



UM10807

SSL5101DB1223 230 V 6 W flyback converter

Rev. 1 — 9 September 2014

User manual

Document information

Info	Content
Keywords	SSL5101DB1223, SSL5101T, non-dimmable, LED driver, flyback converter, GU10
Abstract	This user manual describes the operation of the SSL5101DB1223 230 V 6 W non-dimmable LED driver featuring the SSL5101 using a flyback topology. The demo board has a form factor that is compatible with the base of a GU10 LED lamp fitting used in Solid-State Lighting (SSL) applications.

Revision history

Rev	Date	Description
v.1	20140909	first issue

1. Introduction

WARNING

Lethal voltage and fire ignition hazard



The non-insulated high voltages that are present when operating this product, constitute a risk of electric shock, personal injury, death and/or ignition of fire.

This product is intended for evaluation purposes only. It shall be operated in a designated test area by personnel qualified according to local requirements and labor laws to work with non-insulated mains voltages and high-voltage circuits. This product shall never be operated unattended.

This user manual describes the operation of the SSL5101DB1223 230 V 6 W eco-THD non-dimmable LED driver featuring the SSL5101. The demo board incorporates a GU10 LED lamp compatible form factor. The flyback converter topology provides a simple and efficient solution for mains non-dimmable LED recessed light applications.

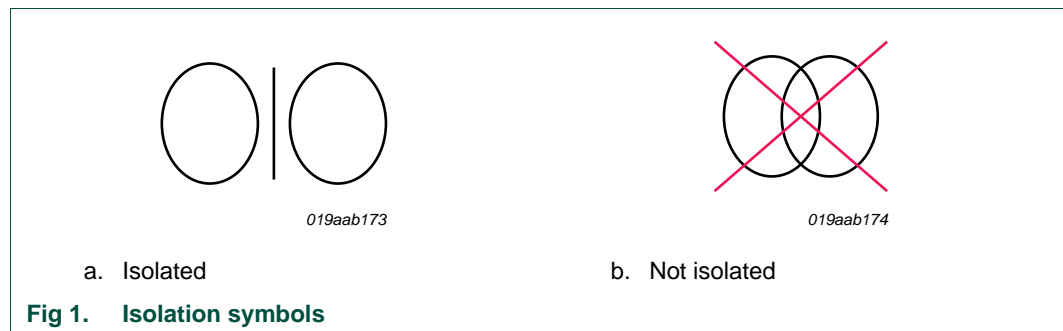
The SSL5101DB1223 demo board complies with EMI and safety regulations.

[Figure 2](#) shows The SSL5101DB1223 demo board dimensions. The board and the components used ensure that the board fits into a GU10 lamp base. [Figure 3](#) shows the top and bottom views of the SSL5101DB1223 demo board.

2. Safety warning

The demo board input is connected to the 230 V mains. Avoid touching the board while it is connected to the mains voltage and when it is in operation. An isolated housing is obligatory when used in uncontrolled, non-laboratory environments. Galvanic isolation from the mains phase using a fixed or variable transformer is always recommended.

[Figure 1](#) shows the symbols on how to recognize these devices.



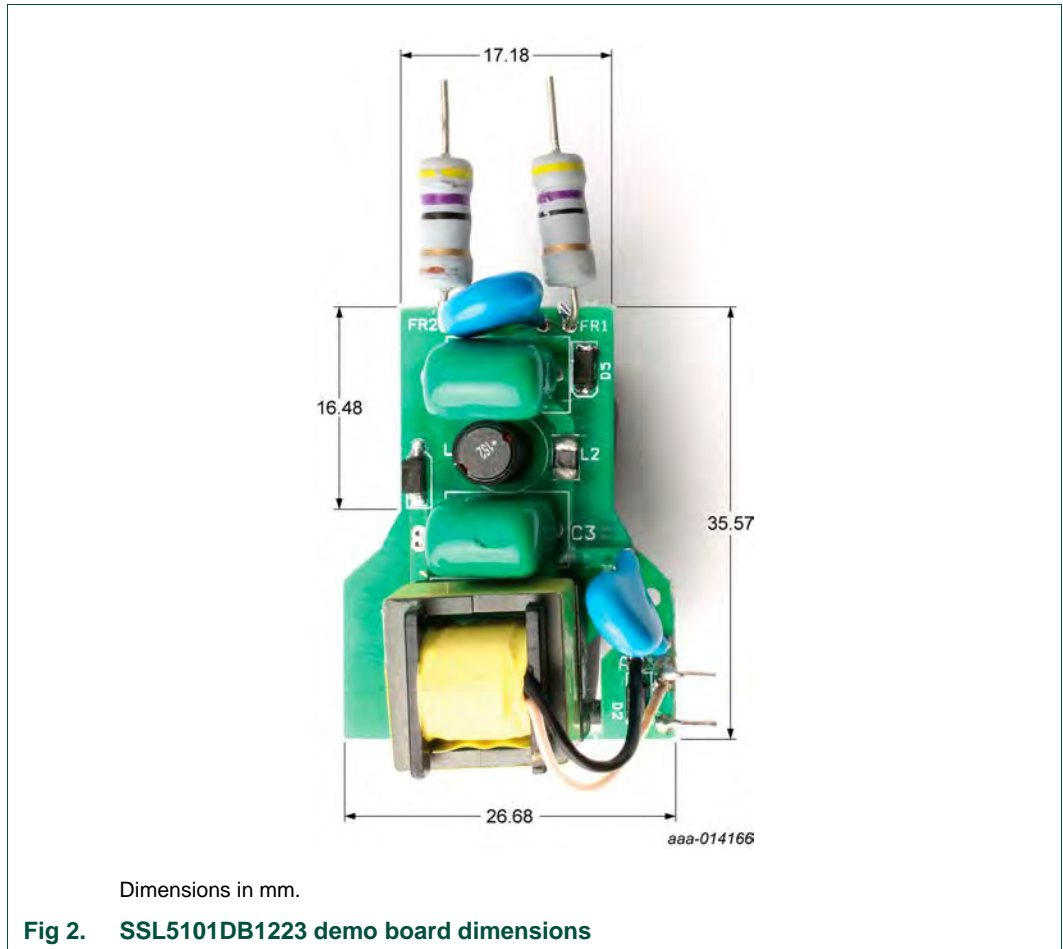
3. Specifications

[Table 1](#) lists the specification of the SSL5101DB1223 demo board.

