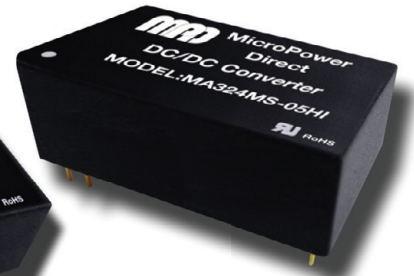


# MA300MHI Series



## High Isolation, 3W Medical Approved DC/DC Converters

### Key Features:

- 3W Output Power
- 3 kVAC rms Isolation
- Reinforced Insulation
- Meets 1xMOPP & 2xMOOP
- 2  $\mu$ A Leakage Current Max
- Fifteen Models
- Compact DIP Case
- Single & Dual Outputs
- Meets EN55022
- 1.0 MH MTBF
- EN 60601 Approved

RoHS



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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       | 5 VDC Input      | 4.5  | 5.0  | 5.5   | VDC   |  |
|                           | 12 VDC Input     | 10.8 | 12.0 | 13.2  |       |  |
|                           | 24 VDC Input     | 21.6 | 24.0 | 26.4  |       |  |
| Input Filter              | Internal LC Type |      |      |       |       |  |
| Short Circuit Input Power |                  |      |      | 2,500 | mW    |  |

| Output                  |                                    |      |            |            |          |  |
|-------------------------|------------------------------------|------|------------|------------|----------|--|
| Parameter               | Conditions                         | Min. | Typ.       | Max.       | Units    |  |
| Output Voltage Accuracy | Nominal $V_{IN}$                   |      |            | $\pm 4.0$  | %        |  |
| Output Voltage Balance  | Dual Output, Balanced Loads        |      | $\pm 2.0$  | $\pm 4.0$  | %        |  |
| Line Regulation         | $V_{IN} = \text{Min to Max}$       |      | $\pm 0.3$  | $\pm 0.5$  | %        |  |
| Load Regulation         | $I_{OUT} = 10\% \text{ to } 100\%$ |      | $\pm 0.5$  | $\pm 1.0$  | %        |  |
| Ripple & Noise (20 MHz) | See Note 2                         |      |            | 50         | mV P - P |  |
| Temperature Coefficient |                                    |      | $\pm 0.01$ | $\pm 0.02$ | %/°C     |  |
| Output Short Circuit    | Continuous (Autorecovery)          |      |            |            |          |  |

| General                               |  |       |      |      |            |  |
|---------------------------------------|--|-------|------|------|------------|--|
| Parameter                             | Conditions                                     | Min.  | Typ. | Max. | Units      |  |
| Isolation Voltage, Rated              | 60 Seconds                                     | 3,000 |      |      | VAC rms    |  |
| Reinforced Insulation Working Voltage | 300 Vrms                                       |       |      |      |            |  |
| Leakage Current                       | 240 VAC, 60 Hz                                 |       |      | 2    | $\mu$ A    |  |
| Isolation Resistance                  | 500 VDC  | 10    |      |      | G $\Omega$ |  |
| Isolation Capacitance                 | 100 kHz, 1V                                    |       | 20   |      | pF         |  |
| Switching Frequency                   |  | 25    | 60   |      | kHz        |  |
| Conducted EMI                         | Complies With EN 55022, Class A                |       |      |      |            |  |
| EMC                                   | Complies With EN 55011 4 <sup>th</sup> Edition |       |      |      |            |  |
| EMS                                   | Complies With EN 60601-1-2                     |       |      |      |            |  |

| Environmental               |                     |      |      |      |       |  |
|-----------------------------|---------------------|------|------|------|-------|--|
| Parameter                   | Conditions          | Min. | Typ. | Max. | Units |  |
| Operating Temperature Range | Ambient             | -40  |      | +75  | °C    |  |
|                             | Case                |      |      | +95  | °C    |  |
| Storage Temperature Range   |                     | -50  |      | +125 | °C    |  |
| Cooling                     | Free Air Convection |      |      |      |       |  |
| Humidity                    | RH, Non-condensing  |      |      | 95   | %     |  |

| Physical      |  |  |  |  |  |  |
|---------------|--|--|--|--|--|--|
| Case Size     | See Mechanical Diagram (Page 2)        |  |  |  |  |  |
| Case Material | Non-Conductive Black Plastic (UL94-V0) |  |  |  |  |  |
| Weight        | 0.30 Oz (12.4g)                        |  |  |  |  |  |

