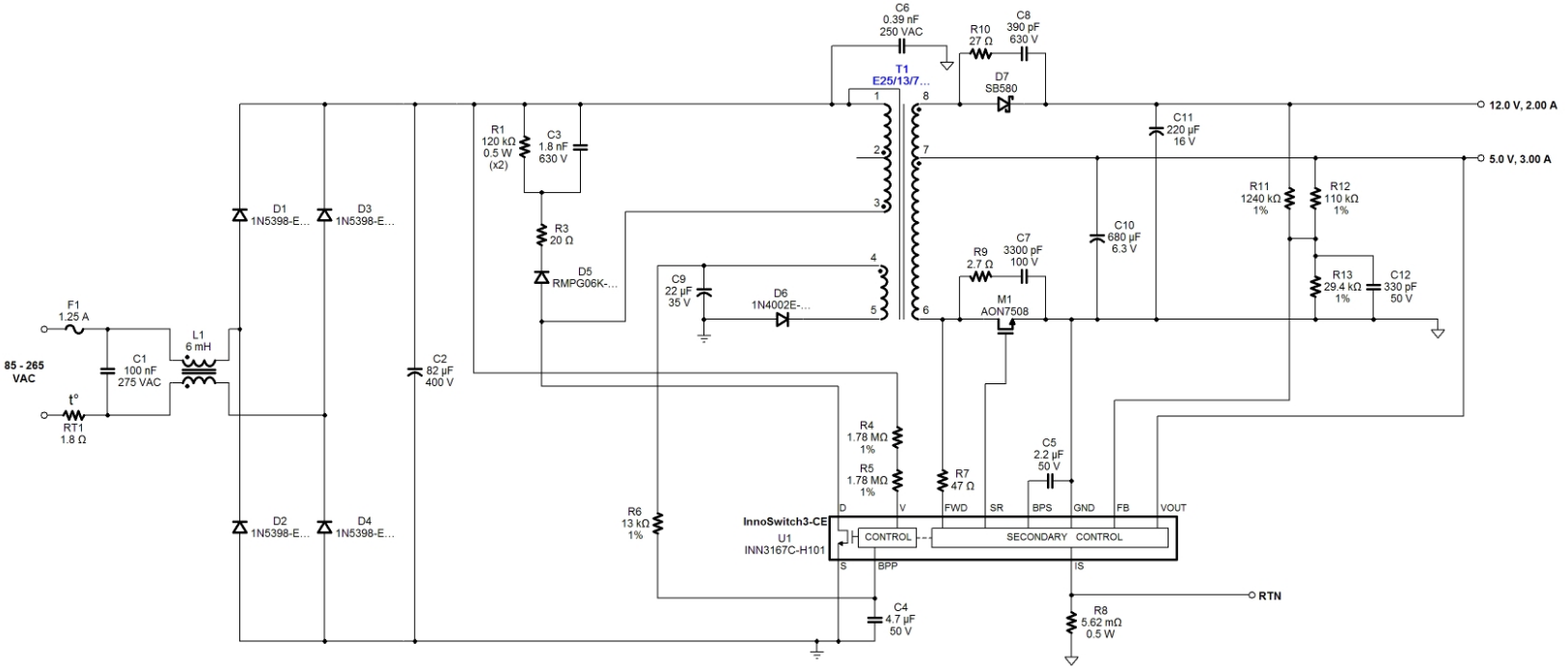


Schematic components that have been frozen by the user will appear with blue reference designators.

For any information regarding user added Shield or Screen and additional EMI features implemented in the Transformer, review Transformer Construction.

