CUI INC
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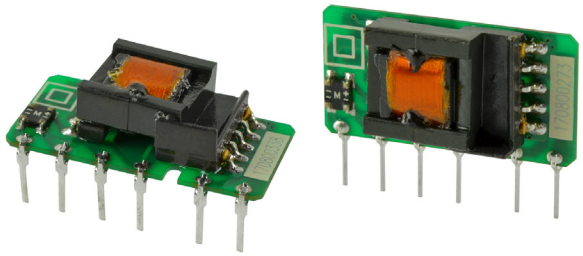
SERIES: PBO-1 | DESCRIPTION: AC-DC POWER SUPPLY

FEATURES

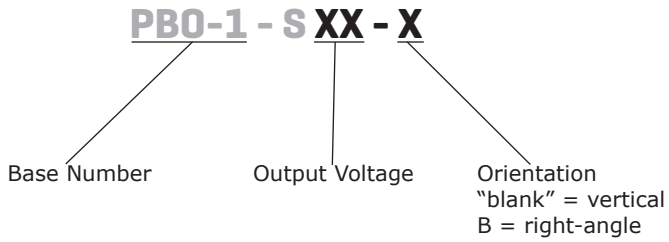
- up to 1 W continuous power
- ultra-compact SIP package
- available in straight-pin and bent-pin configurations
- wide input voltage range
- over current and short circuit protections
- 3,000 Vac isolation



MODEL	output voltage (Vdc)	output current min (mA)	output current max (mA)	output power max (W)	ripple and noise[1] max (mVp-p)	efficiency[2] typ (%)
PBO-1-S5	5	10	200	1	120	66
PBO-1-S9	9	5.55	111	1	120	67
PBO-1-S12	12	4.15	83	1	120	70
PBO-1-S15	15	3.35	67	1	120	69
PBO-1-S24	24	2.1	42	1	120	68

Notes:
1. At full load, nominal input, 20 MHz bandwidth oscilloscope, see Application Circuit.
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 70		305 430	Vac Vdc
frequency		47		63	Hz
current	at 115 Vac at 277 Vac			0.12 0.06	A A
inrush current	at 115 Vac at 277 Vac		9 15		A A
no load power consumption	24 Vdc output models all other models			0.3 0.25	W W

OUTPUT

parameter	conditions/description	min	typ	max	units
capacitive load	5 Vdc output models all other models			220 100	µF µF
initial set point accuracy	5 Vdc output models all other models			±8 ±5	% %
line regulation	at full load		±1.5		%
load regulation	from 5~100% load 24 Vdc output models all other models		 ±6 ±3		 % %
hold-up time	at 230 Vac	150	180		ms
switching frequency				100	kHz
temperature coefficient			±0.15		%/°C

PROTECTIONS

parameter	conditions/description	min	typ	max	units
over current protection	auto recovery	110		500	%
short circuit protection	continuous, auto recovery				

SAFETY & COMPLIANCE

parameter	conditions/description	min	typ	max	units
isolation voltage	input to output for 1 minute	3,000			Vac
safety approvals	certified to 62368: IEC/EN certified to 60950: UL/cUL				
safety class	Class II				
conducted emissions	CISPR32/EN55032, Class A (recommended circuit 1,2,6)				
	CISPR32/EN55032, Class B (recommedned circuit 3,4,5)				
radiated emissions	CISPR32/EN55032, Class A (recommended circuit 1,2,6)				
	CISPR32/EN55032, Class B (recommended circuit 3,4,5)				
ESD	IEC/EN61000-4-2, contact ±4 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 1,2,3), perf. Criteria B				
	IEC/EN61000-4-4, ±4 kV, (recommended circuit 4,5,6), perf. Criteria B				
surge	IEC/EN61000-4-5, line to line ±1 kV, Class B (recommended circuit 1,2), perf. Criteria B				
	IEC/EN61000-4-5, line to line ±2 kV (recommended circuit 6), perf. Criteria B				
	IEC/EN61000-4-5, line to line ±1 kV/line to ground ±2 kV (recommended circuit 3) perf. Criteria B				
	IEC/EN61000-4-5, line to line ±2 kV/line to ground ±4 kV (recommended circuit 4,5) perf. Criteria B				
conducted immunity	IEC/EN61000-4-6 Class A, 10 Vr.m.s, perf. Criteria A				

