Film Capacitors

Metallized Polypropylene Film Capacitors (MKP)

Series/Type: **B32671P ... B32673P**

Date: April 2014

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

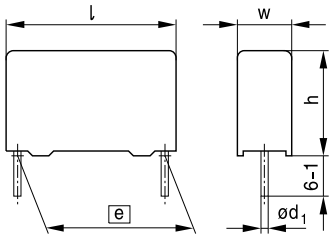
Terminals
- Parallel wire leads, lead free, tinned
- Special lead lengths available on request

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".

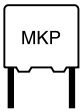
Dimensional drawing



KMK0835-P-E

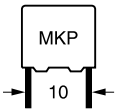
Dimensions in mm

Lead spacing e ±0.4	Lead diameter d_1 ±0.05	Type
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)

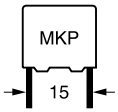
V_R V DC	V_{RMS} f ≤1 kHz V AC	C_R µF	Ordering code (composition see below)	Max. dimensions w × h × l mm	Ammo pack pcs./MOQ	Reel pcs./MOQ	Untaped pcs./MOQ
450	160	0.10	B32671P4104+***	4.0 × 9.0 × 13.0	4000	6800	4000
		0.15	B32671P4154+***	4.0 × 9.0 × 13.0	4000	6800	4000
		0.18	B32671P4184+***	5.0 × 11.0 × 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)

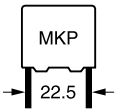
V_R V DC	V_{RMS} f ≤1 kHz V AC	C_R µF	Ordering code (composition see below)	Max. dimensions w × h × l mm	Ammo pack pcs./MOQ	Reel pcs./MOQ	Untaped pcs./MOQ
450	160	0.10	B32672P4104+***	5.0 × 10.5 × 18.0	4680	5200	4000
		0.22	B32672P4224+***	5.0 × 10.5 × 18.0	4680	5200	4000
		0.33	B32672P4334+***	5.0 × 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)

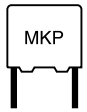
V_R V DC	V_{RMS} f ≤1 kHz V AC	C_R µF	Ordering code (composition see below)	Max. dimensions w × h × l mm	Ammo pack pcs./MOQ	Reel pcs./MOQ	Untaped pcs./MOQ
450	160	1.0	B32673P4105+***	6.0 × 15.0 × 26.5	2720	2800	2880
		1.5	B32673P4155+***	7.0 × 16.0 × 26.5	2320	2400	2520
		2.2	B32673P4225+***	8.5 × 16.5 × 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 °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 δ (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 ≤ 65% (minimum as-delivered values)	30 GΩ ($C_R \leq 0.33$ µF) 10000 s ($C_R > 0.33$ µF)		
DC test voltage	1.4 · V_R, 2 s		
Category voltage V_C (continuous operation with V_{DC} or V_{AC} at f ≤ 1 kHz)	T_A (°C)	DC voltage derating	AC voltage derating
	$T_A \leq 85$	$V_C = V_R$	$V_{C,RMS} = V_{RMS}$
	$85 < T_A \leq 110$	$V_C = V_R \cdot (165 - T_{op})/80$	$V_{C,RMS} = V_{RMS} \cdot (165 - T_{op})/80$
Operating voltage V_{op} for short operating periods (V_{DC} or V_{AC} at f ≤ 1 kHz)	T_{op} (°C)	DC voltage (max. hours)	AC voltage (max. hours)
	$T_{op} \leq 100$	$V_{op} = 1.1 \cdot V_C$ (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 (≤ 1 · 10^{-7}/h) at 0.5 · V_R, 40 °C 200000 h at 0.5 · 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 |ΔC/C|		> 10%
	Dissipation factor tan δ		> 4 × upper limit values
	Insulation resistance R_{ins}		< 150 MΩ ($C_R \leq 0.33$ µF)
	Or time constant τ		< 50 s ($C_R \geq 0.33$ µF)

Pulse handling capability

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

"k_0" represents the maximum permissible pulse characteristic of the waveform applied to the capacitor, expressed in $V^2/\mu s$.

Note:
The values of dV/dt and k_0 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.

