

## 12 V - 150 W power supply based on the STNRG011A digital combo and SRK2001 adaptive synchronous rectifier controller



### Product status link

[EVL011A150ADP](#)

### Features

- Digital controller: STNRG011A
- TM PFC with resonant HB-LLC converter
- Input voltage range: 90 ÷ 264 Vac
- 12 V ± 5% CV output regulation
- Full-load power: 150 W continuous operation
- Peak power loading: 200 W
- Full-load and average efficiency: greater than 90% at 115/230 Vac
- Peak efficiency: greater than 93%
- No-load mains consumption: less than 75 mW
- Hold-up time: greater than 10 ms
- Full set of programmable parameters
- High flexibility thanks to the configurable NVM
- Black box functionality with the installed EEPROM

### Description

The EVL011A150ADP is a 12 V, 150 W power supply demonstration board for 90 Vac to 264 Vac mains, which is representative of an AC/DC converter for an all in one (AIO) computer or a general purpose high power adapter.

The design is based on the STNRG011A IC, a digital combo that controls a two-stage AC/DC SMPL. The front-end is a transition mode PFC pre-regulator and the second stage is an LLC HB resonant converter. The SRK2001 implements the synchronous rectification in order to obtain higher efficiency.

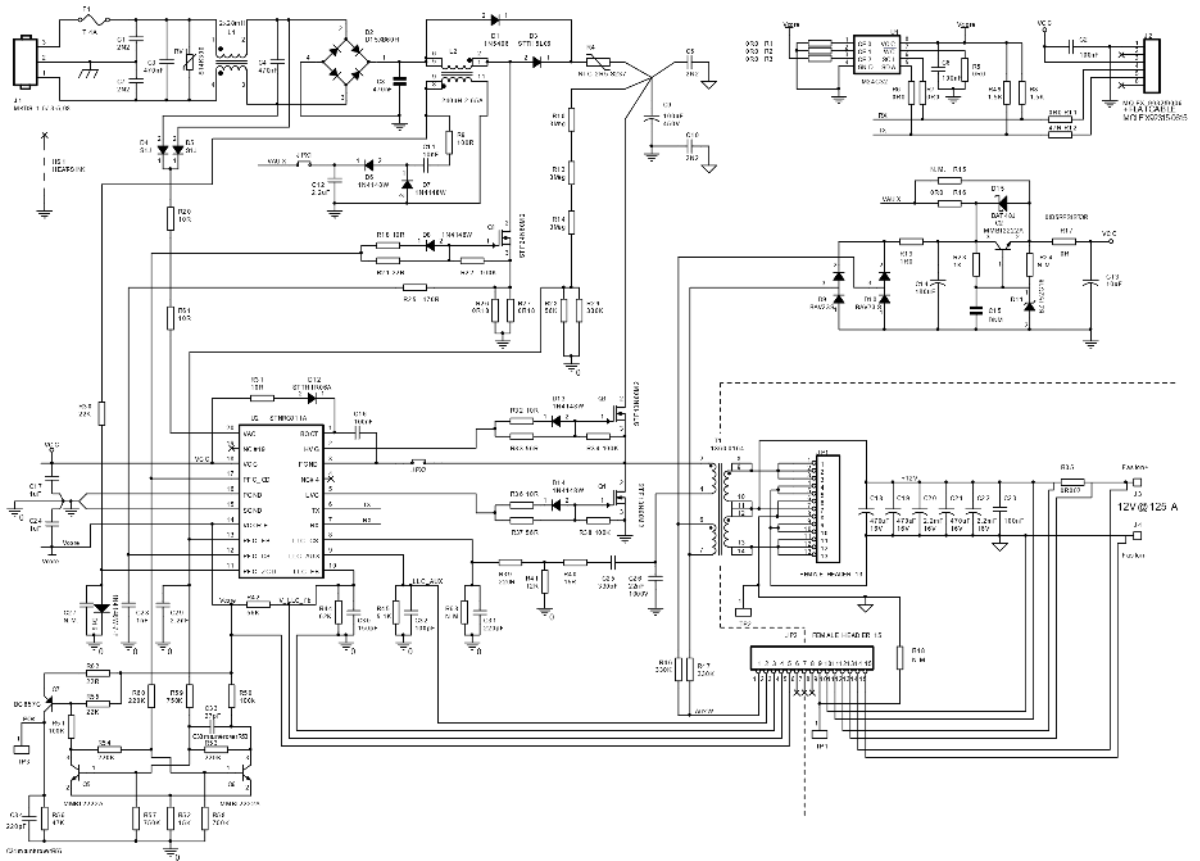
No auxiliary supply is needed due to the very low consumption at no-load.

