



Power Your Critical Mission Today

## VHR15-2800S SERIES

HIGH RELIABILITY COTS DC-DC CONVERTERS

### Models Available

Input: 15 V to 50 V continuous, 80 V transient  
15 W, single output of 3.3 V, 5 V, 12 V, 15 V  
-40 °C to 100 °C Operation

# DATASHEET

## 1.0 DESCRIPTION

The VHR series of industrial grade DC-DC converters provides cost effective, high reliability solutions for use in defense, avionics and manufacturing industries. The VHR industrial grade products leverage decades of VPT's proven heritage in military and aerospace electronics.

VPT's VHR15-2800S series is ideal for non flight-critical solutions in military, avionics, unmanned systems as well as manufacturing equipment and controls. A wide input voltage range which accommodates nominal 28 V inputs, low input and output ripple, fixed operating frequency and companion EMI filters simplify system design while ensuring operating success in the most rugged of environments.

These converters are designed and manufactured in a facility certified to ISO9001, J-STD-001 and IPC-A-610.

This product may incorporate one or more of the following U.S. patents:

5,784,266  
5,790,389  
5,963,438  
5,999,433  
6,005,780  
6,084,792  
6,118,673



## 1.1 FEATURES

- High Reliability at Low Cost
- Up to 15 Watts Maximum Output Power
- Wide Input Voltage Range: 15 to 50 Volts per MIL-STD-704 and MIL-STD-1275
- High Input Transient Voltage: 80 Volts for 1 sec per MIL-STD-704A
- Input Undervoltage Lockout
- Fixed Frequency
- Output Voltage Trim (+10% / -20% )
- Output Soft Start
- Current Limit Protection
- Short Circuit Protection
- Magnetic Feedback, no Optoisolators
- Wide Temperature Range, -40°C to 100°C
- Internally Conformal Coated
- Standard Six Sided Non-Hermetic Rugged Metal Package

## 1.2 COMPLIANCE

- MIL-STD-1275
- MIL-STD-704
- Meets MIL-STD-461C-F and EN55022 when used with an appropriate VHR EMI Filter

## 1.3 PACKAGING

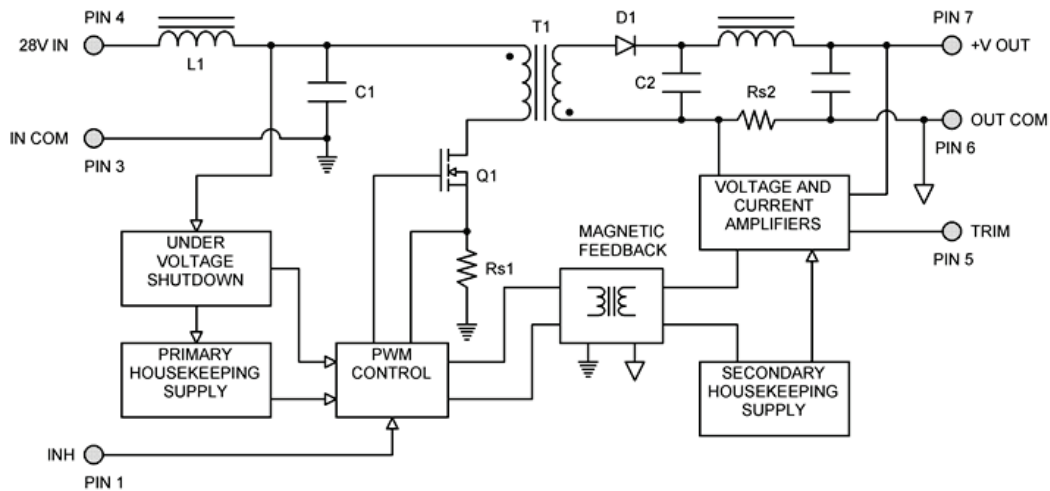
- Low-profile: 1.585" x 1.175" x 0.400"
- Max weight: 32 g

