

## HIGH RELIABILITY HYBRID DC-DC CONVERTERS

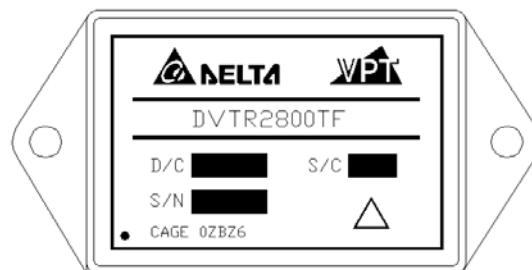
### DESCRIPTION

The DVTR 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 DVTR series is a fault tolerant magnetic feedback circuit. Operating at a nominal fixed frequency of 325 kHz per stage, 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, compliant to AS9000, and certified to MIL-PRF-38534 and MIL-STD-883.

### FEATURES

- High Reliability
- Very Low Output Noise
- Wide Input Voltage Range: 15 to 50 Volts per MIL-STD-704
- Up to 30 Watts Output Power
- Fault Tolerant Magnetic Feedback Circuit
- NO Use of Optoisolators
- Undervoltage Lockout
- Industry Standard Pinout
- High Input Transient Voltage: 80 Volts for 1 sec per MIL-STD-704A
- Precision Seam Welded or Solder Seal Hermetic Package
- High Power Density: > 28 W/in<sup>3</sup>
- 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** – DVTR2800T / DVTR2800TF DC-DC Converter  
(Not To Scale)

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

### ABSOLUTE MAXIMUM RATINGS

Input Voltage (Continuous)	50 V <sub>DC</sub>	Junction Temperature Rise to Case	+15°C
Input Voltage (Transient, 1 second)	80 Volts	Storage Temperature	-65°C to +150°C
Output Power	30 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, T <sub>CASE</sub> = +125°C)	10 Watts	Weight	50 grams

Parameter	Conditions	DVTR28512T			DVTR28515T			Units	
		Min	Typ	Max	Min	Typ	Max		
<b>STATIC</b>									
INPUT Voltage	Continuous	15	28	50	15	28	50	V	
	Transient, 1 sec <sup>4</sup>	-	-	80	-	-	80	V	
Current	Inhibited	-	3.5	7.5	-	3.5	7.5	mA	
	No Load	-	20	40	-	20	40	mA	
Ripple Current	Full Load <sup>5</sup> , 20Hz to 20MHz	-	20	50	-	20	50	mA <sub>p-p</sub>	
Inhibit Pin Input <sup>4</sup>		0	-	1.5	0	-	1.5	V	
Inhibit Pin Open Circuit Voltage <sup>4</sup>		13	15	17	13	15	17	V	
UVLO Turn On		11.5	-	14.5	11.5	-	14.5	V	
UVLO Turn Off <sup>4</sup>		11.0	-	14.5	11.0	-	14.5	V	
OUTPUT Voltage	V <sub>MAIN</sub>	T <sub>CASE</sub> = 25°C	4.95	5.0	5.05	4.95	5.0	5.05	V
	+V <sub>AUX</sub>		11.88	12.0	12.12	14.85	15.0	15.15	V
	-V <sub>AUX</sub>		-12.24	-12.0	-11.76	-15.30	-15.0	-14.70	V
	V <sub>MAIN</sub>	T <sub>CASE</sub> = -55°C to +125°C	4.85	5.0	5.15	4.85	5.0	5.15	V
	+V <sub>AUX</sub>		11.64	12.0	12.36	14.55	15.0	15.45	V
	-V <sub>AUX</sub>		-12.48	-12.0	-11.52	-15.60	-15.0	-14.40	V
Power <sup>4</sup>	Total		0	-	30	0	-	30	W
	V <sub>MAIN</sub>		0	-	15	0	-	15	W
	±V <sub>AUX</sub> <sup>6</sup>		0	-	15	0	-	15	W
Current <sup>3</sup>	V <sub>MAIN</sub>		0	-	3.0	0	-	3.0	A
	±V <sub>AUX</sub>	Either Output <sup>6</sup>	0	-	0.87	0	-	0.70	A
Ripple Voltage	V <sub>MAIN</sub>	Full Load <sup>5</sup> , 20Hz to 10MHz	-	20	60	-	20	60	mV <sub>p-p</sub>
	±V <sub>AUX</sub>		-	40	100	-	40	100	mV <sub>p-p</sub>
Line Regulation	V <sub>MAIN</sub>	V <sub>IN</sub> = 15V to 50V	-	10	25	-	10	25	mV
	+V <sub>AUX</sub>		-	15	50	-	15	50	mV
	-V <sub>AUX</sub>		-	20	100	-	20	100	mV
Load Regulation	V <sub>MAIN</sub>	No Load to Full Load <sup>5</sup>	-	10	25	-	10	25	mV
	+V <sub>AUX</sub>		-	10	50	-	10	50	mV
	-V <sub>AUX</sub>		-	50	250	-	50	250	mV
Cross Regulation	±V <sub>AUX</sub>	+V <sub>OUT</sub> = 30%, -V <sub>OUT</sub> = 70% +V <sub>OUT</sub> = 70%, -V <sub>OUT</sub> = 30%	-	-	5	-	-	5	%
EFFICIENCY		Full Load <sup>5</sup>	74	79	-	75	80	-	%
LOAD FAULT POWER DISSIPATION		Overload <sup>4</sup>	-	-	15	-	-	15	W
		Short Circuit	-	-	10	-	-	10	W
CAPACITIVE LOAD <sup>4</sup>			-	-	500	-	-	500	μF
SWITCHING FREQUENCY			600	650	700	600	650	700	kHz
SYNCHRONIZATION FREQUENCY <sup>7</sup>			700	750	800	700	750	800	kHz
ISOLATION		500 V <sub>DC</sub> , T <sub>CASE</sub> = 25°C	100	-	-	100	-	-	MΩ
THERMAL RESISTANCE		Case to Ambient (θCA)	-	25	-	-	25	-	°C/W
MTBF (MIL-HDBK-217F)		AIF @ T <sub>C</sub> = 55°C	-	307	-	-	307	-	kHrs

