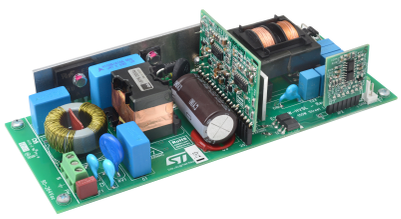
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EVL150W-HVSL

Data brief

150 V - 150 W LED driver using the STCMB1transition mode PFC and HBR resonant tank combo controller



Features

- Universal input mains range: 90 to 264 Vac -frequency 45 to 65 Hz
- Half-bridge topology: LCC
- Max. output voltage and current: 150 V at 1 A continuous operation
- No-load mains consumption: < 0.5 W
- THD < 10% at 230 Vac from 30 to 100% of the full load
- No need of auxiliary SMPS (Viper or equivalent)
- Efficiency: >91% at full load
- No electrolytic capacitors for long term reliability
- Conducted EMC: within EN55022-Class-C limits
- Safety: meets EN60950
- Dimming: analog, resistive, PWM (open collector)
- Feedback loops: constant current and constant voltage
- Protections: LED short-circuit, LED string open, regulation loop failure
- Dimensions: 69x157 mm, 28 mm components maximum height
- PCB: double side, 70 µm, FR-4, mixed PTH/SMT

Product status link
EVL150W-HVSL

Description

The EVL150W-HVSL is an evaluation board of a150 W / 1 A LED driver with wide input mainsrange. The electrical specification is tailored on a typical high-power street lighting application.

It is based on a two-stage architecture, consisting of a front-end PFC pre-regulator and a downstream half-bridge resonant tank converter. The pre-regulator is a transition mode PFC based on constant ON time control, while the resonant converter is an LCC tank that is more suitable than LLC tank to build a current source.

Both stages are based on the new STCMB1 combo controller that integrates, in the same device, a transition mode PFC controller and a half-bridge resonant controller.

Thanks to the STCMB1, the main features of this design are high efficiency, no-load input power consumption is very low, reduced harmonics compliant with the EN61000-3-2 Class-C, and EMI within the relevant EN55022 limits.

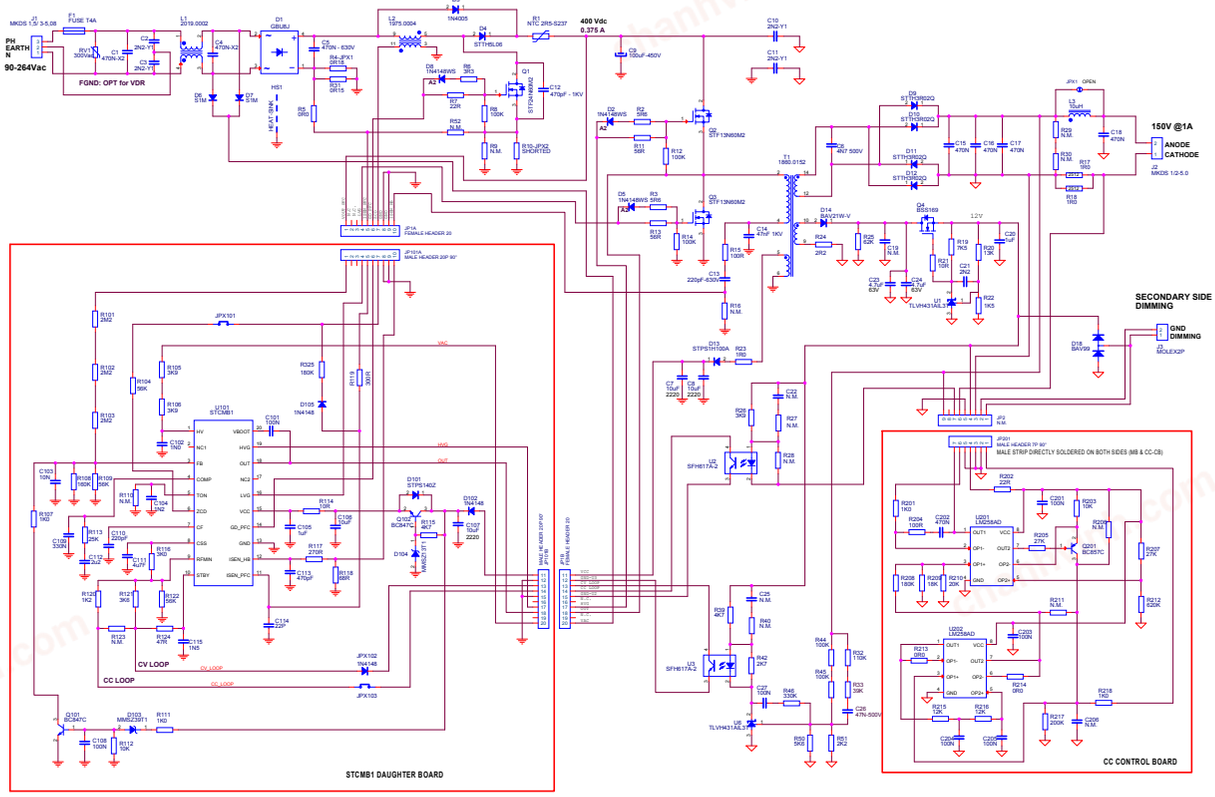
Another noticeable feature of this LED driver is the extremely wide dimming capability, actually the board can regulate the current from maximum level down to less than 10% with analog dimming and to 1% in PWM dimming. The PWM dimming is perfectly flicker free, because even in the case of very low current, it is kept continuous (DC) in the LED and thus independent of the frequency of the PWM dimming signal.

