



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

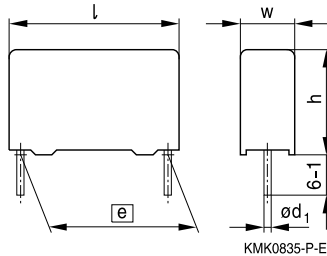
Marking

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

Delivery mode

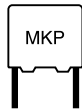
- Bulk (untaped)
- Taped (Ammo pack or reel)

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

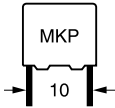
Dimensional drawing


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 (μ F) | | | | | | | | | |
| 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 ≤ 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 | 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.

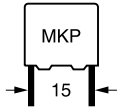
Composition of ordering code

+ = Capacitance tolerance code:

J = ±5%
K = ±10%
M = ±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)


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 × 10.5 × 18.0 | 4680 | 5200 | 4000 |
| | | 0.22 | B32672P4224+*** | 5.0 × 10.5 × 18.0 | 4680 | 5200 | 4000 |
| | | 0.33 | B32672P4334+*** | 5.0 × 10.5 × 18.0 | 4680 | 5200 | 4000 |
| | | 0.47 | B32672P4474+*** | 5.0 × 10.5 × 18.0 | 4680 | 5200 | 4000 |
| | | 0.56 | B32672P4564+*** | 6.0 × 11.0 × 18.0 | 3840 | 4400 | 4000 |
| | | 0.68 | B32672P4684+*** | 6.0 × 12.0 × 18.0 | 3840 | 4400 | 4000 |
| | | 1.0 | B32672P4105+*** | 7.0 × 12.5 × 18.0 | 3320 | 3600 | 4000 |
| | | 1.5 | B32672P4155+*** | 9.0 × 17.5 × 18.0 | 2560 | 2800 | 2000 |
| | | 2.0 | B32672P4205+*** | 9.0 × 17.5 × 18.0 | 2560 | 2800 | 2000 |
| | | 2.2 | B32672P4225+*** | 11.0 × 18.5 × 18.0 | | 2200 | 1200 |
| 520 | 200 | 0.15 | B32672P5154+*** | 5.0 × 10.5 × 18.0 | 4680 | 5200 | 4000 |
| | | 0.22 | B32672P5224+*** | 5.0 × 10.5 × 18.0 | 4680 | 5200 | 4000 |
| | | 0.33 | B32672P5334+*** | 6.0 × 11.0 × 18.0 | 3840 | 4400 | 4000 |
| | | 0.47 | B32672P5474+*** | 7.0 × 12.5 × 18.0 | 3320 | 3600 | 4000 |
| | | 0.68 | B32672P5684+*** | 8.5 × 14.5 × 18.0 | 2720 | 2800 | 2000 |
| | | 1.0 | B32672P5105+*** | 9.0 × 17.5 × 18.0 | 2560 | 2800 | 2000 |
| | | 1.5 | B32672P5155+*** | 11.0 × 18.5 × 18.0 | | 2200 | 1000 |
| 630 | 200 | 0.15 | B32672P6154+*** | 5.0 × 10.5 × 18.0 | 4680 | 5200 | 4000 |
| | | 0.22 | B32672P6224+*** | 6.0 × 11.0 × 18.0 | 3840 | 4400 | 4000 |
| | | 0.33 | B32672P6334+*** | 7.0 × 12.5 × 18.0 | 3320 | 3600 | 4000 |
| | | 0.47 | B32672P6474+*** | 8.0 × 14.0 × 18.0 | 2920 | 3000 | 2000 |
| | | 0.68 | B32672P6684+*** | 9.0 × 17.5 × 18.0 | 2560 | 2800 | 2000 |
| | | 1.0 | B32672P6105+*** | 11.0 × 18.5 × 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 = ±5%

