

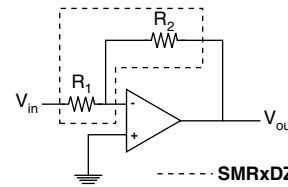
**Ultra High Precision Z-Foil Molded Surface Mount Resistor**  
with TCR down to  $\pm 0.2$  ppm/ $^{\circ}\text{C}$ , PCR of  $\pm 5$  ppm at Rated Power,  
Flexible Terminations, and Load-Life Stability of  $\pm 0.005$  % (50 ppm)

**FEATURES AND BENEFITS**

- Temperature coefficient of resistance (TCR):  $\pm 0.2$  ppm/ $^{\circ}\text{C}$  typical ( $-55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ ,  $+25^{\circ}\text{C}$  ref.)
- Tolerance: to  $\pm 0.01$  %
- Power coefficient of resistance (PCR) "ΔR due to self heating": 5 ppm at rated power
- Flexible Terminations ensure minimal stress transference from the PCB due to a difference in thermal coefficient of expansions (TCE)
- Electrostatic discharge (ESD): at least to 25 kV
- Load-life stability:  $\pm 0.005$  % ( $70^{\circ}\text{C}$ , 2000 h)
- Resistance range: 5 Ω to 80 kΩ (for higher and lower values, please contact us)
- Power rating: to 600 mW at  $+70^{\circ}\text{C}$
- Non-inductive, non-capacitive design
- Current noise:  $-40$  dB
- Voltage coefficient:  $< 0.1$  ppm/V
- Non-inductive:  $< 0.08$
- Non hot spot design
- Terminal finishes available: lead (Pb)-free, tin/lead alloy
- Matched sets with TCR tacking are available upon request
- For higher performances, please contact us
- Any value available within Resistance Range (e.g., 1K234)
- For prototype samples, please contact foil@vpgsensors.com



Any value at any tolerance available within resistance range



**APPLICATIONS**

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

**INTRODUCTION**

The SMRxDZ is an ultra high 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. One of the important parameters influencing stability is the Temperature Coefficient of Resistance (TCR). Although the TCR of foil resistors is considered

**Table 1 – Tolerance and TCR vs. Resistance Value** ( $-55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ ,  $+25^{\circ}\text{C}$  Ref.)

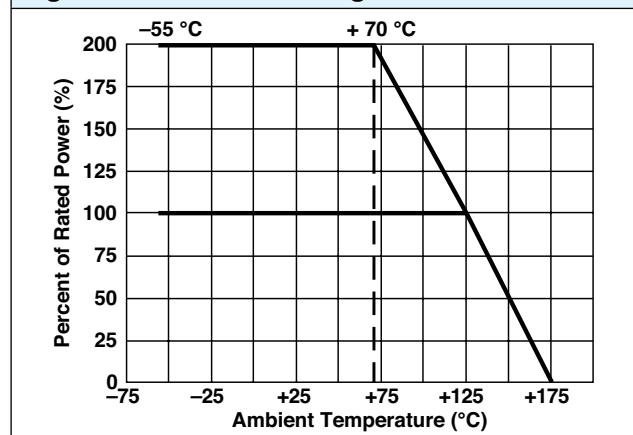
Value (Ω)	Standard Tolerance <sup>(1)</sup> (%)	Typical TCR and Max. Spread <sup>(1)</sup> (ppm/ $^{\circ}\text{C}$ )
50 Ω to 80 kΩ	$\pm 0.01$ %	$\pm 0.2 \pm 1.8$
20 Ω to $< 50$ Ω	$\pm 0.02$ %	$\pm 0.2 \pm 2.8$
10 Ω to $< 20$ Ω	$\pm 0.05$ %	$\pm 0.2 \pm 4.8$
5 Ω to $< 10$ Ω	$\pm 0.1$ %	$\pm 0.2 \pm 6.8$

**Note**  
<sup>(1)</sup> For values  $< 5$  Ω and tighter performance, contact us.

**Note**

\* This datasheet provides information about parts that are RoHS-compliant and/or parts that are non-RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS compliant. Please see the information/tables in this datasheet for details.

**Figure 1 – Power Derating Curve**



extremely low, this characteristic has been further refined over the years. The SMRxDZ utilizes ultra high precision Bulk Metal® Z-Foil.

The Z-Foil technology provides a significant reduction of the resistive element's sensitivity to ambient temperature variations (TCR) and to self heating when power is applied (power coefficient).

