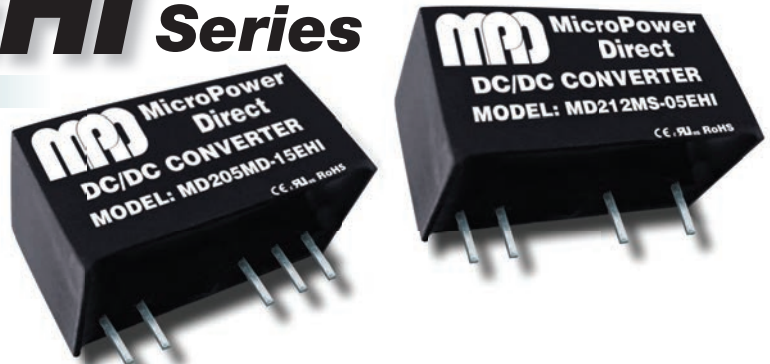


MD200MEHI Series

Miniature, 2W SIP Medical Approved DC/DC Converters



Key Features:

- EN 60601 3RD Ed. Approved
- 2W Output Power
- 4.2 kVAC Isolation
- Reinforced Insulation
- 1 x MOPP & 2 x MOOP per EN 60601-1 3RD Edition & ANSI/AAMI ES 60601-1
- 2 μ A Leakage Current Max
- Compact SIP Case
- Single & Dual Outputs
- 3.5 MH MTBF



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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.

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	
	24 VDC Input	21.6	24.0	26.4	
Input Filter	Capacitor Filter				
Reflected Ripple Current			0.2		A

Parameter	Conditions	Min.	Typ.	Max.	Units
Output Voltage Accuracy			± 5.0		%
Line Regulation	V _{IN} Change of 1%			± 1.5	%
Load Regulation, See Note 1	5.0 V _{OUT}			20	%
	All Other Models			15	
Efficiency	See Model Selection Guide				
Ripple & Noise (20 MHz), See Note 2	5.0 V _{OUT}		80	150	mV P - P
	All Other Models		100	150	
Temperature Coefficient			± 0.02		%/°C
Output Short Circuit	See Note 3			3.0	S

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation Voltage	60 Seconds	4,200			VAC
		6,000			VDC
Leakage Current, See Note 4	250 VAC, 50/60 Hz			2.0	μ A
Isolation Resistance	500 VDC	1.0			G Ω
Isolation Capacitance	100 kHz, 0.1V		5		pF
Switching Frequency			100		kHz

EMI Characteristics, See Note 5

Parameter	Standard	Criteria	Level
Radiated Emissions	EN 55022		Level B
Conducted Emissions	EN 55022		Level B
ESD	EN 61000-4-2	B	± 8 kV Contact

Environmental , See Note 6

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

Physical

Case Size	See Mechanical Diagram (Page 3)
Case Material	Non-Conductive Black Plastic (UL94-V0)
Weight	0.14 Oz (4.2g)

Reliability Specifications

Parameter	Conditions	Min.	Typ.	Max.	Units
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	3.5			MHours
Transformer Creepage		5.0			mm
Transformer Clearance		5.0			mm
PCB Creepage & Clearance		5.5			mm

Safety Approvals, See Note 7	IEC/EN 60601-1 3 RD Edition, 1XMOPP & 2xMOOP
	ANSI/AAMI ES 60601-1 1xMOPP & 2xMOOP Recognition (UL Certificate)
	ANSI/AAMI ES 60601-1, CAN/CSA-C22.2 No.60601-1

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	
	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.

