DVCH2800D Series

HIGH RELIABILITY HYBRID DC-DC CONVERTERS

DESCRIPTION

The DVCH series of high reliability DC-DC converters is operable over the full military (-55 °C to +125 °C) temperature range with no power derating. Unique to the DVCH series are robust and effective input and output filters which provide dramatically reduced input and output noise performance when compared to other manufacturers competing devices. Operating at a nominal fixed frequency of 400 kHz, these regulated, isolated units utilize a high speed magnetic feedback design and well controlled undervoltage lockout circuitry to eliminate slow start-up problems.

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
- Very Low Output Noise
- Wide Input Voltage Range: 12 to 50 Volts per MIL-STD-704
- Up to 1.5 Watts Output Power
- Fault Tolerant Magnetic Feedback Circuit
- NO Use of Optoisolators
- Undervoltage Lockout
- Indefinite Short Circuit Protection
- Current Limit Protection
- Industry Standard Pinout
- High Input Transient Voltage: 80 Volts for 1 sec per MIL-STD-704A
- Precision Projection Welded Hermetic Package
- High Power Density: > 7 W/in^3
- Custom Versions Available
- Additional Environmental Screening Available
- Meets MIL-STD-461 Revisions C, D, E and F EMC Requirements When Used With VPT's EMI Filters
- MIL-PRF-38534 Element Evaluated Components
- Space Applications should consider VPT's "S" Series of Radiation Tolerant Power Conversion Devices. Contact VPT for details.

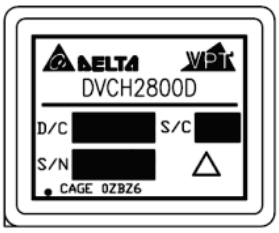


Figure 1 – DVCH2800D DC-DC Converter
(Exact marking may differ from that shown)

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

SPECIFICATIONS (T_{CASE} = -55°C to +125°C, V_{IN} = +28V ± 5%, Full Load, Unless Otherwise Specified)

ABSOLUTE MAXIMUM RATINGS

Input Voltage (Continuous)	50 V_{DC}	Junction Temperature Rise to Case	+5°C
Input Voltage (Transient, 1 second)	80 Volts	Storage Temperature	-65°C to +150°C
Output Power[1]	1.5 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, T_{CASE} = +125°C)	0.6 Watts	Weight (Maximum)	11 Grams
ESD Rating per MIL-PRF-38534	3A		

Parameter	Conditions	DVCH2805D			DVCH2812D			Units
		Min	Typ	Max	Min	Typ	Max	
STATIC								
INPUT Voltage[4]	Continuous	12	28	50	12	28	50	V
	Transient, 1 sec	-	-	80	-	-	80	V
Current	Inhibited	-	-	3.5	-	-	3.5	mA
	No Load	-	-	10	-	-	12	mA
Ripple Current	Full Load, 20Hz to 10MHz	-	-	30	-	-	30	mA_{p-p}
Inhibit Pin Input[4]		0	-	1.5	0	-	1.5	V
Inhibit Pin Open Circuit Voltage[4]		8.0	9.0	11.0	8.0	9.0	11.0	V
UVLO Turn On		6.5	-	11.5	6.5	-	11.5	V
OUTPUT Voltage ±V_{OUT}	T_{CASE} = 25°C	4.95	5.00	5.05	11.88	12.0	12.12	V
±V_{OUT}	T_{CASE} = -55°C to +125°C	4.80	5.00	5.20	11.52	12.0	12.48	V
Power[3] Total		0	-	1.5	0	-	1.5	W
±V_{OUT}	Either Output	0	-	1.2	0	-	1.2	W
Current[3] I_{OUT}	Either Output	0	-	0.24	0	-	0.1	A
Ripple Voltage ±V_{OUT}	Full Load, 20Hz to 10MHz	-	-	50	-	-	100	mV_{p-p}
Line Regulation ±V_{OUT}	V_{IN} = 12V to 50V	-	-	150	-	-	150	mV
Load Regulation ±V_{OUT}	10% Load to Full Load	-	-	400	-	-	700	mV
Load Regulation ±V_{OUT}	50% Load to Full Load	-	-	250	-	-	250	mV
EFFICIENCY		72	79	-	74	79	-	%
LOAD FAULT POWER DISSIPATION	Overload[4]	-	-	3	-	-	3	W
	Short Circuit	-	-	4	-	-	4.5	W
CAPACITIVE LOAD[4]		-	-	500	-	-	200	µF
SWITCHING FREQUENCY		325	400	475	325	400	475	kHz
ISOLATION	500 V_{DC}	100	-	-	100	-	-	MΩ
MTBF (MIL-HDBK-217F)	AIF @ T_C = 55°C	-	841	-	-	841	-	kHrs
DYNAMIC								
Load Step Output Transient ±V_{OUT}	Half Load to Full Load	-	100	300	-	100	300	mV_{PK}
Load Step Recovery[2]		-	200	500	-	100	400	µSec
Line Step Output Transient[4] ±V_{OUT}	V_{IN} = 12V to 50V	-	200	400	-	300	600	mV_{PK}
Line Step Recovery[2, 4]		-	400	600	-	300	600	µSec
Turn On Delay ±V_{OUT}	V_{IN} = 0V to 28V	-	15	20	-	15	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 135°C. 4. Verified by qualification testing.

