

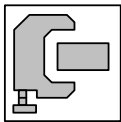
# MIHW2000 Series

3W, Ultra-Wide Input Range DIP, Single & Dual Output DC/DC Converters

## Key Features



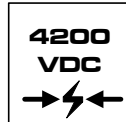
- Efficiency up to 83%
- 4200VDC Isolation
- MTBF > 1,000,000 Hours
- 4:1 Wide Input Range
- Complies With EN55022 Class B
- All I/O Clearance and Creepage Distance 2.0 mm Min.
- Temperature Performance  $-40^{\circ}\text{C}$  to  $+75^{\circ}\text{C}$
- Low Leakage Current
- Low Isolation Capacitance
- CSA60950-1 Safety Approval



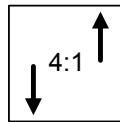
Low Profile



EN55022



I/O Isolation



Wide Range

Minmax's MIHW2000-Series power modules are specially designed to provide ultra-high levels of isolation 4200VDC in a low profile 24-pin DIP package. Operating input voltage ranges of 9-40VDC, 18-80VDC and 36-160VDC which provide precisely regulated output voltages of 5V, 12V,  $\pm 12\text{V}$  and  $\pm 15\text{VDC}$ .

The  $-40^{\circ}\text{C}$  to  $+75^{\circ}\text{C}$  operating temperature range makes it ideal for data communication equipments, mobile battery driven equipments, distributed power systems, telecommunication equipments, mixed analog/digital subsystems, process/machine control equipments, computer peripheral systems and industrial robot systems.

The modules have a maximum power rating of 3W and a typical full-load efficiency of 83%, continuous short circuit, EN55022 Class B conducted noise compliance minimize design-in time, cost and eliminate the need for external filtering.

## Absolute Maximum Ratings

Parameter	Min.	Max.	Unit	
Input Surge Voltage (1000 mS)	24VDC Input Models	-0.7	50	VDC
	48VDC Input Models	-0.7	100	VDC
	110VDC Input Models	-0.7	180	VDC
Lead Temperature (1.5mm from case for 10 Sec.)	---	260	$^{\circ}\text{C}$	
Internal Power Dissipation	---	2,500	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	-40	+75	$^{\circ}\text{C}$
Operating Temperature	Case	-40	+95	$^{\circ}\text{C}$
Storage Temperature		-40	+125	$^{\circ}\text{C}$
Humidity		---	95	%
Cooling	Free-Air Convection			
Conducted EMI	EN55022 Class B			

## Model Selection Guide

Model Number	Input Voltage	Output Voltage	Output Current		Input Current		Reflected Ripple Current	Efficiency
			Max.	Min.	@Max. Load	@No Load		@Max. Load
	VDC	VDC	mA	mA	mA (Typ.)	mA (Typ.)	% (Max.)	% (Typ.)
MIHW2022	24 (9 ~ 40)	5	600	90	160	20	15	78
MIHW2023		12	250	37.5	151			83
MIHW2026		±12	±125	±18.8	151			83
MIHW2027		±15	±100	±15	151			83
MIHW2032	48 (18 ~ 80)	5	600	90	80	10	8	78
MIHW2033		12	250	37.5	75			83
MIHW2036		±12	±125	±18.8	75			83
MIHW2037		±15	±100	±15	75			83
MIHW2042	110 (36 ~ 160)	5	600	90	35	5	3	78
MIHW2043		12	250	37.5	33			83
MIHW2046		±12	±125	±18.8	33			83
MIHW2047		±15	±100	±15	33			83

## Capacitive Load

Models by Vout	5V	12V	±12V #	±15V #	Unit
Maximum Capacitive Load	1000	470	220	220	µF

# For each output

## Input Fuse Selection Guide

24V Input Models	48V Input Models	110V Input Models
1000mA Slow – Blow Type	500mA Slow – Blow Type	300mA Slow – Blow Type

