



Film Capacitors

Metallized Polypropylene Film Capacitors (MKP)

Series/Type: B32671P ... B32673P

Date: April 2014

Power Factor Correction

Typical applications

- PFC (Power Factor Correction)

Climatic

- Max. operating temperature: 125 °C
- Climatic category (IEC 60068-1): 55/110/56

Construction

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

Features

- Very compact design
- Very small dimensions
- Very high ripple and peak current
- High frequency AC operation capability
- High voltage capability
- Excellent self-healing property
- RoHS-compatible
- Halogen-free capacitors available on request

Terminals

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

Marking

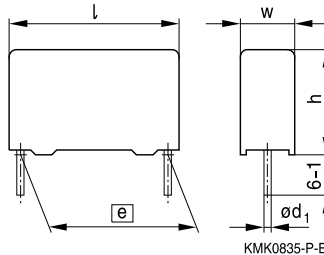
- Manufacturer's logo
- Lot number, series number
- Rated capacitance (coded)
- Capacitance tolerance (code letter)
- Rated DC voltage
- Date of manufacture (coded)

Delivery mode

- Bulk (untaped)
- Taped (Ammo pack or reel)

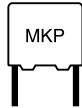
For notes on taping, refer to chapter "Taping and packing".

Dimensional drawing



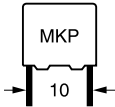
Dimensions in mm

Lead spacing	Lead diameter	Type
$e \pm 0.4$	$d_1 \pm 0.05$	
10	0.6	B32671P
15	0.8	B32672P
22.5	0.8	B32673P



Overview of available types

Lead spacing	10 mm			15 mm			22.5 mm		
Type	B32671P			B32672P			B32673P		
Page	4			5			6		
V_{RMS} (V AC)	160	200	200	160	200	200	160	200	200
V_R (V DC)	450	520	630	450	520	630	450	520	630
C_R (μF)									
0.068									
0.082									
0.10									
0.15									
0.18									
0.22									
0.27									
0.33									
0.39									
0.47									
0.56									
0.68									
1.0									
1.5									
2.0									
2.2									


B32671P
Power Factor Correction
Ordering codes and packing units (lead spacing 10 mm)

V_R V DC	V_{RMS} $f \leq 1$ kHz V AC	C_R μF	Ordering code (composition see below)	Max. dimensions $w \times h \times l$ mm	Ammo pack pcs./MOQ	Reel pcs./MOQ	Untaped pcs./MOQ
450	160	0.10	B32671P4104+***	4.0 × 9.0 × 13.0	4000	6800	4000
		0.15	B32671P4154+***	4.0 × 9.0 × 13.0	4000	6800	4000
		0.18	B32671P4184+***	5.0 × 11.0 × 13.0	3320	5200	4000
		0.22	B32671P4224+***	5.0 × 11.0 × 13.0	3320	5200	4000
		0.27	B32671P4274+***	5.0 × 11.0 × 13.0	3320	5200	4000
		0.33	B32671P4334+***	6.0 × 12.0 × 13.0	2720	4400	4000
		0.39	B32671P4394+***	6.0 × 12.0 × 13.0	2720	4400	4000
		0.47	B32671P4474+***	6.0 × 14.0 × 13.0	2720	4400	4000
		0.68	B32671P4684+***	7.0 × 16.0 × 13.0			4000
		1.0	B32671P4105+***	8.0 × 17.5 × 13.0			4000
520	200	0.082	B32671P5823+***	4.0 × 9.0 × 13.0	4000	6800	4000
		0.10	B32671P5104+***	5.0 × 11.0 × 13.0	3320	5200	4000
		0.15	B32671P5154+***	5.0 × 11.0 × 13.0	3320	5200	4000
		0.22	B32671P5224+***	6.0 × 12.0 × 13.0	2720	4400	4000
		0.33	B32671P5334+***	7.0 × 16.0 × 13.0			4000
		0.47	B32671P5474+***	8.0 × 17.5 × 13.0			4000
630	200	0.068	B32671P6683+***	4.0 × 9.0 × 13.0	4000	6800	4000
		0.082	B32671P6823+***	5.0 × 11.0 × 13.0	3320	5200	4000
		0.10	B32671P6104+***	5.0 × 11.0 × 13.0	3320	5200	4000
		0.15	B32671P6154+***	6.0 × 12.0 × 13.0	2720	4400	4000
		0.18	B32671P6184+***	6.0 × 12.0 × 13.0	2720	4400	4000
		0.22	B32671P6224+***	6.0 × 14.0 × 13.0	2720	4400	4000
		0.33	B32671P6334+***	8.0 × 17.5 × 13.0			4000
		0.39	B32671P6394+***	8.0 × 17.5 × 13.0			4000

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

Further E series, intermediate capacitance values and closer tolerance on request.

