

# **Aluminum electrolytic capacitors**

## Single-ended capacitors

**Series/Type:**        **B41887**

**Date:**                December 2016

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## Long-life grade capacitors

### Applications

- Automotive electronics
- For use in output circuits of switch-mode power supplies of compact design
- For professional industrial electronics, telecommunications and data processing equipment

### Features

- Very low impedance at high frequency
- Long useful life
- High ripple current capability
- RoHS-compatible

### Construction

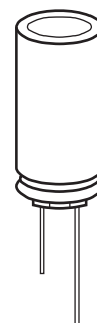
- Radial leads
- Charge-discharge proof, polar
- Aluminum case with insulating sleeve
- Minus pole marking on the insulating sleeve
- Case with safety vent

### Delivery mode

Terminal configurations and packing:

- Bulk
- Taped, Ammo pack
- Cut
- Kinked
- PAPER (Protection Against Polarity Reversal):  
crimped leads, J leads, bent leads

Refer to chapter "Single-ended capacitors – Taping, packing and lead configurations" for further details.





# Specifications and characteristics in brief

Rated voltage $V_R$	16 ... 35 V DC			
Surge voltage $V_S$	$1.15 \cdot V_R$			
Rated capacitance $C_R$	470 ... 5600 $\mu\text{F}$			
Capacitance tolerance	$\pm 20\% \triangleq M$			
Dissipation factor $\tan \delta$ (20 °C, 120 Hz)	For capacitance higher than 1000 $\mu\text{F}$ add 0.02 for every increase of 1000 $\mu\text{F}$ .			
	$V_R$ (V DC)	16	25	35
	$\tan \delta$ (max.)	0.16	0.14	0.12
Leakage current $I_{\text{leak}}$ (20 °C, 5 min)	$I_{\text{leak}} = 0.01 \mu\text{A} \cdot \left( \frac{C_R}{\mu\text{F}} \cdot \frac{V_R}{V} \right)$			
Self-inductance ESL	Diameter (mm)	10 ... 12.5	16	18
	ESL (nH)	20	26	34
Useful life <sup>1)</sup> 105 °C; $V_R$ ; $I_{AC,R}$	> 8000 h for $d = 10$ mm > 10000 h for $d \geq 12.5$ mm			
Requirements	$ \Delta C/C  \leq 30\%$ of initial value $\tan \delta \leq 3$ times initial specified limit $I_{\text{leak}} \leq$ initial specified limit			
Voltage endurance test 105 °C; $V_R$	8000 h for $d = 10$ mm 10000 h for $d \geq 12.5$ mm			
Post test requirements	$ \Delta C/C  \leq 20\%$ of initial value $\tan \delta \leq 2$ times initial specified value $I_{\text{leak}} \leq$ initial specified limit			
Vibration resistance test	To IEC 60068-2-6, test Fc: Frequency range 10 Hz ... 2 kHz, displacement amplitude max. 1.5 mm, acceleration max. 20 g, duration $3 \times 2$ h. Capacitor rigidly clamped by the aluminum case.			
IEC climatic category	To IEC 60068-1: 40/105/56 (–40 °C/+105 °C/56 days damp heat test)			
Sectional specification	IEC 60384-4			

1) Refer to chapter "General technical information, 5 Useful life" on how to interpret useful life.



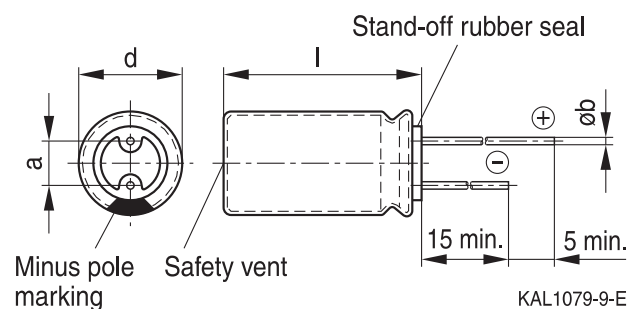
**B41887**

**Long useful life – 105 °C**

## Dimensional drawings

### With stand-off rubber seal

Diameters (mm): 10, 12.5, 16, 18



## Dimensions and weights

Dimensions (mm)				Approx. weight
d +0.5	l	a ±0.5	b	g
10	20 +2.0	5.0	0.60 ±0.05	2.6
12.5	20 +2.0	5.0	0.60 ±0.05	3.6
12.5	25 +2.0	5.0	0.60 ±0.05	4.5
12.5	30 +2.0	5.0	0.80 ±0.05	5.3
12.5	35 +2.0	5.0	0.80 ±0.05	6.4
16	20 +2.0	7.5	0.80 ±0.05	5.5
16	25 +2.0	7.5	0.80 ±0.05	7.5
18	20 +2.0	7.5	0.80 ±0.1	8.0
18	25 +2.0	7.5	0.80 ±0.1	9.0



## Overview of available types

Other voltage and capacitance ratings are available upon request.

$V_R$ (V DC)	16	25	35
	Case dimensions $d \times l$ (mm)		
$C_R$ (μF)			
470			10 × 20
560			12.5 × 20
680			12.5 × 20
820		10 × 20	12.5 × 20
1000		12.5 × 20	
1200		12.5 × 20	12.5 × 25
1500	10 × 20 12.5 × 20	12.5 × 25	12.5 × 30 16 × 20
1800	12.5 × 20	12.5 × 25	12.5 × 35 16 × 25 18 × 20
2200	12.5 × 25	12.5 × 30 16 × 20	
2700	12.5 × 25	12.5 × 35 16 × 25 18 × 20	18 × 25
3300	12.5 × 30 16 × 20	18 × 25	
3900	12.5 × 35 16 × 25 18 × 20		
4700	18 × 25		
5600	18 × 25		