The board also has protection features in case of overload, short-circuit, open loop by each section. For this particular application, all protections in case of intervention have an auto-restart functionality.

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1 Electrical diagram

Figure 1. Electrical diagram



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2 Bill of material

Table 1. **EVL150W-HVSL Evaluation board: bill of material (Rev. 2.3)**

Ref.	Value	Case	Description	Supplier
C1	470 nF - X2	9.0 x 18.0 p. 15 mm	X2 - FILM CAP - B32922C3474K	Epcos
C2	2.2 nF - Y1	p. 10 mm	Y1 SAFETY CAP. DE1E3KX222M	Murata
C3	2.2 nF - Y1	p. 10 mm	Y1 SAFETY CAP. DE1E3KX222M	Murata
C4	470 nF - X2	9.0 × 18.0 p. 15 mm	X2 - FILM CAP - B32922C3474K	Epcos
C5	470 nF 630 V	8.5 x 26.5 p. 22.5 mm	630 V - FILM CAP - B32673Z6474K	Epcos
C6	4.7 nF	5.0 x 13.0	p. 10 mm 450 Vac - FILM CAP - B32651A7472K	Epcos
C7	10 µF	2220	CERCAP - 50 V - X7R - 20 %	TDK
C8	10 µF	2220	CERCAP - 50 V - X7R - 20 %	TDK
C9	100 µF 450 V	diam. 18 x 35.5 mm	Aluminium ELCAP - CY series - 105 °C	Nichicon
C10	2.2 nF - Y1	p. 10 mm	Y1 SAFETY CAP. DE1E3KX222M	Murata
C11	2.2 nF - Y1	p. 10 mm	Y1 SAFETY CAP. DE1E3KX222M	Murata
C12	470 pF - 1 KV	1206	1 KV CERCAP - X7R - 10 %	Murata
C13	220 pF	1206	630 V CERCAP -GRM31A7U2J220JW31	Murata
C14	47 nF - 1 KV	7.0 x 18.0 p. 15 mm	1 KV - FILM CAP - B32652A0473K	Epcos
C15	470 nF	6.0 x 13 p. 10 mm	MKT FILM CAP - B32521C3474M -250 V - 20 %	Epcos
C16	470 nF	6.0 x 13 p. 10 mm	MKT FILM CAP - B32521C3474M -250 V - 20 %	Epcos
C17	470 nF	6.0 x 13 p. 10 mm	MKT FILM CAP - B32521C3474M -250 V - 20 %	Epcos
C18	470 nF	6.0 x 13 p. 10 mm	MKT FILM CAP - B32521C3474M -250 V - 20 %	Epcos
C19	N.M.	1210	CERCAP - 50 V - X7R - 20 %	TDK
C20	1 µF	1206	CERCAP - 50 V - X7R - 20 %	TDK
C21	2.2 nF	0805	50 V CERCAP - C0G - 10 %	AVX
C22	N.M.	0805	Not mounted	
C23	4.7 µF	8.5 x 7.2 p. 5 mm	MKS2 FILM CAP - MKS2C044701M00 - 63 V - 5 %	Wima
C24	4.7 µF	8.5 x 7.2 p. 5 mm	MKS2 FILM CAP - MKS2C044701M00 - 63 V - 5 %	Wima
C25	N.M.	0805	Not mounted	
C26	47 nF - 500 V	1206	CERCAP - 500 V - X7R - 10 %	Kemet