Composition of ordering code

+ = Capacitance tolerance code:

J = $\pm 5\%$

K = $\pm 10\%$

M = $\pm 20\%$

*** = Packaging code:

289 = Straight terminals, Ammo pack

189 = Straight terminals, Reel

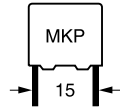
240 = Crimped down to lead spacing 7.5 mm,
Ammo pack

140 = Crimped down to lead spacing 7.5 mm,
Reel

003 = Straight terminals, untaped (lead length
3.2 ± 0.3 mm)

000 = Straight terminals, untaped (lead length
6–1 mm)

B32672P
Power Factor Correction



Ordering codes and packing units (lead spacing 15 mm)

V_R V DC	V_{RMS} $f \leq 1$ kHz V AC	C_R μF	Ordering code (composition see below)	Max. dimensions $w \times h \times l$ mm	Ammo pack pcs./MOQ	Reel pcs./MOQ	Untaped pcs./MOQ
450	160	0.10	B32672P4104+***	$5.0 \times 10.5 \times 18.0$	4680	5200	4000
		0.22	B32672P4224+***	$5.0 \times 10.5 \times 18.0$	4680	5200	4000
		0.33	B32672P4334+***	$5.0 \times 10.5 \times 18.0$	4680	5200	4000
		0.47	B32672P4474+***	$5.0 \times 10.5 \times 18.0$	4680	5200	4000
		0.56	B32672P4564+***	$6.0 \times 11.0 \times 18.0$	3840	4400	4000
		0.68	B32672P4684+***	$6.0 \times 12.0 \times 18.0$	3840	4400	4000
		1.0	B32672P4105+***	$7.0 \times 12.5 \times 18.0$	3320	3600	4000
		1.5	B32672P4155+***	$9.0 \times 17.5 \times 18.0$	2560	2800	2000
		2.0	B32672P4205+***	$9.0 \times 17.5 \times 18.0$	2560	2800	2000
		2.2	B32672P4225+***	$11.0 \times 18.5 \times 18.0$		2200	1200
520	200	0.15	B32672P5154+***	$5.0 \times 10.5 \times 18.0$	4680	5200	4000
		0.22	B32672P5224+***	$5.0 \times 10.5 \times 18.0$	4680	5200	4000
		0.33	B32672P5334+***	$6.0 \times 11.0 \times 18.0$	3840	4400	4000
		0.47	B32672P5474+***	$7.0 \times 12.5 \times 18.0$	3320	3600	4000
		0.68	B32672P5684+***	$8.5 \times 14.5 \times 18.0$	2720	2800	2000
		1.0	B32672P5105+***	$9.0 \times 17.5 \times 18.0$	2560	2800	2000
		1.5	B32672P5155+***	$11.0 \times 18.5 \times 18.0$		2200	1000
630	200	0.15	B32672P6154+***	$5.0 \times 10.5 \times 18.0$	4680	5200	4000
		0.22	B32672P6224+***	$6.0 \times 11.0 \times 18.0$	3840	4400	4000
		0.33	B32672P6334+***	$7.0 \times 12.5 \times 18.0$	3320	3600	4000
		0.47	B32672P6474+***	$8.0 \times 14.0 \times 18.0$	2920	3000	2000
		0.68	B32672P6684+***	$9.0 \times 17.5 \times 18.0$	2560	2800	2000
		1.0	B32672P6105+***	$11.0 \times 18.5 \times 18.0$		2200	1000

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

Further E series, intermediate capacitance values and closer tolerance on request.

