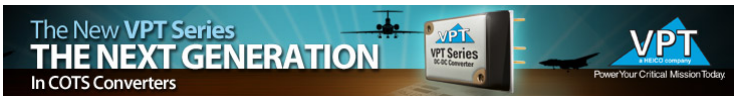
VPT30-2800D Series



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
- Wide Input Voltage Range: 15 to 50 Volts per MIL-STD-704 and MIL-STD-1275
- High Input Transient Voltage: 80 Volts for 1 sec per MIL-STD-704A
- Input Undervoltage Lockout
- Fixed Frequency
- Frequency Synchronization
- Output Soft Start
- Current Limit Protection
- 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 – VPT30-2800D Converter
(Not To Scale)

11314 4th Avenue
West, Suite 206
Everett, WA 98204
http://www.vpt-inc.com

Sales Information:
Phone: (425) 353-3010
Fax: (425) 353-4030
E-mail: vptsales@vpt-inc.com

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}	Junction Temperature Rise to Case	+17°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)	300°C
Power Dissipation (Full Load, T_{CASE} = +100°C)	12 Watts	Weight (Maximum)	48 Grams

Parameter		Conditions	VPT30-2805D			VPT30-2812D			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	-	4	6	-	4	6	mA
		No Load	-	50	90	-	50	90	mA
Ripple Current		Full Load[5], 20Hz to 10MHz	-	30	75	-	30	75	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	$+V_{OUT}$	T_{CASE} = 25°C	4.92	5.00	5.08	11.82	12.0	12.18	V
	$+V_{OUT}$	T_{CASE} = -55°C to +100°C	4.87	5.00	5.13	11.70	12.0	12.30	V
	$-V_{OUT}$	T_{CASE} = 25°C	4.87	5.00	5.13	11.70	12.00	12.30	V
	$-V_{OUT}$	T_{CASE} = -55°C to +100°C	4.82	5.00	5.18	11.58	12.00	12.42	V
Power[3,6]	Total		0	-	30	0	-	30	W
	±Vout	Either Output	0	-	21	0	-	21	W
Current[3,6]	$±V_{OUT}$	Either Output	0	-	4.2	0	-	1.75	A
Ripple Voltage	$±V_{OUT}$	Full Load[5], 20Hz to 10MHz	-	15	50	-	25	50	mV_{p-p}
Line Regulation	$+V_{OUT}$	V_{IN} = 15V to 50V	-	1	10	-	1	10	mV
	$-V_{OUT}$	V_{IN} = 15V to 50V	-	80	150	-	80	150	mV
Load Regulation	$+V_{OUT}$	No Load to Full Load[5]	-	1	10	-	1	10	mV
	$-V_{OUT}$	No Load to Full Load[5,7]	-	30	100	-	30	150	mV
Cross Regulation	$-V_{OUT}$	+Load 70%, -Load 30% +Load 30%, -Load 70%	-	200	400	-	300	500	mV
EFFICIENCY		Full Load[5]	74	81	-	79	84	-	%
LOAD FAULT POWER DISSIPATION		Overload[4]	-	-	16	-	-	14	W
		Short Circuit	-	-	16	-	-	14	W
CAPACITIVE LOAD[4]		Either Output	-	-	500	-	-	500	µF
SWITCHING FREQUENCY			400	450	550	400	450	550	kHz
SYNC FREQUENCY RANGE		V_H - V_L = 5V, D = 20-80%	500	-	600	500	-	600	kHz
ISOLATION		500 V_{DC}	100	-	-	100	-	-	MΩ
MTBF (MIL-HDBK-217F)		GM @ T_C = 55°C	-	371	-	-	371	-	kHrs

See notes on next page.

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}	Junction Temperature Rise to Case	+17°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)	300°C
Power Dissipation (Full Load, T_{CASE} = +100°C)	12 Watts	Weight (Maximum)	48 Grams

Parameter	Conditions	VPT30-2805D			VPT30-2812D			Units
		Min	Typ	Max	Min	Typ	Max	
DYNAMIC								
Load Step Output Transient ±V_{OUT}	Half Load to Full Load	-	100	300	-	250	450	mV_{PK}
Load Step Recovery[2]		-	40	200	-	200	400	µSec
Line Step Output Transient[4] ±V_{OUT}	V_{IN} = 16V to 40V	-	300	600	-	700	1100	mV_{PK}
Line Step Recovery[2, 4]		-	150	400	-	300	500	µSec
Turn On Delay ±V_{OUT}	V_{IN} = 0V to 28V	-	10	20	-	10	20	mSec
Turn On Overshoot		-	0	25	-	0	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 110°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 +100°C, V_{IN} = +28V ± 5%, Full Load, Unless Otherwise Specified)

