Aluminum electrolytic capacitors

Snap-in capacitors

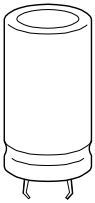
Series/Type: **B43640**

Date: November 2015

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Long-life grade capacitors



Applications

- Frequency converters
- Solar inverters
- Uninterruptible power supplies
- Professional power supplies
- Medical appliances

Features

- Extremely high CV product, ultra compact
- High reliability
- High ripple current capability
- Different case sizes available for each capacitance value
- Capacitors with all insulation versions pass the needle flame test according to IEC 60695-11-5 for all flame exposure times up to 120 s
- RoHS-compatible

Construction

- Charge/discharge-proof, polar
- Aluminum case, fully insulated with PVC
- Version with PET insulation available
- Version with additional PET insulation cap on terminal side available for insulating the capacitor from the PCB
- Snap-in solder pins to hold component in place on PC-board
- Minus pole marking on case surface
- Minus pole not insulated from case
- Overload protection by safety vent on the base

Terminals

- Standard version with 2 terminals, 2 lengths available: 6.3 and 4.5 mm
- 3 terminals to ensure correct insertion: length 4.5 mm



Specifications and characteristics in brief

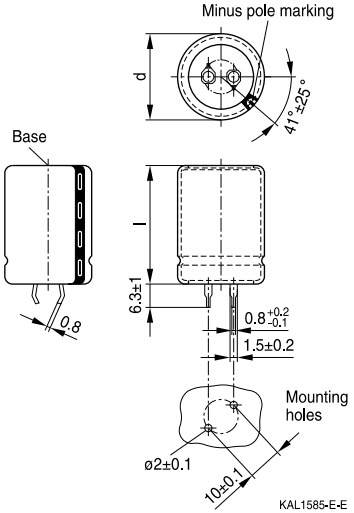
Rated voltage V_R Surge voltage V_S	200 ... 450 V DC 1.15 · V_R (for $V_R \leq$ 250 V DC) 1.10 · V_R (for $V_R \geq$ 400 V DC)	
Rated capacitance C_R Capacitance tolerance	82 ... 3300 µF ±20% ≙ M	
Dissipation factor tan δ (20 °C, 120 Hz)	$V_R \leq$ 250 V DC: tan δ ≤ 0.15 $V_R \geq$ 400 V DC: tan δ ≤ 0.20	
Leakage current I_{leak} (5 min, 20 °C)	$I_{leak} \leq 0.3\ \mu A \cdot \left(\frac{C_R}{\mu F} \cdot \frac{V_R}{V}\right)^{0.7} + 4\ \mu A$	
Self-inductance ESL	Approx. 20 nH	
Useful life[1)] 105 °C; V_R; $I_{AC,R}$	> 2000 h	Requirements: $\lvert\Delta C/C\rvert$ ≤ 20% of initial value tan δ ≤ 2 times initial specified limit I_{leak} ≤ initial specified limit
Voltage endurance test 105 °C; V_R	2000 h	Post test requirements: $\lvert\Delta C/C\rvert$ ≤ 10% of initial value tan δ ≤ 1.3 times initial specified limit I_{leak} ≤ initial specified limit
Vibration resistance test	To IEC 60068-2-6, test Fc: Frequency range 10 Hz ... 55 Hz, displacement amplitude 0.35 mm, acceleration max. 5 *g*, duration 3 × 2 h. Capacitor mounted by its body which is rigidly clamped to the work surface.	
Characteristics at low temperature	Max. impedance ratio at 100 Hz	V_R ≤ 250 V: $Z_{-25\,°C} / Z_{20\,°C}$ = 3; $Z_{-40\,°C} / Z_{20\,°C}$ = 7 V_R ≥ 400 V: $Z_{-25\,°C} / Z_{20\,°C}$ = 5; $Z_{-40\,°C} / Z_{20\,°C}$ = 10
IEC climatic category	To IEC 60068-1: 40/105/56 (−40 °C/+105 °C/56 days damp heat test)	
Detail specification Sectional specification	Similar to CECC 30301-809 IEC 60384-4	

