DELPHI SERIES

FEATURES

- Efficiency up to 86%
- Industry standard form factor and pinout
- Size:
  31.8 x20.3 x10.2mm (1.25” x0.80” x0.40”)
- Input: 5V, 12V, 24V, 48V (2:1)
- Output: 3.3, 5, 12, 15, ±5, ±12, ±15V
- Low ripple and noise
- 1500V isolation
- UL 94V-0 Package Material
- ISO 9001 and ISO14001 certified manufacturing facility
- CSA 60950-1 Recognized

Delphi DIW3000 Series DC/DC Power Modules: 5, 12, 24, 48Vin, 5~6W DIP

The Delphi DIW3000, 5V, 12V, 24V, and 48V 2:1 wide 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 DIW3000 series operate from 5V, 12V, 24V, or 48V (2:1) and provides 3.3V, 5V, 12V, or 15V of single output or ±5V, ±12V, or ±15V of dual output in an industrial standard, metal case encapsulated DIP package (body size: 1.25"x 0.80”x0.40”). This series provides up to 6W of output power with 1500V isolation and a typical full-load efficiency up to 86%. 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
- Telecom
- Data Networking

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	DIW3000 (Standard)			
		Min.	Typ.	Max.	Units
ABSOLUTE MAXIMUM RATINGS					
Input Voltage					
Transient	5V input model, 1000ms	-0.7		10	Vdc
Transient	12V input model, 1000ms	-0.7		25	Vdc
Transient	24V input model, 1000ms	-0.7		50	Vdc
Transient	48V 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		1500			Vdc
INPUT CHARACTERISTICS					
Operating Input Voltage	5V model	4.5	5	9	Vdc
	12V model	9	12	18	Vdc
	24V model	18	24	36	
	48V model	36	48	75	Vdc
Turn-On Voltage Threshold	5V model	3	3.5	4,4	Vdc
	12V model	4.5	6	8	Vdc
	24V model	8	12	16	Vdc
	48V model	16	24	32	Vdc
Turn-Off Voltage Threshold	5V model	---	---	4	Vdc
	12V model	---	---	8	Vdc
	24V model	---	---	16	Vdc
	48V model	---	---	32	Vdc
Maximum Input Current	Please see Model List table on page 6				
No-Load Input Current	5V model		70		mA
	12V model		20		mA
	24V model		5		mA
	48V model		3		mA
Input Reflected Ripple Current	5V model		100		mA
	12V model		25		mA
	24V model		15		mA
	48V model		10		mA
Short Circuit Input Power	All models		1	3	W
Reverse Polarity Input Current				1	A
OUTPUT CHARACTERISTICS					
Output Voltage Set Point Accuracy			±0.5	±1.0	%
Output Voltage Balance	Dual output models		±0.5	±2.0	%
Output Voltage Regulation					
Over Load	Io=10% to 100%		±0.3	±1.0	%
Over Line	Vin= min to max		±0.1	±0.3	%
Over Temperature	Tc=-40°C to 100°C		±0.01	±0.02	%/C
Output Voltage Ripple and Noise	5Hz to 20MHz bandwidth				
Peak-to-Peak	Full Load, 0.47µF ceramic		50	75	mV
Peak-to-Peak, over line, load, temperature	Full Load, 0.47µF ceramic			100	mV
RMS	Full Load, 0.47µF ceramic			15	mV
Output Over Current/Power Protection	Auto restart	120			%
Output Short Circuit	Continuous				
Output Voltage Current Transient					
Step Change in Output Current	25% step change		±2	±6	%
Settling Time (within 1% Vout nominal)			150	300	uS
Maximum Output Capacitance	Single output models			6800	µF
	Dual output models, each output			1000	µF
EFFICIENCY					
100% Load	Please see Model List table on page 6				
ISOLATION CHARACTERISTICS					
Isolation Voltage	Input to output, 60 Seconds	1500			Vdc
Isolation Voltage Test	Flash Test for 1 seconds	1650			Vdc
Isolation Resistance	500VDC	1000			MΩ
Isolation Capacitance	100KHz, 1V		380	500	pF
FEATURE CHARACTERISTICS					
Switching Frequency			300		kHz
GENERAL SPECIFICATIONS					
MTBF	MIL-HDBK-217F; Ta=25°C, Ground Benign	1			M hours
Weight			16.9		grams
Case Material	Non-conductive black plastic				
Flammability	UL94V-0				
Input Fuse	5V model, 3000mA slow blown type				
	12V model, 1500mA slow blown type				
	24V model, 700mA slow blown type				
	48V model, 350mA slow blown type				