ABSOLUTE MAXIMUM RATINGS			
Input Voltage (Continuous)	50 V_{DC}	Junction Temperature Rise to Case	+17°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)	300°C
Power Dissipation (Full Load, T_{CASE} = +100°C)	12 Watts	Weight (Maximum)	48 Grams

Parameter		Conditions	VPT30-2815D			Units
			Min	Typ	Max	
STATIC						
INPUT Voltage[4]		Continuous	15	28	50	V
		Transient, 1 sec	-	-	80	V
Current		Inhibited	-	4	6	mA
		No Load	-	50	90	mA
Ripple Current		Full Load[5], 20Hz to 10MHz	-	30	75	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	$+V_{OUT}$	T_{CASE} = 25°C	14.77	15.0	15.23	V
	$+V_{OUT}$	T_{CASE} = -55°C to +100°C	14.62	15.0	15.38	V
	$-V_{OUT}$	T_{CASE} = 25°C	14.62	15.0	15.38	V
	$-V_{OUT}$	T_{CASE} = -55°C to +100°C	14.47	15.0	15.53	V
Power[3,6]	Total		0	-	30	W
	±Vout	Either Output	0	-	21	W
Current[3,6]	$±V_{OUT}$	Either Output	0	-	1.4	A
Ripple Voltage	$±V_{OUT}$	Full Load[5], 20Hz to 10MHz	-	25	50	mV_{p-p}
Line Regulation	$+V_{OUT}$	V_{IN} = 15V to 50V	-	1	10	mV
	$-V_{OUT}$	V_{IN} = 15V to 50V	-	80	150	mV
Load Regulation	$+V_{OUT}$	No Load to Full Load[5]	-	1	10	mV
	$-V_{OUT}$	No Load to Full Load[5,7]	-	30	150	mV
Cross Regulation	$-V_{OUT}$	+Load 70%, -Load 30% +Load 30%, -Load 70%	-	300	500	mV
EFFICIENCY		Full Load[5]	79	84	-	%
LOAD FAULT POWER DISSIPATION		Overload[4]	-	-	14	W
		Short Circuit	-	-	14	W
CAPACITIVE LOAD[4]		Either Output	-	-	500	µF
SWITCHING FREQUENCY			400	450	550	kHz
SYNC FREQUENCY RANGE		V_H - V_L = 5V, D = 20-80%	500	-	600	kHz
ISOLATION		500 V_{DC}	100	-	-	MΩ
MTBF (MIL-HDBK-217F)		GM @ T_C = 55°C	-	371	-	kHrs

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}	Junction Temperature Rise to Case	+17°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)	300°C
Power Dissipation (Full Load, T_{CASE} = +100°C)	12 Watts	Weight (Maximum)	48 Grams

Parameter	Conditions	VPT30-2815D			Units
		Min	Typ	Max	
DYNAMIC					
Load Step Output Transient ±V_{OUT}	Half Load to Full Load[5]	-	250	450	mV_{PK}
Load Step Recovery[2]		-	200	400	µSec
Line Step Output Transient[4] ±V_{OUT}	V_{IN} = 16V to 40V	-	700	1100	mV_{PK}
Line Step Recovery[2, 4]		-	300	500	µSec
Turn On Delay ±V_{OUT}	V_{IN} = 0V to 28V	-	10	20	mSec
Turn On Overshoot		-	0	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 110°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

