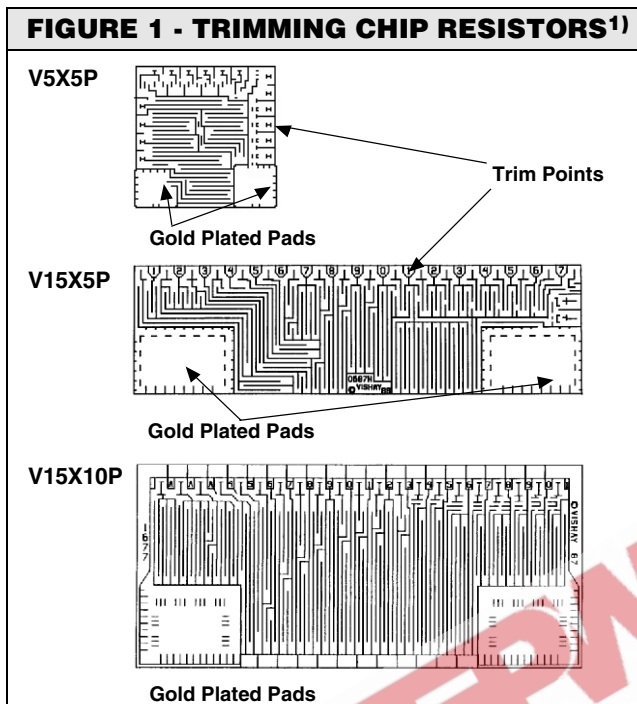




## Bulk Metal® Foil Technology Discrete Chips with TCR of 2 ppm/°C and Tolerance to 0.005 % for use in Hybrid Circuits



The typical pattern and trimming illustrations show that the V5X5P resistor has 16 trimming points, the V15X5P has 20 and the V15X10P has 21. These trimming points are arranged around the chip periphery and are clearly indicated. Trimming to the desired resistance value and tolerance is accomplished by cutting the trim points, thereby producing specific incremental changes in the chip's resistance value relative to the original prevalue; up to + 20 % for the V5X5P, + 30 % for the V15X5P, and + 50 % for the V15X10P (not all trim points need be used; the ΔR necessary to adjust the pre-value to the desired final value dictates which trim points need to be used).

Monitoring of circuit output while "actively" trimming readily permits adjustment of the chip to ± 0.005 %.

Actual trimming charts are supplied on request for all images.

### FEATURES

- Temperature coefficient of resistance (TCR):  
Absolute: ± 2.0 ppm/°C typical  
(- 55 °C to + 125 °C, + 25 °C ref.)  
Tracking: to 0.5 ppm/°C<sup>1, 2)</sup>
- Resistance tolerance:  
Absolute to ± 0.01 % (user trimmable to ± 0.005 %)  
Match: to 0.01 %
- Power rating: 50 to 150 mW at + 70 °C
- Load life stability: ± 0.05 % maximum at + 70 °C, 2000 h at rated power
- Resistance range: 5 Ω to 80 kΩ (see table 2)
- Short time overload: ≤ 0.02 %
- Electrostatic discharge (ESD) above 25 000 V
- Non inductive, non capacitive design
- Rise time: 1 ns without ringing
- Current noise: - 40 dB
- Non inductive: < 0.08 μH
- Non hot spot design



RoHS  
COMPLIANT

Vishay precision chip resistors offer an order of magnitude of improvement over other chip resistors in hybrid applications. With a maximum Temperature Coefficient of Resistance (TCR) of ± 5 ppm/°C, selected TCR tracking to 0.5 ppm/°C and factory supplied resistance tolerances to ± 0.01 %, they provide the user with accuracy and stability not available in other chip resistor products. If desired they can be user trimmed to any value within ± 0.005 %.

Vishay precision chip resistors are designed to meet or exceed the requirements of MIL-PRF-55342 characteristic E. These discrete chips are available either factory trimmed to exact resistance values (option T) or ready for user trimming (option U).

