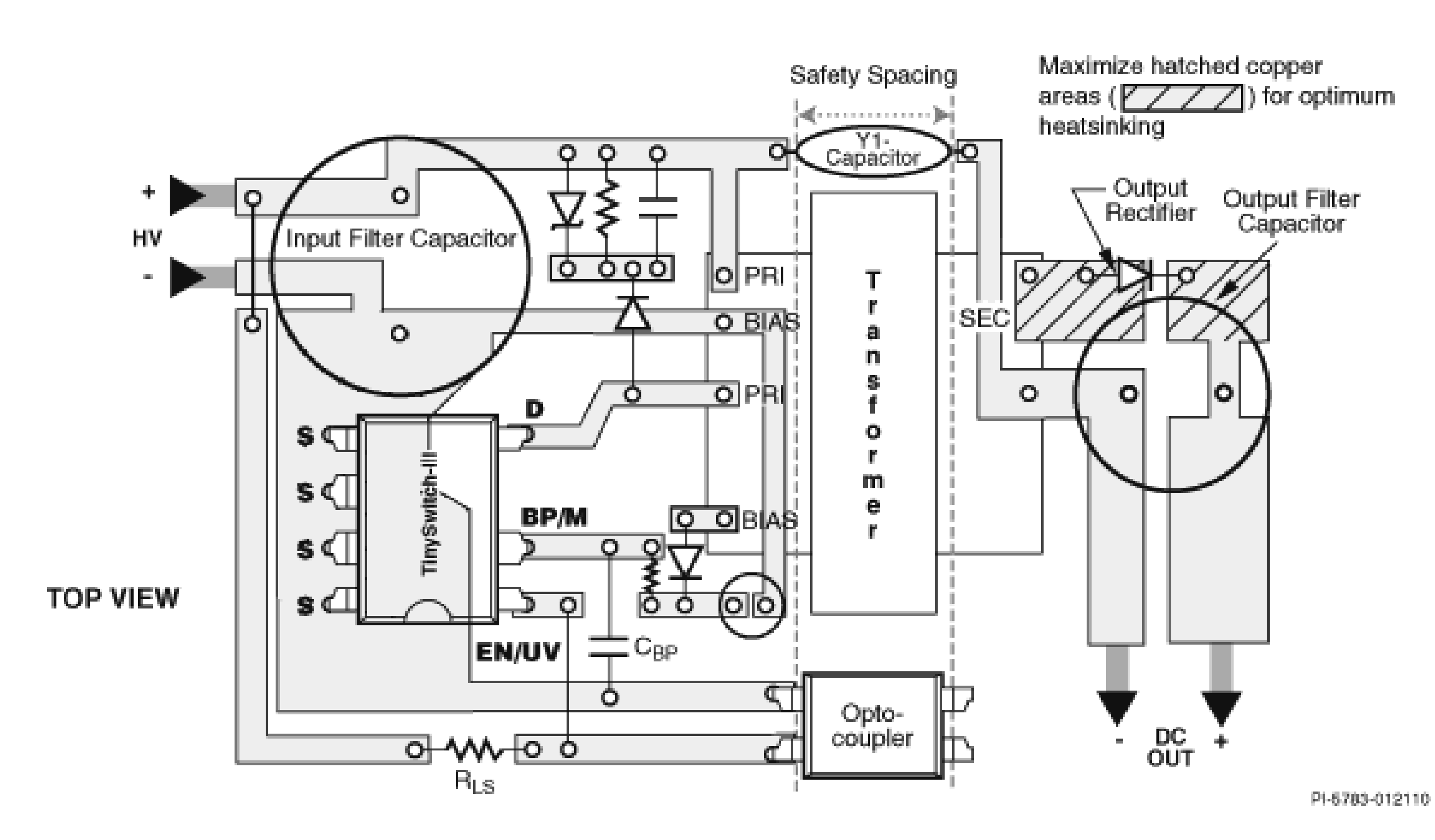
Var	Value	Units	Description
VO	**12.00**	V	Typical Output Voltage
IO	**1.25**	A	Output Current
VOUT_ACTUAL	**12.00**	V	Actual Output Voltage
NS	**13**		Secondary Number of Turns
Wire Size	**25**	AWG	Wire size of secondary winding
Winding Type	**Bifilar (x2)**		Output winding number of parallel strands
L_S_OUT	**1.35**		Secondary Output Winding Layers
DC Copper Loss	**0.15**	W	Secondary DC Losses
VD	**0.85**	V	Output Winding Diode Forward Voltage Drop
VD	**0.85**	V	Output Winding Diode Forward Voltage Drop
PIVS	**59.30**	V	Output Rectifier Maximum Peak Inverse Voltage
ISP	**4.044**	A	Peak Secondary Current
ISRMS	**2.087**	A	Secondary RMS Current
ISRMS_WINDING	**2.087**	A	Secondary Winding RMS Current

