DVHF2800D Series

HIGH RELIABILITY HYBRID DC-DC CONVERTERS

DESCRIPTION

The DVHF 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 DVHF series is a magnetic feedback circuit that is radiation immune. Operating at a nominal fixed frequency of 450 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 20 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 Projection Welded Hermetic Package
- High Power Density: > 37 W/in^3
- Custom Versions Available
- Additional Environmental Screening Available
- Meets MIL-STD-461C and MIL-STD-461D EMC Requirements When Used With a DVMH28 EMI Filter
- Flanged and Non-flanged Versions Available.
- MIL-PRF-38534 Element Evaluated Components

Figure 1 – DVHF2800D / DVHF2800DF DC-DC Converter
(Not To Scale)

11314 4th Avenue
West, Suite 206

Sales Information:
Phone: (425) 353-3010

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	+12°C
Input Voltage (Transient, 1 second)	80 Volts	Storage Temperature	-65°C to +150°C
Output Power[1]	20 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, T_{CASE} = +125°C)	6 Watts	Weight (Maximum) (Un-Flanged / Flanged)	(24 / 28) Grams

Parameter		Conditions	DVHF2805D			DVHF2812D			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	-	40	65	-	40	65	mA
Ripple Current		Full Load[5], 20Hz to 10MHz	-	-	60	-	-	90	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	4.80	5.0	5.20	11.80	12.0	12.20	V
	$-V_{OUT}$	T_{CASE} = -55°C to +125°C	4.75	5.0	5.25	11.52	12.0	12.48	V
Power[3,6]	Total		0	-	15	0	-	20	W
	$\pm V_{OUT}$	Either Output	0	-	10.5	0	-	14	W
Current[3,6]	$\pm V_{OUT}$	Either Output	0	-	2.1	0	-	1.17	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[5,7]	-	-	200	-	-	200	mV
Cross Regulation	$-V_{OUT}$	$+V_{OUT}$ = 70%, $-V_{OUT}$ = 30% $+V_{OUT}$ = 30%, $-V_{OUT}$ = 70%	-	-	500	-	-	500	mV
EFFICIENCY		Full Load[5]	73	-	-	78	-	-	%
LOAD FAULT POWER DISSIPATION		Overload[4]	-	-	8	-	-	8	W
		Short Circuit	-	-	8	-	-	8	W
CAPACITIVE LOAD[4]		Either Output	-	-	500	-	-	500	µF
SWITCHING FREQUENCY			350	450	500	350	450	500	kHz
ISOLATION		500 V_{DC}, T_{CASE} = 25°C	100	-	-	100	-	-	MΩ
MTBF (MIL-HDBK-217F)		AIF @ T_C = 55°C	-	427	-	-	427	-	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	+12°C
Input Voltage (Transient, 1 second)	80 Volts	Storage Temperature	-65°C to +150°C
Output Power[1]	20 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, T_{CASE} = +125°C)	6 Watts	Weight (Maximum) (Un-Flanged / Flanged)	(24 / 28) Grams

Parameter		Conditions	DVHF2805D			DVHF2812D			Units
			Min	Typ	Max	Min	Typ	Max	
DYNAMIC									
Load Step Output Transient	$\pm V_{OUT}$	Half Load to Full Load	-	-	400	-	-	400	mV_{PK}
Load Step Recovery[2]			-	-	500	-	-	500	µSec
Line Step Output Transient[4]	$\pm V_{OUT}$	V_{IN} = 16V to 40V	-	400	800	-	500	900	mV_{PK}
Line Step Recovery[2, 4]			-	300	700	-	300	500	µSec
Turn On Delay	$\pm V_{OUT}$	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.
7. 5% Load to Full Load at -55°C.

