

19 V - 90 W adapter based on the STCMB1, TM PFC and HB LLC combo controller

Data brief



Features

- Universal input mains voltage range: from 90 V ac to 264 V ac- frequency from 45 to 65 Hz
- Output voltage: 19 V, 4.75 A continuous operation
- Average efficiency: > 90%, according to **European CoC ver. 5 Tier 2** for external power supplies
- Efficiency > 60% with Pout = 250 mW, according to **EuP lot 6 Tier 2** for household and office equipment
- No load mains consumption: < 90 mW at 230 V ac, according to **European CoC ver. 5 Tier 2** for external power supplies
- Mains harmonics: meets EN61000-3-2 Class-D and JEITA-MITI Class-D
- EMI: according to EN55022 Class-B
- Safety: meets EN60950 standards
- RoHS compliant

Description

The EVLCMB1-90WADP demonstration board is a 19 V - 90 W converter, tailored for the typical specification of an ac-dc adapter for laptops and notebooks, with a wide input mains range and very low power consumption under light-load.

The architecture is based on a two-stage approach: a front-end transition mode PFC pre-regulator and a downstream LLC resonant half-bridge converter; the PFC and LLC are both integrated in the STCMB1 combo IC.

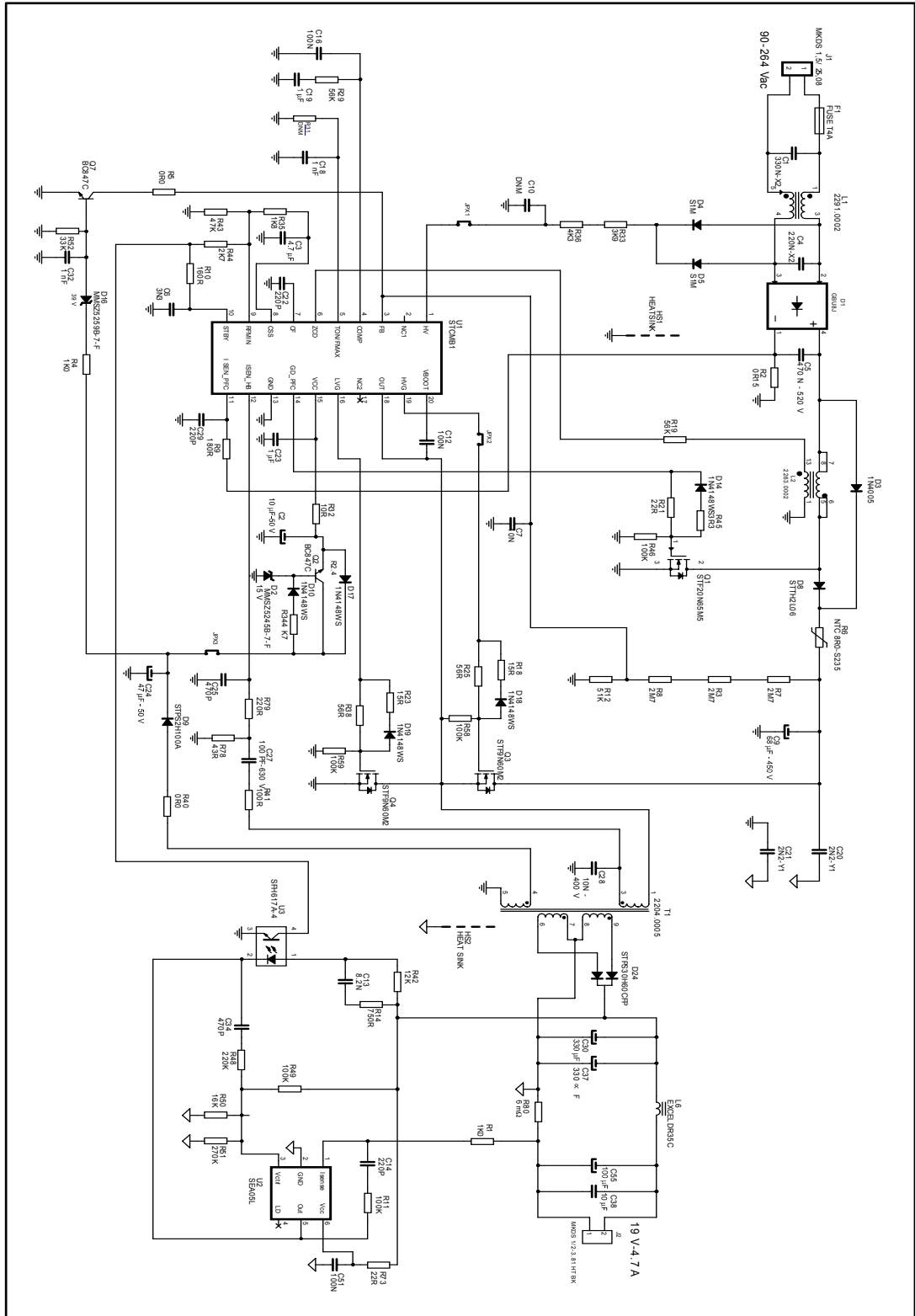
The PFC section uses a proprietary constant on-time control methodology that does not require a sinusoidal input reference, thereby reducing the system cost and external component count. The LLC section is based on a proprietary time shift control method with simple compensation; this improves the dynamic behavior and input ripple rejection resulting in a cleaner output voltage bringing advantages to the circuitry placed to the SMPS secondary side.

