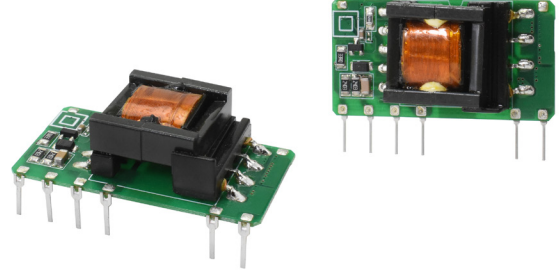


SERIES: PBO-10 | **DESCRIPTION:** AC-DC POWER SUPPLY

FEATURES

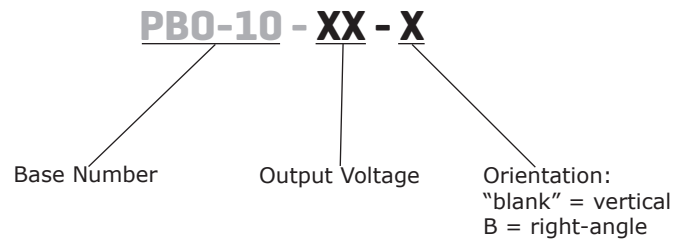
- wide input range (85 ~ 305 VAC)
- wide operating temperature range (-40 to +85 C)
- IEC/EN/UL 62368 certified
- designed to meet 60335 household safety certifications
- over voltage, over current, short circuit protections
- flexible implementations to power a wide array of applications



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

- Notes:
1. At full load, nominal input, 20 MHz bandwidth oscilloscope, with a 1 μF ceramic and 10 μF electrolytic capacitor on the output.
 2. At 230 Vac input.
 3. All specifications are measured at T_a=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 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				

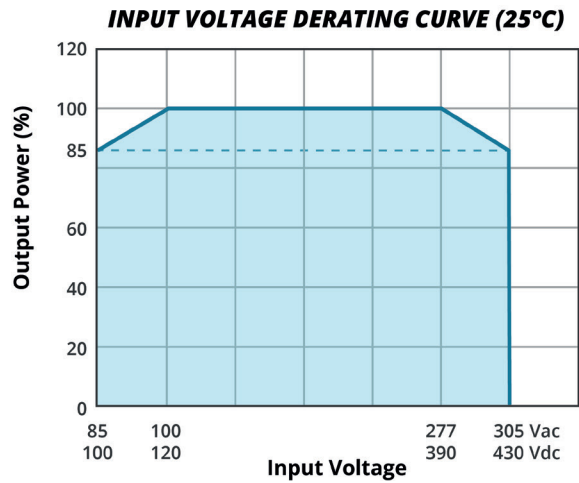
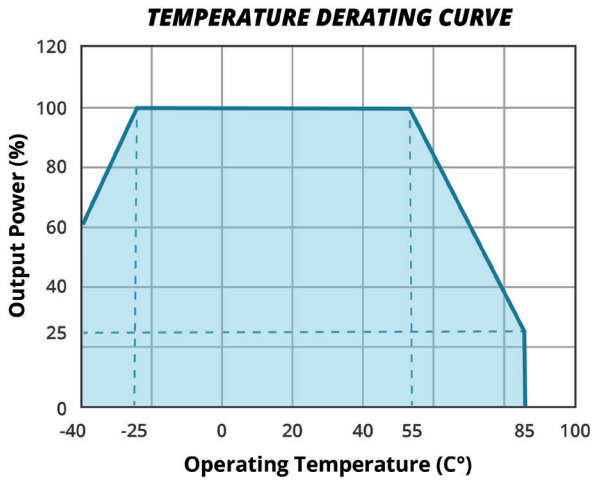
SAFETY & COMPLIANCE

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 designed to meet 60335: IEC, EN				
safety class	class II				
conducted emissions	CISPR32/EN55032 Class A (recommended circuit 1,4) CISPR32/EN55032 Class B (recommended circuit 2,3)				
radiated emissions	CISPR32/EN55032 Class A (recommended circuit 1,4) 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				
	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				
	IEC/EN61000-4-5, line to line ±2kV (recommended circuit 3,4), perf. Criteria B				
	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				

