

UM10833

TEA1836DB1200 TEA18362LT + TEA1892TS 45 W cool cube charger

Rev. 1 — 3 February 2015

User manual

Document information

Info	Content
Keywords	TEA1836DB1200, TEA18362LT, TEA1892TS, very low standby power consumption, active X-cap discharge, burst mode operation, flyback converter, 45 W, charger, converter, power supply, demo board
Abstract	This user manual describes the 45 W cool cube demo board with the TEA18362LT and TEA1892TS. The TEA1836DB1200 demo board provides an output of 19.5 V/2.31 A. It has very small dimensions (31 mm × 52 mm). It fits in the cool cube casing (outer dimensions).



Revision history

Rev	Date	Description
v.1	20150203	first issue

Contact information

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1. Introduction

WARNING

Lethal voltage and fire ignition hazard



The non-insulated high voltages that are present when operating this product, constitute a risk of electric shock, personal injury, death and/or ignition of fire.

This product is intended for evaluation purposes only. It shall be operated in a designated test area by personnel qualified according to local requirements and labor laws to work with non-insulated mains voltages and high-voltage circuits. This product shall never be operated unattended.

1.1 Scope of this document

This user manual describes the 45 W notebook adapter TEA1836DB1200 demo board using the TEA18362LT and TEA1892TS. It contains a set of measurements that shows the main characteristics.

1.2 TEA18362LT

The TEA18362LT is a controller IC for low-cost Switched Mode Power Supplies (SMPS) intended for flyback topologies. The built-in green functions provide high efficiency at all power levels.

At high power levels, the flyback operates in QR mode. When lowering the power levels, the controller switches to DCM or Frequency Reduction (FR) mode. The peak current is reduced to 25 % of the maximum peak current.

At low power levels, when the flyback switching frequency reaches 25 kHz, the flyback converter switches to burst mode. To ensure high efficiency at low power and excellent no-load power performance, a burst mode has been integrated that reduces the opto current to a minimum level. As the switching frequency in this mode has a minimum value of 25 kHz while the burst frequency is always below 800 Hz, the frequencies are outside the audible range.

During the non-switching phase of the burst mode, the internal IC supply current is reduced to optimize efficiency further.

Valley switching is used in all operating modes.

The TEA18362LT includes an OverPower Protection (OPP). The OPP enables the controller to deliver 150 % peak power for a limited amount of time (200 ms) in case of overpower situations. If the output is shorted, the output power is limited to 100 % to keep the average power consumption lower than 5 W.

The TEA18362LT is realized in a high-voltage Silicon-On-Insulator (SOI) process. This process combines the advantages of a low-voltage process, like accuracy, high-speed protection functions, and control, while maintaining the high-voltage capabilities like high-voltage start-up and integrated X-cap discharge.

The TEA18362LT enables low-cost, highly efficient and reliable supplies for power requirements up to 75 W to be designed easily and with a minimum number of external components.

1.3 TEA1892TS

The TEA1892TS is a member of the generation of Synchronous Rectifier (SR) controller ICs for switched mode power supplies. Its high level of integration enables the design of a cost-effective power supply with a very low number of external components.

The TEA1892TS is a controller IC dedicated to synchronous rectification on the secondary side of discontinuous conduction mode and quasi-resonant flyback converters.

1.4 Setup of the 45 W notebook adapter

The board is designed for universal mains (90 V (AC) to 265 V (AC)). When a DC input voltage is applied, the power consumption is higher due to continuous activation of the X-capacitor discharge function.

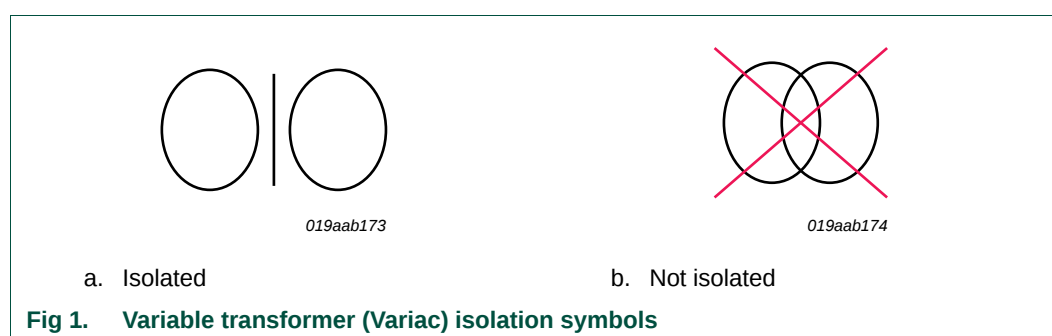
The TEA1836DB1200 demo board incorporates two subcircuits:

- A DCM/QR type flyback converter
- A Synchronous Rectifier (SR)

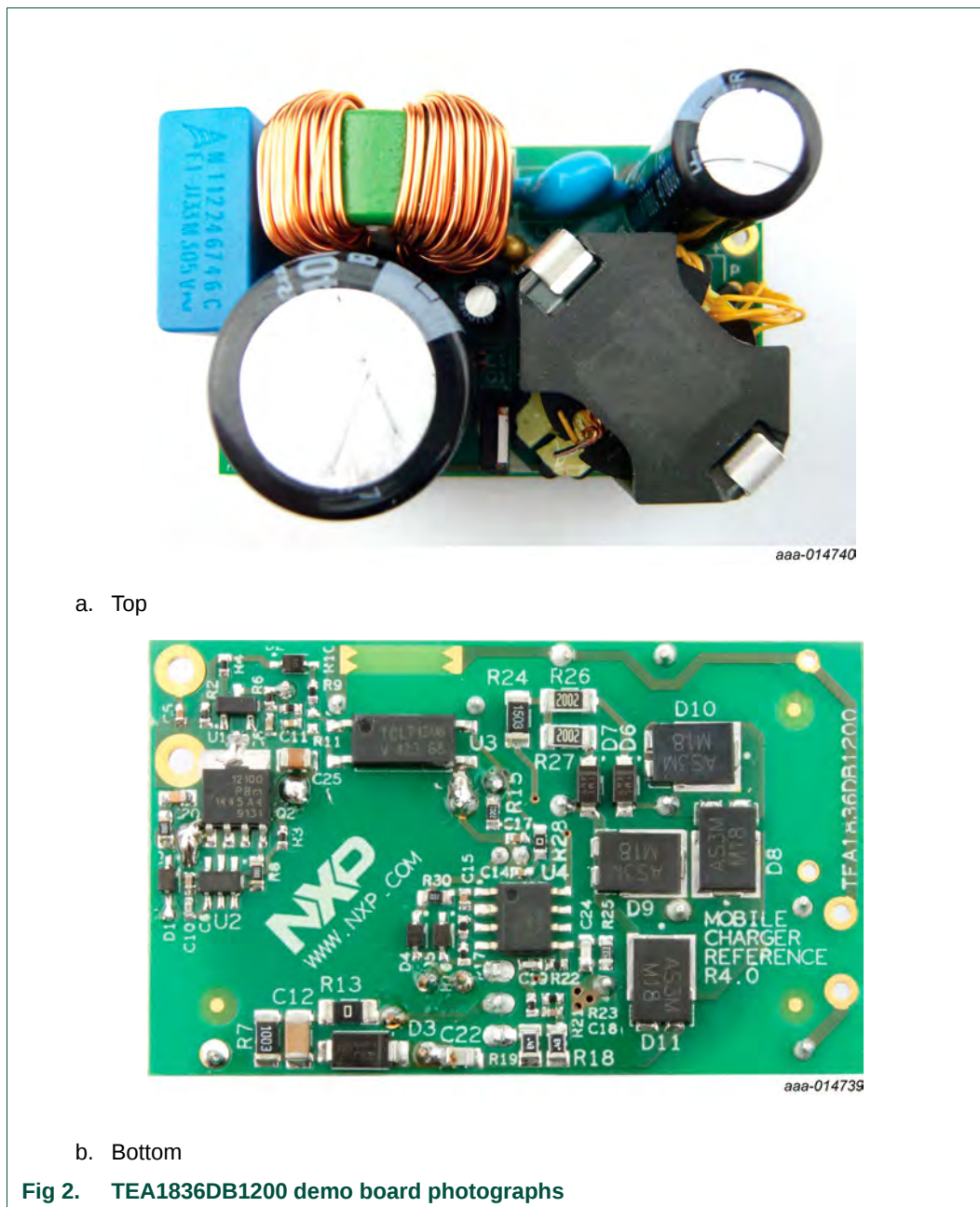
The purpose of the demo board is to show the operation of the TEA18362LT and TEA1892TS in a small-size board. The performance is according to the current general standards including the DoE + CoC efficiency requirements. It can be used as a starting point for further product development.

2. Safety warning

The board must be connected to the mains voltage. Touching the board during operation must always be avoided. An isolated housing is obligatory when used in uncontrolled, non-laboratory environments. Galvanic isolation of the mains phase using a variable transformer is always recommended. [Figure 1](#) shows the symbols by which these devices can be recognized.



3. Board photographs



4. Specifications

Table 1. TEA1836DB1200 specifications

Symbol	Description	Conditions	Value
Input specifications			
V_{in}	input voltage		90 V to 265 V
f_i	input frequency		47 Hz to 64 Hz
$P_{i(noload)}$	no-load input power	at 230 V/50 Hz	< 25 mW
Output specifications			
V_{out}	output voltage		19.5 V
I_{out}	output current		0 A to 2.31 A
$I_{o(peak)}$	peak output current	for 200 ms at $V_i = 90$ V at 60 Hz	3 A
t_{hold}	hold time	at 115 V/60 Hz; full load	> 10 ms
-	line regulation		± 1 %
-	load regulation		± 1 %
$t_{startup}$	start-up time	at 115 V/60 Hz	≤ 1 s
η	efficiency	DoE: > 88.5 % at cable end (including 0.5 % margin); CoC: > 89.5 % at cable end (including 0.5 % margin)	≥ 92 %
-	ElectroMagnetic Interference (EMI)	CISPR22 compliant	pass

5. Measurements

5.1 Test facilities

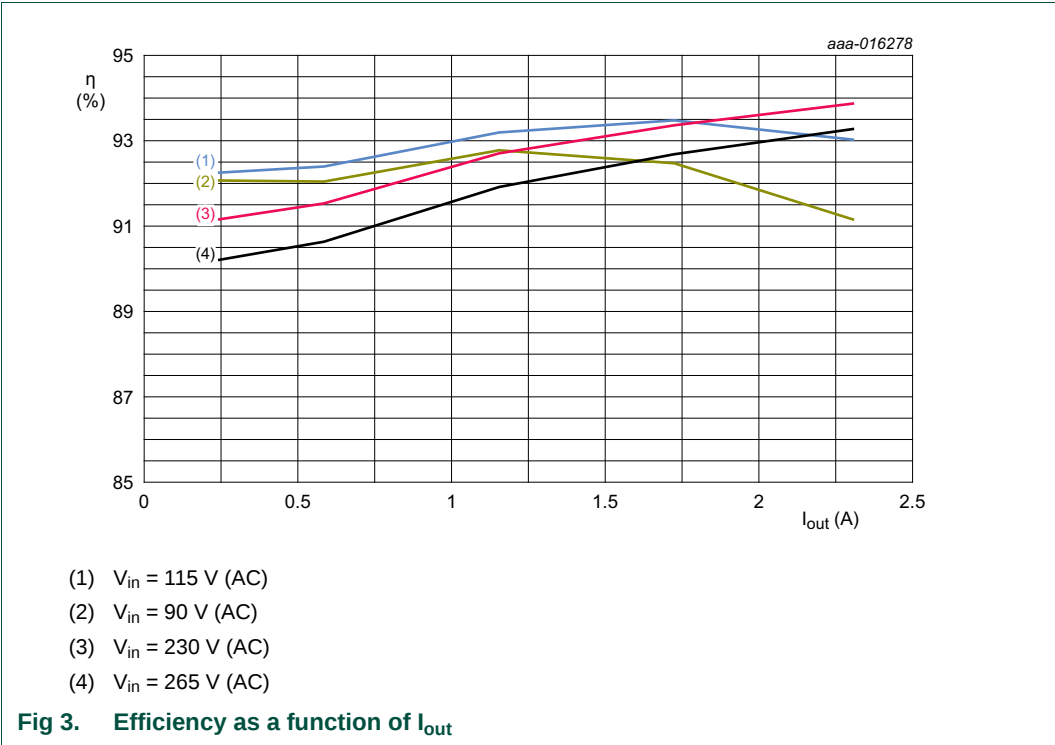
- Oscilloscope: Yokogawa DL9140L
- AC Power Source: Agilent 6812B
- Electronic load: Agilent 6063B
- Digital power meter: Yokogawa WT210

5.2 Efficiency

Efficiency measurements are performed at stabilized conditions. The output voltage and output current is measured directly at the PCB connector. Measurements are done for 90 V/60 Hz, 115 V/60 Hz, 230 V/50 Hz, and 265 V/50 Hz. [Table 2](#) shows the average value of 10 boards.

