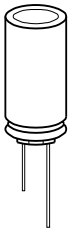
Aluminum electrolytic capacitors

Single-ended capacitors

Series/Type: **B43888**
Date: December 2006



Long-life grade capacitors

Applications

- Professional electronic ballasts
- Power supplies
- Energy-saving lamps

Features

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

Construction

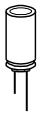
- Radial leads
- Charge-discharge proof, polar
- Aluminum case with insulating sleeve
- Minus pole marking on the insulating sleeve
- Case with safety vent

Delivery mode

Special terminal configurations and packing:

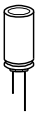
- Bulk
- Taped, Ammo pack
- Cut
- Kinked
- PAPR (protection against polarity reversal): crimped leads, J leads, bent leads

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



Specifications and characteristics in brief

Rated voltage V_R Surge voltage V_S	160 ... 450 V DC $1.1 \cdot V_R$				
Rated capacitance C_R Capacitance tolerance	6.8 ... 100 µF ±20% ≙ M				
Dissipation factor tan δ (20 °C, 120 Hz)	$V_R \leq 350$ V DC: tan δ = 0.20 $V_R \geq 400$ V DC: tan δ = 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	20
	ESL (nH)	20	26	34	38
Useful life 105 °C, V_R, $I_{AC,R}$ 105 °C, V_R, $I_{AC,R}$	 8000 h for d = 10 mm 10000 h for d ≥ 12.5 mm				
Requirements	ΔC/C ≤ ±50% of initial value tan δ ≤ 3 times initial specified limit I_{leak} ≤ initial specified limit				
Voltage endurance test 105 °C, V_R	 8000 h for d = 10 mm 10000 h for d ≥ 12.5 mm				
Post test requirements	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: Displacement amplitude 0.75 mm, frequency range 10 ... 2000 Hz, acceleration max. 20 *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				

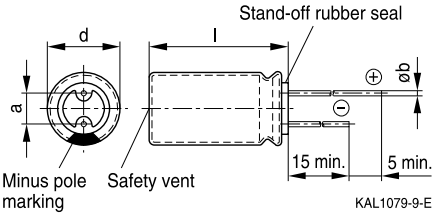


B43888

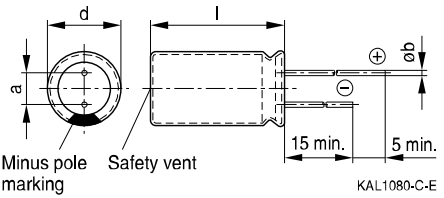
Very long useful life – 105 °C

Dimensional drawings

With stand-off rubber seal
Diameters (mm): 10, 12.5, 16, 18

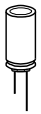


With flat rubber seal
Diameter (mm): 20



Dimensions and weights

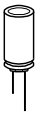
Dimensions (mm)				Approx. weight
d +0.5	l	a ±0.5	b	g
10	16 + 1.0	5.0	0.60 ± 0.05	1.9
10	20 + 2.0	5.0	0.60 ± 0.05	2.6
12.5	20 + 2.0	5.0	0.60 ± 0.05	3.6
12.5	25 + 2.0	5.0	0.60 ± 0.05	4.5
16	20 + 2.0	7.5	0.80 ± 0.05	5.5
16	25 + 2.0	7.5	0.80 ± 0.05	7.5
16	31.5 + 2.0	7.5	0.80 ± 0.05	7.8
18	20 + 2.0	7.5	0.80 ± 0.1	8
18	31.5 + 2.0	7.5	0.80 ± 0.1	11
20	20 + 2.0	10.0	1.0 ± 0.1	10



Overview of available types

V_R (V DC)	160	200	250	350	400	450
	Case dimensions d × l (mm)					
C_R (µF)						
6.8				10 × 16	10 × 16	10 × 20
10	10 × 16	10 × 16	10 × 20	10 × 20	10 × 20	12.5 × 20
22	10 × 20	10 × 20	12.5 × 20	12.5 × 25	12.5 × 25	16 × 25 18 × 20
33	10 × 20	12.5 × 20	12.5 × 20	16 × 20	16 × 25	16 × 31.5
47	12.5 × 20	12.5 × 20	12.5 × 25 16 × 20	16 × 31.5 20 × 20	16 × 31.5 20 × 20	18 × 31.5
68	12.5 × 25 16 × 20	12.5 × 25 16 × 20	16 × 25 20 × 20	18 × 31.5	18 × 31.5	
100	16 × 25 20 × 20	16 × 25 20 × 20	16 × 31.5 20 × 20			

Other voltage and capacitance ratings are available upon request.



