



## Metallized Polypropylene (MKP/MFP)

**Series/Type:**        **B32682**

The following products presented in this data sheet are being withdrawn.

Ordering Code	Substitute Product	Date of Withdrawal	Deadline Last Orders	Last Shipments
B32682		06.09.2002	31.10.2002	31.03.2003
B32683		06.09.2002	31.10.2002	31.03.2003
B32684		06.09.2002	31.10.2002	31.03.2003

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**Wound MFP pulse capacitors  
with highest possible contact reliability**

**Construction**

- Dielectric: polypropylene
- Film metallized on one side and metal foils internally connected in series
- Plastic case (UL 94 V-0)
- Epoxy resin sealing

**Features**

- Very high pulse strength
- Highest possible contact reliability
- Self-healing properties

**Typical applications**

- Pulse circuits with steep voltage rise rates
- High-frequency ac loads
- Snubbing of power semiconductors

**Terminals**

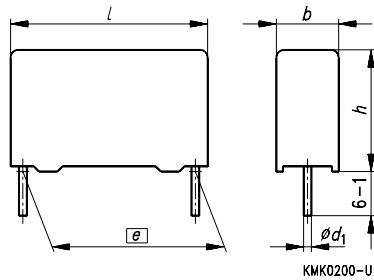
- Parallel wire leads, tinned
- Also available with  $(3,2 \pm 0,3)$  mm lead length

**Marking**

Manufacturer's logo,  
lot number  
style (MFP),  
rated capacitance (coded),  
capacitance tolerance (code letter),  
rated dc voltage,  
date of manufacture (coded)

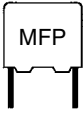
**Delivery mode**

Bulk (untaped)  
Taped (Ammo pack or reels)  
For notes on taping, refer to chapter "Taping and packing", page 274.



Dimensions in mm

Lead spacing	Diameter $d_1$	Type
$e \pm 0,4$		
15,0	0,8	B 32 682
22,5	0,8	B 32 683
27,5	0,8	B 32 684
37,5	1,0	B 32 686



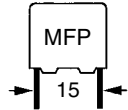
**B 32 682 ...**

**B 32 686**

**Overview of available types**

Lead spacing	15 mm					22,5 mm				
Type	B 32 682					B 32 683				
Page	181					182				
0,10 nF					2000 Vdc 500 Vac					
0,15 nF										
0,22 nF										
0,33 nF										
0,47 nF										
0,68 nF										
1,0 nF										
1,5 nF										
2,2 nF										
3,3 nF			1250 Vdc 450 Vac	1600 Vdc 450 Vac						
4,7 nF	630 Vdc 300 Vac	1000 Vdc 400 Vac								
6,8 nF										
10 nF										
15 nF										
22 nF										
33 nF						1000 Vdc 400 Vac	1250 Vdc 450 Vac	1600 Vdc 450 Vac	2000 Vdc 500 Vac	
47 nF										
68 nF										
0,10 µF						630 Vdc 300 Vac				
0,15 µF										

Lead spacing	27,5 mm					37,5 mm				
Type	B 32 684					B 32 686				
Page	183					184				
15 nF					2000 Vdc 500 Vac					
22 nF										
33 nF										
47 nF										
68 nF		1000 Vdc 400 Vac	1250 Vdc 450 Vac	1600 Vdc 450 Vac						
0,10 µF										
0,15 µF	630 Vdc 300 Vac					1000 Vdc 400 Vac	1250 Vdc 450 Vac	1600 Vdc 450 Vac	2000 Vdc 500 Vac	
0,22 µF										
0,33 µF										
0,47 µF										


