ACDC_InnoSwitch3-EP900V_Flyback_110821; Rev.1.3; Copyright Power Integrations 2021	INPUT	INFO	OUTPUT	UNITS	InnoSwitch3-EP 900V Flyback Design Spreadsheet
APPLICATION VARIABLES					Design Title
VIN_MIN	120		120	V	Minimum AC input voltage
VIN_MAX	440		440	V	Maximum AC input voltage
VIN_RANGE			WIDE RANGE UNIVERSAL		Range of AC input voltage
LINEFREQ	50		50	Hz	AC Input voltage frequency
CAP_INPUT	22.0		22.0	uF	Input capacitor
VOUT	24.00		24.00	V	Output voltage at the board
PERCENT_CDC			0		Cable drop compensation desired at full load
IOUT	0.833		0.833	A	Output current
POUT			19.99	W	Output power
EFFICIENCY	0.89		0.89		AC-DC efficiency estimate at full load given that the converter is switching at the valley of the rectified minimum input AC voltage
FACTOR_Z			0.50		Z-factor estimate
ENCLOSURE			OPEN FRAME		Power supply enclosure
PRIMARY CONTROLLER SELECTION					
ILIMIT_MODE	INCREASED		INCREASED		Device current limit mode
DEVICE_GENERIC	INN36X6C		INN36X6C		Generic device code
DEVICE_CODE			INN3696C		Actual device code
POUT_MAX			30	W	Power capability of the device based on thermal performance
RDSON_100DEG			4.20	Ω	Primary switch on time drain resistance at 100 degC
ILIMIT_MIN			1.305	A	Minimum current limit of the primary switch
ILIMIT_TYP			1.450	A	Typical current limit of the primary switch
ILIMIT_MAX			1.595	A	Maximum current limit of the primary switch
VDRAIN_BREAKDOWN			900	V	Device breakdown voltage
VDRAIN_ON_PRSW			0.76	V	Primary switch on time drain voltage
VDRAIN_OFF_PRSW			760.9	V	Peak drain voltage on the primary switch during turn-off
WORST CASE ELECTRICAL PARAMETERS					
FSWITCHING_MAX	70000		70000	Hz	Maximum switching frequency at full load and valley of the rectified minimum AC input voltage
VOR	70.0		70.0	V	Secondary voltage reflected to the primary when the primary switch turns off
VMIN			117.75	V	Valley of the minimum input AC voltage at full load
KP			1.44		Measure of continuous/discontinuous mode of operation
MODE_OPERATION			DCM		Mode of operation
DUTYCYCLE			0.293		Primary switch duty cycle
TIME_ON			5.24	us	Primary switch on-time

TIME_OFF			10.14	us	Primary switch off-time
LPRIMARY_MIN			387.0	uH	Minimum primary inductance
LPRIMARY_TYP			407.3	uH	Typical primary inductance
LPRIMARY_TOL	5.0		5.0	%	Primary inductance tolerance
LPRIMARY_MAX			427.7	uH	Maximum primary inductance
PRIMARY CURRENT					
IPEAK_PRIMARY			1.454	A	Primary switch peak current
IPEDESTAL_PRIMARY			0.000	A	Primary switch current pedestal
IAVG_PRIMARY			0.181	A	Primary switch average current
IRIPPLE_PRIMARY			1.454	A	Primary switch ripple current
IRMS_PRIMARY			0.419	A	Primary switch RMS current
SECONDARY CURRENT					
IPEAK_SECONDARY			4.258	A	Secondary winding peak current
IPEDESTAL_SECONDARY			0.000	A	Secondary winding current pedestal
IRMS_SECONDARY			1.588	A	Secondary winding RMS current
TRANSFORMER CONSTRUCTION PARAMETERS					
CORE SELECTION					
CORE	EE19		EE19		Core selection
CORE CODE			PC40EE19-Z		Core code
AE			23.00	mm^2	Core cross sectional area
LE			39.40	mm	Core magnetic path length
AL			1250	nH/turns^2	Ungapped core effective inductance
VE			906.0	mm^3	Core volume
BOBBIN			BE19-116 CPFR		Bobbin
AW			36.40	mm^2	Window area of the bobbin
BW			9.10	mm	Bobbin width
MARGIN			0.0	mm	Safety margin width (Half the primary to secondary creepage distance)
PRIMARY WINDING					
NPRIMARY			82		Primary turns
BPEAK			3702	Gauss	Peak flux density
BMAX			3249	Gauss	Maximum flux density
BAC			1624	Gauss	AC flux density (0.5 x Peak to Peak)
ALG			61	nH/turns^2	Typical gapped core effective inductance
LG			0.454	mm	Core gap length
SECONDARY WINDING					
NSECONDARY			28		Secondary turns
BIAS WINDING					
NBIAS			15		Bias turns
PRIMARY COMPONENTS SELECTION					

