



DVHV2800D Series

HIGH RELIABILITY HYBRID DC-DC CONVERTERS

DESCRIPTION

The DVHV series of high reliability DC-DC converters is operable over the full military (-55 °C to +125 °C) temperature range with no power derating. Unique to the DVHV series is a magnetic feedback circuit that is radiation immune. Operating at a nominal fixed frequency of 475 kHz, these regulated, isolated units utilize well controlled undervoltage lockout circuitry to eliminate slow start-up problems.

These converters are designed and manufactured in a facility qualified to ISO9001 and certified to MIL-PRF-38534 and MIL-STD-883.

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

FEATURES

- High Reliability
- Very Low Output Noise
- Wide Input Voltage Range: 15 to 50 Volts per MIL-STD-704
- Up to 15 Watts Output Power
- Radiation Immune Magnetic Feedback Circuit
- NO Use of Optoisolators
- Undervoltage Lockout
- Indefinite Short Circuit Protection
- Current Limit Protection
- Industry Standard Pinout
- High Input Transient Voltage: 80 Volts for 1 sec per MIL-STD-704A
- Radiation Hardened Version Available
- Precision Seam Welded or Solder Seal Hermetic Package
- Custom Versions Available
- Additional Environmental Screening Available
- Meets MIL-STD-461C and MIL-STD-461D EMC Requirements When Used With a DVMC28 EMI Filter
- Flanged and Non-flanged Versions Available.
- MIL-PRF-38534 Element Evaluated Components

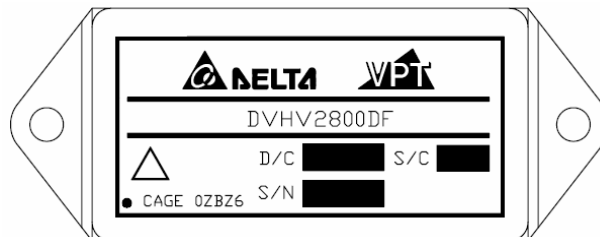


Figure 1 – DVHV2800D / DVHV2800DF DC-DC Converter
(Not To Scale)

SPECIFICATIONS ($T_{CASE} = -55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$, $V_{IN} = +28\text{V} \pm 5\%$, Full Load⁵, Unless Otherwise Specified)

ABSOLUTE MAXIMUM RATINGS

| | | | |
|---|--------------------|---|-----------------|
| Input Voltage (Continuous) | 50 V _{DC} | Junction Temperature Rise to Case | +15°C |
| Input Voltage (Transient, 1 second) | 80 Volts | Storage Temperature | -65°C to +150°C |
| Output Power ¹ | 15 Watts | Lead Solder Temperature (10 seconds) | 270°C |
| Power Dissipation (Full Load, $T_{CASE} = +125^{\circ}\text{C}$) | 11 Watts | Weight (Maximum) (Un-Flanged / Flanged) | (49 / 52) Grams |

| Parameter | | Conditions | DVHV2805D | | | DVHV2812D | | | Units |
|---|-------------------|---|-----------|------|-------|-----------|------|-------|-------------------|
| | | | Min | Typ | Max | Min | Typ | Max | |
| STATIC | | | | | | | | | |
| INPUT Voltage ⁴ | | Continuous | 15 | 28 | 50 | 15 | 28 | 50 | V |
| | | Transient, 1 sec | - | - | 80 | - | - | 80 | V |
| Current | | Inhibited | - | - | 6 | - | - | 6 | mA |
| | | No Load | - | - | 90 | - | - | 90 | mA |
| Ripple Current | | Full Load ⁵ , 20Hz to 10MHz | - | - | 50 | - | - | 50 | mA _{p-p} |
| Inhibit Pin Input ⁴ | | | 0 | - | 1.5 | 0 | - | 1.5 | V |
| Inhibit Pin Open Circuit Voltage ⁴ | | | 9.0 | 11.0 | 13.0 | 9.0 | 11.0 | 13.0 | V |
| UVLO Turn On | | | 12.0 | - | 14.8 | 12.0 | - | 14.8 | V |
| UVLO Turn Off ⁴ | | | 11.0 | - | 14.5 | 11.0 | - | 14.5 | V |
| OUTPUT Voltage ⁵ | +V _{OUT} | T _{CASE} = 25°C | 4.95 | 5.0 | 5.05 | 11.88 | 12.0 | 12.12 | V |
| | +V _{OUT} | T _{CASE} = -55°C to +125°C | 4.925 | 5.0 | 5.075 | 11.82 | 12.0 | 12.18 | V |
| | -V _{OUT} | T _{CASE} = 25°C | 4.925 | 5.0 | 5.075 | 11.82 | 12.0 | 12.18 | V |
| | -V _{OUT} | T _{CASE} = -55°C to +125°C | 4.90 | 5.0 | 5.10 | 11.76 | 12.0 | 12.24 | V |
| Power ^{3,6} | Total | | 0 | - | 15 | 0 | - | 15 | W |
| | ±V _{OUT} | Either Output | 0 | - | 10.5 | 0 | - | 10.5 | W |
| Current ^{3,6} | ±V _{OUT} | Either Output | 0 | - | 2.1 | 0 | - | 0.875 | A |
| Ripple Voltage | ±V _{OUT} | Full Load ⁵ , 20Hz to 10MHz | - | - | 30 | - | - | 40 | mV _{p-p} |
| Line Regulation | +V _{OUT} | V _{IN} = 16V to 40V | - | - | 20 | - | - | 20 | mV |
| | -V _{OUT} | V _{IN} = 16V to 40V | - | - | 200 | - | - | 200 | mV |
| Load Regulation | +V _{OUT} | 5% Load to Full Load ⁵ | - | - | 50 | - | - | 50 | mV |
| | -V _{OUT} | 5% Load to Full Load ⁵ | - | - | 200 | - | - | 200 | mV |
| Cross Regulation | -V _{OUT} | +Load 70%, -Load 30% +Load 30%, -Load 70% | - | - | 500 | - | - | 500 | mV |
| EFFICIENCY | | Full Load ⁵ | 74 | - | - | 76 | - | - | % |
| LOAD FAULT POWER DISSIPATION | | Overload ⁴ | - | - | 11 | - | - | 11 | W |
| | | Short Circuit | - | - | 11 | - | - | 11 | W |
| CAPACITIVE LOAD ⁴ | | Either Output | - | - | 500 | - | - | 500 | μF |
| SWITCHING FREQUENCY | | | 400 | 475 | 550 | 400 | 475 | 550 | kHz |
| SYNC FREQUENCY RANGE | | V _H – V _L = 5V, DC = 20-80% | 500 | - | 600 | 500 | - | 600 | kHz |
| ISOLATION | | 500 V _{DC} , T _{CASE} = 25°C | 100 | - | - | 100 | - | - | MΩ |
| MTBF (MIL-HDBK-217F) | | AIF @ T _C = 55°C | - | 413 | - | - | 413 | - | kHrs |

See notes next page.

