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

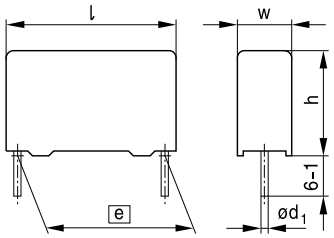
Terminals
- Parallel wire leads, lead free, tinned
- Special lead lengths available on request

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".

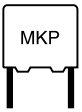
Dimensional drawing



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									

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)

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	$1.4 \cdot V_R$, 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 (≤ $1 \cdot 10^{-7}$/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 $\lvert\Delta C/C\rvert$		> 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.

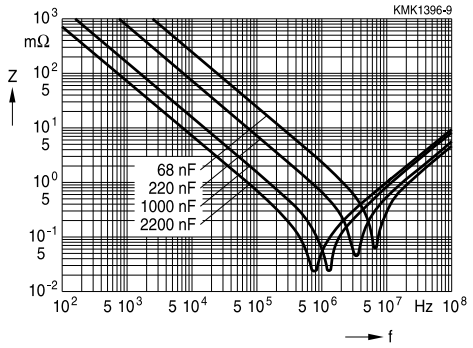
dV/dt values

Lead spacing		10 mm	15 mm	22.5 mm
V_R V 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

k_0 values

Lead spacing		10 mm	15 mm	22.5 mm
V_R V DC	V_{RMS} 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)

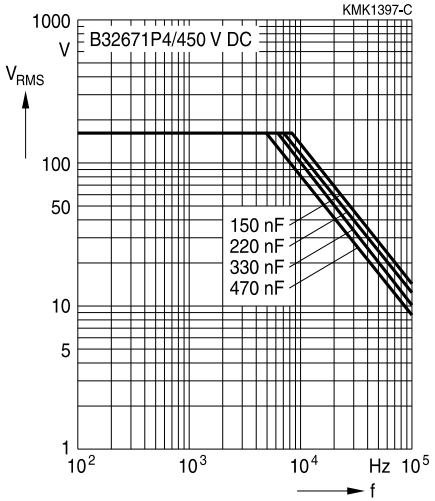


Permissible AC voltage V_{RMS} versus frequency f (for sinusoidal waveforms $T_A \leq 100$ °C)

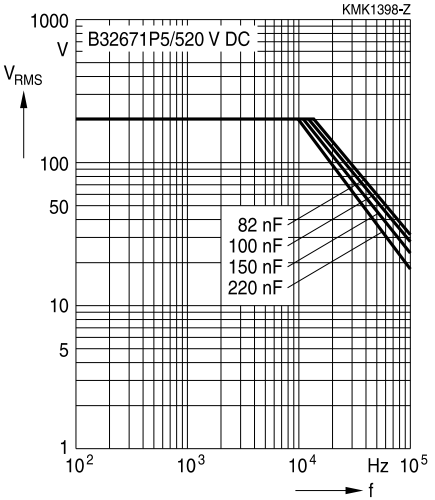
For $T_A > 100$ °C, please use derating factor F_t.

Lead spacing 10 mm

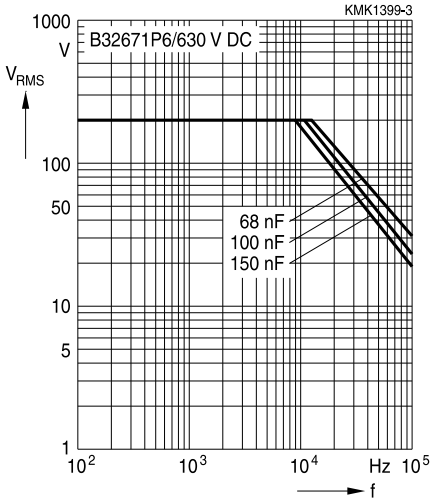
450 V DC/160 V AC



520 V DC/200 V AC



630 V DC/200 V AC

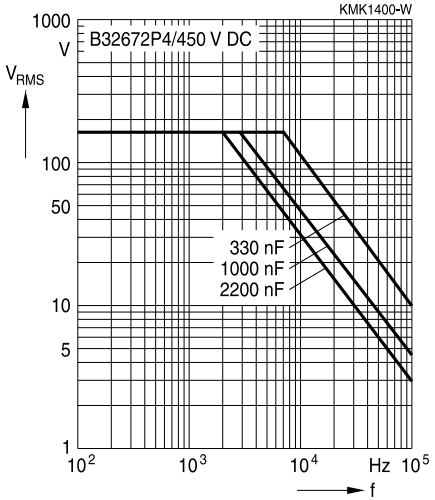


Permissible AC voltage V_{RMS} versus frequency f (for sinusoidal waveforms $T_A \leq 100$ °C)

