# DVST2800T Series

## HIGH RELIABILITY DC-DC CONVERTERS

### DESCRIPTION

The DVST series of high reliability DC-DC converters contains internal EMI filtering and meets MIL-STD-461C and MIL-STD-461D for conducted emissions, providing a one piece COTS solution for power conversion applications. The DVST series is operable over a wide (-55°C to +100°C) temperature range with no power derating. Unique to the DVST series is a magnetic feedback circuit that is radiation immune. The three low noise outputs are fully isolated from each other, allowing for maximum flexibility in system design.

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

- Up to 30 Watts Output Power
- Three Fully Isolated Outputs
- Wide Input Voltage Range: 15 to 50 Volts per MIL-STD-704 with 80 Volt Transient for 1 sec
- Internal Filter Meets MIL-STD-461C and MIL-STD-461D Conducted Emissions Requirements
- NO Use of Optoisolators
- Undervoltage Lockout
- Indefinite Short Circuit Protection
- Current Limit Protection
- Low Output Noise
- Custom Versions Available
- Low Profile (0.380 inches) Package
- Military Environmental Screening Available

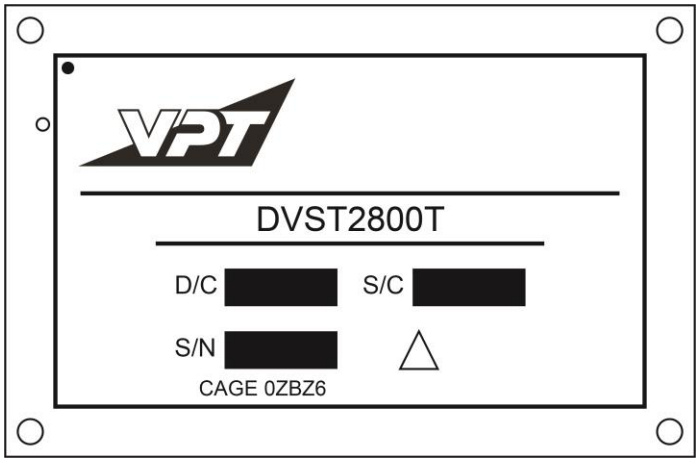



**Figure 1** – DVST2800T DC-DC Converter
(Not To Scale)


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## SPECIFICATIONS ($T_{CASE}$ = -55°C to +100°C, $V_{IN}$ = +28V ± 5%, Full Load, Unless Otherwise Specified)

| ABSOLUTE MAXIMUM RATINGS | | | |
|---|---|---|---|
| Input Voltage (Continuous) | 50 $V_{DC}$ | Operating Case Temperature | -55°C to +100°C |
| Input Voltage (Transient, 1 second) | 80 Volts | Storage Temperature | -55°C to +125°C |
| Output Power[1] | 30 Watts | Lead Solder Temperature (10 seconds) | 270°C |
| Power Dissipation (Full Load, $T_{CASE}$ = +100°C) | 15 Watts | Weight (Maximum) | 100 Grams |

| INPUT | | | | | |
|---|---|---|---|---|---|
| **Parameter** | **Conditions** | **DVST2800T** | | | **Units** |
| | | **Min** | **Typ** | **Max** | |
| **STATIC** | | | | | |
| INPUT Voltage | Continuous | 15 | 28 | 50 | V |
| | Transient, 1 sec | | | 80 | V |
| Current | Inhibited | | 1.6 | 5.0 | mA |
| | No Load | | 65 | 100 | mA |
| Inhibit Pin Input | | 0 | | 1.5 | V |
| Inhibit Pin Open Circuit Voltage | | | 11.0 | 14.0 | V |
| UVLO Turn On | | | | 14.9 | V |
| UVLO Turn Off | | 11.8 | | | V |
| SWITCHING FREQUENCY | | 225 | | 325 | kHz |
| ISOLATION Input / Output / Case | 500 $V_{DC}$ | 100 | | | MΩ |

| MAIN OUTPUT | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Parameter** | | **Conditions** | **DVST283R3xxyyT** | | | **DVST285xxyyT** | | | **Units** |
| | | | **Min** | **Typ** | **Max** | **Min** | **Typ** | **Max** | |
| **STATIC** | | | | | | | | | |
| OUTPUT Voltage | $V_{OUT}$ | $T_{CASE}$ = 25°C | 3.26 | 3.30 | 3.34 | 4.95 | 5.00 | 5.05 | V |
| | $V_{OUT}$ | $T_{CASE}$ = -55°C to +100°C | 3.23 | 3.30 | 3.37 | 4.90 | 5.00 | 5.10 | V |
| Power[2] | | | 0 | | 15 | 0 | | 20 | W |
| Current[2] | $V_{OUT}$ | | 0 | | 4.5 | 0 | | 4.0 | A |
| Ripple Voltage | $V_{OUT}$ | Full Load, 20Hz to 10MHz | | 20 | 50 | | 20 | 50 | $mV_{p-p}$ |
| Line Regulation | $V_{OUT}$ | $V_{IN}$ = 15V to 50V | | 5 | 20 | | 5 | 20 | mV |
| Load Regulation | $V_{OUT}$ | No Load to Full Load | | 10 | 30 | | 10 | 30 | mV |
| EFFICIENCY | | | | 73 | | | 76 | | % |
| CAPACITIVE LOAD | | | | | 1000 | | | 1000 | µF |
| **DYNAMIC** | | | | | | | | | |
| Load Step Output Transient | $V_{OUT}$ | Half Load to Full Load | | 200 | 400 | | 200 | 400 | $mV_{PK}$ |
| Load Step Recovery[3] | | | | 200 | 400 | | 200 | 400 | µSec |
| Line Step Output Transient | $V_{OUT}$ | $V_{IN}$ = 15V to 50V | | 400 | 600 | | 400 | 600 | $mV_{PK}$ |
| Line Step Recovery[3] | | | | 400 | 600 | | 400 | 600 | µSec |
| Turn On Delay | $V_{OUT}$ | $V_{IN}$ = 0V to 28V | | 15 | 20 | | 15 | 20 | mSec |
| Turn On Overshoot | | | | 0 | 30 | | 0 | 50 | $mV_{PK}$ |

