Film Capacitors

Metallized Polypropylene Film Capacitors (MKP)

Series/Type: **B32651 ... B32656**

Date: December 2012

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Typical applications

- Electronic ballasts
- Switch-mode power supplies

Climatic

- Max. operating temperature: 110 °C
- Climatic category (IEC 60068-1): 55/100/56

Construction

- Dielectric: polypropylene (PP)
- Wound capacitor technology with internal series connection for $V_R \geq 1250$ V DC
- Plastic case (UL 94 V-0)
- Epoxy resin sealing

Features

- High pulse strength
- High contact reliability
- RoHS-compatible
- Halogen-free capacitors available on request

Terminals

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

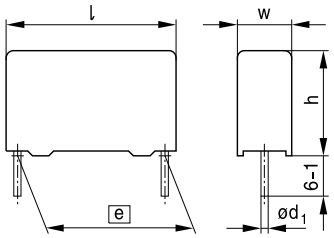
Marking

Manufacturer's logo,
lot number ($e \leq 27.5$ mm), series number
(e.g. 651),
rated capacitance (coded), cap. tolerance (code letter),
rated DC voltage
(AC voltage for 1600 V DC/700 V AC and
2000 V DC/1000 V AC),
date of manufacture (coded)

Delivery mode

Bulk (untaped)
Taped (Ammo pack or reel)
For notes on taping, refer to chapter "Taping and packing".

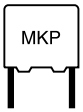
Dimensional drawing



KMK0835-P-E

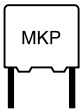
Dimensions in mm

Lead spacing e ±0.4	Lead diameter d_1	Type
10	0.6	B32651
15	0.8	B32652
22.5	0.8	B32653
27.5	0.8	B32654
37.5	1.0	B32656



Overview of available types

Lead spacing	10 mm
Type	B32651
Page	8
V_R (V DC)	1250
V_{RMS} (V AC)	450
C_R (nF)	
2.2	
3.3	
4.7	
6.8	



B32651 ... B32656

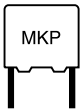
High pulse (wound)

Overview of available types

Lead spacing	15 mm							
Type	B32652							
Page	9							
V_R (V DC)	250	400	630	1000	1250	1600	1600	2000
V_{RMS} (V AC)	160	200	250	250	500	500	700	700
C_R (nF)								
1.0								
1.5								
2.2								
3.3								
4.7								
5.6								
6.8								
10								
12								
15								
22								
33								
47								
56								
68								
100								
120								
150								
220								
330								
390								
470								
560								
680								
820								
1000								

Overview of available types

Lead spacing	22.5 mm							
Type	B32653							
Page	12							
V_R (V DC)	250	400	630	1000	1250	1600	2000	2000
V_{RMS} (V AC)	160	200	250	250	500	500	700	1000
C_R (nF)								
2.2								
3.3								
4.7								
6.8								
10								
12								
15								
22								
33								
47								
56								
68								
82								
100								
120								
150								
220								
330								
470								
560								
680								
1000								
1200								
1500								
2200								
3300								

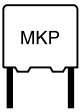


B32651 ... B32656

High pulse (wound)

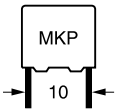
Overview of available types

Lead spacing	27.5 mm						
Type	B32654						
Page	15						
V_R (V DC)	250	400	630	1000	1250	1600	2000
V_{RMS} (V AC)	160	200	250	250	500	500	700
C_R (nF)							
22							
33							
47							
68							
82							
100							
150							
220							
330							
470							
560							
680							
820							
1000							
1200							
1500							
2200							
2700							
3300							
4700							
5600							
6800							
8200							



Overview of available types

Lead spacing	37.5 mm				
Type	B32656				
Page	17				
V_R (V DC)	850	1000	1250	1600	2000
V_{RMS} (V AC)	450	500	500	600	700
C_R (nF)					
100					
120					
150					
220					
270					
330					
390					
470					
560					
680					
820					
1000					
1200					
1500					
2200					



B32651

High pulse (wound)

Ordering codes and packing units (lead spacing 10 mm)

V_R	V_{RMS} f ≤1 kHz	C_R	Max. dimensions w × h × l	Ordering code (composition see	Ammo pack	Reel	Untaped
V DC[1)]	V AC	nF	mm	below)	pcs./MOQ	pcs./MOQ	pcs./MOQ
1250	450	2.2	4.0 × 9.0 × 13.0	B32651A7222+***	4000	6800	4000
		3.3	5.0 × 11.0 × 13.0	B32651A7332+***	3320	5200	4000
		4.7	5.0 × 11.0 × 13.0	B32651A7472+***	3320	5200	4000
		6.8	6.0 × 12.0 × 13.0	B32651A7682+***	2720	4400	4000

MOQ = Minimum Order Quantity, consisting of 4 packing units.
Further E series and intermediate capacitance values on request.

Composition of ordering code

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

*** = Packaging code:
289 = Ammo pack
189 = Reel
000 = Untaped (lead length 6 −1 mm)

1) For pulse loads (pulse width ≤ 1000 µs), a peak voltage of 1400 V_p can be permitted.

Ordering codes and packing units (lead spacing 15 mm)

V_R V DC	V_{RMS} f ≤1 kHz V AC	C_R nF	Max. dimensions w × h × l mm	Ordering code (composition see below)	Ammo pack pcs./MOQ	Reel pcs./ MOQ	Untaped pcs./ MOQ
250	160	150	5.0 × 10.5 × 18.0	B32652A3154+***	4680	5200	4000
		220	6.0 × 11.0 × 18.0	B32652A3224+***	3840	4400	4000
		330	7.0 × 12.5 × 18.0	B32652A3334+***	3320	3600	1000
		470	8.5 × 14.5 × 18.0	B32652A3474+***	2720	2800	2000
		680	9.0 × 17.5 × 18.0	B32652A3684+***	2560	2800	2000
		820	11.0 × 18.5 × 18.0	B32652A3824+***	–	2200	1000
		1000	11.0 × 18.5 × 18.0	B32652A3105+***	–	2200	1000
400	200	68	5.0 × 10.5 × 18.0	B32652A4683+***	4680	5200	4000
		100	5.0 × 10.5 × 18.0	B32652A4104+***	4680	5200	4000
		150	6.0 × 11.0 × 18.0	B32652A4154+***	3840	4400	4000
		220	7.0 × 12.5 × 18.0	B32652A4224+***	3320	3600	4000
		330	8.5 × 14.5 × 18.0	B32652A4334+***	2720	2800	2000
		470	9.0 × 17.5 × 18.0	B32652A4474+***	2560	2800	2000
		560	11.0 × 18.5 × 18.0	B32652A4564+***	–	2200	1000
		680	11.0 × 18.5 × 18.0	B32652A4684+***	–	2200	1000
630	250	33	5.0 × 10.5 × 18.0	B32652A6333+***	4680	5200	4000
		47	5.0 × 10.5 × 18.0	B32652A6473+***	4680	2800	4000
		68	6.0 × 11.0 × 18.0	B32652A6683+***	3840	4400	4000
		100	7.0 × 12.5 × 18.0	B32652A6104+***	3320	3600	4000
		150	8.5 × 14.5 × 18.0	B32652A6154+***	2720	2800	2000
		220	9.0 × 17.5 × 18.0	B32652A6224+***	2560	2800	2000
		330	11.0 × 18.5 × 18.0	B32652A6334+***	–	2200	1000
		390	11.0 × 18.5 × 18.0	B32652A6394+***	–	2200	1000

MOQ = Minimum Order Quantity, consisting of 4 packing units.
Further E series and intermediate capacitance values on request.

