



Aluminum electrolytic capacitors

Single-ended capacitors

Series/Type: B41897

Date: November 2020

Long-life grade capacitors

Applications

- Automotive electronics

Features

- Ultra compact design
- High operating temperature capability up to 150 °C for short periods
- Long useful life
- High ripple current capability
- Low ESR
- RoHS-compatible

Construction

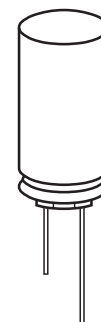
- Radial leads
- Charge-discharge proof, polar
- Coated aluminum case
- Plus pole marking on the case side
- Case with safety vent

Delivery mode

Terminal configurations and packing:

- Bulk
- Taped, Ammo pack
- Cut
- PAPER (Protection Against Polarity Reversal):
J leads, bent leads

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




Specifications and characteristics in brief

Rated voltage V_R	25 ... 75 V DC					
Surge voltage V_S	$1.1 \cdot V_R$					
Rated capacitance C_R	270 ... 12000 μF					
Capacitance tolerance	$\pm 20\% \triangleq M$					
Dissipation factor $\tan \delta$ (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	63	75
	$\tan \delta$ (max.)	0.14	0.12	0.10	0.10	0.08
Leakage current I_{leak} (20 °C, 1 min)	$I_{\text{leak}} \leq 0.03 \mu\text{A} \cdot \left(\frac{C_R}{\mu\text{F}} \cdot \frac{V_R}{\text{V}} \right)$ or 4 μA , whichever is greater					
Self-inductance ESL	Diameter (mm)	12.5	16	18		
	ESL (nH)	20	26	34		
Useful life ¹⁾ 135 °C; V_R ; $I_{\text{AC,R}}$ 135 °C; V_R ; $I_{\text{AC,R}}$ 135 °C; V_R ; $I_{\text{AC,R}}$ 135 °C; V_R ; $I_{\text{AC,R}}$	> 3000 h for $V_R \leq 50$ V > 2000 h for $V_R \geq 63$ V > 2500 h plus 100 h at 150 °C for $V_R \leq 50$ V > 1500 h plus 100 h at 150 °C for $V_R \geq 63$ V			Requirements: $ \Delta C/C \leq 30\%$ of initial value $\tan \delta \leq 3$ times initial specified limit $I_{\text{leak}} \leq$ initial specified limit		
125 °C; V_R ; $I_{\text{AC,max}}$ 125 °C; V_R ; $I_{\text{AC,max}}$	> 3000 h > 2500 h plus 100 h at 150 °C					
Voltage endurance test 135 °C, V_R 125 °C, V_R	3000 h 3000 h			Post test requirements: $ \Delta C/C \leq 25\%$ of initial value $\tan \delta \leq 3$ times initial specified limit $I_{\text{leak}} \leq$ initial specified limit		
Shelf life ²⁾ 125 °C, 0 V	1000 h			Requirements: $ \Delta C/C \leq 20\%$ of initial value $\tan \delta \leq 2$ times initial specified limit $I_{\text{leak}} \leq$ initial specified limit		
Vibration resistance test	To IEC 60068-2-6, test Fc: Frequency range 10 Hz ... 2 kHz, displacement amplitude max. 1.5 mm, acceleration max. 20 g, duration 3×2 h. Capacitor rigidly clamped by the aluminum case e.g. using our standard fixture					
IEC climatic category	To IEC 60068-1: 40/135/56 (–40 °C/+135 °C/56 days damp heat test)					
Sectional specification	IEC 60384-4					
Reference standard	AEC-Q200 ³⁾					

1) Refer to chapter "General technical information, 5 Useful life" on how to interpret useful life.

2) Before the measurement, the capacitor shall be preconditioned by the application of the rated voltage for 1 hour. The voltage shall be applied to the capacitor through a resistor, the value of which shall be approximately 100 Ω .

3) Refer to chapter "General technical information, 2.3 AEC-Q200 standard" for further details.

KAL1681-M-E


Overview of available types

Other voltage and capacitance ratings are available upon request.

