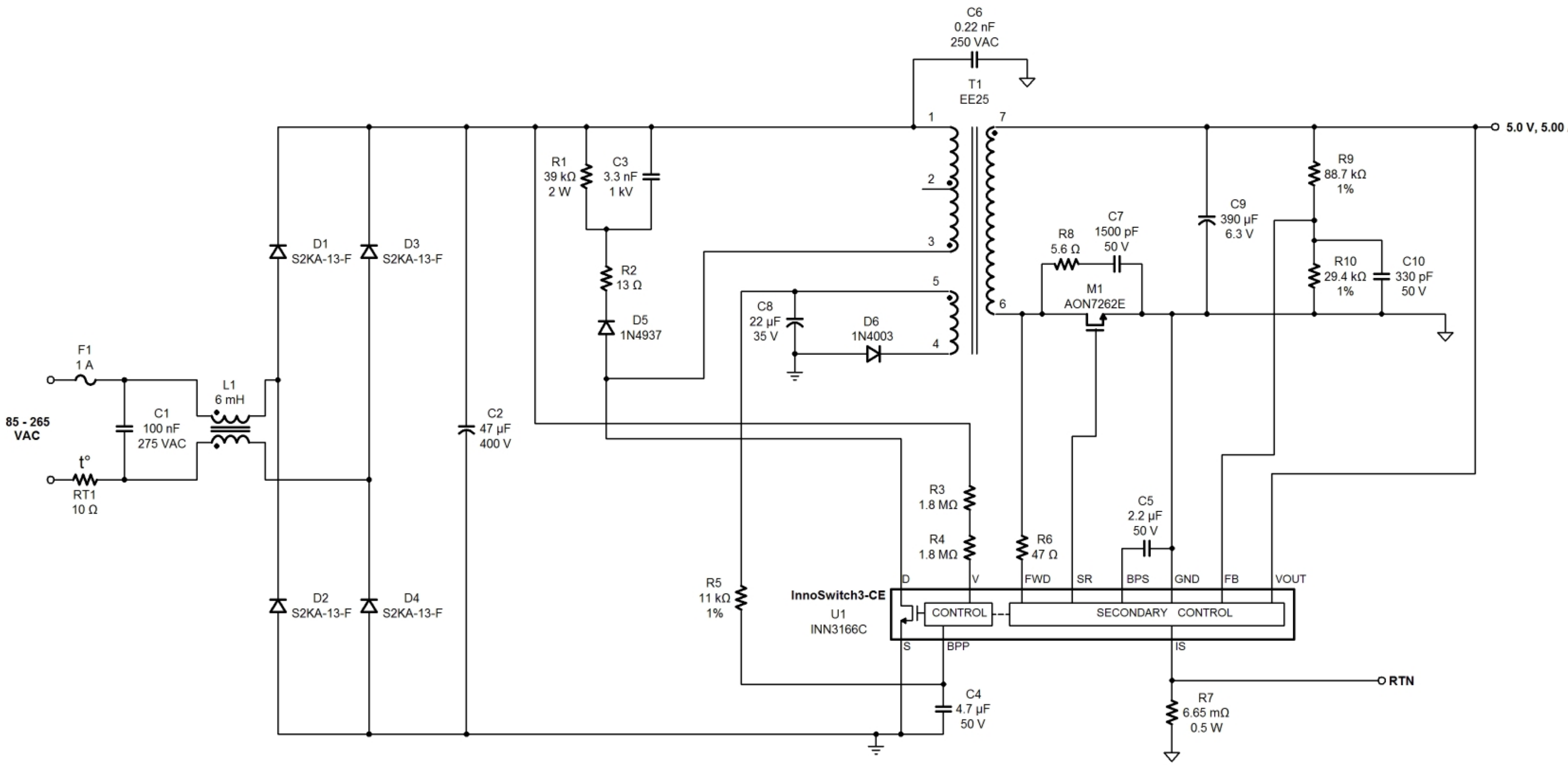


C6
0.22 nF
250 VAC
T1
EE25
1
7
5.0 V, 5.00 A
R1
39 kΩ
2 W
C3
3.3 nF
1 kV
R9
88.7 kΩ
1%
2
C9
390 µF
6.3 V
R8
5.6 Ω
C7
1500 pF
50 V
3
D1
S2KA-13-F
D3
S2KA-13-F
R10
29.4 kΩ
1%
C10
330 pF
50 V
R2
13 Ω
M1
AON7262E
5
C8
22 µF
35 V
D5
1N4937
D6
1N4003
6
4
F1
1 A
L1
6 mH
85 - 265
VAC
C1
100 nF
275 VAC
C2
47 µF
400 V
t°
RT1
10 Ω
R3
1.8 MΩ
C5
2.2 µF
50 V
R4
1.8 MΩ
R6
47 Ω
D
V
FWD
SR
BPS
GND
FB
VOUT
R5
11 kΩ
1%
InnoSwitch3-CE
U1
INN3166C
CONTROL
SECONDARY CONTROL
D2
S2KA-13-F
D4
S2KA-13-F
S
BPP
IS
RTN
C4
4.7 µF
50 V
R7
6.65 mΩ
0.5 W

Power Supply Input

Var	Value	Units	Description
VACMIN	**85**	V	Minimum Input AC Voltage
VACNOM	**115**	V	Nominal AC Voltage (For universal designs low line nominal voltage is displayed)
VACMAX	**265**	V	Maximum Input AC Voltage
FL	**50**	Hz	Line Frequency
η	**87.0**	%	Efficiency Estimate (Target)
TC	**2.71**	ms	Input Rectifier Conduction Time
Z	**0.61**		Loss Allocation Factor
VMIN	**74.4**	V	Minimum DC Input Voltage
VMAX	**374.8**	V	Maximum DC Input Voltage
ENCLOSURE	**Adapter**		Enclosure
TAMB	**60**	°C	Maximum Operating Ambient air Temperature

Input Section

Var	Value	Units	Description
Fuse	**1.00**	A	Input Fuse Rated Current
IAVG	**0.38**	A	Average Diode Bridge Current (DC Input Current)
Thermistor	**10.00**	Ω	Input Thermistor

Device Variables

