



PHI-CON

# 20 W DC-DC Converter P20HxxxxCx-Series

- Wide 4:1 input range
- Efficiency up to 90 %
- Adjustable output voltage
- Remote control on / off
- 1500 V<sub>DC</sub> isolation
- Continuous short circuit protection
- Over voltage protection
- Standard package 2" x 1" x 0.4"



## Model guide

Type	Input voltage		Input current		Output voltage [V <sub>DC</sub> ]	Output current		Efficiency @ full load [%] typ.	Capacitive load (see note 2) [μF] max.
	Nominal [V <sub>DC</sub> ]	Range [V <sub>DC</sub> ]	no load [mA]	full load [mA]		Min. [mA]	Max. [mA]		
P20H243R3CS	24	9...36	40	800	3.3	0	5000	86	10000
P20H2405CS	24	9...36	60	916	5	0	4000	90	10000
P20H2409CS	24	9...36	18	947	9	0	2222	88	4700
P20H2412CS	24	9...36	15	937	12	0	1667	89	1600
P20H2415CS	24	9...36	15	926	15	0	1333	90	1000
P20H2424CS	24	9...36	20	927	24	0	834	90	500
P20H483R3CS	48	18...75	35	400	3.3	0	5000	86	10000
P20H4805CS	48	18...75	35	463	5	0	4000	90	10000
P20H4812CS	48	18...75	10	468	12	0	1667	89	1600
P20H4815CS	48	18...75	10	463	15	0	1333	90	1000
P20H4824CS	48	18...75	10	463	24	0	834	90	500
P20H2405CD	24	9...36	20	969	±5	0	±2000	86	2 x 4800
P20H2409CD	24	9...36	20	969	±9	0	±1111	88	2 x 1000
P20H2412CD	24	9...36	15	948	±12	0	±834	88	2 x 800
P20H2415CD	24	9...36	15	947	±15	0	±667	88	2 x 625
P20H4805CD	48	18...75	18	485	±5	0	±2000	86	2 x 4800
P20H4812CD	48	18...75	14	474	±12	0	±834	88	2 x 800
P20H4815CD	48	18...75	14	468	±15	0	±667	89	2 x 625

With suffix "K" heatsink version

## Specifications

Input		
Start up voltage	P20H24xxCx: ≤9 V <sub>DC</sub> P20H48xxCx: ≤18 V <sub>DC</sub>	
Under voltage lockout	P20H24xxCx: ≥5.5 V <sub>DC</sub> P20H48xxCx: ≥14 V <sub>DC</sub>	
Filter	π – type	
Reflected ripple current	30 mA <sub>p-p</sub> , typ. (see figure 2)	
Remote control threshold	On state	3.5...12 V <sub>DC</sub> , or open input
	Off state	0...1.2 V <sub>DC</sub>
Input idle current @ Off state	4 mA, typ., <7 mA	
Isolation input - output:		
Rated voltage (tested 60 s @ ≤1 mA leakage current)	1500 V <sub>DC</sub>	
Resistance	> 10 <sup>9</sup> Ω, measured @ 500 V <sub>DC</sub>	
Input / output capacitance	All others	1000 pF, typ. @ 100 kHz, 0.1 V
	P20C2424CS	2000 pF, typ. @ 100 kHz, 0.1 V
Output		
Output voltage tolerance	≤ ±3 % @ 0...100 % load range	
Output voltage load regulation	≤ ±1 % deviation, 5...100 % load	
Output voltage trim range	± 10 %, typ.	
Dual output voltage cross balance	≤ ±5 %, @ 90 % load difference	
Output voltage Vin regulation	≤ ±1 % 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	P20Hxx3R3Cx, P20Hxx05Cx: <8 % All others: <5 %	
Over voltage protection via integrated Z-Diode	110...160 %	
Over current protection	110...190 %	
Short circuit protection	Continuous, hiccup	
Short circuit restart	Automatic	
Rippel & noise, BW 20 MHz	≤100 mV <sub>p-p</sub> @ 5...100 % load range (see fig. 3)	
Start up time	10 ms, typ @ R-load	

