HLD15 Series DC-DC Converter Data Sheet
48 VDC Input, 15/15 Amp Dual Half-Brick Converter

RoHS Compliant

Features

- RoHS lead solder exemption compliant
- Single-board, multi-layer design
- Planar magnetics
- Start-up into high capacitive load
- Low profile– 0.5"
- Standard half-brick size and pinout
- 60 Watt total output power
- Independently-regulated outputs
- Flexible load distribution
- Output voltage tracking
- Output overcurrent & overvoltage protection
- Overtemperature protection
- Set point accuracy ±1.5%
- Independent output voltage trim
- 1500 VDC Input/output isolation:, Basic insulation
- UL 1950 Recognition, CSA 22.2 No. 950-95 certification, TUV IEC950

Applications

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

Description

The HLD Series are through-hole mount, **H**alf-brick, **L**ow profile, **D**ual output dc-dc high density converters. The HLD Series provides onboard conversion of telecom and datacom input voltages to isolated low output voltages without the need for a heat sink. The HLD Series is well suited for distributed power architectures, telecom equipment, and LAN/WAN and data processing applications.

Model Selection

MODEL	Input Voltage (VDC)	Input Voltage Range (VDC)	Maximum Input Current (Amps) [1]	Output Voltage (VDC)	Rated Output Current (Amps) [2]	Ripple & Noise pk-pk (mV)	Typical Efficiency [3] in %
HLD15ZGE	48	36-72	2.1	5.0/3.3	12/15	100/100	86
HLD15ZGB	48	36-72	2.1	5.0/1.8	12/15	100/100	85
HLD15ZED	48	36-72	2.1	3.3/2.5	15/15	100/100	83
HLD15ZEB	48	36-72	2.1	3.3/1.8	15/15	100/100	83

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

[1] Maximum input current at minimum input voltage, maximum rated output power.

[2] Current can be drawn from any single output to its maximum rated value, or from both outputs to a combined power level of 60W.

[3] At nominal V in , rated output.

* -G overcurrent protection is latched; all other models hiccup.

* This product is intended for integration into end-use equipment. All required procedures for CE marking of end-use equipment should be followed.

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	Continuos		75	VDC
	Transient, 100 ms		100	VDC
Operating Temperature	Ambient	-40	100	°C
Storage Temperature		-40	125	°C
ON/OFF Control Voltage	Referenced to -Vin	-1	13.5	VDC

Environmental, Mechanical & Reliability Specifications

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

Parameter	Conditions/Description	Min	Nom	Max	Units
Maximum PCB Operating Temp.				100	°C
Operating Humidity	Relative humidity, non-condensing			95	%
Storage Humidity	Relative humidity, non-condensing			95	%
Shock	Halfsine wave, 6ms, 3 axes	50			g
Sinusoidal Vibration	GR-63-Core, Section 5.4.2	1			
Weight			1.7/59		Oz/g
Water Washing	Standard process		Yes		
MTBF	Per Bellcore TR-NWT-000332		1,100		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	Input/Output	1500			VDC
Isolation Resistance	Input/Output	10			MΩ
Isolation Capacitance	Input/Output	1000			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	72	VDC
Turn-On Input Voltage	Ramping Up	30	34	36	VDC
Turn-Off Input Voltage	Ramping Down	28	30	35	VDC
Turn-On Time	To Output Regulation Band 100% Resistive Load		20		ms
Input Reflected Ripple Current	Full Load, 12 µH source inductance			80	mA p-p
Input Inrush Current Limit	Vin = Vin.max			1	A^2s

