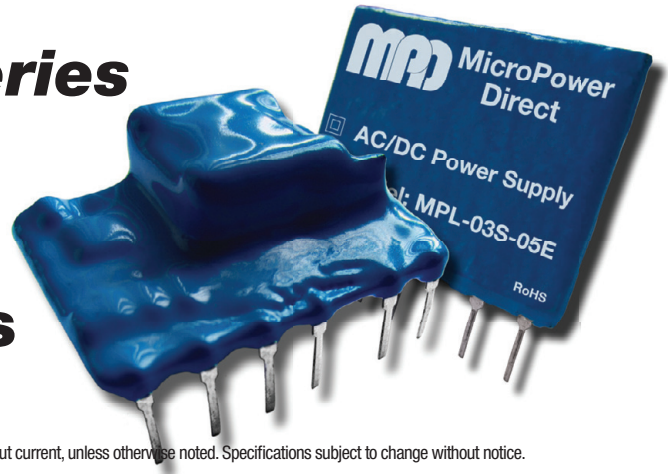


# MPL-03SE Series

## Single Output, 3W Ultra-Miniature SIP AC/DC Power Supplies



### Key Features:

- 3W Output Power
- Universal 85-264 VAC Input
- EN 60950 Approved
- Meets IEC Safety Class II
- Right Angle Pins Available
- Single Regulated Output
- Meets EN 55022 Class A
- >300 kHour MTBF
- **Ultra-Miniature "SIP" Case**



RoHS



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### Electrical Specifications

Specifications typical @ +25°C, 230 VAC input voltage & rated output current, unless otherwise noted. Specifications subject to change without notice.

Input						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Input Voltage Range		85		264	VAC	
		100		400	VDC	
Input Frequency		47		440	Hz	
Input Current	See Model Selection Guide					
Inrush Current	115 VAC		20.0		A Pk	
	230 VAC		40.0			

Output						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Output Voltage Accuracy	See Model Selection Guide					
Standby Power Consumption				0.5	W	
Line Regulation	V <sub>IN</sub> = MIN to MAX	3.3 V <sub>OUT</sub> Model		±0.5	%	
		All Other Models		±1.5		
Load Regulation	I <sub>OUT</sub> = 10% to 100%	3.3 V <sub>OUT</sub> Model		±1.5	%	
		All Other Models		±2.5		
Ripple & Noise (20 MHz)		3.3, 5 V <sub>OUT</sub> Models		70	mV P-P	
		All Other Models		50		
Hold-Up Time		115 VAC	60		msec	
		230 VAC	300			
Temperature Coefficient				±0.02	% / °C	
Over Current Protection			110		140	% I <sub>OUT</sub>
Short Circuit Protection	Continuous (Autorecovery)					

General						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Isolation Voltage	Input to Output	3,000			VAC	
Isolation Resistance	500 VDC	100			MΩ	
Switching Frequency	3.3 V <sub>OUT</sub> Model		100		kHz	
	All Other Models			50		

EMI Characteristics				
Parameter	Standard	Criteria	Level	
Radiated Emissions, See Note 3	EN 55022		Class A	
Conducted Emissions, See Note 3	EN 55022		Class A	
ESD	EN 61000-4-2	B	±4 kV Contact	
RS, See Note 4	EN 61000-4-3	A	10V/m	
EFT, See Note 5	EN 61000-4-4	B	±2 kV	
	EN 61000-4-4	B	±4 kV	
Surge, See Note 6	EN 61000-4-5	B	±1 kV / ±2 kV	
CS, See Note 7	EN 61000-4-6	A	3 Vrms	
PFM	EN 61000-4-8	A	10 A/m	
Voltage Dips	EN 61000-4-11	B	0% - 70%	

Environmental						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Operating Temperature Range	Ambient	-40	+25	+85	°C	
Operating Temperature Range	Surface (Case)			+90	°C	
Storage Temperature Range		-40		+105	°C	
Cooling	Free Air Convection (See Derating Curve)					
Humidity	RH, Non-condensing			85	%	