General		
Safety standard	IEC-, UL-, EN60950-1	
Switching frequency (PWM)	270 kHz, typ.	
Reliability calculated MTBF	> 1 Mio. h	
MIL-HDBK-217F @ 25 °C		
Vibration along X, Y and Z axis	10...55 Hz, 10 g, 30 minutes	
EMC characteristics		
Radiated emissions (see fig. 1)	CISPR22 / EN55022 Class A	
Conducted emissions (see fig.1)	CISPR22 / EN55022 Class A	
Radiated emissions (see fig. 4)	CISPR22 / EN55022 Class B	
Conducted emissions, (see fig. 4)	CISPR22 / EN55022 Class B	
ESD, contact ±4 kV (see fig. 4)	IEC-, EN61000-4-2 perf. crit. B	
RS, 10 V/m	IEC-, EN61000-4-3 perf. crit. A	
EFT, ±2 kV, (see fig. 4)	IEC-, EN61000-4-4 perf. crit. B	
Surge, line to line ±2 kV (see fig. 4)	IEC-, EN61000-4-5 perf. crit. B	
Conducted surge 3 Vrms	IEC-, EN61000-4-6 perf. crit. A	
Voltage dips, short interruptions and voltage variations immunity, 0...70 %	IEC-, EN61000-4-29 perf. crit. B	
Environmental		
Operating ambient temperature	-40 ... 85 °C with derating	
Case temperature	105 °C, max.	
Storage temperature	-55 ... 125 °C	
Over temp. protection	Case temp. 110 °C, typ	
Storage humidity	5...95 %, non condensing	
Cooling	Free air convection	
Physical		
Dimensions	without heatsink	50.80 x 25.40 x 11.8 mm
	with heatsink	50.80 x 25.40 x 16.3 mm
Weight	without heatsink	26 g
	with heatsink	34 g
Case material	Aluminium alloy	
Potting Material	Epoxy (UL94V-0 rated)	
Absolute max. ratings		
Pin soldering temperature	≤300 °C for ≤10 sec, ≥ 1.5 mm distance from body	
Max. input voltage < 1 sec	P20H24xxCx	-0.7...50 V <sub>DC</sub>
	P20H48xxCx	-0.7...100 V <sub>DC</sub>

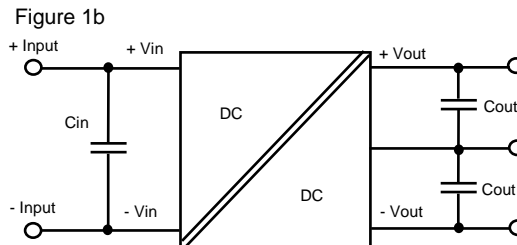
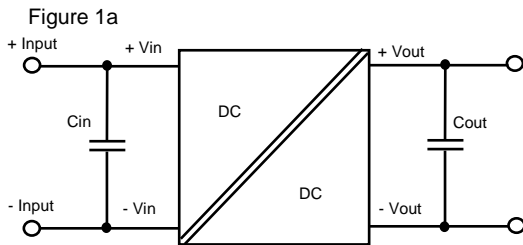
# 20 W DC-DC Converter P20HxxxxCx-Series

**Note:**

1. The recommended unbalanced load of dual output converter should be low than 5 %. If the load asymmetry greater than 5 %, it may not be guaranteed to meet all specifications listed. Please contact our technical support for more details.
2. Maximum capacitive load is tested at full input voltage range and full load current.
3. All specifications measured at Ta 25 °C, humidity < 75 %, nominal input voltage and rated output load current unless otherwise specified.
4. Specifications of this product are subject to changes without prior notice.
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

**1) Recommended circuit**

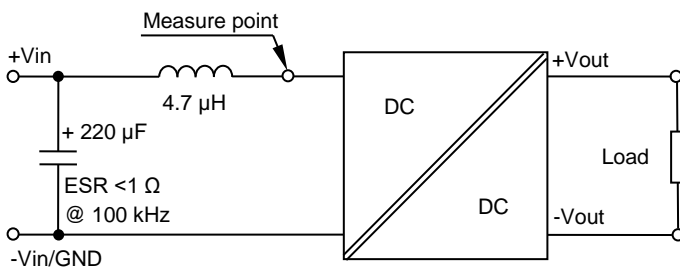
The P20H series is been tested according to the following recommended test circuit before leaving the factory (see Figures 1). If you want to further decrease the input / output ripple, you can increase a capacitance values properly or choose capacitors with low ESR, but the total capacitance of the filter capacitor must not exceed the maximum load capacitance value (see „Model guide“ table).