TABLE 1 - TOLERANCE AND TCR VERSUS RESISTANCE VALUE		
VALUE (Ω)	STANDARD TOLERANCE (%)	TYPICAL TCR AND MAX SPREAD - 55 °C to + 125 °C, + 25 °C Ref. (ppm/°C)
500 to 80K	± 0.01	± 2 ± 3
100 to < 500	± 0.01	± 2 ± 4
50 to < 100	± 0.01	± 2 ± 5
20 to < 50	± 0.02	± 2 ± 6
10 to < 20	± 0.05	± 2 ± 8
5 to < 10	± 0.10	± 2 ± 10

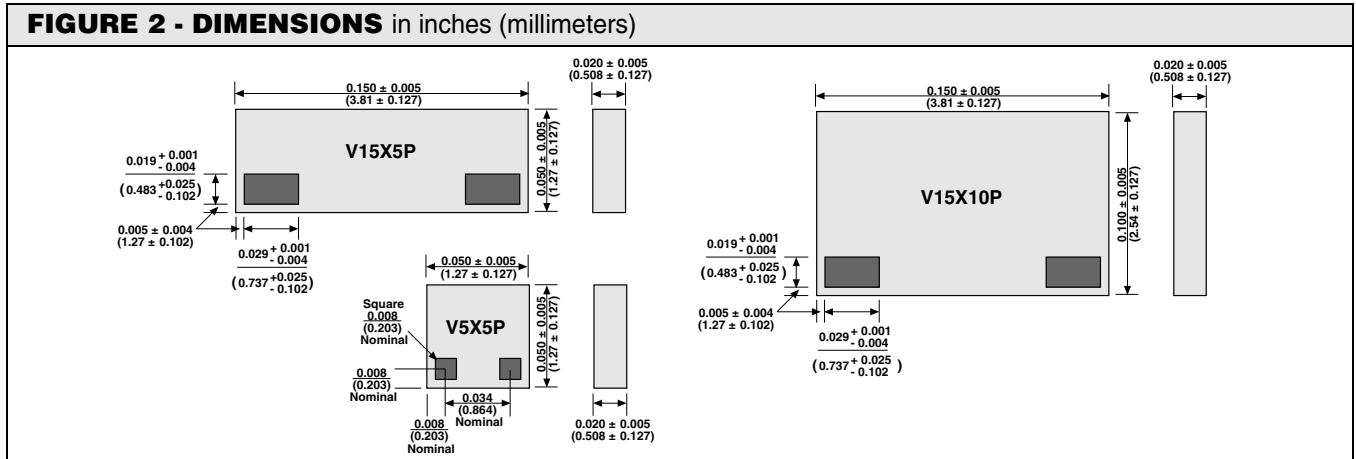
#### Note

- For tighter performances, please contact Vishay Application Engineering

# V5X5P, V15X5P, V15X10P



Vishay Foil Resistors Bulk Metal® Foil Technology Discrete Chips  
with TCR of 2 ppm/°C and Tolerance to 0.005 %  
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<b>TABLE 2 - PRECISION CHIP RESISTOR SPECIFICATIONS<sup>2)</sup></b>	
<b>Resistance range</b>	5 Ω to 10 kΩ (model V5X5P) 5 Ω to 33 kΩ (model V15X5P) 33 kΩ to 80 kΩ (model V15X10P)
<b>Trimming range</b> (Approximate adjustment capability)	0 to 1.2 x nominal prevalue (V5X5P)* 0 to 1.3 x nominal prevalue (V15X5P) 0 to 1.5 x nominal prevalue (V15X10P) <b>Note</b> * The V5X5P chips are being gradually redesigned for a higher trimming factor - 1.3 or more instead of 1.2. For information about the availability of a specific resistance value, contact the factory.
<b>Resistance tolerance</b>	Option T (trimmed to value at Vishay)* ± 0.01 %; ± 0.02 %; ± 0.05 %; ± 0.1 %; ± 0.25 %; ± 0.5 %; ± 1 %; ± 5 % Option U (for user trimming to any value within ± 0.005 %) G.F. = Good for values <b>Note</b> * See table 1 for resistance/tolerance limits
<b>Load life stability</b>	0.05 % ΔR maximum under full rated power for 2000 h at + 70 °C
<b>Power rating</b> (at + 70 °C ambient temperature), (see figure 3)	V5X5P: 0.05 W (22 V maximum) V15X5P: 0.1 W (54 V maximum) V15X10P: 0.15 W (100 V maximum)
<b>High frequency operation</b> Rise time Inductance Capacitance	1 ns without ringing 0.1 μH maximum; 0.08 μH typical 1.0 pF maximum; 0.5 pF typical
<b>Current noise</b>	< 0.010 μV(rms)/V of applied voltage
<b>Voltage coefficient</b>	< - 40 dB
<b>Working voltage</b>	22 V (model V5X5P) 54 V (model V15X5P) 100 V (model V15X10P)



