DVETR2800D Series

HIGH RELIABILITY HYBRID DC-DC CONVERTERS WITH INTEGRAL EMI FILTER

DESCRIPTION

The DVETR 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 DVETR 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 500 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: 15 to 50 Volts per MIL-STD-704
- Up to 40 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: > 30 W/in^3
- Custom Versions Available
- Additional Environmental Screening Available
- No External EMI Filter Required
- Meets MIL-STD-461 Revisions C, D, E and F EMC Requirements When Used With VPT's EMI Filters
- Protects Against Conducted Susceptibility Specified in MIL-STD-461C, CS01 and CS02
- Flanged and Non-flanged Versions Available
- MIL-PRF-38534 Element Evaluated Components

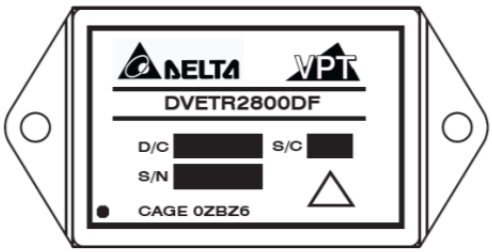


Figure 1 – DVETR2800D / DVETR2800DF DC-DC Converter
(Exact marking may differ from that shown)

11314 4th Avenue
West, Suite 206
Everett, WA 98204
http://www.vpt-inc.com

Sales Information:
Phone: (425) 353-3010
Fax: (425) 353-4030
E-mail: vptsales@vpt-inc.com

SPECIFICATIONS (T_{CASE} = -55°C to +125°C, V_{IN} = +28V ± 5%, Full Load[5], 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]	40 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, T_{CASE} = +125°C)	14 Watts	Weight (Maximum) (Un-Flanged / Flanged)	(56 / 60) Grams

Parameter		Conditions	DVETR2805D			DVETR2812D			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
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	-	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	4.80	5.0	5.20	11.80	12.0	12.20	V
	$-V_{OUT}$	T_{CASE} = -55°C to +125°C	4.70	5.0	5.30	11.64	12.0	12.36	V
Power[3,6]	Total		0	-	30	0	-	40	W
	$\pm V_{OUT}$	Either Output	0	-	21	0	-	28	W
Current[3,6]	$\pm V_{OUT}$	Either Output	0	-	4.2	0	-	2.33	A
Ripple Voltage	$\pm V_{OUT}$	Full Load[5], 20Hz to 10MHz	-	-	60	-	-	50	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	$+V_{OUT}$	No Load to Full Load[5]	-	-	50	-	-	50	mV
	$-V_{OUT}$	No Load to Full Load[5]	-	-	200	-	-	200	mV
Cross Regulation	$-V_{OUT}$	+Load 70%, -Load 30% +Load 30%, -Load 70%	-	-	650	-	-	650	mV
EFFICIENCY		Full Load[5]	70	-	-	74	-	-	%
LOAD FAULT POWER DISSIPATION		Overload[4]	-	-	16	-	-	14	W
		Short Circuit	-	-	16	-	-	14	W
CAPACITIVE LOAD[4]		Either Output	-	-	500	-	-	500	µF
SWITCHING FREQUENCY			400	500	550	400	500	550	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°C to +125°C, V_{IN} = +28V ± 5%, Full Load[5], 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]	40 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, T_{CASE} = +125°C)	14 Watts	Weight (Maximum) (Un-Flanged / Flanged)	(56 / 60) Grams

Parameter		Conditions	DVETR2805D			DVETR2812D			Units
			Min	Typ	Max	Min	Typ	Max	
DYNAMIC									
Load Step Output Transient	±V_{OUT}	Half Load to Full Load	-	-	500	-	-	600	mV_{PK}
Load Step Recovery[2]			-	-	350	-	-	400	µSec
Line Step Output Transient[4]	±V_{OUT}	V_{IN} = 16V to 40V	-	150	600	-	850	1200	mV_{PK}
Line Step Recovery[2, 4]			-	150	500	-	300	500	µSec
Turn On Delay	±V_{OUT}	V_{IN} = 0V to 28V	-	-	20	-	-	20	mSec
Turn On Overshoot			-	-	50	-	-	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°C to +125°C, V_{IN} = +28V ± 5%, Full Load[5], 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]	40 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, T_{CASE} = +125°C)	14 Watts	Weight (Maximum) (Un-Flanged / Flanged)	(56 / 60) Grams