**Ordering codes and packing units, lead spacing 15 mm**

$V_R$ ( $V_{rms}$ , $f \leq 1$ kHz)	$C_R$	Maximum dimensions $b \times h \times l$ (mm)	Ordering code <sup>1)</sup>	Packing units (pcs)		
				Ammo pack	Reel	Untaped
630 Vdc (300 Vac)	4,7 nF	5,0 × 10,5 × 18,0	B32682-A6472-+***	1170	1300	1000
	6,8 nF	5,0 × 10,5 × 18,0	B32682-A6682-+***	1170	1300	1000
	10 nF	5,0 × 10,5 × 18,0	B32682-A6103-+***	1170	1300	1000
	15 nF	6,0 × 11,0 × 18,0	B32682-A6153-+***	960	1100	1000
	22 nF	7,0 × 12,5 × 18,0	B32682-A6223-+***	830	900	1000
	33 nF	8,5 × 14,5 × 18,0	B32682-A6333-+***	680	700	500
	47 nF	9,0 × 17,5 × 18,0	B32682-A6473-+***	640	700	500
1000 Vdc (400 Vac)	3,3 nF	5,0 × 10,5 × 18,0	B32682-A332-+***	1170	1300	1000
	4,7 nF	6,0 × 11,0 × 18,0	B32682-A472-+***	960	1100	1000
	6,8 nF	7,0 × 12,5 × 18,0	B32682-A682-+***	830	900	1000
	10 nF	8,5 × 14,5 × 18,0	B32682-A103-+***	680	700	500
	15 nF	9,0 × 17,5 × 18,0	B32682-A153-+***	640	700	500
1250 Vdc (450 Vac)	2,2 nF	5,0 × 10,5 × 18,0	B32682-A7222-+***	1170	1300	1000
	3,3 nF	6,0 × 11,0 × 18,0	B32682-A7332-+***	960	1100	1000
	4,7 nF	7,0 × 12,5 × 18,0	B32682-A7472-+***	830	900	1000
	6,8 nF	8,5 × 14,5 × 18,0	B32682-A7682-+***	680	700	500
	10 nF	9,0 × 17,5 × 18,0	B32682-A7103-+***	640	700	500
1600 Vdc (450 Vac)	1,5 nF	5,0 × 10,5 × 18,0	B32682-A1152-+***	1170	1300	1000
	2,2 nF	6,0 × 11,0 × 18,0	B32682-A1222-+***	960	1100	1000
	3,3 nF	7,0 × 12,5 × 18,0	B32682-A1332-+***	830	900	1000
	4,7 nF	8,5 × 14,5 × 18,0	B32682-A1472-+***	680	700	500
	6,8 nF	9,0 × 17,5 × 18,0	B32682-A1682-+***	640	700	500
2000 Vdc (500 Vac)	0,10 nF	5,0 × 10,5 × 18,0	B32682-A2101-+***	1170	1300	1000
	0,15 nF	5,0 × 10,5 × 18,0	B32682-A2151-+***	1170	1300	1000
	0,22 nF	5,0 × 10,5 × 18,0	B32682-A2221-+***	1170	1300	1000
	0,33 nF	5,0 × 10,5 × 18,0	B32682-A2331-+***	1170	1300	1000
	0,47 nF	5,0 × 10,5 × 18,0	B32682-A2471-+***	1170	1300	1000
	0,68 nF	5,0 × 10,5 × 18,0	B32682-A2681-+***	1170	1300	1000
	1,0 nF	5,0 × 10,5 × 18,0	B32682-A2102-+***	1170	1300	1000
	1,5 nF	6,0 × 11,0 × 18,0	B32682-A2152-+***	960	1100	1000
	2,2 nF	7,0 × 12,5 × 18,0	B32682-A2222-+***	830	900	1000
	3,3 nF	8,5 × 14,5 × 18,0	B32682-A2332-+***	680	700	500
	4,7 nF	9,0 × 17,5 × 18,0	B32682-A2472-+***	640	700	500

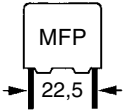
 Capacitance tolerance:  $\pm 10\% \hat{=} K$ ,  $\pm 5\% \hat{=} J$ , ( $\pm 3,5\%$  upon request)

1) + Code letter for capacitance tolerance

\*\*\* Code number for packing: Ammo pack = 289, reel = 189

The ordering code for untaped components ends after the tolerance code letter.

For capacitors with 3,2 mm lead length, append code number "3" to the tolerance code, e.g.: B32682-A6472-K3



**B 32 683**

**Ordering codes and packing units, lead spacing 22,5 mm**

$V_R$ ( $V_{rms}$ , $f \leq 1$ kHz)	$C_R$	Maximum dimensions $b \times h \times l$ (mm)	Ordering code <sup>1)</sup>	Packing units (pcs)		
				Ammo pack	Reel	Untaped
630 Vdc (300 Vac)	33 nF	6,0 × 15,0 × 26,5	B32683-A6333-+***	680	700	720
	47 nF	7,0 × 16,0 × 26,5	B32683-A6473-+***	580	600	630
	68 nF	8,5 × 16,5 × 26,5	B32683-A6683-+***	480	500	510
	0,10 μF	10,5 × 16,5 × 26,5	B32683-A6104-+***	390	400	540
	0,15 μF	11,0 × 20,5 × 26,5	B32683-A6154-+***	370	350	510
1000 Vdc (400 Vac)	10 nF	6,0 × 15,0 × 26,5	B32683-A103-+***	680	700	720
	15 nF	6,0 × 15,0 × 26,5	B32683-A153-+***	680	700	720
	22 nF	7,0 × 16,0 × 26,5	B32683-A223-+***	580	600	630
	33 nF	8,5 × 16,5 × 26,5	B32683-A333-+***	480	500	510
	47 nF	10,5 × 18,5 × 26,5	B32683-A473-+***	390	400	540
1250 Vdc (450 Vac)	10 nF	6,0 × 15,0 × 26,5	B32683-A7103-+***	680	700	720
	15 nF	7,0 × 16,0 × 26,5	B32683-A7153-+***	580	600	630
	22 nF	8,5 × 16,5 × 26,5	B32683-A7223-+***	480	500	510
	33 nF	10,5 × 18,5 × 26,5	B32683-A7333-+***	390	400	540
1600 Vdc (450 Vac)	6,8 nF	6,0 × 15,0 × 26,5	B32683-A1682-+***	680	700	720
	10 nF	7,0 × 16,0 × 26,5	B32683-A1103-+***	580	600	630
	15 nF	8,5 × 16,5 × 26,5	B32683-A1153-+***	480	500	510
	22 nF	10,5 × 18,5 × 26,5	B32683-A1223-+***	390	400	540
2000 Vdc (500 Vac)	2,2 nF	6,0 × 15,0 × 26,5	B32683-A2222-+***	680	700	720
	3,3 nF	6,0 × 15,0 × 26,5	B32683-A2332-+***	680	700	720
	4,7 nF	7,0 × 16,0 × 26,5	B32683-A2472-+***	580	600	630
	6,8 nF	8,5 × 16,5 × 26,5	B32683-A2682-+***	480	500	510
	10 nF	10,5 × 16,5 × 26,5	B32683-A2103-+***	390	400	540
	15 nF	11,0 × 20,5 × 26,5	B32683-A2153-+***	370	350	510

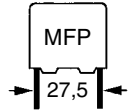
Capacitance tolerance: ± 10 % ≙ K, ± 5 % ≙ J, (± 3,5 % upon request)

1) + Code letter for capacitance tolerance

\*\*\* Code number for the packing: Ammo pack = 289, reel = 189

The ordering code for untaped components ends after the tolerance code letter.

