



# UM10437

GreenChip 65 W TEA1738LT/T and TEA1703 demo board

Rev. 1 — 28 February 2011

User manual

## Document information

Info	Content
<b>Keywords</b>	Notebook adapter, TEA1738LT/T, TEA1703, fixed frequency, ultra-low standby power, high-efficiency, slim line
<b>Abstract</b>	This manual provides the specification, schematics and PCB layout of the 65 W TEA1738LT/T and TEA1703 demo board. For details on the TEA1738LT/T or TEA1703 IC please refer to the application note.



## Revision history

Rev	Date	Description
v.1	20110228	first issue

## Contact information

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## 1. Introduction

### WARNING

#### Lethal voltage and fire ignition hazard



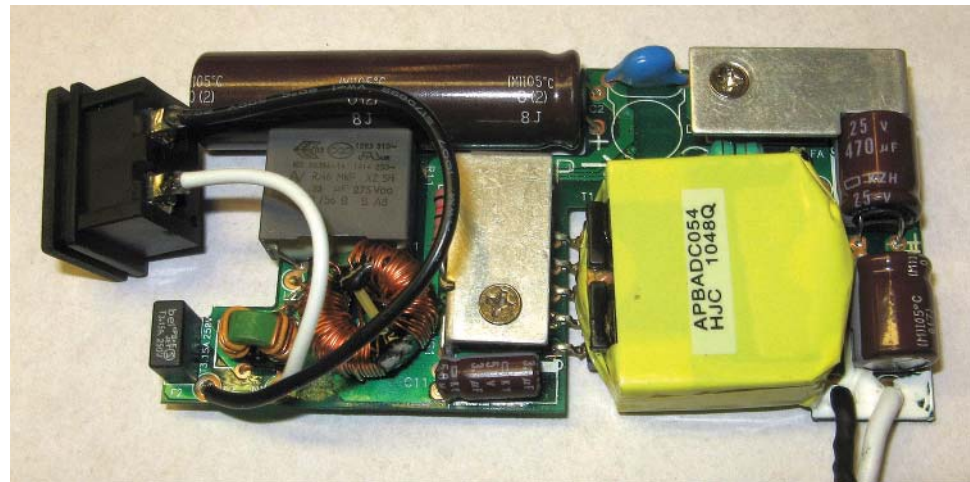
The non-insulated high voltages that are present when operating this product, constitute a risk of electric shock, personal injury, death and/or ignition of fire.

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.

This 65 W TEA1738LT/T and TEA1703 demo board demonstrates the capabilities of the TEA1738LT/T Switched-Mode Power Supply (SMPS) controller and the TEA1703 standby controller. This manual provides the specification, schematics and PCB layout of the 65 W TEA1738LT/T and TEA1703 demo board.

Refer to the TEA1738LT/T *data sheet* and *application note* (AN10981) for details on the TEA1738LT/T. In addition, refer to the *TEA1703 datasheet* and *application note* (AN11012) for details on the TEA1703.

In Standby mode operation (no-load condition), the TEA1703 standby control IC monitors the output voltage and disables the primary controller until the output voltage has reached its lowest preset value. This ensures ultra-low standby power consumption.



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Fig 1. TEA1738LT/T and TEA1703 65 W demo board

### 1.1 Features

- Universal mains supply operation
- OverCurrent Protection (OCP)
- OverPower Protection (OPP)
- Low ripple and noise
- Slim line transformer

- Low-cost implementation
- Indicator LED
- Ultra low no-load standby power (< 50 mW at 230 V, 50 Hz)
- ENERGY STAR compliant
- EMI CISPR22 compliant

## 2. Power supply specification

**Table 1. Input specification**

Symbol	Description	Conditions	Specification	Unit
$V_i$	input voltage	-	90 to 264	V
$f_i$	input frequency	-	47 to 60	Hz
$P_{i(\text{no\_load})}$	input power (no-load)	at 230 V; 50 Hz	< 50	mW

**Table 2. Output specification**

Symbol	Description	Conditions	Specification	Unit
$V_o$	output voltage	-	19	V
$V_{o(\text{min})}$	Minimum output voltage	during standby mode operation	$\geq 12$	V
$V_{o(\text{ripple})(\text{p-p})}$	peak-to-peak output ripple voltage	20 MHz bandwidth	$\leq 200$	mV
$I_o$	output current	continuous	0 to 3.34	A
$I_{o(\text{p})}$	peak output current	for 50 ms	5	A
$P_o$	output power	0 to 40 °C	65	W
$t_{\text{holdup}}$	hold-up time	at 115 V; 60 Hz; full load	5	ms
-	line regulation	-	$\pm 1$	%
-	load regulation	-	$\pm 2$	%
$t_{\text{startup}}$	start-up time	at 115 V; 60 Hz	$\leq 3$	s
$\eta$	efficiency	according to ENERGY STAR (EPS 2)	$\geq 87$	%
-	EMI	CISPR22 compliant	pass	-

## 3. Performance data

Performance figures based on the following PCB design:

- Schematic version: Tuesday 18 November 2010 rev. A

### 3.1 Efficiency

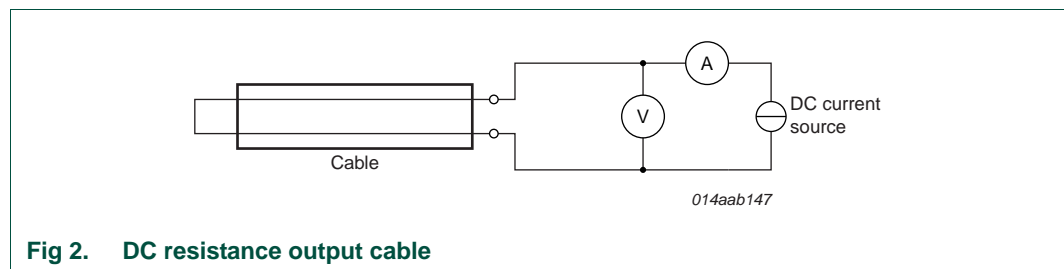
Efficiency measurements were made using an automated test program containing a temperature stability detection algorithm. The output voltage and current were measured using a 4-wire current sense configuration directly at the PCB connector. Measurements were performed for 115 V; 60 Hz and 230 V; 50 Hz.

**Table 3. Efficiency results**<sup>[1][2]</sup>

Condition	ENERGY STAR 2.0 efficiency requirement (%)	Efficiency (%)							
		Average	100 % load	75 % load	50 % load	100 % load	1 W	0.5 W	0.25 W
115 V, 60 Hz	> 87	90.3	88.8	90.5	90.4	90.5	76.8	69.1	57.8
230 V, 50 Hz	> 87	91.6	91.6	92.1	91.7	90.9	74.8	66.4	54.3

[1] Warm-up time: 10 minutes

[2] There is an efficiency loss of 1 % (approximately) when measured at the end of a 1 m output cable.



**Fig 2. DC resistance output cable**

DC resistance cable = voltage drop / current = 0.228 / 3.349 = 0.0681 Ω (2-way).

### 3.2 No-load power consumption

Power consumption performance of the total application board with no-load connected was measured using a Yokogawa WT210 digital power meter. Integration time was set to 6 minutes to calculate the average dissipated power. The output voltage variation results are shown in [Table 4](#). Measurements were performed for 90 V; 60 Hz, 115 V; 60 Hz, 230 V; 50 Hz, and 264 V; 50 Hz.

**Table 4. Output voltage and power consumption: no-load**

Condition	ENERGY STAR 2.0 requirement (mW)	Output voltage high (V)	Output voltage low (V)	No-load power consumption (mW)
90 V; 60 Hz	≤ 300	19.8	14.2	8
115 V; 60 Hz	≤ 300	19.8	14.2	11
230 V; 50 Hz	≤ 300	19.8	14.2	39
264 V; 50 Hz	≤ 300	19.8	14.2	56

### 3.3 Minimum output current in normal operation

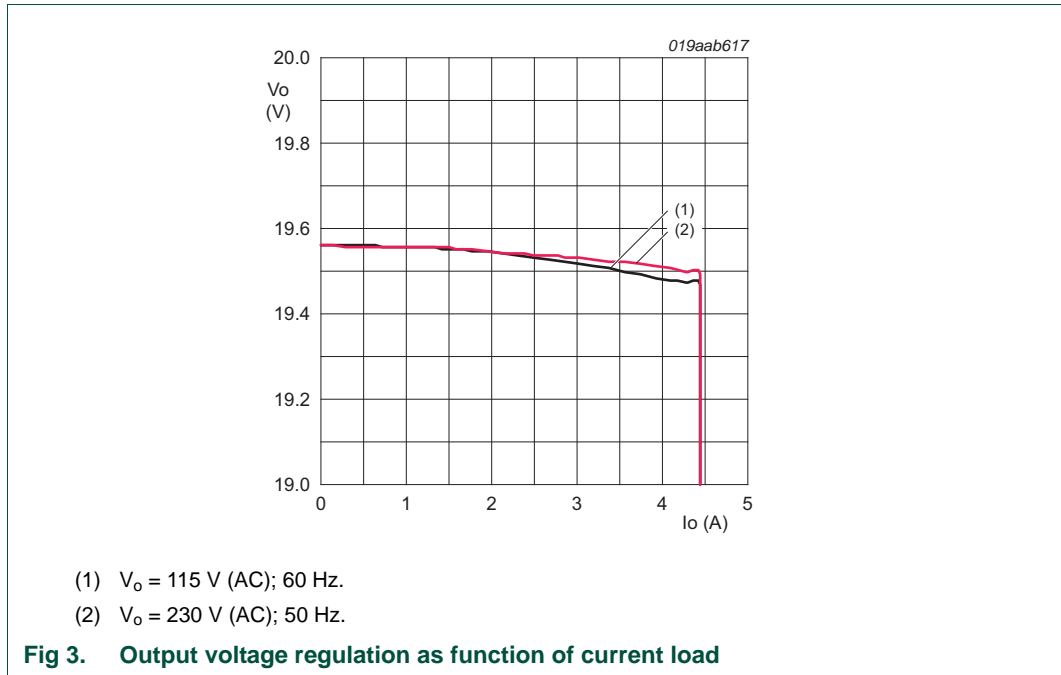
The minimum current required to leave Standby mode and enter normal operation was measured for 90 V; 60 Hz and 264 V; 50 Hz.

