VPF Series DC/DC Converters

interpoint
PREMIER POWER SOLUTIONS

VPF SERIES DC/DC CONVERTERS

- **Up to 21 watts of output power**
- **Dual outputs with trim function**
- **On/Off function**
- **Efficiencies up to 85%**
- **Low noise**
- **-40°C to +90°C operating temperature**
- **No external components required**
- **Over temperature, transient and short circuit protection**
- **Small size: 2.02 x 2.02 x 0.45 inches**

To order, call 1-800-822-8782

GENERAL DESCRIPTION

VPF Series™ DC/DC converters, members of Interpoint's Value/Performance family, feature dual outputs with up to 21 watts of total output power. A trim function for maximum output voltage flexibility is also included. Input voltages range from 18 to 36 or 36 to 72 VDC with dual outputs of ±5, ±12 or ±15 VDC. No external components are required to operate within the specifications. Each unit incorporates circuitry designed to protect your system and the converter. Input and output filtering plus an on/off function further enhance performance. The case operating temperature is -40°C to +90°C.

CONVERTER DESIGN

VPF Series DC/DC converters are current mode pulse-width modulated switching regulators which utilize a single-ended forward converter topology. Input and output filtering eliminate the need for external components. Switching frequency is 220 kHz, nominal. Input to output isolation to the standards of UL1459 reduces ground loops and provides greater versatility for your application. Magnetic coupling electrically isolates the input from the output by 700 VDC for the 28 volt models and 1544 VDC for the 48 volt models.

PROTECTION FEATURES

The VPF Series incorporates several functions to protect both your system and the converter. Internal suppressor diodes protect the converter from input transients of up to 85 volts for 100 milliseconds. Current limiting circuitry provides short circuit protection. Shutdown at case temperatures above 105°C provides thermal protection. Normal operation resumes when the temperature falls below the thermal limit.

NOISE, REGULATION AND STABILITY

Input filtering reduces noise by more than 40 dB of audio rejection while input ripple is held to 90 mA p-p. Output noise is as low as 50 mV p-p. Output filtering and control circuitry reduce output fluctuation with line regulation as low as 0.1%, load regulation as low as 01%, and cross regulation at 1.0%, depending on the model. Short term stability, over a period of 24 hours, results in output voltage drift of less than 0.05%. Long term stability is less than 0.2% of output voltage drift.

CONVENIENT ON/OFF AND TRIM FUNCTIONS

A logic low on the on/off terminal disables the pulse width modulator and turns the converter off. The on/off terminal (pin 1) is referenced to the input common and is compatible with TTL open collector, CMOS and relays. Pulling the on/off terminal low turns the converter off, but the input bulk capacitor remains charged to prevent large inrush current spikes when the input power is cycled. The on/off terminal can be left floating if not used.

The trim terminal (pin 7) can be used to adjust the output voltage or to compensate for voltage drops. Wide trim ranges of up to 43% allow versatility for your non-standard applications. Trimming adjusts both outputs equally. The approximate ranges of voltage adjustments are:

    5 volts — 4.2 to 5.3
    12 volts — 7.4 to 12.9
    15 volts — 8.6 to 16

When trimming increases output voltage, the output current is reduced proportionally. When trimming decreases output voltage, the output current does not exceed the maximum rating.

Additionally, the dual outputs can be combined for an output of 10, 24, or 30 VDC.

SMALL PACKAGE

The 2.02 by 2.02 by 0.45 inch package weighs 65 grams. This five-sided copper package provides both EMI shielding and heat sinking and is water washable. The case shield is connects to the input common terminal (pin 2).

Note: The above paragraphs refer to typical specifications. See characteristics chart for detailed information.

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CHARACTERISTICS: Tc = 25°C, nominal input voltage, full load unless otherwise specified.