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	+12°C
Input Voltage (Transient, 1 second)	80 Volts	Storage Temperature	-65°C to +150°C
Output Power[1]	20 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, T_{CASE} = +125°C)	6 Watts	Weight (Maximum) (Un-Flanged / Flanged)	(24 / 28) Grams

Parameter		Conditions	DVHF2815D			Units
			Min	Typ	Max	
STATIC						
INPUT Voltage[4]		Continuous	15	28	50	V
		Transient, 1 sec	-	-	80	V
Current		Inhibited	-	-	6	mA
		No Load	-	40	65	mA
Ripple Current		Full Load[5], 20Hz to 10MHz	-	-	90	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	14.80	15.0	15.20	V
	$-V_{OUT}$	T_{CASE} = -55°C to +125°C	14.40	15.0	15.60	V
Power[3,6]	Total		-	-	20	W
	$\pm V_{OUT}$	Either Output	-	-	14	W
Current[3,6]	$\pm V_{OUT}$	Either Output	-	-	0.93	A
Ripple Voltage	$\pm V_{OUT}$	Full Load[5], 20Hz to 10MHz	-	-	60	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[5,7]	-	-	200	mV
Cross Regulation	$-V_{OUT}$	$+V_{OUT}$ = 70%, $-V_{OUT}$ = 30% $+V_{OUT}$ = 30%, $-V_{OUT}$ = 70%	-	-	500	mV
EFFICIENCY		Full Load[5]	79	-	-	%
LOAD FAULT POWER DISSIPATION		Overload[4]	-	-	8	W
		Short Circuit	-	-	8	W
CAPACITIVE LOAD[4]		Either Output	-	-	500	µF
SWITCHING FREQUENCY			350	450	500	kHz
ISOLATION		500 V_{DC}, T_{CASE} = 25°C	100	-	-	MΩ
MTBF (MIL-HDBK-217F)		AIF @ T_C = 55°C	-	427	-	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	+12°C
Input Voltage (Transient, 1 second)	80 Volts	Storage Temperature	-65°C to +150°C
Output Power[1]	20 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, T_{CASE} = +125°C)	6 Watts	Weight (Maximum) (Un-Flanged / Flanged)	(24 / 28) Grams

Parameter		Conditions	DVHF2815D			Units
			Min	Typ	Max	
DYNAMIC						
Load Step Output Transient	±V_{OUT}	Half Load to Full Load	-	-	400	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.
7. 5% Load to Full Load at -55°C.

