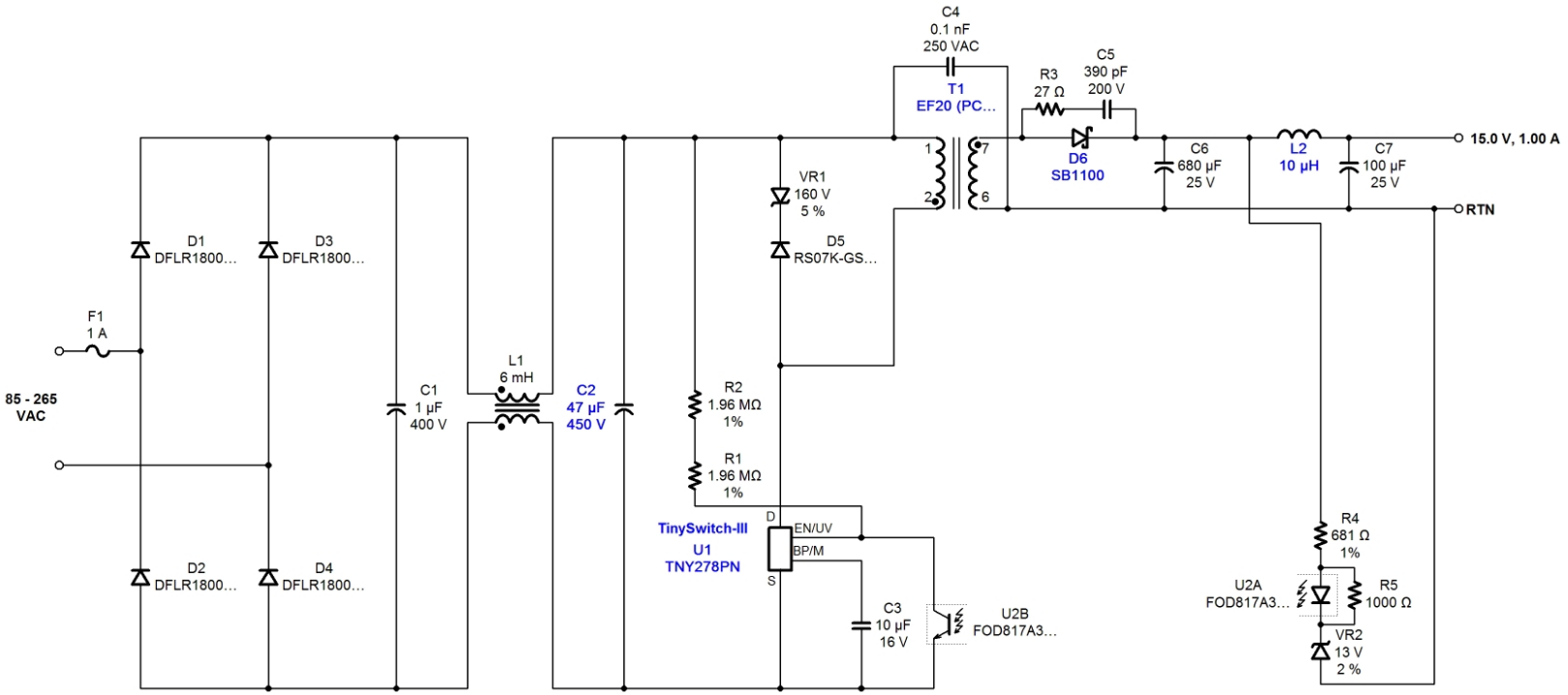


Schematic components that have been frozen by the user will appear with blue reference designators.

