DELPHI SERIES

FEATURES

- Efficiency up to 64%
- Industry standard form factor and pinout
- Size:
  31.8 x20.3 x10.2mm (1.25” x0.80” x0.40”)
- Input: 5V, 12V, 15V (±10%)
- Output: 5, 12, 15, ±5, ±12, ±15V
- Low ripple and noise
- Short circuit protection
- 6000V isolation
- UL 94V-0 Package Material
- ISO 9001 and ISO14001 certified manufacturing facility

Delphi DIR500 Series DC/DC Power Modules: 5, 12, 24Vin, 2W DIP 6000V isolation, single/dual output

The Delphi DIR500, 5V, 12V, and 24V 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 DIR500 series operate from 5V, 12V, or 15V (±10%) and provides 5V, 12V, or 15V of single output or ±5V, ±12V, or ±15V of dual output in an industrial standard, plastic case encapsulated DIP package. This series provides up to 2W of output power with 6000V isolation and a typical full-load efficiency up to 64%. 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

DATASHEET
DS_DIR500_12032008

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	DIR500 (Standard)			
		Min.	Typ.	Max.	Units
ABSOLUTE MAXIMUM RATINGS					
Input Voltage					
Transient	5V input model, 1000ms	-0.7		7.5	Vdc
Transient	12V input model, 1000ms	-0.7		15	Vdc
Transient	24V input model, 1000ms	-0.7		30	
Internal Power Dissipation				2000	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		6000			Vdc
INPUT CHARACTERISTICS					
Operating Input Voltage	5V input model	4.5	5	5.5	Vdc
	12V input model	10.8	12	13.2	Vdc
	24V input model	21.6	24	26.4	Vdc
Maximum Input Current	Please see Model List table on page 6				
No-Load Input Current	5V model		100		mA
	12V model		50		mA
	24V model		30		mA
Reflected Input Repple Current	5V model		15		mA
	12V model		8		mA
	24V model		3		mA
Short circuit input power				2	W
Reverse Polarity Input Current				0.5	A
OUTPUT CHARACTERISTICS					
Output Voltage Set Point Accuracy			±2.0	±4.0	%
Output Voltage Balance	Dual output models		±2.0	±4.0	%
Output Voltage Regulation					
Over Load	Io=10% to 100%		±0.5	±1.0	%
Over Line	Vin = min to max		±0.3	±0.5	%
Over Temperature	Tc=-40°C to 100°C		±0.01	±0.02	%/C
Output Voltage Ripple and Noise	5Hz to 20MHz bandwidth				
Peak-to-Peak	Full Load, 0.33µF ceramic		30	50	mV
Peak-to-Peak, over line, load, temperature	Full Load, 0.33µF ceramic			100	mV
RMS	Full Load, 0.33µF ceramic			5	mV
Output Over Current/Power Protection	Auto restart	120			%
Output Short Circuit	Continuous				
Output Voltage Current Transient					
Step Change in Output Current	50% step change			±6	%
Settling Time (within 1% Vout nominal)				50	uS
Maximum Output Capacitance	Single output models			680	µF
	Dual output models, each output			270	µF
EFFICIENCY					
100% Load	Please see Model List table on page 6				
ISOLATION CHARACTERISTICS					
Isolation Voltage	Input to output, 60 Seconds	6000			Vdc
Isolation Voltage Test	Flash Test for 1 seconds	8000			Vdc
Leakage Current	240VAC, 60Hz			2	µA
Isolation Resistance	500VDC	10			GΩ
Isolation Capacitance	100KHz, 1V		20	30	pF
FEATURE CHARACTERISTICS					
Switching Frequency		25		80	kHz
GENERAL SPECIFICATIONS					
MTBF	MIL-HDBK-217F; Ta=25°C, Ground Benign	0.6			M hours
Weight			12		grams
Case Material	Non-conductive black plastic				
Flammability	UL94V-0				
Input Fuse	5V model, 100mA slow blown type				
	12V model, 500mA slow blown type				
	24V model, 250mA slow blown type				

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.

