



TDK SPICE Netlist Library

~models for multilayer ceramic capacitors~

**TDK-EPC Corporation
Technical Service Center**

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3 types of SPICE models are provided for multilayer ceramic capacitors

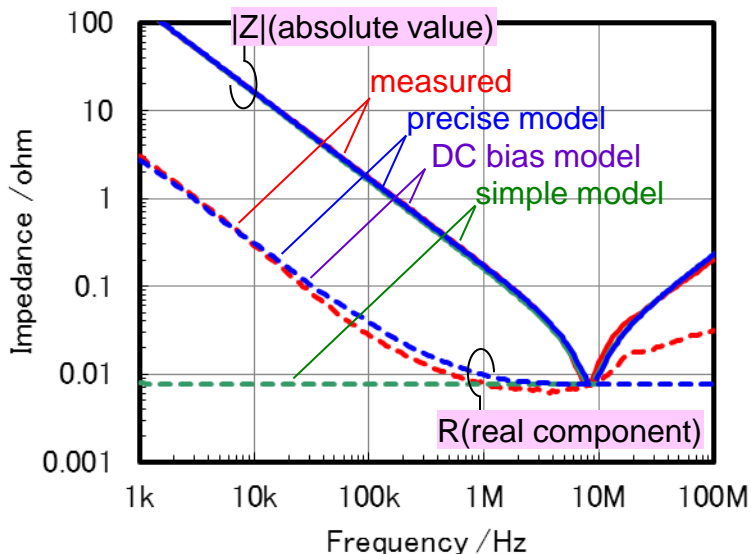
| Type of Model | Simple Model | Precise Model | DC Bias Model |
|--------------------------|--|--|---|
| Contents of Model | Simple equivalent circuit that models only capacitance, self resonance frequency and equivalent series resistance of an capacitor. | Equivalent circuit model that models the frequency dependence of impedance property of an capacitor. | Equivalent circuit model that can simulate DC bias property of multilayered ceramic capacitors. The frequency dependence of impedance property is modeled, too. |
| Scope of Products | <ul style="list-style-type: none"> • temperature compensating type (class1) • high dielectric type(class2) | <ul style="list-style-type: none"> • temperature compensating type (class1) • high dielectric type(class2) | <ul style="list-style-type: none"> • high dielectric type(class2) |

The compared results among those models are shown in the following pages.

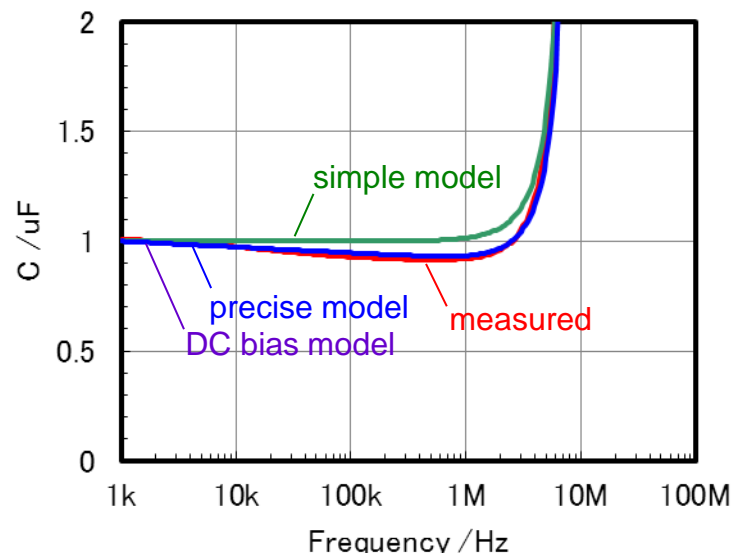
Please use an appropriate model according to the purpose of the simulation.

Part No.: C1005X5R0J105K050BB

frequency dependence of impedance without DC bias voltage



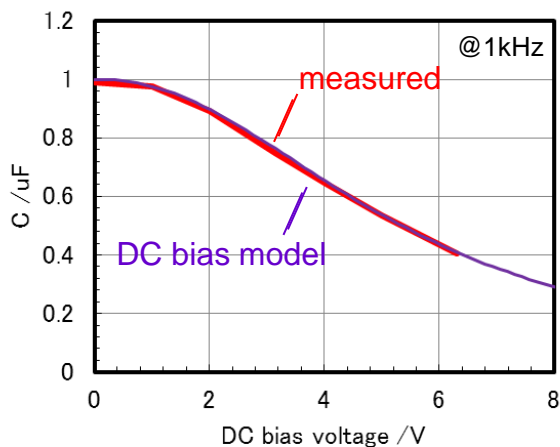
frequency dependence of capacitance without DC bias voltage



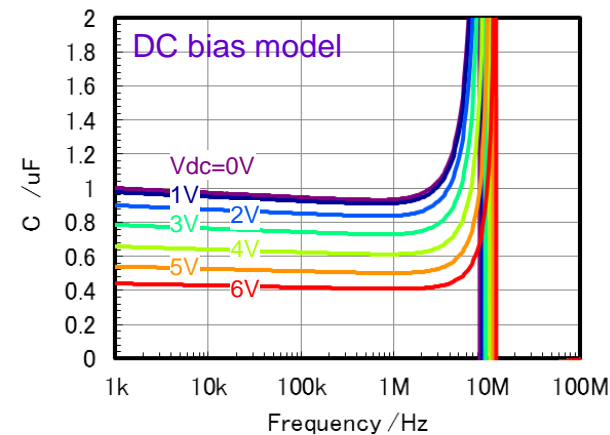
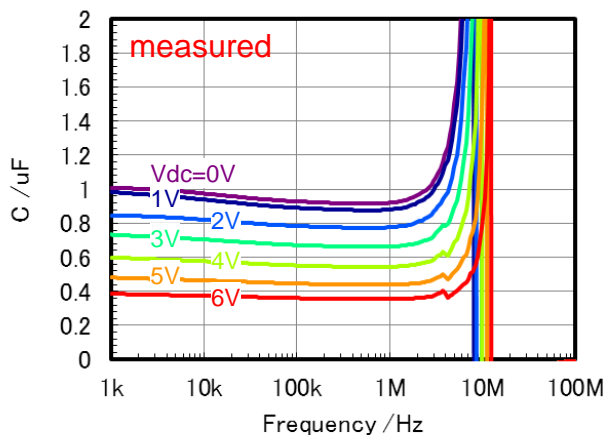
- Regarding $|Z|$, three models fit with the measured result.
- The **precise model** and the **DC bias model** correspond to the measured R at the frequencies below the self resonant frequency. (In these graphs, the results of the **precise model** is completely the same as that of the **DC bias model**.)
- The **simple model** models R only at the self resonant frequency.
- Use the **precise model** or the **DC bias model** if loss is evaluated.
- The DC bias property is not modeled in the **simple model** and the **precise model**.

Part No.: C1005X5R0J105K050BB

capacitance vs. DC bias voltage



frequency dependence of capacitance for various values of DC bias voltage



- The change of capacitance by DC bias voltage can be simulated in the **DC bias model**.
- In the **DC bias model**, the frequency dependence of impedance is also modeled.
- Please use the **DC bias model** if the effect of DC bias voltage is considered.

< Applicable condition >

The parameters in this library are obtained under the condition of 25°C, no DC bias (excepting the DC superimposition model), and small signal operation. Proper result might not be obtained if your condition is different from the above one.

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