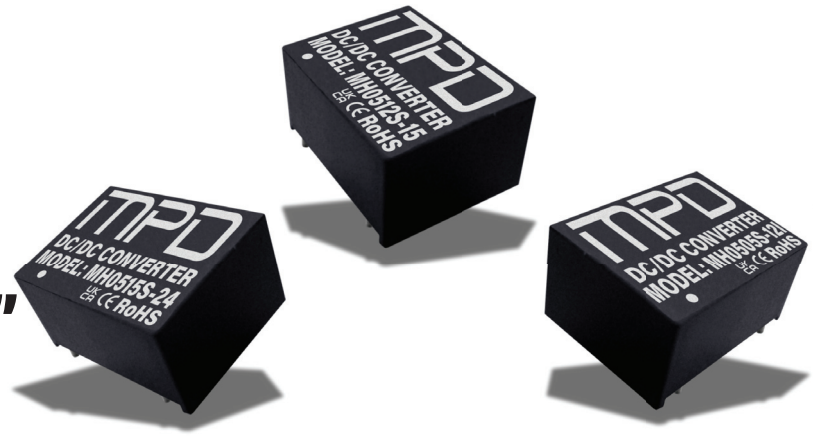
MH05S(I)

Low Cost, 0.50W Compact "Micro-DIP" DC/DC Converters



Key Features:

- 0.5W Output Power
- Compact Micro-DIP Case
- I/O Isolation to 3,000 VDC
- Efficiency To 80%
- 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

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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
Start Up Time	Nominal VIN, Constant Resistive Load		20		mS
Input Filter	Internal Capacitors				

Output

Parameter	Conditions	Min.	Typ.	Max.	Units
Output Voltage Accuracy			±3.0		%
Line Regulation, For VIN Change of 1%	MH0503S-03, MH0503S-05		±1.3		%
	All Other Models		±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, See Page 4

Environmental

Parameter	Conditions	Min.	Typ.	Max.	Units
Operating Temperature Range	Ambient	-40		+89	°C
	Case			+100	
Storage Temperature Range		-40		+125	°C
Cooling	Natural Convection	30		65	LFM
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			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.

