



DVCH2800S 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
- NO Use of Optoisolators
- Fault Tolerant Magnetic Feedback Circuit
- 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/in³
- 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.

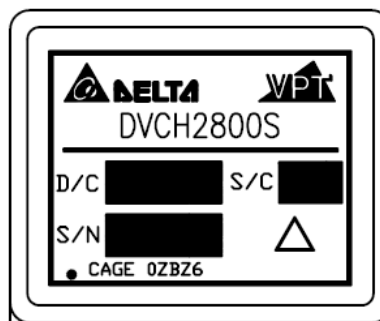


Figure 1 – DVCH2800S DC-DC Converter
(Exact marking may differ from that shown)

SPECIFICATIONS ($T_{CASE} = -55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$, $V_{IN} = +28\text{V} \pm 5\%$, 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, $T_{CASE} = +125^{\circ}\text{C}$)	0.6 Watts	Weight (Maximum)	11 Grams
ESD Rating per MIL-PRF-38534	3A		

Parameter	Conditions	DVCH283R3S			DVCH2805S			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	-	-	10	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} $T_{CASE} = 25^{\circ}\text{C}$	3.267	3.30	3.333	4.95	5.00	5.05	V
	V_{OUT} $T_{CASE} = -55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$	3.17	3.30	3.43	4.80	5.00	5.20	V
Power ³		0	-	1.0	0	-	1.5	W
Current ³	I_{OUT}	0	-	0.3	0	-	0.3	A
Ripple Voltage	V_{OUT} Full Load, 20Hz to 10MHz	-	-	50	-	-	50	mV _{p-p}
Line Regulation	V_{OUT} $V_{IN} = 12\text{V}$ to 50V	-	-	150	-	-	150	mV
Load Regulation	V_{OUT} 10% Load to Full Load	-	-	400	-	-	400	mV
Load Regulation	V_{OUT} 50% Load to Full Load	-	-	250	-	-	250	mV
EFFICIENCY		69	75	-	72	79	-	%
LOAD FAULT POWER DISSIPATION	Overload ⁴	-	-	3	-	-	3	W
	Short Circuit	-	-	4	-	-	4	W
CAPACITIVE LOAD ⁴		-	-	500	-	-	500	μF
SWITCHING FREQUENCY		325	400	475	325	400	475	kHz
ISOLATION	500 V_{DC}	100	-	-	100	-	-	M Ω
MTBF (MIL-HDBK-217F)	AIF @ $T_C = 55^{\circ}\text{C}$	-	841	-	-	841	-	kHrs
DYNAMIC								
Load Step Output Transient ⁵	V_{OUT} Half Load to Full Load	-	150	300	-	150	300	mV _{PK}
Load Step Recovery ²		-	200	500	-	400	600	μSec
Line Step Output Transient ^{4,5}	V_{OUT} $V_{IN} = 12\text{V}$ to 50V	-	150	300	-	250	400	mV _{PK}
Line Step Recovery ^{2,4}		-	200	500	-	400	600	μSec
Turn On Delay	V_{OUT} $V_{IN} = 0\text{V}$ to 28V	-	15	20	-	15	20	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 135°C. 4. Verified by qualification testing.
 5. Does not include changes due to static regulation.

SPECIFICATIONS ($T_{CASE} = -55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$, $V_{IN} = +28\text{V} \pm 5\%$, 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, $T_{CASE} = +125^{\circ}\text{C}$)	0.6 Watts	Weight (Maximum)	11 Grams
ESD Rating per MIL-PRF-38534	3A		