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



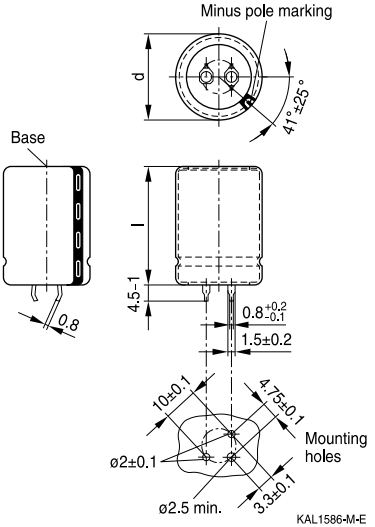
Dimensional drawings

Snap-in capacitors with standard insulation (PVC or PET)



Snap-in terminals, length (6.3 ±1) mm. Also available in a shorter version with a length of (4.5 −1) mm. PET insulation is marked with label "PET" on the sleeve. Safety vent on the base.

Dimensions (mm)		Approx.	Packing
d +1	l ±2	weight (g)	units (pcs.)
22	25	9	160
22	30	12	160
22	35	15	160
22	40	18	160
22	45	20	160
22	50	24	160
25	25	13	130
25	30	17	130
25	35	19	130
25	40	22	130
25	45	25	130
25	50	29	130
25	55	32	130

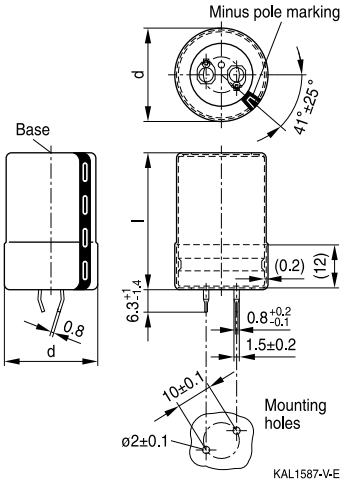


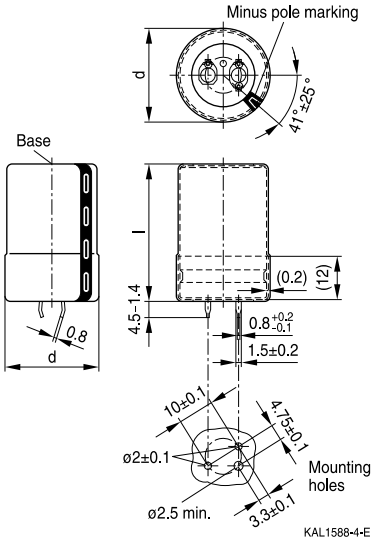
Snap-in capacitors are also available with 3 terminals (length (4.5 −1) mm). PET insulation is marked with label "PET" on the sleeve. Safety vent on the base.

Dimensions (mm)		Approx.	Packing
d +1	l ±2	weight (g)	units (pcs.)
30	25	17	80
30	30	23	80
30	35	29	80
30	40	36	80
30	45	41	80
30	50	46	80
30	55	53	80
35	25	22	60
35	30	29	60
35	35	36	60
35	40	41	60
35	45	56	60
35	50	70	60
35	55	81	60



Snap-in capacitors with PVC insulation and PET insulation cap on terminal side





Snap-in terminals, length (6.3 +1/−1.4) mm. Also available in a shorter version with a length of (4.5 −1.4) mm. PET insulation cap is positioned under the insulation sleeve. Safety vent on the base.

Dimensions (mm)		Approx.	Packing
d +1.4	l +2.2/−2	weight (g)	units (pcs.)
22	25	9	160
22	30	12	160
22	35	15	160
22	40	18	160
22	45	20	160
22	50	24	160
25	25	13	115
25	30	17	115
25	35	19	115
25	40	22	115
25	45	25	115
25	50	29	115
25	55	32	115

Snap-in capacitors are also available with 3 terminals (length (4.5 −1.4) mm). PET insulation cap is positioned under the insulation sleeve. Safety vent on the base.

