



PHI-CON

# 6 W DC-DC Converter P6F-Series

- Wide 4:1 input range
- 1500 V<sub>DC</sub> isolation
- Standard package 1" x 1"
- Continuous short circuit and over voltage protection
- -40...85 °C operating temperature range



## Model guide

Type	Input voltage		Input current		Output voltage [V <sub>DC</sub> ]	Output current		Efficiency @ full load		Capacitive load (Cout) (see note 3) [μF] max.
	nominal [V <sub>DC</sub> ]	Range [V <sub>DC</sub> ]	no load max. [mA]	full load max. [mA]		min. load [mA]	max. load [mA]	[%] min.	[%] typ.	
<b>Single Output</b>										
P6F243R3S	24	9...36	12	270	3.3	0	1500	77	79	1800
P6F2405S	24	9...36	12	310	5	0	1200	81	83	1000
P6F2409S	24	9...36	12	310	5	0	667	83	85	680
P6F2412S	24	9...36	12	310	12	0	500	85	87	470
P6F2415S	24	9...36	12	310	15	0	400	86	88	220
P6F2424S	24	9...36	12	310	24	0	250	86	88	100
P6F483R3S	48	18...75	8	135	3.3	0	1500	77	79	1800
P6F4805S	48	18...75	8	155	5	0	1200	81	83	1000
P6F4812S	48	18...75	8	155	12	0	500	85	87	470
P6F4815S	48	18...75	8	155	15	0	400	86	88	220
P6F4824S	48	18...75	8	155	24	0	250	86	88	100
<b>Dual Output</b>										
P6F2405D	24	9...36	12	310	±5	0	±600	81	83	2 x 470
P6F2412D	24	9...36	12	310	±12	0	±250	85	87	2 x 100
P6F2415D	24	9...36	12	310	±15	0	±200	86	88	2 x 100
P6F2424D	24	9...36	12	310	±24	0	±125	86	88	2 x 100
P6F4805D	48	18...75	8	155	±5	0	±600	81	83	2 x 470
P6F4812D	48	18...75	8	155	±12	0	±250	85	87	2 x 100
P6F4815D	48	18...75	8	155	±15	0	±200	86	88	2 x 100

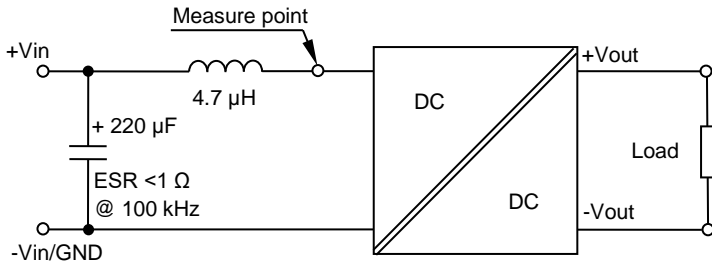
## Specifications

Input	
Start up voltage	P6F24xxx on @ ≤ 9 V <sub>D</sub> P6F48xxx on @ ≤ 18 V <sub>DC</sub>
Under voltage lockout	P6F24xxx off @ ≥ 5.5 V <sub>DC</sub> P6F48xxx off @ ≥ 12 V <sub>DC</sub>
Filter	π - type
Reflected ripple current	20 mAp-p, typ. (see figure 1)
<b>Isolation input - output:</b>	
Rated voltage (tested for 1 min.)	1500 V <sub>DC</sub> , at ≤ 1 mA
Resistance	> 10 <sup>9</sup> Ω, measured @ 500 V <sub>DC</sub>
Capacitance	1000 pF, typ.
Output	
Voltage tolerance	± 3 %, max., load range 0~100 %
Voltage load regulation	± 1.5 %, max. @ 5%...100 % load
Voltage cross balance (dual outputs)	± 1.5 %, max. @ balanced load
Voltage cross deviation (dual outputs)	± 5 %, max. @ 50 % load difference
Input voltage regulation	± 1 %, max @ full Vin range
Temperature coefficient	± 0.03 % / °C
Transient recovery time	≤ 500 μs, @ 25 % load steps
Transient response deviation @ 25 % load steps	≤ 8 %, @ P6Fxx3R3x, P6Fxx05x ≤ 5 % all others
Short circuit protection	Continuous, hiccup
Short circuit restart	Automatic
Over current protection	110 % of rated current, min. 190 % of rated current, max.
Rippel & noise, BW 20MHz	85 mVp-p, max. (see figure 2)
Over voltage protection	110...160 % of rated Vout

