



UM10793

SSL5031BDB1207 120 V 9 W buck converter

Rev. 1 — 20 October 2014

User manual

Document information

Info	Content
Keywords	SSL5031BDB1207, SSL5031BTS, non-dimmable, LED driver, buck converter, A19
Abstract	This user manual describes the operation of the SSL5031BDB1207 120 V 9 W non-dimmable LED driver featuring the SSL5031BTS. The demo board uses a buck topology. It has a form factor that is compatible with the base of a A19 LED lamp fitting used in Solid-State Lighting (SSL) applications.



Revision history

Rev	Date	Description
v.1	20141020	first issue

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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 SSL5031BDB1207 120 V 9 W eco-THD non-dimmable LED driver featuring the SSL5031BTS. The reference board has a A19 LED lamp compatible form factor. The buck converter topology provides a simple and efficient solution for mains non-dimmable LED recessed light applications.

The reference board complies with EMI and safety regulations.

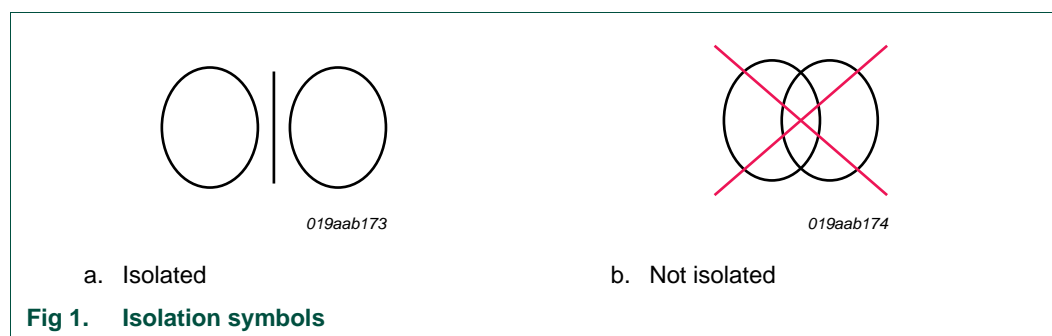
[Figure 2](#) shows the dimensions of the SSL5031BDB1207 demo board. The design of the board allows enough headroom for the board to fit into a A19 lamp base.

[Figure 3](#) shows the SSL5031BDB1207 assembled top and bottom views.

2. Safety warning

The demo board input is connected to the 120 V mains supply. 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.



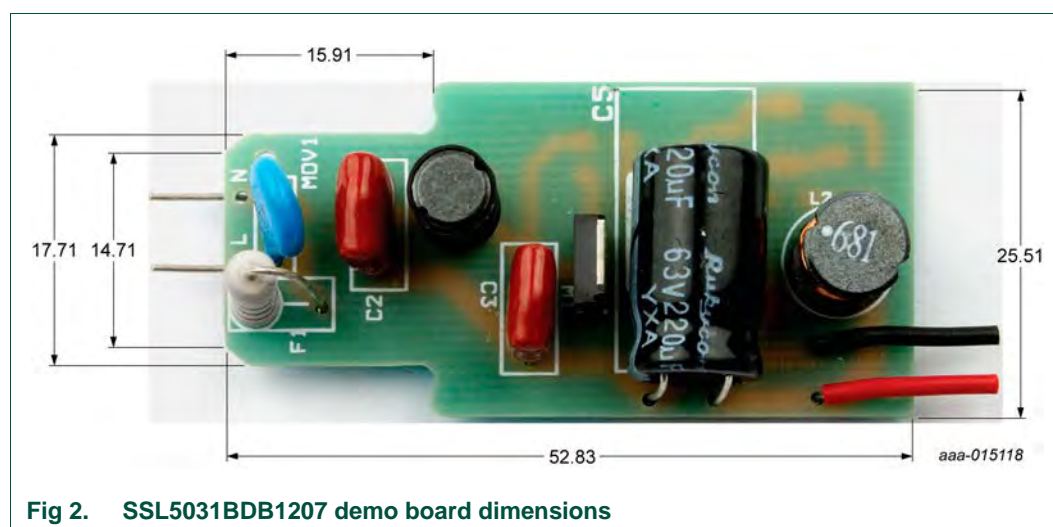
3. Specifications

[Table 1](#) lists the specification of the SSL5031BDB1207 demo board.

