



# Aluminum electrolytic capacitors

Single-ended capacitors

**Series/Type:** B43890  
**Date:** November 2012

## Long-life grade capacitors

### Applications

- Professional power supplies

### Features

- High ripple current capability at high frequency
- Extra long useful life (12000 to 15000 h/105 °C)
- Compact dimensions
- RoHS-compatible

### Construction

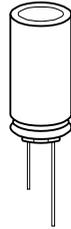
- Radial leads
- Charge-discharge proof, polar
- Aluminum case with insulating sleeve
- Minus pole marking on the insulating sleeve
- Stand-off rubber seal
- Case with safety vent

### Delivery mode

Terminal configurations and packing:

- Bulk
- Taped, Ammo pack
- Cut
- Kinked
- PAPR (protection against polarity reversal):  
crimped leads, J leads, bent leads

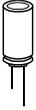
Refer to chapter "Single-ended capacitors – Taping, packing and lead configurations" for further details.




**Specifications and characteristics in brief**

Rated voltage $V_R$	350 ... 450 V DC			
Surge voltage $V_S$	$1.1 \cdot V_R$			
Rated capacitance $C_R$	4.7 ... 68 $\mu\text{F}$			
Capacitance tolerance	$\pm 20\% \triangleq M$			
Dissipation factor $\tan \delta$ (20 °C, 120 Hz)	$\tan \delta$ (max.) = 0.24			
Leakage current $I_{\text{leak}}$ (20 °C, 5 min)	$I_{\text{leak}} = 0.03 \mu\text{A} \cdot \left( \frac{C_R}{\mu\text{F}} \cdot \frac{V_R}{V} \right) + 15 \mu\text{A}$			
Self-inductance ESL	Diameter (mm)	$\leq 12.5$	16	18
	ESL (nH)	20	26	34
Useful life <sup>1)</sup> 105 °C; $V_R$ ; $I_{\text{AC,R}}$	<p>&gt; 12000 h for <math>d = 10</math> mm          &gt; 15000 h for <math>d \geq 12.5</math> mm</p>			
Requirements	<p><math>\Delta C/C \leq \pm 40\%</math> of initial value  <math>\tan \delta \leq 3</math> times initial specified limit  <math>I_{\text{leak}} \leq</math> initial specified limit</p>			
Voltage endurance test 105 °C; $V_R$	<p>12000 h for <math>d = 10</math> mm          15000 h for <math>d \geq 12.5</math> mm</p>			
Post test requirements	<p><math>\Delta C/C \leq \pm 25\%</math> of initial value  <math>\tan \delta \leq 2</math> times initial specified limit  <math>I_{\text{leak}} \leq</math> initial specified limit</p>			
Vibration resistance test	<p>To IEC 60068-2-6, test Fc:          Frequency range 10 Hz ... 2 kHz, displacement amplitude max.          1.5 mm, acceleration max. 20 g, duration <math>3 \times 2</math> h.          Capacitor rigidly clamped by the aluminum case.</p>			
IEC climatic category	<p>To IEC 60068-1:          25/105/56 (–25 °C/+105 °C/56 days damp heat test)</p>			
Sectional specification	IEC 60384-4			

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



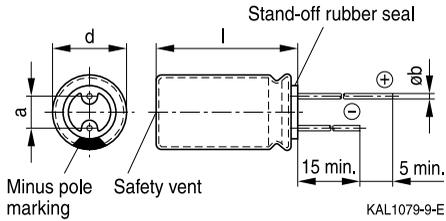
**B43890**

**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	16 +1.0	5.0	0.60 ±0.05	1.9
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
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)	350	400	450
	Case dimensions $d \times l$ (mm)		
$C_R$ ( $\mu\text{F}$ )			
4.7			10 × 16
6.8	10 × 16	10 × 16	10 × 20
10	10 × 20	10 × 20	12.5 × 20 12.5 × 30
15	12.5 × 20	12.5 × 20	12.5 × 25 12.5 × 35
22	12.5 × 25	12.5 × 25	12.5 × 40 16 × 20 18 × 20
33	16 × 20	16 × 25	16 × 31.5 18 × 25
47	16 × 31.5	16 × 31.5	18 × 31.5
68	18 × 31.5	18 × 35	18 × 40

Other voltage and capacitance ratings are available upon request.