Recommended peripheral components to figure 1a		
	Cin	Cout
P20Hxx3R3CS	100 µF	470 µF
P20Hxx05CS		470 µF
P20Hxx09CS		220 µF
P20Hxx12CS		220 µF
P20Hxx15CS		220 µF
P20Hxx24CS		100 µF

Recommended peripheral components to figure 1b		
	Cin	Cout
P20Hxx05CD	100 µF	220 µF
P20Hxx09CD		220 µF
P20Hxx12CD		100 µF
P20Hxx15CD		100 µF

**Figure 2 Measure circuit input reflected ripple current**



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

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Figure 3 Measure circuit input reflected ripple

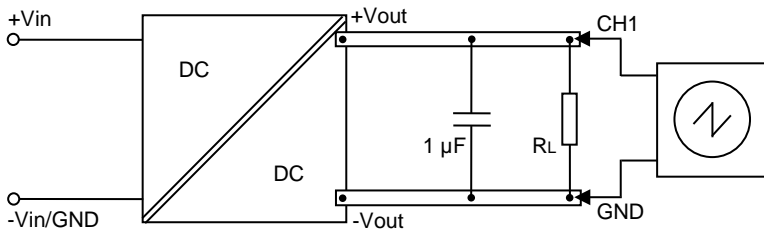
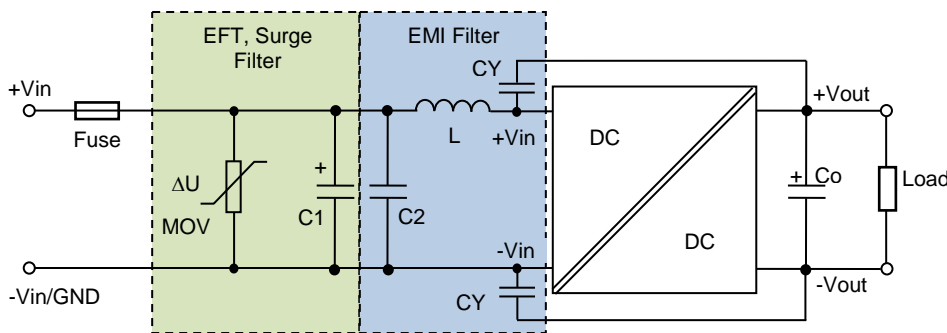
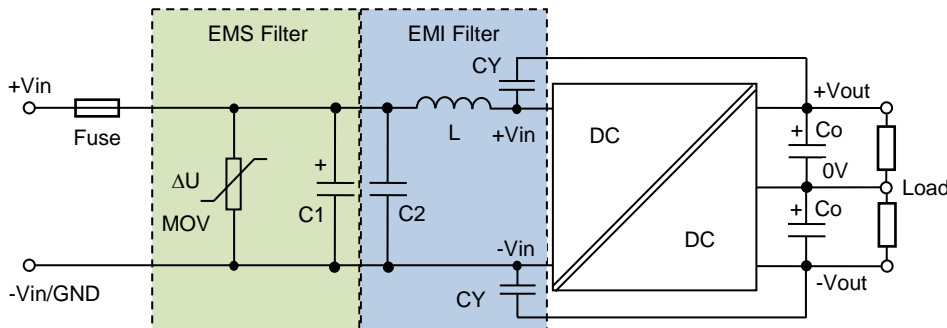


Figure 4, EMC filter circuit for IEC/EN61000-4-4, IEC/EN61000-4-5 performance criteria B and EN55022 Class B Single output



