# MA300RU(I) Series

# Wide 4:1 Input, 3W, Single & Dual Output DC/DC Converters

## Key Features:

- 3W Output Power
- 4:1 Input Voltage Range
- UL 62368 Approved
- Up To 3.0 kVDC Isolation
- 16 Standard Models
- Single & Dual Outputs
- Compact DIP Case
- -40°C to +85°C Operation
- Industry Standard Pin-Out

## 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 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 | | | 17.5 | |
| Input Filter | π (Pi) Filter | | | | |

### Output

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Output Voltage Accuracy | | | | ±2.0 | % |
| Output Voltage Balance | Dual Output, Balanced Loads | | ±0.5 | ±2.0 | % |
| Line Regulation | VIN = Min to Max | | ±0.3 | ±1.0 | % |
| Load Regulation | IOUT = 0% to 100% | | ±0.3 | ±1.0 | % |
| Ripple & Noise (20 MHz) | See Note 1 | | | 70 | mV P - P |
| Transient Recovery Time, See Note 2 | 25% Load Step Change | | 200 | 500 | μSec |
| Transient Response Deviation | | | ±3.0 | ±5.0 | % |
| Temperature Coefficient | | | ±0.01 | ±0.02 | %/°C |
| Output Overload Protection | Foldback | 120 | | | % |
| Output Short Circuit | Continuous (Autorecovery) | | | | |

### General

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Isolation Voltage | 60 Seconds | 1,500 | | | VDC |
| | "I" Version | 3,000 | | | |
| Isolation Resistance | 500 VDC | 1,000 | | | MΩ |
| Isolation Capacitance | 100 kHz/1.0V | | 500 | | pF |
| Switching Frequency | | 90 | | | kHz |

### Environmental

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Operating Temperature Range | Ambient | -40 | +25 | +85 | °C |
| Operating Temperature Range | Case | | | +100 | °C |
| Storage Temperature Range | | -50 | | +125 | °C |
| Cooling | Free Air Convection | | | | |
| Humidity | RH, Non-condensing | | | 95 | % |

### Physical

| | |
|---|---|
| Case Size and Weight | See Mechanical Diagram (Page 3) |
| Case Material | Non-Conductive Black Plastic (UL94-V0) |

### Reliability Specifications

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| MTBF | MIL HDBK 217F, 25°C, Gnd Benign | 1.0 | | | MHours |
| Safety Standards | UL/cUL 62368 recognition (UL certificate) | | | | |
| Shock & Vibration | A random waveform 1~200 Hz/0.52 Grms, 30 min. on each axis (X, Y, Z) and 2~300 Hz/1.05 Grms, 30 min. on each axis (X, Y, and Z) | | | | |

### 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.


***MicroPower Direct***
292 Page Street
Suite D
Stoughton, MA 02072
USA

T: (781) 344-8226
F: (781) 344-8481
E: sales@micropowerdirect.com
W: www.micropowerdirect.com