Parameter	Conditions	DVCH2812S			DVCH2815S			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	-	-	10	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} $T_{CASE} = 25^{\circ}\text{C}$	11.88	12.0	12.12	14.85	15.0	15.15	V
	V_{OUT} $T_{CASE} = -55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$	11.52	12.0	12.48	14.40	15.0	15.60	V
Power ³		0	-	1.5	0	-	1.5	W
Current ³	I_{OUT}	0	-	0.125	0	-	0.1	A
Ripple Voltage	V_{OUT} Full Load, 20Hz to 10MHz	-	-	50	-	-	50	mV _{p-p}
Line Regulation	V_{OUT} $V_{IN} = 12\text{V}$ to 50V	-	-	60	-	-	60	mV
Load Regulation	V_{OUT} 10% Load to Full Load	-	-	700	-	-	700	mV
Load Regulation	V_{OUT} 50% Load to Full Load	-	-	250	-	-	250	mV
EFFICIENCY		76	81	-	77	81	-	%
LOAD FAULT POWER DISSIPATION	Overload ⁴	-	-	3	-	-	3	W
	Short Circuit	-	-	4.5	-	-	4.5	W
CAPACITIVE LOAD ⁴		-	-	200	-	-	200	μF
SWITCHING FREQUENCY		325	400	475	325	400	475	kHz
ISOLATION	500 V_{DC}	100	-	-	100	-	-	M Ω
MTBF (MIL-HDBK-217F)	AIF @ $T_C = 55^{\circ}\text{C}$	-	841	-	-	841	-	kHrs
DYNAMIC								
Load Step Output Transient ⁵	V_{OUT} Half Load to Full Load	-	100	300	-	100	300	mV _{PK}
Load Step Recovery ²		-	50	400	-	50	400	μSec
Line Step Output Transient ^{4,5}	V_{OUT} $V_{IN} = 12\text{V}$ to 50V	-	150	400	-	150	400	mV _{PK}
Line Step Recovery ^{2,4}		-	100	400	-	100	400	μSec
Turn On Delay	V_{OUT} $V_{IN} = 0\text{V}$ to 28V	-	10	20	-	10	20	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 135°C. 4. Verified by qualification testing.
 5. Does not include changes due to static regulation.

SPECIFICATIONS ($T_{CASE} = -55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$, $V_{IN} = +28\text{V} \pm 5\%$, 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, $T_{CASE} = +125^{\circ}\text{C}$)	0.6 Watts	Weight (Maximum)	11 Grams
ESD Rating per MIL-PRF-38534	3A		

Parameter	Conditions	DVCH285R2S			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	-	-	10	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} $T_{CASE} = 25^{\circ}\text{C}$	5.15	5.20	5.25	V
	V_{OUT} $T_{CASE} = -55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$	5.00	5.20	5.40	V
Power ³		0	-	1.5	W
Current ³	I_{OUT}	0	-	0.288	A
Ripple Voltage	V_{OUT} Full Load, 20Hz to 10MHz	-	-	50	mV _{p-p}
Line Regulation	V_{OUT} $V_{IN} = 12\text{V}$ to 50V	-	-	150	mV
Load Regulation	V_{OUT} 10% Load to Full Load	-	-	400	mV
Load Regulation	V_{OUT} 50% Load to Full Load	-	-	250	mV
EFFICIENCY		72	79	-	%
LOAD FAULT POWER DISSIPATION	Overload ⁴	-	-	3	W
	Short Circuit	-	-	4	W
CAPACITIVE LOAD ⁴		-	-	500	μF
SWITCHING FREQUENCY		325	400	475	kHz
ISOLATION	500 V_{DC}	100	-	-	M Ω
MTBF (MIL-HDBK-217F)	AIF @ $T_C = 55^{\circ}\text{C}$	-	841	-	kHrs
DYNAMIC					
Load Step Output Transient ⁵	V_{OUT} Half Load to Full Load	-	150	300	mV _{PK}
Load Step Recovery ²		-	400	600	μSec
Line Step Output Transient ^{4,5}	V_{OUT} $V_{IN} = 12\text{V}$ to 50V	-	250	400	mV _{PK}
Line Step Recovery ^{2,4}		-	400	600	μSec
Turn On Delay	V_{OUT} $V_{IN} = 0\text{V}$ to 28V	-	15	20	mSec
Turn On Overshoot		-	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 135°C. 4. Verified by qualification testing.
 5. Does not include changes due to static regulation.

