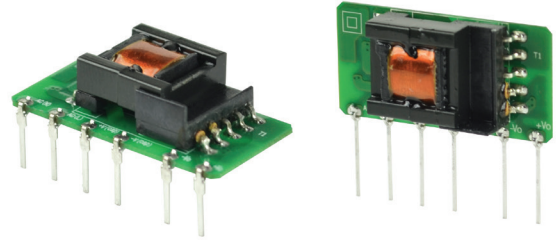


SERIES: PBO-3 | **DESCRIPTION:** AC-DC POWER SUPPLY

FEATURES

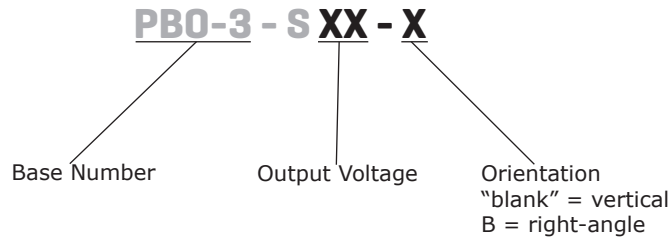
- up to 3 W continuous power
- ultra-compact SIP package
- available in straight-pin and bent-pin configurations
- wide input voltage range
- over current and short circuit protections
- 3,000 Vac isolation
- UL 60950-1, CE safety approvals
- efficiency up to 80%



MODEL	output voltage (Vdc)	output current		output power max (W)	ripple and noise ¹ max (mVp-p)	efficiency ² typ (%)
		min (mA)	max (mA)			
PBO-3-S3.3	3.3	50	500	1.65	150	63
PBO-3-S5	5	50	500	2.5	150	68
PBO-3-S9	9	33.3	333	3	150	75
PBO-3-S12	12	25	250	3	150	77
PBO-3-S15	15	20	200	3	150	78
PBO-3-S24	24	12.5	125	3	150	80

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 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		264	Vac
		70		400	Vdc
frequency		47		440	Hz
current	at 115 Vac			0.12	A
	at 230 Vac			0.06	A
inrush current	at 115 Vac		13		A
	at 230 Vac		23		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, 5 Vdc output models			470	μ F
	9 Vdc output models			150	μ F
	all other models			100	μ F
initial set point accuracy	3.3 Vdc output models			± 8	%
	all other models			± 5	%
line regulation	at full load		± 1.5		%
load regulation	from 10~100% load		± 2.5		%
hold-up time	at 115 Vac		20		ms
	at 230 Vac		80		ms
switching frequency				60	kHz
temperature coefficient			± 0.15		%/ $^{\circ}$ C

PROTECTIONS

parameter	conditions/description	min	typ	max	units
over current protection	auto recovery	110			%
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	UL 60950-1, EN 60950-1				
safety class	class II				
conducted emissions	CISPR22/EN55022 Class A, (external circuit required, see figure 1)				
	CISPR22/EN55022 Class B, (external circuit required, see figure 2)				
radiated emissions	CISPR22/EN55022 Class A, (external circuit required, see figure 1)				
	CISPR22/EN55022 Class B, (external circuit required, see figure 2)				
ESD	IEC/EN61000-4-2 Class B, ± 4 kV				
radiated immunity	IEC/EN61000-4-3 Class A, 10V/m (external circuit required, see figure 2)				
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)				
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 (external circuit required, see figure 2)				
conducted immunity	IEC/EN61000-4-6 Class A, 10 Vr.m.s (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
PFM	IEC/EN61000-4-8 Class A, 10 A/m (external circuit required, see figure 2)				
voltage dips & interruptions	IEC/EN61000-4-11 Class B, 0%-70% (external circuit required, see figure 2)				
MTBF	as per MIL-HDBK-217F at 25 °C	300,000			hours
RoHS	2011/65/EU				

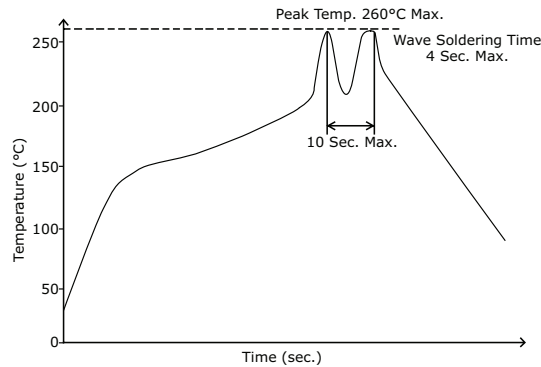
Notes: 1. The power supply is considered a component which will be installed into final equipment. The final equipment still must be tested to meet the necessary EMC directives.