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 rated see Table	0.5			ADC
	Vout2		0			ADC
Line Regulation	Vout1	Vin.min to Vin.max, Iout.max			0.2	%Vout
	Vout2				1	%Vout
Load Regulation,	Vout1	Vin = Vnom, Iout.min to Iout.max			0.5	%Vout
	Vout2				1.0	%Vout
Output Temperature Regulation		(Tboad temp)=-40°C to +100°C)	-		0.03	%/°C
Dynamic Regulation Peak Deviation Settling Time	Vout1	50-75% load step change to 1% error band (di/d t= 1A/µs)			 4 500	 %Vout µs
Admissible Load Capacitance		Iout.max, Nom Vin		5,000		µF
Output Current Limit Threshold**		Vout≤0.97Vout.nom	110		160	%Iout
Switching Frequency				300		kHz
Overvoltage Protection, Non Latching (hiccup type)		Over all input voltage and load conditions	115		140	%Vout
Trim Range	(Vout1 and Vout2)	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
ON/OFF					
Negative Logic (-N)	ON/OFF signal is low or the pin is connected to -Vin – converter is ON				
Converter ON	Von/off in reference to -Vin	-1.0		1.8	VDC
Source Current	ON/OFF pin is connected to -Vin		0.5	1	mADC
Converter OFF	Von/off in reference to -Vin	3.5		13.5	VDC
Open Circuit Voltage	ON/OFF pin is floating			5	VDC
Positive Logic	On/Off signal is low or the pin is floating –converter is OFF				
Converter ON	Von/off in reference to -Vin	3.5		13.5	VDC
Open Circuit Voltage	ON/OFF pin is floating			5	VDC
Converter OFF	Von/off in reference to -Vin	-1.0		1.8	VDC
Source Current	ON/OFF pin is connected to -Vin		0.5	1	mADC
Output Voltage Trim [2]					
Trim Up	Vin = Vin.nom, Iout = I_{rated}			10	%Vout
Trim Down	Vin = Vin.nom, Iout = I_{rated}	-10			%Vout
Overtemperature Protection					
	PCB Temperature	105	110	120	°C
Type,					
Auto-reset (standard model)	Auto-reset upon cooling				
Latching (G p/n suffix) [1]	Recycle input voltage or ON/OFF signal to reset				

[1] Consult factory
[2] Vout1 & Vout2

Characteristic Curves

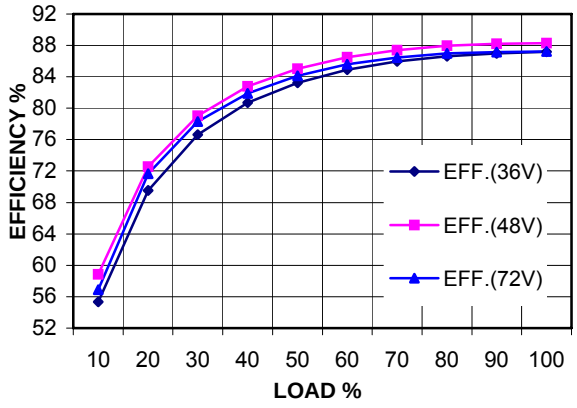


Figure 1. HLD15ZGE Efficiency vs. Output Load

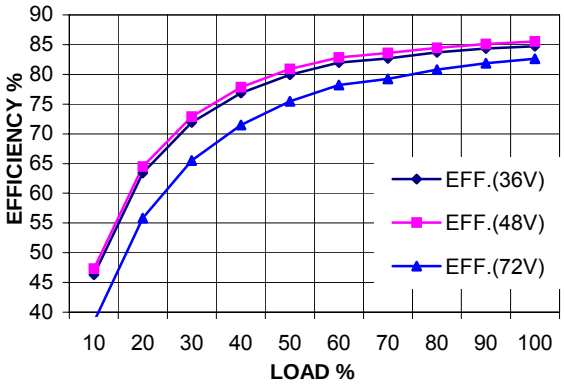


Figure 3. HLD15ZGB Efficiency vs. Output Load

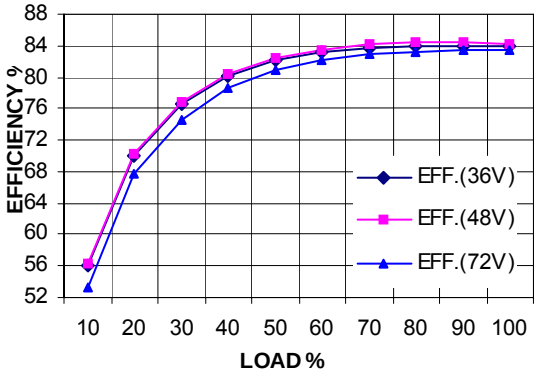


Figure 2. HLD15ZED Efficiency vs. Output Load

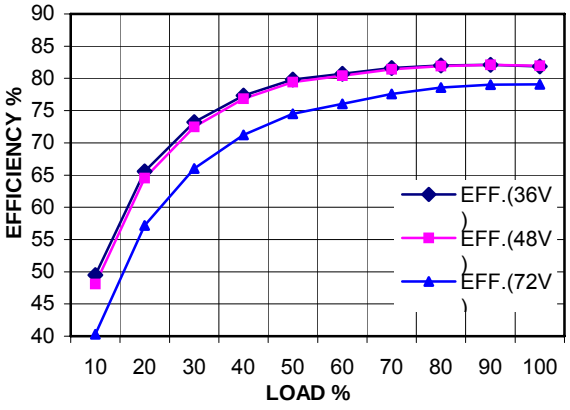


Figure 4. HLD15ZEB Efficiency vs. Output Load

Typical Application

Figure 5 below shows the recommended connections for the HLD Series converter.

