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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

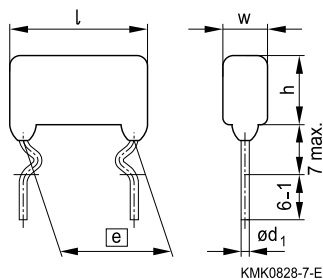
Manufacturer's logo,
rated capacitance (coded),
capacitance tolerance (code letter),
rated DC voltage,
additional for lead spacing ≥15 mm:
style, type, date of manufacture (coded)

Delivery mode

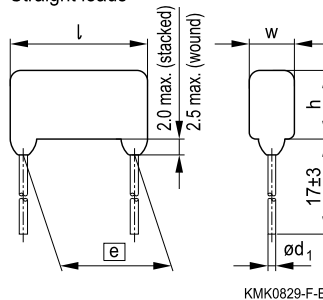
Bulk (untaped)
Taped (Ammo pack or reel) for lead spacing ≤22.5 mm.
For notes on taping, refer to chapter "Taping and packing".

Dimensional drawing

Crimped leads



Straight leads



Dimensions in mm

Lead spacing $e \pm 0.8$	Lead diameter d_1	Type
10.0	0.6 ¹⁾	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 (μF)												
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 (μF)				
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

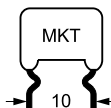
Lead configurations

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



B32591

General purpose (stacked/wound)



Ordering codes and packing units (lead spacing 10 mm)

V_R	V_{rms} $f \leq 60$ Hz VAC	C_R μF	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	$5.0 \times 9.0 \times 13.0$	B32591C1104+***	900	1500	1500
		0.15	$5.0 \times 9.0 \times 13.0$	B32591C1154+***	900	1500	1500
		0.22	$5.0 \times 9.0 \times 13.0$	B32591C1224+***	900	1500	1500
		0.33	$5.5 \times 9.0 \times 13.0$	B32591C1334+***	680	1300	1500
		0.47	$6.0 \times 9.5 \times 13.0$	B32591C1474+***	600	1300	1000
		0.68	$7.0 \times 10.5 \times 13.0$	B32591C1684+***	500	1000	1000
		1.0	$8.0 \times 15.0 \times 13.0$	B32591C1105+***	450	900	500
250	160	0.033	$5.0 \times 9.0 \times 13.0$	B32591C3333+***	900	1500	1500
		0.047	$5.0 \times 9.0 \times 13.0$	B32591C3473+***	900	1500	1500
		0.068	$5.0 \times 9.0 \times 13.0$	B32591C3683+***	900	1500	1500
		0.10	$5.0 \times 9.0 \times 13.0$	B32591C3104+***	900	1500	1000
		0.15	$5.5 \times 10.0 \times 13.0$	B32591C3154+***	680	1300	1000
		0.22	$6.0 \times 10.5 \times 13.0$	B32591C3224+***	680	1300	1000
		0.33	$6.5 \times 11.0 \times 13.0$	B32591C3334+***	580	1100	1000
400	200	0.47	$8.0 \times 13.5 \times 13.0$	B32591C3474+***	450	900	500
		0.010	$5.0 \times 9.0 \times 13.0$	B32591C6103+***	830	1500	1500
		0.015	$5.0 \times 9.0 \times 13.0$	B32591C6153+***	830	1500	1500
		0.022	$5.0 \times 9.0 \times 13.0$	B32591C6223+***	830	1500	1500
		0.033	$5.0 \times 9.0 \times 13.0$	B32591C6333+***	830	1500	1500
		0.047	$5.0 \times 10.5 \times 13.0$	B32591C6473+***	830	1500	1000
		0.068	$5.5 \times 10.5 \times 13.0$	B32591C6683+***	830	1300	1000
630	200	0.10	$6.0 \times 11.5 \times 13.0$	B32591C6104+***	780	1300	1000
		0.010 ▽	$6.5 \times 10.5 \times 13.0$	B32591C8103+***	600	1100	500
		0.015 ▽	$6.5 \times 10.5 \times 13.0$	B32591C8153+***	600	1100	500
		0.022 ▽	$7.5 \times 11.5 \times 13.0$	B32591C8223+***	500	1000	500

▽ Wound capacitor technology

Further E series and intermediate capacitance values on request.

