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By Luigi Galioto

Main components	
VIPER27	Offline high voltage converter
SEA05	Advanced constant voltage and constant current controller

### Specification

- 10W LED driver
- Wide input voltage range: 88Vac to 265Vac
- 300mA LED current
- Isolated SMPS
- Short circuit protection

### Circuit description

The use of LEDs in lighting applications is becoming increasingly popular due to: rapid improvements in lighting efficiency, longer life, higher reliability and overall cost effectiveness.

This converter is a simple example of an offline isolated LED application (10W).

The LEDs are driven by the VIPER27 high voltage converter. The secondary side is managed by the SEA05 advanced CC/CV controller.

Excellent results in terms of current control precision ( $\pm 3\%$ ) and efficiency performance ( $\eta > 80\%$ ), combined with the compact form factor which can fit in existing bulb housing, are key benefits.

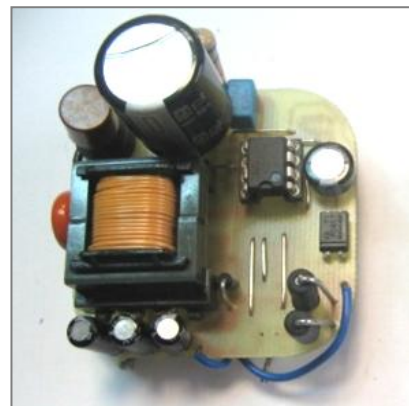
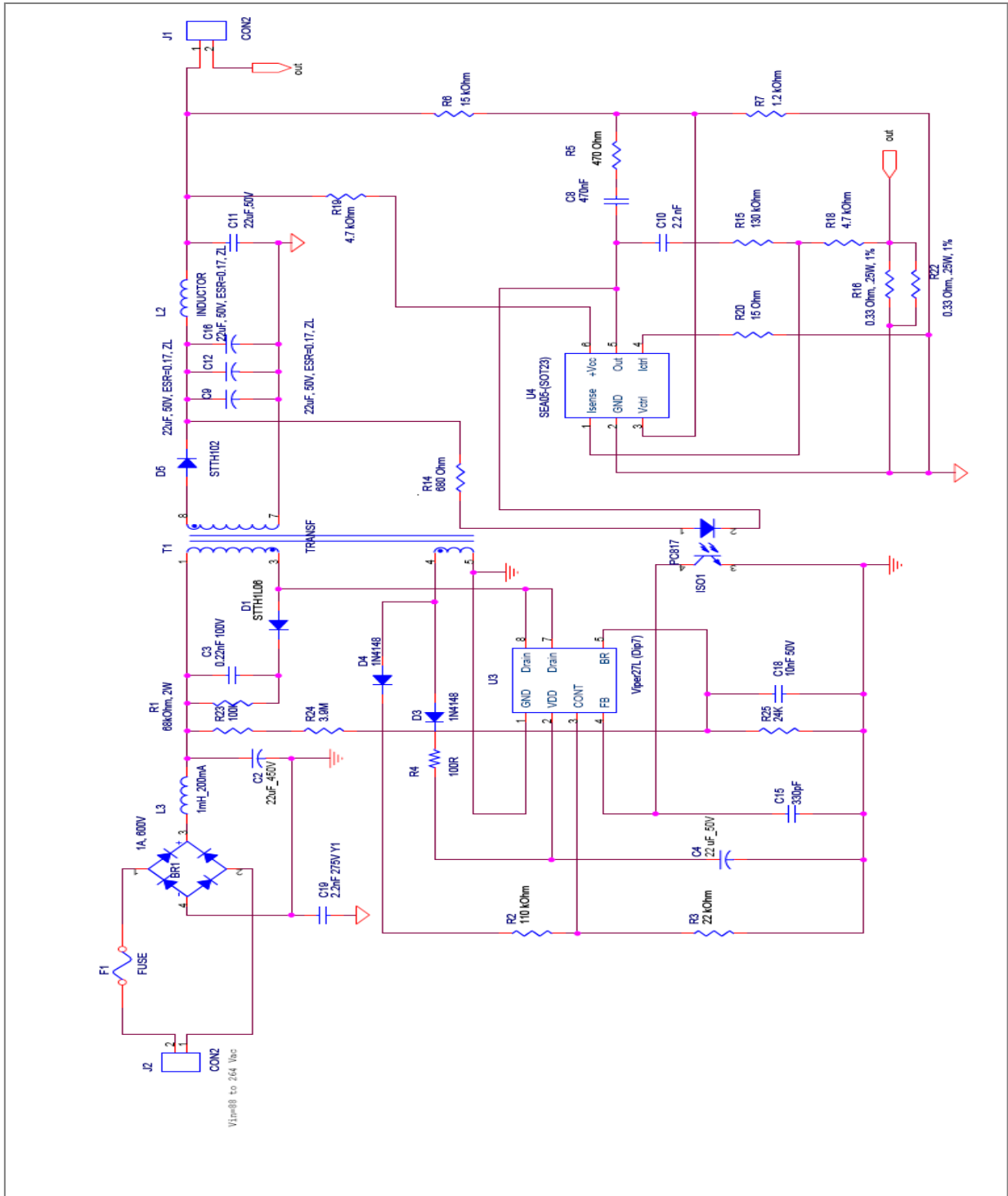