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	0.65		Loss Allocation Factor
VMIN	82.1	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	1.25	A	Input Fuse Rated Current
IAVG	0.53	A	Average Diode Bridge Current (DC Input Current)
Thermistor	1.80	Ω	Input Thermistor

Device Variables

Var	Value	Units	Description
Device	INN3167C-H101		PI Device Name
Current Limit Mode	Increased		Device Current Limit Mode
BVDSS	650	V	Drn-Src Bkdn Voltage
ILIMITMIN	1.501	A	Minimum Current Limit
ILIMITTYP	1.650	A	Typical Current Limit
ILIMITMAX	1.799	A	Maximum Current Limit
RDSON	1.58	Ω	PI Device RDSON (100°C)
RDSON_25C	1.02	Ω	PI Device RDSON (25°C)
PO	39.00	W	Total Output Power
VOR	101.86	V	Reflected Output Voltage
VDS	0.83	V	On state Drain to Source Voltage
FS	90000	Hz	Switching Frequency (at VMIN and Full Load)
KP	0.715		Continuous/Discontinuous Operating Ratio (at VMIN and Full Load)
DMAX	0.556		Maximum Duty Cycle (at VMIN and Full Load)
TIME_OFF	4.93	µs	Expected Device Off-time (at VMIN and Full Load)
TIME_ON	9.97	µs	Primary controller on-time
IP	1.703	A	Peak Primary Current (at VMIN and Full Load)
IR	1.512	A	Primary Ripple Current (at VMIN and Full Load)
IRMS	0.778	A	Primary RMS Current (at VMIN and Full Load)
UVOV_PRIORITY	Overvoltage		Input Undervoltage/Overvoltage Priority type
RTH_DEVICE	54.77	°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	901	mm²	PI Device Heatsink Area.

Clamp Circuit

Var	Value	Units	Description
Clamp Type	RCD Clamp		Clamp Circuit Type
VCLAMP_ESTIMATED	210.02	V	Estimated Clamping Voltage above VMAX
VDRAIN Estimated	584.79	V	Estimated Drain Voltage

Primary Bias Variables

Var	Value	Units	Description
VB	12.0	V	Bias Voltage
VBMIN	11.6	V	Minimum Bias Voltage
VBMAX	30.8	V	Maximum Bias Voltage
Circuit Type	Simple Resistor		Bias Circuit Type
PIVB	79	V	Bias Rectifier Maximum Peak Inverse Voltage
NB	8		Primary Bias Winding Number of Turns

Transformer Construction Parameters

Var	Value	Units	Description
Core Type	E25/13/7 (EF25)		Core Type (Manual Overwrite)
Core Material	3F3		Core Material
Bobbin Reference	EF25/13/7 -1 (P5+ S5)		Bobbin Reference
Bobbin Orientation	Vertical		Bobbin type
Primary Pins	0		Number of Primary pins used
Secondary Pins	0		Number of Secondary pins used
LP_nom	490	µH	Nominal Primary Inductance
LP_Tol	5.0	%	Primary Inductance Tolerance
NP	62.0		Calculated Primary Winding Total Number of Turns
NSM	3		Secondary Main Number of Turns
CMA	325.28	Cmils/A	Primary Winding Current Capacity
BW	15.30	mm	Bobbin Winding Width
ML	0.00	mm	Safety Margin on Left Width
MR	0.00	mm	Safety Margin on Right Width
FF	72.79	%	Actual Transformer Fit Factor. 100% signifies fully utilized winding window
AE	52.50	mm²	Core Cross Sectional Area
ALG	128	nH/T²	Gapped Core Specific Inductance
BM	2661	Gauss	Maximum Flux Density
BP	2910	Gauss	Peak Flux Density
BAC	1330	Gauss	AC Flux Density for Core Loss
LG	0.480	mm	Estimated Gap Length
L_LKG	12.87	µH	Estimated primary leakage inductance
LSEC	15	nH	Secondary Trace Inductance

Primary Winding Section 1

Var	Value	Units	Description
NP1	32		Number of Primary Winding Turns in the First Section of Primary
Wire Size	26	AWG	Primary Winding - Wire Size
Winding Type	Single (x1)		Primary Winding - Number of Parallel Wire Strands
L	1.00		Primary Winding - Number of Layers

