SVGA0510S Series

PHASE 1 PRELIMINARY

ULTRA HIGH RELIABILITY 100krad (Si) RADIATION HARDENED HYBRID DC-DC CONVERTERS

DESCRIPTION

The SVGA series of high reliability DC-DC converters is operable over the full military temperature range (-55°C to +125°C) with no power derating. Operating at a nominal frequency of 250 kHz, these regulated non-isolated converters are optimized for low voltage point of load applications with high efficiency synchronous rectification and fast transient response.

The SVGA series has been characterized and tested for TID (Total Ionizing Dose) at HDR (High Dose Rate) per VPT's RHA plan. The SVGA series has also been characterized for SEE (Single Event Effects). VPT's certified radiation program per MIL-PRF-38534, Appendix G is currently under review by DSCC. Please contact DSCC at 614-692-0585 for details. This characterization and testing is performed at the critical semiconductor component piece-part level (RLAT) from traceable semiconductor lots as well as on the SVGA series hybrid converter level produced from the same traceable semiconductor lots evaluated during RLAT.

These converters are designed and manufactured in a facility qualified to ISO9001 and certified to MIL-PRF-38534 Class H and Class K 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 input
- Adjustable Output Voltage from 0.8V to 3.4V
- Up to 10 Amps or 33 Watts Output Power
- High Efficiency, Up to 94%
- High Power Density, >100W/in^3
- Output Inhibit Control
- Low Output Noise
- No Use of Optoisolators
- Short Circuit Protection
- Precision Projection Welded Hermetic Package
- Additional Environmental Screenings Available
- MIL-PRF-38534 Element Evaluated Components
- Characterized and assured to 100krads(Si), per VPT's RHA plan specified per MIL-PRF-38534, Appendix G, Level R. After radiation exposure, converter testing is performed at 25°C per standard datasheet limits.
- Characterized to 85.4 MeV-cm^2/mg with minor transients only; no dropouts, shutdowns, latch up or burn out.
- Critical semiconductor component piece-parts and assured converter products tested at an HDR of 60 rads(Si)/sec.

Figure 1 – SVGA0510S DC-DC Converter
(Exact marking may differ from that shown)

11314 4th Avenue
West, Suite 206
Everett, WA 98204
http://www.vpt-inc.com

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

SPECIFICATIONS (T_{CASE} = -55°C to +125°C, V_{IN} = +5V ± 1%, Full Load, Unless Otherwise Specified)

ABSOLUTE MAXIMUM RATINGS			
Input Voltage (Continuous)	7 V_{DC}	Junction Temperature Rise to Case	+15°C
Input Voltage Transient (1 second)	7.5 V_{DC}	Storage Temperature	-65°C to +150°C
Output Power[1]	33 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, T_{CASE} = +125°C)	4.5 Watts	Weight (Maximum)	19 Grams

Parameter		Conditions	SVGA0510S			Units
			Min	Typ	Max	
STATIC						
INPUT Voltage[4]		Vout = 0.8V to 2.5V	3.5	-	7.0	V
		Vout = 2.6V to 3.3V	4.1	-	7.0	
Current		Inhibited	-	31	35	mA
		No Load	-	100	200	mA
Inhibit Pin Input[4]			0	-	1.5	V
Inhibit Pin Open Circuit Voltage[4]			-	4.7	Vin	V
UVLO Turn On[4,6]			-	3.0	-	V
UVLO Turn Off[4,6]			-	2.7	-	V
OUTPUT Voltage	V_{OUT}	T_{CASE} = 25°C	-1.5	Vout	+2.5	%V
	V_{OUT}	T_{CASE} = -55°C to +125°C	-2.5	Vout	+2.5	%V
Power[1,3]			0	-	33	W
Current[3]	V_{OUT}		0	-	10	A
Ripple Voltage	V_{OUT}	Full Load, 20Hz to 10MHz	-	45	80	mV_{p-p}
Load Regulation	V_{OUT}	No Load to Full Load	-	10	20	mV
EFFICIENCY[1]		Vout = 3.3V	88	93		%
FAULT POWER DISSIPATION					2	W
CAPACITIVE LOAD[4]					5000	µF
SWITCHING FREQUENCY			200	250	350	kHz
MTBF (MIL-HDBK-217F)		AIF @ T_C = 55°C	-	1214	-	kHrs
DYNAMIC						
Load Step Output Transient[5]	V_{OUT}	Half Load to Full Load	-	90	150	mV
Load Step Recovery[2,5]			-	30	150	µSec
Turn On Delay	V_{OUT}	V_{IN} = 0V to 5V	-	4	7	mSec
Turn On Overshoot			-	2	10	mV_{PK}