The STCMB1 device also embeds a high voltage start up generator, an x-capacitor discharge circuit and a complete set of protections. These features are fully exploited in the EVLCMB1-90WADP device to make a robust and safe SMPS, while keeping a reduced external component count.

The EVLCMB1-90WADP device is characterized by very high efficiency at the light loads that comes from the combination of the design and selection of the power components and the innovative burst mode management functions integrated in the STCMB1, including a proprietary IP that allows minimizing the number of cycles in the burst packet and so minimizing the switching losses.

Schematic diagrams

Figure 1: Evaluation board schematic



Bill of materials

Table 1: Bill of materials

Sch. ref.	Part no.	Case	Description	Supplier
C1	330 nF - X2	9.0 × 18.0 p. 15 mm	X2 - film cap. - B32922C3334M	EPCOS
C2	10 µF - 50 V	Dia. 5 x 11 p. 2 mm	Aluminium ELCAP - YXF series - 105 °C	RUBYCON
C3	2.2 µF	1206	25 V CERCAP - general purpose	AVX
C4	220 nF - X2	9.0 × 18.0 p. 15 mm	X2 - film cap. - B32922C3224K	EPCOS
C5	470 nF - 520 V	9.0 × 18.0 p.15 mm	520 V - film cap. -B32672Z5474K	EPCOS
C6	3.3 nF	0805	50 V CERCAP - general purpose	AVX
C7	10 nF	0805	50 V CERCAP - general purpose	AVX
C9	68 µF - 450 V	DIA 18 x 32 p. 10 mm	450 V aluminium ELCAP - KXG series - 105 °C	UNITED CHEMICON
C10	DNM	1206	2000 V CERCAP - X7R - 10%	
C12	100 nF	1206	50 V CERCAP - General purpose	AVX
C13	8.2 nF	0805	50 V CERCAP - General purpose	AVX
C14	220 pF	0805	50 V - 5% - C0G - CERCAP	AVX
C22	220 pF	0805	50 V - 5% - C0G - CERCAP	AVX
C29	220 pF	0805	50 V - 5% - C0G - CERCAP	AVX
C16	100 nF	0805	50 V CERCAP - general purpose	AVX
C51	100 nF	0805	50 V CERCAP - general purpose	AVX
C18	1 nF	0805	50 V CERCAP - general purpose	AVX
C19	1 µF	0805	50 V CERCAP - X7R - 20%	TDK
C20	2.2 nF - Y1	p. 10 mm	Y1 safety CAP. CD12- E2GA222MYGSA	EPCOS
C21	2.2 nF - Y1	p. 10 mm	Y1 safety CAP. CD12- E2GA222MYGSA	EPCOS
C23	1 µF	1206	50 V CERCAP - X7R - 20%	TDK
C24	47 µF-50 V	DIA 6.3 x 11 p. 2.5 mm	ALUMINIUM ELCAP - YXF series - 105 °C	RUBYCON
C25	470 pF	0805	50 V - 5% - C0G - CERCAP	AVX
C27	100 pF - 630 V	1206	630 V CERCAP - GRM31A7U2J101JW31D	MURATA
C28	10N - 400 V	5 x 10 p. 7.5 mm	400 V - MKP film cap. - B32620A6103	EPCOS

