

## Ultra High Precision Foil Molded Surface Mount Resistor, TCR of $\pm 2 \text{ ppm}/^{\circ}\text{C}$ and Load Life Stability of $\pm 0.005\%$



### INTRODUCTION

Bulk Metal<sup>®</sup> Foil (BMF) Technology out-performs all other resistor technologies available today for applications that require High Precision and High Stability.

This technology has been invented, patented and pioneered by Vishay. Products based on this technology are the most suitable for a wide range of applications.

BMF technology allows to produce customer oriented products designed to satisfy challenging and specific technical requirements.

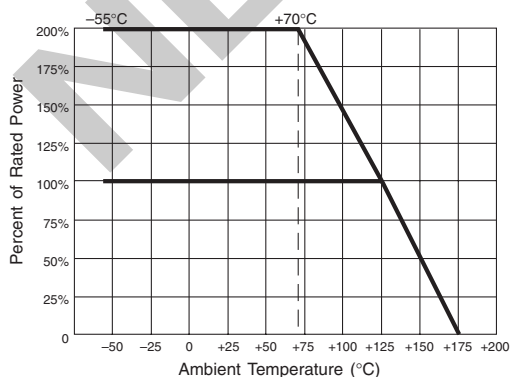
The BMF provides inherently a low and predictable Temperature Coefficient of Resistance (TCR) and excellent load life stability for high precision analog applications.

The SMRxD is a precision molded surface mountable resistor offering all the elements of precision; including lowest TCR, tight tolerance, long term stability, low noise, low thermal EMF, and non-measurable voltage coefficient. It utilizes the Bulk Metal<sup>®</sup> Foil technology for the resistive element with its inherent and legendary low predictable TCR and long term stability. This surface mountable product affords similar performance to the time tested S Series molded through-hole product.

Voltage division with tight tracking  $< 3 \text{ ppm}/^{\circ}\text{C}$  can be achieved with 2 **randomly** selected units even with a large ratio between the two values.

Our Application Engineering Department is available to advise and make recommendations for non standard technical requirements and special applications. Please contact us.

**FIGURE 1 - POWER DERATING CURVE**



### FEATURES

- TCR:  $\pm 2 \text{ ppm}$ / typical, (see Table 1)
- Load Life Stability ( $70^{\circ}\text{C}$  for 2000 hours):  $\pm 0.005\%$
- Power Rating to 600mW at  $+70^{\circ}\text{C}$
- Resistance Range:  $5\Omega$  to  $80\text{K}\Omega$  (for higher and lower values, please contact us)
- Tolerance: to  $\pm 0.01\%$
- Shelf Life Stability:  $0.0025\%$  (25 ppm)
- Low Current Noise: - 40dB "Noise free component"
- Low Voltage Coefficient  $< 0.1 \text{ ppm/V}$
- Non Inductive:  $< 0.08 \mu\text{H}$
- Thermal EMF:  $0.05 \mu\text{V}/^{\circ}\text{C}$
- Terminal Finishes Available:

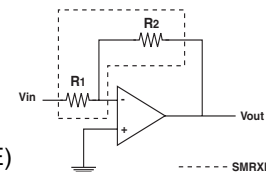
Lead (Pb)-Free  
Tin/Lead Alloy

- Matched sets with TCR tracking  $< 2 \text{ ppm}/^{\circ}\text{C}$  are available per request
- For higher performances please review **VSMP** Series and **VFCP** Series datasheets



### APPLICATIONS

- Precision Amplifiers
- High Precision Instrumentation
- Medical and Test equipment
- Automatic test equipment (ATE)
- Industrial
- Audio (High end stereo equipment)
- EB application
- Military, Airborne and Space
- Pulse application
- Measurement instrumentation



**TABLE 1 - TOLERANCE AND TCR VERSUS RESISTANCE VALUE\***

VALUE ( $\Omega$ )	STANDARD TOLERANCE (%)	TYPICAL TCR AND MAX. SPREAD (PPM/ $^{\circ}\text{C}$ )
50 $\Omega$ to 80K $\Omega$	$\pm 0.01\%$	$\pm 2 \pm 3$
20 $\Omega$ to $< 50\Omega$	$\pm 0.02\%$	$\pm 2 \pm 4$
10 $\Omega$ to $< 20\Omega$	$\pm 0.05\%$	$\pm 2 \pm 6$
5 $\Omega$ to $< 10\Omega$	$\pm 0.10\%$	$\pm 2 \pm 8$

\* For tighter performances, please contact Vishay Application Engineering using the e-mail addresses in the footer below.