ENVIRONMENTAL

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

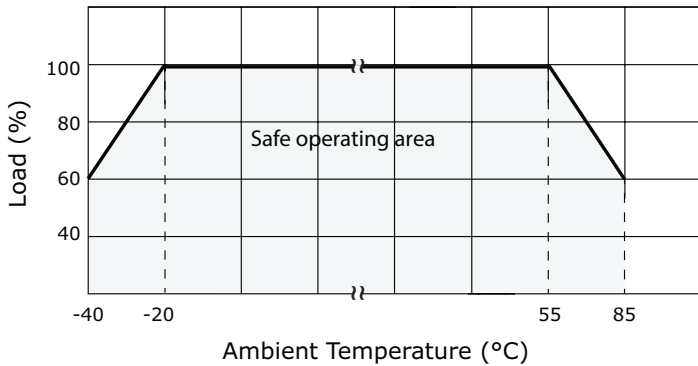
SOLDERABILITY

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

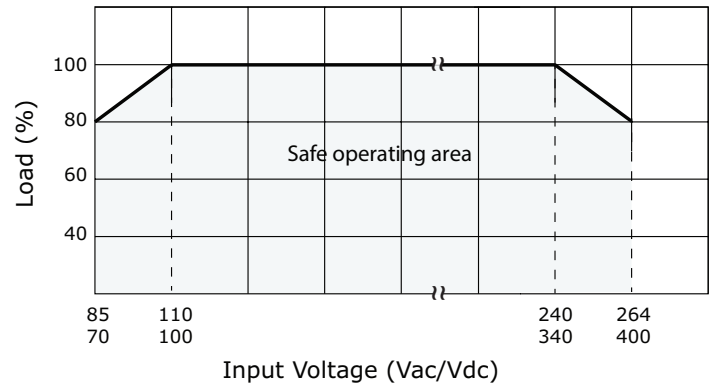


DERATING CURVES

load vs. ambient temperature
(at 110~240 Vac / 100~340 Vdc input voltage)

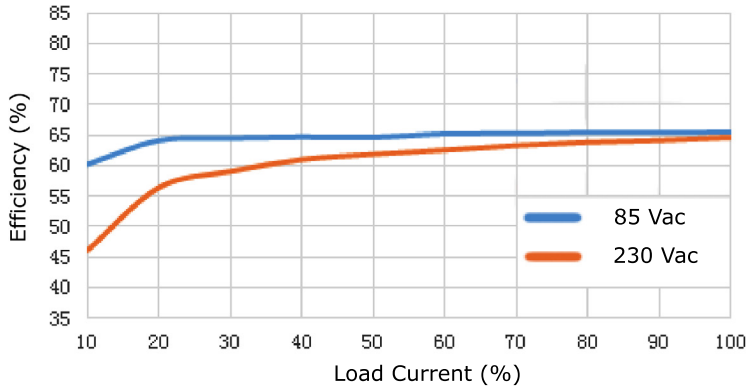


load vs. input voltage
(at 25°C)

