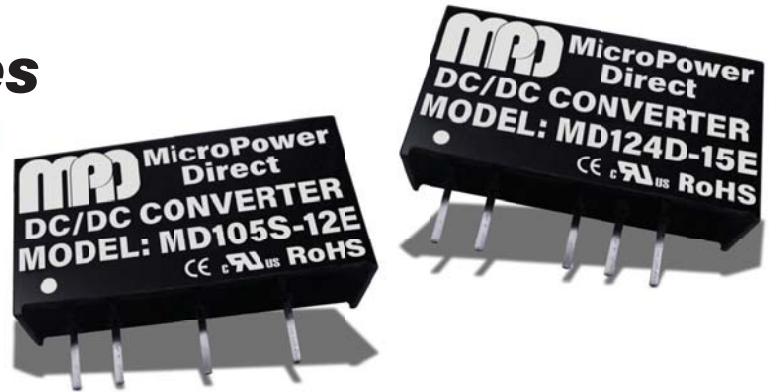


MD100E Series

Low Cost, 1W SIP Single & Dual Output DC/DC Converters



Key Features:

- 1W Output Power
- 1,500 VDC Isolation
- Miniature SIP Case
- EN 62368 Approved
- Short Circuit Protected
- Single & Dual Outputs
- -40°C to +105°C Operation
- >3.5 MHour MTBF
- 40 Standard Models
- Industry Standard Footprint
- **LOW COST!**

3.0 kV Isolation
Models
Available



MicroPower Direct



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	5 VDC Input	4.5	5.0	5.5	VDC	
	12 VDC Input	10.8	12.0	13.2		
	15 VDC Input	13.5	15.0	16.5		
	24 VDC Input	21.6	24.0	26.4		
Reflected Ripple Current			15		mA	
Input Filter	Capacitor					

Output						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Output Voltage Accuracy	See Tolerance Graphs (Page 2 & 3)					
Line Regulation, See Note 3	For V_{IN} Change of 1%			±1.2	%	
Load Regulation, See Note 4	See Model Selection Guide					
Ripple & Noise (20 MHz), See Note 5	24 V_{OUT} Models		50	100	mV P - P	
	All Other Models		30	75		
Temperature Coefficient			±0.02		%/°C	
Output Short Circuit	Continuous (Autorecovery)					

General						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Isolation Voltage	See Note 6	3,000			VDC	
Isolation Resistance	500 VDC	1,000			MΩ	
Isolation Capacitance	100 kHz, 0.1V		20		pF	
Switching Frequency	5 V_{IN} Models		270		kHz	
	All Other Models		260			

EMI Characteristics			
Parameter	Standard	Criteria	Level
Radiated Emissions, See Page 5	CISPR32/EN 55032		Class B
Radiated Emissions	CISPR32/EN 55032		Class B
ESD EN 61000-4-2, 5 V_{IN} Models	EN 61000-4-2	B	±8 kV Air
			±4 kV Contact
ESD EN 61000-4-2, All Other Models	EN 61000-4-2	B	±8 kV Air
			±6 kV Contact

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

Physical						
Case Size	See Mechanical Drawing (Page 6)					
Case Material	Flame Retardant, Non-Conductive, Black Plastic (UL94-V0)					
Weight	See Mechanical Drawing (Page 6)					

Reliability Specifications

Parameter	Conditions	Min.	Typ.	Max.	Units	
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	3.5			MHours	
Safety Standards, See Note 1	UL/cUL 62368-1 recognition (UL certificate)					

Absolute Maximum Ratings

Parameter	Conditions	Min.	Typ.	Max.	Units	
Input Voltage Surge (1 Sec)	5 VDC Input			9.0	VDC	
	12 VDC Input			18.0		
	15 VDC Input			21.0		
	24 VDC Input			30.0		
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.

