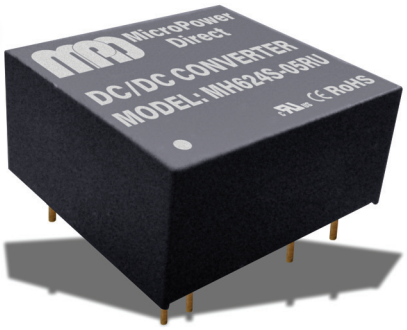
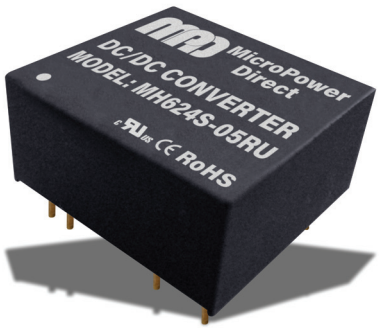
# MH600RU

## Wide 4:1 Input, 6W Ultra-Miniature DC/DC Converters




### Key Features:

- 6W Output Power
- Miniature 0.80 x 0.85" Case
- UL 62368 Approval
- Meets EN 55022 Class A
- Wide 4:1 Input Range
- Single & Dual Outputs
- 1,500 VDC Isolation
- >350 kHour MTBF
- -40°C to +80°C Operation
- 16 Standard Models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## Electrical Specifications

Specifications typical @ +25°C, nominal input voltage & rated output current, unless otherwise noted. Specifications subject to change without notice.

### Input

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Input Voltage Range | 24 VDC Input | 9.0 | 24.0 | 36.0 | VDC |
| | 48 VDC Input | 18.0 | 48.0 | 75.0 | |
| Input Start Voltage | 24 VDC Input | | | 9.0 | VDC |
| | 48 VDC Input | | | 18.0 | |
| Under Voltage Shutdown | 24 VDC Input | | | 8.5 | VDC |
| | 48 VDC Input | | | 17.0 | |
| Short Circuit Input Power | | | | 3.0 | W |
| Input Filter | Internal Capacitor | | | | |

### Output

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Output Voltage Accuracy | | | ±1.0 | ±2.0 | % |
| Output Voltage Balance | Dual Output, Balanced Loads | | ±1.0 | | % |
| Line Regulation | $V_{IN}$ = Min to Max | | ±0.5 | ±1.0 | % |
| Load Regulation | $I_{OUT}$ = 15% to 100% | | ±0.5 | ±1.2 | % |
| Ripple & Noise (20 MHz) | See Note 2 | | 60 | 100 | mV P - P |
| Temperature Coefficient | | | ±0.01 | ±0.02 | %/°C |
| Transient Recovery Time | See Note 3 | | 300 | 600 | µSec |
| Transient Response Deviation | | | ±3.0 | | % |
| Overload Protection | See Note 4 | 110 | 150 | | % |
| Output Short Circuit | Continuous (Autorecovery) | | | | |

### General

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Isolation Voltage | 60 Seconds | 1,500 | | | VDC |
| | 1 Second | 1,800 | | | |
| Isolation Resistance | 500 VDC | 1,000 | | | MΩ |
| Isolation Capacitance | 100 kHz, 1.0V | | 1,200 | 1,500 | pF |
| Switching Frequency | | | 330 | | kHz |

### EMI Characteristics

| Parameter | Standard | Criterea | Level |
|---|---|---|---|
| Conducted Emissions | EN 55022 | | Class A |

### Environmental

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Operating Temperature Range | Ambient | -40 | | +85 | °C |
| | Case | | | +105 | |
| Storage Temperature Range | | -50 | | +125 | °C |
| Cooling | Free Air Convection | | | | |
| Humidity | RH, Non-condensing | | | 95 | % |

### Physical

| | |
|---|---|
| Case Size | See Mechanical Diagram (Page 4) |
| Case Material | Non-Conductive Black Plastic (UL-94V0) |
| Weight | See Mechanical Diagram (Page 4) |

### Reliability Specifications

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| MTBF | MIL HDBK 217F, 25°C, Gnd Benign | 350 | | | kHours |
| Safety Standards | UL/cUL 62368 recognition (UL certificate) | | | | |

### Absolute Maximum Ratings

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Input Voltage Surge (1 Sec) | 24 VDC Input | | | 50.0 | VDC |
| | 48 VDC Input | | | 100.0 | |
| Lead Temperature | 1.5 mm From Case For 10 Sec | | | 260 | °C |

Caution: Exceeding Absolute Maximum Ratings may damage the module. These are not continuous operating ratings.

