# **SERIES:** PDSE1-S | **DESCRIPTION:** DC-DC CONVERTER

## FEATURES

- 1 W isolated output
- unregulated output
- compact SIP package
- single output models
- continuous short circuit protection
- extended temperature range (-40~105°C)
- 1500 Vdc isolation
- no load input current as low as 5 mA
- efficiency up to 85%
- UL 62368-1 certified
- designed to meet EN/BS EN 62368



RoHS c UL us

## MODEL

| MODEL | input voltage | | output voltage | output current | | output power | ripple & noise[1] | efficiency[2] |
|---|---|---|---|---|---|---|---|---|
| | typ (Vdc) | range (Vdc) | (Vdc) | min (mA) | max (mA) | max (W) | max (mVp-p) | typ (%) |
| PDSE1-S3-S3-S | 3.3 | 2.97~3.63 | 3.3 | 30 | 303 | 1 | 75 | 79 |
| PDSE1-S3-S5-S | 3.3 | 2.97~3.63 | 5 | 20 | 200 | 1 | 75 | 82 |
| PDSE1-S3-S9-S[4] | 3.3 | 2.97~3.63 | 9 | 11 | 111 | 1 | 75 | 85 |
| PDSE1-S3-S12-S | 3.3 | 2.97~3.63 | 12 | 8 | 83 | 1 | 75 | 82 |
| PDSE1-S3-S15-S[4] | 3.3 | 2.97~3.63 | 15 | 7 | 67 | 1 | 75 | 82 |
| PDSE1-S3-S24-S[4] | 3.3 | 2.97~3.63 | 24 | 4 | 42 | 1 | 100 | 84 |
| PDSE1-S5-S3-S | 5 | 4.5~5.5 | 3.3 | 30 | 303 | 1 | 75 | 74 |
| PDSE1-S5-S5-S | 5 | 4.5~5.5 | 5 | 20 | 200 | 1 | 75 | 82 |
| PDSE1-S5-S9-S | 5 | 4.5~5.5 | 9 | 12 | 111 | 1 | 75 | 83 |
| PDSE1-S5-S12-S | 5 | 4.5~5.5 | 12 | 9 | 84 | 1 | 75 | 83 |
| PDSE1-S5-S15-S | 5 | 4.5~5.5 | 15 | 7 | 67 | 1 | 75 | 83 |
| PDSE1-S5-S24-S | 5 | 4.5~5.5 | 24 | 4 | 42 | 1 | 100 | 85 |
| PDSE1-S12-S3-S | 12 | 10.8~13.2 | 3.3 | 30 | 303 | 1 | 75 | 75 |
| PDSE1-S12-S5-S | 12 | 10.8~13.2 | 5 | 20 | 200 | 1 | 75 | 80 |
| PDSE1-S12-S9-S | 12 | 10.8~13.2 | 9 | 12 | 111 | 1 | 75 | 80 |
| PDSE1-S12-S12-S | 12 | 10.8~13.2 | 12 | 9 | 83 | 1 | 75 | 80 |
| PDSE1-S12-S15-S | 12 | 10.8~13.2 | 15 | 7 | 67 | 1 | 75 | 81 |
| PDSE1-S12-S24-S | 12 | 10.8~13.2 | 24 | 5 | 42 | 1 | 100 | 81 |
| PDSE1-S15-S5-S | 15 | 13.5~16.5 | 5 | 20 | 200 | 1 | 75 | 80 |
| PDSE1-S15-S9-S | 15 | 13.5~16.5 | 9 | 12 | 111 | 1 | 75 | 80 |
| PDSE1-S15-S12-S | 15 | 13.5~16.5 | 12 | 9 | 83 | 1 | 75 | 80 |
| PDSE1-S15-S15-S | 15 | 13.5~16.5 | 15 | 7 | 67 | 1 | 75 | 81 |
| PDSE1-S15-S24-S[4] | 15 | 13.5~16.5 | 24 | 5 | 42 | 1 | 100 | 81 |
| PDSE1-S24-S3-S | 24 | 21.6~26.4 | 3.3 | 30 | 303 | 1 | 75 | 75 |
| PDSE1-S24-S5-S | 24 | 21.6~26.4 | 5 | 20 | 200 | 1 | 75 | 79 |
| PDSE1-S24-S9-S | 24 | 21.6~26.4 | 9 | 12 | 111 | 1 | 75 | 80 |
| PDSE1-S24-S12-S | 24 | 21.6~26.4 | 12 | 9 | 83 | 1 | 75 | 81 |