**Table 5. Minimum current for normal operation**

Condition	90 V; 60 Hz	264 V; 50 Hz
Current (mA)	2	5

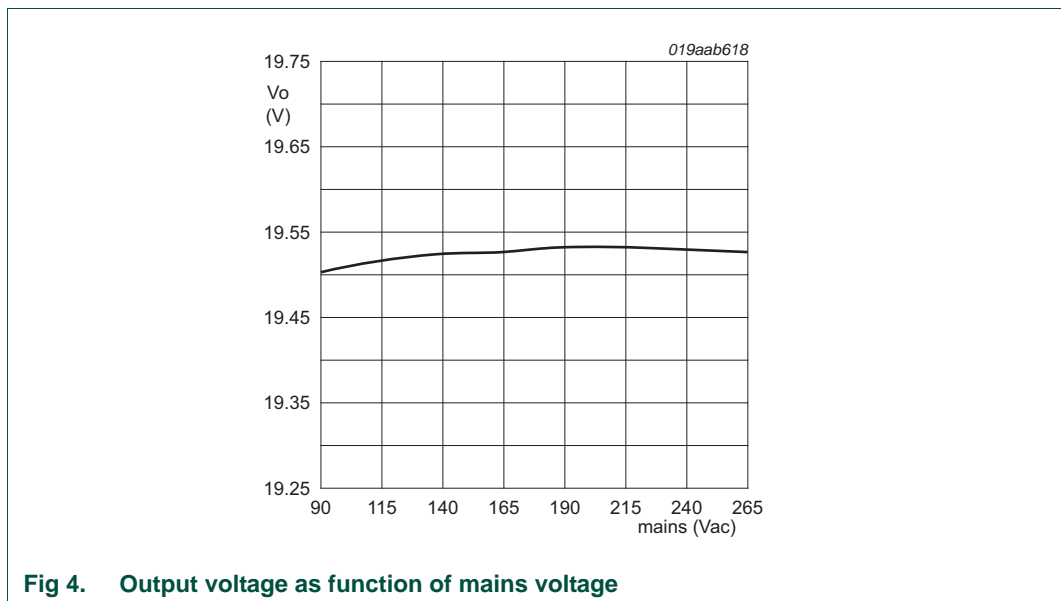
### 3.4 Output regulation

The output voltage as a function of load current was measured using a 4-wire current sense configuration directly at the PCB connector. Measurements were performed without probes attached to the application for 115 V; 60 Hz and 230 V; 50 Hz.



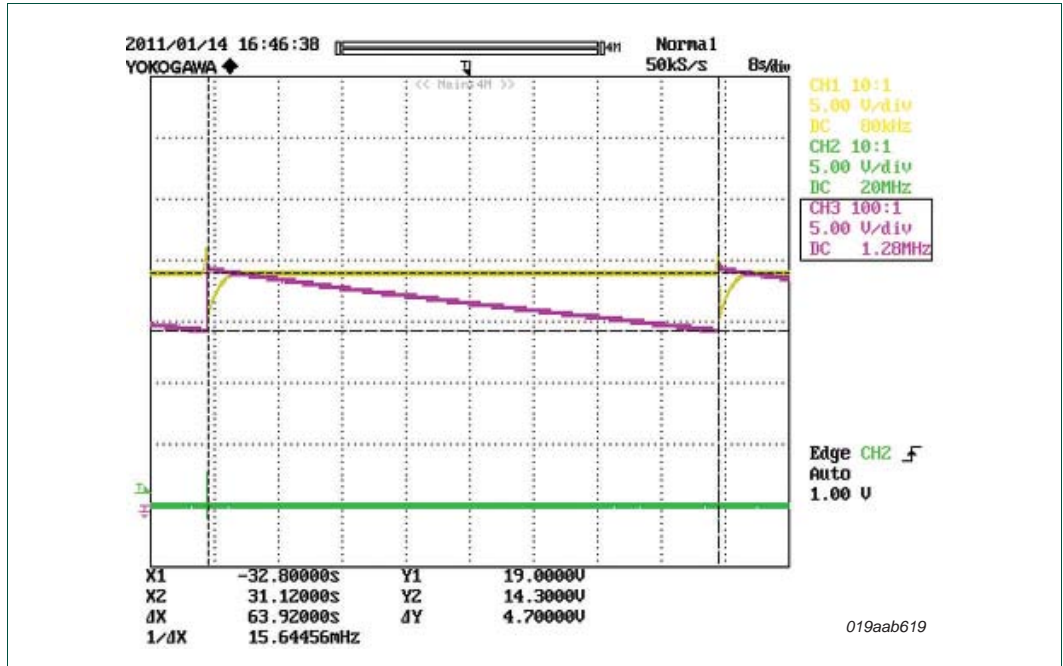
### 3.5 Line regulation

The output voltage as a function of mains input voltage was measured directly at the output connector for full load (3.34 A) condition.



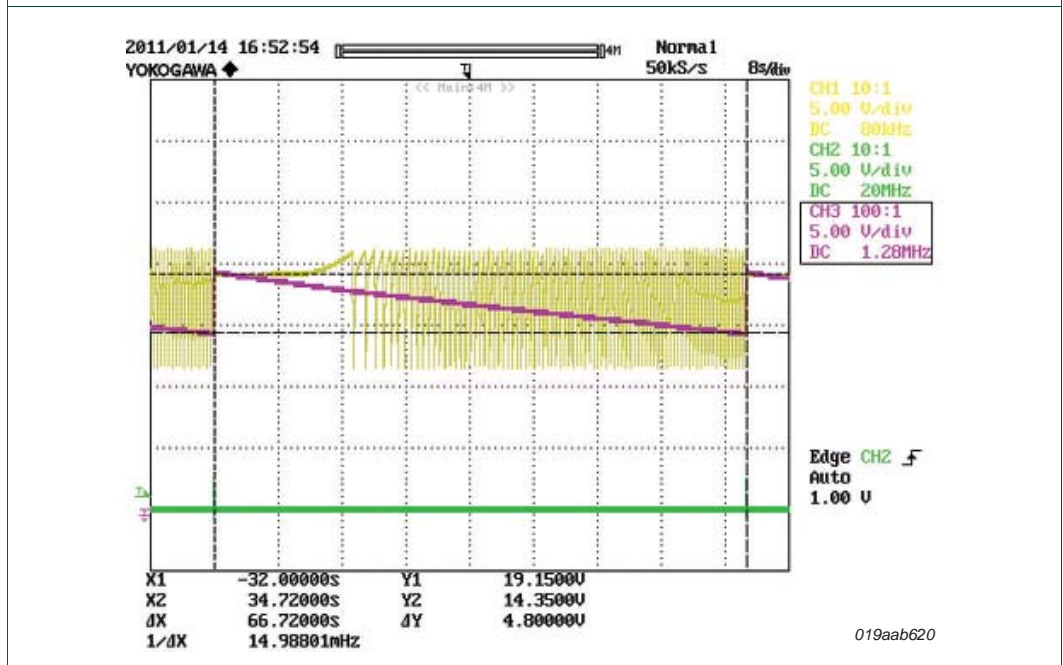
### 3.6 Output voltage regulation in Standby mode

The output voltage regulation during no-load operation was measured for 90 V; 60 Hz and 264 V; 50 Hz.



Chan1 (yellow):  $V_{CC}$ ; Chan2 (green): Gate pulse; Chan3 (magenta):  $V_O$

Fig 5. Output voltage regulation at no-load 90 V; 60 Hz



Chan1 (yellow):  $V_{CC}$ ; Chan2 (green): Gate pulse; Chan3 (magenta):  $V_O$

Fig 6. Output voltage regulation at no-load 264 V; 50 Hz

### 3.7 OverPower Protection (OPP)

Nominal and peak output power was measured directly at the output connector for various mains input voltages. Peak output power was measured after removing C18 and replacing R16 for 180 kΩ.

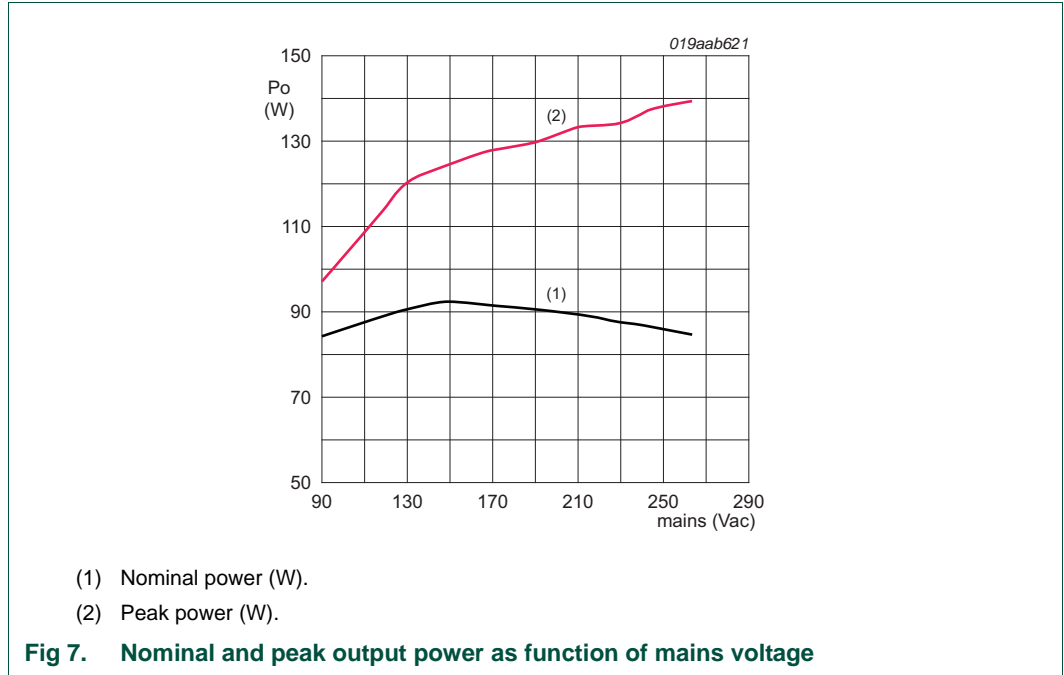


Fig 7. Nominal and peak output power as function of mains voltage

### 3.8 VCC voltage

The IC VCC pin 1 voltage was measured for both no-load and full load (3.34 A) conditions.

Table 6. VCC voltage

Condition	115 V; 60 Hz	230 V; 50 Hz
No-load	18.9	19.0
Full load (3.34 A)	21	20.2

### 3.9 Brownout and start level

Brownout and start level was measured for no-load and full load (3.34 A) conditions.

