VPT100+2800S Series

HIGH RELIABILITY COTS DC-DC CONVERTERS

DESCRIPTION

The VPT100+ 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. A high efficiency design using synchronous rectification reduces input power requirements and eases thermal management. Low input and output ripple, fixed operating frequency, current sharing capability, 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 VPT100 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
- Parallel Up to 5 Units With Current Sharing
- Up to 100 Watts Maximum Output Power
- High Efficiency, Up to 91%
- Wide Input Voltage Range: 16 to 40 Volts per MIL-STD-704 and MIL-STD-1275
- High Input Transient Voltage: 50 Volts for 1 sec
- Input Undervoltage Lockout
- Fixed Frequency
- Output Voltage Trim (+10% / -20%)
- Fast Startup time with 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-461C/D/E Conducted Emissions Requirements When Used With a VPTF series EMI Filter

Figure 1 – VPT100+2800S 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)	40 V_{DC}	Junction Temperature Rise to Case	+17°C
Input Voltage (Transient, 1 second)	50 Volts	Storage Temperature	-55°C to +125°C
Output Power[1]	100 Watts	Lead Solder Temperature (10 seconds)	300°C
Power Dissipation (Full Load, T_{CASE} = +100°C)	18 Watts	Weight (Maximum)	76 Grams

Parameter		Conditions	VPT100+283R3S			VPT100+2805S			Units
			Min	Typ	Max	Min	Typ	Max	
STATIC									
INPUT Voltage[4]		Continuous	16	28	40	16	28	40	V
		Transient, 1 sec	-	-	50	-	-	50	V
Current		Inhibited	-	-	5	-	-	5	mA
		No Load	-	80	150	-	80	150	mA
Ripple Current		Full Load, 20Hz to 10MHz	-	-	180	-	-	200	mA_{p-p}
Inhibit Pin Input[4]			0	-	1.5	0	-	1.5	V
Inhibit Pin Open Circuit Voltage[4]			9.0	11.0	14.0	9.0	11.0	14.0	V
UVLO Turn On			14.5	-	15.8	14.5	-	15.8	V
UVLO Turn Off[4]			14.0	-	15.0	14.0	-	15.0	V
OUTPUT Voltage	V_{OUT}	T_{CASE} = 25°C	3.25	3.30	3.35	4.925	5.00	5.075	V
	V_{OUT}	T_{CASE} = -55°C to +100°C	3.217	3.30	3.383	4.875	5.00	5.125	V
Power[3]			0	-	66	0	-	100	W
Current[3]	V_{OUT}		0	-	20	0	-	20	A
Ripple Voltage	V_{OUT}	Full Load, 20Hz to 10MHz	-	-	150	-	-	150	mV_{p-p}
Line Regulation	V_{OUT}	V_{IN} = 16V to 40V	-	-	20	-	-	20	mV
Load Regulation	V_{OUT}	No Load to Full Load	-	-	50	-	-	50	mV
Share Pin Voltage[4]			0	-	5	0	-	5	V
Current Share Accuracy[4]			-	5	-	-	5	-	%
EFFICIENCY			85	90	-	85	90	-	%
LOAD FAULT POWER DISSIPATION		Overload[4]	-	-	24	-	-	24	W
		Short Circuit	-	-	24	-	-	24	W
CAPACITIVE LOAD[4]			-	-	1000	-	-	1000	µF
SWITCHING FREQUENCY			230	260	290	230	260	290	kHz
SYNC FREQUENCY RANGE		V_H-V_L=5V Duty Cycle = 50%	240	-	325	240	-	325	kHz
ISOLATION		500 V_{DC}	100	-	-	100	-	-	MΩ
MTBF (MIL-HDBK-217F)		GM @ T_C = 55°C	-	344	-	-	344	-	kHrs
DYNAMIC									
Load Step Output Transient	V_{OUT}	Half Load to Full Load	-	-	250	-	-	250	mV_{PK}
Load Step Recovery[2]			-	-	300	-	-	300	µSec
Line Step Output Transient[4]	V_{OUT}	V_{IN} = 16V to 40V	-	-	300	-	-	300	mV_{PK}
Line Step Recovery[2, 4]			-	-	150	-	-	150	µSec
Turn On Delay	V_{OUT}	V_{IN} = 0V to 28V	-	4	10	-	4	10	mSec
Turn On Overshoot			-	0	15	-	0	25	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.

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

ABSOLUTE MAXIMUM RATINGS			
Input Voltage (Continuous)	40 V_{DC}	Junction Temperature Rise to Case	+17°C
Input Voltage (Transient, 1 second)	50 Volts	Storage Temperature	-55°C to +125°C
Output Power[1]	100 Watts	Lead Solder Temperature (10 seconds)	300°C
Power Dissipation (Full Load, T_{CASE} = +100°C)	18 Watts	Weight (Maximum)	76 Grams

