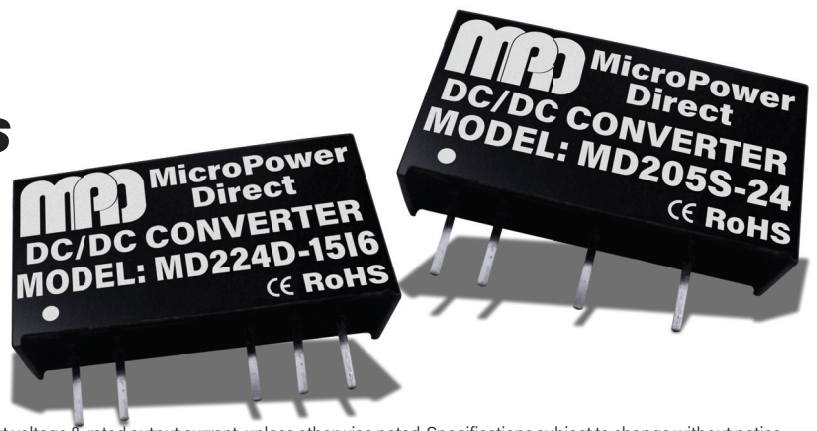


MD200 Series

1 kV To 6 kV Isolation, 2W, Miniature SIP DC/DC Converters



Key Features:

- 2W Output Power
- 1 kV to 6kV Isolation
- 80 Standard Models
- Single & Dual Outputs
- Miniature SIP Case
- Efficiency to 82%
- -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 V _{IN} 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	Model No: MD2xx-xx		1,000		VDC
	Model No: MD2xx-xxl		3,000		
	Model No: MD2xx-xxl4		4,000		
	Model No: MD2xx-xxl5		5,200		
	Model No: MD2xx-xxl6		6,000		
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 (Pages 6 & 7)
Case Material	Non-Conductive Black Plastic (UL94-V0)
Weight	See Mechanical Diagrams (Page 6 & 7)

Reliability Specifications

Parameter	Conditions	Min.	Typ.	Max.	Units
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	1.121			MHours

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.