For capacitors with 3,2 mm lead length, append code number "3" to the tolerance code, e.g.: B32683-A6154-K3


**Ordering codes and packing units, lead spacing 27,5 mm**

$V_R$ ( $V_{rms}$ , $f \leq 1$ kHz)	$C_R$	Maximum dimensions $b \times h \times l$ (mm)	Ordering code <sup>1)</sup>	Packing units (pcs)		
				Ammo pack	Reel	Untaped
630 Vdc (300 Vac)	0,15 $\mu$ F	11,0 $\times$ 21,0 $\times$ 31,5	B32684-A6154-+***	–	350	320
	0,22 $\mu$ F	12,5 $\times$ 21,5 $\times$ 31,5	B32684-A6224-+***	–	300	280
	0,33 $\mu$ F	15,0 $\times$ 24,5 $\times$ 31,5	B32684-A6334-+	–	–	240
	0,47 $\mu$ F	18,0 $\times$ 27,5 $\times$ 31,5	B32684-A6474-+	–	–	200
1000 Vdc (400 Vac)	68 nF	11,0 $\times$ 21,0 $\times$ 31,5	B32684-A683-+***	–	350	320
	0,10 $\mu$ F	12,5 $\times$ 21,5 $\times$ 31,5	B32684-A104-+***	–	300	280
	0,15 $\mu$ F	18,0 $\times$ 27,5 $\times$ 31,5	B32684-A154-+	–	–	200
1250 Vdc (450 Vac)	47 nF	11,0 $\times$ 21,0 $\times$ 31,5	B32684-A7473-+***	–	350	320
	68 nF	13,5 $\times$ 23,0 $\times$ 31,5	B32684-A7683-+***	–	250	260
	0,10 $\mu$ F	15,0 $\times$ 24,5 $\times$ 31,5	B32684-A7104-+	–	–	240
	0,15 $\mu$ F	19,0 $\times$ 30,0 $\times$ 31,5	B32684-A7154-+	–	–	180
1600 Vdc (450 Vac)	33 nF	11,0 $\times$ 21,0 $\times$ 31,5	B32684-A1333-+***	–	350	320
	47 nF	12,5 $\times$ 21,5 $\times$ 31,5	B32684-A1473-+***	–	300	280
	68 nF	15,0 $\times$ 24,5 $\times$ 31,5	B32684-A1683-+	–	–	240
	0,10 $\mu$ F	19,0 $\times$ 30,0 $\times$ 31,5	B32684-A1104-+	–	–	180
2000 Vdc (500 Vac)	15 nF	11,0 $\times$ 21,0 $\times$ 31,5	B32684-A2153-+***	–	350	320
	22 nF	11,0 $\times$ 21,0 $\times$ 31,5	B32684-A2223-+***	–	350	320
	33 nF	14,0 $\times$ 24,5 $\times$ 31,5	B32684-A2333-+	–	–	260
	47 nF	18,0 $\times$ 27,5 $\times$ 31,5	B32684-A2473-+	–	–	200

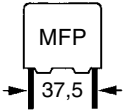
Capacitance tolerance:  $\pm 10\% \hat{=}$  K,  $\pm 5\% \hat{=}$  J, ( $\pm 3,5\%$  upon request)

1) + Code letter for capacitance tolerance

\*\*\* Code number for packing: Reel = 189

The ordering code for untaped components ends after the tolerance code letter.

For capacitors with 3,2 mm lead length, append code number "3" to the tolerance code, e.g.: B32684-A6154-K3


**B 32 686**
**Ordering codes and packing units, lead spacing 37,5 mm**

$V_R$ ( $V_{rms}$ $f < 60$ kHz)	$C_R$	Maximum dimensions $b \times h \times l$ (mm)	Ordering code <sup>1)</sup>	Packing units (pcs)  Untaped
1000 Vdc (400 Vac)	0,10 $\mu$ F	12,0 $\times$ 22,0 $\times$ 41,5	B32686-A104-+	72
	0,15 $\mu$ F	14,0 $\times$ 25,0 $\times$ 41,5	B32686-A154-+	56
	0,22 $\mu$ F	16,0 $\times$ 28,5 $\times$ 41,5	B32686-A224-+	48
	0,33 $\mu$ F	20,0 $\times$ 39,5 $\times$ 41,5	B32686-A334-+	32
	0,47 $\mu$ F	20,0 $\times$ 39,5 $\times$ 41,5	B32686-A474-+	32
1250 Vdc (450 Vac)	68 nF	12,0 $\times$ 22,0 $\times$ 41,5	B32686-A7683-+	72
	0,10 $\mu$ F	14,0 $\times$ 25,0 $\times$ 41,5	B32686-A7104-+	56
	0,15 $\mu$ F	16,0 $\times$ 28,5 $\times$ 41,5	B32686-A7154-+	48
	0,22 $\mu$ F	18,0 $\times$ 32,5 $\times$ 41,5	B32686-A7224-+	48
	0,33 $\mu$ F	20,0 $\times$ 39,5 $\times$ 41,5	B32686-A7334-+	32
1600 Vdc (450 Vac)	47 nF	12,0 $\times$ 22,0 $\times$ 41,5	B32686-A1473-+	72
	68 nF	14,0 $\times$ 25,0 $\times$ 41,5	B32686-A1683-+	56
	0,10 $\mu$ F	18,0 $\times$ 32,5 $\times$ 41,5	B32686-A1104-+	48
	0,15 $\mu$ F	20,0 $\times$ 39,5 $\times$ 41,5	B32686-A1154-+	32
2000 Vdc (500 Vac)	22 nF	12,0 $\times$ 22,0 $\times$ 41,5	B32686-A2223-+	72
	33 nF	14,0 $\times$ 25,0 $\times$ 41,5	B32686-A2333-+	56
	47 nF	16,0 $\times$ 28,5 $\times$ 41,5	B32686-A2473-+	48
	68 nF	18,0 $\times$ 32,5 $\times$ 41,5	B32686-A2683-+	48
	0,10 $\mu$ F	20,0 $\times$ 39,5 $\times$ 41,5	B32686-A2104-+	32

