(1) What is TCR?

A: Resistance of resistor changes with temperature; and TCR stands for temperature coefficient of resistance, which indicates that when temperature changes by 1℃, the relative change of resistance in ppm/℃. Resistance will return to initial value with temperature returns to normal temperature.

Calculation formula: $TCR = \frac{(R2-R1)}{R1(T2-T1)} \times 10^6$

Where:

R1： Resistance (Ω) measured under room temperature

R2： Resistance (Ω) measured at -55℃ or +125℃

T1： Room temperature.

T2： -55℃ or +125℃

(2) What is the function of jumper? Why precision is not required by 0Ω?

A: Jumper resistor is also known as 0Ω resistor. ① In circuit design, the power supply can be separated as multiple channels with 0Ω resistor for commissioning or compatible design. ② It can be used as jumper. If certain section of the line is not used, just simply attached a 0Ω resistor (appearance will not be affected). ③ When the parameter of the matching circuit is uncertain, it can be replaced by 0Ω first and replace it with component with specific value during commissioning. ④ When wiring is impossible, you can also add a 0Ω resistor. ⑤ Under high-frequency signal, it can act as inductor or capacitor (related to the characteristics of external circuit) for dealing with EMC problems. ⑥ Used for cross-over connection of current circuit to provide shorter returning path and reduce interference. ⑦ Sometimes, user will change settings during circuit configuration. In order to reduce maintenance cost, 0Ω resistor can be used as alternative of jumper and welded on board.

The actual resistance of a 0Ω resistor is not zero, the definition of which is ≦50mΩ (or ≦20mΩ). Therefore, parts with ±1% or ±5% share the same specifications. For functional perspective, jumper resistance dose not require precision. What user needed is the maximum rated current (i.e. current allowed to pass) instead of cannot be purchased or produced.

(3) Which series is included in foil process? What is difference from alloy process?

A: Alloy products of Viking include metal foil and metal strip. The former refers to alloy patch and the latter refers to the alloy. Foil process attaches alloy patch on ceramics substrate to form a resistance layer while alloy process produces complete resistor with alloy material. Foil process includes CSM series and MF, MF.A series and alloy process has LR, LRP, LRJ and LRS series.

The common feature is Low TCR. Foil process can be laser trimmed and is able to produce continuous resistance within the range of resistance, so it is convenient to customize the resistance according to customer needs. Due to the limitations of materials and design, the alloy process can produce relatively less resistances, but has good current resistance.

(4) What is the difference between CS and RS? Why TCR of CS is better than RS?

A: CS and RS have the same design and similar product characteristics. Better TCR features are due to various material characteristics and process conditions with higher cost. Low-resistance product usually uses larger current and temperature raising of which will affect performance of circuit design due to resistance drift. Therefore, selecting resistor with better TCR can slow resistance drift to stabilize circuit.

(5) What is the difference between automotive grade product and ordinary ones?

Why automotive grade resistor is more expensive with the same MDS?

A: To achieve the ultimate goal of zero defects, requirements and controls are made specifically for automotive grade resistor:

Material: specified material

Machine: specific machine

Operator: designated personnel

Method: There are many and strict control parameters and more process inspections which uses AOI automatic inspection machine are added for screening. Increase inspection items and number of test samples to ensure automotive grade quality requirements are achieved.

(6) Pulse information of CS low-resistance products

A: All resistors have pulse characteristics and the difference is only the strength of the characteristics. CS is a general ultra-low resistance product which does not have pulse control in both design and process. Pulse varies greatly between production batches. If the current data is included, it will cause misunderstanding when designing and selecting models. Moreover, the ultra-low resistance products have relatively large variations in current design which will also affect performance of pulse characteristics; so they are not intended to be put in. It is recommended that customer provides practical applications for suitable product suggestion.

(7) What is the difference between PWR and SWR and how to select?

A: Due to process difference of PWR and SWR, the pulse and surge resistance feature are different. The characteristics of SWR are slightly better than PWR, but the precision performance is relatively poor. Therefore, PWR should be selected for higher precision and SWR is suitable for high characteristics requirements.

(8) Variation of film thickness and recommendation for 0.1%.

A: It is recommended to use thin film for 0.1% high precision product for better resistance consistency. The 0.1% precision for resistance of thick film is obtained by screening. The product consistency and stability are far less than thin film resistor. From the perspective of product structure, the biggest difference is the material and manufacturing method of the resistance layer.

Thin film applies target material to let alloy film layer formed on ceramics substrate by using vacuum coating to shape resistance layer with <1um general thickness. Thick film forms resistance layer on ceramics substrate by applying printing resistance ink with 5~10um thickness; that is why it is called thick film. Because of the different thickness of

the resistor, laser trimming method is vary as well which determines the various characteristics of the products. The characteristic of thin film resistor focuses on high precision, low TCR and stability.

(9) Why HVR resistance cannot start from 1R? How to show the characteristics of high-voltage resistance?

A: The rated voltage during resistor working is calculated according to Ohm's law with the following formula:

RCWV=√(Rated Power x Resistance Value)

Assuming a resistance of 2512 1W 1Ω which calculated by using formula aforementioned is RCWV=√(1*1)=1(V) that is far less then maximum working voltage, high voltage feature is not needed. Therefore, general resistor is sufficient.

(10) How to select initial resistance for RT trimmable resistor?

A: The initial resistance of Viking trimmable resistance (RT series) is the target value that customer required. Because resistance will be increased by laser trimming, precision is shown by negative values. The precision determines trimming range, length and characteristics which enables customer to select according to actual needs.