## SPECIFICATIONS ($T_{CASE}$ = -55°C to +100°C, $V_{IN}$ = +28V ± 5%, Full Load, Unless Otherwise Specified)

| ABSOLUTE MAXIMUM RATINGS | | | |
|---|---|---|---|
| Input Voltage (Continuous) | 50 $V_{DC}$ | Operating Case Temperature | -55°C to +100°C |
| Input Voltage (Transient, 1 second) | 80 Volts | Storage Temperature | -55°C to +125°C |
| Output Power[1] | 30 Watts | Lead Solder Temperature (10 seconds) | 270°C |
| Power Dissipation (Full Load, $T_{CASE}$ = +100°C) | 15 Watts | Weight (Maximum) | 100 Grams |

| MAIN OUTPUT | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Parameter | | Conditions | DVST281R8xxyyT | | | DVST286R25xxyyT | | | Units |
| | | | Min | Typ | Max | Min | Typ | Max | |
| **STATIC** | | | | | | | | | |
| OUTPUT Voltage | $V_{OUT}$ | $T_{CASE}$ = 25°C | 1.78 | 1.80 | 1.82 | 6.19 | 6.25 | 6.31 | V |
| | $V_{OUT}$ | $T_{CASE}$ = -55°C to +100°C | 1.76 | 1.80 | 1.84 | 6.12 | 6.25 | 6.38 | V |
| Power[2] | | | 0 | | 13.5 | 0 | | 20 | W |
| Current[2] | $V_{OUT}$ | | 0 | | 7.5 | 0 | | 3.2 | A |
| Ripple Voltage | $V_{OUT}$ | Full Load, 20Hz to 10MHz | | 20 | 75 | | 20 | 50 | $mV_{p-p}$ |
| Line Regulation | $V_{OUT}$ | $V_{IN}$ = 15V to 50V | | 5 | 20 | | 5 | 20 | mV |
| Load Regulation | $V_{OUT}$ | No Load to Full Load | | 10 | 30 | | 10 | 30 | mV |
| EFFICIENCY | | | | 66 | | | 76 | | % |
| CAPACITIVE LOAD | | | | | 1000 | | | 1000 | µF |
| **DYNAMIC** | | | | | | | | | |
| Load Step Output Transient | $V_{OUT}$ | Half Load to Full Load | | 200 | 400 | | 200 | 400 | $mV_{PK}$ |
| Load Step Recovery[3] | | | | 500 | 750 | | 200 | 400 | µSec |
| Line Step Output Transient | $V_{OUT}$ | $V_{IN}$ = 15V to 50V | | 400 | 600 | | 400 | 600 | $mV_{PK}$ |
| Line Step Recovery[3] | | | | 400 | 750 | | 400 | 600 | µSec |
| Turn On Delay | $V_{OUT}$ | $V_{IN}$ = 0V to 28V | | 15 | 20 | | 15 | 20 | mSec |
| Turn On Overshoot | | | | 0 | 20 | | 0 | 50 | $mV_{PK}$ |

## SPECIFICATIONS ($T_{CASE}$ = -55°C to +100°C, $V_{IN}$ = +28V ± 5%, Full Load, Unless Otherwise Specified)

| ABSOLUTE MAXIMUM RATINGS | | | |
|---|---|---|---|
| Input Voltage (Continuous) | 50 $V_{DC}$ | Operating Case Temperature | -55°C to +100°C |
| Input Voltage (Transient, 1 second) | 80 Volts | Storage Temperature | -55°C to +125°C |
| Output Power[1] | 30 Watts | Lead Solder Temperature (10 seconds) | 270°C |
| Power Dissipation (Full Load, $T_{CASE}$ = +100°C) | 15 Watts | Weight (Maximum) | 100 Grams |

