



VPT30-2800T Series



HIGH RELIABILITY COTS DC-DC CONVERTERS

DESCRIPTION

The VPT30 series of isolated COTS DC-DC converters is a cost effective solution for many demanding high reliability applications. A wide input voltage range accommodates nominal 28V inputs including avionics, mobile, ground systems, and other applications. Low input and output ripple, fixed operating frequency, and companion EMI filters simplify system design and compliance. A proven design heritage, no optoisolators and a rugged all metal package ensure long term reliability.

The VPT30 series is intended for harsh environments including severe vibration, shock and temperature cycling. Testing is to JESD22, MIL-STD-810, and MIL-STD-883.

These converters are designed and manufactured in the USA in a facility certified to ISO9001, J-STD-001 and IPC-A-610.

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 at Low Cost
- 30 Watts Output Power
- Three Independent Fully Isolated Outputs
- Wide Input Voltage Range: 9 to 80 Volts per MIL-STD-704 and MIL-STD-1275
- High Input Transient Voltage: 100 Volts for 1 sec per MIL-STD-1275
- Each Output can be configured as a Positive or Negative Output
- Zero Cross Regulation
- No Minimum Load Requirement
- Input Undervoltage Lockout
- Fixed Frequency
- Output Soft Start
- Short Circuit Protection
- Magnetic Feedback, no Optoisolators
- Wide Temperature Range, -55°C to 100°C
- Internally Conformal Coated
- Six Sided Non-Hermetic Rugged Metal Enclosure
- Meets MIL-STD-461 Revisions C, D, E and F EMC Requirements When Used With VPT's EMI Filters



Figure 1 – VPT30-2800T DC-DC Converter
(Not To Scale)



VPT30-2800T Series

SPECIFICATIONS ($T_{CASE} = -55^{\circ}\text{C}$ to $+100^{\circ}\text{C}$, $V_{IN} = +28\text{V} \pm 5\%$, Full Load, Unless Otherwise Specified)

ABSOLUTE MAXIMUM RATINGS

| | | | |
|--|-------------|--------------------------------------|-----------------|
| Input Voltage (Continuous) | 80 V_{DC} | Junction Temperature Rise to Case | 24°C |
| Input Voltage (Transient, 1 sec) | 100 Volts | Storage Temperature | -55°C to +125°C |
| Output Power | 30 Watts | Lead Solder Temperature (10 seconds) | 300°C |
| Power Dissipation ⁶ (Full Load, $T_{CASE} = +100^{\circ}\text{C}$) | 9 Watts | Weight (Maximum) | 50 Grams |

| Parameter | Conditions | VPT30-2800T | | | Units |
|---|---------------------------------|-------------|------|------|-----------|
| | | Min | Typ | Max | |
| STATIC | | | | | |
| INPUT Voltage ^{4,5} | Continuous | 9 | 28 | 80 | V |
| | Transient, 1 sec | - | - | 100 | V |
| Current | Inhibited | - | 1 | 5 | mA |
| | No Load | - | 90 | 130 | mA |
| Ripple Current ⁶ | Full Load, 20Hz to 10MHz | - | 30 | 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 | | 9.8 | - | 11.0 | V |
| UVLO Turn Off ⁴ | | 8.0 | - | 8.9 | V |
| OUTPUT POWER | | 0 | - | 30 | W |
| EFFICIENCY ⁶ | Full Load | 77 | 82 | - | % |
| LOAD FAULT POWER DISSIPATION | Short Circuit | - | 2 | 5 | W |
| SWITCHING FREQUENCY | Input | 400 | 500 | 550 | kHz |
| | Output | 325 | 400 | 475 | kHz |
| ISOLATION Input / Output / Case | 500 V_{DC} | 100 | - | - | $M\Omega$ |
| ISOLATION Output / Output | 100 V_{DC} | 20 | - | - | $M\Omega$ |
| MTBF (MIL-HDBK-217F) | GM @ $T_C = 55^{\circ}\text{C}$ | | 672 | | kHrs |

