

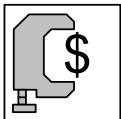
# MIR500 Series

2W, Ultra-High Isolation DIP, Single & Dual Output DC/DC Converters

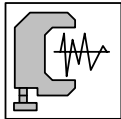
## Key Features



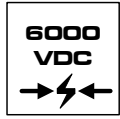
- Low Cost
- 6000VDC Isolation
- MTBF > 600,000 Hours
- Short Circuit Protection
- Input 5, 12 and 24VDC
- Output 5, 12, 15,  $\pm 5$ ,  $\pm 12$  and  $\pm 15$ VDC
- Regulated Outputs
- Low Isolation Capacitance
- Low Leakage Current
- Complies with EN55022 Class A



Low Cost



Low Noise



I/O Isolation



EN55022

Minmax's MIR500 2W DC/DC's are specially designed to provide ultra-high levels of isolation 6000VDC in a low-profile DIP package.

The series consists of 18 models with input voltages of 5V, 12V and 24VDC which offers regulated output voltages of 5V, 12V, 15VDC in both single and dual output configurations.

The MIR500 series is an excellent selection for a variety of applications including mixed analog/digital subsystems, railroad/transportation equipments, medical equipment subsystems, process/machine control equipments and automatic test instrumentation.

## Absolute Maximum Ratings

| Parameter                                      |                    | Min. | Max.  | Unit |
|--|--------------------|------|-------|------|
| Input Surge Voltage<br>(1000 mS)               | 5VDC Input Models  | -0.7 | 7.5   | VDC  |
|  | 12VDC Input Models | -0.7 | 15    | VDC  |
|  | 24VDC Input Models | -0.7 | 30    | VDC  |
| Lead Temperature (1.5mm from case for 10 Sec.) |                    | ---  | 260   | °C   |
| Internal Power Dissipation                     |                    | ---  | 2,000 | mW   |

Exceeding the absolute maximum ratings of the unit could cause damage. These are not continuous operating ratings.

## Environmental Specifications

| Parameter             | Conditions          | Min. | Max. | Unit |
|-----------------------|---------------------|------|------|------|
| Operating Temperature | Ambient             | -25  | +60  | °C   |
| Operating Temperature | Case                | -25  | +90  | °C   |
| Storage Temperature   |                     | -40  | +125 | °C   |
| Humidity              |                     | ---  | 95   | %    |
| Cooling               | Free-Air Convection |      |      |      |
| Conducted EMI         | EN55022 Class A     |      |      |      |

## Model Selection Guide

| Model Number | Input Voltage       | Output Voltage | Output Current |      | Input Current |           | Reflected Ripple Current | Efficiency |
|--------------|---------------------|----------------|----------------|------|---------------|-----------|--------------------------|------------|
|              |                     |                | Max.           | Min. | @Max. Load    | @No Load  |                          |            |
|              | VDC                 | VDC            | mA             | mA   | mA (Typ.)     | mA (Typ.) | % (Max.)                 | % (Typ.)   |
| MIR501       | 5<br>(4.5 ~ 5.5)    | 5              | 400            | 0    | 645           | 100       | 15                       | 62         |
| MIR502       |                     | 12             | 165            |      | 629           |           |                          | 63         |
| MIR503       |                     | 15             | 133            |      | 623           |           |                          | 64         |
| MIR504       |                     | ±5             | ±100           |      | 476           |           |                          | 42         |
| MIR505       |                     | ±12            | ±83            |      | 699           |           |                          | 57         |
| MIR506       |                     | ±15            | ±66            |      | 695           |           |                          | 57         |
| MIR511       | 12<br>(10.8 ~ 13.2) | 5              | 400            | 0    | 269           | 50        | 8                        | 62         |
| MIR512       |                     | 12             | 165            |      | 262           |           |                          | 63         |
| MIR513       |                     | 15             | 133            |      | 260           |           |                          | 64         |
| MIR514       |                     | ±5             | ±100           |      | 185           |           |                          | 45         |
| MIR515       |                     | ±12            | ±83            |      | 281           |           |                          | 59         |
| MIR516       |                     | ±15            | ±66            |      | 280           |           |                          | 59         |
| MIR521       | 24<br>(21.6 ~ 26.4) | 5              | 400            | 0    | 134           | 30        | 3                        | 62         |
| MIR522       |                     | 12             | 165            |      | 131           |           |                          | 63         |
| MIR523       |                     | 15             | 133            |      | 130           |           |                          | 64         |
| MIR524       |                     | ±5             | ±100           |      | 93            |           |                          | 45         |
| MIR525       |                     | ±12            | ±83            |      | 143           |           |                          | 58         |
| MIR526       |                     | ±15            | ±66            |      | 142           |           |                          | 58         |