| MAIN OUTPUT | | | | | | |
|---|---|---|---|---|---|---|
| Parameter | | Conditions | DVST2812xxyyT | | | Units |
| | | | Min | Typ | Max | |
| **STATIC** | | | | | | |
| OUTPUT Voltage | $V_{OUT}$ | $T_{CASE}$ = 25°C | 11.88 | 12.00 | 12.12 | V |
| | $V_{OUT}$ | $T_{CASE}$ = -55°C to +100°C | 11.76 | 12.00 | 12.24 | V |
| Power[2] | | | | | 20 | W |
| Current[2] | $V_{OUT}$ | | | | 1.67 | A |
| Ripple Voltage | $V_{OUT}$ | Full Load, 20Hz to 10MHz | | | 50 | $mV_{p-p}$ |
| Line Regulation | $V_{OUT}$ | $V_{IN}$ = 15V to 50V | | | 50 | mV |
| Load Regulation | $V_{OUT}$ | No Load to Full Load | | | 50 | mV |
| EFFICIENCY | | | | 76 | | % |
| CAPACITIVE LOAD | | | | | 500 | µF |
| **DYNAMIC** | | | | | | |
| Load Step Output Transient | $V_{OUT}$ | Half Load to Full Load | | 200 | 400 | $mV_{PK}$ |
| Load Step Recovery[3] | | | | 200 | 400 | µSec |
| Line Step Output Transient | $V_{OUT}$ | $V_{IN}$ = 15V to 50V | | 400 | 600 | $mV_{PK}$ |
| Line Step Recovery[3] | | | | 200 | 600 | µSec |
| Turn On Delay | $V_{OUT}$ | $V_{IN}$ = 0V to 28V | | 15 | 20 | mSec |
| Turn On Overshoot | | | | 0 | 50 | $mV_{PK}$ |

## SPECIFICATIONS ($T_{CASE}$ = -55°C to +100°C, $V_{IN}$ = +28V ± 5%, Full Load, Unless Otherwise Specified)

| ABSOLUTE MAXIMUM RATINGS | | | |
|---|---|---|---|
| Input Voltage (Continuous) | 50 $V_{DC}$ | Operating Case Temperature | -55°C to +100°C |
| Input Voltage (Transient, 1 second) | 80 Volts | Storage Temperature | -55°C to +125°C |
| Output Power[1] | 30 Watts | Lead Solder Temperature (10 seconds) | 270°C |
| Power Dissipation (Full Load, $T_{CASE}$ = +100°C) | 15 Watts | Weight (Maximum) | 100 Grams |

| AUXILIARY OUTPUT | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Parameter | | Conditions | DVST28x12yyT | | | DVST28x15yyT | | | Units |
| | | | Min | Typ | Max | Min | Typ | Max | |
| **STATIC** | | | | | | | | | | |
| OUTPUT Voltage | $V_{OUT}$ | $T_{CASE}$ = 25°C | 11.76 | 12.00 | 12.24 | 14.70 | 15.00 | 15.30 | V |
| | $V_{OUT}$ | $T_{CASE}$ = -55°C to +100°C | 11.64 | 12.00 | 12.36 | 14.55 | 15.00 | 15.45 | V |
| Power[2] | | | 0 | | 5 | 0 | | 5 | W |
| Current[2] | $V_{OUT}$ | | 0 | | 0.42 | 0 | | 0.33 | A |
| Ripple Voltage | $V_{OUT}$ | Full Load, 20Hz to 10MHz | | 25 | 50 | | 25 | 50 | $mV_{p-p}$ |
| Line Regulation | $V_{OUT}$ | $V_{IN}$ = 15V to 50V | | 5 | 20 | | 5 | 20 | mV |
| Load Regulation | $V_{OUT}$ | No Load to Full Load | | 10 | 50 | | 10 | 50 | mV |
| CAPACITIVE LOAD | | | | | 500 | | | 500 | µF |
| **DYNAMIC** | | | | | | | | | | |
| Load Step Output Transient | $V_{OUT}$ | Half Load to Full Load | | 200 | 400 | | 200 | 400 | $mV_{PK}$ |
| Load Step Recovery[3] | | | | 100 | 200 | | 100 | 200 | µSec |
| Line Step Output Transient | $V_{OUT}$ | $V_{IN}$ = 15V to 50V | | 100 | 400 | | 100 | 400 | $mV_{PK}$ |
| Line Step Recovery[3] | | | | 100 | 200 | | 100 | 200 | µSec |
| Turn On Delay | $V_{OUT}$ | $V_{IN}$ = 0V to 28V | | 2 | 20 | | 2 | 20 | mSec |
| Turn On Overshoot | | | | 100 | 250 | | 100 | 250 | $mV_{PK}$ |

