



PHI-CON

6 W DC-DC Converter P6SxxxxCx-Series

- DIL 24 plastic package
- Wide 4:1 input range
- Efficiency up to 88 %
- 3000 V_{DC} isolation
- Continuous short circuit protection
- Input under- & Output over voltage protection
- -40...+85 °C operating temperature range



Model guide

Type	Input voltage		Input current		Output voltage [V _{DC}]	Output current		Efficiency @ full load [%] typ.	Capacitive load (see Note 2) [μF] max.
	Nominal [V _{DC}]	Range [V _{DC}]	no load [mA] max.	full load [mA] max.		minimum load [mA] typ.	maximum load [mA] typ.		
Single output									
P6S243R3CS	24	9...36	16	330	3.3	0	1500	78	2200
P6S2405CS	24	9...36	16	320	5	0	1200	81	2200
P6S2409CS	24	9...36	16	320	9	0	667	84	1000
P6S2412CS	24	9...36	16	320	12	0	500	84	680
P6S2415CS	24	9...36	16	320	15	0	400	86	680
P6S2424CS	24	9...36	16	320	24	0	250	86	680
P6S483R3CS	48	18...75	7	162	3.3	0	1500	79	2200
P6S4805CS	48	18...75	7	155	5	0	1200	83	2200
P6S4812CS	48	18...75	7	155	12	0	500	87	680
P6S4815CS	48	18...75	7	155	15	0	400	88	680
P6S4824CS	48	18...75	7	155	24	0	250	87	680
Dual output									
P6S2405CD	24	9...36	16	320	±5	0	±600	80	2 x 680
P6S2412CD	24	9...36	16	320	±12	0	±250	83	2 x 330
P6S2415CD	24	9...36	16	320	±15	0	±200	84	2 x 220

Specifications

Input	
Under voltage protection	Vin type Start up Lockout P6S24xxCx 9 V _{DC} 5.5 V _{DC} P6S48xxCx 18 V _{DC} 12 V _{DC}
Filter	π - type
Reflected ripple current	20 mA, typ. (see Figure 1)
Start up time	10 ms, typ @ constant R-load
Rated isolation voltage	
Input / output, 1 Minute test, ≤ 1 mA	≥ 3000 V _{DC}
Resistance	≥ 10 ⁹ Ω, measured @ 500 V _{DC}
Input / output capacitance	1 nF, typ. @ 100 kHz, 0.1V
Output	
Voltage tolerance	P6SxxxxCS ≤ ± 3 % @ 0...100 % load range P6SxxxxCD ≤ ± 3 % @ 5...100 % load range ≤ ± 5 % @ 0...5 % load range
Line regulation	≤ ± 1 % @ full Vin range
Load regulation	≤ ± 1.5 % @ 5...100 % load range
Output voltage balance	≤ ± 1.5 % @ balanced load
Dual output cross regulation	≤ ± 5 % @ one output 50 % load and the other output 10...100 % load
Temperature coefficient	≤ ± 0.03 % / °C
Transient recovery time	≤ 0.5ms @ 25% load change steps
Transient response deviation	≤ 5 % @ 25 % load change steps
Short circuit protection	Continuous, hiccup, auto restart
Ripple & noise, BW 20 MHz	≤ 120 mVp-p (see Figure 2)
Over current protection	P6Sxx24CS 110...270 % of full load All others 110...190 % of full load
Over voltage protection	110...160 % of nominal Vout
General	
Reliability calculated MTBF	> 1 Mio. h
MIL-HDBK-217F @ 25 °C	