Primary Winding Section 2

Var	Value	Units	Description
NP2	30		Rounded (Integer) Number of Primary winding turns in the second section of primary
Wire Size	26	AWG	Primary Winding - Wire Size
Winding Type	Single (x1)		Primary Winding - Number of Parallel Wire Strands
L2	0.94		Primary Number of Layers in 2nd split winding

Output 1

Var	Value	Units	Description
VO	12.00	V	Typical Output Voltage
IO	2.00	A	Output Current
VOUT_ACTUAL	12.48	V	Actual Output Voltage
Cable Drop Compensation	0	mV	Cable Drop Compensation
NS	5		Secondary Number of Turns
Wire Size	16	AWG	Wire size of secondary winding
Winding Type	Single (x1)		Output winding number of parallel strands
L_S_OUT	0.94		Secondary Output Winding Layers
VD	0.85	V	Output Winding Diode Forward Voltage Drop
PIVS	60.84	V	Output Rectifier Maximum Peak Inverse Voltage
ISP	9.025	A	Peak Secondary Current
ISRMS	3.680	A	Secondary RMS Current
ISRMS_WINDING	3.680	A	Secondary Winding RMS Current
CMAS	701	Cmils/A	Secondary Winding Current Capacity
RTH_RECTIFIER	22.26	°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	4404	mm²	Output Rectifier Heatsink Area
CO	220 x 1	µF	Output Capacitor - Capacitance
IRIPPLE	3.089	A	Output Capacitor - RMS Ripple Current
Expected Lifetime	24561	hr	Output Capacitor - Expected Lifetime

Output 2

Var	Value	Units	Description
VO	5.00	V	Typical Output Voltage
IO	3.00	A	Output Current
VOUT_ACTUAL	5.00	V	Actual Output Voltage
Cable Drop Compensation	0	mV	Cable Drop Compensation
NS	3		Secondary Number of Turns
Wire Size	17	AWG	Wire size of secondary winding
Winding Type	Single (x1)		Output winding number of parallel strands
L_S_OUT	0.65		Secondary Output Winding Layers
PIVS	23.13	V	Output Rectifier Maximum Peak Inverse Voltage
ISP	13.537	A	Peak Secondary Current
ISRMS	5.520	A	Secondary RMS Current
ISRMS_WINDING	9.200	A	Secondary Winding RMS Current
CMAS	223	Cmils/A	Secondary Winding Current Capacity
RTH_RECTIFIER	61.96	°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	**104**	mm²	Output Rectifier Heatsink Area
OSR_RDSON	**4.60**	mΩ	Synchronous Rectifier RDSON
CO	**680 x 1**	µF	Output Capacitor - Capacitance
IRIPPLE	**4.634**	A	Output Capacitor - RMS Ripple Current
Expected Lifetime	**20240**	hr	Output Capacitor - Expected Lifetime

Feedback Circuit

Var	Value	Units	Description
DUAL_OUTPUT_FB_FLAG	**YES**		Get feedback from 2 outputs

