



DN0020 Design Note

**DESIGNS
from our
LABS**

10W Wide-Range High Power Factor - Isolated LED Driver based on HVLED815PF

Designs from our labs describe tested circuit designs from ST labs which provide optimized solutions for specific applications. For more information or support, visit www.st.com

By Giovanni Gritti

Main components	
HVLED815PF	Offline LED driver with primary-sensing and high power factor up to 15 W
STPS3150UF	Power Schottky rectifier
STTH1L06A	Turbo 2 ultrafast high voltage rectifier

Specification

- 10W isolated LED driver (flyback topology)
- Wide-range Input (88-265Vac)
- High Power Factor: > 0.95
- Low THD: < 20%
- High LED driver efficiency up to 84%

Circuit description

The LED driver board is based on a flyback topology using the STMicroelectronics HVLED815PF device.

The HVLED815PF is a high-voltage primary switcher intended for operating directly from the rectified mains with minimum external parts and enabling high power factor (> 0.90) to provide an efficient, compact and cost effective solution for LED driving. It combines a high-performance low voltage PWM controller chip and an 800 V, avalanche-rugged Power MOSFET, in the same package. There is no need for the optocoupler thanks to the patented primary sensing regulation (PSR) technique. The device assures protection against LED string fault (open or short).

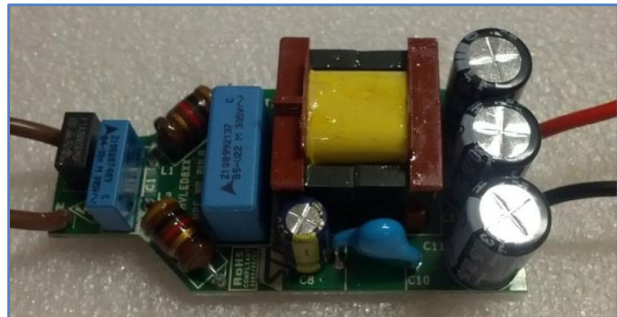
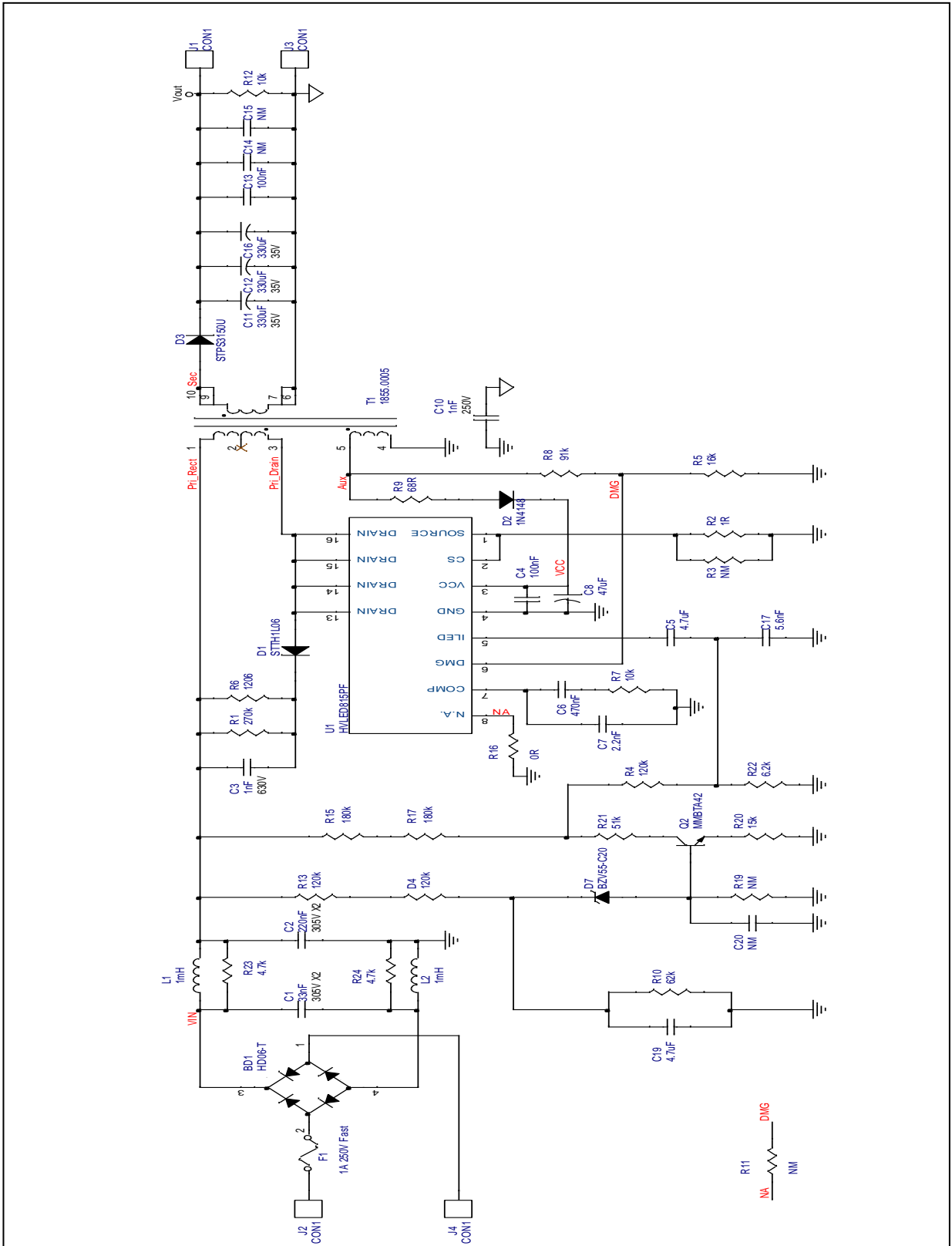


