

SERIES: PBO-10C | DESCRIPTION: INTERNAL 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 61558 & 60335 safety standards
- 1,000,000 hour MTBF
- flexible implementations to power a wide array of applications



MODEL	output voltage (Vdc)	output current max (A)	output power max (W)	ripple and noise ¹ typ (mVp-p)	efficiency ² typ (%)
PBO-10C-3	3.3	2.0	6.6	150	73.0
PBO-10C-5	5.0	2.0	10.0	150	77.0
PBO-10C-9	9.0	1.1	10.0	150	80.0
PBO-10C-12	12.0	0.83	10.0	150	82.0
PBO-10C-15	15.0	0.67	10.0	150	82.0
PBO-10C-24	24.0	0.42	10.0	150	83.0

Note: 1. At full load, nominal input, 20 MHz bandwidth oscilloscope, see Application Circuit.
2. At 230 Vac input.

PART NUMBER KEY

PBO-10C - XX

Base Number

Output Voltage

INPUT

parameter	conditions/description	min	typ	max	units
voltage	ac input	85		305	Vac
	dc input	100		430	Vdc
frequency		47		63	Hz
current	at 115 Vac			0.30	A
	at 230 Vac			0.18	A
inrush current	at 115 Vac		15		A
	at 277 Vac		30		A
no load power consumption	at 230 Vac			0.10	W
	3.3 & 5 Vdc output models			0.12	W
	9, 12 & 15 Vdc output models			0.15	W
	24 Vdc output models				W

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	3.3 Vdc output		±3		%
	other outputs		±2		%
line regulation	at rated load		±1		%
load regulation	0% ~ 100% load		±1.5		%
temperature coefficient			±0.02		%/°C

PROTECTIONS

parameter	conditions/description	min	typ	max	units
over voltage protection	output voltage clamp & hiccup				
	3.3 & 5 Vdc output models			9.0	Vdc
	9 Vdc output models			15.0	Vdc
	12 Vdc output models			16.0	Vdc
	15 Vdc output models			21.0	Vdc
	24 Vdc output models			32.0	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 for 1 minute, leakage current <5mA	3,000			Vac
safety approvals	certified to	62368: IEC/EN/UL			
	designed to meet	61558: IEC, EN			
	designed to meet	60335: IEC, EN			
safety class	class II				
EMI/EMC	CISPR32/EN55032 CLASS A (Recommended circuit 1, 4) CISPR32/EN55032 CLASS B (Recommended circuit 2, 3)				
ESD	IEC/EN 61000-4-2 Contact ±6KV perf. Criteria B				
radiated immunity	IEC/EN61000-4-3 10V/m perf. Criteria A				
EFT/burst	IEC/EN61000-4-4 ±2KV (Recommended circuit 1, 2) perf. Criteria B				
	IEC/EN61000-4-4 ±4KV (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				
conducted immunity	IEC/EN61000-4-6 10Vr.m.s perf. Criteria A				

SAFETY & COMPLIANCE (CONTINUED)

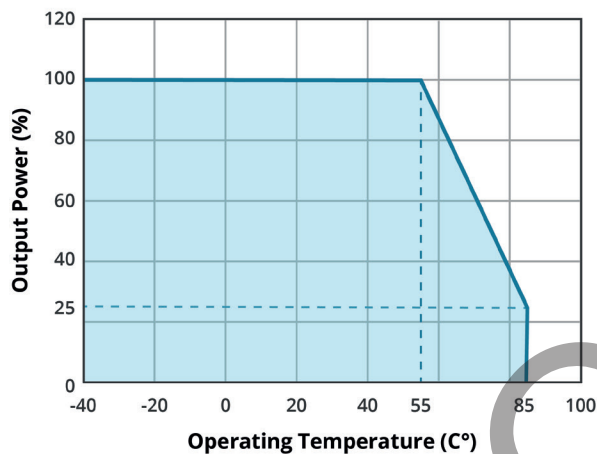
parameter	conditions/description	min	typ	max	units
voltage dips and interruptions	IEC/EN61000-4-11 0%, 70% perf. Criteria B				
MTBF	as per MIL-HDBK-217F at 25 °C	1,000,000			hours
RoHS	yes				