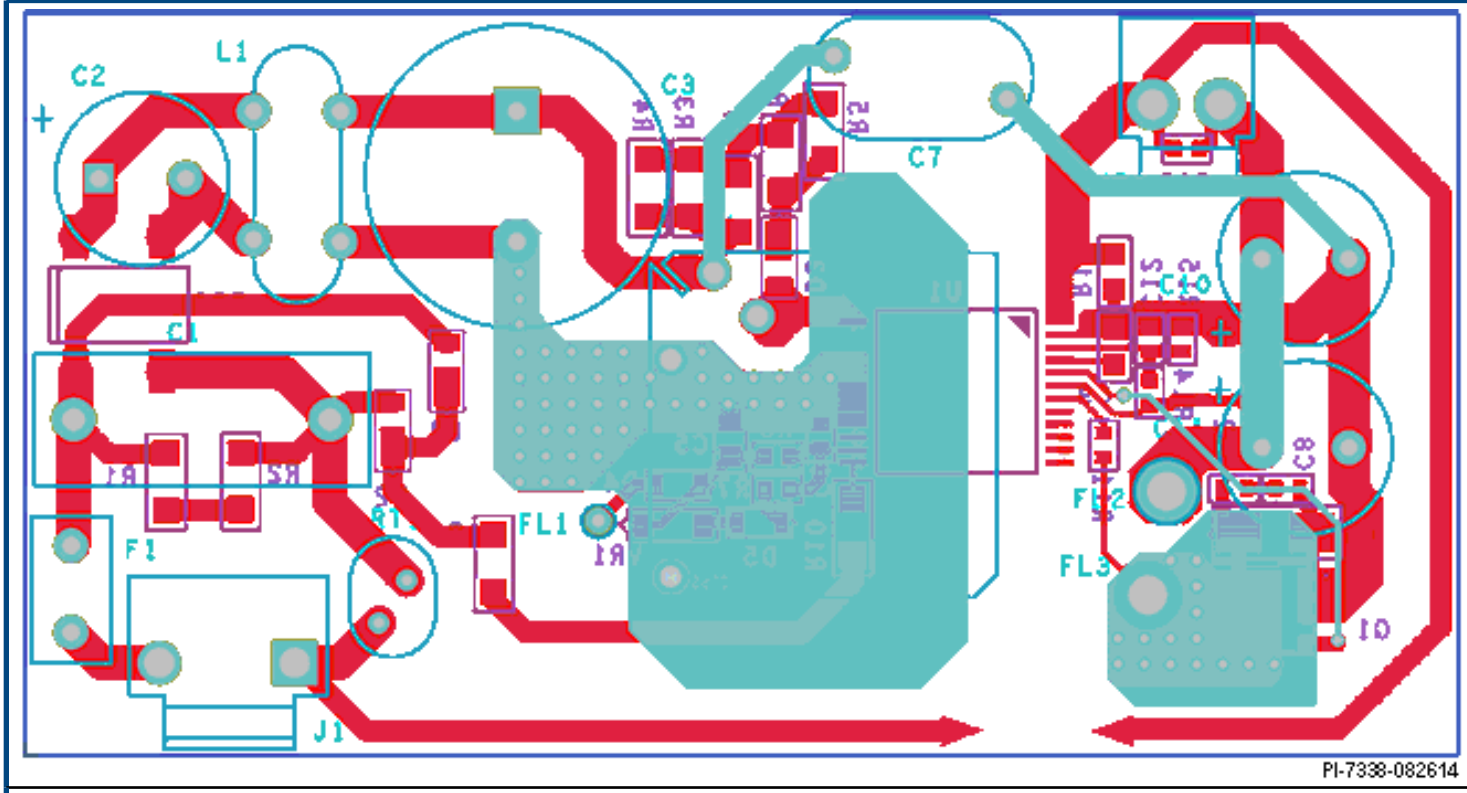
Power Supply Efficiency and Losses (at VACMIN - VACNOM and Full Load)

Var	Value	Units	Description
N_ACTUAL_RANGE	**77.65 - 79.18**	%	Calculated Efficiency
TOTAL_LOSS_RANGE	**10.25 - 11.23**	W	Total Power Supply Losses
DEV_LOSS_RANGE	**1.13 - 1.14**	W	Total Device Circuit Losses
TRF_LOSS_RANGE	**1.55 - 1.71**	W	Total Transformer Losses
INSTAGE_LOSS_RANGE	**2.93 - 3.85**	W	Total Primary Side Losses
OUTSTAGE_LOSS_RANGE	**4.62 - 4.65**	W	Total Secondary Side Losses

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.

