

20 W DC-DC Converter P20J-Series



PHI-CON

- Wide 4:1 input range
- Efficiency up to 89 %
- Adjustable output voltage
- Remote control on / off
- 3000 V_{DC} isolation
- Continuous short circuit protection
- Over voltage protection
- MTBF > 1 Mio. hours
- -40...+85 °C operating temperature range



Model guide

Type	Input voltage		Input current		Output voltage [V _{DC}]	Output current		Efficiency @ full load typ. [%] typ.	Capacitive load (see note 3) [μF] max.
	Nominal [V _{DC}]	Range [V _{DC}]	no load typ. [mA]	full load typ. [mA]		minimum load [mA]	maximum load [A]		
P20J243R3S	24	9...36	40	800	3.3	250	5000	86	10000
P20J2405S	24	9...36	40	935	5	200	4000	89	10000
P20J2409S	24	9...36	10	950	9	111	2222	88	4700
P20J2412S	24	9...36	10	950	12	83	1667	88	1600
P20J2415S	24	9...36	10	950	15	67	1333	89	1000
P20J2424S	24	9...36	10	950	24	42	834	89	500
P20J483R3S	48	18...75	20	400	3.3	250	5000	86	10000
P20J4805S	48	18...75	20	470	5	200	4000	88	10000
P20J4812S	48	18...75	5	470	12	83	1667	88	1600
P20J4815S	48	18...75	5	470	15	67	1333	89	1000
P20J4824S	48	18...75	5	470	24	42	834	89	500

Specifications

Input	
Under voltage protection	Start up Shut down
P20J24xxS	9 V _{DC} , max. 5.5 V _{DC} , min.
P20J48xxS	18 V _{DC} , max. 14 V _{DC} , min.
Filter	π - type
Reflected ripple current *6	30 mA _{p-p} , typ.
Remote control	On state 3.5...12 V _{DC} , or open input
threshold	Off state 0...1.2 V _{DC}
Input idle current @ Off state	7 mA, max.
Isolation input - output:	
Rated voltage @ < 1 mA	3000 V _{DC} for 1 Min.
Resistance @ 500 V _{DC}	10 ⁹ Ω, min
Input / output capacitance	500 pF, typ., @ 100 kHz
Output	
Voltage tolerance	± 3 %, max.
Voltage load regulation	± 1 % @ 5 %...100 % load
Line voltage regulation	± 0.5 %, max @ full Vin range
Output voltage trim range	± 10 % of Vout nominal
Temperature coefficient	± 0.03 % / °C
Transient recovery time	<500 μs, @ 25 % load steps
Transient response deviation	± 8 % @ 25 % load change
Short circuit protection	Continuous, hiccup
Short circuit restart	Automatic
Over voltage protection	160 % of nom voltage, max.
Over load protection	150 % of full load, typ.
Ripple & noise, BW 20 MHz	100 mV _{p-p} , max.
Start up time	10 ms, typ @ R-load
Safety approval	IEC-, EN-, UL60950-1
General	
Switching frequency	270 kHz, typ.
Reliability calculated MTBF MIL-HDBK-217F @ 25 °C	> 1 Mio. hours

EMC characteristics	
Radiated emissions	CISPR22 / EN55022 Class A
Radiated emission, with Fig. 2	CISPR22 / EN55022 Class B
Conducted emissions	CISPR22 / EN55022 Class A
Conducted emissions, with Fig. 2	CISPR22 / EN55022 Class B
ESD (± 4 kV)	EN61000-4-2 perf. crit. B
RS (10 V/m)	EN61000-4-3 perf. crit. A
EFT, (± 2 kV) with Fig. 2	EN61000-4-4 perf. crit. B
Surge, (± 2 kV) with Fig. 2	EN61000-4-5 perf. crit. B
CS (3 Vrms)	EN61000-4-6 perf. crit. A
Immunity of voltage dip, drop and short interruption (0..70 %)	EN61000-4-29 perf. crit. B
Environmental	
Operating ambient temperature	-40 °C to +85 °C with derating
Storage temperature	-55 °C to +125 °C
Storage humidity	5...95 %, non condensing
Cooling	Free air convection
Physical	
Dimension	PCB module 26.5 x 51.5 x 12 mm, 24 g
Weight	Chassis module 31.5 x 76 x 21.2 mm, 46 g
	DIN rail module 31.5 x 76 x 25.8 mm, 66 g
Package material	Plastic, UL94V-0 rated
Potting material	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	P20J24xxS -0.7...50 V _{DC} P20J48xxS -0.7...100 V _{DC}
Vibration, X, Y & Z axis	10..55 Hz, 10 G, 30 minutes