BLOCK DIAGRAM

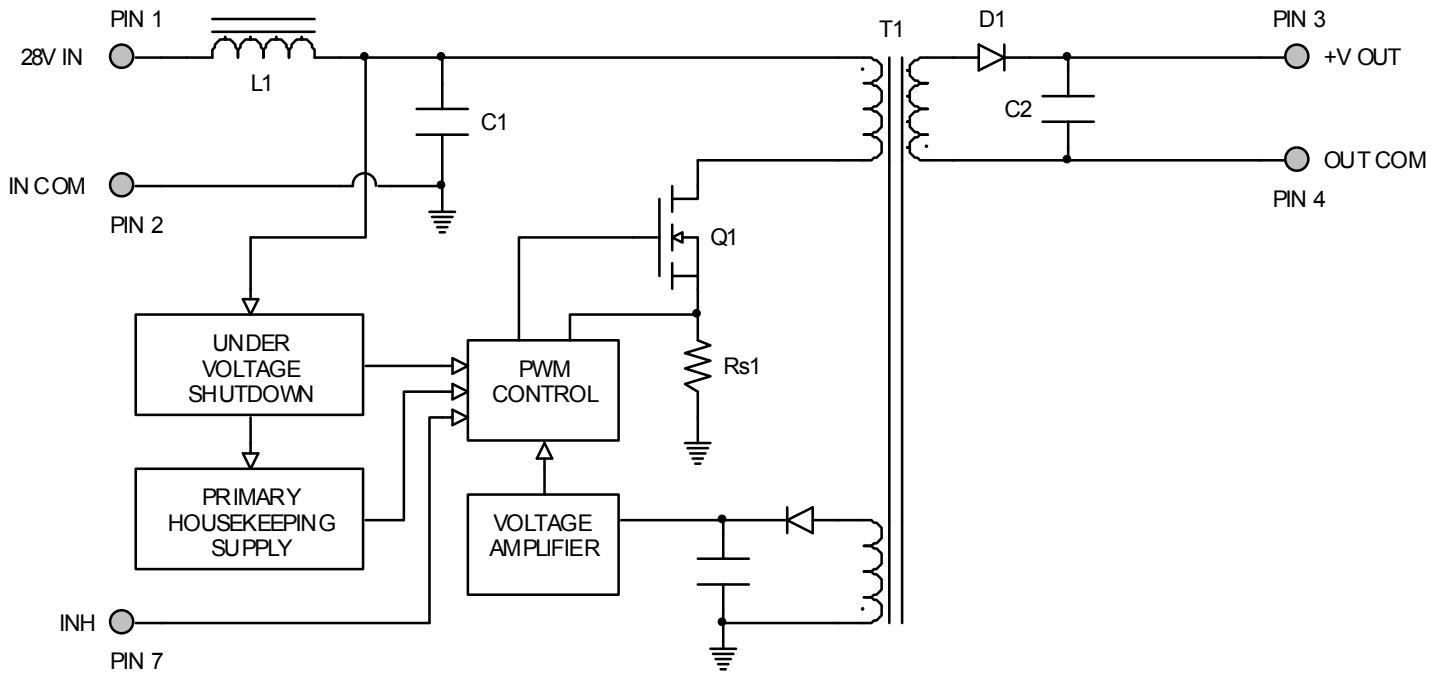


Figure 2

CONNECTION DIAGRAM

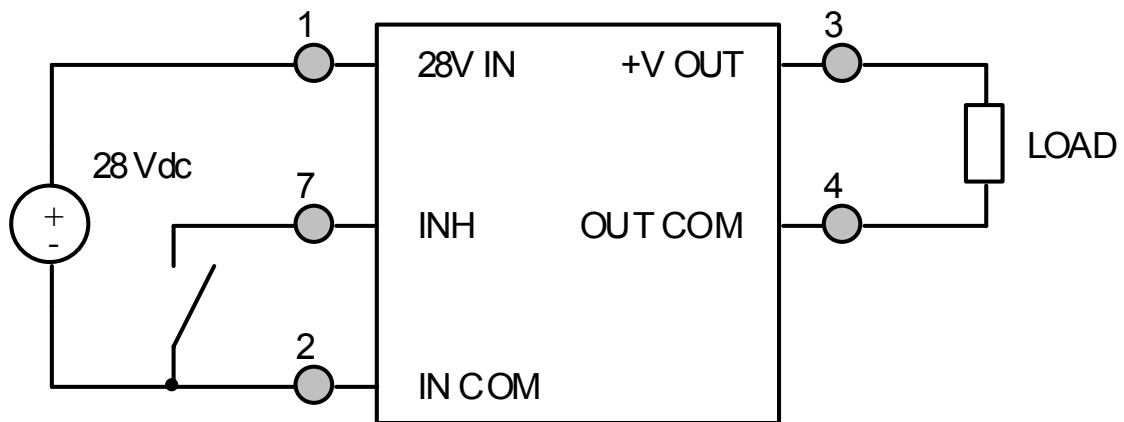


Figure 3

INHIBIT DRIVE CONNECTION DIAGRAMS

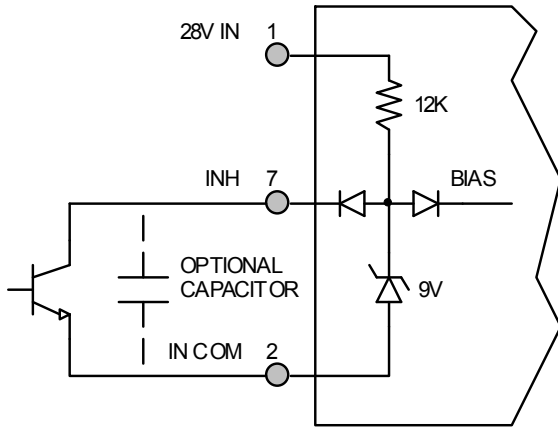


Figure 4 – Internal Inhibit Circuit and Recommended Drive
(Shown with optional capacitor for turn-on delay)

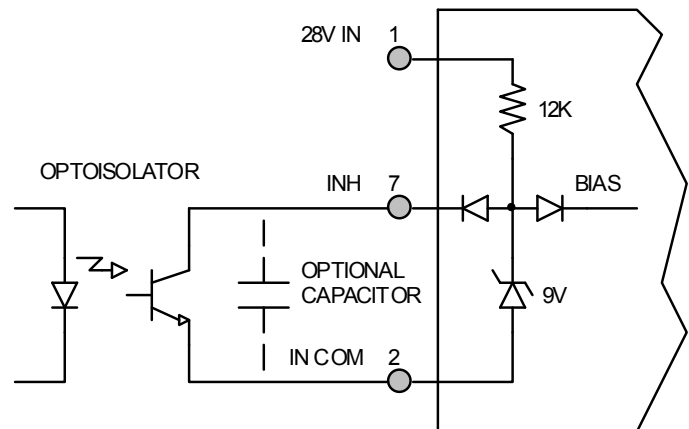


Figure 5 – Isolated Inhibit Drive
(Shown with optional capacitor for turn-on delay)