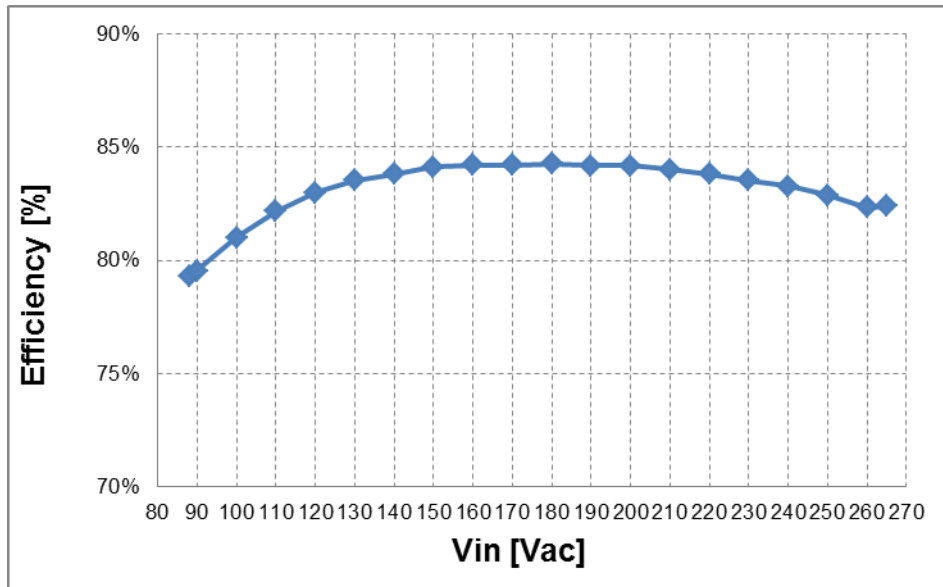
Figure 1. Circuit diagram



Measurement results

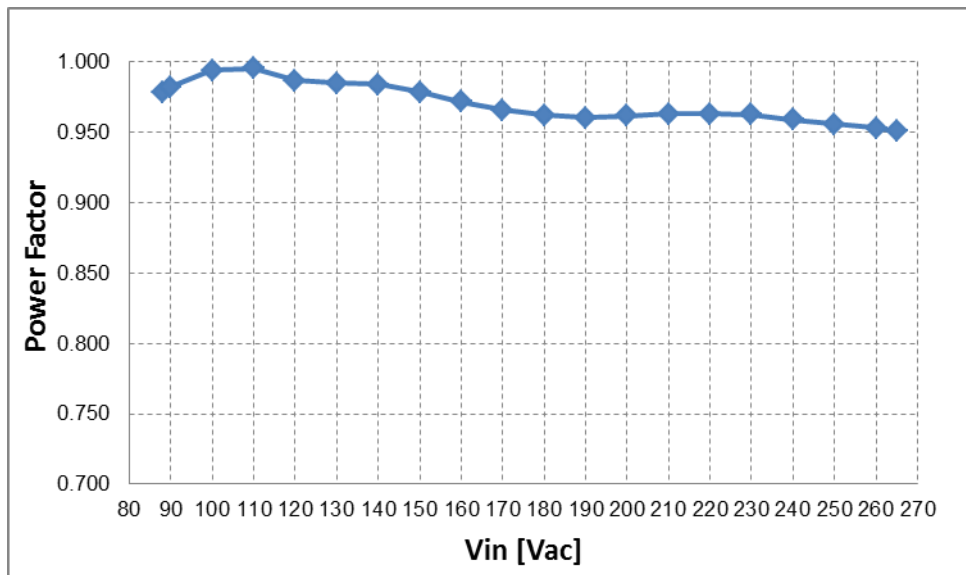
The led driver board has been tested in terms of system efficiency, power factor, output