Notes:
1. Dependant on output voltage.
2. Time for output voltage to settle within 1% or 20mV of its nominal value, whichever is greater.
3. Derate linearly to 0 at 135°C.
4. Verified by qualification testing.
5. With 100µF capacitor from Vin to Ground
6. Vout not necessarily in regulation

BLOCK DIAGRAM

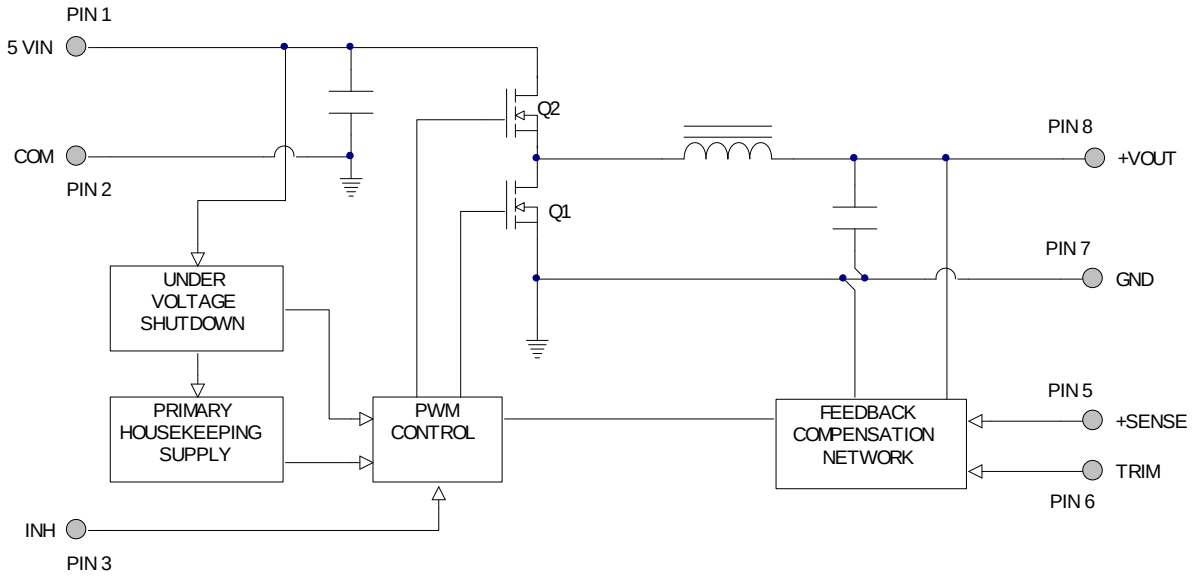


Figure 2

CONNECTION DIAGRAM

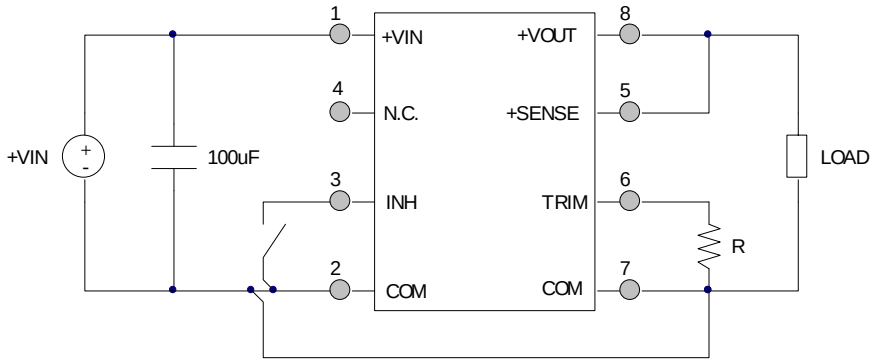


Figure 3

Shown with recommended 100uF capacitor on the input

INHIBIT DRIVE CONNECTION DIAGRAMS

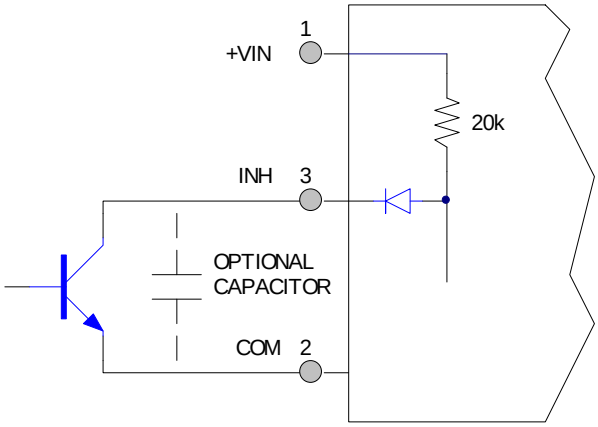
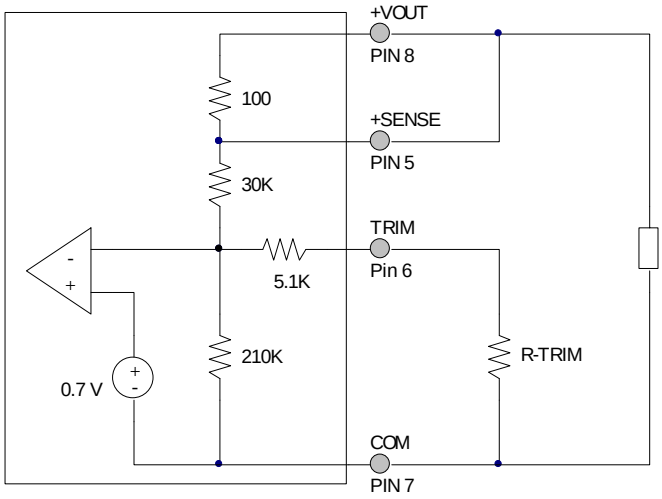


Figure 4 –Internal Inhibit Circuit and Recommended Drive
(Shown with optional capacitor for turn-on delay)

OUTPUT VOLTAGE TRIM



The output voltage is set with an external resistor connected from the TRIM pin to the GND pin 7. 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.

SVGA0510S	
$+V_{OUT}$ (V)	R_{TRIM} (Ω)
0.8	None
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	5.4k
3.0	4.44k
3.3	3.30k
3.4	2.98k

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

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

Figure 5 – Output voltage trim table

EFFICIENCY PERFORMANCE CURVES (T_{CASE} = 25°C, Vin = 5V)

