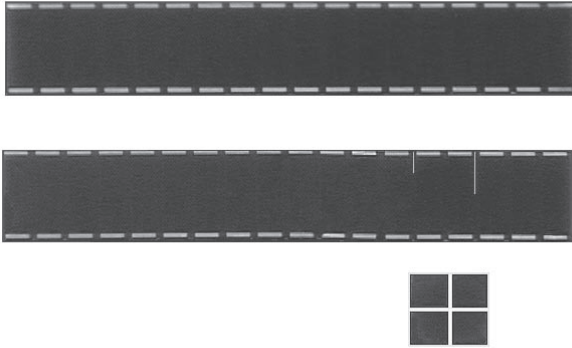


Bulk Metal[®] Foil Technology Custom Chip Networks and Resistor Arrays for Use in Hybrid Circuits



FEATURES

- Temperature Coefficient of Resistance:
Nominal TCR + 0.6 ppm/°C (0 °C to + 25 °C)
- 0.6 ppm/°C (+ 25 °C to + 60 °C)
+ 2.2 ppm/°C (- 55 °C to + 25 °C)
- 1.8 ppm/°C (+ 25 °C to + 125 °C)
- TCR Tracking: 0.5 ppm/°C
- Load-Life Stability: ± 0.05 % maximum ΔR under full rated power at + 70 °C for 2000 hours
- Power Rating: from 0.05 watts/resistor (at + 70 °C ambient temperature)
- Resistance Tolerance:
Absolute as tight as ± 0.02 % (User trimmable to ± 0.005 %)
Resistance Ratio Matching as tight as ± 0.01 %

RESISTOR NETWORK CHIPS AND ARRAYS

Vishay manufactures custom precision resistor arrays ranging from 2 to 30 precision resistive elements on a single substrate. These 0.020 Bulk Metal[®] Foil chips have gold plated terminations for gold ball bonding and are primarily intended for hybrid circuit applications. All the previously discussed performance characteristics of non inductive foil chip resistors are retained in these multi-resistor foil chips.

The special configurations include R/2R/4R/8R arrays, multi-resistor arrays, summing networks and R/2R ladders to 15 bit resolution. Custom circuits can be tailored to your exact requirements.

These Vishay arrays feature all the performance advantages of Bulk Metal[®] Foil discrete resistor networks reduced in size for hybrid, DIP, flatpack and custom packaging requirements.

ORDERING INFORMATION - CUSTOM ARRAYS

Networks are built to your requirements. Send your schematic and electrical requirements to the Applications Engineering Department. A unique part number will be assigned which defines all aspects of your network.

QUAD RESISTOR CHIP

4 resistor "Quad" chips, only 0.150" (3.81 mm) square have the same performance properties as individual chip resistors plus the advantage of automatic TCR tracking of 0.5 ppm/°C. They are ideal for input and feedback resistors in hybrid operational amplifiers, hybrid differential amplifiers requiring precise control of common mode rejection, and precise voltage dividers in hybrid microcircuits.

The Vishay Quad chip, 4 resistor array, is available with a nominal TCR of + 2.2 ppm/°C from - 55 °C to + 25 °C and - 1.8 ppm/°C from + 25 °C to + 125 °C. TCR tracking is 0.5 ppm/°C throughout the full temperature range. Resistance ratio matching between the 4 resistors is available to 0.01 % with the absolute resistance tolerance of each resistor to ± 0.02 %; user trimmable to within ± 0.005 %.

The Quad resistor chips can also be supplied in hermetically sealed TO packages and standard flatpacks.

Bonding, stitching and trimming of the Quad chips are the same as the precision hybrid chips.