current line-regulation, harmonics distortion and thermal stress.

LED Driver Efficiency



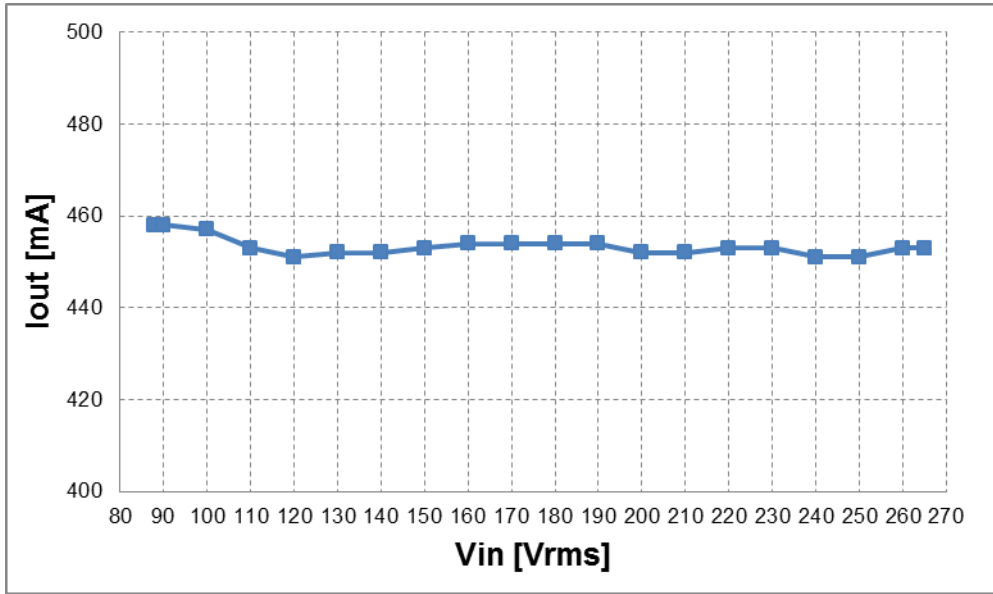
As shown in the previous picture the LED driver efficiency is up to 84%.

