EVL400W-80PL

Data brief

12 V - 400 W adapter based on L4985A, L6699 and SRK2001

Product status link
EVL400W-80PL

Features

- Universal input mains voltage range: from 90 Vac to 264 Vac – frequency from 45 to 65 Hz
- Output voltage: 12 V at 33 A continuous operation
- Overall efficiency at full load: > 89%, according to **ENERGY STAR® 6.1** limit for computer and compliant with **80Plus PLATINUM** level
- Average efficiency: > 89%, according to **European CoC ver. 5 Tier 2** for external power supplies
- Efficiency at 250 mW > 50%, compliant to **EuP lot 6 Tier 2** limit for household and office equipment
- No load mains consumption: < 150 mW at 230 Vac, below **European CoC ver. 5 Tier 2** limit for external power supplies
- Mains harmonics: meets EN-61000-3-2 Class-D and JEITA-MITI Class-D
- EMI: according to EN55022 Class-B
- Safety: meets EN60950 standards
- RoHS compliant

Description

The EVL400W-80PL demonstration board is a 12 V - 400 W converter, tailored to the typical specifications of an AC/DC adapter with wide input mains range, very low power consumption at light load and good average efficiency.

It is composed by a motherboard mounting the high voltage power devices, the primary control board mounting the IC controllers L4985A and L6699 and the secondary control board for the synchronous rectification.

The architecture is based on a two-stage approach: a front-end PFC pre-regulator based on a CCM (Continuous Conduction Mode) boost PFC controller using the L4985A, and a downstream LLC resonant half-bridge converter, designed around the L6699.

At the secondary side, synchronous rectification is implemented by means of the SRK2001 that assures a very high rectification efficiency with a reduction in the size of the heatsink required.

The PFC section uses the L4985A, a peak current-mode PFC controller for boost converter with a proprietary multiplier “emulator” which, in addition to the innovative THD optimizers, guarantees very low Total Harmonic Distortion (THD) performance in all operating conditions.

The device operates in quasi-fixed frequency in all operating conditions thanks to a proprietary off-time modulator and includes the high voltage startup block with the circuitry to discharge the X-capacitors of the EMI filter.

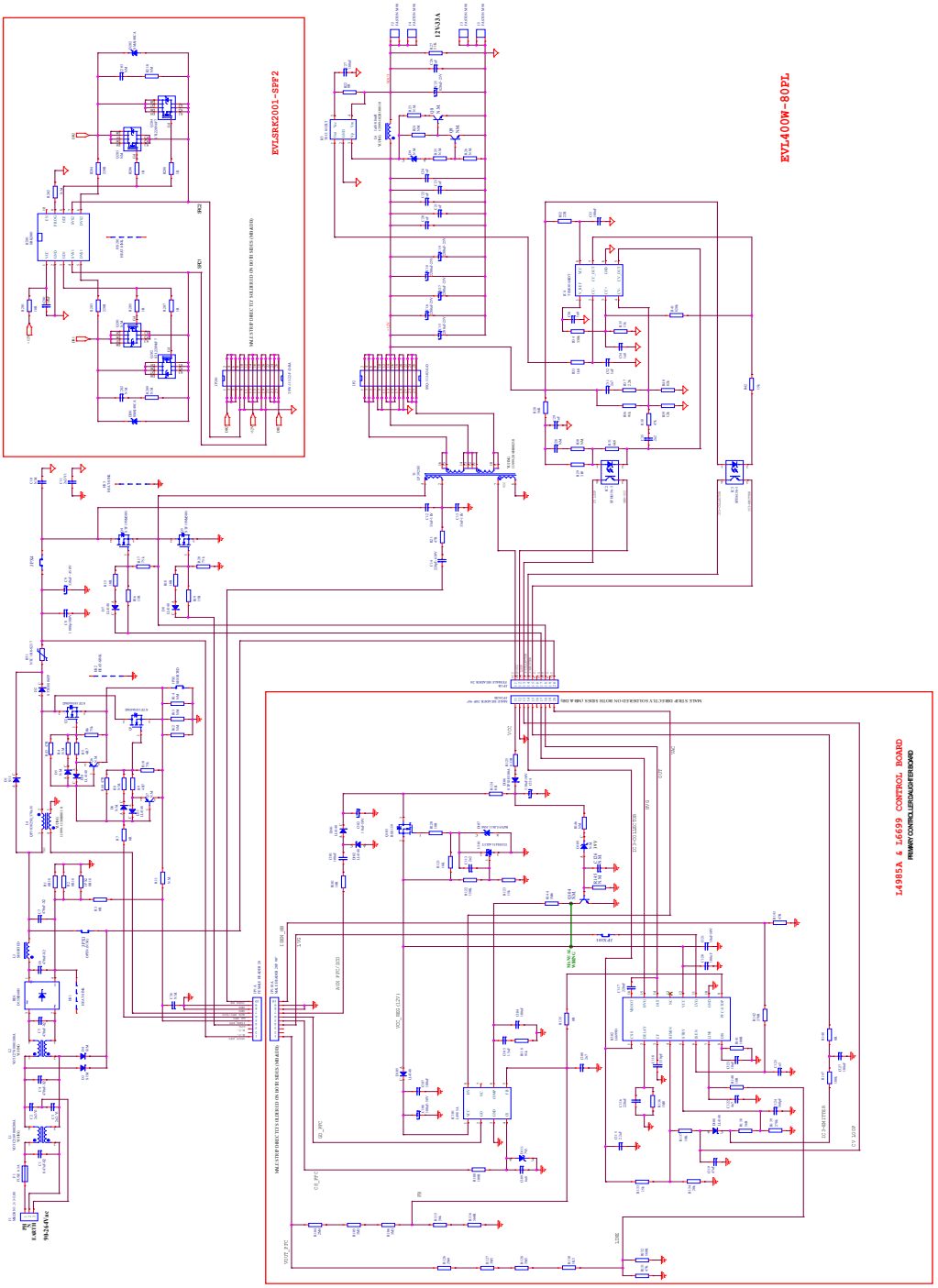
This level of integration allows a low-component count solution for boost PFC pre-regulators.

