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The following products presented in this data sheet are being withdrawn.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

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:
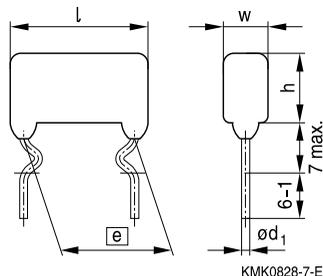style, type, date of manufacture (coded)

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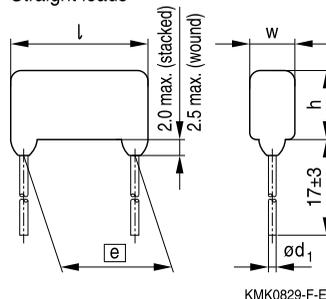Taped (Ammo pack or reel) for lead spacing ≤22.5 mm.
For notes on taping, refer to chapter "Taping and packing".
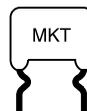
Dimensional drawing

Crimped leads

KMK0828-7-E

Straight leads

KMK0829-F-E

Dimensions in mm

Lead spacing e ±0.8	Lead diameter d_1 ±0.05	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 ≤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 (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						

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

Please read *Cautions and warnings* and
Important notes at the end of this document.

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| MKT | **B32591 ... B32594** |
| | **General purpose (stacked/wound)** |

Overview of available types

Lead spacing	27.5 mm			
Type	B32594			
Page	8			
V_R (V DC)	100	250	400	630
V_{RMS} (V AC)	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	░			

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
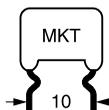
Ordering codes and packing units (lead spacing 10 mm)

V_R V DC	V_{RMS} f ≤60 Hz V AC	C_R µF	Max. dimensions w × h × l mm	Ordering code (composition see below)	Ammo pack pcs./MOQ	Reel pcs./ MOQ	Untaped pcs./ MOQ
630	200	0.010	6.5 × 10.5 × 13.0	B32591C8103+***	2400	4400	2000
		0.015	6.5 × 10.5 × 13.0	B32591C8153+***	2400	4400	2000
		0.022	7.5 × 11.5 × 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:
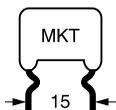
    M = ±20%

    K = ±10%

    J = ±5%

*** = Packaging code:

    289 = Ammo pack

    189 = Reel

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

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

MKT

15

B32592

General purpose (stacked/wound)

Ordering codes and packing units (lead spacing 15 mm)

V_R	V_{RMS} f ≤60 Hz	C_R	Max. dimensions w × h × l	Ordering code (composition see	Ammo pcs./MOQ	Reel pcs./	Untaped pcs./
V DC	V AC	μF	mm	below)		MOQ	MOQ
630	200	0.033	6.5 × 10.5 × 18.0	B32592C8333+***	3320	4400	4000
		0.047	7.0 × 12.0 × 18.0	B32592C8473+***	3120	4000	2000
		0.068	7.5 × 14.0 × 18.0	B32592C8683+***	3120	3720	2000
		0.10	8.5 × 15.0 × 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 = ±20%

    K = ±10%

    J = ±5%

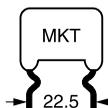*** = Packaging code:

    289 = Ammo pack

    189 = Reel

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

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

MKT

22.5

Ordering codes and packing units (lead spacing 22.5 mm)

V_R V DC	V_{RMS} f ≤60 Hz V AC	C_R μF	Max. dimensions w × h × l mm	Ordering code (composition see below)	Ammo pcs./MOQ	Reel pcs./ MOQ	Untaped pcs./ MOQ
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:
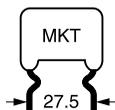   M = ±20%
    K = ±10%
    J = ±5%

*** = Packaging code:
    289 = Ammo pack
    189 = Reel
    010 = Untaped (standard lead length 6 −1 mm)
    008 = Untaped straight (lead length 17±3 mm)

MKT

27.5

B32594

General purpose (wound)

Ordering codes and packing units (lead spacing 27.5 mm)

V_R	V_{RMS} f ≤60 Hz	C_R	Max. dimensions w × h × l	Ordering code (composition see	Untaped
V DC	V AC	µF	mm	below)	pcs./MOQ
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 °C, otherwise is specified.