BLOCK DIAGRAM

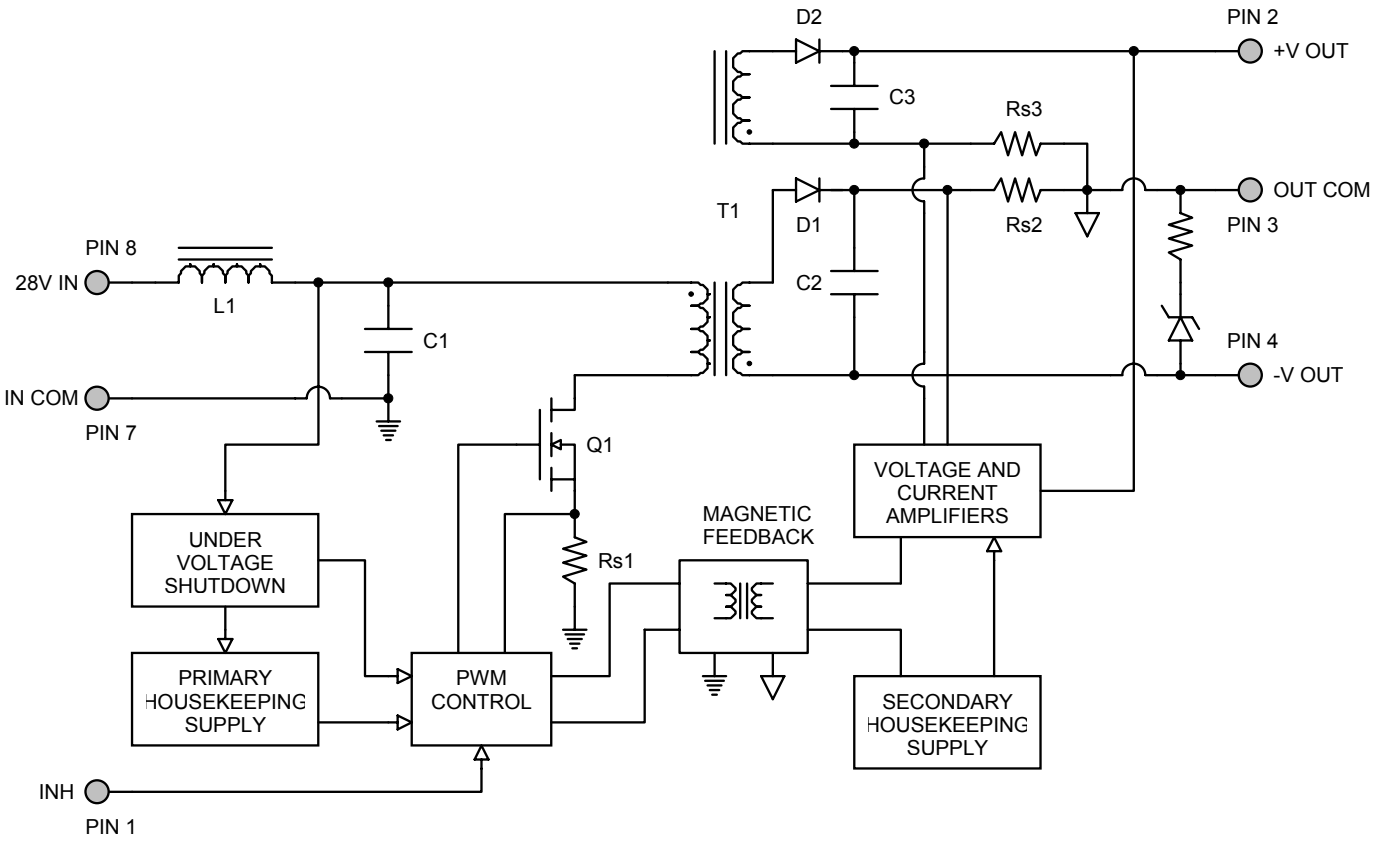


Figure 2

CONNECTION DIAGRAM

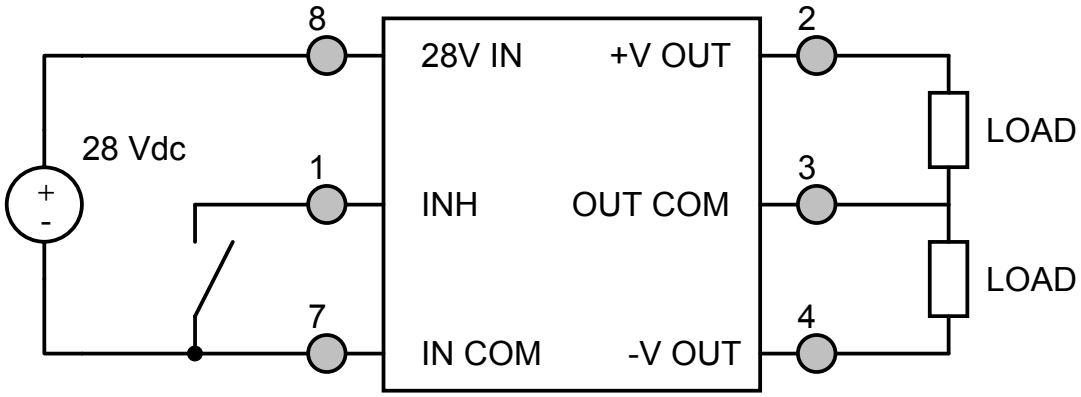


Figure 3

INHIBIT DRIVE CONNECTION DIAGRAMS

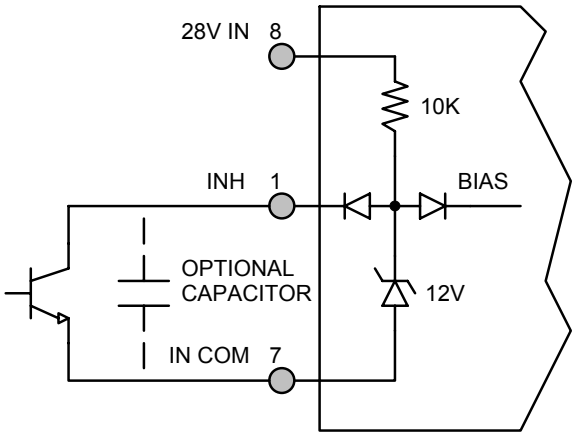


Figure 4 – Internal Inhibit Circuit and Recommended Drive
(Shown with optional capacitor for turn-on delay)

