

# UM10499

230 V and 120 V reference design using UBA20260

Rev. 1 — 30 September 2011

User manual

## Document information

| Info            | Content  |
|-----------------|--|
| <b>Keywords</b> | UBA20260, step-dimmable, half-bridge CFL driver  |
| <b>Abstract</b> | This document describes the correct use of the UBA20260 step-dimmable half-bridge Compact Fluorescent Lamp (CFL) driver for 230 V and 120 V demo boards. |



Revision history

| Rev | Date     | Description |
|-----|----------|-------------|
| v.1 | 20110930 | first issue |

## 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

In this document, a description is given of the UBA20260 demo boards for 230 V and 120 V mains voltages using the UBA20260 power IC. A description is provided, supported by a set of measurements to show the demo boards characteristics.

The UBA20260 circuit is a half-bridge driver IC setup to drive a typical 23 W burner with a lamp current of about 240 mA. Similar lamp types with a nominal lamp power of 20 W can also be driven. The total power drawn from the mains is about 23 W at a nominal mains voltage of 230 V or 120 V (RMS). The UBA20260 board can easily be configured to drive different Compact Fluorescent Lamps (CFL) of different power ratings. Driving different CFL is possible by changing the inductor tap and installing a different lamp capacitor.

The UBA20260 demo board is not recommended for driving lower voltage linear lighting lamps like the T5 or the T8. For these types of lamps the UBA2014, UBA2021 or UBA2016 are the best options.

The IC is able to drive lamps up to 23 W provided the maximum junction temperature of the IC is not exceeded. There are no THD-requirements for mains powers lower than 25 W so that a pre-conditioner function is obsolete.

**Remark:** Unless otherwise stated all voltages are AC.

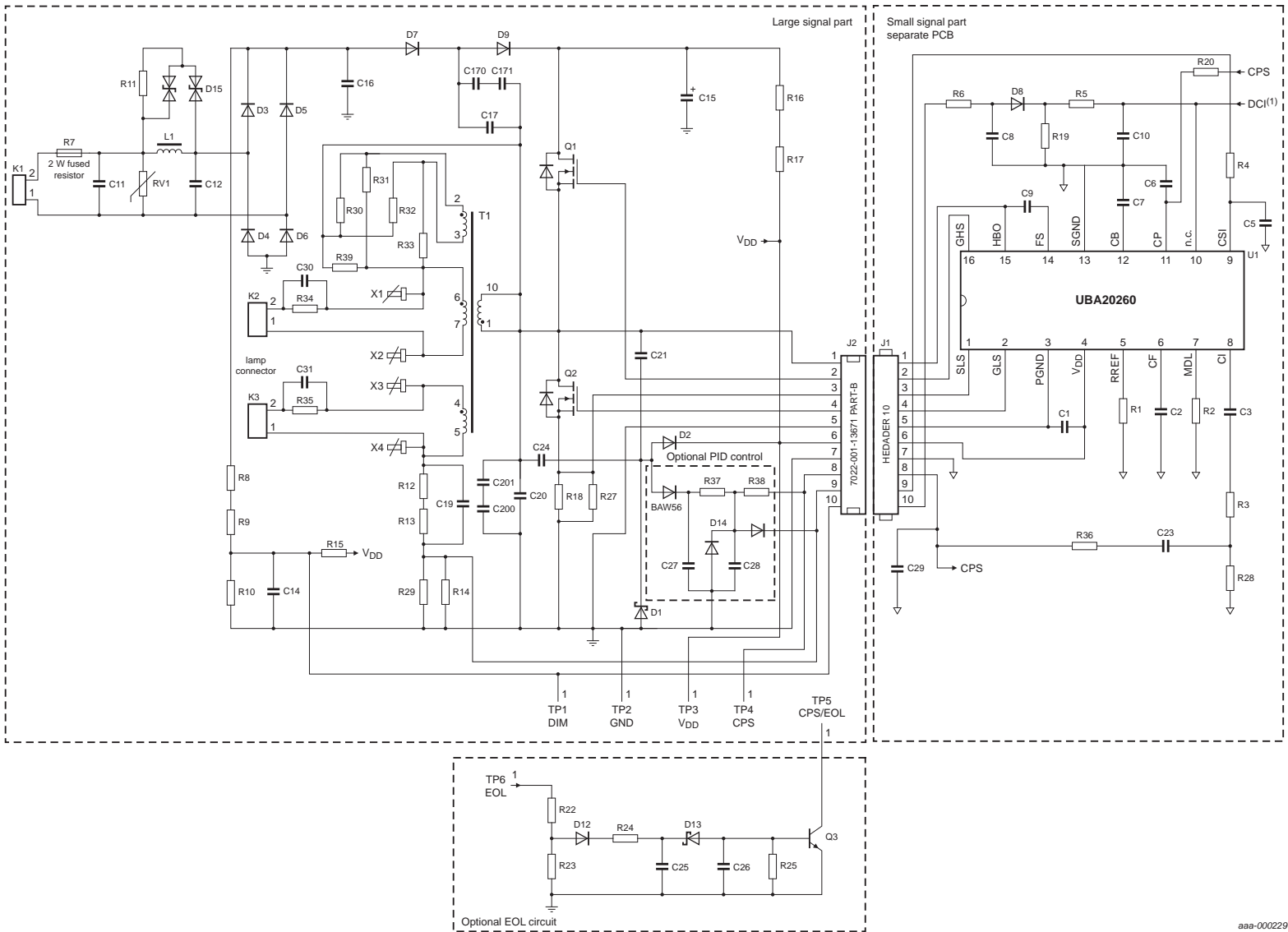
The circuit is set up to perform a preheat so the lamp switches on approximately 1 s after the mains voltage is applied to the board. Lamp current boost value is approximately 1.5. For detailed design steps, on the 18 W lamp solution or how to setup lamps with other power ratings see [Ref. 2](#).

The mains voltage operating range is either set for 90 V to 130 V or 200 V to 250 V (RMS) depending on the board ordered.

The ICs are intended as cost-effective step-dimmable solutions to drive CFL with an integrated ballast (CFLi). Therefore, the ICs are equipped with a thermal, coil saturation, over-power and OverCurrent Protection (OCP) and a lamp strike failure time-out.

**Remark:** If the UBA20260 is used in a non-integrated ballast or a Matchbox type of ballast, an external lamp detection circuit is required. In addition, the standard circuit must include extra End Of Life (EOL) protection. Additional circuits can be set up to trigger the external power-down on the CP pin.

## 2. Schematic diagrams



aaa-000229

(1) To combine the PCB layout with the UBA20270 reference board, pin 10 is connected but not used.