SPECIFICATIONS (T_{CASE} = -55°C to +125°C, V_{IN} = +28V ± 5%, Full Load, Unless Otherwise Specified)

ABSOLUTE MAXIMUM RATINGS

Input Voltage (Continuous)	50 V_{DC}	Junction Temperature Rise to Case	+5°C
Input Voltage (Transient, 1 second)	80 Volts	Storage Temperature	-65°C to +150°C
Output Power[1]	1.5 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, T_{CASE} = +125°C)	0.6 Watts	Weight (Maximum)	11 Grams
ESD Rating per MIL-PRF-38534	3A		

Parameter	Conditions	DVCH2815D			Units
		Min	Typ	Max	
STATIC					
INPUT Voltage[4]	Continuous	12	28	50	V
	Transient, 1 sec	-	-	80	V
Current	Inhibited	-	-	3.5	mA
	No Load	-	-	14	mA
Ripple Current	Full Load, 20Hz to 10MHz	-	-	30	mA_{p-p}
Inhibit Pin Input[4]		0	-	1.5	V
Inhibit Pin Open Circuit Voltage[4]		8.0	9.0	11.0	V
UVLO Turn On		6.5	-	11.5	V
OUTPUT Voltage ±V_{OUT}	T_{CASE} = 25°C	14.85	15.0	15.15	V
±V_{OUT}	T_{CASE} = -55°C to +125°C	14.40	15.0	15.60	V
Power[3] Total		0	-	1.5	W
±V_{OUT}	Either Output	0	-	1.2	W
Current[3] I_{OUT}	Either Output	0	-	0.08	A
Ripple Voltage ±V_{OUT}	Full Load, 20Hz to 10MHz	-	-	100	mV_{p-p}
Line Regulation ±V_{OUT}	V_{IN} = 12V to 50V	-	-	150	mV
Load Regulation ±V_{OUT}	10% Load to Full Load	-	-	700	mV
Load Regulation ±V_{OUT}	50% Load to Full Load	-	-	250	mV
EFFICIENCY		74	79	-	%
LOAD FAULT POWER DISSIPATION	Overload[4]	-	-	3	W
	Short Circuit	-	-	4.5	W
CAPACITIVE LOAD[4]		-	-	200	µF
SWITCHING FREQUENCY		325	400	475	kHz
ISOLATION	500 V_{DC}	100	-	-	MΩ
MTBF (MIL-HDBK-217F)	AIF @ T_C = 55°C	-	841	-	kHrs
DYNAMIC					
Load Step Output Transient ±V_{OUT}	Half Load to Full Load	-	100	300	mV_{PK}
Load Step Recovery[2]		-	100	400	µSec
Line Step Output Transient[4] ±V_{OUT}	V_{IN} = 12V to 50V	-	300	600	mV_{PK}
Line Step Recovery[2, 4]		-	300	600	µSec
Turn On Delay ±V_{OUT}	V_{IN} = 0V to 28V	-	15	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 135°C. 4. Verified by qualification testing.

