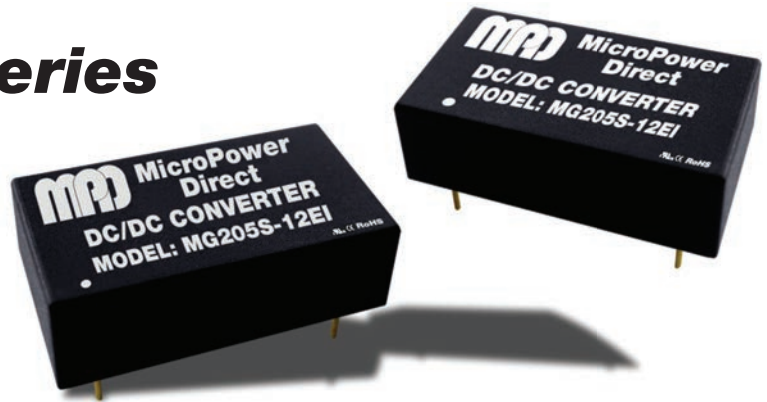


# MG200EI Series

## High Isolation, 2W Miniature DIP DC/DC Converters



### Key Features:

- 2W Output Power
- Miniature DIP Case
- EN 60950 Approved
- 3,000 VDC Isolation
- Single & Dual Outputs
- >3.5 MHour MTBF
- -40°C to +85°C Operation
- LOW COST