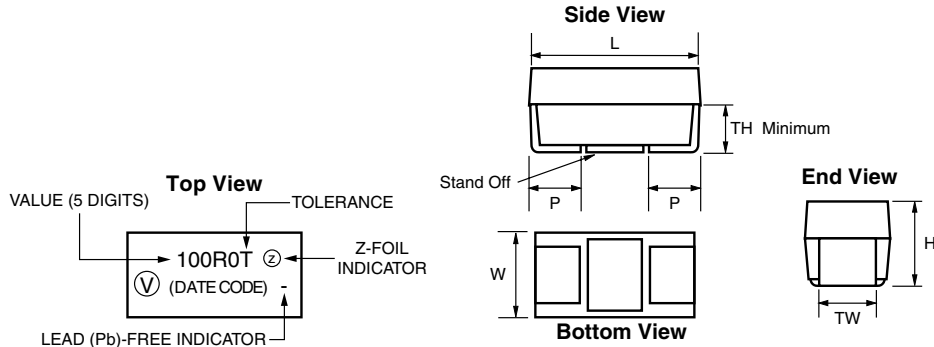
Voltage division with tight tracking <2 ppm/°C can be achieved with two randomly selected units even with a large ratio between the two values.

Our Application Engineering Department is available to advise and make recommendations. For non-standard technical requirements and special applications, please contact us.

**Table 2—Performance Specifications**

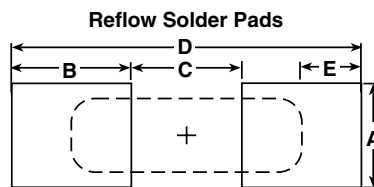
Parameters	Specifications				Maximum Limit <sup>(1)</sup>	
	SMR1DZ		SMR3DZ		SMR1DZ	SMR3DZ
Resistance Range					5 Ω to 33 kΩ	5 Ω to 80 kΩ
Rated Power	5 Ω to 10 kΩ 0.250 W at 70°C 0.125 W at 125°C	10 kΩ to 33 kΩ 0.160 W at 70°C 0.08 W at 125°C	5 Ω to 30 kΩ 0.6 W at 70°C 0.3 W at 125°C	30 kΩ to 80 kΩ 0.4 W at 70°C 0.2 W at 125°C	See Figure 1	
Weight	0.1143 g		0.244 g			
Packaging	Bulk (loose) or tape and reel, per EIA-481-1					
Test	Conditions				Maximum Limit <sup>(1)</sup>	
Max. Working Voltage	73 V		180 V		—	
Max. 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				R >100 Ω: ±0.02% (200 ppm) R ≤100 Ω: ±0.03% (300 ppm)	
Short Time Overload	6.25 x rated power; 5 s				±0.01% (100 ppm)	
Low Temperature Operation	-65°C, 24 h (no load); 45 min at rated power				±0.01% (100 ppm)	
Dielectric Withstanding Voltage	Atmospheric pressure; AC 200 V; 1 min				±0.01% (100 ppm)	
Insulation Resistance	DC 100 V; 1 min				over 10 000 MΩ	
Resistance to Soldering Heat	260°C for 10 s				±0.03%	
Moisture Resistance	+65°C to -10°C; 90% to 98% RH; rated power; 240 h				±0.03% (300 ppm)	
Shock	100 G; Sawtooth				±0.01% (100 ppm)	
Vibration, High Frequency	10~2000~10 Hz; 20 G; X, Y, Z each 2.5 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% 0.05% max	Typical 0.005% 0.015% 0.05% max
High Temperature Exposure	175°C; no load 2000 h				±0.1% (1000 ppm)	
<b>Note</b>						
<sup>(1)</sup> As shown +0.01 Ω to allow for measurement errors at low values.						

Figure 2—Dimensions in Inches (Millimeters)



Model	L	W	H	P	TW	TH (Minimum)
SMR1DZ	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)
SMR3DZ	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)

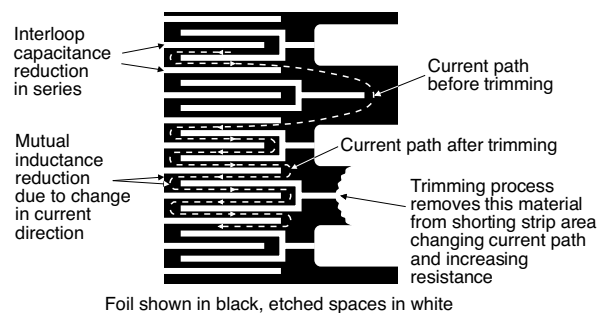
Figure 3—Recommended Mounting Pad Geometries in Inches (Millimeters)