EMI FILTER HOOKUP DIAGRAM

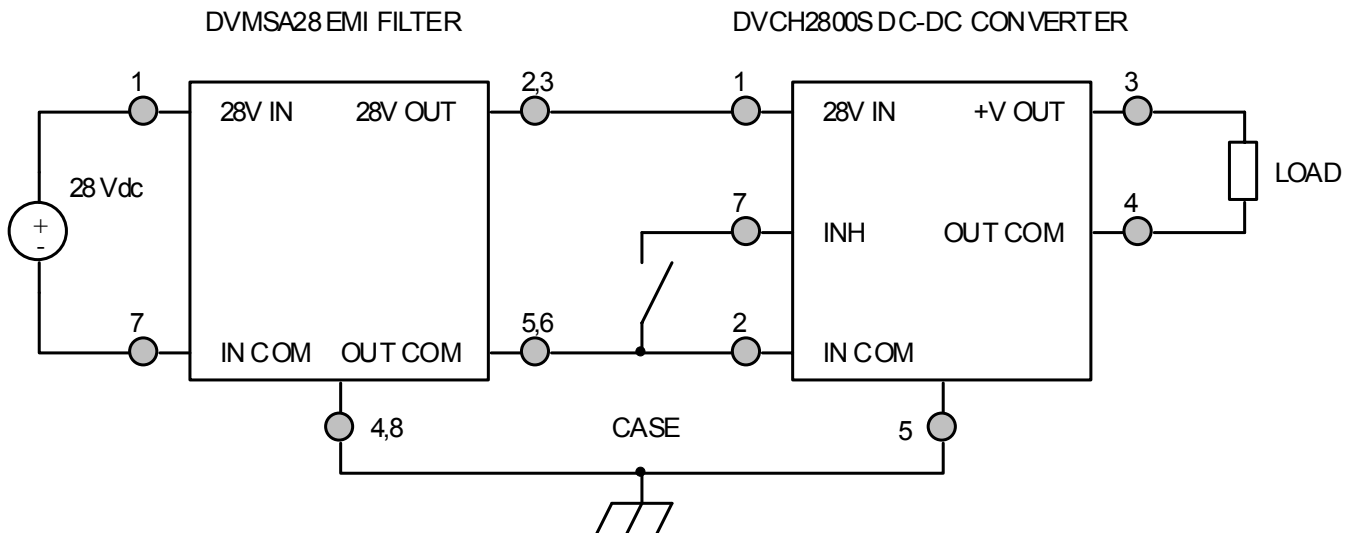


Figure 6 – Converter with EMI Filter

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

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

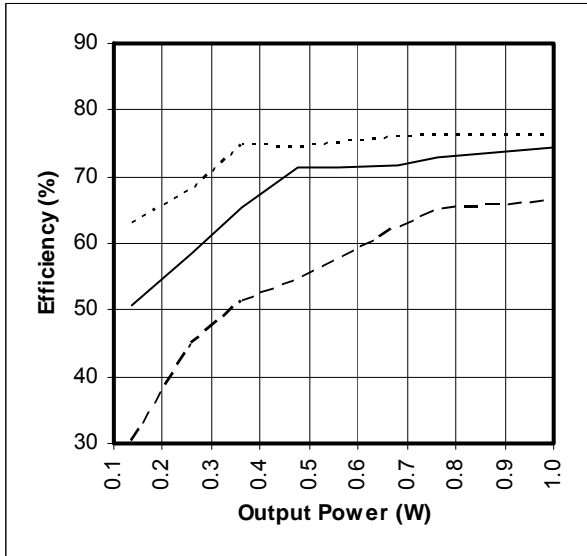


Figure 7 – DVCH283R3S
Efficiency (%) vs. Output Power (W)

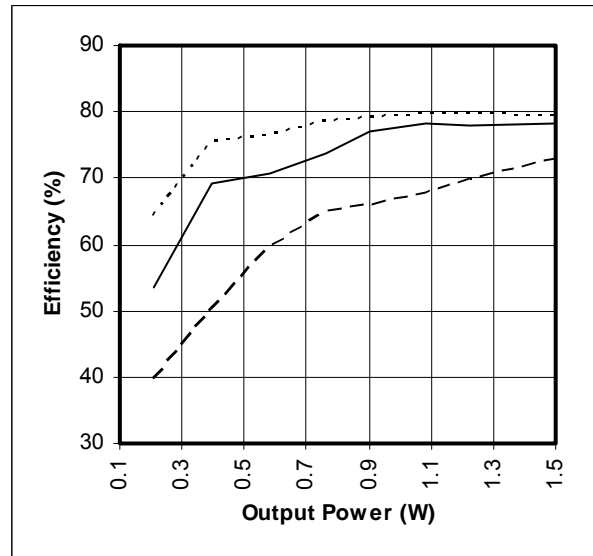


Figure 8 – DVCH2805S / DVCH285R2S
Efficiency (%) vs. Output Power (W)

