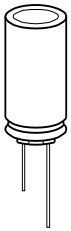
Aluminum electrolytic capacitors

Single-ended capacitors

Series/Type: **B43888**

Date: November 2008

Long-life grade capacitors



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

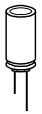
Features
- Compact dimensions
- High ripple current capability at high frequency
- Very long useful life (8000 to 12000 h/105 °C)
- RoHS-compatible

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

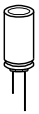
Special terminal configurations and packing:
- Bulk
- Taped, Ammo pack
- Cut
- Kinked
- PAPR (protection against polarity reversal): crimped leads, J leads, bent leads

Refer to chapter "Single-ended capacitors – Taping, packing and lead configurations" for further details 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	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	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 and $V_R \geq 350$ V DC 12000 h for d ≥ 12.5 mm and $V_R \leq 250$ V DC				
Requirements	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	8000 h for d = 10 mm 10000 h for d ≥ 12.5 mm and $V_R \geq 350$ V DC 12000 h for d ≥ 12.5 mm and $V_R \leq 250$ V DC				
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 1.5 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				



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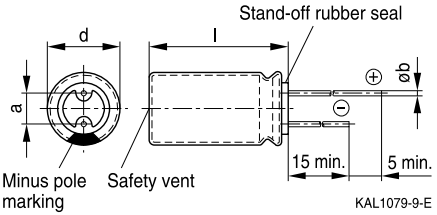
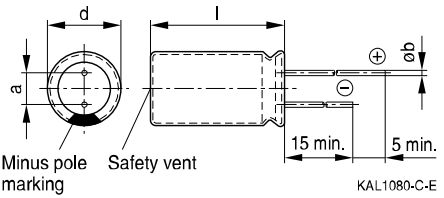
Extended useful life – 105 °C

Dimensional drawings

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

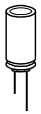


With flat rubber seal
Diameter (mm): 20



Dimensions and weights

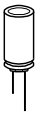
Dimensions (mm)				Approx. weight
d +0.5	l	a ±0.5	b	g
10	12.5 +1.0	5.0	0.60 ±0.05	1.6
10	16 +1.0	5.0	0.60 ±0.05	1.9
10	20 +2.0	5.0	0.60 ±0.05	2.6
12.5	20 +2.0	5.0	0.60 ±0.05	3.6
12.5	25 +2.0	5.0	0.60 ±0.05	4.5
12.5	30 +2.0	5.0	0.80 ±0.05	5.3
12.5	35 +2.0	5.0	0.80 ±0.05	6.4
12.5	40 +2.0	5.0	0.80 ±0.05	7.4
16	25 +2.0	7.5	0.80 ±0.05	7.5
16	31.5 +2.0	7.5	0.80 ±0.05	7.8
18	20 +2.0	7.5	0.80 ±0.1	8.0
18	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
20	40 +2.0	10.0	1.00 ±0.1	20.0



Overview of available types

V_R (V DC)	160	250	350	400	450
	Case dimensions d × l (mm)				
C_R (µF)					
3.3			10 × 12.5	10 × 16	
4.7		10 × 12.5	10 × 12.5	10 × 16	10 × 16
6.8		10 × 16	10 × 16	10 × 20	10 × 20
10		10 × 16	10 × 20	12.5 × 20	12.5 × 20 12.5 × 25
15			12.5 × 20	12.5 × 25	12.5 × 25 12.5 × 30
22	10 × 16	12.5 × 20	12.5 × 25	12.5 × 30	12.5 × 35 18 × 20
33	10 × 20	12.5 × 25	16 × 25	16 × 31.5	16 × 31.5
47	12.5 × 20	12.5 × 30	16 × 31.5	18 × 31.5	18 × 35
68	12.5 × 25	12.5 × 40	18 × 31.5	18 × 40	
100	16 × 25	18 × 31.5	18 × 40		
150		18 × 40			
220	18 × 35				
330	20 × 40				

Other voltage and capacitance ratings are available upon request.



