Aluminum Capacitors
Axial Standard Range

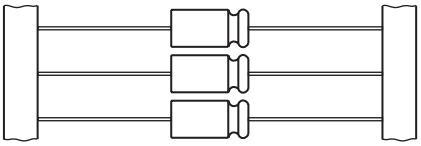
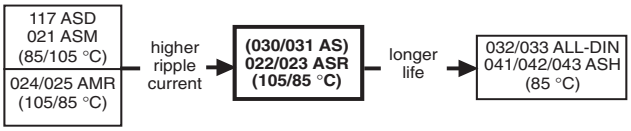


Fig.1 Component outlines



FEATURES

- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Axial leads, cylindrical aluminum case, insulated with a blue sleeve
- Mounting ring version available
- Taped versions up to case ∅ 16 × 30 mm available for automatic insertion
- High ripple current
- Lead (Pb)-free versions are RoHS compliant

Pb-free Available

RoHS* COMPLIANT

APPLICATIONS

- General purpose, industrial, automotive, audio-video
- Smoothing, filtering, buffering and timing
- Low mounting height boards, vibration and shock resistant

MARKING

The capacitors are marked (where possible) with the following information:

- Rated capacitance (in µF)
- Tolerance on rated capacitance, code letter in accordance with IEC 60062 (T for - 10/+ 50 %)
- Rated voltage (in V)
- Category temperature range
- Date code in accordance with IEC 60062
- Name of manufacturer
- Band to indicate the negative terminal
- '+' sign to identify the positive terminal
- Series number (022/023)
- Country of origin

QUICK REFERENCE DATA		
DESCRIPTION	VALUE	
	022	023
Nominal case sizes (∅ D × L in mm)	12 × 25 to 30 × 50	
Rated capacitance range, C_R	100 to 33000 µF	10 to 680 µF
Tolerance on C_R	- 10/+ 50 %	
Rated voltage range, U_R	6.3 to 100 V	160 to 500 V
Category temperature range	- 40 to + 105 °C	- 40 to + 85 °C
Endurance test at upper category temperature	1000 hours	2000 hours
Useful life at 105 °C	2000 hours	-
Useful life at 85 °C	6000 hours	5000 hours
Useful life at 40 °C, 1.4 × I_R applied	160000 hours	150000 hours
Shelf life at 0 V	100 hours/ 105 °C	100 hours/85 °C
Based on sectional specification	IEC 60384-4/EN130300	
Climatic category IEC 60068	40/105/56	40/085/56

SELECTION CHART FOR C_R, U_R AND RELEVANT NOMINAL CASE SIZES FOR 022 SERIES (Ø D x L in mm)

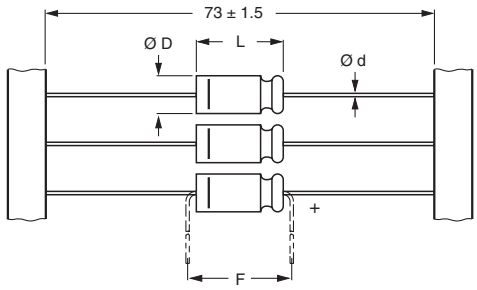
C_R (µF)	U_R (V)							
	6.3	10	16	25	40	50	63	100
100	-	-	-	-	-	-	-	12 × 25
150	-	-	-	-	-	-	-	12 × 25
220	-	for smaller capacitance values, see series 030/031 AS			-	-	12 × 25	16 × 30
330	-				-	12 × 25	12 × 30	16 × 40
470	-	-	-	-	12 × 25	12 × 30	16 × 30	18 × 40
680	-	-	-	12 × 25	12 × 30	16 × 30	16 × 40	21 × 40
1000	-	-	-	12 × 30	16 × 30	16 × 40	18 × 40	25 × 40
1500	-	12 × 25	12 × 30	16 × 30	16 × 40	18 × 40	21 × 40	25 × 50

