

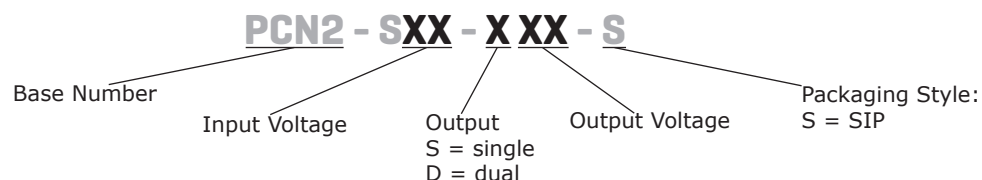
**SERIES: PCN2-S | DESCRIPTION: DC-DC CONVERTER**
**FEATURES**

- up to 2 W isolated output
- industry standard SIP package
- nominal input voltages: 5, 12, 24 Vdc
- single/dual unregulated output
- 1,000 Vdc isolation voltage
- low ripple and noise
- -40 to 100°C
- efficiency up to 86%


**MODEL**

| MODEL          | input voltage |                | output voltage<br>(Vdc) | output current |             | output power<br>max<br>(W) | ripple & noise <sup>1</sup> |         | efficiency<br>typ (%) |
|----------------|---------------|----------------|-------------------------|----------------|-------------|----------------------------|-----------------------------|---------|-----------------------|
|                | typ<br>(Vdc)  | range<br>(Vdc) |                         | min<br>(mA)    | max<br>(mA) |                            | max<br>(mVp-p)              | typ (%) |                       |
| PCN2-S5-S5-S   | 5             | 4.5~5.5        | 5                       | 0              | 400         | 2                          | 100                         | 82      |                       |
| PCN2-S5-S12-S  | 5             | 4.5~5.5        | 12                      | 0              | 167         | 2                          | 150                         | 86      |                       |
| PCN2-S5-S15-S  | 5             | 4.5~5.5        | 15                      | 0              | 134         | 2                          | 150                         | 85      |                       |
| PCN2-S5-D5-S   | 5             | 4.5~5.5        | ±5                      | 0              | ±200        | 2                          | 150                         | 83      |                       |
| PCN2-S5-D12-S  | 5             | 4.5~5.5        | ±12                     | 0              | ±83         | 2                          | 150                         | 86      |                       |
| PCN2-S5-D15-S  | 5             | 4.5~5.5        | ±15                     | 0              | ±67         | 2                          | 150                         | 86      |                       |
| PCN2-S12-S5-S  | 12            | 10.8~13.2      | 5                       | 0              | 400         | 2                          | 100                         | 82      |                       |
| PCN2-S12-S12-S | 12            | 10.8~13.2      | 12                      | 0              | 167         | 2                          | 150                         | 83      |                       |
| PCN2-S12-S15-S | 12            | 10.8~13.2      | 15                      | 0              | 134         | 2                          | 150                         | 84      |                       |
| PCN2-S12-D5-S  | 12            | 10.8~13.2      | ±5                      | 0              | ±200        | 2                          | 150                         | 82      |                       |
| PCN2-S12-D12-S | 12            | 10.8~13.2      | ±12                     | 0              | ±83         | 2                          | 150                         | 82      |                       |
| PCN2-S12-D15-S | 12            | 10.8~13.2      | ±15                     | 0              | ±67         | 2                          | 150                         | 84      |                       |
| PCN2-S24-S5-S  | 24            | 21.6~26.4      | 5                       | 0              | 400         | 2                          | 100                         | 79      |                       |
| PCN2-S24-S12-S | 24            | 21.6~26.4      | 12                      | 0              | 167         | 2                          | 150                         | 81      |                       |
| PCN2-S24-S15-S | 24            | 21.6~26.4      | 15                      | 0              | 134         | 2                          | 150                         | 82      |                       |
| PCN2-S24-D5-S  | 24            | 21.6~26.4      | ±5                      | 0              | ±200        | 2                          | 150                         | 79      |                       |
| PCN2-S24-D12-S | 24            | 21.6~26.4      | ±12                     | 0              | ±83         | 2                          | 150                         | 81      |                       |
| PCN2-S24-D15-S | 24            | 21.6~26.4      | ±15                     | 0              | ±67         | 2                          | 150                         | 82      |                       |

Notes: 1. At full load, nominal input, 20 MHz bandwidth oscilloscope, with a 0.33  $\mu$ F ceramic capacitor on the output.  
 2. Required to add a 2.2  $\mu$ F (5 & 12 Vdc input models) or 10  $\mu$ F (24 Vdc input models) ceramic capacitor to the input to reduce input voltage stress.  
 3. All specifications are measured at  $T_a=25^\circ\text{C}$ , nominal input voltage, and rated output load unless otherwise specified.

**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   |
|                                   | 24 Vdc input models                                          | 21.6 | 24  | 26.4 | Vdc   |
| surge voltage                     | for maximum of 100 ms                                        |      |     |      |       |
|                                   | 5 Vdc input models                                           |      |     | 9    | Vdc   |
|                                   | 12 Vdc input models                                          |      |     | 18   | Vdc   |
|                                   | 24 Vdc input models                                          |      |     | 30   | Vdc   |
| current                           | 5 Vdc input models                                           |      | 500 |      | mA    |
|                                   | 12 Vdc input models                                          |      | 210 |      | mA    |
|                                   | 24 Vdc input models                                          |      | 110 |      | mA    |
| filter                            | capacitive                                                   |      |     |      |       |
| input reverse polarity protection | no                                                           |      |     |      |       |
| input fuse                        | 1 A time delay fuse for 5 Vdc input models (recommended)     |      |     |      |       |
|                                   | 500 mA time delay fuse for 12 Vdc input models (recommended) |      |     |      |       |
|                                   | 250 mA time delay fuse for 24 Vdc input models (recommended) |      |     |      |       |

Notes: 1. Required to add a 2.2  $\mu$ F (5 & 12 Vdc input models) or 10  $\mu$ F (24 Vdc input models) ceramic capacitor to the input to reduce input voltage stress.