Parameter		Conditions	VPT100+2807S			VPT100+2812S			Units
			Min	Typ	Max	Min	Typ	Max	
STATIC									
INPUT Voltage[4]		Continuous	16	28	40	16	28	40	V
		Transient, 1 sec	-	-	50	-	-	50	V
Current		Inhibited	-	-	5	-	-	5	mA
		No Load	-	100	200	-	130	200	mA
Ripple Current		Full Load, 20Hz to 10MHz	-	-	200	-	-	200	mA_{p-p}
Inhibit Pin Input[4]			0	-	1.5	0	-	1.5	V
Inhibit Pin Open Circuit Voltage[4]			9.0	11.0	14.0	9.0	11.0	14.0	V
UVLO Turn On			14.5	-	15.8	14.5	-	15.8	V
UVLO Turn Off[4]			14.0	-	15.0	14.0	-	15.0	V
OUTPUT Voltage	V_{OUT}	T_{CASE} = 25°C	6.895	7.00	7.105	11.82	12.0	12.18	V
	V_{OUT}	T_{CASE} = -55°C to +100°C	6.825	7.00	7.175	11.70	12.0	12.30	V
Power[3]			0	-	100	0	-	100	W
Current[3]	V_{OUT}		0	-	14.28	0	-	8.33	A
Ripple Voltage	V_{OUT}	Full Load, 20Hz to 10MHz	-	-	150	-	-	150	mV_{p-p}
Line Regulation	V_{OUT}	V_{IN} = 16V to 40V	-	-	20	-	-	50	mV
Load Regulation	V_{OUT}	No Load to Full Load	-	-	70	-	-	100	mV
Share Pin Voltage[4]			0	-	5	0	-	5	V
Current Share Accuracy[4]			-	5	-	-	5	-	%
EFFICIENCY			87	90	-	87	90	-	%
LOAD FAULT POWER DISSIPATION		Overload[4]	-	-	24	-	-	24	W
		Short Circuit	-	-	24	-	-	24	W
CAPACITIVE LOAD[4]			-	-	1000	-	-	500	µF
SWITCHING FREQUENCY			300	340	380	300	340	380	kHz
SYNC FREQUENCY RANGE		V_H-V_L=5V Duty Cycle = 50%	300	-	380	300	-	380	kHz
ISOLATION		500 V_{DC}	100	-	-	100	-	-	MΩ
MTBF (MIL-HDBK-217F)		GM @ T_C = 55°C	-	344	-	-	344	-	kHrs
DYNAMIC									
Load Step Output Transient	V_{OUT}	Half Load to Full Load	-	-	750	-	-	500	mV_{PK}
Load Step Recovery[2]			-	-	300	-	-	300	µSec
Line Step Output Transient[4]	V_{OUT}	V_{IN} = 16V to 40V	-	-	750	-	-	300	mV_{PK}
Line Step Recovery[2, 4]			-	-	150	-	-	150	µSec
Turn On Delay	V_{OUT}	V_{IN} = 0V to 28V	-	4	10	-	4	10	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.

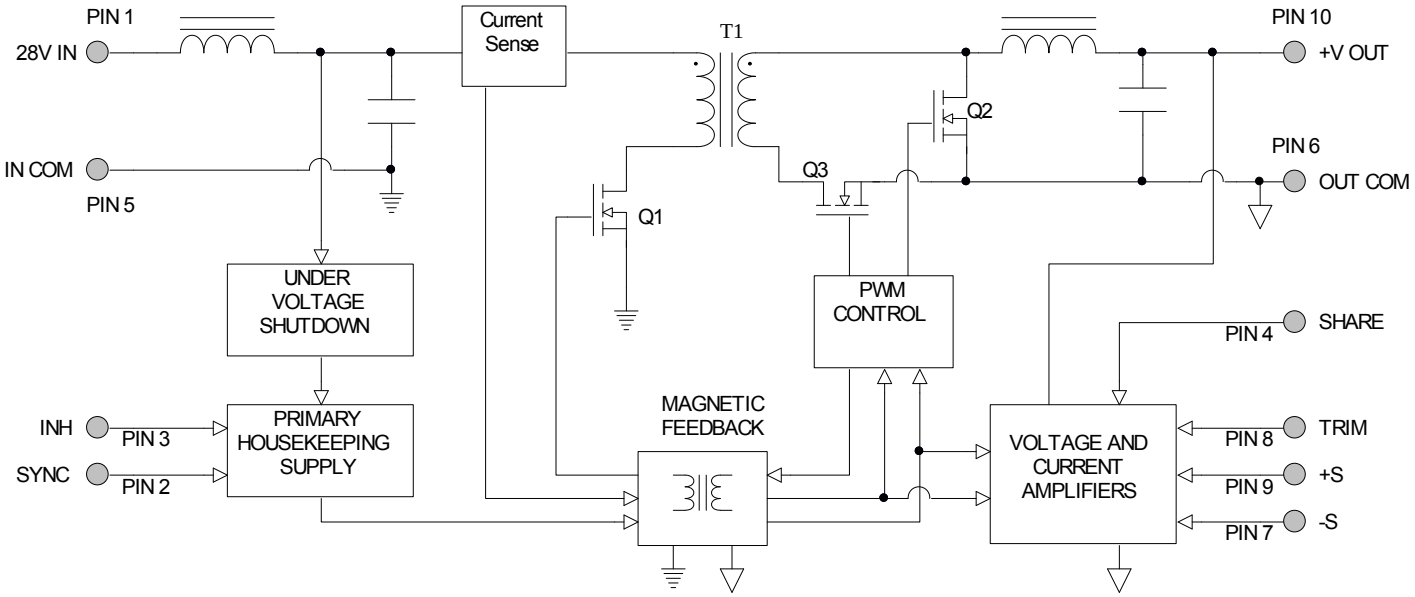
SPECIFICATIONS (T_{CASE} = -55°C to +100°C, V_{IN} = +28V ± 5%, Full Load, Unless Otherwise Specified)

ABSOLUTE MAXIMUM RATINGS			
Input Voltage (Continuous)	40 V_{DC}	Junction Temperature Rise to Case	+17°C
Input Voltage (Transient, 1 second)	50 Volts	Storage Temperature	-55°C to +125°C
Output Power[1]	100 Watts	Lead Solder Temperature (10 seconds)	300°C
Power Dissipation (Full Load, T_{CASE} = +100°C)	18 Watts	Weight (Maximum)	76 Grams