Model Selection Guide

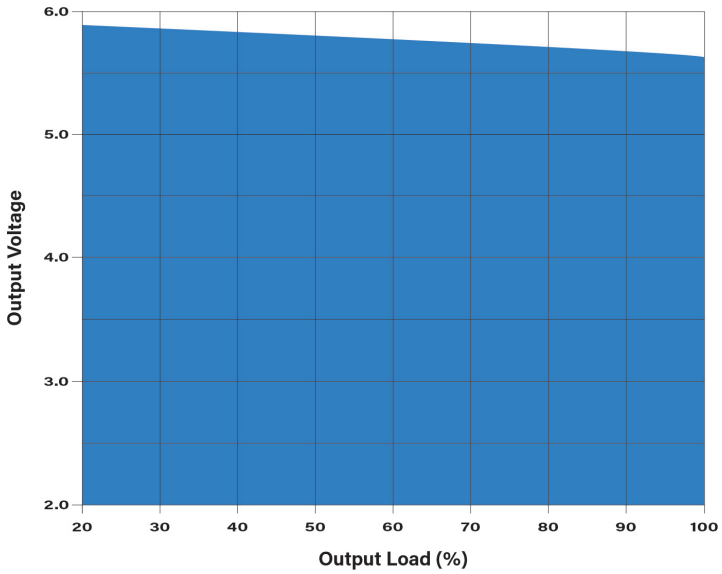
Model Number	Input				Output		Load Regulation (% Typ)	Efficiency (%, Typ)	Capacitive Load (µF, Max)	Fuse Rating Slow-Blow (mA)
	Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA, Max)				
	Nominal	Range	Full-Load	No-Load						
MH0503S-03(I)	3.3	2.97 - 3.63	205	20	3.3	152.0	±10	77	100	315
MH0503S-05(I)	3.3	2.97 - 3.63	216	30	5.0	100.0	±8.0	71	100	315
MH0503S-07(I)	3.3	2.97 - 3.63	216	25	7.2	69.00	±8.0	70	100	315
MH0503S-09(I)	3.3	2.97 - 3.63	216	40	9.0	56.00	±8.0	75	100	315
MH0503S-12(I)	3.3	2.97 - 3.63	201	30	12.0	42.00	±8.0	77	100	315
MH0503S-15(I)	3.3	2.97 - 3.63	208	32	15.0	33.00	±8.0	76	100	315
MH0503S-18(I)	3.3	2.97 - 3.63	208	25	18.0	28.00	±8.0	73	100	315
MH0503S-24(I)	3.3	2.97 - 3.63	208	38	24.0	21.00	±8.0	76	100	315
MH0505S-03(I)	5.0	4.5 - 5.5	132	16	3.3	151.5	±8.0	78	100	200
MH0505S-05(I)	5.0	4.5 - 5.5	124	15	5.0	100.0	±8.0	81	100	200
MH0505S-07(I)	5.0	4.5 - 5.5	134	18	7.2	69.44	±8.0	78	100	200
MH0505S-09(I)	5.0	4.5 - 5.5	128	15	9.0	55.55	±8.0	78	100	200
MH0505S-12(I)	5.0	4.5 - 5.5	127	18	12.0	41.67	±8.0	80	100	200
MH0505S-15(I)	5.0	4.5 - 5.5	130	22	15.0	33.33	±8.0	80	100	200
MH0505S-18(I)	5.0	4.5 - 5.5	127	23	18.0	27.77	±8.0	78	100	200
MH0505S-24(I)	5.0	4.5 - 5.5	134	25	24.0	20.83	±8.0	77	100	200
MH0512S-03(I)	12	10.8 - 13.2	58	15	3.3	151.5	±8.0	72	100	100
MH0512S-05(I)	12	10.8 - 13.2	54	10	5.0	100.0	±8.0	77	100	100
MH0512S-07(I)	12	10.8 - 13.2	57	15	7.2	69.44	±8.0	78	100	100
MH0512S-09(I)	12	10.8 - 13.2	58	15	9.0	55.56	±8.0	76	100	100
MH0512S-12(I)	12	10.8 - 13.2	58	20	12.0	41.67	±8.0	72	100	100
MH0512S-15(I)	12	10.8 - 13.2	61	20	15.0	33.33	±8.0	71	100	100
MH0512S-18(I)	12	10.8 - 13.2	61	20	18.0	27.77	±8.0	68	100	100
MH0512S-24(I)	12	10.8 - 13.2	59	18	24.0	20.83	±8.0	71	100	100
MH0515S-03(I)	15	13.5 - 16.5	44	10	3.3	151.5	±8.0	75	100	100
MH0515S-05(I)	15	13.5 - 16.5	43	8	5.0	100.0	±8.0	78	100	100
MH0515S-07(I)	15	13.5 - 16.5	44	12	7.2	69.44	±8.0	75	100	100
MH0515S-09(I)	15	13.5 - 16.5	44	12	9.0	55.55	±8.0	75	100	100
MH0515S-12(I)	15	13.5 - 16.5	44	15	12.0	41.67	±8.0	72	100	100
MH0515S-15(I)	15	13.5 - 16.5	48	15	15.0	33.33	±8.0	70	100	100
MH0515S-18(I)	15	13.5 - 16.5	51	12	18.0	27.77	±8.0	66	100	100
MH0515S-24(I)	15	13.5 - 16.5	51	15	24.0	20.83	±8.0	73	100	100
MH0524S-03(I)	24	21.6 - 26.4	31	10	3.3	151.5	±8.0	72	100	100
MH0524S-05(I)	24	21.6 - 26.4	29	10	5.0	100.0	±8.0	74	100	100
MH0524S-07(I)	24	21.6 - 26.4	31	10	7.2	69.44	±8.0	69	100	100
MH0524S-09(I)	24	21.6 - 26.4	30	8	9.0	55.55	±8.0	70	100	100
MH0524S-12(I)	24	21.6 - 26.4	31	8	12.0	41.67	±8.0	69	100	100
MH0524S-15(I)	24	21.6 - 26.4	31	10	15.0	33.33	±8.0	73	100	100
MH0524S-18(I)	24	21.6 - 26.4	29	8	18.0	27.77	±8.0	72	100	100
MH0524S-24(I)	24	21.6 - 26.4	29	10	24.0	20.83	±8.0	71	100	100