Parameter		Conditions	DVETR2815D			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
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	14.70	15.0	15.30	V
	$-V_{OUT}$	T_{CASE} = 25°C	14.70	15.0	15.30	V
	$-V_{OUT}$	T_{CASE} = -55°C to +125°C	14.55	15.0	15.45	V
Power[3,6]	Total		-	-	40	W
	$\pm V_{OUT}$	Either Output	-	-	28	W
Current[3,6]	$\pm V_{OUT}$	Either Output	-	-	1.87	A
Ripple Voltage	$\pm V_{OUT}$	Full Load[5], 20Hz to 10MHz	-	-	50	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	$+V_{OUT}$	No Load to Full Load[5]	-	-	50	mV
	$-V_{OUT}$	No Load to Full Load[5]	-	-	200	mV
Cross Regulation	$-V_{OUT}$	+Load 70%, -Load 30% +Load 30%, -Load 70%	-	-	650	mV
EFFICIENCY		Full Load[5]	75	-	-	%
LOAD FAULT POWER DISSIPATION		Overload[4]	-	-	14	W
		Short Circuit	-	-	14	W
CAPACITIVE LOAD[4]		Either Output	-	-	500	µF
SWITCHING FREQUENCY			400	500	550	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°C to +125°C, V_{IN} = +28V ± 5%, Full Load[5], 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]	40 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, T_{CASE} = +125°C)	14 Watts	Weight (Maximum) (Un-Flanged / Flanged)	(56 / 60) Grams

Parameter		Conditions	DVETR2815D			Units
			Min	Typ	Max	
DYNAMIC						
Load Step Output Transient	±V_{OUT}	Half Load to Full Load	-	-	600	mV_{PK}
Load Step Recovery[2]			-	-	300	µSec
Line Step Output Transient[4]	±V_{OUT}	V_{IN} = 16V to 40V	-	850	1200	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

