



PHI-CON

100 W DC-DC Converter P100B-Series

- Wide 4:1 input range
- Efficiency up to 93 %
- Adjustable output voltage
- Remote control on / off
- In/Out isolation 2250 V_{DC}
- Input under voltage protection
- Continuous short circuit protection
- Over current protection
- Over voltage protection
- Over temperature protection
- Five sided shielded metal package



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]	full load [mA]		[mA] min.	[A] max.		
P100B4805S	48	18...75	≤ 80	≤ 2350	5	0	20	91	6000
P100B4812S	48	18...75	≤ 80	≤ 2350	12	0	8.3	92	2000
P100B4815S	48	18...75	≤ 80	≤ 2350	15	0	6.7	93	2000
P100B4824S	48	18...75	≤ 80	≤ 2350	24	0	4.2	92	1000
P100B4848S	48	18...75	≤ 80	≤ 2350	48	0	2.1	92	470

Specifications

Input		
Start up voltage		≤ 18 V _{DC}
Under voltage lockout		≥ 15 V _{DC}
Surge voltage ≤ 1 s		-0.7 ... 90 V _{DC}
Filter		π - type
Reflected ripple current		30 mA _{p-p} , typ. (see figure 1)
Remote control threshold	On state	3.5 ... 12 V _{DC} , or open input
	Off state	0 ... 1.2 V _{DC}
Remote control rise time		> 10V / ms
Input idle current @ Off state		10 mA, max.
Isolation input - output:		
Rated isolation voltage (tested 60 s @ ≤ 1 mA leakage current)	Input to output:	2250 V _{DC} , max.
	Input to case:	1500 V _{DC} , max.
	Output to case:	500 V _{DC} , max.
Resistance		> 10 ⁹ Ω, measured @ 500 V _{DC}
Input / output capacitance		2200 pF, typ. @ 100 kHz, 0.1 V
Output		
Output voltage tolerance		≤ ± 3 %
Line regulation		≤ ± 0.5 %, full input range
Load regulation		≤ ± 0.75 %, 0...100 % load
Output voltage trim range		95 ... 110 %
Output voltage compensation via sense		≤ 105 %
Output voltage V _{in} regulation		≤ ±0.5 % deviation @ full V _{in} range
Temperature coefficient		± 0.03 % / °C
Transient recovery time		≤ 500 μs, @ 25 % load change steps
Transient response deviation @ 25 % load change steps	P100Bxx05S:	< ± 7.5 %
	All others:	< ± 5 %
Over voltage protection		110 ... 160 %
Over current protection		110 ... 190 %
Short circuit protection		Continuous, hiccup
Short circuit restart		Automatic
Rippel & noise, BW 20 MHz (see figure 2)		P100Bxx12S & 15S: ≤200 mV _{p-p} All others: ≤250 mV _{p-p}
Start up time		20 ms, typ @ R-load
General		
Safety standard		
Switching frequency (PWM)		250 kHz, typ.
Reliability calculated MTBF MIL-HDBK-217F @ 25 °C		> 500 000 h
Vibration		IEC-, EN 61373 car body 1 B

Safety Standard	EN 62368-1	
EMI characteristics		
CE:	EN 55032, CISPR32, EN 50121-3-2	Class A or Class B (see figure 4)
RE:	EN 55032, CISPR32, EN 50121-3-2	Class A or Class B (see figure 4)
EMS characteristics		
ESD:	EN-, IEC 61000-4-2, EN 50121-3-2	Contact ± 6 kV, Air ± 8 kV, perf. Criteria B
RS:	EN-, IEC 61000-4-3, EN 50121-3-2	20 V/m perf. Criteria A
EFT:	EN-, IEC 61000-4-4, EN 50121-3-2	± 2 kV, perf. Criteria A (see figure 4a)
Surge:	EN 50121-3-2	Differential mode ± 1 kV, 1.2/50 μs, Source impedance 42 Ω, perf. Criteria B (see figure 4a)
CS:	EN-, IEC 61000-4-6 EN 50121-3-2	10 Vrms, perf. Criteria A
Environmental		
Operating ambient temperature	-40 ... 85 °C with derating	
Storage temperature	-55 ... 125 °C	
Over temperature protection	< 120 °C	
Storage humidity	5...95 %, non condensing	
Cooling	Free air convection, > 20 LFM	
Physical		
Dimensions	P100B48xxS	62 x 56 x 12.7 mm
	P100B48xxSK	61.8 x 40.2 x 27.7 mm
	P100B48xxSHB	62 x 56 x 14.6 mm
Weight	P100B48xxS	89 g
	P100B48xxSK	120 g
	P100B48xxSHB	109 g
Case material	Aluminium alloy	
Potting Material	Plastic (UL94V-0 rated)	
Absolute max. ratings		
Wave soldering temperature	≤ 260 °C for ≤ 10 sec, ≥ 1.5 mm distance from body	
Manual soldering temperature	≤ 300 °C for ≤ 10 sec, ≥ 1.5 mm distance from body	

