



# DVHE2800S Series

## HIGH RELIABILITY HYBRID DC-DC CONVERTERS

### DESCRIPTION

The DVHE series of high reliability DC-DC converters is operable over the full military (-55 °C to +125 °C) temperature range with no power derating. Operating at a fixed frequency, these regulated, isolated units utilize well controlled undervoltage lockout circuitry to eliminate slow start-up problems.

The DVHE is optimized for low voltage applications with high efficiency synchronous rectification and fast transient response.

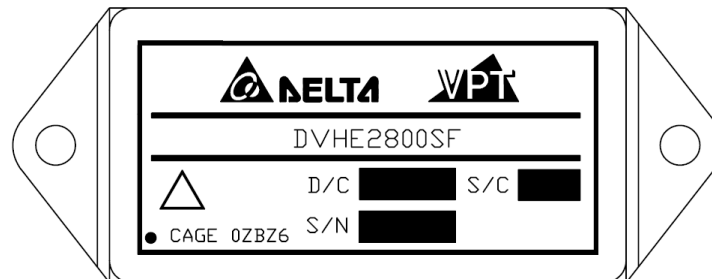
These converters are designed and manufactured in a facility qualified to ISO9001 and certified to MIL-PRF-38534 and MIL-STD-883.

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 Efficiency, Up to 90%
- Low Output Voltage Models
- Up to 50 Watts Output Power
- Up to 10 Amps Output Current
- High Reliability
- Very Low Output Noise
- Wide Input Voltage Range: 16 to 40 Volts
- Input Transient Voltage: 50 Volts for 1 sec
- Output Voltage Trim +/-10%
- NO Use of Optoisolators
- Undervoltage Lockout
- Short Circuit / Current Limit Protection
- High Power Density: > 50 W/in<sup>3</sup>
- Industry Standard Package
- Precision Seam Seal Hermetic Package
- Flanged and Non-flanged Versions Available.
- Custom Versions Available
- Additional Environmental Screening Available
- Meets MIL-STD-461C and MIL-STD-461D EMC Requirements When Used With a DVMC28 EMI Filter
- MIL-PRF-38534 Element Evaluated Components



**Figure 1** – DVHE2800S DC-DC Converter  
(Exact marking may differ from that shown)

## SPECIFICATIONS (T<sub>CASE</sub> = -55°C to +125°C, V<sub>IN</sub> = +28V ± 5%, Full Load, Unless Otherwise Specified)

### ABSOLUTE MAXIMUM RATINGS

Input Voltage (Continuous)	40 V <sub>DC</sub>	Junction Temperature Rise to Case	+10°C
Input Voltage (Transient, 1 second)	50 Volts	Storage Temperature	-65°C to +150°C
Output Power <sup>1</sup>	50 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, T <sub>CASE</sub> = +125°C)	9 Watts	Weight (Maximum) (Un-Flanged / Flanged)	(54 / 56) Grams

Parameter	Conditions	DVHE281R9S			DVHE282R5S			Units
		Min	Typ	Max	Min	Typ	Max	
<b>STATIC</b>								
INPUT Voltage	Continuous	16	28	40	16	28	40	V
	Transient, 1 sec <sup>4</sup>	-	-	50	-	-	50	V
Current	Inhibited	-	-	6	-	-	6	mA
	No Load	-	-	90	-	-	90	mA
Ripple Current	Full Load, 20Hz to 10MHz	-	-	100	-	-	150	mA <sub>p-p</sub>
Inhibit Pin Input <sup>4</sup>		0	-	0.6	0	-	0.6	V
Inhibit Pin Open Circuit Voltage <sup>4</sup>		7	9	11	7	9	11	V
UVLO Turn On		14	15	15.8	14	15	15.8	V
UVLO Turn Off <sup>4</sup>		13	14	15	13	14	15	V
OUTPUT Voltage	V <sub>OUT</sub> T <sub>CASE</sub> = 25°C	1.88	1.90	1.92	2.47	2.50	2.53	V
	V <sub>OUT</sub> T <sub>CASE</sub> = -55°C to +125°C	1.84	1.9	1.96	2.44	2.50	2.56	V
Power <sup>3</sup>		0	-	19	0	-	25	W
Current <sup>3</sup>	V <sub>OUT</sub>	0	-	10	0	-	10	A
Ripple Voltage	V <sub>OUT</sub> Full Load, 20Hz to 10MHz	-	-	150	-	-	150	mV <sub>p-p</sub>
Line Regulation	V <sub>OUT</sub> V <sub>IN</sub> = 16V to 40V	-	1	10	-	1	10	mV
Load Regulation	V <sub>OUT</sub> No Load to Full Load	-	15	30	-	15	30	mV
EFFICIENCY		80	84	-	83	87	-	%
LOAD FAULT POWER DISSIPATION <sup>4</sup>	Overload	-	-	10	-	-	10	W
	Short Circuit	-	-	12	-	-	12	W
CAPACITIVE LOAD <sup>4</sup>		-	-	5000	-	-	5000	μF
SWITCHING FREQUENCY		220	260	300	220	260	300	kHz
ISOLATION	500 V <sub>DC</sub>	100	-	-	100	-	-	MΩ
MTBF (MIL-HDBK-217F)	AIF @ T <sub>C</sub> = 55°C	-	381	-	-	381	-	kHrs
<b>DYNAMIC</b>								
Load Step Output Transient	V <sub>OUT</sub> Half Load to Full Load	-	200	350	-	200	350	mV <sub>PK</sub>
Load Step Recovery <sup>2</sup>		-	200	300	-	200	300	μSec
Line Step Output Transient <sup>4</sup>	V <sub>OUT</sub> V <sub>IN</sub> = 16V to 40V	-	100	200	-	150	250	mV <sub>PK</sub>
Line Step Recovery <sup>2, 4</sup>		-	200	300	-	200	300	μSec
Turn On Delay	V <sub>OUT</sub> V <sub>IN</sub> = 0V to 28V	-	-	40	-	-	30	mSec
Turn On Overshoot		-	-	15	-	-	15	mV <sub>PK</sub>

