Aluminum electrolytic capacitors

Single-ended capacitors

Series/Type: **B43888**
Date: February 2013

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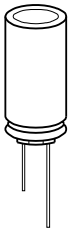
Long-life grade capacitors



Applications
- Professional power supplies

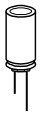
Features
- Compact dimensions
- High ripple current capability at high frequency
- Very long useful life (8000 to 10000 h/105 °C)
- RoHS-compatible

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

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

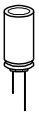
Refer to chapter "Single-ended capacitors – Taping, packing and lead configurations" for further details.



Specifications and characteristics in brief

Rated voltage V_R Surge voltage V_S	160 ... 450 V DC 1.1 · V_R			
Rated capacitance C_R Capacitance tolerance	3.3 ... 330 µF ±20% ≙ M			
Dissipation factor tan δ (20 °C, 120 Hz)	$V_R \leq 350$ V DC: tan δ (max.) = 0.20 $V_R \geq 400$ V DC: tan δ (max.) = 0.24			
Leakage current I_{leak} (20 °C, 5 min)	$I_{leak} = 0.03\,\mu A \cdot \left(\frac{C_R}{\mu F} \cdot \frac{V_R}{V}\right) + 15\,\mu A$			
Self-inductance ESL	Diameter (mm)	≤ 12.5	16	18
	ESL (nH)	20	26	34
Useful life[1)] 105 °C; V_R; $I_{AC,R}$ 105 °C; V_R; $I_{AC,R}$ Requirements	 > 8000 h for d = 10 mm > 10000 h for d ≥ 12.5 mm ΔC/C ≤ ±35% of initial value tan δ ≤ 3 times initial specified limit I_{leak} ≤ initial specified limit			
Voltage endurance test 105 °C; V_R Post test requirements	 8000 h for d = 10 mm 10000 h for d ≥ 12.5 mm ΔC/C ≤ ±25% of initial value tan δ ≤ 2 times initial specified limit I_{leak} ≤ initial specified limit			
Vibration resistance test	To IEC 60068-2-6, test Fc: Frequency range 10 Hz ... 2 kHz, displacement amplitude 0.75 mm, acceleration max. 10 *g,* duration 3 × 2 h. Capacitor rigidly clamped by the aluminum case.			
IEC climatic category	To IEC 60068-1: $V_R \leq 250$ V: 40/105/56 (−40 °C/+105 °C/56 days damp heat test) $V_R \geq 350$ V: 25/105/56 (−25 °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.



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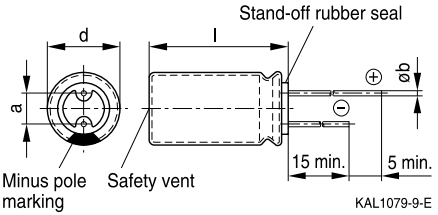
Long useful life – 105 °C

Dimensional drawings

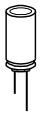
With stand-off rubber seal

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



Dimensions and weights

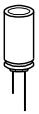
Dimensions (mm)				Approx. weight
d +0.5	l	a ±0.5	b	g
10	16 +1.0	5.0	0.60 ±0.05	1.9
10	20 +2.0	5.0	0.60 ±0.05	2.6
12.5	20 +2.0	5.0	0.60 ±0.05	3.6
12.5	25 +2.0	5.0	0.60 ±0.05	4.5
12.5	30 +2.0	5.0	0.80 ±0.05	5.3
16	20 +2.0	7.5	0.80 ±0.05	5.5
16	25 +2.0	7.5	0.80 ±0.05	7.5
16	31.5 +2.0	7.5	0.80 ±0.05	7.8
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
18	40 +2.0	7.5	0.80 ±0.1	16.0



Overview of available types

V_R (V DC)	160	200	250	350	400	450
	Case dimensions d × l (mm)					
C_R (µF)						
3.3				10 × 16	10 × 16	10 × 16
4.7				10 × 16	10 × 16	10 × 16
6.8				10 × 16	10 × 16	10 × 20
10		10 × 16	10 × 16	10 × 20	10 × 20	10 × 20
15				12.5 × 20	12.5 × 20	12.5 × 20
18						12.5 × 25
22	10 × 16	10 × 16	10 × 20	12.5 × 25	12.5 × 25	12.5 × 30 16 × 20
33	10 × 20	10 × 20	12.5 × 20	12.5 × 30 16 × 20	16 × 25	16 × 25
47	12.5 × 20	12.5 × 25	12.5 × 25	16 × 25	16 × 31.5	18 × 31.5
56					18 × 31.5	18 × 35
68	12.5 × 25	16 × 20	16 × 25	18 × 31.5	18 × 35	18 × 40
82				18 × 35	18 × 40	
100	16 × 20	16 × 25	16 × 31.5	18 × 40		
180			18 × 40			
220	18 × 31.5	18 × 35				
330	18 × 40					

Other voltage and capacitance ratings are available upon request.