The LLC section uses the L6699, a double-ended controller specific to series-resonant half-bridge topology. The output voltage regulation is obtained by modulating the operating frequency.

The main focus of this demonstration board is the light-load efficiency, achieved through the burst mode function of both PFC and LLC controllers with the self-adaptive deadtime of the L6699, modulated by the internal logic according to the half-bridge node transition times, which allows the maximization of the transformer magnetizing inductance, reducing the primary current at light load operation.

1 Electrical diagram

Figure 1. **EVL400W-80PL electrical diagram**



2 Bill of material

Table 1. **Bill of material - motherboard**

Reference	Value	Description	Manufacturer
BD1	D15XB60H	Single-phase bridge rectifier	Shindengen
C1	0.47 uF - X2	X2 - film cap. - R46 series, class X2, 275 Vac, 110 ºC	Kemet
C2, C3, C11	2n2 - Y1	Y1 safety cap. DE1E3KX222M	Murata
C4, C5, C6	470 nF - X2	X2 - film cap. - R46 series, class X2, 310 Vac, 110 ºC	Kemet
C7	470 nF - X2	X2 - film cap. - R46 series, class X2, 275 VAC, 110 ºC	Kemet
C8	1000 p - 500 V	500 Vac Cercap - 1206	Vishay
C9	330 uF - 450 V	Aluminum Elcap - 330 uF-450 V 20% - LLG2W331MELA45	Nichicon
C10	N.M.	Y1 safety cap. - DE1E3KX222M	Murata
C12, C13	33 nF - 1 kV	1 kV DC cap. - B32652A6333	Epcos
C14	220 pF - 630 V	630 V Cercap - GRM31A7U2J221JW31	Murata
C15, C16, C17, C18, C19	2200 uF - 25 V	Elcap KZEseries-EKZE250ELL222MK35S	Nippon CHEMI-CON
C20, C21, C22, C23, C24, C26, C29	1 uF	50 V Cercap - X7R - 10%	TDK
C25	820 uF - 25 V	25 V aluminum cap. - EEUTP1E821	Panasonic
C27, C33	100 nF	50 V Cercap - general purpose	AVX
C36	N.M.	50 V Cercap - general purpose	AVX
C28	N.M.	50 V Cercap - general purpose	AVX
C30, C34	1n0	50 V Cercap - general purpose	AVX
C31	2n7	50 V Cercap - general purpose	AVX
C32	1 uF	50 V Cercap - general purpose	AVX
C35	2n2	50 V Cercap - C0G - 10%	AVX
D1	S3J	General purpose rectifier 600 V 3 A	ON SEMI
D2	STTH8S06FP	Ultrafast high voltage rectifier	STMicroelectronics
D3, D4	S1M	General purpose rectifier, SMT	Fairchild
D5, D6	N.M.	High speed signal diode	Vishay
D7, D8, D10, D11	LL4148	High speed signal diode	Vishay
D9	N.M.	High junction temperature Transil™	STMicroelectronics
F1	Fuse 6.3 A	Fuse TR5/TE5 250V - 6.3 A	Littlefuse
HS1	Heat sink	Heat sink for BD1	
HS2	Heat sink	Heat sink for Q2, Q3, D2	
HS3	Heat sink	Heat sink for Q4, Q5	
IC1	TSC101CILT	High-side current sense amplifier	STMicroelectronics
IC2, IC3	SFH6156-3	Optocoupler, phototransistor output, high reliability, 5300 VRMS	Vishay
IC4	TSM1014AIDT	Low consumption CV/CC controller	STMicroelectronics

