



# Power Mate Technology, Inc MPS02 · MPH02 Series

DC-DC Converter  
Up to 2.01 Watts

**5**  
YEARS  
WARRANTY

**ROHS**  
COMPLIANT

**REACH**  
COMPLIANT



Medical



PV



Automation



Datacom



IPC



Industry



Measurement



Telecom



Automobile



Boat



Charger



Railway



**2**  
x  
MOPP

**5000**  
VAC  
Reinforced  
Insulation

**2 : 1**  
Input  
Range

**LOW**  
Leakage  
Current

Operating  
Altitude  
**5000**  
meter

REMOTE  
ON  
OFF

**OVP**

**SCP**

**UVP**

## PART NUMBER STRUCTURE

| MPS02 -         | 48                        | S                  | 05                         |
|-----------------|---------------------------|--------------------|----------------------------|
| Series Name     | Input<br>Voltage<br>(VDC) | Output<br>Quantity | Output<br>Voltage<br>(VDC) |
| MPS02: SMD type | 05:4.5~12                 | S:Single           | 3P3:3.3                    |
| MPH02: DIP type | 12:9~18                   |                    | 05:5                       |
|                 | 24:18~36                  |                    | 09:9                       |
|                 | 48:36~75                  |                    | 12:12                      |
|                 |                           |                    | 15:15                      |
|                 |                           |                    | 24:24                      |
|                 |                           | D:Dual             | 12:±12                     |
|                 |                           |                    | 15:±15                     |

**TECHNICAL SPECIFICATION** All specifications are typical at nominal input, full load and 25°C unless otherwise noted

| Model Number    | Input Range | Output Voltage | Output Current @ Full Load | Input Current @ No Load | Efficiency | Maximum Capacitor Load |
|-----------------|-------------|----------------|----------------------------|-------------------------|------------|------------------------|
|                 | VDC         | VDC            | mA                         | mA                      | %          | μF                     |
| MPS(H)02-05S3P3 | 4.5 ~ 12    | 3.3            | 600                        | 60                      | 75         | 1000                   |
| MPS(H)02-05S05  | 4.5 ~ 12    | 5              | 400                        | 60                      | 78         | 1000                   |
| MPS(H)02-05S09  | 4.5 ~ 12    | 9              | 222                        | 60                      | 78         | 430                    |
| MPS(H)02-05S12  | 4.5 ~ 12    | 12             | 167                        | 70                      | 82         | 220                    |
| MPS(H)02-05S15  | 4.5 ~ 12    | 15             | 134                        | 80                      | 82         | 170                    |
| MPS(H)02-05S24  | 4.5 ~ 12    | 24             | 83                         | 80                      | 82         | 100                    |
| MPS(H)02-05D12  | 4.5 ~ 12    | ±12            | ±83                        | 80                      | 82         | ±170                   |
| MPS(H)02-05D15  | 4.5 ~ 12    | ±15            | ±67                        | 90                      | 80         | ±100                   |
| MPS(H)02-12S3P3 | 9 ~ 18      | 3.3            | 600                        | 30                      | 76         | 1000                   |
| MPS(H)02-12S05  | 9 ~ 18      | 5              | 400                        | 40                      | 78         | 1000                   |
| MPS(H)02-12S09  | 9 ~ 18      | 9              | 222                        | 40                      | 79         | 430                    |
| MPS(H)02-12S12  | 9 ~ 18      | 12             | 167                        | 40                      | 82         | 220                    |
| MPS(H)02-12S15  | 9 ~ 18      | 15             | 134                        | 45                      | 82         | 170                    |
| MPS(H)02-12S24  | 9 ~ 18      | 24             | 83                         | 45                      | 81         | 100                    |
| MPS(H)02-12D12  | 9 ~ 18      | ±12            | ±83                        | 45                      | 81         | ±170                   |
| MPS(H)02-12D15  | 9 ~ 18      | ±15            | ±67                        | 45                      | 81         | ±100                   |
| MPS(H)02-24S3P3 | 18 ~ 36     | 3.3            | 600                        | 20                      | 76         | 1000                   |
| MPS(H)02-24S05  | 18 ~ 36     | 5              | 400                        | 20                      | 79         | 1000                   |
| MPS(H)02-24S09  | 18 ~ 36     | 9              | 222                        | 25                      | 80         | 430                    |
| MPS(H)02-24S12  | 18 ~ 36     | 12             | 167                        | 25                      | 81         | 220                    |
| MPS(H)02-24S15  | 18 ~ 36     | 15             | 134                        | 25                      | 81         | 170                    |
| MPS(H)02-24S24  | 18 ~ 36     | 24             | 83                         | 25                      | 81         | 100                    |
| MPS(H)02-24D12  | 18 ~ 36     | ±12            | ±83                        | 25                      | 81         | ±170                   |
| MPS(H)02-24D15  | 18 ~ 36     | ±15            | ±67                        | 25                      | 81         | ±100                   |
| MPS(H)02-48S3P3 | 36 ~ 75     | 3.3            | 600                        | 10                      | 76         | 1000                   |
| MPS(H)02-48S05  | 36 ~ 75     | 5              | 400                        | 10                      | 78         | 1000                   |
| MPS(H)02-48S09  | 36 ~ 75     | 9              | 222                        | 12                      | 79         | 430                    |
| MPS(H)02-48S12  | 36 ~ 75     | 12             | 167                        | 12                      | 80         | 220                    |
| MPS(H)02-48S15  | 36 ~ 75     | 15             | 134                        | 12                      | 82         | 170                    |
| MPS(H)02-48S24  | 36 ~ 75     | 24             | 83                         | 12                      | 81         | 100                    |
| MPS(H)02-48D12  | 36 ~ 75     | ±12            | ±83                        | 12                      | 81         | ±170                   |
| MPS(H)02-48D15  | 36 ~ 75     | ±15            | ±67                        | 12                      | 81         | ±100                   |