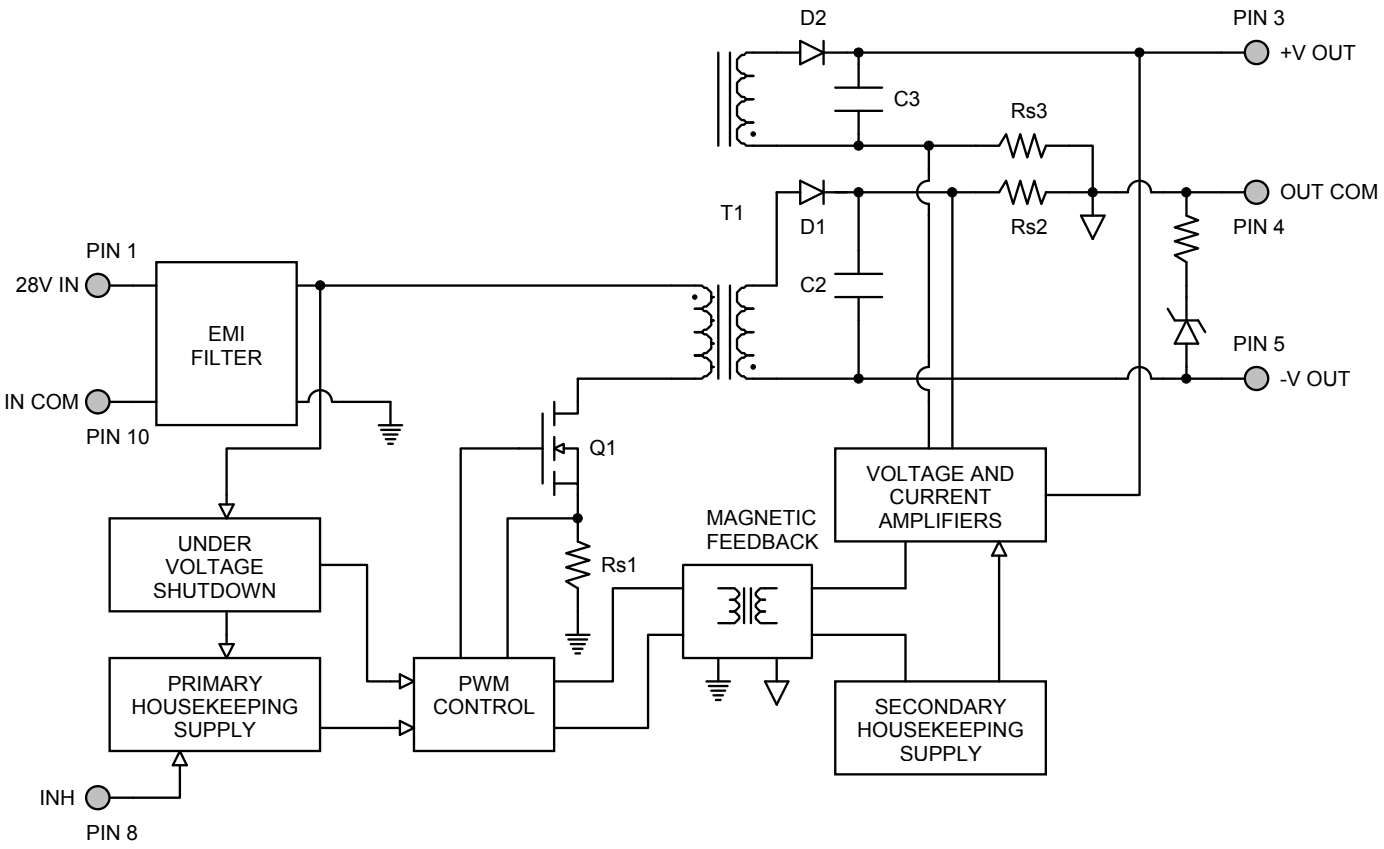


Figure 2

CONNECTION DIAGRAM

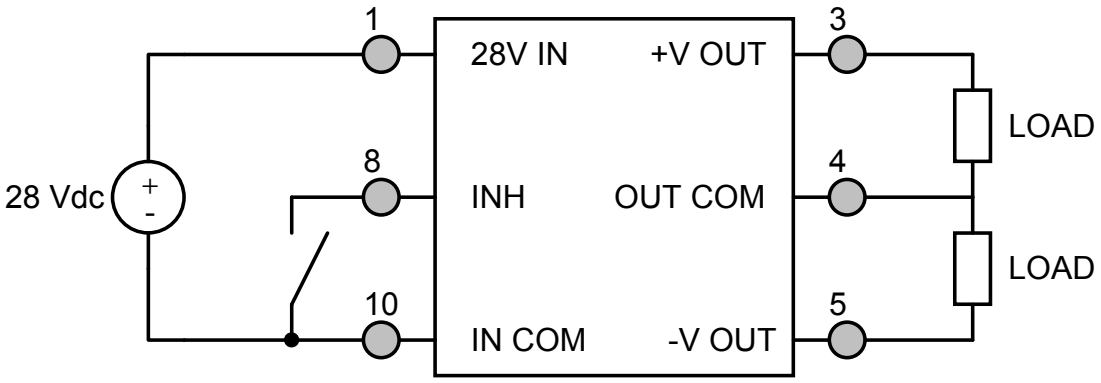


Figure 3

INHIBIT DRIVE CONNECTION DIAGRAMS

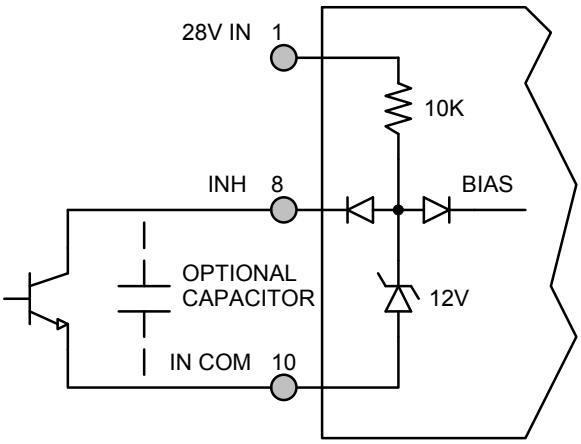


Figure 4 – Internal Inhibit Circuit and Recommended Drive
(Shown with optional capacitor for turn-on delay)