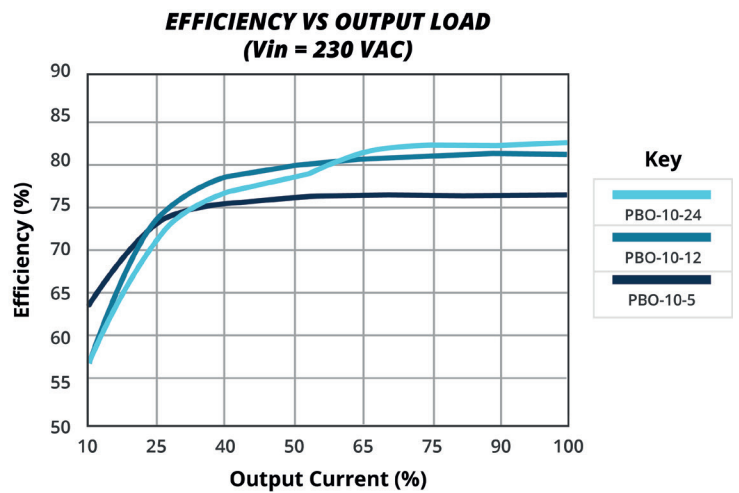
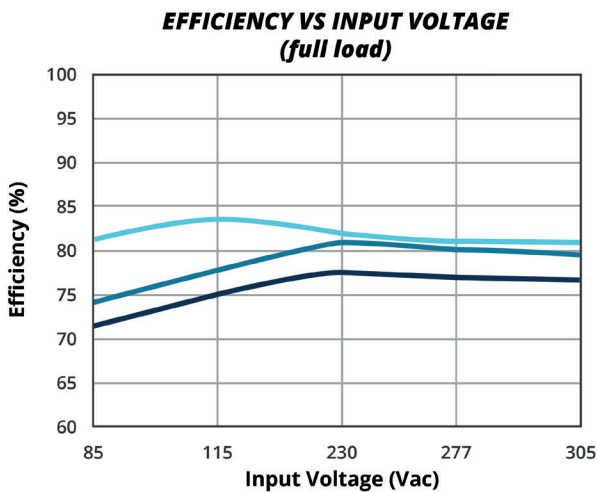
ENVIRONMENTAL

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

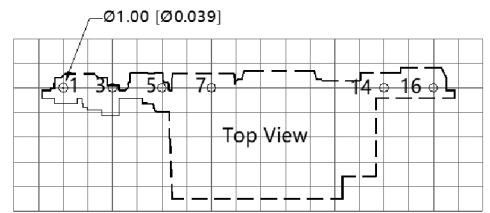
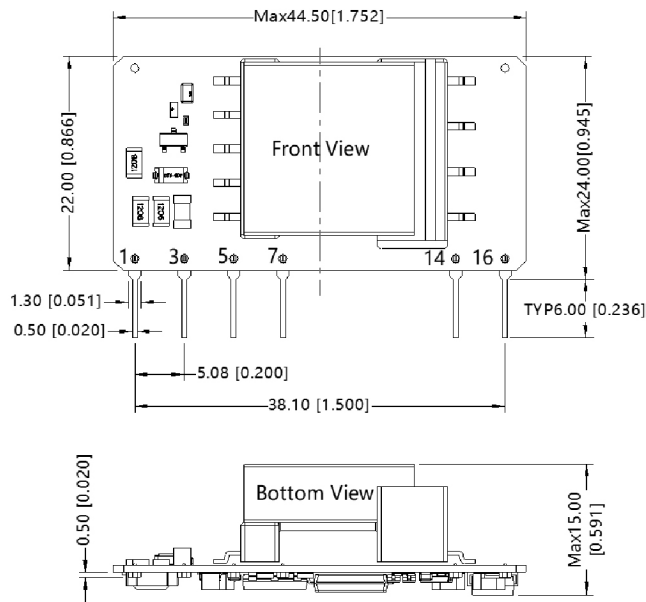
Vertical Orientation

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



Note: Grid 2.54*2.54mm

MECHANICAL DRAWING (CONTINUED)