V_R (V DC)	25	35	50
	Case dimensions $d \times l$ (mm)		
C_R (μF)			
620			12.5 × 20
820			12.5 × 25
1000			16 × 20
1300		12.5 × 20	16 × 25 18 × 20
1600			16 × 31.5
1800		12.5 × 25	18 × 25
2000	12.5 × 20	16 × 20	
2200			16 × 35.5
2400		18 × 20	18 × 31.5
2700			16 × 40
3000	12.5 × 25	16 × 25	18 × 35
3300	16 × 20		
3600		16 × 31.5	18 × 40
3900		18 × 25	
4300	18 × 20	16 × 35.5	
4700	16 × 25	18 × 31.5	
5600	16 × 31.5	16 × 40	
6200	18 × 25	18 × 35	
7500	16 × 35.5 18 × 31.5	18 × 40	
9100	16 × 40		
10000	18 × 35		
12000	18 × 40		



B41897

Low ESR, ultra compact – 135 °C

Overview of available types

Other voltage and capacitance ratings are available upon request.

V_R (V DC)	63	75
	Case dimensions $d \times l$ (mm)	
C_R (μ F)		
270		12.5 × 20
390	12.5 × 20	12.5 × 25
470		16 × 20
560	12.5 × 25	
620		18 × 20
680	16 × 20	16 × 25
750		16 × 31.5
820		18 × 25
910	18 × 20	
1000	16 × 25	16 × 35.5
1100		18 × 31.5
1200	16 × 31.5	
1300	18 × 25	16 × 40 18 × 35
1600	16 × 35.5 18 × 31.5	18 × 40
1800	16 × 40	
2100	18 × 35	
2400	18 × 40	

Technical data and ordering codes

C_R 120 Hz 20 °C μF	Case dimensions $d \times l$ mm	ESR_{max} 100 kHz -40 °C Ω	ESR_{max} 100 kHz 20 °C Ω	$I_{\text{AC,max}}$ 100 kHz 125 °C mA	$I_{\text{AC,R}}$ 100 kHz 135 °C mA	Ordering code (composition see below)
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Composition of ordering code

*** = Version

000 = for standard leads, bulk


B41897
Low ESR, ultra compact – 135 °C
Technical data and ordering codes

C_R	Case dimensions	ESR_{max} 100 kHz –40 °C	ESR_{max} 100 kHz 20 °C	$I_{AC,max}$ 100 kHz 125 °C	$I_{AC,R}$ 100 kHz 135 °C	Ordering code (composition see below)
120 Hz	$d \times l$	Ω	Ω	mA	mA	
20 °C	mm					
μF						

 $V_R = 50 V DC$

620	12.5 × 20	0.88	0.073	2400	1470	B41897A6627M***
820	12.5 × 25	0.67	0.058	3480	2260	B41897A6827M***
1000	16 × 20	0.55	0.050	2960	1870	B41897A6108M***
1300	16 × 25	0.44	0.042	4040	2500	B41897A6138M***
1300	18 × 20	0.44	0.042	3250	2110	B41897B6138M***
1600	16 × 31.5	0.36	0.035	5130	2960	B41897A6168M***
1800	18 × 25	0.32	0.033	4230	2530	B41897A6188M***
2200	16 × 35.5	0.27	0.029	5480	3160	B41897A6228M***
2400	18 × 31.5	0.25	0.028	5240	3020	B41897A6248M***
2700	16 × 40	0.22	0.025	5930	3420	B41897A6278M***
3000	18 × 35	0.20	0.024	5870	3390	B41897A6308M***
3600	18 × 40	0.16	0.023	6420	3700	B41897A6368M***

 $V_R = 63 V DC$

390	12.5 × 20	0.56	0.072	1700	1420	B41897A8397M***
560	12.5 × 25	0.39	0.052	2520	2050	B41897A8567M***
680	16 × 20	0.34	0.053	2300	1910	B41897A8687M***
910	18 × 20	0.26	0.044	2500	2100	B41897A8917M***
1000	16 × 25	0.23	0.038	3100	2680	B41897A8108M***
1200	16 × 31.5	0.20	0.034	3860	3050	B41897A8128M***
1300	18 × 25	0.19	0.033	3300	2810	B41897A8138M***
1600	16 × 35.5	0.15	0.027	4590	3420	B41897A8168M***
1600	18 × 31.5	0.15	0.028	4080	3220	B41897B8168M***
1800	16 × 40	0.14	0.025	5190	3670	B41897A8188M***
2100	18 × 35	0.12	0.022	5220	3690	B41897A8218M***
2400	18 × 40	0.11	0.021	5660	3820	B41897A8248M***

