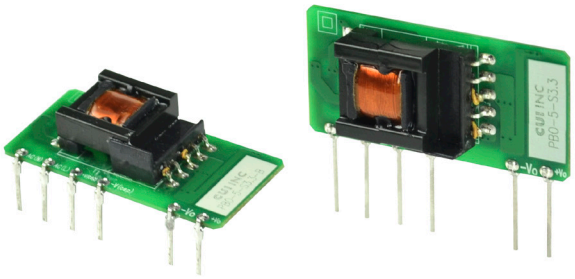
CUI INC®

SERIES: PBO-5 | **DESCRIPTION:** AC-DC POWER SUPPLY

FEATURES

- up to 5 W continuous power
- ultra-compact SIP package
- wide input voltage range
- over current and short circuit protections
- 4,000 Vac isolation
- UL 62368, CE safety approvals
- efficiency up to 79%



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-5-S3.3	3.3	0	1000	3.3	150	67
PBO-5-S5	5	0	1000	5	150	74
PBO-5-S9	9	0	560	5	150	75
PBO-5-S12	12	0	420	5	150	76
PBO-5-S15	15	0	340	5	150	77
PBO-5-S24	24	0	210	5	150	79

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

PBO-5 - S XX - X

- PBO-5: Base Number
- XX: Output Voltage
- X: Orientation: "blank" = vertical; B = right-angle

INPUT

parameter	conditions/description	min	typ	max	units
voltage		85 100		264 400	Vac Vdc
frequency		47		63	Hz
current	at 115 Vac at 230 Vac			0.2 0.1	A A
inrush current	at 115 Vac at 230 Vac		5 10		A A
leakage current	CY0 is 1 nF/400 Vac			0.25	mA
no load power consumption				0.5	W

OUTPUT

parameter	conditions/description	min	typ	max	units
capacitive load	3.3 Vdc output models 5 Vdc output models 9 Vdc output models 12 Vdc output models 15 Vdc output models 24 Vdc output models			2,200 1,500 680 470 330 100	µF µF µF µF µF µF
initial set point accuracy	3.3 Vdc output models all other models			±3 ±2	% %
line regulation	at full load		±0.5		%
load regulation	from 10~100% load			±1.5	%
hold-up time	at 115 Vac at 230 Vac		15 75		ms ms
switching frequency			100		kHz
temperature coefficient			±0.02		%/°C

PROTECTIONS

parameter	conditions/description	min	typ	max	units
over voltage protection	output voltage clamp 3.3 & 5 Vdc output models 9 Vdc output models 12 & 15 Vdc output models 24 Vdc output models			 7.5 15 20 30	 Vdc Vdc Vdc Vdc
over current protection	auto recovery	150			%
short circuit protection	continuous, auto recovery				

SAFETY & COMPLIANCE

parameter	conditions/description	min	typ	max	units
isolation voltage	input to output at 5 mA for 1 minute	4,000			Vac
safety approvals	UL 62368, EN 62368				
safety class	class II				
conducted emissions	CISPR32/EN55032 Class A, (external circuit required, see figure 1)				
	CISPR32/EN55032 Class B, (external circuit required, see figure 2)				
radiated emissions	CISPR32/EN55032 Class B, (external circuit required, see figure 1)				
ESD	IEC/EN61000-4-2 Class B, ±6 kV				
radiated immunity	IEC/EN61000-4-3 Class A, 10V/m				
EFT/burst	IEC/EN61000-4-4 Class B, ±2 kV (external circuit required, see figure 1)				
	IEC/EN61000-4-4 Class B, ±4 kV (external circuit required, see figure 2)				

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.

