100 W DC-DC Converter P100A-Series

PHI-CON

- Wide 4:1 input range
- Efficiency up to 90 %
- 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

CE

Model guide

Type	Input voltage		Input current		Output voltage	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]	[V_{DC}]	Min. [mA]	Max. [A]		
P100A2405S	24	9...36	≤ 160	≤ 4800	5	0	20	89	6000
P100A2412S	24	9...36	≤ 160	≤ 4800	12	0	8.3	90	2000
P100A2415S	24	9...36	≤ 160	≤ 4800	15	0	6.7	90	2000
P100A2424S	24	9...36	≤ 160	≤ 4800	24	0	4.2	90	1000
P100A2428S	24	9...36	≤ 160	≤ 4800	28	0	3.6	90	1000
P100A2448S	24	9...36	≤ 160	≤ 4800	48	0	2.1	90	470

Specifications

Input		
Start up voltage		≤ 9 V_{DC}
Under voltage lockout		≥ 7 V_{DC}
Filter		π – type
Reflected ripple current		30 mAp-p, typ. (see figure 1)
Remote control theshold	On state	3.5…12 V_{DC}, or open input
	Off state	0…1.2 V_{DC}
Input idle current @ Off state		2 mA, typ., < 10 mA
Isolation input - output:		
Rated isolation voltage (tested 60 s @ ≤1 mA leakage current)		Input to output: 2250 V_{DC} Input to case: 1600 V_{DC} Output to case: 500 V_{DC}
Resistance		> 10^8 Ω, measured @ 500 V_{DC}
Input / output capacitance		2200 pF, typ. @ 100 kHz, 0.1 V
Output		
Output voltage tolerance		≤ ±3 % @ 0…100 % load range
Output voltage load regulation		≤ ±0.75 % deviation, 5…100 % load
Line regulation		≤ ±0.5 % deviation @ full Vin range
Transient response deviation @ 25 % load change steps		P100Axx05S: < ±7.5 % All others: < ±5 %
Transient recovery time		≤ 500 µs, @ 25 % load change steps
Output voltage trim range		91…110 %, max.
Output voltage compensation via sense		+110 %, max.
Temperature coefficient		± 0.03 % / °C
Over voltage protection		110…160 %
Over current protection		110…150 %
Short circuit protection		Continuous, hiccup
Short circuit restart		Automatic
Rippel & noise, BW 20 MHz (see figure 2)		P100A2412S & 15S: ≤ 200 mVp-p All others: ≤ 250 mVp-p
Start up time		20 ms, typ @ R-load
General		
Switching frequency (PWM)		250 kHz, typ.
Reliability calculated MTBF MIL-HDBK-217F @ 25 °C		> 500 000 h
Vibration IEC-, EN 61373		Category 1, Grade B
Absolute max. ratings		
Wave soldering temperature		≤ 260 °C, duration ≤10 s, ≥ 1.5 mm distance from body
Manual soldering temperature		≤ 300 °C, duration ≤5 s, ≥ 1.5 mm distance from body
Input surge voltage		-0.7…50 V, duration 1 s max.

Safety Standard		EN 62368-1
EMC characteristics EN 50155		
CE, EN 50121-3-2, (see figure 4)		150..500 kHz, 99 dBµV
CE, EN 55016-2-1 (see figure 4)		500 kHz..30 MHz, 93 dBµV
RE; EN 50121-3-2 (see figure 4)		30..230 MHz, 40 dBµV/m at 10 m
RE, EN 55016-2-1 (see figure 4)		230 MHz..1GHz, 47dBµV/m at 10m
ESD, EN 50121-3-2		Contact ±6 kV, air ±8 kV
RS, EN 50121-3-2		80 MHz...800 MHz, 20 Vrms/m
EFT, EN 50121-3-2 (see fig. 4a)		±2 kV, 5/50 ns, 5 kHz
Surge, EN 50121-3-2 (see fig. 4a)		line to line ±1 kV
CS EN 50121-3-2		150 kHz..80 MHz, 10 Vrms
EMC characteristics EN 55032		
RE, EN 55032, CISPR32		Class A (see figure 4)
CE, EN 55032, CISPR32		Class A (see figure 4)
RE, EN 55032, CISPR32		Class B (see figure 4)
CE, EN 55032, CISPR32		Class B (see figure 4)
ESD, EN 61000-4-2 perf. crit. B		Contact: ±6 kV, air: ±8 kV
RS, EN61000-4-3, perf. crit. A		20 V/m
EFT, EN61000-4-4 perf. crit. A		±2 kV, (see figure 4a)
CS, EN61000-4-6 perf. crit. A		10 Vrms
Environmental		
Operating ambient temperature		-40 … 85 °C with derating
Storage temperature		-55 … 125 °C
Case temperature		105 °C, max.
Over temperature protection		Case temp. 120 °C, max.
Storage humidity		5…95 %, non condensing
Thermal impedance		P100AxxS: 8 K/W P100AxxSK: 5.7 K/W (with heatsink) P100AxxSHB: 6.8 K/W (base plate)
Cooling		Free air convection, 20 LFM
Physical		
Dimensions	P100AxxS	61.8 x 40.2 x 12.7 mm
	P100AxxSK	61.8 x 40.2 x 27.7 mm
	P100AxxSHB	62 x 56 x 14.6 mm
Weight	P100AxxS	86 g
	P100AxxSK	117 g
	P100AxxSHB	106 g
Case material		Aluminium alloy
Potting Material		Plastic, UL94V-0 rated