## Model Selection Guide

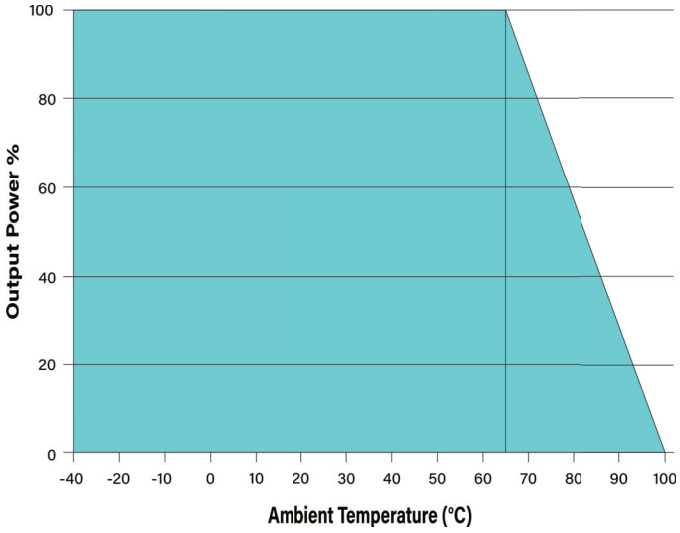


| Model Number | Input | | | | Output | | | Capacitive Load (µF Max) | Efficiency (%, Typ) | Fuse Rating Slow-Blow (mA) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Voltage (VDC) | | Current (mA) | | Voltage (VDC) | Current (mA, Max) | Current (mA, Min) | | | |
| | Nominal | Range | Full-Load | No-Load | | | | | | |
| MH624S-03RU | 24 | 9.0 - 36.0 | 262 | 30 | 3.3 | 1,450.0 | 218.0 | 330 | 76 | 1,500 |
| MH624S-05RU | 24 | 9.0 - 36.0 | 316 | 30 | 5.0 | 1200.0 | 180.0 | 330 | 79 | 1,500 |
| MH624S-12RU | 24 | 9.0 - 36.0 | 301 | 30 | 12.0 | 500.0 | 75.0 | 100 | 83 | 1,500 |
| MH624S-15RU | 24 | 9.0 - 36.0 | 301 | 30 | 15.0 | 400.0 | 60.0 | 100 | 83 | 1,500 |
| MH624S-24RU | 24 | 9.0 - 36.0 | 301 | 30 | 24.0 | 250.0 | 38.0 | 100 | 83 | 1,500 |
| MH624D-05RU | 24 | 9.0 - 36.0 | 301 | 30 | ±5.0 | ±600.0 | ±90.0 | 100 | 82 | 1,500 |
| MH624D-12RU | 24 | 9.0 - 36.0 | 301 | 30 | ±12.0 | ±250.0 | ±38.0 | 100 | 83 | 1,500 |
| MH624D-15RU | 24 | 9.0 - 36.0 | 301 | 30 | ±15.0 | ±200.0 | ±30.0 | 100 | 83 | 1,500 |
| MH648S-03RU | 48 | 18.0 - 75.0 | 131 | 20 | 3.3 | 1,450.0 | 218.0 | 330 | 76 | 750 |
| MH648S-05RU | 48 | 18.0 - 75.0 | 158 | 20 | 5.0 | 1200.0 | 180.0 | 330 | 79 | 750 |
| MH648S-12RU | 48 | 18.0 - 75.0 | 151 | 20 | 12.0 | 500.0 | 75.0 | 100 | 83 | 750 |
| MH648S-15RU | 48 | 18.0 - 75.0 | 151 | 20 | 15.0 | 400.0 | 60.0 | 100 | 83 | 750 |
| MH648S-24RU | 48 | 18.0 - 75.0 | 151 | 20 | 24.0 | 250.0 | 38.0 | 100 | 83 | 750 |
| MH648D-05RU | 48 | 18.0 - 75.0 | 151 | 20 | ±5.0 | ±600.0 | ±90.0 | 100 | 82 | 750 |
| MH648D-12RU | 48 | 18.0 - 75.0 | 151 | 20 | ±12.0 | ±250.0 | ±38.0 | 100 | 83 | 750 |
| MH648D-15RU | 48 | 18.0 - 75.0 | 151 | 10 | ±15.0 | ±200.0 | ±30.0 | 100 | 83 | 750 |

