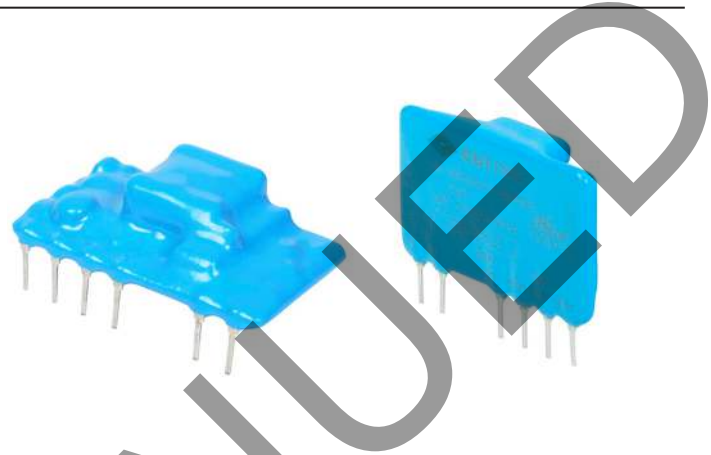


**SERIES:** PBK-5 | **DESCRIPTION:** AC-DC POWER SUPPLY

**FEATURES**

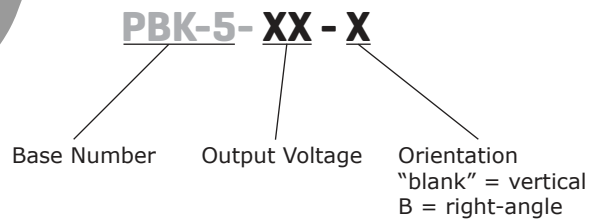
- up to 5 W continuous output
- ultra compact SIP package
- universal input voltage: (85~264 Vac / 100~400 Vdc)
- single regulated outputs from 3.3~24 Vdc
- 3,000 Vac isolation
- over current, short circuit, and over voltage protections
- UL 60950-1 safety approval
- efficiency up to 75%



MODEL	output voltage	output current max	output power max	ripple and noise <sup>1</sup> max	efficiency typ
	(Vdc)	(A)	(W)	(mVp-p)	(%)
PBK-5-3	3.3	1	3.3	150	65
PBK-5-5	5	1	5	120	70
PBK-5-9	9	0.56	5	120	72
PBK-5-12	12	0.42	5	120	74
PBK-5-15	15	0.34	5	120	75
PBK-5-24	24	0.21	5	150	75

Note: 1. Measured at 20 MHz bandwidth, see Test Configuration section.

**PART NUMBER KEY**



**INPUT**

parameter	conditions/description	min	typ	max	units
voltage		85		264	Vac
		100		400	Vdc
frequency		47		440	Hz
current	at 115 Vac			200	mA
	at 230 Vac			100	mA
inrush current	at 115 Vac		20		A
	at 230 Vac		30		A
leakage current	CY0 is 1nF/400Vac			0.25	mA
no load power consumption				0.5	W
input fuse	1 A/250 V, slow-blow type (external, recommended)				

**OUTPUT**

parameter	conditions/description	min	typ	max	units
output current		10			%
capacitive load	3.3 Vdc output models			2200	$\mu$ F
	5 Vdc output models			1500	$\mu$ F
	9 Vdc output models			680	$\mu$ F
	12 Vdc output models			470	$\mu$ F
	15 Vdc output models			330	$\mu$ F
	24 Vdc output models			100	$\mu$ F
line regulation	at full load		$\pm 0.1$	$\pm 0.5$	%
load regulation	at 10%~100% load		$\pm 1.0$	$\pm 1.5$	%
voltage set accuracy	PBK-5-3		$\pm 2$	$\pm 3$	%
	all other models		$\pm 1$	$\pm 2$	%
hold-up time	at 115 Vac	20			ms
	at 230 Vac	80			ms
switching frequency			100		kHz
temperature coefficient			$\pm 0.02$		%/°C

**PROTECTIONS**

parameter	conditions/description	min	typ	max	units
short circuit protection	continuous, auto restart				
over current protection	auto restart	110			%
over voltage protection	zener diode clamp				