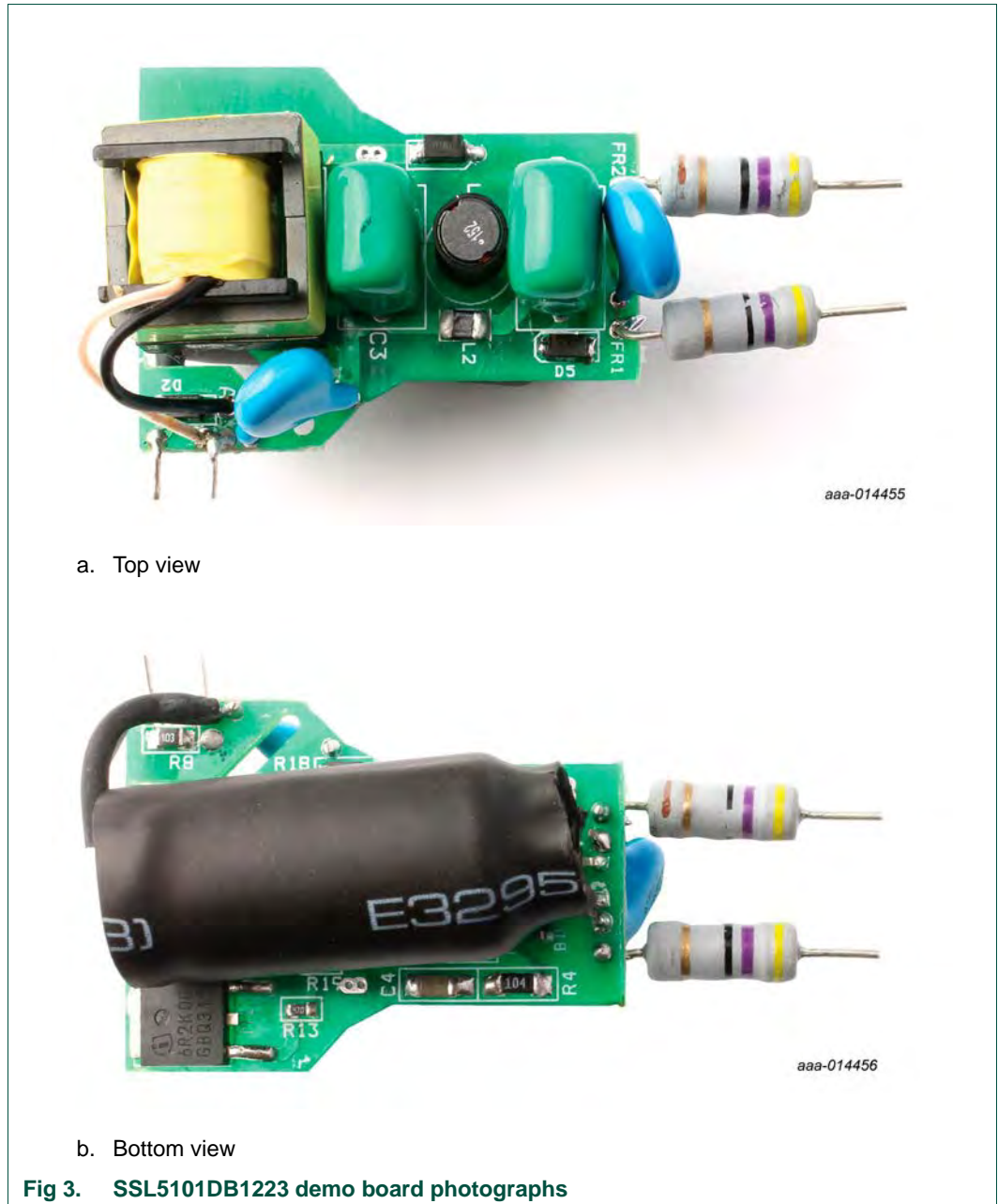
Table 1. SSL5101DB1223 specifications

Symbol	Parameter	Value
V_{mains}	AC mains supply voltage	230 V; $\pm 20\%$
I_{mains}	AC mains input current	35 mA
V_{LED}	output voltage	12 V
I_{LED}	output current	450 mA
$\Delta I_{\text{LED}}/\Delta V_{\text{mains}}$	line rejection	2 %
$\Delta I_{\text{LED}}/\Delta V_{\text{LED}}$	output voltage rejection	2 %
I_{ripple}	output current ripple	$\approx 30\%$
η	efficiency	$> 80\%$
PF	power factor	≈ 0.8
THD	total harmonic distortion	$< 36\%$
T_{oper}	operating temperature	$-40\text{ }^{\circ}\text{C}$ to $+100\text{ }^{\circ}\text{C}$
f_{sw}	switching frequency	55 kHz to 70 kHz
t_{start}	start-up time	0.6 s

[Figure 2](#) shows the dimensions of the demo board.