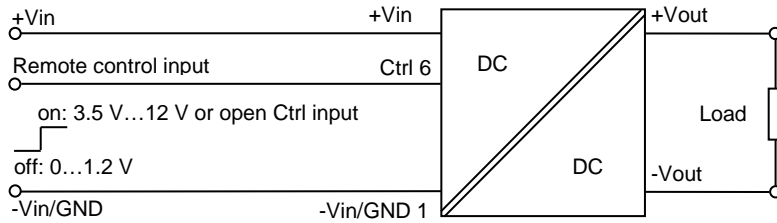
Dual output



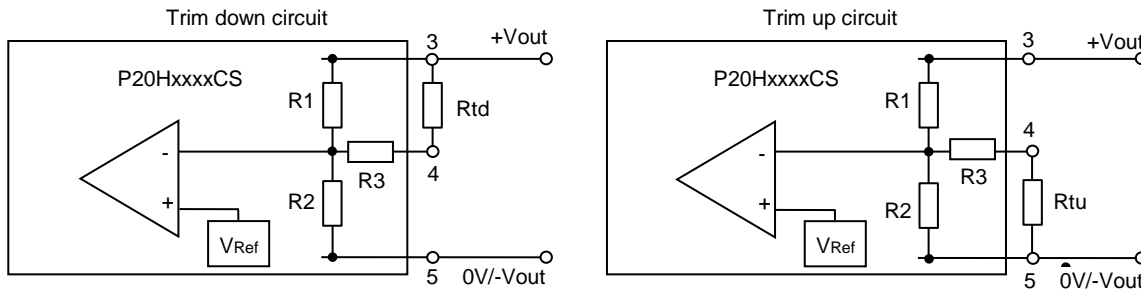
Recommended peripheral components to circuits in figures 4						
Type	Fuse Slow blow	MOV Type	L	C1	C2	CY
P20H24xxCS	2.5 A	S20K30	4.7 µH	330 µF, 50 V	1 µF, 50 V	1 nF, 2 kV
P20H24xxCD	2.5 A	S20K30	4.7 µH	330 µF, 50 V	1 µF, 50 V	1 nF, 2 kV
P20H48xxCS	1.5 A	S14k60	4.7 µH	330 µF; 100 V	1 µF, 100 V	1 nF, 2 kV
P20H48xxCD	1.5 A	S14k60	4.7 µH	330 µF, 100 V	1 µF, 100 V	1 nF, 2 kV

# 20 W DC-DC Converter P20HxxxxCx-Series

## Application circuit for remote control function



## Application circuit for trimming function. Only for single output converter.



## Calculation for trim down resistor (Rtd) or trim up resistor (Rtu)

Model series	R1 [kΩ]	R2 [kΩ]	R3 [kΩ]	V Ref [V]	Rtd min. [kΩ]	Rtu min. [kΩ]
P20Hxx3R3CS	4.801	2.87	12.4	1.24	11.75	6.43
P20Hxx05CS	2.883	2.87	10	2.5	1.28	4.75
P20Hxx09CS	7.5	2.87	15	2.5	30	6.63
P20Hxx12CS	11	2.87	15	2.5	56.2	9.6
P20Hxx15CS	14.494	2.87	15	2.5	83	11.36
P20Hxx24CS	24.872	2.87	17.8	2.5	167	10

