

**SERIES:** PDS2-M | **DESCRIPTION:** DC-DC CONVERTER**FEATURES**

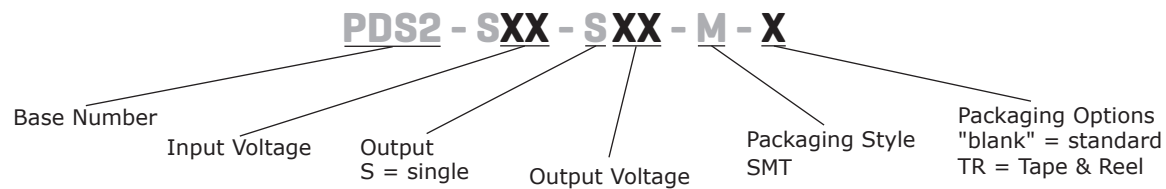
- 2 W isolated output
- smaller package
- single unregulated output
- 1,500 Vdc isolation
- short circuit protection
- extended temperature range (-40~105°C)
- high efficiency at light load
- efficiency up to 84%

**MODEL**

| MODEL                      | input voltage |                | output voltage<br>(Vdc) | output current |             | output power<br>max<br>(W) | ripple and noise <sup>1</sup> |                          |
|----------------------------|---------------|----------------|-------------------------|----------------|-------------|----------------------------|-------------------------------|--------------------------|
|                            | typ<br>(Vdc)  | range<br>(Vdc) |                         | min<br>(mA)    | max<br>(mA) |                            | typ<br>(mVp-p)                | efficiency<br>typ<br>(%) |
| PDS2-S5-S3-M*              | 5             | 4.5~5.5        | 3.3                     | 40             | 400         | 1.32                       | 100                           | 78                       |
| PDS2-S5-S5-M*              | 5             | 4.5~5.5        | 5                       | 40             | 400         | 2                          | 100                           | 79                       |
| PDS2-S5-S9-M*              | 5             | 4.5~5.5        | 9                       | 22             | 222         | 2                          | 100                           | 82                       |
| PDS2-S5-S12-M <sup>3</sup> | 5             | 4.5~5.5        | 12                      | 17             | 167         | 2                          | 100                           | 82                       |
| PDS2-S5-S15-M*             | 5             | 4.5~5.5        | 15                      | 13             | 133         | 2                          | 100                           | 83                       |
| PDS2-S12-S5-M*             | 12            | 10.8~13.2      | 5                       | 40             | 400         | 2                          | 100                           | 79                       |
| PDS2-S12-S9-M*             | 12            | 10.8~13.2      | 9                       | 22             | 222         | 2                          | 100                           | 82                       |
| PDS2-S12-S12-M*            | 12            | 10.8~13.2      | 12                      | 17             | 167         | 2                          | 100                           | 82                       |
| PDS2-S12-S15-M*            | 12            | 10.8~13.2      | 15                      | 13             | 133         | 2                          | 100                           | 83                       |
| PDS2-S12-S24-M*            | 12            | 10.8~13.2      | 24                      | 8              | 83          | 2                          | 100                           | 84                       |
| PDS2-S15-S15-M*            | 15            | 13.5~16.5      | 15                      | 13             | 133         | 2                          | 100                           | 83                       |
| PDS2-S24-S5-M*             | 24            | 21.6~26.4      | 5                       | 40             | 400         | 2                          | 100                           | 79                       |
| PDS2-S24-S9-M*             | 24            | 21.6~26.4      | 9                       | 22             | 222         | 2                          | 100                           | 82                       |
| PDS2-S24-S12-M*            | 24            | 21.6~26.4      | 12                      | 17             | 167         | 2                          | 100                           | 82                       |
| PDS2-S24-S15-M*            | 24            | 21.6~26.4      | 15                      | 13             | 133         | 2                          | 100                           | 83                       |
| PDS2-S24-S24-M*            | 24            | 21.6~26.4      | 24                      | 8              | 83          | 2                          | 100                           | 84                       |

Notes: 1. Ripple and noise are measured at 20 MHz BW by "parallel cable" method with 1  $\mu$ F ceramic and 10  $\mu$ F electrolytic capacitors on the output.  
2. \* Discontinued model (Standard and Tape and Reel options)  
3. Standard option discontinued.