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Extended useful life – 105 °C

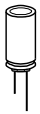
Technical data and ordering codes

C_R 120 Hz 20 °C µF	Case dimensions d × l mm	$I_{AC,R}$ 100 kHz 105 °C mA	$I_{AC,max}$ 100 kHz 85 °C mA	Ordering code (composition see below)
V_R = 160 V DC				
22	10 × 16	380	646	B43888C1226M***
33	10 × 20	500	850	B43888C1336M***
47	12.5 × 20	750	1275	B43888C1476M***
68	12.5 × 25	1200	2040	B43888C1686M***
100	16 × 25	1450	2465	B43888C1107M***
220	18 × 35	2400	4080	B43888C1227M***
330	20 × 40	3200	5440	B43888C1337M***
V_R = 250 V DC				
4.7	10 × 12.5	160	272	B43888C2475M***
6.8	10 × 16	250	425	B43888C2685M***
10	10 × 16	320	544	B43888C2106M***
22	12.5 × 20	500	850	B43888C2226M***
33	12.5 × 25	800	1360	B43888C2336M***
47	12.5 × 30	1000	1700	B43888C2476M***
68	12.5 × 40	1300	2210	B43888C2686M***
100	18 × 31.5	1450	2465	B43888C2107M***
150	18 × 40	2000	3400	B43888C2157M***
V_R = 350 V DC				
3.3	10 × 12.5	120	204	B43888C4335M***
4.7	10 × 12.5	150	255	B43888C4475M***
6.8	10 × 16	280	476	B43888C4685M***
10	10 × 20	350	595	B43888C4106M***
15	12.5 × 20	600	1020	B43888C4156M***
22	12.5 × 25	700	1190	B43888C4226M***
33	16 × 25	900	1530	B43888C4336M***
47	16 × 31.5	1100	1870	B43888C4476M***
68	18 × 31.5	1500	2550	B43888C4686M***
100	18 × 40	1700	2890	B43888C4107M***

Composition of ordering code

*** = Version

- 000 = for standard leads, bulk
- 001 = for kinked leads, bulk (from d × l = 10 × 20 mm to 18 × 40 mm, excluding 12.5 × 30/35/40 mm)
- 002 = for cut leads, bulk (excluding 12.5 × 30/35/40 mm)
- 003 = for crimped leads, blister (from d × l = 16 × 25 mm to 20 × 40 mm)
- 004 = for J leads, blister (from d × l = 10 × 12.5 mm to 18 × 31.5 mm, excluding 12.5 × 30/35/40 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	$I_{AC,R}$ 100 kHz 105 °C mA	$I_{AC,max}$ 100 kHz 85 °C mA	Ordering code (composition see below)
V_R = 400 V DC				
3.3	10 × 16	180	306	B43888C9335M***
4.7	10 × 16	220	374	B43888C9475M***
6.8	10 × 20	280	476	B43888C9685M***
10	12.5 × 20	350	595	B43888C9106M***
15	12.5 × 25	550	935	B43888C9156M***
22	12.5 × 30	750	1275	B43888C9226M***
33	16 × 31.5	900	1530	B43888C9336M***
47	18 × 31.5	1200	2040	B43888C9476M***
68	18 × 40	1500	2550	B43888C9686M***
V_R = 450 V DC				
4.7	10 × 16	180	306	B43888C5475M***
6.8	10 × 20	250	425	B43888C5685M***
10	12.5 × 20	450	765	B43888C5106M***
10	12.5 × 25	500	850	B43888D5106M***
15	12.5 × 25	500	850	B43888C5156M***
15	12.5 × 30	600	1020	B43888D5156M***
22	12.5 × 35	650	1105	B43888C5226M***
22	18 × 20	700	1190	B43888D5226M***
33	16 × 31.5	1000	1700	B43888C5336M***
47	18 × 35	1200	2040	B43888C5476M***

