

## Film Capacitors Metallized Polyester (MKT)

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

The following products presented in this data sheet are being withdrawn.

Ordering Code	Substitute Product	Date of Withdrawal	Deadline Last Orders	Last Shipments
B32592C8683M289	B32522D8683*	2015-06-26	2015-12-31	2016-03-31
B32592C8683M189	B32522D8683*	2015-06-26	2015-12-31	2016-03-31
B32592C8683M011	B32522D8683*	2015-06-26	2015-12-31	2016-03-31



Ordering Code	Substitute Product	Date of Withdrawal	Deadline Last Orders	Last Shipments
B32592C8683M010	B32522D8683*	2015-06-26	2015-12-31	2016-03-31
B32592C8683M008	B32522D8683*	2015-06-26	2015-12-31	2016-03-31
B32592C8683K289	B32522D8683*	2015-06-26	2015-12-31	2016-03-31
B32592C8683K189	B32522D8683*	2015-06-26	2015-12-31	2016-03-31
B32592C8683K011	B32522D8683*	2015-06-26	2015-12-31	2016-03-31
B32592C8683K010	B32522D8683*	2015-06-26	2015-12-31	2016-03-31
B32592C8683K008	B32522D8683*	2015-06-26	2015-12-31	2016-03-31
B32592C8683J289	B32522D8683*	2015-06-26	2015-12-31	2016-03-31
B32592C8683J189	B32522D8683*	2015-06-26	2015-12-31	2016-03-31
B32592C8683J011	B32522D8683*	2015-06-26	2015-12-31	2016-03-31
B32592C8683J010	B32522D8683*	2015-06-26	2015-12-31	2016-03-31
B32592C8683J008	B32522D8683*	2015-06-26	2015-12-31	2016-03-31
B32592C8473M289	B32522D8473*	2015-06-26	2015-12-31	2016-03-31
B32592C8473M189	B32522D8473*	2015-06-26	2015-12-31	2016-03-31
B32592C8473M011	B32522D8473*	2015-06-26	2015-12-31	2016-03-31
B32592C8473M010	B32522D8473*	2015-06-26	2015-12-31	2016-03-31
B32592C8473M008	B32522D8473*	2015-06-26	2015-12-31	2016-03-31
B32592C8473K289	B32522D8473*	2015-06-26	2015-12-31	2016-03-31
B32592C8473K189	B32522D8473*	2015-06-26	2015-12-31	2016-03-31
B32592C8473K011	B32522D8473*	2015-06-26	2015-12-31	2016-03-31
B32592C8473K010	B32522D8473*	2015-06-26	2015-12-31	2016-03-31
B32592C8473K008	B32522D8473*	2015-06-26	2015-12-31	2016-03-31
B32592C8473J289	B32522D8473*	2015-06-26	2015-12-31	2016-03-31
B32592C8473J189	B32522D8473*	2015-06-26	2015-12-31	2016-03-31
B32592C8473J011	B32522D8473*	2015-06-26	2015-12-31	2016-03-31
B32592C8473J010	B32522D8473*	2015-06-26	2015-12-31	2016-03-31
B32592C8473J008	B32522D8473*	2015-06-26	2015-12-31	2016-03-31
B32592C8333M289		2015-06-26	2015-12-31	2016-03-31
B32592C8333M189		2015-06-26	2015-12-31	2016-03-31
B32592C8333M011		2015-06-26	2015-12-31	2016-03-31
B32592C8333M010		2015-06-26	2015-12-31	2016-03-31
B32592C8333M008		2015-06-26	2015-12-31	2016-03-31
B32592C8333K289		2015-06-26	2015-12-31	2016-03-31
B32592C8333K189		2015-06-26	2015-12-31	2016-03-31
B32592C8333K011		2015-06-26	2015-12-31	2016-03-31
B32592C8333K010		2015-06-26	2015-12-31	2016-03-31
B32592C8333K008		2015-06-26	2015-12-31	2016-03-31
B32592C8333J289		2015-06-26	2015-12-31	2016-03-31