**B41887**
**Long useful life – 105 °C**

### Technical data and ordering codes

$C_R$ 120 Hz 20 °C $\mu F$	Case dimensions $d \times l$ mm	$Z_{max}$ 10 kHz –10 °C $\Omega$	$Z_{max}$ 100 kHz 20 °C $\Omega$	$I_{AC,R}$ 100 kHz 105 °C mA	Ordering code (composition see below)
<b><math>V_R = 16 \text{ V DC}</math></b>					
1500	10 × 20	0.084	0.028	2500	B41887A4158M***
1500	12.5 × 20	0.075	0.025	2600	B41887B4158M***
1800	12.5 × 20	0.075	0.025	2600	B41887A4188M***
2200	12.5 × 25	0.057	0.019	3200	B41887A4228M***
2700	12.5 × 25	0.057	0.019	3200	B41887A4278M***
3300	12.5 × 30	0.054	0.018	3660	B41887A4338M***
3300	16 × 20	0.063	0.021	3300	B41887B4338M***
3900	12.5 × 35	0.048	0.016	4120	B41887A4398M***
3900	16 × 25	0.051	0.017	3810	B41887B4398M***
3900	18 × 20	0.060	0.020	3450	B41887C4398M***
4700	18 × 25	0.048	0.016	3880	B41887A4478M***
5600	18 × 25	0.048	0.016	3880	B41887A4568M***
<b><math>V_R = 25 \text{ V DC}</math></b>					
820	10 × 20	0.084	0.028	2500	B41887A5827M***
1000	12.5 × 20	0.075	0.025	2600	B41887A5108M***
1200	12.5 × 20	0.075	0.025	2600	B41887A5128M***
1500	12.5 × 25	0.057	0.019	3200	B41887A5158M***
1800	12.5 × 25	0.057	0.019	3200	B41887A5188M***
2200	12.5 × 30	0.054	0.018	3660	B41887A5228M***
2200	16 × 20	0.063	0.021	3330	B41887B5228M***
2700	12.5 × 35	0.048	0.016	4120	B41887A5278M***
2700	16 × 25	0.051	0.017	3810	B41887C5278M***
2700	18 × 20	0.060	0.020	3450	B41887B5278M***
3300	18 × 25	0.048	0.016	3880	B41887A5338M***

### Composition of ordering code

\*\*\* = Version

- 000 = for standard leads, bulk
- 001 = for kinked leads, bulk (excluding  $d \times l = 12.5 \times 30/35 \text{ mm}$ )
- 002 = for cut leads, bulk (excluding  $d \times l = 12.5 \times 30/35 \text{ mm}$ )
- 003 = for crimped leads, blister (for  $\varnothing 16 \dots 18 \text{ mm}$ )
- 004 = for J leads, blister (excluding  $d \times l = 12.5 \times 30/35 \text{ mm}$ )
- 008 = for taped leads, Ammo Pack, lead spacing  $F = 5.0 \text{ mm}$  (for  $d \times l = 10 \times 20 \dots 12.5 \times 25 \text{ mm}$ )
- 009 = for taped leads, Ammo pack, lead spacing  $F = 7.5 \text{ mm}$  (for  $\varnothing 16 \dots 18 \text{ mm}$ )
- 012 = for bent 90° leads, blister (for  $\varnothing 16 \dots 18 \text{ mm}$ )



## Technical data and ordering codes

$C_R$ 120 Hz 20 °C $\mu F$	Case dimensions $d \times l$ mm	$Z_{max}$ 10 kHz –10 °C $\Omega$	$Z_{max}$ 100 kHz 20 °C $\Omega$	$I_{AC,R}$ 100 kHz 105 °C mA	Ordering code (composition see below)
$V_R = 35 V DC$					
470	10 × 20	0.084	0.028	2500	B41887A7477M***
560	12.5 × 20	0.075	0.025	2600	B41887A7567M***
680	12.5 × 20	0.075	0.025	2600	B41887A7687M***
820	12.5 × 20	0.075	0.025	2600	B41887A7827M***
1200	12.5 × 25	0.057	0.019	3200	B41887A7128M***
1500	12.5 × 30	0.054	0.018	3660	B41887A7158M***
1500	16 × 20	0.063	0.021	3300	B41887B7158M***
1800	12.5 × 35	0.048	0.016	4120	B41887A7188M***
1800	16 × 25	0.051	0.017	3810	B41887B7188M***
1800	18 × 20	0.060	0.020	3450	B41887C7188M***
2700	18 × 25	0.048	0.016	3880	B41887A7278M***

## Composition of ordering code

\*\*\* = Version

000 = for standard leads, bulk

001 = for kinked leads, bulk (excluding  $d \times l = 12.5 \times 30/35$  mm)

002 = for cut leads, bulk (excluding  $d \times l = 12.5 \times 30/35$  mm)

003 = for crimped leads, blister (for  $\varnothing 16 \dots 18$  mm)

004 = for J leads, blister (excluding  $d \times l = 12.5 \times 30/35$  mm)

008 = for taped leads, Ammo Pack, lead spacing  $F = 5.0$  mm (for  $d \times l = 10 \times 20 \dots 12.5 \times 25$  mm)

009 = for taped leads, Ammo pack, lead spacing  $F = 7.5$  mm (for  $\varnothing 16 \dots 18$  mm)

012 = for bent 90° leads, blister (for  $\varnothing 16 \dots 18$  mm)



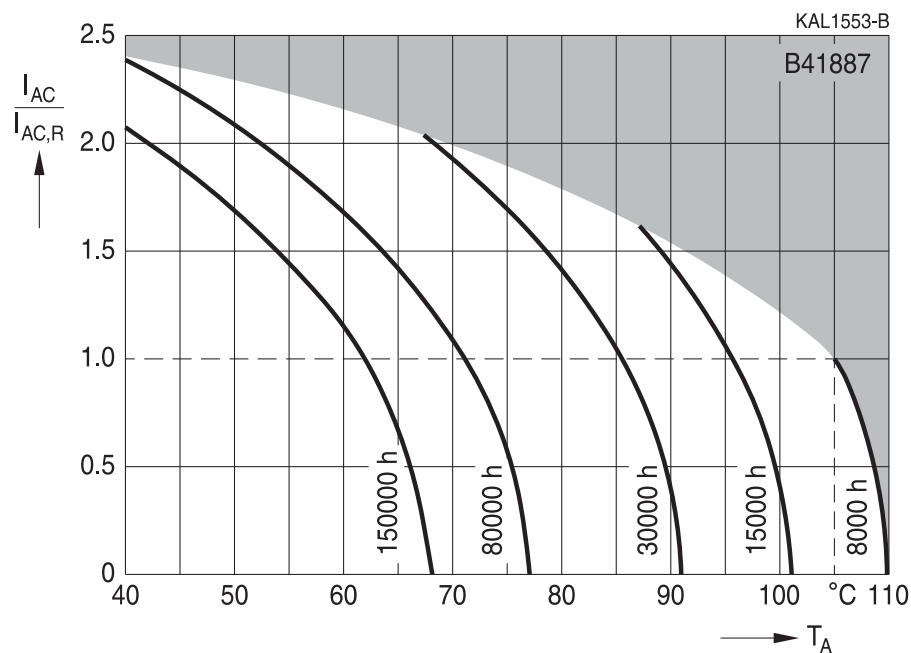
**B41887**

**Long useful life – 105 °C**

### Useful life<sup>1)</sup>

depending on ambient temperature  $T_A$  under ripple current operating conditions