Composition of ordering code

+ = Capacitance tolerance code:

M = $\pm 20\%$

K = $\pm 10\%$

J = $\pm 5\%$

*** = Packaging code:

289 = Ammo pack

189 = Reel

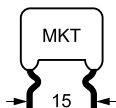
010 = Untaped (lead length 6 – 1 mm)

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	V_{rms} $f \leq 60$ Hz VDC	C_R μF	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	$5.0 \times 9.5 \times 18.0$	B32592C1474+***	1170	1500	1000
		0.68	$5.5 \times 10.5 \times 18.0$	B32592C1684+***	1000	1300	1000
		1.0	$6.5 \times 10.5 \times 18.0$	B32592C1105+***	830	1100	500
		1.5	$7.5 \times 14.0 \times 18.0$	B32592C1155+***	780	930	500
		2.2	$9.0 \times 14.0 \times 18.0$	B32592C1225+***	640	830	250
		3.3	$11.0 \times 17.5 \times 18.0$	B32592C1335+***	500	640	250
		4.7	$11.0 \times 17.5 \times 18.0$	B32592C1475+***	500	640	250
250	160	0.22	$5.5 \times 9.0 \times 18.0$	B32592C3224+***	1000	1300	1000
		0.33	$6.0 \times 10.0 \times 18.0$	B32592C3334+***	930	1300	500
		0.47	$7.0 \times 11.0 \times 18.0$	B32592C3474+***	780	1000	500
		0.68	$8.0 \times 11.5 \times 18.0$	B32592C3684+***	680	900	500
		1.0	$9.5 \times 13.0 \times 18.0$	B32592C3105+***	580	780	500
400	200	0.068	$5.0 \times 9.0 \times 18.0$	B32592C6683+***	1170	1500	1000
		0.10	$5.0 \times 10.0 \times 18.0$	B32592C6104+***	1170	1500	1000
		0.15	$6.0 \times 10.5 \times 18.0$	B32592C6154+***	930	1300	1000
		0.22	$7.0 \times 11.0 \times 18.0$	B32592C6224+***	780	1000	500
		0.33	$8.0 \times 12.0 \times 18.0$	B32592C6334+***	680	900	500
		0.47	$9.5 \times 13.0 \times 18.0$	B32592C6474+***	580	780	250
		0.68	$10.0 \times 16.0 \times 18.0$	B32592C6684+***	550	700	250
630	200	0.033 ▽	$6.5 \times 10.5 \times 18.0$	B32592C8333+***	830	1100	1000
		0.047 ▽	$7.0 \times 12.0 \times 18.0$	B32592C8473+***	780	1000	500
		0.068 ▽	$7.5 \times 14.0 \times 18.0$	B32592C8683+***	780	930	500
		0.10 ▽	$8.5 \times 15.0 \times 18.0$	B32592C8104+***	640	830	500

▽ Wound capacitor technology

Further E series and intermediate capacitance values on request.

Composition of ordering code

+ = Capacitance tolerance code:

M = $\pm 20\%$

K = $\pm 10\%$

J = $\pm 5\%$

*** = 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)

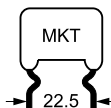
Packaging codes for further lead configurations (untaped):

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



B32593

General purpose (wound)



Ordering codes and packing units (lead spacing 22.5 mm)

V_R	V_{rms} $f \leq 60$ Hz VDC VAC	C_R μF	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	$7.0 \times 14.0 \times 26.5$	B32593C1155+***	500	700	500
		2.2	$8.5 \times 15.0 \times 26.5$	B32593C1225+***	450	600	500
		3.3	$10.0 \times 16.5 \times 26.5$	B32593C1335+***	380	540	200
		4.7	$11.5 \times 18.5 \times 26.5$	B32593C1475+***	300	450	200
		6.8	$13.0 \times 21.5 \times 26.5$	B32593C1685+***	280	380	200
250	160	0.68	$7.0 \times 13.0 \times 26.5$	B32593C3684+***	500	700	500
		1.0	$7.0 \times 15.5 \times 26.5$	B32593C3105+***	500	700	500
		1.5	$8.5 \times 17.0 \times 26.5$	B32593C3155+***	400	580	200
		2.2	$10.0 \times 18.5 \times 26.5$	B32593C3225+***	350	500	200
400	200	0.22	$6.5 \times 13.0 \times 26.5$	B32593C6224+***	550	800	500
		0.33	$7.0 \times 14.0 \times 26.5$	B32593C6334+***	550	800	500
		0.47	$7.0 \times 16.5 \times 26.5$	B32593C6474+***	500	700	500
630	200	0.10	$7.0 \times 14.0 \times 26.5$	B32593C8104+***	500	700	500
		0.15	$7.5 \times 16.0 \times 26.5$	B32593C8154+***	450	650	250
		0.22	$8.5 \times 17.0 \times 26.5$	B32593C8224+***	400	580	250