SAFETY & COMPLIANCE (CONTINUED)

parameter	conditions/description	min	typ	max	units
surge	IEC/EN61000-4-5 Class B, ±1 kV (external circuit required, see figure 1)				
	IEC/EN61000-4-5 Class B, ±1 kV/±2 kV				
conducted immunity	IEC/EN61000-4-6 Class A, 10 Vr.m.s (external circuit required, see figure 2)				
voltage dips & interruptions	IEC/EN61000-4-11 Class B, 0%-70%				
MTBF	as per MIL-HDBK-217F at 25 °C	300,000			hours
RoHS	2011/65/EU				

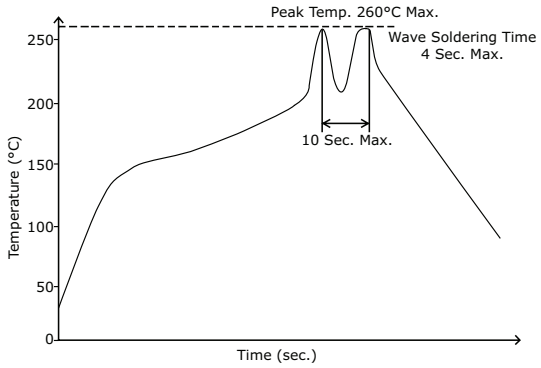
Notes: 1. The power supply is considered a component which will be installed into final equipment. The final equipment still must be tested to meet the necessary EMC directives.

ENVIRONMENTAL

parameter	conditions/description	min	typ	max	units
operating temperature	see derating curves	-25		85	°C
storage temperature		-40		105	°C
storage humidity	non-condensing			85	%

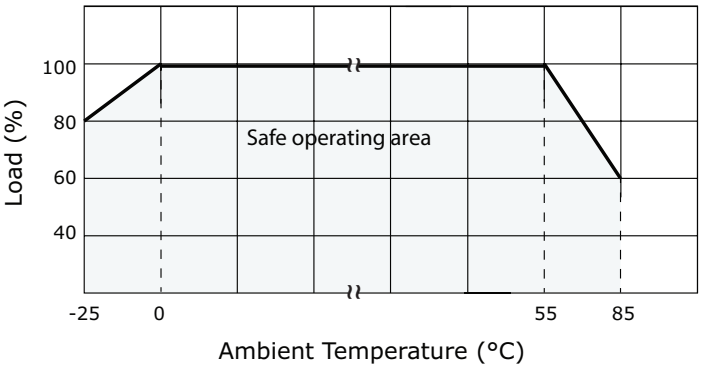
SOLDERABILITY

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

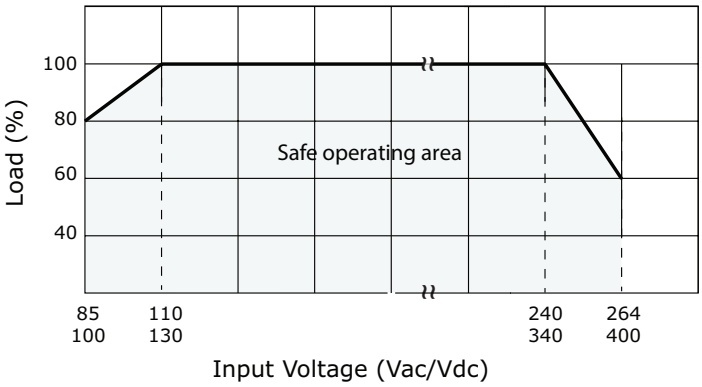


DERATING CURVES

load vs. ambient temperature
(at 85~264 Vac / 100~400 Vdc input voltage)

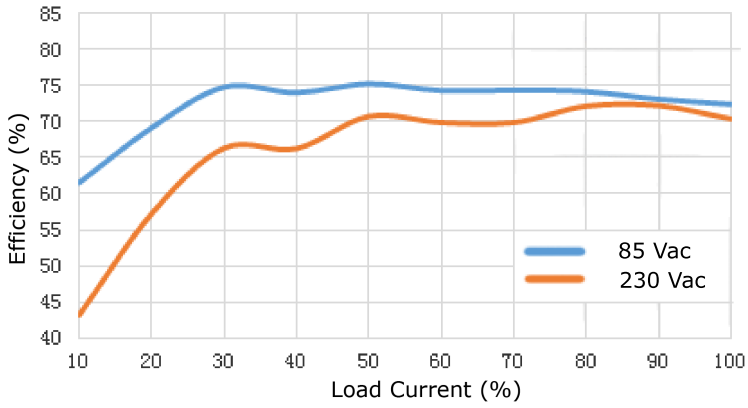


load vs. input voltage
(at 25°C)