SPECIFICATIONS ($T_{CASE} = -55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$, $V_{IN} = +28\text{V} \pm 5\%$, Full Load⁵, Unless Otherwise Specified)

ABSOLUTE MAXIMUM RATINGS

| | | | |
|---|-------------|---|-----------------|
| Input Voltage (Continuous) | 50 V_{DC} | Junction Temperature Rise to Case | +15°C |
| Input Voltage (Transient, 1 second) | 80 Volts | Storage Temperature | -65°C to +150°C |
| Output Power ¹ | 15 Watts | Lead Solder Temperature (10 seconds) | 270°C |
| Power Dissipation (Full Load, $T_{CASE} = +125^{\circ}\text{C}$) | 11 Watts | Weight (Maximum) (Un-Flanged / Flanged) | (49 / 52) Grams |

| Parameter | | Conditions | DVHV2805D | | | DVHV2812D | | | Units |
|---|-------------------|------------------------------|-----------|-----|-----|-----------|-----|-----|------------------|
| | | | Min | Typ | Max | Min | Typ | Max | |
| DYNAMIC | | | | | | | | | |
| Load Step Output Transient | ±V _{OUT} | Half Load to Full Load | - | - | 200 | - | - | 300 | mV _{PK} |
| Load Step Recovery ² | | | - | - | 400 | - | - | 500 | μSec |
| Line Step Output Transient ⁴ | ±V _{OUT} | V _{IN} = 16V to 40V | - | 300 | 600 | - | 500 | 900 | mV _{PK} |
| Line Step Recovery ^{2, 4} | | | - | 300 | 500 | - | 300 | 500 | μSec |
| Turn On Delay | ±V _{OUT} | V _{IN} = 0V to 28V | - | - | 20 | - | - | 20 | mSec |
| Turn On Overshoot | | | - | - | 25 | - | - | 50 | mV _{PK} |

- Notes:
1. Dependant on output voltage.
 2. Time for output voltage to settle within 1% of its nominal value.
 3. Derate linearly to 0 at 135°C.
 4. Verified by qualification testing.
 5. Half load at $+V_{OUT}$ and half load at $-V_{OUT}$.
 6. Up to 70% of the total power or current can be drawn from any one of the two outputs.

SPECIFICATIONS ($T_{CASE} = -55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$, $V_{IN} = +28\text{V} \pm 5\%$, Full Load⁵, Unless Otherwise Specified)

ABSOLUTE MAXIMUM RATINGS

| | | | |
|---|--------------------|---|-----------------|
| Input Voltage (Continuous) | 50 V _{DC} | Junction Temperature Rise to Case | +15°C |
| Input Voltage (Transient, 1 second) | 80 Volts | Storage Temperature | -65°C to +150°C |
| Output Power ¹ | 15 Watts | Lead Solder Temperature (10 seconds) | 270°C |
| Power Dissipation (Full Load, $T_{CASE} = +125^{\circ}\text{C}$) | 11 Watts | Weight (Maximum) (Un-Flanged / Flanged) | (49 / 52) Grams |

| Parameter | | Conditions | DVHV2815D | | | Units |
|---|-------------------|---|-----------|------|--------|-------------------|
| | | | Min | Typ | Max | |
| STATIC | | | | | | |
| INPUT Voltage ⁴ | | Continuous | 15 | 28 | 50 | V |
| | | Transient, 1 sec | - | - | 80 | V |
| Current | | Inhibited | - | - | 6 | mA |
| | | No Load | - | - | 90 | mA |
| Ripple Current | | Full Load ⁵ , 20Hz to 10MHz | - | - | 50 | mA _{p-p} |
| Inhibit Pin Input ⁴ | | | 0 | - | 1.5 | V |
| Inhibit Pin Open Circuit Voltage ⁴ | | | 9.0 | 11.0 | 13.0 | V |
| UVLO Turn On | | | 12.0 | - | 14.8 | V |
| UVLO Turn Off ⁴ | | | 11.0 | - | 14.5 | V |
| OUTPUT Voltage ⁵ | +V _{OUT} | T _{CASE} = 25°C | 14.85 | 15.0 | 15.15 | V |
| | +V _{OUT} | T _{CASE} = -55°C to +125°C | 14.775 | 15.0 | 15.225 | V |
| | -V _{OUT} | T _{CASE} = 25°C | 14.775 | 15.0 | 15.225 | V |
| | -V _{OUT} | T _{CASE} = -55°C to +125°C | 14.70 | 15.0 | 15.30 | V |
| Power ^{3,6} | Total | | - | - | 15 | W |
| | ±V _{OUT} | Either Output | - | - | 10.5 | W |
| Current ^{3,6} | ±V _{OUT} | Either Output | - | - | 0.7 | A |
| Ripple Voltage | ±V _{OUT} | Full Load ⁵ , 20Hz to 10MHz | - | - | 40 | mV _{p-p} |
| Line Regulation | +V _{OUT} | V _{IN} = 16V to 40V | - | - | 20 | mV |
| | -V _{OUT} | V _{IN} = 16V to 40V | - | - | 200 | mV |
| Load Regulation | +V _{OUT} | 5% Load to Full Load ⁵ | - | - | 50 | mV |
| | -V _{OUT} | 5% Load to Full Load ⁵ | - | - | 200 | mV |
| Cross Regulation | -V _{OUT} | +Load 70%, -Load 30% +Load 30%, -Load 70% | - | - | 500 | mV |
| EFFICIENCY | | Full Load ⁵ | 77 | - | - | % |
| LOAD FAULT POWER DISSIPATION | | Overload ⁴ | - | - | 11 | W |
| | | Short Circuit | - | - | 11 | W |
| CAPACITIVE LOAD ⁴ | | Either Output | - | - | 500 | μF |
| SWITCHING FREQUENCY | | | 400 | 475 | 550 | kHz |
| SYNC FREQUENCY RANGE | | V _H – V _L = 5V, DC = 20-80% | 500 | - | 600 | kHz |
| ISOLATION | | 500 V _{DC} , T _{CASE} = 25°C | 100 | - | - | MΩ |
| MTBF (MIL-HDBK-217F) | | AIF @ T _C = 55°C | - | 413 | - | kHrs |

See notes next page.

