

HIGH RELIABILITY HYBRID DC-DC CONVERTERS

DESCRIPTION

The DVWR 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 DVWR series is a fault tolerant magnetic feedback circuit. Operating at a nominal fixed frequency of 325 kHz per stage, 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 25 Watts Output Power
- Fault Tolerant 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
- Precision Seam Welded or Solder Seal Hermetic Package
- High Power Density: > 28 W/in³
- 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

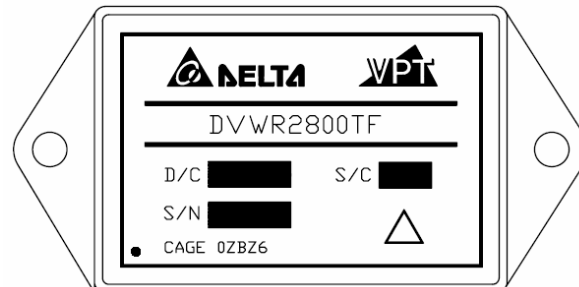


Figure 1 – DVWR2800T DC-DC Converter
(Not To Scale)

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 | 25 Watts | Lead Solder Temperature (10 seconds) | 270°C |
| Power Dissipation (Full Load, $T_{CASE} = +125^{\circ}\text{C}$) | 8 Watts | Weight (Maximum) (Un-Flanged / Flanged) | (50 / 56) Grams |

| Parameter | Conditions | DVWR283R312T | | | DVWR283R315T | | | Units | |
|-----------------------------------------------|----------------------------------------|------------------------------------------------------------------------------------------------------|--------|-------|--------------|--------|-------|-------------------|-------------------|
| | | Min | Typ | Max | Min | Typ | Max | | |
| STATIC | | | | | | | | | |
| INPUT Voltage | Continuous | 15 | 28 | 50 | 15 | 28 | 50 | V | |
| | Transient, 1 sec ⁴ | - | - | 80 | - | - | 80 | V | |
| Current | Inhibited | - | 3.5 | 5 | - | 3.5 | 5 | mA | |
| | No Load | - | 20 | 40 | - | 20 | 40 | mA | |
| Ripple Current | Full Load ⁵ , 20Hz to 10MHz | - | 20 | 50 | - | 20 | 50 | mA _{p-p} | |
| Inhibit Pin Input ⁴ | | 0 | - | 1.5 | 0 | - | 1.5 | V | |
| Inhibit Pin Open Circuit Voltage ⁴ | | 13 | 15 | 17 | 13 | 15 | 17 | V | |
| UVLO Turn On | | 10.5 | - | 14.5 | 10.5 | - | 14.5 | V | |
| UVLO Turn Off ⁴ | | 11.0 | - | 14.5 | 11.0 | - | 14.5 | V | |
| OUTPUT Voltage | V _{MAIN} | $T_{CASE} = 25^{\circ}\text{C}$ | 3.25 | 3.30 | 3.35 | 3.25 | 3.30 | 3.35 | V |
| | +V _{AUX} | | 11.88 | 12.0 | 12.12 | 14.85 | 15.0 | 15.15 | V |
| | -V _{AUX} | | -12.24 | -12.0 | -11.76 | -15.30 | -15.0 | -14.70 | V |
| | V _{MAIN} | $T_{CASE} = -55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$ | 3.20 | 3.30 | 3.40 | 3.20 | 3.30 | 3.40 | V |
| | +V _{AUX} | | 11.64 | 12.0 | 12.36 | 14.55 | 15.0 | 15.45 | V |
| | -V _{AUX} | | -12.48 | -12.0 | -11.52 | -15.60 | -15.0 | -14.40 | V |
| Power ⁴ | Total | | 0 | - | 25 | 0 | - | 25 | W |
| | V _{MAIN} | | 0 | - | 10 | 0 | - | 10 | W |
| | $\pm V_{AUX}$ ⁶ | | 0 | - | 15 | 0 | - | 15 | W |
| Current ³ | V _{MAIN} | | 0 | - | 3.03 | 0 | - | 3.03 | A |
| | $\pm V_{AUX}$ | Either Output ⁶ | 0 | - | 0.87 | 0 | - | 0.70 | A |
| Ripple Voltage | V _{MAIN} | Full Load ⁵ , 20Hz to 10MHz | - | 20 | 60 | - | 20 | 60 | mV _{p-p} |
| | $\pm V_{AUX}$ | | - | 40 | 100 | - | 40 | 100 | mV _{p-p} |
| Line Regulation | V _{MAIN} | $V_{IN} = 15\text{V}$ to 50V | - | 10 | 25 | - | 10 | 25 | mV |
| | +V _{AUX} | | - | 15 | 50 | - | 15 | 50 | mV |
| | -V _{AUX} | | - | 20 | 100 | - | 20 | 100 | mV |
| Load Regulation | V _{MAIN} | No Load to Full Load ^{5,8} | - | 10 | 25 | - | 10 | 25 | mV |
| | +V _{AUX} | | - | 10 | 50 | - | 10 | 50 | mV |
| | -V _{AUX} | | - | 50 | 250 | - | 50 | 250 | mV |
| Cross Regulation | $\pm V_{AUX}$ | +V _{OUT} = 30%, -V _{OUT} = 70% +V _{OUT} = 70%, -V _{OUT} = 30% | - | - | 550 | - | - | 550 | mV |
| EFFICIENCY | | Full Load ⁵ | 74 | 79 | - | 75 | 80 | - | % |
| LOAD FAULT POWER DISSIPATION | | Overload ⁴ | - | - | 15 | - | - | 15 | W |
| | | Short Circuit | - | - | 10 | - | - | 10 | W |
| CAPACITIVE LOAD ⁴ | | | - | - | 500 | - | - | 500 | μF |
| SWITCHING FREQUENCY | | | 550 | 650 | 700 | 550 | 650 | 700 | kHz |
| SYNCHRONIZATION FREQUENCY ⁷ | | | 700 | 750 | 800 | 700 | 750 | 800 | kHz |
| ISOLATION | | 500 V _{DC} , $T_{CASE} = 25^{\circ}\text{C}$ | 100 | - | - | 100 | - | - | M Ω |
| MTBF (MIL-HDBK-217F) | | AIF @ $T_C = 55^{\circ}\text{C}$ | - | 307 | - | - | 307 | - | kHrs |

