Wall Industries, Inc.

DATASHEET
Rev. A

DH40 SERIES

2:1 Wide Input Voltage Ranges
Single & Dual Outputs, Efficiency up to 92%
2.0” x 1.0” x 0.4” Encapsulated Shielded Metal Package
40 Watt DC/DC Power Converters

FEATURES

- RoHS Compliant
- 40 Watts Output Power
- 2:1 Wide Input Voltage Ranges
- Single & Dual Outputs
- Remote ON/OFF Control
- 1500VDC I/O Isolation
- High Efficiency up to 92%
- Under Voltage Lockout (UVLO)
- 2.0” x 1.0” x 0.4” Package Size
- Trimmable Output Voltage
- Shielded Metal Case with Isolated Base-plate
- -40°C to +80°C Operating Temperature Range
- Over Load, Short Circuit, Over Voltage, and Over Temperature Protection
- UL/IEC/EN 60950-1 Safety Approvals (Pending)
- Heatsink (Optional)

DESCRIPTION

The DH40 series is the latest generation of high performance DC/DC converters setting a new standard concerning power density. These converters offer 40 Watts of continuous output power in a 2.0” x 1.0” x 0.4” encapsulated, shielded metal package. The DH40 series has single and dual output models with 2:1 wide input voltage ranges of 9-18VDC, 18-36VDC, and 36-75VDC. Advanced circuit topology provides a very high efficiency up to 92% and an operating temperature range of -40°C to +80°C. Further features include remote on/off, trimmable output voltage, under-voltage lockout as well as over load, over voltage, short circuit, and over-temperature protection. These converters are RoHS compliant and are ideal for use in battery operated equipment, instrumentation, distributed power architectures in communication and industrial electronics and many other space critical applications.

SPECIFICATIONS: DH40 SERIES

All specifications are based on 25°C, Nominal Input Voltage, and Maximum Output Current unless otherwise noted.
We reserve the right to change specifications based on technological advances.

SPECIFICATION		TEST CONDITIONS		Min	Typ	Max	Unit
INPUT SPECIFICATIONS							
Input Voltage Range		12VDC nominal input models		9	12	18	VDC
		24VDC nominal input models		18	24	36	
		48VDC nominal input models		36	48	75	
Input Surge Voltage (1s max.)		12VDC nominal input models		-0.7		25	VDC
		24VDC nominal input models		-0.7		50	
		48VDC nominal input models		-0.7		100	
Start-up Threshold Voltage		12VDC nominal input models				9	VDC
		24VDC nominal input models				18	
		48VDC nominal input models				36	
Under Voltage Lockout (UVLO)		12VDC nominal input models			8.3		VDC
		24VDC nominal input models			16.5		
		48VDC nominal input models			33		
Start-up Time	Power Up	Nominal Vin and constant resistive load				30	ms
	Remote On/Off					30	
Input Current				See Table			
Reflected Ripple Current *(Page 11)*				See Table			
Internal Filter		for EN55022 Class A compliance see page 3		LC Filter			
Input Fuse *(Note 3)*		12VDC nominal input models		8000mA slow-blow type			
		24VDC nominal input models		4000mA slow-blow type			
		48VDC nominal input models		2000mA slow-blow type			
Short Circuit Current				Hiccup mode 1.5Hz typ.			
OUTPUT SPECIFICATIONS							
Output Voltage				See Table			
Output Voltage Balance		Dual Output Models, Balanced loads				±2.0	%
Line Regulation		Low line to high line at full load				±0.5	%
Load Regulation		Single Output Models	Minimum load to full load			±0.5	%
		Dual Output Models				±1.0	
Load Cross Regulation (Dual Output Models)		Asymmetrical load 25% / 100% full load				±5.0	%
Output Voltage Setting Accuracy		At 50% load and nominal Vin				±1.0	%Vnom
Output Voltage Trim *(Page 10)*		% of nominal output voltage		±10			%
Output Power				See Table			
Output Current				See Table			
Minimum Load		Single Output Models		No minimum load required			
		Dual Output Models		See Table			
Ripple & Noise (0-20MHz) *(Page 12)*		Measured with a 1µF M/C and a 10µF T/C in parallel	3.3 & 5VDC Output Models		100		mVp-p
			12, 15, & 24VDC Output Models		150		
			Dual Output Models		150		
Transient Recovery Time *(Note 2)*		25% load step change			250		µs
Temperature Coefficient						±0.02	%/°C
PROTECTION							
Input Polarity Protection				none			
Over Voltage Protection *(page 11)*				See Table			
Over Load Protection				Current limitation at 150% typ. of Io max., hiccup			
Thermal Protection		Shutdown temperature			110		°C
Short Circuit Protection				Hiccup, automatic recovery			
REMOTE ON/OFF *(Page 11)*							
Positive Logic	Converter On			3.5~12V or open circuit			
	Converter Off			0V ~ 1.2 or short circuit			
Control Input Current	On	Vctrl = 5.0V			0.5		mA
	Off	Vctrl = 0V			-0.5		
Control Common				Referenced to negative input			
Stand-by Input Current		Nominal Vin			2.5		mA

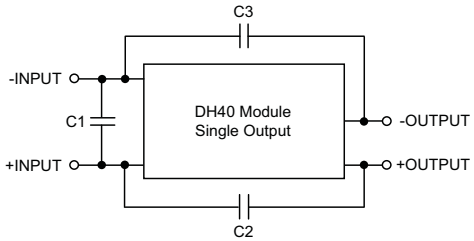
SPECIFICATIONS: DH40 SERIES

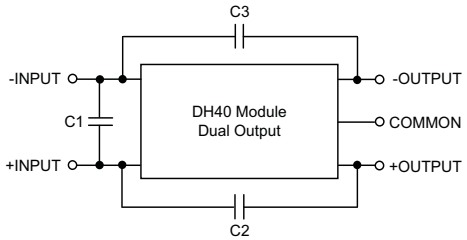
All specifications are based on 25°C, Nominal Input Voltage, and Maximum Output Current unless otherwise noted.
We reserve the right to change specifications based on technological advances.