**Fig 1. Circuit diagram UBA20260 demo board**



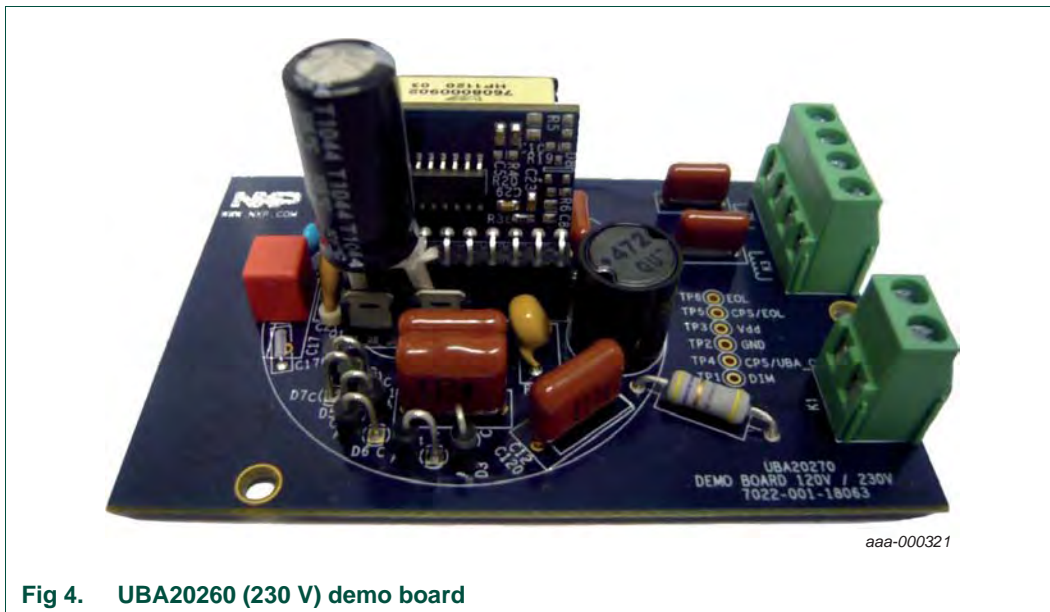


Fig 4. UBA20260 (230 V) demo board

The UBA20260 demo board is set up to drive a typical 23 W burner. The specification for each type is as follows:

#### 230 V:

- Input voltage range: 230 V; 15 %; 50 Hz
- Input power: 23 W at 230 V
- Input current: 179 mA/228 mA (boost)
- Power factor: > 0.55
- Running frequency 45 kHz; start frequency 111 kHz
- Preheat: 0.7 s
- 1.5 × lamp current boost, set for 50 s

#### 120 V:

- Input voltage range: 120 V; 15 %; 60 Hz
- Input power: 23 W at 120 V
- Input current: 328 mA/435 mA (boost)
- Power factor: > 0.55
- Running frequency 45 kHz; start frequency 111 kHz
- Preheat: 0.7 s
- 1.5 × lamp current boost, set for 50 s

**Protective functions:**

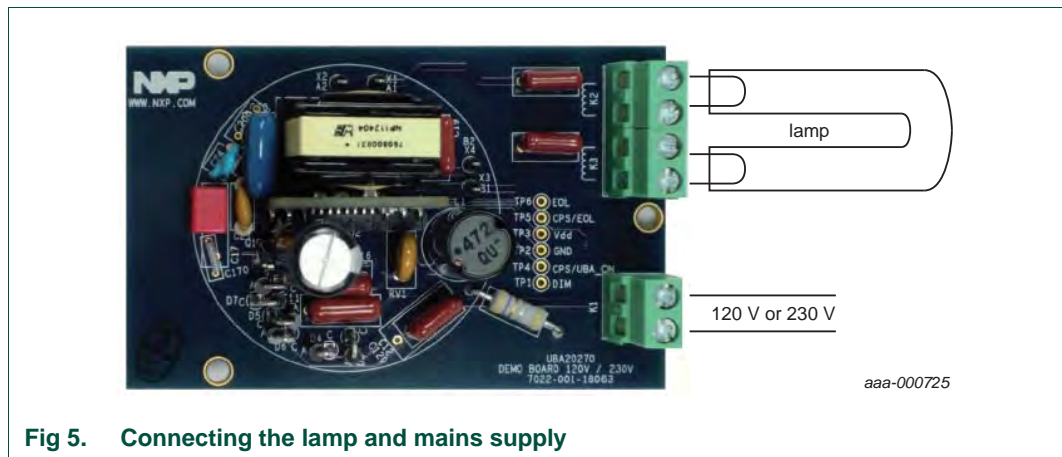
- Coil saturation set at and
  - 230 V: set to 2.3 A
  - 120 V: set to 2.8 A
- OverCurrent Protection (OCP):
  - 230 V: set to 2.3 A
  - 120 V: set to 2.8 A
- Capacitive Mode Protection (CMP)
- OverTemperature Protection (OTP)
- OverPower Protection (OPP)

**Burners:**

- 230 V: typical burner with a lamp voltage of 95 V ( $\pm 10\%$ ) and a lamp current of 160 mA ( $\pm 10\%$ ). Conditions set by resistors R31 and R32
- 120 V: typical burner with a lamp voltage of 110 V ( $\pm 10\%$ ) and a lamp current of 160 mA ( $\pm 10\%$ ). Conditions set by resistors R30 and R33

**4.1 Board connections**

The connection of the lamp and mains supply is shown in [Figure 5](#).



**Fig 5. Connecting the lamp and mains supply**

**4.2 External 6-pin controller connector**

The demo board is equipped with an external control connector intended to control the UBA20260 by a microcontroller or other external control logic. See [Figure 6](#). To be able to control the dimmer input TP1 properly, remove the SMD resistor R8. The connector carries 4 signals, two of which are supply lines, the dimmer input and the short CP pin signal (CPS).

**4.2.1 TP4 the CSP/UBA\_ON pin**

Tp4 the CSP/UBA\_ON is a pin that offers multiple functions. For the 120 V version this pin is used to provide a differential gain path to the UBA20260. It cannot be used as an input or output.

This pin can be used as an external shutdown function when the UBA20260 is in the burn state. To set up for external shutdown, remove the differential gain function, R38, R36 and C29 and install R29.

The CPS pin can be directly short-circuited to ground (TP2 GND) or via an open collector output of a microcontroller. Short circuiting the CP pin to ground sets the UBA20260 in Power-down mode. This state continues as long as the IC is supplied via its  $V_{DD}$  pin, consumption is less than 220  $\mu\text{A}$ . The current from the CPS pin is < 50 mA. To end power-down, power cycle the board or short the TP3 ( $V_{DD}$ ) pin to ground. The current from this pin is < 500  $\mu\text{A}$  when continuously shorted to ground (TP2). When the  $V_{DD}$  pin is shorted to ground, the 470 nF  $V_{DD}$  capacitor is discharged. To prevent large discharge currents, install a 1 k $\Omega$  resistor in series with the capacitor.

The  $V_{DD}$  pin (TP3) has only a limited supply capability for external logic. Do not load this pin by more than 2 mA.

