



DVSA2800S Series

HIGH RELIABILITY HYBRID DC-DC CONVERTERS

DESCRIPTION

The DVSA series of high-reliability DC-DC converters provide decades of successful critical mission support. Operable over the full military (-55 °C to +125 °C) temperature range with no power derating, the DVSA series unique input, and output filters dramatically reduce input and output noise performance. While operating at a nominal fixed frequency of 450 kHz, these regulated, isolated units utilize a high-speed magnetic feedback design and well-controlled under-voltage 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: 15 to 50 Volts per MIL-STD-704
- Up to 6 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: > 19 W/in³
- Custom Versions Available
- Meets MIL-STD-461 Revisions C, D, E and F EMC Requirements When Used With VPT's EMI Filters.
- Flanged and Non-flanged Versions Available.
- MIL-PRF-38534 Element Evaluated Components
- Space Applications should consider VPT's "S" Series of Radiation Tolerant Power Conversion Devices. Contact VPT for details

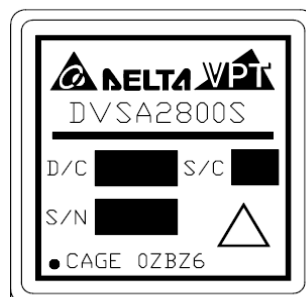


Figure 1 – DVSA2800S DC-DC Converter
(Exact marking may differ from that shown)

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	+10°C
Input Voltage (Transient, 1 second)	80 Volts	Storage Temperature	-65°C to +150°C
Output Power ¹	6 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, T _{CASE} = +125°C)	2.7 Watts	Weight (Maximum) (Un-Flanged / Flanged)	(15 / 20) Grams
ESD Rating per MIL-PRF-38534	3B		

Parameter	Conditions	DVSA283R3S			DVSA2805S			Units	
		Min	Typ	Max	Min	Typ	Max		
STATIC									
INPUT Voltage ⁴	Continuous	15	28	50	15	28	50	V	
	Transient, 1 sec	-	-	80	-	-	80	V	
Current	Inhibited	-	4	6	-	4	6	mA	
	No Load	-	45	60	-	45	60	mA	
Ripple Current	Full Load, 20Hz to 10MHz	-	25	50	-	30	50	mA _{p-p}	
Inhibit Pin Input ⁴		0	-	1.5	0	-	1.5	V	
Inhibit Pin Open Circuit Voltage ⁴		9.0	11.0	13.0	9.0	11.0	13.0	V	
UVLO Turn On		12.0	-	14.8	12.0	-	14.8	V	
UVLO Turn Off ⁴		11.0	-	14.5	11.0	-	14.5	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	3.25	3.30	3.35	4.925	5.00	5.075	V	
Power ³		0	-	4	0	-	5	W	
Current ³	I _{OUT}	0	-	1.21	0	-	1.0	A	
Ripple Voltage	V _{OUT} Full Load, 20Hz to 10MHz	-	10	30	-	10	30	mV _{p-p}	
Line Regulation	V _{OUT} V _{IN} = 15V to 50V	-	2	15	-	2	15	mV	
Load Regulation	V _{OUT} No Load to Full Load	-	20	50	-	15	50	mV	
EFFICIENCY		62	65	-	65	68	-	%	
LOAD FAULT POWER DISSIPATION	Overload ⁴	-	-	3.3	-	-	3.3	W	
	Short Circuit	-	-	3	-	-	3	W	
CAPACITIVE LOAD ⁴		-	-	1000	-	-	1000	μF	
SWITCHING FREQUENCY		350	450	500	350	450	500	kHz	
ISOLATION	500 V _{DC}	100	-	-	100	-	-	MΩ	
MTBF (MIL-HDBK-217F)	AIF @ T _C = 55°C	-	457	-	-	457	-	kHrs	
DYNAMIC									
Load Step Output Transient	V _{OUT}	Half Load to Full Load	-	200	300	-	200	500	mV _{PK}
Load Step Recovery ²			-	450	700	-	450	700	μSec
Line Step Output Transient ⁴	V _{OUT}	V _{IN} = 16V to 40V	-	250	500	-	350	700	mV _{PK}
Line Step Recovery ^{2, 4}			-	600	1200	-	600	1200	μSec
Turn On Delay	V _{OUT}	V _{IN} = 0V to 28V	-	10	20	-	10	20	mSec
Turn On Overshoot			-	0	15	-	0	25	mV _{PK}

Notes:

1. Dependent 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 initial electrical design verification. Post design verification, parameter shall be guaranteed to the limits specified.