ENVIROMENTAL

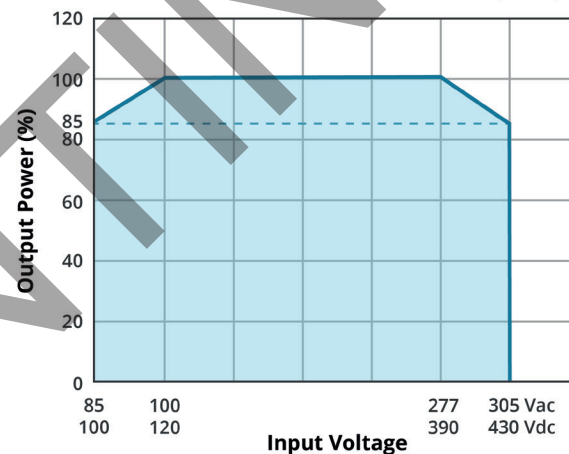
parameter	conditions/description	min	typ	max	units
operating temperature		-40		85	°C
storage temperature		-40		105	°C
storage humidity				95	%

DERATING CURVES

TEMPERATURE DERATING CURVE

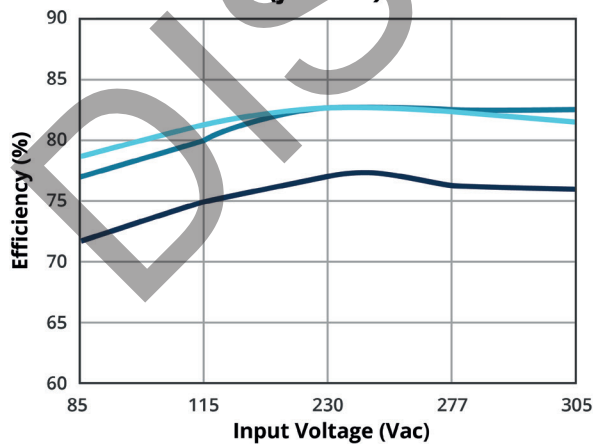


INPUT VOLTAGE DERATING CURVE (25°C)