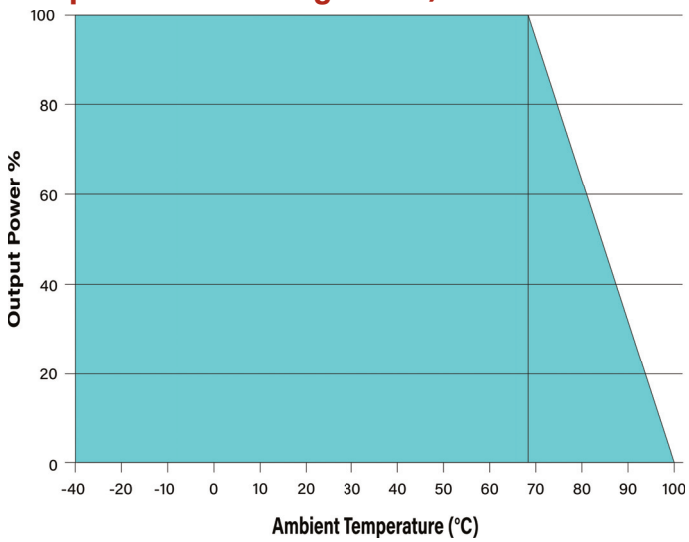
Notes:

1. The specified maximum capacitive load is for each output.
2. When measuring output ripple, it is recommended that an external 0.47 µF ceramic capacitor is connected from the +VOUT to the -VOUT pins. If the application is noise sensitive; connecting a low ESR 3.3 µF capcitor should be mounted as close to the converter as possible.
3. Transient recovery is measured to within a 1% error band for a load step change of 25%.
4. Output overload protection is provided by a fold back current limiting circuit with auto-recovery. A long-term overload could damage the unit.
5. Operation at no load will not damage these units.
6. It is recommended that a fuse be used on the input of a power supply for protection. See the Model Selection table above for the correct rating.