BLOCK DIAGRAM

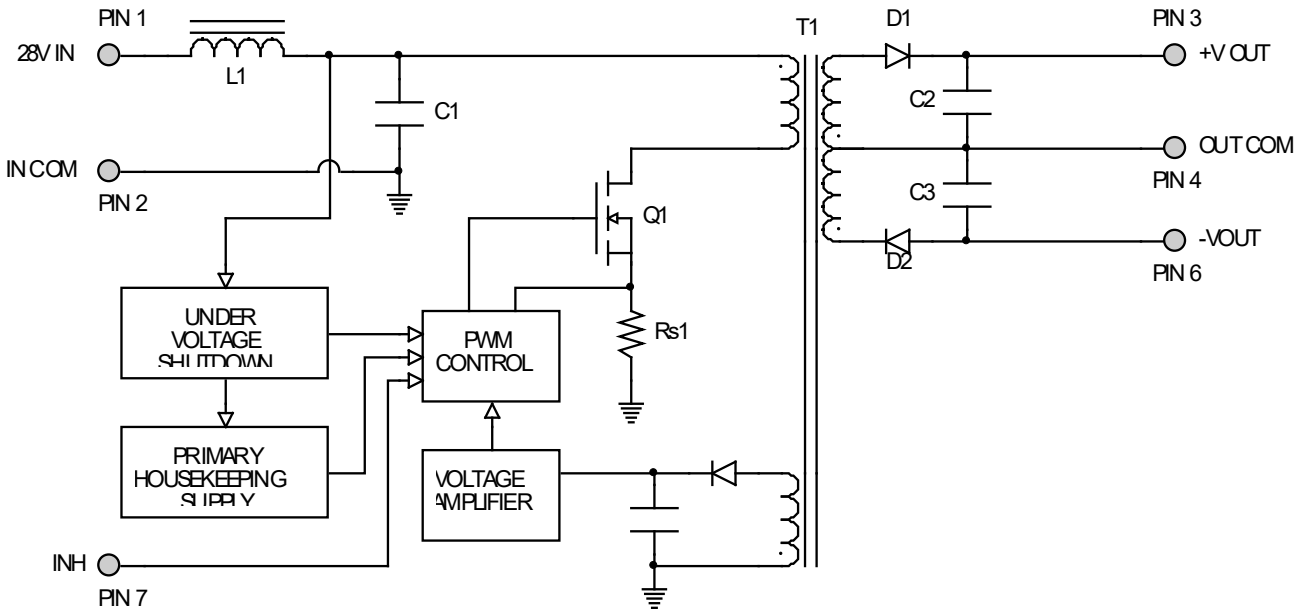


Figure 2

CONNECTION DIAGRAM

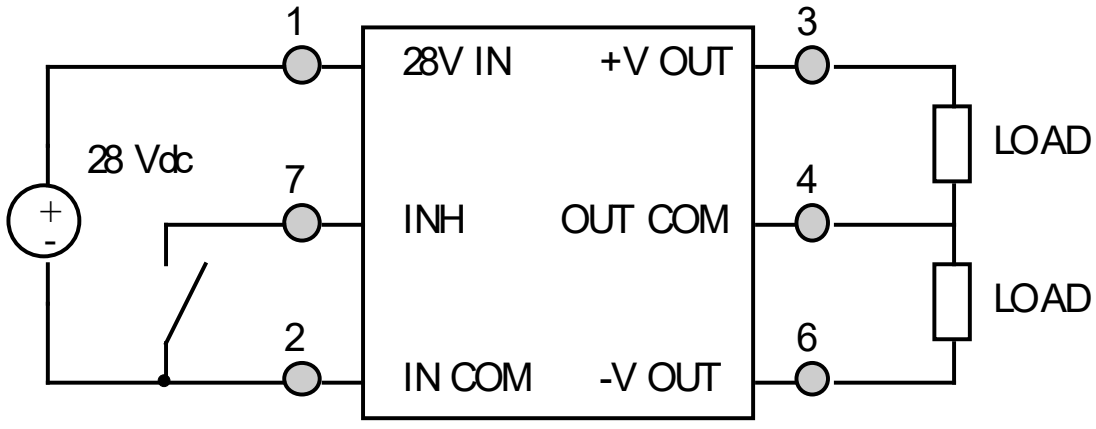


Figure 3

INHIBIT DRIVE CONNECTION DIAGRAMS

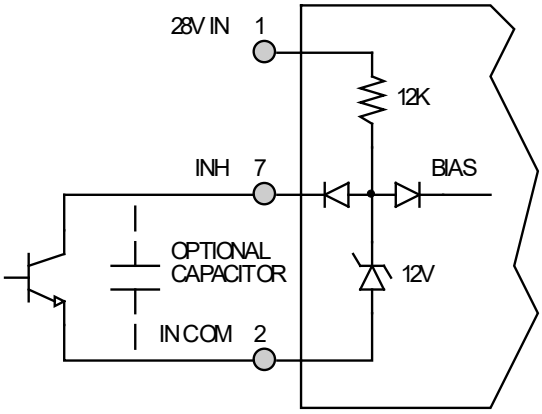


Figure 4 – Internal Inhibit Circuit and Recommended Drive
(Shown with optional capacitor for turn-on delay)