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	79.0	%	Efficiency Estimate (Target)
VMIN	93.1	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)

Device Variables

Var	Value	Units	Description
Device	TNY278PN		PI Device Name (Manual Overwrite)
BVDSS	700	V	Drn-Src Bkdn Voltage
Current Limit Mode	Increased		Device Current Limit Mode
PO	15.00	W	Total Output Power
VDRAIN Estimated	534.77	V	Estimated Drain Voltage
VDS	5.74	V	On state Drain to Source Voltage
I2F_MIN	50.19	A^2kHz	Minimum I2F
I2F_MAX	64.69	A^2kHz	Maximum I2F
FS_AT_ILIMMIN	137129	Hz	Switching Frequency at Current Limit Minimum
KP	0.856		Continuous/Discontinuous Operating Ratio (at VMIN and Full Load)
KP_TRANSIENT	0.65		Transient Ripple to Peak Current Ratio
DMAX	0.607		Maximum Duty Cycle (at VMIN and Full Load)
ILIMITMIN	0.605	A	Minimum Current Limit
ILIMITMAX	0.721	A	Maximum Current Limit
IRMS	0.303	A	Primary RMS Current (at VMIN and Full Load)
RTH_DEVICE	66.87	°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	63	mm^2	PI Device Heatsink Area

Clamp Circuit

Var	Value	Units	Description
Clamp Type	Zener Clamp		Clamp Circuit Type
VCLAMP	25.00	V	Average Clamping Voltage
Estimated Clamp Loss	0.000	W	Clamp total power loss

Transformer Construction Parameters

Var	Value	Units	Description

Core Type	**EF20 (PC40EF20-Z)**		*Core Type (Manual Overwrite)*
Core Material	**PC40**		*Core Material*
Primary Pins	**2**		*Number of Primary pins used*
Secondary Pins	**2**		*Number of Secondary pins used*
USE_SHIELDS	**NO**		*Use shield Windings*
LP_nom	**780**	*µH*	*Nominal Primary Inductance*
LP_Tol	**12.0**	*%*	*Primary Inductance Tolerance*
NP	**102.2**		*Calculated Primary Winding Total Number of Turns*
NSM	**12**		*Secondary Main Number of Turns*
Primary Current Density	**4.88**	*A/mm²*	*Primary Winding Current Density*
VOR	**135.00**	*V*	*Reflected Output Voltage*
BW	**12.50**	*mm*	*Bobbin Winding Width*
FF	**60.17**	*%*	*Actual Transformer Fit Factor. 100% signifies fully utilized winding window*
AE	**33.50**	*mm²*	*Core Cross Sectional Area*
ALG	**66**	*nH/T²*	*Gapped Core Specific Inductance*
BM	**150**	*mT*	*Maximum Flux Density*
BAC	**53**	*mT*	*AC Flux Density for Core Loss*
LG	*0.614*	*mm*	*Estimated Gap Length. See Information section for detail*
L_LKG	**23.39**	*µH*	*Estimated primary leakage inductance*
LSEC	**20**	*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*
L	**2.72**		*Primary Winding - Number of Layers*
DC Copper Loss	**0.11**	*W*	*Primary Section 1 DC Losses*