## PART NUMBER KEY



## INPUT

| parameter               | conditions/description  | min  | typ | max  | units |
|-------------------------|-------------------------|------|-----|------|-------|
| operating input voltage | 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 |      |     |      |       |
|                         | 5 Vdc input models      | -0.7 |     | 9    | Vdc   |
|                         | 12 Vdc input models     | -0.7 |     | 18   | Vdc   |
|                         | 15 Vdc input models     | -0.7 |     | 21   | Vdc   |
| filter                  | 24 Vdc input models     | -0.7 |     | 30   | Vdc   |
|                         | capacitance filter      |      |     |      |       |

## OUTPUT

| parameter               | conditions/description              | min | typ | max   | units |
|-------------------------|-------------------------------------|-----|-----|-------|-------|
| line regulation         | for Vin change of 1%                |     |     |       |       |
|                         | 3.3 Vdc output models               |     |     | ±1.5  | %     |
|                         | all other models                    |     |     | ±1.2  | %     |
| load regulation         | measured from 10% load to full load |     |     |       |       |
|                         | 3.3 Vdc output models               |     | 18  |       | %     |
|                         | 5 Vdc output models                 |     | 12  |       | %     |
|                         | 9 Vdc output models                 |     | 9   |       | %     |
|                         | 12 Vdc output models                |     | 8   |       | %     |
|                         | 15 Vdc output models                |     | 7   |       | %     |
| voltage accuracy        | 24 Vdc output models                |     | 6   |       | %     |
|                         | see tolerance envelope curve        |     |     |       |       |
| switching frequency     | 100% load, nominal input voltage    |     | 100 |       | kHz   |
| temperature coefficient | 100% load                           |     |     | ±0.03 | %/°C  |

## PROTECTIONS

| parameter                             | conditions/description | min | typ | max | units |
|---------------------------------------|------------------------|-----|-----|-----|-------|
| short circuit protection <sup>1</sup> |                        |     |     | 1   | s     |

Notes: 1. The supply voltage must be discontinued at the end of the short circuit duration

## SAFETY AND COMPLIANCE

| parameter            | conditions/description                                            | min       | typ | max | units |
|----------------------|-------------------------------------------------------------------|-----------|-----|-----|-------|
| isolation voltage    | input to output for 1 minute at 1 mA max.                         | 1,500     |     |     | Vdc   |
| isolation resistance | input to output at 500 Vdc                                        | 1,000     |     |     | MΩ    |
| safety approvals     | designed to meet 62368: EN/BS EN                                  |           |     |     |       |
| conducted emissions  | CISPR22/EN55022 class B (external circuit required, see Figure 1) |           |     |     |       |
| radiated emissions   | CISPR22/EN55022 class B (external circuit required, see Figure 1) |           |     |     |       |
| ESD                  | IEC/EN61000-4-2, class B, contact ± 8kV                           |           |     |     |       |
| MTBF                 | as per MIL-HDBK-217F at 25°C                                      | 3,500,000 |     |     | hours |
| RoHS                 | 2011/65/EU                                                        |           |     |     |       |

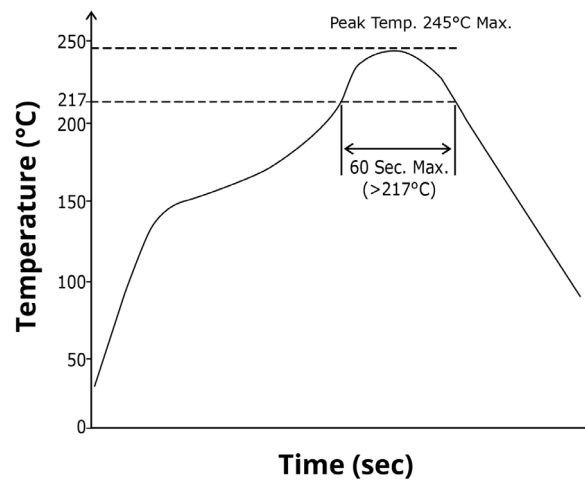
## ENVIRONMENTAL

| parameter             | conditions/description  | min | typ | max | units |
|-----------------------|-------------------------|-----|-----|-----|-------|
| operating temperature | see derating curve      | -40 |     | 105 | °C    |
| storage temperature   |                         | -55 |     | 125 | °C    |
| storage humidity      | non-condensing          |     |     | 95  | %     |
| temperature rise      | at full load, Ta = 25°C |     | 25  |     | °C    |