## 1.4 SIMILAR PRODUCTS AND ACCESSORIES

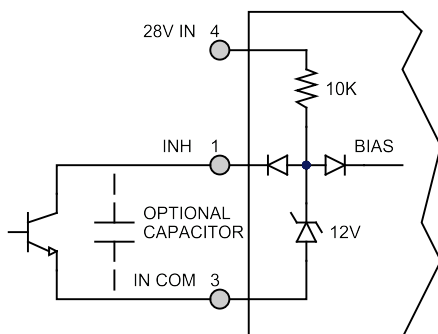
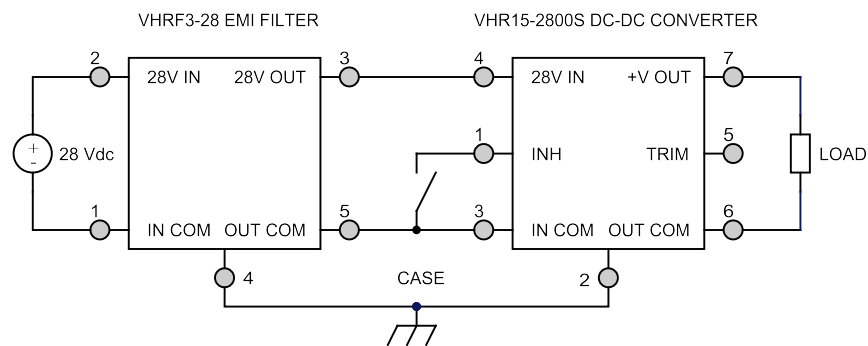
- [DVHF](#) 20 W single output DC-DC Converter
- [VXR15](#) 15W single output COTS DC-DC Converter
- [VPT15](#) 15 W single output COTS DC-DC Converter
- [EMI filters, Thermal Pads, Front-End Modules and Accessories](#)

## 2.0 DESCRIPTION

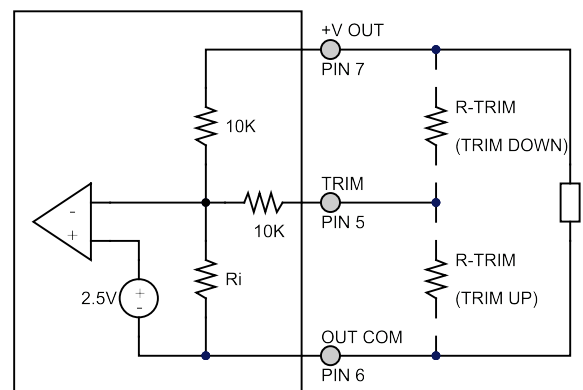
## 2.1 BLOCK DIAGRAM



## 2.2 CONNECTION DIAGRAM



### Inhibit Circuit (Shown with optional capacitor for turn-on delay)



### Output Voltage Trim Circuit

### 3.0 SPECIFICATIONS

#### 3.1 ABSOLUTE MAXIMUM RATINGS

##### Absolute Maximum Ratings

|                                      |      |                                       |                  |
|--------------------------------------|------|---------------------------------------|------------------|
| Input Voltage (Continuous):          | 50 V | Operating Temperature (Full Load):    | -40 °C to 100 °C |
| Input Voltage (Transient, 1 second): | 80 V | Storage Temperature:                  | -55 °C to 125 °C |
|                                      |      | Lead Solder Temperature (10 seconds): | 300 °C           |

#### 3.2 PERFORMANCE SPECIFICATIONS

Tcase = -40 °C to 100 °C, Vin = +28 V ± 5%, Full Load, Unless Otherwise Specified

