Applications

- Distributed power architectures
- Telecommunications equipment
- LAN/WAN applications
- Data processing applications

Features

- RoHS lead solder exemption compliant
- 100/85 Watt total output power
- Independently-regulated outputs
- Flexible load distribution
- Open-frame design with Insulated Metal Substrate
- Low profile – 12.7mm height
- High efficiency - 87%
- Output voltage tracking
- Output overcurrent protection
- Output overvoltage protection
- Overtemperature protection
- Setpoint accuracy ±1.5%
- Independent output voltage trim, positive or negative
- Input/output isolation: 1500 VDC
- Basic insulation
- UL 1950 Recognition, CSA 22.2 No. 950-95 certification, TUV IEC950

Description

The HHD25 is a series of high density **H**alf-brick size, **H**igh current, **D**ual output dc-dc converters with through-hole mounting. The products provide onboard conversion of standard telecom and datacom input voltages to two independently-regulated output voltages. Leading-edge technology provides extremely high efficiency and superior thermal performance which enables the products to deliver full-rated power at 55 °C ambient temperature with only 200 LFM forced air without the addition of a heatsink. The outputs also track each other during both startup and shutdown.

Model Selection

Model	Input Voltage Range, VDC	Input Current, Max, ADC	Output Voltage, VDC	Output Rated Current, ADC	Output Ripple and Noise, mV p-p	Typical Efficiency %
HHD20ZGE	36-72	3.6	5.0/3.3	20/20	100	87
HHD20ZGB	36-72	3.6	5.0/1.8	20/20	100	85
HHD25ZED	36-72	3.1	3.3/2.5	25/20	100	85
HHD25ZEB	36-72	3.1	3.3/1.8	25/20	100	84
HHD20YGE	18-36	7.2	5.0/3.3	20/20	100	85

Model numbers highlighted in yellow or shaded are not recommended for new designs.

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings may cause performance degradation, adversely effect long-term reliability, and cause permanent damage to the converter.

Parameter	Conditions/Description	Min	Max	Units
Input voltage	Continuous	36	75	VDC
	Transient, 100ms		100	VDC
Operating Temperature	At 100% load	-40	100	°C
Storage Temperature		-40	125	°C
ON/OFF Control Voltage	Referenced to -Vin		50	VDC

Environmental and Mechanical Specifications

All specifications apply over specified input voltage, output load, and temperature range, unless otherwise noted.

Parameter	Conditions/Description	Min	Nom	Max	Units
Vibration	Halfsine wave, 10-55 Hz, 3 axes, 5 min each			5	g
Weight			2.3/68		Oz/g
Water Washing	Standard Process		Yes		
MTBF	Per Bellcore TR-NWT-000332		1,780		kHrs

Isolation Specifications

All specifications apply over specified input voltage, output load, and temperature range, unless otherwise noted.

Parameter	Conditions/Description	Min	Nom	Max	Units
Insulation Safety Rating			Basic		
Isolation Voltage		1500			VDC
Isolation Resistance		10			MΩ
Isolation Capacitance		3000			pF

Input Specifications

All specifications apply over specified input voltage, output load, and temperature range, unless otherwise noted.

Parameter	Conditions/Description	Min	Nom	Max	Units
Input Voltage	Continuous	36	48	75	VDC
Turn-On Input Voltage	Ramping Up		33		VDC
Turn-Off Input Voltage	Ramping Down		30		VDC
Turn-On Time	To Output Regulation Band 100% Resistive Load		10		ms
Input Reflected Ripple Current	Full Load, 12μH source inductance			80	mA p-p
Input Inrush Current Limit	Vin=Vin.max		1		A^2s

Changing the Shape of Power

Output Specifications

All specifications apply over specified input voltage, output load, and temperature range, unless otherwise noted.