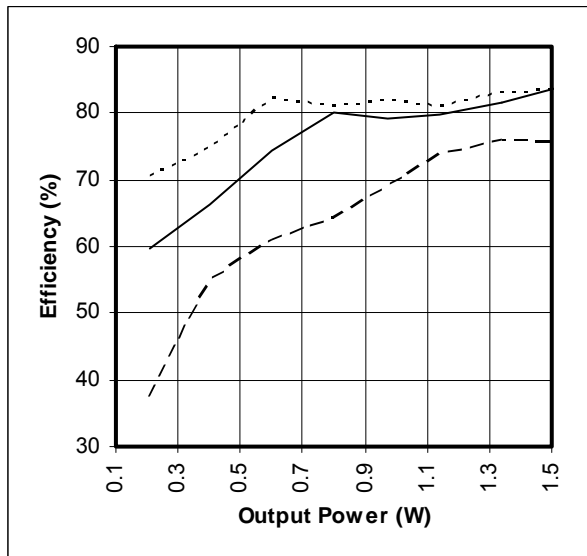


Figure 9 – DVCH2812S
Efficiency (%) vs. Output Power (W)

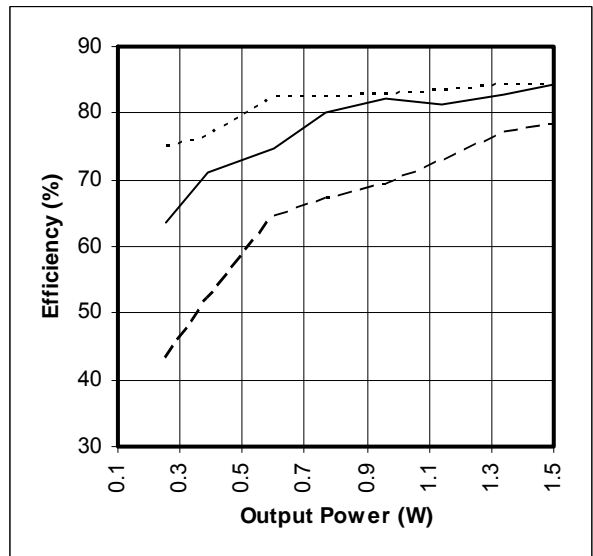


Figure 10 – DVCH2815S
Efficiency (%) vs. Output Power (W)

EMI PERFORMANCE CURVES

($T_{CASE} = 25^{\circ}C$, $V_{IN} = +28V \pm 5\%$, Full Load, Unless Otherwise Specified)

