

50 W converter using HVLED101 quasi-resonant HPF flyback controller with secondary side regulation



Product status link

[EVLHV101SSR50W](#)

Features

- Input voltage: V_{in} : 90 - 265 Vrms, f: 45-66 Hz
- Output voltage 60 V / 833 mA
- High power factor, low THD
- Efficiency > 50% in stand-by ($P_{out} = 240$ mW)
- 4 points (25%, 50%, 75%, 100% load) average efficiency > 91%
- Frequency foldback with valley locking for noise-free operation
- $T_{AMB-MAX} = 60$ °C
- Open load voltage limiting (< 65V)
- Short-circuit protection with auto restart
- NTC overtemperature protection for switching MOSFET
- Safety: Acc. to EN60065
- EMI: Acc. to EN55022 – conducted emissions
- RoHS compliant

Description

The [EVLHV101SSR50W](#) is intended to provide a stable and insulated 60 V voltage for a maximum power of 50W.

It can be used as a standalone power supply or as a front end stage in a dimmable (or non-dimmable) off line LED driver.

A very high power factor, low THD and low BOM cost are obtained from this demonstration board thanks to the features of the HVLED101, which adopts frequency foldback with valley locking operation to reduce the switching losses and minimize acoustic noise.

Extremely low input power is obtained at no-load.

Input voltage variations, excessive input voltage (overvoltage like surges or bursts) and insufficient input voltage are managed by the HVLED101 protections, which improve the reliability of the application.

Output short-circuit and overload protection with auto restart behavior is implemented.