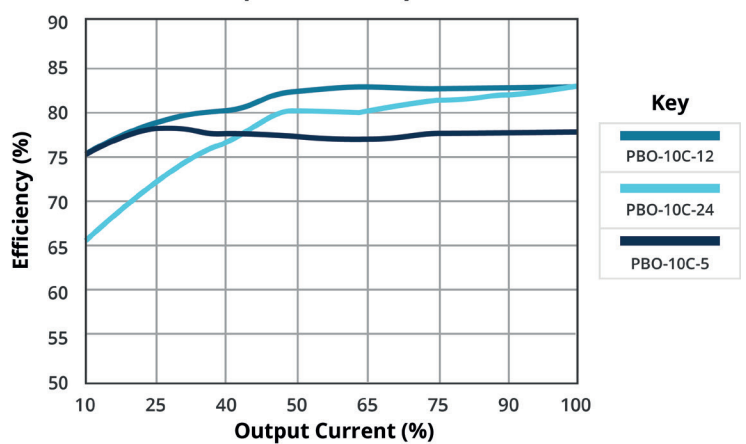


EFFICIENCY CURVES

**EFFICIENCY VS INPUT VOLTAGE
(full load)**



**EFFICIENCY VS OUTPUT LOAD
(Vin = 230 VAC)**

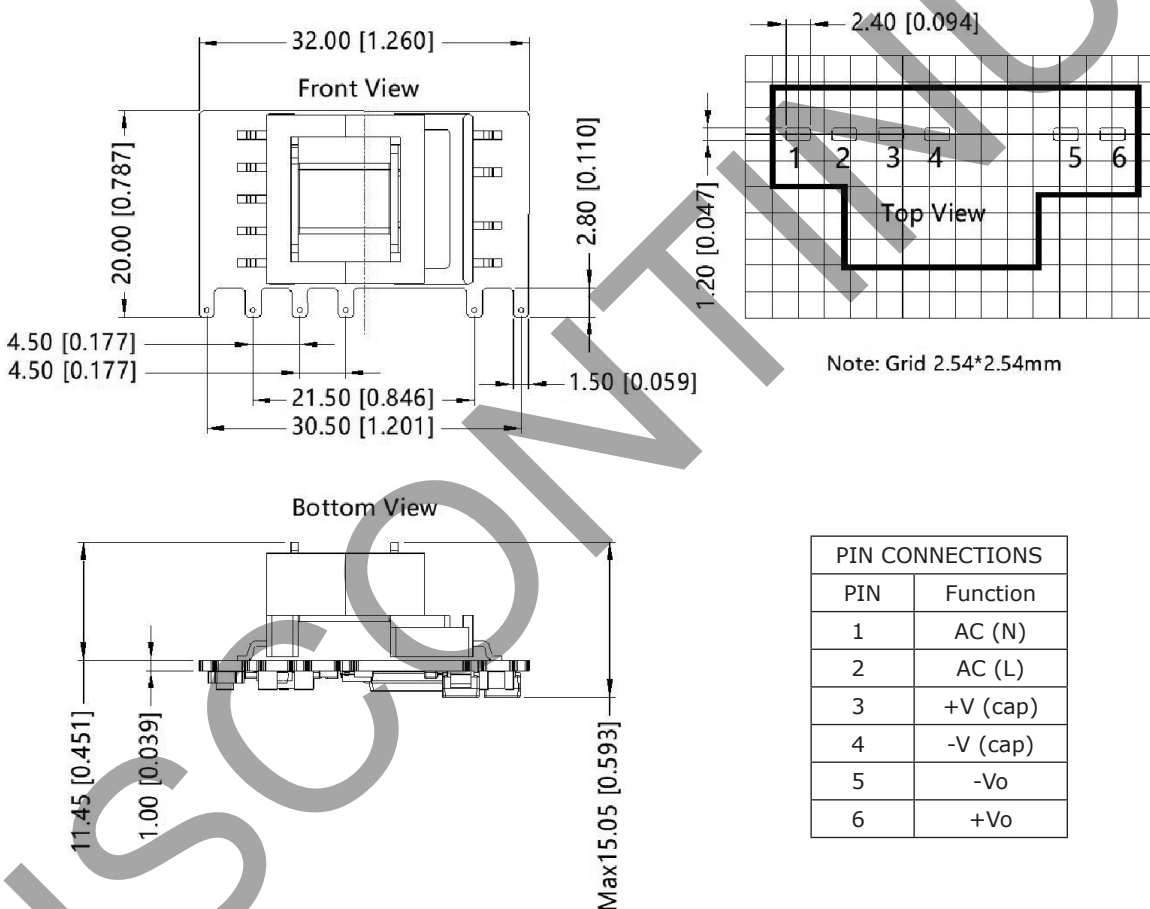


MECHANICAL

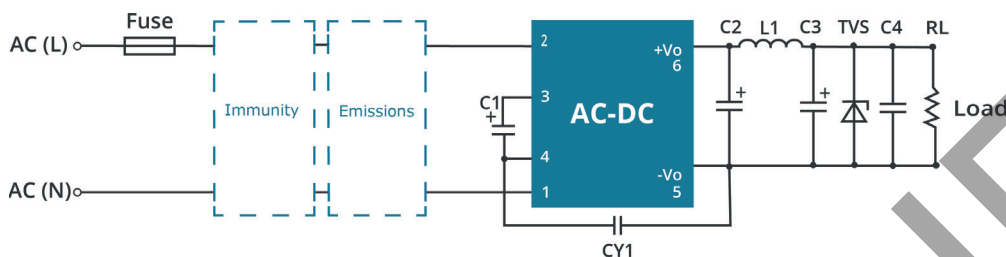
parameter	conditions/description	min	typ	max	units
dimensions	32.00 x 17.20 x 15.05 (1.259 x 0.677 x 0.592 inches)				mm
weight			8.2		g
cooling	free air convection				

MECHANICAL DRAWING

units: mm [inch]

general tolerance: ± 1.00 [± 0.039]

APPLICATION DESIGN REFERENCE



PBO-10C Series additional component selection guide (no EMC devices)

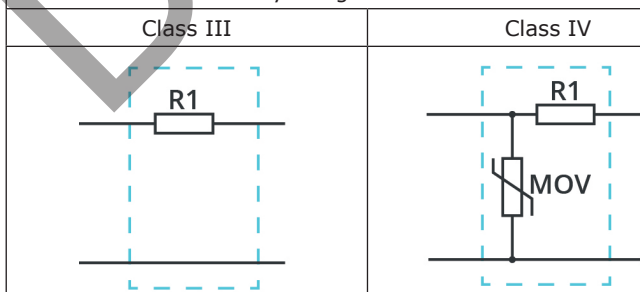
Part no.	C1 ¹ (required)	C2 (required)	L1 (required)	C3 ² (required)	C4	CY1 (required)	TVS ³
PBO-10C-3	22μF/450V	820μF/16V (solid-state capacitor)	2.2μH max 15mΩ/6.5A	150μF/35V	0.1μF/50V (ceramic capacitor)	1.0nF/400Vac	SMBJ7.0A
PBO-10C-5							SMBJ7.0A
PBO-10C-9		270uF/16V (solid-state capacitor)		220μF/35V			SMBJ12A
PBO-10C-12							SMBJ20A
PBO-10C-15		470uF/35V					SMBJ20A
PBO-10C-24							SMBJ30A

- Note:
1. Recommended to use a capacitor with ripple current >300 mA at 100 kHz.
 2. Recommended to use a high frequency, low ESR, electrolytic capacitor with at least 20% margin on voltage rating.
 3. 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.

