



## Film Capacitors

### Metallized Polyester Film Capacitors (MKT)

**Series/Type:** B32591 ... B32594

**Date:** August 2004

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**Typical applications**

- Compact fluorescent lamps (CFL)
- Generators

**Climatic**

- Max. operating temperature: 125 °C
- Climatic category (IEC 60068-1): 55/100/56

**Features**

- High pulse strength
- High contact reliability

**Construction**

- Dielectric: polyethylene terephthalate (polyester, PET)
- Stacked-film technology for lead spacing 10 and 15 mm (100 ... 400 VDC); Wound capacitor technology for lead spacing 10 and 15 mm (630 VDC) as well as for lead spacing 22.5 and 27.5 mm
- Epoxy resin coating (UL 94 V-0)

**Terminals**

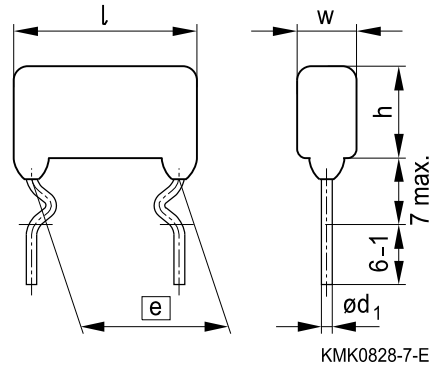
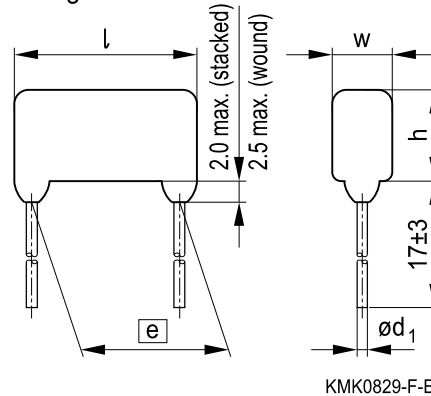
- Crimped wire leads, lead-free tinned, lead length 6 – 1 mm or min. 20 mm
- Straight wire leads, lead-free tinned, lead length 17 ± 3 mm
- Different lead spacings (reduced and enlarged) available, lead length 6 – 1 mm

**Marking**

Manufacturer's logo,  
 rated capacitance (coded),  
 capacitance tolerance (code letter),  
 rated DC voltage,  
 additional for lead spacing ≥ 15 mm:  
 style, type, date of manufacture (coded)

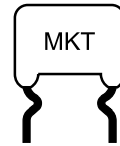
**Delivery mode**

Bulk (untaped)  
 Taped (Ammo pack or reel) for lead spacing ≤ 22.5 mm.  
 For notes on taping, refer to chapter "Taping and packing".

**Dimensional drawing**
**Crimped leads**

**Straight leads**

**Dimensions in mm**

Lead spacing $e \pm 0.8$	Lead diameter $d_1$	Type
10.0	0.6 <sup>1)</sup>	B32591
15.0	0.6	B32592
22.5	0.8	B32593
27.5	0.8	B32594





1) 0.5 mm for capacitor width  $w \leq 5$  mm

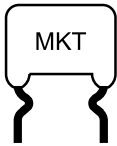

**Overview of available types**

Lead spacing	10.0 mm				15.0 mm				22.5 mm			
Type	B32591				B32592				B32593			
Page	5				6				7			
Technology	s	s	s	w	s	s	s	w	w	w	w	w
$V_R$ (VDC)	100	250	400	630	100	250	400	630	100	250	400	630
$V_{rms}$ (VAC)	63	160	200	200	63	160	200	200	63	160	200	200
$C_R$ ( $\mu$ F)												
0.010												
0.015												
0.022												
0.033												
0.047												
0.068												
0.10												
0.15												
0.22												
0.33												
0.47												
0.68												
1.0												
1.5												
2.2												
3.3												
4.7												
6.8												

Technology: s = Stacked-film technology / w = Wound capacitor technology

**Lead configurations**

Series	Standard	Reduced	Enlarged	Straight
				
B32591	10 mm	5 / 7.5 mm	–	10 mm
B32592	15 mm	7.5 / 10 / 12.5 mm	17.5 mm	15 mm
B32593	22.5 mm	17.5 / 20 mm	25 mm	22.5 mm
B32594	27.5 mm	25 mm	–	27.5 mm



**B32591 ... B32594**





**General purpose (stacked/wound)**

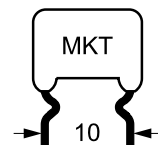
### Overview of available types

Lead spacing	27.5 mm			
Type	B32594			
Page	8			
Technology	w	w	w	w
$V_R$ (VDC)	100	250	400	630
$V_{rms}$ (VAC)	63	160	200	220
$C_R$ ( $\mu$ F)				
0.33				
0.47				
0.68				
1.0				
1.5				
2.2				
3.3				
4.7				
6.8				
10				

Technology: s = Stacked-film technology / w = Wound capacitor technology

### Lead configurations

Series	Standard	Reduced	Enlarged	Straight
				
B32591	10 mm	5 / 7.5 mm	–	10 mm
B32592	15 mm	7.5 / 10 / 12.5 mm	17.5 mm	15 mm
B32593	22.5 mm	17.5 / 20 mm	25 mm	22.5 mm
B32594	27.5 mm	25 mm	–	27.5 mm