Physical						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Case Size	See Mechanical Drawings (Page 4)					
Case Material	Non-Conductive Epoxy (UL94-V0)					
Weight					0.28 Oz (8g)	
Solder Temperature	Wave Soldering (5 - 10s)	255	260	265	°C	
	Manual Soldering (3 - 5s)	350	360	370		

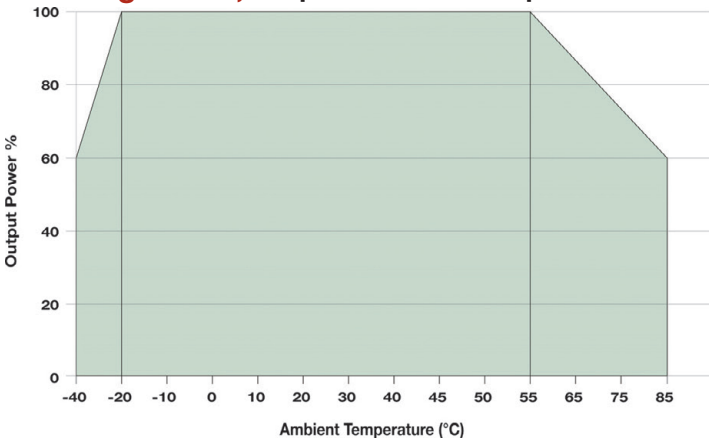
Reliability Specifications						
Parameter	Conditions	Min.	Typ.	Max.	Units	
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	300			kHours	
Safety Standards	EN 60950					
Safety Class	IEC 61140 Class II					

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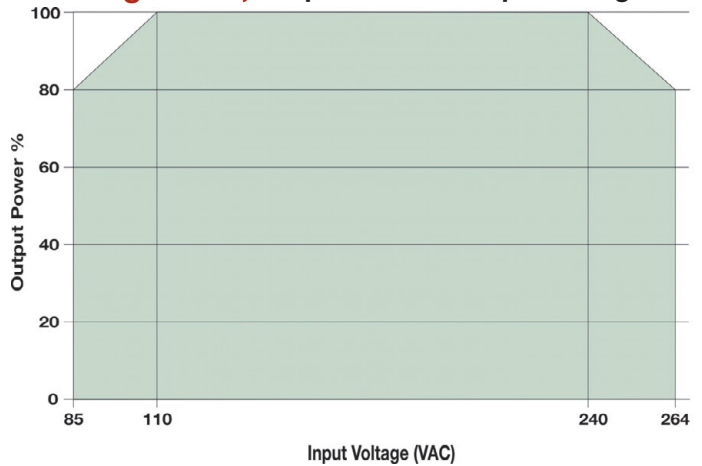
Model Number	Input		Output		Maximum Output Power (W)	Output Voltage Accuracy (%)	Capacitive Load (µF, Max)	Efficiency (% Typ)	Fuse Rating Slow-Blow
	Current (A Max.)		Voltage (VDC)	Current (mA Max.)					
	115 VAC	230 VAC							
MPL-03S-03E(F)	0.120	0.060	3.3	500	1.65	±3.0	2,300	66	1.0A/250 VAC
MPL-03S-05E(F)	0.120	0.060	5.0	500	2.50	±5.0	470	69	1.0A/250 VAC
MPL-03S-09E(F)	0.120	0.060	9.0	333	3.00	±8.0	150	76	1.0A/250 VAC
MPL-03S-12E(F)	0.120	0.060	12.0	250	3.00	±8.0	100	78	1.0A/250 VAC
MPL-03S-15E(F)	0.120	0.060	15.0	200	3.00	±5.0	100	78	1.0A/250 VAC
MPL-03S-24E(F)	0.120	0.060	24.0	125	3.00	±5.0	100	78	1.0A/250 VAC