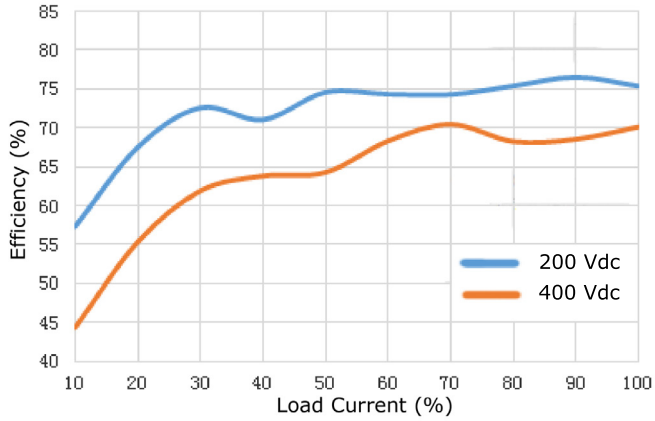


EFFICIENCY CURVES

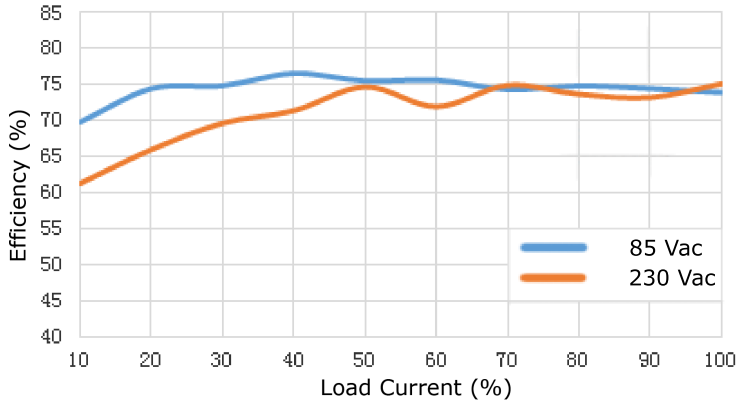
PBO-5-S3.3 AC Input Efficiency Curve
(Efficiency vs. Load Current)



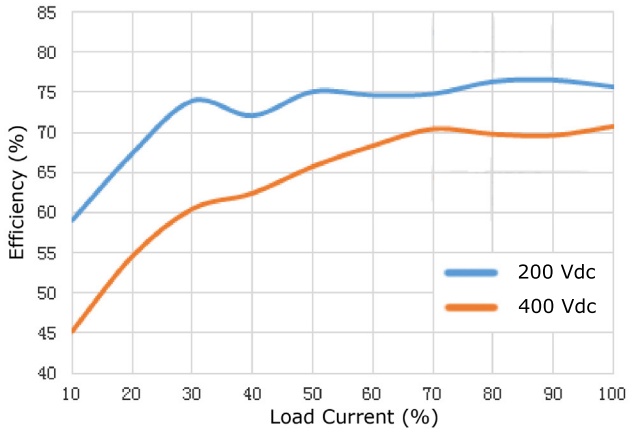
PBO-5-S3.3 DC Input Efficiency Curve
(Efficiency vs. Load Current)



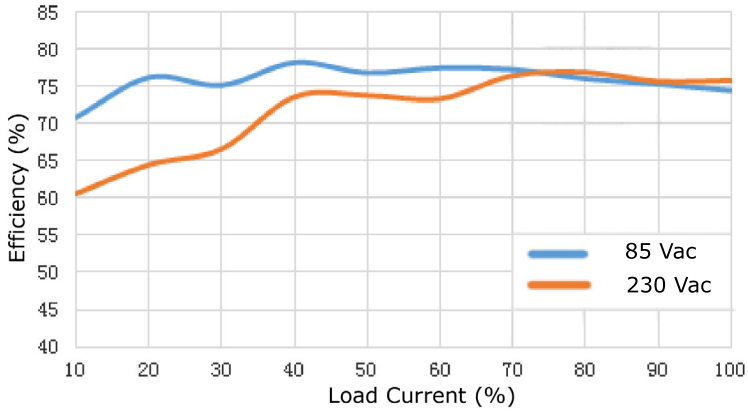
PBO-5-S5 AC Input Efficiency Curve
(Efficiency vs. Load Current)