Figure 1. Circuit diagram



## Measurement results

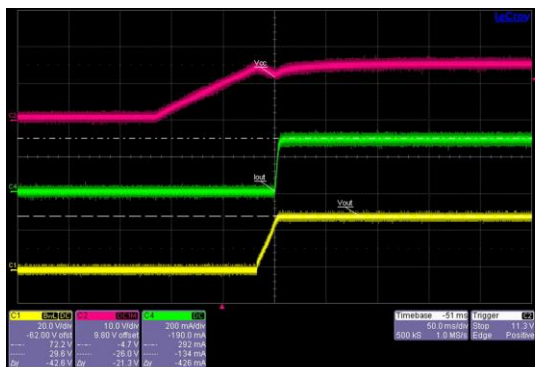
The board was tested in terms of efficiency, output voltage limitation and LED current regulation for a wide input voltage range. Table 1 shows the results obtained for a 30 minute test. High efficiency and excellent LED current regulation were obtained.

**Table 1. Experimental results**

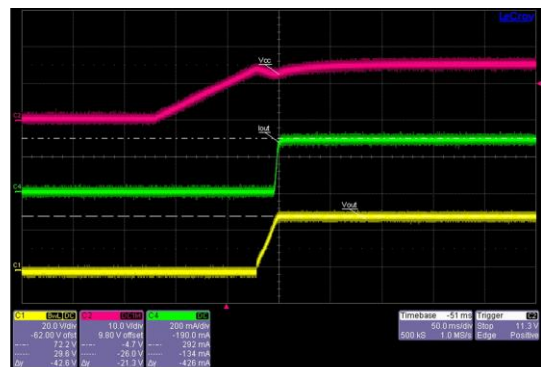
Vin	Pin(W)	In(mA)	Pout(W)	Efficiency	Iout (mA)	Vout(V)
85	10.4	190	8.36	80.34%	294	28.42
110	10.1	155	8.36	82.73%	294	28.42
140	9.9	130	8.41	84.92%	295	28.5
185	10	110	8.35	83.51%	292	28.6
230	10.2	97	8.30	81.37%	290.2	28.6
265	10.35	90	8.32	80.42%	290	28.7

Start up tests with Vin=110V and Vin=230V were also reported in full load and no load conditions. The behavior of Vout, Vcc and Iout were monitored.

