

General-purpose grade capacitors

Applications

- General-purpose applications in the entertainment industry
- Semi-professional to professional application range
- For filtering, coupling and pulse circuits

Features

- Miniaturized dimensions
- Operation up to 105 °C
- High CU product, i.e. very compact

Construction

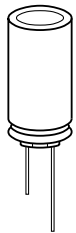
- Radial leads
- Charge-discharge proof, polar
- Aluminum case with insulating sleeve
- Minus pole marking on the insulation sleeve
- Stand off rubber seal
- Case with safety vent from diameter 6,3 mm

Delivery mode

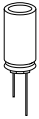
Special terminal configurations and packing:

- Bulk
- Taped, Ammo pack
- Cut
- Kinked
- PAPR (protection against polarity reversal)

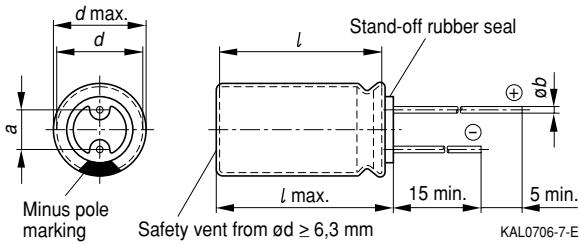
Refer to page 503 for further details and ordering example.



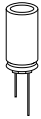
KAL0707-F


B41851 / B43851
Standard Series – 105 °C
Specifications and characteristics in brief

Type	B41851	B43851
Rated voltage U_R	6,3...100 VDC	160...450 VDC
Surge voltage U_S	$1,15 \cdot U_R$	$1,1 \cdot U_R$
Rated capacitance C_R	0,1...10 000 μ F	0,47...470 μ F
Capacitance tolerance	$\pm 20 \% \triangleq M$	$\pm 20 \% \triangleq M$
Useful life 105 °C, U_R ; I_{-R} 40 °C, U_R ; $1,8 \cdot I_{-R}$ 40 °C, U_R ; $2,1 \cdot I_{-R}$	> 2 000 h > 250 000 h —	> 3 000 h — > 250 000 h
Requirements:	$\Delta C/C \leq \pm 45 \%$ of initial value $\tan \delta \leq 3$ times initial specified limit $I_L \leq$ initial specified limit Failure percentage: $\leq 1 \%$ Failure rate: ≤ 100 fit ($\leq 100 \cdot 10^{-9}/h$) (for definition "fit", refer to chapter "Quality", page 62)	
Voltage endurance test 105 °C; U_R	1 000 h	1 000 h
Post test requirements:	$\Delta C/C \leq \pm 30 \%$ of initial value $\tan \delta \leq 2$ times initial specified limit $I_L \leq$ initial specified limit	
Vibration resistance	To IEC 60068-2-6, test Fc: displacement amplitude 0,75 mm, frequency range 10 ... 2000 Hz, acceleration max.10 g, duration 3×2 h	
IEC climatic category	To IEC 60068-1: $U_R \leq 250$ V: 40/105/56 (– 40 °C/+ 105 °C/56 days damp heat test) $U_R \geq 350$ V: 25/105/56 (– 25 °C/+ 105 °C/56 days damp heat test)	
Sectional specification	IEC 60384-4	

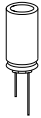

Dimensional drawing

Dimensions and weights

Dimensions (mm)				Approx. weight
$d \times l$	$d_{\max} \times l_{\max}$	$a \pm 0,5$	b	g
5 × 11	5,5 × 12	2,0	0,50 ± 0,05	0,5
6,3 × 11	6,8 × 12	2,5	0,50 ± 0,05	0,7
8 × 11	8,5 × 12	3,5	0,60 ± 0,05	1,0
10 × 12,5	10,5 × 13,5	5,0	0,60 ± 0,05	1,6
10 × 16	10,5 × 17	5,0	0,60 ± 0,05	1,9
10 × 20	10,5 × 22	5,0	0,60 ± 0,05	2,6
12,5 × 20	13 × 22	5,0	0,60 ± 0,05	3,6
12,5 × 25	13 × 27	5,0	0,60 ± 0,05	4,5
16 × 20	16,5 × 22	7,5	0,80 ± 0,05	5,5
16 × 25	16,5 × 27	7,5	0,80 ± 0,05	7,5
16 × 31,5	16,5 × 33,5	7,5	0,80 ± 0,05	7,8
18 × 31,5	18,5 × 32,5	7,5	0,80 ± 0,1	11
18 × 35	18,5 × 36	7,5	0,80 ± 0,1	13
18 × 40	18,5 × 41	7,5	0,80 ± 0,1	16
20 × 30	20,5 × 32	10,0	0,80 ± 0,1	14
20 × 35	20,5 × 37	10,0	0,80 ± 0,1	18
20 × 40	20,5 × 42	10,0	0,80 ± 0,1	20
22 × 35	22,5 × 37	10,0	1,0 ± 0,1	21
22 × 40	22,5 × 42	10,0	1,0 ± 0,1	23