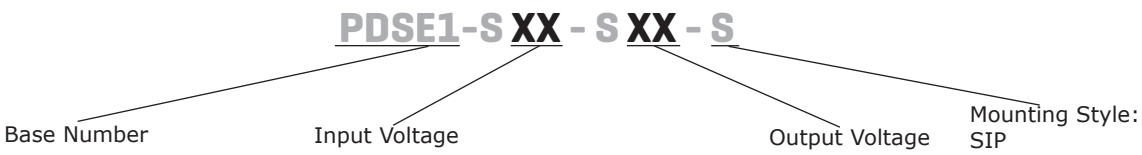
Please read our datasheet & drawing disclaimer here.

## MODEL

| | input voltage | | output voltage | output current | | output power | ripple & noise[1] | efficiency[2] |
|---|---|---|---|---|---|---|---|---|
| | typ (Vdc) | range (Vdc) | (Vdc) | min (mA) | max (mA) | max (W) | max (mVp-p) | typ (%) |
| PDSE1-S24-S15-S | 24 | 21.6~26.4 | 15 | 7 | 67 | 1 | 75 | 81 |
| PDSE1-S24-S24-S | 24 | 21.6~26.4 | 24 | 5 | 42 | 1 | 100 | 81 |

Notes:
1. Measured at nominal input, 20 MHz bandwidth oscilloscope, with 10 µF tantalum and 1 µF ceramic capacitors on the output.
2. Measured at nominal input voltage, full load.
3. All specifications are measured at Ta=25°C, humidity < 75%, nominal input voltage, and rated output load unless otherwise specified.
4. Model is not UL certified.

## PART NUMBER KEY




## INPUT

| parameter | conditions/description | | min | typ | max | units |
|---|---|---|---|---|---|---|
| operating input voltage | 3.3 Vdc input models | | 2.97 | 3.3 | 3.63 | Vdc |
| | 5 Vdc input models | | 4.5 | 5 | 5.5 | Vdc |
| | 12 Vdc input models | | 10.8 | 12 | 13.2 | Vdc |
| | 15 Vdc input models | | 13.5 | 15 | 16.5 | Vdc |
| | 24 Vdc input models | | 21.6 | 24 | 26.4 | Vdc |
| surge voltage | for maximum of 1 second | | | | | |
| | 3.3 Vdc input models | | -0.7 | | 5 | Vdc |
| | 5 Vdc input models | | -0.7 | | 9 | Vdc |
| | 12 Vdc input models | | -0.7 | | 18 | Vdc |
| | 15 Vdc input models | | -0.7 | | 21 | Vdc |
| | 24 Vdc input models | | -0.7 | | 30 | Vdc |
| current | 3.3 Vdc input models | 3.3 Vdc output models | | | 405 | mA |
| | | all other output models | | | 389 | mA |
| | 5 Vdc input models | 3.3, 5 Vdc output models | | | 286 | mA |
| | | 9, 12 Vdc output models | | | 254 | mA |
| | | all other output models | | | 254 | mA |
| | 12 Vdc input models | 3.3 Vdc output models | | | 118 | mA |
| | | 5, 9, 12 Vdc output models | | | 110 | mA |
| | | all other output models | | | 109 | mA |
| | 15 Vdc input models | 5, 9, 12 Vdc output models | | | 88 | mA |
| | | all other output models | | | 87 | mA |
| | 24 Vdc input models | 3.3 Vdc output models | | | 61 | mA |
| | | 5 Vdc output models | | | 58 | mA |
| | | 9 Vdc output models | | | 57 | mA |
| | | all other output models | | | 56 | mA |
| filter | filter capacitor | | | | | |