SPECIFICATIONS ($T_{CASE} = -55^{\circ}C$ to $+125^{\circ}C$, $V_{IN} = +28V \pm 5\%$, 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 | 25 Watts | Lead Solder Temperature (10 seconds) | 270°C |
| Power Dissipation (Full Load, $T_{CASE} = +125^{\circ}C$) | 8 Watts | Weight (Maximum) (Un-Flanged / Flanged) | (50 / 56) Grams |

| Parameter | Conditions | DVWR283R312T | | | DVWR283R315T | | | Units | |
|-----------------------------------------|---------------|-------------------------|-----|-----|--------------|-----|-----|-------|------------------|
| | | Min | Typ | Max | Min | Typ | Max | | |
| DYNAMIC | | | | | | | | | |
| Load Step Output Transient | V_{MAIN} | Half Load to Full Load | - | 150 | 300 | - | 150 | 300 | mV _{PK} |
| | $\pm V_{AUX}$ | | - | 500 | 700 | - | 500 | 700 | mV _{PK} |
| Load Step Recovery ² | V_{MAIN} | | - | 200 | 400 | - | 200 | 400 | μ Sec |
| | $\pm V_{AUX}$ | | - | 200 | 400 | - | 200 | 400 | μ Sec |
| Line Step Output Transient ⁴ | V_{MAIN} | $V_{IN} = 15V$ to $50V$ | - | 80 | 200 | - | 80 | 200 | mV _{PK} |
| | $\pm V_{AUX}$ | | - | 300 | 500 | - | 300 | 500 | mV _{PK} |
| Line Step Recovery ^{2,4} | V_{MAIN} | | - | 200 | 400 | - | 200 | 400 | μ Sec |
| | $\pm V_{AUX}$ | | - | 200 | 400 | - | 200 | 400 | μ Sec |
| Turn On Delay | | | - | - | 20 | - | - | 20 | mSec |
| Turn On Overshoot | V_{MAIN} | $V_{IN} = 0V$ to $28V$ | - | - | 15 | - | - | 15 | mV _{PK} |
| | $\pm V_{AUX}$ | | - | - | 50 | - | - | 50 | mV _{PK} |

- Notes:
1. This note intentionally not used.
 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. 10W on V_{MAIN} and 15W on $\pm V_{AUX}$.
 6. Up to 70% of the total auxiliary power or current can be drawn from either of the auxiliary outputs.
 7. Synchronization is TTL signal with $V_{SYNC\ MAX} = 6V$.
 8. $-V_{AUX}$ is 5% Load to Full Load at $-55^{\circ}C$.

