

# High Precision Bulk Metal® Foil Molded Surface Mount Resistor with TCR down to $\pm 2 \text{ ppm}/^\circ\text{C}$ , Flexible Terminations, and Load Life Stability of $\pm 0.005 \%$ (50 ppm)



Any value at any tolerance available within resistance range

## INTRODUCTION

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

The flexible terminations of this product also reduce stress transference from the PCB to the resistor.

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.

**TABLE 1 - THE SMRxD SERIES IS LISTED IN THE FOLLOWING DSCC SPECIFICATIONS**

MODEL	DSCC	MIL SPEC
SMR1D	06020	MIL-PRF-55182
SMR3D	06021	MIL-PRF-55182

**TABLE 2 - TOLERANCE AND TCR VERSUS RESISTANCE VALUE**  
(- 55 °C to + 125 °C, + 25 °C ref.)

VALUE	STANDARD TOLERANCE <sup>1)</sup>	TYPICAL TCR AND MAX. SPREAD <sup>1)</sup> (ppm/°C)
50 Ω to 80 kΩ	$\pm 0.01 \%$	$\pm 2 \pm 3$
20 Ω to $< 50 \Omega$	$\pm 0.02 \%$	$\pm 2 \pm 4$
10 Ω to $< 20 \Omega$	$\pm 0.05 \%$	$\pm 2 \pm 6$
5 Ω to $< 10 \Omega$	$\pm 0.1 \%$	$\pm 2 \pm 8$

### Note

1. Tighter performances are available

\* Pb containing terminations are not RoHS compliant, exemptions may apply

## FEATURES

- Temperature coefficient of resistance (TCR):  $\pm 2 \text{ ppm}/^\circ\text{C}$  typical (- 55 °C to + 125 °C, + 25 °C ref.)
- Tolerance: to  $\pm 0.01 \%$
- Flexible terminations ensure minimal stress transference from the PCB due to a difference in thermal coefficient of expansions (TCE)
- Electrostatic discharge (ESD) above 25 000 V
- Load life stability:  $\pm 0.005 \%$  (70 °C, 2000 h at rated power)
- Resistance range: 5 Ω to 80 kΩ (for higher and lower values, please contact us)
- Power rating: to 600 mW at 70 °C
- Non inductive, non capacitive design
- Current noise: - 40 dB
- Voltage coefficient:  $< 0.1 \text{ ppm}/\text{V}$
- Non inductive:  $< 0.08 \mu\text{H}$
- Non hot spot design
- Terminal finishes available: lead (Pb)-free tin/lead alloy
- Matched sets with TCR tracking are available upon request
- Any value available within resistance range (e.g. 1K234)
- Prototype samples available from 48 h. For more information, please contact [foil@vishaypg.com](mailto:foil@vishaypg.com)
- For better performances please review SMRxDZ datasheet



RoHS\*  
COMPLIANT

## APPLICATIONS

- Military, airborne and space
- Precision amplifiers
- High precision instrumentation
- Medical
- Automatic test equipment (ATE)
- Industrial
- Audio (high end stereo equipment)
- EB application
- Pulse application
- Measurement instrumentation



