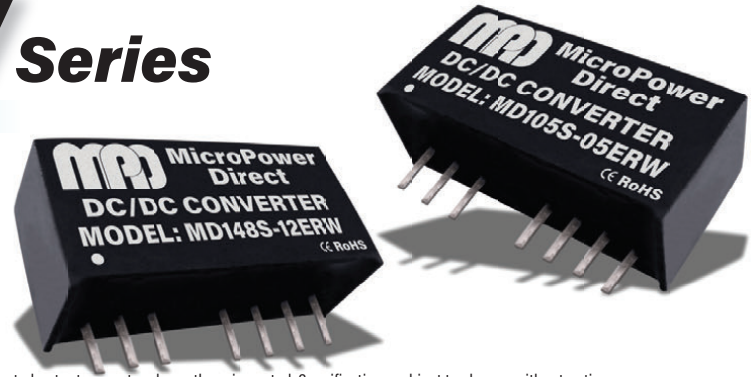


# MD300ERW Series

## 2:1 Input, 3W SIP, Single & Dual Output DC/DC Converters



### Key Features:

- 3W Output Power
- 2:1 Input Voltage Range
- Tight Line/Load Regulation
- Short Circuit Protected
- 1,500 VDC Isolation
- 29 Standard Models
- Miniature SIP Case
- -40°C to +85°C Operation
- Industry Standard Pin-Out
- Low Cost



### MicroPower Direct

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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 Start Voltage	5 VDC Input			4.5	VDC	
	12 VDC Input			9.0		
	24 VDC Input			18.0		
	48 VDC Input			36.0		
Reflected Ripple Current	5 VDC Input		20		mA	
	12 VDC Input		20			
	24 VDC Input		55			
	48 VDC Input		55			
Input Filter	Capacitor Filter					

Output						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Output Voltage Accuracy, See Note 1			±1.0	±3.0	%	
No Load Output Voltage Accuracy	See Note 2		±1.5	±5.0	%	
Line Regulation	Full Load, V <sub>IN</sub> = Min to Max		±0.2	±0.5	%	
Load Regulation	I <sub>OUT</sub> = 5% to 100%		±0.6	±1.0	%	
Ripple & Noise, See Note 3	See Model Selection Guide (Page 2)					
Transient Recovery Time, See Note 4	25% Load Step Change		0.5	3.0	mSec	
Transient Response Deviation			±2.5	±5.0	%	
Temperature Coefficient			±0.02	±0.03	%/°C	
Output Short Circuit	Continuous (Autorecovery)					

General						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Isolation Voltage	See Note 5	1,500			VDC	
Isolation Resistance	500 VDC	1,000			MΩ	
Isolation Capacitance	100 kHz/0.1V		120		pF	
Switching Frequency			250		kHz	

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 Drawing (Page 5)					
Case Material	Non-Conductive Black Plastic (UL94-V0)					
Weight	See Mechanical Drawing (Page 5)					

Reliability Specifications						
Parameter	Conditions	Min.	Typ.	Max.	Units	
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	1.0			MHours	

Absolute Maximum Ratings						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Input Voltage Surge (1 Sec)	5 VDC Input			12	VDC	
	12 VDC Input			25		
	24 VDC Input			50		
	48 VDC Input			100		
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.

