

# Aluminum electrolytic capacitors

## Single-ended capacitors

**Series/Type:** B41890  
**Date:** December 2014

## Long-life grade capacitors

### Applications

- High-reliability equipment in industrial electronics

### Features

- Extra long useful life (10000 to 15000 h/105 °C)
- High reliability
- High ripple current capability
- RoHS-compatible

### Construction

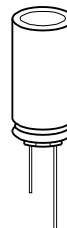
- Charge-discharge proof, polar
- Aluminum case with insulating sleeve
- Minus pole marking on the insulating sleeve
- Case with safety vent

### Delivery mode

Terminal configurations and packing:

- Bulk
- Taped, Ammo pack
- Cut
- Kinked
- PAPR (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 ... 50 V DC			
Surge voltage $V_S$	$1.15 \cdot V_R$			
Rated capacitance $C_R$	100 ... 6800 $\mu\text{F}$			
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	50
	$\tan \delta$ (max.)	0.17	0.12	0.10
Leakage current $I_{\text{leak}}$ (20 °C, 5 min)	$I_{\text{leak}} = 0.01 \mu\text{A} \cdot \left( \frac{C_R}{\mu\text{F}} \cdot \frac{V_R}{V} \right)$ or 3 $\mu\text{A}$ , whichever is greater			
Self-inductance ESL	Diameter (mm)	10 ... 12.5	16	18
	ESL (nH)	20	26	34
Useful life <sup>1)</sup> 105 °C; $V_R$ ; $I_{\text{AC,R}}$	> 10000 h for $\varnothing = 10$ mm > 15000 h for $\varnothing \geq 12.5$ mm			
Requirements	$ \Delta C/C  \leq 35\%$ of initial value $\tan \delta \leq 3$ times initial specified limit $I_{\text{leak}} \leq$ initial specified limit			
Voltage endurance test 105 °C; $V_R$	10000 h for $\varnothing = 10$ mm 15000 h for $\varnothing \geq 12.5$ mm			
Post test requirements	$ \Delta C/C  \leq 30\%$ of initial value $\tan \delta \leq 2$ times initial specified limit $I_{\text{leak}} \leq$ 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: 55/105/56 (–55 °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.



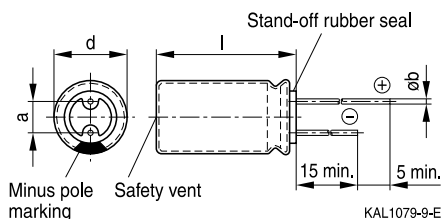
**B41890**

**Extended useful life – 105 °C**

### Dimensional drawing

#### 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	40 +2.0	5.0	0.80 ±0.05	7.4
16	20 +2.0	7.5	0.80 ±0.05	5.5
16	25 +2.0	7.5	0.80 ±0.05	7.5
16	31.5 +2.0	7.5	0.80 ±0.05	7.8
18	20 +2.0	7.5	0.80 ±0.1	8.0
18	25 +2.0	7.5	0.80 ±0.1	9.0
18	31.5 +2.0	7.5	0.80 ±0.1	11.0
18	35 +2.0	7.5	0.80 ±0.1	13.0
18	40 +2.0	7.5	0.80 ±0.1	16.0


**Overview of available types**

$V_R$ (V DC)	16	25	35	50
	Case dimensions $d \times l$ (mm)			
$C_R$ ( $\mu\text{F}$ )				
100			10 × 20	10 × 20
180				10 × 20
220			10 × 20	10 × 20
270			10 × 20	12.5 × 20
330			10 × 20	12.5 × 20
390			12.5 × 20	12.5 × 25
470		10 × 20	12.5 × 20	12.5 × 25 16 × 20
560		10 × 20	12.5 × 25	16 × 20
680		10 × 20	12.5 × 25	16 × 25 18 × 20
820	10 × 20	12.5 × 20	16 × 20	16 × 31.5
1000	12.5 × 20	12.5 × 25 16 × 20	12.5 × 40 16 × 25 18 × 20	16 × 31.5
1200	12.5 × 20	12.5 × 25	16 × 25 18 × 20	18 × 31.5
1500	12.5 × 25	16 × 20	16 × 31.5	18 × 35
1800	12.5 × 25	12.5 × 40 16 × 25 18 × 20	18 × 31.5	18 × 40
2200	12.5 × 30 16 × 20	16 × 31.5 18 × 25	18 × 35	
2700	16 × 25 18 × 20	16 × 31.5	18 × 40	
3300	16 × 31.5	18 × 31.5		
3900	16 × 31.5	18 × 35		
4700	18 × 31.5	18 × 40		
5600	18 × 35			
6800	18 × 40			