SPECIFICATION	TEST CONDITIONS		Min	Typ	Max	Unit
GENERAL						
Efficiency	*(see efficiency curves on pages 6~8)*		See Table			
Switching Frequency				320		KHz
Isolation Voltage (Input to Output)	60 seconds		1500			VDC
Isolation Resistance	500VDC		1000			MΩ
Isolation Capacitance	100kHz, 1V				1500	pF
Maximum Capacitive Load			See Table			
ENVIRONMENTAL SPECIFICATIONS						
Operating Temperature (W/O Heatsink) *(see derating curves on page 5)*	Natural air convection (20LFM) Nominal Vin and full load	3.3VDC Output Models	-40		+66	°C
		5, 12, & 15VDC Output Models	-40		+46	
		Dual Output Models	-40		+40	
Operating Temperature (W/ Heatsink) *(see derating curves on page 5)*	Natural air convection (20LFM) Nominal Vin and full load	3.3VDC Output Models	-40		+73	°C
		5, 12, & 15VDC Output Models	-40		+57	
		Dual Output Models	-40		+52	
Thermal Impedance (W/O Heatsink)	Natural convection (20LFM)		12.0			°C/W
	100LFM convection		9.0			
	200LFM convection		8.0			
	400LFM convection		6.0			
Thermal Impedance (W/ Heatsink)	Natural convection (20LFM)		10.0			°C/W
	100LFM convection		5.4			
	200LFM convection		4.5			
	400LFM convection		3.0			
Case Temperature					+105	°C
Storage Temperature			-50		+125	°C
Humidity (non-condensing)					95	% RH
RFI			Six-sided shielded metal case			
Cooling	Natural convection is about 20LFM and is not still air (0LFM)		natural convection			
Lead Temperature	1.5mm from case for 10 seconds				260	°C
MTBF (calculated)	MIL-HDBK-217F at 25°C, Ground Benign		328,000			hours
PHYSICAL SPECIFICATIONS						
Weight			1.06oz (30g)			
Dimensions (L x W x H)			2.0 x 1.0 x 0.43 inches (50.8 x 25.4 x 11 mm)			
Case Material			Aluminum alloy, black anodized coating			
Base Material			FR4 PCB (flammability to UL 94V-0 rated)			
Potting Material			Epoxy (UL94-V0)			
Pin Material			Copper alloy with gold plate over nickel underplate			
Heatsink (optional)			See page 9			
SAFETY						
Safety Approvals (pending)	UL/cUL 60950-1 recognition (CSA certificate), IEC/EN 60950-1 (CB-scheme)					

EMI-FILTER TO MEET EN55022, CLASS A; FCC PART 15, LEVEL A

Conducted and Radiated Emissions EN55022 Class A





Part No	DH12SXX-40	DH24SXX-40	DH48SXX-40
C1	10µF/25V 1812 MLCC	4.7µF/50V 1812 MLCC	2.2µF/100V 1812 MLCC
C2, C3	1000pF/2KV 1808 MLCC	1000pF/2KV 1808 MLCC	1000pF/2KV 1808 MLCC

Part No	DH12DXX-40	DH24DXX-40	DH48DXX-40
C1	10µF/25V 1812 MLCC	4.7µF/50V 1812 MLCC	2.2µF/100V 1812 MLCC
C2, C4	1000pF/2KV 1808 MLCC	1000pF/2KV 1808 MLCC	1000pF/2KV 1808 MLCC

MODEL SELECTION TABLE

SINGLE OUTPUT MODELS

Model Number	Input Voltage	Output Voltage	Output Current		Input Current		Reflected Ripple Current (Typ)	Over Voltage Protection	Output Power	Efficiency	Maximum Capacitive Load
			Min	Max	No Load	Max Load					
DH12S3.3-26	12 VDC (9 – 18 VDC)	3.3 VDC	0mA	8A	120mA	2.47A	50mA	3.9 VDC	26.4W	89%	21000µF
DH12S5-40		5 VDC	0mA	8A	160mA	3.75A		6.2 VDC	40W	89%	13600µF
DH12S12-40		12 VDC	0mA	3.33A	160mA	3.75A		15 VDC	40W	89%	2400µF
DH12S15-40		15 VDC	0mA	2.67A	150mA	3.7A		18 VDC	40W	90%	1500µF
DH12S24-40		24 VDC	0mA	1.67A	160mA	3.79A		30 VDC	40W	88%	600µF
DH24S3.3-26	24 VDC (18 – 36 VDC)	3.3 VDC	0mA	8A	75mA	1.22A	30mA	3.9 VDC	26.4W	90%	21000µF
DH24S5-40		5 VDC	0mA	8A	80mA	1.83A		6.2 VDC	40W	91%	13600µF
DH24S12-40		12 VDC	0mA	3.33A	85mA	1.83A		15 VDC	40W	91%	2400µF
DH24S15-40		15 VDC	0mA	2.67A	75mA	1.83A		18 VDC	40W	91%	1500µF
DH24S24-40		24 VDC	0mA	1.67A	85mA	1.85A		30 VDC	40W	90%	600µF
DH48S3.3-26	48 VDC (36 – 75 VDC)	3.3 VDC	0mA	8A	40mA	610mA	20mA	3.9 VDC	26.4W	90%	21000µF
DH48S5-40		5 VDC	0mA	8A	50mA	920mA		6.2 VDC	40W	91%	13600µF
DH48S12-40		12 VDC	0mA	3.33A	50mA	910mA		15 VDC	40W	92%	2400µF
DH48S15-40		15 VDC	0mA	2.67A	50mA	910mA		18 VDC	40W	92%	1500µF
DH48S24-40		24 VDC	0mA	1.67A	50mA	920mA		30 VDC	40W	90%	600µF

DUAL OUTPUT MODELS

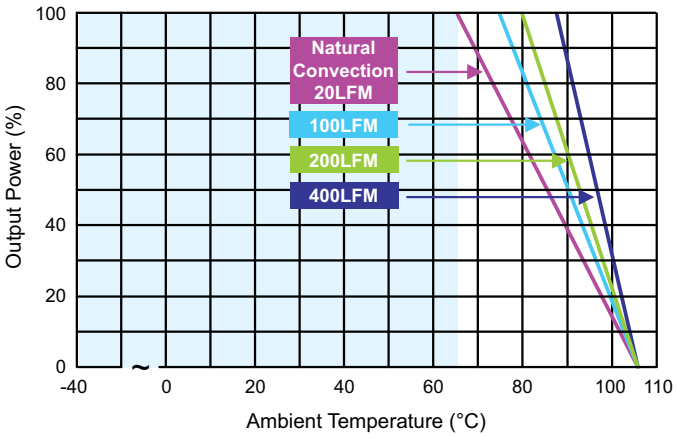
Model Number	Input Voltage	Output Voltage	Output Current		Input Current		Reflected Ripple Current (Typ)	Over Voltage Protection	Output Power	Efficiency	Maximum (1) Capacitive Load
			Min	Max	No Load	Max Load					
DH12D12-40	12 VDC (9 – 18 VDC)	±12 VDC	±145mA	±1.67A	70mA	3.79A	50mA	±15 VDC	40W	88%	1200µF*
DH12D15-40		±15 VDC	±110mA	±1.33A	60mA	3.79A		±18 VDC	40W	88%	750µF*
DH24D12-40	24 VDC (18 – 36 VDC)	±12 VDC	±145mA	±1.67A	50mA	1.87A	30mA	±15 VDC	40W	89%	1200µF*
DH24D15-40		±15 VDC	±110mA	±1.33A	45mA	1.87A		±18 VDC	40W	89%	750µF*
DH48D12-40	48 VDC (36 – 75 VDC)	±12 VDC	±145mA	±1.67A	65mA	940mA	20mA	±15 VDC	40W	89%	1200µF*
DH48D15-40		±15 VDC	±110mA	±1.33A	65mA	940mA		±18 VDC	40W	89%	750µF*

