150 W DC-DC Converter P150B-Series

PHI-CON

- Wide 4:1 input range
- Efficiency up to 91 %
- Adjustable output voltage
- Remote control on / off
- In/Out isolation 2250 V_{DC}
- Input under voltage protection
- Continuous short circuit protection
- Over current protection
- Over temperature protection
- Five sided shielded metal package

Model guide

Type	Input voltage		Input current		Output voltage	Output current		Efficiency @ full load [%] typ.	Capacitive load (see note 2) [µF] max.
	Nominal [V_{DC}]	Range [V_{DC}]	no load [mA]	full load [mA]	[V_{DC}]	[mA] min.	[A] max.		
P150B4805S	48	18...75	≤ 200	≤ 3635	5	0	30	88	6000
P150B4812S	48	18...75	≤ 200	≤ 3635	12	0	12.5	91	2000
P150B4815S	48	18...75	≤ 200	≤ 3635	15	0	10	89	2000
P150B4824S	48	18...75	≤ 200	≤ 3635	24	0	6.25	91	1000
P150B4848S	48	18...75	≤ 200	≤ 3635	48	0	3.13	91	470

Specifications

Input		
Start up voltage		≤ 18 V_{DC}
Under voltage lockout		≥ 14 V_{DC}
Surge voltage ≤ 1 s		-0.7 … 90 V_{DC}
Filter		π – type
Reflected ripple current		250 mAp-p, typ. (see figure 1)
Remote control theshold	On state	3.5 … 12 V_{DC}, or open input
	Off state	0 … 1.2 V_{DC}
Input idle current @ Off state		10 mA, max.
Isolation input - output:		
Rated isolation voltage (tested duration 60 s @ < 5 mA leakage current)		Input to output: 2250 V_{DC}, max.
		Input to case: 1500 V_{DC}, max.
		Output to case: 500 V_{DC}, max.
Resistance		> 10^9 Ω, measured @ 500 V_{DC}
Input / output capacitance		2200 pF, typ. @ 100 kHz, 0.1 V
Output		
Output voltage tolerance		≤ ± 3 %
Line regulation		≤ ± 0.5 %, full input range
Load regulation		≤ ± 0.75 %, 5…100 % load
Output voltage trim range		90 … 110 %
Output voltage compensation via sense		≤ 105 %
Output voltage Vin regulation		≤ ±0.5 % deviation @ full Vin range
Temperature coefficient		± 0.03 % / °C
Transient recovery time		≤ 500 µs @ 25 % load change steps
Transient response deviation @ 25 % load change steps		P150Bxx05S: < ± 7.5 % All others: < ± 5 %
Over voltage protection		110 … 160 % of nominal Vout
Over current protection		110 … 150 % of maximal Iout
Short circuit protection		Continuous, hiccup
Short circuit restart		Automatic
Rippel & noise, BW 20 MHz		≤ 250 mVp-p (see figure 2)
Start up time		20 ms, typ @ R-load
General		
Safety standard		EN 62368-1
Switching frequency (PWM)		250 kHz, typ.
Reliability calculated MTBF MIL-HDBK-217F @ 25 °C		> 500 000 h

