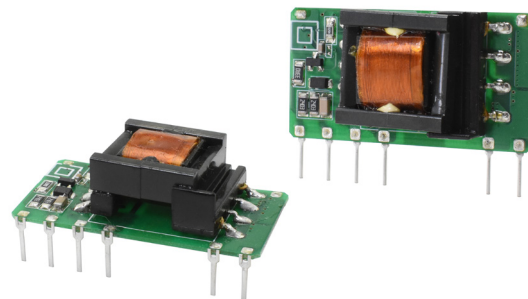


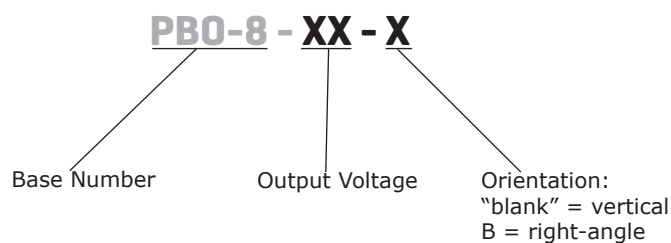
SERIES: PBO-8 | DESCRIPTION: AC-DC POWER SUPPLY
FEATURES

- 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 typ	output power max	ripple and noise ¹ max	efficiency ² typ
	(Vdc)	(A)	(W)	(mVp-p)	(%)
PBO-8-3	3.3	1.6	5.28	150	70
PBO-8-5	5	1.6	8.0	150	74
PBO-8-9	9	0.88	8.0	150	75
PBO-8-12	12	0.67	8.0	150	76
PBO-8-15	15	0.53	8.0	150	77
PBO-8-24	24	0.33	8.0	150	79

Notes: 1. At full load, nominal input, 20 MHz bandwidth oscilloscope, with a 1 μ F ceramic and 10 μ 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.

PART NUMBER KEY


INPUT

parameter	conditions/description	min	typ	max	units
voltage		85 100		305 430	Vac Vdc
frequency		47		63	Hz
current	at 115 Vac at 277 Vac			0.3 0.15	A A
inrush current	at 115 Vac at 277 Vac		15 30		A 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			±2	%
	all other models				%
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				

SAFETY & COMPLIANCE (CONTINUED)

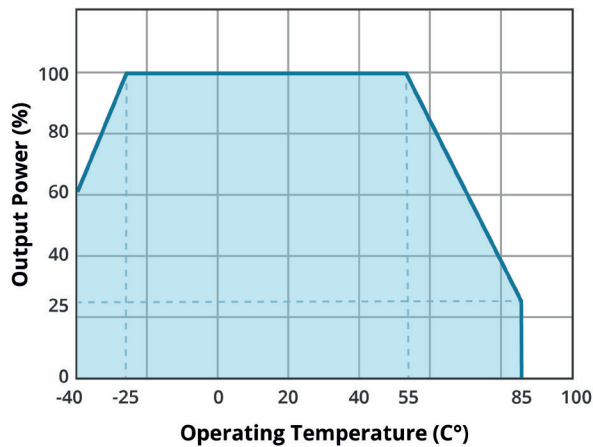
parameter	conditions/description	min	typ	max	units
MTBF	as per MIL-HDBK-217 at °C	300,000			hours
RoHS	yes				

ENVIRONMENTAL

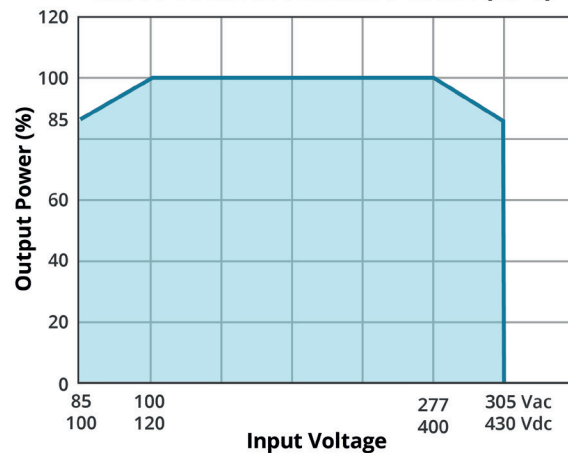
parameter	conditions/description	min	typ	max	units
operating temperature	see derating curves	-40		85	°C
storage temperature		-40		105	°C
storage humidity	non-condensing			95	%