* Pb containing terminations are not RoHS compliant, exemptions may apply

SELECTION CHART FOR C_R, U_R AND RELEVANT NOMINAL CASE SIZES FOR 022 SERIES (Ø D x L in mm)								
C_R (µF)	**U_R (V)**							
	6.3	**10**	**16**	**25**	**40**	**50**	**63**	**100**
2200	12 × 25	12 × 30	16 × 30	16 × 40	18 × 40	21 × 40	25 × 40	30 × 50
3300	12 × 30	16 × 40	16 × 40	18 × 40	21 × 40	25 × 40	25 × 50	-
	-	-	-	-	-	-	30 × 45	-
4700	16 × 40	16 × 40	18 × 40	21 × 40	25 × 40	25 × 50	30 × 50	-
6800	18 × 40	-	21 × 40	25 × 40	25 × 50	30 × 50	-	-
10000	21 × 40	25 × 40	25 × 40	25 × 50	30 × 50	-	-	-
	-	-	-	30 × 40	-	-	-	-
15000	25 × 40	25 × 45	30 × 40	30 × 50	-	-	-	-
22000	25 × 50	30 × 45	30 × 50	-	-	-	-	-
33000	30 × 50	-	-	-	-	-	-	-

SELECTION CHART FOR C_R, U_R AND RELEVANT NOMINAL CASE SIZES FOR 023 SERIES (Ø D x L in mm)							
C_R (µF)	**U_R (V)**						
	160	**250**	**350**	**385**	**400**	**450**	**500**
10	-	-	-	12 × 25	-	12 × 25	12 × 30
15	-	-	-	12 × 25	12 × 25	12 × 30	16 × 30
22	-	12 × 25	-	12 × 30	16 × 30	16 × 30	16 × 40
33	-	12 × 25	-	16 × 30	16 × 30	18 × 30	18 × 40
47	12 × 25	16 × 30	18 × 30	16 × 40	16 × 40	18 × 40	21 × 40
68	12 × 30	18 × 30	-	18 × 40	18 × 40	21 × 40	25 × 40
100	18 × 30	18 × 40	21 × 40	21 × 40	21 × 40	25 × 40	25 × 45
150	18 × 40	21 × 40	25 × 40	25 × 40	25 × 40	30 × 40	30 × 45
220	21 × 40	25 × 40	30 × 40	30 × 40	30 × 40	30 × 50	-
330	25 × 40	25 × 50	30 × 50	-	-	-	-
470	25 × 45	30 × 45	-	-	-	-	-
680	30 × 45	-	-	-	-	-	-

DIMENSIONS in millimeters **AND AVAILABLE FORMS**

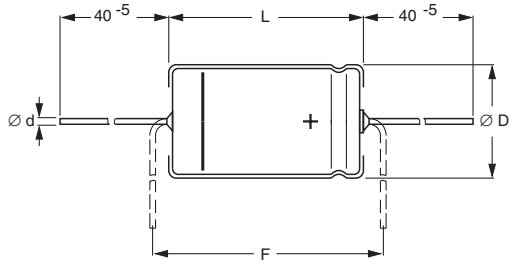


Form BR: Taped on reel

Form BA: Taped in box (ammopack)