ELECTRICAL CHARACTERISTICS CURVES

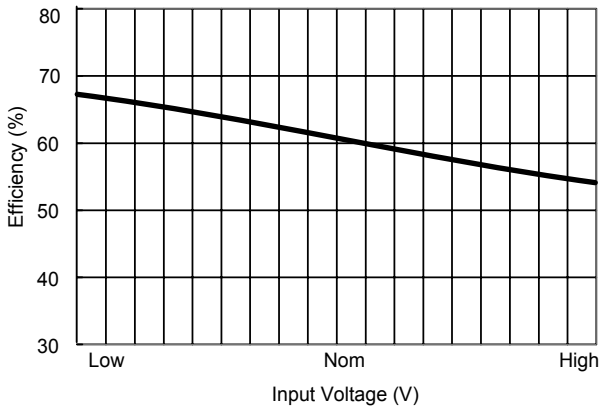


Figure 1: *Efficiency vs. Input Voltage (Single Output)*

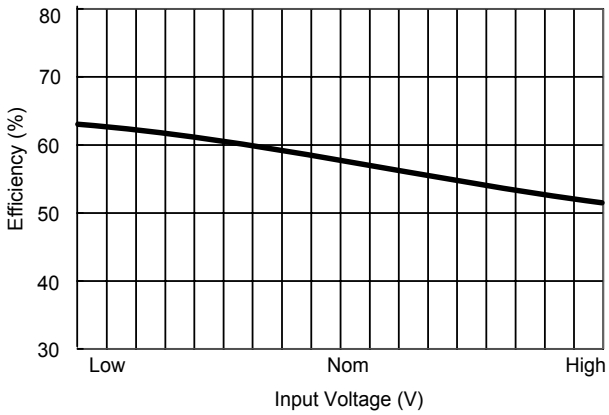


Figure 2: *Efficiency vs. Input Voltage (Dual Output)*

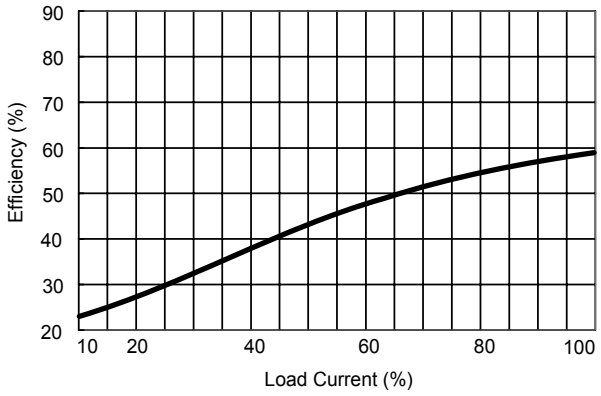


Figure 3: *Efficiency vs. Output Load (Single Output)*

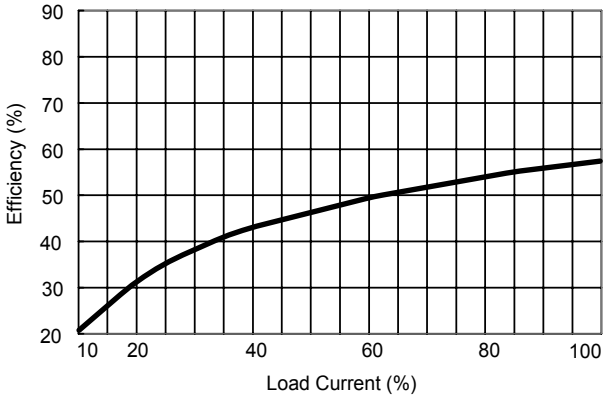


Figure 4: *Efficiency vs. Output Load (Dual Output)*

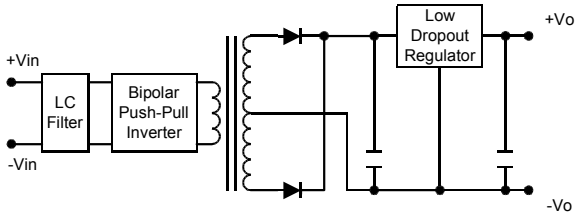


Figure 5: *Block diagram of DIR500 single output modules.*

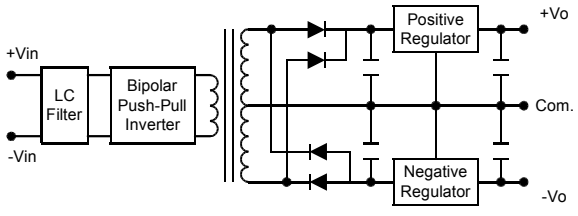


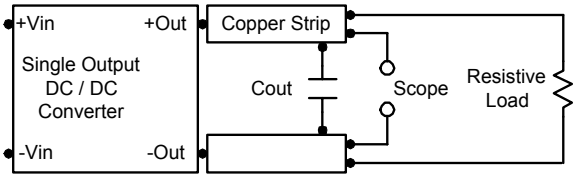
Figure 6: *Block diagram of DIR500 dual output modules.*

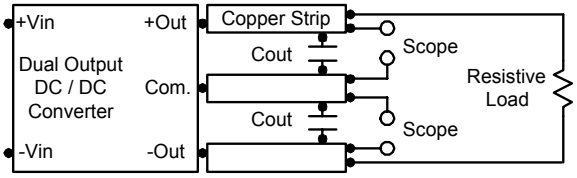
Design & Feature Considerations

The DIR500 circuit block diagrams are shown in Figures 5 and 6.

Peak-to-Peak Output Noise Measurement

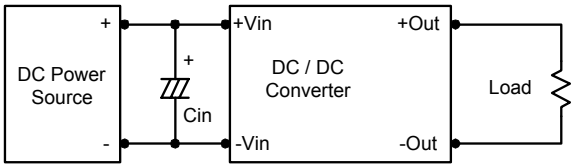
Scope measurement should be made by using a BNC socket, measurement bandwidth is 0-20 MHz. Position the load between 50 mm and 75 mm from the DC/DC Converter. A Cout of 0.33uF ceramic capacitor is placed between the terminals shown below.





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 4.7uF for the 5V input devices, a 2.2uF for the 12V and 24V devices.

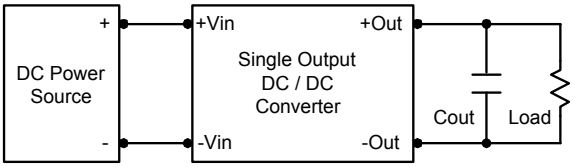
Maximum Capacitive Load

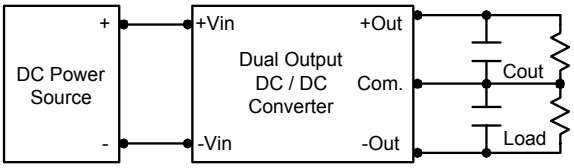
The DIR500 series has limitation of maximum connected capacitance at the output. The power module may be operated in current limiting mode during start-up, affecting the ramp-up and the startup time.

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 1.5uF capacitors at the output.





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.

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'').