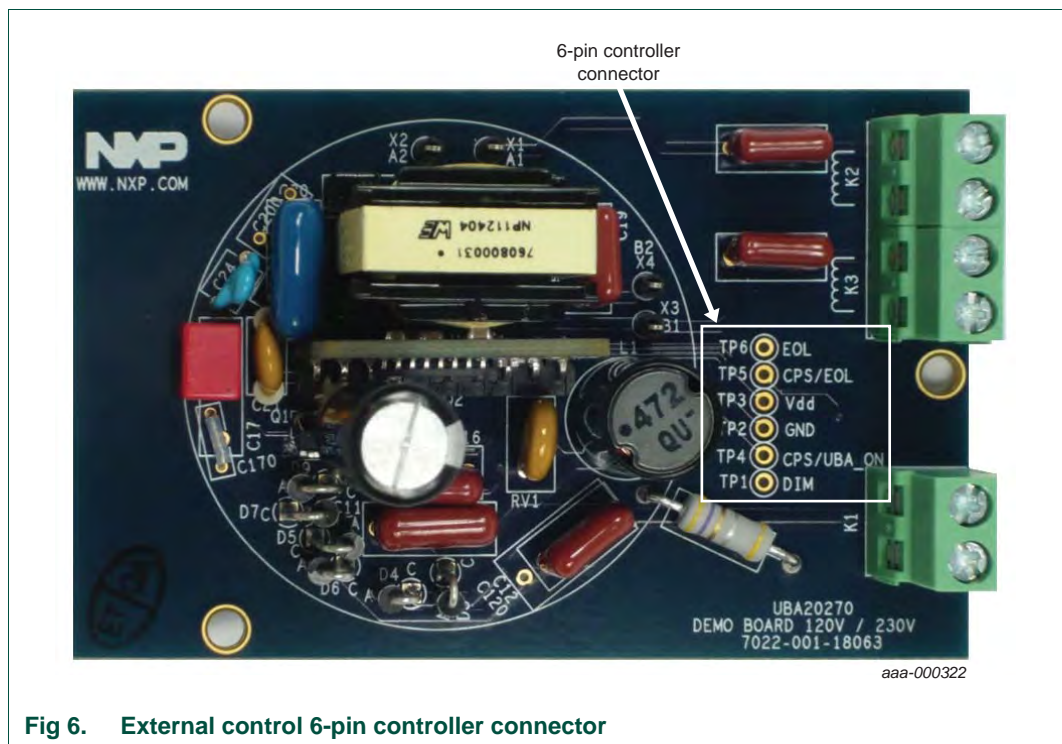


Fig 6. External control 6-pin controller connector

#### 4.2.2 TP5 and TP6 End of life

TP5 CPS\_EOL is the out put of the external EOL circuit on the demo board. Connect this pin to TP4 CSP/UBA\_ON to use the external EOL. Setup TP for external shutdown for this application. See [Section 4.2.1](#).

TP6 is the input of the external EOL circuit. Use the auto transformer winding on T1 in order to use the external EOL. Therefore, remove R30 to R33 and install R39. In addition, hardwire TP6 to T1 pin 2 and hardwire T1 pin 3 to ground.



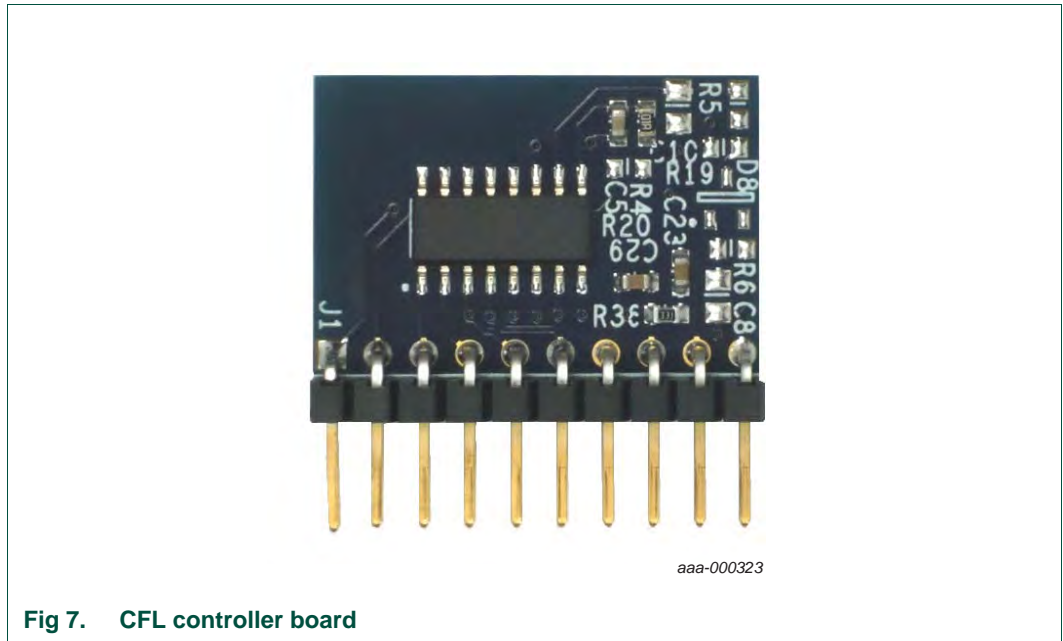


Fig 7. CFL controller board

### 4.3 Using the auto transformer

The inductor supplied with this board accommodates an auto transformer winding. The auto transformer winding lowers or raises the working voltage across the resonant tank capacitor. In addition, it increases the overall efficiency by up to 30 %. Adjust the auto transformer to the lamp voltage to the lamp type connected to the board for correct operation. See [Ref. 2](#).

[Table 1](#) shows how to set the auto transformer. The lamp voltage is the nominal lamp voltage at the rated lamp power when the lamp is not dimmed. The auto transformer is set up as follows for most of the lamps:

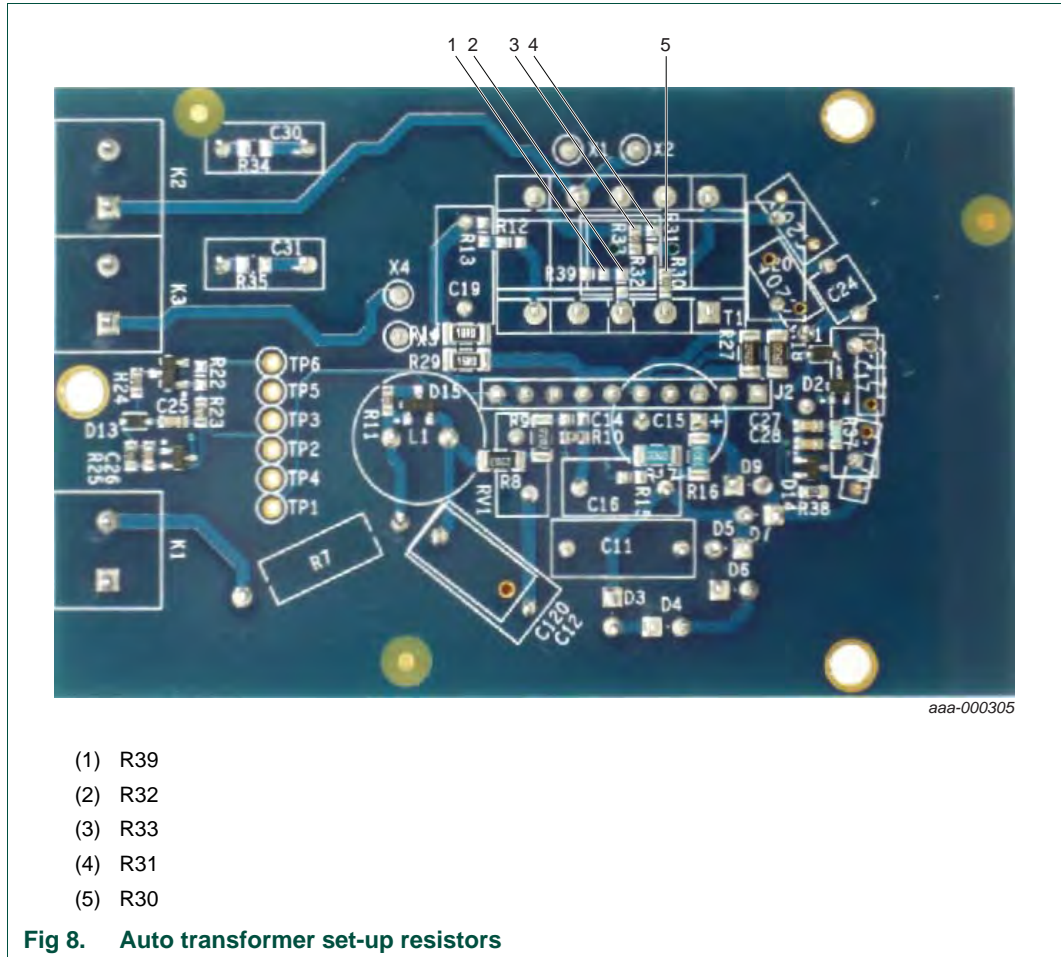
Table 1. Resistor programming

| Lamp voltage                            | Description  | Placement R39 | Placement R30+R33 | Placement R31+R32 |
|---|--|---------------|-------------------|-------------------|
| $V_{lamp} < 95\text{ V}$                | Raise voltage across $C_{res}$ . The voltage source charge pump energy transfer to buffer capacitor is increased |               |                   | ×                 |
| $95\text{ V} < V_{lamp} < 110\text{ V}$ | No auto transformer. Select upon lamp voltage during deep dimming performance                                    | ×             |                   |                   |
| $V_{lamp} > 110\text{ V}$               | Lower voltage across $C_{res}$ . The voltage source charge pump energy transfer to buffer capacitor is decreased |               | ×                 |                   |