Composition of ordering code

+ = Capacitance tolerance code:

J = $\pm 5\%$

K = $\pm 10\%$

M = $\pm 20\%$

*** = Packaging code:

289 = Straight terminals, Ammo pack

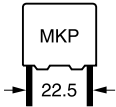
189 = Straight terminals, Reel

255 = Crimped down to lead spacing 7.5 mm,
Ammo pack

155 = Crimped down to lead spacing 7.5 mm,
Reel

003 = Straight terminals, untaped (lead length
 3.2 ± 0.3 mm)

000 = Straight terminals, untaped (lead length
6–1 mm)


B32673P
Power Factor Correction
Ordering codes and packing units (lead spacing 22.5 mm)

V_R V DC	V_{RMS} f ≤ 1 kHz V AC	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	160	1.0	B32673P4105+***	6.0 × 15.0 × 26.5	2720	2800	2880
		1.5	B32673P4155+***	7.0 × 16.0 × 26.5	2320	2400	2520
		2.2	B32673P4225+***	8.5 × 16.5 × 26.5	1920	2000	2040
520	200	0.47	B32673P5474+***	6.0 × 15.0 × 26.5	2720	2800	2880
		0.56	B32673P5564+***	6.0 × 15.0 × 26.5	2720	2800	2880
		0.68	B32673P5684+***	6.0 × 15.0 × 26.5	2720	2800	2880
		1.0	B32673P5105+***	7.0 × 16.0 × 26.5	2320	2400	2520
		1.5	B32673P5155+***	10.5 × 16.5 × 26.5	1560	1600	2160
		2.2	B32673P5225+***	10.5 × 20.5 × 26.5			2160
630	200	0.33	B32673P6334+***	6.0 × 15.0 × 26.5	2720	2800	2880
		0.47	B32673P6474+***	6.0 × 15.0 × 26.5	2720	2800	2880
		0.56	B32673P6564+***	6.0 × 15.0 × 26.5	2720	2800	2880
		0.68	B32673P6684+***	7.0 × 16.0 × 26.5	2320	2400	2520
		1.0	B32673P6105+***	8.5 × 16.5 × 26.5	1920	2000	2040
		1.5	B32673P6155+***	10.5 × 18.5 × 26.5	1560	1600	2160
		2.2	B32673P6225+***	12.0 × 22.0 × 26.5			1800

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

Further E series, intermediate capacitance values and closer tolerance on request.

Composition of ordering code

+ = Capacitance tolerance code:

J = ±5%

K = ±10%

M = ±20%

*** = Packaging code:

289 = Straight terminals, Ammo pack

189 = Straight terminals, Reel

003 = Untaped (lead length 3.2 ± 0.3 mm)

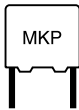
000 = Untaped (lead length 6–1 mm)



Technical data

Reference standard: IEC 60384-16. All data given at $T = 20\text{ °C}$, otherwise is specified.

Operating temperature range	Max. operating temperature $T_{op, max}$ +125 °C Upper category temperature T_{max} +110 °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)	1 kHz 10 kHz 100 kHz	1.0 2.5 25.0	
Insulation resistance R_{ins} at 100 V or time constant $\tau = C_R \cdot R_{ins}$ at 20 °C, rel. humidity $\leq 65\%$ (minimum as-delivered values)	30 G Ω ($C_R \leq 0.33\text{ }\mu\text{F}$) 10000 s ($C_R > 0.33\text{ }\mu\text{F}$)		
DC test voltage	$1.4 \cdot V_R$, 2 s		
Category voltage V_C (continuous operation with V_{DC} or V_{AC} at $f \leq 1\text{ kHz}$)	$T_A \leq 85$	$V_C = V_R$	$V_{C, RMS} = V_{RMS}$
	$85 < T_A \leq 110$	$V_C = V_R \cdot (165 - T_{op})/80$	$V_{C, RMS} = V_{RMS} \cdot (165 - T_{op})/80$
Operating voltage V_{op} for short operating periods (V_{DC} or V_{AC} at $f \leq 1\text{ kHz}$)	$T_{op} \leq 100$	$V_{op} = 1.1 \cdot V_C$ (1000 h)	$V_{op} = 1.0 \cdot V_{C, RMS}$ (1000 h)
	$100 < T_{op} \leq 125$	$V_{op} = 1.0 \cdot V_C$ (1000 h)	$V_{op} = 1.0 \cdot V_{C, RMS}$ (1000 h)
Reliability: Failure rate λ Service life t_{SL}	24 fit ($\leq 1 \cdot 10^{-7}/h$) at $0.5 \cdot V_R$, 40 °C 200000 h at $0.5 \cdot V_R$, 85 °C For conversion to other operating conditions and temperatures, refer to chapter "Reliability", page .		
Failure criteria: Total failure	Short circuit or open circuit		
Failure due to variation of parameters	Capacitance change $ \Delta C/C $	$> 10\%$	
	Dissipation factor $\tan \delta$	$> 4 \times$ upper limit values	
	Insulation resistance R_{ins}	$< 150\text{ M}\Omega$ ($C_R \leq 0.33\text{ }\mu\text{F}$)	
	Or time constant τ	$< 50\text{ s}$ ($C_R \geq 0.33\text{ }\mu\text{F}$)	



Pulse handling capability

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

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

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.