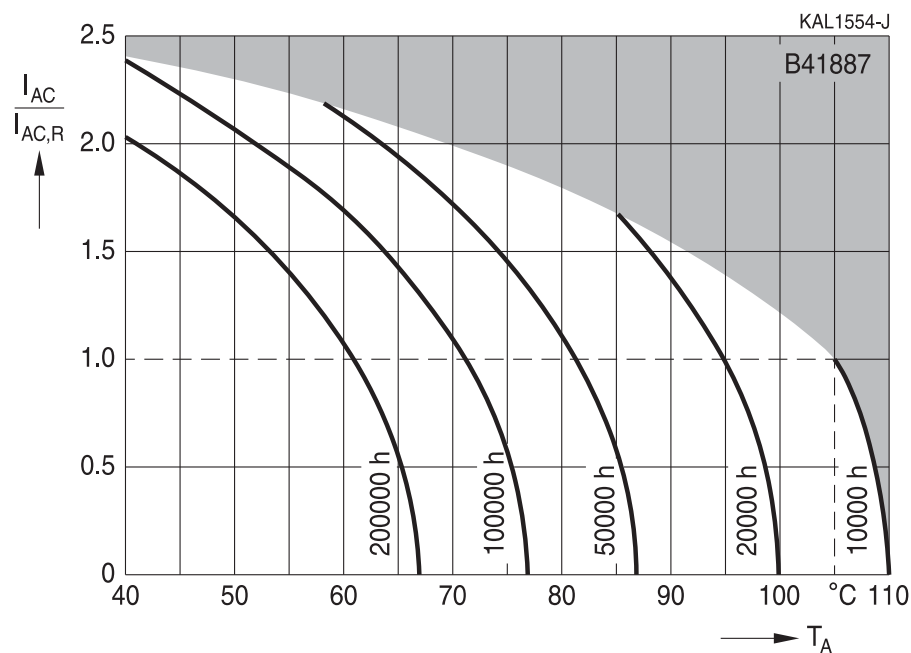
$d = 10 \text{ mm}$



### Useful life<sup>1)</sup>

depending on ambient temperature  $T_A$  under ripple current operating conditions

$d \geq 12.5 \text{ mm}$

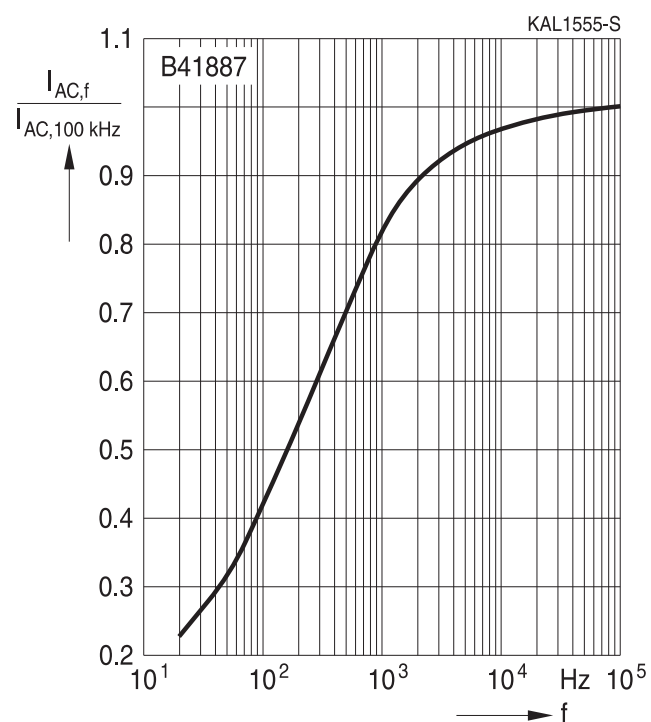


1) Refer to chapter "General technical information, 5 Useful life" on how to interpret useful life.





**Frequency factor of permissible ripple current  $I_{AC}$  versus frequency  $f$**





**B41887**

**Long useful life – 105 °C**

## Taping, packing and lead configurations

### Taping

Single-ended capacitors are available taped in Ammo pack from diameter 8 to 18 mm as follows:

Lead spacing  $F = 3.5$  mm ( $\varnothing d = 8$  mm)

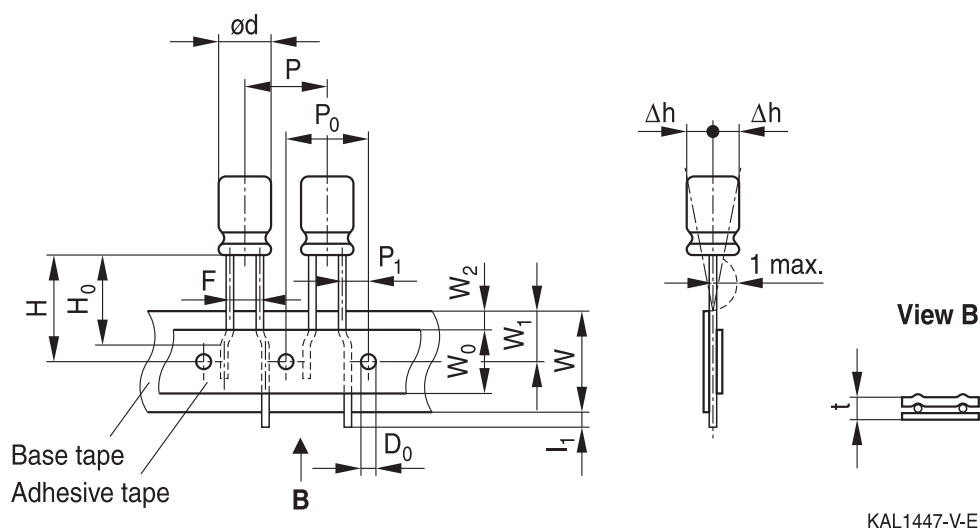
Lead spacing  $F = 5.0$  mm ( $\varnothing d = 8 \dots 12.5$  mm)

Lead spacing  $F = 7.5$  mm ( $\varnothing d = 16 \dots 18$  mm).