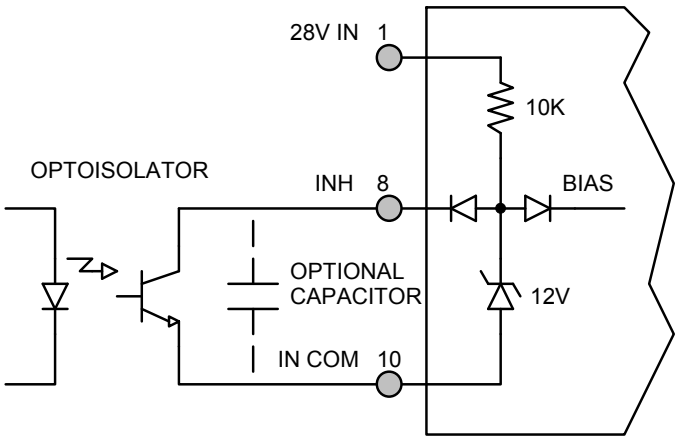


Figure 5 – Isolated Inhibit Drive
(Shown with optional capacitor for turn-on delay)

EFFICIENCY PERFORMANCE CURVES (T_{CASE} = 25°C, Full Load, Unless Otherwise Specified)

V_{IN} = 16V	V_{IN} = 28V	V_{IN} = 40V

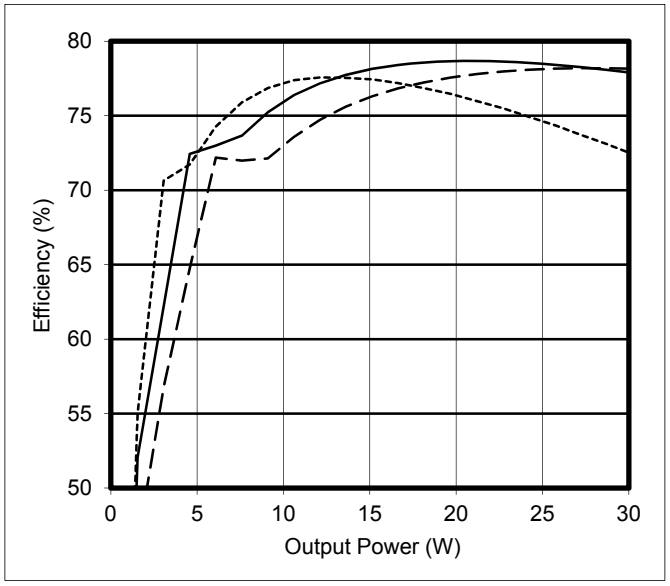


Figure 6 – DVETR2805D
Efficiency (%) vs. Output Power (W)

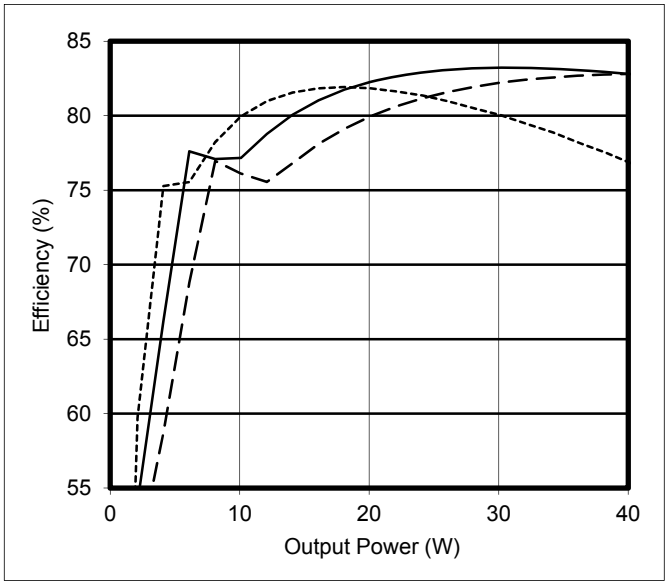


Figure 7 – DVETR2812D
Efficiency (%) vs. Output Power (W)

