

MLCCs – Multilayer Ceramic Chip Capacitors

Characteristics of Class 1 and Class 2 Ceramic Capacitors

Class 1 Ceramic Capacitors (i.e. NPO = COG) are characterized by a small permittivity ϵ_r , thus they have smaller capacitances. Their dependencies of temperature and voltage are linear and their aging is minimal.

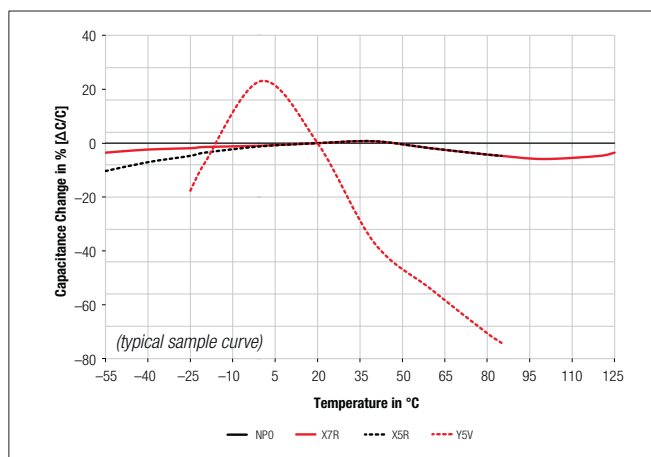
Class 2 Ceramic Capacitors (i.e. X7R, X5R, Y5V) own a higher permittivity ϵ_r . That is why they provide higher capacitances. Their dependencies of temperature and voltage are non-linear and they show aging behavior.

Functions and Applications Class 1 and Class 2 Ceramic Capacitors

Class 1 Ceramic Capacitors provide **high stability and low losses** for example in a resonant circuit, filter, temperature compensation and coupling applications.

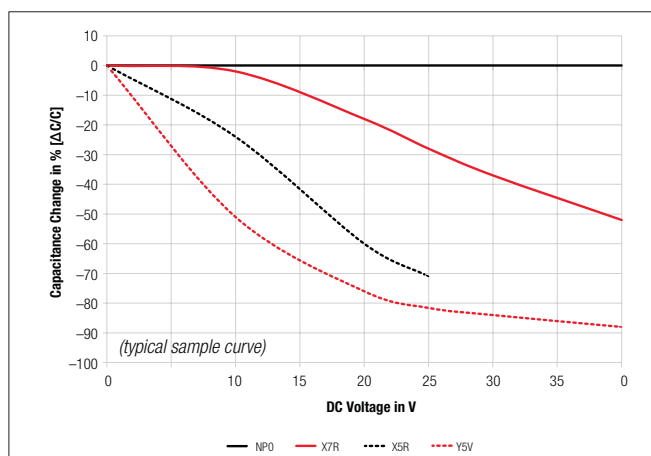
Class 2 Ceramic Capacitors provide **high volumetric capacitance** for example in smoothing, coupling, decoupling and by-pass applications.

Typical Capacitance Change vs. Temperature

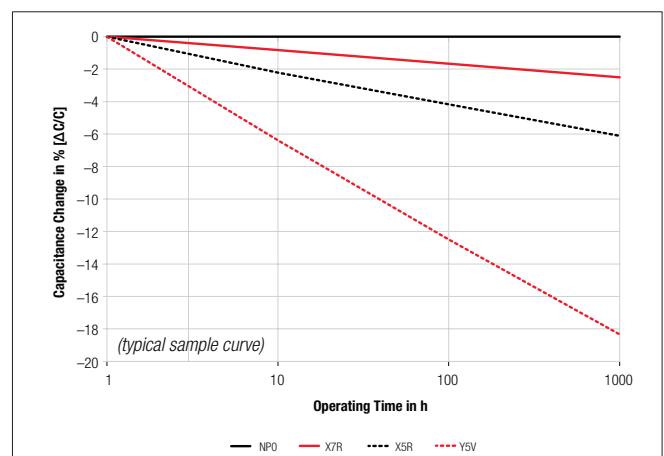


Temperature Characteristics	
Ceramic	Operating Temperature
NPO	-55 °C to + 125 °C
X7R	-55 °C to + 125 °C
X5R	-55 °C to + 85 °C
Y5V	-30 °C to + 85 °C

Typical Capacitance Change vs. DC Voltage*



Typical Capacitance Change vs. Time



*Typical characteristics for ceramic capacitors with a rated DC voltage of 25 V (X5R) and 50 V (NPO, X7R, Y5V)