| Parameter | Conditions | 3.3V Output | | | 5V Output | | | Units | |
|------------------------------|------------|--|------|------|-----------|------|------|-------|-------------------|
| | | Min | Typ | Max | Min | Typ | Max | | |
| STATIC | | | | | | | | | |
| OUTPUT Voltage | V_{OUT} | $T_{CASE} = 25^{\circ}\text{C}$ | 3.25 | 3.30 | 3.35 | 4.92 | 5.00 | 5.08 | V |
| | V_{OUT} | $T_{CASE} = -55^{\circ}\text{C}$ to $+100^{\circ}\text{C}$ | 3.21 | 3.30 | 3.38 | 4.87 | 5.00 | 5.13 | V |
| Power ³ | | | 0 | - | 10 | 0 | - | 15 | W |
| Current ³ | V_{OUT} | | 0 | - | 3.0 | 0 | - | 3.0 | A |
| Ripple Voltage | V_{OUT} | Full Load, 20Hz to 10MHz | - | 40 | 100 | - | 40 | 100 | mV_{P-P} |
| Line Regulation ⁶ | V_{OUT} | $V_{IN} = 9\text{V}$ to 80V | - | 2 | 20 | - | 2 | 20 | mV |
| Load Regulation | V_{OUT} | No Load to Full Load | - | 3 | 30 | - | 3 | 30 | mV |
| CAPACITIVE LOAD ⁴ | | | - | - | 1000 | - | - | 1000 | μF |

See notes on next page.



VPT30-2800T Series

SPECIFICATIONS ($T_{CASE} = -55^{\circ}\text{C}$ to $+100^{\circ}\text{C}$, $V_{IN} = +28\text{V} \pm 5\%$, Full Load, Unless Otherwise Specified)

ABSOLUTE MAXIMUM RATINGS

| | | | |
|--|-------------|--------------------------------------|-----------------|
| Input Voltage (Continuous) | 80 V_{DC} | Junction Temperature Rise to Case | 24°C |
| Input Voltage (Transient, 1 sec) | 100 Volts | Storage Temperature | -55°C to +125°C |
| Output Power | 30 Watts | Lead Solder Temperature (10 seconds) | 300°C |
| Power Dissipation ⁶ (Full Load, $T_{CASE} = +100^{\circ}\text{C}$) | 9 Watts | Weight (Maximum) | 50 Grams |

| Parameter | Conditions | 3.3V Output | | | 5V Output | | | Units | |
|---|------------|------------------------------|-----|-----|-----------|-----|-----|-------|------------------|
| | | Min | Typ | Max | Min | Typ | Max | | |
| DYNAMIC | | | | | | | | | |
| Load Step Output Transient | V_{OUT} | Half Load to Full Load | - | 140 | 280 | - | 100 | 200 | mV _{PK} |
| Load Step Recovery ² | | | - | 120 | 240 | - | 90 | 180 | μSec |
| Line Step Output Transient ^{4,6} | V_{OUT} | $V_{IN} = 16\text{V}$ to 40V | - | 50 | 100 | - | 60 | 120 | mV _{PK} |
| Line Step Recovery ^{2,4,6} | | | - | 50 | 100 | - | 50 | 100 | μSec |
| Turn On Delay ⁶ | V_{OUT} | $V_{IN} = 0\text{V}$ to 28V | - | 14 | 20 | - | 14 | 20 | mSec |
| Turn On Overshoot ⁶ | | | - | 0 | 15 | - | 0 | 25 | mV _{PK} |

| Parameter | Conditions | 12V Output | | | 15V Output | | | Units | |
|---|------------|--|-------|------|------------|-------|------|-------|-------------------|
| | | Min | Typ | Max | Min | Typ | Max | | |
| STATIC | | | | | | | | | |
| OUTPUT Voltage | V_{OUT} | $T_{CASE} = 25^{\circ}\text{C}$ | 11.82 | 12.0 | 12.18 | 14.77 | 15.0 | 15.23 | V |
| | V_{OUT} | $T_{CASE} = -55^{\circ}\text{C}$ to $+100^{\circ}\text{C}$ | 11.70 | 12.0 | 12.30 | 14.62 | 15.0 | 15.38 | V |
| Power ³ | | | 0 | - | 15 | 0 | - | 15 | W |
| Current ³ | V_{OUT} | | 0 | - | 1.25 | 0 | - | 1.0 | A |
| Ripple Voltage | V_{OUT} | Full Load, 20Hz to 10MHz | - | 40 | 100 | - | 40 | 100 | mV _{p-p} |
| Line Regulation ⁶ | V_{OUT} | $V_{IN} = 9\text{V}$ to 80V | - | 2 | 20 | - | 2 | 20 | mV |
| Load Regulation | V_{OUT} | No Load to Full Load | - | 3 | 30 | - | 3 | 30 | mV |
| CAPACITIVE LOAD ⁴ | | | | | 500 | | | 500 | μF |
| DYNAMIC | | | | | | | | | |
| Load Step Output Transient | V_{OUT} | Half Load to Full Load | - | 120 | 240 | - | 110 | 220 | mV _{PK} |
| Load Step Recovery ² | | | - | 0 | 100 | - | 0 | 100 | μSec |
| Line Step Output Transient ^{4,6} | V_{OUT} | $V_{IN} = 16\text{V}$ to 40V | - | 150 | 300 | - | 180 | 360 | mV _{PK} |
| Line Step Recovery ^{2,4,6} | | | - | 50 | 100 | - | 50 | 100 | μSec |
| Turn On Delay ⁶ | V_{OUT} | $V_{IN} = 0\text{V}$ to 28V | - | 14 | 20 | - | 14 | 20 | mSec |
| Turn On Overshoot ⁶ | | | - | 0 | 50 | - | 0 | 50 | mV _{PK} |