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

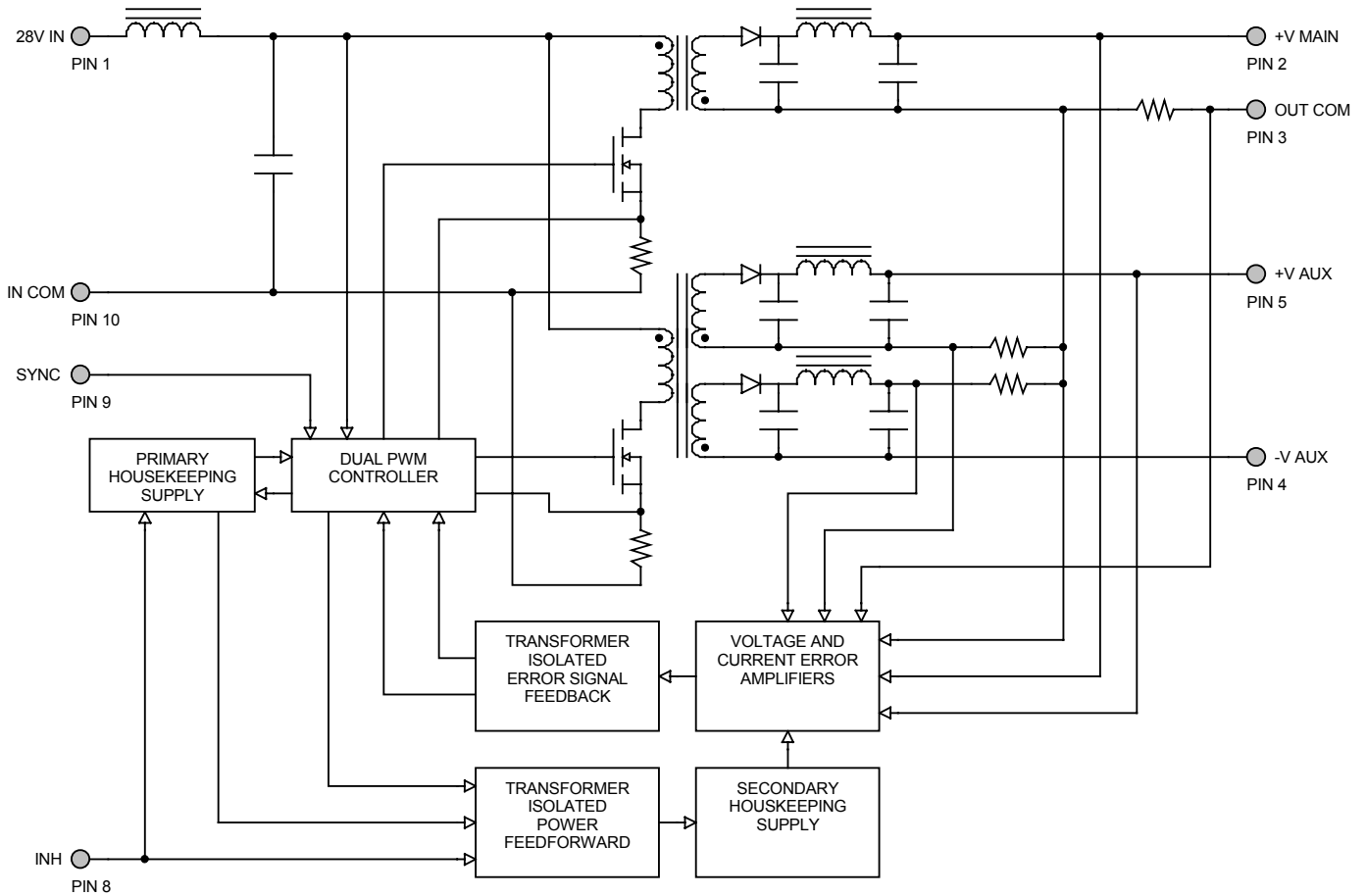
### ABSOLUTE MAXIMUM RATINGS

Input Voltage (Continuous)	50 V <sub>DC</sub>	Junction Temperature Rise to Case	+15°C
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Output Power	30 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, T <sub>CASE</sub> = +125°C)	10 Watts	Weight	50 grams

Parameter	Conditions	DVTR28512T			DVTR28515T			Units	
		Min	Typ	Max	Min	Typ	Max		
<b>DYNAMIC</b>									
Load Step Output Transient	V <sub>MAIN</sub>	Half Load to Full Load	-	200	400	-	200	400	mV <sub>PK</sub>
	±V <sub>AUX</sub>		-	500	700	-	500	700	mV <sub>PK</sub>
Load Step Recovery <sup>2</sup>	V <sub>MAIN</sub>		-	200	400	-	200	400	μSec
	±V <sub>AUX</sub>		-	200	400	-	200	400	μSec
Line Step Output Transient <sup>4</sup>	V <sub>MAIN</sub>	V <sub>IN</sub> = 15V to 50V	-	200	400	-	200	400	mV <sub>PK</sub>
	±V <sub>AUX</sub>		-	300	500	-	300	500	mV <sub>PK</sub>
Line Step Recovery <sup>2, 4</sup>	V <sub>MAIN</sub>		-	200	400	-	200	400	μSec
	±V <sub>AUX</sub>		-	200	400	-	200	400	μSec
Turn On Delay	V <sub>IN</sub> = 0V to 28V	-	-	20	-	-	20	mSec	
Turn On Overshoot <sup>2</sup>		-	-	0	-	-	0	mV <sub>PK</sub>	