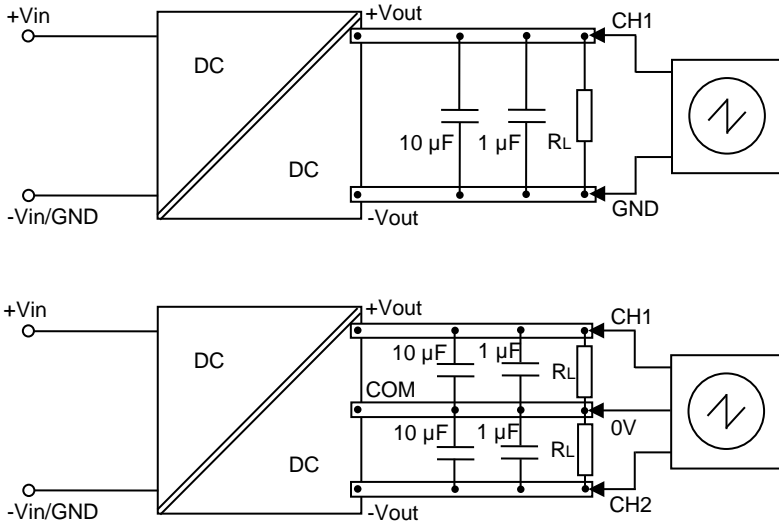
General	
Start up time	10 ms, typ @ R-load
Switching frequency	300 kHz, typ.
Reliability calculated MTBF MIL-HDBK-217F @ 25 °C	> 1 Mio. hours
EMC characteristics	
Radiated emissions	CISPR22 / EN55022 Class A
Radiated emissions, (with Fig. 4)	CISPR22 / EN55022 Class B
Conducted emissions	CISPR22 / EN55022 Class A
Conducted emissions, (with Fig. 4)	CISPR22 / EN55022 Class B
ESD, (with Fig. 2)	EN61000-4-2 Contact ± 4 kV perf. crit. B
RS	EN61000-4-3 10V/m perf. crit. A
EFT (with Fig. 4)	EN61000-4-4 ± 2 kV perf. crit. B
Surge (with Fig. 4)	EN61000-4-5 ± 2 kV perf. crit. B
CS	EN61000-4-6 3 Vrms perf. crit. A
Voltage dips, short interruptions and voltage variations immunity	EN61000-4-29 0.70 % perf. crit. B
Environmental	
Operating ambient temperature	-40 °C ... 85 °C with derating
Storage temperature	-55 °C ... 125 °C
Storage humidity	5...95 %, non condensing
Cooling	Free air convection
Vibration X-, Y- and Z-axis	10 G, 10..55 Hz, 30 minutes
Physical	
Dimensions	25.40 x 25.40 x 11.7 mm
Weight	14 g
Case material	Aluminium Alloy
Potting Material	Epoxy (UL94V-0 rated)
Absolute max. ratings	
Pin soldering temperature	300°C for 10s, 1.5mm body distance
Max. input voltage < 1 s	P6F24xxx -0.7...50 V <sub>DC</sub> P6F48xxx -0.7...100 V <sub>DC</sub>

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**Figure 1 Measure circuit input reflected ripple current**



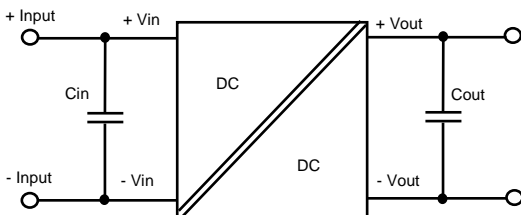
**Figure 2 Measure circuit output ripple & noise voltage**



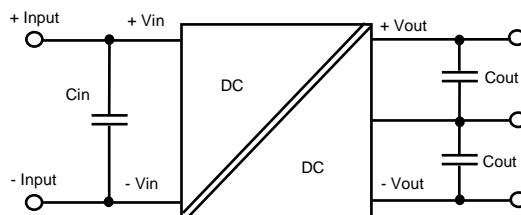
**Figures 3 Typical application circuit**

The P6F series is been tested according to the following recommended test circuit before leaving the factory (see Figures 3a & 3b). If you want to further decrease the input / 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).

