

## SERIES: PGNP1-S | DESCRIPTION: DC-DC CONVERTER

### FEATURES

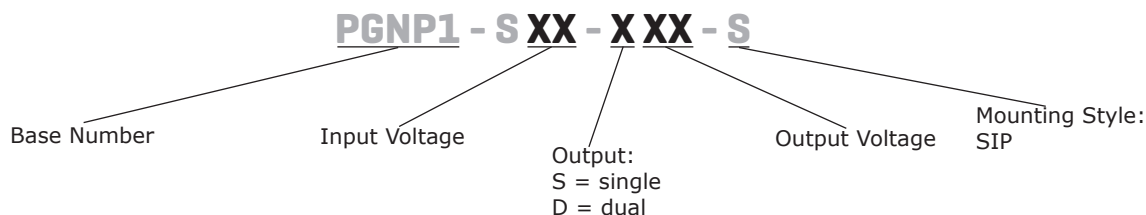
- 6,000 Vdc isolation
- unregulated single/dual outputs
- certified to EN/UL 60601-1 (2x MOPP)
- designed to meet EN 62368-1
- leakage current less than 2  $\mu$ A
- -40 °C ~ 105 °C operating temperature
- continuous output short circuit protection
- reinforced insulation



| MODEL           | input voltage |             | output voltage<br>(Vdc) | output current |          | output power<br>max (W) | ripple & noise <sup>1</sup><br>max (mVp-p) | efficiency <sup>2</sup><br>typ (%) |
|-----------------|---------------|-------------|-------------------------|----------------|----------|-------------------------|--------------------------------------------|------------------------------------|
|                 | typ (Vdc)     | range (Vdc) |                         | min (mA)       | max (mA) |                         |                                            |                                    |
| PGNP1-S12-S3-S  | 12            | 10.8~13.2   | 3.3                     | 31             | 303      | 1                       | 150                                        | 76                                 |
| PGNP1-S12-S5-S  | 12            | 10.8~13.2   | 5                       | 20             | 200      | 1                       | 120                                        | 79                                 |
| PGNP1-S12-S9-S  | 12            | 10.8~13.2   | 9                       | 12             | 111      | 1                       | 120                                        | 81                                 |
| PGNP1-S12-S12-S | 12            | 10.8~13.2   | 12                      | 9              | 84       | 1                       | 120                                        | 83                                 |
| PGNP1-S12-S15-S | 12            | 10.8~13.2   | 15                      | 7              | 67       | 1                       | 120                                        | 83                                 |
| PGNP1-S12-S24-S | 12            | 10.8~13.2   | 24                      | 4              | 42       | 1                       | 120                                        | 82                                 |
| PGNP1-S12-D5-S  | 12            | 10.8~13.2   | ±5                      | ±10            | ±100     | 1                       | 120                                        | 79                                 |
| PGNP1-S12-D9-S  | 12            | 10.8~13.2   | ±9                      | ±6             | ±56      | 1                       | 120                                        | 79                                 |
| PGNP1-S12-D12-S | 12            | 10.8~13.2   | ±12                     | ±5             | ±42      | 1                       | 120                                        | 81                                 |
| PGNP1-S12-D15-S | 12            | 10.8~13.2   | ±15                     | ±4             | ±34      | 1                       | 120                                        | 81                                 |
| PGNP1-S15-D5-S  | 15            | 13.5~16.5   | ±5                      | ±10            | ±100     | 1                       | 120                                        | 77                                 |
| PGNP1-S15-D12-S | 15            | 13.5~16.5   | ±12                     | ±5             | ±42      | 1                       | 120                                        | 79                                 |
| PGNP1-S15-D15-S | 15            | 13.5~16.5   | ±15                     | ±4             | ±33      | 1                       | 120                                        | 79                                 |
| PGNP1-S24-S5-S  | 24            | 21.6~26.4   | 5                       | 20             | 200      | 1                       | 120                                        | 76                                 |
| PGNP1-S24-S9-S  | 24            | 21.6~26.4   | 9                       | 12             | 111      | 1                       | 120                                        | 76                                 |
| PGNP1-S24-S12-S | 24            | 21.6~26.4   | 12                      | 9              | 84       | 1                       | 120                                        | 76                                 |
| PGNP1-S24-S15-S | 24            | 21.6~26.4   | 15                      | 7              | 67       | 1                       | 120                                        | 76                                 |
| PGNP1-S24-S24-S | 24            | 21.6~26.4   | 24                      | 4              | 42       | 1                       | 120                                        | 76                                 |
| PGNP1-S24-D5-S  | 24            | 21.6~26.4   | ±5                      | ±10            | ±100     | 1                       | 120                                        | 75                                 |
| PGNP1-S24-D9-S  | 24            | 21.6~26.4   | ±9                      | ±6             | ±56      | 1                       | 120                                        | 75                                 |
| PGNP1-S24-D12-S | 24            | 21.6~26.4   | ±12                     | ±5             | ±42      | 1                       | 120                                        | 76                                 |
| PGNP1-S24-D15-S | 24            | 21.6~26.4   | ±15                     | ±4             | ±34      | 1                       | 120                                        | 76                                 |

