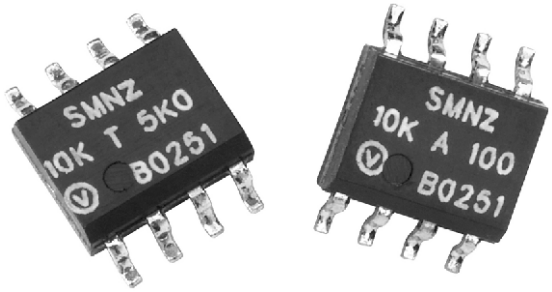
# Ultra High Precision Z-Foil Surface Mount 4 Resistor Network Dual-In-Line Package with TCR Tracking of 0.1 ppm/°C, PCR Tracking of 5 ppm at Rated Power, and Tolerance Match of 0.01 %




**Any value and any ratio available within resistance range**

## INTRODUCTION

The Z-Foil Technology provides a significant reduction of the resistive components' sensitivity to ambient temperature variations (TCR) and applied power changes (PCR). 0.05 ppm/°C Absolute TCR removes errors due to temperature gradients.

Model SMNZ offers extremely low TCR (absolute and tracking), excellent load life stability, tight tolerance (absolute and matching), excellent ratio stability, low current noise, low voltage coefficient and non sensitivity to ESD - **all in the same resistor.**

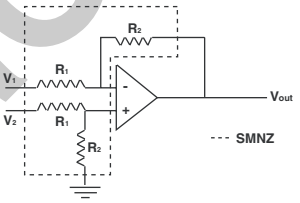
The SMNZ Surface Mount Network is made up of 4 independent Bulk Metal® Z-Foil resistors in a small standard molded epoxy package with 50 MIL lead pitch (JEDEC MS-012 package).

The electrical specification of this integrated construction offers improved performance and better real estate utilization over discrete resistors and matched sets. The resistor may be used independently or as divider pairs.

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

## APPLICATIONS

- Instrumentation Amplifiers
- Bridge Networks
- Differential Amplifiers
- Ratio Arms in Bridge Circuits
- Medical and Test Equipment
- Military
- Airborne etc



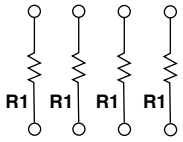

## FEATURES

- Temperature Coefficient of Resistance (TCR):
  Absolute: ± 0.05 ppm/°C typical (0 °C to + 60 °C)
  ± 0.2 ppm/°C typical (-55 °C to + 125 °C, + 25 °C Ref.) (see table 1)
  Tracking: 0.1 ppm/°C typical (see table 1)
- Tolerance Match: 0.01 %
- Power Coefficient Tracking - "R2 -R1 due to self heating": 5 ppm at Rated Power
- Power Rating: at 70 °C
  Entire Package: 0.4 W
  Each Resistor: 0.1 W
- Ratio Stability: 0.005 % (0.1 W at 70 °C, 2000 hours)
- Large Variety of Resistance Ratios
- Electrostatic Discharge (ESD) above 25 000 Volts
- Short Time Overload ≤ 0.0025 %
- Non Inductive, Non Capacitive Design
- Rise Time: 1 ns without ringing
- Current Noise: < - 40 dB
- Voltage Coefficient < 0.1 ppm/V
- Non Inductive: < 0.08 µH
- Non Hot Spot Design
- Terminal Finishes available: Lead (Pb)-free
  Tin/Lead Alloy
- For better performances please contact us
- Any value available within resistance range (e.g. 1K2345)
- Prototype samples available from 48 hours. For more information, please contact foil@vishay.com