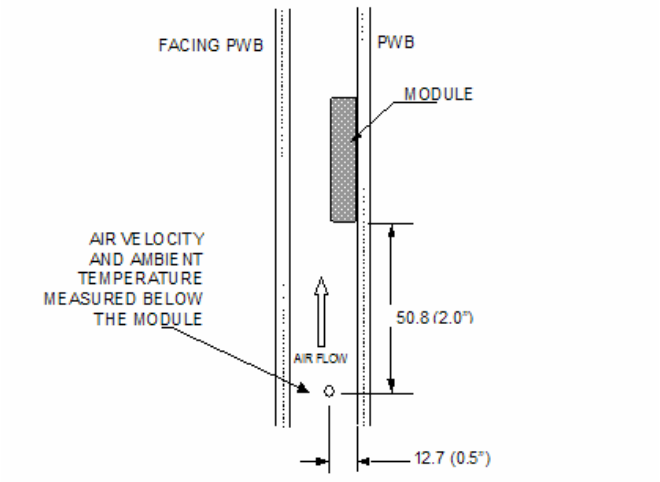


Figure 7: *Wind tunnel test setup*

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

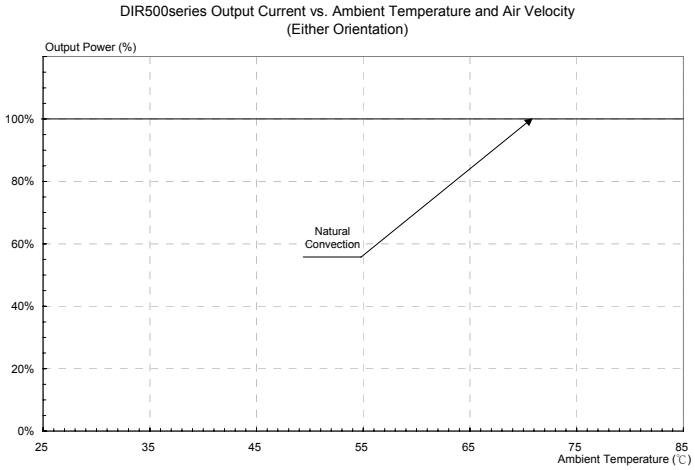


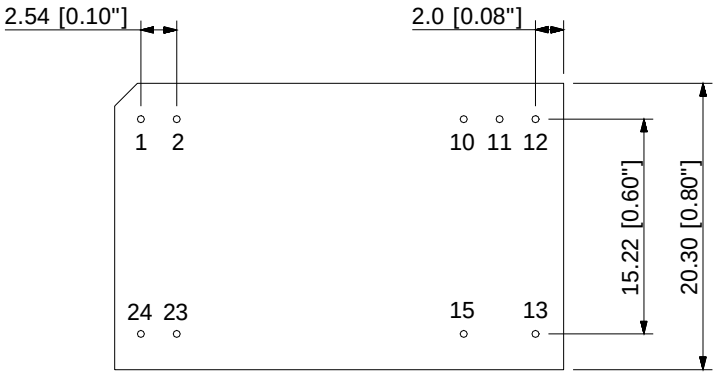
Figure 8: *Derating Curve*

MODEL LIST

	INPUT		OUTPUT			Full Load Efficiency
	Vdc (V)	Max (mA)	Vdc (V)	Max (mA)	Min (mA)	%
DIR501	5 (4.5 ~ 5.5)	645	5	400	0	62
DIR502		629	12	165		63
DIR503		623	15	133		64
DIR504		476	±5	±100		42
DIR505		699	±12	±83		57
DIR506		695	±15	±66		57
DIR507	12 (10.8 ~ 13.2)	269	5	400	0	62
DIR508		262	12	165		63
DIR509		260	15	133		64
DIR510		185	±5	±100		45
DIR511		281	±12	±83		59
DIR512		280	±15	±66		59
DIR513	24 (21.6 ~ 26.4)	134	5	400	0	62
DIR514		131	12	165		63
DIR515		130	15	133		64
DIR516		93	±5	±100		45
DIR517		143	±12	±83		58
DIR518		142	±15	±66		58

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
1	+Vin	+Vin
2	+Vin	+Vin
10	No pin	Common
11	No pin	Common
12	-Vout	No pin
13	+Vout	-Vout
15	No Pin	+Vout
23	-Vin	-Vin
24	-Vin	-Vin

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WARRANTY

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