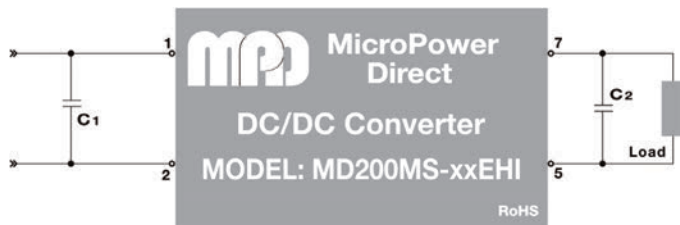
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Model Number	Input				Output			Capacitive Load (μF, Max)	Efficiency (% Typ)	Fuse Rating Slow-Blow (mA)
	Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA, Max)	Current (mA, Min)			
	Nominal	Range	Full-Load	No-Load						
MD205MS-05EHI	5	4.5 - 5.5	519	35	5.0	400.0	40.0	1,000	77	1,000
MD205MS-12EHI	5	4.5 - 5.5	506	35	12.0	167.0	17.0	470	79	1,000
MD205MS-15EHI	5	4.5 - 5.5	506	35	15.0	133.0	133.0	470	79	1,000
MD205MD-05EHI	5	4.5 - 5.5	513	35	±5.0	±200.0	±20.0	470	78	1,000
MD205MD-09EHI	5	4.5 - 5.5	513	35	±9.0	±111.0	±12.0	470	78	1,000
MD205MD-12EHI	5	4.5 - 5.5	513	35	±12.0	±83.0	±9.0	220	78	1,000
MD205MD-15EHI	5	4.5 - 5.5	500	35	±15.0	±67.0	±7.0	220	80	1,000
MD212MS-05EHI	12	10.8 - 13.2	216	15	5.0	400.0	40.0	1,000	77	400
MD212MS-12EHI	12	10.8 - 13.2	208	15	12.0	167.0	17.0	470	80	400
MD212MS-15EHI	12	10.8 - 13.2	203	15	15.0	133.0	133.0	470	82	400
MD212MD-05EHI	12	10.8 - 13.2	214	15	±5.0	±200.0	±20.0	470	78	400
MD212MD-09EHI	12	10.8 - 13.2	203	15	±9.0	±111.0	±12.0	470	82	400
MD212MD-12EHI	12	10.8 - 13.2	203	15	±12.0	±83.0	±9.0	220	82	400
MD212MD-15EHI	12	10.8 - 13.2	208	15	±15.0	±67.0	±7.0	220	80	400
MD224MS-05EHI	24	21.6 - 26.4	105	10	5.0	400.0	40.0	1,000	79	200
MD224MS-12EHI	24	21.6 - 26.4	102	10	12.0	167.0	17.0	470	82	200
MD224MS-15EHI	24	21.6 - 26.4	99	10	15.0	133.0	133.0	470	84	200
MD224MD-05EHI	24	21.6 - 26.4	105	10	±5.0	±200.0	±20.0	470	79	200
MD224MD-09EHI	24	21.6 - 26.4	103	10	±9.0	±111.0	±12.0	470	81	200
MD224MD-12EHI	24	21.6 - 26.4	102	10	±12.0	±83.0	±9.0	220	82	200
MD224MD-15EHI	24	21.6 - 26.4	103	10	±15.0	±67.0	±7.0	220	81	200

Notes:

- Output load regulation is specified for a load change of 10% to 100%.
- When measuring output ripple, it is recommended that an external 1.0 μF ceramic capacitor and a 10 μF electrolytic capacitor be connected in parallel from the +Vout pin to the -Vout pin for single output models, or from each output to common for dual output models.
- In the event of an output short circuit that lasts less than 3 seconds, the unit must be restarted.
- Patient leakage current and reinforced insulation is based on a 250 VAC, 50/60 Hz system input voltage.
- These converters operate without external components. However, to meet specific EMC standards, some external components may be required. Typical connections are shown below.
- All models operate to 85°C ambient without derating. They are not specified for operation over 85°C. Contact the factory for more information.
- The safety certification (EN 60601) and 1xMOPP/2xMOOP rating is for a system input voltage within 250 VAC, 50/60 Hz.
- Operation at no-load will not damage these units. However, they may not meet all specifications.
- It is recommended that a fuse be used on the input of a power supply for protection. See the table above for the correct rating.

