

## 200 W LED driver using the STNRG012



*EVL012LED: 200W Wide input range LED driver*

### Features

- Universal input main range: 90...277 VAC - frequency 45 ÷ 65 Hz
- Maximum output power: 200 W
- Constant current output: 3.6 A max.
- Output voltage range: 36 ÷ 56 Vdc
- Mains harmonics: according to EN61000-3-2 Class-C, JEITA-MITI Class-C
- No load mains consumption: < 0.5 W
- Auxiliary stage: No
- Efficiency: > 93% at full load
- THD: < 7.5% at 230 VAC from 30% to 100% of full load
- Conducted EMC: according to EN55022-class-B limits
- Safety: according to EN60950
- Dimensions: 210x55x15 mm, (L x W x H)
- PCB: dual layer, 35 µm, FR-4, mixed PTH/SMT
- Dimming: analog from 100% to less than 10% with:
  - 100 k ohm potentiometer or:
  - 0 -10 V external voltage
- Feedback loops: constant current and constant voltage
- Protections: input brown-in/out, PFC saturation and PFC OVP LLC capacitive mode, OCP LED output overload and short-circuit, LED string open, feedback disconnections

### Application

- TV LED
- Street and outdoor lighting
- Industrial and home lighting

### Description

The **EVL012LED** is an LED driver board. This architecture is based on a two-stage approach: a front-end PFC preregulator and a downstream resonant half-bridge converter, using the new STNRG012 IC that embeds the controllers of both sections in the same device. Thanks to the STNRG012, the main features of this design are high efficiency, low power consumption at no load without an auxiliary supply, good power factor with low harmonic content, and reduced part count. The board also has a full set of protection features including output overload, short-circuit, and overvoltage; all of which can be easily defined as latched or auto-restart, simply changing a value in the non-volatile memory of the controller.

#### Product status link

[EVL012LED](#)