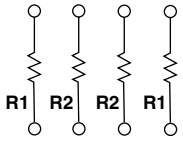
Pb-free Available

**RoHS*** COMPLIANT

## FIGURE 1 - SCHEMATICS




**OPTION 1**
**FOUR RESISTORS, SAME OHMIC VALUE**
**SAME ABSOLUTE TOLERANCE**




**OPTION 2**
**TWO RESISTOR PAIRS**
**R1/R2; R2/R1**

**Note**
1. Different schematics are available (R1, R2, R3, R4)

## TABLE 1 - MODEL SMNZ SPECIFICATIONS

| MODEL | RESISTANCE VALUES[1)] | ABSOLUTE TCR (- 55 °C TO + 125 °C, + 25 °C REF.) (TYPICAL + MAX. SPREAD) | RESISTANCE RATIO | TCR TRACKING | TOLERANCE | |
|---|---|---|---|---|---|---|
| | | | | MAX. | ABSOLUTE | MATCH |
| SMNZ | 100 Ω - 1 kΩ<br>1 kΩ - 10 kΩ | ± 0.2 ± 2.8<br>± 0.2 ± 1.8 | R1/R2 = 1<br>1 < R1/R2 ≤ 10<br>10 < R1/R2 ≤ 100 | 0.5 ppm/°C<br>1.0 ppm/°C<br>2.0 ppm/°C | ± 0.02 %<br>± 0.05 %<br>± 0.1 % | 0.01 %<br>0.02 %<br>0.05 % |

**Note**
1. SMN (Classic Foil) available with values up to 20 kΩ

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

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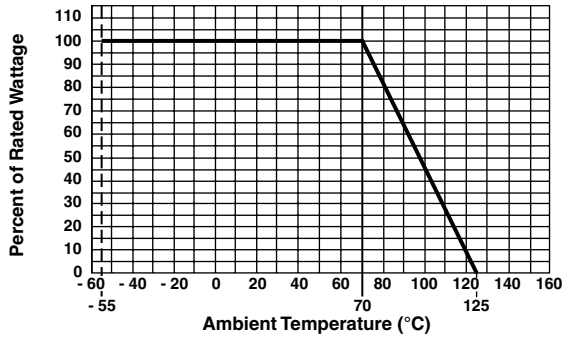
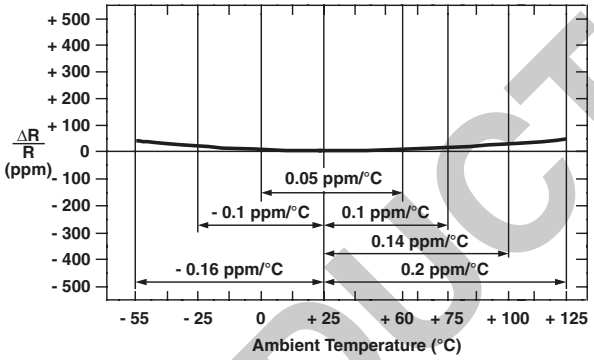
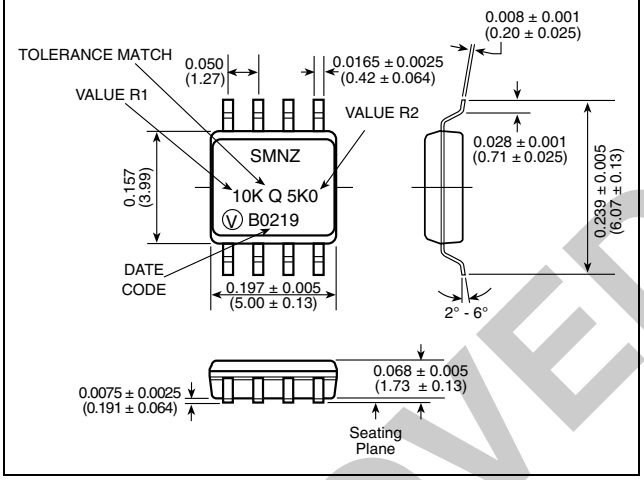
## FIGURE 2 - POWER DERATING CURVE