NOTES

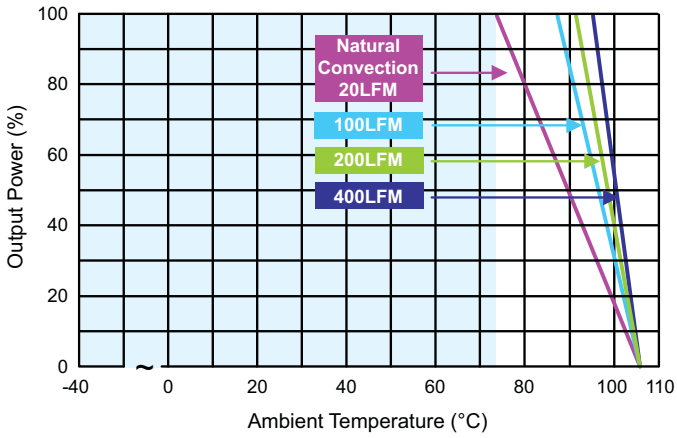
1. "*" for each output
2. Transient recovery time is measured to within 1% error band for a step change in output load from 75% to 100%.
3. All DC/DC converters should be externally fused at the front end for protection.
4. To order the converter with a heatsink, please add the suffix "HS" to the model number. (Ex: DH12S12-40HS)
5. To order the converter without Remote on/off control, please add the suffix "N" to the model number. (Ex: DH12S12-40N)

POWER DERATING CURVES

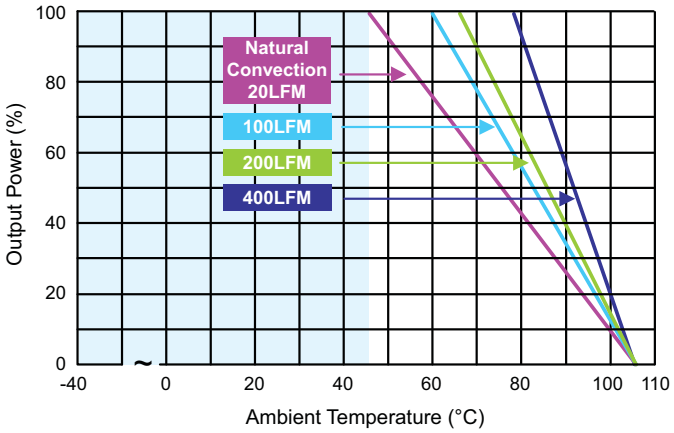
DHXXS3.3-26 Derating Curve without Heatsink



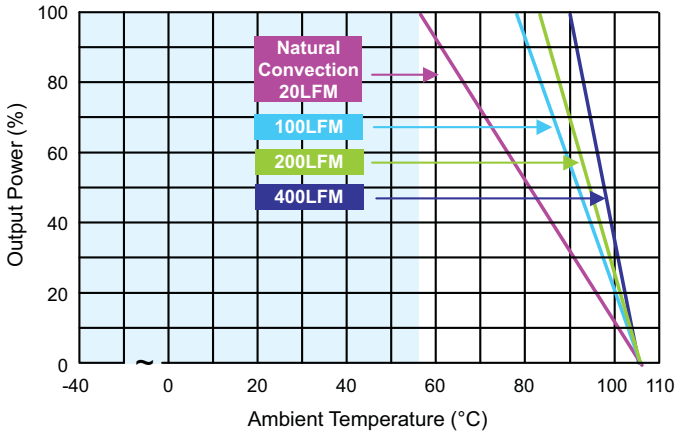
DHXXS3.3-26 Derating Curve with Heatsink



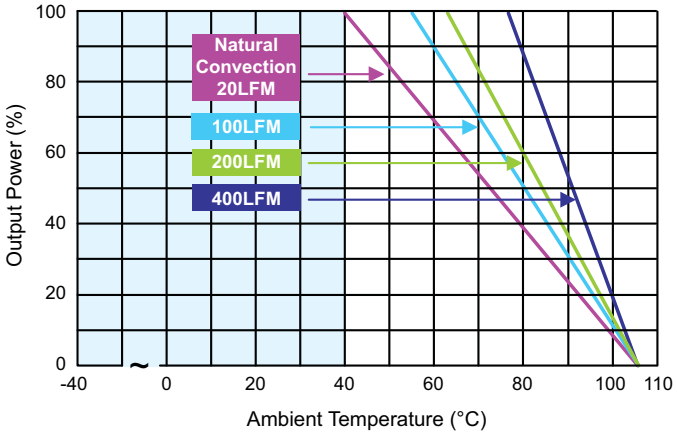
DHXXS5-40, DHXXS12-40, DHXXS15-40 Derating Curve without Heatsink



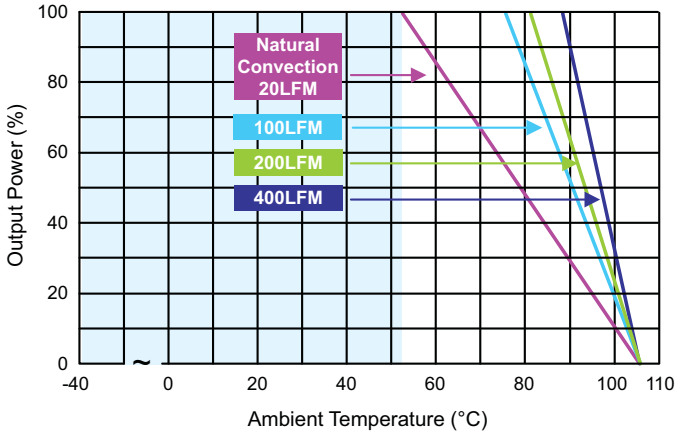
DHXXS5-40, DHXXS12-40, DHXXS15-40 Derating Curve with Heatsink



