Film Capacitors

Metallized Polypropylene Film Capacitors (MKP)

Series/Type: **B32701P ... B32703P**

Date: November 2024

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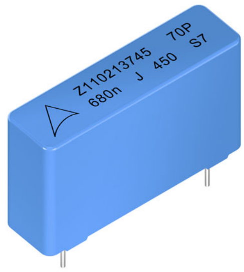


Typical Applications

- PFC (Power Factor Correction)

Climatic

- Max. operating temperature: 110 °C (case)
- Climatic category (IEC 60068-1): 40/110/56

Construction

- Dielectric: polypropylene (MKP)
- Wound capacitor technology
- Plastic case (UL 94 V-0)
- Epoxy resin sealing (UL 94 V-0)

Features

- Very compact design
- Very small dimensions
- High voltage capability
- Excellent self-healing property
- Halogen free capacitors available on request
- RoHS-compatible

Terminals

- Parallel wire leads, lead-free tinned
- Special lead lengths available on request

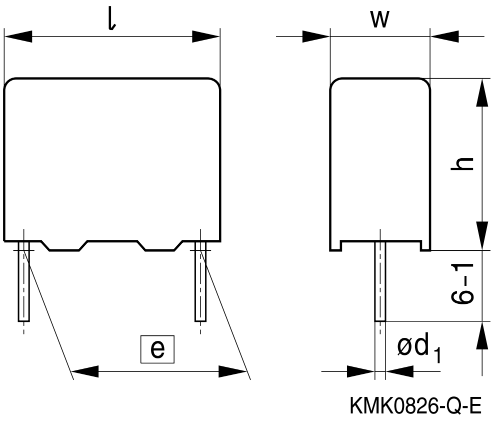
Marking

- Manufacturer’s logo
- Lot number, series number
- 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”

Dimensional drawing



Dimensions in mm

Dimensions and types

Lead spacing e ±0.4	Lead diameter d_1 ±0.05	Type
10	0.6	B32701P
15	0.8	B32702P
22.5	0.8	B32703P

Overview of available types

Lead spacing	10mm	15mm	22.5mm
Type	B32701P	B32702P	B32703P
V_R (V DC)	450 V DC		
C_R (µF)			
0.47			
0.68			
1.0			
1.5			
2.2			

Ordering codes and packing units B32701P (lead spacing 10 mm)

V_R V DC	C_R µF	Ordering code (composition see below)	Max.dimensions w × h × l mm	Ammo pack pcs./MOQ	Reel pcs./MOQ	Untaped pcs./MOQ
450	0.47	B32701P4474+***	5.0 × 11.0 × 13.0	3320	5200	4000
	0.68	B32701P4684+***	6.0 × 12.0 × 13.0	2720	4400	4000
	1.00	B32701P4105+***	7.0 × 16.0 × 13.0	3360	3600	4000
	1.50	B32701P4155+***	8.0 × 17.5 × 13.0	2960	3200	2000
	2.20	B32701P4225+***	9.5 × 19.5 × 13.0	-	-	2000

Ordering codes and packing units B32702P (lead spacing 15 mm)

V_R V DC	C_R µF	Ordering code (composition see below)	Max.dimensions w × h × l mm	Ammo pack pcs./MOQ	Reel pcs./MOQ	Untaped pcs./MOQ
450	0.68	B32702P4684+***	5.0 × 10.5 × 18.0	4680	5200	4000
	1.00	B32702P4105+***	6.0 × 11.0 × 18.0	3840	4400	4000
	1.50	B32702P4155+***	7.0 × 12.5 × 18.0	3320	3600	4000
	2.20	B32702P4225+***	8.5 × 14.5 × 18.0	2720	2800	2000

Ordering codes and packing units B32703P (lead spacing 22.5 mm)

V_R V DC	C_R µF	Ordering code (composition see below)	Max.dimensions w × h × l mm	Ammo pack pcs./MOQ	Reel pcs./MOQ	Untaped pcs./MOQ
450	2.20	B32703P4225+***	6.0 × 15.0 × 26.5	2720	2800	2880

MOQ = Minimum Order Quantity, consisting of 4 packing units.
Intermediate capacitance values and closer tolerance on request. Other lead lengths upon request.

Composition of ordering code

+ = Capacitance tolerance code:
J = ±5%
K = ±10%

*** = Packaging code:
289 = Straight terminals, Ammo pack
189 = Straight terminals, Reel
000 = Straight terminals, Untaped (lead length 6 –1 mm)

Technical data

All data given at T = 20 °C, unless otherwise specified.