**Ordering codes and packing units (lead spacing 10 mm)**

$V_R$ VDC	$V_{rms}$ $f \leq 60$ Hz VAC	$C_R$ $\mu F$	Max. dimensions $w \times h \times l$ mm	Ordering code (composition see below)	Ammo pack pcs./unit	Reel pcs./unit	Untaped pcs./unit
100	63	0.10	5.0 × 9.0 × 13.0	B32591C1104+***	900	1500	1500
		0.15	5.0 × 9.0 × 13.0	B32591C1154+***	900	1500	1500
		0.22	5.0 × 9.0 × 13.0	B32591C1224+***	900	1500	1500
		0.33	5.5 × 9.0 × 13.0	B32591C1334+***	680	1300	1500
		0.47	6.0 × 9.5 × 13.0	B32591C1474+***	600	1300	1000
		0.68	7.0 × 10.5 × 13.0	B32591C1684+***	500	1000	1000
		1.0	8.0 × 15.0 × 13.0	B32591C1105+***	450	900	500
250	160	0.033	5.0 × 9.0 × 13.0	B32591C3333+***	900	1500	1500
		0.047	5.0 × 9.0 × 13.0	B32591C3473+***	900	1500	1500
		0.068	5.0 × 9.0 × 13.0	B32591C3683+***	900	1500	1500
		0.10	5.0 × 9.0 × 13.0	B32591C3104+***	900	1500	1000
		0.15	5.5 × 10.0 × 13.0	B32591C3154+***	680	1300	1000
		0.22	6.0 × 10.5 × 13.0	B32591C3224+***	680	1300	1000
		0.33	6.5 × 11.0 × 13.0	B32591C3334+***	580	1100	1000
		0.47	8.0 × 13.5 × 13.0	B32591C3474+***	450	900	500
400	200	0.010	5.0 × 9.0 × 13.0	B32591C6103+***	830	1500	1500
		0.015	5.0 × 9.0 × 13.0	B32591C6153+***	830	1500	1500
		0.022	5.0 × 9.0 × 13.0	B32591C6223+***	830	1500	1500
		0.033	5.0 × 9.0 × 13.0	B32591C6333+***	830	1500	1500
		0.047	5.0 × 10.5 × 13.0	B32591C6473+***	830	1500	1000
		0.068	5.5 × 10.5 × 13.0	B32591C6683+***	830	1300	1000
		0.10	6.0 × 11.5 × 13.0	B32591C6104+***	780	1300	1000
630	200	0.010 ▽	6.5 × 10.5 × 13.0	B32591C8103+***	600	1100	500
		0.015 ▽	6.5 × 10.5 × 13.0	B32591C8153+***	600	1100	500
		0.022 ▽	7.5 × 11.5 × 13.0	B32591C8223+***	500	1000	500

▽ Wound capacitor technology

Further E series and intermediate capacitance values on request.

**Composition of ordering code**

+ = Capacitance tolerance code:

M = ±20%

K = ±10%

J = ±5%

\*\*\* = Packaging code:

289 = Ammo pack

189 = Reel

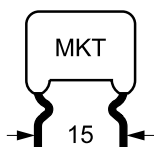
010 = Untaped (lead length 6 – 1 mm)

011 = Untaped (lead length min. 20 mm)

008 = Untaped (straight, lead length 17±3 mm)

Packaging codes for further lead configurations (untaped):

Reduced lead configuration (lead length 6 – 1 mm)	Reduced	Reduced
Lead spacing (mm) / Packaging code	5 / 035	7.5 / 030


**B32592**
**General purpose (stacked/wound)**
**Ordering codes and packing units (lead spacing 15 mm)**

$V_R$ VDC	$V_{rms}$ $f \leq 60$ Hz VAC	$C_R$ $\mu F$	Max. dimensions $w \times h \times l$ mm	Ordering code (composition see below)	Ammo pack pcs./unit	Reel pcs./unit	Untaped pcs./unit
100	63	0.47	5.0 × 9.5 × 18.0	B32592C1474+***	1170	1500	1000
		0.68	5.5 × 10.5 × 18.0	B32592C1684+***	1000	1300	1000
		1.0	6.5 × 10.5 × 18.0	B32592C1105+***	830	1100	500
		1.5	7.5 × 14.0 × 18.0	B32592C1155+***	780	930	500
		2.2	9.0 × 14.0 × 18.0	B32592C1225+***	640	830	250
		3.3	11.0 × 17.5 × 18.0	B32592C1335+***	500	640	250
		4.7	11.0 × 17.5 × 18.0	B32592C1475+***	500	640	250
250	160	0.22	5.5 × 9.0 × 18.0	B32592C3224+***	1000	1300	1000
		0.33	6.0 × 10.0 × 18.0	B32592C3334+***	930	1300	500
		0.47	7.0 × 11.0 × 18.0	B32592C3474+***	780	1000	500
		0.68	8.0 × 11.5 × 18.0	B32592C3684+***	680	900	500
		1.0	9.5 × 13.0 × 18.0	B32592C3105+***	580	780	500
400	200	0.068	5.0 × 9.0 × 18.0	B32592C6683+***	1170	1500	1000
		0.10	5.0 × 10.0 × 18.0	B32592C6104+***	1170	1500	1000
		0.15	6.0 × 10.5 × 18.0	B32592C6154+***	930	1300	1000
		0.22	7.0 × 11.0 × 18.0	B32592C6224+***	780	1000	500
		0.33	8.0 × 12.0 × 18.0	B32592C6334+***	680	900	500
		0.47	9.5 × 13.0 × 18.0	B32592C6474+***	580	780	250
		0.68	10.0 × 16.0 × 18.0	B32592C6684+***	550	700	250
630	200	0.033 ▽	6.5 × 10.5 × 18.0	B32592C8333+***	830	1100	1000
		0.047 ▽	7.0 × 12.0 × 18.0	B32592C8473+***	780	1000	500
		0.068 ▽	7.5 × 14.0 × 18.0	B32592C8683+***	780	930	500
		0.10 ▽	8.5 × 15.0 × 18.0	B32592C8104+***	640	830	500

▽ Wound capacitor technology

Further E series and intermediate capacitance values on request.