4. Board photographs

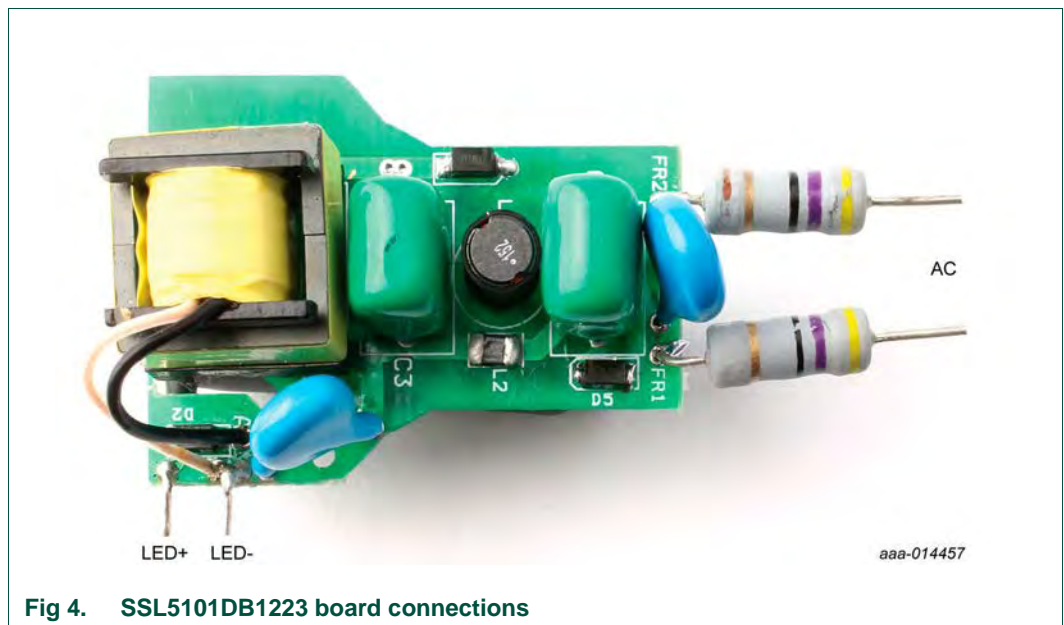


5. Board connections

The board is optimized for a 230 V (50 Hz) mains supply. In addition to the mains voltage optimization, the board is designed to work with multiple LEDs or an LED module with a high forward voltage.

Remark: The maximum rated voltage of the board is 275 V (AC).

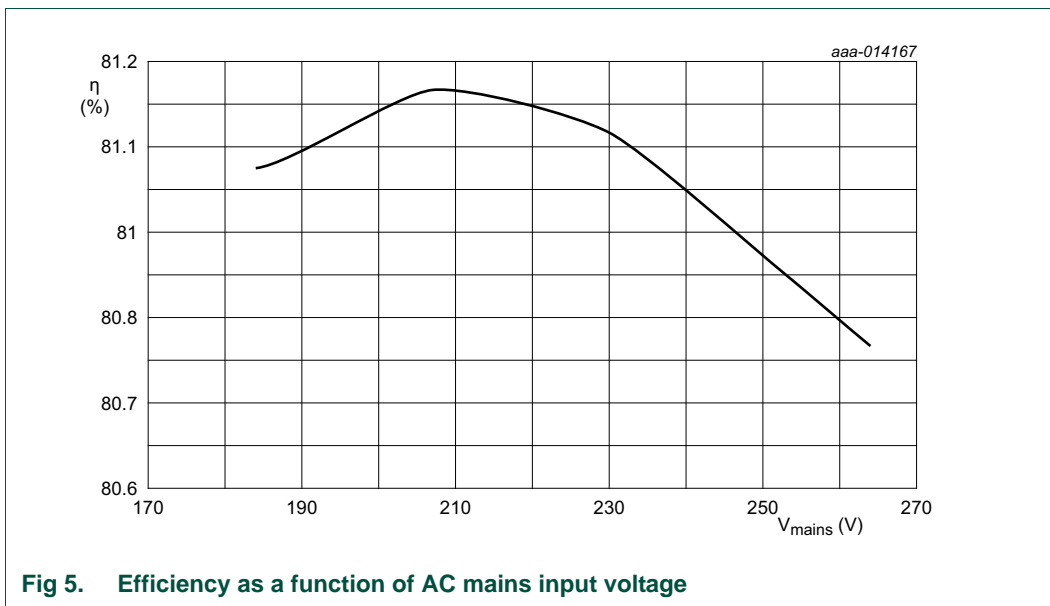
The anode of the LED load is connected to LED+. The cathode is connected to LED-. Use an LED string with a 12 V forward voltage on this demo board. Under the expected conditions, the output current is 450 mA.



