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 is a magnetic feedback circuit that is radiation immune. Operating at a nominal fixed frequency of 400 kHz, these regulated, isolated units utilize 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
- Radiation Immune 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-461C and MIL-STD-461E EMC Requirements When Used With a DVMSA28 EMI Filter
- MIL-PRF-38534 Element Evaluated Components

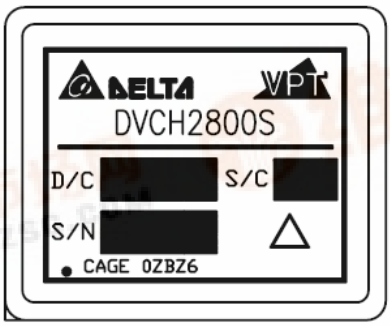


Figure 1 – DVCH2800S DC-DC Converter
(Not To Scale)

11314 4th Avenue
West Suite 206

Sales Information:
Phone: (425) 353-3010

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

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°C	3.267	3.30	3.333	4.95	5.00	5.05	V
	V_{OUT}	T_{CASE} = -55°C to +125°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} = 12V 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	-	-	MΩ
MTBF (MIL-HDBK-217F)		AIF @ T_C = 55°C	-	841	-	-	841	-	kHrs
DYNAMIC									
Load Step Output Transient[5]	V_{OUT}	Half Load to Full Load	-	150	300	-	150	500	mV_{PK}
Load Step Recovery[2]			-	200	500	-	400	600	µSec
Line Step Output Transient[4,5]	V_{OUT}	V_{IN} = 12V 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} = 0V 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°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

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°C	11.88	12.0	12.12	14.85	15.0	15.15	V
	V_{OUT}	T_{CASE} = -55°C to +125°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} = 12V 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	-	-	MΩ
MTBF (MIL-HDBK-217F)		AIF @ T_C = 55°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} = 12V 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} = 0V 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°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

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°C	5.15	5.20	5.25	V
	V_{OUT}	T_{CASE} = -55°C to +125°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} = 12V 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	-	-	MΩ
MTBF (MIL-HDBK-217F)		AIF @ T_C = 55°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} = 12V to 50V	-	250	400	mV_{PK}
Line Step Recovery[2, 4]			-	400	600	µSec
Turn On Delay	V_{OUT}	V_{IN} = 0V 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