#### Product summary

Order code

**EVL012LED**

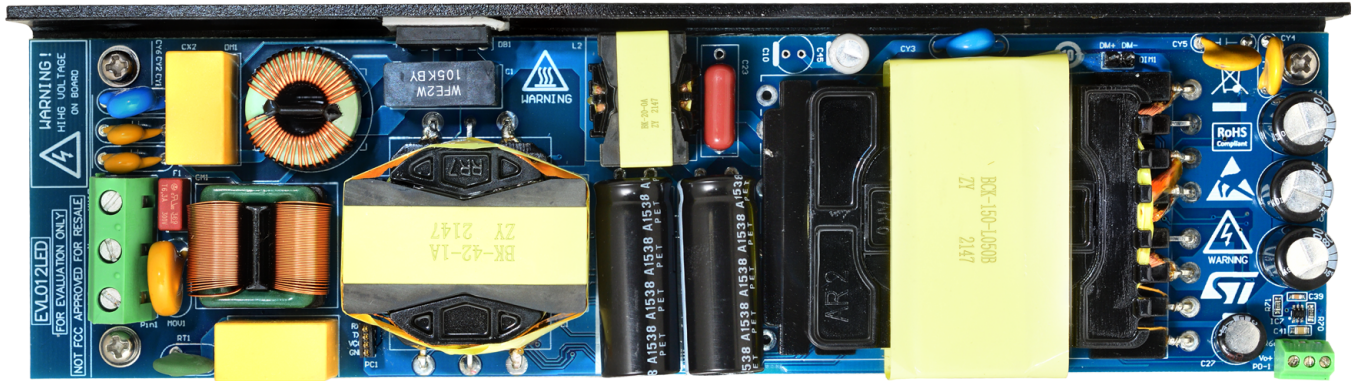
#### Product label



# 1 Schematic diagram and bill of material

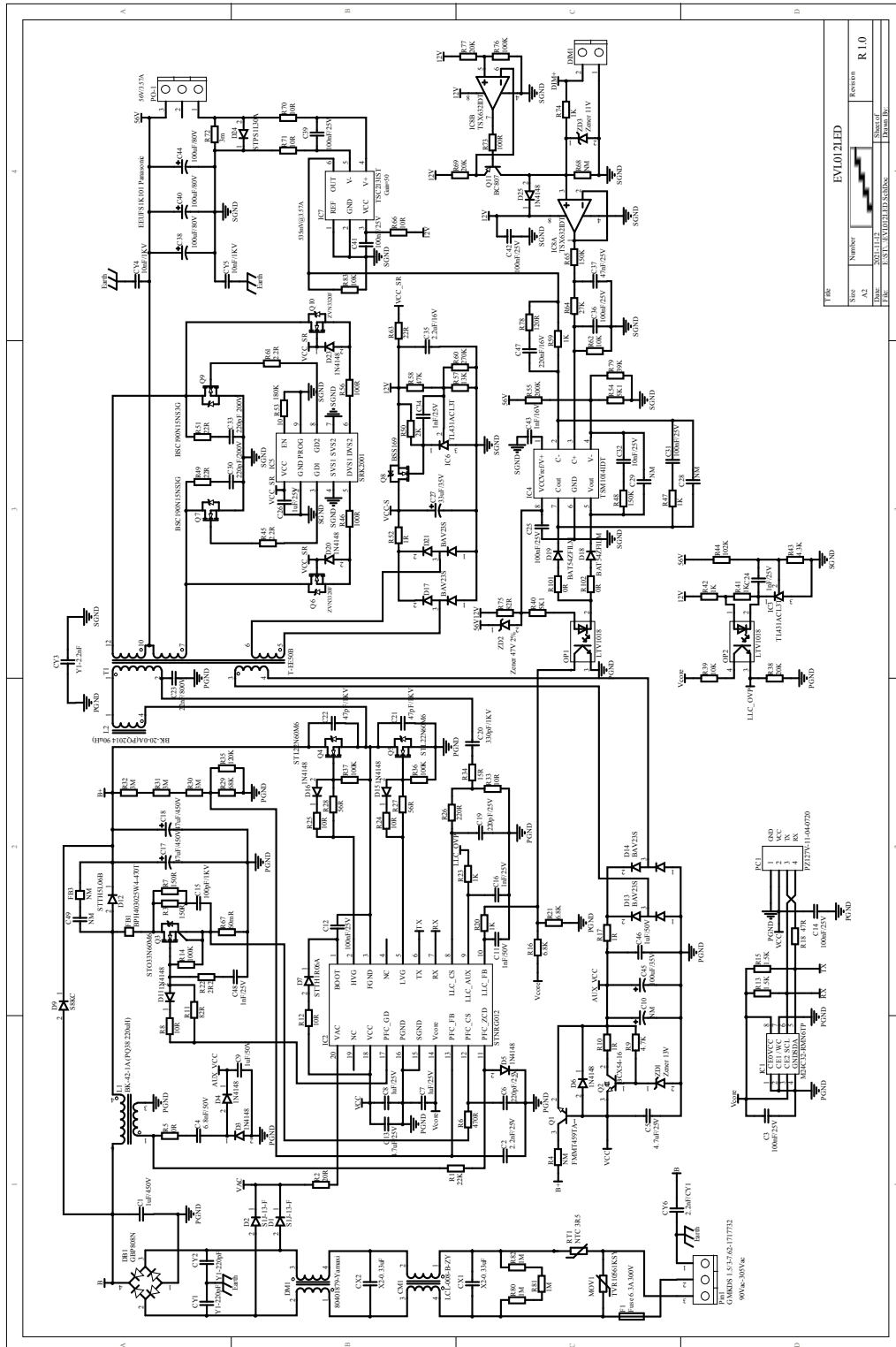
## 1.1 EVL012LED board

Figure 1. EVL012LED board



## 1.2 Schematic diagram

Figure 2. Schematic diagram



### 1.3 Bill of material

**Table 1. Bill of material**

Part nbr/Part value	Designator	Description	Supplier	Package
1uF/450V	C1	Film capacitor	Panasonic	C-BOX-7*18
2.2nF/25V 0603	C2	Ceramic capacitor		C0603
100nF/25V 0603	C3, C14, C25, C31, C36, C39, C42	Ceramic capacitor		C0603
6.8nF/50V 0805	C4	Ceramic capacitor		C0805
4.7uF/25V 0805	C5	Ceramic capacitor		C0805
220pF/25V 0603	C6, C19	Ceramic capacitor		C0603
1uF/25V 0603	C7, C8, C26	Ceramic capacitor		C0603
1uF/50V 0805	C9	Ceramic capacitor		C0805
NM	C10			
1nF/50V 0603	C11	Ceramic capacitor		C0603
100nF/25V 0805	C12, C41	Ceramic capacitor		C0805
4.7uF/25V 0603	C13	Ceramic capacitor		C0603
100pF/1KV 1206	C15	Ceramic capacitor	Yageo	C1206
47uF/450V	C17, C18	Aluminum electrolytic capacitor	Rubycon	2 pins radial (5 mm pitch)
330pF/1KV 1206	C20	Ceramic capacitor	Yageo	C1206
47pF/1KV 1206	C21, C22	Ceramic capacitor	Yageo	C1206
22nF/800V	C23	Film capacitor	Panasonic	2 pins radial (11.5 mm patch)
1nF/25V 0603	C16, C24, C34, C48	Ceramic capacitor		C0603
33uF/35V	C27	Aluminum electrolytic capacitor	Panasonic	2 pins radial (3.5 mm pitch)
NM	C28, C29			
220pF/200V 1206	C30, C33	Ceramic capacitor		C1206
10nF/25V 0603	C32	Ceramic capacitor		C0603
2.2uF/16V 0603	C35	Ceramic capacitor		C0603
47nF/25V 0603	C37	Ceramic capacitor		C0603
100uF/80V	C38, C40, C44	Aluminum electrolytic capacitor	Panasonic	2 pins radial (5mm pitch)
1nF/16V 0603	C43	Ceramic capacitor		C0603
100uF/35V	C45	Aluminum electrolytic capacitor	Panasonic	2 pins radial (2.5 mm pitch)
1uF/50V 0805	C46	Ceramic capacitor		C0805
220nF/16V 0603	C47	Ceramic capacitor		C0603
NM	C49			
LCL-008-B-ZY	CM1	CM choke	Zhengyi	
X2-0.33uF 275VAC	CX1, CX2	X2 capacitor	Champion	2 pins radial (15 mm pitch)
Y1 P=10mm 220pF ±10%	CY1, CY2	Y1 capacitor	Dersonic	2 pins radial (10 mm pitch)
Y1 P=10mm 2.2nF ±10%	CY3, CY6	Y1 capacitor	Dersonic	2 pins radial (10 mm pitch)