1 Components placement

Figure 1. EVLHV101SSR50W – top components placement

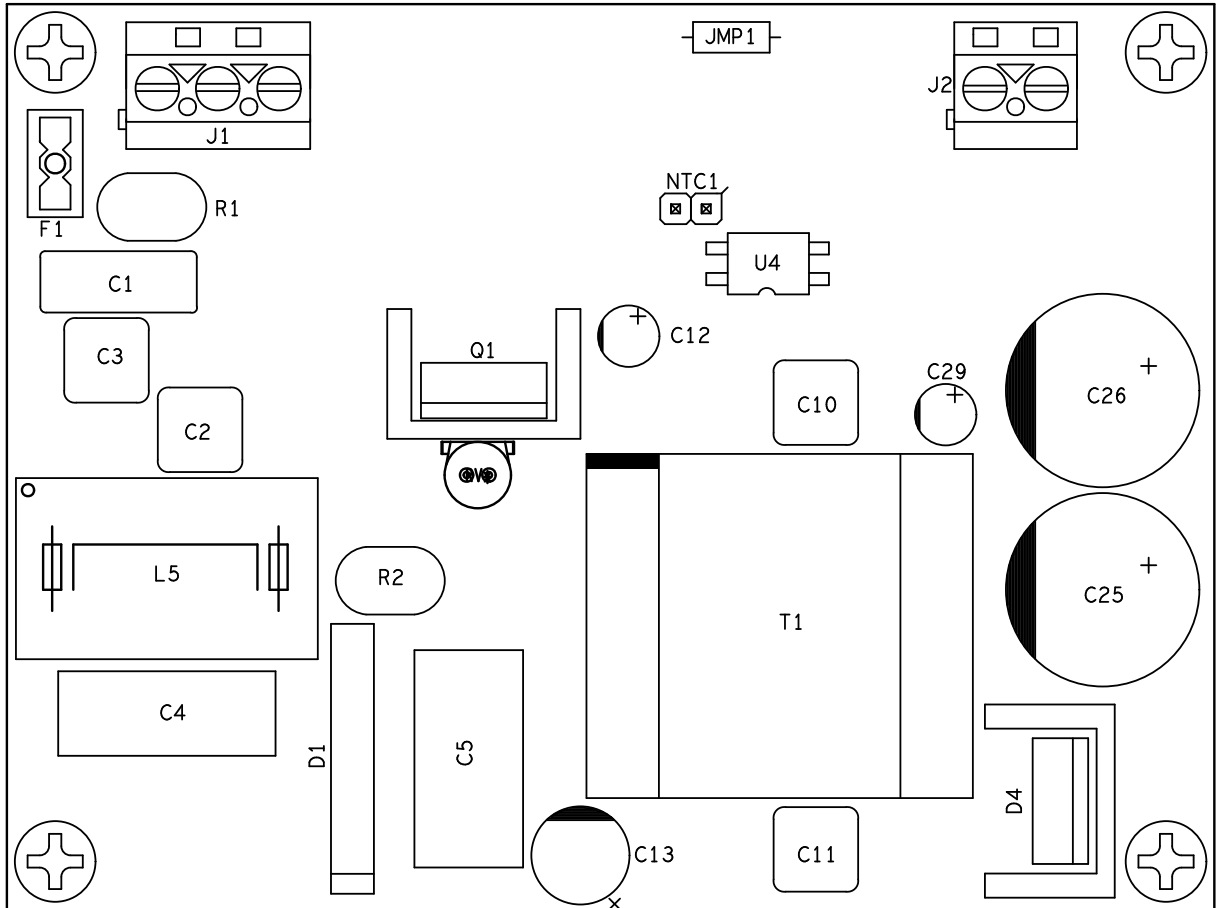
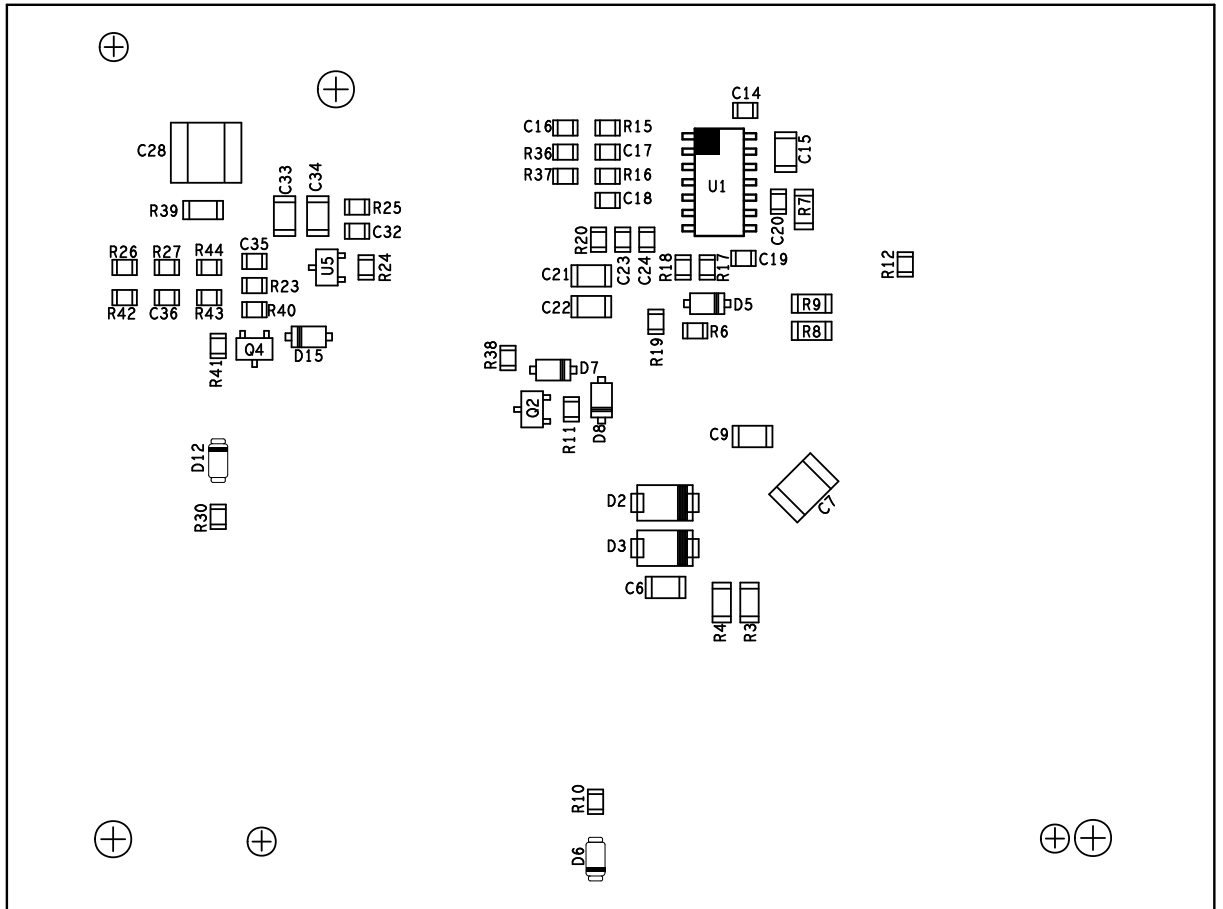