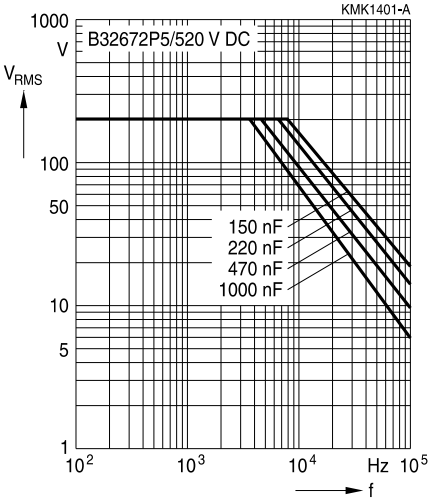
For $T_A > 100$ °C, please use derating factor F_t.

Lead spacing 15 mm

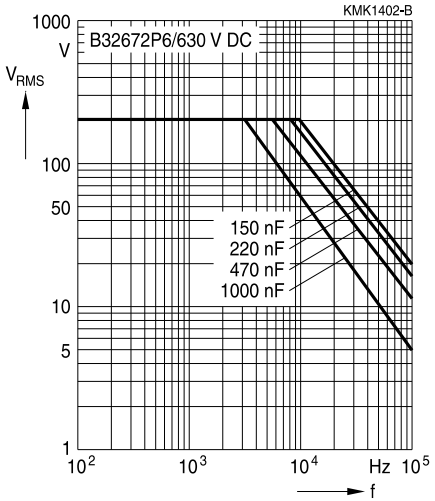
450 V DC/160 V AC



520 V DC/200 V AC



630 V DC/200 V AC

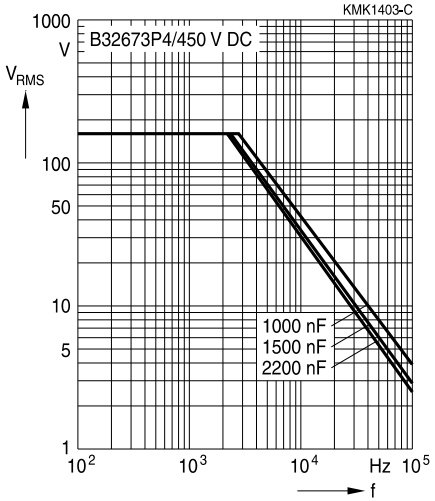


Permissible AC voltage V_{RMS} versus frequency f (for sinusoidal waveforms $T_A \leq 100$ °C)

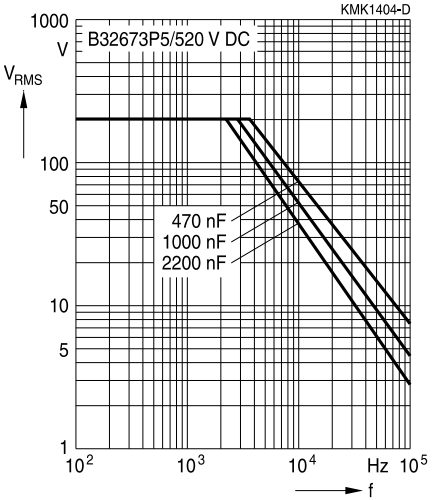
For $T_A > 100$ °C, please use derating factor F_t.