B43888

Very long useful life – 105 °C

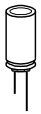
Technical data and ordering codes

C_R 120 Hz 20 °C µF	Case dimensions d × l mm	ESR_{max} 120 Hz −25 °C Ω	ESR_{max} 120 Hz 20 °C Ω	Z_{max} 100 kHz 20 °C Ω	$I_{AC,R}$ 100 kHz 105 °C mA	$I_{AC,max}$ 100 kHz 85 °C mA	Ordering code (composition see beolow)
V_R = 160 V DC							
10	10 × 16	1161	33.2	4.00	220	374	B43888A1106M***
22	10 × 20	528	15.1	1.50	350	595	B43888A1226M***
33	10 × 20	352	10.0	1.55	430	731	B43888A1336M***
47	12.5 × 20	247	7.1	1.05	580	986	B43888A1476M***
68	12.5 × 25	171	4.9	0.81	770	1309	B43888A1686M***
68	16 × 20	171	4.9	0.75	820	1394	B43888F1686M***
100	16 × 25	116	3.3	0.68	1080	1836	B43888A1107M***
100	20 × 20	116	3.3	0.45	1150	1955	B43888F1107M***
V_R = 200 V DC							
10	10 × 16	1161	33.2	4.00	220	374	B43888A2106M***
22	10 × 20	528	15.1	1.50	350	595	B43888A2226M***
33	12.5 × 20	352	10.0	1.40	490	833	B43888A2336M***
47	12.5 × 20	247	7.1	1.05	580	986	B43888A2476M***
68	12.5 × 25	171	4.9	0.81	770	1309	B43888A2686M***
68	16 × 20	171	4.9	0.75	820	1394	B43888K2686M***
100	16 × 25	116	3.3	0.68	1080	1836	B43888A2107M***
100	20 × 20	116	3.3	0.50	1150	1955	B43888K2107M***
V_R = 250 V DC							
10	10 × 20	1161	33.2	3.50	240	408	B43888F2106M***
22	12.5 × 20	528	15.1	2.30	400	680	B43888F2226M***
33	12.5 × 20	352	10.0	2.30	490	833	B43888F2336M***
47	12.5 × 25	247	7.1	1.70	640	1088	B43888F2476M***
47	16 × 20	247	7.1	1.10	680	1156	B43888P2476M***
68	16 × 25	171	4.9	0.78	890	1513	B43888F2686M***
68	20 × 20	171	4.9	0.45	950	1615	B43888P2686M***
100	16 × 31.5	116	3.3	0.63	1180	2006	B43888F2107M***
100	20 × 20	116	3.3	0.45	1150	1955	B43888P2107M***