EMC characteristics		
Conducted emissions EN 55032, CISPR32		Class A (see figure 4)
Radiated emissions EN 55032, CISPR32		Class A (see figure 4)
ESD	IEC-, EN 61000-4-2 EN 50121-3-2	contact ± 6 kV, air ± 8 kV, perf. Criteria B
RS	IEC-, EN 61000-4-3 EN 50121-3-2	10 V/m, perf. Criteria A
EFT	IEC-, EN 61000-4-4 EN 50121-3-2	± 2 kV, perf. Criteria A (see fig. 4a)
Surge	EN 50121-3-2	Differential mode ± 1 kV, 1.2 µs / 50µs, soure Ri 42 Ω perf. Criteria B (see figure 4a)
CS	IEC-, EN 61000-4-6 EN 50121-3-2	10 Vrms, perf. Criteria A
Environmental		
Operating ambient temperature		-40 … 85 °C with derating
Storage temperature		-55 … 125 °C
Over temp. protection		≤ 120 °C
Storage humidity		5…95 %, non condensing
Cooling		See derating diagram
Thermal impedance		P150B48xxS: 7.5 K/W P150B48xxSHB: 6.3 K/W P150B48xxSK: 5.2 K/W
Vibration		IEC-, EN 61373 train 1 B category
Physical		
Dimensions	P150BxxS P150BxxSK P150BxxSHB	61.8 x 40.2 x 12.7 mm 61.8 x 40.2 x 27.7 mm 62 x 56 x 14.6 mm
Weight	P150BxxS P150BxxSK P150BxxSHB	89 g 120 g 109 g
Case material		Aluminium alloy
Potting Material		Plastic (UL94V-0 rated)
Absolute max. ratings		
Wave soldering temperature		≤ 260 °C for ≤10 sec, ≥ 1.5 mm distance from body
Manual soldering temperature		≤ 300 °C for ≤10 sec, ≥ 1.5 mm distance from body

Ordering information

Output Power	Series	Input voltage		Output voltage		Output		Package version	
P150	**B**	**48**		**05**		**S**		**HB**	
150 Watt		48	48 V_{DC}	05	5 V_{DC}	S	single	blank	Standard version
				12	12 V_{DC}			HB	Slotted base plate version
				15	15 V_{DC}			K	Heat sink version
				24	24 V_{DC}				
				48	48 V_{DC}				

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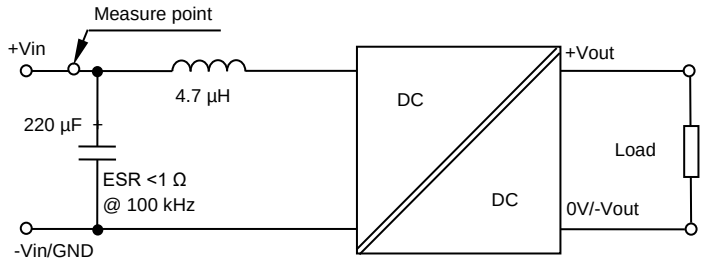
Note:
1. All specifications measured at Ta 25 °C, humidity < 75 %, nominal input voltage and rated output load current unless otherwise specified.
2. Maximum capacitive load is tested at full input voltage range and full load current.
3. It is not recommended to increase the output power capability by connecting two or more converters in parallel.
4. The converter are not hot swappable

Figure 1 Measure circuit input reflected ripple current



The input reflected ripple current is measured with inductor Lin and capacitor Cin to simulate source impedance.

Figure 2 Measure circuit output ripple and noise (BW 20 MHz)

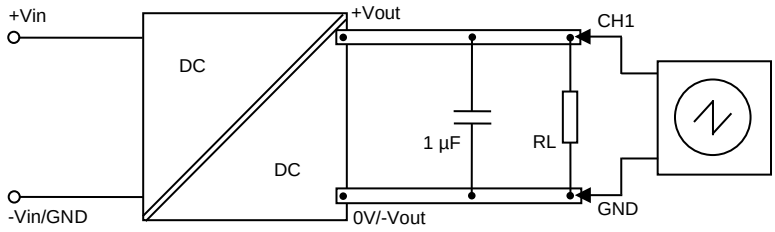
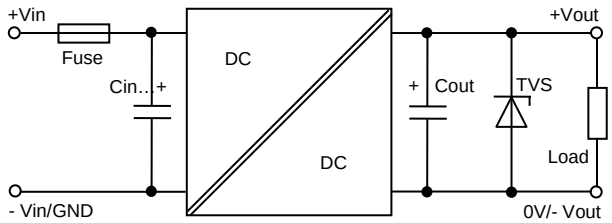


Figure 3 Typical test and application circuit

The P150B series is been tested according to the following recommended test circuit before leaving the factory (see following circuit and table). If you want to further decrease the input or output ripple, you can increase a capacitance values properly or choose capacitors with low ESR, but the total capacitance of the filter capacitor must not exceed the maximum load capacitance value (see „Model guide“ table).