 Capacitance tolerance:  $\pm 20\%$   $\hat{=}$  M,  $\pm 10\%$   $\hat{=}$  K,  $\pm 5\%$   $\hat{=}$  J,  $\pm 5\%$ 

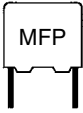
1) + Code letter for capacitance tolerance

For capacitors with 3,2 mm lead length, append code number "3" to the tolerance code, e.g.: B32686-A104-K3

**Technical data**

Climatic category in accordance with IEC 60068-1	55/100/56		
Lower category temperature $T_{\min}$	- 55 °C		
Upper category temperature $T_{\max}$	+ 100 °C		
Damp heat test	56 days/40 °C/93 % relative humidity		
Limit values after damp heat test	Capacitance change $ \Delta C/C $	$\leq 2 \%$	
	Dissipation factor change $\Delta \tan \delta$	$\leq 1,0 \cdot 10^{-3}$ (at 10 kHz)	
	Insulation resistance $R_{\text{is}}$ or time constant $\tau = C_{\text{R}} \cdot R_{\text{is}}$	$\geq 50 \%$ of minimum as-delivered values	
Reliability:			
Reference conditions	0,5 · $V_{\text{R}}$ ; 40 °C		
Failure rate	1 · 10 <sup>-9</sup> /h = 1 fit		
	For a conversion table for other operating conditions and temperatures, refer to chapter "Quality assurance", page 327.		
Service life	200 000 h		
Failure criteria:			
Total failure	Short circuit or open circuit		
Failure due to variation of parameters	Capacitance change $ \Delta C/C $	$> 10 \%$	
	Dissipation factor $\tan \delta$	4 · upper limit values	
	Insulation resistance $R_{\text{is}}$	$< 1500 \text{ M}\Omega$ ( $C_{\text{R}} \leq 0,33 \mu\text{F}$ )	
	or time constant $\tau = C_{\text{R}} \cdot R_{\text{is}}$	$< 500 \text{ s}$ ( $C_{\text{R}} > 0,33 \mu\text{F}$ )	
DC test voltage	2,0 · $V_{\text{R}}$ , 2 s		
Category voltage $V_{\text{C}}$	$T \leq 85 \text{ °C}$ : $V_{\text{C}} = 1,0 \cdot V_{\text{R}}$ or $1,0 \cdot V_{\text{rms}}$		
Operation with dc voltage or ac voltage $V_{\text{rms}}$ up to 1 kHz			
Dissipation factor $\tan \delta$ (in 10 <sup>-3</sup> ) at 20 °C (upper limit values)		$C_{\text{R}} \leq 0,1 \mu\text{F}$	$C_{\text{R}} > 0,1 \mu\text{F}$
	at 1 kHz	–	0,4
	10 kHz	0,4	0,5
	100 kHz	1,0	–
Insulation resistance $R_{\text{is}}$ or time constant $\tau = C_{\text{R}} \cdot R_{\text{is}}$ at 20 °C, rel. humidity $\leq 65 \%$ (minimum as-delivered values)	$C_{\text{R}} \leq 0,33 \mu\text{F}$	$C_{\text{R}} > 0,33 \mu\text{F}$	
	100 G $\Omega$	30 000 s	

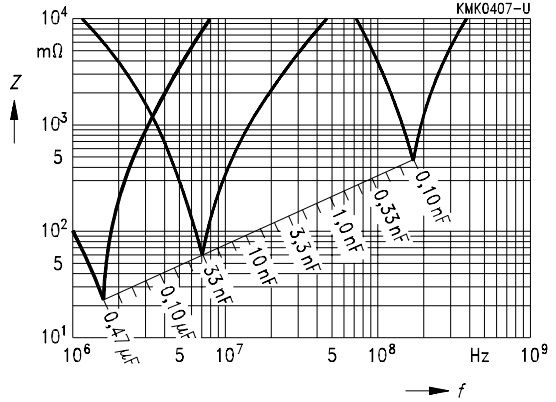




B 32 682 ...