## OUTPUT

| parameter               | conditions/description       | min | typ | max        | units           |
|-------------------------|------------------------------|-----|-----|------------|-----------------|
| maximum capacitive load | at full load                 |     |     | 470        | $\mu$ F         |
| voltage accuracy        |                              |     |     | $\pm 3.0$  | %               |
| line regulation         | 1.0% change in input voltage |     |     | $\pm 1.2$  | %               |
| load regulation         | from full load to 20% load   |     |     | $\pm 10$   | %               |
| switching frequency     | at nominal Vin, full load    |     | 80  |            | kHz             |
| temperature coefficient |                              |     |     | $\pm 0.05$ | %/ $^{\circ}$ C |

## PROTECTIONS

| parameter                | conditions/description | min | typ | max | units |
|--------------------------|------------------------|-----|-----|-----|-------|
| short circuit protection | momentary              |     |     | 1   | s     |

## SAFETY AND COMPLIANCE

| parameter             | conditions/description                                               | min   | typ       | max | units      |
|-----------------------|----------------------------------------------------------------------|-------|-----------|-----|------------|
| isolation voltage     | input to output for 1 minute                                         | 1,000 |           |     | Vdc        |
| isolation resistance  | input to output                                                      | 1,000 |           |     | M $\Omega$ |
| isolation capacitance | input to output                                                      |       | 15        |     | pF         |
| conducted emissions   | EN 55022 Class A & Class B (external circuit required, see Figure 4) |       |           |     |            |
| MTBF                  | as per MIL-HDBK-217F, full load, GB, 25 $^{\circ}$ C                 |       | 3,300,000 |     | hours      |
| RoHS                  | 2011/65/EU                                                           |       |           |     |            |

## ENVIRONMENTAL

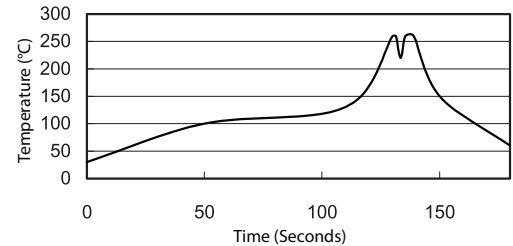
| parameter             | conditions/description | min | typ | max | units        |
|-----------------------|------------------------|-----|-----|-----|--------------|
| operating temperature | see derating curve     | -40 |     | 100 | $^{\circ}$ C |
| storage temperature   |                        | -55 |     | 125 | $^{\circ}$ C |
| operating humidity    | non-condensing         |     |     | 95  | %            |

## SOLDERABILITY

| parameter      | conditions/description     | min | typ | max | units |
|----------------|----------------------------|-----|-----|-----|-------|
| wave soldering | see wave soldering profile |     |     | 260 | °C    |

Notes:

1. Soldering materials: Sn/Cu/Ni
2. Ramp up rate during preheat: 1.4°C/s (from 50°C to 100°C)
3. Soaking temperature: 0.5°C/s (from 100°C to 130°C), 60±20 seconds
4. Peak temperature: 260°C, above 250°C for 3~6 seconds
5. Ramp down rate during cooling: -10°C/s (from 260°C to 150°C)



## MECHANICAL

| parameter     | conditions/description                    | min | typ | max | units  |
|---------------|-------------------------------------------|-----|-----|-----|--------|
| dimensions    | 0.77 x 0.28 x 0.40 [19.6 x 7.2 x 10.2 mm] |     |     |     | inches |
| case material | non-conductive black plastic              |     |     |     |        |
| weight        |                                           |     | 2.7 |     | g      |

## MECHANICAL DRAWING

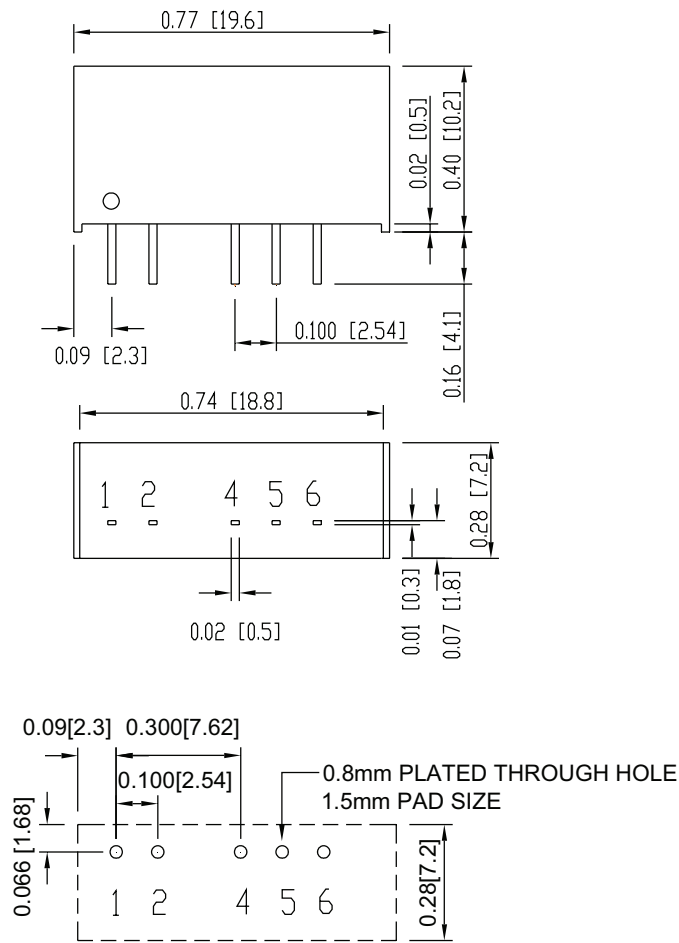
units: inches [mm]

tolerance: X.XX ±0.01 [±0.25]