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<sub>CASE</sub> = -55°C to +125°C, V<sub>IN</sub> = +28V ± 5%, Full Load, Unless Otherwise Specified)

### ABSOLUTE MAXIMUM RATINGS

Input Voltage (Continuous)	40 V <sub>DC</sub>	Junction Temperature Rise to Case	+10°C
Input Voltage (Transient, 1 second)	50 Volts	Storage Temperature	-65°C to +150°C
Output Power <sup>1</sup>	50 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, T <sub>CASE</sub> = +125°C)	9 Watts	Weight (Maximum) (Un-Flanged / Flanged)	(54 / 56) Grams

Parameter	Conditions	DVHE283R3S			DVHE2805S			Units
		Min	Typ	Max	Min	Typ	Max	
<b>STATIC</b>								
INPUT Voltage	Continuous	16	28	40	16	28	40	V
	Transient, 1 sec <sup>4</sup>	-	-	50	-	-	50	V
Current	Inhibited	-	-	6	-	-	6	mA
	No Load	-	-	110	-	-	140	mA
Ripple Current	Full Load, 20Hz to 10MHz	-	-	150	-	-	150	mA <sub>p-p</sub>
Inhibit Pin Input <sup>4</sup>		0	-	0.6	0	-	0.6	V
Inhibit Pin Open Circuit Voltage <sup>4</sup>		7	9	11	7	9	11	V
UVLO Turn On		14	15	15.8	14	15	15.8	V
UVLO Turn Off <sup>4</sup>		13	14	15	13	14	15	V
OUTPUT Voltage	V <sub>OUT</sub> T <sub>CASE</sub> = 25°C	3.27	3.30	3.33	4.95	5.00	5.05	V
	V <sub>OUT</sub> T <sub>CASE</sub> = -55°C to +125°C	3.22	3.30	3.38	4.87	5.00	5.13	V
Power <sup>3</sup>		0	-	33	0	-	50	W
Current <sup>3</sup>	V <sub>OUT</sub>	0	-	10	0	-	10	A
Ripple Voltage	V <sub>OUT</sub> Full Load, 20Hz to 10MHz	-	75	150	-	100	200	mV <sub>p-p</sub>
Line Regulation	V <sub>OUT</sub> V <sub>IN</sub> = 16V to 40V	-	1	10	-	1	10	mV
Load Regulation	V <sub>OUT</sub> No Load to Full Load	-	15	30	-	15	30	mV
EFFICIENCY		85	88	-	86	90	-	%
LOAD FAULT POWER DISSIPATION <sup>4</sup>	Overload	-	-	10	-	-	12	W
	Short Circuit	-	-	14	-	-	16	W
CAPACITIVE LOAD <sup>4</sup>		-	-	5000	-	-	5000	μF
SWITCHING FREQUENCY		220	260	300	300	350	400	kHz
ISOLATION	500 V <sub>DC</sub>	100	-	-	100	-	-	MΩ
MTBF (MIL-HDBK-217F)	AIF @ T <sub>C</sub> = 55°C	-	381	-	-	381	-	kHrs
<b>DYNAMIC</b>								
Load Step Output Transient	V <sub>OUT</sub> Half Load to Full Load	-	200	350	-	250	400	mV <sub>PK</sub>
Load Step Recovery <sup>2</sup>		-	200	300	-	200	300	μSec
Line Step Output Transient <sup>4</sup>	V <sub>OUT</sub> V <sub>IN</sub> = 16V to 40V	-	150	250	-	300	350	mV <sub>PK</sub>
Line Step Recovery <sup>2, 4</sup>		-	200	300	-	200	300	μSec
Turn On Delay	V <sub>OUT</sub> V <sub>IN</sub> = 0V to 28V	-	-	30	-	-	20	mSec
Turn On Overshoot		-	-	15	-	-	25	mV <sub>PK</sub>