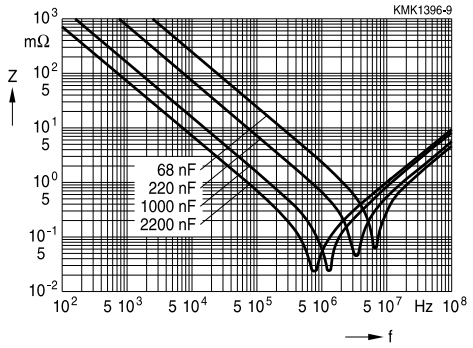
dV/dt values

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

k_0 values

Lead spacing		10 mm	15 mm	22.5 mm
V_R	V_{RMS}			
V DC	V AC	k_0 in $V^2/\mu s$		
450	160	126000	108000	90000
520	200	208000	166000	114000
630	200	315000	226000	163000

Impedance Z versus frequency f (typical values)

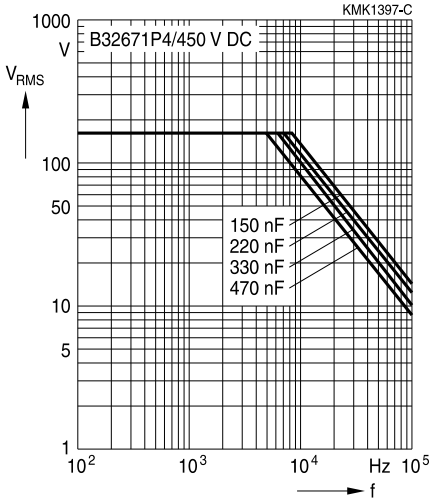


Permissible AC voltage V_{RMS} versus frequency f (for sinusoidal waveforms $T_A \leq 100$ °C)

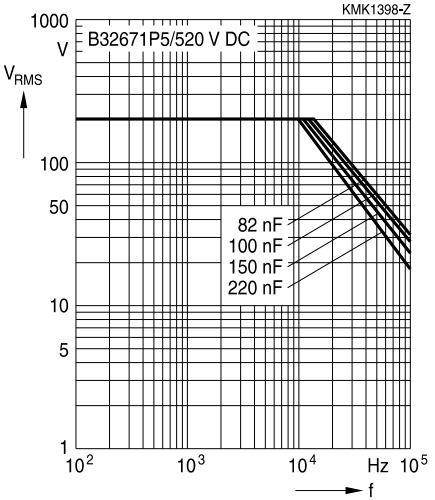
For $T_A > 100$ °C, please use derating factor F_t.

Lead spacing 10 mm

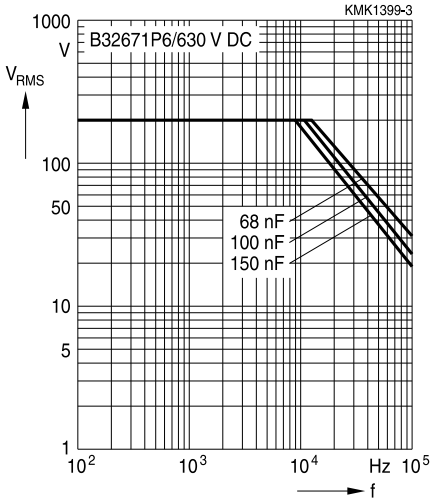
450 V DC/160 V AC

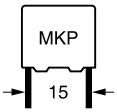


520 V DC/200 V AC



630 V DC/200 V AC



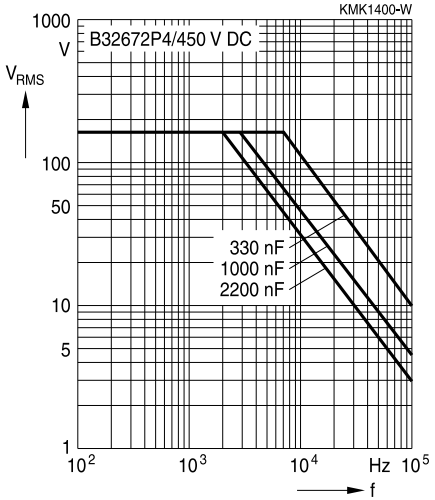


Permissible AC voltage V_{RMS} versus frequency f (for sinusoidal waveforms $T_A \leq 100$ °C)

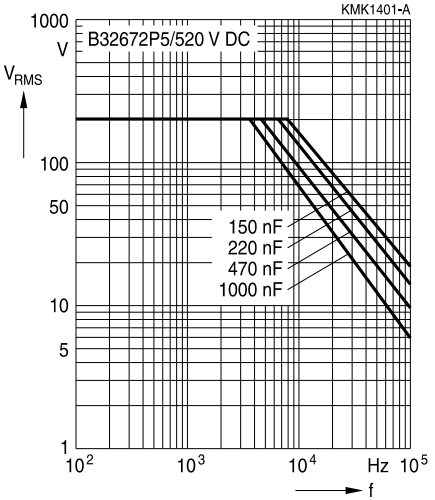
For $T_A > 100$ °C, please use derating factor F_t.