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	+10°C
Input Voltage (Transient, 1 second)	80 Volts	Storage Temperature	-65°C to +150°C
Output Power ¹	6 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, T _{CASE} = +125°C)	2.7 Watts	Weight (Maximum) (Un-Flanged / Flanged)	(15 / 20) Grams
ESD Rating per MIL-PRF-38534	3B		

Parameter	Conditions	DVSA2812S			DVSA2815S			Units	
		Min	Typ	Max	Min	Typ	Max		
STATIC									
INPUT Voltage ⁴	Continuous	15	28	50	15	28	50	V	
	Transient, 1 sec	-	-	80	-	-	80	V	
Current	Inhibited	-	4	6	-	4	6	mA	
	No Load	-	45	60	-	45	60	mA	
Ripple Current	Full Load, 20Hz to 10MHz	-	30	50	-	30	50	mA _{p-p}	
Inhibit Pin Input ⁴		0	-	1.5	0	-	1.5	V	
Inhibit Pin Open Circuit Voltage ⁴		9.0	11.0	13.0	9.0	11.0	13.0	V	
UVLO Turn On		12.0	-	14.8	12.0	-	14.8	V	
UVLO Turn Off ⁴		11.0	-	14.5	11.0	-	14.5	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	11.82	12.0	12.18	14.775	15.0	15.225	V	
Power ³		0	-	6	0	-	6	W	
Current ³	I _{OUT}	0	-	0.5	0	-	0.4	A	
Ripple Voltage	V _{OUT} Full Load, 20Hz to 10MHz	-	10	30	-	10	30	mV _{p-p}	
Line Regulation	V _{OUT} V _{IN} = 15V to 50V	-	2	15	-	2	15	mV	
Load Regulation	V _{OUT} No Load to Full Load	-	5	50	-	5	50	mV	
EFFICIENCY		71	76	-	72	78	-	%	
LOAD FAULT POWER DISSIPATION	Overload ⁴	-	-	3	-	-	3	W	
	Short Circuit	-	-	3	-	-	3	W	
CAPACITIVE LOAD ⁴		-	-	500	-	-	500	μF	
SWITCHING FREQUENCY		350	450	500	350	450	500	kHz	
ISOLATION	500 V _{DC}	100	-	-	100	-	-	MΩ	
MTBF (MIL-HDBK-217F)	AIF @ T _C = 55°C	-	457	-	-	457	-	kHrs	
DYNAMIC									
Load Step Output Transient	V _{OUT}	Half Load to Full Load	-	300	700	-	300	700	mV _{PK}
Load Step Recovery ²			-	200	400	-	200	400	μSec
Line Step Output Transient ⁴	V _{OUT}	V _{IN} = 16V to 40V	-	700	1200	-	700	1300	mV _{PK}
Line Step Recovery ^{2, 4}			-	200	600	-	200	600	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. Dependent 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 initial electrical design verification. Post design verification, parameter shall be guaranteed to the limits specified.

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	+10°C
Input Voltage (Transient, 1 second)	80 Volts	Storage Temperature	-65°C to +150°C
Output Power ¹	6 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, T _{CASE} = +125°C)	2.7 Watts	Weight (Maximum) (Un-Flanged / Flanged)	(15 / 20) Grams
ESD Rating per MIL-PRF-38534	3B		

Parameter	Conditions	DVSA285R2S			Units
		Min	Typ	Max	
STATIC					
INPUT Voltage ⁴	Continuous	15	28	50	V
	Transient, 1 sec	-	-	80	V
Current	Inhibited	-	4	6	mA
	No Load	-	45	60	mA
Ripple Current	Full Load, 20Hz to 10MHz	-	30	50	mA _{p-p}
Inhibit Pin Input ⁴		0	-	1.5	V
Inhibit Pin Open Circuit Voltage ⁴		9.0	11.0	13.0	V
UVLO Turn On		12.0	-	14.8	V
UVLO Turn Off ⁴		11.0	-	14.5	V
OUTPUT Voltage	V _{OUT} T _{CASE} = 25°C	5.148	5.20	5.252	V
	V _{OUT} T _{CASE} = -55°C to +125°C	5.122	5.20	5.278	V
Power ³		0	-	5.2	W
Current ³	I _{OUT}	0	-	1.0	A
Ripple Voltage	V _{OUT} Full Load, 20Hz to 10MHz	-	10	30	mV _{p-p}
Line Regulation	V _{OUT} V _{IN} = 15V to 50V	-	2	15	mV
Load Regulation	V _{OUT} No Load to Full Load	-	15	50	mV
EFFICIENCY		65	68	-	%
LOAD FAULT POWER DISSIPATION	Overload ⁴	-	-	3.3	W
	Short Circuit	-	-	3	W
CAPACITIVE LOAD ⁴		-	-	1000	μF
SWITCHING FREQUENCY		350	450	500	kHz
ISOLATION	500 V _{DC}	100	-	-	MΩ
MTBF (MIL-HDBK-217F)	AIF @ T _C = 55°C	-	457	-	kHrs
DYNAMIC					
Load Step Output Transient	V _{OUT} Half Load to Full Load	-	200	500	mV _{PK}
Load Step Recovery ²		-	450	700	μSec
Line Step Output Transient ⁴	V _{OUT} V _{IN} = 16V to 40V	-	350	700	mV _{PK}
Line Step Recovery ^{2, 4}		-	600	1200	μSec
Turn On Delay	V _{OUT} V _{IN} = 0V to 28V	-	10	20	mSec
Turn On Overshoot		-	0	25	mV _{PK}

Notes:

1. Dependent 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 initial electrical design verification. Post design verification, parameter shall be guaranteed to the limits specified.