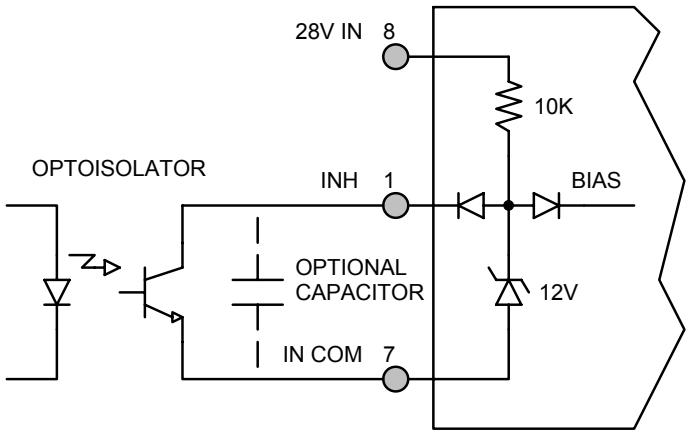


Figure 5 – Isolated Inhibit Drive
(Shown with optional capacitor for turn-on delay)

EMI FILTER HOOKUP DIAGRAM

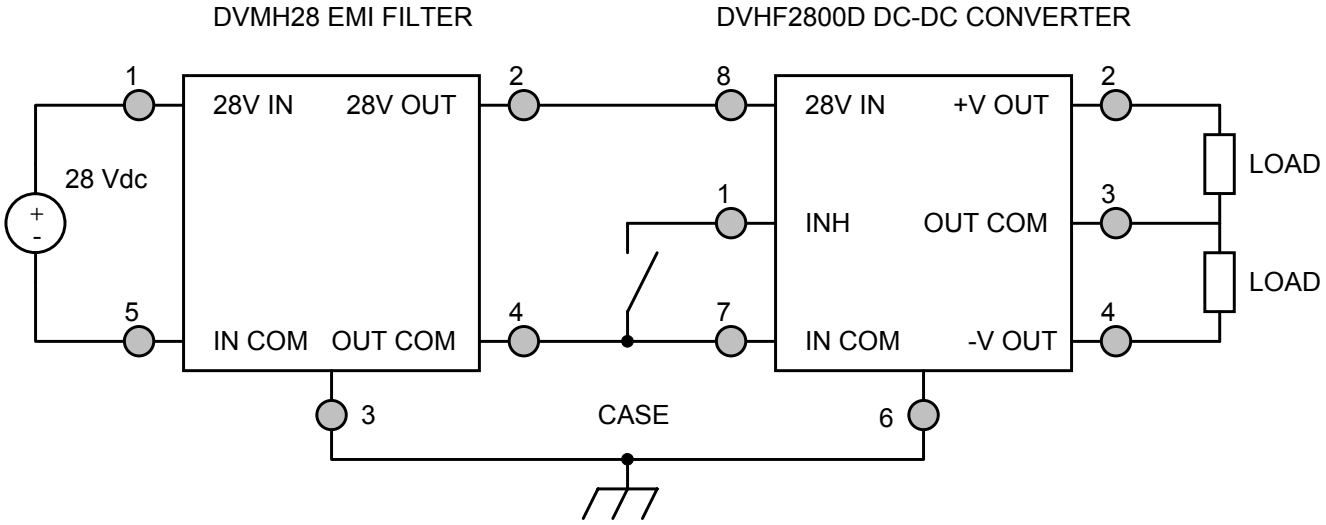


Figure 6 – Converter with EMI Filter

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

------- V_{IN} = 16V	——— V_{IN} = 28V	– – – – – V_{IN} = 40V