Composition of ordering code

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

*** = Packaging code:
289 = Ammo pack
189 = Reel
000 = 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 nF	Max. dimensions w × h × l mm	Ordering code (composition see below)	Ammo pack pcs./MOQ	Reel pcs./ MOQ	Untaped pcs./ MOQ
1000	250	10	5.0 × 10.5 × 18.0	B32652A0103+***	4680	5200	4000
		15	5.0 × 10.5 × 18.0	B32652A0153+***	4680	5200	4000
		22	5.0 × 10.5 × 18.0	B32652A0223+***	4680	5200	4000
		33	6.0 × 11.0 × 18.0	B32652A0333+***	3840	4400	4000
		47	7.0 × 12.5 × 18.0	B32652A0473+***	3320	3600	4000
		68	8.5 × 14.5 × 18.0	B32652A0683+***	2720	2800	2000
		100	9.0 × 17.5 × 18.0	B32652A0104+***	2560	2800	2000
		120	11.0 × 18.5 × 18.0	B32652A0124+***	–	2200	1000
		150	11.0 × 18.5 × 18.0	B32652A0154+***	–	2200	1000
1250	500	6.8	5.0 × 10.5 × 18.0	B32652A7682+***	4680	5200	4000
		10	6.0 × 11.0 × 18.0	B32652A7103+***	3840	4400	4000
		15	7.0 × 12.5 × 18.0	B32652A7153+***	3320	3600	4000
		22	8.5 × 14.5 × 18.0	B32652A7223+***	2720	2800	2000
		33	9.0 × 17.5 × 18.0	B32652A7333+***	2560	2800	2000
		47	11.0 × 18.5 × 18.0	B32652A7473+***	–	2200	1000
		56	11.0 × 18.5 × 18.0	B32652A7563+***	–	2200	1000
1600	500	3.3	5.0 × 10.5 × 18.0	B32652A1332+***	4680	5200	4000
		4.7	6.0 × 11.0 × 18.0	B32652A1472+***	3840	4400	4000
		6.8	7.0 × 12.5 × 18.0	B32652A1682+***	3320	3600	4000
		10	8.5 × 14.5 × 18.0	B32652A1103+***	2720	2800	2000
		15	9.0 × 17.5 × 18.0	B32652A1153+***	2560	2800	2000
		22	11.0 × 18.5 × 18.0	B32652A1223+***	–	2200	1000
1600	700	2.2	5.0 × 10.5 × 18.0	B32652J1222+***	4680	5200	4000
		3.3	6.0 × 11.0 × 18.0	B32652J1332+***	3840	4400	4000
		4.7	7.0 × 12.5 × 18.0	B32652J1472+***	3320	3600	4000
		6.8	8.5 × 14.5 × 18.0	B32652J1682+***	2720	2800	2000
		10	9.0 × 17.5 × 18.0	B32652J1103+***	2560	2800	2000
		12	9.0 × 17.5 × 18.0	B32652J1123+***	2560	2800	2000
		15	11.0 × 18.5 × 18.0	B32652J1153+***	–	2200	1000

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Further E series and intermediate capacitance values on request.

Composition of ordering code

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

*** = Packaging code:
289 = Ammo pack
189 = Reel
000 = Untaped (lead length 6 −1 mm)

Ordering codes and packing units (lead spacing 15 mm)

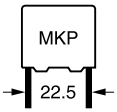
V_R V DC	V_{RMS} f ≤1 kHz V AC	C_R nF	Max. dimensions w × h × l mm	Ordering code (composition see below)	Ammo pack pcs./MOQ	Reel pcs./ MOQ	Untaped pcs./ MOQ
2000	700	1.0	5.0 × 10.5 × 18.0	B32652A2102+***	4680	5200	4000
		1.5	6.0 × 11.0 × 18.0	B32652A2152+***	3840	4400	4000
		2.2	7.0 × 12.5 × 18.0	B32652A2222+***	3320	3600	4000
		3.3	8.5 × 14.5 × 18.0	B32652A2332+***	2720	2800	2000
		4.7	9.0 × 17.5 × 18.0	B32652A2472+***	2560	2800	2000
		5.6	9.0 × 17.5 × 18.0	B32652A2562+***	–	2200	1000
		6.8	11.0 × 18.5 × 18.0	B32652A2682+***	–	2200	1000

MOQ = Minimum Order Quantity, consisting of 4 packing units.
Further E series and intermediate capacitance values on request.

Composition of ordering code

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

*** = Packaging code:
289 = Ammo pack
189 = Reel
000 = Untaped (lead length 6 −1 mm)



Ordering codes and packing units (lead spacing 22.5 mm)

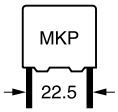
V_R V DC	V_{RMS} f ≤1 kHz V AC	C_R nF	Max. dimensions w × h × l mm	Ordering code (composition see below)	Ammo pack pcs./MOQ	Reel pcs./ MOQ	Untaped pcs./ MOQ
250	160	220	6.0 × 15.0 × 26.5	B32653A3224+***	2720	2800	2880
		330	6.0 × 15.0 × 26.5	B32653A3334+***	2720	2800	2880
		470	7.0 × 16.0 × 26.5	B32653A3474+***	2320	2400	2520
		680	8.5 × 16.5 × 26.5	B32653A3684+***	1920	2000	2040
		1000	10.5 × 16.5 × 26.5	B32653A3105+***	1560	1600	2160
		1200	10.5 × 18.5 × 26.5	B32653A3125+***	1560	1600	2160
		1500	11.0 × 20.5 × 26.5	B32653A3155+***	1480	1400	2040
		2200	14.5 × 29.5 × 26.5	B32653A3225+000	–	–	1040
		3300	14.5 × 29.5 × 26.5	B32653A3335+000	–	–	1040
400	200	150	6.0 × 15.0 × 26.5	B32653A4154+***	2720	2800	2880
		220	6.0 × 15.0 × 26.5	B32653A4224+***	2720	2800	2880
		330	7.0 × 16.0 × 26.5	B32653A4334+***	2320	2400	2520
		470	8.5 × 16.5 × 26.5	B32653A4474+***	1920	2000	2040
		680	10.5 × 16.5 × 26.5	B32653A4684+***	1560	1600	2160
		1000	11.0 × 20.5 × 26.5	B32653A4105+***	1480	1400	2040
		1200	12.0 × 22.0 × 26.5	B32653A4125+000	–	–	1800
		1500	14.5 × 29.5 × 26.5	B32653A4155+000	–	–	1040
		2200	14.5 × 29.5 × 26.5	B32653A4225+000	–	–	1040
630	250	100	6.0 × 15.0 × 26.5	B32653A6104+***	2720	2800	2880
		150	6.0 × 15.0 × 26.5	B32653A6154+***	2720	2800	2880
		220	8.5 × 16.5 × 26.5	B32653A6224+***	1920	2000	2040
		330	10.5 × 16.5 × 26.5	B32653A6334+***	1560	1600	2160
		470	11.0 × 20.5 × 26.5	B32653A6474+***	1480	1400	2040
		560	11.0 × 20.5 × 26.5	B32653A6564+***	1480	1400	2040
		680	14.5 × 29.5 × 26.5	B32653A6684+000	–	–	1040
		1000	14.5 × 29.5 × 26.5	B32653A6105+000	–	–	1040
		1200	14.5 × 29.5 × 26.5	B32653A6125+000	–	–	1040

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

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J = ±5%

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189 = Reel
000 = Untaped (lead length 6 −1 mm)



Ordering codes and packing units (lead spacing 22.5 mm)

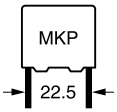
V_R V DC	V_{RMS} f ≤1 kHz V AC	C_R nF	Max. dimensions w × h × l mm	Ordering code (composition see below)	Ammo pack pcs./MOQ	Reel pcs./ MOQ	Untaped pcs./ MOQ
1000	250	33	6.0 × 15.0 × 26.5	B32653A0333+***	2720	2800	2880
		47	6.0 × 15.0 × 26.5	B32653A0473+***	2720	2800	2880
		68	6.0 × 15.0 × 26.5	B32653A0683+***	2720	2800	2880
		100	8.5 × 16.5 × 26.5	B32653A0104+***	1920	2000	2040
		150	10.5 × 16.5 × 26.5	B32653A0154+***	1560	1600	2160
		220	11.0 × 20.5 × 26.5	B32653A0224+***	1480	1400	2040
		330	14.5 × 29.5 × 26.5	B32653A0334+000	–	–	2160
		470	14.5 × 29.5 × 26.5	B32653A0474+000	–	–	2160
		560	14.5 × 29.5 × 26.5	B32653A0564+000	–	–	2160
1250	500	22	6.0 × 15.0 × 26.5	B32653A7223+***	2720	2800	2880
		33	6.0 × 15.0 × 26.5	B32653A7333+***	2720	2800	2880
		47	8.5 × 16.5 × 26.5	B32653A7473+***	1920	2000	2040
		68	10.5 × 16.5 × 26.5	B32653A7683+***	1560	1600	2160
		100	11.0 × 20.5 × 26.5	B32653A7104+***	1480	1400	2040
		120	12.0 × 22.0 × 26.5	B32653A7124+000	–	–	1800
		150	14.5 × 29.5 × 26.5	B32653A7154+000	–	–	1040
		220	14.5 × 29.5 × 26.5	B32653A7224+000	–	–	1040
1600	500	6.8	6.0 × 15.0 × 26.5	B32653A1682+***	2720	2800	2880
		10	6.0 × 15.0 × 26.5	B32653A1103+***	2720	2800	2880
		15	7.0 × 16.0 × 26.5	B32653A1153+***	2320	2400	2520
		22	8.5 × 16.5 × 26.5	B32653A1223+***	1920	2000	2040
		33	10.5 × 16.5 × 26.5	B32653A1333+***	1560	1600	2160
		47	11.0 × 20.5 × 26.5	B32653A1473+***	1480	1400	2040
		56	12.0 × 22.0 × 26.5	B32653A1563+000	–	–	1800
		68	14.5 × 29.5 × 26.5	B32653A1683+000	–	–	1040
		82	14.5 × 29.5 × 26.5	B32653A1823+000	–	–	1040
		100	14.5 × 29.5 × 26.5	B32653A1104+000	–	–	1040

MOQ = Minimum Order Quantity, consisting of 4 packing units.
Further E series and intermediate capacitance values on request.