Rated temperature T_R	+85 °C		
Operation temperature range	Max. operating temperature $T_{op,\ max}$		+110 °C[1)]
	Upper category temperature T_{max}		+100 °C
	Lower category temperature T_{min}		–40 °C
	Rated temperature T_R		+85 °C
Dissipation factor tan δ (in 10^{-3}) at 20°C (upper limit values)	LS 10 1 kHz: 1.0 100 kHz: 30.0	LS 15 1 kHz: 1.0 100 kHz: 30.0	LS 22.5 1 kHz: 1.0 100 kHz: 45.0
Insulation resistance R_{ins} at 100 V or time constant $\tau = C_R \cdot R_{ins}$ at 20 °C, rel. humidity ≤ 65% (minimum as-delivered values)	10000 s		
Test voltage (terminal to terminal)	$1.4 \cdot V_{R,DC}$, 2s		
Peak current Ip(A)	C (µF) x dV/dt		
$V_{R,DC}$ at 85°C	450 V DC		
Continuous operation voltage Vop at 110 °C	380 V DC		
Continuous operating voltage V_{op} For temperature 85 °C < T ≤ 110 °C Voltage derating	0.62%/°C of V_{op} derating compared to V_{op} at 85 °C		
Reliability Failure rate λ Service life t_{SL}	10 fit (≤ $1 \cdot 10^{-9}$) at $0.5 \cdot V_{R,DC}$, 40 °C 50000h at $V_{R,DC}$ and 85 °C For conversion to other operating conditions and temperatures, refer to chapter “Reliability, 2 Reliability.”		

1) 110 ºC is the maximum operating temperature (ambient temperature + self-heating), detailed information can refer to Irms derating versus ambient temperature curve in page 11.

Pulse handling capabillity

"dV/dt" represents the maximum permissible voltage change per unit of time for non-sinusoidal voltages, expressed in V/ms.
"k0" represents the maximum permissible pulse characteristic of the waveform applied to the capacitor, expressed in V^2/ms.
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 pulse, please refer to the curves of permissible AC voltage-current versus frequency.

dV/dt values

Lead spacing	10 mm	15 mm	22.5 mm
V_R V DC	dV/dt in V/µs		
450	60	25	15

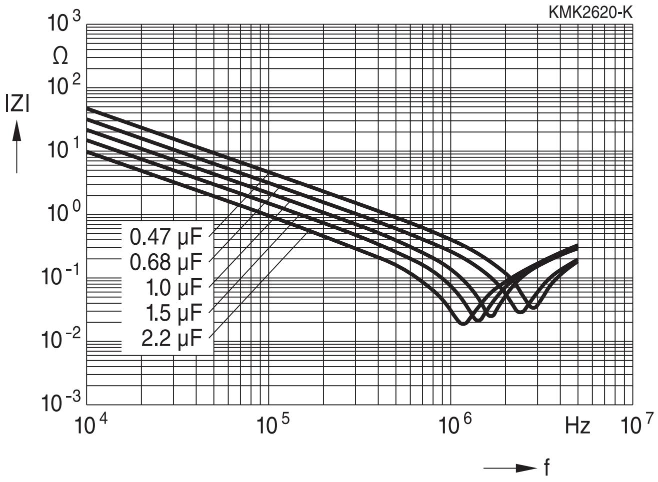
K_0 values

Lead spacing	10 mm	15 mm	22.5 mm
V_R V DC	K_0 in V^2/µs		
450	54000	22500	13500

Characteristics curves

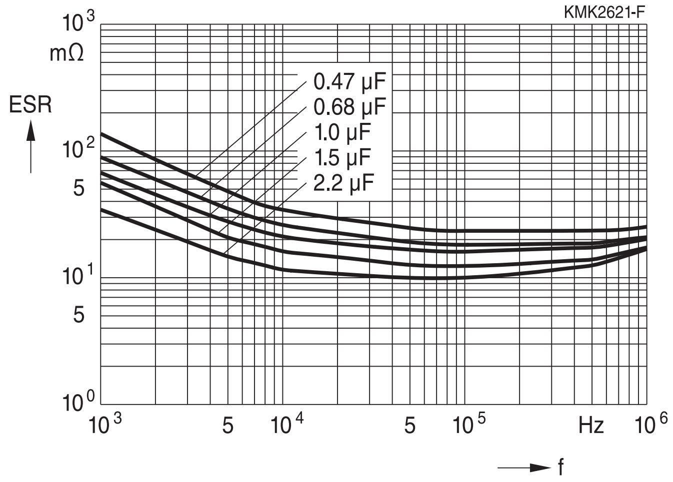
Impedance Z versus frequency f
(Typical values)

Lead spacing 10.0 mm / B32701P4 (2 pins)
450 V DC



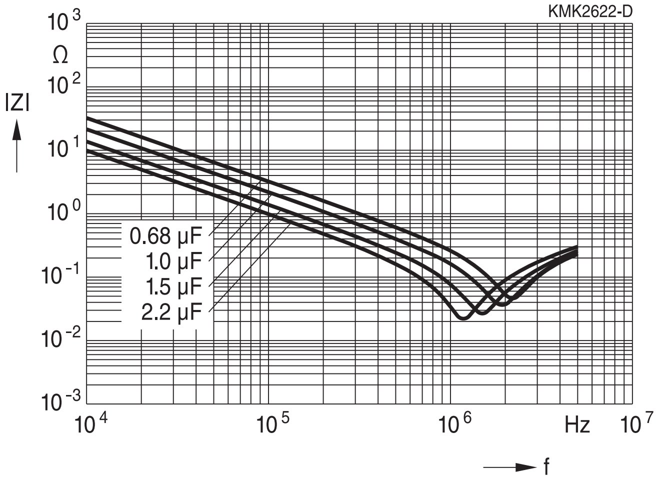
ESR versus frequency f
(Typical values)