B41851 / B43851
Standard Series – 105 °C
Overview of available types
B41851

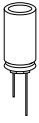
U_R (VDC)	6,3	10	16	25	35	50	63	100
C_R (μF)	Case dimensions $d \times l$ (mm)							
0,10								5 × 11
0,22								5 × 11
0,33								5 × 11
0,47								5 × 11
1,0						5 × 11		5 × 11
2,2						5 × 11		5 × 11
3,3						5 × 11		5 × 11
4,7						5 × 11		5 × 11
10						5 × 11	5 × 11	6,3 × 11
22						5 × 11	6,3 × 11	8 × 11
33					5 × 11	6,3 × 11	6,3 × 11	10 × 12,5
47				5 × 11	5 × 11	6,3 × 11	8 × 11	10 × 12,5
100		5 × 11	5 × 11	6,3 × 11	6,3 × 11	8 × 11	10 × 12,5	10 × 20
220	6,3 × 11	6,3 × 11	6,3 × 11	8 × 11	10 × 12,5	10 × 12,5	10 × 16	12,5 × 25
330	6,3 × 11	8 × 11	8 × 11	10 × 12,5	10 × 12,5	10 × 16	10 × 20	16 × 25
470	8 × 11	8 × 11	10 × 12,5	10 × 12,5	10 × 16	10 × 20	12,5 × 25	16 × 31,5
1 000	10 × 12,5	10 × 12,5	10 × 16	10 × 20	12,5 × 20 12,5 × 25	16 × 20	16 × 31,5	20 × 40
2 200	10 × 20	10 × 20	12,5 × 25	16 × 20	16 × 25 16 × 31,5	18 × 35	20 × 40	
3 300	10 × 20	12,5 × 25	16 × 25	16 × 25	18 × 31,5	18 × 40		
4 700	12,5 × 25	16 × 20	16 × 25	16 × 31,5	18 × 40	22 × 40		
10 000		18 × 35	20 × 35	22 × 40				

Other capacitance and voltage ratings are available upon request.


B43851

U_R (VDC)	160	200	250	350	400	450
C_R (μ F)	Case dimensions $d \times l$ (mm)					
0,47	6,3 × 11	6,3 × 11	6,3 × 11	6,3 × 11		
1,0	6,3 × 11	6,3 × 11	6,3 × 11	6,3 × 11		
2,2	6,3 × 11	6,3 × 11	6,3 × 11	8 × 11	10 × 12,5	10 × 12,5
3,3	6,3 × 11	6,3 × 11	8 × 11	10 × 12,5	10 × 12,5	10 × 16
4,7	8 × 11	8 × 11	10 × 12,5	10 × 12,5	10 × 16	10 × 20
10	10 × 12,5	10 × 12,5	10 × 16	10 × 20	10 × 20	12,5 × 25
22	10 × 16	10 × 20	10 × 20	12,5 × 25	16 × 20	16 × 25
33	10 × 20	10 × 20	12,5 × 25	16 × 25	16 × 25	16 × 31,5
47	12,5 × 25	12,5 × 25	16 × 20	16 × 31,5	16 × 31,5	18 × 31,5
100	16 × 25	16 × 25	18 × 35	20 × 30	20 × 35	20 × 40
220	18 × 31,5	18 × 35	18 × 40			
330	20 × 30	22 × 35	22 × 40			
470	22 × 35					

Other capacitance and voltage ratings are available upon request.