Composition of ordering code

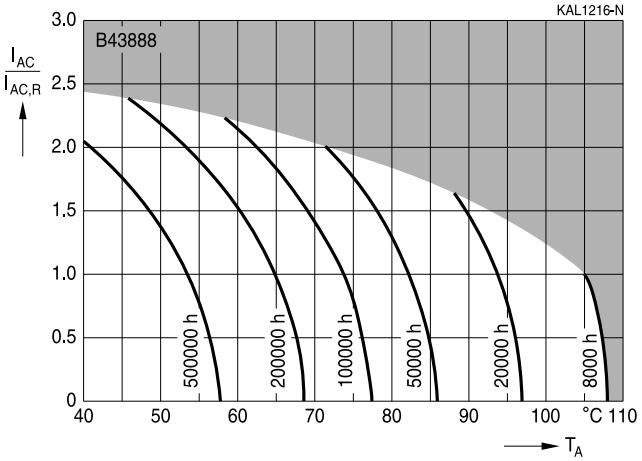
*** = Version

000 = for standard leads, bulk
001 = for kinked leads, bulk (from d × l = 10 × 20 mm to 18 × 40 mm, excluding 12.5 × 30/35/40 mm)
002 = for cut leads, bulk (excluding 12.5 × 30/35/40 mm)
003 = for crimped leads, blister (from d × l = 16 × 25 mm to 20 × 40 mm)
004 = for J leads, blister (from d × l = 10 × 12.5 mm to 18 × 31.5 mm, excluding 12.5 × 30/35/40 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)

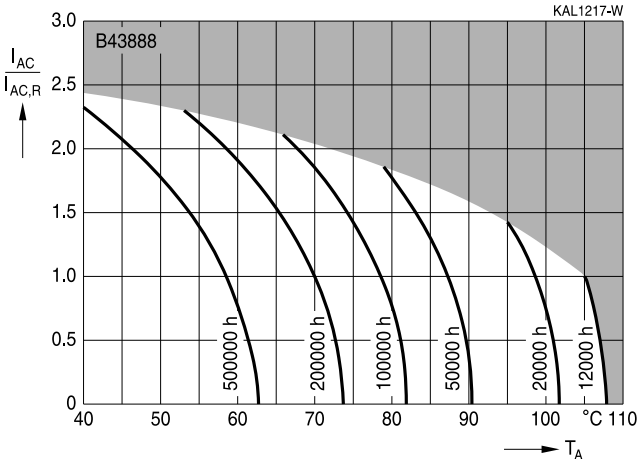
Useful life

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

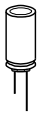
d = 10 mm



d ≥ 12.5 mm and V_R ≤ 250 V



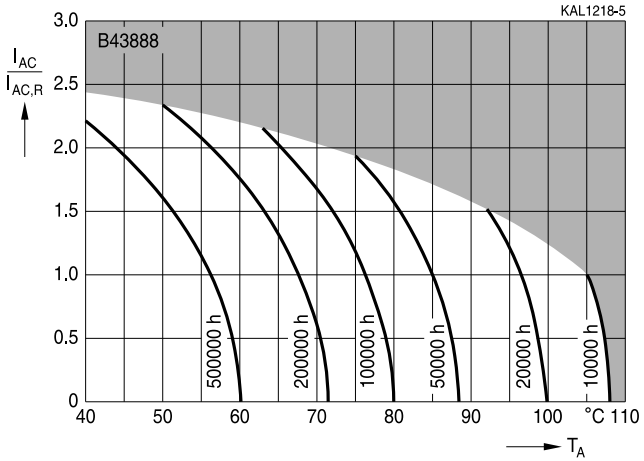
1) Refer to chapter "General technical information, 5.3 Calculation of useful life" for an explanation on how to interpret the useful life graphs.