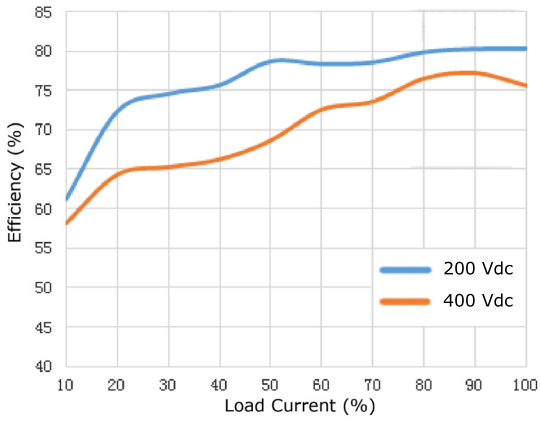
PBO-5-S5 DC Input Efficiency Curve
(Efficiency vs. Load Current)



PBO-5-S9 AC Input Efficiency Curve
(Efficiency vs. Load Current)

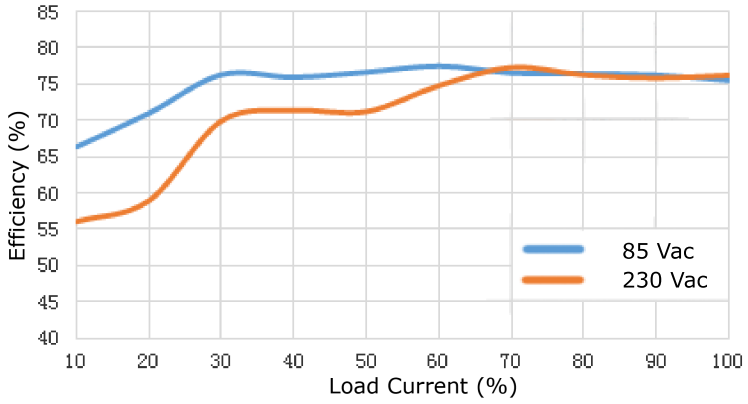


PBO-5-S9 DC Input Efficiency Curve
(Efficiency vs. Load Current)

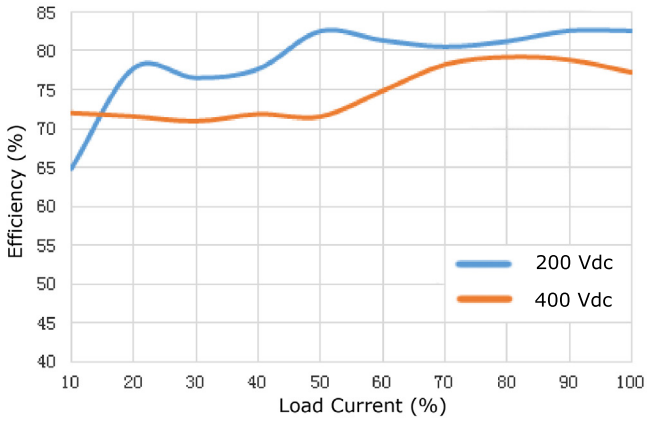


EFFICIENCY CURVES (CONTINUED)

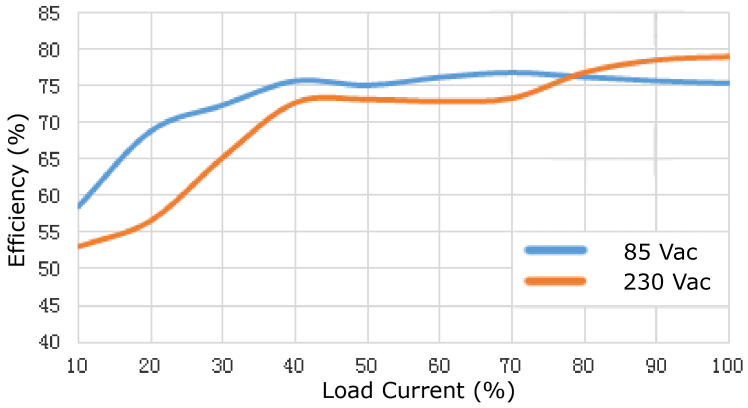
PBO-5-S12 AC Input Efficiency Curve
(Efficiency vs. Load Current)