B41851 / B43851
Standard Series – 105 °C
Technical data and ordering codes

U_R	C_R	Case dimensions	$I_{L, \max}$	$\tan \delta_{\max}$	ESR_{\max}	$I_{\sim R}$	Ordering code ¹⁾
	120 Hz 20 °C	$d \times l$	5 min 20 °C	120 Hz 20 °C	120 Hz 20 °C	120 Hz 105 °C	
VDC	μF	mm	μA		Ω	mA	
B41851							
6,3	220	6,3 × 11	14	0,28	2,1	133	B41851A2227M00*
	330	6,3 × 11	21	0,28	1,4	189	B41851A2337M00*
	470	8 × 11	30	0,28	1,0	231	B41851A2477M00*
	1 000	10 × 12,5	63	0,28	0,46	392	B41851A2108M00*
	2 200	10 × 20	139	0,30	0,23	665	B41851A2228M00*
	3 300	10 × 20	208	0,32	0,16	735	B41851A2338M00*
	4 700	12,5 × 25	296	0,34	0,12	910	B41851A2478M00*
10	100	5 × 11	10	0,24	4,0	84	B41851A3107M00*
	220	6,3 × 11	22	0,24	1,8	154	B41851A3227M00*
	330	8 × 11	33	0,24	1,2	196	B41851A3337M00*
	470	8 × 11	47	0,24	0,85	280	B41851A3477M00*
	1 000	10 × 12,5	100	0,24	0,40	448	B41851A3108M00*
	2 200	10 × 20	220	0,26	0,20	728	B41851A3228M00*
	3 300	12,5 × 25	330	0,28	0,14	1 015	B41851A3338M00*
	4 700	16 × 20	470	0,30	0,11	1 078	B41851A3478M00*
10 000	18 × 35	1 000	0,42	0,07	1 764	B41851A3109M00*	
16	100	5 × 11	16	0,20	3,3	112	B41851A4107M00*
	220	6,3 × 11	35	0,20	1,5	180	B41851F4227M00*
	330	8 × 11	53	0,20	1,0	245	B41851A4337M00*
	470	10 × 12,5	75	0,20	0,71	350	B41851A4477M00*
	1 000	10 × 16	160	0,20	0,33	504	B41851A4108M00*
	2 200	12,5 × 25	352	0,22	0,17	950	B41851A4228M00*
	3 300	16 × 25	528	0,24	0,12	1 106	B41851A4338M00*
	4 700	16 × 25	752	0,26	0,09	1 190	B41851A4478M00*
	10 000	20 × 35	1 600	0,38	0,06	1 820	B41851A4109M00*

Preferred types

1) * = "0" for bulk version.

For taping versions, other lead configurations and packing information see page 503.


Technical data and ordering codes

U_R	C_R 120 Hz 20 °C μF	Case dimensions $d \times l$ mm	$I_{L, \max}$ 5 min 20 °C μA	$\tan \delta_{\max}$ 120 Hz 20 °C	ESR_{\max} 120 Hz 20 °C Ω	I_{-R} 120 Hz 105 °C mA	Ordering code ¹⁾
25	47	5 × 11	12	0,16	5,6	70	B41851A5476M00*
	100	6,3 × 11	25	0,16	2,7	126	B41851A5107M00*
	220	8 × 11	55	0,16	1,2	203	B41851A5227M00*
	330	10 × 12,5	83	0,16	0,80	280	B41851A5337M00*
	470	10 × 12,5	118	0,16	0,56	380	B41851F5477M00*
	1 000	10 × 20	250	0,16	0,27	595	B41851A5108M00*
	2 200	16 × 20	550	0,18	0,14	910	B41851A5228M00*
	3 300	16 × 25	825	0,20	0,10	1 225	B41851A5338M00*
	4 700	16 × 31,5	1 175	0,22	0,08	1 400	B41851A5478M00*
	10 000	22 × 40	2 500	0,34	0,06	2 100	B41851A5109M00*
35	33	5 × 11	12	0,14	7,0	60	B41851A7336M00*
	47	5 × 11	16	0,14	4,9	91	B41851A7476M00*
	100	6,3 × 11	35	0,14	2,3	150	B41851F7107M00*
	220	10 × 12,5	77	0,14	1,1	273	B41851A7227M00*
	330	10 × 12,5	116	0,14	0,70	315	B41851A7337M00*
	470	10 × 16	165	0,14	0,49	399	B41851A7477M00*
	1 000	12,5 × 20	350	0,14	0,23	810	B41851F7108M00*
	1 000	12,5 × 25	350	0,14	0,23	850	B41851A7108M00*
	2 200	16 × 31,5	770	0,16	0,12	1 050	B41851A7228M00*
	3 300	18 × 31,5	1 155	0,18	0,09	1 505	B41851A7338M00*
4 700	18 × 40	1 645	0,20	0,07	1 610	B41851A7478M00*	
50	1	5 × 11	4	0,12	199	12	B41851A6105M00*
	2,2	5 × 11	4	0,12	90	20	B41851A6225M00*
	3,3	5 × 11	4	0,12	60	25	B41851A6335M00*
	4,7	5 × 11	4	0,12	42	30	B41851A6475M00*
	10	5 × 11	5	0,12	20	40	B41851A6106M00*
	22	5 × 11	11	0,12	9,0	63	B41851A6226M00*
	33	6,3 × 11	17	0,12	6,0	77	B41851A6336M00*
	47	6,3 × 11	24	0,12	4,2	105	B41851A6476M00*
	100	8 × 11	50	0,12	2,0	175	B41851A6107M00*
	220	10 × 12,5	110	0,12	0,90	280	B41851A6227M00*
	330	10 × 16	165	0,12	0,60	357	B41851A6337M00*