|                                             |                               | VHR15-283R3S |     |      | VHR15-2805S |     |      |       |
|---------------------------------------------|-------------------------------|--------------|-----|------|-------------|-----|------|-------|
| Parameter                                   | Conditions                    | Min          | Typ | Max  | Min         | Typ | Max  | Units |
| INPUT                                       |                               |              |     |      |             |     |      |       |
| Voltage                                     | Continuous                    | 15           | 28  | 50   | 15          | 28  | 50   | V     |
|                                             | Transient, 1 sec <sup>3</sup> | -            | -   | 80   | -           | -   | 80   | V     |
| Current                                     | INH < 1.5 V                   | -            | 4   | 6    | -           | 4   | 6    | mA    |
|                                             | No Load                       | -            | 50  | 65   | -           | 50  | 65   | mA    |
| Ripple Current                              | 20 Hz to 10 MHz               | -            | 40  | 75   | -           | 50  | 80   | mApp  |
| Undervoltage Lockout                        | Turn On                       | 12           | -   | 14.8 | 12          | -   | 14.8 | V     |
|                                             | Turn Off <sup>3</sup>         | 11           | -   | 14.5 | 11          | -   | 14.5 | V     |
| OUTPUT STATIC                               |                               |              |     |      |             |     |      |       |
| Voltage                                     | Tcase = 25 °C                 | 3.25         | 3.3 | 3.35 | 4.92        | 5   | 5.08 | V     |
|                                             | Tcase = -40 °C to 100 °C      | 3.21         | 3.3 | 3.38 | 4.87        | 5   | 5.13 | V     |
| Power <sup>2</sup>                          |                               | 0            | -   | 10   | 0           | -   | 15   | W     |
| Current <sup>2</sup>                        |                               | 0            | -   | 3    | 0           | -   | 3    | A     |
| Ripple Voltage                              | 20 Hz to 10 MHz               | -            | 10  | 40   | -           | 10  | 40   | mVpp  |
| Line Regulation                             | Vin = 15 V to 50 V            | -            | 1   | 10   | -           | 1   | 10   | mV    |
| Load Regulation                             | No Load to Full Load          | -            | 1   | 10   | -           | 1   | 10   | mV    |
| Load Fault Power Dissipation                | Overload <sup>3</sup>         | -            | -   | 8    | -           | -   | 9    | W     |
|                                             | Short Circuit                 | -            | -   | 8    | -           | -   | 8    | W     |
| OUTPUT DYNAMIC                              |                               |              |     |      |             |     |      |       |
| Load Step, Half to Full Load                | Output Transient              | -            | 170 | 250  | -           | 170 | 250  | mVpk  |
|                                             | Recovery <sup>1</sup>         | -            | 300 | 450  | -           | 300 | 450  | μs    |
| Line Step <sup>3</sup> , Vin = 16 V to 40 V | Output Transient              | -            | 350 | 550  | -           | 350 | 550  | mVpk  |
|                                             | Recovery <sup>1</sup>         | -            | 400 | 550  | -           | 400 | 550  | μs    |
| Turn On, Vin = 0 to 28 V                    | Delay                         | -            | 10  | 20   | -           | 10  | 20   | ms    |
|                                             | Overshoot                     | -            | 0   | 15   | -           | 0   | 25   | mVpk  |
| FUNCTION                                    |                               |              |     |      |             |     |      |       |
| INH Pin Input <sup>3</sup>                  | Output Inhibited              | 0            | -   | 1.5  | 0           | -   | 1.5  | V     |
| INH Pin Open Circuit Voltage <sup>3</sup>   | Output Enabled                | 9            | 11  | 13   | 9           | 11  | 13   | V     |
| Voltage Trim Range                          |                               | -10          | -   | 10   | -20         | -   | 10   | %     |
| GENERAL                                     |                               |              |     |      |             |     |      |       |
| Efficiency                                  |                               | 67           | 70  | -    | 72          | 76  | -    | %     |
| Capacitive Load <sup>3</sup>                |                               | -            | -   | 1000 | -           | -   | 1000 | μF    |
| Switching Frequency                         |                               | 400          | 500 | 550  | 400         | 500 | 550  | kHz   |
| Isolation                                   | 500 V DC, Tcase = 25 °C       | 100          | -   | -    | 100         | -   | -    | MΩ    |
| Weight                                      |                               | -            | -   | 32   | -           | -   | 32   | g     |
| MTBF (MIL-HDBK-217F)                        | GM @ Tcase = 55 °C            | -            | 445 | -    | -           | 445 | -    | kHr   |

1. Time for output voltage to settle within 1% of its nominal value
2. Derate linearly to 0 at 110 °C
3. Verified by qualification testing

