50 W DC-DC Converter P50C-Series

PHI-CON

- 2:1 wide input voltage range
- High efficiency up to 92 %
- Over current protection
- Over voltage protection
- Over temperature protection
- Continuous short circuit protection
- Adjustable output voltage
- On/Off - remote control input
- Soft start
- Standard 2" x 1" package

Model guide

Type	Input voltage		Input current		Output voltage [V_{DC}]	Output current		Efficiency typ. [%]	Capacity load max. [µF]
	nominal [V_{DC}]	range [V_{DC}]	no load [mA] max.	full load [mA] typ.		[mA] min.	[mA] max.		
P50C123R3S	12	9...18	120	3020	3.3	0	10000	90	26000
P50C1205S	12	9...18	170	4600	5.0	0	10000	89	17000
P50C1212S	12	9...18	50	4700	12.0	0	4167	89	3300
P50C1215S	12	9...18	50	4630	15.0	0	3333	89	2200
P50C243R3S	24	18...36	70	1500	3.3	0	10000	91	26000
P50C2405S	24	18...36	90	2250	5.0	0	10000	91	17000
P50C2412S	24	18...36	40	2300	12.0	0	4167	91	3300
P50C2415S	24	18...36	30	2300	15.0	0	3333	91	2200
P50C483R3S	48	36...75	50	750	3.3	0	10000	91	26000
P50C4805S	48	36...75	60	1130	5.0	0	10000	92	17000
P50C4812S	48	36...75	30	1150	12.0	0	4167	91	3300
P50C4815S	48	36...75	40	1140	15.0	0	3333	89	2200

Specifications

Input	
Input Filter:	Pi- type
Start up voltage	P50C12xx: 8.6 V, typ. P50C24xx: 17.8 V, typ. P50C48xx: 24 V, typ.
Under voltage lockout	P50C12xx: 7.9 V, typ. P50C24xx: 16 V, typ. P50C48xx: 29 V, typ.
Start up time	50 ms, typ.
Input reflected ripple current	20 mAp-p, typ (see fig. 1)
Remote control input Pin 3 (see figure 4a & 4b)	"On" 3.0…12 V or open input "Off" Short to -Vin or 0…1.2 V
Input idle current at Ctrl "Off"	5 mA at nominal Vin
Isolation input to output	
Isolation voltage, Input to output or to case, 1 minute tested	1600 V_{DC}, min.
Resistance	10^9 Ω, min.
Capacitance	2000 pF, typ.
Output	
Over voltage protection with Z-diode clamp	P50Cxx3R3: 3.9 V P50Cxx05: 6.2 V P50Cxx12: 15 V P50Cxx15: 18 V
Voltage accuracy	±1 %
Voltage trim range	±10 %, max. (see figure 5)
Ripple and noise (at 20 MHz BW)	100 mVp-p, max. (see figure 2)
Short circuit protection	Hiccup, automatic recovery
Line regulation	± 0.5 %, max.
Load voltage regulation at 0…100% load change	± 0.5 %
Temperature coefficient	± 0.02 % / °C
Transient recovery time at 25 % load change steps	250 µs, typ.
Transient response deviation at 25 % load change steps	± 3 %, max.
Over load protection	140 %, max. of full load

General	
Switching frequency	250 kHz, typ.
Standard in accordance with	EN-, IEC-, cUL-, UL 60950-1 EN-, IEC-, cUL-, UL 62368-1
Radiated emissions	EN 55032 class A
Conducted emissions	EN 55032 class A
ESD	IEC 61000-4-2 pref. criteria A
Radiated immunity	IEC 61000-4-3 pref. criteria A
Fast transient (see figure 3)	IEC 61000-4-4 pref. criteria A
Surge (see figure 3)	IEC 61000-4-5 pref. criteria A
Conducted immunity	IEC 61000-4-6 pref. criteria A
PFMF	IEC 61000-4-8 pref. criteria A
Reliability calculated (MIL-HDBK-217 F) @ 25 °C	MTBF > 200 000 h
Environmental	
Operating ambient temperature	-40 …95 °C (with derating) -40 …50 °C (without derating)
Storage temperature	-40 °C …125 °C
Cooling	Air convection 30…60 LFM (16...33 cm/s)
Thermal impedance	P50CxxxxS: 9.5 K/W P50CxxxxSK: 8.5 K/W
Maximum case temp.	110 °C, max.
Over temperature protection	115 °C, typ
Storage humidity	95 %, non condensing
Physical	
Dimensions	P50CxxxxS: 50.8 x 25.4 x 12 mm P50CxxxxSK: 50.8 x 25.4 x 18.1 mm
Weight	P50CxxxxS: 45 g P50CxxxxSK: 56 g
Case material	Copper
Potting material	Epoxy, UL94V-0 rated
RoHS compliant	yes
Absolute maximum ratings	
Input surge voltage 100 ms max.	P50C12xx: 25 V_{DC} P50C24xx: 50 V_{DC} P50C48xx: 100 V_{DC}
Soldering temperature	≤ 260 °C, ≤ 10 s, ≥ 1.5 mm distance from case

