

**SERIES:** PVB3-D | **DESCRIPTION:** DC-DC CONVERTER**FEATURES**

- 3 W isolated output
- smaller package
- single/dual regulated output
- 3,000 Vdc isolation
- short circuit protection
- temperature range (-40~105°C)
- UL 60950-1 approval
- high efficiency at light load
- efficiency up to 86%



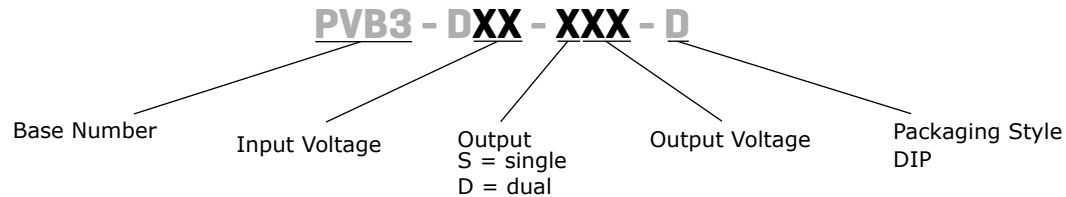
| MODEL                      | input voltage |             | output voltage<br>(Vdc) | output current |          | output power<br>max (W) | ripple and noise <sup>2</sup><br>max (mVp-p) | efficiency<br>typ (%) |
|----------------------------|---------------|-------------|-------------------------|----------------|----------|-------------------------|----------------------------------------------|-----------------------|
|                            | typ (Vdc)     | range (Vdc) |                         | min (mA)       | max (mA) |                         |                                              |                       |
| PVB3-D5-S5-D               | 5             | 4.5~9       | 5                       | 30             | 600      | 3                       | 80                                           | 74                    |
| PVB3-D5-S12-D              | 5             | 4.5~9       | 12                      | 12             | 250      | 3                       | 80                                           | 77                    |
| PVB3-D5-S15-D              | 5             | 4.5~9       | 15                      | 10             | 200      | 3                       | 80                                           | 77                    |
| PVB3-D5-D5-D               | 5             | 4.5~9       | ±5                      | ±15            | ±300     | 3                       | 80                                           | 76                    |
| PVB3-D5-D12-D              | 5             | 4.5~9       | ±12                     | ±6             | ±125     | 3                       | 80                                           | 78                    |
| PVB3-D5-D15-D              | 5             | 4.5~9       | ±15                     | ±5             | ±100     | 3                       | 80                                           | 78                    |
| PVB3-D12-S3-D              | 12            | 9~18        | 3.3                     | 46             | 909      | 3                       | 80                                           | 74                    |
| PVB3-D12-S5-D              | 12            | 9~18        | 5                       | 30             | 600      | 3                       | 80                                           | 81                    |
| PVB3-D12-S12-D             | 12            | 9~18        | 12                      | 12             | 250      | 3                       | 80                                           | 83                    |
| PVB3-D12-S15-D             | 12            | 9~18        | 15                      | 10             | 200      | 3                       | 80                                           | 82                    |
| PVB3-D12-S24-D             | 12            | 9~18        | 24                      | 6              | 125      | 3                       | 80                                           | 83                    |
| PVB3-D12-D5-D              | 12            | 9~18        | ±5                      | ±15            | ±300     | 3                       | 80                                           | 81                    |
| PVB3-D12-D9-D              | 12            | 9~18        | ±9                      | ±8             | ±166     | 3                       | 80                                           | 84                    |
| PVB3-D12-D12-D             | 12            | 9~18        | ±12                     | ±6             | ±125     | 3                       | 80                                           | 84                    |
| PVB3-D12-D15-D             | 12            | 9~18        | ±15                     | ±5             | ±100     | 3                       | 80                                           | 85                    |
| PVB3-D24-S3-D              | 24            | 18~36       | 3.3                     | 46             | 909      | 3                       | 80                                           | 78                    |
| PVB3-D24-S5-D <sup>1</sup> | 24            | 18~36       | 5                       | 30             | 600      | 3                       | 80                                           | 81                    |
| PVB3-D24-S12-D             | 24            | 18~36       | 12                      | 12             | 250      | 3                       | 80                                           | 86                    |
| PVB3-D24-S15-D             | 24            | 18~36       | 15                      | 10             | 200      | 3                       | 80                                           | 86                    |
| PVB3-D24-S24-D             | 24            | 18~36       | 24                      | 6              | 125      | 3                       | 80                                           | 85                    |
| PVB3-D24-D5-D              | 24            | 18~36       | ±5                      | ±15            | ±300     | 3                       | 80                                           | 82                    |
| PVB3-D24-D12-D             | 24            | 18~36       | ±12                     | ±6             | ±125     | 3                       | 80                                           | 84                    |
| PVB3-D24-D15-D             | 24            | 18~36       | ±15                     | ±5             | ±100     | 3                       | 80                                           | 84                    |
| PVB3-D48-S5-D              | 48            | 36~75       | 5                       | 30             | 600      | 3                       | 80                                           | 82                    |
| PVB3-D48-S12-D             | 48            | 36~75       | 12                      | 12             | 250      | 3                       | 80                                           | 86                    |
| PVB3-D48-S15-D             | 48            | 36~75       | 15                      | 10             | 200      | 3                       | 80                                           | 86                    |
| PVB3-D48-D3-D              | 48            | 36~75       | ±3.3                    | ±22            | ±455     | 3                       | 80                                           | 76                    |