Note:
1. All specifications measured at Ta 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 converter are not hot swappable

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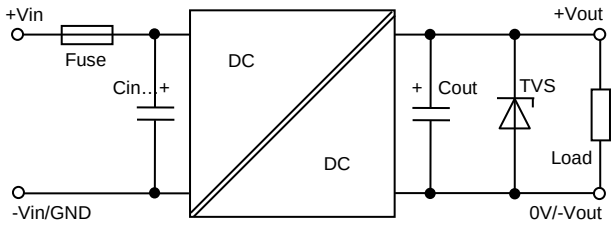
Ordering information									
Output Power	Series	Input voltage		Output voltage		Output		Package version	
P100	**A**	**24**		**05**		**S**		**HB**	
100 Watt		24	24 V_{DC}	05	5 V_{DC}	S	single	blank	Standart version
				12	12 V_{DC}			HB	Slotted base plate version
				15	15 V_{DC}			K	Heat sink version
				24	24 V_{DC}				
				28	28 V_{DC}				
				48	48 V_{DC}				

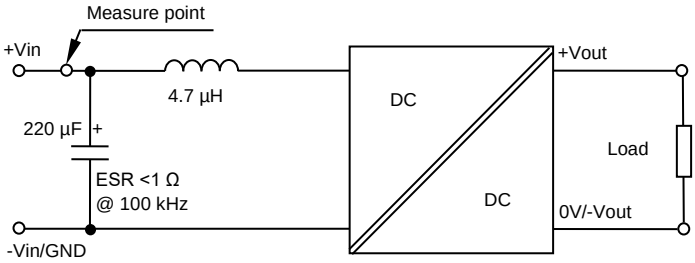
Typical application and test circuit

The P100A 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	Fuse	Cin	Cout	TVS
P100A2405S	20 A Time delay type	220 µF	470 µF	SMDJ7.0A
P100A2412S			220 µF	SMDJ15A
P100A2415S			220 µF	SMDJ18A
P100A2424S			100 µF	SMDJ30A
P100A2428S			100 µF	SMDJ36A
P100A2448S			100 µF	SMDJ64A

Figure 1 Measure circuit input reflected ripple current



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

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

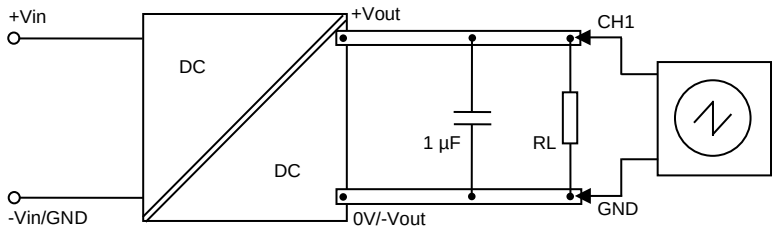


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Figure 4, EMC filter circuit for IEC/EN 61000-4-4, IEC/EN 61000-4-5 performance criteria B and EN 55032 Class B

