TIDA-00618

8.5W Dual Output (5V/12V) Universal Input AC/DC Isolated Flyback Reference Design with PSR.

Primary Side Regulation switcher which provides isolated dual outputs, 5V and 12V rails, with DC stacking of the secondaries to provide output voltage regulation that is equivalent to opto-coupler based solution.

Low system parts count and built in advanced protection features result in a cost-effective solution with an average efficiency of nearly 75% at 230V

Performance Data and Typical Characteristic Curves:

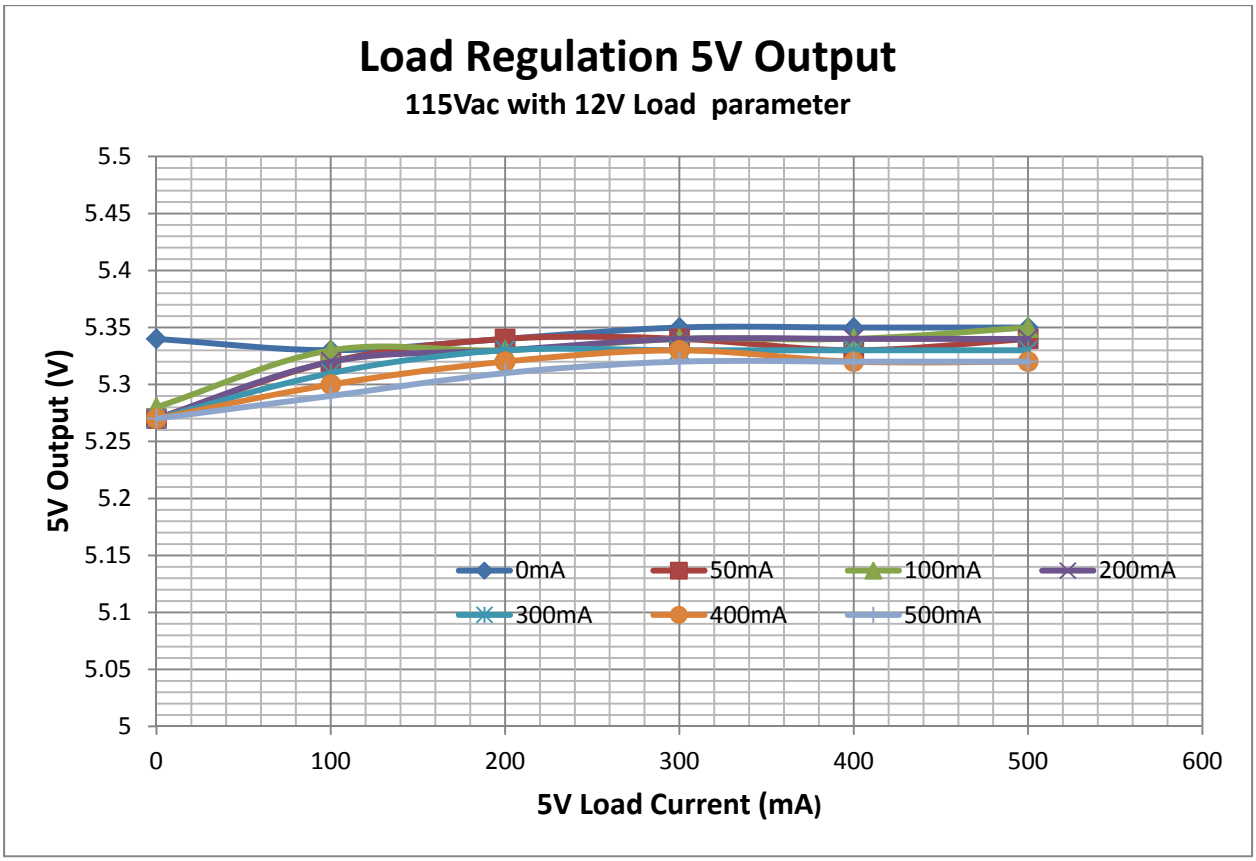

Figure1. 5V Load Regulation

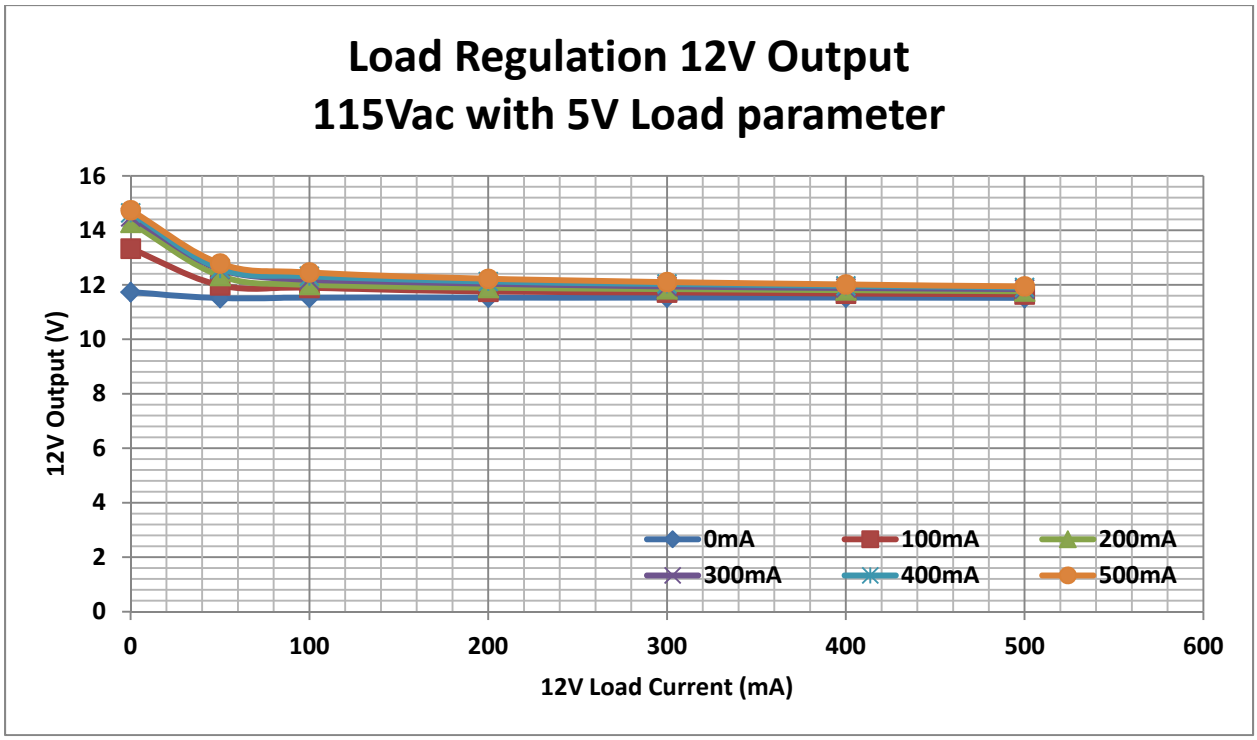

Figure2. 12V Load Regulation

V_5	I_5	I_{12}	V_{12}
5.34	0	0	11.73
5.33	100	0	13.33
5.34	200	0	14.28
5.35	300	0	14.49
5.35	400	0	14.64
5.35	500	0	14.74
5.27	0	50	11.51
5.32	100	50	11.98
5.34	200	50	12.33
5.34	300	50	12.56
5.33	400	50	12.59
5.34	500	50	12.78
5.28	0	100	11.53
5.33	100	100	11.89
5.33	200	100	12
5.34	300	100	12.18
5.34	400	100	12.31
5.35	500	100	12.45
5.27	0	200	11.53
5.32	100	200	11.75
5.33	200	200	11.89
5.34	300	200	12.01
5.34	400	200	12.12
5.34	500	200	12.22
5.27	0	300	11.53
5.31	100	300	11.72
5.33	200	300	11.84
5.33	300	300	11.94
5.33	400	300	12.03
5.33	500	300	12.1
5.27	0	400	11.53
5.3	100	400	11.68
5.32	200	400	11.8
5.33	300	400	11.88
5.32	400	400	11.96
5.32	500	400	12.01
5.27	0	500	11.52
5.29	100	500	11.65
5.31	200	500	11.76
5.32	300	500	11.84
5.32	400	500	11.9
5.32	500	500	11.94