Composition of ordering code

*** = Version

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



Technical data and ordering codes

C_R 120 Hz 20 °C µF	Case dimensions d × l mm	ESR_{max} 120 Hz −25 °C Ω	ESR_{max} 120 Hz 20 °C Ω	Z_{max} 100 kHz 20 °C Ω	$I_{AC,R}$ 100 kHz 105 °C mA	$I_{AC,max}$ 100 kHz 85 °C mA	Ordering code (composition see beolow)
V_R = 350 V DC							
6.8	10 × 16	1707	48.8	5.40	180	306	B43888A4685M***
10	10 × 20	1161	33.2	4.00	240	408	B43888A4106M***
22	12.5 × 25	528	15.1	2.10	440	748	B43888A4226M***
33	16 × 20	352	10.0	3.40	570	969	B43888A4336M***
47	16 × 31.5	247	7.1	1.90	810	1377	B43888A4476M***
47	20 × 20	247	7.1	1.20	790	1343	B43888F4476M***
68	18 × 31.5	171	4.9	1.30	1040	1768	B43888A4686M***
V_R = 400 V DC							
6.8	10 × 16	2048	58.5	5.40	180	306	B43888A9685M***
10	10 × 20	1393	39.8	4.00	240	408	B43888A9106M***
22	12.5 × 25	633	18.1	2.10	440	748	B43888A9226M***
33	16 × 25	422	12.1	2.00	620	1054	B43888A9336M***
47	16 × 31.5	296	8.5	1.50	810	1377	B43888A9476M***
47	20 × 20	296	8.5	1.20	790	1343	B43888F9476M***
68	18 × 31.5	205	5.9	1.30	1040	1768	B43888A9686M***
V_R = 450 V DC							
6.8	10 × 20	2048	58.5	4.00	200	340	B43888A5685M***
10	12.5 × 20	1393	39.8	3.20	270	459	B43888A5106M***
22	16 × 25	633	18.1	2.10	510	867	B43888A5226M***
22	18 × 20	633	18.1	2.60	500	850	B43888F5226M***
33	16 × 31.5	422	12.1	1.90	680	1156	B43888A5336M***
47	18 × 31.5	296	8.5	1.20	870	1479	B43888A5476M***

Composition of ordering code

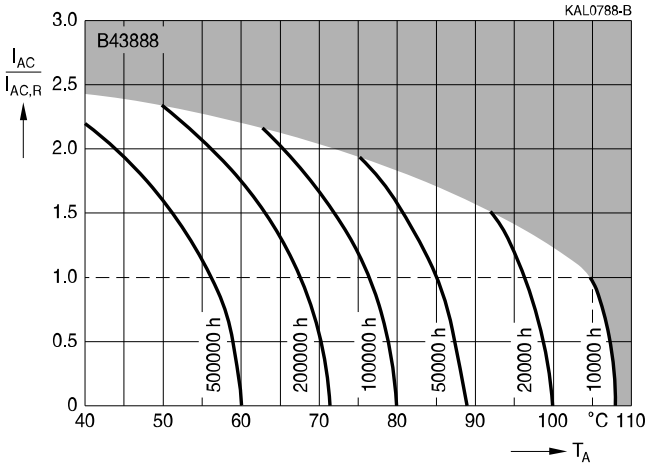
*** = Version

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

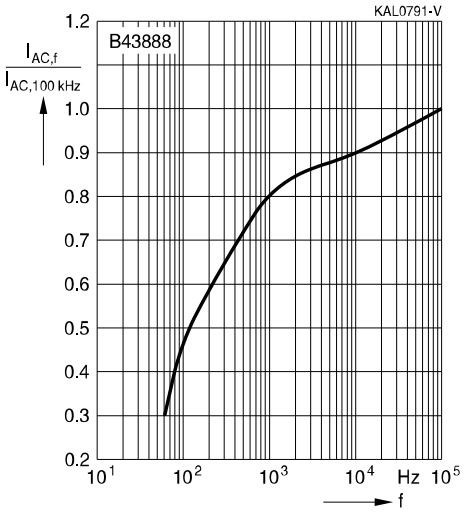
Useful life

depending on ambient temperature T_A under ripple current operating conditions[1)]

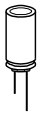
V_R = 160 ... 450 V DC



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



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

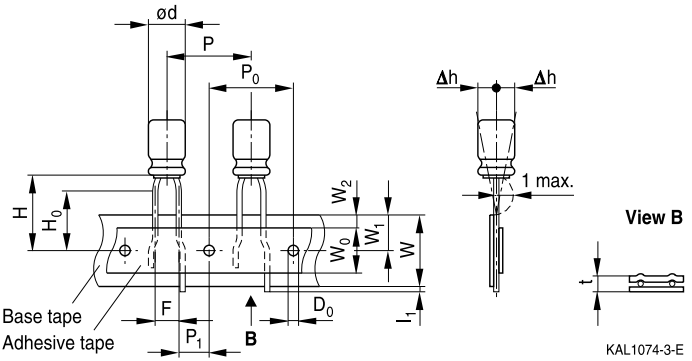


Taping, packing and lead configurations

Taping

Single-ended capacitors are available taped in Ammo pack from diameter 5 to 18 mm as follows:
Lead spacing F = 2.5 mm (∅ d = 5 … 6.3 mm)
Lead spacing F = 3.5 mm (∅ d = 8 mm)
Lead spacing F = 5.0 mm (∅ d = 5 … 12.5 mm)
Lead spacing F = 7.5 mm (∅ d = 16 ... 18 mm).