Recommended peripheral components to figure 3				
Type	Fuse	Cin	Cout	TVS
P150B4805S	15 A Time delayed type	220 µF	470 µF	SMDJ6.0A
P150B4812S			220 µF	SMDJ14A
P150B4815S			220 µF	SMDJ17A
P150B4824S			100 µF	SMDJ28A
P150B4848S			100 µF	SMDJ54A

Figure 4, EMC filter circuit for IEC/EN 61000-4-4, IEC/EN 61000-4-5 performance criteria B and EN 55032 Class B

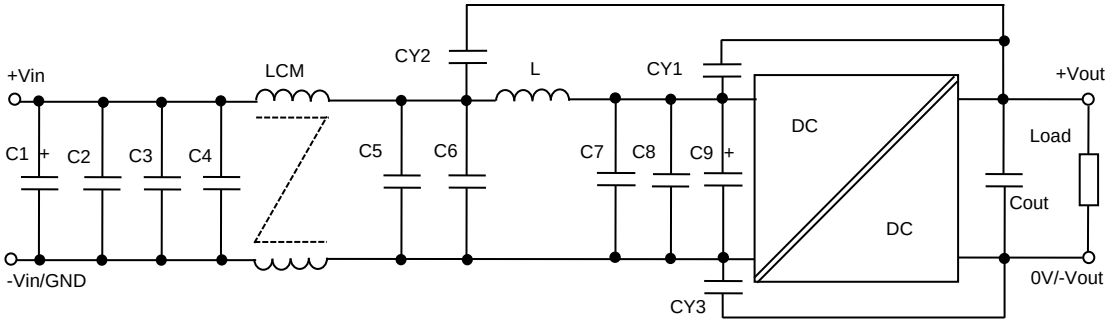
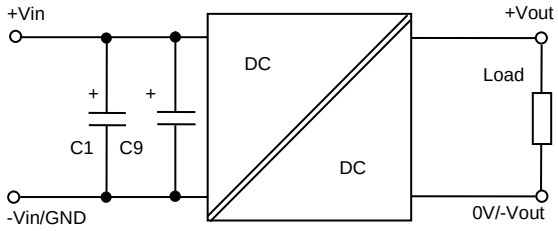
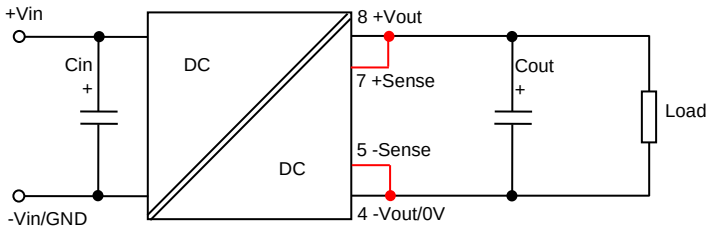


Figure 4a, EMS filter circuit only for IEC/EN 61000-4-4, IEC/EN 61000-4-5 performance criteria B



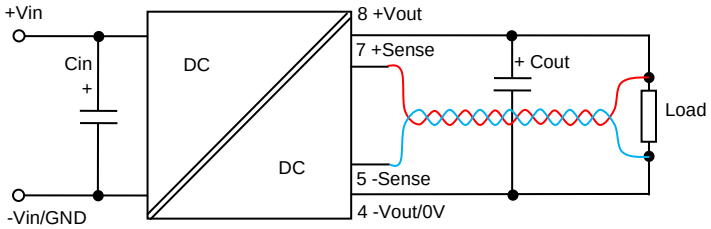
Recommended peripheral components to circuits in figures 4 and 4a							
EN 55032, CISPR32	C1 electrolytic	C11 electrolytic	C2,C3,C4,C5,C6, C7, C8 ceramic chip	LCM	L	CY1, CY2 Type	CY3 Type
Class B	150 µF	47 µF	2.2 µF	1 mH, 15 A	1.5 µH, 15 A	1 nF	2.2 nF

Application circuit without output voltage dropout remote compensation



Usable at applications without output voltage dropout remote compensation. Connect +Vout with +Sense and –Vout/0V with -Sense direct on the DC/DC-converter!

