

HIGH RELIABILITY HYBRID DC-DC CONVERTERS

DESCRIPTION

The DVPL series of high reliability DC-DC converters is operable over the full military (-55 °C to +125 °C) temperature range with no power derating. Operating at a nominal fixed frequency of 300 kHz, these regulated, non-isolated converters are optimized for low voltage point of load applications with high efficiency synchronous rectification, fast transient response, and power sequencing capability.

These converters are designed and manufactured in a facility qualified to ISO9001 and certified to MIL-PRF-38534 and MIL-STD-883.

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
- Operates From 5V or 3.3V Input
- Adjustable Output Voltage, 0.8V to 3.4V
- Up to 5 Amps or 16W Output
- High Efficiency, Up to 97%
- Output Voltage Sequencing
- Output Voltage Tracking
- Operation Into a Pre-Biased Output
- Output Inhibit Control
- Low Output Noise
- NO Use of Optoisolators
- Over Current and Short Circuit Protection
- Precision Projection Welded Hermetic Package
- Meets MIL-STD-461C and MIL-STD-461D EMC Requirements When Used With VPT DC-DC Converters and EMI filters
- Additional Environmental Screening Available
- MIL-PRF-38534 Element Evaluated Components

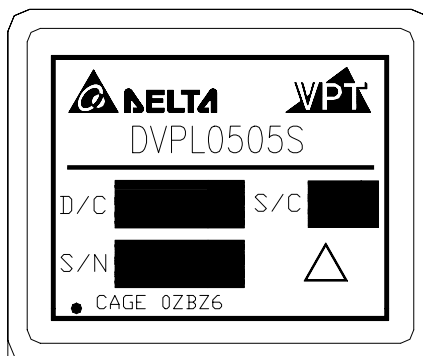


Figure 1 – DVPL0505S DC-DC Converter
(Not To Scale)

SPECIFICATIONS ($T_{CASE} = -55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$, $V_{IN} = +3.3\text{V}$, $+5\text{V} \pm 5\%$, Full Load, Unless Otherwise Specified)

ABSOLUTE MAXIMUM RATINGS

Input Voltage (Continuous)	5.5 V_{DC}	Junction Temperature Rise to Case	+10°C
Input Voltage (Transient)	5.8 V_{DC}	Storage Temperature	-65°C to +150°C
Output Power ¹	16.5 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, $T_{CASE} = +125^{\circ}\text{C}$)	1.3 Watt	Weight (Maximum)	13 Grams

Parameter	Conditions	DVPL0505S			Units	
		Min	Typ	Max		
STATIC						
INPUT Voltage ⁴	V_{IN}	$V_{out} = 0.8\text{V}$ to 2.5V	3.0		5.5	V
	V_{IN}	$V_{out} = 2.6\text{V}$ to 3.3V	4.0		5.5	V
Current		Inhibited	-	-	3	mA
		No Load			60	mA
Inhibit Pin Input ⁴			0	-	1.5	V
Inhibit Pin Open Circuit Voltage ⁴					V_{in}	V
UVLO Turn On ^{4,6}				2.2		V
UVLO Turn Off ⁴				2.0		V
OUTPUT Voltage	V_{OUT}	$T_{CASE} = 25^{\circ}\text{C}$	-1.5	V_{out}	+1.5	% V_{out}
	V_{OUT}	$T_{CASE} = -55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$	-2.5	V_{out}	+2.5	% V_{out}
Power ^{3,1}		$V_{OUT} = 3.3\text{V}$	0		16.5	W
Current ³	V_{OUT}		0		5	A
Ripple Voltage	V_{OUT}	Full Load, 20Hz to 10MHz		35	90	mV _{p-p}
Load Regulation	V_{OUT}	No Load to Full Load		15	40	mV
EFFICIENCY		$V_{in} = 5\text{V}$, $V_{out} = 3.3\text{V}$	93	96		%
FAULT POWER DISSIPATION		Short Circuit			3	W
CAPACITIVE LOAD ⁴					5000	μF
SWITCHING FREQUENCY			240	300	350	kHz
CASE ISOLATION		500 V_{DC}	100	-	-	M Ω
MTBF (MIL-HDBK-217F)		AIF @ $T_C = 55^{\circ}\text{C}$		800		kHrs
DYNAMIC						
Load Step Output Transient ⁵	V_{OUT}	Half Load to Full Load		100	250	mV
Load Step Recovery ^{2,5}				30	75	μSec
Turn On Delay	V_{OUT}	$V_{IN} = 0\text{V}$ to 5V			6	mSec
Turn On Overshoot					40	mV _{PK}
VOLTAGE TRACKING						
Tracking Accuracy ⁴		Power-up		100	300	mV
		Power-down		200	400	mV
Slew Rate ⁴		At track pin	0.1		2	V/msec
Tracking Delay ⁴		From V_{in} to tracking voltage applied	10			ms