SAFETY & COMPLIANCE (CONTINUED)

parameter	conditions/description	min	typ	max	units
voltage dips & interruptions	IEC/EN61000-4-11, 0%-70%, perf. Criteria B				
MTBF	as per MIL-HDBK-217F at 25°C	200,000			hours
RoHS	2011/65/EU				

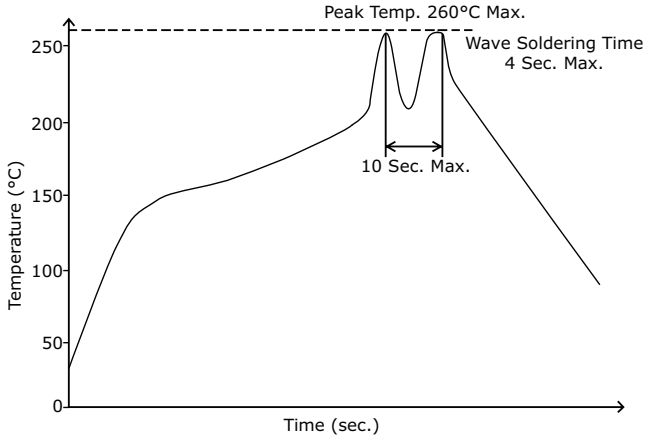
Notes: 1. The power supply is considered a component which will be installed into final equipment. The final equipment still must be tested to meet the necessary EMC directives.

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			85	%

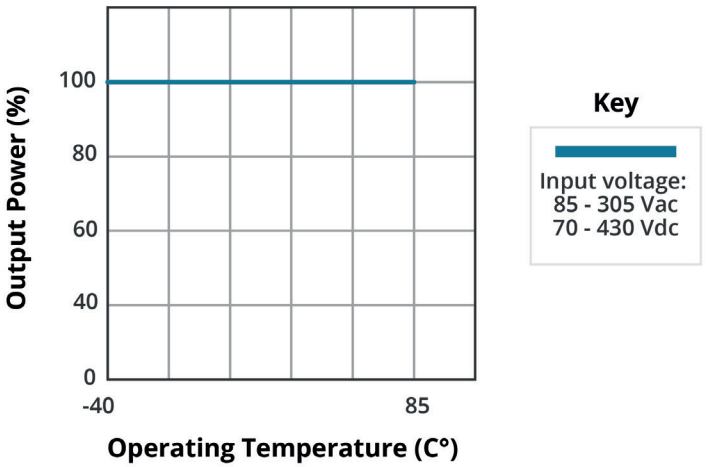
SOLDERABILITY

parameter	conditions/description	min	typ	max	units
hand soldering	for 3~5 seconds	350	360	370	°C
wave soldering	for 5~10 seconds	255	260	265	°C

