



Power Your Critical Mission Today

HTD1R5B-1200D SERIES

HIGH TEMPERATURE HYBRID DC-DC CONVERTERS



HTD1R5B Series DC-DC Converter

Models Available

 Input: 6 V to 20 V continuous, 30 V transient

 1.2 W, dual outputs of ± 5 V

 Temperature: 155 °C operating

1.0 DESCRIPTION

The HTD Series of high temperature DC-DC converters is specifically designed for extreme temperature environments.

Hybrid microcircuit technology provides superior reliability in high temperature applications. Bare semiconductor die are integrated with passive components using thick film conductors on a ceramic substrate. A hermetic metal package protects internal components for long term reliability.

The HTD1R5B Series utilizes a boundary mode, peak current controlled flyback topology with primary side regulation. The flyback topology achieves high efficiency at low power levels, over a wide input voltage range.

High temperature performance is guaranteed through qualification, component lot testing and analysis. The HTD Series has been characterized over the full operating temperature range from -55 °C to +155 °C, including electrical performance, operating life, temperature cycling, mechanical shock and vibration.

The HTD Series is intended for harsh environments including down-hole oil and gas, MWD/LWD and wireline logging tools, aircraft engine electronics, and other industrial applications.

1.1 FEATURES

- Isolated
- 1.2 W rated output power
- Extended operation up to 1.5W
- Wide input voltage range
- Low noise
- Undervoltage lockout
- Short circuit protection
- Soft start

1.2 HIGH TEMPERATURE CHARACTERIZATION

- Guaranteed performance to 155 °C operating
- Characterized to 185 °C

1.3 MANUFACTURING AND COMPLIANCE

- Manufactured in a MIL-PRF-38534 Class H and Class K facility
- MIL-STD-883
- ISO-9001

1.4 PACKAGING

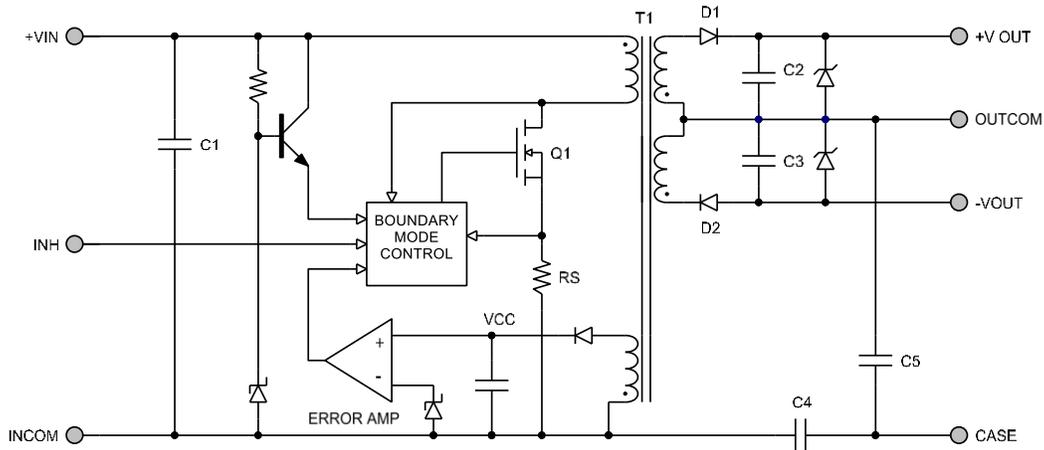
- Low-profile: 0.975" x 0.800" x 0.270"
- Max weight: 11 g
- Industry standard pinout
- Precision projection-welded hermetic metal case

1.5 SIMILAR PRODUCTS AND ACCESSORIES

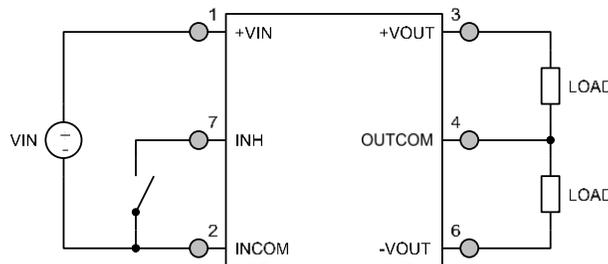
- [DVCH](#) 1.5 W output DC-DC converter
- Custom versions available

