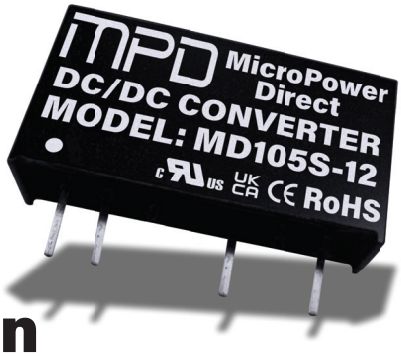
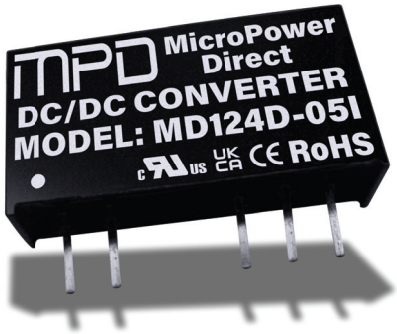
MD100

1W, Miniature SIP
1 kV To 6 kV Isolation
DC/DC Converters





Key Features:

- 1W Output Power
- 1 kV to 6kV Isolation
- 80 Standard Models
- Single & Dual Outputs
- Miniature SIP Case
- EN 62368 Approved
- Efficiency to 86%
- -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

Parameter	Conditions	Min.	Typ.	Max.	Units
Input Voltage Range	3.3 VDC Input	2.97	3.3	3.63	VDC
	5 VDC Input	4.5	5.0	5.5	
	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	
Input Filter	Capacitor Filter				

Output

Parameter	Conditions	Min.	Typ.	Max.	Units
Output Voltage Accuracy				±3.0	%
Line Regulation	For VIN Change of 1%		±1.2		%
Load Regulation	See Note 1			±10	%
Ripple & Noise (20 MHz)				75	mV P - P
Temperature Coefficient			±0.02		%/°C
Output Short Circuit	Momentary (0.5 Sec)				

General

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation Voltage, 60 Sec	See Page 3				
Isolation Resistance		1,000			MΩ
Isolation Capacitance			60		pF
Switching Frequency			80		kHz

EMI Characteristics

Parameter	Standard		Criteria	Level
Radiated Emissions		EN 55032		Class B
Conducted Emissions	See Note 3	EN 55032		Class B
ESD		EN 61000-4-2	A	±6 kV/±8kV
RS		EN 61000-4-3	A	10V/m
EFT	See Note 4	EN 61000-4-4	A	±2 kV
Surge	See Note 4	EN 61000-4-5	A	±1 kV
CS		EN 61000-4-6	A	10 Vrms
PFMF		EN 61000-4-8	A	1A/m

Environmental

Parameter	Conditions	Min.	Typ.	Max.	Units
Operating Temperature Range	Ambient	-40	+25	+85	°C
	Case			+100	
Storage Temperature Range		-40		+125	°C
Cooling	Free Air Convection				
Humidity	RH, Non-condensing			95	%

Physical

Case Size	See Mechanical Diagrams (Page 7)
Case Material	Non-Conductive Black Plastic (UL94-V0)
Weight	See Mechanical Diagrams (Page 7)

Reliability Specifications

Parameter	Conditions	Min.	Typ.	Max.	Units
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	1.121			MHours
Safety Standards	UL/cUL 62368 recognition (UL certificate)				

