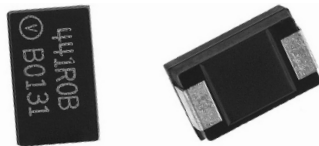


# High Precision Bulk Metal® Foil Molded Surface Mount Resistor with TCR down to $\pm 2 \text{ ppm}/^\circ\text{C}$ , Flexible Terminations, and Load Life Stability of $\pm 0.005 \%$ (50 ppm)



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 $\Omega$ to 80 k $\Omega$ | $\pm 0.01 \%$                    | $\pm 2 \pm 3$                                      |
| 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 $\Omega$  | $\pm 0.1 \%$                     | $\pm 2 \pm 8$                                      |

### Note

1. Tighter performances are available

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

## FEATURES

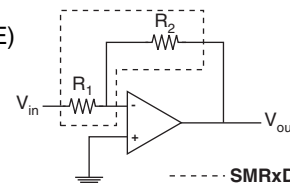
- Temperature coefficient of resistance (TCR):  $\pm 2 \text{ ppm}/^\circ\text{C}$  typical (- 55 °C to + 125 °C, + 25 °C ref.)
- Tolerance: to  $\pm 0.01 \%$
- Flexible terminations ensure minimal stress transference from the PCB due to a difference in thermal coefficient of expansions (TCE)
- Electrostatic discharge (ESD) above 25 000 V
- Load life stability:  $\pm 0.005 \%$  (70 °C, 2000 h at rated power)
- Resistance range: 5  $\Omega$  to 80 k $\Omega$  (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