2.0 DIAGRAMS

2.1 BLOCK DIAGRAM



2.2 CONNECTION DIAGRAM



3.0 SPECIFICATIONS

3.1 ABSOLUTE MAXIMUM RATINGS

Absolute Maximum Ratings

Input Voltage (Continuous):	-0.5 V to 20 V	Operating Temperature (Full Load):	-55 °C to +185 °C
Input Voltage (Transient, 1 second):	-0.5 V to 30 V	Storage Temperature:	-65 °C to +185 °C
		Lead Solder Temperature (10 seconds):	400 °C

3.2 PERFORMANCE SPECIFICATIONS

T_{case} = -55 °C to +155 °C, V_{in} = +12 V ± 5%, P_{out} = 1.2W¹, Unless Otherwise Specified

		HTD1R5B-1205D			
Parameter	Conditions	Min	Typ	Max	Units
INPUT					
Voltage	Continuous	6	12	20	V
	Transient, 1 sec ⁴	-	-	30	V
Current	INH < 1.5 V	-	2	4	mA
	No Load	-	14	25	mA
Ripple Current	20 Hz to 10 MHz	-	30	50	mApp
Undervoltage Lockout	Turn-On	3.0	-	6.0	V
	Turn-Off ⁴	3.0	-	6.0	V
OUTPUT STATIC					
Voltage	±V _{out} , T _{case} = 25 °C	4.80	5	5.20	V
	±V _{out} , T _{case} = -55 °C to +155 °C	4.75	5	5.25	V
Power ²	Total	0	-	1.2	W
	Either Output	0	-	0.9	W
Current ²	Total	0	-	240	mA
	Either Output	0	-	180	mA
Ripple Voltage	20 Hz to 10 MHz	-	20	50	mVpp
Line Regulation	±V _{out} , V _{in} = 6 V to 20 V	-	70	150	mV
Load Regulation	±V _{out} , 0.12W to 1.2W Load	-	240	400	mV
	±V _{out} , 0.6W to 1.2W Load	-	120	250	mV
Load Fault Power Dissipation	Short Circuit, T _{case} ≥ 25 °C	-	1.2	4	W
OUTPUT DYNAMIC					
Load Step, 50% to 100% Load, Either Output	Output Transient	-	100	300	mVpk
	Recovery ³	-	-	600	μs
Turn-On, V _{in} = 0 to 28 V	Delay	-	10	20	ms
	Overshoot	-	-	50	mVpk
FUNCTION					
INH Pin Input ⁴	Output Inhibited	0	-	1.5	V
INH Pin Open Circuit Voltage ⁴	Output Enabled	3	-	12	V
GENERAL					
Efficiency		70	76	-	%
Capacitive Load ⁴		-	-	100	μF
Switching Frequency	V _{in} = 12 V, 1.2W	250	300	400	kHz
	V _{in} = 6 V to 20 V, No Load to 1.2W ⁴	100	-	1100	kHz
Isolation	500 V DC, T _{case} = 25 °C	100	-	-	MΩ
Weight	Standard package option	-	-	11	g

1. Half load at +V_{out} and half load at -V_{out}

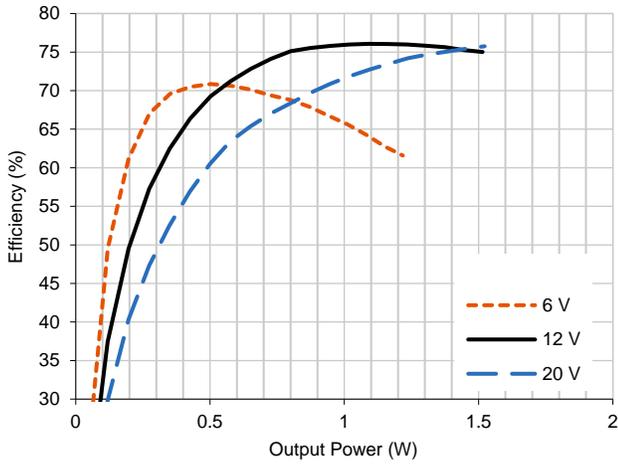
2. Up to 75% of the total power or current can be drawn either of the two outputs