Maximum output voltage adjust range ± 10 % of Vout nominal, see min. Rtd / Rtu

### Trim down resistor formula

$$b = \frac{V_{out} - V_{ref}}{V_{ref}} \cdot R2$$

$$R_{td} = \frac{R1 \cdot b}{R1 - b} - R3$$

### Trim up resistor formula

$$a = \frac{V_{ref}}{V_{out} - V_{ref}} \cdot R1$$

$$R_{tu} = \frac{R2 \cdot a}{R2 - a} - R3$$

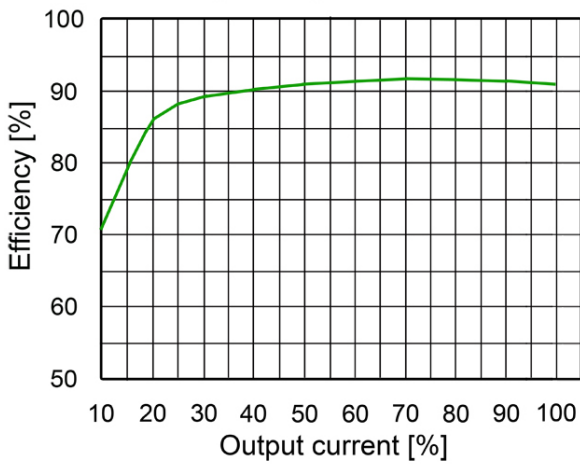


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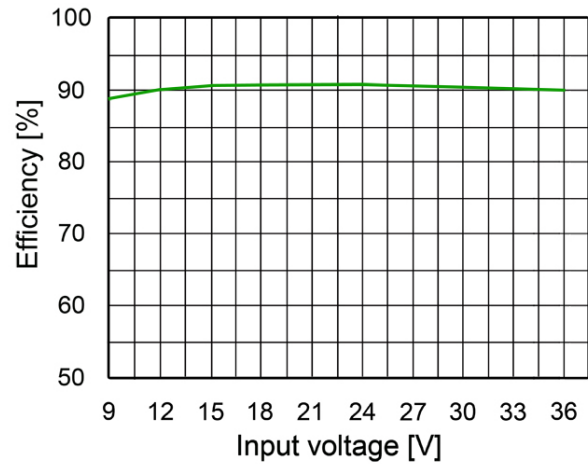
P20H2405CS