BLOCK DIAGRAM

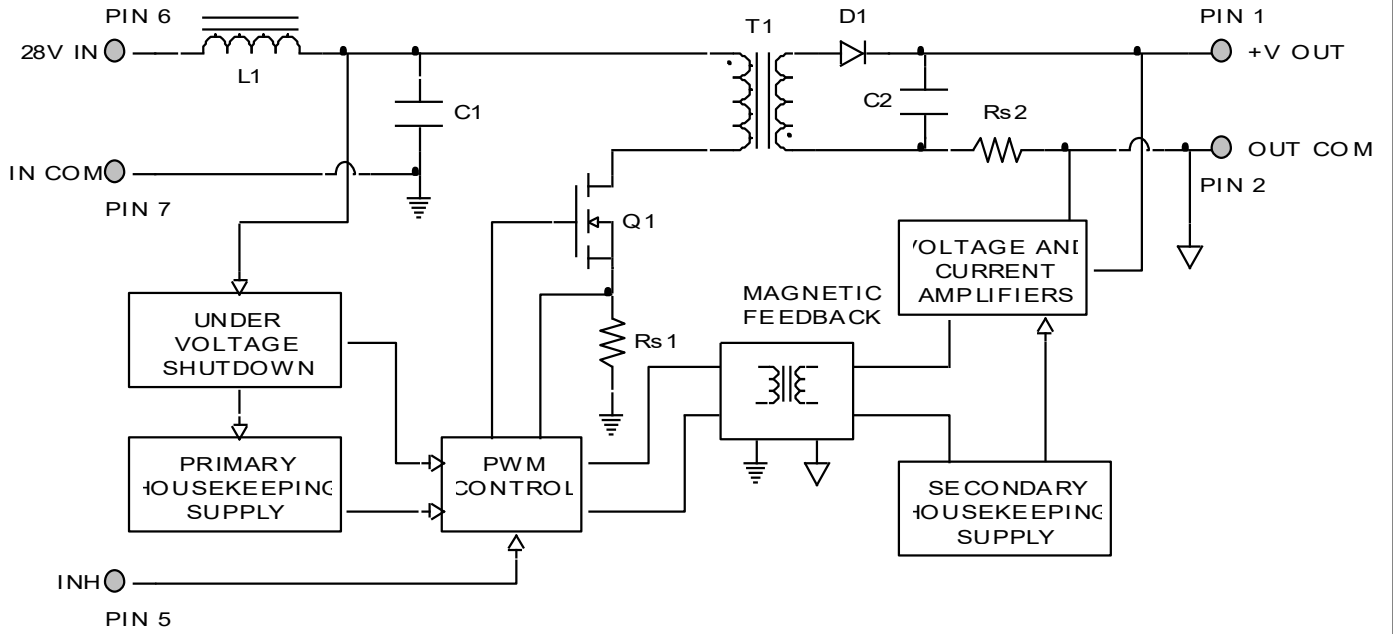


Figure 2

CONNECTION DIAGRAM

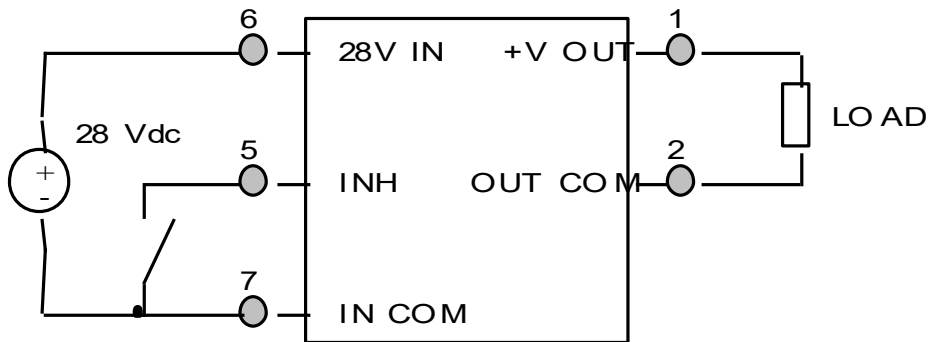


Figure 3

INHIBIT DRIVE CONNECTION DIAGRAMS

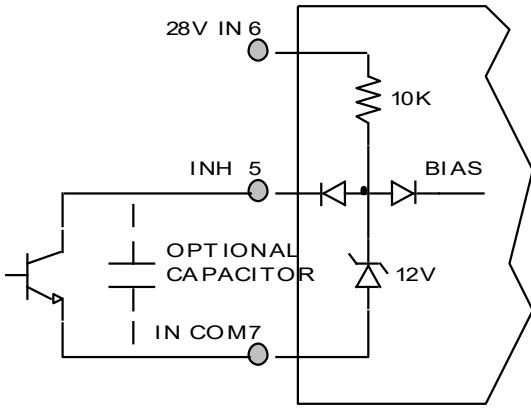


Figure 4 – Internal Inhibit Circuit and Recommended Drive
(Shown with optional capacitor for turn-on delay)

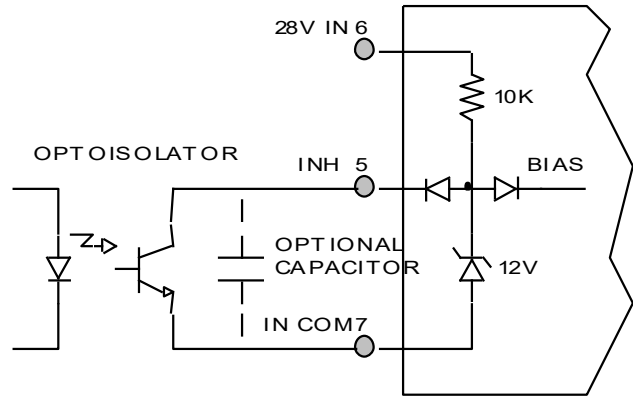


Figure 5 – Isolated Inhibit Drive
(Shown with optional capacitor for turn-on delay)