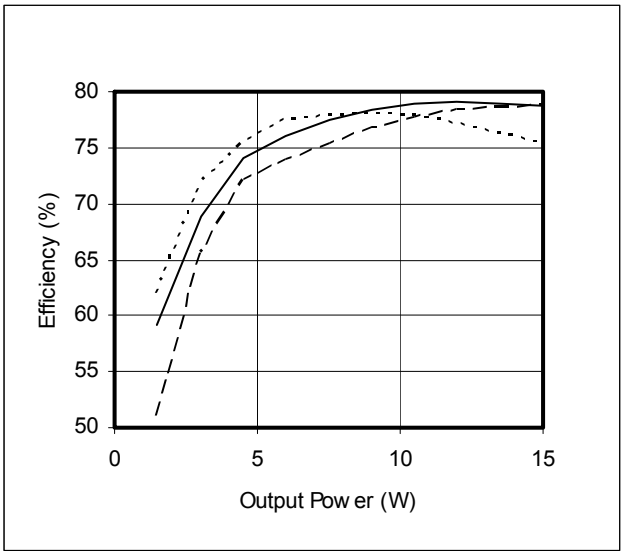


Figure 7 – DVHF2805D
Efficiency (%) vs. Output Power (W)

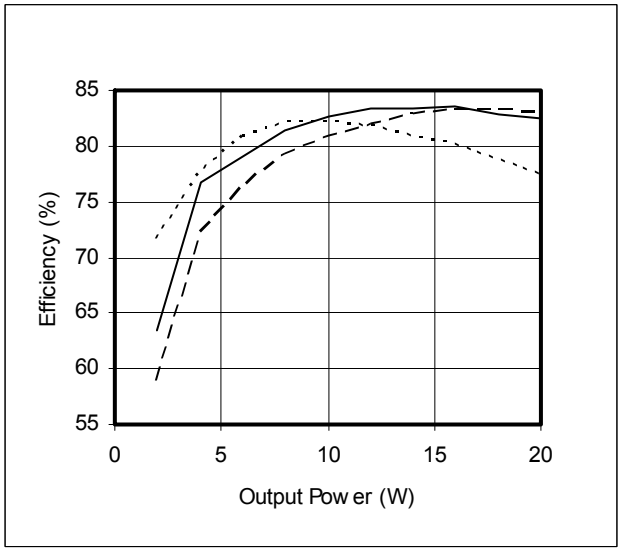


Figure 8 – DVHF2812D
Efficiency (%) vs. Output Power (W)

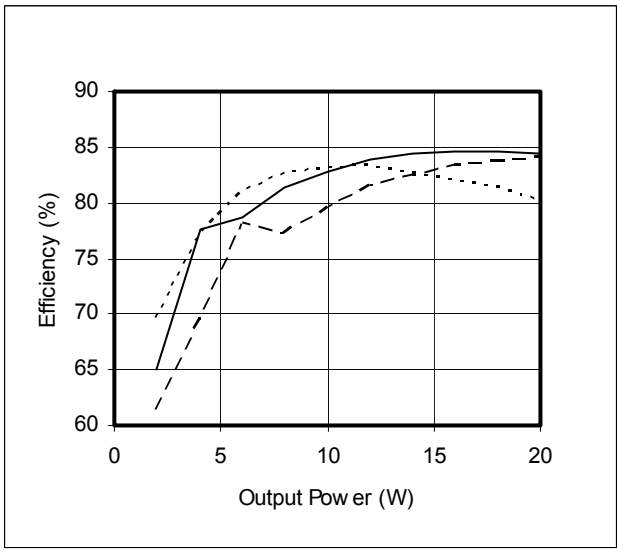


Figure 9 – DVHF2815D
Efficiency (%) vs. Output Power (W)