Safety standard		EN-, IEC-, UL 60950-1 Designed to meet EN 62368-1
Switching frequency		300 kHz, typ. @ 50...100 % load
EMC characteristics		
RE	EN 55032, CISPR 32	Class A (without external Filter) Class B (see Figure 4)
CE	EN 55032, CISPR 32	Class A (without external Filter) Class B (see Figure 4)
ESD	EN 61000-4-2	contact ± 4 kV perf. crit. B (see Figure 4)
RS	EN 61000-4-3	10 V/m perf. crit. A
EFT	EN 61000-4-4	±2 kV perf. crit. B (see Figure 4)
Surge	EN 61000-4-5	±2 kV perf. crit. B (see Figure 4)
CS	EN 61000-4-6	3 Vrms perf. crit. A
Voltage dips, short interruptions and voltage variations immunity		EN 61000-4-29 0-70 % perf. crit. B
Environmental		
Operating ambient temperature		-40 ... 85 °C with derating
Storage temperature		-55 ... 125 °C
Storage humidity		5...95 %, non condensing
Cooling		Free air convection, ≥ 35 LFM
Vibration test duration 30 Min.		10...55 Hz, X, Y & Z axis, 2 g,
Physical		
Dimensions		20.3 x 31.6 x 10.2 mm
Weight		13 g
Case material		Plastic (UL94V-0 rated)
Absolute maximum ratings		
Pin soldering temperature		≤ 300 °C duration ≤ 10 s ≥ 1.5 mm distance from body
Max. input surge voltage < 1 s		P6S24xxCx: -0.7...50 V _{DC} P6S48xxCx: -0.7...100 V _{DC}

Ordering information

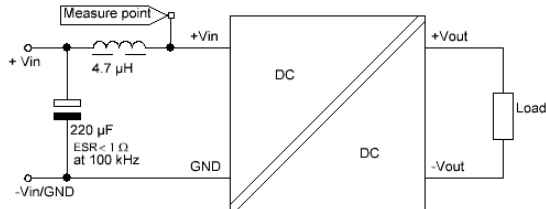
Brand	Output power	Series designation	Input voltage range	Output voltage	Revision	Output configuration					
P	PHI-CON	6	6 W	S	24	9...36 V	3R3	3.3 V	C	S	single output
					48	18...75 V	05	5 V		D	± dual output
							09	9 V			
							12	12 V			
							15	15 V			
							24	24 V			
Example:	P6S2405CS		Pout: 6 W, Vin: 24 V, Vout: 5 V, Single Output								

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Notes:

1. All specifications measured at Ta 25 °C, humidity < 75 %, nominal input voltage and rated output load unless otherwise specified.
2. Maximum capacitive load is tested at input voltage range and full load.
3. Specifications of this product are subject to changes without prior notice.
4. It is not recommended to increase the output power capability by connecting two or more converters in parallel.
5. For efficiency reasons, the converters reduce the switching frequency when the load is below 50%.
6. The converters are not hot swappable.
7. Not usable for IGBT high side driver applications.

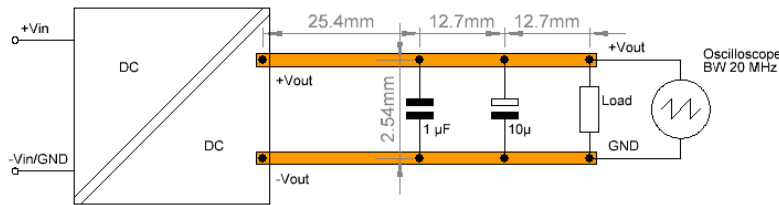
Figure 1 Input reflected ripple current measure circuit



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

Figure 2 Output ripple & noise parallel strip line measurement method, BW 20 MHz

Single output



Dual output

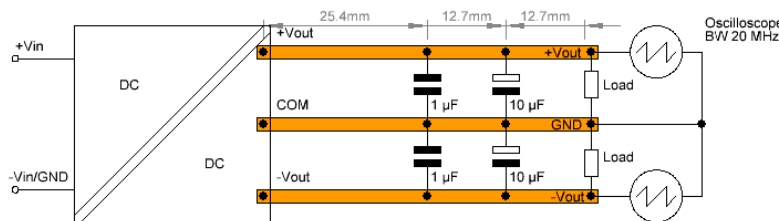
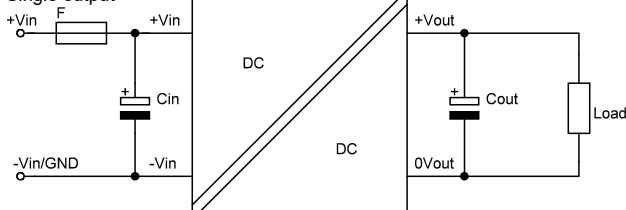


