



DVCH2800D Series

HIGH RELIABILITY HYBRID DC-DC CONVERTERS

DESCRIPTION

The DVCH 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 DVCH series are robust and effective input and output filters which provide dramatically reduced input and output noise performance when compared to other manufacturers competing devices. Operating at a nominal fixed frequency of 400 kHz, these regulated, isolated units utilize a high speed magnetic feedback design and 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: 12 to 50 Volts per MIL-STD-704
- Up to 1.5 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 Projection Welded Hermetic Package
- High Power Density: > 7 W/in³
- Custom Versions Available
- Additional Environmental Screening Available
- Meets MIL-STD-461 Revisions C, D, E and F EMC Requirements When Used With VPT's EMI Filters
- MIL-PRF-38534 Element Evaluated Components
- Space Applications should consider VPT's "S" Series of Radiation Tolerant Power Conversion Devices. Contact VPT for details.

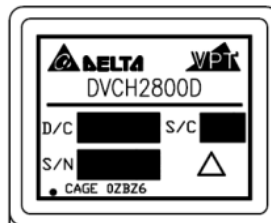


Figure 1 – DVCH2800D DC-DC Converter
(Exact marking may differ from that shown)

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

ABSOLUTE MAXIMUM RATINGS

| | | | |
|---|-------------|--------------------------------------|-----------------|
| Input Voltage (Continuous) | 50 V_{DC} | Junction Temperature Rise to Case | +5°C |
| Input Voltage (Transient, 1 second) | 80 Volts | Storage Temperature | -65°C to +150°C |
| Output Power ¹ | 1.5 Watts | Lead Solder Temperature (10 seconds) | 270°C |
| Power Dissipation (Full Load, $T_{CASE} = +125^{\circ}\text{C}$) | 0.6 Watts | Weight (Maximum) | 11 Grams |
| ESD Rating per MIL-PRF-38534 | 3A | | |

| Parameter | Conditions | DVCH2805D | | | DVCH2812D | | | Units |
|---|--|-----------|------|------|-----------|------|-------|-------------------|
| | | Min | Typ | Max | Min | Typ | Max | |
| STATIC | | | | | | | | |
| INPUT Voltage ⁴ | Continuous | 12 | 28 | 50 | 12 | 28 | 50 | V |
| | Transient, 1 sec | - | - | 80 | - | - | 80 | V |
| Current | Inhibited | - | - | 3.5 | - | - | 3.5 | mA |
| | No Load | - | - | 10 | - | - | 12 | mA |
| Ripple Current | Full Load, 20Hz to 10MHz | - | - | 30 | - | - | 30 | mA _{p-p} |
| Inhibit Pin Input ⁴ | | 0 | - | 1.5 | 0 | - | 1.5 | V |
| Inhibit Pin Open Circuit Voltage ⁴ | | 8.0 | 9.0 | 11.0 | 8.0 | 9.0 | 11.0 | V |
| UVLO Turn On | | 6.5 | - | 11.5 | 6.5 | - | 11.5 | V |
| OUTPUT Voltage | $\pm V_{OUT}$ $T_{CASE} = 25^{\circ}\text{C}$ | 4.95 | 5.00 | 5.05 | 11.88 | 12.0 | 12.12 | V |
| | $\pm V_{OUT}$ $T_{CASE} = -55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$ | 4.80 | 5.00 | 5.20 | 11.52 | 12.0 | 12.48 | V |
| Power ³ | Total | 0 | - | 1.5 | 0 | - | 1.5 | W |
| | $\pm V_{OUT}$ Either Output | 0 | - | 1.2 | 0 | - | 1.2 | W |
| Current ³ | I_{OUT} Either Output | 0 | - | 0.24 | 0 | - | 0.1 | A |
| Ripple Voltage | $\pm V_{OUT}$ Full Load, 20Hz to 10MHz | - | - | 50 | - | - | 100 | mV _{p-p} |
| Line Regulation | $\pm V_{OUT}$ $V_{IN} = 12\text{V}$ to 50V | - | - | 150 | - | - | 150 | mV |
| Load Regulation | $\pm V_{OUT}$ 10% Load to Full Load | - | - | 400 | - | - | 700 | mV |
| Load Regulation | $\pm V_{OUT}$ 50% Load to Full Load | - | - | 250 | - | - | 250 | mV |
| EFFICIENCY | | 72 | 79 | - | 74 | 79 | - | % |
| LOAD FAULT POWER DISSIPATION | Overload ⁴ | - | - | 3 | - | - | 3 | W |
| | Short Circuit | - | - | 4 | - | - | 4.5 | W |
| CAPACITIVE LOAD ⁴ | | - | - | 500 | - | - | 200 | μF |
| SWITCHING FREQUENCY | | 325 | 400 | 475 | 325 | 400 | 475 | kHz |
| ISOLATION | 500 V_{DC} | 100 | - | - | 100 | - | - | M Ω |
| MTBF (MIL-HDBK-217F) | AIF @ $T_C = 55^{\circ}\text{C}$ | - | 841 | - | - | 841 | - | kHrs |
| DYNAMIC | | | | | | | | |
| Load Step Output Transient | $\pm V_{OUT}$ Half Load to Full Load | - | 100 | 300 | - | 100 | 300 | mV _{PK} |
| Load Step Recovery ² | | - | 200 | 500 | - | 100 | 400 | μSec |
| Line Step Output Transient ⁴ | $\pm V_{OUT}$ $V_{IN} = 12\text{V}$ to 50V | - | 200 | 400 | - | 300 | 600 | mV _{PK} |
| Line Step Recovery ^{2,4} | | - | 400 | 600 | - | 300 | 600 | μSec |
| Turn On Delay | $\pm V_{OUT}$ $V_{IN} = 0\text{V}$ to 28V | - | 15 | 20 | - | 15 | 20 | mSec |
| Turn On Overshoot | | - | 0 | 25 | - | 0 | 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.