Table 2. Efficiency PCB end

I _{out} (A)	V _{out} (V)	P _{in} (W)	Efficiency (%)	Average 0.585 A to 2.31 A
90 V (AC)/60 Hz				
0.24	19.392	5.055	92.07	92.11
0.585	19.4	12.33	92.04	
1.155	19.406	24.159	92.78	
1.725	19.411	36.21	92.47	
2.31	19.421	49.22	91.15	
115 V (AC)/60 Hz				
0.24	19.392	5.045	92.25	93.02
0.585	19.4	12.283	92.40	
1.155	19.407	24.052	93.19	
1.725	19.411	35.82	93.48	
2.31	19.418	48.22	93.02	
230 V (AC)/50 Hz				
0.24	19.393	5.106	91.15	92.87
0.585	19.403	12.401	91.53	
1.155	19.408	24.18	92.71	
1.725	19.414	35.87	93.36	
2.31	19.421	47.79	93.87	
265 V (AC)/50 Hz				
0.24	19.394	5.16	90.20	92.13
0.585	19.405	12.525	90.63	
1.155	19.41	24.39	91.92	
1.725	19.418	36.14	92.68	
2.31	19.423	48.1	93.28	



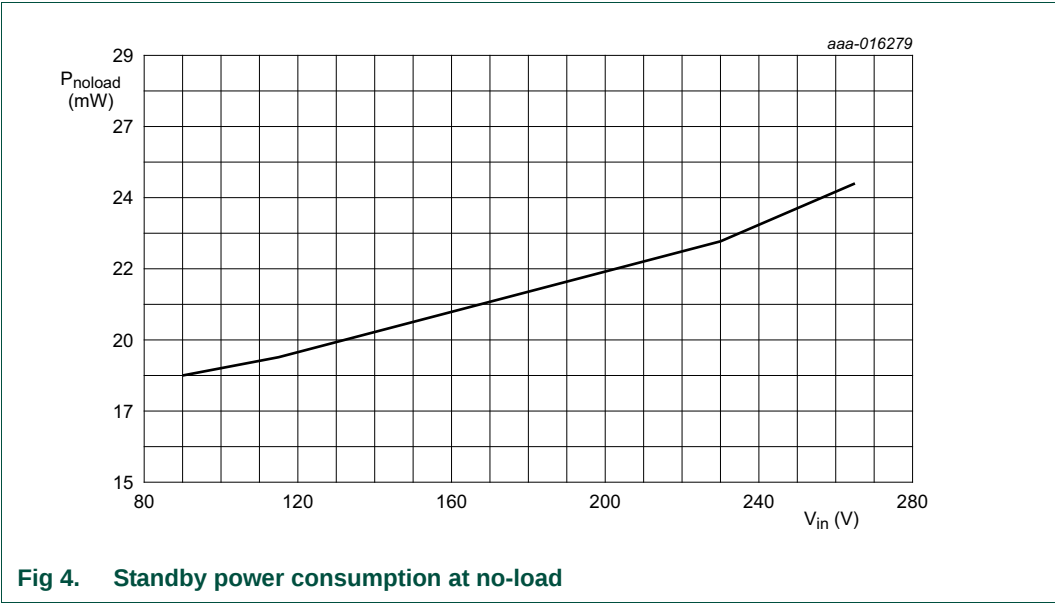
5.3 Standby power consumption

Power consumption performance of the total application board without load connected was measured with a Yokogawa WT210 digital power meter. The standby power consumption has been measured 20 minutes after switch-on.

Measurements were performed for 90 V/60 Hz, 115 V/60 Hz, 230 V/50 Hz, and 265 V/50 Hz. [Table 3](#) shows the average value of 10 boards.

Table 3. Standby power consumption

V _{in} V (AC)	P _{no} load (mW)	V _{out} (V)
90 V/60 Hz	18.5	19.4
115 V/60 Hz	19.1	19.4
230 V/50 Hz	22.9	19.4
265 V/50 Hz	24.8	19.4



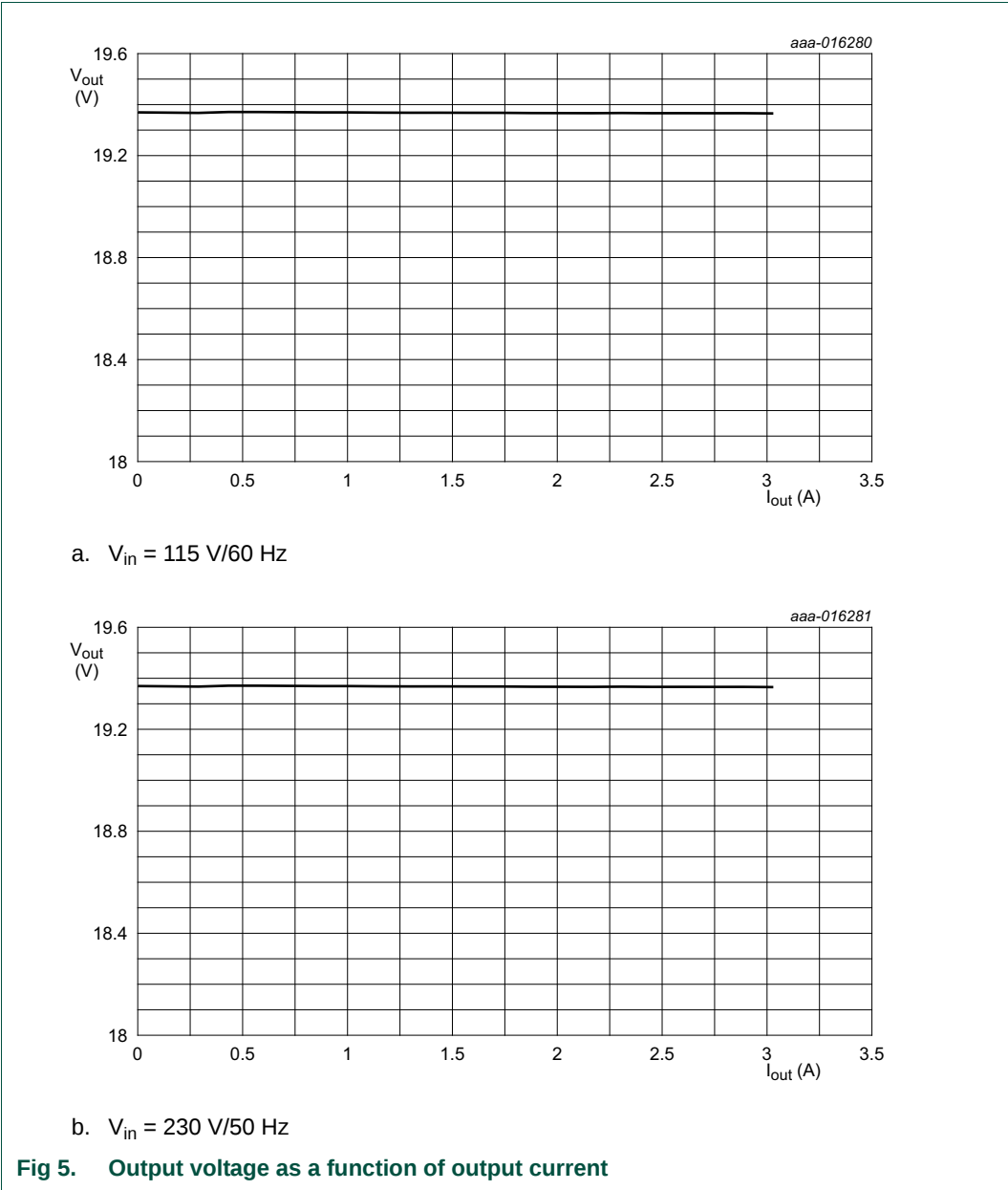
5.4 Current for changing between normal and burst mode operation

Table 4. Current for changing between normal and burst mode operation

Condition	115 V/60 Hz	230 V/50 Hz
From normal mode to burst mode operation		
current (A)	0.40	0.50
power (W)	7.75	9.7
From burst mode to normal mode operation		
current (A)	0.25	0.33
power (W)	4.85	6.4

5.5 Load regulation

The output voltage versus load current was measured at the PCB connector.



5.6 Line regulation

The output voltage versus mains input voltage was measured directly at the output connector for nominal load condition (2.31 A).

The values remain within the target of 19.5 V ±1 %.