Dimensions (mm)		Approx.	Packing
d +1.4	l +2.2/−2	weight (g)	units (pcs.)
30	25	17	80
30	30	23	80
30	35	29	80
30	40	36	80
30	45	41	80
30	50	46	80
30	55	53	80
35	25	22	60
35	30	29	60
35	35	36	60
35	40	41	60
35	45	56	60
35	50	70	60
35	55	81	60



B43640

Ultra compact – 105 °C

Packing of snap-in capacitors



For ecological reasons the packing is pure cardboard. Components can be withdrawn (in full or in part) in the correct position for insertion.

Ordering codes for terminal styles and insulation features

Identification in 3rd block of ordering code

Snap-in capacitors			
Terminal version	Insulation version		
	PVC	PET	PVC plus PET cap
Standard terminals 6.3 mm	M000	M060	M080
Short terminals 4.5 mm	M007	M067	M087
3 terminals 4.5 mm	M002	M062	M082

Ordering examples:

B43640E5107M007 } snap-in capacitor with short terminals and standard PVC insulation
B43640E5107M062 } snap-in capacitor with 3 terminals and PET insulation
B43640E5107M080 } snap-in capacitor with standard terminals and PVC insulation with additional PET insulation cap on terminal side



Overview of available types

V_R (V DC)	200	250	400	450
	Case dimensions d × l (mm)			
C_R (µF)				
82				22 × 25
100				22 × 25
120			22 × 25	22 × 30 25 × 25
150			22 × 30 25 × 25	22 × 35 25 × 30
180			22 × 30 25 × 25	22 × 40 25 × 30 30 × 25
220			22 × 35 25 × 30 30 × 25	22 × 45 25 × 35 30 × 25
270		22 × 25	22 × 40 25 × 35 30 × 25	22 × 50 25 × 40 30 × 30 35 × 25
330		22 × 30	22 × 50 25 × 40 30 × 30 35 × 25	25 × 50 30 × 35 35 × 30
390	22 × 25	22 × 35 25 × 25	25 × 45 30 × 35 35 × 25	25 × 55 30 × 40 35 × 30
470	22 × 30 25 × 25	22 × 35 25 × 30	25 × 50 30 × 35 35 × 30	30 × 45 35 × 35
560	22 × 35 25 × 30	22 × 40 25 × 35 30 × 25	30 × 40 35 × 35	30 × 50 35 × 40
680	22 × 40 25 × 30 30 × 25	22 × 45 25 × 40 30 × 30	30 × 50 35 × 40	35 × 45
820	22 × 45 25 × 35 30 × 30	25 × 45 30 × 35 35 × 25	30 × 55 35 × 45	35 × 55



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Ultra compact – 105 °C

V_R (V DC)	200	250	400	450
	Case dimensions d × l (mm)			
C_R (µF)				
1000	22 × 50 25 × 40 30 × 30 35 × 25	25 × 50 30 × 40 35 × 30	35 × 50	
1200	25 × 45 30 × 35 35 × 30	30 × 45 35 × 35		
1500	25 × 55 30 × 40 35 × 30	30 × 50 35 × 40		
1800	30 × 45 35 × 35	35 × 45		
2200	30 × 55 35 × 40	35 × 50		
2700	35 × 50			
3300	35 × 55			

The capacitance and voltage ratings listed above are available in different cases upon request. Other voltage and capacitance ratings are also available upon request.