Power Factor



As shown in the previous picture the Power Factor (PF) is over 0.95 in all the input voltage range.

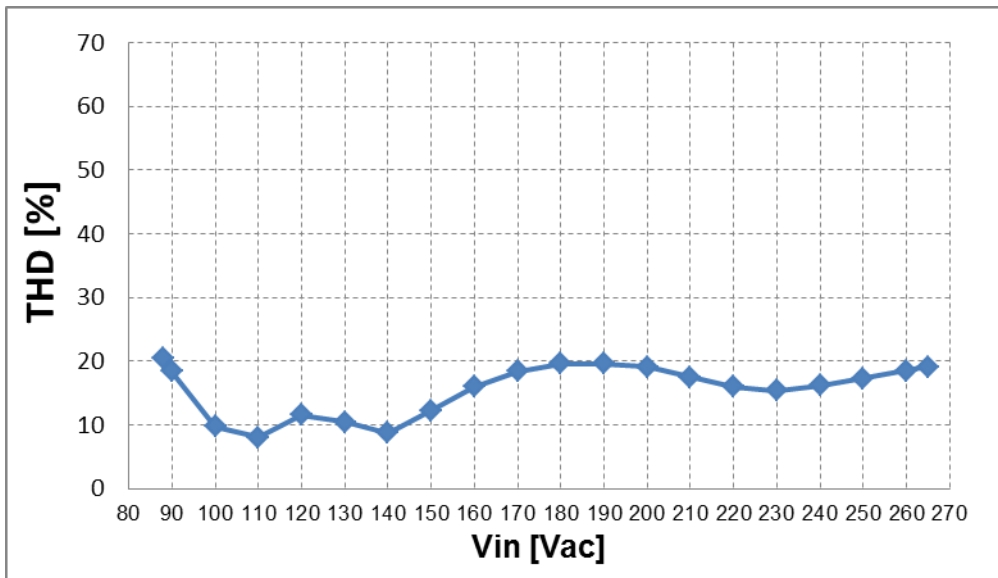
Output Current versus Input Voltage (line regulation)



The output current is 455mA +/- 0.8% over all the input voltage range [88-265] Vac.

Total Harmonic Distortion (THD)

