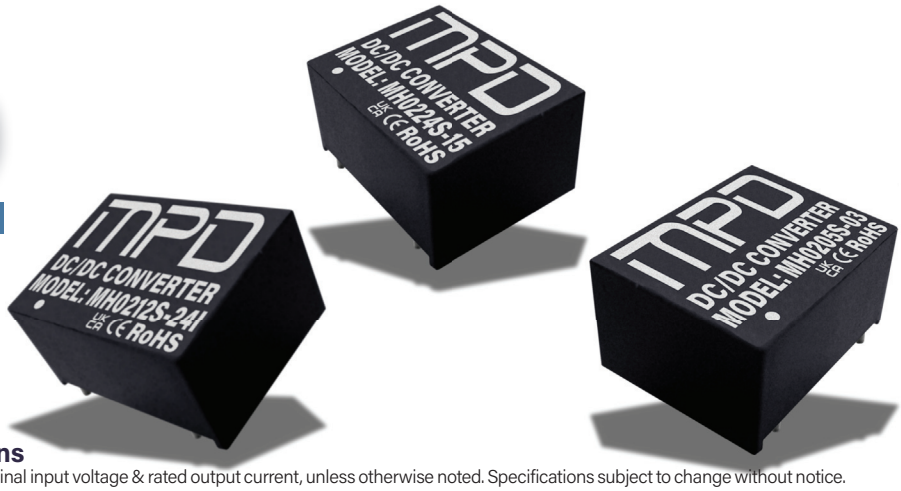
MH02S(I)

Low Cost, 0.25W Compact Micro-DIP DC/DC Converters



Key Features:

- 0.25W Output Power
- Compact Micro-DIP Case
- I/O Isolation to 3,000 VDC
- High Efficiency
- Meets EN 55032
- Meets EN EN/UL62368
- Single & Dual Outputs
- 40 Standard Models
- Wide Temp Operation
- Industry Standard Pin-Out
- ***LOW COST***

Also Available In Ultra-Miniature SIP Case

RoHS

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46 Eastman Street
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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	3.3 VDC Input	2.97	3.3	3.63	VDC
	5 VDC Input	4.50	5.0	5.50	
	12 VDC Input	10.80	12.0	13.20	
	15 VDC Input	13.50	15.0	16.50	
	24 VDC Input	21.60	24.0	26.40	
Input Reflected Ripple Current			20		mA P - P
Input Filter	Internal Capacitors				

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	See Model Selection Guide				
Ripple & Noise (20 MHz)			100		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 Seconds	1,000			VDC
	Units With "I" Suffix	3,000			
Isolation Resistance		1,000			MΩ
Isolation Capacitance			60		pF
Switching Frequency	See Note 2		80		kHz

EMI Characteristics

Parameter		Standard	Criteria	Level
Radiated Emissions		EN 55032		Class B
Conducted Emissions	See Note 4	EN 55032		Class B
ESD		EN 61000-4-2	A	±6 kV Contact
			A	±8kV Air
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	±0.5 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		+85	°C
	Case			+100	
Storage Temperature Range		-40		+125	°C
Cooling	Free Air Convection				
Humidity	RH, Non-condensing			95	%

Physical

Case Size, Weight and Material	See Mechanical Diagrams (Page 6)

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			5.0	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.