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**

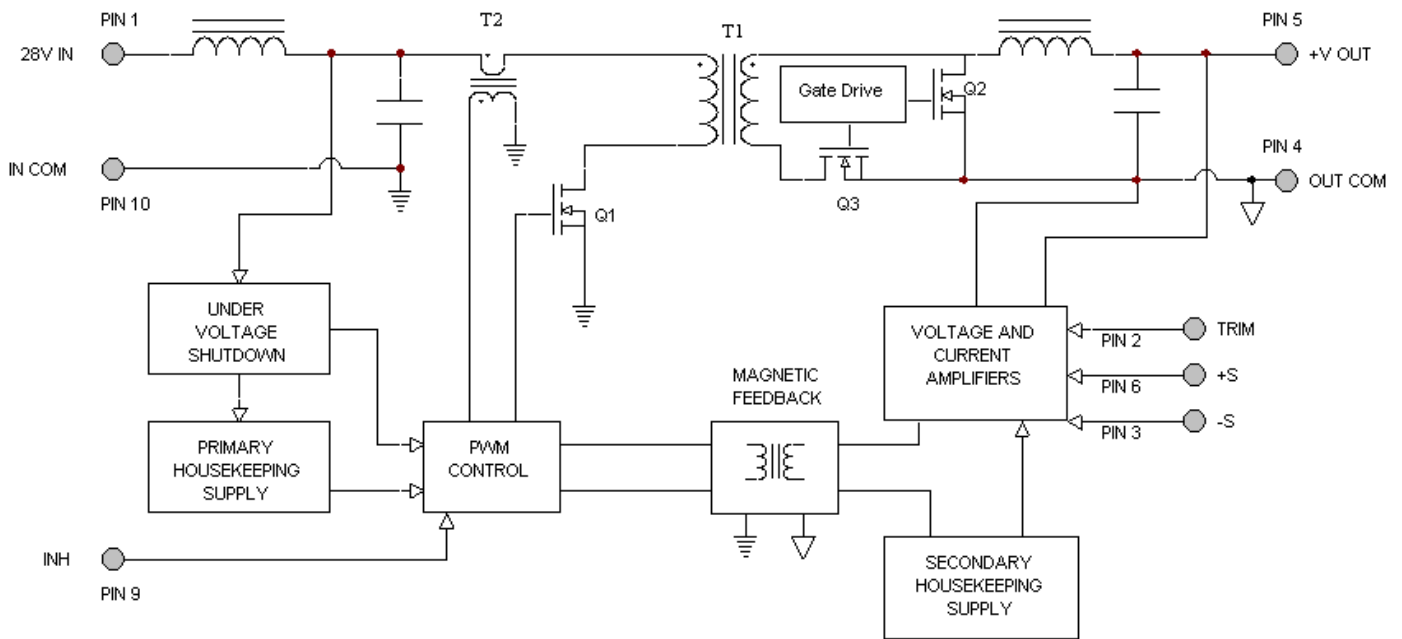


Figure 2

**CONNECTION DIAGRAM**

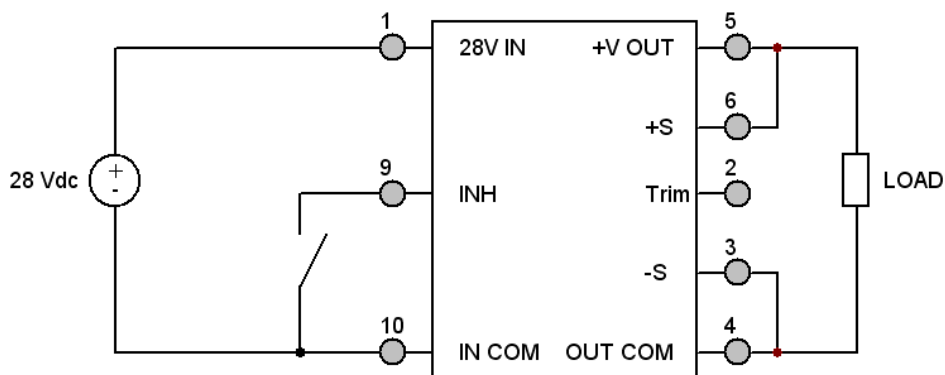
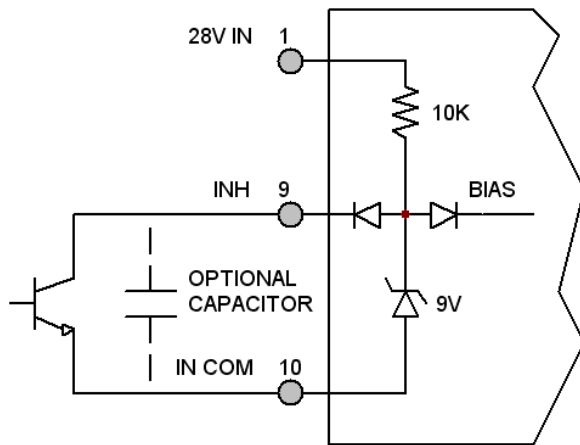
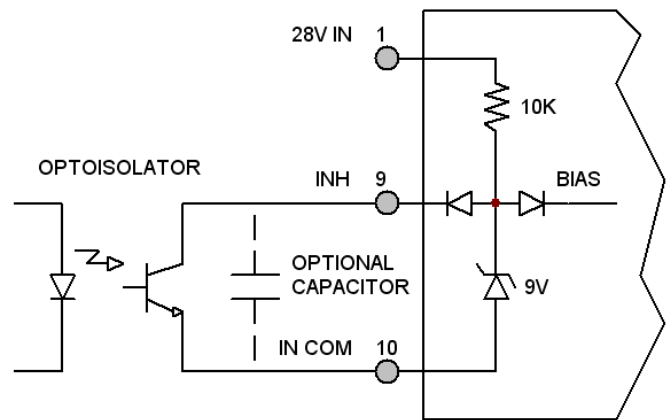