Var	Value	Units	Description
Device	**INN3166C**		PI Device Name
Current Limit Mode	**Increased**		Device Current Limit Mode
BVDSS	**650**	V	Drn-Src Bkdn Voltage
ILIMITMIN	**1.319**	A	Minimum Current Limit
ILIMITTYP	**1.450**	A	Typical Current Limit
ILIMITMAX	**1.581**	A	Maximum Current Limit
RDSON	**2.02**	Ω	PI Device RDSON (100°C)
RDSON_25C	**1.30**	Ω	PI Device RDSON (25°C)
PO	**25.00**	W	Total Output Power
VDRAIN Estimated	**541.70**	V	Estimated Drain Voltage
VOR	**67.6**	V	Reflected Output Voltage
VDS	**2.40**	V	On state Drain to Source Voltage
FS	**90000**	Hz	Switching Frequency (at VMIN and Full Load)
FS_NOM	**68842**	Hz	Nominal Operating Switching Frequency (at Full Load)
KP	**0.80**		Continuous/Discontinuous Operating Ratio (at VMIN and full load)
DMAX	**0.48**		Maximum Duty Cycle (at VMIN and full load)
TIME_OFF	**5.7**	µs	Expected Device Off-time (at VMIN and Full Load)
TIME_ON	**5.4**	µs	Expected Device On-time (at VMIN and Full Load)
IP	**1.31**	A	Peak Primary Current (at VMIN and full load)
IR	**1.05**	A	Primary Ripple Current (at VMIN and full load)
IRMS	**0.58**	A	Primary RMS Current (at VMIN and full load)
UVOV_PRIORITY	**Overvoltage**		Input Undervoltage/Overvoltage Priority type
RTH_DEVICE	**61.02**	°C/W	PI Device Heatsink Maximum Thermal Resistance
DEV_HSINK_TYPE	**2 Oz (70 µ) 2-Sided Copper**		PI Device Heatsink Type