Model Selection Guide

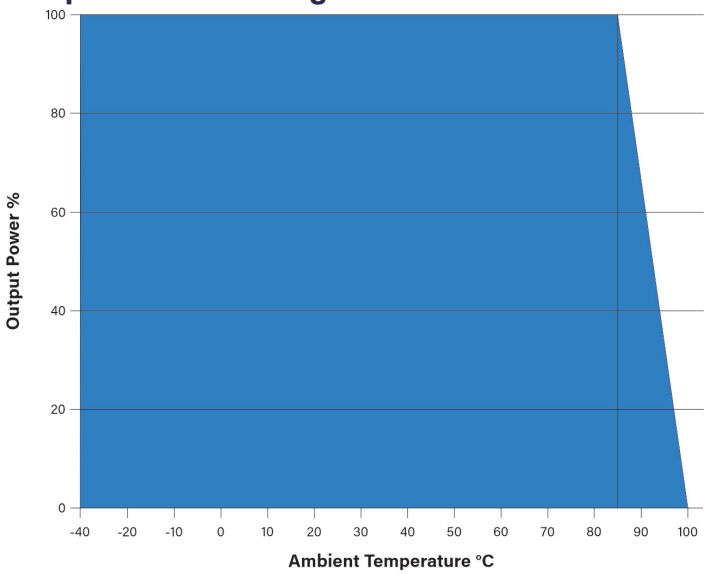
Model Number	Input				Output		Load Regulation (% Typ)	Efficiency (%, Typ)	Capacitive Load (µF, Max)	Fuse Rating Slow-Blow (mA)
	Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA, Max)				
	Nominal	Range	Full-Load	No-Load						
MH0203S-03(I)	3.3	2.97 - 3.63	124	25	3.3	75.7	±20	61	100	250
MH0203S-05(I)	3.3	2.97 - 3.63	118	25	5.0	50.0	±10	64	100	250
MH0203S-07(I)	3.3	2.97 - 3.63	118	25	7.2	34.7	±10	64	100	250
MH0203S-09(I)	3.3	2.97 - 3.63	118	25	9.0	27.7	±10	64	100	250
MH0203S-12(I)	3.3	2.97 - 3.63	120	25	12.0	20.8	±10	63	100	250
MH0203S-15(I)	3.3	2.97 - 3.63	118	25	15.0	16.6	±10	64	100	250
MH0203S-18(I)	3.3	2.97 - 3.63	115	25	18.0	13.8	±10	66	100	250
MH0203S-24(I)	3.3	2.97 - 3.63	115	20	24.0	10.4	±10	66	100	250
MH0205S-03(I)	5.0	4.5 - 5.5	83	20	3.3	75.7	±20	60	100	150
MH0205S-05(I)	5.0	4.5 - 5.5	72	15	5.0	50.0	±10	69	100	150
MH0205S-07(I)	5.0	4.5 - 5.5	71	18	7.2	34.7	±10	70	100	150
MH0205S-09(I)	5.0	4.5 - 5.5	71	18	9.0	27.7	±10	70	100	150
MH0205S-12(I)	5.0	4.5 - 5.5	74	20	12.0	20.8	±10	68	100	150
MH0205S-15(I)	5.0	4.5 - 5.5	74	20	15.0	16.6	±10	68	100	150
MH0205S-18(I)	5.0	4.5 - 5.5	68	17	18.0	13.8	±10	73	100	150
MH0205S-24(I)	5.0	4.5 - 5.5	72	23	24.0	10.4	±10	69	100	150
MH0212S-03(I)	12	10.8 - 13.2	31	12	3.3	75.7	±20	67	100	75
MH0212S-05(I)	12	10.8 - 13.2	32	10	5.0	50.0	±10	65	100	75
MH0212S-07(I)	12	10.8 - 13.2	32	15	7.2	34.7	±10	65	100	75
MH0212S-09(I)	12	10.8 - 13.2	35	12	9.0	27.7	±10	60	100	75
MH0212S-12(I)	12	10.8 - 13.2	31	13	12.0	20.8	±10	68	100	75
MH0212S-15(I)	12	10.8 - 13.2	37	16	15.0	16.6	±10	57	100	75
MH0212S-18(I)	12	10.8 - 13.2	38	16	18.0	13.8	±10	55	100	75
MH0212S-24(I)	12	10.8 - 13.2	41	18	24.0	10.4	±10	51	100	75
MH0215S-03(I)	15	13.5 - 16.5	26	12	3.3	75.7	±20	63	100	50
MH0215S-05(I)	15	13.5 - 16.5	26	10	5.0	50.0	±10	63	100	50
MH0215S-07(I)	15	13.5 - 16.5	28	12	7.2	34.7	±10	60	100	50
MH0215S-09(I)	15	13.5 - 16.5	28	12	9.0	27.7	±10	60	100	50
MH0215S-12(I)	15	13.5 - 16.5	28	12	12.0	20.8	±10	60	100	50
MH0215S-15(I)	15	13.5 - 16.5	28	13	15.0	16.6	±10	59	100	50
MH0215S-18(I)	15	13.5 - 16.5	29	12	18.0	13.8	±10	57	100	50
MH0215S-24(I)	15	13.5 - 16.5	29	12	24.0	10.4	±10	57	100	50
MH0224S-03(I)	24	21.6 - 26.4	18	8	3.3	75.7	±20	58	100	40
MH0224S-05(I)	24	21.6 - 26.4	17	7	5.0	50.0	±10	60	100	40
MH0224S-07(I)	24	21.6 - 26.4	18	8	7.2	34.7	±10	59	100	40
MH0224S-09(I)	24	21.6 - 26.4	18	8	9.0	27.7	±10	58	100	40
MH0224S-12(I)	24	21.6 - 26.4	19	10	12.0	20.8	±10	55	100	40
MH0224S-15(I)	24	21.6 - 26.4	18	7	15.0	16.6	±10	59	100	40
MH0224S-18(I)	24	21.6 - 26.4	20	10	18.0	13.8	±10	53	100	40
MH0224S-24(I)	24	21.6 - 26.4	19	10	24.0	10.4	±10	55	100	40