## Capacitive Load

| Models by Vout          | 5V  | 12V | 15V | ±5V # | ±12V # | ±15V # | Unit |
|-------------------------|-----|-----|-----|-------|--------|--------|------|
| Maximum Capacitive Load | 680 | 680 | 680 | 270   | 270    | 270    | uF   |

# For each output

## Input Fuse Selection Guide

| 5V Input Models         | 12V Input Models       | 24V Input Models       |
|-------------------------|------------------------|------------------------|
| 1000mA Slow – Blow Type | 500mA Slow – Blow Type | 250mA Slow – Blow Type |

## Input Specifications

| Parameter                      | Model            | Min.      | Typ. | Max. | Unit |
|--------------------------------|------------------|-----------|------|------|------|
| Input Voltage Range            | 5V Input Models  | 4.5       | 5    | 5.5  | VDC  |
|                                | 12V Input Models | 10.8      | 12   | 13.2 |      |
|                                | 24V Input Models | 21.6      | 24   | 26.4 |      |
| Reverse Polarity Input Current | All Models       | ---       | ---  | 0.5  | A    |
| Short Circuit Input Power      |                  | ---       | ---  | 2000 | mW   |
| Input Filter                   |                  | Pi Filter |      |      |      |

# MIR500 Series

## Output Specifications

| Parameter               | Conditions                     | Min. | Typ.       | Max.       | Unit   |
|-------------------------|--------------------------------|------|------------|------------|--------|
| Output Voltage Accuracy |                                | ---  | $\pm 2.0$  | $\pm 4.0$  | %      |
| Output Voltage Balance  | Dual Output, Balanced Loads    | ---  | $\pm 2.0$  | $\pm 4.0$  | %      |
| Line Regulation         | $V_{in} = \text{Min. to Max.}$ | ---  | $\pm 0.3$  | $\pm 0.5$  | %      |
| Load Regulation         | $I_o = 10\% \text{ to } 100\%$ | ---  | $\pm 0.5$  | $\pm 1.0$  | %      |
| Ripple & Noise (20MHz)  |                                | ---  | 30         | 50         | mV P-P |
| Ripple & Noise (20MHz)  | Over Line, Load & Temp.        | ---  | ---        | 100        | mV P-P |
| Ripple & Noise (20MHz)  |                                | ---  | ---        | 15         | mV rms |
| Temperature Coefficient |                                | ---  | $\pm 0.01$ | $\pm 0.02$ | %/°C   |
| Output Short Circuit    | Continuous                     |      |            |            |        |

