


**CUI INC**

a bel group

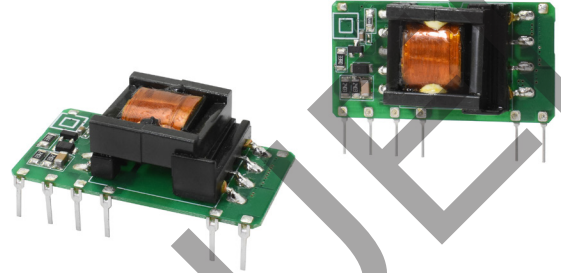
**date** 04/09/2023

**page** 1 of 10

**SERIES:** PBO-10 | **DESCRIPTION:** AC-DC POWER SUPPLY

**FEATURES**

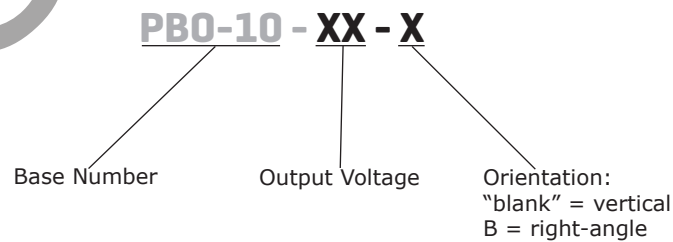
- wide input range (85 ~ 305 VAC)
- wide operating temperature range (-40 to +85 C)
- IEC/EN/UL 62368 certified
- designed to meet 60335 household safety certifications
- over voltage, over current, short circuit protections
- flexible implementations to power a wide array of applications



| MODEL                    | output voltage | output current<br>typ | output power<br>max | ripple and noise <sup>1</sup><br>max | efficiency <sup>2</sup><br>typ |
|--------------------------|----------------|-----------------------|---------------------|--------------------------------------|--------------------------------|
|                          | (Vdc)          | (A)                   | (W)                 | (mVp-p)                              | (%)                            |
| PBO-10-3 <sup>4,5</sup>  | 3.3            | 2.0                   | 6.6                 | 150                                  | 70                             |
| PBO-10-5 <sup>4,5</sup>  | 5              | 2.0                   | 10.0                | 150                                  | 76                             |
| PBO-10-9 <sup>4,5</sup>  | 9              | 1.1                   | 10.0                | 150                                  | 78                             |
| PBO-10-12 <sup>4,5</sup> | 12             | 0.83                  | 10.0                | 150                                  | 80                             |
| PBO-10-15 <sup>4,5</sup> | 15             | 0.67                  | 10.0                | 150                                  | 81                             |
| PBO-10-24 <sup>5</sup>   | 24             | 0.42                  | 10.0                | 150                                  | 82                             |

Notes:

1. At full load, nominal input, 20 MHz bandwidth oscilloscope, with a 1  $\mu$ F ceramic and 10  $\mu$ F electrolytic capacitor on the output.
2. At 230 Vac input.
3. All specifications are measured at Ta=25°C, humidity <75%, 115 or 230 Vac input voltage, and rated output load unless otherwise specified.
4. Discontinued model - vertical
5. Discontinued model - right angle

**PART NUMBER KEY**


## INPUT

| parameter      | conditions/description | min | typ | max  | units |
|----------------|------------------------|-----|-----|------|-------|
| voltage        |                        | 85  |     | 305  | Vac   |
|                |                        | 100 |     | 430  | Vdc   |
| frequency      |                        | 47  |     | 63   | Hz    |
| current        | at 115 Vac             |     |     | 0.3  | A     |
|                | at 230 Vac             |     |     | 0.15 | A     |
| inrush current | at 115 Vac             |     | 15  |      | A     |
|                | at 230 Vac             |     | 30  |      | A     |

## OUTPUT

| parameter                  | conditions/description                    | min | typ   | max   | units |
|----------------------------|-------------------------------------------|-----|-------|-------|-------|
| capacitive load            | 3.3 Vdc output models                     |     |       | 1,500 | μF    |
|                            | 5 Vdc output models                       |     |       | 1,500 | μF    |
|                            | 9 Vdc output models                       |     |       | 1,000 | μF    |
|                            | 12 Vdc output models                      |     |       | 680   | μF    |
|                            | 15 Vdc output models                      |     |       | 470   | μF    |
|                            | 24 Vdc output models                      |     |       | 330   | μF    |
| initial set point accuracy | from 0~100% load                          |     |       | ±3    | %     |
|                            | 3.3 Vdc output models<br>all other models |     |       | ±2    | %     |
| line regulation            | at rated load                             |     | ±0.5  | ±1    | %     |
| load regulation            | from 0~100% load                          |     | ±1    | ±1.5  | %     |
| temperature coefficient    |                                           |     | ±0.02 |       | %/°C  |