X.XXX ±0.005 [±0.13]

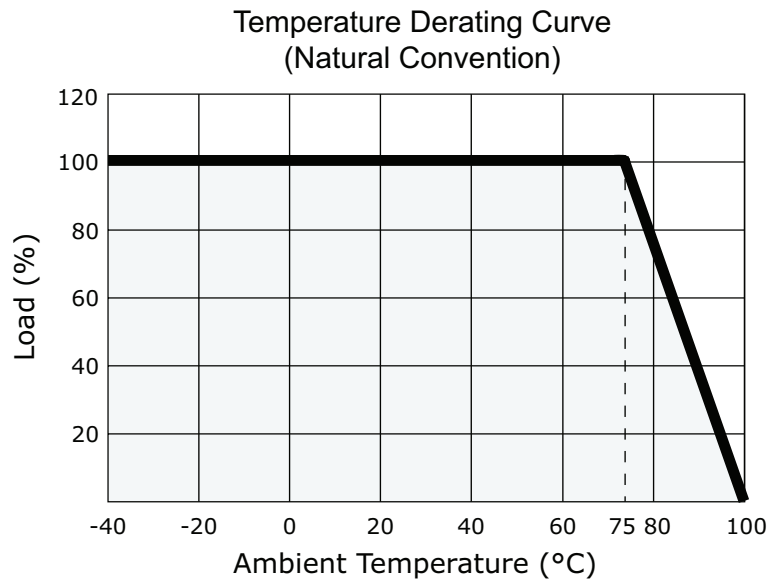
pin section tolerance: ±0.002[±0.05]

| PIN CONNECTIONS |          |        |
|-----------------|----------|--------|
| PIN             | Function |        |
|                 | Single   | Dual   |
| 1               | +Vin     | +Vin   |
| 2               | -Vin     | -Vin   |
| 4               | -Vout    | -Vout  |
| 5               | No pin   | Common |
| 6               | +Vout    | +Vout  |



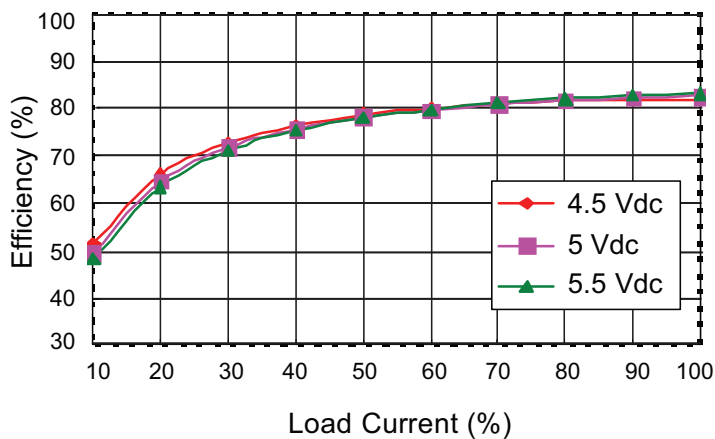
Recommended PCB Layout  
Top View

## DERATING CURVE

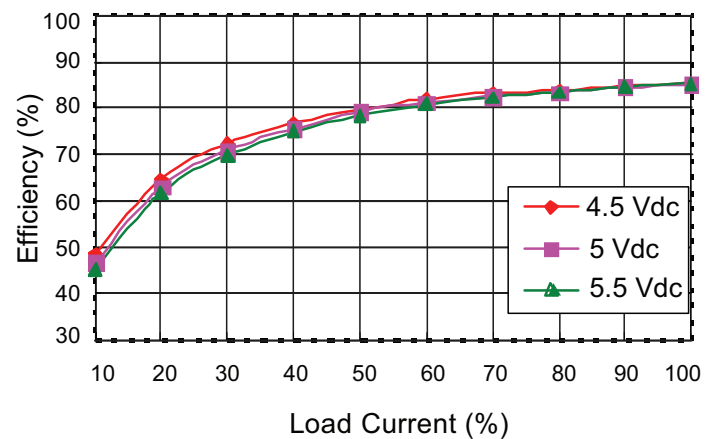


## EFFICIENCY CURVES

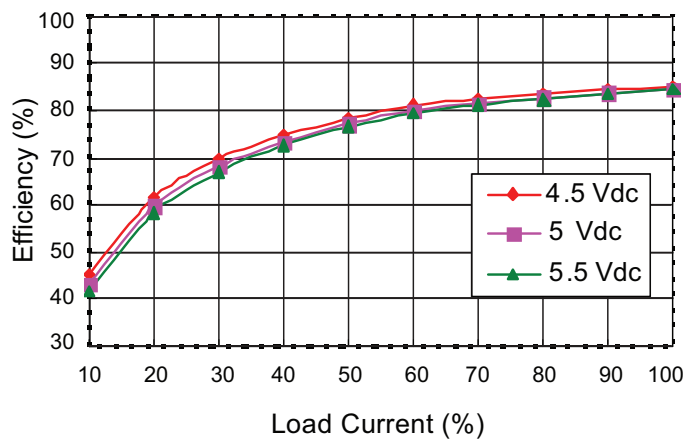
PCN2-S5-S5-S Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current)



