



Film Capacitors

Metallized Polyester Film Capacitors (MKT)

Series/Type: B32559S

Date: June 2018

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Typical applications

- Enhanced types for xDSL applications, suitable for test conditions according to ITU-T K.45 and ITU-T K.20.

Climatic

- Max. operating temperature: 125 °C
- Climatic category (IEC 60068-1:2013): 55/125/56

Construction

- Dielectric: polyethylene terephthalate (polyester, PET)
- Stacked-film technology
- Heat shrinkable tube
- special xDSL types B32559S*9xx: polyolefin 300 µm ±100 µm, 125 °C

Features

- Very small dimensions
- Self-healing properties
- High pulse strength
- RoHS-compatible

Terminals

- Lead spacing 5.0 mm
- Crimped wire leads, lead-free tinned, lead length (6 – 1) mm
- Straight wire leads, lead-free tinned, lead length (6 – 1) mm
- Special lead length available on request

Marking

Manufacturer's logo, rated capacitance (coded), capacitance tolerance (code letter), rated DC voltage, date of manufacture (coded)

Delivery mode

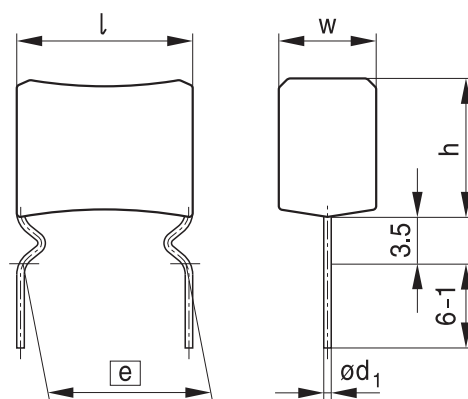
Bulk (untaped)
 Taped (Ammo pack or reel)
 For notes on taping, refer to chapter "Taping and packing".

Notes on soldering

Please observe carefully soldering conditions: Capacitors with straight wire leads will suffer more thermal stress than capacitors with crimped wires.

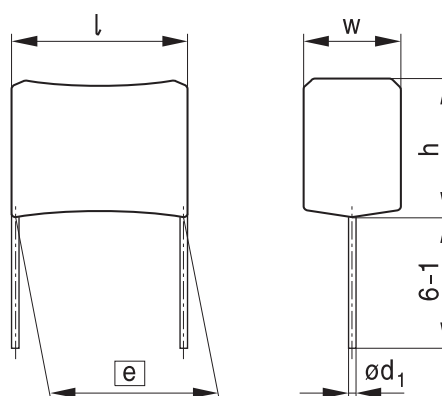
Dimensional drawing

Crimped leads



KMK1104-9-E

Straight leads

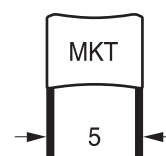


KMK1132-9-E

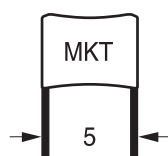
(See "Notes on soldering".)

Dimensions in mm

Lead spacing	Lead diameter d_1
$e \pm 0.4$	± 0.05
5.0	0.5


Overview of available types

Lead spacing	5.0 mm
Type	B32559S
Lead configuration	straight / crimped
Page	4
V_R (V DC)	630
V_{RMS} (V AC)	400
C_R (μ F)	
0.0056	
0.0082	
0.010	
0.012	
0.015	
0.018	
0.022	
0.027	



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xDSL applications, compliant with ITU-T K.45/K.20

Ordering codes and packing units

V_R	V_{RMS} $f \leq 60$ Hz	C_R	Max. dimensions $w \times h \times l$ mm	Ordering code (composition see below)	Ammo pack pcs./MOQ	Reel pcs./MOQ	Untaped pcs./MOQ
V DC	V AC	μF					
630	400	0.0056	4.0 × 8.5 × 7.0	B32559S8562+***	1600	1600	1200
		0.0082	4.0 × 9.0 × 7.0	B32559S8822+***	2000	1600	1600
		0.010	4.5 × 10.0 × 7.0	B32559S8103+***	1800	1500	1400
		0.012	4.5 × 10.0 × 7.0	B32559S8123+***	1800	1500	1400
		0.015	4.5 × 10.0 × 7.0	B32559S8153+***	1800	1500	1400
		0.018	5.0 × 10.0 × 7.0	B32559S8183+***	1700	1400	1300
		0.022	5.5 × 13.0 × 7.0	B32559S8223+***	1600	1400	1200
		0.027	6.0 × 13.5 × 7.0	B32559S8273+***	1600	1400	1200

MOQ = Minimum Order Quantity, consisting of 4 packing units.

Further E series and intermediate capacitance values on request.

B32559S8...+9xx complies with ITU-T K.45 and ITU-T K.20.