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Long useful life – 105 °C

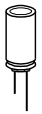
Technical data and ordering codes

C_R 120 Hz 20 °C µF	Case dimensions d × l mm	$I_{AC,R}$ 100 kHz 105 °C mA	Ordering code (composition see below)
V_R = 160 V DC			
22	10 × 16	320	B43888J1226M***
33	10 × 20	530	B43888J1336M***
47	12.5 × 20	750	B43888J1476M***
68	12.5 × 25	1000	B43888J1686M***
100	16 × 20	1100	B43888J1107M***
220	18 × 31.5	2000	B43888J1227M***
330	18 × 40	2400	B43888J1337M***
V_R = 200 V DC			
10	10 × 16	300	B43888G2106M***
22	10 × 16	320	B43888G2226M***
33	10 × 20	590	B43888G2336M***
47	12.5 × 25	900	B43888G2476M***
68	16 × 20	1050	B43888G2686M***
100	16 × 25	1400	B43888G2107M***
220	18 × 35	2200	B43888G2227M***
V_R = 250 V DC			
10	10 × 16	320	B43888J2106M***
22	10 × 20	500	B43888J2226M***
33	12.5 × 20	700	B43888J2336M***
47	12.5 × 25	1000	B43888J2476M***
68	16 × 25	1250	B43888J2686M***
100	16 × 31.5	1700	B43888J2107M***
180	18 × 40	2400	B43888J2187M***

Composition of ordering code

*** = Version

- 000 = for standard leads, bulk
- 001 = for kinked leads, bulk (for d × l = 10 × 20 ... 12.5 × 25 mm and ∅ 16 ... 18 mm)
- 002 = for cut leads, bulk (for ∅ 10 ... 18 mm, excluding d × l = 12.5 × 30 mm)
- 003 = for crimped leads, blister (for ∅ 16 ... 18 mm)
- 004 = for J leads, blister (for ∅ 10 ... 18 mm, excluding d × l = 12.5 × 30 and 18 × 40 mm)
- 008 = for taped leads, Ammo pack, lead spacing F = 5.0 mm (for d × l = 10 × 16 ... 12.5 × 25 mm)
- 009 = for taped leads, Ammo pack, lead spacing F = 7.5 mm (for ∅ 16 mm and d × l = 18 × 31.5 mm)
- 012 = for bent 90° leads, blister (for ∅ 16 ... 18 mm)



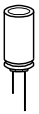
Technical data and ordering codes

C_R 120 Hz 20 °C µF	Case dimensions d × l mm	$I_{AC,R}$ 100 kHz 105 °C mA	Ordering code (composition see below)
V_R = 350 V DC			
3.3	10 × 16	260	B43888G4335M***
4.7	10 × 16	270	B43888G4475M***
6.8	10 × 16	280	B43888G4685M***
10	10 × 20	400	B43888G4106M***
15	12.5 × 20	600	B43888G4156M***
22	12.5 × 25	730	B43888G4226M***
33	12.5 × 30	1100	B43888G4336M***
33	16 × 20	860	B43888H4336M***
47	16 × 25	1150	B43888G4476M***
68	18 × 31.5	1800	B43888G4686M***
82	18 × 35	1900	B43888G4826M***
100	18 × 40	2100	B43888G4107M***
V_R = 400 V DC			
3.3	10 × 16	180	B43888G9335M***
4.7	10 × 16	190	B43888G9475M***
6.8	10 × 16	200	B43888G9685M***
10	10 × 20	350	B43888G9106M***
15	12.5 × 20	500	B43888G9156M***
22	12.5 × 25	600	B43888G9226M***
33	16 × 25	900	B43888G9336M***
47	16 × 31.5	1100	B43888G9476M***
56	18 × 31.5	1300	B43888G9566M***
68	18 × 35	1400	B43888G9686M***
82	18 × 40	1600	B43888G9826M***