## Model Selection Guide



| Model Number | Input | | | | Output | | | Efficiency (%, Typ) | Reflected Ripple Current (mA Typ) | Capacitive Load (µF, Max) | Fuse Rating Slow-Blow (mA) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Voltage (VDC) | | Current (mA) | | Voltage (VDC) | Current (mA, Max) | Current (mA, Min) | | | | |
| | Nominal | Range | Full-Load | No-Load | | | | | | | |
| MA324S-03RU(I) | 24 | 9.0 - 36.0 | 134 | 30 | 3.3 | 750.0 | 0.0 | 77 | 15.0 | 680 | 1,000 |
| MA324S-05RU(I) | 24 | 9.0 - 36.0 | 158 | 30 | 5.0 | 600.0 | 0.0 | 79 | 15.0 | 470 | 1,000 |
| MA324S-12RU(I) | 24 | 9.0 - 36.0 | 152 | 30 | 12.0 | 250.0 | 0.0 | 82 | 15.0 | 330 | 1,000 |
| MA324S-15RU(I) | 24 | 9.0 - 36.0 | 151 | 30 | 15.0 | 200.0 | 0.0 | 83 | 15.0 | 220 | 1,000 |
| MA324S-24RU(I) | 24 | 9.0 - 36.0 | 154 | 30 | 24.0 | 125.0 | 0.0 | 81 | 15.0 | 100 | 1,000 |
| MA324D-05RU(I) | 24 | 9.0 - 36.0 | 130 | 30 | ±5.0 | ±250.0 | ±0.0 | 80 | 15.0 | ±220 | 1,000 |
| MA324D-12RU(I) | 24 | 9.0 - 36.0 | 152 | 30 | ±12.0 | ±125.0 | ±0.0 | 82 | 15.0 | ±150 | 1,000 |
| MA324D-15RU(I) | 24 | 9.0 - 36.0 | 152 | 30 | ±15.0 | ±100.0 | ±0.0 | 82 | 15.0 | ±100 | 1,000 |
| MA348S-03RU(I) | 48 | 18.0 - 75.0 | 67 | 20 | 3.3 | 750.0 | 0.0 | 77 | 10.0 | 680 | 500 |
| MA348S-05RU(I) | 48 | 18.0 - 75.0 | 78 | 20 | 5.0 | 600.0 | 0.0 | 80 | 10.0 | 470 | 500 |
| MA348S-12RU(I) | 48 | 18.0 - 75.0 | 75 | 20 | 12.0 | 250.0 | 0.0 | 83 | 10.0 | 330 | 500 |
| MA348S-15RU(I) | 48 | 18.0 - 75.0 | 74 | 20 | 15.0 | 200.0 | 0.0 | 84 | 10.0 | 220 | 500 |
| MA348S-24RU(I) | 48 | 18.0 - 75.0 | 76 | 20 | 24.0 | 125.0 | 0.0 | 82 | 10.0 | 100 | 500 |
| MA348D-05RU(I) | 48 | 18.0 - 75.0 | 65 | 20 | ±5.0 | ±250.0 | ±0.0 | 80 | 10.0 | ±220 | 500 |
| MA348D-12RU(I) | 48 | 18.0 - 75.0 | 76 | 20 | ±12.0 | ±125.0 | ±0.0 | 82 | 10.0 | ±150 | 500 |
| MA348D-15RU(I) | 48 | 18.0 - 75.0 | 76 | 20 | ±15.0 | ±100.0 | ±0.0 | 82 | 10.0 | ±100 | 500 |

**Notes:**

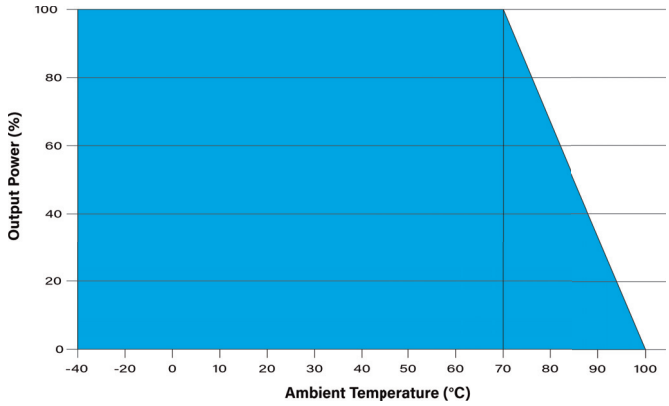
1. When measuring output ripple, it is recommended that an external 3.3 µF ceramic capacitor be placed from the +VOUT pin to the -VOUT pin for single output units and from each output to common for dual output units.
2. Transient recovery is measured to within a 1% error band for a load step change of 75% to 100%.
3. Operation at no-load will not damage these units.
4. An external 220µF/100V capacitor connected across the input pins is required to meet EN61000-4-4 and EN61000-4-5.
5. Dual output units may be connected to provide a 10, 24 or 30 VDC output. To do this, connect the load across the positive (+VOUT) and negative (-VOUT) outputs and float the output common.
6. 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 <1.0*V* at 100 kHz) capacitor be mounted close to the converter. For 5V input units a 8.2 µF is recommended, for 12V input units, a 3.3 µF; and for 24V & 48V units a 1.5 µF.
7. 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.