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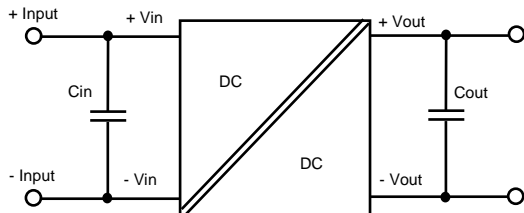


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1) Recommended circuit

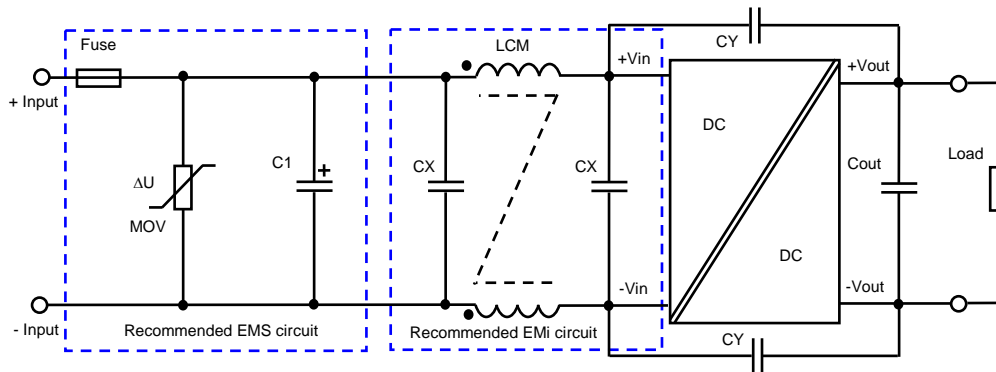
The P20J series is been tested according to the following recommended test circuit before leaving the factory (see Figure 1). If you want to further decrease the input / output ripple, you can increase a capacitance values properly or choose capacitors with low ESR, but the total capacitance of the filter capacitor must not exceed the maximum load capacitance value (see „Model guide“ table).

Figure 1



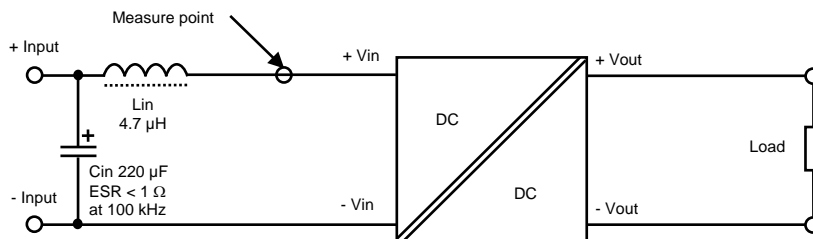
	Cin	Cout
P20Jxx3R3S	100 μ F	470 μ F
P20Jxx05S		470 μ F
P20Jxx09S		220 μ F
P20Jxx12S		220 μ F
P20Jxx15S		220 μ F
P20Jxx24S		100 μ F

Figure 2, Recommended EMC circuit



	Fuse Slow blow	MOV Type	C1	CX	LCM	CY	Cout
P20J24xxS	2.5 A	S14K35	330 μ F, 50 V	1 μ F, 50 V	6.8 mH	1 nF, 3 kV	See table at figure 1
P20J48xxS	1.5 A	S14K60	330 μ F, 100 V	1 μ F, 100 V	6.8 mH	1 nF, 3 kV	