Table 7. Brownout and start level results

Condition	Brownout V (AC)	Start level V (AC)
No-load	63	84
Full load (3.34 A)	78	85

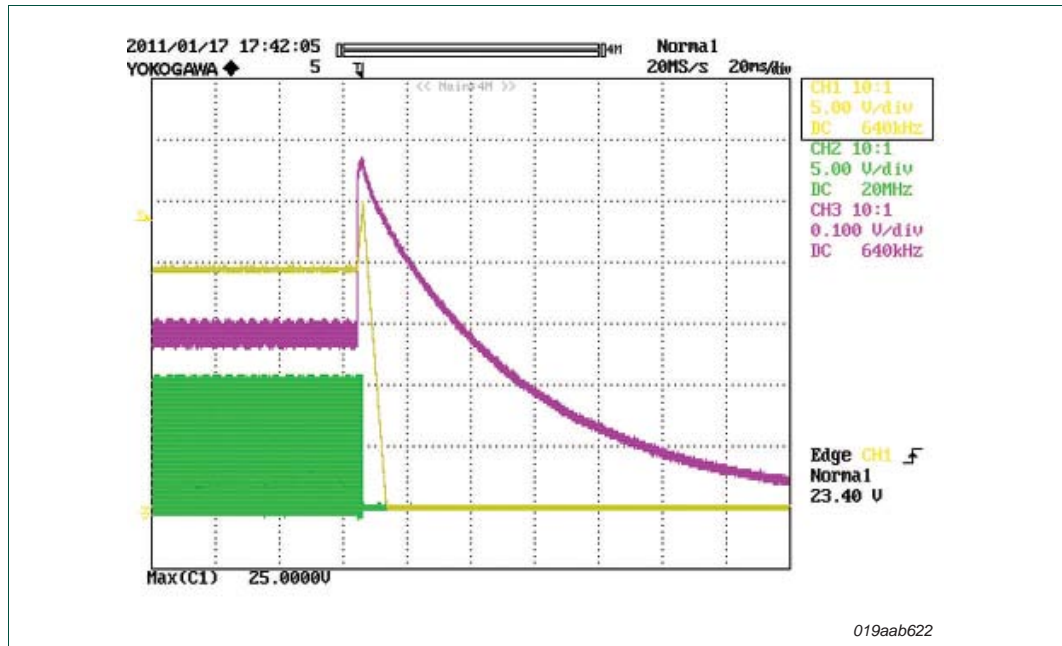
### 3.10 OverVoltage Protection (OVP)

Applying a short-circuit across the opto-LED of the optocoupler (M5) creates an output overvoltage condition. The output voltage was measured directly at the output connector for both full load (3.34 A) and no-load condition. In no-load condition, the fault condition is processed when the primary controller is active.



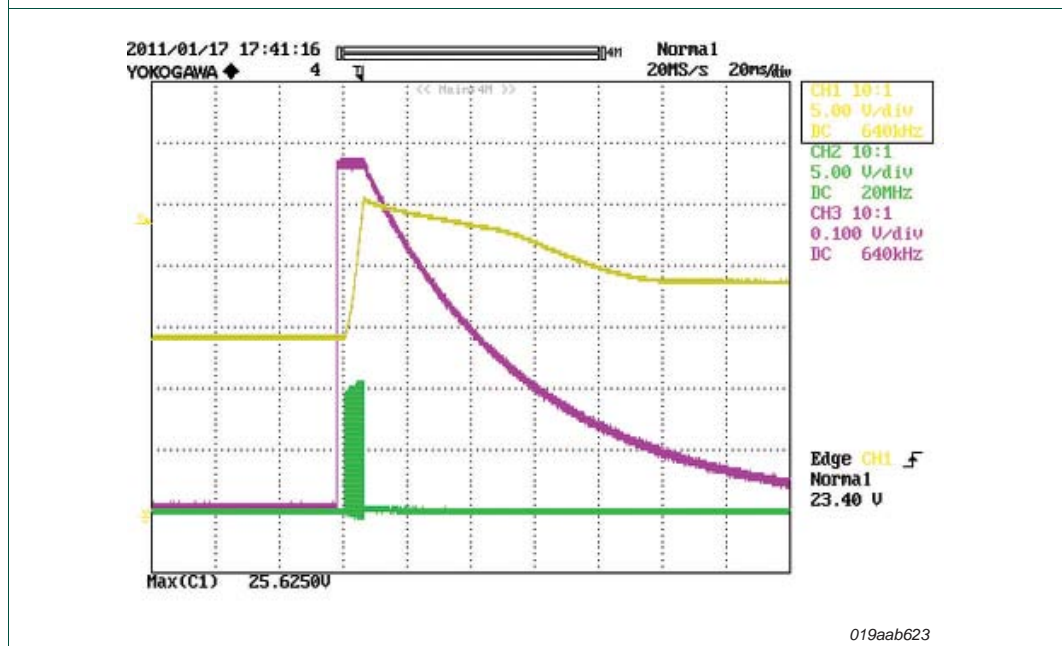
**Table 8. Maximum output voltage in case of OVP**

Condition	115 V (AC)	230 V (AC)
No-load	25.6	25.6
Full load (3.34 A)	25	25.2



Chan1 (yellow):  $V_O$ ; Chan2 (green): Gate pulse; Chan3 (magenta): Ctrl voltage.

**Fig 8. 230 V; 50 Hz; full load maximum output voltage when OVP is triggered**



Chan1 (yellow):  $V_O$ ; Chan2 (green): Gate pulse; Chan3 (magenta): Ctrl voltage.

**Fig 9. 230 V; 50 Hz; no-load maximum output voltage when OVP is triggered**

### 3.11 Start-up time

Start-up time was measured for three mains input voltages and full load (3.34 A) condition.  $V_i$  input measured using a current probe (to avoid adding additional capacitance to the mains input).  $V_o$  was measured using a voltage probe grounded at the secondary side.

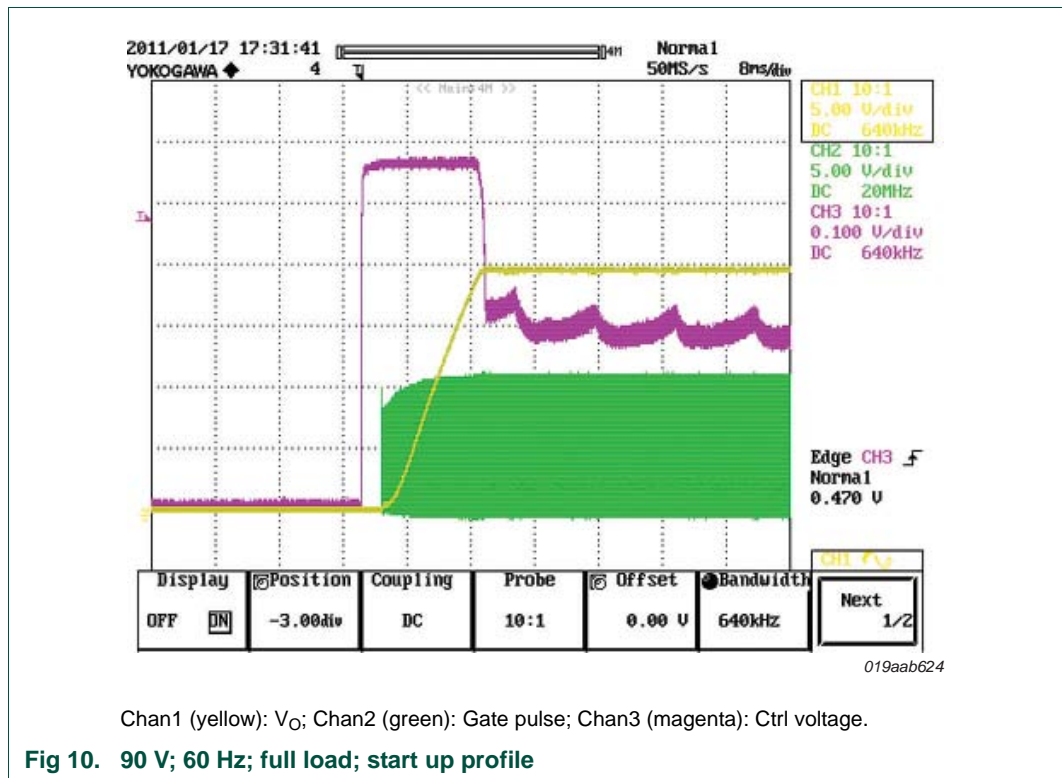
Table 9. Start-up time

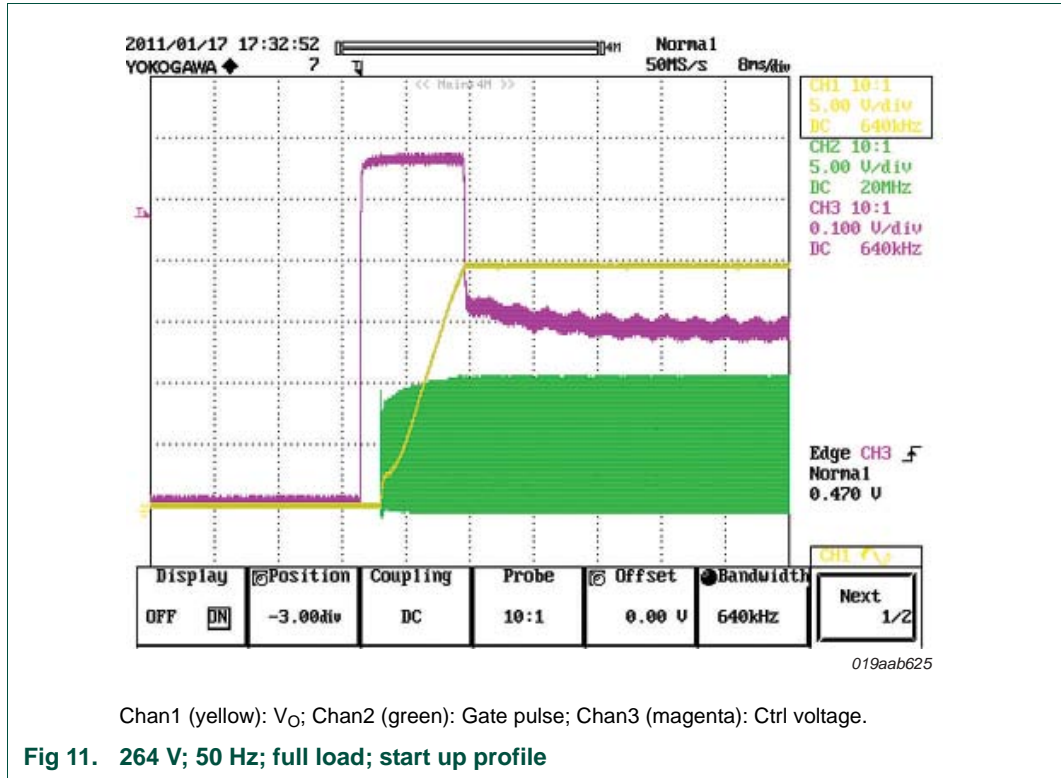
Condition	Start-up time (s)
90 V; 60 Hz	3.2
115 V; 60 Hz	2.0
230 V; 50 Hz	0.8

If the start-up time is considered too long, it is advised to change the input circuit as described in *application note AN10981*.