Lead spacing 2.5 mm (∅ d = 5 ... 6.3 mm)
Last 3 digits of ordering code: 007

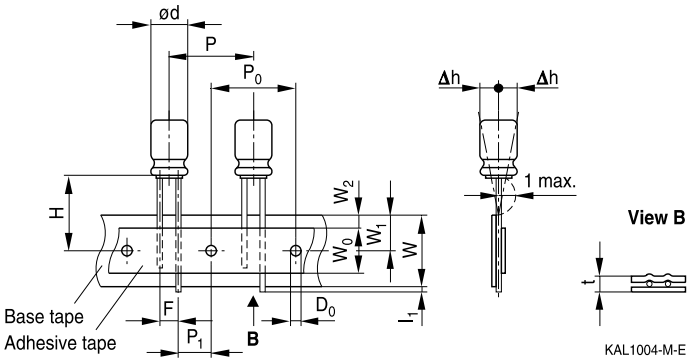


Dimensions in mm

∅ d	F	H	W	W_0	W_1	W_2	H_0	P	P_0	P_1	l_1	t	Δh	D_0
5 6.3	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
Toler-ance	+0.8 −02	±0.75	±0.5	min.	±0.5	max.	±0.5	±1.0	±0.2	±0.5	max.	±0.2	max.	±0.2

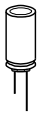
Lead spacing 3.5 mm (∅ d = 8 mm)

Last 3 digits of ordering code: 006



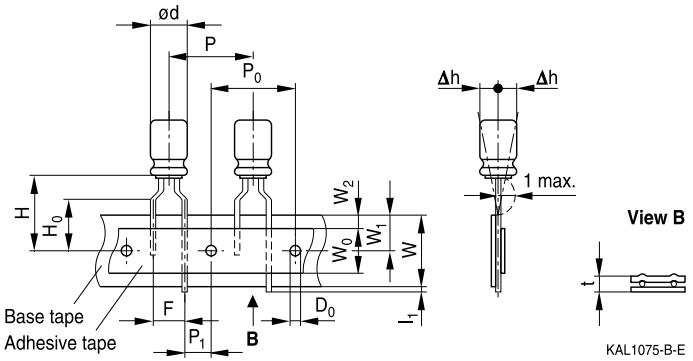
Dimensions in mm

∅ d	F	H	W	W_0	W_1	W_2	P	P_0	P_1	I_1	t	Δh	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 −02	1.0	±0.5	min.	±0.5	max.	±1.0	±0.2	±0.5	max.	±0.2	max.	±0.2



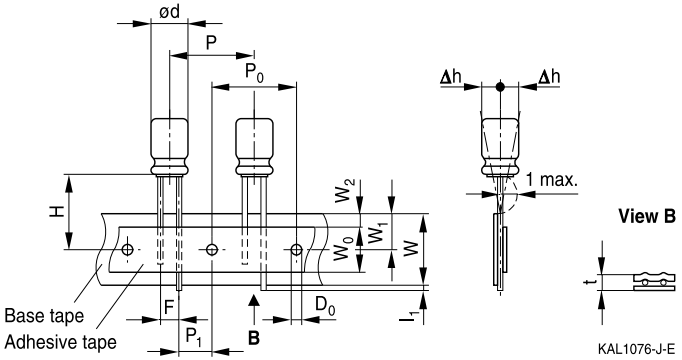
Lead spacing 5.0 mm (∅ d = 5 ... 8 mm)

Last 3 digits of ordering code: 008



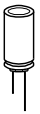
Lead spacing 5.0 mm (∅ d = 10 ... 12.5 mm)

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
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														
8	5.0	20.0	18.0	12.5	9.0	1.5	16.0	12.7	12.7	3.85	1.0	0.7	1.0	4.0
10		19.0					–	12.7	12.7	3.85				
12.5		19.0					–	15.0	15.0	5.0				
Tolerance	+0.8 −02	±0.75	±0.5	min.	±0.5	max.	±0.5	±1.0	±0.2	±0.5	max.	±0.2	max.	±0.2