**Composition of ordering code**

+ = Capacitance tolerance code:

M = ±20%

K = ±10%

J = ±5%

\*\*\* = Packaging code:

289 = Ammo pack

189 = Reel

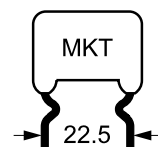
010 = Untaped (lead length 6 – 1 mm)

011 = Untaped (lead length min. 20 mm)

008 = Untaped (straight, lead length 17±3 mm)

Packaging codes for further lead configurations (untaped):

Lead configuration (lead length 6 – 1 mm)	Reduced	Reduced	Reduced	Enlarged
Lead spacing (mm)	7.5	10	12.5	17.5
Packaging code	030	040	050	060


**Ordering codes and packing units (lead spacing 22.5 mm)**

$V_R$ VDC	$V_{rms}$ $f \leq 60$ Hz VAC	$C_R$ $\mu F$	Max. dimensions $w \times h \times l$ mm	Ordering code (composition see below)	Ammo pack pcs./unit	Reel pcs./unit	Untaped pcs./unit
100	63	1.5	7.0 × 14.0 × 26.5	B32593C1155+***	500	700	500
		2.2	8.5 × 15.0 × 26.5	B32593C1225+***	450	600	500
		3.3	10.0 × 16.5 × 26.5	B32593C1335+***	380	540	200
		4.7	11.5 × 18.5 × 26.5	B32593C1475+***	300	450	200
		6.8	13.0 × 21.5 × 26.5	B32593C1685+***	280	380	200
250	160	0.68	7.0 × 13.0 × 26.5	B32593C3684+***	500	700	500
		1.0	7.0 × 15.5 × 26.5	B32593C3105+***	500	700	500
		1.5	8.5 × 17.0 × 26.5	B32593C3155+***	400	580	200
		2.2	10.0 × 18.5 × 26.5	B32593C3225+***	350	500	200
400	200	0.22	6.5 × 13.0 × 26.5	B32593C6224+***	550	800	500
		0.33	7.0 × 14.0 × 26.5	B32593C6334+***	550	800	500
		0.47	7.0 × 16.5 × 26.5	B32593C6474+***	500	700	500
630	200	0.10	7.0 × 14.0 × 26.5	B32593C8104+***	500	700	500
		0.15	7.5 × 16.0 × 26.5	B32593C8154+***	450	650	250
		0.22	8.5 × 17.0 × 26.5	B32593C8224+***	400	580	250

Further E series and intermediate capacitance values on request.

**Composition of ordering code**

+ = Capacitance tolerance code:

M = ±20%

K = ±10%

J = ±5%

\*\*\* = Packaging code:

289 = Ammo pack

189 = Reel

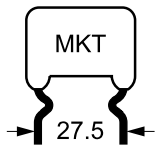
010 = Untaped (lead length 6 – 1 mm)

011 = Untaped (lead length min. 20 mm)

008 = Untaped (straight, lead length 17±3 mm)

Packaging codes for further lead configurations (untaped):

Lead configuration (lead length 6 – 1 mm)	Reduced	Reduced	Enlarged
Lead spacing (mm)	17.5	20	25
Packaging code	060	070	080



**B32594**

**General purpose (wound)**

**Ordering codes and packing units (lead spacing 27.5 mm)**

$V_R$ VDC	$V_{rms}$ $f \leq 60$ Hz VAC	$C_R$ $\mu F$	Max. dimensions $w \times h \times l$ mm	Ordering code (composition see below)	Untaped pcs./unit
100	63	4.7	$10.5 \times 18.5 \times 31.5$	B32594C1475+***	200
		6.8	$12.5 \times 21.0 \times 31.5$	B32594C1685+***	200
		10	$17.0 \times 22.0 \times 31.5$	B32594C1106+***	200
250	160	1.5	$8.5 \times 16.0 \times 31.5$	B32594C3155+***	500
		2.2	$10.0 \times 17.5 \times 31.5$	B32594C3225+***	500
		3.3	$12.0 \times 19.5 \times 31.5$	B32594C3335+***	200
		4.7	$14.0 \times 21.5 \times 31.5$	B32594C3475+***	200
		6.8	$15.0 \times 25.0 \times 31.5$	B32594C3685+***	200
400	200	0.68	$8.0 \times 16.0 \times 31.5$	B32594C6684+***	250
		1.0	$9.5 \times 18.0 \times 31.5$	B32594C6105+***	250
		1.5	$11.5 \times 20.0 \times 31.5$	B32594C6155+***	250
		2.2	$13.5 \times 22.0 \times 31.5$	B32594C6225+***	200
630	220	0.33	$8.0 \times 15.0 \times 31.5$	B32594C8334+***	250
		0.47	$10.0 \times 16.0 \times 31.5$	B32594C8474+***	200
		0.68	$10.5 \times 18.0 \times 31.5$	B32594C8684+***	200

Further E series and intermediate capacitance values on request.