Figure 3

**INHIBIT DRIVE CONNECTION DIAGRAMS**

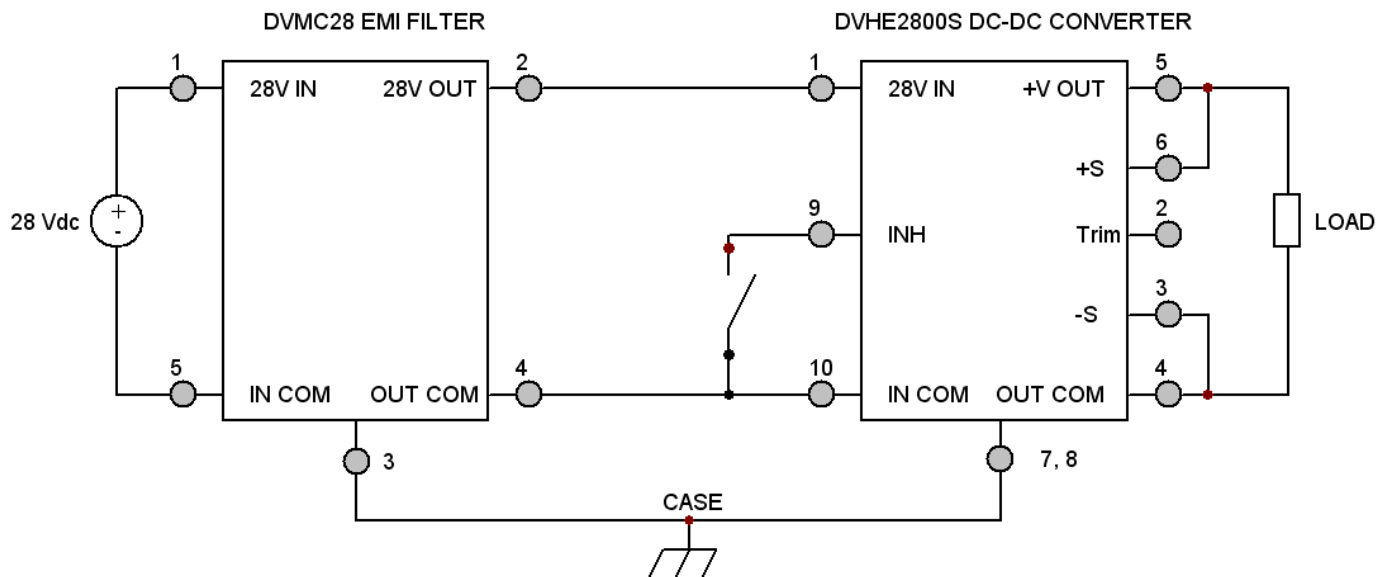


**Figure 4** – Internal Inhibit Circuit and Recommended Drive  
(Shown with optional capacitor for turn-on delay)



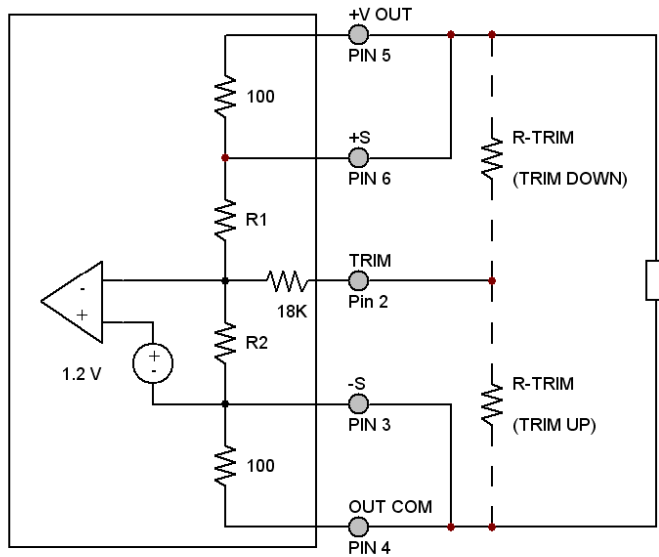
**Figure 5** – Isolated Inhibit Drive  
(Shown with optional capacitor for turn-on delay)