Lead spacing 22.5 mm

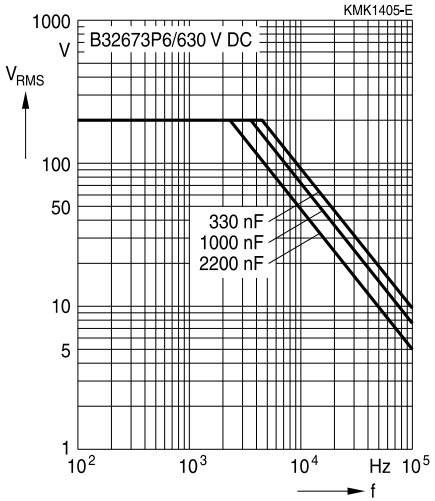
450 V DC/160 V AC



520 V DC/200 V AC



630 V DC/200 V AC

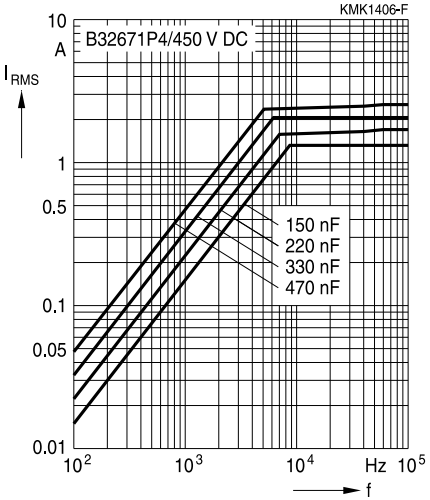


Permissible AC current I_{RMS} versus frequency f (for sinusoidal waveforms $T_A \leq 100$ °C)

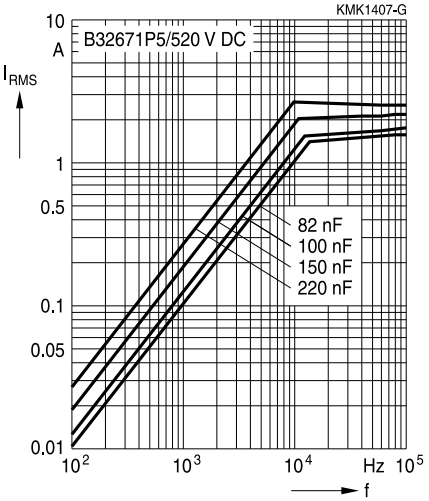
For $T_A > 100$ °C, please use derating factor F_t.

Lead spacing 10 mm

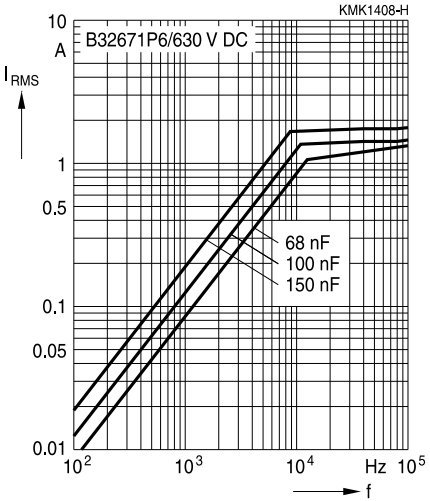
450 V DC/160 V AC



520 V DC/200 V AC



630 V DC/200 V AC

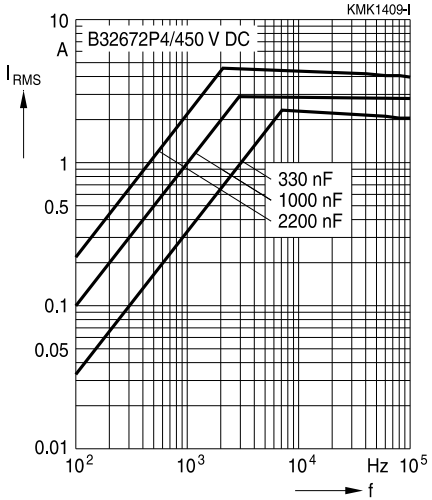


Permissible AC current I_{RMS} versus frequency f (for sinusoidal waveforms $T_A \leq 100$ °C)

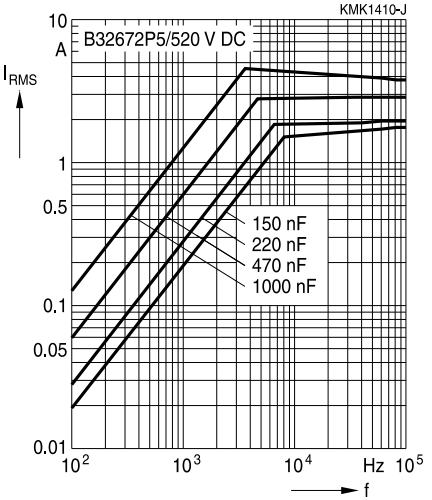
For $T_A > 100$ °C, please use derating factor F_t.