**Figure 3a**



**Figure 3b**



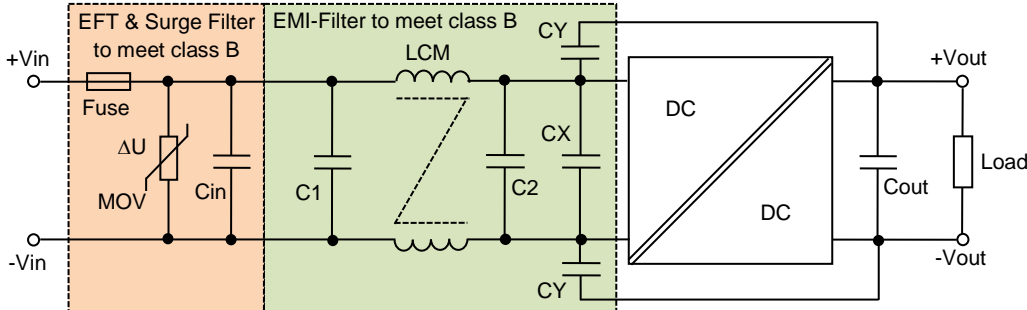
Recommended peripheral components to figure 3a & 3b		
	Cin	Cout
P6F24xxx	100 µF, 50 V	10 µF
P6F48xxx	10...47 µF, 100 V	10 µF

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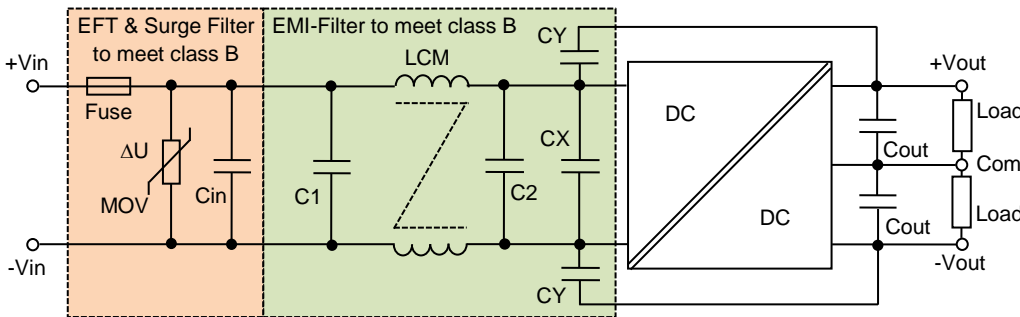
Figures 4a & b

EFT and Surge Filter to meet IEC/EN61000-4-4 Class B and IEC/EN61000-4-5 Class B  
EMI-Filter to meet conducted- and radiated- emission EN55022-, CISPR22- Class B