| INPUT SPECIFICATIONS              |                                                      |                           |                        |      |      |      |
|-----------------------------------|------------------------------------------------------|---------------------------|------------------------|------|------|------|
| Parameter                         |                                                      | Conditions                | Min.                   | Typ. | Max. | Unit |
| Operating input voltage range     |                                                      | 5Vin(nom)                 | 4.5                    | 5    | 12   | VDC  |
|                                   |                                                      | 12Vin(nom)                | 9                      | 12   | 18   |      |
|                                   |                                                      | 24Vin(nom)                | 18                     | 24   | 36   |      |
|                                   |                                                      | 48Vin(nom)                | 36                     | 48   | 75   |      |
| Start up voltage                  |                                                      | 5Vin(nom)                 |                        |      | 4.5  | VDC  |
|                                   |                                                      | 12Vin(nom)                |                        |      | 9    |      |
|                                   |                                                      | 24Vin(nom)                |                        |      | 18   |      |
|                                   |                                                      | 48Vin(nom)                |                        |      | 36   |      |
| Shutdown voltage                  |                                                      | 5Vin(nom)                 | 2                      | 3    | 4    | VDC  |
|                                   |                                                      | 12Vin(nom)                | 6                      | 7    | 8    |      |
|                                   |                                                      | 24Vin(nom)                | 13                     | 15   | 17   |      |
|                                   |                                                      | 48Vin(nom)                | 29                     | 32   | 35   |      |
| Start up time                     | Constant resistive load                              | Power up<br>Remote ON/OFF |                        | 10   | 20   | ms   |
| Input surge voltage               | 1 second, max.                                       | 5Vin(nom)                 |                        |      | 15   | VDC  |
|                                   |                                                      | 12Vin(nom)                |                        |      | 25   |      |
|                                   |                                                      | 24Vin(nom)                |                        |      | 50   |      |
|                                   |                                                      | 48Vin(nom)                |                        |      | 100  |      |
| Input filter                      |                                                      |                           | Capacitor type         |      |      |      |
| Remote ON/OFF                     | Referred to –Vin pin and Ctrl pin<br>applied current | DC-DC ON                  | Open or high impedance |      |      | mA   |
|                                   |                                                      | DC-DC OFF                 | 2.0                    |      |      |      |
|                                   |                                                      | Remote off input current  | 2.5                    |      |      |      |
| <div><div></div><div></div></div> |                                                      |                           |                        |      |      |      |

