## FEATURES

- Smallest Encapsulated 10W Converter
- Industrial Standard DIP-16 Package
- Wide 2:1 Input Voltage Range
- Fully Regulated Output Voltage
- I/O Isolation 1500 VDC
- Operating Ambient Temp. Range -40℃ to +88℃
- Low No Load Power Consumption
- No Min. Load Requirement
- Under-voltage, Overload and Short Circuit Protection
- Shielded Metal Case with Insulated Baseplate
- Conducted EMI EN 55032 Class A & FCC Level A Approved
- UL/cUL/IEC/EN 62368-1(60950-1) Safety Approval & CE Marking

NEW


UL 62368-1
UL 60950-1
CB Scheme
REACH COMPLIANT
3 YEAR WARRANTY
RoHS Compliant

## PRODUCT OVERVIEW

The MDW10 Series is the latest generation of high performance DC-DC converter modules setting a new standard concerning power density 65W/in³. The product offers a full 10Watt isolated DC-DC converter within an small encapsulated DIP-16 package which occupied only 0.5in² of PCB space. There are 24 models available for 12、24 & 48VDC with wide 2:1 input voltage range. Further features included under-voltage protection, overload protection, short circuit protection, very low no load power consumption, no min. load requirement, fast start-up time and conducted EMI class A approved as well. An high efficiency allows operating temperatures range of -40℃ to 88℃. All models have been qualified per the CB scheme with safety approvals to UL/cUL/IEC/EN 62368-1.

These DC-DC Converters offer a superior solution for many space-critical application in battery-powered equipment, instrumentation, distributed power architectures in communication, industrial electronics, energy facilities where PCB space is limited and offer designers the opportunity to reduce overall PCB layout area.

### Model Selection Guide

| Model Number | Input Voltage (Range) | Output Voltage | Output Current | Input Current | | Max. capacitive Load | Efficiency (typ.) |
|---|---|---|---|---|---|---|---|
| | | | Max. | @Max. Load | @No Load | | @Max. Load |
| | VDC | VDC | mA | mA(typ.) | mA(typ.) | μF | % |
| MDW10-12S033 | 12 (9 ~ 18) | 3.3 | 2700 | 940 | 20 | 2600 | 79 |
| MDW10-12S05 | | 5 | 2000 | 1016 | | 1300 | 82 |
| MDW10-12S051 | | 5.1 | 2000 | 1037 | | 1300 | 82 |
| MDW10-12S12 | | 12 | 833 | 969 | | 560 | 86 |
| MDW10-12S15 | | 15 | 666 | 957 | | 560 | 87 |
| MDW10-12S24 | | 24 | 416 | 956 | | 200 | 87 |
| MDW10-12D12 | | ±12 | ±416 | 967 | | 390# | 86 |
| MDW10-12D15 | | ±15 | ±333 | 968 | | 200# | 86 |
| MDW10-24S033 | 24 (18 ~ 36) | 3.3 | 2700 | 464 | 10 | 2600 | 80 |
| MDW10-24S05 | | 5 | 2000 | 502 | | 1300 | 83 |
| MDW10-24S051 | | 5.1 | 2000 | 512 | | 1300 | 83 |
| MDW10-24S12 | | 12 | 833 | 479 | | 560 | 87 |
| MDW10-24S15 | | 15 | 666 | 473 | | 560 | 88 |
| MDW10-24S24 | | 24 | 416 | 473 | | 200 | 88 |
| MDW10-24D12 | | ±12 | ±416 | 478 | | 390# | 87 |
| MDW10-24D15 | | ±15 | ±333 | 478 | | 200# | 87 |
| MDW10-48S033 | 48 (36 ~ 75) | 3.3 | 2700 | 232 | 8 | 2600 | 80 |
| MDW10-48S05 | | 5 | 2000 | 251 | | 1300 | 83 |
| MDW10-48S051 | | 5.1 | 2000 | 256 | | 1300 | 83 |
| MDW10-48S12 | | 12 | 833 | 239 | | 560 | 87 |
| MDW10-48S15 | | 15 | 666 | 237 | | 560 | 88 |
| MDW10-48S24 | | 24 | 416 | 236 | | 200 | 88 |
| MDW10-48D12 | | ±12 | ±416 | 239 | | 390# | 87 |
| MDW10-48D15 | | ±15 | ±333 | 239 | | 200# | 87 |

# For each output

## Input Specifications

| Parameter | Conditions/Model | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Input Surge Voltage (1 sec. max.) | 12V Input Models | -0.7 | --- | 25 | VDC |
| | 24V Input Models | -0.7 | --- | 50 | |
| | 48V Input Models | -0.7 | --- | 100 | |
| Start-Up Threshold Voltage | 12V Input Models | --- | --- | 9 | |
| | 24V Input Models | --- | --- | 18 | |
| | 48V Input Models | --- | --- | 36 | |
| Under Voltage Shutdown | 12V Input Models | --- | 8 | --- | |
| | 24V Input Models | --- | 16 | --- | |
| | 48V Input Models | --- | 34 | --- | |
| Start Up Time (Power On) | Nominal Vin and Constant Resistive Load | --- | 30 | --- | ms |
| Input Filter | All Models | Internal Pi Type | | | |

