



# Aluminum electrolytic capacitors

Single-ended capacitors

**Series/Type:** B43866  
**Date:** November 2008

**Long-life grade capacitors  
for professional electronic ballasts**

**Applications**

- Energy-saving lamps
- Electronic ballasts
- Power supplies

**Features**

- High ripple current capability
- Wide temperature range up to 125 °C
- 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
- 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 and ordering example.




**Specifications and characteristics in brief**

Rated voltage $V_R$	160 ... 450 V DC			
Surge voltage $V_S$	$1.1 \cdot V_R$			
Rated capacitance $C_R$	4.7 ... 150 $\mu\text{F}$			
Capacitance tolerance	$\pm 20\% \triangleq M$			
Dissipation factor $\tan \delta$ (20 °C, 120 Hz)	$V_R \leq 250 \text{ V DC: } \tan \delta \text{ (max.)} = 0.20$ $V_R \geq 350 \text{ V DC: } \tan \delta \text{ (max.)} = 0.25$			
Leakage current $I_{\text{leak}}$ (20 °C, 5 min)	$I_{\text{leak}} = 0.03 \mu\text{A} \cdot \left( \frac{C_R}{\mu\text{F}} \cdot \frac{V_R}{\text{V}} \right) + 15 \mu\text{A}$			
Self-inductance ESL	Diameter (mm)	$\leq 12.5$	16	18
	ESL (nH)	20	26	34
Useful life 125 °C; $V_R$ ; $I_{\text{AC,R}}$	$> 3000 \text{ h for } d = 10 \text{ mm}$ $> 5000 \text{ h for } d \geq 12.5 \text{ mm}$			
Requirements	$\Delta C/C \leq \pm 35\%$ of initial value $\tan \delta \leq 3$ times initial specified limit $I_{\text{leak}} \leq$ initial specified limit			
Voltage endurance test 125 °C; $V_R$	$3000 \text{ h for } d = 10 \text{ mm}$ $5000 \text{ h for } d \geq 12.5 \text{ mm}$			
Post test requirements	$\Delta C/C \leq \pm 30\%$ 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: Displacement amplitude 1.5 mm, frequency range 10 ... 2000 Hz, acceleration max. 20 g, duration $3 \times 2 \text{ h}$ . Capacitor rigidly clamped by the aluminum case.			
IEC climatic category	To IEC 60068-1: $V_R \leq 250 \text{ V: } 40/125/56$ (–40 °C/+125 °C/56 days damp heat test) $V_R \geq 350 \text{ V: } 25/125/56$ (–25 °C/+125 °C/56 days damp heat test)			
Sectional specification	IEC 60384-4			



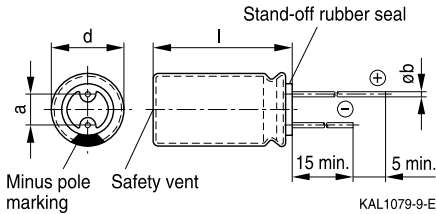
**B43866**

**High ripple current – 125 °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	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
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	31.5 +2.0	7.5	0.80 ±0.1	11.0
18	35 +2.0	7.5	0.80 ±0.1	13.0


**Overview of available types**

$V_R$ (V DC)	160	250	350	400	450
	Case dimensions $d \times l$ (mm)				
$C_R$ ( $\mu\text{F}$ )					
4.7				10 × 16	10 × 16
6.8			10 × 16	10 × 16	10 × 20
10		10 × 16	10 × 20	10 × 20	12.5 × 20
15		10 × 20	12.5 × 20	12.5 × 25	12.5 × 25
22	10 × 16	12.5 × 20	12.5 × 25	12.5 × 30	16 × 25
33	10 × 20	12.5 × 25	16 × 25	16 × 25	16 × 31.5
47	12.5 × 20	16 × 20	16 × 31.5	18 × 31.5	18 × 35
68	12.5 × 25	16 × 31.5	18 × 31.5		
100	16 × 25	18 × 31.5			
150	16 × 31.5				

Other voltage and capacitance ratings are available upon request.