Parameter		Conditions	VPT100+2815S			VPT100+2828S			Units
			Min	Typ	Max	Min	Typ	Max	
STATIC									
INPUT Voltage[4]		Continuous	16	28	40	16	28	40	V
		Transient, 1 sec	-	-	50	-	-	50	V
Current		Inhibited	-	-	5	-	-	5	mA
		No Load	-	130	200	-	30	100	mA
Ripple Current		Full Load, 20Hz to 10MHz	-	-	200	-	-	200	mA_{p-p}
Inhibit Pin Input[4]			0	-	1.5	0	-	1.5	V
Inhibit Pin Open Circuit Voltage[4]			9.0	11.0	14.0	9.0	11.0	14.0	V
UVLO Turn On			14.5	-	15.8	14.5	-	15.8	V
UVLO Turn Off[4]			14.0	-	15.0	14.0	-	15.0	V
OUTPUT Voltage	V_{OUT}	T_{CASE} = 25°C	14.775	15.0	15.225	27.44	28.0	28.56	V
	V_{OUT}	T_{CASE} = -55°C to +100°C	14.625	15.0	15.375	27.16	28.0	28.84	V
Power[3]			0	-	100	0	-	100	W
Current[3]	V_{OUT}		0	-	6.67	0	-	3.57	A
Ripple Voltage	V_{OUT}	Full Load, 20Hz to 10MHz	-	-	150	-	-	300	mV_{p-p}
Line Regulation	V_{OUT}	V_{IN} = 16V to 40V	-	-	50	-	-	50	mV
Load Regulation	V_{OUT}	No Load to Full Load	-	-	100	-	-	100	mV
Share Pin Voltage[4]			0	-	5	0	-	5	V
Current Share Accuracy[4]			-	5	-	-	5	-	%
EFFICIENCY			87	91	-	85	88	-	%
LOAD FAULT POWER DISSIPATION		Overload[4]	-	-	24	-	-	24	W
		Short Circuit	-	-	24	-	-	28	W
CAPACITIVE LOAD[4]			-	-	500	-	-	500	µF
SWITCHING FREQUENCY			300	340	380	300	340	380	kHz
SYNC FREQUENCY RANGE		V_H-V_L=5V Duty Cycle = 50%	300	-	380	300	-	380	kHz
ISOLATION		500 V_{DC}	100	-	-	100	-	-	MΩ
MTBF (MIL-HDBK-217F)		GM @ T_C = 55°C	-	344	-	-	344	-	kHrs
DYNAMIC									
Load Step Output Transient	V_{OUT}	Half Load to Full Load	-	-	500	-	-	1400	mV_{PK}
Load Step Recovery[2]			-	-	300	-	-	300	µSec
Line Step Output Transient[4]	V_{OUT}	V_{IN} = 16V to 40V	-	-	300	-	-	1400	mV_{PK}
Line Step Recovery[2, 4]			-	-	150	-	-	300	µSec
Turn On Delay	V_{OUT}	V_{IN} = 0V to 28V	-	4	10	-	4	10	mSec
Turn On Overshoot			-	0	50	-	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.

BLOCK DIAGRAM



Note: Not applicable to VPT100+2828S

Figure 2

CONNECTION DIAGRAM

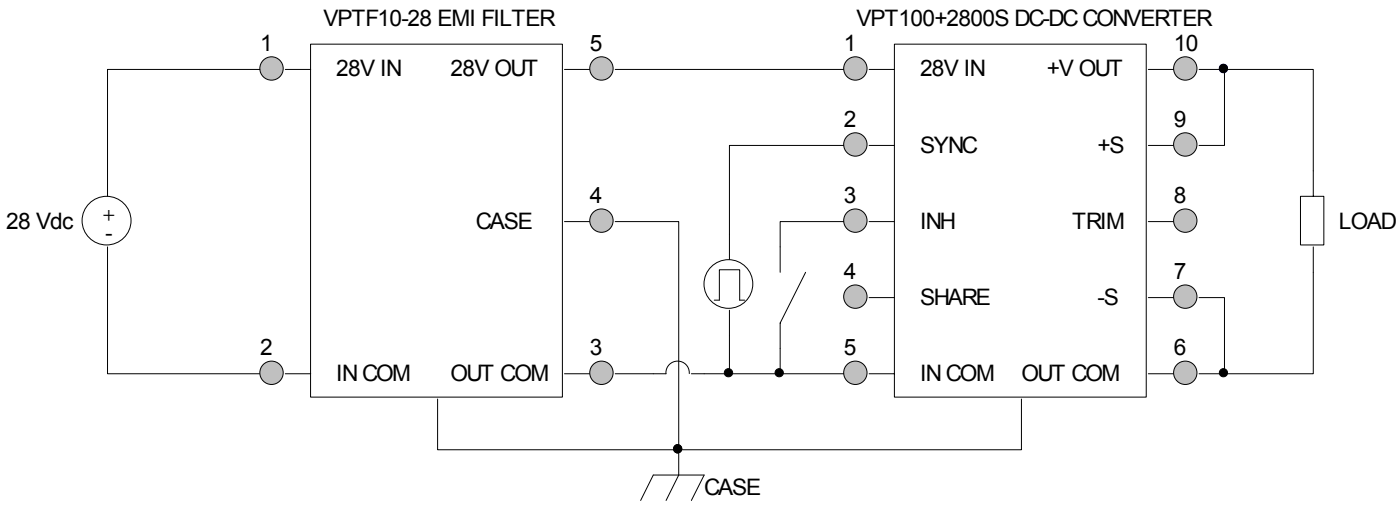


Figure 3
(Shown with optional EMI filter)