DHXXDXX-40 Derating Curve without Heatsink

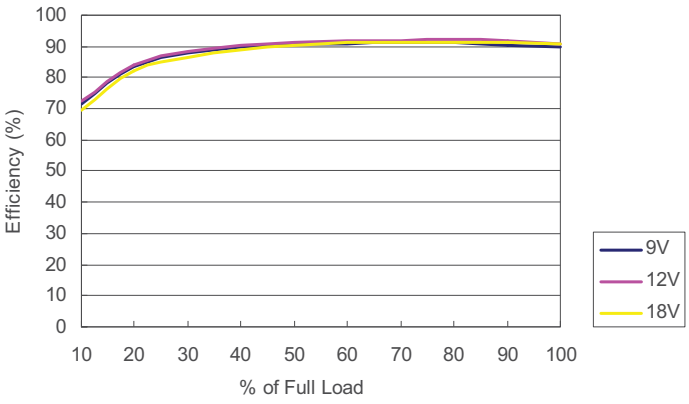


DHXXDXX-40 Derating Curve with Heatsink

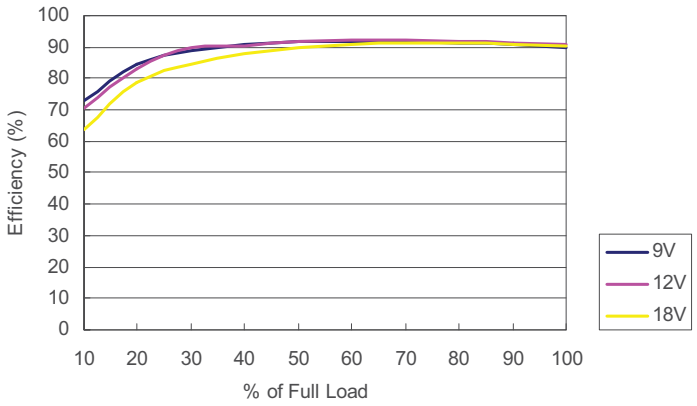


EFFICIENCY CURVES @ 25°C (12VDC INPUT MODELS)

