MF3000ERU

Wide 4:1 Input, 30W Single & Dual Output DC/DC Converters



Key Features:

- 30W Output Power
- 4:1 Input Voltage Range
- 1,500 VDC Isolation
- Single & Dual Outputs
- Efficiency to 90%
- Compact 1.6 x 2 Inch Case
- -40°C to +85°C Operation
- Industry Standard Pin-Out
- Low Cost

RoHS

Cost Cutter

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	
Under Voltage Lockout	24 VDC Input	On			9.0	VDC
		Off	7.8			
	48 VDC Input	On			17.8	
		Off	16.0			
Input Filter	π (Pi) Filter					

Output

Parameter	Conditions	Min.	Typ.	Max.	Units
Output Voltage Accuracy			±1.0	±3.0	%
Output Trim Range			±10		%
Line Regulation	VIN = Min to Max		±0.2	±0.5	%
Load Regulation	IOUT = 5% to 100%		±0.5	±1.0	%
Cross Regulation	See Note 1			±5.0	%
Ripple & Noise (20 MHz)	See Note 2		85	100	mV P - P
Transient Recovery Time, See Note 3	25% Load Step Change		300	500	µSec
Transient Response Deviation			±3.0	±5.0	%
Temperature Coefficient			±0.02		%/°C
Over Power Protection			150		%IOUT
Output Short Circuit, See Note 4	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	100 kHz, 0.1V		2,000		pF
Switching Frequency			400		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

Case Size	2.0 x 1.60 x 0.465 Inches (50.8 x 40.6 x 11.8 mm)
Case Material	Aluminum Alloy With Non-Conductive Base (UL94-V0)
Weight	Without Heatsink: 1.77 Oz (50g)
	With Heatsink: 2.48 Oz (70g)

Remote On/Off

Parameter	Conditions	Min.	Typ.	Max.	Units
Unit On	See Note 5	2.5		12.0	VDC
Unit Off	See Note 5	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

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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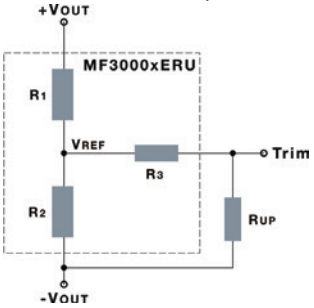
Model Selection Guide

Model Number	Input				Output			Reflected Ripple Current (mA Typ)	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							
MF3024S-05ERU(-H)	24	9.0 - 36.0	1,420	120	5.0	6,000	300	30	6,000	88	8,000
MF3024S-12ERU(-H)	24	9.0 - 36.0	1,420	30	12.0	2,500	125	30	2,500	88	8,000
MF3024S-15ERU(-H)	24	9.0 - 36.0	1,389	30	15.0	2,000	100	30	1,100	90	8,000
MF3024D-05ERU(-H)	24	9.0 - 36.0	1,453	30	±5.0	±3,000	±150	30	±2,000	86	8,000
MF3024D-12ERU(-H)	24	9.0 - 36.0	1,404	30	±12.0	±1,250	±63	30	±1,250	89	8,000
MF3024D-15ERU(-H)	24	9.0 - 36.0	1,389	30	±15.0	±1,000	±50	30	±680	90	8,000
MF3048S-05ERU(-H)	48	18.0 - 75.0	710	100	5.0	6,000	300	30	6,000	88	4,000
MF3048S-12ERU(-H)	48	18.0 - 75.0	710	30	12.0	2,500	125	30	2,500	88	4,000
MF3048S-15ERU(-H)	48	18.0 - 75.0	702	30	15.0	2,000	100	30	1,100	89	4,000
MF3048D-05ERU(-H)	48	18.0 - 75.0	726	30	±5.0	±3,000	±150	30	±2,000	86	4,000
MF3048D-12ERU(-H)	48	18.0 - 75.0	718	30	±12.0	±1,250	±63	30	±1,250	87	4,000
MF3048D-15ERU(-H)	48	18.0 - 75.0	718	30	±15.0	±1,000	±50	30	±680	87	4,000