If the lamp voltage is between 95 V and 110 V, the use of an auto transformer is not necessary. However, set-up and use the auto transformer in the following situations:

- where the lamp voltage is too high at low dimming levels
- when the bus voltage exceeds the buffer capacitor voltage rating

**Remark:** Only short-circuit the resistors indicated; otherwise the inductor winding is shorted.



#### 4.4 Bill Of Materials (BOM)

[Table 2](#) provides detailed component information for the common parts for the UBA20260 230 V and 120 V demo boards.

**Table 2. Common BOM for the UBA20260 230 V and 120 V demo boards**

| Reference | Description and component                        | Package | Manufacturer                       |
|-----------|--|---------|------------------------------------|
| C1        | 470 nF; 10 %; 25 V X7R                           | -       | KEMET                              |
| C2        | 100 pF; 5 %; 50 V C0G-NP0                        | -       | Yageo                              |
| C3        | 220 nF; 10 %; 25 V X7R                           | -       | KEMET                              |
| C5        | 1.5 nF; 10 %; 50 V X7R                           | -       | Yageo                              |
| C6        | 330 nF; 10 %; 25 V X7R                           | -       | KEMET                              |
| C7        | 150 nF; 10 %; 25 V X7R                           | -       | AVX                                |
| C9        | 100 nF; 10 %; 50 V X7R                           | -       | Yageo                              |
| C10       | 470 nF; 10 %; 25 V X7R                           | -       | KEMET                              |
| C17       | 3.3 nF; 10 %; 1 KV MKP                           | -       | Cornell Dubilier                   |
| C19       | 22 nF; 5 %; 400 V                                | -       | Panasonic                          |
| C20       | 4.7 nF; 10 %; 1 KV MKP                           | -       | EPCOS                              |
| C21       | 560 pF; 10 %; 1 KV Y5R                           | -       | Vishay BC Components               |
| C23       | 1 $\mu$ F; 10 %; 16 V X7R                        | -       | Yageo                              |
| C24       | 100 pF; 10 %; 1 KV                               | -       | Murata                             |
| C25       | 100 nF; 10 %; 50 V X7R                           | -       | Yageo                              |
| C26       | 220 nF; 10 %; 16 V X7R                           | -       | Murata                             |
| C27       | 100 nF; 10 %; 50 V X7R                           | -       | Yageo                              |
| C28       | 100 nF; 10 %; 50 V X7R                           | -       | Yageo                              |
| C29       | 150 nF; 10 %; 50 V X7R                           | -       | KEMET                              |
| C30       | 68 nF; 5 %; 250 V                                | -       | Panasonic                          |
| C31       | 68 nF; 5 %; 250 V                                | -       | Panasonic                          |
| D1        | Zener diode; 12 V; 500 mW; BZX84J-C12            | SOD323  | NXP Semiconductors                 |
| D2        | diode; dual                                      | SOT-323 | Multicomp                          |
| D3        | diodes general-purpose rectifier; 1N4007         | -       | Fairchild Semiconductors           |
| D4        | diodes general-purpose rectifier; 1N4007         | -       | Fairchild Semiconductors           |
| D5        | diodes general-purpose rectifier; 1N4007         | -       | Fairchild Semiconductors           |
| D6        | diodes general-purpose rectifier; 1N4007         | -       | Fairchild Semiconductors           |
| D7        | fast recovery diode; 1 A; 600 V; 1N4937          | -       | Fairchild Semiconductors           |
| D8        | general purpose; switching diodes; 200 V; 200 mA | -       | NXP Semiconductors                 |
| D9        | fast recovery diode; 1 A; 600 V; 1N4937          | -       | Fairchild Semiconductors           |
| D12       | general purpose; switching diodes; 200 V; 200 mA | -       | NXP Semiconductors                 |
| D13       | Zener diode; 12 V; 500 mW; BZX84J-C12            | SOD323  | NXP Semiconductors                 |
| D14       | dual-diode; common anode                         | SOT-323 | NXP Semiconductors                 |
| D15       | not mounted                                      | -       | -                                  |
| J1        | pin header; right-angled; 10-pole; 2.54 mm       | -       | TE Connectivity Electronics or AMP |
| J2        | 7022-001-13671 PART-B                            | -       | -                                  |
| K1        | terminal block; 2-pole; 5.08 mm                  | -       | Phoenix contact                    |

Table 2. Common BOM for the UBA20260 230 V and 120 V demo boards ...continued

| Reference | Description and component            | Package | Manufacturer       |
|-----------|--------------------------------------|---------|--------------------|
| K2        | terminal block; 2-pole; 5.08 mm      | -       | Phoenix contact    |
| K3        | terminal block; 2-pole; 5.08 mm      | -       | Phoenix contact    |
| Q3        | BC847CW; NPN; 45 V; 100 mA           | SOT-323 | NXP Semiconductors |
| R1        | 33 k $\Omega$ ; 0.1 W; 1 %; RC22H    | -       | Yageo              |
| R2        | 1.2 k $\Omega$ ; 0.1 W; 1 %; RC22H   | -       | Yageo              |
| R3        | 150 $\Omega$ ; 0.1 W; 1 %; RC22H     | -       | Yageo              |
| R4        | 100 $\Omega$ ; 0.1 W; 1 %; RC22H     | -       | Yageo              |
| R11       | not mounted                          | -       | -                  |
| R12       | not mounted                          | -       | -                  |
| R13       | not mounted                          | -       | -                  |
| R15       | not mounted                          | -       | -                  |
| R20       | not mounted                          | -       | -                  |
| R22       | not mounted                          | -       | -                  |
| R23       | 100 k $\Omega$ ; 0.063 W; 1 %; RC02H | -       | Yageo              |
| R24       | 390 k $\Omega$ ; 0.1 W; 1 %; RC02H   | -       | Yageo              |
| R25       | 1 M $\Omega$ ; 0.1 W; 1 %; RC02H     | -       | Yageo              |
| R34       | not mounted                          | -       | -                  |
| R35       | not mounted                          | -       | -                  |
| R37       | 22 k $\Omega$ ; 0.1 W; 1 %; RC22H    | -       | Yageo              |
| R38       | 330E; 0.1 W; 1 %; CRCW               | -       | Vishay Draloric    |
| R39       | not mounted                          | -       | -                  |
| X1        | terminal; black; PK100 for A1        | -       | Vero               |
| X2        | terminal; black; PK100 for A2        | -       | Vero               |
| X3        | terminal; black; PK100 for B1        | -       | Vero               |
| X4        | terminal; black; PK100 for B2        | -       | Vero               |

[Table 3](#) provides detailed component information for specific parts of the UBA20260 230 V demo board.