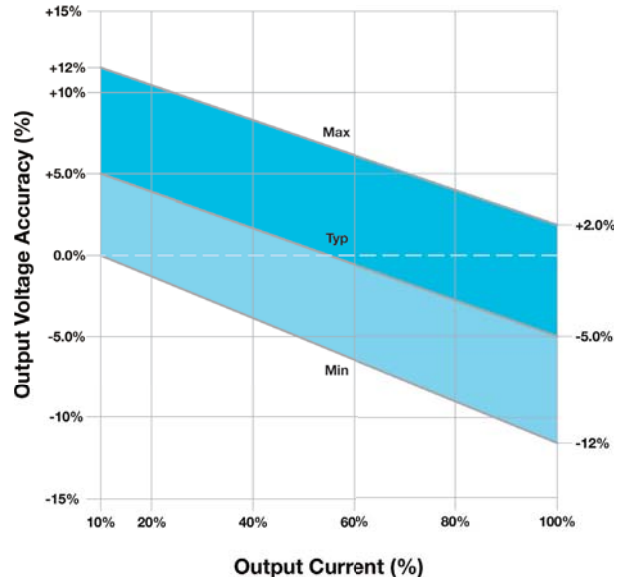
Model Selection Guide

Model Number	Input				Output			Load Regulation (% Typ)	Output 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							
MD105S-03E	5.0	4.5 - 5.5	270	5.0	3.3	303.0	30.0	±15.0	2,400	74	500
MD105S-05E	5.0	4.5 - 5.5	270	5.0	5.0	200.0	20.0	±10.0	2,400	82	500
MD105S-09E	5.0	4.5 - 5.5	241	12	9.0	111.0	12.0	±8.0	1,000	83	500
MD105S-12E	5.0	4.5 - 5.5	241	12	12.0	84.0	9.0	±7.0	560	83	500
MD105S-15E	5.0	4.5 - 5.5	241	18	15.0	67.0	7.0	±6.0	560	83	500
MD105S-24E	5.0	4.5 - 5.5	241	18	24.0	42.0	4.0	±5.0	220	85	500
MD105D-03E	5.0	4.5 - 5.5	270	5.0	±3.3	±152.0	±15.0	±15.0	1,200	74	500
MD105D-05E	5.0	4.5 - 5.5	270	5.0	±5.0	±100.0	±10.0	±10.0	1,200	82	500
MD105D-09E	5.0	4.5 - 5.5	241	12	±9.0	±56.0	±6.0	±8.0	470	83	500
MD105D-12E	5.0	4.5 - 5.5	241	12	±12.0	±42.0	±5.0	±7.0	220	83	500
MD105D-15E	5.0	4.5 - 5.5	241	18	±15.0	±34.0	±4.0	±6.0	220	83	500
MD105D-24E	5.0	4.5 - 5.5	241	18	±24.0	±21.0	±3.0	±5.0	100	85	500
MD112S-03E	12	10.8 - 13.2	105	8.0	3.3	303.0	30.0	±8.0	2,400	75	250
MD112S-05E	12	10.8 - 13.2	105	8.0	5.0	200.0	20.0	±5.0	2,400	80	250
MD112S-09E	12	10.8 - 13.2	105	8.0	9.0	111.0	12.0	±3.0	1,000	80	250
MD112S-12E	12	10.8 - 13.2	105	8.0	12.0	83.0	9.0	±3.0	560	80	250
MD112S-15E	12	10.8 - 13.2	105	8.0	15.0	67.0	7.0	±3.0	560	81	250
MD112S-24E	12	10.8 - 13.2	105	8.0	24.0	42.0	4.0	±2.0	220	81	250
MD112D-03E	12	10.8 - 13.2	105	8.0	±3.3	±152.0	±15.0	±8.0	1,200	75	250
MD112D-05E	12	10.8 - 13.2	105	8.0	±5.0	±100.0	±10.0	±5.0	1,200	80	250
MD112D-12E	12	10.8 - 13.2	105	8.0	±12.0	±42.0	±5.0	±3.0	220	81	250
MD112D-15E	12	10.8 - 13.2	105	8.0	±15.0	±34.0	±4.0	±3.0	220	81	250
MD112D-24E	12	10.8 - 13.2	105	8.0	±24.0	±21.0	±2.0	±2.0	100	80	250
MD115S-05E	15	13.5 - 16.5	84	8.0	5.0	200.0	20.0	±5.0	2,400	80	200
MD115S-09E	15	13.5 - 16.5	84	8.0	9.0	111.0	12.0	±3.0	1,000	80	200
MD115S-12E	15	13.5 - 16.5	84	8.0	12.0	83.0	9.0	±3.0	560	80	200
MD115S-15E	15	13.5 - 16.5	84	8.0	15.0	67.0	7.0	±3.0	560	81	200
MD115D-05E	15	13.5 - 16.5	84	8.0	±5.0	±100.0	±10.0	±5.0	1,200	80	200
MD115D-12E	15	13.5 - 16.5	84	8.0	±12.0	±42.0	±5.0	±3.0	220	80	200
MD115D-15E	15	13.5 - 16.5	84	8.0	±15.0	±34.0	±4.0	±3.0	220	81	200
MD124S-03E	24	21.6 - 26.4	56	8.0	3.3	303.0	30.0	±8.0	2,400	75	100
MD124S-05E	24	21.6 - 26.4	56	8.0	5.0	200.0	20.0	±5.0	2,400	79	100
MD124S-09E	24	21.6 - 26.4	56	8.0	9.0	111.0	12.0	±3.0	1,000	80	100
MD124S-12E	24	21.6 - 26.4	56	8.0	12.0	83.0	9.0	±3.0	560	81	100
MD124S-15E	24	21.6 - 26.4	56	8.0	15.0	67.0	7.0	±3.0	560	81	100
MD124S-24E	24	21.6 - 26.4	56	8.0	24.0	42.0	4.0	±2.0	220	81	100
MD124D-05E	24	21.6 - 26.4	56	8.0	±5.0	±100.0	±10.0	±5.0	1,200	80	100
MD124D-12E	24	21.6 - 26.4	56	8.0	±12.0	±42.0	±5.0	±3.0	220	81	100
MD124D-15E	24	21.6 - 26.4	56	8.0	±15.0	±34.0	±4.0	±3.0	220	79	100
MD124D-24E	24	21.6 - 26.4	56	8.0	±24.0	±21.0	±3.0	±3.0	100	80	100

