

# MB1500ERU

## Low Cost, 1 x 2 Inch 15W, 4:1 Input Range DC/DC Converters



### Key Features:

- 15W Output Power
- 4:1 Input Voltage Range
- 1,500 VDC Isolation
- Single & Dual Outputs
- Efficiency to 90%
- Compact 1 x 2 Inch Case
- -40°C to +85°C Operation
- Industry Standard Pin-Out
- Low Cost

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	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			17.8	
Input Filter	$\pi$ (Pi) Filter				
Start-Up Time	See Note 2		10		mS

Output					
Parameter	Conditions	Min.	Typ.	Max.	Units
Output Voltage Accuracy			±1.0	±3.0	%
Output Voltage Balance	Dual Outputs, Balanced Loads		±0.5	±1.0	
Output Trim Range			±10		%
Line Regulation	V <sub>IN</sub> = Min to Max		±0.2	±0.5	%
Load Regulation	I <sub>OUT</sub> = 10% to 100%		±0.5	±1.0	%
Cross Regulation	See Note 3			±5.0	%
Ripple & Noise (20 MHz)	See Note 4		70	100	mV P - P
Transient Recovery Time, See Note 5	25% Load Step Change		300	500	µSec
Transient Response Deviation			±3.0	±5.0	%
Output Power Protection			160		%
Temperature Coefficient			±0.02		%/°C
Output Short Circuit, See Note 6	Continuous (Autorecovery)				

General					
Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation Voltage	60 Seconds	1,500			VDC
Isolation Resistance	500 VDC	1,000			MΩ
Isolation Capacitance	See Note 7		1,000		pF
Switching Frequency			300		kHz

Environmental					
Parameter	Conditions	Min.	Typ.	Max.	Units
Operating Temperature Range	Ambient	-40	+25	+85	°C
Operating Temperature Range	Case			+105	°C
Storage Temperature Range		-55		+125	°C
Cooling	Free Air Convection				
Humidity	RH, Non-condensing			95	%

Physical					
Parameter	Conditions	Min.	Typ.	Max.	Units
Case Size	See Mechanical Diagram (Page 4)				
Case Material	Aluminum Alloy With Non-Conductive Base (UL94-V0)				
Weight	0.99 Oz (28g)				

Remote On/Off					
Parameter	Conditions	Min.	Typ.	Max.	Units
Unit On	See Note 8	2.5		12.0	VDC
Unit Off	See Note 8	0		1.2	VDC
Off Idle Current			1.0		mA

Reliability Specifications					
Parameter	Conditions	Min.	Typ.	Max.	Units
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	1.0			MHours
Vibration	10 - 55 Hz, 10G, 30 Min, on X, Y & Z Axis				

Absolute Maximum Ratings					
Parameter	Conditions	Min.	Typ.	Max.	Units
Input Voltage Surge (1 Sec)	24 VDC Input	-0.7		50.0	VDC
	48 VDC Input	-0.7		100.0	
Lead Temperature	1.5 mm From Case for 10 Sec			300	°C

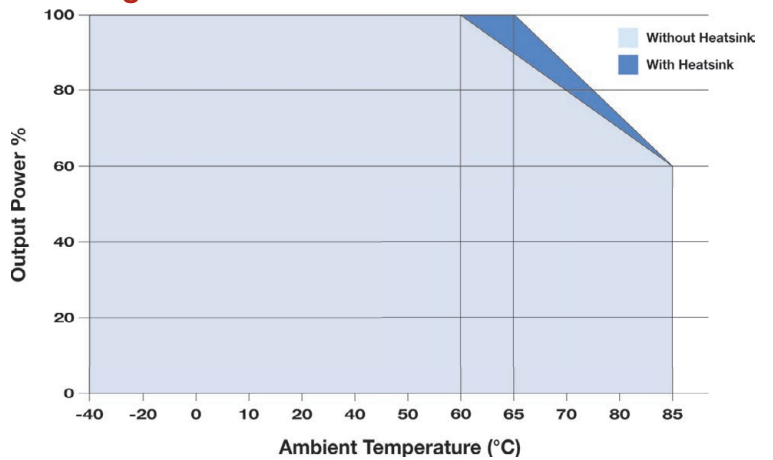
Caution: Exceeding Absolute Maximum Ratings may damage the module. These are not continuous operating ratings.