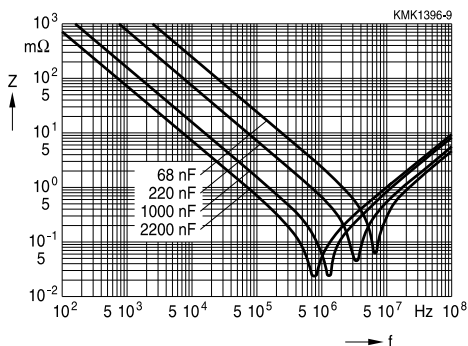
dV/dt values

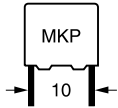
Lead spacing		10 mm	15 mm	22.5 mm
V _R V DC	V _{RMS} V AC	dV/dt in V/ μ s		
450	160	140	120	100
520	200	200	160	110
630	200	250	180	130

k₀ values

Lead spacing		10 mm	15 mm	22.5 mm
V _R V DC	V _{RMS} V AC	k ₀ in V ² / μ s		
450	160	126000	108000	90000
520	200	208000	166000	114000
630	200	315000	226000	163000

Impedance Z versus frequency f (typical values)



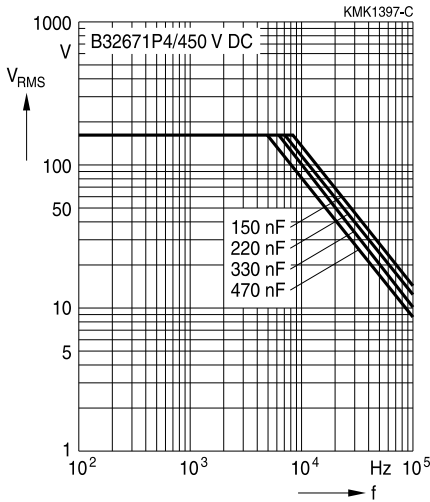


Permissible AC voltage V_{RMS} versus frequency f (for sinusoidal waveforms $T_A \leq 100\text{ }^{\circ}\text{C}$)

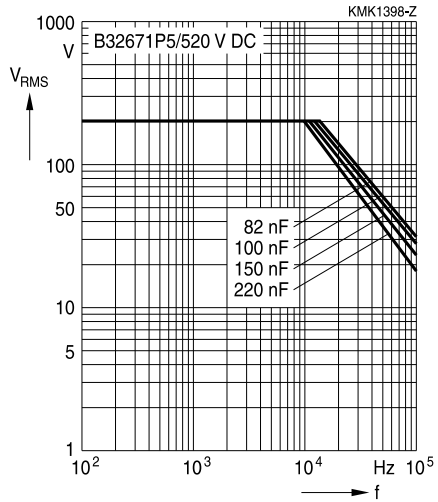
For $T_A > 100\text{ }^{\circ}\text{C}$, please use derating factor F_T .

Lead spacing 10 mm

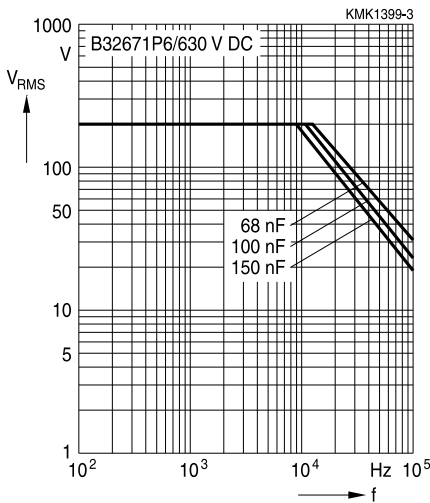
450 V DC/160 V AC

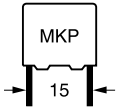


520 V DC/200 V AC



630 V DC/200 V AC





B32672P

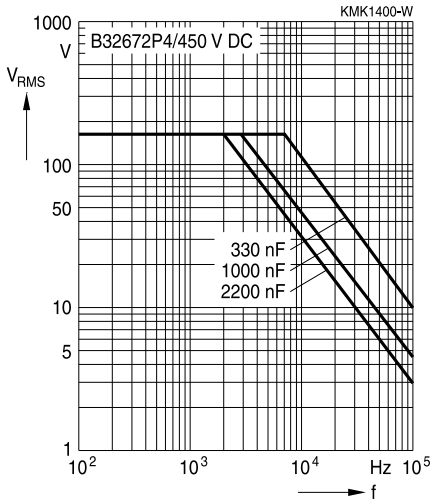
Power Factor Correction

Permissible AC voltage V_{RMS} versus frequency f (for sinusoidal waveforms $T_A \leq 100^\circ\text{C}$)