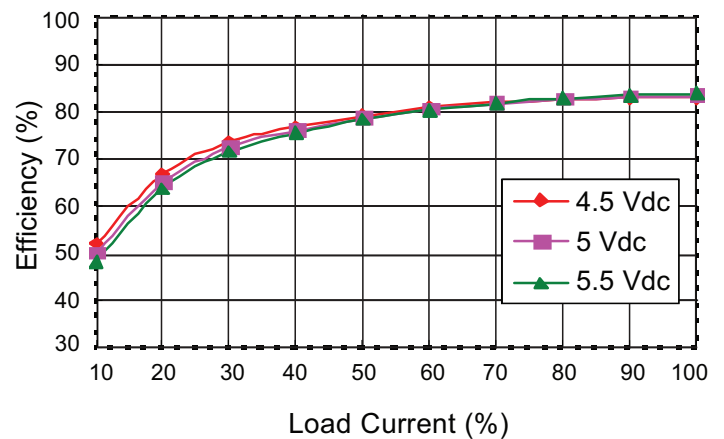
PCN2-S5-S12-S Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current)



PCN2-S5-S15-S Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current)

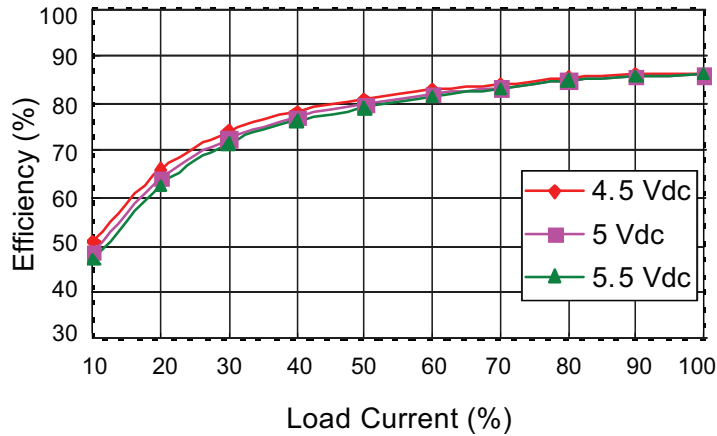


PCN2-S5-D5-S Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current)

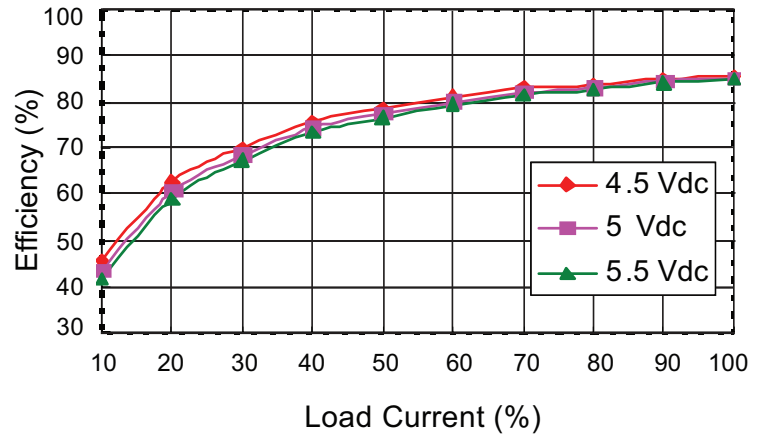


## EFFICIENCY CURVES (CONTINUED)

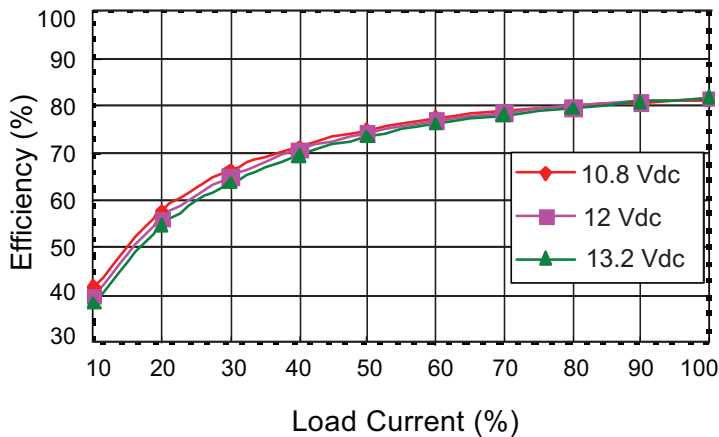
PCN2-S5-D12-S Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current)



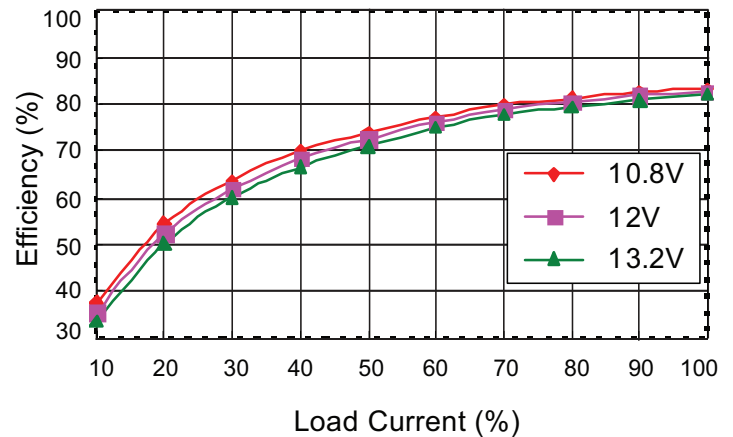
PCN2-S5-D15-S Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current)