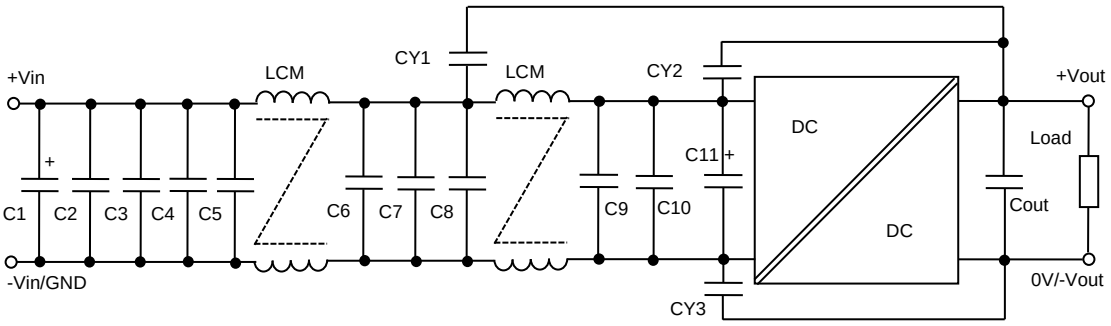
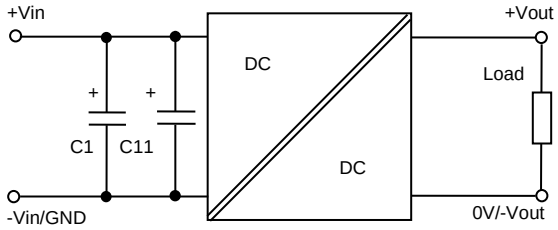
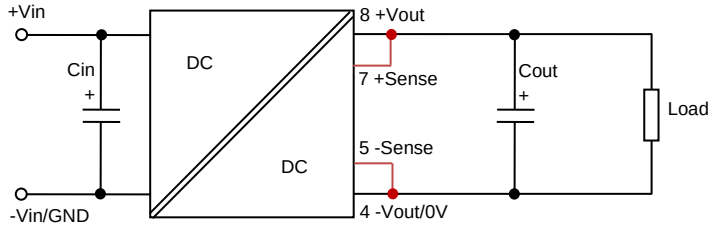


Figure 4a, EMS filter circuit only for IEC/EN 61000-4-4, IEC/EN 61000-4-5 performance criteria B



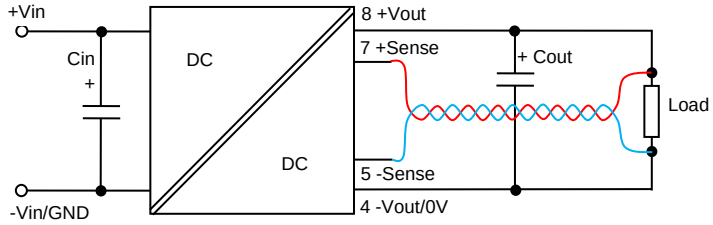
Recommended peripheral components to circuits in figures 4 and 4a						
Conducted Emission	C1 electrolytic	C11 electrolytic	C2,C3,C4,C5,C6, C7, C8, C9, C10 ceramic chip	LCM	CY1, CY2 Y1 safety type	CY3 Y1 safety type
EN 55032 Class A	150 µF	47 µF	10 µF	1.6 mH	-	2.2 nF
EN 55032 Class B	150 µF	47 µF	10 µF	1.6 mH	2.2 nF	2.2 nF

Application circuit for output voltage control without remote dropout compensation



Output voltage control for standard applications. Connect +Vout with +Sense and –Vout/0V with -Sense direct on the DC/DC-converter output!

Application circuit with output voltage remote dropout compensation



Applicable for remote compensation of output voltage drops. Connect +Vout with +Sense and –Vout/0V with –Sense via twisted wire direct on the load!