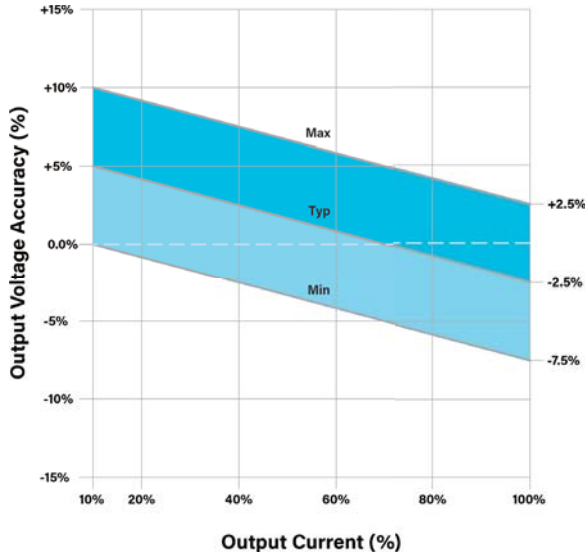
Notes:

1. The model MD105D-03EI has passed testing to EN 62368, but has not been submitted to UL.
2. Output capacitive load is specified for each output.
3. Single & dual 3.3 V_{OUT} models have a specified line regulation of 1.5 %/ %.
4. Output load regulation is specified for a load change of 10% to 100%.
5. When measuring output ripple, it is recommended that an external 1 µF ceramic capacitor & a 10 µF electrolytic capacitor be placed in parallel from the +V_{OUT} pin to the -V_{OUT} pin for single output units or from each output to common for dual output models.
6. Isolation voltage is specified for a period 60S with a leakage current lower than 1 mA.
7. Operation at no load will not damage these units, however, they may not meet all specifications.
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.

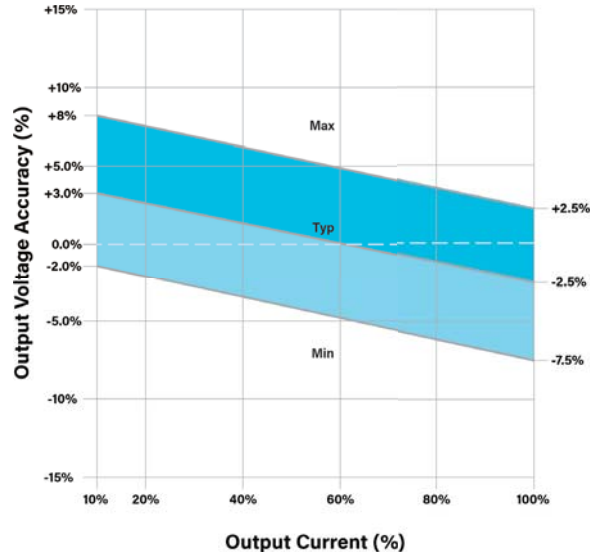
Output Voltage Tolerance: 3.3 V_{OUT} Models



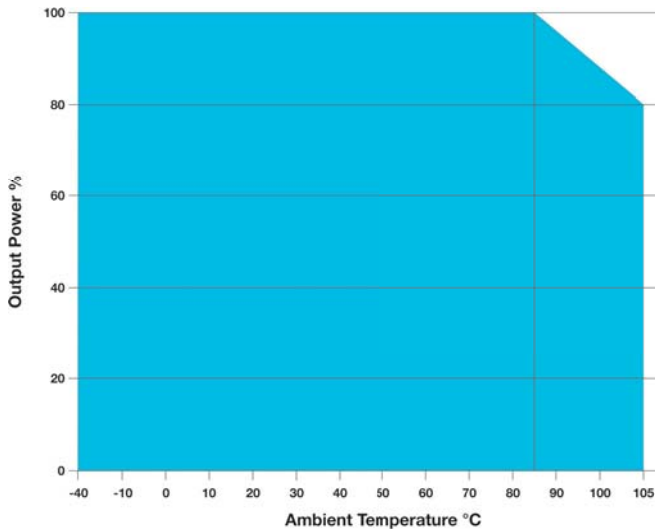
Output Voltage Tolerance: Other 5 VIN Models