Other voltage and capacitance ratings are available upon request.


**B41890**
**Extended useful life – 105 °C**
**Technical data and ordering codes**

$C_R$	Case dimensions	$ESR_{max}$	$ESR_{max}$	$Z_{max}$	$I_{AC,R}$	Ordering code (composition see below)
120 Hz	$d \times l$	10 kHz	10 kHz	100 kHz	100 kHz	
20 °C	mm	–40 °C	20 °C	20 °C	105 °C	
$\mu F$		$\Omega$	$\Omega$	$\Omega$	mA	
<b><math>V_R = 16 V DC</math></b>						
820	10 × 20	0.595	0.074	0.062	1205	B41890A4827M***
1000	12.5 × 20	0.528	0.066	0.055	1820	B41890A4108M***
1200	12.5 × 20	0.528	0.066	0.055	1820	B41890A4128M***
1500	12.5 × 25	0.365	0.046	0.038	2280	B41890A4158M***
1800	12.5 × 25	0.365	0.046	0.038	2280	B41890A4188M***
2200	12.5 × 30	0.298	0.037	0.031	2860	B41890A4228M***
2200	16 × 20	0.365	0.046	0.038	2280	B41890B4228M***
2700	16 × 25	0.288	0.036	0.030	2860	B41890A4278M***
2700	18 × 20	0.336	0.042	0.035	2490	B41890B4278M***
3300	16 × 31.5	0.240	0.030	0.025	3160	B41890A4338M***
3900	16 × 31.5	0.240	0.030	0.025	3160	B41890A4398M***
4700	18 × 31.5	0.230	0.029	0.024	3500	B41890A4478M***
5600	18 × 35	0.211	0.026	0.022	3840	B41890A4568M***
6800	18 × 40	0.173	0.022	0.018	4230	B41890A4688M***

**Composition of ordering code**

\*\*\* = Version

000 = for standard leads, bulk

 001 = for kinked leads, bulk (for  $d \times l = 10 \times 20 \dots 12.5 \times 25$  mm and  $\varnothing 16 \dots 18$  mm)

 002 = for cut leads, bulk (for  $d \times l = 10 \times 20 \dots 12.5 \times 25$  mm and  $\varnothing 16 \dots 18$  mm)

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

 004 = for J leads, blister (for  $\varnothing 10 \dots 18$  mm, excluding  $d \times l = 12.5 \times 30/40$  and  $18 \times 40$  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  $\varnothing 16$  mm and  $d \times l = 18 \times 20 \dots 18 \times 31.5$  mm)

