CUI INC®



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

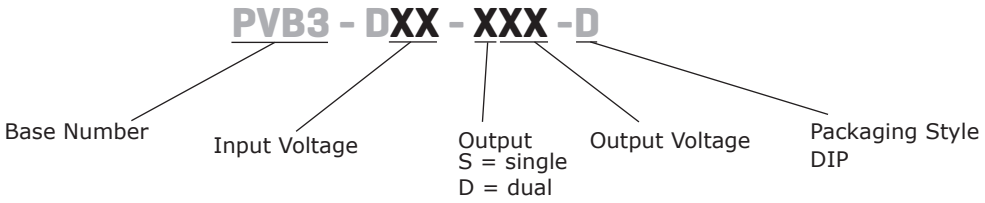
## FEATURES

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


| MODEL | input voltage | | output voltage | output current | | output power | ripple and noise[1] | efficiency |
|---|---|---|---|---|---|---|---|---|
| | typ (Vdc) | range (Vdc) | (Vdc) | min (mA) | max (mA) | max (W) | max (mVp-p) | typ (%) |
| PVB3-D5-S5-D | 5 | 4.5~9 | 5 | 30 | 600 | 3 | 80 | 73 |
| PVB3-D5-S12-D | 5 | 4.5~9 | 12 | 13 | 250 | 3 | 80 | 76 |
| PVB3-D5-S15-D | 5 | 4.5~9 | 15 | 10 | 200 | 3 | 80 | 76 |
| PVB3-D5-D5-D | 5 | 4.5~9 | ±5 | ±15 | ±300 | 3 | 80 | 75 |
| PVB3-D5-D12-D | 5 | 4.5~9 | ±12 | ±6 | ±125 | 3 | 80 | 76 |
| PVB3-D5-D15-D | 5 | 4.5~9 | ±15 | ±5 | ±100 | 3 | 80 | 76 |
| PVB3-D12-S5-D | 12 | 9~18 | 5 | 30 | 600 | 3 | 80 | 80 |
| PVB3-D12-S12-D | 12 | 9~18 | 12 | 13 | 250 | 3 | 80 | 81 |
| PVB3-D12-S15-D | 12 | 9~18 | 15 | 10 | 200 | 3 | 80 | 82 |
| PVB3-D12-S24-D | 12 | 9~18 | 24 | 7 | 125 | 3 | 80 | 83 |
| PVB3-D12-D5-D | 12 | 9~18 | ±5 | ±15 | ±300 | 3 | 80 | 80 |
| PVB3-D12-D12-D | 12 | 9~18 | ±12 | ±6 | ±125 | 3 | 80 | 81 |
| PVB3-D12-D15-D | 12 | 9~18 | ±15 | ±5 | ±100 | 3 | 80 | 82 |
| PVB3-D24-S5-D | 24 | 18~36 | 5 | 30 | 600 | 3 | 80 | 81 |
| PVB3-D24-S12-D | 24 | 18~36 | 12 | 13 | 250 | 3 | 80 | 82 |
| PVB3-D24-S15-D | 24 | 18~36 | 15 | 10 | 200 | 3 | 80 | 84 |
| PVB3-D24-D5-D | 24 | 18~36 | ±5 | ±15 | ±300 | 3 | 80 | 81 |
| PVB3-D24-D12-D | 24 | 18~36 | ±12 | ±6 | ±125 | 3 | 80 | 82 |
| 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 | 13 | 250 | 3 | 80 | 83 |
| PVB3-D48-S15-D | 48 | 36~75 | 15 | 10 | 200 | 3 | 80 | 86 |
| 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 | 83 |
| PVB3-D48-D15-D | 48 | 36~75 | ±15 | ±5 | ±100 | 3 | 80 | 84 |

Notes: 1. ripple and noise are measured at 20 MHz BW by "parallel cable" method

## PART NUMBER KEY




## INPUT

| parameter | conditions/description | min | typ | max | units |
|---|---|---|---|---|---|
| operating input voltage | 5 V input models | 4.5 | 5 | 9 | Vdc |
| | 12 V input models | 9 | 12 | 18 | Vdc |
| | 24 V input models | 18 | 24 | 36 | Vdc |
| | 48 V input models | 36 | 48 | 75 | Vdc |
| start-up voltage | 5 V input models | 3.5 | 4 | 4.5 | Vdc |
| | 12 V input models | 4.5 | 8 | 9 | Vdc |
| | 24 V input models | 11 | 16 | 18 | Vdc |
| | 48 V input models | 24 | 33 | 36 | Vdc |
| surge voltage | for maximum of 1 second | | | | |
| | 5 V input models | -0.7 | | 12 | Vdc |
| | 12 V input models | -0.7 | | 25 | Vdc |
| | 24 V input models | -0.7 | | 50 | Vdc |
| | 48 V 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 | 5% to 100% load | | ±1 | ±3 | % |
| no-load voltage accuracy | input voltage range | | ±1.5 | ±5 | % |
| voltage balance | dual output, balanced loads | | ±0.5 | ±1 | % |
| | dual output, unbalanced loads | | | ±5 | % |
| switching frequency | 100% load, nominal input voltage | | 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 |

