



DVWR2800T Series

HIGH RELIABILITY HYBRID DC-DC CONVERTERS

DESCRIPTION

The DVWR series of high-reliability DC-DC converters provide decades of successful critical mission support. Operable over the full military (-55 °C to +125 °C) temperature range with no power derating, the DVWR series unique input, and output filters dramatically reduce input and output noise performance. While operating at a nominal fixed frequency of 450 kHz, these regulated, isolated units utilize a high-speed magnetic feedback design and well-controlled under-voltage 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 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

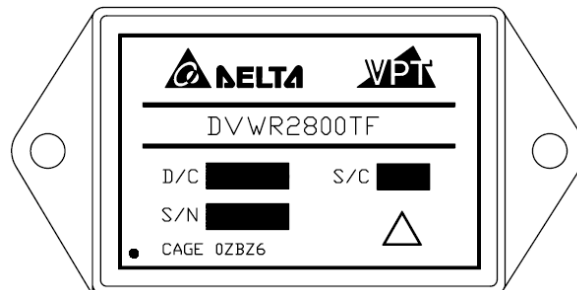


Figure 1 – DVWR2800T DC-DC Converter
(Exact marking may differ from that shown)

SPECIFICATIONS (T_{CASE} = -55°C to +125°C, V_{IN} = +28V ± 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°C) | 8 Watts | Weight (Maximum) (Un-Flanged / Flanged) | (54 / 58) Grams |
| ESD Rating per MIL-PRF-38534 | 3B | | |

| 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 | 60 | - | 20 | 60 | 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°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} | | 11.76 | 12.0 | 12.24 | 14.70 | 15.0 | 15.30 | V |
| | V _{MAIN} | T _{CASE} = -55°C to +125°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} | | 11.52 | 12.0 | 12.48 | 14.40 | 15.0 | 15.60 | V |
| Power ⁴ | Total | | 0 | - | 25 | 0 | - | 25 | W |
| | V _{MAIN} | | 0 | - | 10 | 0 | - | 10 | W |
| | ±V _{AUX} ⁶ | | 0 | - | 15 | 0 | - | 15 | W |
| Current ³ | V _{MAIN} | | 0 | - | 3.03 | 0 | - | 3.03 | A |
| | ±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} |
| | ±V _{AUX} | | - | 40 | 100 | - | 40 | 100 | mV _{p-p} |
| Line Regulation | V _{MAIN} | V _{IN} = 15V 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 | ±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°C | 100 | - | - | 100 | - | - | MΩ |
| MTBF (MIL-HDBK-217F) ⁹ | | AIF @ T _C = 55°C | - | 405 | - | - | 405 | - | kHrs |

SPECIFICATIONS (T_{CASE} = -55°C to +125°C, V_{IN} = +28V ± 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°C) | 8 Watts | Weight (Maximum) (Un-Flanged / Flanged) | (54 / 58) Grams |
| ESD Rating per MIL-PRF-38534 | 3B | | |

| 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} |
| | ±V _{AUX} | | - | 500 | 700 | - | 500 | 700 | mV _{PK} |
| Load Step Recovery ² | V _{MAIN} | | - | 200 | 400 | - | 200 | 400 | μSec |
| | ±V _{AUX} | | - | 200 | 400 | - | 200 | 400 | μSec |
| Line Step Output Transient ⁴ | V _{MAIN} | V _{IN} = 15V to 50V | - | 80 | 200 | - | 80 | 200 | mV _{PK} |
| | ±V _{AUX} | | - | 300 | 500 | - | 300 | 500 | mV _{PK} |
| Line Step Recovery ^{2, 4} | V _{MAIN} | | - | 200 | 400 | - | 200 | 400 | μSec |
| | ±V _{AUX} | | - | 200 | 400 | - | 200 | 400 | μSec |
| Turn On Delay | | | - | - | 20 | - | - | 20 | mSec |
| Turn On Overshoot | V _{MAIN} | | V _{IN} = 0V to 28V | - | - | 15 | - | - | 15 |
| | ±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 initial electrical design verification. Post design verification, parameter shall be guaranteed to the limits specified.
5. 10W on V_{MAIN} and 15W on ±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°C.
9. Correction factor of 0.12 added to ceramic capacitors.