Absolute Maximum Ratings

Parameter	Conditions	Min.	Typ.	Max.	Units
Input Voltage Surge (0.1 Sec)	3.3 VDC Input			6.0	VDC
	5 VDC Input			7.0	
	12 VDC Input			15.0	
	15 VDC Input			18.0	
	24 VDC Input			28.0	
Lead Temperature	1.5 mm From Case for 10 Sec			260	°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)	Reflected Ripple Current (mA Pk-Pk)	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							
MD103S-03xx	3.3	2.97 - 3.63	399	28	3.3	303	0.0	76	20.0	220	800
MD103S-05xx	3.3	2.97 - 3.63	389	22	5.0	200	0.0	78	20.0	220	800
MD103S-07xx	3.3	2.97 - 3.63	389	25	7.2	139	0.0	78	20.0	220	800
MD103S-09xx	3.3	2.97 - 3.63	379	35	9.0	111	0.0	80	20.0	220	800
MD103S-12xx	3.3	2.97 - 3.63	394	30	12.0	83	0.0	77	20.0	220	800
MD103S-15xx	3.3	2.97 - 3.63	389	30	15.0	67	0.0	78	20.0	220	800
MD103S-18xx	3.3	2.97 - 3.63	415	30	18.0	56	0.0	73	20.0	220	800
MD103S-24xx	3.3	2.97 - 3.63	415	30	24.0	42	0.0	73	20.0	220	800
MD103D-03xx	3.3	2.97 - 3.63	459	30	±3.3	±152	±0.0	66	20.0	±100	800
MD103D-05xx	3.3	2.97 - 3.63	433	30	±5.0	±100	±0.0	70	20.0	±100	800
MD103D-07xx	3.3	2.97 - 3.63	421	30	±7.2	±69	±0.0	72	20.0	±100	800
MD103D-09xx	3.3	2.97 - 3.63	404	26	±9.0	±56	±0.0	75	20.0	±100	800
MD103D-12xx	3.3	2.97 - 3.63	394	30	±12.0	±42	±0.0	77	20.0	±100	800
MD103D-15xx	3.3	2.97 - 3.63	389	25	±15.0	±33	±0.0	78	20.0	±100	800
MD103D-18xx	3.3	2.97 - 3.63	404	25	±18.0	±28	±0.0	75	20.0	±100	800
MD103D-24xx	3.3	2.97 - 3.63	404	25	±24.0	±21	±0.0	75	20.0	±100	800
MD105S-03xx	5	4.5 - 5.5	256	15	3.3	303	0.0	78	20.0	220	500
MD105S-05xx	5	4.5 - 5.5	247	17	5.0	200	0.0	81	20.0	220	500
MD105S-07xx	5	4.5 - 5.5	247	16	7.2	139	0.0	81	20.0	220	500
MD105S-09xx	5	4.5 - 5.5	244	15	9.0	111	0.0	82	20.0	220	500
MD105S-12xx	5	4.5 - 5.5	253	17	12.0	83	0.0	79	20.0	220	500
MD105S-15xx	5	4.5 - 5.5	233	17	15.0	67	0.0	86	20.0	220	500
MD105S-18xx	5	4.5 - 5.5	241	16	18.0	56	0.0	83	20.0	220	500
MD105S-24xx	5	4.5 - 5.5	244	20	24.0	42	0.0	82	20.0	220	500
MD105D-03xx	5	4.5 - 5.5	299	20	±3.3	±152	±0.0	67	20.0	±100	500
MD105D-05xx	5	4.5 - 5.5	270	20	±5.0	±100	±0.0	74	20.0	±100	500
MD105D-07xx	5	4.5 - 5.5	253	15	±7.2	±69	±0.0	79	20.0	±100	500
MD105D-09xx	5	4.5 - 5.5	247	15	±9.0	±56	±0.0	81	20.0	±100	500
MD105D-12xx	5	4.5 - 5.5	250	20	±12.0	±42	±0.0	80	20.0	±100	500
MD105D-15xx	5	4.5 - 5.5	244	20	±15.0	±33	±0.0	82	20.0	±100	500
MD105D-18xx	5	4.5 - 5.5	247	22	±18.0	±28	±0.0	81	20.0	±100	500
MD105D-24xx	5	4.5 - 5.5	247	22	±24.0	±21	±0.0	81	20.0	±100	500
MD112S-03xx	12	10.8 - 13.2	111	12	3.3	303	0.0	75	20.0	220	300
MD112S-05xx	12	10.8 - 13.2	105	14	5.0	200	0.0	79	20.0	220	300
MD112S-07xx	12	10.8 - 13.2	111	14	7.2	139	0.0	75	20.0	220	300
MD112S-09xx	12	10.8 - 13.2	104	9	9.0	111	0.0	80	20.0	220	300
MD112S-12xx	12	10.8 - 13.2	105	13	12.0	83	0.0	79	20.0	220	300
MD112S-15xx	12	10.8 - 13.2	102	10	15.0	67	0.0	82	20.0	220	300
MD112S-18xx	12	10.8 - 13.2	103	11	18.0	56	0.0	81	20.0	220	300
MD112S-24xx	12	10.8 - 13.2	110	20	24.0	42	0.0	76	20.0	220	300
MD112D-03xx	12	10.8 - 13.2	123	13	±3.3	±152	±0.0	68	20.0	±100	300
MD112D-05xx	12	10.8 - 13.2	123	10	±5.0	±100	±0.0	74	20.0	±100	300
MD112D-07xx	12	10.8 - 13.2	110	10	±7.2	±69	±0.0	76	20.0	±100	300
MD112D-09xx	12	10.8 - 13.2	110	13	±9.0	±56	±0.0	78	20.0	±100	300
MD112D-12xx	12	10.8 - 13.2	102	10	±12.0	±42	±0.0	82	20.0	±100	300
MD112D-15xx	12	10.8 - 13.2	102	10	±15.0	±33	±0.0	82	20.0	±100	300
MD112D-18xx	12	10.8 - 13.2	103	20	±18.0	±28	±0.0	81	20.0	±100	300
MD112D-24xx	12	10.8 - 13.2	111	20	±24.0	±21	±0.0	75	20.0	±100	300