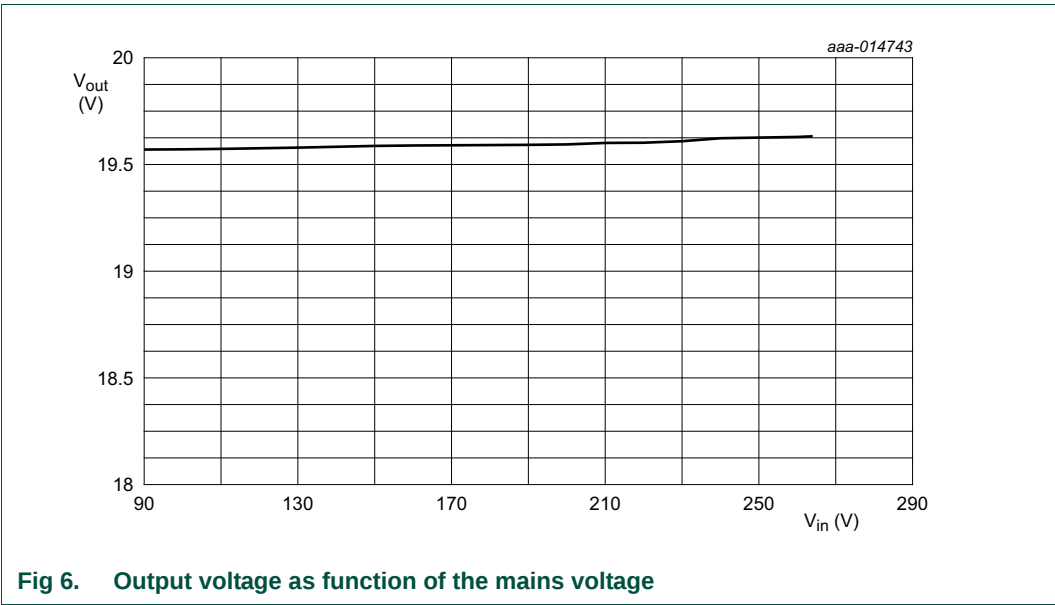
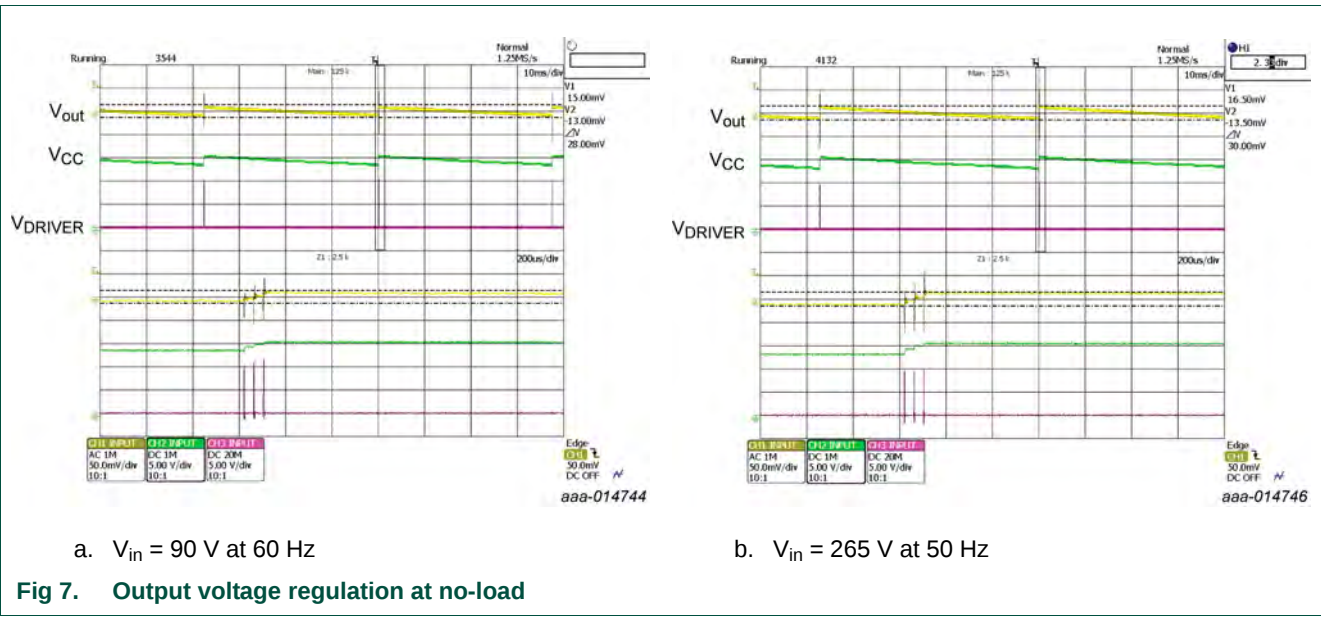


Fig 6. Output voltage as function of the mains voltage

5.7 Output voltage regulation in standby mode

The output voltage regulation during no load operation was measured for 90 V/60 Hz and 265 V/50 Hz.



a. $V_{in} = 90$ V at 60 Hz

b. $V_{in} = 265$ V at 50 Hz

Fig 7. Output voltage regulation at no-load

Table 5. Output voltage ripple at no-load condition

Symbol	90 V/60 Hz	230 V/50 Hz
V _{ripple} (mV)	79	96

5.8 OverPower Protection (OPP)

The continuous maximum peak output power was measured directly at the output connector for various mains input voltages. When this level is exceeded, the protection is activated after the internal overpower counter-passes 200 ms.

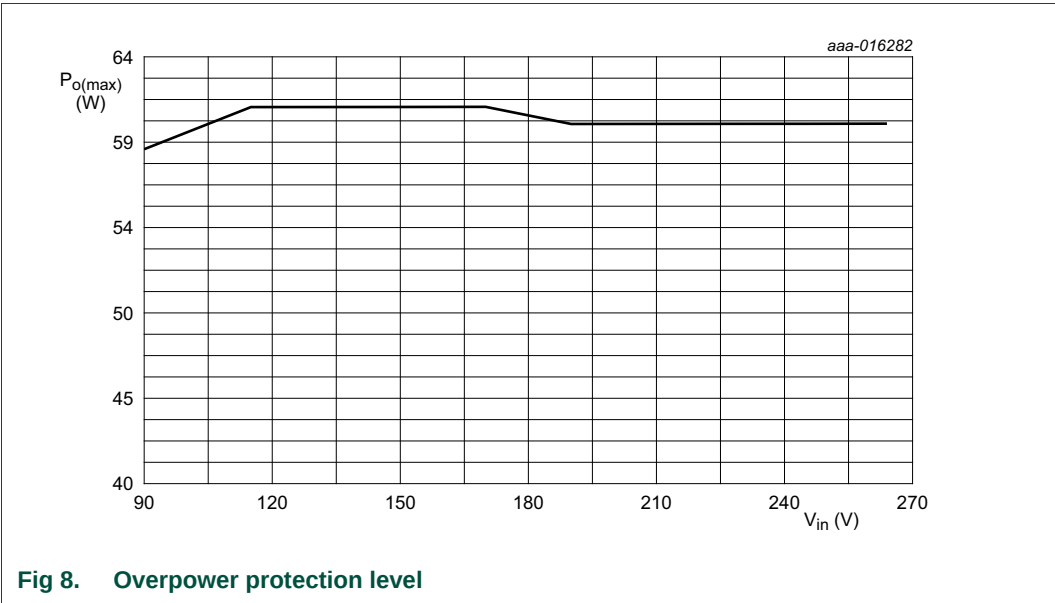


Fig 8. Overpower protection level

5.9 Voltage on pin VCC

Table 6. VCC voltage

Condition	115 V/60 Hz	230 V/50 Hz
no-load	12	12
nominal load	22.9	20.1

5.10 Brownout and start-up level

Table 7. VCC voltage

Condition	Brownout (V)	Start level (V)
no-load	70	79
nominal load	70	79

5.11 Short circuit protection

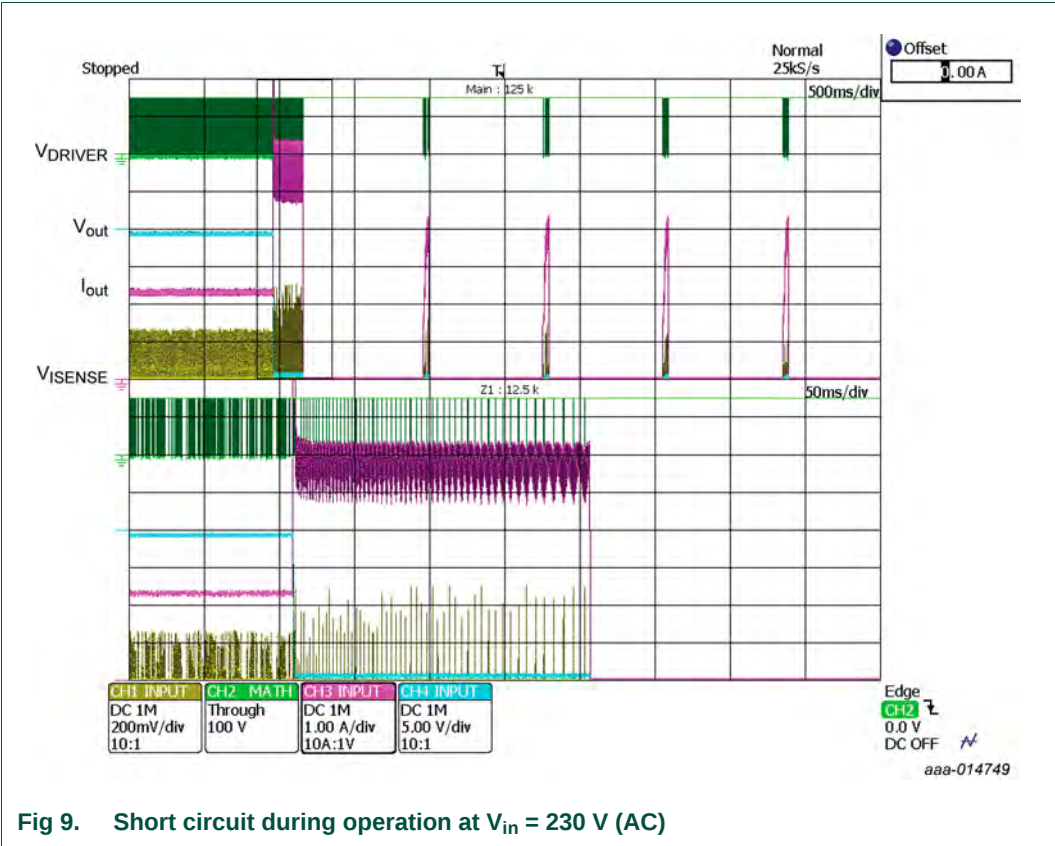
Output short circuit directly at the PCB connectors before switching on the mains voltage or during operation. The system protects and latches during the short circuit condition. With a TEA18362T, the system protects and restarts continuously during the short circuit condition.

Table 8. Behavior during output short circuit condition

Condition	Behavior
output short before applying AC mains voltage	latch
output short circuit during operation at full load and no-load	latch

Table 9. Input power at output short circuit condition

Condition	90 V/60 Hz	230 V/50 Hz	265 V/50 Hz
input power	0.33 W	0.31 W	0.35 W

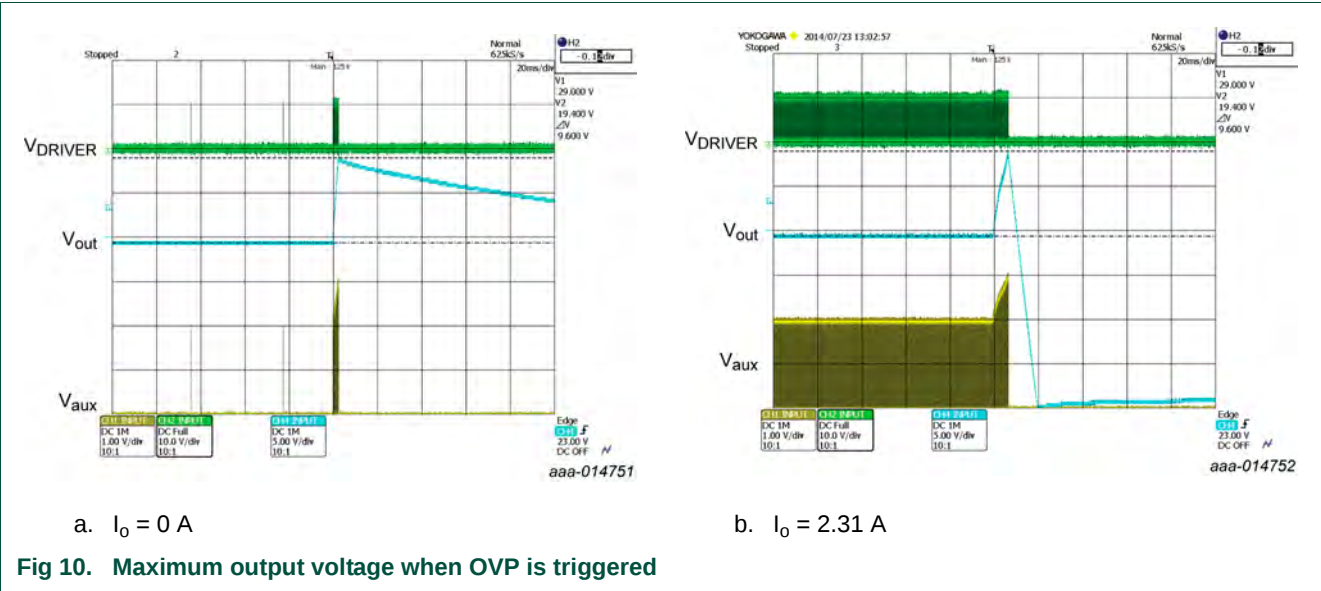


5.12 Overvoltage protection

Applying a short circuit across the optoLED of the optocoupler (OPTO1; see [Figure 22](#)) creates an output overvoltage condition. The overvoltage protection is triggered when the AUX pin voltage increases to 3 V during the OVP detection interval. The output voltage was measured directly at the output connector for both a nominal load (2.31 A) and a no-load condition.