28 VOLT MODELS

| PARAMETERS	CONDITIONS	VPF2805D			VPF2812D			VPF2815D			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
INPUT VOLTAGE	NORMAL	18	28	36	18	28	36	18	28	36	VDC
	TRANSIENT (100ms)	—	—	45	—	—	45	—	—	45	
INPUT CURRENT	FULL LOAD	—	750	—	—	867	—	—	882	—	mA
	NO LOAD	—	12	—	—	12	—	—	12	—	mA
OUTPUT VOLTAGE[1]	NOMINAL INPUT V	±4.95	±5.00	±5.05	±11.90	±12.00	±12.10	±14.90	±15.00	±15.10	VDC
OUTPUT CURRENT	FULL LOAD	0	—	±1.7	0	—	±0.85	0	—	±0.7	A
OUTPUT POWER	FULL LOAD	—	—	17	—	—	20.4	—	—	21	W
EFFICIENCY	FULL LOAD	—	81	—	—	84	—	—	85	—	%
LINE REGULATION	V_{in} = MIN TO MAX	—	<0.1	0.8	—	<0.2	0.8	—	<0.2	0.8	%
LOAD REGULATION[2]	25% TO FULL LOAD	—	0.3	0.7	—	0.1	0.6	—	0.2	0.6	%
CROSS REGULATION[3]		—	2.5	—	—	1.0	—	—	1.0	—	%
OUTPUT RIPPLE[4]	0 TO 20 MHz	—	50	—	—	50	—	—	50	—	mV p-p
	10 kHz to 1 MHz	—	15	—	—	10	—	—	10	—	mV rms
INPUT RIPPLE[5]	0 TO 20 MHz	—	140	—	—	140	—	—	140	—	mA p-p
	10 kHz to 1 MHz	—	40	—	—	40	—	—	40	—	mA rms
TRANSIENT	RECOVERY[6]	—	100	—	—	100	—	—	note 7	—	µs
	RESPONSE[8]	—	70	—	—	120	—	—	100	—	mV peak

48 VOLT MODELS

PARAMETERS	CONDITIONS	VPF4805D			VPF4812D			VPF4815D			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
INPUT VOLTAGE	NORMAL	36	48	72	36	48	72	36	48	72	VDC
	TRANSIENT (100ms)	—	—	85	—	—	85	—	—	85	
INPUT CURRENT	FULL LOAD	—	440	—	—	505	—	—	520	—	mA
	NO LOAD	—	12	—	—	12	—	—	12	—	mA
OUTPUT VOLTAGE[1]	NOMINAL INPUT V	±4.95	±5.00	±5.05	±11.90	±12.00	±12.10	±14.90	±15.00	±15.10	VDC
OUTPUT CURRENT	FULL LOAD	0	—	±1.7	0	—	±0.85	0	—	±0.7	A
OUTPUT POWER	FULL LOAD	—	—	17	—	—	20.4	—	—	21	W
EFFICIENCY	FULL LOAD	—	81	—	—	84	—	—	84	—	%
LINE REGULATION	V_{in} = MIN TO MAX	—	<0.1	0.8	—	<0.2	0.8	—	<0.2	0.8	%
LOAD REGULATION[2]	25% TO FULL LOAD	—	0.3	0.7	—	0.1	0.6	—	0.2	0.6	%
CROSS REGULATION[3]		—	2.5	—	—	1.0	—	—	1.0	—	%
OUTPUT RIPPLE[4]	0 TO 20 MHz	—	50	—	—	50	—	—	50	—	mV p-p
	10 kHz to 1 MHz	—	15	—	—	10	—	—	10	—	mV rms
INPUT RIPPLE[5]	0 TO 20 MHz	—	90	—	—	90	—	—	90	—	mA p-p
	10 kHz to 1 MHz	—	25	—	—	25	—	—	25	—	mA rms
TRANSIENT	RECOVERY[6]	—	100	—	—	100	—	—	note 7	—	µs
	RESPONSE[8]	—	70	—	—	120	—	—	100	—	mV peak

Notes:
1. A 20k trimpot or a fixed resistor may be used to adjust the output voltage. The trim resistor should be connected between the positive output and the negative output with the trim pin connected in between. (See figure at right.) Trimming adjusts both outputs equally.
2. Output voltage changes when both outputs are changed from maximum to minimum load at the same time.
3. Output voltage changes in one output when the other output is changed from 25% load to full load.
4. To simulate normal PCB decoupling, a 0.01 µF ceramic capacitor and a 1 µF tantalum capacitor are placed one inch from the converter when measuring output noise.
5. Measured into a 1 µH source impedance.
6. The time required to settle from a 50 to 75% step load change to within a 1% error band with a steprise time of 2µs.
7. The output never exceeds 1%.
8. The peak overshoot during a transient as defined in note 6.

