



PHI-CON

# 1 W DC-DC Converter P1HxxxxBx-Series

- 7 Pin SIL
- Unregulated
- Reinforced insulation
- Leakage current 2  $\mu$ A max.
- Isolation 6 kV<sub>DC</sub>, 4.2 kV<sub>AC</sub>
- MTBF > 3.5 Mio. h
- Operating temperature range -40...85°C
- Efficiency up to 81 %



## Model guide

Type	Input voltage		Input current		Output voltage [V <sub>oc</sub> ]	Output current		Efficiency typ. [%]	Capacitive load [ $\mu$ F] max.
	nominal [V <sub>oc</sub> ]	Range [V <sub>oc</sub> ]	No load [mA] typ.	Full load [mA] typ.		min. [mA]	max. [mA]		
<b>Single output</b>									
P1H053R3BS	5	4.5...5.5	35	275	3.3	31	303	73	1000
P1H0505BS	5	4.5...5.5	35	275	5.0	20	200	78	1000
P1H0512BS	5	4.5...5.5	35	275	12.0	9	84	76	470
P1H0515BS	5	4.5...5.5	35	275	15.0	7	67	76	470
P1H1205BS	12	10.8...13.2	15	115	5.0	20	200	77	1000
P1H1212BS	12	10.8...13.2	15	115	12.0	9	84	81	470
P1H1215BS	12	10.8...13.2	15	115	15.0	7	67	81	470
P1H2405BS	24	21.6...26.4	10	56	5.0	20	200	76	1000
P1H2412BS	24	21.6...26.4	10	56	12.0	9	84	78	470
P1H2415BS	24	21.6...26.4	10	56	15.0	7	67	78	470
<b>Dual output</b>									
P1H0505BD	5	4.5...5.5	35	275	$\pm$ 5.0	$\pm$ 10	$\pm$ 100	78	2 x 470
P1H0509BD	5	4.5...5.5	35	275	$\pm$ 9.0	$\pm$ 6	$\pm$ 56	80	2 x 470
P1H0512BD	5	4.5...5.5	35	275	$\pm$ 12.0	$\pm$ 5	$\pm$ 42	74	2 x 220
P1H0515BD	5	4.5...5.5	35	275	$\pm$ 15.0	$\pm$ 4	$\pm$ 34	76	2 x 220
P1H1205BD	12	10.8...13.2	15	115	$\pm$ 5.0	$\pm$ 10	$\pm$ 100	77	2 x 470
P1H1209BD	12	10.8...13.2	15	115	$\pm$ 9.0	$\pm$ 6	$\pm$ 56	80	2 x 470
P1H1212BD	12	10.8...13.2	15	115	$\pm$ 12.0	$\pm$ 5	$\pm$ 42	73	2 x 220
P1H1215BD	12	10.8...13.2	15	115	$\pm$ 15.0	$\pm$ 4	$\pm$ 34	75	2 x 220
P1H1515BD	15	13.5...16.5	18	93	$\pm$ 15.0	$\pm$ 4	$\pm$ 34	72	2 x 220
P1H2405BD	24	21.6...26.4	10	56	$\pm$ 5.0	$\pm$ 10	$\pm$ 100	75	2 x 470
P1H2409BD	24	21.6...26.4	10	56	$\pm$ 9.0	$\pm$ 6	$\pm$ 56	79	2 x 470
P1H2412BD	24	21.6...26.4	10	56	$\pm$ 12.0	$\pm$ 5	$\pm$ 42	76	2 x 220
P1H2415BD	24	21.6...26.4	10	56	$\pm$ 15.0	$\pm$ 4	$\pm$ 34	76	2 x 220

