**MA300ERW Series**

**2:1 Input, 3W DIP, Single & Dual Output DC/DC Converters**

**Key Features:**
- 3W Output Power
- 2:1 Input Voltage Range
- 1,500 VDC Isolation
- 30 Standard Models
- Efficiency to 86%
- Compact DIP Case
- -40°C to +85°C Operation
- Industry Standard Pin-Out
- Low Cost

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

**Input**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Voltage Range</td>
<td>5 VDC Input</td>
<td>4.5</td>
<td>5.0</td>
<td>9.0</td>
<td>VDC</td>
</tr>
<tr>
<td></td>
<td>12 VDC Input</td>
<td>9.0</td>
<td>12.0</td>
<td>18.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>24 VDC Input</td>
<td>18.0</td>
<td>24.0</td>
<td>36.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>48 VDC Input</td>
<td>36.0</td>
<td>48.0</td>
<td>75.0</td>
<td></td>
</tr>
<tr>
<td>Input Start Voltage</td>
<td>5 VDC Input</td>
<td>3.5</td>
<td>4.0</td>
<td>4.5</td>
<td>VDC</td>
</tr>
<tr>
<td></td>
<td>12 VDC Input</td>
<td>4.5</td>
<td>8.0</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>24 VDC Input</td>
<td>11.0</td>
<td>16.0</td>
<td>18.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>48 VDC Input</td>
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<td>33.0</td>
<td>36.0</td>
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**Output**

<table>
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<tr>
<th>Parameter</th>
<th>Conditions</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Voltage Accuracy</td>
<td>IOUT = 5% to 100%</td>
<td>±1.0</td>
<td>±3.0</td>
<td>±0.5</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>IOUT = 0%</td>
<td>±1.5</td>
<td>±5.0</td>
<td>±1.0</td>
<td>%</td>
</tr>
<tr>
<td>Output Voltage Balance</td>
<td>Dual Outputs, Balanced Loads</td>
<td>±0.5</td>
<td>±1.0</td>
<td>±0.5</td>
<td>%</td>
</tr>
<tr>
<td>Line Regulation</td>
<td>Vn = Min to Max</td>
<td>±0.2</td>
<td>±0.5</td>
<td>±0.5</td>
<td>%</td>
</tr>
<tr>
<td>Load Regulation</td>
<td>IOUT = 5% to 100%</td>
<td>±0.2</td>
<td>±0.5</td>
<td>±0.5</td>
<td>%</td>
</tr>
<tr>
<td>Ripple &amp; Noise (20 MHz)</td>
<td>See Note 1</td>
<td>15</td>
<td>30</td>
<td></td>
<td>mV P-P</td>
</tr>
<tr>
<td>Noise (20 MHz)</td>
<td></td>
<td>45</td>
<td>75</td>
<td></td>
<td>mV P-P</td>
</tr>
<tr>
<td>Transient Recovery Time</td>
<td>25% Load Step Change</td>
<td>±2.0</td>
<td>±5.0</td>
<td></td>
<td>mSec</td>
</tr>
<tr>
<td>Transient Response Deviation</td>
<td></td>
<td>±0.02</td>
<td>±0.03</td>
<td>±0.0</td>
<td>%/°C</td>
</tr>
<tr>
<td>Temperature Coefficient</td>
<td>Continuous (Autorecovery)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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**General**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolation Voltage</td>
<td>60 Seconds</td>
<td>1,500</td>
<td></td>
<td></td>
<td>VDC</td>
</tr>
<tr>
<td>Isolation Resistance</td>
<td>500 VDC</td>
<td>1,000</td>
<td></td>
<td></td>
<td>MΩ</td>
</tr>
<tr>
<td>Isolation Capacitance</td>
<td>100 kHz/0.1V</td>
<td>120</td>
<td></td>
<td></td>
<td>pF</td>
</tr>
<tr>
<td>Switching Frequency</td>
<td></td>
<td>200</td>
<td></td>
<td></td>
<td>kHz</td>
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**Environmental**

