1	HiperTFS2_Two-switch_Forward_080516; Rev.2.2; Copyright Power Integrations 2016	INPUT	INFO	OUTPUT	UNIT
2	**Hiper-TFS MAIN OUTPUT (TWO-SWITCH FORWARD STAGE)**				
3	**OUTPUT VOLTAGE AND CURRENT**				
4	VMAIN	27.00		27.00	V
5	IMAIN	13.00		13.00	A
6	VOUT2			0.00	V
7	IOUT2			0.00	A
8	**Post Regulated Output**				
9	Post Regulator	**NONE**		NONE	
10	V_SOURCE	**NONE**		NONE	V
11	VOUT3			0.00	V
12	IOUT3			0.00	A
13	n_PR			1.00	
14	**Coupled Inductor (Low Power) derived output**				
15	VOUT4			0.00	V
16	IOUT4			0.00	A
17	**System Power**				
18	POUT(Main)			351.0	W
19	POUT_PEAK(Main)			351.0	W
20	POUT(Standby)			15.3	W
21	POUT_PEAK(Standby)			15.3	W
22	**POUT(System Total)**			**366.3**	**W**
23	POUT_PEAK(System Total)			366.3	W
24					
25					
26	**INPUT VOLTAGE AND UV/OV**				
27	CIN_MIN			313	uF
28	T_HOLDUP			20.0	ms
29	CIN_ACTUAL	**Auto**		330	uF
30	CIN_ESR			0.25	Ω
31	IRMS_CIN			1.16	A
32	PLOSS_CIN			0.34	W
33	VMIN			300	V
34	VNOM			380	V
35	VMAX			420	V
36	RR			3.92	MΩ
37	RL			3.92	MΩ
38	**UV and OV thresholds**				
39	VUV OFF (min)			182	V
40	VUV OFF (max)			225	V
41	VUV ON (min)			296	V
42	VUV ON (max)			327	V
43	VOV OFF (min)			464	V
44	VOV ON (max)			640	V
45	**Clamp Section**				
46	**Clamp Selection**	**CLAMP TO RAIL**			
47	VCLAMP			150	V
48	VDSOP			570	V
49					
50					
51	**DUTY CYCLE VALUES (REGULATION)**				
52	DVMIN			0.57	
53	DVNOM_GOAL			0.45	
54	DVNOM			0.45	
55	DVMAX			0.41	
56	DOVOFF MIN			0.37	
57	**Maximum Duty Cycle values**				
58	DMAX_UVOFF_MIN			0.65	
59	DMAX_VMIN			0.60	
60	DMAX_VNOM			0.56	
61	DMAX_VMAX			0.51	
62	DMAX_OVOFFMIN			0.46	
63					
64					
65	**DEVICE VARIABLES**				
66	**Device**	**Auto**		TFS7708	
67	Select Frequency mode	**66**		66	kHz
68	ILIMIT_MIN			4.61	A
69	ILIMIT_TYP			4.96	A
70	ILIMIT_MAX			5.31	A
71	fSMIN			62,000	Hz
72	fS			66,000	Hz
73	fSMAX			70,000	Hz
74	KI	1.0		1.0	
75	R(FB)			232	kΩ
76	ILIMIT SELECT			4.61	A

77	RDS(ON)			2.37	Ω
78	VDS			4.62	V
79	**Main MOSFET losses**				
80	V_Coss upper FET			150	V
81	MOSFET SWITCHING LOSS			1.0	W
82	MOSFET CONDUCTION LOSS			5.7	W
83	TOTAL_MOSFET_LOSS			6.7	W
84	**Detailed MOSFET Loss Information**				
85	PCOND_LOWER			3.7	W
86	PCOND_UPPER			2.0	W
87	LOWERFET_SW_LOSS			0.8	W
88	UPPERFET_SW_LOSS			0.2	W
89					
90					
91	**MAIN TRANSFORMER**				
92	**Transformer core selection**				
93	**Core Type**	**ETD34**		ETD34	
94	AE			0.97	cm^2
95	LE			7.86	cm
96	AL			2780	nH/T^2
97	BW			20.90	mm
98	B_HT			5.38	mm
99	B_WA			1.12	cm^2
100	M			4.50	mm
101					
102	**Primary Inductance**				
103	LMAG_MAX			40.09	mH
104	LMAG			14.96	mH
105	GAP			0.00	mm
106	FRES_SYS			98	kHz
107	C_SYS			176	pF
108	**Diode Vf Selection**				
109	VDMAIN			0.50	V
110	VDOUT2			0.50	V
111	VDOUT3			0.50	V
112	VDB			0.70	V
113					
114	**Turns**				
115	NMAIN			13	turns
116	NS2			N/A	turns
117	VOUT2 ACTUAL			0.0	V
118	NP			75	turns
119	HI SIDE BIAS WINDING (optional)	**No**		No	
120	VBIAS				V
121	NBIAS				turns
122	VBIAS_ACTUAL				V
123	**Flux calculations**				
124	BM_MAX			2179	Gauss
125	BM PK-PK			3301	Gauss
126	BP_MAX			2940	Gauss
127	BP PK-PK			4454	Gauss