## Specifications

<b>Input</b>	
Filter	Capacitors
Reflected ripple current	200 mAp-p, typ. (see Figure 1)
<b>Input surge voltage &lt; 1s</b>	
P1H05xxx	-0.7...9 V, < 1 s
P1H12xxx	-0.7...18 V, < 1 s
P1H15xxx	-0.7...21 V, < 1 s
P1H24xxx	-0.7...30 V, < 1 s
<b>I/O-Isolation:</b>	
DC-Isolation voltage tested for 60 sec. @ < 1mA	6 kV <sub>DC</sub> 4.2 kV <sub>AC</sub>
Resistance @ 500 V <sub>DC</sub>	10 <sup>9</sup> $\Omega$ , max.
Leakage current	$\leq$ 2 $\mu$ A @ 250 V <sub>AC</sub> , 50/60 Hz
Capacitance	5 pF, typ. @ 100 kHz, 0.1 V
<b>Output</b>	
Voltage accuracy	See load diagram
Voltage balance (dual outputs)	$\pm$ 1 %
Ripple and noise (at 20 MHz BW)	P1Hxx3R3Bx: 150 mVp-p, max. All other: 120 mVp-p, max.(see Figure 2)
Short circuit duration	3 s, max.
Line voltage deviation	P1Hxx3R3Bx: $\leq$ 1.2% @ 1% V <sub>in</sub> change All other: $\leq$ 1.2% @ 1% V <sub>in</sub> change
Output voltage drift at load change 10...100 %	P1Hxx3R3x 20 %, max. P1Hxx05x 20 %, max. All others 15 %, max.
Temperature drift	$\pm$ 0.02 % / °C

<b>CISPR32 / EN55032</b>	
EMI conducted emission	Class B (see Figure 2)
EMI radiated emission	Class B (see Figure 2)
<b>EMS</b>	
ESD IEC / EN61000-4-2	Contact $\pm$ 8 kV perf. criteria B
<b>General</b>	
Safety standard	IEC60950-1
Switching frequency	100 kHz, @ full load
Reliability (MTBF)	3.5 Mio. h
MIL-HDBK-217@25°C	
<b>Environmental</b>	
Operating ambient temperature	-40 ... 85 °C
Case temperature	100 °C, max.
Storage temperature	-55 ... 125 °C
Derating	None required
Storage humidity	Up to 95 % relative humidity, non condensing
Cooling	Free air convection
<b>Physical</b>	
Dimensions	19.5 x 9.8 x 12.5 mm
Weight	4.2 g
Transformer creepage & clearance	$\geq$ 5 mm
PCB creepage & clearance	$\geq$ 5.5 mm
Case material	black plastic (UL94V-0 rated)
Temperature rise @ full load	25 °C, max.
Pin soldering temperature	$\leq$ 300 °C for $\leq$ 10 s, $\geq$ 1.5 mm distance from body

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## 1) Requirement on output load

To ensure this module can operate efficiently and reliably, during operation, the minimum output load could **not be less than 10 %** of the full load. If the actual output power is very small, please connect a resistor with proper resistance at the output end in parallel to increase the load, or use our company's products with a lower rated output power (P1H\_B Series).

## 2) Recommended testing and application circuit

If you want to further decrease the input/output ripple, an "LC" filtering network may be connected to the input and output ends of the DC/DC converter, see (see Figure 4).

It should also be noted that the inductance and the frequency of the "LC" filtering network should be staggered with the DC/DC frequency to avoid mutual interference. However, the capacitance of the output filter capacitor must be proper. If the capacitance is too big, a start up problem might arise. For every channel of output, provided the safe and reliable operation is ensured, the greatest capacitance of its filter capacitor sees (see model guide "Capacitive load max").

## 3) Output Voltage Regulation and Over voltage Protection Circuit

The simplest device for a better line regulation or an output voltage regulation, over voltage and over current protection is a linear voltage regulator with overheat protection that is connected to the input or output end in series (see Figure 5).

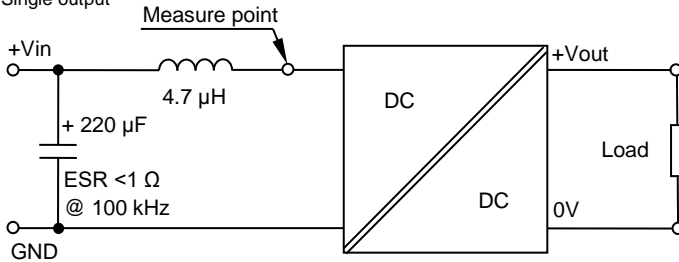
## 4) Overload Protection

Under normal operating conditions, the output circuit of these products has no protection against overload. The simplest method is to connect a self recovery fuse in series at the input end or add a circuit breaker to the circuit.