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:

289 = Ammo pack

189 = Reel

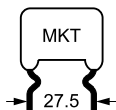
010 = Untaped (lead length 6 – 1 mm)

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 μF	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 ± 3 mm)

Packaging codes for further lead configurations (untaped):

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



B32591 ... B32594

General purpose (stacked/wound)

MKT

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 ≥ 250 VDC	3750 M Ω 7500 M Ω	1250 s 2500 s	
DC test voltage	$1.4 \cdot V_R$, 2 s			
Category voltage V_C (continuous operation with V_{DC} or V_{AC} at $f \leq 60$ Hz)	T_A (°C)	DC voltage derating	AC voltage derating	
	$T_A \leq 85$	$V_C = V_R$	$V_{C,rms} = V_{rms}$	
	$85 < T_A \leq 100$	$V_C = V_R \cdot (165 - T_A)/80$	$V_{C,rms} = V_{rms} \cdot (165 - T_A)/80$	
Operating voltage V_{op} for short operating periods (V_{DC} or V_{AC} at $f \leq 60$ Hz)	T_A (°C)	DC voltage (max. hours)	AC voltage (max. hours)	
	$T_A \leq 100$	$V_{op} = 1.25 \cdot V_C$ (2000 h)	$V_{op} = 1.0 \cdot V_{C,rms}$ (2000 h)	
	$100 < T_A \leq 125$	$V_{op} = 1.25 \cdot V_C$ (1000 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}		$\geq 50\%$ of minimum	
	or time constant $\tau = C_R \cdot R_{ins}$		as-delivered values	
Reliability:				
Failure rate λ	2 fit ($\leq 2 \cdot 10^{-9}/h$) at $0.5 \cdot V_R$, 40 °C			
Service life t_{SL}	200 000 h at $1.0 \cdot V_R$, 40 °C			
	For conversion to other operating conditions and temperatures, refer to chapter "Quality assurance", page .			
Failure criteria:				
Total failure	Short circuit or open circuit			
Failure due to variation of parameters	Capacitance change $ \Delta C/C $		$> 10\%$	
	Dissipation factor $\tan \delta$		$> 2 \cdot$ upper limit value	
	Insulation resistance R_{ins}		< 150 M Ω ($C_R \leq 0.33 \mu F$)	
	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/ μ s.

"k₀" represents the maximum permissible pulse characteristic of the waveform applied to the capacitor, expressed in V²/ μ s.

Note:

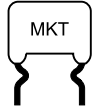
The values of dV/dt and k₀ provided below must not be exceeded in order to avoid damaging the capacitor.

dV/dt values

Lead spacing		10 mm		15 mm		22.5 mm	27.5 mm
Technology		Stacked	Wound	Stacked	Wound	Wound	Wound
V _R VDC	V _{rms} VAC	dV/dt in V/ μ 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

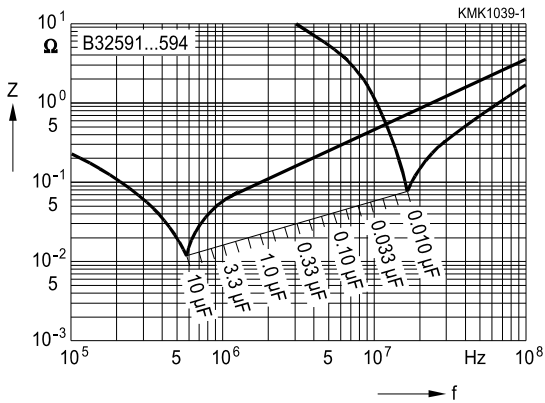
k₀ values

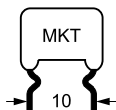
Lead spacing		10 mm		15 mm		22.5 mm	27.5 mm
Technology		Stacked	Wound	Stacked	Wound	Wound	Wound
V _R VDC	V _{rms} VAC	k ₀ in V ² / μ s					
100	63	15 000	—	10 000	—	500	400
250	160	75 000	—	50 000	—	2 000	1 500
400	200	140 000	—	100 000	—	5 600	4 000
630	200	—	25 000	—	19 000	12 600	—
630	220	—	—	—	—	—	10 000



