Substitution Guide:

Parameter	*Substitution Rule*	*Guide*
Dissipation Factor *(DF)* ***Loss Tangent*** *(tanδ)*	↓	Component with **lower** DF or tanδ can be substituted for component with higher DF or tanδ rating
Equivalent Series Resistance *(ESR)*	↓	Component with **lower** ESR can be substituted for component with higher ESR rating
Quality Factor *(Q)*	↑	Component with **higher** Q can be substituted for component with lower Q rating

Understanding capacitor parameters and selection of lower loss (aka; lower DF, tanδ, or ESR) and higher Q components can provide multiple benefits to circuit performance and end-use applications, including:

- improved efficiency of the design
- longer operational time in battery powered applications
- extended operating range
    - increased output power and sensitivity
- extended end-use lifetime and improved component reliability
    - due to a reduced operating temperature of the component

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