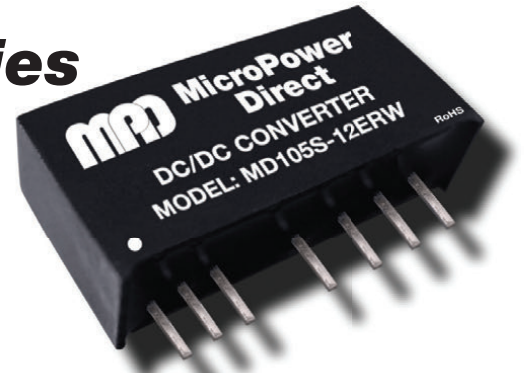


# MD100ERW Series



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

### Key Features:

- 1W Output Power
- 2:1 Input Voltage Range
- 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

RoHS



### 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	4.5	5.0	9.0	VDC	
	12 VDC Input	9.0	12.0	18.0		
	24 VDC Input	18.0	24.0	36.0		
	48 VDC Input	36.0	48.0	75.0		
Input Start Voltage	5 VDC Input	3.5	4.0	4.5	VDC	
	12 VDC Input	4.5	8.0	9.0		
	24 VDC Input	11.0	16.0	18.0		
	48 VDC Input	24.0	33.0	36.0		
Input Filter	Capacitor Filter					

Output						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Output Voltage Accuracy, See Note 1	I <sub>OUT</sub> = 5% to 100%	±1.0	±3.0	%		
Output Voltage Balance, See Note 2	Dual Outputs, Balanced Loads	±0.5	±1.0	%		
Line Regulation	V <sub>IN</sub> = Min to Max	±0.3	±0.5	%		
Load Regulation	I <sub>OUT</sub> = 5% to 100%	±0.4	±0.75	%		
Ripple (20 MHz)	See Note 3	30	50	mV P - P		
Noise (20 MHz)	See Note 3	55	75	mV P - P		
Transient Recovery Time, See Note 4		0.5	2.0	mSec		
Transient Response Deviation	25% Load Step Change	±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	60 Seconds	1,500			VDC	
Isolation Resistance	500 VDC	1,000			MΩ	
Isolation Capacitance	100 kHz/0.1V		120		pF	
Switching Frequency			200		kHz	

EMI Characteristics						
Parameter	Standard		Level			
Radiated Emissions	See Note 5	EN 55022	Class B			
Conducted Emissions	See Note 5	EN 55022	Class B			
ESD		EN 61000-4-2	Criteria B; ±4 kV Contact			
RS		EN 61000-4-3	Criteria A; 10V/m			
EFT	See Note 6	EN 61000-4-4	Criteria B; ±2 kV			
	See Note 6	EN 61000-4-4	Criteria B; ±4 kV			
Surge	See Note 7	EN 61000-4-5	Criteria B; ±2 kV			
CS		EN 61000-4-6	Criteria A; 3 Vrms			
Voltage Dips		EN 61000-4-29	Criteria B; 0% - 70%			

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						
Parameter	Conditions					
Case Size	0.866 x 0.374 x 0.472 Inches (22.00 x 9.50 x 12.00 mm)					
Case Material	Non-Conductive Black Plastic (UL94-V0)					
Weight	0.17 Oz (4.9g)					