## SPECIFICATIONS ($T_{CASE}$ = -55°C to +100°C, $V_{IN}$ = +28V ± 5%, Full Load, Unless Otherwise Specified)

| ABSOLUTE MAXIMUM RATINGS | | | |
|---|---|---|---|
| Input Voltage (Continuous) | 50 $V_{DC}$ | Operating Case Temperature | -55°C to +100°C |
| Input Voltage (Transient, 1 second) | 80 Volts | Storage Temperature | -55°C to +125°C |
| Output Power[1] | 30 Watts | Lead Solder Temperature (10 seconds) | 270°C |
| Power Dissipation (Full Load, $T_{CASE}$ = +100°C) | 15 Watts | Weight (Maximum) | 100 Grams |

| AUXILIARY OUTPUT | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Parameter | | Conditions | DVST28x3R3yyT | | | DVST28x5yyT | | | Units |
| | | | Min | Typ | Max | Min | Typ | Max | |
| **STATIC** | | | | | | | | | | |
| OUTPUT Voltage | $V_{OUT}$ | $T_{CASE}$ = 25°C | 3.23 | 3.30 | 3.37 | 4.90 | 5.00 | 5.10 | V |
| | $V_{OUT}$ | $T_{CASE}$ = -55°C to +100°C | 3.20 | 3.30 | 3.40 | 4.85 | 5.00 | 5.15 | V |
| Power[2] | | | | | 4 | | | 5 | W |
| Current[2] | $V_{OUT}$ | | | | 1.2 | | | 1.0 | A |
| Ripple Voltage | $V_{OUT}$ | Full Load, 20Hz to 10MHz | | 25 | 50 | | 25 | 50 | $mV_{p-p}$ |
| Line Regulation | $V_{OUT}$ | $V_{IN}$ = 15V to 50V | | 5 | 20 | | 5 | 20 | mV |
| Load Regulation | $V_{OUT}$ | No Load to Full Load | | 10 | 30 | | 10 | 30 | mV |
| CAPACITIVE LOAD | | | | | 1000 | | | 1000 | µF |
| **DYNAMIC** | | | | | | | | | | |
| Load Step Output Transient | $V_{OUT}$ | Half Load to Full Load | | 100 | 200 | | 100 | 200 | $mV_{PK}$ |
| Load Step Recovery[3] | | | | 100 | 200 | | 100 | 200 | µSec |
| Line Step Output Transient | $V_{OUT}$ | $V_{IN}$ = 15V to 50V | | 100 | 200 | | 100 | 200 | $mV_{PK}$ |
| Line Step Recovery[3] | | | | 100 | 200 | | 100 | 200 | µSec |
| Turn On Delay | $V_{OUT}$ | $V_{IN}$ = 0V to 28V | | 2 | 20 | | 2 | 20 | mSec |
| Turn On Overshoot | | | | 0 | 50 | | 0 | 50 | $mV_{PK}$ |

Notes: 1. Dependant on output voltage.
2. Derate linearly from full rating at 100°C to 0 at 110°C.
3. Time for output voltage to settle to within 1% of its nominal value.

