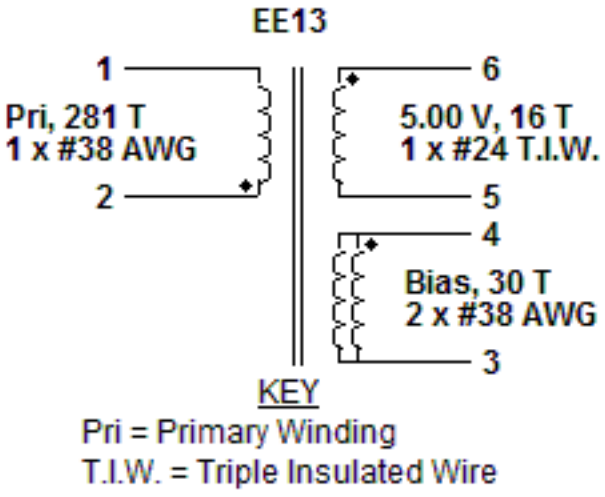
ACDC_LinkSwitchXT2900V_092018; Rev.1.1; Copyright Power Integrations 2018	INPUT	INFO	OUTPUT	UNIT	ACDC_LinkSwitchXT2 900V Flyback Design Spreadsheet
ENTER APPLICATION VARIABLES					Design Title
LINE VOLTAGE RANGE			HIGH LINE		AC line voltage range
VACMIN	195.00		195.00	Volts	Minimum AC line voltage
VACTYP	230.00		230.00	Volts	Typical AC line voltage
VACMAX	400.00		400.00	Volts	Maximum AC line voltage
fL			50	Hertz	AC mains frequency
TIME_BRIDGE_CONDUCTION			2.03	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	0.650		0.650	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			3.25	Watts	Continuous Output Power
CIN	6.80		6.80	uFarads	Input capacitor
VMIN			256.42	Volts	Valley of the rectified VACMIN
VMAX			565.69	Volts	Peak of the VACMAX
FEEDBACK	BIAS		BIAS		Select the type of feedback required. (BIAS = feedback via Bias Winding)
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		LNK3694		Device series
DEVICE CODE			LNK3694G		Device code
PMAX			6.00	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			715.7	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			2.554		Measure of continuous/discontinuous mode of operation
KP_TRANSIENT			0.877		KP under conditions of a transient
DMAX			0.137		Maximum duty cycle at VMIN
TIME_ON			2.211	useconds	MOSFET conduction time at the minimum line voltage
TIME_ON_MIN			0.991	useconds	MOSFET conduction time at the maximum line voltage
IAVG_PRIMARY			0.016	Amperes	Average input current
IRMS_PRIMARY			0.051	Amperes	Root mean squared value of the primary current
LPRIMARY_MIN			2039	uH	Minimum primary inductance
LPRIMARY_TYP			2266	uH	Typical primary inductance
LPRIMARY_MAX			2492	uH	Maximum primary inductance
LPRIMARY_TOL			10		Tolerance of the Primary inductance
SECONDARY WAVEFORM PARAMETERS					
IPEAK_SECONDARY			4.909	Amperes	Peak secondary current
IRMS_SECONDARY			1.647	Amperes	Root mean squared value of the secondary current
PIV_SECONDARY			37.21	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			281		PrImary number of turns
BMAX_TARGET			1500	Gauss	Target value of the magnetic flux density
BMAX_ACTUAL			1318	Gauss	Actual value of the magnetic flux density
BAC			659	Gauss	AC flux density
ALG			29	nH/T^2	Gapped core effective inductance
LG			0.730	mm	Core gap length
LAYERS_PRIMARY			4		Number of primary layers
AWG_PRIMARY	38	Info	38		Overwriting the primary AWG can invalidate the target number of primary layers
OD_PRIMARY_INSULATED			0.125	mm	Primary winding wire outer diameter with insulation
OD_PRIMARY_BARE			0.101	mm	Primary winding wire outer diameter without insulation