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

ABSOLUTE MAXIMUM RATINGS

| | | | |
|---|--------------------|--------------------------------------|-----------------|
| Input Voltage (Continuous) | 50 V _{DC} | Junction Temperature Rise to Case | +5°C |
| Input Voltage (Transient, 1 second) | 80 Volts | Storage Temperature | -65°C to +150°C |
| Output Power ¹ | 1.5 Watts | Lead Solder Temperature (10 seconds) | 270°C |
| Power Dissipation (Full Load, $T_{CASE} = +125^{\circ}\text{C}$) | 0.6 Watts | Weight (Maximum) | 11 Grams |
| ESD Rating per MIL-PRF-38534 | 3A | | |

| Parameter | Conditions | DVCH2815D | | | Units |
|---|--|-----------|------|-------|-------------------|
| | | Min | Typ | Max | |
| STATIC | | | | | |
| INPUT Voltage ⁴ | Continuous | 12 | 28 | 50 | V |
| | Transient, 1 sec | - | - | 80 | V |
| Current | Inhibited | - | - | 3.5 | mA |
| | No Load | - | - | 14 | mA |
| Ripple Current | Full Load, 20Hz to 10MHz | - | - | 30 | mA _{p-p} |
| Inhibit Pin Input ⁴ | | 0 | - | 1.5 | V |
| Inhibit Pin Open Circuit Voltage ⁴ | | 8.0 | 9.0 | 11.0 | V |
| UVLO Turn On | | 6.5 | - | 11.5 | V |
| OUTPUT Voltage | $\pm V_{OUT}$ $T_{CASE} = 25^{\circ}\text{C}$ | 14.85 | 15.0 | 15.15 | V |
| | $\pm V_{OUT}$ $T_{CASE} = -55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$ | 14.40 | 15.0 | 15.60 | V |
| Power ³ | Total | 0 | - | 1.5 | W |
| | $\pm V_{OUT}$ Either Output | 0 | - | 1.2 | W |
| Current ³ | I_{OUT} Either Output | 0 | - | 0.08 | A |
| Ripple Voltage | $\pm V_{OUT}$ Full Load, 20Hz to 10MHz | - | - | 100 | mV _{p-p} |
| Line Regulation | $\pm V_{OUT}$ $V_{IN} = 12\text{V}$ to 50V | - | - | 150 | mV |
| Load Regulation | $\pm V_{OUT}$ 10% Load to Full Load | - | - | 700 | mV |
| Load Regulation | $\pm V_{OUT}$ 50% Load to Full Load | - | - | 250 | mV |
| EFFICIENCY | | 74 | 79 | - | % |
| LOAD FAULT POWER DISSIPATION | Overload ⁴ | - | - | 3 | W |
| | Short Circuit | - | - | 4.5 | W |
| CAPACITIVE LOAD ⁴ | | - | - | 200 | μF |
| SWITCHING FREQUENCY | | 325 | 400 | 475 | kHz |
| ISOLATION | 500 V _{DC} | 100 | - | - | M Ω |
| MTBF (MIL-HDBK-217F) | AIF @ $T_C = 55^{\circ}\text{C}$ | - | 841 | - | kHrs |
| DYNAMIC | | | | | |
| Load Step Output Transient | $\pm V_{OUT}$ Half Load to Full Load | - | 100 | 300 | mV _{PK} |
| Load Step Recovery ² | | - | 100 | 400 | μSec |
| Line Step Output Transient ⁴ | $\pm V_{OUT}$ $V_{IN} = 12\text{V}$ to 50V | - | 300 | 600 | mV _{PK} |
| Line Step Recovery ^{2,4} | | - | 300 | 600 | μSec |
| Turn On Delay | $\pm V_{OUT}$ $V_{IN} = 0\text{V}$ to 28V | - | 15 | 20 | mSec |
| Turn On Overshoot | | - | 0 | 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.