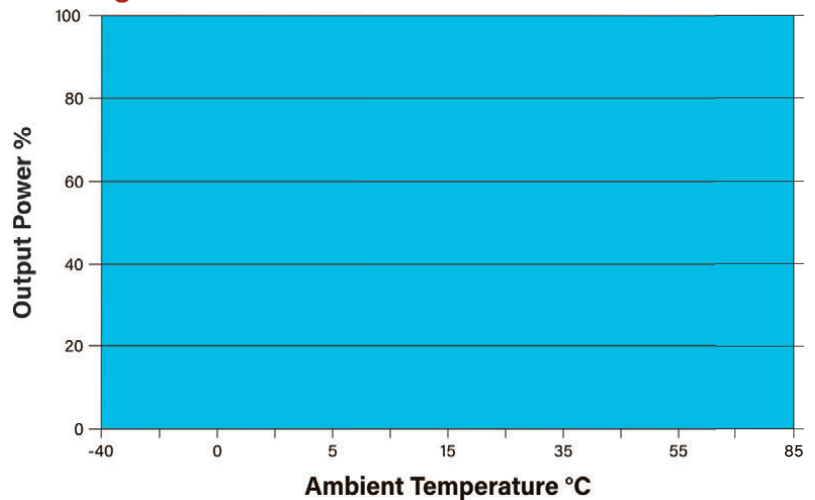
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Model Number	Input				Output			Ripple & Noise		Efficiency (% Typ)	Capacitive Load (µF, Max)	Fuse Rating Slow-Blow (mA)
	Voltage (VDC)		Current (mA, Typ)		Voltage (VDC)	Current (mA, Max)	Current (mA, Min)	(mV Pk-Pk)				
	Nominal	Range	Full-Load	No-Load				Typ	Max			
MD305S-03ERW	5	4.5 - 9.0	735	40	3.3	758	38.0	40	75	68	1,800	600
MD305S-05ERW	5	4.5 - 9.0	805	40	5.0	500	25.0	40	75	73	2,200	600
MD305S-09ERW	5	4.5 - 9.0	805	40	12.0	278	14.0	40	75	74	1,000	600
MD305S-12ERW	5	4.5 - 9.0	805	40	12.0	208	10.0	40	75	77	680	600
MD305S-15ERW	5	4.5 - 9.0	805	40	15.0	167	8.0	40	75	74	470	600
MD305S-24ERW	5	4.5 - 9.0	805	40	24.0	104	5.0	40	75	76	330	600
MD305D-05ERW	5	4.5 - 9.0	805	40	±5.0	±250	±13.0	40	75	74	1,000	600
MD305D-12ERW	5	4.5 - 9.0	805	40	±12.0	±104	±5.0	40	75	77	470	600
MD305D-15ERW	5	4.5 - 9.0	805	40	±15.0	±83	±4.0	40	75	77	330	600
MD305D-24ERW	5	4.5 - 9.0	805	40	±24.0	±52	±3.0	40	75	76	220	600
MD312S-03ERW	12	9.0 - 18.0	278	30	3.3	758	38.0	40	75	75	2,700	220
MD312S-05ERW	12	9.0 - 18.0	314	30	5.0	600	30.0	40	75	76	2,200	220
MD312S-09ERW	12	9.0 - 18.0	314	30	9.0	333	17.0	40	75	79	1,000	220
MD312S-12ERW	12	9.0 - 18.0	314	30	12.0	250	13.0	70	100	82	680	220
MD312S-15ERW	12	9.0 - 18.0	314	30	15.0	200	10.0	70	100	83	470	220
MD312S-24ERW	12	9.0 - 18.0	314	30	24.0	125	6.0	100	150	81	330	220
MD312D-05ERW	12	9.0 - 18.0	314	30	±5.0	±300	±15.0	40	75	78	1,000	220
MD312D-09ERW	12	9.0 - 18.0	314	30	±9.0	±167	±8.0	40	75	78	680	110
MD312D-12ERW	12	9.0 - 18.0	314	30	±12.0	±125	±6.0	40	75	79	470	220
MD312D-15ERW	12	9.0 - 18.0	314	30	±15.0	±100	±5.0	40	75	80	330	220
MD324S-03ERW	24	18.0 - 36.0	140	24	3.3	758	38.0	40	75	74	2,700	110
MD324S-05ERW	24	18.0 - 36.0	154	24	5.0	600	30.0	40	75	81	2,200	110
MD324S-09ERW	24	18.0 - 36.0	154	24	9.0	333	17.0	40	75	83	1,000	
MD324S-12ERW	24	18.0 - 36.0	154	24	12.0	250	13.0	40	75	83	680	110
MD324S-15ERW	24	18.0 - 36.0	154	24	15.0	200	10.0	100	150	83	470	110
MD324S-24ERW	24	18.0 - 36.0	154	24	24.0	125	6.0	100	150	83	330	110
MD324D-05ERW	24	18.0 - 36.0	154	24	±5.0	±300	±15.0	40	75	79	1,000	110
MD324D-09ERW	24	18.0 - 36.0	154	24	±9.0	±167	±8.0	40	75	81	680	110
MD324D-12ERW	24	18.0 - 36.0	154	24	±12.0	±125	±6.0	40	75	83	470	110
MD324D-15ERW	24	18.0 - 36.0	154	24	±15.0	±100	±5.0	40	75	83	330	110
MD348S-03ERW	48	36.0 - 75.0	69	5.0	3.3	758	38.0	100	150	75	2,700	75
MD348S-05ERW	48	36.0 - 75.0	78	5.0	5.0	600	30.0	40	75	76	2,200	75
MD348S-12ERW	48	36.0 - 75.0	78	5.0	12.0	250	13.0	40	75	80	680	75
MD348S-15ERW	48	36.0 - 75.0	78	5.0	15.0	200	10.0	40	75	84	470	75
MD348S-24ERW	48	36.0 - 75.0	78	5.0	24.0	125	6.0	70	100	82	330	75
MD348D-05ERW	48	36.0 - 75.0	78	5.0	±5.0	±300	±15.0	70	100	79	1,000	75
MD348D-12ERW	48	36.0 - 75.0	78	5.0	±12.0	±125	±6.0	40	75	82	470	75
MD348D-15ERW	48	36.0 - 75.0	78	5.0	±15.0	±100	±5.0	40	75	82	330	75

