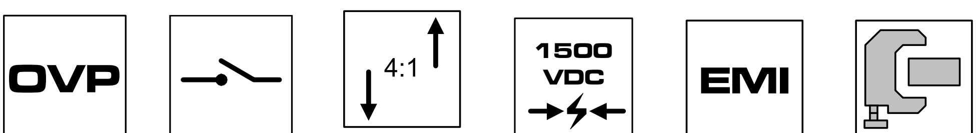
# MPW2100 Series

20W, Wide Input Range, Single & Dual Output DC/DC Converters


### Key Features

- *Efficiency up to 87%*
- *1500VDC Isolation*
- *MTBF > 1,000,000 Hours*
- *Complies with EN55022 Class A*
- *Six−Sided Shielding*
- *Remote On/Off Control*
- *Over Voltage Protection*
- *Output Trim*
- *Low Profile: 0.37"(9.3mm)*
- *Soft Start*



Protection | Remote on/off | Wide Range | I/O Isolation | EN55022 | Low Profile

Minmax's MPW2100−Series power modules are low−profile dc−dc converters that operate over input voltage ranges of 10−40VDC and 18−75VDC which provide precisely regulated output voltages of 3.3V, 5V, 12V, 15V, ±12V and ±15VDC, specially addressing 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.

Packing up to 20W of power into a 2x1.6x0.37inch package, with efficiencies as high as 87%, the MPW2100 includes continuous short circuit protection, overvoltage protection, output trim function, remote on/off, six−sided shielded case and EN55022 Class A 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 |
| Lead Temperature (1.5mm from case for 10 Sec.) | | −−− | 260 | ℃ |
| Internal Power Dissipation | | −−− | 4500 | 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 | +105 | ℃ |
| Storage Temperature | | −50 | +125 | ℃ |
| Humidity | | −−− | 95 | % |
| Cooling | Free−Air Convection | | | |
| RFI | Six−Sided Shielded, Metal Case | | | |
| Conducted EMI | EN55022 Class A | | | |

## Model Selection Guide

| Model Number | Input Voltage | Output Voltage | Output Current | | Input Current | | Reflected Ripple Current | Over Voltage Protection | Efficiency |
|---|---|---|---|---|---|---|---|---|---|
| | | | Max. | Min. | @Max. Load | @No Load | | | @Max. Load |
| | VDC | VDC | mA | mA | mA (Typ.) | mA (Typ.) | mA (Typ.) | VDC | % (Typ.) |
| MPW2131 | 24 ( 10 ~ 40 ) | 3.3 | 4000 | 240 | 688 | 20 | 50 | 3.9 | 80 |
| MPW2132 | | 5 | 4000 | 240 | 1004 | | | 6.8 | 83 |
| MPW2133 | | 12 | 1670 | 100 | 960 | | | 15 | 87 |
| MPW2134 | | 15 | 1340 | 80 | 962 | | | 18 | 87 |
| MPW2136 | | ±12 | ±835 | ±50 | 960 | | | ±15 | 87 |
| MPW2137 | | ±15 | ±670 | ±40 | 962 | | | ±18 | 87 |
| MPW2141 | 48 ( 18 ~ 75 ) | 3.3 | 4000 | 240 | 344 | 10 | 25 | 3.9 | 80 |
| MPW2142 | | 5 | 4000 | 240 | 502 | | | 6.8 | 83 |
| MPW2143 | | 12 | 1670 | 100 | 480 | | | 15 | 87 |
| MPW2144 | | 15 | 1340 | 80 | 481 | | | 18 | 87 |
| MPW2146 | | ±12 | ±835 | ±50 | 480 | | | ±15 | 87 |
| MPW2147 | | ±15 | ±670 | ±40 | 481 | | | ±18 | 87 |

## Capacitive Load

| Models by Vout | 3.3V | 5V | 12V | 15V | ±12V # | ±15V # | Unit |
|---|---|---|---|---|---|---|---|
| Maximum Capacitive Load | 5000 | 5000 | 500 | 500 | 330 | 330 | uF |