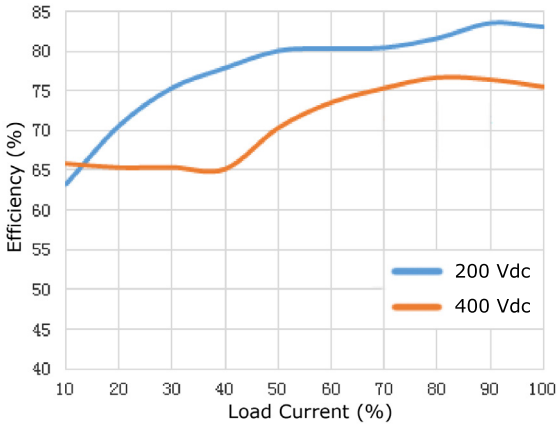
PBO-5-S12 DC Input Efficiency Curve
(Efficiency vs. Load Current)



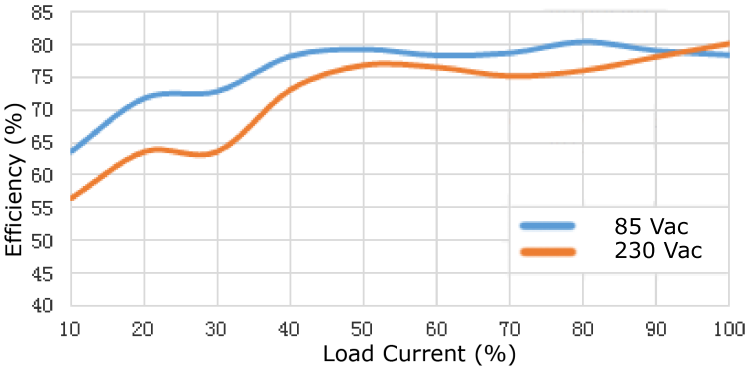
PBO-5-S15 AC Input Efficiency Curve
(Efficiency vs. Load Current)



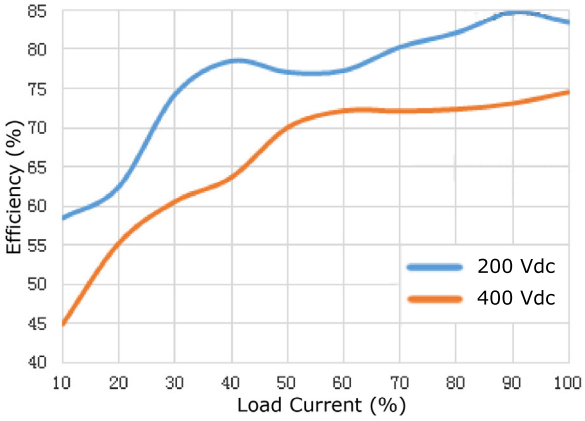
PBO-5-S15 DC Input Efficiency Curve
(Efficiency vs. Load Current)



PBO-5-S24 AC Input Efficiency Curve
(Efficiency vs. Load Current)



PBO-5-S24 DC Input Efficiency Curve
(Efficiency vs. Load Current)