K = ±10%

M = ±20%

*** = Packaging code:

289 = Straight terminals, Ammo pack

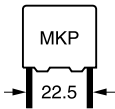
189 = Straight terminals, Reel

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 $T = 20\text{ }^{\circ}\text{C}$, 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 | 1.0 | |
| | 10 kHz | 2.5 | |
| | 100 kHz | 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 $f \leq 1\text{ kHz}$) | $T_A \leq 85$ | DC voltage derating | AC voltage derating |
| | $85 < T_A \leq 110$ | $V_C = V_R$ $V_C = V_R \cdot (165 - T_{op})/80$ | $V_{C, RMS} = V_{RMS}$ $V_{C, RMS} = V_{RMS} \cdot (165 - T_{op})/80$ |
| Operating voltage V_{op} for short operating periods (V_{DC} or V_{AC} at $f \leq 1\text{ kHz}$) | $T_{op} \leq 100$ | DC voltage (max. hours) | AC voltage (max. hours) |
| | $100 < T_{op} \leq 125$ | $V_{op} = 1.1 \cdot V_C$ (1000 h) $V_{op} = 1.0 \cdot V_C$ (1000 h) | $V_{op} = 1.0 \cdot V_{C, RMS}$ (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 | $< 50\text{ s}$ ($C_R \geq 0.33\text{ }\mu\text{F}$) | |



B32671P ... B32673P

Power Factor Correction

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.

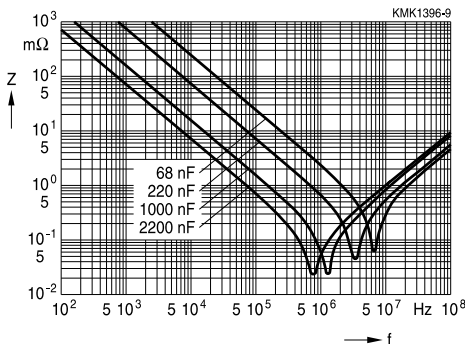
dV/dt values

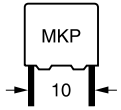
| Lead spacing | 10 mm | 15 mm | 22.5 mm | |
|------------------------|--------------------------|---------------|---------|-----|
| V _R V DC | V _{RMS} V AC | dV/dt in V/μs | | |
| 450 | 160 | 140 | 120 | 100 |
| 520 | 200 | 200 | 160 | 110 |
| 630 | 200 | 250 | 180 | 130 |

k₀ values

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

Impedance Z versus frequency f (typical values)



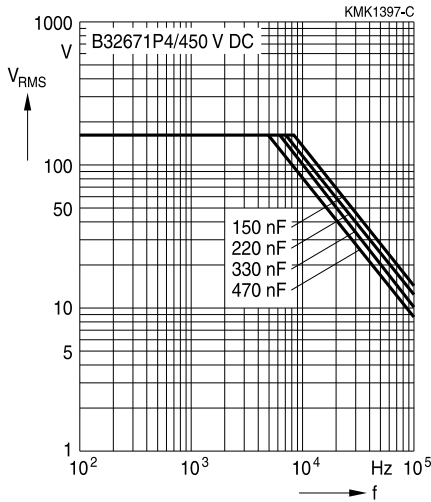


Permissible AC voltage V_{RMS} versus frequency f (for sinusoidal waveforms $T_A \leq 100\text{ }^\circ\text{C}$)

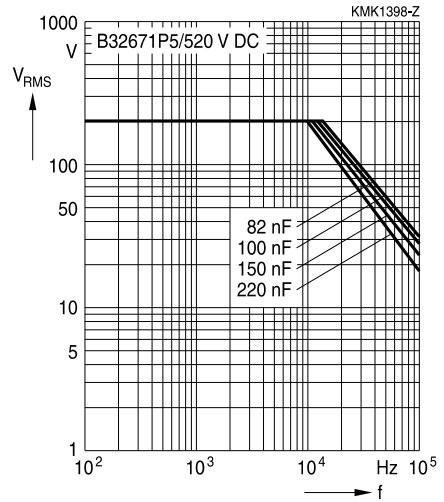
For $T_A > 100\text{ }^\circ\text{C}$, please use derating factor F_T .