Composition of ordering code

*** = Version

- 000 = for standard leads, bulk
- 001 = for kinked leads, bulk (for d × l = 10 × 20 ... 12.5 × 25 mm and ∅ 16 ... 18 mm)
- 002 = for cut leads, bulk (for ∅ 10 ... 18 mm, excluding d × l = 12.5 × 30 mm)
- 003 = for crimped leads, blister (for ∅ 16 ... 18 mm)
- 004 = for J leads, blister (for ∅ 10 ... 18 mm, excluding d × l = 12.5 × 30 and 18 × 40 mm)
- 008 = for taped leads, Ammo pack, lead spacing F = 5.0 mm (for d × l = 10 × 16 ... 12.5 × 25 mm)
- 009 = for taped leads, Ammo pack, lead spacing F = 7.5 mm (for ∅ 16 mm and d × l = 18 × 31.5 mm)
- 012 = for bent 90° leads, blister (for ∅ 16 ... 18 mm)



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Long useful life – 105 °C

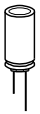
Technical data and ordering codes

C_R 120 Hz 20 °C µF	Case dimensions d × l mm	$I_{AC,R}$ 100 kHz 105 °C mA	Ordering code (composition see below)
V_R = 450 V DC			
3.3	10 × 16	170	B43888G5335M***
4.7	10 × 16	180	B43888G5475M***
6.8	10 × 20	310	B43888G5685M***
10	10 × 20	330	B43888G5106M***
15	12.5 × 20	450	B43888G5156M***
18	12.5 × 25	600	B43888G5186M***
22	12.5 × 30	760	B43888G5226M***
22	16 × 20	660	B43888H5226M***
33	16 × 25	900	B43888G5336M***
47	18 × 31.5	1300	B43888G5476M***
56	18 × 35	1400	B43888G5566M***
68	18 × 40	1600	B43888G5686M***

Composition of ordering code

*** = Version

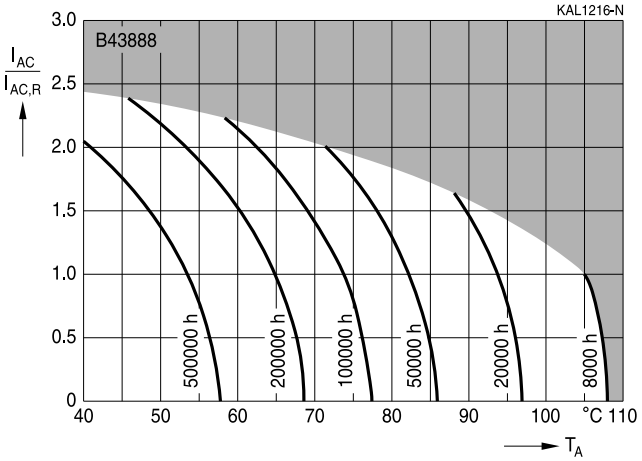
000 = for standard leads, bulk
001 = for kinked leads, bulk (for d × l = 10 × 20 ... 12.5 × 25 mm and ∅ 16 ... 18 mm)
002 = for cut leads, bulk (for ∅ 10 ... 18 mm, excluding d × l = 12.5 × 30 mm)
003 = for crimped leads, blister (for ∅ 16 ... 18 mm)
004 = for J leads, blister (for ∅ 10 ... 18 mm, excluding d × l = 12.5 × 30 and 18 × 40 mm)
008 = for taped leads, Ammo pack, lead spacing F = 5.0 mm (for d × l = 10 × 16 ... 12.5 × 25 mm)
009 = for taped leads, Ammo pack, lead spacing F = 7.5 mm (for ∅ 16 mm and d × l = 18 × 31.5 mm)
012 = for bent 90° leads, blister (for ∅ 16 ... 18 mm)