## CONNECTION DIAGRAM

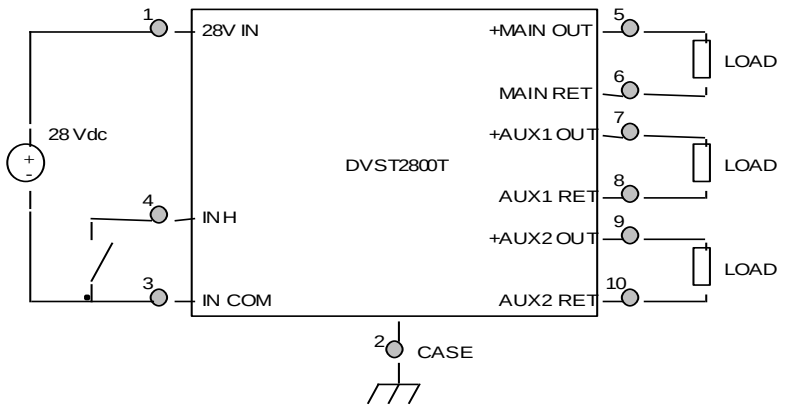



**Figure 2**

## BLOCK DIAGRAM

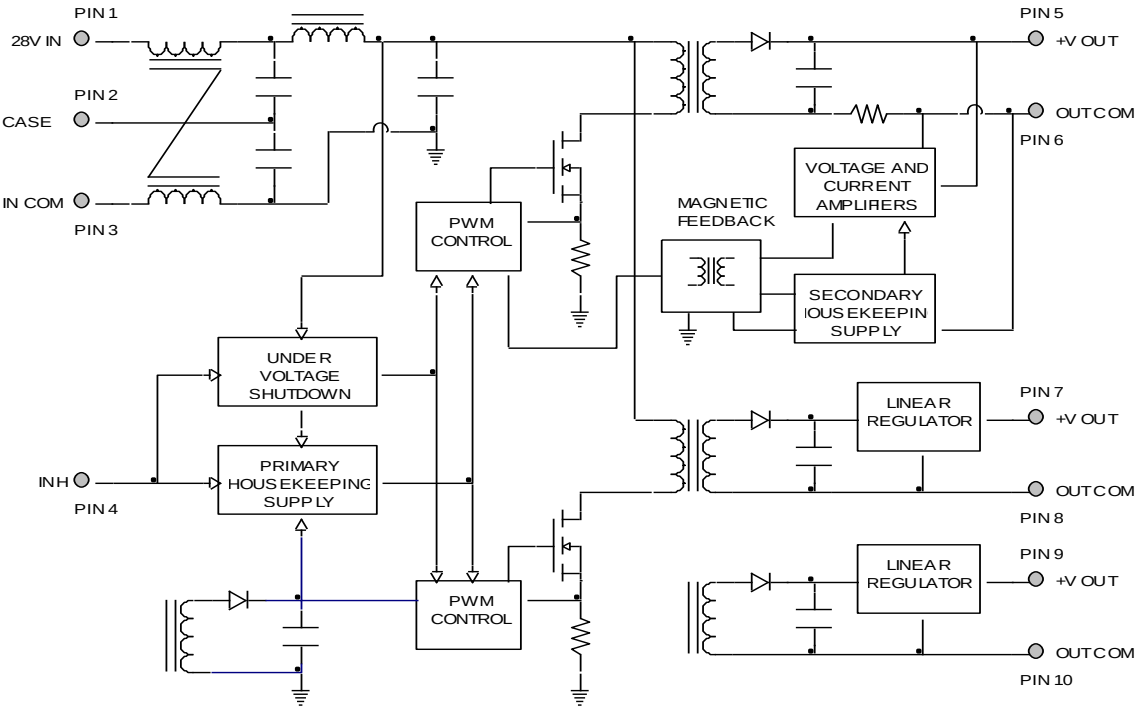



**Figure 3**

## INHIBIT DRIVE CONNECTION DIAGRAMS

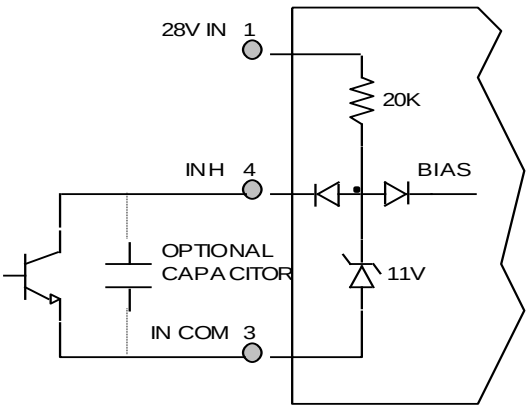



**Figure 4** – Internal Inhibit Circuit and Recommended Drive
(Shown with optional capacitor for turn-on delay)

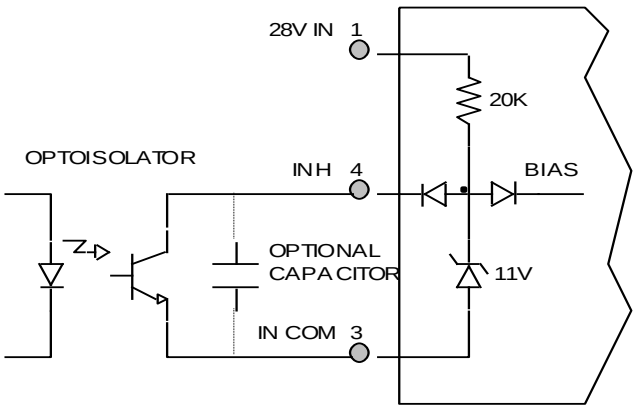



**Figure 5** – Isolated Inhibit Drive
(Shown with optional capacitor for turn-on delay)

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