### 3.2 PERFORMANCE SPECIFICATIONS (CONTINUED)

Tcase = -40 °C to 100 °C, Vin = +28 V ± 5%, Full Load, Unless Otherwise Specified

|                                             |                               | VHR15-2812S |     |       | VHR15-2815S |     |       |       |
|---------------------------------------------|-------------------------------|-------------|-----|-------|-------------|-----|-------|-------|
| Parameter                                   | Conditions                    | Min         | Typ | Max   | Min         | Typ | Max   | Units |
| INPUT                                       |                               |             |     |       |             |     |       |       |
| Voltage                                     | Continuous                    | 15          | 28  | 50    | 15          | 28  | 50    | V     |
|                                             | Transient, 1 sec <sup>3</sup> | -           | -   | 80    | -           | -   | 80    | V     |
| Current                                     | INH < 1.5 V                   | -           | 4   | 6     | -           | 4   | 6     | mA    |
|                                             | No Load                       | -           | 50  | 65    | -           | 50  | 65    | mA    |
| Ripple Current                              | 20 Hz to 10 MHz               | -           | 40  | 80    | -           | 40  | 80    | mApp  |
| Undervoltage Lockout                        | Turn On                       | 12          | -   | 14.8  | 12          | -   | 14.8  | V     |
|                                             | Turn Off <sup>3</sup>         | 11          | -   | 14.5  | 11          | -   | 14.5  | V     |
| OUTPUT STATIC                               |                               |             |     |       |             |     |       |       |
| Voltage                                     | Tcase = 25 °C                 | 11.82       | 12  | 12.18 | 14.77       | 15  | 15.23 | V     |
|                                             | Tcase = -40 °C to 100 °C      | 11.7        | 12  | 12.3  | 14.62       | 15  | 15.38 | V     |
| Power <sup>2</sup>                          |                               | 0           | -   | 15    | 0           | -   | 15    | W     |
| Current <sup>2</sup>                        |                               | 0           | -   | 1.25  | 0           | -   | 1     | A     |
| Ripple Voltage                              | 20 Hz to 10 MHz               | -           | 10  | 30    | -           | 10  | 30    | mVpp  |
| Line Regulation                             | Vin = 15 V to 50 V            | -           | 1   | 10    | -           | 1   | 10    | mV    |
| Load Regulation                             | No Load to Full Load          | -           | 1   | 10    | -           | 1   | 10    | mV    |
| Load Fault Power Dissipation                | Overload <sup>3</sup>         | -           | -   | 8     | -           | -   | 8     | W     |
|                                             | Short Circuit                 | -           | -   | 8     | -           | -   | 8     | W     |
| OUTPUT DYNAMIC                              |                               |             |     |       |             |     |       |       |
| Load Step, Half to Full Load                | Output Transient              | -           | 250 | 350   | -           | 250 | 350   | mVpk  |
|                                             | Recovery <sup>1</sup>         | -           | 150 | 250   | -           | 150 | 250   | µs    |
| Line Step <sup>3</sup> , Vin = 16 V to 40 V | Output Transient              | -           | 450 | 700   | -           | 450 | 700   | mVpk  |
|                                             | Recovery <sup>1</sup>         | -           | 400 | 550   | -           | 400 | 550   | µs    |
| Turn On, Vin = 0 to 28 V                    | Delay                         | -           | 10  | 20    | -           | 10  | 20    | ms    |
|                                             | Overshoot                     | -           | 0   | 50    | -           | 0   | 50    | mVpk  |
| FUNCTION                                    |                               |             |     |       |             |     |       |       |
| INH Pin Input <sup>3</sup>                  | Output Inhibited              | 0           | -   | 1.5   | 0           | -   | 1.5   | V     |
| INH Pin Open Circuit Voltage <sup>3</sup>   | Output Enabled                | 9           | 11  | 13    | 9           | 11  | 13    | V     |
| Voltage Trim Range                          |                               | -20         | -   | 10    | -20         | -   | 10    | %     |
| GENERAL                                     |                               |             |     |       |             |     |       |       |
| Efficiency                                  |                               | 76          | 80  | -     | 76          | 80  | -     | %     |
| Capacitive Load <sup>3</sup>                |                               | -           | -   | 500   | -           | -   | 500   | µF    |
| Switching Frequency                         |                               | 400         | 500 | 550   | 400         | 500 | 550   | kHz   |
| Isolation                                   | 500 V DC, Tcase = 25 °C       | 100         | -   | -     | 100         | -   | -     | MΩ    |
| Weight                                      |                               | -           | -   | 32    | -           | -   | 32    | g     |
| MTBF (MIL-HDBK-217F)                        | GM @ Tcase = 55 °C            | -           | 445 | -     | -           | 445 | -     | kHr   |