## General Specifications

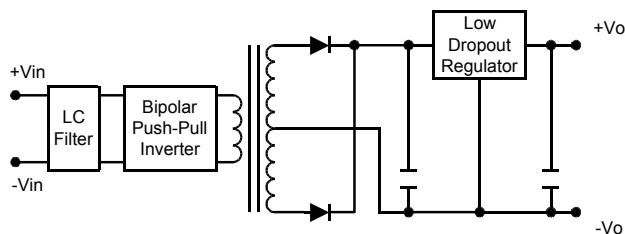
| Parameter               | Conditions                          | Min. | Typ. | Max. | Unit      |
|-------------------------|-------------------------------------|------|------|------|-----------|
| Isolation Voltage Rated | 60 Seconds                          | 6000 | ---  | ---  | VDC       |
| Isolation Voltage Test  | Flash Tested for 1 Second           | 8000 | ---  | ---  | VDC       |
| Leakage Current         | 240VAC, 60Hz                        | ---  | ---  | 2    | $\mu A$   |
| Isolation Resistance    | 500VDC                              | 10   | ---  | ---  | $G\Omega$ |
| Isolation Capacitance   | 100KHz, 1V                          | ---  | 20   | 30   | pF        |
| Switching Frequency     |                                     | 25   | ---  | 80   | KHz       |
| MTBF                    | MIL-HDBK-217F @ 25°C, Ground Benign | 600  | ---  | ---  | K Hours   |

### Notes:

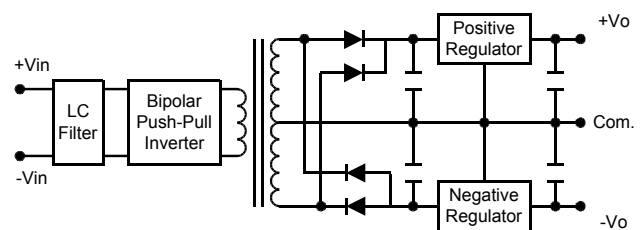
1. Specifications typical at  $T_a = +25^\circ C$ , resistive load, nominal input voltage, rated output current unless otherwise noted.
2. Ripple & Noise measurement bandwidth is 0–20 MHz.
3. All DC/DC converters should be externally fused at the front end for protection.
4. Other input and output voltage may be available, please contact factory.
5. Specifications subject to change without notice.