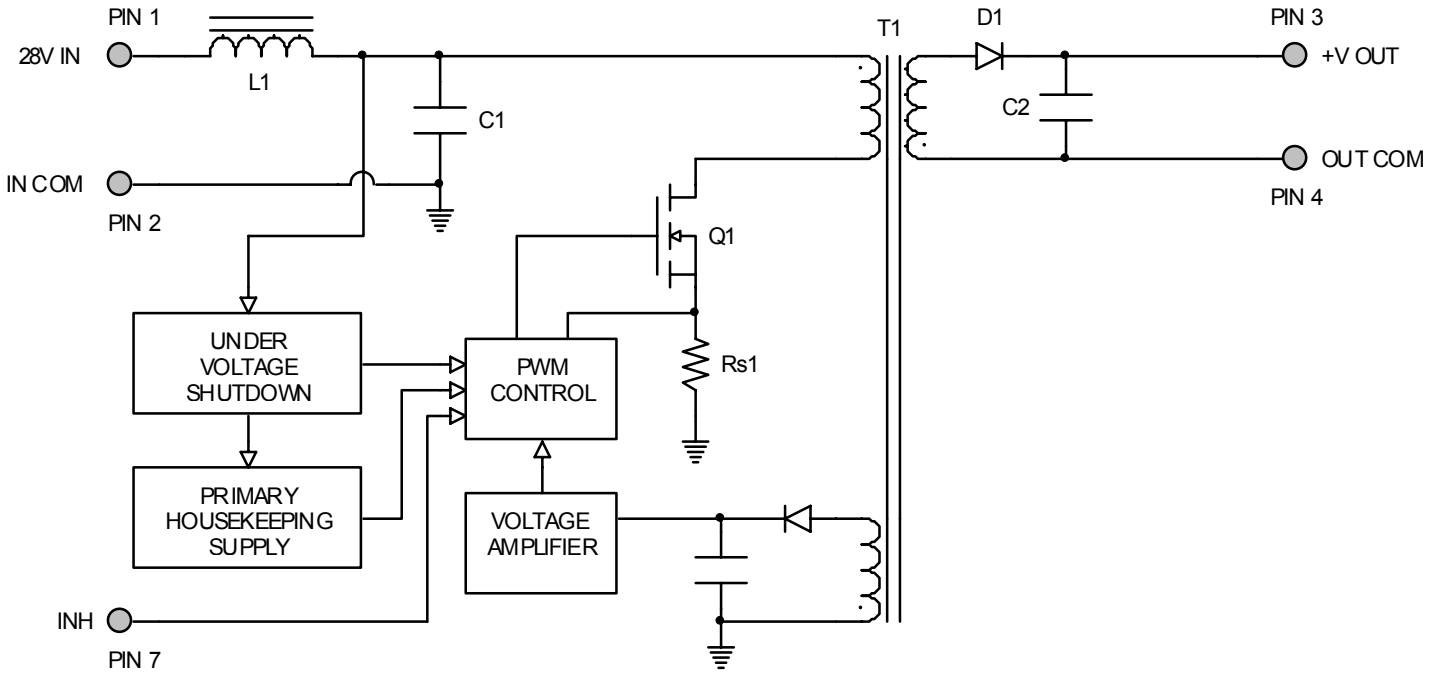


Figure 2

CONNECTION DIAGRAM

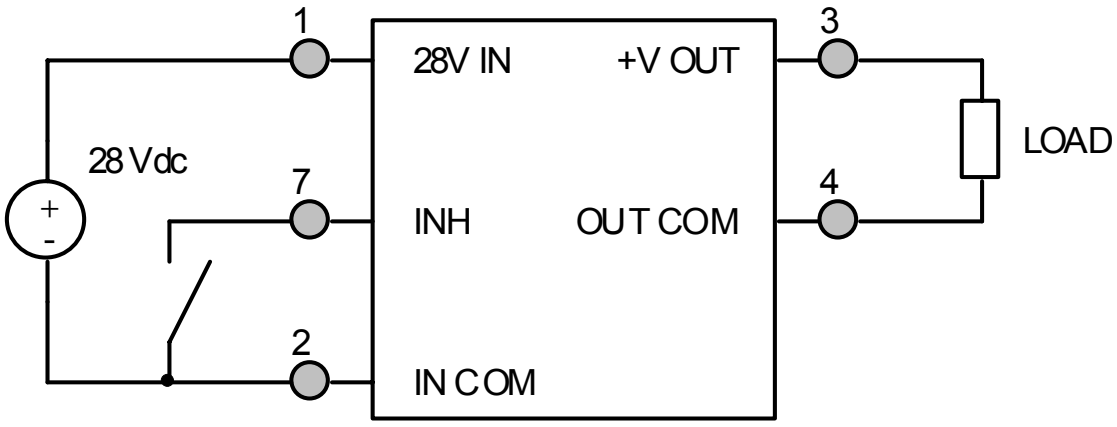


Figure 3

INHIBIT DRIVE CONNECTION DIAGRAMS

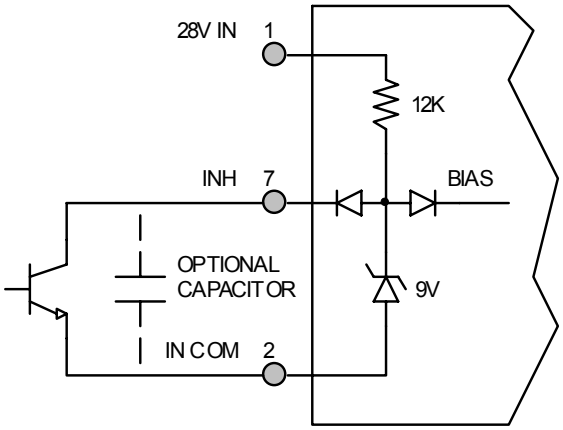


Figure 4 – Internal Inhibit Circuit and Recommended Drive
(Shown with optional capacitor for turn-on delay)