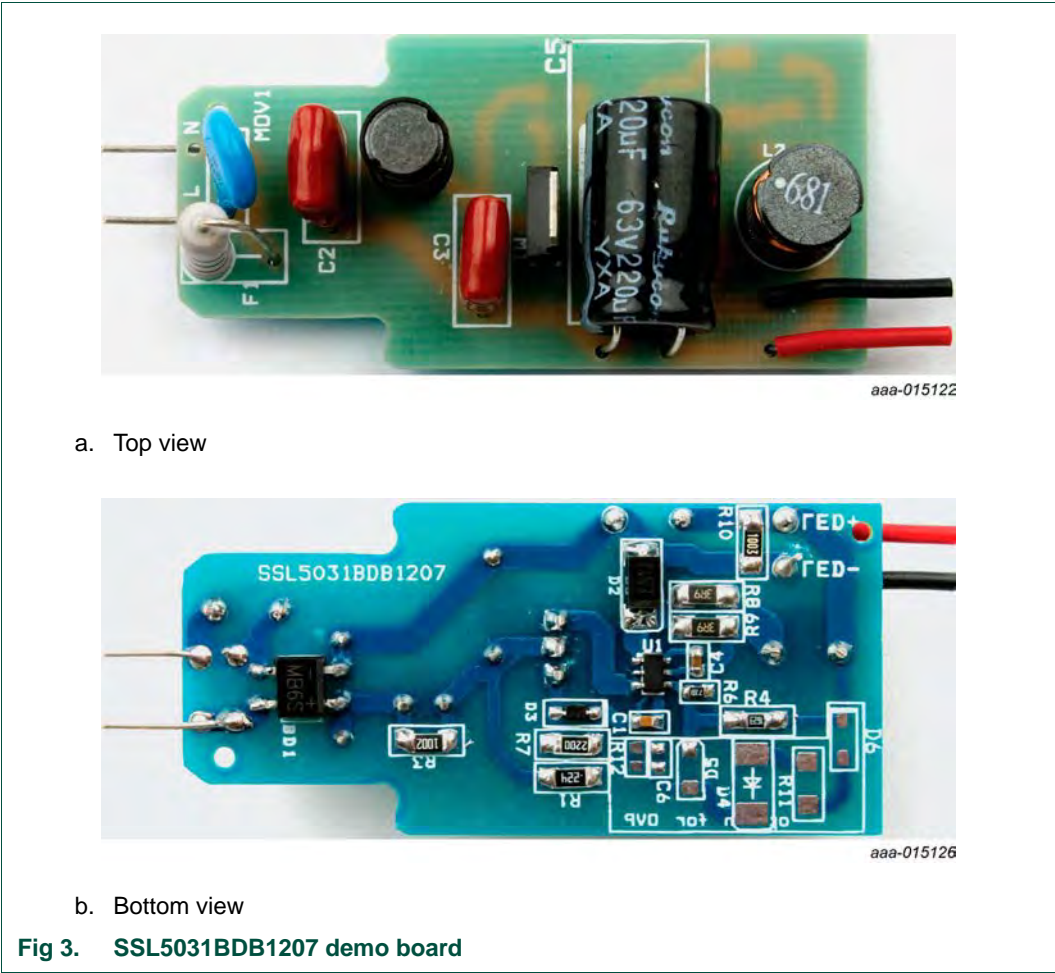
Table 1. SSL5031BDB1207 specifications

Symbol	Parameter	Value
V_{mains}	AC mains supply voltage	120 V (AC); $\pm 10\%$
I_{mains}	AC mains input current	80 mA
V_{LED}	output voltage	40 V
I_{LED}	output current	205 mA
$I_{\text{LED(ripple)}}$	output current ripple	$< 30\%$
$\Delta I_{\text{LED}}/\Delta V_{\text{mains}}$	line rejection	$< 2\%$
$\Delta I_{\text{LED}}/\Delta V_{\text{LED}}$	output voltage rejection	$< 1\%$
η	efficiency	$> 88\%$; at 120 V (AC)/60 Hz
PF	power factor	> 0.95
THD	total harmonic distortion	$< 20\%$
T_{oper}	operating temperature	$-40\text{ }^{\circ}\text{C}$ to $+100\text{ }^{\circ}\text{C}$
f_{sw}	switching frequency	60 kHz to 160 kHz
t_{startup}	start-up time	120 ms

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



4. Board photographs



5. Board connections

The SSL5031BDB1207 demo board is optimized for a 120 V (AC)/60 Hz supply. It is designed to work with multiple LEDs or an LED module.