Table 10. Maximum output voltage at OVP

Condition	115 V/60 Hz	230 V/50 Hz
no-load	29 V	29 V
nominal load (3.37 A)	29 V	29 V



5.13 Start-up time

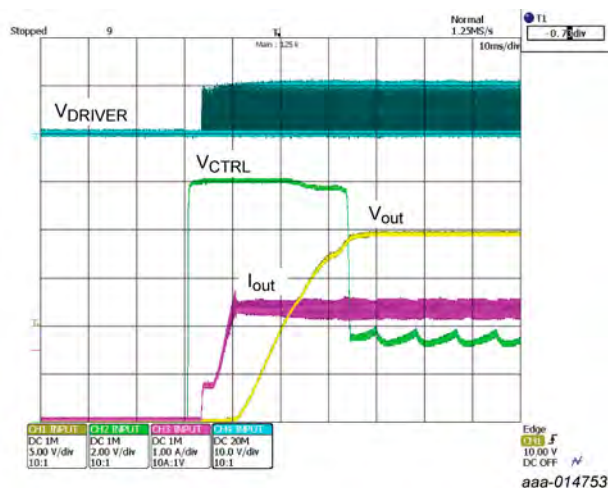
The start-up time is the time between the mains voltage switching on and the nominal output power available at the output.

Table 11. Start-up time

Condition	Start-up time
90 V/60 Hz	370 ms
115 V/60 Hz	210 ms
230 V/50 Hz	150 ms

5.14 Start-up profile

The shape of the output voltage during start-up was measured for 90 V/60 Hz and 265 V/50 Hz. It was measured directly at the output connector for a no-load and a nominal load (2.31 A) condition.



a. $V_{in} = 90 \text{ V (AC)}$

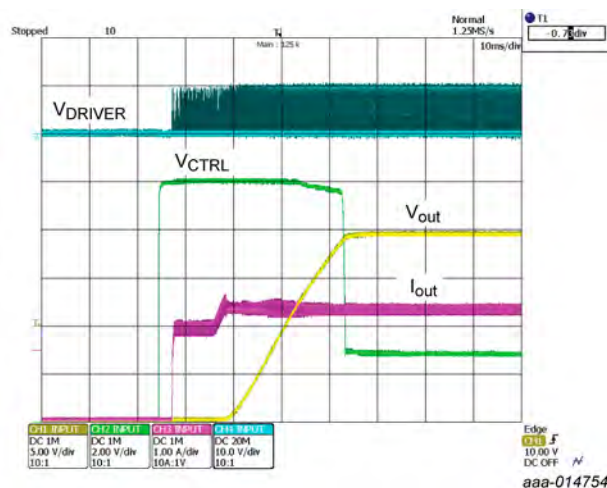
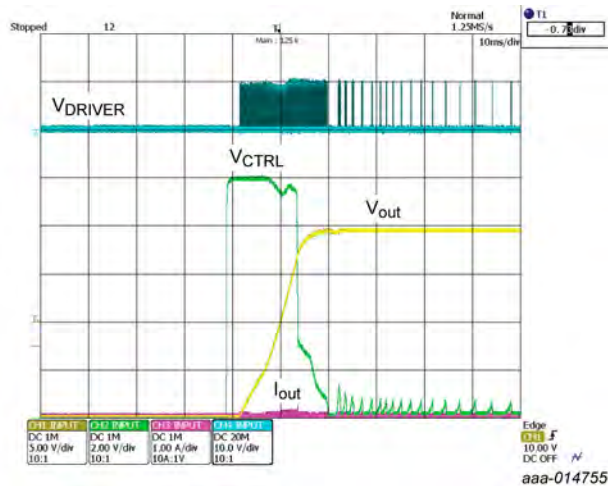
b. $V_{in} = 265 \text{ V (AC)}$

Fig 11. Start-up at nominal output load



a. $V_{in} = 90 \text{ V (AC)}$

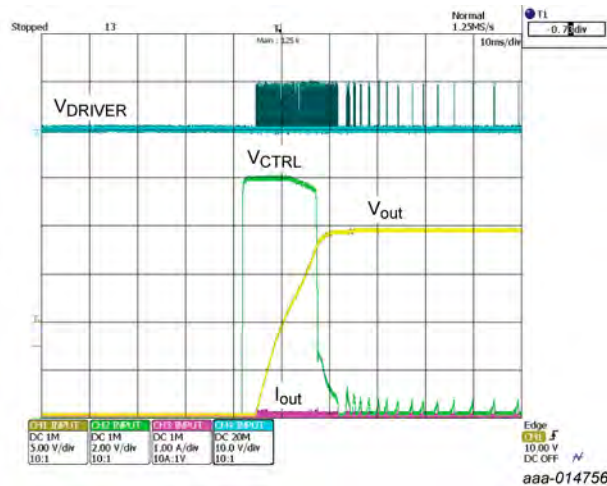
b. $V_{in} = 265 \text{ V (AC)}$

Fig 12. Start-up at no output load

5.15 Hold-up time

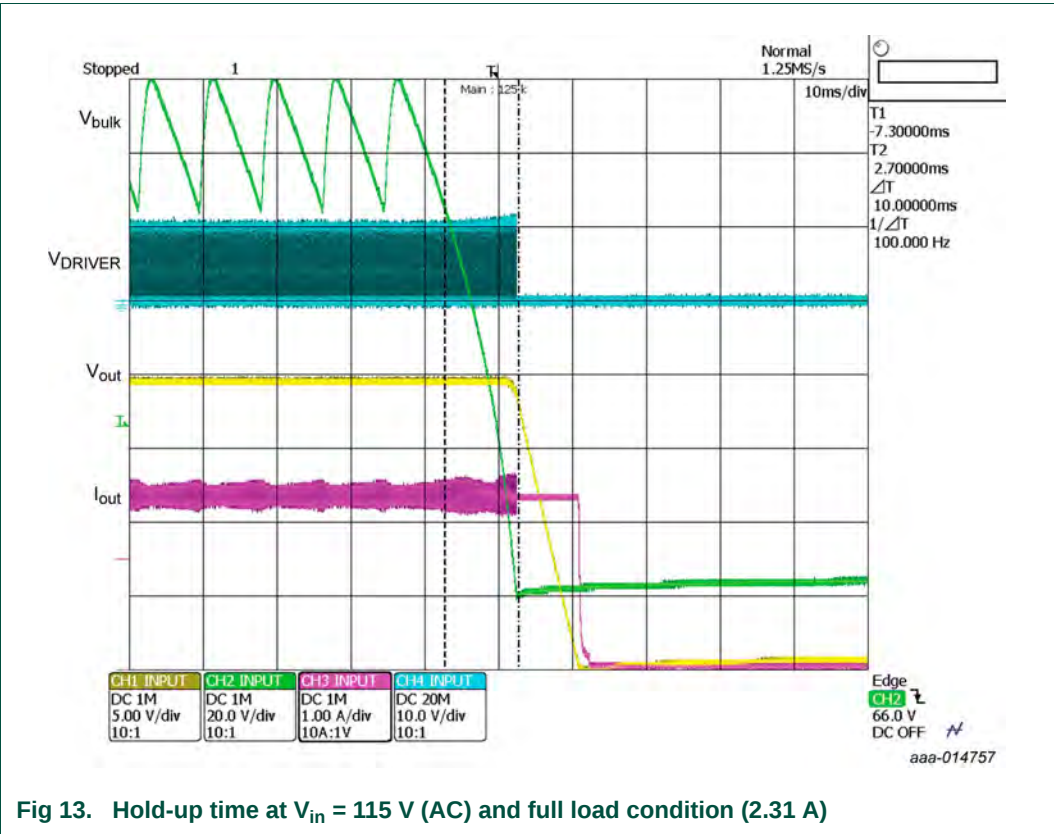
The hold-up time is defined as the time between the following moments:

- After mains switch-off: The moment that the lowest bulk capacitor voltage during a mains cycle is crossed.
- The moment that the output voltage starts to decrease.

The hold-up time is measured for 115 V/60 Hz for a full load (2.31 A) condition. The output voltage was measured directly at the output connector.

Table 12. Hold-up time

Condition	Hold-up time
115 V/60 Hz	10 ms



5.16 Fast latch reset

The fast latch reset time was measured. The fast latch reset time is the time that the voltage on pin VCC requires to drop to the reset level (8.65 V typical) when the mains voltage is disconnected. It is 730 ms.

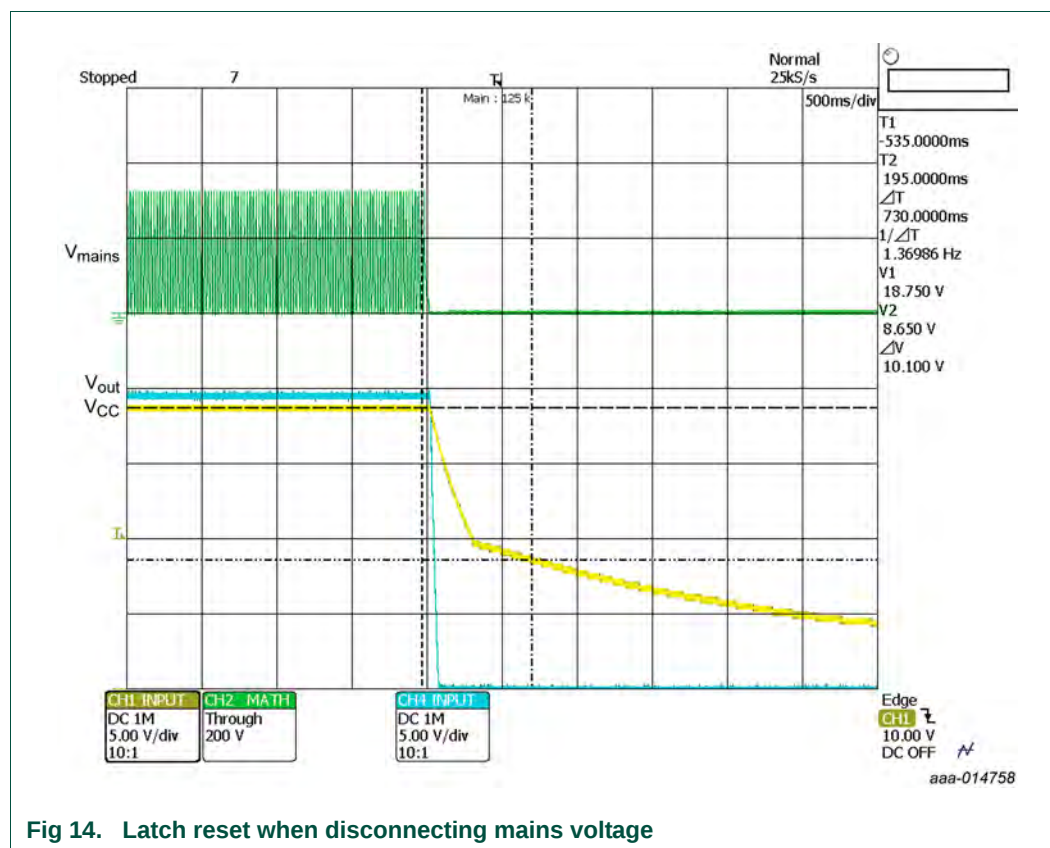


Fig 14. Latch reset when disconnecting mains voltage

5.17 X-capacitor discharge time

Unplug the power line at no-load condition and measure the discharge time at the X-capacitor (330 nF).

