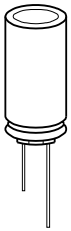
Aluminum electrolytic capacitors

Single-ended capacitors

Series/Type: **B41853**
Date: December 2006



Long-life grade capacitors

Applications

- Automotive electronics: energy reserve for airbag application

Features

- Compact design
- High CV product
- Designed for severe charge and discharge conditions

Construction

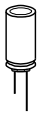
- Radial leads
- Charge/discharge-proof, polar
- Aluminum case with insulating sleeve
- Minus pole marking on the insulating sleeve
- Stand-off rubber seal
- Case with safety vent

Delivery mode

Terminal configurations and packing:

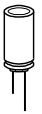
- Bulk
- Taped, Ammo pack
- Cut
- Kinked
- PAPR (protection against polarity reversal): crimped leads, J leads, bent leads

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



Specifications and characteristics in brief

Rated voltage V_R Surge voltage V_S	25 ... 50 V DC 1.15 · V_R				
Rated capacitance C_R Capacitance tolerance	470 ... 6800 µF ±20% ≙ M				
Dissipation factor tan δ (20 °C, 120 Hz)	For capacitance higher than 1000 µF add 0.02 for every increase of 1000 µF.				
	V_R (V DC)	25	35	50	
	tan δ (max.)	0.16	0.14	0.12	
Leakage current I_{leak} (20 °C, 5 min)	$I_{leak} = 0.01\,\mu A \cdot \left(\frac{C_R}{\mu F} \cdot \frac{V_R}{V}\right)$				
Self-inductance ESL	Diameter (mm)	≤ 12.5	16	18	
	ESL (nH)	20	26	34	
Useful life 105 °C, V_R, $I_{AC,R}$	> 3000 h				
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	3000 h				
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: 55/105/56 (−55 °C/+105 °C/56 days damp heat test)				
Sectional specification	AEC-Q200, IEC 60384-4				



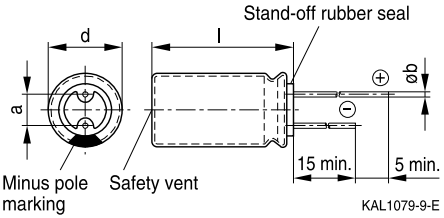
B41853

For airbag applications – 105 °C

Dimensional drawing

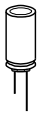
With stand-off rubber seal

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



Dimensions and weights

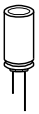
Dimensions (mm)				Approx. weight
d +0.5	l	a ±0.5	b	g
10	20 +2.0	5.0	0.60 ±0.05	2.6
12.5	20 +2.0	5.0	0.60 ±0.05	3.6
12.5	25 +2.0	5.0	0.60 ±0.05	4.5
16	20 +2.0	7.5	0.80 ±0.05	5.5
16	25 +2.0	7.5	0.80 ±0.05	7.5
16	31.5 +2.0	7.5	0.80 ±0.05	7.8
18	20 +2.0	7.5	0.80 ±0.1	8.9
18	25 +2.0	7.5	0.80 ±0.1	9.0
18	31.5 +2.0	7.5	0.80 ±0.1	11.0
18	35 +2.0	7.5	0.80 ±0.1	13.0
18	40 +2.0	7.5	0.80 ±0.1	16.0



Overview of available types

V_R (V DC)	25	35	50
	Case dimensions d × l (mm)		
C_R (µF)			
470		10 × 20	12.5 × 20
560		10 × 20	12.5 × 25
680		12.5 × 20	16 × 20
820		12.5 × 20	18 × 20
1000	10 × 20	12.5 × 20	18 × 20
1200	12.5 × 20	16 × 20	18 × 25
1500	12.5 × 25	16 × 25	18 × 31.5
1800	12.5 × 25	16 × 25	18 × 31.5
2200	16 × 20	18 × 20	18 × 35
2700	18 × 20	18 × 25	18 × 40
3300	18 × 25	18 × 31.5	
3900	16 × 31.5	18 × 31.5	
4700	18 × 31.5	18 × 35	
5600	18 × 35	18 × 40	
6800	18 × 40		

Other voltage and capacitance ratings are available upon request.