Lead spacing 10.0 mm / B32702P4 (2 pins)
450 V DC



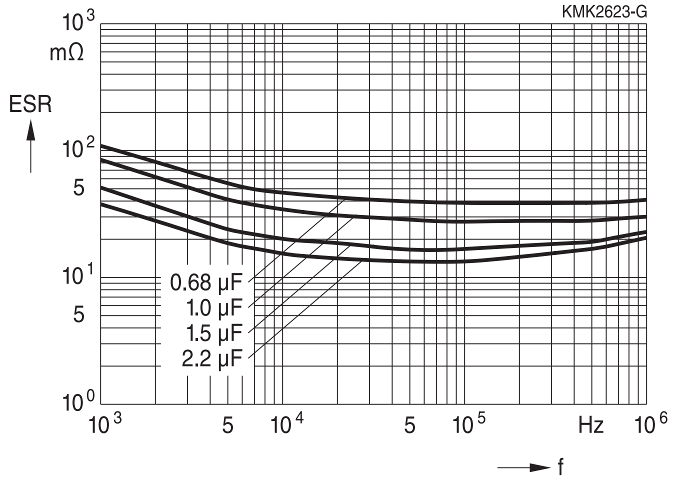
Impedance Z versus frequency f
(Typical values)

Lead spacing 15.0 mm / B32702P4 (2 pins)
450 V DC



ESR versus frequency f
(Typical values)

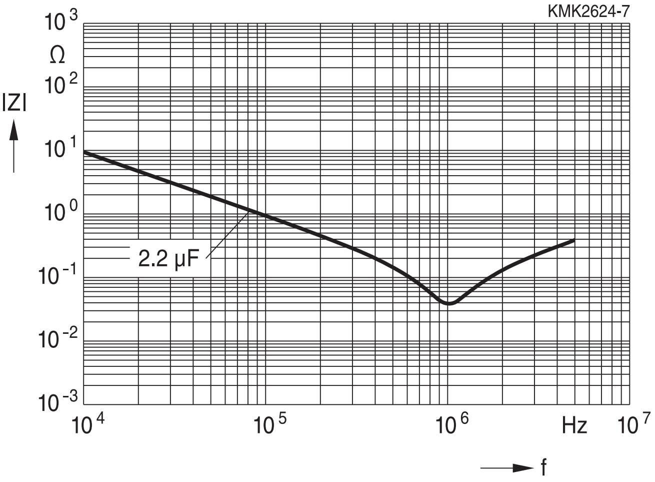
Lead spacing 15.0 mm / B32702P4 (2 pins)
450 V DC



Characteristics curves

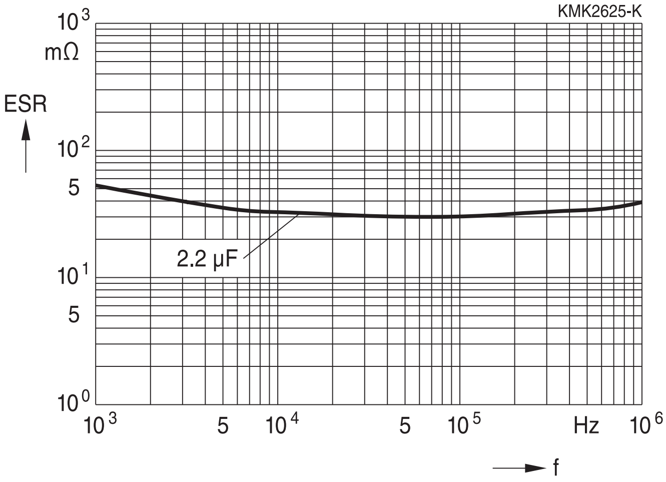
Impedance Z versus frequency f
(Typical values)

Lead spacing 22.5 mm / B32703P4 (2 pins)
450 V DC



ESR versus frequency f
(Typical values)

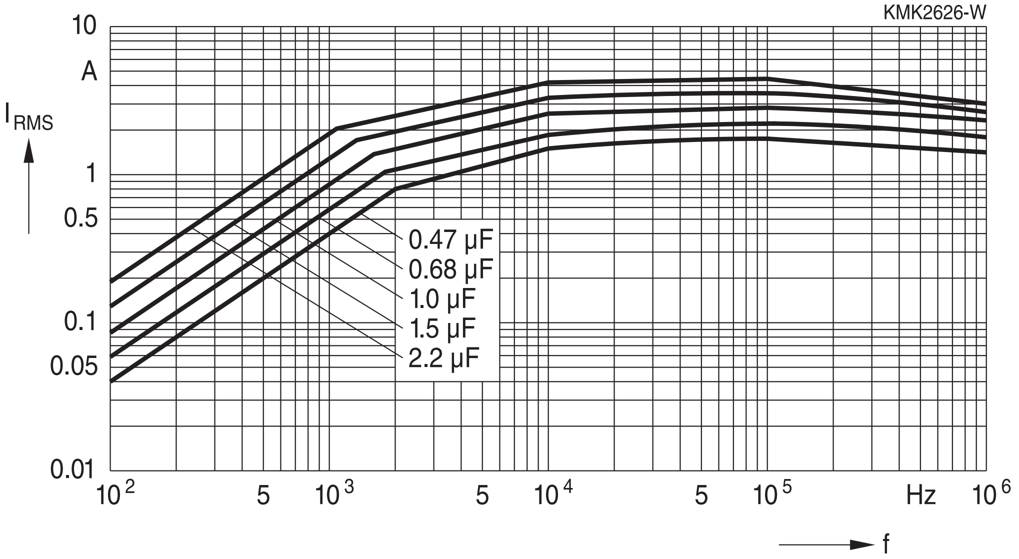
Lead spacing 15.0 mm / B32703P4 (2 pins)
450 V DC