Application circuit with output voltage dropout remote compensation



Usable at applications with output voltage dropout remote compensation. Connect +Vout with +Sense and –Vout/0V with –Sense via twisted wire direct on the point of load!

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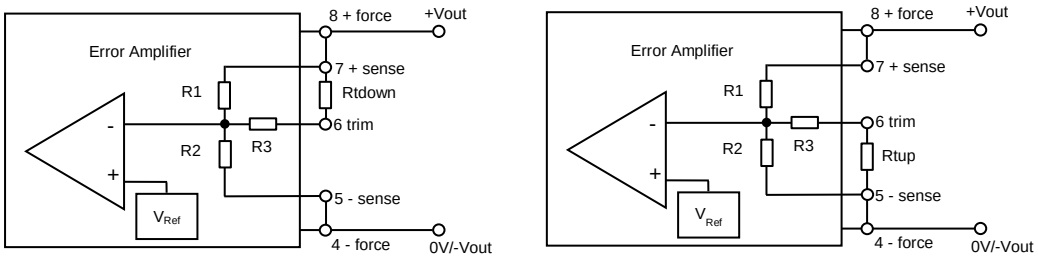
Application circuit for trimming function.



When using the Trim down function make sure that the “RTdown” resistor value is calculated correctly. If the “Trim” pin is shorted with “+Vout” pin, or it`s value of “Rtdown” is too low, the output voltage “Vout” would be lower than 90% of Vout nominal value, which may cause the product to fail.

Model series	R1 [kΩ]	R2 [kΩ]	R3 [kΩ]	V Ref [V]	Rtdown min. [kΩ]	Rtup min. [kΩ]
P150B4805S	3.036	3	10	2.5	14.4	6.15
P150B4812S	11	2.87	15	2.5	129	9.6
P150B4815S	14.03	2.8	15	2.5	197	8.8
P150B4824S	24.872	2.87	15	2.5	355	12.8
P150B4848S	53.017	2.913	15	2.5	937	14.45
Maximum output voltage adjust range 95..110 % of Vout nominal value, see min. Rtdown / Rtu. Exceeding the trim range causes irreversible damage! If trim potentiometers are used, precautions must be taken.						

Trim down resistor formula

$$b = \frac{Vout-Vref}{Vref} * R2$$

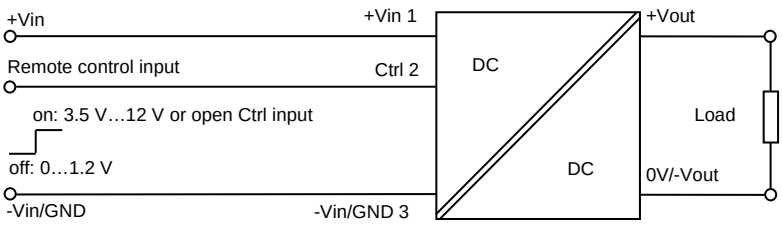
$$Rtdown = \frac{R1*b}{R1-b} - R3$$

Trim up resistor formula

$$a = \frac{Vref}{Vout-Vref} * R1$$

$$Rtup = \frac{R2*a}{R2-a} - R3$$

Application circuit for remote control function



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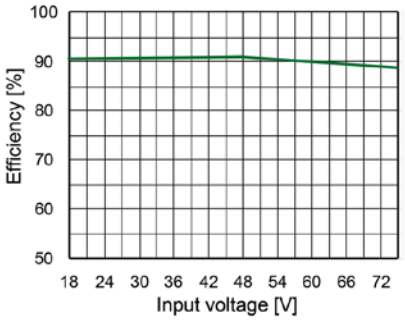
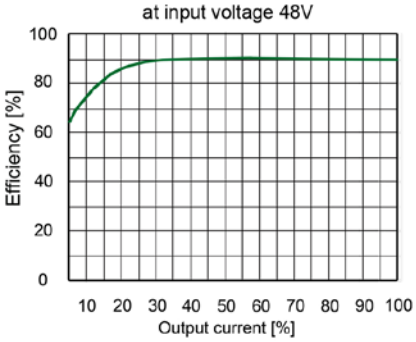
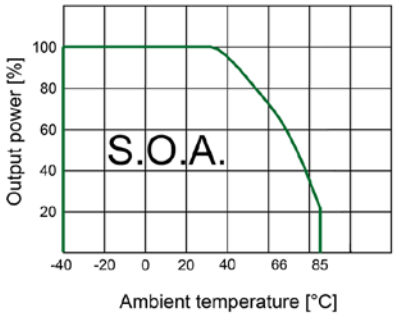
P150B4812S Efficiency vs input Voltage at full load