ELECTRICAL CHARACTERISTICS CURVES

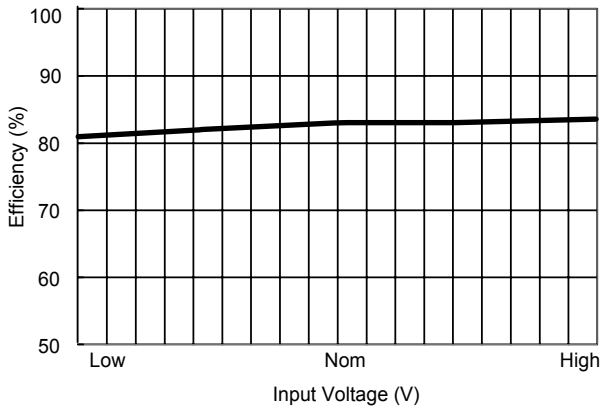


Figure 1: *Efficiency vs. Input Voltage (Single Output)*

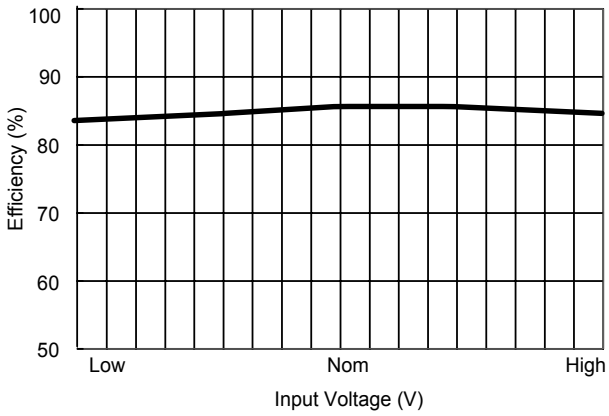


Figure 2: *Efficiency vs. Input Voltages (Dual Output)*

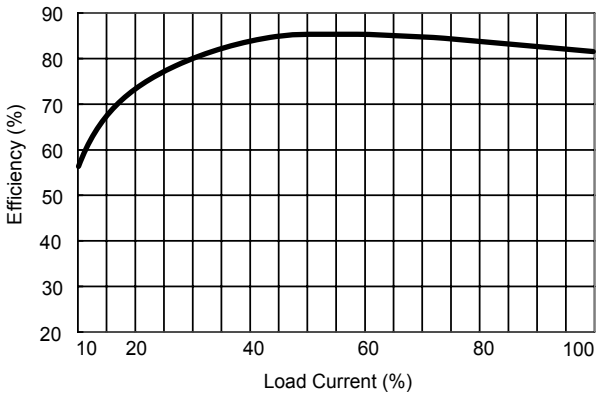


Figure 3: *Efficiency vs. Output Load (Single Output)*

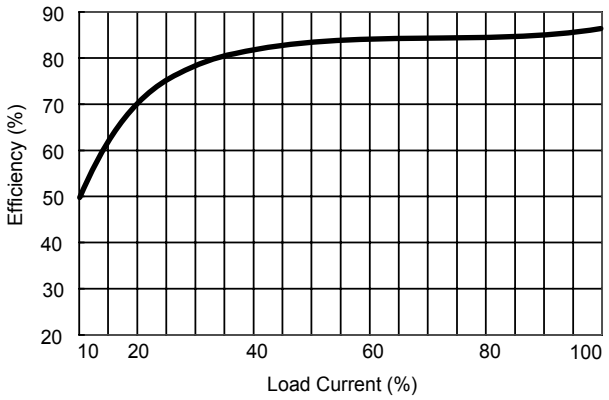
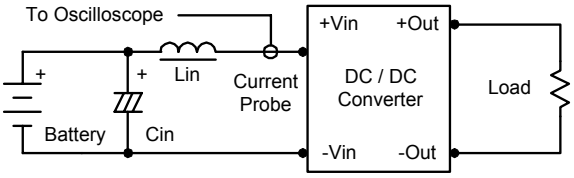


Figure 4: *Efficiency vs. Output Load (Dual Output)*

Test Configurations

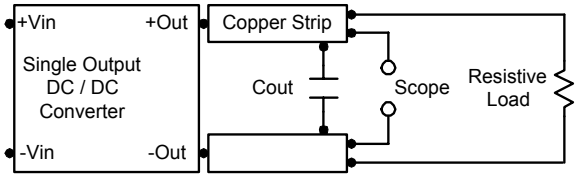


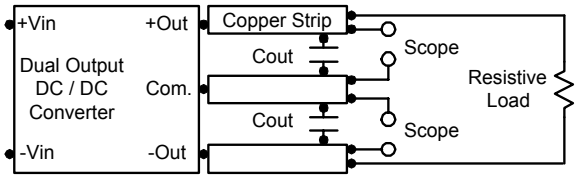
Input Reflected-Ripple Current Test Setup

Input reflected-ripple current is measured with a inductor Lin (4.7uH) and Cin (220uF, 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 0.47uF ceramic capacitor is placed between the terminals shown below.