Impedance Z versus frequency f

(typical values)





B32591

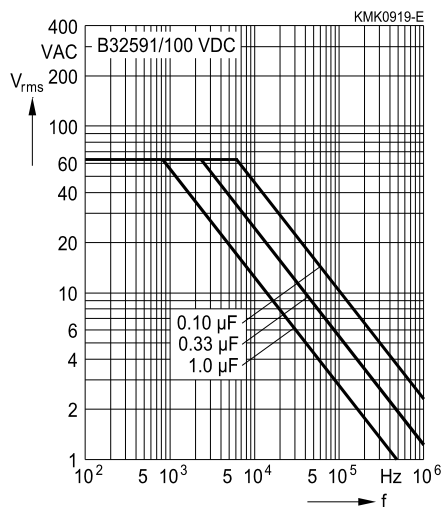
General purpose (stacked/wound)

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

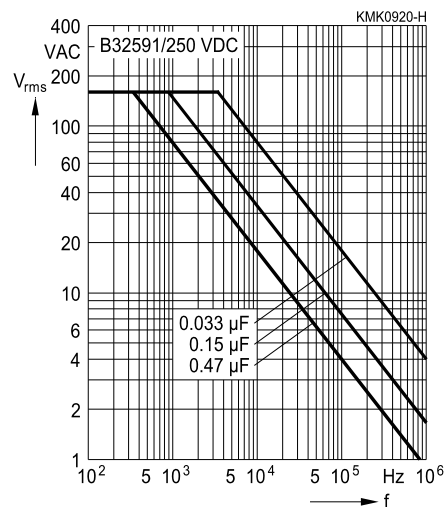
For $T_A > 55^\circ\text{C}$, please refer to "General technical information", section 3.2.3.

Lead spacing 10 mm

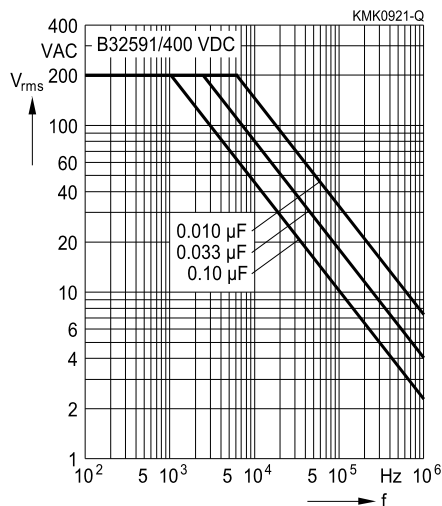
100 VDC/63 VAC



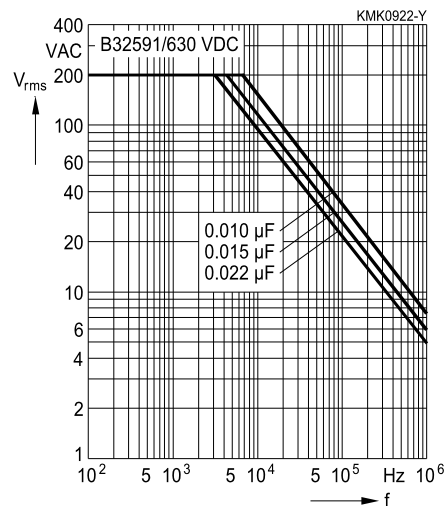
250 VDC/160 VAC

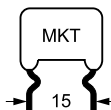


400 VDC/200 VAC



630 VDC/200 VAC



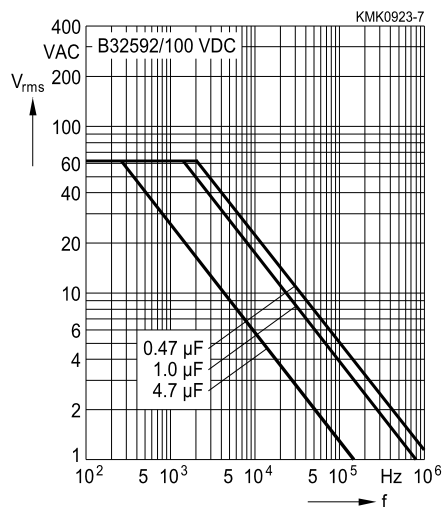


Permissible AC voltage V_{rms} versus frequency f (for sinusoidal waveforms, $T_A \leq 55^\circ\text{C}$)