Ordering Code	Substitute Product	Date of Withdrawal	Deadline Last Orders	Last Shipments
B32592C8333J189		2015-06-26	2015-12-31	2016-03-31
B32592C8333J011		2015-06-26	2015-12-31	2016-03-31
B32592C8333J010		2015-06-26	2015-12-31	2016-03-31
B32592C8333J008		2015-06-26	2015-12-31	2016-03-31
B32592C8104M289	B32522D8104*	2015-06-26	2015-12-31	2016-03-31
B32592C8104M189	B32522D8104*	2015-06-26	2015-12-31	2016-03-31
B32592C8104M011	B32522D8104*	2015-06-26	2015-12-31	2016-03-31
B32592C8104M010	B32522D8104*	2015-06-26	2015-12-31	2016-03-31
B32592C8104M008	B32522D8104*	2015-06-26	2015-12-31	2016-03-31
B32592C8104K289	B32522D8104*	2015-06-26	2015-12-31	2016-03-31
B32592C8104K189	B32522D8104*	2015-06-26	2015-12-31	2016-03-31
B32592C8104K011	B32522D8104*	2015-06-26	2015-12-31	2016-03-31
B32592C8104K010	B32522D8104*	2015-06-26	2015-12-31	2016-03-31
B32592C8104K008	B32522D8104*	2015-06-26	2015-12-31	2016-03-31
B32592C8104J289	B32522D8104*	2015-06-26	2015-12-31	2016-03-31
B32592C8104J189	B32522D8104*	2015-06-26	2015-12-31	2016-03-31
B32592C8104J011	B32522D8104*	2015-06-26	2015-12-31	2016-03-31
B32592C8104J010	B32522D8104*	2015-06-26	2015-12-31	2016-03-31
B32592C8104J008	B32522D8104*	2015-06-26	2015-12-31	2016-03-31
B32591C8223M289	B32521D8223*	2015-06-26	2015-12-31	2016-03-31
B32591C8223M189	B32521D8223*	2015-06-26	2015-12-31	2016-03-31
B32591C8223M011	B32521D8223*	2015-06-26	2015-12-31	2016-03-31
B32591C8223M010	B32521D8223*	2015-06-26	2015-12-31	2015-03-31
B32591C8223M008	B32521D8223*	2015-06-26	2015-12-31	2016-03-31
B32591C8223K289	B32521D8223*	2015-06-26	2015-12-31	2016-03-31
B32591C8223K189	B32521D8223*	2015-06-26	2015-12-31	2016-03-31
B32591C8223K011	B32521D8223*	2015-06-26	2015-12-31	2016-03-31
B32591C8223K010	B32521D8223*	2015-06-26	2015-12-31	2016-03-31
B32591C8223K008	B32521D8223*	2015-06-26	2015-12-31	2016-03-31
B32591C8223J289	B32521D8223*	2015-06-26	2015-12-31	2016-03-31
B32591C8223J189	B32521D8223*	2015-06-26	2015-12-31	2016-03-31
B32591C8223J011	B32521D8223*	2015-06-26	2015-12-31	2016-03-31
B32591C8223J010	B32521D8223*	2015-06-26	2015-12-31	2016-03-31
B32591C8223J008	B32521D8223*	2015-06-26	2015-12-31	2016-03-31
B32591C8153M289	B32521D8153*	2015-06-26	2015-12-31	2016-03-31
B32591C8153M189	B32521D8153*	2015-06-26	2015-12-31	2016-03-31
B32591C8153M011	B32521D8153*	2015-06-26	2015-12-31	2016-03-31
B32591C8153M010	B32521D8153*	2015-06-26	2015-12-31	2016-03-31



Ordering Code	Substitute Product	Date of Withdrawal	Deadline Last Orders	Last Shipments
B32591C8153M008	B32521D8153*	2015-06-26	2015-12-31	2016-03-31
B32591C8153K289	B32521D8153*	2015-06-26	2015-12-31	2016-03-31
B32591C8153K189	B32521D8153*	2015-06-26	2015-12-31	2016-03-31
B32591C8153K011	B32521D8153*	2015-06-26	2015-12-31	2016-03-31
B32591C8153K010	B32521D8153*	2015-06-26	2015-12-31	2016-03-31
B32591C8153K008	B32521D8153*	2015-06-26	2015-12-31	2016-03-31
B32591C8153J289	B32521D8153*	2015-06-26	2015-12-31	2016-03-31
B32591C8153J189	B32521D8153*	2015-06-26	2015-12-31	2016-03-31
B32591C8153J011	B32521D8153*	2015-06-26	2015-12-31	2016-03-31
B32591C8153J010	B32521D8153*	2015-06-26	2015-12-31	2016-03-31
B32591C8153J008	B32521D8103*	2015-06-26	2015-12-31	2016-03-31
B32591C8103M289	B32521D8103*	2015-06-26	2015-12-31	2016-03-31
B32591C8103M189	B32521D8103*	2015-06-26	2015-12-31	2016-03-31
B32591C8103M011	B32521D8103*	2015-06-26	2015-12-31	2016-03-31
B32591C8103M010	B32521D8103*	2015-06-26	2015-12-31	2016-03-31
B32591C8103M008	B32521D8103*	2015-06-26	2015-12-31	2016-03-31
B32591C8103K289	B32521D8103*	2015-06-26	2015-12-31	2016-03-31
B32591C8103K189	B32521D8103*	2015-06-26	2015-12-31	2016-03-31
B32591C8103K011	B32521D8103*	2015-06-26	2015-12-31	2016-03-31
B32591C8103K010	B32521D8103*	2015-06-26	2015-12-31	2016-03-31
B32591C8103K008	B32521D8103*	2015-06-26	2015-12-31	2016-03-31
B32591C8103J289	B32521D8103*	2015-06-26	2015-12-31	2016-03-31
B32591C8103J189	B32521D8103*	2015-06-26	2015-12-31	2016-03-31
B32591C8103J011	B32521D8103*	2015-06-26	2015-12-31	2016-03-31
B32591C8103J010	B32521D8103*	2015-06-26	2015-12-31	2016-03-31
B32591C8103J008	B32521D8103*	2015-06-26	2015-12-31	2016-03-31

For further information please contact your nearest EPCOS sales office, which will also support you in selecting a suitable substitute. The addresses of our worldwide sales network are presented at [www.epcos.com/sales](http://www.epcos.com/sales).