## OUTPUT

| parameter | conditions/description | | min | typ | max | units |
|---|---|---|---|---|---|---|
| maximum capacitive load[4] | 3.3, 5 Vdc output models<br>9 Vdc output models<br>12, 15 Vdc output models<br>all other models | | | | 2,400<br>1,000<br>560<br>220 | µF<br>µF<br>µF<br>µF |
| voltage accuracy | see tolerance envelope curves | | | | | |
| line regulation | for Vin change of 1%<br>3.3 Vdc output models<br>all other models | | | | <br>±1.5<br>±1.2 | <br>%<br>% |
| load regulation | from 10% to full load | | | | | |
| | 3.3 Vdc input models | 3.3 Vdc output models<br>all other models | | | ±18<br>±15 | %<br>% |
| | all other input models | 3.3 Vdc output models<br>5 Vdc output models<br>all other models | | | ±20<br>±15<br>±10 | %<br>%<br>% |
| switching frequency | 100% load, nominal input voltage<br>3.3 Vdc input models<br>all other input models | | | <br>220<br>270 | | <br>kHz<br>kHz |
| temperature coefficient | at full load | | | ±0.02 | | %/°C |

Note: 4. Tested at input voltage range and full load.

## PROTECTIONS

| parameter | conditions/description | min | typ | max | units |
|---|---|---|---|---|---|
| short circuit protection | continuous, self recovery | | | | |

## SAFETY AND COMPLIANCE

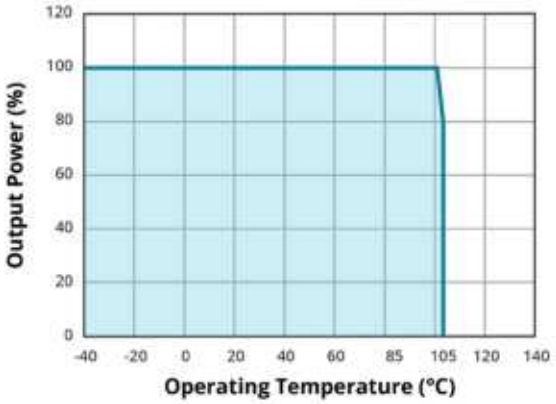
| parameter | conditions/description | min | typ | max | units |
|---|---|---|---|---|---|
| isolation voltage | input to output for 1 minute at 1 mA<br>input to output for 1 second at 1 mA | 1,500<br>3,000 | | | Vdc<br>Vdc |
| isolation resistance | input to output at 500 Vdc | 1,000 | | | MΩ |
| isolation capacitance | input to output, 100 kHz / 0.1 V | | 20 | | pF |
| safety approvals | certified to 62368-1: UL<br>designed to meet 62368: EN/BS EN | | | | |
| conducted emissions | CISPR32/EN55032, class B (external circuit required, see Figure 2) | | | | |
| radiated emissions | CISPR32/EN55032, class B (external circuit required, see Figure 2) | | | | |
| ESD | IEC/EN61000-4-2, air ± 8 kV; contact ± 4 kV, class B | | | | |
| MTBF | as per MIL-HDBK-217F, 25°C | 3,500,000 | | | hours |
| RoHS | yes | | | | |

## ENVIRONMENTAL

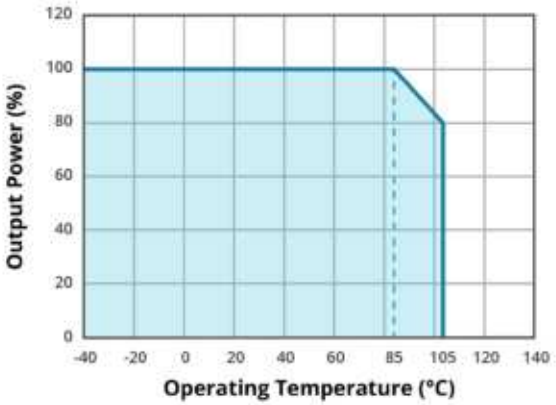
| parameter | conditions/description | | min | typ | max | units |
|---|---|---|---|---|---|---|
| operating temperature | see derating curves | | -40 | | 105 | °C |
| storage temperature | | | -55 | | 125 | °C |
| storage humidity | non-condensing | | | | 95 | % |
| case temperature rise | 3.3 Vdc input models | all output models | | 25 | | °C |
| | all other input models | 3.3 Vdc output model at 25°C<br>all other models at 25°C | | 25<br>15 | | °C<br>°C |