| ------- $V_{IN}$ = 15V | ——— $V_{IN}$ = 28V | – – – – – $V_{IN}$ = 50V |
|---|---|---|

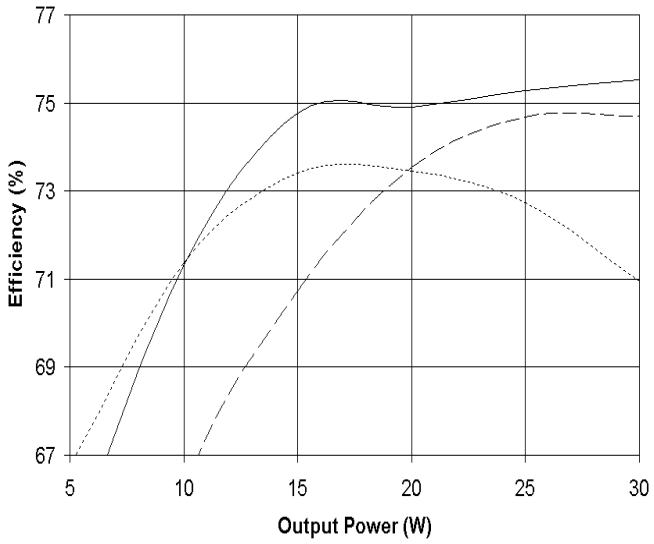



**Figure 6** – DVST2851212T
Efficiency (%) vs. Output Power (W)

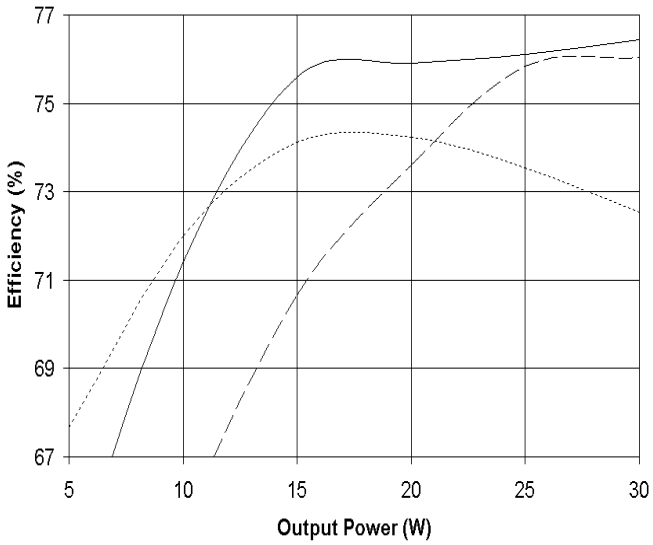



**Figure 7** – DVST2851515T
Efficiency (%) vs. Output Power (W)

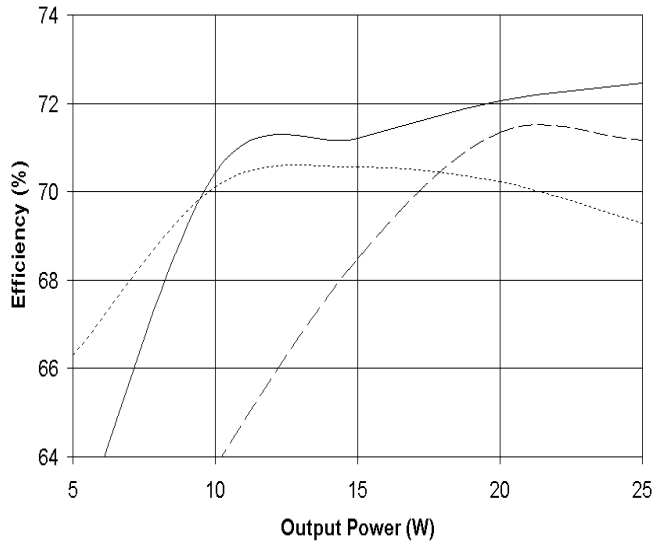



**Figure 8** – DVST283R31212T
Efficiency (%) vs. Output Power (W)

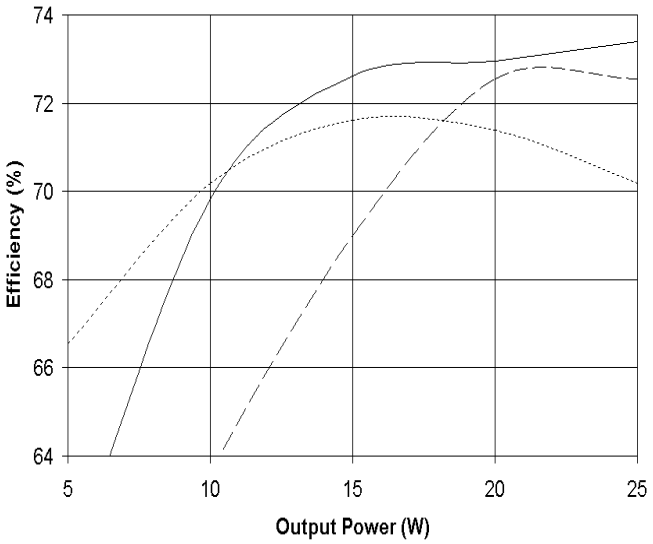
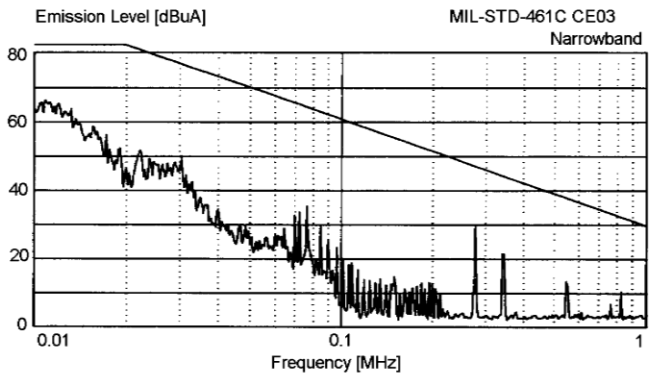



