# MDW1000 Series

*2W, Wide Input Range DIP, Single & Dual Output DC/DC Converters*

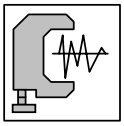
### Key Features

- *Efficiency up to 81%*
- *1500VDC Isolation*
- *MTBF > 1,000,000 Hours*
- *2:1 Wide Input Range*
- *CSA1950 Safety Approval*
- *Low Ripple and Noise*
- *Short Circuit Protection*
- *Complies with EN55022 Class A*
- *UL 94V−0 Package Material*
- *Internal SMD Construction*

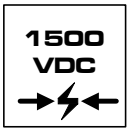

Minmax's MDW1000−Series power modules are low−profile dc−dc converters that operate over input voltage ranges of 4.5−9VDC, 9−18VDC, 18−36VDC and 36−75VDC which provide precisely regulated output voltages of 3.3V, 5V, 12V, 15V, ±5V, ±12V and ±15VDC.

The MDW1000 series is an excellent selection 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.

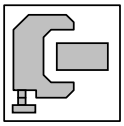
The modules have a maximum power rating of 2W and a typical full−load efficiency of 81%, continuous short circuit, 30mV output ripple, built−in filtering for both input and output minimize the need for external filtering.

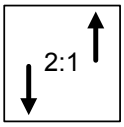

Low Noise

EN55022



I/O Isolation

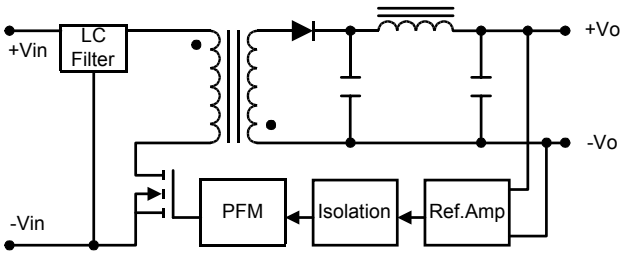

Low Profile



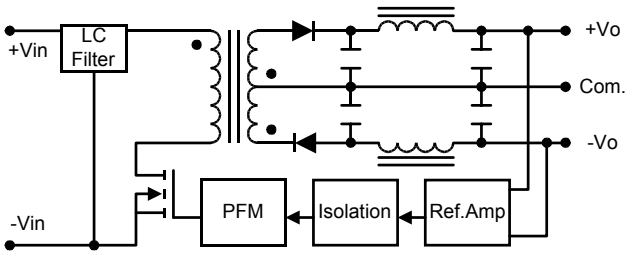
Wide Range

## Block Diagram

### Single Output




### Dual Output



## 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.) | mA (Typ.) | % (Typ.) |
| MDW1011 | 5 ( 4.5 ~ 9 ) | 3.3 | 500 | 125 | 471 | 40 | 100 | 70 |
| MDW1012 | | 5 | 400 | 100 | 548 | | | 73 |
| MDW1013 | | 12 | 167 | 42 | 534 | | | 75 |
| MDW1014 | | 15 | 134 | 33 | 582 | | | 73 |
| MDW1015 | | ±5 | ±200 | ±50 | 667 | | | 64 |
| MDW1016 | | ±12 | ±83 | ±21 | 615 | | | 69 |
| MDW1017 | | ±15 | ±67 | ±17 | 598 | | | 71 |
| MDW1021 | 12 ( 9 ~ 18 ) | 3.3 | 500 | 125 | 184 | 20 | 25 | 73 |
| MDW1022 | | 5 | 400 | 100 | 217 | | | 77 |
| MDW1023 | | 12 | 167 | 42 | 209 | | | 80 |
| MDW1024 | | 15 | 134 | 33 | 220 | | | 80 |
| MDW1025 | | ±5 | ±200 | ±50 | 242 | | | 73 |
| MDW1026 | | ±12 | ±83 | ±21 | 224 | | | 78 |
| MDW1027 | | ±15 | ±67 | ±17 | 226 | | | 78 |
| MDW1031 | 24 ( 18 ~ 36 ) | 3.3 | 500 | 125 | 96 | 10 | 15 | 72 |
| MDW1032 | | 5 | 400 | 100 | 109 | | | 77 |
| MDW1033 | | 12 | 167 | 42 | 109 | | | 80 |
| MDW1034 | | 15 | 134 | 33 | 108 | | | 81 |
| MDW1035 | | ±5 | ±200 | ±50 | 119 | | | 74 |
| MDW1036 | | ±12 | ±83 | ±21 | 112 | | | 78 |
| MDW1037 | | ±15 | ±67 | ±17 | 110 | | | 80 |
| MDW1041 | 48 ( 36 ~ 75 ) | 3.3 | 500 | 125 | 49 | 8 | 10 | 71 |
| MDW1042 | | 5 | 400 | 100 | 57 | | | 73 |
| MDW1043 | | 12 | 167 | 42 | 53 | | | 79 |