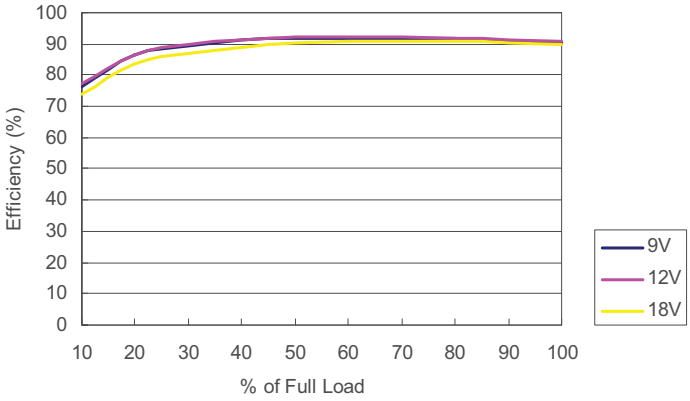
DH12S3.3-26 Efficiency vs Load Current



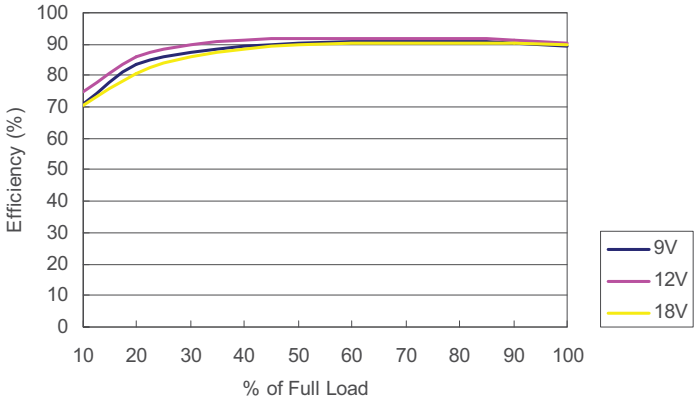
DH12S5-40 Efficiency vs Load Current



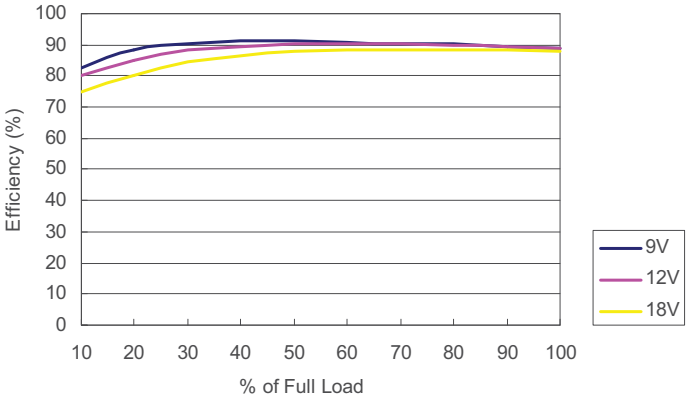
DH12S12-40 Efficiency vs Load Current



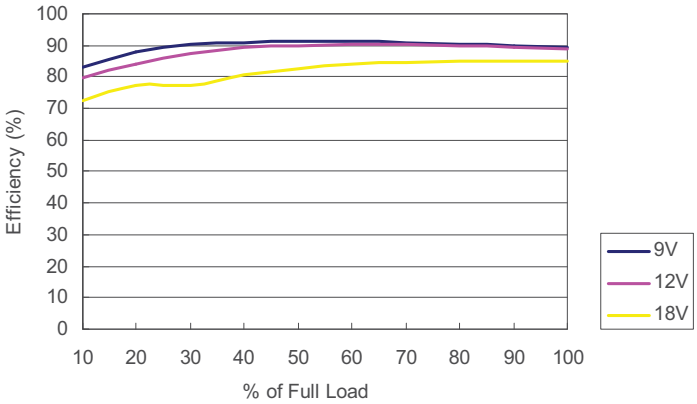
DH12S15-40 Efficiency vs Load Current



DH12D12-40 Efficiency vs Load Current

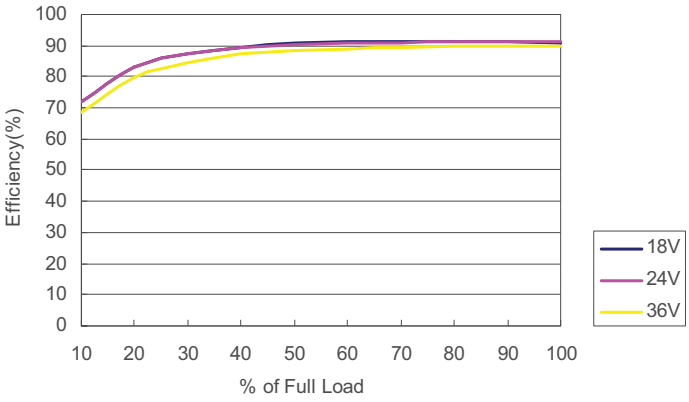


DH12D15-40 Efficiency vs Load Current

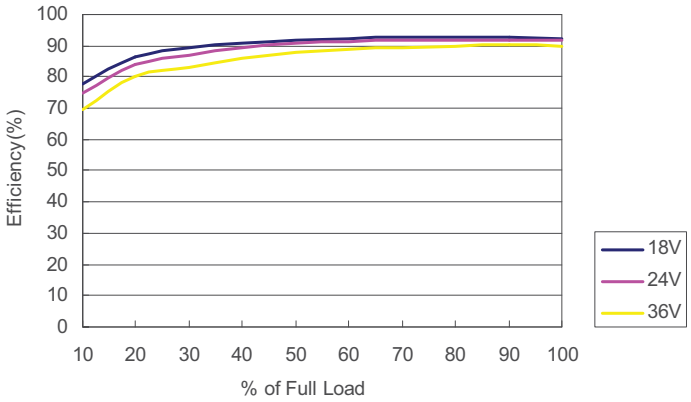


EFFICIENCY CURVES @ 25°C (24VDC INPUT MODELS)

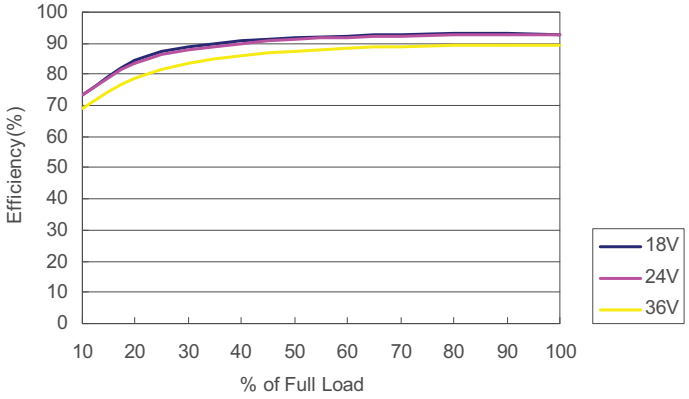
DH24S3.3-26 Efficiency vs Load Current



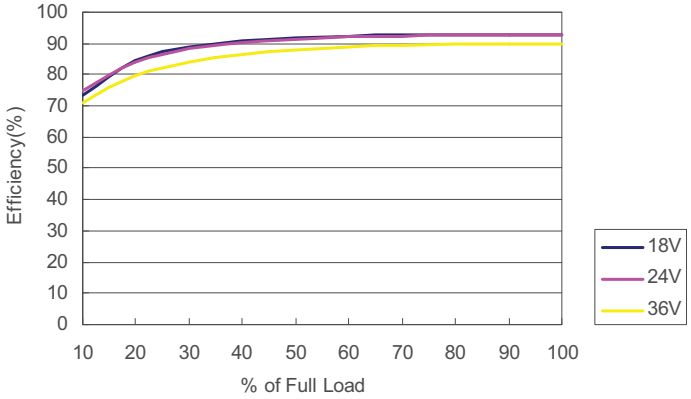
DH24S5-40 Efficiency vs Load Current



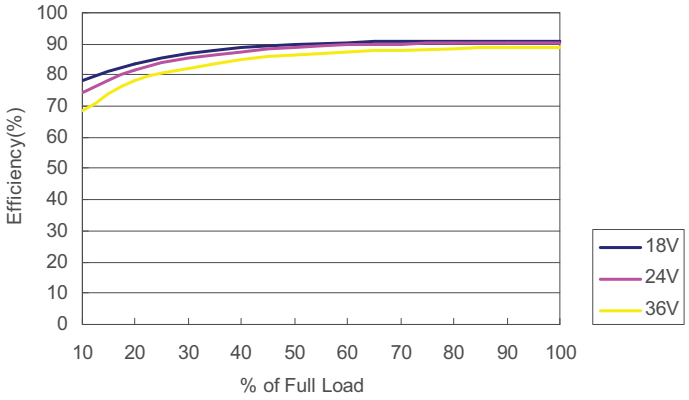
DH24S12-40 Efficiency vs Load Current



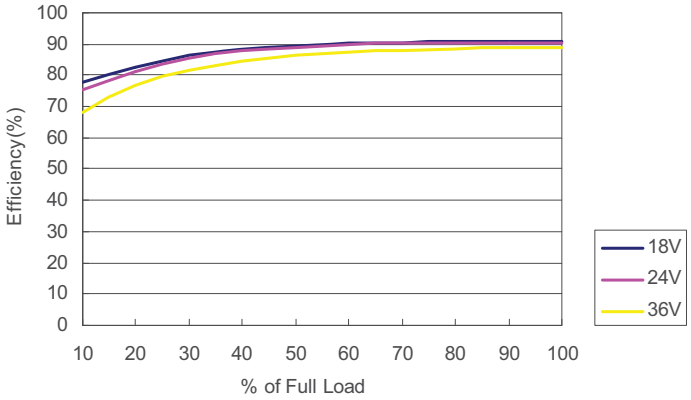
DH24S15-40 Efficiency vs Load Current



DH24D12-40 Efficiency vs Load Current

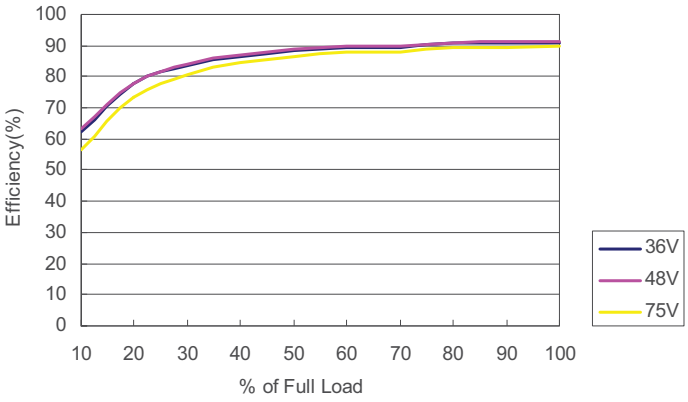


DH24D15-40 Efficiency vs Load Current

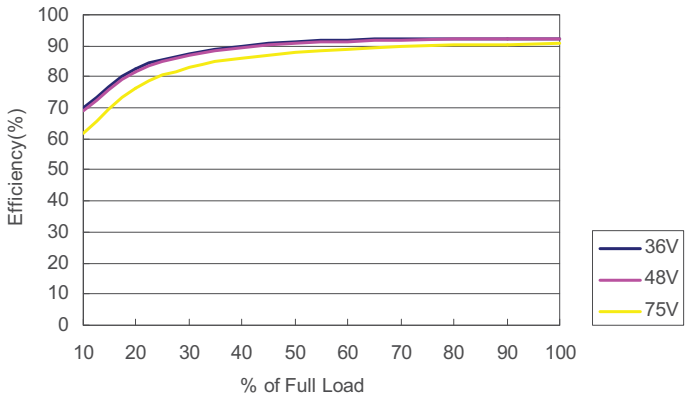


EFFICIENCY CURVES @ 25°C (48VDC INPUT MODELS)