3. Time for output voltage to settle within 1% of steady-state value

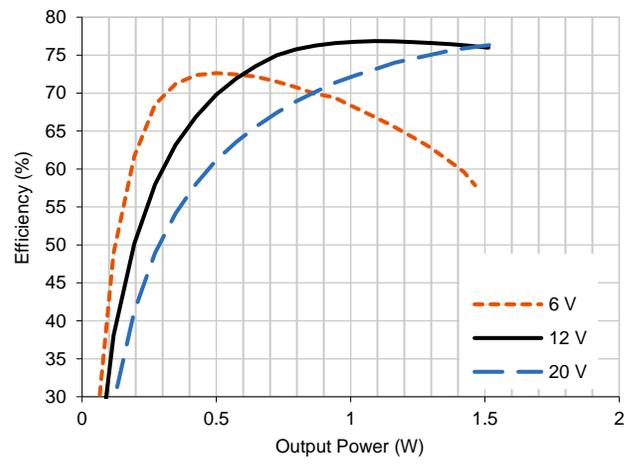
4. Verified by qualification testing

4.0 PERFORMANCE CURVES

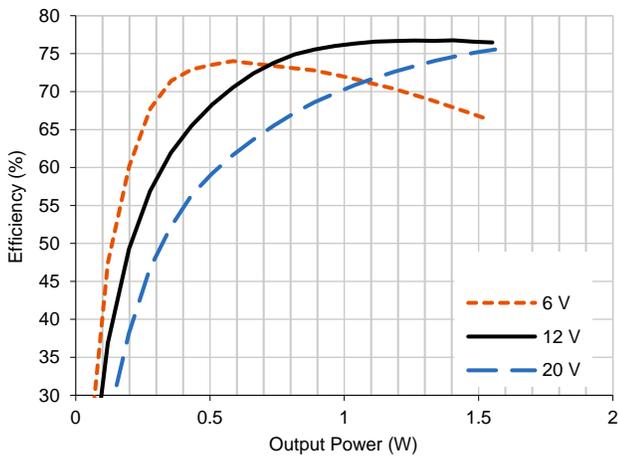
4.1.1 HTD1R5B-1205D Efficiency (Typical, 185 °C)



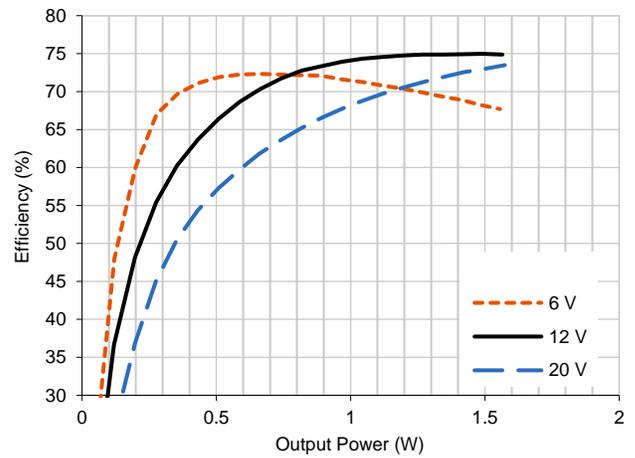
4.1.2 HTD1R5B-1205D Efficiency (Typical, 155 °C)