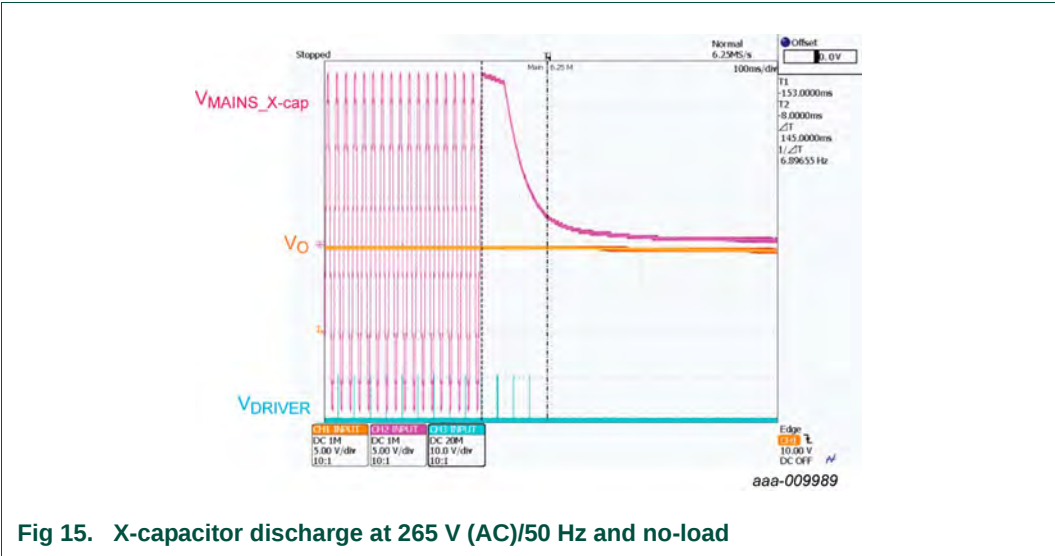
The discharge time is the time between the moment of disconnecting the mains source and the moment when the voltage reaches a defined voltage value.

Table 13. X-capacitor discharge time test results

Condition	from 265 V * $\sqrt{2}$ to 135 V	from 265 V * $\sqrt{2}$ to 60 V
X-capacitor discharge time	55 ms	145 ms

Remark: The discharge can start 100 ms later (worse case) than measured and shown because in burst mode operation the mains measurement interval is approximately 100 ms ($t_{\text{wait(burst)HV}}$).

The TEA1836 complies with Nemko Certification: NO081101 and with the DK-40437-UL certification (see for documentation on the certificates <http://www.nxp.com/demoboard/TEA1836DB1200.html#documentation>).

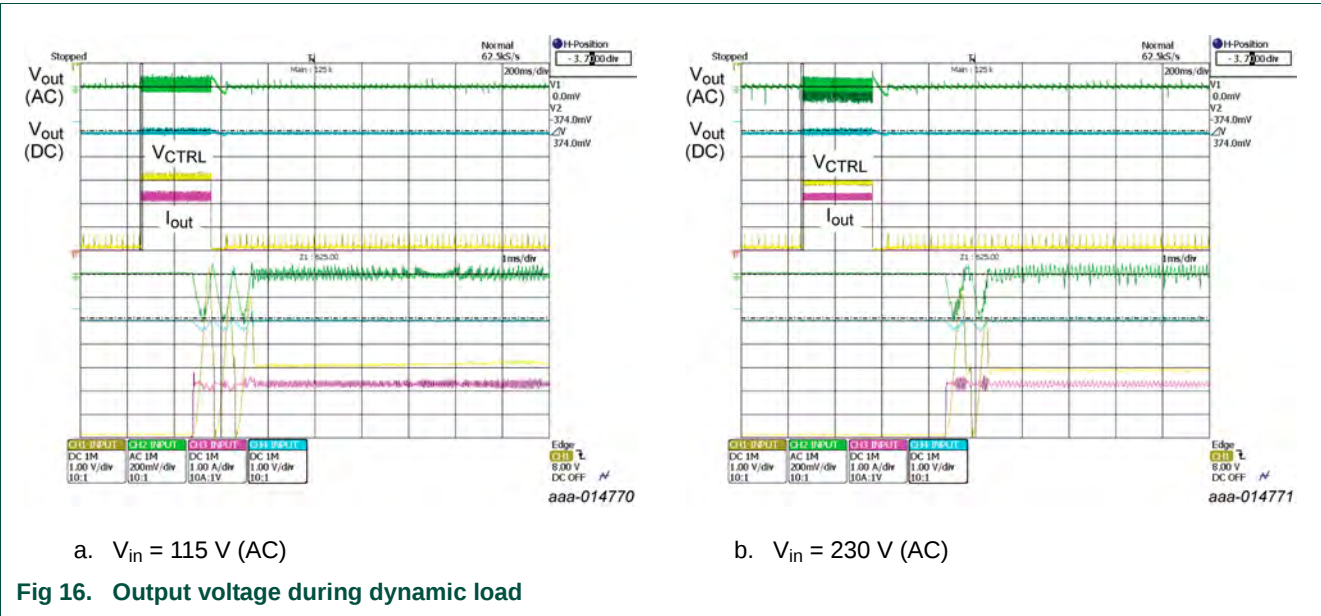


5.18 Dynamic load

The output voltage was measured at the end of the board.

Table 14. Maximum output voltage ripple in case of OVP

Condition	Load	Output voltage ripple (mV)
115 V/60 Hz	I _O : 0 % to 100 %	374
230 V/50 Hz	I _O : 0 % to 100 %	374



5.19 Output ripple

Output ripple was measured at the end of a 16AWG cable with 1.2 m length using a standard filter of 10 μ F + 100 nF on the probing position. Output ripple and noise were measured at nominal output current (2.31 A) and at no-load condition (0 A).

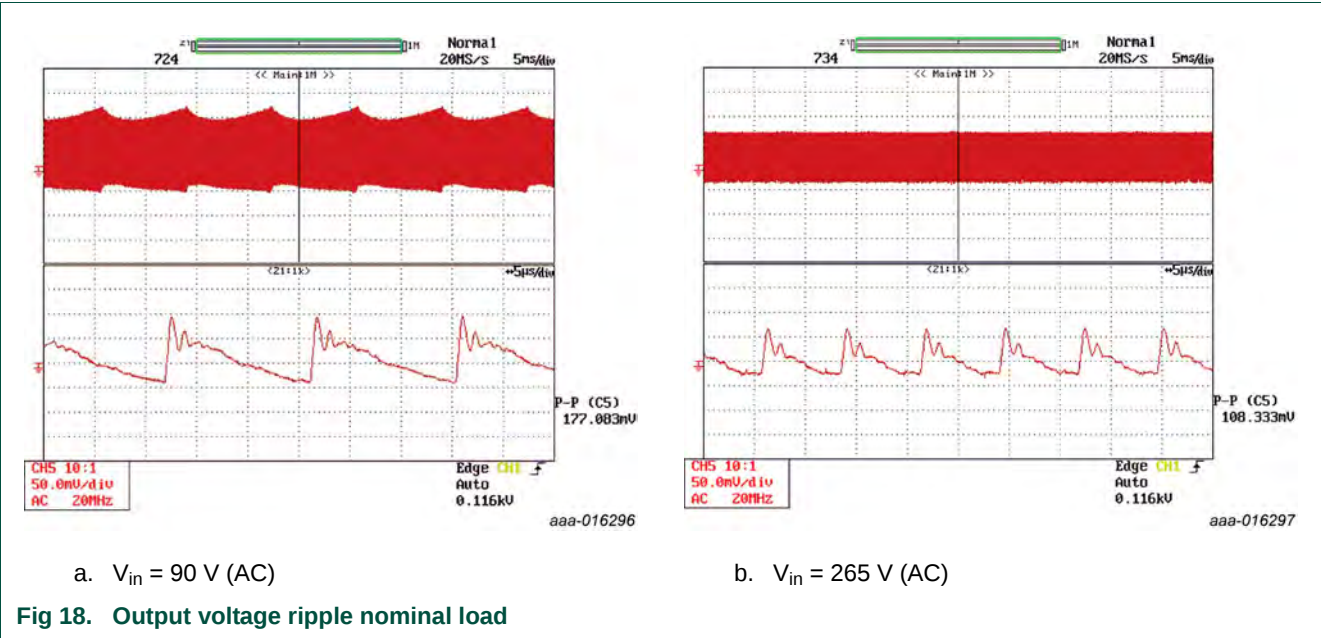
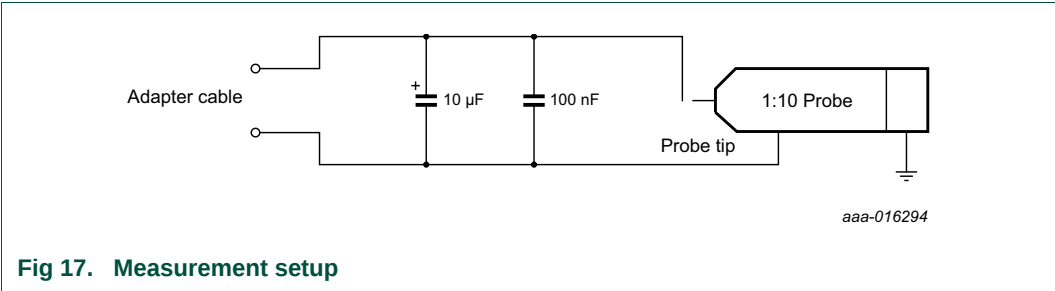


Table 15. Output voltage ripple at nominal load

Condition	peak-to-peak output voltage ripple and noise
90 V/60 Hz	177 mV
265 V/50 Hz	108 mV

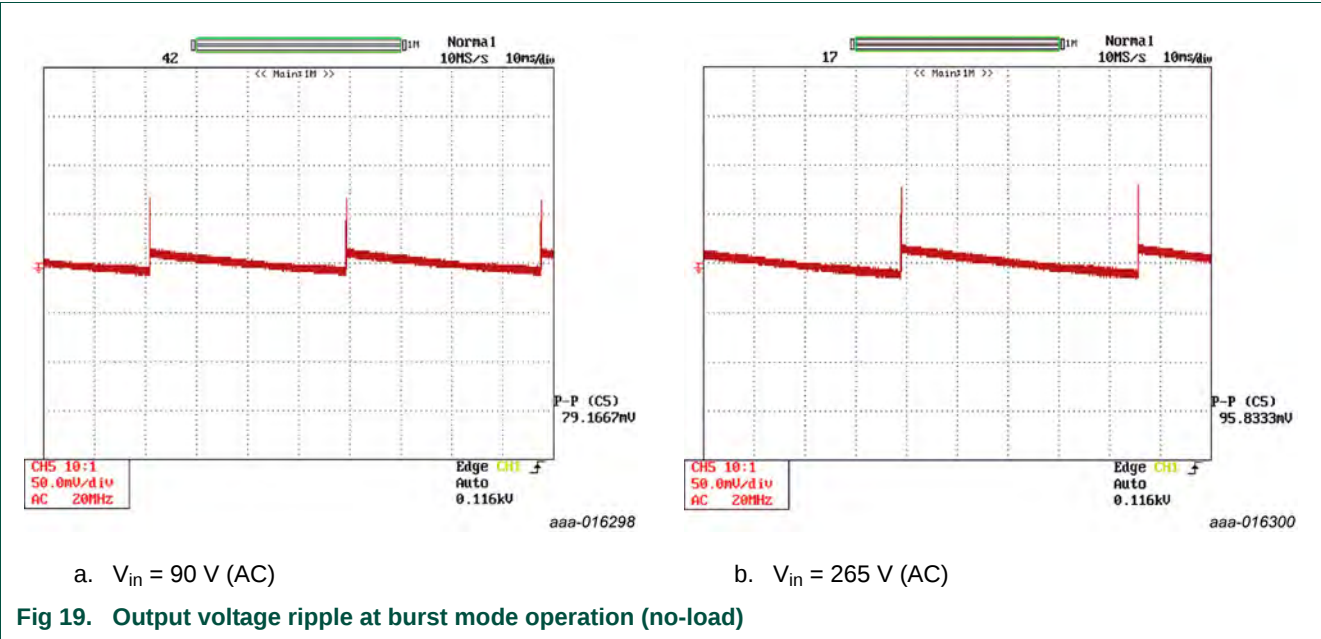


Table 16. Output voltage ripple at no-load

Condition	peak-to-peak output voltage ripple and noise
90 V/60 Hz	70 mV
265 V/50 Hz	96 mV

