



## SERIES: VHS1-SIP | DESCRIPTION: DC-DC CONVERTER

### FEATURES

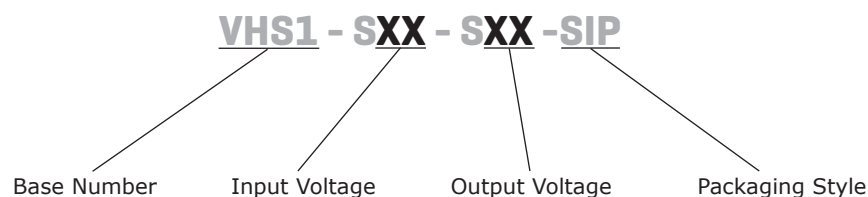
- 1 W isolated output
- industry standard 7 pin SIP package
- single unregulated outputs
- 6,000 V isolation
- short circuit protection
- UL safety approvals
- wide temperature (-40~105°C)
- efficiency up to 82%



| MODEL            | input voltage |                | output voltage<br>(Vdc) | output current |             | output power<br>max<br>(W) | ripple and noise <sup>1</sup><br>max<br>(mVp-p) | efficiency<br>typ<br>(%) |
|------------------|---------------|----------------|-------------------------|----------------|-------------|----------------------------|-------------------------------------------------|--------------------------|
|                  | typ<br>(Vdc)  | range<br>(Vdc) |                         | min<br>(mA)    | max<br>(mA) |                            |                                                 |                          |
| VHS1-S5-S5-SIP   | 5             | 4.5~5.5        | 5                       | 20             | 200         | 1                          | 200                                             | 78                       |
| VHS1-S5-S9-SIP   | 5             | 4.5~5.5        | 9                       | 12             | 111         | 1                          | 200                                             | 79                       |
| VHS1-S5-S12-SIP  | 5             | 4.5~5.5        | 12                      | 9              | 84          | 1                          | 200                                             | 79                       |
| VHS1-S5-S15-SIP  | 5             | 4.5~5.5        | 15                      | 7              | 67          | 1                          | 200                                             | 79                       |
| VHS1-S12-S5-SIP  | 12            | 10.8~13.2      | 5                       | 20             | 200         | 1                          | 200                                             | 80                       |
| VHS1-S12-S9-SIP  | 12            | 10.8~13.2      | 9                       | 12             | 111         | 1                          | 200                                             | 82                       |
| VHS1-S12-S12-SIP | 12            | 10.8~13.2      | 12                      | 9              | 84          | 1                          | 200                                             | 81                       |
| VHS1-S12-S15-SIP | 12            | 10.8~13.2      | 15                      | 7              | 67          | 1                          | 200                                             | 82                       |

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

### PART NUMBER KEY



## INPUT

| parameter               | conditions/description | min  | typ | max  | units |
|-------------------------|------------------------|------|-----|------|-------|
| operating input voltage | 5 V model              | 4.5  | 5   | 5.5  | Vdc   |
|                         | 12 V model             | 10.8 | 12  | 13.2 | Vdc   |

## OUTPUT

| parameter               | conditions/description              |                   | min | typ   | max  | units |
|-------------------------|-------------------------------------|-------------------|-----|-------|------|-------|
| line regulation         | for Vin change of 1%                |                   |     |       | ±1.2 | %     |
| load regulation         | measured from 10% load to full load | 5 V model         |     | 12.8  | 15   | %     |
|                         |                                     | 9 V model         |     | 8.3   | 15   | %     |
|                         |                                     | 12 V model        |     | 6.8   | 15   | %     |
|                         |                                     | 15 V model        |     | 6.3   | 15   | %     |
| voltage accuracy        | see derating curves                 |                   |     |       |      |       |
| switching frequency     | 100% load, input voltage range      | 5 V input models  | 35  | 40    | 65   | kHz   |
|                         |                                     | 12 V input models | 35  | 50    | 65   | kHz   |
| temperature coefficient |                                     |                   |     | ±0.03 |      | %/°C  |

## PROTECTIONS

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

## SAFETY AND COMPLIANCE

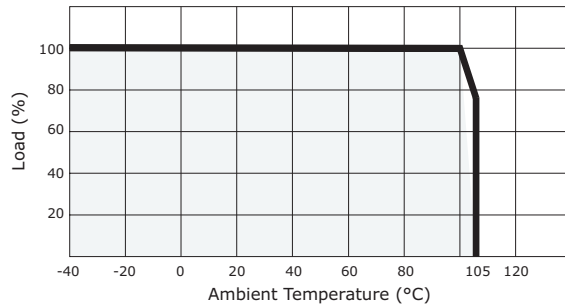
| parameter            | conditions/description    | min       | typ | max | units |
|----------------------|---------------------------|-----------|-----|-----|-------|
| isolation voltage    | for 1 minute at 1 mA max. | 6,000     |     |     | Vdc   |
| isolation resistance | at 500 Vdc                | 1,000     |     |     | MΩ    |
| safety approvals     | UL 60950-1                |           |     |     |       |
| MTBF                 |                           | 3,500,000 |     |     | hours |
| RoHS                 | 2011/65/EU                |           |     |     |       |

