



PHI-CON

# 5 W AC-DC Converter PAC5DxxBS3-Series

- Enclosed plastic case
- 85 ... 305 V<sub>AC</sub>, 100 ... 430 V<sub>DC</sub> universal input range
- Continuous short circuit protection
- Over voltage protection
- Safety EN 62368-1, class II



## Model guide

Type	Output voltage [V <sub>DC</sub> ]	Output current [mA] max.	Efficiency typ. @ full load [%]	Capacitive load max. [μF]
PAC5D03BS3	3.3	1515	71.5	4000
PAC5D05BS3	5.0	1000	77.5	3000
PAC5D09BS3	9.0	555	80.5	1200
PAC5D12BS3	12	416	80.5	1200
PAC5D15BS3	15	333	81.5	680
PAC5D24BS3	24	208	81.5	220

## Specifications

Input	
Voltage range	85...305 V <sub>AC</sub> or 100...430 V <sub>DC</sub>
Line frequency range	47...63 Hz
Full load input current	130 mA, max. @ 115 V <sub>AC</sub> 70 mA, max. @ 230 V <sub>AC</sub>
Inrush current	15 A, typ. @ 115 V <sub>AC</sub> 25 A, typ. @ 230 V <sub>AC</sub>
No load power consumption	0.1 W, typ.
Hold up time @ full load	5 ms, typ. @ 115 V <sub>AC</sub> 50 ms, typ. @ 230 V <sub>AC</sub>
Recommended fuse	1 A / 300 V~, time delayed type
Hot plug	Not possible
Isolation	
Isolation voltage, input to output	4000 V <sub>AC</sub> , test 1 Min., < 5 mA
Leakage current	≤ 0.25 mA @ V <sub>in</sub> 277 V <sub>AC</sub> , 50 Hz
Output	
Output voltage tolerance	PAC5D03S: ±3 % All others: ±2 %
Line regulation at full load	± 0.5 %, typ.
Load regulation	± 1 %, typ. @ 0..100 % load
Minimum load	Not required
Temperature coefficient	± 0.02 % / °C
Ripple & noise @ BW 20 MHz	≤ 100 mVp-p (see Figure 1)
Output over voltage protection	
PAC5D03BS3, PAC5D05BS3	≤ 7.5 V <sub>DC</sub> , TVS diode clamping
PAC5D09BS3	≤ 15 V <sub>DC</sub> , TVS diode clamping
PAC5D12BS3	≤ 16 V <sub>DC</sub> , TVS diode clamping
PAC5D15BS3	≤ 20 V <sub>DC</sub> , TVS diode clamping
PAC5D24BS3	≤ 30 V <sub>DC</sub> , TVS diode clamping
Protection	
Short circuit	Continuous, hiccup, auto restart
Over current	≥ 130 % of rated current
General	
Safety standard	EN 62368-1
Safety standard designed to meet	IEC 62368-1, UL 62368-1, EN 61558-1, EN 60335-1
Safety class	Class II
Switching frequency	65 kHz, typ.
Reliability MTBF MIL-HDBK-217F@25°C	> 2.6 Mio. h
Designed life time @ 230 V <sub>AC</sub> & 100 % load	T <sub>a</sub> 25°C 130 10 <sup>3</sup> h T <sub>a</sub> 55°C 41 10 <sup>3</sup> h