**Figure 2. Test results: start up sequence at full load condition**



Vin=110V



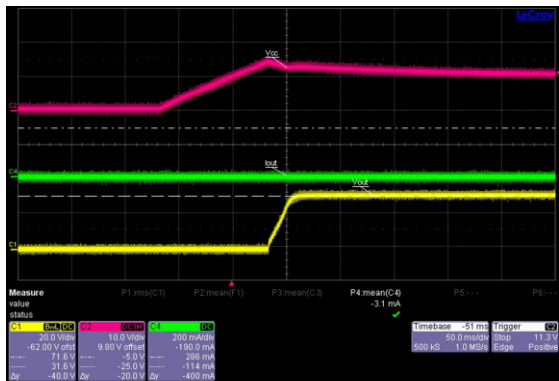
Vin=230V

Yellow => Vout

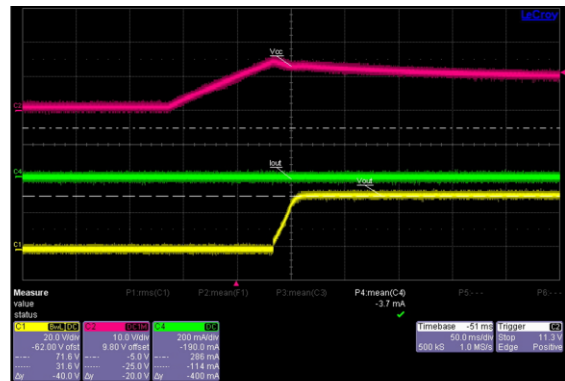
Green => Iout

Purple => Vcc

Figure 3. Test results: start up sequence at no load condition



Vin=110V



Vin=230V

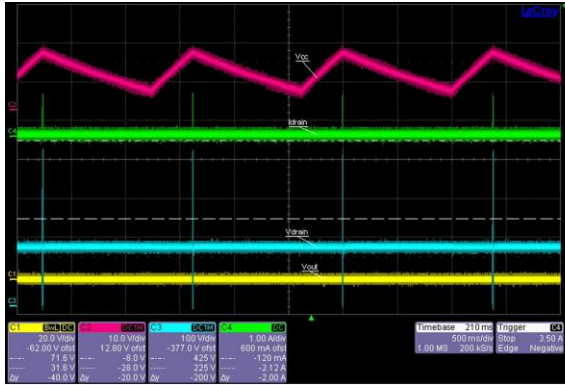
Yellow => Vout

Green => Iout

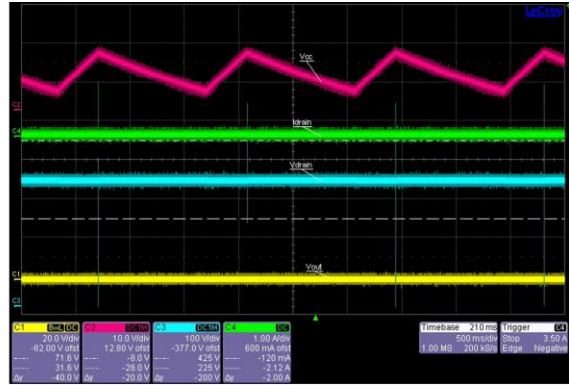
Purple => Vcc

The VIPER27 is protected against short circuits on the secondary rectifier and secondary winding, and a hard-saturation of the flyback transformer. Tests were conducted where the board was subject to short circuits and it protected itself well. The behavior shown in figure 3 illustrates the typical low frequency intermittent operation (hiccup- mode operation).

Figure 4. Test results: short circuit condition



Vin=110V



Vin=230V

Yellow => Vout  
 Green => Idrain  
 Blue => Vdrain  
 Purple => Vcc

## Support material

Related design support material
EVLVIP27-7WLED: 3.5W to 7W high power factor offline LED driver based on VIPer devices
Gerber files for 10W LED driver - <a href="http://www.st.com/internet/com/TECHNICAL_RESOURCES/TECHNICAL_DIAGRAM/PCB_LAYOUT/10wled_pcb_layout.zip">http://www.st.com/internet/com/TECHNICAL_RESOURCES/TECHNICAL_DIAGRAM/PCB_LAYOUT/10wled_pcb_layout.zip</a>
Documentation
Magnetics, Switch Mode Transformer 10W 55kHz 980uH – see attachment at end of document. <a href="http://www.magnetics.eu">www.magnetics.eu</a> Code 1715.0032
AN3212: 3.5W to 7W high power factor offline LED driver based on VIPer devices

## Revision history

Date	Version	Changes
15-May-2012	1	Initial release

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<b>STP 21</b>	<b>Product Technical Specification</b>	<b>Code: 1715.0032</b>
<i>Product:</i> Switch Mode Transformer 10W 55kHz 980uH		
<i>Customer:</i> <b>STMICROELECTRONICS</b>		<i>Customer code:</i>
<i>Date :</i> 27.04.12	<i>Revision:</i> 01	Page 1 of 2

<p><b>TYPICAL APPLICATION</b> TRANSFORMER FOR FLYBACK POWER SUPPLIES IN APPLICATIONS WITH CONTROLLER VIPER28</p> <p><b>CIRCUIT DIAGRAM</b></p>	<p><b>TECHNICAL DATA</b></p> <p><b>INDUCTANCE</b> (MEASURE 1KHZ, TA 20°C)</p> <table> <tr> <td>PIN 3-1</td> <td>980 uH ±15%</td> </tr> <tr> <td>PIN 4-5</td> <td>39 uH ±15%</td> </tr> <tr> <td>PIN 8-7</td> <td>179 uH ±15%</td> </tr> </table> <p><b>RESISTANCE</b> (MEASURE D.C, TA 20°C)</p> <table> <tr> <td>PIN 3-1</td> <td>1.22 Ω MAX</td> </tr> <tr> <td>PIN 4-5</td> <td>280 mΩ MAX</td> </tr> <tr> <td>PIN 8-7</td> <td>250 mΩ MAX</td> </tr> </table> <p><b>TRANSFORMER RATIO</b> (MEASURE 10KHZ, TA 20°C)</p> <table> <tr> <td>PIN 3-1 ↔ 4-5</td> <td>5 ± 5%</td> </tr> <tr> <td>PIN 3-1 ↔ 8-7</td> <td>2.36 ± 5%</td> </tr> </table> <p><b>LEAKAGE INDUCTANCE</b> (MEASURE 3-1 AND 4-5-7-8 IN S.C, F 10KHZ, TA 20°C)</p> <p>2.5 % NOM</p> <p><b>PARASITIC CAPACITANCE</b> (MEASURE 3-1, F 1MHZ, TA 20°C)</p> <p>14 PF NOM</p> <p><b>SATURATION CURRENT</b> (MEASURE 3-1, B<sub>SAT</sub> 0.32T, TA 20°C)</p> <p>0.94A<sub>p</sub> MAX</p> <p><b>OPERATING CURRENT</b> (MEASURE 3-1, P<sub>MAX</sub> 10W ,F 55KHZ, TA 20°C)</p> <p>0.85 A<sub>p</sub> MAX</p> <p><b>OPERATING FREQUENCY</b> (P<sub>MAX</sub> 10W , TA 20°C)</p> <p>55 KHZ NOM</p> <p><b>OPERATING TEMPERATURE RANGE</b> (P<sub>MAX</sub> 10W )</p> <p>-10°C÷+45°C</p> <p><b>PRIMARY TO SECONDARY INSULATION</b> (F 50HZ,DURATION TEST 2", TA 20°C)</p> <p>4 k V</p> <p><b>MAXIMUM DIMENSIONS</b></p> <p>27x22xH18 mm</p> <p><b>WEIGHT</b></p> <p>12 g APPROX</p>	PIN 3-1	980 uH ±15%	PIN 4-5	39 uH ±15%	PIN 8-7	179 uH ±15%	PIN 3-1	1.22 Ω MAX	PIN 4-5	280 mΩ MAX	PIN 8-7	250 mΩ MAX	PIN 3-1 ↔ 4-5	5 ± 5%	PIN 3-1 ↔ 8-7	2.36 ± 5%
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PIN 3-1 ↔ 8-7	2.36 ± 5%																