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 δ (in 10^{-3})	at	$C_R \leq 0.1$ μF	0.1 μF $< C_R \leq 1$ μF	$C_R > 1$ μF
at 20 °C	1 kHz	8	10	10
(upper limit values)	10 kHz	15	20	−
	100 kHz	30	−	−
Insulation resistance R_{ins}	V_R	$C_R \leq 0.33$ μF		$C_R > 0.33$ μF
or time constant $\tau = C_R \cdot R_{ins}$	100 V DC	3750 MΩ		1250 s
at 20 °C, rel. humidity $\leq 65\%$	≥ 250 V DC	7500 MΩ		2500 s
(minimum as-delivered values)				
DC test voltage	$1.4 \cdot V_R$, 2 s			
Category voltage V_C	T_{OP} (°C)	DC voltage derating		AC voltage derating
(continuous operation with V_{DC}	$T_{OP} \leq 85$	$V_C = V_R$		$V_{C,RMS} = V_{RMS}$
or V_{AC} at f $\leq$ 60 Hz)	$85 < T_{OP} \leq 100$	$V_C = V_R \cdot (165 - T_{OP})/80$		$V_{C,RMS} = V_{RMS} \cdot (165 - T_{OP})/80$
Operating voltage V_{op} for	T_{OP} (°C)	DC voltage (max. hours)		AC voltage (max. hours)
short operating periods	$T_{OP} \leq 100$	$V_{op} = 1.25 \cdot V_C$ (2000 h)		$V_{op} = 1.0 \cdot V_{C,RMS}$ (2000 h)
(V_{DC} or V_{AC} at f $\leq$ 60 Hz)	$100 < T_{OP} \leq 125$	$V_{op} = 1.25 \cdot V_C$ (1000 h)		$V_{op} = 1.0 \cdot V_{C,RMS}$ (1000 h)
Reliability:				
Failure rate λ	2 fit ($\leq 1 \cdot 10^{-9}$/h) at $0.5 \cdot V_R$, 40 °C			
Service life t_{SL}	100 000 h at $1.0 \cdot V_R$, 85 °C			
	For conversion to other operating conditions and temperatures, refer to chapter "Quality, 2 Reliability".			
Failure criteria:				
Total failure	Short circuit or open circuit			
Failure due to variation	Capacitance change $|\Delta C/C|$		> 10%	
of parameters	Dissipation factor tan δ		> 2 · upper limit value	
	Insulation resistance R_{ins}		< 150 MΩ ($C_R \leq 0.33$ μF)	
	or time constant $\tau = C_R \cdot R_{ins}$		< 50 s ($C_R > 0.33$ μF)	

MKT

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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/µs.

"k_0" represents the maximum permissible pulse characteristic of the waveform applied to the capacitor, expressed in V^2/µs.

Note:
The values of dV/dt and k_0 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.
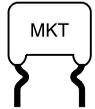*For a train of pulses, please refer to the curves of permissible AC voltage-current versus frequency.*
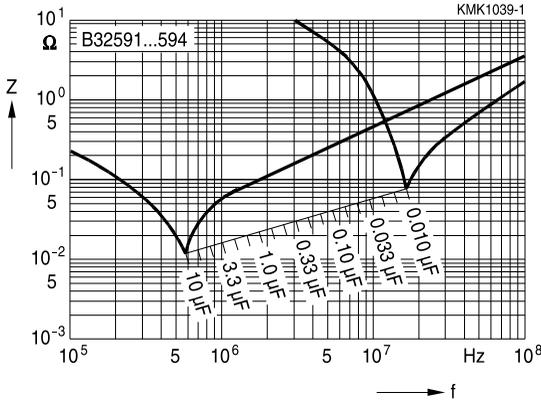
dV/dt values