## ENVIRONMENTAL

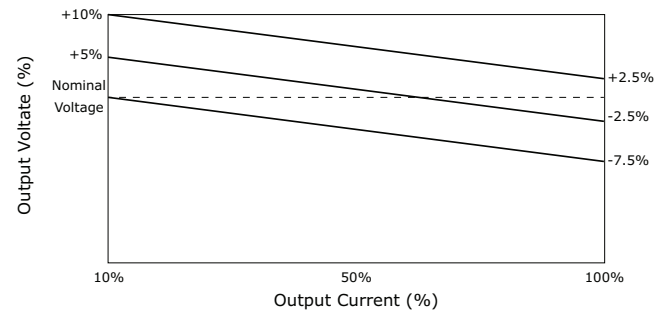
| parameter             | conditions/description          | min | typ | max | units |
|-----------------------|---------------------------------|-----|-----|-----|-------|
| operating temperature | see derating curve              | -40 |     | 105 | °C    |
| storage temperature   |                                 | -55 |     | 125 | °C    |
| storage humidity      | non-condensing                  |     |     | 95  | %     |
| temperature rise      | at full load                    |     | 15  | 25  | °C    |
| lead temperature      | 1.5 mm from case for 10 seconds |     |     | 300 | °C    |

## DERATING CURVES

1. output power vs. ambient temperature



2. output voltage vs. output current

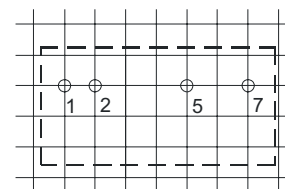
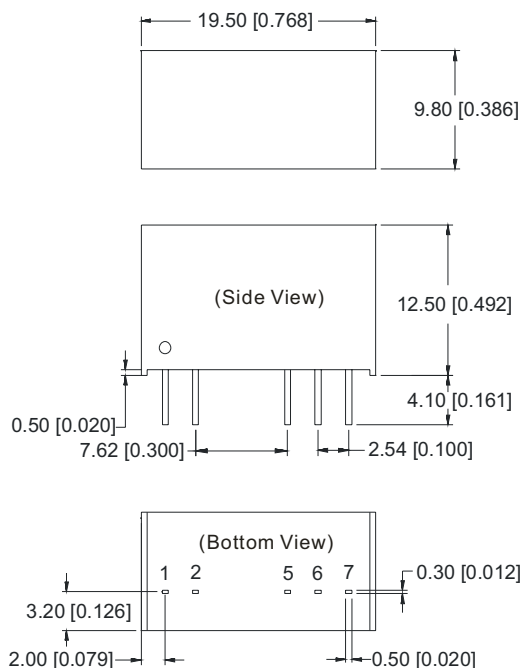


## MECHANICAL

| 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 | plastic (UL94-V0)                                 |     |     |     |       |
| weight        |                                                   |     | 4.2 |     | 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               | +Vin     |
| 2               | GND      |
| 5               | 0 V      |
| 6               | No PIN   |
| 7               | +Vo      |

## 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.

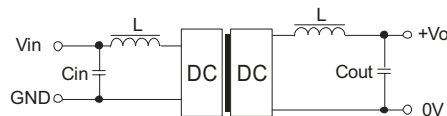
### 2. Overload Protection

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

### 3. Filtering

In some circuits which are sensitive to noise and ripple, a filtering capacitor may be added to the DC/DC output end and input end to reduce the noise and ripple. 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 the external capacitor table. To get an extremely low ripple, an "LC" filtering network may be connected to the input and output ends of the DC/DC converter, which may produce a more significant filtering effect. It should also be noted that the inductance and the frequency of the "LC" filtering network should be staggered with the DC/DC frequency to avoid mutual interference (Figure 1).

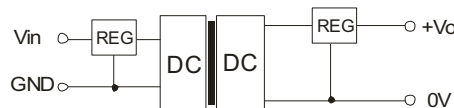
Figure 1



### 4. Output Voltage Regulation and Over-voltage Protection Circuit

The simplest device for output voltage regulation, over-voltage and over-current protection is a linear voltage regulator with overheat protection that is connected to the input or output end in series (Figure 2).

Figure 2



### 5. External Capacitor Table

It is not recommended to connect any external capacitor in the application field with less than 0.5 W output.

Table 1

| Vin<br>(Vdc) | Cout<br>(μF) | Vout<br>(Vdc) | Cout<br>(μF) |
|--------------|--------------|---------------|--------------|
| 5            | 4.7          | 5             | 10           |
| 12           | 2.2          | 9             | 4.7          |
| --           | --           | 12            | 2.2          |
| --           | --           | 15            | 1            |

Note: All specifications measured at 25°C, humidity <75%, nominal input voltage, and full load unless otherwise noted.

## REVISION HISTORY

| rev. | description                                                                                                   | date       |
|------|---------------------------------------------------------------------------------------------------------------|------------|
| 1.0  | initial release                                                                                               | 01/03/2011 |
| 1.01 | new template applied                                                                                          | 04/12/2012 |
| 1.02 | V-Infinity branding removed                                                                                   | 09/05/2012 |
| 1.03 | added 9 and 15 V load regulation data                                                                         | 11/05/2012 |
| 1.04 | 5 V input models changed efficiency, switching frequency, short circuit protection, and operating temperature | 06/17/2013 |
| 1.05 | updated datasheet                                                                                             | 12/02/2014 |

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



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