The dimensions for  $F$ ,  $P_1$  and  $1 \text{ max.}$  are specified with reference to the center of the terminal wires.

### Lead spacing 3.5 mm ( $\varnothing d = 8$ mm)

Last 3 digits of ordering code: 006



### Dimensions in mm

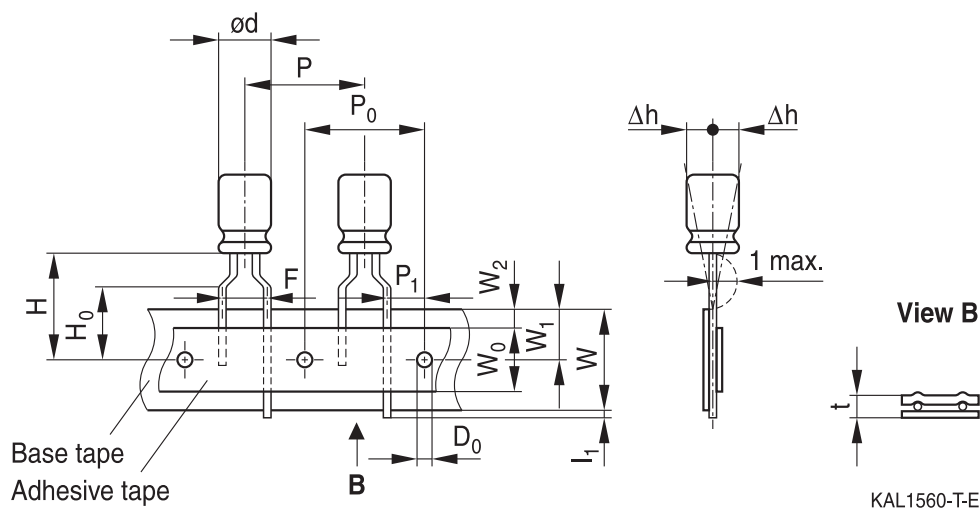
$\varnothing d$	$F$	$H$	$W$	$W_0$	$W_1$	$W_2$	$P$	$P_0$	$P_1$	$L_1$	$t$	$\Delta h$	$D_0$
8	3.5	18.5	18.0	9.5	9.0	3.0	12.7	12.7	4.6	1.0	0.7	1.0	4.0
Tolerance	+0.8 -0.2	$\pm 1.0$	$\pm 0.5$	min.	$\pm 0.5$	max.	$\pm 1.0$	$\pm 0.3$	$\pm 0.6$	max.	$\pm 0.2$	max.	$\pm 0.2$

Leads can also run straight through the taping area.



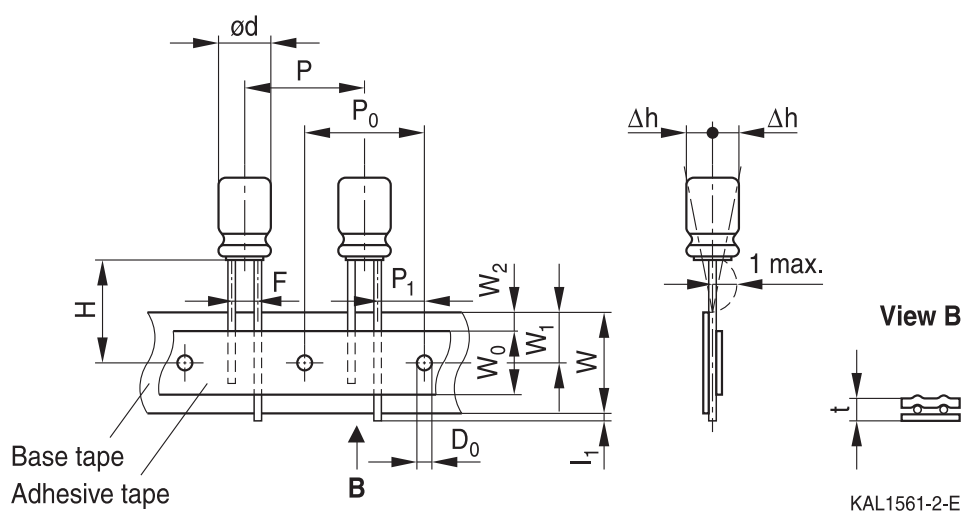
# Lead spacing 5.0 mm ( $\varnothing d = 8$ mm)

Last 3 digits of ordering code: 008



# Lead spacing 5.0 mm ( $\varnothing d = 10 \dots 12.5$ mm)

Last 3 digits of ordering code: 008



## Dimensions in mm

$\varnothing d$	F	H	W	$W_0$	$W_1$	$W_2$	$H_0$	P	$P_0$	$P_1$	$L_1$	t	$\Delta h$	$D_0$
8	5.0	20.0	18.0	9.5	9.0	1.5	16.0	12.7	12.7	3.85	1.0	0.6	1.0	4.0
10		19.0		9.5			—	12.7	12.7	3.85				
12.5		19.0		11.5			—	15.0	15.0	5.0				
Tolerance	+0.8 −0.2	±0.75	±0.5	min.	±0.5	max.	±0.5	±1.0	±0.2	±0.5	max.	+0.3 −0.2	max.	±0.2

Taping is available up to dimensions  $d \times l = 12.5 \times 25$  mm.