Remark: The maximum rated voltage of the board is 132 V (AC).

The anode of the LED load is connected to LED+. The cathode is connected to LED-. Use an LED string with a forward voltage up to 40 V on this reference board. Under the expected conditions, the output current is 205 mA.

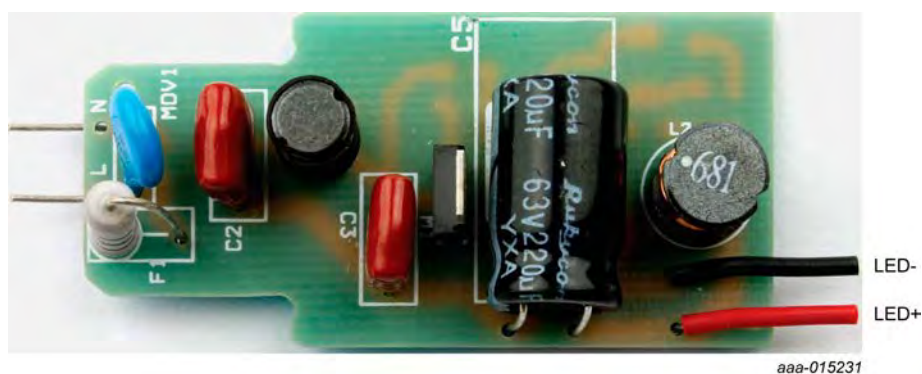
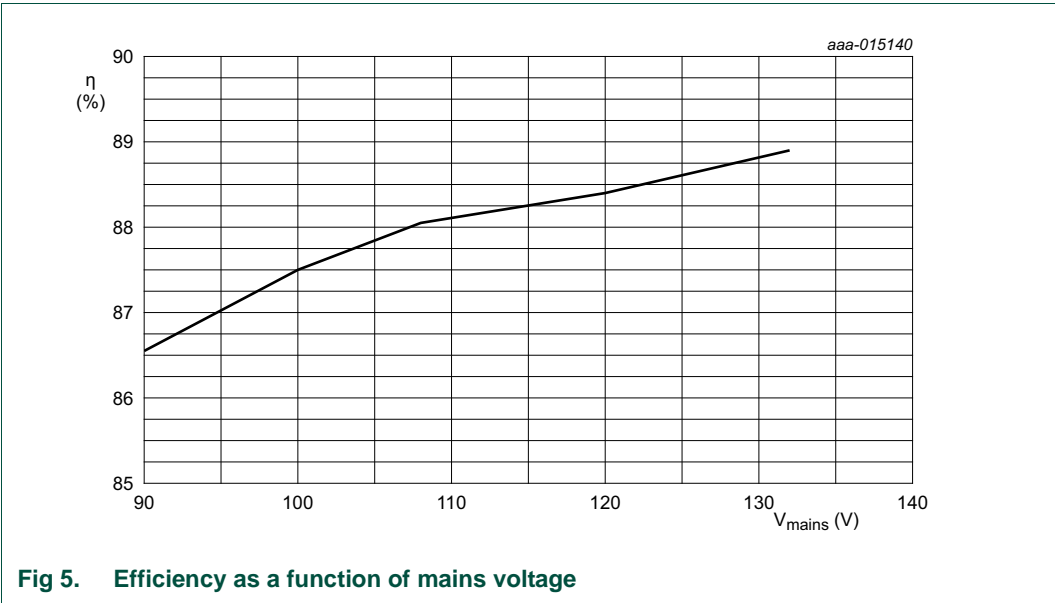