Input reflected ripple measure circuit



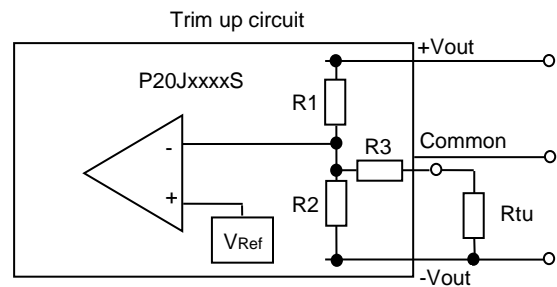
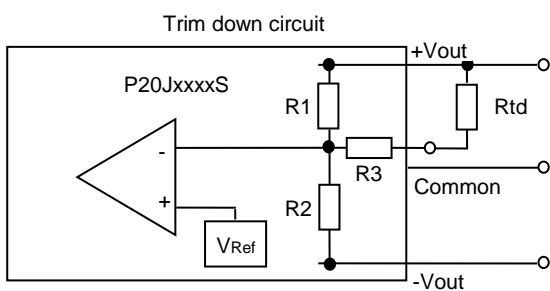
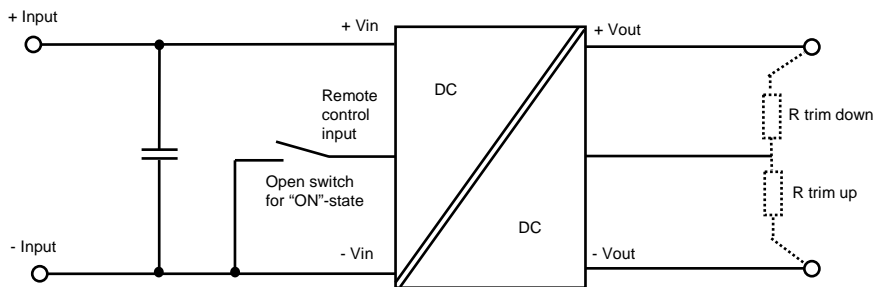
The input reflected ripple current is measured with inductor L_{in} and capacitor C_{in} to simulate source impedance.

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Application note to remote control / trim function



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]
P20Jxx3R3S	4.801	2.864	15	2.5	8.65	4.27
P20Jxx05S	2.883		10		1.16	4.9
P20Jxx09S	7.5		15		29.4	7
P20Jxx12S	10.971		17.8		53.5	6.6
P20Jxx15S	14.497		17.8		78.6	9.1
P20Jxx24S	24.872		20		162	8.37

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

Trim down resistor formula

$$b = \frac{V_{out} - V_{ref}}{V_{ref}} * R_2$$

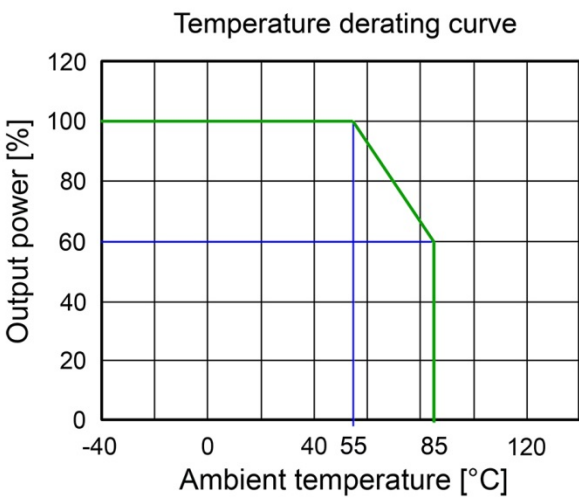
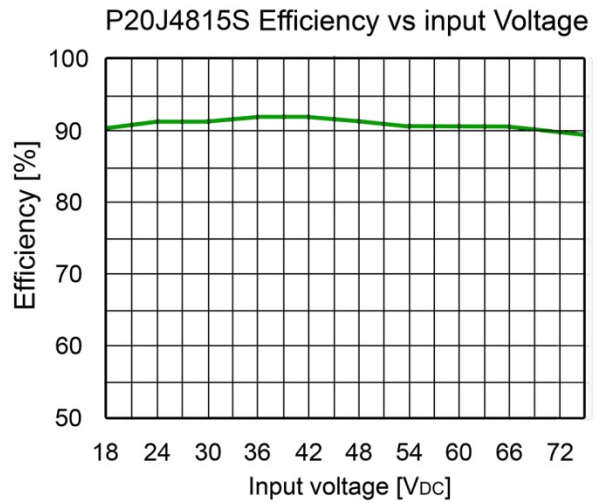
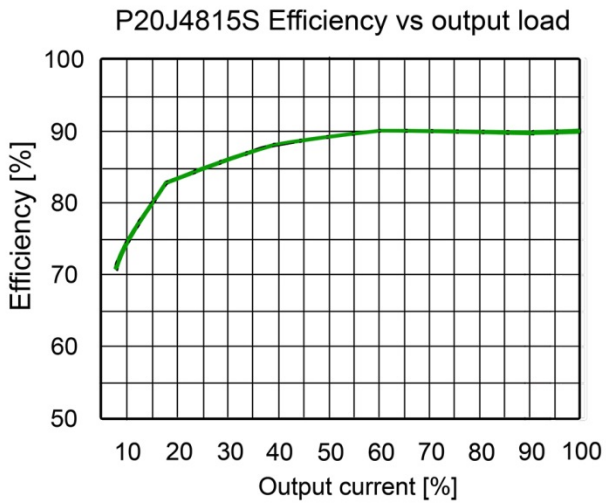
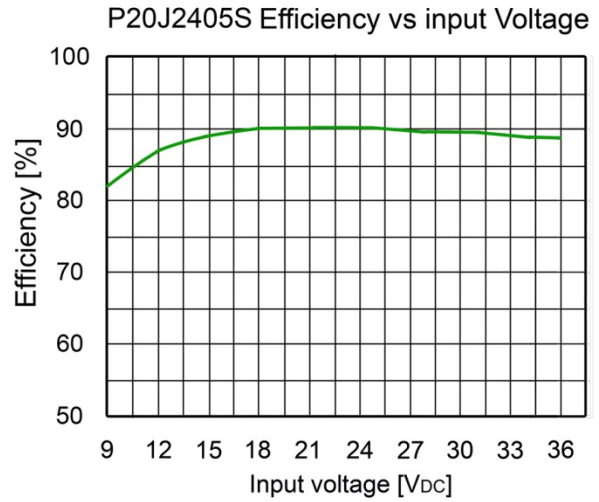
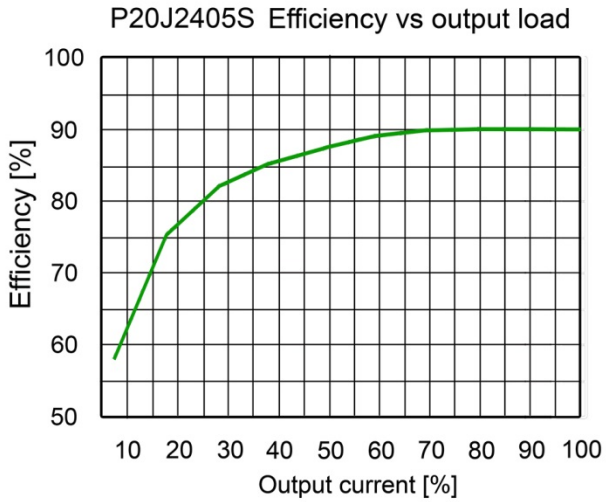
$$R_{td} = \frac{R_1 * b}{R_1 - b} - R_3$$