**# For each output**

## Input Fuse Selection Guide

| 24V Input Models | 48V Input Models |
|---|---|
| 5000mA Slow – Blow Type | 3000mA Slow – Blow Type |

## Input Specifications

| Parameter | Model | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Start Voltage | 24V Input Models | 9.4 | 9.7 | 10 | VDC |
| | 48V Input Models | 17 | 17.5 | 18 | |
| Under Voltage Shutdown | 24V Input Models | 9 | 9.3 | 9.5 | |
| | 48V Input Models | 16 | 16.5 | 17 | |
| Reverse Polarity Input Current | All Models | --- | --- | 2 | A |
| Short Circuit Input Power | | --- | --- | 4500 | mW |
| Input Filter | | Pi Filter | | | |

## Output Specifications

| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Output Voltage Accuracy | | --- | ±0.5 | ±1.0 | % |
| Output Voltage Balance | Dual Output, Balanced Loads | --- | ±0.5 | ±2.0 | % |
| Line Regulation | Vin=Min. to Max. | --- | ±0.2 | ±0.5 | % |
| Load Regulation | Io=50% to 100% | --- | ±0.3 | ±1.0 | % |
| Ripple & Noise (20MHz) | | --- | 55 | 80 | mV P-P |
| Ripple & Noise (20MHz) | Over Line, Load & Temp. | --- | --- | 100 | mV P-P |
| Ripple & Noise (20MHz) | | --- | --- | 10 | mV rms |
| Over Power Protection | | 120 | --- | 220 | % |
| Transient Recovery Time | 25% Load Step Change | --- | 150 | 300 | uS |
| Transient Response Deviation | | --- | ±2 | ±4 | % |
| Temperature Coefficient | | --- | ±0.01 | ±0.02 | %/℃ |
| 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 | --- | 1200 | 1500 | pF |
| Switching Frequency | | 290 | 330 | 360 | KHz |
| MTBF | MIL-HDBK-217F @ 25℃, Ground Benign | 1000 | --- | --- | K Hours |

## Remote On/Off Control

| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Supply On | 2.5 to 50VDC or Open Circuit | | | | VDC |
| Supply Off | | -1 | --- | 1 | VDC |
| Device Standby Input Current | | --- | 2 | 5 | mA |
| Control Input Current ( on ) | Vin -RC = 5.0V | --- | --- | 5 | uA |
| Control Input Current ( off ) | Vin -RC = 0V | --- | --- | -100 | uA |
| Control Common | Referenced to Negative Input | | | | |

## Output Voltage Trim

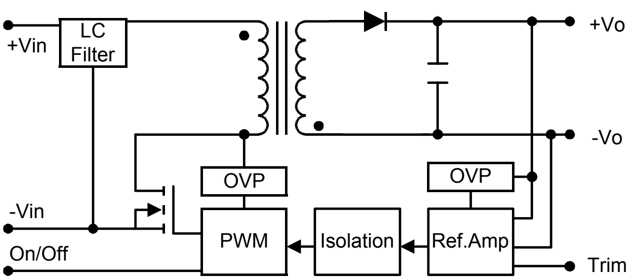
| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Trim Up / Down Range | % of nominal output voltage | ±9.0 | ±10.0 | ±11.0 | % |

### Notes1:

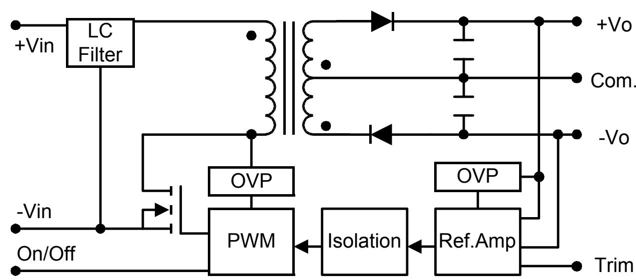
1. Specifications typical at Ta=+25℃, resistive load, nominal input voltage, rated output current unless otherwise noted.
2. Transient recovery time is measured to within 1% error band for a step change in output load of 75% to 100%.
3. Ripple & Noise measurement bandwidth is 0-20 MHz.
4. These power 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 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