Parameter	Conditions/Description	Min	Nom	Max	Units
Output Voltage Setpoint Accuracy	Vin=Vin.nom, Full Load	-1.5		1.5	%Vout
Output Current* Vout1	For MAX see Table	2.0			ADC
Output Current* Vout2	For MAX see Table	2.0			ADC
Line Regulation Vout1	Vin.min to Vin.max, Iout.max			0.2	%Vout
Line Regulation Vout2	Vin.min to Vin.max, Iout.max			1	%Vout
Load Regulation,Vout1,Vout2	Vin=Vnom, Iout.min to Iout.max			1	%Vout
Remote Sense Headroom				0.5	VDC
Dynamic Regulation	50-75% load step change				
Peak Deviation				4	%Vout
Settling Time	to 1% error band			500	μs
Admissible Load Capacitance	Iout.max, Nom Vin	30,000			μF
Output Current Limit Threshold**	Vout≤0.97Vout.nom	115		140	%Iout
Switching Frequency			270		kHz
Overvoltage Protection, Non Latching	Over all input voltage and load conditions	120		140	%Vout
Trim Range	Iout.max, Vin=Vnom	90		110	%Vout

* At Iout<Iout.min, the output may contain low frequency component that exceeds ripple specifications.
** Overcurrent protection is non-latching with auto recovery.

Feature Specifications

All specifications apply over specified input voltage, output load, and temperature range, unless otherwise noted.

Parameter	Conditions/Description	Min	Nom	Max	Units
Shutdown (ON/OFF)					
Negative Logic	On/Off signal is low – converter is ON				
Converter ON		-1.0		1.8	VDC
Source Current	ON/OFF pin is connected to -Vin			1.0	mADC
Converter OFF		3.5		15	VDC
Open Circuit Voltage	ON/OFF pin is floating		2.5		VDC
Positive Logic	On/Off signal is low –converter is OFF				
Converter ON		3.5		15	VDC
Open Circuit Voltage	ON/OFF pin is floating		2.5		VDC
Converter OFF		-1.0		1.8	VDC
Source Current	ON/OFF pin is connected to -Vin			1.0	mADC
Overtemperature Protection	Case Temperature	105	110	115	°C