Lead spacing 15 mm

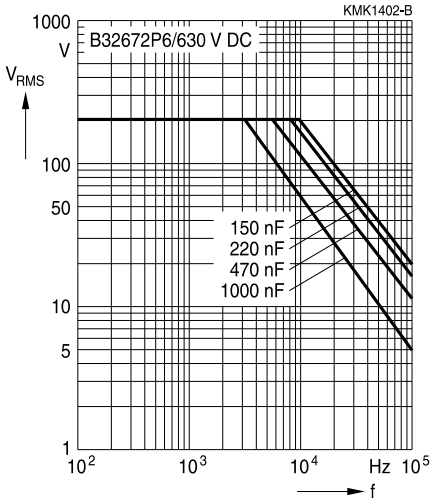
450 V DC/160 V AC

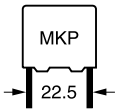


520 V DC/200 V AC



630 V DC/200 V AC



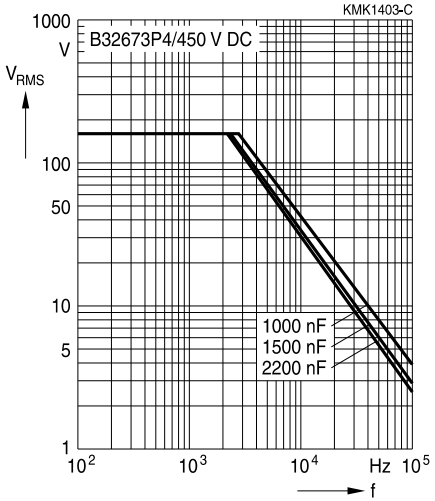


Permissible AC voltage V_{RMS} versus frequency f (for sinusoidal waveforms $T_A \leq 100$ °C)

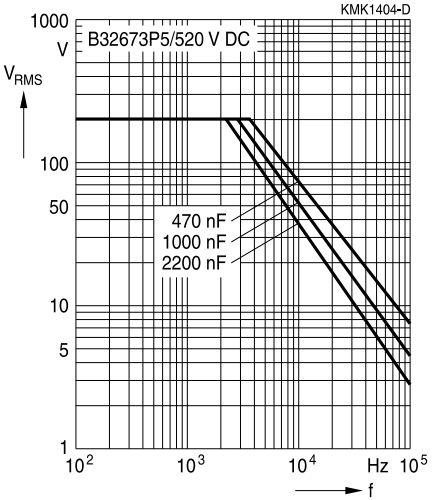
For $T_A > 100$ °C, please use derating factor F_t.

Lead spacing 22.5 mm

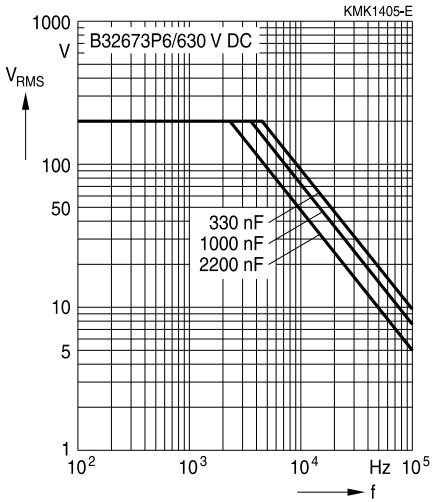
450 V DC/160 V AC

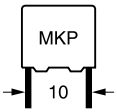


520 V DC/200 V AC



630 V DC/200 V AC



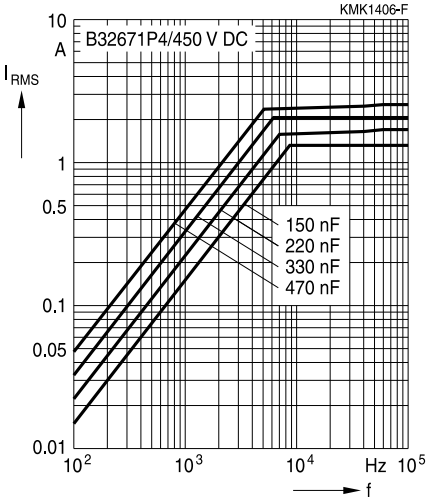


Permissible AC current I_{RMS} versus frequency f (for sinusoidal waveforms $T_A \leq 100$ °C)

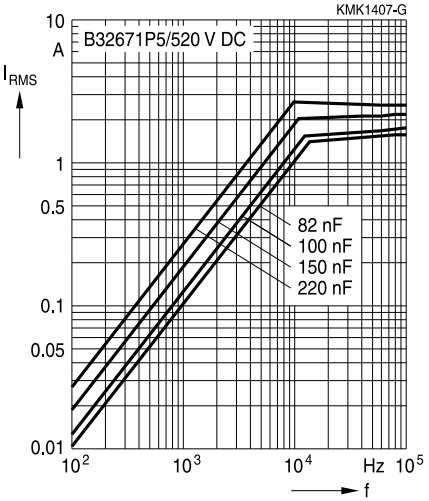
For $T_A > 100$ °C, please use derating factor F_t.