Fig 4. SSL5031BDB1207 board connections

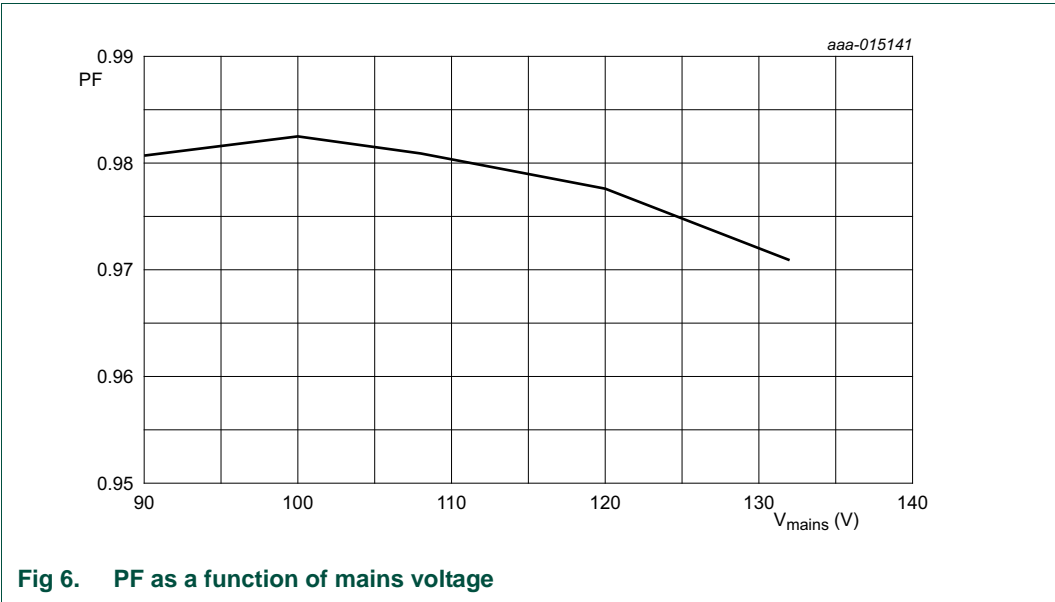
6. Performance

The performance was measured with a 40 V at an LED output load of 205 mA. [Figure 5](#) to [Figure 10](#) show the performance data.