Technical data and ordering codes

C_R 100 Hz 20 °C µF	Case dimensions d × l mm	ESR_{typ} 100 Hz 20 °C mΩ	ESR_{typ} 300 Hz 60 °C mΩ	Z_{max} 10 kHz 20 °C mΩ	$I_{AC,max}$ 100 Hz 60 °C A	$I_{AC,max}$ 100 Hz 85 °C A	$I_{AC,R}$ 100 Hz 105 °C A	Ordering code (composition see below)
V_R = 200 V DC								
390	22 × 25	230	80	330	3.01	2.23	1.13	B43640A2397M0*#
470	22 × 30	190	65	270	3.48	2.58	1.31	B43640A2477M0*#
470	25 × 25	190	75	280	3.26	2.42	1.23	B43640B2477M0*#
560	22 × 35	160	55	230	3.99	2.97	1.51	B43640A2567M0*#
560	25 × 30	160	60	230	3.74	2.79	1.42	B43640B2567M0*#
680	22 × 40	130	45	190	4.66	3.46	1.76	B43640A2687M0*#
680	25 × 30	140	55	200	4.24	3.15	1.59	B43640B2687M0*#
680	30 × 25	150	70	220	3.82	2.85	1.45	B43640C2687M0*#
820	22 × 45	110	38	160	5.42	4.02	2.04	B43640A2827M0*#
820	25 × 35	110	45	170	4.91	3.65	1.85	B43640B2827M0*#
820	30 × 30	120	55	180	4.45	3.33	1.69	B43640C2827M0*#
1000	22 × 50	90	32	130	6.36	4.71	2.39	B43640A2108M0*#
1000	25 × 40	95	38	140	5.73	4.25	2.15	B43640B2108M0*#
1000	30 × 30	110	55	160	4.87	3.63	1.83	B43640C2108M0*#
1000	35 × 25	130	75	190	4.27	3.19	1.61	B43640D2108M0*#
1200	25 × 45	80	32	120	6.61	4.90	2.48	B43640A2128M0*#
1200	30 × 35	90	45	140	5.63	4.20	2.12	B43640B2128M0*#
1200	35 × 30	100	55	150	5.03	3.76	2.03	B43640C2128M0*#
1500	25 × 55	65	26	95	7.99	5.93	3.00	B43640A2158M0*#
1500	30 × 40	70	36	110	6.61	4.92	2.65	B43640B2158M0*#
1500	35 × 30	95	60	150	5.37	4.00	2.14	B43640C2158M0*#
1800	30 × 45	60	32	95	7.56	5.62	3.02	B43640A2188M0*#
1800	35 × 35	75	50	120	6.21	4.63	2.48	B43640B2188M0*#
2200	30 × 55	50	24	75	9.00	6.70	3.60	B43640A2228M0*#
2200	35 × 40	65	40	100	7.15	5.33	2.86	B43640B2228M0*#
2700	35 × 50	50	30	75	8.65	6.45	3.47	B43640A2278M0*#
3300	35 × 55	45	28	70	9.80	7.29	3.91	B43640A2338M0*#

Composition of ordering code

* = Insulation feature
- 0 = PVC insulation
- 6 = PET insulation
- 8 = PVC insulation with additional PET insulation cap on terminal side

\# = Terminal style
- 0 = snap-in standard terminals (6.3 mm)
- 2 = snap-in 3 terminals (4.5 mm)
- 7 = snap-in short terminals (4.5 mm)



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Ultra compact – 105 °C

Technical data and ordering codes

C_R 100 Hz 20 °C µF	Case dimensions d × l mm	ESR_{typ} 100 Hz 20 °C mΩ	ESR_{typ} 300 Hz 60 °C mΩ	Z_{max} 10 kHz 20 °C mΩ	$I_{AC,max}$ 100 Hz 60 °C A	$I_{AC,max}$ 100 Hz 85 °C A	$I_{AC,R}$ 100 Hz 105 °C A	Ordering code (composition see below)
V_R = 250 V DC								
270	22 × 25	260	90	360	2.58	1.92	0.97	B43640E2277M0*#
330	22 × 30	210	75	290	3.00	2.24	1.13	B43640E2337M0*#
390	22 × 35	180	60	250	3.43	2.56	1.30	B43640E2397M0*#
390	25 × 25	190	75	270	3.19	2.38	1.20	B43640F2397M0*#
470	22 × 35	150	55	210	3.95	2.93	1.48	B43640E2477M0*#
470	25 × 30	160	60	220	3.69	2.75	1.39	B43640F2477M0*#
560	22 × 40	130	45	180	4.55	3.38	1.71	B43640E2567M0*#
560	25 × 35	130	50	190	4.23	3.16	1.60	B43640F2567M0*#
560	30 × 25	150	75	220	3.73	2.78	1.40	B43640G2567M0*#
680	22 × 45	110	40	150	5.34	3.96	2.00	B43640E2687M0*#
680	25 × 40	110	40	160	4.93	3.67	1.86	B43640F2687M0*#
680	30 × 30	120	55	180	4.35	3.25	1.65	B43640G2687M0*#
820	25 × 45	90	36	130	5.71	4.25	2.15	B43640E2827M0*#
820	30 × 35	100	45	150	5.03	3.76	1.90	B43640F2827M0*#
820	35 × 25	130	80	190	4.19	3.12	1.57	B43640G2827M0*#
1000	25 × 50	75	30	110	6.68	4.96	2.51	B43640E2108M0*#
1000	30 × 40	85	40	120	5.83	4.35	2.35	B43640F2108M0*#
1000	35 × 30	100	60	150	4.95	3.69	1.99	B43640G2108M0*#
1200	30 × 45	70	34	100	6.68	4.98	2.68	B43640E2128M0*#
1200	35 × 35	85	50	130	5.71	4.26	2.29	B43640F2128M0*#
1500	30 × 50	60	30	85	7.81	5.82	3.12	B43640E2158M0*#
1500	35 × 40	70	40	110	6.62	4.94	2.65	B43640F2158M0*#
1800	35 × 45	60	36	90	7.52	5.61	3.01	B43640E2188M0*#
2200	35 × 50	50	32	80	8.60	6.40	3.43	B43640E2228M0*#