**General purpose (stacked/wound)**
**Typical applications**

- Compact fluorescent lamps (CFL)
- Blocking
- Coupling, decoupling
- Bypassing

**Climatic**

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

**Features**

- High pulse strength
- High contact reliability
- RoHS-compatible

**Construction**

- Dielectric: polyethylene terephthalate (polyester, PET)
- Wound capacitor technology
- 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**

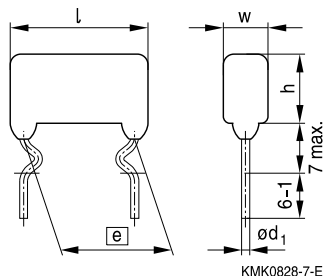
Bulk (untaped)

Taped (Ammo pack or reel) for lead spacing ≤22.5 mm.

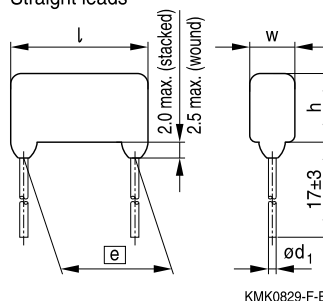
For notes on taping, refer to chapter "Taping and packing".

**Dimensional drawing**

Crimped leads



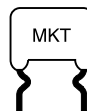
Straight leads



Dimensions in mm

Lead spacing	Lead diameter	Type
$e \pm 0.8$	$d_1 \pm 0.05$	
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			
$V_R$ (V DC)	630	630	100	250	400	630
$V_{RMS}$ (V AC)	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						

**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**

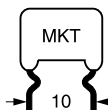
**General purpose (stacked/wound)**

**Overview of available types**

Lead spacing	27.5 mm			
Type	B32594			
Page	8			
V <sub>R</sub> (V DC)	100	250	400	630
V <sub>RMS</sub> (V AC)	63	160	200	220
C <sub>R</sub> (μF)				
0.33				
0.47				
0.68				
1.0				
1.5				
2.2				
3.3				
4.7				
6.8				
10				

**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)**

$V_R$	$V_{RMS}$ $f \leq 60$ Hz	$C_R$	Max. dimensions $w \times h \times l$ mm	Ordering code (composition see below)	Ammo pack pcs./MOQ	Reel pcs./ MOQ	Untaped pcs./ MOQ
V DC	V AC	$\mu F$					
630	200	0.010	$6.5 \times 10.5 \times 13.0$	B32591C8103+***	2400	4400	2000
		0.015	$6.5 \times 10.5 \times 13.0$	B32591C8153+***	2400	4400	2000
		0.022	$7.5 \times 11.5 \times 13.0$	B32591C8223+***	2000	4000	2000

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:

M =  $\pm 20\%$

K =  $\pm 10\%$

J =  $\pm 5\%$

\*\*\* = Packaging code:

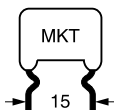
289 = Ammo pack

189 = Reel

010 = Untaped (standard lead length 6 –1 mm)

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




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

$V_R$	$V_{RMS}$ $f \leq 60$ Hz	$C_R$	Max. dimensions $w \times h \times l$ mm	Ordering code (composition see below)	Ammo pcs./MOQ	Reel pcs./ MOQ	Untaped pcs./ MOQ
V DC	V AC	$\mu F$					
630	200	0.033	$6.5 \times 10.5 \times 18.0$	B32592C8333+***	3320	4400	4000
		0.047	$7.0 \times 12.0 \times 18.0$	B32592C8473+***	3120	4000	2000
		0.068	$7.5 \times 14.0 \times 18.0$	B32592C8683+***	3120	3720	2000
		0.10	$8.5 \times 15.0 \times 18.0$	B32592C8104+***	2560	3320	2000

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:

M =  $\pm 20\%$

K =  $\pm 10\%$

J =  $\pm 5\%$

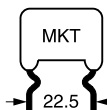
\*\*\* = Packaging code:

289 = Ammo pack

189 = Reel

010 = Untaped (standard lead length  $6 - 1$  mm)

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


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

$V_R$	$V_{RMS}$ $f \leq 60$ Hz	$C_R$	Max. dimensions $w \times h \times l$ mm	Ordering code (composition see below)	Ammo pcs./MOQ	Reel pcs./ MOQ	Untaped pcs./ MOQ
V DC	V AC	$\mu F$					
100	63	1.5	7.0 × 14.0 × 26.5	B32593C1155+***	2000	2800	2000
		2.2	8.5 × 15.0 × 26.5	B32593C1225+***	1800	2400	2000
		3.3	10.0 × 16.5 × 26.5	B32593C1335+***	1520	2160	800
		4.7	11.5 × 18.5 × 26.5	B32593C1475+***	1200	1800	800
		6.8	13.0 × 21.5 × 26.5	B32593C1685+***	1120	1520	800
250	160	0.68	7.0 × 13.0 × 26.5	B32593C3684+***	2000	2800	2000
		1.0	7.0 × 15.5 × 26.5	B32593C3105+***	2000	2800	2000
		1.5	8.5 × 17.0 × 26.5	B32593C3155+***	1600	2320	800
		2.2	10.0 × 18.5 × 26.5	B32593C3225+***	1400	2000	800
400	200	0.22	6.5 × 13.0 × 26.5	B32593C6224+***	2020	3200	2000
		0.33	7.0 × 14.0 × 26.5	B32593C6334+***	2020	3200	2000
		0.47	7.0 × 16.5 × 26.5	B32593C6474+***	2000	2800	2000
630	200	0.10	7.0 × 14.0 × 26.5	B32593C8104+***	2000	2800	2000
		0.15	7.5 × 16.0 × 26.5	B32593C8154+***	1800	2600	1000
		0.22	8.5 × 17.0 × 26.5	B32593C8224+***	1600	2320	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:

M =  $\pm 20\%$

K =  $\pm 10\%$

J =  $\pm 5\%$

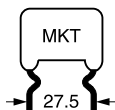
\*\*\* = Packaging code:

289 = Ammo pack

189 = Reel

010 = Untaped (standard lead length 6 –1 mm)

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


**B32594**
**General purpose (wound)**
**Ordering codes and packing units (lead spacing 27.5 mm)**

$V_R$	$V_{RMS}$ $f \leq 60$ Hz	$C_R$	Max. dimensions $w \times h \times l$ mm	Ordering code (composition see below)	Untaped pcs./MOQ
V DC	V AC	$\mu F$			
100	63	4.7	10.5 × 18.5 × 31.5	B32594C1475+***	800
		6.8	12.5 × 21.0 × 31.5	B32594C1685+***	800
		10	17.0 × 22.0 × 31.5	B32594C1106+***	800
250	160	1.5	8.5 × 16.0 × 31.5	B32594C3155+***	2000
		2.2	10.0 × 17.5 × 31.5	B32594C3225+***	2000
		3.3	12.0 × 19.5 × 31.5	B32594C3335+***	800
		4.7	14.0 × 21.5 × 31.5	B32594C3475+***	800
		6.8	15.0 × 25.0 × 31.5	B32594C3685+***	800
400	200	0.68	8.0 × 16.0 × 31.5	B32594C6684+***	1000
		1.0	9.5 × 18.0 × 31.5	B32594C6105+***	1000
		1.5	11.5 × 20.0 × 31.5	B32594C6155+***	1000
		2.2	13.5 × 22.0 × 31.5	B32594C6225+***	800
630	220	0.33	8.0 × 15.0 × 31.5	B32594C8334+***	1000
		0.47	10.0 × 16.0 × 31.5	B32594C8474+***	800
		0.68	10.5 × 18.0 × 31.5	B32594C8684+***	800

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:

M = ±20%

K = ±10%

J = ±5%

\*\*\* = Packaging code:

010 = Untaped (standard lead length 6 –1 mm)

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

**Technical data**

 Reference standard: IEC 60384-2. All data given at  $T = 20\text{ }^{\circ}\text{C}$ , otherwise is specified.

Operating temperature range	Max. operating temperature $T_{op,max}$		+125 $^{\circ}\text{C}$	
	Upper category temperature $T_{max}$		+100 $^{\circ}\text{C}$	
	Lower category temperature $T_{min}$		-55 $^{\circ}\text{C}$	
	Rated temperature $T_R$		+85 $^{\circ}\text{C}$	
Dissipation factor $\tan \delta$ (in $10^{-3}$ ) at 20 $^{\circ}\text{C}$ (upper limit values)	at	$C_R \leq 0.1\text{ }\mu\text{F}$	$0.1\text{ }\mu\text{F} < C_R \leq 1\text{ }\mu\text{F}$	$C_R > 1\text{ }\mu\text{F}$
	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 $^{\circ}\text{C}$ , rel. humidity $\leq 65\%$ (minimum as-delivered values)	$V_R$	$C_R \leq 0.33\text{ }\mu\text{F}$		$C_R > 0.33\text{ }\mu\text{F}$
	100 V DC	3750 M $\Omega$		1250 s
	$\geq 250\text{ V DC}$	7500 M $\Omega$		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 $f \leq 60\text{ Hz}$ )	$T_{OP}$ ( $^{\circ}\text{C}$ )	DC voltage derating	AC voltage derating	
	$T_{OP} \leq 85$	$V_C = V_R$	$V_{C,RMS} = V_{RMS}$	
	$85 < T_{OP} \leq 100$	$V_C = V_R \cdot (165 - T_{OP})/80$	$V_{C,RMS} = V_{RMS} \cdot (165 - T_{OP})/80$	
Operating voltage $V_{op}$ for short operating periods ( $V_{DC}$ or $V_{AC}$ at $f \leq 60\text{ Hz}$ )	$T_{OP}$ ( $^{\circ}\text{C}$ )	DC voltage (max. hours)	AC voltage (max. hours)	
	$T_{OP} \leq 100$	$V_{op} = 1.25 \cdot V_C$ (2000 h)	$V_{op} = 1.0 \cdot V_{C,RMS}$ (2000 h)	
	$100 < T_{OP} \leq 125$	$V_{op} = 1.25 \cdot V_C$ (1000 h)	$V_{op} = 1.0 \cdot V_{C,RMS}$ (1000 h)	
Reliability: Failure rate $\lambda$ Service life $t_{SL}$	2 fit ( $\leq 1 \cdot 10^{-9}/\text{h}$ ) at $0.5 \cdot V_R$ , 40 $^{\circ}\text{C}$ 100 000 h at $1.0 \cdot V_R$ , 85 $^{\circ}\text{C}$ For conversion to other operating conditions and temperatures, refer to chapter "Quality, 2 Reliability".			
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 $R_{ins}$ or time constant $\tau = C_R \cdot R_{ins}$		< 150 M $\Omega$ ( $C_R \leq 0.33\text{ }\mu\text{F}$ ) < 50 s ( $C_R > 0.33\text{ }\mu\text{F}$ )	