EMI FILTER HOOKUP DIAGRAM

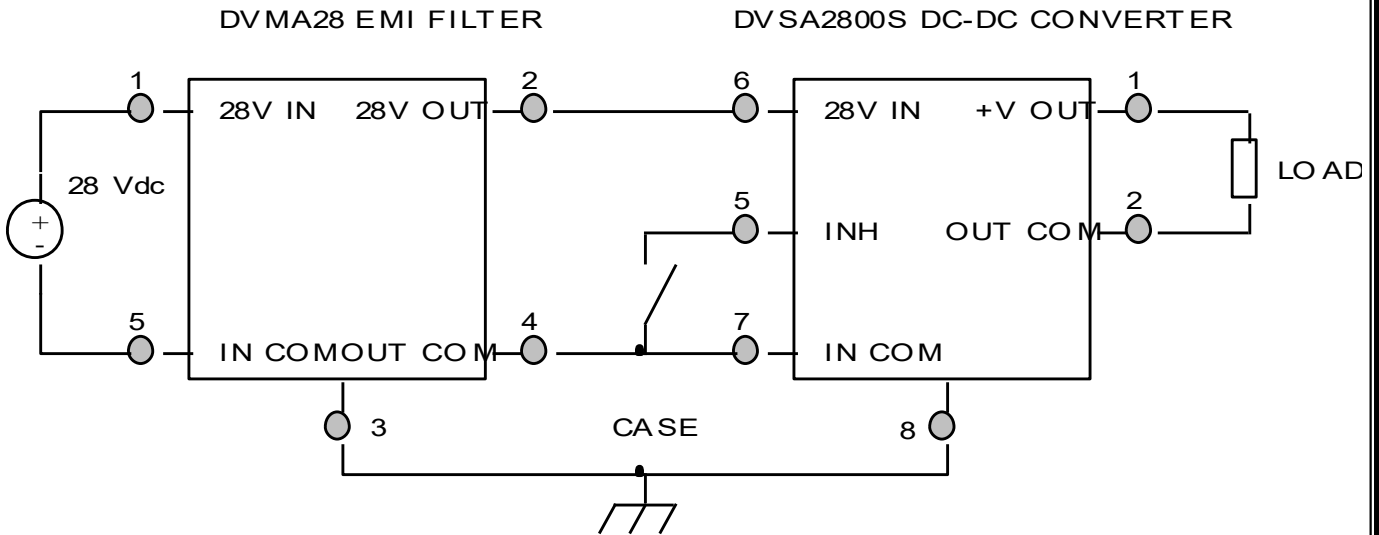


Figure 6 – Converter with EMI Filter

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

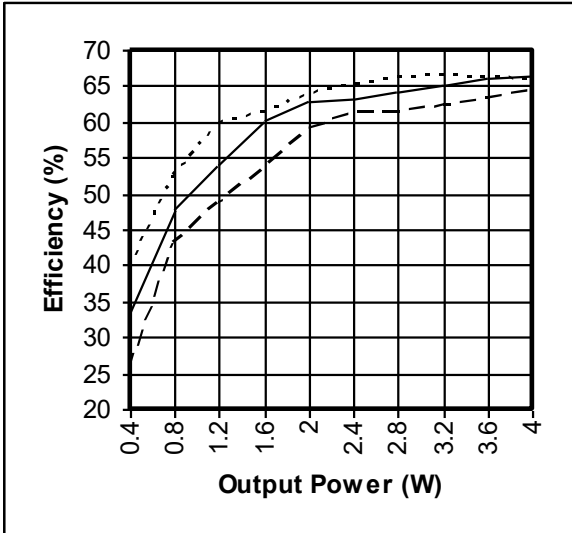


Figure 7 – DVSA283R3S
Efficiency (%) vs. Output Power (W)

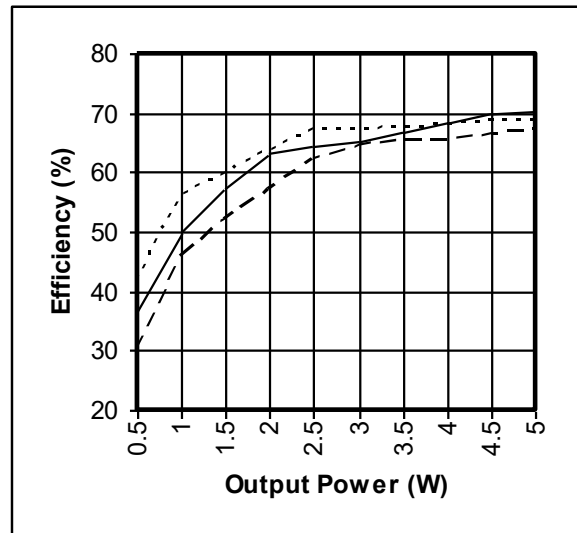