### 3.12 Start-up profile

The shape of the output voltage was measured for three mains input voltages during start-up directly from the output connector under the full load (3.34 A) condition.  $V_o$  was measured using a voltage probe grounded at the secondary side.





**Remark:** The small discontinuity in the output voltage ramp at 264 V; 50 Hz is caused by the slow start function not limiting the primary current because it is hidden by the leading edge blanking period of 300 ns.

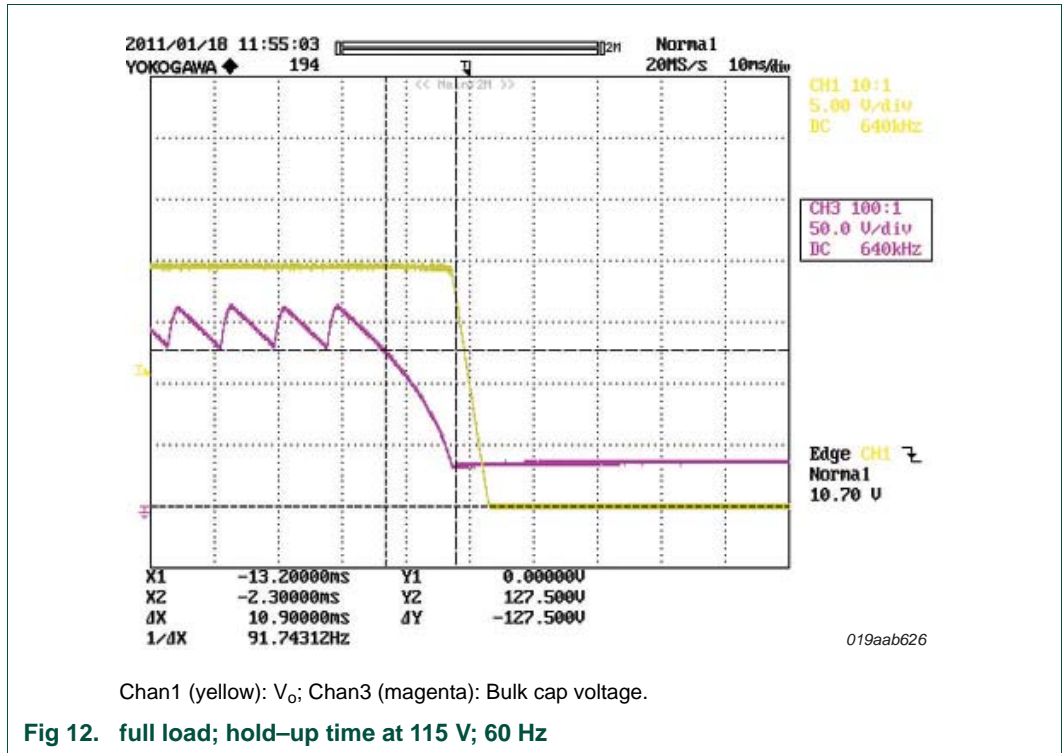
### 3.13 Hold-up time

Hold-up time is defined as the time between the following moments:

- After mains switch off; the moment that the lowest bulk cap voltage during a mains cycle is crossed
- The moment that the output voltage starts to drop

The hold-up time is measured for 115 V; 60 Hz under full load (3.34 A) condition. Output voltage duration was measured directly at the output connector.

The hold-up time at 115 V, 60 Hz is 10.9 ms.

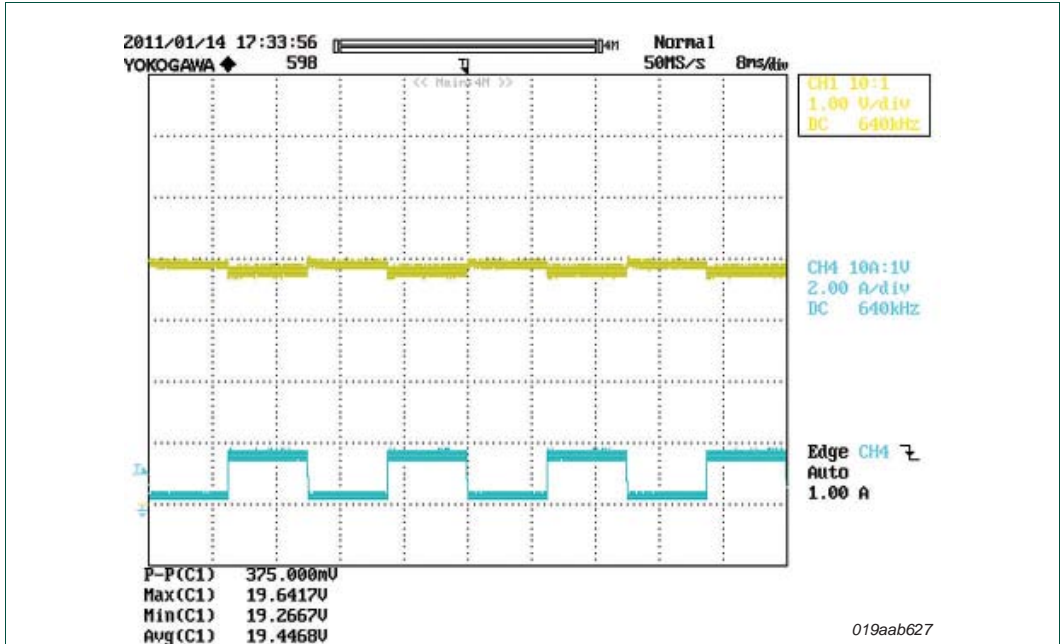


### 3.14 Dynamic loading

The output voltage was measured at the end of the cable. Both channels of the oscilloscope are set to DC mode.

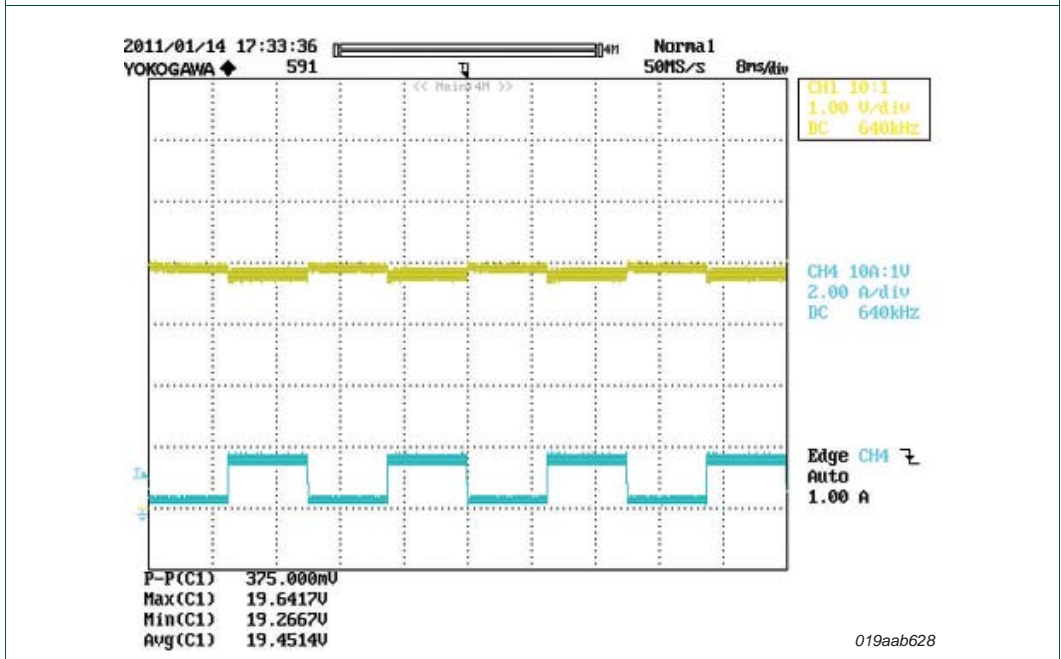
**Table 10. Dynamic loading test conditions and results**

Condition	Loading	$V_{o(ripple)(p-p)}$ (mV)
90 V; 47 Hz	$I_o$ : 0 % to 50 %, frequency 50 Hz; duty cycle 50 %	375
264 V; 63 Hz	$I_o$ : 0 % to 50 %, frequency 50 Hz; duty cycle 50 %	375



Chan1 (yellow):  $V_o$ ; Chan4 (cyan):  $I_o$ .

Fig 13. Dynamic loading 90 V; 47 Hz



Chan1 (yellow):  $V_o$ ; Chan4 (cyan):  $I_o$ .

Fig 14. Dynamic loading 264 V; 63 Hz

### 3.15 Output ripple and noise

Output ripple and noise were measured at the end of the cable using the measurement set-up described in [Figure 15](#). An oscilloscope probe connected to the end of the adapter cable using a probe tip. 100 nF and 1  $\mu$ F capacitors were added between plus and minus to reduce the high frequency noise. Output ripple and noise were measured for mains voltages 90 V; 47 Hz and 264 V; 63 Hz, both at full load (3.34 A) output current.