**Composition of ordering code**

+ = Capacitance tolerance code:

M =  $\pm 20\%$

K =  $\pm 10\%$

J =  $\pm 5\%$

\*\*\* = Packaging code:

010 = Untaped (lead length 6 – 1 mm)

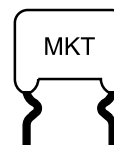
011 = Untaped (lead length min. 20 mm)

008 = Untaped (straight, lead length  $17 \pm 3$  mm)

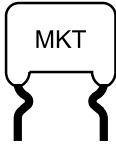
Packaging codes for further lead configurations (untaped):

Lead configuration (lead length 6 – 1 mm)	Reduced
Lead spacing (mm)	25
Packaging code	090




**Technical data**

Operating temperature range	Max. operating temperature $T_{op,max}$ +125 °C Upper category temperature $T_{max}$ +100 °C Lower category temperature $T_{min}$ -55 °C Rated temperature $T_R$ +85 °C			
Dissipation factor $\tan \delta$ (in $10^{-3}$ ) at 20 °C (upper limit values)	at	$C_R \leq 0.1 \mu F$	$0.1 \mu F < C_R \leq 1 \mu F$	$C_R > 1 \mu F$
	1 kHz	8	10	10
	10 kHz	15	20	—
	100 kHz	30	—	—
Insulation resistance $R_{ins}$ or time constant $\tau = C_R \cdot R_{ins}$ at 20 °C, rel. humidity $\leq 65\%$ (minimum as-delivered values)	$V_R$	$C_R \leq 0.33 \mu F$		$C_R > 0.33 \mu F$
	100 VDC $\geq 250$ VDC	3750 M $\Omega$ 7500 M $\Omega$		1250 s 2500 s
DC test voltage	1.4 · $V_R$ , 2 s			
Category voltage $V_C$ (continuous operation with $V_{DC}$ or $V_{AC}$ at $f \leq 60$ Hz)	$T_A$ (°C)	DC voltage derating	AC voltage derating	
	$T_A \leq 85$ $85 < T_A \leq 100$	$V_C = V_R$ $V_C = V_R \cdot (165 - T_A)/80$	$V_{C,rms} = V_{rms}$ $V_{C,rms} = V_{rms} \cdot (165 - T_A)/80$	
Operating voltage $V_{op}$ for short operating periods ( $V_{DC}$ or $V_{AC}$ at $f \leq 60$ Hz)	$T_A$ (°C)	DC voltage (max. hours)	AC voltage (max. hours)	
	$T_A \leq 100$ $100 < T_A \leq 125$	$V_{op} = 1.25 \cdot V_C$ (2000 h) $V_{op} = 1.25 \cdot V_C$ (1000 h)	$V_{op} = 1.0 \cdot V_{C,rms}$ (2000 h) $V_{op} = 1.0 \cdot V_{C,rms}$ (1000 h)	
Damp heat test	56 days/40 °C/93% relative humidity			
Limit values after damp heat test	Capacitance change $ \Delta C/C $		$\leq 5\%$	
	Dissipation factor change $\Delta \tan \delta$		$\leq 5 \cdot 10^{-3}$ (at 10 kHz)	
	Insulation resistance $R_{ins}$ or time constant $\tau = C_R \cdot R_{ins}$		$\geq 50\%$ of minimum as-delivered values	
Reliability: Failure rate $\lambda$ Service life $t_{SL}$	2 fit ( $\leq 2 \cdot 10^{-9}/h$ ) at 0.5 · $V_R$ , 40 °C 200 000 h at 1.0 · $V_R$ , 40 °C For conversion to other operating conditions and temperatures, refer to chapter "Quality assurance", page .			
Failure criteria: Total failure Failure due to variation of parameters	Short circuit or open circuit Capacitance change $ \Delta C/C $ > 10% Dissipation factor $\tan \delta$ > 2 · upper limit value Insulation resistance $R_{ins}$ < 150 M $\Omega$ ( $C_R \leq 0.33 \mu F$ ) or time constant $\tau = C_R \cdot R_{ins}$ < 50 s ( $C_R > 0.33 \mu F$ )			



B32591 ... B32594

General purpose (stacked/wound)

### Pulse handling capability

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

"k<sub>0</sub>" represents the maximum permissible pulse characteristic of the waveform applied to the capacitor, expressed in V<sup>2</sup>/ $\mu$ s.

Note:

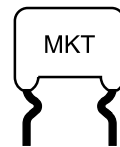
The values of dV/dt and k<sub>0</sub> provided below must not be exceeded in order to avoid damaging the capacitor.

### dV/dt values

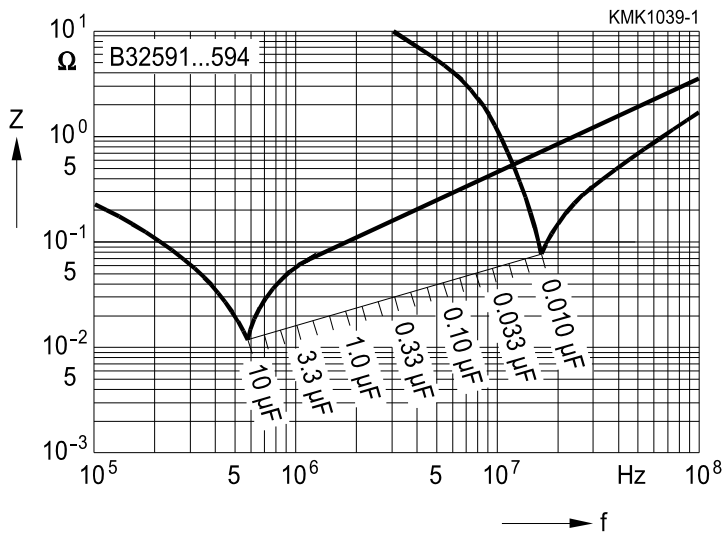
Lead spacing		10 mm		15 mm		22.5 mm	27.5 mm
Technology		Stacked	Wound	Stacked	Wound	Wound	Wound
V <sub>R</sub> VDC	V <sub>rms</sub> VAC	dV/dt in V/ $\mu$ s					
100	63	75	–	50	–	2.5	2
250	160	150	–	100	–	4	3
400	200	175	–	125	–	7	5
630	200	–	20	–	15	10	–
630	220	–	–	–	–	–	8