# V5X5P, V15X5P, V15X10P

Bulk Metal® Foil Technology Discrete Chips Vishay Foil Resistors  
with TCR of 2 ppm/°C and Tolerance to 0.005 %  
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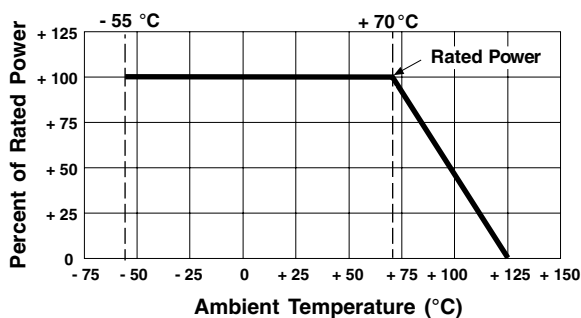
TABLE 3 - ENVIRONMENTAL PERFORMANCE COMPARISON			
	METHOD PARAGRAPH	MIL-PRF-55342 CHARACTERISTIC E LIMITS	TYPICAL VISHAY
<b>Test group I</b> Thermal shock	4.8.3	± 0.1 %	± 0.02 %
<b>Test group II</b> Low temperature operation Short time overload High temperature exposure Resistance to bonding exposure	4.8.5 4.8.6 4.8.7 4.8.8	± 0.1 % ± 0.1 % ± 0.1 % ± 0.2 %	± 0.005 % ± 0.02 % ± 0.02 % ± 0.02 %
<b>Test group III</b> Moisture resistance	4.8.9	± 0.2 %	± 0.1 %
<b>Test group IV</b> Life 2000 h at + 70 °C	4.8.11	± 0.5 %	± 0.04 %

### Notes

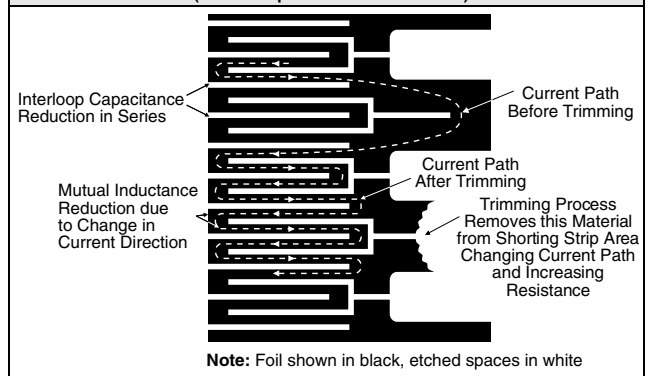
- TCR Tracking is a measure of the similarity of resistance value change in two or more resistors which are undergoing the same temperature changes. Tracking could be expressed as the difference in the temperature coefficients of the resistors, expressed in ppm/°C as  $(\Delta R_1/R_1 - \Delta R_2/R_2) \times 10^{-6}/\Delta T$  °C.
- Selected TCR Tracking is available for specially ordered lots of resistors. The selected TCR tracking can be 3, 2, 1 and as close as 0.5 ppm/°C throughout the full temperature range. Should close TCR tracking be required for differing resistance values, contact the factory.
- All measurements are based on pad-to-pad excluding termination wires. Maximum is 1.0 % A.Q.L. standard for all specifications except TCR (for TCR information, see table 1 and notes 1 and 2).
- The resolution limit of existing test equipment.
- Similar to MIL-Style RM0505 (MIL-PRF-55342/2).
- Similar to MIL-Style RM1505 (MIL-PRF-55342/4).
- When bonded to a ceramic substrate.