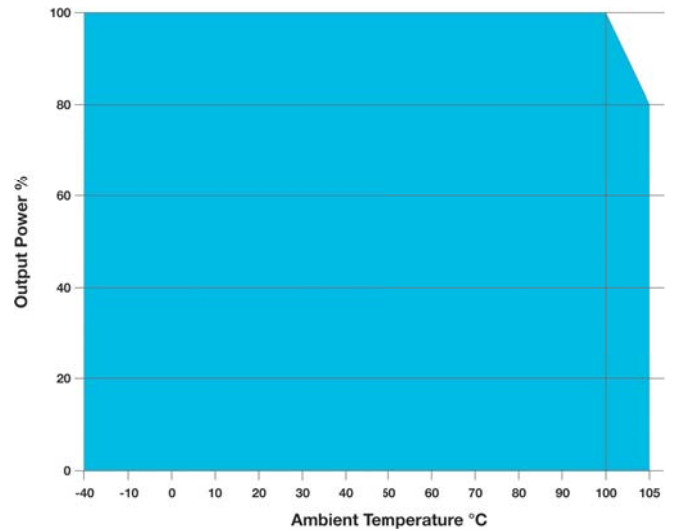
Output Voltage Tolerance: All Other Models



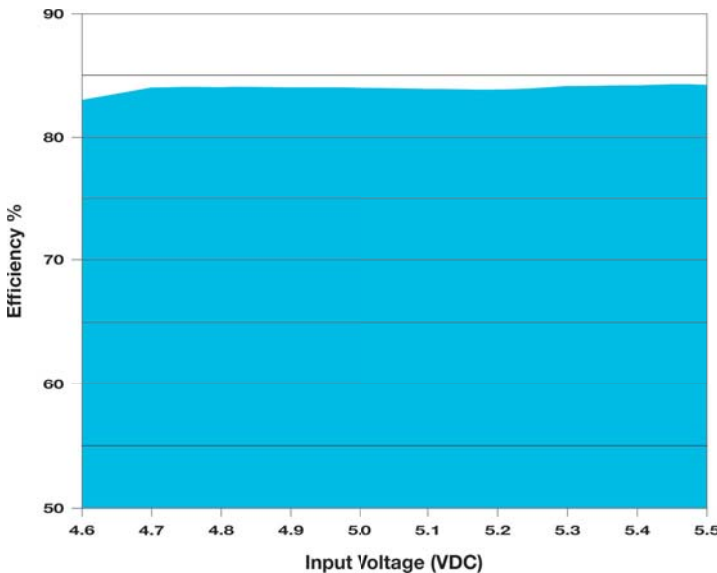
Temperature Derating Curve: 5 VIN Models



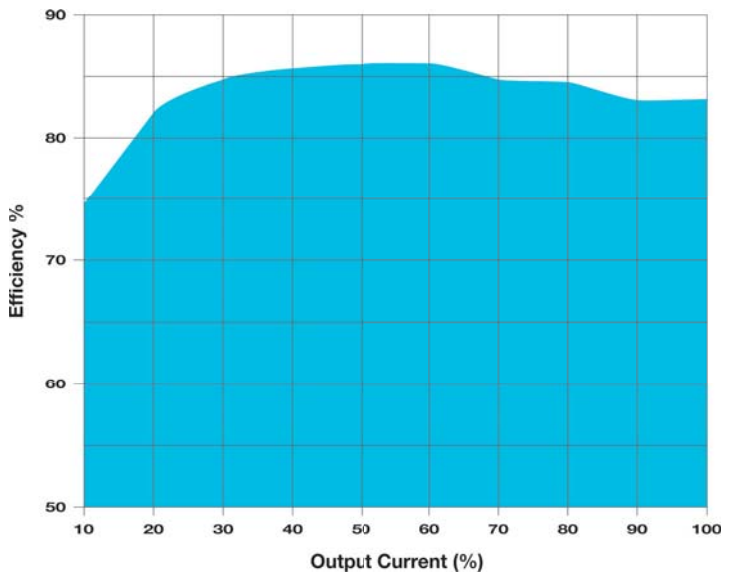
Temperature Derating Curve: All Other Models