RoHS



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www.micropowerdirect.com

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							
MD203S-03xx	3.3	2.97 - 3.63	797	26	3.3	400.0	0.0	76	20.0	470	2,000
• MD203S-05xx	3.3	2.97 - 3.63	797	30	5.0	400.0	0.0	76	20.0	470	2,000
• MD203S-07xx	3.3	2.97 - 3.63	808	30	7.2	277.7	0.0	75	20.0	470	2,000
• MD203S-09xx	3.3	2.97 - 3.63	758	30	9.0	222.2	0.0	80	20.0	470	2,000
• MD203S-12xx	3.3	2.97 - 3.63	748	35	12.0	166.7	0.0	81	20.0	470	2,000
• MD203S-15xx	3.3	2.97 - 3.63	777	40	15.0	133.3	0.0	78	20.0	470	2,000
• MD203S-18xx	3.3	2.97 - 3.63	787	35	18.0	111.1	0.0	77	20.0	470	2,000
• MD203S-24xx	3.3	2.97 - 3.63	767	35	24.0	83.3	0.0	79	20.0	470	2,000
• MD203D-03xx	3.3	2.97 - 3.63	797	25	±3.3	±200.0	±0.0	76	20.0	220	2,000
• MD203D-05xx	3.3	2.97 - 3.63	777	40	±5.0	±200.0	±0.0	78	20.0	220	2,000
• MD203D-07xx	3.3	2.97 - 3.63	797	40	±7.2	±138.8	±0.0	76	20.0	220	2,000
MD203D-09xx	3.3	2.97 - 3.63	797	40	±9.0	±111.1	±0.0	76	20.0	220	2,000
MD203D-12xx	3.3	2.97 - 3.63	777	45	±12.0	±83.3	±0.0	78	20.0	220	2,000
MD203D-15xx	3.3	2.97 - 3.63	777	45	±15.0	±66.6	±0.0	78	20.0	220	2,000
MD203D-18xx	3.3	2.97 - 3.63	777	45	±18.0	±55.5	±0.0	78	20.0	220	2,000
MD203D-24xx	3.3	2.97 - 3.63	777	45	±24.0	±41.6	±0.0	79	20.0	220	2,000
• MD205S-03xx	5	4.5 - 5.5	367	30	3.3	400.0	0.0	72	20.0	470	1,000
• MD205S-05xx	5	4.5 - 5.5	512	30	5.0	400.0	0.0	78	20.0	470	1,000
MD205S-07xx	5	4.5 - 5.5	500	30	7.2	277.7	0.0	80	20.0	470	1,000
MD205S-09xx	5	4.5 - 5.5	500	30	9.0	222.2	0.0	80	20.0	470	1,000
MD205S-12xx	5	4.5 - 5.5	487	30	12.0	166.7	0.0	82	20.0	470	1,000
MD205S-15xx	5	4.5 - 5.5	487	30	15.0	133.3	0.0	82	20.0	470	1,000
MD205S-18xx	5	4.5 - 5.5	487	30	18.0	111.1	0.0	82	20.0	470	1,000
MD205S-24xx	5	4.5 - 5.5	487	30	24.0	83.3	0.0	82	20.0	470	1,000
• MD205D-03xx	5	4.5 - 5.5	406	30	±3.3	±200.0	±0.0	65	20.0	220	1,000
• MD205D-05xx	5	4.5 - 5.5	555	30	±5.0	±200.0	±0.0	72	20.0	220	1,000
• MD205D-07xx	5	4.5 - 5.5	555	30	±7.2	±138.8	±0.0	72	20.0	220	1,000
MD205D-09xx	5	4.5 - 5.5	519	30	±9.0	±111.1	±0.0	77	20.0	220	1,000
• MD205D-12xx	5	4.5 - 5.5	512	38	±12.0	±83.3	±0.0	78	20.0	220	1,000
• MD205D-15xx	5	4.5 - 5.5	500	30	±15.0	±66.6	±0.0	80	20.0	220	1,000
• MD205D-18xx	5	4.5 - 5.5	500	30	±18.0	±55.5	±0.0	80	20.0	220	1,000
• MD205D-24xx	5	4.5 - 5.5	500	30	±24.0	±41.6	±0.0	80	20.0	220	1,000
• MD212S-03xx	12	10.8 - 13.2	169	36	3.3	400.0	0.0	65	20.0	470	600
MD212S-05xx	12	10.8 - 13.2	216	20	5.0	400.0	0.0	77	20.0	470	600
MD212S-07xx	12	10.8 - 13.2	208	20	7.2	277.7	0.0	80	20.0	470	600
MD212S-09xx	12	10.8 - 13.2	208	20	9.0	222.2	0.0	80	20.0	470	600
MD212S-12xx	12	10.8 - 13.2	203	20	12.0	166.7	0.0	82	20.0	470	600
MD212S-15xx	12	10.8 - 13.2	203	20	15.0	133.3	0.0	82	20.0	470	600
MD212S-18xx	12	10.8 - 13.2	208	20	18.0	111.1	0.0	80	20.0	470	600
MD212S-24xx	12	10.8 - 13.2	208	20	24.0	83.3	0.0	80	20.0	470	600
• MD212D-03xx	12	10.8 - 13.2	164	20	±3.3	±200.0	±0.0	67	20.0	220	600
• MD212D-05xx	12	10.8 - 13.2	222	20	±5.0	±200.0	±0.0	75	20.0	220	600
MD212D-07xx	12	10.8 - 13.2	219	20	±7.2	±138.8	±0.0	76	20.0	220	600
MD212D-09xx	12	10.8 - 13.2	216	20	±9.0	±111.1	±0.0	77	20.0	220	600
MD212D-12xx	12	10.8 - 13.2	203	20	±12.0	±83.3	±0.0	82	20.0	220	600
MD212D-15xx	12	10.8 - 13.2	203	20	±15.0	±66.6	±0.0	82	20.0	220	600
MD212D-18xx	12	10.8 - 13.2	203	20	±18.0	±55.5	±0.0	82	20.0	220	600
MD212D-24xx	12	10.8 - 13.2	203	20	±24.0	±41.6	±0.0	82	20.0	220	600
MD224S-03xx	24	21.6 - 26.4	76	10	3.3	400.0	0.0	72	20.0	470	200
MD224S-05xx	24	21.6 - 26.4	105	10	5.0	400.0	0.0	79	20.0	470	200
MD224S-07xx	24	21.6 - 26.4	104	10	7.2	277.7	0.0	80	20.0	470	200
MD224S-09xx	24	21.6 - 26.4	104	10	9.0	222.2	0.0	80	20.0	470	200
MD224S-12xx	24	21.6 - 26.4	102	10	12.0	166.7	0.0	80	20.0	470	200
MD224S-15xx	24	21.6 - 26.4	101	10	15.0	133.3	0.0	82	20.0	470	200
MD224S-18xx	24	21.6 - 26.4	101	10	18.0	111.1	0.0	82	20.0	470	200
MD224S-24xx	24	21.6 - 26.4	104	10	24.0	83.3	0.0	80	20.0	470	200
• MD224D-03xx	24	21.6 - 26.4	80	10	±3.3	±200.0	±0.0	68	20.0	220	200
• MD224D-05xx	24	21.6 - 26.4	111	10	±5.0	±200.0	±0.0	75	20.0	220	200
MD224D-07xx	24	21.6 - 26.4	111	10	±7.2	±138.8	±0.0	75	20.0	220	200
MD224D-09xx	24	21.6 - 26.4	104	10	±9.0	±111.1	±0.0	80	20.0	220	200
MD224D-12xx	24	21.6 - 26.4	101	10	±12.0	±83.3	±0.0	82	20.0	220	200
MD224D-15xx	24	21.6 - 26.4	101	10	±15.0	±66.6	±0.0	82	20.0	220	200
MD224D-18xx	24	21.6 - 26.4	101	10	±18.0	±55.5	±0.0	82	20.0	220	200
MD224D-24xx	24	21.6 - 26.4	101	10	±24.0	±41.6	±0.0	82	20.0	220	200