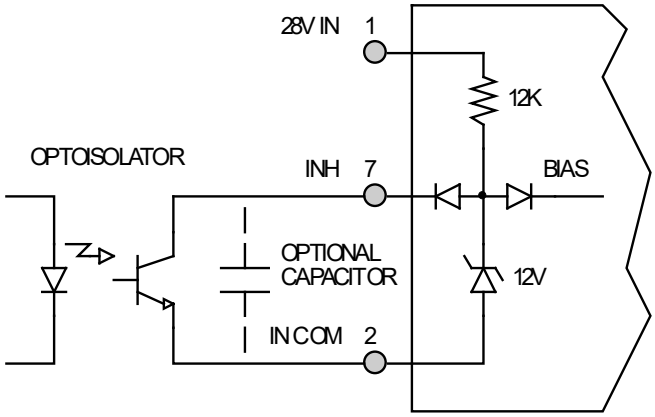


Figure 5 – Isolated Inhibit Drive
(Shown with optional capacitor for turn-on delay)

EMI FILTER HOOKUP DIAGRAM

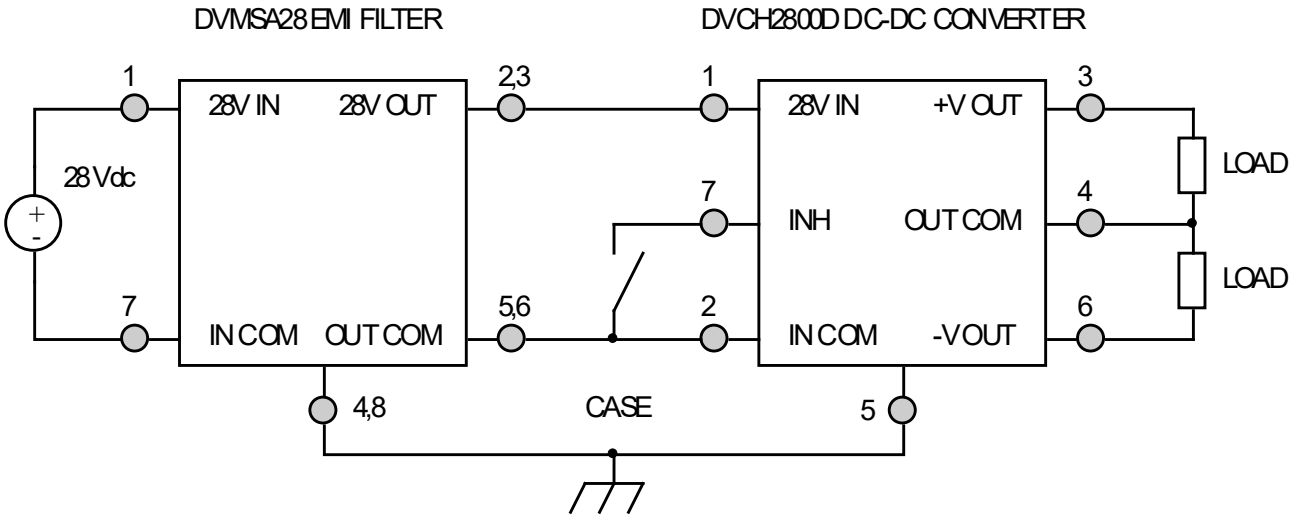


Figure 6 – Converter with EMI Filter

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

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

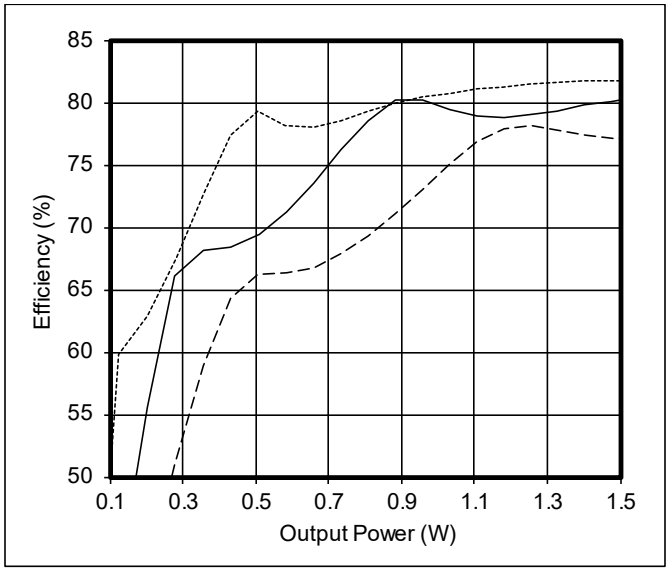


Figure 7 – DVCH2805D
Efficiency (%) vs. Output Power (W)