**FIGURE 3 - POWER DERATING CURVE**

Discrete chips suitable for working temperatures of up to + 175 °C are available on request.



**FIGURE 4 - TRIMMING TO VALUES**  
(Conceptual Illustration)



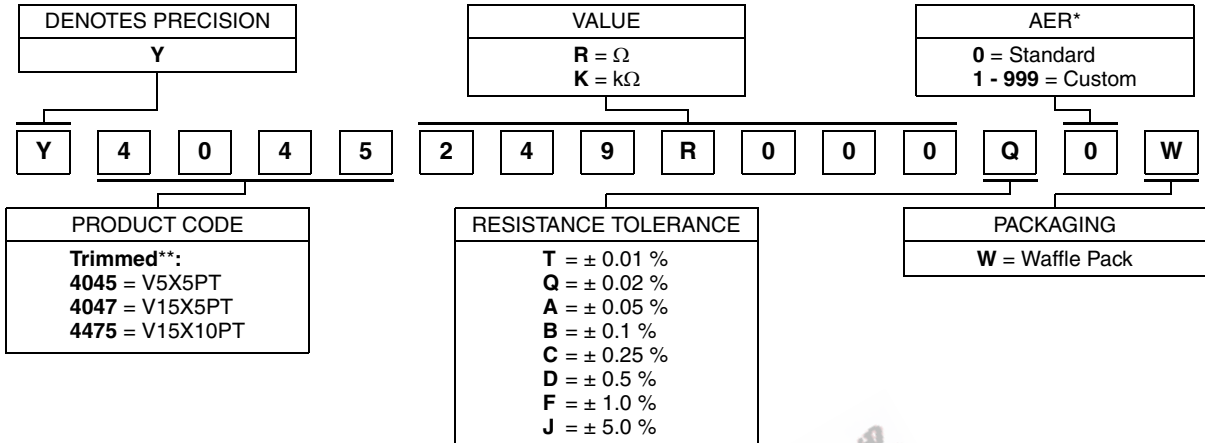
# V5X5P, V15X5P, V15X10P



Vishay Foil Resistors Bulk Metal® Foil Technology Discrete Chips  
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**TABLE 4 - GLOBAL PART NUMBER INFORMATION (Trimmed Option)**

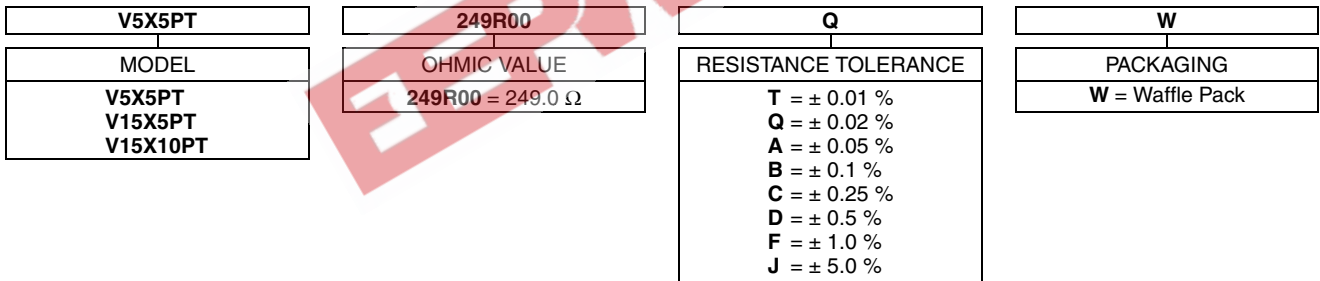
NEW GLOBAL PART NUMBER: Y4045249R000Q0W (preferred part number format)



FOR EXAMPLE: ABOVE GLOBAL ORDER Y4045 249R000 Q 0 W:

TYPE: V5X5P Trimmed  
 VALUE: 249.0 Ω  
 ABSOLUTE TOLERANCE: ± 0.02 %  
 AER TYPE: Standard  
 PACKAGING: Waffle Pack

HISTORICAL PART NUMBER: V5X5PT 249R00 Q W (will continue to be used)



**Notes**

- \* For non-standard requests, please contact Application Engineering.
- \*\* VISHAY to supply chips trimmed to the purchaser's exact resistance and tolerance specifications, ready for insertion into a hybrid microcircuit with no further processing other than bonding and termination. Specify exact resistance value(s) and tolerance(s).