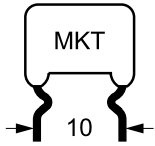
### k<sub>0</sub> values

Lead spacing		10 mm		15 mm		22.5 mm	27.5 mm
Technology		Stacked	Wound	Stacked	Wound	Wound	Wound
V <sub>R</sub> VDC	V <sub>rms</sub> VAC	k <sub>0</sub> in V <sup>2</sup> / $\mu$ s					
100	63	15 000	–	10 000	–	500	400
250	160	75 000	–	50 000	–	2 000	1 500
400	200	140 000	–	100 000	–	5 600	4 000
630	200	–	25 000	–	19 000	12 600	–
630	220	–	–	–	–	–	10 000



**Impedance Z versus frequency f**  
(typical values)





**B32591**

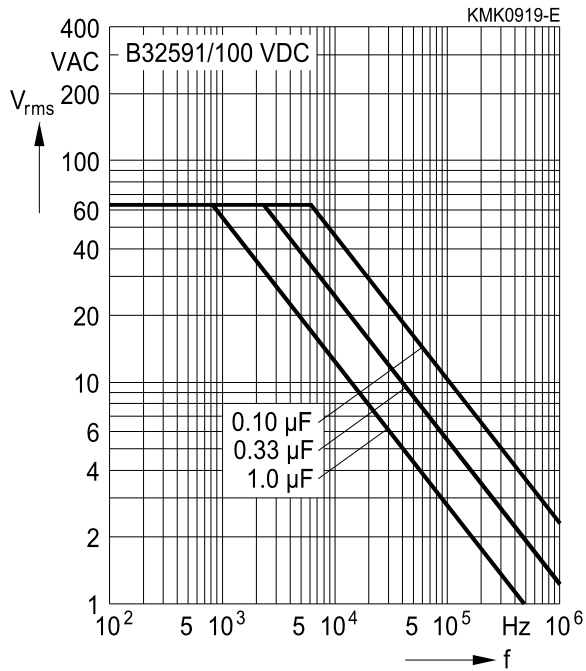
**General purpose (stacked/wound)**

**Permissible AC voltage  $V_{rms}$  versus frequency  $f$  (for sinusoidal waveforms,  $T_A \leq 55^\circ\text{C}$ )**

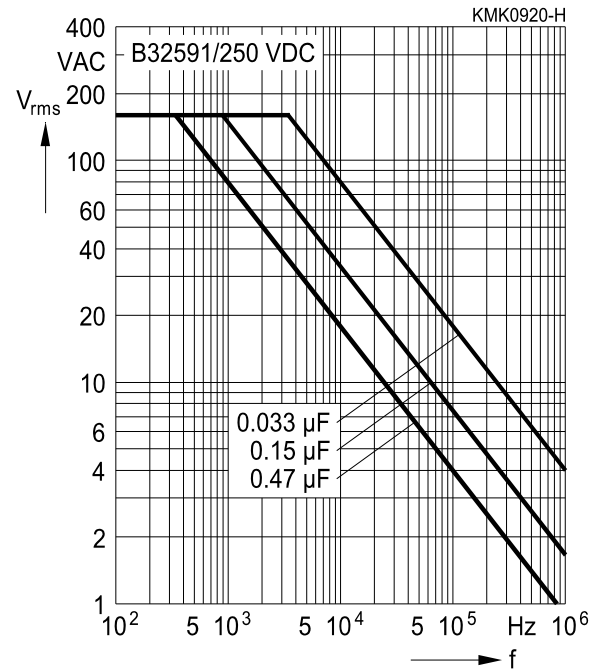
For  $T_A > 55^\circ\text{C}$ , please refer to "General technical information", section 3.2.3.