Composition of ordering code

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K = ±10%
J = ±5%

*** = Packaging code:
289 = Ammo pack
189 = Reel
000 = Untaped (lead length 6 −1 mm)



B32653

High pulse (wound)

Ordering codes and packing units (lead spacing 22.5 mm)

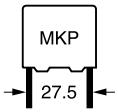
V_R V DC	V_{RMS} f ≤1 kHz V AC	C_R nF	Max. dimensions w × h × l mm	Ordering code (composition see below)	Ammo pack pcs./MOQ	Reel pcs./ MOQ	Untaped pcs./ MOQ
2000	700	3.3	6.0 × 15.0 × 26.5	B32653A2332+***	2720	2800	2880
		4.7	6.0 × 15.0 × 26.5	B32653A2472+***	2720	2800	2880
		6.8	8.5 × 16.5 × 26.5	B32653A2682+***	1920	2000	2040
		10	10.5 × 16.5 × 26.5	B32653A2103+***	1560	1600	2160
		15	11.0 × 20.5 × 26.5	B32653A2153+***	1480	1400	2040
		22	14.5 × 29.5 × 26.5	B32653A2223+000	–	–	2160
		33	14.5 × 29.5 × 26.5	B32653A2333+000	–	–	2160
2000	1000	2.2	6.0 × 15.0 × 26.5	B32653A8222+***	2720	2800	2880
		3.3	6.0 × 15.0 × 26.5	B32653A8332+***	2720	2800	2880
		4.7	8.5 × 16.5 × 26.5	B32653A8472+***	1920	2000	2040
		6.8	10.5 × 16.5 × 26.5	B32653A8682+***	1560	1600	2160
		10	10.5 × 20.5 × 26.5	B32653A8103+***	1560	1600	2160
		12	12.0 × 22.0 × 26.5	B32653A8123+000	–	–	1800
		15	14.5 × 29.5 × 26.5	B32653A8153+000	–	–	2160
		22	14.5 × 29.5 × 26.5	B32653A8223+000	–	–	2160

MOQ = Minimum Order Quantity, consisting of 4 packing units.
Further E series and intermediate capacitance values on request.

Composition of ordering code

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

*** = Packaging code:
289 = Ammo pack
189 = Reel
000 = Untaped (lead length 6 −1 mm)



Ordering codes and packing units (lead spacing 27.5 mm)

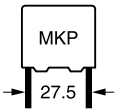
V_R V DC	V_{RMS} f ≤1 kHz V AC	C_R nF	Max. dimensions w × h × l mm	Ordering code (composition see below)	Ammo pack pcs./MOQ	Reel pcs./ MOQ	Untaped pcs./ MOQ
250	160	1500	11.0 × 21.0 × 31.5	B32654A3155+***	–	1400	1280
		2200	12.5 × 21.5 × 31.5	B32654A3225+***	–	1200	1120
		3300	15.0 × 24.5 × 31.5	B32654A3335+000	–	–	960
		4700	18.0 × 27.5 × 31.5	B32654A3475+000	–	–	800
		5600	19.0 × 30.0 × 31.5	B32654A3565+000	–	–	720
		6800	22.0 × 36.5 × 31.5	B32654A3685+000	–	–	640
		8200	22.0 × 36.5 × 31.5	B32654A3825+000	–	–	640
400	200	1000	11.0 × 21.0 × 31.5	B32654A4105+***	–	1400	1280
		1500	12.5 × 21.5 × 31.5	B32654A4155+***	–	1200	1120
		2200	14.0 × 24.5 × 31.5	B32654A4225+***	–	1040	1040
		3300	19.0 × 30.0 × 31.5	B32654A4335+000	–	–	720
		4700	22.0 × 36.5 × 31.5	B32654A4475+000	–	–	640
		5600	22.0 × 36.5 × 31.5	B32654A4565+000	–	–	640
630	250	680	11.0 × 21.0 × 31.5	B32654A6684+***	–	1400	1280
		1000	13.5 × 23.0 × 31.5	B32654A6105+***	–	1000	1040
		1500	18.0 × 27.5 × 31.5	B32654A6155+000	–	–	800
		2200	18.0 × 33.0 × 31.5	B32654A6225+000	–	–	800
		2700	22.0 × 36.5 × 31.5	B32654A6275+000	–	–	640
		3300	22.0 × 36.5 × 31.5	B32654A6335K000	–	–	640
1000	250	220	11.0 × 21.0 × 31.5	B32654A0224+***	–	1400	1280
		330	11.0 × 21.0 × 31.5	B32654A0334+***	–	1400	1280
		470	14.0 × 24.5 × 31.5	B32654A0474+***	–	1040	1040
		680	18.0 × 27.5 × 31.5	B32654A0684+000	–	–	800
		820	19.0 × 30.0 × 31.5	B32654A0824+000	–	–	720
		1000	21.0 × 31.0 × 31.5	B32654A0105+000	–	–	720
		1200	22.0 × 36.5 × 31.5	B32654A0125+000	–	–	640
		1500	22.0 × 36.5 × 31.5	B32654A0155K000	–	–	640

MOQ = Minimum Order Quantity, consisting of 4 packing units.
Further E series and intermediate capacitance values on request.

Composition of ordering code

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

*** = Packaging code:
189 = Reel
000 = Untaped (lead length 6 −1 mm)



B32654

High pulse (wound)

Ordering codes and packing units (lead spacing 27.5 mm)

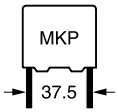
V_R V DC	V_{RMS} f ≤1 kHz V AC	C_R nF	Max. dimensions w × h × l mm	Ordering code (composition see below)	Ammo pack pcs./MOQ	Reel pcs./ MOQ	Untaped pcs./ MOQ
1250	500	100	11.0 × 21.0 × 31.5	B32654A7104+***	–	1400	1280
		150	11.0 × 21.0 × 31.5	B32654A7154+***	–	1400	1280
		220	14.0 × 24.5 × 31.5	B32654A7224+***	–	1040	1040
		330	18.0 × 27.5 × 31.5	B32654A7334+000	–	–	800
		470	21.0 × 31.0 × 31.5	B32654A7474+000	–	–	720
		560	22.0 × 36.5 × 31.5	B32654A7564+000	–	–	640
		680	22.0 × 36.5 × 31.5	B32654A7684+000	–	–	640
1600	500	47	11.0 × 21.0 × 31.5	B32654A1473+***	–	1400	1280
		68	11.0 × 21.0 × 31.5	B32654A1683+***	–	1400	1280
		100	14.0 × 24.5 × 31.5	B32654A1104+***	–	1040	1040
		150	18.0 × 27.5 × 31.5	B32654A1154+000	–	–	800
		220	21.0 × 31.0 × 31.5	B32654A1224+000	–	–	784
2000	700	22	11.0 × 21.0 × 31.5	B32654A2223+***	–	1400	1280
		33	13.5 × 23.0 × 31.5	B32654A2333+***	–	1000	1040
		47	18.0 × 27.5 × 31.5	B32654A2473+000	–	–	800
		68	19.0 × 30.0 × 31.5	B32654A2683+000	–	–	720
		82	22.0 × 36.5 × 31.5	B32654A2823+000	–	–	640
		100	22.0 × 36.5 × 31.5	B32654A2104+000	–	–	640

MOQ = Minimum Order Quantity, consisting of 4 packing units.
Further E series and intermediate capacitance values on request.

Composition of ordering code

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

*** = Packaging code:
189 = Reel
000 = Untaped (lead length 6 −1 mm)



Ordering codes and packing units (lead spacing 37.5 mm)

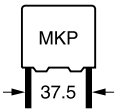
V_R	V_{RMS} f ≤1 kHz	C_R	Max. dimensions w × h × l	Ordering code (composition see	Untaped
V DC	V AC	nF	mm	below)	pcs./MOQ
850	450	220	12.0 × 22.0 × 42.0	B32656A8224+000	1620
		330	12.0 × 22.0 × 42.0	B32656A8334+000	1620
		470	12.0 × 22.0 × 42.0	B32656A8474+000	1620
		680	16.0 × 28.5 × 42.0	B32656A8684+000	800
		680	24.0 × 15.0 × 41.5	B32656T8684+000	1040
		820	24.0 × 19.0 × 41.5	B32656T8824+000	780
		1000	18.0 × 32.5 × 42.0	B32656A8105+000	720
1000	500	470	14.0 × 25.0 × 42.0	B32656A0474+000	1380
		470	24.0 × 15.0 × 41.5	B32656T0474+000	1040
		680	16.0 × 28.5 × 42.0	B32656A0684+000	800
		680	24.0 × 19.0 × 41.5	B32656T0684+000	780
		1000	20.0 × 39.5 × 42.0	B32656A0105+000	640
		1200	28.0 × 37.0 × 42.0	B32656A0125+000	440
		1500	28.0 × 37.0 × 42.0	B32656A0155+000	440
		2200	30.0 × 45.0 × 42.0	B32656A0225+000	400
1250	500	220	14.0 × 25.0 × 42.0	B32656A7224+000	1380
		270	24.0 × 15.0 × 41.5	B32656T7274+000	1040
		330	16.0 × 28.5 × 42.0	B32656A7334+000	800
		390	24.0 × 19.0 × 41.5	B32656T7394+000	780
		470	18.0 × 32.5 × 42.0	B32656A7474+000	720
		680	20.0 × 39.5 × 42.0	B32656A7684+000	640
		820	28.0 × 37.0 × 42.0	B32656A7824+000	440
		1000	28.0 × 37.0 × 42.0	B32656A7105+000	440
		1200	28.0 × 42.5 × 41.5	B32656A7125+000	440

MOQ = Minimum Order Quantity, consisting of 4 packing units.
Further E series and intermediate capacitance values on request.