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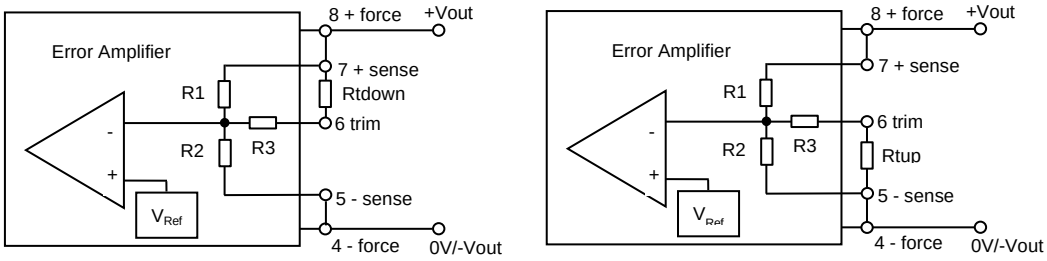
Application circuit for trimming function



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]
P100A2405S	3.036	3	10	2.5	2.97	6.15
P100A2412S	11	2.87	15	2.5	64.7	9.6
P100A2415S	14.03	2.8	15	2.5	98.6	8.8
P100A2424S	24.872	2.87	15	2.5	192	12.8
P100A2428S	29.201	2.851	15	2.5	240.5	12.1
P100A2448S	53.017	2.894	15	2.5	458	14.45
Maximum output voltage adjust range is between 91 ... 110 % of nomina output voltage, see min. Rtdown / Rtup **Attention! A trim down lower than 91 % of nominal output voltage value can destroy the converter!**						

Trim down resistor formula

$$b = \frac{Vout - Vref}{Vref} * R2$$

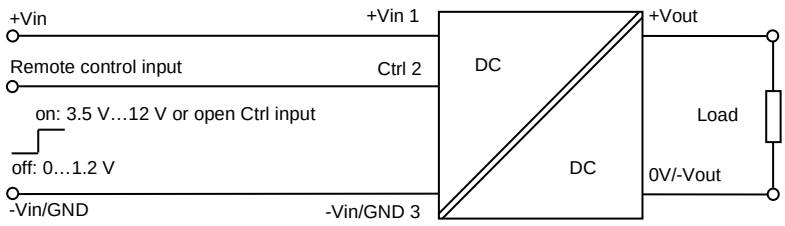
$$Rtdown = \frac{R1 * b}{R1 - b} - R3$$

Trim up resistor formula

$$a = \frac{Vref}{Vout - Vref} * R1$$

$$Rtup = \frac{R2 * a}{R2 - a} - R3$$

Application circuit for remote control function



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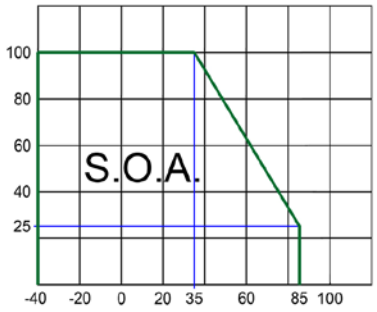
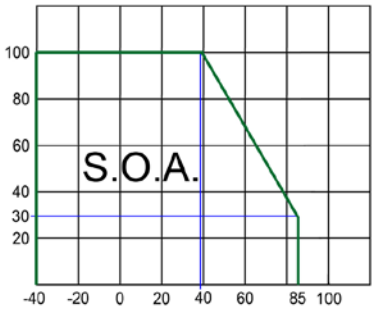
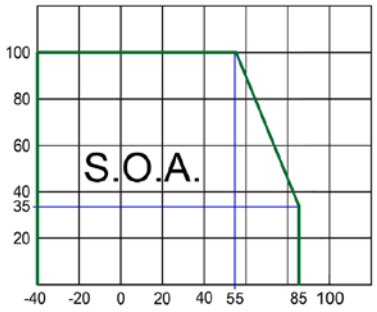
P100A2424S temperature derating
at Vin 24 V and 20 LFM



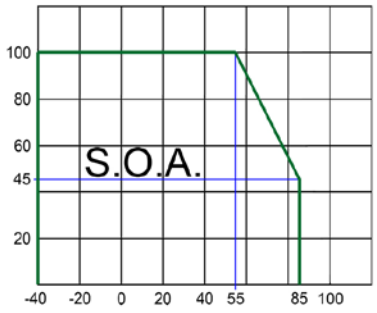
P100A2424SHB temperature derating
at Vin 24 V and 20 LFM



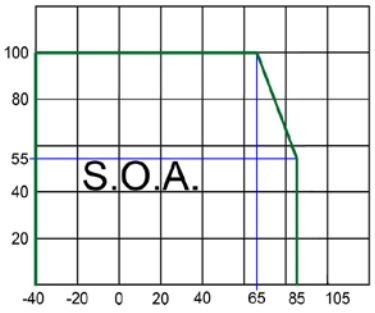
P100A2424SK temperature derating
at Vin 24 V and 20 LFM