**Table 3. Delta list of BOM for the UBA20260 (230 V) demo board**

| Reference | Description and component               | Package | Manufacturer             |
|-----------|---|---------|--------------------------|
| C8        | not mounted                             | -       | -                        |
| C11       | 47 nF; 5 %; 630 V                       | -       | Panasonic                |
| C12       | 22 nF; 5 %; 630 V                       | -       | Panasonic                |
| C14       | not mounted                             | -       | -                        |
| C15       | 10 $\mu$ F; 20 %; 400 V; 12000 HRS      | -       | Rubycon                  |
| C16       | 22 nF; 5 %; 400 V                       | -       | Panasonic                |
| C171      | 560 pF; 5 %; 1 KV                       | -       | WIMA                     |
| L1        | Choke; 4700 $\mu$ H; 0.26 A; $\pm$ 10 % | -       | Panasonic                |
| Q1        | MOSFET Power; N-Channel QFET; 400 V     | -       | Fairchild Semiconductors |
| Q2        | MOSFET Power; N-Channel QFET; 400 V     | -       | Fairchild Semiconductors |
| R5        | not mounted                             | -       | -                        |
| R6        | not mounted                             | -       | -                        |
| R7        | 4.7 $\Omega$ ; 2 W; 10 % EMC            | -       | Welwyn Components        |
| R8        | 220 k $\Omega$ ; 0.250 W; 1 %; RC02H    | -       | Yageo                    |
| R9        | 220 k $\Omega$ ; 0.250 W; 1 %; RC02H    | -       | Yageo                    |
| R10       | not mounted                             | -       | -                        |
| R14       | 12.4E; 0.250 W; 1 %; CRCW               | -       | Vishay Dale              |
| R16       | not mounted                             | -       | -                        |
| R17       | not mounted                             | -       | -                        |
| R18       | 2.2E; 0.250 W; 1 %; RC02H               | -       | Yageo                    |
| R19       | not mounted                             | -       | -                        |
| R27       | 2.2E; 0.250 W; 1 %; RC02H               | -       | Yageo                    |
| R28       | 2.2 k $\Omega$ ; 0.1 W; 1 %; RC02H      | -       | Yageo                    |
| R29       | 12.4E; 0.250 W; 1 %; CRCW               | -       | Vishay Dale              |
| R30       | 0 $\Omega$ ; 0.063 W; RC02H             | -       | Yageo                    |
| R31       | not mounted                             | -       | -                        |
| R32       | not mounted                             | -       | -                        |
| R33       | 0 $\Omega$ ; 0.063 W; RC02H             | -       | Yageo                    |
| R36       | not mounted                             | -       | -                        |
| RV1       | VDR; 275 V; 12 J                        | -       | Vishay BC Components     |
| T1        | driver transformer; 2.0 mH              | -       | Xicon                    |
| U1        | CFL driver; UBA20260                    | SO16    | NXP Semiconductors       |

[Table 4](#) provides detailed component information for specific parts of the UBA20260 120 V demo board.

**Table 4. Delta list of BOM for the UBA20260 (120 V) demo board**

| Reference | Description and component               | Package | Manufacturer             |
|-----------|---|---------|--------------------------|
| C8        | not mounted                             | -       | -                        |
| C11       | 47 nF; 5 %; 400 V                       | -       | Panasonic                |
| C12       | 22 nF; 5 %; 400 V                       | -       | Panasonic                |
| C14       | not mounted                             | -       | -                        |
| C15       | 22 $\mu$ F; 20 %; 250 V; Al. El         | -       | Rubycon                  |
| C16       | 22 nF; 5 %; 400 V                       | -       | Panasonic                |
| C171      | 560 pF; 5 %; 1 KV                       | -       | WIMA                     |
| L1        | Choke; 4700 $\mu$ H; 0.26 A; $\pm$ 10 % | -       | Panasonic                |
| Q1        | MOSFET Power; N-Channel QFET; 400 V     | -       | Fairchild Semiconductors |
| Q2        | MOSFET Power; N-Channel QFET; 400 V     | -       | Fairchild Semiconductors |
| R5        | not mounted                             | -       | -                        |
| R6        | not mounted                             | -       | -                        |
| R7        | 4.7 $\Omega$ ; 10 %; 2 W EMC            | -       | Welwyn Components        |
| R8        | 100 k $\Omega$ ; 0.250 W; 1 %; WCR      | -       | Yageo                    |
| R9        | 100 k $\Omega$ ; 0.250 W; 1 %; WCR      | -       | Yageo                    |
| R10       | not mounted                             | -       | -                        |
| R14       | 12.4E; 0.250 W; 1 %; CRCW               | -       | Vishay Dale              |
| R16       | not mounted                             | -       | -                        |
| R17       | not mounted                             | -       | -                        |
| R18       | 1.8E; 0.330 W; 1 %; ERJ8                | -       | Yageo                    |
| R19       | not mounted                             | -       | -                        |
| R27       | 1.8E; 0.330 W; 1 %; ERJ8                | -       | Panasonic                |
| R28       | 560 $\Omega$ ; 0.1 W; 1 %; RC02H        | -       | Yageo                    |
| R29       | 12.4E; 0.250 W; 1 %; CRCW               | -       | Vishay Dale              |
| R30       | not mounted                             | -       | -                        |
| R31       | 0 $\Omega$ ; 0.063 W; RC02H             | -       | Yageo                    |
| R32       | 0 $\Omega$ ; 0.063 W; RC02H             | -       | Yageo                    |
| R33       | not mounted                             | -       | -                        |
| R36       | 330E; 0.1 W; 1 %; CRCW                  | -       | Vishay Draloric          |
| RV1       | VDR; 150 V; 20 J                        | -       | Vishay BC Components     |
| T1        | driver transformer; 1.0 mH              | -       | Xicon                    |
| U1        | CFL driver; UBA20260                    | SO16    | NXP Semiconductors       |

## 5. SO16 package thermal considerations

The UBA20260 in the SO16 package is mounted on a separate board perpendicular onto the main signal PCB. The reason for this is that the IC is not directly subjected to the thermal radiated heat of the lamp. In this way, distance is created between lamp filaments and the IC. The horizontal signal PCB acts as a heat shield for thermal radiated heat.

The PCB is mounted horizontally into a lamp base for most applications. However, the UBA20260 is an SMD component and means the IC is very close to the lamp filaments. The lamp filaments would directly radiate heat onto the IC and limit the IC drive capabilities. Therefore, it is recommended to either mount some form of heat shield between the lamp filaments and the PCB. Alternatively, mount the PCB vertically into the lamp socket to increase the distance between the IC and lamp filaments.