POSITIVE OUTPUT 4

OUTPUT COMMON 5   + LOAD

TRIM 7

NEGATIVE OUTPUT 6   – LOAD
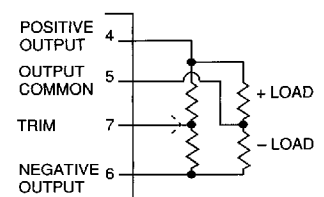
TRIM CONNECTION

■ 4863872 0000739 999 ■

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CHARACTERISTICS: Tc = 25°C, nominal input voltage, full load unless otherwise specified.

Operating Temperature Range (Case)
- Full Power: -40 °C to +90°C
- Absolute: -50°C to +100°C
- Thermal shutdown: 105°C

Storage Temperature Range (Case)
- –55°C to +105°C

Thermal Impedance: case rise over ambient
- 9.5°C/watt dissipated

Temperature coefficient
- 50 ppm / °C typical, 150 ppm / °C max.

Weight
- 65 grams, typical

Isolation: Leakage current 10 μA
- Input to output: 28 volt — 700 V DC
  48 volt — 1544 V DC

Capacitance
- Input to output: 500 pF typical

Conversion Frequency
- 220 kHz, typical

Start-up Time
- 6 milliseconds, typical

Input Ripple Rejection
- > 40 dB, DC to 120 Hz ripple, 1% of V_{in}

Stability: output voltage drift
- Short term, 24 hours: < 0.05 %, typical
- Long term, 1000 hours: <0.2%, typical

On/Off: referenced to input common
- Output enabled = open or high (≥1.6 volts), open circuit voltage = 2.5 VDC
- Output disabled = low (≤0.7 volts), converter input current is typically 5 mA

Resistance
- On/off (pin 1): 20 k ohms
- Trim (pin 7): 60 k ohms

TYPICAL CURVES (ALL MODELS UNLESS OTHERWISE NOTED)
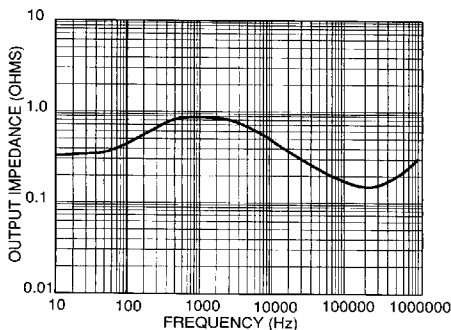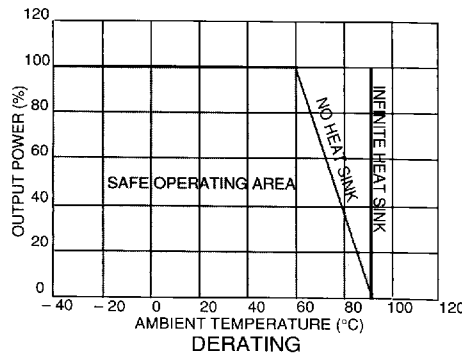

OUTPUT IMPEDANCE vs. FREQUENCY
Figure 1
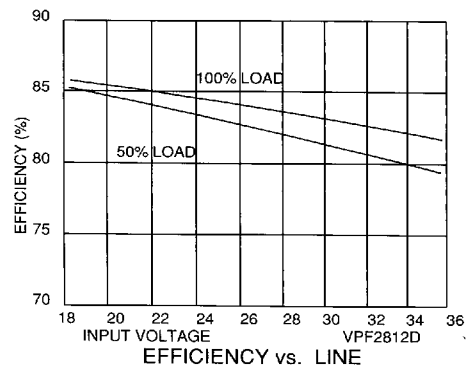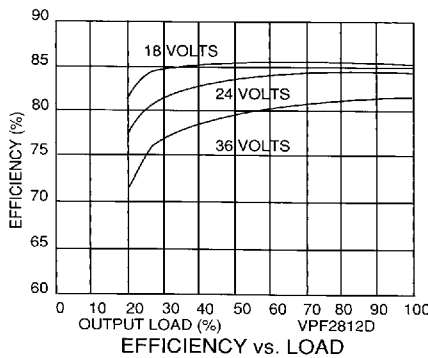