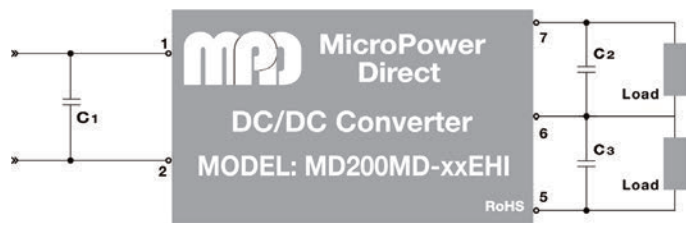
Typical Connection, Single Output Models



These converters are specified for operation without external components. However, in some applications the addition of input/output capacitors will enhance stability and reduce output ripple. For applications that require this, the diagrams above illustrates a typical connection of the MD200Mx-xxEHI series. Suggested component values are given in the table at right.

Capacitors C2 and C3 are not required to meet specifications, but may be used if a lower level of output ripple is required.

Typical Connection, Dual Output Models



V _{IN}	C ₁	V _{OUT}	C ₂	C ₃
5 VDC	10 μF/50V	5.0 VDC	10 μF	---
12 VDC	4.7 μF/50V	12 VDC	2.2 μF	---
24 VDC	2.2 μF/50V	15 VDC	1.0 μF	---
		±5.0 VDC	4.7 μF	4.7 μF
		±9.0 VDC	2.2 μF	2.2 μF
		±12 VDC	1.0 μF	1.0 μF
		±15 VDC	1.0 μF	1.0 μF

Typical Connection, EMI Input Filter

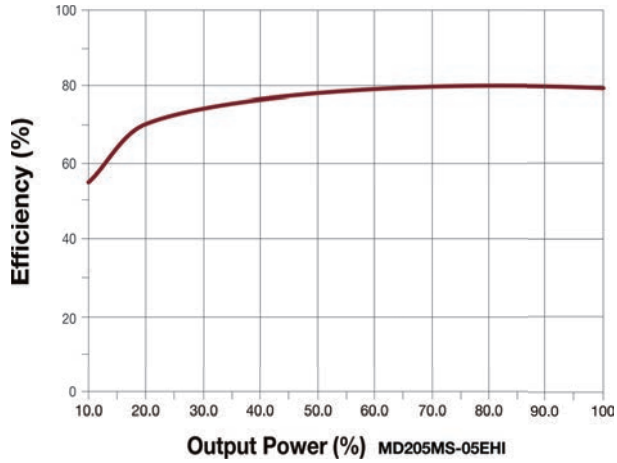


For applications that require meeting EMC standards, the diagram at left illustrates a typical connection of the MD200Mx-xxEHI series. Suggested component values are given in the table at below.

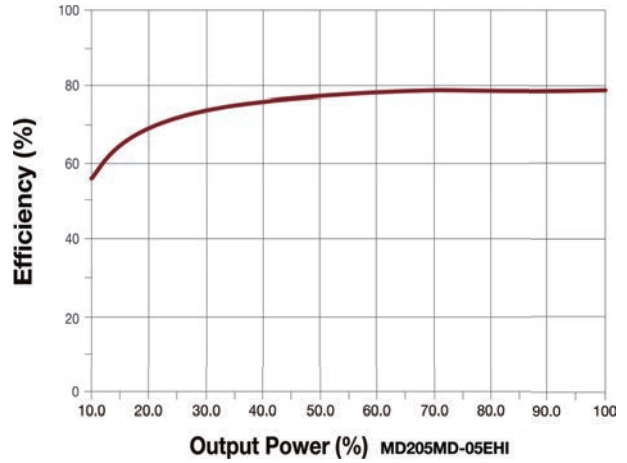
The value for capacitor C2 is given above.

V _{IN}	C ₄	L ₁	C ₅
5 VDC	4.7 μF/50V	6.8 μH	4.7 μF/50V
12 VDC	4.7 μF/50V	6.8 μH	4.7 μF/50V
24 VDC	4.7 μF/50V	15 μH	4.7 μF/50V