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


**Technical data and ordering codes**

$C_R$	Case dimensions	$ESR_{max}$	$ESR_{max}$	$Z_{max}$	$I_{AC,R}$	Ordering code (composition see below)
120 Hz	$d \times l$	10 kHz	10 kHz	100 kHz	100 kHz	
20 °C	mm	-40 °C	20 °C	20 °C	105 °C	
$\mu F$		$\Omega$	$\Omega$	$\Omega$	mA	
<b><math>V_R = 25 V DC</math></b>						
470	10 × 20	0.595	0.074	0.062	1205	B41890A5477M***
560	10 × 20	0.595	0.074	0.062	1205	B41890A5567M***
680	10 × 20	0.595	0.074	0.062	1205	B41890A5687M***
820	12.5 × 20	0.528	0.066	0.055	1820	B41890A5827M***
1000	12.5 × 25	0.365	0.046	0.038	2280	B41890A5108M***
1000	16 × 20	0.365	0.046	0.038	2280	B41890B5108M***
1200	12.5 × 25	0.365	0.046	0.038	2280	B41890A5128M***
1500	16 × 20	0.365	0.046	0.038	2280	B41890A5158M***
1800	12.5 × 40	0.250	0.031	0.026	3340	B41890A5188M***
1800	16 × 25	0.288	0.036	0.030	2860	B41890B5188M***
1800	18 × 20	0.336	0.042	0.035	2490	B41890C5188M***
2200	16 × 31.5	0.240	0.030	0.025	3160	B41890A5228M***
2200	18 × 25	0.269	0.034	0.028	3010	B41890B5228M***
2700	16 × 31.5	0.240	0.030	0.025	3160	B41890A5278M***
3300	18 × 31.5	0.230	0.029	0.024	3500	B41890A5338M***
3900	18 × 35	0.211	0.026	0.022	3840	B41890A5398M***
4700	18 × 40	0.173	0.022	0.018	4230	B41890A5478M***

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- 003 = for crimped leads, blister (for  $\varnothing 16 \dots 18$  mm)
- 004 = for J leads, blister (for  $\varnothing 10 \dots 18$  mm, excluding  $d \times l = 12.5 \times 30/40$  and  $18 \times 40$  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  $\varnothing 16$  mm and  $d \times l = 18 \times 20 \dots 18 \times 31.5$  mm)
- 012 = for bent 90° leads, blister (for  $\varnothing 16 \dots 18$  mm)


**B41890**
**Extended useful life – 105 °C**
**Technical data and ordering codes**

$C_R$ 120 Hz 20 °C $\mu\text{F}$	Case dimensions $d \times l$ mm	$\text{ESR}_{\text{max}}$ 10 kHz –40 °C $\Omega$	$\text{ESR}_{\text{max}}$ 10 kHz 20 °C $\Omega$	$Z_{\text{max}}$ 100 kHz 20 °C $\Omega$	$I_{\text{AC,R}}$ 100 kHz 105 °C mA	Ordering code (composition see below)
$V_R = 35 \text{ V DC}$						
100	10 × 20	0.592	0.074	0.062	1205	B41890B7107M***
220	10 × 20	0.592	0.074	0.062	1205	B41890B7227M***
270	10 × 20	0.595	0.074	0.062	1205	B41890A7277M***
330	10 × 20	0.595	0.074	0.062	1205	B41890A7337M***
390	12.5 × 20	0.528	0.066	0.055	1820	B41890A7397M***
470	12.5 × 20	0.528	0.066	0.055	1820	B41890A7477M***
560	12.5 × 25	0.365	0.046	0.038	2280	B41890A7567M***
680	12.5 × 25	0.365	0.046	0.038	2280	B41890A7687M***
820	16 × 20	0.365	0.046	0.038	2280	B41890A7827M***
1000	12.5 × 40	0.250	0.031	0.026	3340	B41890A7108M***
1000	16 × 25	0.288	0.036	0.030	2860	B41890B7108M***
1000	18 × 20	0.336	0.042	0.035	2490	B41890C7108M***
1200	16 × 25	0.288	0.036	0.030	2860	B41890A7128M***
1200	18 × 20	0.336	0.042	0.035	2490	B41890B7128M***
1500	16 × 31.5	0.240	0.030	0.025	3160	B41890A7158M***
1800	18 × 31.5	0.230	0.029	0.024	3500	B41890A7188M***
2200	18 × 35	0.211	0.026	0.022	3840	B41890A7228M***
2700	18 × 40	0.173	0.022	0.018	4230	B41890A7278M***

**Composition of ordering code**

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 002 = for cut leads, bulk (for  $d \times l = 10 \times 20 \dots 12.5 \times 25 \text{ mm}$  and  $\varnothing 16 \dots 18 \text{ mm}$ )