BLOCK DIAGRAM

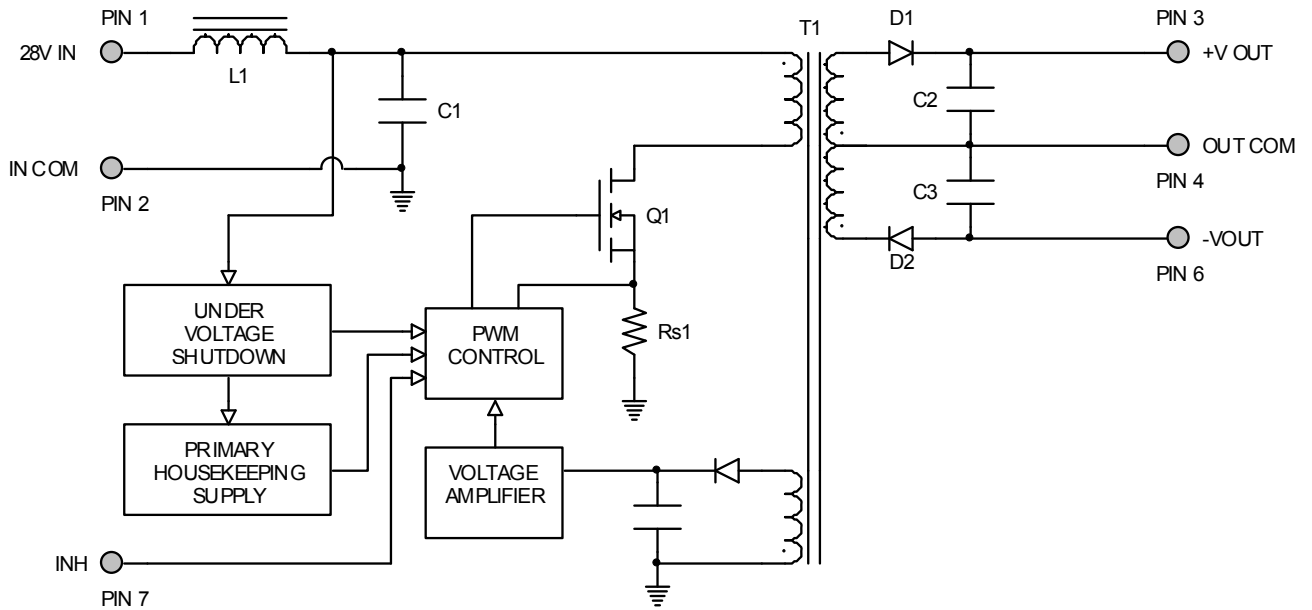


Figure 2

CONNECTION DIAGRAM

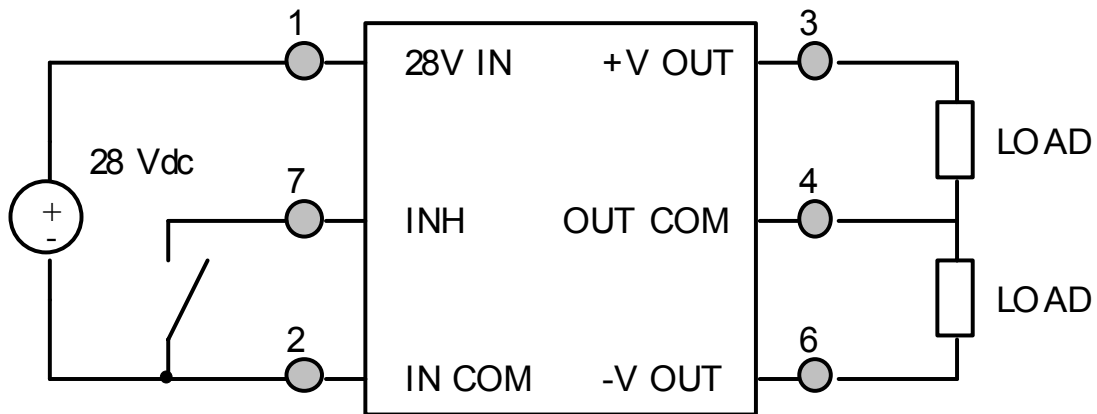


Figure 3

INHIBIT DRIVE CONNECTION DIAGRAMS

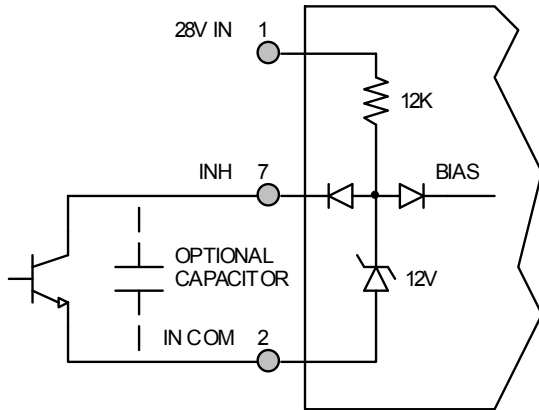


Figure 4 – Internal Inhibit Circuit and Recommended Drive
(Shown with optional capacitor for turn-on delay)

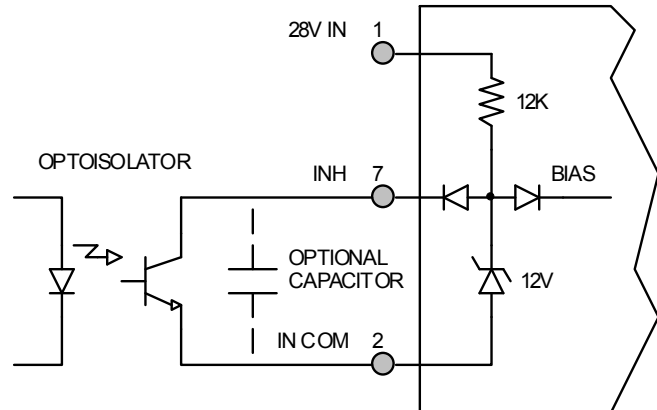


Figure 5 – Isolated Inhibit Drive
(Shown with optional capacitor for turn-on delay)