B 32 686

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



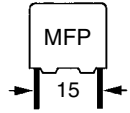
### Pulse handling capability

Maximum permissible voltage change per unit of time for non-sinusoidal voltages (pulse, sawtooth)

$V_R$	Max. rate of voltage rise $V_{pp}/\tau$ in $V/\mu s$ (for $V_{pp} = V_R$ )			
	Lead spacing			
	15 mm	22,5 mm	27,5 mm	37,5 mm
630 Vdc	5 000	3 000	2 000	—
1000 Vdc	9 000	5 000	3 800	2 000
1250 Vdc	12 000	7 000	4 500	2 800
1600 Vdc	16 000	11 000	6 000	3 500
2000 Vdc	17 000	15 000	8 000	4 500

For  $V_{pp} < V_R$ , the permissible voltage rise rate value  $V_{pp}/\tau$  may be multiplied by the factor  $V_R/V_{pp}$ . Also refer to the calculation example in chapter "General technical information", page 302.

$V_R$	Pulse characteristic $k_0$ in $V^2/\mu s$ (for $V_{pp} \leq V_R$ )			
	Lead spacing			
	15 mm	22,5 mm	27,5 mm	37,5 mm
630 Vdc	6 300 000	3 800 000	2 500 000	—
1000 Vdc	18 000 000	10 000 000	7 500 000	4 000 000
1250 Vdc	30 000 000	17 500 000	11 000 000	7 000 000
1600 Vdc	51 000 000	35 000 000	19 000 000	11 000 000
2000 Vdc	68 000 000	60 000 000	32 000 000	18 000 000

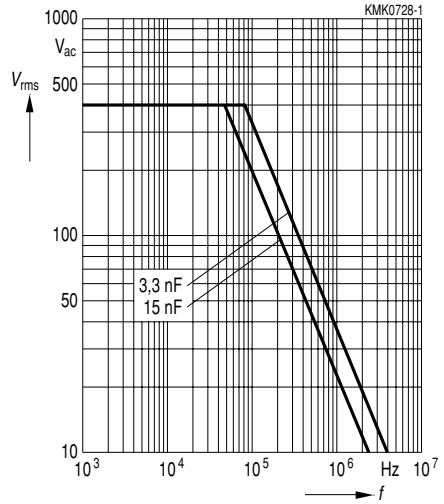
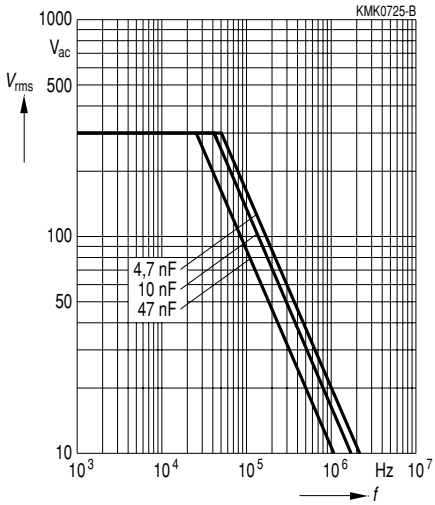


Permissible ac voltage  $V_{rms}$  versus frequency  $f$

Lead spacing 15 mm

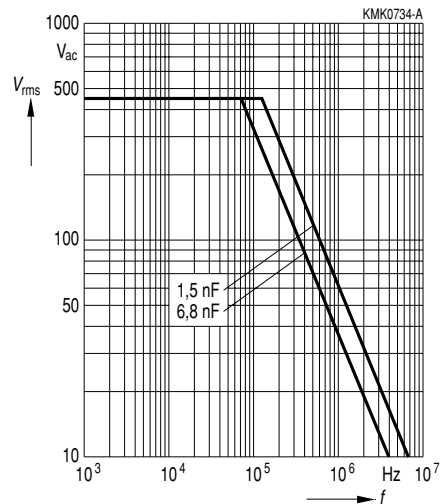
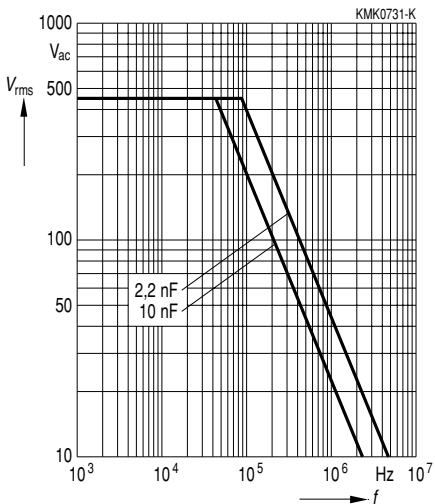
630 Vdc/ 300 Vac

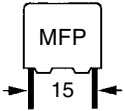
1000 Vdc/ 400 Vac



1250 Vdc/ 450 Vac

1600 Vdc/ 450 Vac





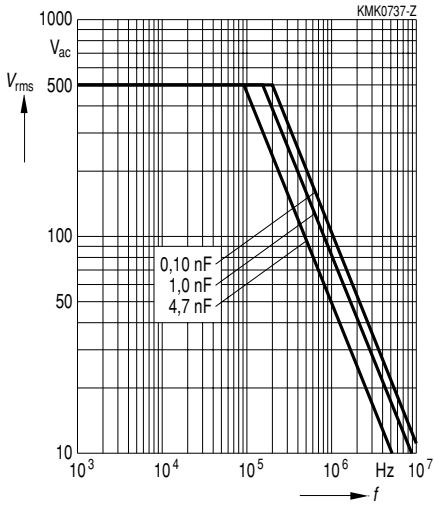
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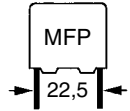
B 32 684