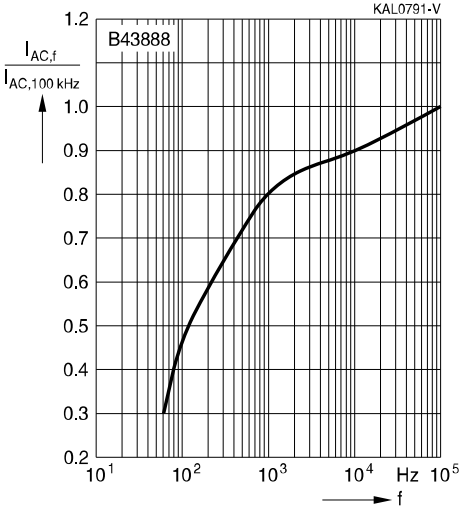
Useful life

depending on ambient temperature T_A under ripple current operating conditions[2)]

d ≥ 12.5 mm and V_R ≥ 350 V



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



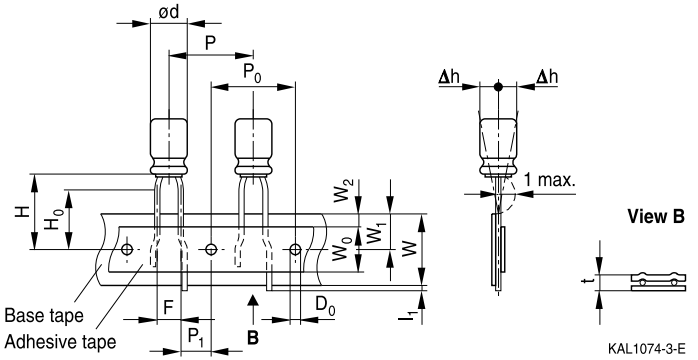
2) Refer to chapter "General technical information, 5.3 Calculation of useful life" for an explanation on how to interpret the useful life graphs.

Taping, packing and lead configurations

Taping

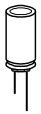
Single-ended capacitors are available taped in Ammo pack from diameter 5 to 18 mm as follows:
Lead spacing F = 2.5 mm (∅ d = 5 … 6.3 mm)
Lead spacing F = 3.5 mm (∅ d = 8 mm)
Lead spacing F = 5.0 mm (from d × l = 10 × 12.5 mm to 12.5 × 30 mm)
Lead spacing F = 7.5 mm (∅ d = 16 ... 18 mm).

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



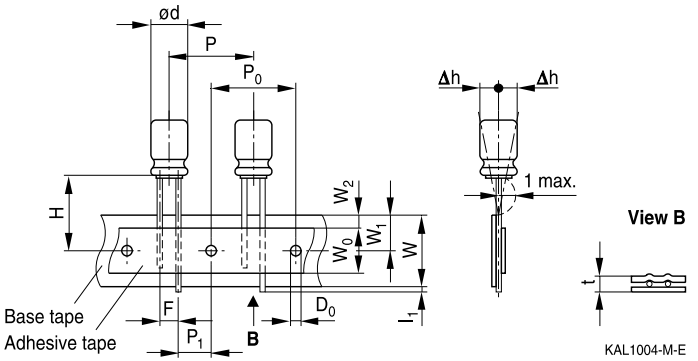
Dimensions in mm

∅ 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 −0.2	±0.75	±0.5	min.	±0.5	max.	±0.5	±1.0	±0.2	±0.5	max.	±0.2	max.	±0.2



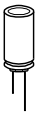
Lead spacing 3.5 mm (∅ d = 8 mm)