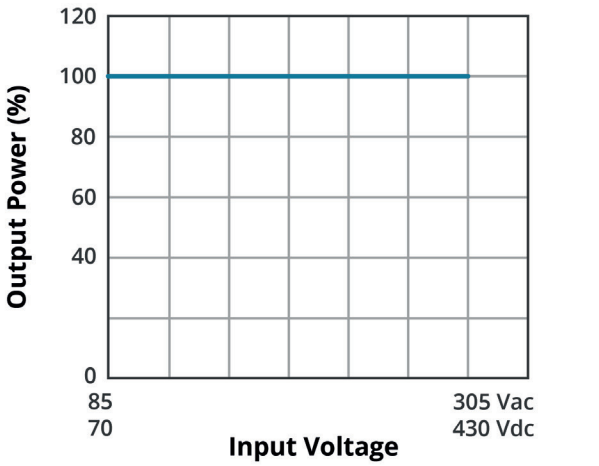


DERATING CURVES

TEMPERATURE DERATING CURVE

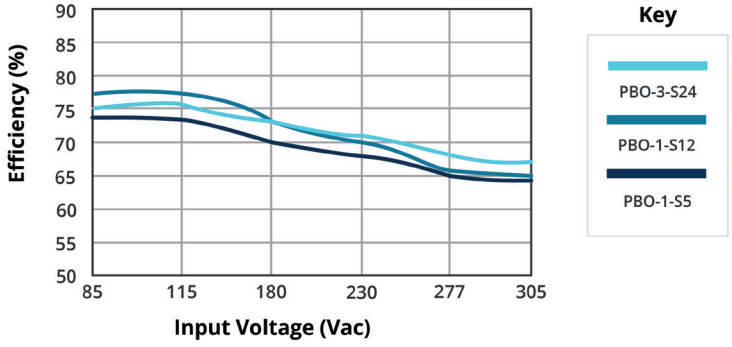


INPUT VOLTAGE DERATING CURVE (25°C)

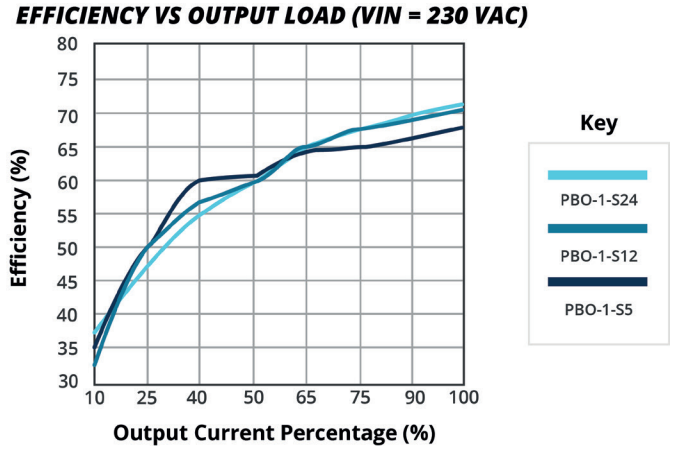


EFFICIENCY CURVES

EFFICIENCY VS INPUT VOLTAGE (FULL LOAD)



EFFICIENCY VS OUTPUT LOAD (VIN = 230 VAC)



MECHANICAL

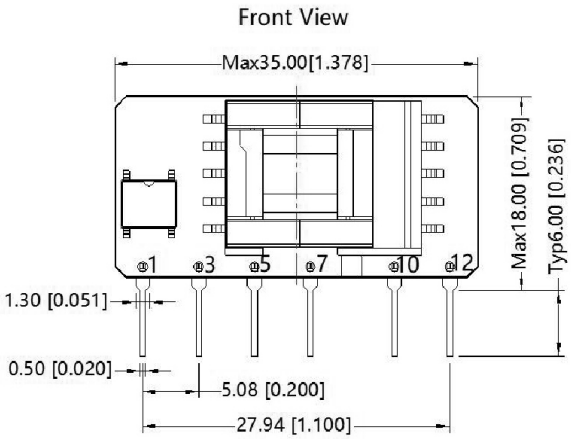
parameter	conditions/description	min	typ	max	units
dimensions	vertical models: 35.00 x 11.00 x 18.00 (1.38 x 0.43 x 0.71 inches) right-angle models: 35.00 x 18.00 x 11.00 (1.38 x 0.71 x 0.43 inches)				mm mm
weight			6		g

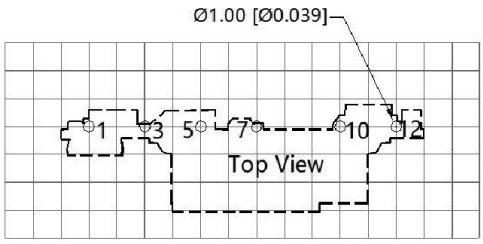
MECHANICAL DRAWING

Vertical Orientation
units: mm[inch]
tolerance: ±0.50[±0.020]
pin section tolerance: ±0.10[±0.004]

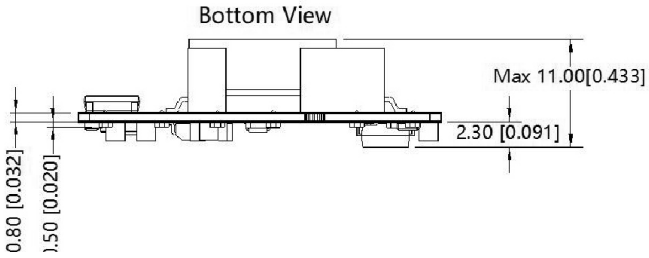
PIN CONNECTIONS	
PIN	Function
1	AC (N)
3	AC (L)
5	+V(CAP)
7	-V(CAP)
10	-Vo
12	+Vo

Note: 1. It is required to add C1 between pins 5 & 7 (see application circuits).





