

ML300ERW Series

Low Cost, 3W SMT 2:1 Input Range DC/DC Converters



Key Features:

- 3W Output Power
- 2:1 Input Voltage Range
- 1,500 VDC Isolation
- Compact SMT Case
- Nine Standard Models
- Short Circuit Protected
- -40°C to +85°C Operation
- Available On Tape/Reel
- Low Cost



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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	12 VDC Input	9.0	12.0	18.0	VDC
	24 VDC Input	18.0	24.0	36.0	
	48 VDC Input	36.0	48.0	75.0	
Input Start Voltage	12 VDC Input	4.5	8.0	9.0	VDC
	24 VDC Input	11.0	16.0	18.0	
	48 VDC Input	24.0	33.0	36.0	
Input Filter	π (Pi) Filter				
Reflected Ripple Current			30		mA

Output

Parameter	Conditions	Min.	Typ.	Max.	Units
Output Voltage Accuracy			±1.0	±3.0	%
Line Regulation	V _{IN} = Min to Max		±0.2	±0.4	%
Load Regulation	I _{OUT} = 5% to 100%		±0.2	±0.75	%
Ripple (20 MHz)	See Note 1		20	35	mV P - P
Noise (20 MHz)	See Note 1		45	60	mV P - P
Transient Recovery Time, See Note 2	25% Load Step Change		0.5	1.0	mSec
Transient Response Deviation			±2.0	±5.0	%
Temperature Coefficient			±0.02	±0.03	%/°C
Output Short Circuit, See Note 3	Continuous (Autorecovery)				

General

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation Voltage	60 Seconds	1,500			VDC
Isolation Resistance	500 VDC	1,000			M Ω
Isolation Capacitance	100 kHz, 0.1V		1,000		pF
Switching Frequency			350		kHz

Environmental

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

Physical

Case Size	See Mechanical Drawing (Page 4)				
Case Material	Non-Conductive Black Plastic (UL94-V0)				
Weight	0.183 Oz (5.2g)				

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)	12 VDC Input	-0.7		25.0	VDC
	24 VDC Input	-0.7		50.0	
	48 VDC Input	-0.7		100.0	
Peak Reflow Temperature				240	°C
Lead Temperature	1.5 mm From Case for 10 Sec			300	°C

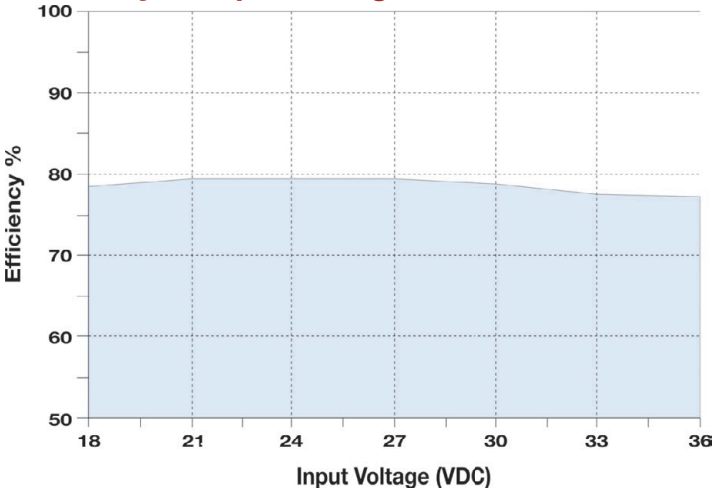
Caution: Exceeding Absolute Maximum Ratings may damage the module. These are not continuous operating ratings.