- 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 135°C. 4. Verified by qualification testing.
 5. With 100 μF capacitor from V_{in} to Ground
 6. V_{out} not necessarily in regulation.

BLOCK DIAGRAM

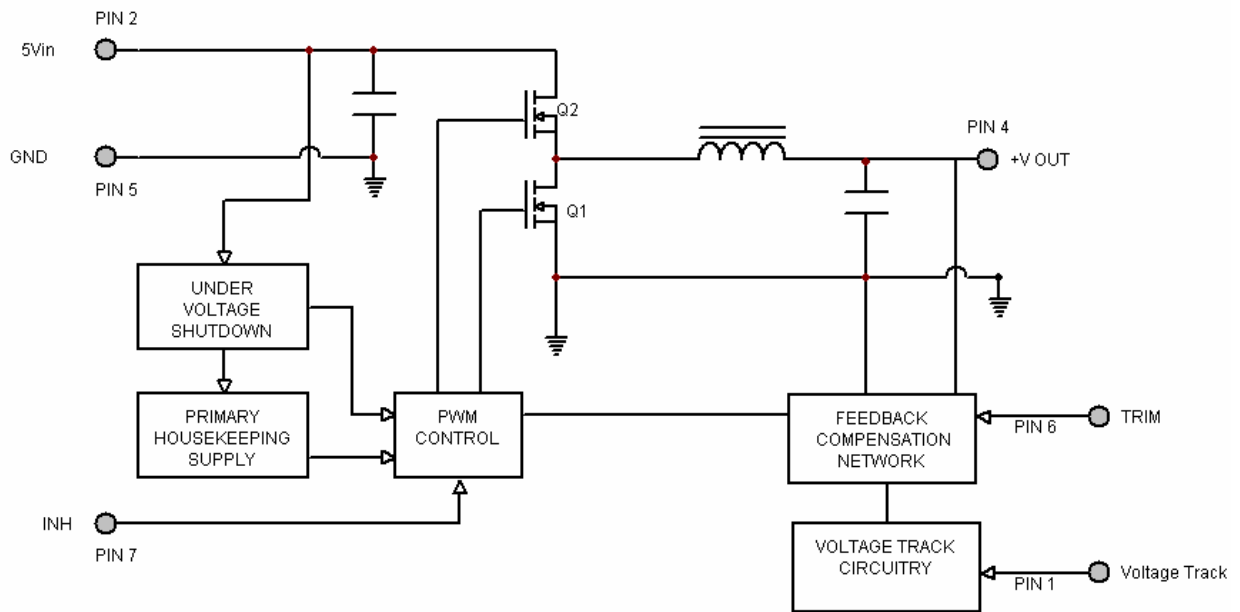


Figure 2

CONNECTION DIAGRAM

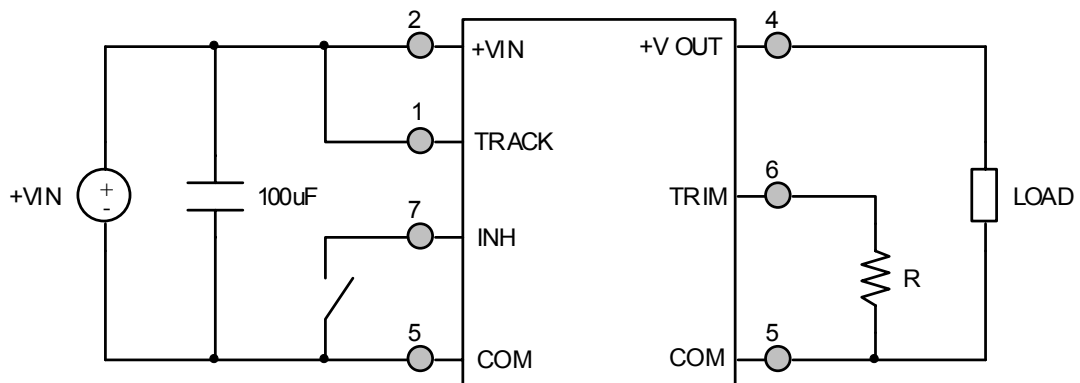


Figure 3

(Shown with recommended 100uF input capacitor)