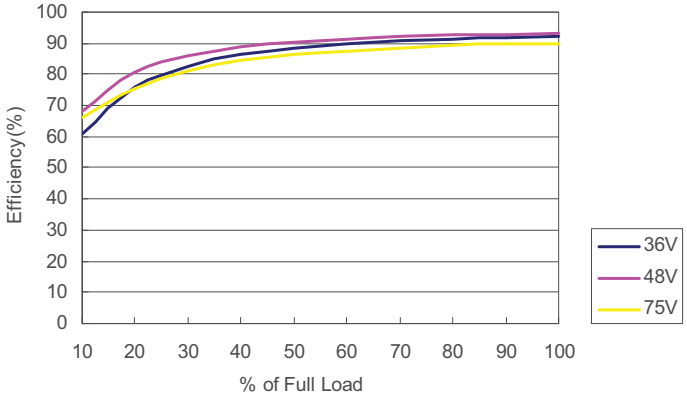
DH48S3.3-26 Efficiency vs Load Current



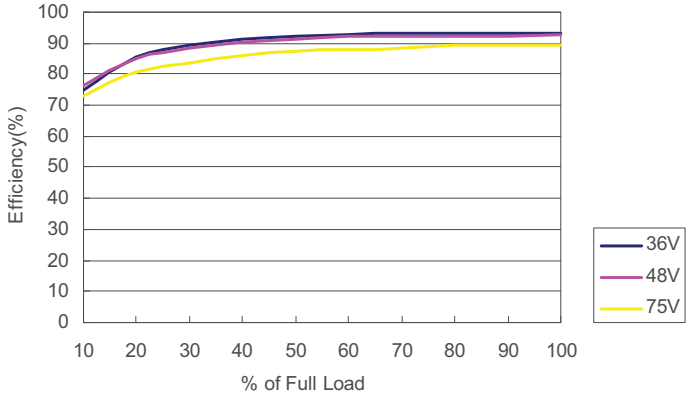
DH48S5-40 Efficiency vs Load Current



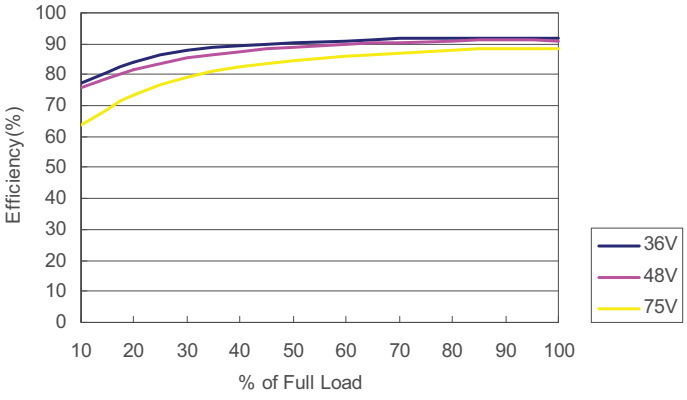
DH48S12-40 Efficiency vs Load Current



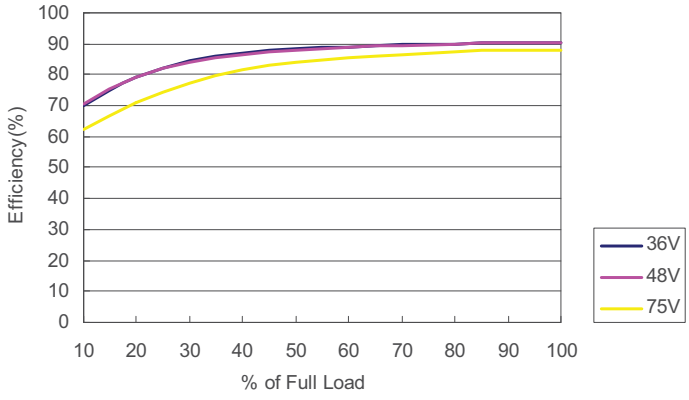
DH48S15-40 Efficiency vs Load Current



DH48D12-40 Efficiency vs Load Current

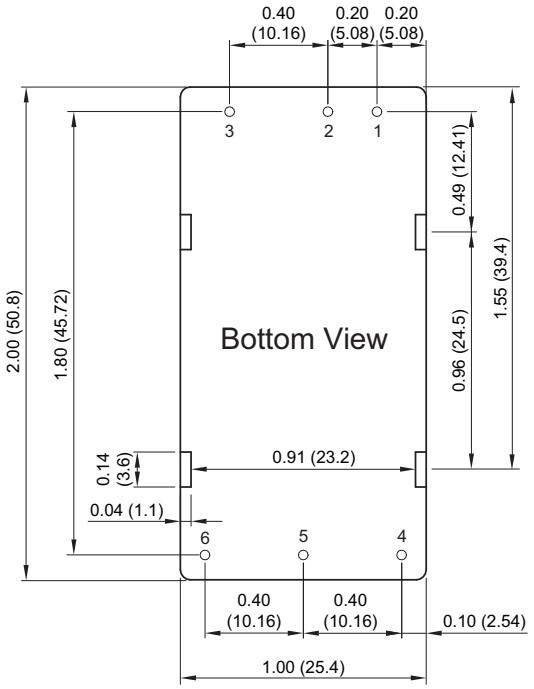


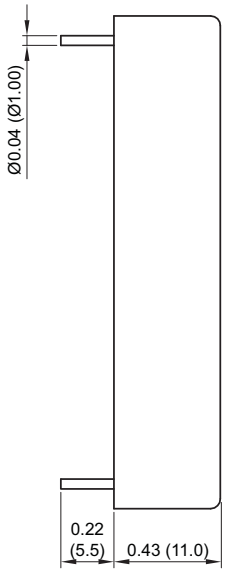
DH48D15-40 Efficiency vs Load Current



MECHANICAL DRAWING

Unit: inches (mm)





PIN CONNECTIONS		
Pin	**Single Output**	**Dual Output**
1	+Vin	+Vin
2	-Vin	-Vin
3	Remote On/Off	Remote On/Off
4	+Vout	+Vout
5	-Vout	Common
6	Trim	-Vout

Tolerance: X.XX±0.01 (X.X±0.25)
X.XXX±0.005 (X.XX±0.13)