| OUTPUT SPECIFICATIONS            |                                    |         |                                 |      |       |       |
|----------------------------------|------------------------------------|---------|---------------------------------|------|-------|-------|
| Parameter                        | Conditions                         |         | Min.                            | Typ. | Max.  | Unit  |
| Voltage accuracy                 |                                    |         | -1.0                            |      | +1.0  | %     |
| Line regulation                  | Low Line to High Line at Full Load |         | -0.2                            |      | +0.2  | %     |
| Load regulation                  | No Load to Full Load               | Single  | -1.0                            |      | +1.0  | %     |
|                                  |                                    | Dual    | -1.0                            |      | +1.0  |       |
|                                  | 10% Load to 90% Load               | Single  | -0.5                            |      | +0.5  | %     |
| Dual                             | -0.8                               |         | +0.8                            |      |       |       |
| Cross regulation                 | Asymmetrical load 25%/100% FL      | Dual    | -5.0                            |      | +5.0  | %     |
| Ripple and noise                 | Measured by 20MHz bandwidth        |         |                                 | 50   |       | mVp-p |
| Temperature coefficient          |                                    |         | -0.02                           |      | +0.02 | %/°C  |
| Transient response recovery time | 25% load step change               |         |                                 | 500  |       | µs    |
| Over voltage protection          |                                    | 3.3Vout | 4.0                             |      | 6.5   | VDC   |
|                                  |                                    | 5Vout   | 6.0                             |      | 8.0   |       |
|                                  |                                    | 9Vout   | 10.0                            |      | 14.0  |       |
|                                  |                                    | 12Vout  | 13.0                            |      | 19.0  |       |
|                                  |                                    | 15Vout  | 16.0                            |      | 22.0  |       |
|                                  |                                    | 24Vout  | 25.0                            |      | 35.0  |       |
| Short circuit protection         |                                    |         | Continuous, automatics recovery |      |       |       |

## GENERAL SPECIFICATIONS

| Parameter             | Conditions                                                   | Min. | Typ. | Max.                                     | Unit |
|-----------------------|--------------------------------------------------------------|------|------|------------------------------------------|------|
| Isolation voltage     | 1 minute<br>Reinforced insulation for 250VAC working voltage | 5000 |      |                                          | VAC  |
| Isolation resistance  | 500VDC                                                       | 10   |      |                                          | GΩ   |
| Isolation capacitance |                                                              |      | 16   | 20                                       | pF   |
| Leakage current       | 240VAC, 60Hz                                                 |      |      | 2                                        | μA   |
| Switching frequency   |                                                              | 100  |      |                                          | kHz  |
| Clearance/Creepage    |                                                              | 8    |      |                                          | mm   |
| Safety approvals      | IEC/ EN/ ANSI/AAMI ES 60601-1<br>IEC/ EN/ UL 62368-1         |      |      | UL:E360199<br>UL:E193009<br>CB:UL(Demko) |      |
| Case material         |                                                              |      |      | Non-conductive black plastic             |      |
| Base material         |                                                              |      |      | Non-conductive black plastic             |      |
| Potting material      |                                                              |      |      | Silicone (UL94 V-0)                      |      |
| Weight                |                                                              |      |      | 7.0g (0.24oz)                            |      |
| MTBF                  | MIL-HDBK-217F, Full load                                     |      |      | 6.809 x 10 <sup>6</sup> hrs              |      |