## DERATING CURVES

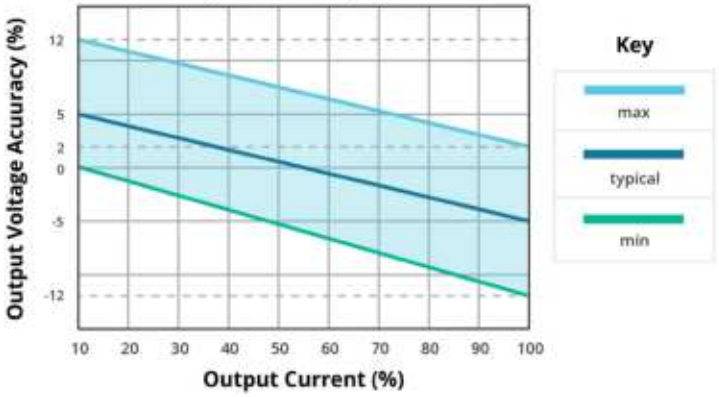
***TEMPERATURE DERATING CURVE***
***3.3 Vdc input models***



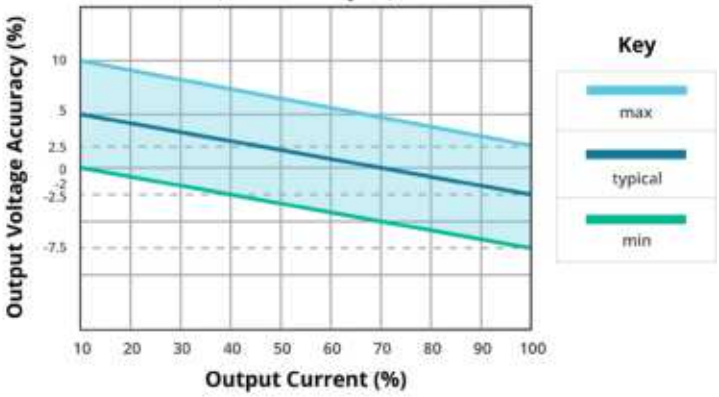

***TEMPERATURE DERATING CURVE***
***all other input models***



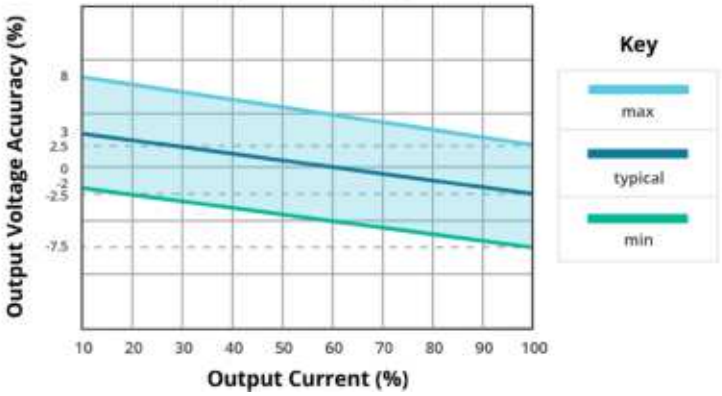

***OUTPUT REGULATION CURVE***
***3.3 Vdc output models***
***(nominal input)***



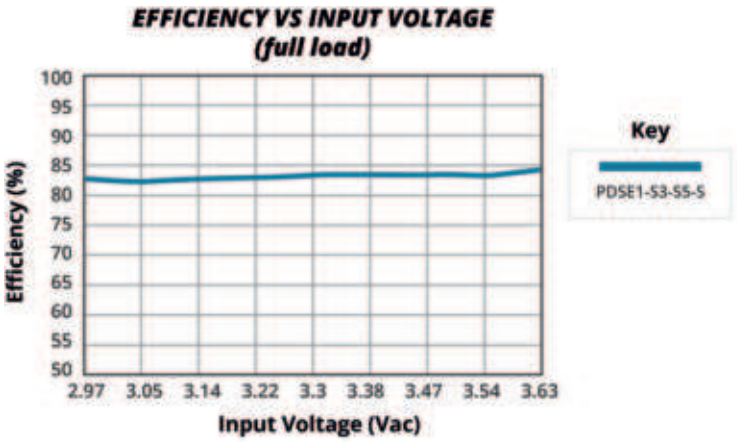

***OUTPUT REGULATION CURVE***
***3.3, 5 Vdc input model / 5, 9, 12, 15, 24 Vdc output models***
***(nominal input)***

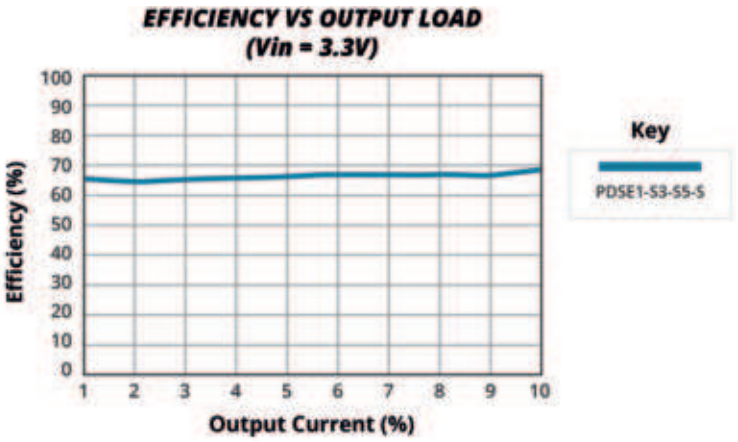