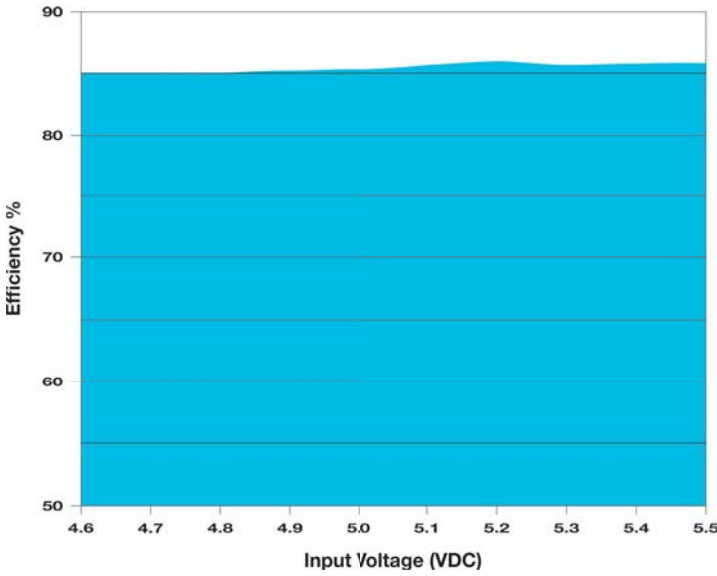
Efficiency vs Input: MD105S-05E



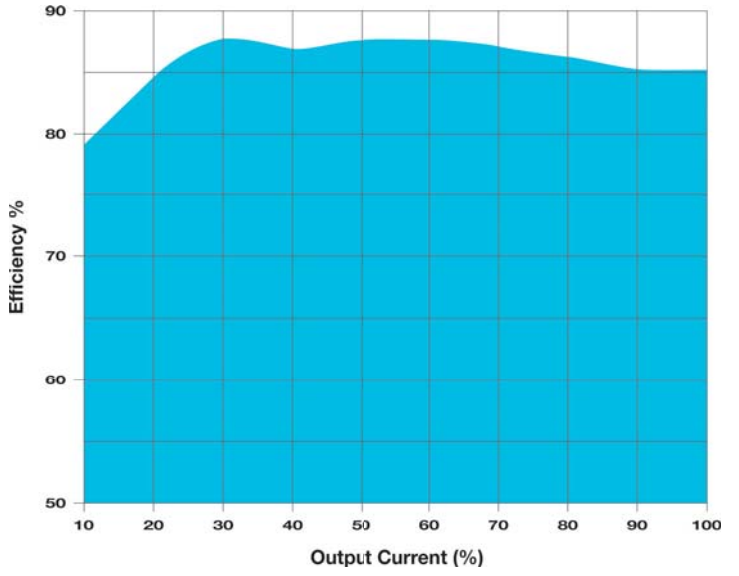
Efficiency vs Output Load: MD105S-05E



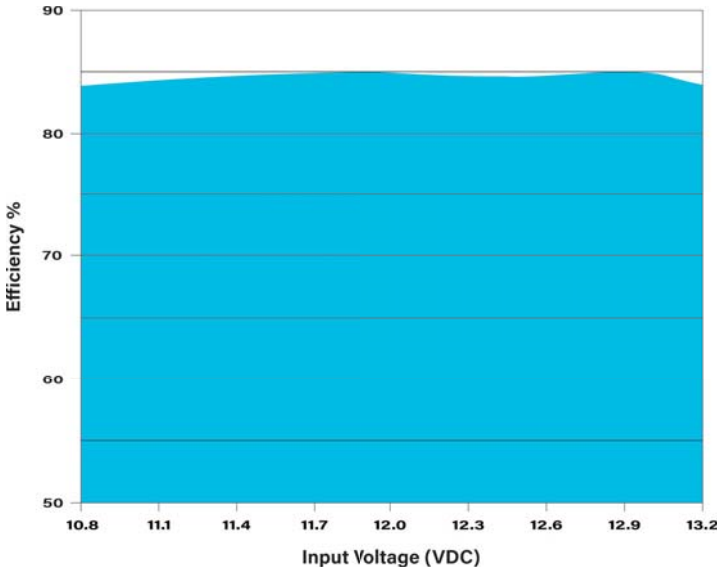
Efficiency vs Input: MD105DS-05EI



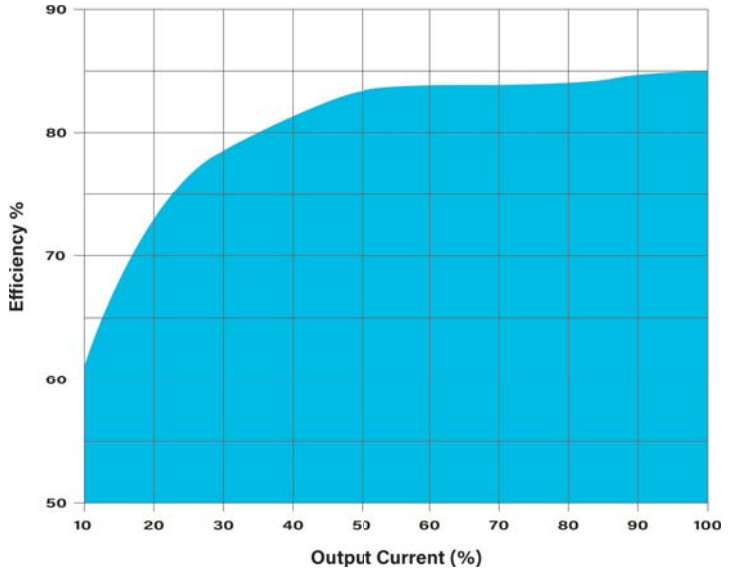
Efficiency vs Output Load: MD105D-05EI



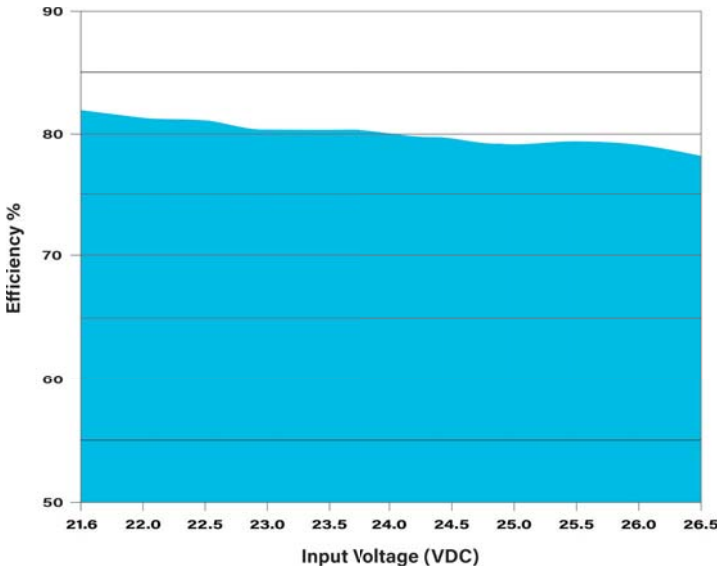
Efficiency vs Input: MD112S-05EI



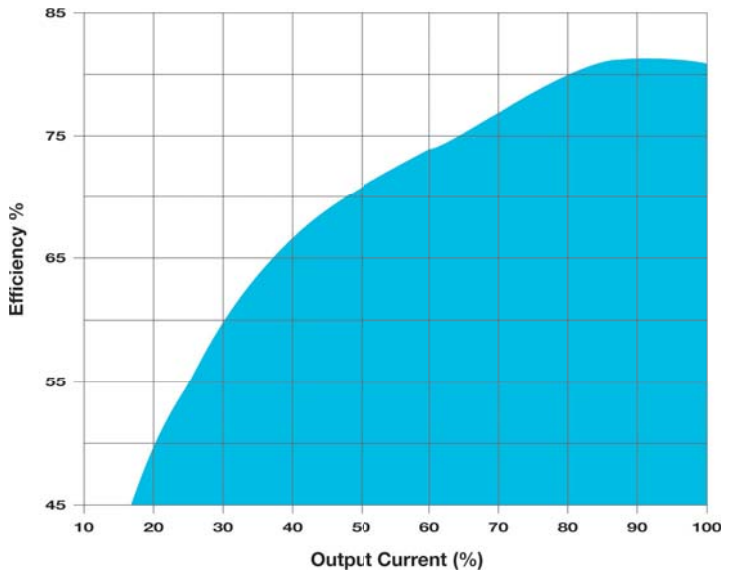
Efficiency vs Output Load: MD112S-05EI



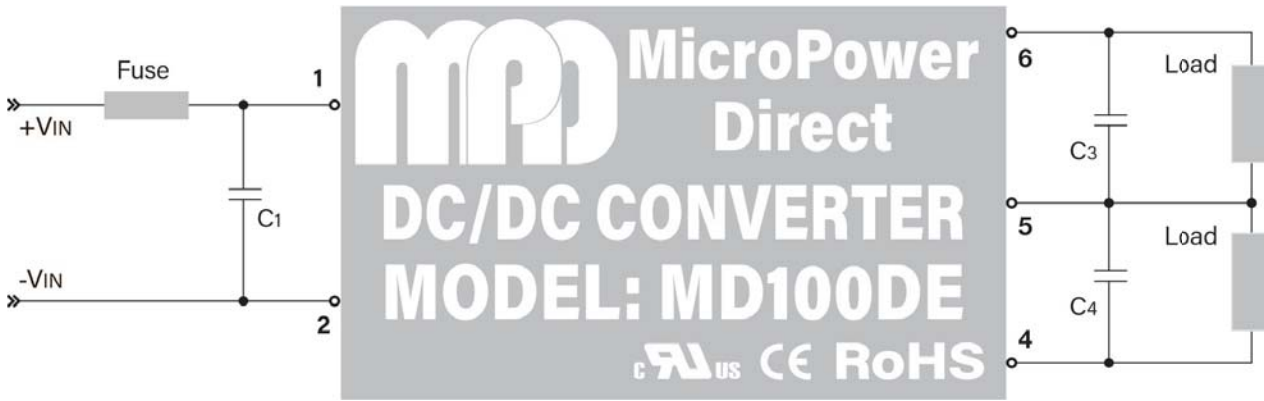
Efficiency vs Input: MD124S-05EI



Efficiency vs Output Load: MD124S-05EI



Simple Connection

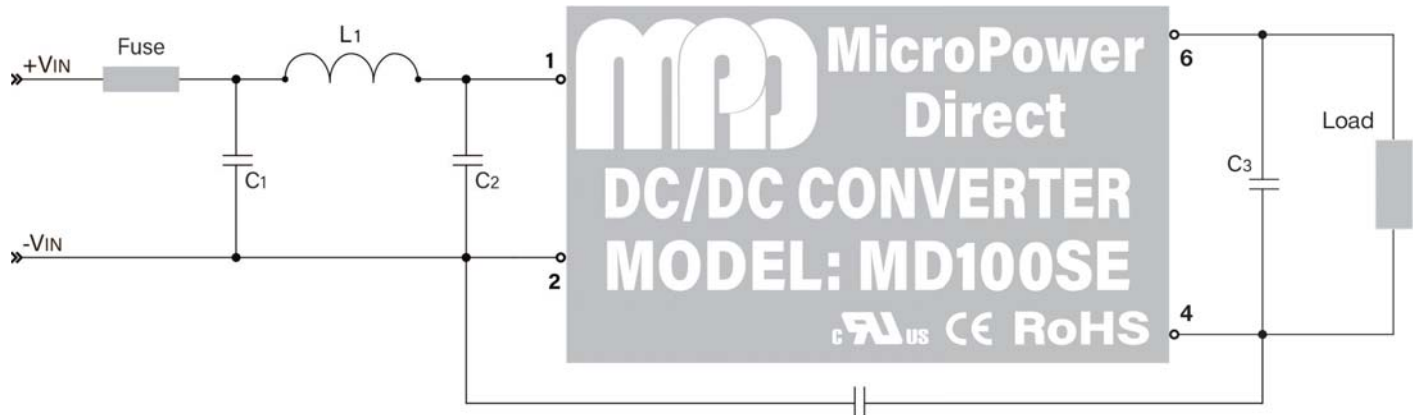