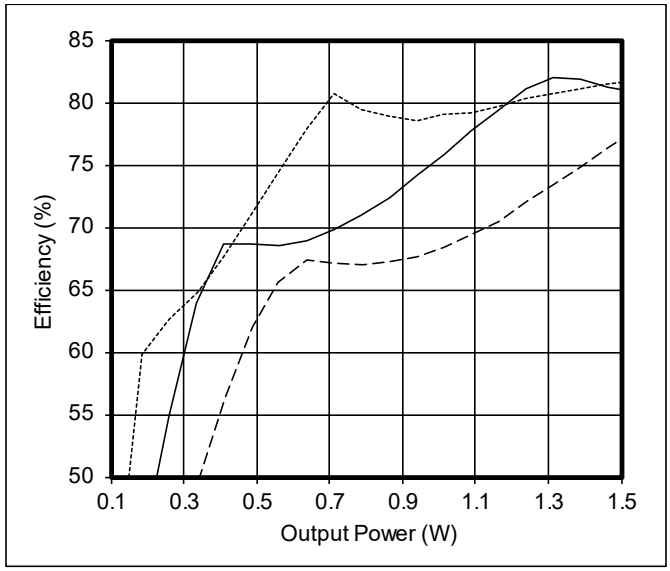


Figure 8 – DVCH2812D
Efficiency (%) vs. Output Power (W)

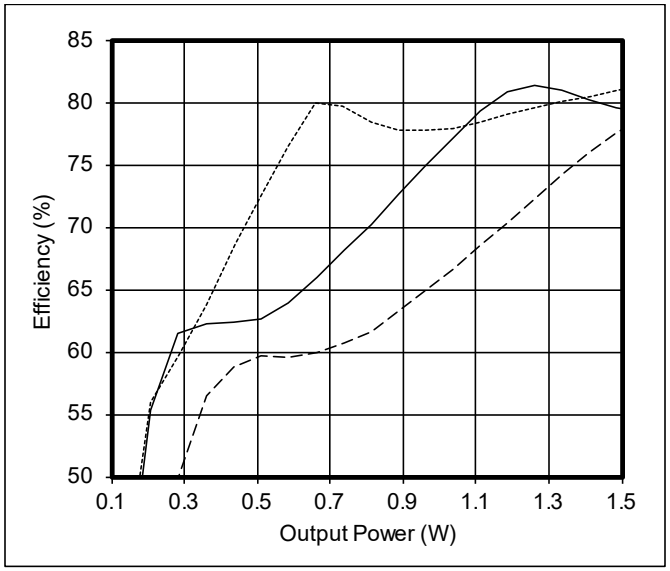


Figure 9 – DVCH2815D
Efficiency (%) vs. Output Power (W)

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

+Io = 10%	+Io = 20%	+Io = 50%	+Io = 80%

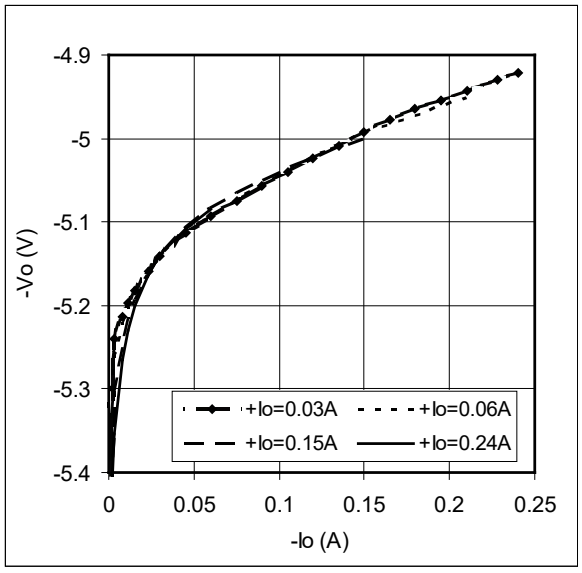


Figure 10 – DVCH2805D

-Vout (V) vs. -Iout (A)