For the 3 kV isolation models, add suffix "I" to model number (i.e. **MH0512S-05I**)

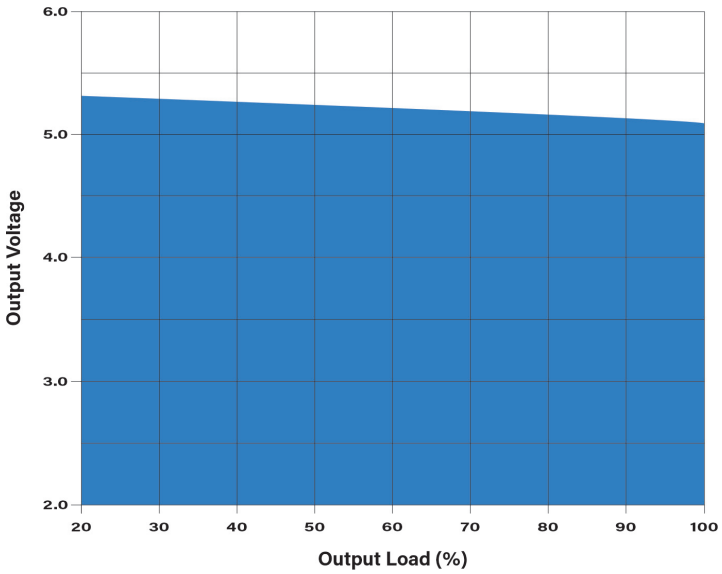
Notes:

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. 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.
5. 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.

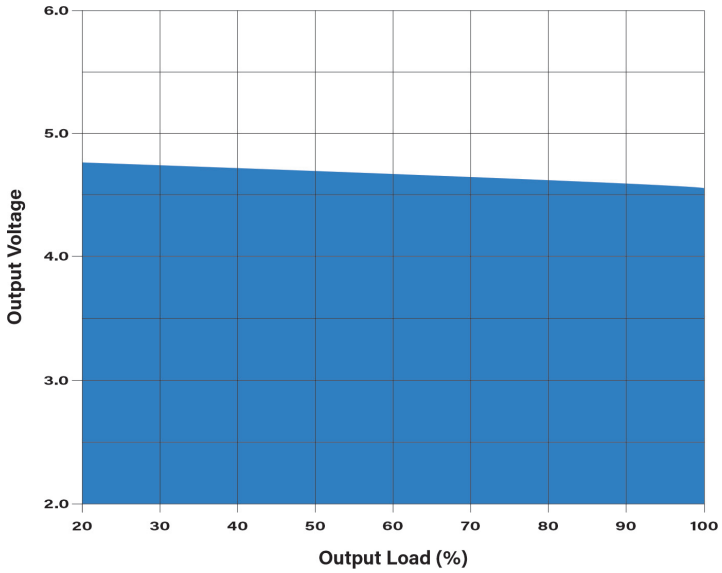
Output Load vs Output Voltage: MH0505, High Line