Lead spacing 10 mm

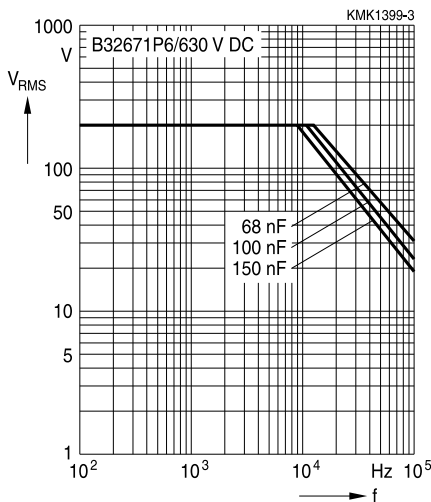
450 V DC/160 V AC

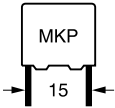


520 V DC/200 V AC



630 V DC/200 V AC





B32672P

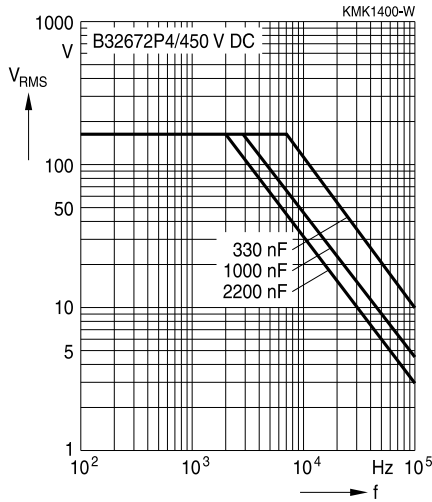
Power Factor Correction

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

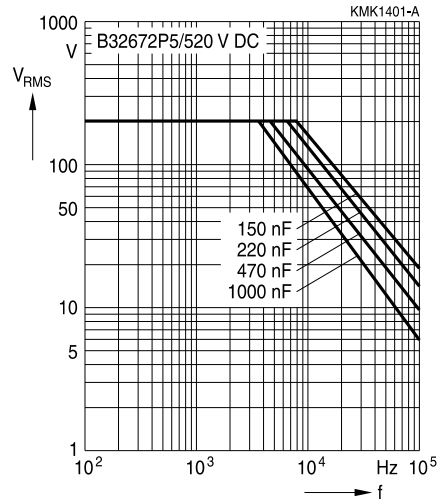
For $T_A > 100\text{ }^\circ\text{C}$, please use derating factor F_T .

Lead spacing 15 mm

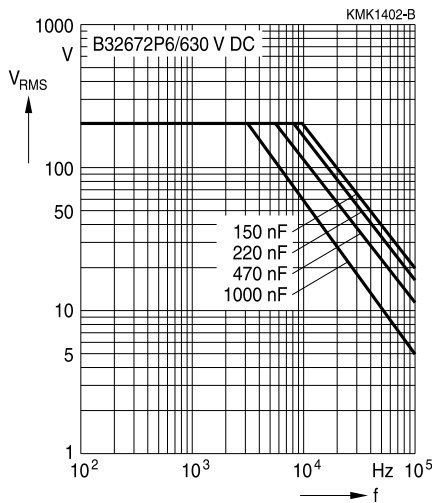
450 V DC/160 V AC

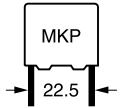


520 V DC/200 V AC



630 V DC/200 V AC



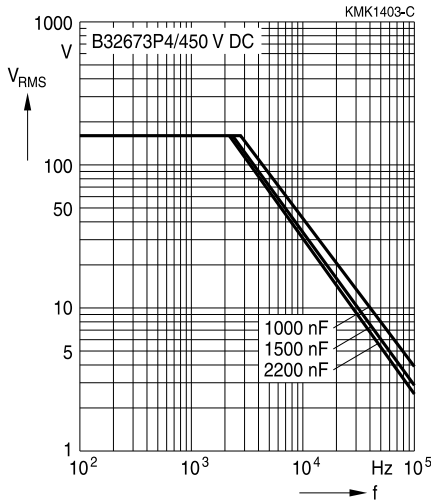


Permissible AC voltage V_{RMS} versus frequency f (for sinusoidal waveforms $T_A \leq 100\text{ }^\circ\text{C}$)

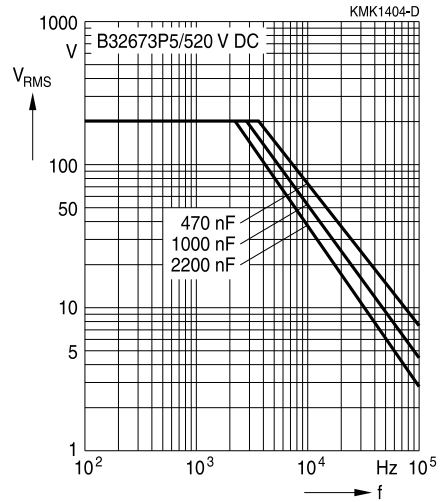
For $T_A > 100\text{ }^\circ\text{C}$, please use derating factor F_T .