Composition of ordering code

*** = Version

000 = for standard leads, bulk

002 = for cut leads, bulk

004 = for J leads, blister

 008 = for taped leads, Ammo pack, lead spacing F = 5.0 mm (for \varnothing 12.5 mm)

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

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


Technical data and ordering codes

C_R 120 Hz 20 °C μF	Case dimensions $d \times l$ mm	ESR_{max} 100 kHz –40 °C Ω	ESR_{max} 100 kHz 20 °C Ω	$I_{\text{AC,max}}$ 100 kHz 125 °C mA	$I_{\text{AC,R}}$ 100 kHz 135 °C mA	Ordering code (composition see below)
$V_R = 75 \text{ V DC}$						
270	12.5 × 20	0.78	0.101	1700	1420	B41897A0277M***
390	12.5 × 25	0.55	0.073	2520	2050	B41897A0397M***
470	16 × 20	0.48	0.074	2300	1910	B41897A0477M***
620	18 × 20	0.36	0.062	2500	2100	B41897A0627M***
680	16 × 25	0.32	0.051	3100	2680	B41897A0687M***
750	16 × 31.5	0.29	0.041	3860	3050	B41897A0757M***
820	18 × 25	0.27	0.043	3300	2810	B41897A0827M***
1000	16 × 35.5	0.21	0.032	4590	3420	B41897A0108M***
1100	18 × 31.5	0.21	0.038	4080	3220	B41897A0118M***
1300	16 × 40	0.20	0.035	5190	3670	B41897A0138M***
1300	18 × 35	0.17	0.031	5220	3690	B41897B0138M***
1600	18 × 40	0.16	0.029	5660	3820	B41897A0168M***

Composition of ordering code

*** = Version

000 = for standard leads, bulk

002 = for cut leads, bulk

004 = for J leads, blister

008 = for taped leads, Ammo pack, lead spacing $F = 5.0 \text{ mm}$ (for $\varnothing 12.5 \text{ mm}$)

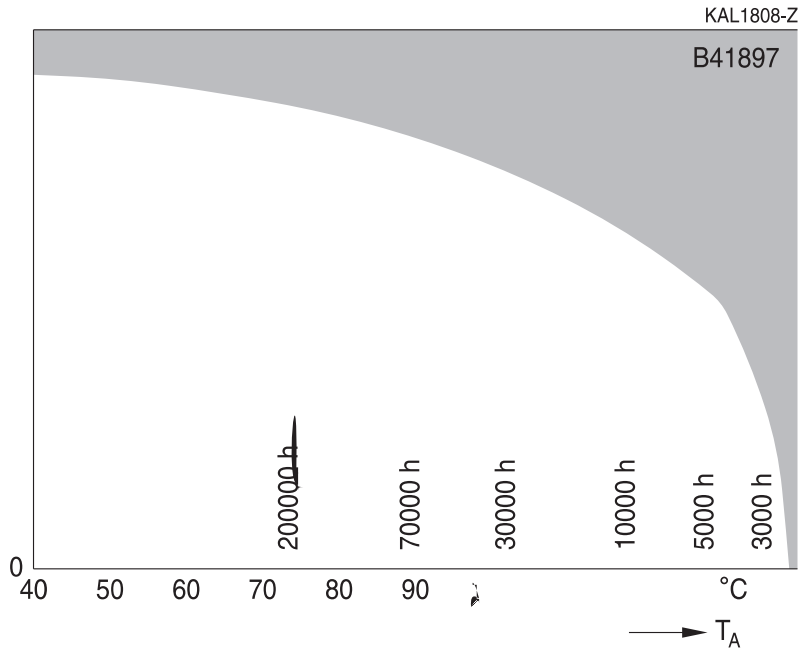
009 = for taped leads, Ammo pack, lead spacing $F = 7.5 \text{ mm}$ (for $d \times l = 16 \times 20 \dots 16 \times 31.5 \text{ mm}$ and $18 \times 20 \dots 18 \times 31.5 \text{ mm}$)

012 = for bent 90° leads, blister (for $\varnothing 16 \dots 18 \text{ mm}$)