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Ref.	Value	Case	Description	Supplier
C27	100 nF	0805	CERCAP - 50 V - X7R - 10 %	Kemet
C101	100 nF	1206	50 V CERCAP - general purpose - X7R- 10 %	TDK
C102	1.0 nF	1206	2 KV CERCAP - X7R - 10 %	Epcos
C103	10 nF	0805	50 V CERCAP - general purpose - X7R - 10 %	TDK
C104	1.2 nF	0805	50 V CERCAP - general purpose - X7R - 10 %	Epcos
C105	1 µF	1206	50 V CERCAP - general purpose - X7R - 10 %	TDK
C106	10 µF	1206	CERCAP - 25 V - X7R - 20 %	TDK
C107	10 µF	2220	CERCAP - 50 V - X7R - 20 %	TDK
C108	100 nF	0805	CERCAP - 50 V - X7R - 10 %	TDK
C109	330 nF	0805	50 V CERCAP - general purpose - X7R- 10 %	TDK
C110	220 pF	0805	50 V CERCAP - general purpose - COG- 5 %	Epcos
C111	4.7 µF	1206	16 V CERCAP - general purpose - X7R- 10 %	TDK
C112	2.2 µF	1206	16 V CERCAP - general purpose - X7R- 10 %	TDK
C113	470 pF	0805	50 V CERCAP - general purpose - COG- 5 %	Epcos
C114	22 pF	0805	50 V CERCAP - general purpose - COG- 5 %	Epcos
C115	1.5 nF	0805	50 V CERCAP - general purpose - COG- 5 %	Epcos
C201	100 nF	0805	CERCAP - 50 V - X7R - 10 %	Kemet
C202	470 nF	0805	CERCAP - 25 V - C0G - 10 %	AVX
C203	100 nF	0805	CERCAP - 50 V - X7R - 10 %	Kemet
C204	100 nF	0805	CERCAP - 50 V - X7R - 10 %	Kemet
C205	100 nF	0805	CERCAP - 50 V - X7R - 10 %	Kemet
C206	N.M.	0805	Not mounted	
D1	GBU8J	STYLE GBU	Single phase bridge rectifier	Vishay
D2	1N4148WS	SOD-323	High speed signal diode	Vishay
D3	1N4005	DO-41	General purpose rectifier	Vishay
D4	STTH5L06	DO-201	Ultrafast high voltage rectifier	STMicroelectronics
D5	1N4148WS	SOD-323	High speed signal diode	Vishay
D6	S1M	DO214AC	General purpose rectifier, SMT	Fairchild
D7	S1M	DO214AC	General purpose rectifier, SMT	Fairchild
D8	1N4148WS	SOD-323	High speed signal diode	Vishay
D9	STTH3R02Q	DO-15	Ultra fast rectifier	STMicroelectronics
D10	STTH3R02Q	DO-15	Ultra fast rectifier	STMicroelectronics
D11	STTH3R02Q	DO-15	Ultra fast rectifier	STMicroelectronics
D12	STTH3R02Q	DO-15	Ultra fast rectifier	STMicroelectronics
D13	STPS1H100A	SMA	Power SCHOTTKY diode	STMicroelectronics
D14	BAV21W-V	SOD-123	Small signal diode high voltage	Vishay
D18	BAV99	SOT-23	Dual small signal diode	Vishay
D101	STPS140Z	SOD-123	Power SCHOTTKY diode	STMicroelectronics
D102	1N4148	DO-35	Fast switching diode	Vishay
D103	MMSZ39T1	SOD-123	39 V Zener diode	ON Semi