Last 3 digits of ordering code: 006



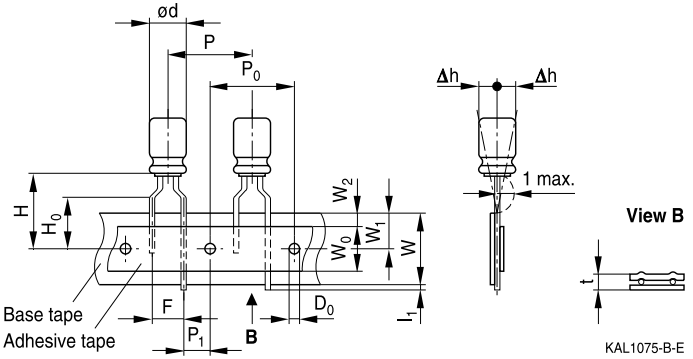
Dimensions in mm

∅ 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	12.5	9.0	1.5	12.7	12.7	4.6	1.0	0.7	1.0	4.0
Toler-ance	+0.8 −0.2	±1.0	±0.5	min.	±0.5	max.	±1.0	±0.2	±0.5	max.	±0.2	max.	±0.2



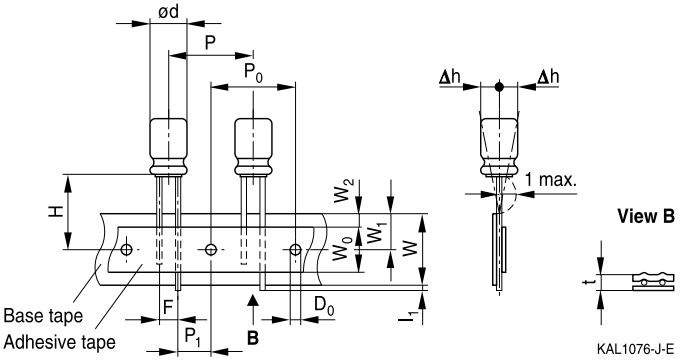
Lead spacing 5.0 mm (∅ d = 5 ... 8 mm)

Last 3 digits of ordering code: 008



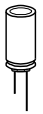
Lead spacing 5.0 mm (from d × l = 10 × 12.5 mm to 12.5 × 30 mm)

Last 3 digits of ordering code: 008



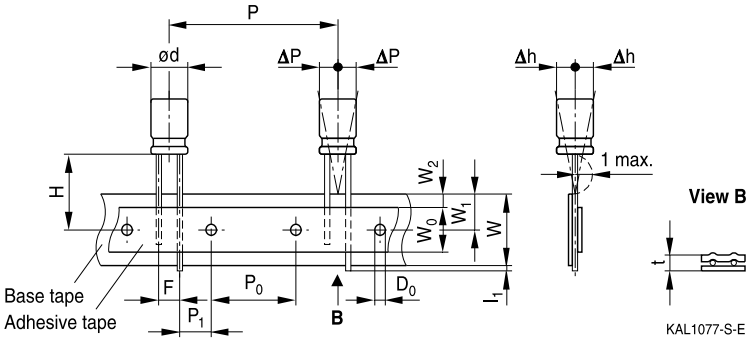
Dimensions in mm

∅ d	F	H	W	W_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 −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



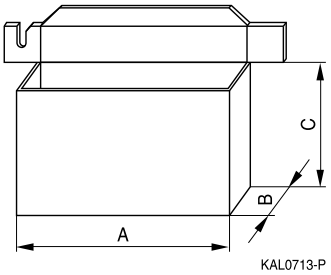
Dimensions in mm

∅ d	F	H	W	W_0	W_1	W_2	P	P_0	P_1	l_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

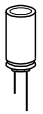
*) Available only for case dimensions 18 × 20, 18 × 25 and 18 × 31.5 mm

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
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