Figure 3 Typical application circuits

Single output



Dual output

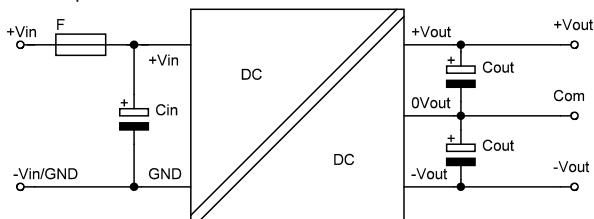


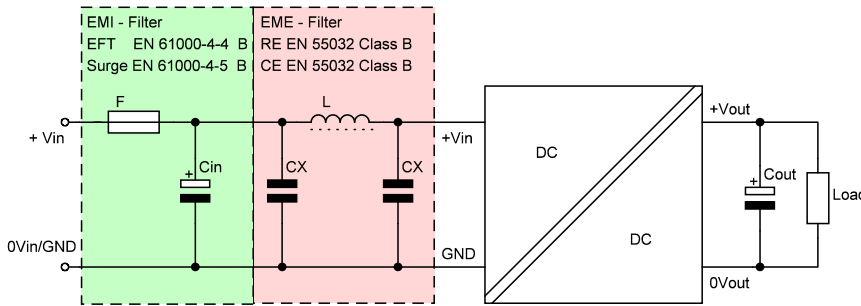
Table A Recommended peripheral components			
Type (Vin)	Cin	Type (Vout)	Cout
P6S24xxCx	100 µF, 50 V	P6Sxx3R3CS	10 µF, 16V
P6S48xxCx	47 µF, 100 V	P6Sxx05CS	10 µF, 16V
		P6Sxx09CS	10 µF, 16V
		P6Sxx12CS	10 µF, 25V
		P6Sxx15CS	10 µF, 25V
		P6Sxx24CS	10 µF, 50V
		P6S2405CD	2 x 10 µF
		P6S2412CD	2 x 10 µF
		P6S2415CD	2 x 10 µF

The P6SxxxxCx series is tested according to the following recommended test circuit before leaving the factory (see Figure 3). If you want to further decrease the input and output ripple, you can increase 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 right column)

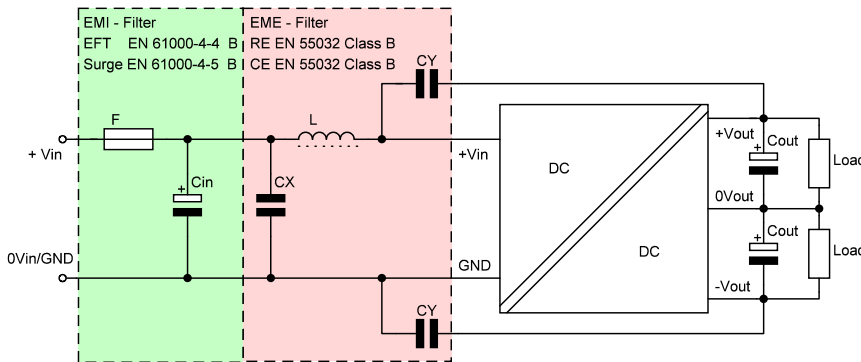
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Figure 4 Recommended EMC circuit for higher performance of EN 61000-4-4, EN 61000-4-5 and EN 55032 Class B for single output modules