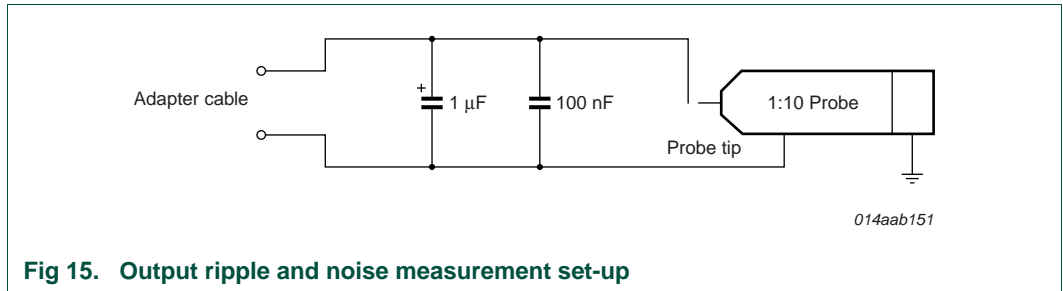


Fig 15. Output ripple and noise measurement set-up

Table 11. Output ripple and noise measurements

Condition	$V_{o(ripple)(p-p)}$ (mV)
90 V; 47 Hz	130
264 V; 63 Hz	110

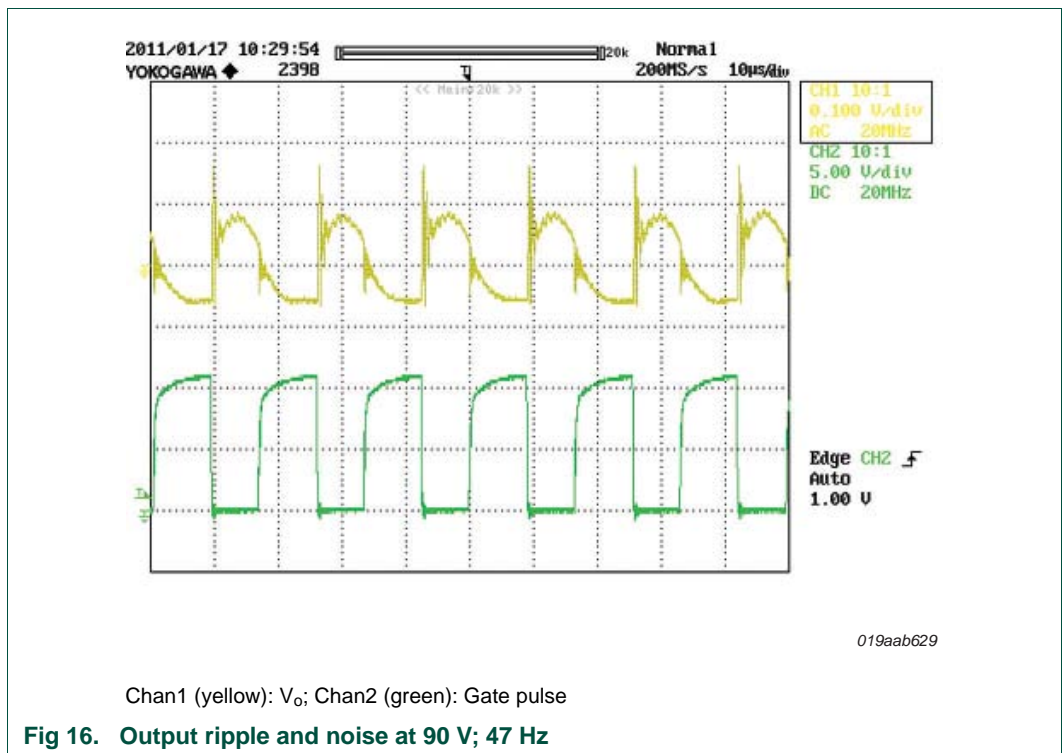
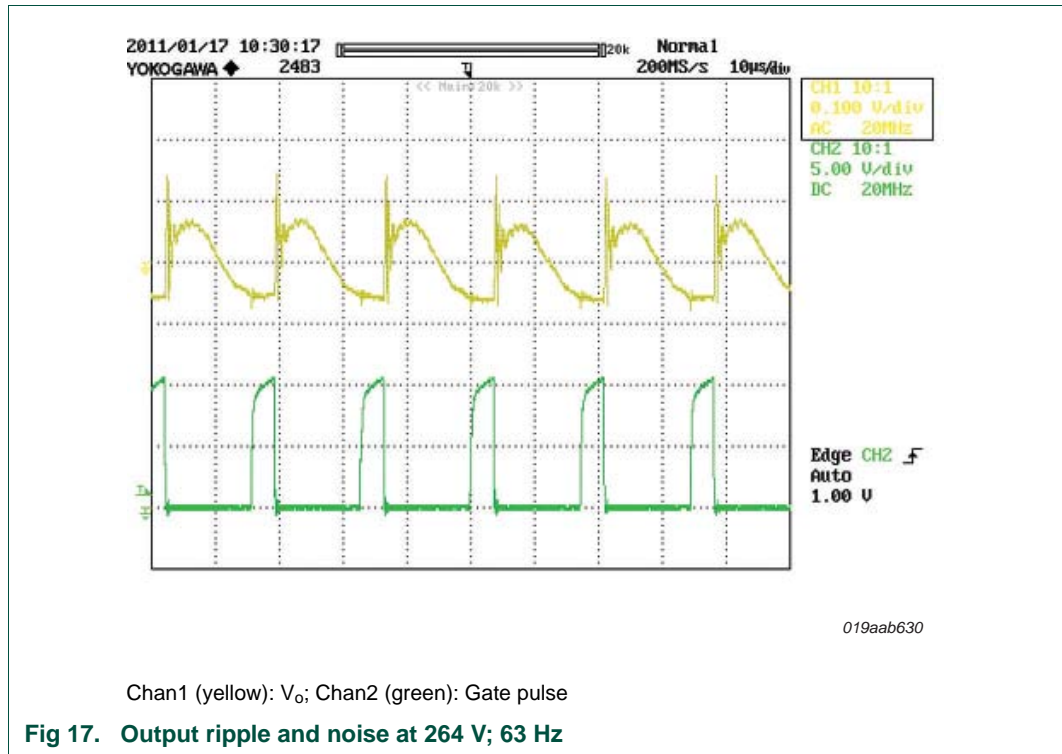


Fig 16. Output ripple and noise at 90 V; 47 Hz

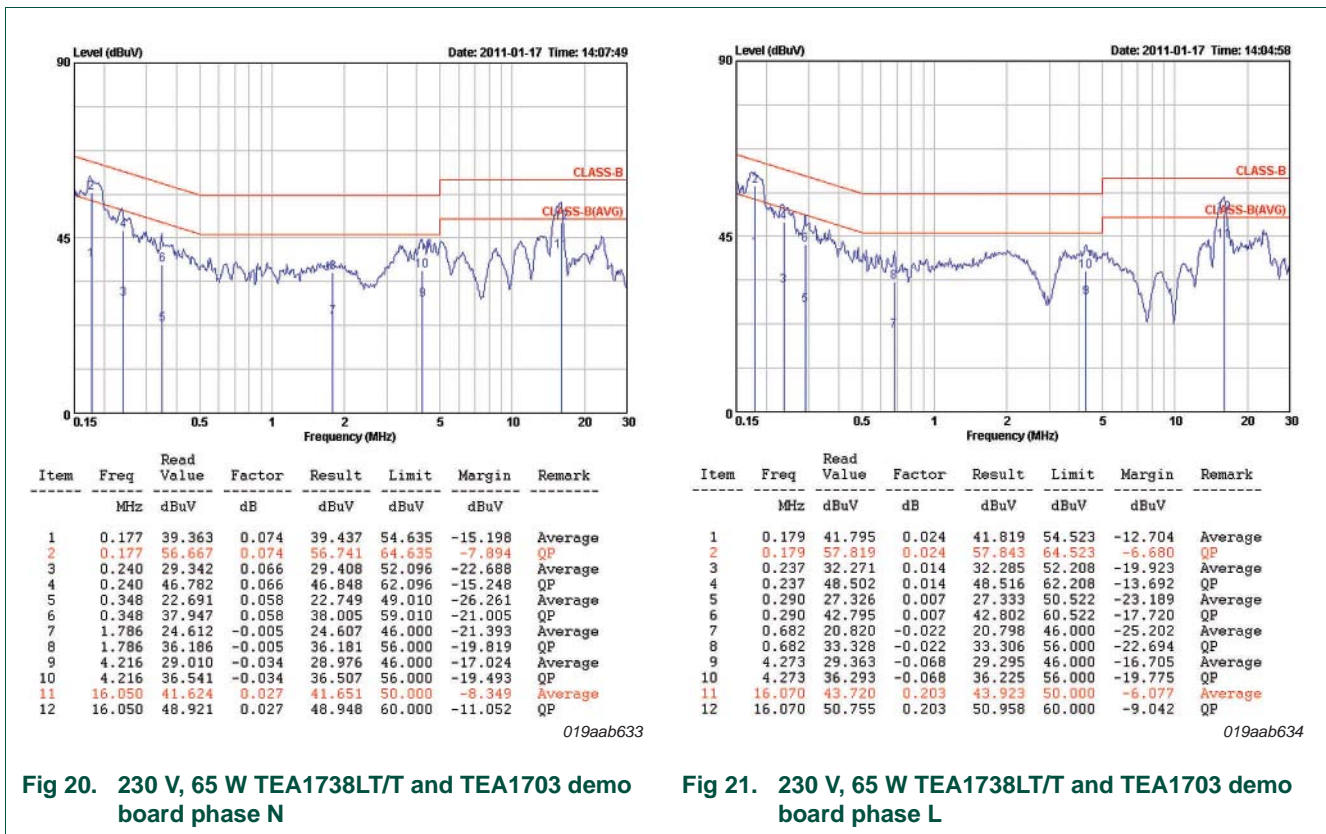
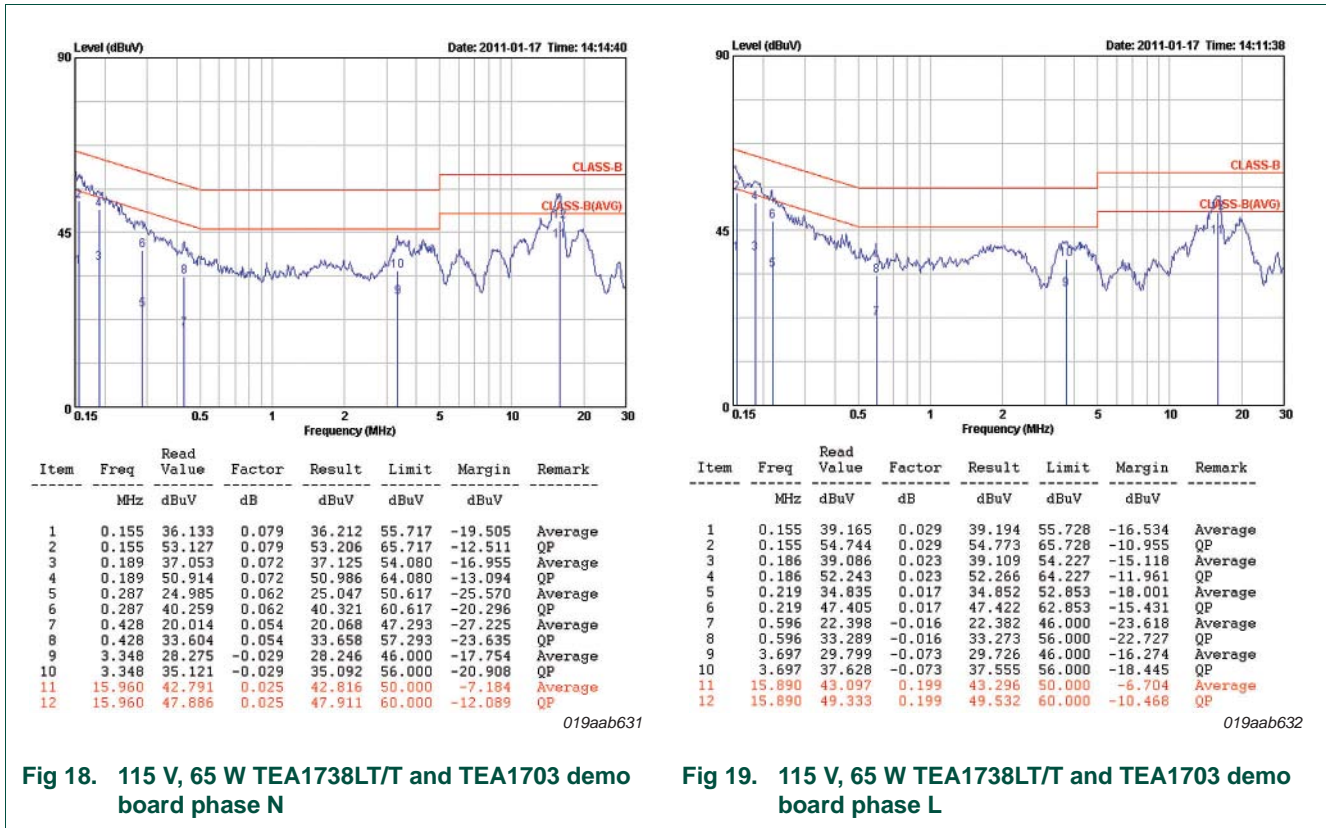