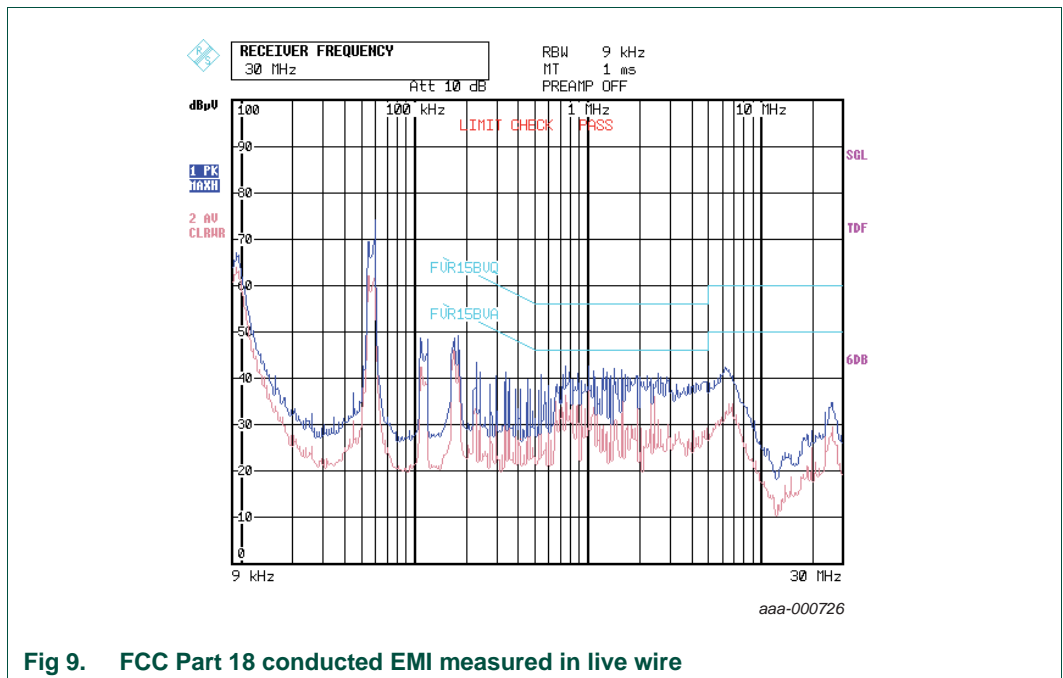
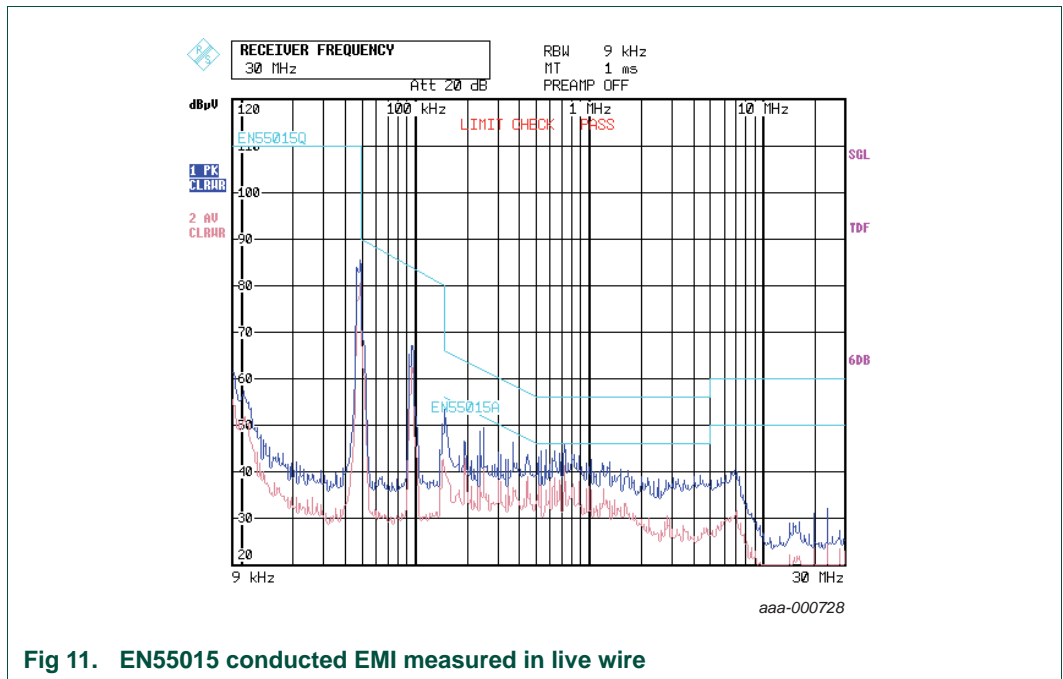
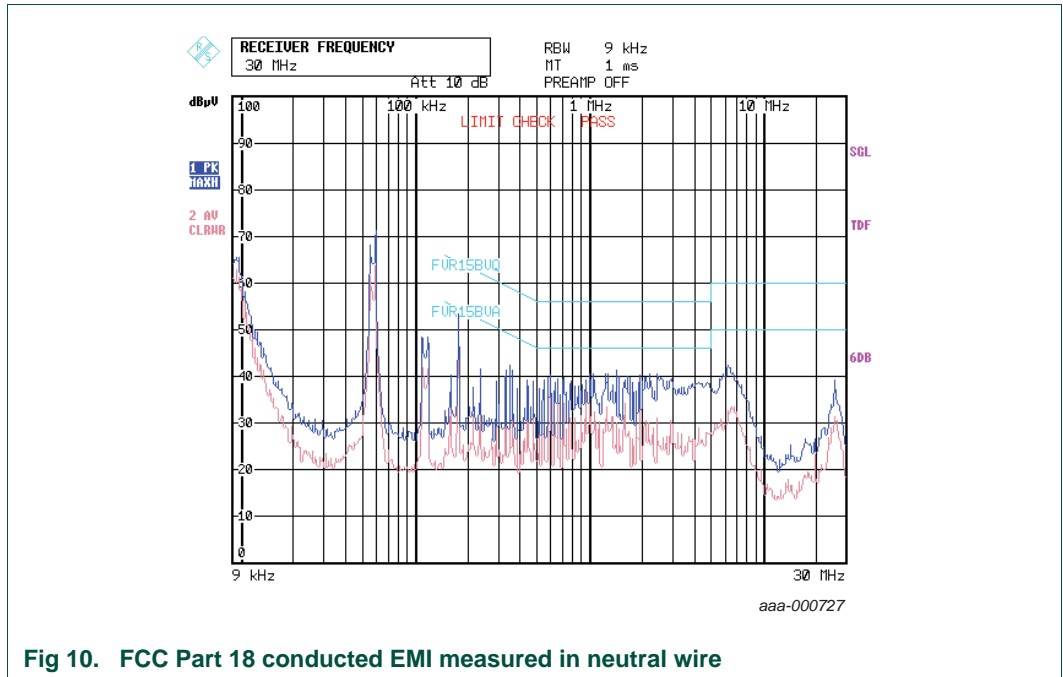