Model Selection Guide

Model Number	Input				Output			Efficiency (%, Typ)	Reflected Ripple Current (mA Pk-Pk)	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							
MD115S-03xx	15	13.5 - 16.5	83	10	3.3	303	0.0	80	20.0	220	300
MD115S-05xx	15	13.5 - 16.5	82	7	5.0	200	0.0	81	20.0	220	300
MD115S-07xx	15	13.5 - 16.5	85	10	7.2	139	0.0	78	20.0	220	300
MD115S-09xx	15	13.5 - 16.5	85	10	9.0	111	0.0	78	20.0	220	300
MD115S-12xx	15	13.5 - 16.5	83	8	12.0	83	0.0	80	20.0	220	300
MD115S-15xx	15	13.5 - 16.5	84	12	15.0	67	0.0	79	20.0	220	300
MD115S-18xx	15	13.5 - 16.5	83	10	18.0	56	0.0	80	20.0	220	300
MD115S-24xx	15	13.5 - 16.5	80	5	24.0	42	0.0	83	20.0	220	300
MD115D-03xx	15	13.5 - 16.5	89	20	±3.3	±152	±0.0	75	20.0	±100	300
MD115D-05xx	15	13.5 - 16.5	89	20	±5.0	±100	±0.0	75	20.0	±100	300
MD115D-07xx	15	13.5 - 16.5	89	18	±7.2	±69	±0.0	75	20.0	±100	300
MD115D-09xx	15	13.5 - 16.5	87	18	±9.0	±56	±0.0	77	20.0	±100	300
MD115D-12xx	15	13.5 - 16.5	87	20	±12.0	±42	±0.0	77	20.0	±100	300
MD115D-15xx	15	13.5 - 16.5	87	20	±15.0	±33	±0.0	77	20.0	±100	300
MD115D-18xx	15	13.5 - 16.5	89	15	±18.0	±28	±0.0	75	20.0	±100	300
MD115D-24xx	15	13.5 - 16.5	89	15	±24.0	±21	±0.0	75	20.0	±100	300
MD124S-03xx	24	21.6 - 26.4	56	8	3.3	303	0.0	74	20.0	220	300
MD124S-05xx	24	21.6 - 26.4	54	6	5.0	200	0.0	77	20.0	220	300
MD124S-07xx	24	21.6 - 26.4	57	6	7.2	139	0.0	73	20.0	220	300
MD124S-09xx	24	21.6 - 26.4	55	6	9.0	111	0.0	76	20.0	220	300
MD124S-12xx	24	21.6 - 26.4	53	6	12.0	83	0.0	78	20.0	220	300
MD124S-15xx	24	21.6 - 26.4	52	5	15.0	67	0.0	80	20.0	220	300
MD124S-18xx	24	21.6 - 26.4	51	5	18.0	56	0.0	82	20.0	220	300
MD124S-24xx	24	21.6 - 26.4	52	8	24.0	42	0.0	80	20.0	220	300
MD124D-03xx	24	21.6 - 26.4	62	7	±3.3	±152	±0.0	67	20.0	±100	300
MD124D-05xx	24	21.6 - 26.4	56	6	±5.0	±100	±0.0	74	20.0	±100	300
MD124D-07xx	24	21.6 - 26.4	56	7	±7.2	±69	±0.0	78	20.0	±100	300
MD124D-09xx	24	21.6 - 26.4	56	7	±9.0	±56	±0.0	78	20.0	±100	300
MD124D-12xx	24	21.6 - 26.4	52	6	±12.0	±42	±0.0	80	20.0	±100	300
MD124D-15xx	24	21.6 - 26.4	52	8	±15.0	±33	±0.0	80	20.0	±100	300
MD124D-18xx	24	21.6 - 26.4	51	6	±18.0	±28	±0.0	81	20.0	±100	300
MD124D-24xx	24	21.6 - 26.4	51	8	±24.0	±21	±0.0	82	20.0	±100	300

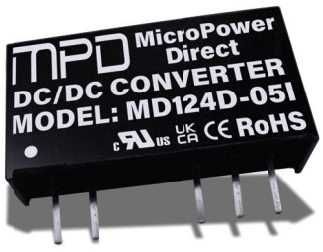
Notes:

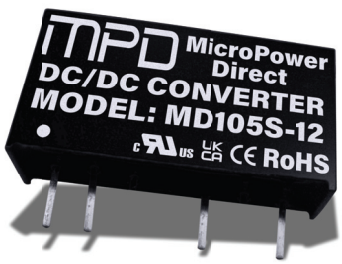
1. Load regulation is measured over a range of 20% IOUT to 100% IOUT. Load regulation for 3.3 VDC output models is specified at ±20% typical.
2. Operation at no-load will not damage the unit, but they may not meet all specifications.
3. With the addition of input filter components, all models will meet EN 55022 class B. A suggested circuit is shown on page 6. Contact the factory for more information.
4. To meet the requirements of EN 61000-4-4 and EN 61000-4-5, external components are needed. A suggested circuit is shown on page 6. Contact the factory for more information.
5. It is recommended that a fuse be used on the input of a power supply for protection. See the Model Selection tables for the correct rating.

I/O Isolation

Models are available with input/output isolation levels ranging from 1 kVDC to 6 kVDC. To order units with higher isolation levels an "Ix" is added to the Model number, as shown in the table below.

Model No	Isolation Level
MD1xxx-xx	1 kVDC
MD1xxx-xxI	3 kVDC
MD1xxx-xxI4	4 kVDC
MD1xxx-xxI5	5.2 kVDC
MD1xxx-xxI6	6 kVDC