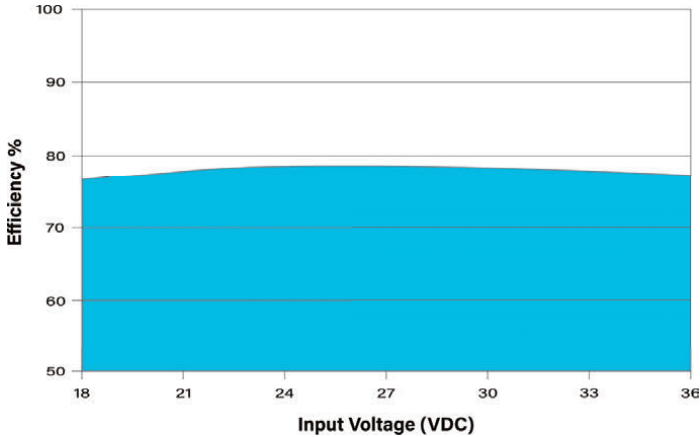
Notes:

- Output voltage accuracy is specified over a load range of 5% to 100%.
- No load output voltage accuracy is specified over the product input voltage range. For the MD312S-03ERW & MD348S-03ERW, output accuracy is ± 5% typ and ± 8% Max.
- When measuring output ripple & noise, it is recommended that an external capacitor (100 µF typ.) be placed from the +Vout to the -Vout pins for single output units and from each output to common for dual output models.
- Transient recovery is measured to within a 1% error band for a load step change of 25%.
- Isolation voltage is specified for a period 60S with a leakage current lower than 1 mA.
- Operation at no-load will not damage the unit, but they may not meet all specifications.
- If the module is powered by an unregulated power source, care must be taken to insure that peak input current requirements of the unit are met to insure proper start up. These are:  
 5VIN - 445 mA  
 12 VIN - 205 mA  
 24 VIN - 104 mA  
 48 VIN - 53 mA  
 Contact the factory for more information.
- 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.