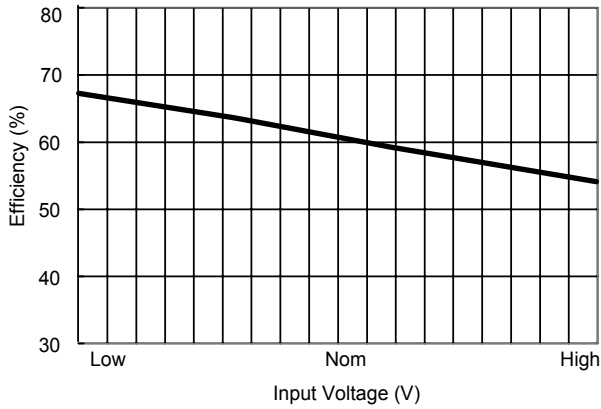
## Block Diagram

### Single Output

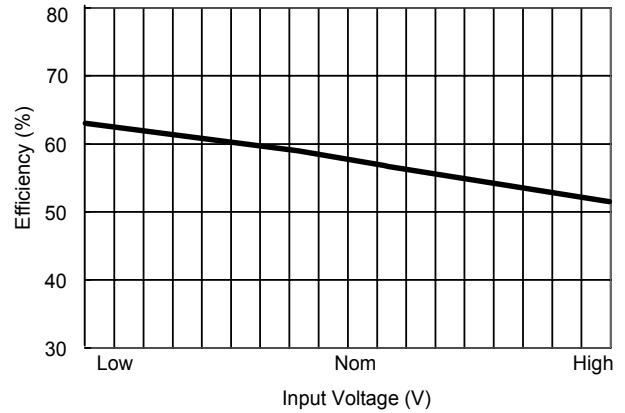


### Dual Output

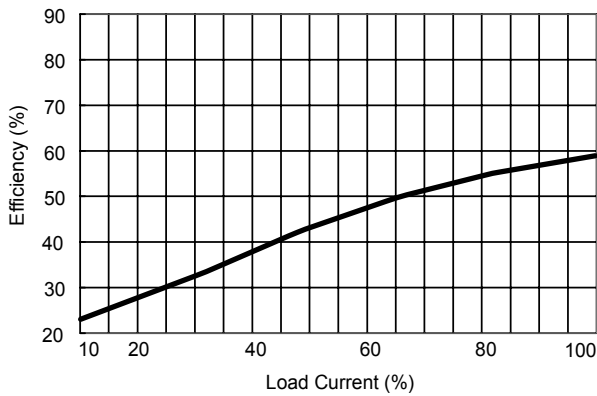




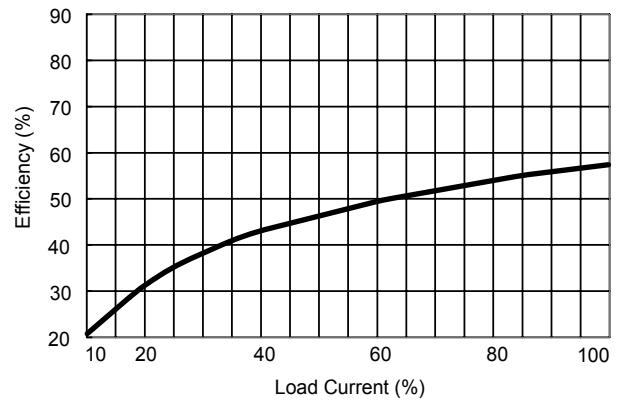
**Efficiency vs Input Voltage ( Single Output )**



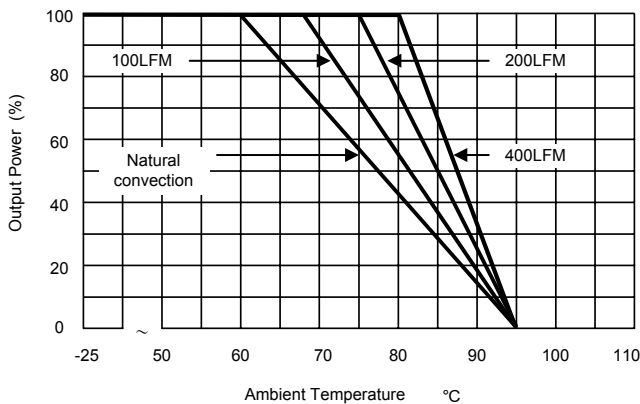
**Efficiency vs Input Voltage ( Dual Output )**



**Efficiency vs Output Load ( Single Output )**



**Efficiency vs Output Load ( Dual Output )**



**Derating Curve**

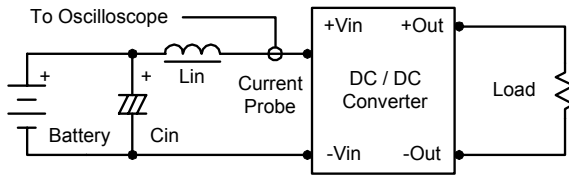
## Test Configurations

### Input Reflected-Ripple Current Test Setup

Input reflected-ripple current is measured with an inductor  $L_{in}$  (4.7uH) and  $C_{in}$  (220uF, ESR < 1.0Ω at 100 KHz) to simulate source impedance.

Capacitor  $C_{in}$ , offsets possible battery impedance.

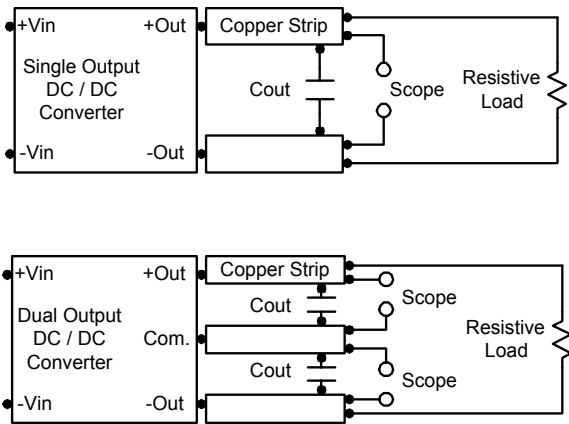
Current ripple is measured at the input terminals of the module, measurement bandwidth is 0–500 KHz.