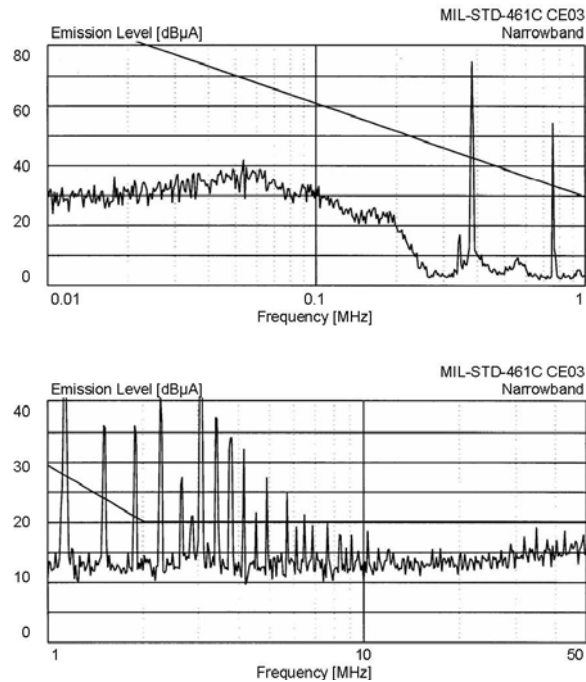


Figure 11 – DVCH2800S without EMI Filter

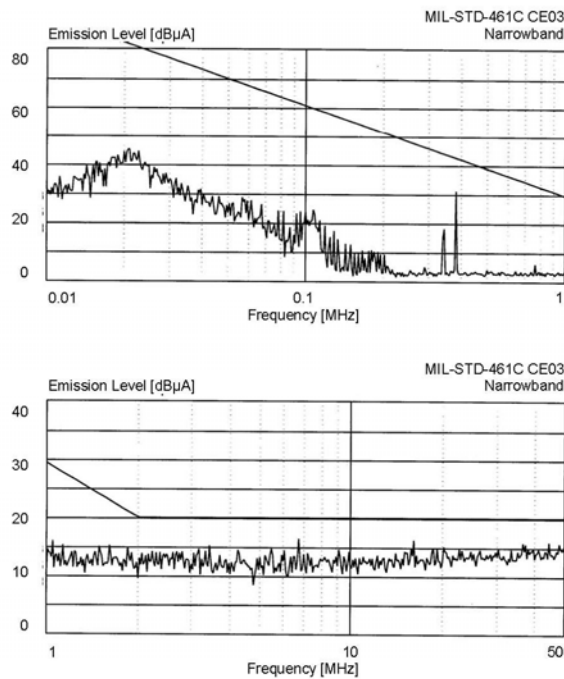
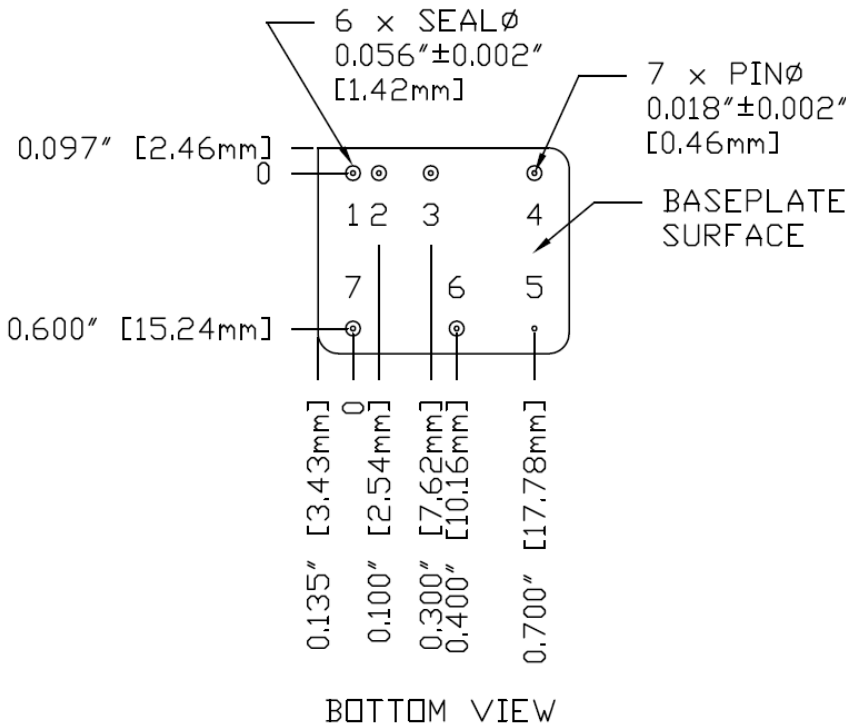
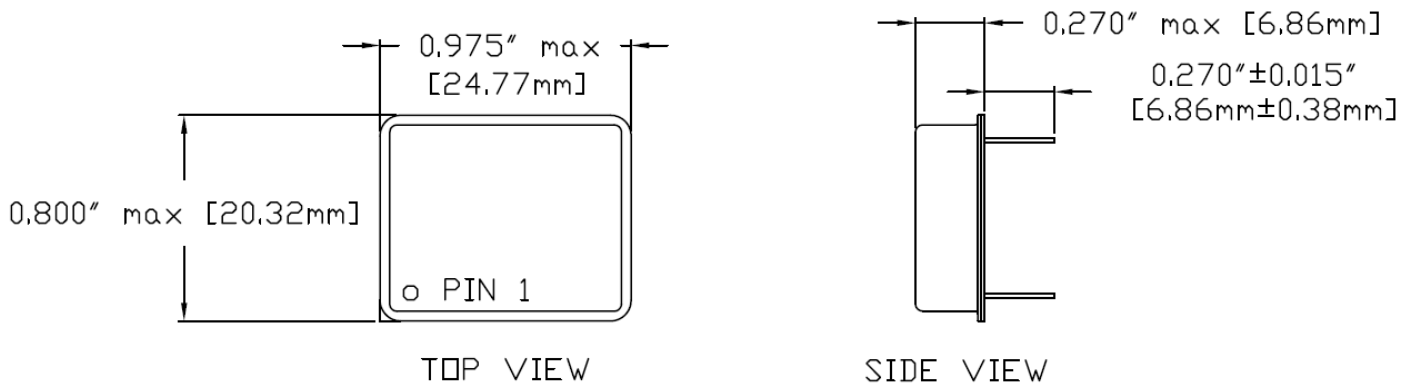