BLOCK DIAGRAM

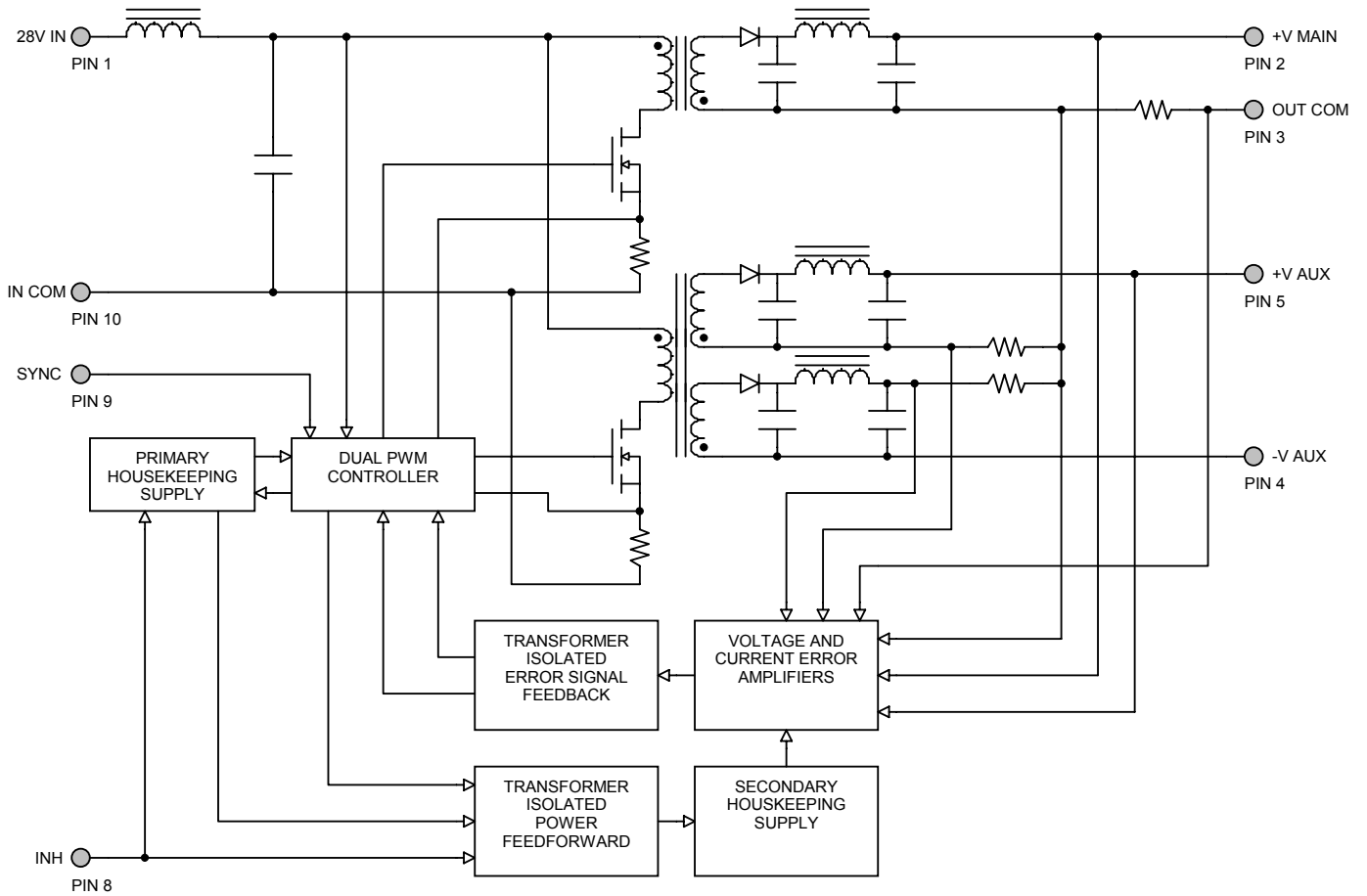


Figure 2

CONNECTION DIAGRAM

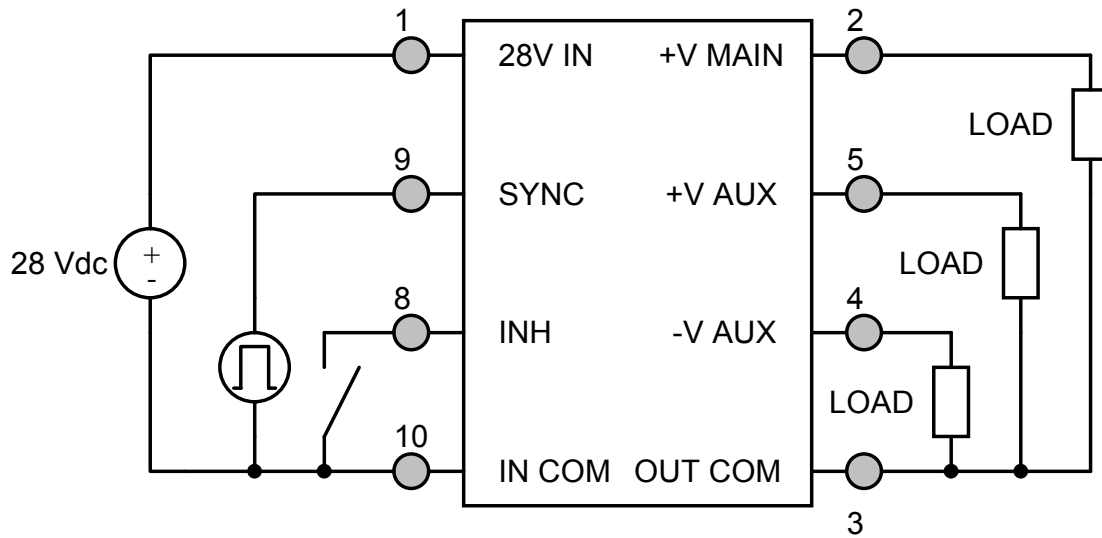


Figure 3

INHIBIT DRIVE CONNECTION DIAGRAMS

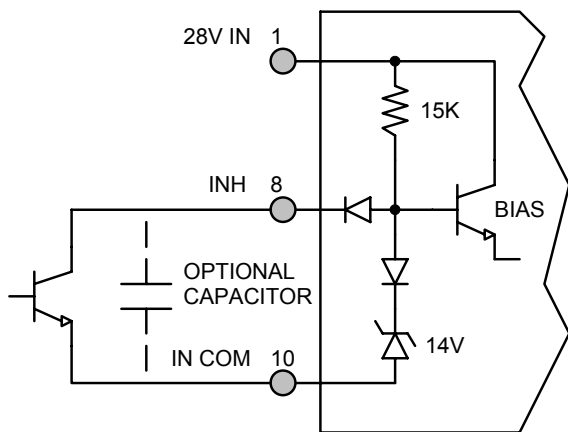


Figure 4 – Internal Inhibit Circuit and Recommended Drive
(Shown with optional capacitor for turn-on delay)

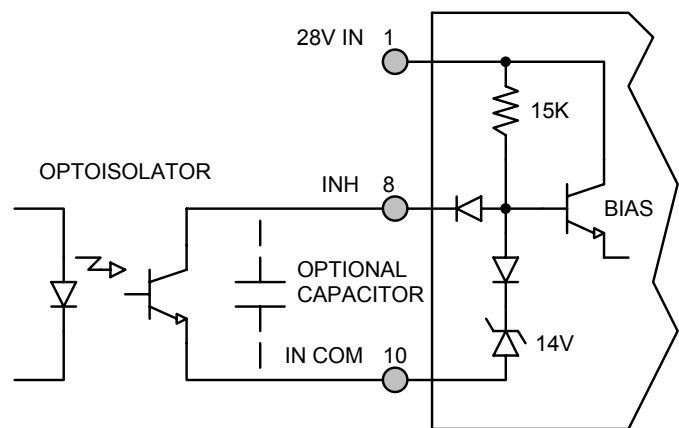


Figure 5 – Isolated Inhibit Drive
(Shown with optional capacitor for turn-on delay)