## ENVIRONMENTAL SPECIFICATIONS

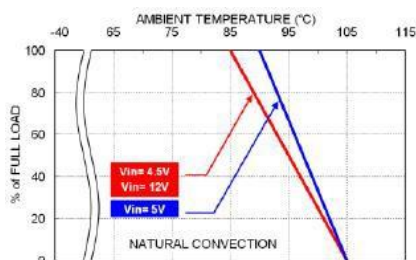
| Parameter                       | Conditions        | Min. | Typ. | Max.                      | Unit |
|---------------------------------|-------------------|------|------|---------------------------|------|
| Operating ambient temperature   | With derating     | -40  |      | +105                      | °C   |
| Maximum case temperature        |                   |      |      | 105                       | °C   |
| Storage temperature range       |                   | -55  |      | +125                      | °C   |
| Operating altitude              |                   |      |      | 5000                      | m    |
| Thermal shock                   |                   |      |      | MIL-STD-810F              |      |
| Shock                           |                   |      |      | MIL-STD-810F              |      |
| Vibration                       |                   |      |      | MIL-STD-810F              |      |
| Relative humidity               |                   |      |      | 5% to 95% RH              |      |
| Lead-free reflow solder process | Only for SMD type |      |      | IPC J-STD-020E            |      |
| Moisture sensitivity level(MSL) | Only for SMD type |      |      | IPC J-STD-033C<br>Level 2 |      |

## EMC SPECIFICATIONS

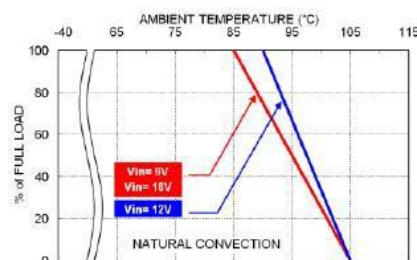
| Parameter                      | Conditions                                                                                                                                                                  | Level            |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| EMI                            | EN55011, EN55032, EN60601-1-2 and FCC Part 18 / 15<br>With external components                                                                                              | Class A, Class B |
| EMS                            | EN55024 and EN60601-1-2                                                                                                                                                     |                  |
| ESD                            | EN61000-4-2 Air $\pm 15\text{kV}$ and Contact $\pm 8\text{kV}$                                                                                                              | Perf. Criteria A |
| Radiated immunity              | EN61000-4-3 10 V/m                                                                                                                                                          | Perf. Criteria A |
| Fast transient                 | EN61000-4-4 $\pm 2\text{kV}$                                                                                                                                                | Perf. Criteria A |
|                                | MPS(H)02-05□□□ With an aluminum electrolytic capacitor (Nippon chemi-con KY series, 1000 $\mu\text{F}$ /25V) and a TVS(SMAJ18A, 18V, 400Watt peak pulse power) in parallel. |                  |
|                                | MPS(H)02-12□□□ With an external input filter capacitor (Nippon chemi-con KY series, 470 $\mu\text{F}$ /50V)                                                                 |                  |
|                                | MPS(H)02-24□□□ With an external input filter capacitor (Nippon chemi-con KY series, 470 $\mu\text{F}$ /50V)                                                                 |                  |
|                                | MPS(H)02-48□□□ With an external input filter capacitor (Nippon chemi-con KY series, 220 $\mu\text{F}$ /100V)                                                                |                  |
| Surge                          | EN61000-4-5 $\pm 1\text{kV}$                                                                                                                                                | Perf. Criteria A |
|                                | MPS(H)02-05□□□ With an aluminum electrolytic capacitor (Nippon chemi-con KY series, 1000 $\mu\text{F}$ /25V) and a TVS(SMAJ18A, 18V, 400Watt peak pulse power) in parallel. |                  |
|                                | MPS(H)02-12□□□ With an external input filter capacitor (Nippon chemi-con KY series, 470 $\mu\text{F}$ /50V)                                                                 |                  |
|                                | MPS(H)02-24□□□ With an external input filter capacitor (Nippon chemi-con KY series, 470 $\mu\text{F}$ /50V)                                                                 |                  |
|                                | MPS(H)02-48□□□ With an external input filter capacitor (Nippon chemi-con KY series, 220 $\mu\text{F}$ /100V)                                                                |                  |
| Conducted immunity             | EN61000-4-6 10 Vr.m.s                                                                                                                                                       | Perf. Criteria A |
| Power frequency magnetic field | EN61000-4-8 100A/m continuous; 1000A/m 1 second                                                                                                                             | Perf. Criteria A |