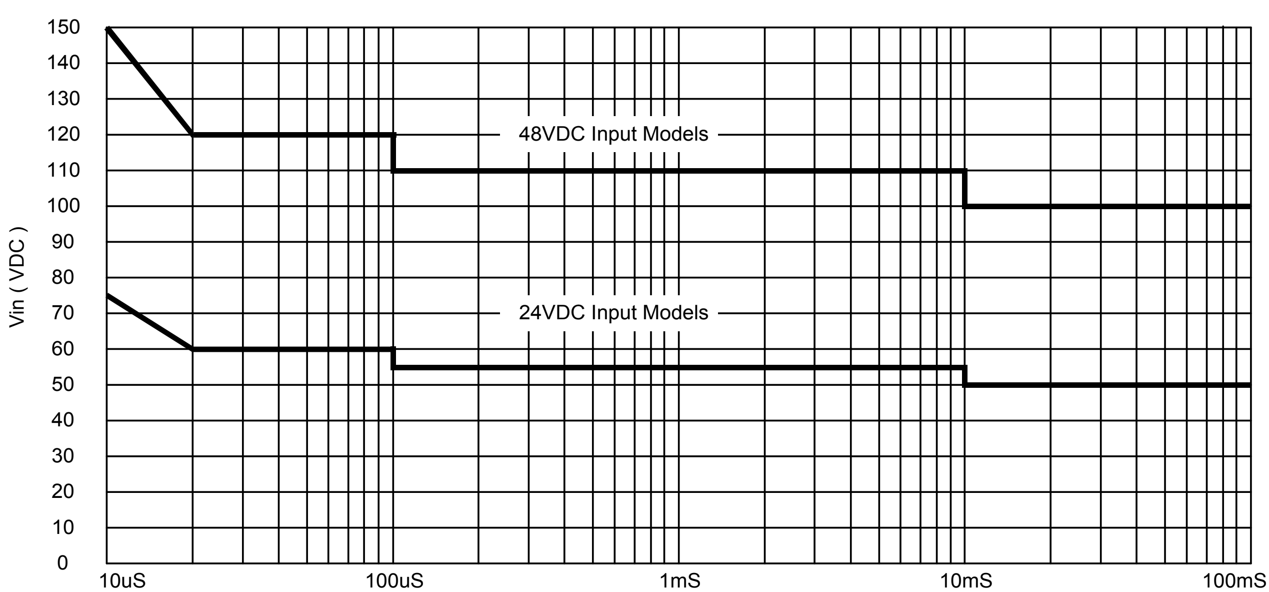
### Single Output

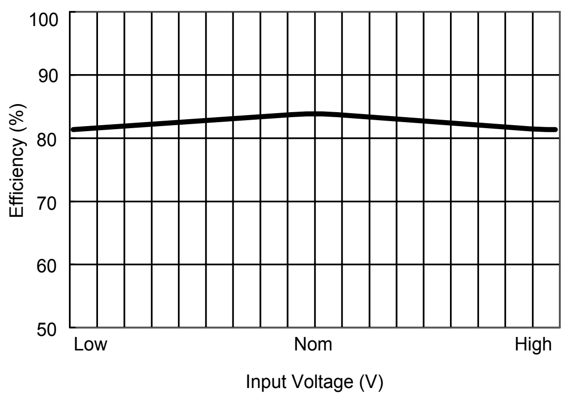



### Dual Output

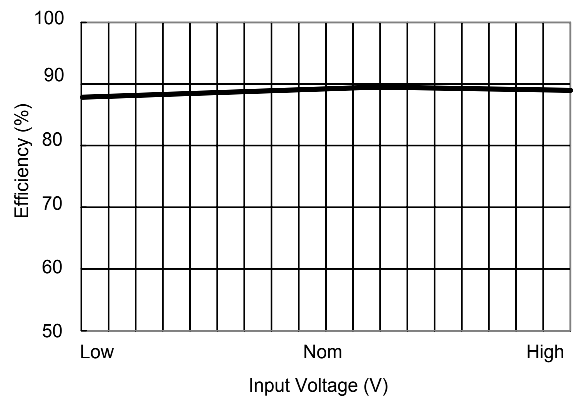



## Input Voltage Transient Rating

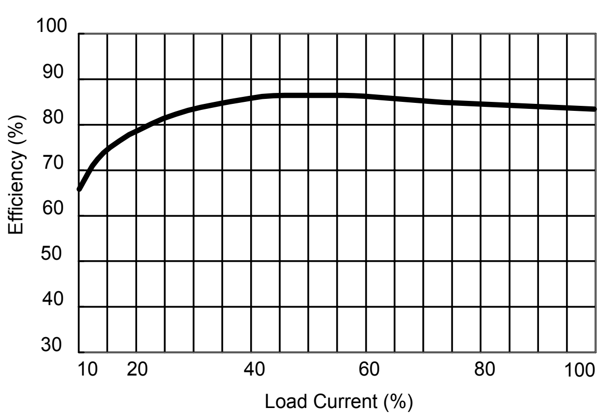




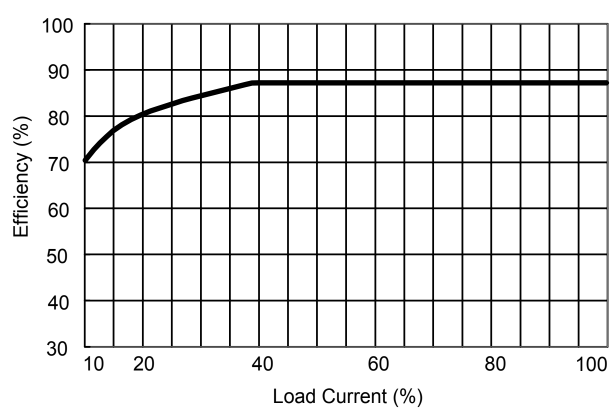

***Efficiency vs Input Voltage ( Single Output )***



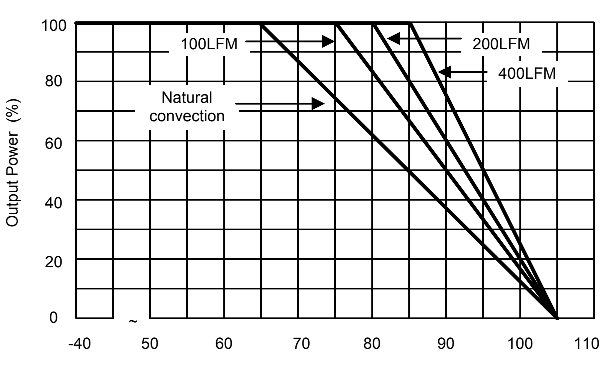

***Efficiency vs Input Voltage ( Dual Output )***




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




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

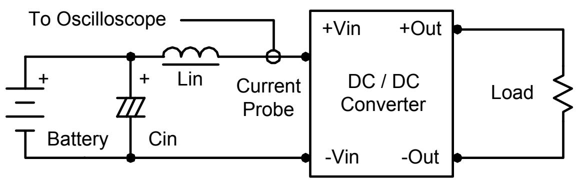



***Derating Curve***

## Test Configurations

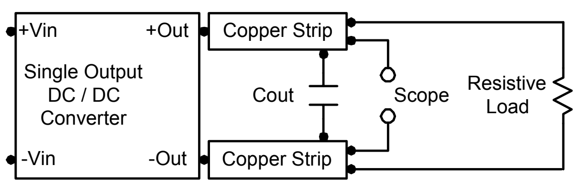
### Input Reflected-Ripple Current Test Setup