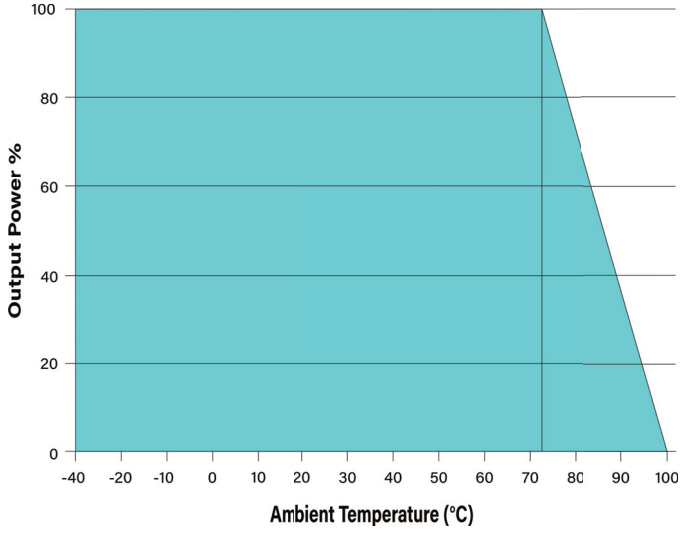
## Temperature Derating Curve, 50 LFM



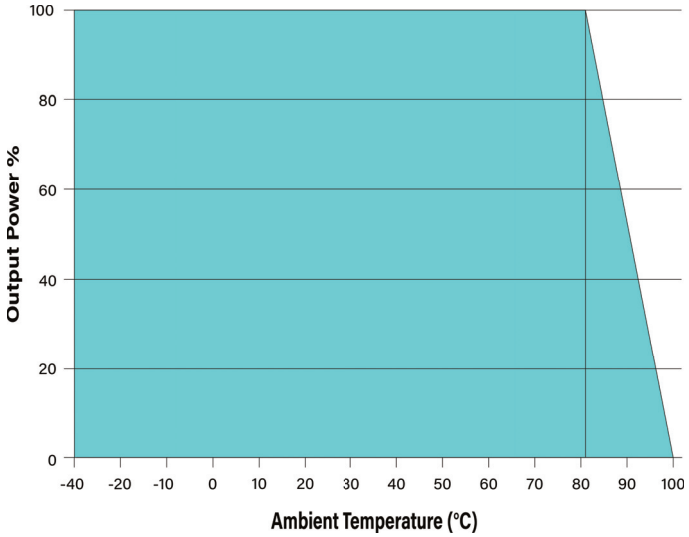

## Temperature Derating Curve, 100 LFM



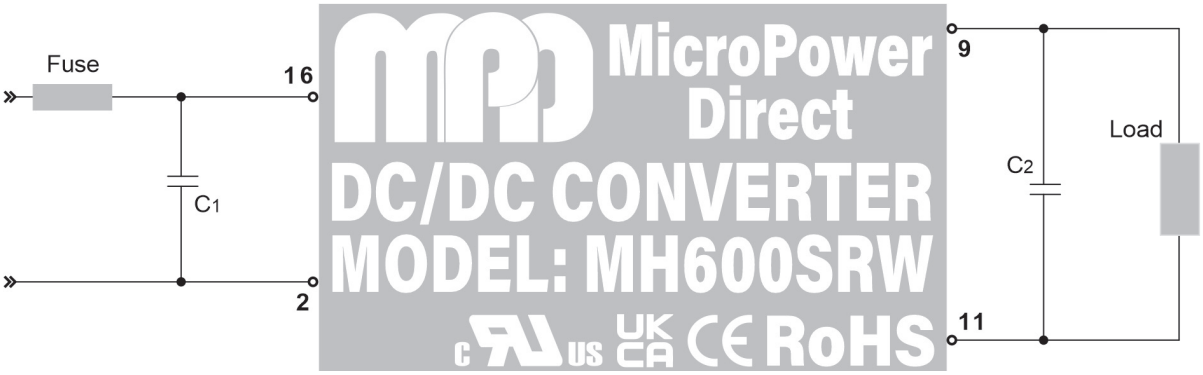

## Temperature Derating Curve, 200 LFM



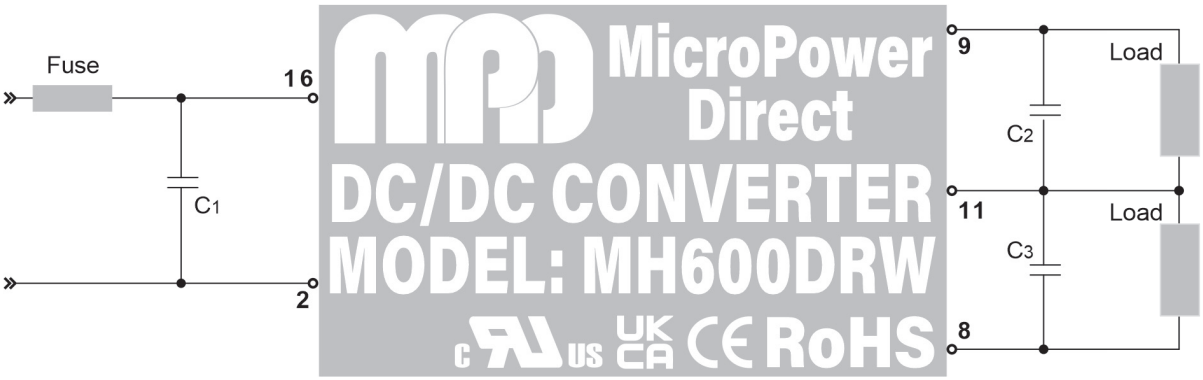

## Temperature Derating Curve, 400 LFM



## Typical Connection: Single Ouput




## Typical Connection: Dual Ouput




These converters are specified for operation without external components. However, in some applications the addition of input/output capacitors, as shown in the typical connection diagrams above, will enhance stability and reduce output ripple. These simple connections include a low ESR (<1Ω at 100 kHz) capacitor connected across the input. It is recommended that a 4.7 $\mu$F be used for 24V input models, and a 2.2 $\mu$F for 48V models.

To improve the output ripple performance, a 3.3 $\mu$F is connected across the output. For dual output units, a 3.3 $\mu$F capacitor should be connected from each output to common.