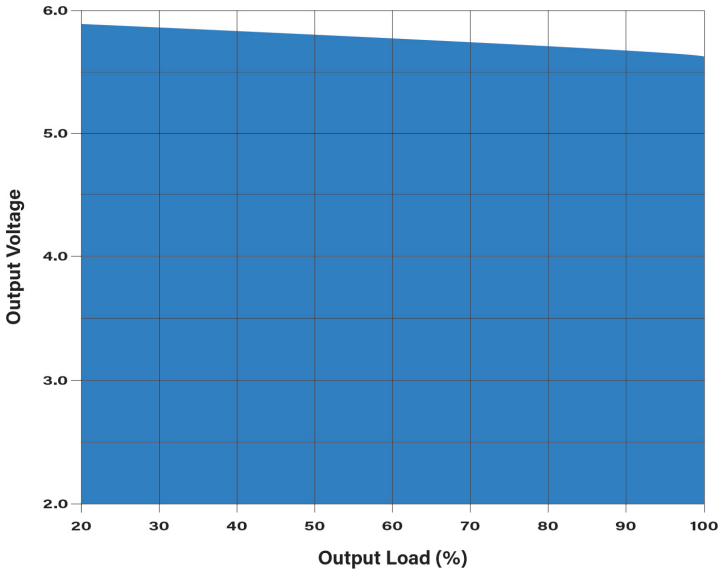
Output Load vs Output Voltage: MH0505, Nom Line



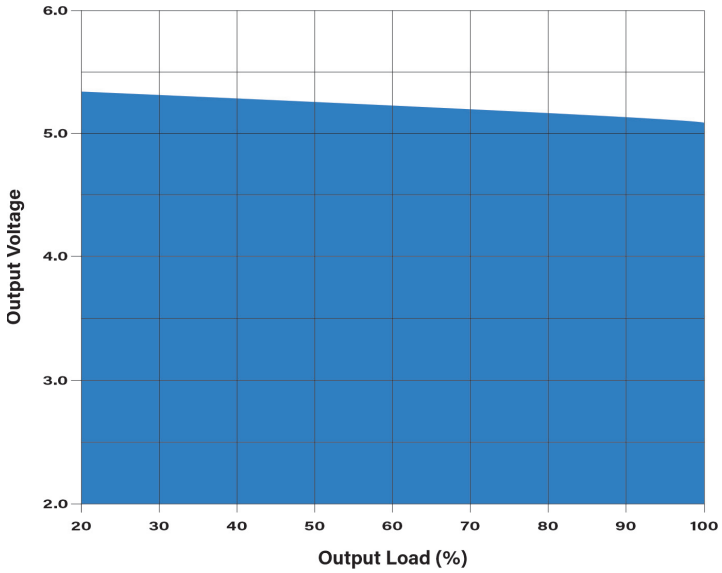
Output Load vs Output Voltage: MH0505, Low Line



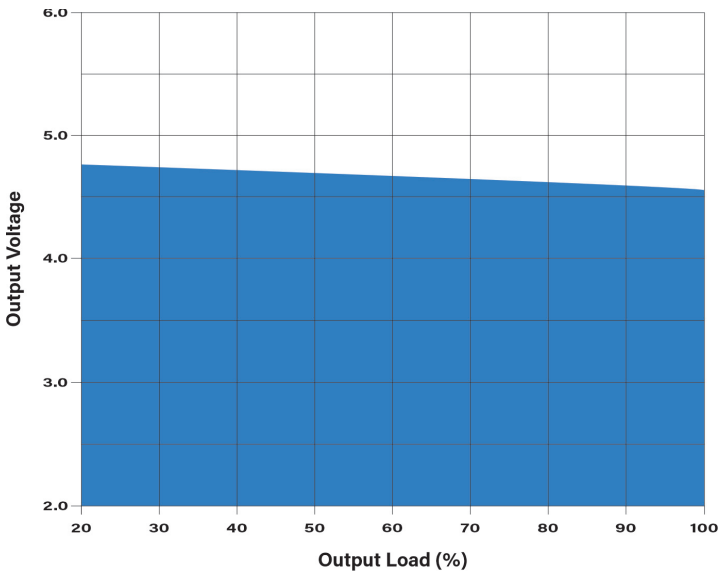
Output Load vs Output Voltage: MH0512, High Line



