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FILM CAPACITOR TECHNICAL INFORMATION AND SELECTOR GUIDE

Capacitance: Nominal capacitance value the capacitor has been designed to. Standard test frequency used is 1kHz.

Capacitance Tolerance: The maximum deviation from the nominal capacitance the capacitor is allowed to have. Standard tolerance values are ±10% (K), ±5% (J), ±2% (G) and ±1% (F).

Temperature Coeficient: The reversible capacitance change versus temperature expressed in parts/million.

$$\text{T.C.} = \frac{C_1 - C_0}{C_0(\text{T}_1 - \text{T}_0)}$$

Where C_1 = Capacitance measured at T_1
Co = Capacitance measure at 20°C
T_1 = Temperature of interest
T_0 = 20°C

Rated Voltage: The maximum voltage the capacitor can tolerate without failure and maintain a long reliable operating life. Rated voltage can be expressed in volts DC, volts AC or pulse voltage.

At no time does the sum of the voltages applied exceed the rated voltage.

Temperature Derated Voltage: The amount of voltage derating required to prevent premature failure of a capacitor operated above +85°C.

Test Voltage Between Leads: The amount of overvoltage applied to capacitor to test the dielectric's strength.

Test Voltage Between Leads and Case: The amount of voltage to be applied to the capacitor's leads tied together and its outer casing to test the other casing material's insulation strength.

Rated r.m.s. Current: The maximum rms current to flow through the capacitor at the specified temperature and frequency.

Operating Temperatures Range: The maximum and minimum temperatures the capacitor can be operated continuously.

Voltage Temperature Derating: The amount of derating required to allow the capacitor to be operated continuously. Typically –1.25% per C°.

Self Inductance: The inductive part of the capacitor. It is due to the inductiveness of the electrodes, internal connections and dielectrics, self inductance is frequency and temperature dependent. Expressed as 1nH per mm along the capacitor pitch or body length plus the length of the lead wires.

Pulse Rise Time

The pulse rise time is the slope of the voltage waveform during charging or discharging of the capacitor. The purse rise time should be determined from the steepest portion of the voltage waveform. Dv/dt rating is 10% of the dv/dt applied to the capacitor after 10,000 cycles at a 1Hz repetition rate. Expressed in volts per microsecond.

Peak Current

The maximum or peak current the capacitor can withstand without failure:

$$I_{pk} = C \bullet dv/dt$$

The peak current flowing through the capacitor can cause localized heating in the contact area due to the contact resistance between the leads and winding heads. When the pulse stress is repetitive and continuously applied, the localized heating can extend to throughout the entire body of the capacitor. The energy involved with the heating of the capacitor is:

$$W = \bullet \quad I^2 R dt$$

Where R = Internal Resistance of the Capacitor
W = Energy

The energy content of the waveform is:

$$Ko = \int_0^t (dv/dt)^2 \cdot dt$$

Where t = Pulse Width
K is expressed in $V^2/\mu s$

Power Dissipation

The amount of heat dissipated in a capacitor when pulsed or oscillating waveforms are applied to a capacitor:

$$P = \sum_1^n (V_{rmsi})^2 \; 2\pi fi \, C \tan \delta$$

For sinusoidal waveforms

$$P = (Vrms)^2 \; 2\pi fi \, C \tan \delta$$

Where P = power dissipated in watts
V_{rmsi} = rms voltage of the ith harmonic in volts
fi = Frequency of the ith harmonic in Hz
n = Number of significant harmonics
Tan δ dissipation factor at the ith-harmonic frequency

The maximum power dissipation can be approximated using the following equation:

P = K · S · • •

Where • • = Temperature rise on the capacitor over the ambient
temperature
S = Surface area of the capacitor expressed in cm^2

K will vary depending on the design and shape of the capacitor. In general, use the lower K value for general purpose metallized capacitors and the higher K value for film/foil and double sided metallized electrode capacitors.

• • is the hot spot temperature rise of the capacitor. It is recommended that the ambient temperature plus the • • not exceed the temperature rating of the selected capacitor. General purpose capacitors • • should be limited to +20°C maximum and +40°C for film/foil and double-sided metallized electrode capacitors. At 85°C • • should be limited to +5°C for general purpose capacitors and +10°C for film/foil and double-sided metallized electrode capacitors.

Ideally, • • should be limited to +15°C or less no matter what type of capacitor is selected.