**EMI FILTER HOOKUP DIAGRAM**



**Figure 6** – Converter with EMI Filter

**OUTPUT VOLTAGE TRIM**

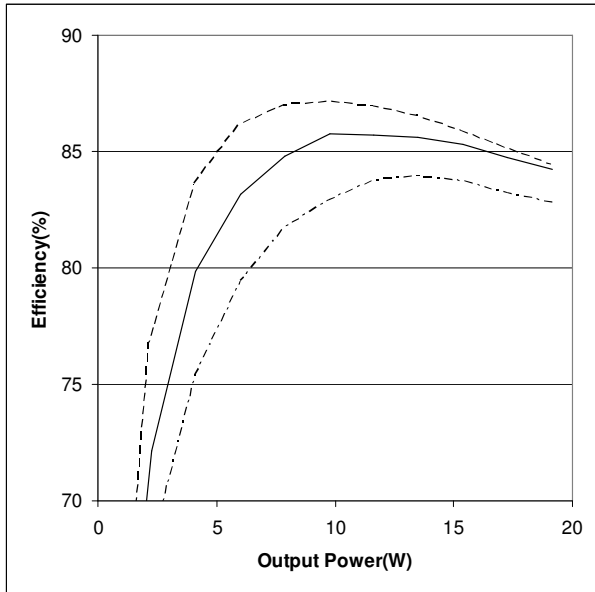


The output voltage can be trimmed down by connecting a resistor between the TRIM pin (PIN 2) and the +V OUT pin (PIN 5), or can be trimmed up by connecting a resistor between the TRIM pin (PIN 2) and the OUT COM pin (PIN 4). The maximum trim range is +10% up and -10% down. The appropriate resistor values versus the output voltage are given in the trim table below.

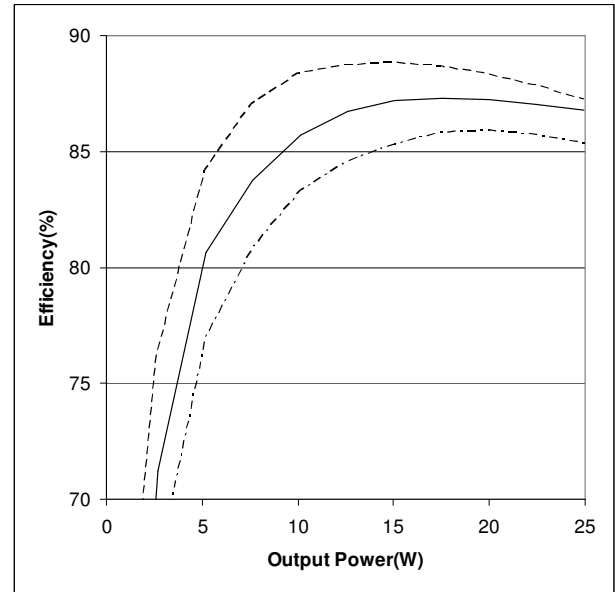
**Figure 7 – Output Voltage Trim**

DVHE281R9S		DVHE282R5S		DVHE283R3S		DVHE2805S	
+V <sub>OUT</sub> (V)	R <sub>TRIM</sub> (Ω)	+V <sub>OUT</sub> (V)	R <sub>TRIM</sub> (Ω)	+V <sub>OUT</sub> (V)	R <sub>TRIM</sub> (Ω)	+V <sub>OUT</sub> (V)	R <sub>TRIM</sub> (Ω)
1.71	11.8k	2.25	26.9k	2.97	34.8k	4.50	46.5k
1.72	14.1k	2.27	31.8k	3.00	41k	4.55	54.8k
1.74	19.6k	2.30	40.8k	3.04	51.7k	4.60	65.1k
1.76	26.7k	2.32	48.6k	3.07	62.1k	4.65	78.4k
1.78	36k	2.35	64k	3.10	75.6k	4.70	96.1k
1.80	49.2k	2.37	78.3k	3.13	93.8k	4.75	120.9k
1.82	69k	2.40	110k	3.17	131k	4.80	158k
1.84	102k	2.42	145k	3.20	179k	4.85	220k
1.86	168k	2.45	249k	3.23	268k	4.90	343.9k
1.88	365k	2.47	435k	3.27	662k	4.95	715.5k
1.90	-	2.50	-	3.30	-	5.00	-
1.92	707k	2.52	624k	3.33	392k	5.05	216.7k
1.94	345k	2.55	239k	3.36	187k	5.10	99.4k
1.96	224k	2.57	165k	3.40	105k	5.15	60.2k
1.99	143k	2.60	110k	3.43	76.7k	5.20	40.7k
2.00	127k	2.62	89k	3.46	58.9k	5.25	28.9k
2.01	114k	2.65	67.6k	3.50	43.5k	5.30	21.1k
2.03	93.6k	2.67	57.5k	3.53	35.5k	5.35	15.5k
2.05	78.7k	2.70	46.2k	3.56	29.3k	5.40	11.3k
2.07	67.4k	2.72	40.4k	3.60	23k	5.45	8k
2.10	54.5k	2.75	33.4k	3.63	19.3k	5.50	5.5k