Lead spacing 15 mm

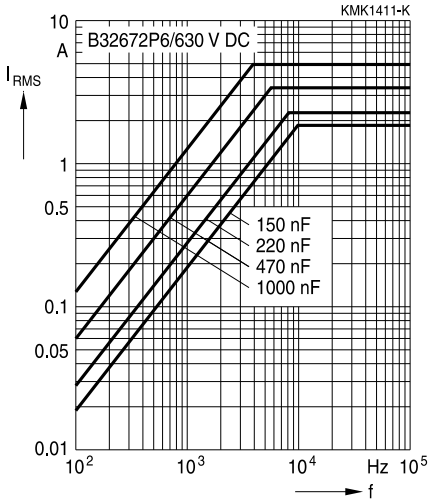
450 V DC/160 V AC



520 V DC/200 V AC



630 V DC/200 V AC

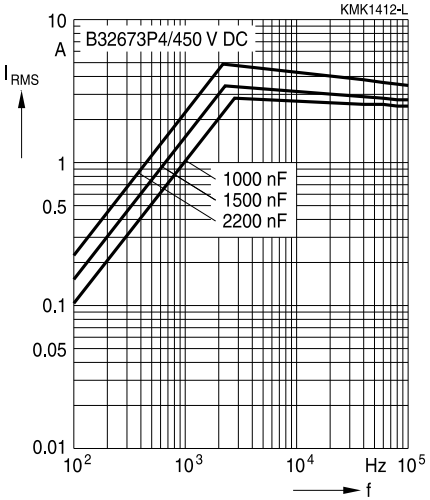


Permissible AC current I_{RMS} versus frequency f (for sinusoidal waveforms $T_A \leq 100$ °C)

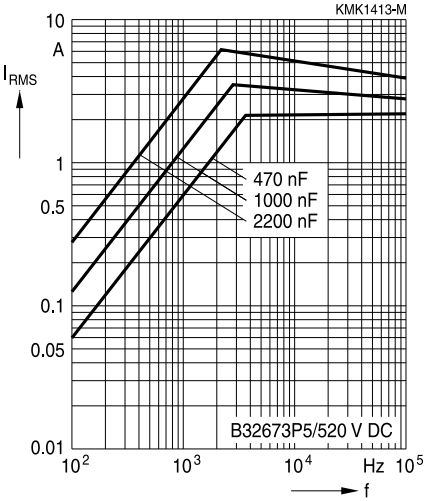
For $T_A > 100$ °C, please use derating factor F_t.

Lead spacing 22.5 mm

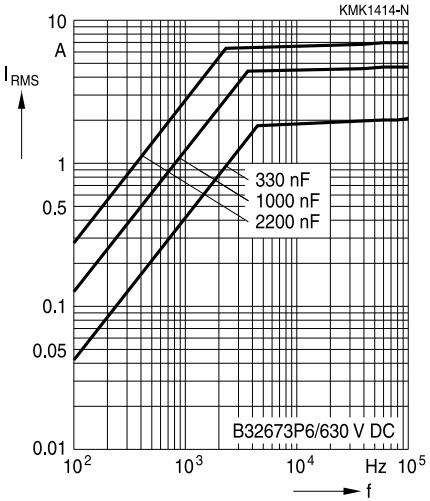
450 V DC/160 V AC



520 V DC/200 V AC



630 V DC/200 V AC



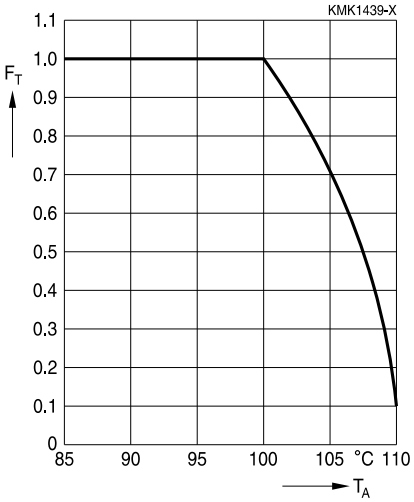
Maximum AC voltage (V_{RMS}), current (I_{RMS}) vs. frequency and temperature for T_A > 100 ºC

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
		$0.5 < d_1 \leq 0.8$ 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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