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Ref.	Value	Case	Description	Supplier
D104	MMSZ13T1	SOD-123	13 V Zener diode	ON Semi
D105	1N4148	DO-35	Fast switching diode	Vishay
F1	FUSE T4A	8.5 x 4 mm p. 5.08 mm	FUSE 4 A - TIME LAG - 3921400	Littlefuse
HS1	HEATSINK	DWG	Heatsink for D1, Q1, Q2, Q3	
J1	MKDS 1,5/3-5,08	DWG	PCB TERM. BLOCK, SCREW CONN., PITCH 5 mm - 3 W.	Phoenix Contact
J2	MKDS 1/2-5.0	DWG	PCB TERM. BLOCK, SCREW CONN., PITCH 5 mm - 2 W.	Phoenix Contact
J3	MOLEX2P	HEADER	2.54 Male header 2.54 mm - 2P	Molex
JP1A	Female header 20	DWG	Female header p. 2.54 mm PRECI-DIP	
JP1B	Female header 20	DWG	Female header p. 2.54 mm PRECI-DIP	
JP2	Female header 9	DWG	Female header p. 2.54 mm PRECI-DIP	
JP101A	Male header 20P 90°	DWG	Male header p. 2.54 mm 90°	
JP101B	Male header 20P 90°	DWG	Male header p. 2.54 mm 90°	
JP201	Male header 7P 90°	DWG	Male header p. 2.54 mm 90°	
JPX101	WIRE JUMPER	SHORTED	JUMPER	
JPX102	1N4148	DO-35	Fast switching diode	Vishay
JPX103	WIRE JUMPER	SHORTED	JUMPER	
L1	2019.0002	DWG	Input EMI filter	Magnetica
L2	1975.0004	DWG	PFC inductor - 0.31 mH - PQ26/25	Magnetica
L3	10 µH	diam 8.8 mm p. 5 mm	Drum coil RFB0807-100	Coilcraft
Q1	STF24N60M2	TO-220FP	N-Channel Power MOSFET	STMicroelectronics
Q2	STF13N60M2	TO-220FP	N-Channel Power MOSFET	STMicroelectronics
Q3	STF13N60M2	TO-220FP	N-Channel Power MOSFET	STMicroelectronics
Q4	BSS169	SOT-23	N-CH depletion MOSFET	Infineon
Q101	BC847C	SOT-23	Small signal NPN BJT	Vishay
Q102	BC847C	SOT-23	Small signal NPN BJT	Vishay
Q201	BC857C	SOT-23	Small signal PNP BJT	Vishay
R1	NTC 2.5 Ω - S237	DWG	NTC resistor P/N B57237S0259M000	Epcos
R2	5.6 Ω	0805	SMD standard film RES - 1/8 W - 5 % 250 ppm/°C	Vishay
R3	5.6 Ω	0805	SMD standard film RES - 1/8 W - 5 % 250 ppm/°C	Vishay
R4-JPX1	0.18 Ω	PTH	RSMF1TB - METAL FILM RES - 1 W 2 % - 200 ppm/°C	Akanehom

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Ref.	Value	Case	Description	Supplier
R5	0.0 Ω	0805	SMD standard film RES - 1/8 W - 5 % 200 ppm/°C	Vishay
R6	3.3 Ω	0805	SMD standard film RES - 1/8 W - 5 % 250 ppm/°C	Vishay
R7	22 Ω	0805	SMD standard film RES - 1/8 W - 5 % 250 ppm/°C	Vishay
R8	100 KΩ	0805	SMD standard film RES - 1/8 W - 5 % 250 ppm/°C	Vishay
R9	N.M.	PTH	Not mounted	
R10-JPX2	SHORTED	PTH	Wire jumper	
R11	56 Ω	0805	SMD standard film RES - 1/8 W - 5 % 250 ppm/°C	Vishay
R12	100 KΩ	0805	SMD standard film RES - 1/8 W - 5 % 250 ppm/°C	Vishay
R13	56 Ω	0805	SMD standard film RES - 1/8 W - 5 % 250 ppm/°C	Vishay
R14	100 KΩ	0805	SMD standard film RES - 1/8 W - 5 % 250 ppm/°C	Vishay
R15	100 Ω	1206	SMD standard film RES - 1/4 W - 1 % 100 ppm/°C	Vishay
R16	N.M.	0805	Not mounted	
R17	1.0 Ω	2512	SMD current sense resistor - 1 W - 1 %	Panasonic
R18	1.0 Ω	2512	SMD current sense resistor - 1 W - 1 %	Panasonic
R19	7.5 KΩ	0805	SMD standard film RES - 1/8 W - 5 % 200 ppm/°C	Vishay
R20	13 KΩ	0805	SMD standard film RES - 1/8 W - 1 % 100 ppm/°C	Vishay
R21	10 Ω	0805	SMD standard film RES - 1/8 W - 5 % 200 ppm/°C	Vishay
R22	1.5 KΩ	0805	SMD standard film RES - 1/8 W - 1 % 100 ppm/°C	Vishay
R23	1.0 Ω	1206	SMD standard film RES - 1/4 W - 1 % 100 ppm/°C	Vishay
R24	2.2 Ω	0805	SMD standard film RES - 1/8 W - 5 % 250 ppm/°C	Vishay
R25	62 KΩ	0805	SMD standard film RES - 1/8 W - 5 % 200 ppm/°C	Vishay
R26	3.9 KΩ	0805	SMD standard film RES - 1/8 W - 5 % 250 ppm/°C	Vishay
R27	N.M.	0805	Not mounted	
R28	N.M.	0805	Not mounted	
R29	N.M.	1206	Not mounted	