### Reliability Specifications

| Parameter        | Conditions   | Min. | Typ. | Max. | Units  |  |
|------------------|--|------|------|------|--------|--|
| MTBF             | MIL HDBK 217F, 25°C, Gnd Benign  | 1.0  |      |      | MHours |  |
| Safety Approvals | UL 60601-1, EN 60601-1 3rd Edition, UL 60950, EN 60950<br>ANSI/AAMI ES 60601-1 1xMOPP & 2XMOOP Recognition |      |      |      |        |  |

### Absolute Maximum Ratings

| Parameter                   | Conditions                  | Min. | Typ. | Max. | Units |  |
|-----------------------------|-----------------------------|------|------|------|-------|--|
| Input Voltage Surge (1 Sec) | 5 VDC Input                 |      |      | 7.5  | VDC   |  |
|                             | 12 VDC Input                |      |      | 15.0 |       |  |
|                             | 24 VDC Input                |      |      | 30.0 |       |  |
| 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.

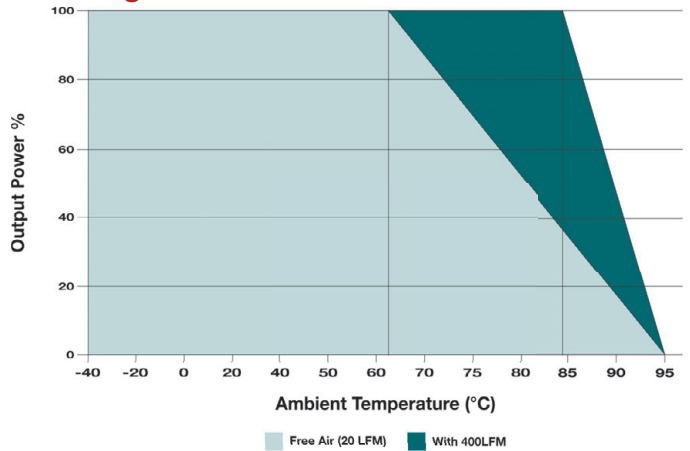
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| Model Number | Input         |             |              |         | Output        |                   |                   | Capacitive Load (μF, Max) | Efficiency (% Typ) | Fuse Rating Slow-Blow (mA) |
|--------------|---------------|-------------|--------------|---------|---------------|-------------------|-------------------|---------------------------|--------------------|----------------------------|
|              | Voltage (VDC) |             | Current (mA) |         | Voltage (VDC) | Current (mA, Max) | Current (mA, Min) |                           |                    |                            |
|              | Nominal       | Range       | Full-Load    | No-Load |               |                   |                   |                           |                    |                            |
| MA305MS-05HI | 5.0           | 4.5 - 5.5   | 1,000        | 130     | 5.0           | 600               | 0.0               | 470                       | 60                 | 2,000                      |
| MA305MS-12HI | 5.0           | 4.5 - 5.5   | 960          | 130     | 12.0          | 250               | 0.0               | 470                       | 62                 | 2,000                      |
| MA305MS-15HI | 5.0           | 4.5 - 5.5   | 960          | 130     | 15.0          | 200               | 0.0               | 470                       | 62                 | 2,000                      |
| MA305MD-12HI | 5.0           | 4.5 - 5.5   | 1,000        | 130     | ±12.0         | ±125              | ±0.0              | 220                       | 60                 | 2,000                      |
| MA305MD-15HI | 5.0           | 4.5 - 5.5   | 1,000        | 130     | ±15.0         | ±100              | ±0.0              | 220                       | 60                 | 2,000                      |
| MA312MS-05HI | 12            | 10.8 - 13.2 | 420          | 60      | 5.0           | 600               | 0.0               | 470                       | 60                 | 1,000                      |
| MA312MS-12HI | 12            | 10.8 - 13.2 | 400          | 60      | 12.0          | 250               | 0.0               | 470                       | 62                 | 1,000                      |
| MA312MS-15HI | 12            | 10.8 - 13.2 | 400          | 60      | 15.0          | 200               | 0.0               | 470                       | 62                 | 1,000                      |
| MA312MD-12HI | 12            | 10.8 - 13.2 | 420          | 60      | ±12.0         | ±125              | ±0.0              | 220                       | 60                 | 1,000                      |
| MA312MD-15HI | 12            | 10.8 - 13.2 | 420          | 60      | ±15.0         | ±100              | ±0.0              | 220                       | 60                 | 1,000                      |
| MA324MS-05HI | 24            | 21.6 - 26.4 | 210          | 40      | 5.0           | 600               | 0.0               | 470                       | 60                 | 500                        |
| MA324MS-12HI | 24            | 21.6 - 26.4 | 195          | 40      | 12.0          | 250               | 0.0               | 470                       | 64                 | 500                        |
| MA324MS-15HI | 24            | 21.6 - 26.4 | 195          | 40      | 15.0          | 200               | 0.0               | 470                       | 64                 | 500                        |
| MA324MD-12HI | 24            | 21.6 - 26.4 | 210          | 40      | ±12.0         | ±125              | ±0.0              | 220                       | 60                 | 500                        |
| MA324MD-15HI | 24            | 21.6 - 26.4 | 210          | 40      | ±15.0         | ±100              | ±0.0              | 220                       | 60                 | 500                        |