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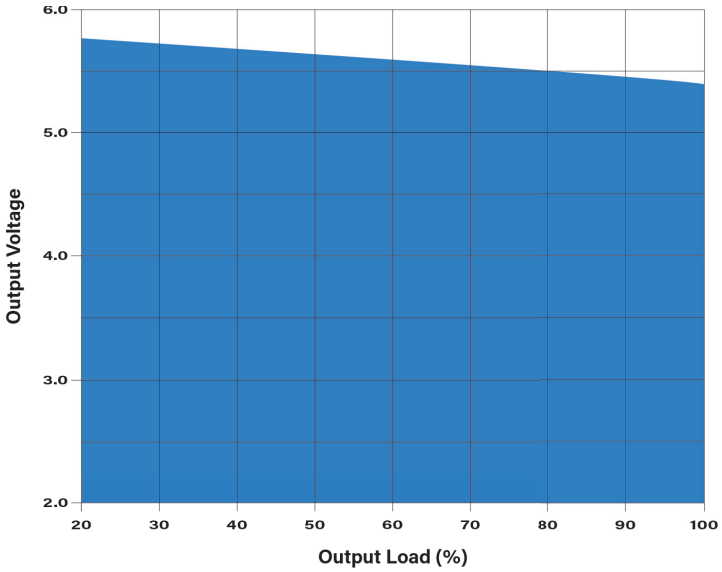
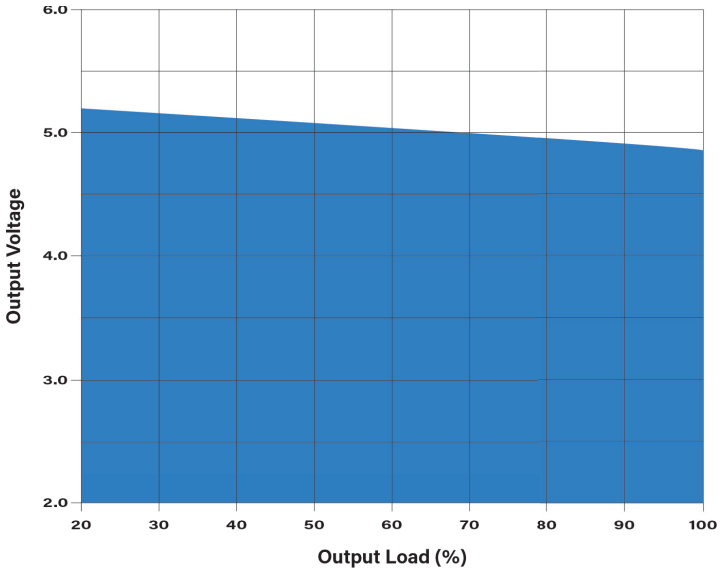
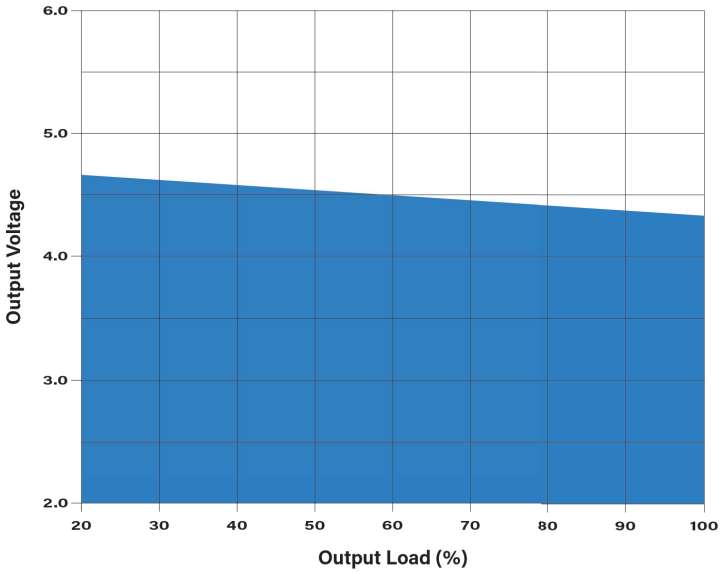
Output Load vs Output Voltage: MD105, High Line



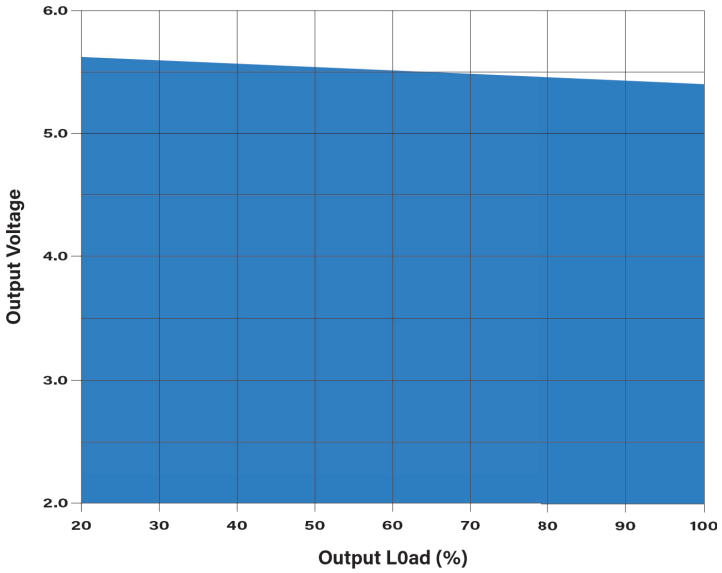
Output Load vs Output Voltage: MD105, Nom Line



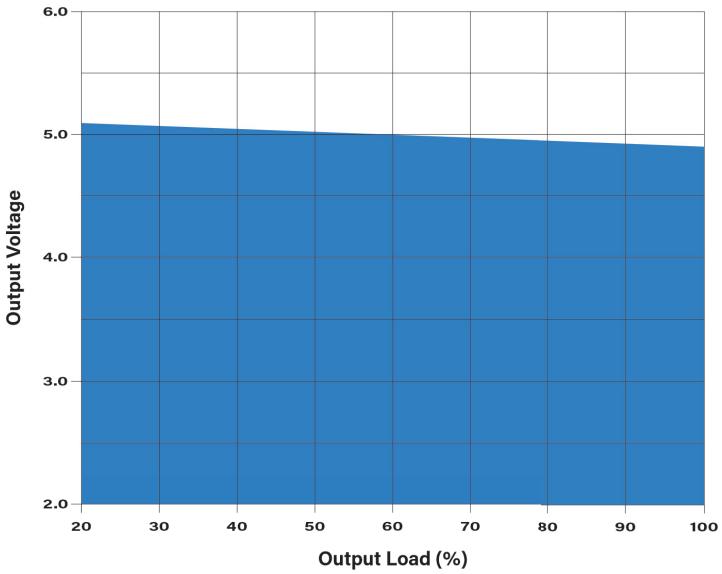
Output Load vs Output Voltage: MD105, Low Line



