DELPHI SERIES

FEATURES

- Efficiency up to 84%
- Industry standard form factor and pinout
- Size:
  31.8 x20.3 x10.7mm (1.25" x0.80" x0.42")
- Input: 5V, 12V, 24V, 48V (2:1)
- Output: 5, 12, 24, ±12, ±15V
- Low ripple and noise
- Short circuit protection
- 5600 Vdc isolation
- Meets UL60950-1
- ISO 9001 and ISO14001 certified manufacturing facility

Delphi DIHW1000 Series DC/DC Power Modules: 5, 12, 24, 48Vin, 3W DIP 5600Vdc isolation, single/dual output

The Delphi DIHW1000, 5, 12, 24, 48V input, single or dual output, DIP form factor, isolated DC/DC converter is the latest offering from a world leader in power systems technology and manufacturing — Delta Electronics, Inc. The DIHW1000 series operate from 5V, 12V, 24V, or 48V (2:1) and provides 5V, 12V or 24V of single output and ±12V or ±15V of dual output in an industrial standard, plastic case encapsulated DIP package. This series provides up to 3W of output power with 5600Vdc isolation and a typical full-load efficiency up to 84%. With creative design technology and optimization of component placement, these converters possess outstanding electrical and thermal performance, as well as extremely high reliability under highly stressful operating conditions.

OPTIONS

APPLICATIONS

- Industrial
- Transportation
- Process/ Automation
- Medical

DATASHEET
DS_DIHW1000_04072009

Delta Electronics, Inc.

TECHNICAL SPECIFICATIONS

T_A = 25°C, airflow rate = 0 LFM, nominal Vin, nominal Vout, resistive load unless otherwise noted.

PARAMETER	NOTES and CONDITIONS	DIHW1000 (Standard)			
		Min.	Typ.	Max.	Units
ABSOLUTE MAXIMUM RATINGS					
Input Voltage					
Transient	5VDC input model, 1000ms	-0.7		11	Vdc
Transient	12VDC input model, 1000ms	-0.7		25	Vdc
Transient	24VDC input model, 1000ms	-0.7		50	Vdc
Transient	48VDC input model, 1000ms	-0.7		100	Vdc
Internal Power Dissipation				2500	mW
Operating Temperature	Ambient	-40		85	°C
	Case	-40		100	°C
Storage Temperature		-40		125	°C
Humidity				95	%
Lead Temperature in Assembly	1.5mm from case for 10 seconds			260	°C
Input/Output Isolation Voltage		5600			Vdc
INPUT CHARACTERISTICS					
Operating Input Voltage	5V model	4.5	5	9	Vdc
	12V model	9	12	18	Vdc
	24V model	18	24	36	Vdc
	48V model	36	48	75	Vdc
Turn-On Voltage Threshold	5V model	3.7	4	4.5	Vdc
	12V model	8	8.5	9	Vdc
	24V model	15	17	18	Vdc
	48V model	30	33	36	Vdc
Turn-Off Voltage Threshold	5V model	---	---	4	Vdc
	12V model	---	---	8.5	Vdc
	24V model	---	---	17	Vdc
	48V model	---	---	34	Vdc
Maximum Input Current	Please see Model List table on page 6				
No-Load Input Current	5V model		40		mA
	12V model		30		mA
	24V model		20		mA
	48V model		10		mA
Input Reflected Ripple Current	5V model			60	%
	12V model			30	%
	24V model			15	%
	48V model			10	%
Short Circuit Input Power	All models			2	W
Reverse Polarity Input Current				0.3	A
OUTPUT CHARACTERISTICS					
Output Voltage Set Point Accuracy			±0.5	±1.0	%
Output Voltage Balance	Dual output models, balanced loads		±0.5	±2.0	%
Output Voltage Regulation					
Over Load	Io=25% to 100%		±0.5	±1.0	%
Over Line	Vin = min to max		±0.3	±0.5	%
Over Temperature	Tc=-40°C to 100°C		±0.02	±0.05	%/C
Output Voltage Ripple and Noise	5Hz to 20MHz bandwidth				
Peak-to-Peak	5V output, Full Load, 0.33μF ceramic		75	100	mVp-p
Peak-to-Peak	Other outputs, Full Load, 0.33μF ceramic		100	150	mVp-p
Peak-to-Peak, over line, load, temperature	Full Load, 0.33μF ceramic			180	mVp-p
RMS	Full Load, 0.33μF ceramic			25	mVrms
Output Over Current/Power Protection	Auto restart	120			%
Output Short Circuit	Continuous				
Output Voltage Current Transient					
Step Change in Output Current	25% step change		±3	±6	%
Settling Time (within 1% Vout nominal)			150	500	μS
Maximum Output Capacitance	5V output			1000	μF
	12, 24V output			470	μF
	Dual output models, each output			220	μF
EFFICIENCY					
100% Load	Please see Model List table on page 6				
ISOLATION CHARACTERISTICS					
Isolation Voltage	Input to output, 60 Seconds	5600			Vdc
Isolation Voltage Test	Flash Test for 1 seconds	6000			Vdc
Leakage Current	240VAC, 60Hz			2	μA
Isolation Resistance	500VDC	1000			MΩ
Isolation Capacitance	100KHz, 1V		7	13	pF
FEATURE CHARACTERISTICS					
Switching Frequency			150		kHz
GENERAL SPECIFICATIONS					
MTBF	MIL-HDBK-217F; Ta=25°C, Ground Benign	1			M hours
Weight			16.2		grams
Case Material	Non-conductive black plastic				
Flammability	UL94V-0				
Input Fuse	5V model, 2000mA slow blown type				
	12V model, 1000mA slow blown type				
	24V model, 500mA slow blown type				
	48V model, 250mA slow blown type				