Table1. Typical Load Regulation Test Data

Vin = 115Vac								
Load	**Pin**	**V12**	**I12**	**V5**	**I5**	**Pout**	**EFF**	**AVG EFF**
100	12.03	11.95	0.5	5.325	0.5	8.64	71.80	73.71
75	8.93	11.94	0.375	5.322	0.375	6.47	72.49	
50	5.82	11.9	0.25	5.322	0.25	4.31	73.98	
25	2.8	11.83	0.125	5.319	0.125	2.14	76.56	
10	1.12	11.79	0.05	5.316	0.05	0.86	76.37	
0	0.038	11.73	0	5.34	0	0.00	0.00	

Table 2 Efficiency at 115Vac

Vin = 230Vac								
Load	Pin	V12	I12	V5	I5	Pout	EFF	AVG EFF
100	11.67	12.01	0.5	5.352	0.5	8.68	74.39	74.78
75	8.71	12	0.375	5.346	0.375	6.50	74.68	
50	5.73	11.93	0.25	5.344	0.25	4.32	75.37	
25	2.89	11.94	0.125	5.326	0.125	2.16	74.68	
10	1.14	11.81	0.05	5.326	0.05	0.86	75.16	
0	0.042	11.75	0	5.35	0	0	0.00	

Table 3 Efficiency at 230Vac

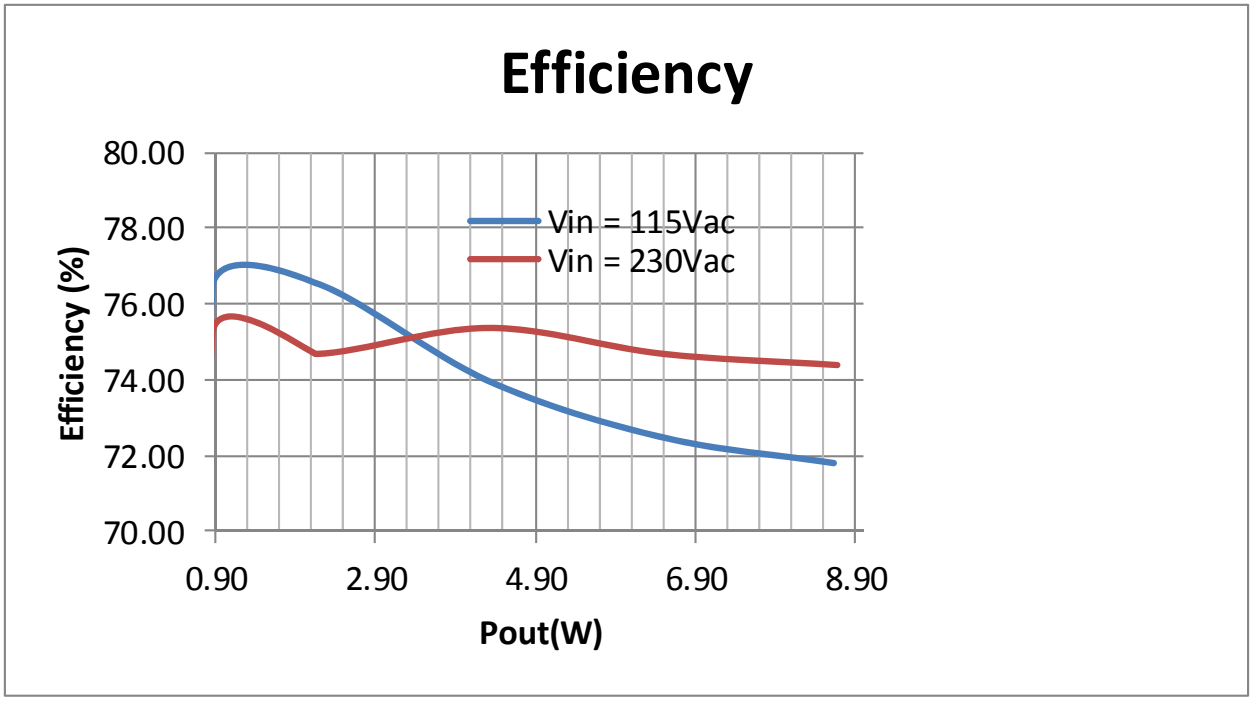

Figure3 Efficiency

Figure 4 12V ripple with both outputs at full load
50mV/div 100uS/div

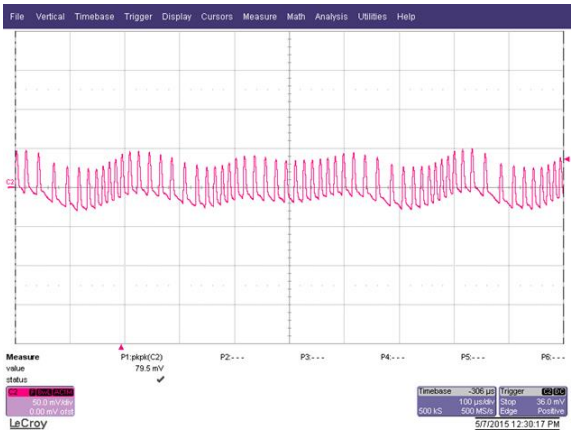

Figure 5 5V ripple with both outputs at full load
50mV/div 100uS/div

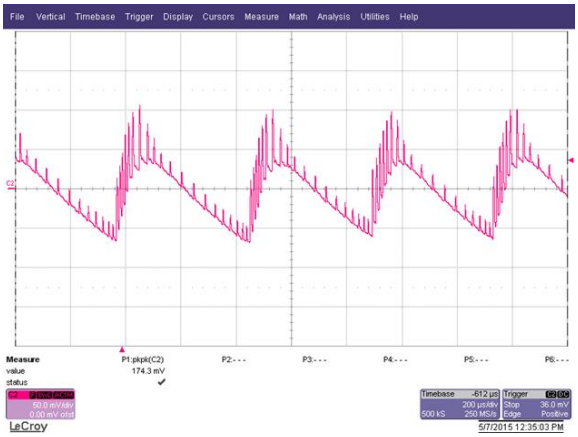

Figure 6 Worst case ripple for 12V rail (12V at no load and 5V at full load)
50mV/div 200uS/div