Useful life¹⁾

depending on ambient temperature T_A under ripple current operating conditions

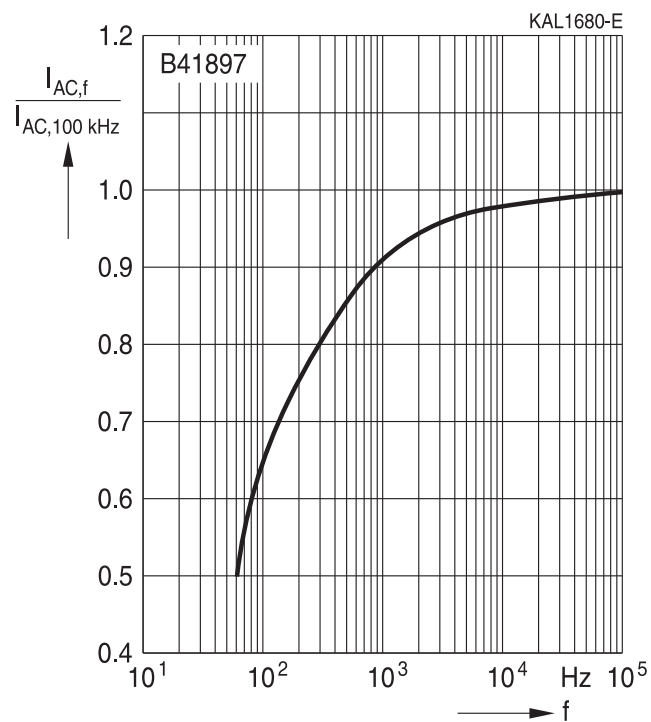
$$V_R \leq 50 \text{ V}$$



1) Refer to chapter "General technical information, 5 Useful life" on how to interpret useful life.



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



Taping

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

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

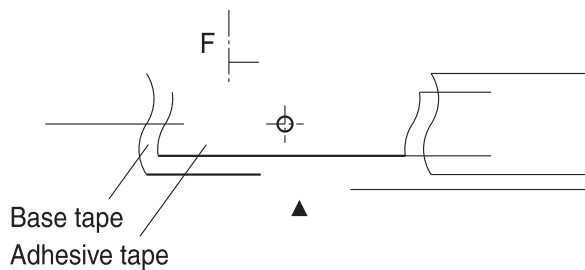
Lead spacing $F = 5.0$ mm ($\varnothing d = 8 \dots 12.5$ mm)

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

The dimensions for F , P_1 and 1 max. are specified with reference to the center of the terminal wires.

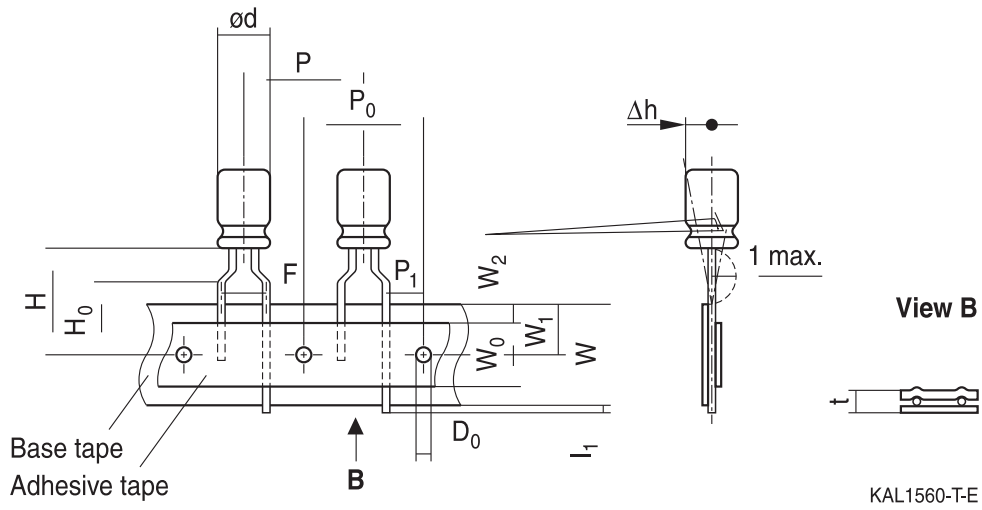
Lead spacing 3.5 mm ($\varnothing d = 8$ mm)