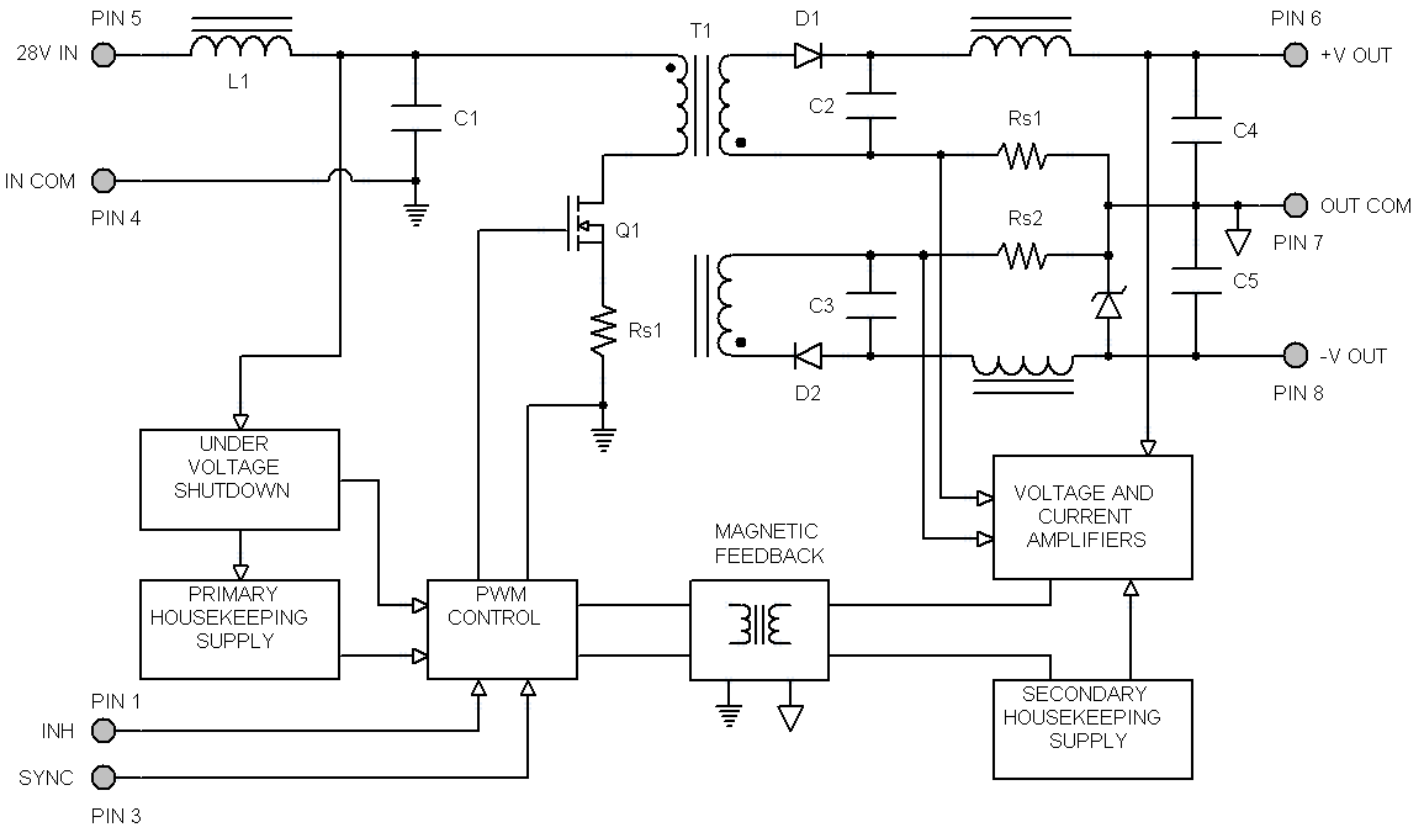


Figure 2

CONNECTION DIAGRAM

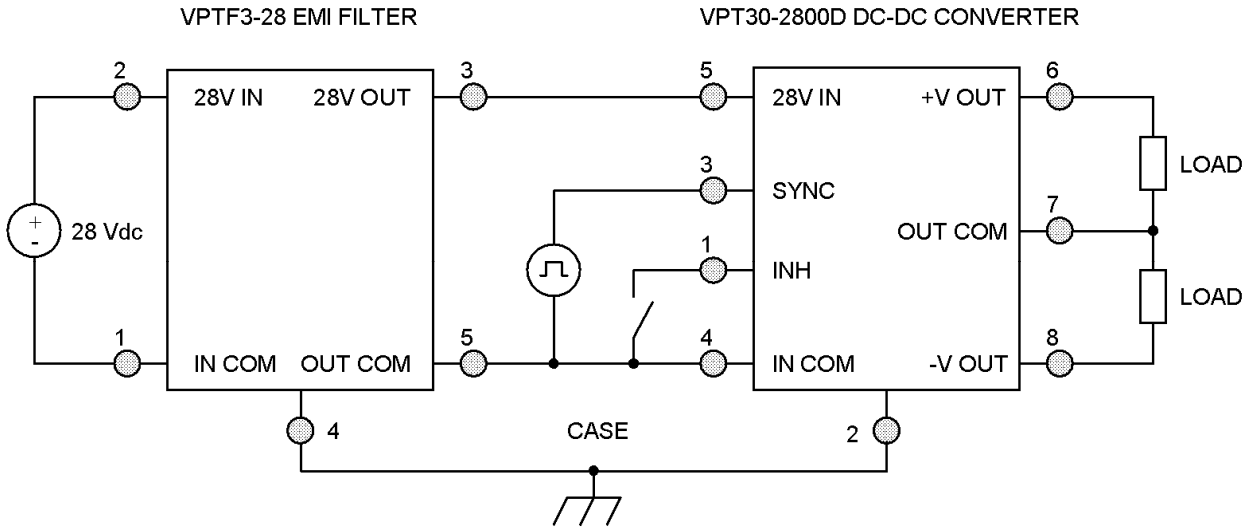


Figure 3
(Shown with optional EMI filter)

CONNECTION DIAGRAMS

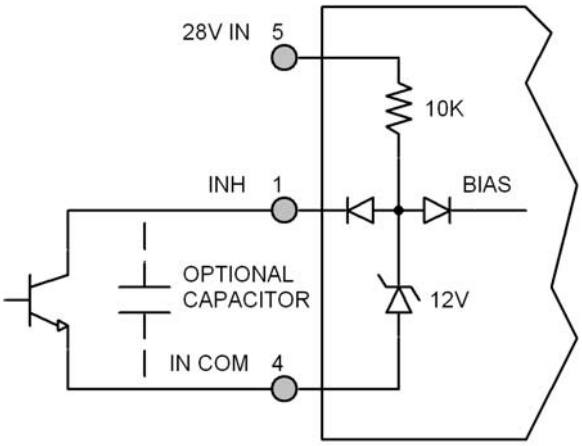