Fig 9. FCC Part 18 conducted EMI measured in live wire





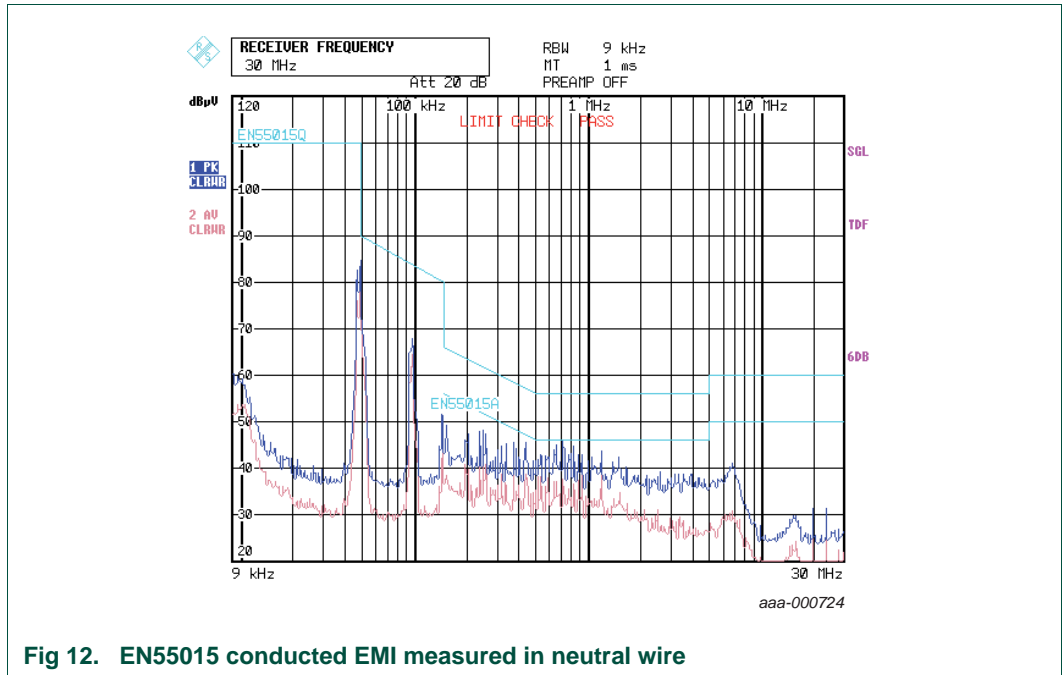


Fig 12. EN55015 conducted EMI measured in neutral wire

6. PCB layout

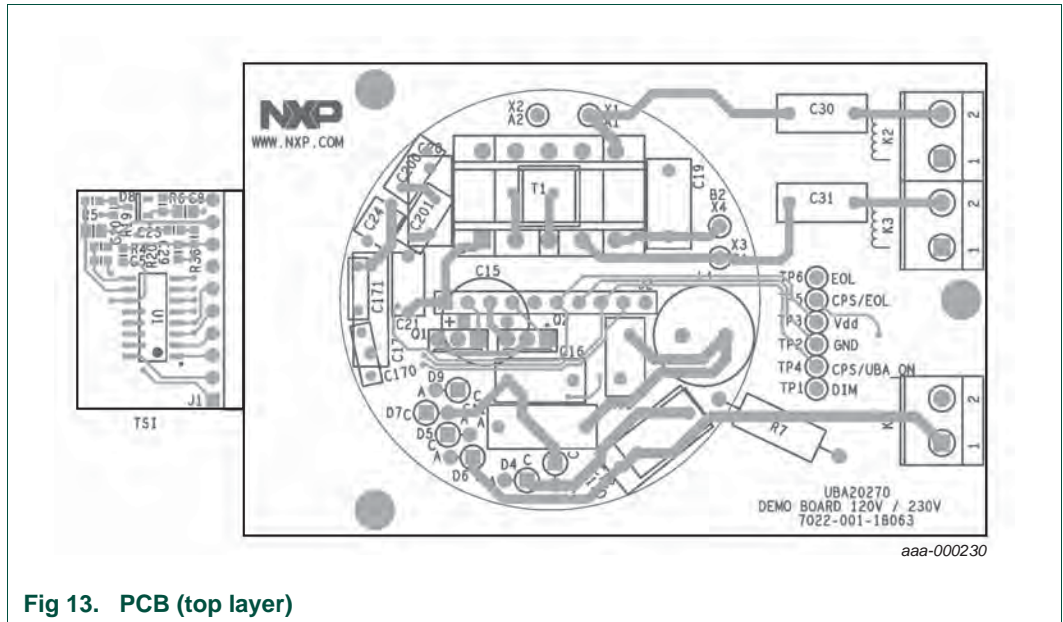


Fig 13. PCB (top layer)

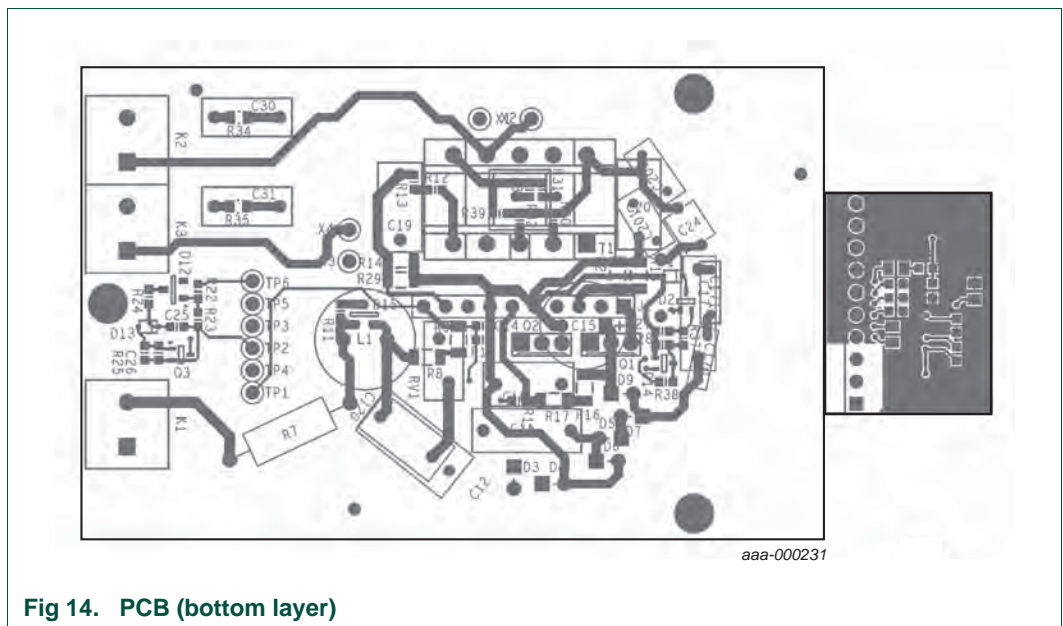


Fig 14. PCB (bottom layer)

## 7. Inductor specification

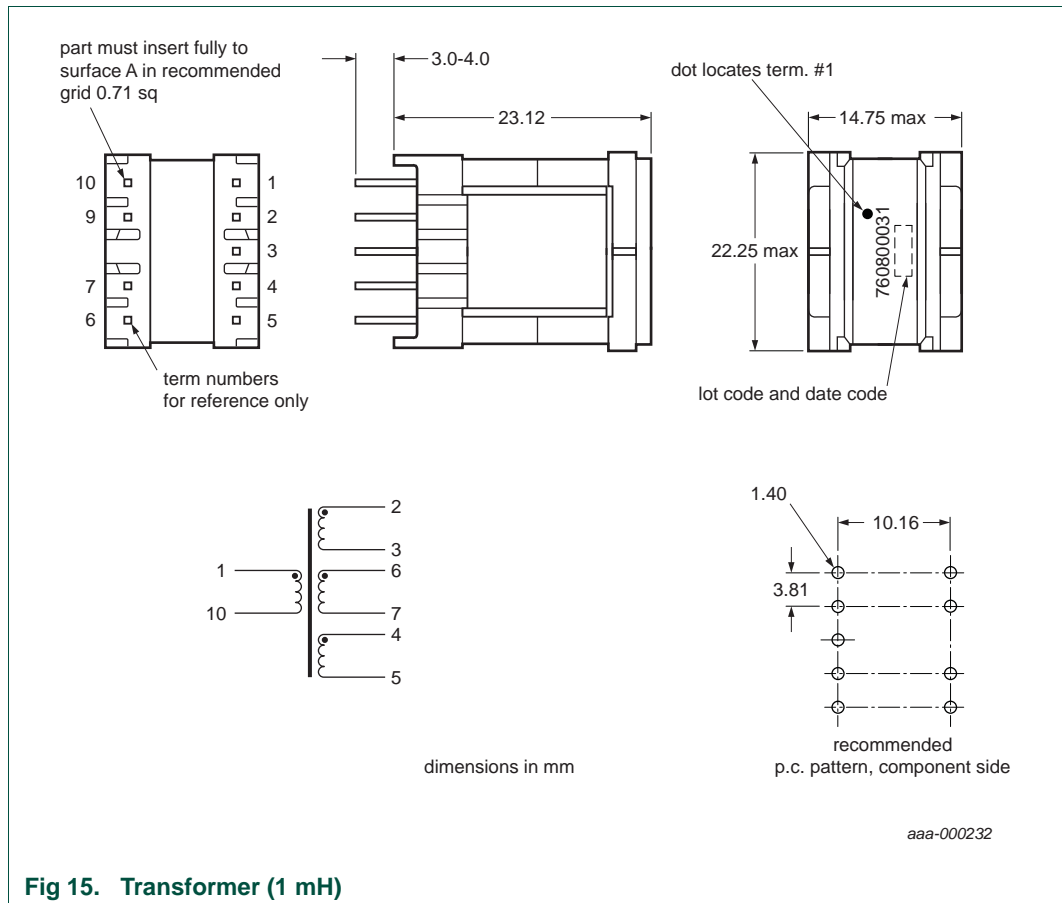


Fig 15. Transformer (1 mH)