Last 3 digits of ordering code: 006



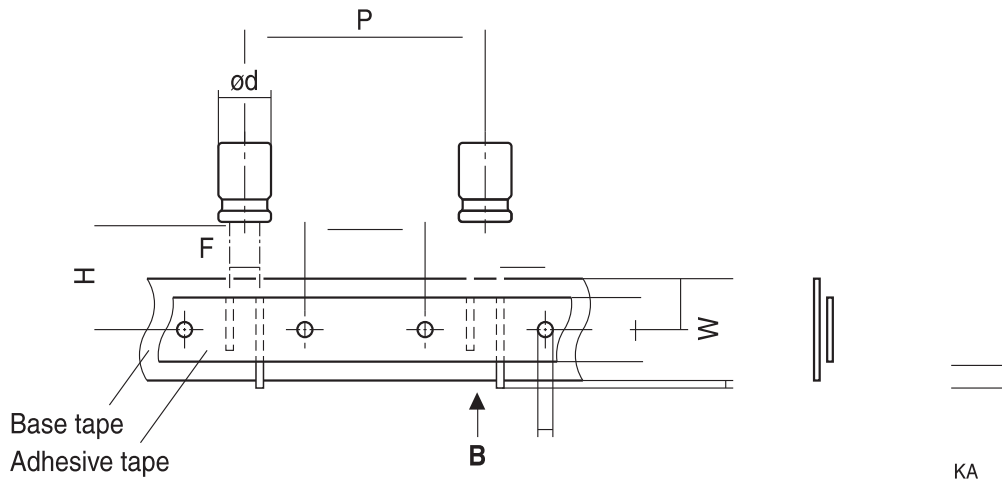
Lead spacing 5.0 mm ($\varnothing d = 8$ mm)