## PROTECTIONS

| parameter                | conditions/description            | min | typ | max | units |
|--------------------------|-----------------------------------|-----|-----|-----|-------|
| over voltage protection  | output voltage clamp or hiccup    |     |     |     |       |
|                          | 3.3 & 5 Vdc output models         |     |     | 9   | Vdc   |
|                          | 9 Vdc output models               |     |     | 15  | Vdc   |
|                          | 12 & 15 Vdc output models         |     |     | 25  | Vdc   |
|                          | 24 Vdc output models              |     |     | 35  | Vdc   |
| over current protection  | auto recovery                     | 110 |     |     | %     |
| short circuit protection | continuous, auto recovery, hiccup |     |     |     |       |

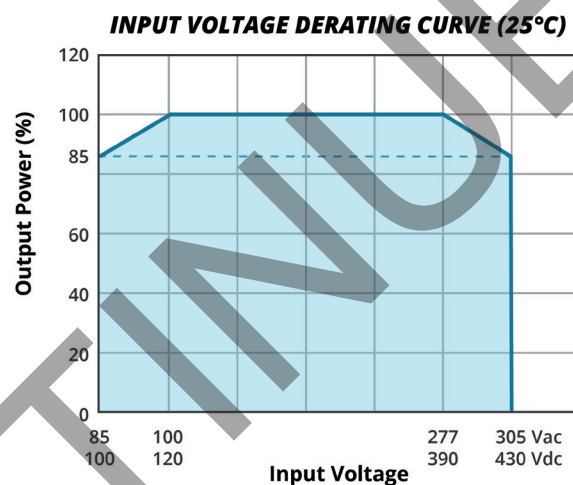
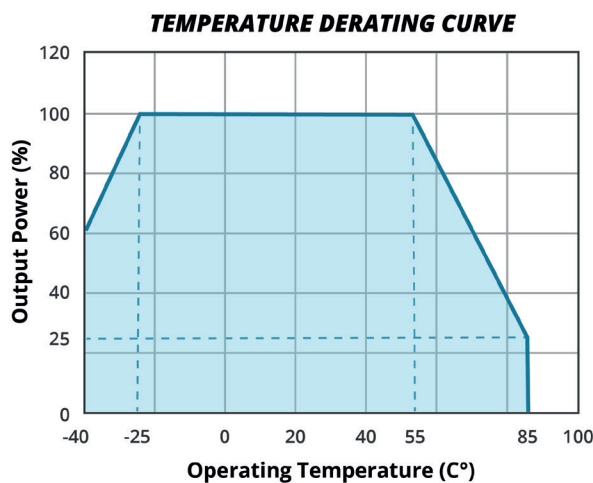
## SAFETY & COMPLIANCE

| parameter                    | conditions/description                                                                                                                                                                                                                           | min     | typ | max | units |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-----|-----|-------|
| isolation voltage            | input to output, 1 min, <5mA                                                                                                                                                                                                                     | 3,000   |     |     | Vac   |
| safety approvals             | certified to 62368: IEC, EN, UL<br>designed to meet 60335: IEC, EN                                                                                                                                                                               |         |     |     |       |
| safety class                 | class II                                                                                                                                                                                                                                         |         |     |     |       |
| conducted emissions          | CISPR32/EN55032 Class A (recommended circuit 1,4)<br>CISPR32/EN55032 Class B (recommended circuit 2,3)                                                                                                                                           |         |     |     |       |
| radiated emissions           | CISPR32/EN55032 Class A (recommended circuit 1,4)<br>CISPR32/EN55032 Class B (recommended circuit 2,3)                                                                                                                                           |         |     |     |       |
| ESD                          | IEC/EN61000-4-2, ±6 kV, perf. Criteria B                                                                                                                                                                                                         |         |     |     |       |
| radiated immunity            | IEC/EN61000-4-3, 10V/m, perf. Criteria A                                                                                                                                                                                                         |         |     |     |       |
| EFT/burst                    | IEC/EN61000-4-4, ±2 kV (recommended circuit 1,2), perf. Criteria B<br>IEC/EN61000-4-4, ±4 kV (recommended circuit 3,4), perf. Criteria B                                                                                                         |         |     |     |       |
| surge                        | IEC/EN61000-4-5, line to line ±1kV (recommended circuit 1,2), perf. Criteria B<br>IEC/EN61000-4-5, line to line ±2kV (recommended circuit 3,4), perf. Criteria B<br>IEC/EN61000-4-5, line to line ±4kV (recommended circuit 4), perf. Criteria B |         |     |     |       |
| conducted immunity           | IEC/EN61000-4-6, 10 Vr.m.s, perf. Criteria A                                                                                                                                                                                                     |         |     |     |       |
| voltage dips & interruptions | IEC/EN61000-4-11 0%, 70%, perf. Criteria B                                                                                                                                                                                                       |         |     |     |       |
| MTBF                         | as per MIL-HDBK-217 at °C                                                                                                                                                                                                                        | 300,000 |     |     | hours |
| RoHS                         | yes                                                                                                                                                                                                                                              |         |     |     |       |