Note:Grid 2.54*2.54mm

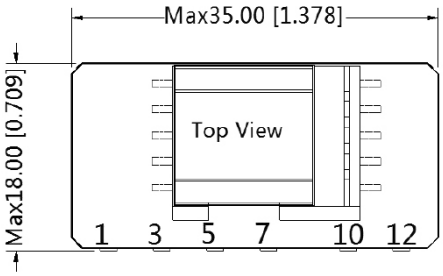


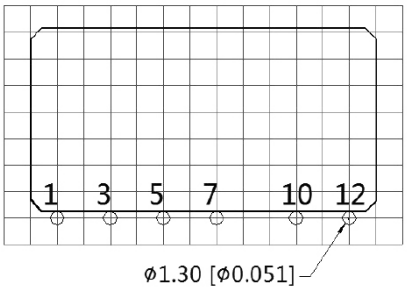
MECHANICAL DRAWING (CONTINUED)

Right-angle Orientation
units: mm[inch]
tolerance: ±0.50[±0.020]
pin section tolerance: ±0.10[±0.004]

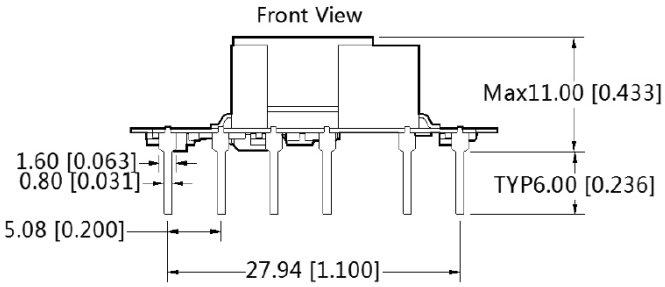
PIN CONNECTIONS	
PIN	Function
1	AC (N)
3	AC (L)
5	+V(CAP)
7	-V(CAP)
10	-Vo
12	+Vo

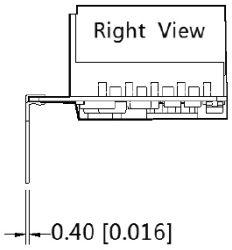
Note: 1. It is required to add C1 between pins 5 & 7 (see application circuits).



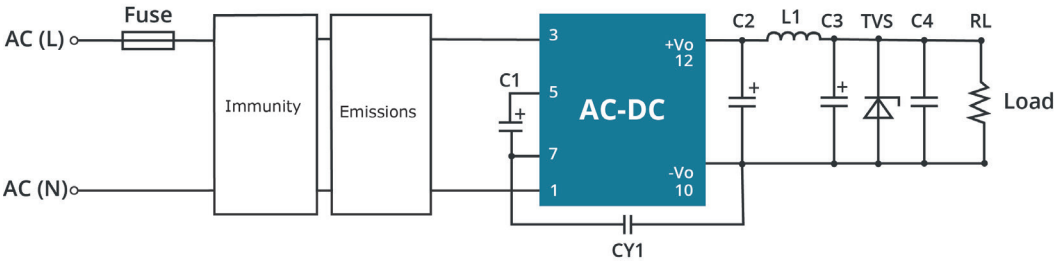


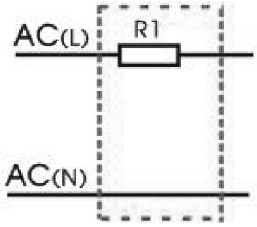
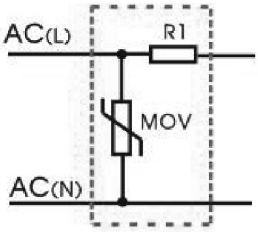
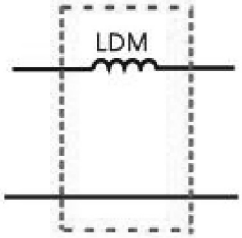
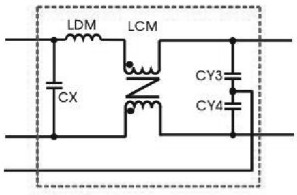
Note:Grid 2.54*2.54mm