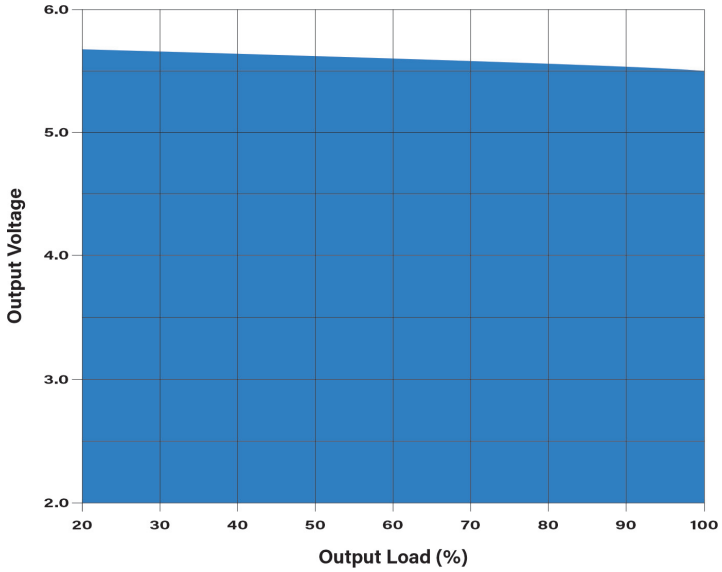
Output Load vs Output Voltage: MH0512, Nom Line



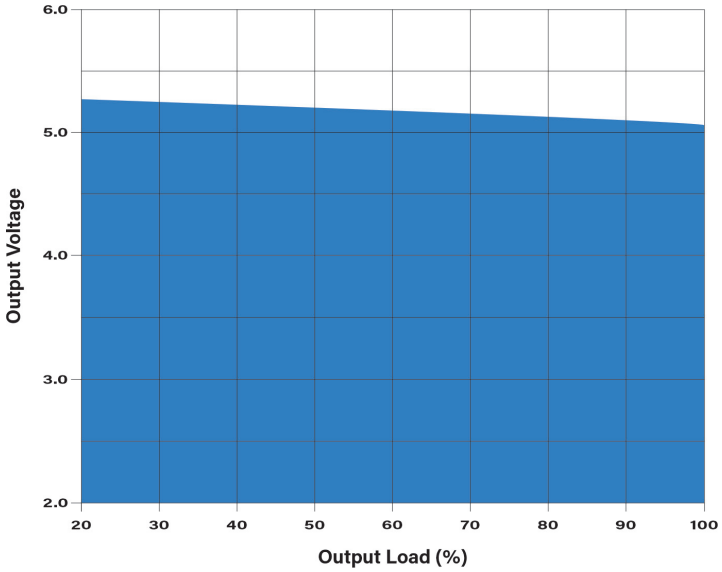
Output Load vs Output Voltage: MH0512, Low Line



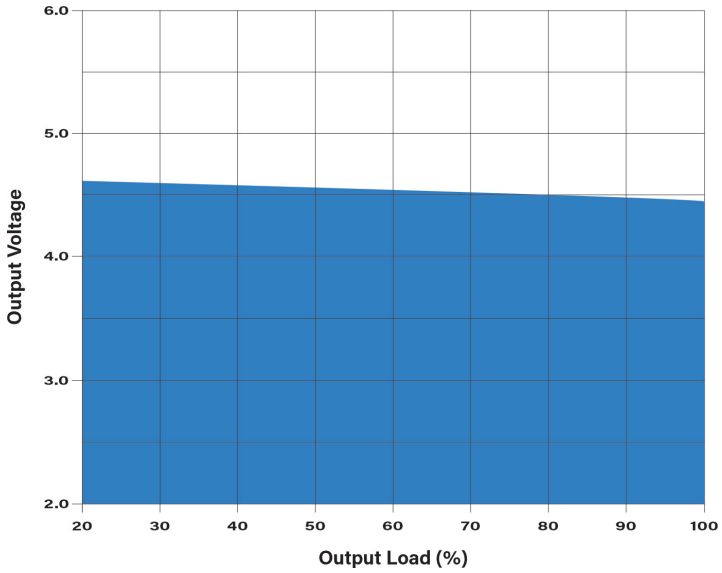
Output Load vs Output Voltage: MH0524, High Line