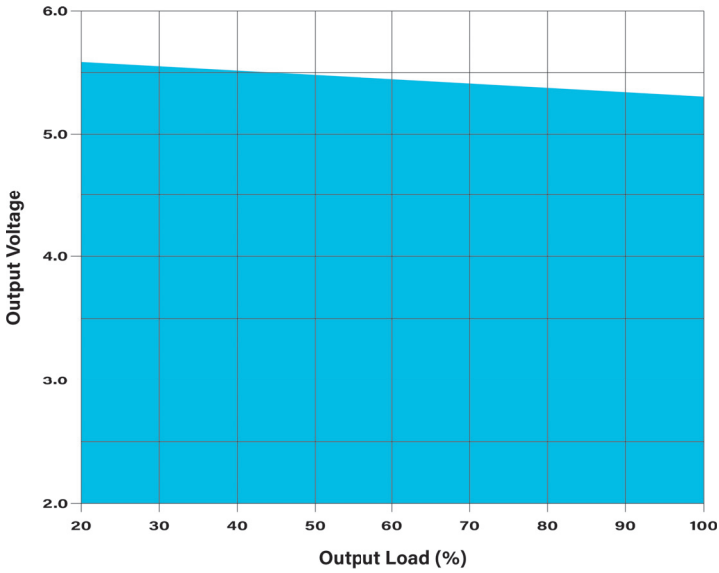
Notes:

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

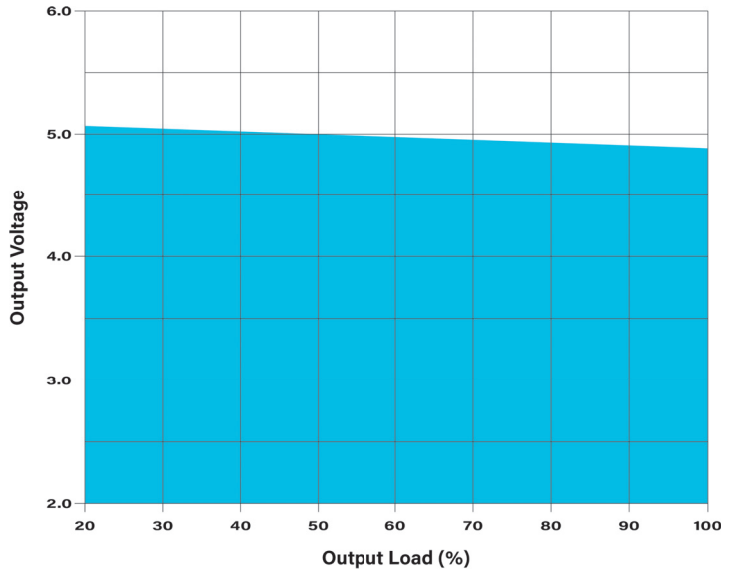
- models will meet EN 55022 class B. A suggested circuit is shown on page 6. Contact the factory for more information.
4. To meet the requirements of EN 61000-4-4 and EN 61000-4-5, external components are needed. A suggested circuit is shown on page 5. Contact the factory for more information.

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.
6. Some (or all) models marked with a "•" may be packaged in a slightly larger case. See page 7 for more information.

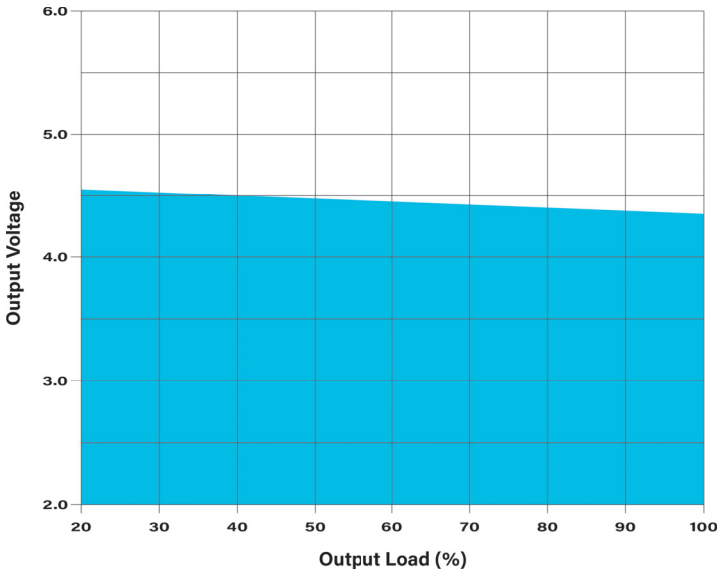
Output Load vs Output Voltage: MD205, High Line