For the 3 kV isolation models, add suffix "I" to model number (i.e. **MH0224S-05I**)

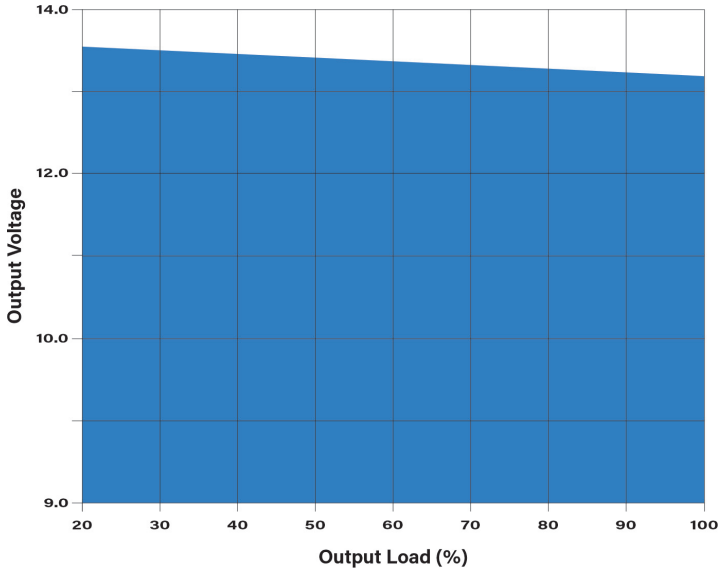
Notes:

1. Output load regulation is specified for a load change of 20% to 100%.
2. Switching frequency is typically 80 kHz, but may vary with differing operating conditions.
3. Operation at no-load will not damage these units. However, they may not meet all specifications.
4. These converters will operate without external components. However, to meet the specified EMI limits, a simple external input filter is required. See page 5 for more information.
5. All units are rated for operation at full output power to +85°C. Operation over +85°C without airflow is not recommended. Output power should be derated linearly from 100% at 85°C to 0% at 100°C.
6. 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.