| MDW1044 | | 15 | 134 | 33 | 55 | | | 79 |
| MDW1045 | | ±5 | ±200 | ±50 | 62 | | | 71 |
| MDW1046 | | ±12 | ±83 | ±21 | 57 | | | 77 |
| MDW1047 | | ±15 | ±67 | ±17 | 57 | | | 77 |

## Absolute Maximum Ratings

| Parameter | | Min. | Max. | Unit |
|---|---|---|---|---|
| Input Surge Voltage ( 1000 mS ) | 5VDC Input Models | −0.7 | 11 | VDC |
| | 12VDC Input Models | −0.7 | 25 | VDC |
| | 24VDC Input Models | −0.7 | 50 | VDC |
| | 48VDC Input Models | −0.7 | 100 | VDC |
| Lead Temperature (1.5mm from case for 10 Sec.) | | −−− | 260 | ℃ |
| Internal Power Dissipation | | −−− | 1,800 | 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 | +65 | ℃ |
| Operating Temperature | Case | −40 | +90 | ℃ |
| Storage Temperature | | −40 | +125 | ℃ |
| Humidity | | −−− | 95 | % |
| Cooling | Free−Air Convection | | | |
| Conducted EMI | EN55022 Class A | | | |

## NoteS :

1. Specifications typical at Ta=+25℃, 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 on the front end for protection.
7. Other input and output voltage may be available, please contact factory.
8. Specifications subject to change without notice.

## Input Specifications

| Parameter | Model | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Start Voltage | 5V Input Models | 3.5 | 4 | 4.5 | VDC |
| | 12V Input Models | 4.5 | 7 | 9 | |
| | 24V Input Models | 8 | 12 | 18 | |
| | 48V Input Models | 16 | 24 | 36 | |
| Under Voltage Shutdown | 5V Input Models | --- | 3.5 | 4 | |
| | 12V Input Models | --- | 6.5 | 8.5 | |
| | 24V Input Models | --- | 11 | 17 | |
| | 48V Input Models | --- | 22 | 34 | |
| Reverse Polarity Input Current | All Models | --- | --- | 1 | A |
| Short Circuit Input Power | | --- | --- | 1500 | mW |
| Input Filter | | Pi Filter | | | |

## Output Specifications

| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Output Voltage Accuracy | | --- | ±1.0 | ±2.0 | % |
| Output Voltage Balance | Dual Output, Balanced Loads | --- | ±1.0 | ±2.0 | % |
| Line Regulation | Vin=Min. to Max. | --- | ±0.3 | ±0.5 | % |
| Load Regulation | Io=25% to 100% | --- | ±0.5 | ±0.75 | % |
| Ripple & Noise (20MHz) | | --- | 30 | 50 | mV P-P |
| Ripple & Noise (20MHz) | Over Line, Load & Temp. | --- | --- | 75 | mV P-P |
| Ripple & Noise (20MHz) | | --- | --- | 15 | mV rms |
| Over Power Protection | | 120 | --- | --- | % |
| Transient Recovery Time | 25% Load Step Change | --- | 100 | 300 | uS |
| Transient Response Deviation | | --- | ±3 | ±5 | % |
| Temperature Coefficient | | --- | ±0.01 | ±0.02 | %/°C |
| Output Short Circuit | Continuous | | | | |