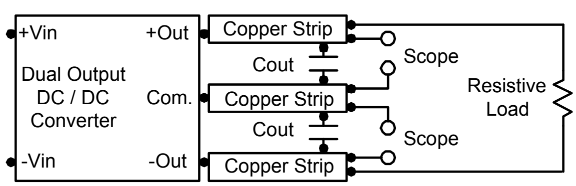
Input reflected−ripple current is measured with a inductor Lin (4.7uH) and Cin (220uF, ESR < 1.0Ω at 100 KHz) to simulate source impedance.
Capacitor Cin, offsets possible battery impedance.
Current ripple is measured at the input terminals of the module, measurement bandwidth is 0−500 KHz.




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

Use a Cout 1.0uF 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.



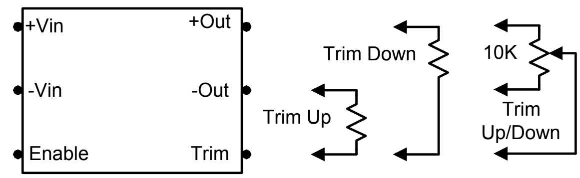

## Design & Feature Considerations

### Remote On/Off

Positive logic remote on/off turns the module on during a logic high voltage on the remote on/off pin, and off during a logic low.
To turn the power module on and off, the user must supply a switch to control the voltage between the on/off terminal and the −Vin terminal.
The switch can be an open collector or equivalent.
A logic low is −1V to 1.0V.
A logic high is 2.5V to 100V.
The maximum sink current at the on/off terminal (Pin 4) during a logic low is −100 uA.
The maximum allowable leakage current of a switch connected to the on/off terminal (Pin 4) at logic hight (2.5V to 100V) is 5uA.

### Output Voltage Trim

Output voltage trim allows the user to increase or decrease the output voltage set point of a module.
The output voltage can be adjusted by placing an external resistor (Radj) between the Trim and +Vout or −Vout terminals. By adjusting Radj, the output voltage can be change by ±10% of the nominal output voltage.




A 10K, 1 or 10 Turn trimpot is usually specified for continuous trimming. Trim pin may be safely left floating if it is not used.
Connecting the external resistor (Radj−up) between the Trim and −Vout pins increases the output voltage to set the point as defined in the following equation:

$$Radj{-}up = \frac{(33 \times Vout) - (30 \times Vadj)}{Vadj - Vout}$$

Connecting the external resistor (Radj−down) between the Trim and +Vout pins decreases the output voltage set point as defined in the following equation:

$$Radj{-}down = \frac{(36.667 \times Vadj) - (33 \times Vout)}{Vout - Vadj}$$

Vout : Nominal Output Voltage
Vadj : Adjusted Output Voltage
Units : VDC/ KΩ

### 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.

### Overvoltage Protection

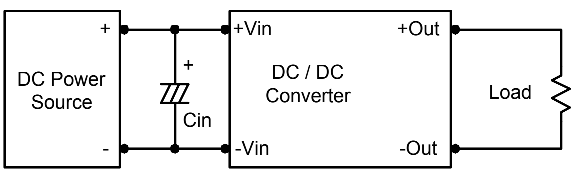
The output overvoltage clamp consists of control circuitry, which is independent of the primary regulation loop, that monitors the voltage on the output terminals.
The control loop of the clamp has a higher voltage set point than the primary loop.
This provides a redundant voltage control that reduces the risk of output overvoltage.
The OVP level can be found in the output data.

### *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.

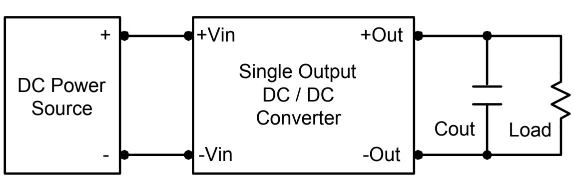
Capacitor mounted close to the power module helps ensure stability of the unit, it is recommended to use a good quality low Equivalent Series Resistance (ESR < 1.0Ω at 100 KHz) capacitor of a 33uF for the 24V input devices and a 10uF for the 48V devices.