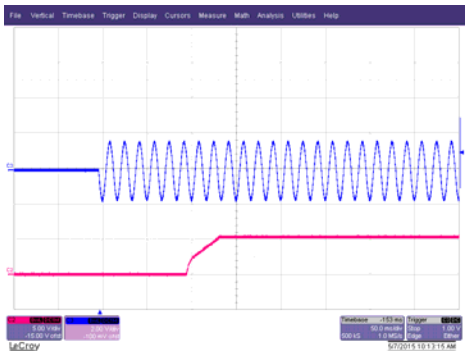

Figure 7 Output voltage start 115Vac, Full Load
5V/div 50mS/div

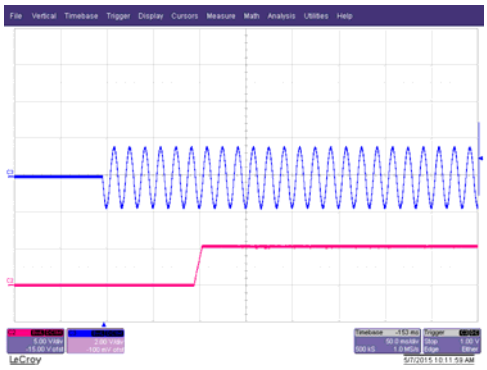

Figure 8 Output voltage start, 115VVac, No Load load

5V/div 50mS/div

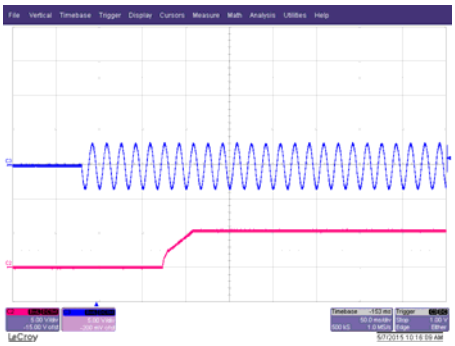

Figure 9 Output voltage start 230Vac, Full Load
5V/div 50mS/div

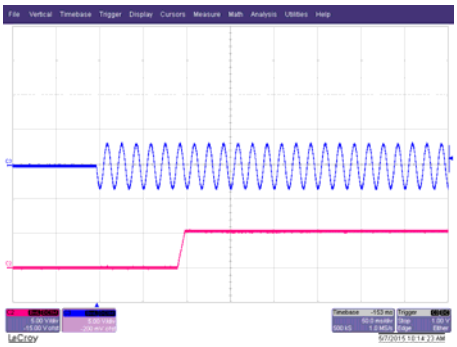

Figure 10 Output voltage start 230Vac, No Load

5V/div 50mS/div

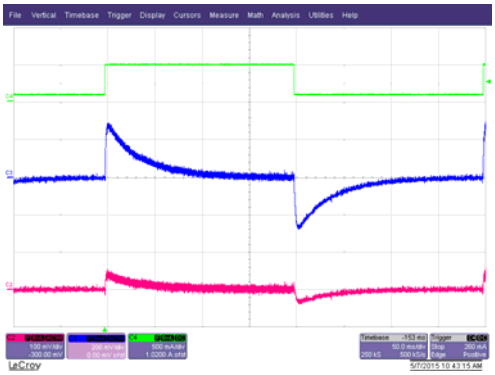

Figure 11 Step Load 5V(0.1A to 0.5A) 12V(0.5A)

CH4 (5V) 0.5A/div, CH3(12V) 0.2V/div, C2(5V)0.1V/div

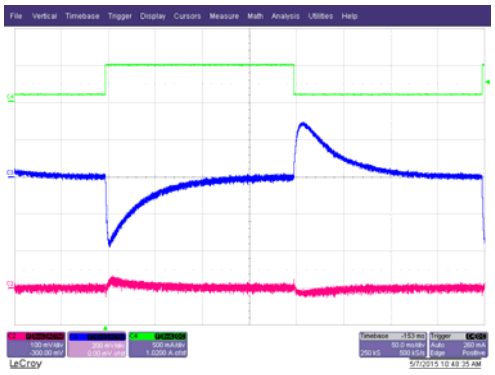

Figure 12 Step Load 12V(0.1A to 0.5A) 5V(0.5A)