B41853

For airbag applications – 105 °C

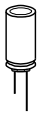
Technical data and ordering codes

C_R 120 Hz 20 °C µF	Case dimensions d × l mm	ESR_{max} 10 kHz −40 °C Ω	ESR_{max} 120 Hz 20 °C Ω	ESR_{max} 10 kHz 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 below)
V_R = 25 V DC								
1000	10 × 20	1.265	0.202	0.158	0.136	1200	1560	B41853W5108M***
1200	12.5 × 20	0.781	0.168	0.098	0.085	1700	2210	B41853W5128M***
1500	12.5 × 25	0.715	0.135	0.089	0.078	2000	2600	B41853W5158M***
1800	12.5 × 25	0.715	0.112	0.089	0.078	2000	2600	B41853W5188M***
2200	16 × 20	0.666	0.103	0.083	0.075	2000	2600	B41853W5228M***
2700	18 × 20	0.483	0.084	0.060	0.054	2500	3250	B41853W5278M***
3300	18 × 25	0.399	0.077	0.050	0.045	3400	4420	B41853W5338M***
3900	16 × 31.5	0.426	0.065	0.053	0.048	3400	4420	B41853W5398M***
4700	18 × 31.5	0.373	0.059	0.047	0.042	3600	4680	B41853W5478M***
5600	18 × 35	0.318	0.050	0.040	0.036	4100	5330	B41853W5568M***
6800	18 × 40	0.224	0.040	0.028	0.026	5100	6630	B41853W5688M***
V_R = 35 V DC								
470	10 × 20	1.265	0.376	0.158	0.136	1100	1430	B41853W7477M***
560	10 × 20	1.265	0.316	0.158	0.136	1100	1430	B41853W7567M***
680	12.5 × 20	0.781	0.260	0.098	0.085	1600	2080	B41853W7687M***
820	12.5 × 20	0.781	0.216	0.098	0.085	1600	2080	B41853W7827M***
1000	12.5 × 20	0.781	0.177	0.098	0.085	1600	2080	B41853W7108M***
1200	16 × 20	0.666	0.147	0.083	0.075	2000	2600	B41853W7128M***
1500	16 × 25	0.559	0.118	0.070	0.063	2300	2990	B41853W7158M***
1800	16 × 25	0.559	0.098	0.070	0.063	2300	2990	B41853W7188M***
2200	18 × 20	0.483	0.090	0.060	0.054	2800	3640	B41853W7228M***
2700	18 × 25	0.399	0.075	0.050	0.045	2500	3250	B41853W7278M***
3300	18 × 31.5	0.373	0.069	0.047	0.042	3200	4160	B41853W7338M***
3900	18 × 31.5	0.373	0.058	0.047	0.042	3200	4160	B41853W7398M***
4700	18 × 35	0.318	0.050	0.040	0.036	3700	4810	B41853W7478M***
5600	18 × 40	0.224	0.040	0.028	0.026	4200	5460	B41853W7568M***

Composition of ordering code

*** = Version

012 = for bent 90° leads, blister (for ∅ 16 and 18 mm)
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 × 20 mm to 18 × 35 mm)
008 = for taped leads, Ammo pack, lead spacing F = 5.0 mm (for d × l = 10 × 20 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} 10 kHz −40 °C Ω	ESR_{max} 120 Hz 20 °C Ω	ESR_{max} 10 kHz 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 below)
V_R = 50 V DC								
470	12.5 × 20	0.781	0.323	0.098	0.085	1170	1521	B41853W6477M***
560	12.5 × 25	0.715	0.271	0.089	0.078	1500	1950	B41853W6567M***
680	16 × 20	0.666	0.223	0.083	0.075	1350	1755	B41853W6687M***
820	18 × 20	0.537	0.185	0.067	0.060	1850	2405	B41853W6827M***
1000	18 × 20	0.537	0.152	0.067	0.060	1850	2405	B41853W6108M***
1200	18 × 25	0.399	0.126	0.050	0.045	2200	2860	B41853W6128M***
1500	18 × 31.5	0.373	0.101	0.047	0.042	2600	3380	B41853W6158M***
1800	18 × 31.5	0.373	0.084	0.047	0.042	2600	3380	B41853W6188M***
2200	18 × 35	0.318	0.080	0.040	0.036	2900	3770	B41853R6228M***
2700	18 × 40	0.224	0.065	0.028	0.026	3500	4550	B41853W6278M***