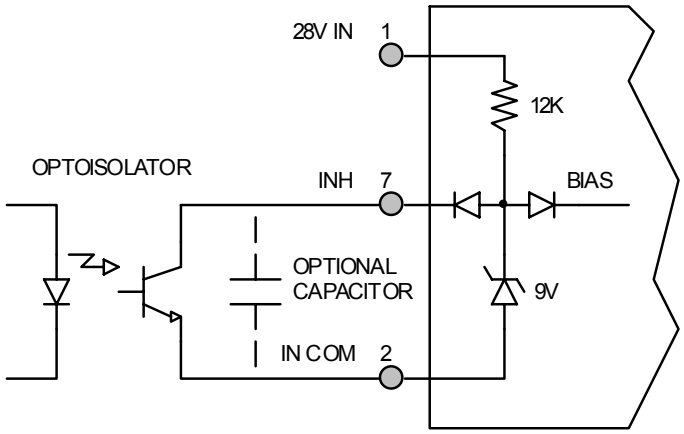


Figure 5 – Isolated Inhibit Drive
(Shown with optional capacitor for turn-on delay)

EMI FILTER HOOKUP DIAGRAM

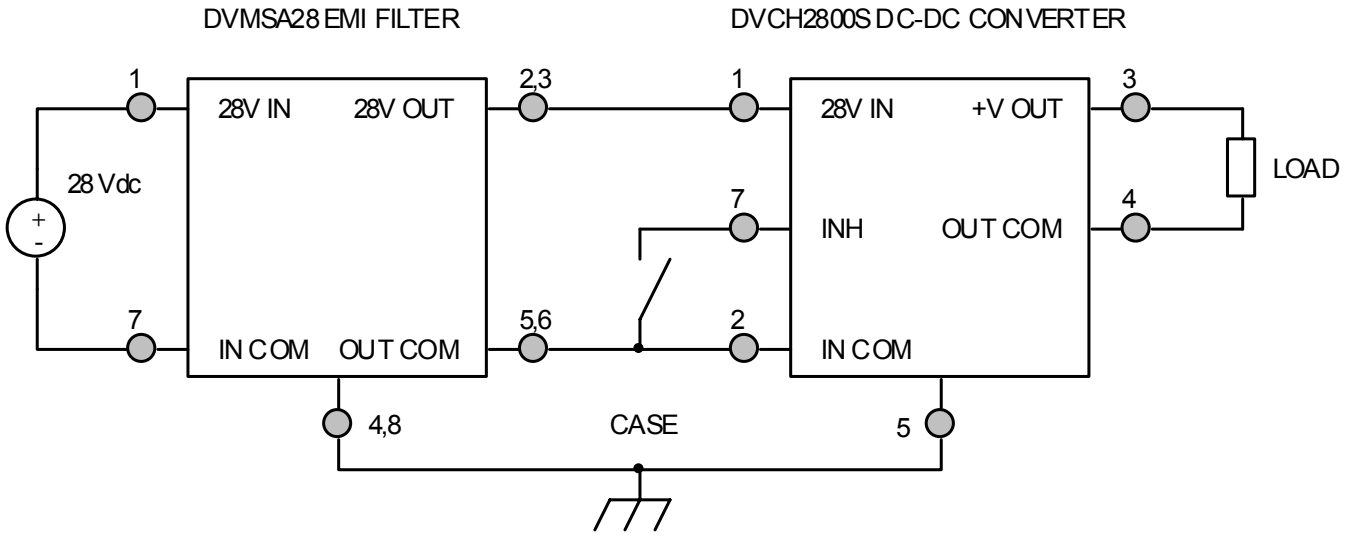


Figure 6 – Converter with EMI Filter

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

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

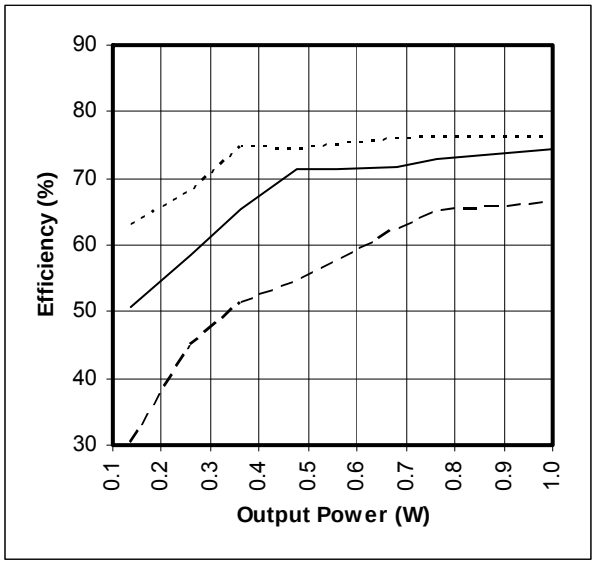