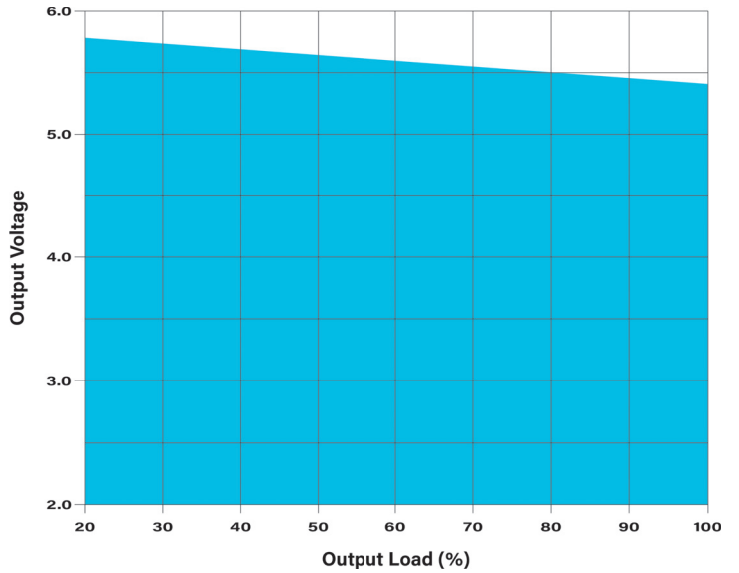
Output Load vs Output Voltage: MD205, Nom Line



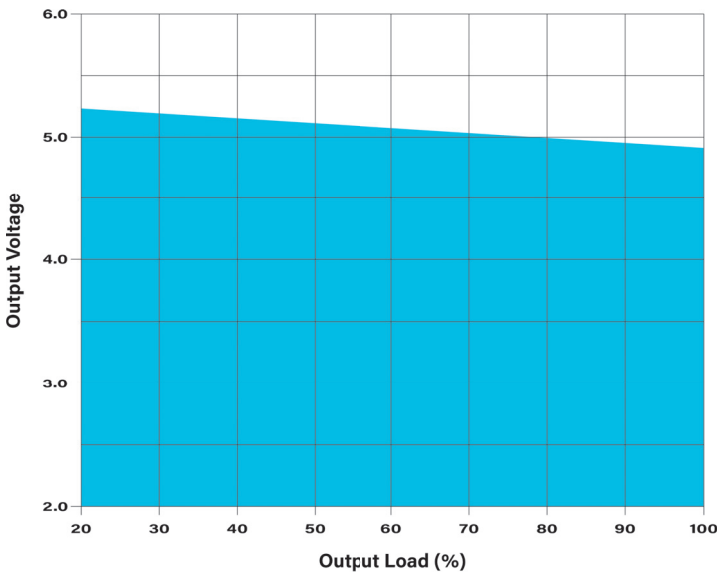
Output Load vs Output Voltage: MD205, Low Line



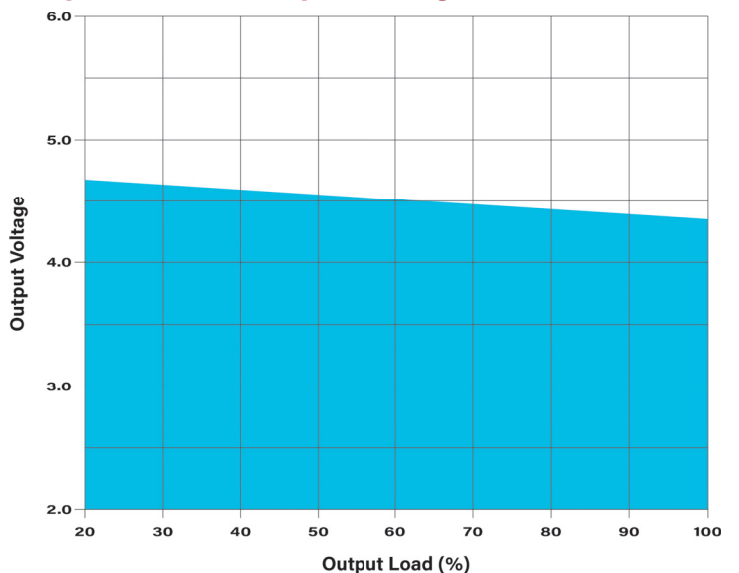
Output Load vs Output Voltage: MD212, High Line



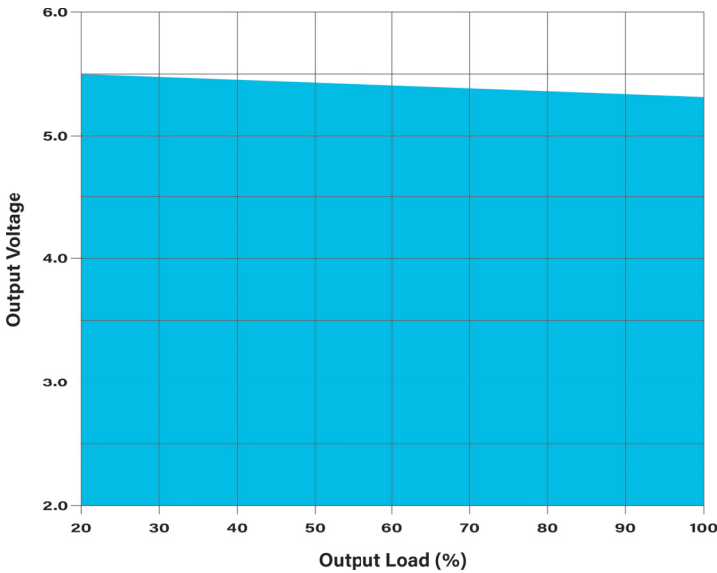
Output Load vs Output Voltage: MD212, Nom Line