Composition of ordering code

+ = Capacitance tolerance code:

M = $\pm 20\%$

K = $\pm 10\%$

J = $\pm 5\%$

*** = Packaging code: (See notes on soldering)

904 = Ammo pack crimped

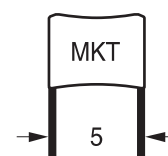
908 = Reel crimped

900 = Untaped crimped (lead length 6–1 mm)

907 = Ammo pack straight

910 = Reel straight

902 = Untaped straight (lead length 6–1 mm)

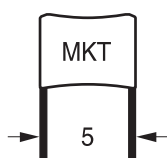


Technical data

Reference standard: IEC 60384-2:2005. Complies with ITU-K.45:2008 and ITU-K.20:2008.

All data given at $T = 20\text{ °C}$, unless otherwise specified.

Operating temperature range	Max. operating temperature $T_{op,max}$	+125 °C	
	Upper category temperature T_{max}	+125 °C	
	Lower category temperature T_{min}	-55 °C	
	Rated temperature T_R	+85 °C	
Dissipation factor $\tan \delta$ (in 10^{-3}) at 20 °C (upper limit values)	at	$C_R \leq 0.1\ \mu\text{F}$	
	1 kHz	8	
	10 kHz	15	
	100 kHz	30	
Insulation resistance R_{ins} or time constant $\tau = C_R \cdot R_{ins}$ at 20 °C, rel. humidity $\leq 65\%$ (minimum as-delivered values)	V_R	$C_R \leq 0.33\ \mu\text{F}$	
	$\geq 250\ \text{V DC}$	7500 M Ω	
DC test voltage	1500 V DC, 2 s		
Category voltage V_C (continuous operation with V_{DC} or V_{AC} at $f \leq 60\ \text{Hz}$)	T_{op} (°C)	DC voltage derating	AC voltage derating
	$T_{op} \leq 85$	$V_C = V_R$	$V_{C,RMS} = V_{RMS}$
	$85 < T_{op} \leq 125$	$V_C = V_R \cdot (165 - T_{op})/80$	$V_{C,RMS} = V_{RMS} \cdot (165 - T_{op})/80$
Operating voltage V_{op} for short operating periods (V_{DC} or V_{AC} at $f \leq 60\ \text{Hz}$)	T_{op} (°C)	DC voltage (max. hours)	AC voltage (max. hours)
	$T_{op} \leq 100$	$V_{op} = 1.25 \cdot V_C$ (2000 h)	$V_{op} = 1.0 \cdot V_{C,RMS}$ (2000 h)
	$100 < T_{op} \leq 125$	$V_{op} = 1.25 \cdot V_C$ (1000 h)	$V_{op} = 1.0 \cdot V_{C,RMS}$ (1000 h)
Reliability:			
Failure rate λ	2 fit ($\leq 1 \cdot 10^{-9}/\text{h}$) at $0.5 \cdot V_R$, 40 °C		
Service life t_{SL}	100 000 h at $1.0 \cdot V_R$, 85 °C		
	For conversion to other operating conditions and temperatures, refer to chapter "Quality, 2 Reliability".		
Failure criteria:			
Total failure	Short circuit or open circuit		
Failure due to variation of parameters	Capacitance change $ \Delta C/C $	> 10%	
	Dissipation factor $\tan \delta$	> 2 · upper limit value	
	Insulation resistance R_{ins}	< 150 M Ω ($C_R \leq 0.33\ \mu\text{F}$)	
	or time constant $\tau = C_R \cdot R_{ins}$	< 50 s ($C_R > 0.33\ \mu\text{F}$)	
Soldering conditions	Please observe carefully soldering conditions.		



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xDSL applications, compliant with ITU-T K.45/K.20

Pulse handling capability

"dV/dt" represents the maximum permissible voltage change per unit of time for non-sinusoidal voltages, expressed in V/μs.

"k₀" represents the maximum permissible pulse characteristic of the waveform applied to the capacitor, expressed in V²/μs.

Note:

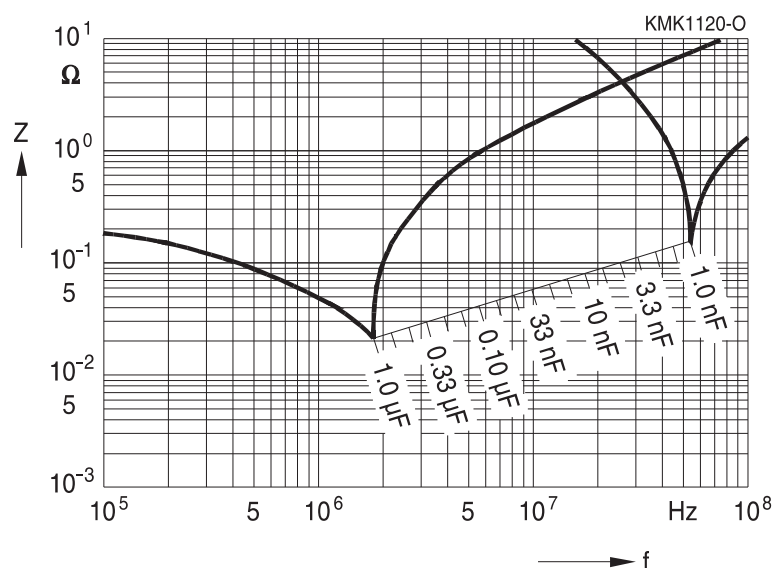
The values of dV/dt and k₀ provided below must not be exceeded in order to avoid damaging the capacitor. These parameters are given for isolated pulses in such a way that the heat generated by one pulse will be completely dissipated before applying the next pulse. For a train of pulses, please refer to the curves of permissible AC voltage-current versus frequency.

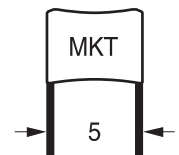
dV/dt and k₀ values

V _R (V DC)	V _{RMS} (V AC)	dV/dt in V/μs	k ₀ in V ² /μs
63	40	250	30 000
100	63	300	60 000
250	160	400	200 000
400	200	600	500 000
630	400	800	1 000 000

Impedance Z versus frequency f

(typical values)



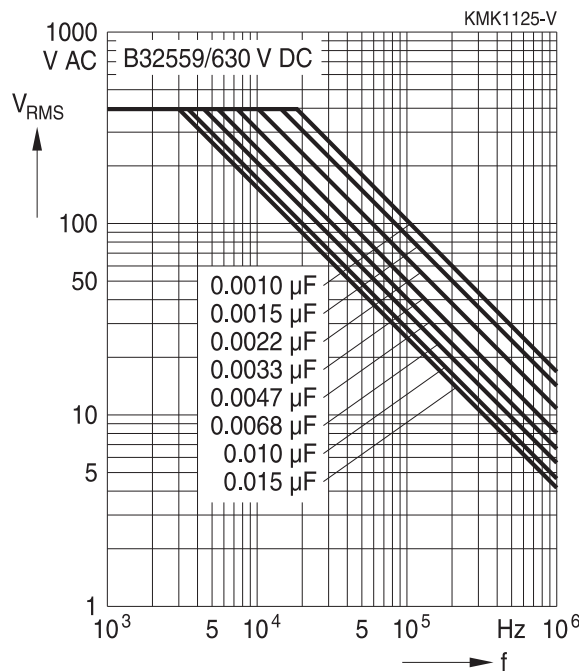


Permissible AC voltage V_{RMS} versus frequency f (for sinusoidal waveforms, $T_A \leq 55^\circ C$)

For $T_A > 55^\circ C$, please refer to "General technical information", section 3.2.3.

Lead spacing 5 mm

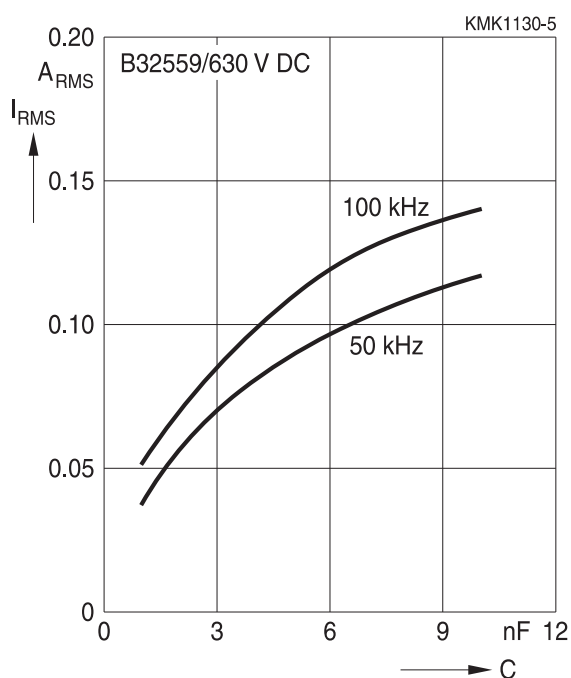
630 V DC/400 V AC

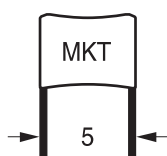


Permissible AC current I_{RMS} versus frequency f

Lead spacing 5 mm

630 V DC/400 V AC



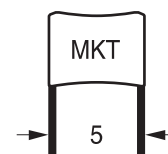


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xDSL applications, compliant with ITU-T K.45/K.20