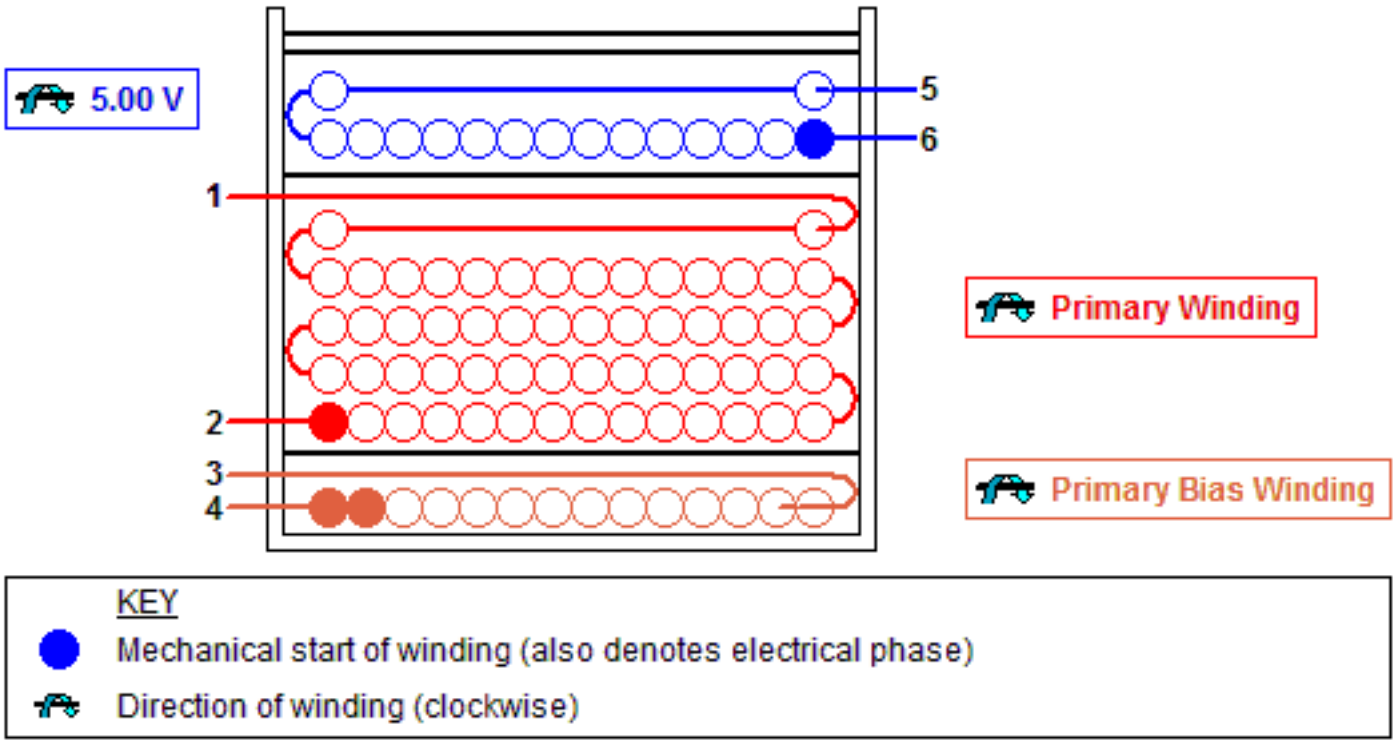
CMA_PRIMARY			306	mil^2/Amperes	Primary winding wire CMA
Secondary winding					
NSECONDARY			16		Secondary turns
AWG_SECONDARY			24		Secondary winding wire AWG
OD_SECONDARY_INSULATED			0.815	mm	Secondary winding wire outer diameter with insulation
OD_SECONDARY_BARE			0.511	mm	Secondary winding wire outer diameter without insulation
CMA_SECONDARY			245	mil^2/Amperes	Secondary winding CMA
Bias winding					
NBIAS			30		Bias turns
VF_BIAS			0.70	Volts	Bias diode forward voltage drop
VBIAS		Warning	10.69	Volts	Increase the bias winding turns to ensure VBIAS > 12V
PIVB			71.08	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			13000	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			0.650	Amperes	Output Current 1
POUT1			3.25	Watts	Output Power 1
VD1			0.70	Volts	Secondary diode forward voltage drop for output 1
NS1			16		Number of turns for output 1
ISRMS1			1.647	Amperes	Root mean squared value of the secondary current for output 1
IRIPPLE1			1.514	Amperes	Current ripple on the secondary waveform for output 1
PIV1			37.21	Volts	Peak inverse voltage on the secondary diode for output 1
DIODE1_RECOMMENDED			SB360		Recommended diode for output 1
PRELOAD			1.65	kohms	Preload resistor to ensure a load of at least 3mA on the first output for BIAS, 2mA for MAIN
CMS1			329.5	Cmils	Bare conductor effective area in circular mils for output 1
AWGS1			24	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			*4.03*	*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			*4.03*	*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			*3.25*	*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

Primary Bias Winding

Start on pin(s) 4 and wind 30 turns (x 2 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 281 turns (x 1 filar) of item [5]. in 5 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 16 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, , gapped for ALG of 29 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: 38 AWG (0.1 mm), Solderable Double Coated**
[6]	**Triple Insulated Wire: 24 AWG (0.55 mm)**

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.**	**2266**
Tolerance, ±%	**Tolerance of Primary Inductance**	**10.0**
Maximum Primary Leakage, µH	**Measured between Pin 1 to Pin 2, with all other Windings shorted.**	**90.63**

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	2266	µH	Nominal Primary Inductance
ML	0.00	mm	Safety Margin on Left Width
MR	0.00	mm	Safety Margin on Right Width
LG	0.730	mm	Estimated Gap Length

Primary Bias Variables

Var	Value	Units	Description
NB	30		Primary Bias Winding Number of Turns
Wire Size	38	AWG	Wire size of Bias windings
Winding Type	Bifilar (x2)		Wire type of Bias windings
Layers	0.98		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	281		Number of Primary Winding Turns in the First Section of Primary
Wire Size	38	AWG	Primary Winding - Wire Size
Winding Type	Single (x1)		Primary Winding - Number of Parallel Wire Strands
CMA	311.21	Cmils/A	Primary Winding Current Capacity
L	4.60		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	0.65	A	Output Current
VOUT_ACTUAL	5.00	V	Actual Output Voltage
NS	16		Secondary Number of Turns
Wire Size	24	AWG	Wire size of secondary winding
Winding Type	Single (x1)		Output winding number of parallel strands
ISRMS_WINDING	1.647	A	Secondary Winding RMS Current
CMAS	245	Cmils/A	Secondary Winding Current Capacity
L_S_OUT	1.58		Secondary Output Winding Layers
Start Pin(s)	6		Starting pin(s) for Output winding
Termination Pin(s)	5		Termination pin(s) for Output winding