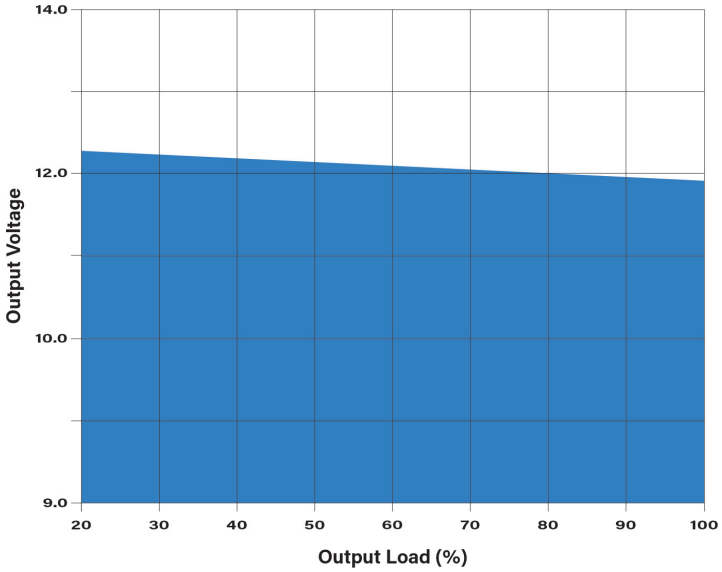
Temperature Derating Curve



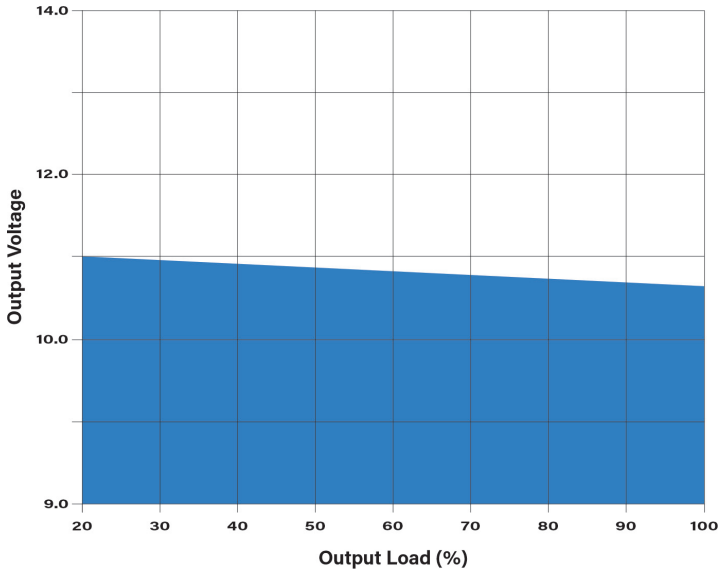
Output Load vs Output Voltage: MH0203, High Line



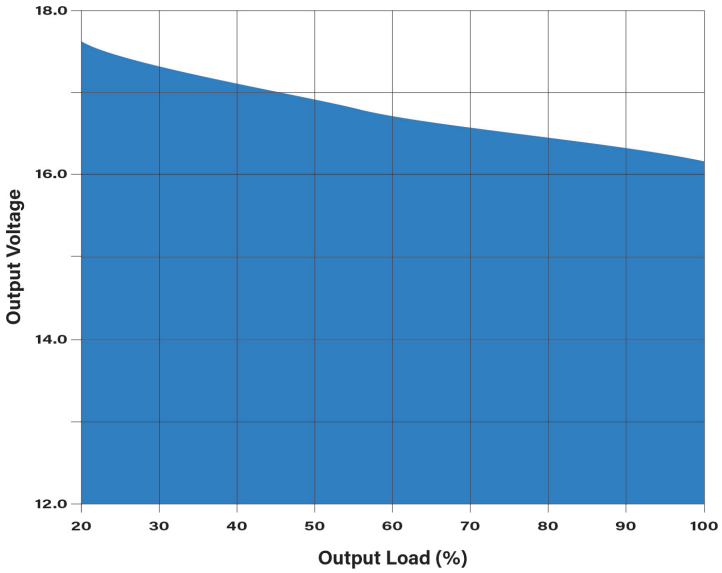
Output Load vs Output Voltage: MH0203, Nom Line



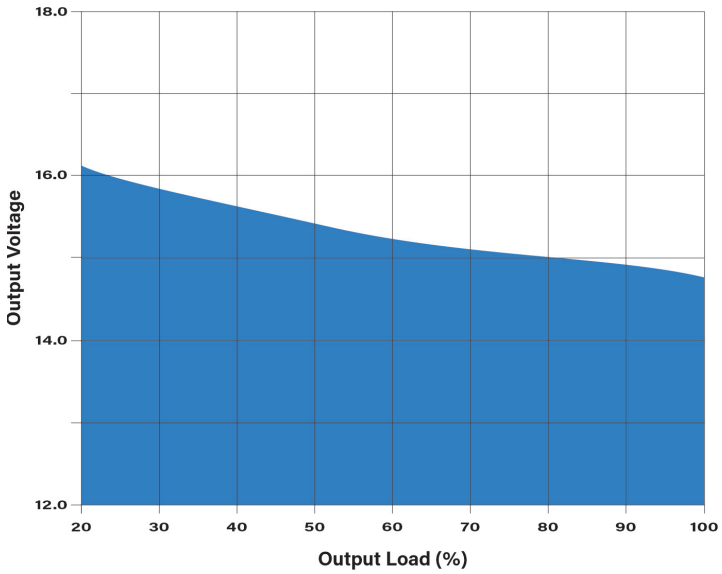
Output Load vs Output Voltage: MH0203, Low Line



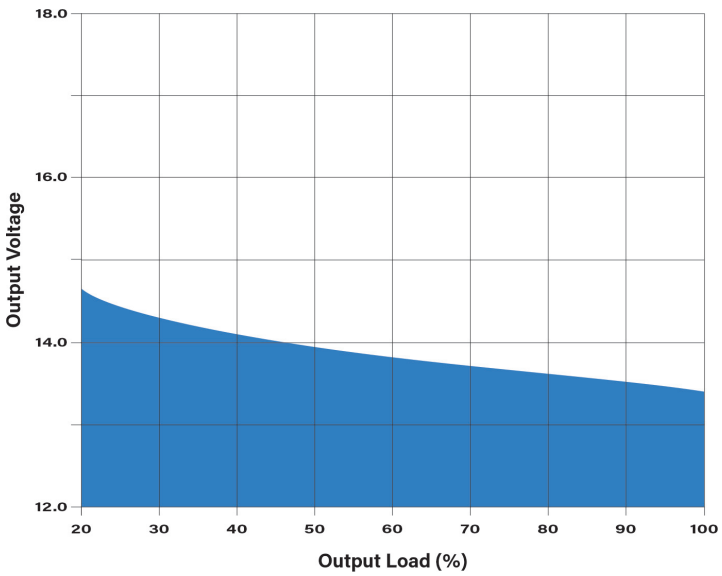
Output Load vs Output Voltage: MH0205, High Line