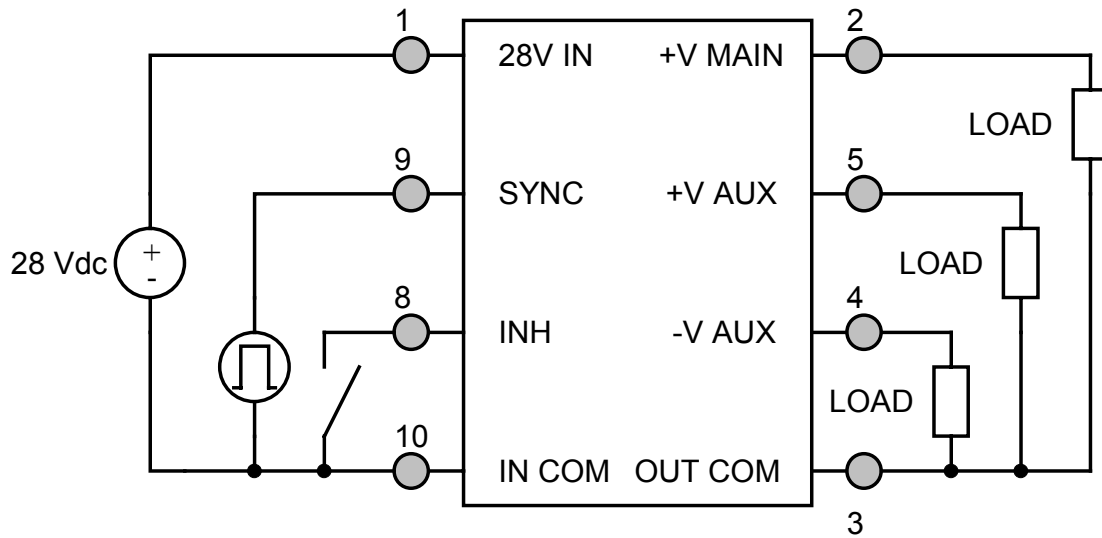
- Notes:
1. This note intentionally not used.
  2. Time for output voltage to settle within 1% of its nominal value.
  3. Derate linearly to 0 at 135°C.
  4. Verified by qualification testing.
  5. 15W on V<sub>MAIN</sub> and 15W on ±V<sub>AUX</sub>.
  6. Up to 70% of the total auxiliary power or current can be drawn from either of the auxiliary outputs.
  7. Synchronization is TTL signal with V<sub>SYNC MAX</sub> = 6V.