Case ∅ D × L = 12 × 25 to 16 × 30 mm

Fig. 2 **Forms BA and BR**



Form AA: Axial in box

Case ∅ D × L = 12 × 25 to 30 × 50 mm

Fig. 3 **Form AA**

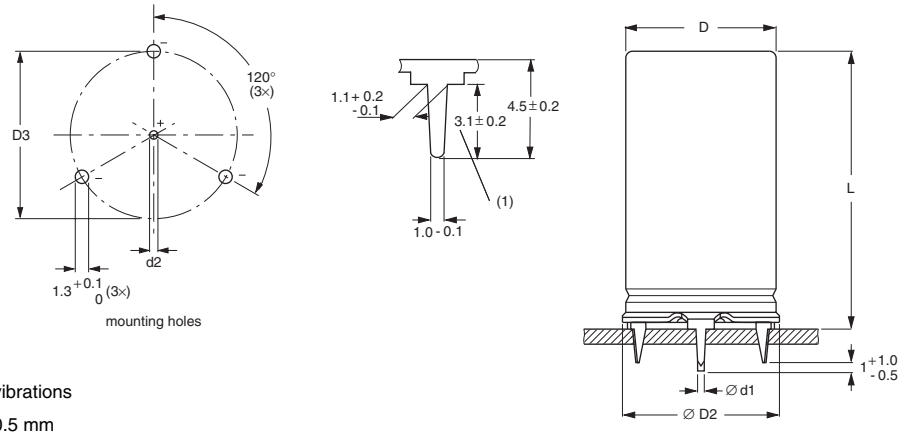
Table 1

AXIAL; DIMENSIONS in millimeters, **MASS AND PACKAGING QUANTITIES**								
NOMINAL CASE SIZE ∅ D × L	**AXIAL: FORM AA, BA, and BR**				**MASS (g)**	**PACKAGING QUANTITIES**		
	∅ d	**∅ D_{max}**	**L_{max}**	**F_{min}**		**FORM AA**	**FORM BA**	**FORM BR**
12 × 25	0.8	12.5	26.5	30	≈ 4	800	700	450
12 × 30	0.8	12.5	31.5	35	≈ 6	800	700	450
16 × 30	0.8	16.5	30.0	35	≈ 8	150	400	250
16 × 40	0.8	16.5	40.0	45	≈ 11	150	-	-
18 × 30	0.8	18.5	30.5	35	≈ 10	125	-	-
18 × 40	0.8	18.5	40.5	45	≈ 15	125	-	-
21 × 40	0.8	21.5	41.0	45	≈ 21	100	-	-
25 × 40	0.8	25.5	41.0	45	≈ 31	90	-	-
25 × 45	0.8	25.5	47.0	51	≈ 38	90	-	-
25 × 50	0.8	25.5	51.0	55	≈ 44	90	-	-
30 × 40	1.0	30.5	41.0	45	≈ 46	78	-	-
30 × 45	1.0	30.5	47.0	51	≈ 54	78	-	-
30 × 50	1.0	30.5	51.0	55	≈ 64	78	-	-

Note

1. Detailed tape dimensions see section ‘PACKAGING’.

Fig. 4 Mounting hole diagram and outline; **Form MR;** mounting ring and pins.



Form MR: case ∅ D × L = 16 × 30 to 30 × 50 mm
Case not insulated (insulation on request)
Especially for applications with severe shocks and vibrations

For MR versions with ∅ 18 mm, pin length is 4.5 ± 0.5 mm

Table 2

MOUNTING RING; DIMENSIONS in millimeters, **MASS AND PACKAGING QUANTITIES**							
NOMINAL CASE SIZE ∅ D × L	**MOUNTING RING: FORM MR**					**MASS (g)**	**PACKAGING QUANTITIES**
	∅ d1	**∅ d2**	**∅ $D2_{max}$**	**D3**	**L_{max}**		
16 × 30	1.0	1.2 + 0.4	17.2	16.5 ± 0.2	32	≈ 12	504
16 × 40	1.0	1.2 + 0.4	17.2	16.5 ± 0.2	42	≈ 13	336
18 × 30(1)	1.0	1.2 + 0.4	19.2	18.5 ± 0.2	32	≈ 13	429
18 × 40(1)	1.0	1.2 + 0.4	19.2	18.5 ± 0.2	42	≈ 19	286
21 × 40	1.0	1.2 + 0.4	22.2	21.5 ± 0.2	42	≈ 24	220
25 × 40	1.0	1.2 + 0.4	26.2	25.5 ± 0.2	42	≈ 28	144
25 × 45	1.0	1.2 + 0.4	26.2	25.5 ± 0.2	48	≈ 33	144
25 × 50	1.0	1.2 + 0.4	26.2	25.5 ± 0.2	53	≈ 40	144
30 × 40	1.0	1.2 + 0.4	31.2	30.5 ± 0.2	42	≈ 42	112
30 × 45	1.0	1.2 + 0.4	31.2	30.5 ± 0.2	48	≈ 46	112
30 × 50	1.0	1.2 + 0.4	31.2	30.5 ± 0.2	53	≈ 50	112

Note

1. For MR versions with ∅ 18 mm, pin length is 4.5 ± 0.5 mm; see Fig. 4

ELECTRICAL DATA	
SYMBOL	**DESCRIPTION**
C_R	rated capacitance at 100 Hz, tolerance - 10/+ 50 %
I_R	rated RMS ripple current at 100 Hz, 105 °C, 6.3 to 100 V; 85 °C, 160 to 500 V
I_{L5}	max. leakage current after 5 minutes at U_R
Tan δ	max. dissipation factor at 100 Hz
ESR	max. equivalent series resistance at 100 Hz
Z	max. impedance at 10 kHz