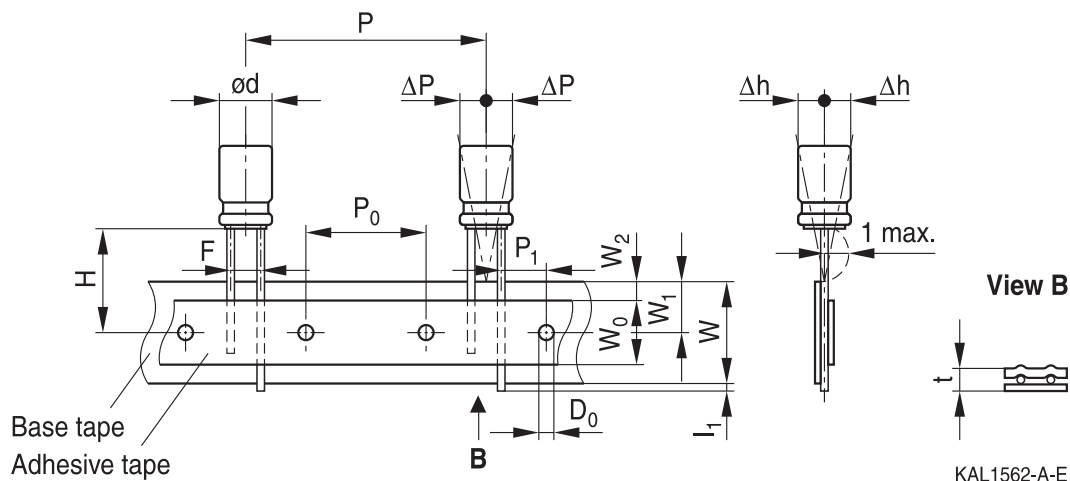


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**Lead spacing 7.5 mm ( $\varnothing d = 16 \dots 18$  mm)**

Last 3 digits of ordering code: 009



### Dimensions in mm

$\varnothing d$	F	H	W	$W_0$	$W_1$	$W_2$	P	$P_0$	$P_1$	$L_1$	t	$\Delta P$	$\Delta h$	$D_0$
16	7.5	18.5	18.0	12.5	9.0	1.5	30.0	15.0	3.75	1.0	0.7	0	0	4.0
18														
Tolerance	$\pm 0.8$	$-0.5$ $+0.75$	$\pm 0.5$	min.	$\pm 0.5$	max.	$\pm 1.0$	$\pm 0.2$	$\pm 0.5$	max.	$\pm 0.2$	$\pm 1.0$	$\pm 1.0$	$\pm 0.2$

Taping is available up to dimensions  $d \times l = 16 \times 31.5$  mm and  $18 \times 31.5$  mm.



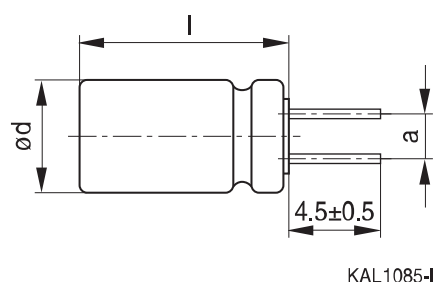
## Cut or kinked leads

Single-ended capacitors are available with cut or kinked leads. Other lead configurations also available upon request.

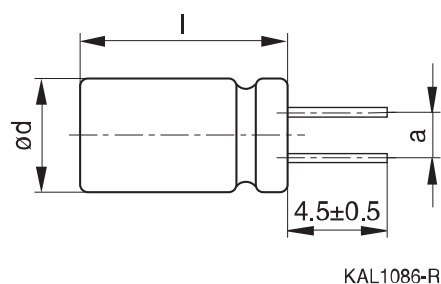
## Cut leads

Last 3 digits of ordering code: 002

### With stand-off rubber seal



### With flat rubber seal



Case size $d \times l$ (mm)	Dimensions (mm) $a \pm 0.5$
10 × 12.5	5.0
10 × 16	5.0
10 × 20	5.0
12.5 × 20	5.0
12.5 × 25	5.0
16 × 20	7.5
16 × 25	7.5
16 × 31.5	7.5
16 × 35.5	7.5
18 × 20	7.5
18 × 25	7.5
18 × 31.5	7.5
18 × 35	7.5
18 × 40	7.5



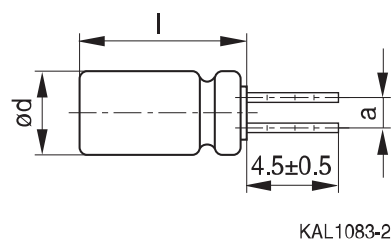
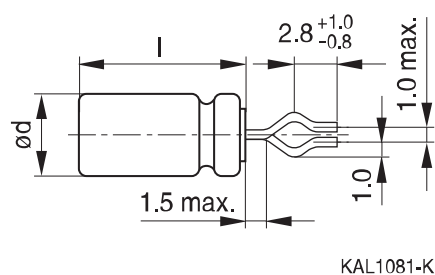
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**Long useful life – 105 °C**

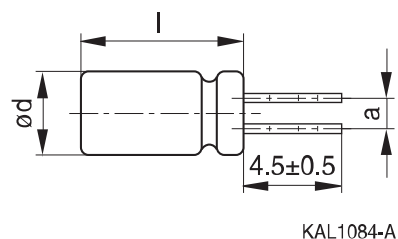
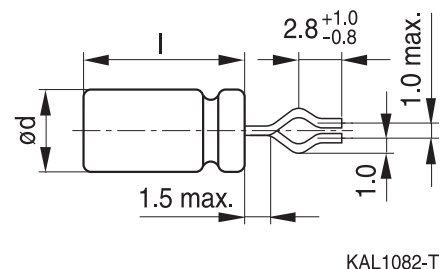
## Kinked leads

Last 3 digits of ordering code: 001

### With stand-off rubber seal



### With flat rubber seal



Case size $d \times l$ (mm)	Dimensions (mm) $a \pm 0.5$
10 × 20	5.0
12.5 × 20	5.0
12.5 × 25	5.0
16 × 20	7.5
16 × 25	7.5
16 × 31.5	7.5
16 × 35.5	7.5
18 × 20	7.5
18 × 25	7.5
18 × 31.5	7.5
18 × 35	7.5
18 × 40	7.5



## PAPR leads (Protection Against Polarity Reversal)

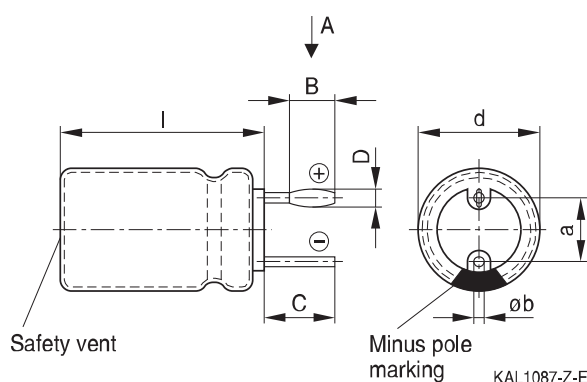
These lead configurations ensure correct placement of the capacitor on the PCB with regard to polarity. PAPR leads are available for diameters from 10 mm up to 18 mm (excluding  $d \times l = 12.5 \times 30/35/40$  mm).

