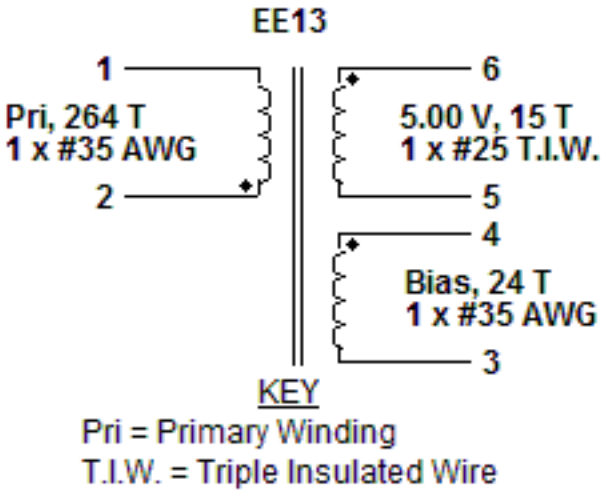
ACDC_LinkSwitchXT2900V_092018; Rev.1.1; Copyright Power Integrations 2018	INPUT	INFO	OUTPUT	UNIT	ACDC_LinkSwitchXT2 900V Flyback Design Spreadsheet
ENTER APPLICATION VARIABLES					Design Title
LINE VOLTAGE RANGE			UNIVERSAL		AC line voltage range
VACMIN	85.00		85.00	Volts	Minimum AC line voltage
VACTYP			115.00	Volts	Typical AC line voltage
VACMAX	440.00		440.00	Volts	Maximum AC line voltage
fL			50	Hertz	AC mains frequency
TIME_BRIDGE_CONDUCTION			2.88	mseconds	Input bridge rectifier diode conduction time
LINE RECTIFICATION			F		Select 'F'ull wave rectification or 'H'alf wave rectification
VOUT	5.00		5.00	Volts	Output voltage
IOUT	0.600		0.600	Amperes	Average output current specification
EFFICIENCY			0.80		Efficiency Estimate at output terminals. Under 0.8 if no better data available
LOSS ALLOCATION FACTOR			0.50		The ratio of power losses during the MOSFET off-state to the total system losses
POUT			3.00	Watts	Continuous Output Power
CIN			6.80	uFarads	Input capacitor
VMIN			79.13	Volts	Valley of the rectified VACMIN
VMAX			622.25	Volts	Peak of the VACMAX
FEEDBACK			MAIN		Select the type of feedback required. (MAIN = feedback via Main Output - Non-isolated)
BIAS WINDING	YES		YES		Select whether a bias winding is required
LINKSWITCH-XT2 VARIABLES					
CURRENT LIMIT MODE	STD		STD		Pick between 'RED' (Reduced) or 'STD' (Standard) current limit mode of operation
PACKAGE	SMD-8C		SMD-8C		Device package
ENCLOSURE			OPEN FRAME		Device enclosure
GENERIC DEVICE			LNK3694		Device series
DEVICE CODE			LNK3694G		Device code
PMAX			4.00	Watts	Device maximum power capability
VOR			100	Volts	Voltage reflected to the primary winding when the MOSFET is off
VDSON			10.0	Volts	MOSFET on-time drain to source peak voltage
VDSOFF			772.3	Volts	Estimated MOSFET drain-to-source voltage during Off-time
ILIMITMIN			0.241	Amperes	Minimum current limit
ILIMITTYP			0.260	Amperes	Typical current limit
ILIMITMAX			0.280	Amperes	Maximum current limit
FSMIN			62000	Hertz	Minimum switching frequency
FSTYP			66000	Hertz	Typical switching frequency
FSMAX			70000	Hertz	Maximum switching frequency
RDSON			31.00	Ohms	MOSFET drain to source resistance at 25degC
PRIMARY WAVEFORM PARAMETERS					