Last 3 digits of ordering code: 008



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

Last 3 digits of ordering code: 009





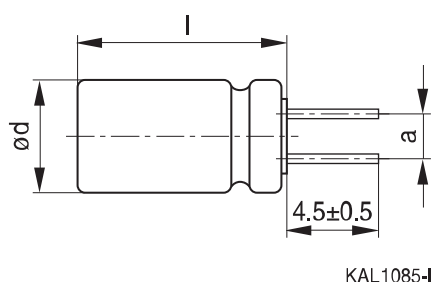
Cut or kinked leads

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

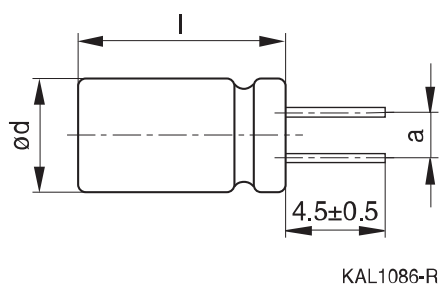
Cut leads

Last 3 digits of ordering code: 002

With stand-off rubber seal



With flat rubber seal



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



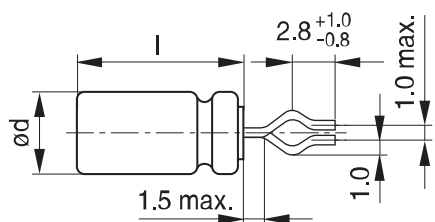
B41897

Low ESR, ultra compact – 135 °C

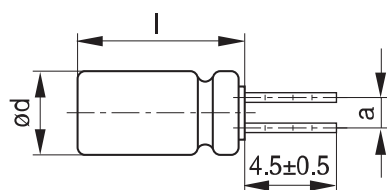
Kinked leads

Last 3 digits of ordering code: 001

With stand-off rubber seal

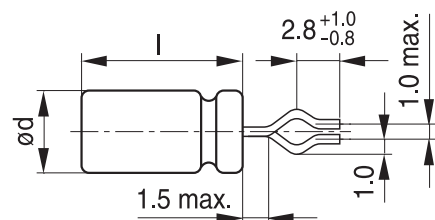


KAL1081-K

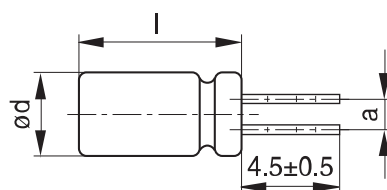


KAL1083-2

With flat rubber seal



KAL1082-T



KAL1084-A

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

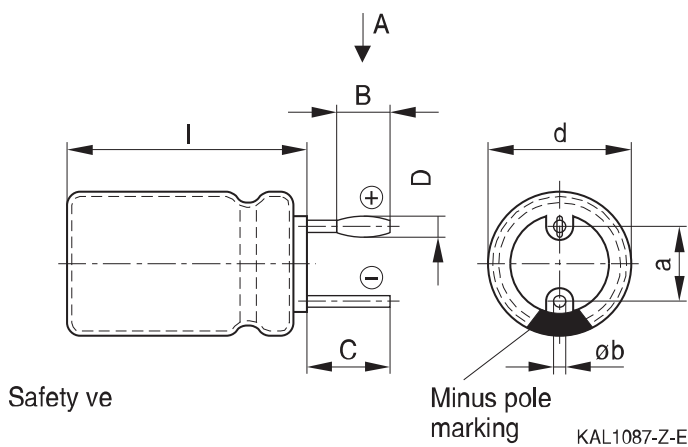
PAPR leads (Protection Against Polarity Reversal)

These lead configurations ensure correct placement of the capacitor on the PCB with regard to polarity. PAPR leads are available for diameters from 10 mm up to 18 mm. There are three configurations available: Crimped leads, J leads, bent 90° leads.

Crimped leads

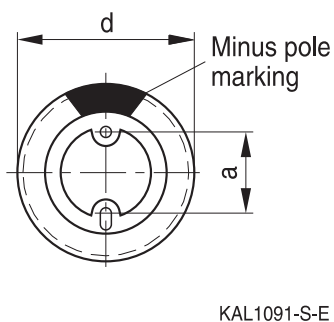
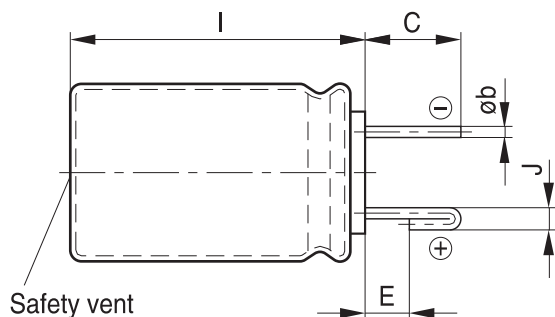
Last 3 digits of ordering code: 003

With stand-off rubber seal



J leads

Last 3 digits of ordering code: 004

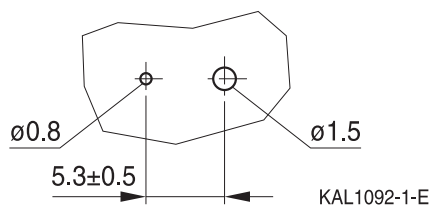


KAL1091-S-E

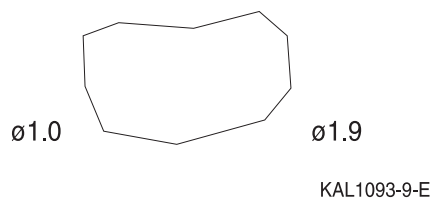
The series B41897, B41898 and B41899 have no sleeve nor minus pole marking, the positive pole is marked on the aluminum case side instead.

Suggestion for PCB hole diameter

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

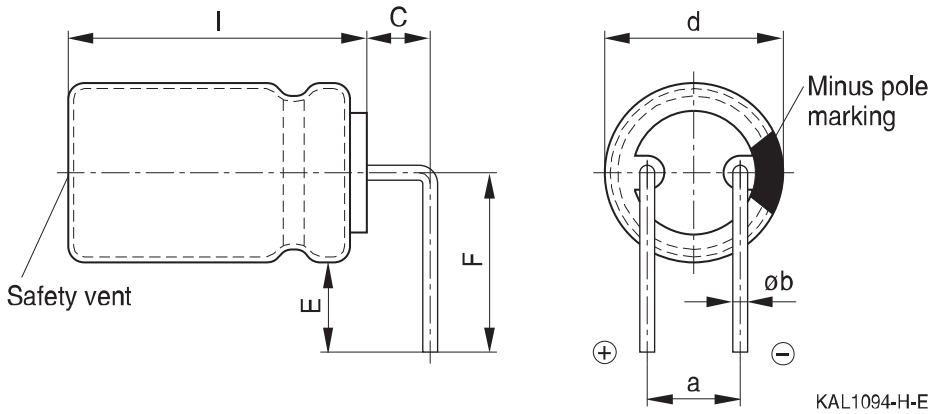


Suggestion for



Bent 90° leads for horizontal mounting pinning

Last 3 digits of ordering code: 012



The series B41897, B41898 and B41899 have no sleeve nor minus pole marking, the positive pole is marked on the aluminum case side instead.