Part number designation key

PHI-CON	Output power		Series designation	Input voltage range		Output voltage		Output configuration	
P	**50**	50 W	**C**	**12**	9…18 V	**3R3**	3.3 V	**S**	single output
				24	18…36 V	**5**	5 V	**SK**	Single outp. with heat sink
				48	36…75 V	**12**	12 V		
						15	15 V		

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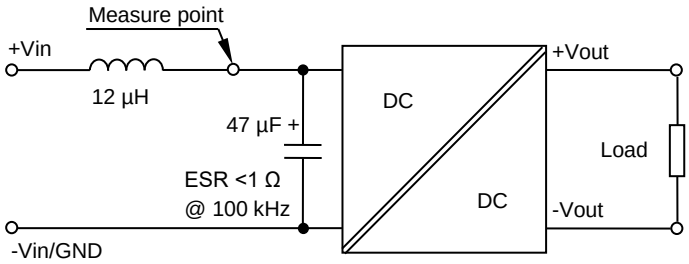
Figure 1 Input reflected ripple current measure circuit



The input reflected ripple current is measured through a source inductor 12 µH and a source capacitor Cin 47 µF, ESR <1 Ω at 100 kHz at nominal input voltage and full load.

Figure 2 Output ripple & noise measure circuit

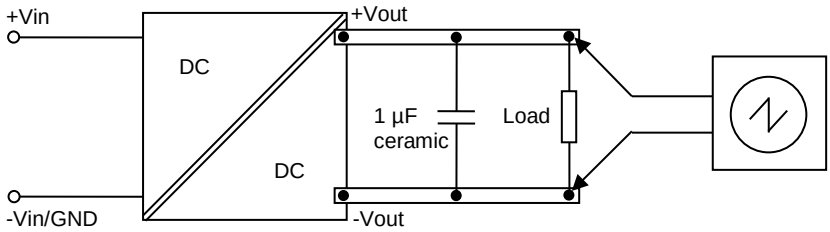
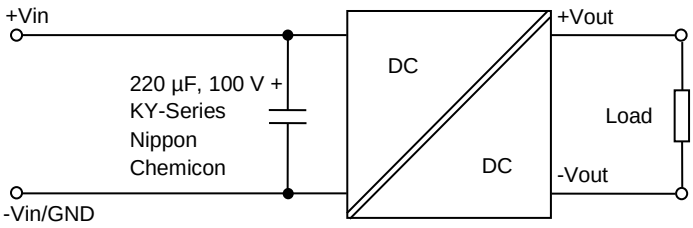
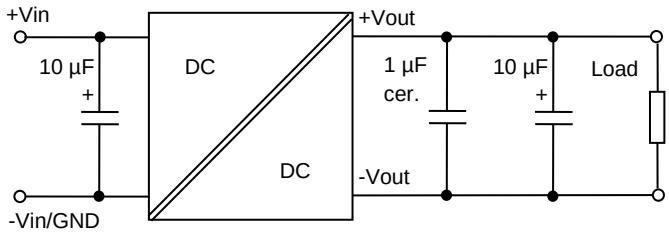


Figure 3 Recommended circuit to meet (EFT) IEC61000-4-4 and (Surge) IEC61000-4-5



Output ripple & noise reduction



To reduce ripple and noise, it is recommended to use a ceramic capacitor and an electrolytic capacitor.

Figure 4a On / Off remote control circuit for positive logic

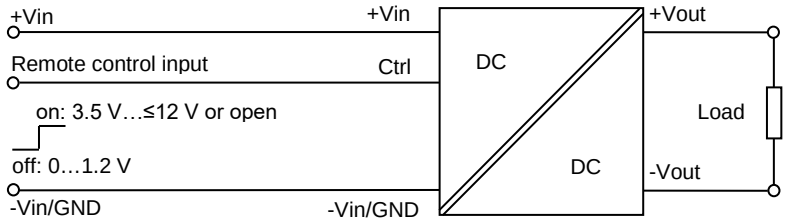


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Figure 4b On / Off remote control circuit for inverse logic