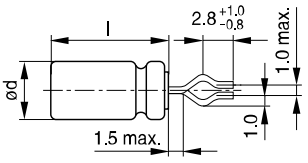
Kinked or cut leads

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

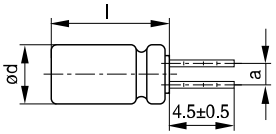
Kinked leads

Last 3 digits of ordering code: 001

With stand-off rubber seal

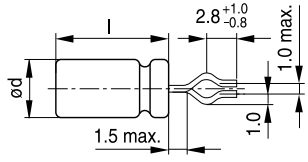


KAL1081-K

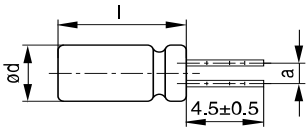


KAL1083-2

With flat rubber seal

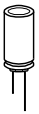


KAL1082-T



KAL1084-A

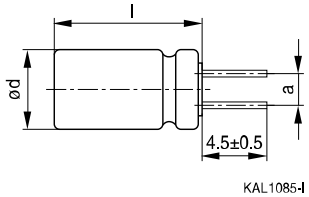
Case size d × l (mm)	Dimensions (mm) a ±0.5
10 × 20	5.0
12.5 × 20	5.0
12.5 × 25	5.0
16 × 20	7.5
16 × 25	7.5
16 × 31.5	7.5
18 × 20	7.5
18 × 25	7.5
18 × 31.5	7.5
18 × 35	7.5
18 × 40	7.5



Cut leads

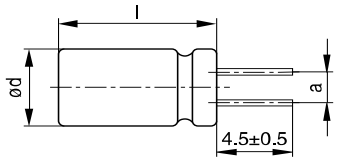
Last 3 digits of ordering code: 002

With stand-off rubber seal



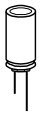
KAL1085-I

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
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

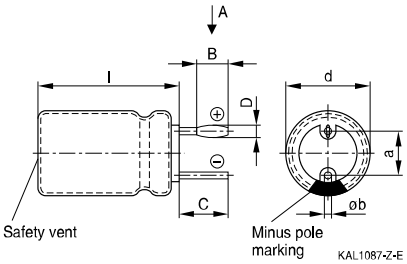


PAPR leads (Protection Against Polarity Reversal)

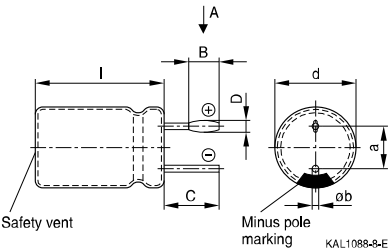
These lead configurations ensure correct placement of the capacitor on the PCB with regard to polarity. PAPR leads are available for diameters from 10 mm up to 20 mm.
There are three configurations available: Crimped leads, J leads, bent 90° leads

Crimped leads
Last 3 digits of ordering code: 003

With stand-off rubber seal

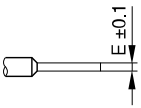


With flat rubber seal

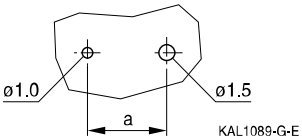


Suggestion for PCB hole diameter

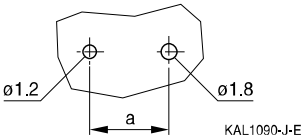
View A



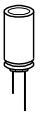
Suggestion for PCB hole diameter, wire ø0.8 mm



Suggestion for PCB hole diameter, wire ø1.0 mm

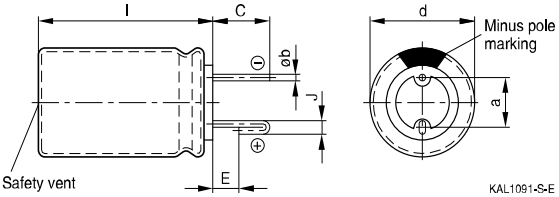


Case size	Dimensions (mm)					
d × l (mm)	B ±0.2	C ±0.5	D ±0.1	E ±0.1	a ±0.5	∅b
16 × 20	1.5	3.0	1.3	0.3	7.5	0.8 ±0.05
16 × 25	1.5	3.0	1.3	0.3	7.5	0.8 ±0.05
16 × 31.5	1.5	3.0	1.3	0.3	7.5	0.8 ±0.05
18 × 20	1.5	3.0	1.3	0.3	7.5	0.8 ±0.1
18 × 25	1.5	3.0	1.3	0.3	7.5	0.8 ±0.1
18 × 31.5	1.5	3.0	1.3	0.3	7.5	0.8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