Figure 8 – DVSA2805S / DVSA285R2S
Efficiency (%) vs. Output Power (W)

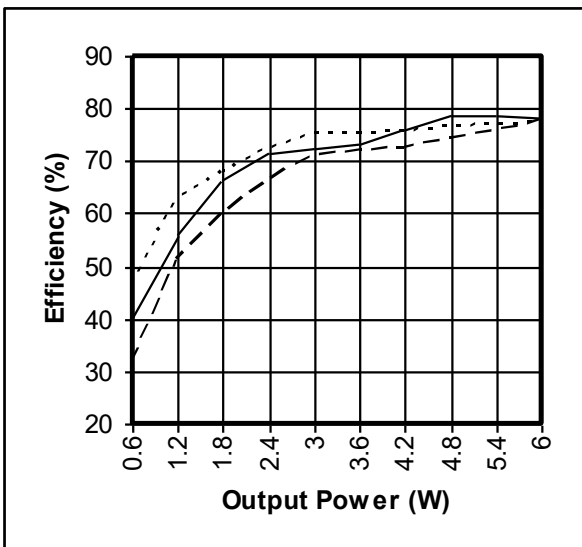


Figure 9 – DVSA2812S
Efficiency (%) vs. Output Power (W)

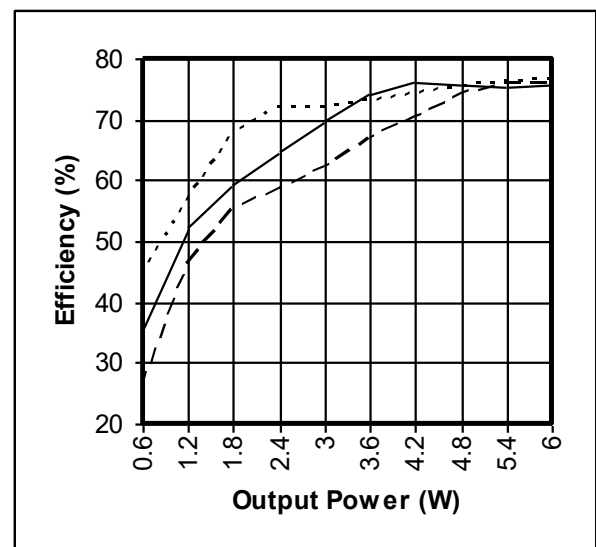


Figure 10 – DVSA2815S
Efficiency (%) vs. Output Power (W)