4.1.3 HTD1R5B-1205D Efficiency (Typical, 25 °C)

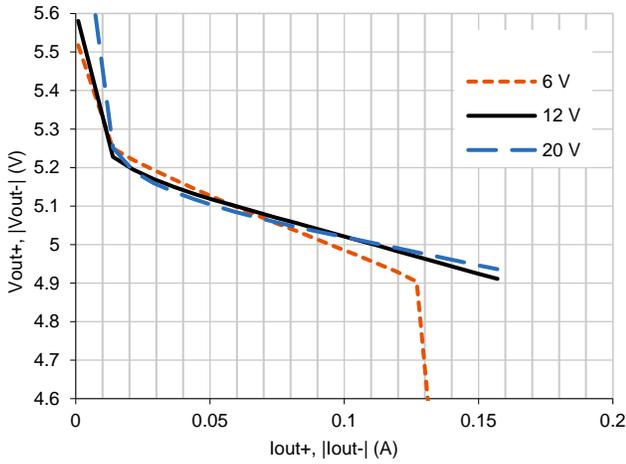


4.1.4 HTD1R5B-1205D Efficiency (Typical, -55 °C)

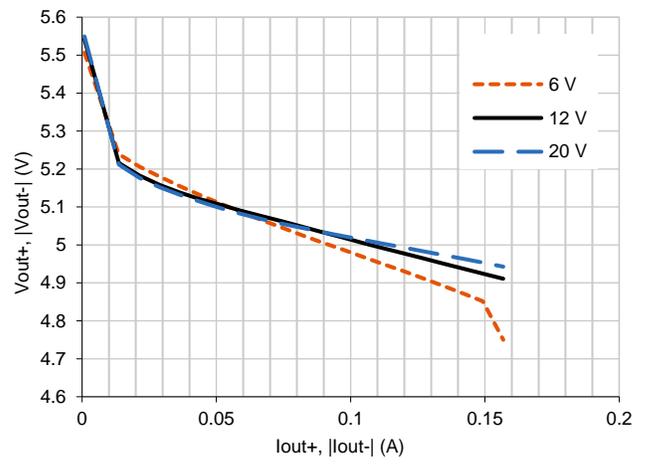


4.0 PERFORMANCE CURVES (CONTINUED)

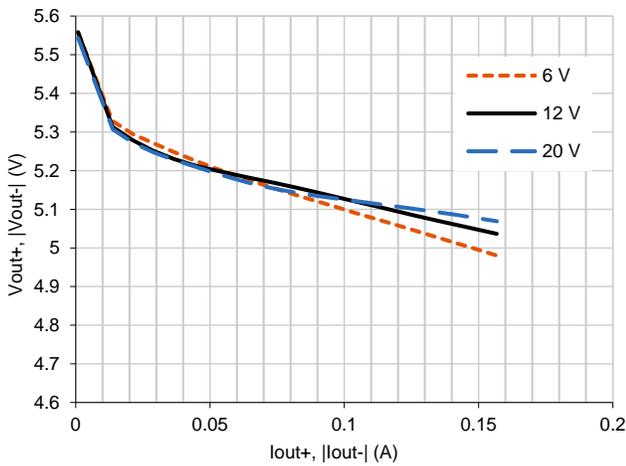
4.2.1 HTD1R5B-1205D Output Voltage (Typical, 185 °C)



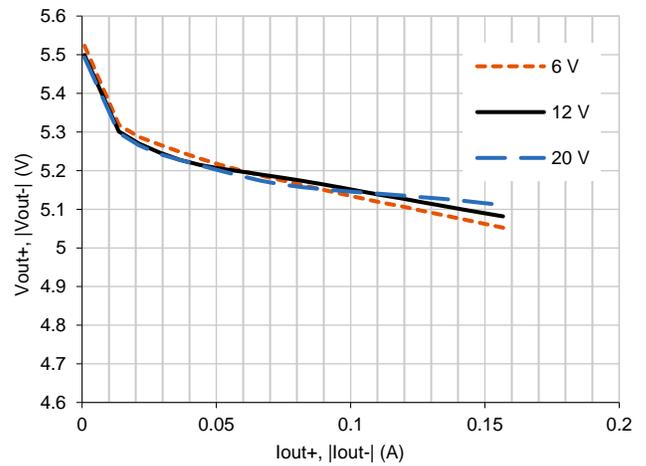
4.2.2 HTD1R5B-1205D Output Voltage (Typical, 155 °C)