Composition of ordering code

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

*** = Packaging code:
000 = Untaped (lead length 6 −1 mm)



B32656

High pulse (wound)

V_R V DC	V_{RMS} f ≤1 kHz V AC	C_R nF	Max. dimensions w × h × l mm	Ordering code (composition see below)	Untaped pcs./MOQ
1600	600	100	12.0 × 22.0 × 42.0	B32656J1104+000	1620
		150	14.0 × 25.0 × 42.0	B32656J1154+000	1380
		150	24.0 × 15.0 × 41.5	B32656T1154+000	1040
		220	16.0 × 28.5 × 42.0	B32656J1224+000	800
		220	24.0 × 19.0 × 41.5	B32656T1224+000	780
		330	20.0 × 39.5 × 41.5	B32656J1334+000	640
		470	28.0 × 37.0 × 42.0	B32656J1474+000	440
		560	28.0 × 37.0 × 42.0	B32656J1564+000	440
		680	28.0 × 42.5 × 41.5	B32656J1684+000	440
		820	30.0 × 45.0 × 42.0	B32656J1824+000	400
2000	700	100	14.0 × 25.0 × 42.0	B32656J2104+000	1380
		100	24.0 × 15.0 × 41.5	B32656T2104+000	1040
		120	24.0 × 19.0 × 41.5	B32656T2124+000	780
		150	18.0 × 32.5 × 42.0	B32656J2154+000	720
		220	20.0 × 39.5 × 42.0	B32656J2224+000	640
		330	28.0 × 37.0 × 42.0	B32656J2334+000	440
		470	30.0 × 45.0 × 42.0	B32656J2474+000	400

MOQ = Minimum Order Quantity, consisting of 4 packing units.
Further E series and intermediate capacitance values on request.

Composition of ordering code

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

*** = Packaging code:
000 = Untaped (lead length 6 −1 mm)

Technical data

Operating temperature range	Max. operating temperature $T_{op,max}$		+110 °C		
	Upper category temperature T_{max}		+100 °C		
	Lower category temperature T_{min}		−55 °C		
	Rated temperature T_R		+85 °C		
Dissipation factor tan δ (in 10^{-3})	at	≤27 nF	27 nF<C_R≤0.1 µF	0.1 µF<C_R≤1 µF	>1 µF
at 20 °C	1 kHz	0.8	0.8	0.8	0.8
(upper limit values)	10 kHz	1.0	1.0	1.0	–
	100 kHz	2.0	3.0	–	–
Insulation resistance R_{ins}	C_R ≤ 0.33 µF		C_R > 0.33 µF		
or time constant $\tau = C_R \cdot R_{ins}$	100 GΩ		30000 s		
at 20 °C, rel. humidity ≤ 65%					
(minimum as-delivered values)					
DC test voltage	1.6 · V_R, 2 s				
Category voltage V_C	T_A (°C)		DC voltage derating	AC voltage derating	
(continuous operation with V_{DC}	T_A ≤ 85		$V_C = V_R$	$V_{C,RMS} = V_{RMS}$	
or V_{AC} at f ≤ 1 kHz)	85<T_A≤100		$V_C = V_R \cdot (165 - T_A)/80$	$V_{C,RMS}=V_{RMS} \cdot (165 - T_A)/80$	
Operating voltage V_{op} for	T_A (°C)		DC voltage (max. hours)	AC voltage (max. hours)	
short operating periods	T_A ≤ 85		V_{op} = 1.25 · V_C (2000 h)	V_{op} = 1.0 · $V_{C,RMS}$ (2000 h)	
(V_{DC} or V_{AC} at f ≤ 1 kHz)	85<T_A≤100		V_{op} = 1.25 · V_C (2000 h)	V_{op} = 1.0 · $V_{C,RMS}$ (2000 h)	
Damp heat test	56 days/40 °C/93% relative humidity				
Limit values after damp	Capacitance change |ΔC/C|			≤ 3%	
heat test	Dissipation factor change Δ tan δ			≤ 0.5 · 10^{-3} (at 1 kHz)	
				≤ 1.0 · 10^{-3} (at 10 kHz)	
	Insulation resistance R_{ins}			≥ 50% of minimum	
	or time constant $\tau = C_R \cdot R_{ins}$			as-delivered values	
Reliability:					
Failure rate λ	1 fit (≤ 1 · 10^{-9}/h) at 0.5 · V_R, 40 °C				
Service life t_{SL}	200 000 h at 1.0 · V_R, 85 °C				
	For conversion to other operating conditions and temperatures, refer to chapter "Quality, 2 Reliability".				
Failure criteria:					
Total failure	Short circuit or open circuit				
Failure due to variation	Capacitance change |ΔC/C|			> 10%	
of parameters	Dissipation factor tan δ			> 4 · upper limit value	
	Insulation resistance R_{ins}			< 1500 MΩ (C_R≤0.33 µF)	
	or time constant $\tau = C_R \cdot R_{ins}$			< 500 s (C_R>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.

dV/dt values

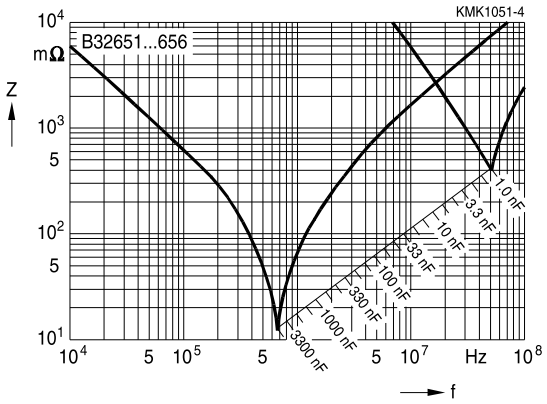
Lead spacing		10 mm	15 mm	22.5 mm	27.5 mm	37.5 mm
V_R V DC	V_{RMS} V AC	dV/dt in V/µs				
250	160	–	200	120	50	–
400	200	–	300	180	100	–
630	250	–	400	300	150	–
850	450	–	–	–	–	90
1000	250	–	975	600	300	–
	500	–	–	–	–	100
1250	450	4000	–	–	–	–
	500	–	1850	1150	600	140
1600	500	–	4500	2400	1000	–
	600	–	–	–	–	210
	700	–	5200	–	–	–
2000	700	–	8000	7000	2300	200
	1000	–	–	7500	–	–

k_0 values

Lead spacing		10 mm	15 mm	22.5 mm	27.5 mm	37.5 mm
V_R V DC	V_{RMS} V AC	k_0 in $V^2/\mu s$				
250	160	–	100 000	60 000	25 000	–
400	200	–	250 000	200 000	110 000	–
630	250	–	500 000	350 000	250 000	–
850	450	–	–	–	–	153 000
1000	250	–	3 000 000	1 500 000	1 000 000	–
	500	–	–	–	–	180 000
1250	450	25 000 000	–	–	–	–
	500	–	9 000 000	3 750 000	2 000 000	350 000
1600	500	–	20 000 000	10 000 000	4 000 000	–
	600	–	–	–	–	672 000
	700	–	28 000 000		–	–
2000	700	–	60 000 000	40 000 000	15 000 000	800 000
	1000	–	–	50 000 000	–	–

Impedance Z versus frequency f

(typical values)

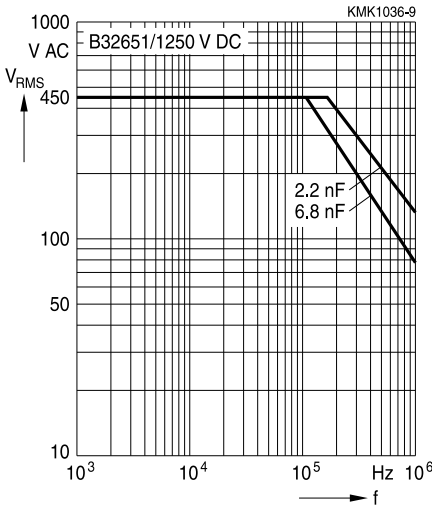


Permissible AC voltage V_{RMS} versus frequency f (for sinusoidal waveforms, $T_A \leq 90$ °C)

For T_A >90 °C, please refer to "General technical information", section 3.2.3.