PARALLEL CONNECTION DIAGRAMS

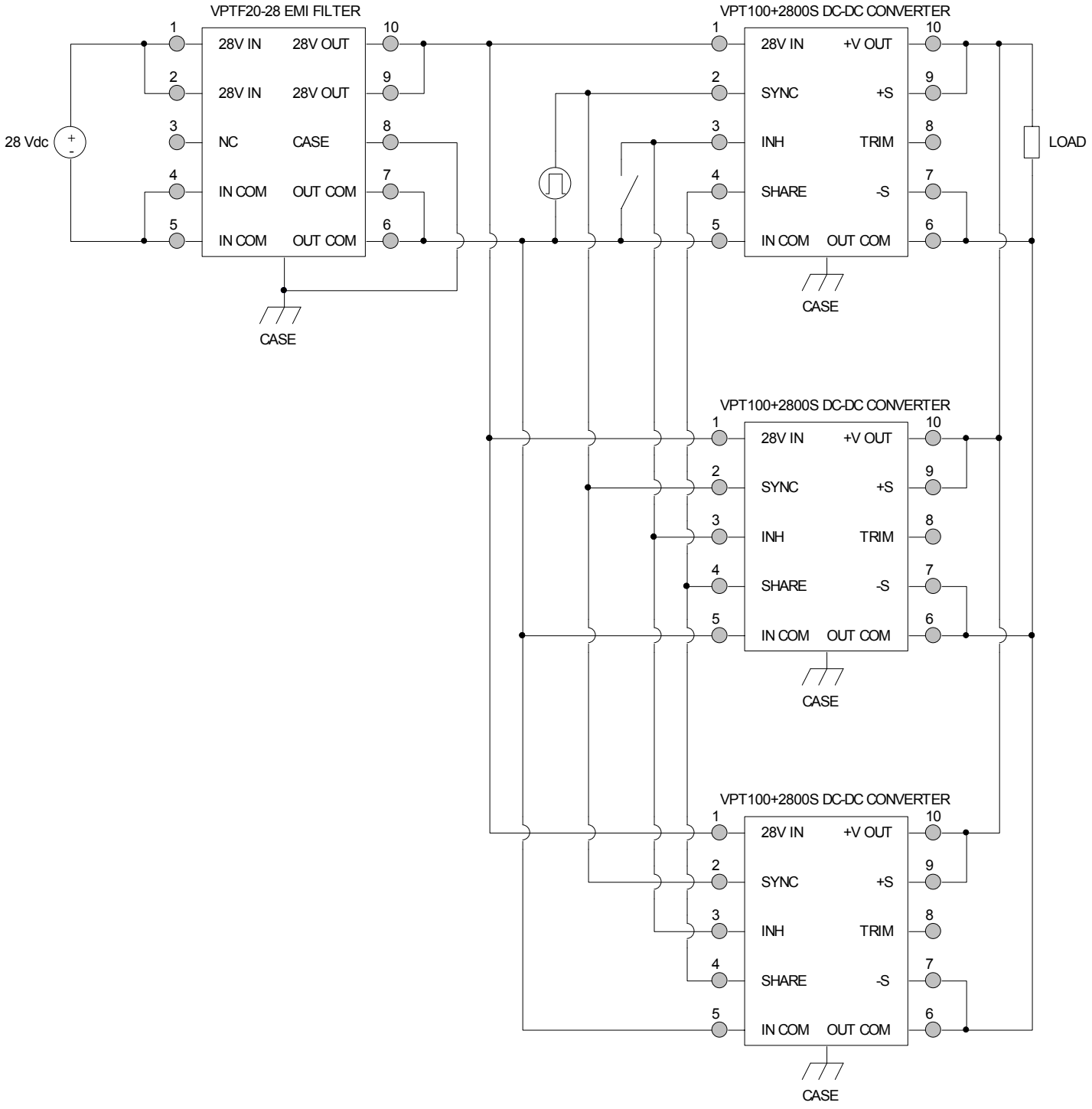


Figure 4 – Current Sharing Parallel Connection for Multiple Converters
(SYNC connection is optional)

CONNECTION DIAGRAMS

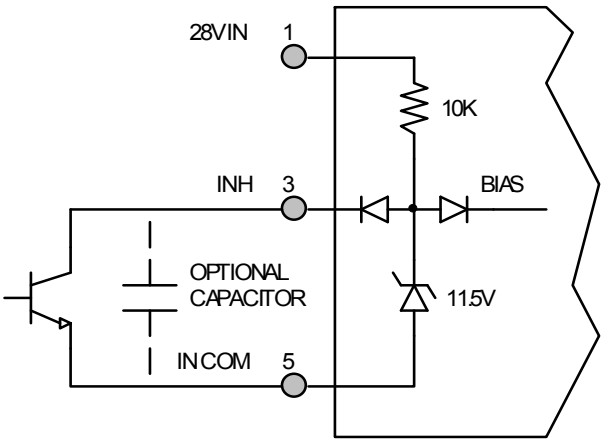


Figure 5 –Inhibit Circuit
(Shown with optional capacitor for turn-on delay)