Ordering information									
Output Power	Series	Input voltage		Output voltage		Output		Package	
P100	B	48		05		S		HB	
100 Watt		48	48 V _{DC}	05	5 V _{DC}	S	single	blank	Standart version
					12 V _{DC}			HB	Slotted base plate version
					15 V _{DC}			K	With heat sink version
					24 V _{DC}				
					48 V _{DC}				

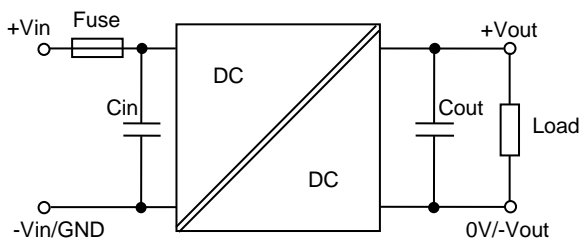
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Note:

1. All specifications measured at T_a 25 °C, humidity < 75 %, nominal input voltage and rated output load current unless otherwise specified.
2. Maximum capacitive load is tested at full input voltage range and full load current.
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. The converters are not hot swappable

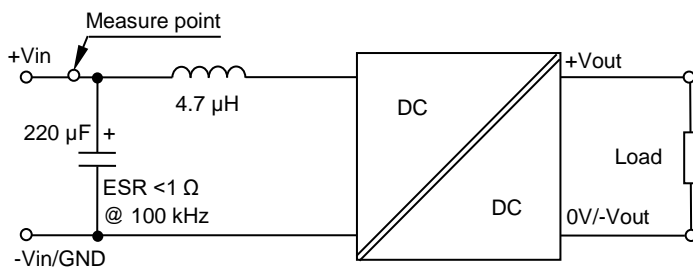
Test circuit

The P100B series is been tested according to the following recommended test circuit before leaving the factory (see following circuit and table). If you want to further decrease the input or 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).



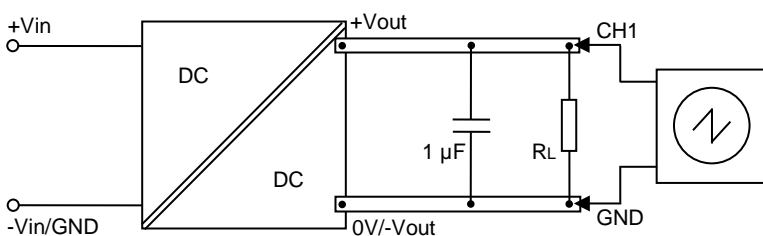
Recommended peripheral components to figure 1			
Type	Cout	Fuse	Cin
P100B4805S	470 μ F	10 A Time delay type	220 μ F
P100B4812S	220 μ F		
P100B4815S	220 μ F		
P100B4824S	100 μ F		
P100B4848S	100 μ F		

Figure 1 Measure circuit input reflected ripple current



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

Figure 2 Measure circuit output ripple and noise (BW 20 MHz)



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Figure 4a, EMC filter circuit for IEC/EN 61000-4-4, IEC/EN 61000-4-5 performance criteria B and EN 55032 Class B

