

# 1 W SMD DC-DC Converter P1ES\_CS-Series



PHI-CON

- Single output
- Up to 1500 V<sub>DC</sub> isolation
- MTBF > 3.5 Mio. h at 25 °C
- -40...105 °C Operating temperature range
- Efficiency up to 85 %
- Continuous short circuit protection
- Unregulated



## Model guide

Type	Input voltage		Output voltage [V <sub>DC</sub> ]	Input current at Vin nominal		Output current		Output voltage drift @ load 10~100% [%] max.	Efficiency typ. [%]	Capacitive load max. [μF]
	Nominal [V <sub>DC</sub> ]	Range [V <sub>DC</sub> ]		no load [mA] typ.	full load [mA] typ.	[mA] min.	[mA] max.			
P1ES053R3CS	5.0	4.5..5.5	3.3	5	270	30	303	20	74	2400
P1ES0505CS	5.0	4.5..5.5	5.0	5	270	20	200	15	82	2400
P1ES0509CS	5.0	4.5..5.5	9.0	12	240	12	111	10	83	1000
P1ES0512CS	5.0	4.5..5.5	12.0	12	240	9	84	10	83	560
P1ES0515CS	5.0	4.5..5.5	15.0	18	240	7	67	10	83	560
P1ES0524CS	5.0	4.5..5.5	24.0	18	240	4	42	10	85	220
P1ES1205CS	12	10.8..13.2	5.0	8	107	20	200	15	82	2400
P1ES1209CS	12	10.8..13.2	9.0	8	106	12	111	10	83	1000
P1ES1212CS	12	10.8..13.2	12.0	8	106	9	84	10	83	560
P1ES1215CS	12	10.8..13.2	15.0	8	106	7	67	10	83	560
P1ES1224CS	12	10.8..13.2	24.0	8	103	4	42	10	85	220
P1ES1505CS	15	13.5..16.5	5.0	8	86	20	200	15	82	2400
P1ES1515CS	15	13.5..16.5	15.0	8	85	7	67	10	83	560
P1ES2405CS	24	21.6..26.4	5.0	8	55	20	200	15	82	2400
P1ES2409CS	24	21.6..26.4	9.0	8	55	12	111	10	83	1000
P1ES2412CS	24	21.6..26.4	12.0	8	55	9	84	10	83	560
P1ES2415CS	24	21.6..26.4	15.0	8	55	7	67	10	83	560
P1ES2424CS	24	21.6..26.4	24.0	8	53	4	42	10	85	220

## Specifications

Input	
Voltage range	± 10 %
Filter	Capacitor
Reflected input ripple current	P1ES05xxCS: 15 mA, typ. All others: 30 mA, typ. (see Figure 1)
Surge voltage, ≤1 s	P1ES05xxCS: Vin -0.7 ~ 9 V <sub>DC</sub> P1ES12xxCS: Vin -0.7 ~ 18 V <sub>DC</sub> P1ES15xxCS: Vin -0.7 ~ 21 V <sub>DC</sub> P1ES24xxCS: Vin -0.7 ~ 30 V <sub>DC</sub>
Input / output:	
Isolation voltage tested for 60 sec. @ leakage current < 1 mA	1.5 kV <sub>DC</sub>
Isolation Resistance @ 500 V <sub>DC</sub>	≥ 10 <sup>9</sup> Ω
Capacitance @ 100 mV, 100 kHz	20 pF, typ.
Output	
Voltage deviation @ 1% V <sub>in</sub> change	P1ES053R3CS: ± 1.5 %, max. All others: ± 1.2 %, max.
Output voltage tolerance	See diagrams on page 3
Temperature coefficient	0.02 % / °C, max., at full load
Ripple & noise (BW 20 MHz)	P1ES0524CS: ≤ 100 mVp-p All others: ≤ 75 mVp-p
Short circuit protection	Continuous, hiccup, auto restart
General	
Switching frequency	265 kHz, typ.
Reliability, MIL-HDBK-217@25 °C	MTBF 3.5 Mio. h