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Model Number	Input				Output			Efficiency (% Typ)	Over Voltage Protection (VDC 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							
MB1524S-03ERU	24	9.0 - 36.0	633	45	3.3	4,000	200	87	3.9	10,200	1,500
MB1524S-05ERU	24	9.0 - 36.0	695	45	5.0	3,000	150	90	6.2	4,020	1,500
MB1524S-12ERU	24	9.0 - 36.0	703	15	12.0	1,250	63	89	15.0	1,035	1,500
MB1524S-15ERU	24	9.0 - 36.0	703	15	15.0	1,000	50	89	18.0	705	1,500
MB1524S-24ERU	24	9.0 - 36.0	695	20	24.0	625	31	90	30.0	470	1,500
MB1524D-05ERU	24	9.0 - 36.0	727	20	±5.0	±1,500	±75	86	±6.2	4,800	1,500
MB1524D-12ERU	24	9.0 - 36.0	710	15	±12.0	±625	±32	88	±15.0	800	1,500
MB1524D-15ERU	24	9.0 - 36.0	710	15	±15.0	±500	±25	88	±18.0	500	1,500
MB1548S-03ERU	48	18.0 - 75.0	316	35	3.3	4,000	200	87	3.9	10,200	1,000
MB1548S-05ERU	48	18.0 - 75.0	351	35	5.0	3,000	150	89	6.2	4,020	1,000
MB1548S-12ERU	48	18.0 - 75.0	355	10	12.0	1,250	63	88	15.0	1,035	1,000
MB1548S-15ERU	48	18.0 - 75.0	347	10	15.0	1,000	50	90	18.0	705	1,000
MB1548D-05ERU	48	18.0 - 75.0	363	20	±5.0	±1,500	±75	86	±6.2	4,800	1,000
MB1548D-12ERU	48	18.0 - 75.0	355	15	±12.0	±625	±32	88	±15.0	800	1,000
MB1548D-15ERU	48	18.0 - 75.0	351	15	±15.0	±500	±25	89	±18.0	500	1,000

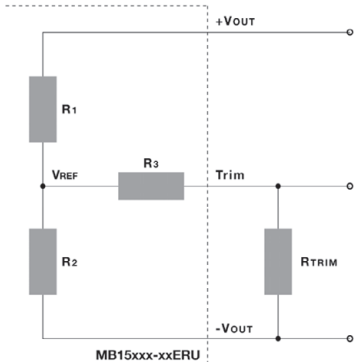
- Notes:
- The specified maximum capacitive load is for each output.
  - Start up time is measured at nominal input and with a constant resistive load.
  - Cross regulation is measured with the main output set at 50% load. The second output is varied from 10% to 100% load.
  - When measuring output ripple, it is recommended that an external ceramic capacitor (approx 1 µF to 10 µF) be placed from the +V<sub>OUT</sub> to the -V<sub>OUT</sub> pins.
  - Transient recovery is measured to within a 1% error band for a load step change of 25%.
  - Short circuit protection is provided by a "hiccup mode" circuit.
  - Isolation capacitance for 24 VDC output models is 2,000 pF. Isolation capacitance is measured from input to output at 100 kHz/0.1V.
  - The control input (pin 6) is referenced to the -V<sub>IN</sub> (pin 2) input. If it is grounded, the unit will shut off.
  - These units should not be operated with a load under 10% of full load. Operation at no-load will not damage the unit, but they may not meet all specifications.
  - These units should not be operated over +85°C. Exceeding +85°C may damage the unit.
  - 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.