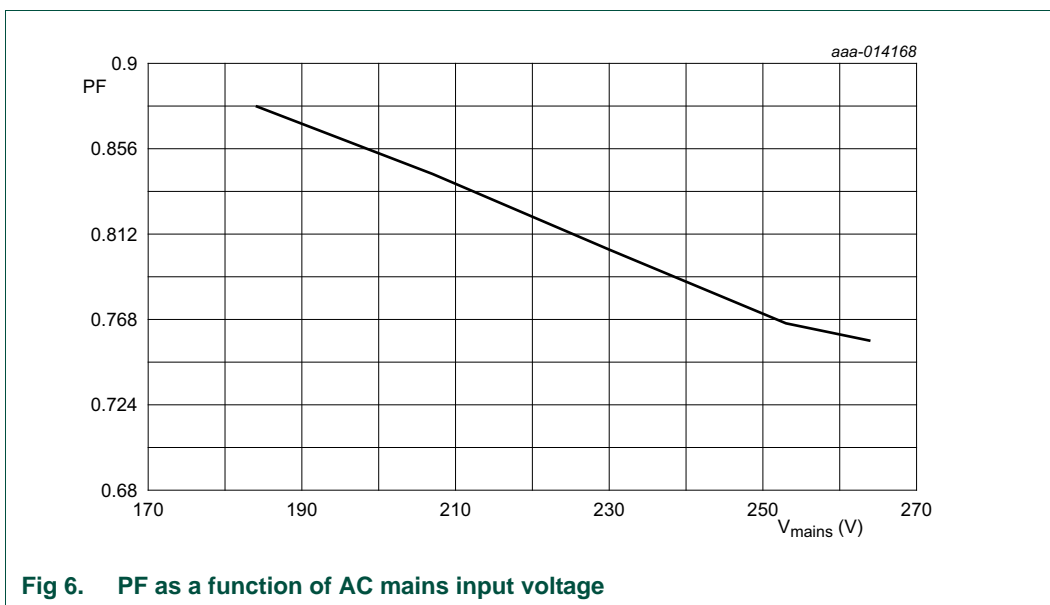
6. Performance

The performance was measured using an LED load with a 12 V forward voltage at a 450 mA LED output current. Performance data is shown in [Figure 5](#) to [Figure 10](#).

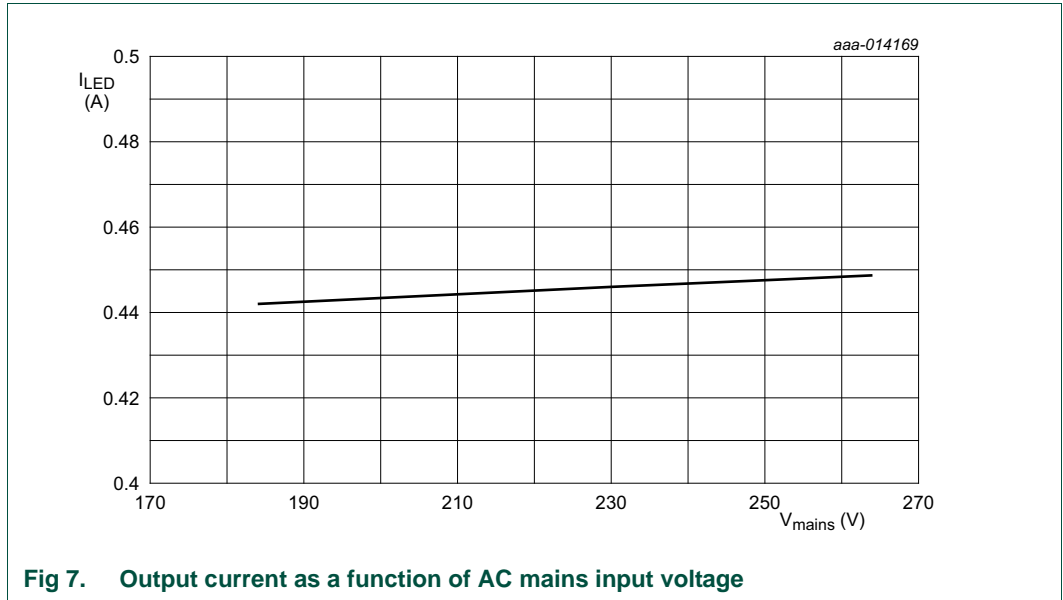
6.1 Efficiency



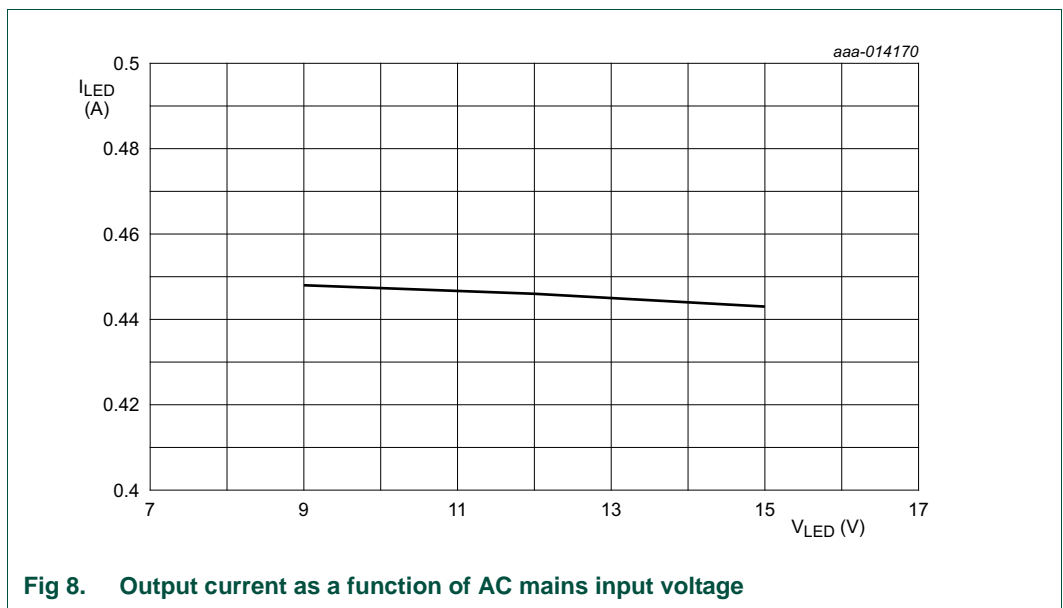
6.2 Power Factor (PF)