SPECIFICATIONS ($T_{CASE} = -55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$, $V_{IN} = +28\text{V} \pm 5\%$, Full Load⁵, Unless Otherwise Specified)

ABSOLUTE MAXIMUM RATINGS

| | | | |
|---|-------------|---|-----------------|
| Input Voltage (Continuous) | 50 V_{DC} | Junction Temperature Rise to Case | +15°C |
| Input Voltage (Transient, 1 second) | 80 Volts | Storage Temperature | -65°C to +150°C |
| Output Power ¹ | 15 Watts | Lead Solder Temperature (10 seconds) | 270°C |
| Power Dissipation (Full Load, $T_{CASE} = +125^{\circ}\text{C}$) | 11 Watts | Weight (Maximum) (Un-Flanged / Flanged) | (49 / 52) Grams |

| Parameter | | Conditions | DVHV2815D | | | Units |
|---|-------------------|------------------------------|-----------|-----|-----|------------------|
| | | | Min | Typ | Max | |
| DYNAMIC | | | | | | |
| Load Step Output Transient | ±V _{OUT} | Half Load to Full Load | - | - | 350 | mV _{PK} |
| Load Step Recovery ² | | | - | - | 500 | μSec |
| Line Step Output Transient ⁴ | ±V _{OUT} | V _{IN} = 16V to 40V | - | 500 | 900 | mV _{PK} |
| Line Step Recovery ^{2, 4} | | | - | 300 | 500 | μSec |
| Turn On Delay | ±V _{OUT} | V _{IN} = 0V to 28V | - | - | 20 | mSec |
| Turn On Overshoot | | | - | - | 50 | mV _{PK} |

- Notes:
1. Dependant on output voltage.
 2. Time for output voltage to settle within 1% of its nominal value.
 3. Derate linearly to 0 at 135°C.
 4. Verified by qualification testing.
 5. Half load at $+V_{OUT}$ and half load at $-V_{OUT}$.
 6. Up to 70% of the total power or current can be drawn from any one of the two outputs.

BLOCK DIAGRAM

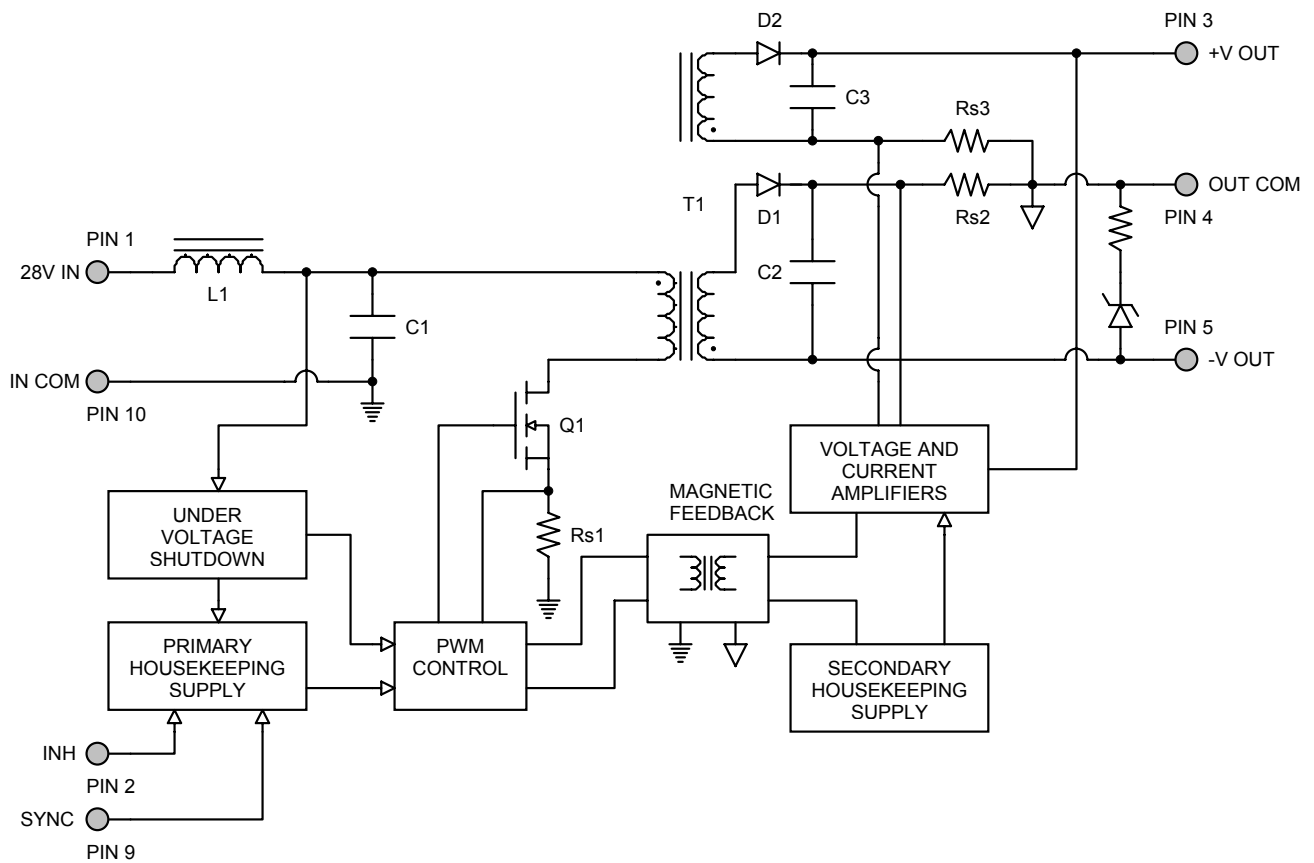


Figure 2

CONNECTION DIAGRAM

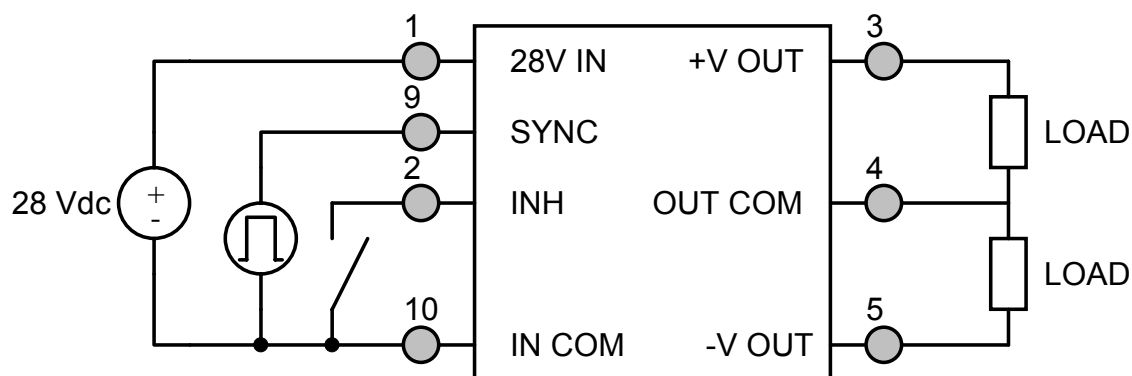


Figure 3

INHIBIT DRIVE CONNECTION DIAGRAMS

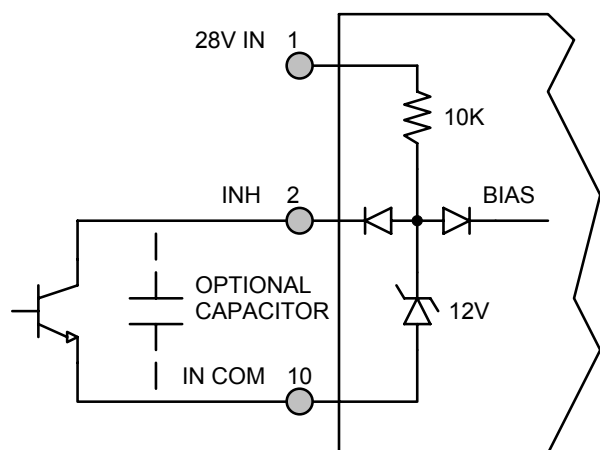


Figure 4 – Internal Inhibit Circuit and Recommended Drive
(Shown with optional capacitor for turn-on delay)