Lead spacing 10 mm

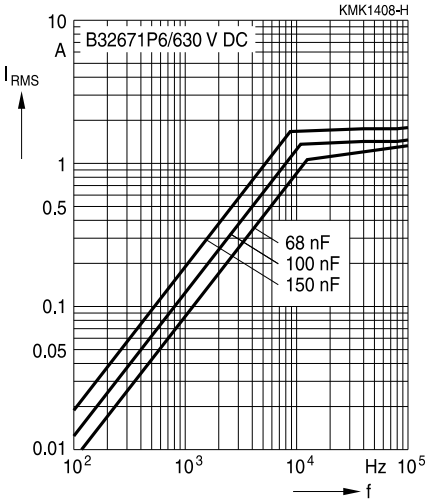
450 V DC/160 V AC



520 V DC/200 V AC



630 V DC/200 V AC

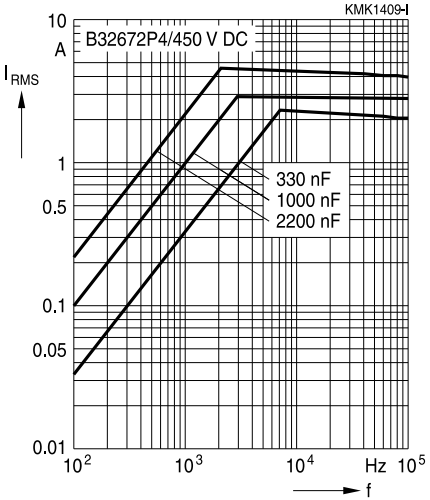


Permissible AC current I_{RMS} versus frequency f (for sinusoidal waveforms $T_A \leq 100$ °C)

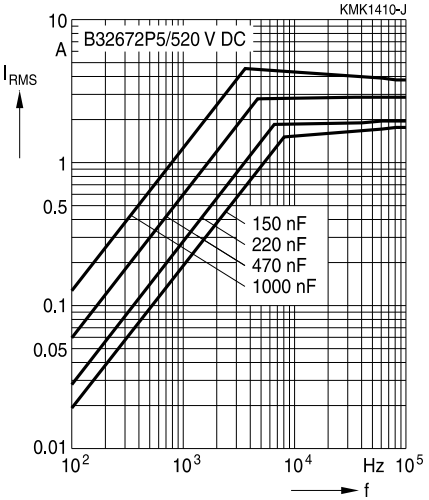
For $T_A > 100$ °C, please use derating factor F_t.

Lead spacing 15 mm

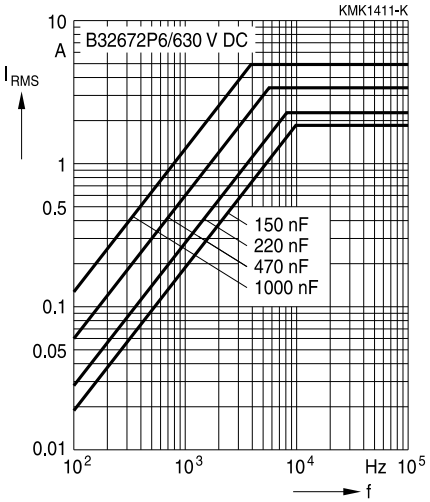
450 V DC/160 V AC



520 V DC/200 V AC



630 V DC/200 V AC

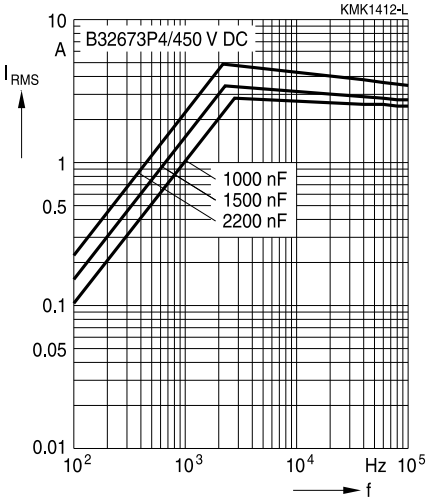


Permissible AC current I_{RMS} versus frequency f (for sinusoidal waveforms $T_A \leq 100$ °C)