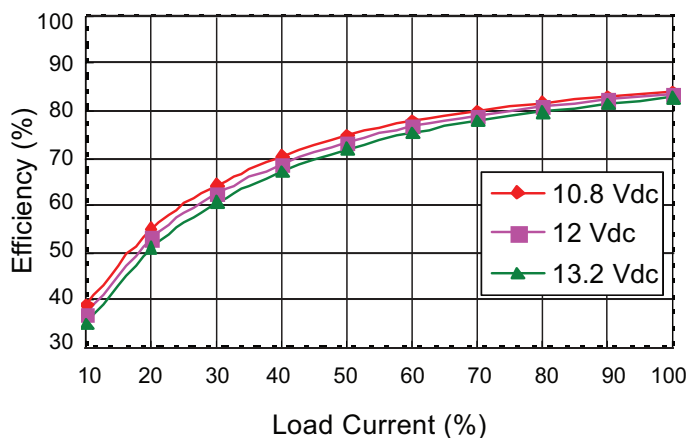
PCN2-S12-S5-S Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current)



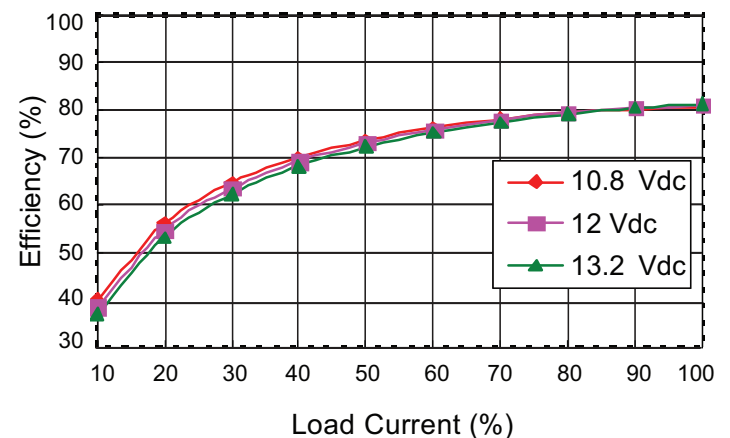
PCN2-S12-S12-S Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current)



PCN2-S12-S15-S Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current)

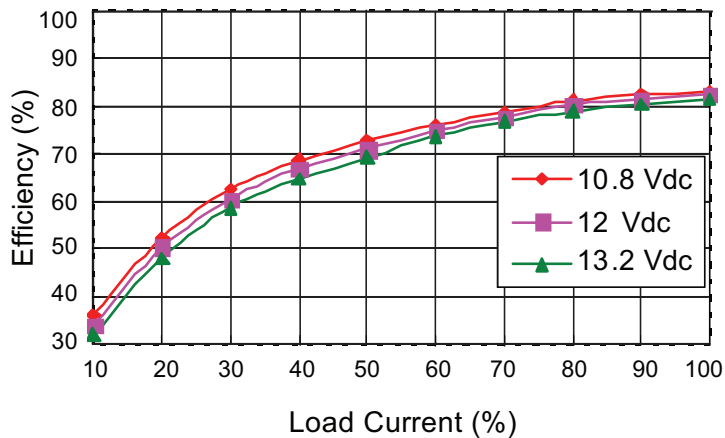


PCN2-S12-D5-S Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current)

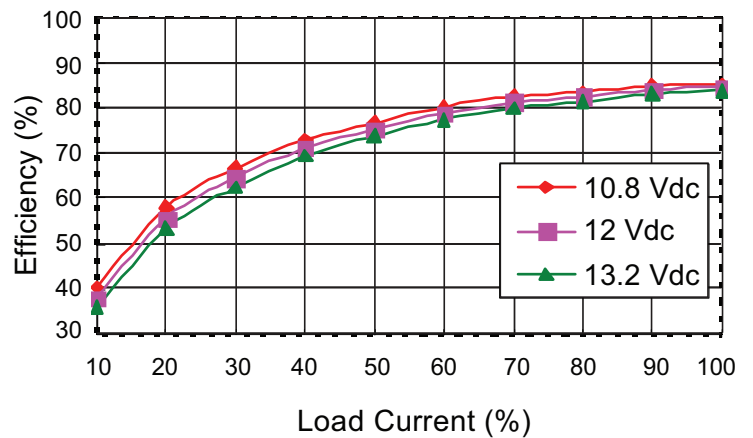


## EFFICIENCY CURVES (CONTINUED)

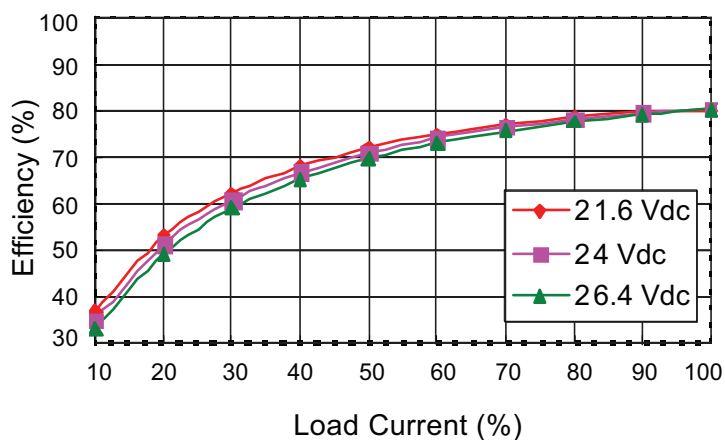
PCN2-S12-D12-S Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current)