For the 3.0 kVDC isolated version, add an "I" to the model number: **MA3xxx-xxRUI**

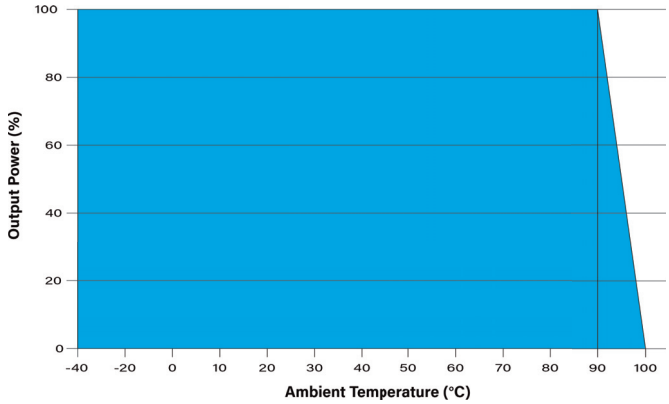
For the 2:1 input models, see the datasheet for the: **MA3xxx-xxRW(I) s**eries

**MPD** offers a variety of DC/DC converters ranging from 0.25W to 75W. Standard packages include DIP, SIP, SMT, MicroDIP, 1 x 1", 1 x 2" and 2 x 2". Standard DC/DC models are available specifically designed to meet the requirements of high speed gate drive, medical, railway, photovoltaic and point of load regulation. A full range of AC/DC power supplies are also available.

## Derating Curve, 20 LFM




## Derating Curve, 400 LFM

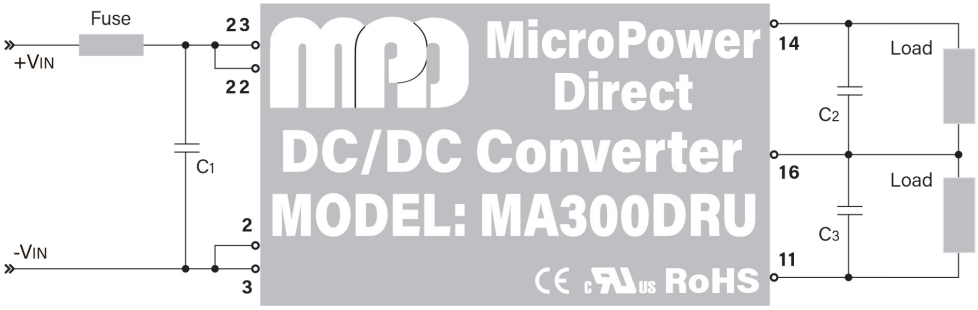


## EMI/EMC Characteristics

| Parameter | Standard | Criteria | Level |
|---|---|---|---|
| Radiated Emissions | EN 55032 | | Class A |
| Conducted Emissions | EN 55032 | | Class A |
| ESD | EN 61000-4-2 | A | ±6 kV Contact |
| | | | ±8kV Air |
| RS | EN 61000-4-3 | A | 10V/m |
| EFT, See note at left | EN 61000-4-4 | A | ±2 kV |
| Surge, See note at left | EN 61000-4-5 | A | ±1 kV |
| CS | EN 61000-4-6 | A | 10 Vrms |

To meet the specified EN 61000-4-4 and EN 61000-4-5 limits, an external capacitor must be connected across the input pins of the module ($C_1$). A 220 $\mu$F/100V capacitor is recommended. This capacitor should be mounted as close to the module as possible.