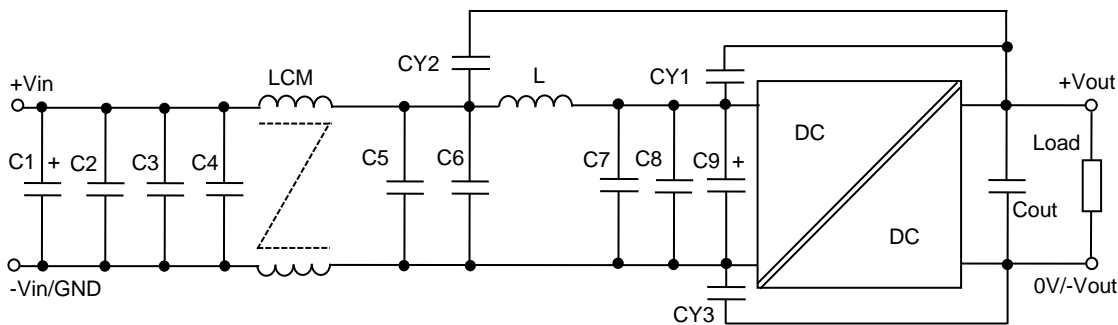
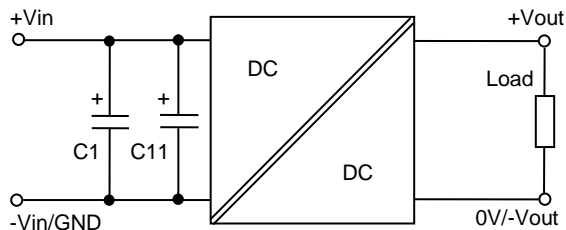
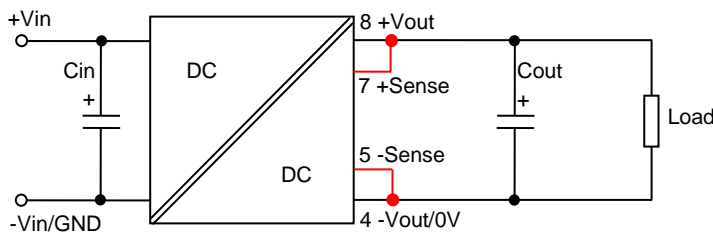


Figure 4b, EMS filter circuit only for IEC/EN 61000-4-4, IEC/EN 61000-4-5 performance criteria B



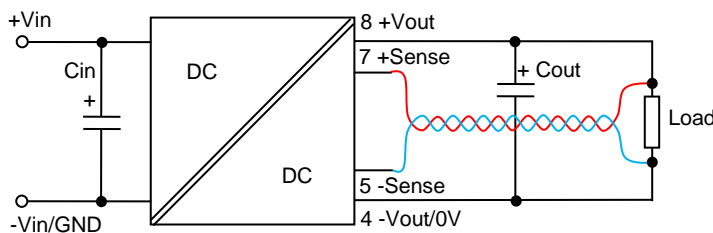
Recommended peripheral components to circuits in figures 4a & 4b						
EN 55032, CISPR 32	C1 electrolytic	C11 electrolytic	C2, C3, C4, C5, C6, C7, C8, C9, C10 ceramic chip	LCM	CY1, CY2 Y1 Type	CY3 Y1 Type
Class A	150 μ F	47 μ F	10 μ F	1.6 mH	-	2.2 nF
Class B	150 μ F	47 μ F	10 μ F	1.6 mH	2.2 nF	1 nF

Application circuit without output voltage dropout remote compensation



1. If the sense function is not used for remote regulation the user must connect the +Sense to +Vo and -Sense to 0V at the DC-DC converter pins and will compensate for voltage drop across pins only.
2. The connections between Sense lines and their respective power lines must be kept as short as possible, otherwise they may be picking up noise, interference and/or causing unstable operation of the power module.