Design & Feature Considerations

The DIW3000 circuit block diagrams are shown in Figures 5 and 6.

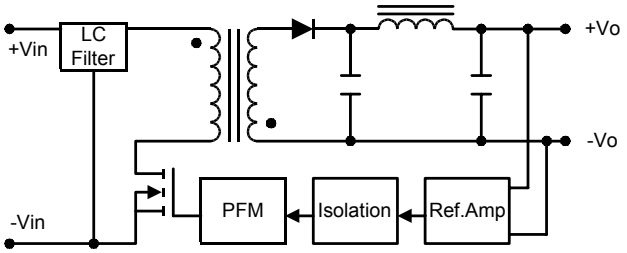


Figure 5: *Block diagram of DIW3000 single output modules.*

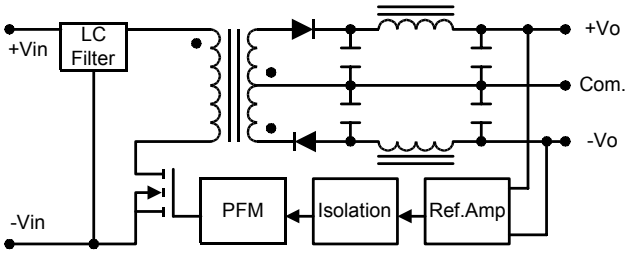
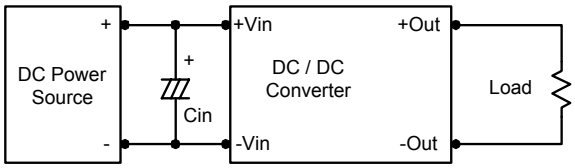


Figure 6: *Block diagram of DIW3000 dual output modules*

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 10uF for the 5V input devices, a 3.3uF for the 12V input devices, and a 2.2uF for the 24V and 48V devices.

Design & Feature Considerations

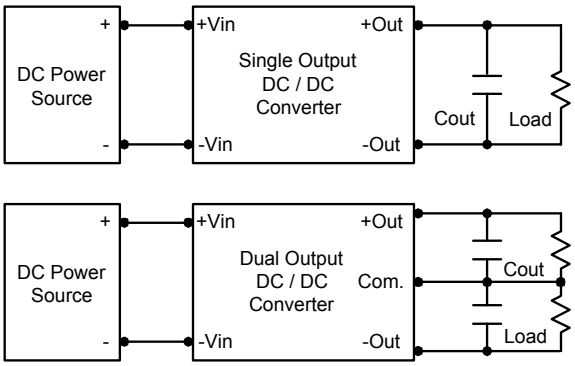
Maximum Capacitive Load

The DIW3000 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. For optimum performance we recommend 1000uF maximum capacitive load for dual outputs and 6800uF capacitive load for single outputs.

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 3.3uF 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 6 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

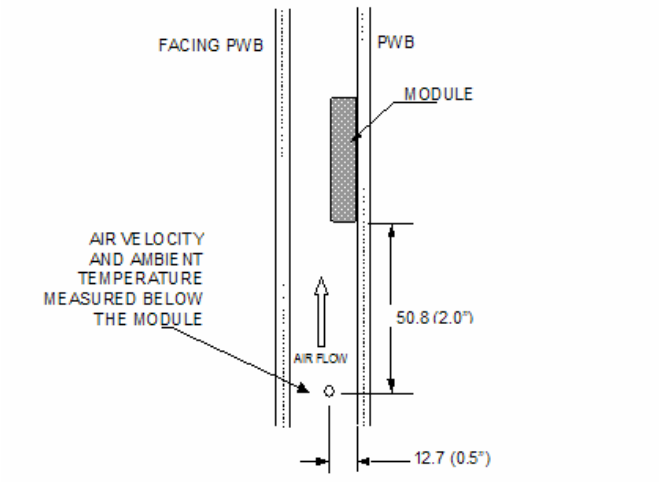
Thermal management is an important part of the system design. To ensure proper, reliable operation, sufficient cooling of the power module is needed over the entire temperature range of the module. Convection cooling is usually the dominant mode of heat transfer.