Notes: 1. Measured at nominal input, 20 MHz bandwidth oscilloscope.  
 2. Measured at full load.  
 3. All specifications are measured at Ta=25°C, humidity < 75%, nominal input voltage, and rated output load unless otherwise specified.

## PART NUMBER KEY



## INPUT

| parameter                                       | conditions/description  | min  | typ    | max   | units |
|-------------------------------------------------|-------------------------|------|--------|-------|-------|
| operating input voltage<br>(full load/ no load) | 12 Vdc input models     |      | 106/10 | 116/- | mA    |
|                                                 | 15 Vdc input models     |      | 90/10  | 100/- | mA    |
|                                                 | 24 Vdc input models     |      | 56/12  | 59/-  | mA    |
| surge voltage                                   | for maximum of 1 second |      |        |       |       |
|                                                 | 12 Vdc input models     | -0.7 |        | 18    | Vdc   |
|                                                 | 15 Vdc input models     | -0.7 |        | 21    | Vdc   |
|                                                 | 24 Vdc input models     | -0.7 |        | 30    | Vdc   |
| reflected ripple current <sup>4</sup>           |                         |      | 200    |       | mA    |
| filter                                          | filter capacitor        |      |        |       |       |

Note: 4. Refer to DC-DC Converter Application notes for detailed description of reflected ripple current test

## OUTPUT

| parameter                            | conditions/description         | min | typ   | max   | units |
|--------------------------------------|--------------------------------|-----|-------|-------|-------|
| maximum capacitive load <sup>5</sup> | 3.3, 5 Vdc output models       |     |       | 2,200 | μF    |
|                                      | 9 Vdc output models            |     |       | 680   | μF    |
|                                      | ±9, 12, 15 Vdc output models   |     |       | 470   | μF    |
|                                      | 24, ±12, ±15 Vdc output models |     |       | 220   | μF    |
|                                      | ±5 Vdc output models           |     |       | 1,000 | μF    |
| voltage accuracy                     | see tolerance envelope curves  |     |       |       |       |
| line regulation                      | for Vin change of 1%           |     |       |       |       |
|                                      | 3.3 Vdc output models          |     |       | 1.5   | %     |
|                                      | all other models               |     |       | 1.2   | %     |
| load regulation                      | from 10% to full load          |     |       | 20    | %     |
|                                      | 3.3 & 5 Vdc output models      |     |       | 15    | %     |
|                                      | all other models               |     |       |       |       |
| switching frequency                  | at nominal input, full load    |     | 200   |       | kHz   |
| temperature coefficient              | at full load                   |     | ±0.02 |       | %/°C  |

Note: 5. The capacitive loads of positive and negative outputs are identical.