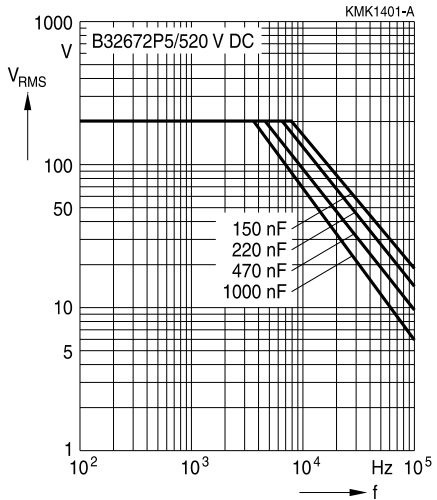
For $T_A > 100^\circ\text{C}$, please use derating factor F_T .

Lead spacing 15 mm

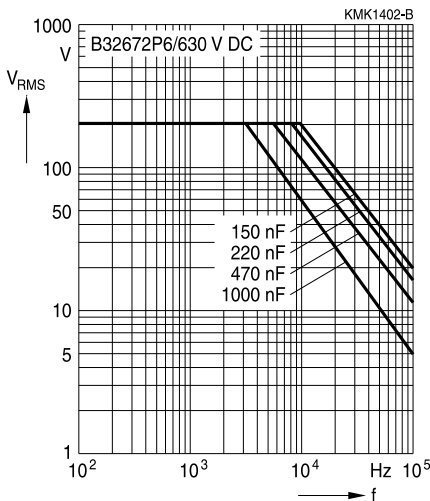
450 V DC/160 V AC

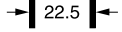


520 V DC/200 V AC



630 V DC/200 V AC



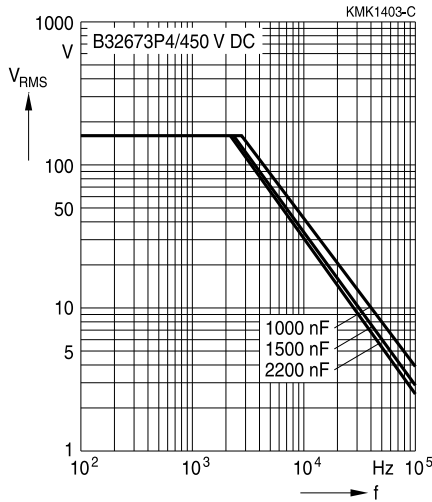


Permissible AC voltage V_{RMS} versus frequency f (for sinusoidal waveforms $T_A \leq 100^\circ\text{C}$)

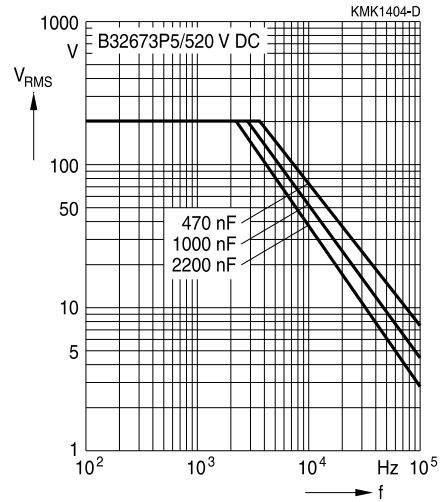
For $T_A > 100^\circ\text{C}$, please use derating factor F_T .