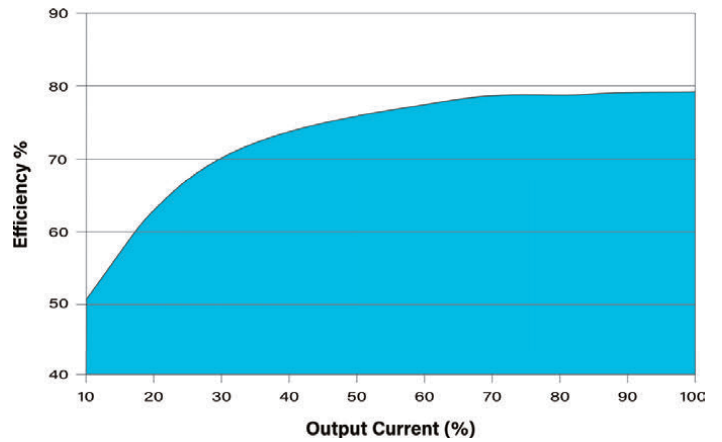
Derating Curve



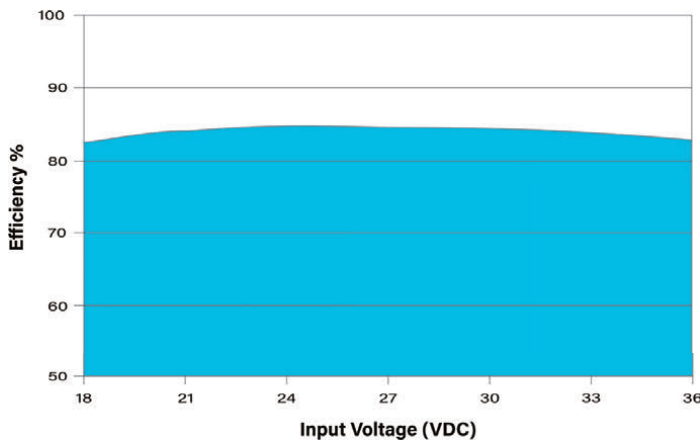
**Efficiency vs Input Voltage: Single Output, 24 VIN**



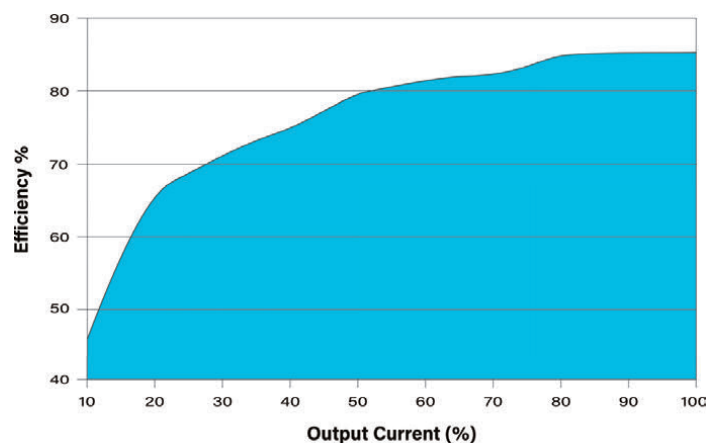
**Efficiency vs Output Load: Single Output, 24 VIN**



**Efficiency vs Input Voltage: Dual Output, 24 VIN**



**Efficiency vs Output Load: Dual Output, 24 VIN**



**Simple Connection: Single Output**



Recommended values for components are:

Component	5 & 12 VIN	24 & 48 VIN
C1	100 $\mu$ F	10 $\mu$ F
L1	4.7 $\mu$ H - 12 $\mu$ H	
C2	47 $\mu$ F	1.0 $\mu$ F
Cs	10 $\mu$ F - 22 $\mu$ F	
C3	100 $\mu$ F (Typ)	

The diagram above illustrates a simple connection of the MD300SERW. For applications that do not require the circuit to meet EMI/EMC specifications, the input Pi filter and output capacitor (C3) will reduce input/output ripple and improve the converter stability over time and temperature. If further reduction of output ripple is required, capacitor Cs may be added. The recommended component values are given in the table at right.

**Efficiency vs Input Voltage: Dual Output**



Recommended values for components are:

Component	5 & 12 VIN	24 & 48 VIN
C1	100 $\mu$ F	10 $\mu$ F
L1	4.7 $\mu$ H - 12 $\mu$ H	
C2	47 $\mu$ F	1.0 $\mu$ F
LOUT	2.2 $\mu$ F - 10 $\mu$ F	
C3	100 $\mu$ F (Typ)	
C4	100 $\mu$ F (Typ)	

The diagram above illustrates a simple connection of the MD300DERW. For applications that do not require the circuit to meet EMI/EMC specifications, the input Pi filter and output LC filters 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.