**B43890**
**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	$I_{AC,R}$ 100 kHz 105 °C mA	Ordering code (composition see below)
<b><math>V_R = 350 \text{ V DC}</math></b>			
6.8	10 × 16	240	B43890A4685M***
10	10 × 20	318	B43890A4106M***
15	12.5 × 20	446	B43890A4156M***
22	12.5 × 25	590	B43890A4226M***
33	16 × 20	753	B43890A4336M***
47	16 × 31.5	1061	B43890A4476M***
68	18 × 31.5	1379	B43890A4686M***
<b><math>V_R = 400 \text{ V DC}</math></b>			
6.8	10 × 16	240	B43890A9685M***
10	10 × 20	318	B43890A9106M***
15	12.5 × 20	446	B43890A9156M***
22	12.5 × 25	590	B43890A9226M***
33	16 × 25	818	B43890A9336M***
47	16 × 31.5	1061	B43890A9476M***
68	18 × 35	1438	B43890A9686M***
<b><math>V_R = 450 \text{ V DC}</math></b>			
4.7	10 × 16	200	B43890A5475M***
6.8	10 × 20	262	B43890A5685M***
10	12.5 × 20	365	B43890A5106M***
10	12.5 × 30	526	B43890C5106M***
15	12.5 × 25	487	B43890A5156M***
15	12.5 × 35	558	B43890C5156M***
22	12.5 × 40	588	B43890C5226M***
22	16 × 20	615	B43890A5226M***
22	18 × 20	664	B43890B5226M***
33	16 × 31.5	889	B43890A5336M***
33	18 × 25	880	B43890B5336M***
47	18 × 31.5	1147	B43890A5476M***
68	18 × 40	1517	B43890A5686M***

**Composition of ordering code**

\*\*\* = Version

000 = for standard leads, bulk

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

002 = for cut leads, bulk (for  $\varnothing 10 \dots 18 \text{ mm}$ , excluding  $d \times l = 12.5 \times 30/35/40 \text{ mm}$ )

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  $d \times l = 12.5 \times 30/35/40$  and  $18 \times 40 \text{ mm}$ )

008 = for taped leads, Ammo pack, lead spacing  $F = 5.0 \text{ mm}$  (for  $d \times l = 10 \times 16 \dots 12.5 \times 25 \text{ mm}$ )

009 = for taped leads, Ammo pack, lead spacing  $F = 7.5 \text{ mm}$  (for  $\varnothing 16 \text{ mm}$  and  $d \times l = 18 \times 20 \dots 18 \times 31.5 \text{ mm}$ )

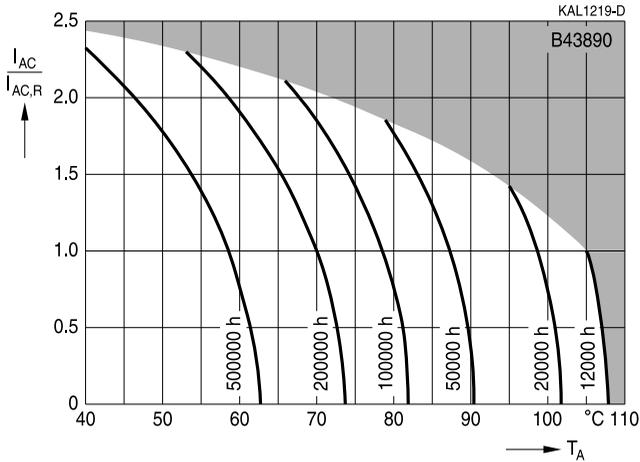
012 = for bent 90° leads, blister (for  $\varnothing 16 \dots 18 \text{ mm}$ )