A full set of auxiliary functions and protections is also provided; this allows to reduce the overall BOM while maintaining a rugged design.

The performance of the EVL011A150ADP can meet the requirements of major standards ENERGY STAR® for computers ver. 6.1, Eup Lot 6 Tier 2, European CoC ver. 5 Tier-2, in terms of efficiency, no-load input power and power factor and feature harmonics content well below the limits of European Standard EN61000-3-2 Class-D and Japanese standard JEITA-MITI Class-D regulations.

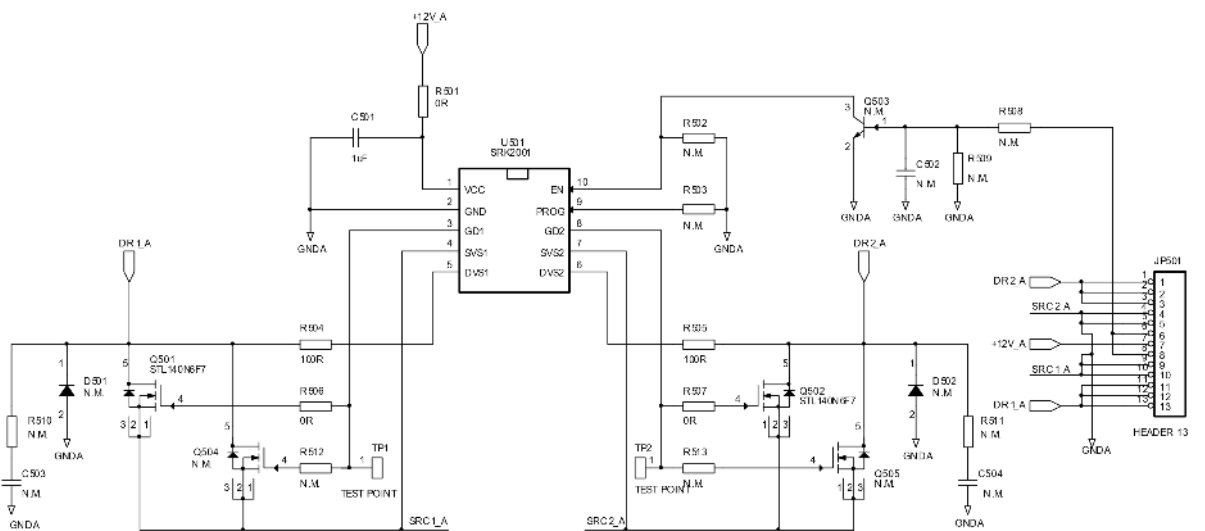
# 1 Electrical diagrams

**Figure 1. Motherboard electrical diagram**



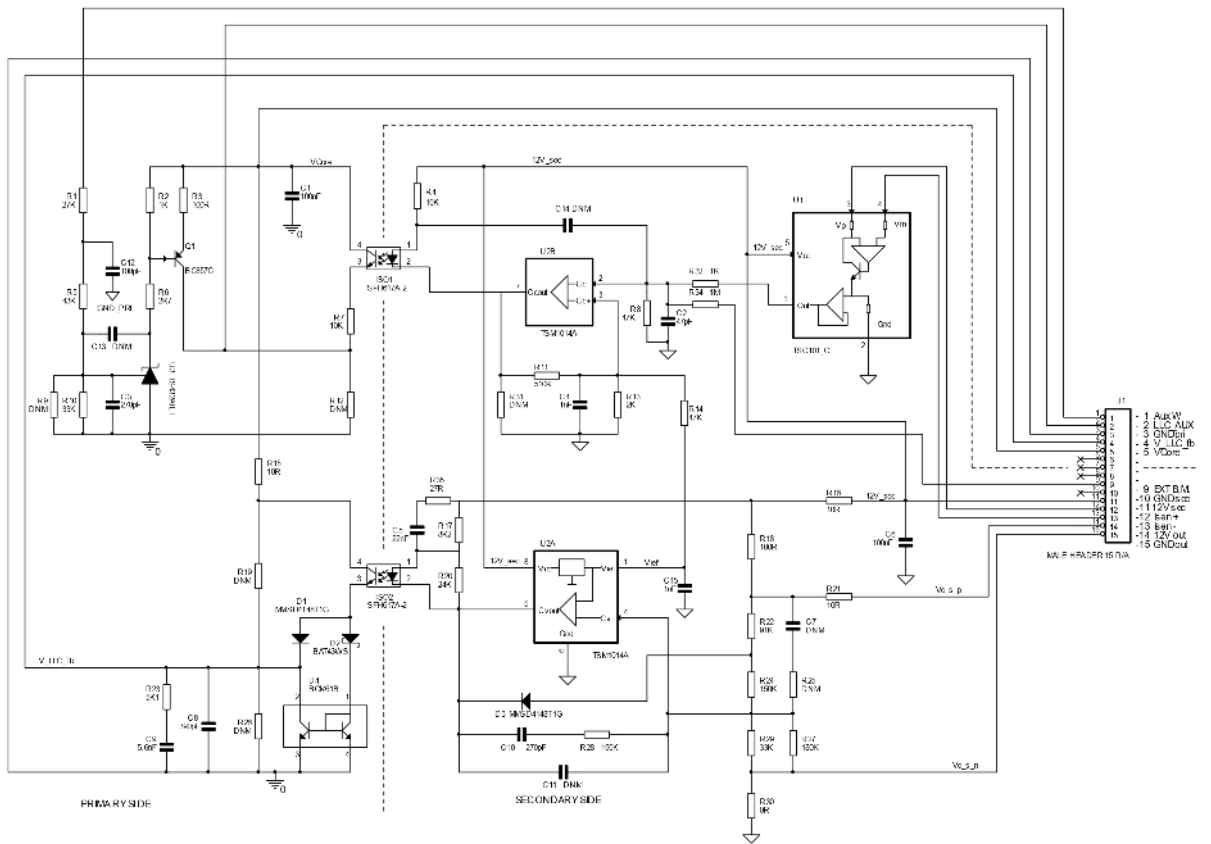
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**Figure 2. Feedback (control) board electrical diagram**



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**Figure 3. Synchronous rectification (SRK) board electrical diagram**



AM040232

## 2 Bill of materials

**Table 1. EVL011A150ADP motherboard bill of materials.**

Reference	Part number / part value	Description	Supplier	Case
C1, C5, C7, C10	2N2	Ceramic Y1 capacitor - 250Vac	Murata	p10mm
C2, C6, C23	100nF	SMD ceramic capacitor X7R	AVX	0805
C3, C4	470nF	Polypropylene X2 capacitor - 275Vac	EPCOS	9.0 × 18.0 p15mm
C8	470nF	Polypropylene film cap. - 630Vdc	EPCOS	Plastic Radial
C9	100uF	Electrolytic capacitor TXW - 450V	Rubycon	DIA 18 x 32 mm
C11	10nF	SMD ceramic capacitor X7R - 100V	AVX	1206