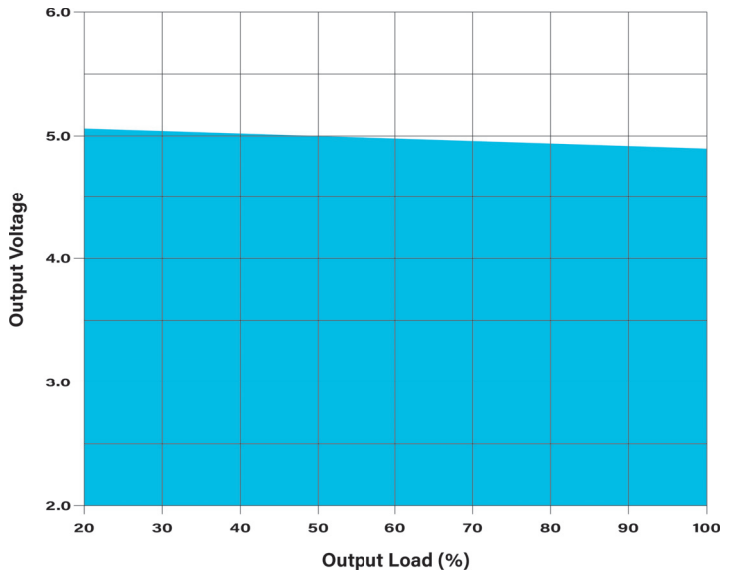
Output Load vs Output Voltage: MD212, Low Line



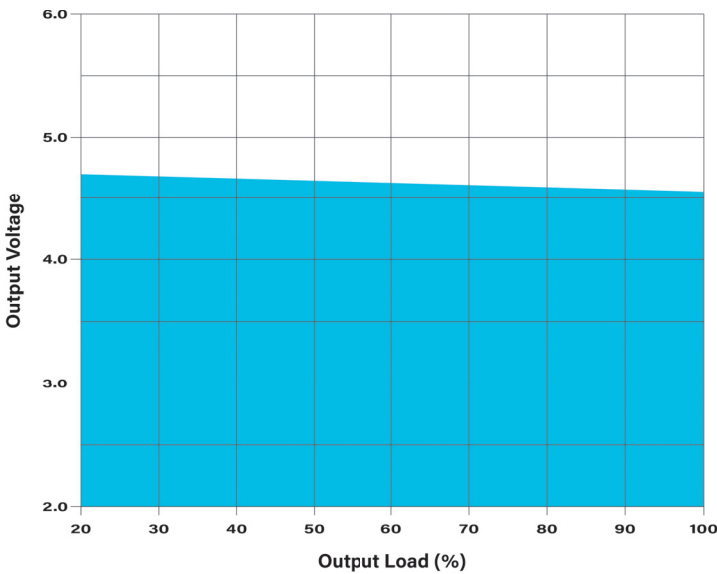
Output Load vs Output Voltage: MD224, High Line



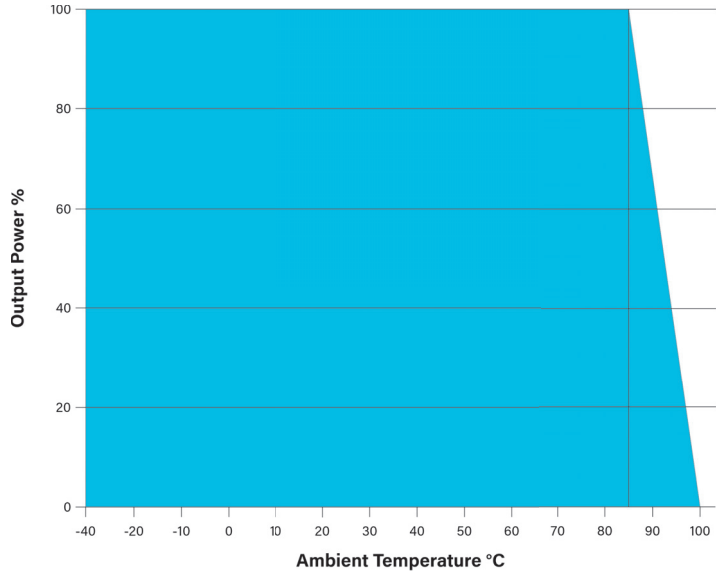
Output Load vs Output Voltage: MD224, Nom Line