# MIHW2000 Series

## Input Specifications

Parameter	Model	Min.	Typ.	Max.	Unit
Input Voltage Range	24V Input Models	8	8.5	9	VDC
	48V Input Models	13	15	17	
	110V Input Models	26	30	34	
Under Voltage Shutdown	24V Input Models	---	---	8.5	
	48V Input Models	---	---	16	
	110V Input Models	---	---	32	
Reverse Polarity Input Current	All Models	---	---	0.3	A
Short Circuit Input Power		---	---	2000	mW
Input Filter		Pi Filter			

## Output Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
Output Voltage Accuracy		---	$\pm 0.5$	$\pm 1.0$	%
Output Voltage Balance	Dual Output, Balanced Loads	---	$\pm 0.5$	$\pm 2.0$	%
Line Regulation	$V_{in} = \text{Min. to Max.}$	---	$\pm 0.3$	$\pm 0.5$	%
Load Regulation	$I_o = 100\% \text{ to } 25\%$	---	$\pm 0.5$	$\pm 1.0$	%
Ripple & Noise (20MHz)	5V Output Models	---	75	100	mV P-P
	Other Output Models	---	100	150	mV P-P
Ripple & Noise (20MHz)	Over Line, Load & Temp.	---	---	180	mV P-P
Ripple & Noise (20MHz)		---	---	15	mV rms
Over Power Protection		120	---	---	%
Transient Recovery Time	25% Load Step Change	---	150	500	$\mu\text{S}$
Transient Response Deviation		---	$\pm 3$	$\pm 6$	%
Temperature Coefficient		---	$\pm 0.02$	$\pm 0.05$	%/°C
Output Short Circuit	Continuous				

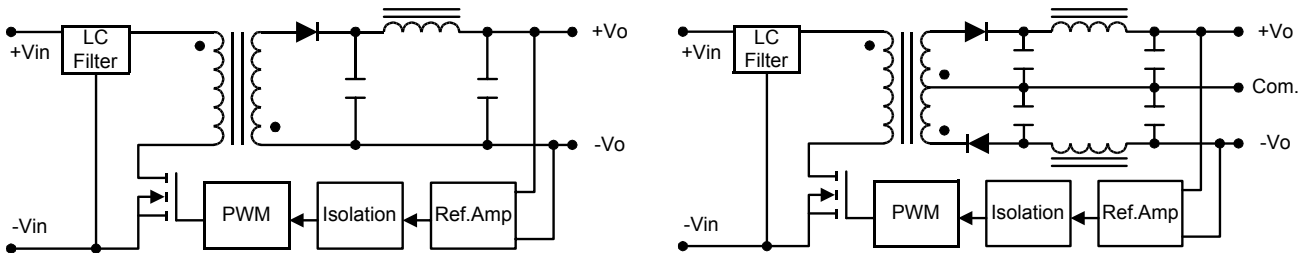
## General Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
Isolation Voltage Rated	60 Seconds	4200	---	---	VDC
Isolation Voltage Test	Flash Tested for 1 Second	5000	---	---	VDC
Leakage Current	240VAC, 60Hz	---	---	2	$\mu\text{A}$
Isolation Resistance	500VDC	1000	---	---	M $\Omega$
Isolation Capacitance	100KHz, 1V	---	7	13	pF
Switching Frequency		---	150	---	KHz
MTBF	MIL-HDBK-217F @ 25°C, Ground Benign	1000	---	---	K Hours