## SOLDERABILITY

| parameter        | conditions/description          | min | typ | max | units |
|------------------|---------------------------------|-----|-----|-----|-------|
| hand soldering   | 1.5 mm from case for 10 seconds |     |     | 300 | °C    |
| reflow soldering | see reflow soldering profile    |     |     | 245 | °C    |

### WAVE SOLDERING PROFILE



## MECHANICAL

| parameter     | conditions/description                            | min | typ | max | units |
|---------------|---------------------------------------------------|-----|-----|-----|-------|
| dimensions    | 12.70 x 11.20 x 7.25 (0.500 x 0.441 x 0.285 inch) |     |     |     | mm    |
| case material | epoxy resin (UL94-V0)                             |     |     |     |       |
| weight        |                                                   |     | 1.6 |     | g     |

## MECHANICAL DRAWING

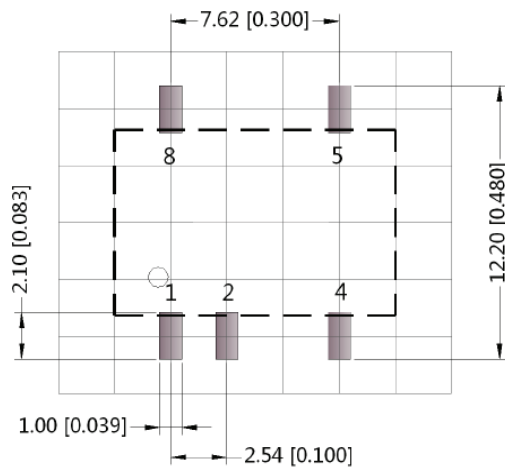
units: mm[inch]

tolerance:  $\pm 0.25[\pm 0.010]$ pin section tolerance:  $\pm 0.10[\pm 0.004]$ 

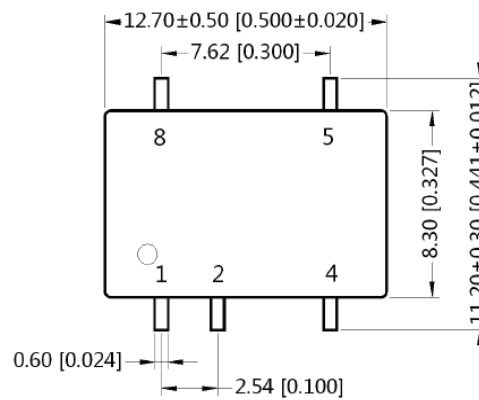
| PIN CONNECTIONS |          |
|-----------------|----------|
| PIN             | FUNCTION |
| 1               | GND      |
| 2               | Vin      |
| 4               | 0V       |
| 5               | +Vo      |
| 8               | NC       |

NC: No Connection

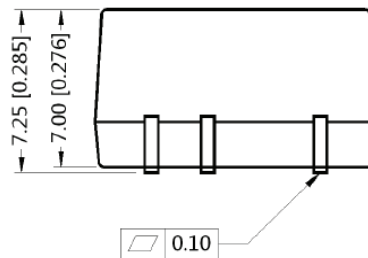
Note: Grid 2.54\*2.54mm



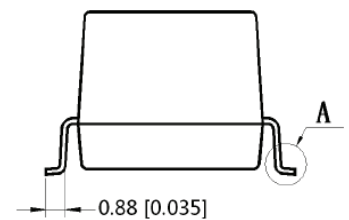
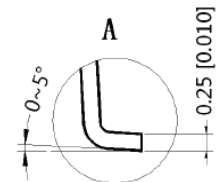
Top View  
PCB Layout