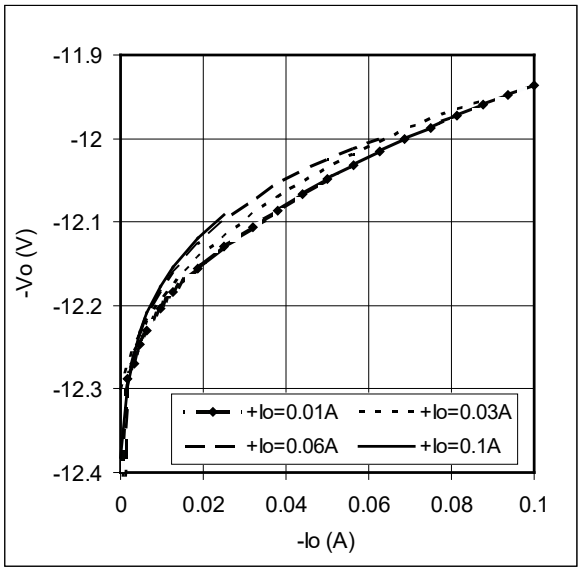


Figure 11 – DVCH2812D

-Vout (V) vs. -Iout (A)

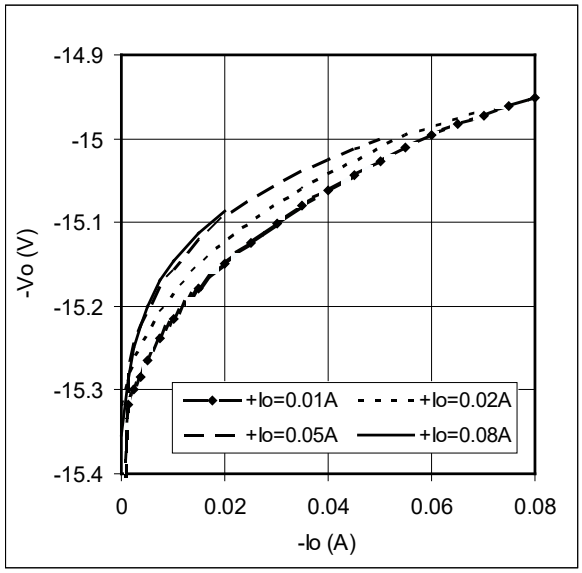


Figure 12 – DVCH2815D

-Vout (V) vs. -Iout (A)