EMC		
CE	EN 55032, CISPR 32	Class B (see Figure 2, 3 & 4)
	EN 55014-1	
RE	EN 55032, CISPR 32	Class B (see Figure 2, 3 & 4)
	EN 55014-1	
ESD	EN -, IEC 61000-4-2	Contact ± 6 kV, Air ±8 kV, perf. Crit. B
	EN 55014-2	perf. Crit. B
RS	EN -, IEC 61000-4-3	10 V/m perf. Crit. A
	EN 55014-2	perf. Crit. A
EFT	EN -, IEC 61000-4-4	± 2kV, perf. Crit. B (see Figure 2) ± 4kV, perf. Crit. B (see Figure 3) ± 4kV, perf. Crit. A (see Figure 4)
	EN 55014-2	perf. Crit. B
Surge	EN -, IEC 61000-4-5	Line to line ± 1 kV perf. Crit. B (see Fig. 2) Line to line ± 2 kV, perf. Crit. B (see Figure 3) Line to line ± 2 kV, Line to ground ± 4 kV, perf. Crit. B (see Fig. 4)
	EN 55014-2	perf. Crit. B
CS	EN -, IEC 61000-4-6	10 Vrms perf. Crit. A
	EN 55014-2	perf. Crit. A
Voltage dips, short interruptions and voltage variations	EN -, IEC 61000-4-11	0 %, 70 % perf. Crit. B
	EN 55014-2	perf. Crit. B
Environmental		
Operating ambient temperature	-40 ... 85 °C with derating	
Storage temperature	-40 ... 105 °C	
Altitude	≤ 5000 m	
Power derating PAC5D03BS3	70 °C...85 °C	≥ 2.33 % per °C, (see diagram)
	85 V <sub>AC</sub> ...100 V <sub>AC</sub>	≥ 1.33 % per V <sub>AC</sub>
Power derating All others	70 °C...85 °C	≥ 1.33 % per °C, (see diagram)
	85 V <sub>AC</sub> ...100 V <sub>AC</sub>	≥ 1.33 % per V <sub>AC</sub>
Storage humidity	95 %, non condensing	
Cooling	Free air convection, ≥ 35 LFM	
Physical		
	Dimensions [mm]	Weight [g]
PAC5DxxBS3	25.4 x 25.4 x 17.6	18
PAC5DxxBS3A2	31.5 x 76 x 26.4	38
PAC5DxxBS3A4	31.5 x 76 x 31	58
Case material	Black plastic, UL94V-0 rated	
Wave soldering temperature	≤ 260 °C duration ≤ 10 s, ≥ 1.5 mm distance from case	
Manual soldering temperature	≤ 360 °C duration ≤ 5 s, ≥ 1.5 mm distance from case	

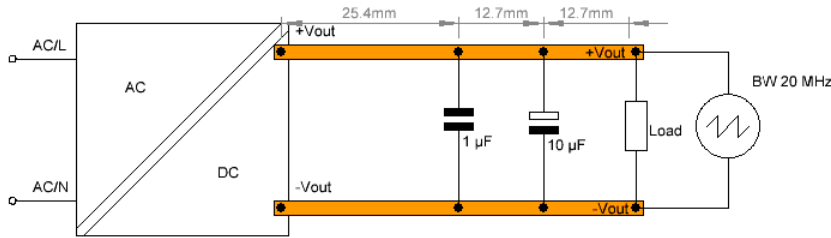
Part number information													
PHI-CON	AC/DC-Converter	Output Power		Series	Output voltage		Rev.	Output		Extended V <sub>in</sub> range	Mountable on		
P	AC	5	5 W	D	03	3.3 V	B	S	single	3	85...305 V~	blanc	PCB
					05	5 V						A2	Chassis
					09	9 V						A4	DIN Rail
					12	12 V							
					15	15 V							
					24	24 V							
Example:	PAC5D12BS3	PHI-CON AC/DC Converter, Pout: 5 W, Vout: 12 V, Vin range: 85...305 V~, single Out, PCB mountable											

# 5 W AC-DC Converter PAC5DxxBS3-Series

Note:

1. Unless otherwise specified are all values specified at Ta 25 °C, humidity < 75 % and rated output load current.
2. The outputs of the AC/DC converters are not suitable for parallel operation.