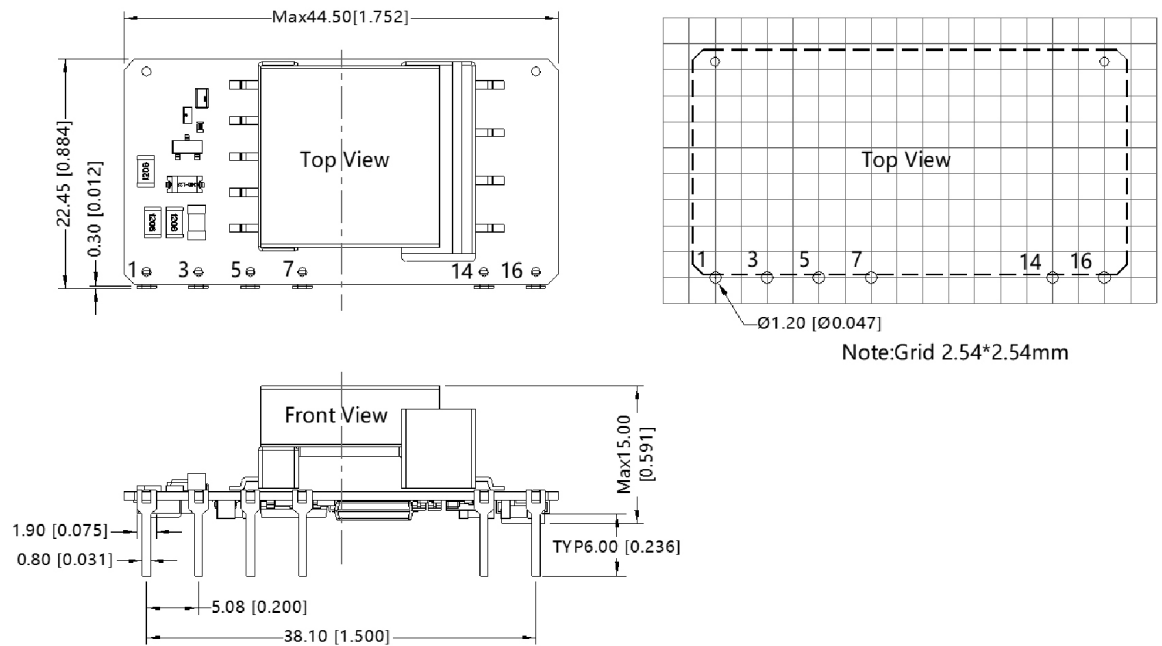
Right-angle Orientation

units: mm[inch]

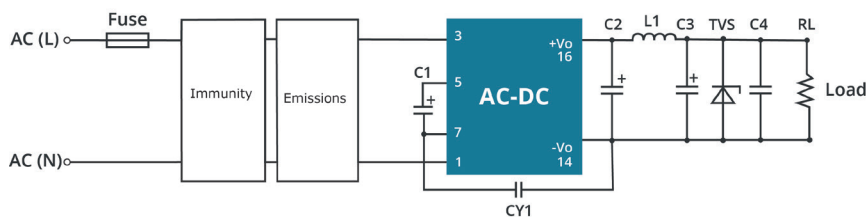
tolerance: ± 0.50 [± 0.020]

pin section tolerance: ± 0.10 [± 0.004]

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



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 (required)	C1 (required)	C2 (required)	L1 (required)	C3 ¹ (required)	C4	CY1 (required)	TVS ²
PBO-10-3	1A/300V	22μF/450V	470μF/16V (solid-state capacitor)	4.7μF (max 60mΩ)	150μF/35V	0.1μF/50V	1.0nF/400Vac	SMBJ7.0A
PBO-10-5			SMBJ7.0A					
PBO-10-9			SMBJ12A					
PBO-10-12			270μF/16V (solid-state capacitor)		47μF/35V			SMBJ20A
PBO-10-15			470μF/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		-25° ~ 55°C	Class B	Class IV
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 Surge: line to gnd ±4KV EFT: Class IV	