EMI PERFORMANCE CURVES

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

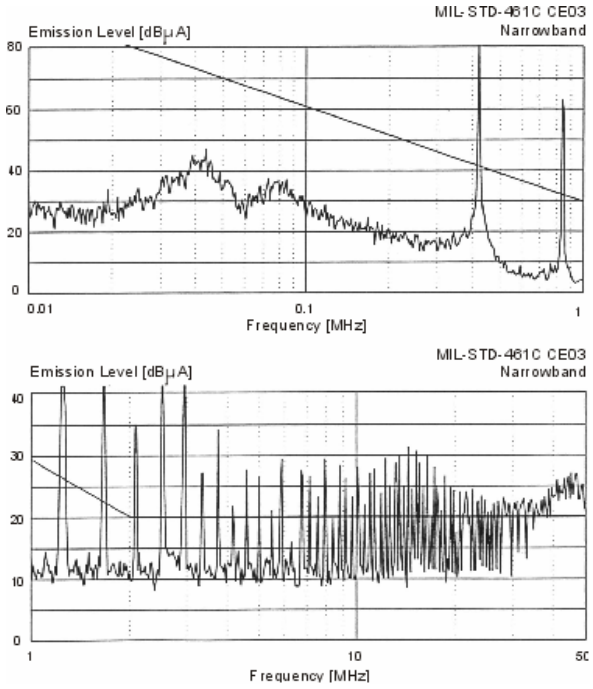


Figure 10 – DVHF2800D <u>without</u> EMI Filter

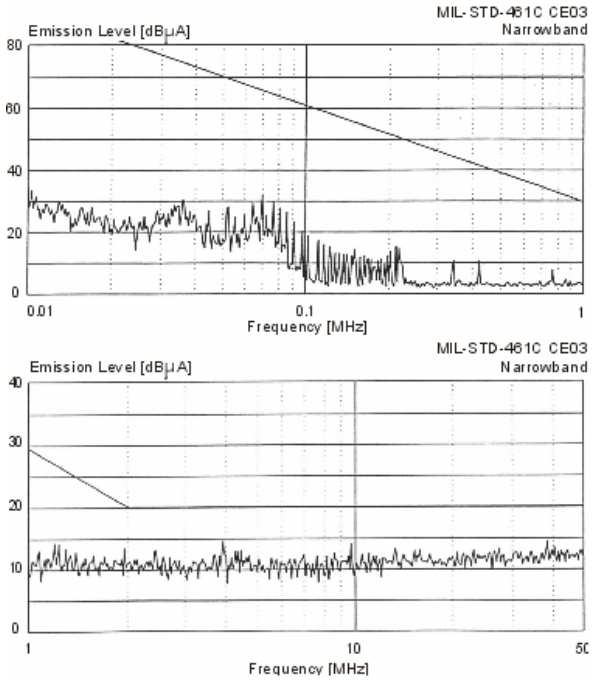
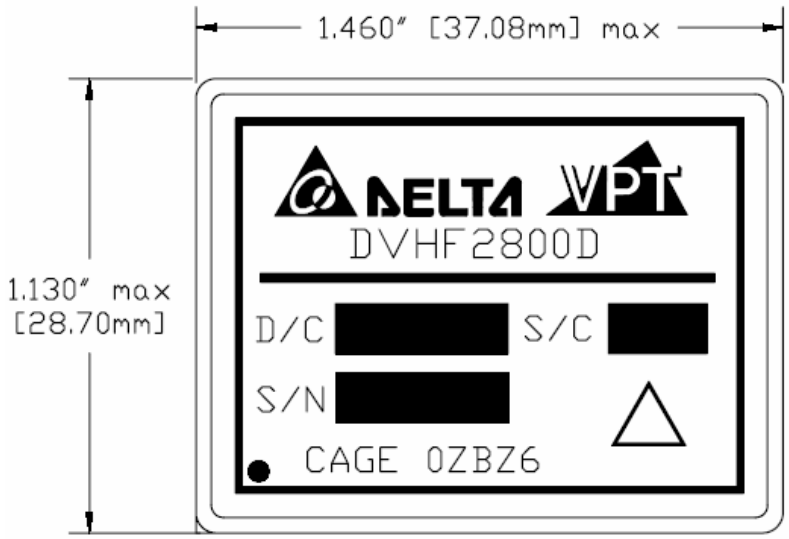
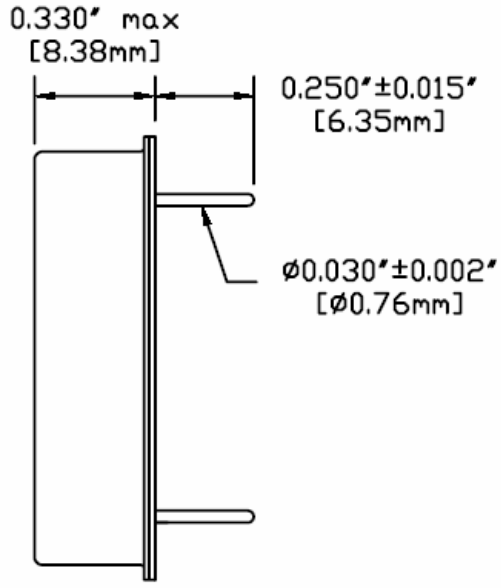