## PROTECTIONS

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

## SAFETY AND COMPLIANCE

| parameter                    | conditions/description               | min   | typ | max | units |
|------------------------------|--------------------------------------|-------|-----|-----|-------|
| isolation voltage            | input to output for 1 minute at 1 mA | 5,000 |     |     | Vac   |
|                              |                                      | 6,000 |     |     | Vdc   |
| isolation resistance         | input to output at 500 Vdc           | 1,000 |     |     | MΩ    |
| leakage current <sup>6</sup> | at 230 Vac, 50/60 Hz                 |       |     | 2   | μA    |
| isolation capacitance        | input to output, 100 kHz / 0.1 V     |       | 4   |     | pF    |
| safety approvals             | certified to 60601-1: EN, UL         |       |     |     |       |
|                              | designed to meet 62368-1: EN/BS EN   |       |     |     |       |

## SAFETY AND COMPLIANCE (CONTINUED)

| parameter                     | conditions/description                                                                                                                     | min        | typ | max | units |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|------------|-----|-----|-------|
| conducted emissions           | CISPR32/EN55032 CLASS B (see Fig. 4. for recommended circuit)<br>EN60601-1-2/CISPR 11 GROUP1 CLASS B (see Fig. 4. for recommended circuit) |            |     |     |       |
| radiated emissions            | CISPR32/EN55032 CLASS B (see Fig. 4. for recommended circuit)<br>EN60601-1-2/CISPR 11 GROUP1 CLASS B (see Fig. 4. for recommended circuit) |            |     |     |       |
| ESD                           | EN60601-1-2 (IEC/EN61000-4-2) Air $\pm 15$ kV, Contact $\pm 8$ kV, perf. Criteria B                                                        |            |     |     |       |
| MTBF                          | as per MIL-HDBK-217F, 25°C                                                                                                                 | 19,360,000 |     |     | hours |
| creepage & clearance distance |                                                                                                                                            | 8          |     |     | mm    |
| RoHS                          | yes                                                                                                                                        |            |     |     |       |

Note: 6. Leakage current and reinforced insulation is based on 250 VAC, 50/60 Hz system input voltage

## ENVIRONMENTAL

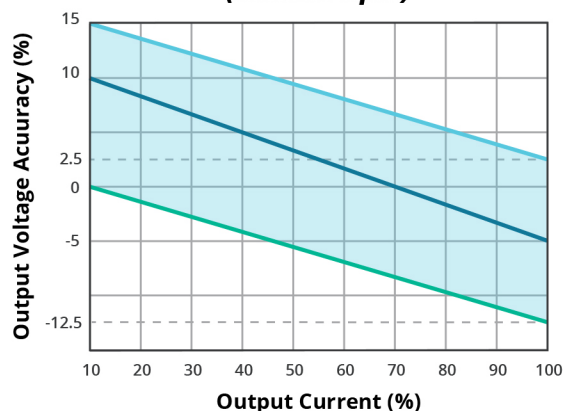
| parameter             | conditions/description | min | typ | max | units |
|-----------------------|------------------------|-----|-----|-----|-------|
| operating temperature | see derating curves    | -40 |     | 105 | °C    |
| storage temperature   |                        | -55 |     | 125 | °C    |
| storage humidity      | non-condensing         | 5   |     | 95  | %     |
| case temperature rise |                        |     | 25  |     | °C    |