Derating Curve

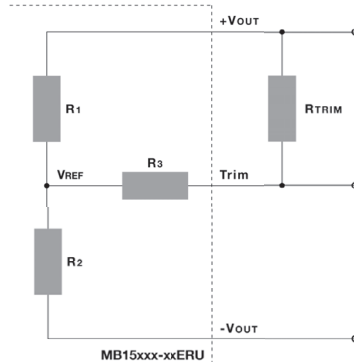


External Trim

Trim Up



Trim Down



External Trim Notes:

On single output units, an external resistor can be used to adjust the converter output up/down by about 10%. The connection is shown in the diagram at left. The required resistor value is calculated by the formulas:

$$\text{Trim Up} = R_{TRIM} = \frac{A \cdot R_2}{R_3 - A} - R_3 \quad \text{Where } A = \frac{V_{REF}}{V_{TRIM} - V_{REF}} \cdot R_1$$

$$\text{Trim Down} = R_{TRIM} = \frac{A \cdot R_1}{R_1 - A} - R_3 \quad \text{Where } A = \frac{V_{TRIM} - V_{REF}}{V_{REF}} \cdot R_2$$

Where R<sub>TRIM</sub> = The value of the external trim resistor  
 V<sub>TRIM</sub> = The amount of voltage adjustment required

The value of R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub> and V<sub>REF</sub> are given in the table below.

Parameter	Output Voltage (VDC)					
	3.3	5.0	9.0	12	15	24
R1 (kΩ)	4.801	2.883	7.500	10.971	14.497	24.872
R2 (kΩ)	2.863	2.864	2.864	2.864	2.864	2.864
R3 (kΩ)	15.00	10.00	15.00	17.80	17.80	20.00
VREF (V)	1.24	2.50	2.50	2.50	2.50	2.50

If not used, the Trim pin (pin 4) should be left open. Please contact the factory for more information.



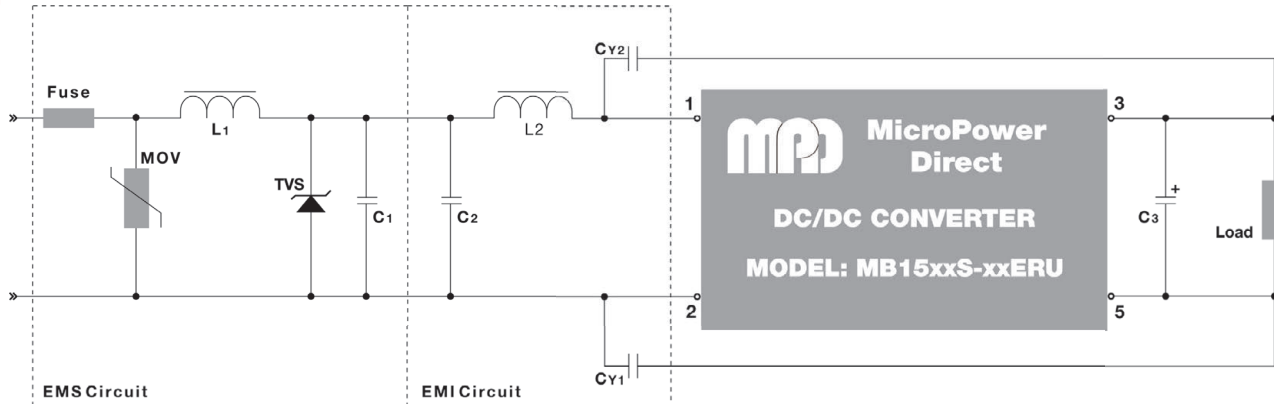
EMC Specifications

Parameter	Standard		
Radiated Emissions	See Note 1	EN 55022	Class A
Conducted Emissions	See Note 1	EN 55022	Class A
ESD		EN 61000-4-2	Criteria B; ±4 kV Contact
RS		EN 61000-4-3	Criteria A; 10V/m
EFT	See Note 2	EN 61000-4-4	Criteria B; ±2 kV
Surge	See Note 3	EN 61000-4-5	Criteria B; ±2 kV
CS		EN 61000-4-6	Criteria A; 3 Vrms
Voltage Dips		EN 61000-4-29	Criteria B; 0% - 70%

Notes:

- 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.
- To meet the requirements of EN 61000-4-4 (±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.
- 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-02(W)**. Contact the factory for more information.