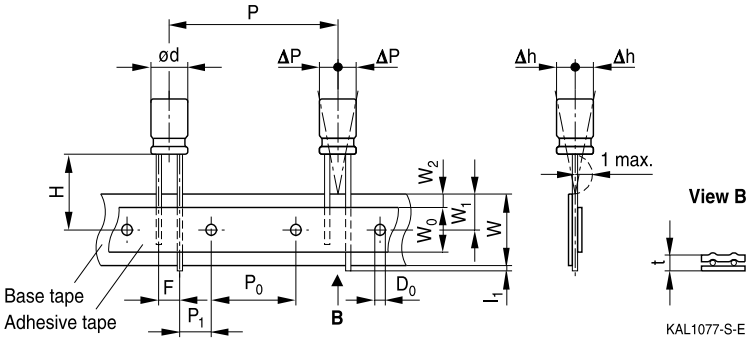


B43888

Very long useful life – 105 °C

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

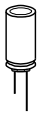
Last 3 digits of ordering code: 009



Dimensions in mm

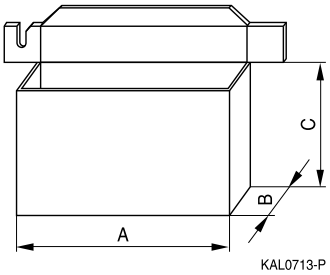
∅ d	F	H	W	W_0	W_1	W_2	P	P_0	P_1	I_1	t	ΔP	Δh	D_0
16 18 *)	7.5	18.5	18.0	12.5	9.0	1.5	30.0	15.0	3.75	1.0	0.7	0	0	4.0
Tolerance	±0.8	−0.5 +0.75	±0.5	min.	±0.5	max.	±1.0	±0.2	±0.5	max.	±0.2	±1.0	±1.0	±0.2

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

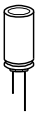


Packing units and box dimensions

Ammo pack



Case size d × l	Dimensions (mm)			Packing units
mm	A_{max}	B_{max}	C_{max}	pcs.
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
12.5 × 25	345	65	280	500
12.5 × 30	345	65	275	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



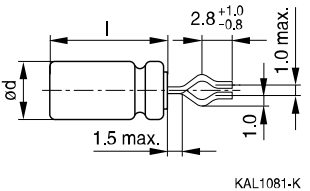
Kinked or cut leads

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

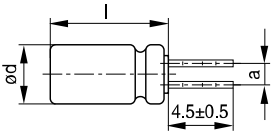
Kinked leads

Last 3 digits of ordering code: 001

With stand-off rubber seal

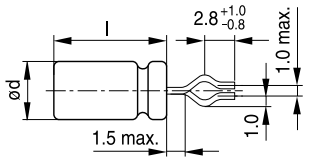


KAL1081-K

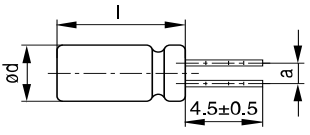


KAL1083-2

With flat rubber seal

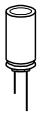


KAL1082-T



KAL1084-A

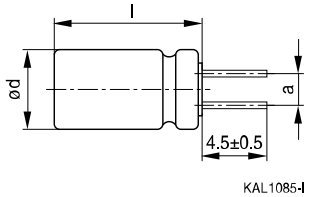
Case size d × l (mm)	Dimensions (mm) a ±0.5
10 × 20	5.0
12.5 × 20	5.0
12.5 × 25	5.0
12.5 × 30	5.0
12.5 × 35	5.0
12.5 × 40	5.0
16 × 20	7.5
16 × 25	7.5
16 × 31.5	7.5
18 × 20	7.5
18 × 25	7.5
18 × 31.5	7.5
18 × 35	7.5
18 × 40	7.5
20 × 20	10.0
20 × 25	10.0
20 × 40	10.0
22 × 30	10.0
22 × 35	10.0
22 × 40	10.0



Cut leads

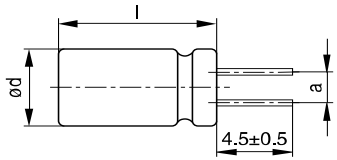
Last 3 digits of ordering code: 002

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
12.5 × 30	5.0
12.5 × 35	5.0
12.5 × 40	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 × 40	10.0