## Output Specifications

| Parameter | Conditions/Model | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Output Voltage Setting Accuracy | | | --- | --- | ±1.0 | %Vnom. |
| Output Voltage Balance | Dual Output, Balanced Loads | | --- | ±1.0 | ±2.0 | % |
| Line Regulation | Vin=Min. to Max. @Full Load | | --- | ±0.2 | ±0.8 | % |
| Load Regulation | Io=0% to 100% | | --- | --- | ±1.0 | % |
| Load Cross Regulation (Dual Output Models) | Asymmetrical Load 25/100% Full Load | | --- | --- | ±5.0 | % |
| Minimum Load | No minimum Load Requirement | | | | | |
| Ripple & Noise | 0-20 MHz Bandwidth | 3.3, 5V, 5.1V Output | --- | 60 | --- | mV P-P |
| | | Other Output | --- | 80 | --- | mV P-P |
| Transient Recovery Time | 25% Load Step Change | | --- | --- | 500 | µsec |
| Transient Response Deviation | | | --- | ±3 | ±5 | % |
| Temperature Coefficient | | | --- | ±0.01 | ±0.02 | %/℃ |
| Over Load Protection | Hiccup | | --- | 160 | --- | % |
| Short Circuit Protection | Continuous, Automatic Recovery (Hiccup Mode 0.3Hz typ.) | | | | | |

## General Specifications

| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| I/O Isolation Voltage | 60 Seconds | 1500 | --- | --- | VDC |
| | 1 Second | 1800 | --- | --- | VDC |
| Isolation Voltage Input/Output to case | | 1000 | --- | --- | VDC |
| I/O Isolation Resistance | 500 VDC | 1000 | --- | --- | MΩ |
| I/O Isolation Capacitance | 100kHz, 1V | --- | --- | 1500 | pF |
| Switching Frequency | | --- | 420 | --- | kHz |
| MTBF (calculated) | MIL-HDBK-217F@25℃, Ground Benign | 1,814,779 | --- | --- | Hours |
| Safety Approvals | UL/cUL 60950-1 recognition (UL certificate), IEC/EN 60950-1 (CB-report) | | | | |
| | UL/cUL 62368-1 recognition (UL certificate), IEC/EN 62368-1 (CB-report) | | | | |

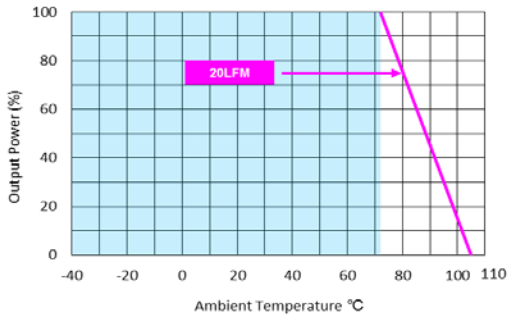
## EMC Specifications

| Parameter | Standards & Level | | | Performance |
|---|---|---|---|---|
| EMI | Conduction | EN 55032, FCC part 15 | | Class A |
| EMS | EN 55024 | | | |
| | ESD | Direct discharge | Indirect discharge HCP & VCP | |
| | | EN 61000-4-2 Air ± 8kV, Contact ± 6kV | Contact ± 6kV | A |
| | Radiated immunity | EN 61000-4-3 20V/m | | A |
| | Fast transient (5) | EN 61000-4-4 ±2kV | | A |
| | Surge (5) | EN 61000-4-5 ±2kV | | A |
| | Conducted immunity | EN 61000-4-6 10Vrms | | A |
| | PFMF | EN 61000-4-8 100A/m, 1000A/m (1 sec.) | | A |

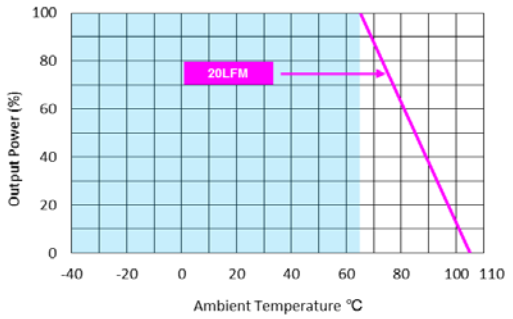
## Environmental Specifications

| Parameter | Conditions/Model | Min. | Max. | Unit |
|---|---|---|---|---|
| Operating Ambient Temperature Range Nominal Vin, Load 100% Inom. (for Power Derating see relative Derating Curves) | MDW10-12S15, MDW10-12S24, MDW10-24S12, MDW10-24S15 MDW10-24S24, MDW10-24D12, MDW10-24D15, MDW10-48S12 MDW10-48S15, MDW10-48S24, MDW10-48D12, MDW10-48D15 | -40 | +72 | ℃ |
| | MDW10-12S12, MDW10-12D12, MDW10-12D15 | | +65 | |
| | MDW10-12S05, MDW10-12S051, MDW10-24S033, MDW10-24S05 MDW10-24S051, MDW10-48S033, MDW10-48S05, MDW10-48S051 | | +54 | |
| | MDW10-12S033 | | +47 | |
| Case Temperature | | --- | +105 | ℃ |
| Storage Temperature Range | | -50 | +125 | ℃ |
| Humidity (non condensing) | | --- | 95 | % rel. H |
| Lead Temperature (1.5mm from case for 10 sec.) | | --- | 260 | ℃ |