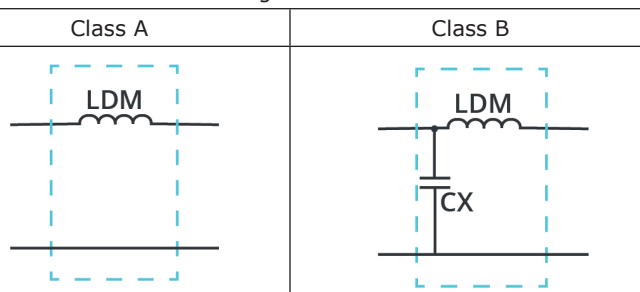
PBO-10C Series Enviromental and EMC selection guide

Recommended circuit	Application enviromental	Typical industry	Input voltage range	Enviroment temperature	Emissions	Immunity
1	Basic application	None	85~305Vac	-40°C to 85°C	Class A	Class III
2	Indoor civil enviroment	Smart home/Home appliances (2 Y-caps)		-25°C to 55°C	Class B	Class III
	Indoor general enviroment	Intelligent building/ Intelligent agriculture				
3	Indoor industrial	Manufacturing workshope		-25°C to 55°C	Class B	Class IV
4	Outdoor general enviroment	ITS/Video monitoring/ Charging point/Com-munication/Security and protection		-40°C to 85°C	Class A	Class IV

Immunity design circuits reference



Emissions design circuits reference



APPLICATION DESIGN REFERENCE (CONTINUED)

Circuit 1

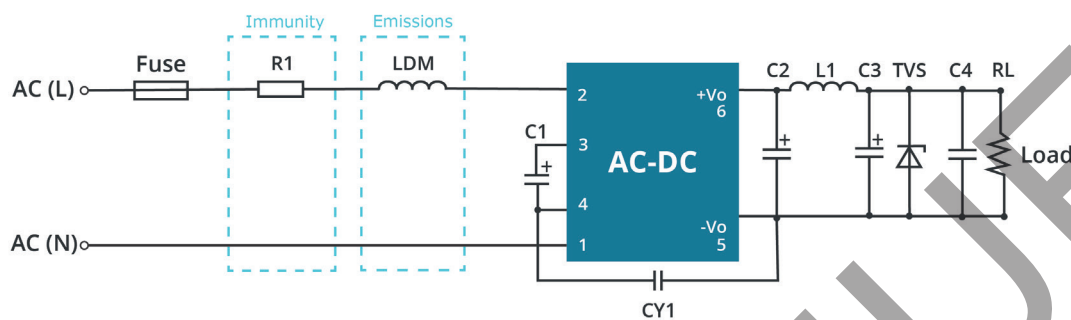


Table 1

Application enviromental	Ambient temperature range	Imunity Class	Emissions Class
Basic application	-40°C ~ 85°C	Class III	Class A

Component	Recommended value
FUSE (required)	1A/300V, slow blow
R1 (wire-wound resistor, required)	6.8Ω/3W
LDM	2.2mH/4Ω max/0.24A min

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

Circuit 2

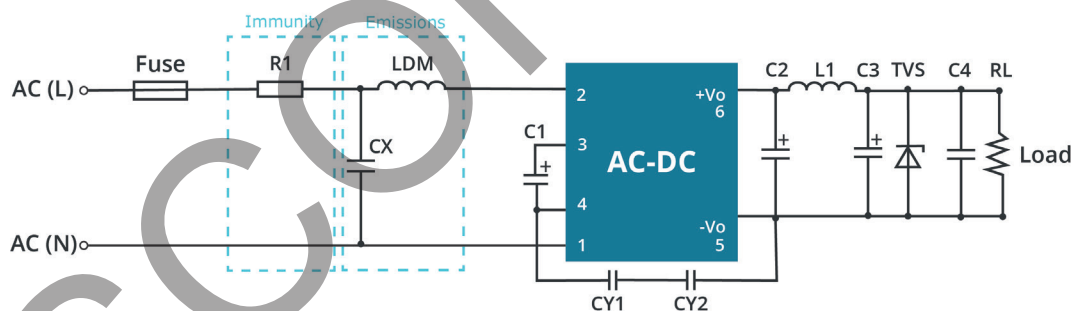


Table 2

Application enviromental	Ambient temperature range	Imunity Class	Emissions Class
Indoor civil / general	-25°C ~ 55°C	Class III	Class B