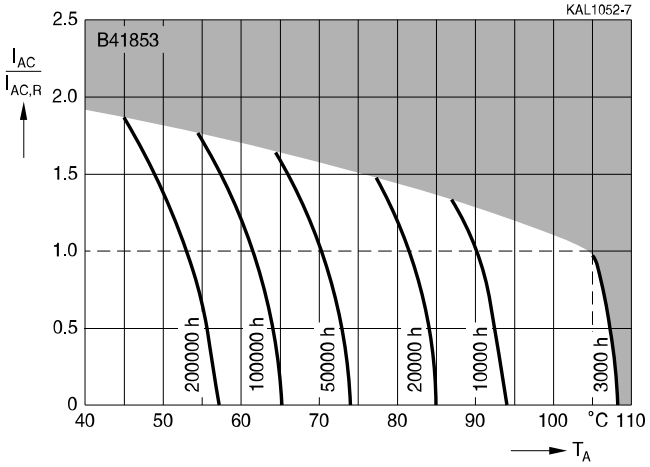
Composition of ordering code

*** = Version

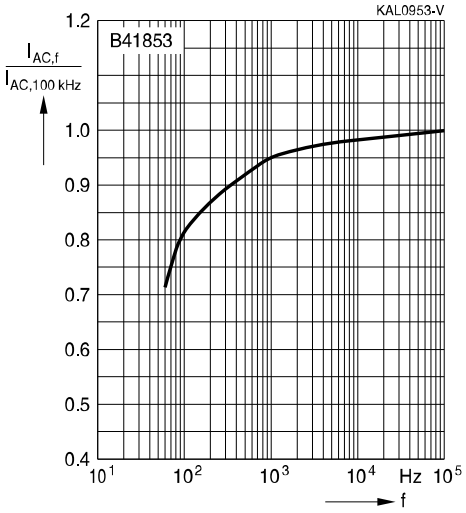
012 = for bent 90° leads, blister (for ∅ 16 and 18 mm)
000 = for standard leads, bulk
001 = for kinked leads, bulk (for ∅ ≥ 10 mm)
002 = for cut leads, bulk (for ∅ ≥ 10 mm)
003 = for crimped leads, blister (for ∅ ≥ 16 mm)
004 = for J leads, blister (from d × l = 10 × 20 mm to 18 × 35 mm)
008 = for taped leads, Ammo pack, lead spacing F = 5.0 mm (for d × l = 10 × 20 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

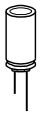
depending on ambient temperature T_A under ripple current operating conditions[1)]



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.

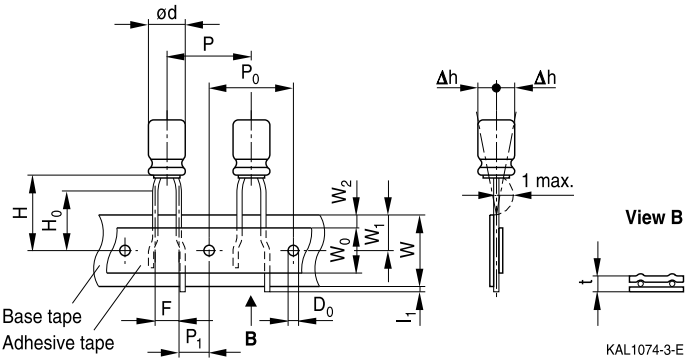


Taping, packing and lead configurations

Taping

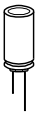
Single-ended capacitors are available taped in Ammo pack from diameter 5 to 18 mm as follows:
Lead spacing F = 2.5 mm (∅ d = 5 … 6.3 mm)
Lead spacing F = 3.5 mm (∅ d = 8 mm)
Lead spacing F = 5.0 mm (∅ d = 5 … 12.5 mm)
Lead spacing F = 7.5 mm (∅ d = 16 ... 18 mm).