Notes: 1. UL approved  
 2. Ripple and noise are measured at 20 MHz BW by "parallel cable" method with 1 µF ceramic and 10 µF electrolytic capacitors on the output.

**MODEL  
(CONTINUED)**

|                | input voltage |                | output voltage | output current |             | output power | ripple and noise <sup>2</sup> | efficiency |
|----------------|---------------|----------------|----------------|----------------|-------------|--------------|-------------------------------|------------|
|                | typ<br>(Vdc)  | range<br>(Vdc) | (Vdc)          | min<br>(mA)    | max<br>(mA) | max<br>(W)   | typ<br>(mVp-p)                | typ<br>(%) |
| PVB3-D48-D5-D  | 48            | 36~75          | ±5             | ±15            | ±300        | 3            | 80                            | 82         |
| PVB3-D48-D12-D | 48            | 36~75          | ±12            | ±6             | ±125        | 3            | 80                            | 84         |
| PVB3-D48-D15-D | 48            | 36~75          | ±15            | ±5             | ±100        | 3            | 80                            | 85         |

Notes: 1. UL approved  
2. Ripple and noise are measured at 20 MHz BW by "parallel cable" method with 1 µF ceramic and 10 µF electrolytic capacitors on the output.

**PART NUMBER KEY****INPUT**

| parameter               | conditions/description  | min  | typ | max | units |
|-------------------------|-------------------------|------|-----|-----|-------|
| operating input voltage | 5 Vdc input models      | 4.5  | 5   | 9   | Vdc   |
|                         | 12 Vdc input models     | 9    | 12  | 18  | Vdc   |
|                         | 24 Vdc input models     | 18   | 24  | 36  | Vdc   |
|                         | 48 Vdc input models     | 36   | 48  | 75  | Vdc   |
| start-up voltage        | 5 Vdc input models      |      |     | 4.5 | Vdc   |
|                         | 12 Vdc input models     |      |     | 9   | Vdc   |
|                         | 24 Vdc input models     |      |     | 18  | Vdc   |
|                         | 48 Vdc input models     |      |     | 36  | Vdc   |
| surge voltage           | for maximum of 1 second |      |     |     |       |
|                         | 5 Vdc input models      | -0.7 |     | 12  | Vdc   |
|                         | 12 Vdc input models     | -0.7 |     | 25  | Vdc   |
|                         | 24 Vdc input models     | -0.7 |     | 50  | Vdc   |
|                         | 48 Vdc input models     | -0.7 |     | 100 | Vdc   |
| filter                  | pi filter               |      |     |     |       |

