

## Summary



By the intelligentization and electrification of traditional fuel vehicles, Battery Management System, Charging System, and Electronic Control Unit use a lot of MLCC in the vehicle power supply unit. The request of control module is increasing by the development of intelligentization. By the requirement of safety and comfortable experience on vehicle, car networking include more electronic sensing devices in autopilot technology like camera, optical radar, and 3D map calculating computer. All of these require high quality and high specification MLCC.

### Multi-Layer Ceramic Capacitance(MLCC)

MLCC is parallel stack up by ceramic and electrode material. Each ceramic layer is clamp by two electrode layers become a parallel capacitor. By able to wafering high durability of voltage and heat, lower consuming under high frequency, MLCC replace Aluminum capacitor, and Tantalum capacitor in switching- mode filter circuit.

### Capacitance Loss Due to DC Bias in MLCC

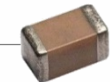
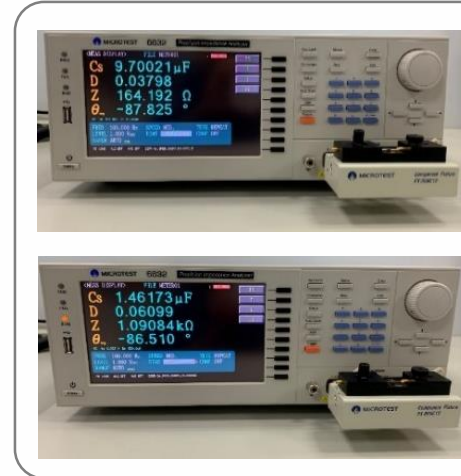
The so-call DC bias means that a DC voltage applied to capacitors to cause a decreasing in electrostatic capacitance. The reason is that the capacitor uses a barium titanate-based ferroelectric, which is a phenomenon unique to the high dielectric constant MLCC. Therefore, high dielectric or II type capacitors(X5R, X7R,Y5V,F,B) have bias characteristics that cause a drop in capacitance due to a DC voltage.

### Three Key parameters for MLCC

MLCC apply on designing power module, such as eliminate noise and control voltage fluctuation, it's frequency spec. , resistance, ESR are the important parameters when engineers are designing loop.

Electrode consuming cause ESR and ESL on the wire increasing will affect the performance of capacitor when the frequency goes higher.

Around resonance point, Resistance(Z) will affect by ESR and ESL. Resistance (Z) 's minimum value of frequency will be the natural frequency of vibration. The specification will transfer from Capacitance to Inductance.



Y5V type 1206

- Without DC voltage  
Cs rate is 9.70uF
- With DC voltage 12V  
Cs rate decrease to 1.46uF
- D value increase  
from 0037 to 0.060