- Notes:
1. Dependant on output voltage.
 2. Time for output voltage to settle to within 1% of its nominal value.
 3. Derate linearly to 0 at 110°C.
 4. Verified by qualification testing.
 5. Operation down to 9V is possible after the input voltage is taken above 11V to start the module.
 6. Tested with a balanced full load of 10W per each output.

BLOCK DIAGRAM

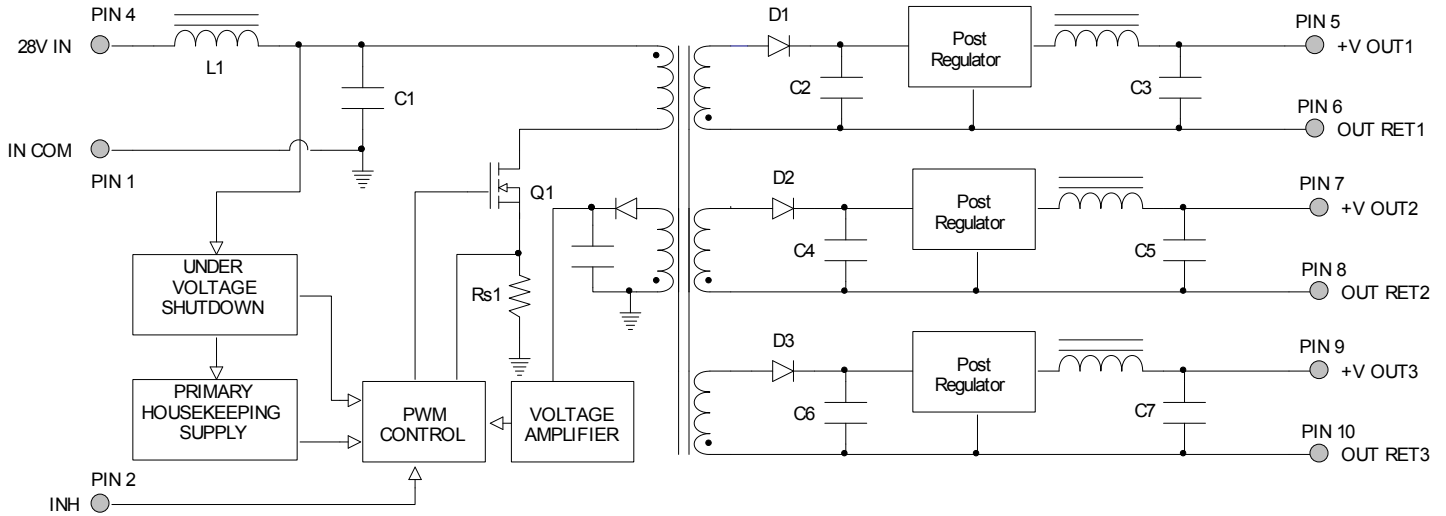


Figure 2

CONNECTION DIAGRAM

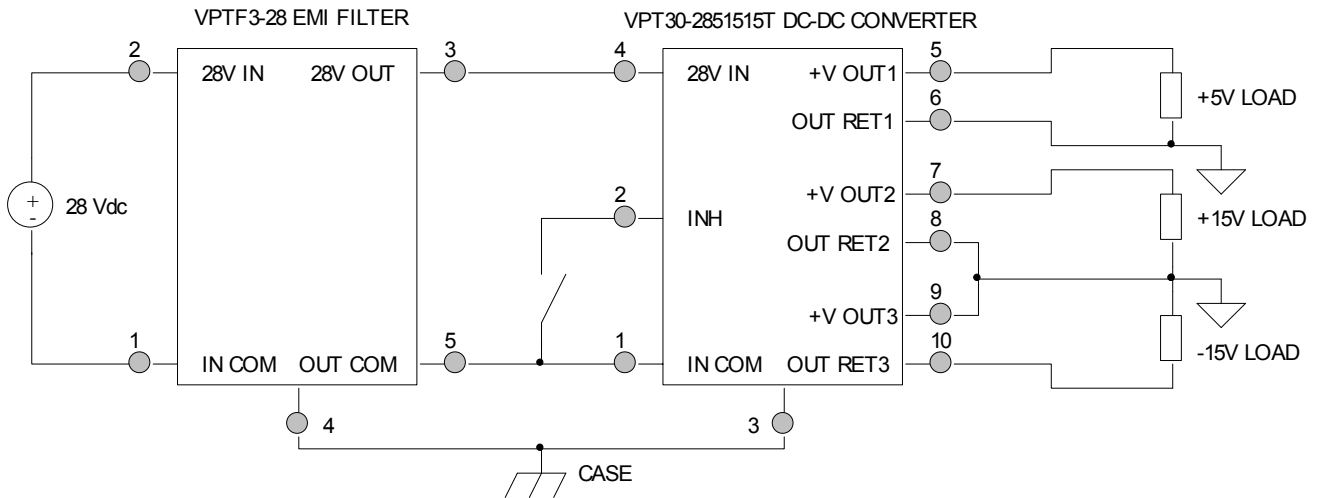