EMI FILTER HOOKUP DIAGRAM

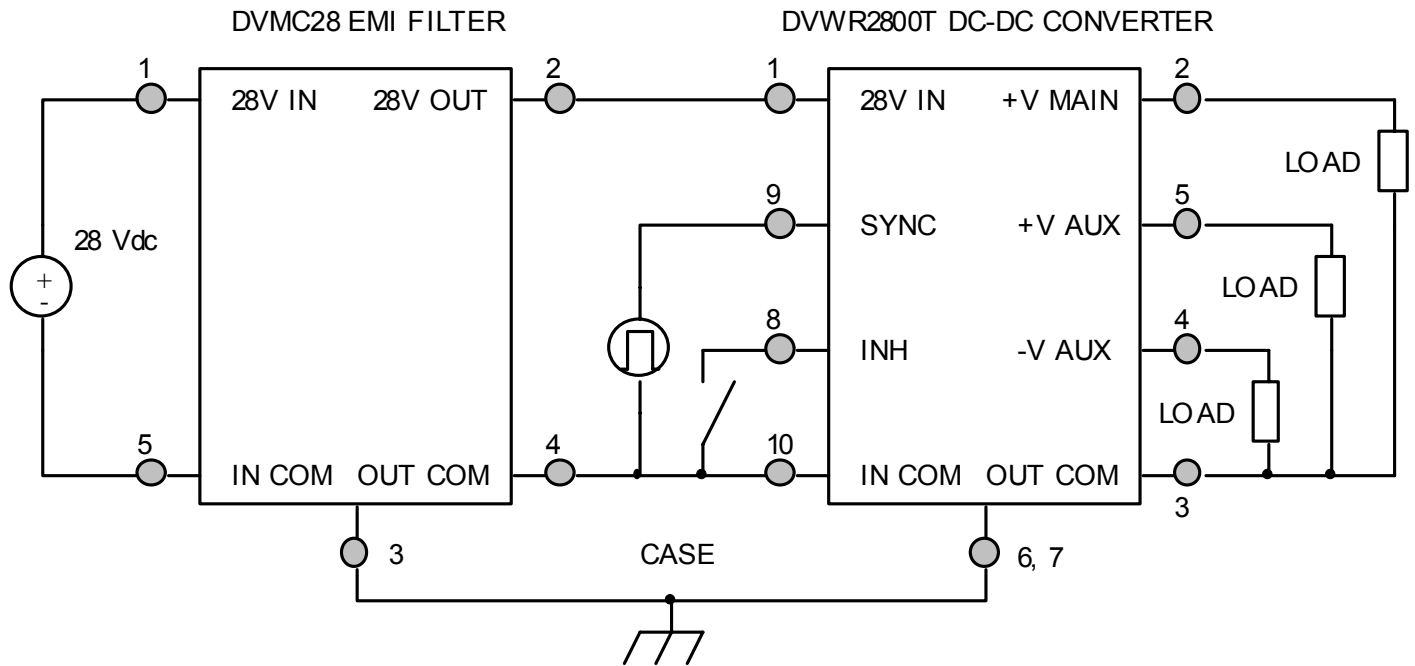


Figure 6 – Converter with EMI Filter

EFFICIENCY PERFORMANCE CURVES ($T_{CASE} = 25^{\circ}C$)

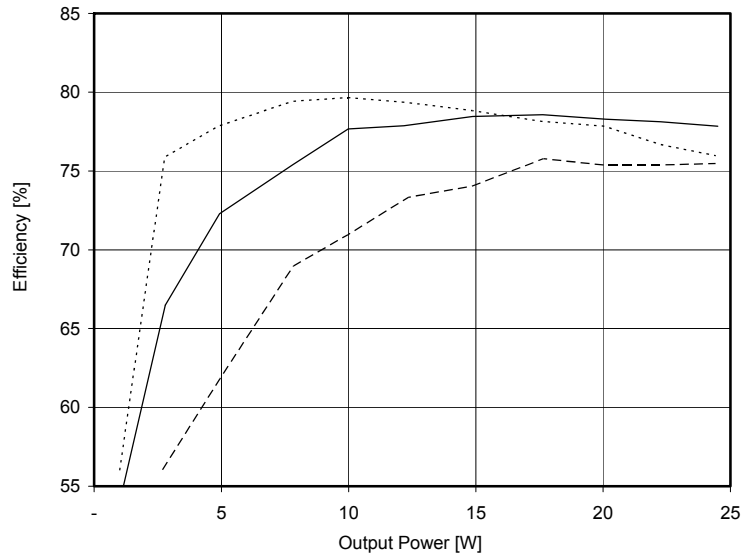


Figure 7 – DVWR283R312T
Efficiency (%) vs. Output Power (W)

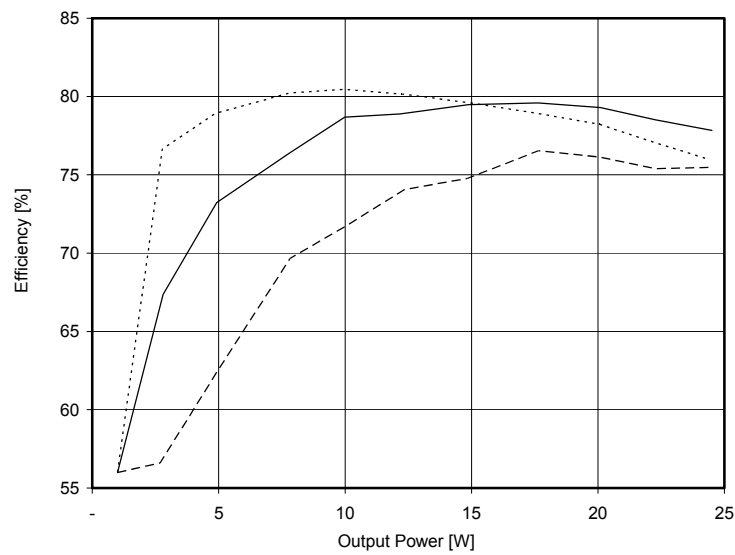


Figure 8 – DVWR283R315T
Efficiency (%) vs. Output Power (W)