Useful life[1)]

depending on ambient temperature T_A under ripple current operating conditions

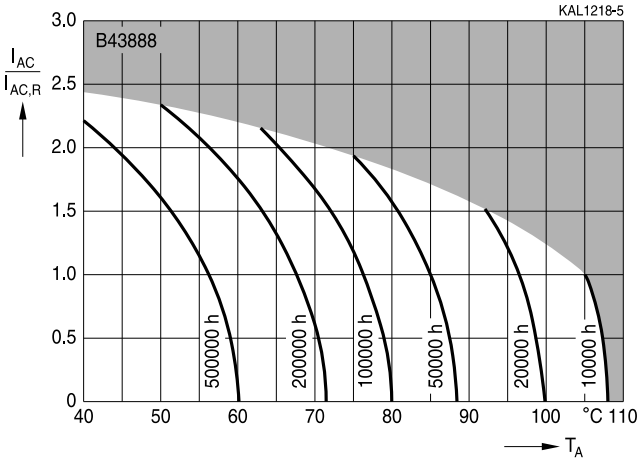
d = 10 mm



Useful life[1)]

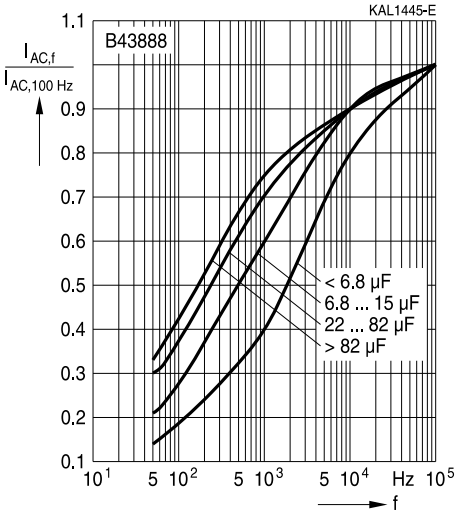
depending on ambient temperature T_A under ripple current operating conditions

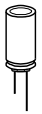
d ≥ 12.5 mm and V_R ≥ 350 V



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





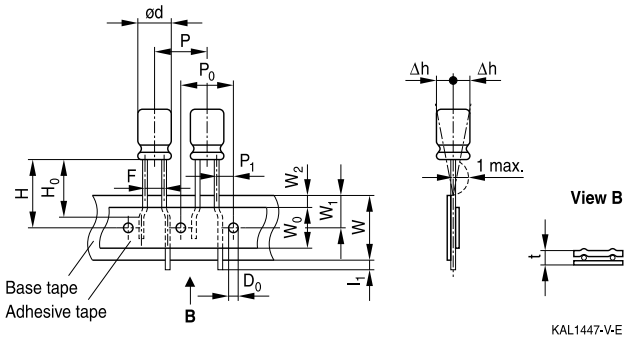
Taping, packing and lead configurations

Taping

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

Lead spacing F = 3.5 mm (∅ d = 8 mm)
Lead spacing F = 5.0 mm (∅ d = 8 … 12.5 mm)
Lead spacing F = 7.5 mm (∅ d = 16 ... 18 mm).

Lead spacing 3.5 mm (∅ d = 8 mm)
Last 3 digits of ordering code: 006



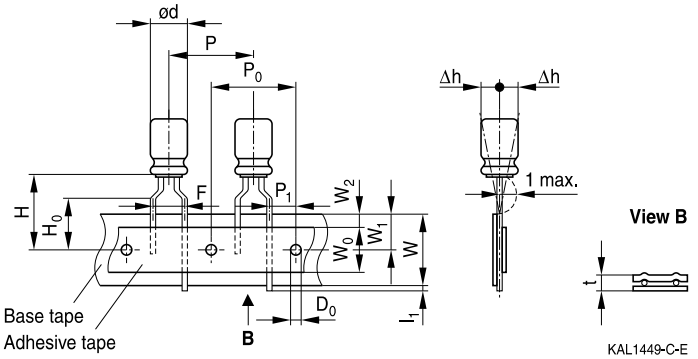
Dimensions in mm

∅ d	F	H	W	W_0	W_1	W_2	P	P_0	P_1	l_1	t	Δh	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.