Output 1

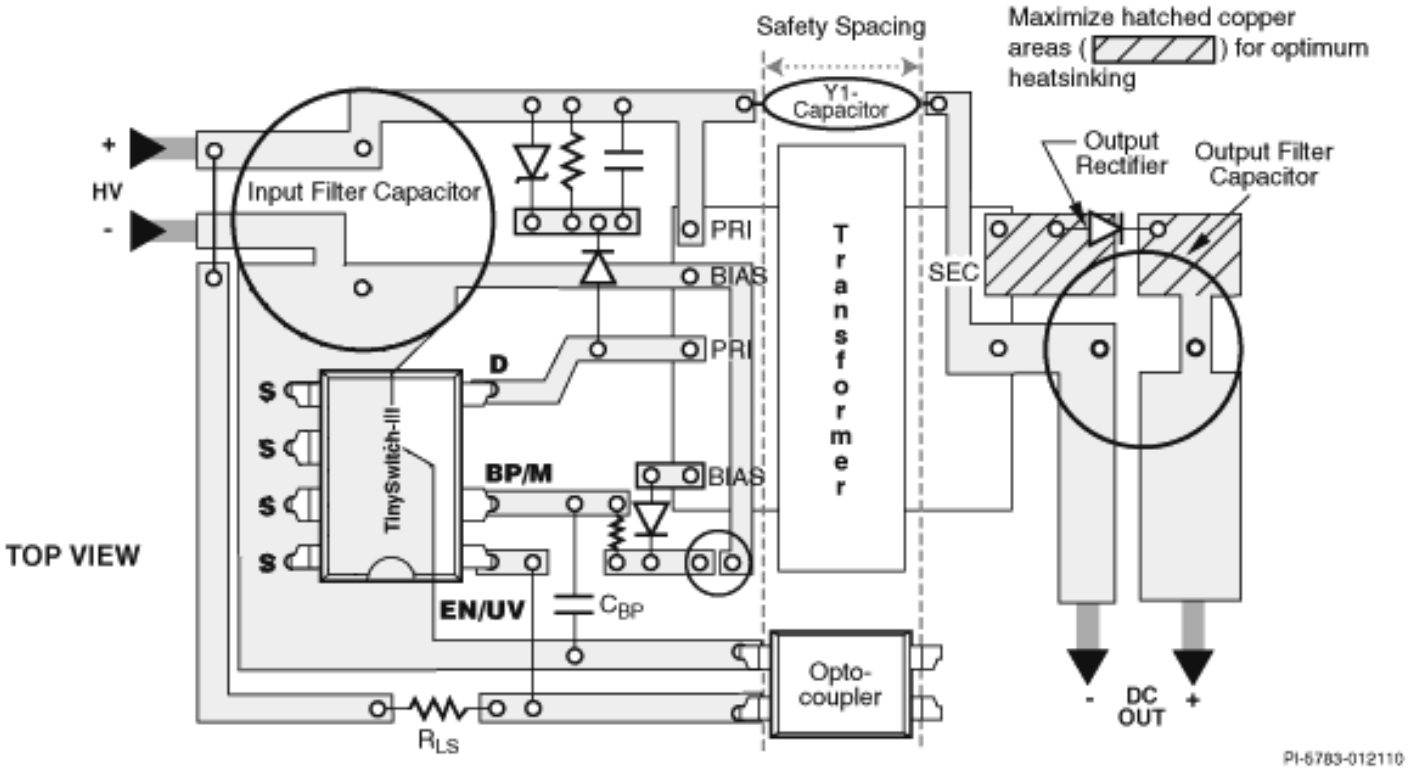
Var	*Value*	*Units*	*Description*
VO	**15.00**	*V*	*Typical Output Voltage*
IO	**1.00**	*A*	*Output Current*
VOUT_ACTUAL	**15.00**	*V*	*Actual Output Voltage*
NS	**12**		*Secondary Number of Turns*
L_S_OUT	**0.72**		*Secondary Output Winding Layers*
DC Copper Loss	**0.20**	*W*	*Secondary DC Losses*
VD	**0.85**	*V*	*Output Winding Diode Forward Voltage Drop (Manual Overwrite)*
VD	**0.85**	*V*	*Output Winding Diode Forward Voltage Drop (Manual Overwrite)*
PIVS	**58.66**	*V*	*Output Rectifier Maximum Peak Inverse Voltage*
ISP	**5.153**	*A*	*Peak Secondary Current*
ISRMS	**2.012**	*A*	*Secondary RMS Current*
ISRMS_WINDING	**2.012**	*A*	*Secondary Winding RMS Current*
Secondary Current Density	**8**	*A/mm²*	*Secondary Winding Current Density*
RTH_RECTIFIER	**59.45**	*°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	**99**	*mm²*	*Output Rectifier Heatsink Area*
CO	**680 x 1**	*µF*	*Output Capacitor - Capacitance*
IRIPPLE	**1.746**	*A*	*Output Capacitor - RMS Ripple Current*
Expected Lifetime	**33810**	*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