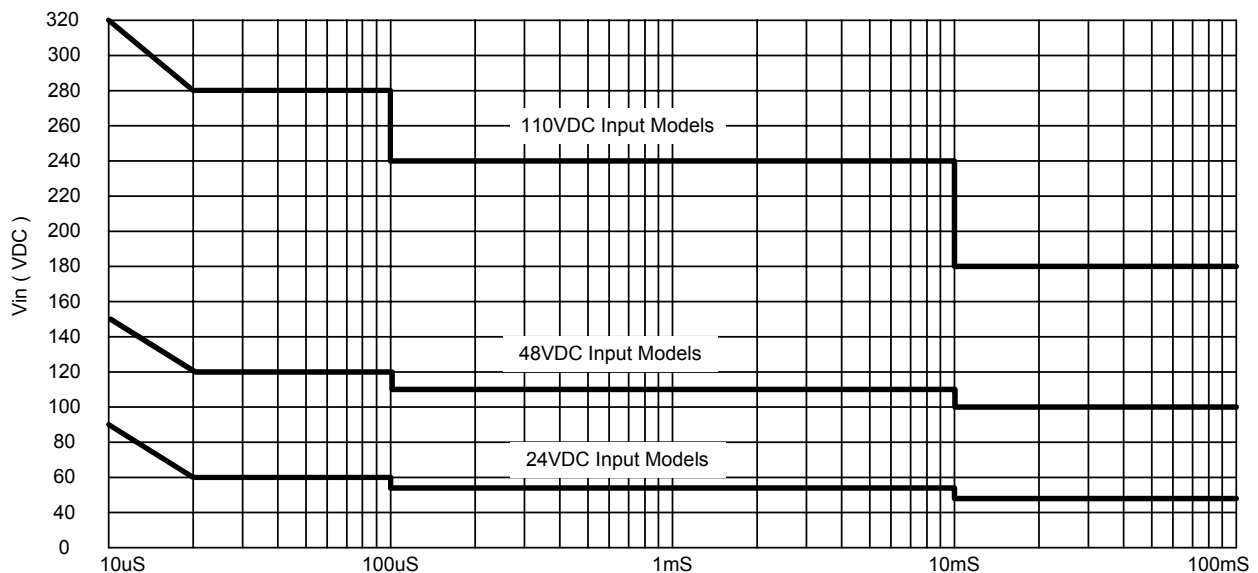
## Notes :

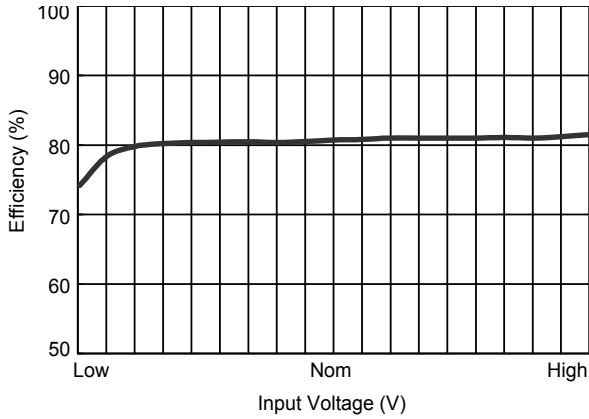
1. Specifications typical at  $T_a=+25^{\circ}\text{C}$ , resistive load, nominal input voltage, rated output current unless otherwise noted.
2. Transient recovery time is measured to within 1% error band for a step change in output load of 75% to 100%.
3. Ripple & Noise measurement bandwidth is 0–20 MHz.
4. These power converters require a minimum output loading to maintain specified regulation.
5. Operation under no-load conditions will not damage these modules; however, they may not meet all specifications listed.
6. All DC/DC converters should be externally fused at the front end for protection.
7. Other input and output voltage may be available, please contact factory.
8. Specifications subject to change without notice.