Figure 3

(Shown with optional VPTF3-28 EMI filter, recommended for input voltages > 13V, and optional negative output configuration.)

CONNECTION DIAGRAM

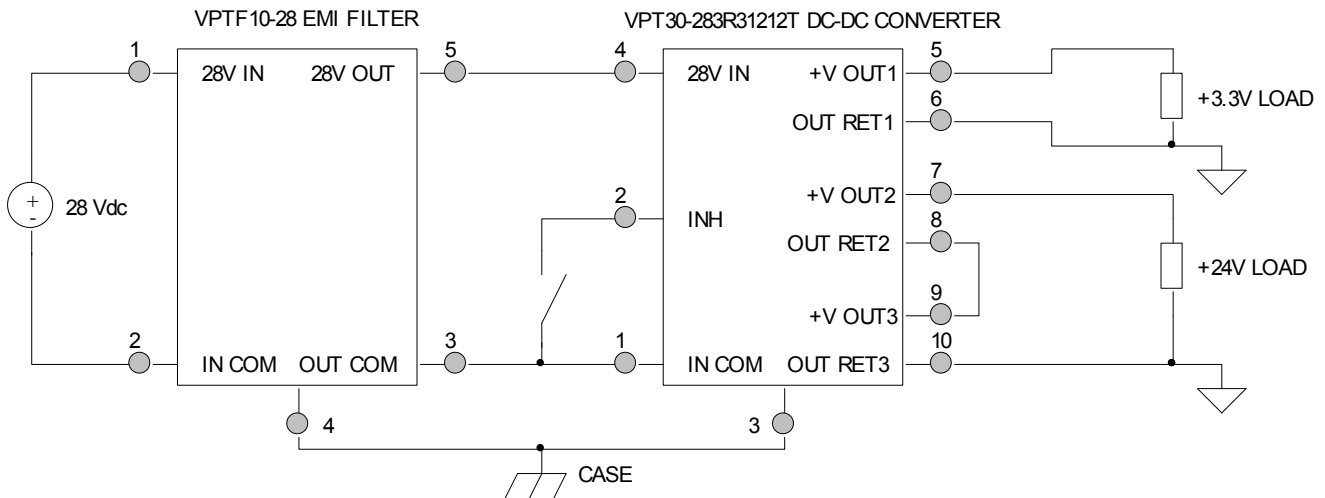


Figure 4

(Shown with optional VPTF10-28 EMI filter, recommended for input voltages < 13V, and optional stacked output configuration.)

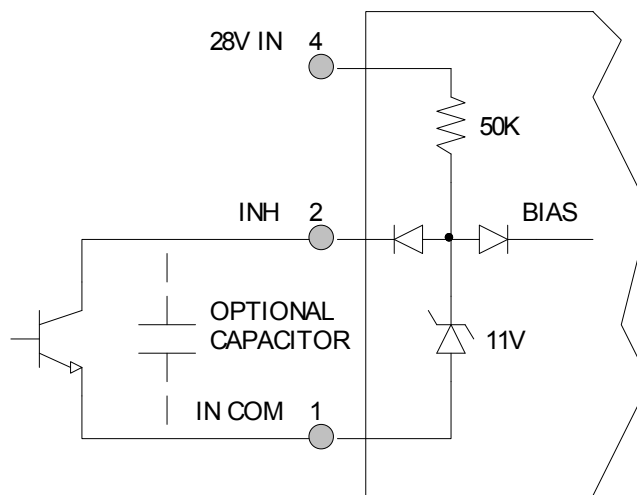


Figure 5 - Inhibit Circuit

(Shown with optional capacitor for turn-on delay)