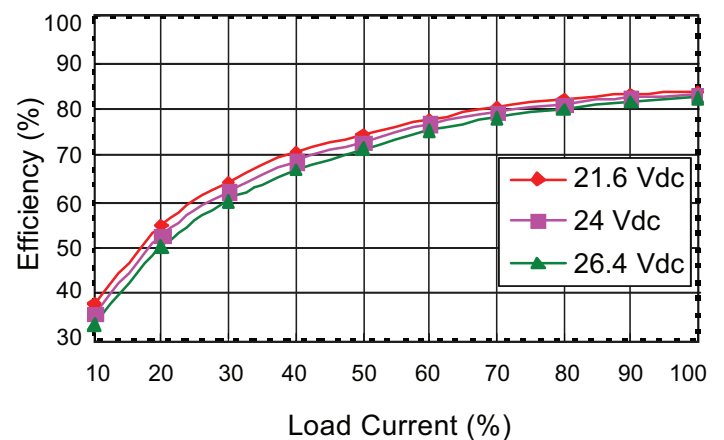
PCN2-S12-D15-S Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current)



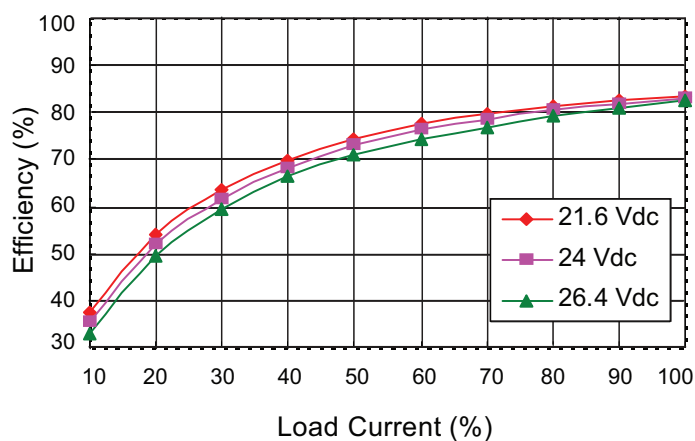
PCN2-S24-S5-S Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current)



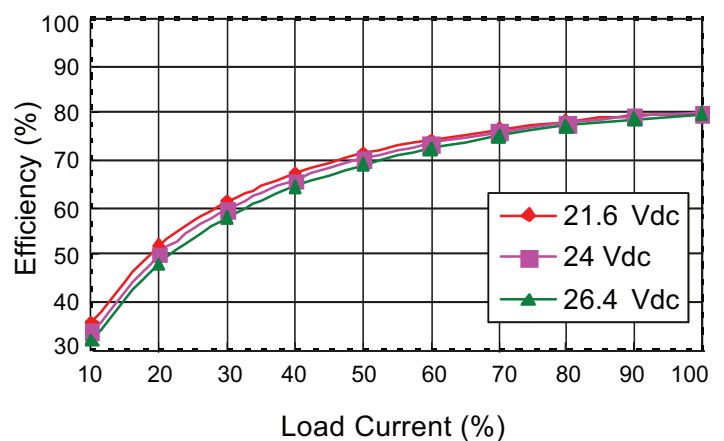
PCN2-S24-S12-S Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current)



PCN2-S24-S15-S Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current)

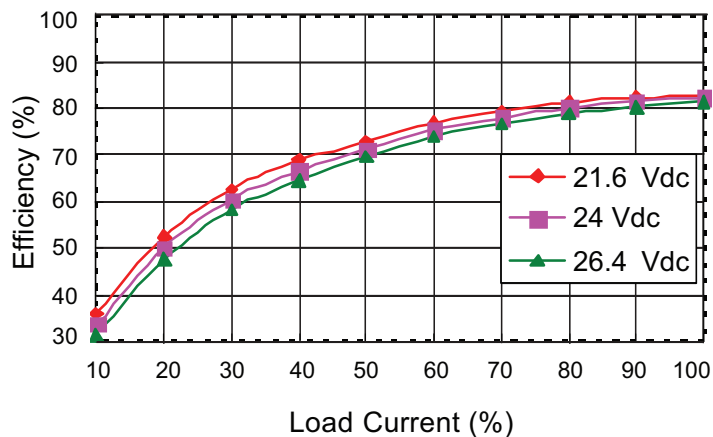


PCN2-S24-D5-S Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current)

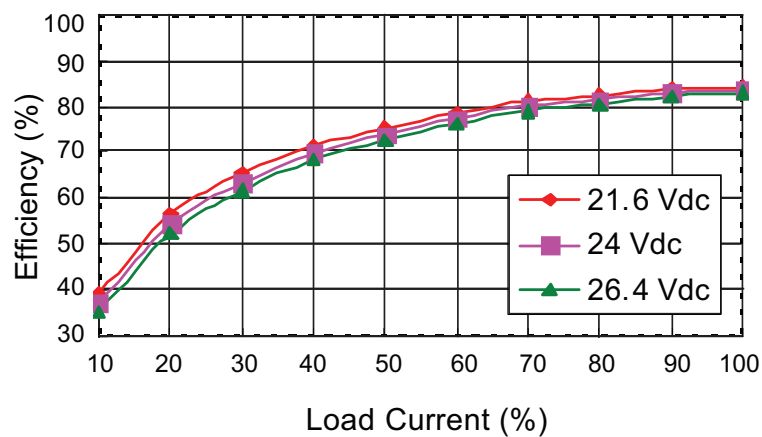


## EFFICIENCY CURVES (CONTINUED)

PCN2-S24-D12-S Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current)



PCN2-S24-D15-S Efficiency Curve  
(Efficiency vs. Line Voltage and Load Current)