EMI PERFORMANCE CURVES

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

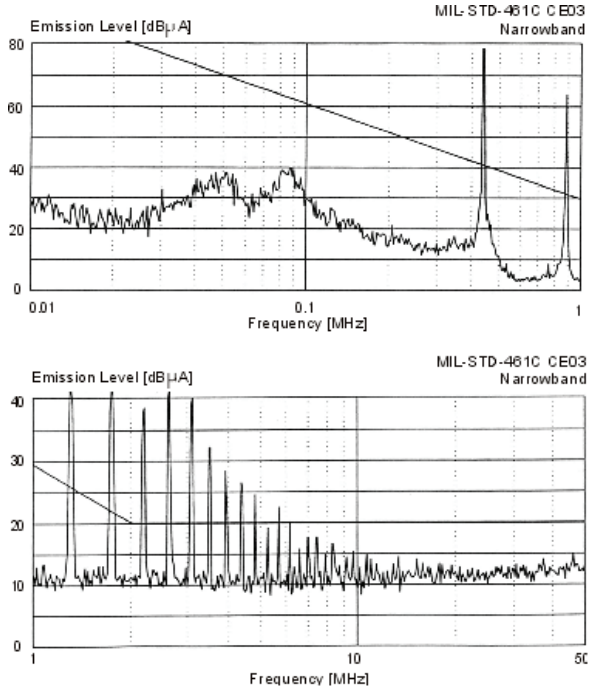


Figure 13 – DVCH2800D without EMI Filter

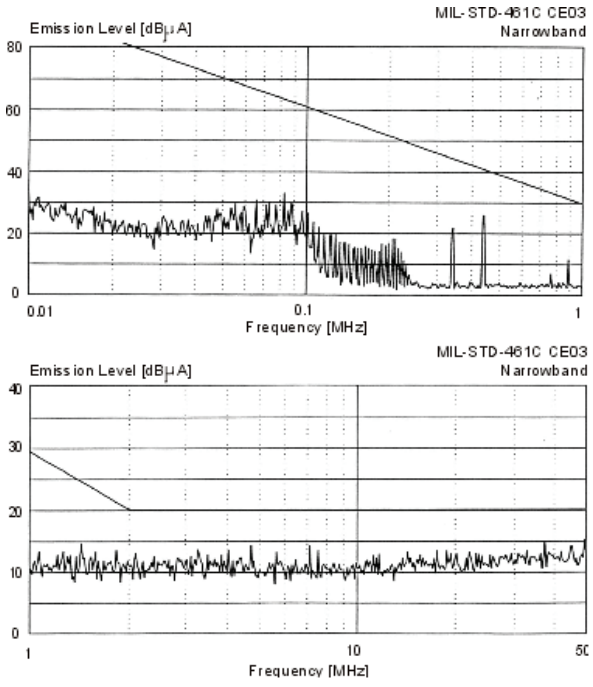
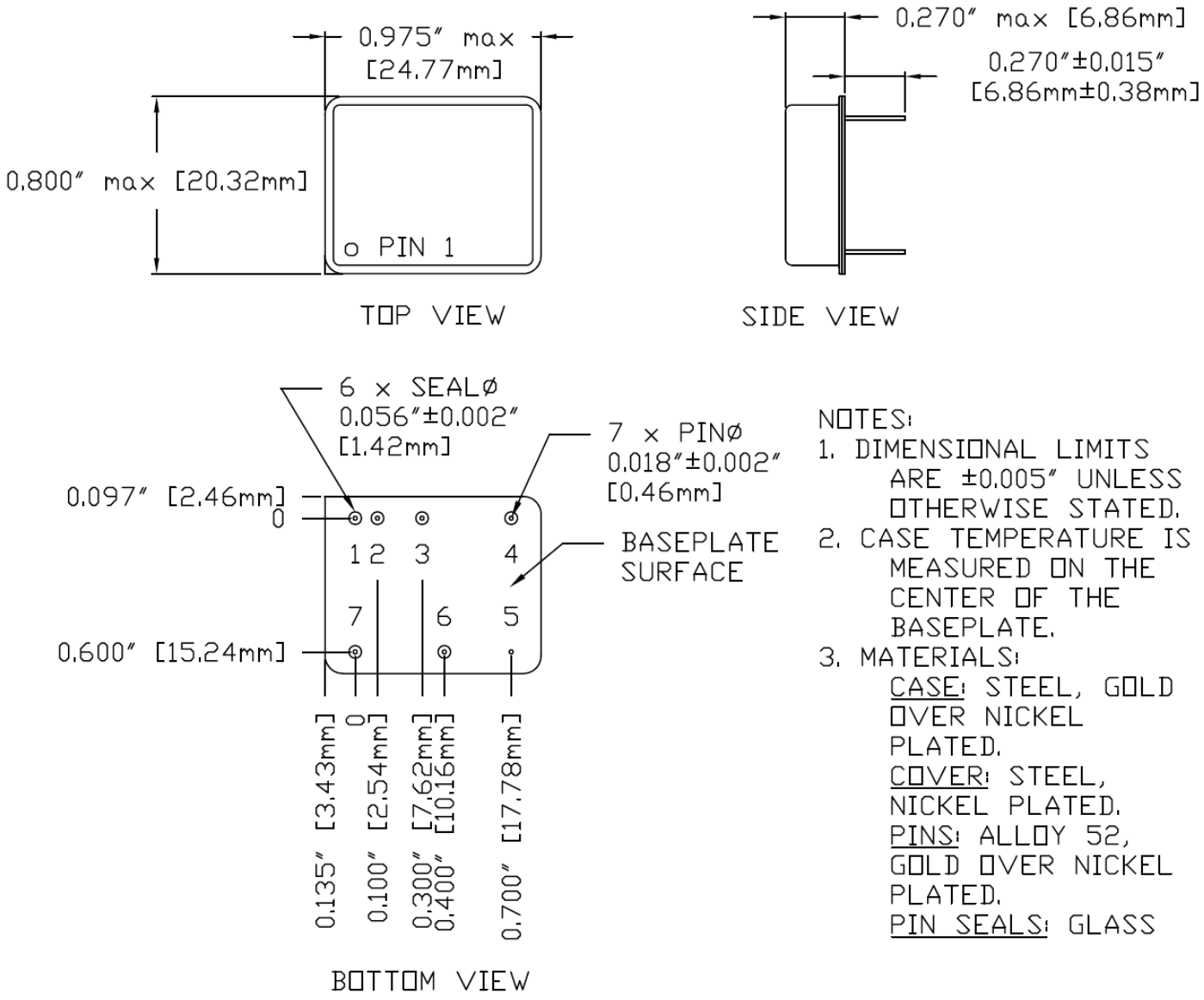


Figure 14 – DVCH2800D with EMI Filter

PACKAGE SPECIFICATIONS



Pin	Function	Pin	Function
1	28V IN	5	CASE
2	IN COM	6	-V OUT
3	+V OUT	7	INHIBIT
4	OUT COM		

Figure 15 – Package and Pinout

PACKAGE PIN DESCRIPTION

Pin	Function	Description
1	28V IN	Positive Input Voltage Connection
2	IN COM	Input Common Connection
3	+V OUT	Positive Output Voltage Connection
4	OUT COM	Output Common Connection
5	CASE	Case Connection
6	-V OUT	Negative Output Voltage Connection
7	INHIBIT	Logic Low = Disabled Output. Connecting the inhibit pin to input common causes converter shutdown. Logic High = Enabled Output. Unconnected or open collector TTL.