There are three configurations available: Crimped leads, J leads, bent 90° leads.

## Crimped leads

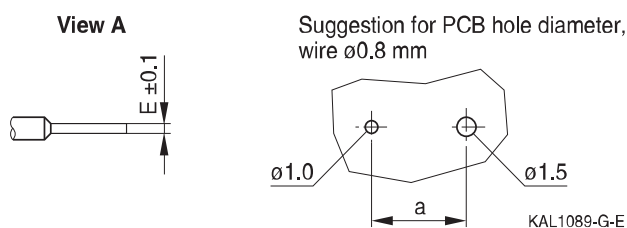
Last 3 digits of ordering code: 003

## With stand-off rubber seal



The series B41898 has no sleeve nor minus pole marking, the positive pole is marked on the aluminum case side instead.

## Suggestion for PCB hole diameter



Case size $d \times l$ (mm)	Dimensions (mm)					
	$B \pm 0.2$	$C \pm 0.5$	$D \pm 0.1$	$E \pm 0.1$	$a \pm 0.5$	$\varnothing b$
16 × 20	1.5	3.0	1.3	0.3	7.5	$0.8 \pm 0.05$
16 × 25	1.5	3.0	1.3	0.3	7.5	$0.8 \pm 0.05$
16 × 31.5	1.5	3.0	1.3	0.3	7.5	$0.8 \pm 0.05$
16 × 35.5	1.5	3.0	1.3	0.3	7.5	$0.8 \pm 0.05$
18 × 20	1.5	3.0	1.3	0.3	7.5	$0.8 \pm 0.1$
18 × 25	1.5	3.0	1.3	0.3	7.5	$0.8 \pm 0.1$
18 × 31.5	1.5	3.0	1.3	0.3	7.5	$0.8 \pm 0.1$
18 × 35	1.5	3.0	1.3	0.3	7.5	$0.8 \pm 0.1$
18 × 40	1.5	3.0	1.3	0.3	7.5	$0.8 \pm 0.1$

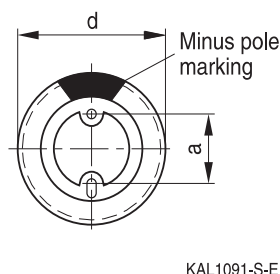
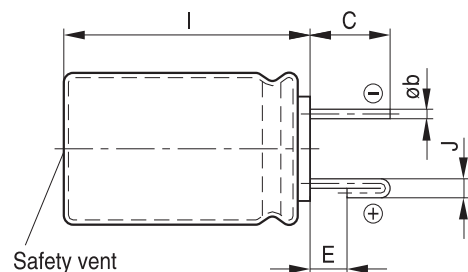


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**Long useful life – 105 °C**

## J leads

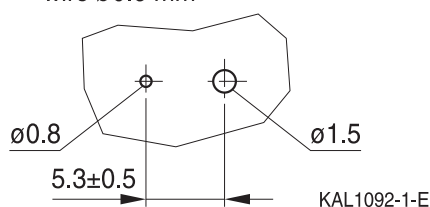
Last 3 digits of ordering code: 004



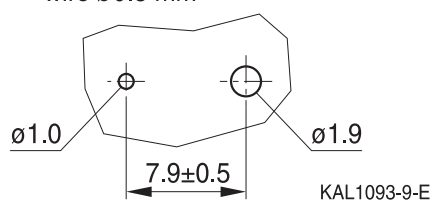
The series B41898 has no sleeve nor minus pole marking, the positive pole is marked on the aluminum case side instead.

## Suggestion for PCB hole diameter

Suggestion for PCB hole diameter,  
wire  $\varnothing 0.6$  mm



Suggestion for PCB hole diameter,  
wire  $\varnothing 0.8$  mm



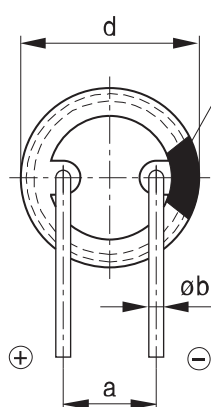
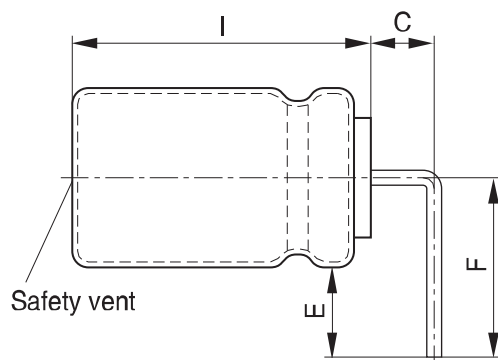
Case size $d \times l$ (mm)	Dimensions (mm)				
	$C \pm 0.5$	$E \pm 0.5$	$J \pm 0.2$	$a \pm 0.5$	$\varnothing b$
10 × 12.5	3.2	0.7	1.2	5.0	$0.6 \pm 0.05$
10 × 16	3.2	0.7	1.2	5.0	$0.6 \pm 0.05$
10 × 20	3.2	0.7	1.2	5.0	$0.6 \pm 0.05$
12.5 × 20	3.2	0.7	1.2	5.0	$0.6 \pm 0.05$
12.5 × 25	3.2	0.7	1.2	5.0	$0.6 \pm 0.05$
16 × 20	3.5	0.7	1.6	7.5	$0.8 \pm 0.05$
16 × 25	3.5	0.7	1.6	7.5	$0.8 \pm 0.05$
16 × 31.5	3.5	0.7	1.6	7.5	$0.8 \pm 0.05$
16 × 35.5	3.5	0.7	1.6	7.5	$0.8 \pm 0.05$
18 × 20	3.5	0.7	1.6	7.5	$0.8 \pm 0.1$
18 × 25	3.5	0.7	1.6	7.5	$0.8 \pm 0.1$
18 × 31.5	3.5	0.7	1.6	7.5	$0.8 \pm 0.1$
18 × 35	3.5	0.7	1.6	7.5	$0.8 \pm 0.1$





# Bent 90° leads for horizontal mounting pinning

Last 3 digits of ordering code: 012



Minus pole marking

The series B41898 has no sleeve nor minus pole marking, the positive pole is marked on the aluminum case side instead.