## 5) Not for parallel connection

## 6) Not for hot plug application

Figure 1 Reflected input ripple current measure circuit  
Single output



Dual output

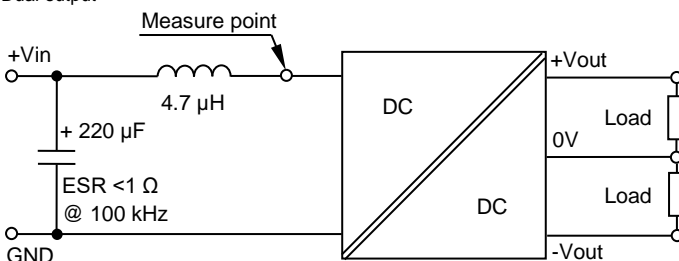
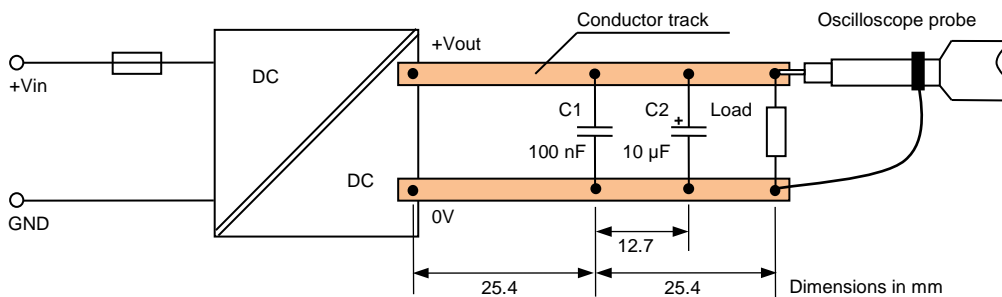


Figure 2 Ripple & noise measure method (Band wide 20 MHz)





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Figure 3a Typical application circuit single output

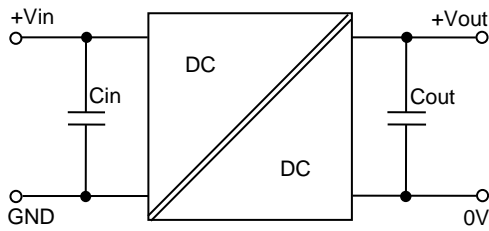
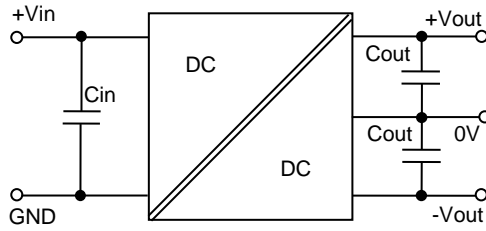


Figure 3b Typical application circuit dual output



Cin value to Figure 3a & 3b	
Type (Vin)	Cin [μF]
P1H05xxBx	10
P1H12xxBx	4.7
P1H15xxBx	4.7
P1H24xxBx	2.2

Cout value to Figure 3a & 4	
Single out type	Cout [μF]
P1Hxx3R3BS	10
P1Hxx05BS	10
P1Hxx12BS	2.2
P1Hxx15BS	1

Cout value to Figure 3b & 4	
Dual out type	Cout [μF]
P1Hxx05BD	2 x 4.7
P1Hxx09BD	2 x 2.2
P1Hxx12BD	2 x 1
P1Hxx15BD	2 x 1