**BLOCK DIAGRAM**



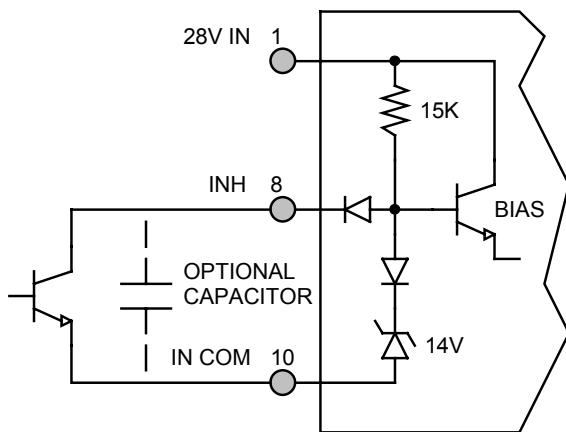
**Figure 2**

**CONNECTION DIAGRAM**

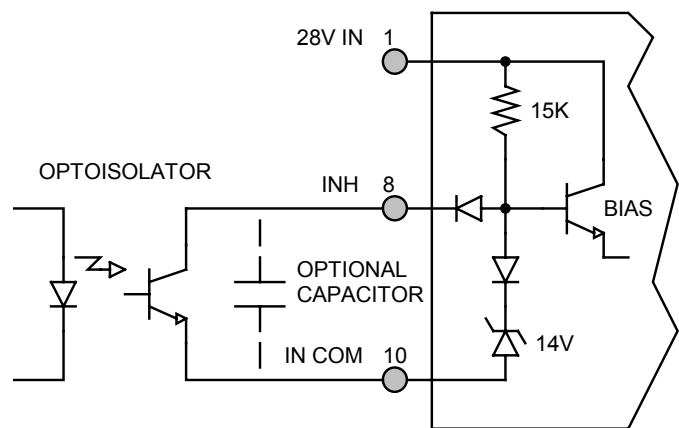


**Figure 3**

**INHIBIT DRIVE CONNECTION DIAGRAMS**

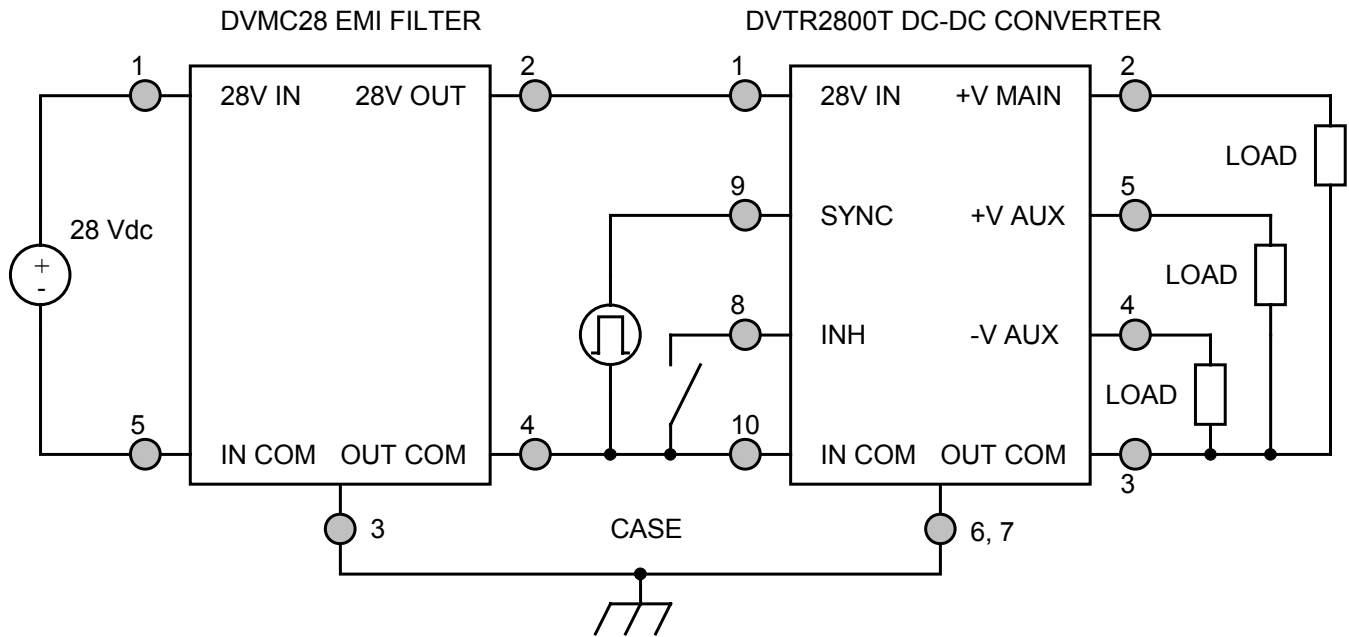


**Figure 4 – Internal Inhibit Circuit and Recommended Drive**  
(Shown with optional capacitor for turn-on delay)



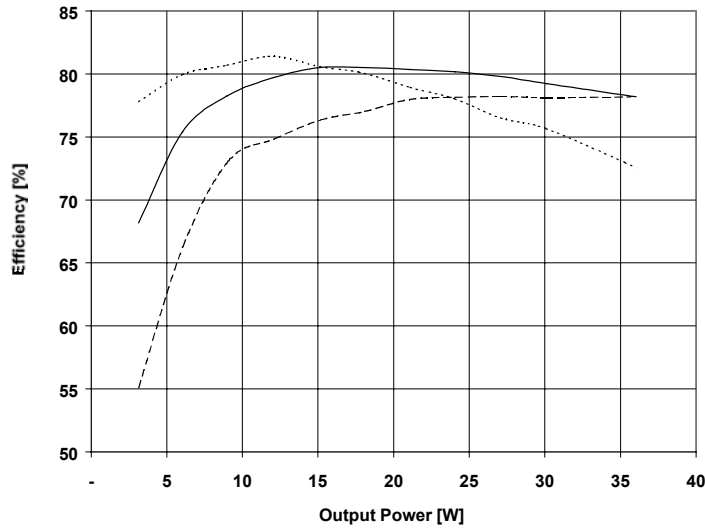
**Figure 5 – Isolated Inhibit Drive**  
(Shown with optional capacitor for turn-on delay)

## EMI FILTER HOOKUP DIAGRAM

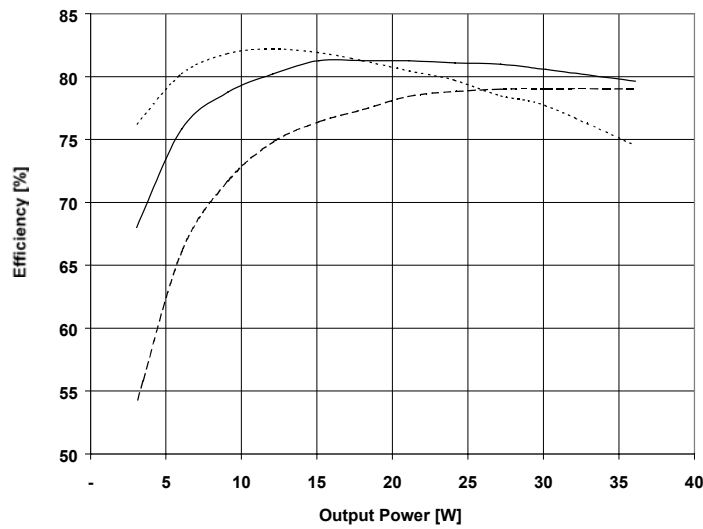


**Figure 6** – Converter with EMI Filter

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



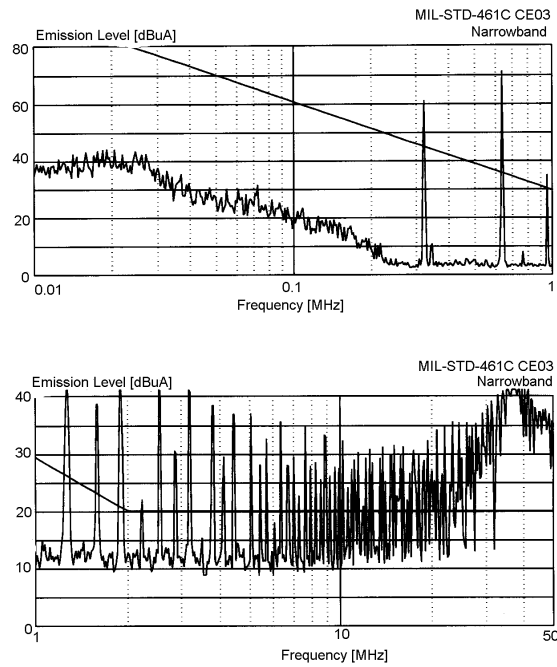
**Figure 7 – DVTR28512T**  
Efficiency (%) vs. Output Power (W)