### Peak-to-Peak Output Noise Measurement Test

Use a  $C_{out}$  0.33uF ceramic capacitor.

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.



## Design & Feature Considerations

### Maximum Capacitive Load

The MIR500 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 270uF maximum capacitive load for dual outputs and 680uF capacitive load for single outputs.

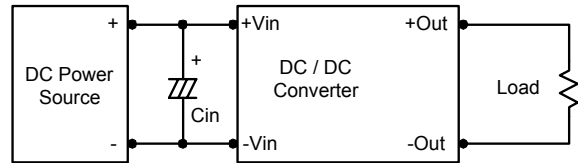
The maximum capacitance can be found in the data sheet.

### 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.

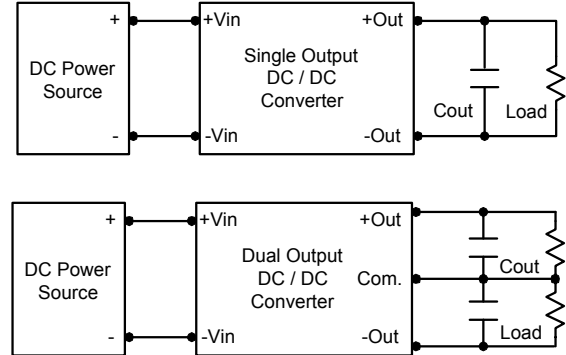
Capacitor mounted close to the power module helps ensure stability of the unit, it is recommended to use a good quality low Equivalent Series Resistance (ESR < 1.0Ω at 100 KHz) capacitor of a 4.7uF for the 5V input devices and a 2.2uF for the 12V and 24V devices.



### 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.

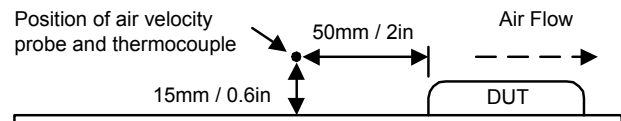
To reduce output ripple, it is recommended to use 1.5uF capacitors at the output.



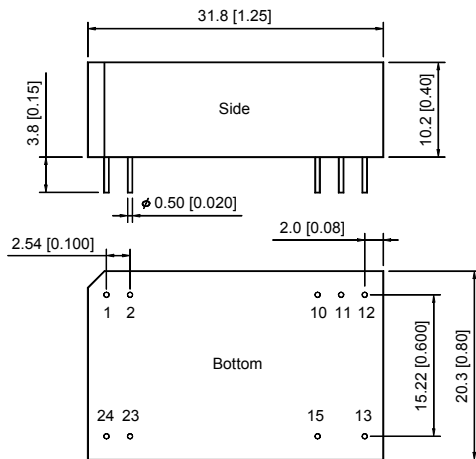
### Thermal Considerations

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 90°C.

The derating curves were determined from measurements obtained in an experimental apparatus.



## Mechanical Dimensions



| Tolerance | Millimeters     | Inches            |
|-----------|-----------------|-------------------|
|           | $X.X \pm 0.25$  | $X.XX \pm 0.01$   |
|           | $X.XX \pm 0.13$ | $X.XXX \pm 0.005$ |
| Pin       | $\pm 0.05$      | $\pm 0.002$       |

## Physical Characteristics

|               |   |  |
|---------------|---|--|
| Case Size     | : | 31.8x20.3x10.2 mm<br>1.25x0.80x0.40 inches |
| Case Material | : | Non-Conductive Black Plastic               |
| Weight        | : | 12.4g                                      |
| Flammability  | : | UL94V-0                                    |

## Pin Connections

| 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        |