## General Specifications

| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Isolation Voltage Rated | 60 Seconds | 1500 | --- | --- | VDC |
| Isolation Voltage Test | Flash Tested for 1 Second | 1650 | --- | --- | VDC |
| Isolation Resistance | 500VDC | 1000 | --- | --- | MΩ |
| Isolation Capacitance | 100KHz,1V | --- | 250 | 420 | pF |
| Switching Frequency | | --- | 300 | --- | KHz |
| MTBF | MIL-HDBK-217F @ 25°C, Ground Benign | 1000 | --- | --- | K Hours |

## Capacitive Load

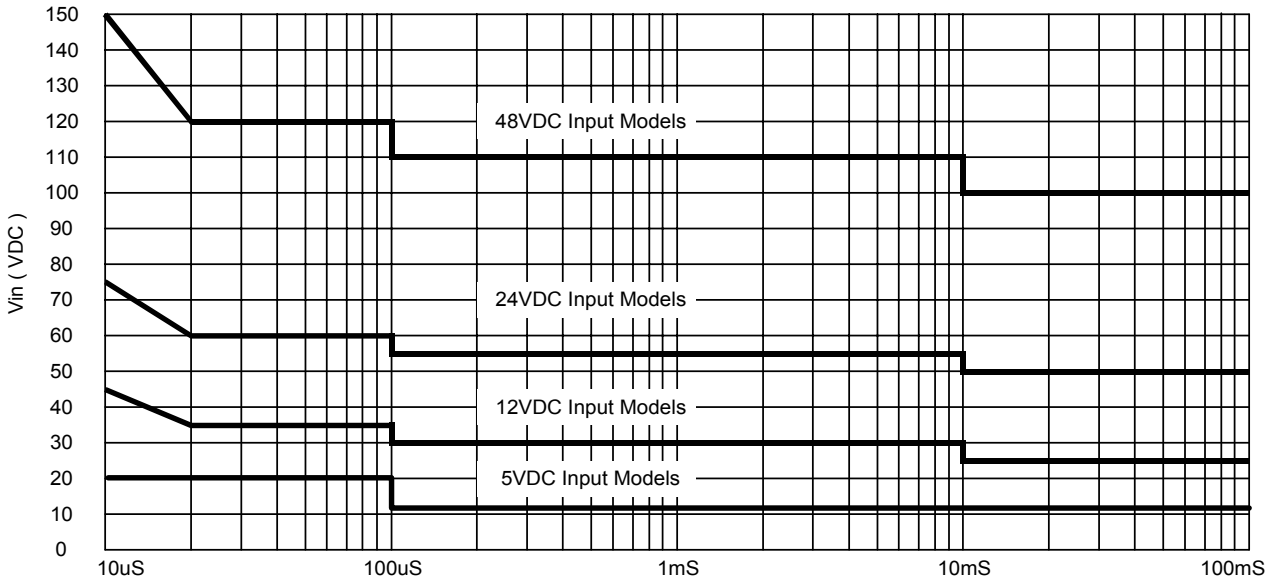
| Models by Vout | 3.3V | 5V | 12V | 15V | ±5V # | ±12V # | ±15V # | Unit |
|---|---|---|---|---|---|---|---|---|
| Maximum Capacitive Load | 2200 | 1000 | 170 | 110 | 470 | 100 | 47 | uF |