Figure 1 Output ripple & noise measure method BW 20 MHz



Typical application circuit

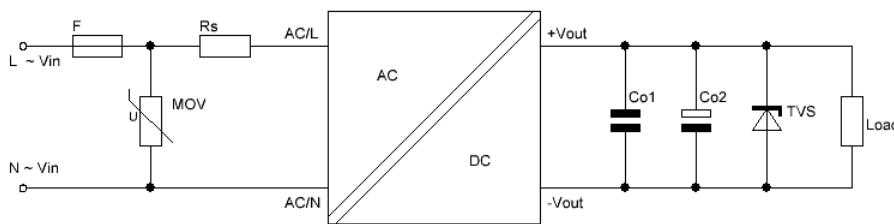


Figure 2

Table 1 Bill of material for typical application circuit (see typical application circuit)						
Type	F (Time delayed type)	MOV	Rs (wire wound type)	Co1	Co2	TVS
PAC5D03BS3	1 AT / $\geq 300$ V~	S10K350	12 $\Omega$ , 3 W	1 $\mu$ F, MLCC	150 $\mu$ F, $\geq 10$ V	SMBJ7.0A
PAC5D05BS3	1 AT / $\geq 300$ V~	S10K350	12 $\Omega$ , 3 W	1 $\mu$ F, MLCC	150 $\mu$ F, $\geq 10$ V	SMBJ7.0A
PAC5D09BS3	1 AT / $\geq 300$ V~	S10K350	12 $\Omega$ , 3 W	1 $\mu$ F, MLCC	120 $\mu$ F, $\geq 25$ V	SMBJ12A
PAC5D12BS3	1 AT / $\geq 300$ V~	S10K350	12 $\Omega$ , 3 W	1 $\mu$ F, MLCC	120 $\mu$ F, $\geq 25$ V	SMBJ20A
PAC5D15BS3	1 AT / $\geq 300$ V~	S10K350	12 $\Omega$ , 3 W	1 $\mu$ F, MLCC	120 $\mu$ F, $\geq 25$ V	SMBJ20A
PAC5D24BS3	1 AT / $\geq 300$ V~	S10K350	12 $\Omega$ , 3 W	1 $\mu$ F, MLCC	68 $\mu$ F, $\geq 35$ V	SMBJ30A

Figure 3

Table 2 Bill of material for typical application circuit with higher performance (see typical application circuit)						
Type	F (Time delayed type)	MOV	Rs (wire wound type)	Co1	Co2	TVS
PAC5D03BS3	2 AT / $\geq 300$ V~	S14K350	33 $\Omega$ , 3 W	1 $\mu$ F, MLCC	150 $\mu$ F, $\geq 14$ V	SMBJ7.0A
PAC5D05BS3	2 AT / $\geq 300$ V~	S14K350	33 $\Omega$ , 3 W	1 $\mu$ F, MLCC	150 $\mu$ F, $\geq 14$ V	SMBJ7.0A
PAC5D09BS3	2 AT / $\geq 300$ V~	S14K350	33 $\Omega$ , 3 W	1 $\mu$ F, MLCC	120 $\mu$ F, $\geq 25$ V	SMBJ12A
PAC5D12BS3	2 AT / $\geq 300$ V~	S14K350	33 $\Omega$ , 3 W	1 $\mu$ F, MLCC	120 $\mu$ F, $\geq 25$ V	SMBJ20A
PAC5D15BS3	2 AT / $\geq 300$ V~	S14K350	33 $\Omega$ , 3 W	1 $\mu$ F, MLCC	120 $\mu$ F, $\geq 25$ V	SMBJ20A
PAC5D24BS3	2 AT / $\geq 300$ V~	S14K350	33 $\Omega$ , 3 W	1 $\mu$ F, MLCC	68 $\mu$ F, $\geq 35$ V	SMBJ30A