* Preferred types

1) * = "0" for bulk version. For taping versions, other lead configurations and packing information see page 503.


B41851 / B43851
Standard Series – 105 °C
Technical data and ordering codes

U_R	C_R 120 Hz 20 °C μF	Case dimensions $d \times l$ mm	$I_{L, \max}$ 5 min 20 °C μA	$\tan \delta_{\max}$ 120 Hz 20 °C	ESR_{\max} 120 Hz 20 °C Ω	$I_{\sim R}$ 120 Hz 105 °C mA	Ordering code ¹⁾
50	470	10 × 20	235	0,12	0,42	490	B41851A6477M00*
	1 000	16 × 20	500	0,12	0,20	770	B41851A6108M00*
	2 200	18 × 35	1 100	0,14	0,11	1 190	B41851A6228M00*
	3 300	18 × 40	1 650	0,16	0,08	1 330	B41851A6338M00*
	4 700	22 × 40	2 350	0,18	0,06	1 540	B41851A6478M00*
63	10	5 × 11	6,3	0,12	20	42	B41851A8106M00*
	22	6,3 × 11	14	0,12	9,0	77	B41851A8226M00*
	33	6,3 × 11	21	0,12	6,0	91	B41851A8336M00*
	47	8 × 11	30	0,12	4,2	126	B41851A8476M00*
	100	10 × 12,5	63	0,12	2,0	203	B41851A8107M00*
	220	10 × 16	139	0,12	0,90	329	B41851A8227M00*
	330	10 × 20	208	0,12	0,60	434	B41851A8337M00*
	470	12,5 × 25	296	0,12	0,42	630	B41851A8477M00*
	1 000	16 × 31,5	630	0,12	0,20	1 050	B41851A8108M00*
	2 200	20 × 40	1 386	0,14	0,11	1 540	B41851A8228M00*
100	0,10	5 × 11	3,0	0,10	1 658	1,4	B41851A9104M00*
	0,22	5 × 11	3,0	0,10	754	2,8	B41851A9224M00*
	0,33	5 × 11	3,0	0,10	502	4,9	B41851A9334M00*
	0,47	5 × 11	3,0	0,10	353	7,0	B41851A9474M00*
	1	5 × 11	3,0	0,10	166	14	B41851A9105M00*
	2,2	5 × 11	3,0	0,10	75	21	B41851A9225M00*
	3,3	5 × 11	3,3	0,10	50	28	B41851A9335M00*
	4,7	5 × 11	4,7	0,10	35	31	B41851A9475M00*
	10	6,3 × 11	10	0,10	17	52	B41851A9106M00*
	22	8 × 11	22	0,10	7,5	91	B41851A9226M00*
	33	10 × 12,5	33	0,10	5,0	133	B41851A9336M00*
	47	10 × 12,5	47	0,10	3,5	161	B41851B9476M00*
	100	10 × 20	100	0,10	1,7	245	B41851A9107M00*
	220	12,5 × 25	220	0,10	0,75	434	B41851A9227M00*
	330	16 × 25	330	0,10	0,50	560	B41851A9337M00*
	470	16 × 31,5	470	0,10	0,35	630	B41851A9477M00*
	1 000	20 × 40	1 000	0,10	0,17	910	B41851A9108M00*

Preferred types

1) * = "0" for bulk version. For taping versions, other lead configurations and packing information see page 503.