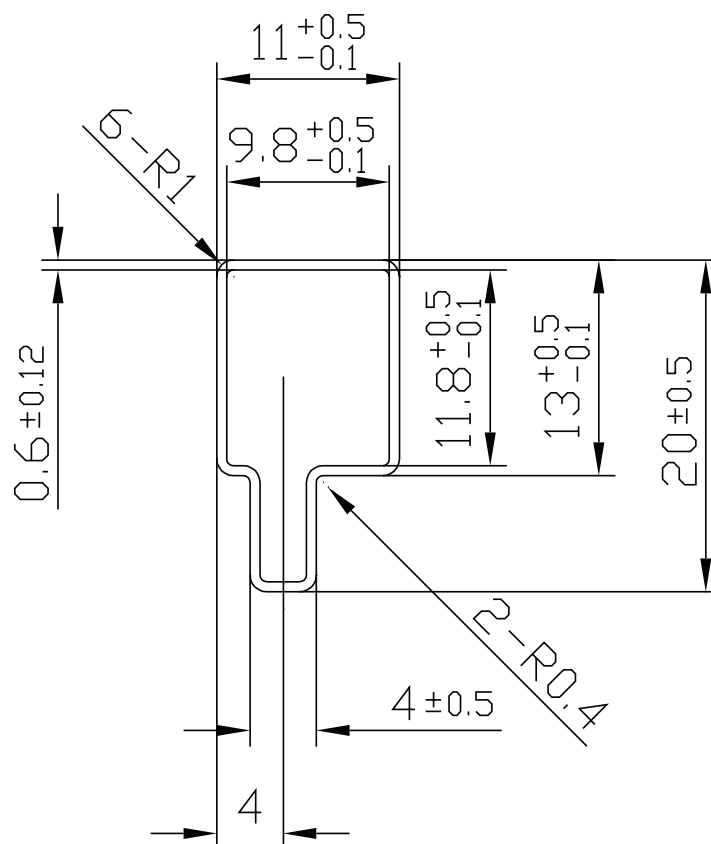


## PACKAGING

units: mm

Tube size: 20 x 11 x 330 mm

QTY: 14 pcs



TEST CONFIGURATIONS

Input Ripple Current & Output Noise

Figure 1 Measuring Input  
Ripple Current

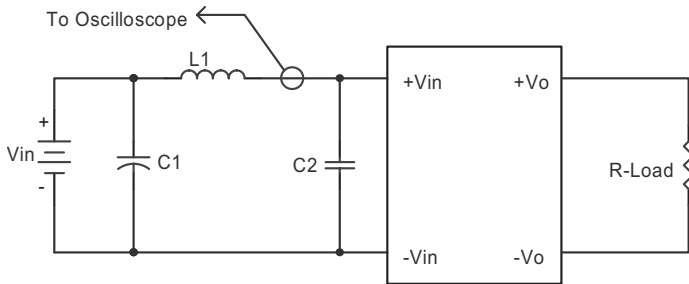


Table 1

| Input Voltage (Vdc) | L1         | C1                             | C2 |
|---------------------|------------|--------------------------------|----|
| 5                   | 12 $\mu$ H | 2.2 $\mu$ F tantalum capacitor | NC |
| 12                  | 12 $\mu$ H | 2.2 $\mu$ F tantalum capacitor | NC |
| 24                  | 12 $\mu$ H | 10 $\mu$ F ceramic capacitor   | NC |

Figure 2 Measuring Output Ripple & Noise for Single Output Models

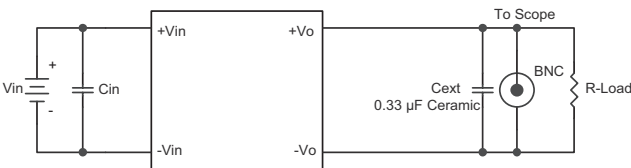


Figure 3 Measuring Output Ripple & Noise for Dual Output Models

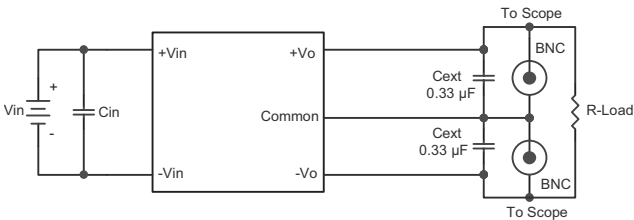


Table 2

| Input Voltage (Vdc) | Cin                           |
|---------------------|-------------------------------|
| 5                   | 2.2 $\mu$ F ceramic capacitor |
| 12                  | 2.2 $\mu$ F ceramic capacitor |
| 24                  | 10 $\mu$ F ceramic capacitor  |