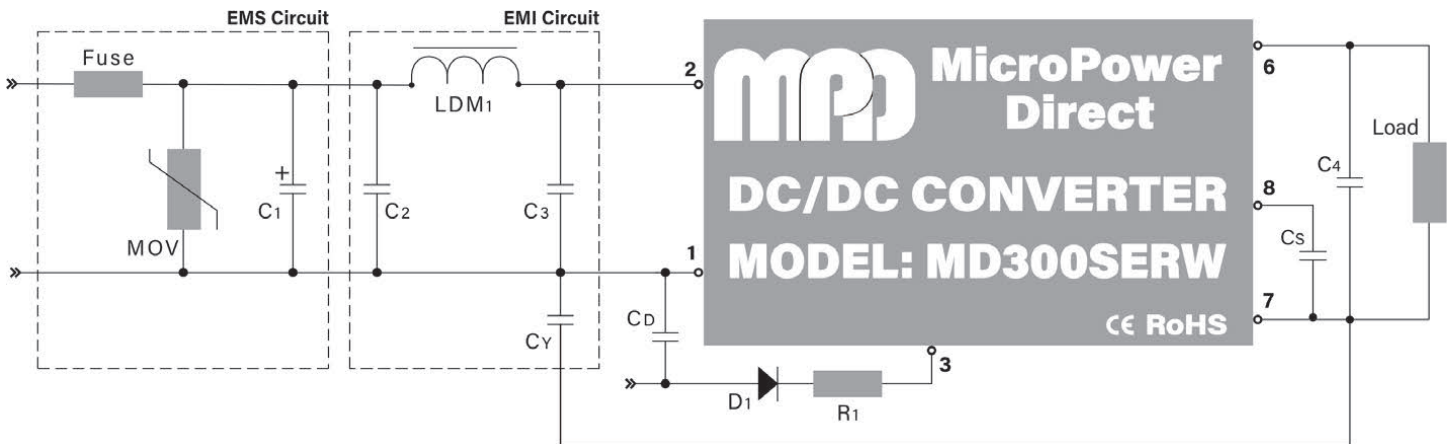
## EMI Characteristics

Parameter	Standard	Criteria	Level	
Radiated Emissions	CISPR 32/EN 55032		Class B (See Typical Connection Below)	
Conducted Emissions	CISPR 32/EN 55032		Class B (See Typical Connection Below)	
ESD	EN 61000-4-2	B	±4 kV Contact	
RS	EN 61000-4-3	A	10V/m	
EFT	See Note 2	EN 61000-4-4	B	±2 kV
Surge	See Note 3	EN 61000-4-5	B	±2 kV L-L
CS		EN 61000-4-6	A	3 Vrms
Voltage Dips		EN 61000-4-29	B	0% - 70%

### Notes:

1. If the application does not require that emissions meet international standards, simply adding capacitors to the input and output circuits may be sufficient to reduce ripple & noise. See the Simple Connection diagram and notes on page 3.
2. To meet the requirements of EN 61000-4-4, external components are needed. The Typical Connection diagram below shows an external input filter that would typically achieve this. Contact the factory for more information.
3. To meet the requirements of EN 61000-4-5, external components are needed. This can be done as shown in the Typical Connection diagram below. Contact the factory for more information.

## Typical Connection



For applications that require meeting EMC standards, the diagram above illustrates a typical connection of the MD300xERW series. The units do not require external components to operate as specified. Some notes on this diagram (starting with the input circuit) are:

1. An external fuse should be used in all power module applications. The recommended fuse is shown in the model chart on page 2.
2. To protect against a surge, an external MOV is recommended on the input. A suggested value is given in the table at right.
4. The capacitor CS is required to meet all specifications on single output units.
5. 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.
6. In many applications simply adding input/output capacitors will enhance the input surge protection and reduce output ripple sufficiently. The value of the input capacitor can range from 10 µF to 100 µF, depending on the needs of the application. The output capacitor would typically be 100 µF. See the "Simple Connections" on page 3.
7. The capacitor CS provides additional output filtering. If used, a value of 10 µF to 20 µF is recommended. This capacitor is not required for specified operation. See the "Simple Connections" on page 3.