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	-0.7		12.0	VDC	
	12 VDC Input	-0.7		25.0		
	24 VDC Input	-0.7		50.0		
	48 VDC Input	-0.7		100.0		
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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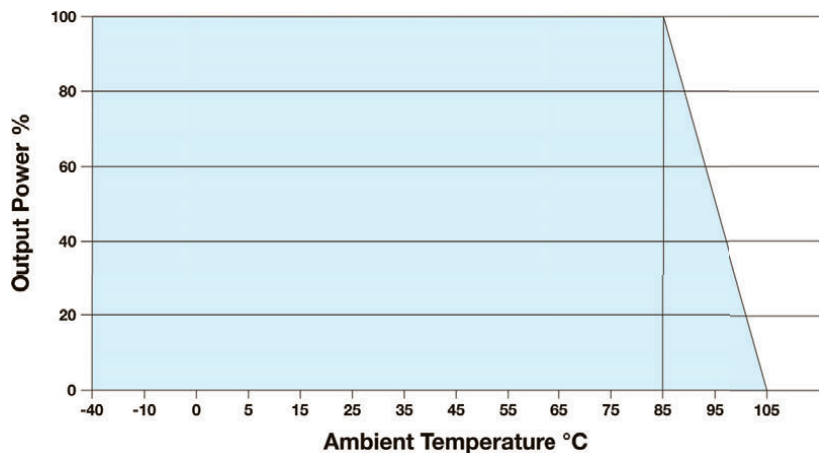
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Model Number	Input				Output			Efficiency (% Typ)	Reflected Ripple Current (mA Typ)	Capacitive Load (µF, Max)	Fuse Rating Slow-Blow (mA)
	Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA, Max)	Current (mA, Min)				
	Nominal	Range	Full-Load	No-Load							
MD105S-05ERW	5	4.5 - 9.0	278	25	5.0	200	10.0	72	30.0	2,200	600
MD105S-12ERW	5	4.5 - 9.0	263	25	12.0	83	4.0	76	30.0	1,000	600
MD105S-15ERW	5	4.5 - 9.0	267	25	15.0	67	3.0	75	30.0	680	600
MD105D-05ERW	5	4.5 - 9.0	274	25	±5.0	±100	±5.0	73	30.0	1,000	600
MD105D-12ERW	5	4.5 - 9.0	263	25	±12.0	±42	±2.0	76	30.0	470	600
MD105D-15ERW	5	4.5 - 9.0	267	25	±15.0	±33	±2.0	75	30.0	330	600
MD112S-03ERW	12	9.0 - 18.0	112	12	3.3	303	15.0	75	40.0	2,700	250
MD112S-05ERW	12	9.0 - 18.0	108	12	5.0	200	10.0	77	40.0	2,200	250
MD112S-12ERW	12	9.0 - 18.0	106	12	9.0	111	6.0	79	40.0	1,800	250
MD112S-12ERW	12	9.0 - 18.0	104	12	12.0	83	4.0	80	40.0	1,000	250
MD112S-15ERW	12	9.0 - 18.0	104	12	15.0	67	3.0	80	40.0	680	250
MD112D-05ERW	12	9.0 - 18.0	107	12	±5.0	±100	±5.0	78	40.0	1,000	250
MD112D-12ERW	12	9.0 - 18.0	103	12	±12.0	±42	±2.0	81	40.0	470	250
MD112D-15ERW	12	9.0 - 18.0	104	12	±15.0	±33	±2.0	80	40.0	330	250
MD124S-03ERW	24	18.0 - 36.0	56	6	3.3	303	15.0	75	55.0	2,700	125
MD124S-05ERW	24	18.0 - 36.0	54	6	5.0	200	10.0	77	55.0	2,200	125
MD124S-12ERW	24	18.0 - 36.0	51	6	12.0	83	4.0	81	55.0	1,000	125
MD124S-15ERW	24	18.0 - 36.0	53	6	15.0	67	3.0	79	55.0	680	125
MD124S-24ERW	24	18.0 - 36.0	54	6	24.0	42	2.0	77	55.0	470	125
MD124D-05ERW	24	18.0 - 36.0	52	6	±5.0	±100	±5.0	80	55.0	1,000	125
MD124D-12ERW	24	18.0 - 36.0	52	6	±12.0	±42	±2.0	80	55.0	470	125
MD124D-15ERW	24	18.0 - 36.0	52	6	±15.0	±33	±2.0	80	55.0	330	125
MD148S-03ERW	48	36.0 - 75.0	28	4	3.3	758	38	75	70.0	2,700	75
MD148S-05ERW	48	36.0 - 75.0	27	4	5.0	200	10.0	76	70.0	2,200	75
MD148S-12ERW	48	36.0 - 75.0	26	4	12.0	83	4.0	81	70.0	1,000	75
MD148S-15ERW	48	36.0 - 75.0	26	4	15.0	67	3.0	80	70.0	680	75
MD148D-05ERW	48	36.0 - 75.0	27	4	±5.0	±100	±5.0	76	70.0	1,000	75
MD148D-12ERW	48	36.0 - 75.0	26	4	±12.0	±42	±2.0	80	70.0	470	75
MD148D-15ERW	48	36.0 - 75.0	26	4	±15.0	±33	±2.0	80	70.0	330	75