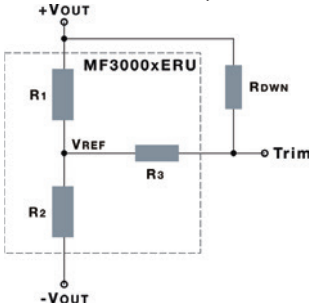
Notes:

1. Cross regulation is measured with the output being tested at 50% load. The second output is varied from 10% to 100% load.
2. When measuring output ripple, it is recommended that an external ceramic capacitor (approx 4.7 - 10 µF) be placed from the +VOUT to the -VOUT pins for single output models; or from each output to common for dual output models.
3. Transient recovery is measured to within a 1% error band for a load step change of 25%.
4. Short circuit protection is provided by a "hiccup mode" circuit.
5. If the on/off pin is left open, the unit operates. If it is grounded, the unit will shut off. THe control circuit is referenced to the minus (-) input.
6. 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.
7. These units should not be operated over +85°C. Exceeding +85°C may damage the unit.
8. 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.

External Trim, UP



External Trim, Down



A simple external circuit may be used to adjust the converter output ±10%. The trim circuit is illustrated in the diagrams above. The following formulas may be used to calculate the correct resistor value. To trim the output up, the correct resistor value (in kΩ) equals:

$$R_{UP} = \frac{A \times R_2}{R_2 - A} - R_3 \quad \text{Where: } A = \frac{2.5}{V_{ADJ} - 2.5} \times R_1$$

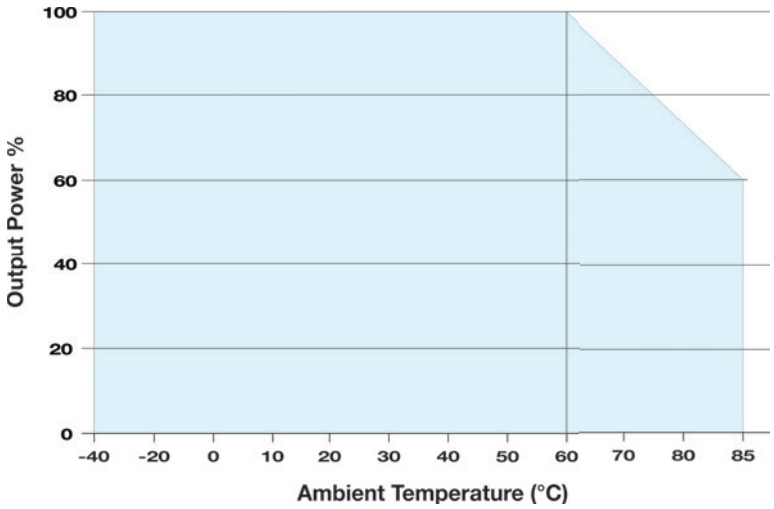
To trim the output down, the correct resistor value (in kΩ) equals:

$$R_{DWN} = \frac{A \times R_1}{R_1 - A} - R_3 \quad \text{Where: } A = \frac{V_{ADJ} - 2.5}{2.5} \times R_2$$

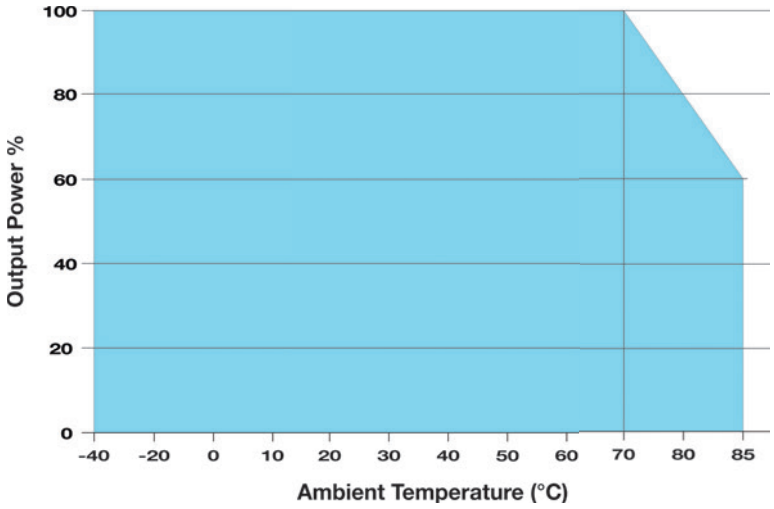
Other equation values are:

	Unit Output Voltage		
	5V	12V	15V
R_1	2.883	10.971	14.497
R_2	2.864	2.864	2.864
R_3	10.0	17.8	17.8
V_{ADJ}	Amount of Adjustment		

Derating Curve, Without Heatsink



Derating Curve, With Heatsink



For the heatsink option, add suffix "H" to the model number (i.e. **MF3024S-05ERU-H**)

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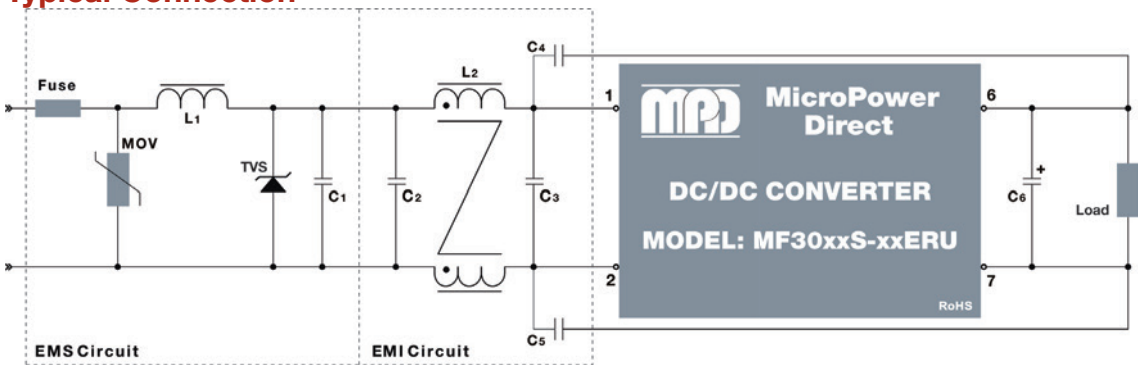
EMC Specifications

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:

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-1B** (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, as shown on the typical connection diagram below. Use the **MDCFM-1B** to 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-1B**. Contact the factory for more information.

Typical Connection



The diagram at left illustrates a typical connection of the **MF3000xERU** 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 below.
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 below.
4. The output filtering capacitor (C_5) 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 illustrations at left show connections for single and dual output units. Voltage derating of capacitors should be 80% or above.
5. Recommended values for components are:

Component	24 V_{IN}	48 V_{IN}
MOV	10D560k	10D101k
L_1	56 µH	56 µH
TVS	SMCJ48A	SMCJ90A
C_1	120 µF/50V	120 µF/100V
C_2	4.7 µF/50V	2.2 µF/100V
L_2	2.2 mH	2.2 mH
C_3	4.7 µF/50V	2.2 µF/100V
C_4, C_5	1.0 nF/2 kV	1.0 nF/2 kV

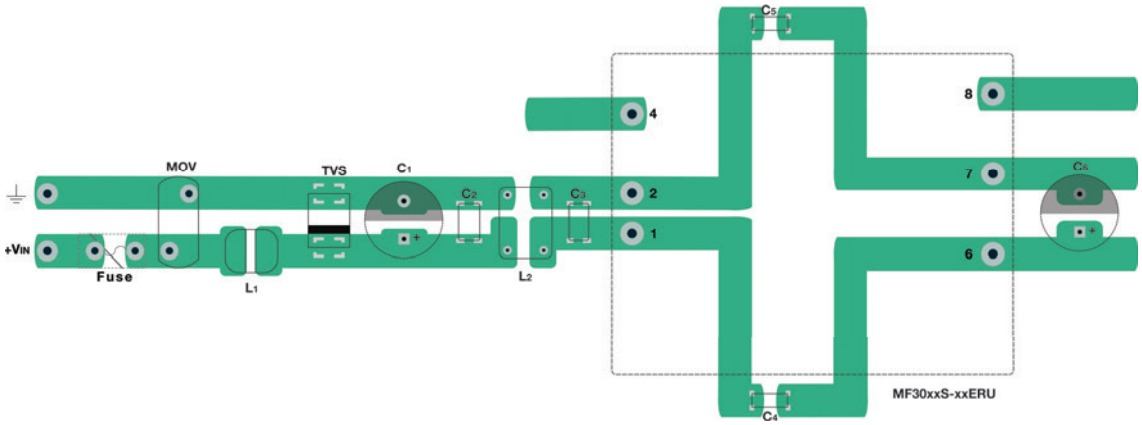
6. In many applications simply adding input/output capacitors will enhance the input surge protection and reduce output ripple sufficiently. The input capacitor C_1 and output capacitors C_6 and C_7 shown in the typical connection diagram above, and board layout drawings at left their connection. In this case, recommended capacitor values are:

   C_{IN}: 10 µF for 24V input models
   10 µF for 48V input models

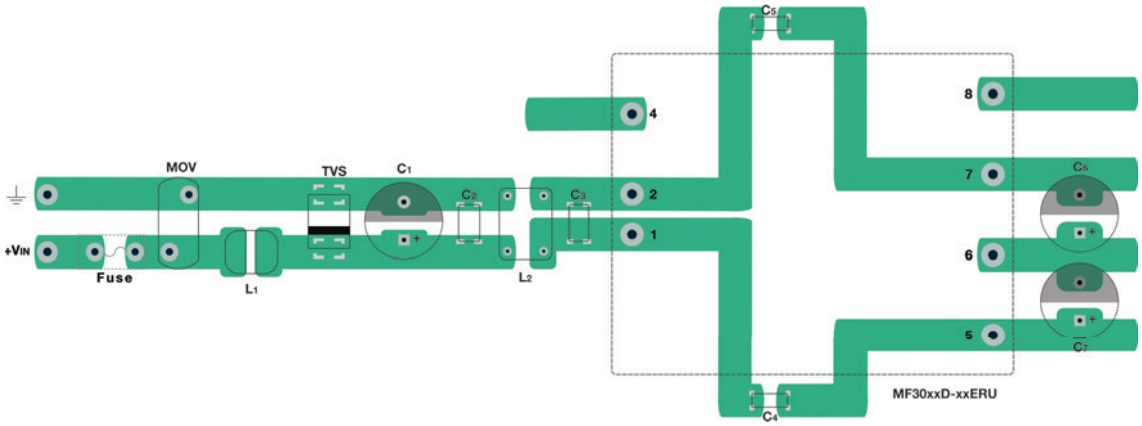
   C_{OUT}: 10 µF for 5V_{OUT} models
   4.7 µF for 12/15V_{OUT} models

8. The pad spacing between input/output (C_4 & C_5) in the board layout drawings below should be a minimum of 2 mm.

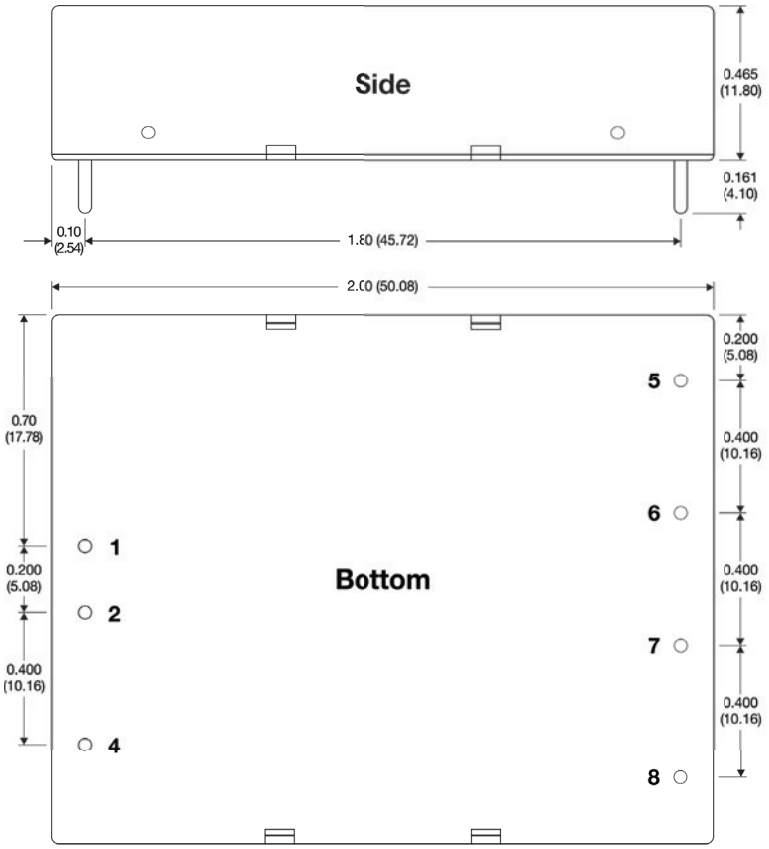
Typical Board Layout: With External Filter/Surge Components for Single Output Unit



