

Bulk Metal® Foil Technology Discrete Chips

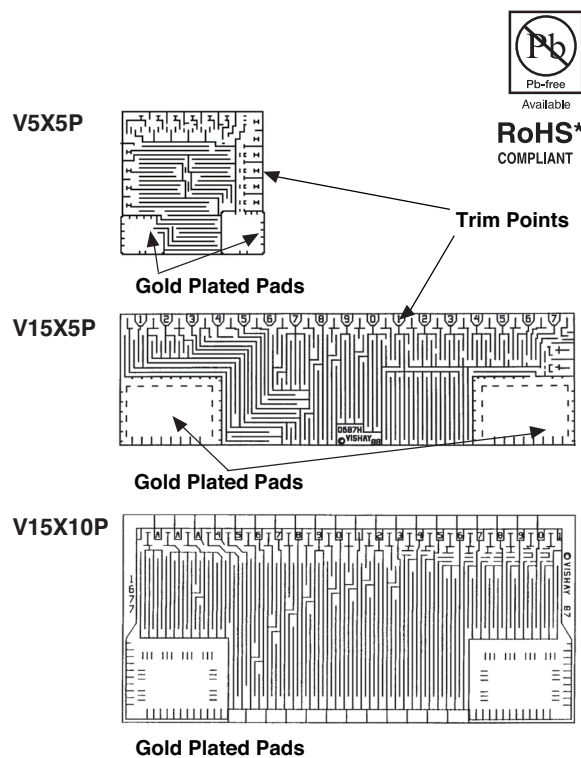
with TCR of 2 ppm/°C, Tolerance to 0.005%, and Load Life Stability of ±0.01% for 10 000 h for Use in Hybrid Circuits

FEATURES

- Temperature coefficient of resistance (TCR):
Absolute: ±2.0 ppm/°C (–55°C to +125°C, +25°C ref.)
TCR tracking: to 0.5 ppm/°C
- Resistance tolerance:
Absolute to ±0.01% (user trimmable to ±0.005%)
Match: to 0.01%
- Power rating: 50 mW to 150 mW at +70°C
- Load life stability: ±0.01% at +70°C, 10 000 h at rated power
- Resistance range: 5 Ω to 80 kΩ
- Hybrid chips are also available for high temperature applications
- Short time overload: ≤0.02%

VFR precision chip resistors are available either factory-trimmed to exact resistance values (option T) or ready for user trimming (option U); user trimming can be done either before or after bonding – using standard epoxies – onto the hybrid circuit substrate using standard laser, air abrade, or manual adjustment techniques. However care should be taken that no carbonization occurs when laser trimming.

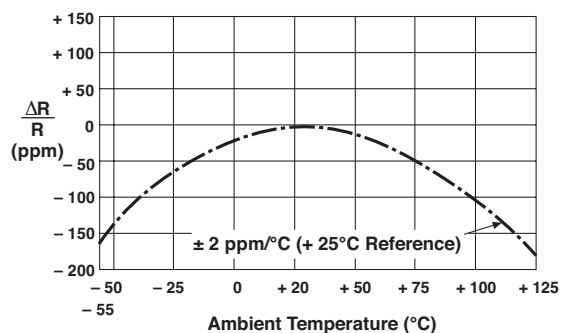
Trimming Chip Resistors



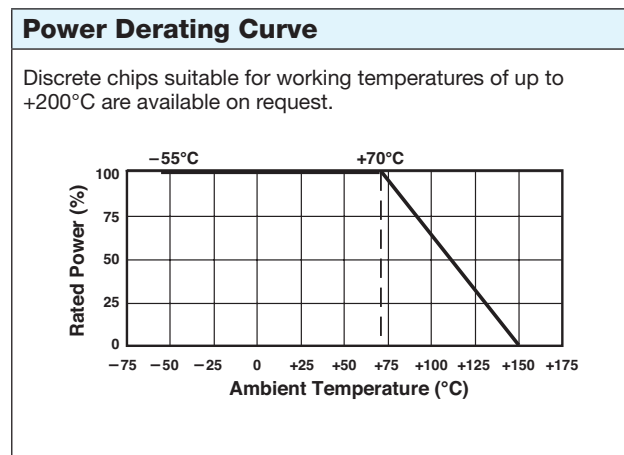
Tolerance and TCR Vs. Resistance Value

VALUE (Ω)	STANDARD TOLERANCE (%)	TYPICAL TCR AND MAX SPREAD –55°C to +125°C, +25°C Ref. (ppm/°C) ⁽²⁾
500 to 80K	±0.01	±2±3
100 to <500	±0.02	±2±4
50 to <100	±0.02	±2±5
20 to <50	±0.05	±2±6
10 to <20	±0.05	±2±8
5 to <10	±0.1	±2±10