BLOCK DIAGRAM

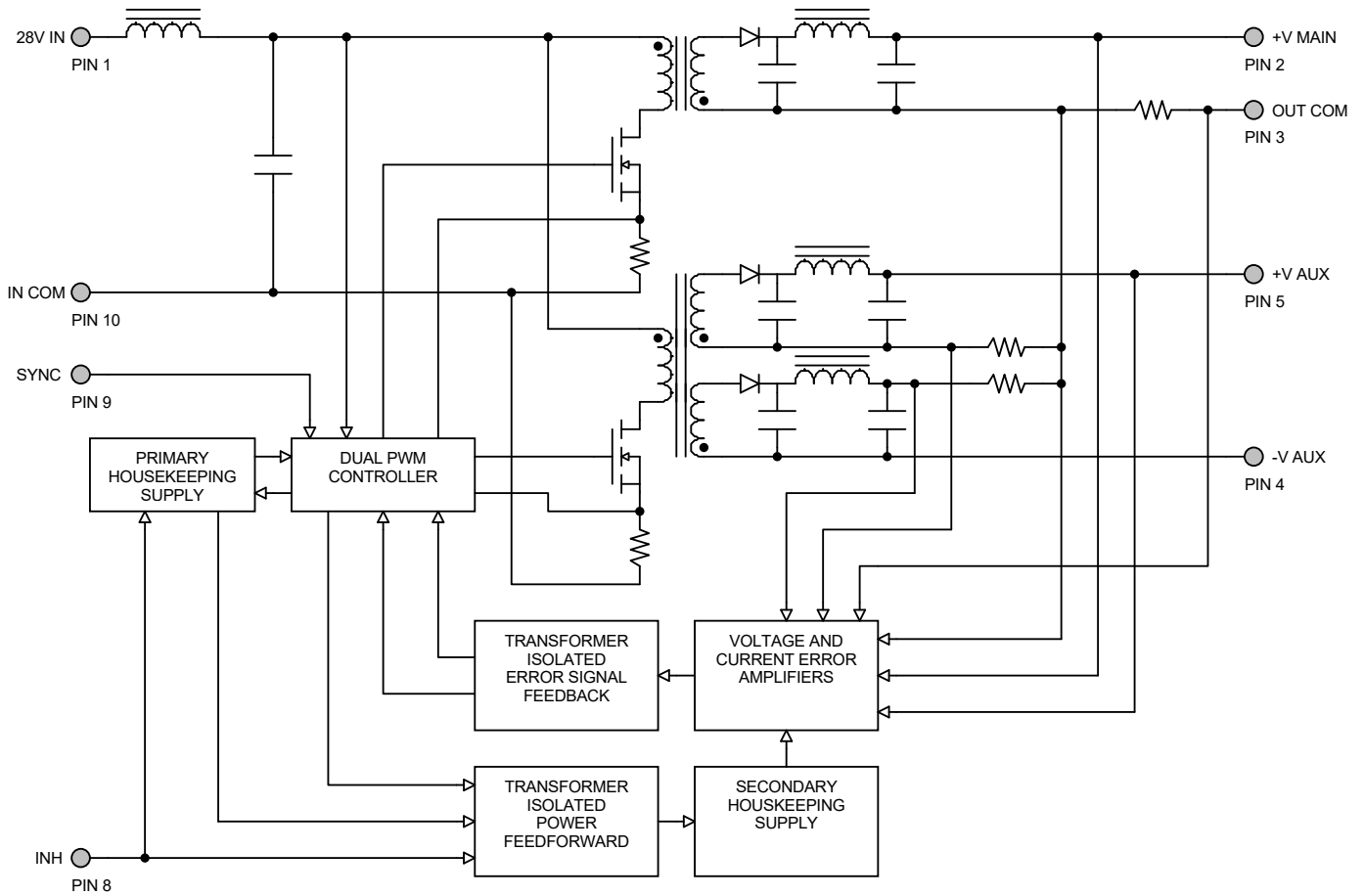


Figure 2

CONNECTION DIAGRAM

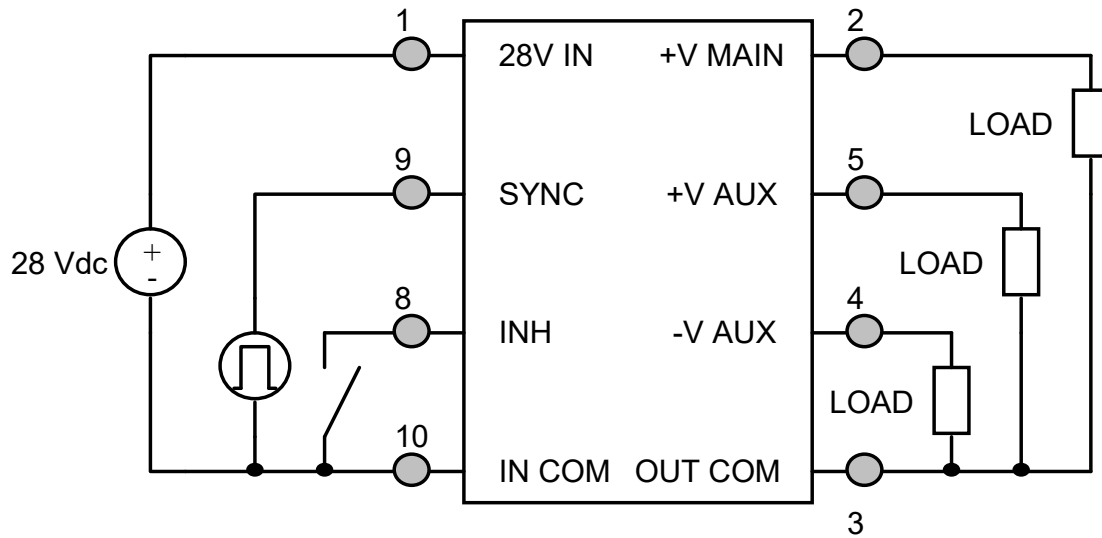


Figure 3

INHIBIT DRIVE CONNECTION DIAGRAMS

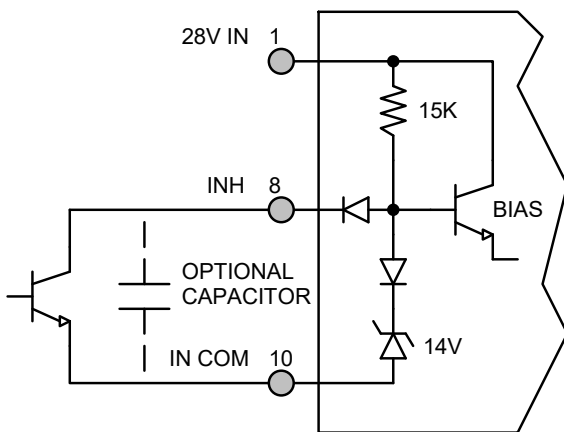


Figure 4 – Internal Inhibit Circuit and Recommended Drive
(Shown with optional capacitor for turn-on delay)

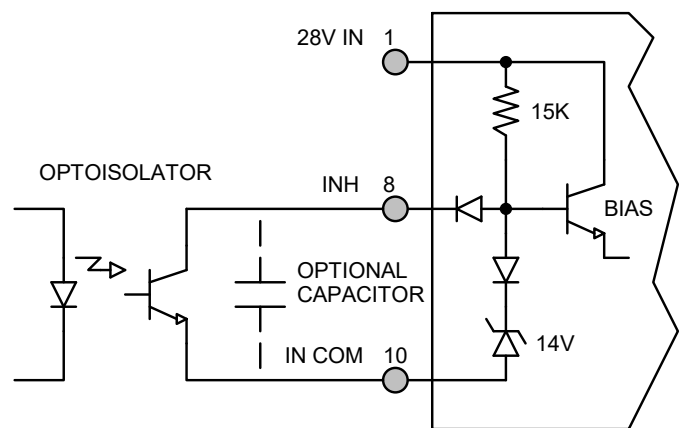


Figure 5 – Isolated Inhibit Drive
(Shown with optional capacitor for turn-on delay)