128					
129					
130	**TRANSFORMER LOSSES AND FIT ESTIMATE**				
131	**Core loss**				
132	Core material	**PC44**		PC44	
133	core_loss_multiplier			23.97	
134	f_coeff			1.56	
135	BAC_coeff			2.89	
136	specific core loss			90	mW/cc
137	core volume			7.63	cm^3
138	core loss			0.68	W
139	**Primary Winding Fit and losses**				
140	L	2		2	layers
141	OD_PRI			0.63	mm
142	FILAR_PRI			1	strands
143	MLT_PRI			6.00	cm
144	DCR_PRI			317	mΩ
145	PCOND_PRI			0.76	W
146	FILL_PRI			21	%
147	**Secondary Winding 1 (lower winding when AC stacked)**				
148	**VOUT**			27.0	V
149	NS1			13.0	turns
150	IRMS_SEC1			10.6	A
151	Foil/Wire	**WIRE**		WIRE	foil/wire
152	OD/Thickness			0.57	mm
153	FILAR_SEC1	4		4	strands
154	SEC1_WIDTH		Warning	N/A	mm

155	SEC1_MLT			6.00	cm
156	DCR_SEC1			17.10	mΩ
157	PCOND_SEC1			1.91	W
158	FILL_SEC1			12	%
159	**Secondary Winding 2 (upper winding when AC stacked)**				
160	**VOUT**			0.0	V
161	NS2			0.0	turns
162	IRMS_SEC2			0.0	A
163	Foil/Wire	**FOIL**		FOIL	foil/wire
164	OD/Thickness			0.13	mm
165	FILAR_SEC2			N/A	strands
166	SEC2_WIDTH			18.00	mm
167	SEC2_MLT			6.00	cm
168	DCR_SEC2			0.00	mΩ
169	PCOND_SEC2			0.00	W
170	FILL_SEC2			0	%
171	**Fill Factor and losses of main transformer**				
172	FILL_TOTAL			33	%
173	TOTAL_CU_LOSS			2.67	W
174	TOTAL_CORE_LOSS			0.68	W
175	TOTAL_TRF_LOSS			3.35	W
176					
177					
178	**CURRENT WAVESHAPE PARAMETERS**				
179	IP			2.90	A
180	IP_PEAK			2.90	A
181	IPRMS(NOM)			1.55	A
182	IMAG			0.17	A
183					
184					
185	**OUTPUT INDUCTOR**				
186	KDI_ACTUAL			0.42	
187	**Turns**				
188	POWDER TURNS MULTIPLIER			3.00	
189	NMAIN_INDUCTOR			39.0	turns
190	NOUT2_INDUCTOR				turns
191	NOUT4_INDUCTOR			N/A	turns
192	**Inductance and flux**				
193	LMAIN_ACTUAL			45.0	uH
194	LOUT_2			0.0	uH
195	BM_IND			2411	gauss
196	BAC_IND			501	gauss
197					
198	**Core Selection**				
199	**Core Type**	**Auto**		Kool Mu 125u	
200	**Core**	**Auto**		77324(O.D)=36.7	
201	AE			67.80	mm^2
202	LE			89.80	mm
203	AL			117	nH/T^2
204	BW			67.54	mm
205	VE			6088	mm^3
206	**Powder cores (Sendust and Powdered Iron) Cores**				
207	MUR			125	
208	H			61.56	AT/cm
209	MUR_RATIO			0.25	
210	LMAIN_0bias			178.0	uH
211					
212	**Ferrite Cores**				
213	LG			N/A	mm
214	Target BM			N/A	Gauss
215					
216	**Choke wires**				
217	Total number of layers			1.42	layers
218	IRMS_MAIN			13.02	A
219	IRMS_AUX			0.00	A
220	AWG_MAIN			17	AWG
221	OD_MAIN			1.22	mm
222	FILAR_MAIN			2	strands
223	RDC_MAIN			13.65	mΩ
224	AC Resistance Ratio (Main)			6.43	
225	CMA_MAIN			315	CMA
226	J_MAIN			11.06	A/mm^2
227	AWG_AUX			0	AWG
228	OD_AUX			N/A	mm
229	FILAR_AUX			2	strands
230	RDC_AUX			0.00	mΩ
231	AC Resistance Ratio (Aux)			0.00	
232	CMA_AUX		Info	0	CMA

233	J_AUX			0.00	A/mm^2
234					
235	**Choke Losses**				
236	PCOPPER_MAIN			2.31	W
237	PCOPPER_AUX			0.00	W
238	PCORE			0.69	W
239	PTOTAL_IND			3.01	W
240					
241					
242	**SECONDARY OUTPUT DIODE PARAMETERS**				
243	**Main Output**				
244	ISFWDRMS			10.56	A
245	ISCATCHRMS			11.68	A
246	IDAVMAINF			7.43	A
247	IDAVMAINC			7.72	A
248	IRMSMAIN			1.59	A
249	PD_LOSS_MAIN			6.50	W