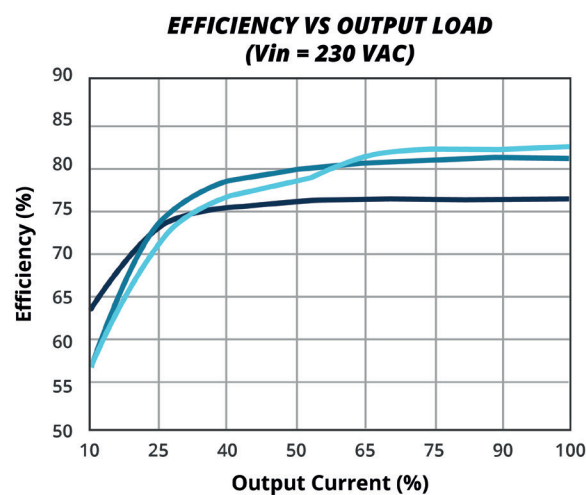
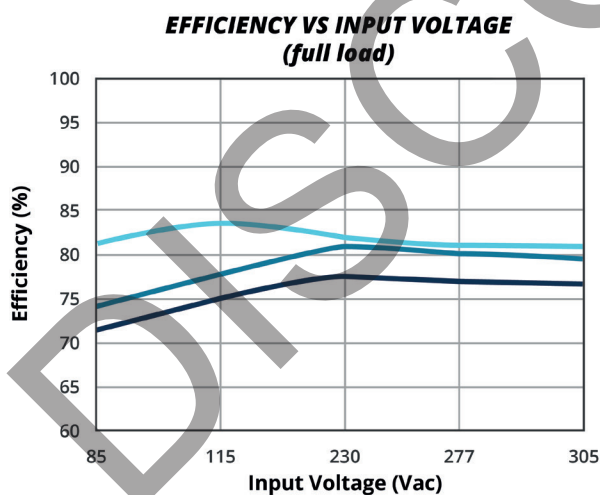
## ENVIRONMENTAL

| parameter             | conditions/description | min | typ | max | units |
|-----------------------|------------------------|-----|-----|-----|-------|
| operating temperature | see derating curves    | -40 |     | 85  | °C    |
| storage temperature   |                        | -40 |     | 105 | °C    |
| storage humidity      | non-condensing         |     |     | 95  | %     |

## DERATING CURVES



## EFFICIENCY CURVES



## MECHANICAL

| parameter  | conditions/description                               | min | typ | max | units |
|------------|------------------------------------------------------|-----|-----|-----|-------|
| dimensions | 44.50 x 24.00 x 15.00 (1.751 x 0.944 x 0.590 inches) |     |     |     | mm    |
| weight     |                                                      |     | 11  |     | g     |