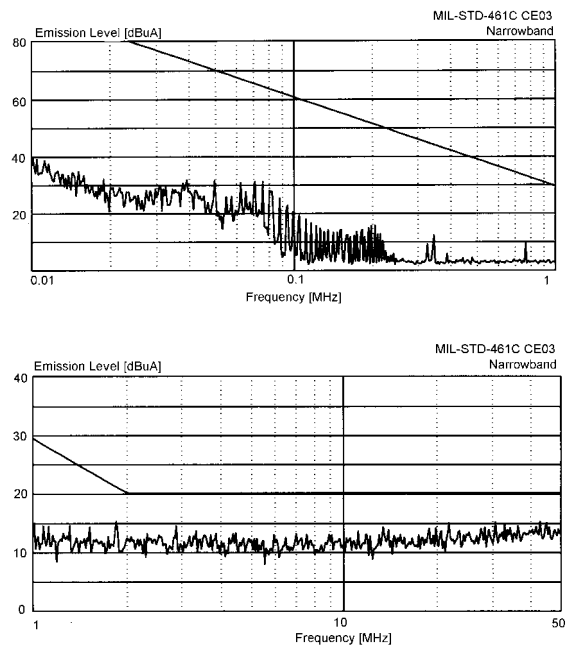
**Figure 8 – DVTR28515T**  
Efficiency (%) vs. Output Power (W)

## EMI PERFORMANCE CURVES

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



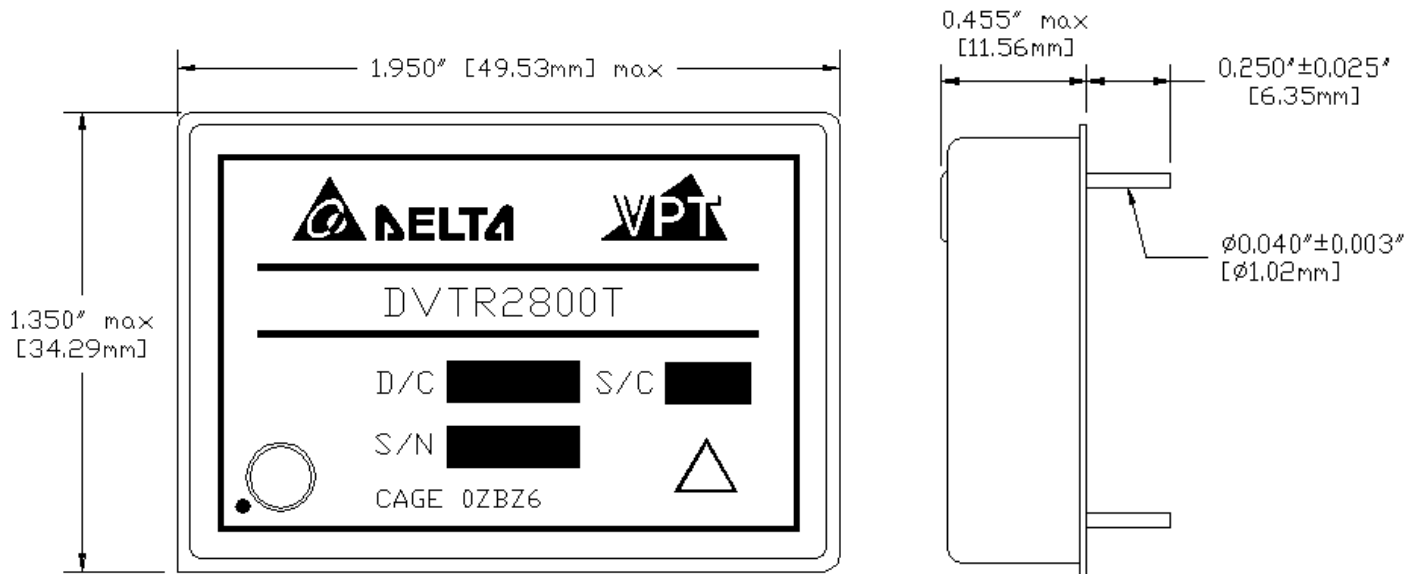
**Figure 9 – DVTR2800T without EMI Filter**



