

**SERIES: VWRBS1 | DESCRIPTION: DC-DC CONVERTER**
**FEATURES**

- 1 W isolated output
- wide input (2:1)
- industry standard 8 pin SIP package style
- single unregulated outputs
- 1,500 V isolation
- short circuit protection
- wide temperature (-40~85°C)
- efficiency up to 80%


**MODEL**

| MODEL              | input voltage |             | output voltage<br>(Vdc) | output current |          | output power<br>max (W) | ripple and noise <sup>1</sup><br>typ (mVp-p) | efficiency<br>typ (%) |
|--------------------|---------------|-------------|-------------------------|----------------|----------|-------------------------|----------------------------------------------|-----------------------|
|                    | typ (Vdc)     | range (Vdc) |                         | min (mA)       | max (mA) |                         |                                              |                       |
| VWRBS1-D5-S5-SIP   | 5             | 4.5~9       | 5                       | 20             | 200      | 1                       | 35                                           | 70                    |
| VWRBS1-D5-S9-SIP   | 5             | 4.5~9       | 9                       | 11             | 111      | 1                       | 35                                           | 71                    |
| VWRBS1-D5-S12-SIP  | 5             | 4.5~9       | 12                      | 8              | 83       | 1                       | 35                                           | 76                    |
| VWRBS1-D5-S15-SIP  | 5             | 4.5~9       | 15                      | 7              | 67       | 1                       | 35                                           | 75                    |
| VWRBS1-D12-S5-SIP  | 12            | 9~18        | 5                       | 20             | 200      | 1                       | 30                                           | 76                    |
| VWRBS1-D12-S9-SIP  | 12            | 9~18        | 9                       | 11             | 111      | 1                       | 30                                           | 78                    |
| VWRBS1-D12-S12-SIP | 12            | 9~18        | 12                      | 8              | 83       | 1                       | 30                                           | 79                    |
| VWRBS1-D12-S15-SIP | 12            | 9~18        | 15                      | 7              | 67       | 1                       | 30                                           | 80                    |
| VWRBS1-D15-S5-SIP  | 15            | 9~18        | 5                       | 20             | 200      | 1                       | 80                                           | 75                    |
| VWRBS1-D15-S9-SIP  | 15            | 9~18        | 9                       | 11             | 111      | 1                       | 80                                           | 79                    |
| VWRBS1-D15-S12-SIP | 15            | 9~18        | 12                      | 8              | 83       | 1                       | 80                                           | 80                    |
| VWRBS1-D15-S15-SIP | 15            | 9~18        | 15                      | 7              | 67       | 1                       | 80                                           | 81                    |
| VWRBS1-D24-S5-SIP  | 24            | 18~36       | 5                       | 20             | 200      | 1                       | 55                                           | 76                    |
| VWRBS1-D24-S9-SIP  | 24            | 18~36       | 9                       | 11             | 111      | 1                       | 55                                           | 78                    |
| VWRBS1-D24-S12-SIP | 24            | 18~36       | 12                      | 8              | 83       | 1                       | 55                                           | 80                    |
| VWRBS1-D24-S15-SIP | 24            | 18~36       | 15                      | 7              | 67       | 1                       | 55                                           | 80                    |
| VWRBS1-D48-S5-SIP  | 48            | 36~72       | 5                       | 20             | 200      | 1                       | 382                                          | 76                    |
| VWRBS1-D48-S9-SIP  | 48            | 36~72       | 9                       | 11             | 111      | 1                       | 382                                          | 78                    |
| VWRBS1-D48-S12-SIP | 48            | 36~72       | 12                      | 8              | 83       | 1                       | 382                                          | 80                    |
| VWRBS1-D48-S15-SIP | 48            | 36~72       | 15                      | 7              | 67       | 1                       | 382                                          | 80                    |

Notes: 1. ripple and noise are measured at 20 MHz BW

**PART NUMBER KEY**
**VWRBS1 - DXX - SXX - SIP**

Base Number

Input Voltage

Output Voltage

Packaging Style

## INPUT

| parameter                  | conditions/description | min          | typ  | max | units |
|----------------------------|------------------------|--------------|------|-----|-------|
| input surge voltage        | for 1,000 ms           | 5 Vdc model  | -0.7 | 12  | Vdc   |
|                            |                        | 12 Vdc model | -0.7 | 25  | Vdc   |
|                            |                        | 24 Vdc model | -0.7 | 50  | Vdc   |
|                            |                        | 48 Vdc model | -0.7 | 100 | Vdc   |
| internal power dissipation |                        |              |      | 1.6 | W     |
| short circuit input power  |                        |              | 1    |     | W     |
| input filter               | C filter               |              |      |     |       |