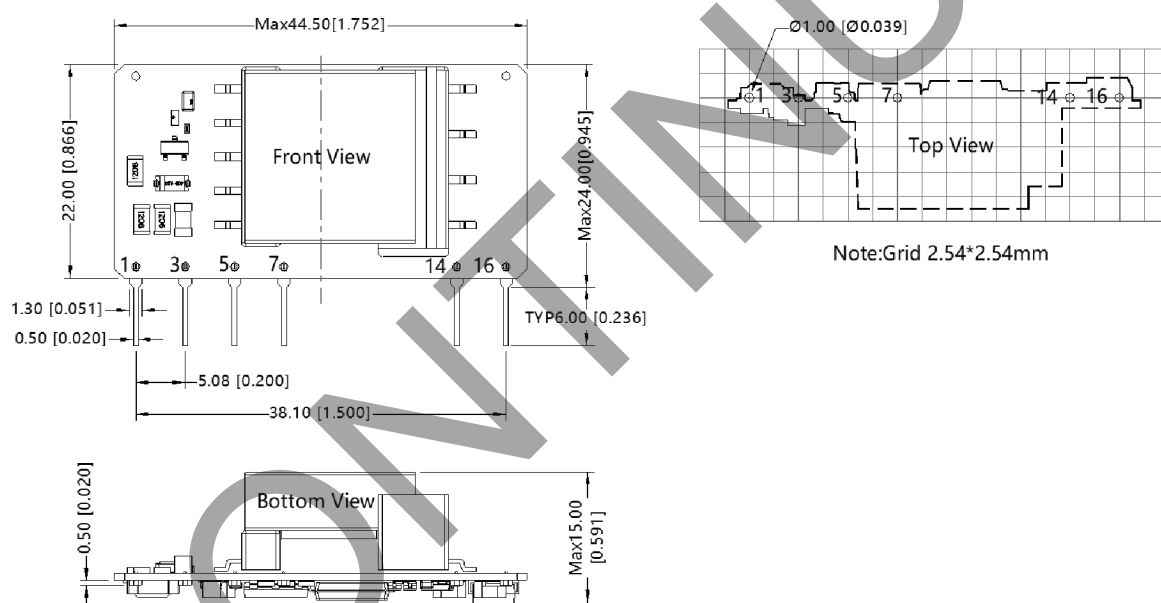
## MECHANICAL DRAWING

### Vertical Orientation

units: mm[inch]

pin section tolerance:  $\pm 0.10[\pm 0.004]$ tolerance:  $\pm 0.50[\pm 0.020]$ 

| PIN CONNECTIONS |          |
|-----------------|----------|
| PIN             | Function |
| 1               | AC (N)   |
| 3               | AC (L)   |
| 5               | +V(CAP)  |
| 7               | -V(CAP)  |
| 14              | -Vo      |
| 16              | +Vo      |



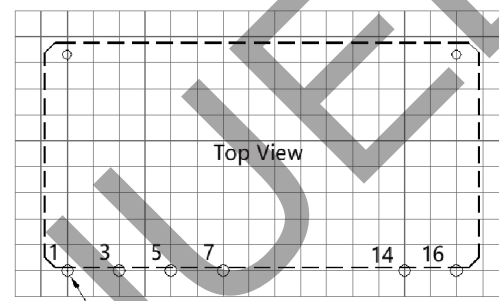
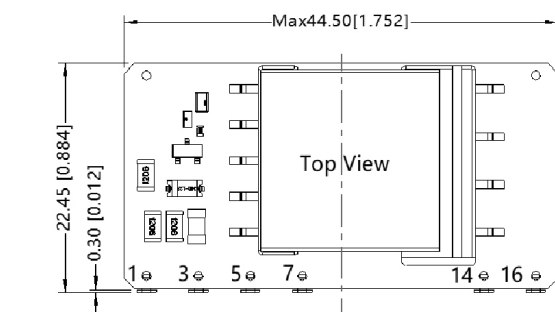
## MECHANICAL DRAWING (CONTINUED)

### Right-angle Orientation

units: mm[inch]

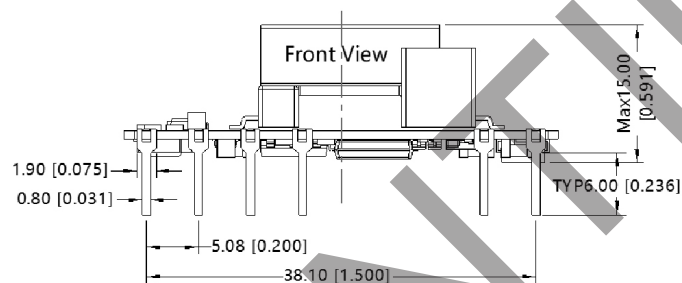
tolerance:  $\pm 0.50$  [ $\pm 0.020$ ]pin section tolerance:  $\pm 0.10$  [ $\pm 0.004$ ]

| PIN CONNECTIONS |          |
|-----------------|----------|
| PIN             | Function |
| 1               | AC (N)   |
| 3               | AC (L)   |
| 5               | +V(CAP)  |
| 7               | -V(CAP)  |
| 14              | -Vo      |
| 16              | +Vo      |