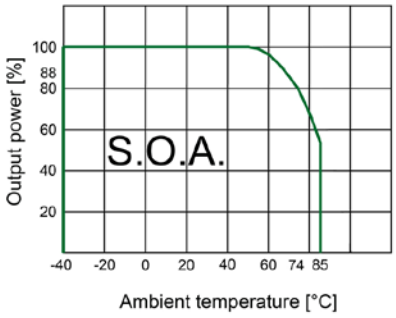
P150B4812S Efficiency vs output load at input voltage 48V



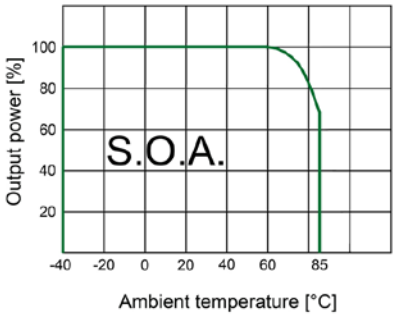
P150B4824S Temperature derating at 20 LFM (free air convection)



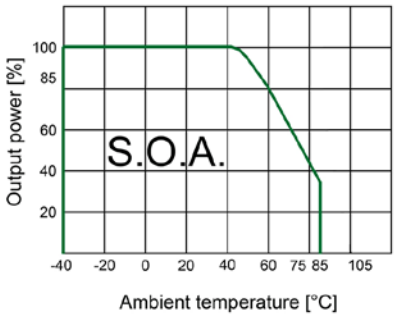
P150B4824S Temperature derating at air flow 200 LFM



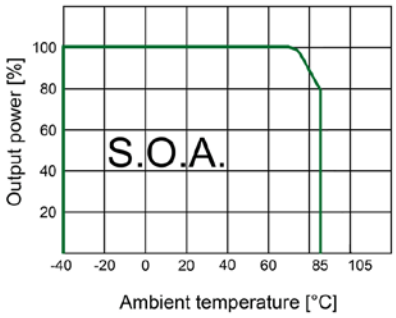
P150B4824S Temperature derating at air flow 400 LFM



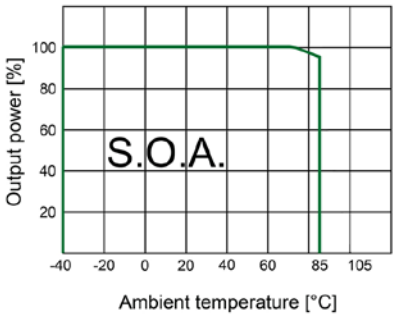
P150B4824SK Temperature derating at 20 LFM (free air convection)