EMI PERFORMANCE CURVES

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

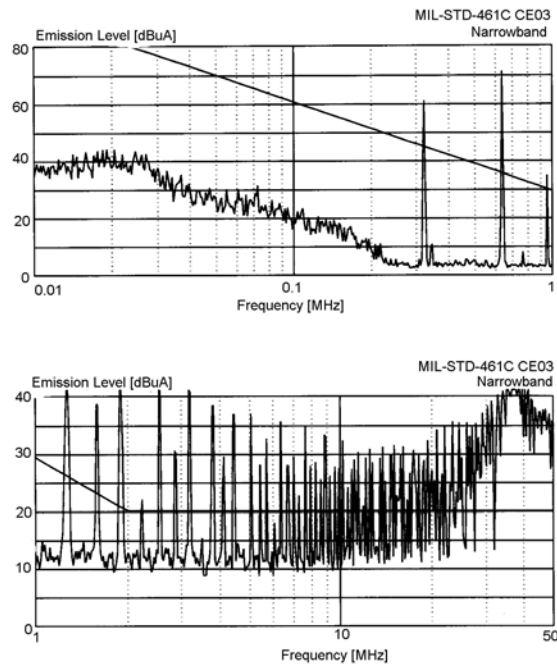


Figure 9 – DVWR2800T without EMI Filter

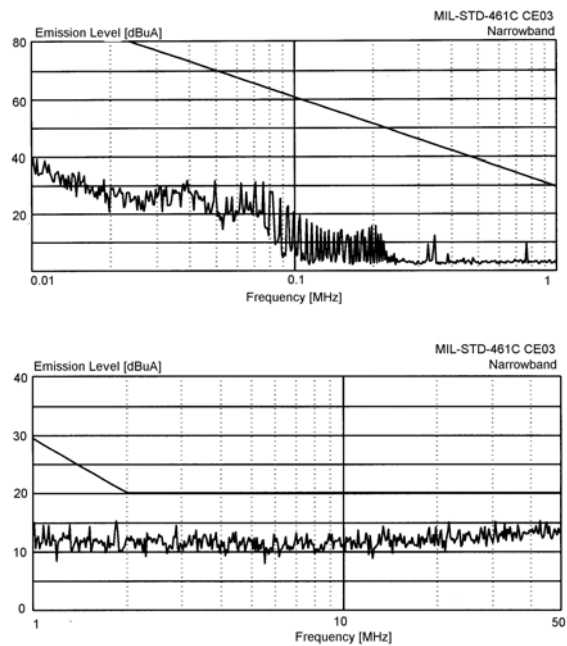
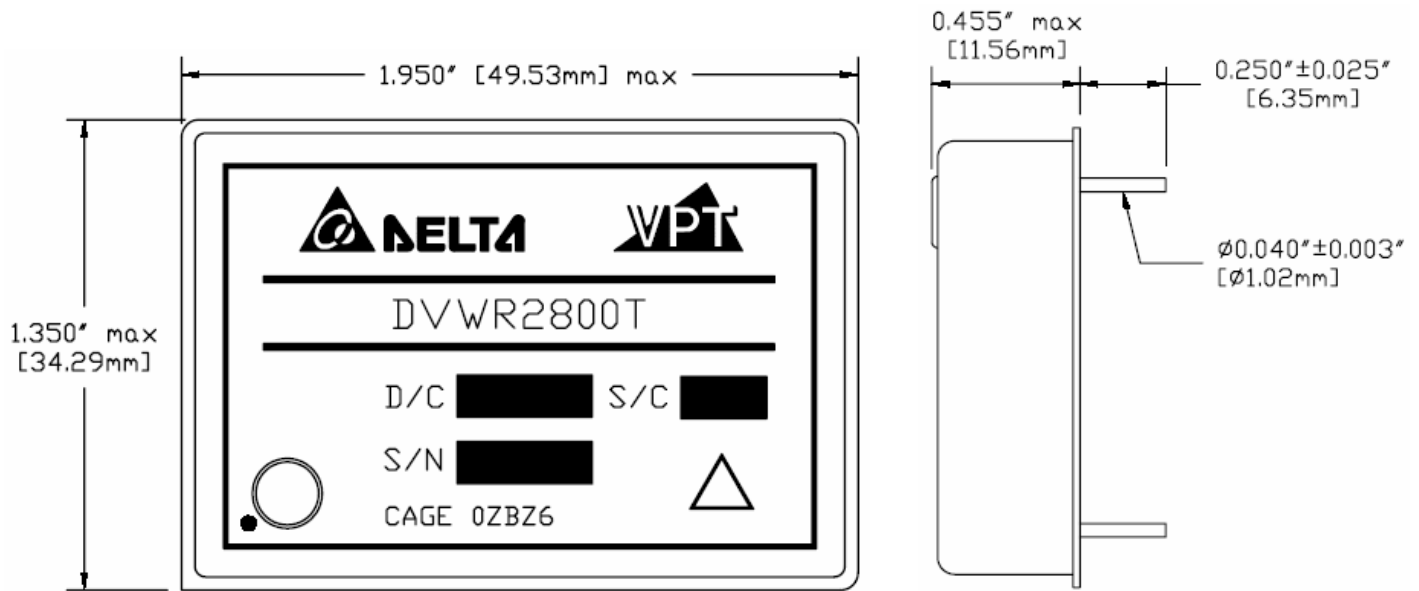