Typical Resistance/Temperature Curve



Precision Chip Resistor Specifications ⁽²⁾	
Resistance range	5 Ω to 10 kΩ (model V5X5P) 5 Ω to 33 kΩ (model V15X5P) 33 kΩ to 80 kΩ (model V15X10P)
TCR (-55°C to +125°C, +25°C Ref. (ppm/°C))	According to Tolerance and TCR vs. Resistance Value table
Trimming range (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) * The V5X5P chips are being gradually redesigned for a higher trimming factor – 1.3 or more instead of 1.2.
Resistance tolerance	Option T (trimmed to value at VFR) ±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
Power rating (at +70°C ambient temperature),	V5X5P: 0.05 W (22 V maximum) V15X5P: 0.1 W (54 V maximum) V15X10P: 0.15 W (100 V maximum)
High frequency operation Rise time Inductance Capacitance	1 ns without ringing 0.1 μH maximum; 0.08 μH typical 1.0 pF maximum; 0.5 pF typical
Current noise	<0.010 μV _{RMS} /V of applied voltage (<-40 dB)
Voltage coefficient	<0.1 ppm/V
Working voltage	22 V (model V5X5P) 54 V (model V15X5P) 100 V (model V15X10P)



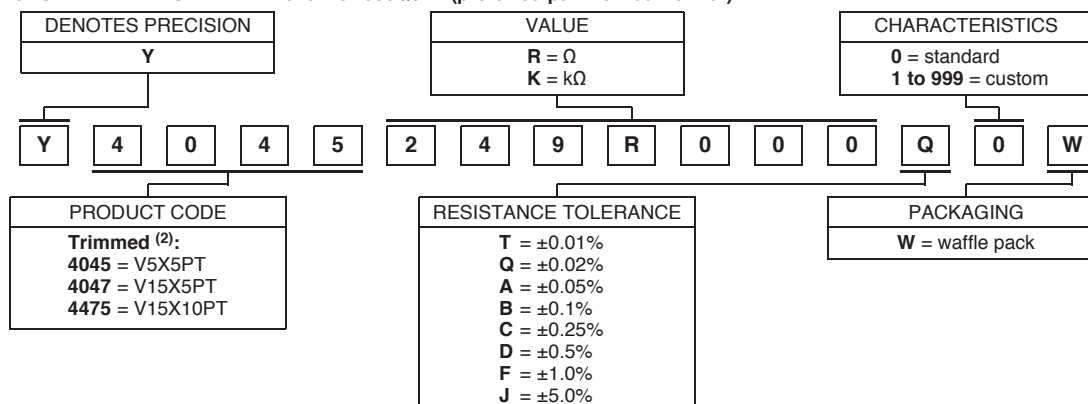
Environmental Performance Comparison		
	TYPICAL VISHAY	MAXIMUM
Test group I Thermal shock	±0.02%	±0.04%
Test group II Low temperature operation Short time overload High temperature exposure Resistance to bonding exposure	±0.005% ±0.02% ±0.02% ±0.02%	±0.01% ±0.04% ±0.05% ±0.05%
Test group III Moisture resistance	±0.03%	±0.1%
Test group IV (Load Life Stability) 2000 h at +70°C 10 000 h at +70°C	±0.005% ±0.01%	±0.015% ±0.05%

Notes

- (1) 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.
- (2) 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.

Global Part Number Information (trimmed option)⁽¹⁾⁽²⁾

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



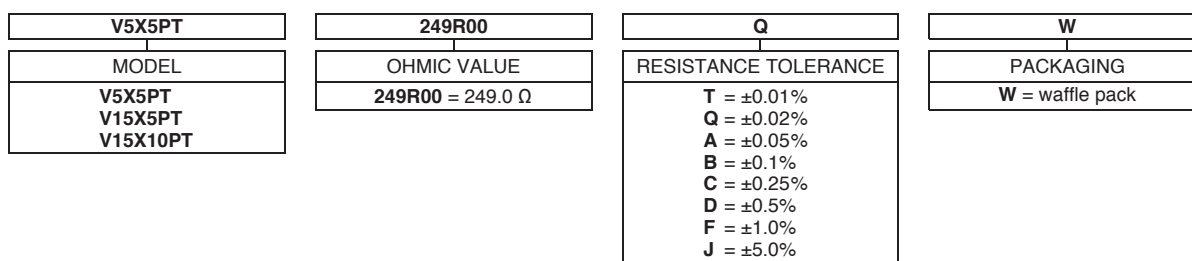
FOR EXAMPLE: ABOVE GLOBAL ORDER Y4045 249R000 Q 0 W:

TYPE: V5X5P trimmed

VALUE: 249.0 Ω ABSOLUTE TOLERANCE: $\pm 0.02\%$

PACKAGING: waffle pack

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

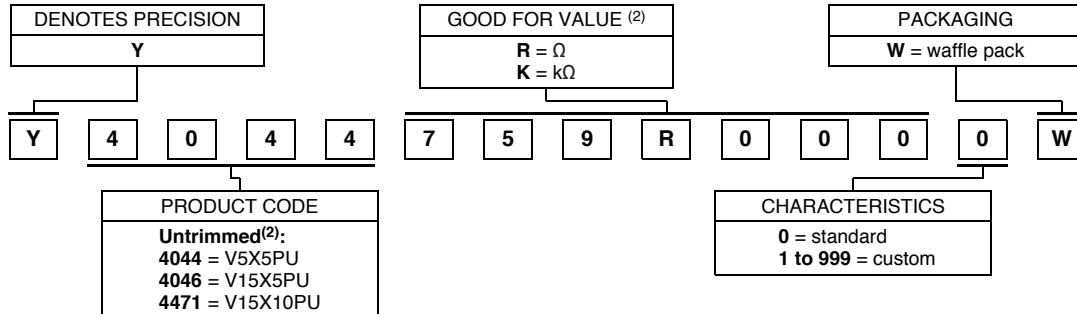


Notes

- ⁽¹⁾ For non-standard requests, please contact application engineering.
- ⁽²⁾ VFR 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).

Global Part Number Information (untrimmed option)⁽¹⁾⁽²⁾

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



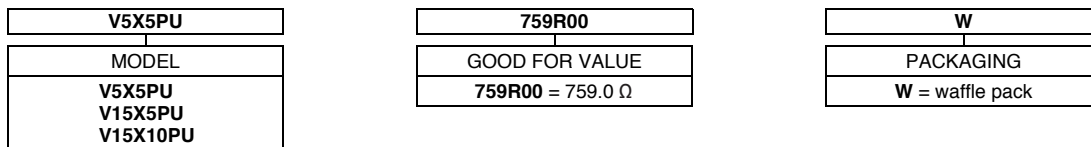
FOR EXAMPLE: ABOVE GLOBAL ORDER Y4044 759R000 0 W:

TYPE: V5X5P untrimmed

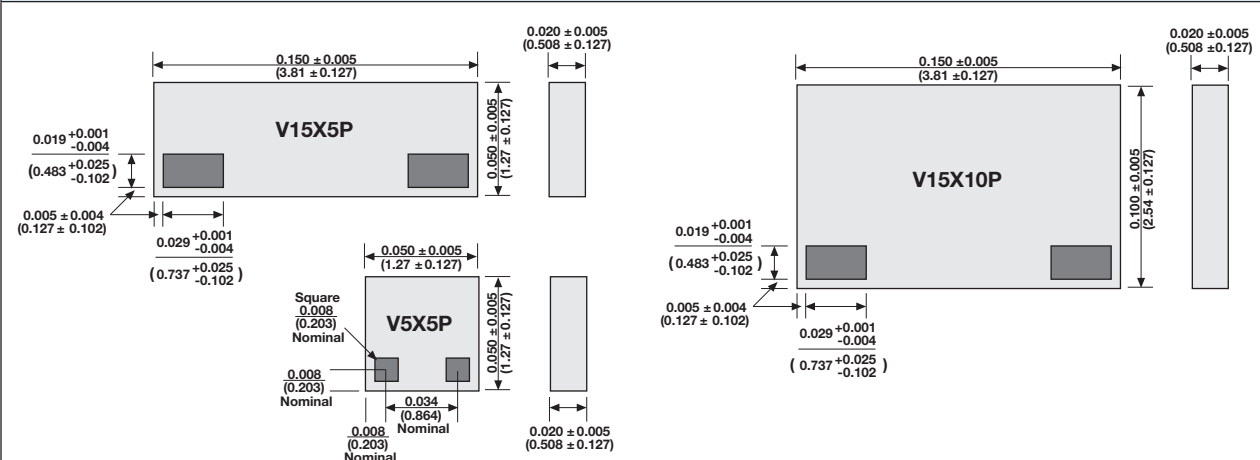
GOOD FOR VALUE: 759.0 Ω

PACKAGING: waffle pack

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



Dimensions in inches (millimeters)



Notes

(1) For non-standard requests, please contact application engineering.