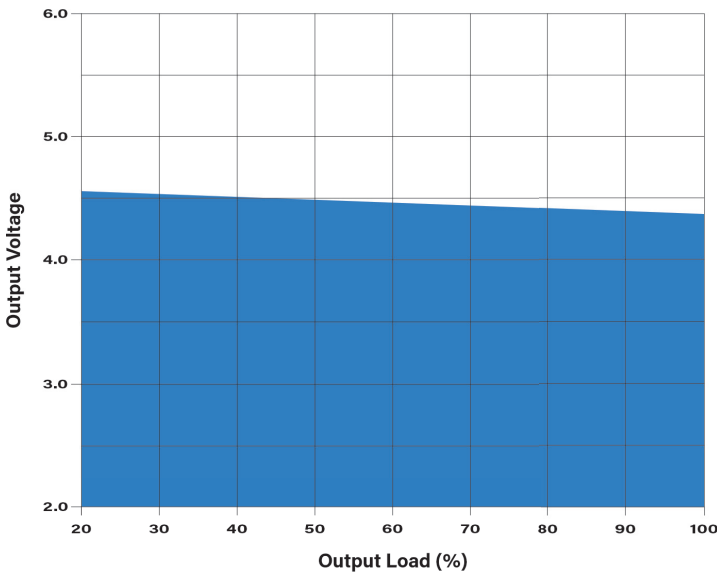
Output Load vs Output Voltage: MD112, High Line



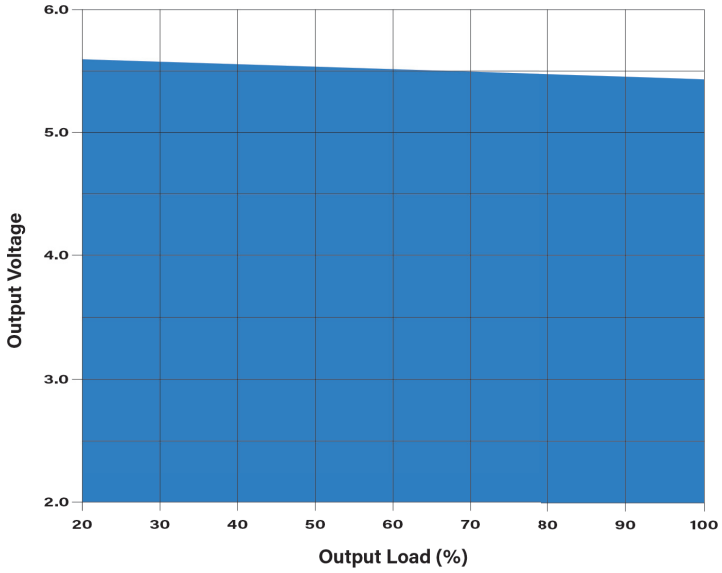
Output Load vs Output Voltage: MD112, Nom Line



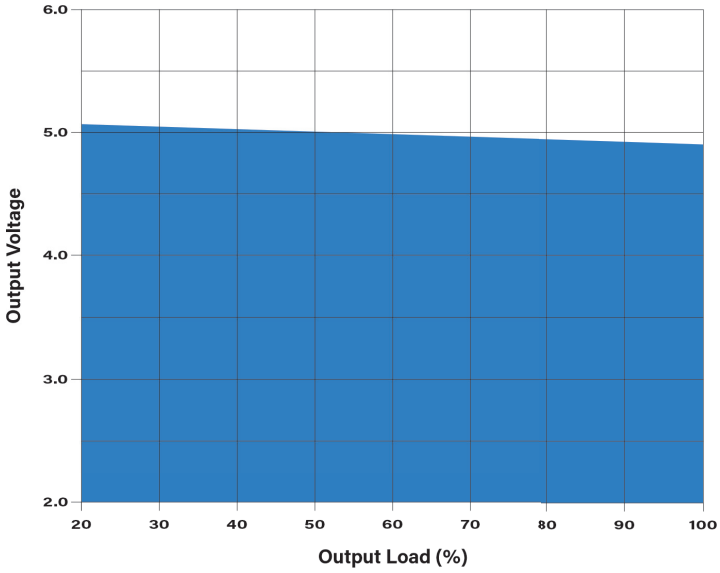
Output Load vs Output Voltage: MD112, Low Line



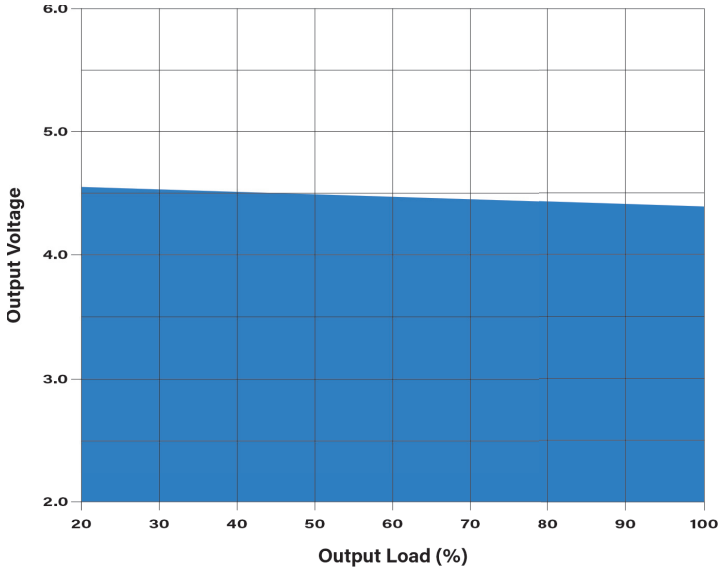
Output Load vs Output Voltage: MD124, High Line