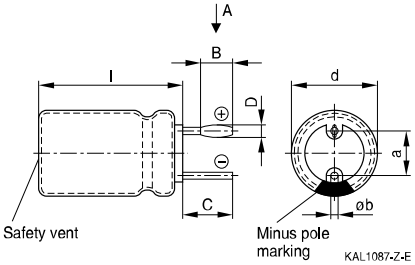
PAPR leads (Protection Against Polarity Reversal)

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

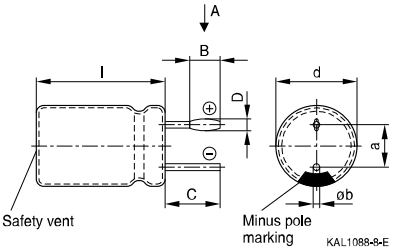
Crimped leads

Last 3 digits of ordering code: 003

With stand-off rubber seal

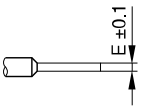


With flat rubber seal

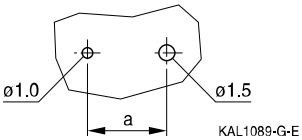


Suggestion for PCB hole diameter

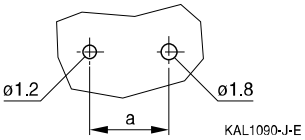
View A



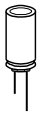
Suggestion for PCB hole diameter, wire ø0.8 mm



Suggestion for PCB hole diameter, wire ø1.0 mm

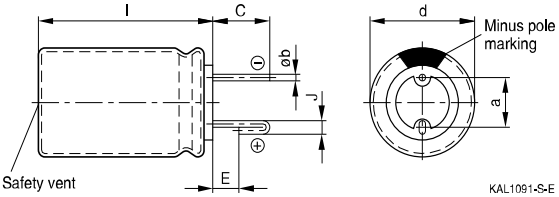


Case size	Dimensions (mm)					
d × l (mm)	B ±0.2	C ±0.5	D ±0.1	E ±0.1	a ±0.5	∅b
16 × 20	1.5	3.0	1.3	0.3	7.5	0.8 ±0.05
16 × 25	1.5	3.0	1.3	0.3	7.5	0.8 ±0.05
16 × 31.5	1.5	3.0	1.3	0.3	7.5	0.8 ±0.05
18 × 20	1.5	3.0	1.3	0.3	7.5	0.8 ±0.1
18 × 25	1.5	3.0	1.3	0.3	7.5	0.8 ±0.1
18 × 31.5	1.5	3.0	1.3	0.3	7.5	0.8 ±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 × 40	1.5	3.0	1.6	0.3	10.0	1.0 ±0.1



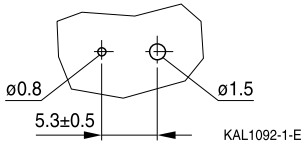
J leads

Last 3 digits of ordering code: 004

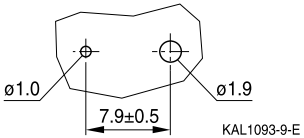


Suggestion for PCB hole diameter

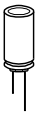
Suggestion for PCB hole diameter, wire ø0.6 mm



Suggestion for PCB hole diameter, wire ø0.8 mm

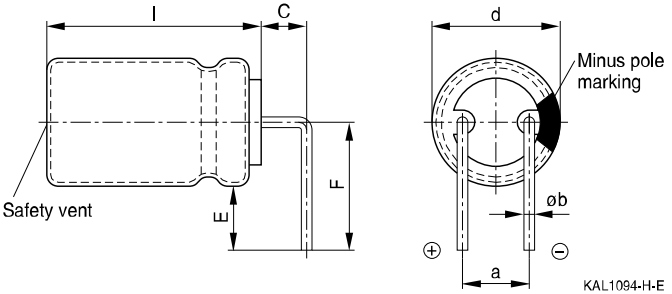


Case size	Dimensions (mm)				
d × l (mm)	C ±0.5	E ±0.5	J ±0.2	a ±0.5	∅b
10 × 12.5	3.2	0.7	1.2	5.0	0.6 ±0.05
10 × 16	3.2	0.7	1.2	5.0	0.6 ±0.05
10 × 20	3.2	0.7	1.2	5.0	0.6 ±0.05
12.5 × 20	3.2	0.7	1.2	5.0	0.6 ±0.05
12.5 × 25	3.2	0.7	1.2	5.0	0.6 ±0.05
16 × 20	3.5	0.7	1.6	7.5	0.8 ±0.05
16 × 25	3.5	0.7	1.6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