APPLICATION DESIGN REFERENCE



PBO-1 series additional circuits design reference			
Immunity design circuits for reference		Emissions design circuits for reference	
Class III	Class IV	Class A	Class B
			

PBO-1 Series additional component selection guide								
Part no.	FUSE (required)	C1 (required)	C2 (required)	L1 (required)	C3 (required)	C4	CY1 (required)	TVS
PBO-1-S5	1A/300V	4.7μF/450V (-20°C~85°C) 10μF/450V (-40°C~85°C)	270μF/16V (solid-state capacitor)	2.2μH (max 60mΩ)	68μF/35V	0.1μF/50V	1.0nF/400 Vac	SMBJ7.0A
PBO-1-S9			100μF/16V (solid-state capacitor)					SMBJ12A
PBO-1-S12								SMBJ20A
PBO-1-S15			100μF/35V					SMBJ20A
PBO-1-S24								SMBJ30A

Note: 1. C1: Input capacitors, C2: output storage capacitors, must be connected externally.
2. It is recommended using an electrolytic capacitor with high frequency and low ESR rating for C3. Combined with C2, L1, they form a pí-type filter circuit. Choose a capacitor voltage rating with at least 20% margin, in other words not exceeding 80%. C4 is a ceramic capacitor, used for filtering high frequency noise. A suppressor diode (TVS) is a recomended to protect the application in case of a converter failure and specification should be 1.2 times of the output voltage.

PBO-1 Series Enviromental and EMC selection guide						
Recommended circuit	Application enviromental	Typical industry	Input voltage range	Enviroment temperature	Emissions	Immunity
1/2	Basic application	None	85 ~ 305 Vac	-40° ~ 88°C	Class A	Class III
3	Indoor civil enviroment	Smart home / Home appliances (2Y)		-25° ~ 55°C	Class B	Class III
	Indoor general enviroment	Intelligent building / Intelligent agriculture				
4/5	Indoor industrial enviroment	Manufacturing workshop		-25° ~ 55°C	Class B	Class IV
6	Oudoor general enviroment	ITS / Video monitoring / Charging point / Communica-tion / Securitiy and protection		-40° ~ 85°C	Class A	Class IV

EMC RECOMMENDED CIRCUIT

Circuit 1

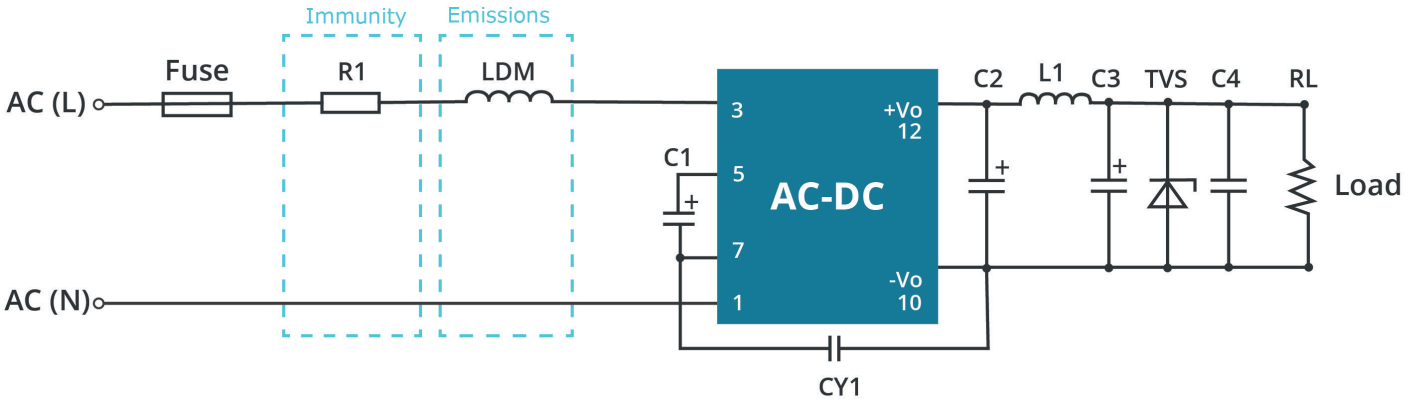


Table 1

Application enviromental	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
FUSE (required)	1A/300V, slow-blow