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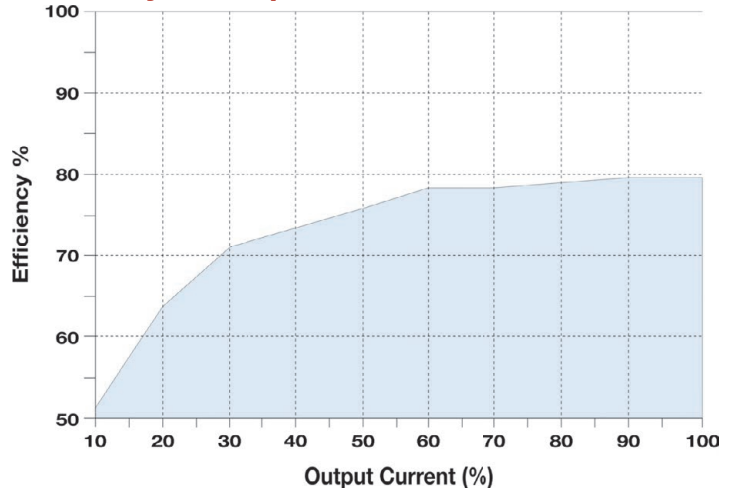
Model Number	Input				Output			Efficiency (% Typ)	Capacitive Load (µF, Max)	Fuse Rating Slow-Blow (mA)
	Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA, Max)	Current (mA, Min)			
	Nominal	Range	Full-Load	No-Load						
ML312S-05ERW	12	9.0 - 18.0	333	22	5.0	600	30	75	3,300	600
ML312S-12ERW	12	9.0 - 18.0	325	22	12.0	250	12	77	1,800	600
ML312S-15ERW	12	9.0 - 18.0	316	22	15.0	200	10	79	1,000	600
ML324S-05ERW	24	18.0 - 36.0	164	12	5.0	600	30	76	3,300	300
ML324S-12ERW	24	18.0 - 36.0	154	12	12.0	250	12	81	1,800	300
ML324S-15ERW	24	18.0 - 36.0	156	12	15.0	200	10	80	1,000	300
ML348S-05ERW	48	36.0 - 75.0	81	8	5.0	600	30	77	3,300	150
ML348S-12ERW	48	36.0 - 75.0	78	8	12.0	250	12	80	1,800	150
ML348S-15ERW	48	36.0 - 75.0	78	8	15.0	200	10	80	1,000	150

- Notes:
- When measuring output ripple & noise, it is recommended that an external ceramic capacitor (approx 10 µF) be placed from the +Vout to the -Vout 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.
 - 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.
 - The recommended reflow settings are a peak temperature of 245 °C for a maximum period (T_P) of 10S and a time above liquidous (T_L) of <60 seconds at 217 °C. A suggested temperature profile is shown on page four. For more information, please contact the factory.
 - 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.

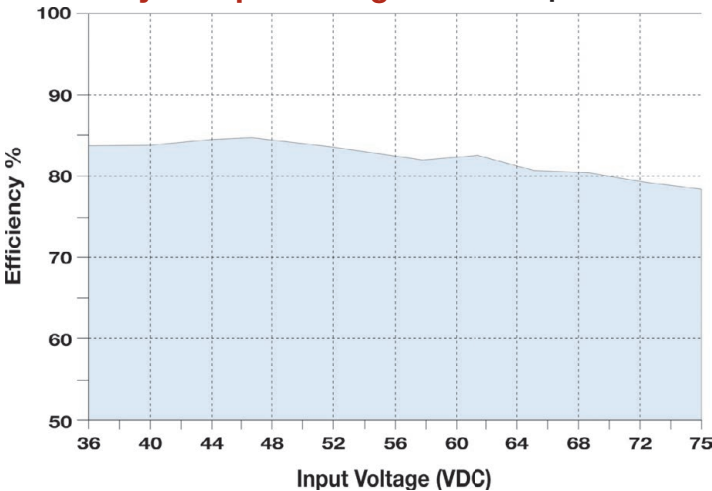
Efficiency vs Input Voltage 24 VDC Input