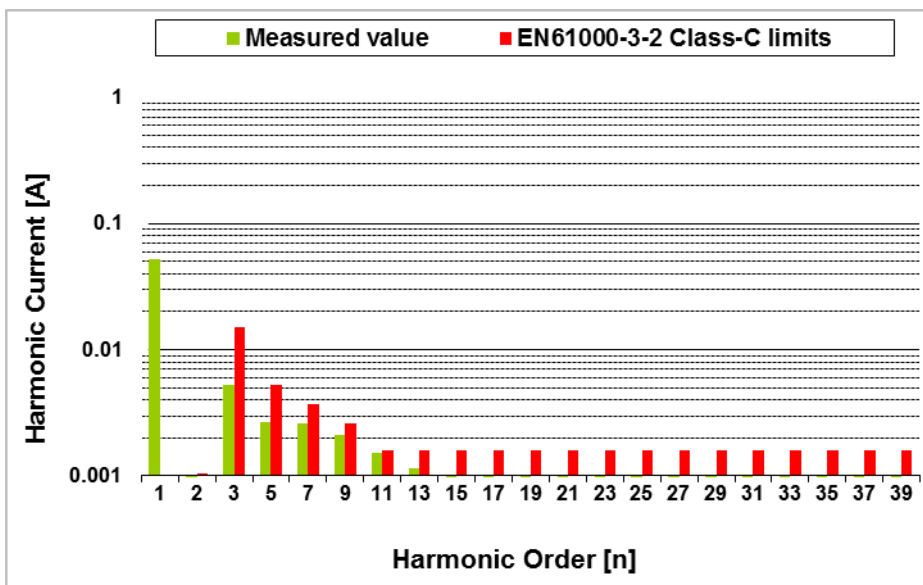
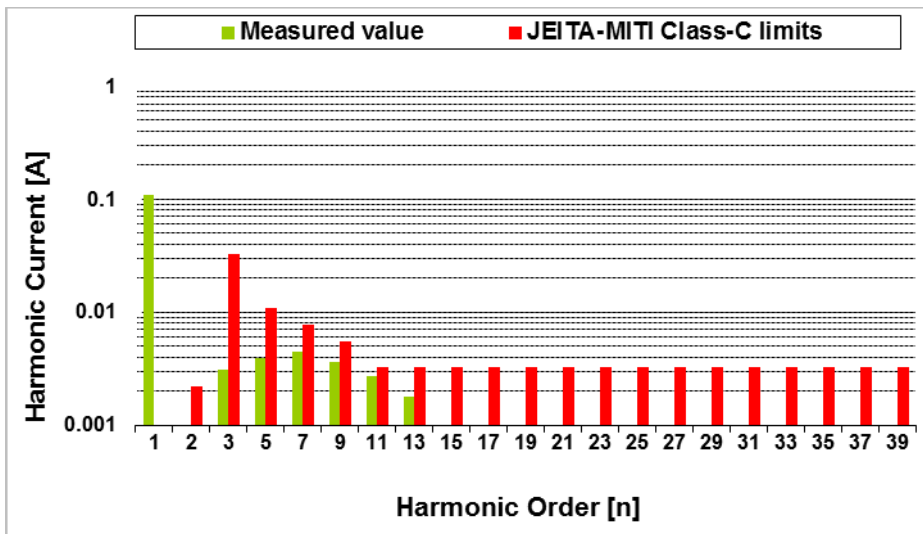
The following pictures show the total harmonic distortion (THD) versus line voltage:



THD at nominal input voltage is lower than 20%.

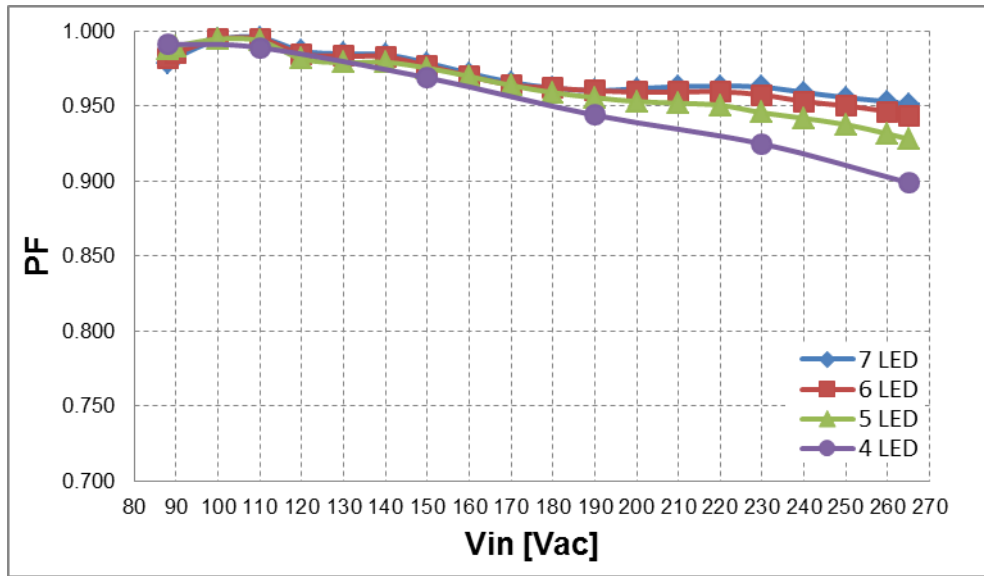
Harmonics

The following pictures show the harmonic at 110Vac and 230Vac line input voltage:



The previous pictures show as the harmonics respect the limits for Class C equipment.