**Figure 9** – DVST283R31515T
Efficiency (%) vs. Output Power (W)

## EMI PERFORMANCE CURVES

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



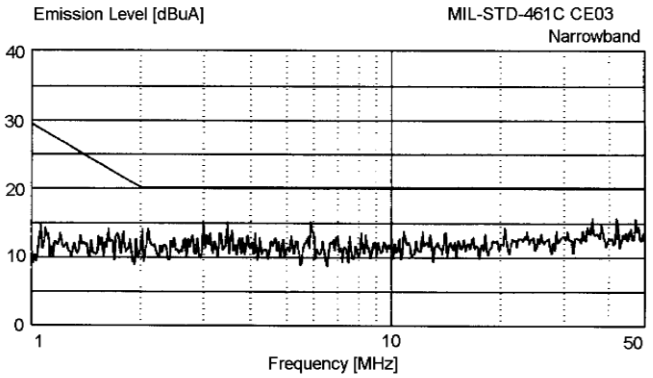
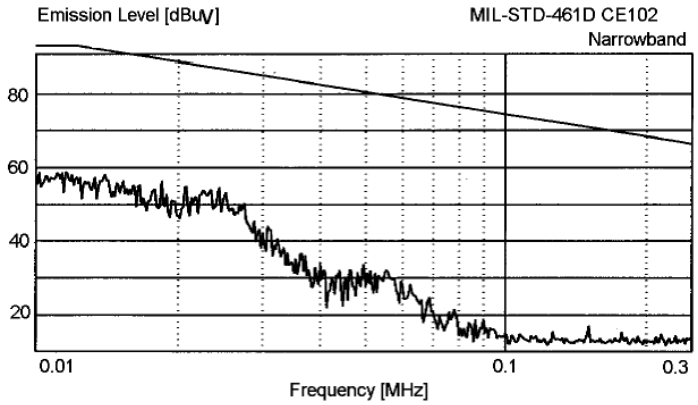




**Figure 10** –
MIL-STD-461C CE03 Conducted Emissions



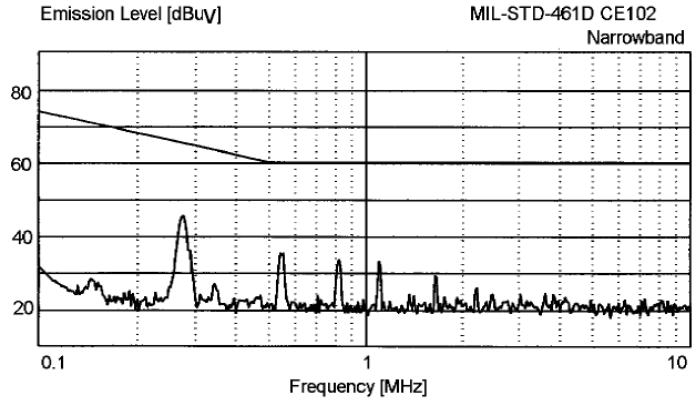
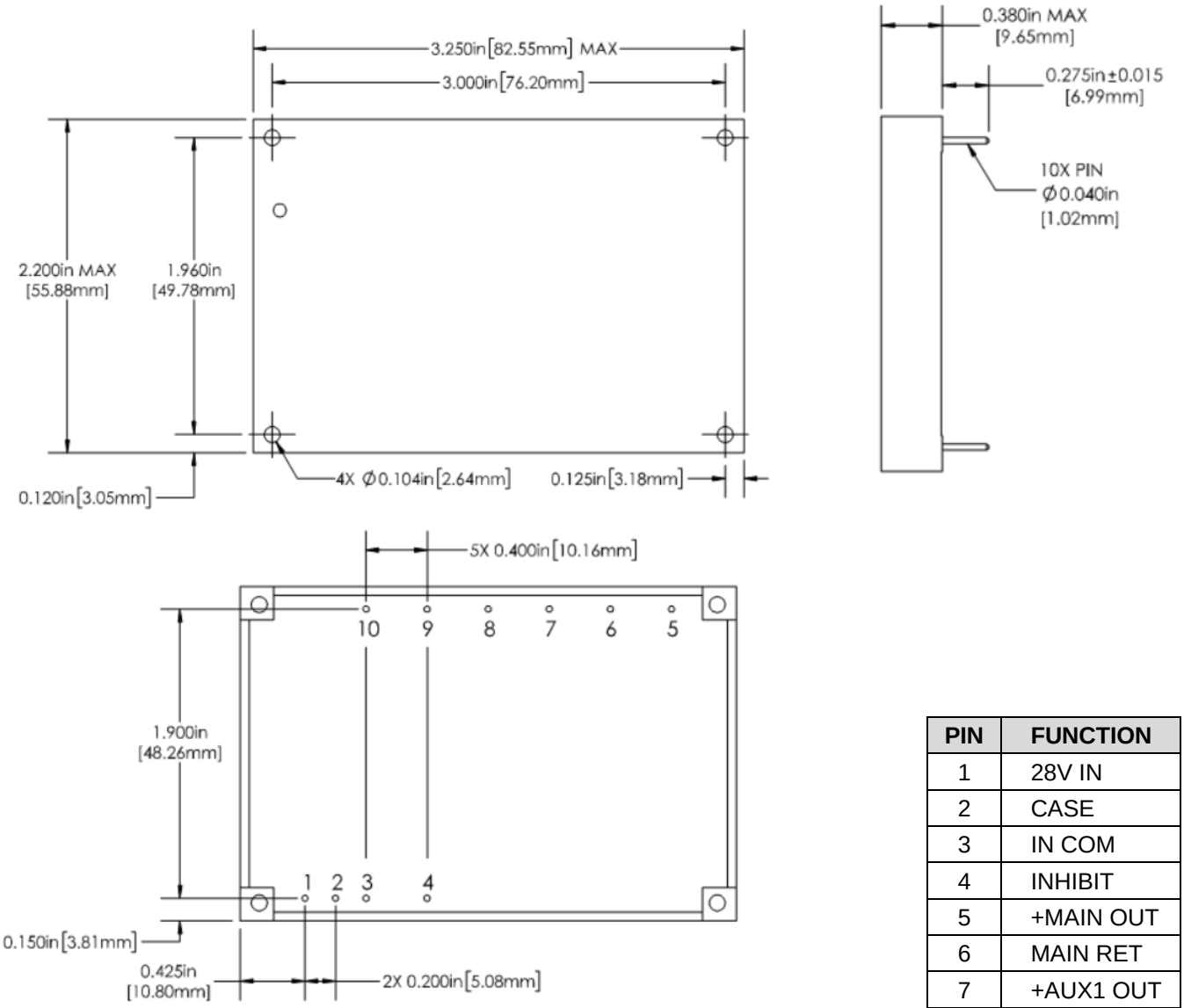