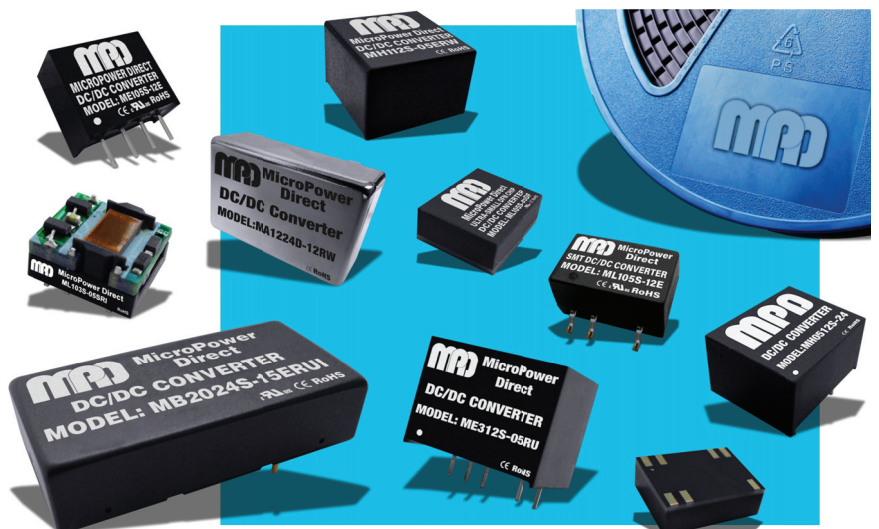
Output Load vs Output Voltage: MD224, Low Line



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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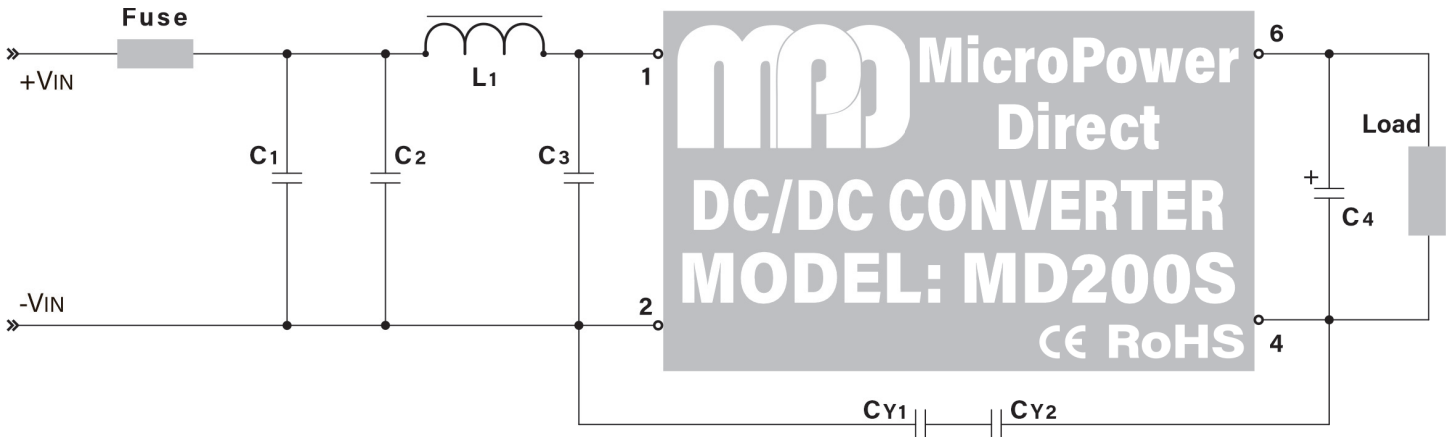
Typical Connection



The diagram above illustrates a typical connection of the MD200D. For applications that do not require the circuit to meet EMI/EMC specifications, the capacitors C1, C4 and C5 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	V _{OUT}	C ₄	V _{OUT}	C _{4/C5}
3.3 VDC	5.0 μF/25V	3.3 VDC	10 μF/16V	±3.3 VDC	10 μF/16V
5 VDC	5.0 μF/25V	5 VDC	10 μF/16V	±5 VDC	10 μF/16V
12 VDC	7.5 μF/50V	7.2 VDC	10 μF/16V	±7.2 VDC	10 μF/16V
15 VDC	7.5 μF/50V	9 VDC	10 μF/16V	±9 VDC	10 μF/16V
24 VDC	10 μF/50V	12 VDC	10 μF/25V	±12 VDC	10 μF/25V
		15 VDC	10 μF/25V	±15 VDC	10 μF/25V
		18 VDC	10 μF/35V	±18 VDC	10 μF/35V
		24 VDC	10 μF/50V	±24 VDC	10 μF/50V

EMI Connection



The diagram above illustrates a connection of the MD200S 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