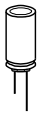
Bent 90° leads for horizontal mounting pinning

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
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

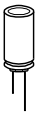
Bent leads for diameter 12.5 mm available upon request.



Overview of packing units and code numbers for case sizes 5 × 11 ... 16 × 31.5

							PAPR	
Case size d × l	Standard, bulk	Taped, Ammo pack			Kinked leads, bulk	Cut leads, bulk	Crimped leads	J leads	Bent 90° leads, blister
mm	pcs.	pcs.			pcs.	pcs.	pcs.	pcs.	pcs.
5 × 11	2000	2000			–	–	–	–	
6.3 × 11	2500	2000			–	–	–	–	
8 × 11.5	1000	1000			–	–	–	–	
10 × 12.5	1000	750			–	1000	–	675	
10 × 16	100	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	500			175	175	–	180	1)
12.5 × 35	175	-			175	175	–	150	1)
12.5 × 40	175	-			175	175	–	150	1)
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	**000**	Code	F (mm)	d (mm)	**001**	**002**	**003**	**004**	**012**
		006	3.5	8					
		007	2.5	5...6.3					
		008	5	5...12.5					
		009	7.5	16...18					

1) Available upon request

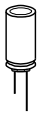


B43888

Very long useful life – 105 °C

Overview of packing units and code numbers for case sizes 18 × 20 ... 25 × 40

							PAPR		
Case size d × l	Stan-dard, bulk	Taped, Ammo pack			Kinked leads, bulk	Cut leads, bulk	Crimped leads	J leads	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
20 × 20	125	–			125	125	200	–	–
20 × 25	125	–			125	125	200	–	–
20 × 30	100	–			100	100	120	–	–
20 × 35	100	–			100	100	120	–	–
20 × 40	100	–			100	100	120	–	–
22 × 30	80	–			100	100	–	–	–
22 × 35	80	–			100	100	–	–	–
22 × 40	80	–			100	100	–	–	–
25 × 40	40	–			100	–	–	–	–
The last three digits of the complete ordering code state the lead configuration	**000**	Code	F (mm)	d (mm)	**001**	**002**	**003**	**004**	**012**
		007	2.5	4...6.3					
		008	5	6.3...12.5					
		009	7.5	16...18					



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.

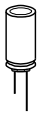
As far as possible, EPCOS does not use any dangerous chemicals or compounds to produce operating electrolytes. However, in exceptional cases, such materials must be used in order to achieve specific physical and electrical properties because no safe substitute materials are currently known. However, 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"



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"

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 passive 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 a passive electronic component could endanger human life or health (e.g. in accident prevention or life-saving 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 a passive 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). Should you have any more detailed questions, please contact our sales offices.
5. We constantly strive to improve our products. Consequently, **the products described in this publication may change from time to time**. The same is true of the corresponding product specifications. Please check therefore to what extent product descriptions and specifications contained in this publication are still applicable before or when you place an order. We also **reserve the right to discontinue production and delivery of products**. Consequently, we cannot guarantee that all products named in this publication will always be available.
6. Unless otherwise agreed in individual contracts, **all orders are subject to the current version of the "General Terms of Delivery for Products and Services in the Electrical Industry" published by the German Electrical and Electronics Industry Association (ZVEI)**.
7. The trade names EPCOS, EPCOS-JONES, BAOKE, Alu-X, CeraDiode, CSSP, MLSC, PhaseCap, PhaseMod, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMID, SIOV, SIP5D, SIP5K, UltraCap, WindCap are **trademarks registered or pending** in Europe and in other countries. Further information will be found on the Internet at www.epcos.com/trademarks.