Note

1. Unless otherwise specified, all electrical values in Tables 3 and 4 apply at T_{amb} = 20 °C, P = 86 to 106 kPa, RH = 45 to 75 %

ORDERING EXAMPLE*

Electrolytic capacitor 022/023 series

1000 µF/25 V; - 10/+ 50 %

Nominal case size: ∅ 12 × 30 mm; Form AA

Catalog number: 2222 022 16102

* Note: To ensure delivery of lead (Pb)-free parts during the transition period, please contact your Vishay sales agent.

Table 3

ELECTRICAL DATA AND ORDERING INFORMATION FOR 022 SERIES

U_R (V)	C_R 100 Hz (µF)	NOMINAL CASE SIZE ∅ D × L (mm)	I_R 100 Hz 85 °C (mA)	I_{L5} 5 min (µA)	Tan∆ 100 Hz	ESR 100 Hz (Ω)	Z 10 kHz (W)	CATALOG NUMBER 2222 022 ..... AXIAL LOOSE IN BOX FORM AA	AXIAL TAPED ON REEL FORM BR	AXIAL TAPED IN BOX FORM BA	MOUNTING RING FORM MR
6.3	2200	12 × 25	1.0	24	0.24	0.200	0.100	13222	23222	33222	-
	3300	12 × 30	1.6	34	0.26	0.150	0.070	13332	23332	33332	-
	4700	16 × 40	1.8	47	0.28	0.110	0.050	13472	-	-	43472
	6800	18 × 40	2.1	67	0.30	0.066	< 0.050	13682	-	-	43682
	10000	21 × 40	2.4	98	0.34	0.055	< 0.050	13103	-	-	43103
	15000	25 × 40	2.5	145	0.45	0.050	< 0.050	13153	-	-	43153
	22000	25 × 50	3.0	211	0.50	< 0.050	< 0.050	13223	-	-	43223
	33000	30 × 50	3.0	315	0.80	< 0.050	< 0.050	13333	-	-	43333
10	1500	12 × 25	1.0	26	0.21	0.220	0.110	14152	24152	34152	-
	2200	12 × 30	1.3	36	0.22	0.160	0.080	14222	24222	34222	-
	3300	16 × 40	1.9	53	0.25	0.120	0.050	14332	-	-	44332
	4700	16 × 40	2.2	74	0.26	0.090	< 0.050	14472	-	-	44472
	10000	25 × 40	2.7	153	0.36	0.060	< 0.050	14103	-	-	44103
	15000	25 × 45	2.9	228	0.48	0.050	< 0.050	14153	-	-	44153
	22000	30 × 45	2.9	333	0.62	< 0.050	< 0.050	14223	-	-	44223
16	1500	12 × 30	1.2	39	0.17	0.180	0.090	15152	25152	35152	-
	2200	16 × 30	1.6	56	0.18	0.130	0.060	15222	25222	35222	45222
	3300	16 × 40	2.1	82	0.21	0.100	< 0.050	15332	-	-	45332
	4700	18 × 40	2.4	116	0.24	0.080	< 0.050	15472	-	-	45472
	6800	21 × 40	2.5	166	0.28	0.070	< 0.050	15682	-	-	45682
	10000	25 × 40	2.6	243	0.34	0.050	< 0.050	15103	-	-	45103
	15000	30 × 40	2.5	363	0.44	< 0.050	< 0.050	15153	-	-	45153
	22000	30 × 50	3.0	531	0.58	< 0.050	< 0.050	15223	-	-	45223
25	680	12 × 25	0.87	29	0.14	0.320	0.130	16681	26681	36681	-
	1000	12 × 30	1.1	41	0.14	0.220	0.090	16102	26102	36102	-
	1500	16 × 30	1.5	59	0.15	0.160	0.060	16152	26152	36152	46152
	2200	16 × 40	1.9	86	0.16	0.120	< 0.050	16222	-	-	46222
	3300	18 × 40	2.2	127	0.19	0.090	< 0.050	16332	-	-	46332
	4700	21 × 40	2.4	179	0.21	0.070	< 0.050	16472	-	-	46472
	6800	25 × 40	2.5	258	0.26	0.060	< 0.050	16682	-	-	46682
	10000	25 × 40	2.9	378	0.32	0.050	< 0.050	16103	-	-	46103
	10000	30 × 40	2.8	378	0.32	0.050	< 0.050	90001	-	-	90005
	15000	30 × 50	3.0	566	0.36	< 0.050	< 0.050	16153	-	-	46153