TYPICAL DISTRIBUTED APPLICATION

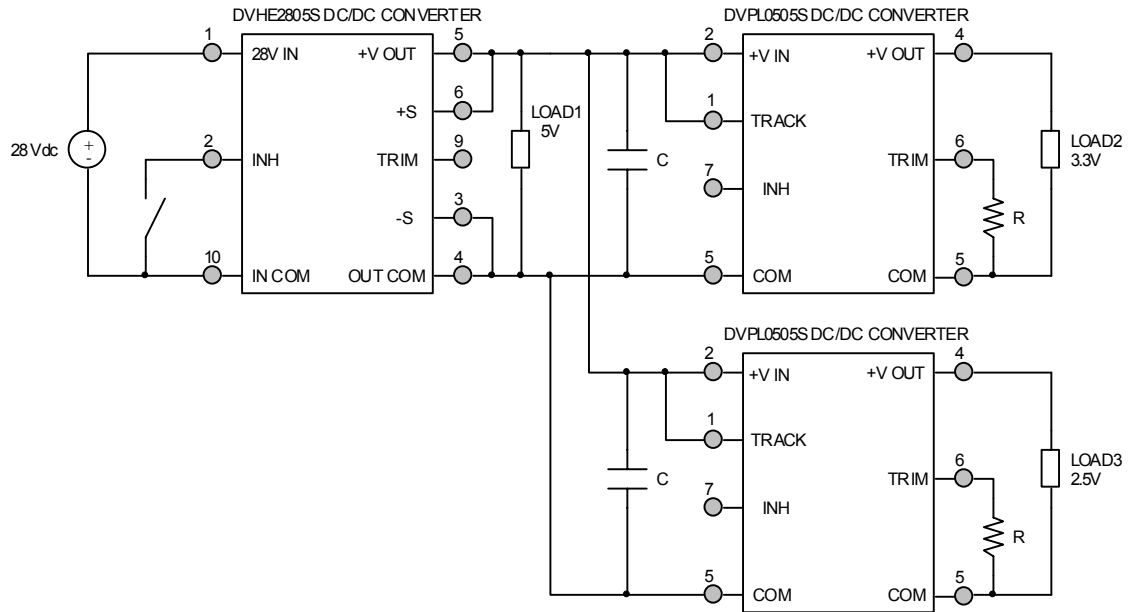


Figure 4

TRACKING APPLICATION

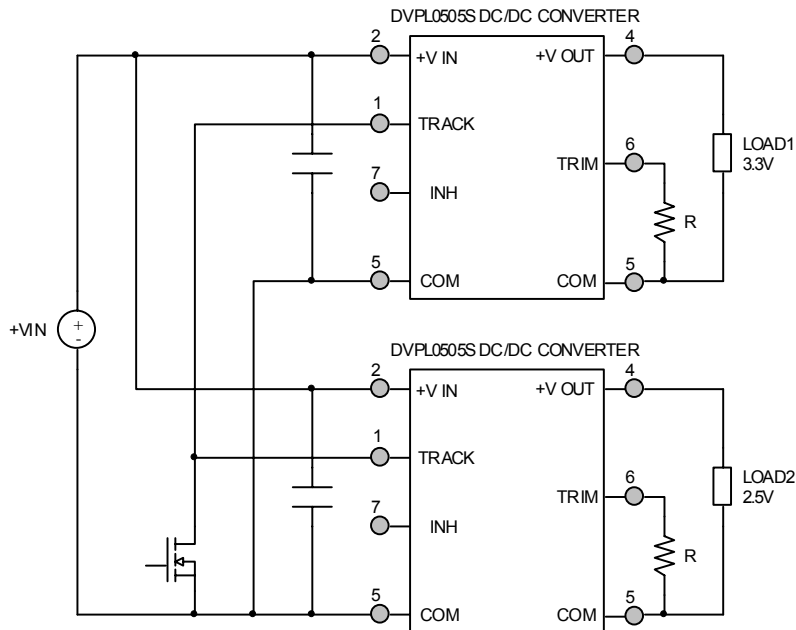


Figure 5

INTERNAL CONNECTION DIAGRAMS

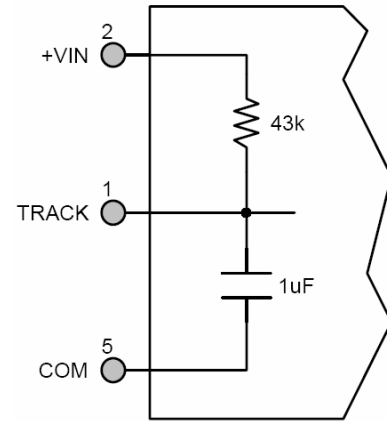
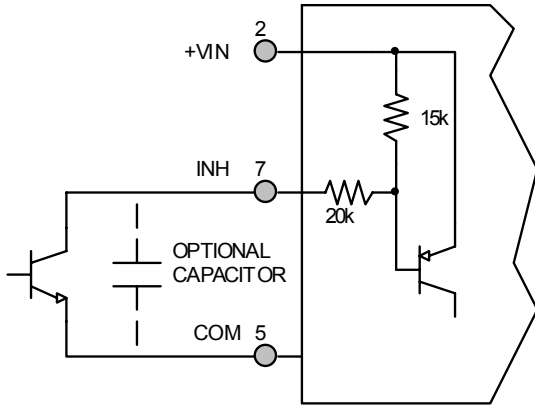


Figure 6 – Internal Inhibit Circuit and Recommended Drive
(Shown with optional capacitor for turn-on delay)

Figure 7 – Internal Track Circuit