- Notes:**
- Operation at no load will not damage the units, however, they may not meet all specifications.
  - The external capacitors (C<sub>1</sub> & C<sub>3</sub>) shown in the typical connection diagrams on page 3 are required to meet specified operation.
  - All units will meet EN 55022 (CE/RE) class A with the input circuit shown in the "Typical Connection 1" diagram on page 3. The **MPL03SE** will meet class B with the additional filtering shown in the "Typical Connection 2" diagram on page 3. **MPD** offers filter modules that will save on board space and make the input filter design easier. Contact the factory for more information.
  - To meet the requirements of EN 61000-4-3, (10V/m) external filtering (as shown in the "Typical Connection 2" diagram on page 3) is required. This filtering may be added discretely, or by using a filter module from **MPD**. Contact the factory for more information.
  - All units will meet EN 61000-4-4 (±2 kV) with the input circuit shown in the "Typical Connection 1" diagram on page 3. To meet the requirements of EN 61000-4-4 (±4 kV), external components (as shown in the "Typical Connection 2" diagram on page 3) are required. This filtering may be added discretely, or by using a filter module from **MPD**. Contact the factory for more information.
  - All units will meet the requirements of EN 61000-4-5 (±1 kV/±2 kV), with the input circuit shown in the "Typical Connection 2" diagram on page 3. This filtering may be added discretely, or by using a filter module from **MPD**. Contact the factory for more information.
  - All units will meet the requirements of EN 61000-4-6 (3V rms), with the input circuit shown in the "Typical Connection 2" diagram on page 3. This filtering may be added discretely, or by using a filter module from **MPD**. Contact the factory for more information.
  - It is recommended that a fuse be used on the input of a power supply for protection. For the **MPL-03SE(F)** series, a 1.0A/250 VAC slow blow should be used.
  - The **MPL-03SE(F)** is available with the pins factory set to a 90° angle (see mechanical diagrams on page 4). To order units with this modification, add an "F" to the model number (i.e. **MPL-03S-12EF**).

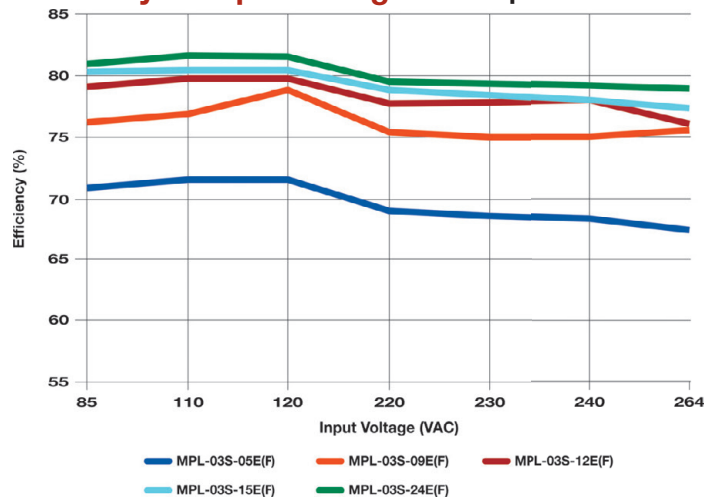
**Derating Curve, Output Power vs Temperature**



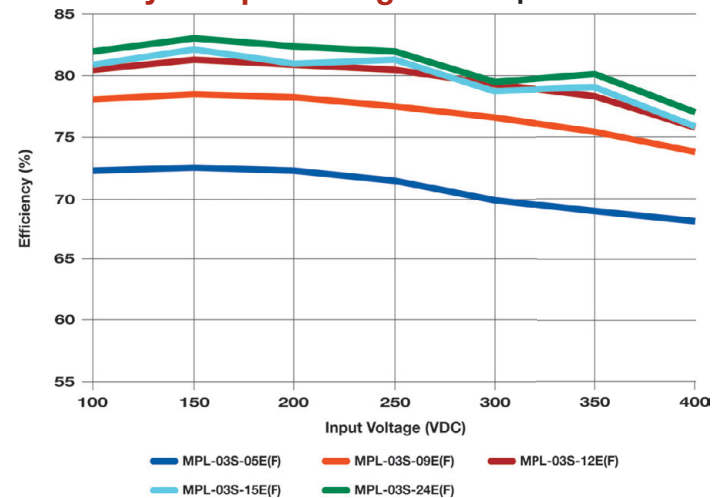
**Derating Curve, Output Power vs Input Voltage**



