Technical Information

VCR – Voltage Coefficient of Resistance

The voltage coefficient or resistance is non-linear characteristic of resistors. It shows the resistance change in dependency on the applied voltage. The calculation is according the following formula:

$$VCR\ (ppm/V) = \frac{(R_o - R)}{R} * \frac{1}{(V_0 - V)} * 10^6$$

R_0: measured resistance @ measuring voltage V_0
R: measured resistance @ measuring voltage V

Both voltages are free selectable. The unit of the VCR is „ppm/V“, but “%/V” is quite common too, whereby 1% correlates to 10,000 ppm.

The resistance change at a given VCR is therefore as follows: $R = R_0 (1 + VCR * (V-V_0))$

The voltage coefficient according MIL-STD-202G, Method 309 will be generated as follows:

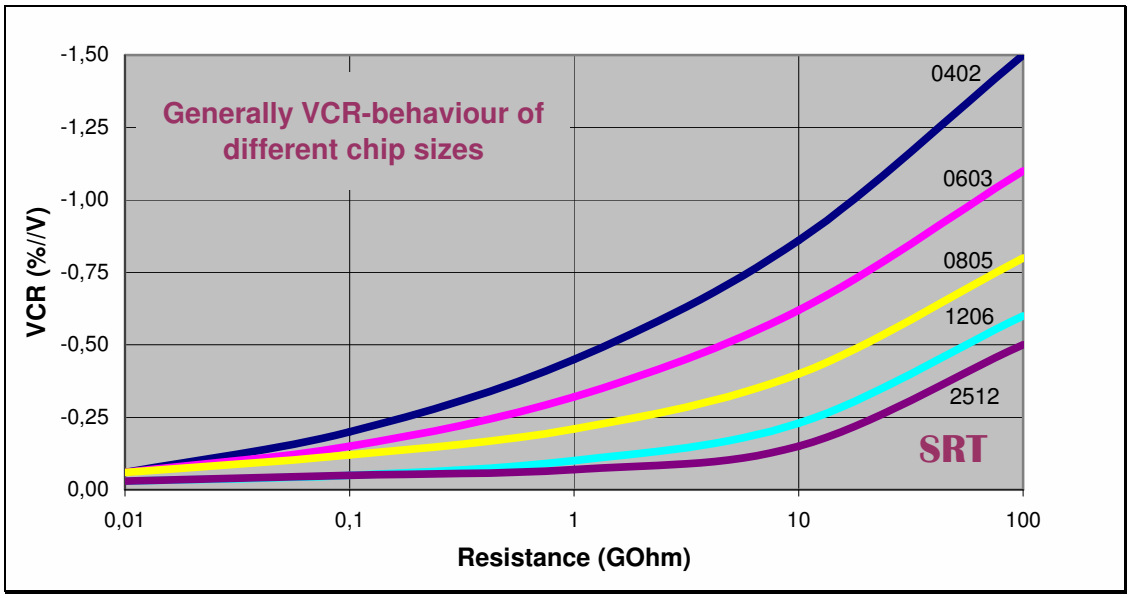
$$VC = \frac{(R-r) * 100}{0.9\ E\ r}$$

R: resistance @ specified max. working voltage E
r: resistance @ 10% of specified max. working voltage E

The voltage coefficient is commonly negative, i.e. the resistance is lower at higher measuring voltages (the reason are the conduction mechanisms in film resistors.
With increasing resistance values the VCR values are increasing as well (at the same chip size).
Contrary to that the VCR value is decreasing with increasing resistor sizes at the same resistance value (see graphic). Additional is to remark that the VCR is non-linear by itself, at higher measuring voltages the VCR values are lower.

In practice the VCR values are only mattering at large voltage differences (V_0-V; multiplier) as well as at high value resistors (high VCR-values).

Example: While a VCR of -5 ppm/V at a 1 kΩ-resistor with a voltage difference of 10V causes a change of resistance of -0,005%, is the resistance change at a 1GΩ-resistor with -500 ppm/V and 100 V voltage difference considerable -5%!



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SRT Resistor Technology GmbH
Ostlandstr. 31
D-90556 Cadolzburg

Fon: ++49 / 09103 / 79520
Fax: ++49 / 09103 / 5128
Mail to: webmaster@srt-restech.de
Internet: www.srt-restech.de