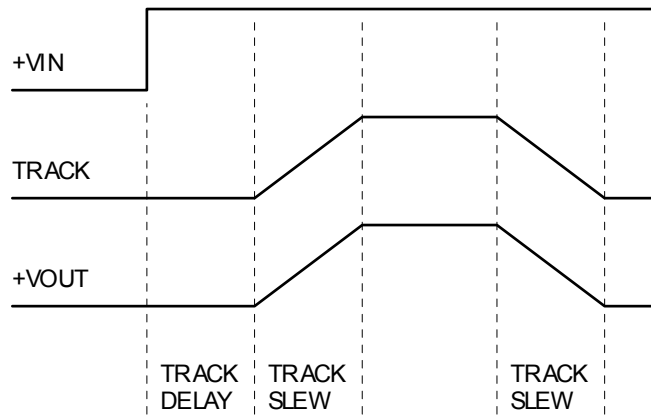
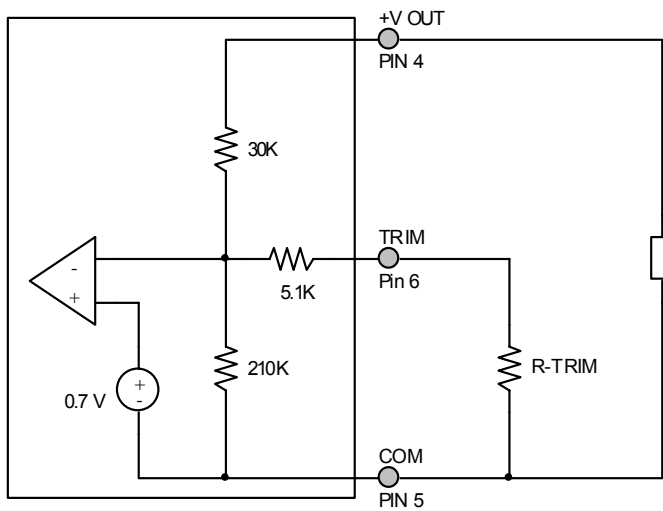


Figure 8 – Track timing relations

OUTPUT VOLTAGE TRIM



The output voltage is set with an external resistor connected from Trim pin to GND pin. This resistor must have a tolerance of 1% or less to achieve an accurate output voltage.

The default output voltage with the TRIM pin left open is 0.80V.