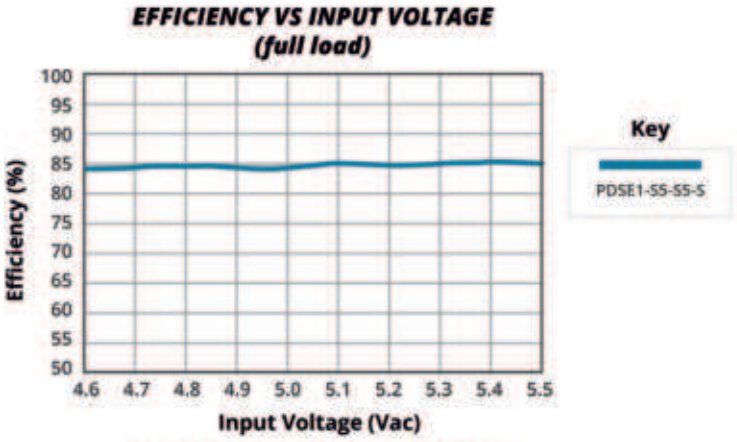

***OUTPUT REGULATION CURVE***
***all other input models / 5, 9, 12, 15, 24 Vdc output models***
***(nominal input)***

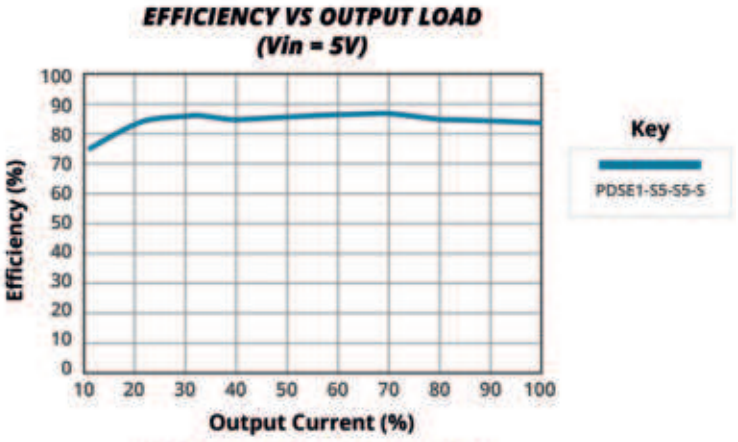


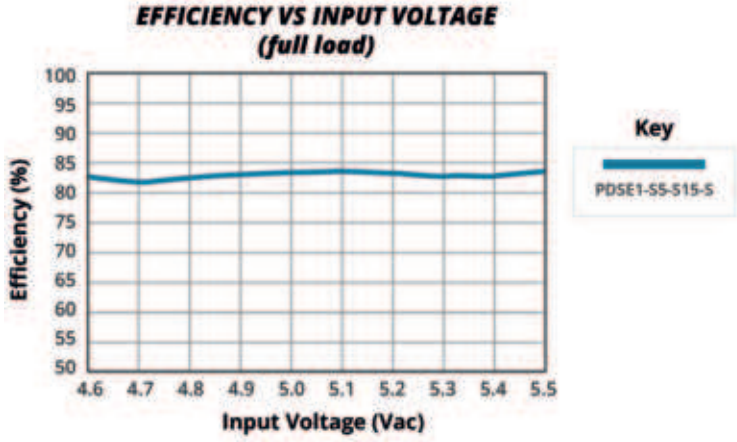
## EFFICIENCY CURVES

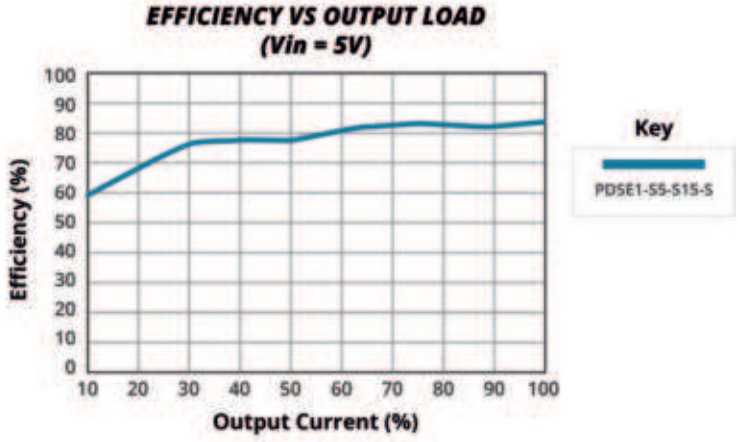


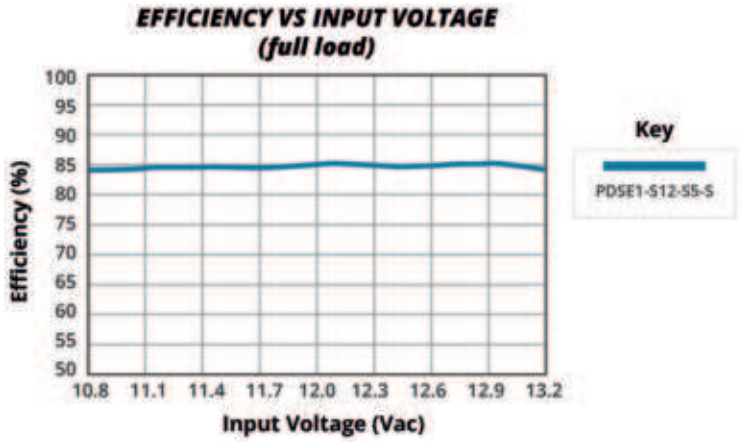



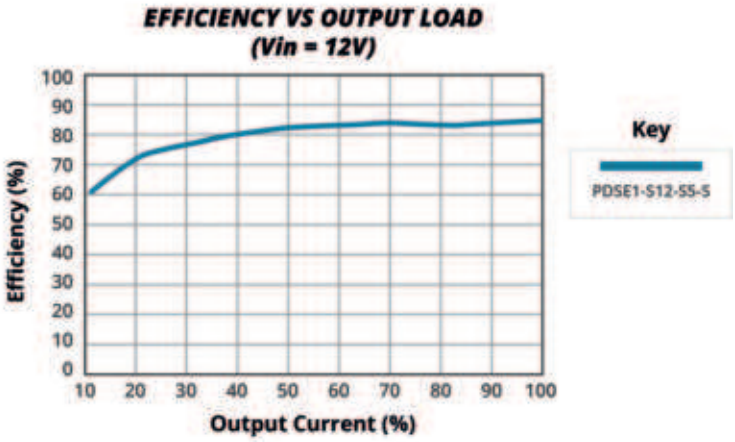



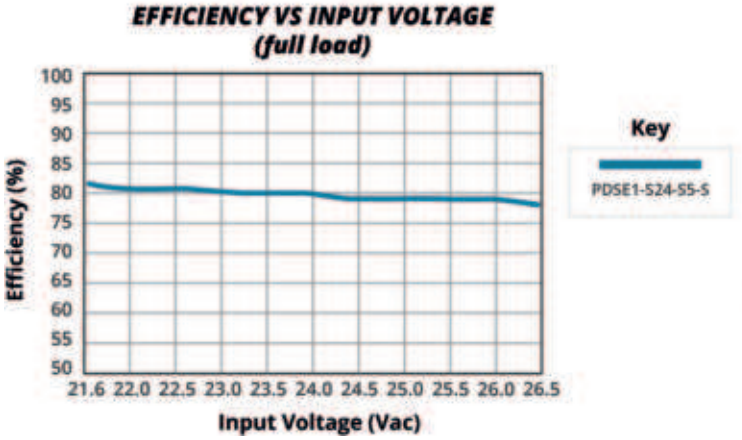



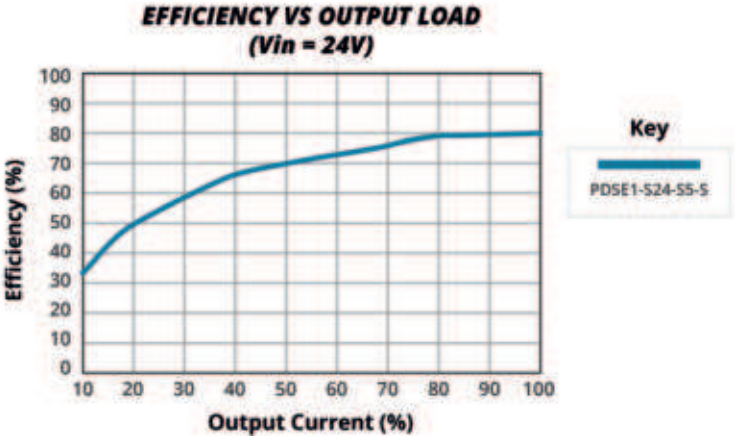



## EFFICIENCY CURVES (CONTINUED)



## SOLDERABILITY

| parameter | conditions/description | min | typ | max | units |
