

## High Precision Surface Mount 4 Resistor Network

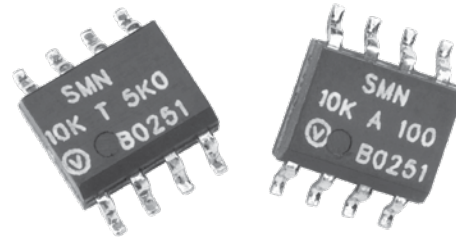
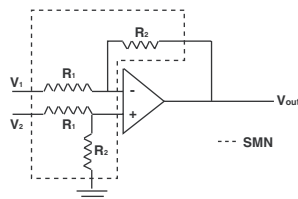
### Dual-In-Line Package with TCR Tracking $\leq 0.5$ ppm/°C, Tolerance Match of 0.01% and Ratio Stability of 0.005%

#### FEATURES

- Temperature coefficient of resistance (TCR) (-55°C to +125°C, +25°C ref):
  - Absolute:  $\pm 0.2$  ppm/°C typical (see Table 2)
  - Tracking:  $\pm 0.5$  ppm/°C typical (see Table 2)
- Power rating (at 70°C):
  - Entire package: 0.4 W
  - Each resistor: 0.1 W
- Resistance tolerance match: 0.01%
- Ratio stability: 0.005% (0.1 W at 70°C, 2000 hours)
- Large variety of resistance ratios
- Electrostatic discharge (ESD) to 25 kV
- Short time overload:  $\leq 0.0025\%$
- Non inductive, non capacitive design
- Rise time: 1 ns without ringing
- Current Noise:  $< -40$  dB
- Thermal EMF: 0.05  $\mu$ V/°C
- Voltage coefficient  $< 0.1$  ppm/V
- Non inductive:  $< 0.08$   $\mu$ H
- Non hot spot design
- Terminal finishes available: Lead (Pb)-free; Tin/Lead alloy
- For better performances please contact us
- Available with Z-Foil technology, please see SMNZ datasheet.

#### APPLICATIONS

- Instrumentation amplifiers
- Bridge networks
- Differential amplifiers
- Ratio arms in bridge circuits
- Medical and test equipment
- Military
- Airborne, etc.



Any value and any ratio available within resistance range

#### INTRODUCTION

Bulk Metal® Foil (BMF) Technology outperforms all other resistor technologies available today for applications that require high precision and high stability.

This technology has been pioneered and developed by Vishay Foil Resistors, and products based on this technology are the most suitable for a wide range of applications.

BMF technology allows us to produce Customer Orientated products designed to satisfy challenging and specific technical requirements.

Model SMN offers low TCR (absolute and tracking), excellent load life stability, tight tolerance (absolute and match), excellent ratio stability, low thermal EMF, low current noise and low voltage coefficient - all in the same resistor.

The SMN Surface Mount Network is made up of 4 independent BMF 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.

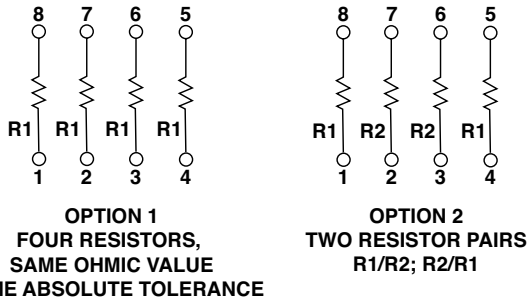
Our Application Engineering Department is available to advise and make recommendations. For non-standard technical requirements and special applications, please contact us. Contact us using the e-mail address in the footer below.

**Table 1 – Resistance Values and Tolerances**  
(Tighter performances are available)

Resistance Values	100 $\Omega$ – 10 k $\Omega$ per resistor
Absolute Tolerance Each Resistor	$\pm 0.02\%$ , $\pm 0.05\%$ , $\pm 0.1\%$
Resistance Tolerance Match	0.01%, 0.02%, 0.05%

\* 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 – Schematics <sup>(1)</sup>



<sup>(1)</sup> Different schematics are available (R1, R2, R3, R4).