1.5 kV Isolation  
Models  
Available



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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	5 VDC Input	4.50	5.0	5.50	VDC		
	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 Filter	Internal Capacitor						
Output							
Parameter	Conditions	Min.	Typ.	Max.	Units		
Output Voltage Accuracy	See Tolerance Graph (Page 3)						
Line Regulation	For VIN Change of 1%			±1.2	%		
Load Regulation, See Note 3	See Model Selection Guide						
Ripple & Noise (20 MHz)	See Note 4		75	200	mV P - P		
Temperature Coefficient				±0.03	%/°C		
Output Short Circuit, See Note 5	5 VIN Units except ±12, ±15, & 24 Vout All Other Models	Continuous (Autorecovery) Momentary (1S)					
General							
Parameter	Conditions	Min.	Typ.	Max.	Units		
Isolation Voltage	60 Seconds	3,000			VDC		
Isolation Resistance	500 VDC	1,000			MΩ		
Isolation Capacitance, See Note 6	100 kHz, 1V		20		pF		
Switching Frequency			100		kHz		
EMI Characteristics							
Parameter	Standard	Criteria		Level			
Radiated Emissions, See Page 3	EN 55032			Class B			
Conducted Emissions, See Page 3	EN 55032			Class B			
ESD, Single Output Models	EN 61000-4-2	B	Contact ±8 kV				
ESD, Dual Output Models	EN 61000-4-2	B	Contact ±6 kV				
Environmental							
Parameter	Conditions	Min.	Typ.	Max.	Units		
Operating Temperature Range	Ambient	-40	+25	+85	°C		
Storage Temperature Range		-55		+125	°C		
Cooling	Free Air Convection						
Humidity	RH, Non-condensing			95	%		
Physical							
Case Size	See Mechanical Dimensions (Page 4)						
Case Material	Non-Conductive Black Plastic (UL-94V0)						
Weight	0.08 Oz (2.4g)						
Reliability Specifications							
Parameter	Conditions	Min.	Typ.	Max.	Units		
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	3.5			MHours		
Safety Standards	UL/cUL 60950-1 recognition (UL certificate)						
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			
	15 VDC Input			21.0			
	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			Load Regulation (% Typ)	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							
<b>UL</b>	MG205S-05EI	5	4.5 - 5.5	50	25	5.0	400	40.0	10.0	220	80	1,000
<b>UL</b>	MG205S-09EI	5	4.5 - 5.5	476	25	9.0	222	22.0	9.0	220	84	1,000
<b>UL</b>	MG205S-12EI	5	4.5 - 5.5	476	25	12.0	167	17.0	8.0	220	84	1,000
<b>UL</b>	MG205S-15EI	5	4.5 - 5.5	476	25	15.0	133	13.0	7.0	220	84	1,000
<b>UL</b>	MG205S-24EI	5	4.5 - 5.5	476	25	24.0	83	8.0	6.0	220	84	1,000
<b>UL</b>	MG205D-05EI	5	4.5 - 5.5	500	25	±5.0	±200	±20.0	10.0	100	80	1,000
<b>UL</b>	MG205D-09EI	5	4.5 - 5.5	476	25	±9.0	±111	±11.0	9.0	100	84	1,000
<b>UL</b>	MG205D-12EI	5	4.5 - 5.5	476	25	±12.0	±83	±8.0	8.0	100	84	1,000
<b>UL</b>	MG205D-15EI	5	4.5 - 5.5	476	25	±15.0	±67	±7.0	7.0	100	84	1,000
<b>UL</b>	MG212S-05EI	12	10.8 - 13.2	208	15	5.0	400	40.0	10.0	220	80	500
<b>UL</b>	MG212S-12EI	12	10.8 - 13.2	203	15	12.0	167	17.0	8.0	220	82	500
<b>UL</b>	MG212S-15EI	12	10.8 - 13.2	198	15	15.0	133	13.0	7.0	220	84	500
<b>UL</b>	MG212S-24EI	12	10.8 - 13.2	196	15	24.0	83	8.0	6.0	220	85	500
<b>UL</b>	MG212D-05EI	12	10.8 - 13.2	208	15	±5.0	±200	±20.0	10.0	100	80	500
<b>UL</b>	MG212D-12EI	12	10.8 - 13.2	201	15	±12.0	±83	±8.0	8.0	100	83	500
<b>UL</b>	MG212D-15EI	12	10.8 - 13.2	196	15	±15.0	±67	±7.0	7.0	100	85	500
<b>UL</b>	MG212D-24EI	12	10.8 - 13.2	196	15	±24.0	±42	±4.0	6.0	100	85	500
	MG215S-05EI	15	13.5 - 16.5	169	15	5.0	400	40.0	10.0	220	79	400
	MG215S-09EI	15	13.5 - 16.5	163	15	9.0	222	22.0	9.0	220	82	400
	MG215S-15EI	15	13.5 - 16.5	169	15	15.0	133	13.0	7.0	220	79	400
	MG215D-09EI	15	13.5 - 16.5	165	15	±9.0	±111	±11.0	9.0	100	81	400
	MG215D-15EI	15	13.5 - 16.5	165	15	±15.0	±67	±7.0	7.0	100	81	400
<b>UL</b>	MG224S-05EI	24	21.6 - 26.4	104	10	5.0	400	40.0	10.0	220	80	200
<b>UL</b>	MG224S-09EI	24	21.6 - 26.4	98	10	9.0	222	22.0	9.0	220	85	200
<b>UL</b>	MG224S-12EI	24	21.6 - 26.4	100	10	12.0	167	17.0	8.0	220	83	200
<b>UL</b>	MG224S-15EI	24	21.6 - 26.4	99	10	15.0	133	13.0	7.0	220	84	200
<b>UL</b>	MG224S-24EI	24	21.6 - 26.4	98	10	24.0	83	8.0	6.0	220	85	200
<b>UL</b>	MG224D-05EI	24	21.6 - 26.4	105	10	±5.0	±200	±20.0	10.0	100	79	200
<b>UL</b>	MG224D-12EI	24	21.6 - 26.4	100	10	±12.0	±83	±8.0	8.0	100	83	200
<b>UL</b>	MG224D-15EI	24	21.6 - 26.4	99	10	±15.0	±67	±7.0	7.0	100	84	200
<b>UL</b>	MG224D-24EI	24	21.6 - 26.4	99	10	±24.0	±42	±4.0	6.0	100	84	200

Notes:

1. Units that are marked with the "UL" in the model selection table above are approved to EN 60950.
2. Output capacitive load is specified for each output.
3. Output load regulation is specified for a load change of 10% to 100%.
4. When measuring output ripple, it is recommended that an external 1 µF ceramic capacitor & 10 µF electrolytic capacitor be placed in parallel from the +Vout pin to the -Vout pin for single output models, or from each output to common for dual output models.
5. Units with limited short circuit protection must be restarted after a fault.
6. The 24 Vin models have a typical isolation capacitance of 50 pF.
7. Operation at no load will not damage these units, however, they may not meet all specifications.
8. 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.

This series is also available with an I/O isolation of 1.5 kV. See the MG200E series.

For comparable performance in a miniature SIP package, see the MD200EI series. A SIP product with 1.5 kV I/O isolation is also available. The MD200E series.