Lead spacing 22.5 mm

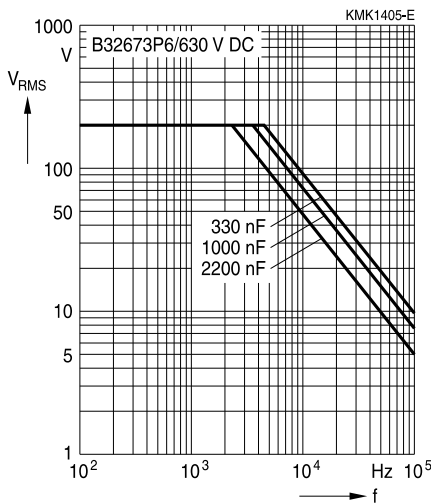
450 V DC/160 V AC

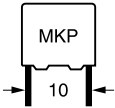


520 V DC/200 V AC



630 V DC/200 V AC





B32671P

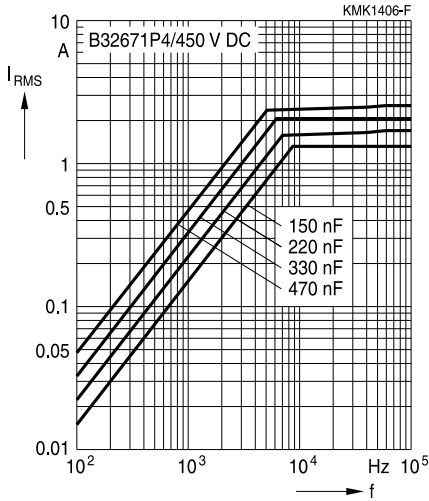
Power Factor Correction

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

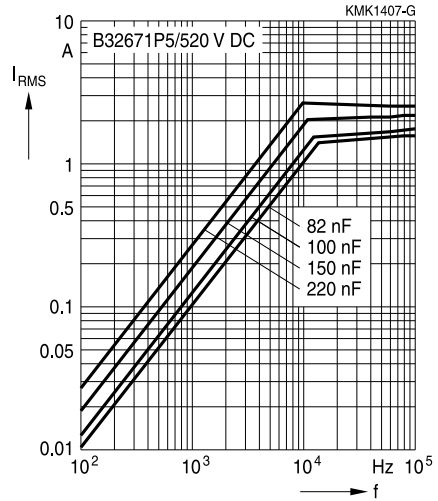
For $T_A > 100\text{ }^\circ\text{C}$, please use derating factor F_T .

Lead spacing 10 mm

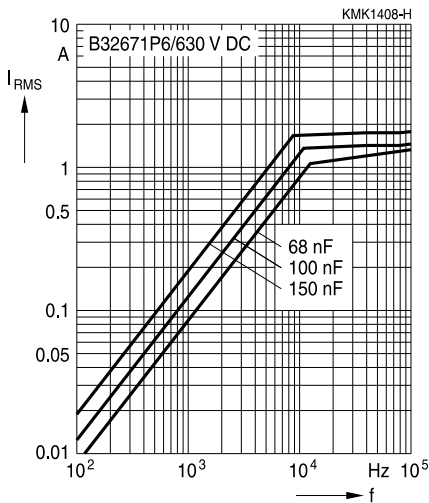
450 V DC/160 V AC

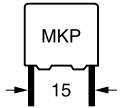


520 V DC/200 V AC



630 V DC/200 V AC



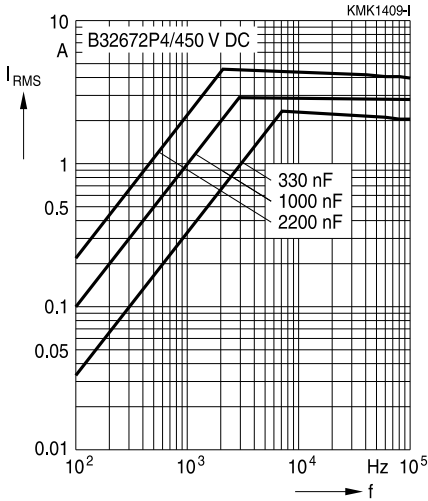


Permissible AC current I_{RMS} versus frequency f (for sinusoidal waveforms $T_A \leq 100^\circ\text{C}$)