TABLE 1 - QUAD CHIP & CUSTOM ARRAY SPECS¹⁾

Temperature Coefficient of Resistance:	
Nominal TCR ²⁾ + 0.6 ppm/°C 0 °C to + 25 °C - 0.6 ppm/°C + 25 °C to + 60 °C + 2.2 ppm/°C - 55 °C to + 25 °C - 1.8 ppm/°C + 25 °C to + 125 °C	
Standard Spread From Nominal ³⁾	
± 1.5 ppm/°C 0 °C to + 25 °C; + 25 °C to 60 °C ± 2.0 ppm/°C - 55 °C to + 25 °C; + 25 °C to 125 °C	
Maximum Spread From Nominal ⁴⁾	
± 2.5 ppm/°C 0 °C to + 25 °C; + 25 °C to 60 °C ± 2.3 ppm/°C - 55 °C to + 25 °C; + 25 °C to 125 °C	
Tracking ^{5), 6)} - Between Resistors on Different Chips	
5.0 ppm/°C Max 0 °C to + 25 °C; + 25 °C to 60 °C 4.6 ppm/°C Max - 55 °C to + 25 °C; + 25 °C to 125 °C	
Tracking ⁶⁾ - Between Resistors on Same Chips	
0.5 ppm/°C 0 °C to + 25 °C; + 25 °C to 60 °C 0.5 ppm/°C - 55 °C to + 25 °C; + 25 °C to 125 °C	
Standard Resistance Sets (Quad Chips):	
4 each 10 kΩ Resistors	(R1 = R2 = R3 = R4 = 10 kΩ Nominal)
2 each 10 kΩ, 2 each 5 kΩ Resistors	(R1 = R3 = 10 kΩ Nominal; R2 = R4 = 5 kΩ Nominal)
Other value sets designed on request. ⁷⁾	
Absolute Resistance Tolerance:	
Trimmed to value at Vishay as tight as ± 0.02 % User trimming in circuit as tight as ± 0.005 %	
Resistance Ratio Matching: As tight as ± 0.01 %	
Load-Life Stability: ± 0.05 % maximum ΔR under full rated power at 70 °C for 2000 hrs	
Power Rating: 0.05 watts/resistor; 0.2 watts/chip (at + 70 °C ambient temp)	
High Frequency Operation:	
Rise/Decay Time	1 ns at 1 kΩ
Inductance	0.1 μH maximum; 0.08 μH typical
Capacitance	1.0 pF maximum; 0.5 pF typical
Current Noise: < 0.010 μV(RMS)/volt of applied voltage (- 40 dB)	
Voltage Coefficient: < 0.00001 %/volt ⁸⁾	
Working Voltage: 40 volts maximum	

NOTES:

1. All measurements are based pad-to-pad excluding termination wires. Maximum is 1.0 % A.Q.L. standard for all specifications except TCR. (For TCR information, see notes 2-6.) Typical is a designers reference which represents that 85 % of the units supplied, over a long period of time, will be at least the figure shown or better.

2. Vishay Nominal TCR is defined as the chord slopes of the relative change of resistance/temperature, expressed in ppm (parts per million), called (RT) curve from 0 °C to + 25 °C and + 25 °C to + 60 °C ("Instrument" Range), and from - 55 °C to + 25 °C and + 25 °C to + 125 °C ("Military" Range). These specifications and the definition of Nominal TCR apply to all resistance values.

3. Vishay Standard TCR Spread is defined as a designers reference which represents that at least 92 % of the units and 82 % of the lots supplied by Vishay, will be within the stated band centered on the nominal curve. This definition of the Vishay Standard TCR Spread from Nominal applies to all resistance values. However, as the resistance value decreases below 300 Ω, the Vishay Standard TCR Spread from Nominal starts to increase.

4. Vishay Maximum TCR Spread is defined as the 3 σ (sigma) limit of a normal Gaussian distribution (99.73 % of a production lot) which is within a band, centered on the nominal curve. This Vishay Maximum TCR Spread is no greater than ± 2.5 ppm/°C from nominal throughout the full temperature range. This definition of the Vishay Maximum TCR Spread from Nominal applies to all resistance values. However as the resistance value decreases below 300 Ω, the Vishay maximum TCR Spread from Nominal specification starts to increase (see Figure 3 in datasheet "7 Technical Reasons to Specify Bulk Metal[®] Foil Resistor Networks").

5. 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.

6. 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 $(\Delta R_1/R_1 - \Delta R_2/R_2) \times 10^{-6}/\Delta T$. When a number of resistors are referenced to a nominal TCR, the spread or envelope around the nominal would be the difference. If the spread is ± 1.5 ppm/°C about a nominal, the tracking, as defined above, will be 3 ppm/°C.

7. Other resistance values close to the standards used, can be trimmed if requested (i.e.; 4.9 kΩ/9.8 kΩ). Special values for Quad Resistor Chips can be designed on request.