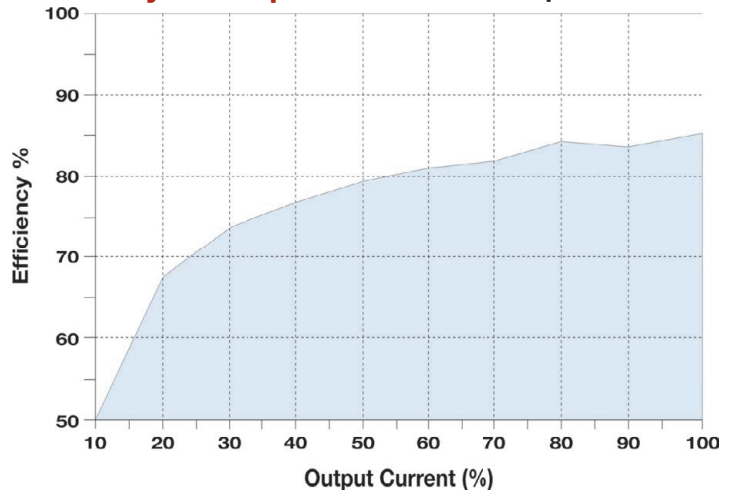
Efficiency vs Output Load 24 VDC Input



Efficiency vs Input Voltage 48 VDC Input



Efficiency vs Output Load 48 VDC Input



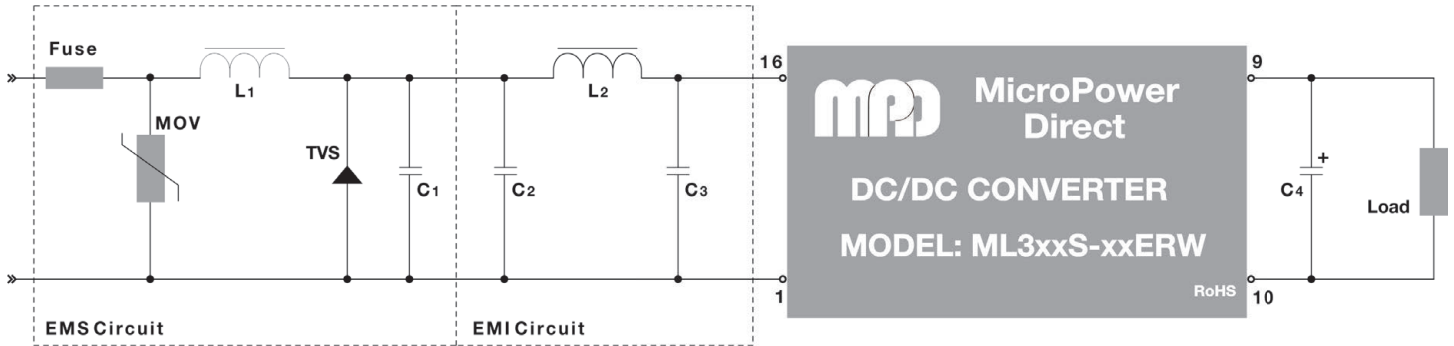
EMC Specifications

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-0x** (or a similar discrete filter circuit). Contact the factory for more information.
- To meet the requirements of EN 61000-4-4 (±2 kV or ±4 kV), external components are needed. This can be done discretely, or with the addition of the **MDCFM-0x**. 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-0x**. Contact the factory for more information.

Typical Connection



The diagram above illustrates a typical connection of the **ML300ERW** 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 (C4) 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:

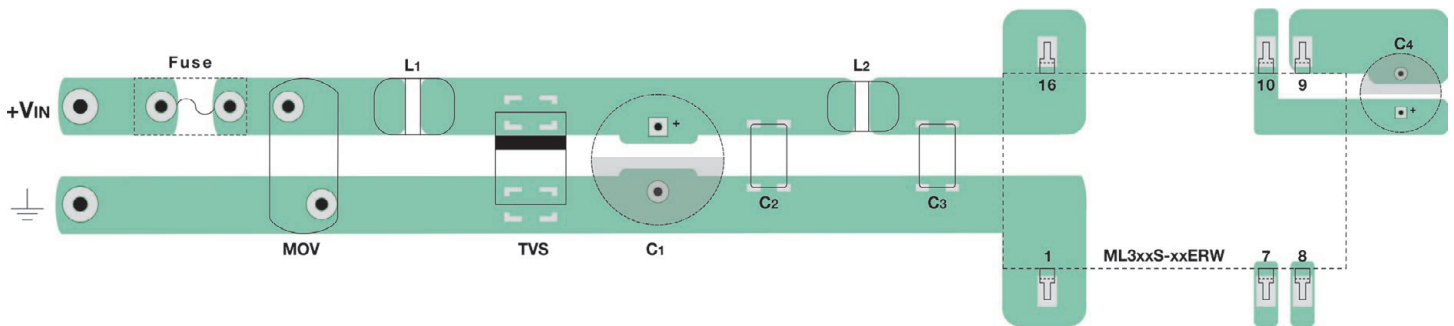
Component	12 V _{IN}	24 V _{IN}	48 V _{IN}
MOV	---	10D560	10D101
L1	---	56 µH	56 µH
TVS	SMCJ28A	SMCJ48A	SMCJ90A
C1	680 µF/25V	120 µF/50V	120 µF/100V
C2	4.7 µF/50V	4.7 µF/50V	4.7 µF/100V
L2		4.7 µH	4.7 µH
C3	4.7 µF/50V	4.7 µF/50V	4.7 µF/100V
C4	10 µF	10 µF	10 µF