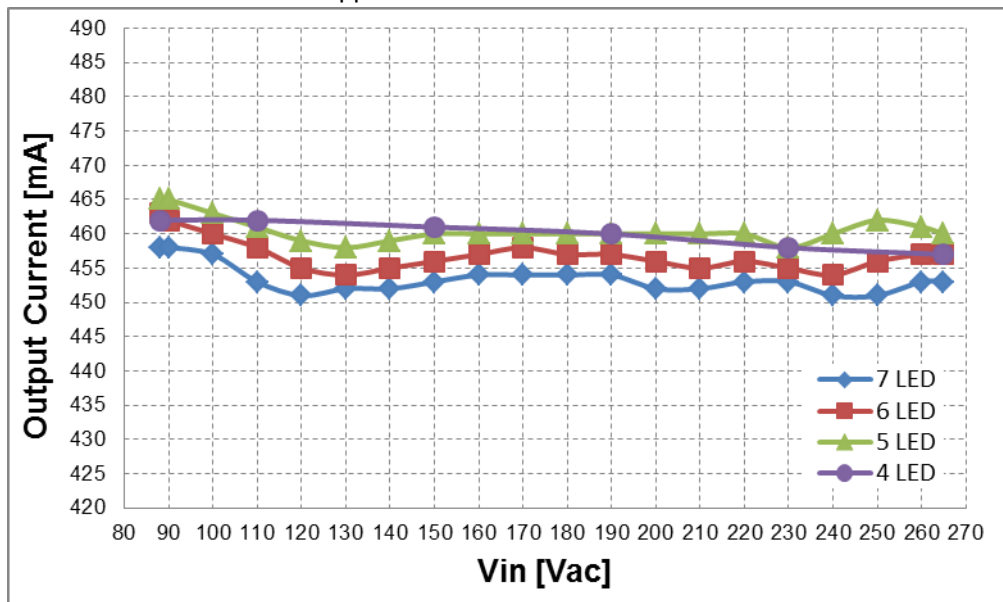
Power Factor at different LED load number



As shown in the previous picture the Power Factor (PF) is over 0.90 in all the input voltage range [88-265]Vac also varying the number of LED.