Efficiency vs output load at Vin 24 V



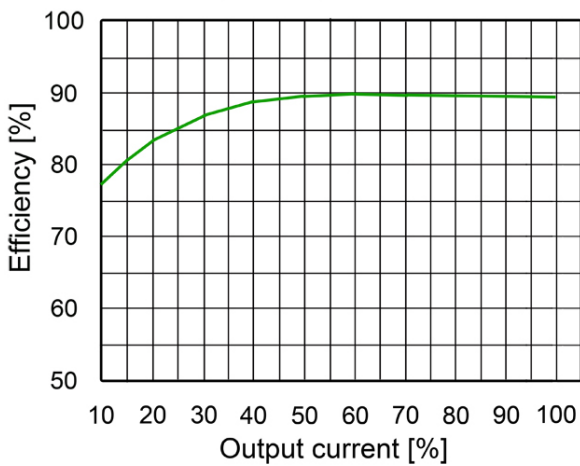
P20H2405CS

Efficiency vs input voltage at full load



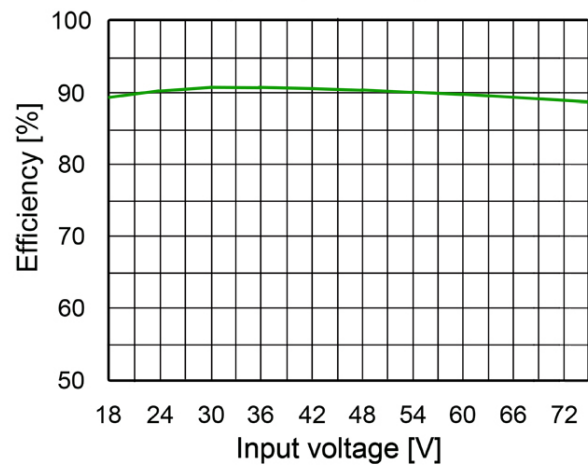
P20H4815CD

Efficiency vs output load at Vin 48 V

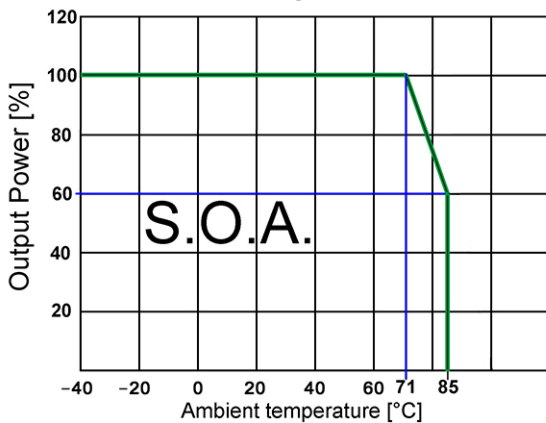


P20H4815CD

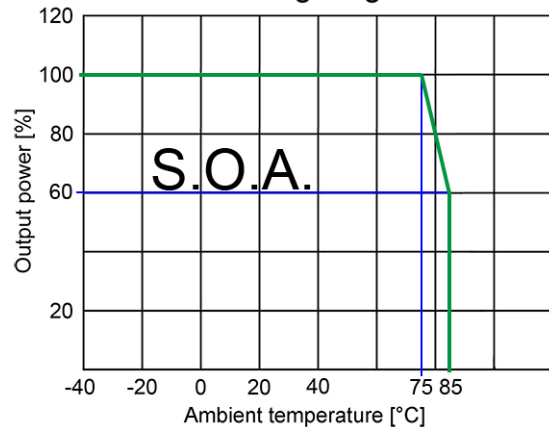
Efficiency vs input voltage at full load



Without heatsink  
Derating Curve

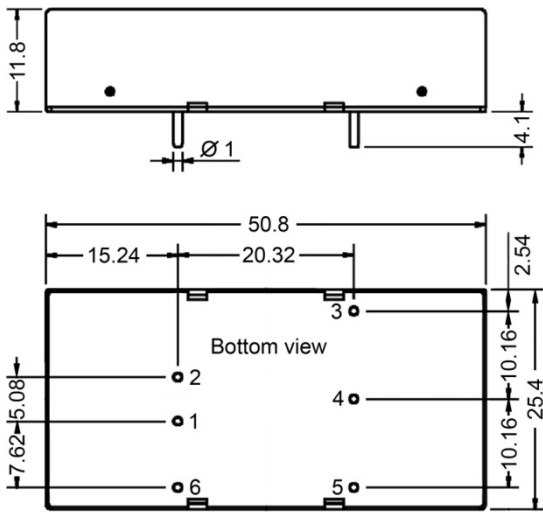


With heatsink  
Derating diagram



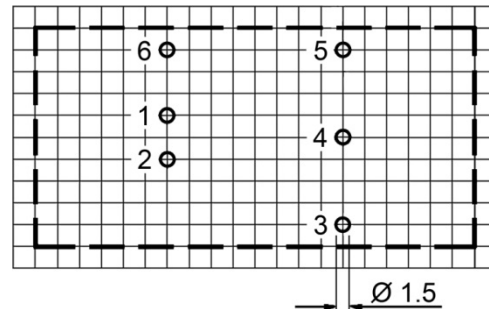
# 20 W DC-DC Converter P20HxxxxCx-Series

## Dimensions standard version

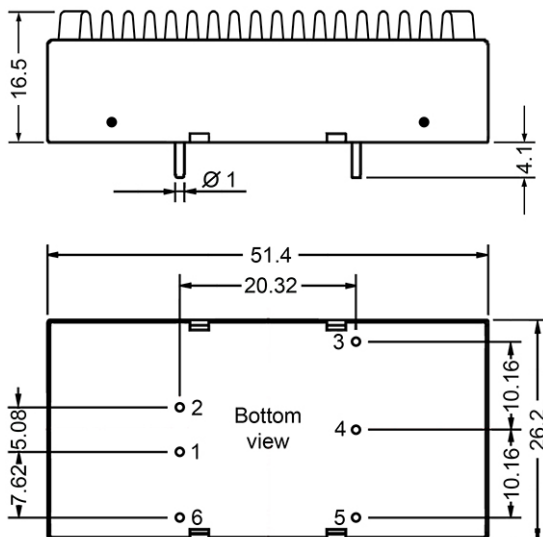


Unit: mm  
 Pin diameter tolerance: 0.1 mm  
 Pin height tolerance: 0.5 mm  
 General tolerances: 0.5 mm

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



## Dimensions heatsink version



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

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