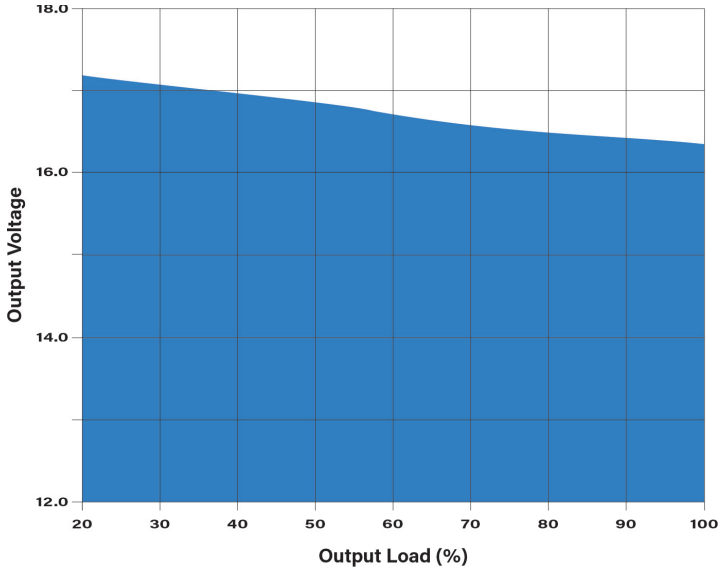
Output Load vs Output Voltage: MH0205, Nom Line



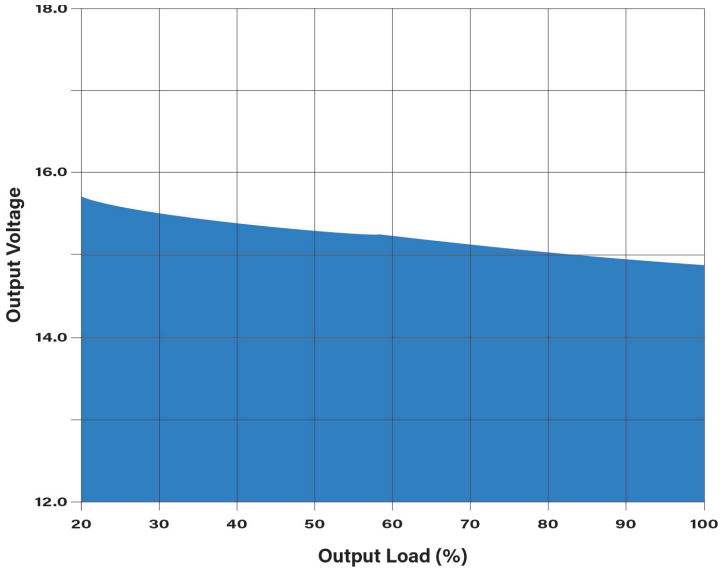
Output Load vs Output Voltage: MH0205, Low Line



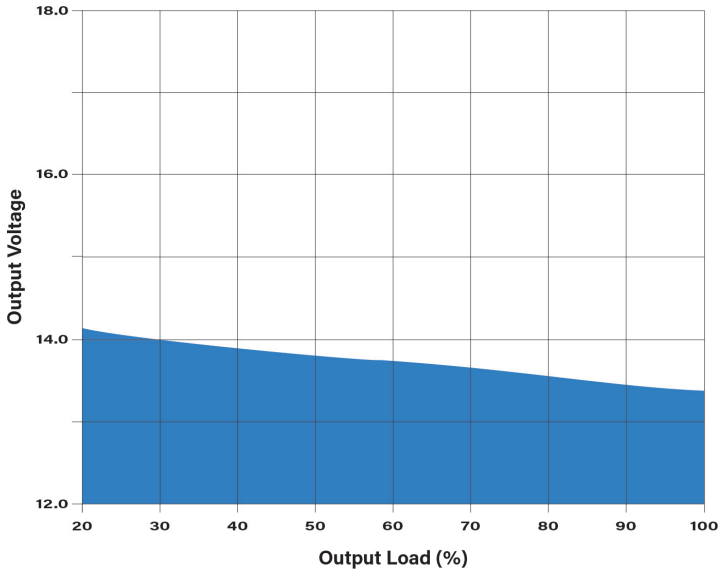
Output Load vs Output Voltage: MH0212, High Line