**B43866**
**High ripple current – 125 °C**
**Technical data and ordering codes**

$C_R$	Case dimensions	$I_{AC,R}$	$I_{AC,max}$	Ordering code (composition see below)
120 Hz	$d \times l$	100 kHz	100 kHz	
20 °C	mm	125 °C	105 °C	
$\mu F$		mA	mA	
<b><math>V_R = 160 V DC</math></b>				
22	10 × 16	225	315	B43866C1226M***
33	10 × 20	280	392	B43866C1336M***
47	12.5 × 20	300	420	B43866C1476M***
68	12.5 × 25	370	518	B43866C1686M***
100	16 × 25	500	700	B43866C1107M***
150	16 × 31.5	650	910	B43866C1157M***
<b><math>V_R = 250 V DC</math></b>				
10	10 × 16	125	175	B43866C2106M***
15	10 × 20	185	259	B43866C2156M***
22	12.5 × 20	250	350	B43866C2226M***
33	12.5 × 25	280	392	B43866C2336M***
47	16 × 20	320	448	B43866C2476M***
68	16 × 31.5	550	770	B43866C2686M***
100	18 × 31.5	600	840	B43866C2107M***
<b><math>V_R = 350 V DC</math></b>				
6.8	10 × 16	100	140	B43866C4685M***
10	10 × 20	160	224	B43866C4106M***
15	12.5 × 20	200	280	B43866C4156M***
22	12.5 × 25	250	350	B43866C4226M***
33	16 × 25	340	476	B43866C4336M***
47	16 × 31.5	365	511	B43866C4476M***
68	18 × 31.5	480	672	B43866C4686M***

**Composition of ordering code**

\*\*\* = Version

000 = for standard leads, bulk

001 = for kinked leads, bulk (from  $d \times l = 10 \times 20$  mm to  $18 \times 35$  mm, excluding  $12.5 \times 30$  mm)

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

003 = for crimped leads, blister (from  $d \times l = 16 \times 20$  mm to  $18 \times 35$  mm)

004 = for J leads, blister (from  $d \times l = 10 \times 16$  mm to  $18 \times 25$  mm, excluding  $12.5 \times 30$  mm)

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

009 = for taped leads, Ammo pack, lead spacing  $F = 7.5$  mm (from  $d \times l = 16 \times 20$  mm to  $18 \times 31.5$  mm)

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


**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 125 °C mA	$I_{AC,max}$ 100 kHz 105 °C mA	Ordering code (composition see below)
<b><math>V_R = 400 \text{ V DC}</math></b>				
4.7	10 × 16	100	140	B43866C9475M***
6.8	10 × 16	100	140	B43866C9685M***
10	10 × 20	160	224	B43866C9106M***
15	12.5 × 25	250	350	B43866C9156M***
22	12.5 × 30	280	392	B43866C9226M***
33	16 × 25	340	476	B43866C9336M***
47	18 × 31.5	480	672	B43866C9476M***
<b><math>V_R = 450 \text{ V DC}</math></b>				
4.7	10 × 16	100	140	B43866C5475M***
6.8	10 × 20	160	224	B43866C5685M***
10	12.5 × 20	200	280	B43866C5106M***
15	12.5 × 25	250	350	B43866C5156M***
22	16 × 25	300	420	B43866C5226M***
33	16 × 31.5	365	511	B43866C5336M***
47	18 × 35	480	672	B43866C5476M***