Reference	Value	Description	Manufacturer
JPX1	Open (N.M.)	Wire jumper	
JPX2 (R211 su schema)	0R18	RSMF1TB - metal film res - 1 W - 2% - 250 ppm/°C	Akanehom
JPX3	Shorted	Wire jumper (see Mech Parts)	
JPX4	Shorted	Wire jumper (see Mech Parts)	
JP1	Female header 20	Female header p.2,54 mm PRECI-DIP	
JP2	SSQ-113-02-G-D	13x2p straight female receptacle SSQ series	Samtec
J1	MKDSN 1,5/ 3-5,08	PCB term. block, screw conn., pitch 5.08 mm - 3 W.	Phoenix Contact
J2, J3, J4, J5	Faston M 90	Faston - connector	TE Connectivity
L1	VOTC2109000200A	Input EMI filter 2 mHx2 - 4.7 A	Yujing
L2	VOTC2708001500A	Input EMI filter 15 mHx2 - 3.7A	Yujing
L3	Shorted	Wire jumper (see Mech Parts)	

Table 2. Bill of material – primary control board

Reference	Value	Description	Manufacturer
C101	100 nF	100 V Cercap - general purpose	AVX
C102	10 uF - 50 V	Aluminum Elcap - YXF series - 105 °C	Rubycon
C104, C107, C127	100 nF	50 V Cercap - general purpose	AVX
C105	1.5 uF	50 V Cercap - general purpose	AVX
C106	100 uF - 50 V	Aluminum Elcap - YXF series - 105 °C	Rubycon
C108	2 n7	50 V Cercap - general purpose	AVX
C122	4 n7	50 V Cercap - general purpose	AVX
C109	6 n8	50 V Cercap - general purpose	AVX
C113	2 n2	50 V Cercap - C0G - 10%	AVX
C114	330 uF - 50 V	Aluminum Elcap - 105 °C	Panasonic
C115	2.2 uF	25 V Cercap - general purpose	AVX
C116, C117	220 nF	25 V Cercap - general purpose	AVX
C118	330 pF	50 V Cercap - general purpose	AVX
C119	47 nF	50 V Cercap - general purpose	AVX
C120	100 nF	50 V Cercap - general purpose	AVX
C121	10 uF - 50 V	50 V Cercap - general purpose	TDK
C123	10 nF	50 V Cercap - general purpose	AVX
C124	560 pF	50 V Cercap - general purpose	AVX
C125	1 n5	50 V Cercap - general purpose	AVX
C126	N.M.	50 V Cercap - X7R - 10%	AVX
D101, D102, D105, D108	LL4148	High speed signal diode	Vishay
D106	STPS1H100A	Power Schottky diode	STMicroelectronics
D107	BZV55 - B11-NM	Zener diode	Vishay
D109	N.M.	Zener diode	Diodes