**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.*

*These parameters are given for isolated pulses in such a way that the heat generated by one pulse will be completely dissipated before applying the next pulse.*

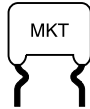
*For a train of pulses, please refer to the curves of permissible AC voltage-current versus frequency.*

### dV/dt values

Lead spacing	10 mm	15 mm	22.5 mm	27.5 mm	
Technology	Wound	Wound	Wound	Wound	
V <sub>R</sub> V DC	V <sub>RMS</sub> V AC	dV/dt in V/ $\mu$ s			
100	63	–	–	2.5	2
250	160	–	–	4	3
400	200	–	–	7	5
630	200	20	15	10	–
630	220	–	–	–	8

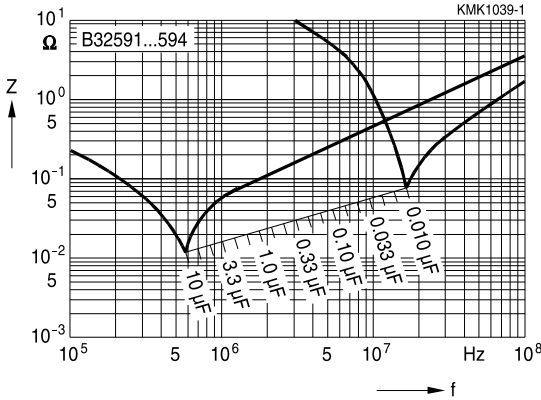
### k<sub>0</sub> values

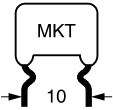
Lead spacing	10 mm	15 mm	22.5 mm	27.5 mm	
Technology	Wound	Wound	Wound	Wound	
V <sub>R</sub> V DC	V <sub>RMS</sub> V AC	k <sub>0</sub> in V <sup>2</sup> / $\mu$ s			
100	63	–	–	500	400
250	160	–	–	2 000	1 500
400	200	–	–	5 600	4 000
630	200	25 000	19 000	12 600	–
630	220	–	–	–	10 000



**Impedance Z versus frequency f**

(typical values)





**B32591**

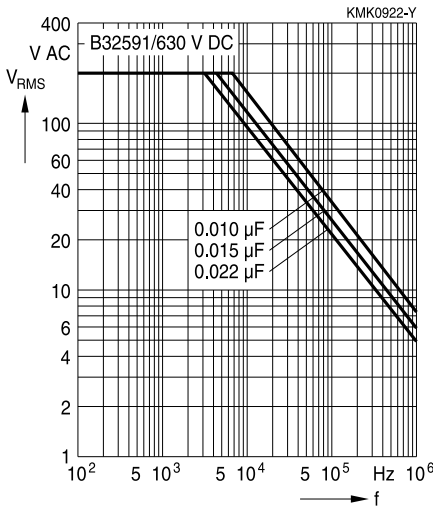
**General purpose (stacked/wound)**

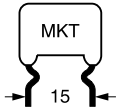
**Permissible AC voltage  $V_{RMS}$  versus frequency  $f$  (for sinusoidal waveforms,  $T_A \leq 55^\circ C$ )**

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

**Lead spacing 10 mm**

630 V DC/200 V AC



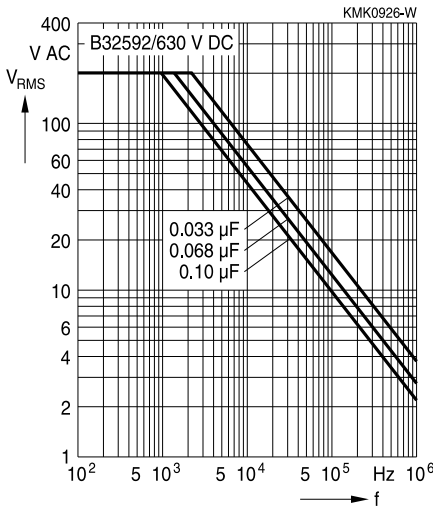


**Permissible AC voltage  $V_{RMS}$  versus frequency  $f$  (for sinusoidal waveforms,  $T_A \leq 55^\circ C$ )**

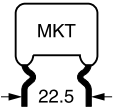
For  $T_A > 55^\circ C$ , please refer to "General technical information", section 3.2.3.