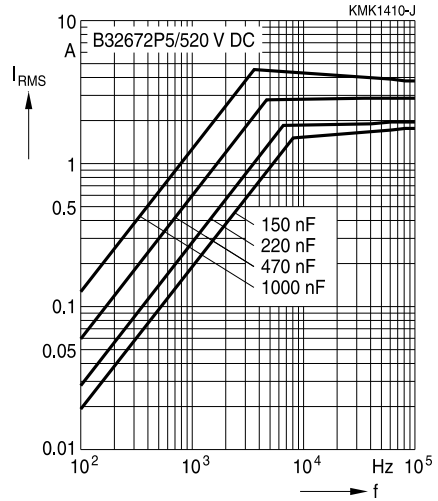
For $T_A > 100^\circ\text{C}$, please use derating factor F_T .

Lead spacing 15 mm

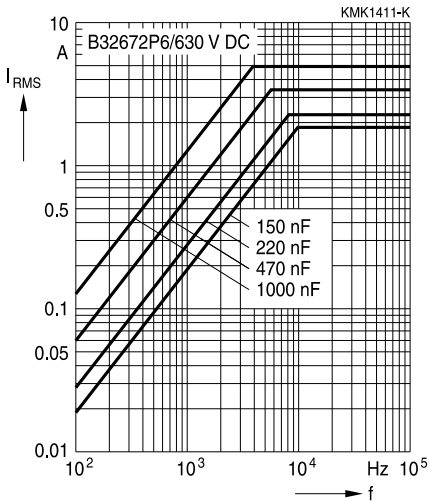
450 V DC/160 V AC

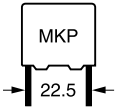


520 V DC/200 V AC



630 V DC/200 V AC





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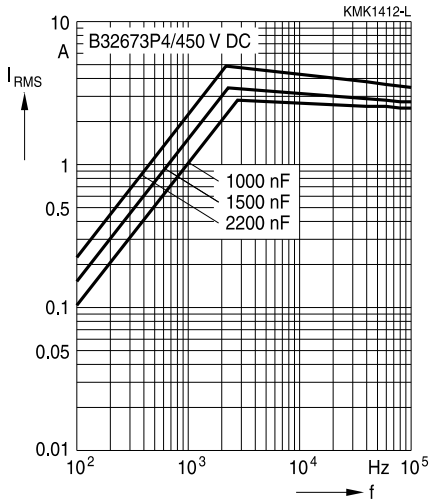
Power Factor Correction

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

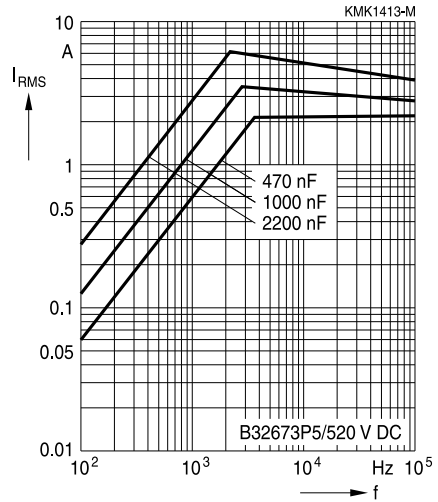
For $T_A > 100\text{ }^\circ\text{C}$, please use derating factor F_T .

Lead spacing 22.5 mm

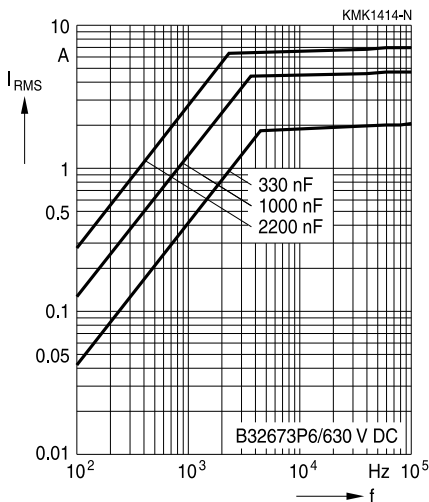
450 V DC/160 V AC

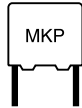


520 V DC/200 V AC



630 V DC/200 V AC





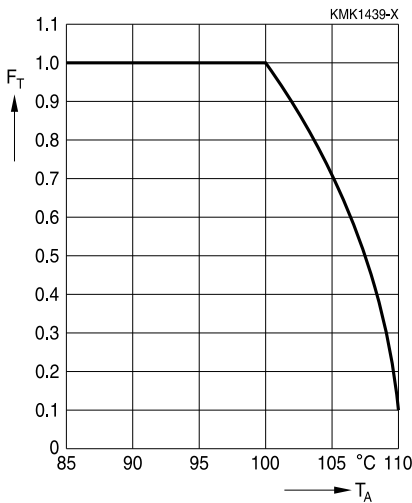
Maximum AC voltage (V_{RMS}), current (I_{RMS}) vs. frequency and temperature for $T_A > 100\text{ }^\circ\text{C}$