Lead spacing 22.5 mm

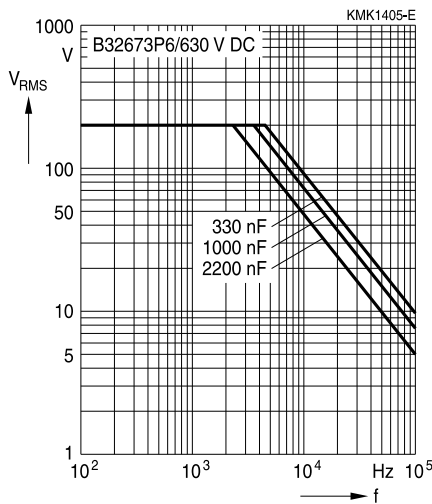
450 V DC/160 V AC

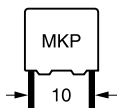


520 V DC/200 V AC



630 V DC/200 V AC





B32671P

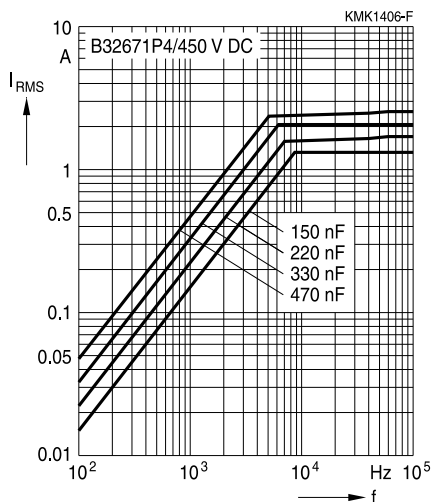
Power Factor Correction

Permissible AC current I_{RMS} versus frequency f (for sinusoidal waveforms $T_A \leq 100^\circ\text{C}$)

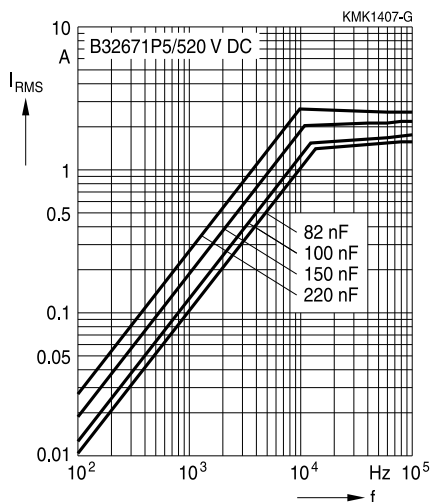
For $T_A > 100^\circ\text{C}$, please use derating factor F_T .

Lead spacing 10 mm

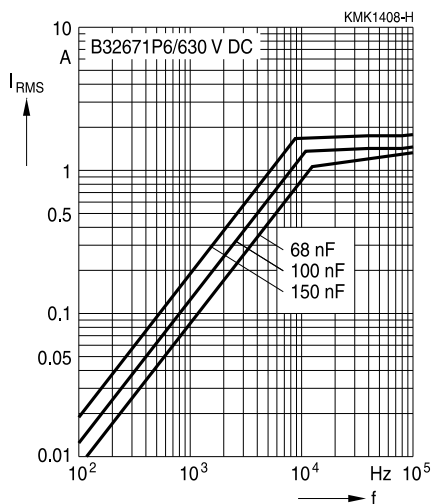
450 V DC/160 V AC

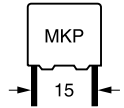


520 V DC/200 V AC



630 V DC/200 V AC



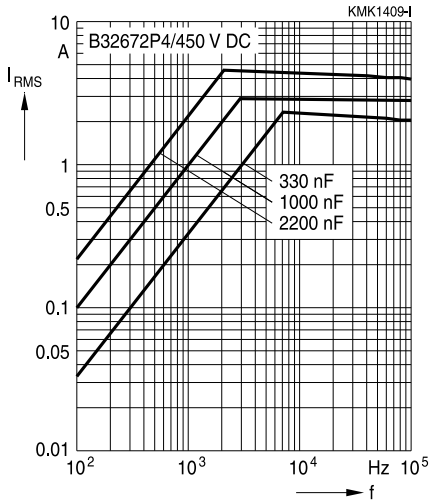


Permissible AC current I_{RMS} versus frequency f (for sinusoidal waveforms $T_A \leq 100\text{ }^{\circ}\text{C}$)

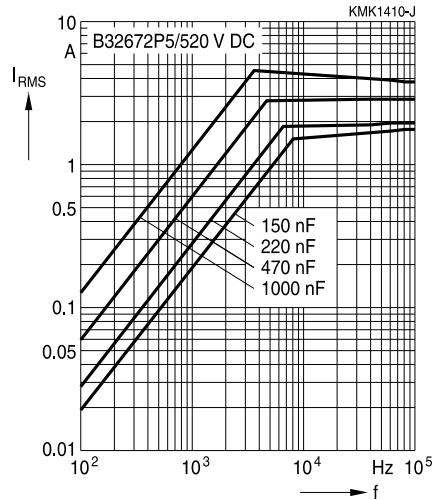
For $T_A > 100\text{ }^{\circ}\text{C}$, please use derating factor F_T .