**Lead spacing 15 mm**

630 V DC/200 V AC







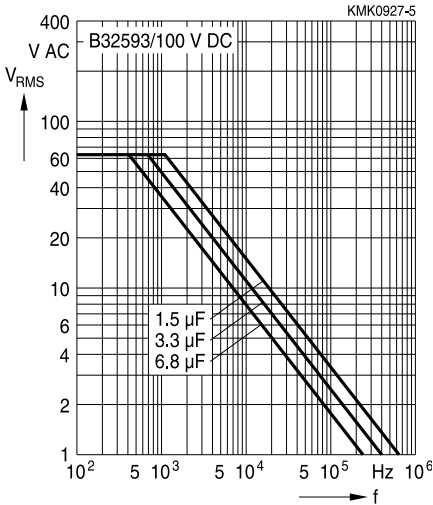
B32593

General purpose (wound)

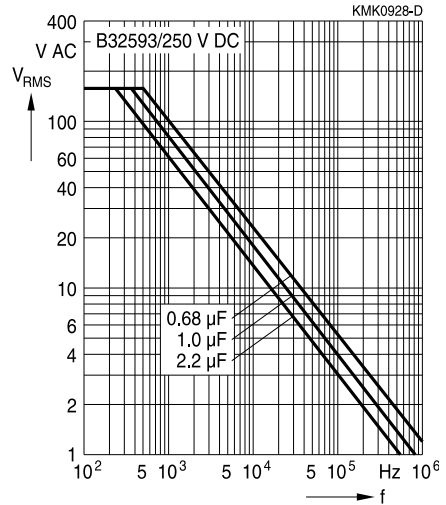
**Permissible AC voltage  $V_{RMS}$  versus frequency  $f$  (for sinusoidal waveforms,  $T_A \leq 55^\circ C$ )**  
 For  $T_A > 55^\circ C$ , please refer to "General technical information", section 3.2.3.

**Lead spacing 22.5 mm**

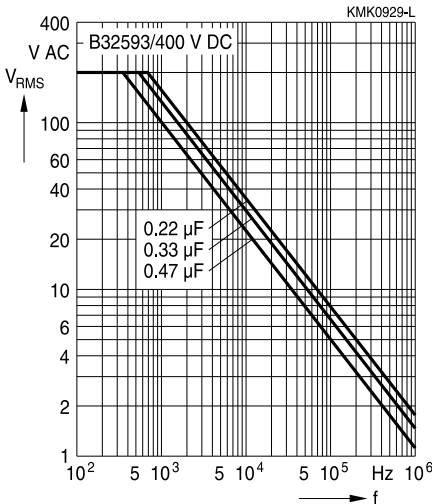
100 V DC/63 V AC



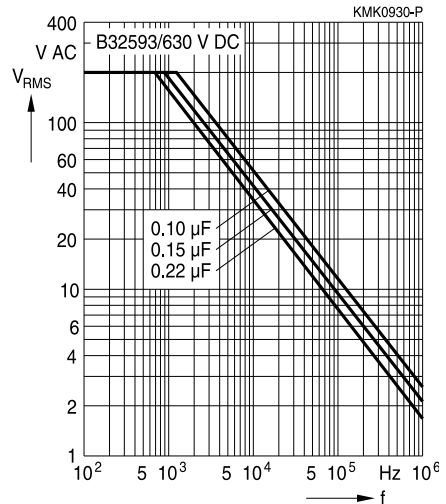
250 V DC/160 V AC

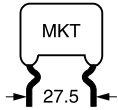


400 V DC/200 V AC



630 V DC/200 V AC

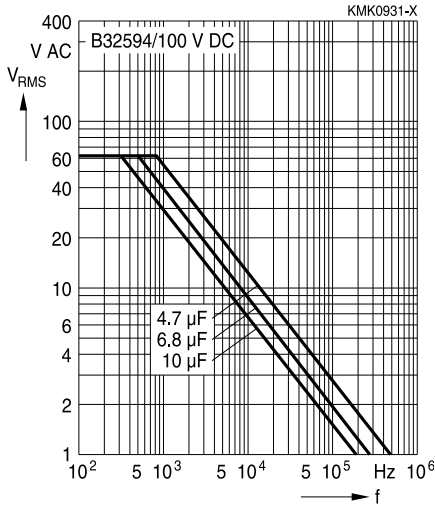




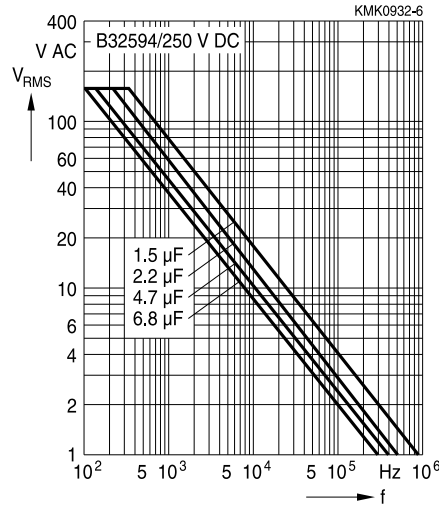
**Permissible AC voltage  $V_{RMS}$  versus frequency  $f$  (for sinusoidal waveforms,  $T_A \leq 55^\circ C$ )**  
 For  $T_A > 55^\circ C$ , please refer to "General technical information", section 3.2.3.