DVPL0505S	
+V _{OUT} (V)	R _{TRIM} (Ω)
0.8	-
0.9	205k
1.0	99.9k
1.2	47.4k
1.5	24.9k
1.8	15.9k
1.9	13.9k
2.0	12.4k
2.5	7.25k
2.8	5.40k
3.0	4.44k
3.3	3.30k
3.4	2.98k

$$V_o = \frac{168R_{TRIM} + 5.267 * 10^6}{210R_{TRIM} + 1.071 * 10^6}$$

$$R_{TRIM} = \frac{5.267 * 10^6 - 1.071 * 10^6 * V_o}{210 * V_o - 168}$$

Figure 9 – Output Voltage Trim

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

—— $V_{OUT} = 3.3V$	- - - - $V_{OUT} = 2.5V$	- · - · - $V_{OUT} = 1.5V$	- · - · - $V_{OUT} = 0.8V$
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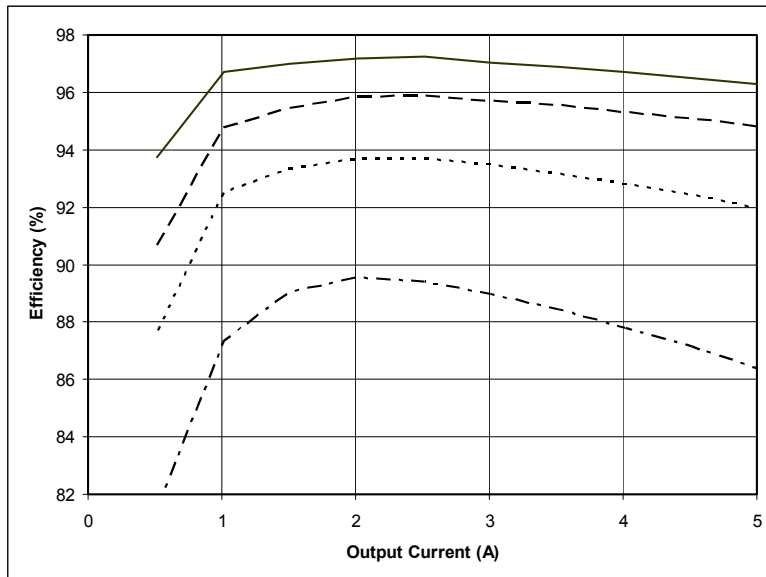


Figure 10 – DVPL0505S $V_{in}=5.0V$
Efficiency (%) vs. Output Current (A)

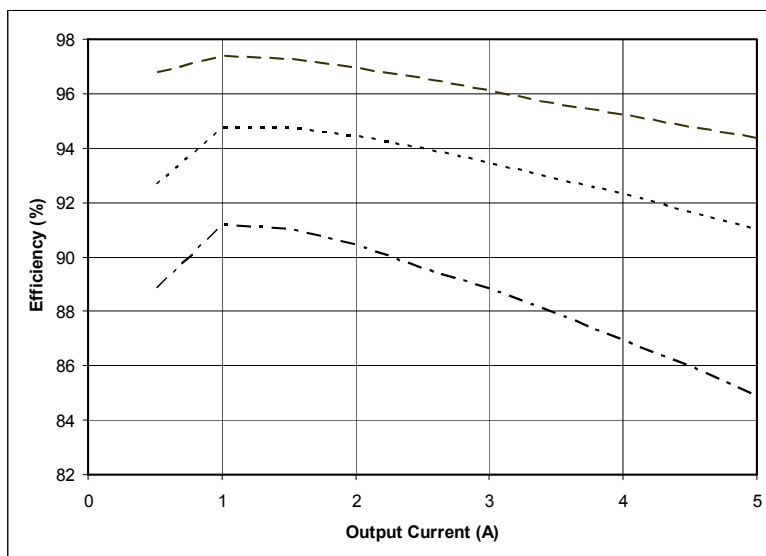


Figure 11 – DVPL0505S $V_{in}=3.3V$
Efficiency (%) vs. Output Current (A)