MODE OF OPERATION			DCM		Mode of operation
KRP/KDP			1.760		Measure of continuous/discontinuous mode of operation
KP_TRANSIENT			0.950		KP under conditions of a transient
DMAX			0.451		Maximum duty cycle at VMIN
TIME_ON			7.275	useconds	MOSFET conduction time at the minimum line voltage
TIME_ON_MIN			0.855	useconds	MOSFET conduction time at the maximum line voltage
IAVG_PRIMARY			0.054	Amperes	Average input current
IRMS_PRIMARY			0.093	Amperes	Root mean squared value of the primary current
LPRIMARY_MIN			1882	uH	Minimum primary inductance
LPRIMARY_TYP			2091	uH	Typical primary inductance
LPRIMARY_MAX			2301	uH	Maximum primary inductance
LPRIMARY_TOL			10		Tolerance of the Primary inductance
SECONDARY WAVEFORM PARAMETERS					
IPEAK_SECONDARY			4.919	Amperes	Peak secondary current
IRMS_SECONDARY			1.586	Amperes	Root mean squared value of the secondary current
PIV_SECONDARY			40.36	Volts	Peak inverse voltage on the secondary diode, not including the leakage spike
VF_SECONDARY			0.70	Volts	Secondary diode forward voltage drop
TRANSFORMER CONSTRUCTION PARAMETERS					
Core selection					
CORE	EE13		EE13		Select the transformer core
BOBBIN			B-EE13-H		Bobbin name
AE			17.10	mm^2	Cross sectional area of the core
LE			30.20	mm	Effective magnetic path length of the core
AL			1130.0	nH/(turns^2)	Ungapped effective inductance of the core
VE			517.0	mm^3	Volume of the core
AW			18.43	mm^2	Window area of the bobbin
BW			7.60	mm	Width of the bobbin
MLT			0.00	mm	Mean length per turn of the bobbin
MARGIN			0.00	mm	Safety margin
Primary winding					
NPRIMARY			264		Prlmary number of turns
BMAX_TARGET			1500	Gauss	Target value of the magnetic flux density
BMAX_ACTUAL			1295	Gauss	Actual value of the magnetic flux density
BAC			647	Gauss	AC flux density
ALG			30	nH/T^2	Gapped core effective inductance
LG			0.697	mm	Core gap length
LAYERS_PRIMARY			6		Number of primary layers
AWG_PRIMARY			36		Primary winding wire AWG