Safety standard		EN-, IEC-, UL 62368-1
Environmental		
CE	EN 55032, CISPR 32	Class B (see Figure 3)
RE	EN 55032, CISPR 32	Class B (see Figure 3)
ESD	EN-, IEC 61000-4-2	Air ± 8 kV perf. criteria B
	P1ES05xxCS:	Contact ± 4 kV perf. criteria B
	P1ES12xxCS:	Contact ± 6 kV perf. criteria B
	P1ES15xxCS:	Contact ± 6 kV perf. criteria B
P1ES24xxCS:	Contact ± 6 kV perf. criteria B	
Operating ambient temperature		-40 °C .. 105 °C see derating diagram
Storage temperature		-55 °C .. 125 °C
Case temperature rise at full load		25 °C, typ.
Derating		See derating curve
Storage humidity		Up to 95 %, non condensing
Cooling		Free air convection, 35...60 LFM
Physical		
Package material		Heat resistant plastic (UL94 V-0)
Weight		1.4 g
Mechanical dimensions		11.4 x 13.2 x 7.25 mm
Moisture sensitivity level IPC/JEDEC J-STD-020D.1		MSL1
Absolute maximum ratings		
Reflow soldering temperature		≤ 217 °C duration ≤ 60 s, ≤ 245 °C peak duration ≤ 10 s

## Ordering information

PHI-CON & output power	Series designation	Mounting technology	Input voltage		Output voltage		Revision	Output configuration		Packing	
P1 1 W	E	S SMD	05	5 V	3R3	3.3V	C	S	Single	ST	Short tube
			12	12 V	05	5 V				LT	Long tube
			15	15 V	09	9 V				TR	Tape & Reel
			24	24 V	12	12 V					
					15	15 V					
					24	24 V					



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Note:

1. Operation under minimum load will not damage the converter. However, they may not meet all specifications.
2. In order to ensure the converter can work reliably with high efficiency, the minimum load should not less than 10 % rated load when it is used. If the needed power is indeed small, please parallel a resistor on the output side. The sum of the efficient power and resistor consumption power should not be less than 10 %.
3. Maximum capacitive load is tested at nominal input voltage and full load.
4. Unless otherwise noted, all specifications are measured at Ta 25 °C, humidity <75 %, nominal input voltage and rated output load.
5. Specifications of this product are subject to changes without prior notice.
6. P1ES series is not usable for HV-IGBT driver applications.
7. The converter are not hot pluggable

Figure 1 Measure circuit for Input reflected ripple current

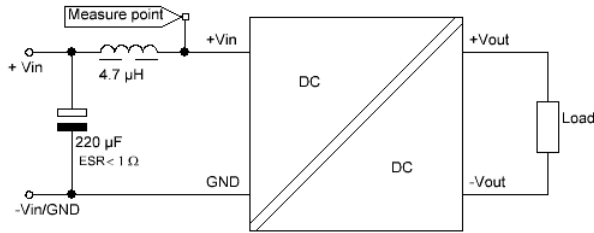
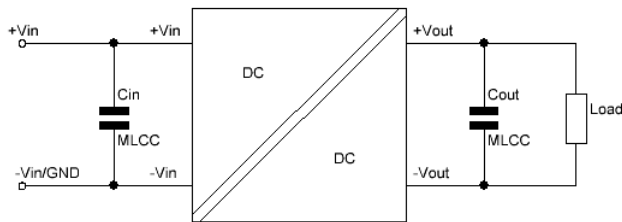


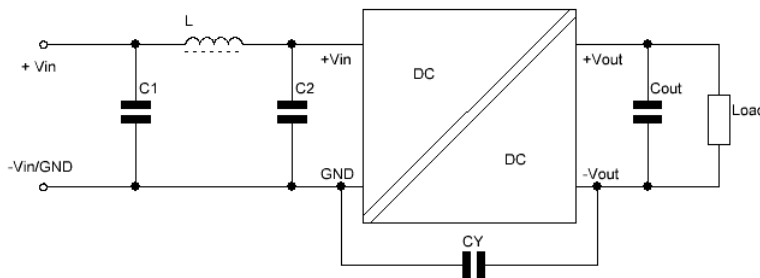
Figure 2 Typical peripheral circuit for ripple & noise reduction