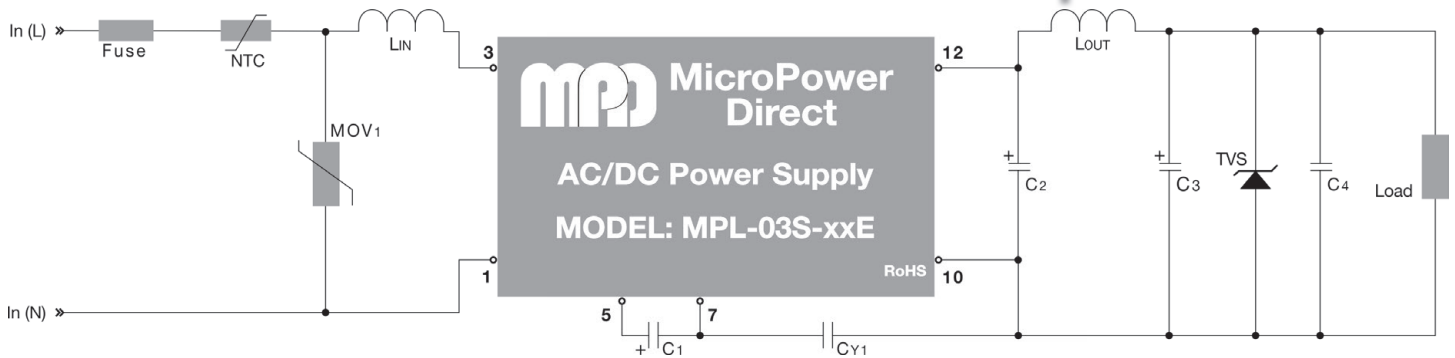
**Efficiency vs Input Voltage VAC Input**