Sch. ref.	Part no.	Case	Description	Supplier
C30	330 μ F	DIA10X13 p. 5 mm	25 V OSCON ELCAP - SEPF series - 105 °C	SANYO
C37	330 μ F	DIA10X13 p. 5 mm	25 V OSCON ELCAP - SEPF series - 105 °C	SANYO
C32	1 nF	0805	25 V CERCAP - general purpose	AVX
C34	470 nF	0805	50 V CERCAP - general purpose	AVX
C38	10 μ F	1206	50 V CERCAP - X5R - 20%	TDK
C55	100 μ F	Dia. 8 x 11.5 p. 3.5 mm	50 V aluminium ELCAP - ZLH series - 105 °C	RUBYCON
D1	GBU8J	STYLE GBU	Single phase bridge rectifier	VISHAY
D2	MMSZ5245B-7-F	SOD-123	Zener diode	DIODES
D3	1N4005	DO - 41	General purpose rectifier	VISHAY
D4	S1M	DO214AC	General purpose rectifier, SMT	FAIRCHILD
D5	S1M	DO214AC	General purpose rectifier, SMT	FAIRCHILD
D8	STTH2L06	DO-41	Ultrafast high voltage rectifier	ST
D9	STPS2H100A	SMA	Power Schottky diode	ST
D10	1N4148WS	SOD-323	High speed signal diode	VISHAY
D14	1N4148WS	SOD-323	High speed signal diode	VISHAY
D17	1N4148WS	SOD-323	High speed signal diode	VISHAY
D18	1N4148WS	SOD-323	High speed signal diode	VISHAY
D19	1N4148WS	SOD-323	High speed signal diode	VISHAY
D16	MMSZ5259B-7-F	SOD-123	Zener diode	DIODES
D24	STPS30H60CFP	TO-220FP	Dual power Schottky rectifier	ST
F1	Fuse T4A	8.5 x 4 p. 5.08 mm	Fuse 4 A - time lag - 3921400	LITTLEFUSE
HS1	Heatsink	DWG	Heatsink for D1, Q1	
HS2	Heatsink	DWG	Heatsink for D24	
JPX1	Shorted	Wire jumper (see mech. part)		
JPX2	Shorted	Wire jumper (see mech. part)		
JPX3	Shorted	Wire jumper (see mech. part)		
J1	MKDS 1,5 / 2-5,08	DWG	PCB term. block, screw conn., pitch 5 mm - 2 W	PHOENIX CONTACT
J2	MKDS 1/2-3.81 HT BK	DWG	PCB term. block, screw conn., 3.81 mm, 2 W, black	PHOENIX CONTACT