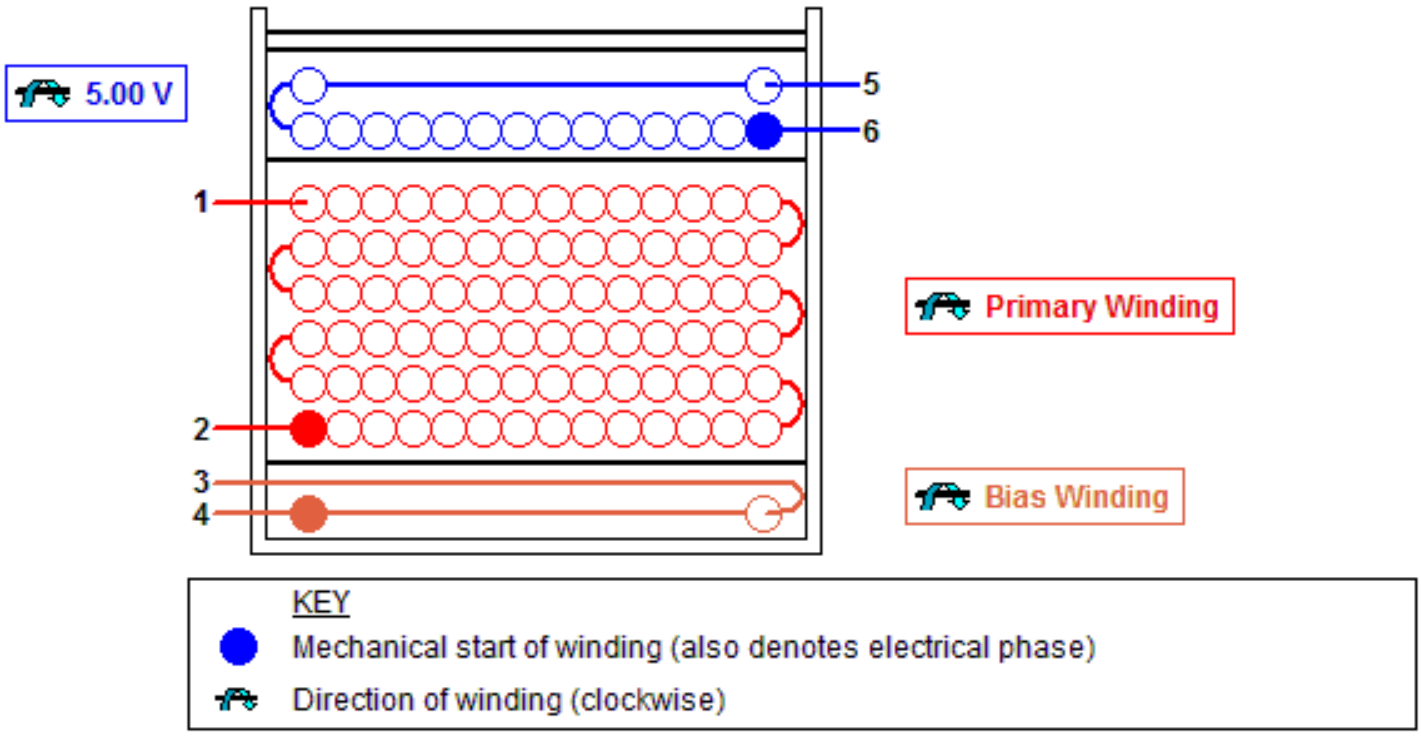
OD_PRIMARY_INSULATED			0.157	mm	Primary winding wire outer diameter with insulation
OD_PRIMARY_BARE			0.127	mm	Primary winding wire outer diameter without insulation
CMA_PRIMARY			268	mil^2/Amperes	Primary winding wire CMA
Secondary winding					
NSECONDARY			15		Secondary turns
AWG_SECONDARY			25		Secondary winding wire AWG
OD_SECONDARY_INSULATED			0.760	mm	Secondary winding wire outer diameter with insulation
OD_SECONDARY_BARE			0.455	mm	Secondary winding wire outer diameter without insulation
CMA_SECONDARY			202	mil^2/Amperes	Secondary winding CMA
Bias winding					
NBIAS			24		Bias turns
VF_BIAS			0.70	Volts	Bias diode forward voltage drop
VBIAS		Warning	9.12	Volts	Increase the bias winding turns to ensure VBIAS > 12V
PIVB			65.69	Volts	Peak inverse voltage on the bias diode
CBP			0.1	uF	BP pin capacitor
FEEDBACK PARAMETERS					
DIODE_BIAS			1N4003-4007		Recommended diode is 1N4003. Place diode on return leg of bias winding for optimal EMI
RUPPER			4500	ohms	CV bias resistor for CV/CC circuit. See LinkSwitch-XT2 Design Guide
RLOWER			3000	ohms	Resistor to set CC linearity for CV/CC circuit. See LinkSwitch-XT2 900V Design Guide
MULTIPLE OUTPUT PARAMETERS					
Output 1					
VOUT1			5.00	Volts	Output Voltage 1
IOUT1			0.600	Amperes	Output Current 1
POUT1			3.00	Watts	Output Power 1
VD1			0.70	Volts	Secondary diode forward voltage drop for output 1
NS1			15		Number of turns for output 1
ISRMS1			1.586	Amperes	Root mean squared value of the secondary current for output 1
IRIPPLE1			1.468	Amperes	Current ripple on the secondary waveform for output 1
PIV1			40.36	Volts	Peak inverse voltage on the secondary diode for output 1
DIODE1_RECOMMENDED			SB360		Recommended diode for output 1
PRELOAD			2.49	kohms	Preload resistor to ensure a load of at least 3mA on the first output for BIAS, 2mA for MAIN
CMS1			317.2	Cmils	Bare conductor effective area in circular mils for output 1
AWGS1			25	AWG	Wire size for output 1

Output 2					
VOUT2			*0.00*	*Volts*	*Output Voltage 2*
IOUT2			*0.000*	*Amperes*	*Output Current 2*
POUT2			*0.00*	*Watts*	*Output Power 2*
VD2			*0.70*	*Volts*	*Secondary diode forward voltage drop for output 2*
NS2			*2*		*Number of turns for output 2*
ISRMS2			*0.000*	*Amperes*	*Root mean squared value of the secondary current for output 2*
IRIPPLE2			*0.000*	*Amperes*	*Current ripple on the secondary waveform for output 2*
PIV2			*4.71*	*Volts*	*Peak inverse voltage on the secondary diode for output 2*
DIODE2_RECOMMENDED			*NA*		*Recommended diode for output 2*
CMS2			*0.0*	*Cmils*	*Bare conductor effective area in circular mils for output 2*
AWGS2			*0*	*AWG*	*Wire size for output 2*
Output 3					
VOUT3			*0.00*	*Volts*	*Output Voltage 3*
IOUT3			*0.000*	*Amperes*	*Output Current 3*
POUT3			*0.00*	*Watts*	*Output Power 3*
VD3			*0.70*	*Volts*	*Secondary diode forward voltage drop for output 3*
NS3			*2*		*Number of turns for output 3*
ISRMS3			*0.000*	*Amperes*	*Root mean squared value of the secondary current for output 3*
IRIPPLE3			*0.000*	*Amperes*	*Current ripple on the secondary waveform for output 3*
PIV3			*4.71*	*Volts*	*Peak inverse voltage on the secondary diode for output 3*
DIODE3_RECOMMENDED			*NA*		*Recommended diode for output 3*
CMS3			*0.0*	*Cmils*	*Bare conductor effective area in circular mils for output 3*
AWGS3			*0*	*AWG*	*Wire size output for 3*
PO_TOTAL			*3.00*	*Watts*	*Total power of all outputs*
NEGATIVE OUTPUT			*N/A*		*If negative output exists, enter the output number; e.g. If VO2 is negative output, select 2*