**Efficiency vs Input Voltage VDC Input**

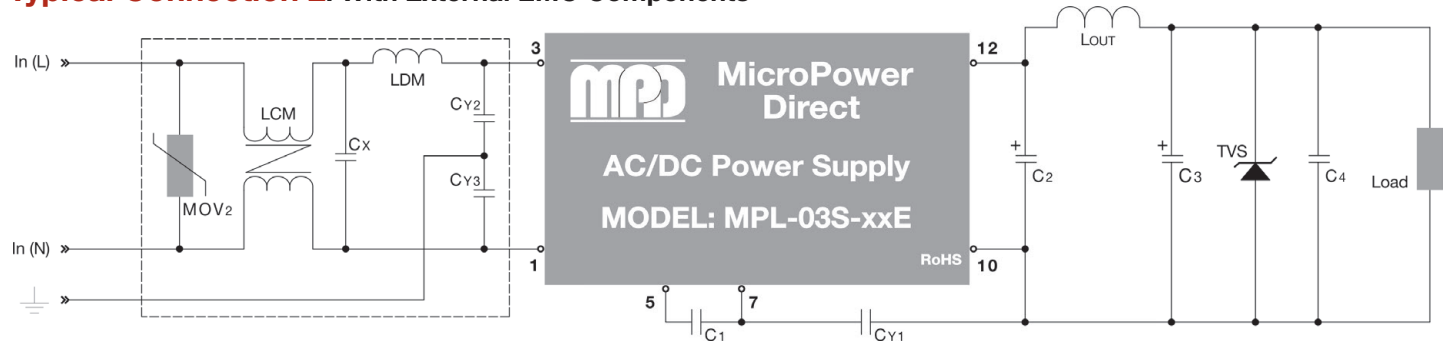


### Typical Connection 1



The diagram above illustrates a typical connection of the **MPL-03SE** series. With this connection, the unit will meet EN 55022 class A, EN 61000-4-2 ( $\pm 4kV$ ), EN61000-4-4 ( $\pm 2kV$ ), EN 61000-4-8 and EN 61000-4-11. Components C1 and C3 are required to meet specified operation limits. The recommended input components are a 5D-9 (NTC), S10K300 (MOV1) and 5 mH (LIN). The recommended output component values are given in the table below.

### Typical Connection 2: With External EMC Components



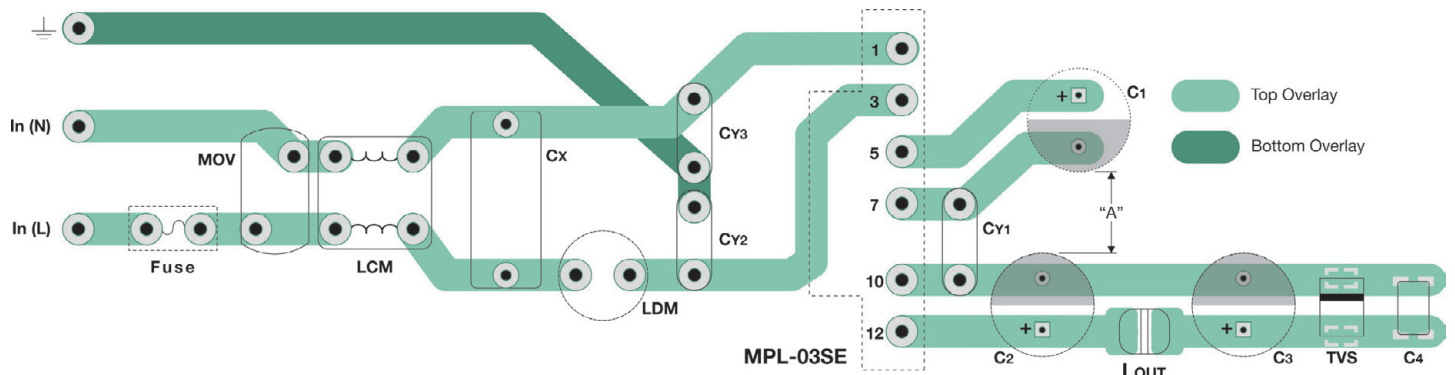
For applications that require meeting higher EMC standards, the circuit shown above is recommended. Some notes on this diagram (starting with the input circuit) are:

1. It is recommended that an external fuse be used. The recommended fuse is 1A/250V.
2. The capacitors Cx and CYx are "safety" capacitors.
3. Capacitor C1 is a filter component. This capacitor is required to meet specified operation. It should be a high frequency, low ESR electrolytic capacitor. The recommended value is given in the table below.
4. Capacitors C2 and C3 are output filter components. Capacitor C3 is required to meet specified operation. Low ESR, high frequency electrolytic capacitors should be used. The recommended values are given in the table below.
5. Recommended values for components are:

6. The output TVS will help protect system circuitry if power supply fails. A recommended value is given in the table below.
7. Capacitor C4 is ceramic. This capacitor is used to filter high frequency noise. A recommended value is given in the table below.
8. All of the components within the dotted lines of the input EMC circuit are included in a filter module available from **MPD**. Please contact the factory for more information.