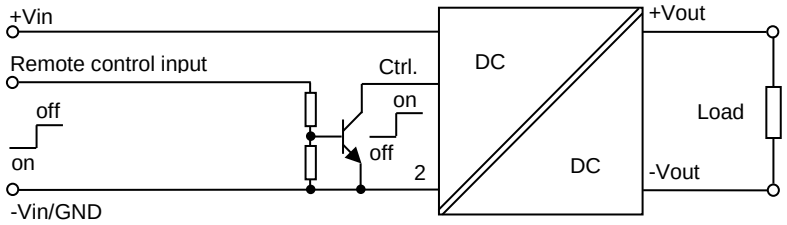
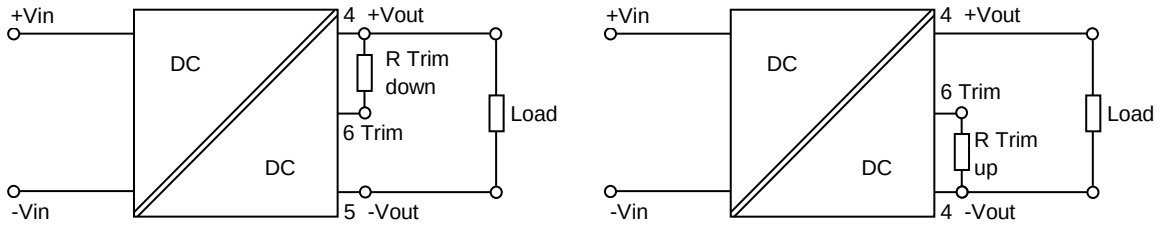


Figure 5 Trim circuit example

Output voltage trim function allows the user to increase or decrease the output voltage set point. the module maybe connected with an externalresistor (R_{trim}) between Trim and either +Vout or -Vout pin.
By adjusting R_{trim}, the output voltage can be changed by 10 % of nominal output voltage.



P50Cxx3R3S											
Trim down	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	[%]
V out	3.267	3.234	3.201	3.168	3.135	3.102	3.069	3.036	3.003	2.97	Vdc
R trim down	316	172	113	79.8	59.2	44.9	34.5	26.6	20.4	15.3	kΩ
Trim up	1	2	3	4	5	6	7	8	9	10	[%]
V out	3.333	3.366	3.399	3.432	3.465	3.498	3.531	3.564	3.597	3.63	Vdc
R trim up	545	184	103	67.7	47.7	34.8	25.9	19.3	14.2	10.3	kΩ
P50Cxx05S											
Trim down	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	[%]
V out	4.95	4.9	4.85	4.8	4.75	4.7	4.65	4.6	4.55	4.5	Vdc
R trim down	231	106	64.3	43.3	30.6	22.2	16.2	11.7	8.1	5.3	kΩ
Trim up	1	2	3	4	5	6	7	8	9	10	[%]
V out	5.05	5.1	5.15	5.2	5.25	5.3	5.35	5.4	5.45	5.5	Vdc
R trim up	245	114	70.6	49.1	36.3	27.7	21.6	17	13.4	10.6	kΩ
P50Cxx12S											
Trim down	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	[%]
V out	11.88	11.76	11.64	11.52	11.4	11.28	11.16	11.04	10.92	10.8	Vdc
R trim down	327	142	83.9	55.5	38.6	27.4	19.5	13.5	8.9	5.3	kΩ
Trim up	1	2	3	4	5	6	7	8	9	10	[%]
V out	12.12	12.24	12.36	12.48	12.6	12.72	12.84	12.96	13.08	13.2	Vdc
R trim up	371	184	118	84	63.5	49.8	39.9	32.5	26.7	22.1	kΩ
P50Cxx15S											
Trim down	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	[%]
V out	14.85	14.7	14.55	14.4	14.25	14.1	13.95	13.8	13.65	13.5	Vdc
R trim down	434	175	101	66	45.5	32.1	22.6	15.6	10.2	5.8	kΩ
Trim up	1	2	3	4	5	6	7	8	9	10	[%]
V out	15.15	15.3	15.45	15.6	15.75	15.9	16.05	16.2	16.35	16.5	Vdc
R trim up	347	179	115	82	61.7	47.9	37.9	30.3	24.4	19.7	kΩ