## Remote On/Off

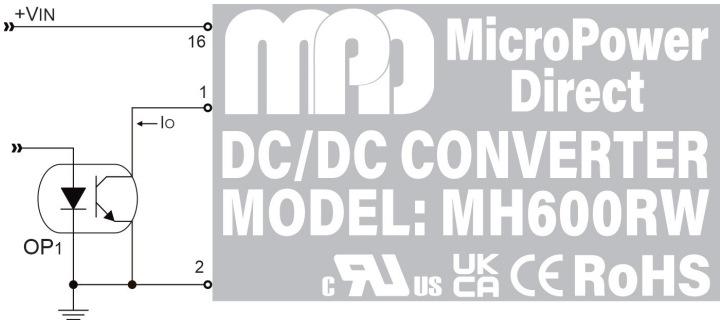
All models of the **MH6000RU** series can be turned on/off remotely by applying by applying a positive logic signal to pin 1. The specifications for the ON/OFF function are given in the table below.

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Unit On | 2.5 VDC - 50.0 VDC or Open Circuit | | | | |
| Unit Off | 0.7 VDC - 0.8 VDC or Short Circuit | | | | |
| Control Input Current, ON | $V_{CTRL}$ = 5V | | | 500 | $\mu$A |
| Control Input Current, OFF | $V_{CTRL}$ = 0V | | | -500 | $\mu$A |
| Control Common | Referenced to -$V_{IN}$ (Pin 2) | | | | |
| Standby Input Current | | | | 10.0 | mA |

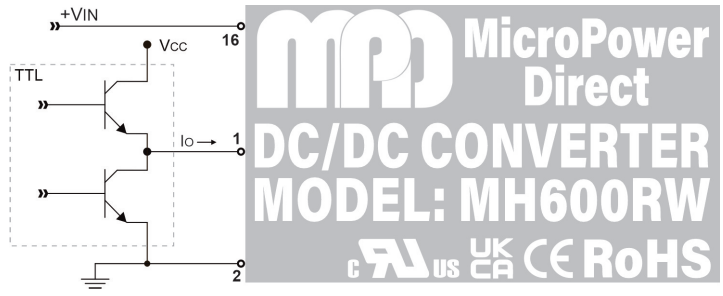
The maximum sink current at the control pin (pin 1) during a logic low is -500 $\mu$A. The maximum allowable leakage current of a switch connected to the control pin during a logic high is 500 $\mu$A.

The switch used can be an open collector transistor, FET or optocoupler. Two possible connections are illustrated in the diagrams at right. For more information, please contact the factory.