Figure 4 Application circuit for higher EMC performance

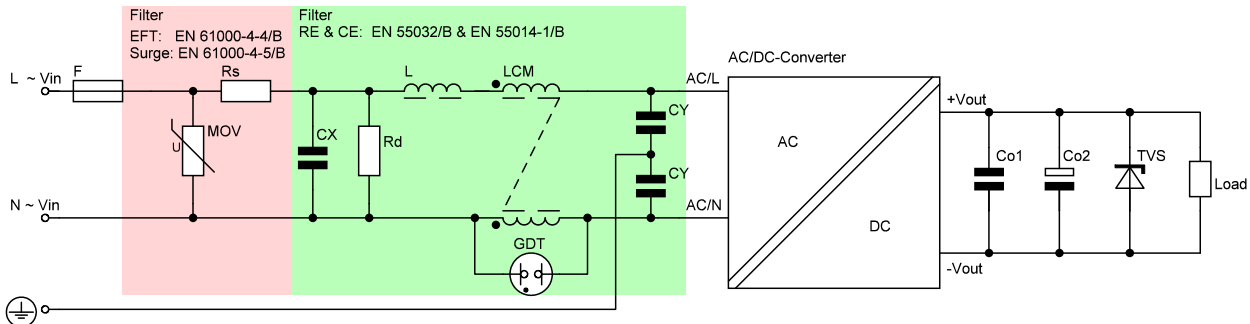


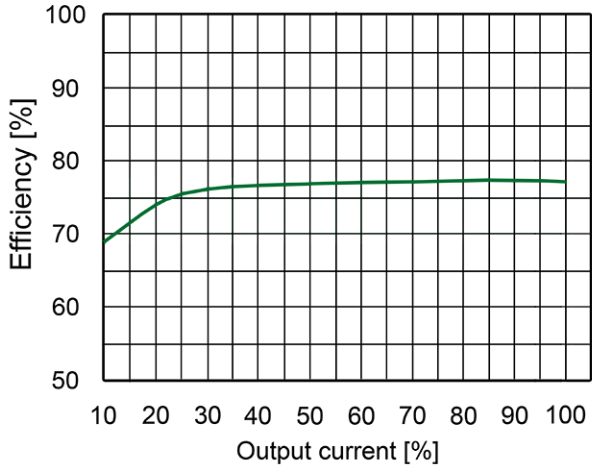
Table for Figure 4												
F1 (Time delayed type)	MOV1	Rs	CX	Rd	L	LCM	GDT	CY	Rs	Co1	Co2	TVS
2 AT, $\geq 300$ V~	S14K350	33 $\Omega$ , 3 W	330 nF, 400 V <sub>AC</sub>	2.2 M $\Omega$ (Operating voltage > 500 V)	1.2 $\mu$ H, 0.3 A	20 mH	300 V, 1 kA	1 nF, 400 V <sub>AC</sub>	33 $\Omega$ , 3 W	See Table 1		

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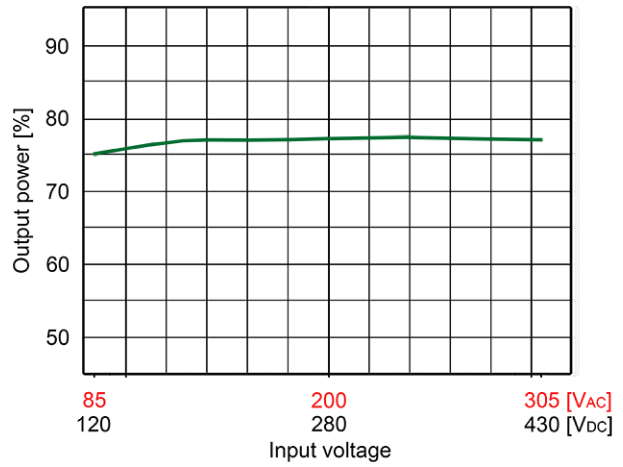


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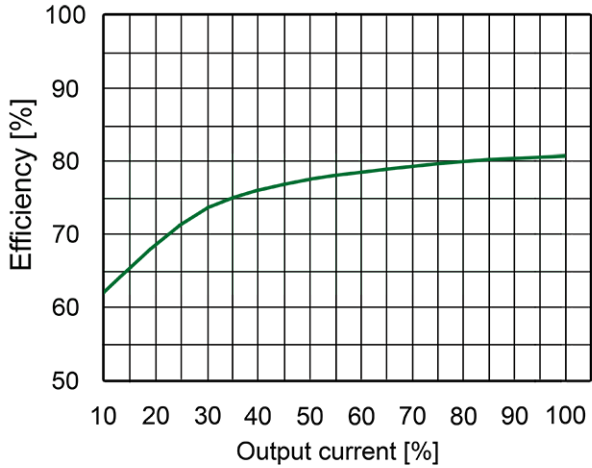
PAC5D05BS3 Efficiency vs output load at Vin 230 VAC