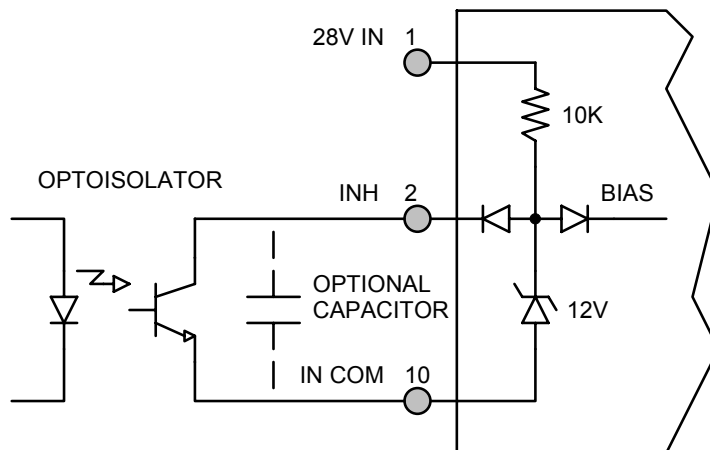


Figure 5 – Isolated Inhibit Drive
(Shown with optional capacitor for turn-on delay)

EMI FILTER HOOKUP DIAGRAM

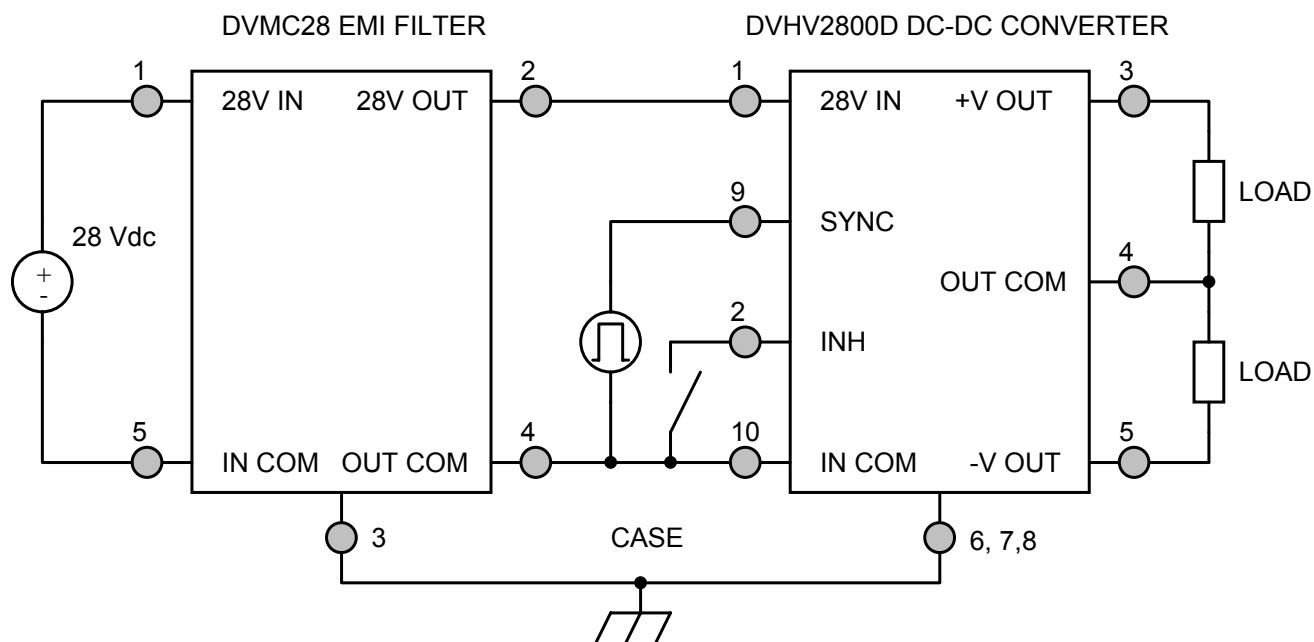


Figure 6 – Converter with EMI Filter

EFFICIENCY PERFORMANCE CURVES ($T_{CASE} = 25^{\circ}C$, Full Load, Unless Otherwise Specified)

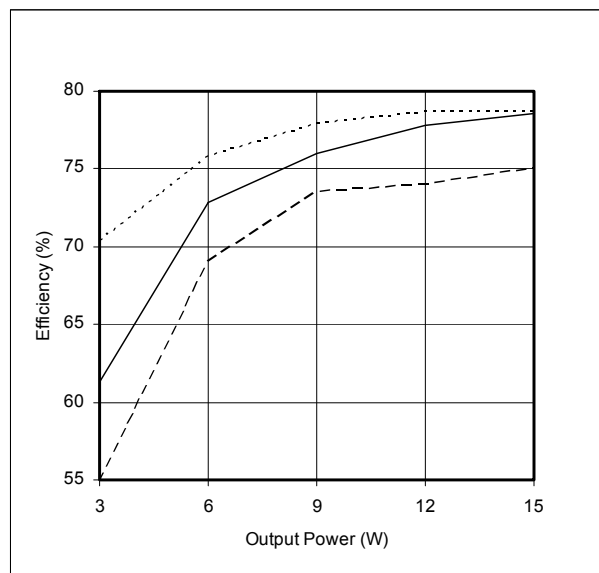
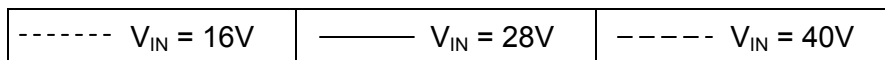


Figure 7 – DVHV2805D
Efficiency (%) vs. Output Power (W)

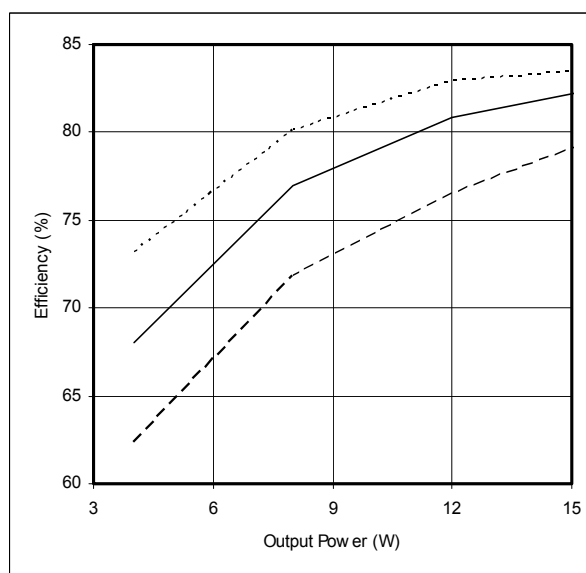


Figure 8 – DVHV2812D
Efficiency (%) vs. Output Power (W)