EMI FILTER HOOKUP DIAGRAM

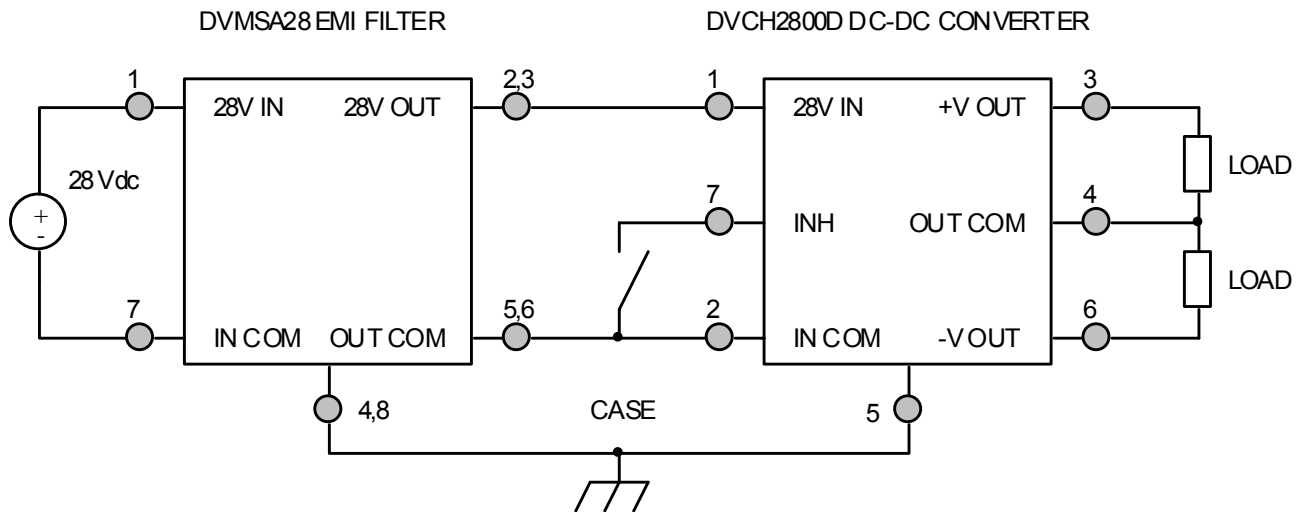


Figure 6 – Converter with EMI Filter

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

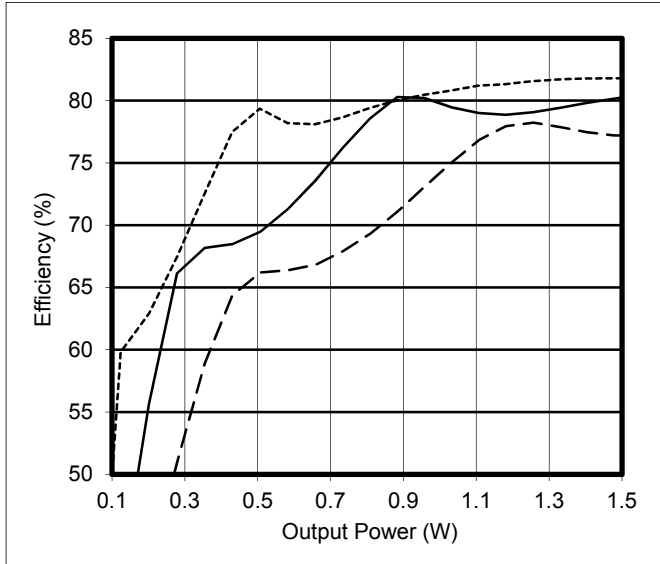


Figure 7 – DVCH2805D
Efficiency (%) vs. Output Power (W)

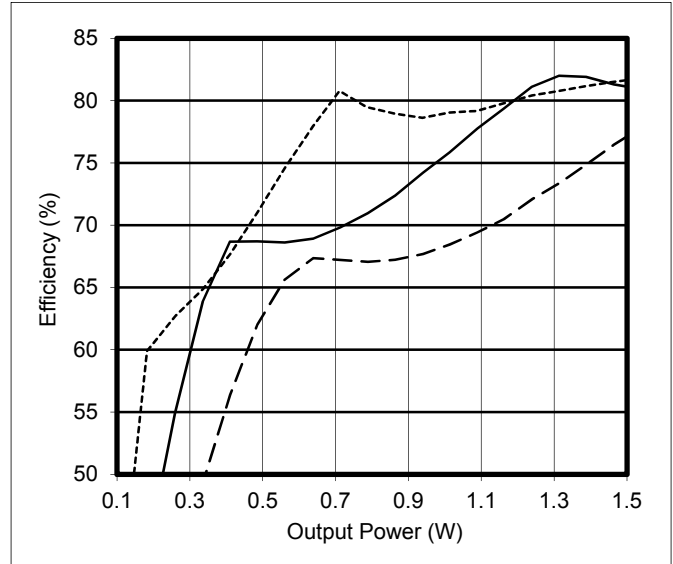


Figure 8 – DVCH2812D
Efficiency (%) vs. Output Power (W)

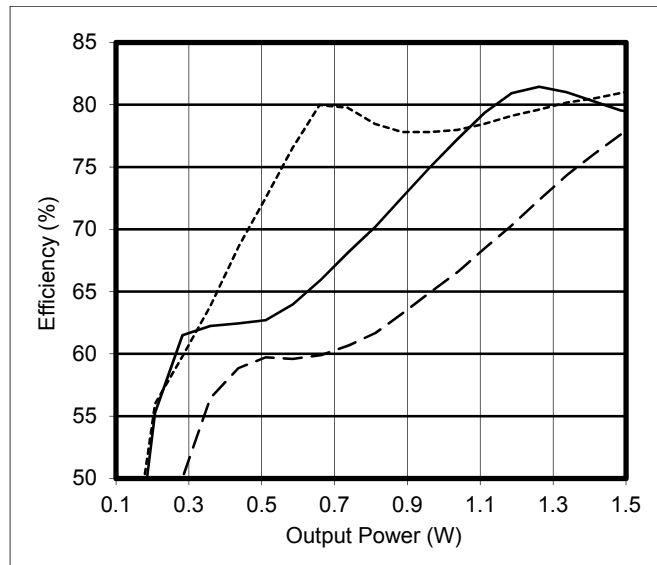


Figure 9 – DVCH2815D
Efficiency (%) vs. Output Power (W)