**Composition of ordering code**

\*\*\* = Version

- 000 = for standard leads, bulk
- 001 = for kinked leads, bulk (from  $d \times l = 10 \times 20 \text{ mm}$  to  $18 \times 35 \text{ mm}$ , excluding  $12.5 \times 30 \text{ mm}$ )
- 002 = for cut leads, bulk (excluding  $12.5 \times 30 \text{ mm}$ )
- 003 = for crimped leads, blister (from  $d \times l = 16 \times 20 \text{ mm}$  to  $18 \times 35 \text{ mm}$ )
- 004 = for J leads, blister (from  $d \times l = 10 \times 16 \text{ mm}$  to  $18 \times 25 \text{ mm}$ , excluding  $12.5 \times 30 \text{ mm}$ )
- 008 = for taped leads, Ammo pack, lead spacing  $F = 5.0 \text{ mm}$  (from  $d \times l = 10 \times 16 \text{ mm}$  to  $12.5 \times 25 \text{ mm}$ )
- 009 = for taped leads, Ammo pack, lead spacing  $F = 7.5 \text{ mm}$  (from  $d \times l = 16 \times 20 \text{ mm}$  to  $18 \times 31.5 \text{ mm}$ )
- 012 = for bent 90° leads, blister (for  $\varnothing 16$  and  $18 \text{ mm}$ )



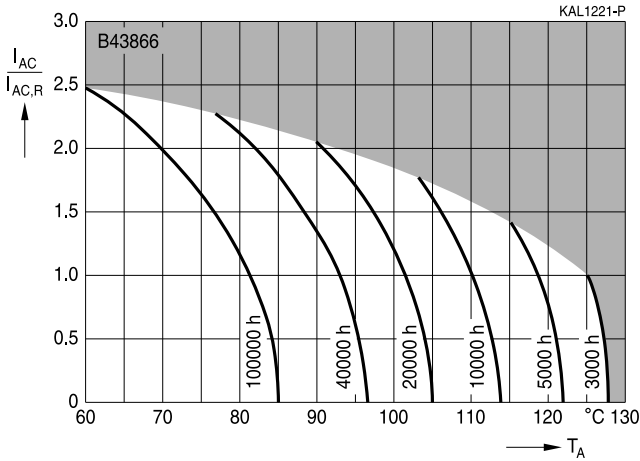
**B43866**

**High ripple current – 125 °C**

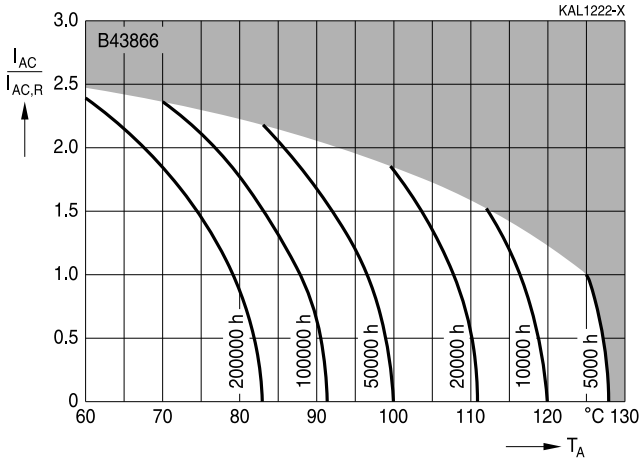
**Useful life**

depending on ambient temperature  $T_A$  under ripple current operating conditions<sup>1)</sup>

$d = 10 \text{ mm}$



$d \geq 12.5 \text{ mm}$

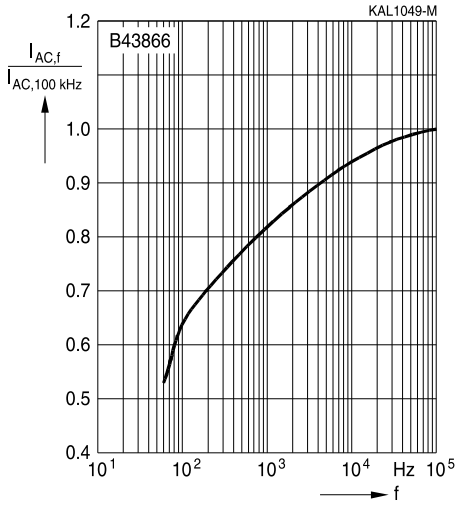


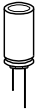
1) Refer to chapter "General technical information, 5.3 Calculation of useful life" for an explanation on how to interpret the useful life graphs.