Figure 2. EVLHV101SSR50W – bottom components placement



2 Connector map

Figure 3. Connector map

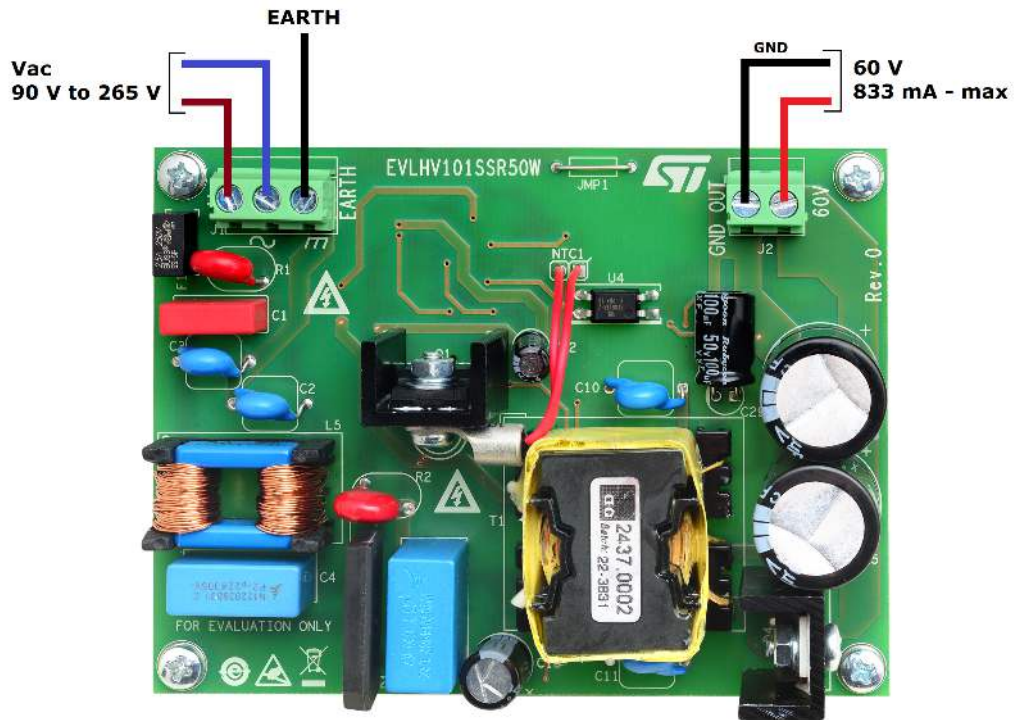


Table 1. Connector map

| Ref. | Pin # | Name | Type | Description |
|------|-------|-------|--------|--|
| J1 | 1 | Vac | Input | First connection to AC mains – Warning high voltage |
| | 2 | Vac | Input | Second connection to AC mains – Warning high voltage |
| | 3 | EARTH | Input | Earth connection |
| J2 | 1 | GND | Output | Ground |
| | 2 | 60V | Output | 60V output (isolated) |