6.3 Line regulation



6.4 Load regulation



6.5 THD

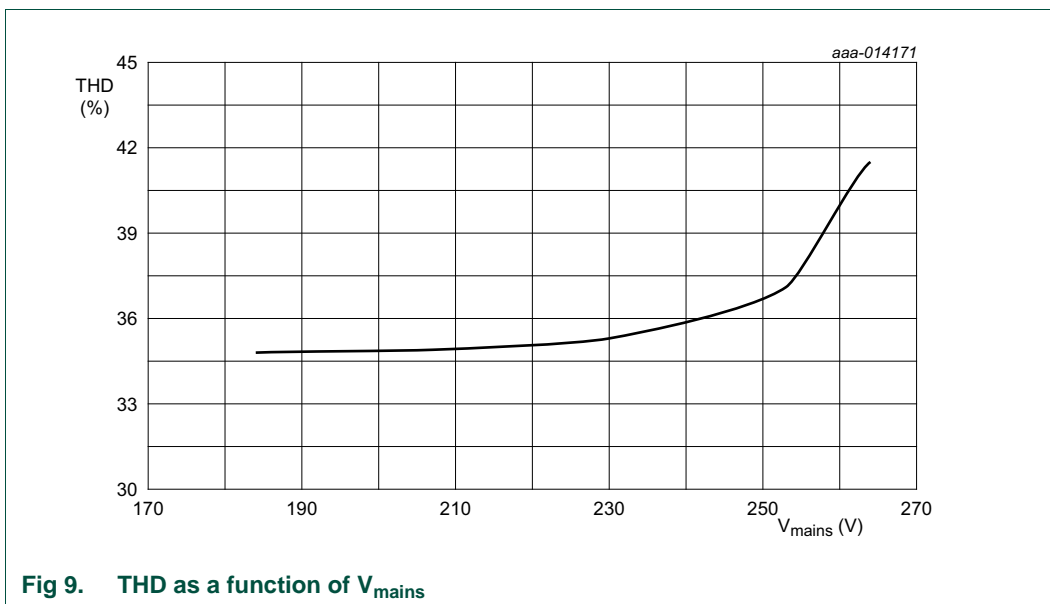


Fig 9. THD as a function of V_{mains}

6.6 ElectroMagnetic Interference (EMI)

The ElectroMagnetic Interference (EMI) was measured according to the EN55015 standard. The board complies with the requirements (see [Figure 10](#) and [Figure 11](#)).

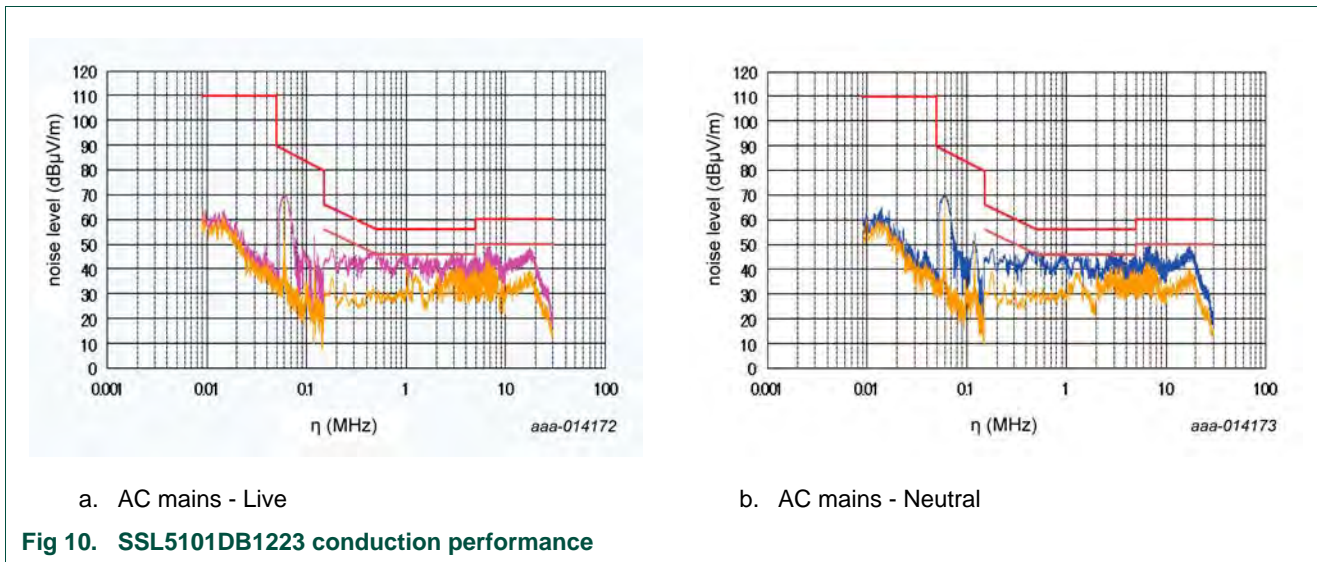
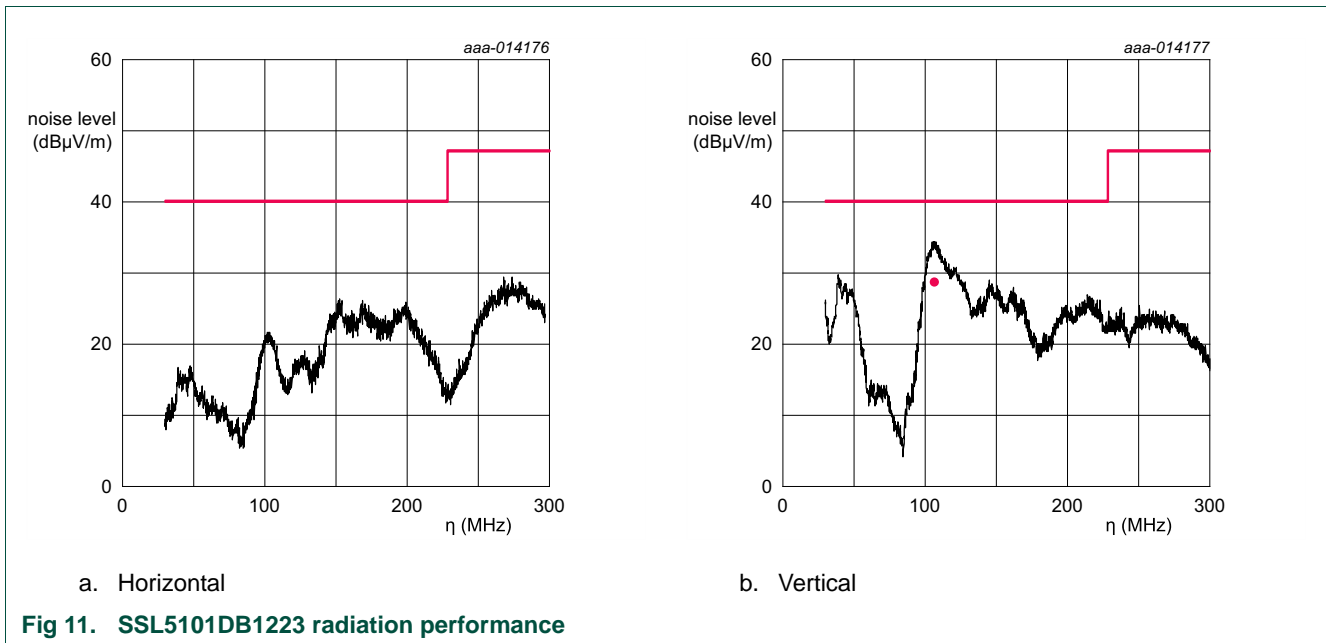