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





**B43866**

**High ripple current – 125 °C**

## Taping, packing and lead configurations

### Taping

Single-ended capacitors are available taped in Ammo pack from diameter 5 to 18 mm as follows:

Lead spacing  $F = 2.5$  mm ( $\varnothing d = 5 \dots 6.3$  mm)

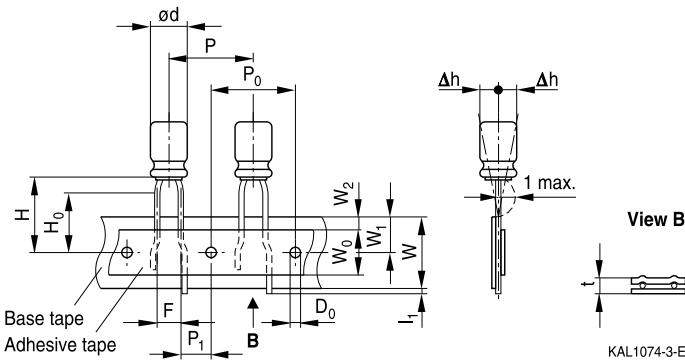
Lead spacing  $F = 3.5$  mm ( $\varnothing d = 8$  mm)

Lead spacing  $F = 5.0$  mm (from  $d \times l = 10 \times 12.5$  mm to  $12.5 \times 30$  mm)

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

### Lead spacing 2.5 mm ( $\varnothing d = 5 \dots 6.3$ mm)

Last 3 digits of ordering code: 007

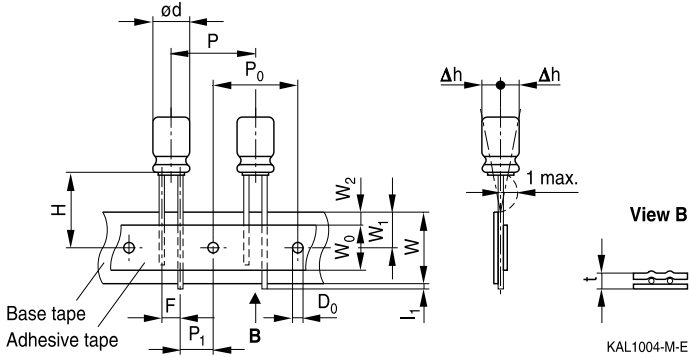


### Dimensions in mm

$\varnothing d$	F	H	W	$W_0$	$W_1$	$W_2$	$H_0$	P	$P_0$	$P_1$	$L_1$	t	$\Delta h$	$D_0$
5	2.5	18.5	18.0	5.5	9.0	1.5	16.0	12.7	12.7	5.1	1.0	0.7	1.0	4.0
6.3														
Tolerance	+0.8 -0.2	$\pm 0.75$	$\pm 0.5$	min.	$\pm 0.5$	max.	$\pm 0.5$	$\pm 1.0$	$\pm 0.2$	$\pm 0.5$	max.	$\pm 0.2$	max.	$\pm 0.2$


**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	12.5	9.0	1.5	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.	$\pm 1.0$	$\pm 0.2$	$\pm 0.5$	max.	$\pm 0.2$	max.	$\pm 0.2$