DEV_HSINK_AREA	358	mm²	PI Device Heatsink Area

Clamp Circuit

Var	Value	Units	Description
Clamp Type	RCD Clamp		Clamp Circuit Type
VCLAMP	99	V	Average Clamping Voltage
VC_MARGIN	107.65	V	Clamp Voltage Safety Margin

Bias Variables

Var	Value	Units	Description
VB	12.0	V	Bias Voltage
VBMIN	9.6	V	Minimum Bias Voltage
VBMAX	24.0	V	Maximum Bias Voltage
Use Linear Regulator	NO		Use Linear Regulator Circuit
PIVB	88	V	Bias Rectifier Maximum Peak Inverse Voltage
NB	11		Bias Winding Number of Turns

Transformer Construction Parameters

Var	Value	Units	Description
Core Type	EE25		Core Type (Manual Overwrite)
Core Material	PC95		Core Material
Bobbin Reference	Generic, 5 pri. + 5 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	412	μH	Nominal Primary Inductance
LP_Tol	10.0	%	Primary Inductance Tolerance
NP	54.1		Calculated Primary Winding Total Number of Turns
NSM	4		Secondary Main Number of Turns
CMA	696	Cmils/A	Primary Winding Current Capacity
BW	9.80	mm	Bobbin Winding Width
ML	0.00	mm	Safety Margin on Left Width
MR	0.00	mm	Safety Margin on Right Width
FF	114	%	Actual Transformer Fit Factor. 100% signifies fully utilized winding window
AE	41.00	mm²	Core Cross Sectional Area
ALG	141	nH/T²	Gapped Core Specific Inductance
BM	2424	Gauss	Maximum Flux Density
BP	3229	Gauss	Peak Flux Density
BAC	971	Gauss	AC Flux Density for Core Loss
LG	0.342	mm	Estimated Gap Length
L_LKG	10.29	μH	Estimated primary leakage inductance
LSEC	15	nH	Secondary Trace Inductance

Primary Winding Section 1

Var	Value	Units	Description
NP1	28		Number of Primary Winding Turns in the First Section of Primary

Wire Size	**24**	*AWG*	*Primary Winding - Wire Size*
Winding Type	**Single (x1)**		*Primary Winding - Number of Parallel Wire Strands*
L	**1.62**		*Primary Winding - Number of Layers*

Primary Winding Section 2

Var	*Value*	*Units*	*Description*
NP2	**27**		*Rounded (Integer) Number of Primary winding turns in the second section of primary*
Wire Size	**24**	*AWG*	*Primary Winding - Wire Size*
Winding Type	**Single (x1)**		*Primary Winding - Number of Parallel Wire Strands*
L2	**1.56**		*Primary Number of Layers in 2nd split winding*

Output 1

Var	*Value*	*Units*	*Description*
VO	**5.00**	*V*	*Typical Output Voltage*
IO	**5.00**	*A*	*Output Current*
VOUT_ACTUAL	**5.00**	*V*	*Actual Output Voltage*
Cable Drop Compensation	**0**	*mV*	*Cable Drop Compensation*
NS	**4**		*Secondary Number of Turns*
Wire Size	**23**	*AWG*	*Wire size of secondary winding*
Winding Type	**Trifilar (x3)**		*Output winding number of parallel strands*
L_S_OUT	**0.98**		*Secondary Output Winding Layers*
PIVS	**32**	*V*	*Output Rectifier Maximum Peak Inverse Voltage*
ISP	**17.65**	*A*	*Peak Secondary Current*
ISRMS	**8.14**	*A*	*Secondary RMS Current*
RTH_RECTIFIER	**44.04**	*°C/W*	*Output Rectifier Heatsink Maximum Thermal Resistance*
OR_HSINK_TYPE	**2 Oz (70 µ) 2-Sided Copper**		*Output Rectifier Heatsink Type*
OR_HSINK_AREA	**316**	*mm²*	*Output Rectifier Heatsink Area*
OSR_RDSON	**8.50**	*mΩ*	*Synchronous Rectifier RDSON*
CO	**390 x 1**	*µF*	*Output Capacitor - Capacitance*
IRIPPLE	**6.43**	*A*	*Output Capacitor - RMS Ripple Current*
Expected Lifetime	**16682**	*hr*	*Output Capacitor - Expected Lifetime*

