

Dielectric Characteristics

Capacitor Selection

Multilayer capacitors (MLC) and single layer capacitors are categorized by performance with temperature. Component selection is typically determined by dielectric performance, electrical environment, and temperature stability.

In determining the proper component for a specific application, the following information should be considered.

Dielectric Type

There are three basic dielectric classes (characteristics) available:

Dielectric Properties

Dielectric Type Stability Class Description

BP *Ultra Stable*
(NPO and COG) *Class I*

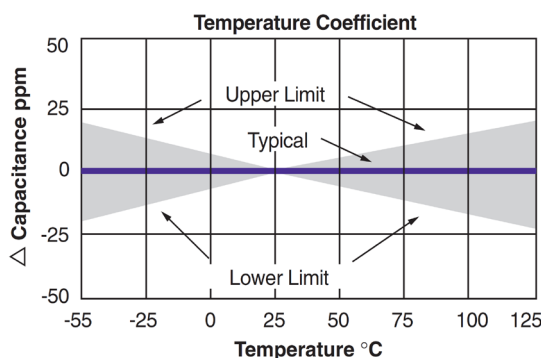
Effects on electrical properties are minimal with temperature, frequency, or time. Used in applications which require stable performance.

BQ *Stable*
BX and X7R *Class II*

Effects on electrical properties predictably change with temperature, voltage, frequency and time. Selected for applications where blocking, coupling, by-passing, and frequency discriminating elements are used. Offers higher capacitance than Class I (COG).

Z5U and Y5V *General Purpose*
Class II

Exhibits a greater variation of properties with temperature. Dielectric constant is higher than Class I and Class II dielectrics. Extremely high capacitance per unit volume and used in general performance applications.



Dielectric Characteristics NPO (COG)

Operating Temperature Range: -55°C to 125°C
Temperature Coefficient: 0 ± 30 ppm/°C
Dissipation Factor: .001 (0.1%) max.@25°C
Insulation Resistance: 25°C 10⁶ Megohms
 125°C 10⁵ Megohms
Dielectric Withstanding Voltage: 50 to 200V, 2.5 x VDCW
 201 to 500V, 1.5 x VDCW, or 500V*
 >500V, 1.2 VDCW or 750V*
Aging Rate: 0% per decade hour.
Test Parameters: 1 KHz, 1.0 ± 0.2 VRMS, 25°C
 1 MHz for capacitance ≤1,000 pF

*Whichever is greater

Capacitor Size

The capacitor body size impacts its utility to the design requirements in respect to capacitance value and voltage rating. Typically smaller units are less expensive and provide for greater space savings. Because mass affects the thermal response of the chips, size should be considered when selecting the attachment method to the circuit.

Termination Material

Material Type Recommended Usage

Silver Palladium: Nonmagnetic application requirements. Recommended for conductive epoxy and leaded attachment methods. For soldering applications, use solder reflow below 230°C.

Silver: Most ductile of the available termination methods. Used in applications which will be leaded, to minimize thermal stresses.

Dielectric Characteristics Continued

X7R

<i>Operating Temperature Range:</i>	-55°C to 125°C
<i>Temperature Coefficient:</i>	± 15% ΔC max.
<i>Dissipation Factor:</i>	.025 (2.5%) max. @ 25°C
<i>Insulation Resistance:</i>	25°C 10 ⁶ Megohms 125°C 10 ⁵ Megohms
<i>Dielectric Withstanding Voltage:</i>	50 to 200V, 2.5 x VDCW 201 to 500V, 1.5 x VDCW, or 500V* >500V, 1.2 VDCW or 750V*
<i>Aging Rate:</i>	<2.0% per decade hour.
<i>Test Parameters:</i>	1 KHz, 1.0 ± 0.2 VRMS, 25°C 1 KHz, 1.0 VRMS ± 0.2 VRMS, 25°C