Notes:

1. These power converters require a minimum output load to maintain specified regulation (please see page 7 for the suggested minimum load). Operation under no-load conditions will not damage these modules; however, they may not meet all specifications listed above.
2. These DC/DC converters should be externally fused at the front end for protection.

ELECTRICAL CHARACTERISTICS CURVES

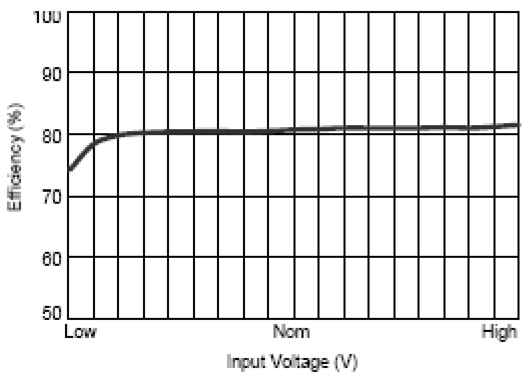


Figure 1: *Efficiency vs. Input Voltage (Single Output)*

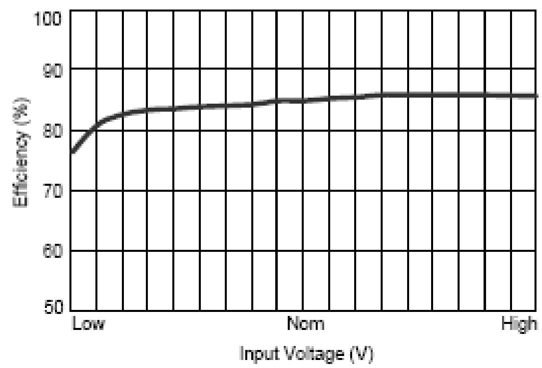


Figure 2: *Efficiency vs. Input Voltage (Dual Output)*

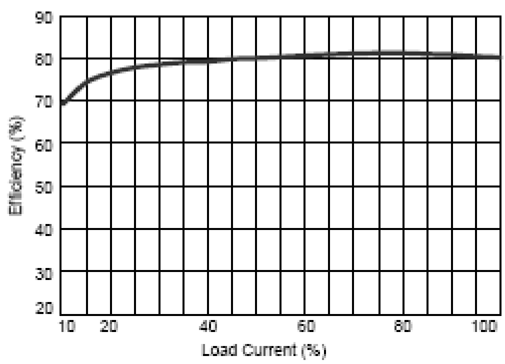


Figure 3: *Efficiency vs. Output Load (Single Output)*

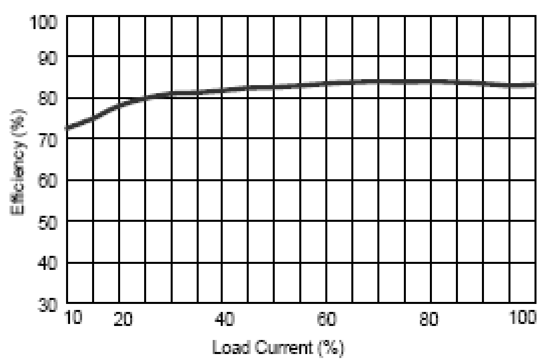


Figure 4: *Efficiency vs. Output Load (Dual Output)*

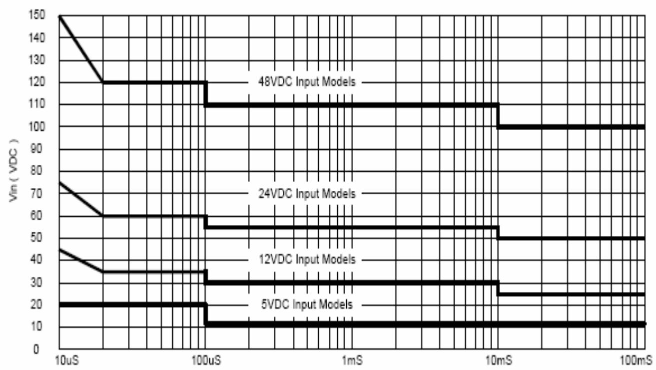