Feedback Circuit

Var	*Value*	*Units*	*Description*
DUAL_OUTPUT_FB_FLAG	**NO**		*Get feedback from 2 outputs*

Power Supply Efficiency and Losses (at VACMIN - VACNOM and Full Load)

Var	*Value*	*Units*	*Description*
N_ACTUAL_RANGE	**82.5 - 85.8**	*%*	*Calculated Efficiency*
TOTAL_LOSS_RANGE	**4.15 - 5.29**	*W*	*Total Power Supply Losses*
Device Circuit Losses	**0.66 - 1.04**	*W*	*Total Device Circuit Losses*
TRF_LOSS_RANGE	**0.89 - 1.01**	*W*	*Total Transformer Losses*
INSTAGE_LOSS_RANGE	**1.45 - 2.12**	*W*	*Total Primary Side Losses*
OUTSTAGE_LOSS_RANGE	**1.13 - 1.15**	*W*	*Total Secondary Side Losses*

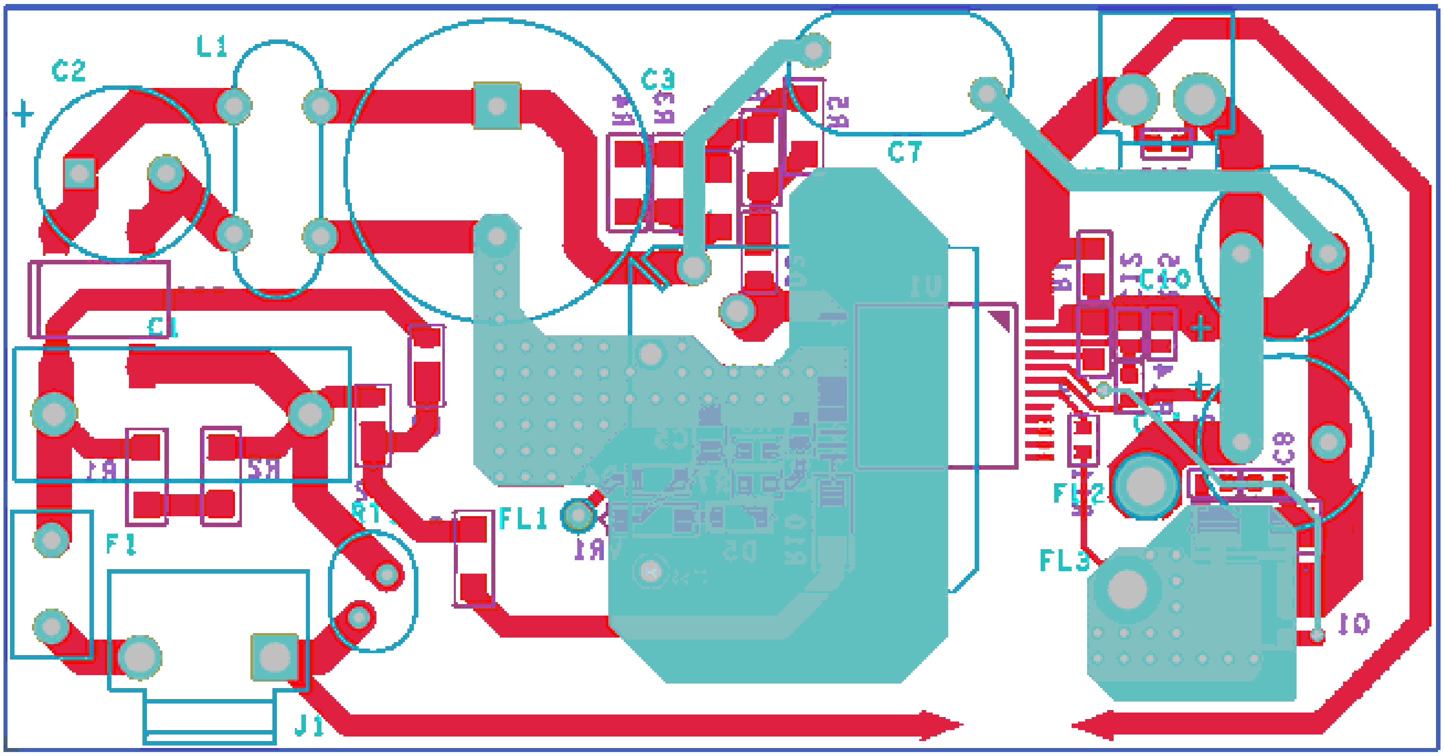
High output current Flyback design.