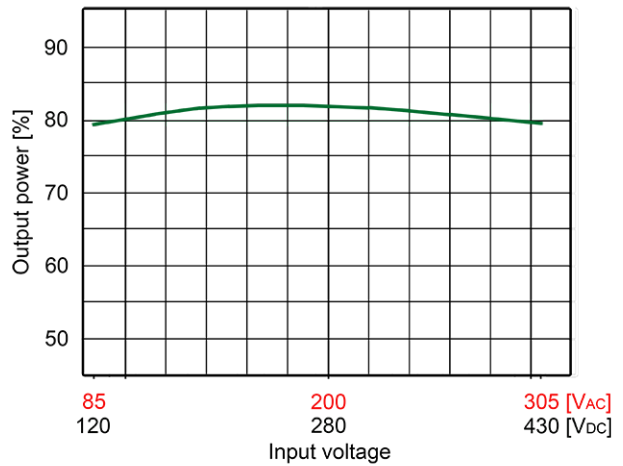
PAC5D05BS3 Efficiency vs input voltage at Ta 25°C



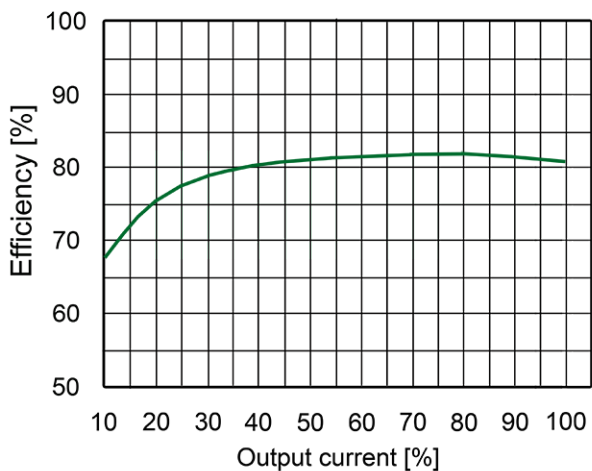
PAC5D12BS3 Efficiency vs output load at Vin 230 VAC



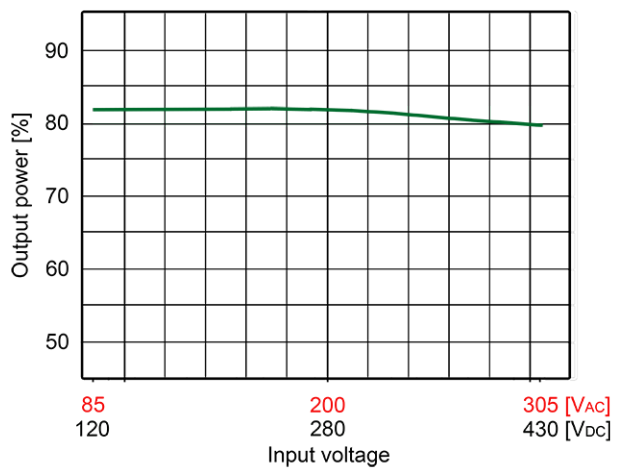
PAC5D12BS3 Efficiency vs input voltage at Ta 25°C