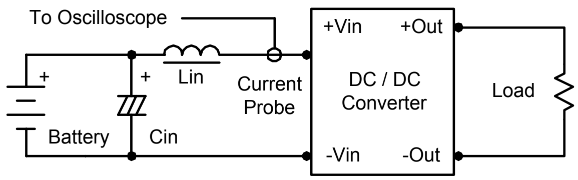


Figure 5: *Input Voltage Transient Rating*

Test Configurations

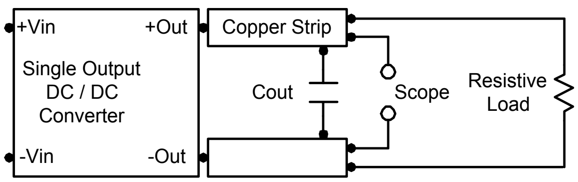


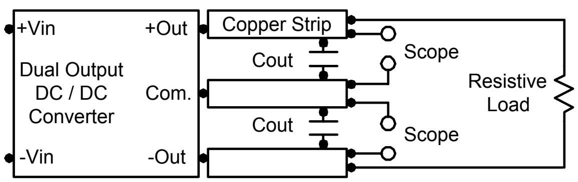
Input Reflected-Ripple Current Test Setup

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 is to offset possible battery impedance. Current ripple is measured at the input terminals of the module and measurement bandwidth is 0-500 KHz.

Peak-to-Peak Output Noise Measurement

Scope measurement should be made by using a BNC socket, measurement bandwidth is 0-20 MHz. Position the load between 50 mm and 75 mm from the DC/DC Converter. A Cout of 0.47μF ceramic capacitor is placed between the terminals shown below.





Design & Feature Considerations

The DIHW1000 circuit block diagrams are shown in Figures 6 and 7.