ELECTRICAL DATA AND ORDERING INFORMATION FOR 022 SERIES

U_R (V)	C_R 100 Hz (µF)	NOMINAL CASE SIZE ∅ D × L (mm)	I_R 100 Hz 85 °C (mA)	I_{L5} 5 min (µA)	Tanδ 100 Hz	ESR 100 Hz (Ω)	Z 10 kHz (W)	CATALOG NUMBER 2222 022			
								AXIAL LOOSE IN BOX FORM AA	AXIAL TAPED ON REEL FORM BR	AXIAL TAPED IN BOX FORM BA	MOUNTING RING FORM MR
40	470	12 × 25	0.75	31	0.10	0.410	0.150	17471	27471	37471	-
	680	12 × 30	0.94	44	0.10	0.280	0.120	17681	27681	37681	-
	1000	16 × 30	1.3	63	0.10	0.190	0.080	17102	27102	37102	47102
	1500	16 × 40	1.6	93	0.13	0.140	0.060	17152	-	-	47152
	2200	18 × 40	2.0	135	0.14	0.100	< 0.050	17222	-	-	47222
	3300	21 × 40	2.2	201	0.17	0.080	< 0.050	17332	-	-	47332
	4700	25 × 40	2.4	285	0.18	0.070	< 0.050	17472	-	-	47472
	6800	25 × 50	2.8	411	0.24	0.060	< 0.050	17682	-	-	47682
	10000	30 × 50	2.9	603	0.32	< 0.050	< 0.050	17103	-	-	47103
50	330	12 × 25	0.63	28	0.10	0.480	0.200	11331	21331	31331	-
	470	12 × 30	0.78	38	0.10	0.340	0.140	11471	21471	31471	-
	680	16 × 30	1.1	54	0.10	0.240	0.100	11681	21681	31681	41681
	1000	16 × 40	1.4	78	0.10	0.160	0.070	11102	-	-	41102
	1500	18 × 40	1.7	116	0.11	0.120	0.050	11152	-	-	41152
	2200	21 × 40	2.1	168	0.12	0.090	< 0.050	11222	-	-	41222
	3300	25 × 40	2.3	251	0.15	0.070	< 0.050	11332	-	-	41332
	4700	25 × 50	2.8	356	0.18	0.060	< 0.050	11472	-	-	41472
	6800	30 × 50	3.0	513	0.22	0.050	< 0.050	11682	-	-	41682
63	220	12 × 25	0.52	24	0.08	0.580	0.250	18221	28221	38221	-
	330	12 × 30	0.67	34	0.08	0.380	0.170	18331	28331	38331	-
	470	16 × 30	0.92	47	0.08	0.270	0.120	18471	28471	38471	48471
	680	16 × 40	1.2	67	0.08	0.200	0.090	18681	-	-	48681
	1000	18 × 40	1.5	98	0.08	0.130	0.060	18102	-	-	48102
	1500	21 × 40	1.9	145	0.09	0.100	0.050	18152	-	-	48152
	2200	25 × 40	2.2	211	0.10	0.070	< 0.050	18222	-	-	48222
	3300	25 × 50	2.6	315	0.13	0.060	< 0.050	18332	-	-	48332
	3300	30 × 45	2.6	315	0.13	0.060	< 0.050	90004	-	-	90008
	4700	30 × 50	2.8	447	0.15	0.050	< 0.050	18472	-	-	48472
100	100	12 × 25	0.31	18	0.07	1.110	0.500	19101	29101	39101	-
	150	12 × 25	0.37	26	0.07	0.740	0.330	19151	29151	39151	-
	220	16 × 30	0.54	36	0.07	0.510	0.200	19221	29221	39221	49221
	330	16 × 40	0.70	53	0.07	0.340	0.130	19331	-	-	49331
	470	18 × 40	0.90	74	0.07	0.240	0.090	19471	-	-	49471
	680	21 × 40	1.2	105	0.07	0.160	0.070	19681	-	-	49681
	1000	25 × 40	1.5	153	0.07	0.110	0.050	19102	-	-	49102
	1500	25 × 50	1.9	228	0.08	0.090	< 0.050	19152	-	-	49152
	2200	30 × 50	2.3	333	0.10	0.070	< 0.050	19222	-	-	49222