Single output

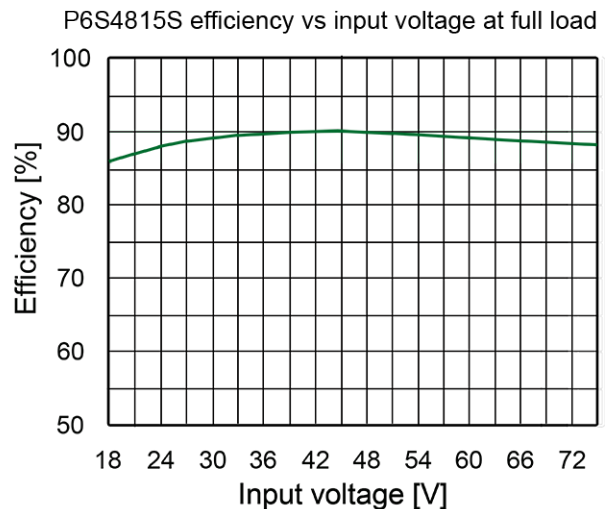
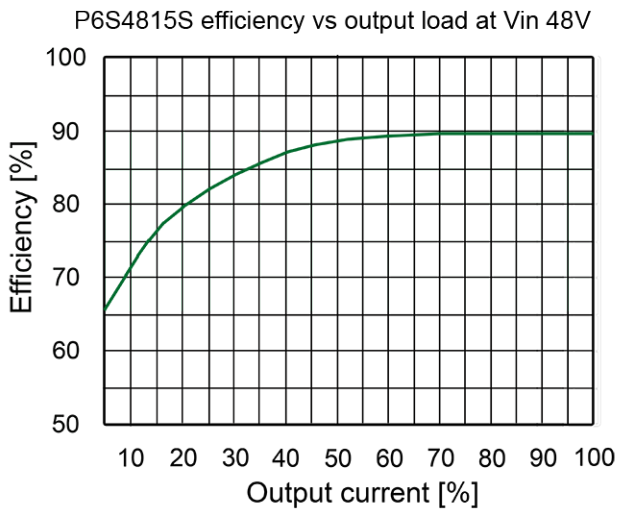
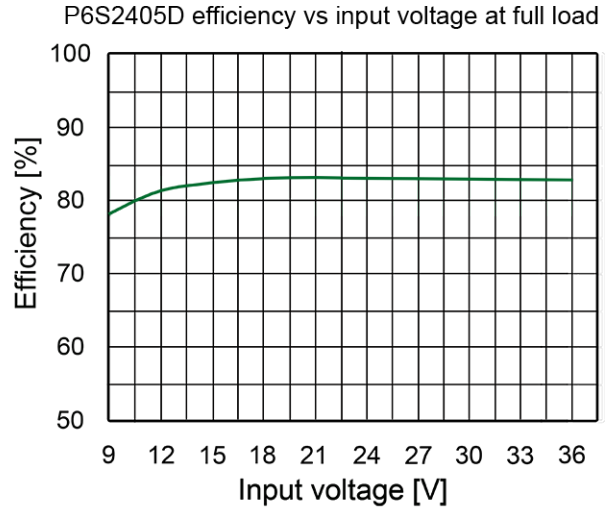
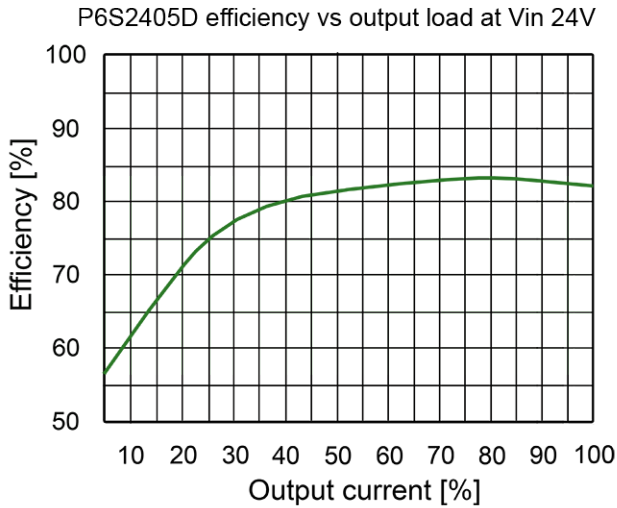
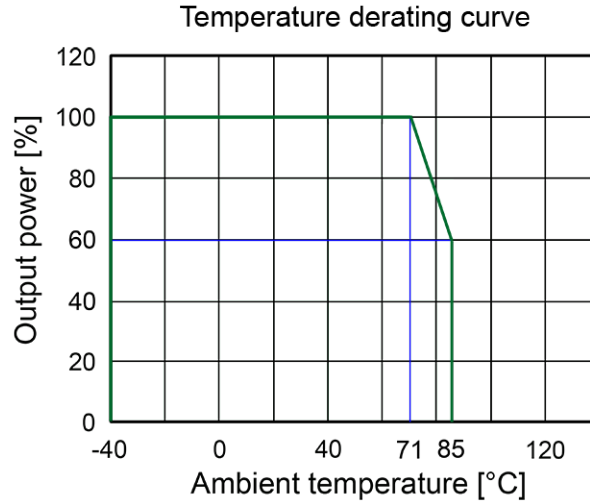