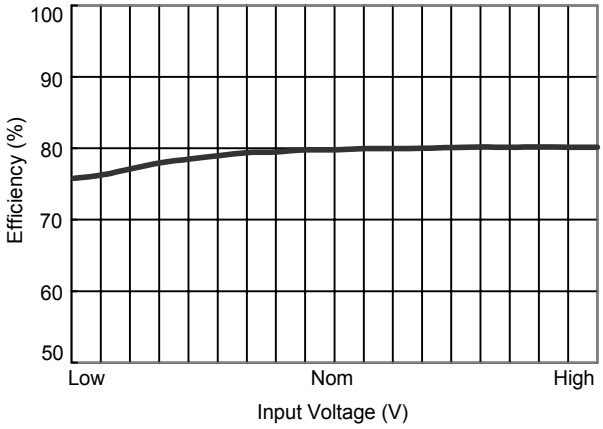
**# For each output**

## Input Fuse Selection Guide

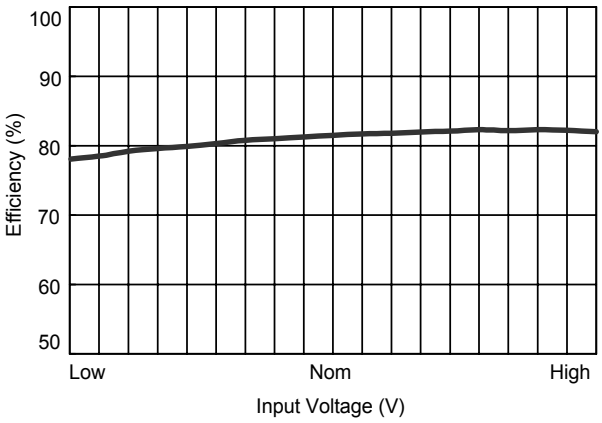
| 5V Input Models | 12V Input Models | 24V Input Models | 48V Input Models |
|---|---|---|---|
| 1000mA Slow − Blow Type | 500mA Slow − Blow Type | 250mA Slow − Blow Type | 120mA Slow − Blow Type |

