



HVCC – DID YOU KNOW? X7R VERSUS Y6P – WHAT IS THE DIFFERENCE?

To start with, let's recall the temperature characteristic of capacitance (TCC) definition: it expresses the capacitance drift of a component over a certain temperature range.

Ceramic materials are classified into different ceramic classes (Class 1, 2, and 3). The TCC definition based on the Electronic Industry Association (EIA) provides a three-character code that describes the low and high temperature limit and the range of the capacitance change. In Table 1 below you'll find the explanation of the system for Class 2 ceramics:

TCC System for Class 2 Ceramics Acc. to EIA198

Minimum Temperature		Maximum Temperature		Capacitance Change Permitted	
X	-55 °C	4	+65 °C	A	± 10 %
Y	-30 °C	5	+85 °C	B	± 15 %
Z	+10 °C	6	+105 °C	C	± 2.2 %
		7	+125 °C	D	± 3. %
		8	+150 °C	E	± 4.7 %
		9	+200 °C	F	±7.5 %
				P	± 10 %
				R	± 15 %
				S	± 22 %
				T	+22 % / -33 %
				U	+22 % / -56 %
				V	+22 % / -82 %

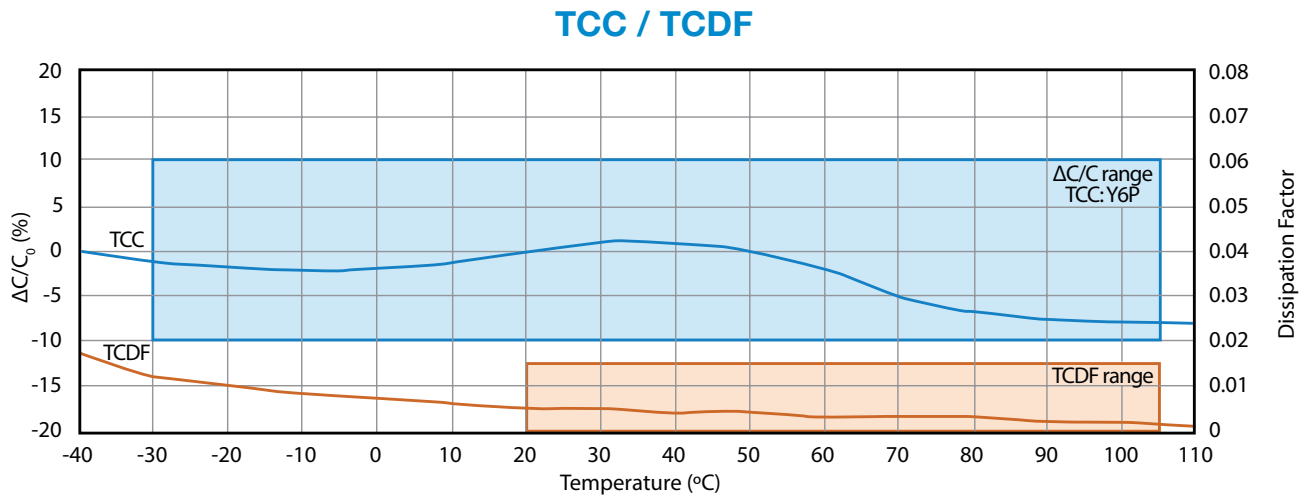
The X7R dielectric is used in most Class 2 ceramics applications. It is very well known by engineers and end users. For this reason many people think it's the most stable ceramic dielectric available on the market, but this is not actually the case.

Let's take a look at the alphanumeric dielectric codes. The first letter of the code describes the lower temperature limit. In the specific case of X7R, "X" stands for -55 °C. The upper limit temperature is described by the second digit; "7" means +125 °C. The third letter provides the maximum permissible change of capacitance within the aforementioned temperature range. "R" stands for a total range of ± 15 %.

Vishay uses a Y6P ceramic dielectric for its new High Voltage Ceramic Capacitors (HVCC) series. "Y6" describes a temperature range from -30 °C to +105 °C. This temperature range reflects the actual operating temperature range of the capacitor. Please be aware that this harmonization is not a "must" when specifying the operating temperature of the capacitor and its ceramic dielectric. The third letter – "P" – defines a maximum tolerance range of only ± 10 %. Please also have a look at following Chart 1.



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Considering the permissible operating temperature range from -30 °C to +105 °C, the Y6P ceramic dielectric is generally more stable than the X7R. This high stability is important in many applications where the component must have a well-defined capacitance value at every operating temperature. Lower stability doesn't mean that your application won't work at all, but it could result in weak performance.