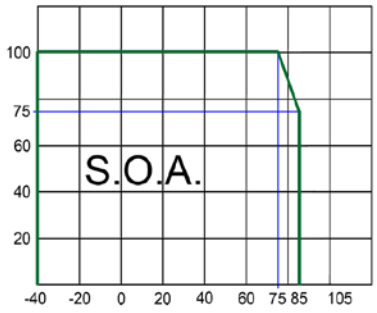
P100A2424S temperature derating
at Vin 24 V and 100 LFM



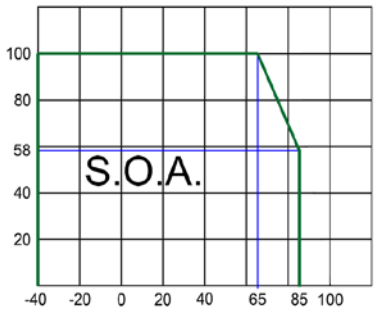
P100A2424SHB temperature derating
at Vin 24 V and 100 LFM



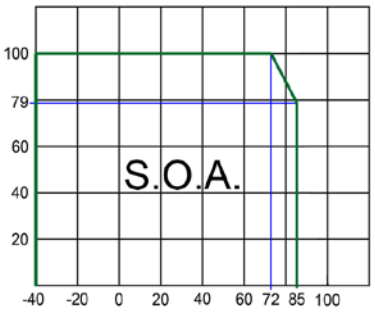
P100A2424SK temperature derating
at Vin 24 V and 100 LFM



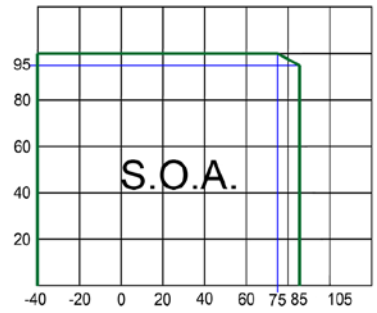
P100A2424S temperature derating
at Vin 24 V and 300 LFM



P100A2424SHB temperature derating
at Vin 24 V and 300 LFM



P100A2424SK temperature derating
at Vin 24 V and 300 LFM



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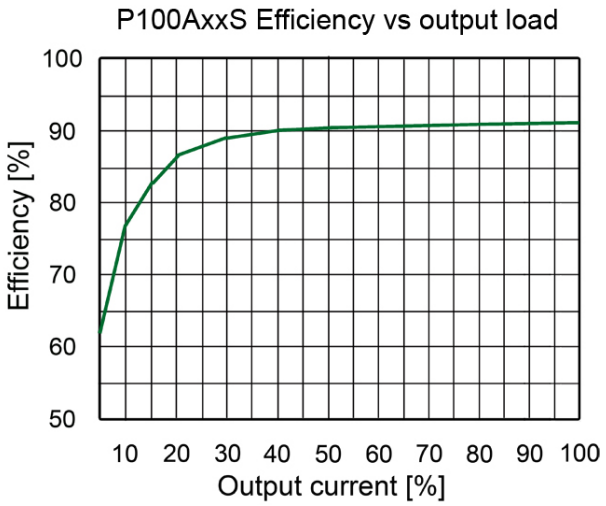
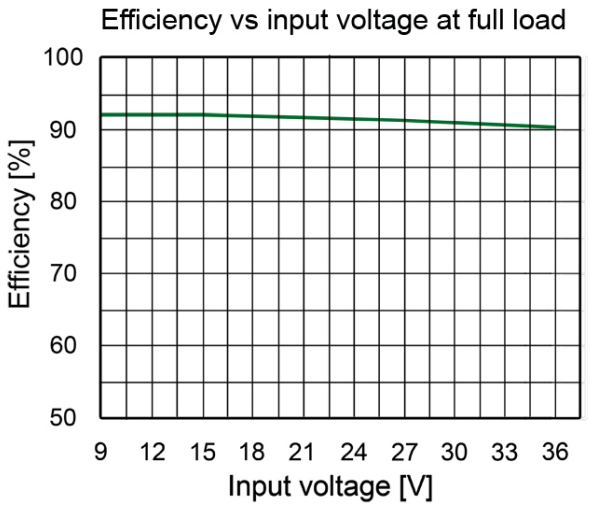
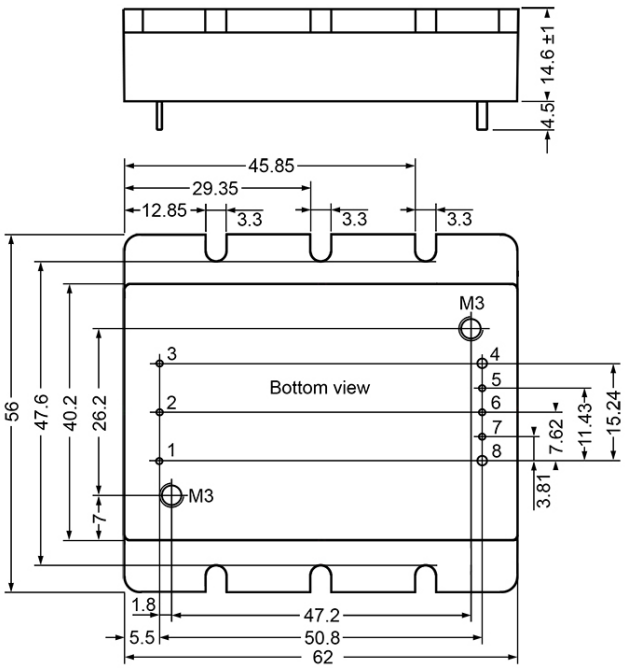
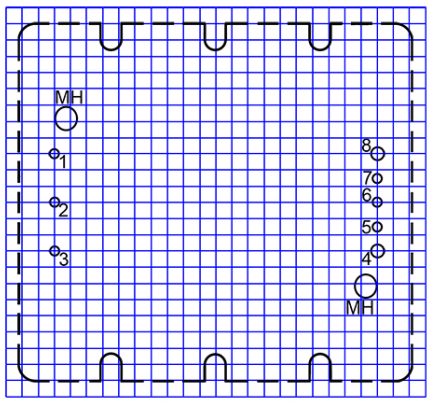