The diagram above illustrates a simple connection of the **MD100DE**. For applications that do not require the circuit to meet EMI/EMC specifications, the capacitors C1, C3 and C4 will reduce input/output ripple and improve the converter stability over time and temperature. The recommended component values are given in the table at right.

V _{IN}	C ₁
5 VDC	4.7 μ F/25V
12 VDC	2.2 μ F/50V
15 VDC	2.2 μ F/50V
24 VDC	1.0 μ F/50V

V _{OUT}	C _{3/C4}
3.3 VDC	10 μ F/16V
5 VDC	10 μ F/16V
9 VDC	2.2 μ F/16V
12 VDC	2.2 μ F/25V
15 VDC	1.0 μ F/25V
24 VDC	1.0 μ F/50V
\pm 3.3 VDC	4.7 μ F/16V
\pm 5 VDC	4.7 μ F/16V
\pm 9 VDC	1.0 μ F/16V
\pm 12 VDC	1.0 μ F/25V
\pm 15 VDC	0.47 μ F/25V
\pm 24 VDC	0.47 μ F/50V

EMC Connection



The diagram above illustrates a typical connection of the **MD100SE** for an application that requires compliance to EMI/EMC standards EN 55032 and EN 61000-4 (as specified on page 1). Some notes on these components are:

1. An external fuse is recommended to protect the unit in the event a fault occurs on the input line. A recommended value is given in the model selection table on page 2.
2. In many applications, the cap C2 may not be needed.
3. 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. Voltage derating of capacitors should be 80% or above.