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

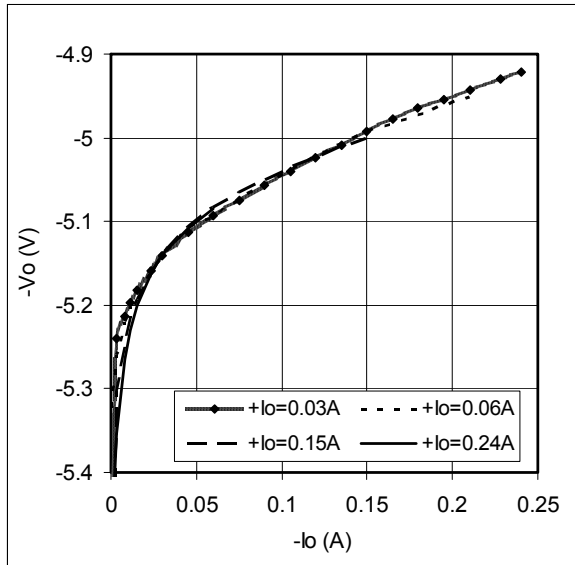
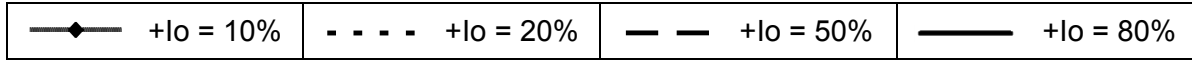


Figure 10 – DVCH2805D
-Vout (V) vs. -Iout (A)

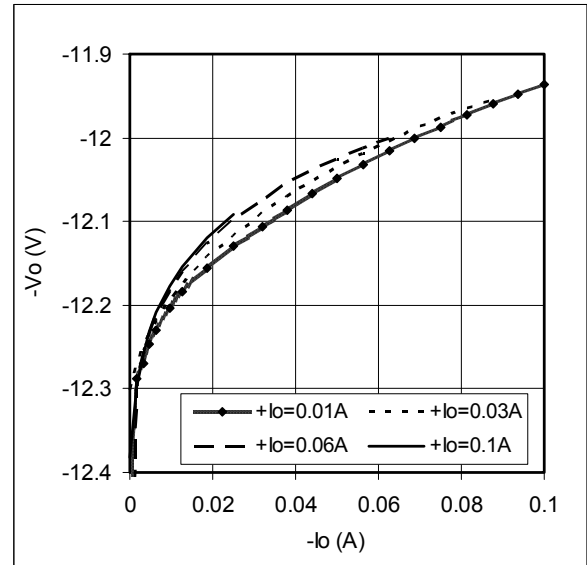


Figure 11 – DVCH2812D
-Vout (V) vs. -Iout (A)

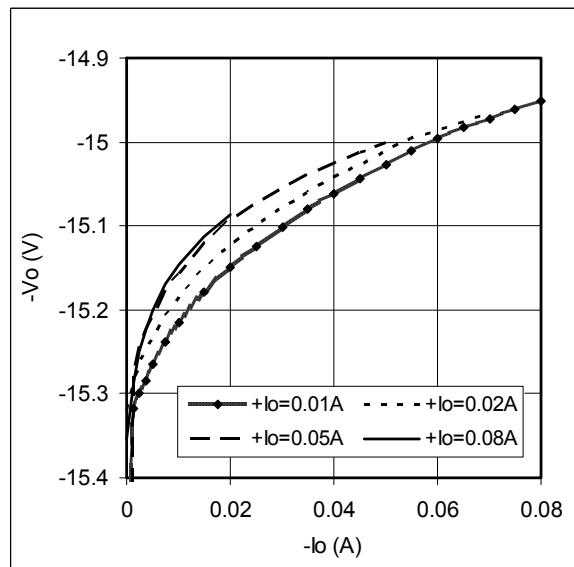


Figure 12 – DVCH2815D
-Vout (V) vs. -Iout (A)