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

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

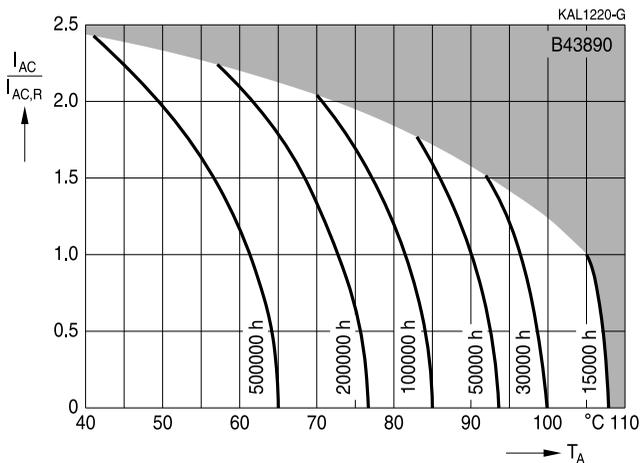
$d = 10 \text{ mm}$



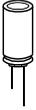
**Useful life<sup>1)</sup>**

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

$d \geq 12.5 \text{ mm}$



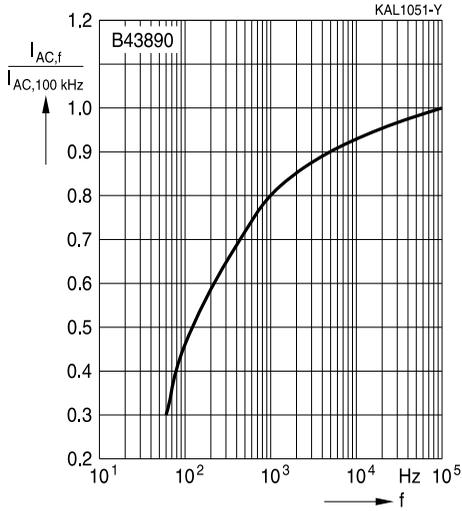
1) Refer to chapter "General technical information, 5 Useful life" on how to interpret useful life.



**B43890**

**Extended useful life – 105 °C**

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





## Taping, packing and lead configurations

### Taping

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

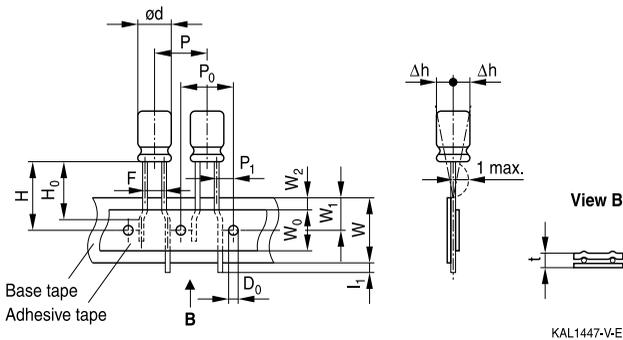
Lead spacing  $F = 3.5$  mm ( $\varnothing d = 8$  mm)

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).

### Lead spacing 3.5 mm ( $\varnothing d = 8$ 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	±1.0	±0.5	min.	±0.5	max.	±1.0	±0.3	±0.6	max.	±0.2	max.	±0.2

Leads can also run straight through the taping area.

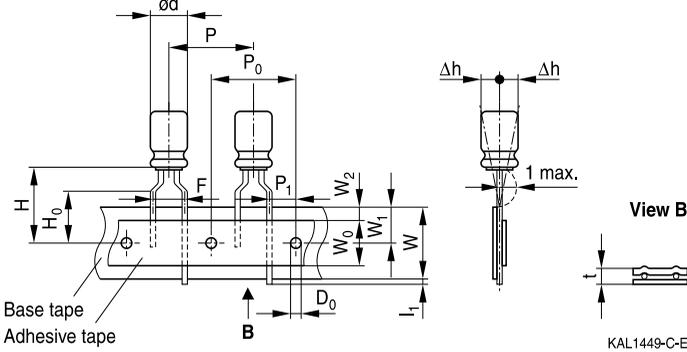


**B43890**

**Extended useful life – 105 °C**

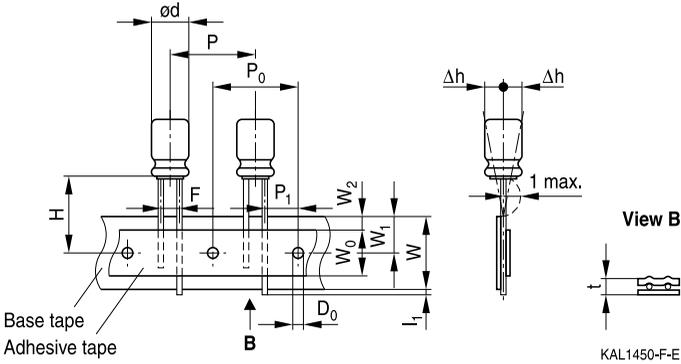
**Lead spacing 5.0 mm (∅ d = 8 mm)**

Last 3 digits of ordering code: 008



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

Last 3 digits of ordering code: 008



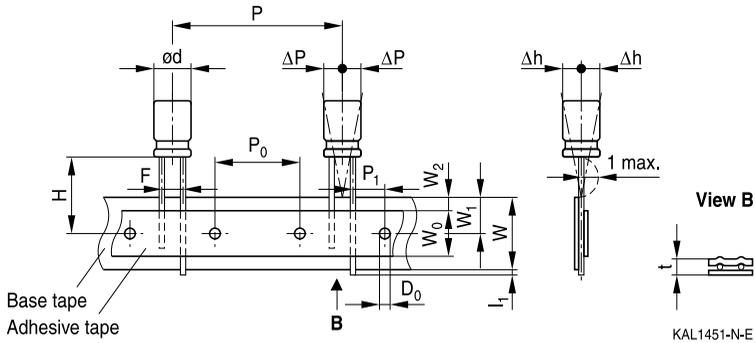
**Dimensions in mm**

∅ 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>
4 ... 6.3	5.0	18.5	18.0	5.5	9.0	1.5	16.0	12.7	12.7	3.85	1.0	0.6	1.0	4.0
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 × l = 12.5 × 25 mm.