## SOLDERABILITY

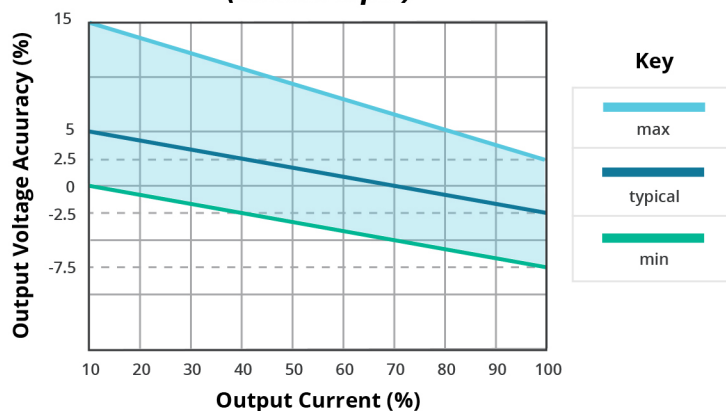
| parameter                 | conditions/description          | min | typ | max | units |
|---------------------------|---------------------------------|-----|-----|-----|-------|
| pin soldering temperature | 1.5 mm from case for 10 seconds |     |     | 300 | °C    |

## DERATING CURVES

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

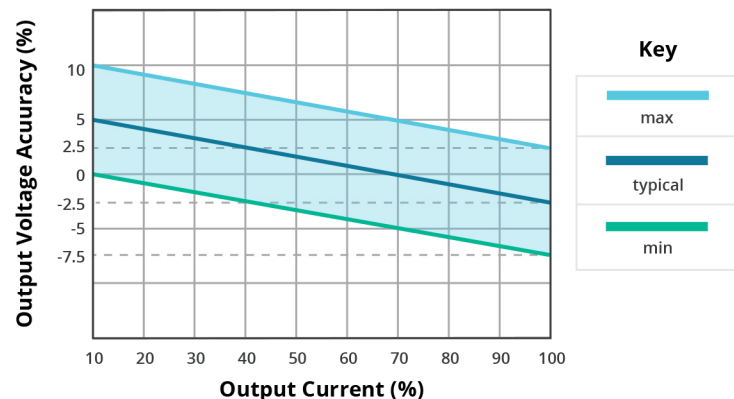


**OUTPUT REGULATION CURVE**  
**5 Vdc output model**  
**(nominal input)**

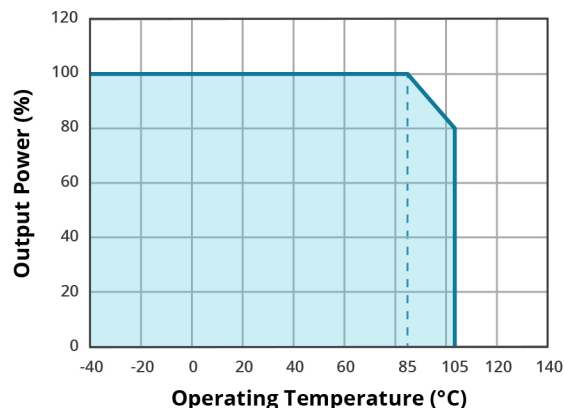


## DERATING CURVES (CONTINUED)

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



### TEMPERATURE DERATING CURVE



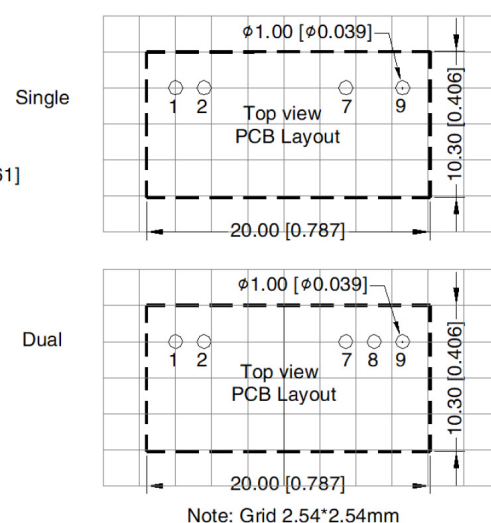
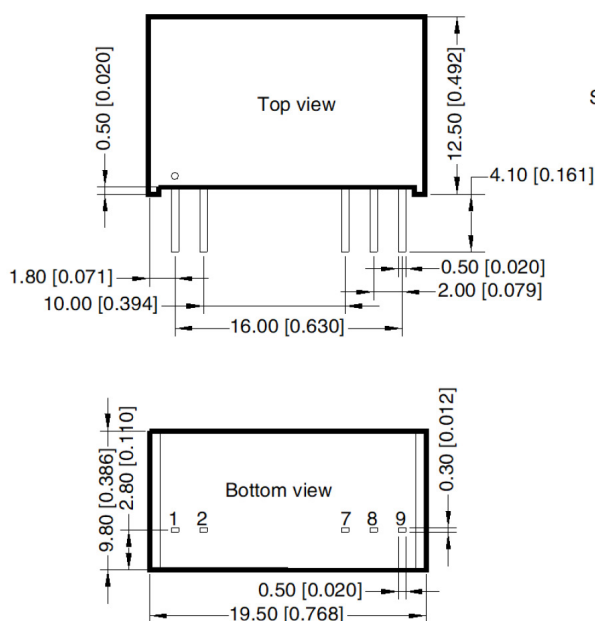
## MECHANICAL