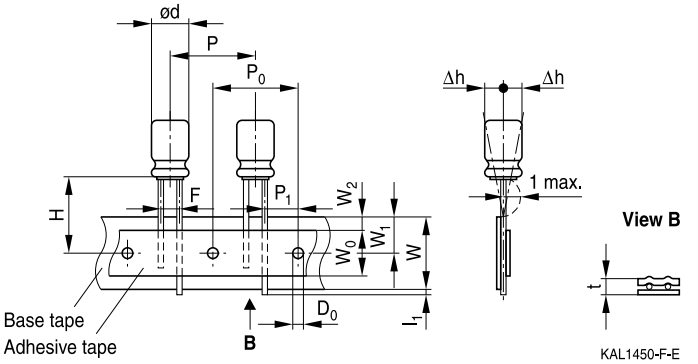
Lead spacing 5.0 mm (∅ d = 8 mm)

Last 3 digits of ordering code: 008



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

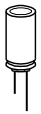
Last 3 digits of ordering code: 008



Dimensions in mm

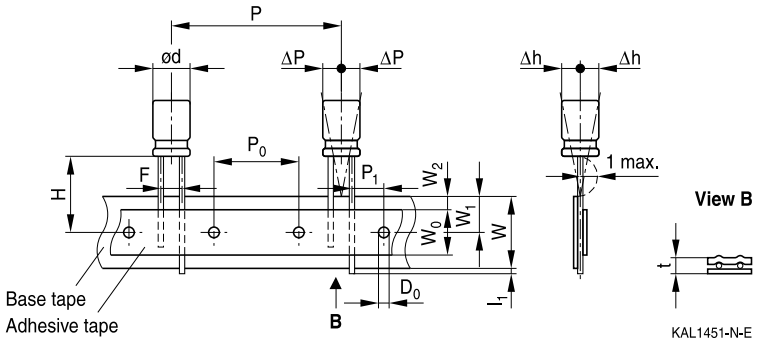
∅ d	F	H	W	W_0	W_1	W_2	H_0	P	P_0	P_1	l_1	t	Δh	D_0
4 ... 6.3	5.0	18.5	18.0	5.5	9.0	1.5	16.0	12.7	12.7	3.85	1.0	0.6	1.0	4.0
8	5.0	20.0	18.0	9.5	9.0	1.5	16.0	12.7	12.7	3.85	1.0	0.6	1.0	4.0
10		19.0		9.5			–	12.7	12.7	3.85				
12.5		19.0		11.5			–	15.0	15.0	5.0				
Tolerance	+0.8 −0.2	±0.75	±0.5	min.	±0.5	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)

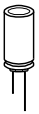
Last 3 digits of ordering code: 009



Dimensions in mm

∅ d	F	H	W	W_0	W_1	W_2	P	P_0	P_1	l_1	t	ΔP	Δh	D_0
16	7.5	18.5	18.0	12.5	9.0	1.5	30.0	15.0	3.75	1.0	0.7	0	0	4.0
18														
Tolerance	±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.



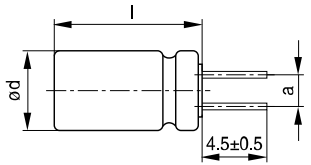
Cut or kinked leads

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

Cut leads

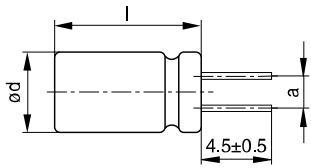
Last 3 digits of ordering code: 002

With stand-off rubber seal



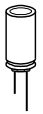
KAL1085-I

With flat rubber seal



KAL1086-R

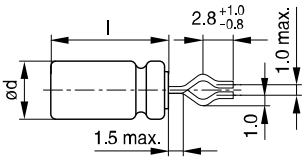
Case size d × l (mm)	Dimensions (mm) a ±0.5
10 × 12.5	5.0
10 × 16	5.0
10 × 20	5.0
12.5 × 20	5.0
12.5 × 25	5.0
16 × 20	7.5
16 × 25	7.5
16 × 31.5	7.5
16 × 35.5	7.5
18 × 20	7.5
18 × 25	7.5
18 × 31.5	7.5
18 × 35	7.5
18 × 40	7.5



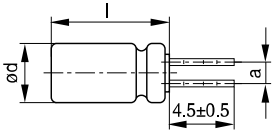
Kinked leads

Last 3 digits of ordering code: 001

With stand-off rubber seal

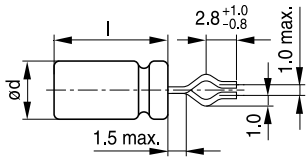


KAL1081-K

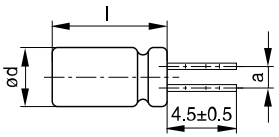


KAL1083-2

With flat rubber seal

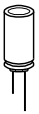


KAL1082-T



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

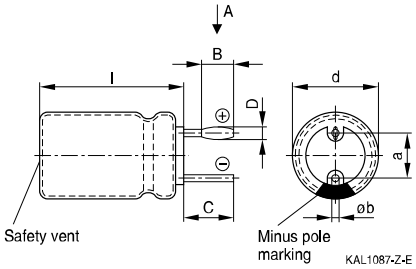


PAPR leads (Protection Against Polarity Reversal)