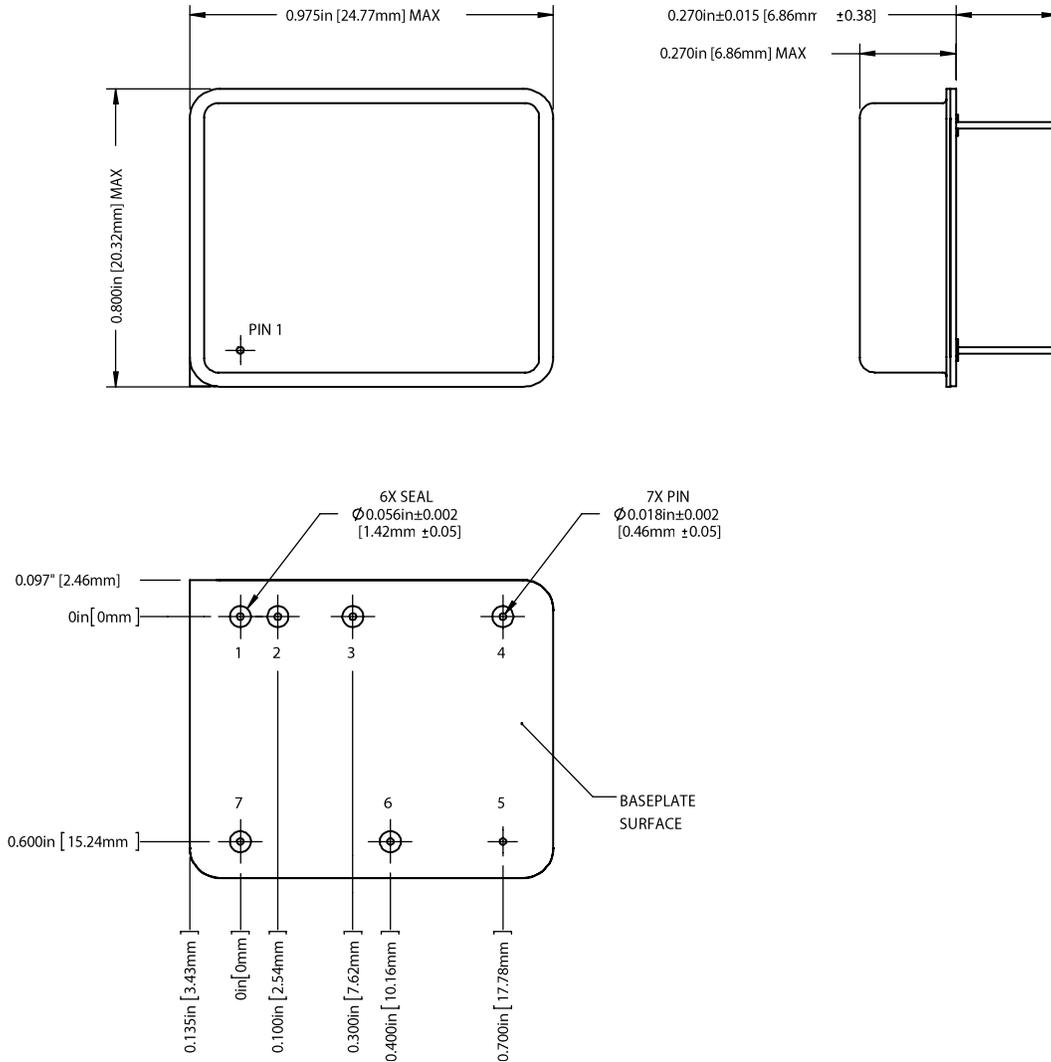
4.2.3 HTD1R5B-1205D Output Voltage (Typical, 25 °C)



4.2.4 HTD1R5B-1205D Output Voltage (Typical, -55 °C)



5.0 MECHANICAL OUTLINES AND PINOUT



1. Tolerances are +0.005" unless otherwise stated
2. Case temperature is measured on the center of the baseplate surface
3. Materials: Case (Steel, gold over nickel plated); Cover (Steel, nickel plated); Pin (Copper-cored alloy 52, gold over nickel plated); Pin Seals (Glass)

Pin	Function	Pin	Function	Pin	Function	Pin	Function
1	+VIN	3	+VOUT	5	CASE	7	INHIBIT
2	INCOM	4	OUTCOM	6	-VOUT		

6.0 TECHNICAL NOTES



Please note that many of these functions are also demonstrated in detail on the VPT website in the form of [technical video labs](#).