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



PI-7338-082614

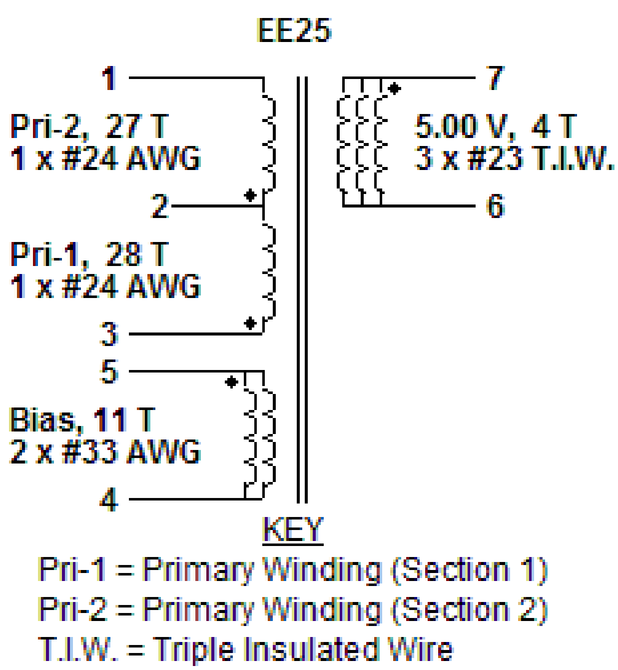
Click on the "Show me" icon to highlight relevant areas on the sample layout.

	Description	Show Me
1	*Minimize loop area formed by secondary winding, the output rectifier and the output filter capacitor*	
2	*Y-capacitor connected directly to the DC pin of the primary and secondary GND*	
3	*Minimize loop area formed by drain, clamp and transformer*	
4	*Maximize hatched area for heat-sinking*	
5	*Minimize loop area formed by drain, input capacitor and transformer*	
6	*Spark gaps with adequate creepage help in steering away the destructive energy created during an ESD event through the protection components such as the Y-cap.*	
7	*The BYPASS pin capacitor should be located as close as possible to the BYPASS and SOURCE pins*	