| parameter     | conditions/description                                     | min | typ | max | units |
|---------------|------------------------------------------------------------|-----|-----|-----|-------|
| dimensions    | 19.50 x 9.80 x 12.50 [0.768 x 0.386 x 0.492 inch]          |     |     |     | mm    |
| case material | black flame-retardant and heat-resistant plastic (UL94V-0) |     |     |     |       |
| weight        |                                                            |     | 4   |     | g     |

## MECHANICAL DRAWING

units: mm [inch]  
tolerance:  $\pm 0.50[\pm 0.020]$   
pin section tolerance:  $\pm 0.10[\pm 0.004]$

| PIN CONNECTIONS |          |       |
|-----------------|----------|-------|
| PIN             | Function |       |
|                 | Single   | Dual  |
| 1               | Vin      | Vin   |
| 2               | GND      | GND   |
| 7               | 0V       | -Vout |
| 8               | No Pin   | 0V    |
| 9               | +Vout    | +Vout |



APPLICATION CIRCUIT

If it is required to further reduce input and output ripple, a filter capacitor can be connected to the input and output terminals, see Fig. 1 & 2. Moreover, choosing suitable filter capacitor is very important, start-up problems may be caused by too large capacitance. To ensured the modules running well, the recommended capacitive load values as shown in Tables 1 & 2.

Figure 1  
Single Output Models

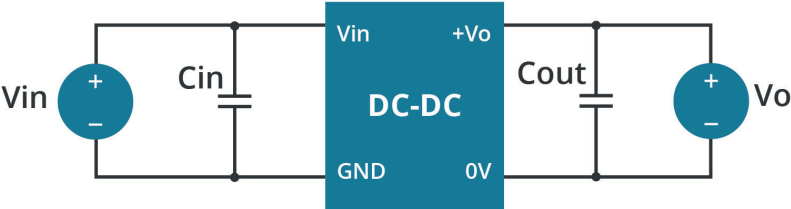


Table 1

| Vin (Vdc) | Cin (μF/V) | Vo (Vdc) | Cout (μF/V) |
|-----------|------------|----------|-------------|
| 12        | 10μF/25V   | 3.3, 5   | 10μF/16V    |
| 15        | 1μF/25V    | 9        | 10μF/16V    |
| 24        | 2.2μF/50V  | 12       | 2.2μF/25V   |
| -         | -          | 15       | 1μF/25V     |
| -         | -          | 24       | 0.47μF/50V  |