Vin version	Cin	Vout version	Cout
P1ES05xxCS	4.7 µF	P1ES053R3CS	10 µF
P1ES12xxCS	2.2 µF	P1ESxx05CS	10 µF
P1ES15xxCS	2.2 µF	P1ESxx09CS	4.7 µF
P1ES24xxCS	1 µF	P1ESxx12CS	2.2 µF
		P1ESxx15CS	1 µF
		P1ESxx24CS	0.47 µF

If it is required to further reduce input and output ripple, a filter capacitor may be connected to the input and output terminals (see Figure 2). Moreover, choosing a suitable filter capacitor is very important, start-up problems may be caused if the capacitance is too large. Under the condition of safe and reliable operation, the recommended capacitive load values are shown in (see table page 1).

Figure 3 Recommended external EMI circuit for Class B



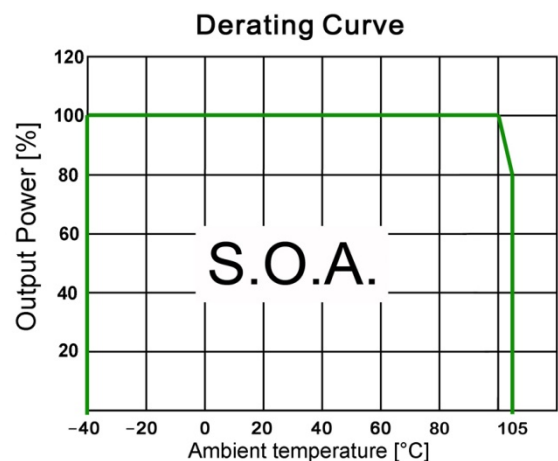
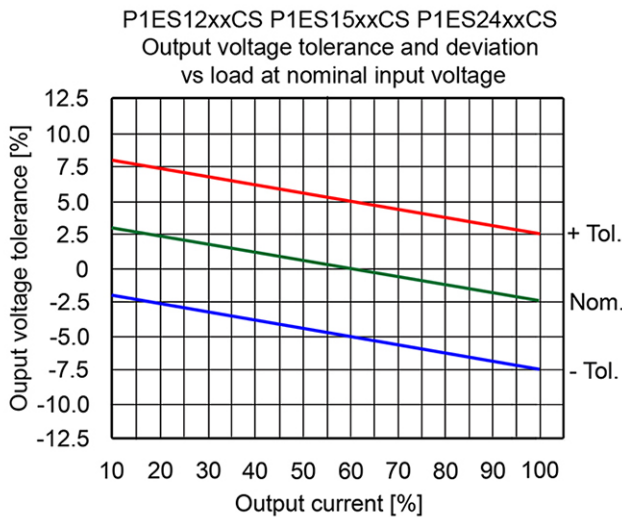
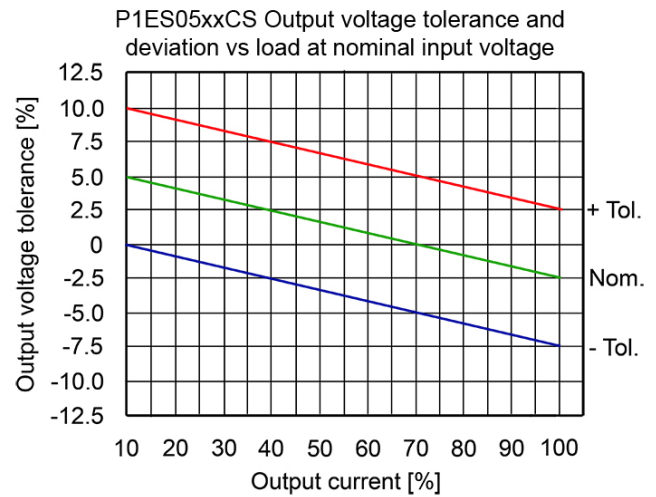
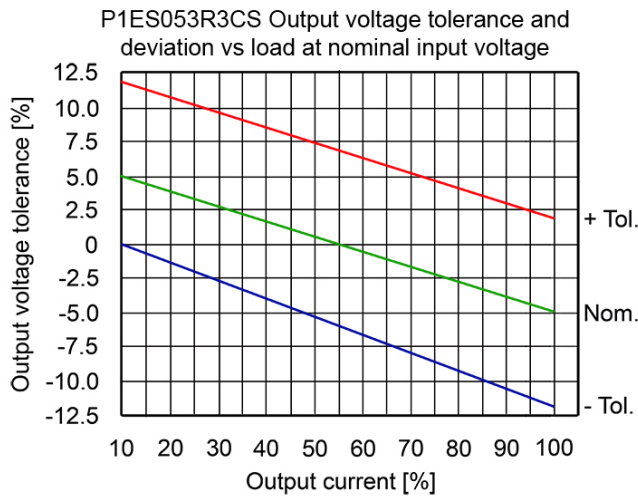
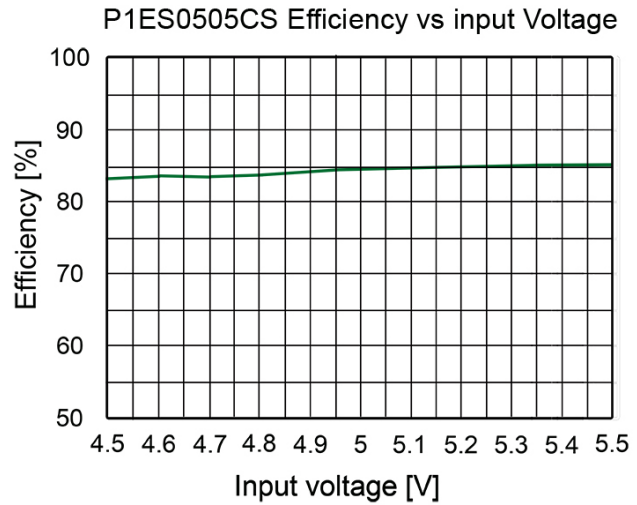
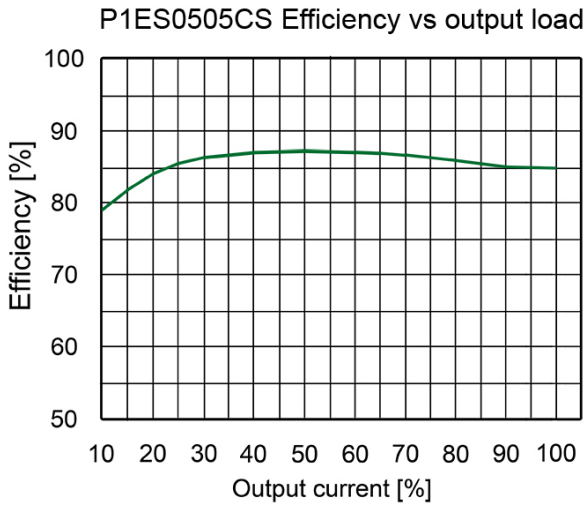
Model series	C1, C2	L	CY
P1ES05xxCS	4.7 µF, 25 V	6.8 µH	-
P1ES09xxCS	4.7 µF, 50 V	6.8 µH	-
P1ES12xxCS	4.7 µF, 50 V	6.8 µH	270 pF, 4 kV
P1ES15xxCS	4.7 µF, 50 V	6.8 µH	270 pF, 4 kV
P1ES24xxCS	4.7 µF, 50 V	6.8 µH	270 pF, 4 kV