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

 004 = for J leads, blister (for  $\varnothing 10 \dots 18 \text{ mm}$ , excluding  $d \times l = 12.5 \times 30/40$  and  $18 \times 40 \text{ mm}$ )

 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  $\varnothing 16 \text{ mm}$  and  $d \times l = 18 \times 20 \dots 18 \times 31.5 \text{ mm}$ )

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




**Technical data and ordering codes**

$C_R$	Case dimensions	$ESR_{max}$	$ESR_{max}$	$Z_{max}$	$I_{AC,R}$	Ordering code (composition see below)
120 Hz	$d \times l$	10 kHz	10 kHz	100 kHz	100 kHz	
20 °C	mm	-40 °C	20 °C	20 °C	105 °C	
$\mu F$		$\Omega$	$\Omega$	$\Omega$	mA	
<b><math>V_R = 50</math> V DC</b>						
100	10 × 20	0.592	0.074	0.062	1205	B41890B6107M***
180	10 × 20	0.672	0.084	0.070	1205	B41890A6187M***
220	10 × 20	0.672	0.084	0.070	1205	B41890A6227M***
270	12.5 × 20	0.576	0.072	0.060	1820	B41890A6277M***
330	12.5 × 20	0.576	0.072	0.060	1820	B41890A6337M***
390	12.5 × 25	0.413	0.052	0.043	2280	B41890A6397M***
470	12.5 × 25	0.413	0.050	0.043	2280	B41890A6477M***
470	16 × 20	0.403	0.052	0.042	2280	B41890B6477M***
560	16 × 20	0.403	0.050	0.042	2280	B41890A6567M***
680	16 × 25	0.326	0.041	0.034	2860	B41890A6687M***
680	18 × 20	0.365	0.046	0.038	2490	B41890B6687M***
820	16 × 31.5	0.269	0.034	0.028	3160	B41890A6827M***
1000	16 × 31.5	0.269	0.034	0.028	3160	B41890A6108M***
1200	18 × 31.5	0.259	0.032	0.027	3500	B41890A6128M***
1500	18 × 35	0.240	0.030	0.025	3840	B41890A6158M***
1800	18 × 40	0.192	0.024	0.020	4230	B41890A6188M***

**Composition of ordering code**

\*\*\* = Version

000 = for standard leads, bulk

 001 = for kinked leads, bulk (for  $d \times l = 10 \times 20 \dots 12.5 \times 25$  mm and  $\varnothing 16 \dots 18$  mm)

 002 = for cut leads, bulk (for  $d \times l = 10 \times 20 \dots 12.5 \times 25$  mm and  $\varnothing 16 \dots 18$  mm)

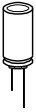
 003 = for crimped leads, blister (for  $\varnothing 16 \dots 18$  mm)

 004 = for J leads, blister (for  $\varnothing 10 \dots 18$  mm, excluding  $d \times l = 12.5 \times 30/40$  and  $18 \times 40$  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  $\varnothing 16$  mm and  $d \times l = 18 \times 20 \dots 18 \times 31.5$  mm)