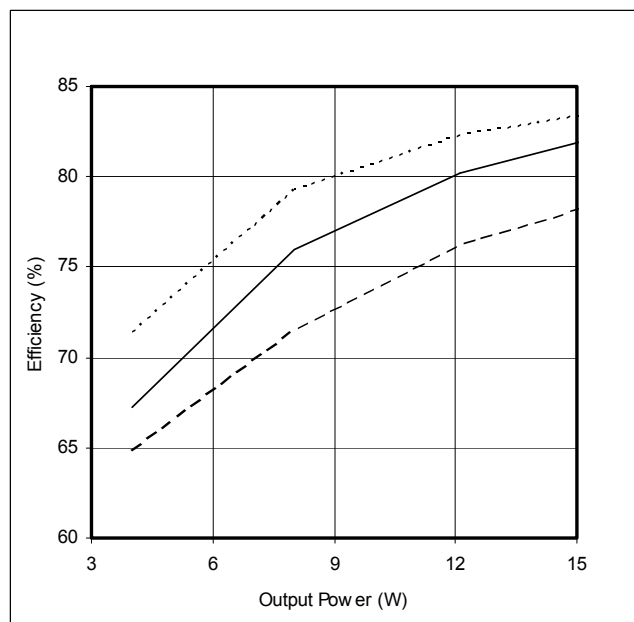


Figure 9 – DVHV2815D
Efficiency (%) vs. Output Power (W)

EMI PERFORMANCE CURVES

($T_{CASE} = 25^{\circ}\text{C}$, $V_{IN} = +28\text{V} \pm 5\%$, Full Load, Unless Otherwise Specified)

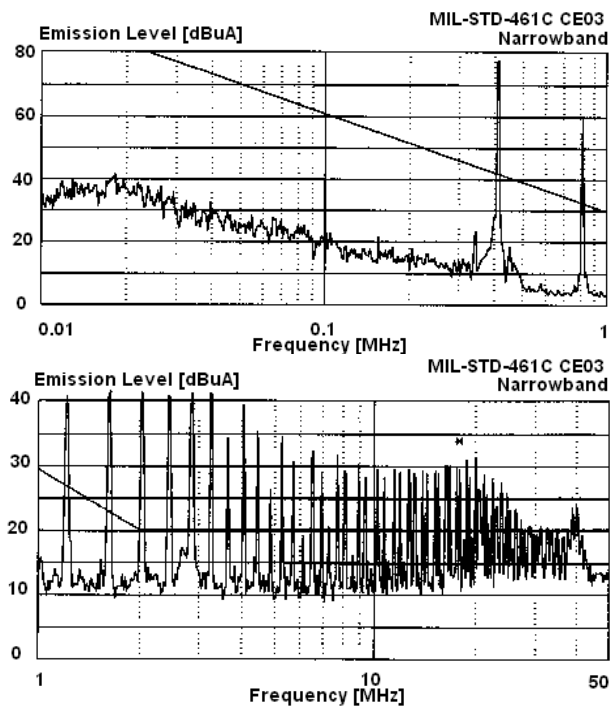


Figure 10 – DVHV2800D without EMI Filter

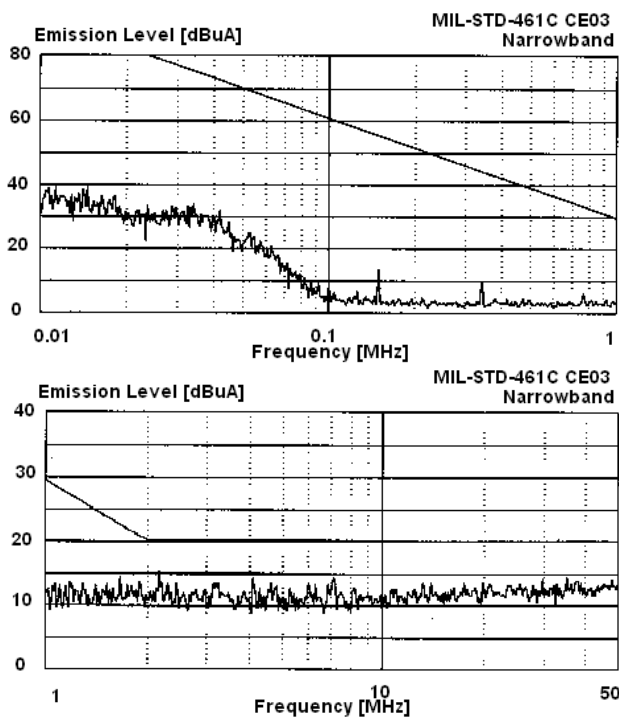
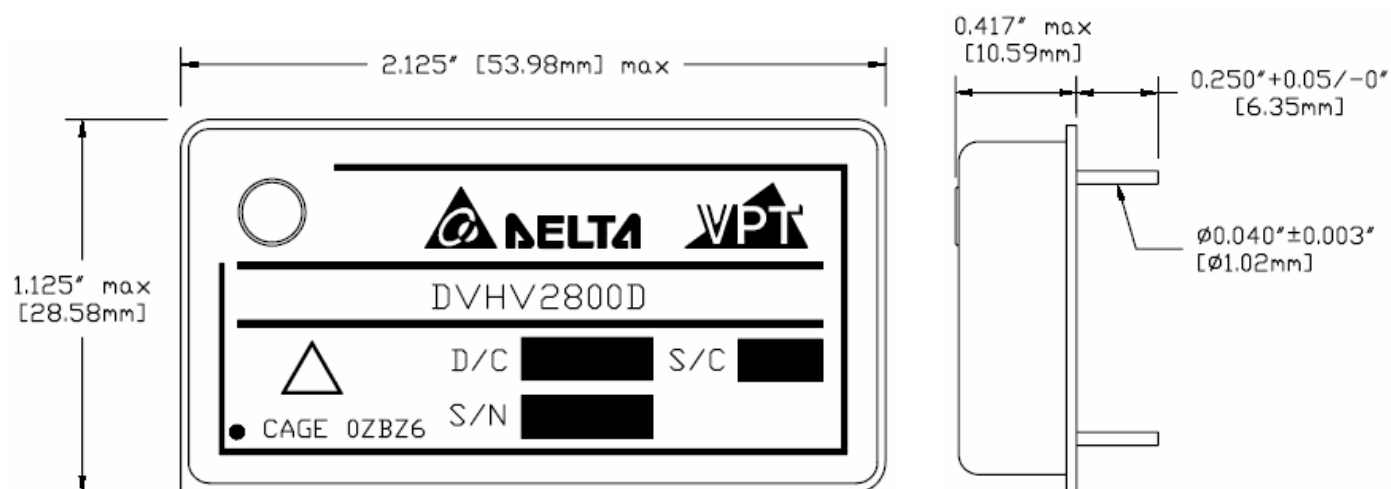