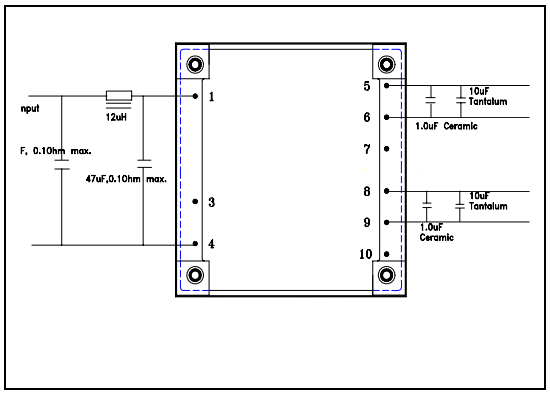


Figure 5. Typical Application of HLD Series

The HLD 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 HLD Series.

If 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 to use a 10 µF tantalum and a1 µF ceramic capacitors 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 HLD Series converters functions as a normal soft shutdown. It is referenced to the –Vin pin. 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.

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

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

Table 1. Output 1 Trim Formula Parameters

Model	Trim Up		Trim Down	
	A	B	A	B
HLD15ZGE	3.774	5.11	11.376	8.14
HLD15ZGB	3.774	5.11	11.376	8.14
HLD15ZED (-G)	2.047	5.11	3.431	6.77
HLD15ZEB	2.047	5.11	3.431	6.77

Table 2. Output 2 Trim Formula Parameters

Model	Trim Up		Trim Down	
	A	B	A	B
HLD15ZGE	0.80	0.365	0.256	0.685
HLD15ZGB	2.50	2.74	1.10	4.74
HLD15ZED (-G)	6.176	10.0	6.149	14.93
HLD15ZEB	2.50	2.74	1.10	4.74

Notes:
1. When the output voltage is trimmed up, the output power from the converter must not exceed its maximum rating. This is determined by measuring the output voltage on the output pins, and multiplying it by the output current.

2. The HLD Series converters will trim down further than the 10% limit. In general, this is permissible. The user must confirm that the results are acceptable in the application.

Ripple and Noise

To improve accuracy and repeatability of ripple and noise measurements, Power-One utilizes the test setup shown in Figure 6.

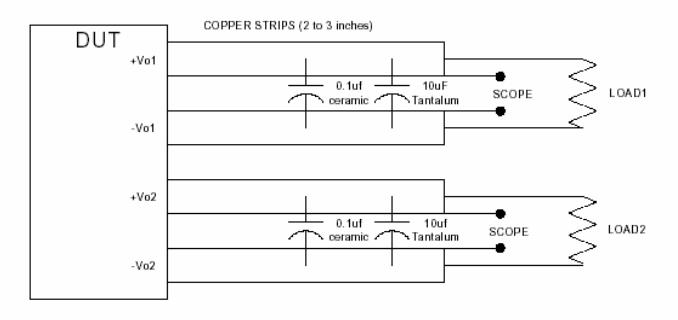


Figure 6. . Output Ripple & Noise Measurement Test Setup

A BNC connector is used for the measurements to eliminate noise pickup associated with long ground leads of conventional scope probes. The connector, a 0.1 μF ceramic and a 10 μF tantalum capacitors, and the load are located 2-3" away from the converter.

Safety Considerations

The HLD 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 HLD 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 3.15 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 HLD 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 HLD converter, must pass a dielectric withstand test for Reinforced insulation. Design of this type of systems requires expert engineering and understanding of the overall safety requirements and should be performed by qualified personnel.

Thermal Considerations

The HLD 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 7-10 show the maximum output current of the HLD Series converters at different local ambient temperatures at both natural and forced (longitudinal airflow direction, from pin 1 to pin 4) convection.

Iout1=Iout2 for all derating curves.