8. The resolution limit of existing test equipment.

FIGURE 1 - QUAD RESISTOR CHIP

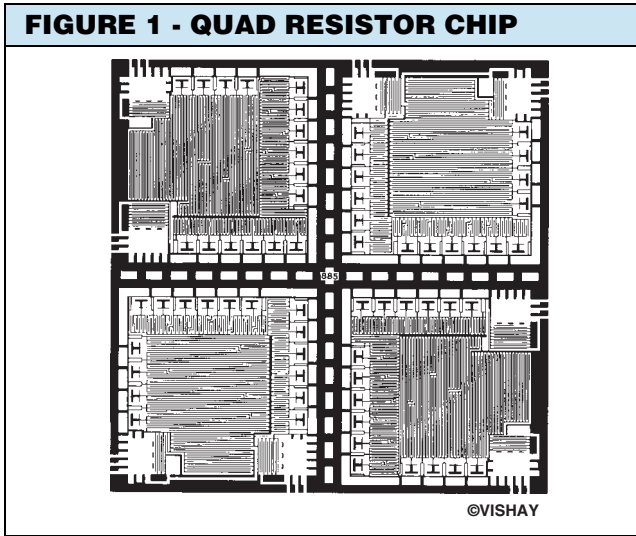


FIGURE 2 - R/2R/4R/8R ARRAY

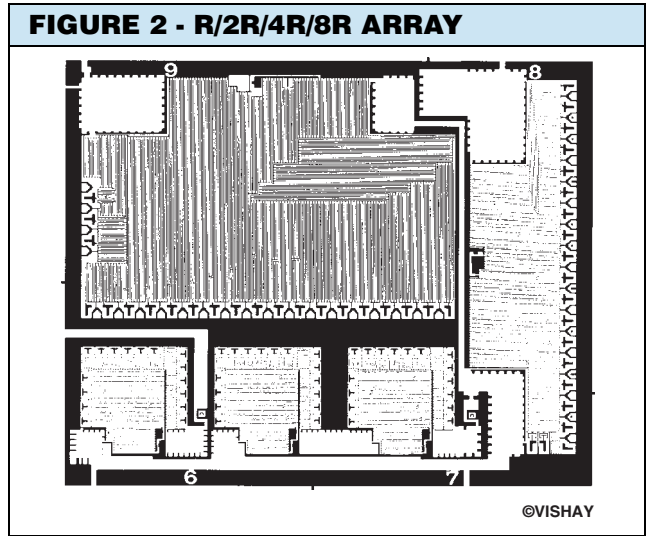
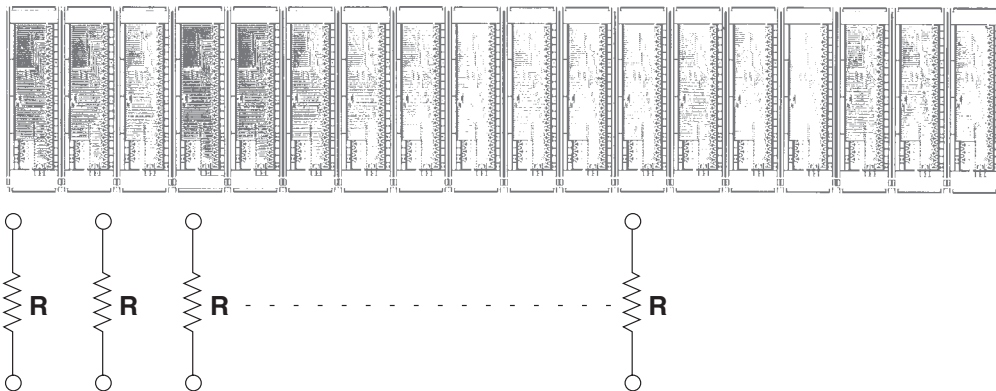


FIGURE 3 - TYPICAL NETWORK AND RESISTOR ARRAYS

18 Resistor Array

2K - Nominal

(Available in 3R increments; ie. 3, 6, 9, 12, 15 resistors and more)



15 Bit R2R Ladder Network

300 Ω/600 Ω Nominal

(Supplied in 3 bit increments; ie. 3, 6, 9, 12, 15 bits and more)