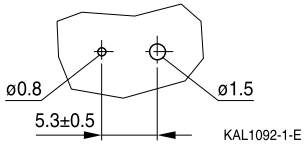
J leads

Last 3 digits of ordering code: 004

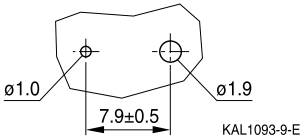


Suggestion for PCB hole diameter

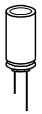
Suggestion for PCB hole diameter, wire ø0.6 mm



Suggestion for PCB hole diameter, wire ø0.8 mm

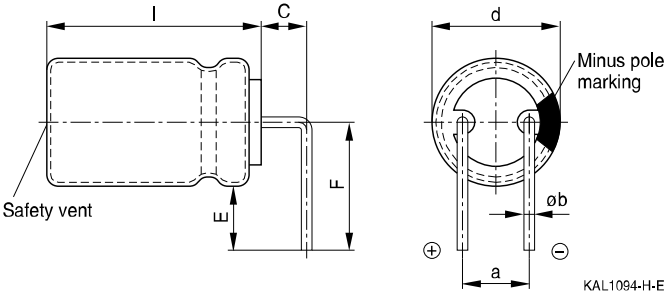


Case size	Dimensions (mm)				
d × l (mm)	C ±0.5	E ±0.5	J ±0.2	a ±0.5	∅b
10 × 12.5	3.2	0.7	1.2	5.0	0.6 ±0.05
10 × 16	3.2	0.7	1.2	5.0	0.6 ±0.05
10 × 20	3.2	0.7	1.2	5.0	0.6 ±0.05
12.5 × 20	3.2	0.7	1.2	5.0	0.6 ±0.05
12.5 × 25	3.2	0.7	1.2	5.0	0.6 ±0.05
16 × 20	3.5	0.7	1.6	7.5	0.8 ±0.05
16 × 25	3.5	0.7	1.6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



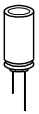
Bent 90° leads for horizontal mounting pinning

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.



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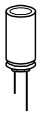
Extended useful life – 105 °C

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

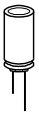
							PAPR		
Case size d × l	Stan-dard, bulk	Taped, Ammo pack			Kinked leads, bulk	Cut leads, bulk	Crimped leads, blister	J leads, blister	Bent 90° leads, blister
mm	pcs.	pcs.			pcs.	pcs.	pcs.	pcs.	pcs.
5 × 11	2000	2000			–	–	–	–	
6.3 × 11	2500	2000			–	–	–	–	
8 × 11.5	1000	1000			–	–	–	–	
10 × 12.5	1000	750			–	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	**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



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, 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
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	**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

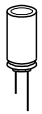
Personal safety

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:

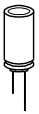
- Any escaping electrolyte should not come into contact with eyes or skin.
- If electrolyte does come into contact with the skin, wash the affected parts immediately with running water. If the eyes are affected, rinse them for 10 minutes with plenty of water. If symptoms persist, seek medical treatment.
- 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"



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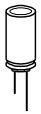
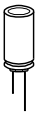
Topic	Safety information	Reference Chapter "General technical information"
Soldering, cleaning agents	Do not allow halogenated hydrocarbons to come into contact with aluminum electrolytic capacitors.	11.6 "Cleaning agents"
Passive flammability	Avoid external energy, such as fire or electricity.	8.1 "Passive 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
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; $2 \cdot \pi \cdot f$

Notes

All dimensions are given in mm.

Important notes

The following applies to all products named in this publication:

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