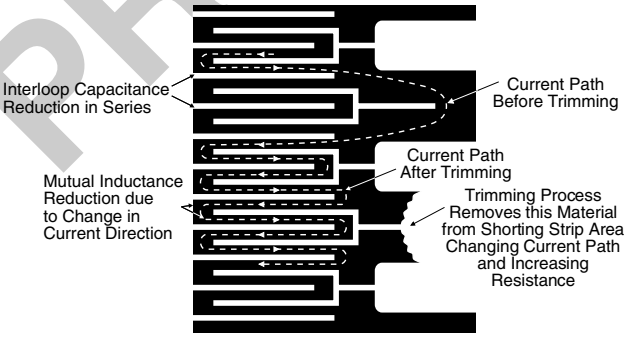

## FIGURE 4 - TYPICAL TCR CURVE Z-FOIL




## FIGURE 3 - DIMENSIONS AND IMPRINTING EXAMPLE in inches (millimeters)

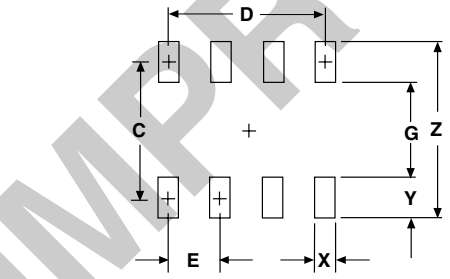



## FIGURE 5 - TRIMMING TO VALUES (Conceptual Illustration)




**Note:** Foil shown in black, etched spaces in white

## FIGURE 6 - LAND PATTERN in inches (millimeters)




| | Z | G | X | Y | C | D | E |
|---|---|---|---|---|---|---|---|
| MINIMUM | 0.283 (7.19) | 0.102 (2.59) | 0.024 (0.61) | 0.095 (2.41) | 0.197 (5.00) | 0.150 (3.81) | 0.050 (1.27) |
| MAXIMUM | 0.291 (7.39) | 0.110 (2.79) | 0.032 (0.81) | REFERENCE | | | |

| **TABLE 2 - PERFORMANCE SPECIFICATIONS** (Per MIL-PRF 914 Test Methods) | |
|---|---|
| **SPECIFICATIONS** | **TYPICAL LIMITS** |
| **Power Rating** at + 70 °C | Each resistor: 0.1 watts<br>Entire package: 0.4 watts |
| **Maximum Working Voltage** (each resistor) | $(P \times R)^{½}$ |
| **Thermal Shock**<br>25 x (- 65 °C to + 125 °C) | ΔR = 0.01 % (100 ppm)<br>ΔRatio = 0.01 % (100 ppm) |
| **Thermal Shock** 5 x (- 65 °C to + 125 °C) and<br>**Power Conditioning** 1.5 rated power at 25 °C, 100 hours | ΔR = 0.02 % (200 ppm)<br>ΔRatio = 0.015 % (150 ppm) |
| **DWV Atm. Pressure** 200 V (A.C), 1 minute | Successfully passed |
| **Insulation Resistance** 100 V (D.C), 1 minute | > $10^4$ MΩ |
| **Resistance to Soldering Heat** | ΔR = 0.01 % (100 ppm)<br>ΔRatio = 0.005 % (50 ppm) |
| **Moisture Resistance**<br>+ 65 °C to - 10 °C; 90 % to 98 % RH; 0.1 x rated power; 240 hours | ΔR = 0.02 % (200 ppm)<br>ΔRatio = 0.005 % (50 ppm) |
| **Shock (Specified Pulse)**<br>100G | ΔR = 0.01 % (100 ppm)<br>ΔRatio = 0.01 % (100 ppm) |
| **Vibration, High Frequency**<br>(10 Hz - 2000 Hz), 20G | ΔR = 0.005 % (50 ppm)<br>ΔRatio = 0.005 % (50 ppm) |
| **High Temperature Exposure**<br>100 hours at 125 °C | ΔR = 0.01 % (100 ppm)<br>ΔRatio = 0.005 % (50 ppm) |
| **Low Temperature Storage**<br>24 hours at - 65 °C | ΔR = 0.005 % (50 ppm)<br>ΔRatio = 0.005 % (50 ppm) |
| **Load Life Stability**<br>at 70 °C; 0.1 watt per resistor, 2000 hours | ΔR = 0.005 % (50 ppm)<br>ΔRatio = 0.005 % (50 ppm) |
| **Short Time Overload**<br>6.25 x Rated Power; 5 seconds | ΔR = 0.005 % (50 ppm)<br>ΔRatio = 0.0025 % (25 ppm) |
| **Weight** | 0.08 g |