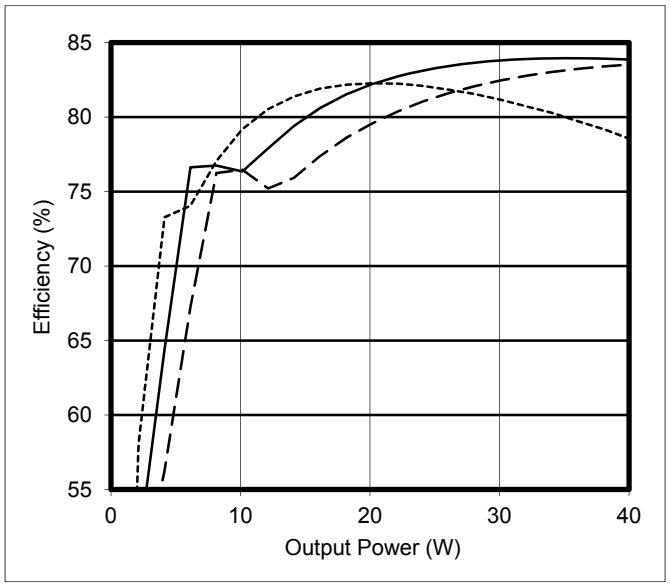


Figure 8 – DVETR2815D
Efficiency (%) vs. Output Power (W)

CROSS REGULATION CURVES (T_{CASE} = 25°C, Full Load, Unless Otherwise Specified)

+Io = 10%	+Io = 30%	+Io = 50%	+Io = 70%

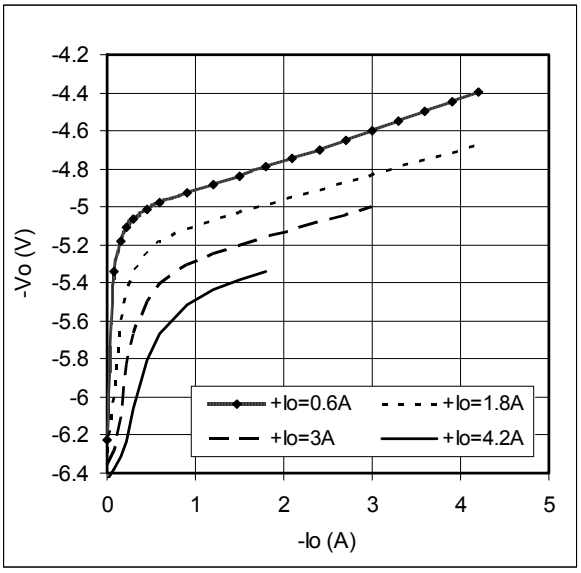


Figure 9 – DVETR2805D

-Vout (V) vs. -Iout (A)

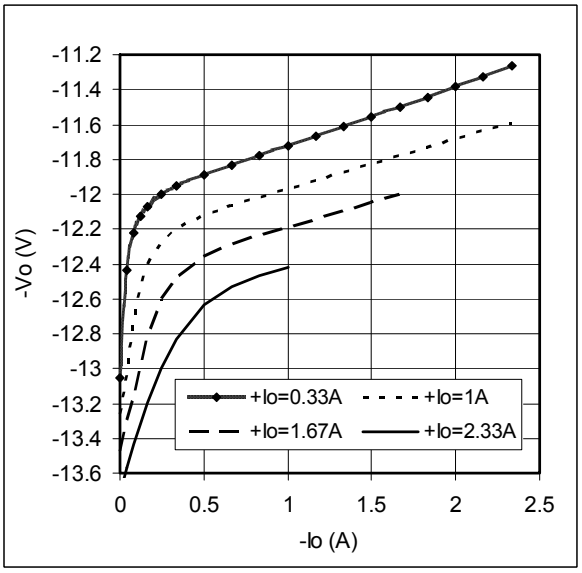


Figure 10 – DVETR2812D

-Vout (V) vs. -Iout (A)