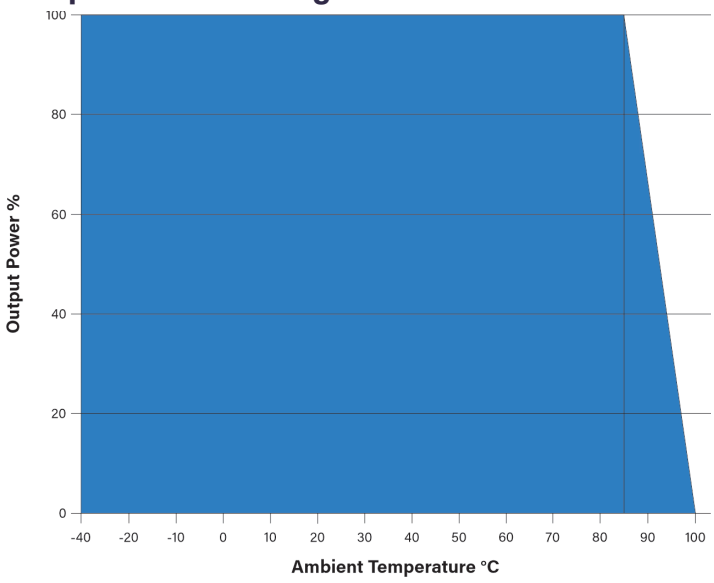
Output Load vs Output Voltage: MD124, Nom Line



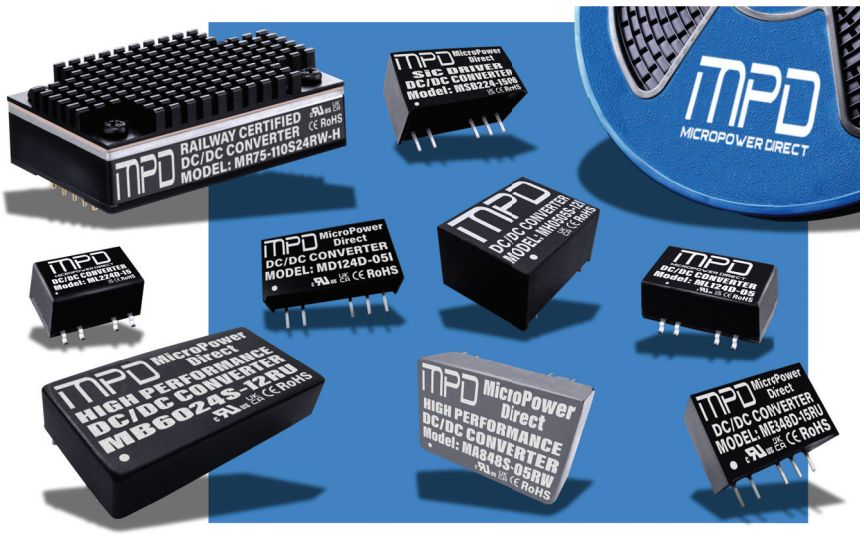
Output Load vs Output Voltage: MD124, Low Line



Temperature Derating Curve



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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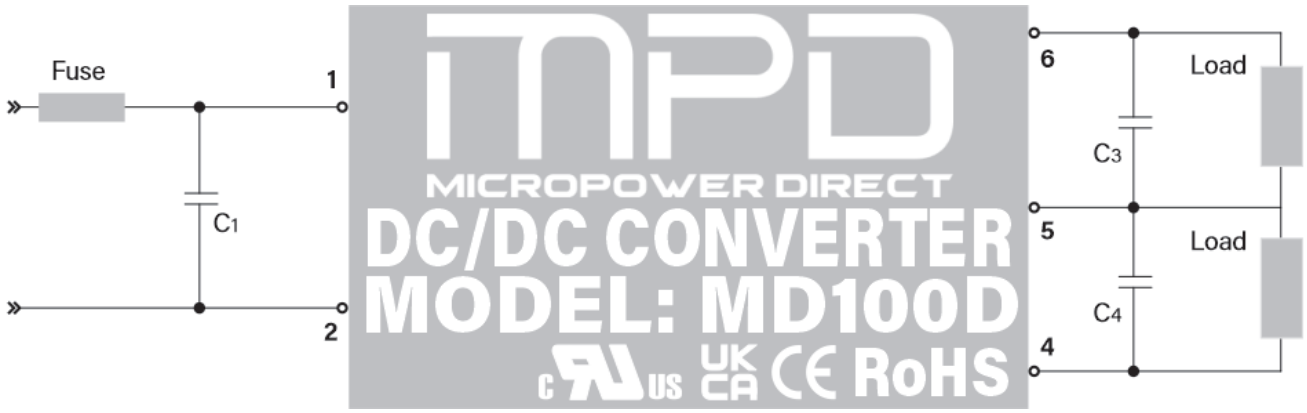
Typical Connection