**CAUTION:** This power module is not internally fused. An input line fuse must always be used.

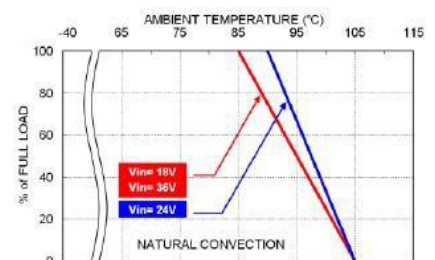
## CHARACTERISTIC CURVE



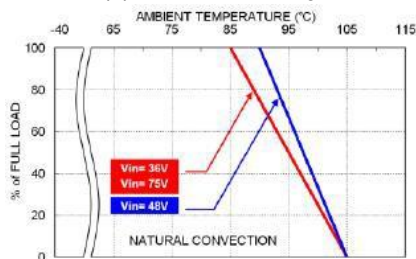
MPS(H)02-05□□□ Derating Curve



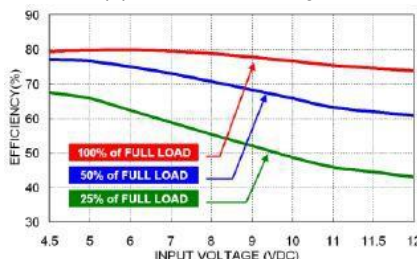
MPS(H)02-12□□□ Derating Curve



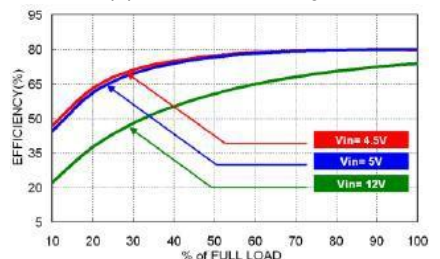
MPS(H)02-24□□□ Derating Curve



MPS(H)02-48□□□ Derating Curve



MPS(H)02-05S05 Efficiency vs. Input Voltage



MPS(H)02-05S05 Efficiency vs. Output Current

## FUSE CONSIDERATION

This power module is not internally fused. An input line fuse must always be used.

This encapsulated power module can be used in a wide variety of applications, ranging from simple stand-alone operation to an integrated part of sophisticated power architecture.

To maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse.

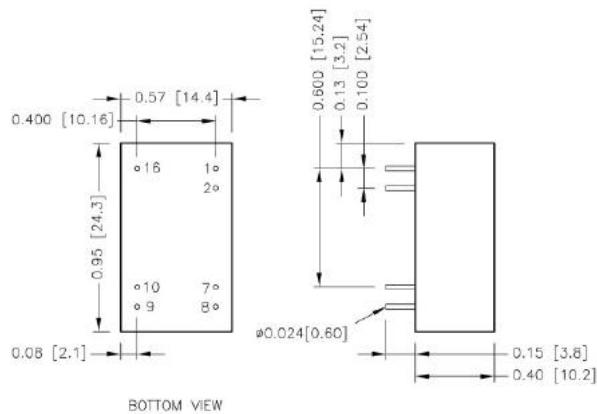
The input line fuse suggest as below :

| Modules                        | Fuse Rating (A) | Fuse Type |
|--------------------------------|-----------------|-----------|
| MPS(H)02-05S□□, MPS(H)02-05D□□ | 1               | Slow-Blow |
| MPS(H)02-12S□□, MPS(H)02-12D□□ | 0.5             | Slow-Blow |
| MPS(H)02-24S□□, MPS(H)02-24D□□ | 0.315           | Slow-Blow |
| MPS(H)02-48S□□, MPS(H)02-48D□□ | 0.16            | Slow-Blow |

The table based on the information provided in this data sheet on inrush energy and maximum DC input current at low Vin.