Figure 2 – Power Derating Curve

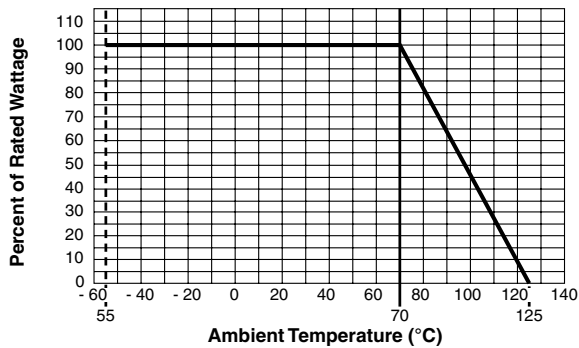
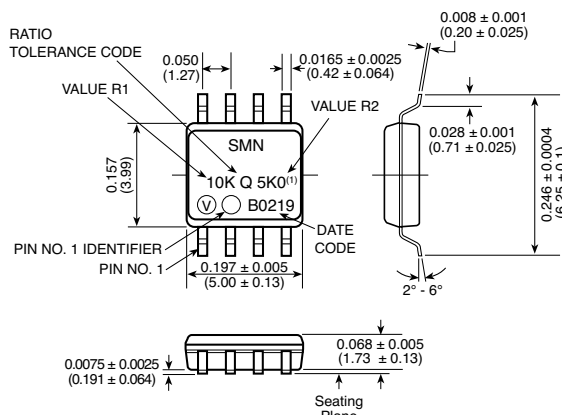


Figure 3 – Dimensions and Imprinting Example in inches (millimeters)



<sup>(1)</sup> If the resistance value of R1 and R2 contains more than 6 characters together, the VCODE will be printed instead (see Resistance Value Code List for Popular Ratios Table) followed by the ratio tolerance code

Figure 4 – Typical TCR Curve (for more details, see Table 2)

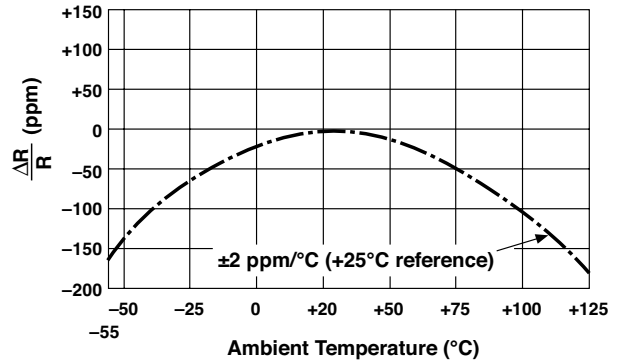
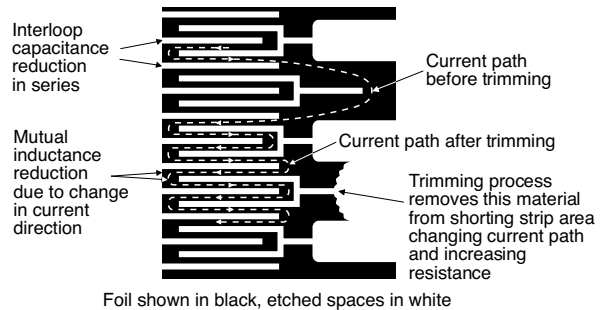
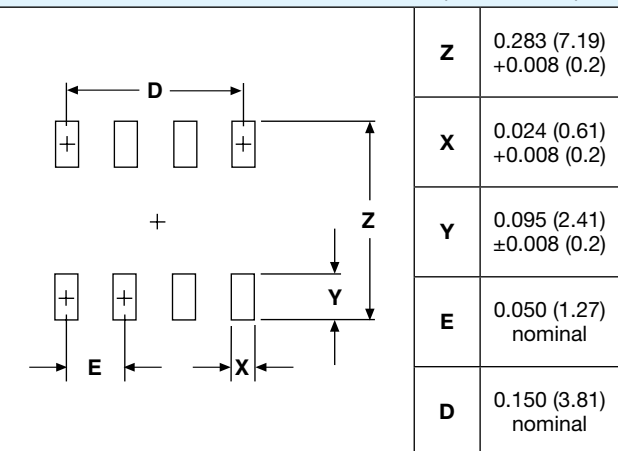


Figure 5 – Trimming to Values (conceptual illustration)



**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 Bulk Metal Foil resistors.

Figure 6 – Land Pattern in inches (millimeters)