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



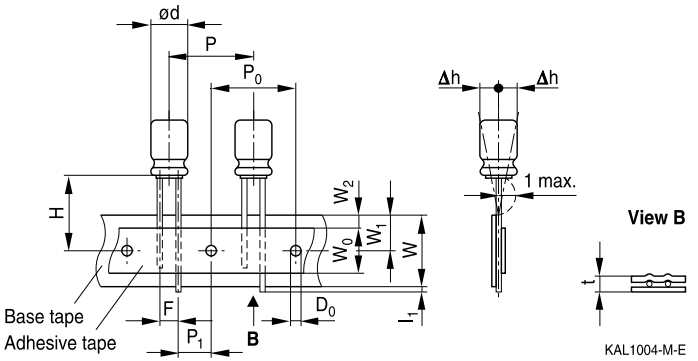
Dimensions in mm

∅ 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
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



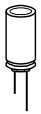
Lead spacing 3.5 mm (∅ d = 8 mm)

Last 3 digits of ordering code: 006

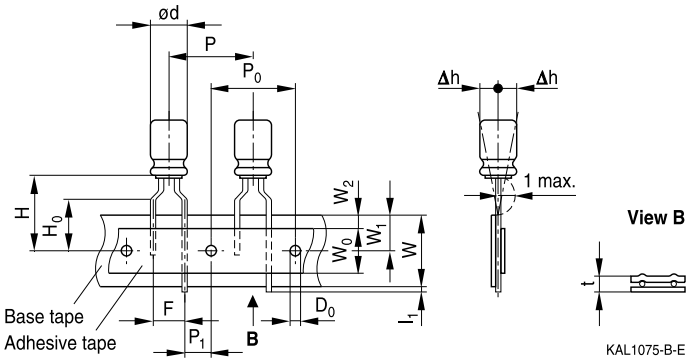


Dimensions in mm

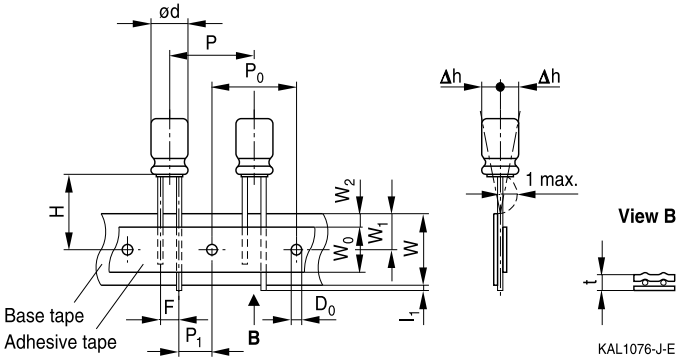
∅ d	F	H	W	W_0	W_1	W_2	P	P_0	P_1	l_1	t	Δh	D_0
8	3.5	18.5	18.0	12.5	9.0	1.5	12.7	12.7	4.6	1.0	0.7	1.0	4.0
Tolerance	+0.8 −02	1.0	±0.5	min.	±0.5	max.	±1.0	±0.2	±0.5	max.	±0.2	max.	±0.2