Composition of ordering code

* = Insulation feature
- 0 = PVC insulation
- 6 = PET insulation
- 8 = PVC insulation with additional PET insulation cap on terminal side

\# = Terminal style
- 0 = snap-in standard terminals (6.3 mm)
- 2 = snap-in 3 terminals (4.5 mm)
- 7 = snap-in short terminals (4.5 mm)



Technical data and ordering codes

C_R 100 Hz 20 °C µF	Case dimensions d × l mm	ESR_{typ} 100 Hz 20 °C mΩ	ESR_{typ} 300 Hz 60 °C mΩ	Z_{max} 10 kHz 20 °C mΩ	$I_{AC,max}$ 100 Hz 60 °C A	$I_{AC,max}$ 100 Hz 85 °C A	$I_{AC,R}$ 100 Hz 105 °C A	Ordering code (composition see below)
V_R = 400 V DC								
120	22 × 25	820	220	1210	1.72	1.28	0.65	B43640A9127M0*#
150	22 × 30	650	170	960	2.03	1.51	0.77	B43640A9157M0*#
150	25 × 25	660	180	980	1.98	1.47	0.75	B43640B9157M0*#
180	22 × 30	620	160	930	2.33	1.74	0.87	B43640E9187M0*#
180	25 × 25	620	170	950	2.25	1.68	0.84	B43640F9187M0*#
220	22 × 35	500	130	760	2.73	2.04	1.02	B43640E9227M0*#
220	25 × 30	450	130	670	2.64	1.96	1.00	B43640B9227M0*#
220	30 × 25	460	140	690	2.53	1.88	0.96	B43640C9227M0*#
270	22 × 40	410	110	620	3.23	2.41	1.20	B43640E9277M0*#
270	25 × 35	370	100	550	3.09	2.29	1.17	B43640B9277M0*#
270	30 × 25	430	130	660	2.87	2.15	1.08	B43640F9277M0*#
330	22 × 50	300	80	440	3.87	2.86	1.45	B43640A9337M0*#
330	25 × 40	300	85	450	3.64	2.69	1.37	B43640B9337M0*#
330	30 × 30	320	100	470	3.36	2.50	1.27	B43640C9337M0*#
330	35 × 25	330	120	500	3.18	2.37	1.20	B43640D9337M0*#
390	25 × 45	260	75	380	4.16	3.08	1.56	B43640A9397M0*#
390	30 × 35	270	85	400	3.82	2.84	1.44	B43640B9397M0*#
390	35 × 25	320	120	500	3.47	2.59	1.30	B43640E9397M0*#
470	25 × 50	210	60	320	4.87	3.60	1.82	B43640A9477M0*#
470	30 × 35	250	80	390	4.32	3.22	1.61	B43640E9477M0*#
470	35 × 30	240	90	360	4.02	2.99	1.61	B43640C9477M0*#
560	30 × 40	210	65	330	4.95	3.69	1.97	B43640E9567M0*#
560	35 × 35	200	75	300	4.60	3.42	1.85	B43640B9567M0*#
680	30 × 50	160	50	240	5.90	4.38	2.36	B43640A9687M0*#
680	35 × 40	160	60	250	5.30	3.94	2.13	B43640B9687M0*#
820	30 × 55	140	45	220	6.75	5.03	2.69	B43640E9827M0*#
820	35 × 45	140	55	210	6.09	4.52	2.44	B43640A9827M0*#
1000	35 × 50	120	45	180	7.05	5.23	2.81	B43640A9108M0*#