Typical Connection



The diagram above illustrates a typical connection of the **MB1500ERU** 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:

- It is recommended that an external fuse be used. The recommended fuse is shown in the model chart on page 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.
- 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.
- The output filtering capacitor (C3) 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. The board layout illustration below shows a connection for dual output units. Voltage derating of capacitors should be 80% or above.

5. Recommended values for components are:

Component	24 V <sub>IN</sub>	48 V <sub>IN</sub>
MOV	S14K35	S14K60
L1	56 μH	56 μH
TVS	SMCJ48A	SMCJ90A
C1	330 μF/50V	330 μF/100V
C2	1.0 μF/50V	1.0 μF/100V
L2	4.7 μH	4.7 μH
Cy1, Cy2	1,000 pF/2 kV	1,000 pF/2 kV

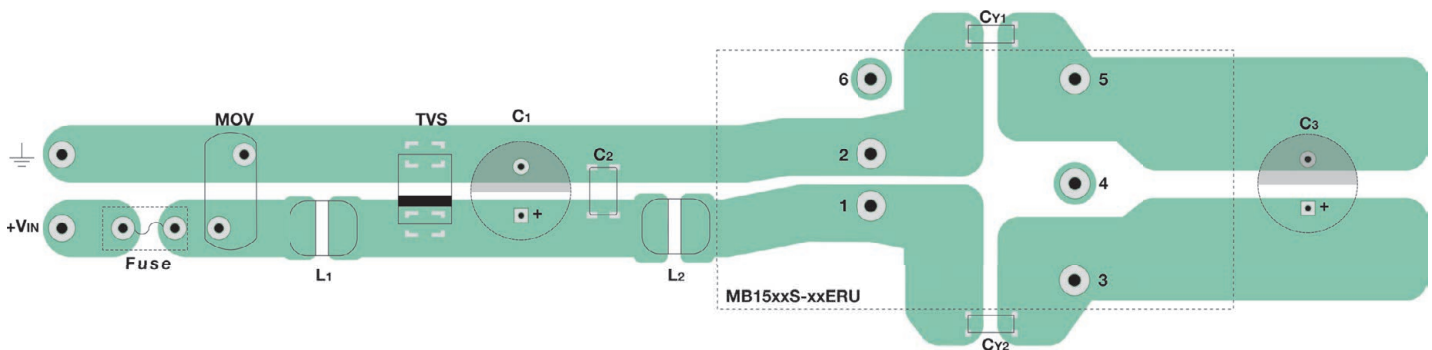
6. Input noise and surge suppression modules are available for a number of **MPD** DC/DC power supplies. For pricing or full technical information on these modules please contact the factory.