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

| | | | | | | | | | |
|-------|---------------|-------|----------------|-------|----------------|-------|----------------|-------|----------------|
| ----- | $V_{IN} = 9V$ | ----- | $V_{IN} = 16V$ | ----- | $V_{IN} = 28V$ | ----- | $V_{IN} = 40V$ | ----- | $V_{IN} = 80V$ |
|-------|---------------|-------|----------------|-------|----------------|-------|----------------|-------|----------------|

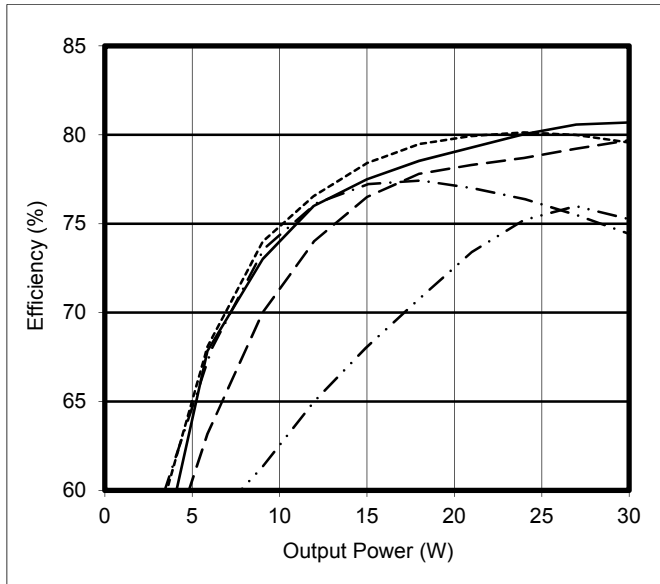


Figure 6 – VPT30-283R31212T
Efficiency (%) vs. Output Power (W)

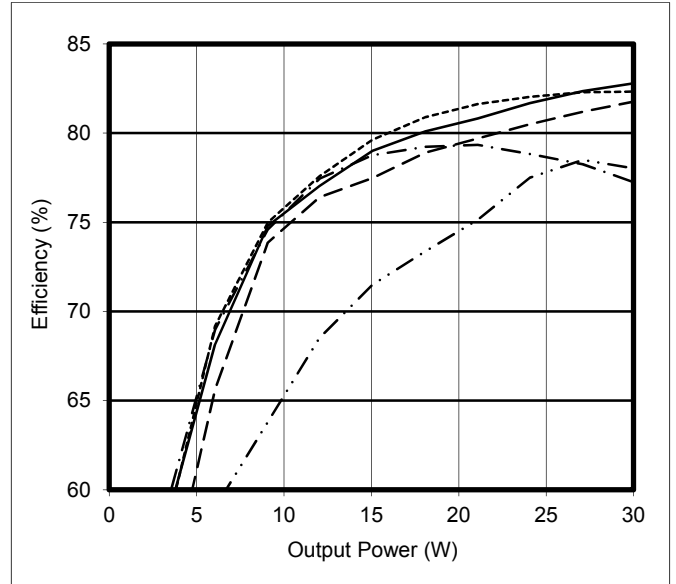


Figure 7 – VPT30-2851515T
Efficiency (%) vs. Output Power (W)