5.20 EMI performance

Conditions:

- Type: Conducted EMI measurement
- Frequency range: 150 kHz to 30 MHz
- Output power: Full load condition
- Input voltage: 115 V and 230 V
- Secondary GND connected to PE GND

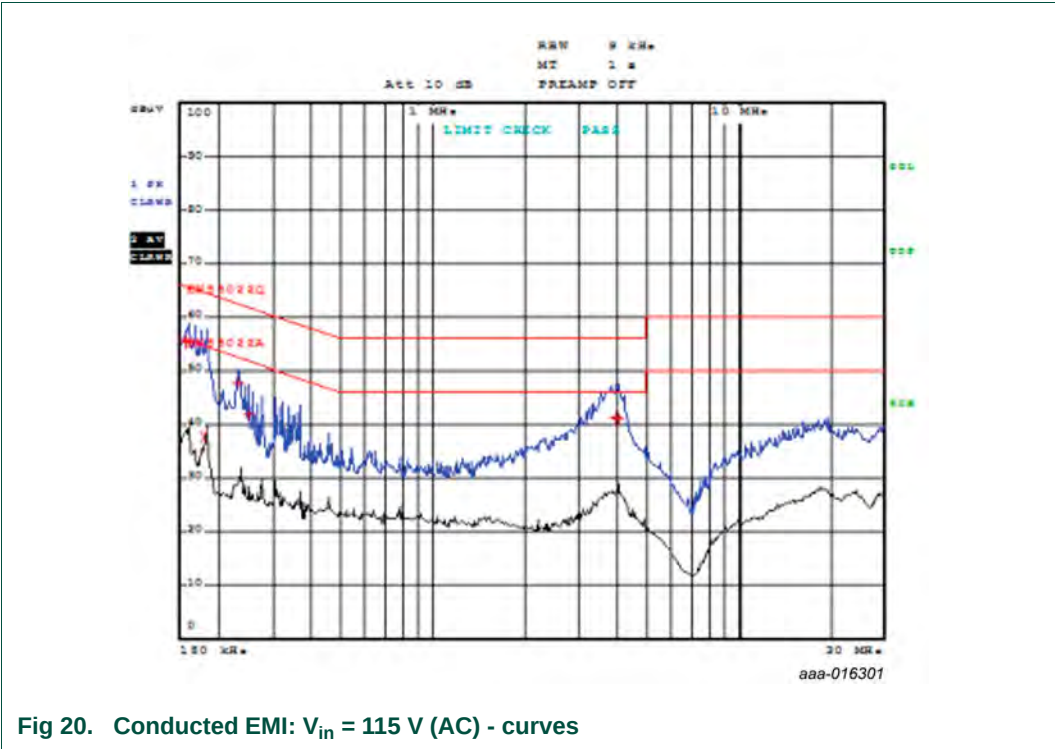


Fig 20. Conducted EMI: $V_{in} = 115\text{ V (AC)}$ - curves

Table 17. Conducted EMI: $V_{mains} = 115\text{ V (AC)}$ - sheet

Trace 1: EN55022Q			
Trace 2: EN55022A			
Trace 3: ---			
Trace	Frequency	Level dBμV	Delta limit dB
1 quasi peak	158 kHz	55.25 N	−10.31
1 quasi peak	3.97 MHz	41.43 N	−14.56
1 quasi peak	230 kHz	47.80 N	−14.64
1 quasi peak	4.046 MHz	41.01 N	−14.99
2 average	182 kHz	37.77 N	−16.62
1 quasi peak	250 kHz	41.94 N	−19.80

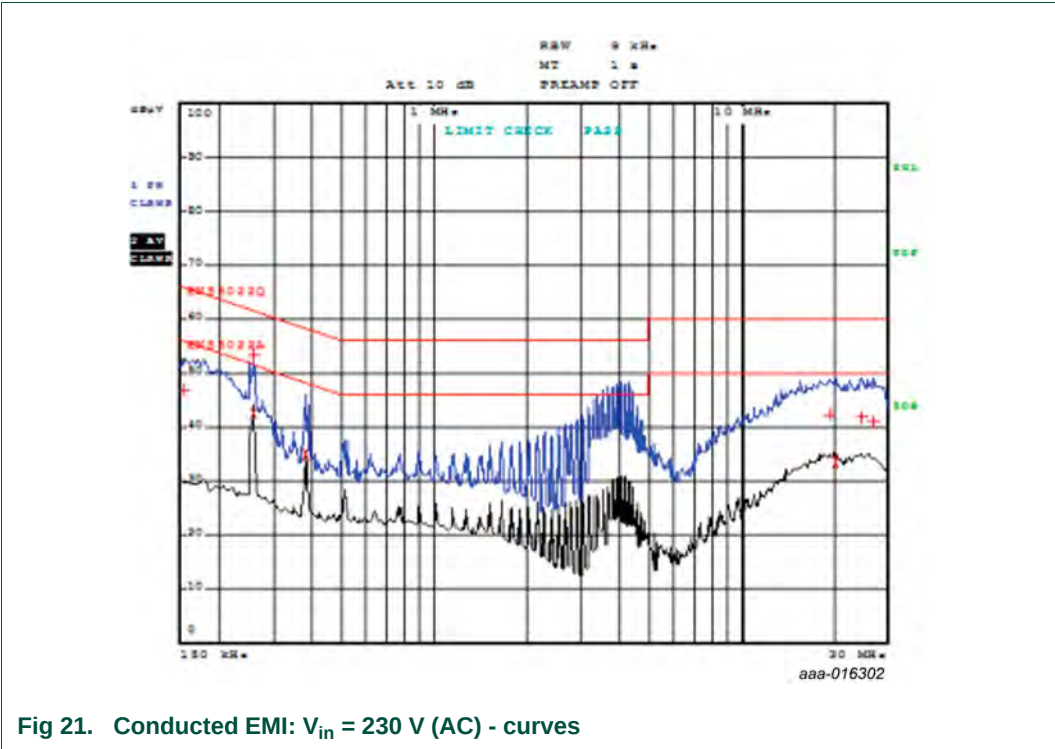


Table 18. Conducted EMI: $V_{in} = 230\text{ V (AC)}$ - sheet

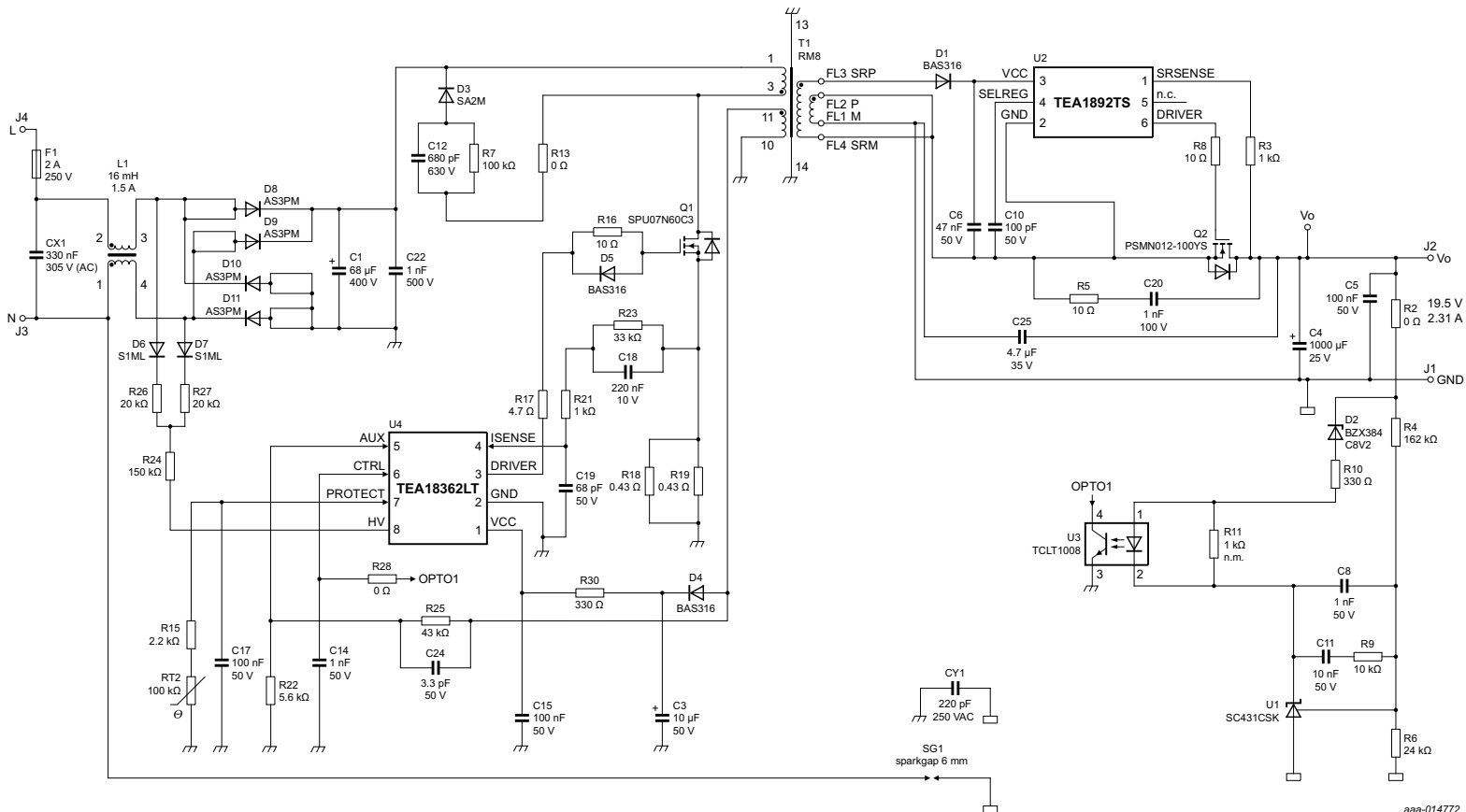
Trace 1: EN55022Q			
Trace 2: EN55022A			
Trace 3: ---			
Trace	Frequency	Level dBμV	Delta limit dB
1 quasi peak	258 kHz	53.49 N	-8.00
2 average	258 kHz	42.63 N	-8.86
2 average	382 kHz	35.00 N	-13.23
2 average	20.166 MHz	33.80 N	-16.19
1 quasi peak	19.37 MHz	42.46 N	-17.53
1 quasi peak	24.706 MHz	41.82 L1	-18.17
1 quasi peak	154 kHz	47.03 N	-18.74
1 quasi peak	26.958 MHz	41.08 L1	-18.91

5.21 Thermal measurements

The component temperatures were measured with open frame. The open PCB was placed on the table. After 1 hour of warming up time at full load (2.31 A), the component temperatures were measured using an infrared thermal camera. $T_{amb} = 25\text{ }^{\circ}\text{C}$. The MOSFET switch uses thermal compound for cooling.