**OUTPUT**

| parameter                    | conditions/description                     | min | typ   | max   | units |
|------------------------------|--------------------------------------------|-----|-------|-------|-------|
| line regulation              | full load, input voltage from low to high  |     | ±0.2  | ±0.5  | %     |
| load regulation              | 5% to 100% load                            |     | ±0.2  | ±0.5  | %     |
| voltage accuracy             |                                            |     | ±1    | ±3    | %     |
| no-load voltage accuracy     |                                            |     | ±1.5  | ±5    | %     |
| voltage balance <sup>3</sup> | dual output, balanced loads                |     | ±0.5  | ±1    | %     |
| switching frequency          | 100% load, nominal input voltage, PFM mode |     | 200   |       | kHz   |
| transient recovery time      | 25% load step change                       |     | 0.5   | 2     | ms    |
| transient response deviation | 25% load step change                       |     | ±2    | ±5    | %     |
| temperature coefficient      | 100% load                                  |     | ±0.02 | ±0.03 | %/°C  |

Notes: 3. For dual output models, unbalanced loads should not exceed ±5%. If ±5% is exceeded, it may not meet all specifications.

**PROTECTIONS**

| parameter                             | conditions/description | min | typ | max | units |
|---------------------------------------|------------------------|-----|-----|-----|-------|
| short circuit protection <sup>4</sup> |                        |     |     | 1   | s     |

Notes: 4. 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.                                   | 3,000     |     |     | Vdc   |
| isolation resistance          | input to output at 500 Vdc                                                  | 1,000     |     |     | MΩ    |
| safety approvals <sup>1</sup> | UL 60950-1                                                                  |           |     |     |       |
| conducted emissions           | CISPR22/EN55022, class B (external circuit required, see Figure 1-b)        |           |     |     |       |
| radiated emissions            | CISPR22/EN55022, class B (external circuit required, see Figure 1-b)        |           |     |     |       |
| ESD                           | IEC/EN61000-4-2, class B, contact ± 4kV/air ± 8kV                           |           |     |     |       |
| radiated immunity             | IEC/EN61000-4-3, class A, 10V/m                                             |           |     |     |       |
| EFT/burst                     | IEC/EN61000-4-4, class B, ± 2kV (external circuit required, see Figure 1-a) |           |     |     |       |
| surge                         | IEC/EN61000-4-5, class B, ± 2kV (external circuit required, see Figure 1-a) |           |     |     |       |
| conducted immunity            | IEC/EN61000-4-6, class A, 3 Vr.m.s                                          |           |     |     |       |
| voltage dips & interruptions  | IEC/EN61000-4-29, class B, 0%-70%                                           |           |     |     |       |
| MTBF                          | as per MIL-HDBK-217F @ 25°C                                                 | 1,000,000 |     |     | hours |
| RoHS                          | 2011/65/EU                                                                  |           |     |     |       |

Notes: 1. See specific model noted on page 1

## 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         | 5   |     | 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    |
| wave soldering | see wave soldering profile      |     |     | 260 | °C    |

## MECHANICAL

| parameter     | conditions/description                             | min | typ | max | units |
|---------------|----------------------------------------------------|-----|-----|-----|-------|
| dimensions    | 31.60 x 20.30 x 10.20 (1.244 x 0.799 x 0.402 inch) |     |     |     | mm    |
| case material | plastic (UL94-V0)                                  |     |     |     |       |
| weight        |                                                    |     | 14  |     | g     |