Mechanical dimensions half brick version with slotted base plate P100A24xxSHB





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

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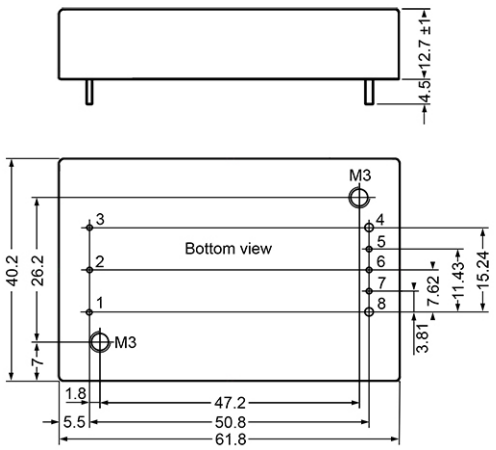
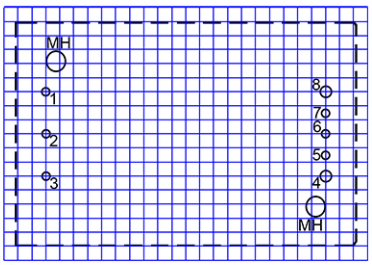
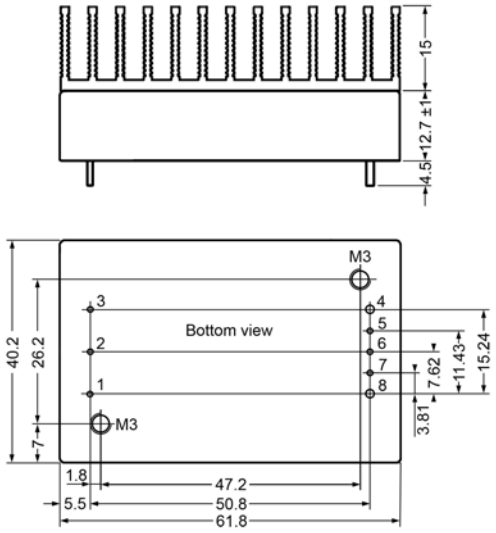
Mechnical dimensions standard version P100A24xxS





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

Mechanical dimensions heatsink version P100A24xxSK



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

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

Rev: 20190820 f

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