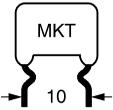| Lead spacing		10 mm	15 mm	22.5 mm	27.5 mm
Technology		Wound	Wound	Wound	Wound
V_R V DC	V_{RMS} V AC	dV/dt in V/µs			
100	63	–	–	2.5	2
250	160	–	–	4	3
400	200	–	–	7	5
630	200	20	15	10	–
630	220	–	–	–	8

k_0 values

Lead spacing		10 mm	15 mm	22.5 mm	27.5 mm
Technology		Wound	Wound	Wound	Wound
V_R V DC	V_{RMS} V AC	k_0 in V^2/µs			
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)

Please read *Cautions and warnings* and
Important notes at the end of this document.

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TDK

MKT

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B32591

General purpose (stacked/wound)

Permissible AC voltage V$_{RMS}$ versus frequency f (for sinusoidal waveforms, T$_A$ ≤55 °C)

For T$_A$ >55 °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$_A$ ≤55 °C)
For T$_A$ >55 °C, please refer to "General technical information", section 3.2.3.

Lead spacing 15 mm

630 V DC/200 V AC

Please read *Cautions and warnings* and
Important notes at the end of this document.

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MKT

22.5

B32593

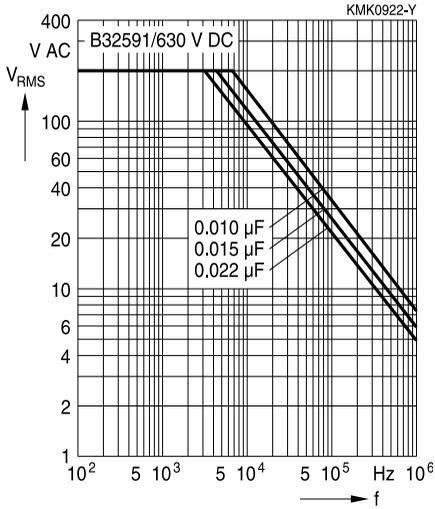**General purpose (wound)**

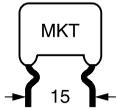**Permissible AC voltage V$_{RMS}$ versus frequency f (for sinusoidal waveforms, T$_A$ ≤55 °C)**

For T$_A$ >55 °C, please refer to "General technical information", section 3.2.3.

Lead spacing 22.5 mm

100 V DC/63 V AC
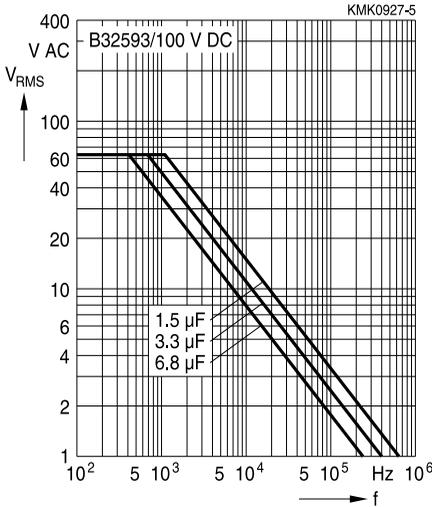
250 V DC/160 V AC
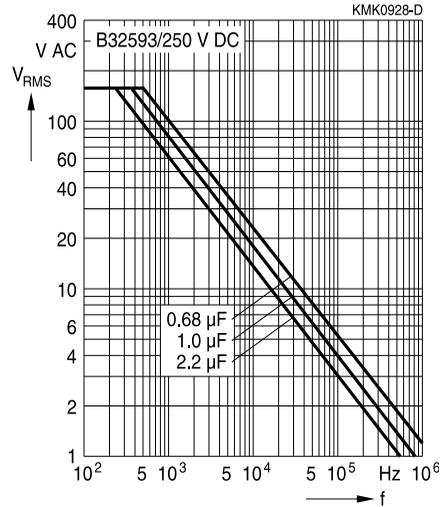
400 V DC/200 V AC