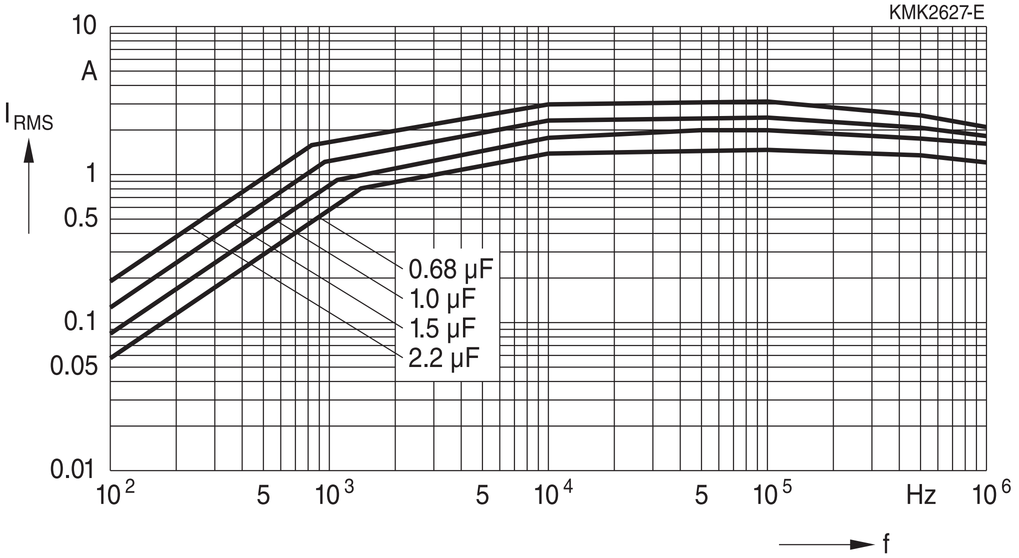
Permissible current Irms versus frequency f (for sinusoidal waveforms, ambient temperature T_A ≤ 85 °C, ΔT ≤ 15 °C)

For T_A > 85 °C, please use derating factor F_T.