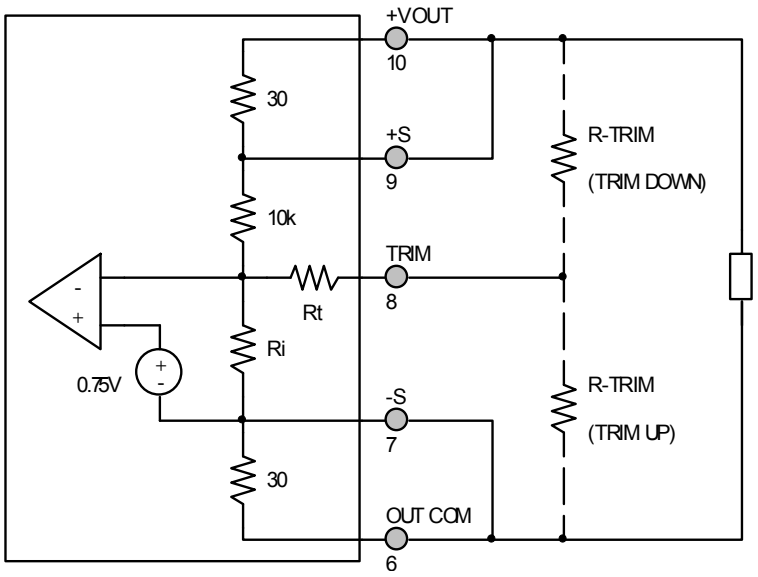


Figure 6 –Output Voltage Trim Circuit

OUTPUT VOLTAGE TRIM

The output voltage can be trimmed down by connecting a resistor between the TRIM pin and the +V OUT pin, or can be trimmed up by connecting a resistor between the TRIM pin and the OUT COM pin as shown in Figure 6. The maximum trim range is +10% up and –20% down. The appropriate resistor values versus the output voltage are given in the trim table below.

VPT100+283R3S		VPT100+2805S		VPT100+2807S		VPT100+2812S		VPT100+2815S		VPT100+2828S	
$+V_{OUT}$ (V)	R_{TRIM} (Ω)	$+V_{OUT}$ (V)	R_{TRIM} (Ω)	$+V_{OUT}$ (V)	R_{TRIM} (Ω)	$+V_{OUT}$ (V)	R_{TRIM} (Ω)	$+V_{OUT}$ (V)	R_{TRIM} (Ω)	$+V_{OUT}$ (V)	R_{TRIM} (Ω)
3.60	3.94k	5.5	980	7.7	714	13.2	1.14k	16.50	686	30.5	720
3.55	8.92k	5.4	4.72k	7.5	5.00k	13.0	2.39k	16.25	1.69k	30.0	1.46k
3.50	16.4k	5.3	10.9k	7.3	15.0k	12.8	4.26k	16.00	3.19k	29.5	2.68k
3.45	28.8k	5.2	23.4k	7.1	65.0k	12.6	7.39k	15.75	5.7k	29.0	5.12k
3.40	53.5k	5.1	60.5k	7.0	—	12.4	13.6k	15.50	10.7k	28.5	12.3k
3.35	127k	5.0	--	6.9	605k	12.2	32.4k	15.25	25.9k	28.0	--
3.30	--	4.9	404k	6.7	188k	12.0	--	15.00	--	27.5	551k
3.25	486k	4.8	189k	6.5	105k	11.8	548k	14.75	552k	27.0	265k
3.20	226k	4.7	118k	6.3	69.3k	11.6	266k	14.50	270k	26.5	171k
3.15	140k	4.6	82.4k	6.1	49.4k	11.4	172k	14.25	175k	26.0	125k
3.10	96.9k	4.5	61.1k	5.9	36.8k	11.2	126k	14.00	128k	25.5	97.4k
3.05	71.3k	4.4	46.9k	5.7	28.1k	11.0	97.4k	13.75	99.5k	25.0	79k
3.00	54.2k	4.3	36.8k	5.6	24.6k	10.8	78.6k	13.50	80.6k	24.5	65.9k
2.95	42k	4.2	29.2k			10.6	65.3k	13.25	67k	24.0	56.1k
2.90	32.8k	4.1	23.3k			10.4	55.2k	13.00	56.9k	23.5	48.5k
2.85	25.7k	4.0	18.5k			10.2	47.4k	12.75	49k	23.0	42.4k
2.80	20.1k					10.0	41.1k	12.50	42.6k	22.5	37.4k
2.75	15.4k					9.8	36k	12.25	37.5k		
2.70	11.5k					9.6	31.8k	12.00	33.2k		
2.65	8.26k										

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

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

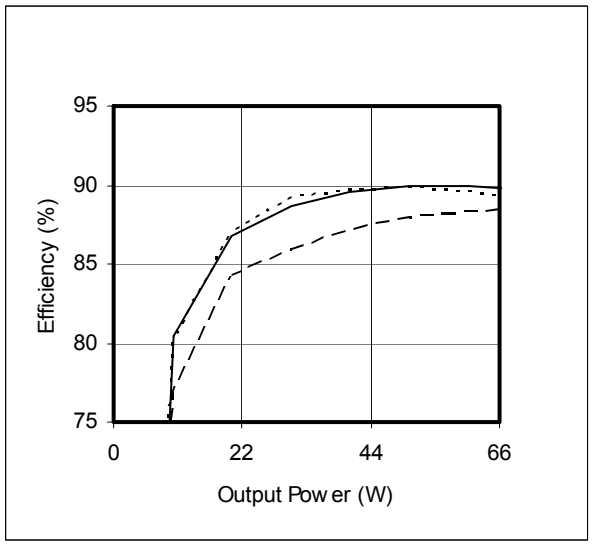


Figure 7 – VPT100+283R3S
Efficiency (%) vs. Output Power (W)