6.1 GENERAL INFORMATION

6.1.1 Topology Description

The HTD1R5B-1200D Series is an isolated dual-output flyback converter. It provides a positive and negative output voltage with respect to the OUTCOM pin. Up to 75% of the total output power is available from either output. The internal voltage regulation loop actively regulates a primary referenced voltage. The secondary positive and negative outputs are regulated by cross-regulation of the transformer windings.

6.1.2 External Components

The HTD1R5B-1200D Series is designed to operate stand-alone in most applications. It does not require any external components for proper operation or to meet the datasheet specifications. Input and output capacitors are provided internally for low ripple and noise. Adding an input inductor will reduce input current ripple. Output ripple and noise can be further reduced by adding a small ceramic capacitor, 1 μF to 10 μF , at the output. Most output ripple requirements can be met with the addition of capacitors alone. Output capacitance can be added up to the maximum listed in Section 3.2.

6.1.3 Source Impedance

The impedance of the input source can interact with the DC-DC converter and can affect performance. High source impedance is often caused by a long input cable or components added in series with the input. Source resistance will cause a DC voltage drop as the converter draws DC input current. This voltage drop is simply the cable resistance multiplied by the input current at low line. The voltage drop and the actual voltage at the input to the converter will determine the minimum source voltage at which the converter will operate. A high source inductance can interact with the feedback control loop of the converter. In some cases, additional input capacitance will be needed to stabilize the system.

6.1.4 Output Configurations

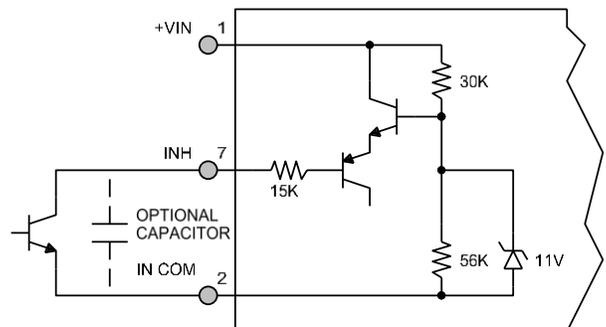
Since the converter is isolated, the outputs can be used as a traditional dual-output, with a positive and negative voltage referenced to OUTCOM, or as a single-ended output referenced to $-V_{\text{OUT}}$ or $+V_{\text{OUT}}$. For example, the HTD1R5B-1205D model can provide +5 V and -5 V in the traditional dual output configuration, or can provide +10 V referenced to $-V_{\text{OUT}}$, or -10 V referenced to $+V_{\text{OUT}}$ in single-ended configuration. In the single-ended configuration, the OUTCOM pin will be at +5 V relative to $-V_{\text{OUT}}$.

The outputs of multiple converters can be stacked in series to provide higher voltages. When outputs of multiple modules are stacked, they naturally share the load. For example, two HTD1R5B-1205D converters can be stacked to provide a 20 V output.

6.2 FUNCTION DESCRIPTIONS

6.2.1 On/Off Control (INH)

The INH (Inhibit) pin is a primary-side control pin referenced to INCOM. The INH pin must be driven using an open collector or open drain configuration. Pulling the INH pin low disables the converter output, removes bias voltage from internal control circuitry, and puts the converter in a state of minimum input current draw. Leaving INH open enables the output, allowing the converter to operate normally. The pin must be pulled below 1.5 V to disable the output. An optional capacitor from INH to INCOM may be used to delay turn-on. The INH pin should be left open if not used.