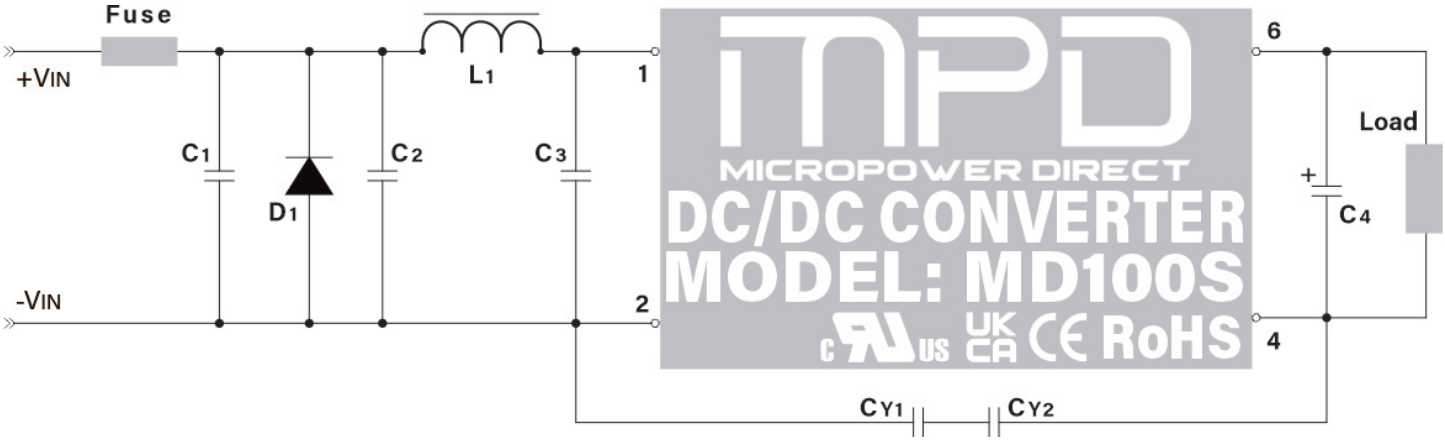
The diagram above illustrates a typical connection of the **MD100D**. For applications that do not require the circuit to meet EMI/EMC specifications, the capacitors C1, C3 and C4 will reduce input/output ripple and improve the converter stability over time and temperature. The recommended component values are given in the table at right.

VIN	C1
3.3 VDC	5.0 µF/25V
5 VDC	5.0 µF/25V
12 VDC	7.5 µF/25V
15 VDC	7.5 µF/50V
24 VDC	10 µF/50V

VOUT	C3
3.3 VDC	10 µF/16V
5 VDC	10 µF/16V
7.2 VDC	10 µF/16V
9 VDC	10 µF/16V
12 VDC	10 µF/25V
15 VDC	10 µF/25V
18 VDC	10 µF/35V
24 VDC	10 µF/50V

VOUT	C3/C4
±3.3 VDC	10 µF/16V
±5 VDC	10 µF/16V
±7.2 VDC	10 µF/16V
±9 VDC	10 µF/16V
±12 VDC	10 µF/25V
±15 VDC	10 µF/25V
±18 VDC	10 µF/35V
±24 VDC	10 µF/50V

EMI Connection



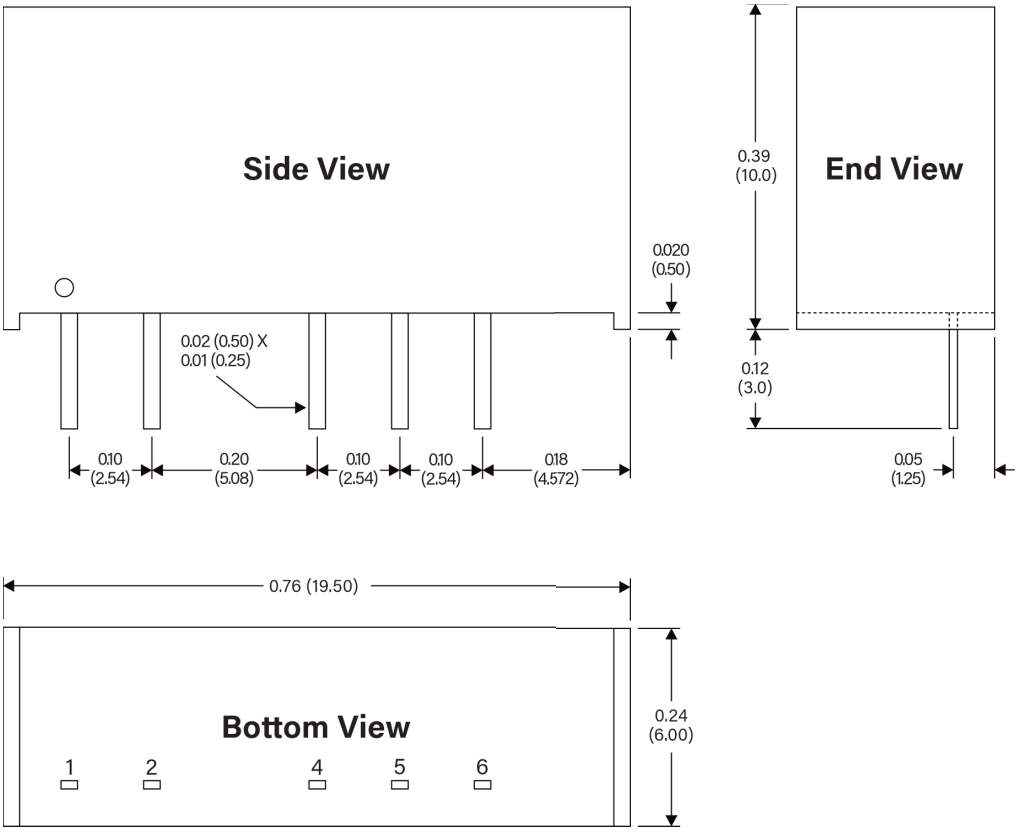
The diagram above illustrates a connection of the **MD100S** for an application that requires compliance to EMI/EMC standards EN 55032 and EN 61000-4 (as specified on page 1). Some notes on these components are:

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. 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. Voltage derating of capacitors should be 80% or above.
3. Recommended component values for all external components are given in the table below.
4. In many applications, simply adding input/output capacitors will enhance the input surge protection & and reduce output ripple sufficiently. In this case, capacitors could be connected as shown in the typical connection at the top of the page, without the other filter components.

Suggested component values are:

VIN	Isolation Level	C1	D1	C2	L1	C3	CY1	CY2
3.3 VDC	All Models	Nippon Chemi-Con KY Series 2,200 µF/100V	SMAJ5A	MLCC 2.2 µF/100V	18 µH	Not Required	Not Required	Not Required
5 VDC	All Models		SMAJ6.5A					
12 VDC	All Models		SMAJ14A					
15 VDC	All Models		SMAJ18A					
24 VDC	1 kV - 3 kV		SMAJ26A			MLCC 2.2 µF/100V	MLCC 470 pF/3 kV	
24 VDC	4 kV - 6 kV		SMAJ26A				MLCC 1,000 pF/3 kV	MLCC 1,000 pF/3 kV

Mechanical Dimensions, MD100X-xx Models



Pin Connections

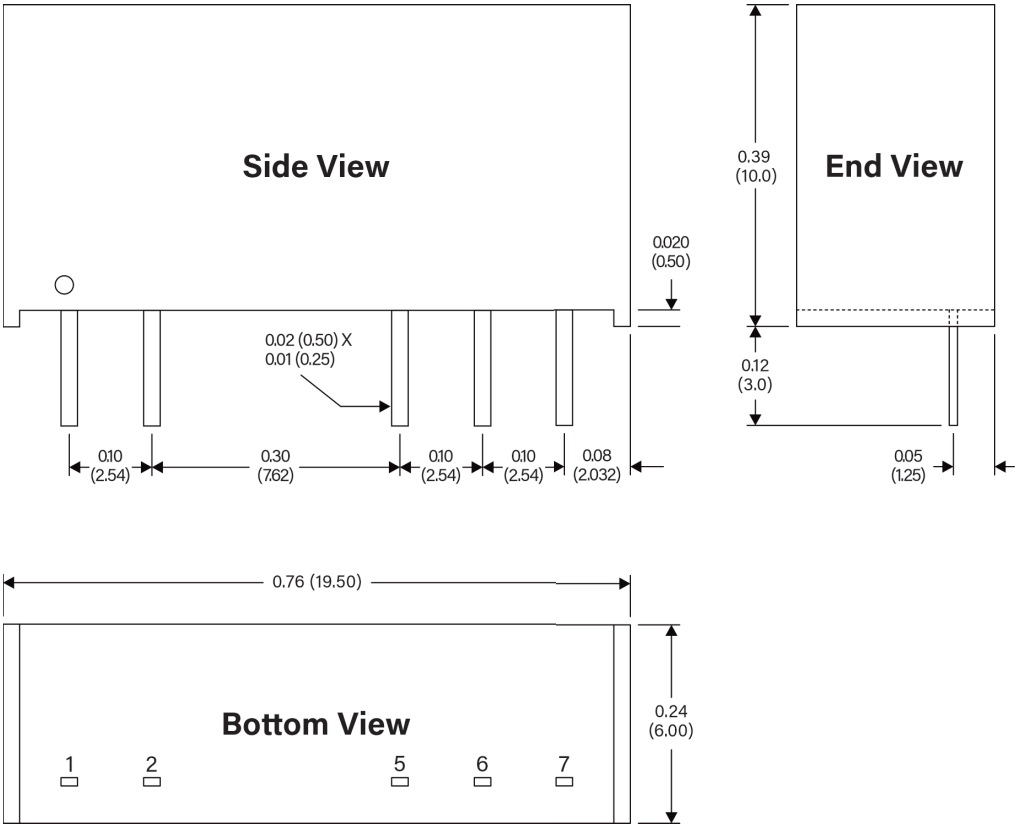
Pin	Single Output
1	+VIN
2	-VIN
4	-VOUT
5	No Pin
6	+VOUT

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 = ±0.02 (±0.50)
- Pin Tolerance = ±0.002 (±0.05)
- Recommended pin hole size (on the application PC Board) is Ø 0.039 (Ø1.00)
- Weight (Typ) = 0.08 Oz (2.3g)

Mechanical Dimensions, MD100X-xxIx Models



Pin Connections

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

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

Notes:

- All dimensions are typical in inches (mm)
- Pin 1 is marked by a "dot" or indentation on the unit
- General Tolerance = ±0.02 (±0.50)
- Pin Tolerance = ±0.002 (±0.05)
- Recommended pin hole size (on the application PC Board) is Ø 0.039 (Ø1.00)
- Weight (Typ) = 0.08 Oz (2.3g)