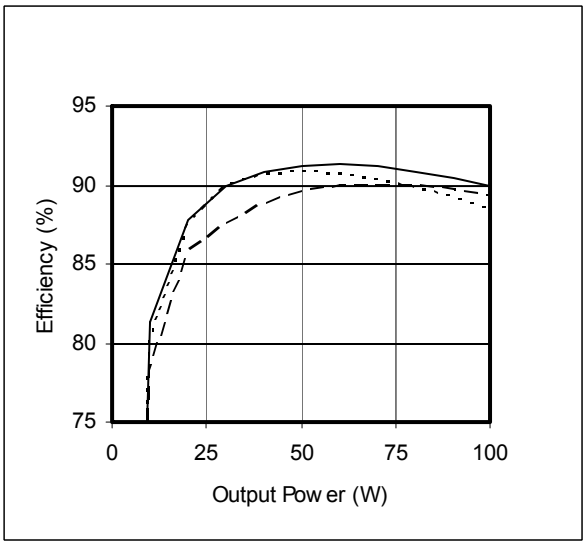


Figure 8 – VPT100+2805S
Efficiency (%) vs. Output Power (W)

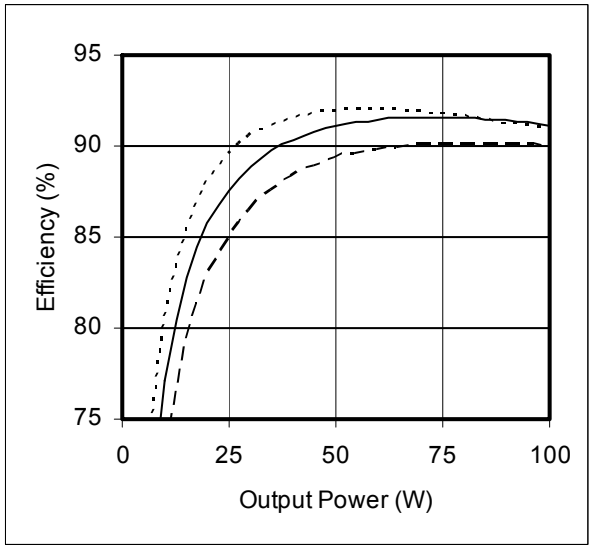


Figure 9 – VPT100+2807S
Efficiency (%) vs. Output Power (W)

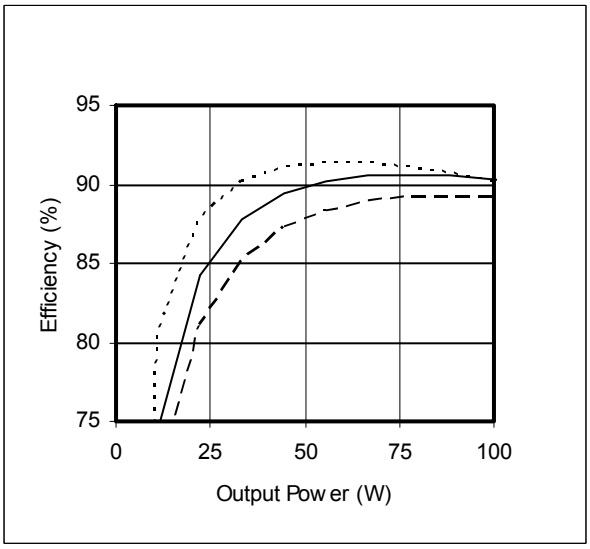


Figure 10 – VPT100+2812S
Efficiency (%) vs. Output Power (W)

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

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

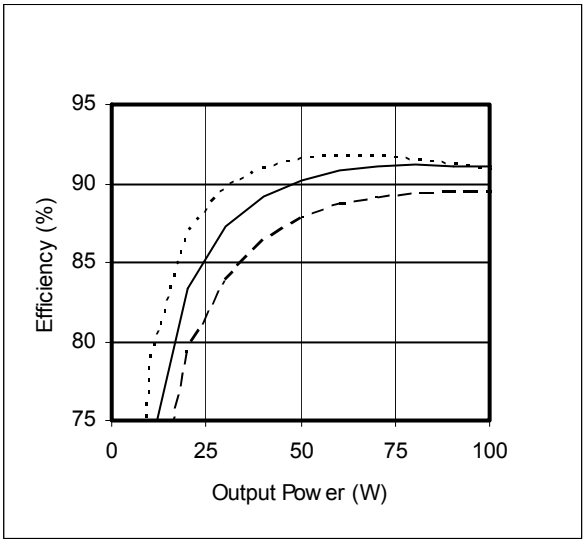


Figure 11 – VPT100+2815S
Efficiency (%) vs. Output Power (W)

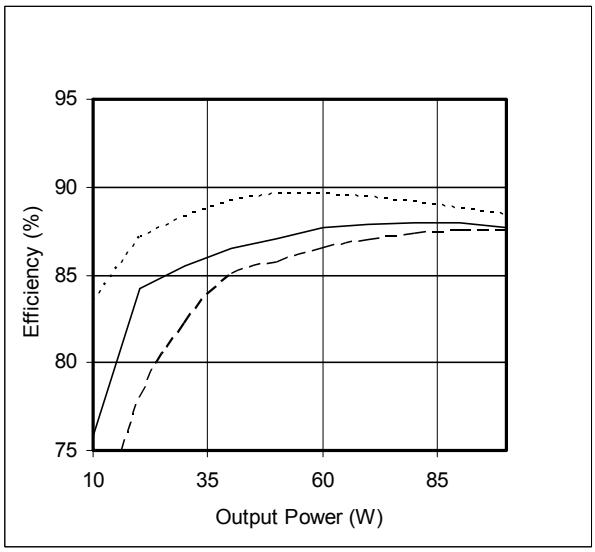


Figure 12 – VPT100+2828S
Efficiency (%) vs. Output Power (W)