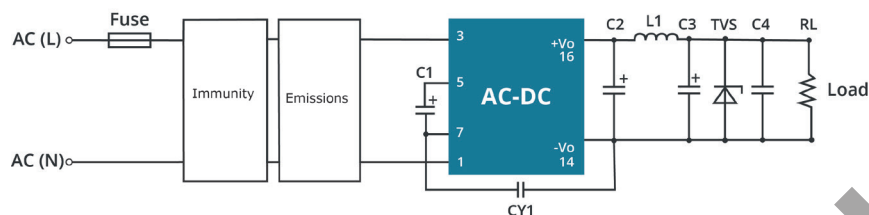


Ø1.20 [Ø0.047]

Note: Grid 2.54\*2.54mm



## APPLICATION DESIGN REFERENCE



PBO-10 series additional circuits design reference

| Immunity design circuits for reference |          | Emissions design circuits for reference |         |
|----------------------------------------|----------|-----------------------------------------|---------|
| Class III                              | Class IV | Class A                                 | Class B |
|                                        |          |                                         |         |

PBO-10 Series additional component selection guide

| Part no.  | FUSE<br>(required) | C1<br>(required) | C2<br>(required)                     | L1<br>(required)    | C3 <sup>1</sup><br>(required) | C4        | CY1<br>(required) | TVS <sup>2</sup> |
|-----------|--------------------|------------------|--------------------------------------|---------------------|-------------------------------|-----------|-------------------|------------------|
| PBO-10-3  | 1A/300V            | 22μF/450V        | 470μF/16V<br>(solid-state capacitor) | 4.7μF<br>(max 60mΩ) | 150μF/35V                     | 0.1μF/50V | 1.0nF/400Vac      | SMBJ7.0A         |
| PBO-10-5  |                    |                  |                                      |                     |                               |           |                   | SMBJ7.0A         |
| PBO-10-9  |                    |                  | 270μF/16V<br>(solid-state capacitor) |                     | 100μF/35V                     |           |                   | SMBJ12A          |
| PBO-10-12 |                    |                  |                                      |                     |                               |           |                   | SMBJ20A          |
| PBO-10-15 |                    |                  | 470μF/35V                            |                     | 47μF/35V                      |           |                   | SMBJ20A          |
| PBO-10-24 |                    |                  | 220μF/35V                            |                     |                               |           |                   | SMBJ30A          |

Note: 1. Recommended to use a high frequency, low ESR, electrolytic capacitor with at least 20% margin on voltage rating.

2. A suppressor diode (TVS) is recommended to protect the downstream application in case of converter failure and should be rated for a minimum of 1.2 times the converter's output voltage.

PBO-10 Series Environmental and EMC selection guide

| Recommended circuit | Application environment | Typical industry                                                                  | Input voltage range | Environment temperature | Emissions | Immunity                                             |
|---------------------|-------------------------|-----------------------------------------------------------------------------------|---------------------|-------------------------|-----------|------------------------------------------------------|
| 1                   | Basic application       | None                                                                              | 85 ~ 305 Vac        | -40° ~ 85°C             | Class A   | Class III                                            |
| 2                   | Indoor civil            | Smart home / Home appliances (2 Y-caps)                                           |                     | -25° ~ 55°C             | Class B   | Class III                                            |
|                     | Indoor general          | Intelligent building / Intelligent agriculture                                    |                     |                         |           |                                                      |
| 3                   | Indoor industrial       | Manufacturing workshop                                                            |                     | -25° ~ 55°C             | Class B   | Class IV                                             |
| 4                   | Outdoor general         | ITS / Video monitoring / Charging point / Communication / Security and protection |                     | -40° ~ 85°C             | Class A   | Class IV                                             |
|                     | Outdoor harsh           | On-line power meter Communication base station                                    |                     | -40° ~ 85°C             | Class A   | Class IV<br>Surge: line to gnd ±4KV<br>EFT: Class IV |