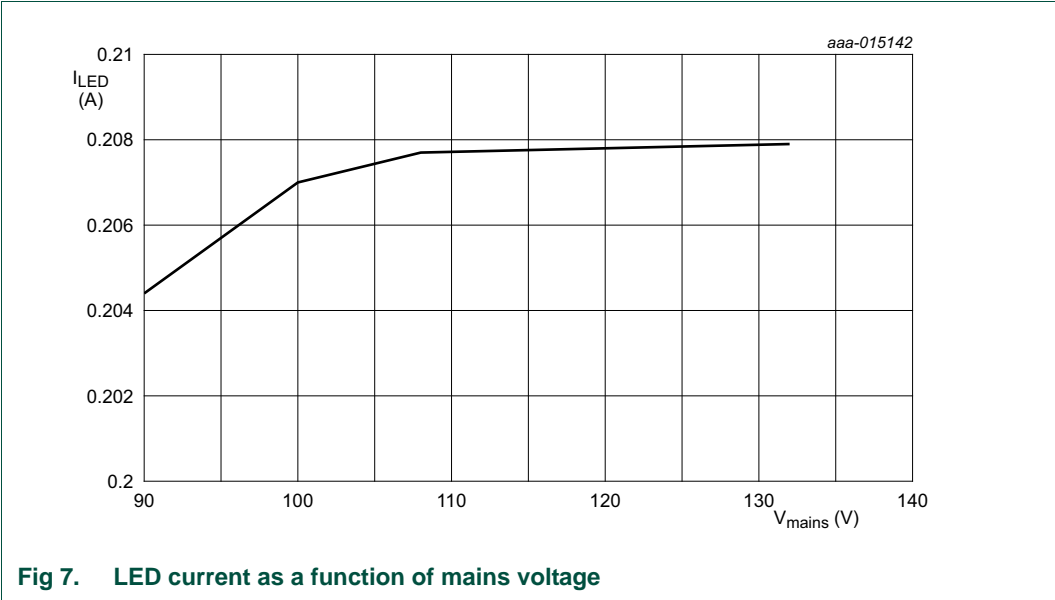
6.1 Efficiency



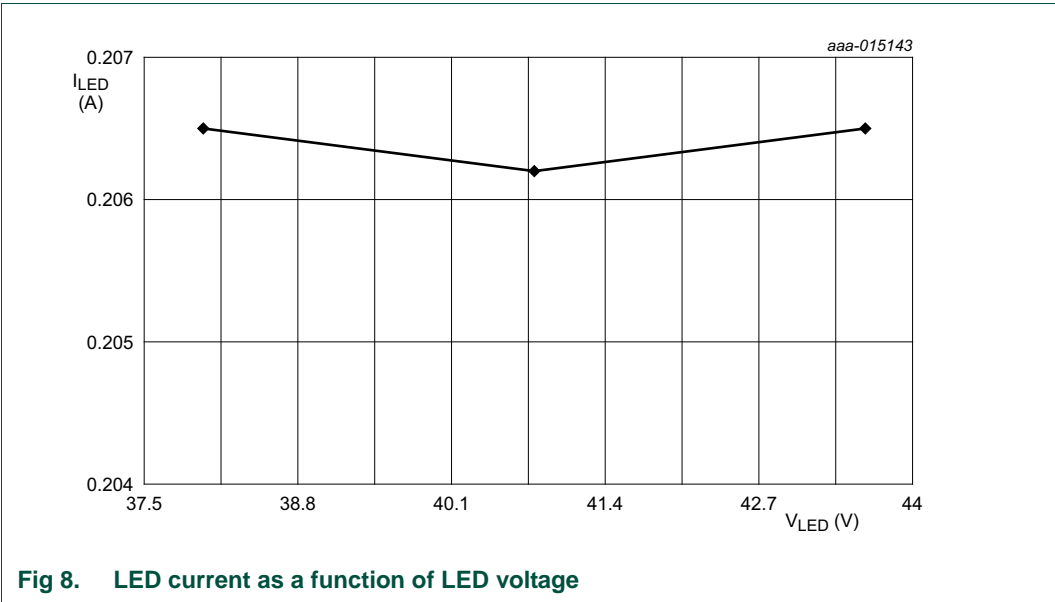
6.2 Power Factor (PF)