EMI FILTER HOOKUP DIAGRAM

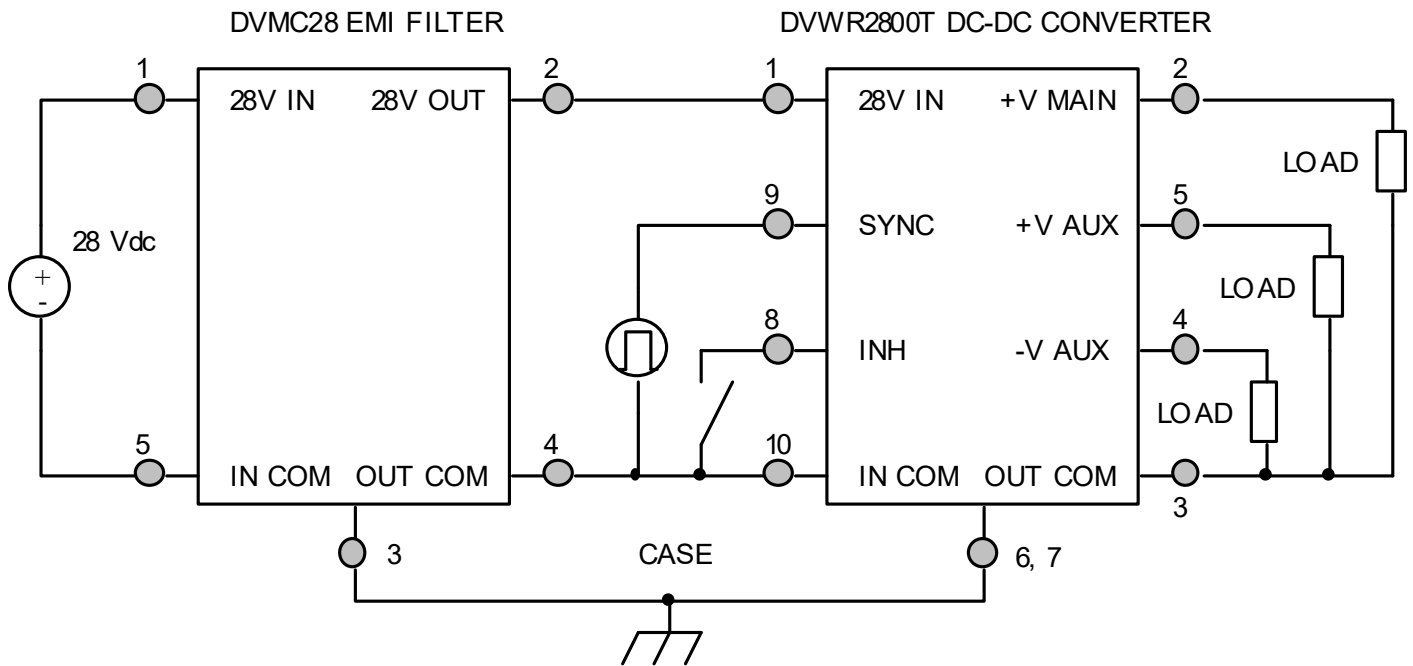


Figure 6 – Converter with EMI Filter

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

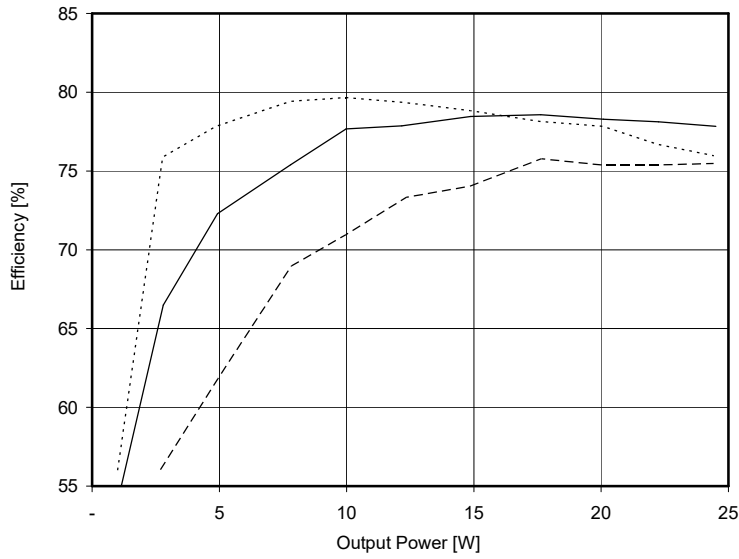


Figure 7 – DVWR283R312T
Efficiency (%) vs. Output Power (W)