Application circuit with output voltage dropout remote compensation



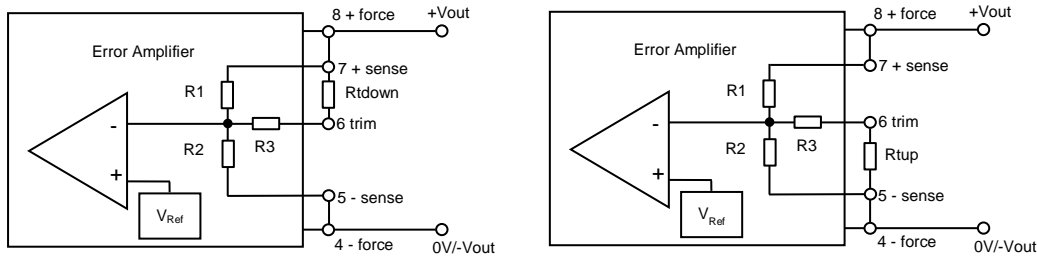
1. PCB-tracks or wires for Remote Sense must be kept as short as possible.
2. In cables and discrete wiring applications, twisted pair or other techniques should be implemented.
3. Using remote sense with long wires long wires may cause unstable operation. Note that large wire impedance may cause oscillation of the output voltage and/or increased ripple.
4. We recommend using adequate cross section for PCB-track layout and/or cables to connect the power supply module to the load in.



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Application circuit for trimming function.



Calculation for trim down resistor (Rtdown) or trim up resistor (Rtup)

Model series	R1 [kΩ]	R2 [kΩ]	R3 [kΩ]	V Ref [V]	Rtdown min. [kΩ]	Rtup min. [kΩ]
P100B4805S	3.036	3	10	2.5	14.4	6.15
P100B4812S	11	2.87	15	2.5	129	9.6
P100B4815S	14.03	2.8	15	2.5	197	8.8
P100B4824S	24.872	2.87	15	2.5	355	12.8
P100B4848S	53.017	2.913	15	2.5	937	14.45

Maximum output voltage adjust range 95..110 % of Vout nominal value, see min. Rtdown / Rtup.

Exceeding the trim range causes irreversible damage!

Trim down resistor formula

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

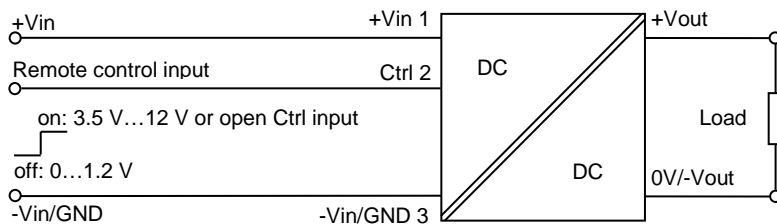
$$R_{tdown} = \frac{R1 * b}{R1 - b} - R3$$

Trim up resistor formula

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

$$R_{tup} = \frac{R2 * a}{R2 - a} - R3$$

Application circuit for remote control function



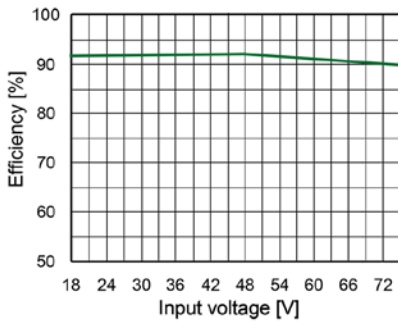


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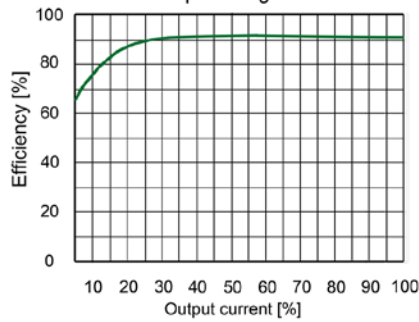
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All de-rating diagrams are for the heatsink version

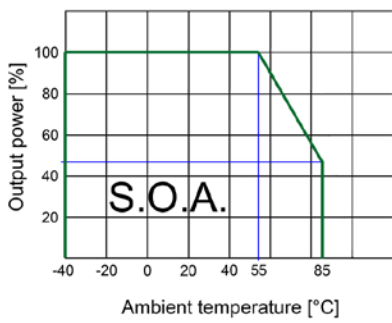
P100B4812S Efficiency vs input Voltage at full load