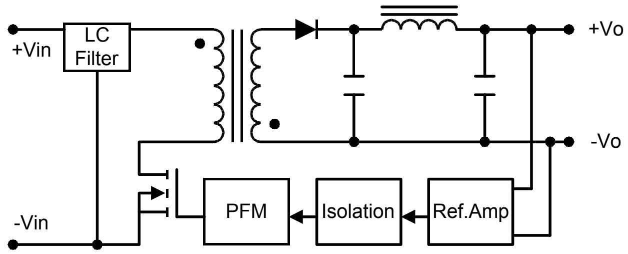


***Figure 6**: Block diagram of DIHW1000 single output modules.*

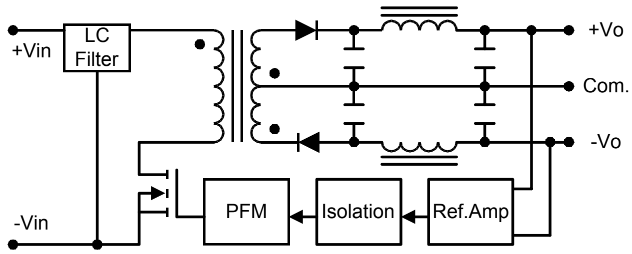
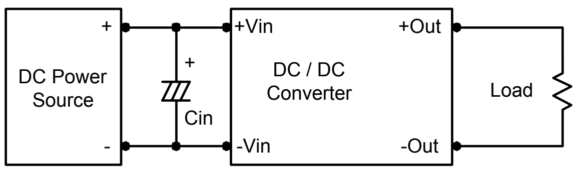


***Figure 7:** Block diagram of DIHW1000 dual output modules*

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 input of 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 a 10μF for the 5V input devices, a 4.7 μF for the 12V and a 2.2μF for the 24V and 48V devices.

Design & Feature Considerations

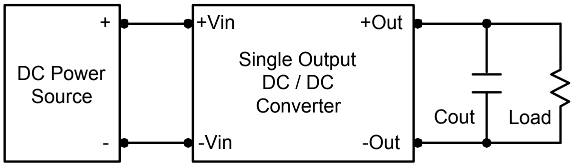
Maximum Capacitive Load

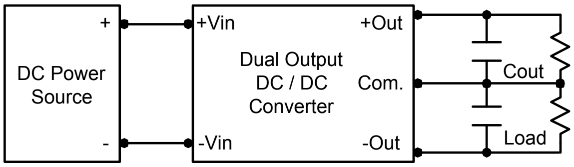
The DIHW1000 series has limitation of maximum connected capacitance at the output. The power module may be operated in current limiting mode during start-up, affecting the ramp-up and the startup time. The maximum capacitance can be found on page 2 of this datasheet.

Output Ripple Reduction

A good quality low ESR capacitor placed as close as practicable across the load will give the best ripple and noise performance.

To reduce output ripple, it is recommended to use 3.3μF capacitors at the output.





Overcurrent Protection

To provide protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure current limiting for an unlimited duration. At the point of current-limit inception, the unit shifts from voltage control to current control. The unit operates normally once the output current is brought back into its specified range.

Soldering and Cleaning Considerations

Post solder cleaning is usually the final board assembly process before the board or system undergoes electrical testing. Inadequate cleaning and/or drying may lower the reliability of a power module and severely affect the finished circuit board assembly test. Adequate cleaning and/or drying is especially important for un-encapsulated and/or open frame type power modules. For assistance on appropriate soldering and cleaning procedures, please contact Delta's technical support team.

Notes:

1. These power converters require a minimum output load to maintain specified regulation (please see page 2 for the suggested minimum load). Operation under no-load conditions will not damage these modules; however, they may not meet all specifications listed above.