LINE UNDERVOLTAGE					
BROWN-IN REQURED	110.0		110.0	V	Required AC RMS line voltage brown-in threshold
RLS			6.17	MΩ	Connect two 3.09 MOhm resistors to the V-pin for the required UV/OV threshold
BROWN-IN ACTUAL			87.0 - 109.8	V	Actual AC RMS brown-in range
BROWN-OUT ACTUAL			78.4 - 97.8	V	Actual AC RMS brown-out range
LINE OVERVOLTAGE					
OV_TARGET	445.0		445.0	V	AC RMS line voltage at which overvoltage will trigger. For High Line desings, brown-in threshold might need to be lowered to get the required overvoltage
RV_BIAS_ENABLED	YES		YES		Resistor between BPP and V pins to increase Line OV threshold without increasing Line UV
RV_BIAS			1075	kΩ	Biasing resistor between BPP and V pins of the device
OVERVOLTAGE_LINE		Warning	445 - 509	V	The device voltage stress will be 860V when overvoltage is trigerred. It is recommended to keep the stress below 810V
BIAS DIODE					
VBIAS			12.0	V	Rectified bias voltage
VF_BIAS			0.70	V	Bias winding diode forward drop
VREVERSE_BIASDIODE			125.57	V	Bias diode reverse voltage (not accounting parasitic voltage ring)
CBIAS			22	uF	Bias winding rectification capacitor
CBPP			4.70	uF	BPP pin capacitor
SECONDARY COMPONENTS					
RFB_UPPER			100.00	kΩ	Upper feedback resistor (connected to the first output voltage)
RFB_LOWER			5.62	kΩ	Lower feedback resistor
CFB_LOWER			330	pF	Lower feedback resistor decoupling capacitor
MULTIPLE OUTPUT PARAMETERS					
OUTPUT 1					
VOUT1			24.00	V	Output 1 voltage
IOUT1	0.83		0.83	A	Output 1 current
POUT1			19.92	W	Output 1 power
IRMS_SECONDARY1			1.582	A	Root mean squared value of the secondary current for output 1
IRIPPLE_CAP_OUTPUT1			1.347	A	Current ripple on the secondary waveform for output 1
NSECONDARY1			28		Number of turns for output 1
VREVERSE_RECTIFIER1			236.00	V	SRFET reverse voltage (not accounting parasitic voltage ring) for output 1
SRFET1	AUTO	Info	AON7254		The voltage stress (including the parasitic ring) on the secondary MOSFET selected may exceed the device BVDSS: pick a MOSFET with a higher BVDSS
VF_SRFET1			0.055	V	SRFET on-time drain voltage for output 1
VBREAKDOWN_SRFET1			150	V	SRFET breakdown voltage for output 1
RDSON_SRFET1			66.0	mΩ	SRFET on-time drain resistance at 25degC and VGS=4.4V for output 1
OUTPUT 2					

VOUT2			0.00	V	Output 2 voltage
IOUT2			0.000	A	Output 2 current
POUT2			0.00	W	Output 2 power
IRMS_SECONDARY2			0.000	A	Root mean squared value of the secondary current for output 2
IRIPPLE_CAP_OUTPUT2			0.000	A	Current ripple on the secondary waveform for output 2
NSECONDARY2			0		Number of turns for output 2
VREVERSE_RECTIFIER2			0.00	V	SRFET reverse voltage (not accounting parasitic voltage ring) for output 2
SRFET2	AUTO		NA		Secondary rectifier (Logic MOSFET) for output 2
VF_SRFET2			NA	V	SRFET on-time drain voltage for output 2
VBREAKDOWN_SRFET2			NA	V	SRFET breakdown voltage for output 2
RDSON_SRFET2			NA	mΩ	SRFET on-time drain resistance at 25degC and VGS=4.4V for output 2
OUTPUT 3					
VOUT3			0.00	V	Output 3 voltage
IOUT3			0.000	A	Output 3 current
POUT3			0.00	W	Output 3 power
IRMS_SECONDARY3			0.000	A	Root mean squared value of the secondary current for output 3
IRIPPLE_CAP_OUTPUT3			0.000	A	Current ripple on the secondary waveform for output 3
NSECONDARY3			0		Number of turns for output 3
VREVERSE_RECTIFIER3			0.00	V	SRFET reverse voltage (not accounting parasitic voltage ring) for output 3
SRFET3	AUTO		NA		Secondary rectifier (Logic MOSFET) for output 3
VF_SRFET3			NA	V	SRFET on-time drain voltage for output 3
VBREAKDOWN_SRFET3			NA	V	SRFET breakdown voltage for output 3
RDSON_SRFET3			NA	mΩ	SRFET on-time drain resistance at 25degC and VGS=4.4V for output 3
PO_TOTAL			19.92	W	Total power of all outputs
NEGATIVE OUTPUT	N/A		N/A		If negative output exists, enter the output number; e.g. If VO2 is negative output, select 2