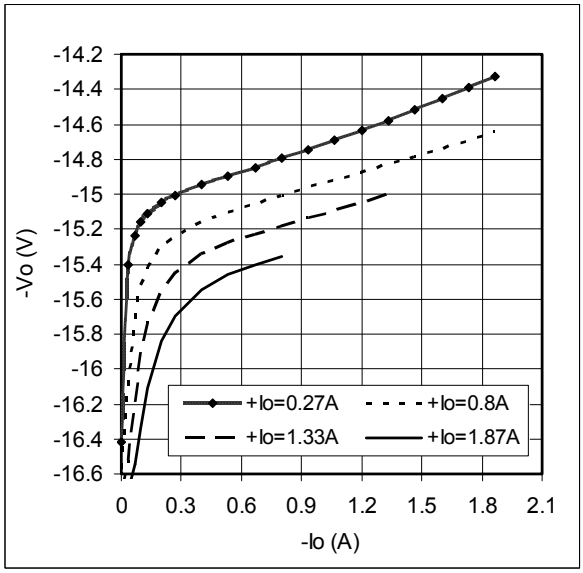


Figure 11 – DVETR2815D

-Vout (V) vs. -Iout (A)

EMI PERFORMANCE CURVES

(T_{CASE} = 25°C, V_{IN} = +28V ± 5%, Full Load, Unless Otherwise Specified)