CMAS	**307**	*Cmils/A*	*Secondary Winding Current Capacity*
RTH_RECTIFIER	**52.78**	*°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	**157**	*mm²*	*Output Rectifier Heatsink Area*
CO	**680 x 1**	*µF*	*Output Capacitor - Capacitance*
IRIPPLE	**1.671**	*A*	*Output Capacitor - RMS Ripple Current*
Expected Lifetime	**35673**	*hr*	*Output Capacitor - Expected Lifetime*

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



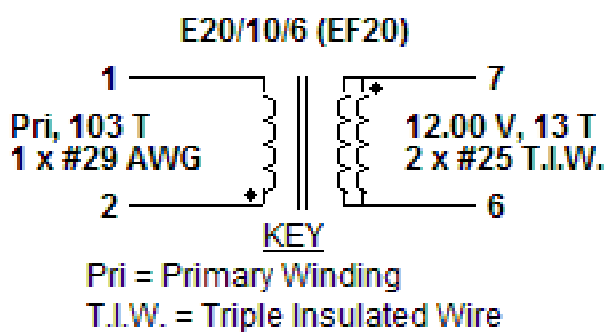
Click on the "Show me" icon to highlight relevant areas on the sample layout.

	Description	*Show Me*
1	*Maximize source area for good heat-sinking*	
2	*Keep drain trace short*	
3	*The BYPASS pin capacitor should be located as close as possible to the BYPASS and SOURCE pins*	
4	*Keep noisy traces away from EN/UV pin*	
5	*Route bias winding currents back to the bulk cap*	
6	*Keep clamp loop short*	
7	*Connect Y capacitor to the B+ rail on the primary side for better surge immunity. Keep Y capacitor traces short*	
8	*The area of the loop connecting the secondary winding, the output rectifier and the output filter capacitor should be minimized*	