Line regulation at different LED load number

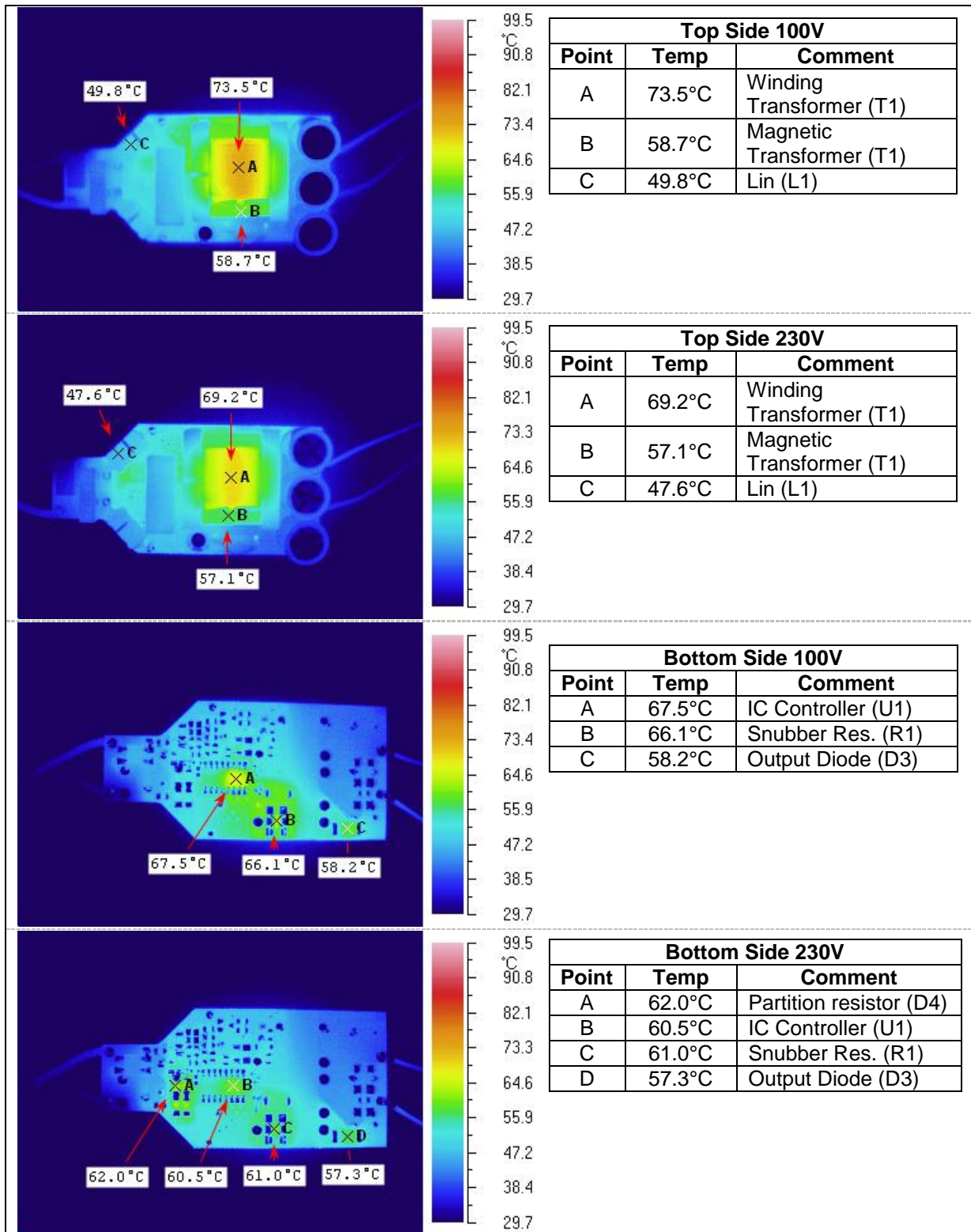
The following pictures show the measured average output current versus line voltage at different numbers of LEDs applied:



The output current is varying +/- 3% changing the load over all the input voltage range [88-265] Vac.