MECHANICAL

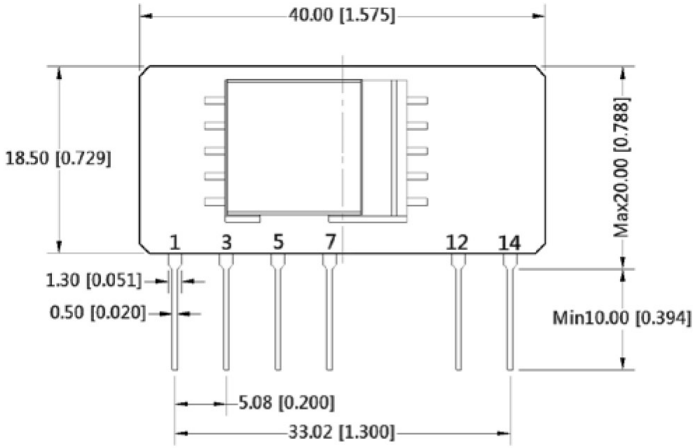
parameter	conditions/description	min	typ	max	units
dimensions	vertical models: 40.00 x 12.80 x 18.50 (1.575 x 0.504 x 0.729 inches) right-angle models: 40.00 x 20.00 x 12.80 (1.575 x 0.787 x 0.504 inches)				mm mm
weight			7		g

MECHANICAL DRAWING

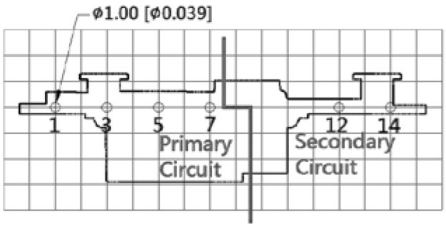
Vertical Orientation
units: mm[inch]
tolerance: ±0.50[±0.020]
pin section tolerance: ±0.10[±0.004]

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

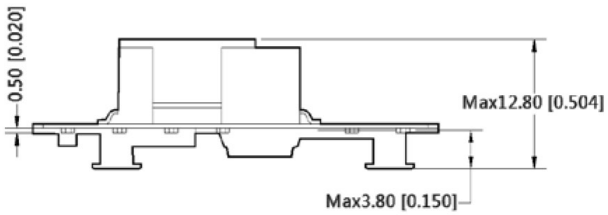
Note: 1. It is required to add C1 between pins 5 & 7 (see application circuits).



Front View



Note:Grid 2.54*2.54mm
Top View
PCB Layout



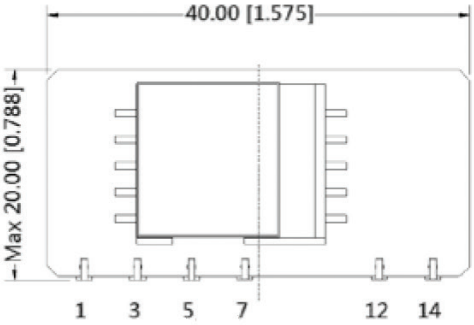
Bottom View

MECHANICAL DRAWING (CONTINUED)

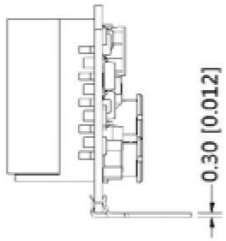
Right-angle Orientation
units: mm[inch]
tolerance: ±0.50[±0.020]
pin section tolerance: ±0.10[±0.004]

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

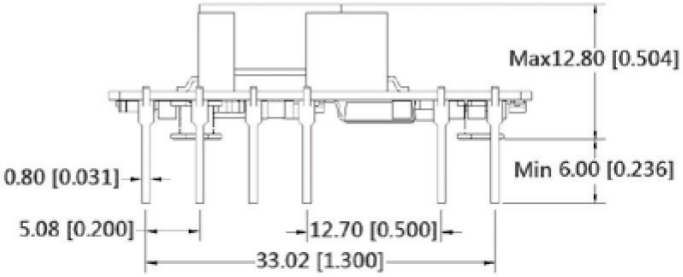
Note: 1. It is required to add C1 between pins 5 & 7 (see application circuits).