### 3.16 EMI performance

Conditions:

- Type: conducted EMC measurement
- Frequency range: 150 kHz to 30 MHz
- Output power: full load condition
- Supply voltage: 110 V and 230 V (AC)
- Margin: 6 dB below limit
- Measurements performed by Cerpasp technology corp. Taipei (Taiwan)

**Remark:** The displayed trace line in the following graphs is the quasi-peak measurement result





4. Schematic 65 W TEA1738LT/T and TEA1703 reference board

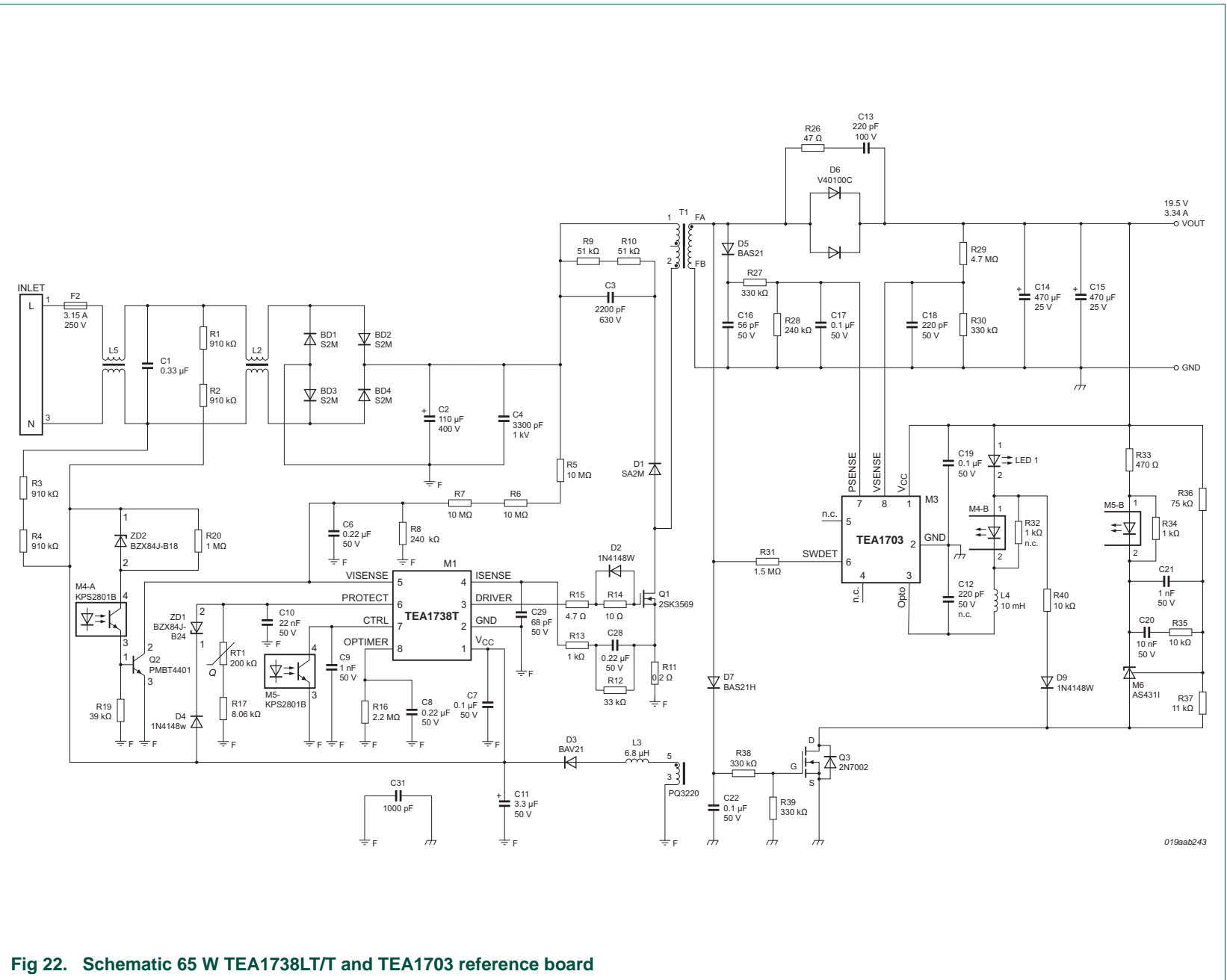


Fig 22. Schematic 65 W TEA1738LT/T and TEA1703 reference board

## 5. Bill of materials

### 5.1 Components list

Table 12. Bill of materials

Reference	Value	Description	Package
R1	910 k $\Omega$ ; 1 %; 4 W	resistor; thin film chip	SMD 1206
R2	910 k $\Omega$ ; 1 %; 4 W	resistor; thin film chip	SMD 1206
R3	910 k $\Omega$ ; 1 %; 4 W	resistor; thin film chip	SMD 1206
R4	910 k $\Omega$ ; 1 %; 4 W	resistor; thin film chip	SMD 1206
R5	10 M $\Omega$ ; 1 %; 4 W	resistor; thin film chip	SMD 1206
R6	10 M $\Omega$ ; 1 %; 4 W	resistor; thin film chip	SMD 1206
R7	10 M $\Omega$ ; 1 %; 4 W	resistor; thin film chip	SMD 1206
R8	240 k $\Omega$ ; 5 %; 8 W	resistor; thin film chip	SMD 0805
R9	51 k $\Omega$ ; 1 %; 1 W	resistor; thin film chip	SMD 1206
R10	51 k $\Omega$ ; 1 %; 1 W	resistor; thin film chip	SMD 1206
R11	0.2 $\Omega$ ; 1 %; 1 W	resistor; MOF	axial lead
R12	33 k $\Omega$ ; 1 %; 10 W	resistor; thin film chip	SMD 0603
R13	1 k $\Omega$ ; 1 %; 1 W	resistor; thin film chip	SMD 0603
R14	10 $\Omega$ ; 5 %; 8 W	resistor; thin film chip	SMD 0603
R15	4.7 $\Omega$ ; 5 %; 8 W	resistor; thin film chip	SMD 0805
R16	2.2 M $\Omega$ ; 5 %; 10 W	resistor; thin film chip	SMD 0603
R17	8.06 k $\Omega$ ; 5 %; 10 W	resistor; thin film chip	SMD 0603
R19	39 k $\Omega$ ; 5 %; 10 W	resistor; thin film chip	SMD 0603
R20	1 M $\Omega$ ; 5 %; 10 W	resistor; thin film chip	SMD 0603
R26	4.7 $\Omega$ ; 5 %; 8 W	resistor; thin film chip	SMD 0603
R27	330 k $\Omega$ ; 5 %; 10 W	resistor; thin film chip	SMD 0603
R28	240 k $\Omega$ ; 5 %; 10 W	resistor; thin film chip	SMD 0603
R29	4.7 M $\Omega$ ; 5 %; 10 W	resistor; thin film chip	SMD 0603
R30	330 k $\Omega$ ; 5 %; 10 W	resistor; thin film chip	SMD 0603
R31	1.5 M $\Omega$ ; 5 %; 10 W	resistor; thin film chip	SMD 0603
R32	-	not mounted	-
R33	470 $\Omega$ ; 5 %; 8 W	resistor; thin film chip	SMD 0603
R34	1 k $\Omega$ ; 5 %; 10 W	resistor; thin film chip	SMD 0603
R35	10 k $\Omega$ ; 5 %; 10 W	resistor; thin film chip	SMD 0603
R36	75 k $\Omega$ ; 5 %; 10 W	resistor; thin film chip	SMD 0603
R37	11 k $\Omega$ ; 5 %; 10 W	resistor; thin film chip	SMD 0603
R38	330 k $\Omega$ ; 5 %; 10 W	resistor; thin film chip	SMD 0603
R39	330 k $\Omega$ ; 5 %; 10 W	resistor; thin film chip	SMD 0603
R40	10 k $\Omega$ ; 5 %; 10 W	resistor; thin film chip	SMD 0603
RT1	200 k $\Omega$ ; 5 %	NTC resistor	SMD 0805
C1	330 $\mu$ F; 400 V; 105 $^{\circ}$ C	X2-cap; Arcotronics	15 mm $\times$ 14.5 mm $\times$ 8.5 mm
C2	110 $\mu$ F; 400 V; 105 $^{\circ}$ C	electric; $\pm$ 20 %, NCC	50 mm $\times$ 11.5 mm