## Simple Connection

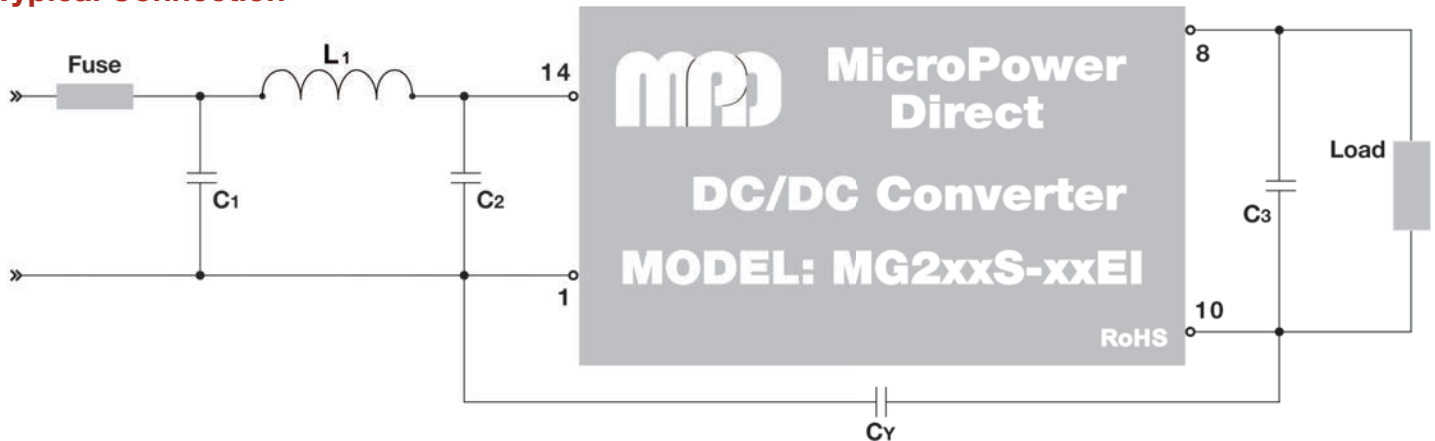


V <sub>IN</sub>	C1
5 VDC	4.7 $\mu$ F/50V
12 VDC	2.2 $\mu$ F/50V
15 VDC	2.2 $\mu$ F/50V
24 VDC	1.0 $\mu$ F/50V

V <sub>OUT</sub>	C3/C4
5 VDC	10 $\mu$ F
9 VDC	4.7 $\mu$ F
12 VDC	2.2 $\mu$ F
15 VDC	1.0 $\mu$ F
24 VDC	0.47 $\mu$ F
$\pm$ 5 VDC	4.7 $\mu$ F
$\pm$ 9 VDC	2.2 $\mu$ F
$\pm$ 12 VDC	1.0 $\mu$ F
$\pm$ 15 VDC	0.47 $\mu$ F
$\pm$ 24 VDC	0.47 $\mu$ F

The diagram above illustrates a simple connection of the MG200xEI series. 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.

## Typical Connection



The diagram above illustrates a typical connection of the MG200xEI series 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 of a fault on the input line. A recommended value is given in model selection table on page 2.
2. The output filtering capacitor (C3) is a high frequency, low resistance electrolytic capacitor. Care must be taken in choosing this capacitor not to exceed the capacitive load specification

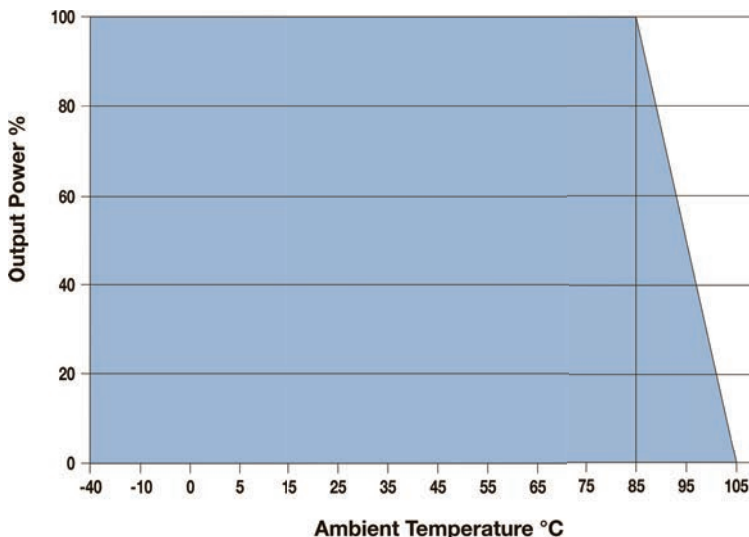
for the unit. Voltage derating of capacitors should be 80% or above.