Circuit 2

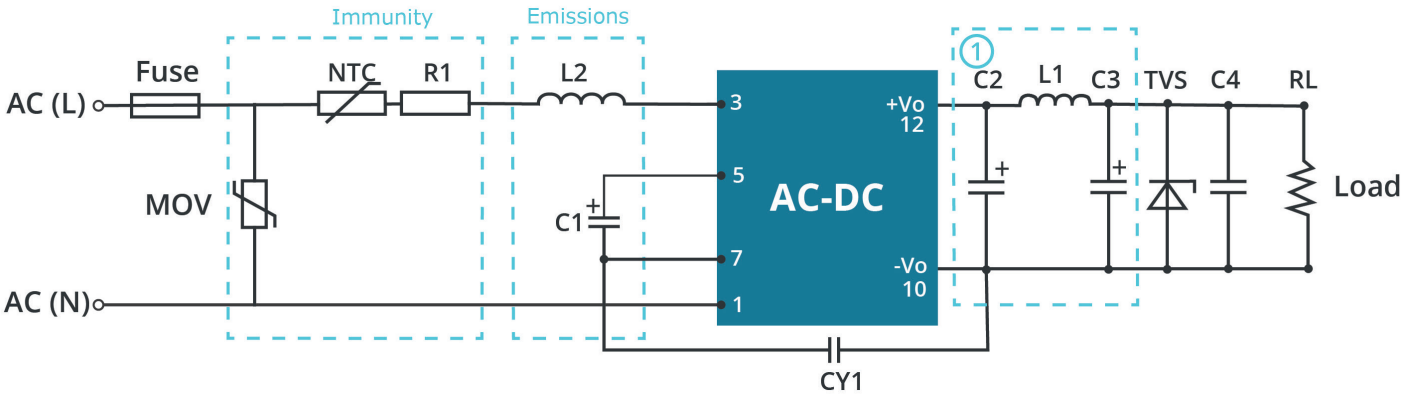


Table 2

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

Component	Recommended value
R1	12Ω/2W
L2	4.7mH
NTC	13D-5
MOV	S14K350
FUSE (required)	1A/300V, slow-blow

EMC RECOMMENDED CIRCUIT (CONTINUED)