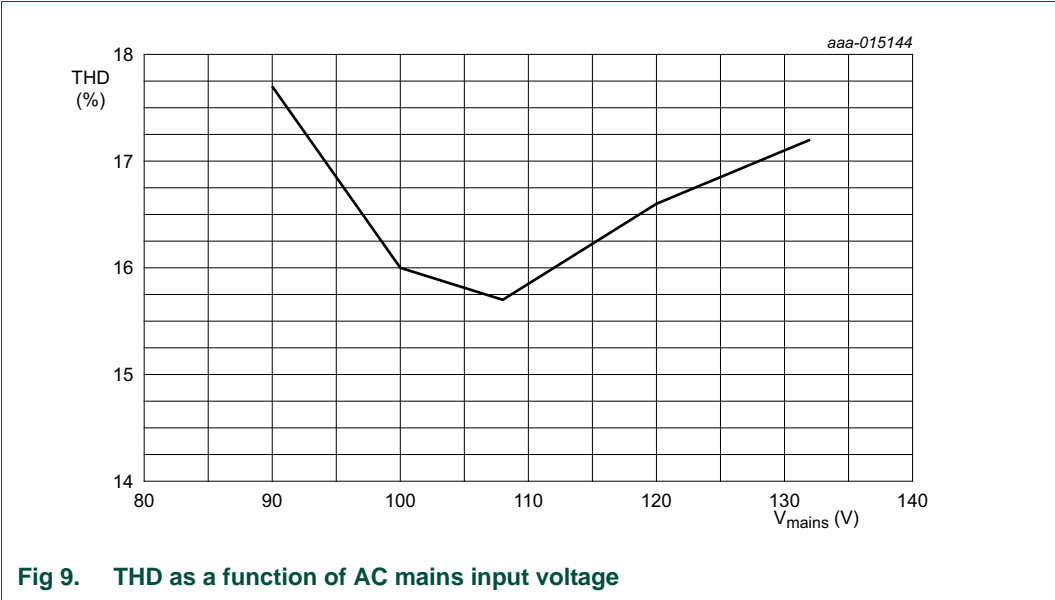
6.3 Line regulation



6.4 Load regulation

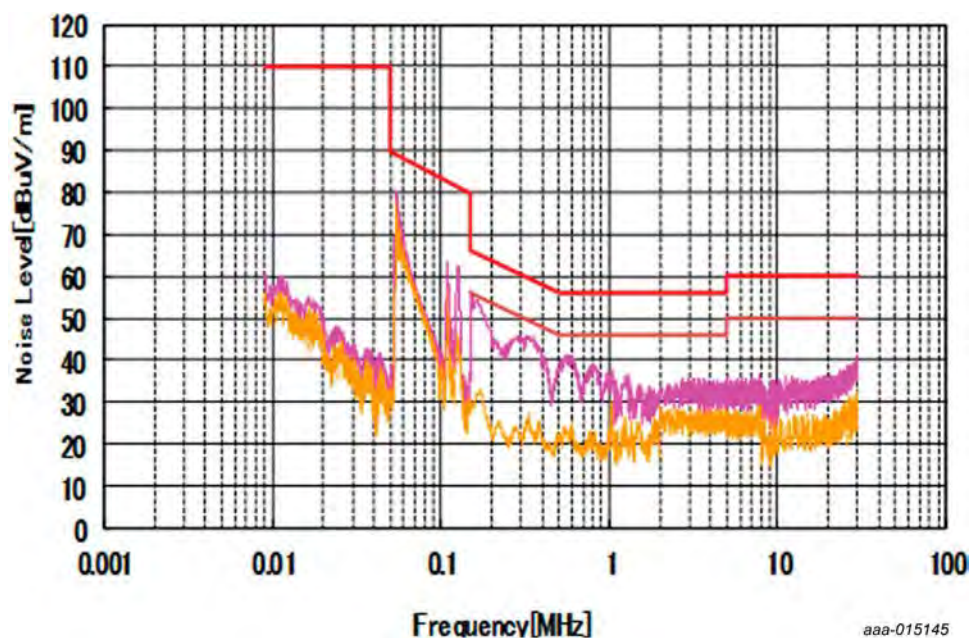


6.5 Total Harmonic Distortion (THD)

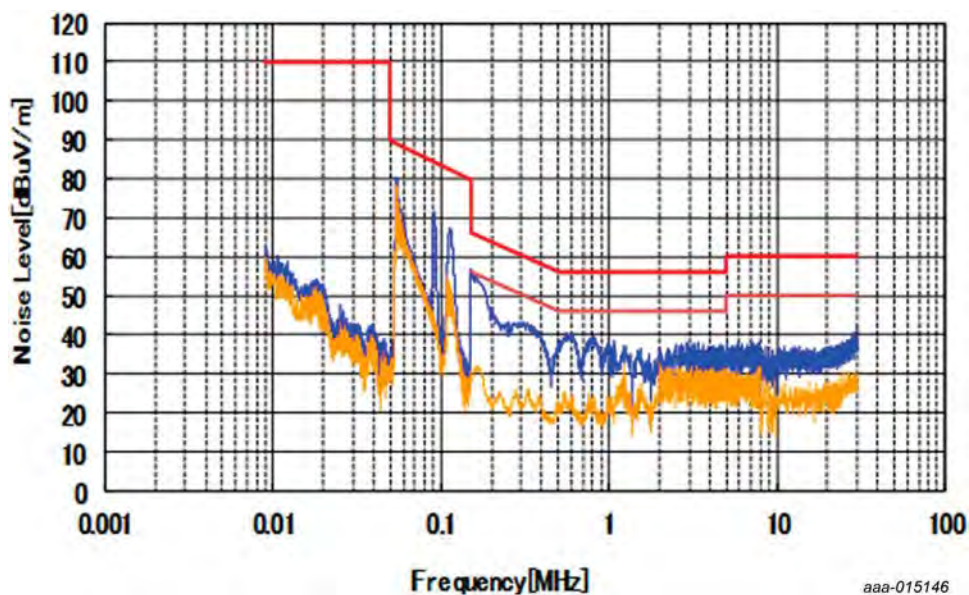


6.6 ElectroMagnetic Interference (EMI)

Figure 10 shows the EMI performance. The board complies with the EN55015 standard requirements.



a. AC mains - Line



b. AC mains - Neutral

Fig 10. SSL5031BDB1207 demo board conduction performance

7. Protections

The IC incorporates the following protections:

- UnderVoltage LockOut (UVLO)
- OverCurrent Protection (OCP)
- Output Short Protection (OSP)
- Output open OverVoltage Protection (OVP)
- Internal OverTemperature Protection (OTP)
- External thermal foldback (optional)

All protections are not latched and lead to a safe restart of the converter. For more information about protections, see the *SSL5031BTS data sheet* ([Ref. 1](#)).