Figure 4 – Inhibit Circuit
(Shown with optional capacitor for turn-on delay)

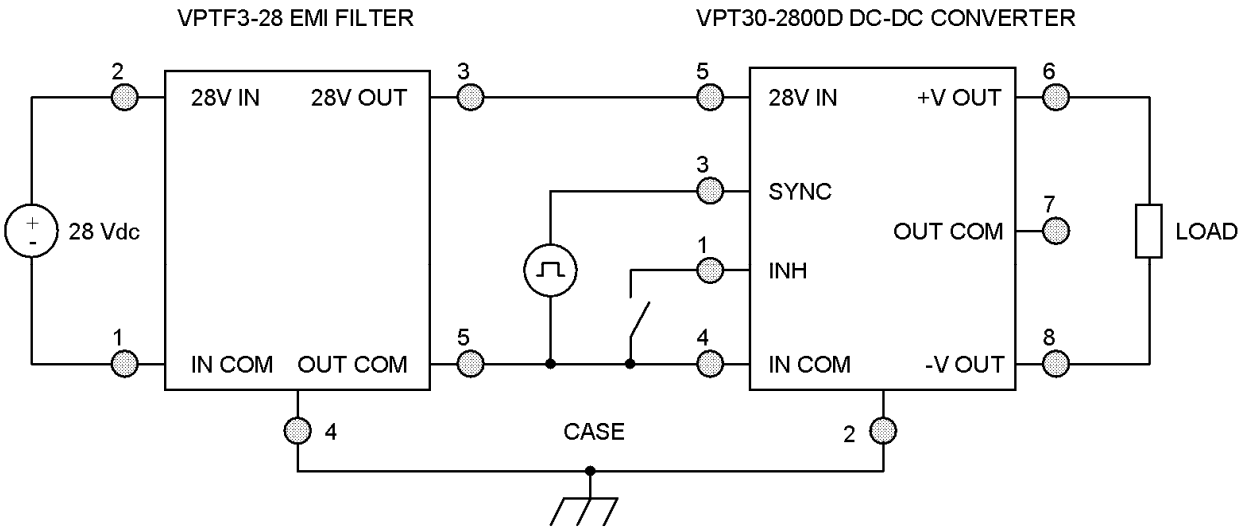


Figure 5 – Stacked Output Connection
(Shown with optional EMI filter)