**Figure 10 – DVTR2800T with EMI Filter**

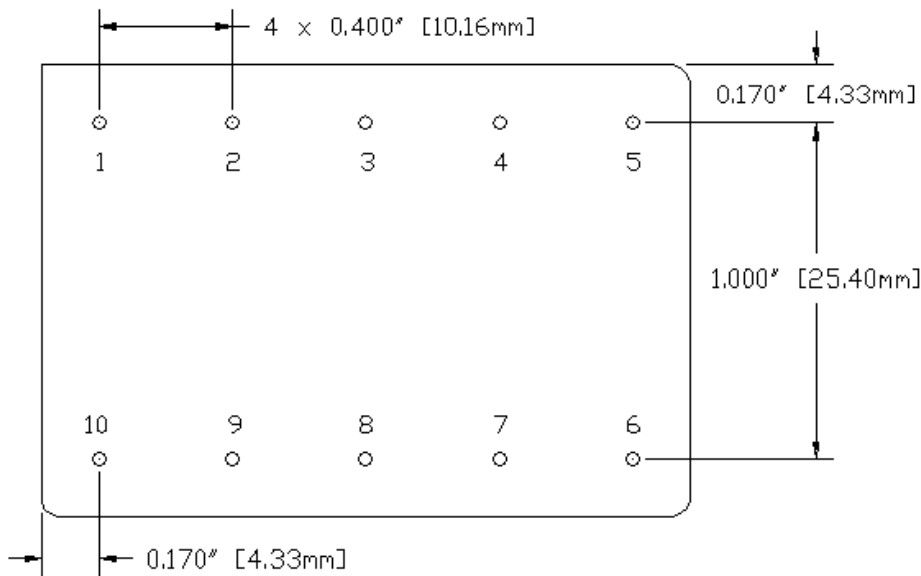


## PACKAGE SPECIFICATIONS (NON-FLANGED, SOLDER SEAL)



**TOP VIEW**

**SIDE VIEW**

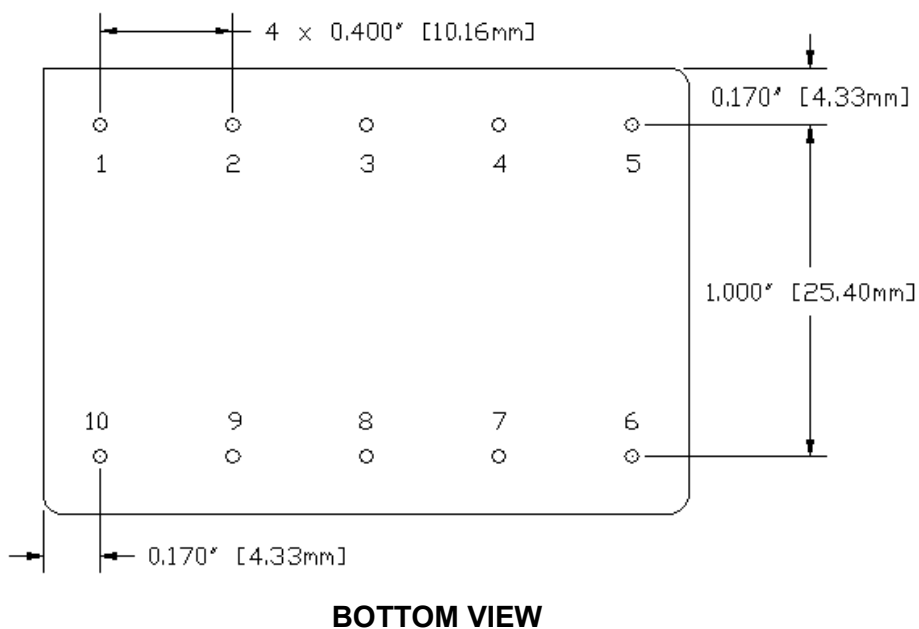
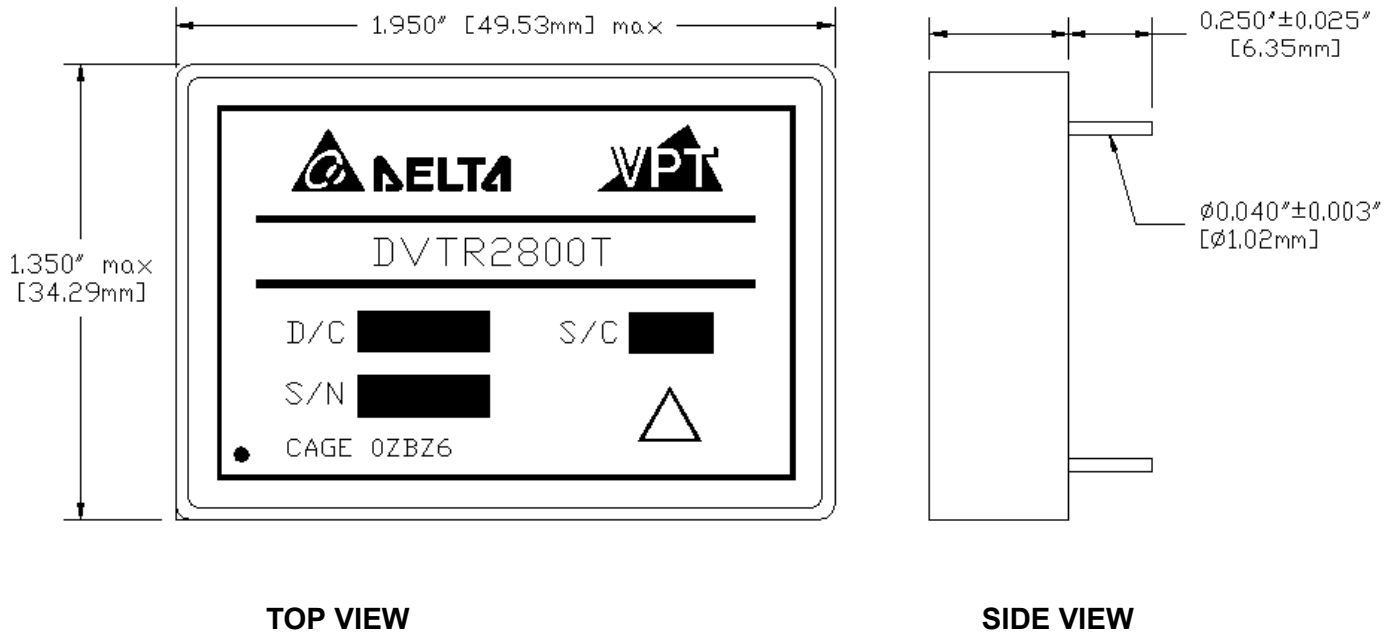


PIN	FUNCTION
1	28V IN
2	+V MAIN
3	OUT COM
4	-V AUX
5	+V AUX
6	CASE
7	CASE
8	INHIBIT
9	SYNC
10	IN COM

**BOTTOM VIEW**

**Figure 11 – Non-Flanged, Solder Seal Package and Pinout**  
(Dimensional Limits are  $\pm 0.005$ " Unless Otherwise Stated)