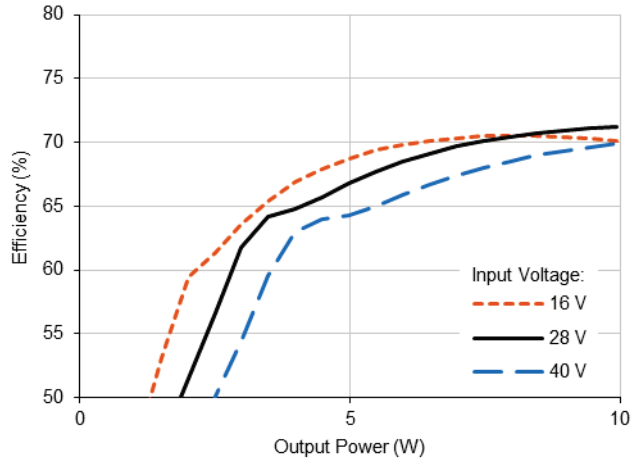
1. Dependent on output voltage
2. Time for output voltage to settle within 1% of its nominal value
3. Derate linearly to 0 at 110 °C
4. Verified by qualification testing

## 4.0 PERFORMANCE CURVES

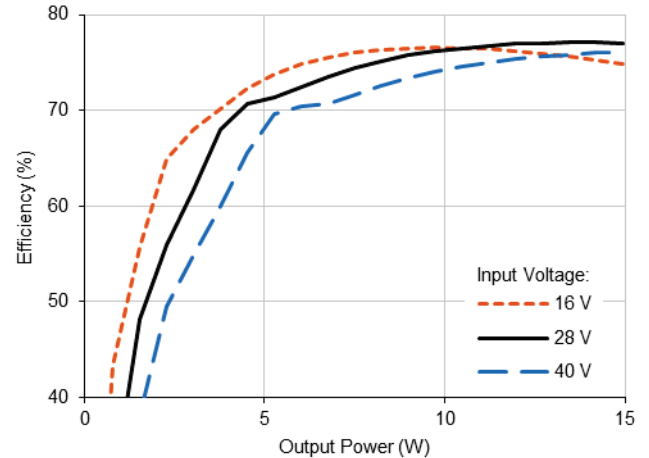
T<sub>case</sub> = 25 °C, Full Load, Unless Otherwise Specified

### 4.1 EFFICIENCY PERFORMANCE CURVES

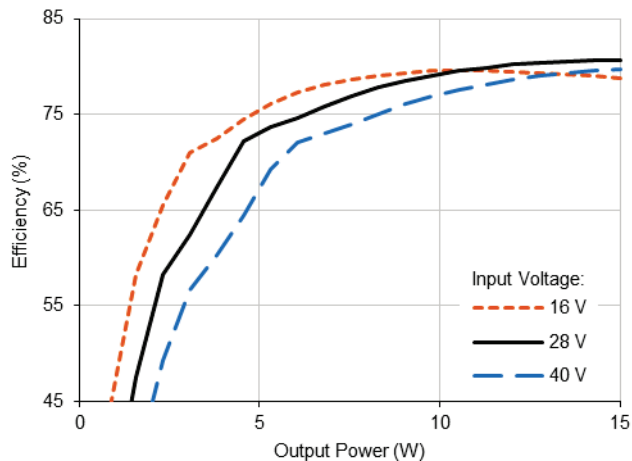
#### 4.1.1 VHR15-283R3S Efficiency (%) vs. Output Power (W)