|---|---|---|---|---|---|
| hand soldering | 1.5 mm from case for 10 seconds | | | 300 | °C |

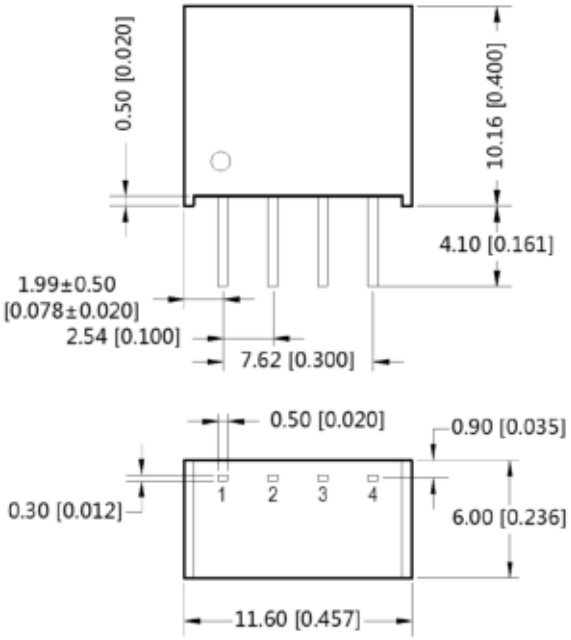
## MECHANICAL

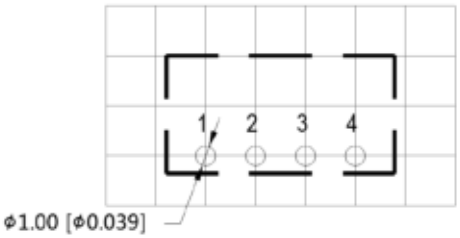
| parameter | conditions/description | min | typ | max | units |
|---|---|---|---|---|---|
| dimensions | 11.60 x 6.00 x 10.16 [0.457 x 0.236 x 0.400 inch] | | | | mm |
| case material | black flame-retardant and heat-resistant plastic (UL94V-0) | | | | |
| weight | | | 1.3 | | g |

## MECHANICAL DRAWING

units: mm [inch]
tolerance: ±0.25[±0.010]
pin section tolerance: ±0.10[±0.004]

| PIN CONNECTIONS | |
|---|---|
| PIN | Function |
| 1 | GND |
| 2 | Vin |
| 3 | 0V |
| 4 | +Vout |




Note : Grid 2.54*2.54mm

Recommended PCB Layout
Top View

## APPLICATION CIRCUIT

If you want to further reduce the input and output ripple, a filter capacitor may be connected to the input and output terminals (Figure 1) provided that the capacitance is less than the maximum capacitive load of the model, otherwise start-up problems may be caused if the capacitance is too large.