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<th>Conditions</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature Range</td>
<td>Ambient</td>
<td>-40</td>
<td>+25</td>
<td>+85</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature Range</td>
<td></td>
<td>-55</td>
<td></td>
<td>+125</td>
<td>°C</td>
</tr>
<tr>
<td>Humidity</td>
<td>RH, Non-condensing</td>
<td>95</td>
<td></td>
<td></td>
<td>%</td>
</tr>
</tbody>
</table>

**Physical**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case Size</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case Material</td>
<td>Aluminum Alloy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>0.49 Oz (14g)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Reliability Specifications**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTBF</td>
<td>MIL HDBK 217F, 25°C, Gnd Benign</td>
<td>1.0</td>
<td></td>
<td></td>
<td>MHours</td>
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</table>

**Absolute Maximum Ratings**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Voltage Surge (1 Sec)</td>
<td>5 VDC Input</td>
<td>-0.7</td>
<td>12.0</td>
<td></td>
<td>VDC</td>
</tr>
<tr>
<td></td>
<td>12 VDC Input</td>
<td>-0.7</td>
<td>25.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>24 VDC Input</td>
<td>-0.7</td>
<td>50.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>48 VDC Input</td>
<td>-0.7</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lead Temperature</td>
<td>1.5 mm From Case for 10 Sec</td>
<td>-0.7</td>
<td>300</td>
<td></td>
<td>°C</td>
</tr>
</tbody>
</table>

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

**Notes:**

1. When measuring output ripple & noise, it is recommended that an external capacitor (1 µF to 10 µF) be placed from the +VOUT to the -VOUT pins for single output units and from each output to common for dual output models.

2. Transient recovery is measured to within a 1% error band for a load step change of 25%.

3. These units should not be operated with a load under 5% of full load. Operation at no-load will not damage the unit, but they may not meet all specifications.

4. 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.