DERATING
Figure 2

EFFICIENCY vs. LINE
Figure 3

EFFICIENCY vs. LOAD
Figure 4

INPUT CURRENT vs. INPUT VOLTAGE
Figure 5

EFFICIENCY vs. LINE
Figure 6

EFFICIENCY vs. LOAD
Figure 7
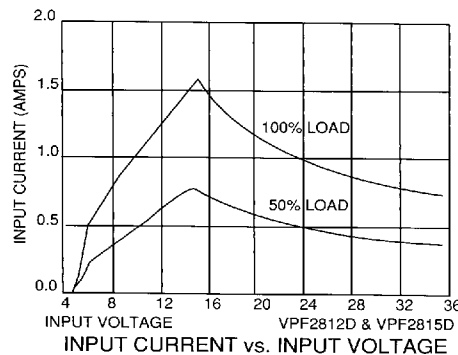
INPUT CURRENT vs. INPUT VOLTAGE
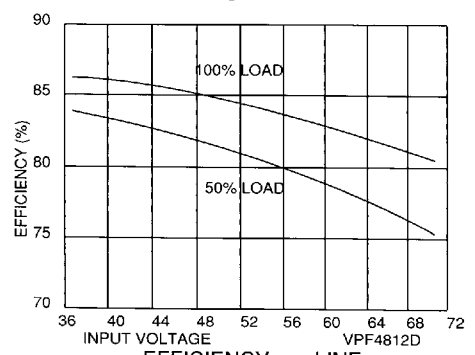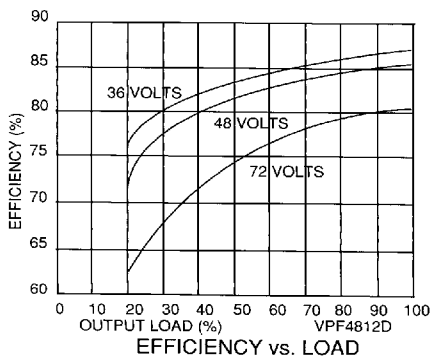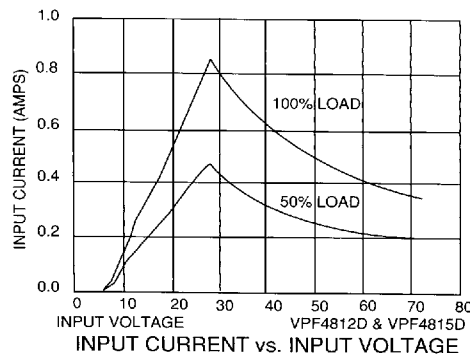**Figure 8**

Note:
The input current curves (figures 5 and 8) are for the ±12 an d ±15 volt output models. For the ±5 volt output models the current is approximately 15% less.

The efficiency curves were generated for the 12 volt output models (figures 3, 4, 6 and 7). For other output models use the following adjustments:
For the 5 volt output models subtract approximately 2%.
For the 15 volt output models add approximately 1%.

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OPTIONAL ENVIRONMENTAL SCREENING

Environmental screening consists of the following procedures (Methods and Conditions refer to MIL-STD-202):

- 96 hours of burn-in at 85°C, per method 108.
- Mechanical shock per method 213, condition D.

- Temperature shock per method 107, condition A (modified).
- Final electrical test per Interpoint acceptance test procedure.