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

Test	MIL-STD-883 Test Method, Condition	No Suffix (Standard) Non-QML ⑤	/ES (Extended) Non-QML ⑤	/H (Class H)	/K (Class K)
Non-Destructive Bond Pull	TM2023	• ④	• ④	• ④	•
Internal Visual	TM2010, TM2017, TM2032 (MIL-STD-750, TM2072, TM2073)	•	•	•	•
Temperature Cycling	TM1010, Condition C -65°C to 150°C, Ambient			•	•
	TM1010, Condition B -55°C to 125°C, Ambient		•		
Constant Acceleration	TM2001, 3000g, Y1 Direction			•	•
	TM2001, 500g, Y1 Direction		•		
PIND ⑦	TM2020, Condition A				•
Pre Burn-In Electrical	25°C				•
Burn-In	TM1015, 320 hrs, 125°C, Case Typ				•
	TM1015, 160 hrs, 125°C, Case Typ			•	
	96 hrs, 125°C, Case Typ		•		
	24 hrs, 125°C, Case Typ	•			
Final Electrical	MIL-PRF-38534, Group A Subgroups 1-6 -55°C, 25°C, 125°C ③			•	•
	MIL-PRF-38534, Group A Subgroups 1 and 4 25°C	•	•		
Hermeticity (Seal)	TM1014, Fine Leak, Condition A2 or B1		•	•	•
	TM1014, Gross Leak, Condition C or B2		•	•	•
	Gross Leak, Dip (1×10^{-3})	•			
Radiography ⑧	TM2012				•
External Visual	TM2009	•	•	•	•

Notes:
① Contact Sales for more information concerning additional environmental screening and testing options desired.
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.
③ 100% R&R testing with all test data included in product shipment.
④ Not required per MIL-PRF-38534. Test is performed for additional product quality assurance.
⑤ Non-QML products may not meet all requirements of MIL-PRF-38534.
⑥ Note intentionally not used.
⑦ PIND test Certificate of Compliance included in product shipment.
⑧ Radiographic test Certificate of Compliance and film(s) or data CD included in product shipment.

ORDERING INFORMATION

DVCH	28	05	D	/H	-	XXX
1	2	3	4	5		6

(1) (2) (3)

Product Series	Nominal Input Voltage		Output Voltage	
DVCH	**28**	28 Volts	**05** **12** **15**	5 Volts 12 Volts 15 Volts

(4) (5) (6)

Number of Outputs		Screening Code[1]		Additional Screening Code
D	Dual	**None** **/ES** **/H** **/K**	Standard Extended Class H Class K	Contact Sales

Notes: 1. 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)	DVCH2800D Series Similar Part Number
5962-0924301HXC	DVCH2805D/H
5962-0924301HXA	DVCH2805D/H-E
5962-0924301KXC	DVCH2805D/K
5962-0924301KXA	DVCH2805D/K-E
5962-0924302HXC	DVCH2812D/H
5962-0924302HXA	DVCH2812D/H-E
5962-0924302KXC	DVCH2812D/K
5962-0924302KXA	DVCH2812D/K-E
5962-0924303HXC	DVCH2815D/H
5962-0924303HXA	DVCH2815D/H-E
5962-0924303KXC	DVCH2815D/K
5962-0924303KXA	DVCH2815D/K-E

Do not use the DVCH2800S Series similar part number for DLA Land and Maritime (Previously known as DSCC) Drawing product acquisition. It is listed for reference only. For exact specifications for the DLA Drawing product, refer to the DLA Drawing. DLA Drawings can be downloaded from the DLA website at https://landandmaritimeapps.dla.mil/programs/defaultapps.asp. The DLA Drawing number listed above represents the Federal Stock Class, Device Type, Device Class Designator, Case Outline, Lead Finish and RHA Designator (where applicable). Please reference the DLA Drawing for other screening levels, lead finishes, and radiation levels. All DLA Drawing products are marked with a “Q” on the cover as specified by the QML certification mark requirement of MIL-PRF-38534.

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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E-mail: vptsales@vptpower.com

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