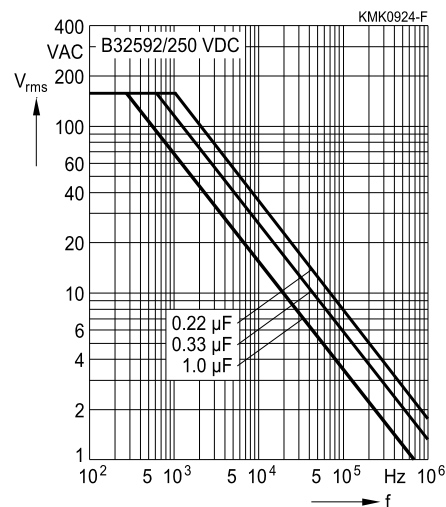
For $T_A > 55^\circ\text{C}$, please refer to "General technical information", section 3.2.3.

Lead spacing 15 mm

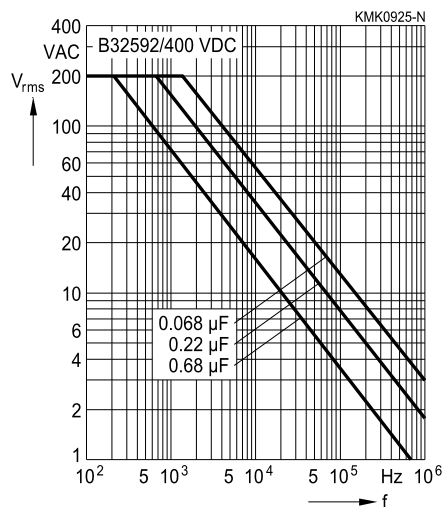
100 VDC/63 VAC



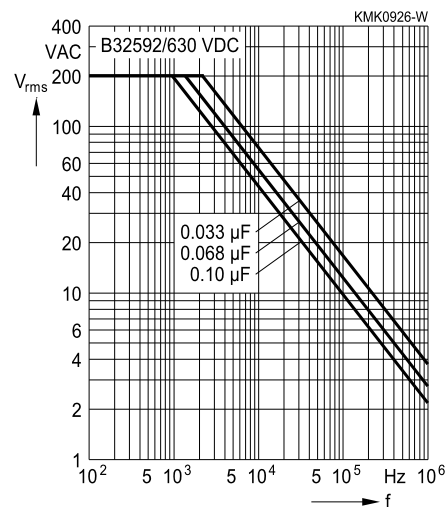
250 VDC/160 VAC

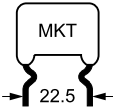


400 VDC/200 VAC



630 VDC/200 VAC





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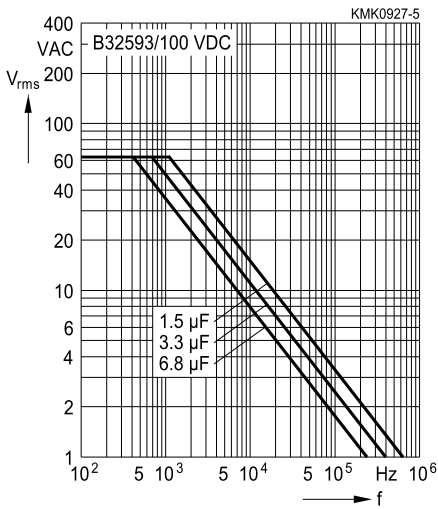
General purpose (wound)

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

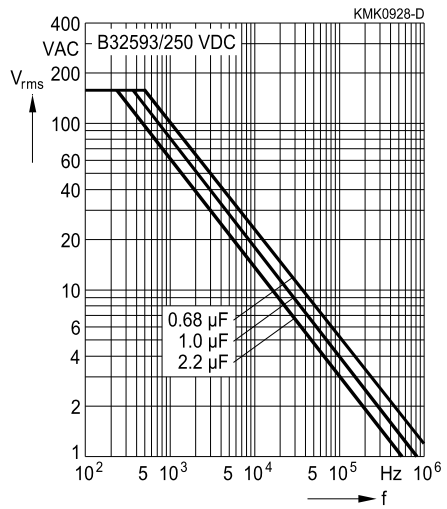
For $T_A > 55^\circ\text{C}$, please refer to "General technical information", section 3.2.3.