**SAFETY & COMPLIANCE**

parameter	conditions/description	min	typ	max	units
isolation voltage	input to output for 1 minute at 5mA	3,000			Vac
isolation resistance		100			M $\Omega$
safety approvals	UL 60950-1				
safety standards	UL 60950-1				
safety class	class II				
conducted emissions	CISPR22/EN55022 external circuit required, Class A (see figure 2); Class B (see figure 3)				
radiated emissions	CISPR22/EN55022 external circuit required, Class B (see figures 2 or 3)				
ESD	IEC/EN61000-4-2 Class B, contact $\pm 4$ kV				
radiated immunity	IEC/EN61000-4-3 Class A, 10V/m				
EFT/burst	IEC/EN61000-4-4 Class B, $\pm 2$ kV (external circuit required, see figure 2)				
	IEC/EN61000-4-4 Class B, $\pm 4$ kV (external circuit required, see figure 3)				

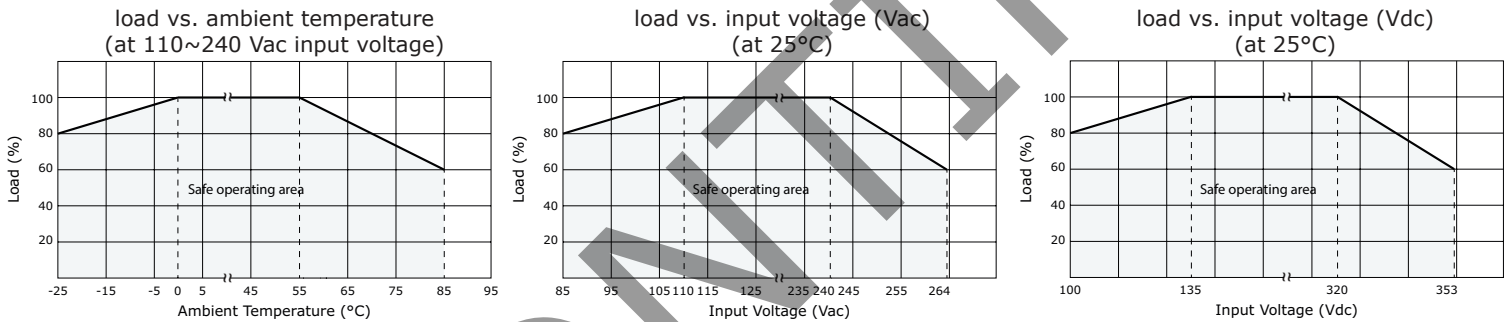
## SAFETY & COMPLIANCE (CONTINUED)

parameter	conditions/description	min	typ	max	units
surge	IEC/EN61000-4-5 Class B, ±1 kV/±2 kV (external circuit required, see figure 3)				
conducted immunity	IEC/EN61000-4-6 Class A, 3 Vr.m.s (external circuit required, see figure 3)				
PFM	IEC/EN61000-4-8 Class A, 10 A/m				
voltage dips & interruptions	IEC/EN61000-4-11 Class B, 0%-70%				
MTBF	at 25°C, max. load	300,000			hours
RoHS	2011/65/EU				