## MECHANICAL DRAWING

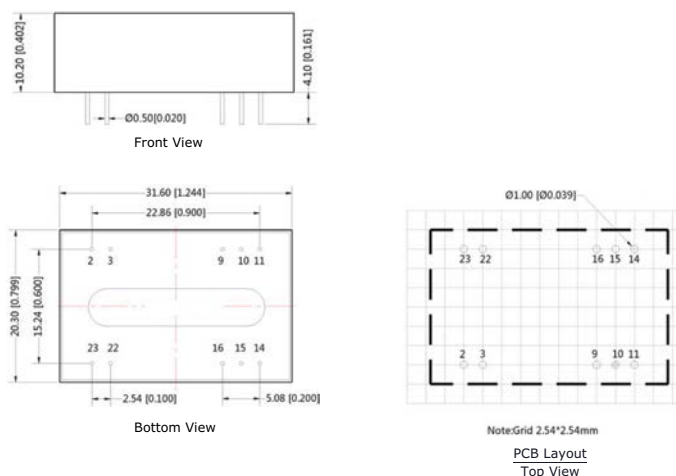
units: mm[inch]

tolerance: ±0.50[±0.020]

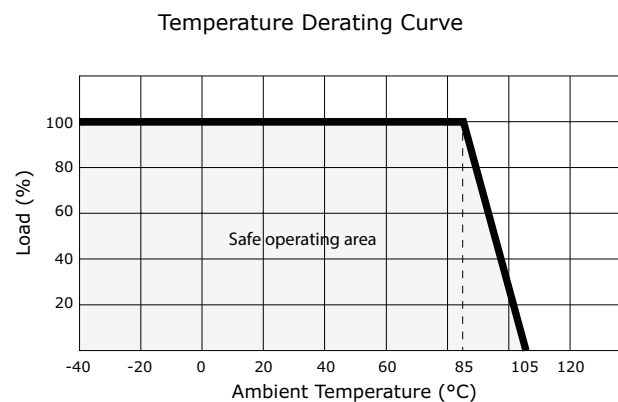
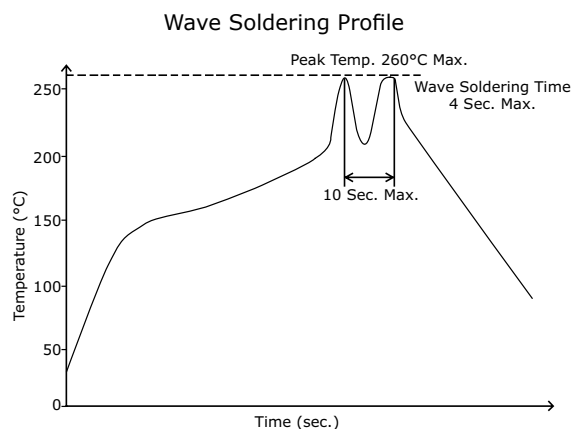
pin section tolerance: ±0.10[±0.004]

| PIN CONNECTIONS |               |             |
|-----------------|---------------|-------------|
| PIN             | Single Output | Dual Output |
| 2, 3            | GND           | GND         |
| 9               | NC            | 0V          |
| 10,15           | NC            | NC          |
| 11              | NC            | -Vo         |
| 14              | +Vo           | +Vo         |
| 16              | 0V            | 0V          |
| 22, 23          | Vin           | Vin         |