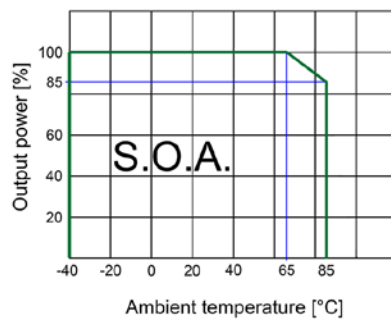
P100B4812S Efficiency vs output load at input voltage 48V



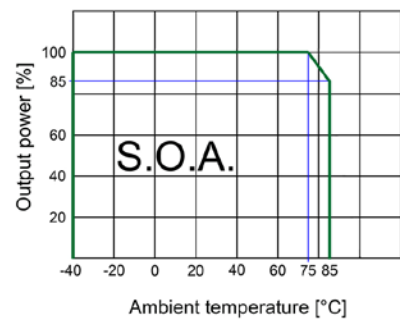
P100B4824S Temperature derating at air flow 20 LFM & Vin 24 V



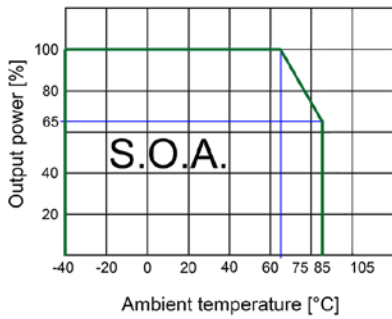
P100B4824S Temperature derating at air flow 200 LFM & Vin 24 V



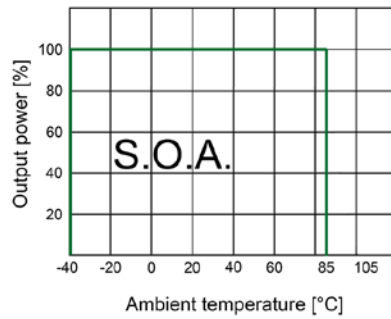
P100B4824S Temperature derating at air flow 400 LFM & Vin 24 V



P100B4824SK Temperature derating at air flow 20 LFM & Vin 24 V



P100B4824SK Temperature derating at air flow >100 LFM & Vin 24 V

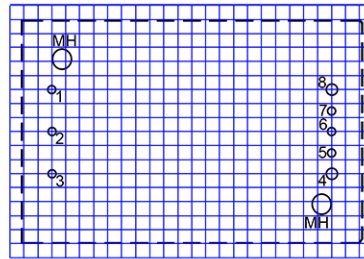
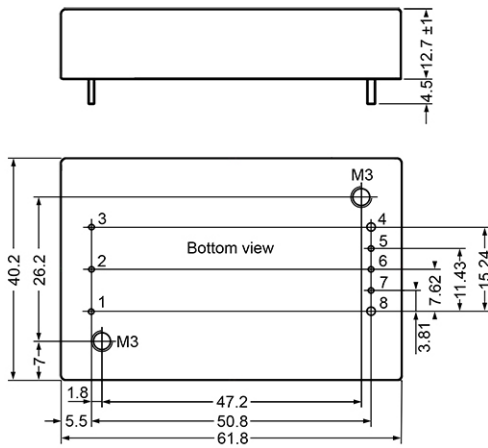




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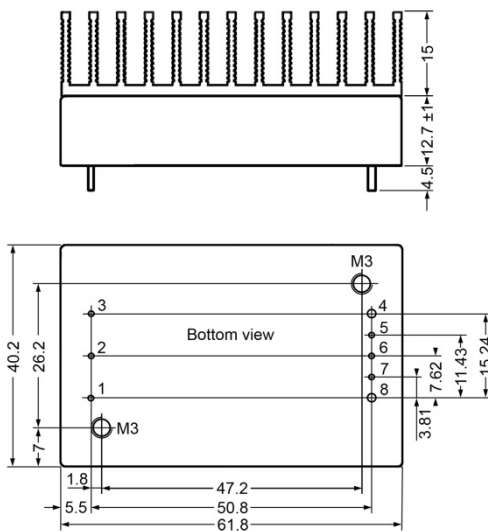
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Mechanical dimensions standard version P100B48xxS