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

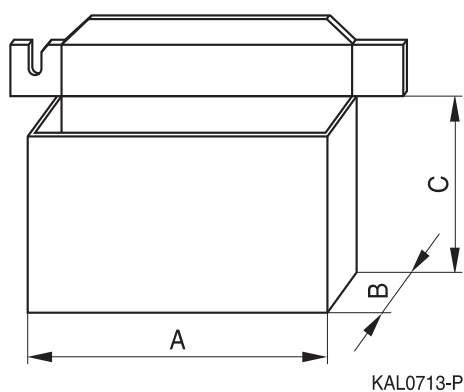


B41897

Low ESR, ultra compact – 135 °C

Packing units and box dimensions

Ammo pack



Case size d × l mm	Dimensions (mm)			Packing units pcs.
	A _{max}	B _{max}	C _{max}	
8 × 11.5	345	60	240	1000
10 × 12.5	345	60	280	750
10 × 16	345	65	200	500
10 × 20	345	65	200	500
12.5 × 20	345	65	260	500
12.5 × 25	345	70	260	500
16 × 20	325	65	285	300
16 × 25	325	65	285	300
16 × 31.5	325	80	275	300
18 × 20	325	65	285	250
18 × 25	325	65	285	250
18 × 31.5	325	80	275	250


Overview of packing units and code numbers

Case size d × l mm	Stan- dard, bulk pcs.	Taped, Ammo pack pcs.			Kinked leads, bulk pcs.	Cut leads, bulk pcs.	PAPR		
							Crimped leads, blister pcs.	J leads, blister pcs.	Bent 90° leads, blister pcs.
8 × 11.5	1000	1000			–	–	–	–	
10 × 12.5	1000	750			–	1000	–	900	
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)
16 × 20	250	300			200	200	200	200	420
16 × 25	250	300			200	200	216	216	216
16 × 31.5	200	300			250	250	180	180	180
16 × 35.5	100	–			100	100	150	150	150
16 × 40	125	–			100	100	72	72	72
18 × 20	175	250			175	175	200	200	420
18 × 25	150	250			150	150	200	200	200
18 × 31.5	100	250			100	100	150	150	150
18 × 35	100	–			100	100	150	150	150
18 × 40	125	–			100	100	72	–	72
The last three digits of the complete ordering code state the lead configuration	000	Code	F (mm)	d (mm)	001	002	003	004	012
		006	3.5	8					
		008	5	8...12.5					
		009	7.5	16...18					

1) Available upon request

Cautions and warnings

Personal safety

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

As far as possible, we do not use any dangerous chemicals or compounds to produce operating electrolytes, although in exceptional cases, such materials must be used in order to achieve specific physical and electrical properties because no alternative materials are currently known. We do, however, restrict the amount of dangerous materials used in our products to an absolute minimum.

Materials and chemicals used in our aluminum electrolytic capacitors are continuously adapted in compliance with the TDK Electronics Corporate Environmental Policy and the latest EU regulations and guidelines such as RoHS, REACH/SVHC, GADSL, and ELV.

MDS (Material Data Sheets) are available on our website for all types listed in the data book.

MDS for customer specific capacitors are available upon request.

MSDS (Material Safety Data Sheets) are available for our electrolytes upon request.

Nevertheless, the following rules should be observed when handling aluminum electrolytic capacitors: No electrolyte should come into contact with eyes or skin. If electrolyte does come into contact with the skin, wash the affected areas immediately with running water. If the eyes are affected, rinse them for 10 minutes with plenty of water. If symptoms persist, seek medical treatment. Avoid inhaling electrolyte vapor or mists. Workplaces and other affected areas should be well ventilated. Clothing that has been contaminated by electrolyte must be changed and rinsed in water.