C12	2.2uF	SMD ceramic capacitor X7R	AVX	1206
C13	10uF	Electrolytic capacitor YXF	Rubycon	DIA 5.0 x 11 mm p2mm
C14	180uF	Electrolytic capacitor ZLH - 63V	Rubycon	DIA10 x 20 mm p5mm
C15	N.M.	SMD ceramic capacitor		1206
C16	100nF	SMD ceramic capacitor X7R	AVX	1206
C17	1uF	SMD ceramic capacitor X7R	AVX	1206
C18, C19, C21	470uF	Aluminium Polymer capacitor	Panasonic	DIA 10 x 13 mm p5mm
C20, C22	2.2mF	Elect Cap.	RUBYCON	Radial
C24	1uF	SMD ceramic capacitor X7R	AVX	0805
C25	330pF	Ceramic capacitor - 1kV	MURATA	1206
C26	22nF	Film capacitor - 1kV	EPCOS / TDK	CKR05
C27	N.M.	SMD ceramic capacitor X7R	AVX	0805
C28	1nF	SMD ceramic capacitor X7R	AVX	0805
C29	2.2nF	SMD ceramic capacitor X7R	AVX	0805
C30	150pF	SMD ceramic capacitor X7R	AVX	0805
C31	220pF	SMD ceramic capacitor X7R	AVX	0805
C32	100pF	SMD ceramic capacitor X7R	AVX	0805
C33 on R53	27pF	SMD ceramic capacitor X7R	AVX	0805
C34 on R56	220pF	SMD ceramic capacitor X7R	AVX	0805
D1	1N5406	General purpose rectifier	Vishay	DO201
D2	D15XB60H	Bridge rectifier	Shindengen	5S
D3	STTH5L06	Ultrafast diode	STMicroelectronics	DO201
D4, D5	S1J	Diode	Vishay	DO214AC-SMA
D6, D7, D8, D13, D14	1N4148W	SMD diode	Vishay	SOD123
D9, D10	BAV23S	Switching rectifier	Diodes Inc.	SOT23
D11	BZT52C16	SMD Zener diode	Diodes Inc.	SOD123
D12	STTH1R06A	Ultrafast rectifier	STMicroelectronics	DO214AC-SMA
D15	BAT48J	SMD Schottky diode SOD-323	STMicroelectronics	SOD323