Testing and Standards

Test	Reference	Conditions of test	Performance requirements
Electrical parameters	IEC 60384-2:2005	Voltage proof, $1.4 V_R$, 1 minute Insulation resistance, R_{ins} Capacitance, C Dissipation factor, $\tan \delta$	Within specified limits
Robustness of terminations	IEC 60068-2-21:2006	Tensile strength (test Ua1) Wire diameter Tensile force $0.3 < d_1 \leq 0.5 \text{ mm}$ 5 N	No visible damage Capacitance and $\tan \delta$ within specified limits
Resistance to soldering heat	IEC 60068-2-20:2008, test Tb, method 1A	Solder bath temperature at $260 \pm 5 \text{ }^\circ\text{C}$, immersion for 4 seconds (lead spacing $\leq 10\text{mm}$)	$\Delta C/C_0 \leq 2\%$ $ \Delta \tan \delta \leq 0.003$ for $C \leq 1 \mu\text{F}$ $ \Delta \tan \delta \leq 0.002$ for $C > 1 \mu\text{F}$
Rapid change of temperature	IEC 60384-2:2005	T_A = lower category temperature T_B = upper category temperature Five cycles, duration $t = 30 \text{ min.}$	$\Delta C/C_0 \leq 5\%$ $ \Delta \tan \delta \leq 0.003$ for $C \leq 1 \mu\text{F}$ $ \Delta \tan \delta \leq 0.002$ for $C > 1 \mu\text{F}$ $R_{ins} \geq 50\%$ of initial limit
Vibration	IEC 60384-2:2005	Test F_C : vibration sinusoidal Displacement: 0.75 mm Acceleration: 98 m/s^2 Frequency: 10 Hz ... 500 Hz Test duration: 3 orthogonal axes, 2 hours each axe	No visible damage
Bump	IEC 60384-2:2005	Test E_b : Total 4000 bumps with 390 m/s^2 mounted on PCB Duration: 6 ms	$\Delta C/C_0 \leq 5\%$ $ \Delta \tan \delta \leq 0.003$ for $C \leq 1 \mu\text{F}$ $ \Delta \tan \delta \leq 0.002$ for $C > 1 \mu\text{F}$ $R_{ins} \geq 50\%$ of initial limit
Climatic sequence	IEC 60384-2:2005	Dry heat T_b / 16 h Damp heat cyclic, 1 st cycle $+55 \text{ }^\circ\text{C} / 24 \text{ h} / 95\% \dots 100\% \text{ RH}$ Cold T_a / 2 h Damp heat cyclic, 5 cycles $+55 \text{ }^\circ\text{C} / 24 \text{ h} / 95\% \dots 100\% \text{ RH}$	$\Delta C/C_0 \leq 5\%$ $ \Delta \tan \delta \leq 0.005$ for $C \leq 1 \mu\text{F}$ $ \Delta \tan \delta \leq 0.003$ for $C > 1 \mu\text{F}$ $R_{ins} \geq 50\%$ of initial limit
Damp heat, steady state	IEC 60384-2:2005	Test C_a $40 \text{ }^\circ\text{C} / 93\% \text{ RH} / 56 \text{ days}$	No visible damage $ \Delta C/C_0 \leq 5\%$ $ \Delta \tan \delta \leq 0.005$ $R_{ins} \geq 50\%$ of initial limit



Test	Reference	Conditions of test	Performance requirements
Endurance A	IEC 60384-2:2005	85 °C / 1.25 V _R / 2000 hours	No visible damage ΔC/C ₀ ≤ 5% Δ tan δ ≤ 0.003 for C ≤ 1 μF Δ tan δ ≤ 0.002 for C > 1 μF R _{ins} ≥ 50% of initial limit
Endurance B	IEC 60384-2:2005	125 °C / 1.25 V _C / 2000 hours	No visible damage ΔC/C ₀ ≤ 5% Δ tan δ ≤ 0.003 for C ≤ 1 μF Δ tan δ ≤ 0.002 for C > 1 μF R _{ins} ≥ 50% of initial limit

Mounting guidelines

1 Soldering

1.1 Solderability of leads

The solderability of terminal leads is tested to IEC 60068-2-20:2008, test Ta, method 1.

Before a solderability test is carried out, terminals are subjected to accelerated ageing (to IEC 60068-2-2:2007, test Ba: 4 h exposure to dry heat at 155 °C). Since the ageing temperature is far higher than the upper category temperature of the capacitors, the terminal wires should be cut off from the capacitor before the ageing procedure to prevent the solderability being impaired by the products of any capacitor decomposition that might occur.