## Block Diagram

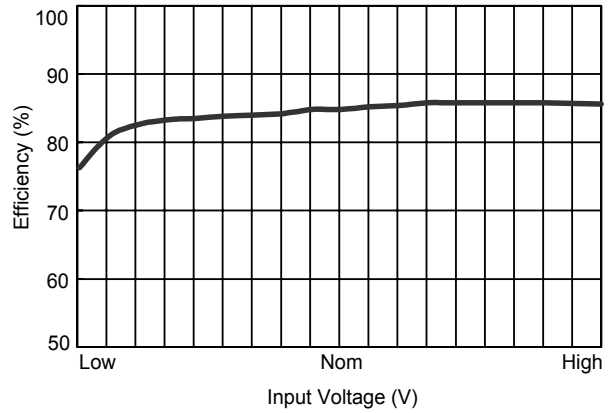


## Input Voltage Transient Rating

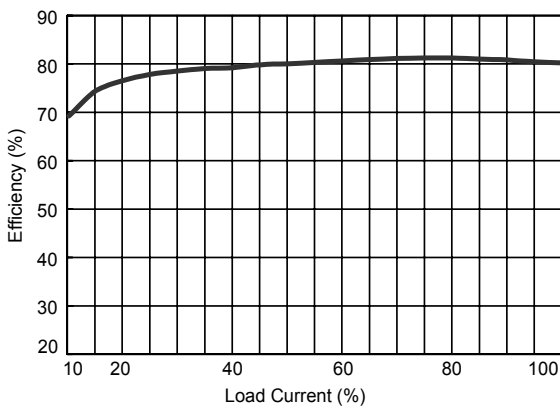




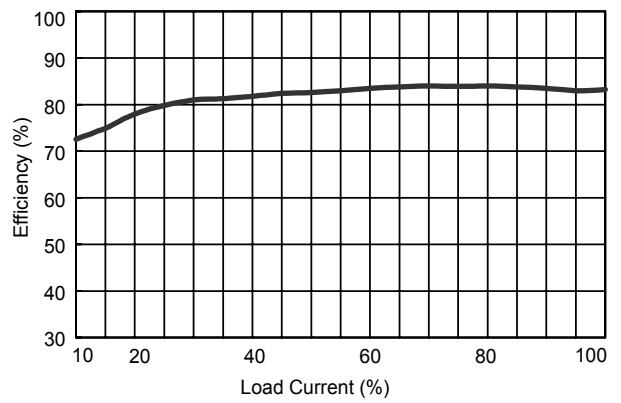
**Efficiency vs Input Voltage ( Single Output )**



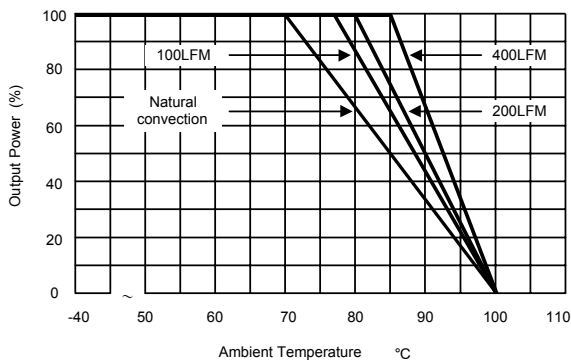
**Efficiency vs Input Voltage ( Dual Output )**



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



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



**Derating Curve**

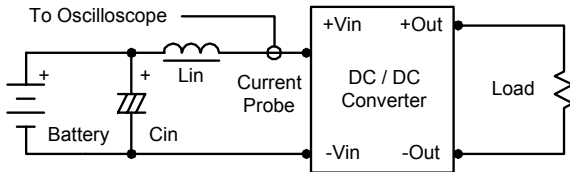
## Test Configurations

### Input Reflected-Ripple Current Test Setup

Input reflected-ripple current is measured with an inductor  $L_{in}$  (4.7 $\mu$ H) and  $C_{in}$  (220 $\mu$ F, ESR < 1.0 $\Omega$  at 100 kHz) to simulated source impedance.

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

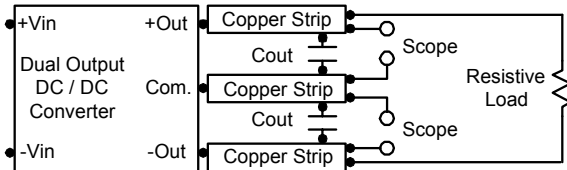
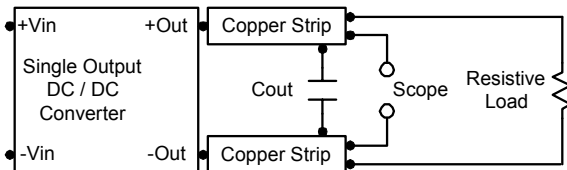
Current ripple is measured at the input terminals of the module, measurement bandwidth is 0–500KHz.



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

Use a  $C_{out}$  0.47 $\mu$ F 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 MIHW2000 series has limitation of maximum connected capacitance on the output.