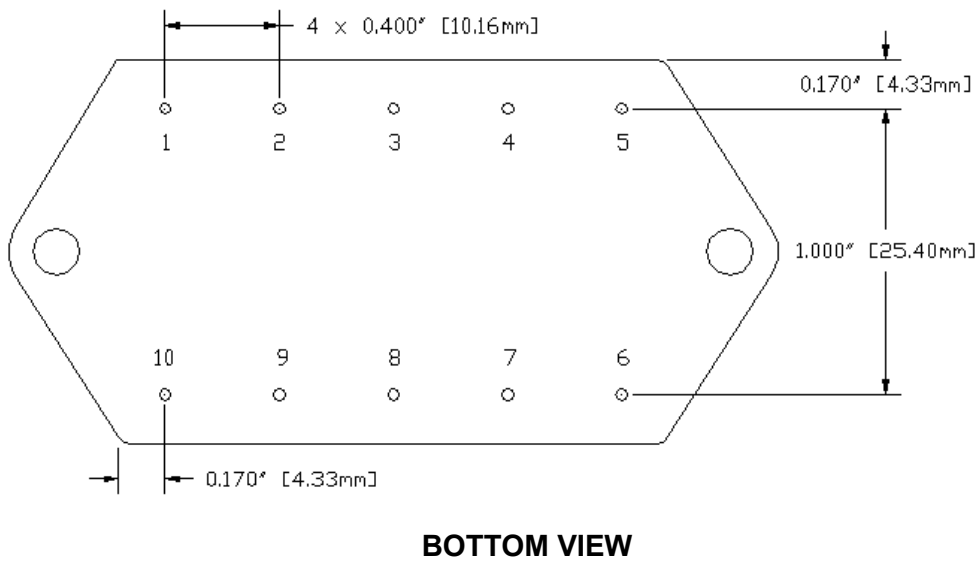
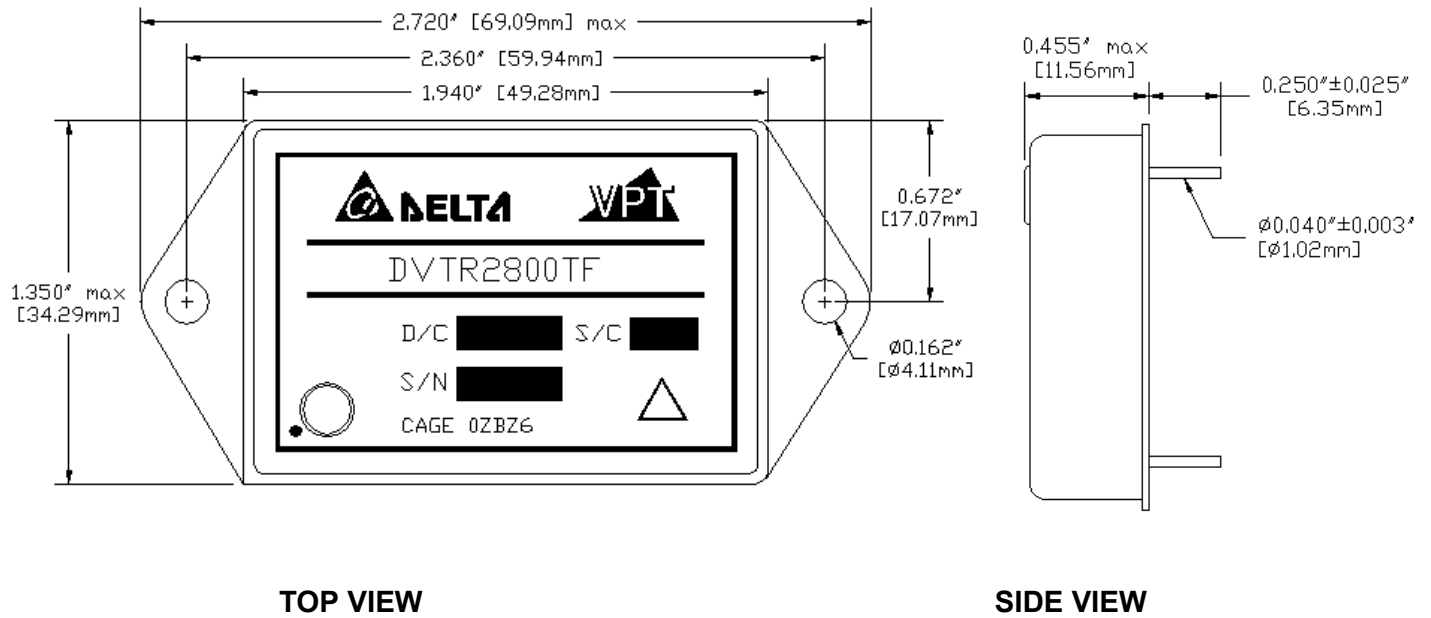
## PACKAGE SPECIFICATIONS (NON-FLANGED, SEAM SEAL)



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

**Figure 12** – Non-Flanged, Seam Seal Package and Pinout (/HB Screened Units Only)  
(Dimensional Limits are  $\pm 0.005$ " Unless Otherwise Stated)