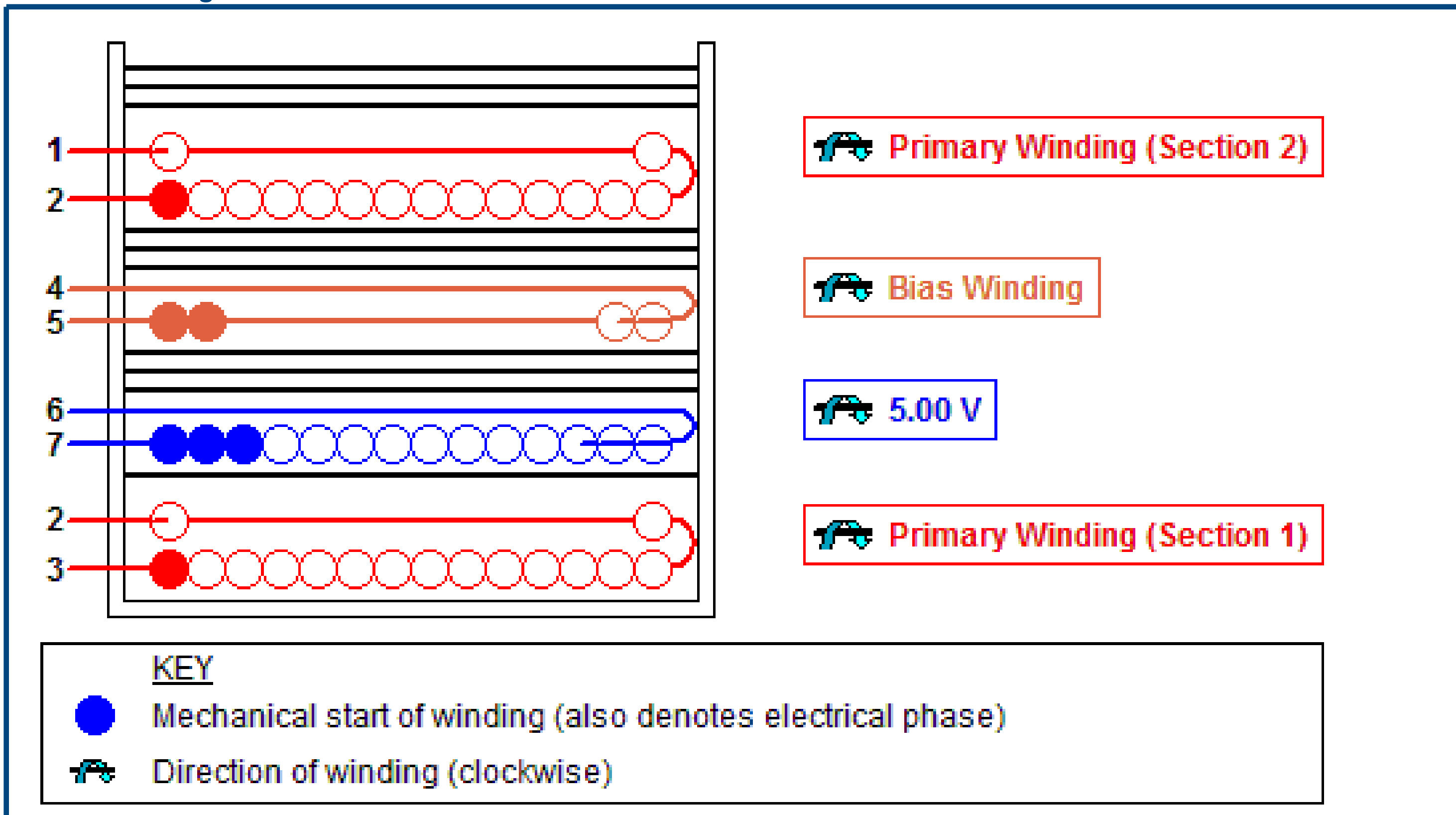
Bill Of Materials

Item #	Quantity	Part Ref	Value	Description	Mfg	Mfg Part Number
1	1	C1	100 nF	100 nF, 275 VAC, Film, X Class	Kemet	R46KI310000M1K
2	1	C2	47 µF	47 µF, 400 V, High Voltage Al Electrolytic, (30 mm x 12.5 mm)	United Chemi-Con	EPAG400VB47RM12X30LL
3	1	C3	3.3 nF	3.3 nF, 1 kV, High Voltage Ceramic	NIC Components Corp	NCD332M1KVZ5U
4	1	C4	4.7 µF	4.7 µF, 50 V, Ceramic, X7R	AVX Corp	SE035C475KAR
5	1	C5	2.2 µF	2.2 µF, 50 V, Ceramic, X7R	Murata	RDER71H225K2K1C03B
6	1	C6	0.22 nF	0.22 nF, 250 VAC, Ceramic, Y Class	Vishay Cera-Mite	440LT22-R
7	1	C7	1500 pF	1500 pF, 50 V, Ceramic, C0G	TDK	FK18C0G1H152J
8	1	C8	22 µF	22 µF, 35 V, Electrolytic, Gen Purpose, 17 mΩ, (8 mm x 6.3 mm)	Rubycon	35MH722MEFCTZ6.3X7
9	1	C9	390 µF	390 µF, 6.3 V, Al Organic Polymer, 5 mΩ, (13 mm x 8 mm)	Nichicon	RR50J391MDN1PX
10	1	C10	330 pF	330 pF, 50 V, Ceramic, C0G	TDK	FK18C0G1H331J
11	4	D1, D2, D3, D4	S2KA-13-F	800 V, 1.5 A, Standard Recovery, DO-214AC(SMA)	Diodes Inc.	S2KA-13-F
12	1	D5	1N4937	600 V, 1 A, Fast Recovery, 200 ns, DO-41	Vishay	1N4937
13	1	D6	1N4003	200 V, 1 A, Standard Recovery, DO-41	Vishay	1N4003
14	1	F1	1 A	250 VAC, 1 A, Radial TR5, Time Lag Fuse	Littelfuse / Wickmann(R)	37411000410
15	1	L1	6 mH	6 mH, 1.6 A	Panasonic	ELF18N016
16	1	M1	AON7262E	MOSFET, N-Channel, 60 V, 17 A, DFN 3x3	Alpha & Omega Semiconductor Inc.	AON7262E
17	1	R1	39 kΩ	39 kΩ, 5 %, 2 W, Metal Oxide Film	Generic	
18	1	R2	13 Ω	13 Ω, 5 %, 0.25 W, Carbon Film	Generic	
19	2	R3, R4	1.8 MΩ	1.8 MΩ, 5 %, 0.25 W, Carbon Film	Generic	
20	1	R5	11 kΩ	11 kΩ, 1 %, 0.125 W, Metal Film	Generic	
21	1	R6	47 Ω	47 Ω, 5 %, 0.125 W, Carbon Film	Generic	
22	1	R7	6.65 mΩ	6.65 mΩ, 1 %, 0.5 W, Metal Film	Generic	
23	1	R8	5.6 Ω	5.6 Ω, 5 %, 0.25 W, Carbon Film	Generic	
24	1	R9	88.7 kΩ	88.7 kΩ, 1 %, 0.125 W, Metal Film	Generic	
25	1	R10	29.4 kΩ	29.4 kΩ, 1 %, 0.125 W, Metal Film	Generic	
26	1	RT1	10 Ω	NTC Thermistor 10 Ω, 1.7 A	Thermometrics	CL-120
