

# Film Chip Capacitors



## Characteristics of Film SMD Capacitors

	PET-HT (MKT)	PEN (MKN)	PPS (MKI)	NPO	X7R	Tantalum
Operating temperature (°C)	-55/125	-55/125	-55/140	-55/125	-55/125	-55/125
$\Delta C/C$ with temperature (%)	±5	±5	±1.5	±1	±15	±10
DC voltage coefficient (%)	no.	no.	no.	no.	-20	no.
$\Delta C$ aging rate (%/h dec.)	negl.	negl.	negl.	negl.	2	n.a.
Dissipation factor (%) 1 kHz 10 kHz 100 kHz	0.8 1.5 3.0	0.8 1.5 3.0	0.2 0.25 0.5	0.10 0.10 0.10	2.5	8
ESR	low	low	very low	low	moderate to high	high
IR (M $\Omega$ . $\mu$ F) 25°C 85°C	10000 1000	10000 1000	10000 1000	10000 1000	1000 500	100 10
Dielectric absorption (%)	0.5	1	0.05	0.6	2.5	n.a.
Capacitance range from (pF) to ( $\mu$ F)	1000 10	1000 4.7	100 1	10 0.047	100 4.7	100000 1000
Capacitance tolerance (±%)	15 10 20	5 10 20	2.5 5 10 20	5 10	10 20	10 20
Self-healing	yes	yes	no	no	no	no
Typical failure mode	open	open	open	short	short	short
Reliability	high	high	high	high	moderate	low
Piezoelectric effect	no	no	no	yes	yes	yes
Resistance to thermal and mechanical shock	high	high	high	moderate to low	moderate to low	high
Non-linear distortion (3 <sup>rd</sup> harmonic)	very low	very low	very low	low	high	n.a.
Polarity	no	no	no	no	no	yes

1) All data are typical values

N.B.: SMD = Surface Mounted Device  
SMT = Surface Mounted Technology

	PET	PP	PEN	PPS	NPO	X7R	Tantalum
<b>Dielectric constant 1 kHz/23°C</b>	3.3 (positive as temperature rise)	2.2 (negative as temperature rise)	3.0 (positive as temperature rise)	3.0 (very constant versus temperature)	12...40	700...2000	26
<b>Operating temperature (°C)</b>	-55...+105	-55...+100	-55...+125	-55...+140	-55...+125	-55...+125	-55...+125
<b>Dielectric absorption (%)</b>	0.5	0.05...0.10	1	0.05	0.6	2.5	n.a.
<b>ΔC/C versus temperature (%)</b>	± 5	± 2.5	± 5	± 1.5	± 1	± 15	± 10
<b>ΔC/C versus voltage (%)</b>	neglectible	neglectible	neglectible	neglectible	neglectible	-20	neglectible
<b>ΔC aging rate (%/h decreasing.)</b>	neglectible	neglectible	neglectible	neglectible	neglectible	2	n.a.
<b>Dissipation factor (%) 1 kHz 10 kHz 100 kHz</b>	0.8 1.5 3.0	0.05 0.08 0.25	0.8 1.5 3.0	0.2 0.25 0.5	0.10 0.10 0.10	2.5	8
<b>ESR</b>	low	very low	low	very low	low	moderate	high
<b>Ris (MΩ x μF) 25 °C 85 °C</b>	10000 1000	100000 10000	10000 1000	10000 1000	10000 1000	1000 500	100 10
<b>Capacitance range from pF to μF</b>	220...220	27...100	1000...6.8	10000...0.47	1...0.1	100...2.2	100000...1000
<b>Capacitance tolerance (+/- %)</b>	5/10/20	1/2.5/5/10	5/10/20	2.5/5/10/20	5/10	10/20	10/20
<b>Self-healing</b>	yes	yes	yes	yes	no	no	no
<b>Typical failure mode at end of life</b>	open	open	open	open	short	short	short
<b>Reliability</b>	high	high	high	high	high	moderate	low
<b>Piezoelectric effect</b>	no	no	no	no	yes	yes	yes
<b>Resistance to thermal and mechanical shock</b>	high	high	high	high	moderate to low	moderate to low	high
<b>Polarity</b>	no	no	no	no	no	no	yes