## OUTPUT

| parameter                    | conditions/description              | min | typ  | max   | units |
|------------------------------|-------------------------------------|-----|------|-------|-------|
| voltage accuracy             | positive                            |     | ±1   | ±3    | %     |
|                              | negative                            |     | ±2   | ±5    | %     |
| line regulation              | measured from low line to high line |     | ±0.2 | ±0.5  | %     |
| load regulation              | measured from 10% to 100% full load |     | ±0.5 | ±0.75 | %     |
| transient recovery time      | 25% load step change                |     | 8    | 10    | ms    |
| transient response deviation | 25% load step change                |     | ±3   | ±5    | %     |
| ripple & noise               | all other models                    |     | 25   | 75    | mVp-p |
|                              | 15 V model                          |     | 80   | 150   | mVp-p |
| switching frequency          | 100% load, nominal input voltage    |     | 300  |       | kHz   |
| temperature coefficient      |                                     |     |      | ±0.03 | %/°C  |

## PROTECTIONS

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

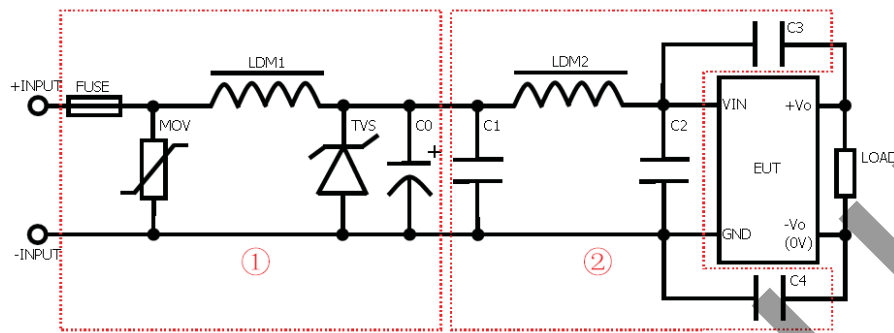
## SAFETY AND COMPLIANCE

| parameter             | conditions/description           | min       | typ | max | units |
|-----------------------|----------------------------------|-----------|-----|-----|-------|
| isolation voltage     | tested for 1 minute at 1 mA max. | 1,500     |     |     | Vdc   |
| insulation resistance | at 500 Vdc                       | 1,000     |     |     | MΩ    |
| isolation capacitance | input to output                  |           | 35  |     | pF    |
| RoHS compliant        | yes                              |           |     |     |       |
| MTBF                  | MIL-HDBK-217F, 25°C              | 1,000,000 |     |     | hours |

## ENVIRONMENTAL

| parameter             | conditions/description          | min | typ | max | units |
|-----------------------|---------------------------------|-----|-----|-----|-------|
| operating temperature |                                 | -40 |     | 85  | °C    |
| storage temperature   |                                 | -50 |     | 125 | °C    |
| storage humidity      | non-condensing                  |     |     | 95  | %     |
| temperature rise      | at full load, 25°C              |     | 15  | 35  | °C    |
|                       | all other models                |     | 80  | 150 | °C    |
| lead temperature      | 15 V model                      |     |     |     | °C    |
|                       | 1.5 mm from case for 10 seconds |     |     | 300 | °C    |