#### SALES

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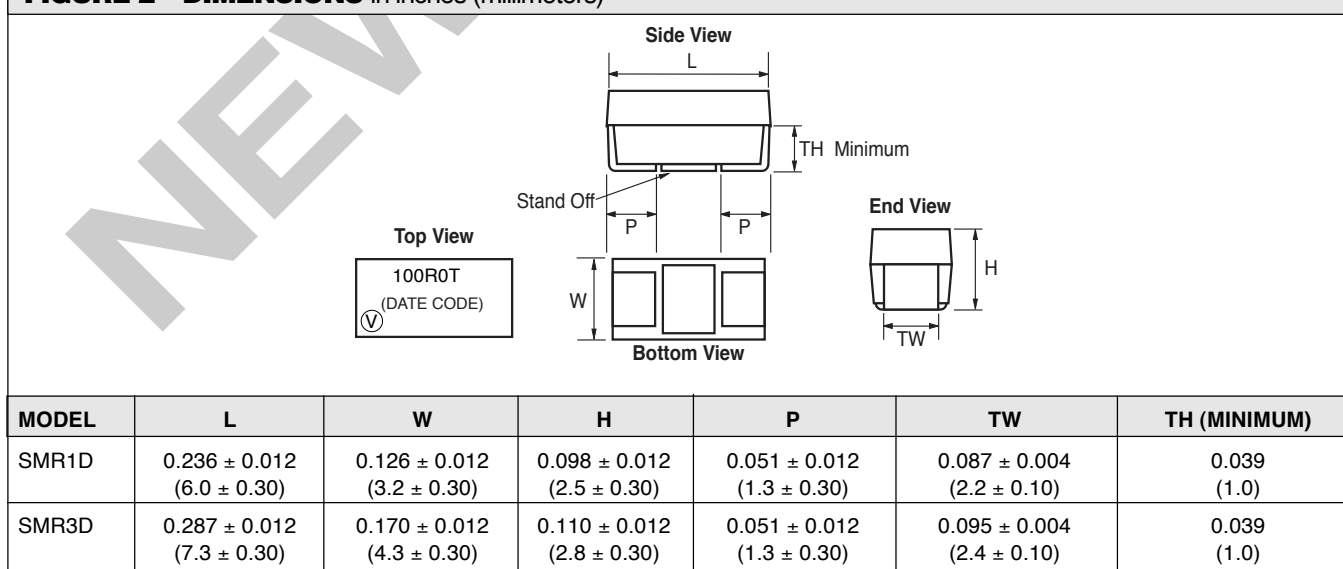


Ultra High Precision  
Foil Molded Surface Mount Resistor,  
TCR of  $\pm 2$  ppm/°C and Load Life Stability of  $\pm 0.005\%$

**TABLE 2 - MODELS SMR1D AND SMR3D SPECIFICATIONS**

TEST	CONDITIONS				MAXIMUM LIMIT*	
	SMR1D		SMR3D		SMR1D	SMR3D
Resistance Range					5Ω to 33KΩ	5Ω to 80KΩ
Rated Power	5Ω to 10KΩ 0.250 W @ 70°C 0.125 W @ 125°C	Above 10KΩ 0.160 W @ 70°C 0.08 W @ 125°C	5Ω to 30K 0.6 W @ 70°C 0.3 W @ 125°C	Above 30K 0.4 W @ 70°C 0.2 W @ 125°C	See Figure 1, previous page	
Maximum Working Voltage					73 V	180 V
Maximum Operating Temperature	+ 175°C (See Figure 1)					
Working Temperature Range	– 55°C to + 125°C (MIL range)					
Thermal Shock	– 65°C to + 175°C; 30 minutes.; 5 cycles				± 0.01%	
Short Time Overload	2.5 x Rated Voltage; 5 Seconds				± 0.01%	
Low Temperature Operation	– 65°C, 24 hours (no load); 45 minutes @ Rated Power				± 0.01%	
Dielectric Withstanding Voltage	Atmospheric Pressure; AC 200 V; 1 minute				± 0.01%	
Insulation Resistance (MΩ)	DC 100 V; 1 minute				over 10,000	
Resistance to Soldering Heat (%)	260°C; 10 seconds				± 0.02%, ± 0.01% typical	
Moisture Resistance	+ 65°C to – 10°C; 90% to 98% RH; Rated Power; 240 hours				± 0.02%	
Shock	100 G; Sawtooth				± 0.01%	
Vibration, High Frequency	10~ 2,000~ 10 Hz; 20 G; X, Y, Z each 2.5 hours				± 0.01%	
Load Life Stability (2000 hours)					Typical	
	0.04 watts @ + 70°C 0.25 watts @ + 70°C 0.125 watts @ + 125°C		0.1 watts @ + 70°C 0.6 watts @ + 70°C 0.3 watts @ + 125°C		± 0.005% ± 0.02% ± 0.02%	± 0.005% ± 0.015% ± 0.015%
High Temperature Exposure	+ 175°C; No Load 2,000 hours				± 0.05%	
Shelf Life Stability	15°C to 35°C; 15% to 75% RH; No Load				± 0.0025%	
Weight					0.1143 grams	0.244 grams
Packaging	Bulk (Loose) or Tape & Reel, per EIA-481-1					