### Isolated Control

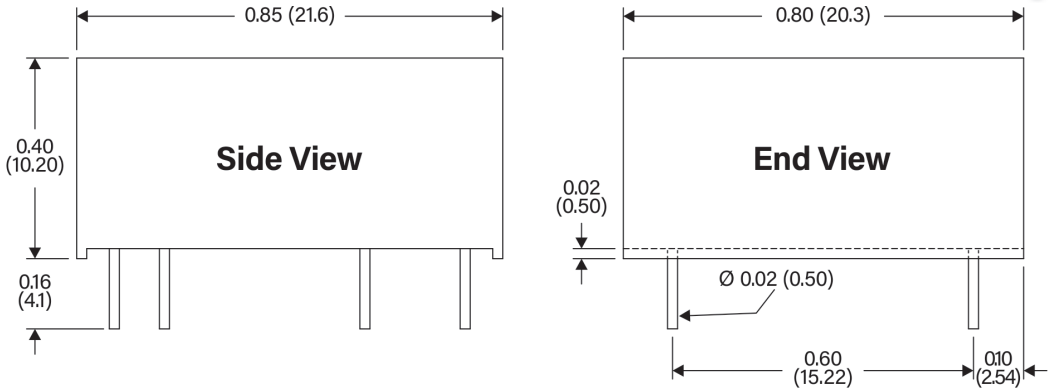


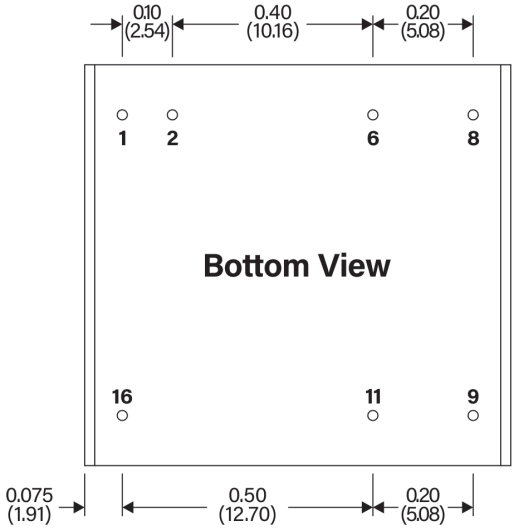

### TTL Control



## Mechanical Dimensions






## Pin Connections

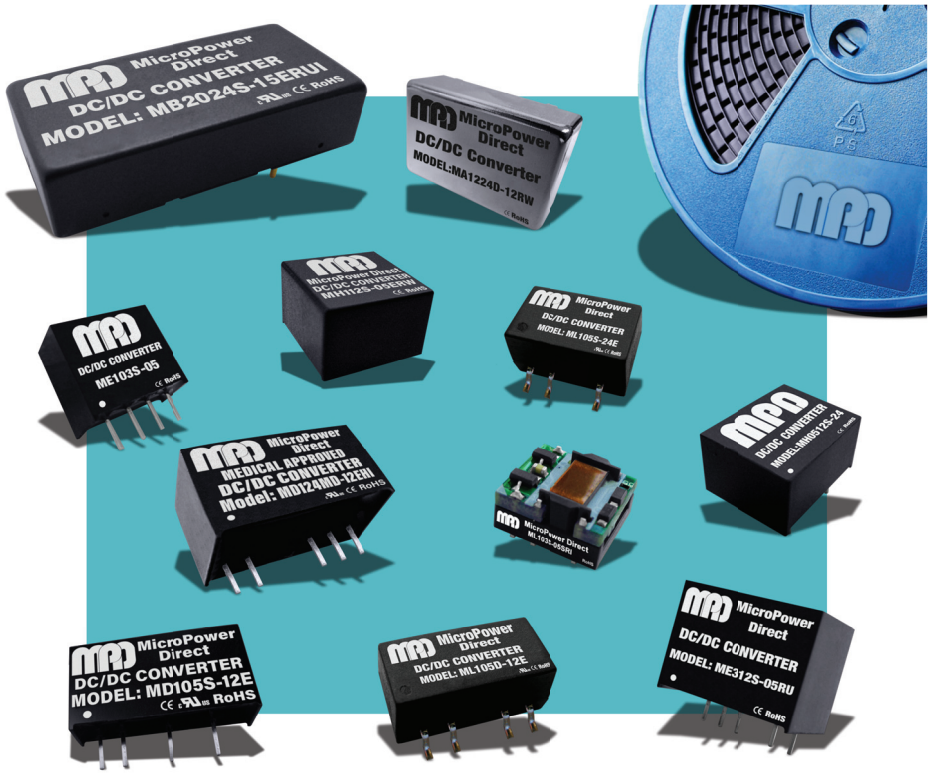
| Pin | Single |
|---|---|
| 1 | Remote On/Off |
| 2 | -VIN |
| 6 | No Connection |
| 8 | No Connection |
| 9 | +VOUT |
| 11 | -VOUT |
| 16 | +VIN |

| Pin | Dual |
|---|---|
| 1 | Remote On/Off |
| 2 | -VIN |
| 6 | Common |
| 8 | -VOUT |
| 9 | +VOUT |
| 11 | Common |
| 16 | +VIN |

**Notes:**

- All dimensions are typical in inches (mm)
- General Tolerance = ±0.010 (±0.25)
- Pin Tolerance = ±0.002 (±0.05)
- Recommended pin hole size (on the application PC Board) is Ø 0.039 (Ø1.00)
- Pin 1 is marked by a "dot" or indentation on the unit
- Weight: 0.32 Oz (9.1g)

**MPD** offers a very wide variety of DC/DC converters. Our standard product line includes SMT, SIP, and DIP potted modules, industry standard 1 x 1" & 1 x 2" modules, as well as new models in an ultra miniature DFN package. Our units are used in applications ranging from high speed gate drive circuits to instrumentation to industrial equipment and medical equipment/instrumentation. Units are available over a power range of 0.25 to 60W. Most models meet international EMC/EMI standards and many are fully approved to EN 62368. Call today, or go to our website to find the right DC/DC power module for your application.

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