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



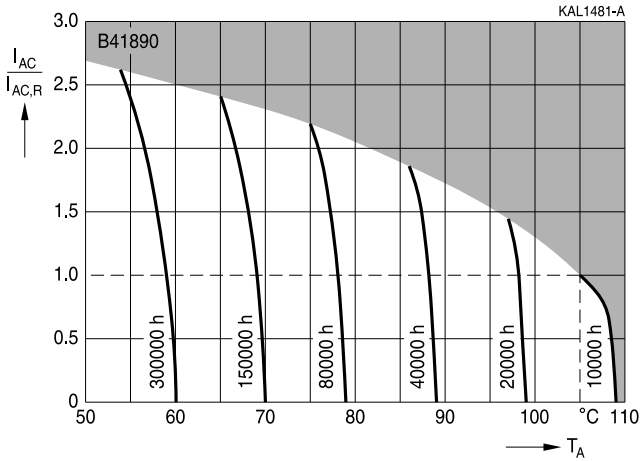
## B41890

### Extended useful life – 105 °C

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

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

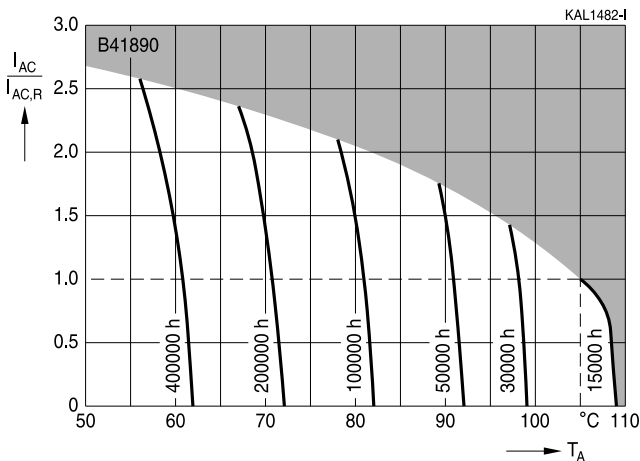
$d = 10 \text{ mm}$



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

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

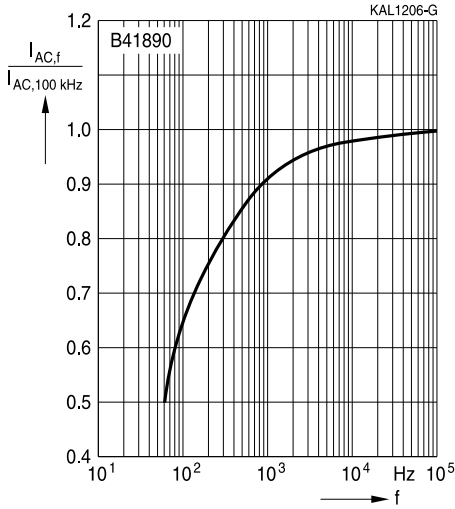
$d \geq 12.5 \text{ mm}$



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  $f$**





**B41890**

**Extended 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  $F = 3.5 \text{ mm}$  ( $\varnothing d = 8 \text{ mm}$ )

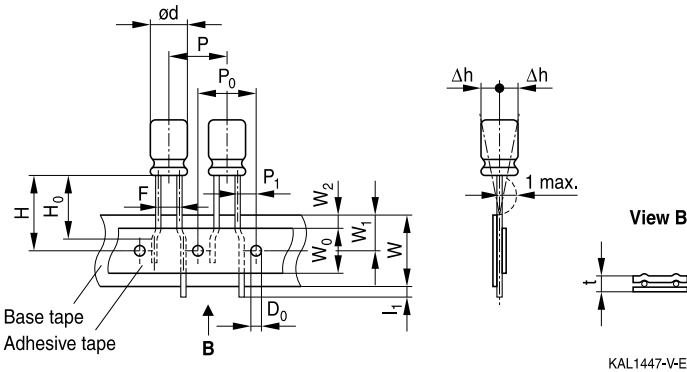
Lead spacing  $F = 5.0 \text{ mm}$  ( $\varnothing d = 8 \dots 12.5 \text{ mm}$ )

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

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 ( $\varnothing d = 8 \text{ mm}$ )**