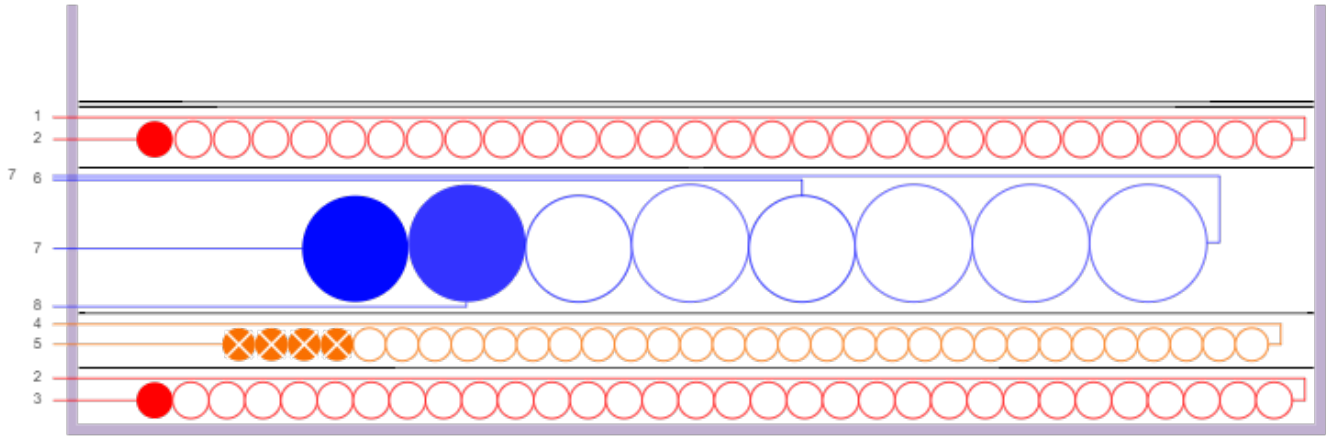
	Description	Show Me
1	*Minimize loop area formed by secondary winding, the output rectifier and the output filter capacitor*	
2	*Y-capacitor connected directly to the DC pin of the primary and secondary GND*	
3	*Minimize loop area formed by drain, clamp and transformer*	
4	*Maximize hatched area for 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