EMI PERFORMANCE CURVES

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

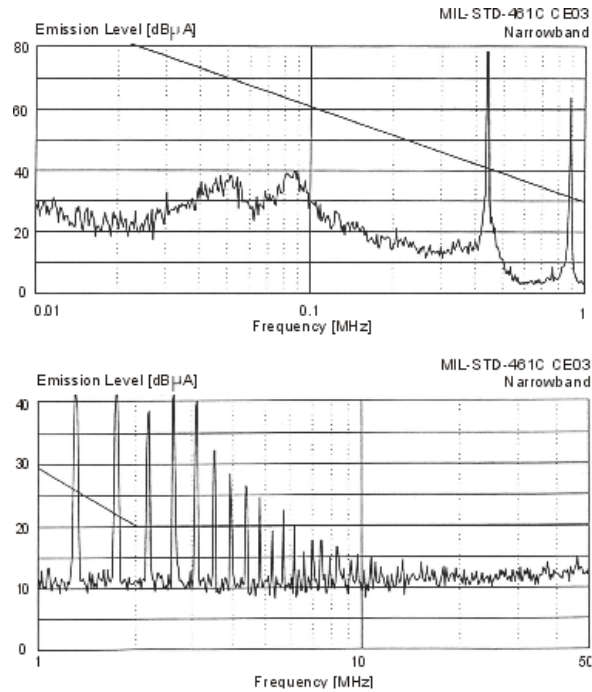


Figure 13 – DVCH2800D without EMI Filter