The power module may operate in current limiting mode during start-up, affecting the ramp-up and the startup time.

Connect capacitors at the point of load for best performance.

The maximum capacitance can be found in the data sheet.

### Overcurrent Protection

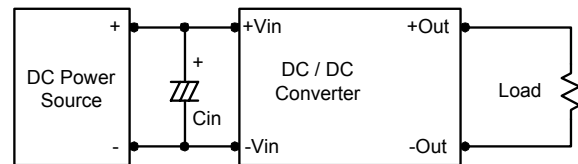
To provide protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure current limiting for an unlimited duration. At the point of current-limit inception, the unit shifts from voltage control to current control. The unit operates normally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

### 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 on the input to insure startup.

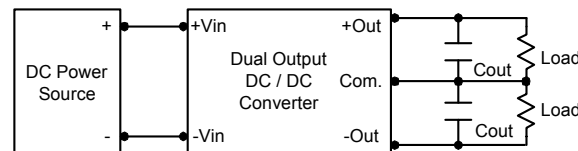
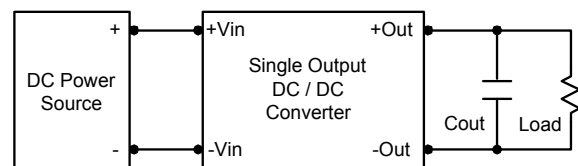
By using a good quality low Equivalent Series Resistance (ESR < 1.0 $\Omega$  at 100 kHz) capacitor of a 4.7 $\mu$ F for the 24V input devices and a 2.2 $\mu$ F for the 48V devices, capacitor mounted close to the power module helps ensure stability of the unit.



### 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.

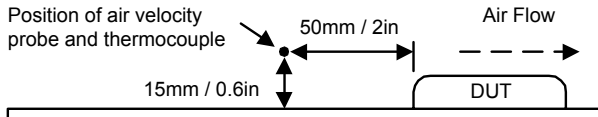
To reduce output ripple, it is recommended that 3.3 $\mu$ F capacitors are used on output.



## 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.



## Safety according to EN 60950 / CSA 60950

Insulation between adjacent primary circuits or between primary & secondary circuits:

Operational-, Basic- and Supplementary insulation for working voltages up to 420 VDC /300 VAC.

Reinforced insulation for working voltages up to 210 VDC / 150 VAC.

Insulation between adjacent secondary circuits:

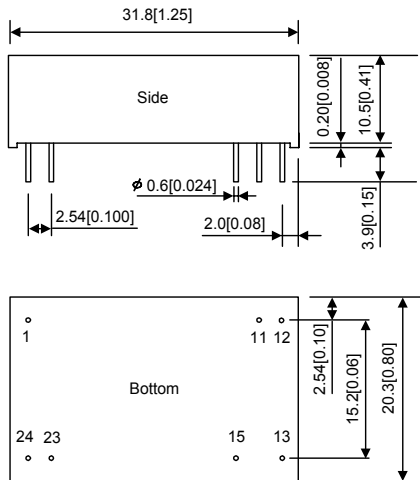
Operational-, Basic- Supplementary and Reinforced insulation for working voltages up to 420 VDC /300 VAC.

## Electromagnetic emission EN 55022 < B

Conducted and radiated emissions

MIHW204X-types EN 55022 < A ; with external coupling capacitor  $C_{io}=1$  nF < B

## Mechanical Dimensions



## Physical Characteristics

- Case Size** : 31.8×20.3×10.7 mm  
1.25×0.8×0.42 inches
- Case Material** : Non-Conductive Black Plastic
- Weight** : 16.2g
- Flammability** : UL94V-0

Tolerance	Millimeters	Inches
	X.X±0.25	X.XX±0.01
	X.XX±0.13	X.XXX±0.005
Pin	±0.05	±0.002

## Pin Connections

Pin	Single Output	Dual Output
1	+Vin	+Vin
11	No Pin	Common
12	-Vout	No Pin
13	+Vout	-Vout
15	No Pin	+Vout
23	-Vin	-Vin
24	-Vin	-Vin