Lead spacing 15 mm

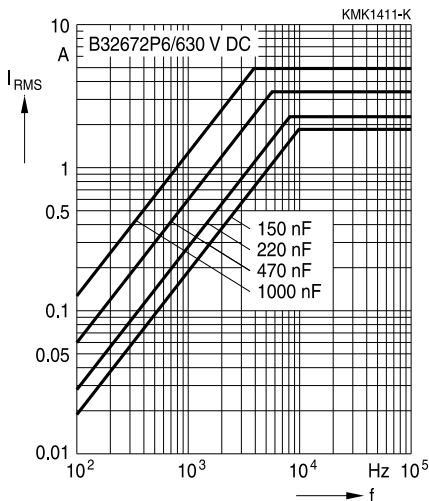
450 V DC/160 V AC

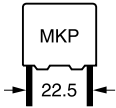


520 V DC/200 V AC



630 V DC/200 V AC





B32673P

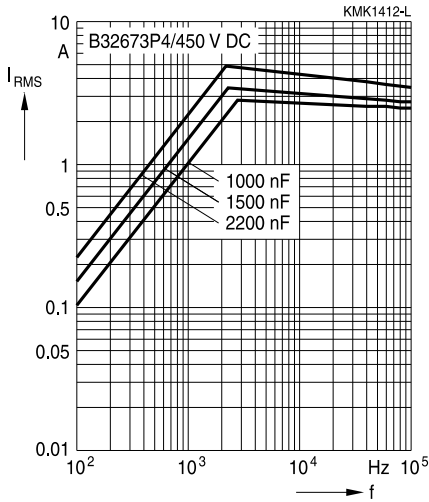
Power Factor Correction

Permissible AC current I_{RMS} versus frequency f (for sinusoidal waveforms $T_A \leq 100^\circ\text{C}$)

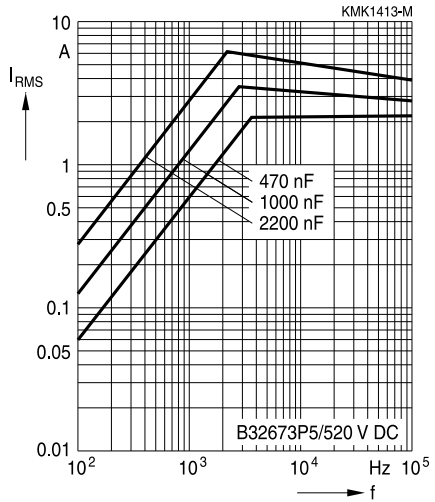
For $T_A > 100^\circ\text{C}$, please use derating factor F_T .

Lead spacing 22.5 mm

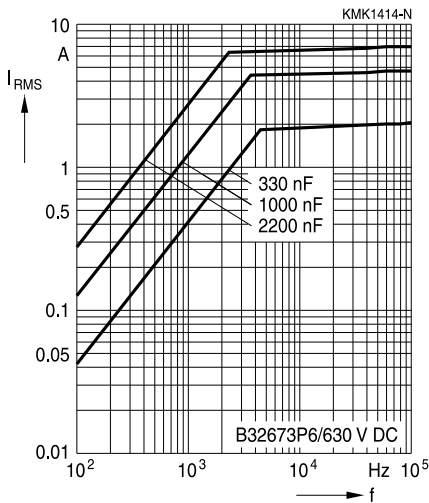
450 V DC/160 V AC

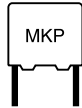


520 V DC/200 V AC



630 V DC/200 V AC





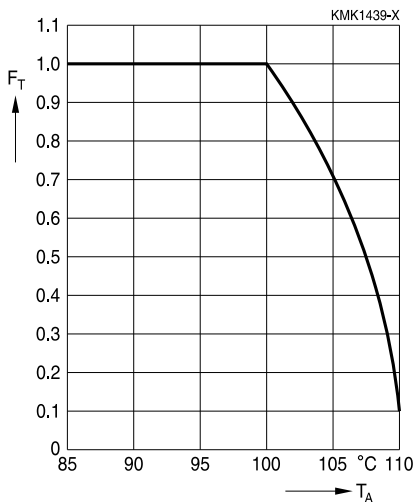
Maximum AC voltage (V_{RMS}), current (I_{RMS}) vs. frequency and temperature for $T_A > 100\text{ }^{\circ}\text{C}$