Transformer electrical specifications, centered at 25 °C, are as follows:

### DC resistance (at 20 °C):

- 1 to 10, 1.7 Ω, ±10 %
- 2 to 3, 0.8 Ω, ±10 %
- 4 to 5, 0.175 Ω, ±10 %
- 6 to 7, 0.19 Ω, ±10 %

### Dielectric rating:

- 1 kV (AC), 1 minute tested by applying 1.25 kV (AC) for 1 s between pins 1 to 2 (3 + 6, 4 + 7)

### Inductance:

- 1.0 mH ±10 %, 10 kHz, 100 mV (AC), 0 mA (DC), 1 to 10, Ls
- 2.5 μH ±15 %, 10 kHz, 100 mV (AC), 0 mA (DC), 6 to 7, Ls
- 2.4 μH ±15 %, 10 kHz, 100 mV (AC), 0 mA (DC), 4 to 5, Ls
- 44.0 μH ±15 %, 10 kHz, 100 mV (AC), 0 mA (DC), 2 to 3, Ls

**Saturation current:**

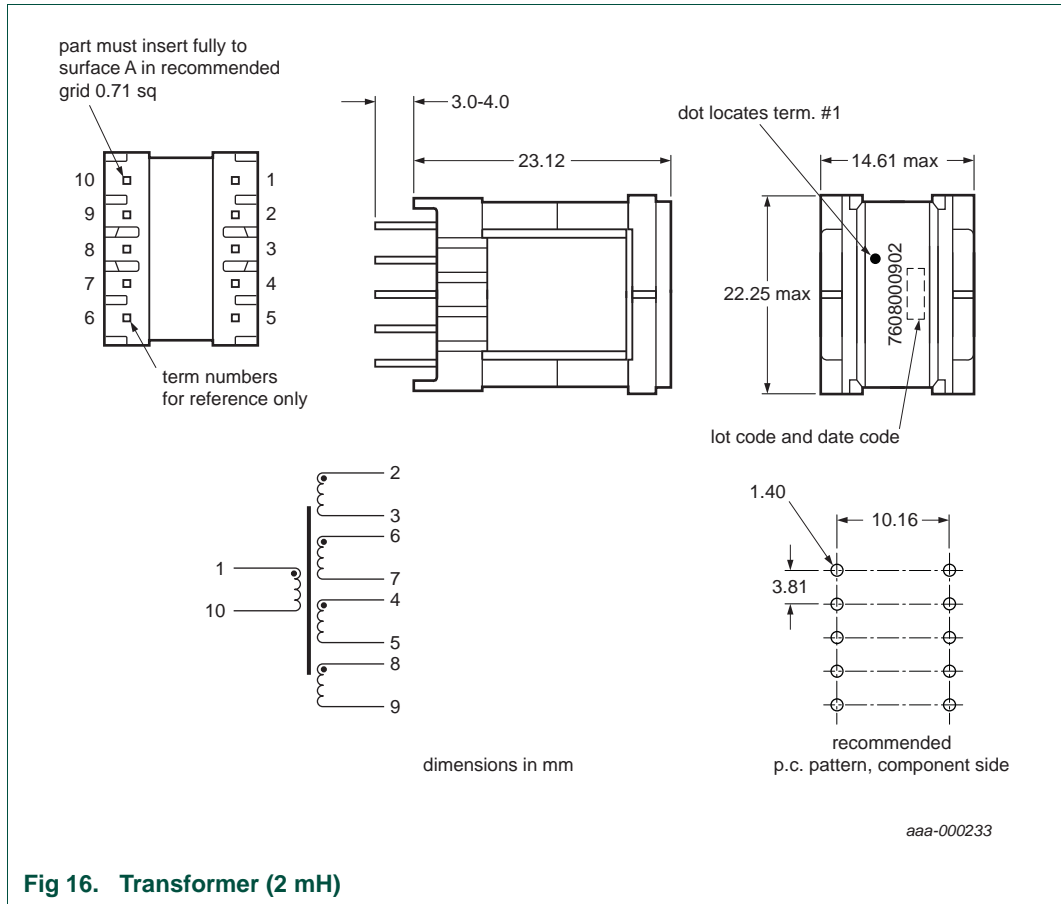
- 2.2 A saturation current causing 20 % roll off from initial inductance.

**Turns ratio:**

- (1 to 10):(6 to 7), (25.93):(1),  $\pm 2$  %
- (1 to 10):(4 to 5), (25.93):(1),  $\pm 2$  %
- (1 to 10):(2 to 3), (7.25):(1),  $\pm 2$  %

**Operating temperature range:**

- $-40$  °C to  $125$  °C including temperature rise.



Transformer electrical specifications centered at 25 °C is as follows:

**DC resistance (at 20 °C):**

- 1 to 10, 4.5 Ω, ±10 %
- 2 to 3, 0.75 Ω, ±10 %
- 4 to 5, 0.180 Ω, ±10 %
- 6 to 7, 0.175 Ω, ±10 %
- 8 to 9, 0.42 Ω, ±10 %

**Dielectric rating:**

- 1 kV (AC), 1 minute tested by applying 1.25 kV (AC) for 1 s between pins 1 to 2 (3 + 4, 5 + 6, 7 + 8)

**Inductance:**

- 2.0 mH ±10 %, 10 kHz, 100 mV (AC), 0 mA (DC), 1 to 10, Ls

**Saturation current:**

- 1.55 A saturation current causing 20 % roll off from initial inductance.

**Turns ratio:**

- (1 to 10):(2 to 3), (9.74):(1),  $\pm 1$  %
- (1 to 10):(6 to 7), (34.78):(1),  $\pm 1$  %
- (1 to 10):(4 to 5), (34.78):(1),  $\pm 1$  %
- (1 to 10):(8 to 9), (15.21):(1),  $\pm 1$  %

## 8. Abbreviations

Table 5. Abbreviations

| Acronym | Description  |
|---------|--|
| CFL     | Compact Fluorescent Lamp                             |
| CFLi    | Compact Fluorescent Lamps with an integrated ballast |
| CMP     | Capacitive Mode Protection                           |
| EMC     | ElectroMagnetic Compatibility                        |
| EMI     | ElectroMagnetic Interference                         |
| EOL     | End Of Life  |
| ESD     | ElectroStatic Discharge                              |
| MOSFET  | Metal-Oxide Semiconductor Field-Effect Transistor    |
| OCP     | OverCurrent Protection                               |
| OPP     | OverPower Protection                                 |
| PCB     | Printed-Circuit Board                                |
| RMS     | Root Mean Square                                     |

## 9. References

- [1] **UBA20260** — Data sheet: 600 V driver IC for step-dimmable compact fluorescent lamps
- [2] **AN10962** — Application note: Step-dimmable CFL using the UBA2026X
- [3] **AN10803** — Application note: Triac dimmable CFL application using the UBA2028/UBA2014/UBA2027

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