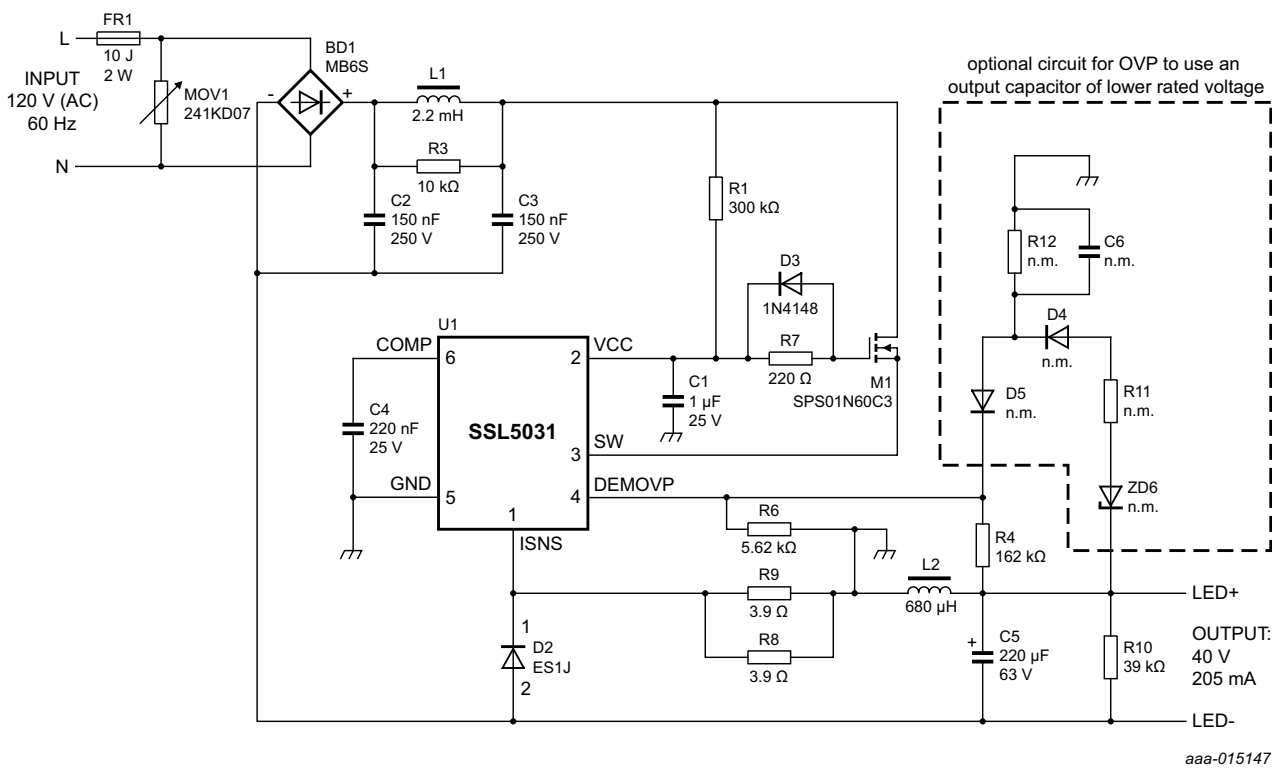


Fig 11. SSL5031BDB1207 schematic diagram

8. Schematic

9. Bill Of Materials (BOM)

Table 2. SSL5031BDB1207 bill of materials

Reference	Description and values	Part number	Manufacturer
BD1	bridge rectifier; 600 V; 500 mA; MBS-1	MB6S	MCC
C1	capacitor; 1 μ F; 25 V; 0603	GRM188R71E105KA12D	Murata
C2; C3	capacitor; film; 150 nF; 250 V; CL21; pitch = 7.5 mm	-	-
C4	capacitor; 220 nF; 25 V; 0603	GRM188R71E224KA88D	Murata
C5	capacitor; 220 μ F; 63 V; pitch = 5 mm; 10 mm \times 16 mm	OLKE21J221MF	Shanghai Yongming Electronics
C6	capacitor; not mounted	-	-
D2	diode; ultrafast; 600 V; 1 A; SMA	ES1J	Taiwan Semiconductor
D3	diode; ultrafast; 75 V; 150 mA; SOD323	1N4148	DiodesZetex
D4; D5	diode; not mounted	-	-
FR1	fuse resistor; 10 Ω ; 2 W; 5 %	RF10-2W10J	TY-OHM
L1	inductor; 2.2 mH; I_{sat} = 0.16 A; pitch = 3 mm; 6 mm \times 8 mm	DR0608-222 A	KEE
L2	inductor; 680 μ H; I_{sat} = 0.6 A; pitch = 5 mm; 8 mm \times 10 mm	744 772 681	Würth Elektronik
M1	MOSFET; $R_{\text{DS(on)}}$ = 6 Ω ; I_{d} = 0.8 A; V_{ds} = 650 V; TO-251	SPS01N60C3	Infineon
MOV1	varistor; 150 V (AC); 200 V (DC); \varnothing = 7 mm	241KD07	BrightKing
R1	resistor; 300 k Ω ; 5 %; 1206	-	-
R3	resistor; 10 k Ω ; 5 %; 1206	-	-
R4	resistor; 162 k Ω ; 1 %; 1206	-	-