Top View



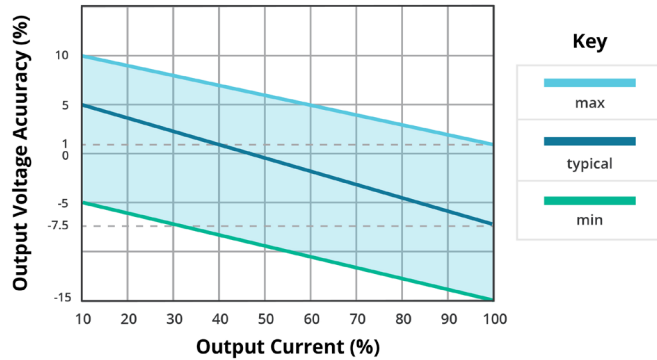
Front View



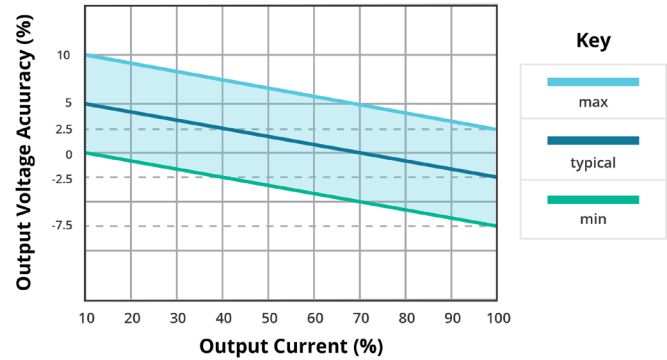
Side View

## DERATING CURVES

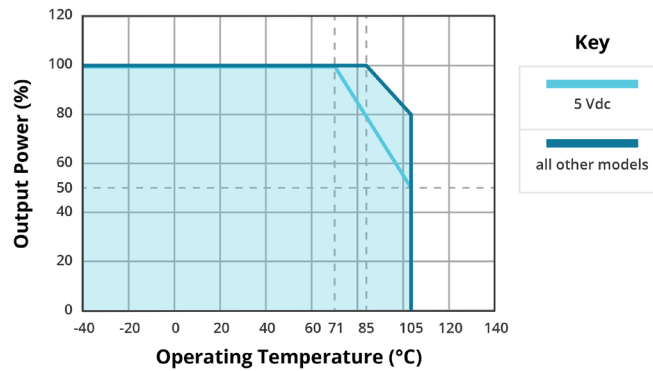
**OUTPUT REGULATION CURVE**  
3.3 Vdc output model  
(nominal input)



**OUTPUT REGULATION CURVE**  
all other output models  
(nominal input)

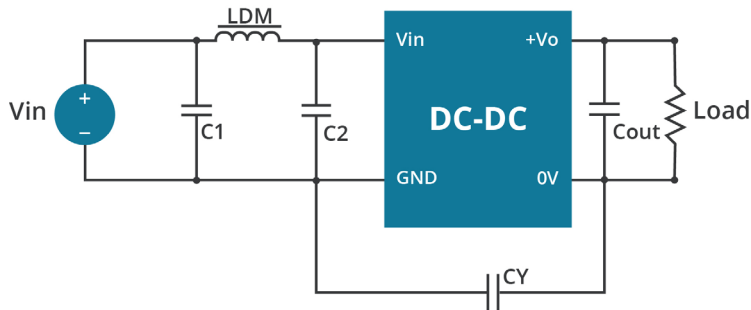


**TEMPERATURE DERATING CURVE**



## EMC RECOMMENDED CIRCUIT

**Figure 1**



**Table 1**

| Recommended external circuit components |           |           |                 |       |
|-----------------------------------------|-----------|-----------|-----------------|-------|
| Vin (Vdc)                               | C1        | C2        | CY <sup>1</sup> | LDM   |
| 5                                       | 4.7μF/50V | 4.7μF/50V | --              | 6.8μH |
| 12                                      | 4.7μF/50V | 4.7μF/50V | --              | 6.8μH |
| 15                                      | 4.7μF/50V | 4.7μF/50V | --              | 6.8μH |
| 24                                      | 4.7μF/50V | 4.7μF/50V | 1nF/2kV         | 6.8μH |

Note:

1. CY of 1nF/2kV required for PDS2-S12-S24-M
2. See Table 2 for Cout values

## APPLICATION NOTES

### 1. Output load requirement

To ensure this module can operate efficiently and reliably, the minimum output load may not be less than 10% of the full load during operation. If the actual output power is low, connect a resistor at the output end in parallel to increase the load.