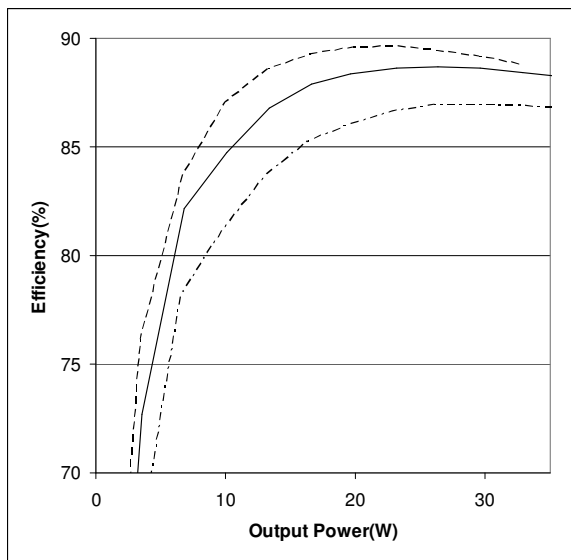
**EFFICIENCY PERFORMANCE CURVES** ( $T_{CASE} = 25^{\circ}C$ , Full Load, Unless Otherwise Specified)



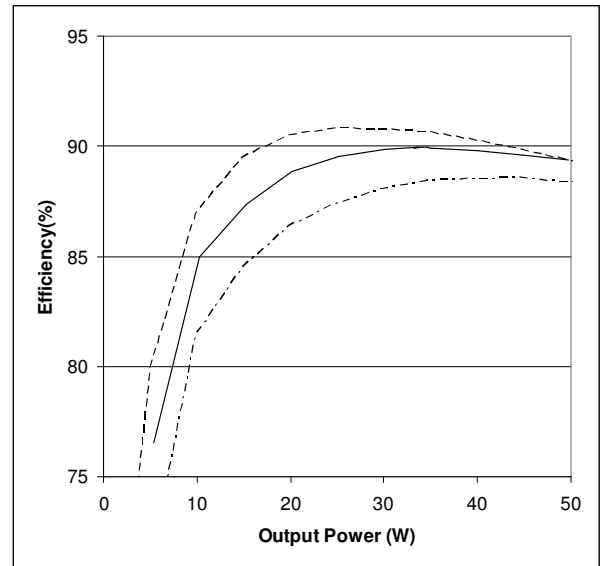
**Figure 8 – DVHE281R9S**  
Efficiency (%) vs. Output Power (W)



**Figure 9 – DVHE282R5S**  
Efficiency (%) vs. Output Power (W)



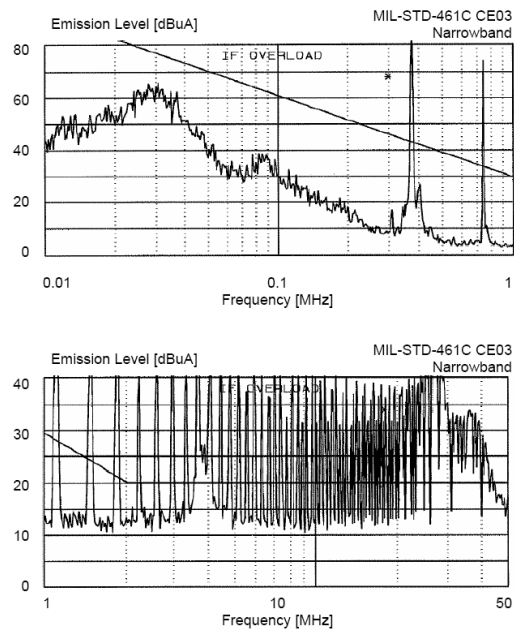
**Figure 10 – DVHE283R3S**  
Efficiency (%) vs. Output Power (W)



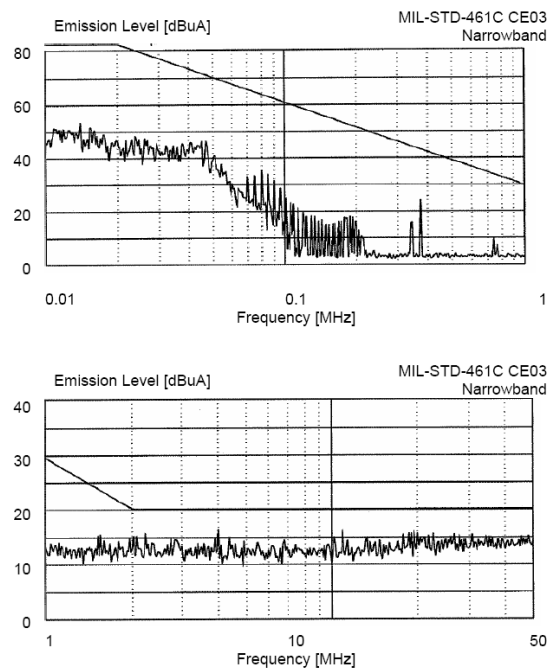
**Figure 11 – DVHE2805S**  
Efficiency (%) vs. Output Power (W)