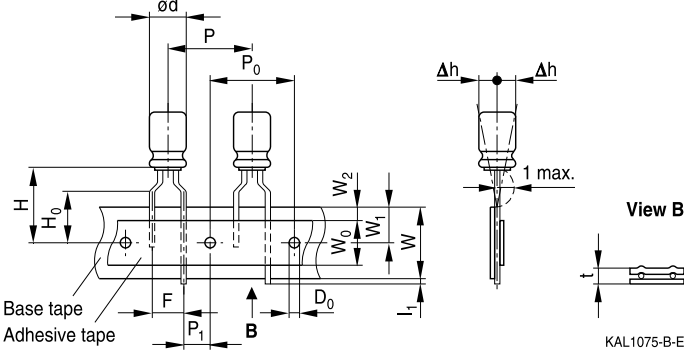


**B43866**

**High ripple current – 125 °C**

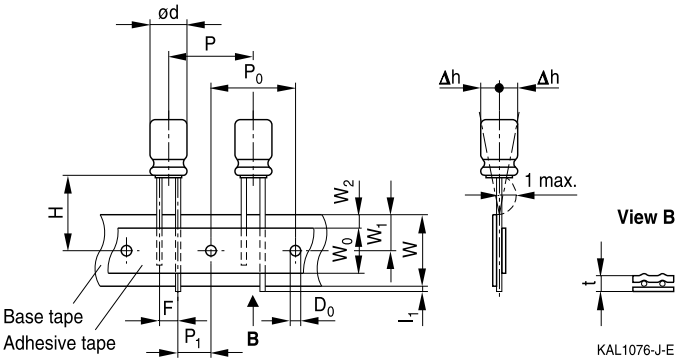
**Lead spacing 5.0 mm (∅ d = 5 ... 8 mm)**

Last 3 digits of ordering code: 008



**Lead spacing 5.0 mm (from d × l = 10 × 12.5 mm to 12.5 × 30 mm)**

Last 3 digits of ordering code: 008

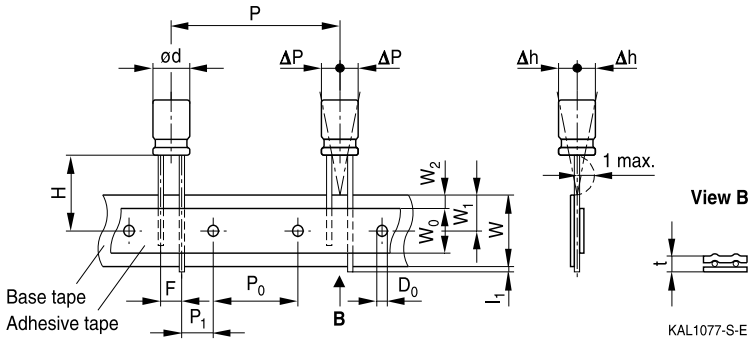


**Dimensions in mm**

∅ 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>
5	5.0	18.5	18.0	5.5	9.0	1.5	16.0	12.7	12.7	3.85	1.0	0.7	1.0	4.0
6.3		20.0					16.0	12.7	12.7	3.85				
8	5.0	19.0	18.0	12.5	9.0	1.5	–	12.7	12.7	3.85	1.0	0.7	1.0	4.0
10		19.0					–	15.0	15.0	5.0				
12.5		19.0					–	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.	±0.2	max.	±0.2

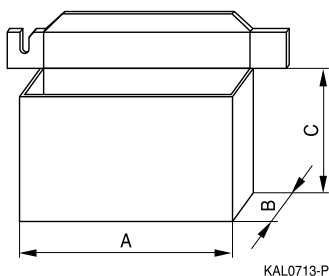

**Lead spacing 7.5 mm (∅ d = 16 ...18 mm)**

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>	I <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

\*) Available only for case dimensions 18 × 20, 18 × 25 and 18 × 31.5 mm


**B43866**
**High ripple current – 125 °C**
**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>	
5 × 11	345	55	240	2000
6.3 × 11	345	55	290	2000
8 × 11.5	345	55	240	1000
10 × 12.5	345	55	280	750
10 × 16	345	60	200	500
10 × 20	345	60	200	500
12.5 × 20	345	65	280	500
12.5 × 25	345	65	280	500
16 × 20	315	65	275	300
16 × 25	315	65	275	300
16 × 31.5	315	65	275	300
18 × 20	315	65	275	250
18 × 25	315	65	275	250
18 × 31.5	315	65	275	250



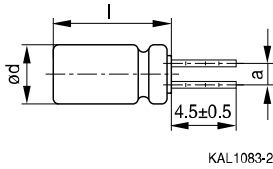
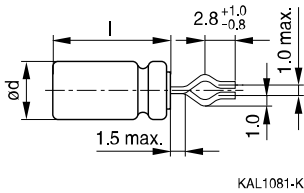
### Kinked or cut leads