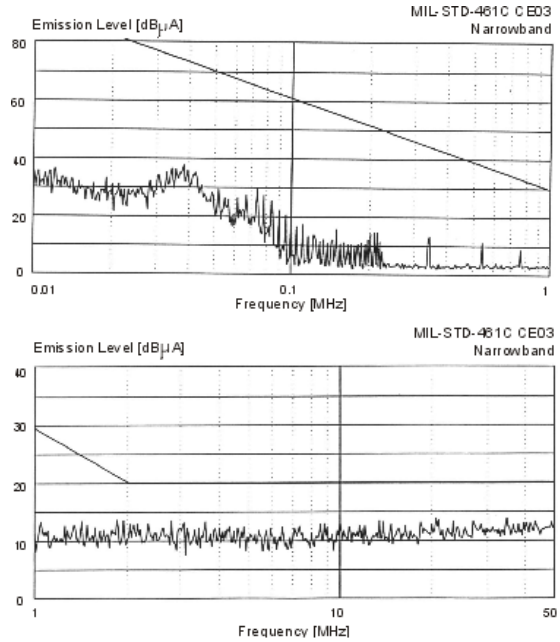


Figure 12 – MIL-STD-461C
DVETR2800D

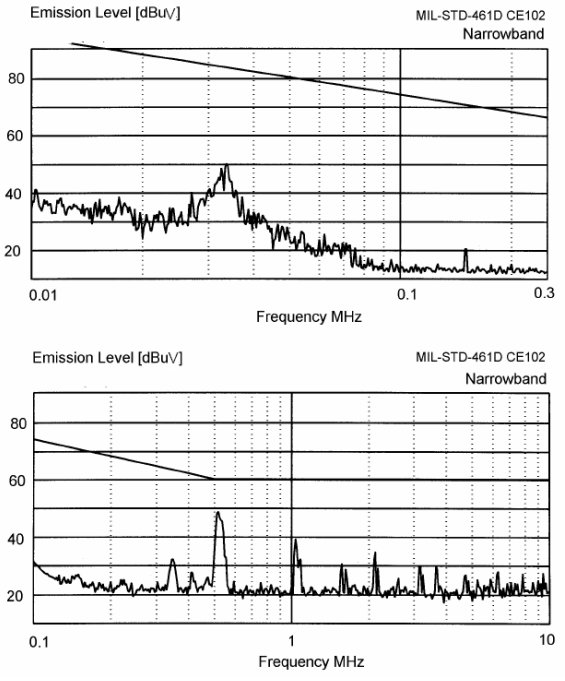
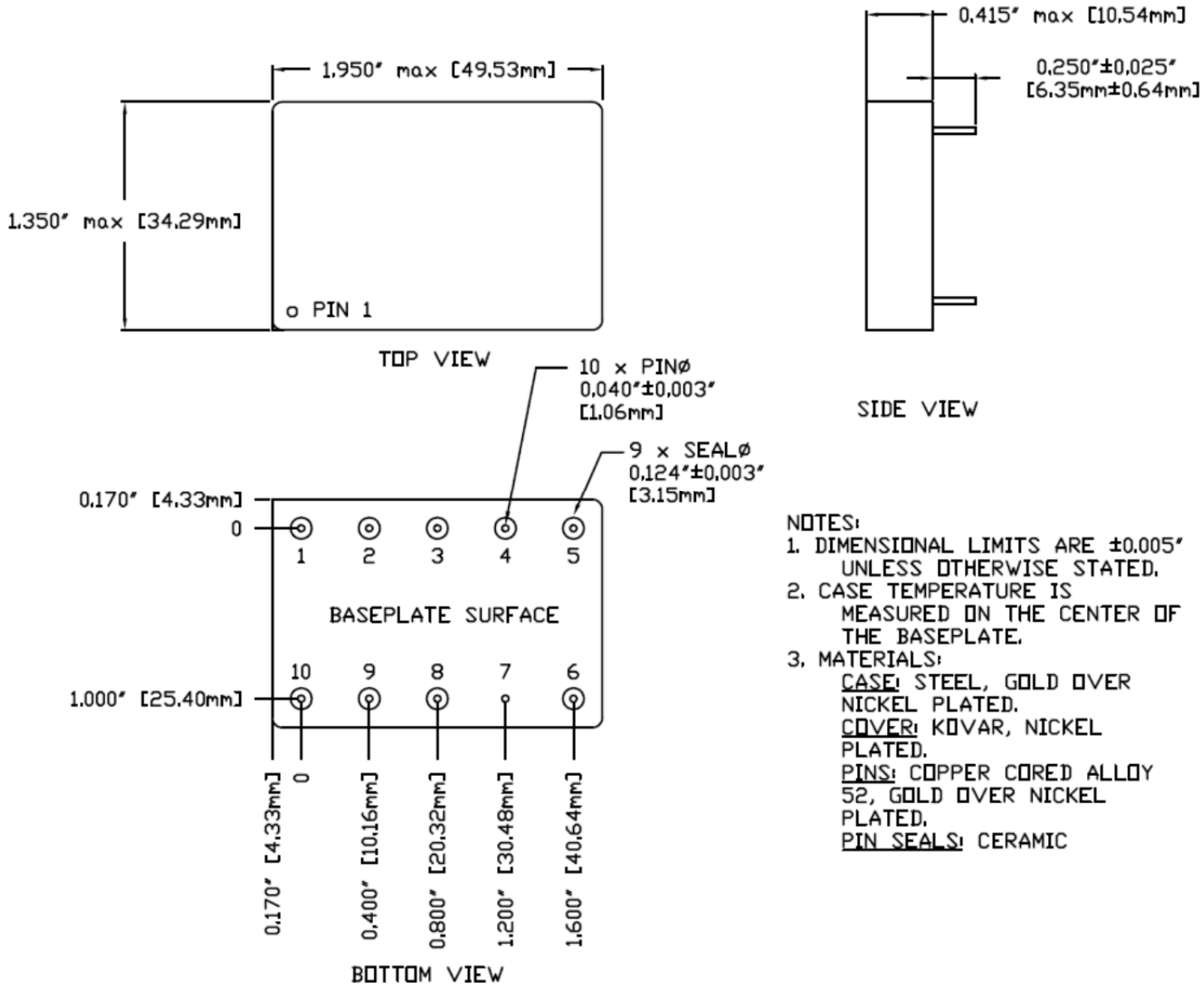