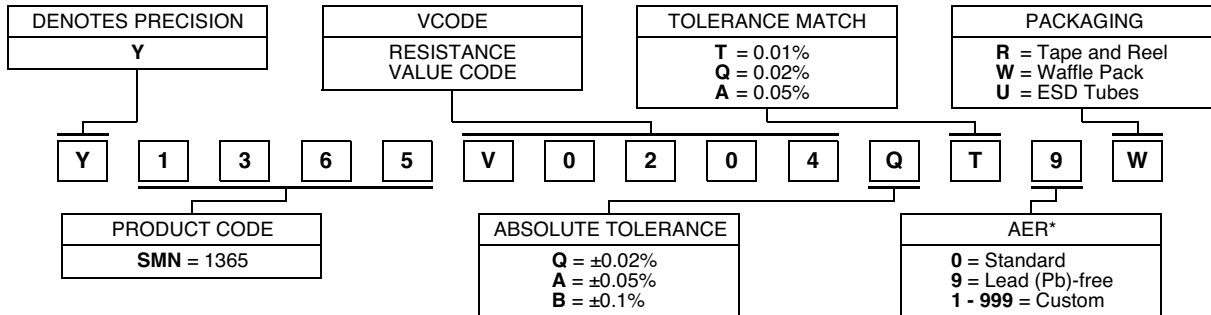


**Table 2—Performance Specifications** (per MIL-PRF 914 Test Methods)

Specifications	Typical Limits
<b>Power rating</b> at + 70 °C	Each resistor: 0.1 W Entire package: 0.4 W
<b>Maximum working voltage (each resistor)</b>	$(P \times R)^{1/2}$
<b>TCR</b> -55°C to +125°C (25°C reference)	Absolute (typical and max. spread): $\pm 2 \pm 3$ ppm/°C Tracking (maximum): For $R1/R2 = 1$ 1.0 ppm/°C For $1 < R1/R2 \leq 10$ 2.0 ppm/°C For $10 < R1/R2 \leq 100$ 3.0 ppm/°C
<b>Thermal shock</b> 25 x (-65°C to +125°C)	$\Delta R = 0.01\%$ (100 ppm) $\Delta R = 0.01\%$ (100 ppm)
<b>Thermal shock</b> 5 x (-65°C to +125°C) and <b>Power conditioning</b> 1.5 rated power at 25 °C, 100 hours	$\Delta R = 0.02\%$ (200 ppm) $\Delta R_{\text{Ratio}} = 0.015\%$ (150 ppm)
<b>DWV atm. pressure</b> 200 V (A.C), 1 minute	Successfully passed
<b>Insulation resistance</b> 100 V (D.C), 1 minute	$> 10^4$ M $\Omega$
<b>Resistance to soldering heat</b>	$\Delta R = 0.01\%$ (100 ppm) $\Delta R_{\text{Ratio}} = 0.005\%$ (50 ppm)
<b>Moisture resistance</b> +65°C to -10°C; 90% to 98% RH; 0.1 x rated power; 240 hours	$\Delta R = 0.02\%$ (200 ppm) $\Delta R_{\text{Ratio}} = 0.005\%$ (50 ppm)
<b>Shock (specified pulse)</b> 100 G	$\Delta R = 0.01\%$ (100 ppm) $\Delta R_{\text{Ratio}} = 0.01\%$ (100 ppm)
<b>Vibration, high frequency</b> (10 Hz–2000 Hz), 20 G	$\Delta R = 0.005\%$ (50 ppm) $\Delta R_{\text{Ratio}} = 0.005\%$ (50 ppm)
<b>High temperature exposure</b> 100 hours at 125°C	$\Delta R = 0.01\%$ (100 ppm) $\Delta R_{\text{Ratio}} = 0.005\%$ (50 ppm)
<b>Low temperature storage</b> 24 hours at -65°C	$\Delta R = 0.005\%$ (50 ppm) $\Delta R_{\text{Ratio}} = 0.005\%$ (50 ppm)
<b>Load life stability</b> at 70°C; 0.1 W per resistor, 2000 hours	$\Delta R = 0.005\%$ (50 ppm) $\Delta R_{\text{Ratio}} = 0.005\%$ (50 ppm)
<b>Short time overload</b> 6.25 x rated power; 5 seconds	$\Delta R = 0.005\%$ (50 ppm) $\Delta R_{\text{Ratio}} = 0.0025\%$ (25 ppm)
<b>Weight</b>	0.08 g

**Table 3—Part Number Information <sup>(1)</sup>**

NEW GLOBAL PART NUMBER: Y1365V0204QT9W (preferred part number format)



FOR EXAMPLE: ABOVE GLOBAL ORDER Y1365 V0204 Q T 9 W:

TYPE: SMN  
VALUES: 10K/500R  
ABSOLUTE TOLERANCE: ±0.02%  
TOLERANCE MATCH: 0.01%  
TERMINATION: Lead (Pb)-free  
PACKAGING: Waffle Pack

HISTORICAL PART NUMBER: SMN 10K/500R TCR2 Q T S W (will continue to be used)

SMN	10K/500R	TCR2	Q	T	S	W
MODEL	RESISTANCE VALUE	ABSOLUTE TCR	ABSOLUTE TOLERANCE	TOLERANCE MATCH	TERMINATION	PACKAGING
SMN	R <sub>1</sub> = 10k R <sub>2</sub> = 500	TCR2	Q = ±0.02% A = ±0.05% B = ±0.1%	T = 0.01% Q = 0.02% A = 0.05%	S = Lead (Pb)-free B = Tin/Lead	T = Tape and reel W = Waffle pack U = ESD tubes

<sup>(1)</sup> For non-standard requests, please contact Application Engineering.

**Table 4—Resistance Value Code List for Popular Ratios (other values available)**

VCODES	R1/R2RATIO	R1	R2	VCODES	R1/R2RATIO	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	10K	1K	V0183	400R		400R	
V0195	5	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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