6. Recommended values for components are:

Component	5 VIN	12 VIN	24 VIN	48 VIN
MOV	---	S14K20	S14K30	S14K60
C1	680 µF/25V	680 µF/25V	330 µF/50V	330 µF/100V
C2	4.7 µF/50V	4.7 µF/50V	4.7 µF/50V	4.7 µF/100V
LDM1	12 µH	12 µH	12 µH	12 µH
C3	4.7 µF/50V	4.7 µF/50V	4.7 µF/50V	4.7 µF/100V
CY	1nF/2 kV	1nF/2 kV	1nF/2 kV	1nF/2 kV
CS	10 µF - 22 µF			
C4	100 µF	100 µF	100 µF	100 µF

## Remote ON/OFF Control

The MD300ERW may be started or shutdown by the control pin input (pin 3). This input is current controlled. The unit operates when pin 3 is left open. When the input is "high" (current flowing into the pin), the converter shuts down. If used, the input current to this pin should be kept between 5 mA to 10 mA. Exceeding 20 mA on this input or connecting it directly to ground could damage the converter.

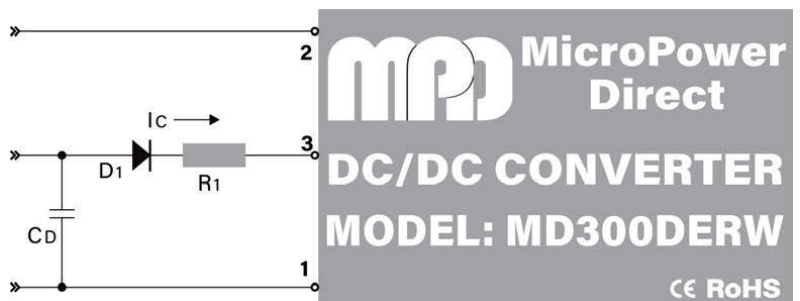
The diagram at right gives a suggested input circuit for the control pin. The diode (D1) is an RB160M-60/1A and CD is a 47 nF/100V. The resistor R1 is determined by the formula:

$$R = [(VC - VD - 1.0) / IC] - 300$$

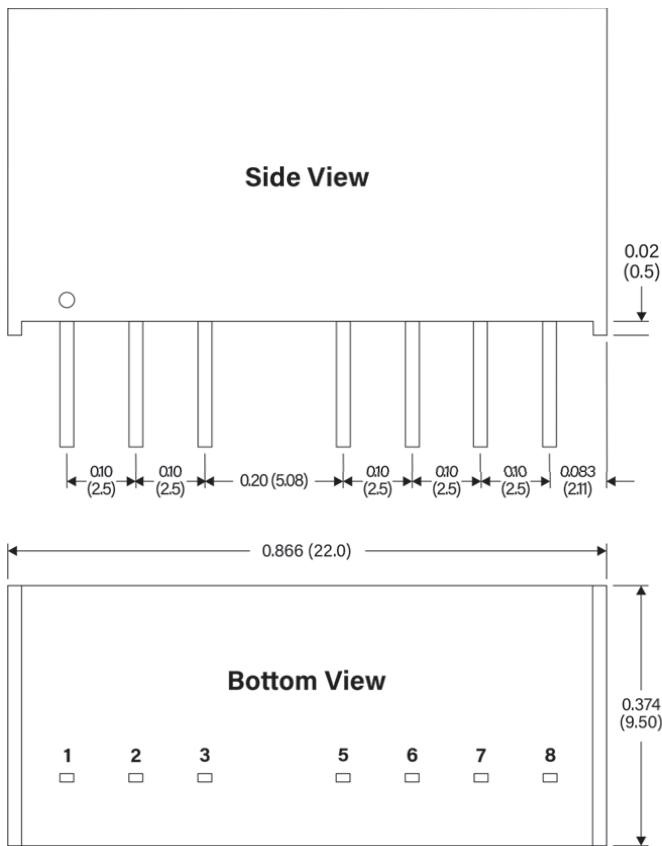
Where: VC = voltage to ground from pin 3