Component	Recommended value
FUSE (required)	1A/300V, slow-blow
R1 (wire-wound resistor, required)	6.8Ω/3W
CY1 (CY2)	1.0nF/400Vac
LDM	2.2mH/ 4Ω/0.24A
CX	0.1μF/310Vac

Note: 1. For Smart Home and Home Appliance applications two Y-capacitors are required in series (2.2 nF/250 Vac each) to meet 60335 household safety requirements.
 2. Many safety standards require a bleeder resistor no greater than 3.8MΩ in parallel with the X-capacitor.
 3. R1 must be a wire-wound resistor; do not use a chip or carbon film resistor.

APPLICATION DESIGN REFERENCE (CONTINUED)

Circuit 3

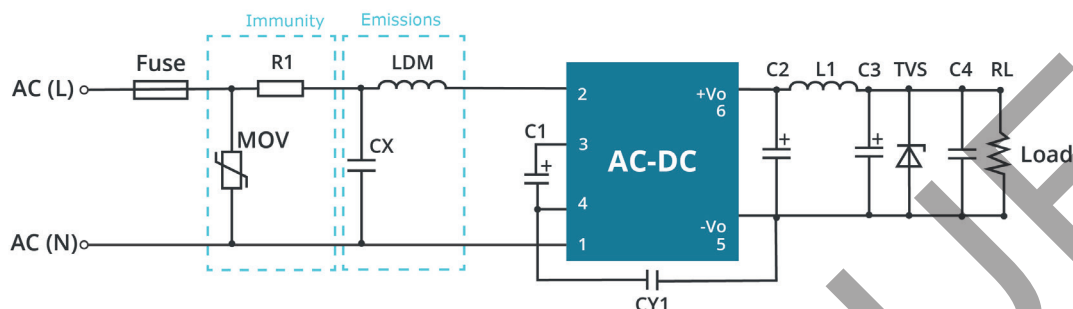


Table 3

Application enviromental	Ambient temperature range	Imunity Class	Emissions Class
Indoor industrial	-25°C ~ 55°C	Class IV	Class B

Component	Recommended value
FUSE (required)	2A/300V, slow-blow
MOV	S14K350
CY1	1.0nF/400Vac
CX	0.1μF/310Vac
LDM	2.2mH/ 4Ω/0.24A
R1 (wire-wound resistor, required)	6.8Ω/3W

Note: 1. Many safety standards require a bleeder resistor no greater than 3.8MΩ in parallel with the X-capacitor.
 2. R1 must be a wire-wound resistor; do not use a chip or carbon film resistor.

Circuit 4

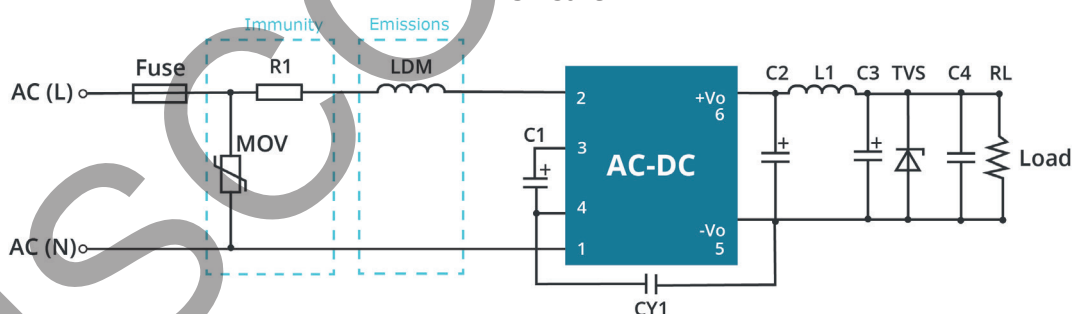


Table 4

Application enviromental	Ambient temperature range	Imunity Class	Emissions Class
Outdoor general enviroment	-40°C ~ 85°C	Class IV	Class A

Component	Recommended value
FUSE (required)	2A/300V, slow-blow
MOV	S14K350
LDM	2.2mH/ 4Ω/0.24A
R1 (wire-wound resistor, required)	6.8Ω/3W

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	11/12/2020
1.01	derating and efficiency curves updated	01/21/2022
1.02	UKCA mark added	05/26/2022

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



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