EMI PERFORMANCE CURVES

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

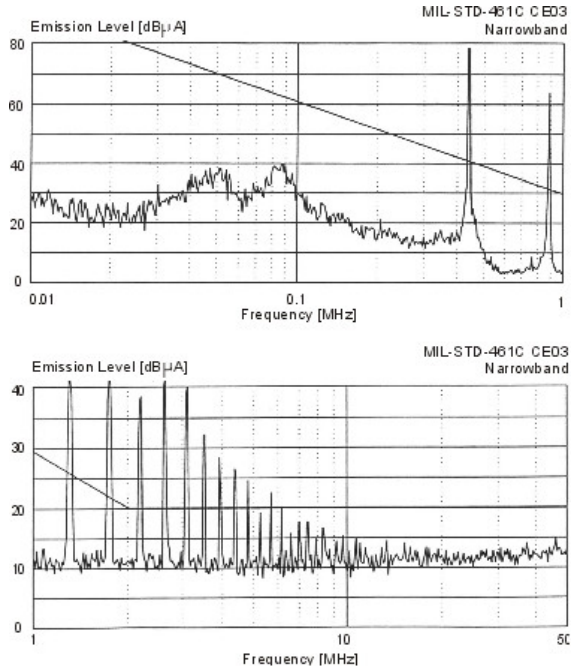


Figure 11 – DVSA2800S without EMI Filter

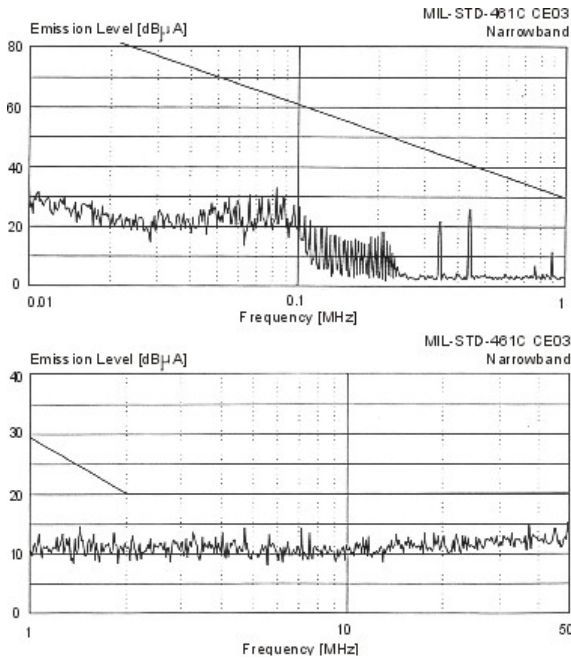
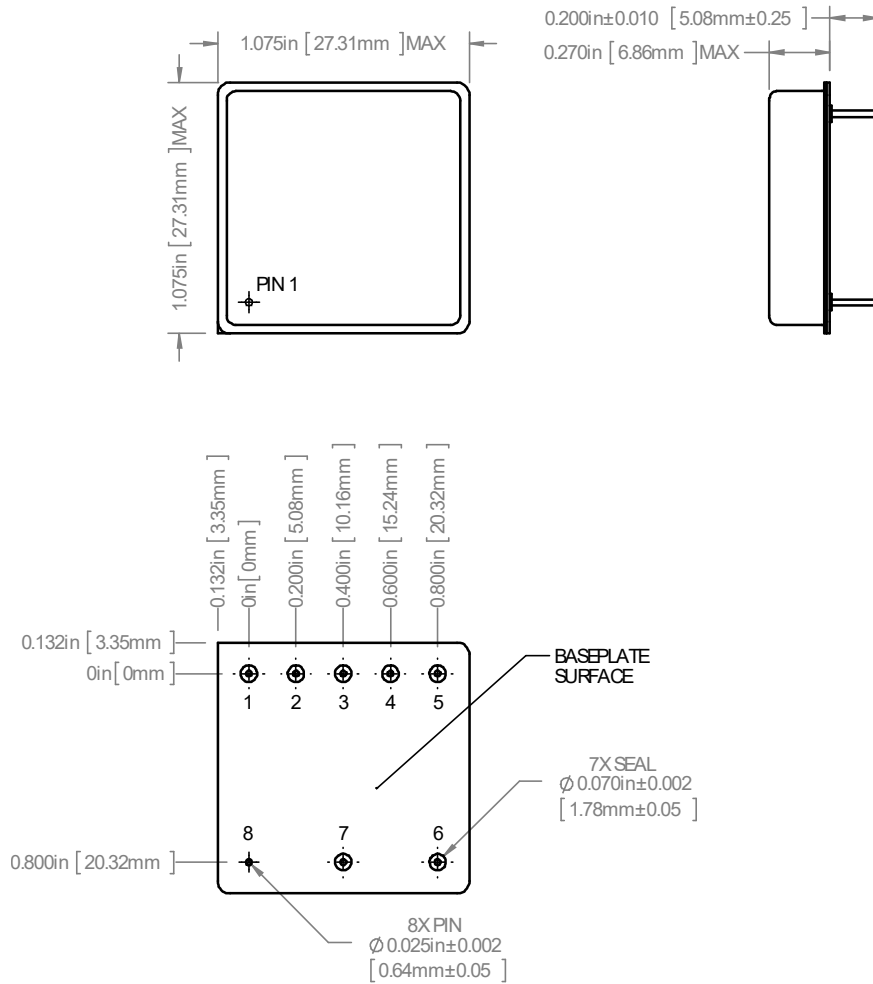