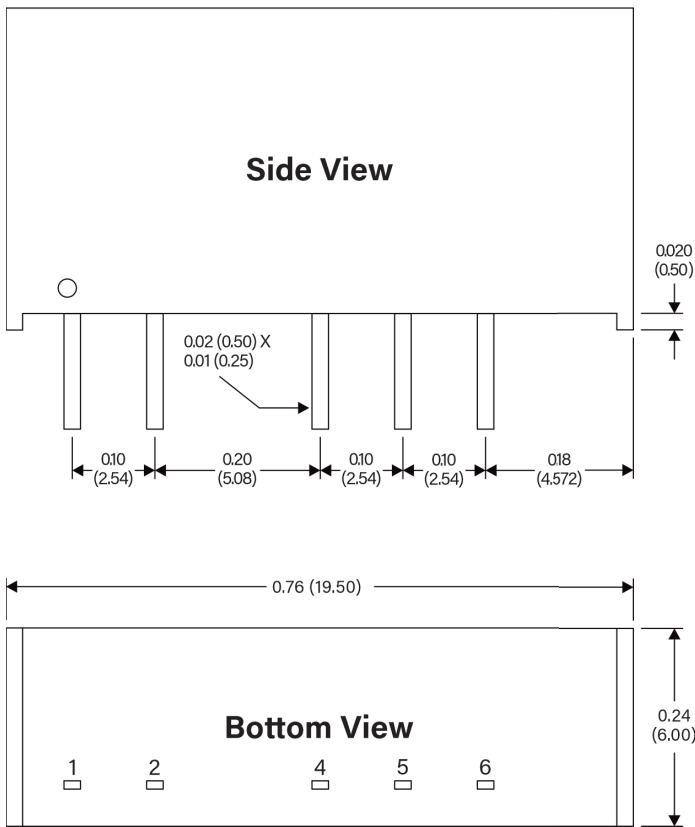
load specification for the unit. Voltage derating of capacitors should be 80% or above.

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:

V _{IN}	Isolation Level	C ₁	C ₂	L ₁	C ₃	CY ₁	CY ₂
3.3 VDC	All Models	Nippon Chemi-Con KY Series 470 μF/100V	MLCC 2.2 μF/100V	18 μH	Not Required	Not Required	Not Required
5 VDC	All Models						
12 VDC	All Models						
15 VDC	All Models				MLCC 2.2 μF/100V	MLCC 470 pF/3 kV	
24 VDC	1 kV - 3 kV						
24 VDC	4 kV - 6 kV						

Mechanical Dimensions, MD200X-xx Models



Pin Connections

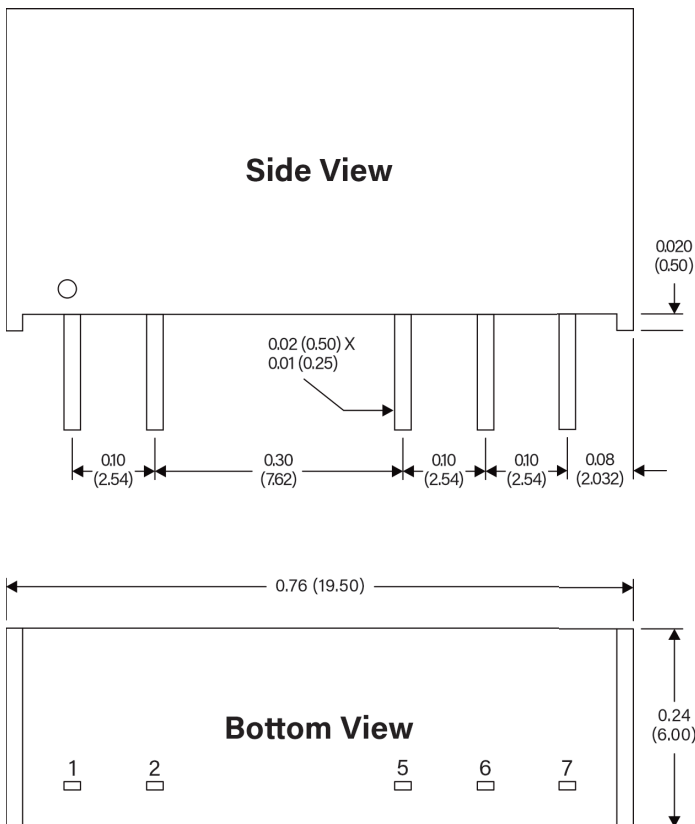
Pin	Single Output
1	+VIN
2	-VIN
4	-VOUT
5	No Pin
6	+VOUT

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 $\varnothing 0.039$ ($\varnothing 1.00$)
- Weight (Typ) = 0.08 Oz (2.3g)

Mechanical Dimensions, MD200X-xxlx Models



Pin Connections

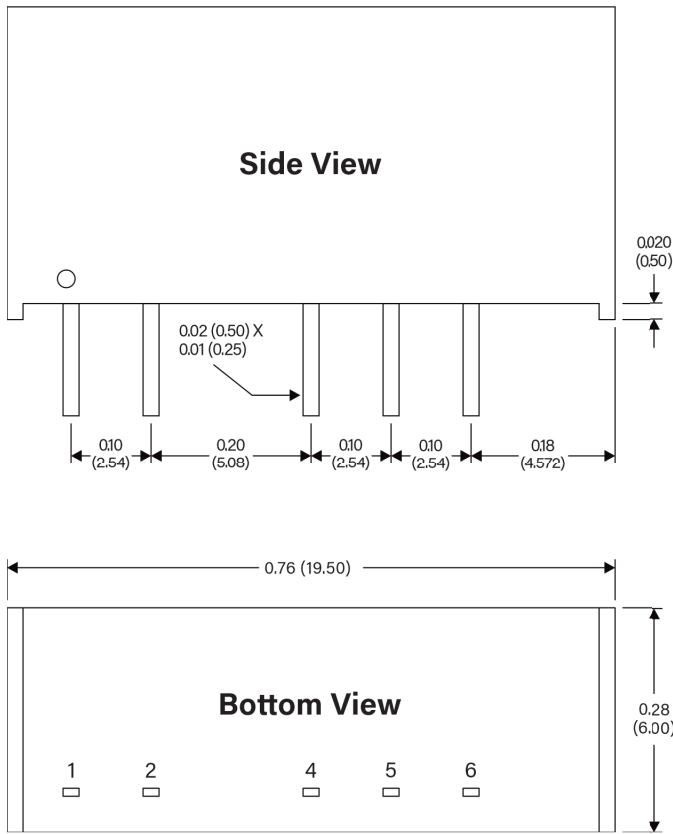
Pin	Single Output
1	+VIN
2	-VIN
5	-VOUT
6	No Pin
7	+VOUT