Permissible ac voltage  $V_{rms}$  versus frequency  $f$

Lead spacing 15 mm

2000 Vdc/ 500 Vac



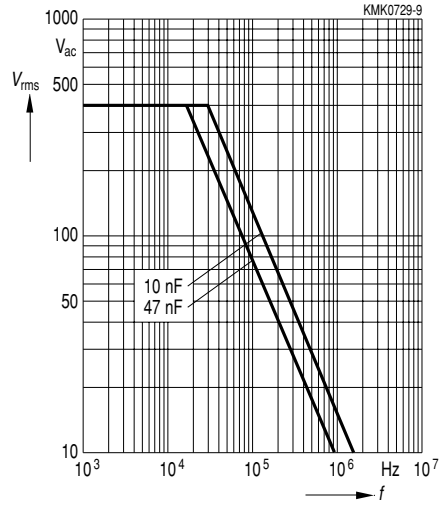
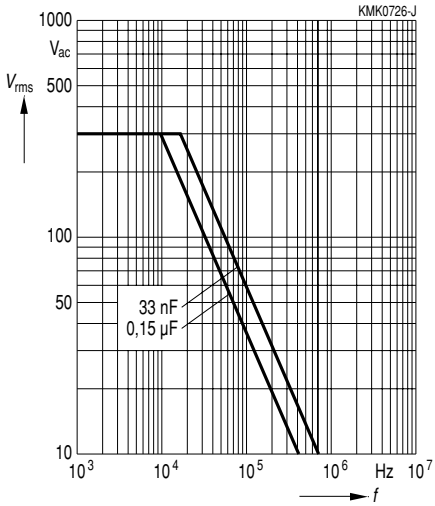


Permissible ac voltage  $V_{rms}$  versus frequency  $f$

Lead spacing 22,5 mm

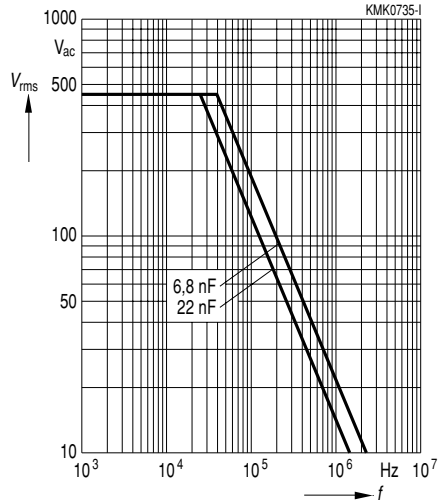
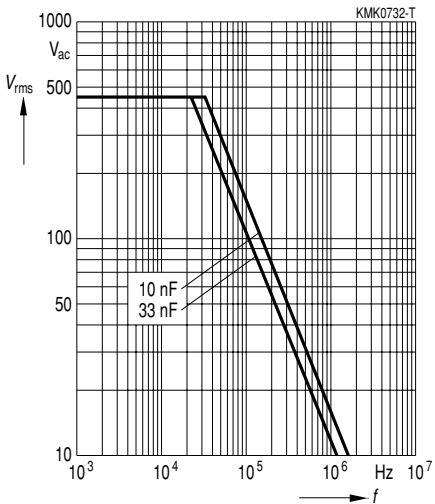
630 Vdc/ 300 Vac

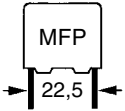
1000 Vdc/ 400 Vac



1250 Vdc/ 450 Vac

1600 Vdc/ 450 Vac



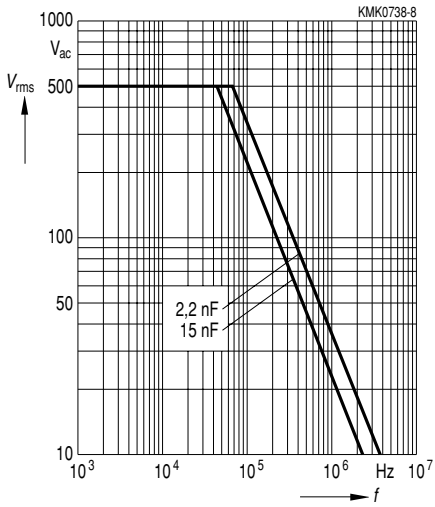


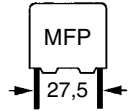
B 32 683

Permissible ac voltage  $V_{rms}$  versus frequency  $f$

Lead spacing 22,5 mm

2000 Vdc/ 500 Vac



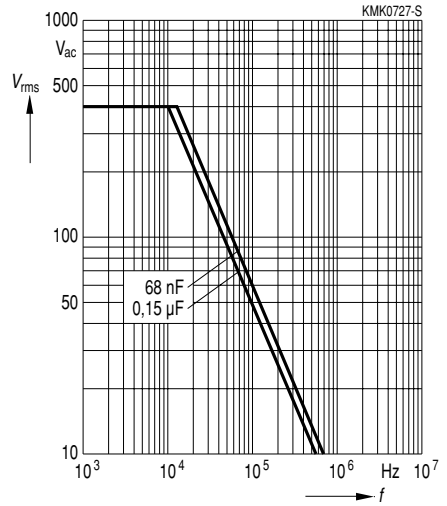
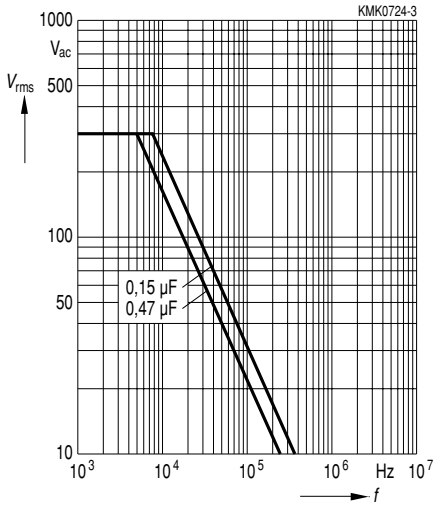


