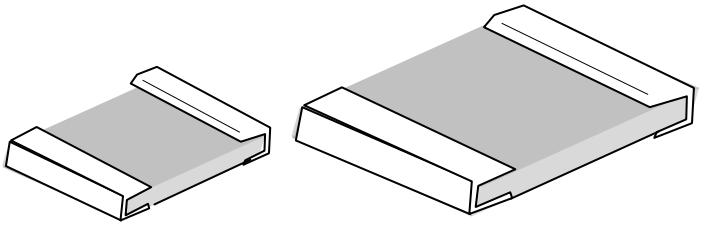
RESISTORS • CAPACITORS • COILS • DELAY LINES



Application Guide R-41
RCD Series HR and SRH High Value Chip Resistors

RCD offers the industry's widest selection of precision high value chip resistors with …

- values to 1TΩ (10^{12}Ω)
- temperature coefficients as tight as 25ppm/ºC (10ppm on custom basis)
- resistance tolerances s tight as 0.1%
- voltage ratings to 5KV
- 7 sizes from 0.03" x 0.05" (1/60W) to 0.20" x 1.0" (2W)
- a wide range of custom sizes, increased voltages, etc.

When using high value chip resistors, consideration must be given to a variety of factors in order to achieve optimum performance …

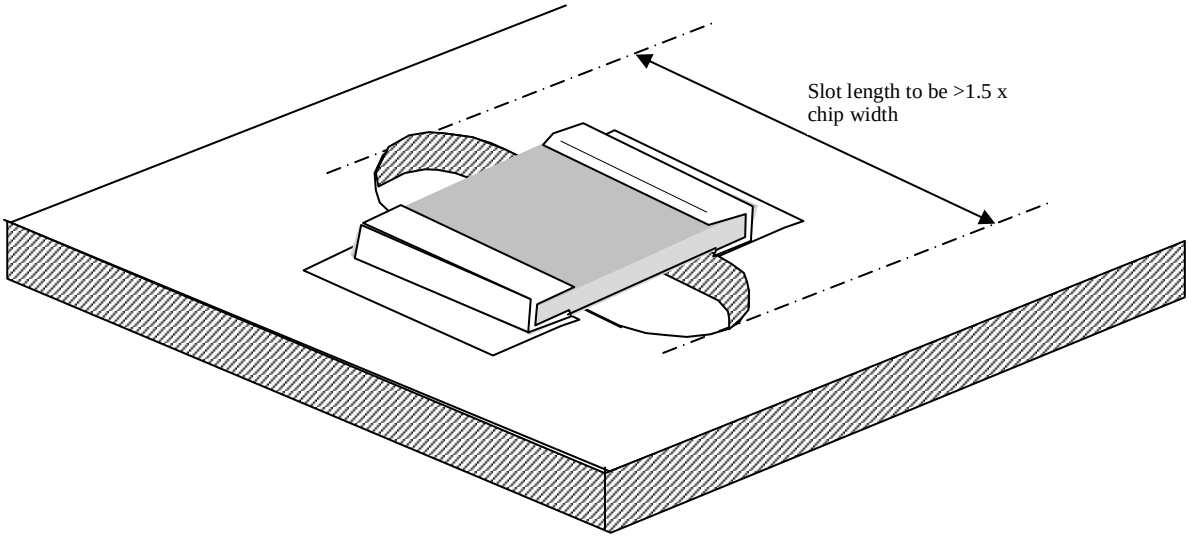
Temperature Coefficient of Resistance: TCR ratings are based on resistance measurements at +25ºC and +75ºC. Lower or higher temperature extremes can result in greater TCR instability (since the TCR slope isn't linear) and should be designed accordingly. Contact RCD Engineering for assistance.

Voltage Coefficient of Resistance: RCD measures type SRH high voltage chip resistor VCR at 1/10 rated voltage and full rated voltage. The HR series, which is intended for low voltage circuits, is tested for VCR at suitably lower voltage levels (5V and 15V). The material composition and chip size geometry affect the VCR. The greater the film's length and lower the resistance value, the lower the VCR. RCD's SRH1020, at 1" length, is the industry's longest chip resistor enabling VCR levels vastly superior to competitive models. The VCR of SRH2512 is typically 20ppm/V or better; SRH5020 5ppm; SRH7020 2ppm, and SRH1020 VCR is typically better than 1ppm. By comparison, Series HR miniature chips have VCR's above 100ppm (refer to data sheet for VCR listing).

Operating Temperature Range and Coefficient of Expansion: The operating temperature range of RCD's HR and SRH series is -55ºC to +150ºC. Due consideration must be given to larger body sizes resulting from differences in the coefficient of thermal expansion (CTE) between the PCB material and the chip resistor ceramic substrate. Large ceramic chips are not intended for glass-epoxy PCB's which are subjected to thermal shock or wide temperature gradients. Common PCB laminates such

as FR-4 have a CTE of 16 to 18 ppm/ºC as compared to the 7ppm/ºC of ceramic chip resistors. Such mismatches can result in significant stresses to the solder joints.

PCB Geometry: When dealing with high resistance values (especially in small surface areas), it is important to optimize insulation resistance and prevent parallel leakage paths which could offset the "true" resistance value. This can be achieved by designing a slot into the PCB (see illustration) to prevent any flux or contaminants from getting entrapped below the chip body. Some customers have been able to achieve similar results by building up the solder pads with heavy copper plating (such as 4 oz. Cu). The slotted PCB design also reduces capacitive coupling between the chip resistor and PCB thereby enabling improved high frequency operation. In order to achieve highest voltage ratings and minimal leakage current, there should be no conductor paths positioned underneath the resistors.



Applications: Typical applications involve extremely low signal detection/ amplification circuits, including electron microscopes, high impedance and photodiode signal amplifiers, electrometers, photomultipliers, radiation testers, ion detection, etc. RCD's Series HR and Series SRH high-ohmic chip resistors are also useful as input resistors in high impedance voltage division and gain setting.

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