EMI PERFORMANCE CURVES

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

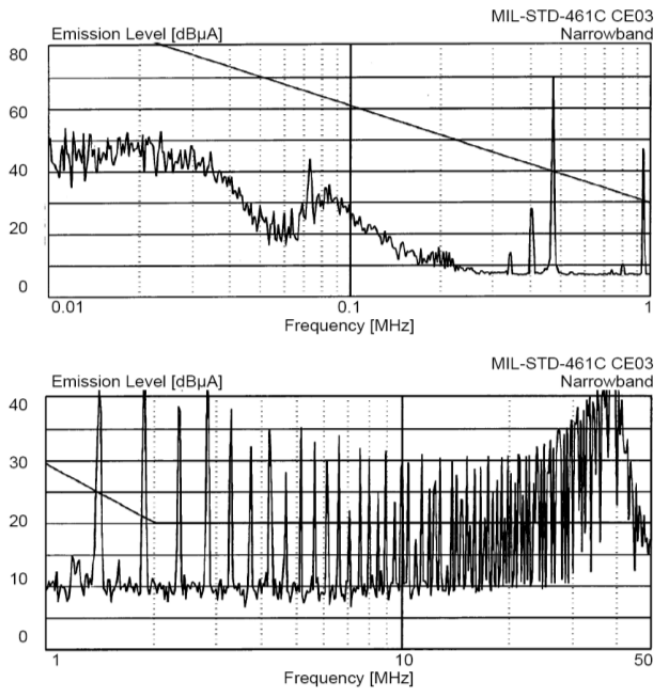


Figure 8 – VPT30-2800T without EMI Filter

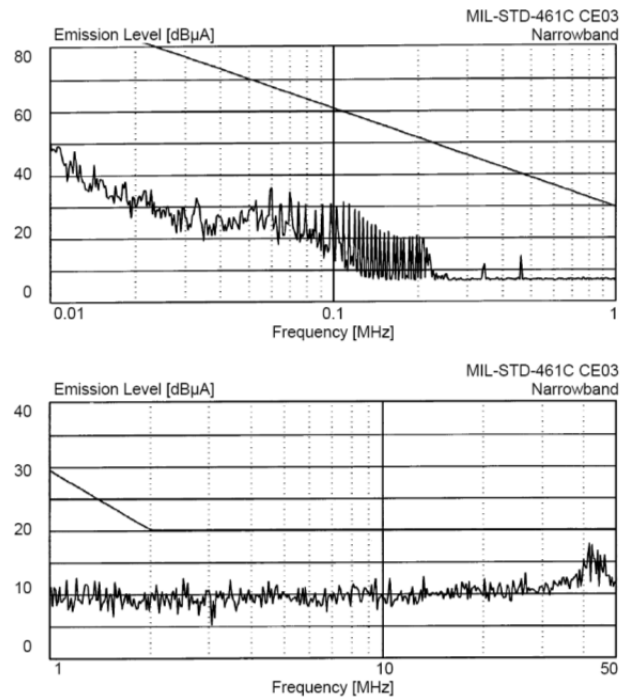


Figure 9 – VPT30-2800T with VPTF3-28 EMI Filter

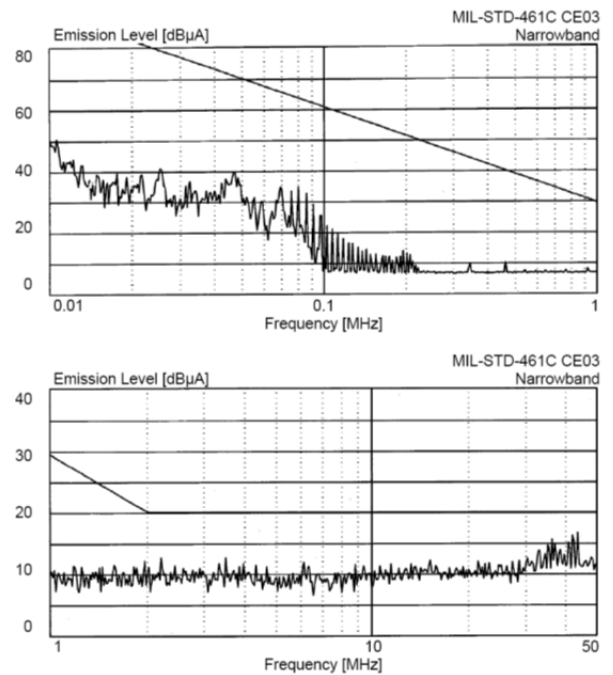


Figure 10 – VPT30-2800T with VPTF10-28 EMI Filter

EMI PERFORMANCE CURVES

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

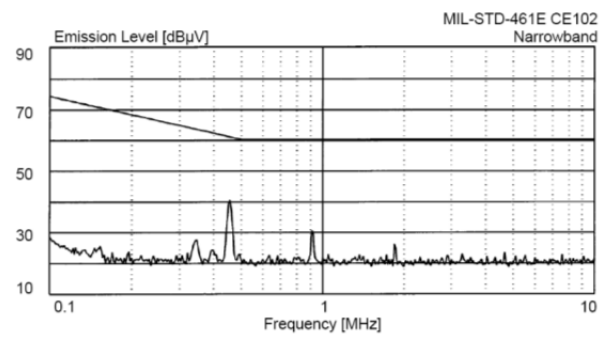
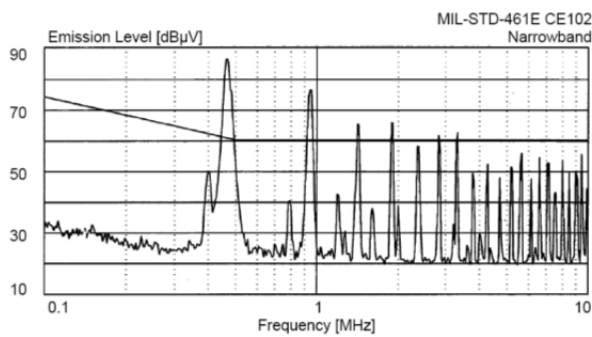
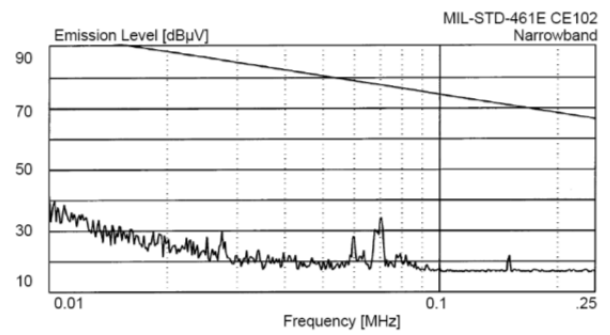
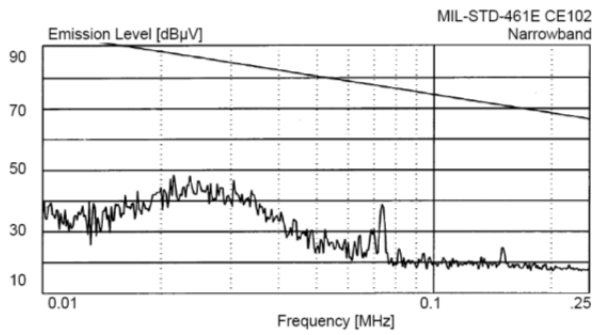