Notes:

- At no load, output voltage accuracy is ±1.5% typical and ±5.0% max.
- The load on dual output units should not be unbalanced more than ±5%. Units operated with unbalanced loads greater than ±5% may not meet all specifications.
- 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%.
- With the addition of the **DCFM-0x** (or a similar discrete filter), all models will meet EN 55022 class B. A suggested input circuit is shown in the connection diagram on page 3. Contact the factory for more information.
- To meet the requirements of EN 61000-4-4 (±2 kV), external components are needed. The connection diagram on page 3 shows an external input filter that would typically achieve this. With the addition of the **DCFM-0x**, EN 61000-4-4 (±4 kV) can be achieved. Contact the factory for more information.
- To meet the requirements of EN 61000-4-5 (±2 kV), external components are needed. This can be done discretely (as shown in the connection diagram on page 3), or with the addition of the **DCFM-0x**. Contact the factory for more information.
- These units should not be operated with a load under 5% of full load. Operation at no-load will not damage the unit, but 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 Model Selection table above for the correct rating.

Derating Curve



The **MD100x-ERW** may be started or shutdown by the control pin input (pin 3). This input is current controlled. The unit operates when this input is open. When the input is "high" (current is flowing into the pin), the converter shuts down. 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 C0 is a 47 nF/100V. The resistor R1 is determined by the formula:

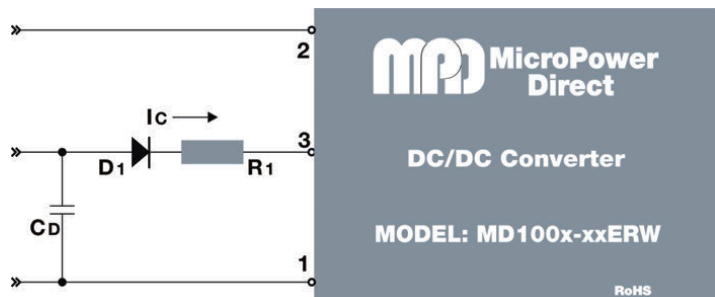
$$R = [(Vc - Vd - 1.0) / I_c] - 300$$

Where: Vc = voltage to ground from pin 3

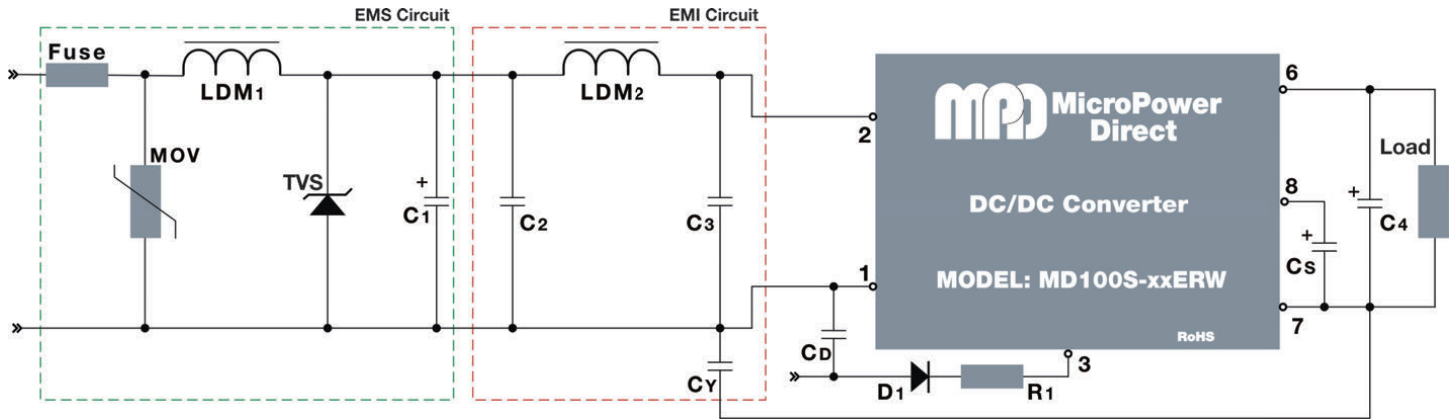
Vd = the forward conduction voltage drop of D1