7. In many applications simply adding input/output capacitors will

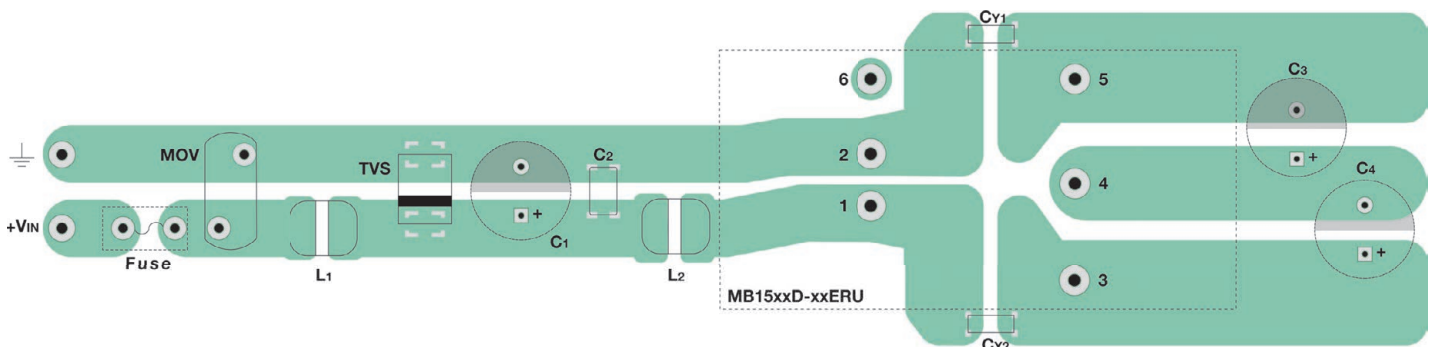
enhance the input surge protection and reduce output ripple sufficiently. The input capacitor C1 and output capacitors C3 and C4 shown in the typical connection diagram above (and board layout drawings below) illustrate their connection. Recommended capacitor values are given in the table at right.

V <sub>in</sub> (VDC)	Input Capacitor	V <sub>out</sub> (VDC)	Output Capacitor
24	330 μF	3.3	470 μF
		5.0	470 μF
48	330 μF	12	220 μF
		15	220 μF
		24	100 μF
		±5	±220 μF
		±12	±100 μF
		±15	±100 μF

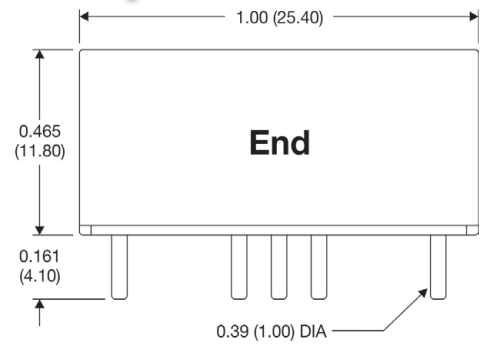
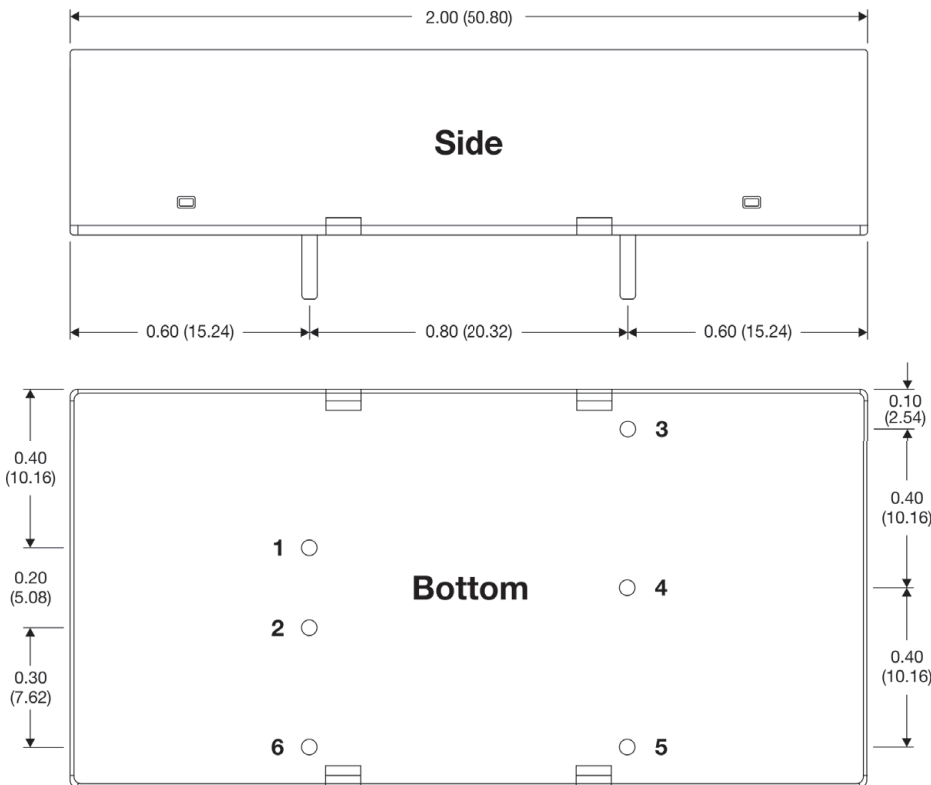
Typical Board Layout: With External Filter/Surge Components for Single Output Unit