Table 4

ELECTRICAL DATA AND ORDERING INFORMATION FOR 023 SERIES

U_R (V)	C_R 100 Hz (µF)	NOMINAL CASE SIZE ∅ D × L (mm)	I_R 100 Hz 85 °C (mA)	I_{L5} 5 min (µA)	Tanδ 100 Hz	ESR 100 Hz (Ω)	Z 10 kHZ (W)	CATALOG NUMBER 2222 023			
								AXIAL LOOSE IN BOX FORM AA	AXIAL TAPED ON REEL FORM BR	AXIAL TAPED IN BOX FORM BA	MOUNTING RING FORM MR
160	47	12 × 25	0.29	123	0.07	2.37	0.730	11479	21479	31479	-
	68	12 × 30	0.37	173	0.07	1.64	0.505	11689	21689	31689	-
	100	18 × 30	0.56	250	0.07	1.12	0.350	11101	-	-	41101
	150	18 × 40	0.73	370	0.07	0.745	0.235	11151	-	-	41151
	220	21 × 40	0.97	538	0.07	0.505	0.165	11221	-	-	41221
	330	25 × 40	1.9	802	0.07	0.340	0.115	11331	-	-	41331
	470	25 × 45	1.6	1138	0.07	0.235	0.085	11471	-	-	41471
	680	30 × 45	2.0	1642	0.07	0.165	0.065	11681	-	-	41681
250	22	12 × 25	0.20	93	0.07	5.07	1.84	13229	23229	33229	-
	33	12 × 25	0.26	134	0.07	3.38	1.23	13339	23339	33339	-
	47	16 × 30	0.38	186	0.07	2.37	0.865	13479	23479	33479	43479
	68	18 × 30	0.49	265	0.07	1.64	0.600	13689	-	-	43689
	100	18 × 40	0.63	385	0.07	1.12	0.410	13101	-	-	43101
	150	21 × 40	0.86	573	0.07	0.745	0.280	13151	-	-	43151
	220	25 × 40	1.1	835	0.07	0.505	0.195	13221	-	-	43221
	330	25 × 50	1.5	1248	0.07	0.340	0.135	13331	-	-	43331
	470	30 × 45	1.8	1773	0.07	0.235	0.105	13471	-	-	43471
350	47	18 × 30	0.41	257	0.09	2.67	1.62	15479	-	-	45479
	100	21 × 40	0.69	535	0.09	1.26	0.765	15101	-	-	45101
	150	25 × 40	0.95	798	0.09	0.855	0.520	15151	-	-	45151
	220	30 × 40	1.26	1165	0.09	0.595	0.370	15221	-	-	45221
	330	30 × 50	1.61	1743	0.09	0.400	0.250	15331	-	-	45331
385	10	12 × 25	0.13	68	0.10	16	6.85	18109	28109	38109	-
	15	12 × 25	0.16	97	0.10	11	4.57	18159	28159	38159	-
	22	12 × 30	0.21	137	0.10	7.24	3.12	18229	28229	38229	-
	33	16 × 30	0.31	201	0.10	4.83	2.09	18339	28339	38339	48339
	47	16 × 40	0.39	281	0.10	3.39	1.73	18479	-	-	48479
	68	18 × 40	0.52	403	0.10	2.34	1.02	18689	-	-	48689
	100	21 × 40	0.70	588	0.10	1.59	0.825	18101	-	-	48101
	150	25 × 40	0.96	876	0.10	1.06	0.520	18151	-	-	48151
	220	30 × 40	1.26	1281	0.10	0.725	0.340	18221	-	-	48221
400	15	12 × 25	0.18	100	0.06	5.64	3.130	16159	26159	36159	-
	22	16 × 30	0.28	142	0.06	3.74	2.080	16229	26229	36229	-
	33	16 × 30	0.35	208	0.06	2.505	1.390	16339	26339	36339	46339
	47	16 × 40	0.45	292	0.06	1.755	0.975	16479	-	-	46479
	68	18 × 40	0.59	418	0.06	1.220	0.680	16689	-	-	46689
	100	21 × 40	0.78	610	0.06	1.840	0.470	16101	-	-	46101
	150	25 × 40	1.00	910	0.06	1.575	0.325	16151	-	-	46151
	220	30 × 40	1.40	1330	0.07	0.410	0.235	16221	-	-	46221
450	10	12 × 25	0.13	78	0.15	24	6.21	17109	27109	37109	-
	15	12 × 30	0.17	111	0.15	16	4.14	17159	27159	37159	-
	22	16 × 30	0.24	159	0.15	11	2.83	17229	27229	37229	47229
	33	18 × 30	0.33	233	0.15	7.24	1.89	17339	-	-	47339
	47	18 × 40	0.42	327	0.15	5.08	1.33	17479	-	-	47479
	68	21 × 40	0.56	469	0.15	3.52	0.920	17689	-	-	47689
	100	25 × 40	0.76	685	0.15	2.39	0.635	17101	-	-	47101
	150	30 × 40	1.03	1023	0.15	1.59	0.435	17151	-	-	47151
	220	30 × 50	1.31	1495	0.15	1.09	0.300	17221	-	-	47221