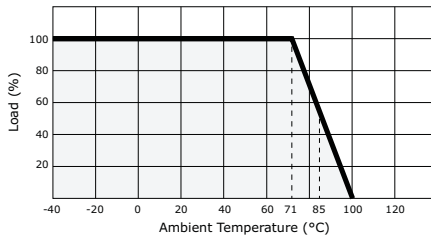
## EMC RECOMMENDED CIRCUIT



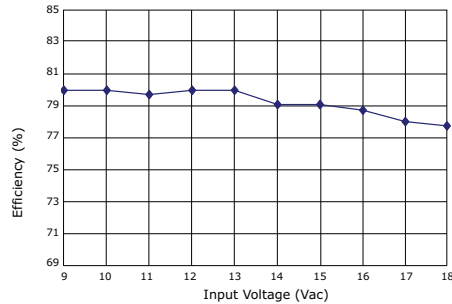
| RECOMMENDED EXTERNAL<br>CIRCUIT PARAMETERS | Vin = 5V                 | Vin = 12V                | Vin = 24V                | Vin = 48V                 |
|--------------------------------------------|--------------------------|--------------------------|--------------------------|---------------------------|
| FUSE                                       | choose according to load |                          |                          |                           |
| MOV                                        | ---                      | ---                      | 10D560K                  | 10D121K                   |
| LDM1                                       | ---                      | ---                      | 82 $\mu$ H, CD53         |                           |
| TVS                                        | SMCJ13A                  | SMCJ28A                  | SMCJ48A                  | SMCJ100A                  |
| C0                                         | 680 $\mu$ F / 16 V       | 680 $\mu$ F / 25 V       | 120 $\mu$ F / 50 V       | 120 $\mu$ F / 100 V       |
| C1                                         | 4.7 $\mu$ F / 50 V, 1210 | 2.2 $\mu$ F / 50 V, 1210 | 4.7 $\mu$ F / 50 V, 1210 | 4.7 $\mu$ F / 100 V, 1210 |
| LDM2                                       | 12 $\mu$ H, CD43         |                          |                          |                           |
| C2                                         | 1 $\mu$ F / 50 V, 1210   | 1 $\mu$ F / 50 V, 1210   | 1 $\mu$ F / 50 V, 1210   | 1 $\mu$ F / 100 V, 1210   |
| C4                                         | 100 pF / 2 kV, 1206      |                          | 100 pF / 2 kV, 1206      | 100 pF / 2 kV, 1206       |

## DERATING CURVES

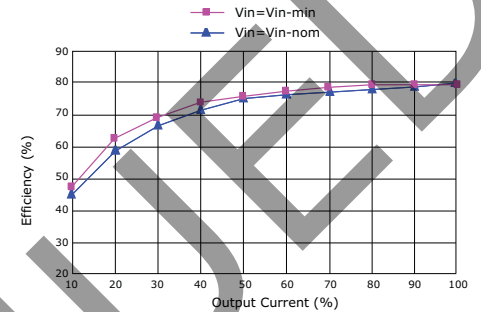
1. output power vs. ambient temperature



2. efficiency vs. output power



3. efficiency vs. output current

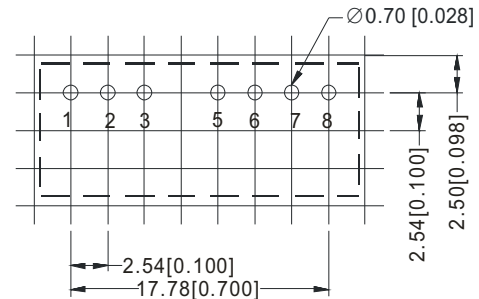
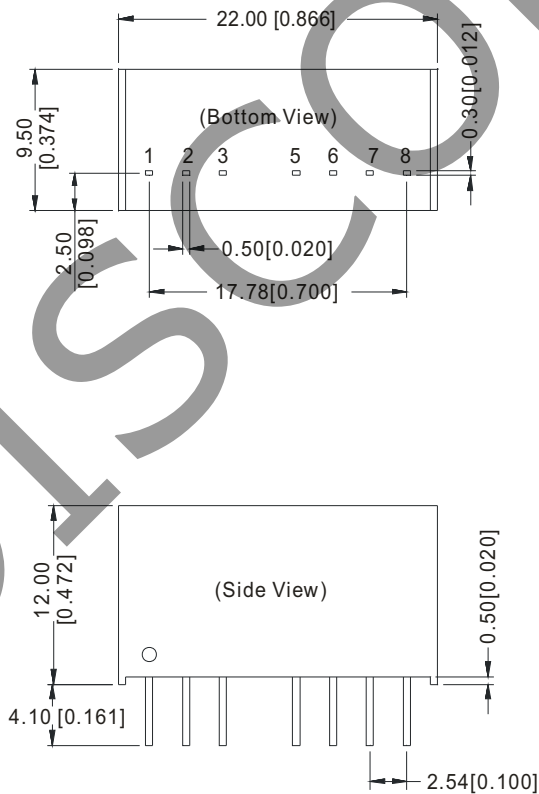