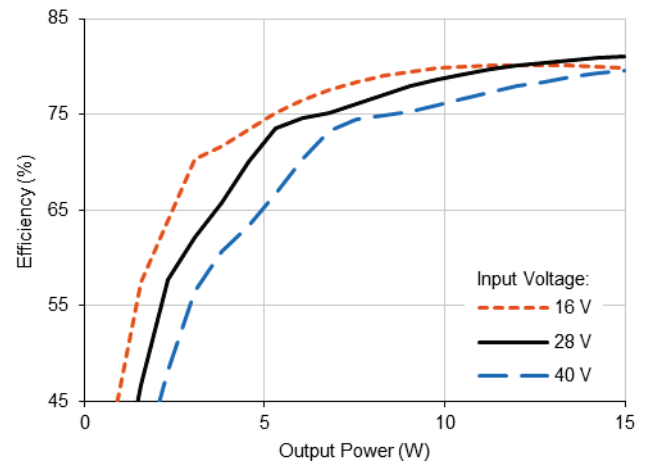
#### 4.1.2 VHR15-2805S Efficiency (%) vs. Output Power (W)



#### 4.1.3 VHR15-2812S Efficiency (%) vs. Output Power (W)

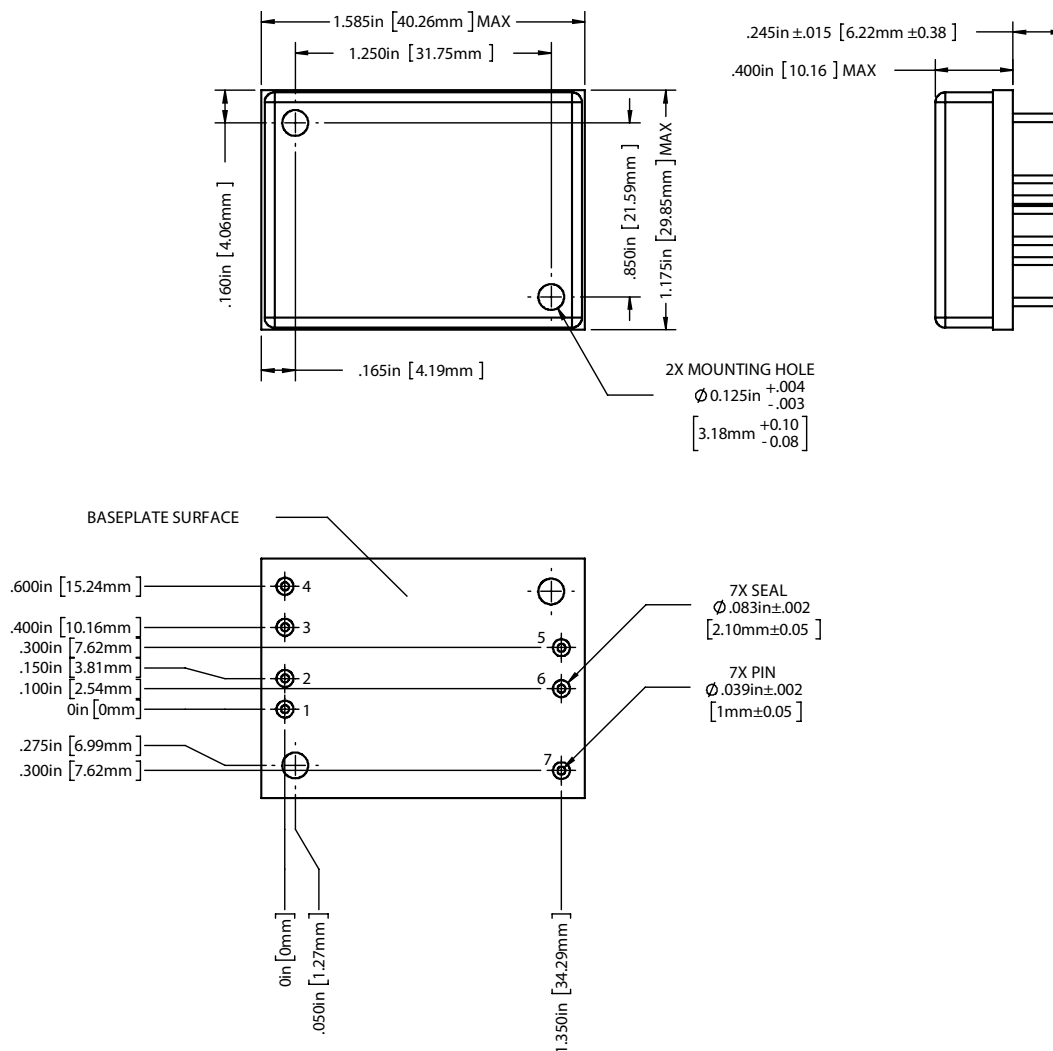


#### 4.1.4 VHR15-2815S Efficiency (%) vs. Output Power (W)



## 5.0 MECHANICAL OUTLINES AND PINOUT

### Standard Metal Package:



1. Case temperature is measured on the center of the baseplate surface.
2. Materials: Baseplate (Aluminum, conductive conversion coating); Cover (Nickel Plated); Pins (Copper, gold over nickel plating)
3. Mounting holes are not threaded. Recommended fastener is 4-40
4. This Package is not hermetic. VPT offers a wide range of hermetic products. Please contact VPT for details if hermetic products are required.

| Pin | Function | Pin | Function |
|-----|----------|-----|----------|
| 1   | INHIBIT  | 5   | TRIM     |
| 2   | CASE     | 6   | OUTCOM   |
| 3   | INCOM    | 7   | +VOUT    |
| 4   | 28VIN    |     |          |

## 6.0 PACKAGE PIN DESCRIPTION

| Pin | Function | Description                                                                                                                                                                              |
|-----|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | INHIBIT  | This is an open collector input. Logic Low = Disabled Output. Connect the inhibit pin to input common to disable the output. Unconnected, open collector or open drain = Enabled Output. |
| 2   | CASE     | Case Connection.                                                                                                                                                                         |
| 3   | INCOM    | Input Return Connection.                                                                                                                                                                 |
| 4   | 28VIN    | Positive Input Voltage Connection.                                                                                                                                                       |
| 5   | TRIM     | Trim Output Voltage to +10%, -20% of Nominal Value. Leave open if not used.                                                                                                              |
| 6   | OUTCOM   | Output Return Connection.                                                                                                                                                                |
| 7   | +VOUT    | Positive Output Voltage Connection.                                                                                                                                                      |

## 7.0 OUTPUT VOLTAGE TRIM

The output voltage can be trimmed down by connecting a resistor between the TRIM pin and the +VOUT pin, or can be trimmed up by connecting a resistor between the TRIM pin and the OUTCOM pin as shown in Section 2.2. The maximum trim range is +10% up and -20% down. The appropriate resistor values versus the output voltage are given in the trim table below.