Characteristic Curves

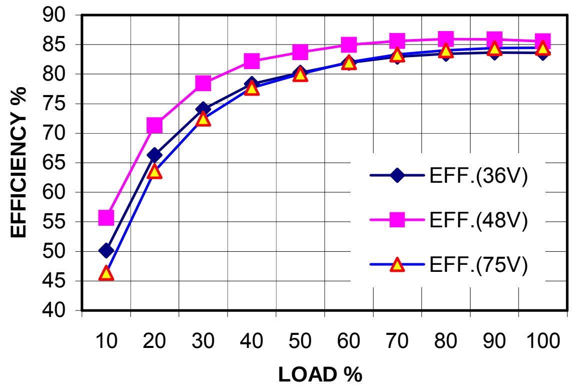


Figure 1. HHD20ZGE Efficiency vs. Output Load

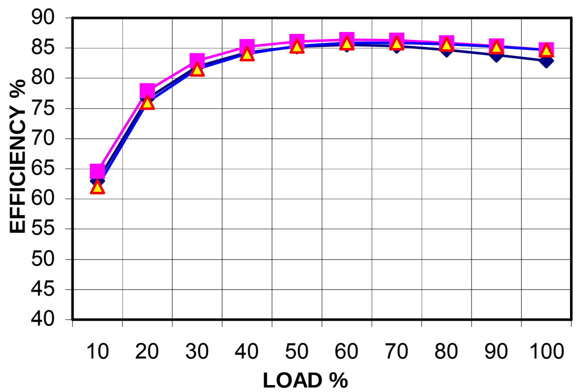


Figure 2. HHD20ZED Efficiency vs. Output Load

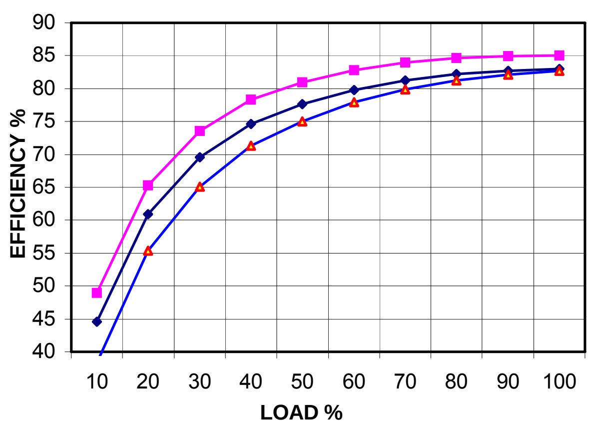


Figure 3. HHD20ZGB Efficiency vs. Output Load

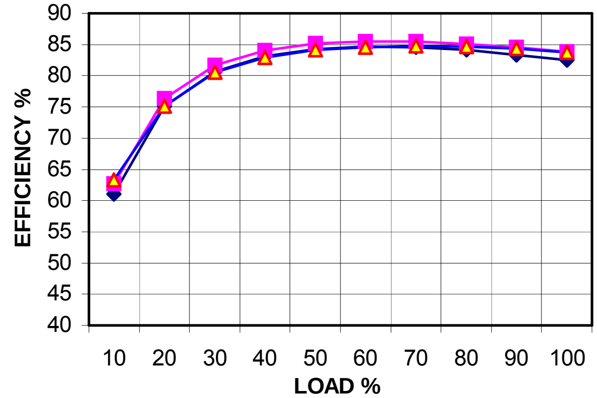


Figure 4. HHD25ZEB Efficiency vs. Output Load

Typical Application

Figure 5 shows recommended connections for the HHD Series converter.

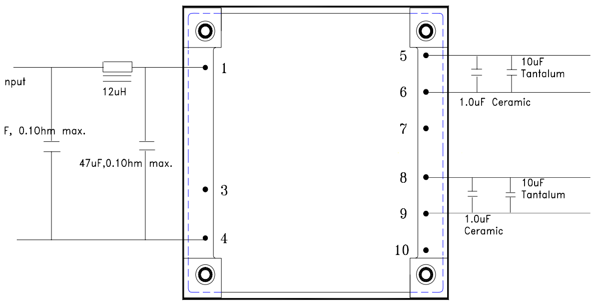


Figure 5. Typical Application of HHD Series

The HHD Series converters do not require any external components for proper operation. However, if the distribution of the input voltage to the converter contains significant inductance, the capacitor C1 may be required to enhance performance of the converter. A minimum of a 47 μF electrolytic capacitor with the ESR<0.7Ω is recommended for the HHD Series.

If the magnitude of the inrush current needs to be limited, see the “Inrush Current Control Application Note” on www.power-one.com.

For output decoupling, we recommend using a 10 μF tantalum and a 1 μF ceramic capacitor connected directly across the output pins of the converter. Note that the capacitors do not substitute the filtering required by the load.

Shutdown Feature Description

The ON/OFF pin in the HHD Series converters functions as a normal soft shutdown. It is referenced to the –Vin pin (see Figure 5). With the standard positive logic, when the ON/OFF pin is pulled low, the output is turned off and the unit goes into a very low input power mode.

With optional negative logic, when the ON/OFF pin is pulled low, the unit is turned on.

An open collector switch is recommended to control the voltage between the ON/OFF pin and the -Vin pin of the converter. The ON/OFF pin is pulled up internally, so no external voltage source is required. The user should avoid connecting a resistor between the ON/OFF pin and the +Vin pin.

When the ON/OFF pin is used to achieve remote control, the user must take care to insure that the pin reference for the control is really the -Vin pin. The control signal must not be referenced ahead of EMI filtering, or remotely from the unit. Optically coupling the information and locating the optical coupler directly at the module will solve any of these problems.

Note:
If the ON/OFF pin is not used, it can be left floating (positive logic), or connected to the -Vin pin (negative logic).

Output Voltage Trim

The trim feature allows the user to adjust the output voltage from the nominal. This can be used to accommodate a different requirement or to do production margin testing.

The general equation for changing the output voltage on the standard trim modules is invariant, but the internal values are different for different output voltages, so the constants in the equation change.

$$R_{TRIM} = \frac{A - B \times \Delta V}{\Delta V}, \quad \text{k}\Omega$$

where A and B are constants from the table below, and ΔV is the absolute value of the desired change in the output voltage in Volts.

Table 1. Output 1 Trim Formula Parameter.

Model	Trim up		Trim down	
	A	B	A	B
HHD20ZGE	2.5	3.32	2.5	4.32
HHD20ZGB	2.5	3.32	2.5	4.32
HHD25ZED	2.047	5.11	3.431	6.77
HHD25ZEB	2.047	5.11	3.431	6.77

Table 2. Trim Formula Parameter.