Reference	Part number / part value	Description	Supplier	Case
D16	1N4148W-7-F	Fast switching rectifier	Diodes Inc.	SOD123
F1	T 4A	PCB fuse 4A time lag	Littelfuse	TE5
HS1	HEAT-SINK	HEAT SINK FOR D2, Q1, Q3, Q4		DWG
JPX1, JPX2	SHORTED	WIRE JUMPER		DWG
JP1	STRIP1X36PF	FEMALE HEADER 13 pin		p2.54mm
JP2	STRIP1X36PF	FEMALE HEADER 15 pin – pin 6,7,8 removed		p2.54mm
J1	MKDS 1,5/ 3-5,08	AC socket	Phoenix Contact	3P - p5mm
J2	MOLEX 90325-0006	Molex PicoFlex Connector 6P 1,27mm pitch	MOLEX	1.27mm pitch
J3	FASTBFH/A1/6,3	Faston .250 TAB PCB	KEYSTONE	DWG
J4	FASTBFH/A1/6,3	Faston .250 TAB PCB	KEYSTONE	DWG
L1	2x28mH	Input EMI filter	Magnetics	DWG
L2	240uH 2.65A	PFC INDUCTOR - Add Kapton to isolate Inductor from PCB	Magnetics	DWG
Q1	STF24N60M2	Power MOSFET	STMicroelectronics	TO220-FP
Q2, Q5, Q6	MMBT2222A	SMD NPN transistor		SOT23
Q3, Q4	STF13N60M2	Power MOSFET	STMicroelectronics	TO220-FP
Q7	BC857C	Trans. PNP general purpose	NXP	SOT23
RV1	S14K300	Metal oxide varistor	EPCOS	DIA.15x5 mm p7.5mm
R1, R2, R3, R5, R6, R7, R11, R16	0R0	SMD resistor	Vishay	0805
R4	NTC 2R5-S237	NTC resistor S237	EPCOS	DWG
R8, R49	1.5K	SMD resistor	Vishay	0805
R9	100R	SMD resistor 1/2W	Vishay	1206
R10, R13, R14	3M	SMD resistor	Vishay	1206
R12	47R	SMD resistor	Vishay	0805
R15, R24	N.M.	SMD resistor	Vishay	0805
R17	0R	SMD resistor	TTI	0805
R18, R32, R36	10R	SMD resistor	Vishay	0805
R19	1R0	SMD resistor	Vishay	1206
R20, R31, R61	10R	SMD resistor	Vishay	1206
R21, R62	22R	SMD resistor	Vishay	0805
R22, R34, R38, R50, R51	100K	SMD resistor	MultiComp	0805
R23	1K	SMD resistor	Vishay	0805
R25	470R	SMD resistor	Vishay	0805
R26, R27	0R18	SMD resistor	YAGEO (PHYCOMP)	2512
R28, R42	56K	SMD resistor	MultiComp	0805
R29	330K	SMD resistor	MultiComp	0805
R30, R55	22K	SMD resistor	Vishay	0805
R33, R37	56R	SMD resistor	Vishay	0805

Reference	Part number / part value	Description	Supplier	Case
R35	0R002	SMD resistor	YAGEO	2512
R39	220R	SMD resistor	Vishay	1206
R40	15R	SMD resistor	Vishay	0805
R41	12R	SMD resistor	MultiComp	0805
R44	62K	SMD resistor	MultiComp	0805
R45	5K1	SMD resistor	MultiComp	0805
R46, R47	330K	SMD resistor		1206
R48	N.M.	SMD resistor	Vishay	0805
R52	15K	SMD resistor	MultiComp	0805
R53, R54, R60	220K	SMD resistor	Multicomp	0805
R56	47K	SMD resistor	MultiComp	0805
R57, R58, R59	750K	SMD resistor	MultiComp	0805
TP1, TP2, TP3	TEST POINT	Testpoint		
T1	1860.0164	LLC transformer	Magnetics	ETD34
U1	M24C32	32-Kbit I <sup>2</sup> C 1MHz EEPROM	STMicroelectronics	SO8
U2	STNRG011A	Digital combo controller	STMicroelectronics	SO20