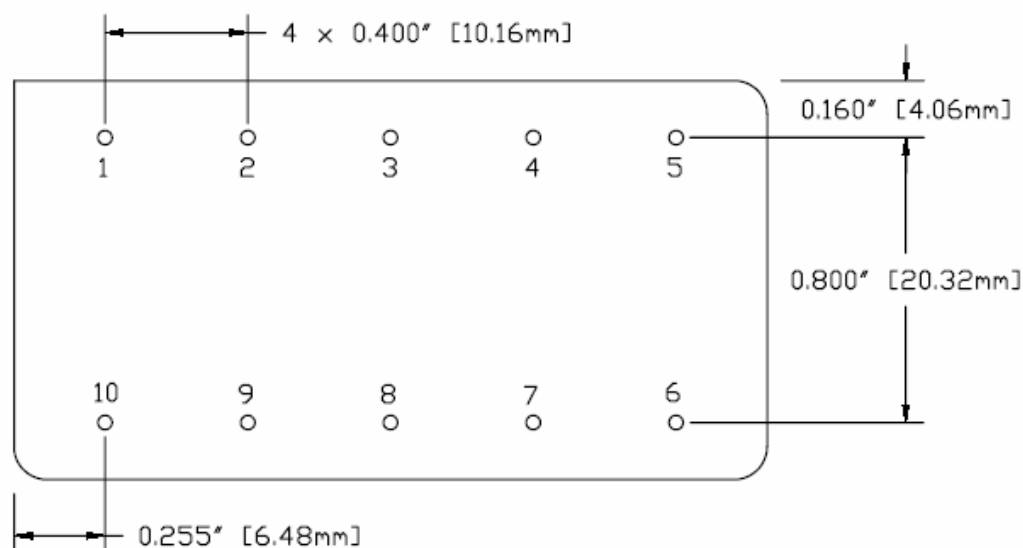
Figure 11 – DVHV2800D with EMI Filter

PACKAGE SPECIFICATIONS (NON-FLANGED, SOLDER SEAL)



TOP VIEW

SIDE VIEW

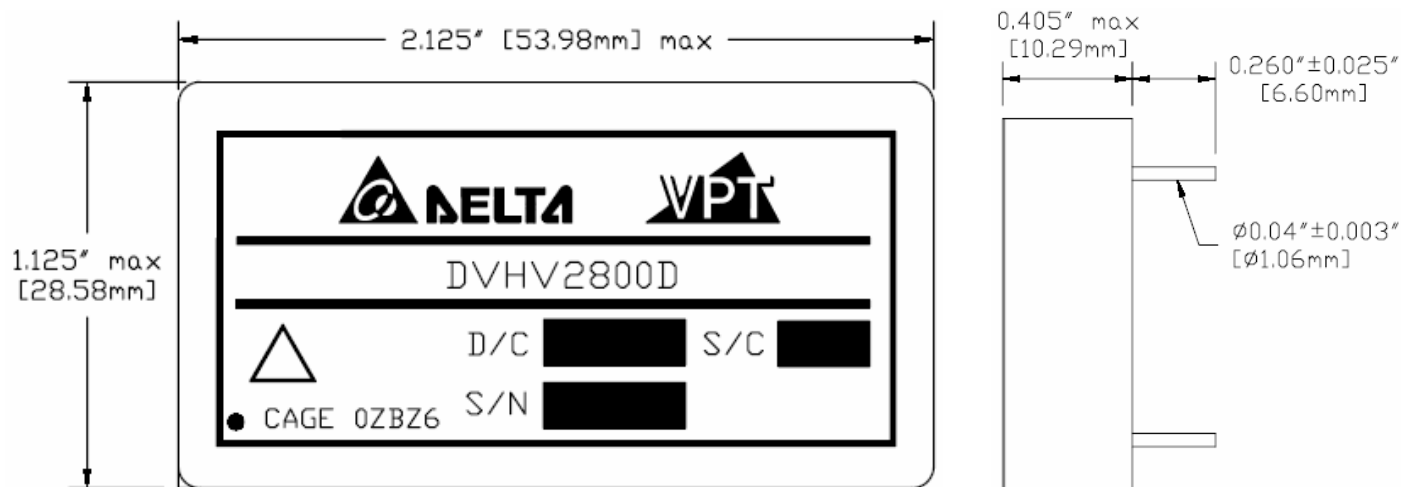


BOTTOM VIEW

| PIN | FUNCTION |
|-----|----------|
| 1 | 28V IN |
| 2 | INHIBIT |
| 3 | +V OUT |
| 4 | OUT COM |
| 5 | -V OUT |
| 6 | CASE |
| 7 | CASE |
| 8 | CASE |
| 9 | SYNC |
| 10 | IN COM |

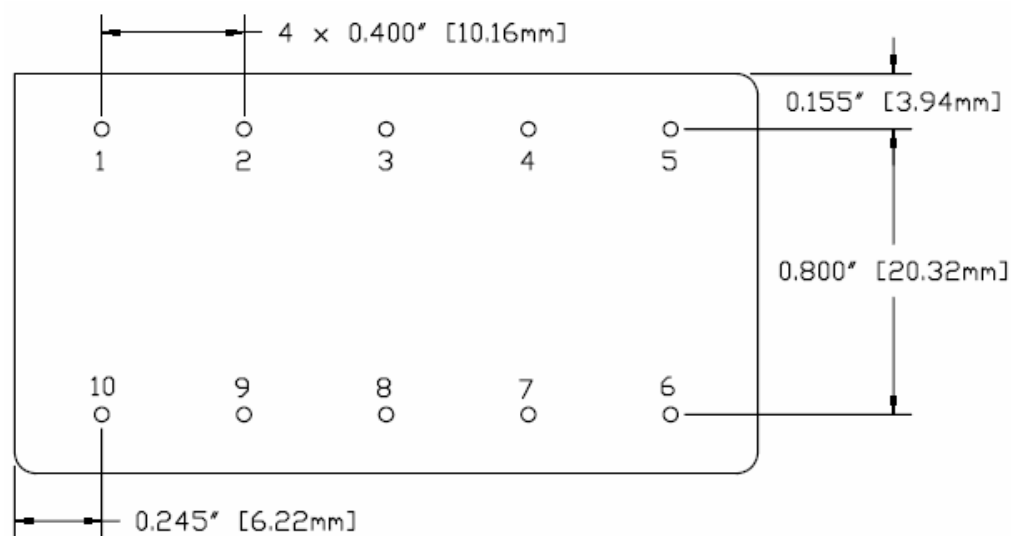
Figure 12 – Non-Flanged, Solder Seal Tin Plated Package and Pinout (Not Used for /HB or Higher Screened Products)
(Dimensional Limits are ±0.005" Unless Otherwise Stated)