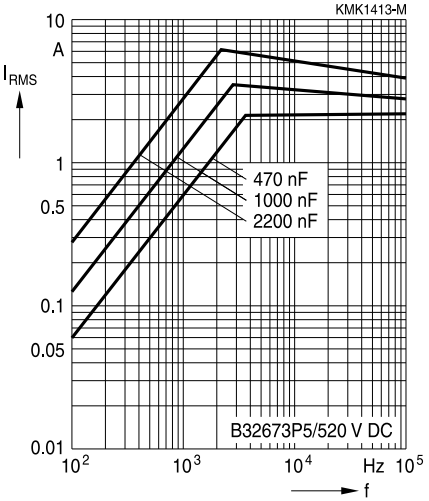
For $T_A > 100$ °C, please use derating factor F_t.

Lead spacing 22.5 mm

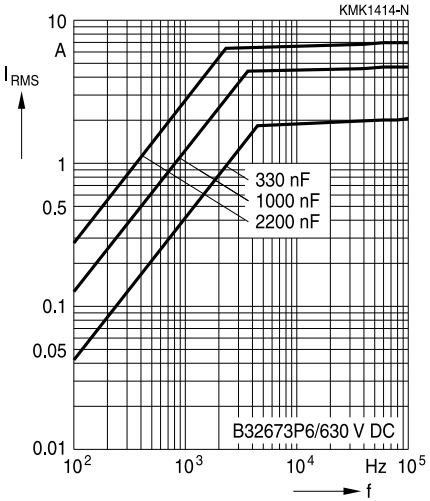
450 V DC/160 V AC



520 V DC/200 V AC



630 V DC/200 V AC



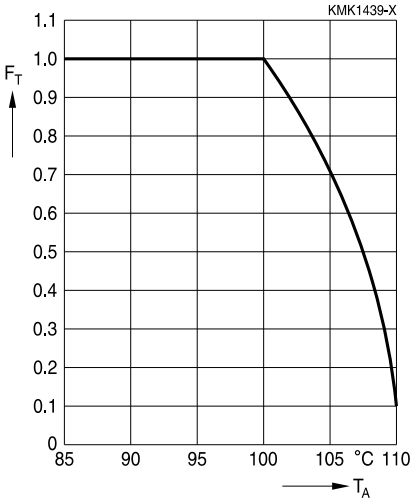
Maximum AC voltage (V_{RMS}), current (I_{RMS}) vs. frequency and temperature for T_A > 100 ºC

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 $T_A \leq 100$ ºC. 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:

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

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

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	Tensile force	Capacitance and tan δ within specified limits
		0.5 < d_1 ≤ 0.8 mm	10 N	
Resistance to soldering heat	IEC 60068-2-20, test Tb, method 1A	Solder bath temperature at 260 ± 5 °C, immersion for 10 seconds		$\Delta C/C_0 \leq 2\%$ $I\Delta \tan \delta I \leq 0.001$
Rapid change of temperature	IEC 60384-16	T_A = lower category temperature T_B = upper category temperature Five cycles, duration t = 30 min.		$I\Delta C/C_0 I \leq 2\%$ $I\Delta \tan \delta I \leq 0.002$ $R_{INS} \geq 50\%$ of initial limit
Vibration	IEC 60384-16	Test F_C: vibration sinusoidal Displacement: 0.75 mm Accleration: 98 m/s² 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/s² mounted on PCB 6 ms duration		No visible damage $I\Delta C/C_0 I \leq 2\%$ $I\Delta \tan \delta I \leq 0.001$ $R_{INS} \geq 50\%$ of initial limit
Climatic sequence	IEC 60384-16	Dry heat Tb / 16 h. Damp heat cyclic, 1st cycle + 55 °C / 24h / 95% ... 100% RH Cold Ta / 2h Damp heat cyclic, 5 cycles + 55 °C / 24h / 95% ... 100% rh		No visible damage $I\Delta C/C_0 I \leq 2\%$ $I\Delta \tan \delta I \leq 0.001$ $R_{INS} \geq 50\%$ of initial limit
Damp Heat Steady State	IEC 60384-16	Test Ca 40 °C / 93% RH / 56 days		No visible damage $I\Delta C/C_0 I \leq 3\%$ $I\Delta \tan \delta I \leq 0.003$ $R_{INS} \geq 50\%$ of initial limit
High temperature high humidity with load		60 °C / 95% RH / 1000 hours with $V_{R, DC}$		No visible damage $I\Delta C/C_0 I \leq 10\%$ $I\Delta \tan \delta I \leq 0.004$ $R_{INS} \geq 50\%$ of initial limit

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

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