PIN DESCRIPTION				
PIN(*)	FUNCTION		PIN(*)	FUNCTION
1	PRIMARY +V <sub>B</sub> 120-400VDC		6	NOT USED
2	NOT USED		7	SECONDARY GROUND
3	PRIMARY DRAIN		8	SECONDARY
4	AUXILIARY	+15V 15mA	9	NOT USED
5	AUXILIARY GROUND			

(\*)PIN WITH THE SAME SUBSCRIPT MUST BE CONNECTED TOGETHER ON PCB



Product: Switch Mode Transformer 10W 55kHz 980uH

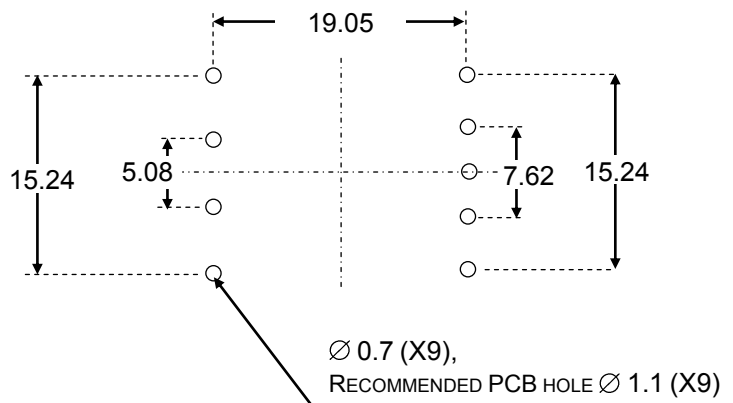
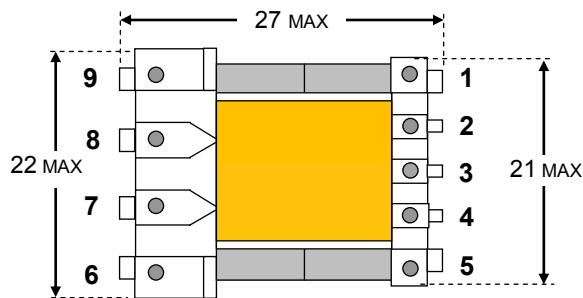
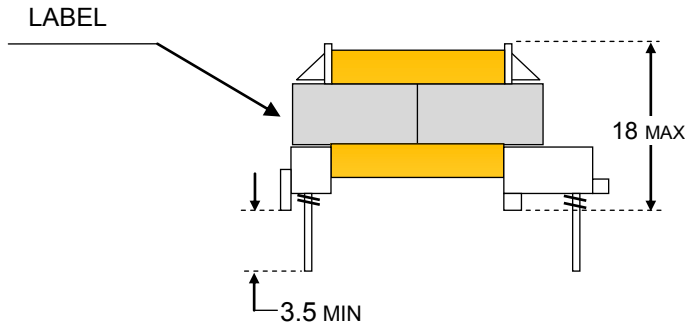
Customer: **STMICROELECTRONICS**

Customer code:

Date : 27.04.12 Revision: 01

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**DIMENSIONAL DRAWING**



**BOTTOM VIEW (PIN SIDE)**

DIMENSIONS IN MILLIMETERS, DRAWING NOT IN SCALE