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

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

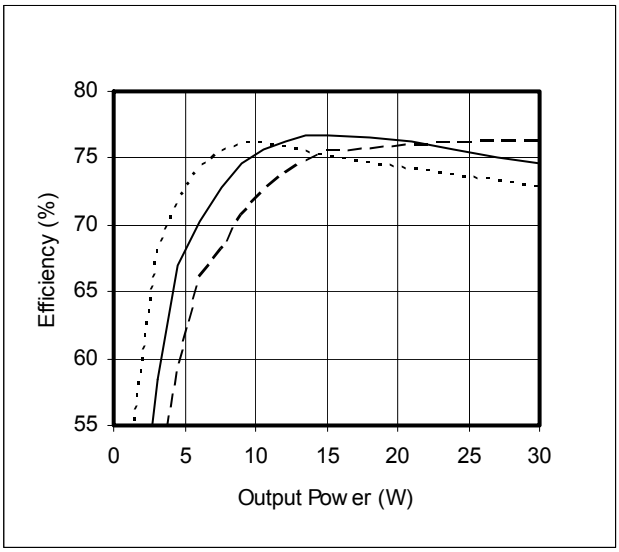


Figure 6 – VPT30-2805D
Efficiency (%) vs. Output Power (W)

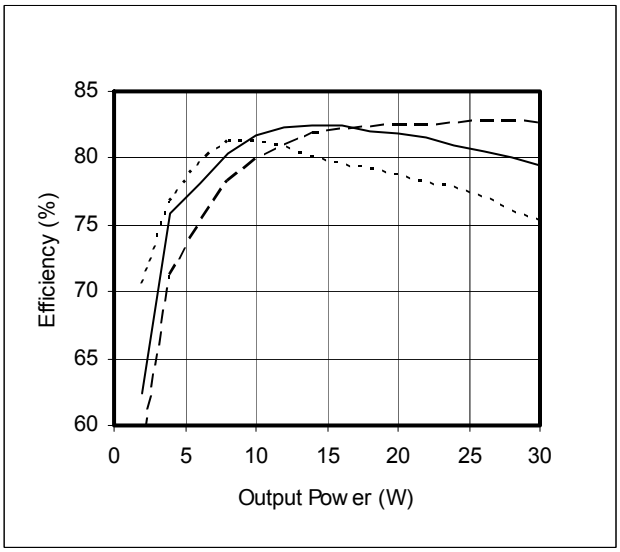


Figure 7 – VPT30-2812D
Efficiency (%) vs. Output Power (W)

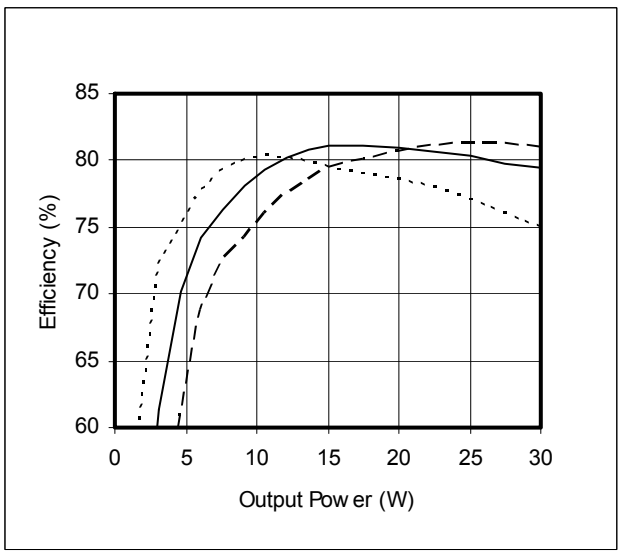


Figure 8 – VPT30-2815D
Efficiency (%) vs. Output Power (W)