**Lead spacing 27.5 mm**

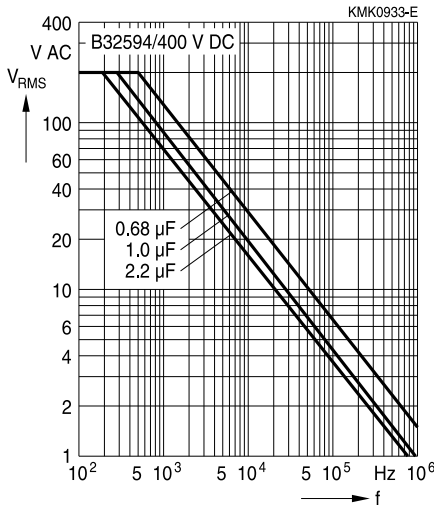
100 V DC/63 V AC



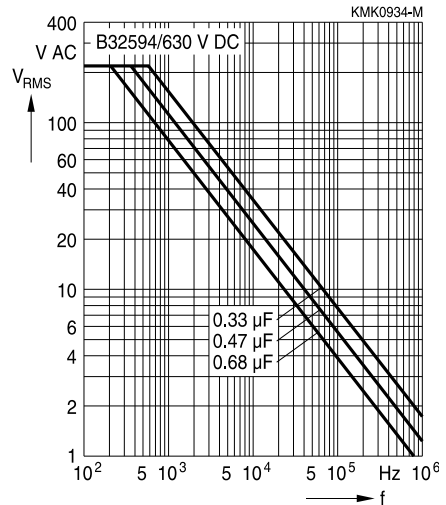
250 V DC/160 V AC



400 V DC/200 V AC



630 V DC/220 V AC





B32591 ... B32594

General purpose (stacked/wound)

### Testing and Standards

Test	Reference	Conditions of test	Performance requirements
Electrical Parameters	IEC 60384-2	Voltage proof, $1.4 V_R$ , 1 minute Insulation resistance, $R_{INS}$ Capacitance, C Dissipation factor, $\tan \delta$	Within specified limits
Robustness of terminations	IEC 60068-2-21	Tensile strength (test Ua1) Wire diameter	No visible damage Capacitance and $\tan \delta$ within specified limits
		Tensile force	
Resistance to soldering heat	IEC 60068-2-20, test Tb, method 1A	$0.3 < d_1 < 0.5 \text{ mm}$	$\Delta C/C_0 \leq 2\%$ $ \Delta \tan \delta  \leq 0.003$ for $C \leq 1 \mu\text{F}$ $ \Delta \tan \delta  \leq 0.002$ for $C > 1 \mu\text{F}$
		$0.5 < d_1 < 0.8 \text{ mm}$	
Rapid change of temperature	IEC 60384-2	$T_A$ = lower category temperature $T_B$ = upper category temperature Five cycles, duration $t = 30 \text{ min}$ .	$ \Delta C/C_0  \leq 5\%$ $ \Delta \tan \delta  \leq 0.003$ for $C \leq 1 \mu\text{F}$ $ \Delta \tan \delta  \leq 0.002$ for $C > 1 \mu\text{F}$ $R_{INS} \geq 50\%$ of initial limit
Vibration	IEC 60384-2	Test Fc: vibration sinusoidal Displacement: 0.75 mm Acceleration: $98 \text{ m/s}^2$ Frequency: 10 Hz ... 500 Hz Test duration: 3 orthogonal axes, 2 hours each axe	No visible damage
Bump	IEC 60384-2	Test Eb: Total 4000 bumps with $390 \text{ m/s}^2$ mounted on PCB 6 ms duration	$ \Delta C/C_0  \leq 5\%$ $ \Delta \tan \delta  \leq 0.003$ for $C \leq 1 \mu\text{F}$ $ \Delta \tan \delta  \leq 0.002$ for $C > 1 \mu\text{F}$ $R_{INS} \geq 50\%$ of initial limit
Climatic sequence	IEC 60384-2	Dry heat Tb / 16 h. Damp heat cyclic, 1st cycle + $55 \text{ }^\circ\text{C}$ / 24h / 95% ... 100% RH Cold Ta / 2h Damp heat cyclic, 5 cycles + $55 \text{ }^\circ\text{C}$ / 24h / 95% ... 100% rh	$ \Delta C/C_0  \leq 5\%$ $ \Delta \tan \delta  \leq 0.005$ for $C \leq 1 \mu\text{F}$ $ \Delta \tan \delta  \leq 0.003$ for $C > 1 \mu\text{F}$ $R_{INS} \geq 50\%$ of initial limit