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

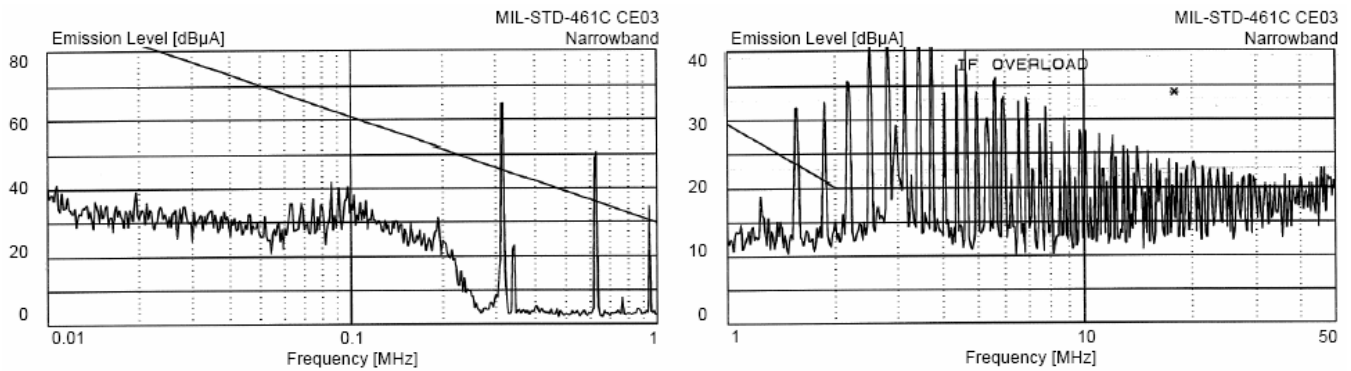


Figure 12 – 5V input line, DVPL, $C_{IN}=100\mu F$

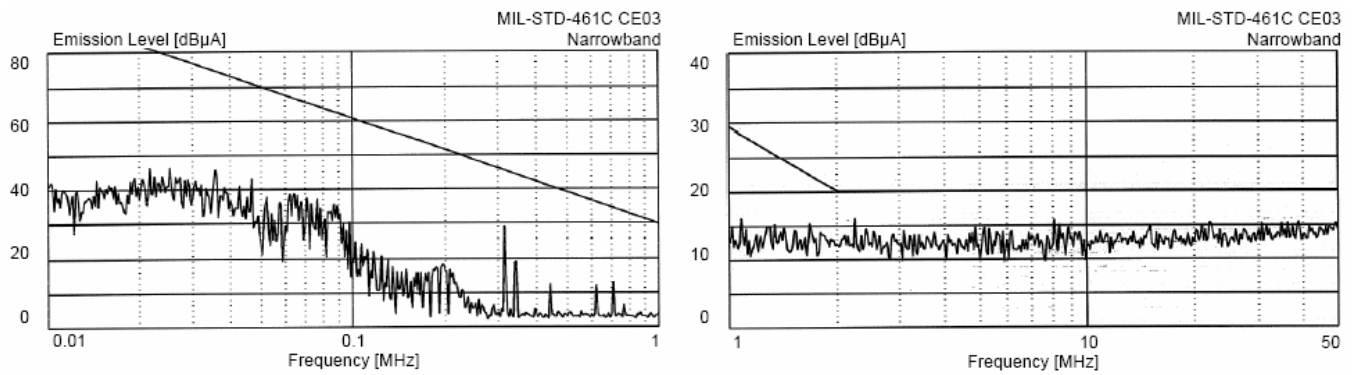


Figure 13 – 5V input line, DVMC and DVPL, $C_{IN}=100\mu F$

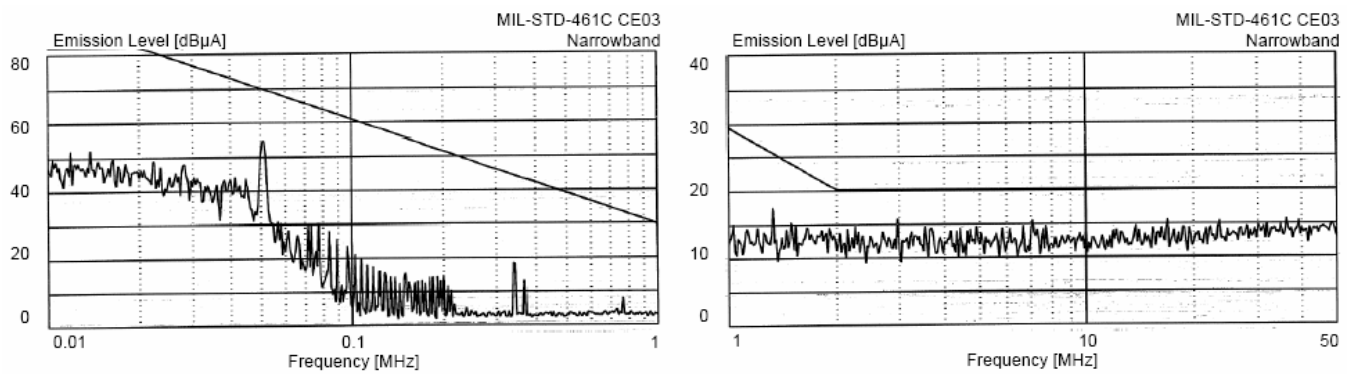
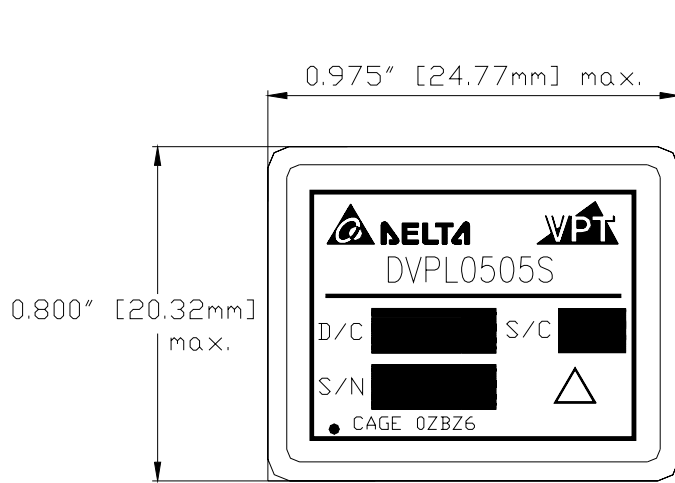
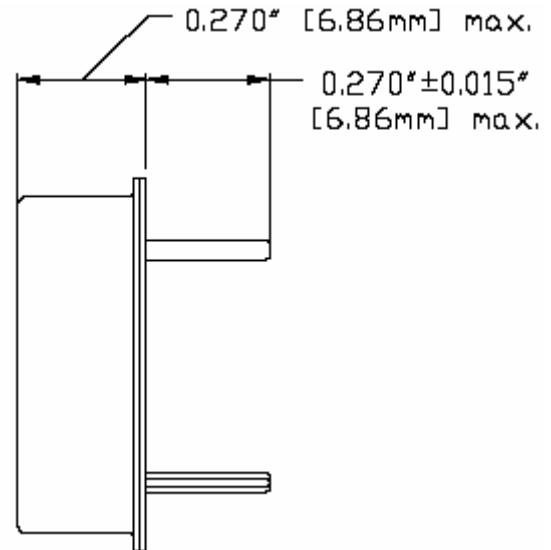