Figure 4 Recommended filter circuit for EMC EN55032 Class B compliance

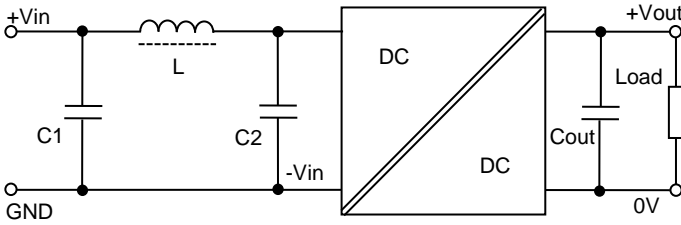
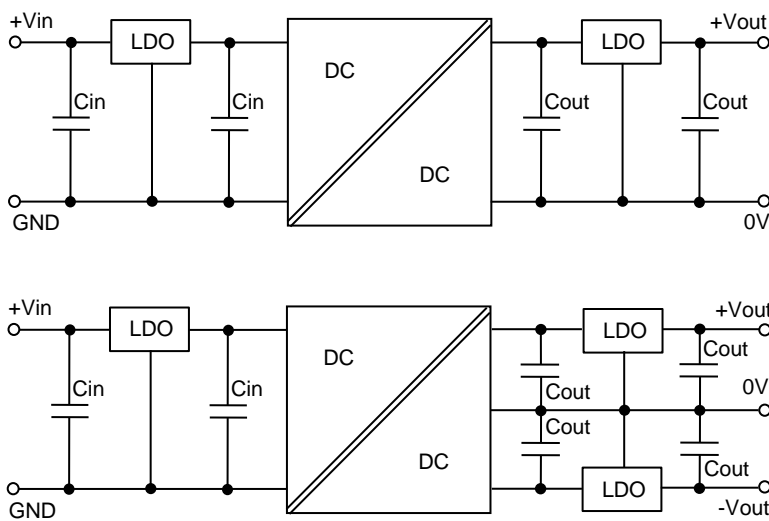


Table of components to figure 4			
Type	C1, C2		L
	[μF]	[V]	[μH]
P1H05xxBx	4.7	50	6.8
P1H12xxBx	4.7	50	6.8
P1H15xxBx	4.7	50	6.8
P1H24xxBx	4.7	50	6.8

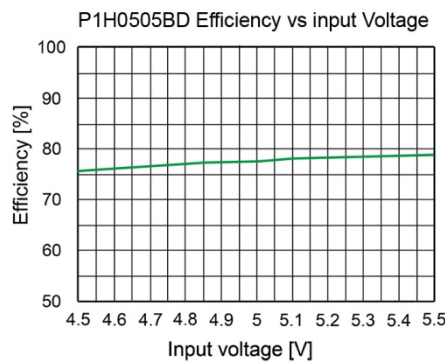
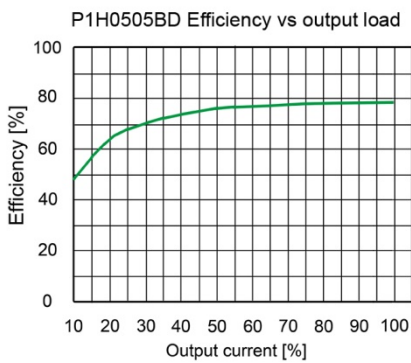
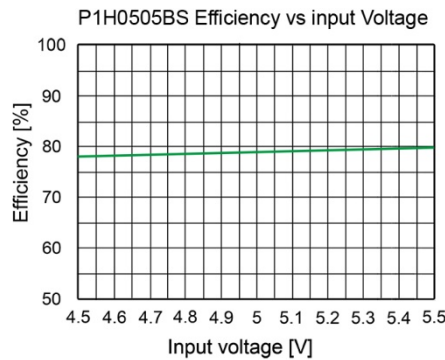
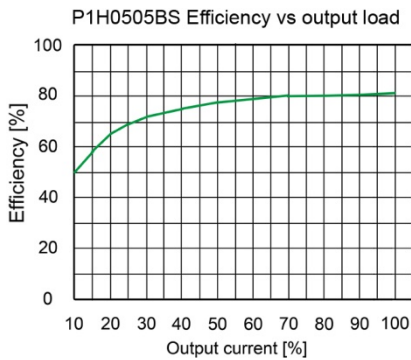
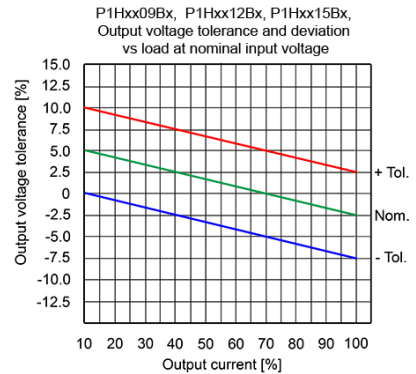
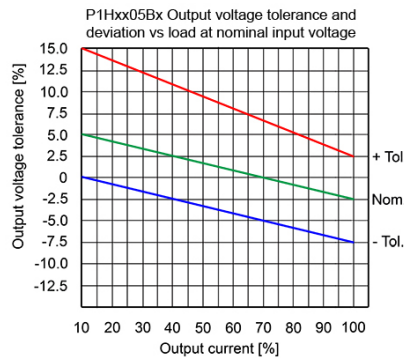
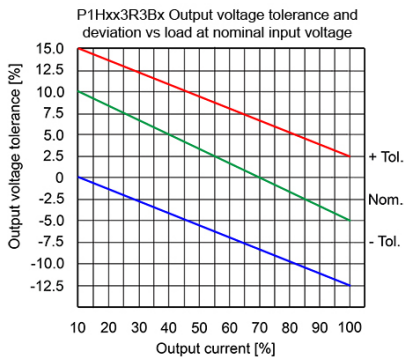
Figure 5 Simple circuit example for wide input range and (or) regulated output