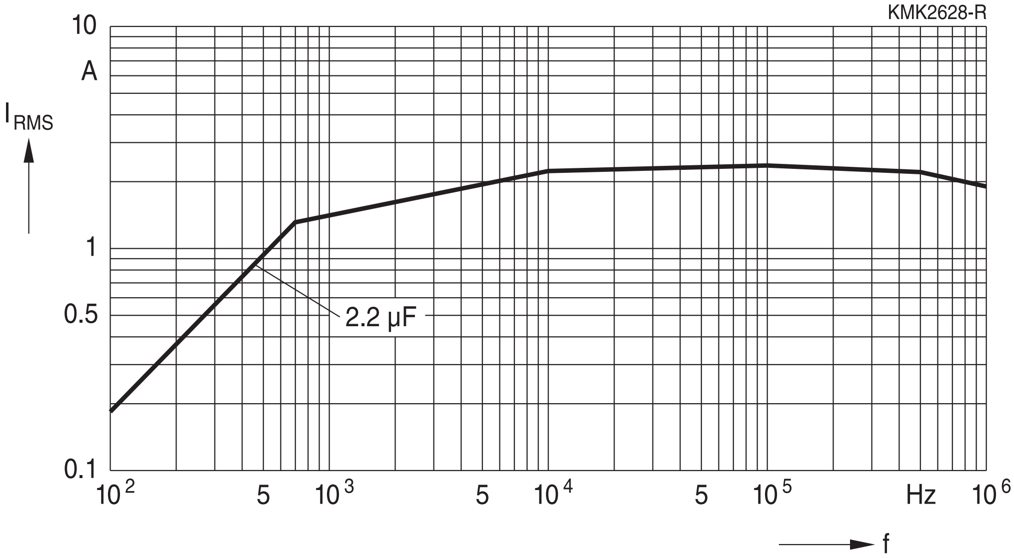
Lead spacing 10 mm
450 V DC



Lead spacing 15 mm
450 V DC

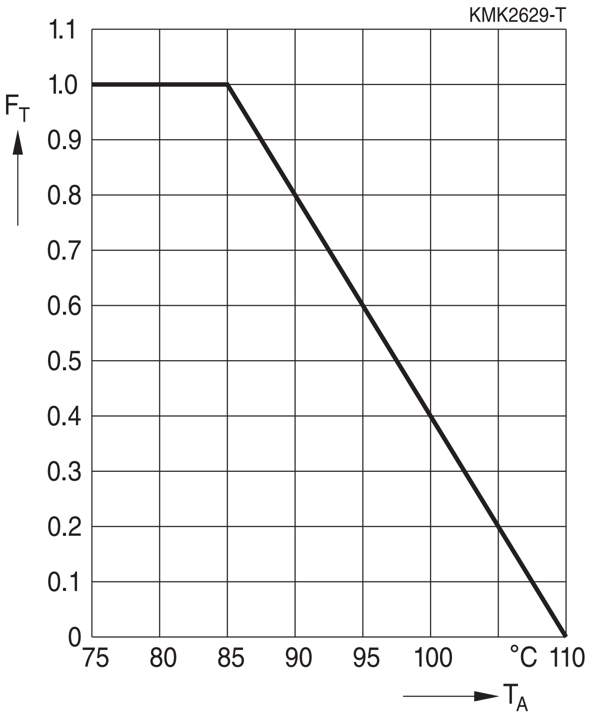


Lead spacing 22.5 mm
450 V DC



Maximum current (I_{RMS}) versus frequency and temperature for T_A > 85 °C

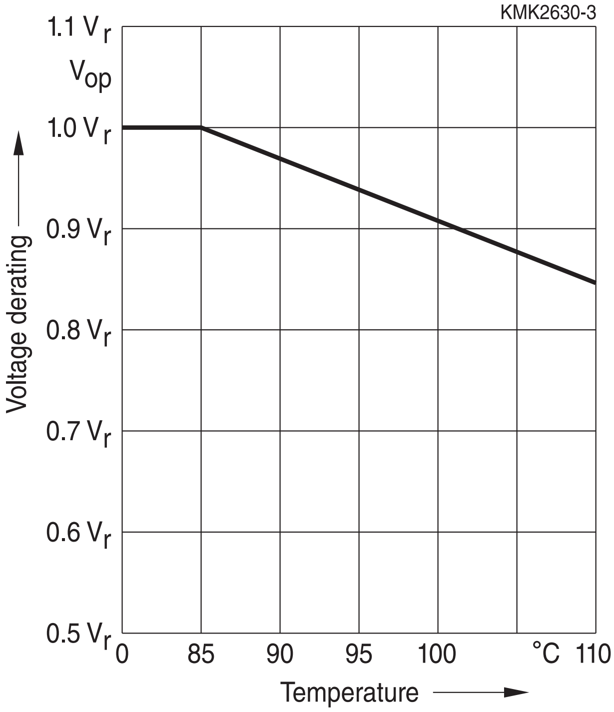
The graphs described in the previous section for the permissible current (I_{RMS}) versus frequency are given for a maximum ambient temperature $T_A \leq 85$ °C. In case of higher ambient temperatures (T_A), the self-heating (ΔT) of the component must be reduced to avoid that temperature of the component ($T_{op} = T_A + \Delta T$) reaches values above maximum operating temperature. The factor F_T shall be applied in the following way:



Maximum I_{RMS} as function of the ambient temperature:

$I_{RMS}(T_A) = I_{RMS,TA \leq 85\,°C} \cdot F_T(T_A)$

Maximum permissible DC voltage as a function of temperature (voltage derating)



Reliability Items

Test description	Reference	Test conditions	Performance requirements
0-Electrical parameters	IEC 60384-16:2019	Capacitance: 1 kHz,1.0 V; Loss factor: 1 kHz, 1.0 V; 100 KHz, 1.0 V; Voltage proof: 1.4 U_R, 1 min; Insulation Resistance: 100 V,1 min;	Within specified limits
1-Robustness of terminations	IEC 60068-2-21:2006	Tensile strength (test Ua1) Wire diameter: $0.5 < d \le 0.8$ mm — Tensile force: 10 N	Capacitance and tan within tan δ specified limits
2-Rapid change of temperature	IEC 60384-16:2019	T_A = lower category temperature T_B = upper category temperature Five cycles, duration t = 30 min	$\lvert \Delta C/C_0 \rvert \le 2\%$ $\lvert \Delta \tan \delta \rvert \le 0.002$ $R_{ins} \ge 50\%$ of initial limit
Vibration	IEC 60384-16:2019	Test F_C: vibration sinusoidal Displacement: 0.75 mm Accleration: 98 m/s^2 Whichever is the lower amplitude Frequency: 10 Hz ... 500 Hz Test duration: 3 orthogonal axes, 2 hours each axe	No visible damage
3-Bump	IEC 60384-16:2019	Test Eb: Total 4000 bumps with 400 m/s^2 mounted on PCB Duration: 6 ms	No visible damage $\lvert \Delta C/C_0 \rvert \le 2\%$ $\lvert \Delta \tan \delta \rvert \le 0.002$ $R_{ins} \ge 50\%$ of initial limit
4-Climatic Sequence	IEC 60384-16:2019	Dry heat Tb / 16 h Damp heat cyclic, 1st cycle +55 °C / 24 h / 95% ... 100% RH Cold Ta / 2 h Damp heat cyclic, 5 cycles +55 °C / 24 h / 95% ... 100% RH	No visible damage $\lvert \Delta C/C_0 \rvert \le 3\%$ $\lvert \Delta \tan \delta \rvert \le 0.002$ $R_{ins} \ge 50\%$ of initial limit
5- Damp heat, loading		Test Ca 40 °C / 93% RH / $V_{R,DC}$/1000 hours	No visible damage $\lvert \Delta C/C_0 \rvert \le 10\%$
6-Endurance A		85 °C / 1.11 $V_{R,DC}$ / 1000 hours	No visible damage $\lvert \Delta C/C_0 \rvert \le 5\%$ $\lvert \Delta \tan \delta \rvert \le 0.004$ $R_{ins} \ge 50\%$ of initial limit
7-Endurance B		110 °C / 1.11 Vop / 1000 hours	No visible damage $\lvert \Delta C/C_0 \rvert \le 5\%$ $\lvert \Delta \tan \delta \rvert \le 0.004$ $R_{ins} \ge 50\%$ of initial limit