Last 3 digits of ordering code: 006



KAL1447-V-E

**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.

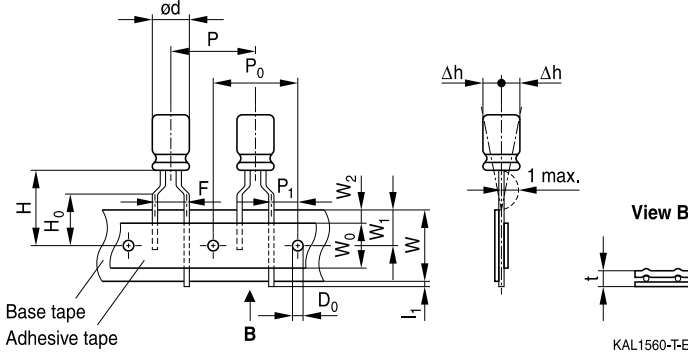


B41890

Extended useful life – 105 °C

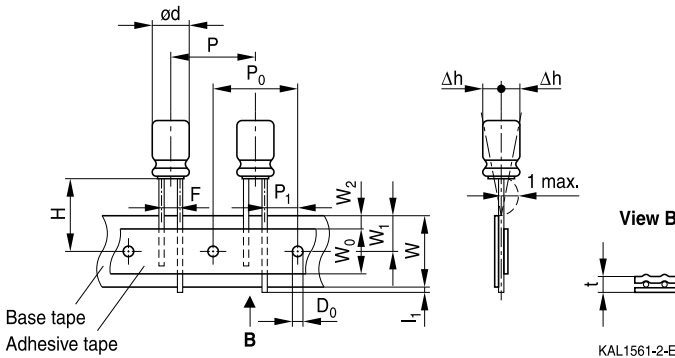
**Lead spacing 5.0 mm (∅ d = 8 mm)**

Last 3 digits of ordering code: 008



**Lead spacing 5.0 mm (∅ d = 10 ... 12.5 mm)**

Last 3 digits of ordering code: 008



**Dimensions in mm**

∅ d	F	H	W	W <sub>0</sub>	W <sub>1</sub>	W <sub>2</sub>	H <sub>0</sub>	P	P <sub>0</sub>	P <sub>1</sub>	l <sub>1</sub>	t	Δh	D <sub>0</sub>
8		20.0		9.5			16.0	12.7	12.7	3.85				
10	5.0	19.0	18.0	9.5	9.0	1.5	–	12.7	12.7	3.85	1.0	0.6	1.0	4.0
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 × l = 12.5 × 25 mm.

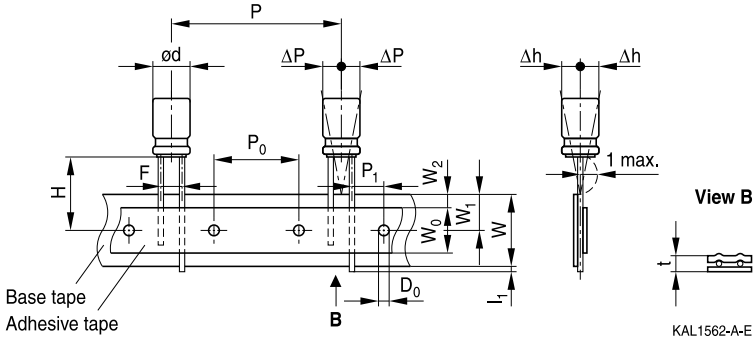


**B41890**

**Extended useful life – 105 °C**

**Lead spacing 7.5 mm (∅ d = 16 ...18 mm)**

Last 3 digits of ordering code: 009



**Dimensions in mm**

∅ d	F	H	W	W <sub>0</sub>	W <sub>1</sub>	W <sub>2</sub>	P	P <sub>0</sub>	P <sub>1</sub>	l <sub>1</sub>	t	ΔP	Δh	D <sub>0</sub>
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	±0.8	-0.5 +0.75	±0.5	min.	±0.5	max.	±1.0	±0.2	±0.5	max.	±0.2	±1.0	±1.0	±0.2

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



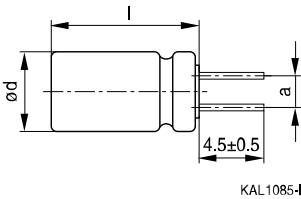
**Cut or kinked leads**

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

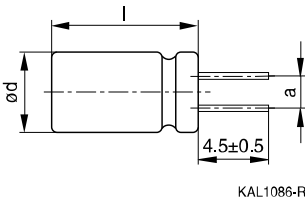
**Cut leads**

Last 3 digits of ordering code: 002

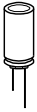
**With stand-off rubber seal**



**With flat rubber seal**



Case size d × l (mm)	Dimensions (mm) a ±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