Figure 7 – DVCH283R3S
Efficiency (%) vs. Output Power (W)

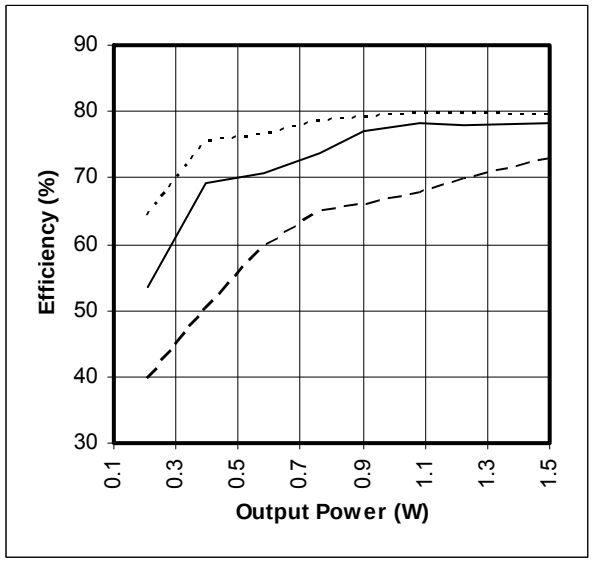


Figure 8 – DVCH2805S / DVCH285R2S
Efficiency (%) vs. Output Power (W)

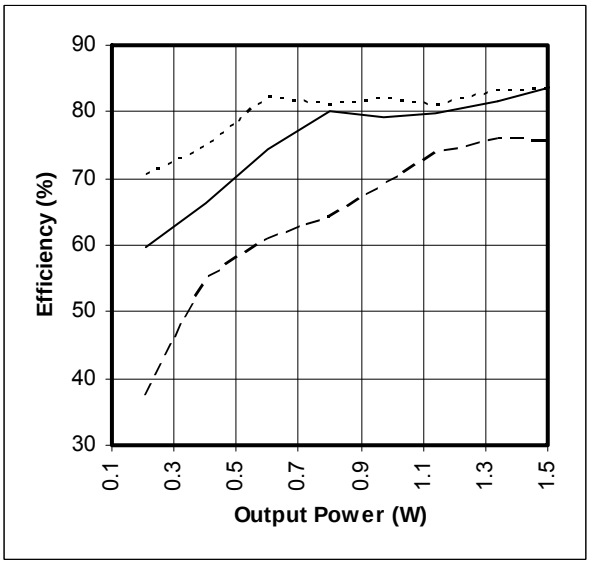


Figure 9 – DVCH2812S
Efficiency (%) vs. Output Power (W)

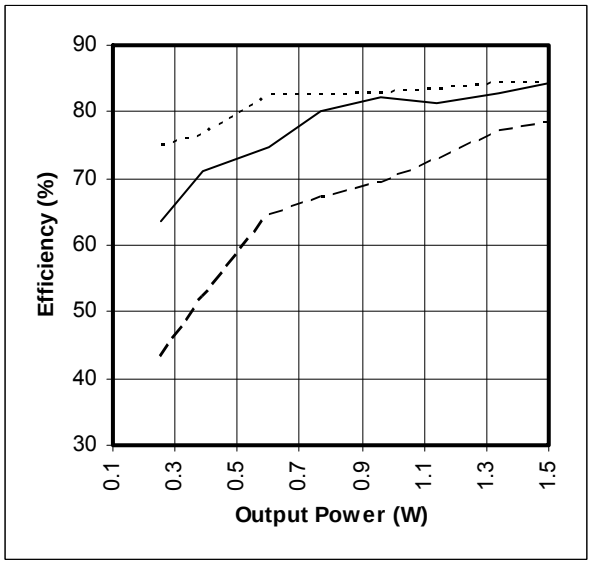


Figure 10 – DVCH2815S
Efficiency (%) vs. Output Power (W)