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Input Voltage (VDC)</th>
<th>Input Current (mA)</th>
<th>Output Voltage (VDC)</th>
<th>Output Current (mA)</th>
<th>Efficiency (%), Typ</th>
<th>Reflected Ripple Current (mA Typ)</th>
<th>Capacitive Load (µF, Max)</th>
<th>Fuse Rating Slow-Blow (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA305S-05ERW</td>
<td>5</td>
<td>4.5 - 9.0</td>
<td>5.0</td>
<td>600</td>
<td>74</td>
<td>20.0</td>
<td>4,700</td>
<td>1,600</td>
</tr>
<tr>
<td>MA305S-12ERW</td>
<td>5</td>
<td>4.5 - 9.0</td>
<td>12.0</td>
<td>250</td>
<td>77</td>
<td>20.0</td>
<td>2,700</td>
<td>1,600</td>
</tr>
<tr>
<td>MA305D-05ERW</td>
<td>5</td>
<td>4.5 - 9.0</td>
<td>±5.0</td>
<td>±300</td>
<td>±15</td>
<td>20.0</td>
<td>2,200</td>
<td>1,600</td>
</tr>
<tr>
<td>MA305D-12ERW</td>
<td>5</td>
<td>4.5 - 9.0</td>
<td>±12.0</td>
<td>±125</td>
<td>±6</td>
<td>20.0</td>
<td>1,800</td>
<td>1,600</td>
</tr>
<tr>
<td>MA305D-15ERW</td>
<td>5</td>
<td>4.5 - 9.0</td>
<td>±15.0</td>
<td>±100</td>
<td>±5</td>
<td>20.0</td>
<td>1,000</td>
<td>1,600</td>
</tr>
<tr>
<td>MA312S-03ERW</td>
<td>12</td>
<td>9.0 - 18.0</td>
<td>3.3</td>
<td>909</td>
<td>74</td>
<td>30.0</td>
<td>4,700</td>
<td>750</td>
</tr>
<tr>
<td>MA312S-05ERW</td>
<td>12</td>
<td>9.0 - 18.0</td>
<td>5.0</td>
<td>600</td>
<td>81</td>
<td>30.0</td>
<td>4,700</td>
<td>750</td>
</tr>
<tr>
<td>MA312S-12ERW</td>
<td>12</td>
<td>9.0 - 18.0</td>
<td>12.0</td>
<td>250</td>
<td>83</td>
<td>30.0</td>
<td>2,700</td>
<td>750</td>
</tr>
<tr>
<td>MA312S-15ERW</td>
<td>12</td>
<td>9.0 - 18.0</td>
<td>15.0</td>
<td>200</td>
<td>82</td>
<td>30.0</td>
<td>2,200</td>
<td>750</td>
</tr>
<tr>
<td>MA312S-24ERW</td>
<td>12</td>
<td>9.0 - 18.0</td>
<td>24.0</td>
<td>125</td>
<td>83</td>
<td>30.0</td>
<td>1,800</td>
<td>750</td>
</tr>
<tr>
<td>MA312D-05ERW</td>
<td>12</td>
<td>9.0 - 18.0</td>
<td>±5.0</td>
<td>±300</td>
<td>±15</td>
<td>30.0</td>
<td>2,200</td>
<td>750</td>
</tr>
<tr>
<td>MA312D-12ERW</td>
<td>12</td>
<td>9.0 - 18.0</td>
<td>±9.0</td>
<td>±166</td>
<td>±8</td>
<td>30.0</td>
<td>2,000</td>
<td>750</td>
</tr>
<tr>
<td>MA312D-15ERW</td>
<td>12</td>
<td>9.0 - 18.0</td>
<td>±12.0</td>
<td>±125</td>
<td>±6</td>
<td>30.0</td>
<td>1,800</td>
<td>750</td>
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<tr>
<td>MA324S-03ERW</td>
<td>24</td>
<td>18.0 - 36.0</td>
<td>3.3</td>
<td>909</td>
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<td>4,700</td>
<td>300</td>
</tr>
<tr>
<td>MA324S-05ERW</td>
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<td>18.0 - 36.0</td>
<td>5.0</td>
<td>600</td>
<td>81</td>
<td>30.0</td>
<td>4,700</td>
<td>300</td>
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<tr>
<td>MA324S-12ERW</td>
<td>24</td>
<td>18.0 - 36.0</td>
<td>12.0</td>
<td>250</td>
<td>83</td>
<td>30.0</td>
<td>2,700</td>
<td>300</td>
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<tr>
<td>MA324S-15ERW</td>
<td>24</td>
<td>18.0 - 36.0</td>
<td>15.0</td>
<td>200</td>
<td>82</td>
<td>30.0</td>
<td>2,200</td>
<td>300</td>
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<tr>
<td>MA324S-24ERW</td>
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<td>18.0 - 36.0</td>
<td>24.0</td>
<td>125</td>
<td>85</td>
<td>30.0</td>
<td>1,800</td>
<td>300</td>
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<tr>
<td>MA324D-05ERW</td>
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<td>18.0 - 36.0</td>
<td>±5.0</td>
<td>±300</td>
<td>±15</td>
<td>30.0</td>
<td>2,200</td>
<td>300</td>
</tr>
<tr>
<td>MA324D-12ERW</td>
<td>24</td>
<td>18.0 - 36.0</td>
<td>±9.0</td>
<td>±166</td>
<td>±8</td>
<td>30.0</td>
<td>2,000</td>
<td>300</td>
</tr>
<tr>
<td>MA324D-15ERW</td>
<td>24</td>
<td>18.0 - 36.0</td>
<td>±12.0</td>
<td>±125</td>
<td>±6</td>
<td>30.0</td>
<td>1,800</td>
<td>300</td>
</tr>
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<td>MA348S-03ERW</td>
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<td>36.0 - 75.0</td>
<td>3.3</td>
<td>909</td>
<td>76</td>
<td>30.0</td>
<td>4,700</td>
<td>150</td>
</tr>
<tr>
<td>MA348S-05ERW</td>
<td>48</td>
<td>36.0 - 75.0</td>
<td>5.0</td>
<td>600</td>
<td>82</td>
<td>30.0</td>
<td>4,700</td>
<td>150</td>
</tr>
<tr>
<td>MA348S-12ERW</td>
<td>48</td>
<td>36.0 - 75.0</td>
<td>12.0</td>
<td>250</td>
<td>86</td>
<td>30.0</td>
<td>2,700</td>
<td>150</td>
</tr>
<tr>
<td>MA348S-15ERW</td>
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<td>36.0 - 75.0</td>
<td>15.0</td>
<td>200</td>
<td>86</td>
<td>30.0</td>
<td>2,200</td>
<td>150</td>
</tr>
<tr>
<td>MA348D-05ERW</td>
<td>48</td>
<td>36.0 - 75.0</td>
<td>±5.0</td>
<td>±300</td>
<td>±15</td>
<td>30.0</td>
<td>2,200</td>
<td>150</td>
</tr>
<tr>
<td>MA348D-12ERW</td>
<td>48</td>
<td>36.0 - 75.0</td>
<td>±9.0</td>
<td>±166</td>
<td>±8</td>
<td>30.0</td>
<td>1,800</td>
<td>150</td>
</tr>
<tr>
<td>MA348D-15ERW</td>
<td>48</td>
<td>36.0 - 75.0</td>
<td>±12.0</td>
<td>±125</td>
<td>±6</td>
<td>30.0</td>
<td>1,000</td>
<td>150</td>
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</table>