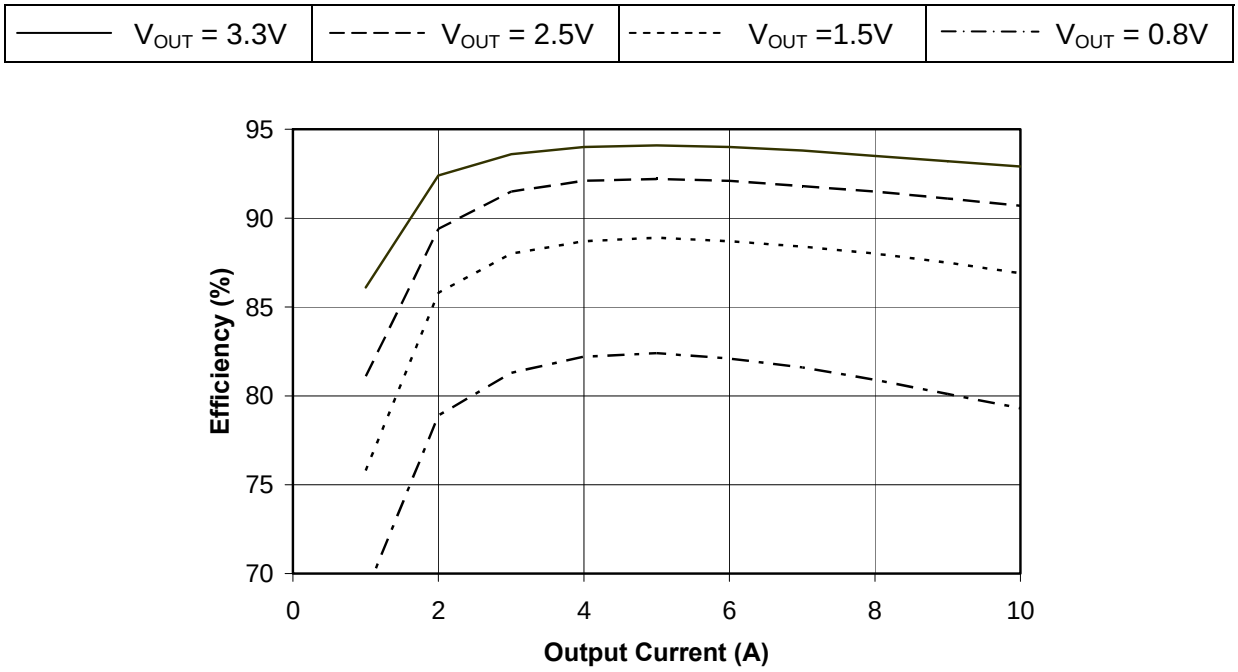