EMI PERFORMANCE CURVES

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

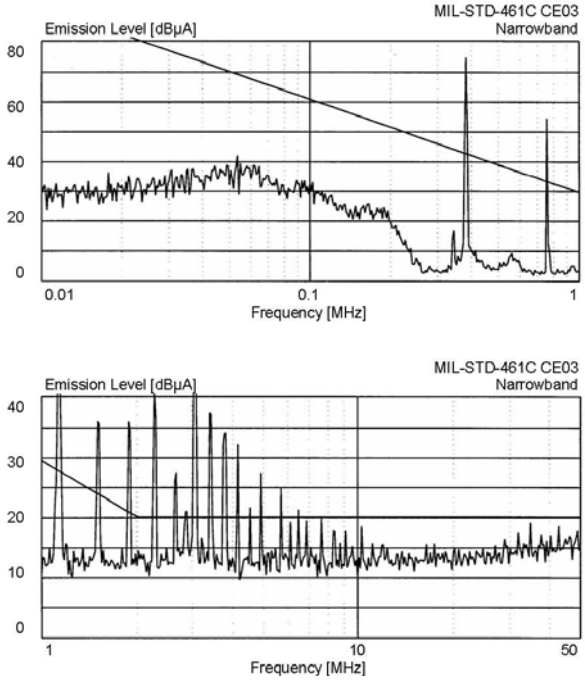


Figure 11 – DVCH2800S <u>without</u> EMI Filter

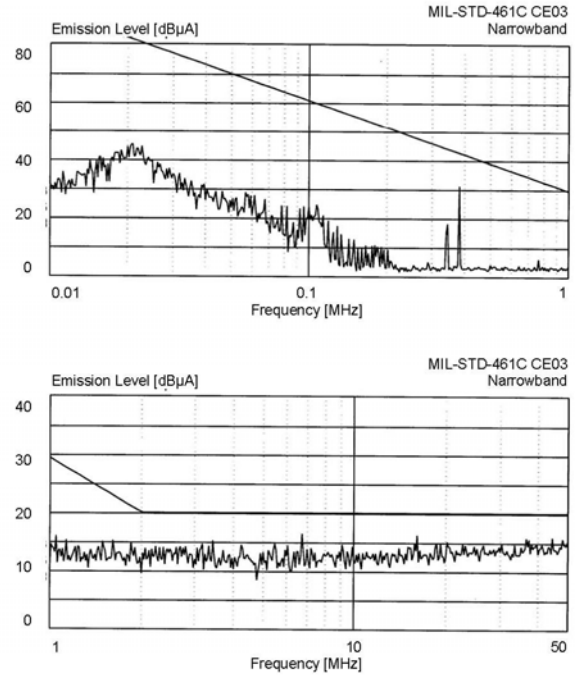
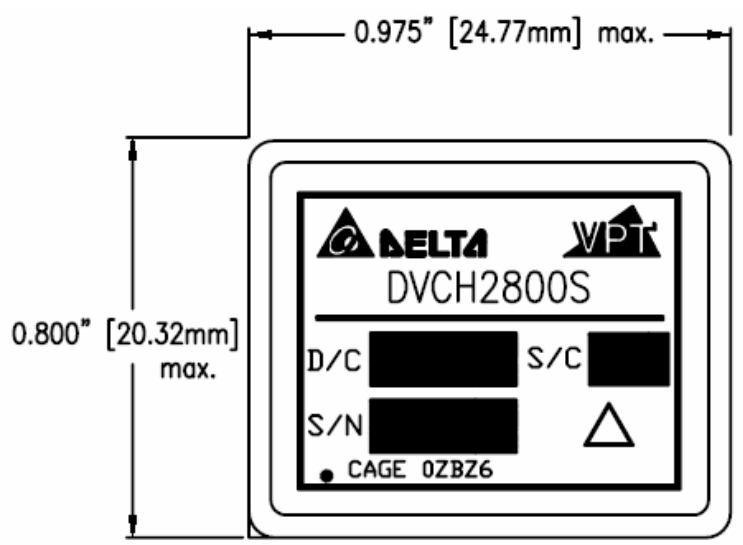
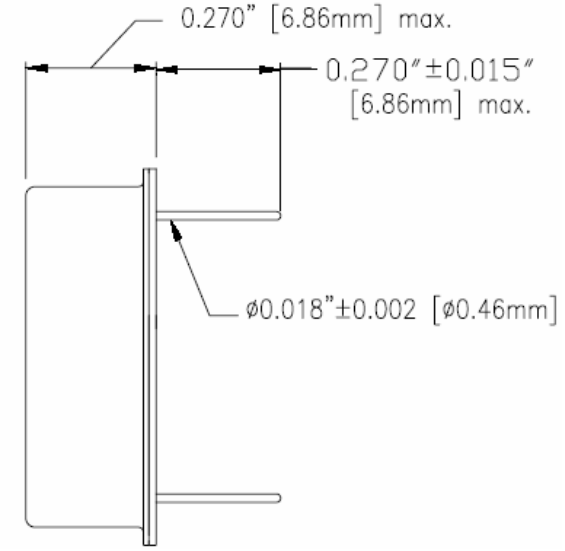