Electrical Diagram



Mechanical Diagram



Winding Instruction

Bias Winding

Start on pin(s) 4 and wind 24 turns (x 1 filar) of item [5]. Winding direction is clockwise. Spread the winding evenly across entire bobbin. Finish this winding on pin(s) 3.

Add 1 layer of tape, item [3], for insulation.

Primary Winding

Start on pin(s) 2 and wind 264 turns (x 1 filar) of item [5]. in 6 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. Continue the same way as in previous 2 layers. On the final layer, spread the winding evenly across entire bobbin. Finish this winding on pin(s) 1.

Add 1 layer of tape, item [3], for insulation.

Secondary Winding

Start on pin(s) 6 and wind 15 turns (x 1 filar) of item [6]. Spread the winding evenly across entire bobbin. Winding direction is clockwise. Finish this winding on pin(s) 5.

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: EE13, 3F3, gapped for ALG of 30 nH/T²**
[2]	**Bobbin: Generic, 4 pri. + 2 sec.**
[3]	**Barrier Tape: Polyester film [1 mil (25 µm) base thickness], 7.60 mm wide**
[4]	**Varnish**
[5]	**Magnet Wire: 35 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 1,2,3,4 to pins 5,6.**	**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.**	**2091**
Tolerance, ±%	**Tolerance of Primary Inductance**	**10.0**
Maximum Primary Leakage, µH	**Measured between Pin 1 to Pin 2, with all other Windings shorted.**	**83.66**

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.

Transformer Construction Parameters

Var	Value	Units	Description
Core Type	**EE13**		Core Type
Core Material	**3F3**		Core Material
Bobbin Reference	**Generic, 4 pri. + 2 sec.**		Bobbin Reference
Bobbin Orientation	**Horizontal**		Bobbin type
Primary Pins	**4**		Number of Primary pins used
Secondary Pins	**2**		Number of Secondary pins used
LP	**2091**	µH	Nominal Primary Inductance
ML	**0.00**	mm	Safety Margin on Left Width
MR	**0.00**	mm	Safety Margin on Right Width
LG	**0.697**	mm	Estimated Gap Length

Bias Variables

Var	Value	Units	Description
NB	**24**		Primary Bias Winding Number of Turns
Wire Size	**35**	AWG	Wire size of Bias windings
Winding Type	**Single (x1)**		Wire type of Bias windings
Layers	**0.54**		Primary Bias Winding Layers
Start Pin(s)	**4**		Starting pin(s) for Bias winding
Termination Pin(s)	**3**		Termination pin(s) for Bias winding

Primary Winding Section 1

Var	Value	Units	Description
NP1	**264**		Number of Primary Winding Turns in the First Section of Primary
Wire Size	**35**	AWG	Primary Winding - Wire Size
Winding Type	**Single (x1)**		Primary Winding - Number of Parallel Wire Strands
L	**5.91**		Primary Winding - Number of Layers
Start Pin(s)	**2**		Starting pin(s) for first section of primary winding
Termination Pin(s)	**1**		Termination pin(s) for first section of primary winding

Output 1

Var	Value	Units	Description
VO	**5.00**	V	Typical Output Voltage
IO	**0.60**	A	Output Current
VOUT_ACTUAL	**5.00**	V	Actual Output Voltage
NS	**15**		Secondary Number of Turns
Wire Size	**25**	AWG	Wire size of secondary winding
Winding Type	**Single (x1)**		Output winding number of parallel strands
L_S_OUT	**1.28**		Secondary Output Winding Layers
Start Pin(s)	**6**		Starting pin(s) for Output winding
Termination Pin(s)	**5**		Termination pin(s) for Output winding