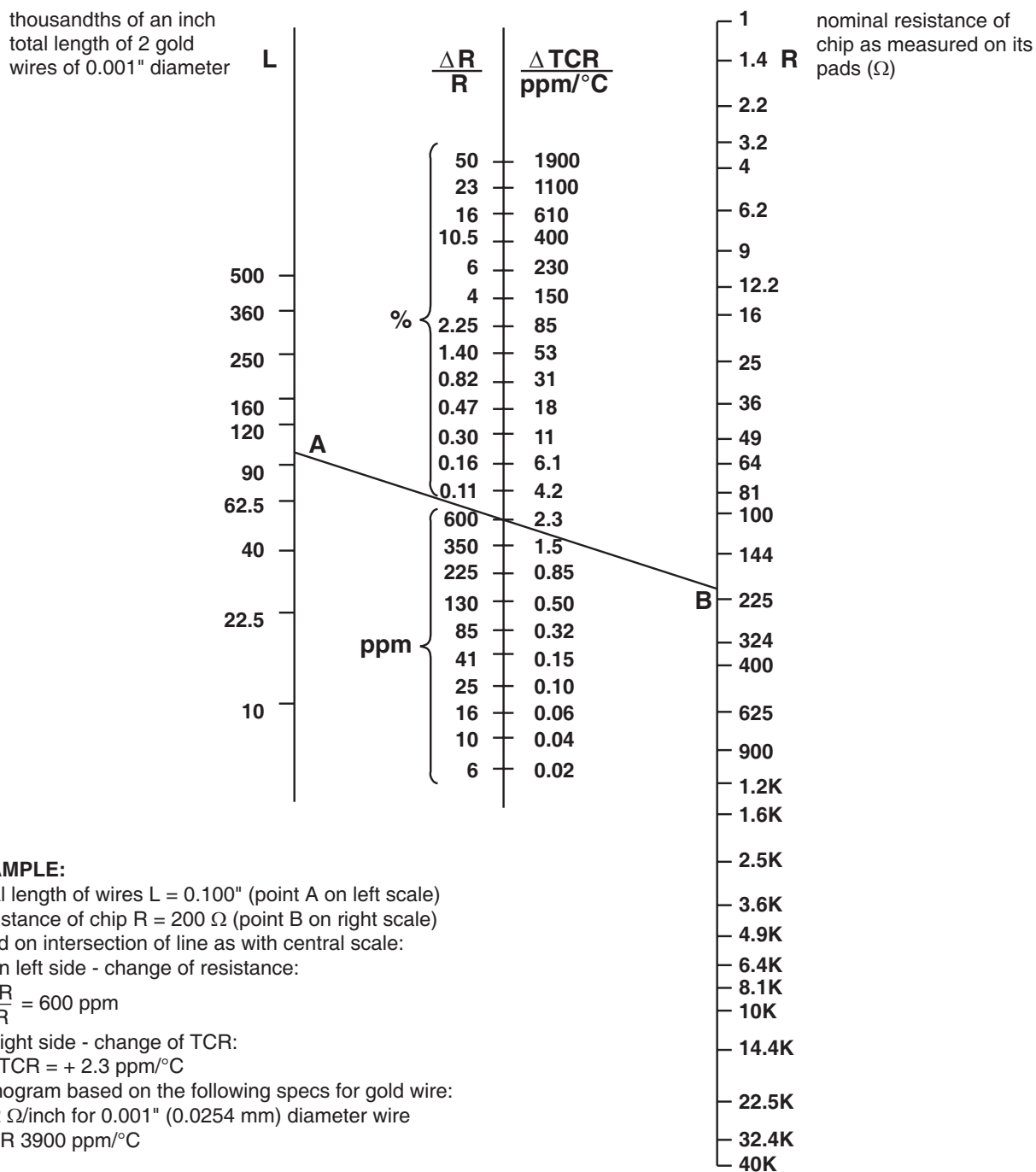
(2) To order user trimmable chips specify the final resistance value desired.

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 in (0.0254 mm) diameter gold wire.

NOMOGRAM

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

**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:

$$\Delta TCR = + 2.3 \text{ ppm}/^{\circ}C$$

Nomogram based on the following specs for gold wire:

- 1.2 Ω /inch for 0.001" (0.0254 mm) diameter wire
- TCR 3900 ppm/ $^{\circ}C$