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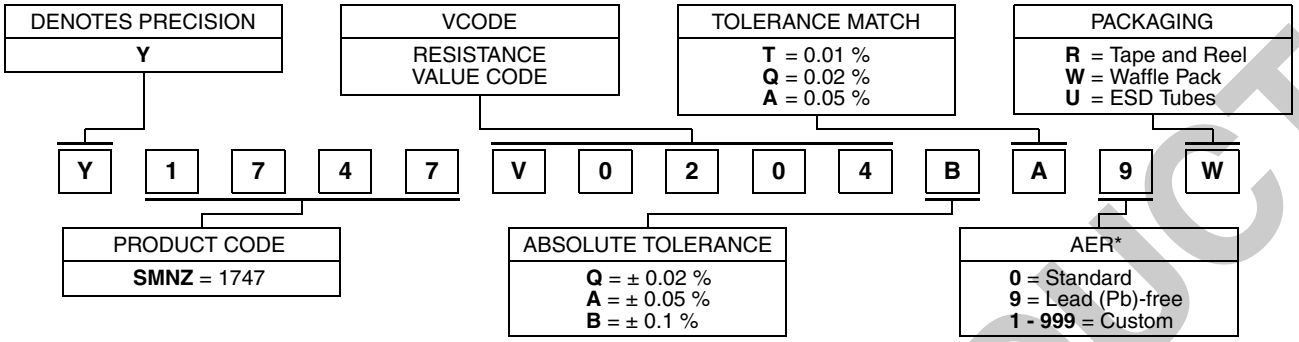
## TABLE 3 - GLOBAL PART NUMBER INFORMATION

**NEW GLOBAL PART NUMBER: Y1747V0204BA9W (preferred part number format)**




FOR EXAMPLE: ABOVE GLOBAL ORDER Y1747 V0204 B A 9 W:
TYPE: SMNZ
VALUES: 10K/500R
ABSOLUTE TOLERANCE: ± 0.1 %
TOLERANCE MATCH: 0.05 %
TERMINATION: Lead (Pb)-free
PACKAGING: Waffle Pack

**HISTORICAL PART NUMBER: SMNZ 10K/500R TCR0.2 B A S W (will continue to be used)**

| SMNZ | 10K/500R | TCR0.2 | B | A | S | W |
|---|---|---|---|---|---|---|
| MODEL | RESISTANCE VALUE | ABSOLUTE TCR | ABSOLUTE TOLERANCE | TOLERANCE MATCH | TERMINATION | PACKAGING |
| **SMNZ** | **$R_1$** = 10 kΩ<br>**$R_2$** = 500 Ω | **TCR0.2** | **Q** = ± 0.02 %<br>**A** = ± 0.05 %<br>**B** = ± 0.1 % | **T** = 0.01 %<br>**Q** = 0.02 %<br>**A** = 0.05 % | **S** = Lead (Pb)-free<br>**B** = Tin/Lead | **T** = Tape and Reel<br>**W** = Waffle Pack<br>**U** = ESD Tubes |

**Note**

* For non-standard requests, please contact Application Engineering.

## TABLE 4 - RESISTANCE VALUE CODE LIST FOR POPULAR RATIOS

(other values available upon request)

| VCODES | R1/R2 RATIO | R1 | R2 | VCODES | R1/R2 RATIO | R1 | R2 |
|---|---|---|---|---|---|---|---|
| V0201 | 100 | 10K | 100R | V0189 | 2.5 | 1K | 400R |
| V0202 | 50 | 10K | 200R | V0185 | | 500R | 200R |
| V0197 | | 5K | 100R | V0207 | 2 | 10K | 5K |
| V0203 | 25 | 10K | 400R | V0175 | | 2K | 1K |
| V0198 | | 5K | 200R | V0190 | | 1K | 500R |
| V0204 | 20 | 10K | 500R | V0182 | | 400R | 200R |
| V0193 | | 2K | 100R | V0179 | | 200R | 100R |
| V0205 | 10 | 10K | 1K | V0186 | 1.25 | 500R | 400R |
| V0194 | | 2K | 200R | V0178 | 1 | 100R | 100R |
| V0187 | | 1K | 100R | V0180 | | 200R | 200R |
| V0200 | 5 | 5K | 1K | V0183 | | 400R | 400R |
| V0195 | | 2K | 400R | V0023 | | 500R | 500R |
| V0188 | | 1K | 200R | V0191 | | 1K | 1K |
| V0184 | | 500R | 100R | V0176 | | 2K | 2K |
| V0196 | 4 | 2K | 500R | V0019 | | 5K | 5K |
| V0181 | | 400R | 100R | V0008 | | 10K | 10K |

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All product specifications and data are subject to change without notice.

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