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

Notes:

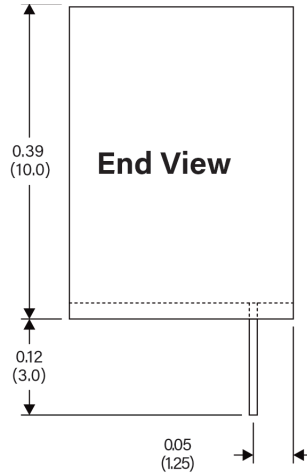
- All dimensions are typical in inches (mm)
- Pin 1 is marked by a "dot" or indentation on the unit
- General Tolerance = ± 0.02 (± 0.50)
- Pin Tolerance = ± 0.002 (± 0.05)
- Recommended pin hole size (on the application PC Board) is $\varnothing 0.039$ ($\varnothing 1.00$)
- Weight (Typ) = 0.08 Oz (2.3g)

Mechanical Dimensions, MD200X-xx Models



The following models are cased in a slightly larger package (see drawings at left).

MD203S-05	All Models
MD203S-07	All Models
MD203S-09	I, I4, I5 & I6 Models
MD203S-12	All Models
MD203S-15	All Models
MD203S-18	All Models
MD203S-24	All Models
MD203D-03	All Models
MD203D-05	All Models
MD203D-07	I5 & I6 Models
MD205S-05	I4, & I5 Models
MD205D-05	I5 Models
MD205D-07	I5 & I6 Models
MD205D-15	I4, I5 & I6 Models



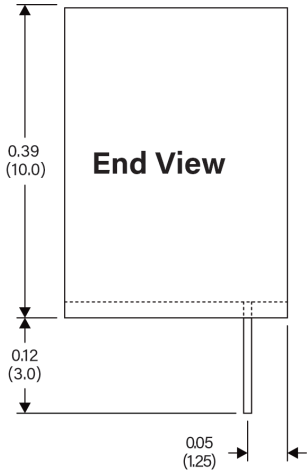
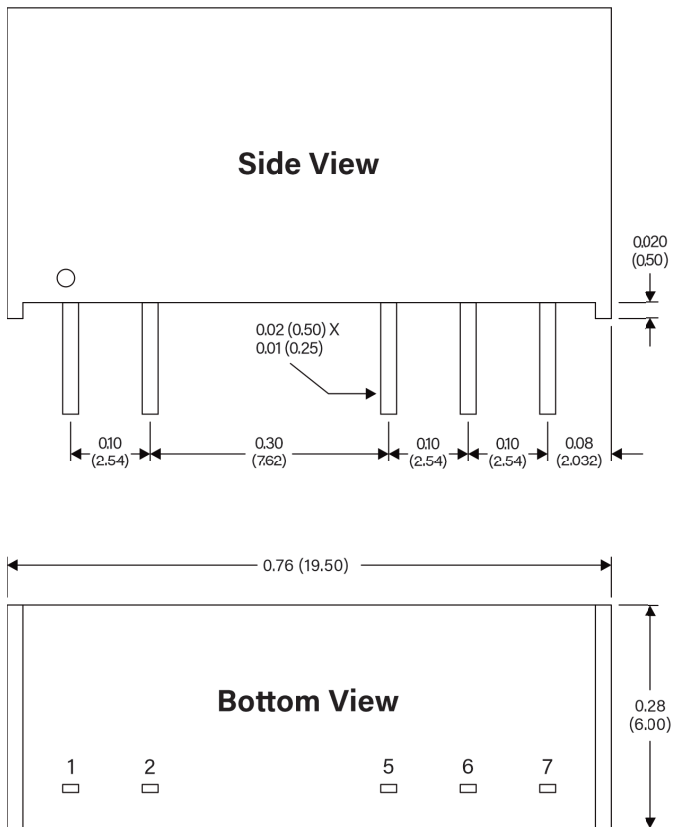
Pin Connections

Pin	Single Output	Pin	Dual Output
1	+VIN	1	+VIN
2	-VIN	2	-VIN
4	-VOUT	4	-VOUT
5	No Pin	5	Common
6	+VOUT	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 $\varnothing 0.039$ ($\varnothing 1.00$)
- Weight (Typ) = 0.08 Oz (2.3g)

Mechanical Dimensions, MD200X-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 $\varnothing 0.039$ ($\varnothing 1.00$)
- Weight (Typ) = 0.08 Oz (2.3g)



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