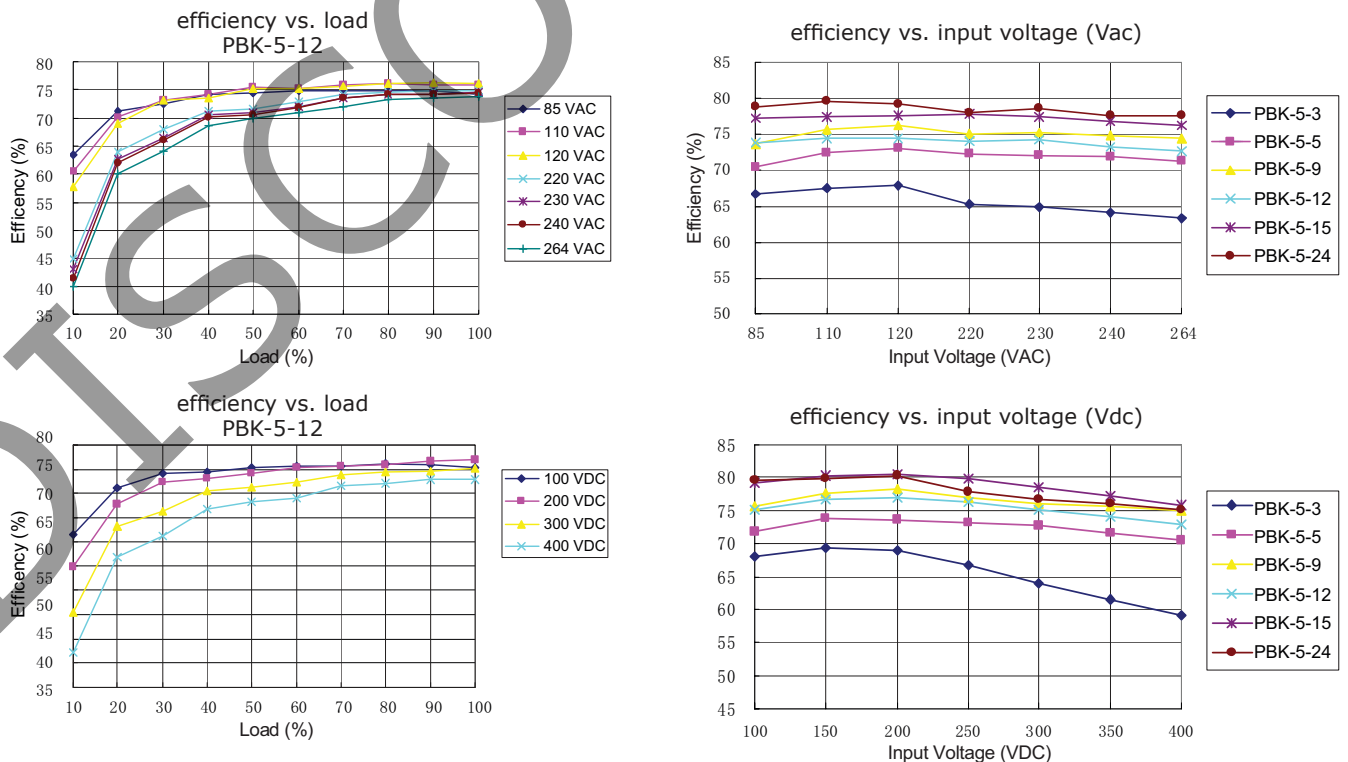
## ENVIRONMENTAL

parameter	conditions/description	min	typ	max	units
operating temperature	see derating curves	-25		85	°C
storage temperature		-40		105	°C
case temperature				100	°C
humidity	non-condensing			85	%

## DERATING CURVES



## EFFICIENCY CURVES



## 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

## MECHANICAL

parameter	conditions/description	min	typ	max	units
dimensions	vertical models: 42 x 11 x 27 right-angle models: 42 x 25 x 13				mm mm
material	UL94V-0				
weight			10		g

## MECHANICAL DRAWING

### VERTICAL ORIENTATION

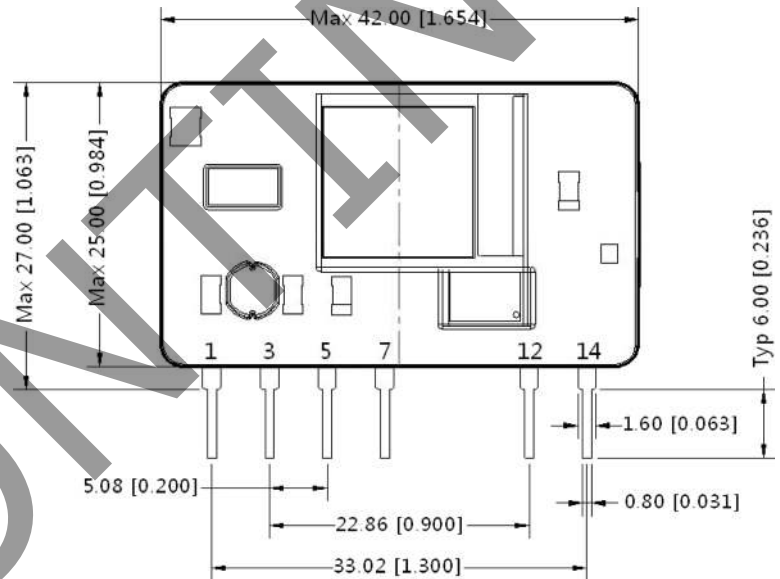
units: mm[inch]

tolerance: ±0.5[±0.020]

pin tolerance: ±0.1[±0.004]