Dual output



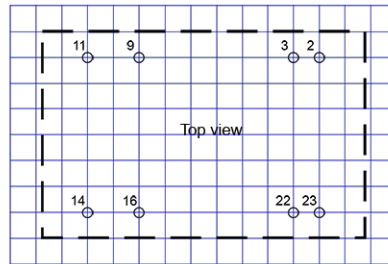
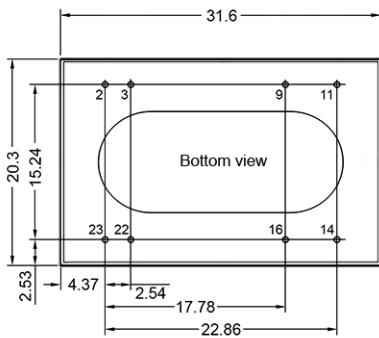
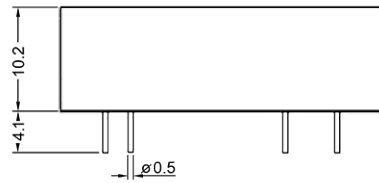
Recommended peripheral components to for figure 4, single output version							
Type	Fuse time delayed type	Cin	Cx	LCM	L	CY	Cout
P6S243R3CS	1 A	1000 µF, 50V	2.2 µF, 50 V	2.2 mH	-	-	10 µF, 16V
P6S2405CS	1 A	1000 µF, 50V	2.2 µF, 50 V	2.2 mH	-	-	10 µF, 16V
P6S2409CS	1 A	1000 µF, 50V	2.2 µF, 50 V	2.2 mH	-	-	10 µF, 16V
P6S2412CS	1 A	1000 µF, 50V	2.2 µF, 50 V	2.2 mH	-	-	10 µF, 25V
P6S2415CS	1 A	1000 µF, 50V	2.2 µF, 50 V	2.2 mH	-	-	10 µF, 25V
P6S2424CS	1 A	1000 µF, 50V	2.2 µF, 50 V	2.2 mH	-	-	10 µF, 50V
P6S483R3CS	0.5 A	680 µF, 1000V	2.2 µF, 100 V	2.2 mH	-	-	10 µF, 16V
P6S4805CS	0.5 A	680 µF, 1000V	2.2 µF, 100 V	2.2 mH	-	-	10 µF, 16V
P6S4809CS	0.5 A	680 µF, 1000V	2.2 µF, 100 V	2.2 mH	-	-	10 µF, 16V
P6S4812CS	0.5 A	680 µF, 1000V	2.2 µF, 100 V	2.2 mH	-	-	10 µF, 25V
P6S4815CS	0.5 A	680 µF, 1000V	2.2 µF, 100 V	2.2 mH	-	-	10 µF, 25V
P6S4824CS	0.5 A	680 µF, 1000V	2.2 µF, 100 V	2.2 mH	-	-	10 µF, 50V
P6S2405CD	1 A	1000 µF, 50V	1 µF, 50 V	-	4.7 µH	1 nF, 5 kV	10 µF, 16V
P6S2412CD	1 A	1000 µF, 50V	1 µF, 50 V	-	4.7 µH	1 nF, 5 kV	10 µF, 25V
P6S2415CD	1 A	1000 µF, 50V	1 µF, 50 V	-	4.7 µH	1 nF, 5 kV	10 µF, 25V

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Mechanical dimensions



Pin assignment		
	single	dual
2	GND	GND
3	GND	GND
9	No pin	0Vout
11	NC	-Vout
14	+Vout	+Vout
16	0Vout	0Vout
22	+Vin	+Vin
23	+Vin	+Vin

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

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