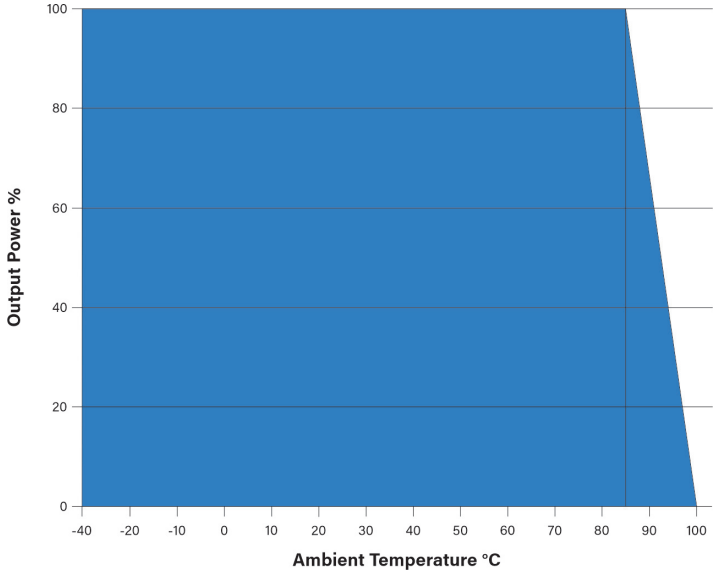
Output Load vs Output Voltage: MH0524, Nom Line



Output Load vs Output Voltage: MH0524, Low Line



Temperature Derating Curve



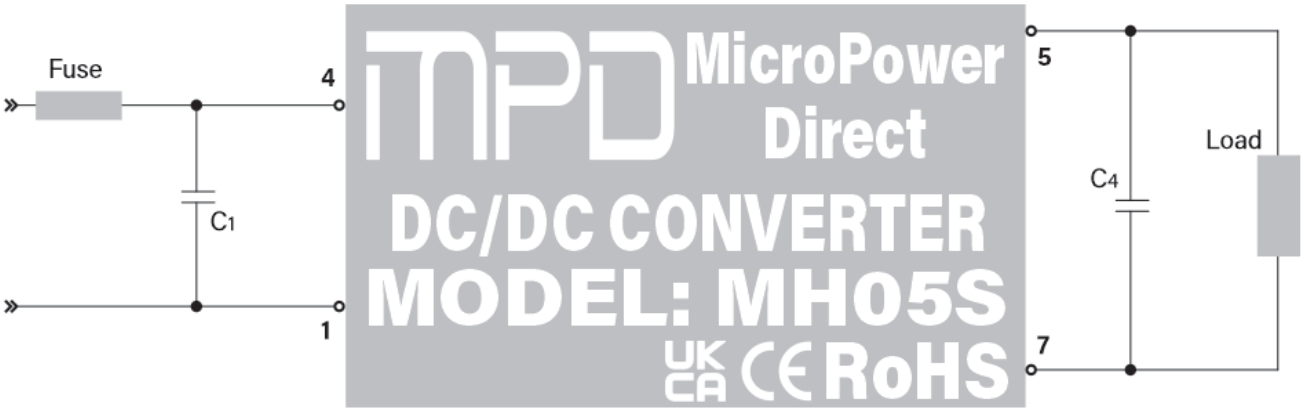
EMI/EMC Characteristics

Parameter		Standard	Criteria	Level
Radiated Emissions		EN 55032		Class B
Conducted Emissions	See Note 1	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 2	EN 61000-4-4	A	±2 kV
Surge	See Note 2	EN 61000-4-5	A	±0.5 kV
CS		EN 61000-4-6	A	10 Vrms
PFMF		EN 61000-4-8	A	1A/m

Notes:

1. 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.
2. To meet the specified EN 61000-4-4 and EN 61000-4-5 limits, an external input capacitor must be connected across the input pins of the unit. See page 5 for more information.