Figure 13 – MIL-STD-461D
DVETR2800D

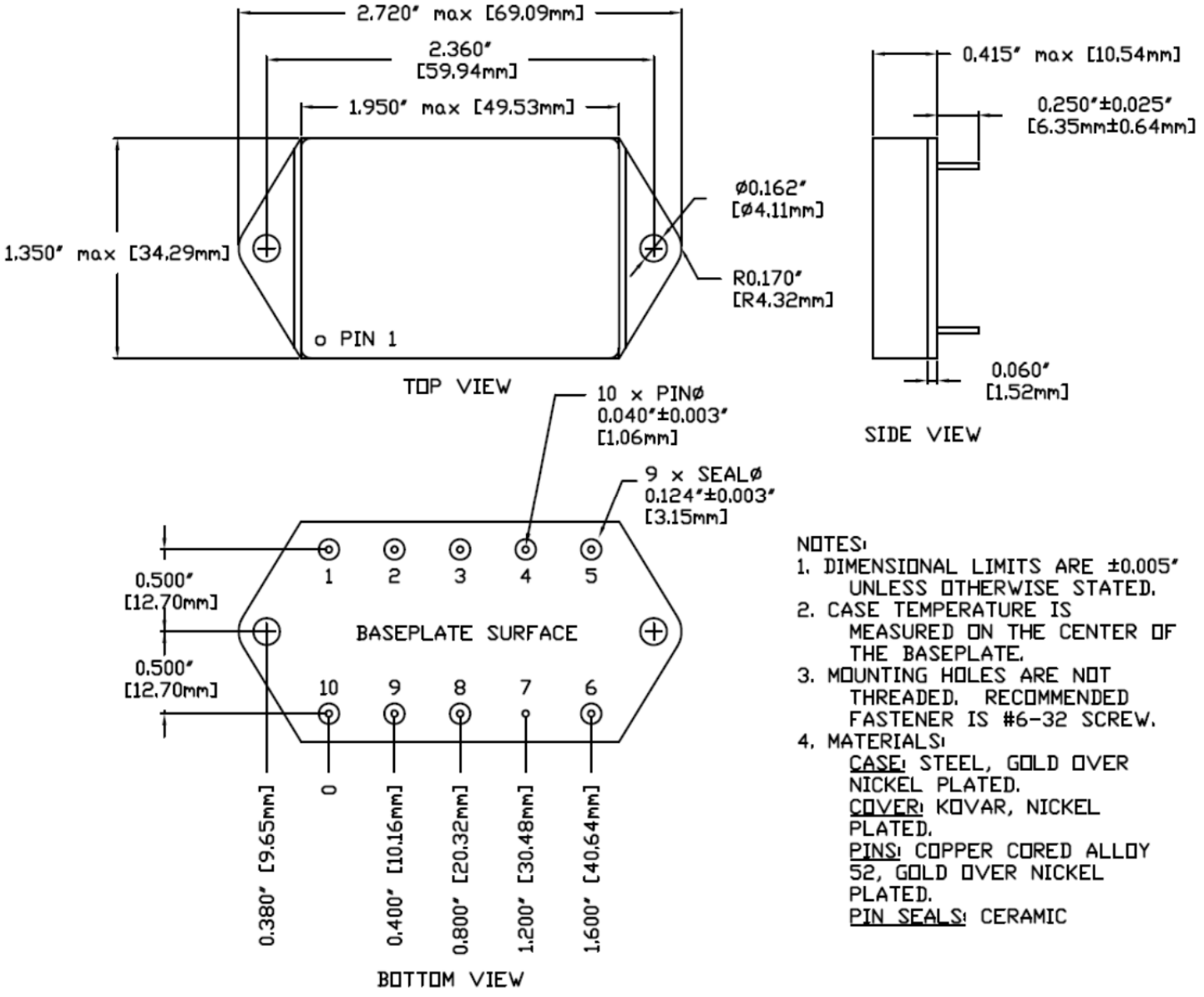
PACKAGE SPECIFICATIONS (NON-FLANGED, SEAM SEAL)



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

Figure 14 – Non-Flanged, Seam Seal Package and Pinout

PACKAGE SPECIFICATIONS (FLANGED, SEAM SEAL)



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

Figure 15 – Flanged, Seam Seal Package and Pinout

PACKAGE PIN DESCRIPTION

Pin	Function	Description
1	28V IN	Positive Input Voltage Connection
2	N/C	No Connection
3	+V OUT	Positive Output Voltage Connection
4	OUT COM	Output Common Connection
5	-V OUT	Negative Output Voltage Connection
6	N/C	No 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	N/C	No Connection
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

DVETR	28	05	D	F	/HB	-	XXX
1	2	3	4	5	6		7

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

Product Series	Nominal Input Voltage		Output Voltage		Number of Outputs	
DVETR	**28**	28 Volts	**05** **12** **15**	± 5 Volts ± 12 Volts ± 15 Volts	**D**	Dual

(5) (6) (7)

Package Option		Screening Code[1]		Additional Screening Code
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)	DVETR2800D Series Similar Part Number
*T.B.D.	DVETR2805D/H DVETR2805DF/H
*T.B.D.	DVETR2812D/H DVETR2812DF/H
*T.B.D.	DVETR2815D/H DVERT2815DF/H

Do not use the DVETR2800D 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.dscc.dla.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. 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