630 V DC/200 V AC
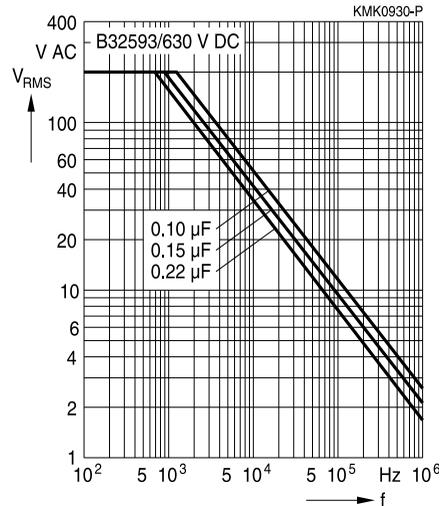
Please read *Cautions and warnings* and
Important notes at the end of this document.

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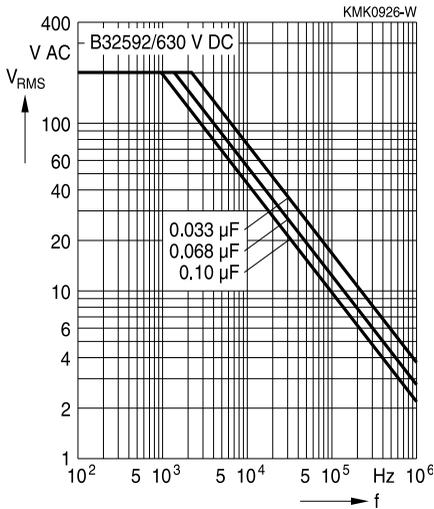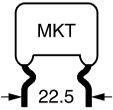**Permissible AC voltage V$_{RMS}$ versus frequency f (for sinusoidal waveforms, T$_A$ ≤55 °C)**
For T$_A$ >55 °C, please refer to "General technical information", section 3.2.3.

Lead spacing 27.5 mm

100 V DC/63 V AC

KMK0931-X
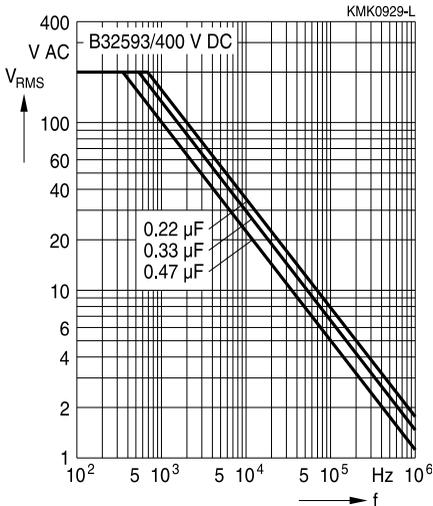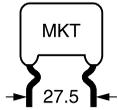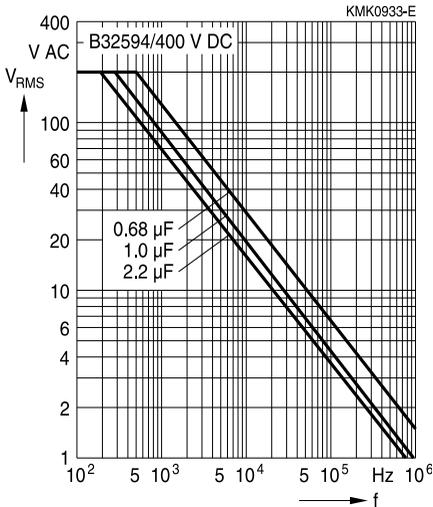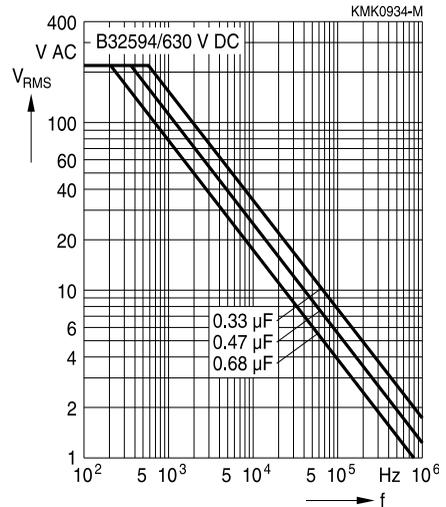

