1	ACDC_TinySwitch-III_062021; Rev.1.28; Copyright Power Integrations 2021	INPUT	INFO	OUTPUT	UNIT	ACDC_TinySwitch-III_062021_Rev1-28.xls; TinySwitch-III Continuous/Discontinuous Flyback Transformer Design Spreadsheet
2	**ENTER APPLICATION VARIABLES**					**Customer**
3	VACMIN	180			Volts	Minimum AC Input Voltage
4	VACMAX	265			Volts	Maximum AC Input Voltage
5	fL	50			Hertz	AC Mains Frequency
6	VO	12.00			Volts	Output Voltage (at continuous power)
7	IO	0.70			Amps	Power Supply Output Current (corresponding to peak power)
8	Power			8.4	Watts	Continuous Output Power
9	n	0.85				Efficiency Estimate at output terminals. Under 0.7 if no better data available
10	Z	0.50				Z Factor. Ratio of secondary side losses to the total losses in the power supply. Use 0.5 if no better data available
11	tC	3.00			mSeconds	Bridge Rectifier Conduction Time Estimate
12	CIN	8.00	Info	8.00	uFarads	!!! Increase CIN. Ensure that CIN is atleast 1uF/Watt
13						
14	**ENTER TinySwitch-III VARIABLES**					
15	**TinySwitch-III**	TNY274P		TNY274P		User defined TinySwitch-III
16	Chosen Device		TNY274P			
17	Chose Configuration	**STD**		Standard Current Limit		Enter "RED" for reduced current limit (sealed adapters), "STD" for standard current limit or "INC" for increased current limit (peak or higher power applications)
18	ILIMITMIN			0.233	Amps	Minimum Current Limit
19	ILIMITTYP			0.250	Amps	Typical Current Limit
20	ILIMITMAX			0.267	Amps	Maximum Current Limit
21	fSmin			124000	Hertz	Minimum Device Switching Frequency
22	I^2fmin			7.425	A^2kHz	I^2f (product of current limit squared and frequency is trimmed for tighter tolerance)
23	VOR	133.00		133.00	Volts	Reflected Output Voltage (VOR < 135 V Recommended)
24	VDS			10.00	Volts	TinySwitch-III on-state Drain to Source Voltage
25	VD			0.70	Volts	Output Winding Diode Forward Voltage Drop
26	KP			0.96		Ripple to Peak Current Ratio (KP < 6)
27	KP_TRANSIENT			0.72		Transient Ripple to Peak Current Ratio. Ensure KP_TRANSIENT > 0.25
28						
29	**ENTER BIAS WINDING VARIABLES**					
30	VB			22.00	Volts	Bias Winding Voltage
31	VDB			0.70	Volts	Bias Winding Diode Forward Voltage Drop
32	NB			27.72		Bias Winding Number of Turns
33	VZOV			28.00	Volts	Over Voltage Protection zener diode voltage.
34						
35	**UVLO VARIABLES**					
36	V_UV_TARGET			239.75	Volts	Target DC under-voltage threshold, above which the power supply with start
37	V_UV_ACTUAL			229.70	Volts	Typical DC start-up voltage based on standard value of RUV_ACTUAL
38	RUV_IDEAL			9.50	Mohms	Calculated value for UV Lockout resistor
39	RUV_ACTUAL			9.10	Mohms	Closest standard value of resistor to RUV_IDEAL
40						
41	**ENTER TRANSFORMER CORE/CONSTRUCTION VARIABLES**					
42	**Core Type**	EE16		EE16		Enter Transformer Core
43	Core		EE16		P/N:	PC40EE16-Z
44	Bobbin			EE16_BOBBIN	P/N:	EE16_BOBBIN
45	AE			0.19	cm^2	Core Effective Cross Sectional Area
46	LE			3.50	cm	Core Effective Path Length
47	AL			1140.00	nH/T^2	Ungapped Core Effective Inductance
48	BW			8.60	mm	Bobbin Physical Winding Width
49	M			0.00	mm	Safety Margin Width (Half the Primary to Secondary Creepage Distance)
50	L			3.00		Number of Primary Layers
51	NS	16		16		Number of Secondary Turns
52						
53	**DC INPUT VOLTAGE PARAMETERS**					
54	VMIN			217.96	Volts	Minimum DC Input Voltage
55	VMAX			374.77	Volts	Maximum DC Input Voltage
56						
57	**CURRENT WAVEFORM SHAPE PARAMETERS**					
58	DMAX			0.39		Duty Ratio at full load, minimum primary inductance and minimum input voltage
59	IAVG			0.05	Amps	Average Primary Current
60	IP			0.23	Amps	Minimum Peak Primary Current
61	IR			0.23	Amps	Primary Ripple Current
62	IRMS			0.10	Amps	Primary RMS Current
63						
64	**TRANSFORMER PRIMARY DESIGN PARAMETERS**					
65	LP			2741	uHenries	Typical Primary Inductance. +/- 10% to ensure a minimum primary inductance of 2466 uH
66	LP_TOLERANCE			10	%	Primary inductance tolerance
67	NP			168		Primary Winding Number of Turns