**Lead spacing 10 mm**

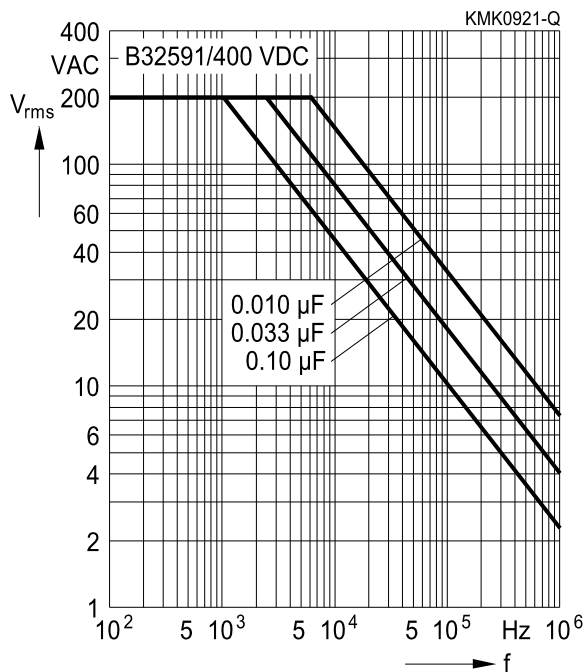
**100 VDC/63 VAC**



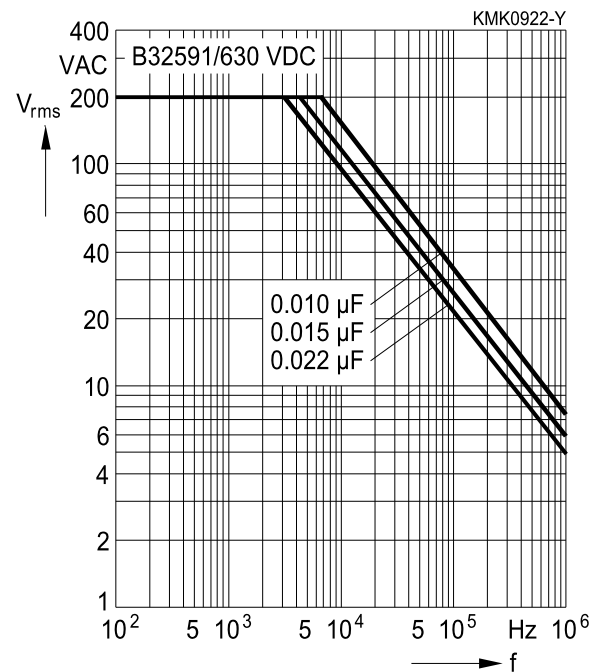
**250 VDC/160 VAC**

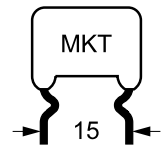


**400 VDC/200 VAC**



**630 VDC/200 VAC**



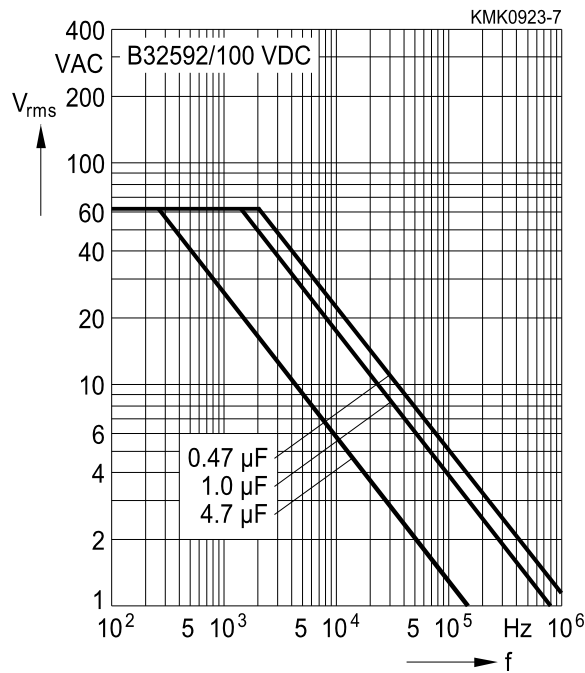


**Permissible AC voltage  $V_{rms}$  versus frequency  $f$  (for sinusoidal waveforms,  $T_A \leq 55^\circ C$ )**

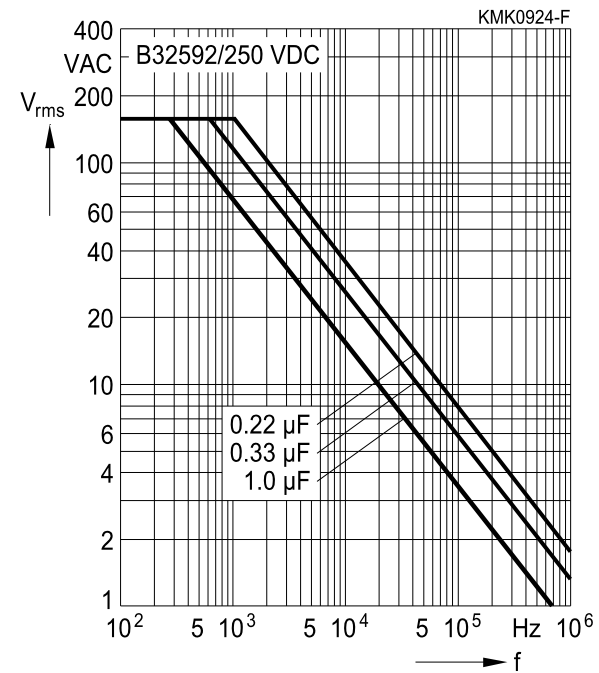
For  $T_A > 55^\circ C$ , please refer to "General technical information", section 3.2.3.