Pin Diameter: Ø0.04±0.002 (Ø1.0±0.05)

Physical Characteristics

Case Size: 2.0 x 1.0 x 0.43 inches (50.8 x 25.4 x 11 mm)

Case Material: Aluminum alloy, black anodized coating

Base Material: FR4 PCB (flammability to UL 94V-0 rated)

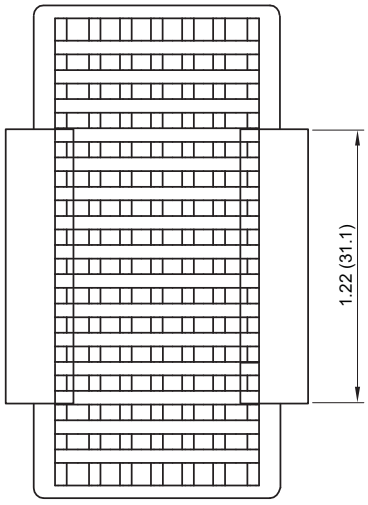
Pin Material: Copper alloy with gold plate over nickel underplate

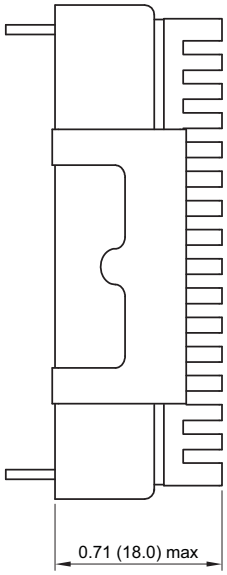
Potting Material: Epoxy (UL94-V0)

Weight: 1.06oz (30g)

Heatsink Option (“HS” Suffix)

Unit: inches (mm)





Physical Characteristics

Heatsink Material: Aluminum

Finish: Black Anodized Coating

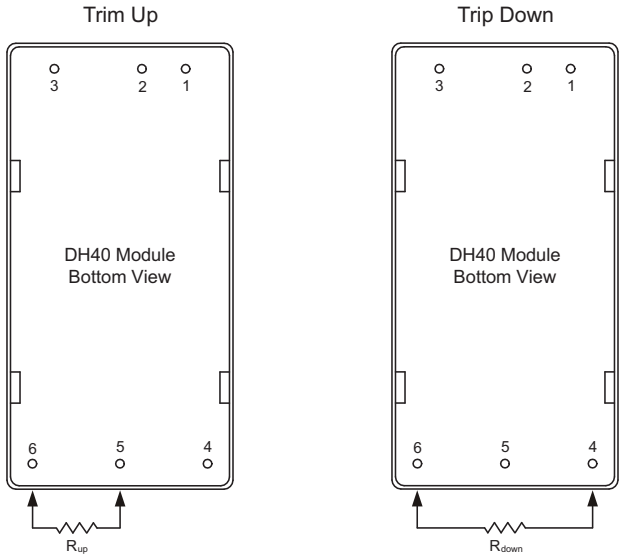
Weight: 0.3oz (9g)

Advantages of Adding a Heatsink

1. To help heat dissipation and increase the stability and reliability of DC/DC converters at high operating temperature atmosphere.
2. To upgrade the operating temperature of DC/DC converters, please refer to Derating Curves.

EXTERNAL OUTPUT TRIM

Output can be externally trimmed by using the method shown below



DHXXS3.3-26 TRIM TABLE				
Trim	$Trim_{up}$	R_{up}	$Trim_{down}$	R_{down}
1%	3.333V	70.50kΩ	3.267V	63.59kΩ
2%	3.366V	29.28kΩ	3.234V	30.28kΩ
3%	3.399V	16.87kΩ	3.201V	18.19kΩ
4%	3.432V	10.90kΩ	3.168V	11.95kΩ
5%	3.465V	7.38kΩ	3.135V	8.13kΩ
6%	3.498V	5.06kΩ	3.102V	5.56kΩ
7%	3.531V	3.42kΩ	3.069V	3.70kΩ
8%	3.564V	2.20kΩ	3.036V	2.31kΩ
9%	3.597V	1.25kΩ	3.003V	1.21kΩ
10%	3.630V	0.49kΩ	2.970V	0.34kΩ

DHXXS5-40 TRIM TABLE				
Trim	$Trim_{up}$	R_{up}	$Trim_{down}$	R_{down}
1%	5.050V	36.57kΩ	4.950V	45.53kΩ
2%	5.100V	16.58kΩ	4.900V	20.61kΩ
3%	5.150V	9.92kΩ	4.850V	12.31kΩ
4%	5.200V	6.59kΩ	4.800V	8.15kΩ
5%	5.250V	4.59kΩ	4.750V	5.66kΩ
6%	5.300V	3.25kΩ	4.700V	4.00kΩ
7%	5.350V	2.30kΩ	4.650V	2.81kΩ
8%	5.400V	1.59kΩ	4.600V	1.92kΩ
9%	5.450V	1.03kΩ	4.550V	1.23kΩ
10%	5.500V	0.59kΩ	4.500V	0.68kΩ

DHXXS12-40 TRIM TABLE				
Trim	$Trim_{up}$	R_{up}	$Trim_{down}$	R_{down}
1%	12.120V	368.92kΩ	11.880V	394.50kΩ
2%	12.240V	161.92kΩ	11.760V	179.74kΩ
3%	12.360V	94.97kΩ	11.640V	106.08kΩ
4%	12.480V	61.86kΩ	11.520V	68.86kΩ
5%	12.600V	42.12kΩ	11.400V	46.39kΩ
6%	12.720V	29.00kΩ	11.280V	31.36kΩ
7%	12.840V	19.66kΩ	11.160V	20.60kΩ
8%	12.960V	12.66kΩ	11.040V	12.51kΩ
9%	13.080V	7.23kΩ	10.920V	6.21kΩ
10%	13.200V	2.89kΩ	10.800V	1.17kΩ

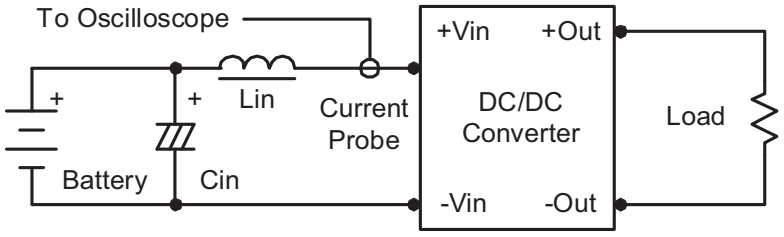
DHXXS15-40 TRIM TABLE				
Trim	$Trim_{up}$	R_{up}	$Trim_{down}$	R_{down}
1%	15.150V	392.98kΩ	14.850V	572.67kΩ
2%	15.300V	182.12kΩ	14.700V	248.63kΩ
3%	15.450V	108.73kΩ	14.550V	145.60kΩ
4%	15.600V	71.43kΩ	14.400V	94.97kΩ
5%	15.750V	48.85kΩ	14.250V	64.87kΩ
6%	15.900V	33.71kΩ	14.100V	44.92kΩ
7%	16.050V	22.86kΩ	13.950V	30.72kΩ
8%	16.200V	14.69kΩ	13.800V	20.10kΩ
9%	16.350V	8.33kΩ	13.650V	11.86kΩ
10%	16.500V	3.23kΩ	13.500V	5.28kΩ