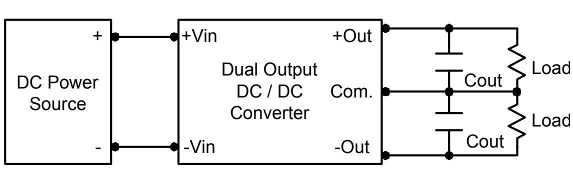



### *Output Ripple Reduction*

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 4.7uF capacitors at the output.




### *Maximum Capacitive Load*

The MPW2100 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.

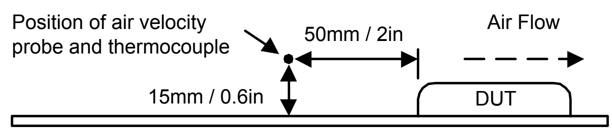
For optimum performance we recommend 330uF maximum capacitive load for dual outputs, 500uF capacitive load for 12V & 15V outputs and 5000uF capacitive load for 3.3V & 5V outputs.

The maximum capacitance can be found in the data sheet.

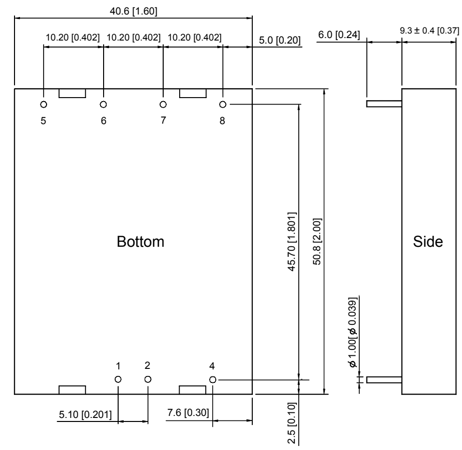
### *Thermal Considerations*

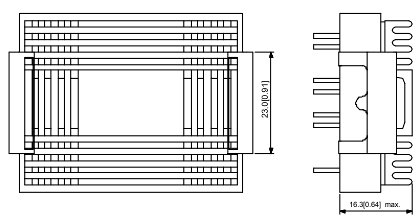
Many conditions affect the thermal performance of the power module, such as orientation, airflow over the module and board spacing. To avoid exceeding the maximum temperature rating of the components inside the power module, the case temperature must be kept below 105°C.

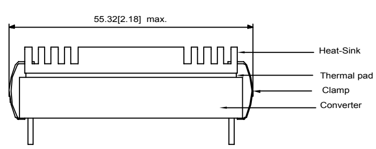
The derating curves are determined from measurements obtained in an experimental apparatus.



## 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 |

**Notes2:**

1. To order the converter with Heatsink, please add a suffix H (e.g. MPW2142H).

## Physical Characteristics

| | | |
|---|---|---|
| **Case Size** | : | 50.8×40.6×9.3 mm<br>2.0×1.6×0.37 inches |
| **Case Material** | : | Metal With Non−Conductive Baseplate |
| **Weight** | : | 48g |
| **Flammability** | : | UL94V−0 |

| | | |
|---|---|---|
| **Heat-sink Material** | : | Aluminum |
| **Finish** | : | Anodic treatment (black) |
| **Weight** | : | 2g |

**The advantages of adding a heatsink are:**

1. To help heat dissipation and increase the stability and reliability of DC/DC converters at high operating temperature atmosphere.
2. To upgrade the operating temperature of DC/DC converters, please refer to Derating Curve.

## Pin Connections

| Pin | Single Output | Dual Output |
|---|---|---|
| 1 | +Vin | +Vin |
| 2 | −Vin | −Vin |
| 4 | Remote On/Off | Remote On/Off |
| 5 | No Pin | +Vout |
| 6 | +Vout | Common |
| 7 | −Vout | −Vout |
| 8 | Trim | Trim |