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

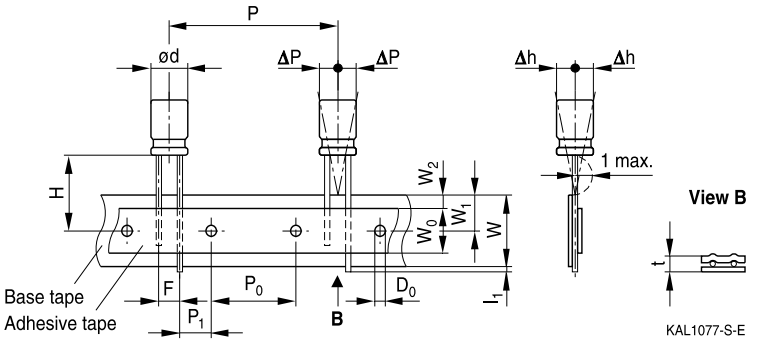


Dimensions in mm

∅ 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

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

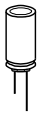
Last 3 digits of ordering code: 009



Dimensions in mm

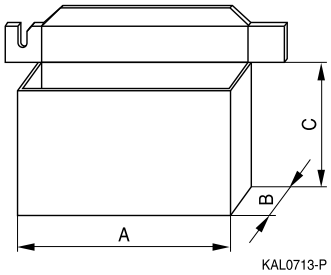
∅ d	F	H	W	W_0	W_1	W_2	P	P_0	P_1	l_1	t	ΔP	Δh	D_0
16	7.5	18.5	18.0	12.5	9.0	1.5	30.0	15.0	3.75	1.0	0.7	0	0	4.0
18 *)														
Tolerance	±0.8	−0.5 +0.75	±0.5	min.	±0.5	max.	±1.0	±0.2	±0.5	max.	±0.2	±1.0	±1.0	±0.2

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

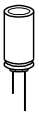


Packing units and box dimensions

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



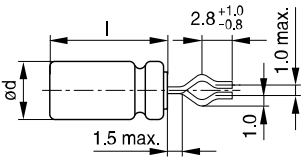
Kinked or cut leads

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

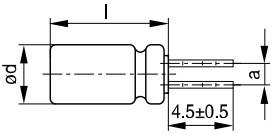
Kinked leads

Last 3 digits of ordering code: 001

With stand-off rubber seal

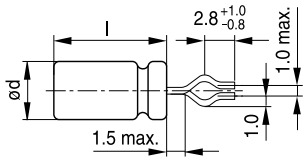


KAL1081-K

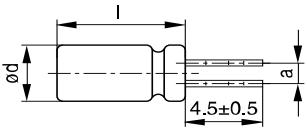


KAL1083-2

With flat rubber seal

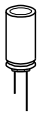


KAL1082-T



KAL1084-A

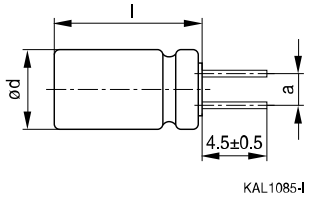
Case size d × l (mm)	Dimensions (mm) a ±0.5
10 × 20	5.0
12.5 × 20	5.0
12.5 × 25	5.0
12.5 × 30	5.0
12.5 × 35	5.0
12.5 × 40	5.0
16 × 20	7.5
16 × 25	7.5
16 × 31.5	7.5
18 × 20	7.5
18 × 25	7.5
18 × 31.5	7.5
18 × 35	7.5
18 × 40	7.5
20 × 20	10.0
20 × 25	10.0
20 × 40	10.0
22 × 30	10.0
22 × 35	10.0
22 × 40	10.0



Cut leads

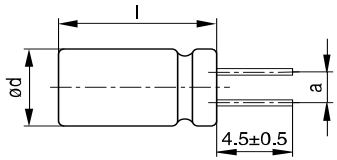
Last 3 digits of ordering code: 002

With stand-off rubber seal



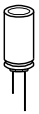
KAL1085-I

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



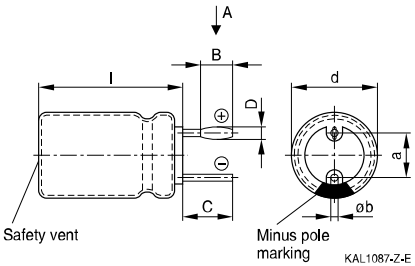
PAPR leads (Protection Against Polarity Reversal)

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

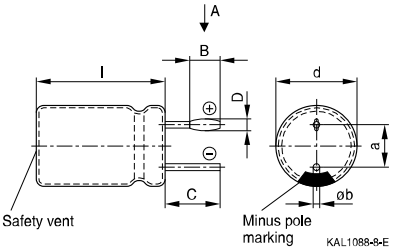
Crimped leads

Last 3 digits of ordering code: 003

With stand-off rubber seal

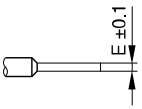


With flat rubber seal

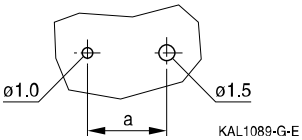


Suggestion for PCB hole diameter

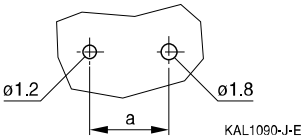
View A



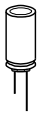
Suggestion for PCB hole diameter, wire ø0.8 mm



