Types of Capacitors
Ceramic Capacitor Impedance and Resistance

Capacitor data sources
- Murata Simsurfing
- TDK SEAT

https://m.samsungsem.com/global/product/passive-component/mlcc.do

* Internal Cu electrode is only applied to limited products.
MLCC

- Capacitor codes, e.g. X7R or C0G standardized to define stability over temperature
  - **Class-II**: Codes begin with X, Y, or Z (e.g. X7R, Y5V)
  - **Class-I**: Codes begin with [CBLAMPRSTVU] (e.g. C0G, NPO)
2.2μF, 50V X7R (Class-II) 0603 footprint

Remaining: 7.2% at full voltage
10nF, 50V C0G (Class-I) 0603 footprint
10nF, 50V X7R (Class-II) 0603 footprint
10nF, 50V C0G (Class-I) varied footprint
Same 0603 Footprint

- **GRT100R51H225KE13** [2] | ±DCOV, 25degC | **2.2µF X5R**
- **GCM1885C1H03GAE1** [2] | ±DCOV, 25degC | **10nF C0G**
Class-II Capacitor Hysteresis Loss

$C_{OSS}$ Hysteresis

Fig. 15. Losses per cycle versus normalized, by (8), $dV/dt$ for the three studied devices and two additional “extreme performance” devices. The red outline around the TPH3202LS results indicates applied voltages under 300 V and $\beta = 1.46$ in (8). All recorded measurements are included here. There are no measurements for the TPH3202LS 30 MHz $\Phi_2$, as the $\Phi_2$ wave generator could not be tuned to maintain ZVS with the TPH3202LS device and $C_{REF}$ in parallel.
Transistor Structure and Material

SiC

Si Superjunction

Si

Fig. 4: $C_{OSS}$ losses for three devices from 1-35 MHz.

(b) High-frequency $C_{OSS}$ losses for the R6011KNTJL device.

Fig. 6: Silicon superjunction $C_{OSS}$ loss data.

Fig. 7: $C_{OSS}$ losses for STI3NK50ZT4.