4 Bill of material

Table 2. Bill of material

| Item | Q.ty | Ref. Des. | Value - Rating | Description | Manufacturer | Part Number |
|------|------|-----------|----------------|--|---------------------|-------------------|
| 1 | 1 | C1 | 47n - 305VAC | X2 film capacitor 305VAC (MKP) | Wurth | 890334023015CS |
| 2 | 2 | C2,C3 | 1n5 | X1-Y2 ceramic capacitor 440-300VAC CS series | TDK | CS75ZU2GA152MANKA |
| 3 | 1 | C4 | 220n - 305VAC | X2 film capacitor 305VAC (MKP) | TDK | B32922C3224K |
| 4 | 1 | C5 | 330n | Polypropylene film capacitor 630VDC-310VAC | TDK | B32672Z6334K000 |
| 5 | 1 | C6 | 2n2-1kV | Multilayer ceramic capacitor X7R 1kV | AVX | 1206AC222KAT1A |
| 6 | 1 | C7 | 10n-1kV | Multilayer ceramic capacitor X7R 1kV | AVX | 1812AC103KAT1A |
| 7 | 1 | C9 | 100p-1kV | Multilayer ceramic capacitor C0G 1kV | AVX | 1206AA101JAT1A |
| 8 | 2 | C10,C11 | 1n5 - 400VAC | X1-Y1 ceramic capacitor 440-400VAC CD series | TDK | CD45-E2GA152M-NKA |
| 9 | 1 | C12 | 33uF-25V | Aluminium ELCAP - 105°C | Rubycon | 25YXF33M5X11 |
| 10 | 1 | C13 | 22uF-100V | Aluminium ELCAP - YXF series - 105°C | Rubycon | 100YXF22M8X11 |
| 11 | 1 | C14 | 100nF - 50V | Cercap X7R - SMD-0805 | --- | --- |
| 12 | 1 | C15 | 100nF - 50V | Cercap X7R - SMD-1206 | --- | --- |
| 13 | 1 | C16 | 1nF - 50V | Cercap X7R - SMD-0805 | --- | --- |
| 14 | 1 | C17 | 220p - 50V | Cercap C0G - SMD-0805 | --- | --- |
| 15 | 2 | C18,C24 | 4n7 - 50V | Cercap X7R - SMD-0805 | --- | --- |
| 16 | 1 | C19 | 3n3 - 50V | Cercap X7R - SMD-0805 | --- | --- |
| 17 | 1 | C20 | 150p - 50V | Cercap C0G - SMD-0805 | --- | --- |
| 18 | 1 | C23 | 100n - 50V | Cercap X7R - SMD-0805 | --- | --- |
| 19 | 2 | C25,C26 | 680uF-80V | Aluminium ELECAP FS series 105°C | Panasonic | EEUFS1K681 |
| 20 | 1 | C28 | 4u7 - 100V | Cercap X7R - SMD-2020 | AVX | 22201C475KAT2A |
| 21 | 1 | C29 | 100uF-50V | Aluminium ELCAP - 105°C | Rubycon | 50YXF100M8X11.5 |
| 22 | 1 | C33 | 10u - 25V | Cercap X7R - SMD-1206 | --- | --- |
| 23 | 1 | C35 | 1uF - 25V | Cercap X7R - SMD-0805 | --- | --- |
| 24 | 1 | D1 | --- | 4A glass passivated brodge rectifier - GBU | Diodes Incorporated | GBU406 |
| 25 | 1 | D2 | --- | High voltage ultrafast rectifier 800V - SMA | STMicroelectronics | STTH108A |
| 26 | 1 | D4 | --- | 2X ultrafast recovery diode 400V - TO220AB | STMicroelectronics | STTH16R04CT |
| 27 | 1 | D5 | --- | Small signal switching diode - SOD-123 | Vishay | 1N4148W |

| Item | Q.ty | Ref. Des. | Value - Rating | Description | Manufacturer | Part Number |
|------|------|-----------|----------------|---|--------------------|--|
| 28 | 2 | D6,D12 | --- | Small signal switching diode - SOD80 (Minimelf) | Vishay | BAV103-GS18 |
| 29 | 1 | D7 | --- | Small signal schottky diode - SOD-123 | Vishay | BAT43W |
| 30 | 2 | D8,D15 | --- | Zener diode MMSZ series 0.5W 5% - SOD-123 | ON-Semi | MMSZ10T1G |
| 31 | 1 | F1 | 2.5A-250VAC | FUSE SS-5F series 2.5A-250VAC fast acting | Bussmann | SS-5F-2.5A |
| 32 | 1 | J1 | --- | PCB connector 3 PIN | Weidmuller | PM 5.08/03/90 3.5SN BK BX - 1760520000 |
| 33 | 1 | J2 | --- | PCB connector 2 PIN | Weidmuller | PM 5.08/02/90 3.5SN BK BX - 1760510000 |
| 34 | 1 | JMP1 | --- | Tinned copper wire jumper DIA 0.7MM | --- | --- |
| 35 | 1 | L5 | 27mH | 27mH common mode choke filter | Epcos | B82732F2901B001 |
| 36 | 1 | NTC1 | 100k | NTC - 100k - 1% - wired thermostat with metallic ring | Vishay | NTCALUG01A104FA |
| 37 | 1 | Q1 | --- | N-channel power MOSFET 800V 0.4OHM | STMicroelectronics | STF14N80K5 |
| 38 | 2 | Q2,Q4 | --- | Small signal N-channel depletion MOSFET 100V | Infineon | BSS169 |
| 39 | 2 | R1,R2 | VDR-320V | Metal-oxide varistor la series | Littelfuse | V320LA7P |
| 40 | 2 | R3,R4 | 300k - 200V | Stand. filmRES - 1/4W - 5% - SMD-1206 | --- | --- |
| 41 | 1 | R6 | 47R - 150V | Stand. filmRES - 1/8W - 5% - SMD-0805 | --- | --- |
| 42 | 1 | R7 | 240R - 200V | Stand. filmRES - 1/4W - 1% - SMD-1206 | --- | --- |
| 43 | 1 | R8 | 0.39R - 200V | Stand. filmRES - 1/4W - 1% - SMD-1206 | --- | --- |
| 44 | 1 | R9 | 0.47R - 200V | Stand. filmRES - 1/4W - 1% - SMD-1206 | --- | --- |
| 45 | 2 | R10,R30 | 10R | Stand. filmRES - 1/8W - 5% - SMD-0805 | --- | --- |
| 46 | 2 | R11,R40 | 6k2 - 150V | Stand. filmRES - 1/8W - 5% - SMD-0805 | --- | --- |
| 47 | 1 | R12 | 1k0 - 150V | Stand. filmRES - 1/8W - 5% - SMD-0805 | --- | --- |
| 48 | 1 | R15 | 150k - 150V | Stand. filmRES - 1/8W - 1% - SMD-0805 | --- | --- |
| 49 | 1 | R16 | 130k - 150V | Stand. filmRES - 1/8W - 1% - SMD-0805 | --- | --- |
| 50 | 1 | R17 | 2k7 - 150V | Stand. filmRES - 1/8W - 1% - SMD-0805 | --- | --- |
| 51 | 1 | R19 | 47k - 150V | Stand. filmRES - 1/8W - 1% - SMD-0805 | --- | --- |
| 52 | 1 | R23 | 9k1 - 150V | Stand. filmRES - 1/8W - 5% - SMD-0805 | --- | --- |