Fig 10. SSL5101DB1223 conduction performance



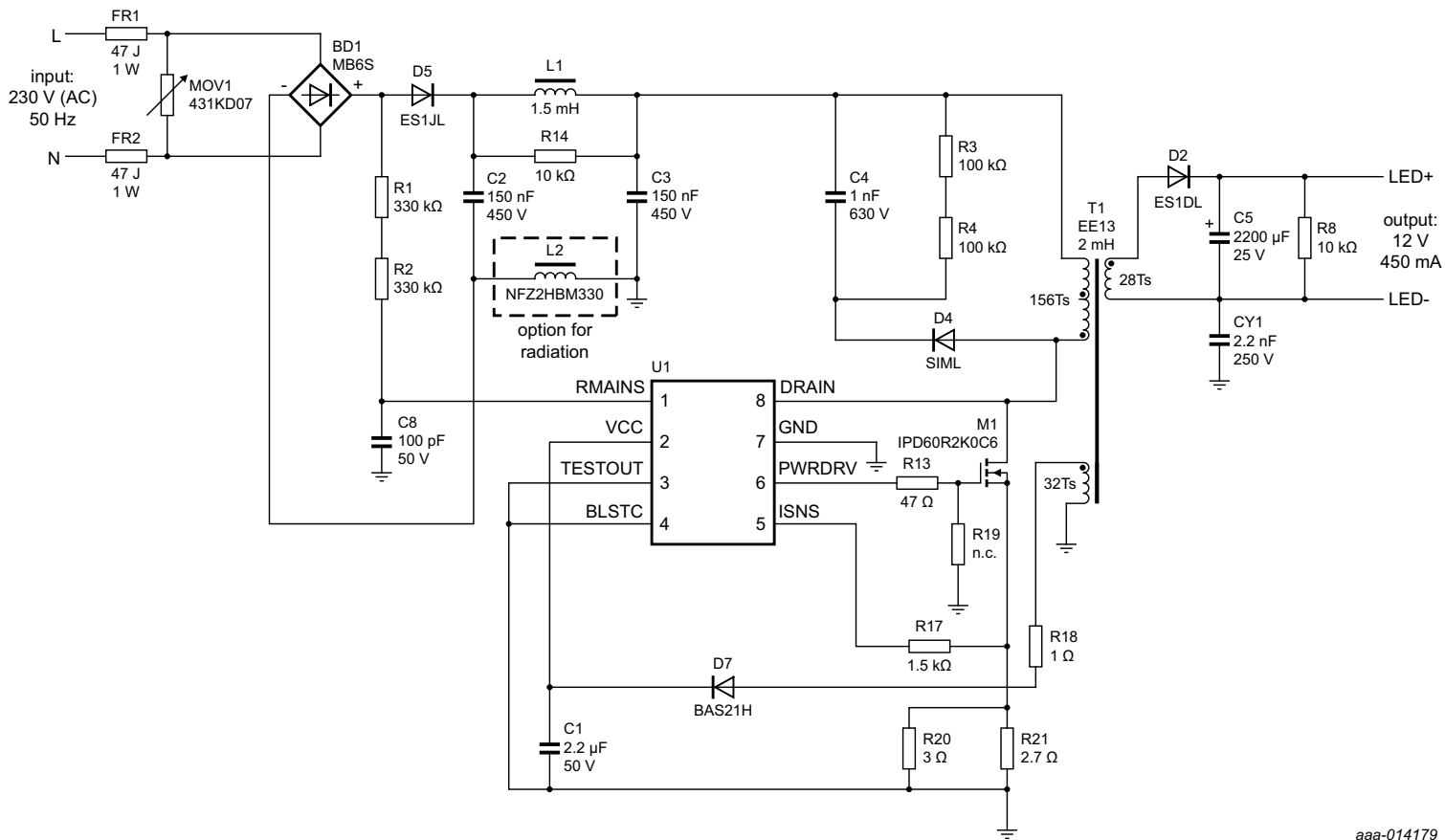
7. Protections

The IC incorporates the following protections:

- UnderVoltage LockOut (UVLO)
- OverCurrent Protection (OCP)
- Brownout protection
- Output Short Protection (OSP)
- Output open OverVoltage Protection (OVP)
- Internal OverTemperature Protection (OTP)
- Mains synchronization loss protection
- Leading Edge Blanking (LEB)

Output open OVP is a latched protection. Power-off cycling is required to exit the latched state. All other protections are not latched and lead to a safe restart of the converter. For more information about protections, see the *SSL5101T data sheet* ([Ref. 1](#)).