| VHR15-283R3S |           | VHR15-2805S |           | VHR15-2812S |           | VHR15-2815S |           |
|--------------|-----------|-------------|-----------|-------------|-----------|-------------|-----------|
| +Vout (V)    | Rtrim (Ω) | + Vout (V)  | Rtrim (Ω) | + Vout (V)  | Rtrim (Ω) | + Vout (V)  | Rtrim (Ω) |
| 3.60         | 7.27k     | 5.5         | 39.6k     | 13.2        | 10.7k     | 16.50       | 6.5k      |
| 3.55         | 89.2k     | 5.4         | 52k       | 13.0        | 14.8k     | 16.25       | 9.8k      |
| 3.50         | 114k      | 5.3         | 72.6k     | 12.8        | 21k       | 16.00       | 14.8k     |
| 3.45         | 155k      | 5.2         | 113.9k    | 12.6        | 31.3k     | 15.75       | 23k       |
| 3.40         | 238k      | 5.1         | 237k      | 12.4        | 51.9k     | 15.50       | 39.6k     |
| 3.35         | 487k      | 5.0         | --        | 12.2        | 114k      | 15.25       | 89k       |
| 3.30         | --        | 4.9         | 232.5k    | 12.0        | --        | 15.00       | --        |
| 3.25         | 144k      | 4.8         | 106.1k    | 11.8        | 457k      | 14.75       | 482k      |
| 3.20         | 61.9k     | 4.7         | 64k       | 11.6        | 218k      | 14.50       | 231k      |
| 3.15         | 34.7k     | 4.6         | 43k       | 11.4        | 139k      | 14.25       | 147k      |
| 3.10         | 21k       | 4.5         | 30.4k     | 11.2        | 99k       | 14.00       | 105k      |
| 3.05         | 12.79k    | 4.4         | 22k       | 11.0        | 75.2k     | 13.75       | 80.2k     |
| 3.00         | 7.33k     | 4.3         | 16k       | 10.8        | 59.4k     | 13.50       | 63.5k     |
|              |           | 4.2         | 11.5k     | 10.6        | 48k       | 13.25       | 51.6k     |
|              |           | 4.1         | 8.0k      | 10.4        | 39.5k     | 13.00       | 42.6k     |
|              |           | 4.0         | 5.2k      | 10.2        | 32.9k     | 12.75       | 35.6k     |
|              |           |             |           | 10.0        | 27.6k     | 12.50       | 30k       |
|              |           |             |           | 9.8         | 23.3k     | 12.25       | 25.5k     |
|              |           |             |           | 9.6         | 19.7k     | 12.00       | 21.7k     |

## 8.0 ENVIRONMENTAL SCREENING

| Screening        | Condition          |
|------------------|--------------------|
| Internal Visual  | IPC-A-610, Class 3 |
| Final Electrical | 100% at 25 °C      |
| External Visual  | Internal Procedure |

## 9.0 ORDERING INFORMATION

|               |           |           |          |
|---------------|-----------|-----------|----------|
| <b>VHR15-</b> | <b>28</b> | <b>05</b> | <b>S</b> |
| 1             | 2         | 3         | 4        |

| (1)<br>Product<br>Series | (2)<br>Nominal Input<br>Voltage | (3)<br>Output Voltage                                                                 | (4)<br>Number of<br>Outputs |
|--------------------------|---------------------------------|---------------------------------------------------------------------------------------|-----------------------------|
| <b>VHR15-</b>            | <b>28</b> 28 Volts              | <b>3R3</b> 3.3 Volts<br><b>05</b> 5 Volts<br><b>12</b> 12 Volts<br><b>15</b> 15 Volts | <b>S</b> Single             |

Please contact your sales representative or the VPT Inc. Sales Department for more information concerning additional environmental screening and testing, different input voltage, output voltage, power requirements, and source inspection.

## 10.0 CONTACT INFORMATION

To request a quotation or place orders please contact your sales representative or the VPT, Inc. Sales Department at:

**Phone:** (425) 353-3010  
**Fax:** (425) 353-4030  
**E-mail:** [vptsales@vptpower.com](mailto:vptsales@vptpower.com)

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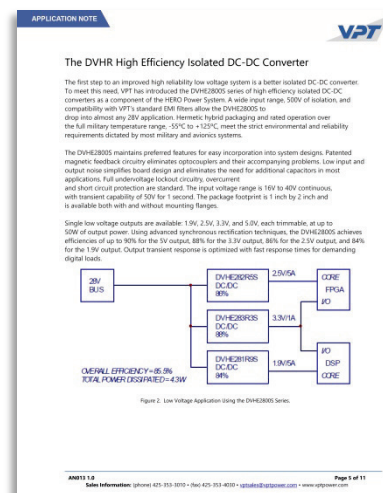
## 11.0 ADDITIONAL INFORMATION

Visit the [VPT website](http://www.vptpower.com) for additional technical resources, including:

### Product Literature



### Application Notes and White Papers



### Technical Video Labs



### Additional Products For Avionics/Military, Hi-Temp, Hi-Rel COTS, and Space Applications