Technical data and ordering codes

U_R	C_R	Case dimensions	$I_{L, \max}$	$\tan \delta_{\max}$	ESR_{\max}	$I_{\sim R}$	Ordering code ¹⁾
VDC	120 Hz 20 °C μF	$d \times l$ mm	5 min 20 °C μA	120 Hz 20 °C	120 Hz 20 °C Ω	120 Hz 105 °C mA	

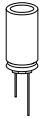
B43851

160	0,47	6,3 × 11	17	0,20	705	9,8	B43851A1474M00*	
	1,0	6,3 × 11	20	0,20	332	15	B43851A1105M00*	
	2,2	6,3 × 11	26	0,20	151	28	B43851A1225M00*	
	3,3	6,3 × 11	31	0,20	100	32	B43851A1335M00*	
	4,7	8 × 11	38	0,20	71	39	B43851A1475M00*	
	10	10 × 12,5	63	0,20	33	60	B43851A1106M00*	
	22	10 × 16	121	0,20	15	91	B43851A1226M00*	
	33	10 × 20	173	0,20	10	123	B43851A1336M00*	
	47	12,5 × 25	241	0,20	7,1	182	B43851A1476M00*	
	100	16 × 25	495	0,20	3,3	287	B43851A1107M00*	
	220	18 × 31,5	1 071	0,20	1,5	462	B43851A1227M00*	
200	330	20 × 30	1 599	0,20	1,0	525	B43851A1337M00*	
	470	22 × 35	2 271	0,20	0,71	700	B43851A1477M00*	
	200	0,47	6,3 × 11	18	0,20	705	9	B43851A2474M00*
		1,0	6,3 × 11	21	0,20	332	15	B43851A2105M00*
		2,2	6,3 × 11	28	0,20	151	28	B43851A2225M00*
		3,3	6,3 × 11	35	0,20	100	32	B43851A2335M00*
		4,7	8 × 11	43	0,20	71	39	B43851A2475M00*
		10	10 × 12,5	75	0,20	33	56	B43851B2106M00*
		22	10 × 20	147	0,20	15	98	B43851A2226M00*
		33	10 × 20	213	0,20	10	109	B43851B2336M00*
		47	12,5 × 25	297	0,20	7,1	175	B43851A2476M00*
100		16 × 25	615	0,20	3,3	287	B43851A2107M00*	
220		18 × 35	1 335	0,20	1,5	700	B43851A2227M00*	
330	22 × 35	1 995	0,20	1,0	840	B43851A2337M00*		

Preferred types

1) * = "0" for bulk version.

For taping versions, other lead configurations and packing information see page 503.


B41851 / B43851
Standard Series – 105 °C
Technical data and ordering codes

U_R	C_R 120 Hz 20 °C μF	Case dimensions $d \times l$ mm	$I_{L, \max}$ 5 min 20 °C μA	$\tan \delta_{\max}$ 120 Hz 20 °C	ESR_{\max} 120 Hz 20 °C Ω	I_{-R} 120 Hz 105 °C mA	Ordering code ¹⁾
250	0,47	6,3 × 11	19	0,20	705	8	B43851F2474M00*
	1,0	6,3 × 11	23	0,20	332	15	B43851F2105M00*
	2,2	6,3 × 11	32	0,20	151	32	B43851F2225M00*
	3,3	8 × 11	40	0,20	100	35	B43851F2335M00*
	4,7	10 × 12,5	50	0,20	71	49	B43851F2475M00*
	10	10 × 16	90	0,20	33	63	B43851F2106M00*
	22	10 × 20	180	0,20	15	102	B43851F2226M00*
	33	12,5 × 25	263	0,20	10	151	B43851F2336M00*
	47	16 × 20	368	0,20	7,1	210	B43851F2476M00*
	100	18 × 35	765	0,20	3,3	490	B43851F2107M00*
220	18 × 40	1 665	0,20	1,5	700	B43851F2227M00*	
330	22 × 40	2 490	0,20	1,0	840	B43851F2337M00*	
350	0,47	6,3 × 11	20	0,20	705	8	B43851A4474M00*
	1,0	6,3 × 11	26	0,20	332	15	B43851A4105M00*
	2,2	8 × 11	38	0,20	151	21	B43851A4225M00*
	3,3	10 × 12,5	50	0,20	100	32	B43851A4335M00*
	4,7	10 × 12,5	64	0,20	71	39	B43851A4475M00*
	10	10 × 20	120	0,20	33	67	B43851A4106M00*
	22	12,5 × 25	246	0,20	15	123	B43851A4226M00*
	33	16 × 25	362	0,20	10	168	B43851A4336M00*
	47	16 × 31,5	509	0,20	7,1	224	B43851A4476M00*
	100	20 × 30	1 065	0,20	3,3	420	B43851A4107M00*
400	2,2	10 × 12,5	41	0,20	151	28	B43851A9225M00*
	3,3	10 × 12,5	55	0,20	100	32	B43851A9335M00*
	4,7	10 × 16	71	0,20	71	42	B43851A9475M00*
	10	10 × 20	135	0,20	33	67	B43851A9106M00*
	22	16 × 20	279	0,20	15	126	B43851A9226M00*
	33	16 × 25	411	0,20	10	168	B43851A9336M00*
	47	16 × 31,5	579	0,20	7,1	217	B43851A9476M00*
	100	20 × 35	1 215	0,20	3,3	420	B43851A9107M00*