2. These DC/DC converters should be externally fused at the front end for protection.

THERMAL CONSIDERATIONS

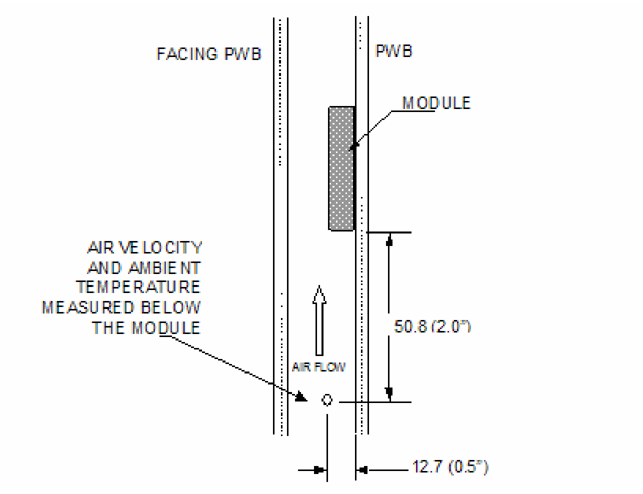
Thermal management is an important part of the system design. To ensure proper, reliable operation, sufficient cooling of the power module is needed over the entire temperature range of the module. Convection cooling is usually the dominant mode of heat transfer.

Hence, the choice of equipment to characterize the thermal performance of the power module is a wind tunnel.

Thermal Testing Setup

Delta's DC/DC power modules are characterized in heated vertical wind tunnels that simulate the thermal environments encountered in most electronics equipment. This type of equipment commonly uses vertically mounted circuit cards in cabinet racks in which the power modules are mounted.

The following figure shows the wind tunnel characterization setup. The power module is mounted on a test PWB and is vertically positioned within the wind tunnel. The space between the facing PWB and PWB is constantly kept at 25.4mm (1'').



Note: Wind Tunnel Test Setup Figure Dimensions are in millimeters and (Inches)

Figure 7: *Wind tunnel test setup*

Thermal Derating

Heat can be removed by increasing airflow over the module. To enhance system reliability, the power module should always be operated below the maximum operating temperature. If the temperature exceeds the maximum module temperature, reliability of the unit may be affected.

THERMAL CURVES

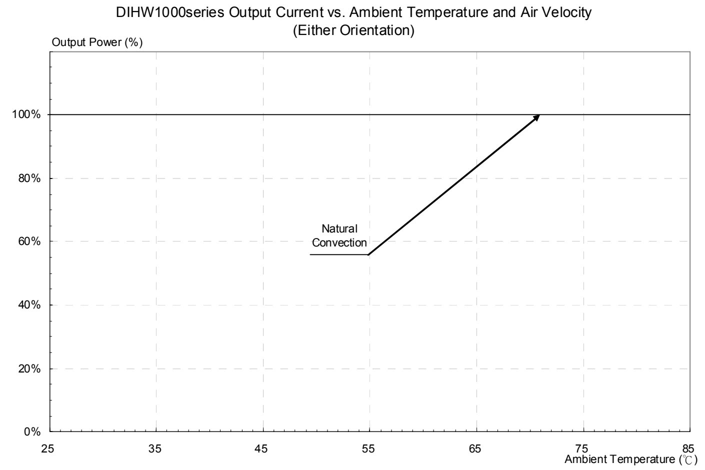
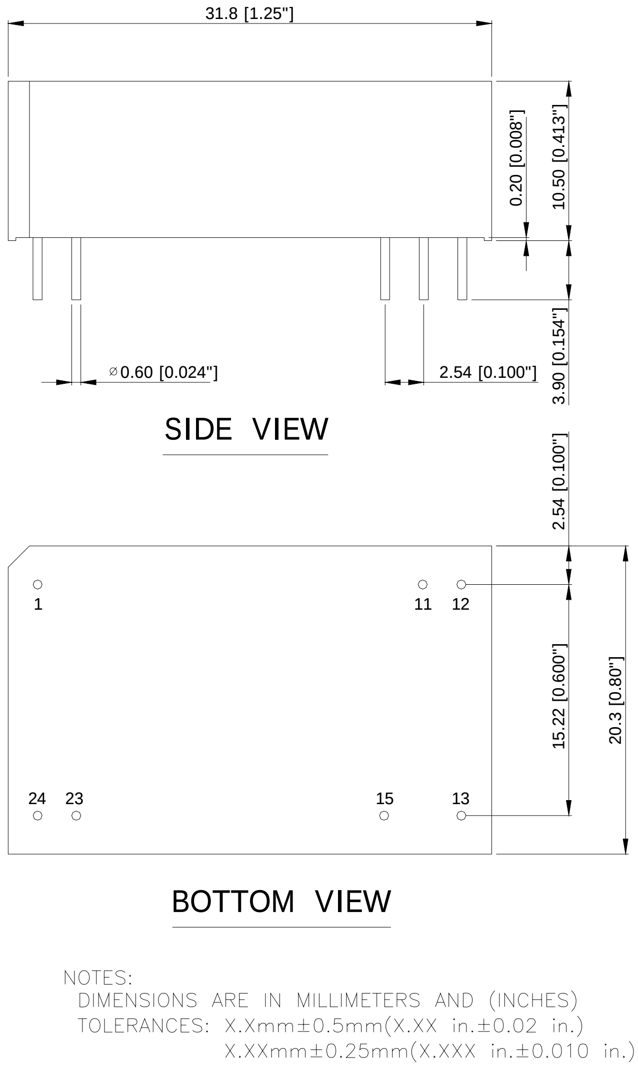