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Ref.	Value	Case	Description	Supplier
R30	N.M.	1206	Not mounted	
R31	0.15 Ω	PTH	RSMF1TB - metal film RES - 1 W - 2 % 200 ppm/°C	
R32	110 KΩ	0805	SMD standard film RES - 1/8 W - 5 % 250 ppm/°C	Vishay
R33	39 KΩ	0805	SMD standard film RES - 1/8 W - 5 % 250 ppm/°C	Vishay
R39	4.7 KΩ	0805	SMD standard film RES - 1/8 W - 5 % 250 ppm/°C	Vishay
R40	N.M.	0805	Not mounted	
R42	2.7 KΩ	0805	SMD standard film RES - 1/8 W - 5 % 250 ppm/°C	Vishay
R44	100 KΩ	0805	SMD standard film RES - 1/8 W - 1 % 100 ppm/°C	Vishay
R45	100 KΩ	0805	SMD standard film RES - 1/8 W - 1 % 100 ppm/°C	Vishay
R46	330 KΩ	0805	SMD standard film RES - 1/8 W - 5 % 250 ppm/°C	Vishay
R50	5.6 KΩ	0805	SMD standard film RES - 1/8 W - 1 % 100 ppm/°C	Vishay
R51	2.2 KΩ	0805	SMD standard film RES - 1/8 W - 1 % 100 ppm/°C	Vishay
R52	N.M.	0805	Not mounted	
R101	2.2 MΩ	1206	SMD standard film RES - 1/4 W - 1 % 100 ppm/°C	Vishay
R102	2.2 MΩ	1206	SMD standard film RES - 1/4 W - 1 % 100 ppm/°C	Vishay
R103	2.2 MΩ	1206	SMD standard film RES - 1/4 W - 1 % 100 ppm/°C	Vishay
R104	56 KΩ	1/4 W	PTH standard film res. - 1/4 W - 5% 250 ppm/°C	Vishay
R105	3.9 KΩ	1206	SMD standard film RES - 1/4 W - 5 % 200 ppm/°C	Vishay
R106	3.9 KΩ	1206	SMD standard film RES - 1/4 W - 5 % 200 ppm/°C	Vishay
R107	1.0 KΩ	0805	SMD standard film RES - 1/8 W - 5 % 200 ppm/°C	Vishay
R108	160 KΩ	0805	SMD standard film RES - 1/8 W - 1 % 100 ppm/°C	Vishay
R109	56 KΩ	0805	SMD standard film RES - 1/8 W - 1 % 100 ppm/°C	Vishay