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

+Io = 10%	+Io = 30%	+Io = 50%	+Io = 70%

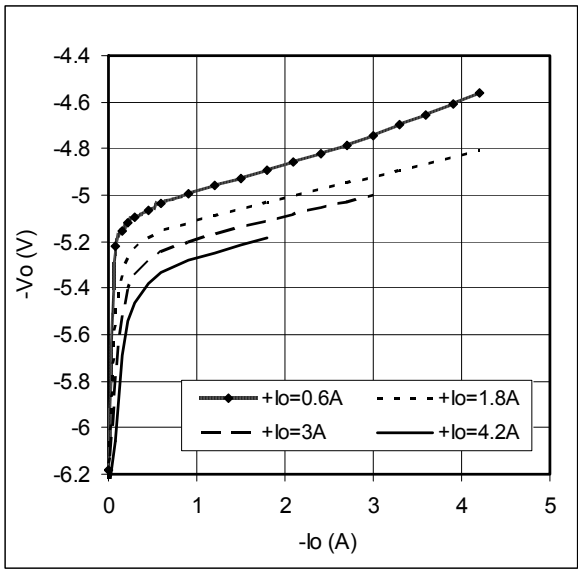


Figure 9 – VPT30-2805D
-Vout (V) vs. -Iout (A)

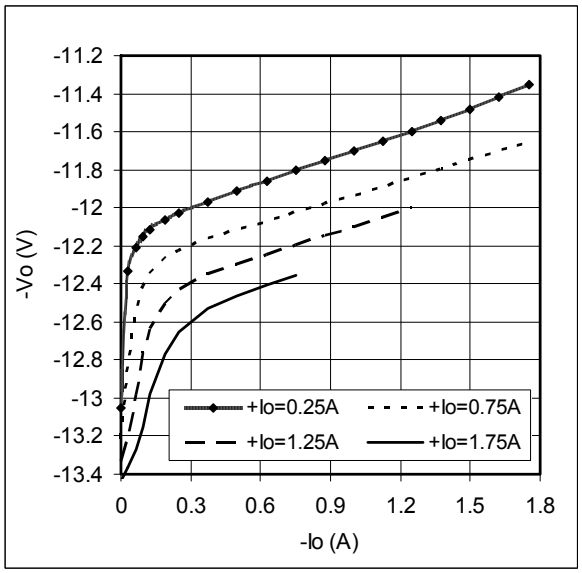


Figure 10 – VPT30-2812D
-Vout (V) vs. -Iout (A)

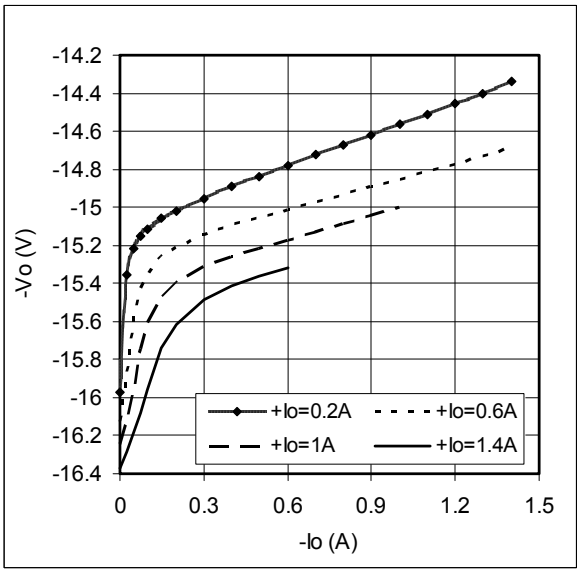


Figure 11 – VPT30-2815D
-Vout (V) vs. -Iout (A)