Figure 2  
Dual Output Models

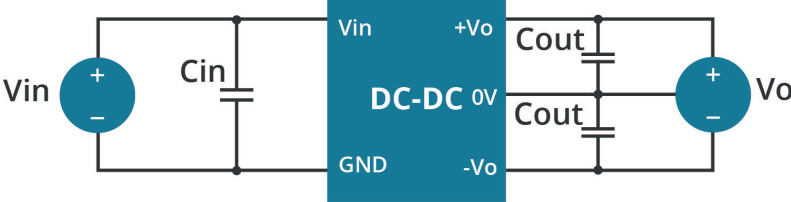


Table 2

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

EMC CLASS B RECOMMENDED CIRCUIT

12 V INPUT MODELS

Figure 3

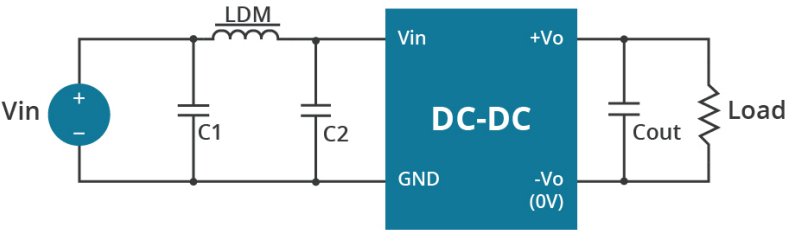


Table 3

| Recommended External Circuit Components |                              |
|-----------------------------------------|------------------------------|
| Vin                                     | 12 V                         |
| C1/C2                                   | 4.7 μF / 25 V                |
| Cout                                    | refer to Cout in Tables 1, 2 |
| LDM                                     | 22 μH                        |

EMC CLASS B RECOMMENDED CIRCUIT (CONTINUED)

24 V INPUT MODELS

Figure 4

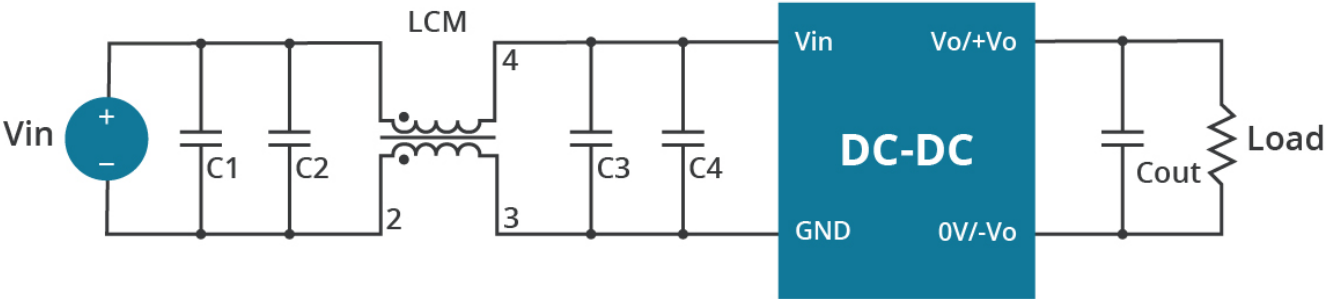


Table 4

| Recommended External Circuit Components |                                   |                    |
|-----------------------------------------|-----------------------------------|--------------------|
| $V_{in}$                                | 24 V                              |                    |
| $C1/C2$                                 | 4.7 $\mu F$ / 50 V                |                    |
| $C3$                                    | dual 24V outputs                  | 100 $\mu F$ / 50 V |
|                                         | all other outputs                 | 4.7 $\mu F$ / 50 V |
| $C4$                                    | dual 24V outputs                  | --                 |
|                                         | all other outputs                 | 4.7 $\mu F$ / 50 V |
| $C_{out}$                               | refer to $C_{out}$ in Tables 1, 2 |                    |
| LCM                                     | 22 $\mu H$                        |                    |

Minimum Output Load Requirement

For a reliable and efficient operation of the converter, the minimum load should never be less than 10% of the rated output load. If the total required output power is below 10%, a parallel bleeding resistor is required on the output, ensuring that the sum of the power consumption is always maintained at 10% minimum.

## REVISION HISTORY

| rev. | description     | date       |
|------|-----------------|------------|
| 1.0  | initial release | 08/08/2023 |
| 1.01 | table 4 updated | 09/26/2023 |

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



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