68	ALG			98	nH/T^2	Gapped Core Effective Inductance

69	BM			2275	Gauss	Maximum Operating Flux Density, BM<3000 is recommended
70	BAC			1137	Gauss	AC Flux Density for Core Loss Curves (0.5 X Peak to Peak)
71	ur			1654		Relative Permeability of Ungapped Core
72	LG			0.23	mm	Gap Length (Lg > 0.1 mm)
73	BWE			25.8	mm	Effective Bobbin Width
74	OD			0.15	mm	Maximum Primary Wire Diameter including insulation
75	INS			0.04	mm	Estimated Total Insulation Thickness (= 2 * film thickness)
76	DIA			0.12	mm	Bare conductor diameter
77	AWG			37	AWG	Primary Wire Gauge (Rounded to next smaller standard AWG value)
78	CM			20	Cmils	Bare conductor effective area in circular mils
79	CMA			210	Cmils/Amp	Primary Winding Current Capacity (200 < CMA < 500)
80						
81	**TRANSFORMER SECONDARY DESIGN PARAMETERS**					
82	**Lumped parameters**					
83	ISP			2.44	Amps	Peak Secondary Current
84	ISRMS			1.29	Amps	Secondary RMS Current
85	IRIPPLE			1.08	Amps	Output Capacitor RMS Ripple Current
86	CMS			258	Cmils	Secondary Bare Conductor minimum circular mils
87	AWGS			25	AWG	Secondary Wire Gauge (Rounded up to next larger standard AWG value)
88						
89	**VOLTAGE STRESS PARAMETERS**					
90	VDRAIN			674	Volts	Maximum Drain Voltage Estimate (Assumes 20% zener clamp tolerance and an additional 10% temperature tolerance)
91	PIVS			48	Volts	Output Rectifier Maximum Peak Inverse Voltage
92						
93	**TRANSFORMER SECONDARY DESIGN PARAMETERS (MULTIPLE OUTPUTS)**					
94	**1st output**					
95	VO1			12.00	Volts	Main Output Voltage (if unused, defaults to single output design)
96	IO1			0.70	Amps	Output DC Current
97	PO1			8.40	Watts	Output Power
98	VD1			0.70	Volts	Output Diode Forward Voltage Drop
99	NS1			16.00		Output Winding Number of Turns
100	ISRMS1			1.289	Amps	Output Winding RMS Current
101	IRIPPLE1			1.08	Amps	Output Capacitor RMS Ripple Current
102	PIVS1			48	Volts	Output Rectifier Maximum Peak Inverse Voltage
103	Recommended Diodes			**SB360, MBR360**		Recommended Diodes for this output
104	CMS1			258	Cmils	Output Winding Bare Conductor minimum circular mils
105	AWGS1			25	AWG	Wire Gauge (Rounded up to next larger standard AWG value)
106	DIAS1			0.46	mm	Minimum Bare Conductor Diameter
107	ODS1			0.54	mm	Maximum Outside Diameter for Triple Insulated Wire
108						
109	**2nd output**					
110	VO2				Volts	Output Voltage
111	IO2				Amps	Output DC Current
112	PO2			0.00	Watts	Output Power
113	VD2			0.70	Volts	Output Diode Forward Voltage Drop
114	NS2			0.88		Output Winding Number of Turns
115	ISRMS2			0.000	Amps	Output Winding RMS Current
116	IRIPPLE2			0.00	Amps	Output Capacitor RMS Ripple Current
117	PIVS2			2	Volts	Output Rectifier Maximum Peak Inverse Voltage
118	Recommended Diode					Recommended Diodes for this output
119	CMS2			0	Cmils	Output Winding Bare Conductor minimum circular mils
120	AWGS2			N/A	AWG	Wire Gauge (Rounded up to next larger standard AWG value)
121	DIAS2			N/A	mm	Minimum Bare Conductor Diameter
122	ODS2			N/A	mm	Maximum Outside Diameter for Triple Insulated Wire
123						
124	**3rd output**					
125	VO3				Volts	Output Voltage
126	IO3				Amps	Output DC Current
127	PO3			0.00	Watts	Output Power
128	VD3			0.70	Volts	Output Diode Forward Voltage Drop
129	NS3			0.88		Output Winding Number of Turns
130	ISRMS3			0.000	Amps	Output Winding RMS Current
131	IRIPPLE3			0.00	Amps	Output Capacitor RMS Ripple Current
132	PIVS3			2	Volts	Output Rectifier Maximum Peak Inverse Voltage
133	Recommended Diode					Recommended Diodes for this output
134	CMS3			0	Cmils	Output Winding Bare Conductor minimum circular mils
135	AWGS3			N/A	AWG	Wire Gauge (Rounded up to next larger standard AWG value)
136	DIAS3			N/A	mm	Minimum Bare Conductor Diameter
137	ODS3			N/A	mm	Maximum Outside Diameter for Triple Insulated Wire
138						
139	**Total power**			8.4	Watts	Total Output Power
140						
141	Negative Output	N/A		N/A		If negative output exists enter Output number; eg: If VO2 is negative output, enter 2