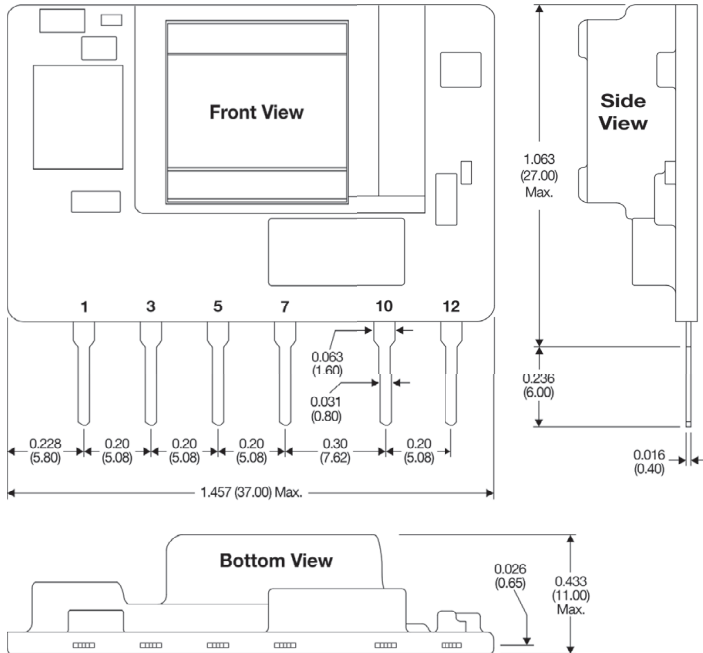
Model Number	External Components											
	MOV	LCM	Cx	LDM	CY2/CY3	C1 (Required)	CY1	C2	LOUT	C3 (Required)	C4	TVS
MPL-03S-03E	S10k300	3.5 mH	0.1 $\mu F/275$ VAC	5 mH	1 nF/400 VAC	22 $\mu F/400V$	1 nF/400 VAC	330 $\mu F/25V$	2.2 $\mu H$	120 $\mu F/25V$	0.1 $\mu F/50V$	SMBJ7.0A
MPL-03S-05E												SMBJ12A
MPL-03S-09E												SMBJ20A
MPL-03S-12E												SMBJ20A
MPL-03S-15E												SMBJ30A
MPL-03S-24E							100 $\mu F/35V$					

### Typical Board Layout: With External EMC Components

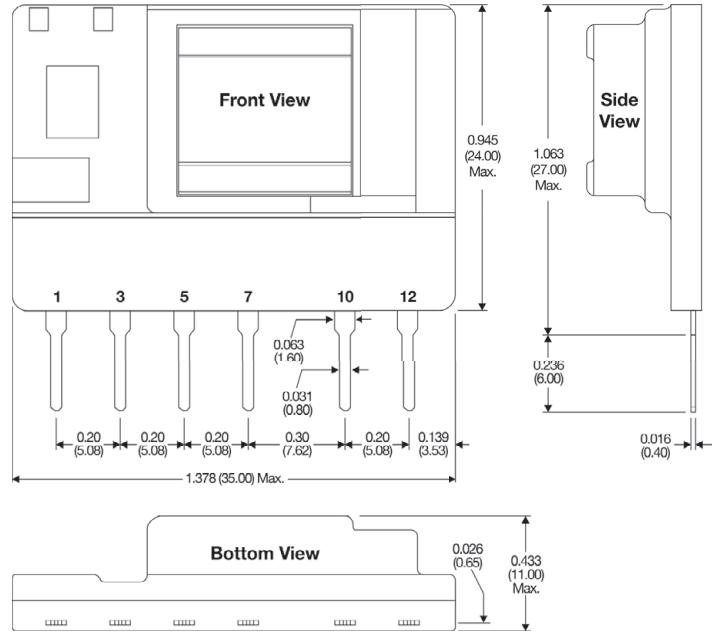


The diagram above shows a typical board layout for the **MPL-03SE** with the recommended EMI components shown in the "Typical Connection 2" diagram. Filter modules are available from **MPD**. Contact the factory for more information. To meet safety regulations, the board trace widths should be  $\geq 3$  mm, the distance between traces should be  $\geq 6$  mm, and the distance between traces and ground should be  $\geq 6$  mm. The distance "A" noted on the drawing should be  $\geq 6.4$  mm.