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



**Mechanical Dimensions**



**Pin Connections**

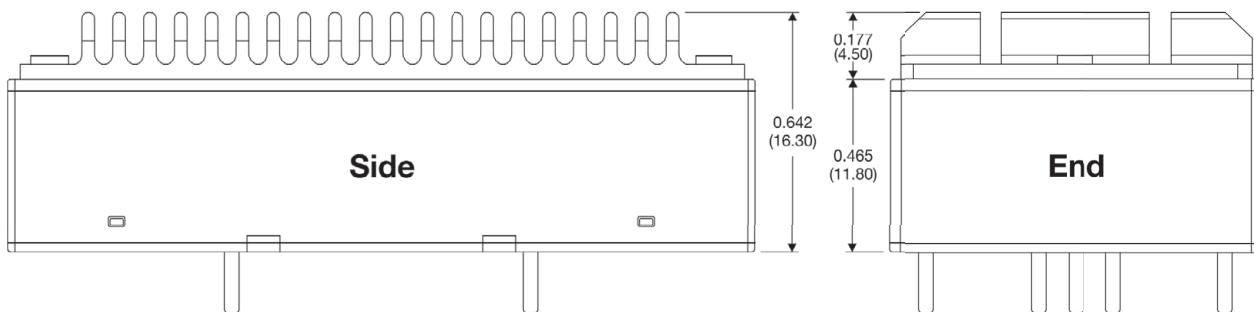
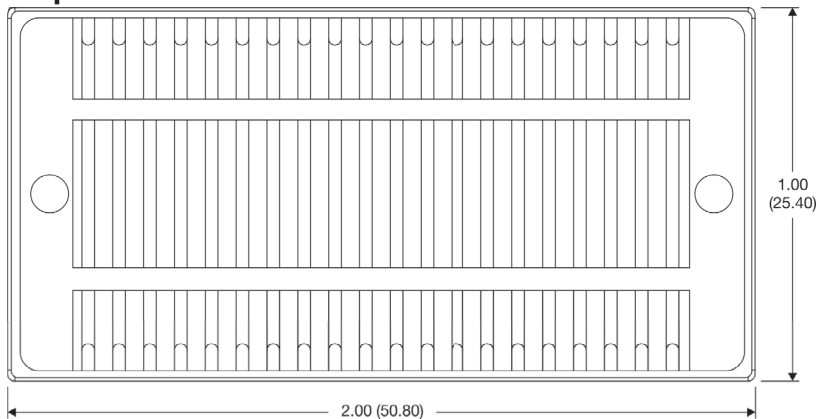
Pin	Single Output	Pin	Dual Output
1	+VIN	1	+VIN
2	-VIN	2	-VIN
3	+VOUT	3	+VOUT
4	Trim	4	Common
5	-VOUT	5	-VOUT
6	Remote On/Off	6	Remote On/Off

**Adapter Plate**



All models of the **MB1500x-xxERU** series are available mounted on an adapter plate similar to the one pictured at left. The adapter plate makes it easier to mount the unit to a chassis or to a standard DIN rail. Please contact the factory for more information.

**Mechanical Dimensions: With Optional Heatsink Top**



For the heatsink option, add suffix "H" to the model number (i.e. **MB1524S-05ERU-H**)