DERATING CURVES

TEMPERATURE DERATING CURVE

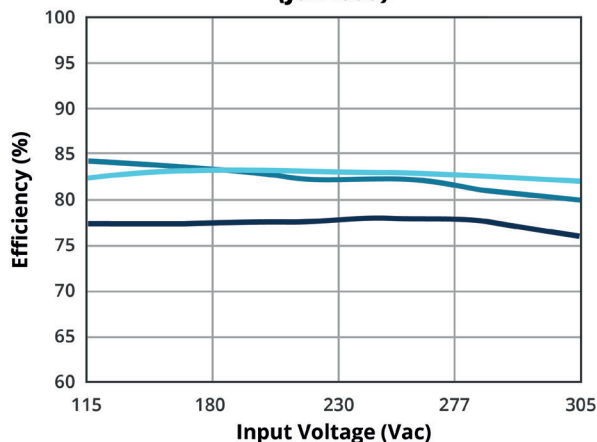


INPUT VOLTAGE DERATING CURVE (25°C)

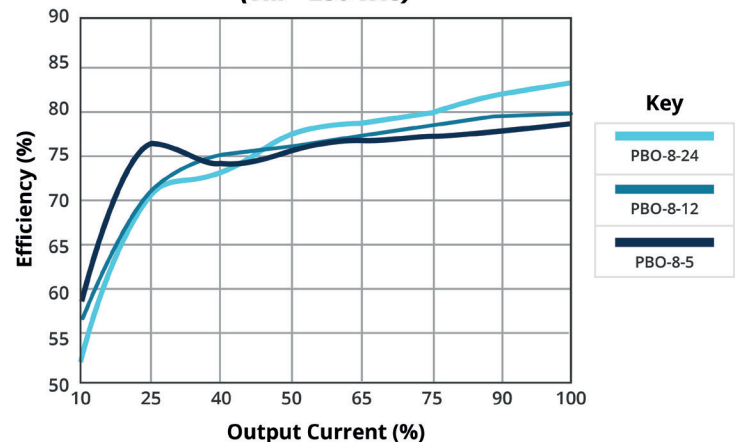


EFFICIENCY CURVES

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



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



MECHANICAL

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

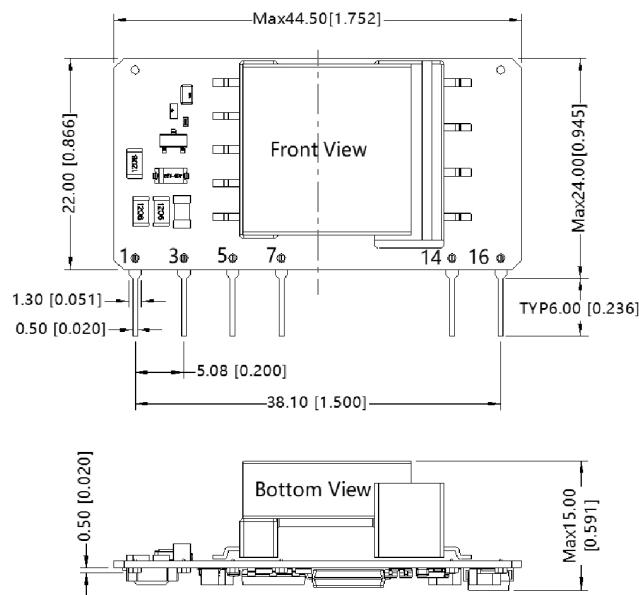
MECHANICAL DRAWING

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



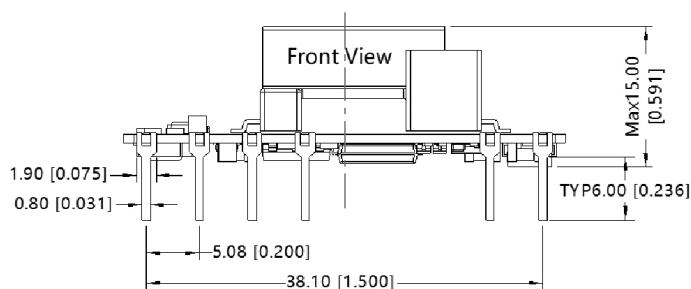
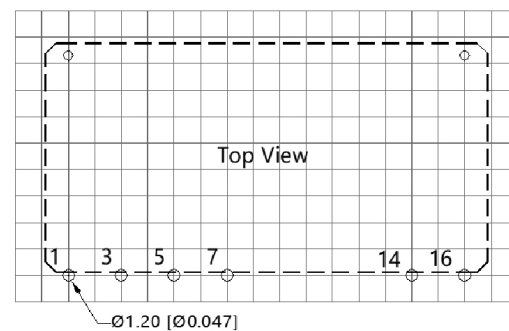
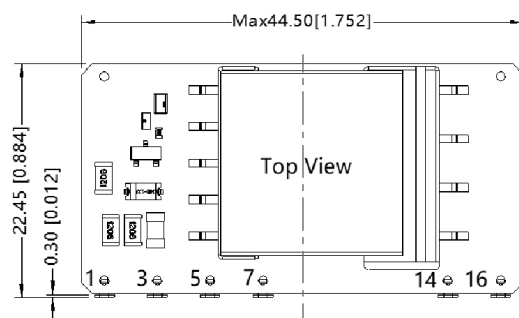
MECHANICAL DRAWING (CONTINUED)

Right-angle Orientation

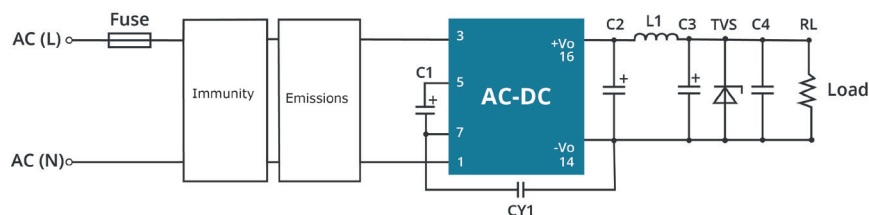
units: mm[inch]

tolerance: ± 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-8 series additional circuits design reference

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

PBO-8 Series additional component selection guide

Part no.	FUSE (required)	C1 (required)	C2 (required)	L1 (required)	C3 ¹ (required)	C4	CY1 (required)	TVS ²
PBO-8-3.3	1A/300V	22μF/450V	470μF/16V (solid-state capacitor)	4.7μF/50V (max 60mΩ)	150μF/35V	0.1μF/50V	1.0nF/400Vac	SMBJ7.0A
PBO-8-5								SMBJ7.0A
PBO-8-9			220μF/16V (solid-state capacitor)		100μF/35V			SMBJ12A
PBO-8-12								SMBJ20A
PBO-8-15			470μF/35V		47μF/35V			SMBJ20A
PBO-8-24			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-8 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 Surge: line to gnd ±4KV EFT: Class IV