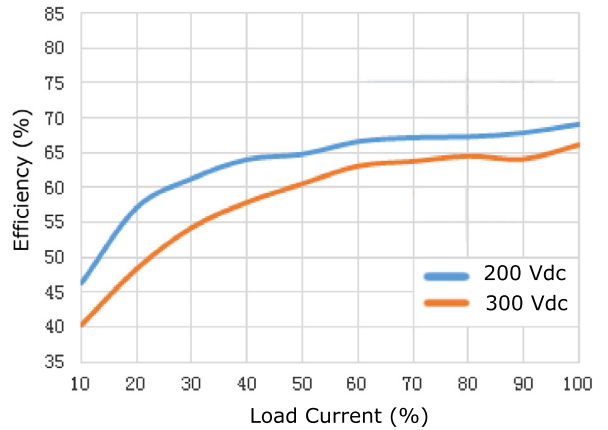


EFFICIENCY CURVES

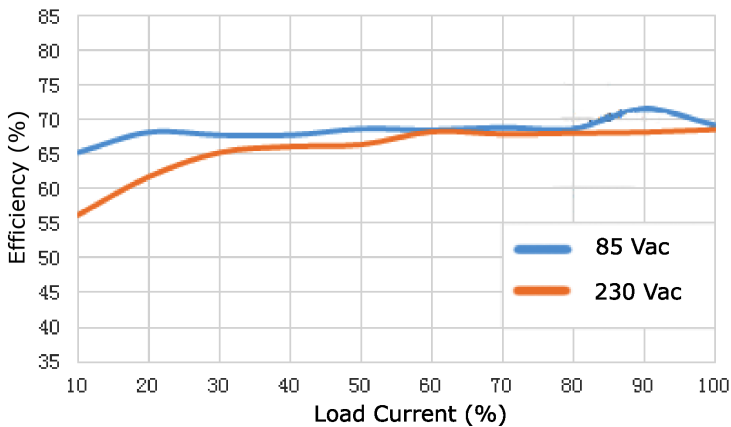
PBO-3-S3.3 AC Input Efficiency Curve
(Efficiency vs. Load Current)



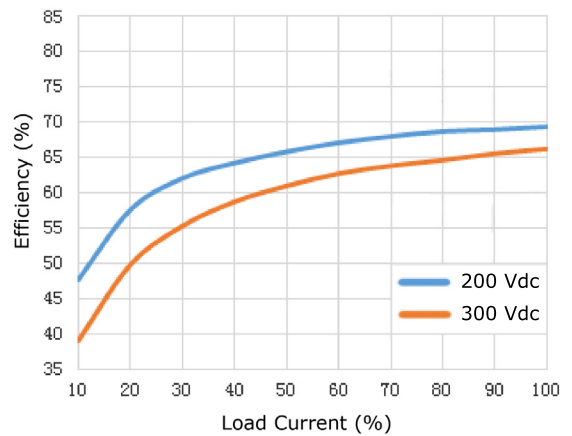
PBO-3-S3.3 DC Input Efficiency Curve
(Efficiency vs. Load Current)



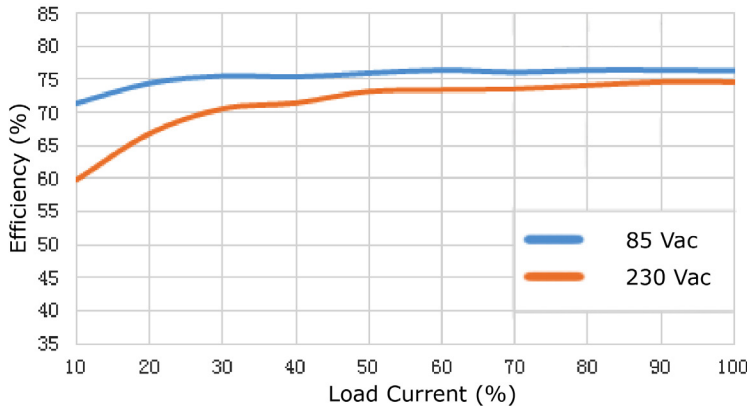
PBO-3-S5 AC Input Efficiency Curve
(Efficiency vs. Load Current)