PAC5D24BS3 Efficiency vs output load at Vin 230 VAC



PAC5D24BS3 Efficiency vs input voltage at Ta 25°C

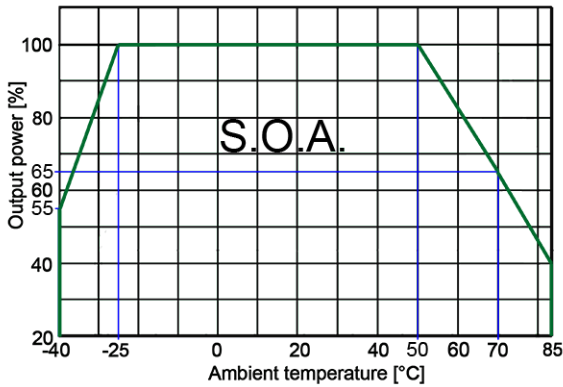




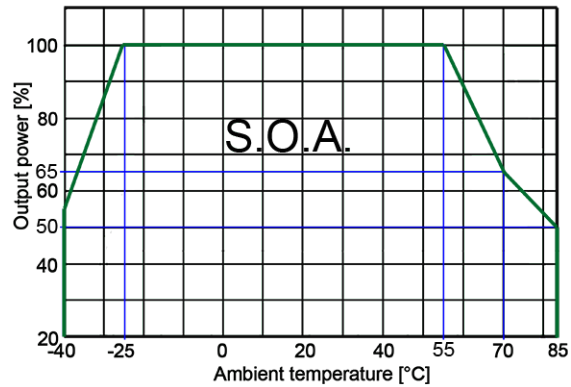
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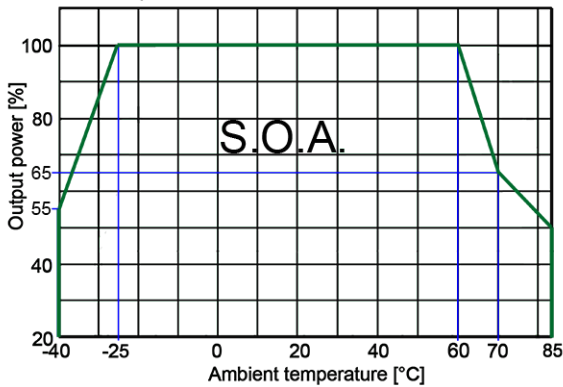
PAC5D03BS3 power derating vs ambient temperature at Vin (85 ~ 305 V<sub>AC</sub> or 100 ~ 430V<sub>DC</sub>)



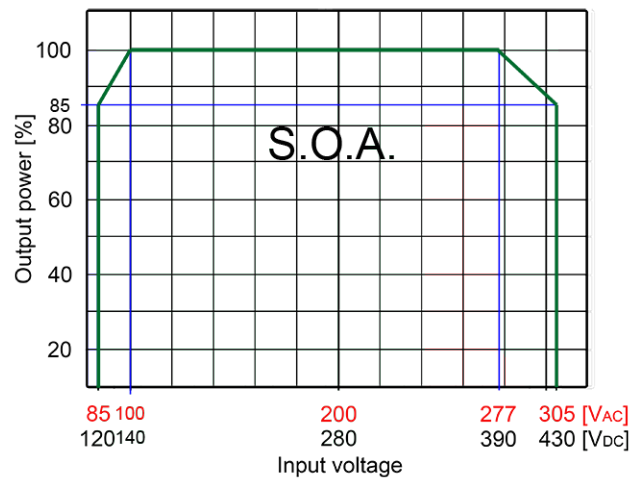
PAC5D05BS3, PAC5D09BS3, PAC5D12BS3 power derating vs ambient temperature at Vin 85 ~ 305 V<sub>AC</sub> or 100 ~ 430V<sub>DC</sub>



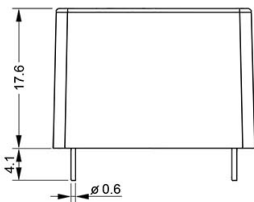
PAC5D15BS3 & PAC5D24BS3 power derating vs ambient temperature at Vin 85 ~ 305 V<sub>AC</sub> or 100 ~ 430V<sub>DC</sub>



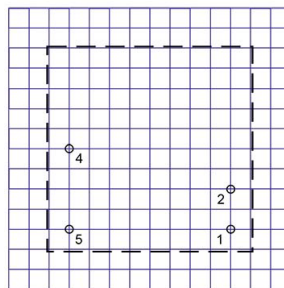
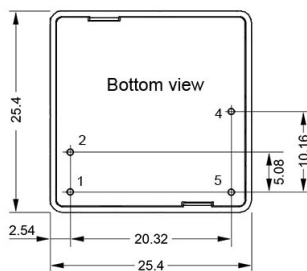
Derating vs input Voltage