Trim up resistor formula

$$a = \frac{V_{ref}}{V_{out} - V_{ref}} * R_1$$

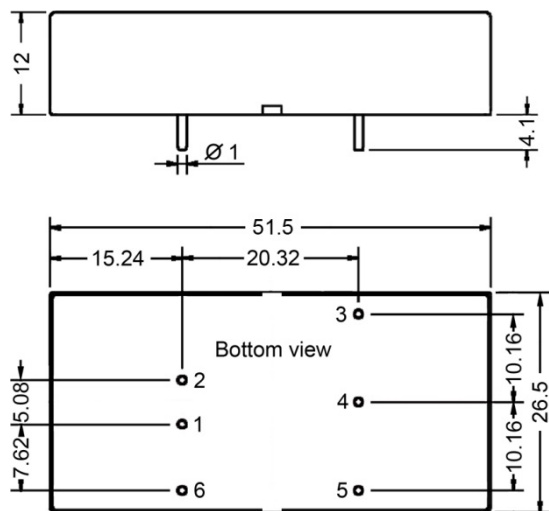
$$R_{tu} = \frac{R_2 * a}{R_2 - a} - R_3$$

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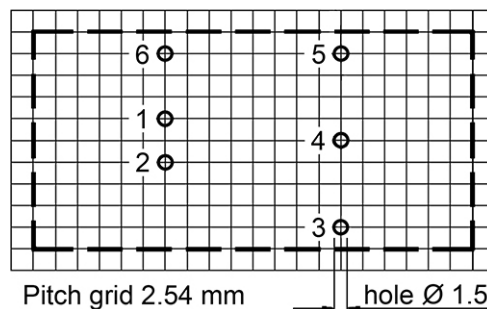


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Dimensions



Pinning	
Pin	Single
1	- Vin
2	+ Vin
3	+ Vout
4	Trim
5	- Vout
6	Remote control



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

Note:

1. Minimum load should be more than 5 %, otherwise the ripple exceeds the specified values. Operation at lower than 5 % load will not damage the converter.
2. Maximum capacitive load is tested within the input voltage range and at full load.
3. All specifications measured at Ta 25 °C, humidity < 75 %, nominal input voltage and rated output load unless otherwise specified.
4. It is not recommended to increase the output power capability by connecting two or more converters in parallel.
5. The converters are not hot swappable!

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