Preferred types

1) * = "0" for bulk version.

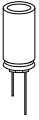
For taping versions, other lead configurations and packing information see page 503.


Technical data and ordering codes

U_R	C_R	Case dimensions	$I_{L, \max}$	$\tan \delta_{\max}$	ESR_{\max}	$I_{\sim R}$	Ordering code ¹⁾
VDC	120 Hz 20 °C μF	$d \times l$ mm	5 min 20 °C μA	120 Hz 20 °C	120 Hz 20 °C Ω	120 Hz 105 °C mA	
450	2,2	10 × 12,5	45	0,20	151	20	B43851A5225M00*
	3,3	10 × 16	60	0,20	100	31	B43851A5335M00*
	4,7	10 × 20	78	0,20	71	35	B43851A5475M00*
	10	12,5 × 25	150	0,20	33	63	B43851A5106M00*
	22	16 × 25	312	0,20	15	116	B43851A5226M00*
	33	16 × 31,5	460	0,20	10	154	B43851A5336M00*
	47	18 × 31,5	650	0,20	7,1	186	B43851A5476M00*
	100	20 × 40	1 365	0,20	3,3	420	B43851A5107M00*

1) * = "0" for bulk version.

For taping versions, other lead configurations and packing information see page 503.



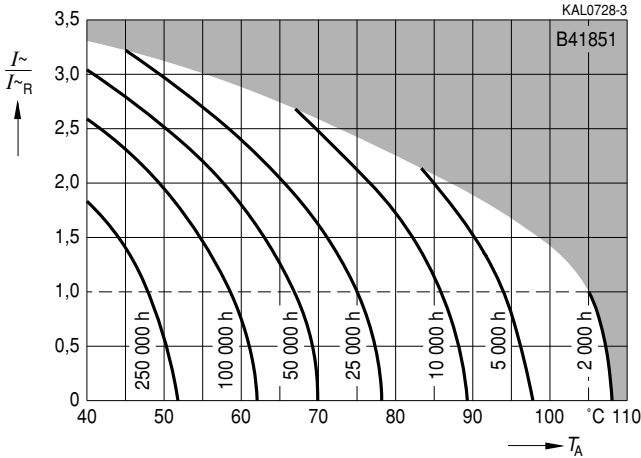
B41851 / B43851

Standard Series – 105 °C

Useful life