Composition of ordering code

* = Insulation feature
- 0 = PVC insulation
- 6 = PET insulation
- 8 = PVC insulation with additional PET insulation cap on terminal side

\# = Terminal style
- 0 = snap-in standard terminals (6.3 mm)
- 2 = snap-in 3 terminals (4.5 mm)
- 7 = snap-in short terminals (4.5 mm)



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Ultra compact – 105 °C

Technical data and ordering codes

C_R 100 Hz 20 °C µF	Case dimensions d × l mm	ESR_{typ} 100 Hz 20 °C mΩ	ESR_{typ} 300 Hz 60 °C mΩ	Z_{max} 10 kHz 20 °C mΩ	$I_{AC,max}$ 100 Hz 60 °C A	$I_{AC,max}$ 100 Hz 85 °C A	$I_{AC,R}$ 100 Hz 105 °C A	Ordering code (composition see below)
V_R = 450 V DC								
82	22 × 25	1160	300	1720	1.41	1.04	0.53	B43640A5826M0*#
100	22 × 25	1020	260	1530	1.62	1.21	0.61	B43640E5107M0*#
120	22 × 30	790	210	1180	1.89	1.40	0.71	B43640A5127M0*#
120	25 × 25	800	220	1190	1.84	1.37	0.70	B43640B5127M0*#
150	22 × 35	630	170	940	2.26	1.67	0.85	B43640A5157M0*#
150	25 × 30	640	170	950	2.17	1.61	0.82	B43640B5157M0*#
180	22 × 40	530	140	790	2.62	1.94	0.98	B43640A5187M0*#
180	25 × 30	580	160	870	2.46	1.83	0.92	B43640E5187M0*#
180	30 × 25	550	160	820	2.41	1.79	0.91	B43640C5187M0*#
220	22 × 45	430	120	650	3.10	2.29	1.16	B43640A5227M0*#
220	25 × 35	470	130	710	2.87	2.14	1.08	B43640E5227M0*#
220	30 × 25	490	150	740	2.73	2.04	1.02	B43640F5227M0*#
270	22 × 50	380	100	570	3.59	2.68	1.34	B43640E5277M0*#
270	25 × 40	380	100	580	3.38	2.52	1.26	B43640F5277M0*#
270	30 × 30	400	120	600	3.16	2.36	1.18	B43640G5277M0*#
270	35 × 25	390	130	590	3.07	2.28	1.15	B43640C5277M0*#
330	25 × 50	290	80	440	4.09	3.03	1.54	B43640A5337M0*#
330	30 × 35	320	95	490	3.68	2.75	1.38	B43640E5337M0*#
330	35 × 30	310	100	480	3.56	2.65	1.43	B43640C5337M0*#
390	25 × 55	260	70	400	4.59	3.42	1.72	B43640E5397M0*#
390	30 × 40	260	80	390	4.31	3.19	1.72	B43640A5397M0*#
390	35 × 30	290	100	450	3.87	2.89	1.55	B43640F5397M0*#
470	30 × 45	230	70	350	4.85	3.62	1.94	B43640E5477M0*#
470	35 × 35	240	80	370	4.45	3.32	1.78	B43640F5477M0*#
560	30 × 50	190	60	300	5.59	4.17	2.23	B43640E5567M0*#
560	35 × 40	200	70	310	5.08	3.80	2.03	B43640F5567M0*#
680	35 × 45	170	60	260	5.89	4.39	2.35	B43640E5687M0*#
820	35 × 55	130	45	200	7.04	5.22	2.81	B43640A5827M0*#