Single output application



Dual output application

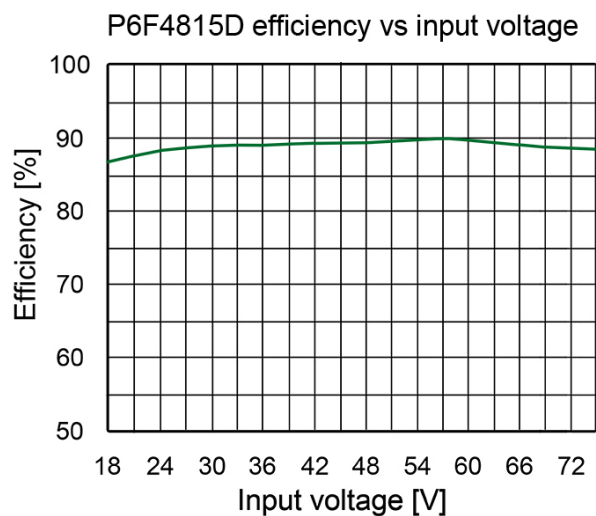
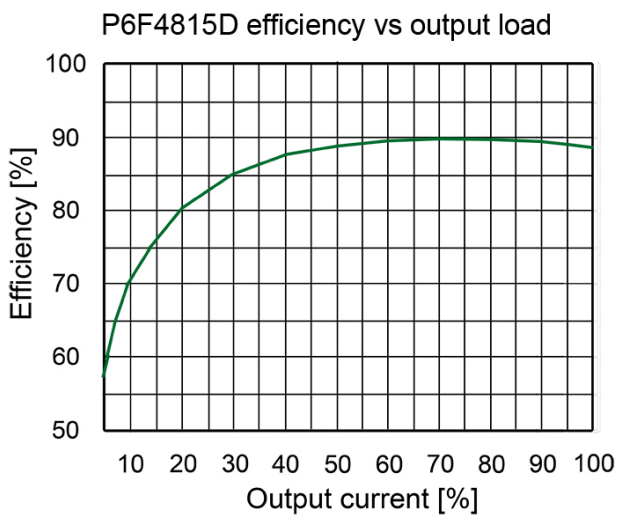
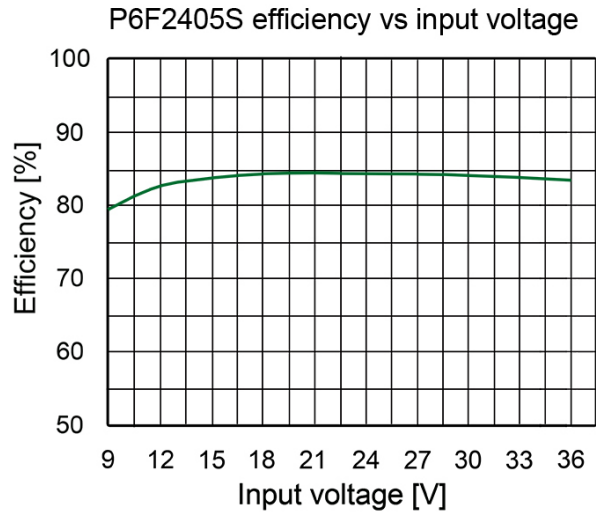
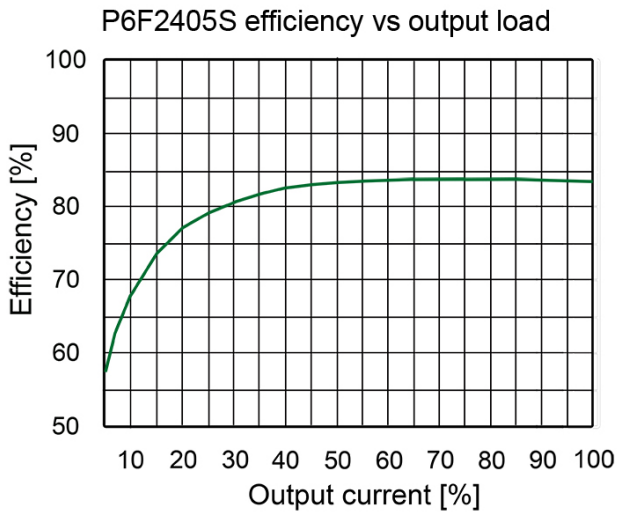
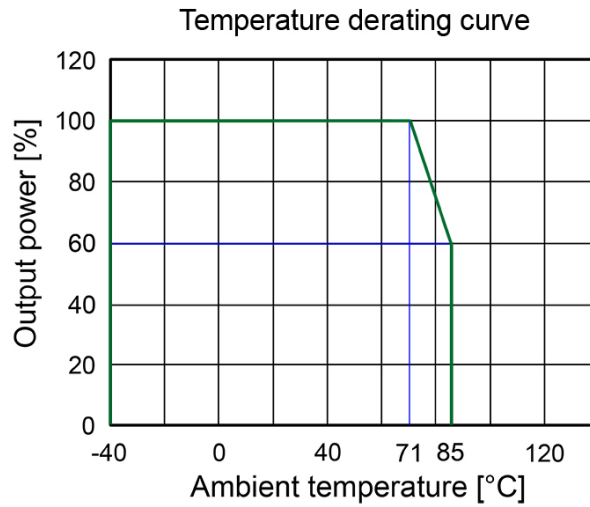