CH4 (5V) 0.5A/div, CH3(12V) 0.2V/div, C2(5V)0.1V/div

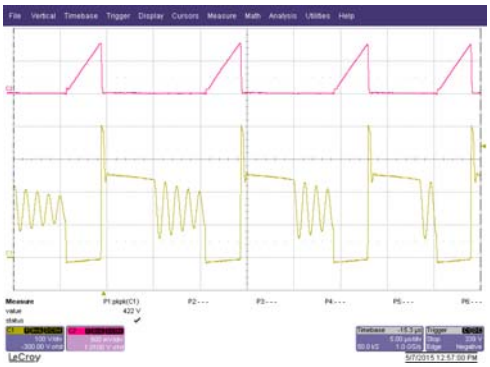

Figure 13 Primary switching voltage and current at 115Vac and full load

CH1 (VDS) 100V/Div CH2 (RIPK) 0.5V/Div

Figure 14 Primary switching voltage and current at 230Vac and full load

CH1 (VDS) 100V/Div CH2 (RIPK) 0.5V/Div

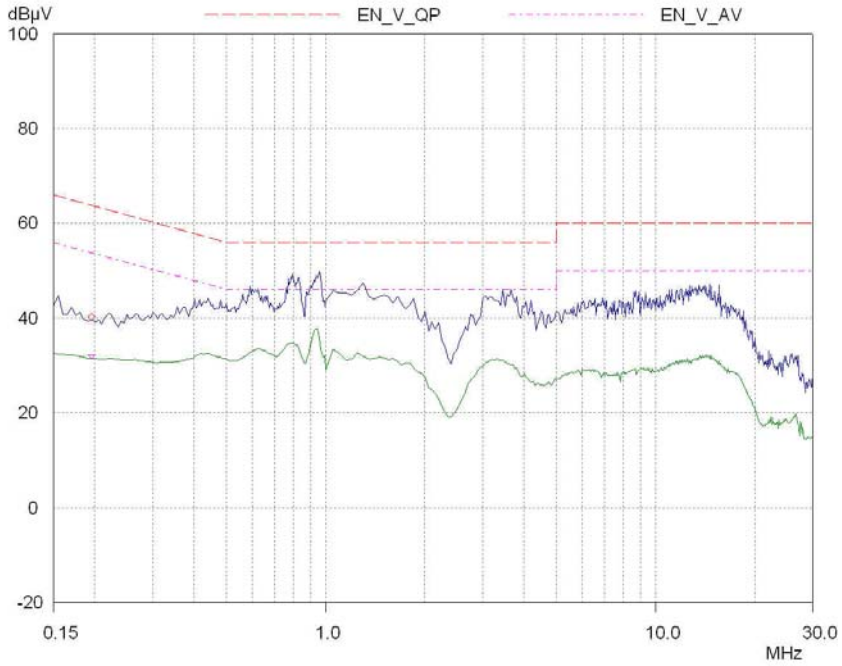

Figure 15 Conducted Emissions at 115Vac and full load with load ungrounded

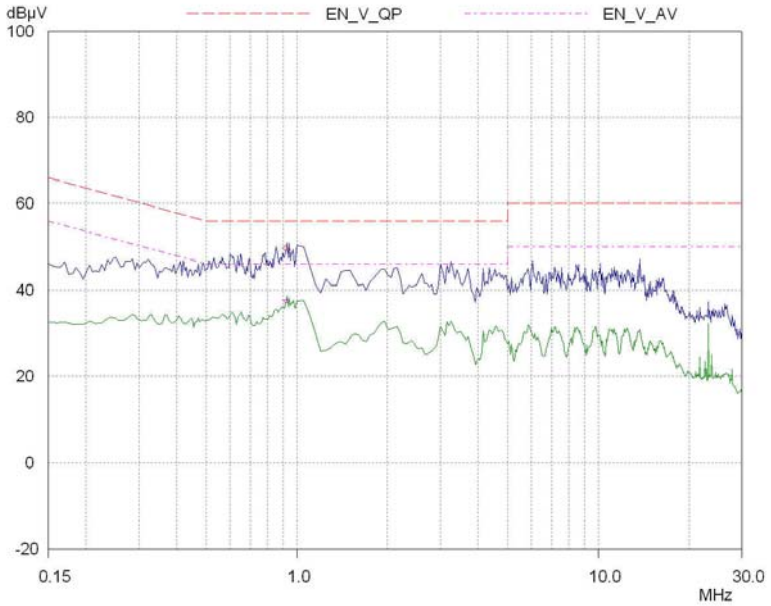

Figure 16 Conducted Emissions at 230Vac and full load with load ungrounded

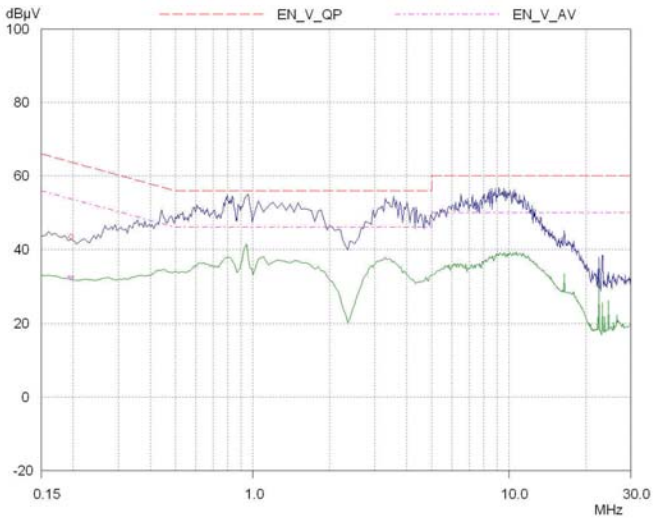

Figure 17 Conducted Emissions at 115Vac and full load with load grounded

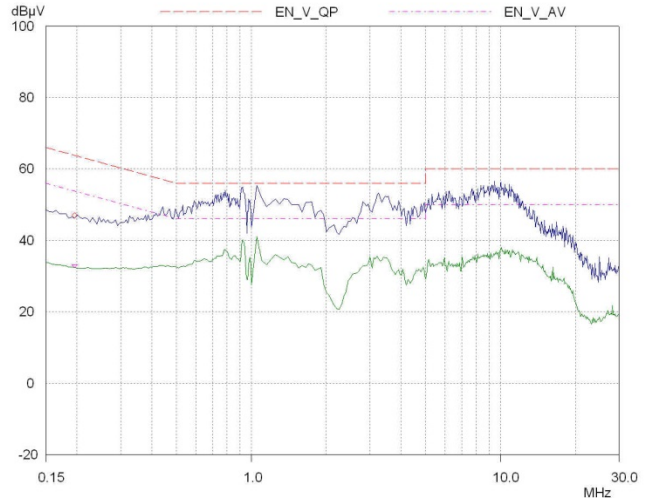

Figure 18 Conducted Emissions at 115Vac and full load with load grounded

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Flyback Transformer

Material List

- EPC17 ferrite core pair
- EPC17 10 pin through hole, horizontal bobbin
- 0.15mm enamel copper wire
- 0.2mm enamel copper wire
- 0.4mm Furukawa TEX-E triple insulated copper wire or equivalent
- 10.6mm wide mylar tape

Winding Table

Winding	Start	Finish	Wire	Winding Direction	Turns	NOTES
PRI	8	10	0.15mm	CW	95	Wind 48 turns, Single turn tape, Wind final 47 turns
BIAS	6	7	0.2mm	CW	18	Bifilar winding. Single Layer
BIAS	6	7	0.2mm	CW	18	
CANC	6	NC	0.15mm	CW	2	Winding is unterminated
SHIELD		7	FOIL	CW	1	Shield
SEC1	1	2	0.4mm TEX	CW	7	Wind 6 bifilar turns and finish with extra turn on SEC1
SEC2	3	4	0.4mm TEX	CW	6	