Permissible ac voltage  $V_{rms}$  versus frequency  $f$

Lead spacing 27,5 mm

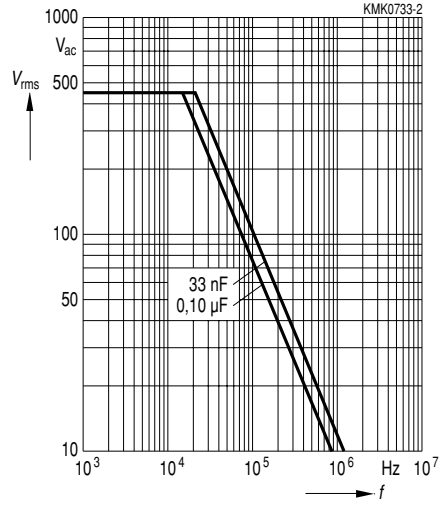
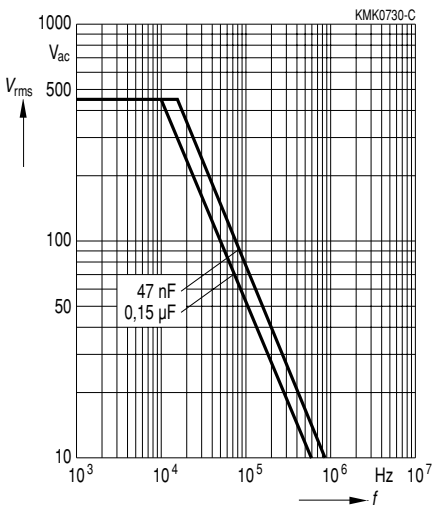
630 Vdc/ 300 Vac

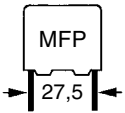
1000 Vdc/ 400 Vac



1250 Vdc/ 450 Vac

1600 Vdc/ 450 Vac



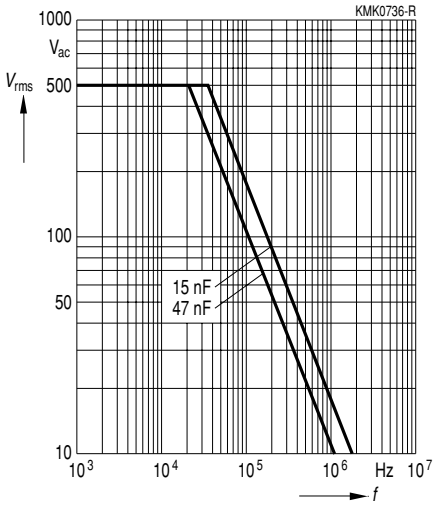


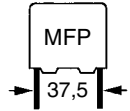
B 32 684

Permissible ac voltage  $V_{rms}$  versus frequency  $f$

Lead spacing 27,5 mm

2000 Vdc/ 500 Vac

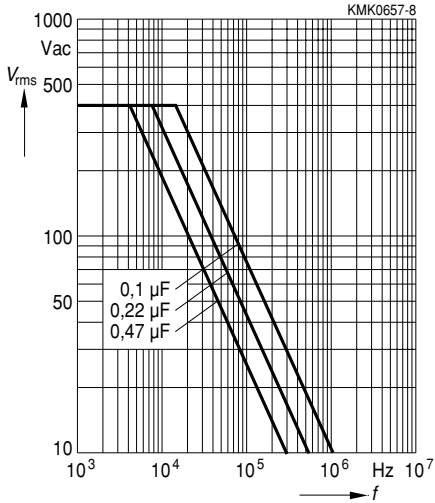




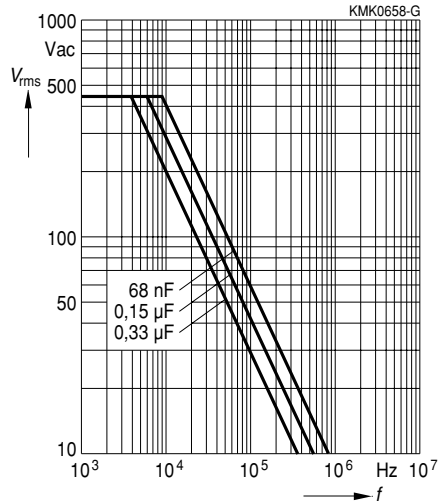
Permissible ac voltage  $V_{rms}$  versus frequency  $f$