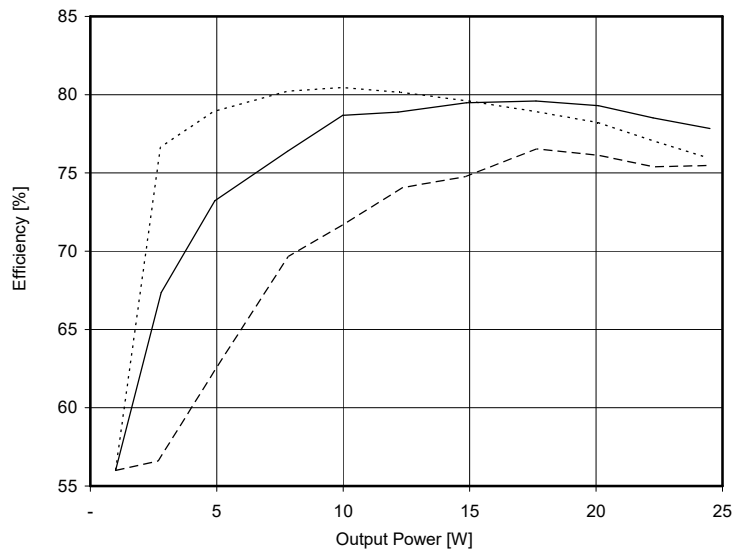


Figure 8 – DVWR283R315T
Efficiency (%) vs. Output Power (W)