BX

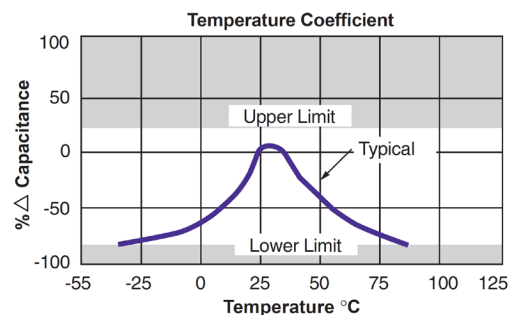
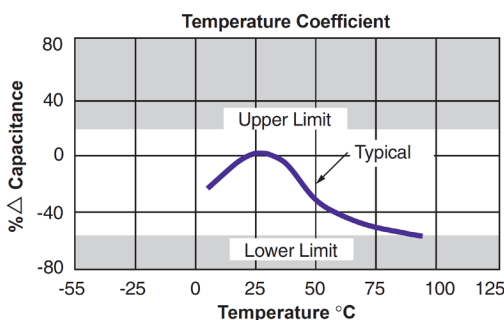
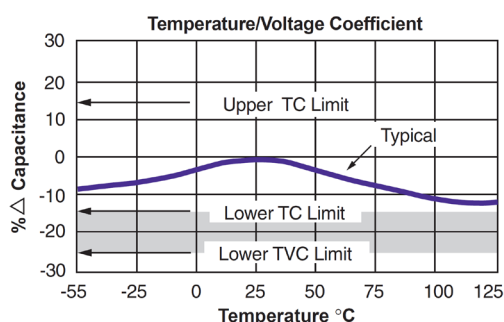
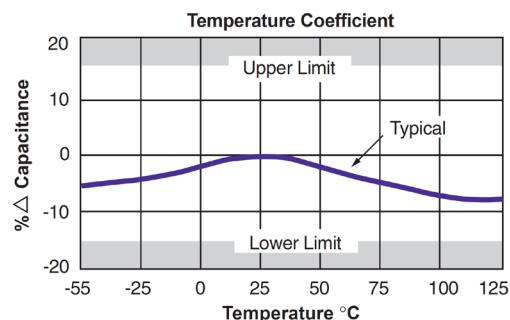
<i>Operating Temperature Range:</i>	-55°C to 125°C
<i>Temperature Coefficient:</i>	± 15% ΔC max.
<i>Temperature Voltage Coefficient:</i>	+ 15% -25% ΔC max.
<i>Dissipation Factor:</i>	.025 (2.5%) max. @ 25°C
<i>Insulation Resistance:</i>	25°C 10 ⁶ Megohms 125°C 10 ⁵ Megohms
<i>Dielectric Withstanding Voltage:</i>	50 to 200V, 2.5 x VDCW 201 to 500V, 1.5 x VDCW, or 500V* >500V, 1.2 VDCW or 750V*
<i>Aging Rate:</i>	2.0% per decade hour.
<i>Test Parameters:</i>	1 KHz, 1.0 ± 0.2 VRMS, 25°C 1 KHz, 1.0 VRMS ± 0.2 VRMS, 25°C

Z50

<i>Operating Temperature Range:</i>	+10°C to 85°C
<i>Temperature Coefficient:</i>	± 22% -56% ΔC max.
<i>Dissipation Factor:</i>	.030 (3.0%) max. @ 25°C
<i>Insulation Resistance:</i>	25°C 10 ⁵ Megohms
<i>Dielectric Withstanding Voltage:</i>	50 to 200V, 2.5 x VDCW 250V, 1.5 x VDCW
<i>Aging Rate:</i>	-2.0% per decade hour.
<i>Test Parameters:</i>	1 KHz, 0.5 VRMS ± 0.1 VRMS, 25°C

Y5V

<i>Operating Temperature Range:</i>	-30°C to 85°C
<i>Temperature Coefficient:</i>	+22% - 82% ΔC max.
<i>Dissipation Factor:</i>	.050 (5.0%) max. @ 25°C
<i>Insulation Resistance:</i>	25°C 10 ⁵ Megohms
<i>Dielectric Withstanding Voltage:</i>	50 to 200V, 2.5 x VDCW 250V, 1.5 x VDCW
<i>Aging Rate:</i>	-2.0% per decade hour.
<i>Test Parameters:</i>	1 KHz, 1.0 VRMS ± 0.2 VRMS, 25°C



* Whichever is greater