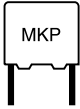
The graphs described in the previous section for the permissible AC voltage (V_{RMS}) or current (I_{RMS}) vs. frequency are given for a maximum ambient temperature $T_A \leq 100\text{ }^\circ\text{C}$. In case of higher ambient temperatures (T_A), the self-heating (ΔT) of the component must be reduced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



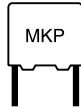


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Power Factor Correction

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, $\tan \delta$ | Within specified limits |
| Robustness of terminations | IEC 60068-2-21 | Tensile strength (test Ua1) Wire diameter | Capacitance and $\tan \delta$ within specified limits |
| | | Tensile force $0.5 < d_1 \leq 0.8 \text{ mm}$ | |
| Resistance to soldering heat | IEC 60068-2-20, test Tb, method 1A | Solder bath temperature at $260 \pm 5 \text{ }^\circ\text{C}$, immersion for 10 seconds | $\Delta C/C_0 \leq 2\%$ $\Delta \tan \delta \leq 0.001$ |
| Rapid change of temperature | IEC 60384-16 | T_A = lower category temperature T_B = upper category temperature Five cycles, duration $t = 30 \text{ min.}$ | $\Delta C/C_0 \leq 2\%$ $\Delta \tan \delta \leq 0.002$ $R_{INS} \geq 50\%$ 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 $\Delta C/C_0 \leq 2\%$ $\Delta \tan \delta \leq 0.001$ $R_{INS} \geq 50\%$ of initial limit |
| Climatic sequence | IEC 60384-16 | Dry heat Tb / 16 h. Damp heat cyclic, 1st cycle + $55 \text{ }^\circ\text{C} / 24\text{h} / 95\% \dots 100\% \text{ RH}$ Cold Ta / 2h Damp heat cyclic, 5 cycles + $55 \text{ }^\circ\text{C} / 24\text{h} / 95\% \dots 100\% \text{ rh}$ | No visible damage $\Delta C/C_0 \leq 2\%$ $\Delta \tan \delta \leq 0.001$ $R_{INS} \geq 50\%$ of initial limit |
| Damp Heat Steady State | IEC 60384-16 | Test Ca $40 \text{ }^\circ\text{C} / 93\% \text{ RH} / 56 \text{ days}$ | No visible damage $\Delta C/C_0 \leq 3\%$ $\Delta \tan \delta \leq 0.003$ $R_{INS} \geq 50\%$ of initial limit |
| High temperature high humidity with load | | $60 \text{ }^\circ\text{C} / 95\% \text{ RH} / 1000 \text{ hours}$ with $V_{R,DC}$ | No visible damage $\Delta C/C_0 \leq 10\%$ $\Delta \tan \delta \leq 0.004$ $R_{INS} \geq 50\%$ of initial limit |



| | | | |
|-------------|--|--|---|
| Endurance A | | 85 °C/ 1.1 V _R / 1000 hours | No visible damage ΔC/C ₀ ≤ 5% Δ tan δ ≤ 0.004 R _{INS} ≥ 50% of initial limit |
| Endurance B | | 110 °C/ 1.1 V _C / 1000 hours | No visible damage ΔC/C ₀ ≤ 10% Δ tan δ ≤ 0.004 R _{INS} ≥ 50% of initial limit |
| Endurance C | | 125 °C/ 1.1 V _C / 1000 hours | No visible damage ΔC/C ₀ ≤ 10% Δ tan δ ≤ 0.004 R _{INS} ≥ 50% of initial limit |
| Endurance D | | 85 °C/ V _R + 4 A _{RMS,1000 KHz} / 1000 hours | No visible damage ΔC/C ₀ ≤ 10% Δ tan δ ≤ 0.004 R _{INS} ≥ 50% of initial limit |

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