Lead spacing 10 mm

1250 V DC/450 V AC

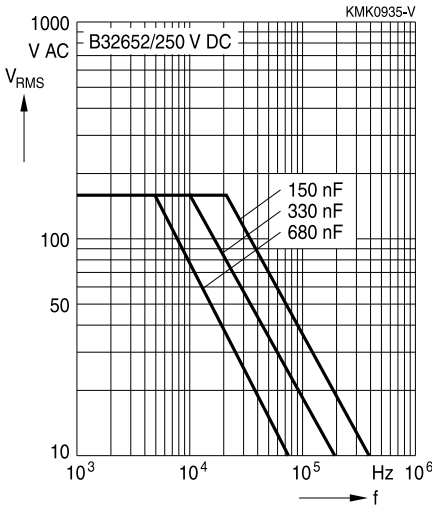


Permissible AC voltage V_{RMS} versus frequency f (for sinusoidal waveforms, $T_A \leq 90$ °C)

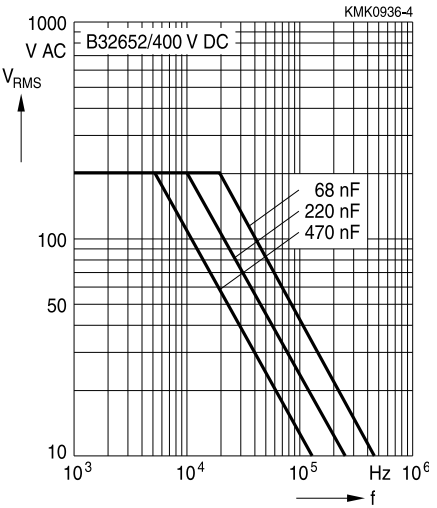
For T_A >90 °C, please refer to "General technical information", section 3.2.3.

Lead spacing 15 mm

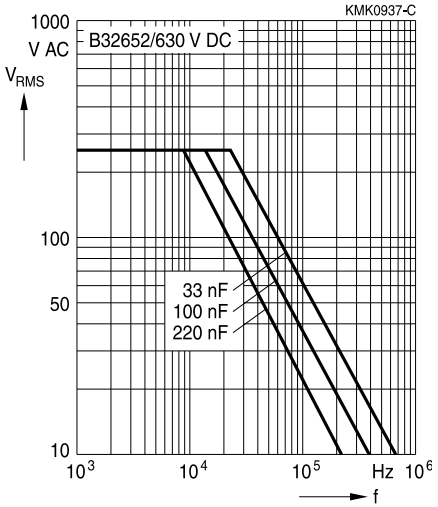
250 V DC/160 V AC



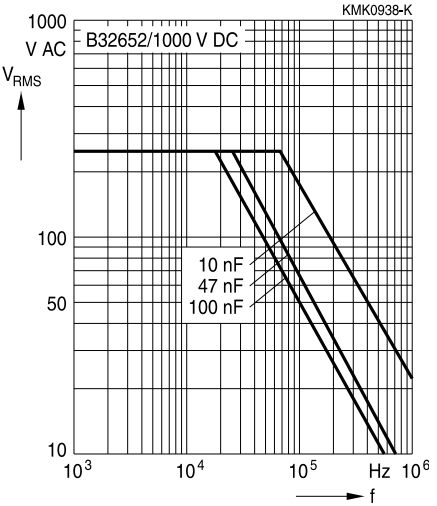
400 V DC/200 V AC



630 V DC/250 V AC



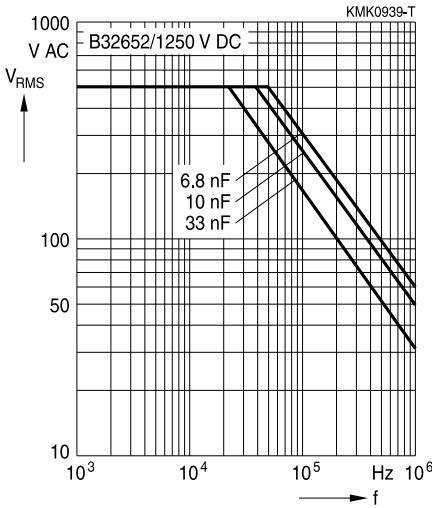
1000 V DC/250 V AC



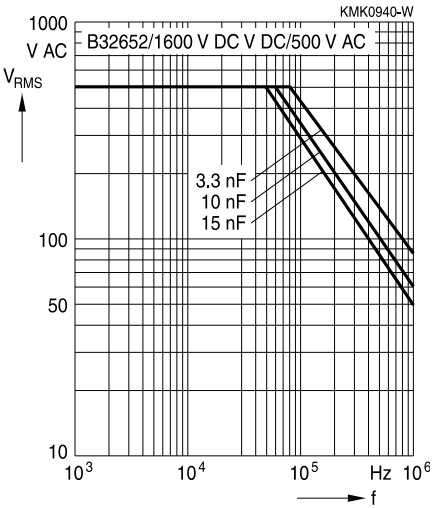
Permissible AC voltage V_{RMS} versus frequency f (for sinusoidal waveforms, $T_A \leq 90$ °C)
For T_A >90 °C, please refer to "General technical information", section 3.2.3.

Lead spacing 15 mm

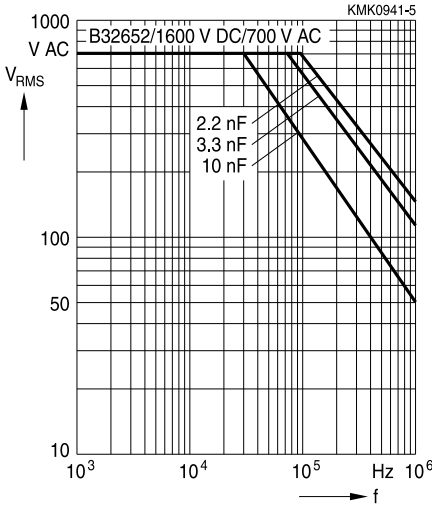
1250 V DC/500 V AC



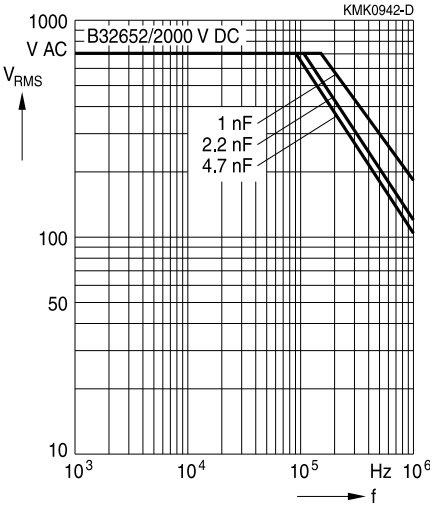
1600 V DC/500 V AC



1600 V DC/700 V AC



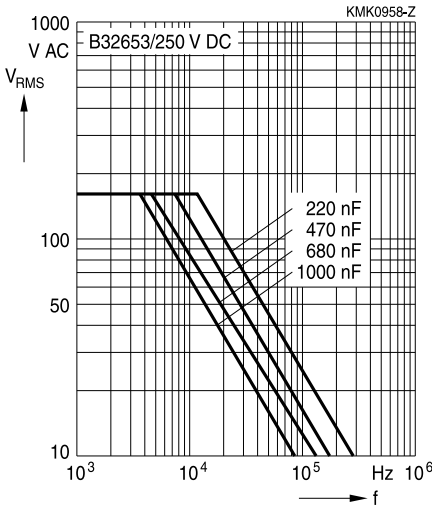
2000 V DC/700 V AC



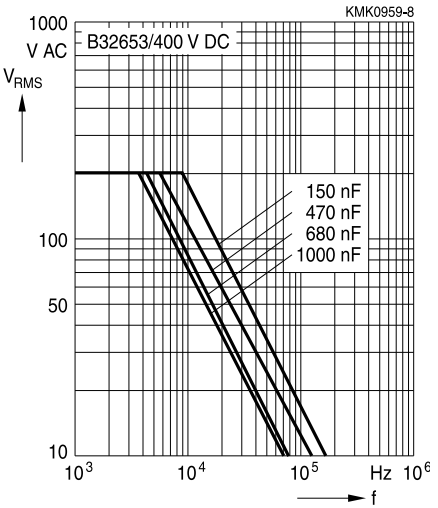
Permissible AC voltage V_{RMS} versus frequency f (for sinusoidal waveforms, $T_A \leq 90$ °C)
For T_A >90 °C, please refer to "General technical information", section 3.2.3.