Model	Trim up		Trim down	
	A	B	A	B
HHD20ZGE	0.80	0.365	0.256	0.685
HHD20ZGB	2.50	2.74	1.10	4.74
HHD25ZED	6.176	10.0	6.149	14.93
HHD25ZEB	2.50	2.74	1.10	4.74

The HHD Series converters feature 1500 Volt DC isolation from input to output. The input-to-output resistance is greater than 10MΩ. These converters are provided with Basic insulation between input and output circuits according to all IEC60950 based standards. Nevertheless, if the system using the converter needs to receive safety agency approval, certain rules must be followed in the design of the system. In particular, all of the creepage and clearance requirements of the end-use safety requirements must be observed. These documents include UL60950 - CSA60950-00 and EN60950, although specific applications may have other or additional requirements.

The HHD Series converters have no internal fuse. The external fuse must be provided to protect the system from catastrophic failure. The fuse with a rating not greater than 10 A is recommended. The user can select a lower rating fuse based upon the inrush transient and the maximum input current of the converter, which occurs at the minimum input voltage. Both input traces and the chassis ground trace (if applicable) must be capable of conducting a current of 1.5 times the value of the fuse without opening. The fuse must not be placed in the grounded input line, if any.

In order for the output of the HHD Series converter to be considered as SELV (Safety Extra Low Voltage) or TNV-1, according to all IEC60950 based standards, one of the following requirements must be met in the system design:

- If the voltage source feeding the module is SELV or TNV-2, the output of the converter may be grounded or ungrounded.

- If the voltage source feeding the module is ELV, the output of the converter may be considered SELV only if the output is grounded per the requirements of the standard.

- If the voltage source feeding the module is a Hazardous Voltage Secondary Circuit, the voltage source feeding the module must be provided with at least Basic insulation between the source to the converter and any hazardous voltages. The entire system, including the HHD converter, must pass a dielectric withstand test for reinforced insulation. Design of this type of system requires expert engineering and under-standing of the overall safety requirements and should be performed by qualified personnel.

Thermal Considerations

The HHD Series converters are designed for natural or forced convection cooling. The output power of the converters is determined by the maximum semiconductor junction temperature. To provide reliable long-term operation of the converters, Power-One limits maximum allowable junction temperature to 120 °C.

The graphs in Figures 6-9 show the maximum output current of the HHD Series converters at different local ambient temperatures at both natural and forced (longitudinal airflow direction, from pin 1 to pin 4) convection.