EMI PERFORMANCE CURVES

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

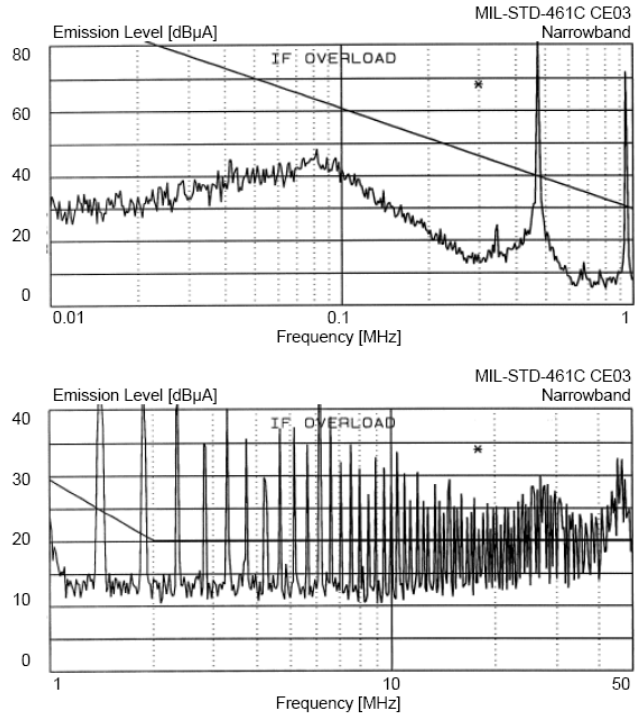


Figure 12 – VPT30-2800D without EMI Filter

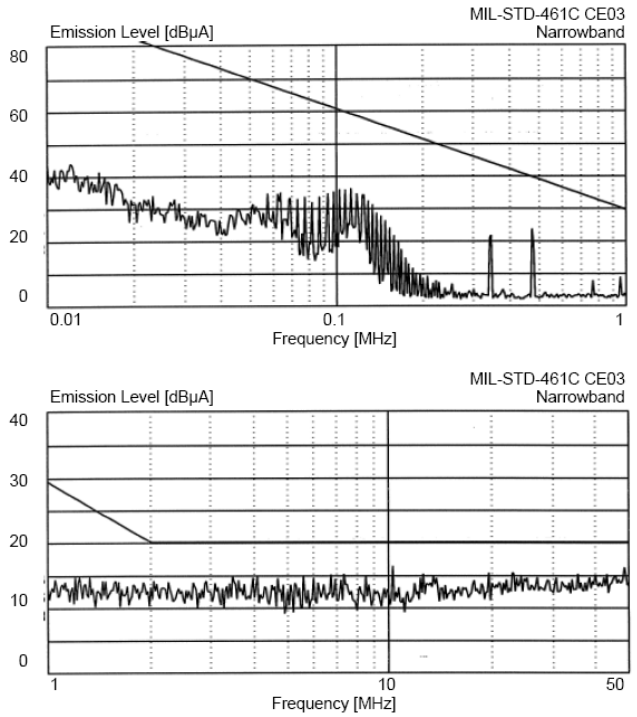


Figure 13 – VPT30-2800D with VPTF Series EMI Filter

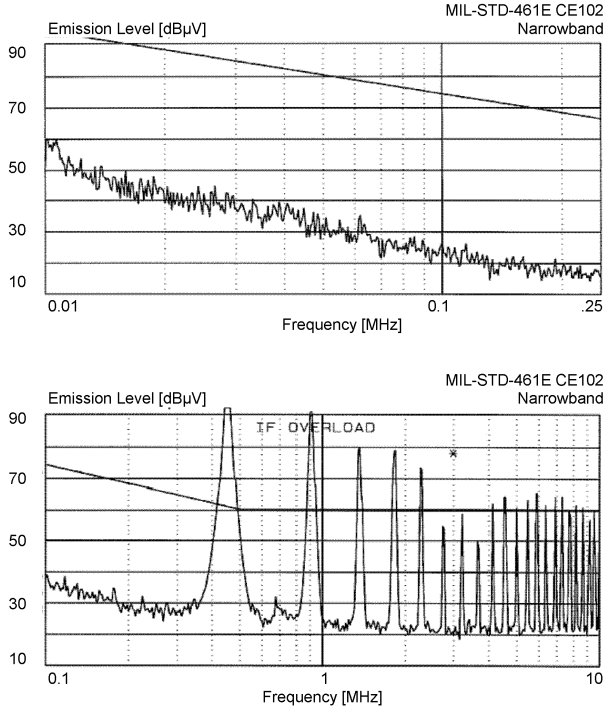


Figure 14 – VPT30-2800D without VPTF Series EMI Filter

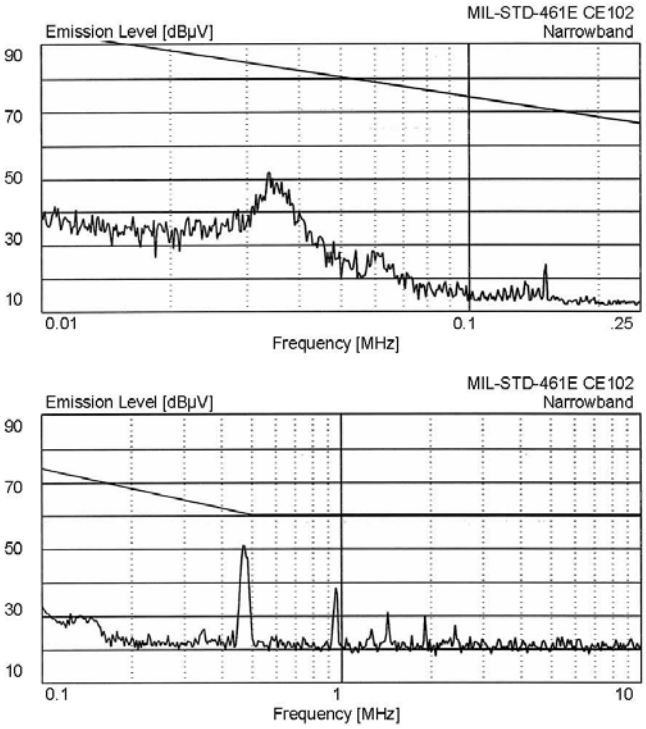
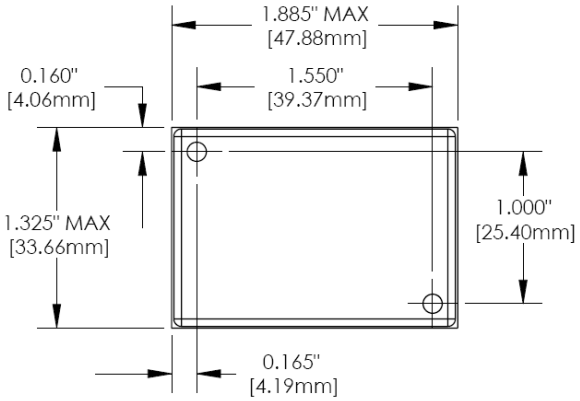
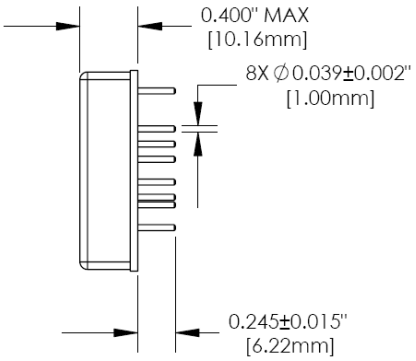


Figure 15 – VPT30-2800D with VPTF Series EMI Filter

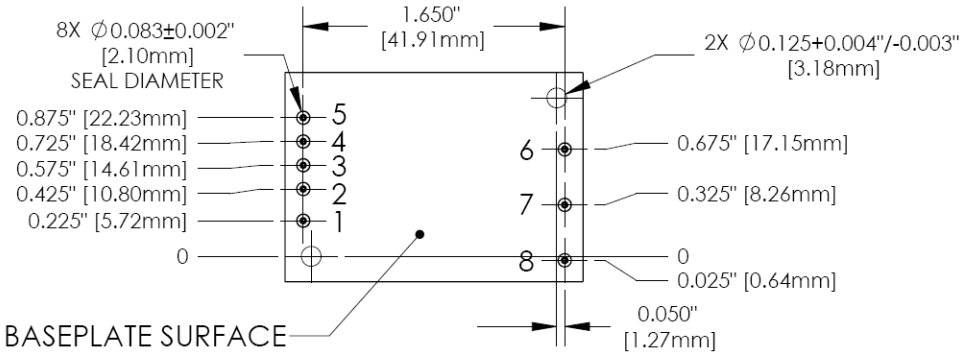
PACKAGE SPECIFICATIONS



TOP VIEW



SIDE VIEW



BOTTOM VIEW

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

Figure 16 – Package and Pinout
(Dimensional Limits are ±0.005" Unless Otherwise Stated)

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

PACKAGE PIN DESCRIPTION

Pin	Function	Description
1	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.
2	CASE	Case Connection.
3	SYNC	Frequency Synchronization Signal Input. TTL squarewave, 5Vpp, 20 – 80% duty cycle, internally capacitively coupled.
4	IN COM	Input Return Connection.
5	28V IN	Positive Input Voltage Connection.
6	+VOUT	Positive Output Voltage Connection.
7	OUT COM	Output Return Connection.
8	-V OUT	Negative Output Voltage 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	MIL-STD-883, Method 2009

ORDERING INFORMATION

VPT30-	28	05	D
1	2	3	4

(1)	(2)		(3)		(4)	
Product Series	**Nominal Input Voltage**		**Output Voltage**		**Number of Outputs**	
VPT30-	**28**	28 Volts	**05** **12** **15**	±5 Volts ±12 Volts ±15 Volts	**D**	Dual

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