Typical Connection

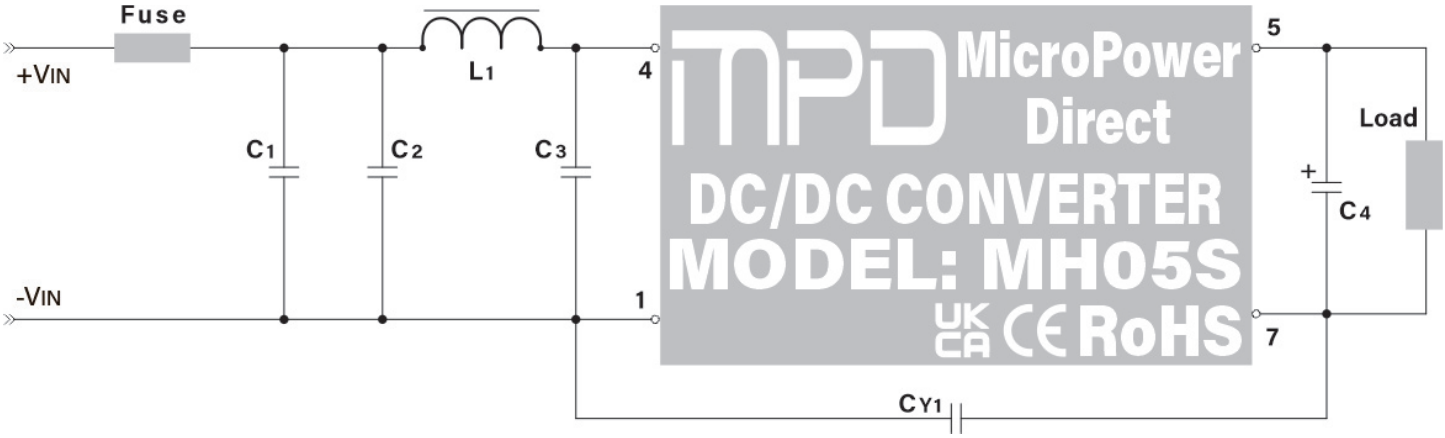


The diagram above illustrates a typical connection of the **MH05S**. For applications that do not require the circuit to meet EMI/EMC specifications, the capacitors C1 and C4 will reduce input/output ripple and improve the converter stability over time and temperature. The recommended component values 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



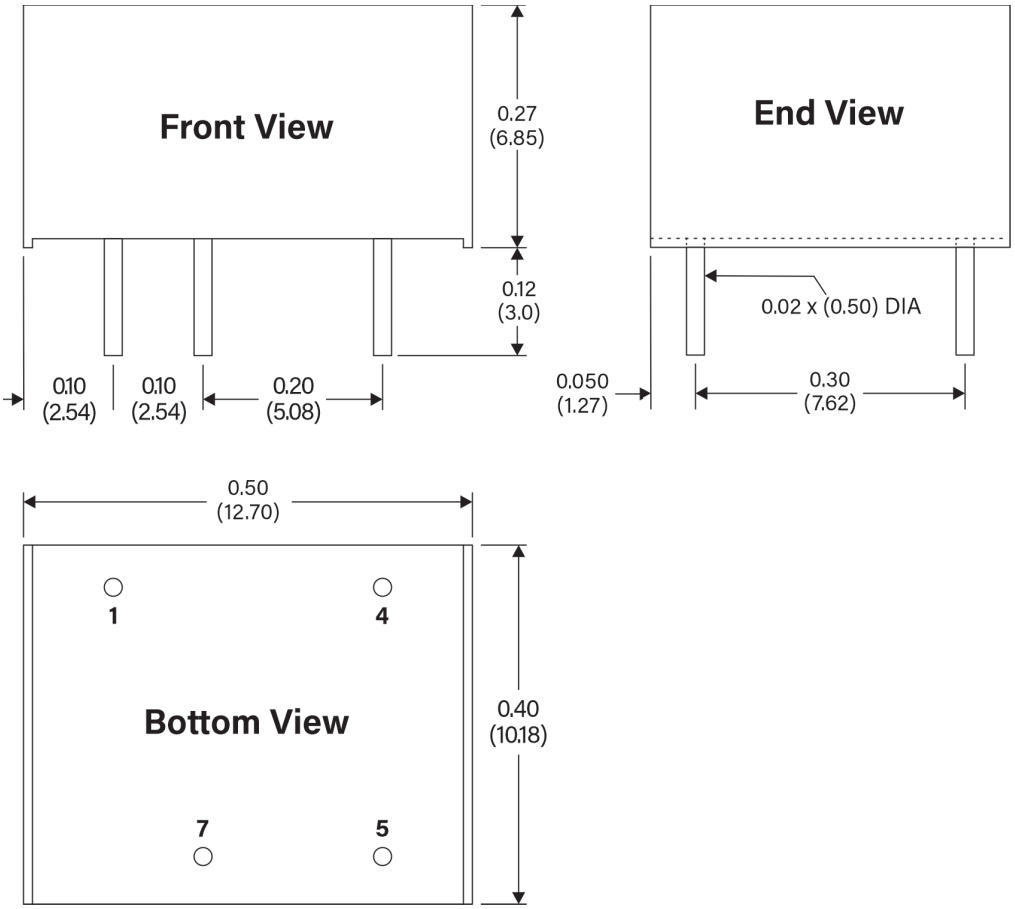
The diagram above illustrates a connection of the **MH05S** for an application that requires compliance to EMI/EMC standards EN 55032 and EN 61000-4 (as specified on page 4). Some notes on these components are:

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 input 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



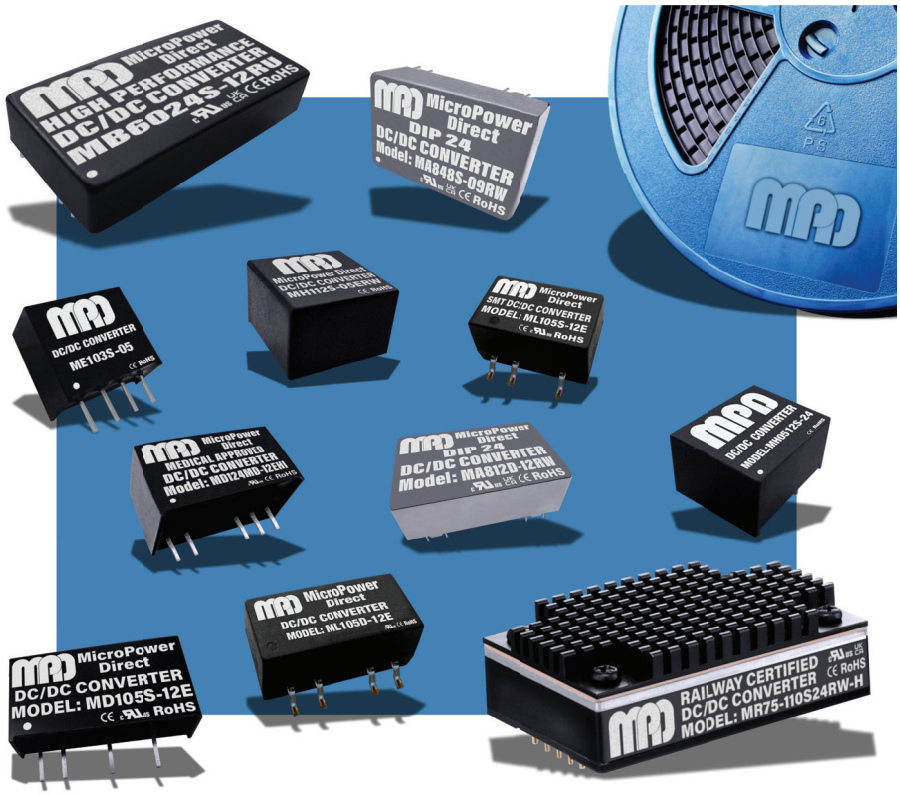
Pin Connections

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 Tolerance = ±0.002 (±0.05)
- Recommended pin hole size (on the application PC Board) is Ø 0.039 (Ø1.00)
- Weight (Typ) = 0.063 Oz (1.8g)

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 fully 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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