Sch. ref.	Part no.	Case	Description	Supplier
L1	2291.0002	DWG	Common mode inductor 2 x 30 mH 1 A	MAGNETICA
L2	2263.0002	DWG	PFC inductor 520 μ H 1.5 A 90 W	MAGNETICA
L6	EXCELD35C	DWG	Bead on wire 9 x 3.8 p. 5 mm	PANASONIC
Q1	STF20N65 m5	TO-220FP	N-channel power MOSFET	ST
Q2	BC847C	SOT-23	NPN small signal BJT	VISHAY
Q7	BC847C	SOT-23	NPN small signal BJT	VISHAY
Q3	STF9N60M2	TO-220FP	N-channel power MOSFET	ST
Q4	STF9N60M2	TO-220FP	N-channel power MOSFET	ST
R1	1 k Ω	1206	SMD standard film res. - 1/4 W - 1% - 100 ppm/ $^{\circ}$ C	VISHAY
R2	0.15 Ω	PTH	RSMF1TB - metal film res. - 1 W - 2% - 200 ppm/ $^{\circ}$ C	AKANEOHM
R3	2.7 M Ω	1206	SMD standard film res. - 1/4 W - 1% - 100 ppm/ $^{\circ}$ C	VISHAY
R8	2.7 M Ω	1206	SMD standard film res. - 1/4 W - 1% - 100 ppm/ $^{\circ}$ C	VISHAY
R4	1 k Ω	0805	SMD standard film res. - 1/8 W - 5% - 200 ppm/ $^{\circ}$ C	VISHAY
R5	0 Ω	0805	SMD standard film res. - 1/8 W - 5% - 200 ppm/ $^{\circ}$ C	VISHAY
R9	180 Ω	0805	SMD standard film res. - 1/8 W - 5% - 200 ppm/ $^{\circ}$ C	VISHAY
R6	NTC 8R0-S235	DWG	NTC resistor P/N B57235S0809M000	EPCOS
R7	2.7 M Ω	PTH	PTH standard film res. - 1/8 W - 5% - 200 ppm/ $^{\circ}$ C	VISHAY
R10	160 Ω	0805	SMD standard film res. - 1/8 W - 5% - 200 ppm/ $^{\circ}$ C	VISHAY
R11	100 k Ω	0805	SMD standard film res. - 1/8 W - 1% - 100 ppm/ $^{\circ}$ C	VISHAY
R46	100 k Ω	0805	SMD standard film res. - 1/8 W - 1% - 100 ppm/ $^{\circ}$ C	VISHAY
R49	100 k Ω	0805	SMD standard film res. - 1/8 W - 1% - 100 ppm/ $^{\circ}$ C	VISHAY
R58	100 k Ω	0805	SMD standard film res. - 1/8 W - 1% - 100 ppm/ $^{\circ}$ C	VISHAY
R59	100 k Ω	0805	SMD standard film res. - 1/8 W - 1% - 100 ppm/ $^{\circ}$ C	VISHAY
R12	51 k Ω	0805	SMD standard film res. - 1/8 W - 1% - 100 ppm/ $^{\circ}$ C	VISHAY
R14	750 Ω	0805	SMD standard film res. - 1/8 W - 1% - 100 ppm/ $^{\circ}$ C	VISHAY