Lead spacing 22.5 mm

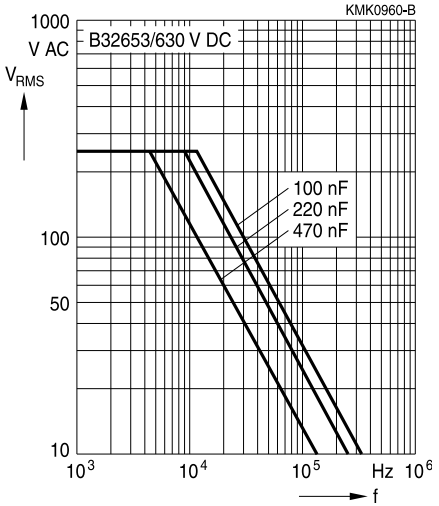
250 V DC/160 V AC



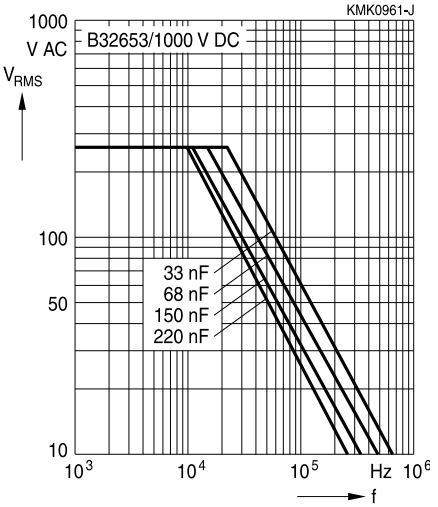
400 V DC/200 V AC



630 V DC/250 V AC



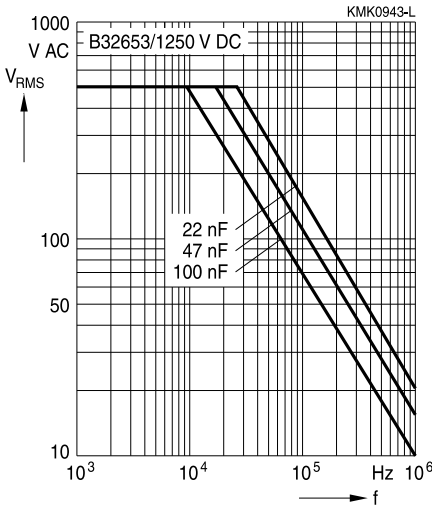
1000 V DC/250 V AC



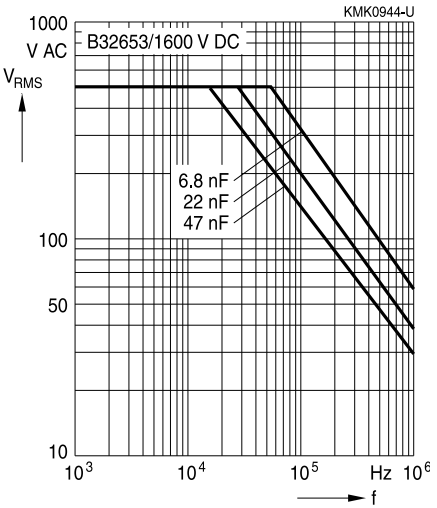
Permissible AC voltage V_{RMS} versus frequency f (for sinusoidal waveforms, $T_A \leq 90$ °C)
For T_A >90 °C, please refer to "General technical information", section 3.2.3.

Lead spacing 22.5 mm

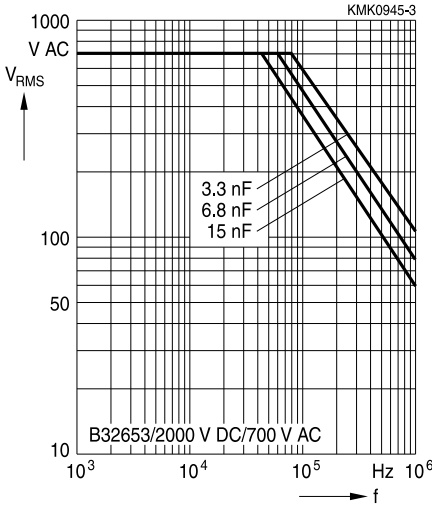
1250 V DC/500 V AC



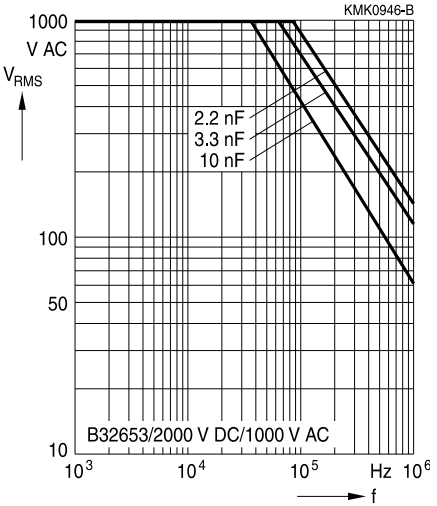
1600 V DC/500 V AC



2000 V DC/700 V AC



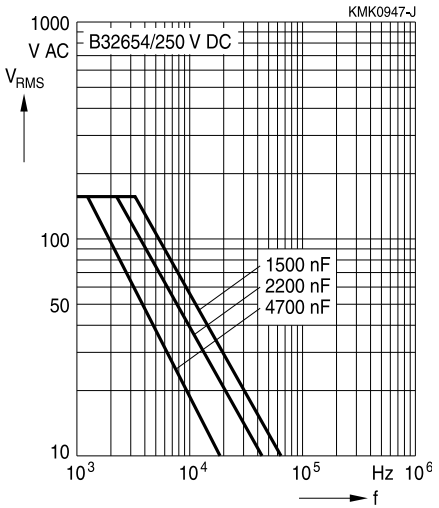
2000 V DC/1000 V AC



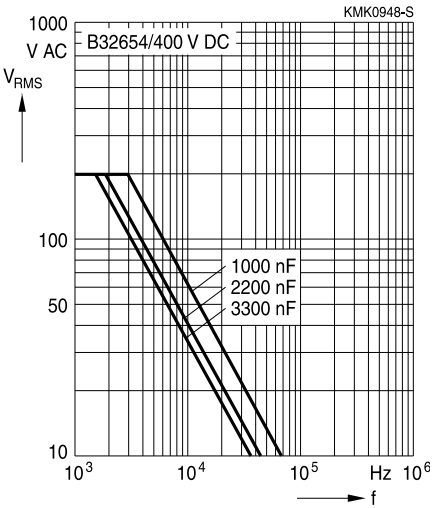
Permissible AC voltage V_{RMS} versus frequency f (for sinusoidal waveforms, $T_A \leq 90$ °C)
For T_A >90 °C, please refer to "General technical information", section 3.2.3.

Lead spacing 27.5 mm

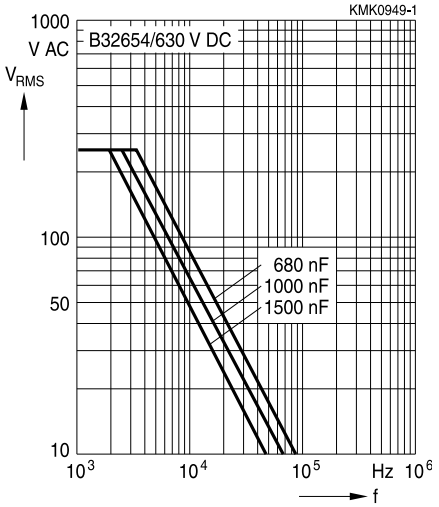
250 V DC/160 V AC



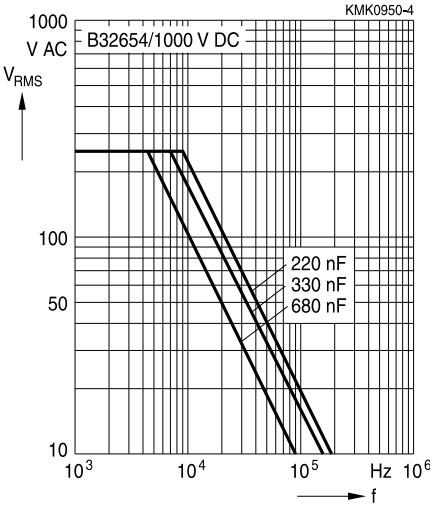
400 V DC/200 V AC



630 V DC/250 V AC



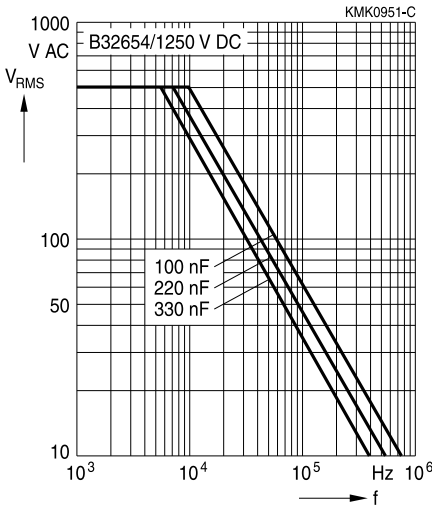
1000 V DC/250 V AC



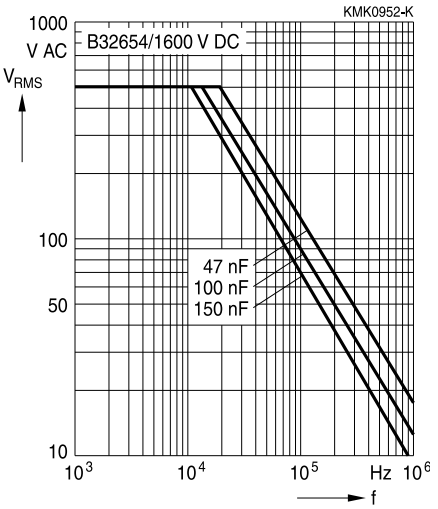
Permissible AC voltage V_{RMS} versus frequency f (for sinusoidal waveforms, $T_A \leq 90$ °C)
For T_A >90 °C, please refer to "General technical information", section 3.2.3.