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 TDK Electronics.
- 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. TDK Electronics 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"
Soldering	Do not exceed the specified time or temperature limits during soldering.	1 "Soldering"
Cleaning	Use only suitable solvents for cleaning capacitors.	2 "Cleaning"
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 TDK Electronics products

The ordering code for one and the same product can be represented differently in data sheets, data books, other publications, on the company website, 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.tdk-electronics.tdk.com/orderingcodes.

Correlation of data sheet values and modelling tool outputs

Data sheet values and results of design tools may deviate as they have not been derived in the same context.
While data sheets show individual parameter statements without considering a possible dependency to other parameters. Tools model a complete given scenario as input and processed inside the tool.
Furthermore as we constantly strive to improve our models, the results of tools can change over time and be a non-binding indication only.

Soldering

Solderability of leads

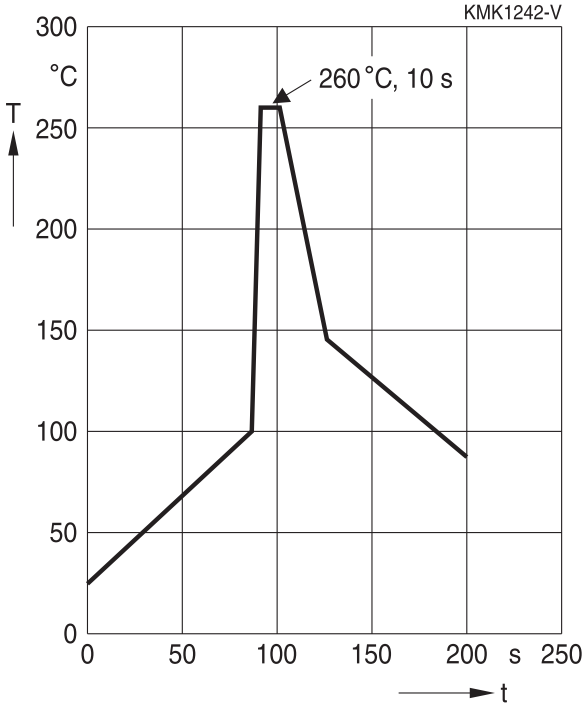
The solderability of terminal leads is tested to IEC 60068-2-20:2008, test Ta, method 1.
Before a solderability test is carried out, terminals are subjected to accelerated ageing (to IEC 60068-2-2:2007, test Ba: 4 h exposure to dry heat at 155 °C). Since the ageing temperature is far higher than the 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

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
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 MKT	(lead spacing ≤ 7.5 mm) 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 δ	As specified in sectional specification

General notes on soldering

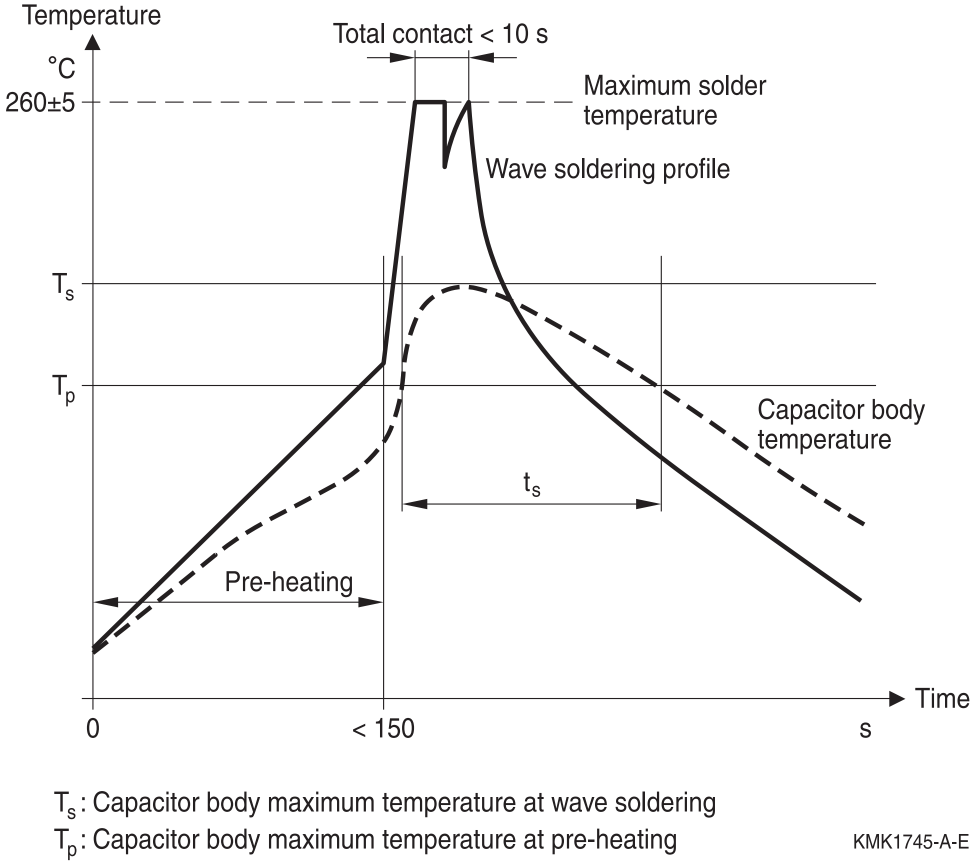
Permissible heat exposure loads on film capacitors are primarily characterized by the upper category temperature T_{max}. Long exposure to temperatures above this type-related temperature limit can lead to changes in the plastic dielectric and thus change irreversibly a capacitor's electrical characteristics. 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:

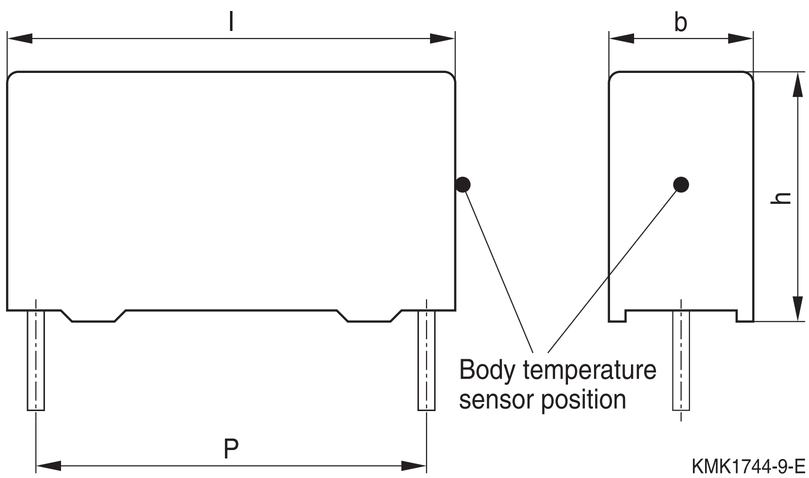
- Pre-heating temperature and time
- Forced cooling immediately after soldering
- Terminal characteristics:
  diameter, length, thermal resistance, special configurations (e.g. crimping)
- Height of capacitor above solder bath
- Shadowing by neighboring components
- Additional heating due to heat dissipation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

TDK Recommendations

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





Body temperature should follow the description below:

- MKP capacitor
  During pre-heating: $T_p \leq 110$ °C
  During soldering: $T_s \leq 120$ °C, $t_s \leq 45$ s
- MKT capacitor
  During pre-heating: $T_p \leq 125$ °C
  During soldering: $T_s \leq 160$ °C, $t_s \leq 45$ 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 (Ts) must be ≤ 120 °C.
One recommended condition for manual soldering is that the tip of the soldering iron should be < 360 °C and the soldering contact time should be no longer than 3 seconds.
For uncoated MKT capacitors with lead spacings ≤ 10 mm (B32560/B32561) the following measures are recommended:

- pre-heating to not more than 110 °C in the preheater phase
- rapid cooling after soldering

Cleaning

To determine whether the following solvents, often used to remove flux residues and other substances, are suitable for the capacitors described, refer to the table below:

Type	Ethanol, isopropanol, n-propanol	n-propanol-water mixtures, water with surface tension-reducing tensides (neutral)
MKT (uncoated)	Suitable	Unsuitable
MKT, MKP, MFP (coated/boxed)		Suitable

Even when suitable solvents are used, a reversible change of the electrical characteristics may occur in uncoated capacitors immediately after they are washed. Thus it is always recommended to dry the components (e.g. 4 h at 70 °C) before they are subjected to subsequent electrical testing.

Caution:

Consult us first if you wish to use new solvents!

Embedding of capacitors in finished assemblies

In many applications, finished circuit assemblies are embedded in plastic resins. In this case, both chemical and thermal influences of the embedding ("potting") and curing processes must be taken into account.
Our experience has shown that the following potting materials can be recommended: non-flexible epoxy resins with acid-anhydride hardeners; chemically inert, non-conducting fillers; maximum curing temperature of 100 °C.

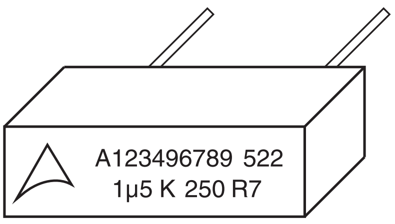
Caution:

Consult us first if you wish to embed uncoated types!

Marking

1 Capacitor markings

Depending on the capacitor size, the markings are positioned either on the side and/or the top of the component. The coded forms specified in IEC 60062:2004 are used to indicate the rated capacitance, capacitance tolerance and date of manufacture.
The lot number (production batch number) ensures unique identification of a particular capacitor and allows, together with the date of manufacture, exact assignment to the process data of the entire production run (traceability).