R6	resistor; 5.62 k Ω ; 1 %; 0603	-	-
R7	resistor; 220 Ω ; 5 %; 1206	-	-
R8; R9	resistor; 3.9 Ω ; 1 %; 1206	-	-
R10	resistor; 39 k Ω ; 5 %; 1206	-	-
R11; R12	resistor; not mounted	-	-
U1	controller; TSOP6	SSL5031BTS	NXP Semiconductors
ZD6	diode; Zener; not mounted	-	-

10. Board layout

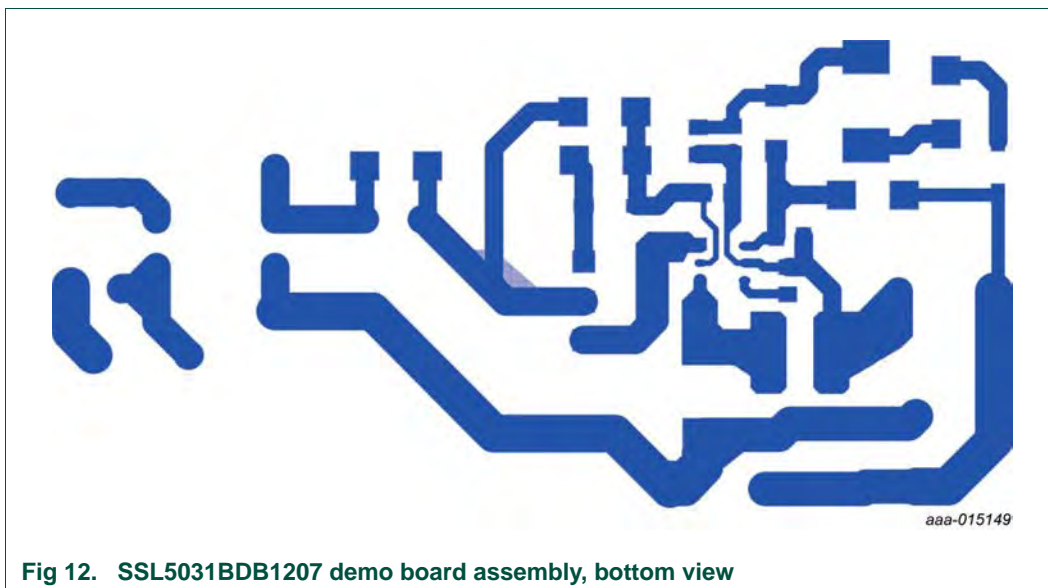


Fig 12. SSL5031BDB1207 demo board assembly, bottom view

11. Abbreviations

Table 3. Abbreviations

Acronym	Description
EMI	ElectroMagnetic Interference
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

12. References

- [1] **SSL5031BTS data sheet** — Compact high power factor/low-THD buck LED driver IC

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14. Contents

1	Introduction	3
2	Safety warning	3
3	Specifications	4
4	Board photographs	5
5	Board connections	6
6	Performance	7
6.1	Efficiency	7
6.2	Power Factor (PF)	7
6.3	Line regulation	8
6.4	Load regulation	8
6.5	Total Harmonic Distortion (THD)	9
6.6	ElectroMagnetic Interference (EMI)	10
7	Protections	11
8	Schematic	12
9	Bill Of Materials (BOM)	13
10	Board layout	14
11	Abbreviations	14
12	References	14
13	Legal information	15
13.1	Definitions	15
13.2	Disclaimers	15
13.3	Trademarks	15
14	Contents	16

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