EMI PERFORMANCE CURVES

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

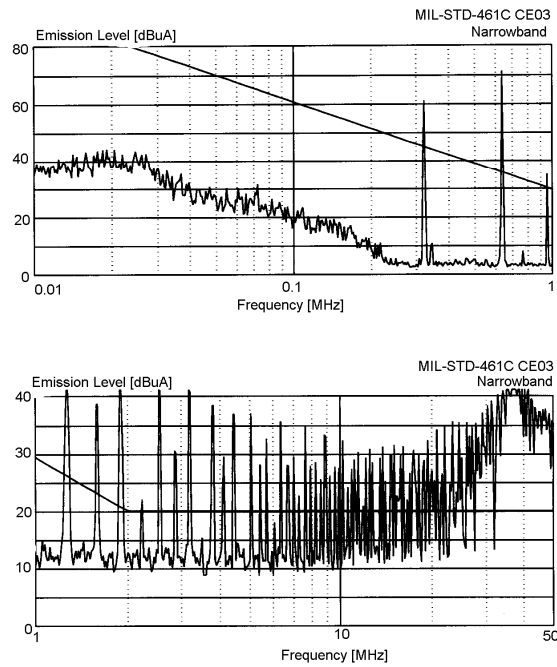


Figure 9 – DVWR2800T without EMI Filter

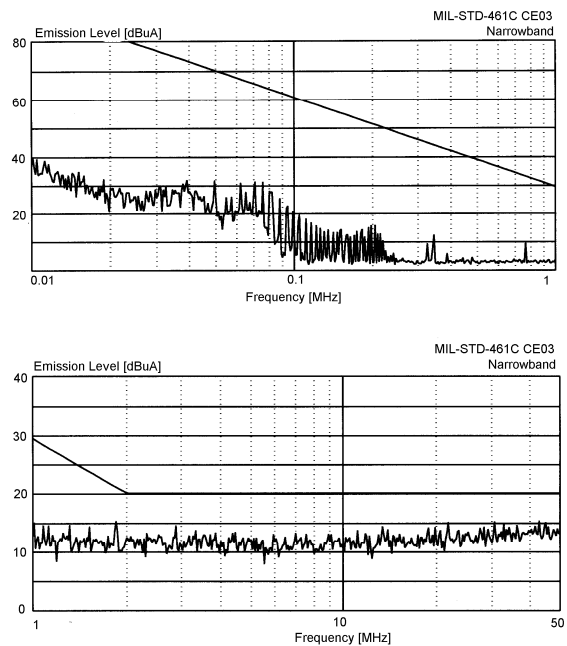
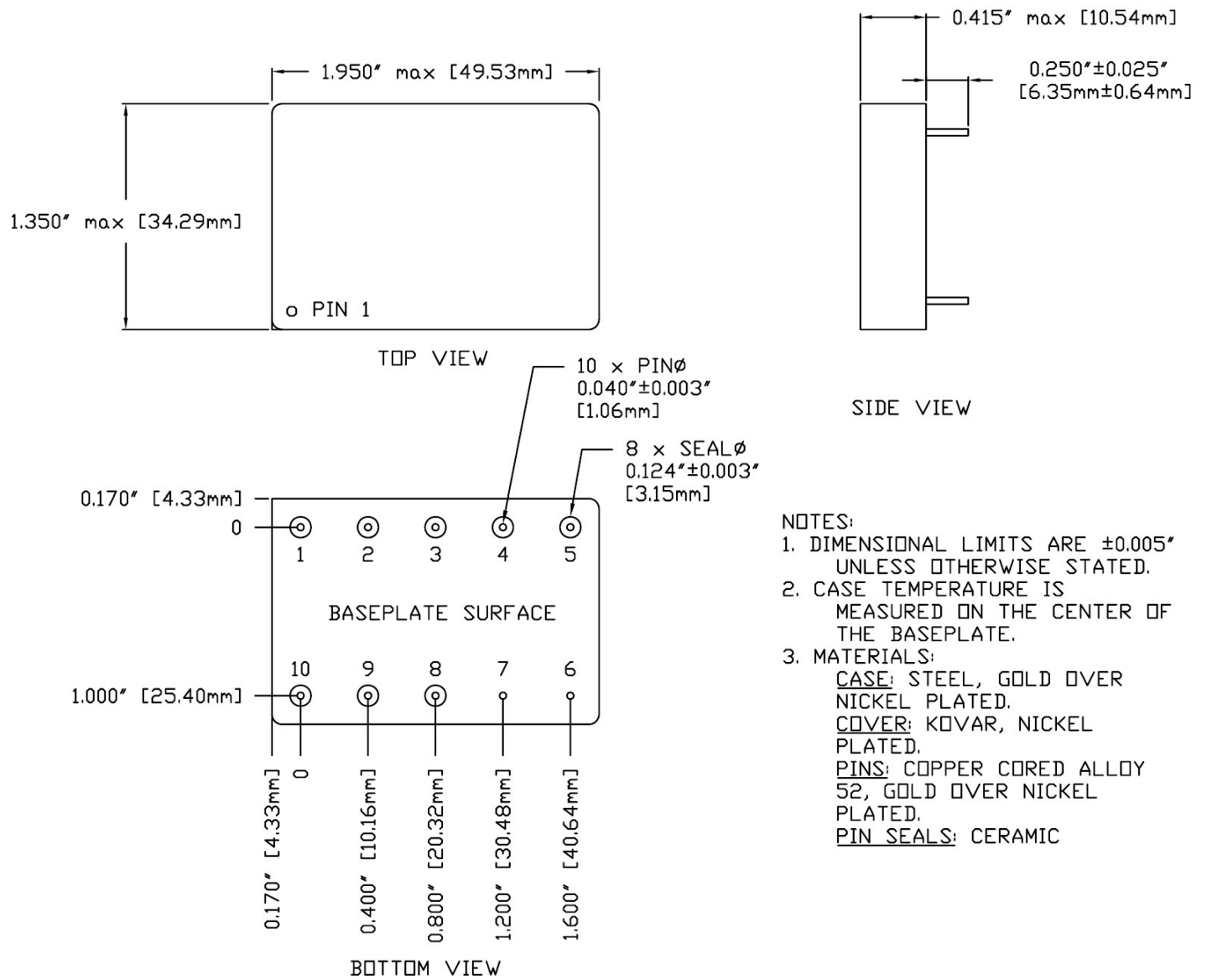