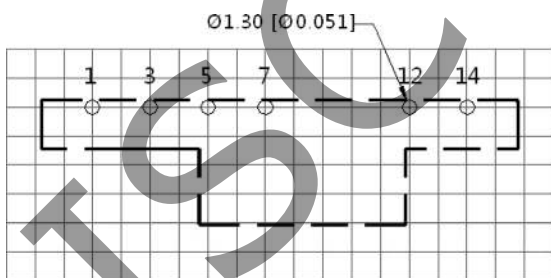
PIN CONNECTIONS	
PIN	FUNCTION
1	-Vin (N)
3	+Vin (L)
5	+V(CAP)
7	-V(CAP)
12	-Vo
14	+Vo

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

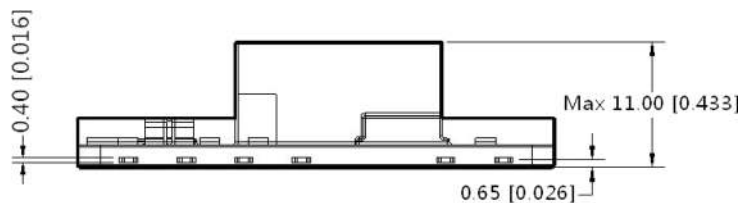


Front View

Note: Grid 2.54\*2.54mm



Top View  
PCB Layout



Bottom View

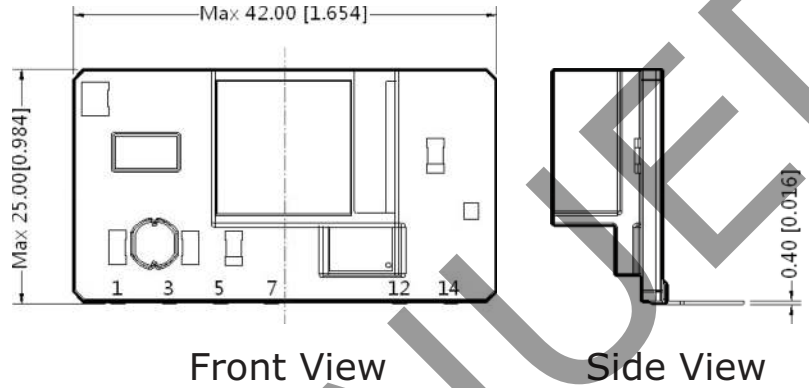
## MECHANICAL DRAWING (CONTINUED)

### RIGHT-ANGLE ORIENTATION

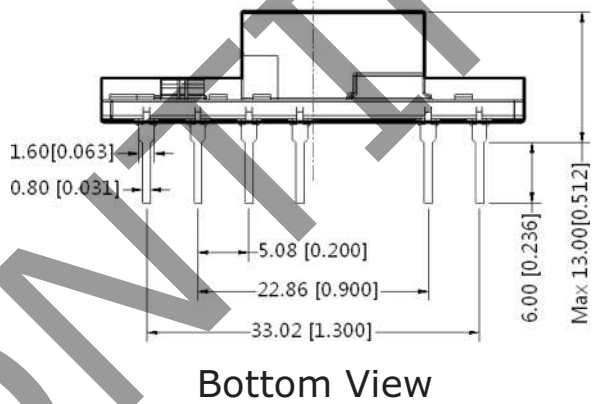
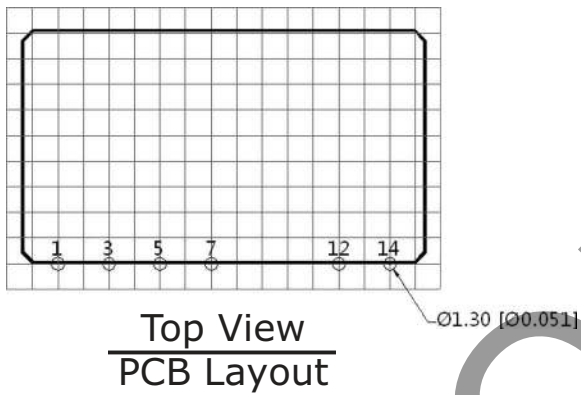
units: mm[inch]  
 tolerance:  $\pm 0.5[\pm 0.020]$   
 pin tolerance:  $\pm 0.1[\pm 0.004]$