Figure 11 – VPT30-2800T without EMI Filter

Figure 12 – VPT30-2800T with VPTF3-28 EMI Filter

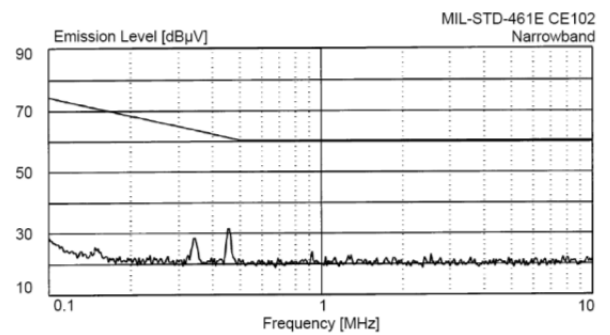
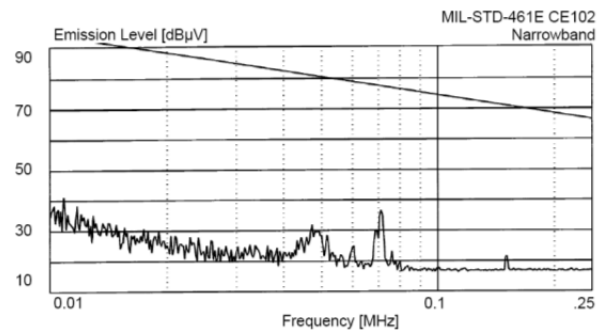
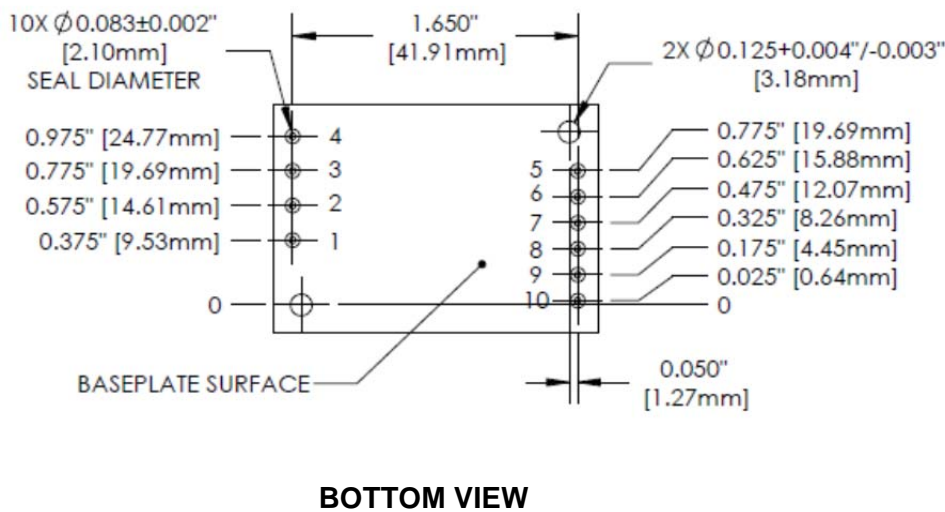
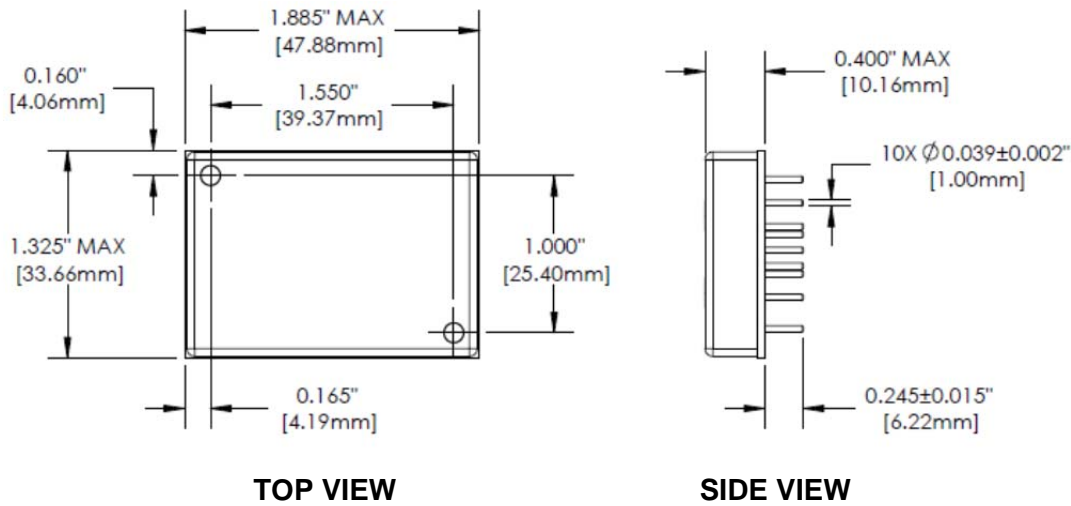