6.3 PROTECTION FEATURES

6.3.1 Input Undervoltage Lockout

The HTD1R5B-1200D Series provides input undervoltage lockout protection. For input voltages below the turn-on voltage, the converter will remain off, drawing minimal current from the source. When the input voltage exceeds the turn-on voltage, the converter will start. The lockout circuit is designed to tolerate slow ramping input voltage waveforms.

6.3.2 Output Soft Start

The HTD1R5B-1200D Series utilizes an output soft-start function to ramp the output in a controlled manner, eliminating output voltage overshoot and limiting inrush current at turn-on. A voltage-mode soft-start ensures the output waveform remains consistent regardless of changes in the load current. The output rise time is approximately 4 ms. The soft-start function is active whether the module is turned on with an application of input voltage or from release of the inhibit pin. Under normal conditions, current drawn from the source during turn-on will not exceed the full load input current. The turn-on delay time is specified from the application of input voltage (or release of the inhibit pin) until the output reaches 90% of its final value.

6.3.3 Output Overcurrent Protection

The HTD1R5B-1200D Series provides output short circuit protection. During a load fault condition, a peak current limiting function reduces the converter duty cycle and switching frequency to limit the total output current into the fault. The short circuit protection feature senses primary current. It does not distinguish if the fault is on the positive or negative output. The converter will continue to operate into any overload or short circuit condition. This feature allows the converter to start into any capacitive load. Recovery is automatic and immediate upon removal of the fault condition. Sustained short circuit or overload operation can cause excessive power dissipation. Care should be taken to control the operating temperature of the converter in this condition.

6.4 THERMAL CONSIDERATIONS

The HTD1R5B-1200D Series is rated for full power operation at 155 °C. The operating temperature of the converter is specified on the baseplate of the converter. The converter is designed to be conduction-cooled, with the baseplate mounted to a heat sink, chassis, PCB or other thermal surface. The internal power dissipating components are mounted to the baseplate of the converter and all heat flow is through the baseplate and mounting flanges. The lid of the converter does not provide a good thermal path.

The hybrid DC-DC converter contains many semiconductor components. The maximum temperature rise from junction to case is TBD °C at full load.

7.0 ENVIRONMENTAL SCREENING

100% tested per MIL-STD-883 as referenced to MIL-PRF-38534.

Contact sales for more information concerning additional environmental screening and testing options. VPT, Inc. reserves the right to ship higher screened or SMD products to meet orders for lower screening levels at our sole discretion unless specifically forbidden by customer contract.

Test	MIL-STD-883 Test Method, Condition	High Temp Non-QML ¹
Non-Destructive Bond Pull	TM2023 ²	•
Internal Visual	TM2010, TM2017, TM2032 (MIL-STD-750, TM2072, TM2073)	•
Temperature Cycling	TM1010, Condition H -55 °C to 185 °C, Ambient	•
Constant Acceleration	TM2001, 3000g, Y1 Direction	•
Pre Burn-In Electrical	25 °C	•
Burn-In	TM1015, 48 hrs. 155 °C, Case Typ.	•
Final Electrical	MIL-PRF-38534, Group A Subgroups 1-6 -55 °C, 25 °C, 155 °C ³	•
Hermeticity (Seal)	TM1014, Fine Leak, Condition A2 TM1014, Gross Leak, Condition C	• •
External Visual	TM2009	•

1. Non-QML products may not meet all requirements of MIL-PRF-38534

2. Not required per MIL-PRF-38534. Test performed for additional product quality assurance

3. 100% R&R testing with all test data included in product shipment

8.0 ORDERING INFORMATION

HTD1R5B -	12	05	D
1	2	3	4

(1) Product Series	(2) Nominal Input Voltage	(3) Output Voltage	(4) Number of Outputs
HTD1R5B-	12 12 Volts	05 05 Volts	D Dual

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 requirements, source inspection, and/or special element evaluation.

9.0 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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10.0 ADDITIONAL INFORMATION

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[Application Notes and White Papers](#)



[Technical Video Labs](#)



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