**Lead spacing 15 mm**

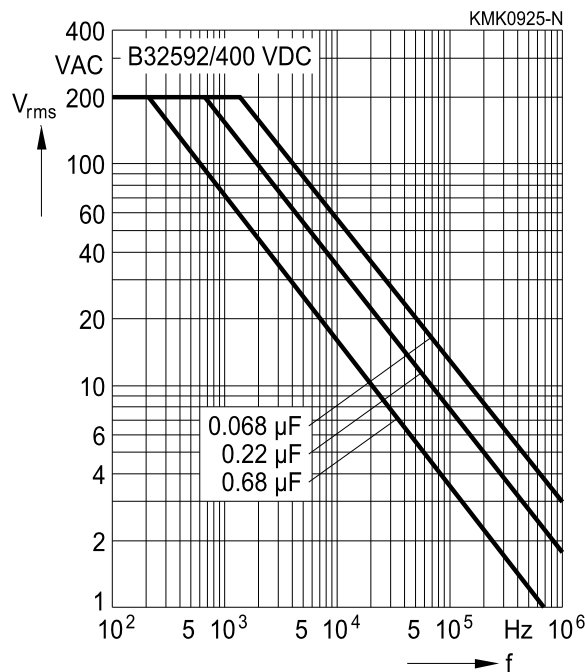
100 VDC/63 VAC



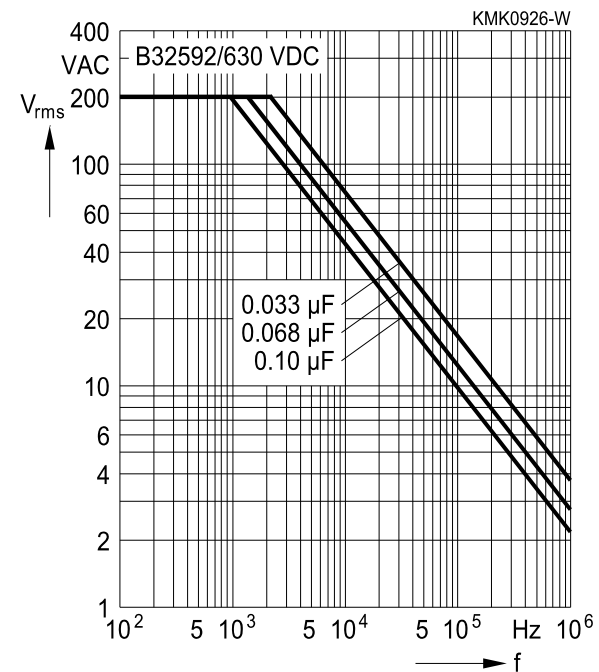
250 VDC/160 VAC

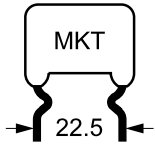


400 VDC/200 VAC



630 VDC/200 VAC





**B32593**

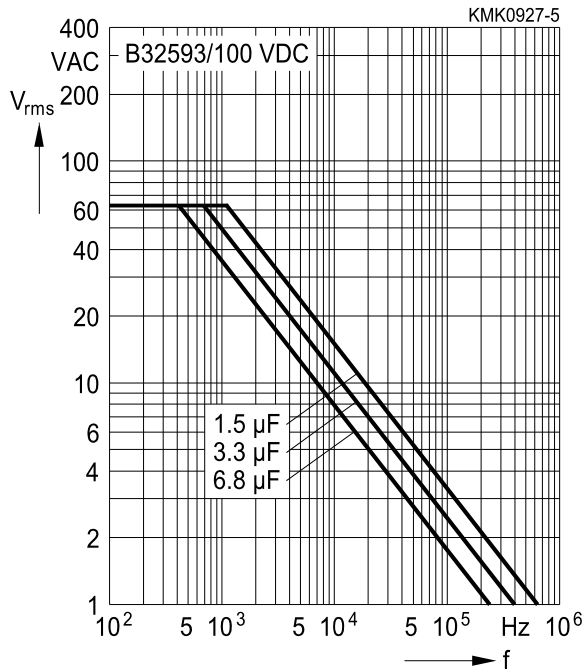
**General purpose (wound)**

**Permissible AC voltage  $V_{rms}$  versus frequency  $f$  (for sinusoidal waveforms,  $T_A \leq 55^\circ\text{C}$ )**

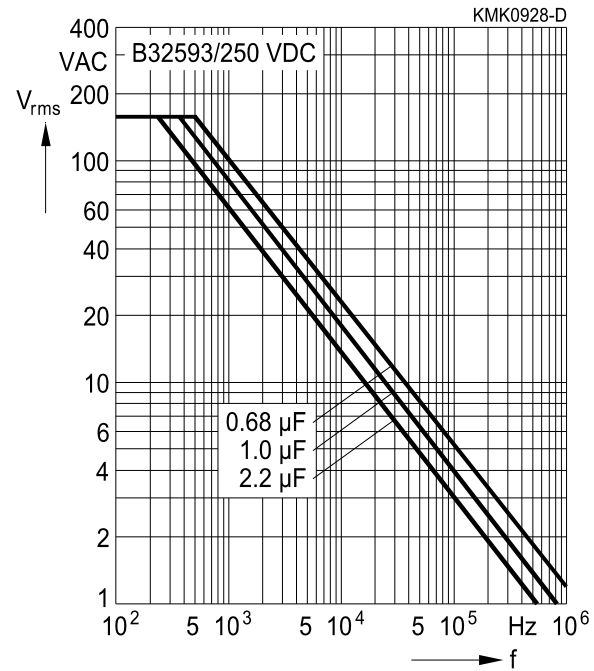
For  $T_A > 55^\circ\text{C}$ , please refer to "General technical information", section 3.2.3.