27	1	T1	EE25	PC95 Core Material See Transformer Construction's Materials List for complete information	TDK	PC40EL25-Z
28	1	U1	INN3166C	InnoSwitch3-CE, INN3166C, inSOP-24D	Power Integrations	INN3166C-H101
29	1			358 mm² area on Copper PCB. 2 oz (70 µm) thickness. Heatsink for use with Device U1.	Custom	
30	1			316 mm² area on Copper PCB. 2 oz (70 µm) thickness. Heatsink for use with Rectifier M1.	Custom	

Electrical Diagram



Mechanical Diagram



Winding Instruction

Primary Winding (Section 1)

Start on pin(s) 3 and wind 28 turns (x 1 filar) of item [5]. in 2 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. 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.

Secondary Winding

Start on pin(s) 7 and wind 4 turns (x 3 filar) of item [6]. Spread the winding evenly across entire bobbin. Winding direction is clockwise. Finish this winding on pin(s) 6.

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

Bias Winding

Start on pin(s) 5 and wind 11 turns (x 2 filar) of item [7]. 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.

Primary Winding (Section 2)

Start on pin(s) 2 and wind 27 turns (x 1 filar) of item [5]. in 2 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. 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: EE25, PC95, gapped for ALG of 141 nH/T²
[2]	Bobbin: Generic, 5 pri. + 5 sec.
[3]	Barrier Tape: Polyester film [1 mil (25 µm) base thickness], 9.80 mm wide
[4]	Varnish
[5]	Magnet Wire: 24 AWG, Solderable Double Coated
[6]	Triple Insulated Wire: 23 AWG
[7]	Magnet Wire: 33 AWG, Solderable Double Coated

Electrical Test Specifications

Parameter	*Condition*	*Spec*
Electrical Strength, VAC	**60 Hz 1 second, from pins 1,2,3,4,5 to pins 6,7.**	**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.**	**412**
Tolerance, ±%	**Tolerance of Primary Inductance**	**10.0**
Maximum Primary Leakage, µH	**Measured between Pin 1 to Pin 3, with all other Windings shorted.**	**10.29**

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.