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

Remote ON/OFF Control



### Typical Connection



For applications that require meeting EMC standards, the diagram above illustrates a typical connection of the MD100xERW series. The units do not require external components to operate as specified. Some notes on this diagram (starting with the input circuit) are:

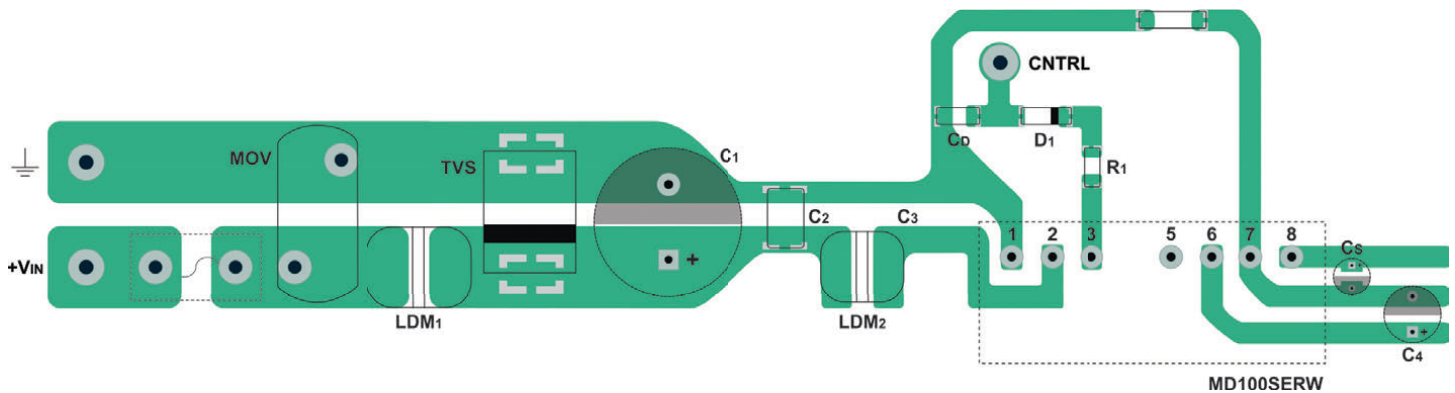
1. An external fuse should be used in all power module applications. The recommended fuse is shown in the model chart on page 2.
2. To protect against a surge, an external MOV is recommended on the input. A suggested value is given in the table at right.
3. To protect against voltage spikes, it is recommended that a TVS be used 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. Recommended values for components are:

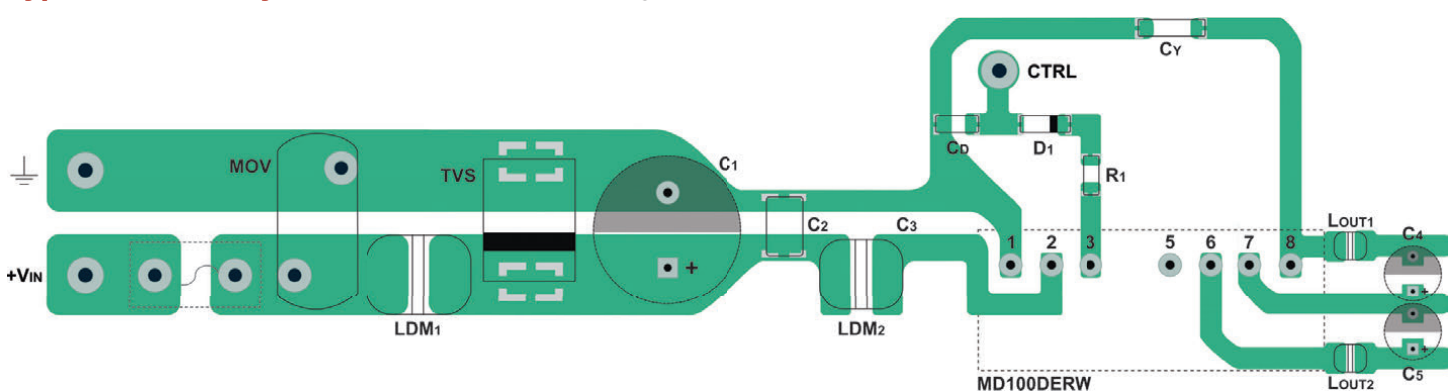
Component	5 V <sub>IN</sub>	12 V <sub>IN</sub>	24 V <sub>IN</sub>	48 V <sub>IN</sub>
MOV	---	---	S14K35	S14K60
LDM1	---	---	56 μH	56 μH
TVS	SMCJ13A	SMCJ28A	SMCJ48A	SMCJ90A
C1	680 μF/16V	680 μF/25V	330 μF/50V	330 μF/100V
C2	4.7 μF/50V	4.7 μF/50V	4.7 μF/100V	4.7 μF/100V
LDM2	12 μH	12 μH	12 μH	12 μH
C3	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

7. The drawings below show typical board layouts for the EMC/EMI circuit shown above (one for single output models and one for dual output units).
8. 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.
9. 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.

### Typical Board Layout: With External Filter/Surge Components for Single Output Unit



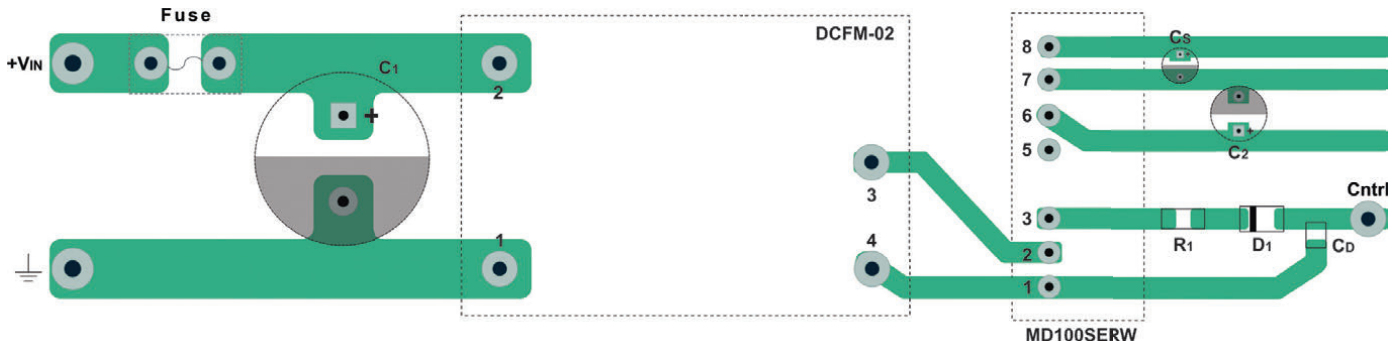
### Typical Board Layout: With External Filter/Surge Components for Dual Output Unit