Figure 10 – DVWR2800T with EMI Filter

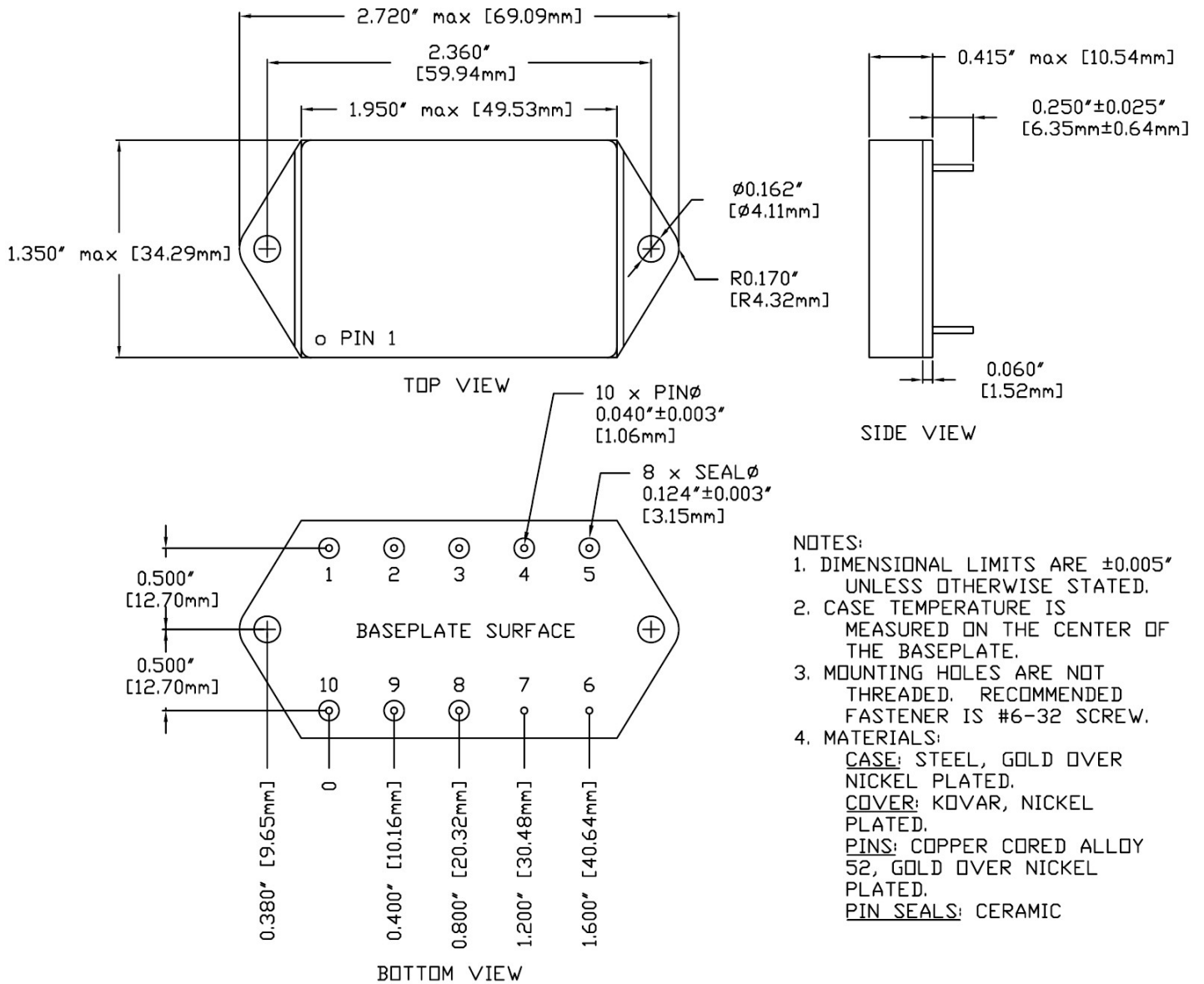
PACKAGE SPECIFICATIONS (NON-FLANGED, SEAM SEAL)



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

Figure 11 – Non-Flanged, Seam Seal Package and Pinout

PACKAGE SPECIFICATIONS (FLANGED, SEAM SEAL)