PACKAGE SPECIFICATIONS (NON-FLANGED, SEAM SEAL)



TOP VIEW

SIDE VIEW

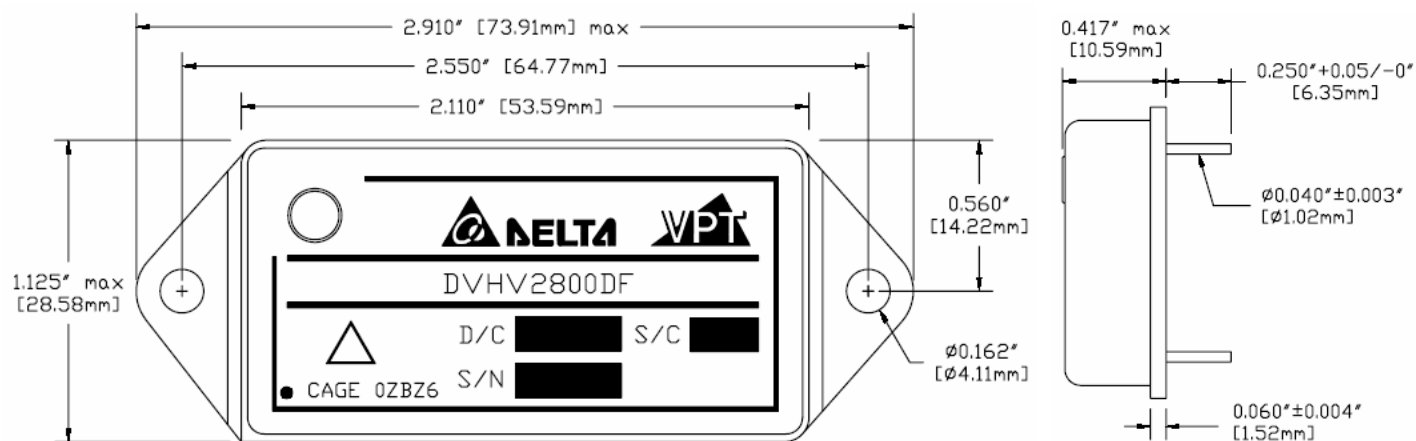


BOTTOM VIEW

| PIN | FUNCTION |
|-----|----------|
| 1 | 28V IN |
| 2 | INHIBIT |
| 3 | +V OUT |
| 4 | OUT COM |
| 5 | -V OUT |
| 6 | CASE |
| 7 | CASE |
| 8 | CASE |
| 9 | SYNC |
| 10 | IN COM |

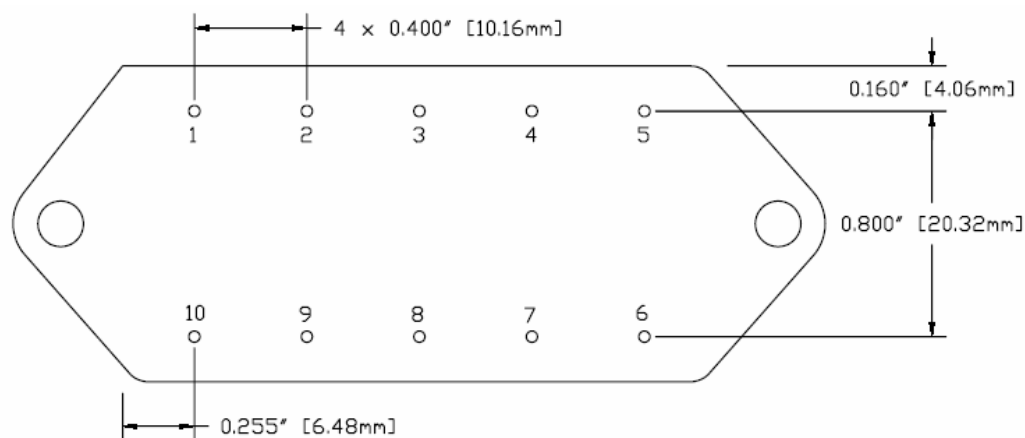
Figure 13 – Non-Flanged, Seam Seal Package and Pinout
(Dimensional Limits are ±0.005" Unless Otherwise Stated)

PACKAGE SPECIFICATIONS (FLANGED, SOLDER SEAL)



TOP VIEW

SIDE VIEW

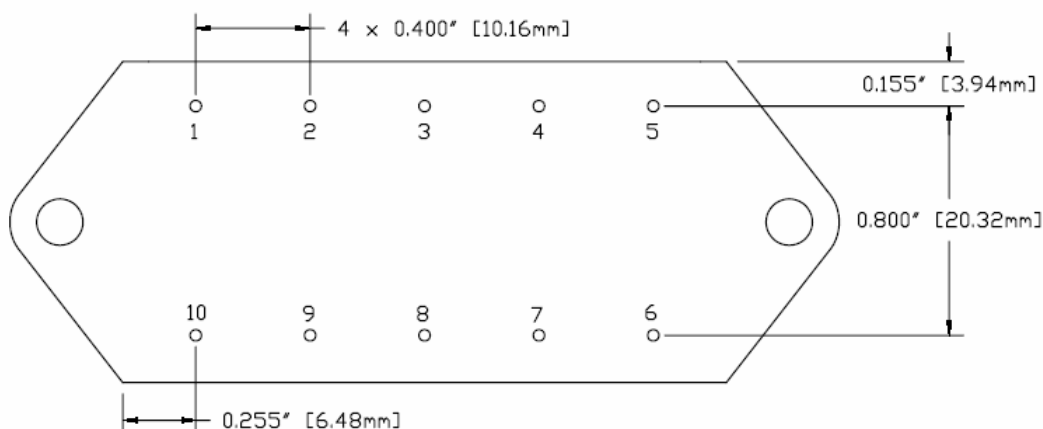
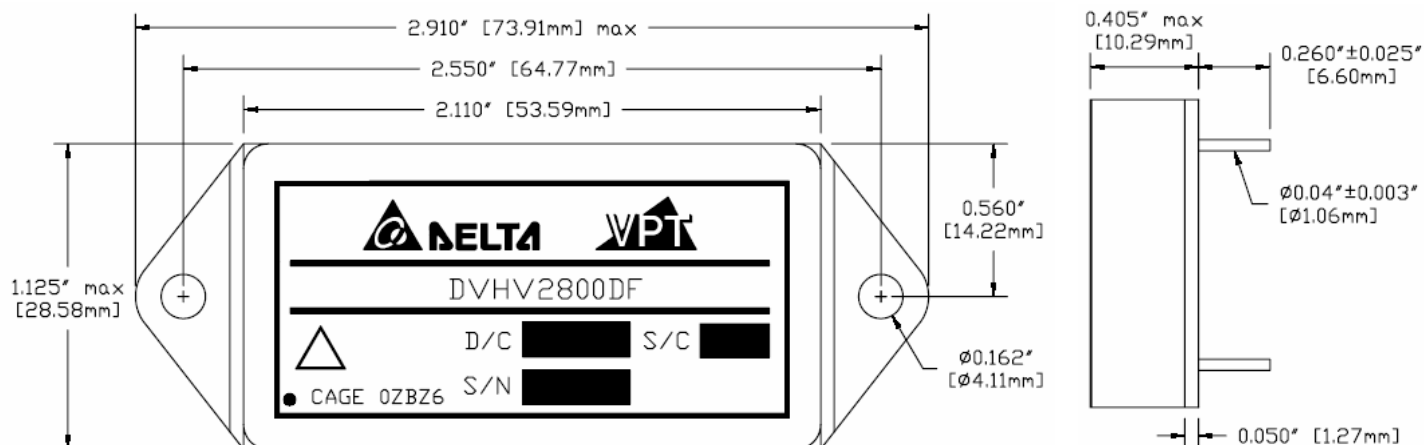