depending on ambient temperature T_A under ripple current operating conditions¹⁾

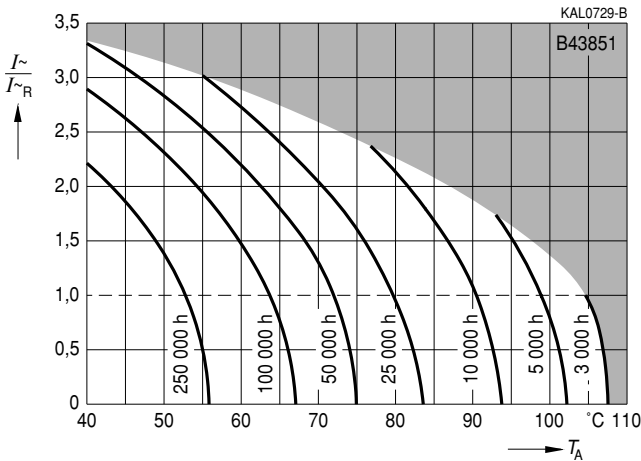
$U_R = 6,3 \dots 100 \text{ VDC}$



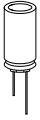
Useful life

depending on ambient temperature T_A under ripple current operating conditions¹⁾

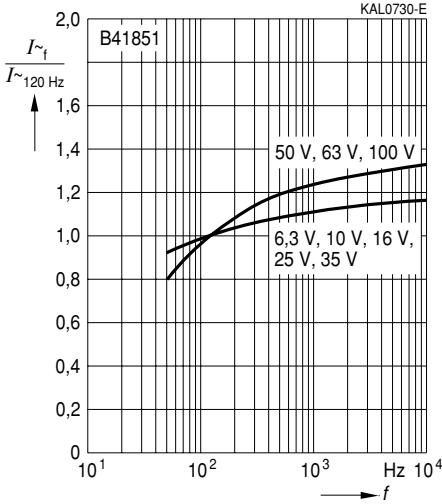
$U_R = 160 \dots 450 \text{ VDC}$



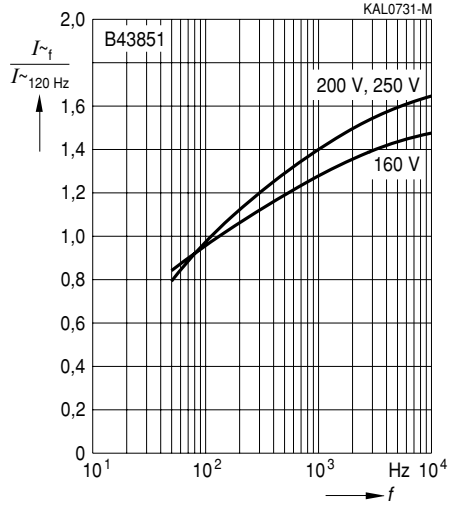
1) Refer to page 40 for an explanation on how to interpret the useful life graphs.



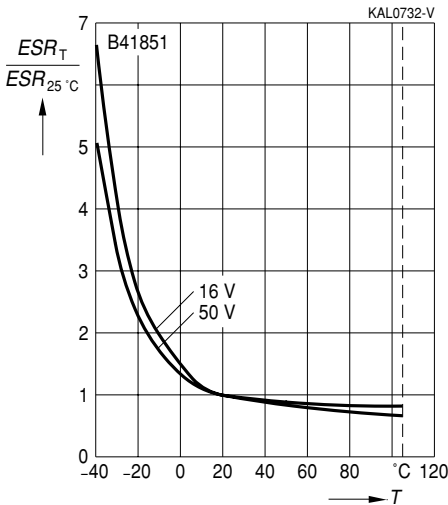
Frequency factor of permissible ripple current I_{\sim} versus frequency f
 $U_R \leq 100$ VDC



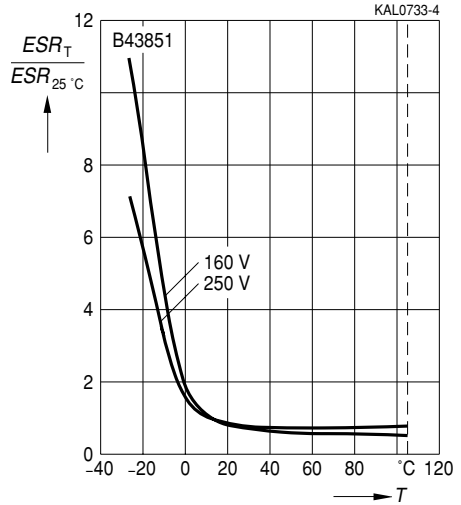
Frequency factor of permissible ripple current I_{\sim} versus frequency f
 $U_R \geq 160$ VDC

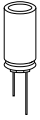


Equivalent series resistance ESR at $f = 120$ Hz versus temperature T
 Typical behavior
 $U_R \leq 100$ VDC



Equivalent series resistance ESR at $f = 120$ Hz versus temperature T
 Typical behavior
 $U_R \geq 160$ VDC