PIN CONNECTIONS	
PIN	FUNCTION
1	-Vin (N)
3	+Vin (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).



Note: Grid 2.54\*2.54mm



## TEST CONFIGURATION

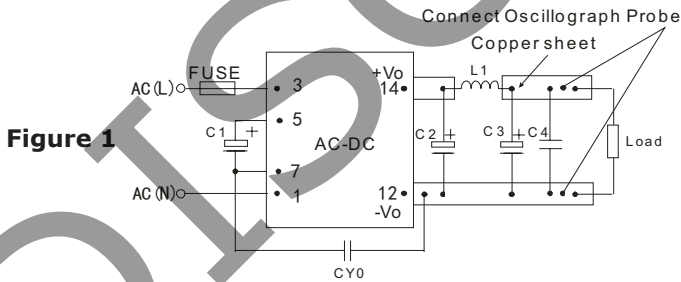
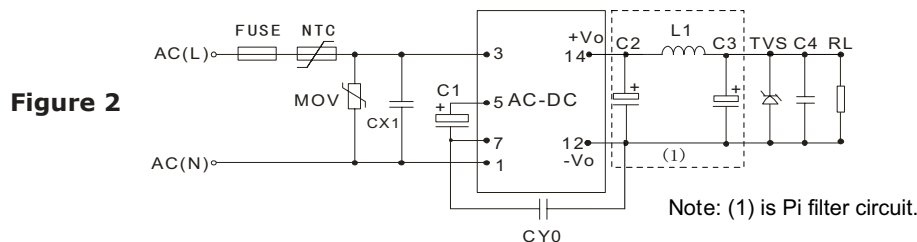


Table 1

$V_{OUT}$ (Vdc)	Recommended External Circuit Components					
	C1 <sup>1</sup>	C2 <sup>1</sup>	L1 <sup>1</sup>	C3 <sup>1</sup>	C4	CY0 (Y1 capacitor)
3.3	22 $\mu$ F/400V	470 $\mu$ F/10V	0.47 $\mu$ H	150 $\mu$ F/35V	100nF/50V	1nF/400Vac
5	22 $\mu$ F/400V	470 $\mu$ F/16V	0.47 $\mu$ H	150 $\mu$ F/35V	100nF/50V	1nF/400Vac
9	22 $\mu$ F/400V	330 $\mu$ F/25V	1 $\mu$ H	150 $\mu$ F/35V	100nF/50V	1nF/400Vac
12	22 $\mu$ F/400V	330 $\mu$ F/25V	1 $\mu$ H	150 $\mu$ F/35V	100nF/50V	1nF/400Vac
15	22 $\mu$ F/400V	330 $\mu$ F/25V	1 $\mu$ H	150 $\mu$ F/35V	100nF/50V	1nF/400Vac
24	22 $\mu$ F/400V	100 $\mu$ F/35V	4.7 $\mu$ H	47 $\mu$ F/35V	100nF/50V	1nF/400Vac

Note: 1. Required components.  
 2. 1 A/250 V fuse required.