Figure 12 – DVCH2800S with EMI Filter

PACKAGE SPECIFICATIONS



- NOTES:
1. DIMENSIONAL LIMITS ARE ± 0.005 " UNLESS OTHERWISE STATED.
 2. CASE TEMPERATURE IS MEASURED ON THE CENTER OF THE BASEPLATE.
 3. MATERIALS:
CASE: STEEL, GOLD OVER NICKEL PLATED.
COVER: STEEL, NICKEL PLATED.
PINS: ALLOY 52, GOLD OVER NICKEL PLATED.
PIN SEALS: GLASS

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

Figure 13 – 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	N/C	No 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.

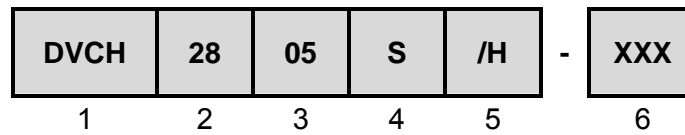
ENVIRONMENTAL SCREENING (100% Tested Per MIL-STD-883 as referenced to MIL-PRF-38534)

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		•	•	•
	TM1014, Gross Leak, Condition C		•	•	•
	Gross Leak, Dip (1 x 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



(1)	(2)		(3)	
Product Series	Nominal Input Voltage		Output Voltage	
DVCH	28	28 Volts	3R3 05 5R2 12 15	3.3 Volts 5 Volts 5.2 Volts 12 Volts 15 Volts

(4)		(5)		(6)
Number of Outputs		Screening Code ¹		Additional Screening Code
S	Single	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)	DVCH2800S Series Similar Part Number
5962-0924201HXC 5962-0924201KXC	DVCH283R3S/H DVCH283R3S/K
5962-0924202HXC 5962-0924202KXC	DVCH2805S/H DVCH2805S/K
5962-0924203HXC 5962-0924203KXC	DVCH285R2S/H DVCH285R2S/K
5962-0924204HXC 5962-0924204KXC	DVCH2812S/H DVCH2812S/K
5962-0924205HXC 5962-0924205KXC	DVCH2815S/H DVCH2815S/K

Do not use the DVCH2800S 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 DLA Land and Maritime (Previously known as DSCC) website at <http://www.dsccl.dla.mil/programs/smcr/>. The SMD number listed above is for 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. All SMD 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:

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

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