BOTTOM VIEW

| PIN | FUNCTION |
|-----|----------|
| 1 | 28V IN |
| 2 | INHIBIT |
| 3 | +V OUT |
| 4 | OUT COM |
| 5 | -V OUT |
| 6 | CASE |
| 7 | CASE |
| 8 | CASE |
| 9 | SYNC |
| 10 | IN COM |

Figure 14 – Flanged, Solder Seal Tin Plated Package and Pinout (Not Used for /HB or Higher Screened Products)
(Dimensional Limits are ±0.005" Unless Otherwise Stated)

PACKAGE SPECIFICATIONS (FLANGED, SEAM SEAL)



| PIN | FUNCTION |
|-----|----------|
| 1 | 28V IN |
| 2 | INHIBIT |
| 3 | +V OUT |
| 4 | OUT COM |
| 5 | -V OUT |
| 6 | CASE |
| 7 | CASE |
| 8 | CASE |
| 9 | SYNC |
| 10 | IN COM |

Figure 15 – Flanged, Seam Seal Package and Pinout
(Dimensional Limits are ±0.005" Unless Otherwise Stated)

PACKAGE PIN DESCRIPTION

| Pin | Function | Description |
|-----|----------|---|
| 1 | 28V IN | Positive Input Voltage Connection |
| 2 | INHIBIT | Logic Low = Disabled Output. Connecting the inhibit pin to input common causes converter shutdown. Logic High = Enabled Output. Unconnected or open collector TTL. |
| 3 | +V OUT | Positive Output Voltage Connection |
| 4 | OUT COM | Output Common Connection |
| 5 | -V OUT | Negative Output Voltage Connection |
| 6 | CASE | Case Connection |
| 7 | CASE | Case Connection |
| 8 | CASE | Case Connection |
| 9 | SYNC | Synchronization Signal |
| 10 | IN COM | Input Common Connection |

ENVIRONMENTAL SCREENING (100% Tested Per MIL-STD-883 as referenced to MIL-PRF-38534)

| Screening | MIL-STD-883 | Standard (No Suffix) | Extended /ES | HB /HB | Class H /H | Class K /K |
|---------------------------|--|-------------------------|-----------------|-----------|---------------|---------------|
| Non-Destructive Bond Pull | Method 2023 | • | • | • | • | • |
| Internal Visual | Method 2017, 2032 Internal Procedure | • | • | • | • | • |
| Temperature Cycling | Method 1010, Condition C Method 1010, -55°C to 125°C | | • | • | • | • |
| Constant Acceleration | Method 2001, 3000g, Y1 Direction Method 2001, 500g, Y1 Direction | | • | • | • | • |
| PIND | Method 2020, Condition A ² | | | | | • |
| Pre Burn-In Electrical | 100% at 25°C | | | | | • |
| Burn-In | Method 1015, 320 hours at +125°C Method 1015, 160 hours at +125°C 96 hours at +125°C 24 hours at +125°C | • | • | • | • | • |
| Final Electrical | MIL-PRF-38534, Group A ¹ 100% at 25°C | • | • | • | • | • |
| Hermeticity | Method 1014, Fine Leak, Condition A Method 1014, Gross Leak, Condition C Dip (1×10^{-3}) | • | • • | • • | • • | • • |
| Radiography | Method 2012 ³ | | | | | • |
| External Visual | Method 2009 | • | • | • | • | • |

- Notes:
1. 100% R&R testing at -55°C, +25°C, and +125°C with all test data included in product shipment.
 2. PIND test Certificate of Compliance included in product shipment.
 3. Radiographic test Certificate of Compliance and film(s) included in product shipment.

ORDERING INFORMATION

| | | | | | | | | |
|------|----|----|---|---|---|-----|---|-----|
| DVHV | 28 | 05 | D | F | R | /HB | - | XXX |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | | 8 |

| (1) Product Series | (2) Nominal Input Voltage | (3) Output Voltage | (4) Number of Outputs |
|-----------------------|------------------------------|---|--------------------------|
| DVHV | 28 28 Volts | 05 12 15 ± 5 Volts ± 12 Volts ± 15 Volts | D Dual |

| (5) Package Option | (6) Rad-Hard Option ² | (7) Screening Code ^{1,3} | (8) Additional Screening Code |
|-------------------------------------|-------------------------------------|--|----------------------------------|
| None F Non-Flanged Flanged | None R Standard 100 kRad | None /ES /HB /H /K Standard Extended HB Class H Class K | Contact Sales |

- Notes:
1. Contact the VPT Inc. Sales Department for availability of Class H (/H) or Class K (/K) qualified products.
 2. VPT Inc. is not currently certified to a DSCC certified radiation hardness assurance program.
 3. VPT Inc. reserves the right to ship higher screened or SMD products to meet lower screened orders at our sole discretion unless specifically forbidden by customer contract.

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 requirement, source inspection, and/or special element evaluation for space or other higher quality applications.

SMD (STANDARD MICROCIRCUIT DRAWING) NUMBERS

| Standard Microcircuit Drawing (SMD) | DVHV2800D Series Similar Part Number |
|-------------------------------------|--------------------------------------|
| *T.B.D. | DVHV2805D/H DVHV2805DF/H |
| *T.B.D. | DVHV2812D/H DVHV2812DF/H |
| *T.B.D. | DVHV2815D/H DVHV2815DF/H |

Do not use the DVHV2800D Series similar part number for SMD product acquisition. It is listed for reference only. For exact specifications for the SMD product, refer to the SMD drawing. SMD's can be downloaded from the DSCC website at <http://www.dscclia.mil/programs/smcr/>. The SMD number listed above is for MIL-PRF-38534 Class H screening, standard gold plated lead finish, and no RHA (Radiation Hardness Assurance) level. Please reference the SMD for other screening levels, lead finishes, and radiation levels.

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@vpt-inc.com

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