KAL1094-H-E

Case size d × l (mm)	Dimensions (mm)				
	C ±0.5	E ±0.5	F ±0.5	a ±0.5	Øb
16 × 20	4.0	4.0	12.0	7.5	0.8 ±0.05
16 × 25	4.0	4.0	12.0	7.5	0.8 ±0.05
16 × 31.5	4.0	4.0	12.0	7.5	0.8 ±0.05
16 × 35.5	4.0	4.0	12.0	7.5	0.8 ±0.05
18 × 20	4.0	4.0	13.0	7.5	0.8 ±0.1
18 × 25	4.0	4.0	13.0	7.5	0.8 ±0.1
18 × 31.5	4.0	4.0	13.0	7.5	0.8 ±0.1
18 × 35	4.0	4.0	13.0	7.5	0.8 ±0.1
18 × 40	4.0	4.0	13.0	7.5	0.8 ±0.1

Bent leads for diameter 12.5 mm available upon request.

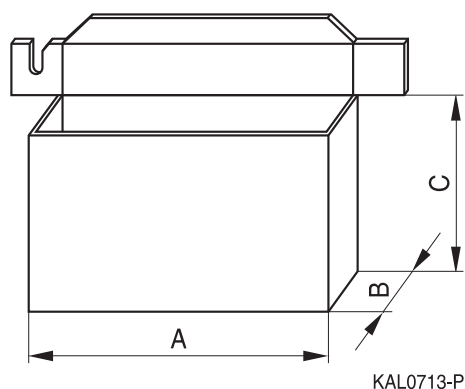


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## Packing units and box dimensions

### Ammo pack



Case size d × l mm	Dimensions (mm)			Packing units pcs.
	A <sub>max</sub>	B <sub>max</sub>	C <sub>max</sub>	
8 × 11.5	345	60	240	1000
10 × 12.5	345	60	280	750
10 × 16	345	65	200	500
10 × 20	345	65	200	500
12.5 × 20	345	65	260	500
12.5 × 25	345	70	260	500
16 × 20	325	65	285	300
16 × 25	325	65	285	300
16 × 31.5	325	80	275	300
18 × 20	325	65	285	250
18 × 25	325	65	285	250
18 × 31.5	325	80	275	250



## Overview of packing units and code numbers

						PAPR			
Case size d × l	Stan- dard, bulk pcs.	Taped, Ammo pack			Kinked leads, bulk pcs.	Cut leads, bulk pcs.	Crimped leads, blister pcs.	J leads, blister pcs.	Bent 90° leads, blister pcs.
mm	pcs.	pcs.			pcs.	pcs.	pcs.	pcs.	pcs.
8 × 11.5	1000	1000			—	—	—	—	
10 × 12.5	1000	750			—	1000	—	900	
10 × 16	1000	500			—	1000	—	675	
10 × 20	500	500			500	500	—	500	
12.5 × 20	350	500			350	350	—	300	1)
12.5 × 25	250	500			500	500	—	225	1)
12.5 × 30	200	—			—	—	—	—	
12.5 × 35	175	—			—	—	—	—	
12.5 × 40	175	—			—	—	—	—	
16 × 20	250	300			200	200	200	200	420
16 × 25	250	300			200	200	216	216	216
16 × 31.5	200	300			250	250	180	180	180
16 × 35.5	100	—			100	100	150	150	150
18 × 20	175	250			175	175	200	200	420
18 × 25	150	250			150	150	200	200	200
18 × 31.5	100	250			100	100	150	150	150
18 × 35	100	—			100	100	150	150	150
18 × 40	125	—			100	100	72	—	72
The last three digits of the complete ordering code state the lead configuration	000	Code	F (mm)	d (mm)	001	002	003	004	012
		006	3.5	8					
		008	5	8...12.5					
		009	7.5	16...18					

1) Available upon request



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## Cautions and warnings

### Personal safety

The electrolytes used by EPCOS have been optimized both with a view to the intended application and with regard to health and environmental compatibility. They do not contain any solvents that are detrimental to health, e.g. dimethyl formamide (DMF) or dimethyl acetamide (DMAC).

Furthermore, some of the high-voltage electrolytes used by EPCOS are self-extinguishing.

As far as possible, EPCOS does not use any dangerous chemicals or compounds to produce operating electrolytes, although in exceptional cases, such materials must be used in order to achieve specific physical and electrical properties because no alternative materials are currently known. We do, however, restrict the amount of dangerous materials used in our products to an absolute minimum.

Materials and chemicals used in EPCOS aluminum electrolytic capacitors are continuously adapted in compliance with the EPCOS Corporate Environmental Policy and the latest EU regulations and guidelines such as RoHS, REACH/SVHC, GADSL, and ELV.

MDS (Material Data Sheets) are available on the EPCOS website for all types listed in the data book. MDS for customer specific capacitors are available upon request.

MSDS (Material Safety Data Sheets) are available for all of our electrolytes upon request.

Nevertheless, the following rules should be observed when handling aluminum electrolytic capacitors: No electrolyte should come into contact with eyes or skin. If electrolyte does come into contact with the skin, wash the affected areas immediately with running water. If the eyes are affected, rinse them for 10 minutes with plenty of water. If symptoms persist, seek medical treatment. Avoid inhaling electrolyte vapor or mists. Workplaces and other affected areas should be well ventilated. Clothing that has been contaminated by electrolyte must be changed and rinsed in water.



## Product safety

The table below summarizes the safety instructions that must be observed without fail. A detailed description can be found in the relevant sections of chapter "General technical information".