To order optional screening, add suffix -/ST to model number. Example: VPF2805D/ST. On unscreened parts, the screening code block is blank. On screened parts, the block is marked "ST."
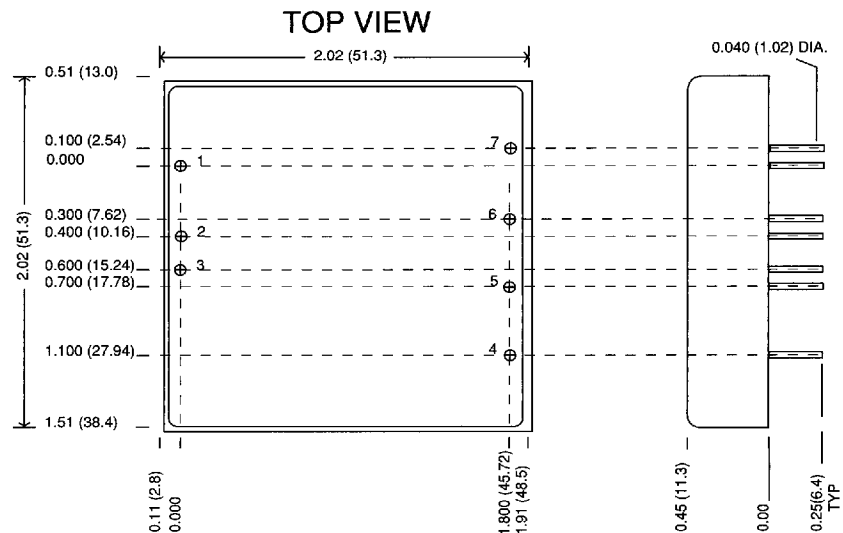
BLOCK DIAGRAM
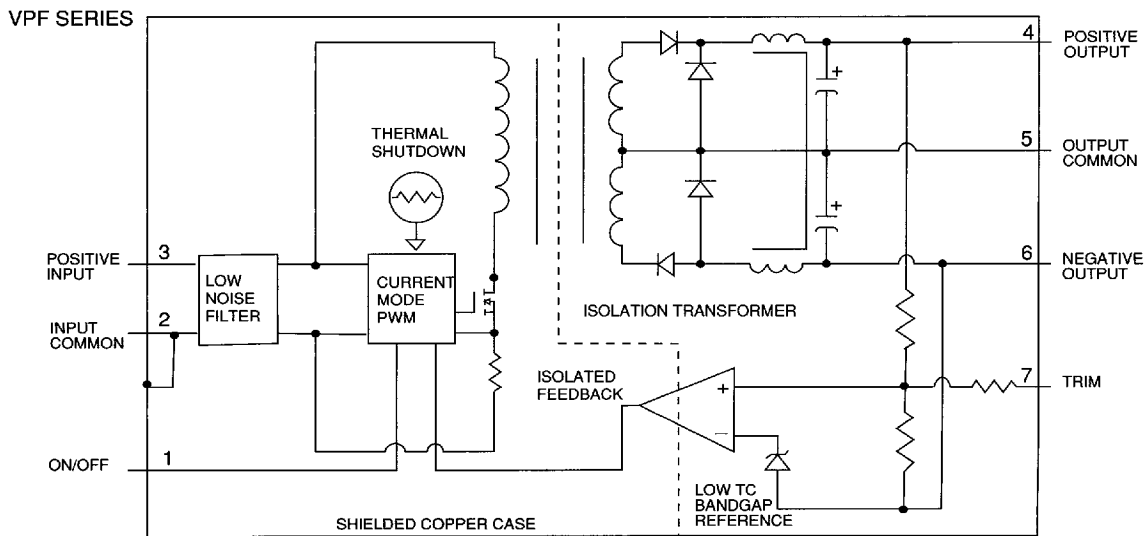
METAL AND EPOXY CASE

VPF SERIES CASE DRAWING
NOMINAL CASE DIMENSIONS IN INCHES
TOLERANCE X.XXX ±0.10 (0.25), X.XXX ±0.005 (0.13)

Designation	Pin #
On/Off	1
Input common	2
Positive input	3
Positive output	4
Output common	5
Negative output	6
Trim	7

Note: Case is connected to input common (pin 2).

TOP VIEW

VPF SERIES is a trademark of Interpoint Corporation.

All technical information in this data sheet has been carefully checked and is believed to be accurate, but no responsibility is assumed for errors or omissions. Interpoint reserves the right to make changes without notice in products or specifications.

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