Damp Heat Steady State	IEC 60384-2	Test Ca 40 °C / 93% RH / 56 days	No visible damage $ \Delta C/C_0  \leq 5\%$ $ \Delta \tan \delta  \leq 0.005$ $R_{INS} \geq 50\%$ of initial limit
Endurance A	IEC 60384-2	85 °C / 1.25 V <sub>R</sub> / 2000 hours	No visible damage $ \Delta C/C_0  \leq 5\%$ $ \Delta \tan \delta  \leq 0.003$ for C ≤ 1 μF $ \Delta \tan \delta  \leq 0.002$ for C > 1 μF $R_{INS} \geq 50\%$ of initial limit
Endurance B	IEC 60384-2	100 °C / 1.25 V <sub>C</sub> / 2000 hours	No visible damage $ \Delta C/C_0  \leq 5\%$ $ \Delta \tan \delta  \leq 0.003$ for C ≤ 1 μF $ \Delta \tan \delta  \leq 0.002$ for C > 1 μF $R_{INS} \geq 50\%$ of initial limit

### 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

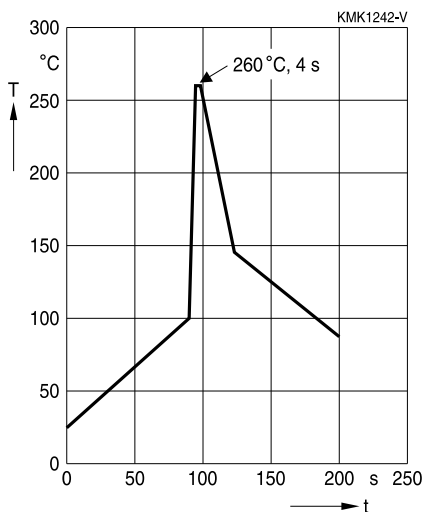
Resistance to soldering heat is tested to IEC 60068-2-20, test Tb, method 1A.

Conditions:

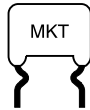
Series	Solder bath temperature	Soldering time
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**B32591 ... B32594**
**General purpose (stacked/wound)**

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 (lead spacing ≤ 7.5 mm)		< 4 s
MKT uncoated (lead spacing ≤ 10 mm) insulated (B32559)		recommended soldering profile for MKT uncoated (lead spacing ≤ 10 mm) and insulated (B32559)



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
ΔC/C <sub>0</sub>	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  $\leq 10$  mm (B32560/B32561) the following measures are recommended:

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



**B32591 ... B32594**

**General purpose (stacked/wound)**

### 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"

### Display of ordering codes for EPCOS products

The ordering code for one and the same product can be represented differently in data sheets, data books, other publications and the website of EPCOS, or in order-related documents such as shipping notes, order confirmations and product labels. **The varying representations of the ordering codes are due to different processes employed and do not affect the specifications of the respective products.** Detailed information can be found on the Internet under [www.epcos.com/orderingcodes](http://www.epcos.com/orderingcodes).





B32591 ... B32594

General purpose (stacked/wound)

## Symbols and terms

Symbol	English	German
$\alpha$	Heat transfer coefficient	Wärmeübergangszahl
$\alpha_C$	Temperature coefficient of capacitance	Temperaturkoeffizient der Kapazität
A	Capacitor surface area	Kondensatoroberfläche
$\beta_C$	Humidity coefficient of capacitance	Feuchtekoeffizient der Kapazität
C	Capacitance	Kapazität
$C_R$	Rated capacitance	Nennkapazität
$\Delta C$	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
$\Delta t$	Time interval	Zeitintervall
$\Delta T$	Absolute temperature change (self-heating)	Absolute Temperaturänderung (Selbsterwärmung)
$\Delta \tan \delta$	Absolute change of dissipation factor	Absolute Änderung des Verlustfaktors
$\Delta V$	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)

**General purpose (stacked/wound)**

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	Impuls Kennwert
$L_S$	Series inductance	Serieninduktivität
$\lambda$	Failure rate	Ausfallrate
$\lambda_0$	Constant failure rate during useful service life	Konstante Ausfallrate in der Nutzungsphase
$\lambda_{test}$	Failure rate, determined by tests	Experimentell ermittelte Ausfallrate
$P_{diss}$	Dissipated power	Abgegebene Verlustleistung
$P_{gen}$	Generated power	Erzeugte Verlustleistung
$Q$	Heat energy	Wärmeenergie
$\rho$	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 (Feuchtestest)
$t$	Time	Zeit
$T$	Temperature	Temperatur
$\tau$	Time constant	Zeitkonstante
$\tan \delta$	Dissipation factor	Verlustfaktor
$\tan \delta_D$	Dielectric component of dissipation factor	Dielektrischer Anteil des Verlustfaktors
$\tan \delta_P$	Parallel component of dissipation factor	Parallelanteil des Verlustfaktors
$\tan \delta_S$	Series component of dissipation factor	Serienanteil des Verlustfaktors
$T_A$	Temperature of the air surrounding the component	Temperatur der Luft, die das Bauteil umgibt
$T_{max}$	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	Betriebstemperatur
$T_R$	Rated temperature	Nenntemperatur
$T_{ref}$	Reference temperature	Referenztemperatur
$t_{SL}$	Reference service life	Referenz-Lebensdauer



**B32591 ... B32594**

**General purpose (stacked/wound)**

Symbol	English	German
$V_{AC}$	AC voltage	Wechselspannung
$V_C$	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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