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

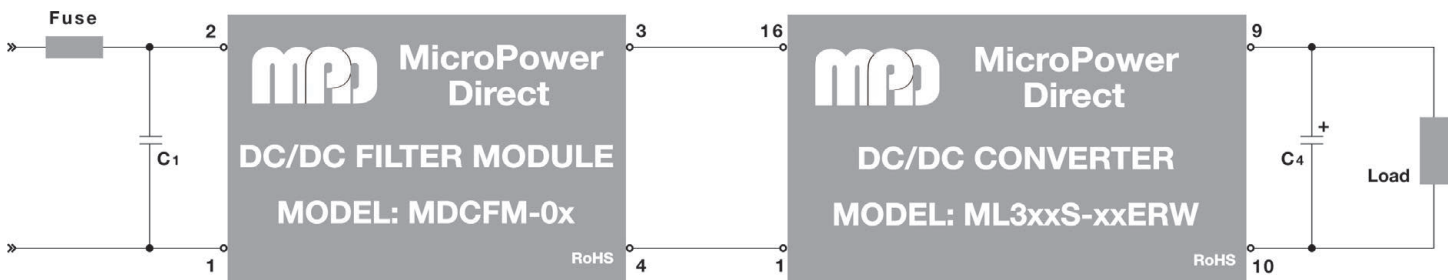
enhance the input surge protection and reduce output ripple sufficiently. The input capacitor C1 and output capacitor C4 shown in the typical connection diagram above (and board layout drawing below) illustrate their connection. Recommended capacitor values are given in the table at right.

V _{IN} (VDC)	Input Capacitor	V _{OUT} (VDC)	Output Capacitor
12	100 µF	5.0	10 µF
24	10 - 47 µF	12	10 µF
48	10 - 47 µF	15	10 µF

Typical Board Layout: With External Filter/Surge Components

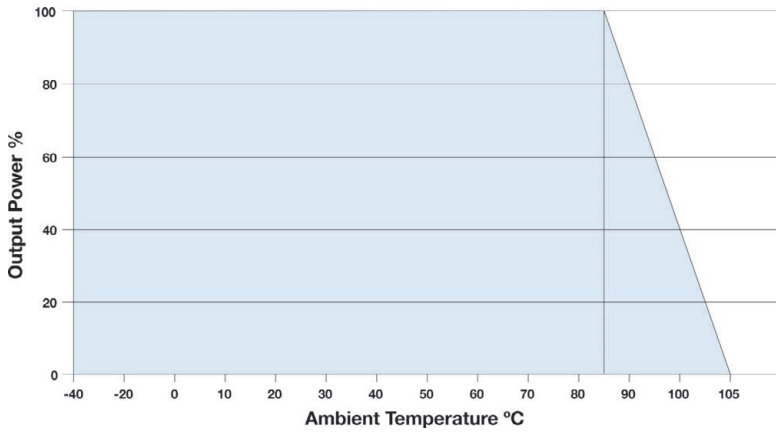


Typical Connection: With External Filter Module MDCFM-0x



For 12V and 24V input models, the value of C1 should be a 330 µF/50V. For 48V input models, the value of C1 should be a 330 µF/100V. For more information on the **MDCFM-0x**, please contact the factory.