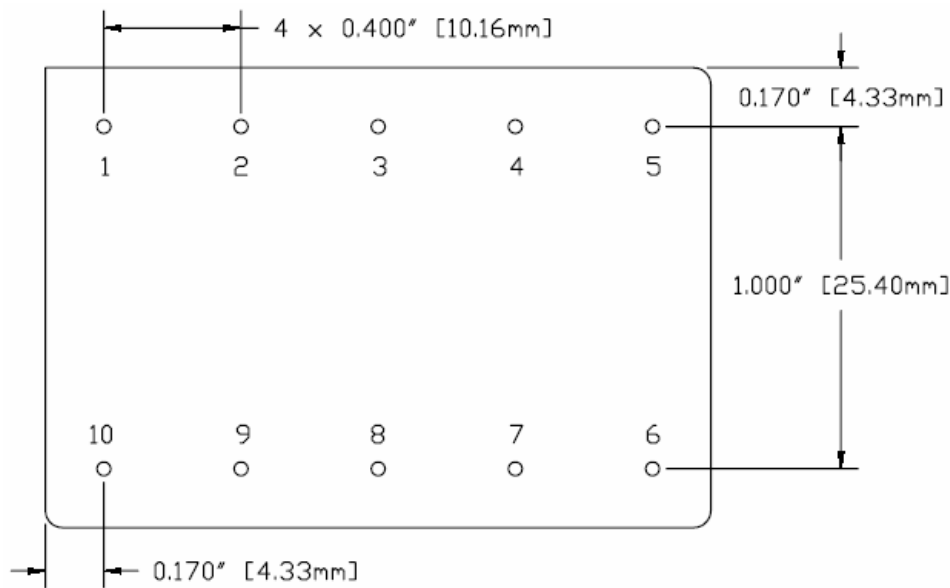
Figure 10 – DVWR2800T with EMI Filter

PACKAGE SPECIFICATIONS (NON-FLANGED, SOLDER SEAL)



TOP VIEW

SIDE VIEW

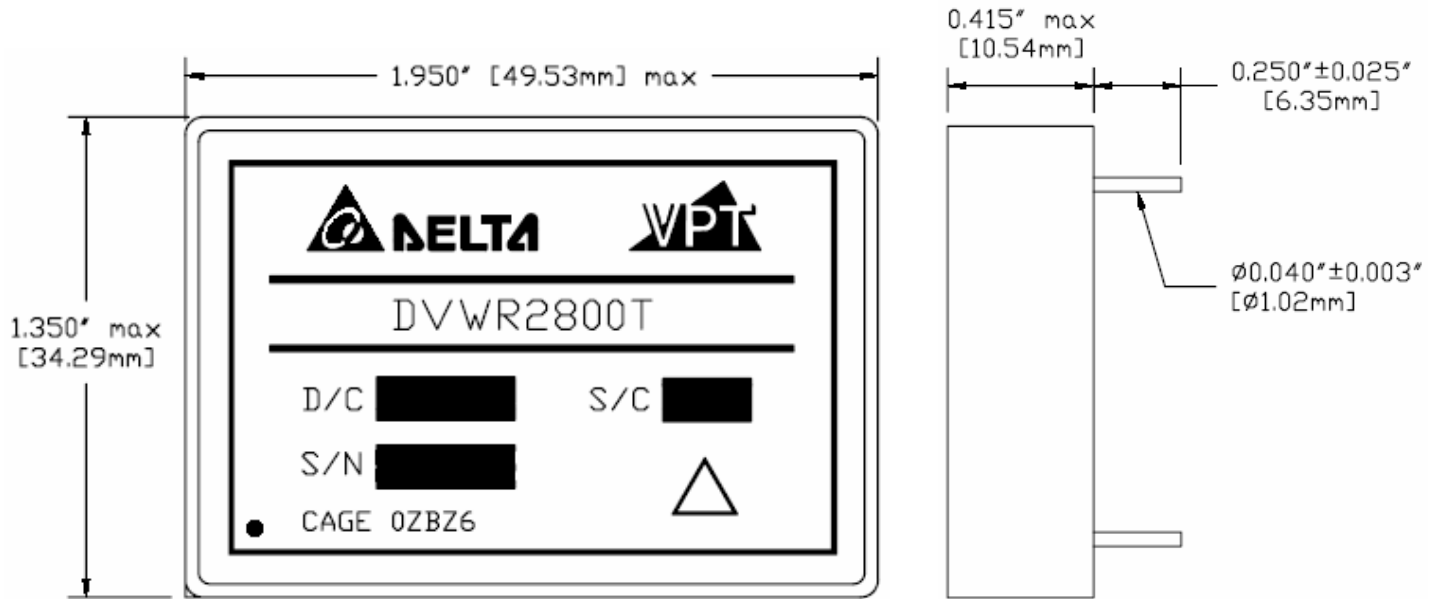


| PIN | FUNCTION |
|-----|----------|
| 1 | 28V IN |
| 2 | +V MAIN |
| 3 | OUT COM |
| 4 | -V AUX |
| 5 | +V AUX |
| 6 | CASE |
| 7 | CASE |
| 8 | INHIBIT |
| 9 | SYNC |
| 10 | IN COM |

BOTTOM VIEW

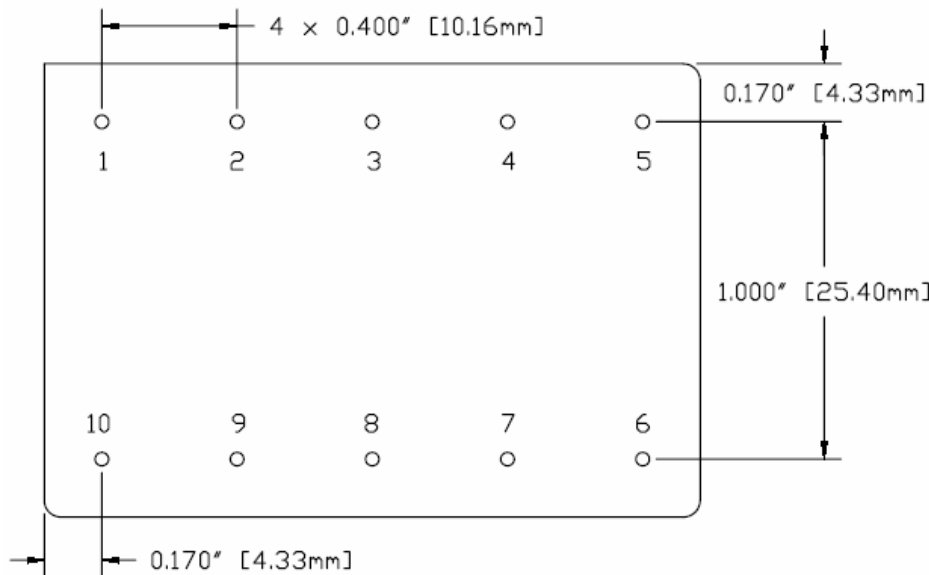
Figure 11 – Non-Flanged, Solder Seal Tin Plated Package and Pinout (Not Used for /HB or Higher Screened Products)
(Dimensional Limits are ± 0.005 " Unless Otherwise Stated)