Figure 13 – VPT30-2800T with VPTF10-28 EMI Filter

PACKAGE SPECIFICATIONS



| PIN | FUNCTION |
|-----|----------|
| 1 | IN COM |
| 2 | INHIBIT |
| 3 | CASE |
| 4 | 28V IN |
| 5 | +V OUT1 |
| 6 | OUT RET1 |
| 7 | +V OUT2 |
| 8 | OUT RET2 |
| 9 | +V OUT3 |
| 10 | OUT RET3 |

Figure 14 – Package and Pinout
(Dimensional Limits are ± 0.005 " Unless Otherwise Stated)

Package Notes:

- Case temperature is measured on the center of the baseplate surface.
- Materials: Baseplate – aluminum, conductive conversion coating.
Cover – nickel plated.
Pins – copper, gold over nickel plating.
- Mounting holes are not threaded. Recommended fastener is 4-40.
- This Package is not hermetic. VPT offers a wide range of hermetic products. Please contact VPT for details if hermetic products are required.
- For applications requiring exposure to liquid cleaning, please contact VPT.



PACKAGE PIN DESCRIPTION

| Pin | Function | Description |
|-----|----------|--|
| 1 | IN COM | Input Return Connection. |
| 2 | INHIBIT | This is an open collector input. Logic Low = Disabled Output. Connect the inhibit pin to input common to disable the output. Unconnected, open collector or open drain = Enabled Output. |
| 3 | CASE | Case Connection. |
| 4 | 28V IN | Positive Input Voltage Connection. |
| 5 | +V OUT1 | Positive Output 1 Voltage Connection. |
| 6 | OUT RET1 | Output Return 1 Connection. |
| 7 | +V OUT2 | Positive Output 2 Voltage Connection. |
| 8 | OUT RET2 | Output Return 2 Connection. |
| 9 | +V OUT3 | Positive Output 3 Voltage Connection. |
| 10 | OUT RET3 | Output Return 3 Connection. |

100% ENVIRONMENTAL SCREENING

| Screening | Condition |
|---------------------|---|
| Internal Visual | IPC-A-610 |
| Stabilization Bake | MIL-STD-883, Method 1008, Condition B, 125°C, 24 hours |
| Temperature Cycling | MIL-STD-883, Method 1010, Condition B, -55°C to +125°C, 10 Cycles |
| Burn-In | 96 hours at +100°C |
| Final Electrical | 100% at 25°C |
| External Visual | Internal Procedure |



ORDERING INFORMATION

| | | | | |
|--------|----|---|------|---|
| VPT30- | 28 | 5 | 1515 | T |
| 1 | 2 | 3 | 4 | 5 |

| (1) | (2) | | (3) | | (4) | | (5) | |
|----------------|-----------------------|----------|----------|----------------------|---------------|----------------------|-------------------|--------|
| Product Series | Nominal Input Voltage | | Output 1 | | Outputs 2 & 3 | | Number of Outputs | |
| VPT30 | 28 | 28 Volts | 3R3 5 | 3.3 Volts 5 Volts | 1212 1515 | 12 Volts 15 Volts | T | Triple |

This commercially available product series was specifically designed to accommodate factory configurable output voltage combinations in addition to those defined per the product ordering information table. Please contact your sales representative or the VPT Inc. Sales Department for more information.

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

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