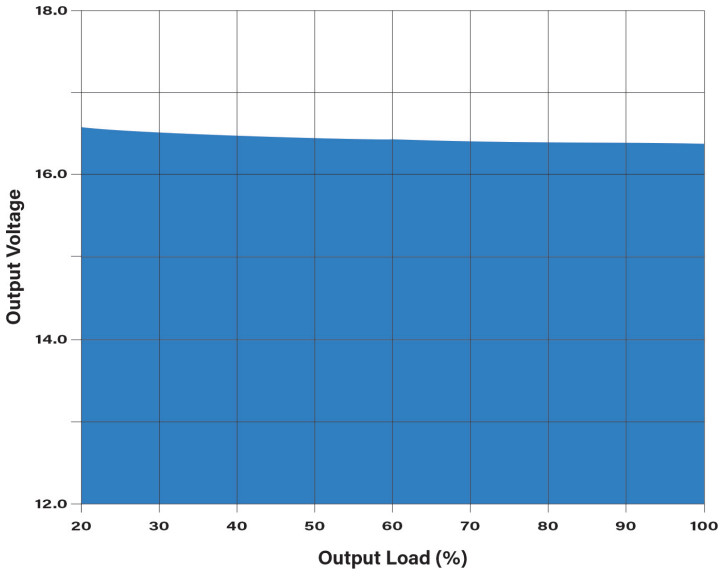
Output Load vs Output Voltage: MH0212, Nom Line



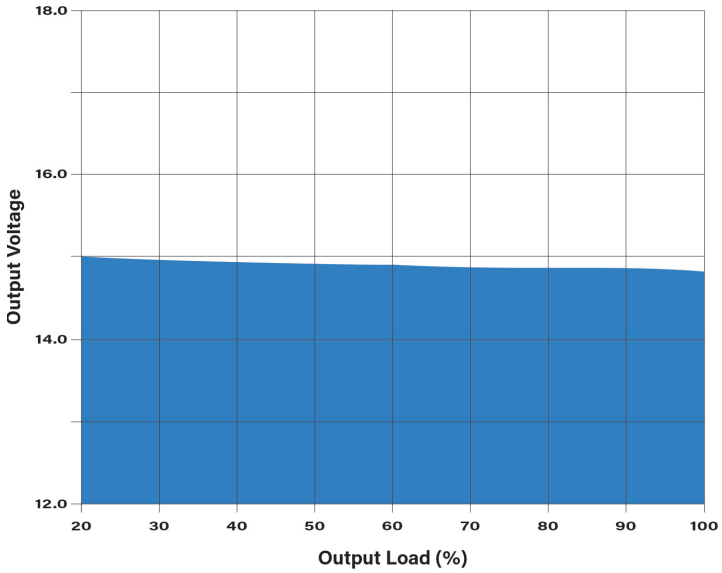
Output Load vs Output Voltage: MH0212, Low Line



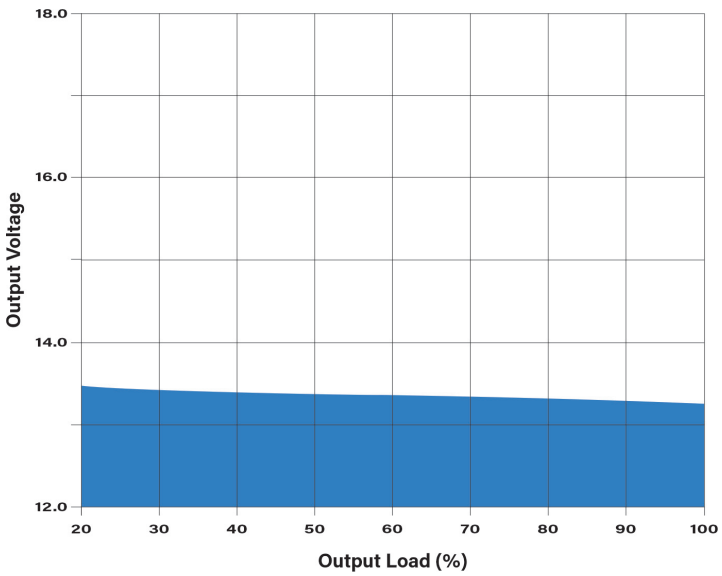
Output Load vs Output Voltage: MH0224, High Line