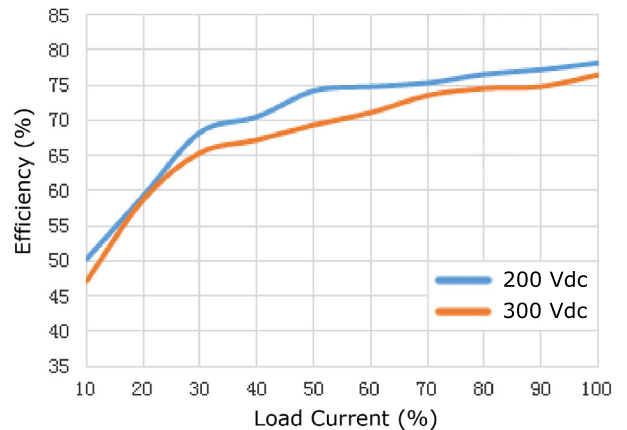
PBO-3-S5 DC Input Efficiency Curve
(Efficiency vs. Load Current)



PBO-3-S9 AC Input Efficiency Curve
(Efficiency vs. Load Current)

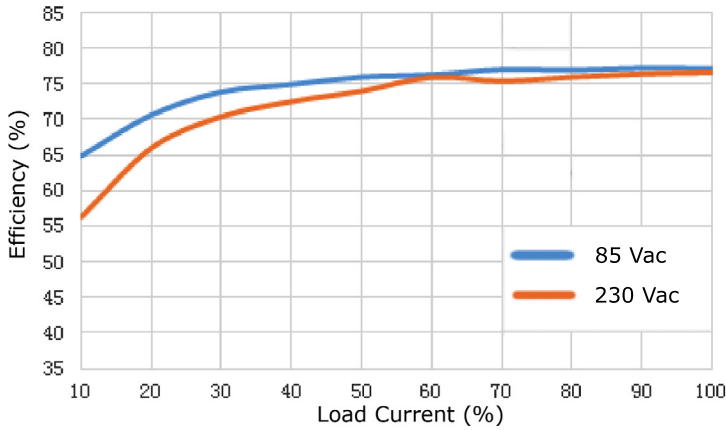


PBO-3-S9 DC Input Efficiency Curve
(Efficiency vs. Load Current)

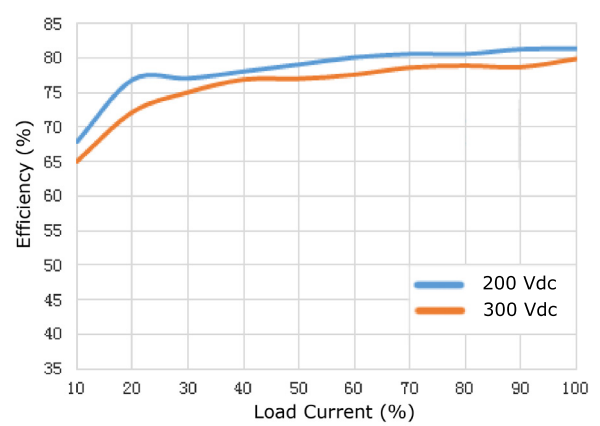


EFFICIENCY CURVES (CONTINUED)

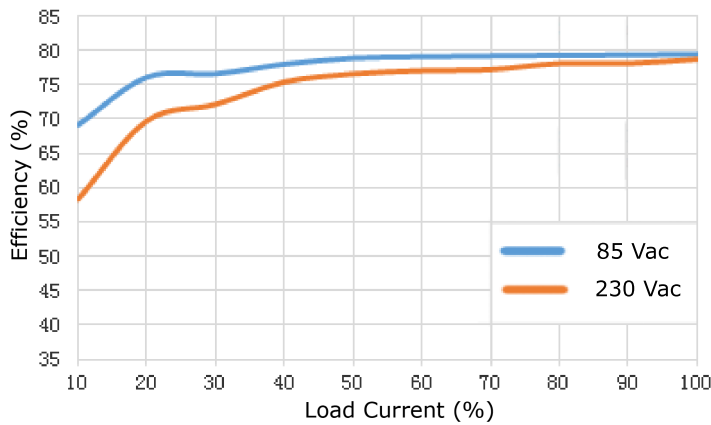
PBO-3-S12 AC Input Efficiency Curve
(Efficiency vs. Load Current)