3. Suggested component values are:

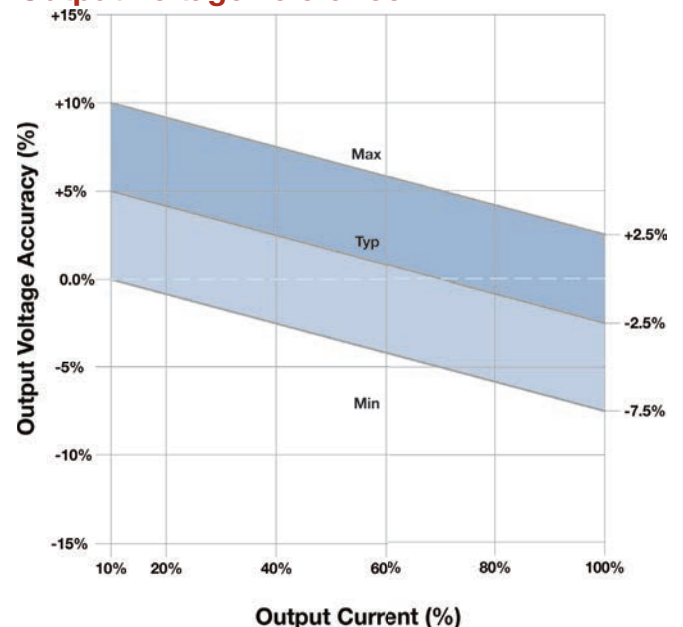
Component	V <sub>IN</sub> : 5V, 12V, 15V	V <sub>IN</sub> : 24V
C1	4.7 $\mu$ F/50V	4.7 $\mu$ F/50V
C2	4.7 $\mu$ F/50V	4.7 $\mu$ F/50V
L1	6.8 $\mu$ H	6.8 $\mu$ H
C3	See C3/C4 in Table Above	
C4	---	1 nF/3 kV

4. In many applications, simply adding input/output capacitors will enhance the input surge protection & and reduce output ripple sufficiently. In this case, capacitors C1, C3 and C4 could be connected as shown in the simple connection above, without the other filter components. Recommended capacitor values are given in the table above.

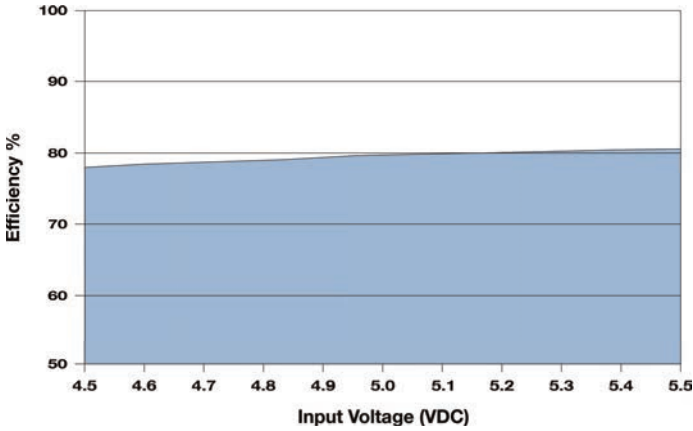
## Derating Curve



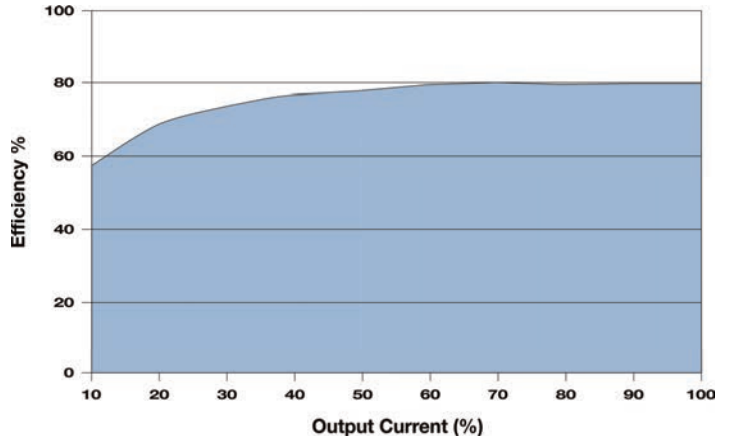
## Output Voltage Tolerance



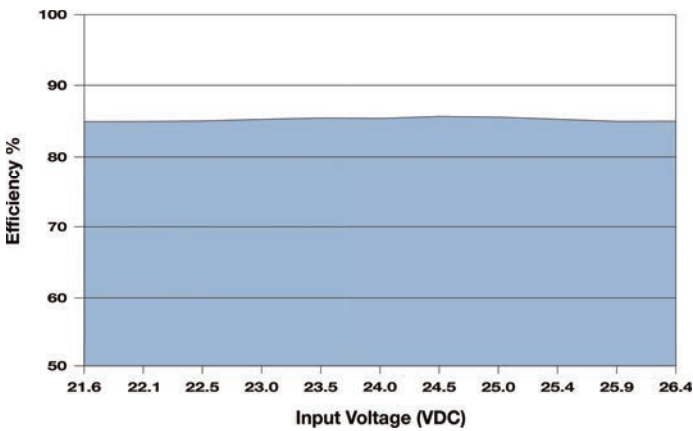
Efficiency vs Input Voltage (5VIN, Full Load)