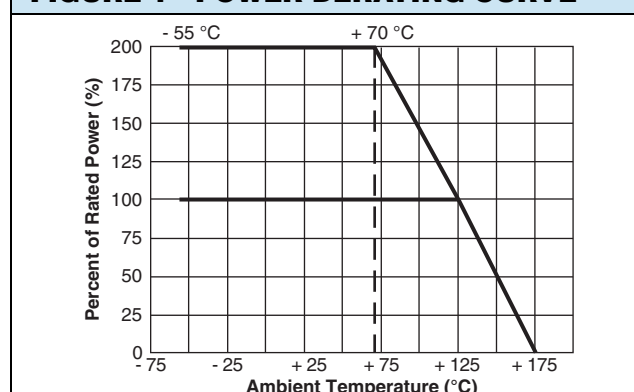
Available  
**RoHS\***  
COMPLIANT

## 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**

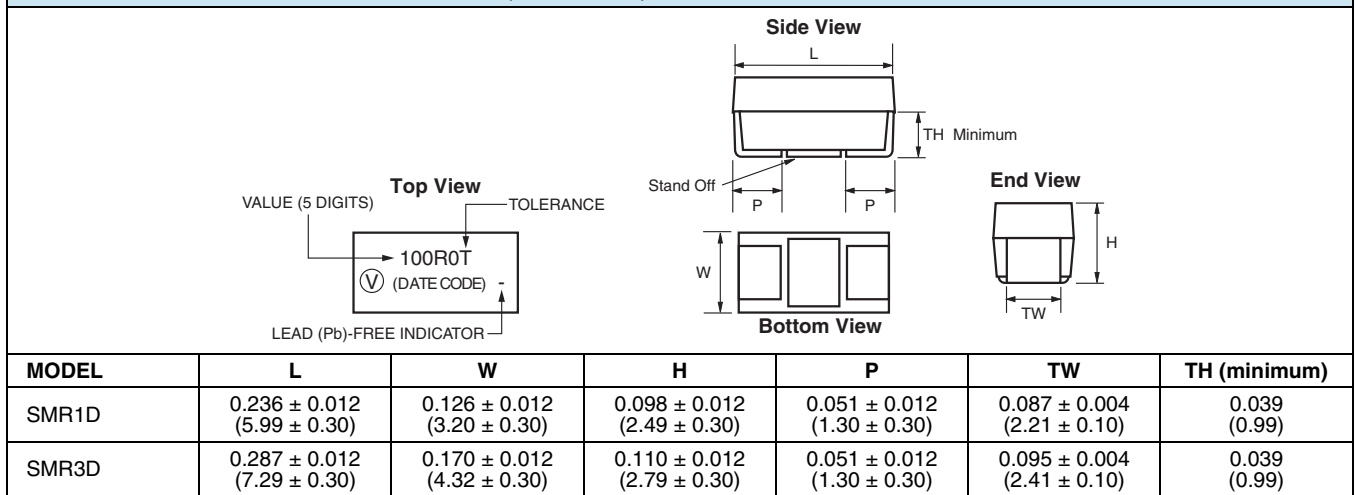


**TABLE 3 - PERFORMANCE SPECIFICATIONS**

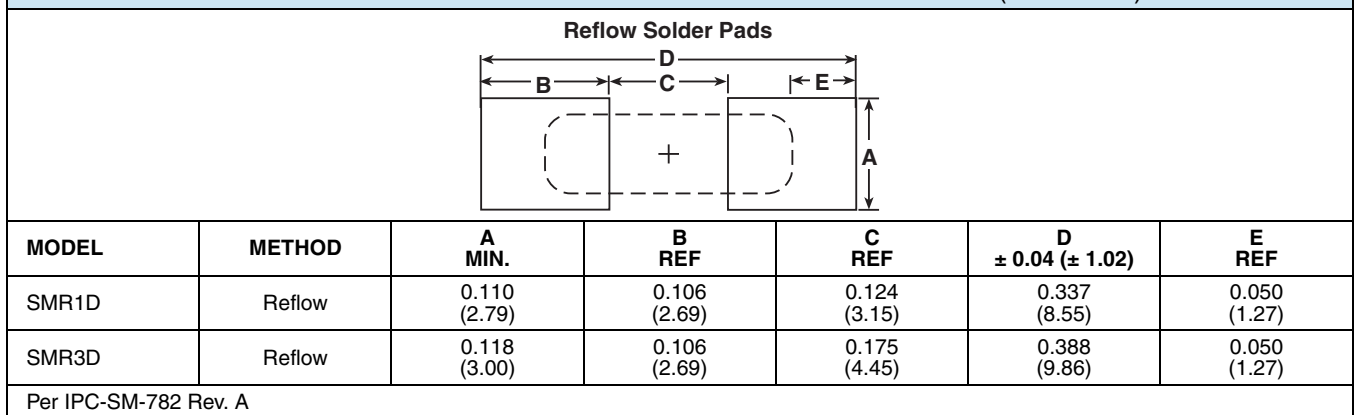
| TEST                             | CONDITIONS                                                    |                                                        |                                                           |                                                     | MAXIMUM LIMIT <sup>1)</sup>            |                                          |
|----------------------------------|---------------------------------------------------------------|--------------------------------------------------------|-----------------------------------------------------------|-----------------------------------------------------|----------------------------------------|------------------------------------------|
|                                  | SMR1D                                                         |                                                        | SMR3D                                                     |                                                     | SMR1D                                  | SMR3D                                    |
| Resistance Range                 |                                                               |                                                        |                                                           |                                                     | 5 Ω to 33 kΩ                           | 5 Ω to 80 kΩ                             |
| Rated Power                      | 5 Ω to 10 kΩ<br>0.250 W at 70 °C<br>0.125 W at 125 °C         | 10 kΩ to 33 kΩ<br>0.160 W at 70 °C<br>0.08 W at 125 °C | 5 Ω to 30 kΩ<br>0.6 W at 70 °C<br>0.3 W at 125 °C         | 30 kΩ to 80 kΩ<br>0.4 W at 70 °C<br>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<br>0.25 W at + 70 °C<br>0.125 W at + 125 °C |                                                        | 0.1 W at + 70 °C<br>0.6 W at + 70 °C<br>0.3 W at + 125 °C |                                                     | Typical<br>0.005 %<br>0.02 %<br>0.02 % | Typical<br>0.005 %<br>0.015 %<br>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  $\Omega$  to allow for measurement error at low values