Figure 12 – DVSA2800S with EMI Filter

PACKAGE SPECIFICATIONS (NON-FLANGED)



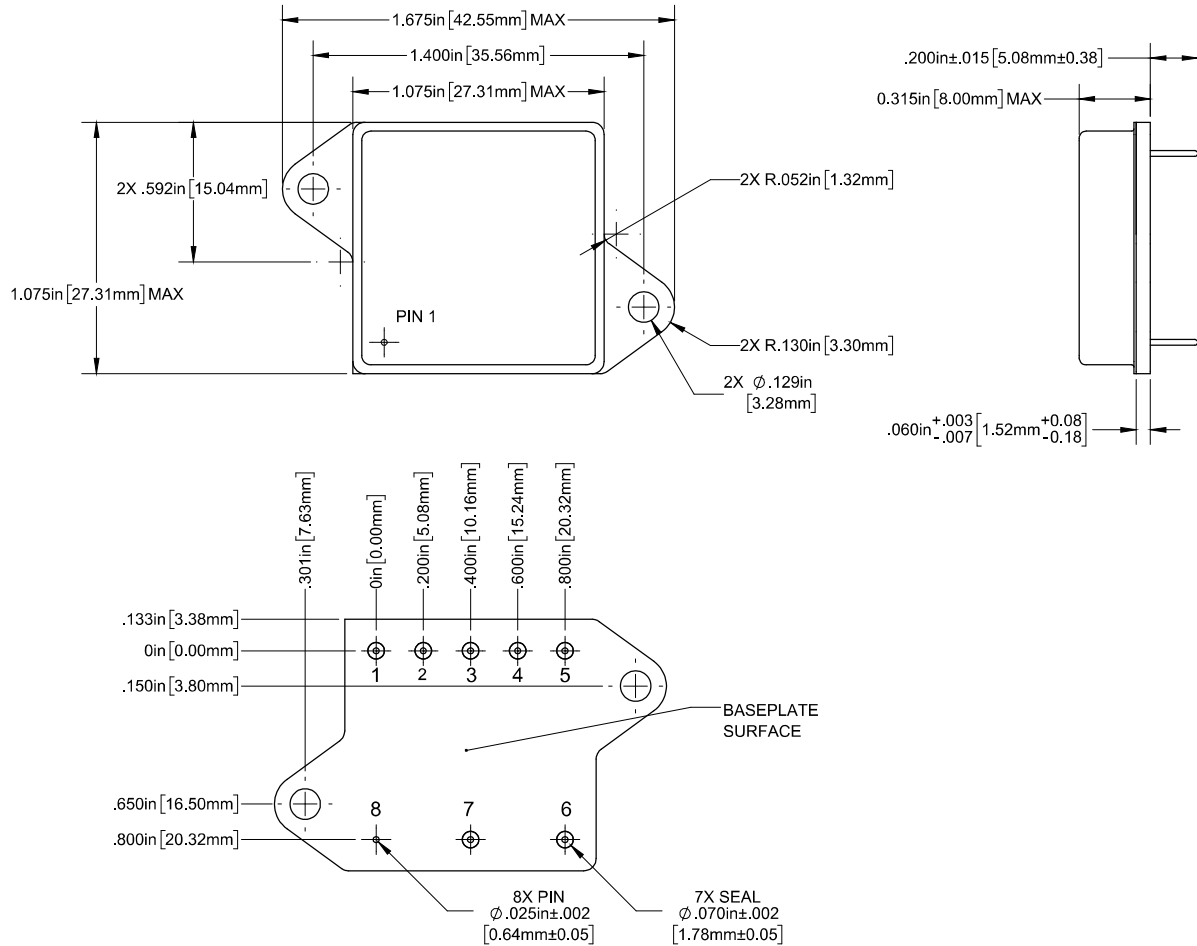
Notes:

1. Dimensional limits are ± 0.005 " unless otherwise specified.
2. Case temperature is measured on the center of the baseplate.
3. Material:
Case (Steel, Gold over Nickel Plated), Cover (Steel, Nickel Plated), Pins (Alloy 52, Gold over Nickel Plated), Pin Seal (Glass).