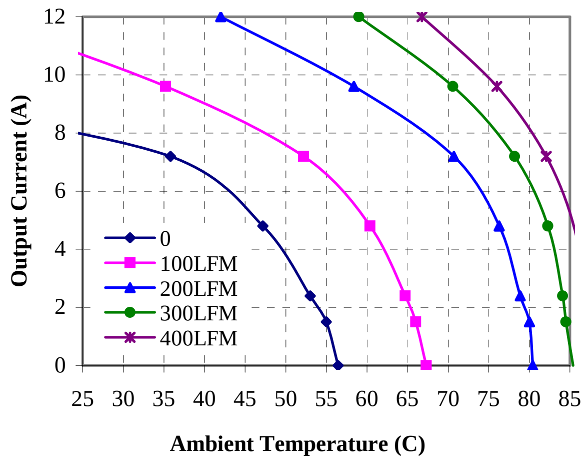


Figure 6. HHD20ZGE Derating Curves

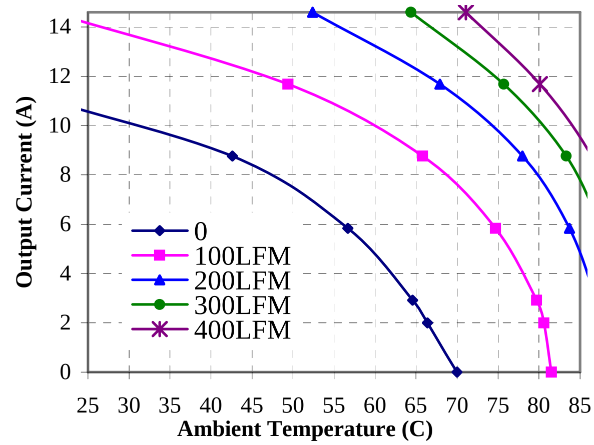


Figure 7. HHD25ZED Derating Curves

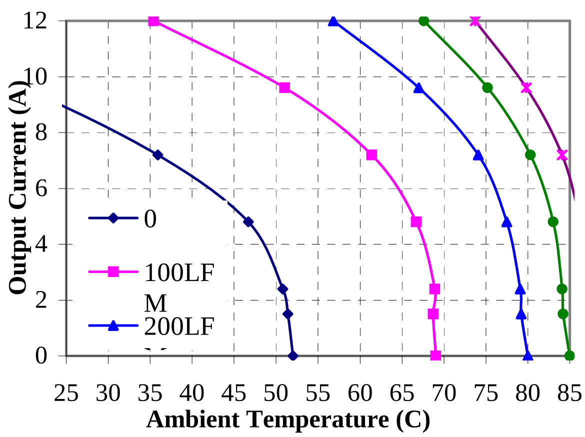


Figure 8. HD20ZGB Derating Curves

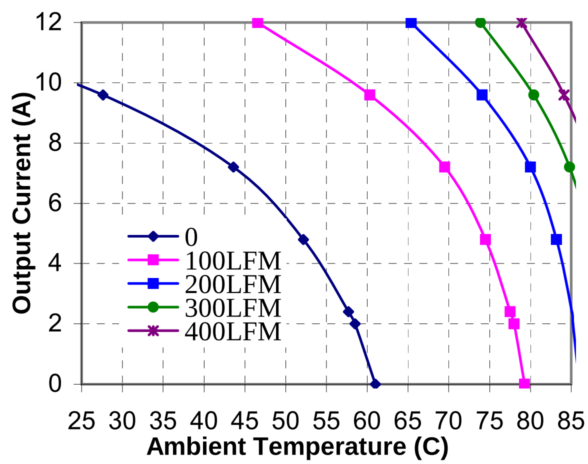
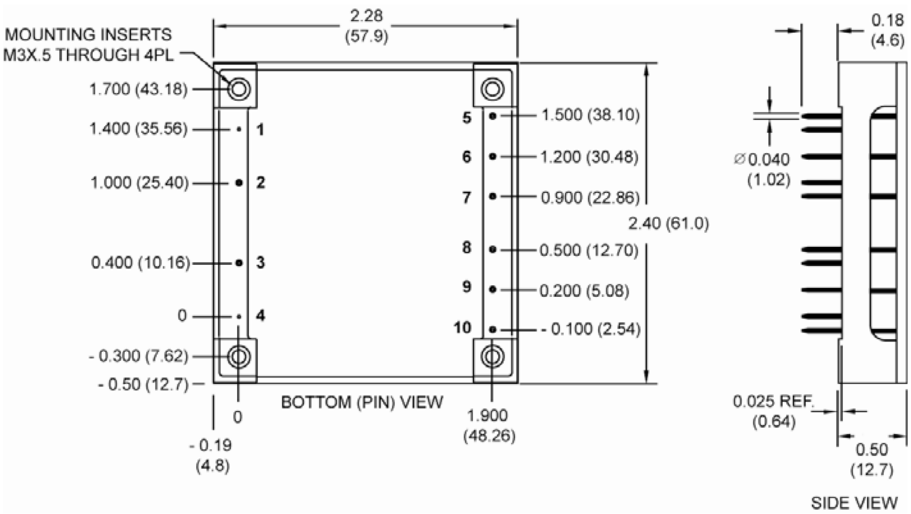


Figure 9. HHD25ZEB Derating Curves

Mechanical Drawing



Pin #	Function
1	-Vin
2	Case
3	On/Off
4	+Vin
5	+V2 out
6	V2 Return
7	V2 Trim
8	+V1 out
9	V1 Return
10	V1 Trim

Tolerances: .xx ± .020 (.5)
.xxx ± .010 (.25)
Pin diameter ± 0.002 (.05)

Ordering Information

Options	Suffixes to add to part number
Remote On/Off	Positive- Standard, no suffix required
	Negative- Add “N” suffix
Pin Length	0.18”- Standard, no suffix required
	0.11”- Add “8” suffix
	0.15”- Add “9” suffix

Notes
1. Consult factory for the complete list of available options.

NUCLEAR AND MEDICAL APPLICATIONS - Power-One products are not designed, intended for use in, or authorized for use as critical components in life support systems, equipment used in hazardous environments, or nuclear control systems without the express written consent of the respective divisional president of Power-One, Inc.

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