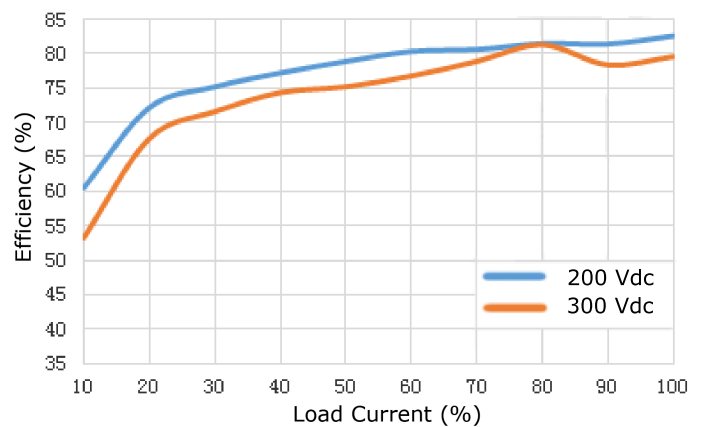
PBO-3-S12 DC Input Efficiency Curve
(Efficiency vs. Load Current)



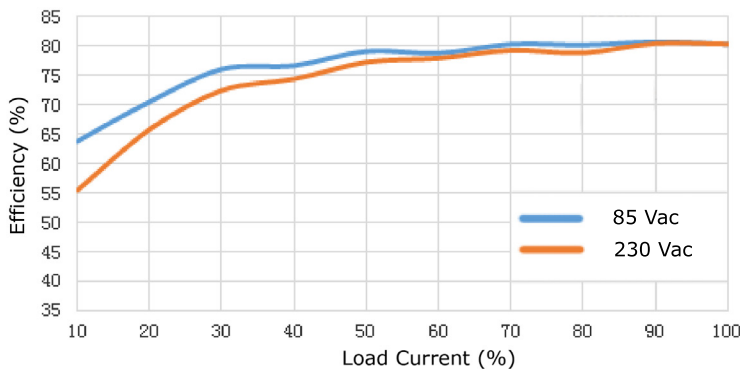
PBO-3-S15 AC Input Efficiency Curve
(Efficiency vs. Load Current)



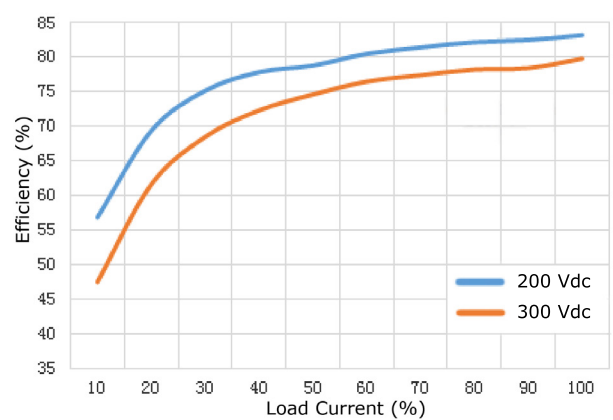
PBO-3-S15 DC Input Efficiency Curve
(Efficiency vs. Load Current)



PBO-3-S24 AC Input Efficiency Curve
(Efficiency vs. Load Current)



PBO-3-S24 DC Input Efficiency Curve
(Efficiency vs. Load Current)