Part nbr/Part value	Designator	Description	Supplier	Package
10nF/1KV	CY4, CY5	Y3 capacitor	Fenghua	2 pins radial (7.5 mm pitch)
S1J-13-F SMA	D1, D2	Diode	Diodes	SMA
1N4148 SOD-123	D3, D4, D5, D6, D11, D15, D16, D20, D23, D25	Fast diode		SOD-123
STTH1R06A SMA	D7	Fast diode	ST	SMA
S8KC SMC	D9	Diode	Diodes	SMC
STTH5L06B DPAK	D12	Fast diode	ST	DPAK
BAV23S SOT-23	D13, D14, D17, D21	Fast diode	Nexperia	SOT-23
BAT54ZFILM SOD-123	D18, D19	Schottky diode	ST	SOD-123
STPS1L30A SMA	D24	Schottky diode	ST	SMA
GBP808N	DB1	Rectifier bridge	LITEON	4 pins (3.8 mm pitch)
2 pins (p=2.54mm)	DIM1	Connector	Harwin Inc.	4 pins radial (2.54 mm pitch)
80401879-Yamaxi	DM1	DM choke	Yamaxi	
Fuse 6.3A 300V	F1	Fuse	Littelfuse	2 pins radial (5.08 mm pitch)
BPH403025W4-470T	FB1	Ferrite bead	TAI-TECH	SMD,4x3.1x2.5mm
NM	FB3			
M24C32-RMN6TP	IC1	EEPROM	ST	SO-8
STNRG012 SO20	IC2	PFC & LLC comb		SO20
TL431ACL3T	IC3, IC6	IC	ST	SOT-23
TSM1014IDT	IC4	IC	ST	SO-8
SRK2001	IC5	SR controller	ST	SSOP10
TSC213ICT	IC7	Amplifier	ST	SC70-6
TSX632IDT	IC8A, IC8B	Amplifier	ST	MiniSO-8
BK-42-1A (PQ38 220uH)	L1	PDC inductor	Zhengyi	
BK-20-0A(PQ2014 90uH)	L2	LLC inductor	Zhengyi	
TVR10561KSY	MOV1	Varistor (voltage-sensitive resistor)	Thinking	2 pin radial
LTV1018	OP1, OP2	Optocoupler	Liten	LTV-10XX-G series
PZ127V-11-04-0720	PC1	Connector	Harwin Inc.	4 pins radial (1.27 mm pitch)
			Samtec Inc.	4 pins radial (1.27 mm pitch)
GMKDS 1.5/3-7.62-1717732	Pin1	Connector	Phoenix	3 pins radial (7.62 mm pitch)
	PO-1	Connector	Phoenix	3 pins radial (2.54 mm pitch)
NM	Q1	NPN BJT		
BCX54-16 SOT89	Q2	NPN BJT	Nexperia	SOT89
STO33N60M6	Q3	N-Channel power MOSFET	ST	TOLL
STL22N60M6	Q4, Q5	N-Channel power MOSFET	ST	PowerFLAT™ 5x6 HV