Circuit 3

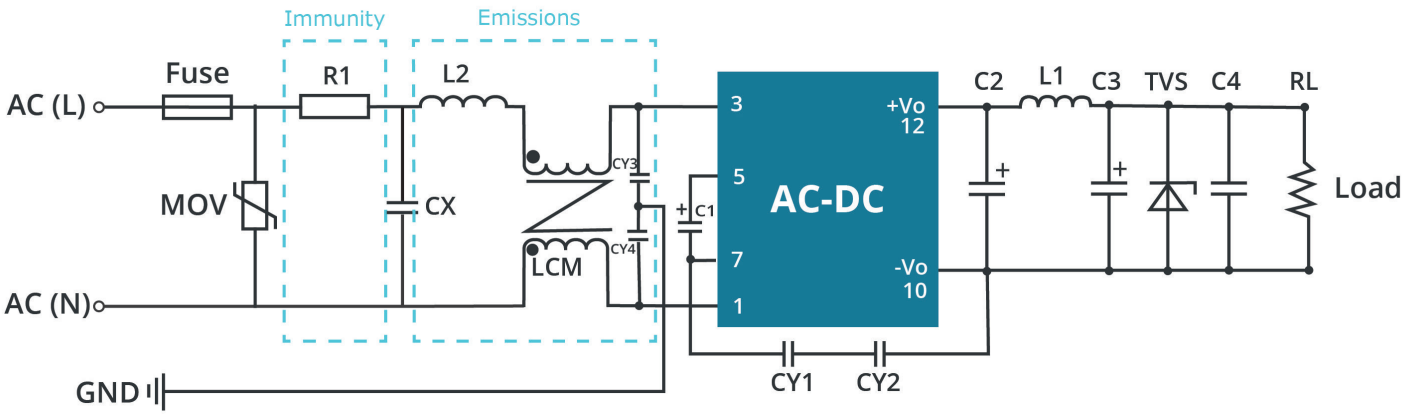


Table 3

Application enviromental	Ambient temperature range	Immunity Class	Emissions Class
Indoor civil / general	-40°C ~ 55°C	Class III	Class B

Component	Recommended value
R1	12Ω/3W
CY1 (CY2)	1.0nF/400Vac
LCM	3.5mH
LDM	0.33mH
CX	0.1μF/310Vac
CY3, CY4	0.56nF/400Vac
FUSE (required)	1A/300V, slow-blow

Note: In the home appliance application enviroment, the two Y capacitors of the primary and secondary need to be externally connected (CY1/CY2, value at 2.2nF/400Vac) which can meet the EN60335 certification. In other industries, only one Y capacitor is required.

EMC RECOMMENDED CIRCUIT (CONTINUED)

Circuit 4

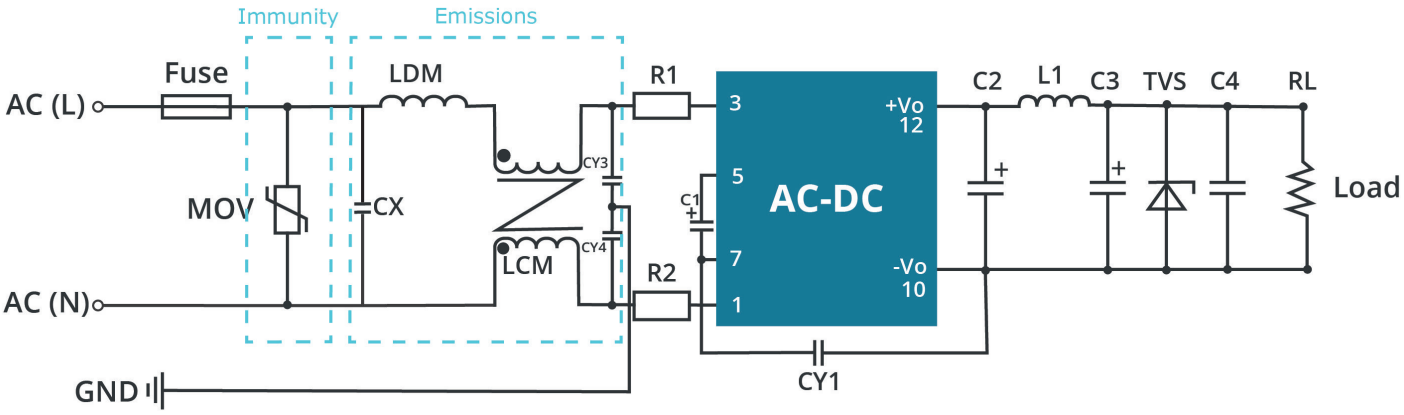


Table 4

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

Component	Recommended value
MOV	S14K350
C1	450V/22uF
CY1	2.2nF/400Vac
CX	0.1μF/310Vac
LCM	3.5mH
LDM	0.33mH
R1, R2	12Ω/2W
CY3, CY4	0.56nF/400Vac
FUSE (required)	2A/300V, slow-blow

EMC RECOMMENDED CIRCUIT (CONTINUED)