P150B4824SK Temperature derating at air flow >200 LFM



P150B4824SK Temperature derating at air flow 400 LFM



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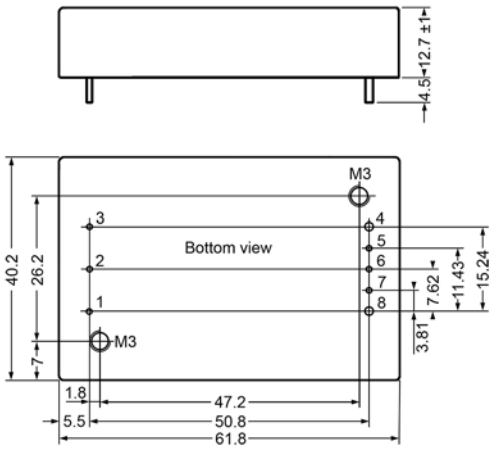
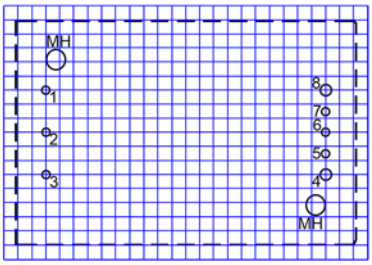
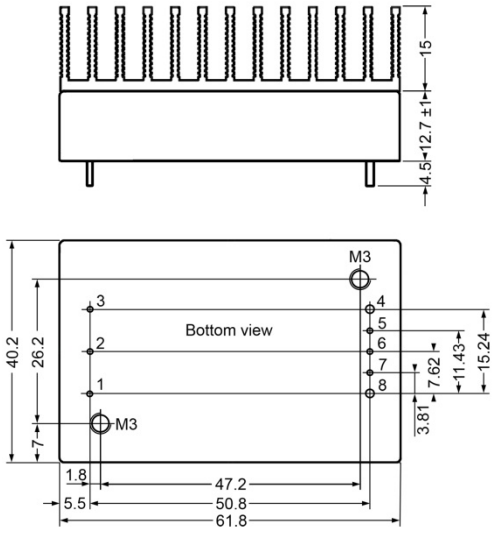
Mechanical dimensions standard version P150B48xxS





Note
All units in mm
Diameter pin 1, 2, 3, 5, 6, 7: 1 mm
Diameter pin 4, 8: 1.5 mm
Pin diameter tolerance: ± 0.1 mm
Pin height tolerance: ± 0.5 mm
General tolerances: ± 0.5 mm
Mounting hole (MH) diameter: 3.5 mm
Mounting thread hole: M3
Mounting torque: < 0.4 Nm

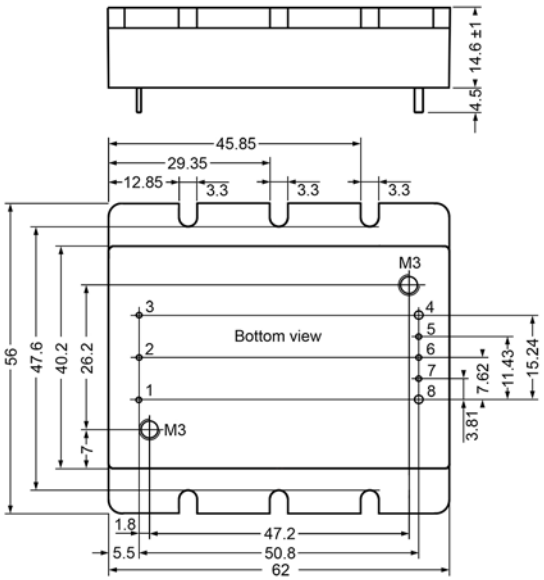
Mechanical dimensions heatsink version P150B48xxSK

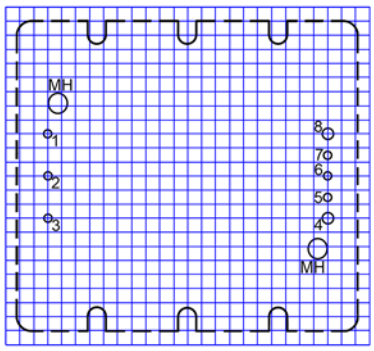


Pin Assignment	
Pin	Single
1	+ Vin
2	Rem. Ctrl.
3	- Vin/GND
4	0V/-Vout
5	- Sense
6	Trim
7	+ Sense
8	+ Vout

Note
All units in mm
Diameter pin 1, 2, 3, 5, 6, 7: 1 mm
Diameter pin 4, 8: ± 1.5 mm
Pin diameter tolerance: ± 0.1 mm
Pin height tolerance: ± 0.5 mm
General tolerances: ± 0.5 mm
Mounting thread hole: M3
Mounting torque: < 0.4 Nm

Mechanical dimensions half brick version with slotted base plate P150B48xxSHB





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