CY: Johanson dielectrics, Type 202R18W102KV4E or HEC: C1206X102K202T

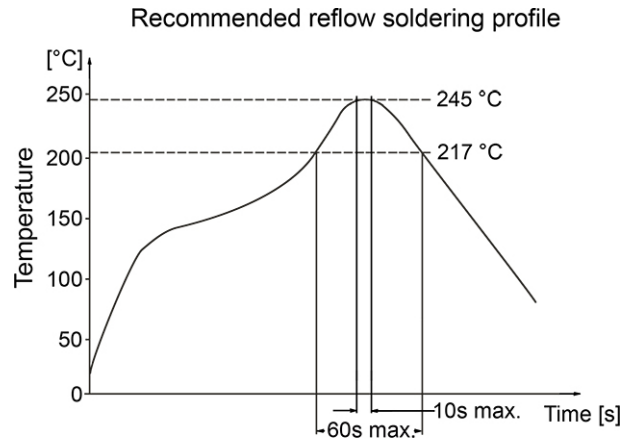
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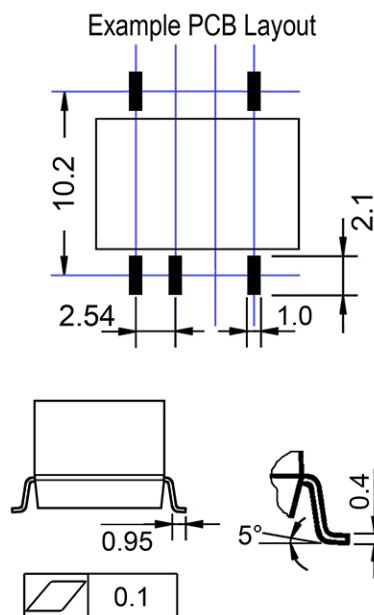
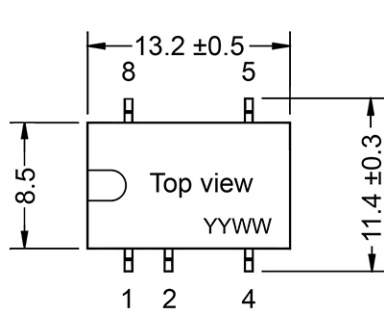


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This curve applies only to hot air reflow soldering.

## Mechanical package dimensions and footprint layout



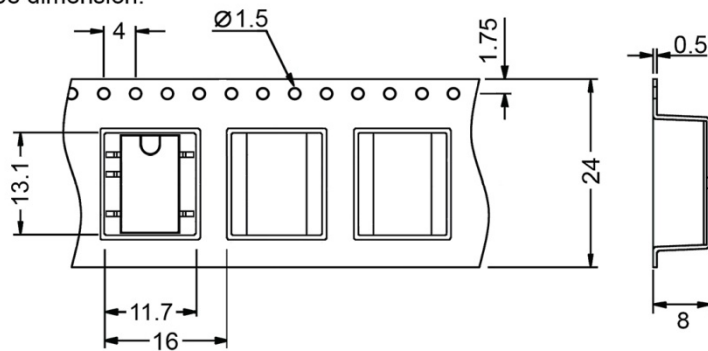
Notes:  
All dimensions are in mm  
General tolerances  $\pm 0.25$  mm  
Pin tolerances  $\pm 0.1$  mm

Lead assignment	
Lead	Lead connection
1	- Vin / GND
2	+ Vin
3	No lead
4	- Vout / 0V
5	+ Vout
6	No lead
7	No lead
8	Not connected

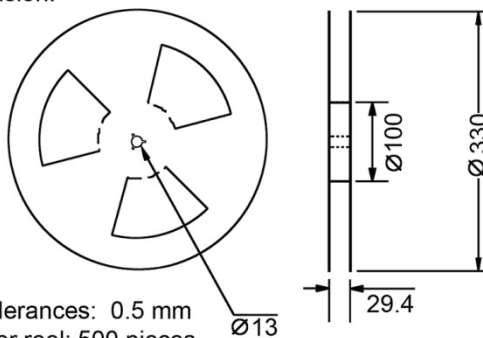
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Tape dimension:

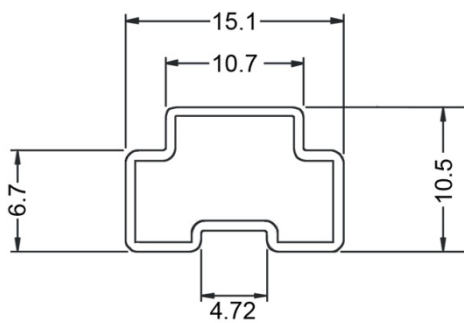


Reel dimension:



Unit: mm  
 General tolerances: 0.5 mm  
 Quantity per reel: 500 pieces

Dimensions tube packing



Note:  
 Unit: mm  
 General tolerances: ± 0.5 mm  
 Short tube quantity 18 pieces

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