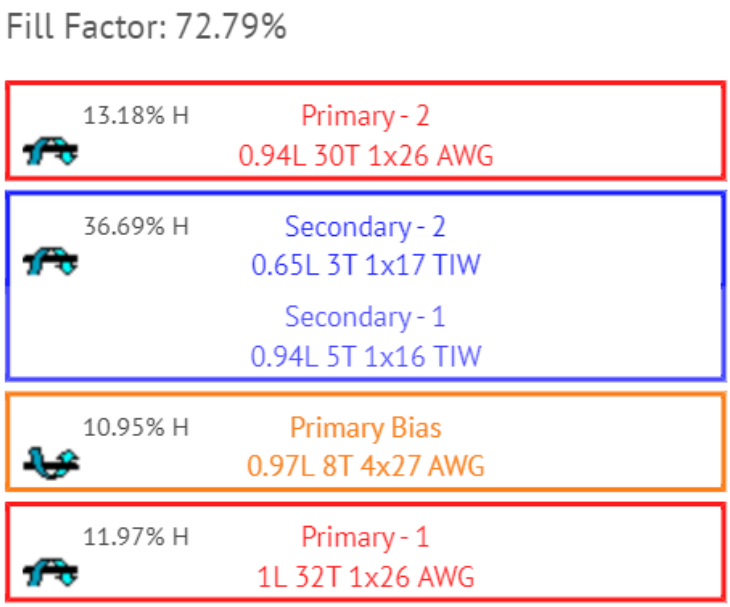
Item #	Quantity	Part Ref	Value	Description	Mfg	Mfg Part Number
1	1	C1	100 nF	100 nF, 275 VAC, Film, X Class	Kemet	R46KI310000M1K
2	1	C2	82 µF	82 µF, 400 V, High Voltage Al Electrolytic, (25 mm x 18 mm)	United Chemi-Con	EKXG401ELL680MM25S
3	1	C3	1.8 nF	1.8 nF, 630 V, High Voltage Ceramic	TDK	FA26C0G2J182JNU00
4	1	C4	4.7 µF	4.7 µF, 50 V, Ceramic, X7R	Murata	RCER71H475K3M1H03A
5	1	C5	2.2 µF	2.2 µF, 50 V, Ceramic, X7R	Kemet	C340C225K5R5TA
6	1	C6	0.39 nF	0.39 nF, 250 VAC, Ceramic, Y Class	TDK	CD90-B2GA391KYNS
7	1	C7	3300 pF	3300 pF, 100 V, Ceramic, X7R	Kemet	C315C332K1R5TA
8	1	C8	390 pF	390 pF, 630 V, High Voltage Ceramic	TDK	FG26C0G2J391JNT06
9	1	C9	22 µF	22 µF, 35 V, Electrolytic, Gen Purpose, 800 mΩ, (11 mm x 5 mm)	Panasonic	EEU-FC1V220H
10	1	C10	680 µF	680 µF, 6.3 V, Al Organic Polymer, 8 mΩ, (8 mm x 8 mm)	Nichicon	RL80J681MDN1PX
11	1	C11	220 µF	220 µF, 16 V, Al Organic Polymer, 12 mΩ, (8 mm x 8 mm)	Nichicon	RL81C221MDN1KX
12	1	C12	330 pF	330 pF, 50 V, Ceramic, C0G	TDK	FK18C0G1H331J
13	4	D1, D2, D3, D4	1N5398-E3/54	800 V, 1.5 A, Standard Recovery, DO-15	Vishay	1N5398-E3/54
14	1	D5	RMPG06K-E3/54	800 V, 1 A, Fast Recovery, 250 ns, MPG06	Vishay	RMPG06K-E3/54
15	1	D6	1N4002E-E3/73	100 V, 1 A, Standard Recovery, DO-204AL	Vishay	1N4002E-E3/73
16	1	D7	SB580	80 V, 5 A, Schottky, DO-201AD	ON Semiconductor	SB580
17	1	F1	1.25 A	250 VAC, 1.25 A, Radial TR5, Time Lag Fuse	Littelfuse / Wickmann(R)	37411250410
18	1	L1	6 mH	6 mH, 1.6 A	Panasonic	ELF18N016
19	1	M1	AON7508	MOSFET, N-Channel, 30 V, 21 A, DFN 5x6	Alpha & Omega Semiconductor Inc.	AON7508
20	2	R1, R2	120 kΩ	120 kΩ, 5 %, 0.5 W, Carbon Film	Generic	
21	1	R3	20 Ω	20 Ω, 5 %, 0.25 W, Carbon Film	Generic	
22	2	R4, R5	1.78 MΩ	1.78 MΩ, 1 %, 0.25 W, Metal Film	Generic	
23	1	R6	13 kΩ	13 kΩ, 1 %, 0.125 W, Metal Film	Generic	
24	1	R7	47 Ω	47 Ω, 5 %, 0.125 W, Carbon Film	Generic	
25	1	R8	5.62 mΩ	5.62 mΩ, 1 %, 0.5 W, Metal Film	Generic	
26	1	R9	2.7 Ω	2.7 Ω, 5 %, 0.25 W, Carbon Film	Generic	
27	1	R10	27 Ω	27 Ω, 5 %, 0.25 W, Carbon Film	Generic	
28	1	R11	1240 kΩ	1240 kΩ, 1 %, 0.125 W, Metal Film	Generic	
29	1	R12	110 kΩ	110 kΩ, 1 %, 0.125 W, Metal Film	Generic	
30	1	R13	29.4 kΩ	29.4 kΩ, 1 %, 0.125 W, Metal Film	Generic	
31	1	RT1	1.8 Ω	NTC Thermistor 1.8 Ω, 2.5 A	Murata	PTGL07AS1R8K2B51B0