Part nbr/Part value	Designator	Description	Supplier	Package
ZVN3320F SOT-23	Q6, Q10	N-Channel power MOSFET	Diodes	SOT-23
BSC190N15NS3G	Q7, Q9	N-Channel power MOSFET	Infineon	PowerFLAT™ 5x6
BSS169	Q8	N-Channel power MOSFET	Infineon	SOT-23
BC807 SOT-23	Q11	PNP BJT	Nexperia	SOT-23
22K 0603 ±1%	R1	Resistor		R0603
20R 1206 ±1%	R2	Resistor		R1206
150R 1206 ±1%	R3, R7	Resistor		R1206
1R 1206 ±1%	R17, R52	Resistor		R1206
0R 1206 ±1%	R5	Resistor		R1206
470R 0603 ±1%	R6	Resistor		R0603
10R 0805 ±1%	R8, R12, R24, R25	Resistor		R0805
4.7K 0603 ±1%	R9	Resistor		R0603
1R 0603 ±1%	R10	Resistor		R0603
82R 0805 ±1%	R11	Resistor		R0805
1.5K 0603 ±1%	R13, R15	Resistor		R0603
100K 0603 ±1%	R14, R36, R37, R76	Resistor		R0603
6.8K 0603 ±1%	R16, R21	Resistor		R0603
47R 0603 ±1%	R18	Resistor		R0603
1K 0603 ±1%	R20, R23, R41, R42, R47, R59, R74	Resistor		R0603
2R2 0603 ±1%	R22	Resistor		R0603
220R 0603 ±1%	R26	Resistor		R0603
56R 0805 ±1%	R27, R28	Resistor		R0805
68K 0603 ±1%	R29	Resistor		R0603
3M 1206 ±1%	R30, R31, R32	Resistor		R1206
10R 0603 ±1%	R33, R66, R70, R71	Resistor		R0603
15R 0603 ±1%	R34	Resistor		R0603
120K 0603 ±1%	R35	Resistor		R0603
20K 0603 ±1%	R38, R69, R77	Resistor		R0603
10K 0603 ±1%	R39, R62, R83	Resistor		R0603
5K1 0603 ±1%	R40, R54	Resistor		R0603
4.3K 0603 ±1%	R43	Resistor		R0603
102K 0603 ±1%	R44	Resistor		R0603
2.2R 0805 ±1%	R45, R61	Resistor		R0805
100R 0603 ±1%	R46, R56, R73	Resistor		R0603
150K 0603 ±1%	R48, R65	Resistor		R0603
22R 1206 ±1%	R49, R51	Resistor		R1206
2K 0603 ±1%	R50	Resistor		R0603
180K 0603 ±1%	R53	Resistor		R0603

Part nbr/Part value	Designator	Description	Supplier	Package
200K 0805 ±1%	R55	Resistor		R0805
13K 0603 ±1%	R57	Resistor		R0603
47K 0603 ±1%	R58	Resistor		R0603
270K 0603 ±1%	R60	Resistor		R0603
22R 0603 ±1%	R63	Resistor		R0603
27K 0603 ±1%	R64	Resistor		R0603
60mR 2512 ±1%	R67	Resistor		R2512
NM	R4,R68	Resistor		R0603
3m 2512 ±1%	R72	Resistor		R2512
82R 0603 ±1%	R75	Resistor		R0603
120R 0603 ±1%	R78	Resistor		R0603
39K 0603 ±1%	R79	Resistor		R0603
1M 1206 ±1%	R80, R81, R82	Resistor		R1206
0R 0603 ±1%	R101, R102	Resistor		R0603
NTC SCK10035MSY	RT1	NTC resistor	Thinking	2 pins radial (5 mm pitch)
T-EE50B	T1	Transformer	Zhengyi	
Zener 13V ±2% SOD-123	ZD1	Zener	Nexperia	SOD-123
Zener 47V ±2% SOD-123	ZD2	Zener	Nexperia	SOD-123
Zener 11V ±2% SOD-123	ZD3	Zener	Nexperia	SOD-123
		Aluminum shell		
210x80x0.25mm		MYLAR		
60x45x0.25mm		Thermally conductive insulator		
30x20x0.25mm	DB1	Thermally conductive insulator		
15x15x2mm	DB1, Q4, Q5	Thermally conductive gap pad		
15x15x0.8mm	Q3, D12	Thermally conductive gap pad		

## Revision history

**Table 2. Document revision history**

Date	Version	Changes
22-Feb-2022	1	Initial release.



## Contents

<b>1</b>	<b>Schematic diagram and bill of material</b> .....	<b>2</b>
1.1	EVL012LED board .....	2
1.2	Schematic diagram .....	3
1.3	Bill of material .....	4
	<b>Revision history</b> .....	<b>8</b>
	<b>Contents</b> .....	<b>9</b>
	<b>List of tables</b> .....	<b>10</b>
	<b>List of figures</b> .....	<b>11</b>

## List of tables

<b>Table 1.</b>	Bill of material . . . . .	4
<b>Table 2.</b>	Document revision history . . . . .	8

## List of figures

<b>Figure 1.</b>	EVL012LED board .....	2
<b>Figure 2.</b>	Schematic diagram .....	3

**IMPORTANT NOTICE – PLEASE READ CAREFULLY**

STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. For additional information about ST trademarks, please refer to [www.st.com/trademarks](http://www.st.com/trademarks). All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2022 STMicroelectronics – All rights reserved