**EMI PERFORMANCE CURVES**

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



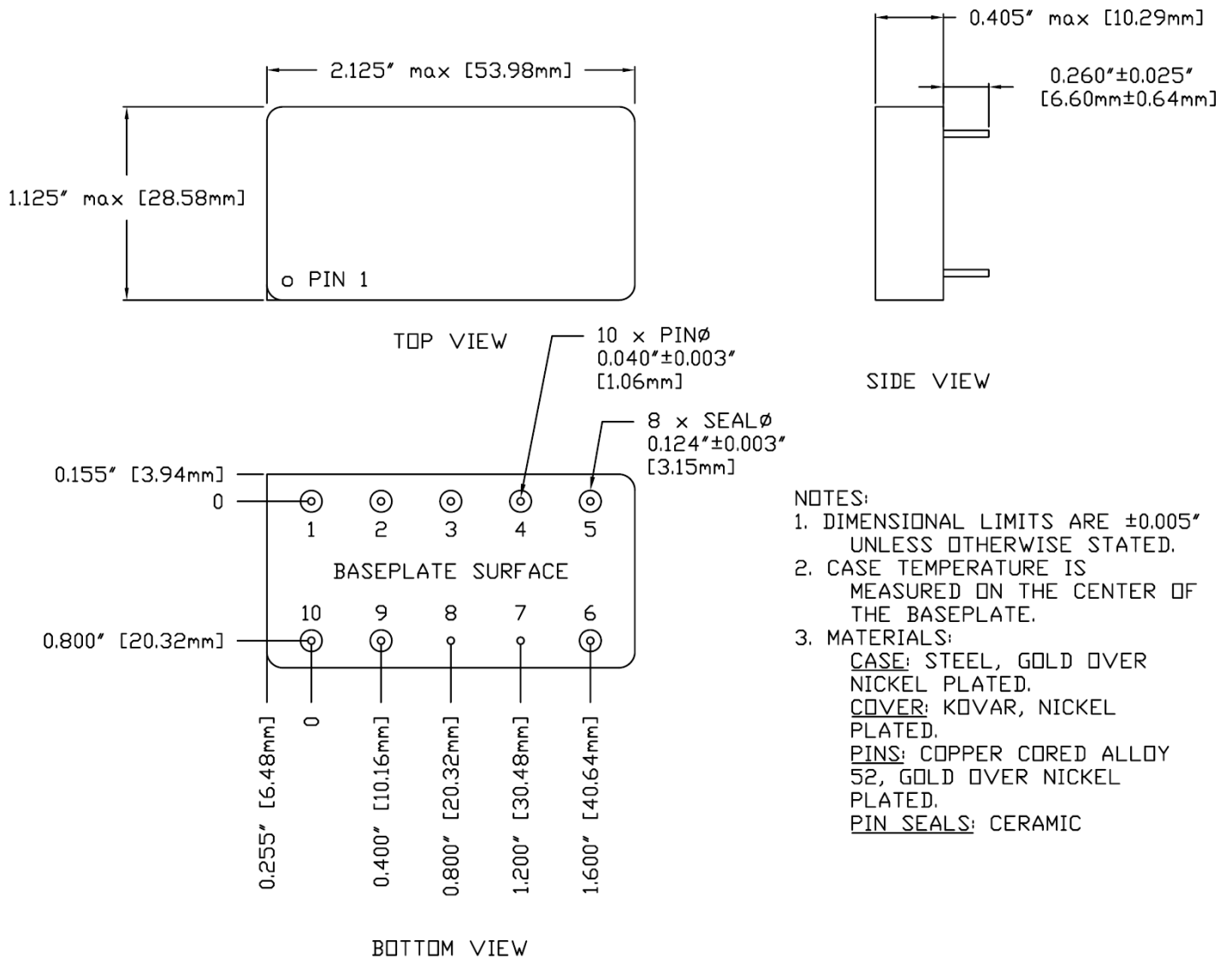
**Figure 12 – DVHE2800S without EMI Filter**