Figure 14- 28V input line, DVMC, DVHE and DVPL, $C_{IN}=100\mu F$

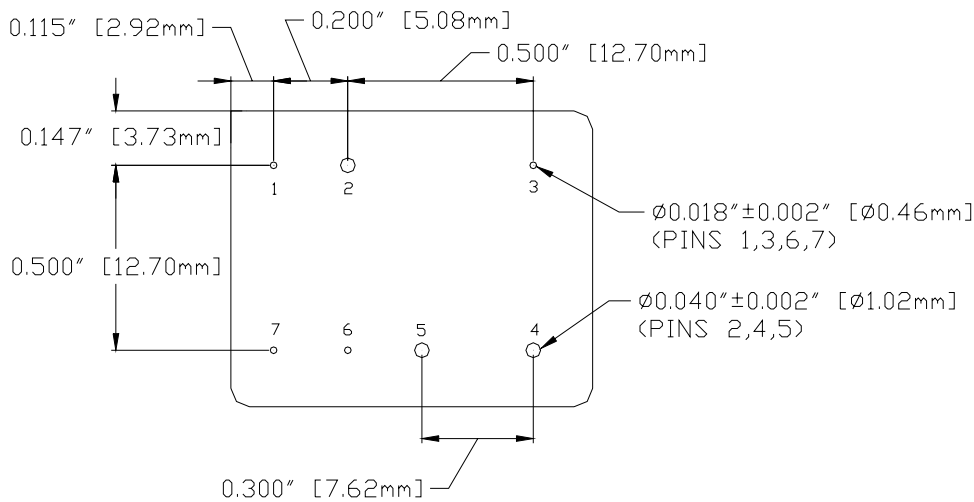
PACKAGE SPECIFICATIONS



TOP VIEW



SIDE VIEW



BOTTOM VIEW

PIN	FUNCTION
1	TRACK
2	+V IN
3	CASE
4	+V OUT
5	COM
6	TRIM
7	INHIBIT

Figure 15 – Package and Pinout
(Dimensional Limits are ± 0.005 inches Unless Otherwise Stated)