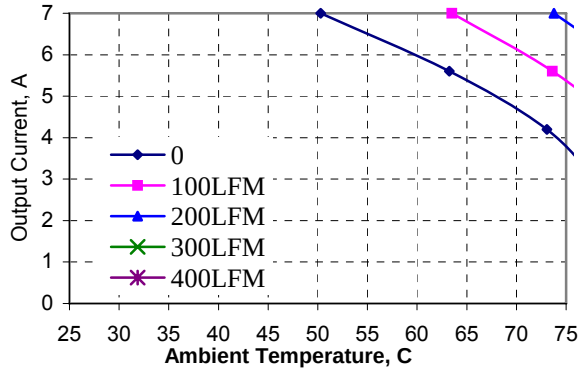


Figure 7. HLD15ZGE Derating Curves

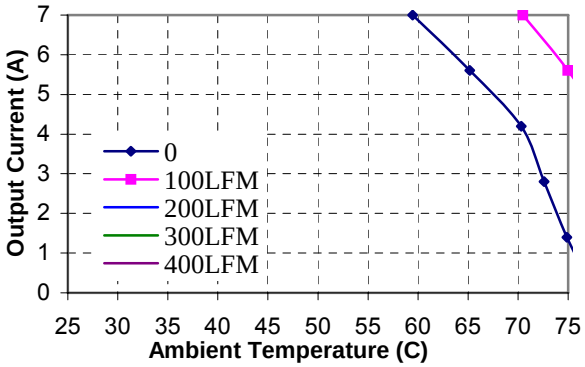


Figure 9. HLD15ZGB Derating Curves

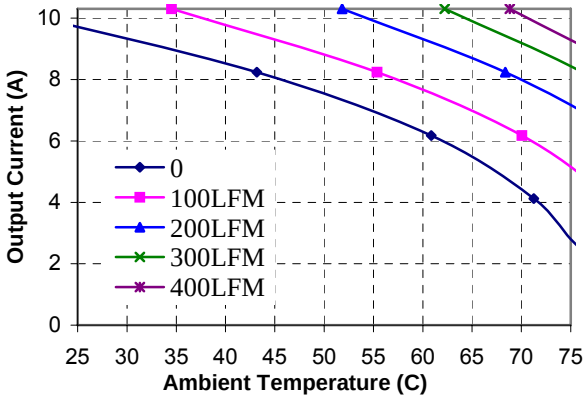


Figure 8. HLD15ZED Derating Curves

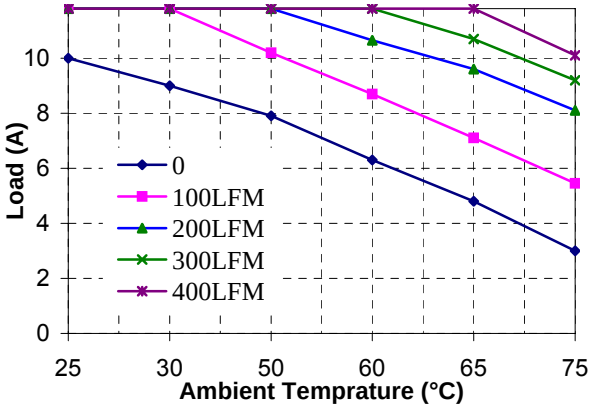
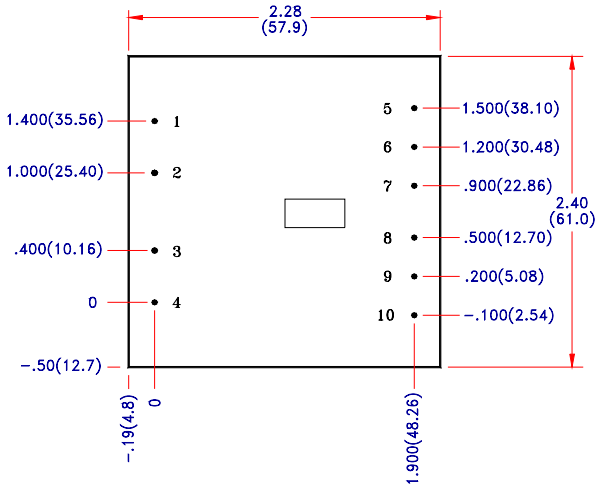
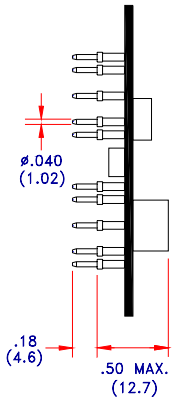


Figure 10. HLD15ZEB Derating Curves

Mechanical Drawing



Bottom View *Units: inches (mm)*



Side View

Pin	Function
1	-Vin
2	No Pin
3	On/Off
4	+Vin
5	+Vout2
6	Vout2 Rtn
7	Vout2 Trim
8	+Vout1
9	Vout1 Rtn
10	Vout1 Trim

Mechanical Tolerances

Inches	Millimeters
X.XX ± 0.020	X.X ± 0.5
X.XXX ± 0.010	X.XX ± 0.25
Pin	
± 0.002	± 0.05

Ordering Information

Options	Suffixes to add to part number
Remote ON/OFF	Positive- no suffix required
	Negative - Add “N” suffix
Pin Length	0.18”- Standard, no suffix required
	0.145”- Add “7” suffix [1]
	0.110”- Add “8” suffix [1]

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