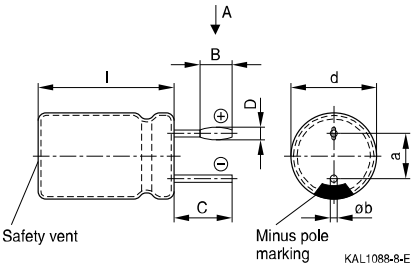
These lead configurations ensure correct placement of the capacitor on the PCB with regard to polarity. PAPR leads are available for diameters from 10 mm up to 18 mm (excluding d × l = 12.5 × 30/35/40 mm).
There are three configurations available: Crimped leads, J leads, bent 90° leads

Crimped leads
Last 3 digits of ordering code: 003

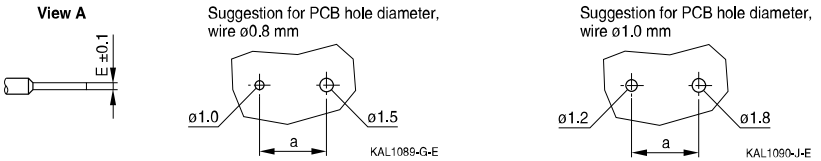
With stand-off rubber seal



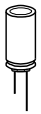
With flat rubber seal



Suggestion for PCB hole diameter

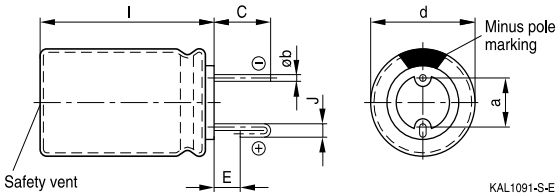


Case size	Dimensions (mm)					
d × l (mm)	B ±0.2	C ±0.5	D ±0.1	E ±0.1	a ±0.5	∅b
16 × 20	1.5	3.0	1.3	0.3	7.5	0.8 ±0.05
16 × 25	1.5	3.0	1.3	0.3	7.5	0.8 ±0.05
16 × 31.5	1.5	3.0	1.3	0.3	7.5	0.8 ±0.05
16 × 35.5	1.5	3.0	1.3	0.3	7.5	0.8 ±0.05
18 × 20	1.5	3.0	1.3	0.3	7.5	0.8 ±0.1
18 × 25	1.5	3.0	1.3	0.3	7.5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



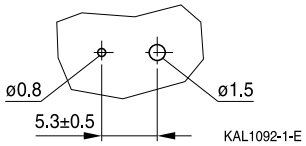
J leads

Last 3 digits of ordering code: 004

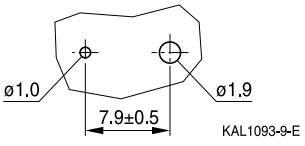


Suggestion for PCB hole diameter

Suggestion for PCB hole diameter, wire ø0.6 mm



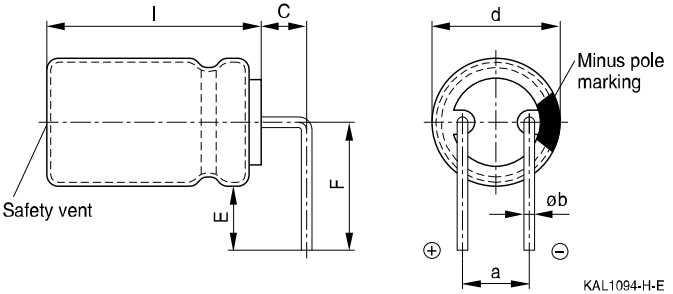
Suggestion for PCB hole diameter, wire ø0.8 mm



Case size	Dimensions (mm)				
d × l (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

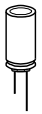
Bent 90° leads for horizontal mounting pinning