| Item | Q.ty | Ref. Des. | Value - Rating | Description | Manufacturer | Part Number |
|------|------|-----------|----------------|---------------------------------------|--------------------|-------------|
| 53 | 1 | R24 | 5k6 - 150V | Stand. filmRES - 1/8W - 5% - SMD-0805 | --- | --- |
| 54 | 1 | R25 | 2k4 - 150V | Stand. filmRES - 1/8W - 5% - SMD-0805 | | |
| 55 | 2 | R26,R27 | 36k - 150V | Stand. filmRES - 1/8W - 1% - SMD-0805 | --- | --- |
| 56 | 1 | R36 | 51k - 150V | Stand. filmRES - 1/8W - 5% - SMD-0805 | --- | --- |
| 57 | 1 | R37 | 18k - 150V | Stand. filmRES - 1/8W - 5% - SMD-0805 | --- | --- |
| 58 | 1 | R39 | 270k - 200V | Stand. filmRES - 1/4W - 1% - SMD-1206 | --- | --- |
| 59 | 1 | R43 | 3k6 - 150V | Stand. filmRES - 1/8W - 1% - SMD-0805 | --- | --- |
| 60 | 1 | R44 | 24k - 150V | Stand. filmRES - 1/8W - 1% - SMD-0805 | --- | --- |
| 61 | 1 | T1 | --- | PQ26/22.5 flyback transformer 320uH | Magnetics | CUSTOM |
| 62 | 1 | U1 | --- | High power factor flyback controller | STMicroelectronics | HVLED101 |
| 63 | 1 | U4 | --- | HR optocoupler 400 MIL (OPT 6) | Vishay | SFH617-A2 |
| 64 | 1 | U5 | --- | Adjustable 1% shunt voltage reference | STMicroelectronics | TL432AIL3T |

5 Board performance

Table 3. Efficiency table (Vout = 60 V)

| Load [%] | Iout [mA] | @ VIN = 115 V _{AC} | @ VIN = 230 V _{AC} |
|---------------|-----------|-----------------------------|-----------------------------|
| 25 | 208 | 89.6% | 88.8% |
| 33 | 278 | 90.7% | 90.4% |
| 50 | 416 | 91.5% | 91.4% |
| 75 | 625 | 91.8% | 92.1% |
| 100 | 833 | 91.7% | 92.4% |
| 4 points avg. | | 91.1% | 91.2% |

Table 4. No-load & standby consumption

| Condition | @ VIN = 115 V _{AC} | @ VIN = 230 V _{AC} |
|-----------------------|-----------------------------|-----------------------------|
| No load | 135 mW | 140 mW |
| Stand-by (Pout=240mW) | 450 mW | 440 mW |

Revision history

Table 5. Document revision history

| Date | Version | Changes |
|-------------|---------|------------------|
| 24-Nov-2022 | 1 | Initial release. |

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