Composition of ordering code

* = Insulation feature
- 0 = PVC insulation
- 6 = PET insulation
- 8 = PVC insulation with additional PET insulation cap on terminal side

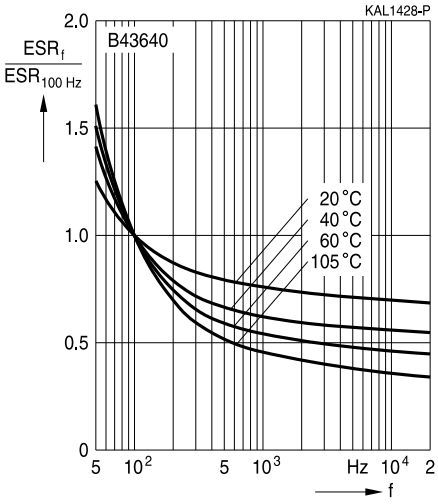
\# = Terminal style
- 0 = snap-in standard terminals (6.3 mm)
- 2 = snap-in 3 terminals (4.5 mm)
- 7 = snap-in short terminals (4.5 mm)



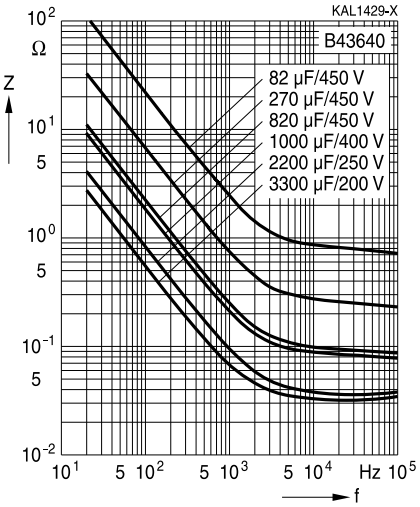
Useful life[1)]

For useful life calculations, please use our web-based "AlCap Useful Life Calculation Tool", which can be found on the Internet under the following link
http://www.epcos.com/designtools/alu_useful_life/Useful_life.swf.
The AlCap Useful Life Calculation Tool provides calculations of useful life as well as additional data for selected capacitor types under operating conditions defined by the user.

Frequency characteristics of ESR
Typical behavior



Impedance Z versus frequency f
Typical behavior at 20 °C



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



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Cautions and warnings

Personal safety

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

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

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

MDS (Material Data Sheets) are available on the EPCOS website for all types listed in the data book. MDS for customer specific capacitors are available upon request.
MSDS (Material Safety Data Sheets) are available for all of our electrolytes upon request.

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



Product safety

The table below summarizes the safety instructions that must be observed without fail. A detailed description can be found in the relevant sections of chapter "General technical information".

Topic	Safety information	Reference chapter "General technical information"
Polarity	Make sure that polar capacitors are connected with the right polarity.	1 "Basic construction of aluminum electrolytic capacitors"
Reverse voltage	Voltages 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"



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Topic	Safety information	Reference chapter "General technical information"
Active flammability	Avoid overload of the capacitors.	8.2 "Active flammability"
Maintenance	Make periodic inspections of the capacitors. Before the inspection, make sure that the power supply is turned off and carefully discharge the electricity of the capacitors. Do not apply 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 EPCOS products

The ordering code for one and the same product can be represented differently in data sheets, data books, other publications and the website of EPCOS, 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.epcos.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)



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

Note

All dimensions are given in mm.

Important notes

The following applies to all products named in this publication:

1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application**. As a rule, EPCOS is either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether an EPCOS product with the properties described in the product specification is suitable for use in a particular customer application.
2. We also point out that **in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified**. In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or lifesaving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.
3. **The warnings, cautions and product-specific notes must be observed.**
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. The aforementioned does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.
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)**.

Important notes

7. The trade names EPCOS, Alu-X, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CSSP, CTVS, DeltaCap, DigiSiMic, DSSP, ExoCore, FilterCap, FormFit, LeaXield, MiniBlue, MiniCell, MKD, MKK, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PQSine, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, SIP5D, SIP5K, TFAP, ThermoFuse, WindCap are **trademarks registered or pending** in Europe and in other countries. Further information will be found on the Internet at www.epcos.com/trademarks.