Output Load vs Output Voltage: MH0224, Nom Line



Output Load vs Output Voltage: MH0224, Low Line



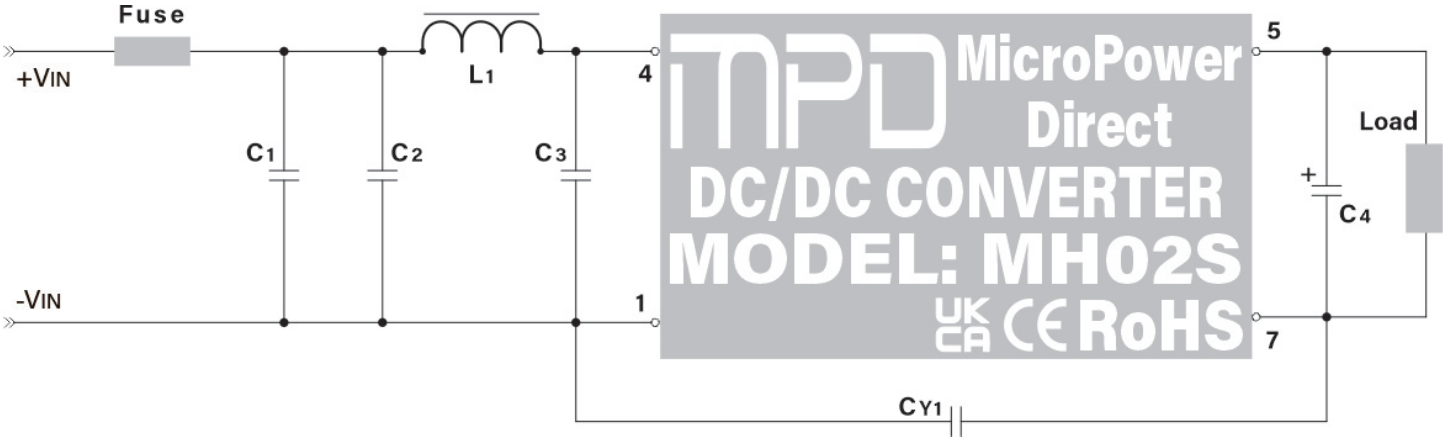
Typical Connection

The diagram above illustrates a typical connection of the **MH02S**. For applications that do not require the circuit to meet EMI/EMC specifications, the capacitors C1 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	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



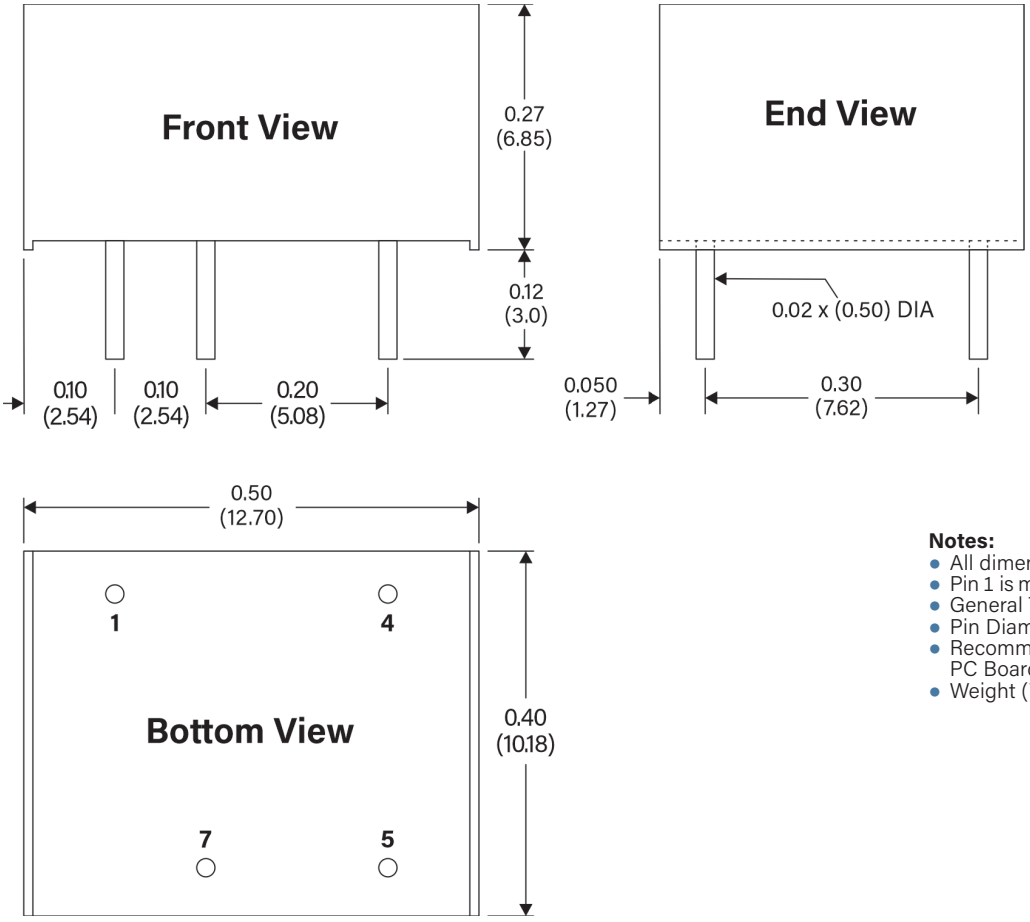
The diagram above illustrates a connection of the **MH02S** for an application that requires compliance to EMI/EMC standards EN 55032 and EN 61000-4 (as specified on page 1). Some notes on these components are:

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	C1	C2	L1	C3	CY1
3.3 VDC	Nippon Chemi-Con KY Series 470 µF/100V	MLCC 2.2 µF/100V	18 µH	Not Required	Not Required
5 VDC					
12 VDC					
15 VDC					
24 VDC				MLCC 2.2 µF/100V	MLCC 470 pF/3 kV

Mechanical Dimensions



Pin Connections

Pin	Description
1	-VIN
4	+VIN
5	+VOUT
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 Diameter = ±0.2 ±0.002 (±0.5 ±0.05)
- Recommended pin hole size (on the application PC Board) is Ø 0.039 (Ø1.00)
- Weight (Typ) = 0.063 Oz (1.8g)

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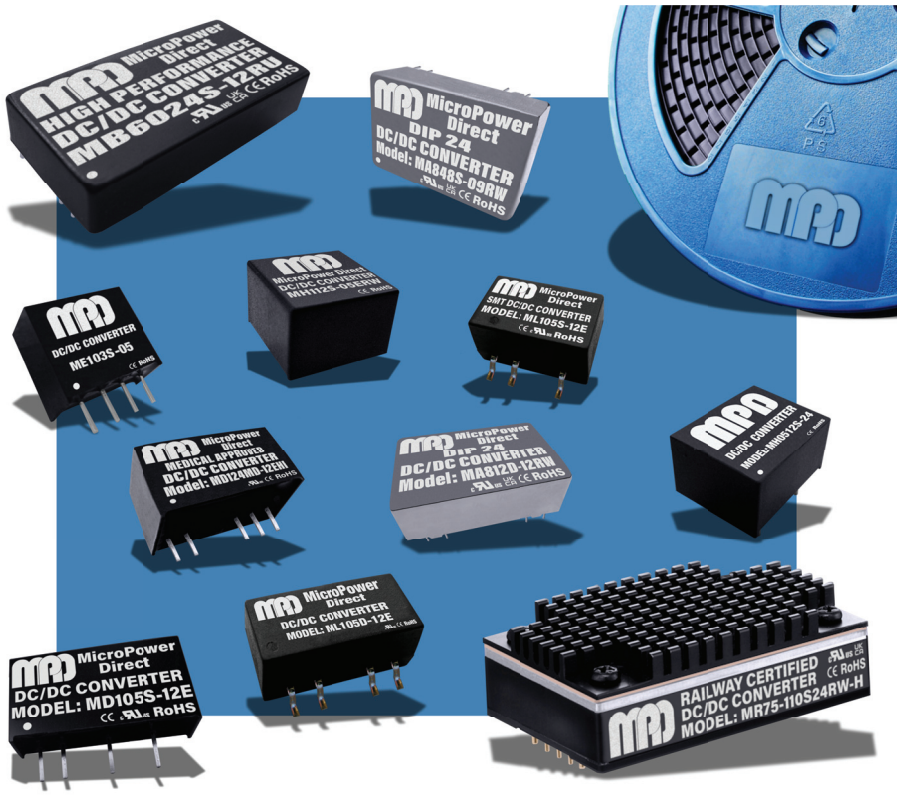

MicroPower Direct
46 Eastman Street, Unit 1, Easton, MA 02375 • TEL: (781) 344-8226 • E-Mail: sales@micropowerdirect.com