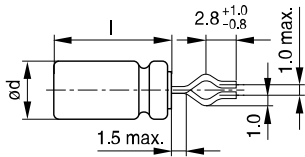
**B41890**

**Extended useful life – 105 °C**

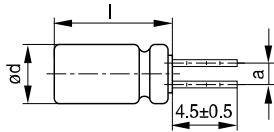
**Kinked leads**

Last 3 digits of ordering code: 001

**With stand-off rubber seal**

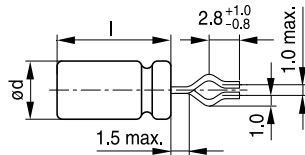


KAL1081-K

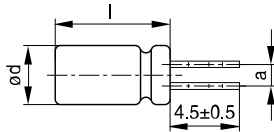


KAL1083-2

**With flat rubber seal**



KAL1082-T



KAL1084-A

Case size d × l (mm)	Dimensions (mm) a ±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)

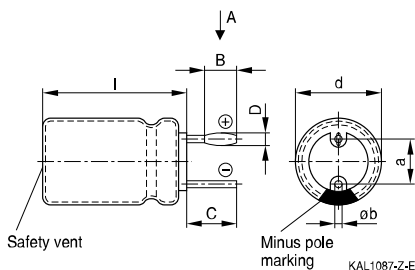
These lead configurations ensure correct placement of the capacitor on the PCB with regard to polarity. PAPR leads are available for diameters from 10 mm up to 18 mm (excluding  $d \times l = 12.5 \times 30/35/40$  mm).

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

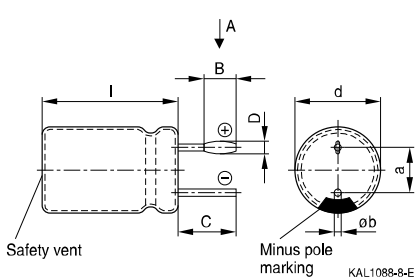
### Crimped leads

Last 3 digits of ordering code: 003

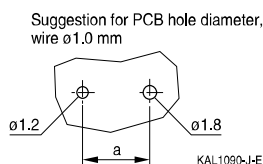
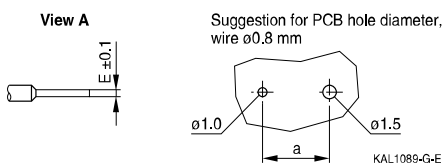
#### With stand-off rubber seal



#### With flat rubber seal



### 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 ± 0.05
16 × 25	1.5	3.0	1.3	0.3	7.5	0.8 ± 0.05
16 × 31.5	1.5	3.0	1.3	0.3	7.5	0.8 ± 0.05
16 × 35.5	1.5	3.0	1.3	0.3	7.5	0.8 ± 0.05
18 × 20	1.5	3.0	1.3	0.3	7.5	0.8 ± 0.1
18 × 25	1.5	3.0	1.3	0.3	7.5	0.8 ± 0.1
18 × 31.5	1.5	3.0	1.3	0.3	7.5	0.8 ± 0.1
18 × 35	1.5	3.0	1.3	0.3	7.5	0.8 ± 0.1
18 × 40	1.5	3.0	1.3	0.3	7.5	0.8 ± 0.1

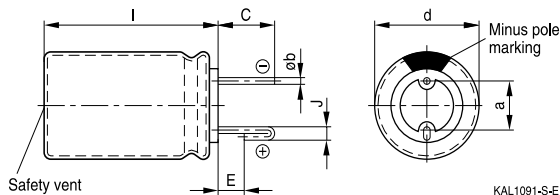


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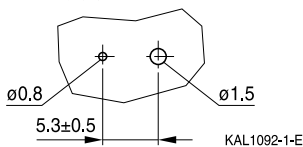
**J leads**