## Input Voltage Transient Rating

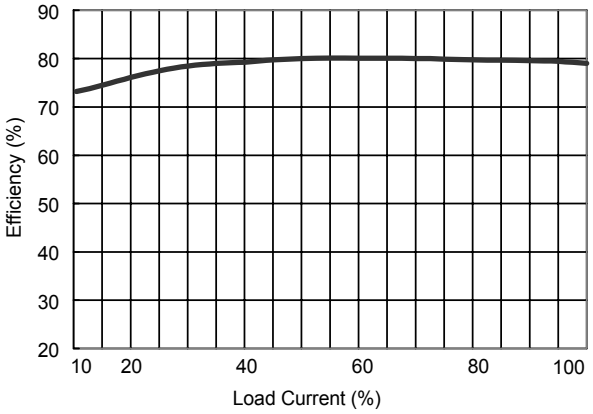




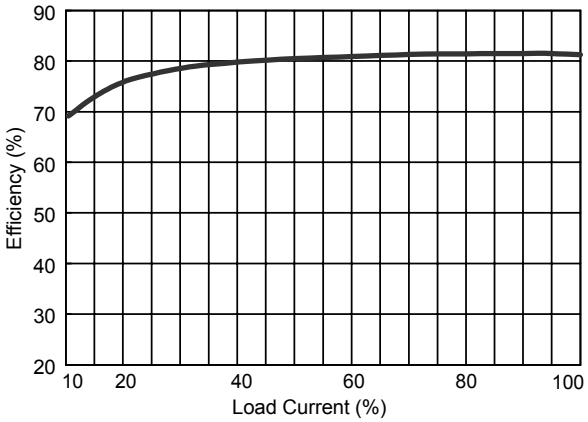

***Efficiency vs Input Voltage ( Single Output )***



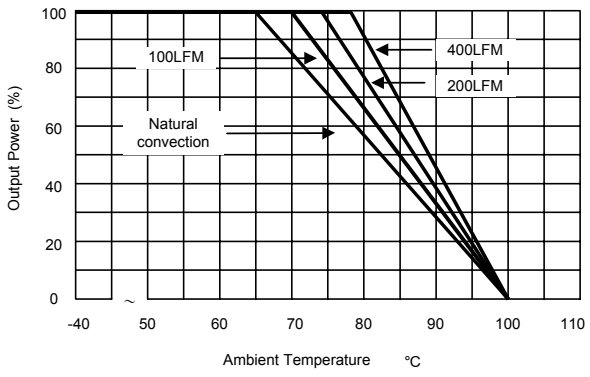

***Efficiency vs Input Voltage ( Dual Output )***




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




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




***Derating Curve***

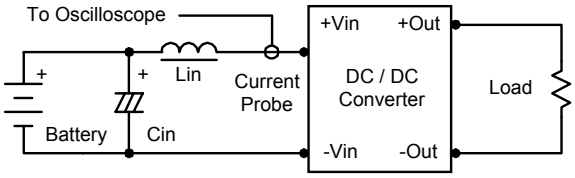
## Test Configurations

### Input Reflected-Ripple Current Test Setup

Input reflected−ripple current is measured with a inductor Lin (4.7uH) and Cin (220uF, ESR < 1.0Ω at 100 kHz) to simulated source impedance.

Capacitor Cin, offsets possible battery impedance.

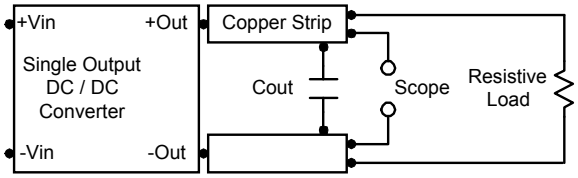
Current ripple is measured at the input terminals of the module, measurement bandwidth is 0−500KHz.

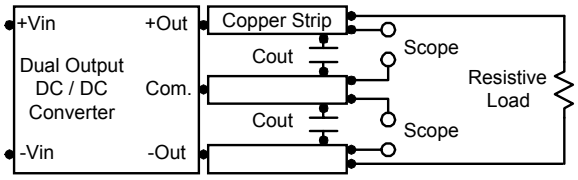



### Peak-to-Peak Output Noise Measurement Test

Use a Cout 0.47uF 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 MDW1000 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.

The maximum capacitance can be found in the data sheet.

### Overcurrent Protection

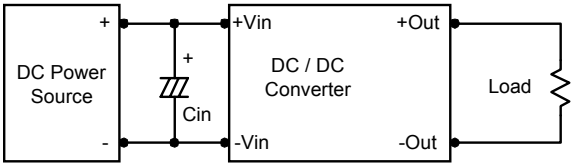
To provide protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure current limiting for an unlimited duration. At the point of current−limit inception, the unit shifts from voltage control to current control. The unit operates normally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

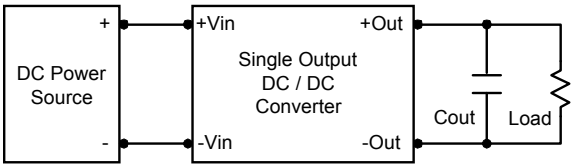
By using a good quality low Equivalent Series Resistance (ESR < 1.0Ω at 100 kHz) capacitor of a 8.2uF for the 5V input devices, a 3.3uF for the 12V input devices and a 1.5uF for the 24V and 48V devices, capacitor mounted close to the power module helps ensure stability of the unit.

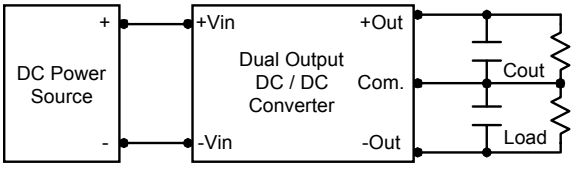



### Output Ripple Reduction

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 3.3uF capacitors are used on output.