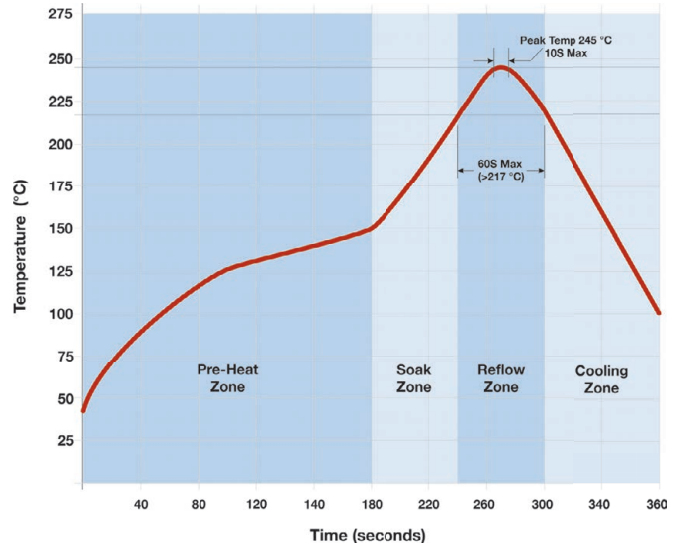
Derating Curve



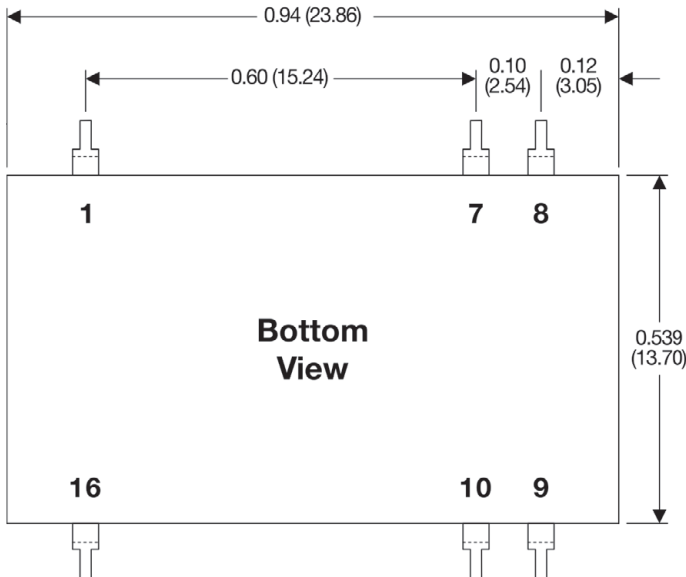
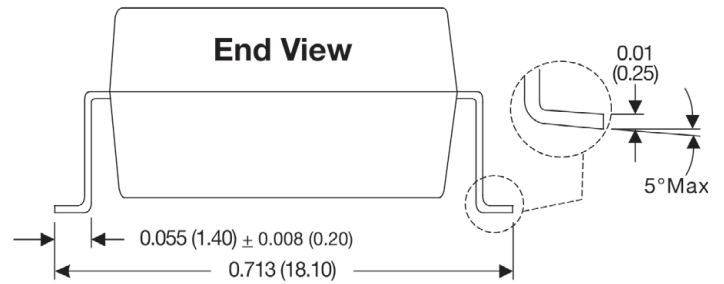
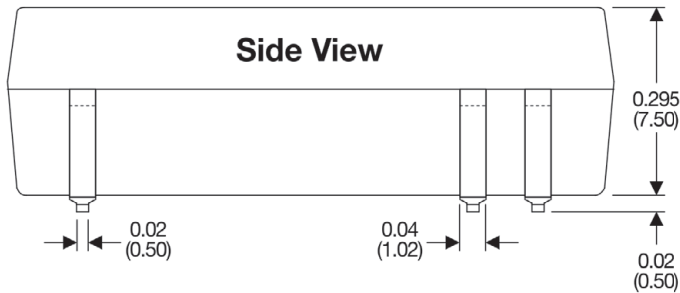
Pin Connections

Pin	Function	Pin	Function
1	-VIN	9	+VOUT
7	No Connection	10	-VOUT
8	No Connection	16	+VIN

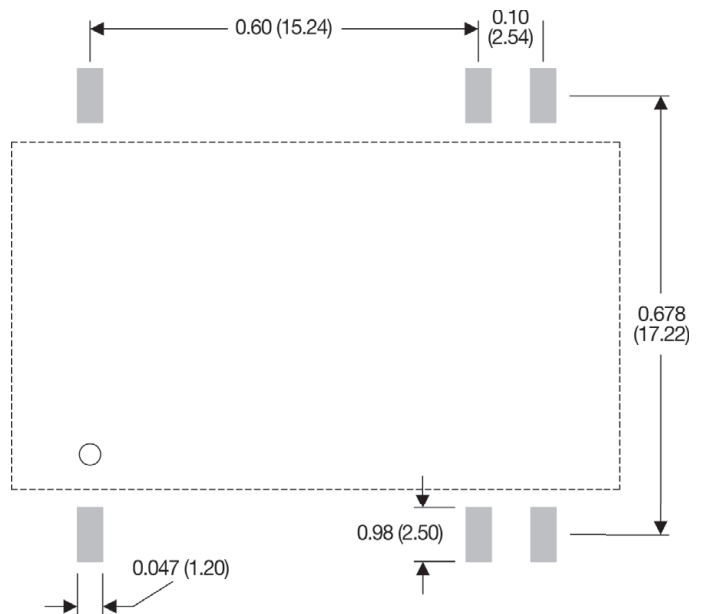
Suggested Solder Profile



Mechanical Dimensions



Board Layout



Notes:

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