EMC RECOMMENDED CIRCUIT

Circuit 1

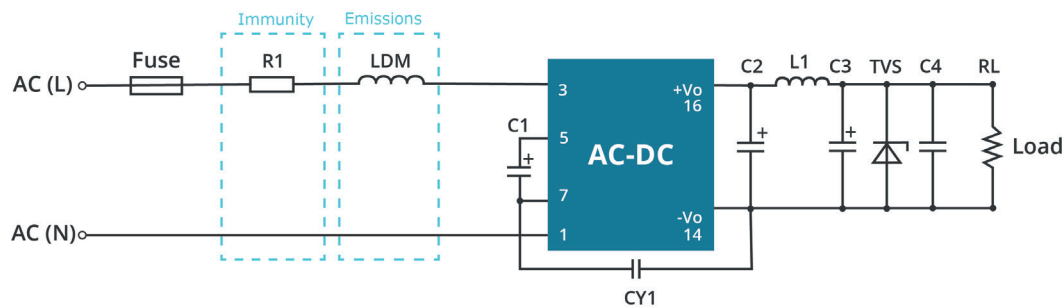


Table 1

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

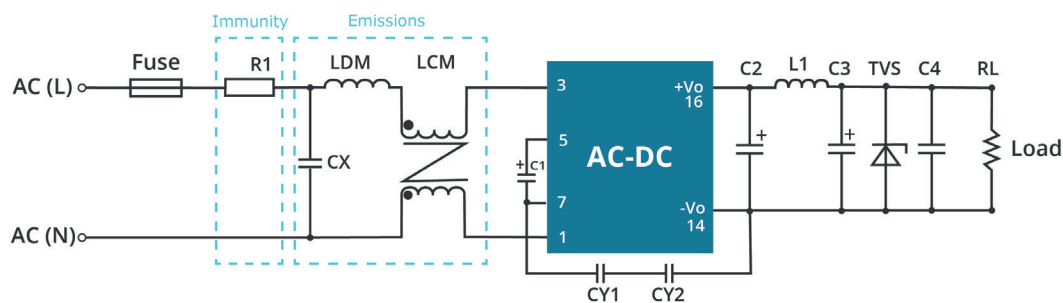


Table 2

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

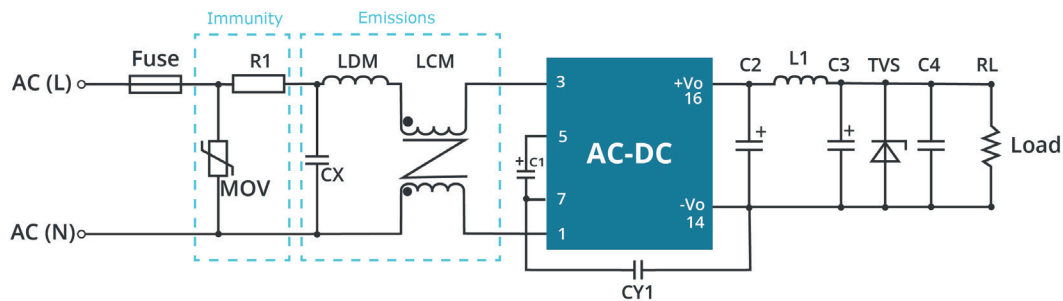


Table 3

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

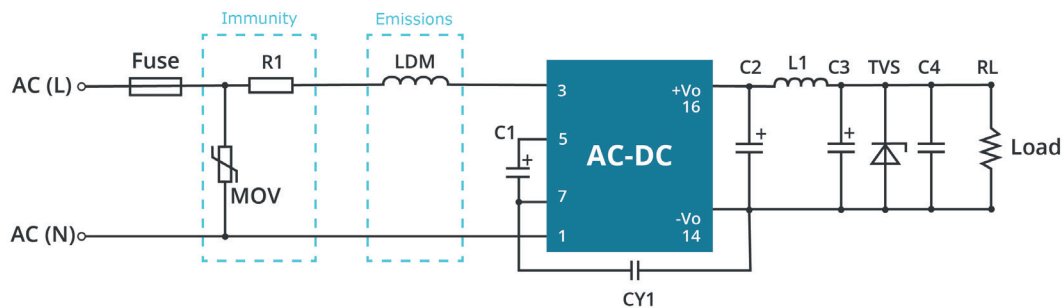


Table 4

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

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



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