**Efficiency vs Input Voltage:** Typical 24 VDC Input

**Efficiency vs Output Load:** Typical 24 VDC Input

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[Diagram of Derating Curve]
EMC Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiated Emissions</td>
<td>See Note 1 EN 55022 Class A</td>
</tr>
<tr>
<td>Conducted Emissions</td>
<td>See Note 1 EN 55022 Class A</td>
</tr>
<tr>
<td>ESD</td>
<td>EN 61000-4-2 Criteria B; ±4 kV Contact, ±8 kV Air</td>
</tr>
<tr>
<td>RS</td>
<td>EN 61000-4-3 Criteria A; 10V/m</td>
</tr>
<tr>
<td>EFT</td>
<td>See Note 2 EN 61000-4-4 Criteria B; ±2 kV</td>
</tr>
<tr>
<td>Surge</td>
<td>See Note 3 EN 61000-4-5 Criteria B; ±2 kV</td>
</tr>
<tr>
<td>CS</td>
<td>EN 61000-4-6 Criteria A; 3 Vrms</td>
</tr>
<tr>
<td>Voltage Dips</td>
<td>EN 61000-4-29 Criteria B; 0% - 70%</td>
</tr>
</tbody>
</table>

Notes:
1. All units are rated for EN 55022 (CE/RE) class A without external components. They will meet class B with the addition of the MDCFM-02A(W) or a similar discrete filter circuit. Contact the factory for more information.
2. To meet the requirements of EN 61000-4-4 (±2 kV), external components are needed. This can be done discretely as shown in the typical connection diagram below. With the addition of the MDCFM-02A(W), the unit will meet EN 61000-4-4 (±4 kV). Contact the factory for more information.
3. To meet the requirements of EN 61000-4-5 (±2 kV), external components are needed. This can be done discretely, or with the addition of the MDCFM-02A(W). Contact the factory for more information.

Typical Connection

The diagram above illustrates a typical connection of the MA300xERW series for applications that require meeting EMC standards. The units do not require external components to operate as specified. Some notes on this diagram (starting with the input circuit) are:

1. It is recommended that an external fuse be used. The recommended fuse is shown in the model chart on page 2.
2. An external MOV is recommended on the input to protect the unit in the event of a surge. A recommended value is given in the table at right.
3. An external TVS is recommended on the input to protect the unit in the event of a voltage spike. A recommended value is given in the table at right.
4. The output filtering capacitor (C5) is a high frequency, low resistance electrolytic capacitor. Care must be taken in choosing this capacitor not to exceed the capacitive load specification for the unit. Voltage derating of capacitors should be 80% or above.