PACKAGE SPECIFICATIONS (NON-FLANGED, SEAM SEAL)



TOP VIEW

SIDE VIEW

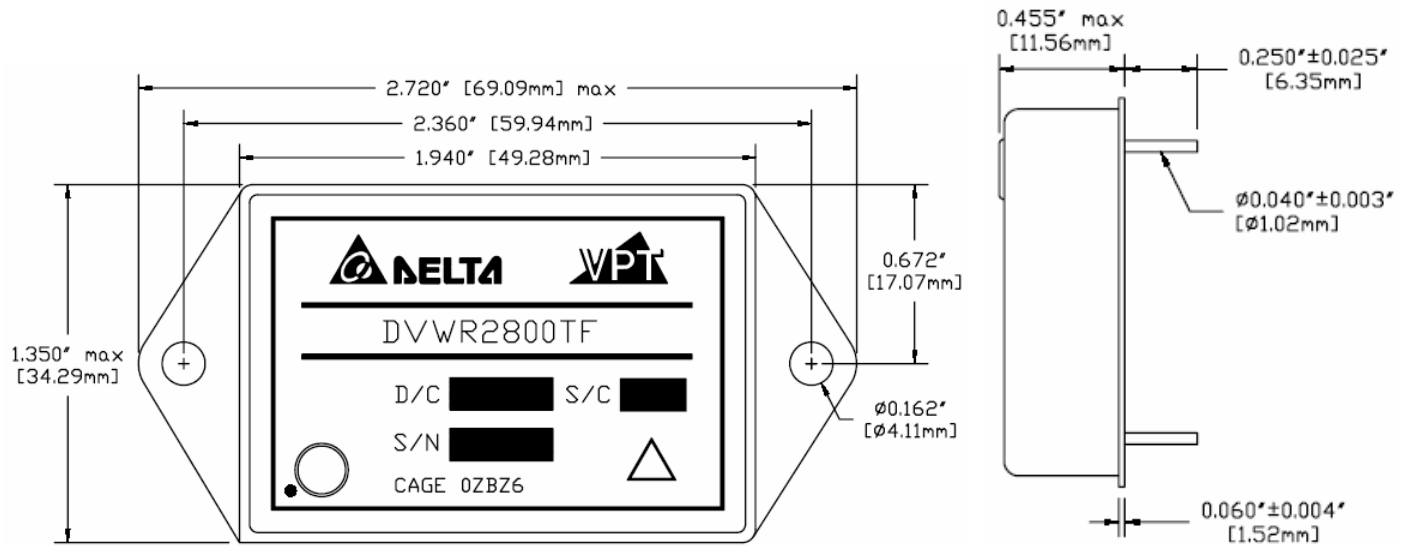


BOTTOM VIEW

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

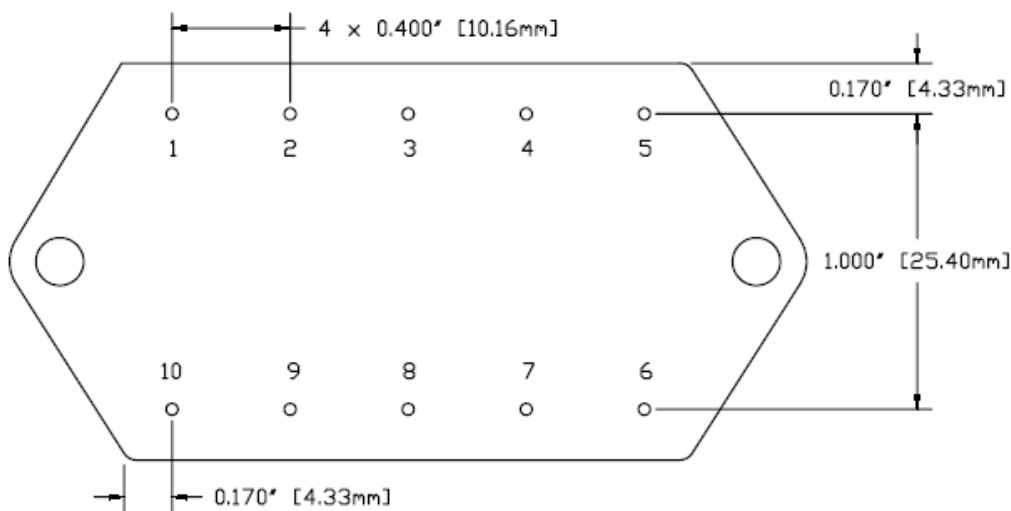
Figure 12 – Non-Flanged, Seam Seal Package and Pinout
(Dimensional Limits are ±0.005" Unless Otherwise Stated)

PACKAGE SPECIFICATIONS (FLANGED, SOLDER SEAL)