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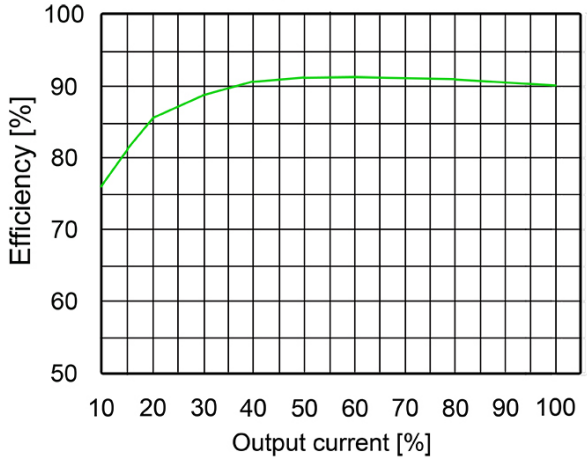
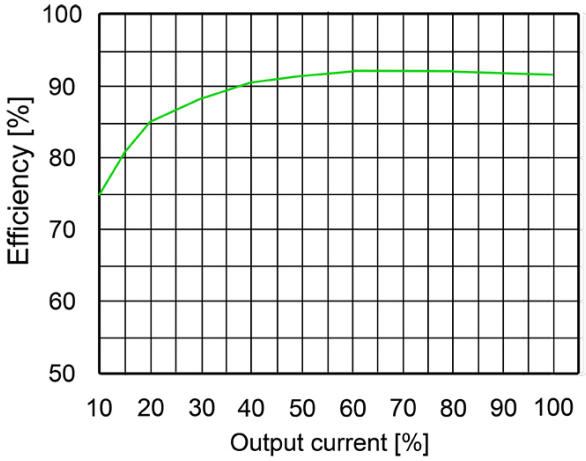
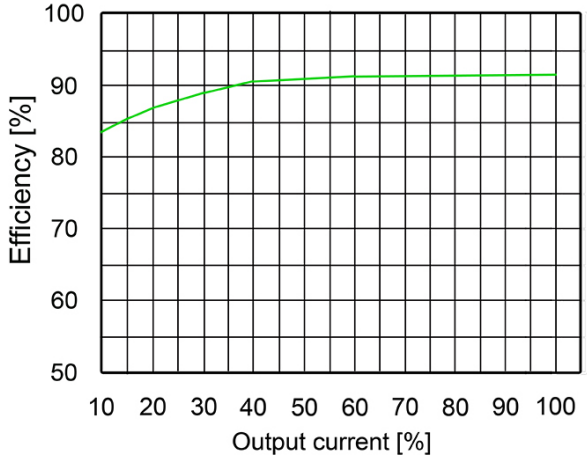
P50C1205S Efficiency vs output current
@ Vin 12 V



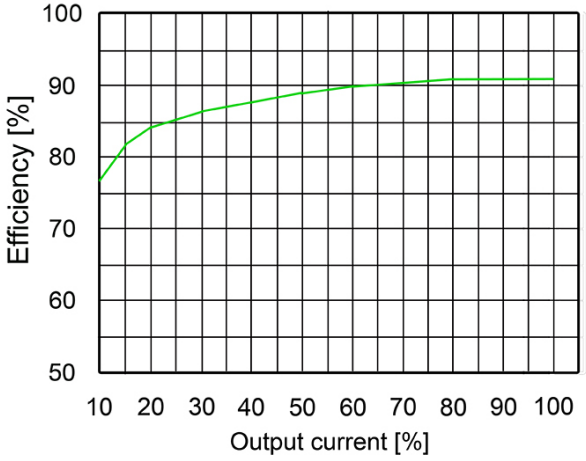
P50C2405S Efficiency vs output current
@ Vin 24 V



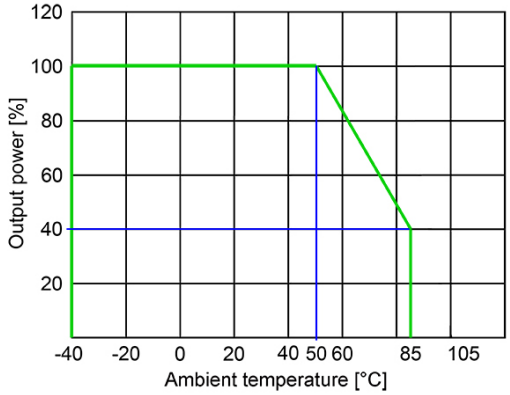
P50C2412S Efficiency vs output current
@ Vin24 V



P50C4815S Efficiency vs output current
@ Vin 48 V



Derating diagram without heatsink



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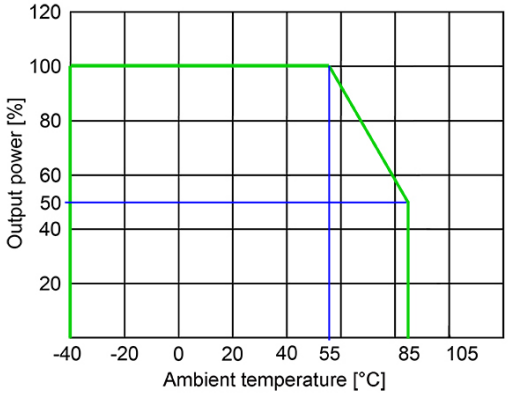