**Figure 11** –
MIL-STD-461D CE102 Conducted Emissions

## ENVIRONMENTAL QUALIFICATION

| Description | MIL-STD-883 | MIL-STD-202 | Test Condition |
|---|---|---|---|
| Temperature Cycling | 1010 | 102A | -55°C to +100°C, 100 cycles |
| Constant Acceleration | 2001 | 212A | 500g, 1min. |
| Mechanical Shock | 2002 Cond. A | 213B Cond. D | 500g, 1ms |
| Random Vibration | 2026 Cond. D | 214A Cond. D | 11.6G RMS, operating |
| Moisture Resistance | 1004 | 106F | 10 days |
| Barometric Pressure | 1001 Cond. D | 105C Cond. C | 70,000 ft, operating |
| Salt Atmosphere | 1009 Cond. B | 101D Cond. B | 48 hrs. |
| Resistance to Solvents | 2015 | 215J | |
| Solderability | 2003 | 208H | |

## PACKAGE SPECIFICATIONS




| PIN | FUNCTION |
|---|---|
| 1 | 28V IN |
| 2 | CASE |
| 3 | IN COM |
| 4 | INHIBIT |
| 5 | +MAIN OUT |
| 6 | MAIN RET |
| 7 | +AUX1 OUT |
| 8 | AUX1 RET |
| 9 | +AUX2 OUT |
| 10 | AUX2 RET |

Note: Additional mounting options are available. Consult the factory for details.

**Figure 12** – Package and Pinout
(Dimensional Limits are ±0.005" Unless Otherwise Stated)

## PACKAGE PIN DESCRIPTION

| Pin | Function | Description |
|---|---|---|
| 1 | 28V IN | Positive Input voltage Connection |
| 2 | CASE | Case Connection |
| 3 | IN COM | Input Common Connection |
| 4 | INHIBIT | Logic Low = Disabled Output. Connecting the inhibit pin to input common (PIN 7) causes converter shutdown.<br>Logic High = Enabled Output. Unconnected or open collector TTL. |
| 5 | +MAIN OUT | Main Positive Output Voltage Connection |
| 6 | MAIN RET | Main Output Return Connection |
| 7 | +AUX1 OUT | Auxiliary Positive Output Voltage Connection |
| 8 | AUX1 RET | Auxiliary Output Return Connection |
| 9 | +AUX2 OUT | Auxiliary Positive Output Voltage Connection |
| 10 | AUX2 RET | Auxiliary Output Return Connection |

## ENVIRONMENTAL SCREENING

| Screening | Condition | Standard (No Suffix) | Military /ML |
|---|---|---|---|
| Pre-Cap Inspection | IPC-A-610 Class II | • | • |
| Temperature Cycling | -55°C, 100°C, 10 Cycles | | • |
| Burn-In | 96 hours at +100°C<br>12 hours at +100°C | • | • |
| Final Electrical | 100% at -55°C, 25°C, 100°C[1]<br>100% at 25°C | • | • |
| Final Inspection | MIL-STD-883, Test Method 2009 | • | • |

## ORDERING INFORMATION

| DVST | 28 | 5 | 15 | 15 | T | | /ML | - | XXX |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | 9 |

| (1) | (2) | | (3) | | (4) | | (5) | |
|---|---|---|---|---|---|---|---|---|
| **Product Series** | **Nominal Input Voltage** | | **Main Output** | | **Auxiliary Output 1** | | **Auxiliary Output 2** | |
| **DVST** | **28** | 28 Volts | **1R8**<br>**3R3**<br>**5**<br>**6R25**<br>**12** | 1.8 Volts<br>3.3 Volts<br>5 Volts<br>6.25 Volts<br>12 Volts | **3R3**<br>**5**<br>**12**<br>**15** | 3.3 Volts<br>5 Volts<br>12 Volts<br>15 Volts | **5**<br>**12**<br>**15** | 5 Volts<br>12 Volts<br>15 Volts |

| (6) | | (7) | | (8) | | (9) |
|---|---|---|---|---|---|---|
| **Number of Outputs** | | **Package Option** | | **Screening Code[1]** | | **Additional Screening Code** |
| **T** | Triple | **None** | Standard | **None**<br>**/ML** | Standard<br>Military | Contact Sales |

Notes: 1. VPT Inc. reserves the right to ship higher screened 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, or packaging requirements.

## CONTACT INFORMATION

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

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