Figure 12 – DVCH2800S <u>with</u> EMI Filter

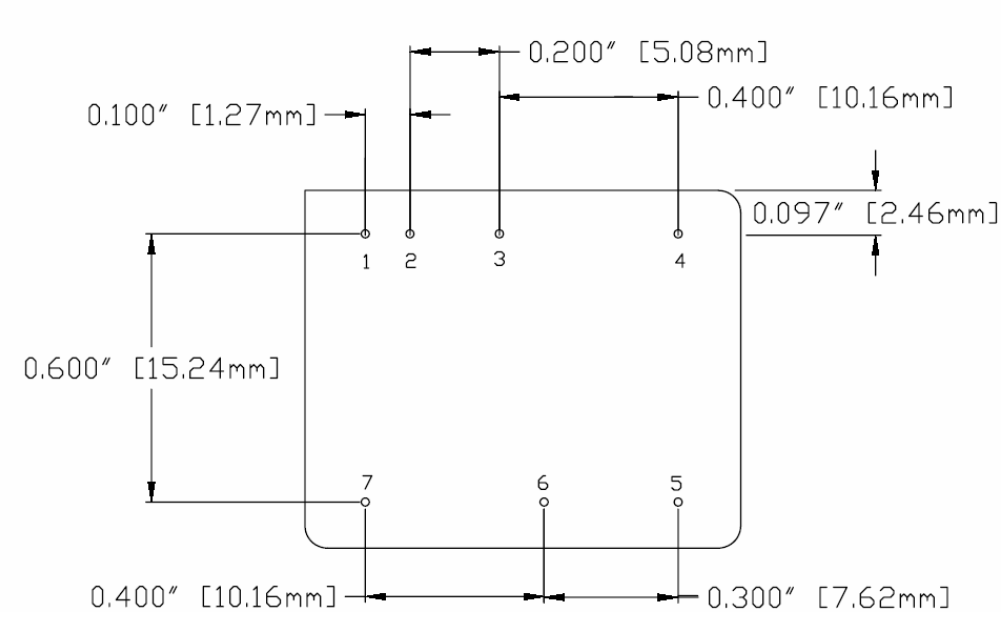
PACKAGE SPECIFICATIONS



TOP VIEW



SIDE VIEW



BOTTOM VIEW

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

Figure 13 – Package and Pinout
(Dimensional Limits are ±0.005" Unless Otherwise Stated)

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)

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 x 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

DVCH	28	05	S	/HB	-	XXX
1	2	3	4	5		6

(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, 2]**		**Additional Screening Code**
S	Single	**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)	DVCH2800S Series Similar Part Number
*T.B.D.	DVCH283R3S/H
*T.B.D.	DVCH2805S/H
*T.B.D.	DVCH285R2S/H
*T.B.D.	DVCH2812S/H
*T.B.D.	DVCH2815S/H

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 DSCC website at http://www.dscc.dla.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