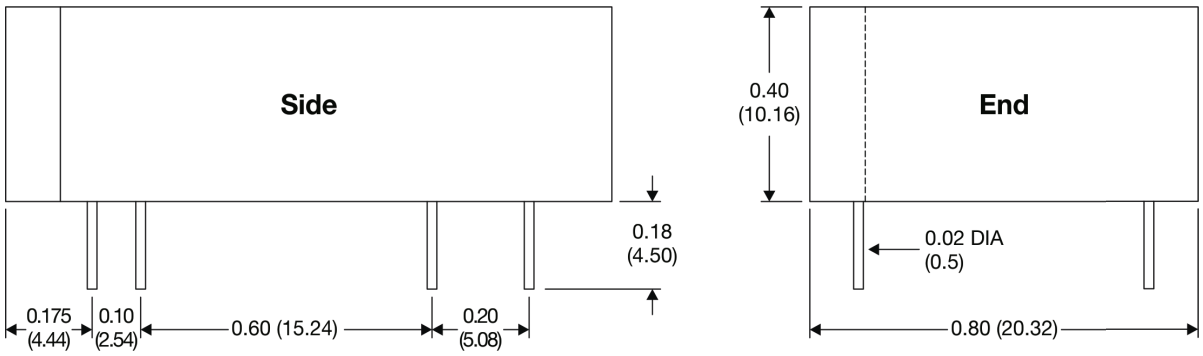
## Typical Connection

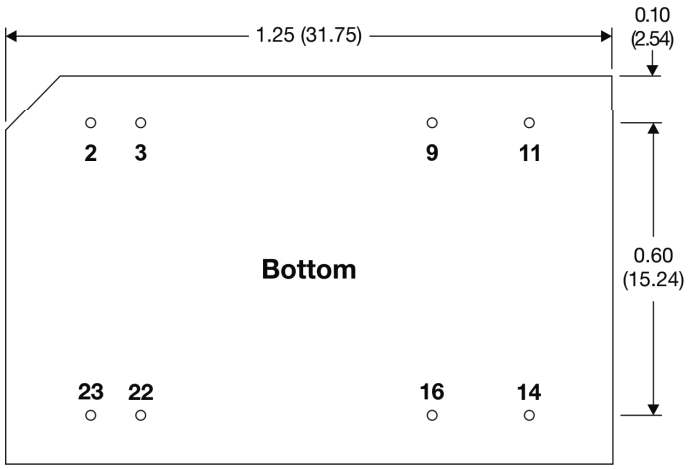



These converters are specified for operation without external components. However, in some applications the addition of input/output capacitors, as shown in the typical connection diagram at right, will enhance stability and reduce output ripple. This simple connection includes a low ESR (<1Ω at 100 kHz) capacitor connected across the input. The recommended values are given in note 6 on page 2.

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

## Mechanical Dimensions




## Pin Connections

| Pin | Single | Dual |
|---|---|---|
| 2 | -VIN | -VIN |
| 3 | -VIN | -VIN |
| 9 | No Pin | Common |
| 11 | NC | -VOUT |
| 14 | +VOUT | +VOUT |
| 16 | -VOUT | Common |
| 22 | +VIN | +VIN |
| 23 | +VIN | +VIN |

NC: No Connection

**Notes:**
- All dimensions are typical in inches (mm)
- General Tolerance = ±0.02 (±0.5)
- Pin Tolerance = ±0.002 (±0.05)
- Recommended pin hole size (on the application PC Board) is Ø 0.039 (Ø1.00)
- Pin 2 is marked by an angle on the unit case
- Weight: 0.45 Oz (12.8g)

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292 Page Street Ste D Stoughton, MA 02072 ▪ TEL: (781) 344-8226 ▪ FAX: (781) 344-8481 ▪ E-Mail: sales@micropowerdirect.com