## EMC RECOMMENDED CIRCUIT

Circuit 1

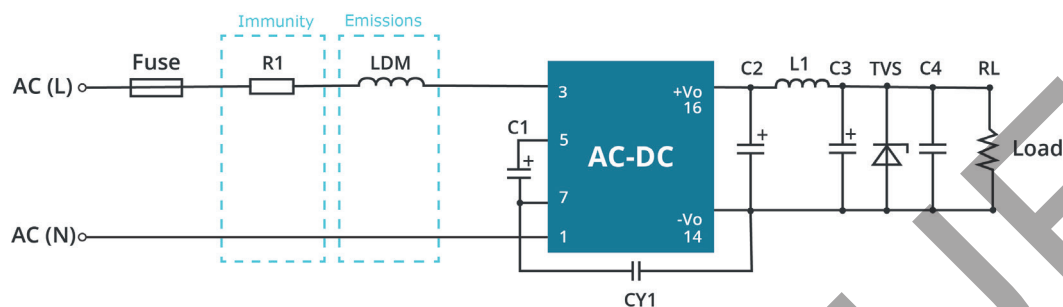


Table 1

| Application environment | Ambient temperature range | Immunity Class | Emissions Class |
|-------------------------|---------------------------|----------------|-----------------|
| Basic application       | -40°C ~ 85°C              | Class III      | Class A         |

| Component | Recommended value |
|-----------|-------------------|
| R1        | 12Ω/3W            |
| LDM       | 4.7mH             |

Note: R1 must be a wire-wound resistor; do not use a chip or carbon film resistor.

Circuit 2

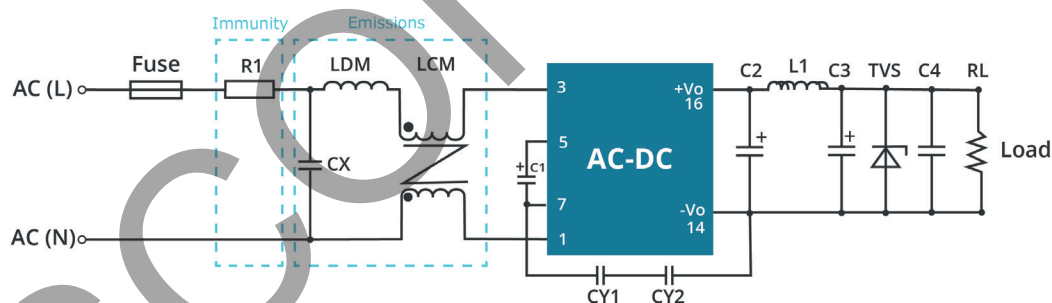


Table 2

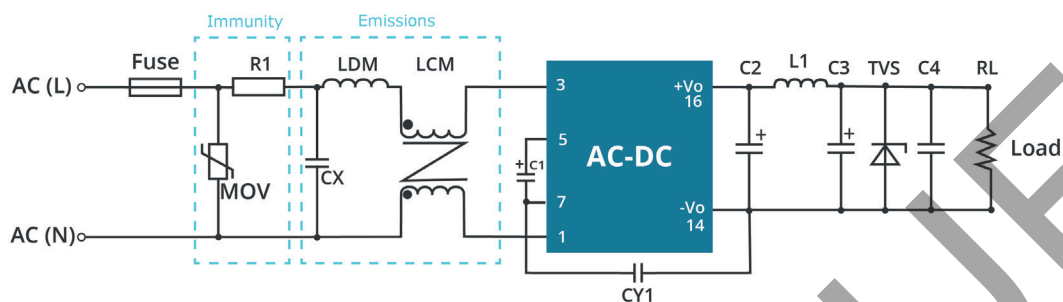
| Application environment | Ambient temperature range | Immunity Class | Emissions Class |
|-------------------------|---------------------------|----------------|-----------------|
| Indoor civil / general  | -25°C ~ 55°C              | Class III      | Class B         |

| Component       | Recommended value  |
|-----------------|--------------------|
| R1              | 12Ω/3W             |
| CY1 (CY2)       | 1.0nF/400Vac       |
| LCM             | 3.5 mH             |
| LDM             | 0.33 mH            |
| CX              | 0.1μF/310Vac       |
| FUSE (required) | 1A/300V, slow-blow |

Note: 1. For Smart Home and Home Appliance applications two Y-capacitors are required in series (2.2 nF/400 Vac each) to meet 60335 household safety requirements.  
2. R1 must be a wire-wound resistor; do not use a chip or carbon film resistor.