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

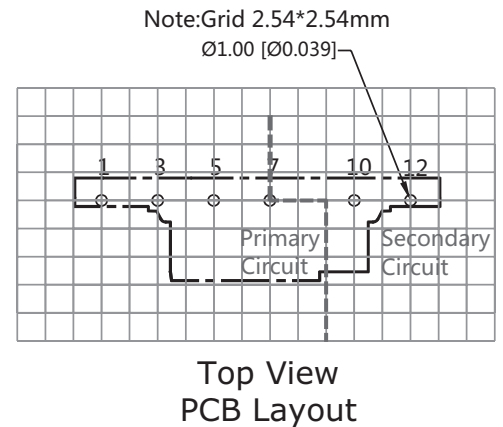
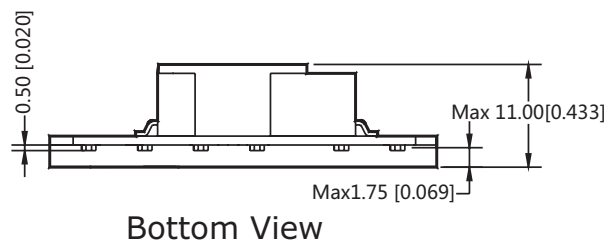
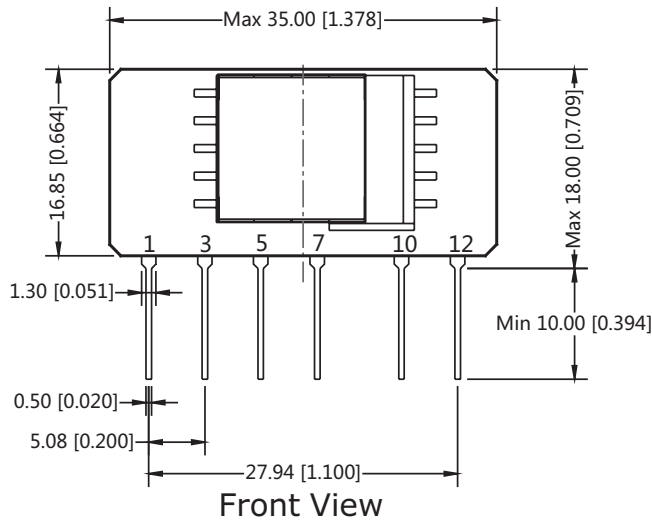
units: mm[inch]

tolerance: $\pm 0.50[\pm 0.020]$

pin section tolerance: $\pm 0.10[\pm 0.004]$

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).



Top View
PCB Layout

MECHANICAL DRAWING (CONTINUED)

Right-angle Orientation

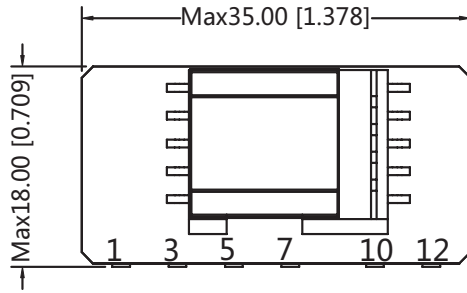
units: mm[inch]

tolerance: ± 0.50 [± 0.020]

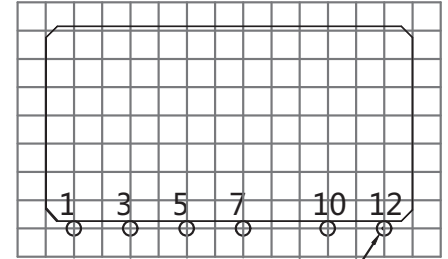
pin section tolerance: ± 0.10 [± 0.004]

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).