### 2. Overload Protection

Under normal operating conditions, the output circuit of this product has no protection against overload. The simplest method to add this is to add a circuit breaker to the circuit.

### 3. Recommended circuit

If you want to further decrease the input/output ripple, you can increase the capacitance accordingly or choose capacitors with low ESR (see Figure 2 & Table 2). However, the capacitance of the output filter capacitor must be appropriate. If the capacitance is too high, a startup problem might arise. For every channel of the output, to ensure safe and reliable operation, the maximum capacitance must be less than the maximum capacitive load (see Table 3).

Figure 2

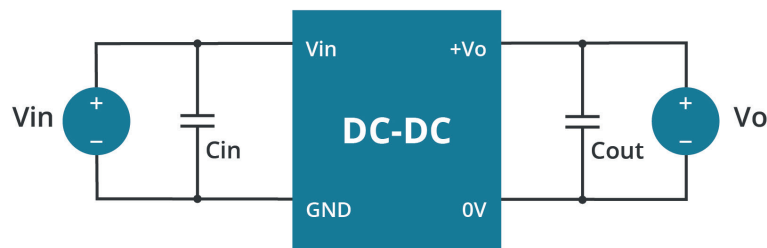


Table 2

| Vin (Vdc) | Cin (μF) | Vo (Vdc) | Cout (μF) |
|-----------|----------|----------|-----------|
| 5         | 4.7      | 3.3      | 10        |
| 12        | 2.2      | 5        | 10        |
| 15        | 2.2      | 9        | 4.7       |
| 24        | 1        | 12       | 2.2       |
| --        | --       | 15       | 1         |
| --        | --       | 24       | 0.47      |

Table 3

| Vout (Vdc) | Max. Capacitive Load (μF) |
|------------|---------------------------|
| 3.3        | 220                       |
| 5          | 220                       |
| 9          | 220                       |
| 12         | 220                       |
| 15         | 220                       |
| 24         | 220                       |

Note:

1. Operation under minimum load will not damage the converter; however, they may not meet all specifications listed.
2. Max. capacitive load tested at input voltage range and full load.
3. All specifications measured at: Ta=25°C, humidity<75%, nominal input voltage and rated output load, unless otherwise specified.

## REVISION HISTORY

| rev. | description                                                                                                                                                                                                                                                                                                                          | date       |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| 1.0  | initial release                                                                                                                                                                                                                                                                                                                      | 04/08/2014 |
| 1.01 | updated tolerance envelope curves, discontinued models                                                                                                                                                                                                                                                                               | 08/13/2015 |
| 1.02 | safeties updated in features and safety approvals line                                                                                                                                                                                                                                                                               | 01/19/2021 |
| 1.03 | derating curves and circuit figures updated                                                                                                                                                                                                                                                                                          | 07/12/2021 |
| 1.04 | CE certification removed                                                                                                                                                                                                                                                                                                             | 11/09/2022 |
| 1.05 | discontinued models PDS2-S12-S24-M, PDS2-S12-S24-M-TR, PDS2-S12-S9-M, PDS2-S24-S12-M, PDS2-S24-S24-M, PDS2-S24-S9-M, PDS2-S24-S9-M-TR, PDS2-S5-S15-M, PDS2-S5-S3-M & PDS2-S5-S9-M                                                                                                                                                    | 09/26/2023 |
| 1.06 | discontinued models PDS2-S12-S12-M, PDS2-S12-S15-M, PDS2-S12-S15-M-TR, PDS2-S12-S5-M, PDS2-S12-S9-M-TR, PDS2-S15-S15-M, PDS2-S15-S15-M-TR, PDS2-S24-S12-M-TR, PDS2-S24-S15-M, PDS2-S24-S15-M-TR, PDS2-S24-S24-M-TR, PDS2-S24-S5-M, PDS2-S24-S5-M-TR, PDS2-S5-S12-M, PDS2-S5-S15-M-TR, PDS2-S5-S3-M-TR, PDS2-S5-S5-M, PDS2-S5-S9-M-TR | 01/11/2024 |
| 1.07 | discontinued models PDS2-S12-S12-M-TR, PDS2-S12-S5-M-TR & PDS2-S5-S5-M-TR                                                                                                                                                                                                                                                            | 04/05/2024 |

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



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