## MECHANICAL

| parameter     | conditions/description                          | min | typ | max | units |
|---------------|-------------------------------------------------|-----|-----|-----|-------|
| dimensions    | 0.866 x 0.472 x 0.374 (22.00 x 12.00 x 9.50 mm) |     |     |     | inch  |
| case material | UL94-V0 epoxy resin                             |     |     |     |       |
| weight        |                                                 |     | 5   |     | g     |

## MECHANICAL DRAWING

units: mm [inches]

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

| PIN CONNECTIONS |          |
|-----------------|----------|
| PIN             | FUNCTION |
| 1               | GND      |
| 2               | Vin      |
| 3               | CTRL     |
| 5               | NC       |
| 6               | +Vo      |
| 7               | 0 V      |
| 8               | CS       |

## APPLICATION NOTES

### 1. Requirement on Output Load

In order to ensure the product operates efficiently and reliably, make sure the specified range of input voltage is not exceeded and the minimum output load is not less than 10% load. If the actual load is less than the specified minimum load, the output ripple may increase sharply while its efficiency and reliability will reduce greatly. If the actual output power is very small, please add an appropriate resistor as extra loading.

### 2. Overload Protection

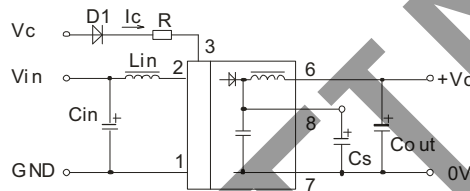
Under normal operating conditions, the output circuit of these products has no protection against overload. The simplest method is to connect a self-recovery fuse in series at the end or add a circuit breaker to the circuit.

| 5 Vdc models            | 12 Vdc models         | 24 Vdc models         | 48 Vdc models         |
|-------------------------|-----------------------|-----------------------|-----------------------|
| 1,000 mA slow-blow type | 500 mA slow-blow type | 250 mA slow-blow type | 120 mA slow-blow type |

### 3. Recommended Circuit

All VWRBS1 converters have been tested according to the following recommended testing circuit before leaving the factory. This series should be tested under load, never under no load (Figure 1).

Figure 1



However, the capacitance of the output filter capacitor must be proper. If the capacitance is too big, a startup problem might arise. For every channel of output, provided the safe and reliable operation is ensured, the greatest capacitance of its filter capacitor sees (Table 1).

General:

|      |                 |             |
|------|-----------------|-------------|
| Cin  | 5, 12 V         | 100 $\mu$ F |
|      | 24, 48 V        | 10 $\mu$ F  |
| Cout | 47 $\mu$ F typ. |             |
| Lin  | 4.7~120 $\mu$ H |             |
| Lout | 2.2~10 $\mu$ H  |             |
| Cs   | 10~22 $\mu$ F   |             |

Table 1

| Vout (Vdc) | Cout ( $\mu$ F) |
|------------|-----------------|
| 3.3        | 2,200           |
| 5          | 1,000           |
| 9          | 680             |
| 12         | 470             |
| 15         | 330             |

### 4. CTRL Terminal

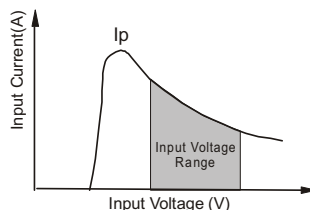
When open or high impedance, the converter work well; When this pin is 'high', the converter shutdown; It should be note that the input current should between 5~10 mA, exceeding the maximum 20 mA will cause permanence damage to the converter. The value of R can be derived as follows:

$$R = \frac{V_C - V_D - 1.0}{I_C}$$

### 5. Input Current

While using unstable power source, please ensure the output voltage and ripple voltage do not exceed indexes of the converter. The preceding power source must be able to provide for converter sufficient starting current  $I_p$ .

General:  $I_p \leq 1.4 \cdot I_{in-max}$



### 6. No parallel connection or plug and play

## REVISION HISTORY

| rev. | description                 | date       |
|------|-----------------------------|------------|
| 1.0  | initial release             | 09/10/2008 |
| 1.01 | new template applied        | 05/23/2012 |
| 1.02 | V-Infinity branding removed | 09/04/2012 |

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



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