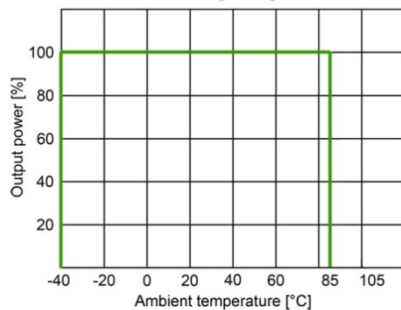


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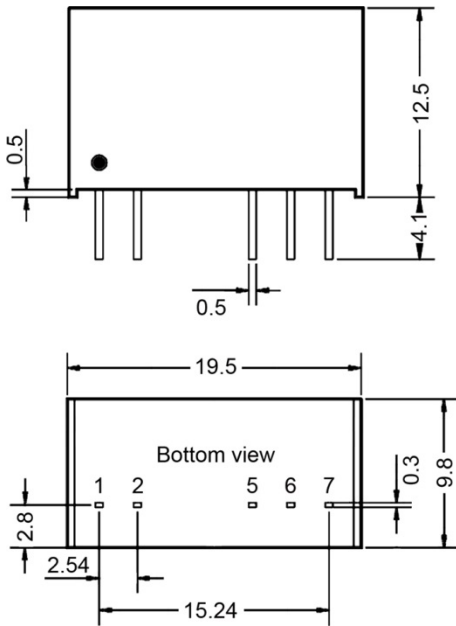


Derating diagram



# 1 W DC-DC Converter P1HxxxxBx-Series

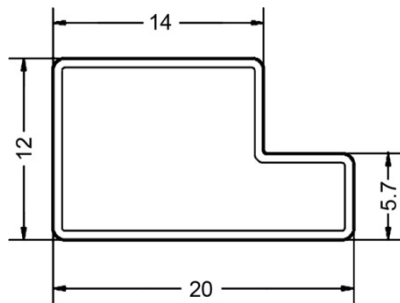
## Package dimensions



Pin assignment		
Pin	Single	Dual
1	+V Input	+V Input
2	-V Input	-V Input
5	-V Output	-V Output
6	No pin	Common
7	+V Output	+V Output

Unit in mm  
Pin section tolerances  $\pm 0.1$  mm  
General tolerances  $\pm 0.25$  mm

## Packing tube dimensions



Unit in mm  
General tolerances  $\pm 0.5$  mm  
Short tube 10 pieces, length 220 mm  
Long tube 22 pieces, length 530 mm

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