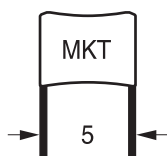
Solder bath temperature	235 ±5 °C
Soldering time	2.0 ±0.5 s
Immersion depth	2.0 +0/−0.5 mm from capacitor body or seating plane
Evaluation criteria:	
Visual inspection	Wetting of wire surface by new solder ≥90%, free-flowing solder

1.2 Resistance to soldering heat

Resistance to soldering heat is tested to IEC 60068-2-20:2008, test Tb, method 1.

Conditions:

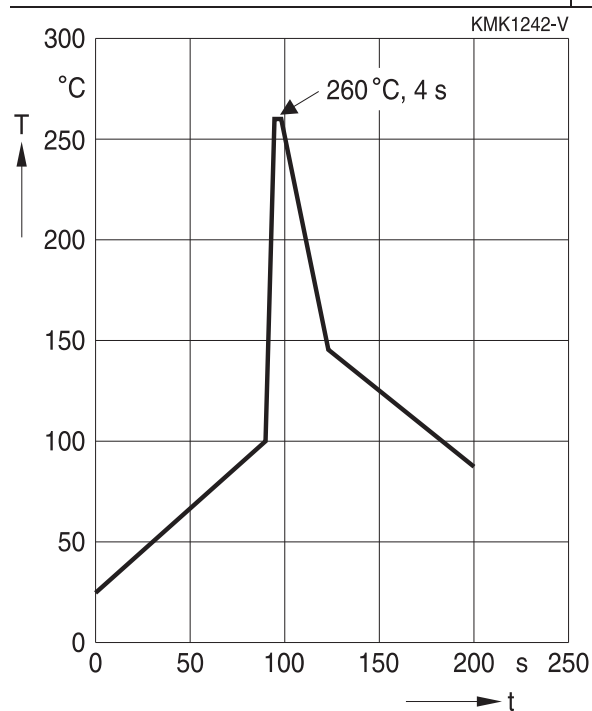
Series	Solder bath temperature	Soldering time
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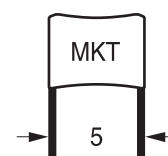
B32559S

xDSL applications, compliant with ITU-T K.45/K.20

MKT boxed (except 2.5 × 6.5 × 7.2 mm) coated uncoated (lead spacing >10 mm)	260 ±5 °C	10 ±1 s
MFP MKP (lead spacing >7.5 mm)		
MKT boxed (case 2.5 × 6.5 × 7.2 mm)		5 ±1 s
MKP (lead spacing ≤7.5 mm) MKT uncoated (lead spacing ≤10 mm) insulated (B32559)		<4 s recommended soldering profile for MKT uncoated (lead spacing ≤ 10 mm) and insulated (B32559)



Immersion depth	2.0 +0/−0.5 mm from capacitor body or seating plane
Shield	Heat-absorbing board, (1.5 ±0.5) mm thick, between capacitor body and liquid solder
Evaluation criteria:	
Visual inspection	No visible damage
$\Delta C/C_0$	2% for MKT/MKP/MFP 5% for EMI suppression capacitors
$\tan \delta$	As specified in sectional specification



1.3 General notes on soldering

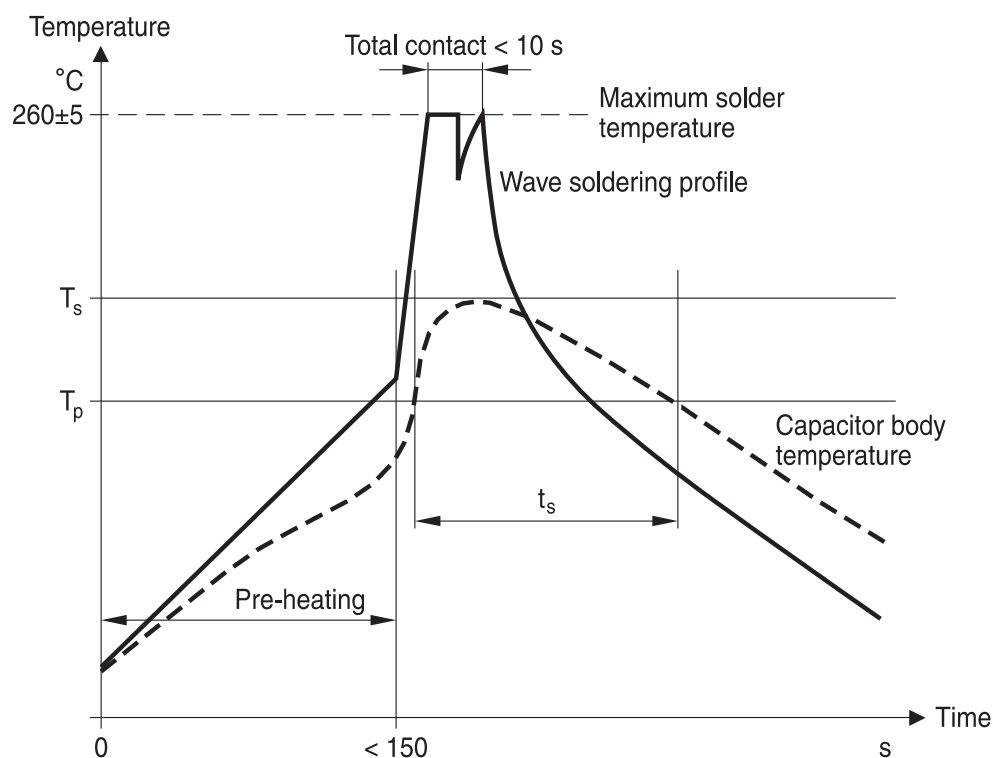
Permissible heat exposure loads on film capacitors are primarily characterized by the upper category temperature T_{max} . Long exposure to temperatures above this type-related temperature limit can lead to changes in the plastic dielectric and thus change irreversibly a capacitor's electrical characteristics. For short exposures (as in practical soldering processes) the heat load (and thus the possible effects on a capacitor) will also depend on other factors like:

- Pre-heating temperature and time
- Forced cooling immediately after soldering
- Terminal characteristics:
diameter, length, thermal resistance, special configurations (e.g. crimping)
- Height of capacitor above solder bath
- Shadowing by neighboring components
- Additional heating due to heat dissipation by neighboring components
- Use of solder-resist coatings

The overheating associated with some of these factors can usually be reduced by suitable countermeasures. For example, if a pre-heating step cannot be avoided, an additional or reinforced cooling process may possibly have to be included.

EPCOS recommendations

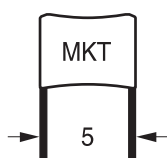
As a reference, the recommended wave soldering profile for our film capacitors is as follows:



T_s : Capacitor body maximum temperature at wave soldering

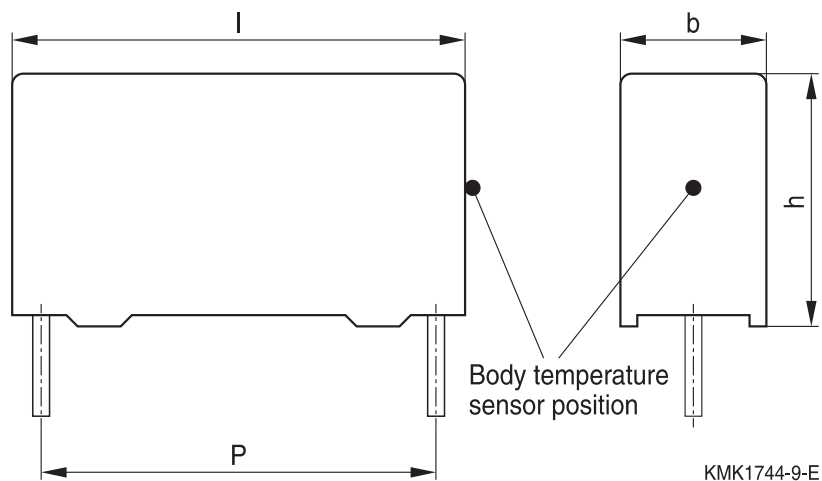
T_p : Capacitor body maximum temperature at pre-heating

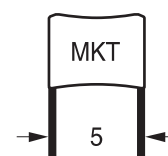
KMK1745-A-E



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xDSL applications, compliant with ITU-T K.45/K.20





Body temperature should follow the description below:

- MKP capacitor
 - During pre-heating: $T_p \leq 110 \text{ }^\circ\text{C}$
 - During soldering: $T_s \leq 120 \text{ }^\circ\text{C}$, $t_s \leq 45 \text{ s}$
- MKT capacitor
 - During pre-heating: $T_p \leq 125 \text{ }^\circ\text{C}$
 - During soldering: $T_s \leq 160 \text{ }^\circ\text{C}$, $t_s \leq 45 \text{ s}$

When SMD components are used together with leaded ones, the film capacitors should not pass into the SMD adhesive curing oven. The leaded components should be assembled after the SMD curing step.

Leaded film capacitors are not suitable for reflow soldering.

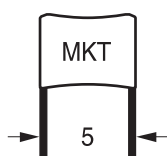
In order to ensure proper conditions for manual or selective soldering, the body temperature of the capacitor (T_s) must be $\leq 120 \text{ }^\circ\text{C}$.

One recommended condition for manual soldering is that the tip of the soldering iron should be $< 360 \text{ }^\circ\text{C}$ and the soldering contact time should be no longer than 3 seconds.