**Mechanical Dimensions, 3.3V Output Model**

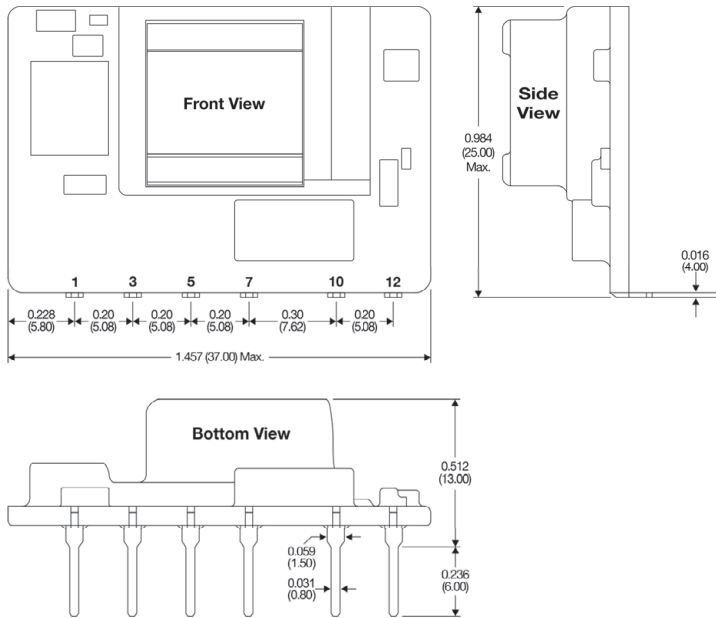


**Mechanical Dimensions, All Other Models**

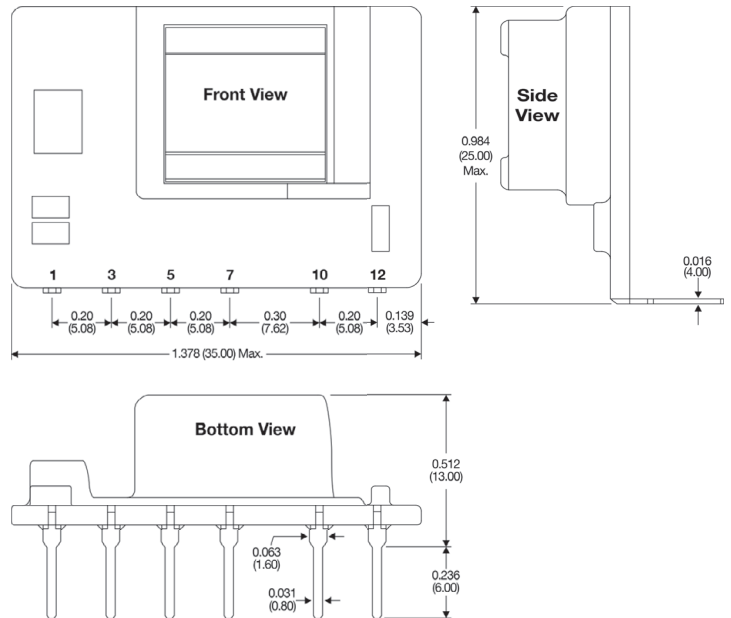


**Right Angle Pin Models**

**Mechanical Dimensions, 3.3V Output Model**



**Mechanical Dimensions, All Other Models**



**Pin Connections**

Pin	Function	Pin	Function
1	AC-Neutral	7	-VCAP
3	AC-Line	10	-VOUT
5	+VCAP	12	+VOUT

**Notes:**

- All dimensions are typical in inches (mm)
- Tolerance x.xx = ±0.02 (±0.50)

For the "Right Angle" pins option, add suffix "F" to the model number (i.e. MPL-03S-12EF)