Product safety

The table below summarizes the safety instructions that must be observed without fail. A detailed description can be found in the relevant sections of separate file 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 of opposite polarity should be prevented by connecting a diode.	3.1.6 "Reverse voltage"
Mounting position of screw-terminal capacitors	Screw terminal capacitors must not be mounted with terminals facing down unless otherwise specified.	11.1. "Mounting positions of capacitors with screw terminals"
Robustness of terminals	The following maximum tightening torques must not be exceeded when connecting screw terminals: M5: 2.5 Nm M6: 4.0 Nm	11.3 "Mounting torques"
Mounting of single-ended capacitors	The internal structure of single-ended capacitors might be damaged if excessive force is applied to the lead wires. Avoid any compressive, tensile or flexural stress. Do not move the capacitor after soldering to PC board. Do not pick up the PC board by the soldered capacitor. Do not insert the capacitor on the PC board with a hole space different to the lead space specified.	11.4 "Mounting considerations for single-ended capacitors"
Soldering	Do not exceed the specified time or temperature limits during soldering.	11.5 "Soldering"
Soldering, cleaning agents	Do not allow halogenated hydrocarbons to come into contact with aluminum electrolytic capacitors.	11.6 "Cleaning agents"
Upper category temperature	Do not exceed the upper category temperature.	7.2 "Maximum permissible operating temperature"
Passive flammability	Avoid external energy, e.g. fire.	8.1 "Passive flammability"



B41897

Low ESR, ultra compact – 135 °C

Topic	Safety information	Reference chapter "General technical information"
Active flammability	Avoid overload of the capacitors.	8.2 "Active flammability"
Maintenance	Make periodic inspections of the capacitors. Before the inspection, make sure that the power supply is turned off and carefully discharge the capacitors. Do not apply excessive mechanical stress to the capacitor terminals when mounting.	10 "Maintenance"
Storage	Do not store capacitors at high temperatures or high humidity. Capacitors should be stored at +5 to +35 °C and a relative humidity of ≤ 75%.	7.3 "Shelf life and storage conditions"
		Reference chapter "Capacitors with screw terminals"
Breakdown strength of insulating sleeves	Do not damage the insulating sleeve, especially when ring clips are used for mounting.	"Screw terminals – accessories"

Display of ordering codes for TDK Electronics products

The ordering code for one and the same product can be represented differently in data sheets, data books, other publications, on the company website, or in order-related documents such as shipping notes, order confirmations and product labels. The varying representations of the ordering codes are due to different processes employed and do not affect the specifications of the respective products.

Detailed information can be found on the Internet under www.tdk-electronics.tdk.com/orderingcodes.



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_{leak}	Leakage current	Reststrom
$I_{leak,op}$	Operating leakage current	Betriebsreststrom
l	Case length, nominal dimension	Gehäuselänge, Nennmaß
l_{max}	Maximum case length (without terminals and mounting stud)	Maximale Gehäuselänge (ohne Anschlüsse und Gewindebolzen)
R	Resistance	Widerstand
R_{ins}	Insulation resistance	Isolationswiderstand
R_{symm}	Balancing resistance	Symmetrierwiderstand
T	Temperature	Temperatur
ΔT	Temperature difference	Temperaturdifferenz
T_A	Ambient temperature	Umgebungstemperatur
T_C	Case temperature	Gehäusetemperatur
T_B	Capacitor base temperature	Temperatur des Gehäusebodens
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
$\tan \delta$	Dissipation factor	Verlustfaktor
λ	Failure rate	Ausfallrate
ϵ_0		

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, we are 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 a product with the properties described in the product specification is suitable for use in a particular customer application.
2. We also point out that **in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified**. In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or lifesaving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.
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Important notes

7. **Our manufacturing sites serving the automotive business apply the IATF 16949 standard.** The IATF certifications confirm our compliance with requirements regarding the quality management system in the automotive industry. Referring to customer requirements and customer specific requirements (“CSR”) TDK always has and will continue to have the policy of respecting individual agreements. Even if IATF 16949 may appear to support the acceptance of unilateral requirements, we hereby like to emphasize that **only requirements mutually agreed upon can and will be implemented in our Quality Management System.** For clarification purposes we like to point out that obligations from IATF 16949 shall only become legally binding if individually agreed upon.
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