**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 × l = 16 × 31.5 mm and 18 × 31.5 mm.



**B43890**

**Extended useful life – 105 °C**

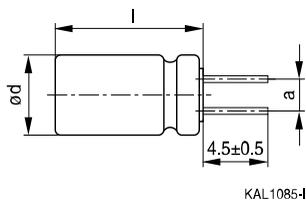
### Cut or kinked leads

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

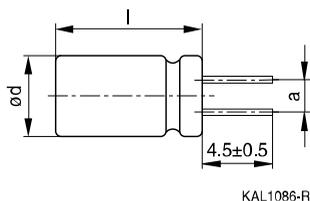
### Cut leads

Last 3 digits of ordering code: 002

#### With stand-off rubber seal



#### With flat rubber seal



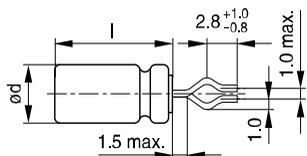
Case size d × l (mm)	Dimensions (mm) a ±0.5
10 × 12.5	5.0
10 × 16	5.0
10 × 20	5.0
12.5 × 20	5.0
12.5 × 25	5.0
16 × 20	7.5
16 × 25	7.5
16 × 31.5	7.5
16 × 35.5	7.5
18 × 20	7.5
18 × 25	7.5
18 × 31.5	7.5
18 × 35	7.5
18 × 40	7.5



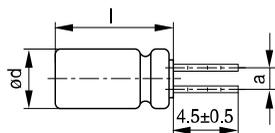
### Kinked leads

Last 3 digits of ordering code: 001

#### With stand-off rubber seal

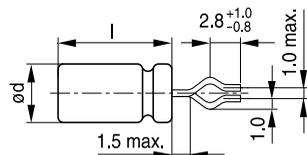


KAL1081-K

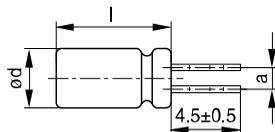


KAL1083-2

#### 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



**B43890**

**Extended useful life – 105 °C**

**PAPR leads** (Protection Against Polarity Reversal)

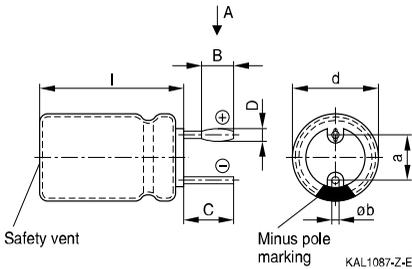
These lead configurations ensure correct placement of the capacitor on the PCB with regard to polarity. PAPR leads are available for diameters from 10 mm up to 18 mm (excluding  $d \times l = 12.5 \times 30/35/40$  mm).

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

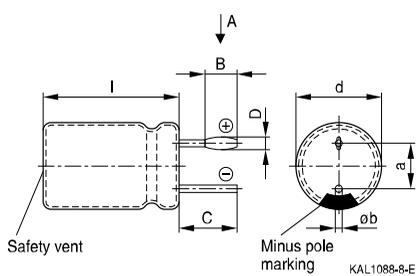
**Crimped leads**

Last 3 digits of ordering code: 003

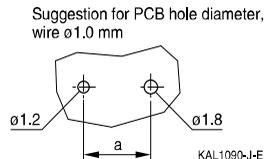
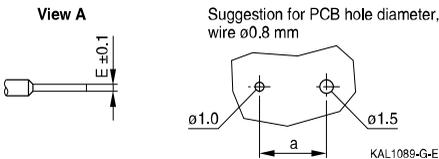
**With stand-off rubber seal**