## Mechanical dimensions PCB mountable version

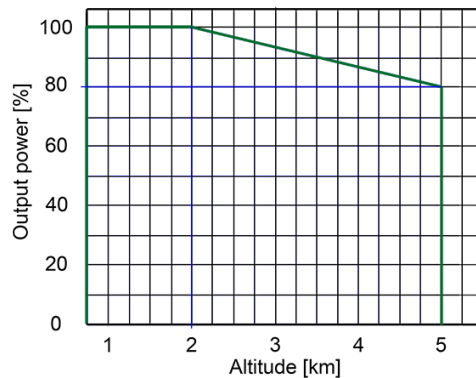


Note  
Unit: mm  
Pin diameter tolerance: ± 0.1 mm  
General tolerances: ± 0.5 mm



Grid: 2.54 mm  
Recommended hole diameter: 1.1 mm

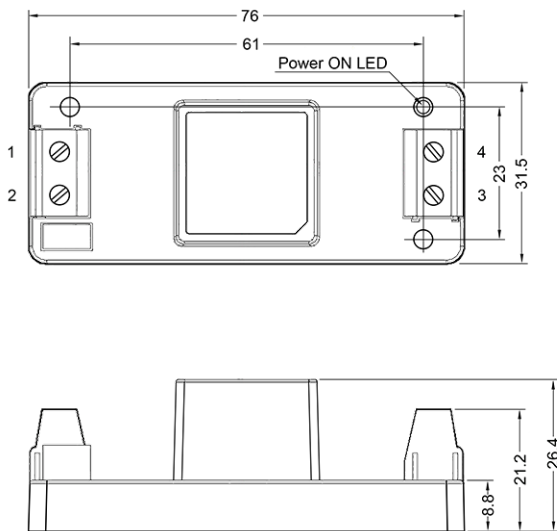
Derating vs input Voltage



Pin assignment	
1	AC In (N)
2	AC In (L)
3	No Pin
4	- DC Out
5	+ DC Out

# 5 W AC-DC Converter PAC5DxxBS3-Series

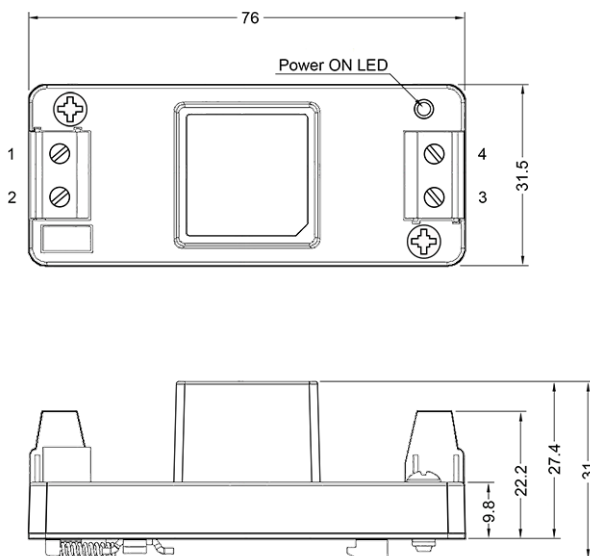
## Mechanical dimensions chassis mountable version



Terminal assignment	
1	AC In (N)
2	AC In (L)
3	- Vout
4	+ Vout

Note  
 Unit: mm  
 General tolerances:  $\pm 1$  mm  
 Wire range: 12...24 AWG  
 Tightening torque:  $< 0.4$  Nm

## Mechanical dimensions DIN-rail mountable version



Terminal assignment	
1	AC In (N)
2	AC In (L)
3	- Vout
4	+ Vout

Note  
 Unit: mm  
 General tolerances:  $\pm 1$  mm  
 Wire range: 12...24 AWG  
 Tightening torque:  $< 0.4$  Nm  
 Mountable on DIN Rail TS35  
 DIN Rail must be connected with protection earth

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