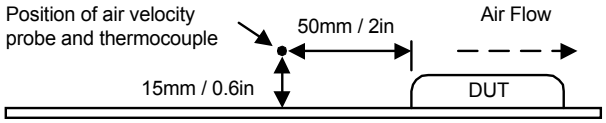


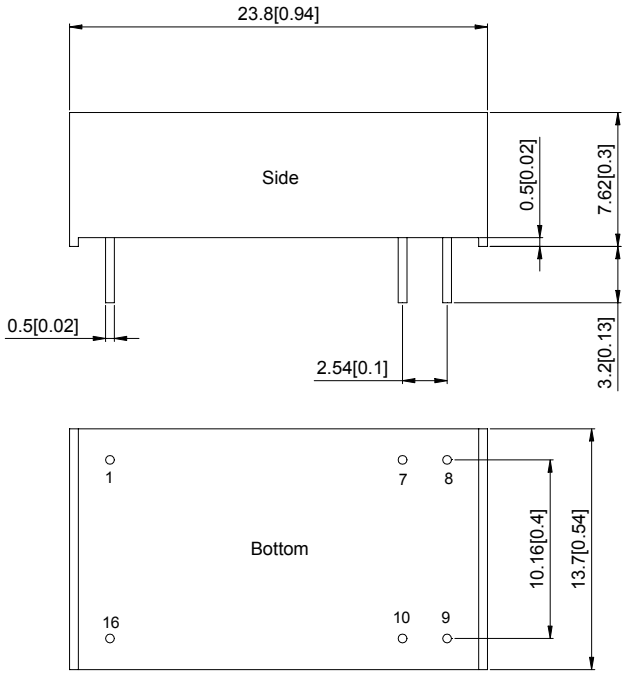
### *Thermal Considerations*

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.



## Mechanical Dimensions

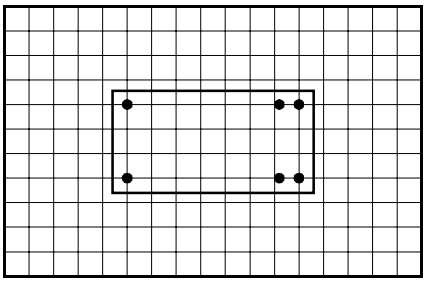



| Tolerance | Millimeters | Inches |
|---|---|---|
| | X.X±0.25 | X.XX±0.01 |
| | X.XX±0.13 | X.XXX±0.005 |
| Pin | ±0.05 | ±0.002 |

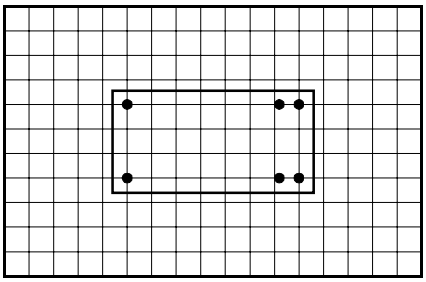
## Connecting Pin Patterns

*Top View ( 2.54 mm / 0.1 inch grids )*

### Single Output



### Dual Output



## Pin Connections

| Pin | Single Output | Dual Output |
|---|---|---|
| 1 | −Vin | −Vin |
| 7 | NC | NC |
| 8 | NC | Common |
| 9 | +Vout | +Vout |
| 10 | −Vout | −Vout |
| 16 | +Vin | +Vin |

NC: No Connection

## Physical Characteristics

**Case Size** : 23.8×13.7×7.62 mm
0.94×0.54×0.30 inches

**Case Material** : Non−Conductive Black Plastic

**Weight** : 5.1g

**Flammability** : UL94V−0

*The MDW1000 converter is encapsulated in a low thermal resistance molding compound that has excellent resistance/electrical characteristics over a wide temperature range or in high humidity environments.*
*The encapsulant and unit case are both rated to UL 94V−0 flammability specifications.*
*Leads are tin plated for improved solderability.*