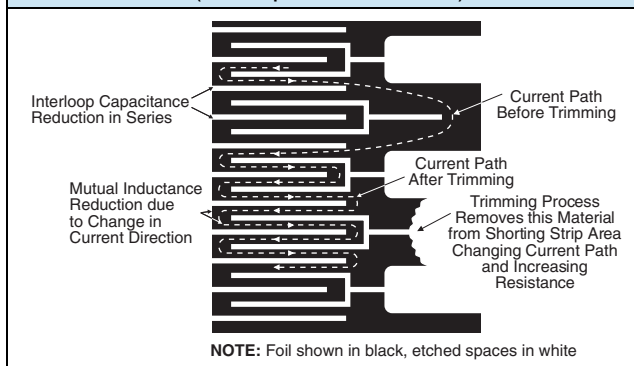
**FIGURE 2 - DIMENSIONS** in inches (millimeters)



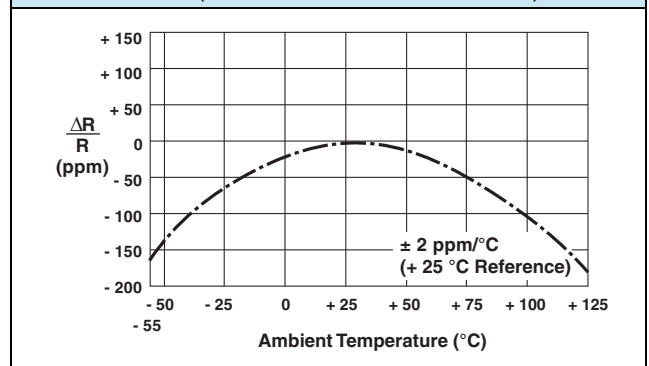
**FIGURE 3 - RECOMMENDED MOUNTING PAD GEOMETRIES** in inches (millimeters)



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



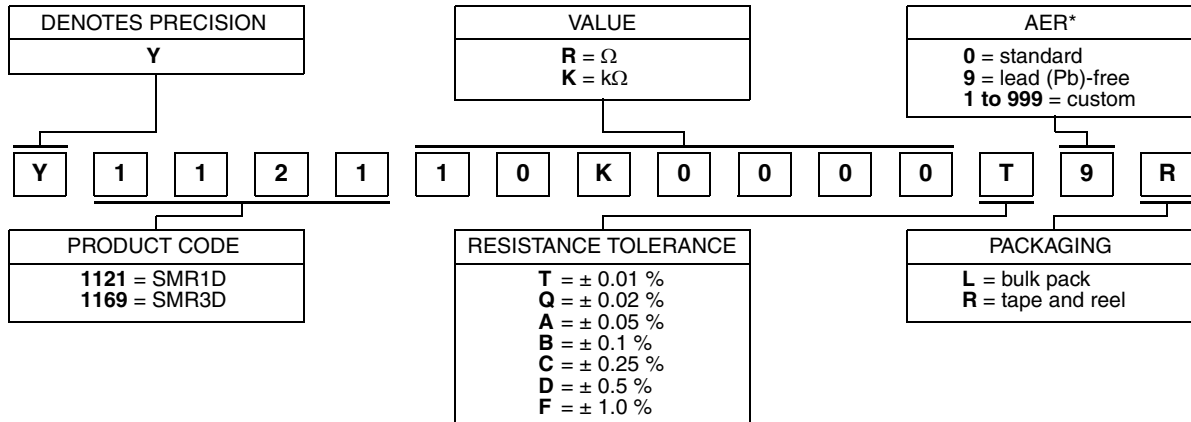
**FIGURE 5 - TYPICAL TCR CURVE**  
(for more details, see table 2)



**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)

| SMR1D          | 10K000         | TCR2               | T                                                                                                                                                                                      | S                                                | T                                                |
|----------------|----------------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------|
| MODEL          | OHMIC VALUE    | TCR CHARACTERISTIC | RESISTANCE TOLERANCE                                                                                                                                                                   | TERMINATION                                      | PACKAGING                                        |
| SMR1D<br>SMR3D | 10.0 $k\Omega$ |                    | <b>T</b> = $\pm 0.01\%$<br><b>Q</b> = $\pm 0.02\%$<br><b>A</b> = $\pm 0.05\%$<br><b>B</b> = $\pm 0.1\%$<br><b>C</b> = $\pm 0.25\%$<br><b>D</b> = $\pm 0.5\%$<br><b>F</b> = $\pm 1.0\%$ | <b>S</b> = lead (Pb)-free<br><b>B</b> = tin/lead | <b>B</b> = bulk pack<br><b>T</b> = tape and reel |

**Note**

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

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