## TYPICAL APPLICATION CIRCUIT

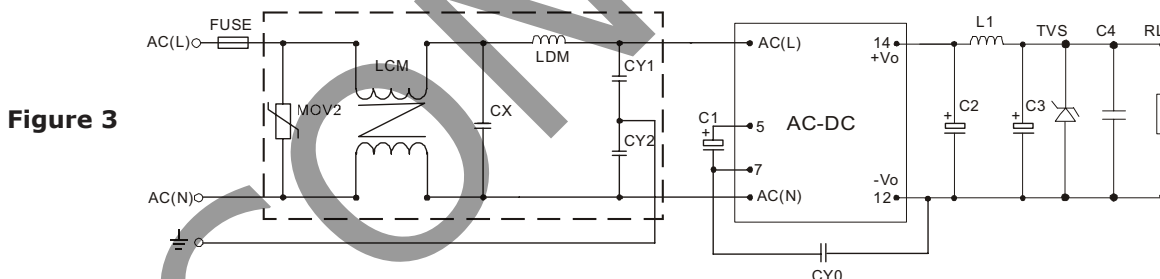


**Table 2**

Recommended external circuit components											
$V_{OUT}$ (Vdc)	C1 <sup>1</sup>	C2 <sup>1</sup>	L1 <sup>1</sup>	C3 <sup>1</sup>	C4	CX1	CY0	FUSE	NTC	MOV	TVS
3.3	22 $\mu$ F/400V	470 $\mu$ F/10V	0.47 $\mu$ H	150 $\mu$ F/35V	100nF/50V	0.1 $\mu$ F/275Vac	1nF/400Vac	1A/250V	5D-9	S14K350	SMBJ7.0A
5	22 $\mu$ F/400V	470 $\mu$ F/16V	0.47 $\mu$ H	150 $\mu$ F/35V	100nF/50V	0.1 $\mu$ F/275Vac	1nF/400Vac	1A/250V	5D-9	S14K350	SMBJ7.0A
9	22 $\mu$ F/400V	330 $\mu$ F/25V	1 $\mu$ H	150 $\mu$ F/35V	100nF/50V	0.1 $\mu$ F/275Vac	1nF/400Vac	1A/250V	5D-9	S14K350	SMBJ12A
12	22 $\mu$ F/400V	330 $\mu$ F/25V	1 $\mu$ H	150 $\mu$ F/35V	100nF/50V	0.1 $\mu$ F/275Vac	1nF/400Vac	1A/250V	5D-9	S14K350	SMBJ20A
15	22 $\mu$ F/400V	330 $\mu$ F/25V	1 $\mu$ H	150 $\mu$ F/35V	100nF/50V	0.1 $\mu$ F/275Vac	1nF/400Vac	1A/250V	5D-9	S14K350	SMBJ20A
24	22 $\mu$ F/400V	100 $\mu$ F/35V	4.7 $\mu$ H	47 $\mu$ F/35V	100nF/50V	0.1 $\mu$ F/275Vac	1nF/400Vac	1A/250V	5D-9	S14K350	SMBJ30A

Note: 1. Required components.

## EMC RECOMMENDED CIRCUIT



**Table 3**

Recommended External Circuit Components	
MOV2	S10K300
CY1, CY2	1nF/400Vac
CX	0.1 $\mu$ F/275Vac
LCM	3.5mH
LDM	5mH
FUSE	1A/250V

Note: 1. Also refer to Table 2.

- Notes:
- C1, C2, and C3 are electrolytic capacitors. They are required for both AC input and DC input.
  - For AC input, C1 is used as a filter capacitor. The recommended C1 value is 22  $\mu$ F/400V.
  - For DC input, C1 is used as an EMC filter capacitor. The recommended C1 value is 10 $\mu$ F/400V. When the input voltage is above 370VDC, we recommend a 10 $\mu$ F/450V capacitor.
  - C2 and C3 are output filter capacitors, we recommend 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.
  - C4 is a ceramic capacitor which is used to filter high frequency noise.
  - C2, C3 and L1 form a pi-type filter circuit. For the current of L1, refer to the datasheets provided by the manufacturers, current derating should be 80% or above.
  - TVS is a recommended component to protect post-circuits (if converter fails).
  - For standard EMC requirements, please refer to figure 2. If a higher EMC is required, please refer to figure 3.
  - All specifications measured at Ta=25C, humidity <75%, 115 Vac & 230 Vac input voltage, and rated output load, unless otherwise specified.

## REVISION HISTORY

rev.	description	date
1.0	initial release	08/09/2013
1.01	added bent pin model options, updated emc recommendations	06/20/2014
1.02	updated pin connection tables	06/07/2016

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



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