Table 19. Thermal measurements

Component	Part reference	Temperature ($^{\circ}\text{C}$)
$V_{in} = 115\text{ V (AC)}$		
TEA1836	U4	76.8
Transformer core	T1	84.1
Transformer winding	T1	88.5
MOSFET switch SPU07N60C3	Q1	92.5
Clamp diode SA2M	D3	83.1
Discharge resistor in peak clamp	R7	84.3
SR MOSFET PSMN012-100YS	Q2	63.2
$V_{in} = 230\text{ V (AC)}$		
TEA1836	U4	73.5
Transformer core	T1	84
Transformer winding	T1	86.5
MOSFET switch SPU07N60C3	Q1	88.8
Clamp diode SA2M	D3	82.7
Discharge resistor in peak clamp	R7	84.7
SR MOSFET PSMN012-100YS	Q2	68.7



aaa-014772

6. Schematic

Fig 22. TEA1836DB1200 schematic diagram TEA18362LT and TEA1892TS 45 W charger demo board

7. Bill Of Materials (BOM)

Table 20. TEA1836DB1200 bill of material

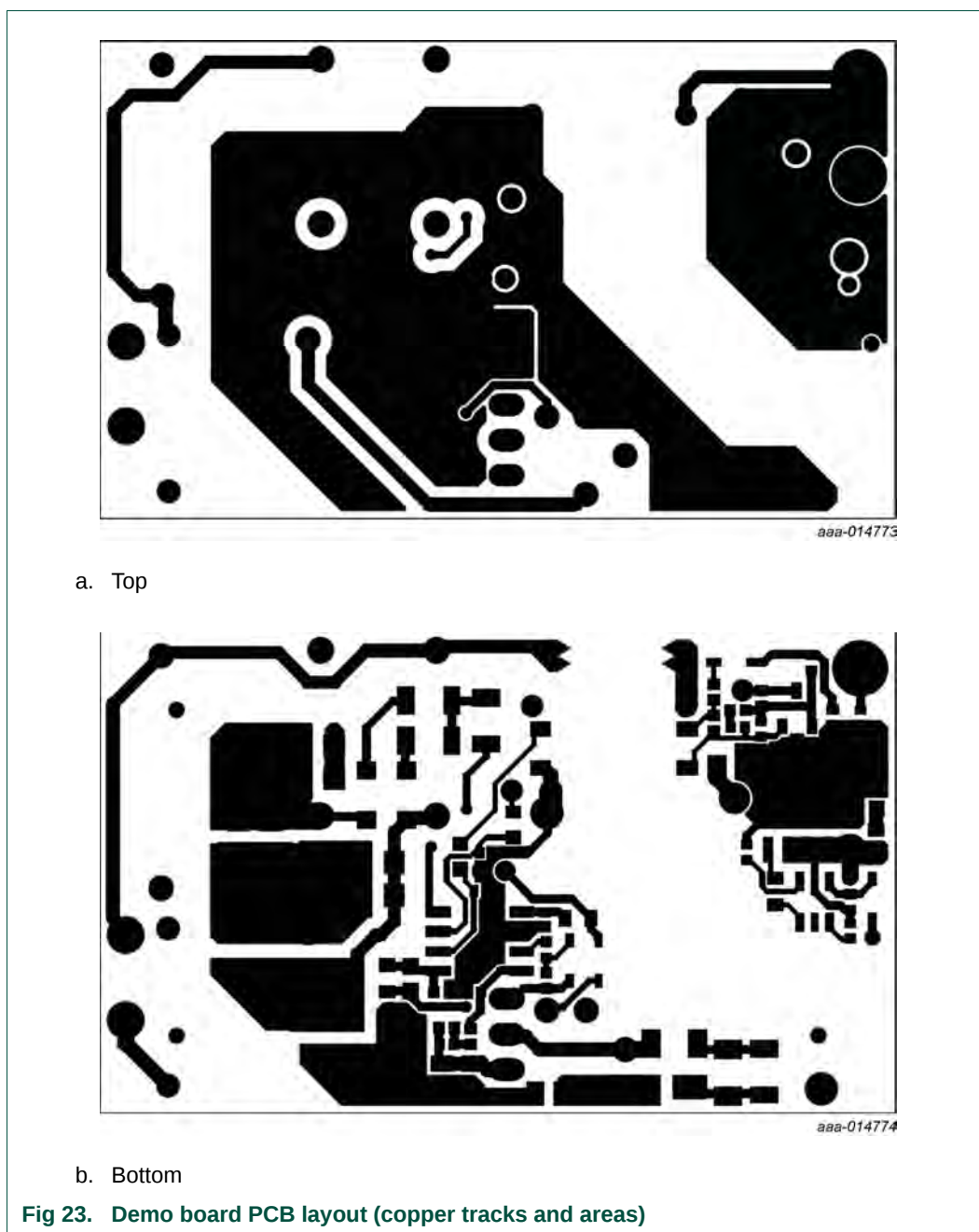
Reference	Description and values	Part number	Manufacturer
C1	capacitor; 68 μ F; 20 %; 400 V; aluminum; THT	400BXW68MEFC18X20	Rubycon
C3	capacitor; 10 μ F; 20 %; 35 V; aluminum; THT	35ML10MEFC4X7	Rubycon
C4	capacitor; 1000 μ F; 20 %; 25 V; aluminum; 10 mm $\times$ 20 mm	EEUFR1E102	Panasonic
C5; C15; C17	capacitor; 100 nF; 10 %; 50 V; X7R; 0402	C1005X7R1H104K050BB	TDK
C6	capacitor; 47 nF; 10 %; 50 V; X7R; 0402	CGA2B3X7R1H473K050BB	TDK
C8; C14	capacitor; 1 nF; 10 %; 50 V; X7R; 0402	C0402C102K5RACTU	KEMET
C10	capacitor; 100 pF; 5 %; 50 V; C0G; 0402	C0402C101J5GACTU	KEMET
C11	capacitor; 10 nF; 10 %; 50 V; X7R; 0402	C0402C103K5RACTU	KEMET
C12	capacitor; 680 pF; 10 %; 630 V; X7R; 1206	C1206C681KBRCTU	KEMET
C18	capacitor; 220 nF; 10 %; 10 V; X5R; 0402	GRM155R61A224KE19D	Murata
C19	capacitor; 68 pF; 5 %; 50 V; C0G; 0402	C0402C680J5GACTU	KEMET
C20	capacitor; 1 nF; 10 %; 100 V; X7R; 0603	C1608X7R2A102K080AA	TDK
C22	capacitor; 1 nF; 5 %; 500 V; X7R; 0805	501R15W102KV4E	Johanson Dielectrics
C24	capacitor; 3.3 pF; 0.25 pF; 50 V; C0G; 0402	06035A3R3CAT2A	AVX
C25	capacitor; 4.7 μ F; 10 %; 35 V; X7R; 0805	C2012X7R1V475K125AC	TDK
CX1	capacitor; X2; 330 nF; 20 %; 630 V; MKP	B32922C3334M189	EPCOS
CY1	capacitor; X1/Y1; 220 pF; 10 %; 250 V (AC); DE1	DE1B3KX221KA5B	Murata
D1; D4; D5	diode; 100 V; 250 mA	BAS316	NXP Semiconductors
D2	diode; Zener; 8.2 V; 200 mA	BZX384-C8V2	NXP Semiconductors
D3	diode; 1000 V; 2 A	SA2M-E3/61T	Vishay
D6; D7	diode; 1000 V; 1 A	S1ML	Taiwan Semiconductor
D8; D9; D10; D11	diode; 1 kV; 3 A	AS3PM-M3/86A	Vishay
F1	fuse; 250 V; 2 A; slow blow	MCPMP 2A 250V	Multicomp
L1	CM-choke: T16 $\times$ 12 $\times$ 8 (16.5 mH); 0.6 ϕ 60T:60T	AC10300301	Axis Power
Q1	MOSFET-N; 650 V; 7.3 A	SPU07N60C3	Infineon
Q2	MOSFET-N; 100 V; 15 A; LFPK	PSMN012-100YS,115	NXP Semiconductors
R2	resistor; 0 Ω ; 63 mW; 0402	CRCW04020000Z0ED	Vishay
R3; R21	resistor; 1 k Ω ; 1 %; 63 mW; 0402	CRCW04021K00FKED	Vishay
R4	resistor; 162 k Ω ; 1 %; 63 mW; 0402	CRCW0402162KFKED	Vishay
R5; R8	resistor; 10 Ω ; 1 %; 63 mW; 0603	-	-
R6	resistor; 24 k Ω ; 1 %; 63 mW; 0402	CRCW040224K0FKED	Vishay
R7	resistor; 100 k Ω ; 1 %; 500 mW; 1206	CRCW1206100KFKEAHP	Vishay
R9	resistor; 10 k Ω ; 1 %; 63 mW; 0402	CRCW040210K0FKED	Vishay
R10	resistor; 330 Ω ; 1 %; 63 mW; 0402	CRCW0402330RFKED	Vishay
R13	resistor; jumper; 0 Ω ; 2 A; 250 mW; 1206	-	-