**Lead spacing 22.5 mm**

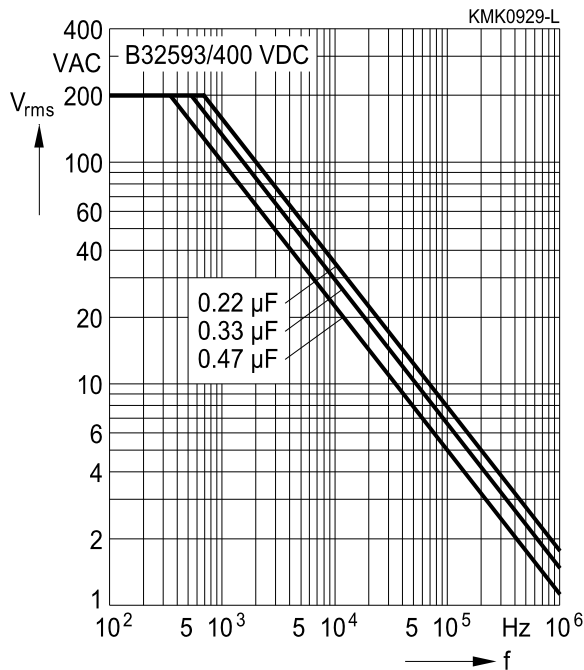
**100 VDC/63 VAC**



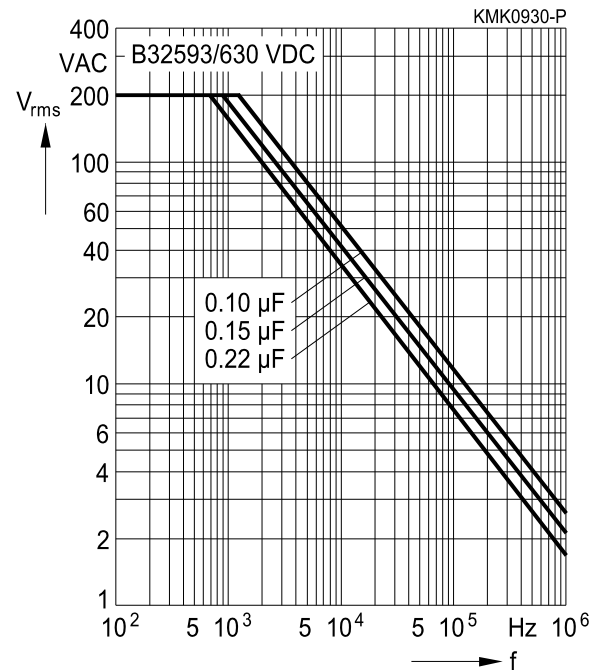
**250 VDC/160 VAC**

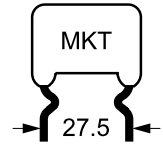


**400 VDC/200 VAC**



**630 VDC/200 VAC**



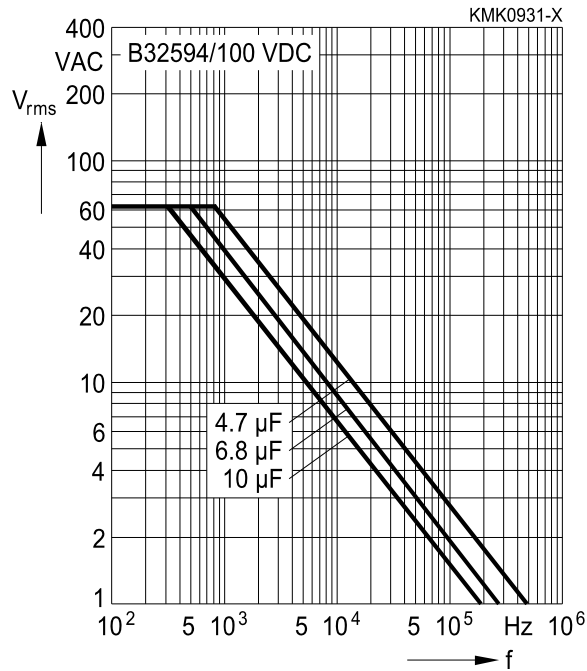


**Permissible AC voltage  $V_{rms}$  versus frequency  $f$  (for sinusoidal waveforms,  $T_A \leq 55^\circ\text{C}$ )**

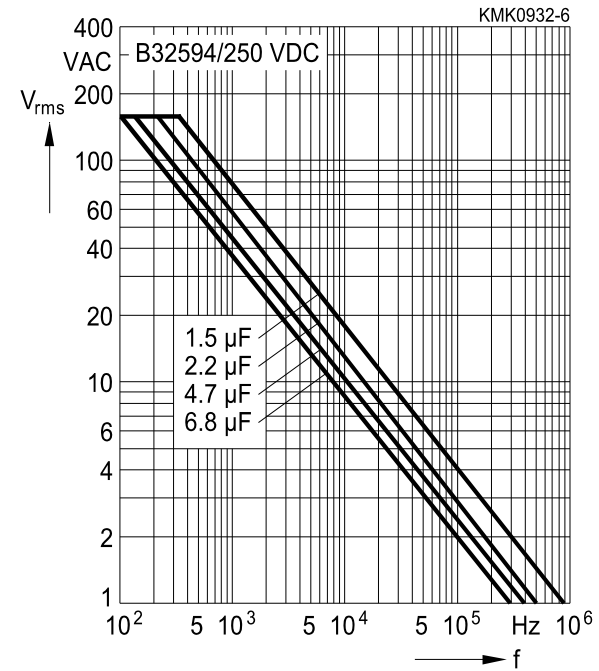
For  $T_A > 55^\circ\text{C}$ , please refer to "General technical information", section 3.2.3.

**Lead spacing 27.5 mm**

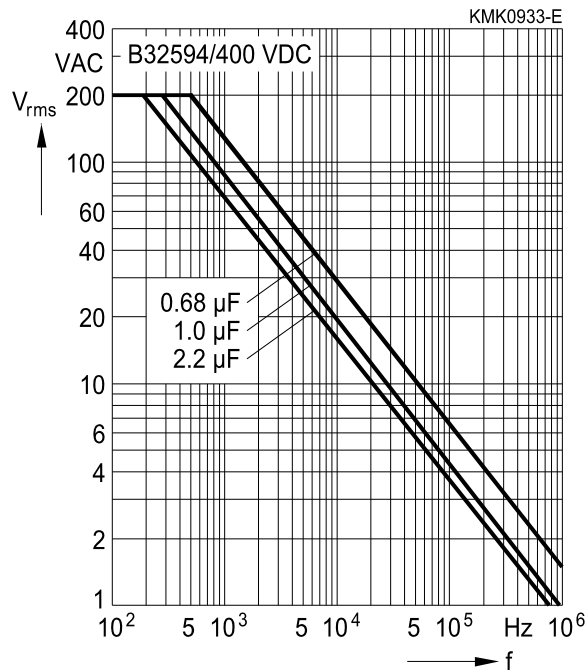
100 VDC/63 VAC



250 VDC/160 VAC



400 VDC/200 VAC



630 VDC/220 VAC