EMC RECOMMENDED CIRCUIT

Circuit 1

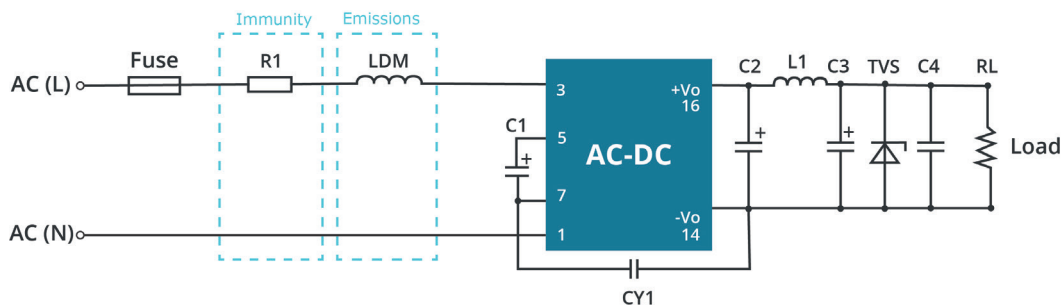


Table 1

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

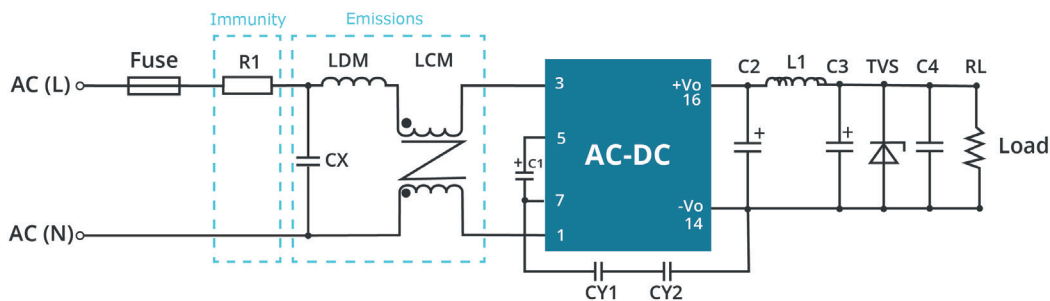


Table 2

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

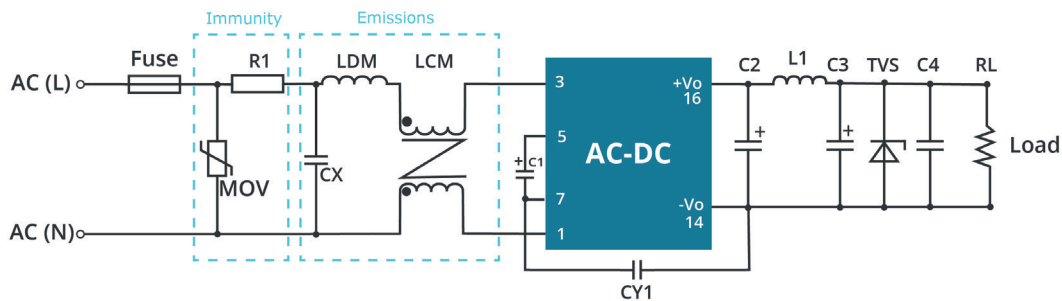


Table 3

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

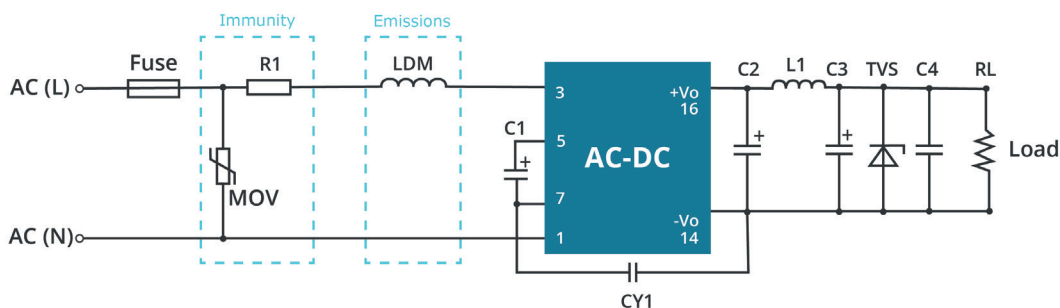


Table 4

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 surge: line to ground ± 4kV 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.



CUI INC
a bel group

Headquarters
20050 SW 112th Ave.
Tualatin, OR 97062
800.275.4899

Fax 503.612.2383
cui.com
techsupport@cui.com

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