PACKAGE PIN DESCRIPTION

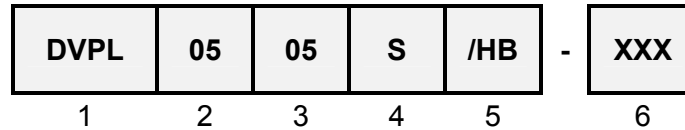
Pin	Function	Description
1	TRACK	The output voltage will follow this pin. Used for output voltage sequencing or tracking. If not used, the Track pin should be connected to Vin.
2	+V IN	Positive Input Voltage Connection
3	CASE	Case Connection
4	+V OUT	Positive Output Voltage Connection
5	COM	Common Return Connection
6	TRIM	Trim pin sets output voltage with a resistor to Common
7	INHIBIT	Logic Low = Disabled Output. Connecting the inhibit pin to common causes converter shutdown. Logic High (open collector or open drain) = Enabled Output. Leave open if not used.

ENVIRONMENTAL SCREENING (100% Tested Per MIL-STD-883 as referenced to MIL-PRF-38534)

Screening	MIL-STD-883	Standard (No Suffix)	Extended /ES	HB /HB	Class H /H	Class K /K
Non-Destructive Bond Pull	Method 2023	•	•	•	•	•
Internal Visual	Method 2017, 2032 Internal Procedure	•	•	•	•	•
Temperature Cycling	Method 1010, Condition C Method 1010, -55°C to 125°C		•	•	•	•
Constant Acceleration	Method 2001, 3000g, Y1 Direction Method 2001, 500g, Y1 Direction		•	•	•	•
PIND	Method 2020, Condition A ²					•
Pre Burn-In Electrical	100% at 25°C					•
Burn-In	Method 1015, 320 hours at +125°C Method 1015, 160 hours at +125°C 96 hours at +125°C 24 hours at +125°C	•	•	•	•	•
Final Electrical	MIL-PRF-38534, Group A ¹ 100% at 25°C	•	•	•	•	•
Hermeticity	Method 1014, Fine Leak, Condition A Method 1014, Gross Leak, Condition C Dip (1×10^{-3})	•	•	•	•	•
Radiography	Method 2012 ³					•
External Visual	Method 2009	•	•	•	•	•

- Notes:
1. 100% R&R testing at -55°C, +25°C, and +125°C with all test data included in product shipment.
 2. PIND test Certificate of Compliance included in product shipment.
 3. Radiographic test Certificate of Compliance and film(s) included in product shipment.

ORDERING INFORMATION



(1)

(2)

(3)

(4)

Product Series	Nominal Input Voltage		Output Current		Number of Outputs	
DVPL	05	5 Volts	05	5 Amps	S	Single

(5)

(6)

Screening Code ^{1,2}		Additional Screening Code
None /ES /HB /H /K	Standard Extended HB Class H Class K	Contact Sales

- Notes:
1. Contact the VPT Inc. Sales Department for availability of Class H (/H) or Class K (/K) qualified products.
 2. VPT Inc. reserves the right to ship higher screened or SMD 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 requirement, source inspection, and/or special element evaluation for space or other higher quality applications.

SMD (STANDARD MICROCIRCUIT DRAWING) NUMBERS

Standard Microcircuit Drawing (SMD)	DVPL0505S Series Similar Part Number
*T.B.D.	DVPL0505S/H

Do not use the DVPL0505S Series similar part number for SMD product acquisition. It is listed for reference only. For exact specifications for the SMD product, refer to the SMD drawing. SMD's can be downloaded from the DSCC website at <http://www.dscclia.mil/programs/smcr/>. The SMD number listed above is for MIL-PRF-38534 Class H screening, standard gold plated lead finish, and no RHA (Radiation Hardness Assurance) level. Please reference the SMD for other screening levels, lead finishes, and radiation levels.

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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