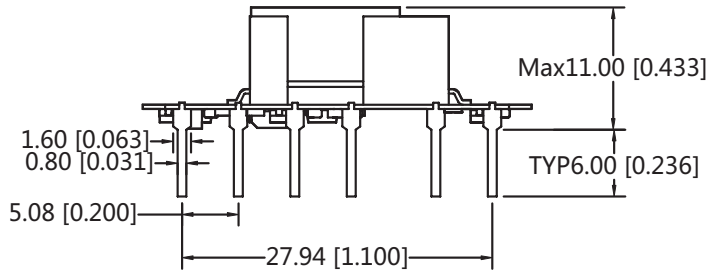


Top View

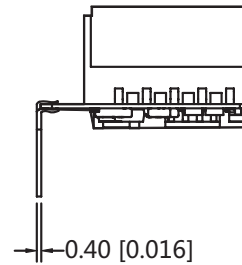


$\varnothing 1.30$ [$\varnothing 0.051$]
Note: Grid 2.54*2.54mm

Top View
PCB Layout



Front View



Right View

APPLICATION CIRCUIT

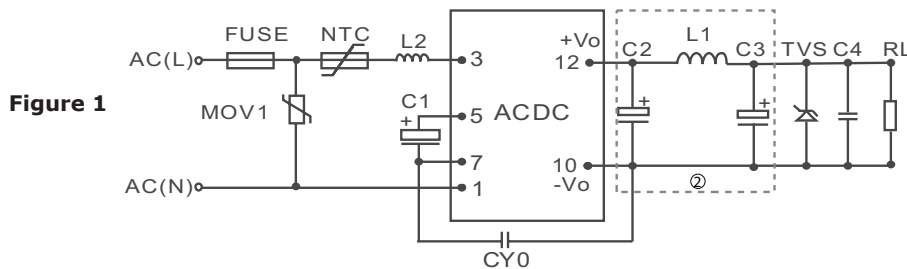


Figure 1

Table 1

Recommended External Circuit Components											
Vo (Vdc)	FUSE ¹	MOV1	NTC	L2	C1 ¹	CY0	C2 ¹	L1 ¹	C3 ¹	TVS	C4
3.3	1A/250V	S14K320	13D-5	4.7mH	10μF/400V	1nF/400Vac	330μF/25V	2.2μH	120μF/25V	SMBJ7.0A	0.1μF/50V
5	1A/250V	S14K320	13D-5	4.7mH	10μF/400V	1nF/400Vac	330μF/25V	2.2μH	68μF/35V	SMBJ7.0A	0.1μF/50V
9	1A/250V	S14K320	13D-5	4.7mH	10μF/400V	1nF/400Vac	330μF/25V	2.2μH	68μF/35V	SMBJ12A	0.1μF/50V
12	1A/250V	S14K320	13D-5	4.7mH	10μF/400V	1nF/400Vac	150μF/35V	2.2μH	68μF/35V	SMBJ20A	0.1μF/50V
15	1A/250V	S14K320	13D-5	4.7mH	10μF/400V	1nF/400Vac	150μF/35V	2.2μH	68μF/35V	SMBJ20A	0.1μF/50V
24	1A/250V	S14K320	13D-5	4.7mH	10μF/400V	1nF/400Vac	100μF/35V	2.2μH	68μF/35V	SMBJ30A	0.1μF/50V

Note: 1. Required components.
2. C2, C3, & L1 form pi-type filter circuit.

EMC RECOMMENDED CIRCUIT

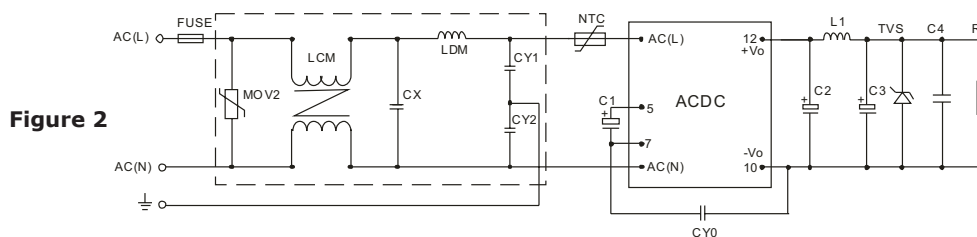


Figure 2

Table 2

Recommended External Circuit Components	
FUSE	1A/250V, slow fusing
MOV2	S14K320
LCM	3.5mH
CX	0.1μF/275 Vac
LDM	0.33mH
CY1, CY2	1nF/400 Vac
NTC	13D-5
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. It is required to add pi-type filter circuit (C2, C3, & L1) to the output. The capacitors are recommended to be high frequency and low impedance electrolytic capacitors. 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. When operating in the -40~20°C and 55~85°C temperature ranges, the 3.3 and 5 Vdc output models should use a 270 μF / 16 V solid-state capacitor for C2.
4. C4 is a ceramic capacitor used to filter high frequency noise.
5. For current of L1 & L2 refer to the datasheets provided by the manufacturers. Current derating should be 80% or above.
6. TVS is a recommended component to protect post-circuits (if converter fails).
7. It is required to have a distance ≥6.4 mm for safety between external components in primary and secondary circuit.
8. It is recommended to add an insulation sheet between the bottom of the right-angle versions and the PCB when mounting.

REVISION HISTORY

rev.	description	date
1.0	initial release	10/18/2016

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



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