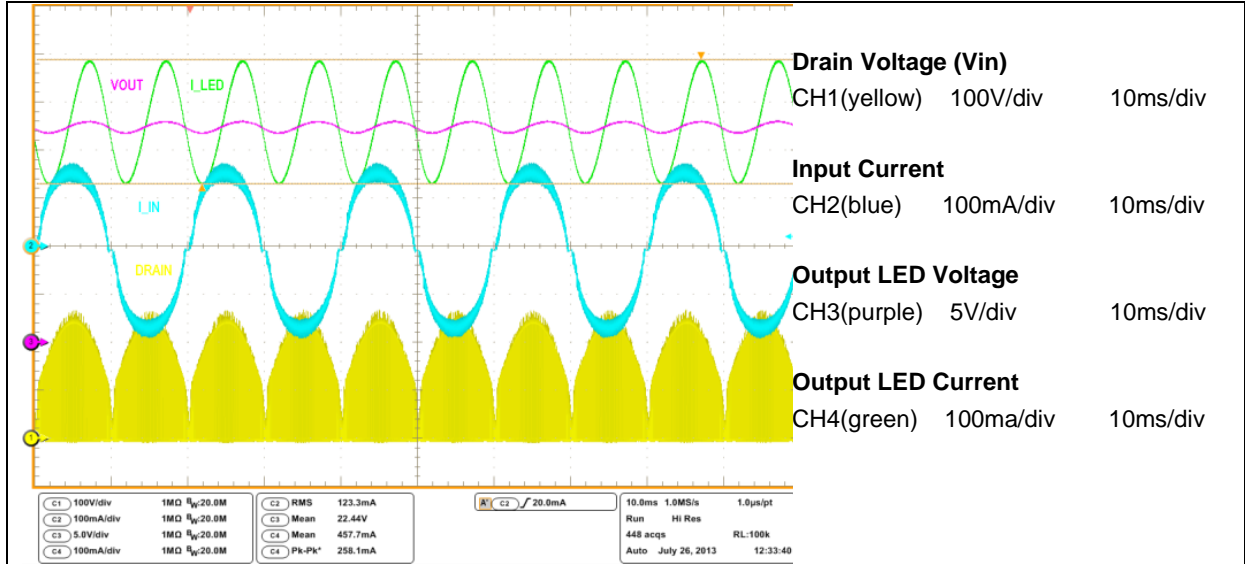
Thermal

LED driver has been tested at nominal output power (10W) at ambient temperature:

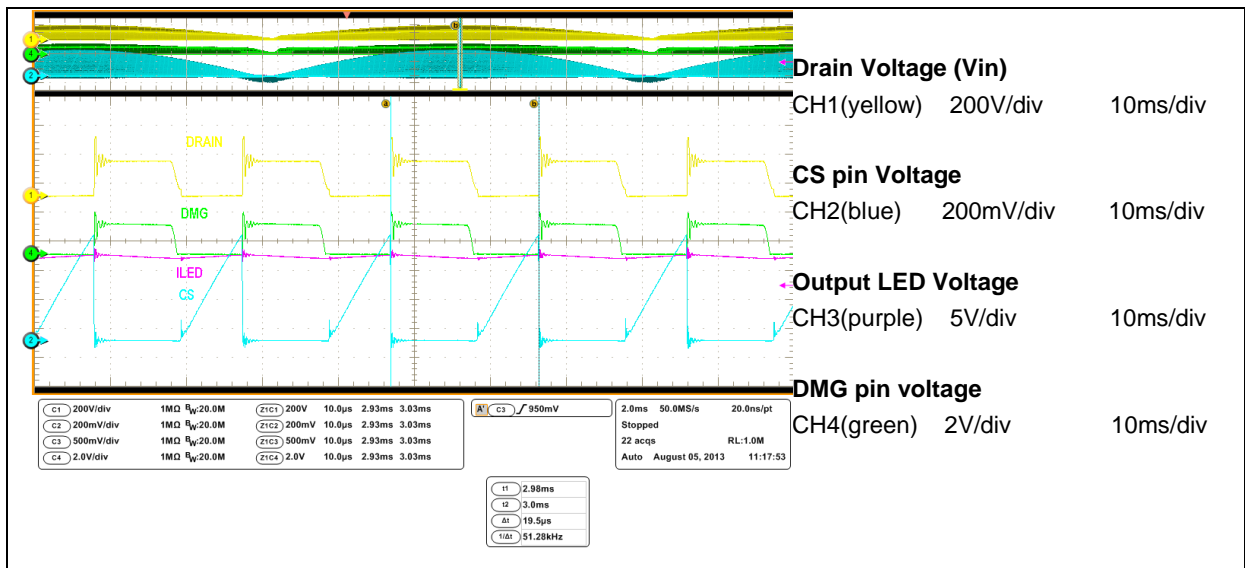


Electrical Waveform

Input and output LED driver waveforms



Transition Mode Operation



Support material

Documentation
HVLED815PF: Offline LED driver with primary-sensing and high power factor up to 15 W

Revision history

Date	Version	Changes
29-Aug-2013	1.0	Initial release

Please Read Carefully

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at anytime, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

UNLESS EXPRESSLY APPROVED IN WRITING BY TWO AUTHORIZED ST REPRESENTATIVES, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVEGRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2013 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com