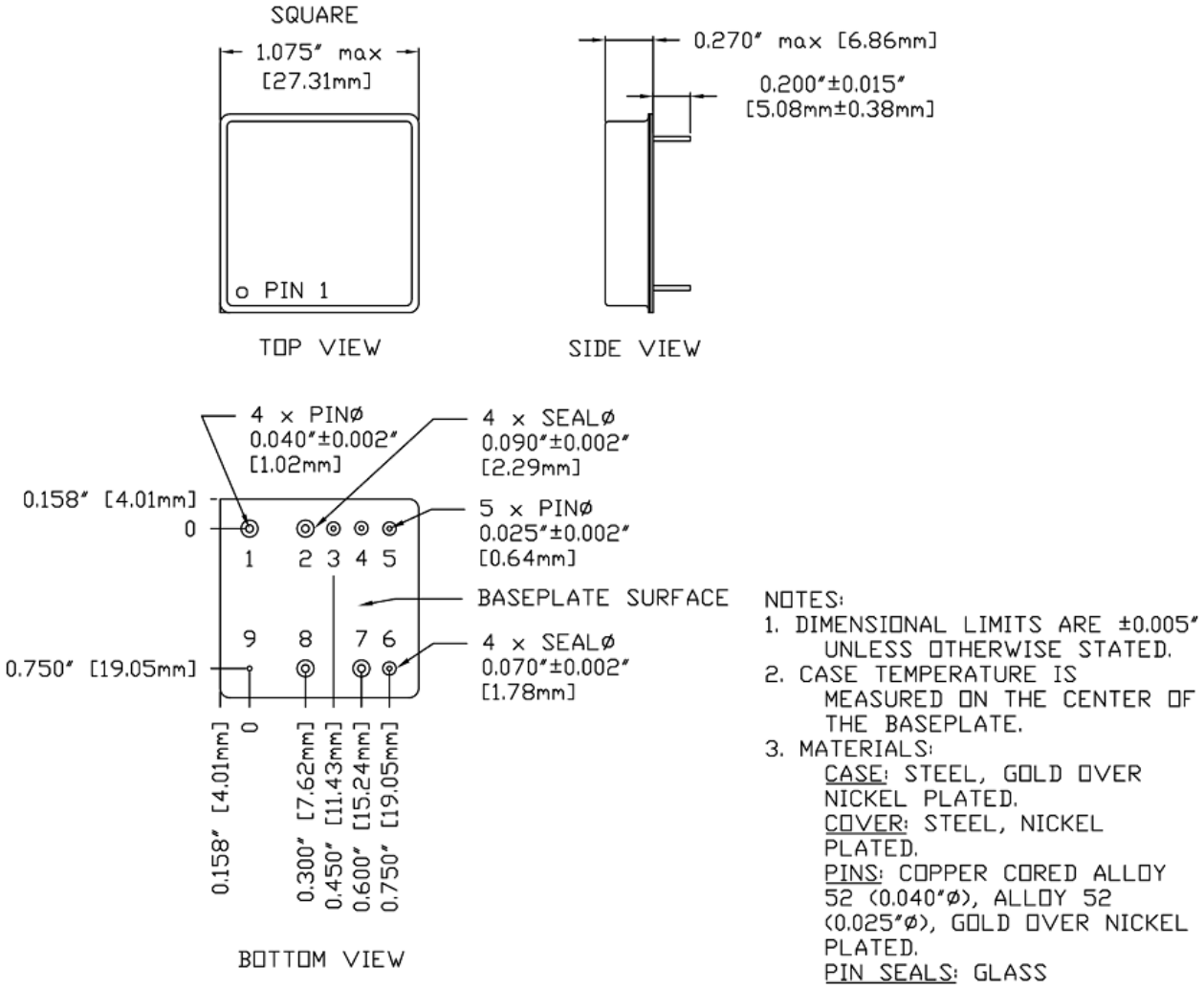