TEST CONFIGURATIONS

Input Reflected-Ripple Current Test Setup

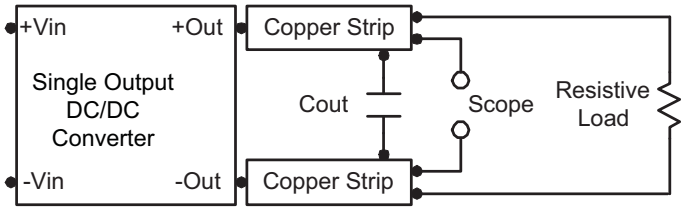
Input reflected-ripple current is measured with an inductor Lin (4.7µH) and Cin (220µF, ESR < 1.0Ω at 100 KHz) to simulate source impedance. Capacitor Cin offsets possible battery impedance.

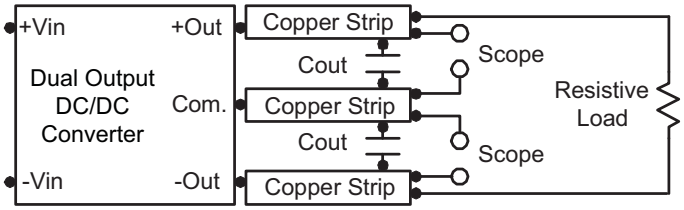
Current ripple is measured at the input terminals of the module. Measurement bandwidth is 0-500 KHz.



Peak-to-Peak Output Noise Measurement Test

Use a 1µF ceramic capacitor and a 10µF tantalum capacitor. Scope measurement should be made by using a BNC socket, measurement bandwidth is 0-20MHz. Position the load between 50mm and 75mm from the DC/DC converter.





DESIGN & FEATURE CONSIDERATIONS

Remote On/Off

Positive logic remote on/off turns the module on during a logic high voltage on the remote on/off pin and off during a logic low. To turn the module on and off, the user must supply a switch to control the voltage between the on/off terminal and the –Vin terminal. The switch can be an open collector or equivalent. A logic low is 0V to 1.2V. A logic high is 3.5V to 12V. The maximum sink current at on/off terminal (Pin 3) during a logic low is -100µA

Over Current Protection

To provide protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure overload for an unlimited duration.

Over Voltage Protection

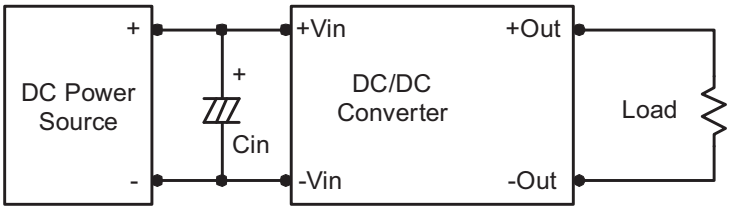
The output over voltage clamp consists of control circuitry which is independent of the primary regulation loop that monitors the voltage on the output terminals. The control loop of the clamp has a higher voltage set point than the primary loop. This provides a redundant voltage control that reduces the risk of output over voltage. The OVP level can be found in the model selection table.

Input Source Impedance

The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module.

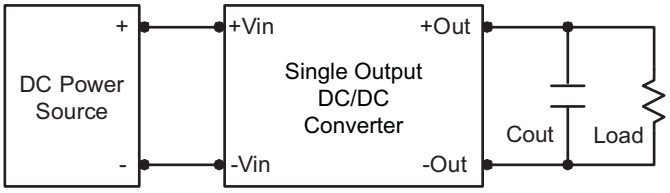
In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup.

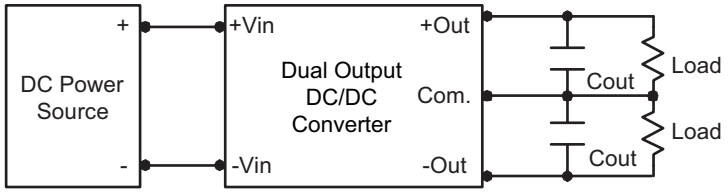
Capacitor mounted close to the power module helps ensure stability of the unit, it is recommended to use a good quality low Equivalent Series Resistance (ESR < 1.0Ω at 100 KHz) capacitor of 33µF for the 12V input devices and a 10µF for the 24V and 48V devices.



Output Ripple Reduction

A good quality low ESR capacitor placed as close as possible across the load will give the best ripple and noise performance. To reduce output ripple, it is recommended to use 4.7µF capacitors at the output.



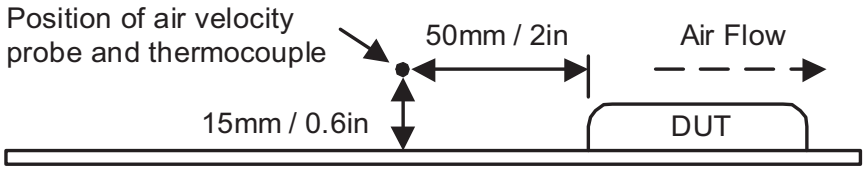


Maximum Capacitive Load

The DH40 series has a limitation of maximum connected capacitance on the output. The power module may be operated in current limiting mode during start-up, affecting the ramp-up and the start-up time. The maximum capacitance can be found in the model selection table.

Thermal Considerations

Many conditions affect the thermal performance of the power module, such as orientation, airflow over the module, and board spacing. To avoid exceeding the maximum temperature rating of the components inside the power module, the case temperature must be kept below 105°C. The derating curves are determined from measurements obtained in a test setup.



COMPANY INFORMATION

Wall Industries, Inc. has created custom and modified units for over 50 years. Our in-house research and development engineers will provide a solution that exceeds your performance requirements on-time and on budget. Our ISO9001-2008 certification is just one example of our commitment to producing a high quality, well-documented product for our customers.

Our past projects demonstrate our commitment to you, our customer. Wall Industries, Inc. has a reputation for working closely with its customers to ensure each solution meets or exceeds form, fit and function requirements. We will continue to provide ongoing support for your project above and beyond the design and production phases. Give us a call today to discuss your future projects.

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