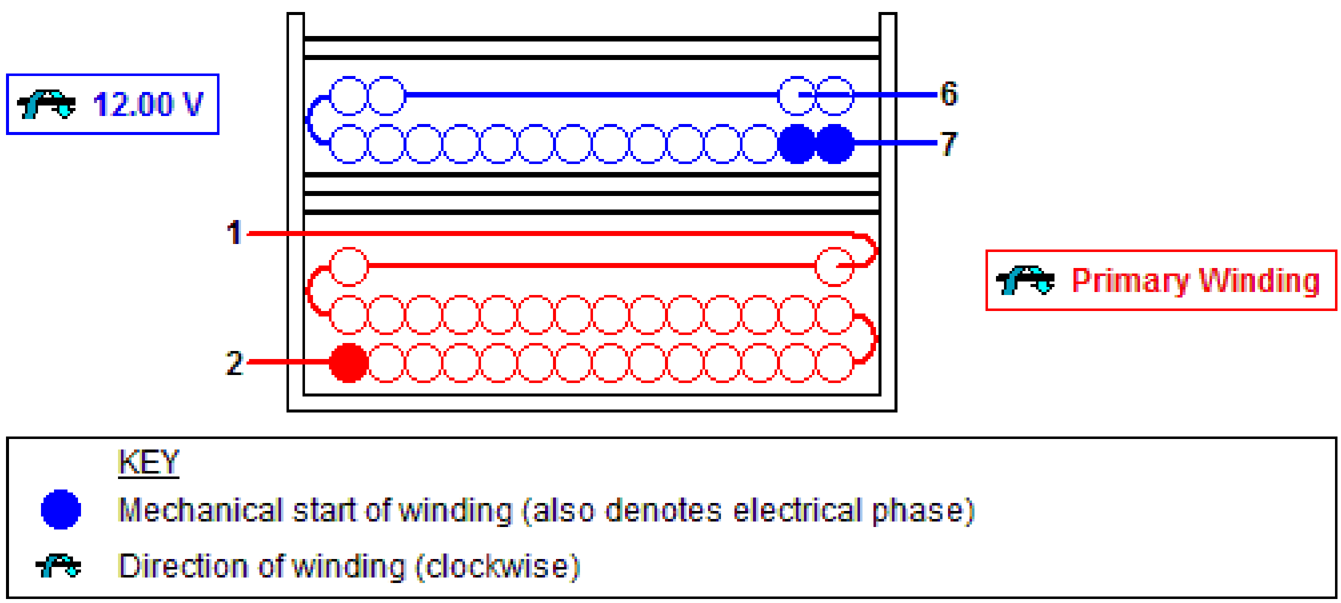
Bill Of Materials

Item #	Quantity	Part Ref	Value	Description	Mfg	Mfg Part Number
1	2	C1, C2	18 µF	18 µF, 400 V, High Voltage Al Electrolytic, (20 mm x 10 mm)	United Chemi-Con	EKXJ401ELL180MJ20S
2	1	C3	10 µF	10 µF, 16 V, Ceramic, X7R	TDK	FK14X5R1C106K
3	1	C4	0.15 nF	0.15 nF, 250 VAC, Ceramic, Y Class	TDK	CD70-B2GA151KYNS
4	1	C5	390 pF	390 pF, 630 V, High Voltage Ceramic	TDK	FG26C0G2J391JNT06
5	1	C6	680 µF	680 µF, 25 V, Electrolytic, Super Low ESR, 23 mΩ, (20 mm x 10 mm)	United Chemi-Con	EKZE250ELL681MJ20S
6	1	C7	100 µF	100 µF, 16 V, Electrolytic, Low ESR, 250 mΩ, (11.5 mm x 6.3 mm)	United Chemi-Con	ELXZ160ELL101MFB5D
7	4	D1, D2, D3, D4	1N4006-E3/54	800 V, 1 A, Standard Recovery, DO-41	Vishay	1N4006-E3/54
8	1	D5	RMPG06K-E3/54	800 V, 1 A, Fast Recovery, 250 ns, MPG06	Vishay	RMPG06K-E3/54
9	1	D6	SB380	80 V, 3 A, Schottky, DO-201AD	Vishay	SB380
10	1	F1	1.25 A	250 VAC, 1.25 A, Radial TR5, Time Lag Fuse	Littelfuse / Wickmann(R)	37411250410
11	1	L1	6 mH	6 mH, 1.6 A	Panasonic	ELF18N016
12	1	L2	3.3 µH	3.3 µH, 2.66 A	Bourns Inc.	RL822-3R3K-RC
13	2	R1, R2	1.96 MΩ	1.96 MΩ, 1 %, 0.25 W, Metal Film	Generic	
14	1	R3	27 Ω	27 Ω, 5 %, 0.25 W, Carbon Film	Generic	
15	1	R4	1000 Ω	1000 Ω, 5 %, 0.125 W, Carbon Film	Generic	
16	1	T1	E20/10/6 (EF20)	3F3 Core Material See Transformer Construction’s Materials List for complete information	Epcos	B66311-G-X127
17	1	U1	TNY277PN	TinySwitch-III, TNY277PN, DIP-8	Power Integrations	TNY277PN
18	1	U2	LTV817A	Optocoupler LTV817A, 35 V, CTR 80 - 160 %, 4-DIP	Liteon	LTV817A
19	1	VR1	P6KE120A-E3/54	120 V, 5 W, 5 %, DO-204AC, TVS	Vishay	P6KE120A-E3/54
20	1	VR2	BZX79-B11,133	11 V, 500 mW, 2 %, DO-35, General Purpose	Nexperia	BZX79-B11,133
21	1			346 mm² area on Copper PCB. 2 oz (70 µm) thickness. Heatsink for use with Device U1.	Custom	
22	1			157 mm² area on Copper PCB. 2 oz (70 µm) thickness. Heatsink for use with Rectifier D6.	Custom	

Electrical Diagram



Mechanical Diagram



Winding Instruction

Primary Winding

Start on pin(s) 2 and wind 103 turns (x 1 filar) of item [5]. in 3 layer(s) from left to right. Winding direction is clockwise. At the end of 1st layer, continue to wind the next layer from right to left. At the end of 2nd layer, continue to wind the next layer 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.

Secondary Winding

Start on pin(s) 7 and wind 13 turns (x 2 filar) of item [6]. Spread the winding evenly across entire bobbin. Winding direction is clockwise. Finish this winding on pin(s) 6.

Add 2 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. For non margin wound transformers use triple insulated wire for all secondary windings.

Materials

Item	*Description*
[1]	**Core: E20/10/6 (EF20), 3F3, gapped for ALG of 139 nH/T²**
[2]	**Bobbin: Generic, 5 pri. + 5 sec.**

[3]	**Barrier Tape: Polyester film [1 mil (25 µm) base thickness], 12.50 mm wide**
[4]	**Varnish**
[5]	**Magnet Wire: 29 AWG, Solderable Double Coated**
[6]	**Triple Insulated Wire: 25 AWG**

Electrical Test Specifications

Parameter	***Condition***	***Spec***
Electrical Strength, VAC	**60 Hz 1 second, from pins 1,2 to pins 6,7.**	**3000**
Nominal Primary Inductance, µH	**Measured at 1 V pk-pk, typical switching frequency, between pin 1 to pin 2, with all other Windings open.**	**1664**
Tolerance, ±%	**Tolerance of Primary Inductance**	**12.0**
Maximum Primary Leakage, µH	**Measured between Pin 1 to Pin 2, with all other Windings shorted.**	**49.92**

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.

Design Passed (Optimization Done)