Table 20. TEA1836DB1200 bill of material ...continued

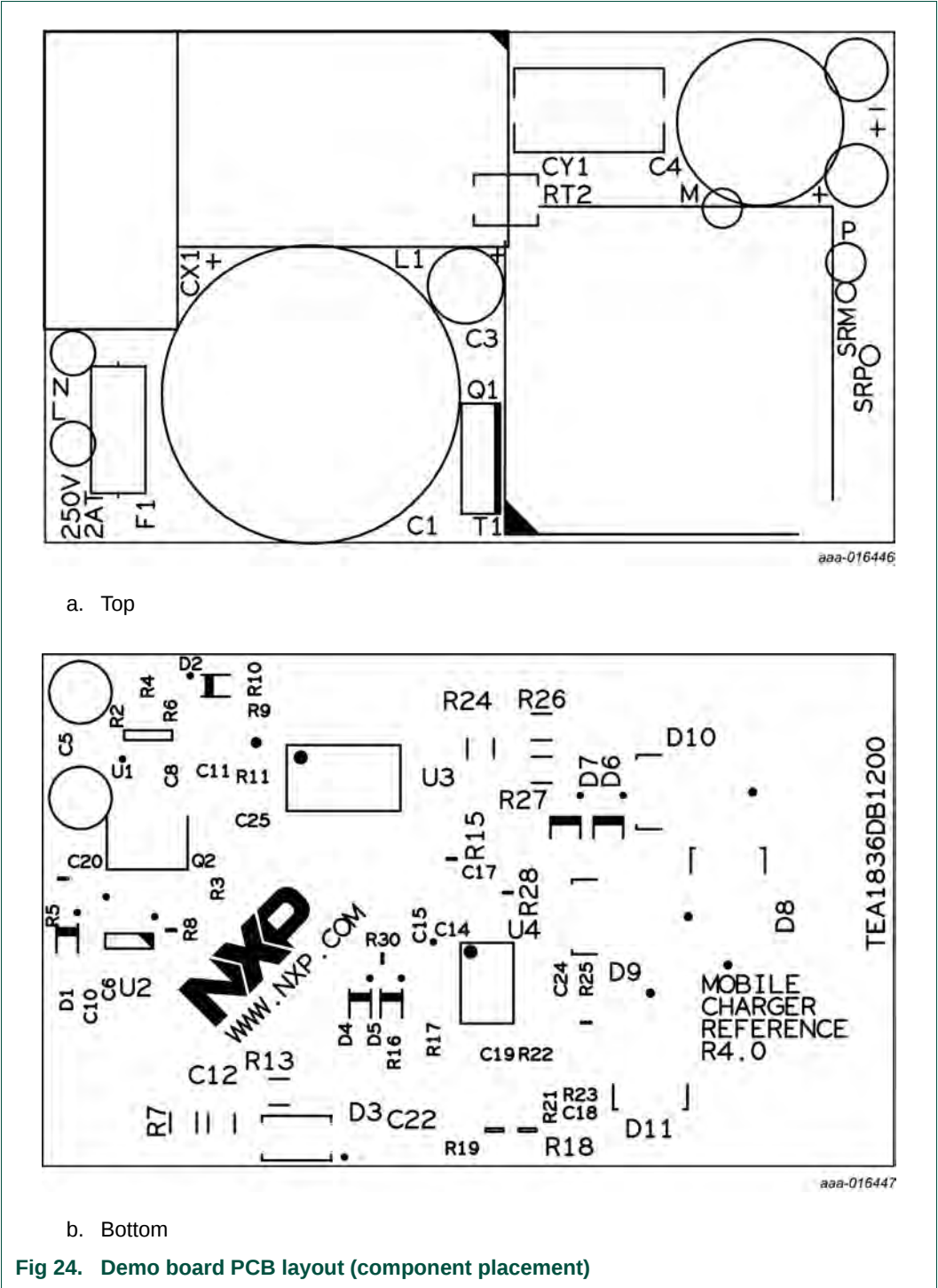
Reference	Description and values	Part number	Manufacturer
R15	resistor; 2.2 k Ω ; 1 %; 100 mW; 0603	RC0603FR-072K2L	Yageo
R16	resistor; 10 Ω ; 1 %; 63 mW; 0402	CRCW040210R0FKED	Vishay
R17	resistor; 4.7 Ω ; 5 %; 63 mW; 0402	CRCW04024R70JNEAIF	Vishay
R18; R19	resistor; 0.43 Ω ; 1 %; 250 mW; 0805	ERJ6BQFR43V	Panasonic
R22	resistor; 5.6 k Ω ; 1 %; 63 mW; 0402	CRCW04025K60FKED	Vishay
R23	resistor; 33 k Ω ; 1 %; 63 mW; 0402	CRCW040233K0FKED	Vishay
R24	resistor; 150 k Ω ; 1 %; 250 mW; 1206	-	-
R25	resistor; 43 k Ω ; 1 %; 63 mW; 0402	-	-
R26; R27	resistor; 20 k Ω ; 1 %; 250 mW; 1206	-	-
R28	resistor; jumper; 0 Ω ; 63 mW; 0603	-	-
R30	resistor; 330 Ω ; 5 %; 63 mW; 0603	-	-
RT2	resistor; NTC; 100 k Ω ; 5 %; 100 mW; 4190K; mount high against transformer T1 (top)	NTCLE100E3104JB0	Vishay
T1	transformer; RM8; 12P	TEA1836DB1200_T1	NXP Semiconductors
U1	voltage regulator; 2.495 V to 30 V; 1 %; 150 mA	SC431CSK-1TRT	Semtech Corporation
U2	synchronization rectifier controller; TEA1892TS	TEA1892TS-1	NXP Semiconductors
U3	optocoupler; 70 V; 50 mA; controller 130 % to 260 %	TCLT1008	Vishay
U4	SMTP controller; TEA18362LT	TEA18362LT	NXP Semiconductors

8. PCB layout

8.1 Copper tracks and area



8.2 Component placement



9. Transformer data

9.1 Introduction

For this demo board, requirements were set to show high performance in a very small 45 W form factor board using a basic circuit configuration. To reach this goal, the transformer design requires extra attention to support the combination of high-efficiency performance while still being EMI-compliant using a 220 pF Y-capacitor. At the same time, the concept must deliver 45 W nominal output power and generate a peak output power that is 50 % higher.

An RM8 core was used in combination with a customized bobbin type to build the transformer.

9.2 Transformer data

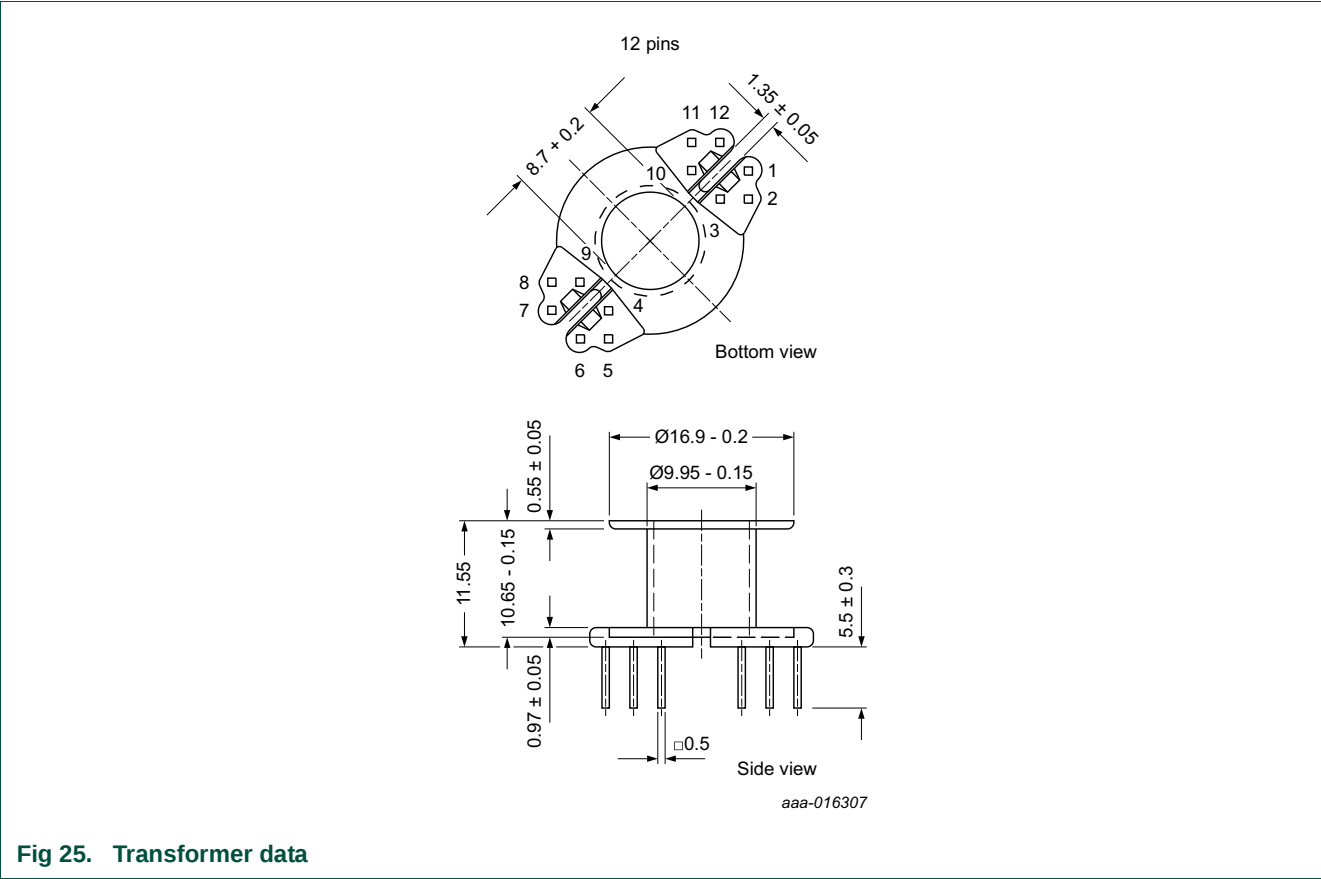


Fig 25. Transformer data

Table 21. Technical specifications transformer

Description	Value/requirement
bobbin	RM8
ferrite material	N87 (EPCOS) or equivalent
input voltage	85 V to 265 V (AC)
output voltage	19.5 V

Table 21. Technical specifications transformer ...continued

Description	Value/requirement
output current	2.36 A
maximum switching frequency	130 kHz
inductance	340 μH; ±3 %

9.3 Transformer winding construction

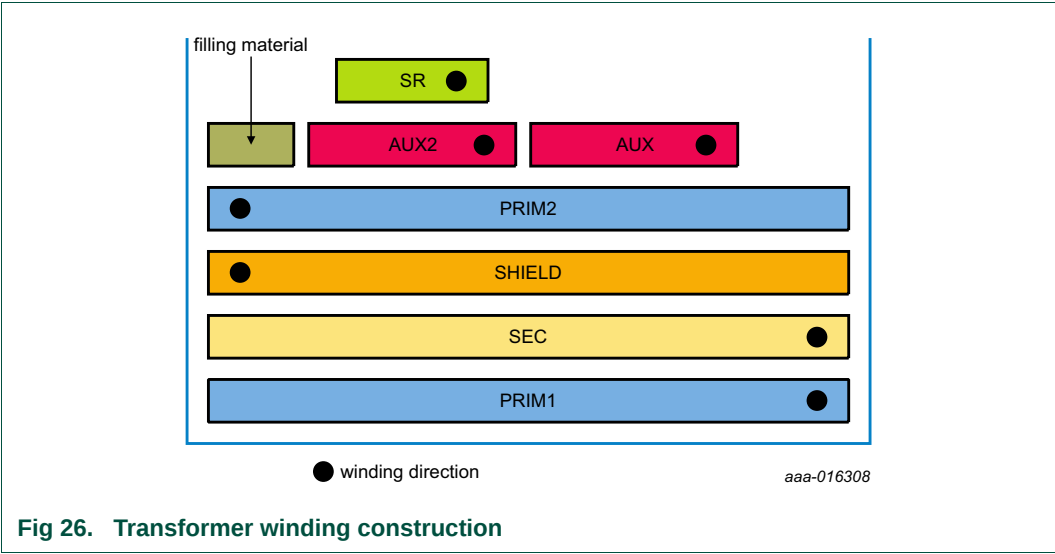


Table 22. Transformer winding construction

Layer	Name	Number of turns	Wires parallel	Wire type	Wire diameter (μm)	Pin (in)	Pin (out)
1	1/2 PRIM	18	2	enameled	212	pin 1	flying lead
2	SEC	8	2	TIW	350	flying lead	flying lead
3	SHIELD	-1	1	foil (CuSn6)	20	pin 10	-
4	1/2 PRIM	24	1	enameled	280	flying lead	pin 3
5	AUX	7	1	enameled	150	pin 10	pin 11
6	AUX2	7	1	TIW	200	pin 11	flying lead
7	SR	4	1	TIW	200	flying lead	flying lead

10. Abbreviations

Table 23. Abbreviations

Acronym	Description
BCM	Boundary Conduction Mode
DCM	Discontinuous Conduction Mode
EMI	ElectroMagnetic Interference
MOSFET	Metal-Oxide Semiconductor Field-Effect Transistor
OCP	OverCurrent Protection
OPP	OverPower Protection
OVP	OverVoltage Protection
OLP	Open-Loop Protection
PCB	Printed-Circuit Board
QR	Quasi Resonant
RMS	Root Mean Square
SOI	Silicon-On-Insulator
SR	Synchronous Rectification

11. References

- [1] **TEA18361LT data sheet** — GreenChip SMPS control IC
- [2] **TEA18361T data sheet** — GreenChip SMPS control IC
- [3] **TEA18362LT data sheet** — GreenChip SMPS control IC
- [4] **TEA18362T data sheet** — GreenChip SMPS control IC
- [5] **TEA18363LT data sheet** — GreenChip SMPS control IC
- [6] **TEA18363T data sheet** — GreenChip SMPS control IC
- [7] **TEA1892TS data sheet** — GreenChip synchronous rectifier controller
- [8] **AN11403 application note** — TEA1836XT GreenChip SMPS control IC
- [9] **AN11149 application note** — TEA1792 GreenChip synchronous rectifier controller
- [10] **UM10758 user manual** — TEA1836DB1094 TEA1836 + TEA1792 65 W notebook adapter

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