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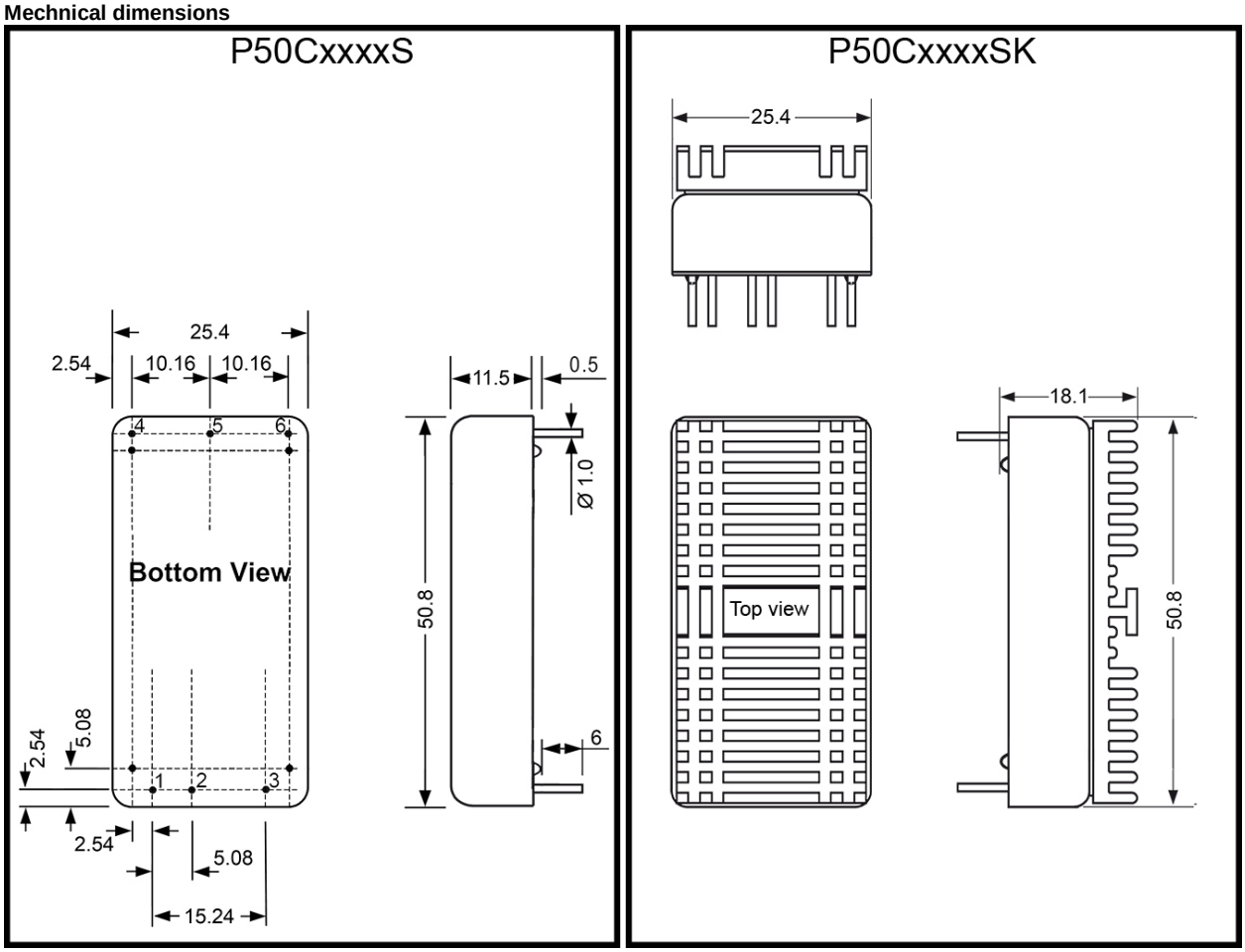
Mechnical dimensions



Dimensions in mm

1. Pin diameter tolerance: ± 0.05 mm
2. Pin length tolerance: ± 0.35 mm
3. Pitch tolerance: ± 0.35 mm
4. Case tolerance: ± 0.5 mm
5. Stand-off tolerance: ± 0.1 mm

Pin assignment	
1	+Vin
2	-Vin
3	Rem. Ctrl.
4	+ Vout
5	- Vout
6	Trim

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