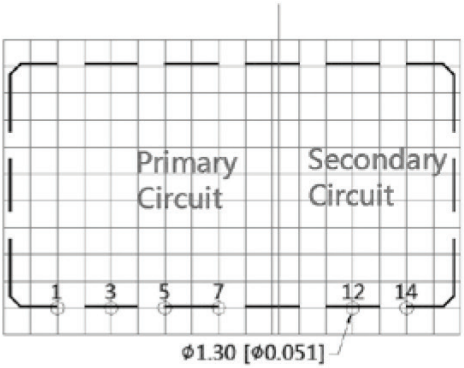
Top View



Right View



Front View



Top View
PCB Layout

APPLICATION CIRCUIT

Figure 1

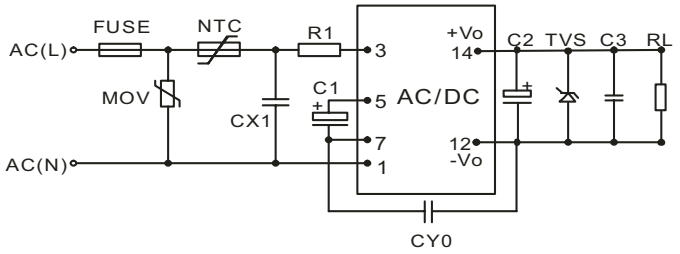


Table 1

Recommended External Circuit Components										
Vo (Vdc)	FUSE[1]	MOV	NTC	CX1	R1	C1[1]	CY0	C2[1]	TVS	C3
3.3	1A/250V	S14K350	13D-5	0.1µF/275Vac	12Ω/2W	10µF/400V	1nF/400Vac	220µF/35V	SMBJ7.0A	100nF/50V
5	1A/250V	S14K350	13D-5	0.1µF/275Vac	12Ω/2W	10µF/400V	1nF/400Vac	220µF/35V	SMBJ7.0A	100nF/50V
9	1A/250V	S14K350	13D-5	0.1µF/275Vac	12Ω/2W	10µF/400V	1nF/400Vac	220µF/35V	SMBJ12A	100nF/50V
12	1A/250V	S14K350	13D-5	0.1µF/275Vac	12Ω/2W	10µF/400V	1nF/400Vac	150µF/35V	SMBJ20A	100nF/50V
15	1A/250V	S14K350	13D-5	0.1µF/275Vac	12Ω/2W	10µF/400V	1nF/400Vac	150µF/35V	SMBJ20A	100nF/50V
24	1A/250V	S14K350	13D-5	0.1µF/275Vac	12Ω/2W	10µF/400V	1nF/400Vac	100µF/35V	SMBJ30A	100nF/50V

Note: 1. Required components.

EMC RECOMMENDED CIRCUIT

Figure 2

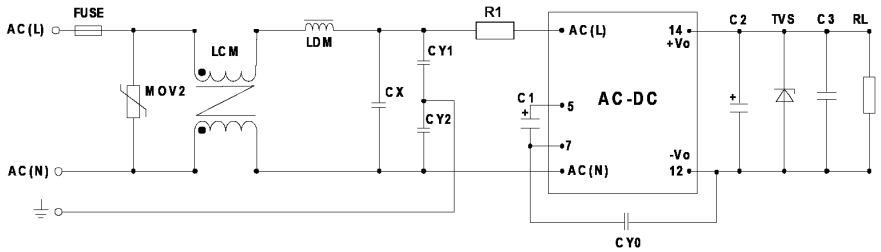


Table 2

Recommended External Circuit Components	
FUSE	1A/250V, slow fusing
MOV2	S14K320
LCM	3.5mH
LDM	330µH
CX	0.1µF/275 Vac
CY1, CY2	1nF/400 Vac
R1	12Ω/2W
C1	10µF/400V
CY0	1nF/400Vac

Note: Also refer to Table 1.

Notes:
1. C1 is required for both AC and DC inputs. For input voltages greater than 370 Vdc, the recommended value is 10 µF / 450 V.
2. C2 is recommended to be a high frequency and low impedance capacitor. For capacitance and rated ripple current of capacitors, refer to the datasheets provided by the manufacturers. Voltage derating of capacitors should be 80% or above.
3. C3 is a ceramic capacitor used to filter high frequency noise.
4. TVS is a recommended component to protect post-circuits (if converter fails).
5. It is required to have a distance ≥6.4 mm for safety between external components in primary and secondary circuit.

REVISION HISTORY

rev.	description	date
1.0	initial release	10/18/2016
1.01	added right-angle pin versions, updated to 62368 safety approvals, reduced component height to 12.80 mm max	04/19/2018

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.