Suggestion for PCB hole diameter, wire ø1.0 mm

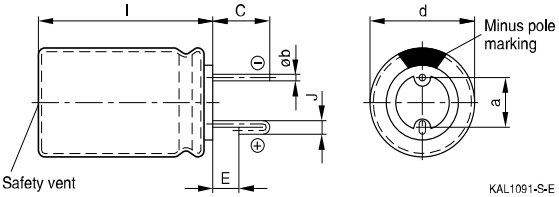


Case size	Dimensions (mm)					
d × l (mm)	B ±0.2	C ±0.5	D ±0.1	E ±0.1	a ±0.5	∅b
16 × 20	1.5	3.0	1.3	0.3	7.5	0.8 ±0.05
16 × 25	1.5	3.0	1.3	0.3	7.5	0.8 ±0.05
16 × 31.5	1.5	3.0	1.3	0.3	7.5	0.8 ±0.05
18 × 20	1.5	3.0	1.3	0.3	7.5	0.8 ±0.1
18 × 25	1.5	3.0	1.3	0.3	7.5	0.8 ±0.1
18 × 31.5	1.5	3.0	1.3	0.3	7.5	0.8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



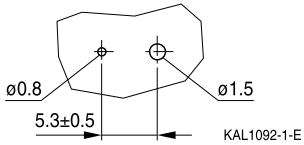
J leads

Last 3 digits of ordering code: 004

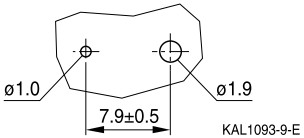


Suggestion for PCB hole diameter

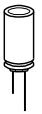
Suggestion for PCB hole diameter, wire ø0.6 mm



Suggestion for PCB hole diameter, wire ø0.8 mm

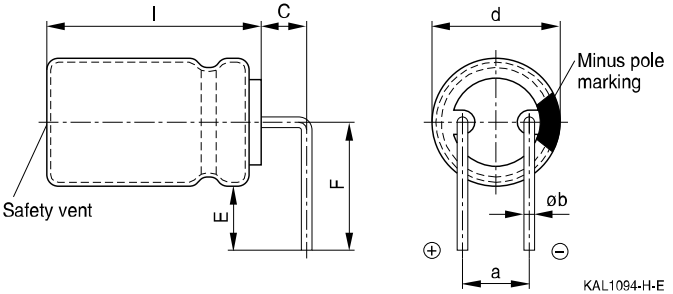


Case size	Dimensions (mm)				
d × l (mm)	C ±0.5	E ±0.5	J ±0.2	a ±0.5	∅b
10 × 12.5	3.2	0.7	1.2	5.0	0.6 ±0.05
10 × 16	3.2	0.7	1.2	5.0	0.6 ±0.05
10 × 20	3.2	0.7	1.2	5.0	0.6 ±0.05
12.5 × 20	3.2	0.7	1.2	5.0	0.6 ±0.05
12.5 × 25	3.2	0.7	1.2	5.0	0.6 ±0.05
16 × 20	3.5	0.7	1.6	7.5	0.8 ±0.05
16 × 25	3.5	0.7	1.6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



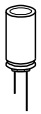
Bent 90° leads for horizontal mounting pinning

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

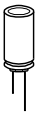
Bent leads for diameter 12.5 mm available upon request.



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

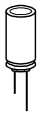


B41853

For airbag applications – 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.

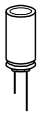
As far as possible, EPCOS does not use any dangerous chemicals or compounds to produce operating electrolytes. However, in exceptional cases, such materials must be used in order to achieve specific physical and electrical properties because no safe substitute materials are currently known. However,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