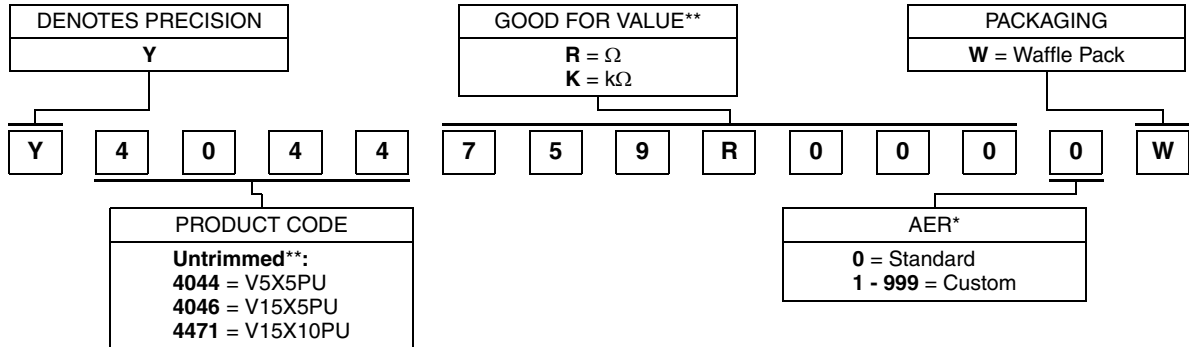


# V5X5P, V15X5P, V15X10P

Bulk Metal<sup>®</sup> Foil Technology Discrete Chips Vishay Foil Resistors  
 with TCR of 2 ppm/°C and Tolerance to 0.005 %  
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**TABLE 5 - GLOBAL PART NUMBER INFORMATION (Untrimmed Option)**

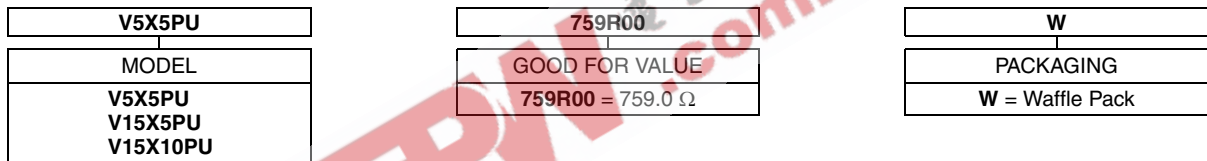
NEW GLOBAL PART NUMBER: Y4044759R0000W (preferred part number format)



FOR EXAMPLE: ABOVE GLOBAL ORDER Y4044 759R000 0 W:

TYPE: V5X5P Untrimmed  
 GOOD FOR VALUE: 759.0 Ω  
 AER TYPE: Standard  
 PACKAGING: Waffle Pack

HISTORICAL PART NUMBER: V5X5PU 759R00 W (will continue to be used)



**Notes**

- \* For non-standard requests, please contact Application Engineering.
- \*\* To order user trimmable chips specify the final resistance value desired.