Table 12. Bill of materials ...continued

Reference	Value	Description	Package
C3	2200 pF; 630 V	MLCC; Z5U	SMD 1206
C4	3300 pF; 1 kV	MLCC; Z5U	SMD 1206
C6	0.22 $\mu$ F; 50 V	$\pm 10$ %; MLCC; X7R; lead free	SMD 0603
C7	0.1 $\mu$ F; 50 V	$\pm 10$ %; MLCC; X7R	SMD 0603
C8	0.22 $\mu$ F; 50 V	$\pm 10$ %; MLCC; X7R; lead free	SMD 0603
C9	1 nF; 50 V	$\pm 10$ %; MLCC; X7R	SMD 0603
C10	22 nF; 50 V	$\pm 5$ %; MLCC; X7R	SMD 0603
C11	3.3 $\mu$ F; 50 V; 105 $^{\circ}$ C	electric, $\pm 20$ %; KY/NCC	5 mm $\times$ 11.5 mm
C12	-	not mounted	-
C13	220 pF; 100 V	$\pm 5$ %; MLCC; NPO; KZH/NCC	SMD 0805
C14	470 $\mu$ F; 50 V; 105 $^{\circ}$ C	electric, $\pm 20$ %; KZH/NCC	radial lead; 10 mm $\times$ 12.5 mm
C15	470 $\mu$ F; 50 V; 105 $^{\circ}$ C	electric, $\pm 20$ %; KZH/NCC	radial lead; 10 mm $\times$ 12.5 mm
C16	56 pF; 50 V	$\pm 5$ %; MLCC; X7R	SMD 0603
C17	0.1 $\mu$ F; 50 V	$\pm 10$ %; MLCC; X7R	SMD 0603
C18	220 pF; 50 V	$\pm 5$ %; MLCC; X7R	SMD 0603
C19	0.1 $\mu$ F; 50 V	$\pm 10$ %; MLCC; X7R	SMD 0603
C20	10 nF; 50 V	$\pm 10$ %; MLCC; X7R	SMD 0603
C21	1 nF; 50 V	$\pm 10$ %; MLCC; X7R	SMD 0603
C22	0.1 nF; 50 V	$\pm 10$ %; MLCC; X7R	SMD 0603
C28	0.22 nF; 50 V	$\pm 10$ %; MLCC; X7R; lead free	SMD 0603
C31	1000 pF; 400 V (AC)	Y1-cap	-
BD1	2 A; 1 kV	general purpose diode; S2M; trr = 2 $\mu$ S; MCCsemi	SMB
BD2	2 A; 1 kV	general purpose diode; S2M; trr = 2 $\mu$ S; MCCsemi	SMB
BD3	2 A; 1 kV	general purpose diode; S2M; trr = 2 $\mu$ S; MCCsemi	SMB
BD4	2 A; 1 kV	general purpose diode; S2M; trr = 2 $\mu$ S; MCCsemi	SMB
D1	2 A; 1 kV	general purpose diode; S2M; trr = 2 $\mu$ S; MCCsemi	SMT SMB
D2	0.15 A; 100 V	switching diode; 1N4148W; trr = 4 nS	SMT SOD123
D3	0.2 A; 250 V	diode; BAV21W/Vishay; trr = 50 nS	SMT SOD123
D4	0.15 A; 100 V	switching diode; 1N4148W; trr = 4 nS	SMT SOD123
D5	0.2 A; 250 V	diode; BAV21W/Vishay; trr = 50 nS	SMT SOD123
D6	40 A; 100 V	Schottky; V40100C; Vishay	TO220AB
D7	0.2 A; 250 V	diode; BAV21H/Vishay; trr = 50 nS; NXP	SMT SOD123
D8	0.15 A; 100 V	switching diode; 1N4148W; trr = 4 nS	SMT SOD123
D9	0.15 A; 100 V	switching diode; 1N4148W; trr = 4 nS	SMT SOD123
ZD1	24 V	Zener diode; BZX84J-B24; Vz = 23.5 V to 24.5 V; zt = 5 mA; Ir = 50 nA	SMT SOD323F
ZD2	24 V	Zener diode; BZX84J-B18; Vz = 17.6 V to 18.4 V; zt = 5 mA; Ir = 50 nA	SMT SOD323F

Table 12. Bill of materials ...continued

Reference	Value	Description	Package
ZD3	-	not mounted	-
Q1	15 A; 600 V; 0.5 $\Omega$	MOSFET; n-channel; 2SK3569/Toshiba; $R_{DS(on)} = 0.5 \Omega$ ; $V_{GS(on)} = 3 V$ ; $I_D = 15 A$ ; $C_{iss} = 1600 pF$ ; $V_{DS} = 600 V$ ; $V_{GS} = \pm 30 V$	SMT TO220
Q2	PMBT4401	NPN transistor 80 hFE; $V_{CEO} = 40 V$ ; $I_C = 600 mA$	SMT TO220
Q3	15 A; 600 V; 0.5 $\Omega$	MOSFET; n-channel; 2SK3569/Toshiba; $R_{DS(on)} = 5.3 \Omega$ ; $V_{GS(on)} = 1 V$ ; $I_D = 300 mA$ ; $C_{iss} = 40 pF$ ; $V_{DS} = 60 V$ ; $V_{GS} = \pm 30 V$	SMT SOT23
M1	TEA1738LT/T	GreenChip SMPS control IC; NXP Semiconductors	SO8
M3	TEA1703	GreenChip SMPS control IC; NXP Semiconductors	SO8
M4	KPS2801B	optocoupler; CTR = 130 % ~ 260 %; 1-channel; COSMO	4-pin SOP
M5	KPS2801B	optocoupler; CTR = 130 % ~ 260 %; 1-channel; COSMO	4-pin SOP
M6	AS431I	adjustable precision shunt regulator BCD	SMT SOT23
T1	$L_p = 400 \mu H$	transformer; $N_p : N_s : N_{aux} = 36 : 6 : 6$ ; JPP44A; A-core	ATQ28/11.2D
L2	choke	$N_1 : N_2 = 52 : 52$ ; JPH10F; A-core	$D = 0.45 mm$ ; 14 mm $\times$ 5–9C
L3	6.8 $\mu H$	choke; $\pm 10 \%$ ; 275 $\mu A$ ; DCR = 1 $\Omega$ ; WIS252018N-6R8K; Mingstar	SMT 2.5 mm $\times$ 2 mm $\times$ 1.8 mm
L4	10 $\mu H$	choke	DIP
L5	choke	$N_1 : N_2 = 7 : 7$ ; JPZ10K; A-core	$D = 0.45 mm$ ; T8 mm $\times$ 4 mm $\times$ 4–9C
F2	T3.15 A; 250 V	fuse; f7use; DIP; MST	8.35 mm $\times$ 4.3 mm $\times$ 7.7 mm
LED1	LED 5.0 V; blue	M02-0603QBC; $V_r = 5 V$ ; $I_F = 30 mA$ ; Hi-light	SMD 0603; 1.6 mm $\times$ 0.8 mm $\times$ 0.8 mm
Inlet	inlet	-	2P
Cable	cable	16AWG/1571	L = 1200 mm

## 6. Transformer specification

### 6.1 Transformer schematic diagram

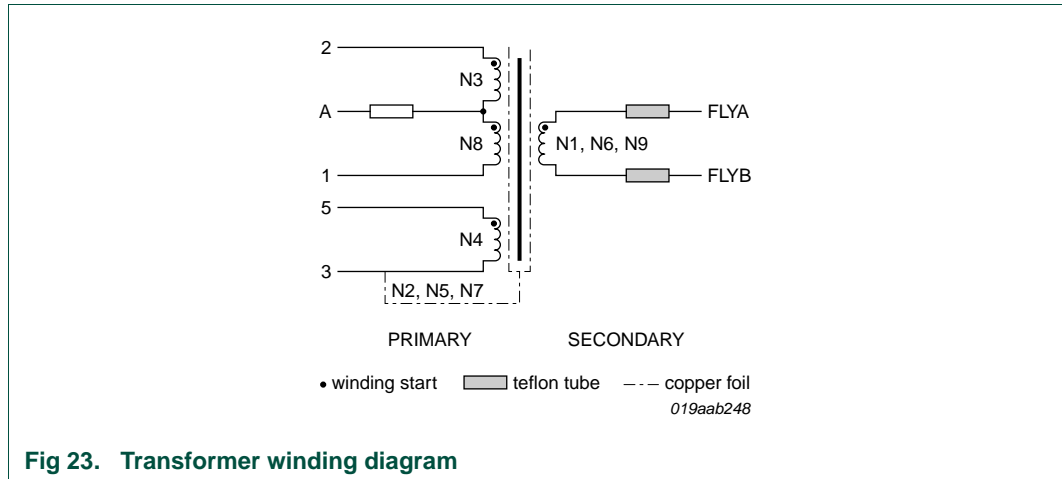


Fig 23. Transformer winding diagram

Table 13. Winding construction

Number	Layers	Turns	Wires	Copper/diameter	Type
9	secondary	6	2	0.32	triso
8c	primary	6	1	0.35	enamelled
8b	primary	6	1	0.35	enamelled
8a	primary	6	1	0.35	enamelled
7	Cu foil	-	-	-	-
6	secondary	6	2	0.35	triso
5	Cu foil	-	-	-	-
4	auxiliary	6	2	0.32	enamelled
3c	primary	6	1	0.15	enamelled
3b	primary	6	1	0.35	enamelled
3a	primary	6	1	0.35	enamelled
2	Cu foil	-	-	-	-
1	secondary	6	2	0.32	triso

## 6.2 Winding specification

Table 14. Winding table

Winding order		Pin		Wire	Turns	Layers	Turn/Layer	Insulation after winding
		Start	Finish					
1	N1	FA	FB	0.32 mm $\varnothing$ $\times$ 2 mm <sup>[1]</sup>	6	1	6	tape 1 Ts <sup>[3]</sup>
2	S1	-	3 <sup>[6]</sup>	0.025 mm $\times$ 7 mm <sup>[2]</sup>	1	1	1	tape 1 Ts <sup>[3]</sup>
3	N3	2	A	0.35 mm $\varnothing$ $\times$ 2 mm	18	3	6/3	tape 1 Ts <sup>[3]</sup>
4	N4	5	3 <sup>[6]</sup>	0.15 mm $\varnothing$ $\times$ 2 mm	6	1	6	tape 1 Ts <sup>[3][5]</sup>
5	S2	-	3	0.025 mm $\times$ 7 mm <sup>[2]</sup>	1	1	1	tape 1 Ts <sup>[3]</sup>
6	N6	FA	FB	0.32 mm $\varnothing$ $\times$ 2 mm <sup>[1]</sup>	6	1	6	tape 1 Ts <sup>[3]</sup>
7	S3	-	3 <sup>[6]</sup>	0.025 mm $\times$ 7 mm <sup>[2]</sup>	1	1	1	tape 1 Ts <sup>[3]</sup>
8	N8	A <sup>[4]</sup>	1	0.35 mm $\varnothing$ $\times$ 2 mm	18	3	6/3	tape 1 Ts <sup>[3]</sup>
9	N9	FA	FB	0.3 mm $\varnothing$ $\times$ 2 mm <sup>[1]</sup>	6	1	6	tape 1 Ts <sup>[3]</sup>

[1] Furukawa.

[2] Copper foil.

[3] Spread winding.

[4] Intermediate connection A is not connected to a pin.

[5] Insulation tape 3M #1350 or #1298.

[6] Copper foil connected to pin 3 using 0.25  $\varnothing$  lead wire.