EMI PERFORMANCE CURVES

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

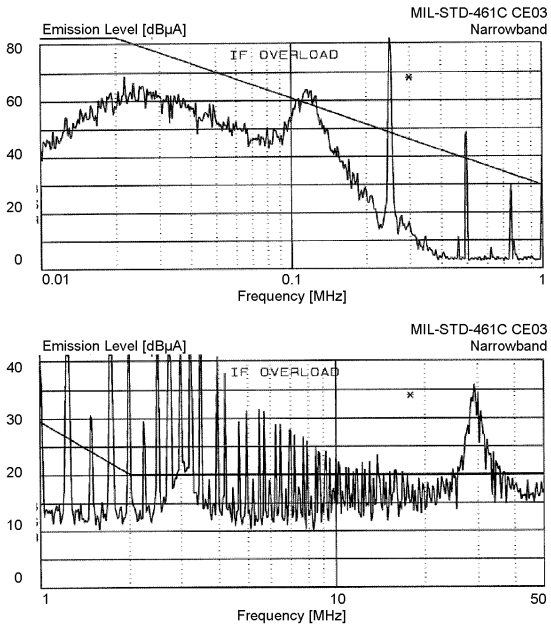


Figure 13 – VPT100+2800S <u>without</u> EMI Filter

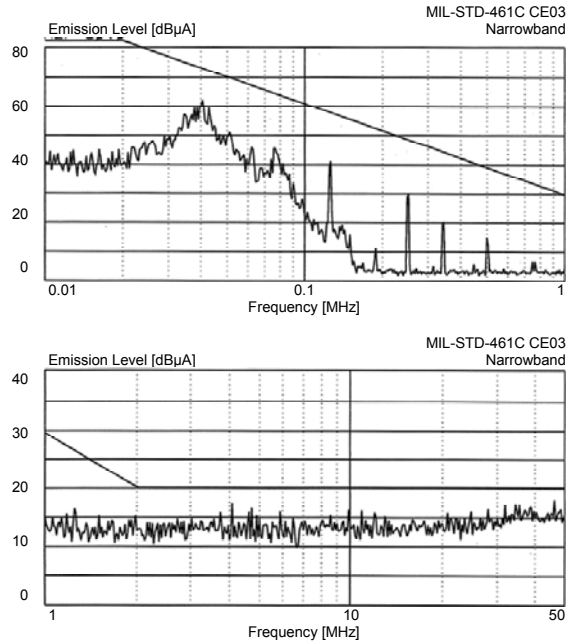


Figure 14 – VPT100+2800S <u>with</u> VPTF Series EMI Filter

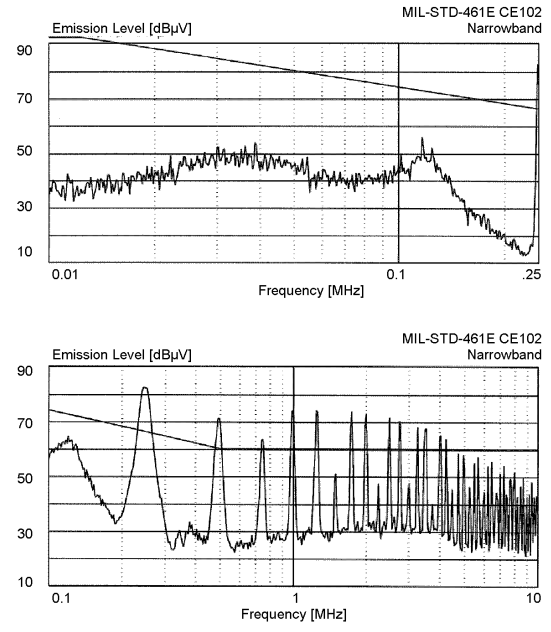


Figure 15 – VPT100+2800S <u>without</u> EMI Filter

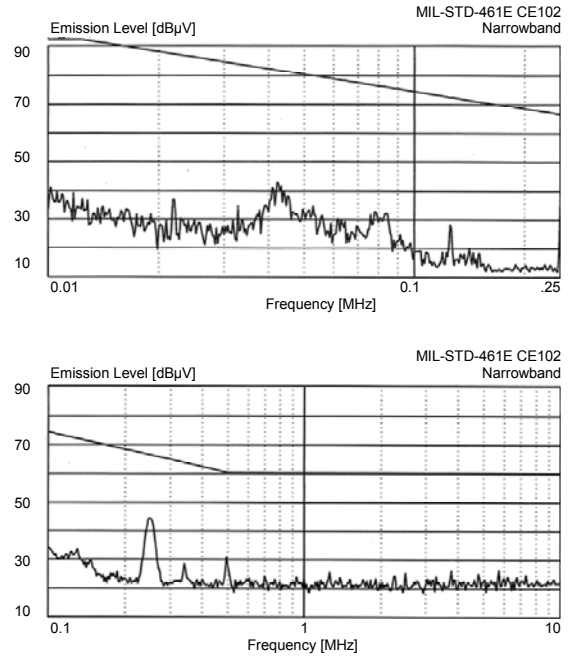
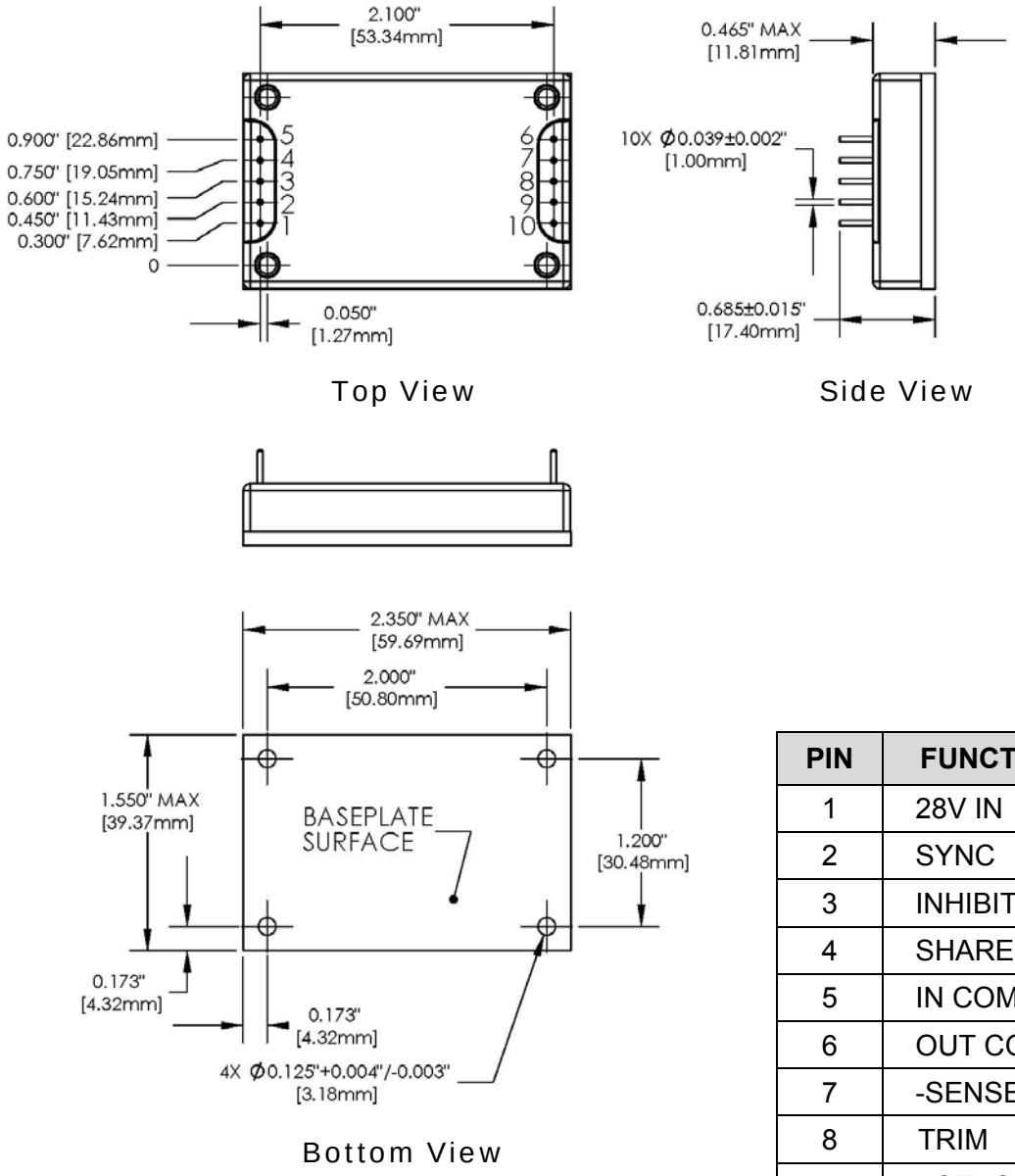


Figure 16 – VPT100+2800S <u>with</u> VPTF Series EMI Filter

PACKAGE SPECIFICATIONS



PIN	FUNCTION
1	28V IN
2	SYNC
3	INHIBIT
4	SHARE
5	IN COM
6	OUT COM
7	-SENSE
8	TRIM
9	+SENSE
10	+V OUT

Figure 17 – 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	28VIN	Positive Input Voltage Connection
2	SYNC	Input Synchronization Signal. TTL squarewave, 5Vpp, 20 - 80% duty cycle, internally capacitively coupled.
3	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.
4	SHARE	Current Share Connection
5	INCOM	Input Return Connection
6	OUTCOM	Output Return Connection
7	-SENSE	Output Return Remote Sense. Compensate for up to 0.5V total drop (positive and return).
8	TRIM	Trim Output Voltage to +10%, -20% of Nominal Value. Leave open if not used.
9	+SENSE	Positive Output Voltage Remote Sense. Compensate for up to 0.5V total drop (positive and return).
10	+V OUT	Positive 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	MIL-STD-883, Method 1015, 96 hours at +100°C
Final Electrical	100% at 25°C
External Visual	MIL-STD-883, Method 2009

ORDERING INFORMATION

VPT100+	28	05	S
1	2	3	4

(1)	(2)		(3)		(4)	
Product Series	**Nominal Input Voltage**		**Output Voltage**		**Number of Outputs**	
VPT100+	**28**	28 Volts	**3R3** **05** **07** **12** **15** **28**	3.3 Volts 5 Volts 7 Volts 12 Volts 15 Volts 28 Volts	**S**	Single

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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