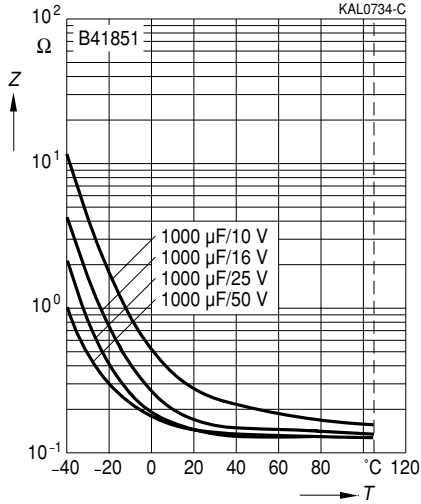




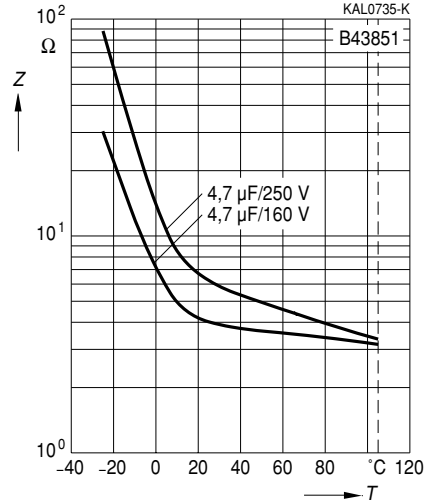
B41851 / B43851

Standard Series – 105 °C

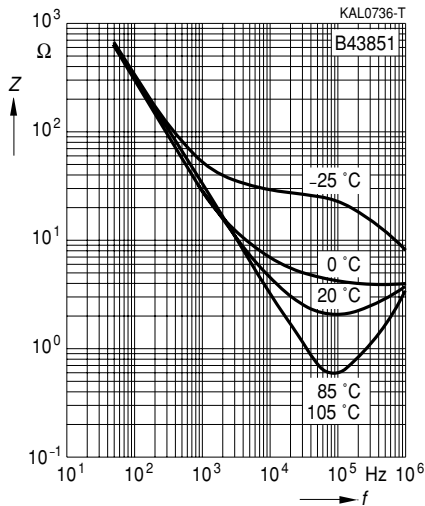
Impedance Z at $f = 10$ kHz
 versus temperature T
 Typical behavior
 $U_R \leq 100$ VDC



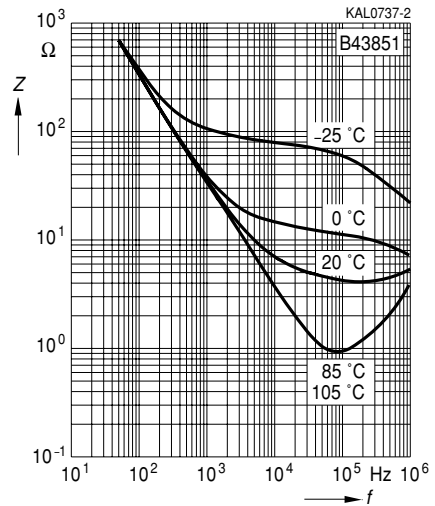
Impedance Z at $f = 10$ kHz
 versus temperature T
 Typical behavior
 $U_R \geq 160$ VDC



Impedance Z
 versus frequency f and temperature T
 for 4,7 μF/160 VDC
 Typical behavior



Impedance Z
 versus frequency f and temperature T
 for 10 μF/160 VDC
 Typical behavior

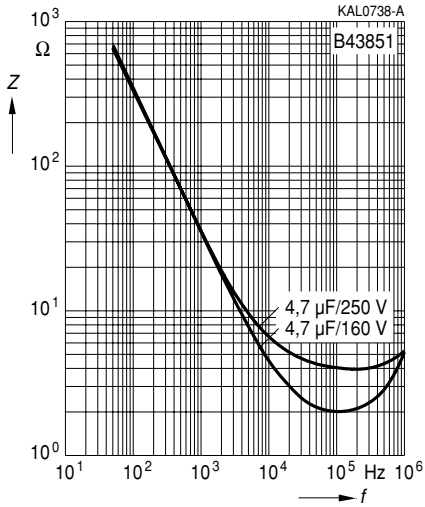




Impedance Z

versus frequency f

Typical behavior at 20 °C



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Unternehmenskommunikation, Postfach 80 17 09, 81617 München, DEUTSCHLAND

☎ ++49 89 636 09, FAX (0 89) 636-2 26 89

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