NC: No Connection

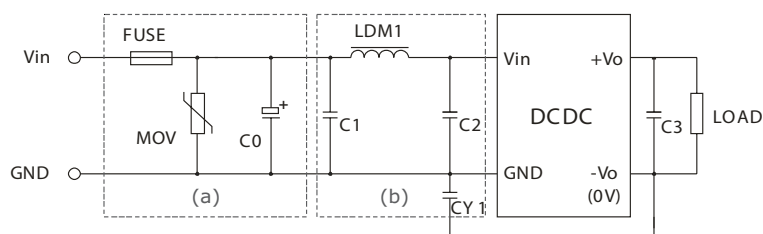


## DERATING CURVES



## EMC RECOMMENDED CIRCUIT

**Figure 1**



**Table 1**

| Recommended external circuit components |                                             |           |           |            |
|-----------------------------------------|---------------------------------------------|-----------|-----------|------------|
| Vin (Vdc)                               | 5                                           | 12        | 24        | 48         |
| FUSE                                    | choose according to practical input current |           |           |            |
| MOV                                     | --                                          | S14K25    | S14K35    | S14K60     |
| C0                                      | 1000μF                                      | 1000μF    | 330μF/50V | 330μF/100V |
| C1                                      | 4.7μF/50V                                   | 4.7μF/50V | 4.7μF/50V | 4.7μF/100V |
| LDM1                                    | 12μH                                        | 12μH      | 12μH      | 12μH       |
| C2                                      | 4.7μF/50V                                   | 4.7μF/50V | 4.7μF/50V | 4.7μF/100V |
| C3                                      | 10μF                                        | 10μF      | 10μF      | 10μF       |
| CY1                                     | 1nF/3kV                                     | 1nF/3kV   | 1nF/3kV   | 1nF/3kV    |

## APPLICATION NOTES

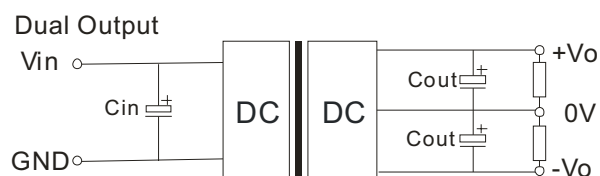
### 1. Output load requirement

To ensure this module can operate efficiently and reliably, the minimum output load may not be less than 5% 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. Recommended circuit

This series has been tested according to the following recommended testing circuit before leaving the factory. This series should be tested under load (see Figure 2 & Table 2). If you want to further decrease the input/output ripple, you can increase the capacitance accordingly or choose capacitors with low ESR. 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**

| $V_{in}$<br>(Vdc) | $C_{in}$<br>( $\mu F$ ) | $C_{out}$<br>( $\mu F$ ) |
|-------------------|-------------------------|--------------------------|
| 5                 | 100                     | 10                       |
| 12                | 100                     | 10                       |
| 24                | 10~47                   | 10                       |
| 48                | 10~47                   | 10                       |

**Table 3**

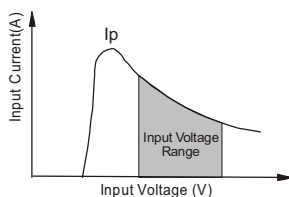
| Single<br>Vout<br>(Vdc) | Max. Capacitive<br>Load<br>( $\mu F$ ) | Dual<br>Vout<br>(Vdc) | Max. Capacitive<br>Load <sup>1</sup><br>( $\mu F$ ) |
|-------------------------|----------------------------------------|-----------------------|-----------------------------------------------------|
| 3.3                     | 4700                                   | 3.3                   | 4700                                                |
| 5                       | 4700                                   | 5                     | 2200                                                |
| 12                      | 2700                                   | 9                     | 2000                                                |
| 15                      | 2200                                   | 12                    | 1800                                                |
| 24                      | 1800                                   | 15                    | 1000                                                |

Note: 1. For each output.

### 3. Input Current

When it is used in an unregulated condition, make sure that the input fluctuations and ripple voltage do not exceed the module standard. Refer to Figure 3 and Table 4 for the startup current of this dc-dc module.

**Figure 3**



**Table 4**

| $V_{in}$<br>(Vdc) | $I_p$<br>(mA) |
|-------------------|---------------|
| 5                 | 1400          |
| 12                | 620           |
| 24                | 310           |
| 48                | 150           |

Note: 1. Minimum load shouldn't be less than 5%, otherwise ripple may increase dramatically. Operation under minimum load will not damage the converter, however, they may not meet all specifications listed.  
2. Maximum capacitive load is tested at input voltage range and full load.  
3. All specifications are measured at  $T_a=25^\circ C$ , humidity<75%, nominal input voltage and rated output load unless otherwise specified.

## REVISION HISTORY

| rev. | description                                                 | date       |
|------|-------------------------------------------------------------|------------|
| 1.0  | initial release                                             | 03/19/2013 |
| 1.01 | added models, added UL approval to model, updated datasheet | 08/12/2015 |

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



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