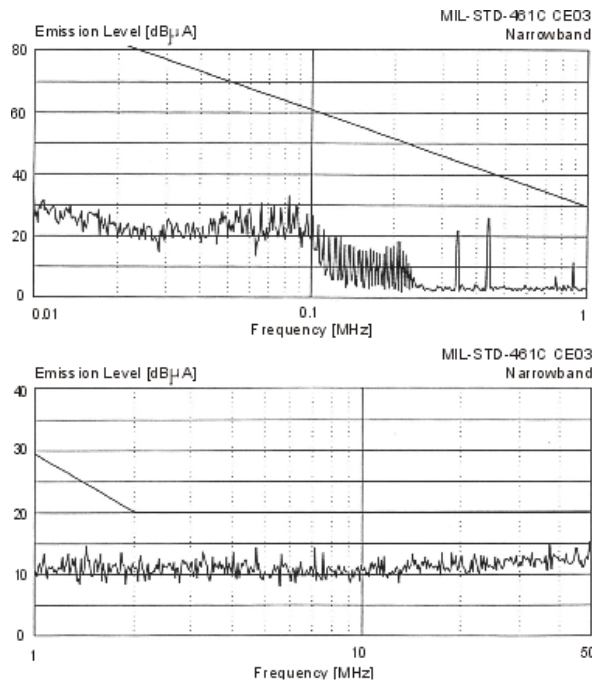
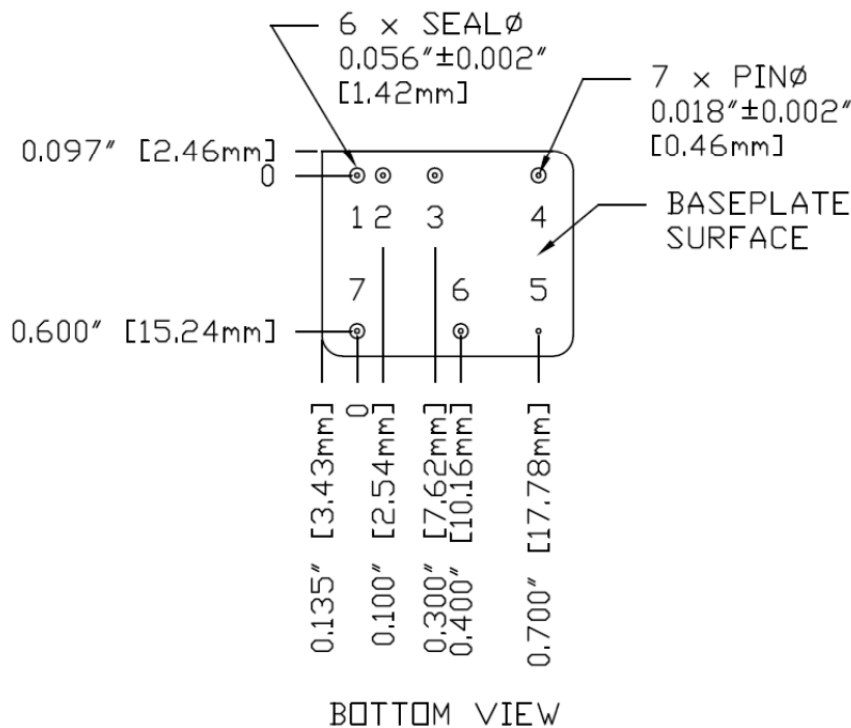
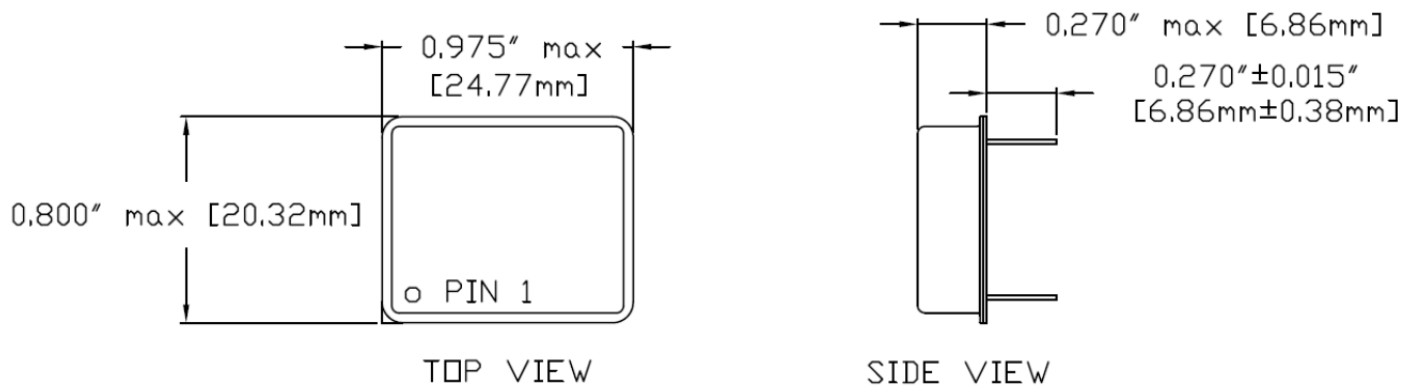