250 V DC/160 V AC

KMK0932-6

400 V DC/200 V AC

KMK0933-E

630 V DC/220 V AC

KMK0934-M

Please read *Cautions and warnings* and
Important notes at the end of this document.

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MKT

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 δ		Within specified limits
Robustness of terminations	IEC 60068-2-21	Tensile strength (test Ua1)		No visible damage Capacitance and tan δ within specified limits
		Wire diameter	Tensile force	
		0.3 < d_1 < 0.5 mm	5 N	
		0.5 < d_1 < 0.8 mm	10 N	
Resistance to soldering heat	IEC 60068-2-20, test Tb, method 1A	Solder bath temperature at 260 ± 5 °C, immersion for 4 seconds (lead spacing $\leq$ 10 mm) 10 seconds (lead spacing > 10 mm)		$\Delta C/C_0 \leq 2\%$ IΔ tan δ I $\leq$ 0.003 for C $\leq$ 1 µF IΔ tan δ I $\leq$ 0.002 for C > 1 µF
Rapid change of temperature	IEC 60384-2	T_A = lower category temperature T_B = upper category temperature Five cycles, duration t = 30 min.		I$\Delta C/C_0$ I $\leq$ 5% IΔ tan δ I $\leq$ 0.003 for C $\leq$ 1 µF IΔ tan δ I $\leq$ 0.002 for C > 1 µF $R_{INS} \geq$ 50% of initial limit
Vibration	IEC 60384-2	Test F_C: vibration sinusoidal Displacement: 0.75 mm Accleration: 98 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 m/s^2 mounted on PCB 6 ms duration		I$\Delta C/C_0$ I $\leq$ 5% IΔ tan δ I $\leq$ 0.003 for C $\leq$ 1 µF IΔ tan δ I $\leq$ 0.002 for C > 1 µF $R_{INS} \geq$ 50% of initial limit
Climatic sequence	IEC 60384-2	Dry heat Tb / 16 h. Damp heat cyclic, 1st cycle + 55 °C / 24h / 95% ... 100% RH Cold Ta / 2h Damp heat cyclic, 5 cycles + 55 °C / 24h / 95% ... 100% rh		I$\Delta C/C_0$ I $\leq$ 5% IΔ tan δ I $\leq$ 0.005 for C $\leq$ 1 µF IΔ tan δ I $\leq$ 0.003 for C > 1 µF $R_{INS} \geq$ 50% of initial limit

Damp Heat Steady State	IEC 60384-2	Test Ca 40 °C / 93% RH / 56 days	No visible damage $I\Delta C/C_0 I \leq 5\%$ $I\Delta \tan \delta I \leq 0.005$ $R_{INS} \geq 50\%$ of initial limit
Endurance A	IEC 60384-2	85 °C/ 1.25 V_R / 2000 hours	No visible damage $I\Delta C/C_0 I \leq 5\%$ $I\Delta \tan \delta I \leq 0.003$ for $C \leq 1 \mu F$ $I\Delta \tan \delta I \leq 0.002$ for $C > 1 \mu F$ $R_{INS} \geq 50\%$ of initial limit
Endurance B	IEC 60384-2	100 °C/ 1.25 V_C / 2000 hours	No visible damage $I\Delta C/C_0 I \leq 5\%$ $I\Delta \tan \delta I \leq 0.003$ for $C \leq 1 \mu F$ $I\Delta \tan \delta I \leq 0.002$ for $C > 1 \mu F$ $R_{INS} \geq 50\%$ 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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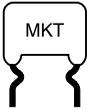
B32591 ... B32594