Lead spacing 22.5 mm

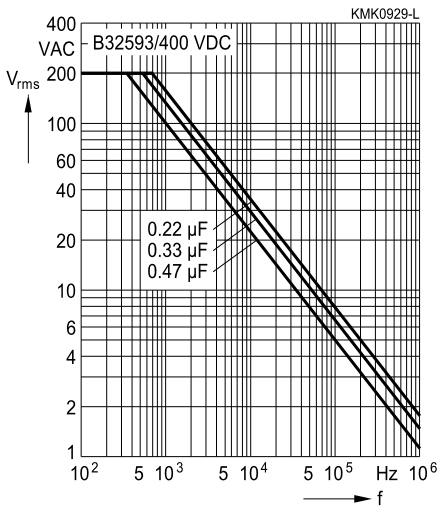
100 VDC/63 VAC



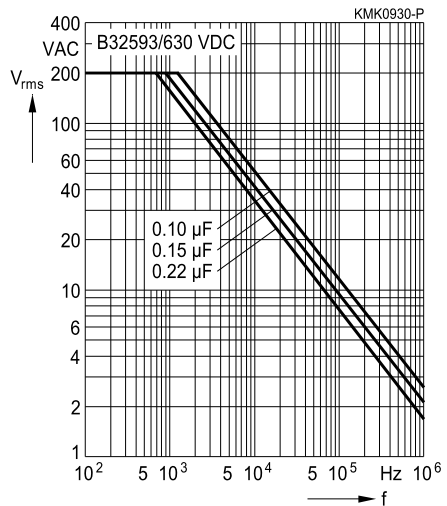
250 VDC/160 VAC



400 VDC/200 VAC



630 VDC/200 VAC

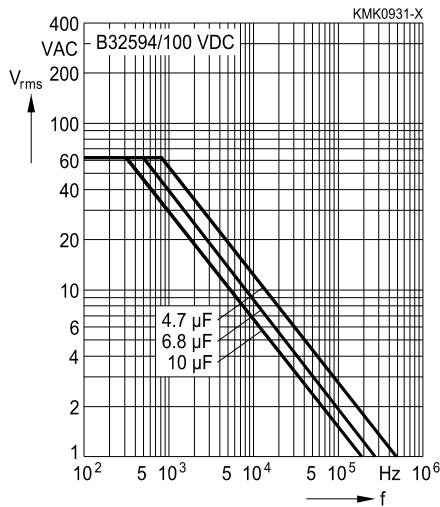


Permissible AC voltage V_{rms} versus frequency f (for sinusoidal waveforms, $T_A \leq 55^\circ\text{C}$)

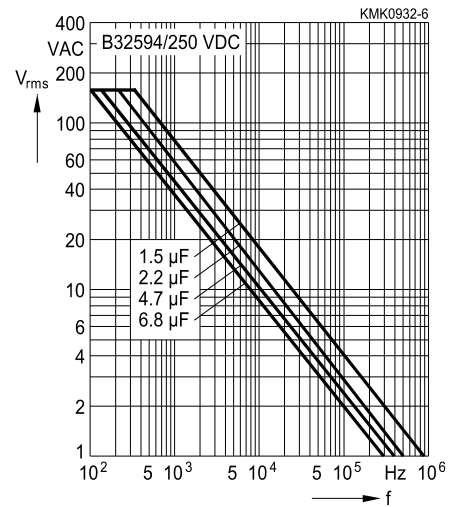
For $T_A > 55^\circ\text{C}$, please refer to "General technical information", section 3.2.3.

Lead spacing 27.5 mm

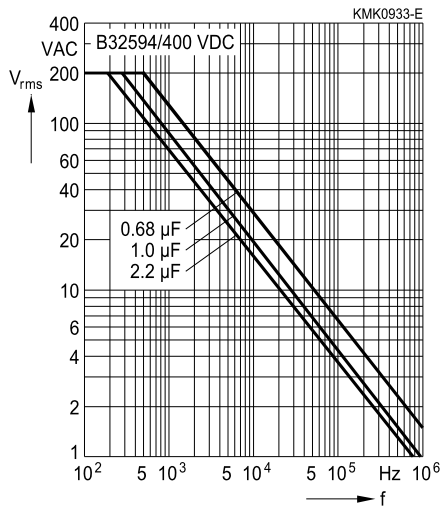
100 VDC/63 VAC



250 VDC/160 VAC



400 VDC/200 VAC



630 VDC/220 VAC