Lead spacing 37,5 mm

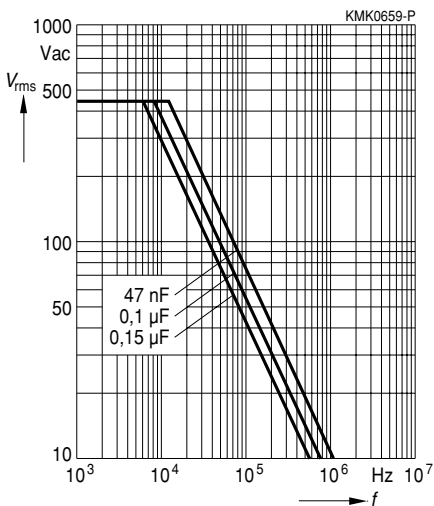
1000 Vdc/ 400 Vac



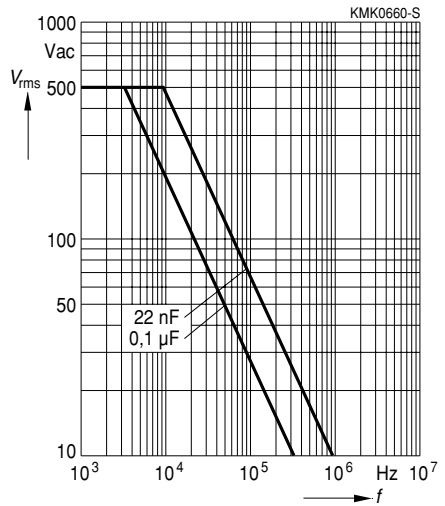
1250 Vdc/ 450 Vac



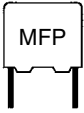
1600 Vdc/ 450 Vac



2000 Vdc/ 500 Vac







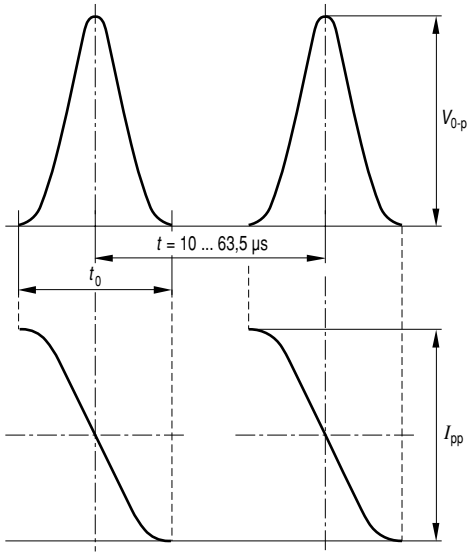
B 32 682 ...

B 32 686

### Flyback application

#### Permissible voltage and current / waveform

Permissible current  $I_{pp}$  versus frequency for a duty cycle of 20 % ( $t_0/t = 0,2$ ):



KMK0720-5

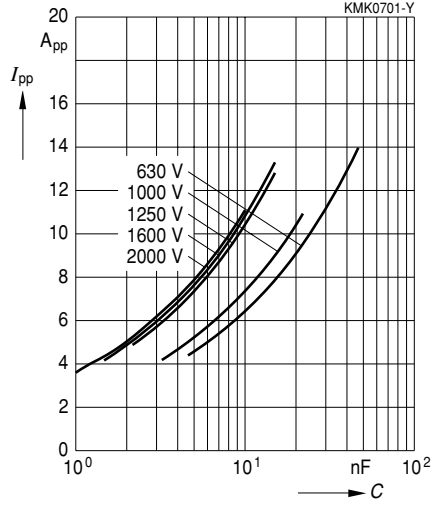
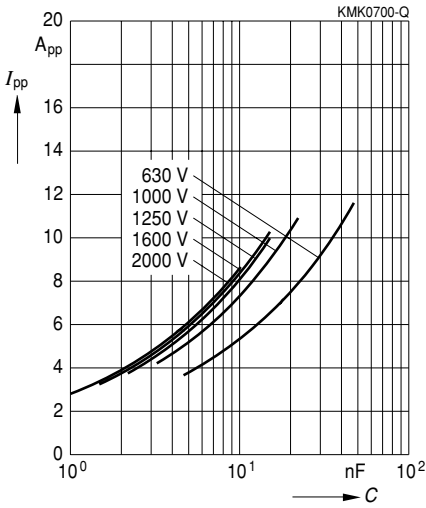
Approximation formular for duty cycle higher than 20 %:

$$I'_{pp} = I_{pp} \sqrt{\frac{t_0^3}{t^3}}$$

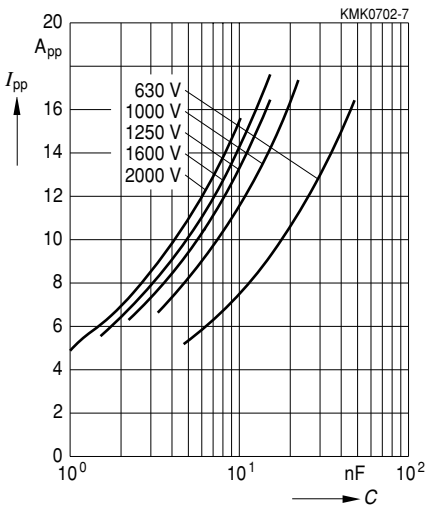
**Flyback application**  
**permissible current  $I_{pp}$  versus rated capacitance  $C_R$**

Frequency = 15,75 kHz

Frequency = 31,5 kHz



Frequency = 95 kHz



**Herausgegeben von EPCOS AG**

**Marketing Kommunikation, Postfach 80 17 09, 81617 München, DEUTSCHLAND**

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