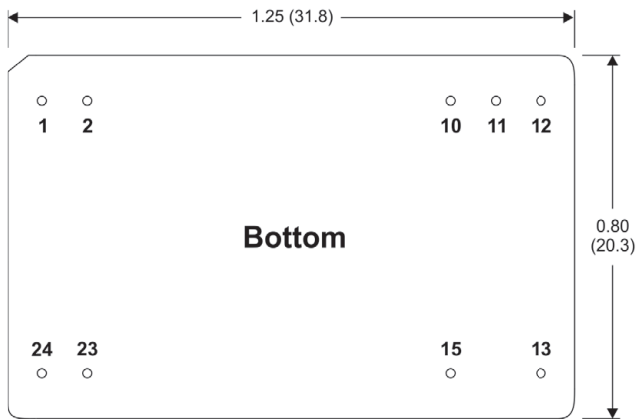
Notes:

- The specified maximum capacitive load is for each output.
- When measuring output ripple, it is recommended that an external 0.33 μF ceramic capacitor be placed from the +Vout pin to the -Vout pin for single output units and from each output to common for dual output units. For noise sensitive applications, the use of 1.5 μF capacitors will reduce the output ripple.
- Dual output units may be connected to provide a 24 VDC or 30 VDC output. To do this, connect the load across the positive (+Vout) and negative (-Vout) outputs and float the output common.
- The converter should be connected to a low ac-impedance source. An input source with a highly inductive impedance may affect the stability of the converter. In applications where the converter output loading is high and input power is supplied over long lines, it may be necessary to use a capacitor on the input to insure start-up. In this case, it is recommended that a low ESR (ESR < 1.0Ω at 100 kHz) capacitor be mounted close to the converter. For 5V input units a 4.7 μF is recommended, for 12V and 24V units a 2.2 μF.
- It is recommended that a fuse be used on the input of a power supply for protection. See the table above for the correct rating.

Derating Curve

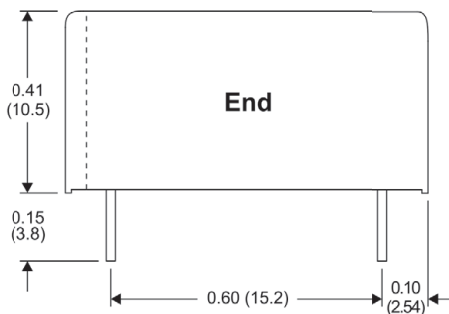
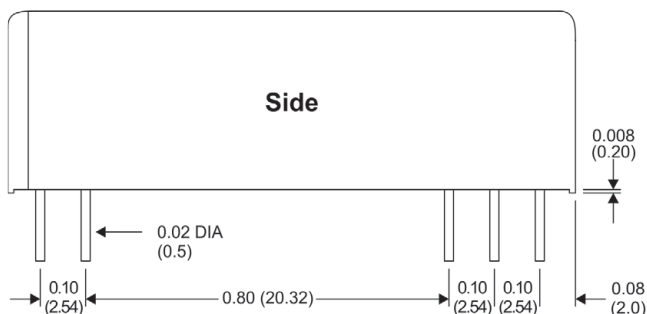


Mechanical Dimensions



Pin Connections

| Pin | Single | Dual   | Pin | Single | Dual  |
|-----|--------|--------|-----|--------|-------|
| 1   | +VIN   | +VIN   | 13  | +VOUT  | -VOUT |
| 2   | +VIN   | +VIN   | 15  | No Pin | +VOUT |
| 10  | No Pin | Common | 23  | -VIN   | -VIN  |
| 11  | No Pin | Common | 24  | -VIN   | -VIN  |
| 12  | -VOUT  | No Pin |     |        |       |



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Mechanical Notes:

- All dimensions are typical in inches (mm)
- Tolerance x.xx = ±0.01 (±0.25)