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

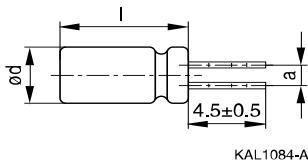
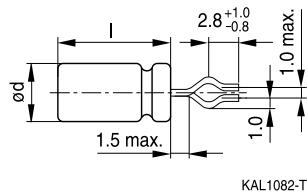
### Kinked leads

Last 3 digits of ordering code: 001

#### With stand-off rubber seal



#### With flat rubber seal



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
18 × 20	7.5
18 × 25	7.5
18 × 31.5	7.5
18 × 35	7.5
18 × 40	7.5



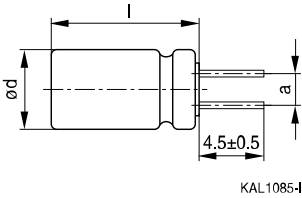
**B43866**

**High ripple current – 125 °C**

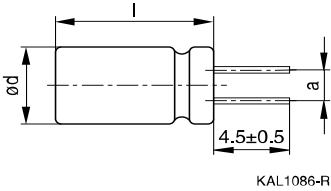
**Cut leads**

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
18 × 20	7.5
18 × 25	7.5
18 × 31.5	7.5
18 × 35	7.5
18 × 40	7.5
20 × 20	10.0
20 × 25	10.0
20 × 30	10.0
20 × 35	10.0
20 × 40	10.0
22 × 30	10.0
22 × 35	10.0
22 × 40	10.0





### PAPR leads (Protection Against Polarity Reversal)

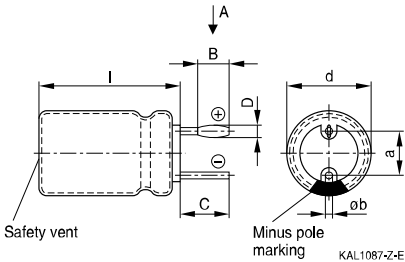
These lead configurations ensure correct placement of the capacitor on the PCB with regard to polarity. PAPR leads are available for diameters from 10 mm up to 20 mm.

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

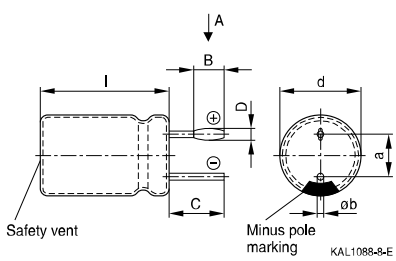
#### Crimped leads

Last 3 digits of ordering code: 003

##### With stand-off rubber seal

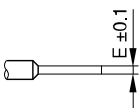


##### With flat rubber seal

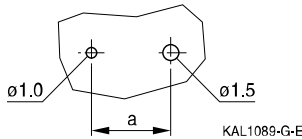


#### Suggestion for PCB hole diameter

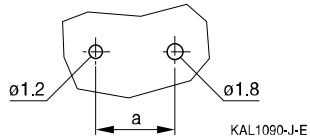
##### View A



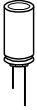
Suggestion for PCB hole diameter,  
wire ø0.8 mm



Suggestion for PCB hole diameter,  
wire ø1.0 mm



Case size d × 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
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
20 × 20	1.5	3.0	1.6	0.3	10.0	1.0 ±0.1
20 × 25	1.5	3.0	1.6	0.3	10.0	1.0 ±0.1
20 × 30	1.5	3.0	1.6	0.3	10.0	1.0 ±0.1
20 × 35	1.5	3.0	1.6	0.3	10.0	1.0 ±0.1
20 × 40	1.5	3.0	1.6	0.3	10.0	1.0 ±0.1

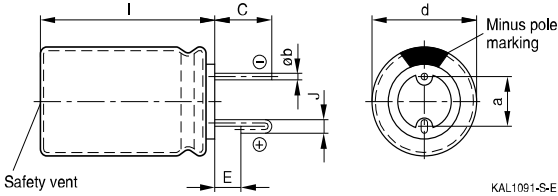


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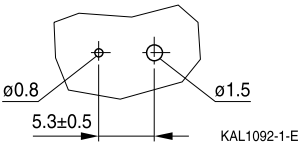
**J leads**