Figure 6 – Efficiency curves for typical output voltages.

PACKAGE SPECIFICATIONS



PIN	FUNCTION	PIN	FUNCTION	PIN	FUNCTION
1	+V IN	4	N/C	7	COM
2	COM	5	+SENSE	8	+V OUT
3	INHIBIT	6	TRIM	9	CASE

Figure 7 – Package and Pinout

PACKAGE PIN DESCRIPTION

Pin	Function	Description
1	+VIN	Positive Input Voltage Connection
2	COM	Common Return Connection, Input Side
3	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.
4	N/C	No Connection
5	+SENSE	Positive Sense
6	TRIM	Trim pin sets output voltage with a resistor to pin 7
7	COM	Common Return Connection, Output Side
8	+VOUT	Positive Output Voltage Connection
9	CASE	Case Connection

ENVIRONMENTAL SCREENING (Per MIL-STD-883 as referenced to MIL-PRF-38534, Class H)

Screening	MIL-STD-883	Class HB+ /HB+	Engineering Model[5] /EM
Non-Destructive Bond Pull	Method 2023	•	•
Internal Visual	Method 2017, 2032 Internal Procedure	•	•
Temperature Cycling	Method 1010, Condition C	•	
Constant Acceleration	Method 2001, 3000g, Y1 Direction	•	
PIND	Method 2020, Condition A[2]	•	
Burn-In	Method 1015, 160 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})	• •	•
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. This is an additional screening test not required per MIL-PRF-38534, Class H.
3. Non-Destructive bond pull per Method 2023 performed. This is an additional screening test not required per MIL-PRF-38534, Class H.
4. Please contact your sales representative or the VPT Inc. Sales Department for more information concerning additional environmental screening and testing options desired.
5. Engineering Models are electrically identical in performance to HB+ products however are not characterized or guaranteed for radiation performance, have minimal environmental screening, and are not considered as flight worthy devices.

ORDERING INFORMATION

SVGA	05	10	S	/HB+	-	XXX
1	2	3	4	5		6

(1)	(2)		(3)		(4)	
Product Series	**Nominal Input Voltage**		**Output Current**		**Number of Outputs**	
SVGA	**05**	5 Volts	**10**	10 A	**S**	Single

(5)		(6)
Screening Code		**Additional Screening Code**
/HB+ /EM	HB+ Engineering Model	Contact Sales Regarding Class H and Class K products

Note: Engineering models utilize only the standard screening specified and are not considered compliant for flight use. These models are intended for low volume engineering characterization only and have no guarantee regarding operation in a radiation environment. The customer must place the following statement on each line item of their purchase order(s) for /EM units when ordering engineering models:

"(Customer Name) acknowledges that the /EM unit listed in this line item is not permitted for flight use and will be used for Engineering characterization only."

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.

Important Notice: Quotation and/or Purchase of these devices will require the submission of an End Use Certificate by the requestor. The requestor agrees to abide by the United States Export Control of Technical Data and Equipment under the International Traffic in Arms Regulations (ITAR) and Export Administration Regulations (EAR). The recipient agrees to abide by these laws and their regulations not only for export and re-export, but for disclosure to non-U.S. citizens.

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