## EMC RECOMMENDED CIRCUIT (CONTINUED)

### Circuit 3



### Table 3

| Application environment | Ambient temperature range | Immunity Class | Emissions Class |
|-------------------------|---------------------------|----------------|-----------------|
| Indoor industrial       | -25°C ~ 55°C              | Class IV       | Class B         |

| Component       | Recommended value  |
|-----------------|--------------------|
| MOV             | S14K350            |
| C1              | 22uF/450V          |
| CY1             | 2.2nF/400Vac       |
| CX              | 0.1μF/310Vac       |
| LCM             | 3.5mH              |
| LDM             | 0.33mH             |
| R1              | 12Ω/3W             |
| FUSE (required) | 2A/300V, slow-blow |

Note: R1 must be a wire-wound resistor; do not use a chip or carbon film resistor.



## EMC RECOMMENDED CIRCUIT (CONTINUED)

Circuit 4

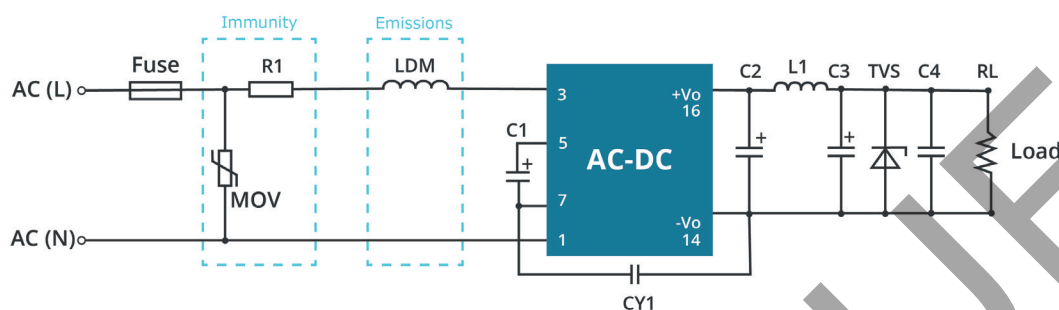


Table 4

| Application environment | Ambient temperature range | Immunity Class | Emissions Class |
|-------------------------|---------------------------|----------------|-----------------|
| Outdoor general         | -40°C ~ 85°C              | Class IV       | Class A         |

| Component       | Recommended value  |
|-----------------|--------------------|
| MOV             | S14K350            |
| C1              | 22uF/450V          |
| LDM             | 4.7mH              |
| R1              | 12Ω/3W             |
| FUSE (required) | 2A/300V, slow-blow |

Note: R1 must be a wire-wound resistor; do not use a chip or carbon film resistor.

Table 5

| Application environment | Ambient temperature range | Immunity Class                                           | Emissions Class |
|-------------------------|---------------------------|----------------------------------------------------------|-----------------|
| Outdoor harsh           | -40°C ~ 85°C              | Class IV<br>surge: line to ground ± 4kV<br>EFT: Class IV | Class A         |

| Component       | Recommended value                     |
|-----------------|---------------------------------------|
| MOV             | S20K350                               |
| C1              | 33uF/450V (surge protection priority) |
| LDM             | 4.7mH                                 |
| R1              | 33Ω/5W                                |
| FUSE (required) | 6.3A/300V, slow-blow                  |

Note: R1 must be a wire-wound resistor; do not use a chip or carbon film resistor.

## REVISION HISTORY

| rev. | description                                                                                                                                      | date       |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| 1.0  | initial release                                                                                                                                  | 12/10/2020 |
| 1.01 | derating and efficiency curves updated                                                                                                           | 01/21/2022 |
| 1.02 | UKCA added to spec                                                                                                                               | 05/25/2022 |
| 1.03 | discontinued models PBO-10-3 PBO-10-5, PBO-10-9, PBO-10-12, PBO-10-15, PBO-10-3-B, PBO-10-5-B, PBO-10-9-B, PBO-10-12-B, PBO-10-15-B, PBO-10-24-B | 04/09/2023 |

The revision history provided is for informational purposes only and is believed to be accurate.



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CUI offers a two (2) year limited warranty. Complete warranty information is listed on our website.

CUI reserves the right to make changes to the product at any time without notice. Information provided by CUI is believed to be accurate and reliable. However, no responsibility is assumed by CUI for its use, nor for any infringements of patents or other rights of third parties which may result from its use.

CUI products are not authorized or warranted for use as critical components in equipment that requires an extremely high level of reliability. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.