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



Mechanical Dimensions

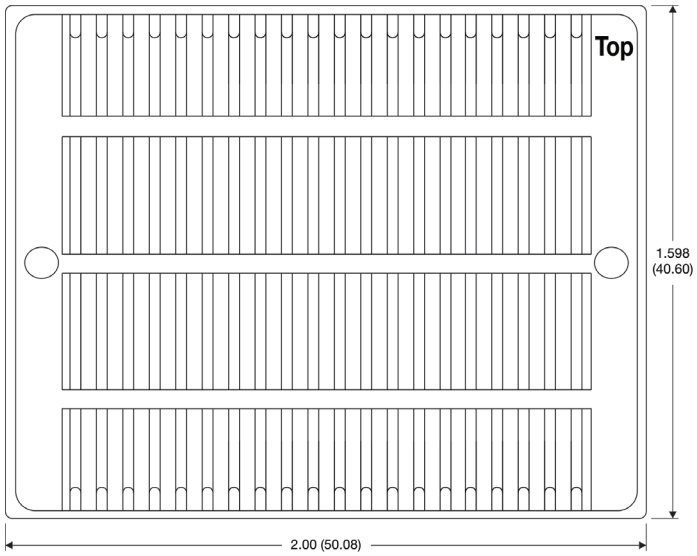


Pin Connections

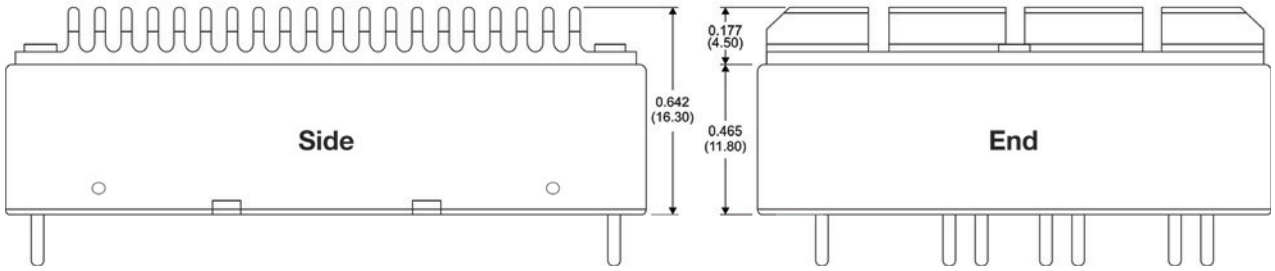
Pin	Single Output
1	+Vin
2	-Vin
4	Remote On/Off
5	No Pin
6	+Vout
7	-Vout
8	Trim

Pin	Dual Output
1	+Vin
2	-Vin
4	Remote On/Off
5	+Vout
6	Common
7	-Vout
8	Trim

Mechanical Dimensions: With Optional Heatsink



For the heatsink option, add suffix "H" to the model number (i.e. **MF3048D-12ERU-H**)



Notes:
- All dimensions are typical in inches (mm)
- Tolerance x.xx = ±0.02 (±0.50)

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