# V5X5P, V15X5P, V15X10P



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## EFFECTS OF GOLD WIRE

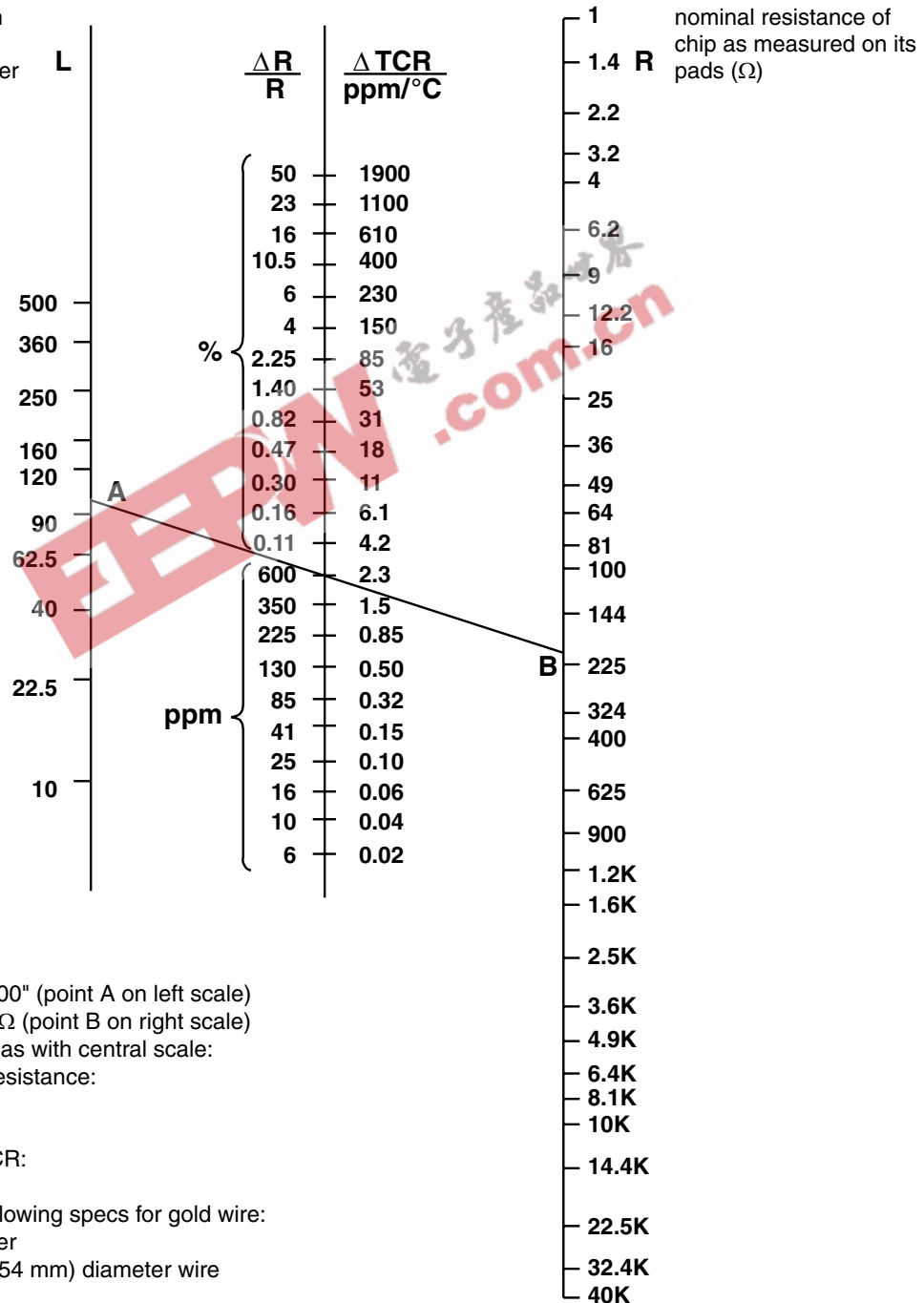
The bonding of the gold wires to the chip has an effect on the overall resistance and on the temperature coefficient, according to the length of wire used.

The nomogram below shows the effect on both parameters with varying lengths of 0.001" (0.0254 mm) diameter gold wire.

## NOMOGRAM

Change of resistance and TCR due to a length L of gold wire added at wire bonding.

thousandths of an inch  
total length of 2 gold  
wires of 0.001" diameter



### EXAMPLE:

Total length of wires  $L = 0.100''$  (point A on left scale)

Resistance of chip  $R = 200 \Omega$  (point B on right scale)

Read on intersection of line as with central scale:

On left side - change of resistance:

$$\frac{\Delta R}{R} = 600 \text{ ppm}$$

On right side - change of TCR:

$$\Delta TCR = \pm 2.3 \text{ ppm}$$

Nomogram based on the following specs for gold wire:

- Conductivity 72 % of copper
- 1.2  $\Omega$ /inch for 0.001" (0.0254 mm) diameter wire
- TCR 3900 ppm/°C



### Disclaimer

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

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