8. Schematic



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Fig 12. SSL5101DB1223 schematic diagram

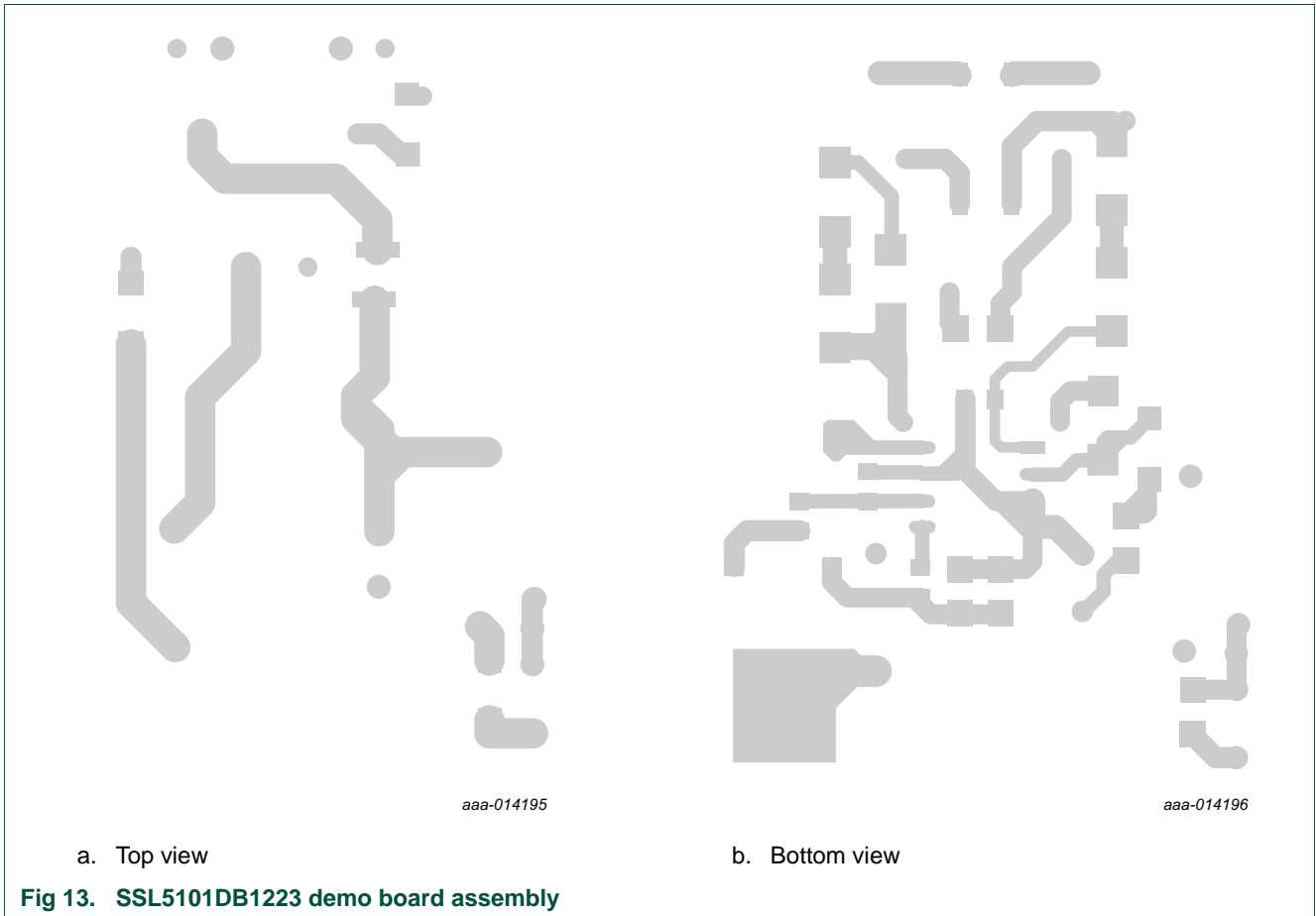
9. Bill Of Materials (BOM)

Table 2. SSL5101DB1223 bill of materials

Reference	Description and values	Part number	Manufacturer
BD1	bridge rectifier; 600 V; 500 mA; MBS-1	MB6S	MCC
CY1	Y-capacitor; 2.2 nF; 250 V (AC); pitch = 7.5 mm	-	-
C1	capacitor; 2.2 μ F; 50 V; 1206	GRM31CR71H225KA88L	Murata
C2; C3	capacitor; film; 150 nF; 450 V; CL21; pitch = 7.5 mm	-	-
C4	capacitor; 1 nF; 630 V; 1206	GRM31BR72J103KW01L	Murata
C5	capacitor; 2200 μ F; 25 V; pitch = 5 mm; 12.5 mm \times 25 mm	OLKLB1E222MF	Yongming
C8	capacitor; 100 pF; 50 V; 0603	GRM1885C1H101GA01D	Murata
D2	diode; ultrafast; 200 V; 1 A; sub-SMA	ES1DL	Taiwan Semiconductor
D4	diode; slow; 1000 V; 1 A; sub-SMA	SIML	Taiwan Semiconductor
D5	diode; ultrafast; 600 V; 1 A; sub-SMA	ES1JL	Taiwan Semiconductor
D7	diode; ultrafast; 200 V; 0.2 A; SOD123F	BAS21H	NXP Semiconductors
FR1; FR2	fuse resistor; 47 Ω ; 1 W; 5 %	RF10-1W47J	TY-OHM
L1	inductor; 1.5 mH; pitch = 2.5 mm; 6 mm \times 8 mm	744 746 215 2	Würth Elektronik
L2	inductor; radiation option; 33 Ω ; 1 MHz; 0.5 A	NFZ2HBM330SN10L	Murata
MOV1	varistor; 270 V (AC)/350 V (DC); diameter = 7 mm	431KD07	BrightKing
M1	MOSFET; 650 V; 2 Ω ; DPAK	IPD60R2K0C6	Infineon
R1; R2	resistor; 330 k Ω ; 5 %; 1206	-	-
R3; R4	resistor; 100 k Ω ; 5 %; 1206	-	-
R8	resistor; 10 k Ω ; 5 %; 0805	-	-
R13	resistor; 47 Ω ; 5 %; 0603	-	-
R14	resistor; 15 k Ω ; 5 %; 0805	-	-
R17	resistor; 1.5 k Ω ; 5 %; 0603	-	-
R18	resistor; 1 Ω ; 5 %	-	-
R19	resistor; not connected	-	-
R20	resistor; 3 Ω ; 1 %	-	-
R21	resistor; 2.7 Ω ; 1 %	-	-
T1	transformer; 2 mH; core: EE13	EE13401-202-A	KEE
U1	IC; digital controller; SO8	SSL5101T	Silergy Corp.