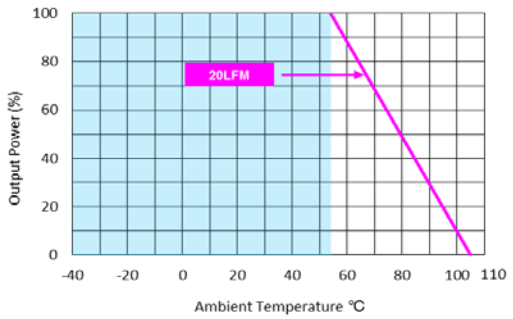
## Power Derating Curve



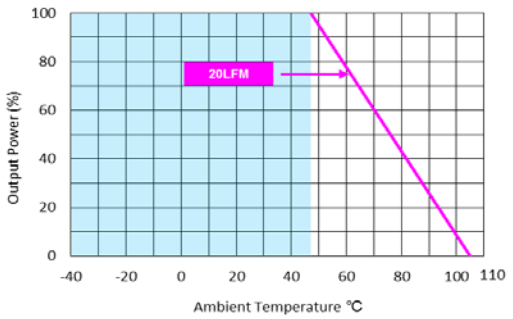

MDW10-12S15, MDW10-12S24, MDW10-24S12, MDW10-24S15, MDW10-24S24, MDW10-24D12, MDW10-24D15, MDW10-48S12 MDW10-48S15, MDW10-48S24, MDW10-48D12, MDW10-48D15




MDW10-12S12, MDW10-12D12, MDW10-12D15




MDW10-12S05, MDW10-12S051, MDW10-24S033, MDW10-24S05 MDW10-24S051, MDW10-48S033, MDW10-48S05, MDW10-48S051



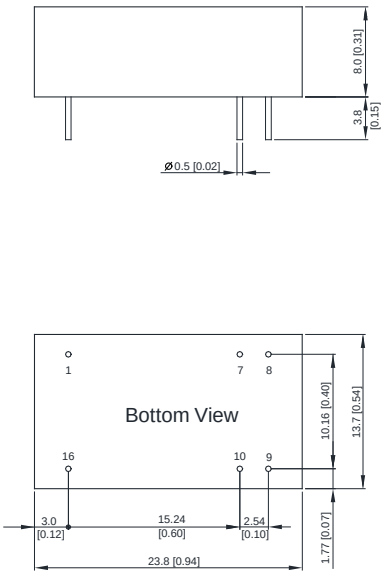

MDW10-12S033

## Notes

1. Specifications typical at Ta=+25℃, resistive load, nominal input voltage and 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. We recommend to protect the converter by a slow blow fuse in the input supply line.
4. Other input and output voltage may be available, please contact factory.
5. To meet EN 61000-4-4 & EN 61000-4-5 an external filter requested, please contact MINMAX.
6. Specifications are subject to change without notice.

## Package Specifications

### Mechanical Dimensions




### 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

- ▶ All dimensions in mm (inches)
- ▶ Tolerance: X.X±0.5 (X.XX±0.02)
  X.XX±0.25 ( X.XXX±0.01)
- ▶ Pin diameter ∅ 0.5 ±0.05 (0.02±0.002)

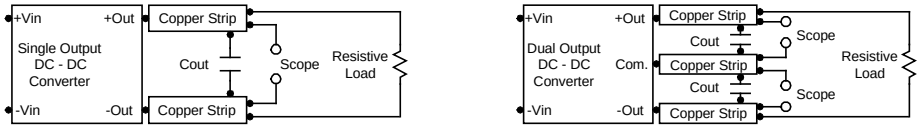
## Physical Characteristics

| | | |
|---|---|---|
| Case Size | : | 23.8x13.7x8.0 mm (0.94x0.54x0.31 inches) |
| Case Material | : | Aluminium Alloy, Black Anodized Coating |
| Pin Material | : | Tinned Copper |
| Weight | : | 6.5g |

## Test Setup

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

Refer to the output specifications or add 4.7μF capacitor if the output specifications undefine Cout. 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.



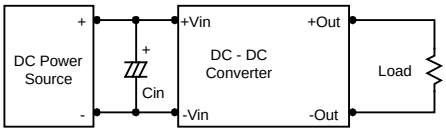

## Technical Notes

### Overload Protection

To provide hiccup mode protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure overload for an unlimited duration.

### 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 2.2μF for the 12V, 24V and 48V input 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 to use 3.3μF capacitors at the output.


### Maximum Capacitive Load

The MDW10 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.

### 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 105℃. The derating curves are determined from measurements obtained in a test setup.