250					
251	**Second Output**				
252	ISFWD2RMS			0.00	A
253	ISCATCH2RMS			0.00	A
254	IDAVOUT2F			0.00	A
255	IDAVOUT2C			0.00	A
256	IRMSOUT2			0.00	A
257	PD_LOSS_OUT2			0.00	W
258					
259	**Diode Derating**				
260	VPIVMAINF	1.00		98.80	V
261	VPIVMAINC	1.00		72.80	V
262	VPIVOUT2F	1.00		0.00	V
263	VPIVOUT2C	1.00		0.00	V
264	VPIVB	1.00		N/A	V
265					
266					
267	**Hiper-TFS STANDBY SECTION (FLYBACK STAGE)**				
268	**ENTER APPLICATION VARIABLES**				
269	VACMIN			85	V
270	VACMAX			265	V
271	fL			50	Hz
272	VO_SB			5.0	V
273	IO_SB			3.00	A
274	IO_SB_PK			3.00	A
275	POUT_SB			15.00	W
276	POUT_SB_TOTAL			15.32	W
277	POUT_SB_PK			15.32	W
278	n			0.70	
279	Z			0.50	
280	tC			3.00	ms
281					
282					
283	**ENTER Hiper-TFS STANDBY VARIABLES**				
284	Select Current Limit	**INC**		Increased Current Limit	
285	ILIM_MIN			0.70	A
286	ILIM_TYP			0.75	A
287	ILIM_MAX			0.80	A
288	R(EN)			107	kΩ
289	fSmin			124,000	Hz
290	I^2fmin			66.8	A^2kHz
291	VOR			100	V
292	VDS			10.0	V
293	VD_SB			0.50	V
294	KP			0.89	
295	KP_TRANSIENT			0.61	
296					
297					
298	**ENTER BIAS WINDING VARIABLES**				
299	VB			16.0	V
300	IB			20.0	mA
301	PB			0.32	W
302	VDB			0.70	V
303	NB			9.1	turns
304	VZOV			22	V
305					
306					
307	**UVLO VARIABLES**				
308	RLS			3.92	MΩ
309	V_UV_ACTUAL			100	V
310					
311					
312	**ENTER TRANSFORMER CORE/CONSTRUCTION VARIABLES**				

313	**Core Type**	**EEL22**		**EEL22**	
314	AE			0.36	cm^2
315	LE			6.32	cm
316	AL			1400	nH/T^2
317	BW			18.00	mm
318	M			0.00	mm
319	L			3	
320	NS_SB			3	
321					
322					
323	**DC INPUT VOLTAGE PARAMETERS**				
324	VMIN_SB			116	V
325	VMAX_SB			375	V
326					
327					
328	**CURRENT WAVEFORM SHAPE PARAMETERS**				
329	DMAX_SB			0.49	
330	IAVG			0.21	A
331	IP_SB			0.70	A
332	IR_SB			0.62	A
333	IRMS_SB			0.34	A
334					
335					
336	**TRANSFORMER PRIMARY DESIGN PARAMETERS**				
337	LP_SB			621	uH
338	LP_TOLERANCE			10.0	%
339	NP_SB			55	turns
340	ALG			209	nH/T^2
341	BM			2550	Gauss
342	BAC			1130	Gauss
343	ur			1967	
344	LG			0.18	mm
345	BWE			54	mm
346	OD			0.99	mm
347	INS			0.08	mm
348	DIA			0.91	mm
349	AWG			20	AWG
350	CM			1024	Cmils
351	CMA		Info	2988	Cmils/Amp
352					
353					
354	**TRANSFORMER SECONDARY DESIGN PARAMETERS**				
355	**Lumped parameters**				
356	ISP			12.7	A
357	ISRMS			6.42	A
358	IRIPPLE			5.67	A
359	CMS			1283	Cmils
360	AWGS			19	AWG
361					
362					
363	**VOLTAGE STRESS PARAMETERS**				
364	VDRAIN			605	V
365	PIVS			26	V
366					
367					
368	**Forward DC-DC System efficiency**				
369	P_MOSFET_MAIN_TOTAL			6.70	W
370	P_XFMR_LOSS			3.4	W
371	P_MAIN_OUT_DIODE			6.5	W
372	P_CIN_ESR			0.34	W
373	P_IND_MAIN			3.0	W
374	OTHER_LOSSES			0.46	W
375					
376	EFFICIENCY_STDBY			70.0%	
377	EFFICIENCY_MAIN			94.5%	
378	EFFICIENCY_SYSTEM			93.2%	
379	**Other Losses**				
380	PCB trace losses			0.46	W
381					
382	**Detailed Mosfet Loss Information**				
383	P_MAIN_COND_LOWER			3.69	W
384	P_MAIN_COND_UPPER			2.02	W
385	COSS_LOWER			78	pF
386	COSS_UPPER			205	pF
387	P_MAIN_LOWER_SW			0.84	W
388	P_MAIN_UPPER_SW			0.15	W
389	P_STANDBY_COND			0.65	W
390					