Last 3 digits of ordering code: 012



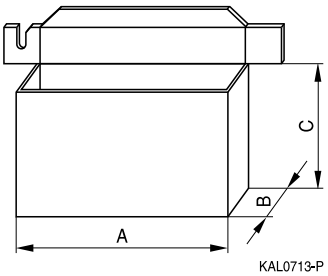
Case size	Dimensions (mm)				
d × l (mm)	C ±0.5	E ±0.5	F ±0.5	a ±0.5	∅b
16 × 20	4.0	4.0	12.0	7.5	0.8 ±0.05
16 × 25	4.0	4.0	12.0	7.5	0.8 ±0.05
16 × 31.5	4.0	4.0	12.0	7.5	0.8 ±0.05
16 × 35.5	4.0	4.0	12.0	7.5	0.8 ±0.05
18 × 20	4.0	4.0	13.0	7.5	0.8 ±0.1
18 × 25	4.0	4.0	13.0	7.5	0.8 ±0.1
18 × 31.5	4.0	4.0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

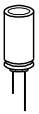


Packing units and box dimensions

Ammo pack



Case size d × l	Dimensions (mm)			Packing units
mm	A_{max}	B_{max}	C_{max}	pcs.
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



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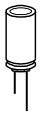
Long useful life – 105 °C

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

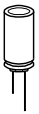
							PAPR		
Case size d × l mm	Standard, bulk pcs.	Taped, Ammo pack pcs.			Kinked leads, bulk pcs.	Cut leads, bulk pcs.	Crimped leads, blister pcs.	J leads, blister pcs.	Bent 90° leads, blister pcs.
8 × 11.5	1000	1000			–	–	–	–	
10 × 12.5	1000	750			–	1000	–	675	
10 × 16	1000	500			–	1000	–	675	
10 × 20	500	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	**000**	Code	F (mm)	d (mm)	**001**	**002**	**003**	**004**	**012**
		006	3.5	8					
		008	5	8...12.5					
		009	7.5	16...18					

1) Available upon request



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

							PAPR		
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.
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	**000**	Code	F (mm)	d (mm)	**001**	**002**	**003**	**004**	**012**
		009	7.5	16...18					



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Long useful life – 105 °C

Cautions and warnings

Personal safety

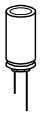
The electrolytes used by EPCOS have been optimized both with a view to the intended application and with regard to health and environmental compatibility. They do not contain any solvents that are detrimental to health, e.g. dimethyl formamide (DMF) or dimethyl acetamide (DMAC).
Furthermore, some of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

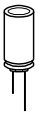
Nevertheless, the following rules should be observed when handling aluminum electrolytic capacitors: No electrolyte should come into contact with eyes or skin. If electrolyte does come into contact with the skin, wash the affected areas immediately with running water. If the eyes are affected, rinse 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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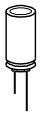
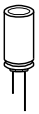
Long useful life – 105 °C

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 any mechanical stress to the capacitor terminals.	10 "Maintenance"
Storage	Do not store capacitors at high temperatures or high humidity. Capacitors should be stored at +5 to +35 °C and a relative humidity of ≤ 75%.	7.3 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
ΔT	Temperature difference	Temperaturdifferenz
T_A	Ambient temperature	Umgebungstemperatur
T_C	Case temperature	Gehäusetemperatur
T_B	Capacitor base temperature	Temperatur des Becherbodens
t	Time	Zeit
Δt	Period	Zeitraum
t_b	Service life (operating hours)	Brauchbarkeitsdauer (Betriebszeit)



Symbol	English	German
V	Voltage	Spannung
V_F	Forming voltage	Formierspannung
V_{op}	Operating voltage	Betriebsspannung
V_R	Rated voltage, DC voltage	Nennspannung, Gleichspannung
V_S	Surge voltage	Spitzenspannung
X_C	Capacitive reactance	Kapazitiver Blindwiderstand
X_L	Inductive reactance	Induktiver Blindwiderstand
Z	Impedance	Scheinwiderstand
Z_T	Impedance at temperature T	Scheinwiderstand bei Temperatur T
tan δ	Dissipation factor	Verlustfaktor
λ	Failure rate	Ausfallrate
ε_0	Absolute permittivity	Elektrische Feldkonstante
ε_r	Relative permittivity	Dielektrizitätszahl
ω	Angular velocity; $2 \cdot \pi \cdot f$	Kreisfrequenz; $2 \cdot \pi \cdot f$

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.**
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