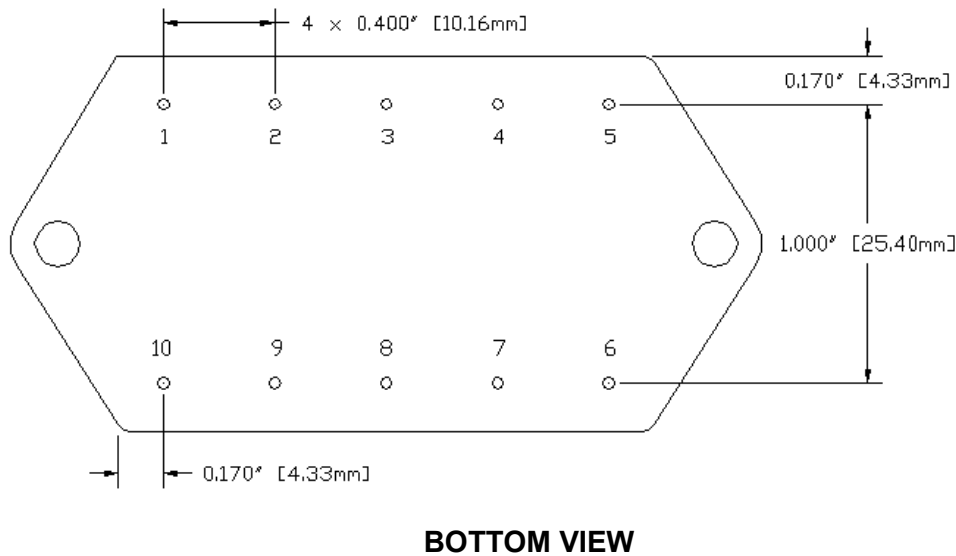
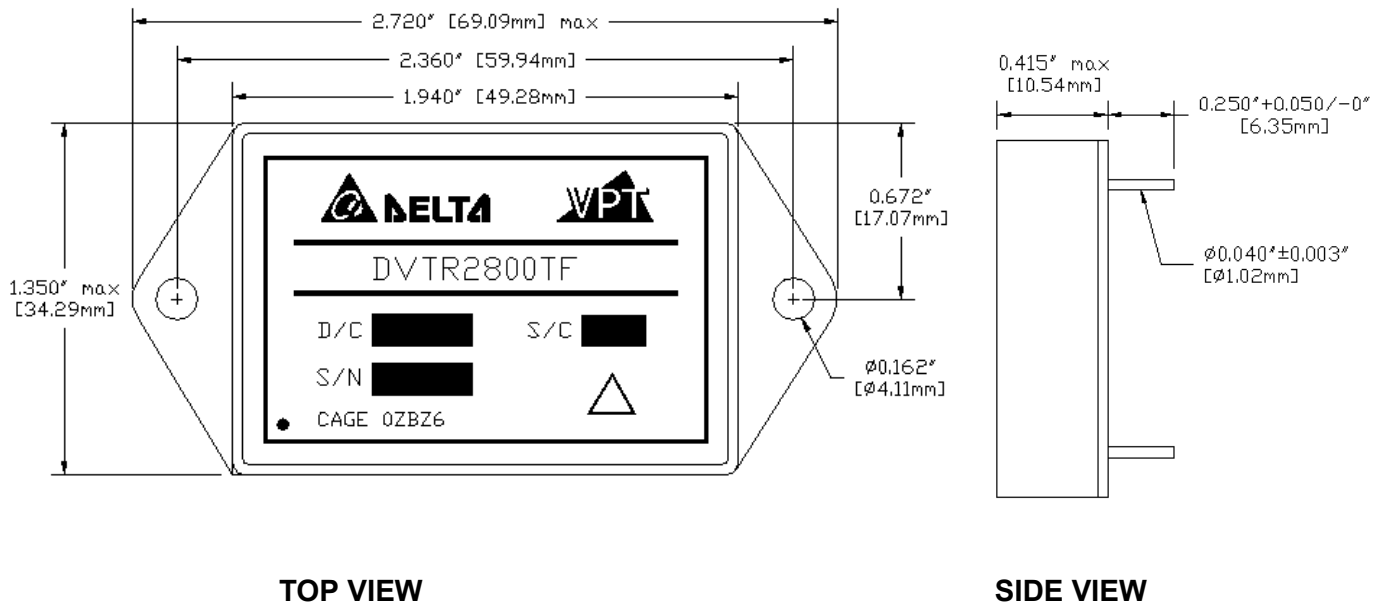
## PACKAGE SPECIFICATIONS (FLANGED, SOLDER SEAL)



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

**Figure 13** – Flanged, Solder Seal Package and Pinout  
(Dimensional Limits are  $\pm 0.005"$  Unless Otherwise Stated)

## PACKAGE SPECIFICATIONS (FLANGED, SEAM SEAL)



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

**Figure 14** – Flanged, Seam Seal Package and Pinout (/HB Screened Units Only)  
(Dimensional Limits are  $\pm 0.005$ " Unless Otherwise Stated)

## 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 (Per MIL-STD-883 as referenced to MIL-PRF-38534, Class H)

Screening	MIL-STD-883	Standard (No Suffix)	Extended /ES	HB /HB
Pre-Cap Inspection	Method 2017, 2032 Internal Procedure	•	•	•
Temperature Cycling	Method 1010, Condition C Method 1010, -55°C to 125°C		•	•
Constant Acceleration	Method 2001, Condition A Method 2001, 500g		•	•
Burn-In	Method 1015, 160 hours at +125°C 96 hours at +125°C 24 hours at +125°C	•	•	•
Hermeticity	Method 1014, Fine Leak, Condition A Method 1014, Gross Leak, Condition C Dip ( $1 \times 10^{-3}$ )	•	•	•
Final Electrical	MIL-PRF-38534, Group A <sup>1</sup> 100% at 25°C	•	•	•
Final Inspection	Method 2009	•	•	•

Note: 1. 100% R&R testing at -55°C, +25°C, and +125°C with all test data included in product shipment.

## ORDERING INFORMATION

<b>DVTR</b>	<b>28</b>	<b>5</b>	<b>12</b>	<b>T</b>	<b>F</b>	<b>/HB</b>	<b>-</b>	<b>XXX</b>
1	2	3	4	5	6	7		8

(1) Product Series	(2) Nominal Input Voltage		(3) Main Output Voltage		(4) Auxiliary Output Voltages	
<b>DVTR</b>	<b>28</b>	28 Volts	<b>5</b>	+ 5 Volts	<b>12</b> <b>15</b>	± 12 Volts ± 15 Volts

(5) Number of Outputs		(6) Package Option		(7) Screening Code		(8) Additional Screening Code
<b>T</b>	Triple	<b>None</b> <b>F</b>	Non-Flanged Flanged	<b>None</b> <b>/ES</b> <b>/HB</b>	Standard Extended HB	Contact Sales

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.

## CONTACT INFORMATION

To request a quotation or place an order please contact your sales representative or the VPT Inc. Sales Department at:

**Phone:** (425) 487-4850  
**Fax:** (425) 487-4802  
**E-mail:** sales@vpt-inc.com

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