For uncoated MKT capacitors with lead spacings $\leq 10 \text{ mm}$ (B32560/B32561) the following measures are recommended:

- pre-heating to not more than $110 \text{ }^\circ\text{C}$ in the preheater phase
- rapid cooling after soldering

Please refer to EPCOS Film Capacitor Data Book in case more details are needed.



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xDSL applications, compliant with ITU-T K.45/K.20

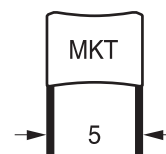
Cautions and warnings

- Do not exceed the upper category temperature (UCT).
- Do not apply any mechanical stress to the capacitor terminals.
- Avoid any compressive, tensile or flexural stress.
- Do not move the capacitor after it has been soldered to the PC board.
- Do not pick up the PC board by the soldered capacitor.
- Do not place the capacitor on a PC board whose PTH hole spacing differs from the specified lead spacing.
- Do not exceed the specified time or temperature limits during soldering.
- Avoid external energy inputs, such as fire or electricity.
- Avoid overload of the capacitors.
- Consult us if application is with severe temperature and humidity condition.
- There are no serviceable or repairable parts inside the capacitor. Opening the capacitor or any attempts to open or repair the capacitor will void the warranty and liability of EPCOS.
- Please note that the standards referred to in this publication may have been revised in the meantime.

The table below summarizes the safety instructions that must always be observed. A detailed description can be found in the relevant sections of the chapters "General technical information" and "Mounting guidelines".

Topic	Safety information	Reference chapter "General technical information"
Storage conditions	Make sure that capacitors are stored within the specified range of time, temperature and humidity conditions.	4.5 "Storage conditions"
Flammability	Avoid external energy, such as fire or electricity (passive flammability), avoid overload of the capacitors (active flammability) and consider the flammability of materials.	5.3 "Flammability"
Resistance to vibration	Do not exceed the tested ability to withstand vibration. The capacitors are tested to IEC 60068-2-6:2007. EPCOS offers film capacitors specially designed for operation under more severe vibration regimes such as those found in automotive applications. Consult our catalog "Film Capacitors for Automotive Electronics".	5.2 "Resistance to vibration"

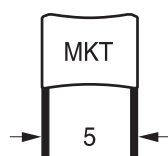
Topic	Safety information	Reference chapter "Mounting guidelines"
Soldering	Do not exceed the specified time or temperature limits during soldering.	1 "Soldering"
Cleaning	Use only suitable solvents for cleaning capacitors.	2 "Cleaning"



Topic	Safety information	Reference chapter "Mounting guidelines"
Embedding of capacitors in finished assemblies	When embedding finished circuit assemblies in plastic resins, chemical and thermal influences must be taken into account. Caution: Consult us first, if you also wish to embed other uncoated component types!	3 "Embedding of capacitors in finished assemblies"

Display of ordering codes for EPCOS products

The ordering code for one and the same product can be represented differently in data sheets, data books, other publications and the website of EPCOS, or in order-related documents such as shipping notes, order confirmations and product labels. **The varying representations of the ordering codes are due to different processes employed and do not affect the specifications of the respective products.** Detailed information can be found on the Internet under www.epcos.com/orderingcodes.

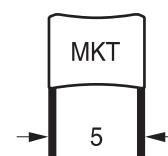


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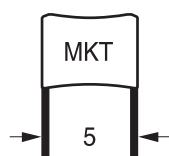
xDSL applications, compliant with ITU-T K.45/K.20

Symbols and terms

Symbol	English	German
α	Heat transfer coefficient	Wärmeübergangszahl
α_C	Temperature coefficient of capacitance	Temperaturkoeffizient der Kapazität
A	Capacitor surface area	Kondensatoroberfläche
β_C	Humidity coefficient of capacitance	Feuchtekoeffizient der Kapazität
C	Capacitance	Kapazität
C_R	Rated capacitance	Nennkapazität
ΔC	Absolute capacitance change	Absolute Kapazitätsänderung
$\Delta C/C$	Relative capacitance change (relative deviation of actual value)	Relative Kapazitätsänderung (relative Abweichung vom Ist-Wert)
$\Delta C/C_R$	Capacitance tolerance (relative deviation from rated capacitance)	Kapazitätstoleranz (relative Abweichung vom Nennwert)
dt	Time differential	Differentielle Zeit
Δt	Time interval	Zeitintervall
ΔT	Absolute temperature change (self-heating)	Absolute Temperaturänderung (Selbsterwärmung)
$\Delta \tan \delta$	Absolute change of dissipation factor	Absolute Änderung des Verlustfaktors
ΔV	Absolute voltage change	Absolute Spannungsänderung
dV/dt	Time differential of voltage function (rate of voltage rise)	Differentielle Spannungsänderung (Spannungsflankensteilheit)
$\Delta V/\Delta t$	Voltage change per time interval	Spannungsänderung pro Zeitintervall
E	Activation energy for diffusion	Aktivierungsenergie zur Diffusion
ESL	Self-inductance	Eigeninduktivität
ESR	Equivalent series resistance	Ersatz-Serienwiderstand
f	Frequency	Frequenz
f_1	Frequency limit for reducing permissible AC voltage due to thermal limits	Grenzfrequenz für thermisch bedingte Reduzierung der zulässigen Wechselspannung
f_2	Frequency limit for reducing permissible AC voltage due to current limit	Grenzfrequenz für strombedingte Reduzierung der zulässigen Wechselspannung
f_r	Resonant frequency	Resonanzfrequenz
F_D	Thermal acceleration factor for diffusion	Therm. Beschleunigungsfaktor zur Diffusion
F_T	Derating factor	Deratingfaktor
i	Current (peak)	Stromspitze
I_C	Category current (max. continuous current)	Kategoriestrom (max. Dauerstrom)