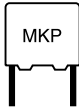
The graphs described in the previous section for the permissible AC voltage (V_{RMS}) or current (I_{RMS}) vs. frequency are given for a maximum ambient temperature $T_A \leq 100\text{ }^{\circ}\text{C}$. In case of higher ambient temperatures (T_A), the self-heating (ΔT) of the component must be reduced 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:

$$I_{RMS}(T_A) = I_{RMS, T_A \leq 100\text{ }^{\circ}\text{C}} \cdot F_T(T_A)$$

$$V_{RMS}(T_A) = V_{RMS, T_A \leq 100\text{ }^{\circ}\text{C}} \cdot F_T(T_A)$$

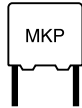
And F_T is given by the following curve:





Testing and Standards

Test	Reference	Conditions of test	Performance requirements
Electrical Parameters	IEC 60384-16	Voltage proof, 1.4 V _R , 1 minute Insulation resistance, R _{INS} Capacitance, C Dissipation factor, tan δ	Within specified limits
Robustness of terminations	IEC 60068-2-21	Tensile strength (test Ua1) Wire diameter	Capacitance and tan δ within specified limits
		0.5 < d _l ≤ 0.8 mm	
Resistance to soldering heat	IEC 60068-2-20, test Tb, method 1A	Solder bath temperature at 260 ± 5 °C, immersion for 10 seconds	ΔC/C ₀ ≤ 2% Δ tan δ ≤ 0.001
Rapid change of temperature	IEC 60384-16	T _A = lower category temperature T _B = upper category temperature Five cycles, duration t = 30 min.	ΔC/C ₀ ≤ 2% Δ tan δ ≤ 0.002 R _{INS} ≥ 50% of initial limit
Vibration	IEC 60384-16	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 60384-16	Test Eb: Total 4000 bumps with 390 m/s ² mounted on PCB 6 ms duration	No visible damage ΔC/C ₀ ≤ 2% Δ tan δ ≤ 0.001 R _{INS} ≥ 50% of initial limit
Climatic sequence	IEC 60384-16	Dry heat Tb / 16 h. Damp heat cyclic, 1st cycle + 55 °C / 24h / 95% ... 100% RH Cold Ta / 2h Damp heat cyclic, 5 cycles + 55 °C / 24h / 95% ... 100% rh	No visible damage ΔC/C ₀ ≤ 2% Δ tan δ ≤ 0.001 R _{INS} ≥ 50% of initial limit
Damp Heat Steady State	IEC 60384-16	Test Ca 40 °C / 93% RH / 56 days	No visible damage ΔC/C ₀ ≤ 3% Δ tan δ ≤ 0.003 R _{INS} ≥ 50% of initial limit
High temperature high humidity with load		60 °C / 95% RH / 1000 hours with V _{R, DC}	No visible damage ΔC/C ₀ ≤ 10% Δ tan δ ≤ 0.004 R _{INS} ≥ 50% of initial limit



Endurance A		85 °C/ 1.1 V _R / 1000 hours	No visible damage $ \Delta C/C_0 \leq 5\%$ $ \Delta \tan \delta \leq 0.004$ $R_{INS} \geq 50\%$ of initial limit
Endurance B		110 °C/ 1.1 V _C / 1000 hours	No visible damage $ \Delta C/C_0 \leq 10\%$ $ \Delta \tan \delta \leq 0.004$ $R_{INS} \geq 50\%$ of initial limit
Endurance C		125 °C/ 1.1 V _C / 1000 hours	No visible damage $ \Delta C/C_0 \leq 10\%$ $ \Delta \tan \delta \leq 0.004$ $R_{INS} \geq 50\%$ of initial limit
Endurance D		85 °C/ V _R + 4 A _{RMS,1000 KHz} / 1000 hours	No visible damage $ \Delta C/C_0 \leq 10\%$ $ \Delta \tan \delta \leq 0.004$ $R_{INS} \geq 50\%$ of initial limit

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, EPCOS is 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 an EPCOS 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 lifesaving 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.epcos.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 the current version of the "General Terms of Delivery for Products and Services in the Electrical Industry" published by the German Electrical and Electronics Industry Association (ZVEI)**.
7. The trade names EPCOS, BAOKE, Alu-X, CeraDiode, CeraLink, CeraPlas, CSMP, CSSP, CTVS, DeltaCap, DigiSiMic, DSSP, FilterCap, FormFit, MiniBlue, MiniCell, MKD, MKK, MLSC, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, SIP5D, SIP5K, TFAP, ThermoFuse, WindCap are **trademarks registered or pending** in Europe and in other countries. Further information will be found on the Internet at www.epcos.com/trademarks.