## MECHANICAL DRAWING

### MPH02

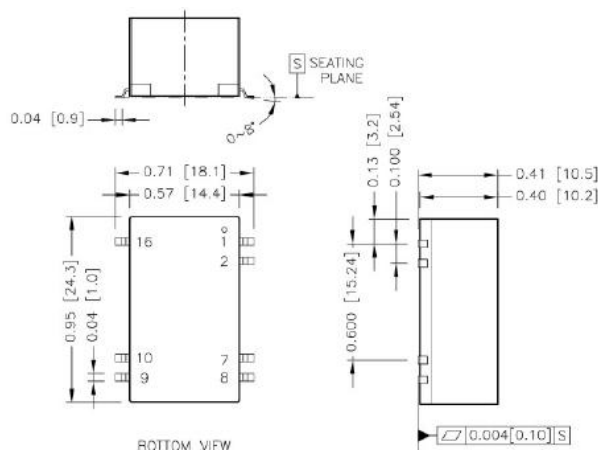


### PIN CONNECTION

| PIN | SINGLE | DUAL   |
|-----|--------|--------|
| 1   | -Vin   | -Vin   |
| 2   | Ctrl   | Ctrl   |
| 7   | NC     | NC     |
| 8   | NC     | Common |
| 9   | +Vout  | +Vout  |
| 10  | -Vout  | -Vout  |
| 16  | +Vin   | +Vin   |

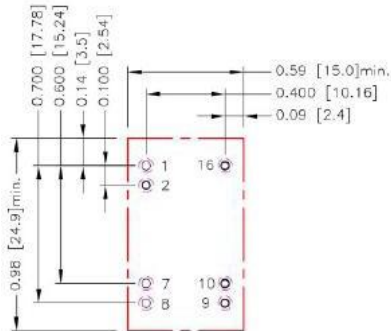
- All dimensions in inch [mm]
- Tolerance :x.xx±0.02 [x.x±0.5]  
x.xxx±0.010 [x.xx±0.25]
- Pin dimension tolerance ±0.004[0.10]

### MPS02



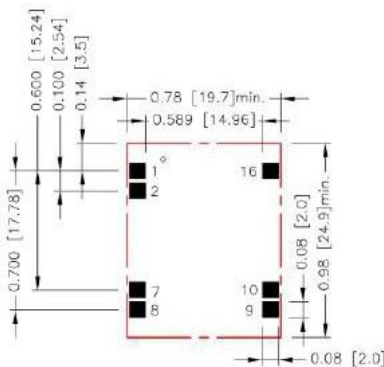
## RECOMMENDED PAD LAYOUT

### MPH02



All dimensions in inch[mm]  
Pad size(lead free recommended)  
Through hole 1.2.7.8.9.10.16:  $\varnothing 0.035[0.90]$   
Top view pad 1.2.7.8.9.10.16:  $\varnothing 0.044[1.13]$   
Bottom view pad 1.2.7.8.9.10.16:  $\varnothing 0.071[1.80]$

### MPS02



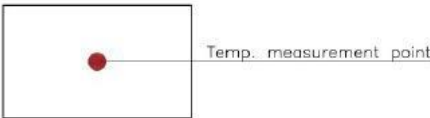
All dimensions in inch[mm]  
Pad size(lead free recommended)  
Top view pad:0.080x0.080[2.00x2.00]

- \* There should be at least 8mm distance between primary and secondary circuit.
- \*\* For further information, please contact :sales@powermateusa.com

## THERMAL CONSIDERATIONS

The power module operates in a variety of thermal environments. However, sufficient cooling should be provided to help ensure reliable operation of the unit. Heat is removed by conduction, convection, and radiation to the surrounding environment. Proper cooling can be verified by measuring the point as the figure below. The temperature at this location should not exceed "Maximum case temperature". When operating, adequate cooling must be provided to maintain the test point temperature at or below "Maximum case temperature". You can limit this temperature to a lower value for extremely high reliability.

- Thermal test condition with vertical direction by natural convection (20LFM).



TOP VIEW