**Figure 1**

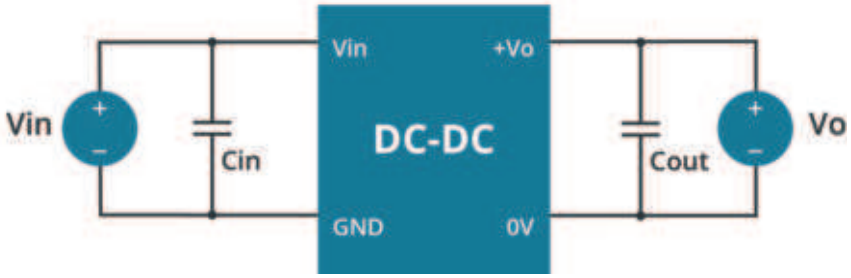



**Table 1**

| Vin (Vdc) | Cin (μF/V) | Vo (Vdc) | Cout (μF/V) |
|---|---|---|---|
| 3.3 | 10/25 | 3.3 | 10/16 |
| | 10/25 | 5 | 10/16 |
| | 10/25 | 9 | 2.2/16 |
| | 10/25 | 12 | 2.2/25 |
| | 10/25 | 15 | 1/25 |
| | 10/25 | 24 | 1/50 |
| 5 | 4.7 | 3.3, 5 | 10 |
| | | 9, 12 | 2.2 |
| | | 15, 24 | 1 |
| 12 | 2.2/25 | 3.3 | 10/16 |
| 15 | 2.2/25 | 5 | 10/16 |
| 24 | 1/50 | 9 | 2.2/16 |
| -- | -- | 12 | 2.2/25 |
| -- | -- | 15 | 1/25 |
| -- | -- | 24 | 1/50 |

## EMC RECOMMENDED CIRCUIT

**Figure 2**

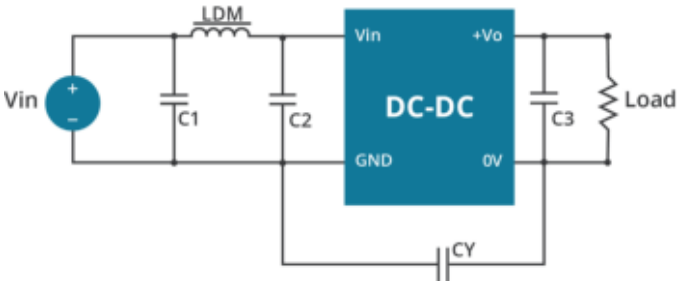



**Table 2**

| Recommended External Circuit Components | | | |
|---|---|---|---|
| Vin (Vdc) | Vo (Vdc) | 3.3, 5 | 9, 12, 15, 24 |
| 3.3 | C1, C2 | 4.7 μF / 16 V | 4.7 μF / 16 V |
| | CY | -- | 270 pF / 4 kVdc |
| | C3 | refer to the Cout in Table 1 | |
| | LDM | 6.8 μH | 6.8 μH |
| Vin (Vdc) | Vo (Vdc) | 3.3, 5, 9 | 12, 15, 24 |
| 5 | CY | -- | 1 nF / 4kVdc |
| | C3 | refer to the Cout in Table 1 | |
| | C1, C2 | 4.7 μF / 25 V | 4.7 μF / 25 V |
| | LDM | 6.8 μH | 6.8 μH |
| 12, 15, 24 | C1 | 4.7 μF / 50 V | 4.7 μF / 50 V |
| | C2 | 4.7 μF / 50 V | 4.7 μF / 50 V |
| | C3 | refer to the Cout in Table 1 | |
| | LDM | 6.8 μH | 6.8 μH |
| | CY | 270 pF / 2 kV | 270 pF / 2 kV |

## REVISION HISTORY

| rev. | description | date |
|---|---|---|
| 1.0 | initial release | 05/10/2019 |
| 1.01 | safeties updated in features and safety line, packaging removed | 01/18/2021 |
| 1.02 | datasheet updated | 06/21/2021 |
| 1.03 | CE certification removed | 11/07/2022 |
| 1.04 | 3.3V input models added | 03/08/2024 |

The revision history provided is for informational purposes only and is believed to be accurate.

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