Recommended peripheral components to circuits in figures 4 a & b									
Type	Fuse Time delay type	MOV Type	LCM	Cin	C1	C2	CY	CX	Cout
P6F24xxS	2 A	S20K30	4.7 mH	680 $\mu$ F, 50 V	1 $\mu$ F, 50 V	330 $\mu$ F, 50 V	1 nF, 2 kV	4.7 $\mu$ F, 50 V	See model guide table
P6F24xxD	2 A	S20K30	4.7 mH	680 $\mu$ F, 50 V	1 $\mu$ F, 50 V	330 $\mu$ F, 50 V	1 nF, 2 kV	4.7 $\mu$ F, 50 V	
P6F48xxS	1 A	S14K60	4.7 mH	680 $\mu$ F, 100 V	1 $\mu$ F, 100 V	330 $\mu$ F, 100 V	1 nF, 2 kV	4.7 $\mu$ F, 100 V	
P6F48xxD	1 A	S14K60	4.7 mH	680 $\mu$ F, 100 V	1 $\mu$ F, 100 V	330 $\mu$ F, 100 V	1 nF, 2 kV	4.7 $\mu$ F, 100 V	

Note:

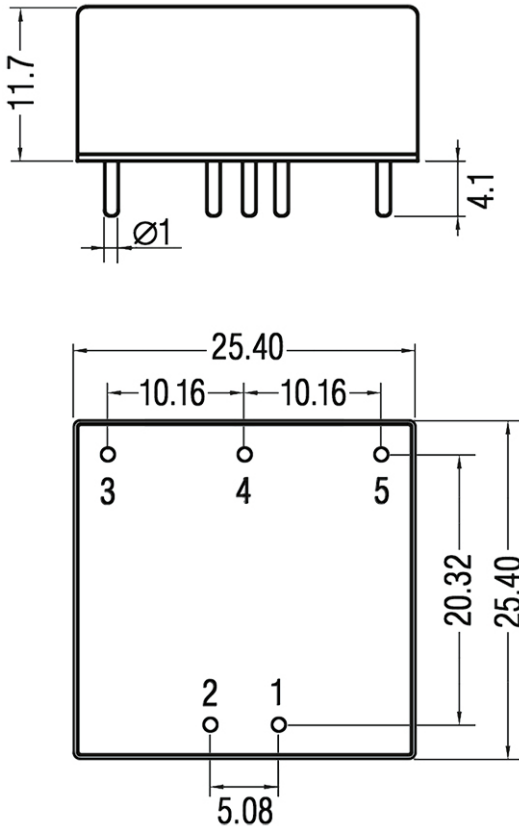
1. Min. load should not be less than 5 %, otherwise ripple maybe increased dramatically, If the product operates under min. load, it may not be guaranteed to meet all specifications listed. Operation under minimum load will not damage the converter.
2. The recommended unbalanced load of dual output converter should be  $\leq 5\%$ . At load asymmetry  $\geq 5\%$ , it may not be guaranteed to meet all specifications listed.
3. Maximum capacitive load is tested at input voltage range and full load.
4. All specifications measured at Ta 25 °C, humidity < 75 %, nominal input voltage and rated output load unless otherwise specified.
5. It is not recommended to increase the output power capability by connecting two or more converters in parallel.
6. The converters are not hot swappable

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## Dimensions



Pin assignment		
Pin	Single	Dual
1	- Vin	- Vin
2	+ Vin	+ Vin
3	+ Vout	+ Vout
4	No pin	Common
5	- Vout	- Vout

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

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