Topic	Safety information	Reference chapter "General technical information"
Polarity	Make sure that polar capacitors are connected with the right polarity.	1 "Basic construction of aluminum electrolytic capacitors"
Reverse voltage	Voltages of opposite polarity should be prevented by connecting a diode.	3.1.6 "Reverse voltage"
Mounting position of screw-terminal capacitors	Screw terminal capacitors must not be mounted with terminals facing down unless otherwise specified.	11.1. "Mounting positions of capacitors with screw terminals"
Robustness of terminals	The following maximum tightening torques must not be exceeded when connecting screw terminals: M5: 2.5 Nm M6: 4.0 Nm	11.3 "Mounting torques"
Mounting of single-ended capacitors	The internal structure of single-ended capacitors might be damaged if excessive force is applied to the lead wires. Avoid any compressive, tensile or flexural stress. Do not move the capacitor after soldering to PC board. Do not pick up the PC board by the soldered capacitor. Do not insert the capacitor on the PC board with a hole space different to the lead space specified.	11.4 "Mounting considerations for single-ended capacitors"
Soldering	Do not exceed the specified time or temperature limits during soldering.	11.5 "Soldering"
Soldering, cleaning agents	Do not allow halogenated hydrocarbons to come into contact with aluminum electrolytic capacitors.	11.6 "Cleaning agents"
Upper category temperature	Do not exceed the upper category temperature.	7.2 "Maximum permissible operating temperature"
Passive flammability	Avoid external energy, e.g. fire.	8.1 "Passive flammability"



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Topic	Safety information	Reference chapter "General technical information"
Active flammability	Avoid overload of the capacitors.	8.2 "Active flammability"
Maintenance	Make periodic inspections of the capacitors. Before the inspection, make sure that the power supply is turned off and carefully discharge the capacitors. Do not apply excessive mechanical stress to the capacitor terminals when mounting.	10 "Maintenance"
Storage	Do not store capacitors at high temperatures or high humidity. Capacitors should be stored at +5 to +35 °C and a relative humidity of ≤ 75%.	7.3 "Shelf life and storage conditions"
		Reference chapter "Capacitors with screw terminals"
Breakdown strength of insulating sleeves	Do not damage the insulating sleeve, especially when ring clips are used for mounting.	"Screw terminals – accessories"

### 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).



## Symbols and terms

Symbol	English	German
C	Capacitance	Kapazität
$C_R$	Rated capacitance	Nennkapazität
$C_S$	Series capacitance	Serienkapazität
$C_{S,T}$	Series capacitance at temperature T	Serienkapazität bei Temperatur T
$C_f$	Capacitance at frequency f	Kapazität bei Frequenz f
d	Case diameter, nominal dimension	Gehäusedurchmesser, Nennmaß
$d_{\max}$	Maximum case diameter	Maximaler Gehäusedurchmesser
ESL	Self-inductance	Eigeninduktivität
ESR	Equivalent series resistance	Ersatzserienwiderstand
$ESR_f$	Equivalent series resistance at frequency f	Ersatzserienwiderstand bei Frequenz f
$ESR_T$	Equivalent series resistance at temperature T	Ersatzserienwiderstand bei Temperatur T
f	Frequency	Frequenz
I	Current	Strom
$I_{AC}$	Alternating current (ripple current)	Wechselstrom
$I_{AC,RMS}$	Root-mean-square value of alternating current	Wechselstrom, Effektivwert
$I_{AC,f}$	Ripple current at frequency f	Wechselstrom bei Frequenz f
$I_{AC,max}$	Maximum permissible ripple current	Maximal zulässiger Wechselstrom
$I_{AC,R}$	Rated ripple current	Nennwechselstrom
$I_{leak}$	Leakage current	Reststrom
$I_{leak,op}$	Operating leakage current	Betriebsreststrom
l	Case length, nominal dimension	Gehäuselänge, Nennmaß
$l_{\max}$	Maximum case length (without terminals and mounting stud)	Maximale Gehäuselänge (ohne Anschlüsse und Gewindebolzen)
R	Resistance	Widerstand
$R_{ins}$	Insulation resistance	Isolationswiderstand
$R_{symm}$	Balancing resistance	Symmetrierwiderstand
T	Temperature	Temperatur
$\Delta T$	Temperature difference	Temperaturdifferenz
$T_A$	Ambient temperature	Umgebungstemperatur
$T_C$	Case temperature	Gehäusetemperatur
$T_B$	Capacitor base temperature	Temperatur des Gehäusebodens
t	Time	Zeit
$\Delta t$	Period	Zeitraum
$t_b$	Service life (operating hours)	Brauchbarkeitsdauer (Betriebszeit)



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Symbol	English	German
V	Voltage	Spannung
V <sub>F</sub>	Forming voltage	Formierspannung
V <sub>op</sub>	Operating voltage	Betriebsspannung
V <sub>R</sub>	Rated voltage, DC voltage	Nennspannung, Gleichspannung
V <sub>S</sub>	Surge voltage	Spitzenspannung
X <sub>C</sub>	Capacitive reactance	Kapazitiver Blindwiderstand
X <sub>L</sub>	Inductive reactance	Induktiver Blindwiderstand
Z	Impedance	Scheinwiderstand
Z <sub>T</sub>	Impedance at temperature T	Scheinwiderstand bei Temperatur T
tan δ	Dissipation factor	Verlustfaktor
λ	Failure rate	Ausfallrate
ε <sub>0</sub>	Absolute permittivity	Elektrische Feldkonstante
ε <sub>r</sub>	Relative permittivity	Dielektrizitätszahl
ω	Angular velocity; 2 · π · f	Kreisfrequenz; 2 · π · f

## Note

All dimensions are given in mm.



## 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](http://www.epcos.com/material)). Should you have any more detailed questions, please contact our sales offices.
5. We constantly strive to improve our products. Consequently, **the products described in this publication may change from time to time**. The same is true of the corresponding product specifications. Please check therefore to what extent product descriptions and specifications contained in this publication are still applicable before or when you place an order. We also **reserve the right to discontinue production and delivery of products**. Consequently, we cannot guarantee that all products named in this publication will always be available. The aforementioned does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.
6. Unless otherwise agreed in individual contracts, **all orders are subject to the current version of the "General Terms of Delivery for Products and Services in the Electrical Industry" published by the German Electrical and Electronics Industry Association (ZVEI)**.

## Important notes

7. The trade names EPCOS, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CSSP, CTVS, DeltaCap, DigiSiMic, DSSP, ExoCore, FilterCap, FormFit, LeaXield, MiniBlue, MiniCell, MKD, MKK, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PQSine, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, SIP5D, SIP5K, TFAP, ThermoFuse, WindCap are **trademarks registered or pending** in Europe and in other countries. Further information will be found on the Internet at [www.epcos.com/trademarks](http://www.epcos.com/trademarks).