4. Suggested component values are:

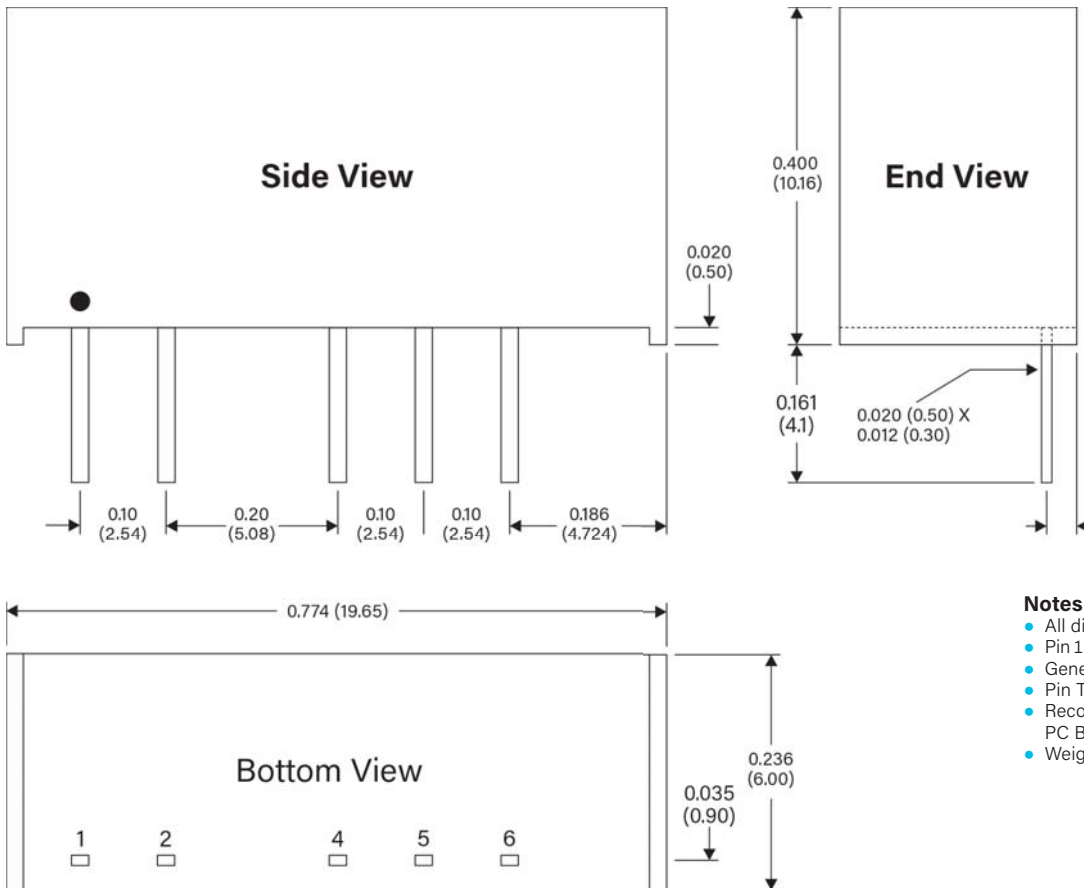
	V _{IN} : 5V	V _{IN} : 12V	V _{IN} : 15V	V _{IN} : 24V
C1	4.7 μ F/25V	4.7 μ F/50V	4.7 μ F/50V	4.7 μ F/50V
C2	4.7 μ F/25V	4.7 μ F/50V	4.7 μ F/50V	4.7 μ F/50V
L1	6.8 μ H	6.8 μ H	6.8 μ H	6.8 μ H
C3	See C3/C4 in Table Above			
CY	1 nF/4 kV	270 pF/3 kV		

5. In many applications, simply adding input/output capacitors will enhance the input surge protection & and reduce output ripple

sufficiently. In this case, capacitors C1, C3 and C4 could be connected as shown in the simple connection above, without the other filter components. Recommended capacitor values are given in the table above.

Mechanical Dimensions

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Pin Connections

Pin	Single Output
1	+VIN
2	-VIN
4	-VOUT
5	No Pin
6	+VOUT

Pin	Dual Output
1	+VIN
2	-VIN
4	-VOUT
5	Common
6	+VOUT

Notes:

- All dimensions are typical in inches (mm)
- Pin 1 is marked by a "dot" or indentation on the unit
- General Tolerance = ± 0.01 (± 0.25)
- Pin Tolerance = ± 0.004 (± 0.10)
- Recommended pin hole size (on the application PC Board) is $\varnothing 0.039$ ($\varnothing 1.00$)
- Weight (Typ) = 0.07 Oz (2.1g)

MPD offers a very wide variety of DC/DC converters. Our standard product line includes SMT, SIP, and DIP potted modules, industry standard 1 x 1" & 1 x 2" modules, as well as new models in an ultra miniature DFN package. Our units are used in applications ranging from high speed gate drive circuits to instrumentation to industrial equipment and medical equipment/instrumentation. Units are available over a power range of 0.25 to 60W. Most models meet international EMC/EMI standards and many are approved to EN 62368. Call today, or go to our website to find the right DC/DC power module for your application.

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