Model	Method	A Min	B Ref	C Ref	D ±0.04 (±1.02)	E Ref
SMR1DZ	Reflow	0.110 (2.79)	0.106 (2.69)	0.124 (3.15)	0.337 (8.55)	0.050 (1.27)
SMR3DZ		0.118 (3.00)				

Per IPC-SM-782 Rev A

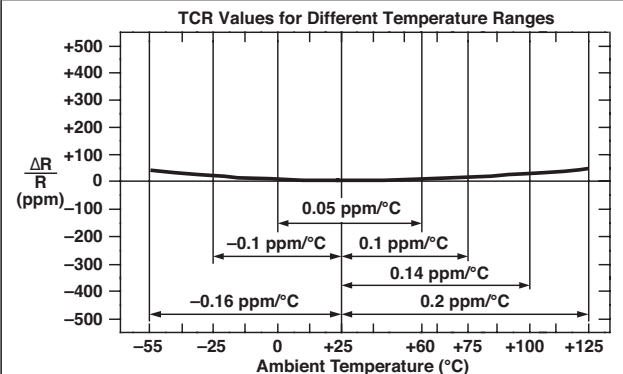
Figure 4—Trimming to Values (conceptual illustration)



**Note**

To acquire a precision resistance value, the Bulk Metal Foil chip is trimmed by selectively removing built-in “shorting bars.” To increase the resistance in known increments, marked areas are cut, producing progressively smaller increases in resistance. This method reduces the effect of “hot spots” and improves the long-term stability of VFR resistors.

Figure 5—Typical TCR Curve Z-Foil

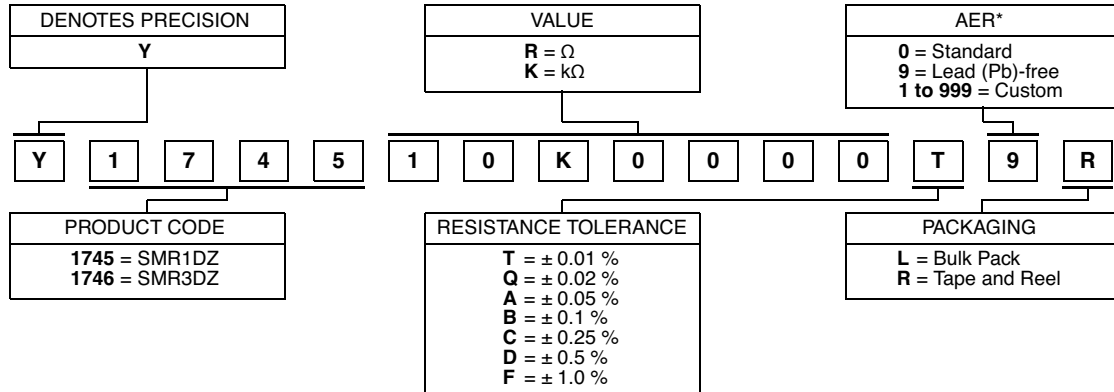


**Notes**

- For more details, see Table 1.
- The TCR values for <80 Ω are influenced by the termination composition and the result is deviation from this curve.

**Table 3—Part Number Information**

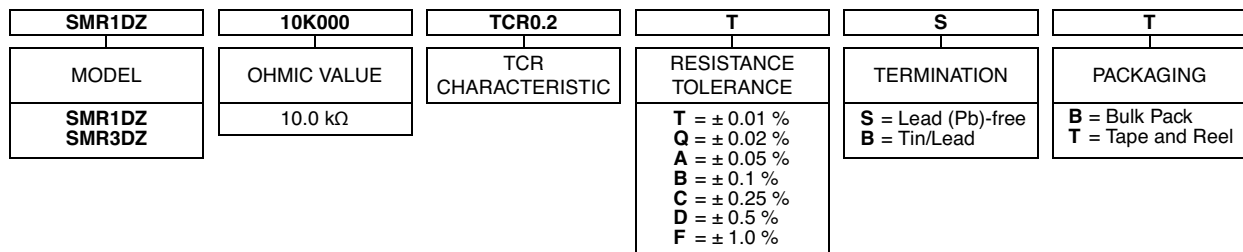
**NEW GLOBAL PART NUMBER: Y174510K0000T9R (preferred part number format)**



FOR EXAMPLE: ABOVE GLOBAL ORDER Y1745 10K0000 T 9 R:

TYPE: SMR1DZ  
VALUE: 10.0 kΩ  
ABSOLUTE TOLERANCE: ± 0.01 %  
TERMINATION: Lead (Pb)-free  
PACKAGING: Tape and Reel

**HISTORICAL PART NUMBER: SMR1DZ 10K000 TCR0.2 T S T (will continue to be used)**



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