Reference	Value	Description	Manufacturer
D111	7 V5	Zener diode	Vishay
IC101	L4985A	Low consumption CV/CC controller	STMicroelectronics
IC102	L6699D	Improved HV resonant controller	STMicroelectronics
JPX101	Shorted	Wire jumper (see Mech Parts)	
JP101	Male header 20P 90°	Male header p.2,54 mm 90°	
Q103	BSS159	N-CH depletion MOSFET	Infineon
Q104	N.M.	NPN small signal BJT	Vishay
R101, R140	10 R	SMD standard film resistor - 1/4 W - 1% - 100 ppm/°C	Vishay
R104, R126	2M4	SMD standard film resistor - 1/4 W - 1% - 100 ppm/°C	Vishay
R105, R106, R127, R128	3M3	SMD standard film resistor - 1/4 1/8 W - 1% - 100 ppm/°C	Vishay
R108, R141	100 R	SMD standard film resistor - 1/8 W - 1% - 100 ppm/°C	Vishay
R115	56 k	SMD standard film resistor - 1/8 W - 1% - 100 ppm/°C	Vishay
R116	560 R	SMD standard film resistor - 1/8 W - 1% - 100 ppm/°C	Vishay
R118	91 k	SMD standard film resistor - 1/8 W - 1% - 100 ppm/°C	Vishay
R120	10 R	SMD standard film resistor - 1/8 W - 1% - 100 ppm/°C	Vishay
R121	16 K	SMD standard film resistor - 1/8 W - 1% - 100 ppm/°C	Vishay
R122	150 K	SMD standard film resistor - 1/8 W - 1% - 100 ppm/°C	Vishay
R123	15 k	SMD standard film resistor - 1/4 W - 1% - 100 ppm/°C	Vishay
R124	0 R	SMD standard film resistor – 1/4 W - 1% - 100 ppm/°C	Vishay
R125	0.33 R	SMD standard film resistor - 1/4 W - 1% - 100 ppm/°C	Vishay
R130	1 K5	SMD standard film resistor - 1/8 W - 1% - 100 ppm/°C	Vishay
R131	47 K	SMD standard film resistor - 1/8 W - 1% - 100 ppm/°C	Vishay
R132	560 K	SMD standard film resistor - 1/8 W - 1% - 100 ppm/°C	Vishay
R133	15 k	SMD standard film resistor - 1/8 W - 1% - 100 ppm/°C	Vishay
R134	20 k	SMD standard film resistor - 1/8 W - 1% - 100 ppm/°C	Vishay
R135, R148	0 R	SMD standard film resistor - 1/8 W - 1% - 100 ppm/°C	Vishay
R136	1 M0	SMD standard film resistor - 1/8 W - 1% - 100 ppm/°C	Vishay
R137	10 K	SMD standard film resistor - 1/8 W - 1% - 100 ppm/°C	Vishay
R138	56 R	SMD standard film resistor - 1/8 W - 1% - 100 ppm/°C	Vishay

Table 3. Bill of material - EVLSRK2001-SPF

Reference	Value	Description	Manufacturer
C201	10 uF	35 V Cercap X5R - general purpose	TDK
C202, C203	N.M.	100 V Cercap - X7R - 10%	TDK
D201, D202	SMAJ40CA	High junction temperature Transil	STMicroelectronics
HS201	Heat sink	Heat sink for Q201, Q202, Q203, Q204	
IC201	SRK2001	SRK2001 SR controller	STMicroelectronics
JP201	TSW-113-22-F-D-RA	13x2p right angle male header TSW series	Samtec
Q201, Q203	N.M.	N-channel power MOSFET	STMicroelectronics
Q202, Q204	STL220N6F7	N-channel power MOSFET	STMicroelectronics

Reference	Value	Description	Manufacturer
R201	10 R	SMD standard film resistor - 1/4 W - 1% - 100 ppm/°C	Vishay
R202	N.M.	SMD standard film resistor - 1/8 W - 5% - 250 ppm/°C	Vishay
R203, R204	220 R	SMD standard film resistor - 1/8 W - 5% - 250 ppm/°C	Vishay
R205, R206, R207, R208	1 R	SMD standard film resistor - 1/8 W - 5% - 250 ppm/°C	Vishay
R209, R210	N.M.	SMD standard film resistor - 1/4 W - 5% - 250 ppm/°C	Vishay

Revision history

Table 4. **Document revision history**

Date	Version	Changes
05-Jul-2022	1	Initial release.

Contents