32	1	T1	E25/13/7 (EF25)	Core Material See Transformer Construction's Materials List for complete information	Epcos	B66317-G-X127
33	1	U1	INN3167C-H101	InnoSwitch3-CE, INN3167C-H101, inSOP-24D	Power Integrations	INN3167C-H101
34	1			901 mm² area on Copper PCB. 2 oz (70 µm) thickness. Heatsink for use with Device U1.	Custom	
35	1			104 mm² area on Copper PCB. 2 oz (70 µm) thickness. Heatsink for use with Rectifier M1.	Custom	
36	1			4404 mm² area on Copper PCB. 2 oz (70 µm) thickness. Heatsink for use with Rectifier D7.	Custom	

Mechanical diagram



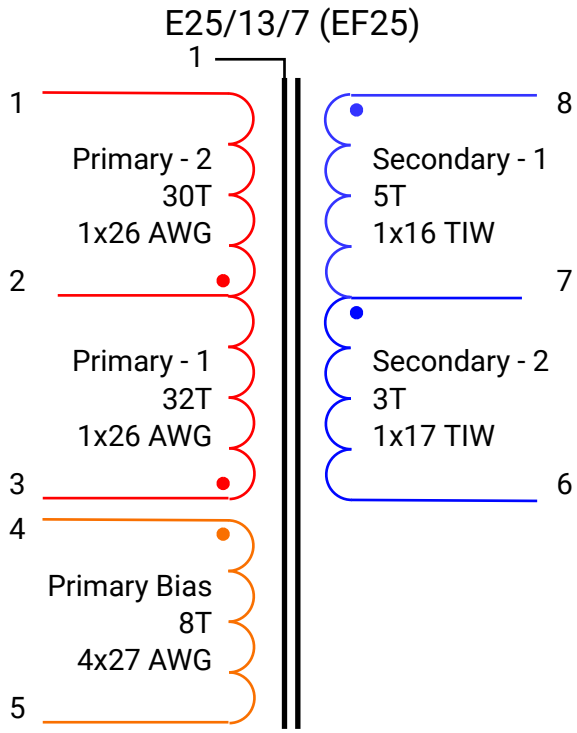
Winding Info



Core/Coil Former Parameters

Core	E25/13/7 (EF25)
Core Part Number	B66317-G-X127
Ferrite Material	3F3
Coil Former Part Number	EF25/13/7 -1 (P5+ S5)
Orientation	0
Available Pins	10
Bobbin Window Length, mm	15.3
X-Tolerance, %	0
Maximum Stack Height, mm	4.2
Y-Tolerance, %	0
External Shielding	Core Connection
Connect To	1

Electrical Diagram



Winding Parameters

Type	Power	Power	Power	Bias	Power
Name	Primary - 2	Secondary - 2	Secondary - 1	Primary Bias	Primary - 1
Turns	30	3	5	8	32
Layers	0.94	0.65	0.94	0.97	1
Color	Red	Blue	Lavender	Orange	Red
Wire Type	Single Core	Single Core	Single Core	Single Core	Single Core
Wire Size, AWG	26	17	16	27	26
Wire Grade	Heavy Build	TIW	TIW	Heavy Build	Heavy Build
Filar	1	1	1	4	1
Wire Tolerance, %	0	0	0	0	0
Split	Series	False	False	False	Series
Continuous Pin	None				None
Spread	YES	NO	NO	NO	NO
Arrangement	Independent	Interleave	Interleave	Independent	Independent
Direction	Clockwise	Clockwise	Clockwise	Counter-Clockwise	Clockwise
Z winding	NO	NO	NO	NO	NO
Opposite start	NO	NO	NO	NO	NO
Winding Start	Pin	Pin	Pin	Pin	Pin
Winding End	Pin	Pin	Pin	Pin	Pin
Start Pin	2	7	8	5	3
End Pin	1	6	7	4	2
Sleeving	None	None	None	None	None
Connection	Split	AC-Stack	AC-Stack	Floating	Split
Margin Left, mm	0	0	0	0	0
Margin Right, mm	0	0	0	0	0
Tape Between Layers	NO	NO	NO	NO	NO
Tape Between Lead & Winding	NO	NO	NO	NO	NO
Tape on top	2	1	1	1	1
Tape Thickness, mm	0.0508	0.0508	0.0508	0.0508	0.0508