Symbol	English	German
I_{RMS}	(Sinusoidal) alternating current, root-mean-square value	(Sinusförmiger) Wechselstrom
i_z	Capacitance drift	Inkonstanz der Kapazität
k_0	Pulse characteristic	Impuls Kennwert
L_S	Series inductance	Serieninduktivität
λ	Failure rate	Ausfallrate
λ_0	Constant failure rate during useful service life	Konstante Ausfallrate in der Nutzungsphase
λ_{test}	Failure rate, determined by tests	Experimentell ermittelte Ausfallrate
P_{diss}	Dissipated power	Abgegebene Verlustleistung
P_{gen}	Generated power	Erzeugte Verlustleistung
Q	Heat energy	Wärmeenergie
ρ	Density of water vapor in air	Dichte von Wasserdampf in Luft
R	Universal molar constant for gases	Allg. Molarkonstante für Gas
R	Ohmic resistance of discharge circuit	Ohmscher Widerstand des Entladekreises
R_i	Internal resistance	Innenwiderstand
R_{ins}	Insulation resistance	Isolationswiderstand
R_P	Parallel resistance	Parallelwiderstand
R_S	Series resistance	Serienwiderstand
S	severity (humidity test)	Schärfegrad (Feuchtetest)
t	Time	Zeit
T	Temperature	Temperatur
τ	Time constant	Zeitkonstante
$\tan \delta$	Dissipation factor	Verlustfaktor
$\tan \delta_D$	Dielectric component of dissipation factor	Dielektrischer Anteil des Verlustfaktors
$\tan \delta_P$	Parallel component of dissipation factor	Parallelanteil des Verlustfaktors
$\tan \delta_S$	Series component of dissipation factor	Serienanteil des Verlustfaktors
T_A	Temperature of the air surrounding the component	Temperatur der Luft, die das Bauteil umgibt
T_{max}	Upper category temperature	Obere Kategorietemperatur
T_{min}	Lower category temperature	Untere Kategorietemperatur
t_{OL}	Operating life at operating temperature and voltage	Betriebszeit bei Betriebstemperatur und -spannung
T_{op}	Operating temperature, $T_A + \Delta T$	Betriebstemperatur, $T_A + \Delta T$
T_R	Rated temperature	Nenntemperatur
T_{ref}	Reference temperature	Referenztemperatur
t_{SL}	Reference service life	Referenz-Lebensdauer



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xDSL applications, compliant with ITU-T K.45/K.20

Symbol	English	German
V_{AC}	AC voltage	Wechselspannung
V_C	Category voltage	Kategoriespannung
$V_{C,RMS}$	Category AC voltage	(Sinusförmige) Kategorie-Wechselspannung
V_{CD}	Corona-discharge onset voltage	Teilentlade-Einsatzspannung
V_{ch}	Charging voltage	Ladespannung
V_{DC}	DC voltage	Gleichspannung
V_{FB}	Fly-back capacitor voltage	Spannung (Flyback)
V_i	Input voltage	Eingangsspannung
V_o	Output voltage	Ausgangsspannung
V_{op}	Operating voltage	Betriebsspannung
V_p	Peak pulse voltage	Impuls-Spitzenspannung
V_{pp}	Peak-to-peak voltage Impedance	Spannungshub
V_R	Rated voltage	Nennspannung
\hat{V}_R	Amplitude of rated AC voltage	Amplitude der Nenn-Wechselspannung
V_{RMS}	(Sinusoidal) alternating voltage, root-mean-square value	(Sinusförmige) Wechselspannung
V_{SC}	S-correction voltage	Spannung bei Anwendung "S-correction"
V_{sn}	Snubber capacitor voltage	Spannung bei Anwendung "Beschaltung"
Z	Impedance	Scheinwiderstand
e	Lead spacing	Rastermaß

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Important notes

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