Figure 11 – DVHF2800D <u>with</u> EMI Filter

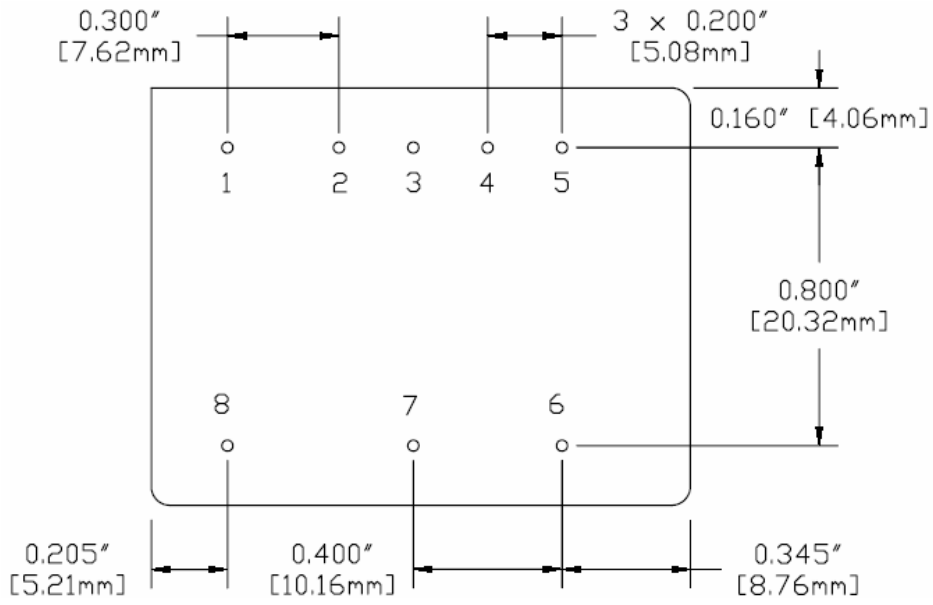
PACKAGE SPECIFICATIONS (NON-FLANGED)