VD = the forward conduction voltage drop of D1

IC = the control pin current (5 - 10 mA)



## Mechanical Dimensions



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## Pin Connections

Pin	Single Output
1	-VIN
2	+VIN
3	Remote On/Off
5	No Connection
6	+VOUT
7	-VOUT
8	CS

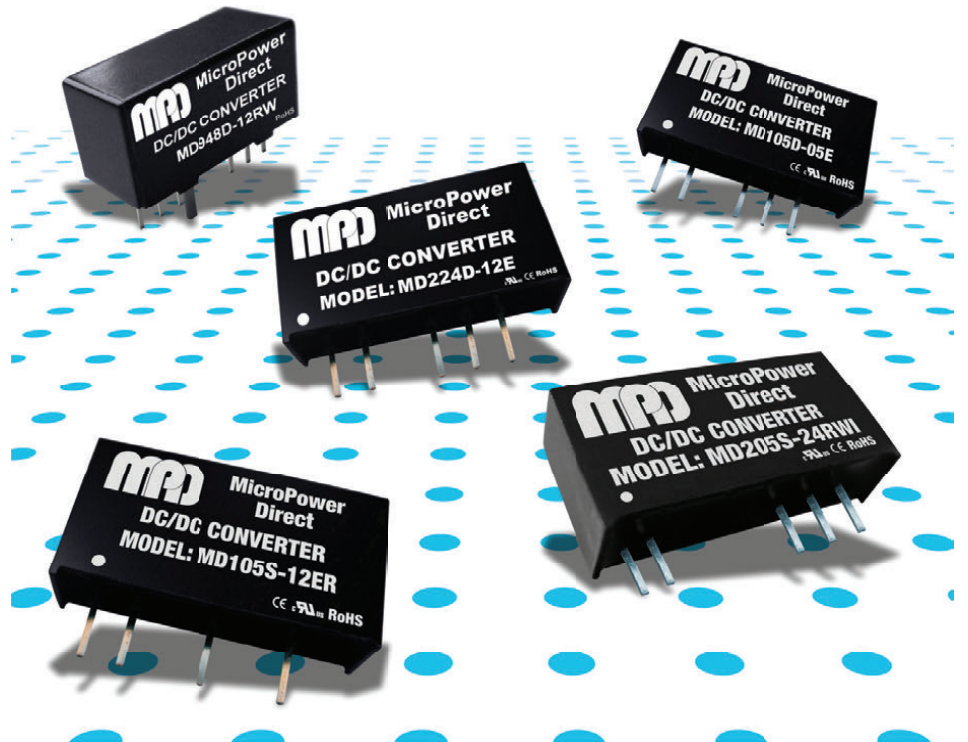
Pin	Dual Output
1	-VIN
2	+VIN
3	Remote On/Off
5	No Connection
6	+VOUT
7	Common
8	-VOUT

### Notes:

- All dimensions are typical in inches (mm)
- Pin 1 is marked by a "dot" or indentation on the unit
- General Tolerance =  $\pm 0.01$  ( $\pm 0.25$ )
- Pin Tolerance =  $\pm 0.004$  ( $\pm 0.10$ )
- Recommended pin hole size (on the application PC Board) is  $\varnothing 0.039$  ( $\varnothing 1.00$ )
- Weight (Typ) = 0.17 Oz (4.2g)

MPD offers a wide range of miniature DC/DC converters in Single-In-Line (SIP) packages. Miniature 4-pin models range from 0.25W to 3W. Slightly larger 6 & 8 pin models range from 1W to 9W. These space saving converters offer wide temperature operation, wide input ranges, single/dual outputs, and I/O isolation. Most meet international EMC/EMI standards and many are approved to EN 62368. For full information, go to our website or contact the factory.

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