TOP VIEW

SIDE VIEW

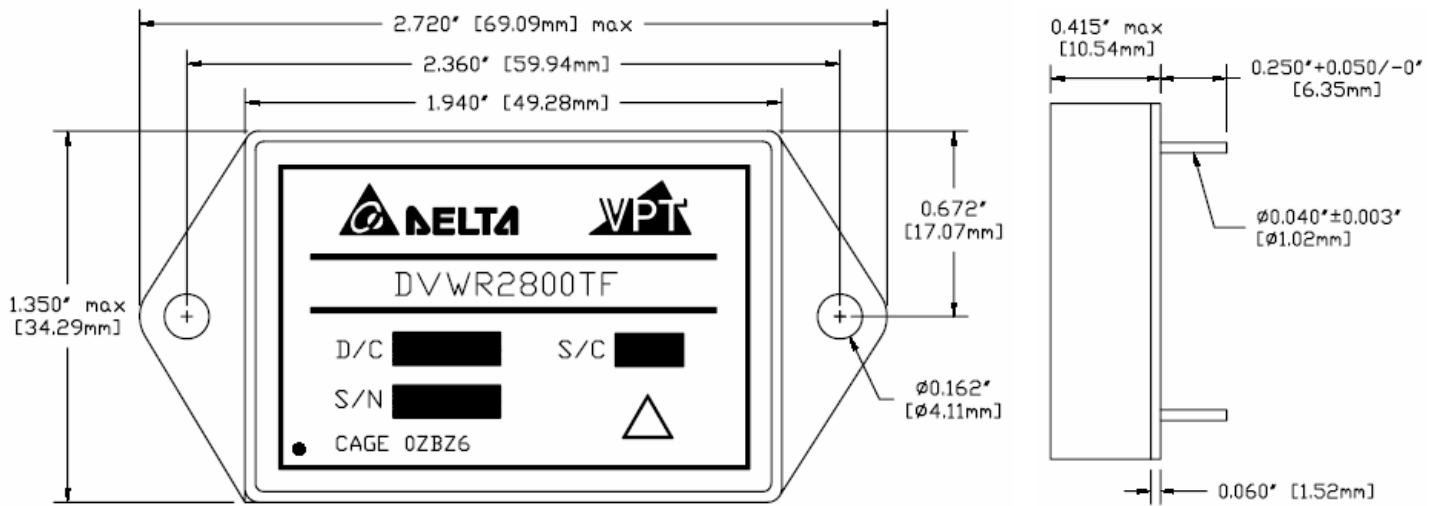


BOTTOM VIEW

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

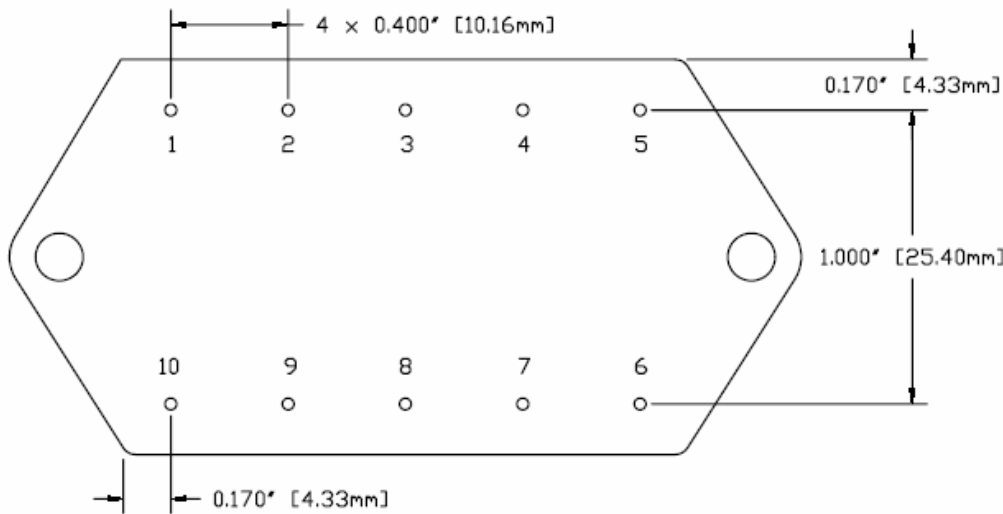
Figure 13 – Flanged, Solder Seal Tin Plated Package and Pinout (Not Used for /HB or Higher Screened Products)
(Dimensional Limits are ±0.005" Unless Otherwise Stated)

PACKAGE SPECIFICATIONS (FLANGED, SEAM SEAL)



TOP VIEW

SIDE VIEW



BOTTOM VIEW

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

Figure 14 – 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 | +V MAIN | Positive Main Output Voltage Connection |
| 3 | OUT COM | Output Common Connection |
| 4 | -V AUX | Negative Auxiliary Output Voltage Connection |
| 5 | +V AUX | Positive Auxiliary Output Voltage Connection |
| 6 | CASE | Case Connection |
| 7 | CASE | Case Connection |
| 8 | INHIBIT | Logic Low = Disabled Output. Connecting the inhibit pin to input common causes converter shutdown. Logic High = Enabled Output. Unconnected or open collector TTL. |
| 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 x 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

| | | | | | | | | |
|-------------|-----------|------------|-----------|----------|----------|------------|---|------------|
| DVWR | 28 | 3R3 | 12 | T | F | /HB | - | XXX |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | | 8 |

| (1) Product Series | (2) Nominal Input Voltage | | (3) Main Output Voltage | | (4) Auxiliary Output Voltages | |
|-----------------------|------------------------------|----------|----------------------------|-------------|----------------------------------|--------------------------|
| DVWR | 28 | 28 Volts | 3R3 | + 3.3 Volts | 12 15 | ± 12 Volts ± 15 Volts |

| (5) Number of Outputs | | (6) Package Option | | (7) Screening Code ^{1,2} | | (8) Additional Screening Code |
|--------------------------|--------|-------------------------|------------------------|-------------------------------------------------------------------|--------------------------------------------------|----------------------------------|
| T | Triple | None F | Non-Flanged Flanged | 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. 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) | DVWR2800T Series Similar Part Number |
|-------------------------------------|--------------------------------------|
| *T.B.D. | DVWR283R312T/H DVWR283R312TF/H |
| *T.B.D. | DVWR283R315T/H DVWR283R315TF/H |

Do not use the DVWR2800T 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.dsccl.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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