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

Figure 12 – Flanged, Seam Seal Package and Pinout

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)

| Test | MIL-STD-883 Test Method, Condition | No Suffix (Standard) Non-QML 5 | /ES (Extended) Non-QML 5 | /H (Class H) | /KL1 Non-QML 5,9 |
|---------------------------|--|-----------------------------------|-----------------------------|----------------|---------------------|
| Non-Destructive Bond Pull | TM2023 | • ⁴ | • ⁴ | • ⁴ | • |
| Internal Visual | TM2010, TM2017, TM2032 (MIL-STD-750, TM2072, TM2073) | • | • | • | • |
| Temperature Cycling | TM1010, Condition C -65°C to 150°C, Ambient | | | • | • |
| | TM1010, Condition B -55°C to 125°C, Ambient | | • | | |
| Constant Acceleration | TM2001, 3000g, Y1 Direction | | | • | • |
| | TM2001, 500g, Y1 Direction | | • | | |
| PIND ⁷ | TM2020, Condition A | | | | • |
| Pre Burn-In Electrical | 25°C | | | | • |
| Burn-In | TM1015, 320 hrs, 125°C, Case Typ | | | | • |
| | TM1015, 160 hrs, 125°C, Case Typ | | | • | |
| | 96 hrs, 125°C, Case Typ | | • | | |
| | 24 hrs, 125°C, Case Typ | • | | | |
| Final Electrical | MIL-PRF-38534, Group A Subgroups 1-6 -55°C, 25°C, 125°C ³ | | | • | • |
| | MIL-PRF-38534, Group A Subgroups 1 and 4 25°C | • | • | | |
| Hermeticity (Seal) | TM1014, Fine Leak, Condition A2 or B1 | | • | • | • |
| | TM1014, Gross Leak, Condition C1 or B2 | | • | • | • |
| | Gross Leak, Dip (No Bomb), Visual Verification | • | | | |
| Radiography ⁸ | TM2012 | | | | • |
| External Visual | TM2009 | • | • | • | • |

- Notes:
- Contact Sales for more information concerning additional environmental screening and testing options desired.
 - 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.
 - 100% R&R testing with all test data included in product shipment.
 - Not required per MIL-PRF-38534. Test is performed for additional product quality assurance.
 - Non-QML products may not meet all requirements of MIL-PRF-38534.
 - Note intentionally not used.
 - PIND test Certificate of Compliance included in product shipment.
 - Radiographic test Certificate of Compliance and film(s) or data CD included in product shipment.
 - KL1 products are identical in every way with Class K products in compliance with MIL-PRF-38534 revision L and later revisions except they contain elements evaluated to the requirements of MIL-PRF-38534 revision K and previous revisions. These devices are not marked with an SMD number or MIL-PRF-38534 certification mark and are marked with -KL1 screening code in place of -K.

ORDERING INFORMATION

| | | | | | | | | |
|------|----|-----|----|---|---|------|---|-----|
| DVWR | 28 | 3R3 | 12 | T | F | /KL1 | - | XXX |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | | 8 |

(1) (2) (3) (4)

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

(5) (6) (7) (8)

| Number of Outputs | | Package Option | | Screening Code ¹ | | Additional Screening Code |
|-------------------|--------|----------------|------------------------|-----------------------------|--|---------------------------|
| T | Triple | None F | Non-Flanged Flanged | None /ES /H /KL1 | Standard Extended Class H Class KL1 | Contact Sales |

- Notes:
1. Contact the VPT Inc. Sales Department for availability of Class H (/H) and KL1 (/KL1) 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.
 3. -KL1 products are identical in every way with Class K products in compliance with MIL-PRF-38534 revision L and later revisions except they contain elements evaluated to the requirements of MIL-PRF-38534 revision K and previous revisions. These devices are not marked with an SMD number or MIL-PRF-38534 certification mark and are marked with -KL1 screening code in place of -K.

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 |
|--|--|
| 5962-1620301HXC 5962-1620301HXA 5962-1620301HYC 5962-1620301HYA | DVWR283R312T/H DVWR283R312T/H-E DVWR283R312TF/H DVWR283R312TF/H-E |
| 5962-1620302HXC 5962-1620302HXA 5962-1620302HYC 5962-1620302HYA | DVWR283R315T/H DVWR283R315T/H-E DVWR283R315TF/H DVWR283R315TF/H-E |

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. SMDs can be downloaded from the DLA Land and Maritime (Previously known as DSCC) website at <https://landandmaritimeapps.dla.mil/programs/defaultapps.asp>. The SMD number listed above represents the Federal Stock Class, Device Type, Device Class Designator, Case Outline, Lead Finish and RHA Designator (where applicable). Please reference the SMD for other screening levels, lead finishes, and radiation levels. All SMD products are marked with a "Q" on the cover as specified by the QML certification mark requirement of MIL-PRF-38534.

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

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