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Ref.	Value	Case	Description	Supplier
R110	N.M.	0805	Not mounted	
R111	1.0 KΩ	0805	SMD standard film RES - 1/8 W - 5 % 200 ppm/°C	Vishay
R112	10 KΩ	0805	SMD standard film RES - 1/8 W - 5 % 200 ppm/°C	Vishay
R113	25 KΩ	0805	SMD standard film RES - 1/8 W - 1 % 100 ppm/°C	Vishay
R114	10 Ω	1206	SMD standard film RES - 1/4 W - 5 % 250 ppm/°C	Vishay
R115	4.7 KΩ	0805	SMD standard film RES - 1/8 W - 5 % 200 ppm/°C	Vishay
R116	3.0 KΩ	0805	SMD standard film RES - 1/8 W - 1 % 100 ppm/°C	Vishay
R117	270 Ω	0805	SMD standard film RES - 1/8 W - 5 % 250 ppm/°C	Vishay
R118	68 Ω	0805	SMD standard film RES - 1/8 W - 1 % 100 ppm/°C	Vishay
R119	300 Ω	0805	SMD standard film RES - 1/8 W - 5 % 250 ppm/°C	Vishay
R120	1.2 KΩ	0805	SMD standard film RES - 1/8 W - 1 % 100 ppm/°C	Vishay
R121	3.6 KΩ	0805	SMD standard film RES - 1/8 W - 1 % 100 ppm/°C	Vishay
R122	56 KΩ	0805	SMD standard film RES - 1/8 W - 1 % 100 ppm/°C	Vishay
R123	N.M.	0805	Not mounted	
R124	47 Ω	0805	SMD standard film RES - 1/8 W - 5 % 250 ppm/°C	Vishay
R201	1.0 KΩ	0805	SMD standard film RES - 1/8 W - 1 % 100 ppm/°C	Vishay
R202	22 Ω	0805	SMD standard film RES - 1/8 W - 5 % 250 ppm/°C	Vishay
R203	10 KΩ	0805	SMD standard film RES - 1/8 W - 1 % 100 ppm/°C	Vishay
R204	100 Ω	0805	SMD standard film RES - 1/8 W - 5 % 250 ppm/°C	Vishay
R205	27 KΩ	0805	SMD standard film RES - 1/8 W - 5 % 250 ppm/°C	Vishay
R206	N.M	0805	Not mounted	
R207	27 KΩ	0805	SMD standard film RES - 1/8 W - 1 % 100 ppm/°C	Vishay

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Ref.	Value	Case	Description	Supplier
R208	180 KΩ	0805	SMD standard film RES - 1/8 W - 1 % 100 ppm/°C	Vishay
R209	18 KΩ	0805	SMD standard film RES - 1/8 W - 1 % 100 ppm/°C	Vishay
R210	20 KΩ	0805	SMD standard film RES - 1/8 W - 1 % 100 ppm/°C	Vishay
R211	N.M	0805	Not mounted	
R212	620 KΩ	0805	SMD standard film RES - 1/8 W - 1 % 100 ppm/°C	Vishay
R213	0.0 Ω	0805	SMD standard film RES - 1/8 W - 5 % 200 ppm/°C	Vishay
R214	0.0 Ω	0805	SMD standard film RES - 1/8 W - 5 % 200 ppm/°C	Vishay
R215	12 KΩ	0805	SMD standard film RES - 1/8 W - 1 % 100 ppm/°C	Vishay
R216	12 KΩ	0805	SMD standard film RES - 1/8 W - 1 % 100 ppm/°C	Vishay
R217	200 KΩ	0805	SMD standard film RES - 1/8 W - 1 % 100 ppm/°C	Vishay
R218	1.0 KΩ	0805	SMD standard film RES - 1/8 W - 1 % 100 ppm/°C	Vishay
R325	180 KΩ	1206	SMD standard film RES - 1/8 W - 5 % 250 ppm/°C	Vishay
RV1	300 Vac	diam. 15 x 5 p. 7.5 mm	300V METAL OXIDE VARISTOR - B72214S0301K101	Epcos
T1	1860.0152	DWG	Resonant transformer	Magnetica
U1	TLVH431AIL3T	SOT23-3L	1.24 V programmable shunt voltage reference	STMicroelectronics
U2	SFH617A-2	DIP-4 - 10.16 mm	Optocoupler	Vishay
U3	SFH617A-2	DIP-4 - 10.16 mm	Optocoupler	Vishay
U6	TLVH431AIL3T	SOT23-3L	1.24 V programmable shunt voltage reference	STMicroelectronics
U101	STCMB1	SO20W	TM PFC & LLC resonant Combo controller	STMicroelectronics
U201	LM258AD	SO-8	Low power dual OP AMP	STMicroelectronics
U202	LM258AD	SO-8	Low power dual OP AMP	STMicroelectronics
Z1	PCB REV. 2.0		STCMB1 power board	
Z101	PCB REV. 1.0		STCMB1 daughterboard	
Z201	PCB REV. 1.0		CC control board	

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Revision history

Table 2. **Document revision history**

Date	Version	Changes
04-Oct-2017	1	Initial release.
29-Mar-2019	2	Features and description update.
26-Feb-2020	3	Updated THD value in Section feature and description

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