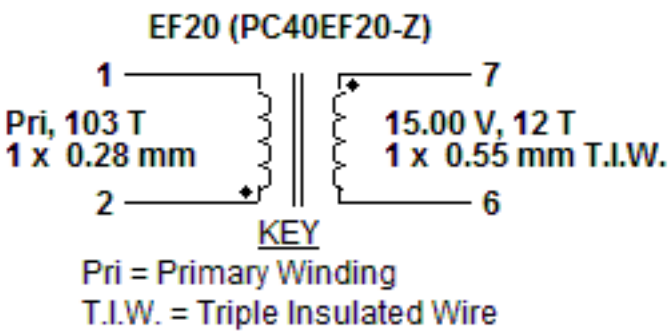
Click on the "Show me" icon to highlight relevant areas on the sample layout.

	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*	

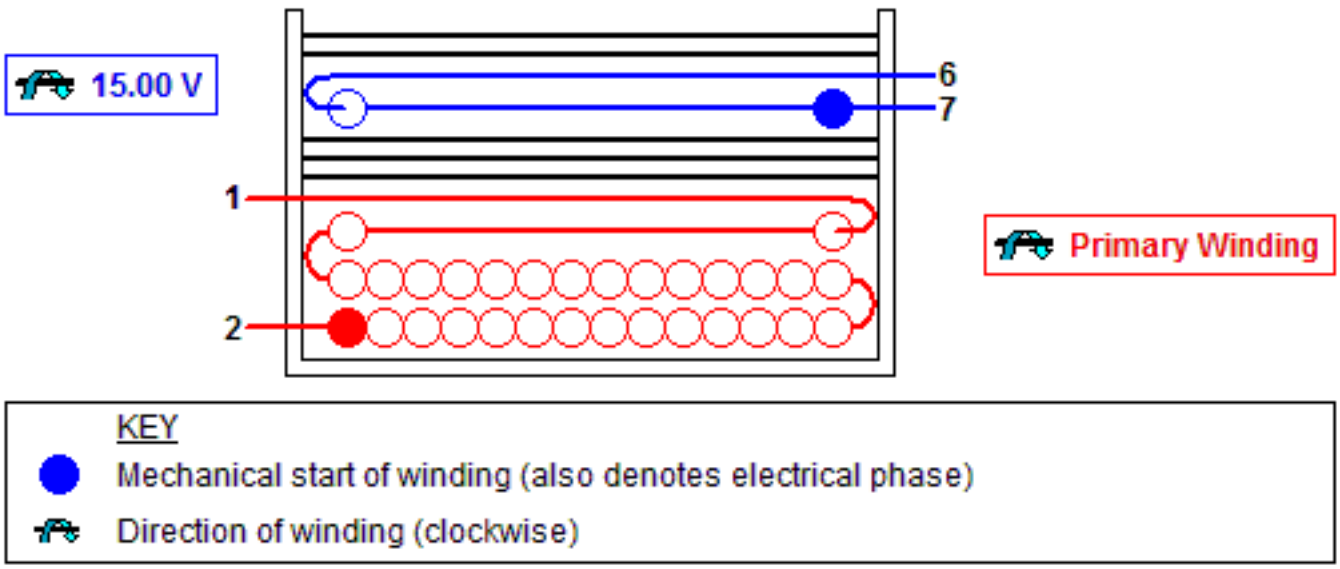
Bill Of Materials

Item #	Quantity	Part Ref	Value	Description	Mfg	Mfg Part Number
1	1	C1	1 µF	1 µF, 400 V, High Voltage Al Electrolytic, (11 mm x 6.3 mm)	Nippon Chemi-Con	ESMG401ELL1R0MF11D
2	1	C2	47 µF	47 µF, 450 V, High Voltage Al Electrolytic, (26.5 mm x 18 mm)	Nichicon	UCS2W470MHD
3	1	C3	10 µF	10 µF, 16 V, Ceramic, X7R	Kemet	C1206C106K4RACTU
4	1	C4	0.1 nF	0.1 nF, 250 VAC, Ceramic, Y Class	Murata	GA342QR7GF101KW01L
5	1	C5	390 pF	390 pF, 200 V, High Voltage Ceramic	AVX Corp	08052C391KAT2A
6	1	C6	680 µF	680 µF, 25 V, Electrolytic, Super Low ESR, 23 mΩ, (20 mm x 10 mm)	United Chemi-Con	EKZE250ELL681MJ20S
7	1	C7	100 µF	100 µF, 25 V, Electrolytic, Low ESR, 260 mΩ, (8 mm x 6.2 mm)	Panasonic	EEEFK1E101AP
8	4	D1, D2, D3, D4	DFLR1800-7	800 V, 1 A, Standard Recovery, POWERDI123	Diodes Inc.	DFLR1800-7
9	1	D5	RS07K-GS08	800 V, 1.4 A, Fast Recovery, 300 ns, DO-219AB	Vishay	RS07K-GS08
10	1	D6	SB1100	100 V, 1 A, Schottky, DO-201AD	ON Semiconductor	SB1100
11	1	F1	1 A	250 VAC, 1 A, Radial TR5, Time Lag Fuse	Littelfuse / Wickmann(R)	37411000410
12	1	L1	6 mH	6 mH, 1.6 A	Panasonic	ELF18N016
13	1	L2	10 µH	10 µH, 5 A	Eaton	HCM1103-100-R
14	2	R1, R2	1.96 MΩ	1.96 MΩ, 1 %, 0.25 W, Thick Film	Generic	
15	1	R3	27 Ω	27 Ω, 5 %, 0.25 W, Thick Film	Generic	
16	1	R4	681 Ω	681 Ω, 1 %, 0.125 W, Thick Film	Generic	
17	1	R5	1000 Ω	1000 Ω, 5 %, 0.125 W, Thick Film	Generic	