Circuit 5

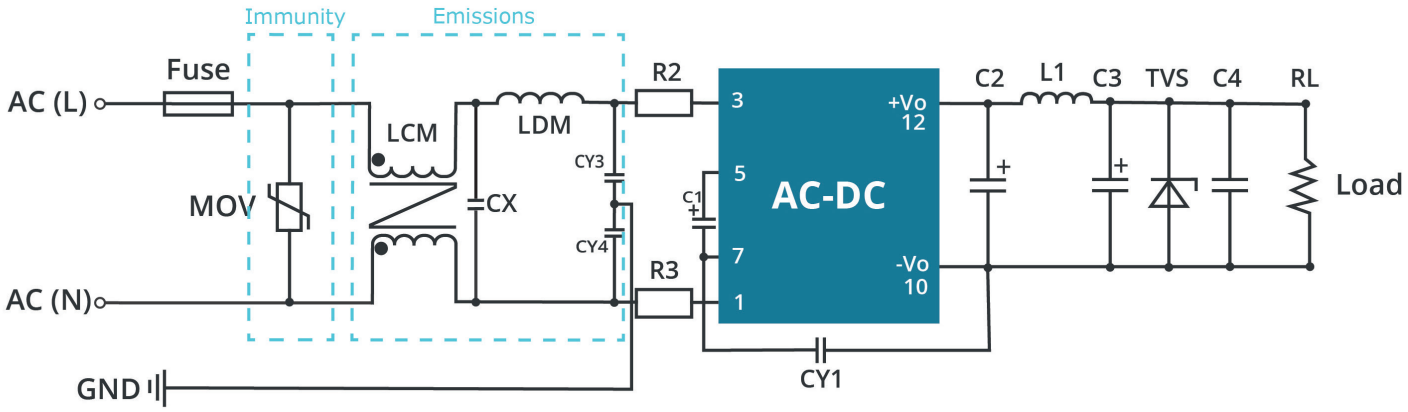


Table 5

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

Component	Recommended value
MOV	S14K350
C1	450V/22uF
CY1	2.2nF/400Vac
CY3/CY4	0.56μF/400Vac
CX	0.1μF/310Vac
LCM	3.5mH
LDM	0.33mH
R2/R3	12Ω/2W
FUSE (required)	2A/300V, slow-blow

EMC RECOMMENDED CIRCUIT (CONTINUED)

Circuit 6

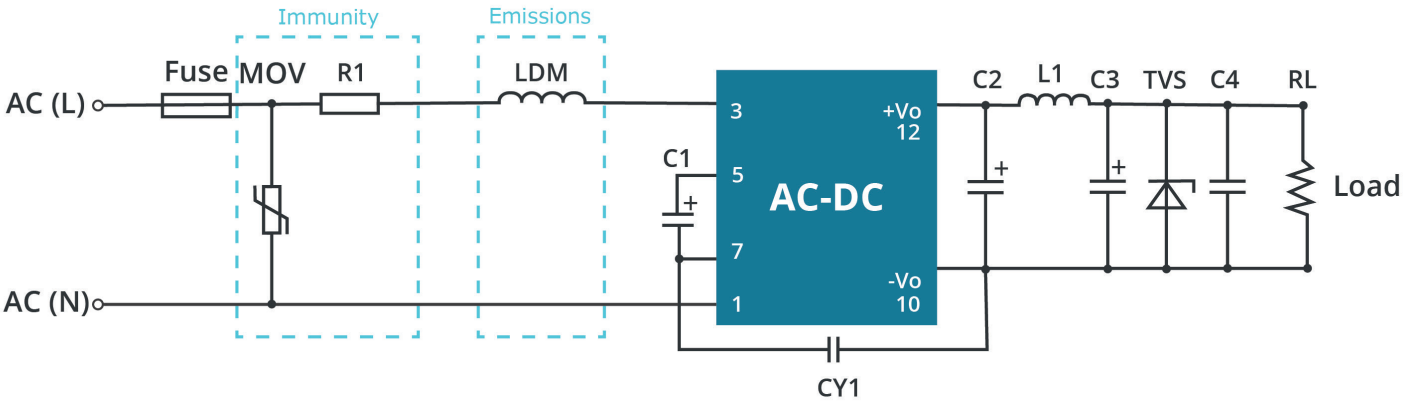


Table 6

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

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

REVISION HISTORY

rev.	description	date
1.0	initial release	12/08/2017
1.02	datasheet update, safety approvals updated to match 62368 certification, PCN-656-95022R-01	10/12/2020
1.03	clarified safety certifications	11/24/2020

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

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