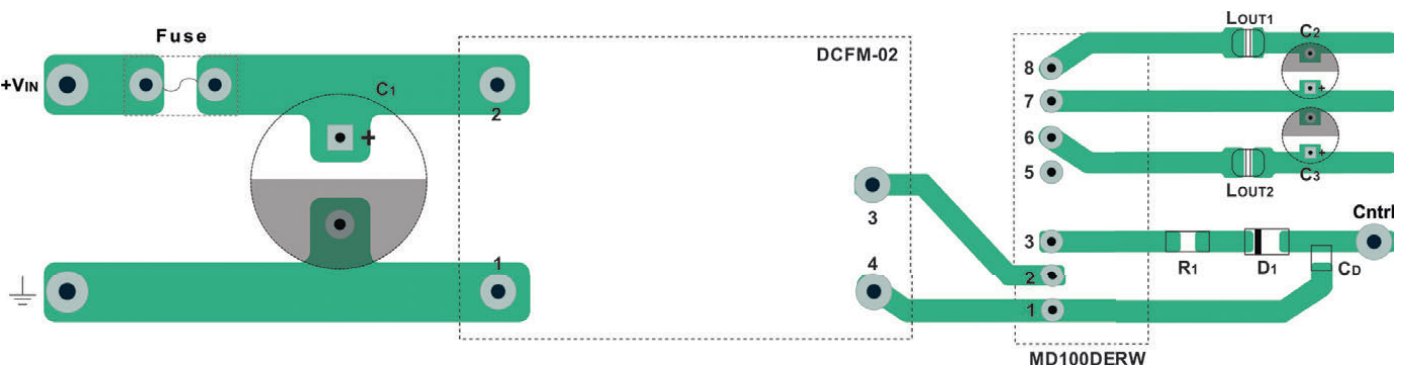
Input noise and surge suppression modules are available for a number of MPD DC/DC power supplies. An MD100xERW connection with the DCFM-02 (noise suppression) module connected to the input is shown in the diagrams below.

The recommended input capacitor (C1) is a 330  $\mu\text{F}/50\text{V}$  for 5, 12, and 24 VDC input models and 330  $\mu\text{F}/100\text{V}$  for 48 VDC input units. The output capacitors (C2 & C3) are 100  $\mu\text{F}$ . For pricing or full technical information on these modules (DCFM-01, DCFM-02 and DCFM-03) please contact the factory.

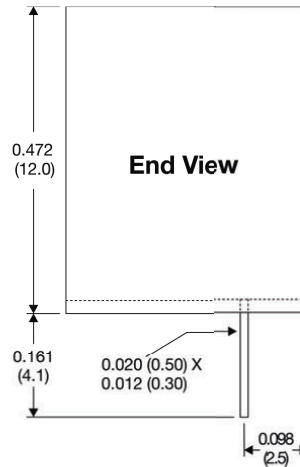
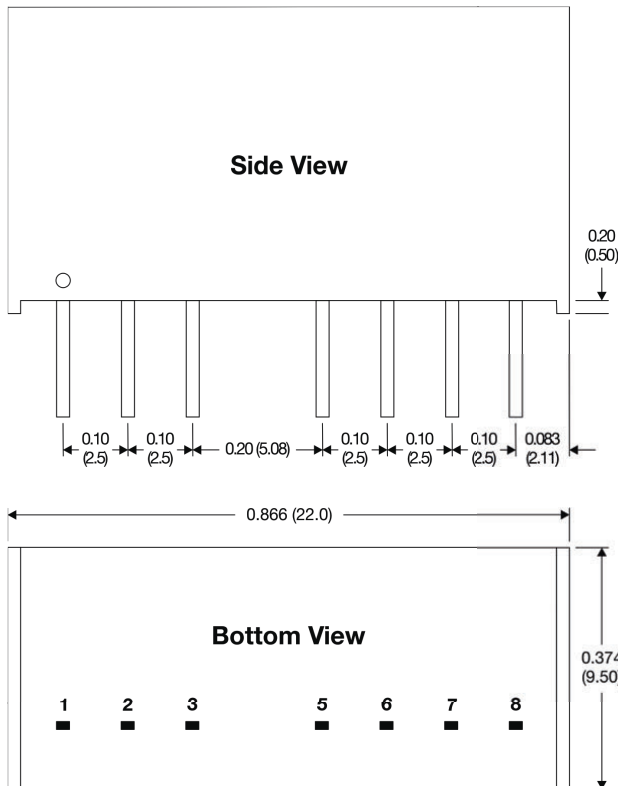
**Typical Connection: With DCFM-02 Surge Suppression and Filter Modules, Single Output**



**Typical Connection: With DCFM-02 Surge Suppression and Filter Modules, Dual Output**



**Mechanical Dimensions**



**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 Section Tolerance x.xxx =  $\pm 0.004$  ( $\pm 0.100$ )
- General Tolerance x.xx =  $\pm 0.01$  ( $\pm 0.25$ )
- Pin 1 is marked by a "dot" or indentation on the top of the unit



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