Lead spacing 27.5 mm

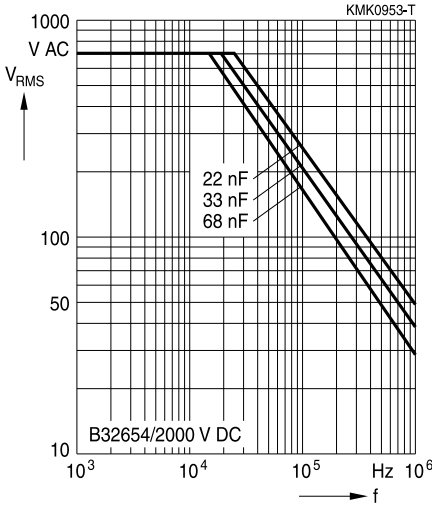
1250 V DC/500 V AC



1600 V DC/500 V AC



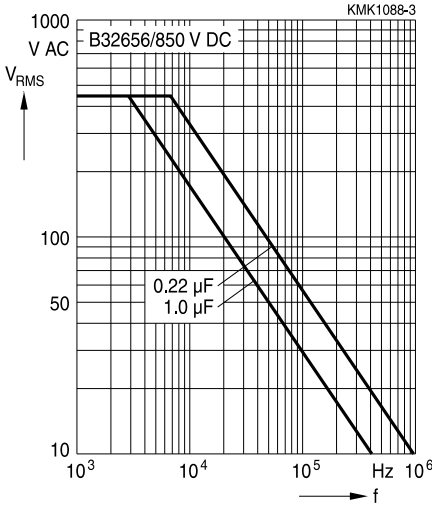
2000 V DC/700 V AC



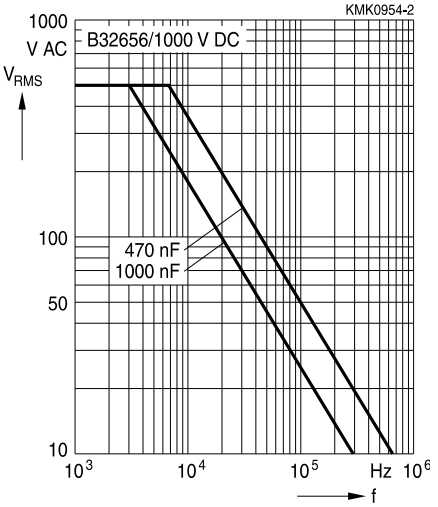
Permissible AC voltage V_{RMS} versus frequency f (for sinusoidal waveforms, $T_A \leq 90$ °C)
For T_A >90 °C, please refer to "General technical information", section 3.2.3.

Lead spacing 37.5 mm

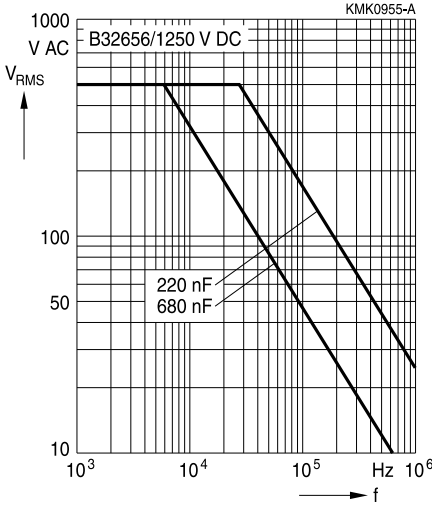
850 V DC/450 V AC



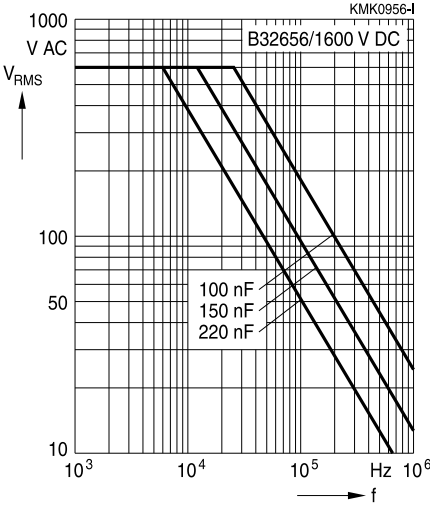
1000 V DC/500 V AC

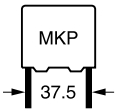


1250 V DC/500 V AC



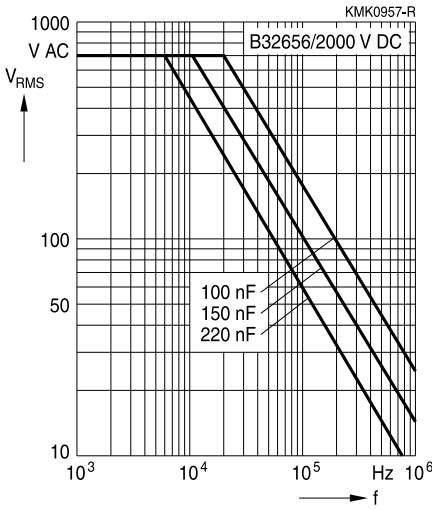
1600 V DC/600 V AC





Permissible AC voltage V_{RMS} versus frequency f (for sinusoidal waveforms, $T_A \leq 90$ °C)
For T_A >90 °C, please refer to "General technical information", section 3.2.3.

Lead spacing 37.5 mm
2000 V DC/700 V AC



Mounting guidelines

1 Soldering

1.1 Solderability of leads

The solderability of terminal leads is tested to IEC 60068-2-20, test Ta, method 1.

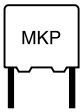
Before a solderability test is carried out, terminals are subjected to accelerated ageing (to IEC 60068-2-2, test Ba: 4 h exposure to dry heat at 155 °C). Since the ageing temperature is far higher than the upper category temperature of the capacitors, the terminal wires should be cut off from the capacitor before the ageing procedure to prevent the solderability being impaired by the products of any capacitor decomposition that might occur.

Solder bath temperature	235 ±5 °C
Soldering time	2.0 ±0.5 s
Immersion depth	2.0 +0/−0.5 mm from capacitor body or seating plane
Evaluation criteria: Visual inspection	 Wetting of wire surface by new solder ≥90%, free-flowing solder

1.2 Resistance to soldering heat

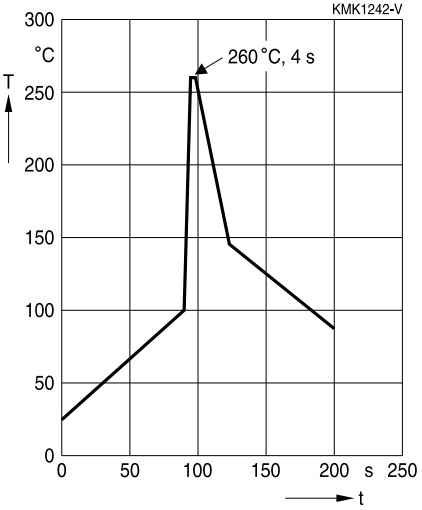
Resistance to soldering heat is tested to IEC 60068-2-20, test Tb, method 1A.
Conditions:

Series		Solder bath temperature	Soldering time
MKT	boxed (except 2.5 × 6.5 × 7.2 mm) coated uncoated (lead spacing > 10 mm)	260 ±5 °C	10 ±1 s
MFP MKP	 (lead spacing > 7.5 mm)		
MKT	boxed (case 2.5 × 6.5 × 7.2 mm)		5 ±1 s
MKP MKT	(lead spacing ≤ 7.5 mm) uncoated (lead spacing ≤ 10 mm) insulated (B32559)		< 4 s recommended soldering profile for MKT uncoated (lead spacing ≤ 10 mm) and insulated (B32559)



B32651 ... B32656

High pulse (wound)



Immersion depth	2.0 +0/−0.5 mm from capacitor body or seating plane
Shield	Heat-absorbing board, (1.5 ±0.5) mm thick, between capacitor body and liquid solder
Evaluation criteria:	
Visual inspection	No visible damage
$\Delta C/C_0$	2% for MKT/MKP/MFP 5% for EMI suppression capacitors
tan δ	As specified in sectional specification

1.3 General notes on soldering

Permissible heat exposure loads on film capacitors are primarily characterized by the upper category temperature T_{max}. Long exposure to temperatures above this type-related temperature limit can lead to changes in the plastic dielectric and thus change irreversibly a capacitor's electrical characteristics. For short exposures (as in practical soldering processes) the heat load (and thus the possible effects on a capacitor) will also depend on other factors like:

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

The overheating associated with some of these factors can usually be reduced by suitable countermeasures. For example, if a pre-heating step cannot be avoided, an additional or reinforced cooling process may possibly have to be included.