**Figure 13 – DVHE2800S with DVMC28 EMI Filter**



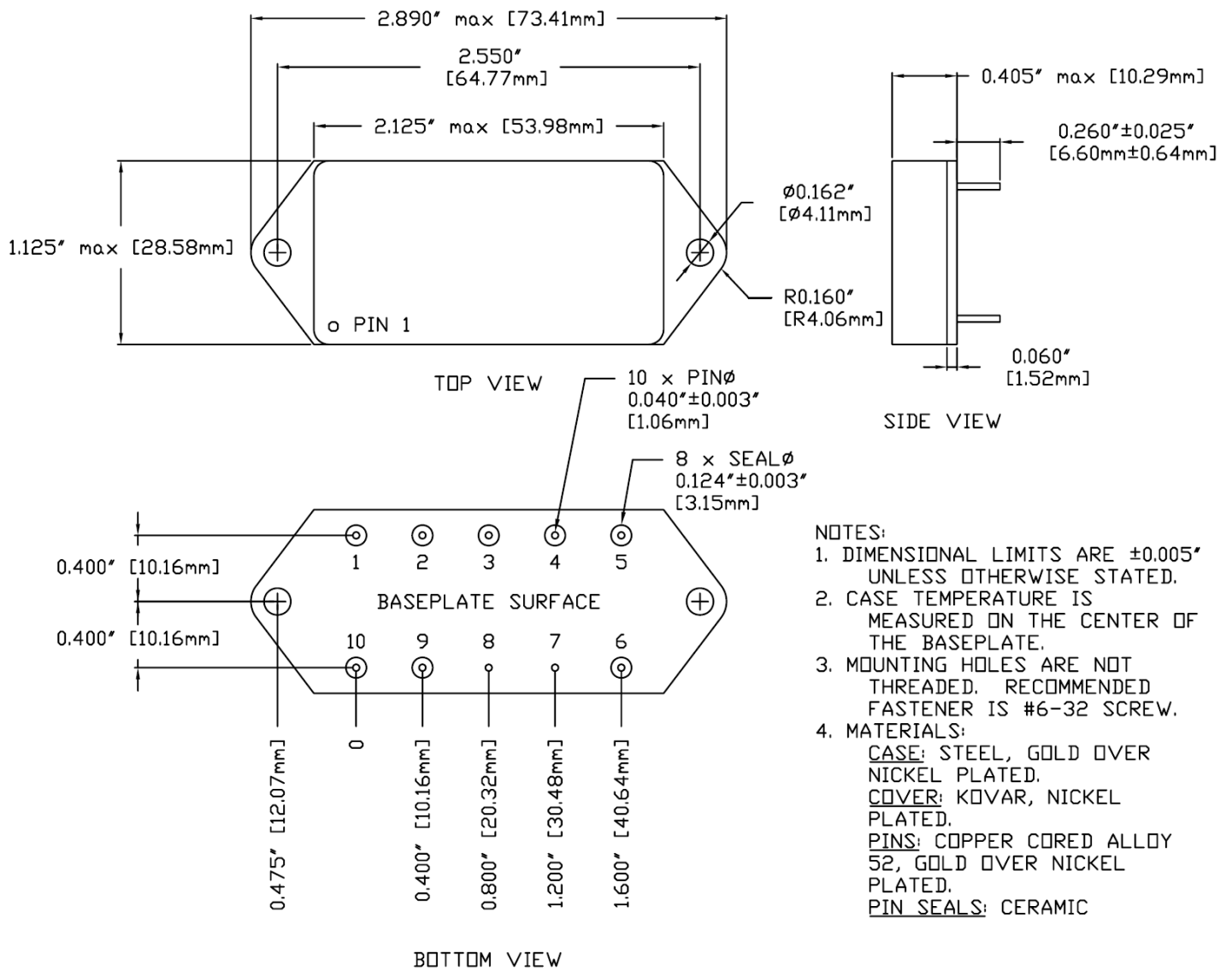
**PACKAGE SPECIFICATIONS (NON-FLANGED, SEAM SEAL)**



PIN	FUNCTION	PIN	FUNCTION
1	28V IN	6	+S
2	TRIM	7	CASE
3	-S	8	CASE
4	OUT COM	9	INHIBIT
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	+S
2	TRIM	7	CASE
3	-S	8	CASE
4	OUT COM	9	INHIBIT
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	TRIM	Trim the Output Voltage +/- 10%
3	-S	Return Sense
4	OUT COM	Output Common Connection
5	+V OUT	Positive Output Voltage Connection
6	+S	Positive Sense
7	CASE	Case Connection
8	CASE	Case Connection
9	INHIBIT	Logic Low = Disabled Output. Connecting the inhibit pin to input common causes converter shutdown. Logic High = Enabled Output. Unconnected or open collector TTL.
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)	/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 <sup>-3</sup> )	•			
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.



## SMD (STANDARD MICROCIRCUIT DRAWING) NUMBERS

Standard Microcircuit Drawing (SMD)	DVHE2800S Series Similar Part Number
5962-1523001HXC 5962-1523001HXA 5962-1523001HYC 5962-1523001HYA 5962-1523001KXC 5962-1523001KXA 5962-1523001KYC 5962-1523001KYA	DVHE281R9S/H DVHE281R9S/H-E DVHE281R9SF/H DVHE281R9SF/H-E DVHE281R9S/K DVHE281R9S/K-E DVHE281R9SF/K DVHE281R9SF/K-E
5962-1523002HXC 5962-1523002HXA 5962-1523002HYC 5962-1523002HYA 5962-1523002KXC 5962-1523002KXA 5962-1523002KYC 5962-1523002KYA	DVHE282R5S/H DVHE282R5S/H-E DVHE282R5SF/H DVHE282R5F/H-E DVHE282R5S/K DVHE282R5S/K-E DVHE282R5SF/K DVHE282R5SF/K-E
5962-1523003HXC 5962-1523003HXA 5962-1523003HYC 5962-1523003HYA 5962-1523003KXC 5962-1523003KXA 5962-1523003KYC 5962-1523003KYA	DVHE283R3S/H DVHE283R3S/H-E DVHE283R3SF/H DVHE283R3SF/H-E DVHE283R3S/K DVHE283R3S/K-E DVHE283R3SF/K DVHE283R3SF/K-E
5962-1523004HXC 5962-1523004HXA 5962-1523004HYC 5962-1523004HYA 5962-1523004KXC 5962-1523004KXA 5962-1523004KYC 5962-1523004KYA	DVHE2805S/H DVHE2805S/H-E DVHE2805SF/H DVHE2805S/H-E DVHE2805S/K DVHE2805S/K-E DVHE2805SF/K DVHE2805S/K-E

Do not use the DVHE2800S 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 <https://landandmaritimeapps.dla.mil/programs/defaultapps.asp>. The SMD number listed above is for 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@vptpower.com](mailto:vptsales@vptpower.com)

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