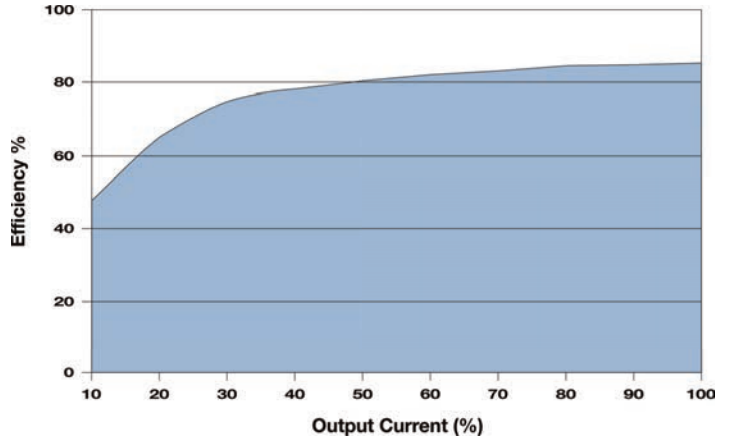
Efficiency vs Output Power (VIN = 5 VDC)



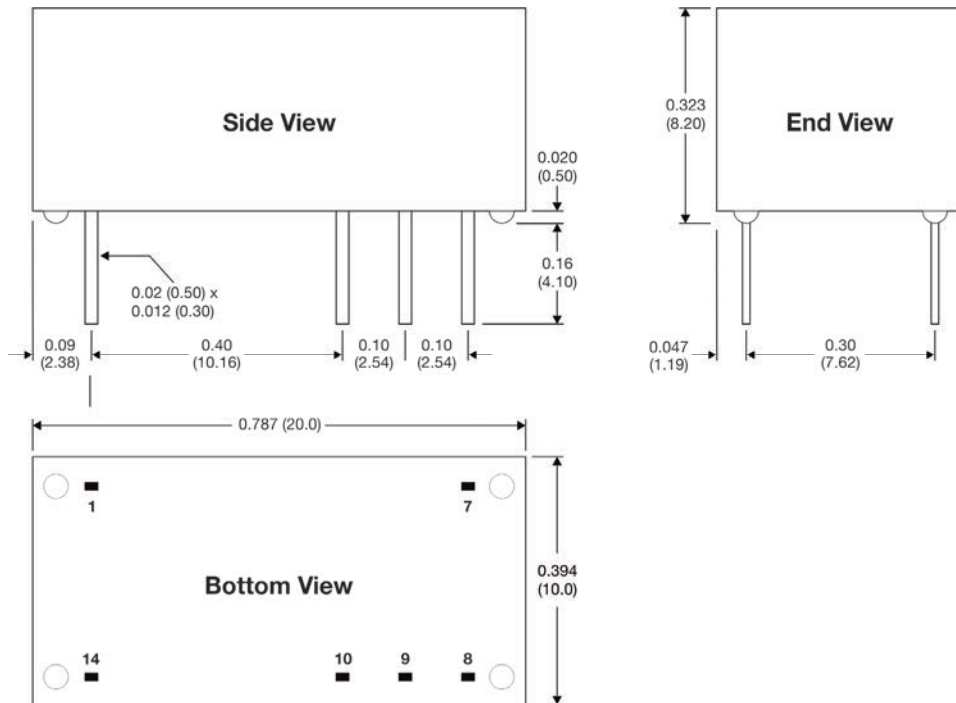
Efficiency vs Input Voltage (24VIN, Full Load)



Efficiency vs Output Power (VIN = 24 VDC)



Mechanical Dimensions



Pin Connections

Pin	Single	Dual
1	-VIN	-VIN
7	NC	NC
8	+VOUT	+VOUT
9	No Pin	Common
10	-VOUT	-VOUT
14	+VIN	+VIN

NC: No Connection

Notes:

- All dimensions are typical in inches (mm)
- Tolerance x.xx = ±0.02 (±0.50)
- Pin 1 is marked by a "dot" or indentation on the unit