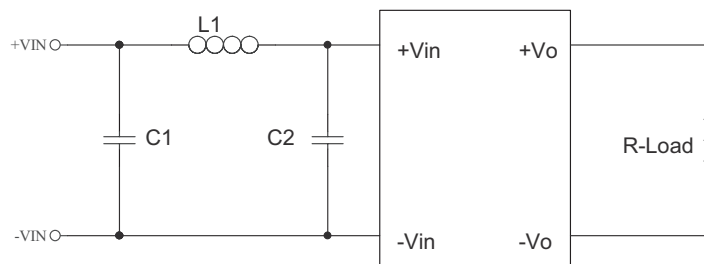
## EMC RECOMMENDED CIRCUIT

### Test Condition

Input Voltage: Nominal

Output Load: Full Load

**Figure 4 Conducted Emissions Test Circuit**



**Table 3**

| EN55022 Class A<br>Recommended External Circuit Components |                    |                    |             |
|------------------------------------------------------------|--------------------|--------------------|-------------|
| Model                                                      | C1 <sup>1</sup>    | C2 <sup>1</sup>    | L1          |
| PCN2-S5-S5-S                                               | 4.7 $\mu$ F / 50 V | NC                 | 2.2 $\mu$ H |
| PCN2-S5-S12-S                                              | 4.7 $\mu$ F / 50 V | NC                 | 2.2 $\mu$ H |
| PCN2-S5-S15-S                                              | 10 $\mu$ F / 25 V  | NC                 | 5.6 $\mu$ H |
| PCN2-S5-D5-S                                               | 4.7 $\mu$ F / 50 V | NC                 | 2.2 $\mu$ H |
| PCN2-S5-D12-S                                              | 4.7 $\mu$ F / 50 V | NC                 | 2.2 $\mu$ H |
| PCN2-S5-D15-S                                              | 10 $\mu$ F / 25 V  | NC                 | 5.6 $\mu$ H |
| PCN2-S12-S5-S                                              | 10 $\mu$ F / 25 V  | NC                 | 5.6 $\mu$ H |
| PCN2-S12-S12-S                                             | 4.7 $\mu$ F / 50 V | NC                 | 5.6 $\mu$ H |
| PCN2-S12-S15-S                                             | 4.7 $\mu$ F / 50 V | NC                 | 5.6 $\mu$ H |
| PCN2-S12-D5-S                                              | 10 $\mu$ F / 25 V  | NC                 | 5.6 $\mu$ H |
| PCN2-S12-D12-S                                             | 4.7 $\mu$ F / 50 V | NC                 | 5.6 $\mu$ H |
| PCN2-S12-D15-S                                             | 4.7 $\mu$ F / 50 V | NC                 | 5.6 $\mu$ H |
| PCN2-S24-S5-S                                              | 4.7 $\mu$ F / 50 V | 4.7 $\mu$ F / 50 V | 5.6 $\mu$ H |
| PCN2-S24-S12-S                                             | 4.7 $\mu$ F / 50 V | 4.7 $\mu$ F / 50 V | 5.6 $\mu$ H |
| PCN2-S24-S15-S                                             | 4.7 $\mu$ F / 50 V | 4.7 $\mu$ F / 50 V | 5.6 $\mu$ H |
| PCN2-S24-D5-S                                              | 4.7 $\mu$ F / 50 V | 4.7 $\mu$ F / 50 V | 5.6 $\mu$ H |
| PCN2-S24-D12-S                                             | 4.7 $\mu$ F / 50 V | 4.7 $\mu$ F / 50 V | 5.6 $\mu$ H |
| PCN2-S24-D15-S                                             | 4.7 $\mu$ F / 50 V | 4.7 $\mu$ F / 50 V | 5.6 $\mu$ H |

Notes: 1. Ceramic Capacitor

**Table 4**

| EN55022 Class B<br>Recommended External Circuit Components |                   |                   |             |
|------------------------------------------------------------|-------------------|-------------------|-------------|
| Model                                                      | C1 <sup>1</sup>   | C2 <sup>1</sup>   | L1          |
| PCN2-S5-S5-S                                               | 10 $\mu$ F / 25 V | NC                | 5.6 $\mu$ H |
| PCN2-S5-S12-S                                              | 10 $\mu$ F / 25 V | NC                | 5.6 $\mu$ H |
| PCN2-S5-S15-S                                              | 10 $\mu$ F / 25 V | 10 $\mu$ F / 25 V | 5.6 $\mu$ H |
| PCN2-S5-D5-S                                               | 10 $\mu$ F / 25 V | NC                | 5.6 $\mu$ H |
| PCN2-S5-D12-S                                              | 10 $\mu$ F / 25 V | NC                | 5.6 $\mu$ H |
| PCN2-S5-D15-S                                              | 10 $\mu$ F / 25 V | 10 $\mu$ F / 25 V | 5.6 $\mu$ H |
| PCN2-S12-S5-S                                              | 10 $\mu$ F / 25 V | 10 $\mu$ F / 25 V | 5.6 $\mu$ H |
| PCN2-S12-S12-S                                             | 10 $\mu$ F / 25 V | 10 $\mu$ F / 25 V | 5.6 $\mu$ H |
| PCN2-S12-S15-S                                             | 10 $\mu$ F / 25 V | 10 $\mu$ F / 25 V | 5.6 $\mu$ H |
| PCN2-S12-D5-S                                              | 10 $\mu$ F / 25 V | 10 $\mu$ F / 25 V | 5.6 $\mu$ H |
| PCN2-S12-D12-S                                             | 10 $\mu$ F / 25 V | 10 $\mu$ F / 25 V | 5.6 $\mu$ H |
| PCN2-S12-D15-S                                             | 10 $\mu$ F / 25 V | 10 $\mu$ F / 25 V | 5.6 $\mu$ H |
| PCN2-S24-S5-S                                              | 10 $\mu$ F / 50 V | 10 $\mu$ F / 50 V | 5.6 $\mu$ H |
| PCN2-S24-S12-S                                             | 10 $\mu$ F / 50 V | 10 $\mu$ F / 50 V | 5.6 $\mu$ H |
| PCN2-S24-S15-S                                             | 10 $\mu$ F / 50 V | 10 $\mu$ F / 50 V | 5.6 $\mu$ H |
| PCN2-S24-D5-S                                              | 10 $\mu$ F / 50 V | 10 $\mu$ F / 50 V | 5.6 $\mu$ H |
| PCN2-S24-D12-S                                             | 10 $\mu$ F / 50 V | 10 $\mu$ F / 50 V | 5.6 $\mu$ H |
| PCN2-S24-D15-S                                             | 10 $\mu$ F / 50 V | 10 $\mu$ F / 50 V | 5.6 $\mu$ H |

Notes: 1. Ceramic Capacitor

## REVISION HISTORY

| rev. | description     | date       |
|------|-----------------|------------|
| 1.0  | initial release | 07/26/2016 |

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



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