Table 5

Transformer Cross Section

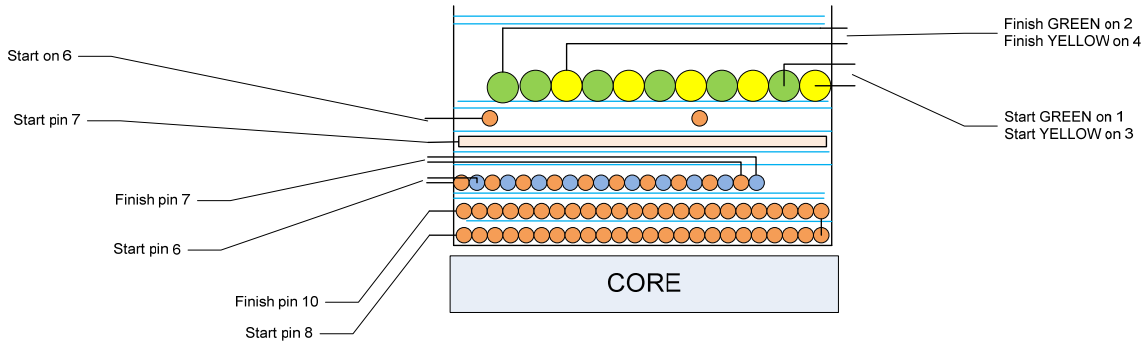


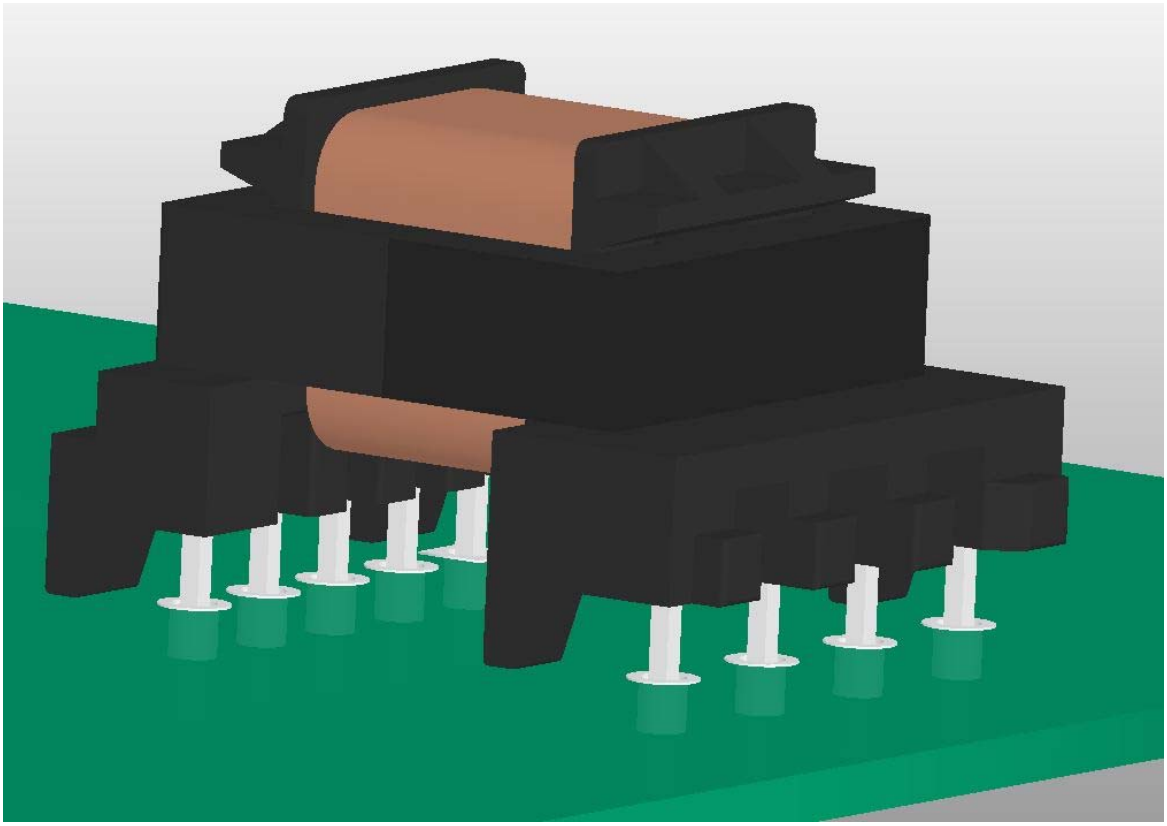
Figure 25

Electrical Specifications

Parameter	Pins	Test Conditions	Value
DC Resistance	8 to 10		2.25Ω 10%
DC Resistance	6 to 7		0.16Ω 10%
DC Resistance	1 to 2		0.057Ω 15%
DC Resistance	3 to 4		0.055Ω 15%
Inductance	8 to 10	10kHz,100mV	750µH 10%
Dielectric	10 to 1	2750Vac, 1 sec	No breakdown
Dielectric	10 to 6	625Vac, 1 sec	No breakdown
Turns Ratio	(8-10): (6-7)		5.28:1 1%
Turns Ratio	(8-10): (1-2)		13.57:1 1%
Turns Ratio	(8-10): (3-4)		15.83:1 1%

Pin 7 connected to core

Part View



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