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

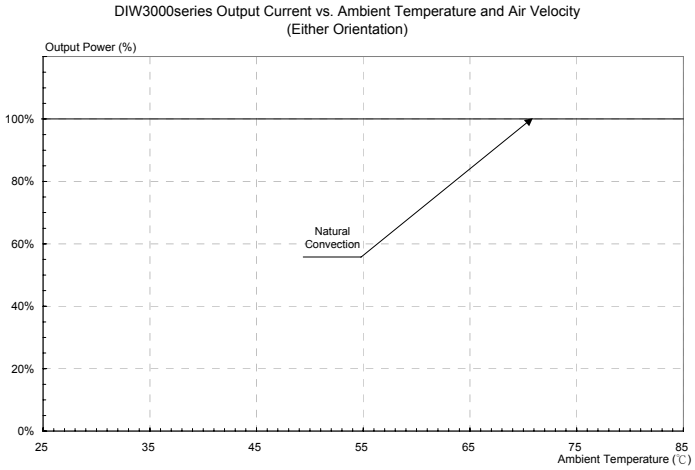
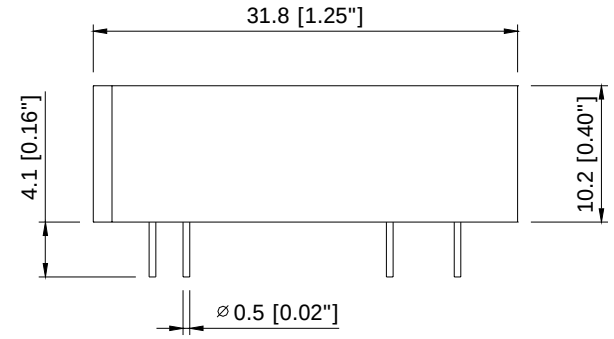


Figure 8: *Derating Curve*

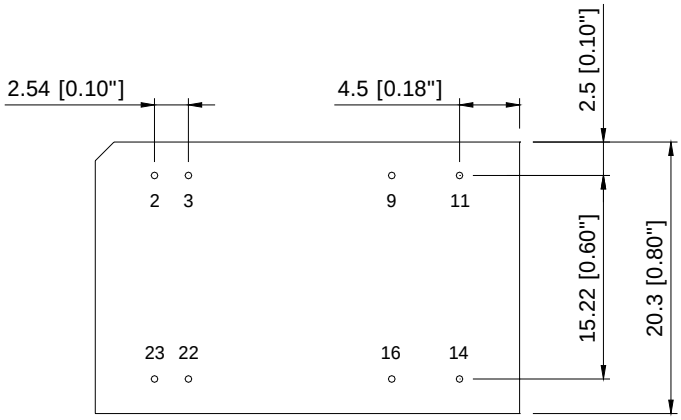
MODEL LIST

	INPUT		OUTPUT			Full Load Efficiency
	Vdc (V)	Max (mA)	Vdc (V)	Max (mA)	Min (mA)	%
DIW3011	5 (4.5 ~ 9)	1056	3.3	1200	60	75
DIW3012		1265	5	1000	50	79
DIW3013		1463	12	500	25	82
DIW3014		1463	15	400	20	82
DIW3015		1265	±5	±500	±25	79
DIW3016		1463	±12	±250	±12.5	82
DIW3017		1463	±15	±200	±10	82
DIW3021	12 (9 ~ 18)	429	3.3	1200	60	77
DIW3022		514	5	1000	50	81
DIW3023		595	12	500	25	84
DIW3024		595	15	400	20	84
DIW3025		514	±5	±500	±25	81
DIW3026		595	±12	±250	±12.5	84
DIW3027		595	±15	±200	±10	84
DIW3031	24 (18 ~ 36)	209	3.3	1200	60	79
DIW3032		251	5	1000	50	83
DIW3033		291	12	500	25	86
DIW3034		291	15	400	20	86
DIW3035		251	±5	±500	±25	83
DIW3036		291	±12	±250	±12.5	86
DIW3037		291	±15	±200	±10	86
DIW3041	48 (36 ~ 75)	104	3.3	1200	60	79
DIW3042		126	5	1000	50	83
DIW3043		145	12	500	25	86
DIW3044		145	15	400	20	86
DIW3045		126	±5	±500	±25	83
DIW3046		145	±12	±250	±12.5	86
DIW3047		145	±15	±200	±10	86

MECHANICAL DRAWING



SIDE VIEW



BOTTOM VIEW

NOTES:
DIMENSIONS ARE IN MILLIMETERS AND (INCHES)
TOLERANCES: X.Xmm±0.5mm(X.XX in.±0.02 in.)
X.XXmm±0.25mm(X.XXX in.±0.010 in.)

Pin	Single Output	Dual Output
2	-Vin	-Vin
3	-Vin	-Vin
9	No Pin	Common
11	NC	-Vout
14	+Vout	+Vout
16	-Vout	Common
22	+Vin	+Vin
23	+Vin	+Vin

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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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