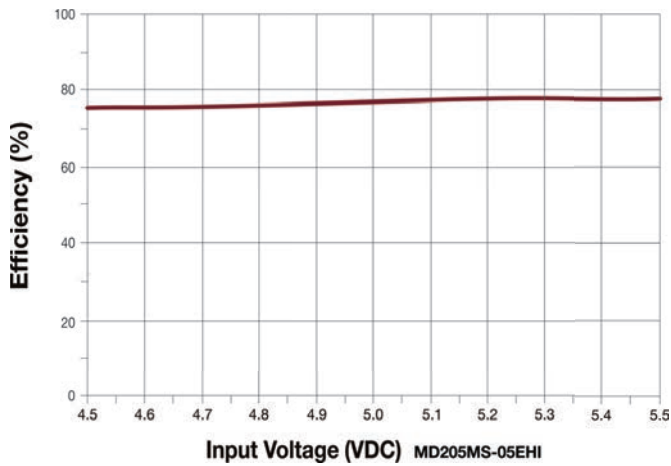
Typical Efficiency vs Output, Nom Input



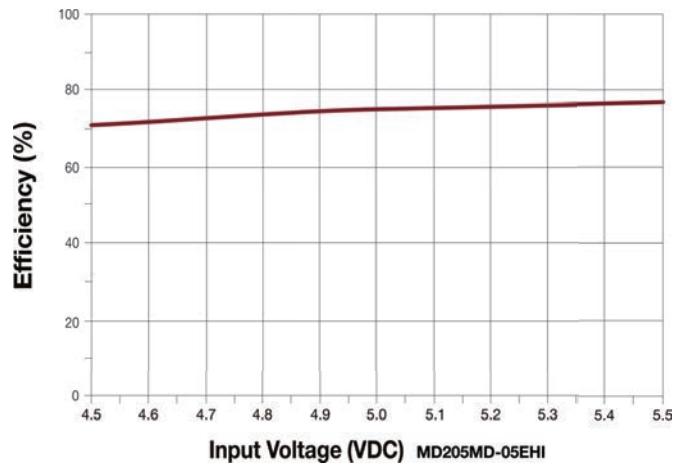
Typical Efficiency vs Output, Nom Input



Typical Efficiency vs Input, Full Load



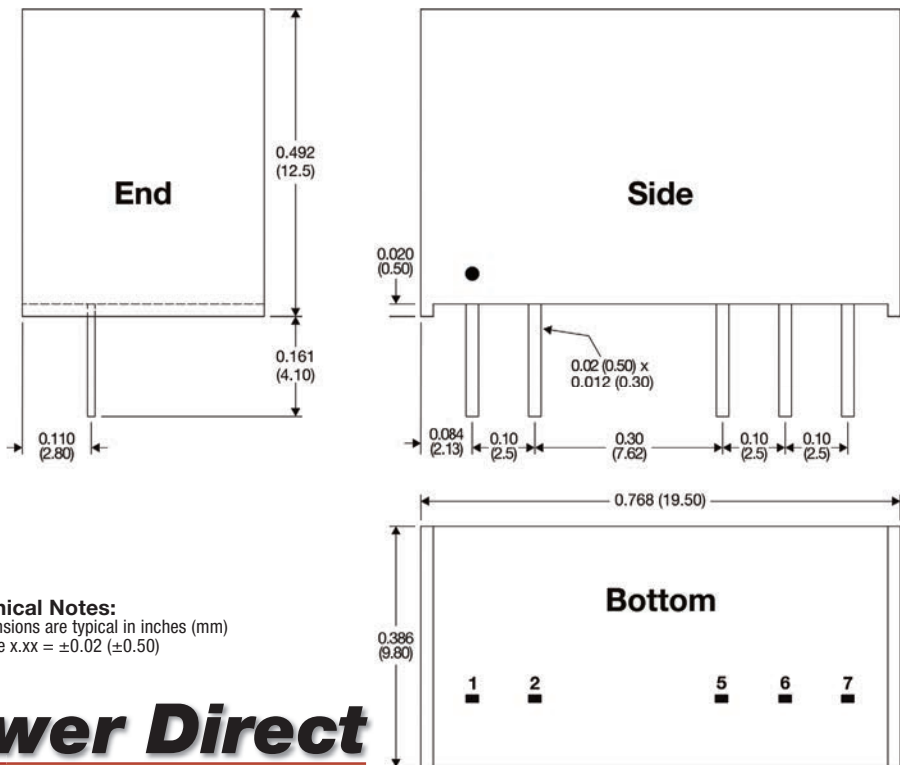
Typical Efficiency vs Input, Full Load



Mechanical Dimensions

Pin Connections

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



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



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