

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 ¹⁾ | TYPICAL TCR AND MAX. SPREAD ¹⁾ (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
- 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 ¹⁾ | |
|----------------------------------|---|--|---|---|--|--|
| | 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)

| SMR1D | 10K000 | TCR2 | T | S | T |
|----------------|----------------|--------------------|---|------------------------------------|------------------------------------|
| 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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