Building Instructions

ELECTRICAL PARAMETERS

Parameter: Electrical Strength;
Condition: 60 Hz 1 second, from pins 1,2,3,4,5 to pins 6,7,8.;
Spec: 3000 VAC;

Parameter: Nominal Primary Inductance;
Condition: Measured at 1 V pk-pk, typical switching frequency, between pin 3 to pin 1, with all other Windings open.;
Spec: 490 uH +- 5.0%;

Parameter: Maximum Primary Leakage;
Condition: Measured between Pin 3 to Pin 1, with all other Windings shorted.;
Spec: 12.87 uH;

LIST OF MATERIALS

Item Description
[1] Core: E25/13/7 (EF25), 3F3, gapped for ALG of 128 nH / T^2
[2] Bobbin: Generic, 5 pri. + 5 sec.
[3] Varnish
[4] Single core wire: 26 AWG, insulation Grade 2
[5] Separation Tape: Polyester film [2 mil (50.8 micrometers) base thickness], 15.3 mm wide
[6] Single core wire: 27 AWG, insulation Grade 2
[7] Triple Insulated Wire: 17 AWG
[8] Triple Insulated Wire: 16 AWG

WINDING INSTRUCTIONS

1. Primary - 1
Start with 1 lead(s) of Item [4] from Pin 3, and wind 32 turns in Clockwise direction in total of 1 layer(s).

Wind one layer from left to right.

Finish this winding on Pin 2. Add 1 layer(s) of tape, Item [5], on the top.

2. Primary Bias
Start with 4 lead(s) of Item [6] from Pin 5, and wind 8 turns in Counter-Clockwise direction in total of 1 layer(s).

Wind one layer from left to right.

Finish this winding on Pin 4. Add 1 layer(s) of tape, Item [5], on the top.

3. Secondary - 2, Secondary - 1
Start with Power winding, Secondary - 2, using Item [7] (x1 lead) from Pin 7, together with Power winding, Secondary - 1, using Item [8] (x1 lead) from Pin 8, and wind them together in Clockwise direction.

Wind 3 turn(s) (1 layer) for Secondary - 2 and 5 turn(s) (1 layer) for Secondary - 1.

Wind one layer from left to right. After making 3 turn(s), For Secondary - 2, finish this winding on Pin 6

Continue winding Secondary - 1 for 2 turn(s). For Secondary - 1, finish this winding on Pin 7.

Add 1 layer(s) of tape, Item [5], on the top.

4. Primary - 2
Start with 1 lead(s) of Item [4] from Pin 2, and wind 30 turns in Clockwise direction in total of 1 layer(s).

Wind one layer from left to right. Spread the winding evenly across the entire bobbin.

Finish this winding on Pin 1. Add 2 layer(s) of tape, Item [5], on the top.

BUILDING PREPARATIONS

1. Gap the core halves to get 490 uH +-5.0%.

FINISHING INSTRUCTIONS

Using a piece of wire, connect the core to Pin 1.

Varnish with Item [3]

Comments:

Achieving compliance to applicable safety standard may require additional considerations for transformer construction, manufacturing and methods used for termination of wires.
It is the responsibility of the user to verify that all applicable safety requirements are met and make additional changes as applicable.

Design Notepad

1 Design Passed (No Optimization)

	Description	Fix	Ref. #
	Large device PCB copper area 813 mm2 is required for heatsinking.	Verify that the copper area is achievable in your design.	680