**FIGURE 1 - POWER DERATING CURVE**



**TABLE 3 - PERFORMANCE SPECIFICATIONS**

TEST	CONDITIONS				MAXIMUM LIMIT <sup>1)</sup>	
	SMR1D		SMR3D		SMR1D	SMR3D
Resistance Range					5 Ω to 33 kΩ	5 Ω to 80 kΩ
Rated Power	5 Ω to 10 kΩ 0.250 W at 70 °C 0.125 W at 125 °C	10 kΩ to 33 kΩ 0.160 W at 70 °C 0.08 W at 125 °C	5 Ω to 30 kΩ 0.6 W at 70 °C 0.3 W at 125 °C	30 kΩ to 80 kΩ 0.4 W at 70 °C 0.2 W at 125 °C	see figure 1	
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 + 150 °C; 30 min; 5 cycles				± 0.01 % (100 ppm)	
Short Time Overload	6.25 x rated power; 5 s				± 0.01 % (100 ppm)	
Low Temperature Storage	24 h at - 65 °C				± 0.01 % (100 ppm)	
Low Temperature Operation	45 min, rated power at - 65 °C				± 0.01 % (100 ppm)	
Dielectric Withstanding Voltage	atmospheric pressure; AC 200 V; 1 min				± 0.01 % (100 ppm)	
Insulation Resistance (MΩ)	DC 100 V; 1 min				over 10 000	
Resistance to Soldering Heat (%)	260 °C; 10 s				± 0.02 %, ± 0.01 % typical	
Moisture Resistance	+ 65 °C to - 10 °C; 90 % to 98 % RH; rated power; 240 h				± 0.02 % (200 ppm)	
Shock	100 G; sawtooth				± 0.01 % (100 ppm)	
Vibration, High Frequency	10 ~ 2000 ~ 10 Hz; 20 G; Y, Z each 4 h				± 0.01 % (100 ppm)	
Load Life Stability (2000 h)	0.04 W at + 70 °C 0.25 W at + 70 °C 0.125 W at + 125 °C		0.1 W at + 70 °C 0.6 W at + 70 °C 0.3 W at + 125 °C		Typical 0.005 % 0.02 % 0.02 %	Typical 0.005 % 0.015 % 0.015 %
High Temperature Exposure	175 °C; no load 2000 h				± 0.05 % (500 ppm)	
Weight					0.1143 g	0.244 g
Packaging	bulk (loose) or tape and reel, per EIA-481-1					

**Note**

1. As shown + 0.01 Ω to allow for measurement error at low values

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



MODEL	L	W	H	P	TW	TH (minimum)
SMR1D	0.236 ± 0.012 (5.99 ± 0.30)	0.126 ± 0.012 (3.20 ± 0.30)	0.098 ± 0.012 (2.49 ± 0.30)	0.051 ± 0.012 (1.30 ± 0.30)	0.087 ± 0.004 (2.21 ± 0.10)	0.039 (0.99)
SMR3D	0.287 ± 0.012 (7.29 ± 0.30)	0.170 ± 0.012 (4.32 ± 0.30)	0.110 ± 0.012 (2.79 ± 0.30)	0.051 ± 0.012 (1.30 ± 0.30)	0.095 ± 0.004 (2.41 ± 0.10)	0.039 (0.99)

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



MODEL	METHOD	A MIN.	B REF	C REF	D ± 0.04 (± 1.02)	E REF
SMR1D	Reflow	0.110 (2.79)	0.106 (2.69)	0.124 (3.15)	0.337 (8.55)	0.050 (1.27)
SMR3D	Reflow	0.118 (3.00)	0.106 (2.69)	0.175 (4.45)	0.388 (9.86)	0.050 (1.27)

Per IPC-SM-782 Rev. A

**FIGURE 4 - TRIMMING TO VALUES**  
(conceptual illustration)



**FIGURE 5 - TYPICAL TCR CURVE**  
(for more details, see table 2)



**Note:** The TCR values for < 80 Ω are influenced by the termination composition and the result in deviation from this curve

**TABLE 4 - GLOBAL PART NUMBER INFORMATION**

NEW GLOBAL PART NUMBER: Y112110K0000T9R (preferred part number format)



FOR EXAMPLE: ABOVE GLOBAL ORDER Y1121 10K0000 T 9 R:

TYPE: SMR1D  
 VALUE: 10.0  $k\Omega$   
 ABSOLUTE TOLERANCE:  $\pm 0.01\%$   
 TERMINATION: lead (Pb)-free  
 PACKAGING: tape and reel

HISTORICAL PART NUMBER: SMR1D 10K000 TCR2 T S T (will continue to be used)

<b>SMR1D</b>	<b>10K000</b>	<b>TCR2</b>	<b>T</b>	<b>S</b>	<b>T</b>
MODEL	OHMIC VALUE	TCR CHARACTERISTIC	RESISTANCE TOLERANCE	TERMINATION	PACKAGING
SMR1D SMR3D	10.0 $k\Omega$		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	B = bulk pack T = tape and reel

**Note**

\* For non-standard requests, please contact application engineering.

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