10. Board layout

[Figure 13](#) shows the outer layers of the board with their corresponding silk screen indicating component positions.



11. Transformer specification

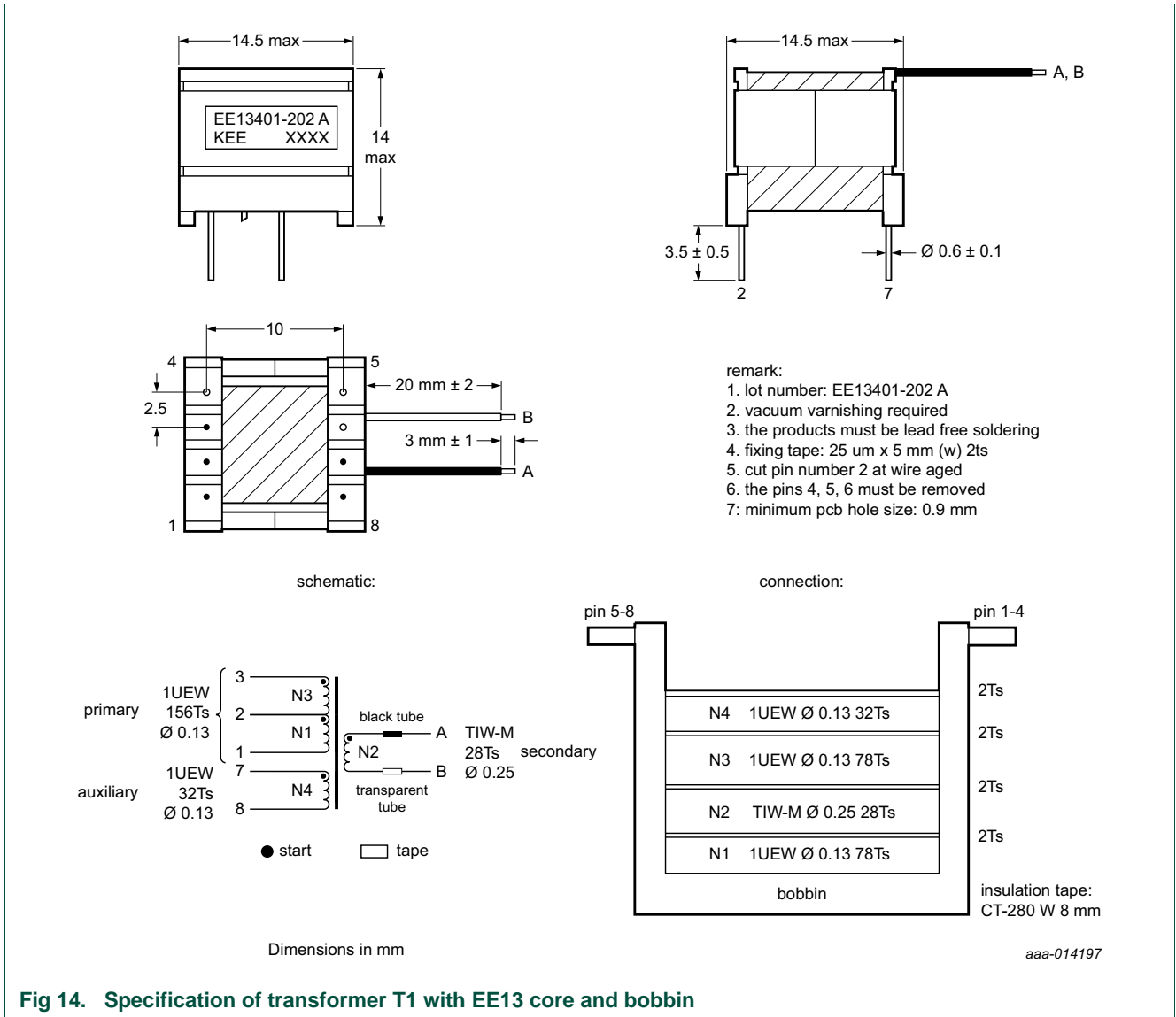


Fig 14. Specification of transformer T1 with EE13 core and bobbin

12. Abbreviations

Table 3. Abbreviations

Acronym	Description
EMI	ElectroMagnetic Interference
LEB	Leading-Edge Blanking
LED	Light Emitting Diode
OCP	OverCurrent Protection
OSP	Output Short Protection
OTP	OverTemperature Protection
OVP	OverVoltage Protection
PF	Power Factor
SSL	Solid-State Lighting
THD	Total Harmonic Distortion
UVLO	UnderVoltage LockOut

13. References

- [1] [SSL5101T data sheet](#) — GreenChip controller for LED lighting