Typical Board Layout: With External Filter/Surge Components for Single Output Unit

Typical Board Layout: With External Filter/Surge Components for Dual Output Unit

5. Recommended values for components are:

<table>
<thead>
<tr>
<th>Component</th>
<th>S Vin</th>
<th>12 Vin</th>
<th>24 Vin</th>
<th>48 Vin</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOV</td>
<td>---</td>
<td>---</td>
<td>31µF</td>
<td>31µF</td>
</tr>
<tr>
<td>LM1</td>
<td>---</td>
<td>---</td>
<td>56µH</td>
<td>56µH</td>
</tr>
<tr>
<td>TVS</td>
<td>SMCJ13A</td>
<td>SMCJ28A</td>
<td>SMCJ48A</td>
<td>SMCJ90A</td>
</tr>
<tr>
<td>C1</td>
<td>680 µF/1kV</td>
<td>680 µF/5kV</td>
<td>330 µF/5kV</td>
<td>330 µF/10kV</td>
</tr>
<tr>
<td>C2</td>
<td>4.7 µF/5kV</td>
<td>4.7 µF/5kV</td>
<td>4.7 µF/5kV</td>
<td>4.7 µF/10kV</td>
</tr>
<tr>
<td>LDM1</td>
<td>12 µH</td>
<td>12 µH</td>
<td>12 µH</td>
<td>12 µH</td>
</tr>
<tr>
<td>C3</td>
<td>4.7 µF/5kV</td>
<td>4.7 µF/5kV</td>
<td>4.7 µF/5kV</td>
<td>4.7 µF/10kV</td>
</tr>
<tr>
<td>LDM2</td>
<td>1nF/2kV</td>
<td>1nF/2kV</td>
<td>1nF/2kV</td>
<td>1nF/2kV</td>
</tr>
<tr>
<td>C4</td>
<td>10 µF</td>
<td>10 µF</td>
<td>10 µF</td>
<td>10 µF</td>
</tr>
<tr>
<td>C5</td>
<td>10 µF</td>
<td>10 µF</td>
<td>10 µF</td>
<td>10 µF</td>
</tr>
</tbody>
</table>

6. Input noise and surge suppression modules are available for a number of MPD DC/DC power supplies. For pricing or full technical information, please contact the factory.
7. In many applications simply adding input/output capacitors will enhance the input surge protection and reduce output ripple sufficiently. The input capacitor C1 and output capacitors C5 and C6 shown in the typical connection diagram above (board layout drawing below), illustrate their connection.

The recommended capacitor values are as follows:

- CIN 5V/12V Input: 100 µF
- 24V/48V Input: 10µF - 47 µF
- Cout All Models: 10µF/100mA
Mechanical Dimensions

Pin Connections

<table>
<thead>
<tr>
<th>Pin</th>
<th>Single Output</th>
<th>Dual Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>-VIN</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>-VIN</td>
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<td>No Pin</td>
<td>9</td>
</tr>
<tr>
<td>11</td>
<td>No Connection</td>
<td>11</td>
</tr>
<tr>
<td>14</td>
<td>+VOUT</td>
<td>14</td>
</tr>
<tr>
<td>16</td>
<td>-VOUT</td>
<td>16</td>
</tr>
<tr>
<td>22</td>
<td>+VIN</td>
<td>22</td>
</tr>
<tr>
<td>23</td>
<td>+VIN</td>
<td>23</td>
</tr>
</tbody>
</table>

Notes:
- All dimensions are typical in inches (mm)
- Tolerance ±0.02 (±0.50)
- Pin 1 is marked by a “dot” or indentation on the top of the unit

Packing Tube Dimensions

Notes:
- Tube length equals 20.866 (530), unit quantity equals 15 pcs.
- Tube length equals 8.661 (220), unit quantity equals 6 pcs.
- All dimensions are typical in inches (mm)
- Tolerance ±0.02 (±0.50)