\*As shown +0.01Ω to allow for measurement error at low values

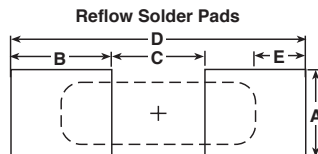
**FIGURE 2 - DIMENSIONS** in inches (millimeters)

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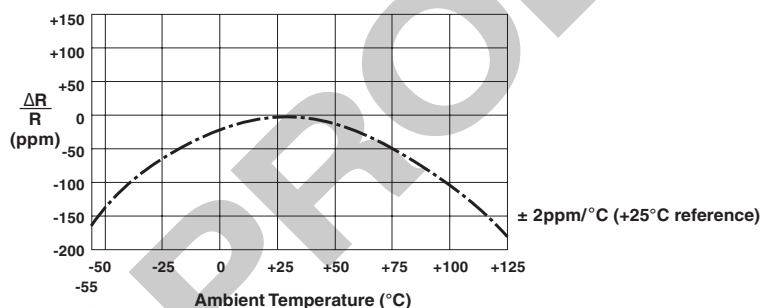
**FIGURE 3 - RECOMMENDED MOUNTING PAD GEOMETRIES** in inches (millimeters)



MODEL	METHOD	A MINIMUM	B REF	C REF	D $\pm 0.04 (\pm 1.0)$	E REF
SMR1D	Reflow	0.110 (2.79)	0.106 (2.70)	0.124 (3.15)	0.337 (8.55)	0.050 (1.28)
SMR3D	Reflow	0.118 (3.00)	0.106 (2.70)	0.175 (4.45)	0.388 (9.85)	0.050 (1.28)

Per IPC-SM-782 Rev A

**FIGURE 4 - TYPICAL TCR CURVE** (For more details, see table 1)



Note: The TCR values for  $< 100\Omega$  are influenced by the termination composition and result in deviation from this curve

**TABLE 3 - ORDERING INFORMATION**

MODEL RANGE	RESISTANCE	RESISTANCE VALUE		ABSOLUTE TCR	ABSOLUTE TOLERANCE	TERMINATION	PACKAGING
		LETTER DESIGNATOR	MULTIPLIER FACTOR				
SMR1D	5Ω to $< 1\text{K}\Omega$ Example: 249R00 - 249Ω	R	x 1.0	TCR2	T = $\pm 0.01\%$ Q = $\pm 0.02\%$ A = $\pm 0.05\%$ B = $\pm 0.1\%$ C = $\pm 0.25\%$ D = $\pm 0.5\%$ F = $\pm 1.0\%$	S = Lead (Pb)-Free B = Tin/Lead	T = Tape and Reel B = Bulk Pack
SMR3D	1KΩ to 80KΩ Example: 33K000 = 33.0KΩ	K	x 10 <sup>3</sup>				

Example:  
SMR3D 10K000 TCR2TSB

Model: SMR3D

Value: 10KΩ

**TCR2: 2 ppm/°C typical refers to any value in the resistance range.**

Tolerance:  $\pm 0.01\%$

Termination: Lead (Pb)-Free

Packaging: Bulk Pack

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