## PROTECTIONS

| parameter | conditions/description | min | typ | max | units |
|---|---|---|---|---|---|
| short circuit protection | continuous, automatic recovery | | | | |
| over current protection | | 120 | | | % |

## SAFETY AND COMPLIANCE

| parameter | conditions/description | min | typ | max | units |
|---|---|---|---|---|---|
| isolation voltage | for 1 minute at 1 mA max. | 3,000 | | | Vdc |
| isolation resistance | at 500 Vdc | 1,000 | | | MΩ |
| conducted emissions | CISPR22/EN55022, class A, class B (external circuit required, see Figure 1-b) | | | | |
| radiated emissions | CISPR22/EN55022, class A, 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) | | | | |

## SAFETY AND COMPLIANCE (CONTINUED)

| parameter | conditions/description | min | typ | max | units |
|---|---|---|---|---|---|
| surge | IEC/EN61000-4-5, class B, ± 2kV (external circuit required, see Figure 1-b) | | | | |
| 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 compliant | yes | | | | |

## 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

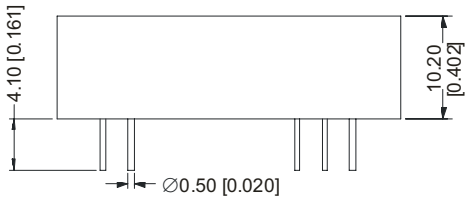
| parameter | conditions/description | min | typ | max | units |
|---|---|---|---|---|---|
| hand soldering | 1.5 mm from case for 10 seconds | | | 300 | °C |
| wave soldering | see wave soldering profile | | | 260 | °C |

## MECHANICAL

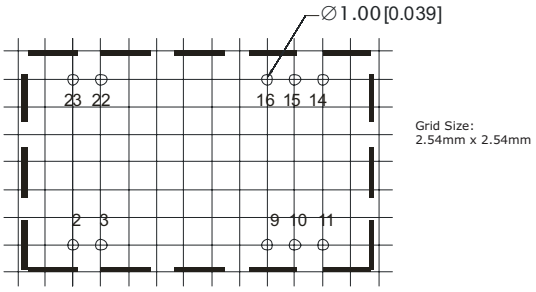
| parameter | conditions/description | min | typ | max | units |
|---|---|---|---|---|---|
| dimensions | 31.80 x 20.30 x 10.20 (1.252 x 0.80 x 0.402 inch) | | | | mm |
| case material | plastic (UL94-V0) | | | | |
| weight | | | 14 | | g |

## MECHANICAL DRAWING

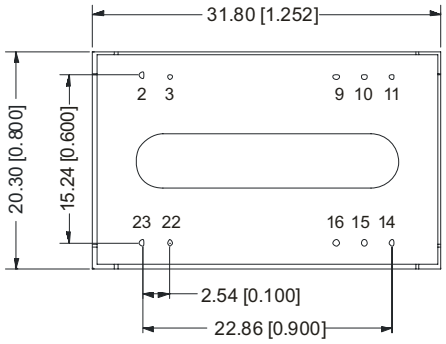
units: mm[inch]
tolerance: ±0.25[±0.010]
pin section tolerance: ±0.10[±0.004]