Sch. ref.	Part no.	Case	Description	Supplier
R18	15 Ω	0805	SMD standard film res. - 1/8 W - 5% - 200 ppm/ $^{\circ}$ C	VISHAY
R23	15 Ω	0805	SMD standard film res. - 1/8 W - 5% - 200 ppm/ $^{\circ}$ C	VISHAY
R19	56 k Ω	0805	SMD standard film res. - 1/8 W - 5% - 200 ppm/ $^{\circ}$ C	VISHAY
R21	22 Ω	0805	SMD standard film res. - 1/8 W - 5% - 200 ppm/ $^{\circ}$ C	VISHAY
R73	22 Ω	0805	SMD standard film res. - 1/8 W - 5% - 200 ppm/ $^{\circ}$ C	VISHAY
R25	56 Ω	0805	SMD standard film res. - 1/8 W - 5% - 200 ppm/ $^{\circ}$ C	VISHAY
R38	56 Ω	0805	SMD standard film res. - 1/8 W - 5% - 200 ppm/ $^{\circ}$ C	VISHAY
R29	56 k Ω	0805	SMD standard film res. - 1/8 W - 1% - 100 ppm/ $^{\circ}$ C	VISHAY
R31	DNM	0805	SMD standard film res. - 1/8 W - 1% - 100 ppm/ $^{\circ}$ C	VISHAY
R32	10 Ω	1206	SMD standard film res. - 1/4 W - 5% - 200 ppm/ $^{\circ}$ C	VISHAY
R33	3.9 k Ω	1206	SMD standard film res. - 1/4 W - 5% - 200 ppm/ $^{\circ}$ C	VISHAY
R34	4.7 k Ω	0805	SMD standard film res. - 1/8 W - 1% - 100 ppm/ $^{\circ}$ C	VISHAY
R35	1.8 k Ω	0805	SMD standard film res. - 1/8 W - 1% - 100 ppm/ $^{\circ}$ C	VISHAY
R36	4.3 k Ω	1206	SMD standard film res. - 1/4 W - 5% - 200 ppm/ $^{\circ}$ C	VISHAY
R40	0 Ω	1206	SMD standard film res. - 1/4 W - 5% - 200 ppm/ $^{\circ}$ C	VISHAY
R41	100 Ω	0805	SMD standard film res. - 1/8 W - 5% - 200 ppm/ $^{\circ}$ C	VISHAY
R42	12 k Ω	0805	SMD standard film res. - 1/8 W - 5% - 200 ppm/ $^{\circ}$ C	VISHAY
R43	47 k Ω	0805	SMD standard film res. - 1/8 W - 1% - 100 ppm/ $^{\circ}$ C	VISHAY
R44	2.7 k Ω	0805	SMD standard film res. - 1/8 W - 1% - 100 ppm/ $^{\circ}$ C	VISHAY
R45	3.3 Ω	0805	SMD standard film res. - 1/8 W - 5% - 200 ppm/ $^{\circ}$ C	VISHAY
R48	220 k Ω	0805	SMD standard film res. - 1/8 W - 1% - 100 ppm/ $^{\circ}$ C	VISHAY
R50	16 k Ω	0805	SMD standard film res. - 1/8 W - 1% - 100 ppm/ $^{\circ}$ C	VISHAY

Sch. ref.	Part no.	Case	Description	Supplier
R51	270 k Ω	0805	SMD standard film res. - 1/8 W - 1% - 100 ppm/ $^{\circ}$ C	VISHAY
R52	33 k Ω	0805	SMD standard film res. - 1/8 W - 1% - 100 ppm/ $^{\circ}$ C	VISHAY
R78	43 Ω	0805	SMD standard film res.. - 1/8 W - 1% - 100 ppm/ $^{\circ}$ C	VISHAY
R79	220 Ω	0805	SMD standard film res. - 1/8 W - 5% - 200 ppm/ $^{\circ}$ C	VISHAY
R80	6 m Ω	2512	SMD curr. sense res. - TE conn. TLR - 2.5 W - 1% - 75 ppm/ $^{\circ}$ C	TE CONN.
T1	2204.0005	DWG - E25	Resonant switch mode transformer 100 W, 600 μ H, 170 kHz, 19 V	MAGNETICA
U1	STCMB1	SO20W	TM PFC and LLC resonant combo controller	ST
U2	SEA05L	SOT23-6L	Advanced CV/CC controller with LED driver	ST
U3	SFH617A-4	DIP-4 10.16 mm	Optocoupler	INFINEON

Revision history

Table 2: Document revision history

Date	Version	Changes
15-Mar-2016	1	Initial release.
16-Aug-2017	2	Updated cover page Features Updated <i>Figure 1: "Evaluation board schematic"</i> and <i>Table 1: "Bill of materials"</i> .