Pitch grid 2.54 mm
 Recommended drill diameter
 Hole 1, 2, 3, 5, 6, 7: \varnothing 1.5 mm
 Hole 4, 8: 2 mm
 Mounting holes 4, 8: \varnothing 3.5 mm

Mechanical dimensions heat sink version P100B48xxSK



Pin Assignment	
1	+ Vin
2	Rem. Ctrl.
3	- Vin/GND
4	0V/-Vout
5	- Sense
6	Trim
7	+ Sense
8	+ Vout



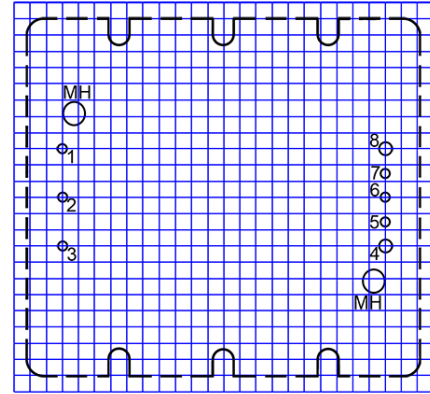
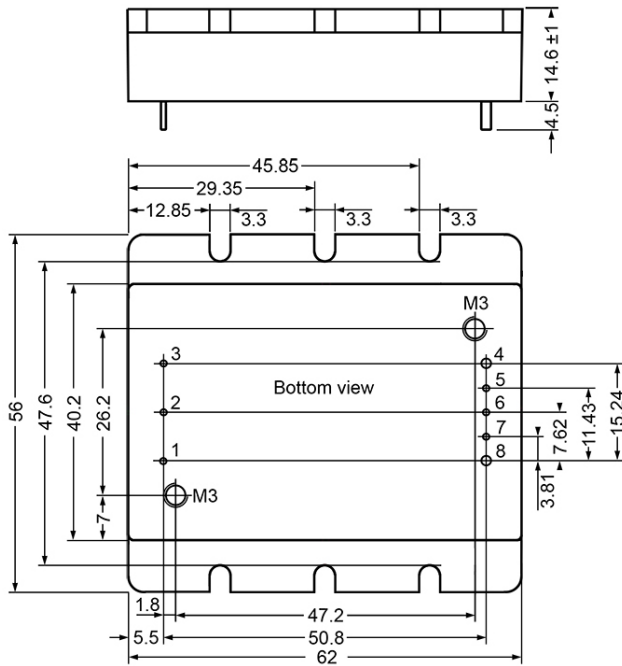
Note

All units in mm
 Diameter pin 1, 2, 3, 5, 6, 7: 1 mm
 Diameter pin 4, 8: 1.5 mm
 Pin diameter tolerance: 0.1 mm
 Pin height tolerance: 0.5 mm
 General tolerances: 0.5 mm
 Mounting thread hole: M3
 Mounting torque: < 0.4 Nm

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Mechanical dimensions half brick version with slotted base plate P100B48xxSHB



Pitch grid 2.54 mm
 Recommended drill diameter
 Hole 1, 2, 3, 5, 6, 7: \varnothing 1.5 mm
 Hole 4, 8: 2 mm
 Mounting holes 4, 8: \varnothing 3.5 mm

Pin Assignment	
1	+ Vin
2	Rem. Ctrl.
3	- Vin/GND
4	0V/-Vout
5	- Sense
6	Trim
7	+ Sense
8	+ Vout

Note
 All units in mm
 Diameter pin 1, 2, 3, 5, 6, 7: 1 mm
 Diameter pin 4, 8: 1.5 mm
 Pin diameter tolerance: 0.1 mm
 Pin height tolerance: 0.5 mm
 General tolerances: 0.5 mm
 Mounting thread hole: M3
 Mounting torque: < 0.4 Nm

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Rev: 20190820 f