Front View




PCB Layout
Top View

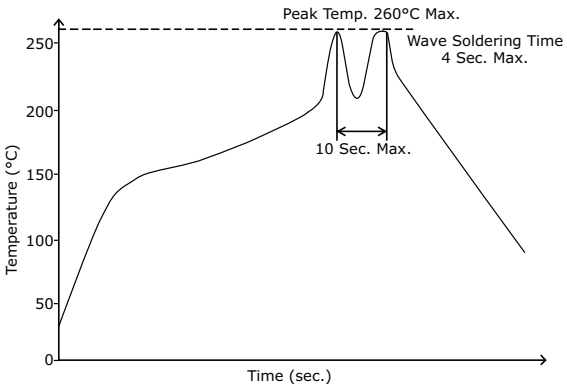



Bottom View

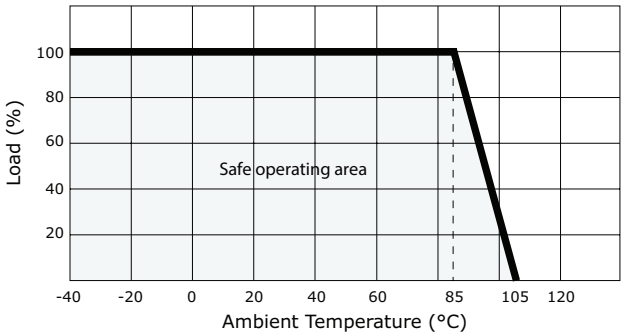
| PIN CONNECTIONS | | |
|---|---|---|
| PIN | Single Output | Dual Output |
| 2, 3 | GND | GND |
| 9 | NC | 0V |
| 10, 15 | NC | NC |
| 11 | NC | -Vo |
| 14 | +Vo | +Vo |
| 16 | 0V | 0V |
| 22, 23 | Vin | Vin |

## DERATING CURVES

Wave Soldering Profile

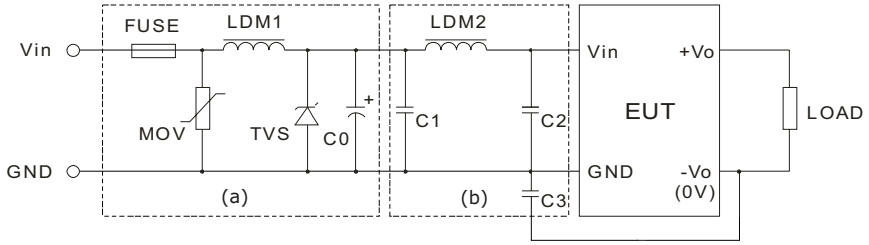



Temperature Derating Curve



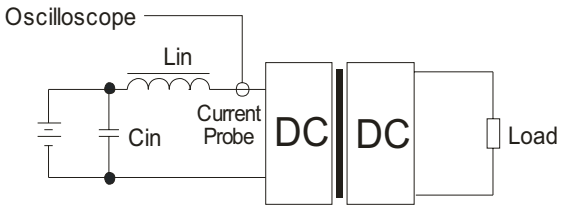

## EMC RECOMMENDED CIRCUIT

**Figure 1**




| Recommended external circuit components | | | | |
|---|---|---|---|---|
| Vin (Vdc) | 5 | 12 | 24 | 48 |
| FUSE | choose according to practical input current | | | |
| MOV | -- | -- | 10D560K | 10D101K |
| LDM1 | -- | -- | 56µH | 56µH |
| TVS | SMCJ13A | SMCJ28A | SMCJ48A | SMCJ90A |
| C0 | 680µF/16V | 680µF/25V | 120µF/50V | 120µF/100V |
| C1 | 4.7µF/50V | 4.7µF/50V | 4.7µF/50V | 4.7µF/100V |
| LDM2 | 12µH | 12µH | 12µH | 12µH |
| C2 | 4.7µF/50V | 4.7µF/50V | 4.7µF/50V | 4.7µF/100V |
| C3 | 1µF | 1µF | 1µF | 1µF |

## TEST CONFIGURATION




| External components | |
|---|---|
| Lin | 4.7µH |
| Cin | 220µF, ESR < 1.0Ω at 100 KHz |

Note: Input reflected-ripple current is measured with an inductor Lin and Capacitor Cin to simulate source impedance.

## 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). 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 1).

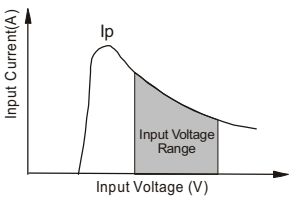

**Figure 2**

**Table 1**

| Vin (Vdc) | Cin (μF) | Cout (μF/mA) |
|---|---|---|
| 5 | 100 | 10/100 |
| 12 | 100 | 10/100 |
| 24 | 10~47 | 10/100 |
| 48 | 10~47 | 10/100 |

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 for the startup current of this dc-dc module.

**Figure 3**




| Vin (Vdc) | Ip (mA) |
|---|---|
| 5 | 1400 |
| 12 | 620 |
| 24 | 300 |
| 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 Ta=25°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 |

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

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CUI offers a two (2) year limited warranty. Complete warranty information is listed on our website.

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