Pin	Function	Pin	Function
1	+V OUT	5	INHIBIT
2	OUT COM	6	28V IN
3	N/C	7	IN COM
4	N/C	8	CASE

Figure 13 – Package and Pinout

PACKAGE SPECIFICATIONS (FLANGED)



Notes:

1. Dimensional limits are ±0.005" unless otherwise specified.
2. Case temperature is measured on the center of the baseplate.
3. Mounting holes are not threaded. Recommended fastener is #4-40 screw.
4. Material:
Case (Steel, Gold over Nickel Plated), Cover (Steel, Nickel Plated), Pins (Alloy 52, Gold over Nickel Plated), Pin Seal (Glass).

Pin	Function	Pin	Function
1	+V OUT	5	INHIBIT
2	OUT COM	6	28V IN
3	N/C	7	IN COM
4	N/C	8	CASE

Figure 14 – Flanged Package and Pinout

PACKAGE PIN DESCRIPTION

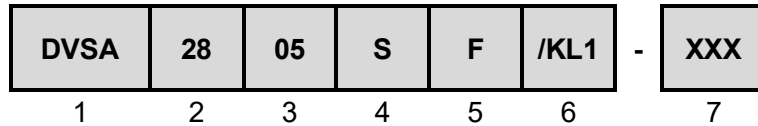
Pin	Function	Description
1	+V OUT	Positive Output Voltage Connection
2	OUT COM	Output Common Connection
3	N/C	No Connection
4	N/C	No Connection
5	INHIBIT	Logic Low = Disabled Output. Connecting the inhibit pin to input common causes converter shutdown. Logic High = Enabled Output. Unconnected or open collector TTL.
6	28V IN	Positive Input Voltage Connection
7	IN COM	Input Common Connection
8	CASE	Case Connection

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)	/KL1 Non-QML ^{5,9}
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 C1 or B2		•	•	•
	Gross Leak, Dip (No Bomb), Visual Verification	•			
Radiography ⁸	TM2012				•
External Visual	TM2009	•	•	•	•

- Notes:
- Contact Sales for more information concerning additional environmental screening and testing options desired.
 - 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.
 - 100% R&R testing with all test data included in product shipment.
 - Not required per MIL-PRF-38534. Test is performed for additional product quality assurance.
 - Non-QML products may not meet all requirements of MIL-PRF-38534.
 - Note intentionally not used.
 - PIND test Certificate of Compliance included in product shipment.
 - Radiographic test Certificate of Compliance and film(s) or data CD included in product shipment.
 - KL1 products are identical in every way with Class K products in compliance with MIL-PRF-38534 revision L and later revisions except they contain elements evaluated to the requirements of MIL-PRF-38534 revision K and previous revisions. These devices are not marked with an SMD number or MIL-PRF-38534 certification mark and are marked with -KL1 screening code in place of -K.

ORDERING INFORMATION



(1)

(2)

(3)

(4)

Product Series	Nominal Input Voltage		Output Voltage		Number of Outputs	
DVSA	28	28 Volts	3R3 05 5R2 12 15	3.3 Volts 5 Volts 5.2 Volts 12 Volts 15 Volts	S	Single

(5)

(6)

(7)

Package Option		Screening Code ^{1,2,3}		Additional Screening Code
None F	Non-Flanged Flanged	None /ES /H /KL1	Standard Extended Class H Class KL1	Contact Sales

- Notes:
1. Contact the VPT Inc. Sales Department for availability of Class H (/H) and KL1 (/KL1) 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.
 3. -KL1 products are identical in every way with Class K products in compliance with MIL-PRF-38534 revision L and later revisions except they contain elements evaluated to the requirements of MIL-PRF-38534 revision K and previous revisions. These devices are not marked with an SMD number or MIL-PRF-38534 certification mark and are marked with -KL1 screening code in place of -K.

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)	DVSA2800S Series Similar Part Number
5962-0324101HXC 5962-0324101HXA 5962-0324101HYC 5962-0324101HYA	DVSA283R3S/H DVSA283R3S/H-E DVSA283R3SF/H DVSA283R3SF/H-E
5962-0324102HXC 5962-0324102HXA 5962-0324102HYC 5962-0324102HYA	DVSA2805S/H DVSA2805S/H-E DVSA2805SF/H DVSA2805SF/H-E
5962-0324103HXC 5962-0324103HXA 5962-0324103HYC 5962-0324103HYA	DVSA285R2S/H DVSA285R2S/H-E DVSA285R2SF/H DVSA285R2SF/H-E
5962-0324104HXC 5962-0324104HXA 5962-0324104HYC 5962-0324104HYA	DVSA2812S/H DVSA2812S/H-E DVSA2812SF/H DVSA2812SF/H-E
5962-0324105HXC 5962-0324105HXA 5962-0324105HYC 5962-0324105HYA	DVSA2815S/H DVSA2815S/H-E DVSA2815SF/H DVSA2815SF/H-E

Do not use the DVSA2800S 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 <https://landandmaritimeapps.dla.mil/programs/defaultapps.asp>. 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. 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@vptpower.com

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