TOP VIEW



SIDE VIEW

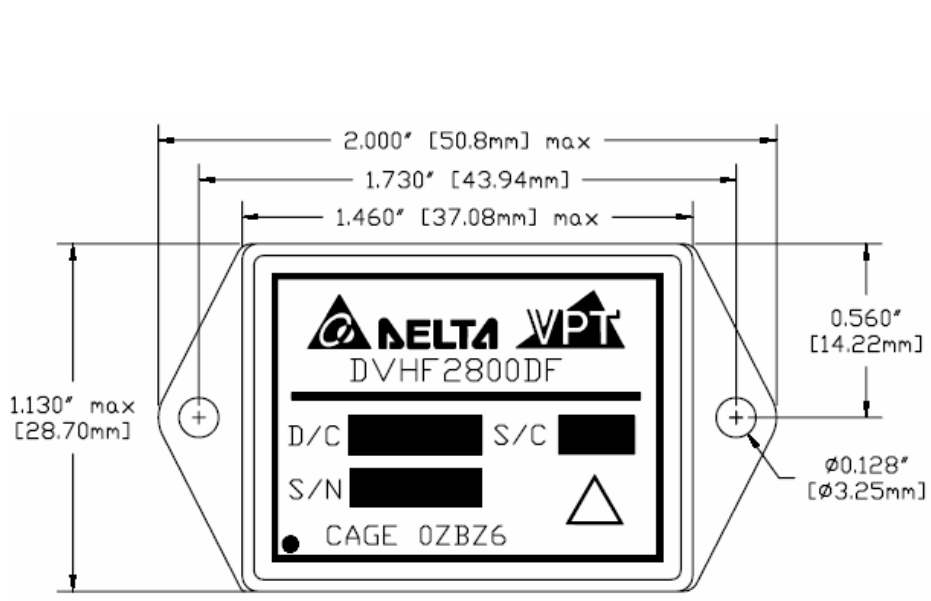


BOTTOM VIEW

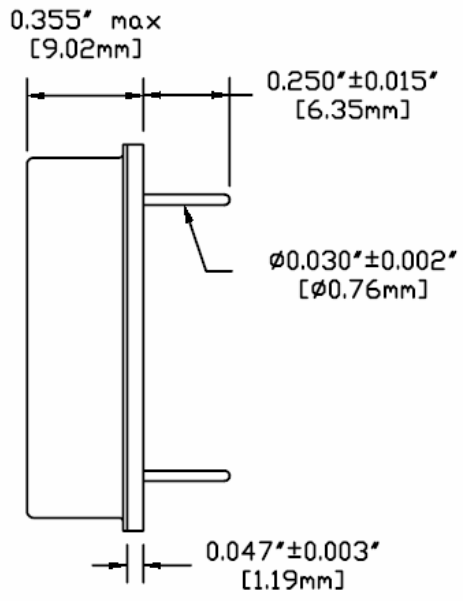
PIN	FUNCTION
1	INHIBIT
2	+V OUT
3	OUT COM
4	-V OUT
5	N/C
6	CASE
7	IN COM
8	28V IN

Figure 12 – Non-Flanged Package and Pinout
(Dimensional Limits are ±0.005” Unless Otherwise Stated)

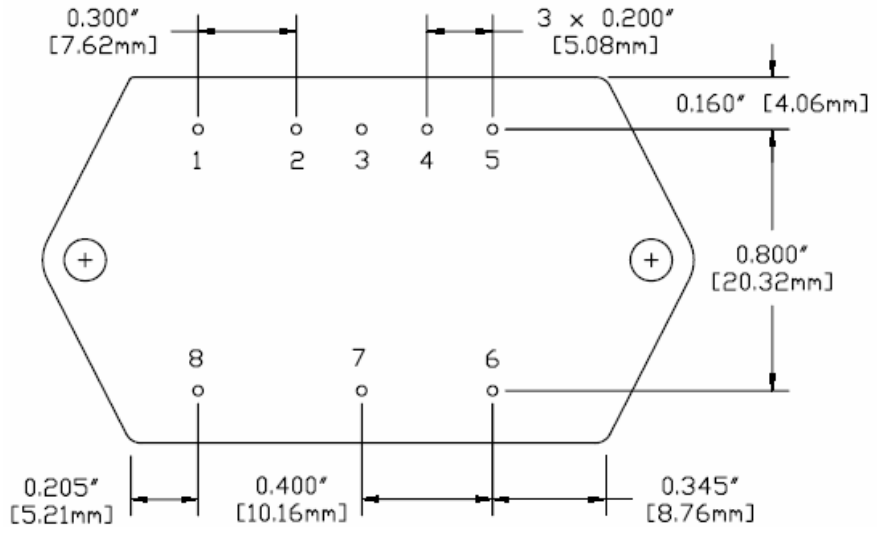
PACKAGE SPECIFICATIONS (FLANGED)



TOP VIEW



SIDE VIEW



BOTTOM VIEW

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

Figure 13 – Flanged Package and Pinout
(Dimensional Limits are ±0.005" Unless Otherwise Stated)

PACKAGE PIN DESCRIPTION

Pin	Function	Description
1	INHIBIT	Logic Low = Disabled Output. Connecting the inhibit pin to input common (PIN 7) causes converter shutdown. Logic High = Enabled Output. Unconnected or open collector TTL.
2	+V OUT	Positive Output Voltage Connection
3	OUT COM	Output Common Connection
4	-V OUT	Negative Output Voltage Connection
5	N/C	No Connection
6	CASE	Case Connection
7	IN COM	Input Common Connection
8	28V IN	Positive Input Voltage 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

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

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

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

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

Package Option		Rad-Hard Option[2]		Screening Code[1,3]		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 qualified 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)	DVHF2800D Series Similar Part Number
5962-0324401HXC 5962-0324401HYC	DVHF2805D/H DVHF2805DF/H
5962-0324402HXC 5962-0324402HYC	DVHF2812D/H DVHF2812DF/H
5962-0324403HXC 5962-0324403HYC	DVHF2815D/H DVHF2815DF/H

Do not use the DVHF2800D 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.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.

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