Marking example	Remarks
 KMK2733-O	Manufacturer‘s logo 1st line: Lot number (1 character, 9 digits), series number (film material is coded in the series number) 2nd line: C_R, tolerance, V_R, date of manufacture (year and month coded)

Codes for rated capacitance

Rated capacitance	To IEC 60062	Short code
100 pF	100p	n1
150 pF	150p	n15
1.0 nF	1n0	1n
1.5 nF	1n5	
10 nF	10n	
100 nF	100n	µ1
150 nF	150n	µ15
1.0 µF	1µ0	1µ
1.5 µF	1µ5	
10 µF	10µ	
15 µF	15µ	

Codes for capacitance tolerance

Capacitance tolerance	Code letter	Remark
	A	Capacitance tolerances for which no code letter is defined can be indicated by an A. The meaning of code A must then be mutually specified in other documentation.
±2.5%	H	
±5%	J	
±10%	K	
±20%	M	

Codes for date of manufacture (to IEC 60062:2004)

Code for year				Code for month			
Year	Code letter	Year	Code letter	Month	Code numeral	Month	Code numeral/letter
2023	R	2029	X	January	1	July	7
2024	S	2030	A	February	2	August	8
2025	T	2031	B	March	3	September	9
2026	U	2032	C	April	4	October	O
2027	V	2033	D	May	5	November	N
2028	W	2034	E	June	6	December	D

E.g.: J5 2017 May

Marking types

The capacitors may have either an ink-jet marking or a laser marking. The main advantage of laser marking is that it cannot be removed by solvents, which ensures the reliable identification of the capacitor. Moreover, because the laser marking process reduces the amount of chemicals used, it is an environmentally friendly marking solution.

2 Ordering code system

A component and the packing in which it is to be delivered are defined by the ordering code, which has 15 digits (plus 3 additional digits for internal use). For all capacitors the ordering codes are explicitly stated (together with the corresponding tolerance and/or packing variants) in the data sheets.
Should there be any doubt about the coding system, however, then it is better to order the capacitor using a plain text description (i.e. without a code).

Basic structure of the ordering code:

Digit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	B																	
	Block 1							Block 2					Block 3			Block 4 (for internal use)		

Digit	Meaning
1	B = Passive components
2,3	32 = Metallized film capacitors, EMI suppression capacitors 81 = EMI suppression capacitors
4 ... 6	Type (block 1 is termed the "type number")
7	Revision status
8	Rated DC voltage, coded (not for EMI suppression capacitors)
9 ... 11	Rated capacitance (coding method for value in pF) Examples:
	Digit 9 10 11 B 3 2 7 0 1 P 4 1 0 5 K = 15 • 10^5 pF = 1000 nF
12	Code letter for capacitance tolerance
13 ... 15	Codes for lead and taping parameters (refer to respective data sheet)
16 ... 18	Internal use

Display of ordering codes for TDK Electronics products

The ordering code for one and the same product can be represented differently in data sheets, data books, other publications, on the company website, 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.tdk-electronics.tdk.com/orderingcodes.

Important notes

The following applies to all products named in this publication:

1 Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application**. As a rule we are either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether a product with the properties described in the product specification is suitable for use in a particular customer application.

2 We also point out that **in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified**. In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or life-saving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.

3 **The warnings, cautions and product-specific notes must be observed**.

4 In order to satisfy certain technical requirements, **some of the products described in this publication may contain substances subject to restrictions in certain jurisdictions (e.g. because they are classed as hazardous)**. Useful information on this will be found in our Material Data Sheets on the Internet (www.tdk-electronics.tdk.com/material). Should you have any more detailed questions, please contact our sales offices.

5 We constantly strive to improve our products. Consequently, **the products described in this publication may change from time to time**. The same is true of the corresponding product specifications. Please check therefore to what extent product descriptions and specifications contained in this publication are still applicable before or when you place an order.
We also **reserve the right to discontinue production and delivery of products**. Consequently, we cannot guarantee that all products named in this publication will always be available. The aforementioned does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.

6 Unless otherwise agreed in individual contracts, **all orders are subject to our General Terms and Conditions of Supply**.

7 **Our manufacturing sites serving the automotive business apply the IATF 16949 standard**. The IATF certifications confirm our compliance with requirements regarding the quality management system in the automotive industry. Referring to customer requirements and customer specific requirements (“CSR”) TDK always has and will continue to have the policy of respecting individual agreements. Even if IATF 16949 may appear to support the acceptance of unilateral requirements, we hereby like to emphasize that **only requirements mutually agreed upon can and will be implemented in our Quality Management System**. For clarification purposes we like to point out that obligations from IATF 16949 shall only become legally binding if individually agreed upon.

8 The trade names EPCOS, CarXield, CeraCharge, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CTVS, DeltaCap, DigiSiMic, FilterCap, FormFit, InsuGate, LeaXield, MediPlas, MiniBlue, MiniCell, MKD, MKK, ModCap, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PiezoBrush, PlasmaBrush, PowerHap, PQSine, PQvar, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, SurfIND, ThermoFuse, WindCap, XieldCap are **trademarks registered or pending** in Europe and in other countries. Further information will be found on the Internet at www.tdk-electronics.tdk.com/trademarks.

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