18	1	T1	EF20 (PC40EF20-Z)	PC40 Core Material Refer to Manufacturer datasheet for a number of parts to purchase	TDK	PC40EF20-Z
19	1	T1 Bobbin	EF20 - 1 (P5-S5)	Bobbin Material : GFR polyterephthalate	EPCOS (TDK)	B66206
20	1	T1 Core Acc.1	B66206	Yoke . Stainless spring steel	EPCOS (TDK)	B66206
21	1	U1	TNY278PN	TinySwitch-III, TNY278PN, DIP-8	Power Integrations	TNY278PN
22	1	U2	FOD817A3SD	Optocoupler FOD817A3SD , 70 V, CTR 80 - 160 %, 4-SMD	ON Semiconductor	FOD817A3SD
23	1	VR1	P6SMB160A-E3/52	160 V, 5 W, 5 %, DO-214AA, TVS	Vishay	P6SMB160A-E3/52
24	1	VR2	BZT55B13-GS08	13 V, 500 mW, 2 %, SOD-80, General Purpose	Vishay	BZT55B13-GS08
25	1			63 mm² area on Copper PCB. 2 oz (70 µm) thickness. Heatsink for use with Device U1.	Custom	
26	1			99 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 12 turns (x 1 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: EF20 (PC40EF20-Z), PC40, gapped for ALG of 66 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: 0.28 mm, Solderable Double Coated**
[6]	**Triple Insulated Wire: 0.55 mm**

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.**	**780**
Tolerance, ±%	**Tolerance of Primary Inductance**	**12.0**
Maximum Primary Leakage, µH	**Measured between Pin 1 to Pin 2, with all other Windings shorted.**	**23.39**

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.

	Description	Fix	Ref. #
	Gap length too big.	Decrease transformer size, decrease secondary turns (NS), decrease KP.	217
	Selected Post Filter values are too large on output(s) '1'.	Reduce post filter values such that resonant frequency is above 8 kHz (30 kHz for DPASwitch)	175