**Table 2. EVL011A150ADP daughter-(control)-board bill of materials.**

Reference	Part number / part value	Description	Supplier	Case
C1, C6	100nF	SMD ceramic capacitor X7R	SCI	0603
C2	47pF	SMD ceramic capacitor C0G/NP0	SCI	0603
C3, C10	270pF	SMD ceramic capacitor X7R	SCI	0603
C4, C15	1nF	SMD ceramic capacitor X7R	SCI	0603
C5	22nF	SMD ceramic capacitor X7R	SCI	0603
C7, C11, C13	N.M.	SMD ceramic capacitor		0805
C8	390pF	SMD ceramic capacitor C0G/NP0	SCI	0603
C9	5.6nF	SMD ceramic capacitor C0G/NP0	SCI	0805
C12	100pF	SMD ceramic capacitor C0G/NP0	SCI	0603
C14	N.M.	SMD ceramic capacitor	SCI	0603
D1, D3	MMSD4148T1G	Switching rectifier	SCI	SOD123
D2	BAT43WS	Schottky rectifier	SCI	SOD323
ISO1, ISO2	SFH617A-2	Optocoupler	Vishay	DIP4
J1	MALE HEADER 15 R/A	Strip male 15 Pin, 90° - pin 6,7,8,9,10 removed	SCI	p2.54mm
Q1	BC857C	Trans. PNP general purpose	SCI	SOT23
R1	27K	SMD resistor	SCI	0805
R2	1K	SMD resistor	SCI	0805
R3, R18	100R	SMD resistor	SCI	0603
R4, R7	10K	SMD resistor	SCI	0603
R5	43K	SMD resistor		0603

Reference	Part number / part value	Description	Supplier	Case
R6	2K7	SMD resistor	SCI	0805
R8, R14	47K	SMD resistor	SCI	0603
R9, R19, R25, R26	N.M.	SMD resistor		0805
R10	33K	SMD resistor	SCI	0805
R11	510K	SMD resistor	SCI	0805
R12	N.M.	SMD resistor		0603
R13	2K	SMD resistor	SCI	0603
R15, R16, R21	10R	SMD resistor	SCI	0603
R17	8K2	SMD resistor	SCI	0603
R20	24K	SMD resistor	SCI	0805
R22	91K	SMD resistor	SCI	0603
R23	5K1	SMD resistor	SCI	0603
R24, R28	150K	SMD resistor	SCI	0603
R27	180K	SMD resistor	SCI	0805
R29	33K	SMD resistor	SCI	0603
R30	0R	SMD resistor	SCI	0603
R31	N.M.	SMD resistor		0603
R32	1K	SMD resistor	SCI	0603
R34	1M	SMD resistor	SCI	0603
R35	27R	SMD resistor	SCI	0603
U1	TSC101_C	High side current sense amplifier	STMicroelectronics	SOT23-5
U2	TSM1014A	Voltage and current controller	STMicroelectronics	SO8
U3	TS432AILT	Vol. Reg.	STMicroelectronics	SOT23
U4	BCM61B	Bipolar rectifier	SCI	SOT143-B

**Table 3. EVL011A150ADP synchronous rectifier (SRK) board bill of materials.**

Reference	Part number / part value	Description	Supplier	Case
C501	1uF	SMD ceramic capacitor X7R	SCI	0805
C502	N.M.	SMD ceramic capacitor X7R		0805
C503, C504	N.M.	SMD ceramic capacitor X7R		0805
D501, D502	N.M.	SMD Transil		0805
JP501	STRIP36PMDD90	Strip male 13 Pin, 90°	SCI	p2.54mm
Q501, Q502	STL140N6F7	Power MOSFET	STMicroelectronics	PoweFLAT 5x6
Q503	N.M.	SMD NPN transistor		SOT-23
Q504, Q505	N.M.	Power MOSFET		PoweFLAT 5x6
R501, R506, R507	0R	SMD resistor	SCI	0805
R504, R505	100R	SMD resistor	SCI	0805
R508, R509	N.M.	SMD resistor		0805
R502	N.M.	SMD resistor		0805
R503	N.M.	SMD resistor		0805

Reference	Part number / part value	Description	Supplier	Case
R510, R511, R512, R513	N.M.	SMD resistor		0805
U501	SRK2001	SR controller	STMicroelectronics	SSOP10



## Revision history

**Table 4. Document revision history**

Date	Version	Changes
01-Aug-2022	1	Initial release.

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