Figure 8: *Derating Curve*

MODEL LIST

MODEL NAME	INPUT		OUTPUT			Full Load Efficiency
	Vdc (V)	Max (mA)	Vdc (V)	Max (mA)	Min (mA)	%
DIHW1002	5 (4.5 ~ 18)	857	5	600	90	70
DIHW1003		800	12	250	37.5	75
DIHW1008		800	24	125	18.8	76
DIHW1006		800	±12	±125	±18.8	75
DIHW1007		800	±15	±100	±15	75
DIHW1012	12 (9 ~ 18)	338	5	600	90	74
DIHW1013		313	12	250	37.5	80
DIHW1018		313	24	125	18.8	81
DIHW1016		313	±12	±125	±18.8	80
DIHW1017		313	±15	±100	±15	80
DIHW1022	24 (18 ~36)	160	5	600	90	78
DIHW1023		151	12	250	37.5	83
DIHW1028		151	24	125	18.8	84
DIHW1026		151	±12	±125	±18.8	83
DIHW1027		151	±15	±100	±15	83
DIHW1032	48 (36 ~75)	80	5	600	90	78
DIHW1033		75	12	250	37.5	83
DIHW1038		75	24	125	18.8	84
DIHW1036		75	±12	±125	±18.8	83
DIHW1037		75	±15	±100	±15	83

MECHANICAL DRAWING



Pin	Single Output	Dual Output
1	+Vin	+Vin
11	NC	Common
12	-Vout	NC
13	+Vout	-Vout
15	NC	+Vout
23	-Vin	-Vin
24	-Vin	-Vin

CONTACT: www.delta.com.tw/dcdc

USA:
Telephone:
East Coast: (888) 335 8201
West Coast: (888) 335 8208
Fax: (978) 656 3964
Email: DCDC@delta-corp.com

Europe:
Phone: +41 31 998 53 11
Fax: +41 31 998 53 53
Email: DCDC@delta-es.com

Asia & the rest of world:
Telephone: +886 3 4526107 ext 6220~6224
Fax: +886 3 4513485
Email: DCDC@delta.com.tw

WARRANTY

Delta offers a two (2) year limited warranty. Complete warranty information is listed on our web site or is available upon request from Delta.

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