EPCOS recommends the following conditions:

- Pre-heating with a maximum temperature of 110 °C
- Temperature inside the capacitor should not exceed the following limits:
  - MKP/MFP 110 °C
  - MKT 160 °C
- When SMD components are used together with leaded ones, the leaded film capacitors should not pass into the SMD adhesive curing oven. The leaded components should be assembled after the SMD curing step.
- Leaded film capacitors are not suitable for reflow soldering.

Uncoated capacitors

For uncoated MKT capacitors with lead spacings ≤10 mm (B32560/B32561) the following measures are recommended:

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

Cautions and warnings

- Do not exceed the upper category temperature (UCT).
- Do not apply any mechanical stress to the capacitor terminals.
- Avoid any compressive, tensile or flexural stress.
- Do not move the capacitor after it has been soldered to the PC board.
- Do not pick up the PC board by the soldered capacitor.
- Do not place the capacitor on a PC board whose PTH hole spacing differs from the specified lead spacing.
- Do not exceed the specified time or temperature limits during soldering.
- Avoid external energy inputs, such as fire or electricity.
- Avoid overload of the capacitors.

The table below summarizes the safety instructions that must always be observed. A detailed description can be found in the relevant sections of the chapters "General technical information" and "Mounting guidelines".

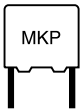
Topic	Safety information	Reference chapter "General technical information"
Storage conditions	Make sure that capacitors are stored within the specified range of time, temperature and humidity conditions.	4.5 "Storage conditions"
Flammability	Avoid external energy, such as fire or electricity (passive flammability), avoid overload of the capacitors (active flammability) and consider the flammability of materials.	5.3 "Flammability"
Resistance to vibration	Do not exceed the tested ability to withstand vibration. The capacitors are tested to IEC 60068-2-6. EPCOS offers film capacitors specially designed for operation under more severe vibration regimes such as those found in automotive applications. Consult our catalog "Film Capacitors for Automotive Electronics".	5.2 "Resistance to vibration"

Topic	Safety information	Reference chapter "Mounting guidelines"
Soldering	Do not exceed the specified time or temperature limits during soldering.	1 "Soldering"
Cleaning	Use only suitable solvents for cleaning capacitors.	2 "Cleaning"
Embedding of capacitors in finished assemblies	When embedding finished circuit assemblies in plastic resins, chemical and thermal influences must be taken into account. Caution: Consult us first, if you also wish to embed other uncoated component types!	3 "Embedding of capacitors in finished assemblies"

Symbols and terms

Symbol	English	German
α	Heat transfer coefficient	Wärmeübergangszahl
α_C	Temperature coefficient of capacitance	Temperaturkoeffizient der Kapazität
A	Capacitor surface area	Kondensatoroberfläche
β_C	Humidity coefficient of capacitance	Feuchtekoeffizient der Kapazität
C	Capacitance	Kapazität
C_R	Rated capacitance	Nennkapazität
ΔC	Absolute capacitance change	Absolute Kapazitätsänderung
$\Delta C/C$	Relative capacitance change (relative deviation of actual value)	Relative Kapazitätsänderung (relative Abweichung vom Ist-Wert)
$\Delta C/C_R$	Capacitance tolerance (relative deviation from rated capacitance)	Kapazitätstoleranz (relative Abweichung vom Nennwert)
dt	Time differential	Differentielle Zeit
Δt	Time interval	Zeitintervall
ΔT	Absolute temperature change (self-heating)	Absolute Temperaturänderung (Selbsterwärmung)
$\Delta \tan \delta$	Absolute change of dissipation factor	Absolute Änderung des Verlustfaktors
ΔV	Absolute voltage change	Absolute Spannungsänderung
dV/dt	Time differential of voltage function (rate of voltage rise)	Differentielle Spannungsänderung (Spannungsflankensteilheit)
$\Delta V/\Delta t$	Voltage change per time interval	Spannungsänderung pro Zeitintervall
E	Activation energy for diffusion	Aktivierungsenergie zur Diffusion
ESL	Self-inductance	Eigeninduktivität
ESR	Equivalent series resistance	Ersatz-Serienwiderstand
f	Frequency	Frequenz
f_1	Frequency limit for reducing permissible AC voltage due to thermal limits	Grenzfrequenz für thermisch bedingte Reduzierung der zulässigen Wechselspannung
f_2	Frequency limit for reducing permissible AC voltage due to current limit	Grenzfrequenz für strombedingte Reduzierung der zulässigen Wechselspannung
f_r	Resonant frequency	Resonanzfrequenz
F_D	Thermal acceleration factor for diffusion	Therm. Beschleunigungsfaktor zur Diffusion
F_T	Derating factor	Deratingfaktor
i	Current (peak)	Stromspitze
I_C	Category current (max. continuous current)	Kategoriestrom (max. Dauerstrom)

Symbol	English	German
I_{RMS}	(Sinusoidal) alternating current, root-mean-square value	(Sinusförmiger) Wechselstrom
i_z	Capacitance drift	Inkonstanz der Kapazität
k_0	Pulse characteristic	Impulskennwert
L_S	Series inductance	Serieninduktivität
λ	Failure rate	Ausfallrate
λ_0	Constant failure rate during useful service life	Konstante Ausfallrate in der Nutzungsphase
λ_{test}	Failure rate, determined by tests	Experimentell ermittelte Ausfallrate
P_{diss}	Dissipated power	Abgegebene Verlustleistung
P_{gen}	Generated power	Erzeugte Verlustleistung
Q	Heat energy	Wärmeenergie
ρ	Density of water vapor in air	Dichte von Wasserdampf in Luft
R	Universal molar constant for gases	Allg. Molarkonstante für Gas
R	Ohmic resistance of discharge circuit	Ohmscher Widerstand des Entladekreises
R_i	Internal resistance	Innenwiderstand
R_{ins}	Insulation resistance	Isolationswiderstand
R_P	Parallel resistance	Parallelwiderstand
R_S	Series resistance	Serienwiderstand
S	severity (humidity test)	Schärfegrad (Feuchtetest)
t	Time	Zeit
T	Temperature	Temperatur
τ	Time constant	Zeitkonstante
tan δ	Dissipation factor	Verlustfaktor
tan δ_D	Dielectric component of dissipation factor	Dielektrischer Anteil des Verlustfaktors
tan δ_P	Parallel component of dissipation factor	Parallelanteil des Verlfustfaktors
tan δ_S	Series component of dissipation factor	Serienanteil des Verlustfaktors
T_A	Ambient temperature	Umgebungstemperatur
T_{max}	Upper category temperature	Obere Kategorietemperatur
T_{min}	Lower category temperature	Untere Kategorietemperatur
t_{OL}	Operating life at operating temperature and voltage	Betriebszeit bei Betriebstemperatur und -spannung
T_{op}	Operating temperature	Beriebstemperatur
T_R	Rated temperature	Nenntemperatur
T_{ref}	Reference temperature	Referenztemperatur
t_{SL}	Reference service life	Referenz-Lebensdauer
V_{AC}	AC voltage	Wechselspannung



B32651 ... B32656

High pulse (wound)

Symbol	English	German
V_C	Category voltage	Kategoriespannung
$V_{C,RMS}$	Category AC voltage	(Sinusförmige) Kategorie-Wechselspannung
V_{CD}	Corona-discharge onset voltage	Teilentlade-Einsatzspannung
V_{ch}	Charging voltage	Ladespannung
V_{DC}	DC voltage	Gleichspannung
V_{FB}	Fly-back capacitor voltage	Spannung (Flyback)
V_i	Input voltage	Eingangsspannung
V_o	Output voltage	Ausgangssspannung
V_{op}	Operating voltage	Betriebsspannung
V_p	Peak pulse voltage	Impuls-Spitzenspannung
V_{pp}	Peak-to-peak voltage Impedance	Spannungshub
V_R	Rated voltage	Nennspannung
$\hat{v}_R$	Amplitude of rated AC voltage	Amplitude der Nenn-Wechselspannung
V_{RMS}	(Sinusoidal) alternating voltage, root-mean-square value	(Sinusförmige) Wechselspannung
V_{SC}	S-correction voltage	Spannung bei Anwendung "S-correction"
V_{sn}	Snubber capacitor voltage	Spannung bei Anwendung "Beschaltung"
Z	Impedance	Scheinwiderstand
e	Lead spacing	Rastermaß

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.**
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