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 MKT	(lead spacing ≤ 7.5 mm) uncoated (lead spacing ≤ 10 mm) insulated (B32559)		< 4 s recommended soldering profile for MKT uncoated (lead spacing ≤ 10 mm) and insulated (B32559)
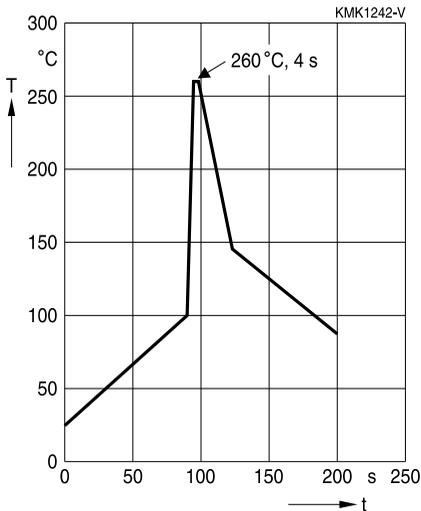
Immersion depth	2.0 +0/−0.5 mm from capacitor body or seating plane
Shield	Heat-absorbing board, (1.5 ±0.5) mm thick, between capacitor body and liquid solder
Evaluation criteria:	
Visual inspection	No visible damage
$\Delta C/C_0$	2% for MKT/MKP/MFP 5% for EMI suppression capacitors
tan δ	As specified in sectional specification
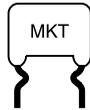
1.3 General notes on soldering

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

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

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

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

Uncoated capacitors

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

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

Please read *Cautions and warnings* and
Important notes at the end of this document.

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MKT

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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"

Please read *Cautions and warnings* and
Important notes at the end of this document.

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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.
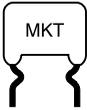
Please read *Cautions and warnings* and
Important notes at the end of this document.

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Symbols and terms

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

Symbol	English	German
I_{RMS}	(Sinusoidal) alternating current, root-mean-square value	(Sinusförmiger) Wechselstrom
i_z	Capacitance drift	Inkonstanz der Kapazität
k_0	Pulse characteristic	Impulskennwert
L_S	Series inductance	Serieninduktivität
λ	Failure rate	Ausfallrate
λ_0	Constant failure rate during useful service life	Konstante Ausfallrate in der Nutzungsphase
λ_{test}	Failure rate, determined by tests	Experimentell ermittelte Ausfallrate
P_{diss}	Dissipated power	Abgegebene Verlustleistung
P_{gen}	Generated power	Erzeugte Verlustleistung
Q	Heat energy	Wärmeenergie
ρ	Density of water vapor in air	Dichte von Wasserdampf in Luft
R	Universal molar constant for gases	Allg. Molarkonstante für Gas
R	Ohmic resistance of discharge circuit	Ohmscher Widerstand des Entladekreises
R_i	Internal resistance	Innenwiderstand
R_{ins}	Insulation resistance	Isolationswiderstand
R_P	Parallel resistance	Parallelwiderstand
R_S	Series resistance	Serienwiderstand
S	severity (humidity test)	Schärfegrad (Feuchtetest)
t	Time	Zeit
T	Temperature	Temperatur
τ	Time constant	Zeitkonstante
$\tan \delta$	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 Verlfustfaktors
$\tan \delta_S$	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	Beriebstemperatur
T_R	Rated temperature	Nenntemperatur
T_{ref}	Reference temperature	Referenztemperatur
t_{SL}	Reference service life	Referenz-Lebensdauer

Please read *Cautions and warnings* and
Important notes at the end of this document.

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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
$\boxed{e}$	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.**

4. In order to satisfy certain technical requirements, **some of the products described in this publication may contain substances subject to restrictions in certain jurisdictions (e.g. because they are classed as hazardous)**. Useful information on this will be found in our Material Data Sheets on the Internet (www.epcos.com/material). Should you have any more detailed questions, please contact our sales offices.

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