Last 3 digits of ordering code: 004

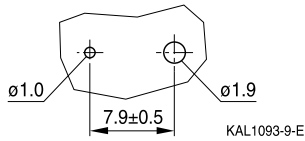


**Suggestion for PCB hole diameter**

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



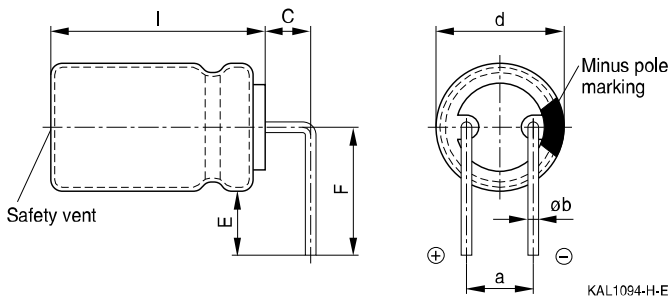
Suggestion for PCB hole diameter,  
wire  $\varnothing 0.8$  mm



Case size $d \times l$ (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 ±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
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
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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**Overview of packing units and code numbers for case sizes 5 × 11 ... 16 × 31.5**

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.	
5 × 11	2000	2000		–	–	–	–		
6.3 × 11	2500	2000		–	–	–	–		
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	120	
16 × 31.5	200	300		250	250	344	344	120	
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>007</b>	2.5	5...6.3					
		<b>008</b>	5	5...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 ... 25 × 40**

Case size d × l  mm	Standard, bulk pcs.	Taped, Ammo pack			Kinked leads, bulk pcs.	Cut leads, bulk pcs.	PAPR		
		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
20 × 20	125	–			–	125	200	–	–
20 × 25	125	–			–	125	200	–	–
20 × 30	100	–			–	100	120	–	–
20 × 35	100	–			–	100	120	–	–
20 × 40	100	–			–	100	120	–	–
22 × 30	80	–			–	100	–	–	–
22 × 35	80	–			–	100	–	–	–
22 × 40	80	–			–	100	–	–	–
25 × 40	40	–			–	–	–	–	–
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>007</b>	2.5	4...6.3					
		<b>008</b>	5	6.3...12.5					
		<b>009</b>	7.5	16...18					



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## Cautions and warnings

### Personal safety

The electrolytes used by EPCOS have not only been optimized with a view to the intended application, but also 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, part of the high-voltage electrolytes used by EPCOS are self-extinguishing. They contain flame-retarding substances which will quickly extinguish any flame that may have been ignited.

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 safe substitute materials are currently known. However, the amount of dangerous materials used in our products has been limited to an absolute minimum. Nevertheless, the following rules should be observed when handling Al electrolytic capacitors:

- Any escaping electrolyte should not come into contact with eyes or skin.
- If electrolyte does come into contact with the skin, wash the affected parts 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 breathing in 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 summarize 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"
Upper category temperature	Do not exceed the upper category temperatur.	7.2 "Maximum permissible operating temperature"
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 any mechanical stress to the capacitor terminals.	10 "Maintenance"
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"
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"
Robustness of terminals	The following maximum tightening torques must not be exceeded when connecting screw terminals: M5: 2 Nm M6: 2.5 Nm	11.3 "Mounting torques"
Soldering	Do not exceed the specified time or temperature limits during soldering.	11.5 "Soldering"



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Topic	Safety information	Reference Chapter "General technical information"
Soldering, cleaning agents	Do not allow halogenated hydrocarbons to come into contact with aluminum electrolytic capacitors.	11.6 "Cleaning agents"
Passive flammability	Avoid external energy, such as fire or electricity.	8.1 "Passive flammability"
Active flammability	Avoid overload of the capacitors.	8.2 "Active flammability"
		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	Ableitstrom
$I_{leak,op}$	Operating leakage current	Ableitstrom bei Betrieb
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; $2 \cdot \pi \cdot f$	Kreisfrequenz; $2 \cdot \pi \cdot f$

**Notes**

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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