## 6.3 Electrical characteristics

Table 15. Electrical characteristics

Description	Pin	Specification	Remark
Inductance	1 to 2	700 $\mu$ H $\pm$ 5 %	65 kHz; 1 V

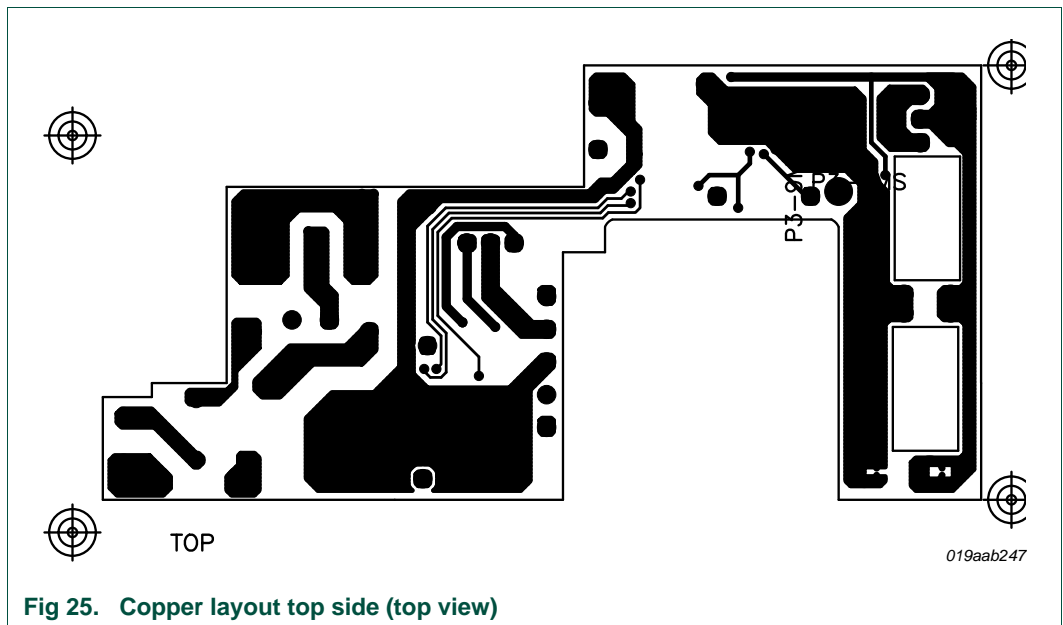
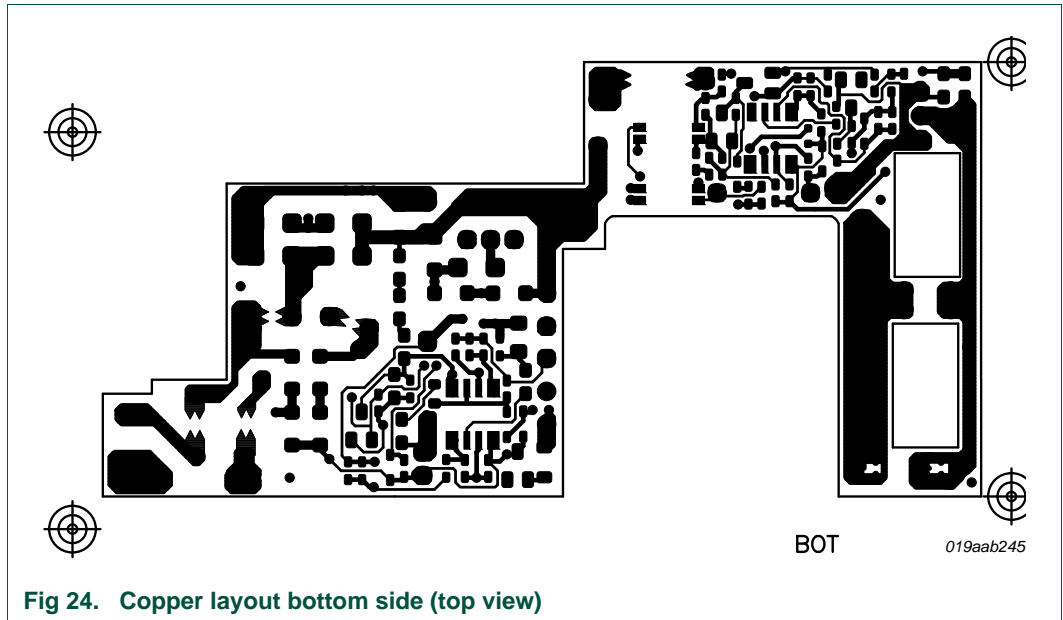
## 6.4 Core and bobbin

Core: ATQ28/11.2D; A-Core, JPP44A

## 6.5 Marking

Main board: APBADC054

## 7. Layout of the 65 W TEA1738LT/T and TEA1703 reference board



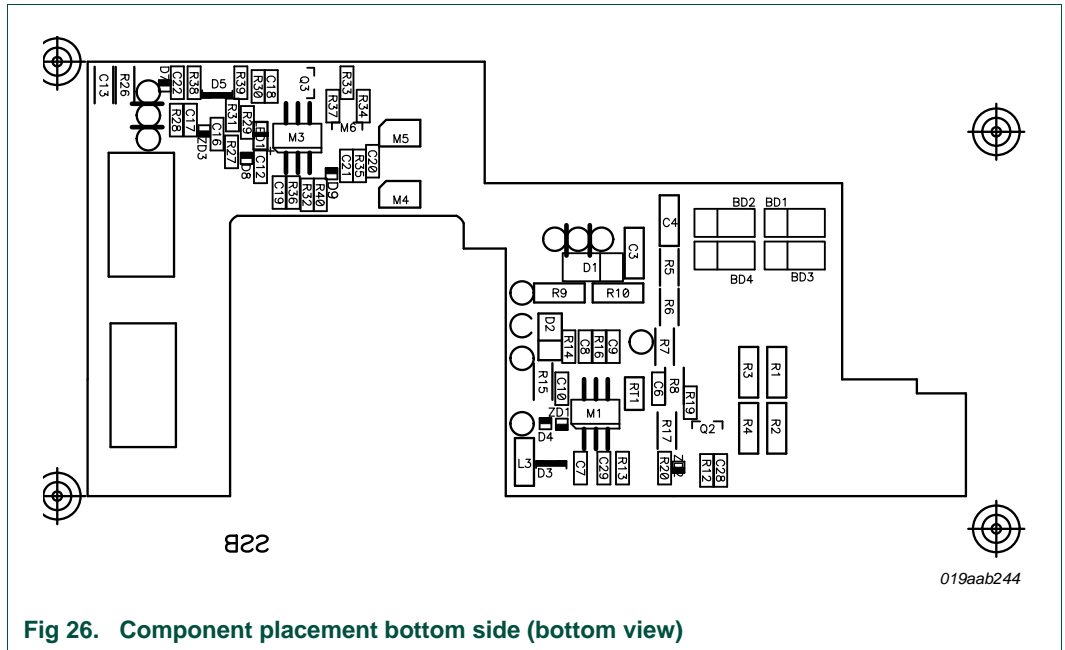


Fig 26. Component placement bottom side (bottom view)

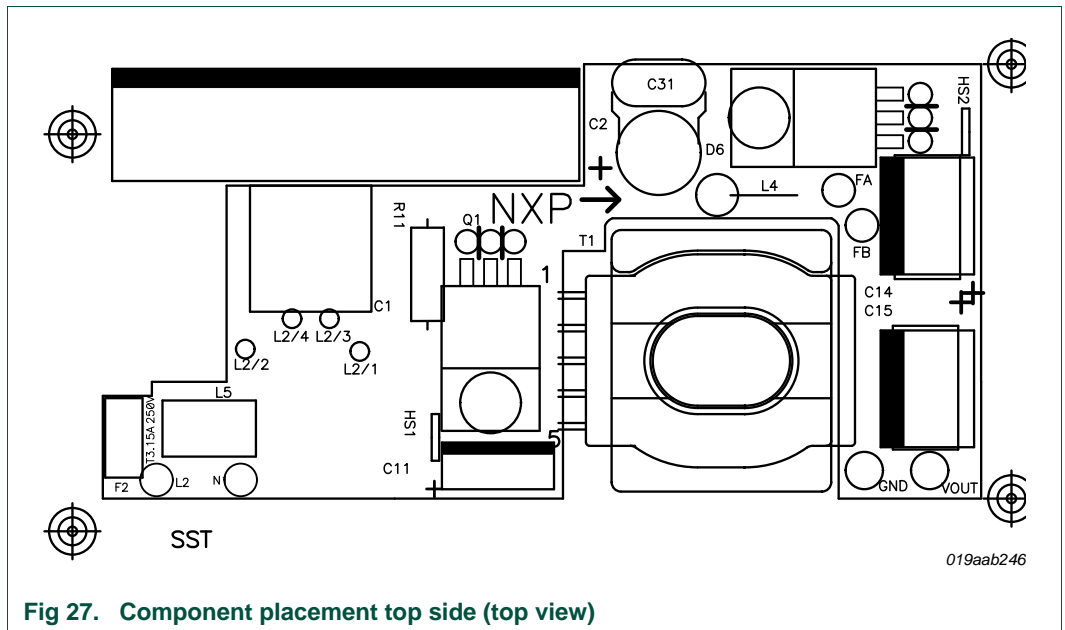


Fig 27. Component placement top side (top view)



## 8. Alternative circuit options

### 8.1 Changing the output voltage

By changing the following components, the output voltage can be changed ( $\pm 30\%$ ). Refer to the *TEA1738(L)T application note* for additional information on this topic. Make sure that the Aux voltage remains within its operation limits (12.2 V – 30 V typical) and is high enough to start up (20.6 V typical).

#### R23/R24

The resistor divider R36 and R37 determine the output voltage based on  $V_o = 2.5 \text{ V} \times (R36 + R37) / (R37)$ .

#### C13/C14

The voltage rating of these electrolytic capacitors must be chosen to be higher than the output voltage. Decrease the value of the capacitors for applications with a lower output current.

### 8.2 TEA1703 adjustments

In this design the following items can be improved by changing the value of the inductor L4 to 4m7H. Currently the current through opto LED M4 is too low.

- Output power level threshold to enter Standby mode is very low
- The  $V_{CC}$  clamp cannot sink enough current for high mains. This causes the TEA1738 to restart in Standby mode at 264 V; 60 Hz. This behavior is not recommended

The minimum output voltage in Standby mode can be adjusted using resistor R30. By increasing resistor R30 from 330 k $\Omega$  to 420 k $\Omega$ , an additional < 2 mW can be saved and the minimum output voltage will drop to 9 V.

Refer to the TEA1703 application note for adjustment information.

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