Last 3 digits of ordering code: 004

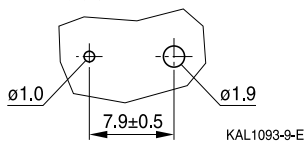


**Suggestion for PCB hole diameter**

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



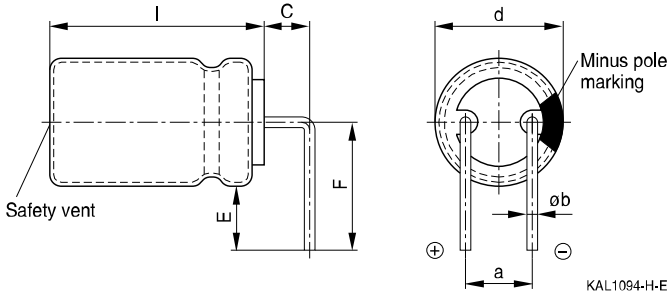
Suggestion for PCB hole diameter,  
wire  $\varnothing 0.8$  mm



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


**Bent 90° leads for horizontal mounting pinning**

Last 3 digits of ordering code: 012



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.

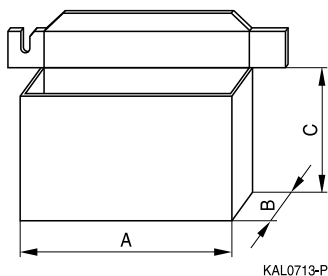


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**Packing units and box dimensions**

**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	65	260	500
16 × 20	320	65	285	300
16 × 25	320	65	285	300
16 × 31.5	320	75	275	300
18 × 20	320	65	285	250
18 × 25	320	65	285	250
18 × 31.5	320	75	275	250


**Overview of packing units and code numbers for case sizes 8 × 11.5 ... 16 × 35.5**

					<b>PAPR</b>				
Case size d × l	Stan- dard, bulk	Taped, Ammo pack		Kinked leads, bulk	Cut leads, bulk	Crimped leads, blister	J leads, blister	Bent 90° leads, blister	
mm	pcs.	pcs.		pcs.	pcs.	pcs.	pcs.	pcs.	
8 × 11.5	1000	1000		–	–	–	–		
10 × 12.5	1000	750		–	1000	–	675		
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	120	
16 × 25	250	300		200	200	200	200	216	
16 × 31.5	200	300		250	250	344	344	180	
16 × 35.5	100	–		100	100	150	150	150	
The last three digits of the complete ordering code state the lead configuration	<b>000</b>	Code	F (mm)	d (mm)	<b>001</b>	<b>002</b>	<b>003</b>	<b>004</b>	<b>012</b>
		<b>006</b>	3.5	8					
		<b>008</b>	5	8...12.5					
		<b>009</b>	7.5	16...18					

1) Available upon request



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**Overview of packing units and code numbers for case sizes 18 × 20 ... 18 × 40**

					<b>PAPR</b>				
Case size d × l  mm	Standard, bulk pcs.	Taped, Ammo pack pcs.			Kinked leads, bulk pcs.	Cut leads, bulk pcs.	Crimped leads, blister pcs.	J leads, blister pcs.	Bent 90° leads, blister pcs.
18 × 20	175	250			175	175	200	200	120
18 × 25	150	250			150	150	200	200	120
18 × 31.5	100	250			100	100	150	150	120
18 × 35	100	–			100	100	150	150	150
18 × 40	125	–			100	100	120	–	72
The last three digits of the complete ordering code state the lead configuration	<b>000</b>	Code	F (mm)	d (mm)	<b>001</b>	<b>002</b>	<b>003</b>	<b>004</b>	<b>012</b>
		<b>009</b>	7.5	16...18					



## 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. However, in exceptional cases, such materials must be used in order to achieve specific physical and electrical properties because no alternative materials are currently known. However, the amount of dangerous materials used in our products is limited 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.



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### 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"





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 electricity of 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 $\leq 75\%$ .	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)



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## 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)



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, Alu-X, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CSSP, CTVS, DeltaCap, DigiSiMic, DSSP, FilterCap, FormFit, LeaXield, MiniBlue, MiniCell, MKD, MKK, MLSC, 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.vvv](http://www.epcos.com/trademarks.vvv)