Figure 14 – DVCH2800D with EMI Filter

PACKAGE SPECIFICATIONS



NOTES:

1. DIMENSIONAL LIMITS ARE ± 0.005 " UNLESS OTHERWISE STATED.
2. CASE TEMPERATURE IS MEASURED ON THE CENTER OF THE BASEPLATE.
3. MATERIALS:
CASE: STEEL, GOLD OVER NICKEL PLATED.
COVER: STEEL, NICKEL PLATED.
PINS: ALLOY 52, GOLD OVER NICKEL PLATED.
PIN SEALS: GLASS

| Pin | Function | Pin | Function |
|-----|----------|-----|----------|
| 1 | 28V IN | 5 | CASE |
| 2 | IN COM | 6 | -V OUT |
| 3 | +V OUT | 7 | INHIBIT |
| 4 | OUT COM | | |

Figure 15 – Package and Pinout

PACKAGE PIN DESCRIPTION

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

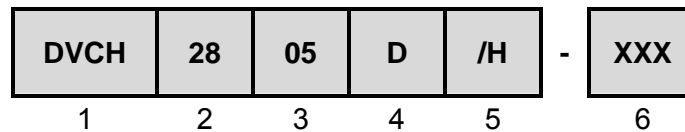
ENVIRONMENTAL SCREENING (100% Tested Per MIL-STD-883 as referenced to MIL-PRF-38534)

| Test | MIL-STD-883 Test Method, Condition | No Suffix (Standard) Non-QML ⑤ | /ES (Extended) Non-QML ⑤ | /H (Class H) | /K (Class K) |
|---------------------------|---|--------------------------------|--------------------------|--------------|--------------|
| 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 | | • | • | • |
| | TM1014, Gross Leak, Condition C | | • | • | • |
| | Gross Leak, Dip (1 x 10 ⁻³) | • | | | |
| Radiography ⑧ | TM2012 | | | | • |
| External Visual | TM2009 | • | • | • | • |

Notes:

- ① Contact Sales for more information concerning additional environmental screening and testing options desired.
- 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.
- ③ 100% R&R testing with all test data included in product shipment.
- ④ Not required per MIL-PRF-38534. Test is performed for additional product quality assurance.
- ⑤ Non-QML products may not meet all requirements of MIL-PRF-38534.
- ⑥ Note intentionally not used.
- ⑦ PIND test Certificate of Compliance included in product shipment.
- ⑧ Radiographic test Certificate of Compliance and film(s) or data CD included in product shipment.

ORDERING INFORMATION



| (1) Product Series | (2) Nominal Input Voltage | | (3) Output Voltage | |
|-----------------------|------------------------------|----------|-------------------------------------|---------------------------------|
| DVCH | 28 | 28 Volts | 05 12 15 | 5 Volts 12 Volts 15 Volts |

| (4) Number of Outputs | | (5) Screening Code ¹ | | (6) Additional Screening Code |
|--------------------------|------|---|--|----------------------------------|
| D | Dual | None /ES /H /K | Standard Extended Class H Class K | Contact Sales |

Notes: 1. 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) | DVCH2800D Series Similar Part Number |
|-------------------------------------|--------------------------------------|
| 5962-0924301HXC 5962-0924301KXC | DVCH2805D/H DVCH2805D/K |
| 5962-0924302HXC 5962-0924302KXC | DVCH2812D/H DVCH2812D/K |
| 5962-0924303HXC 5962-0924303KXC | DVCH2815D/H DVCH2815D/K |

Do not use the DVCH2800D 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 DLA Land and Maritime (Previously known as DSCC) website at <http://www.dsccl.dla.mil/programs/smcr/>. The SMD number listed above is 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. 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@vpt-inc.com

All information contained in this datasheet is believed to be accurate, however, no responsibility is assumed for possible errors or omissions. The products or specifications contained herein are subject to change without notice.