**With flat rubber seal**



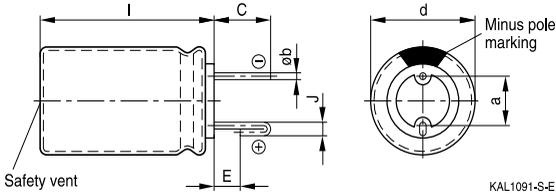
**Suggestion for PCB hole diameter**

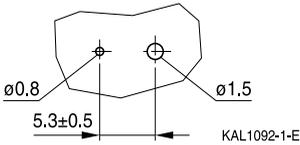
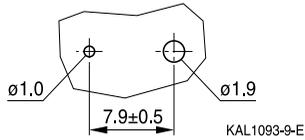


Case size $d \times l$ (mm)	Dimensions (mm)					
	B ±0.2	C ±0.5	D ±0.1	E ±0.1	a ±0.5	Øb
16 × 20	1.5	3.0	1.3	0.3	7.5	0.8 ±0.05
16 × 25	1.5	3.0	1.3	0.3	7.5	0.8 ±0.05
16 × 31.5	1.5	3.0	1.3	0.3	7.5	0.8 ±0.05
16 × 35.5	1.5	3.0	1.3	0.3	7.5	0.8 ±0.05
18 × 20	1.5	3.0	1.3	0.3	7.5	0.8 ±0.1
18 × 25	1.5	3.0	1.3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

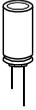

**J leads**

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 $d \times l$ (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	$0.8 \pm 0.1$

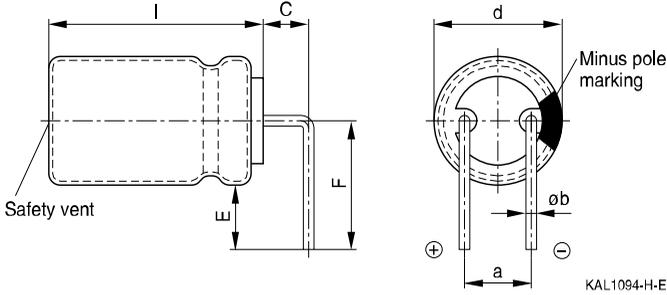


**B43890**

**Extended useful life – 105 °C**

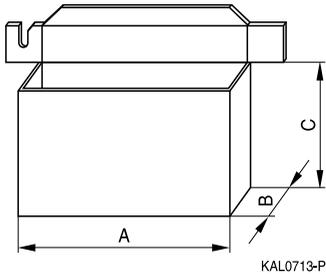
**Bent 90° leads for horizontal mounting pinning**

Last 3 digits of ordering code: 012



Case size $d \times l$ (mm)	Dimensions (mm)				
	$C \pm 0.5$	$E \pm 0.5$	$F \pm 0.5$	$a \pm 0.5$	$\varnothing b$
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.


**Packing units and box dimensions**
**Ammo pack**


Case size $d \times l$ mm	Dimensions (mm)			Packing units pcs.
	$A_{max}$	$B_{max}$	$C_{max}$	
$8 \times 11.5$	345	55	240	1000
$10 \times 12.5$	345	55	280	750
$10 \times 16$	345	60	200	500
$10 \times 20$	345	60	200	500
$12.5 \times 20$	345	65	280	500
$12.5 \times 25$	345	65	280	500
$16 \times 20$	315	65	275	300
$16 \times 25$	315	65	275	300
$16 \times 31.5$	315	65	275	300
$18 \times 20$	315	65	275	250
$18 \times 25$	315	65	275	250
$18 \times 31.5$	315	65	275	250


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

Case size d × l  mm	Standard, bulk pcs.	Taped, Ammo pack pcs.	Kinked leads, bulk pcs.	Cut leads, bulk pcs.	PAPR				
					Crimped leads, blister pcs.	J leads, blister pcs.	Bent 90° leads, blister 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


**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					



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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. 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.



## 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 polarity classes should be prevented by connecting a diode.	3.1.6 "Reverse voltage"
Mounting position of screw-terminal capacitors	Do not mount the capacitor with the terminals (safety vent) upside down.	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, such as fire or electricity.	8.1 "Passive flammability"



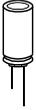
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Topic	Safety information	Reference chapter "General technical information"
Active flammability	Avoid overload of the capacitors.	8.2 "Active flammability"
Maintenance	<p>Make periodic inspections of the capacitors. Before the inspection, make sure that the power supply is turned off and carefully discharge the electricity of the capacitors.</p> <p>Do not apply any mechanical stress to the capacitor terminals.</p>	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 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"


**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
$I_{AC,R} (B)$	Rated ripple current for base cooling	Nennwechselstromstrom für Bodenkühlung
$I_{leak}$	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 Becherbodens
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.
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