ELECTRICAL DATA AND ORDERING INFORMATION FOR 023 SERIES

U_R (V)	C_R 100 Hz (µF)	NOMINAL CASE SIZE ∅ D × L (mm)	I_R 100 Hz 85 °C (mA)	I_{L5} 5 min (µA)	Tanδ 100 Hz	ESR 100 Hz (Ω)	Z 10 kHZ (W)	CATALOG NUMBER 2222 023 ..... AXIAL LOOSE IN BOX FORM AA	AXIAL TAPED ON REEL FORM BR	AXIAL TAPED IN BOX FORM BA	MOUNTING RING FORM MR
500	10	12 × 30	0.15	85	0.08	10.845	6.650	19109	29109	39109	-
	15	16 × 30	0.23	123	0.08	7.035	4.315	19159	29159	39159	49159
	22	16 × 40	0.30	175	0.08	4.795	2.945	19229	-	-	49229
	33	18 × 40	0.40	258	0.08	3.205	1.965	19339	-	-	49339
	47	21 × 40	0.52	362	0.08	2.255	1.385	19479	-	-	49479
	68	25 × 40	0.70	520	0.08	1.570	0.970	19689	-	-	49689
	100	25 × 45	0.88	760	0.08	1.075	0.665	19101	-	-	49101
	150	30 × 45	1.20	1135	0.08	0.730	0.455	19151	-	-	49151

ADDITIONAL ELECTRICAL DATA

PARAMETER	CONDITIONS	VALUE
Voltage		
Surge voltage	≤ 100 V versions	$U_s \leq 1.15 \times U_R$
	≥ 160 V versions	$U_s \leq 1.10 \times U_R$
Reverse voltage		$U_{rev} \leq 1$ V
Current		
Leakage current	after 5 minutes at U_R:	
	$U_R \leq 100$ V	$I_{L5} \leq 0.0015\ C_R \times U_R + 3$ µA
	$U_R > 100$ V	$I_{L5} \leq 0.0150\ C_R \times U_R + 10$ µA
Inductance		
Equivalent series inductance (ESL)	case ∅ D × L mm:	
	12 × 25	typ. 10 nH
	12 × 30	typ. 22 nH
	16 × 30	typ. 85 nH
	16 × 40	typ. 25 nH
	18 × 30	typ. 40 nH
	18 × 40	typ. 61 nH
	21 × 40	typ. 38 nH
	25 × 40	typ. 38 nH
	25 × 45	typ. 46 nH
	25 × 50	typ. 48 nH
	30 × 40	typ. 50 nH
	30 × 45	typ. 54 nH
	30 × 50	typ. 59 nH

LOW TEMPERATURE BEHAVIOUR

Table 5 is for the calculation of the maximum 10 kHz impedance at low temperatures: $Z\ (10\ \text{kHz})\ [\Omega] = \frac{\text{tabular value}}{C_R[\mu F]}$

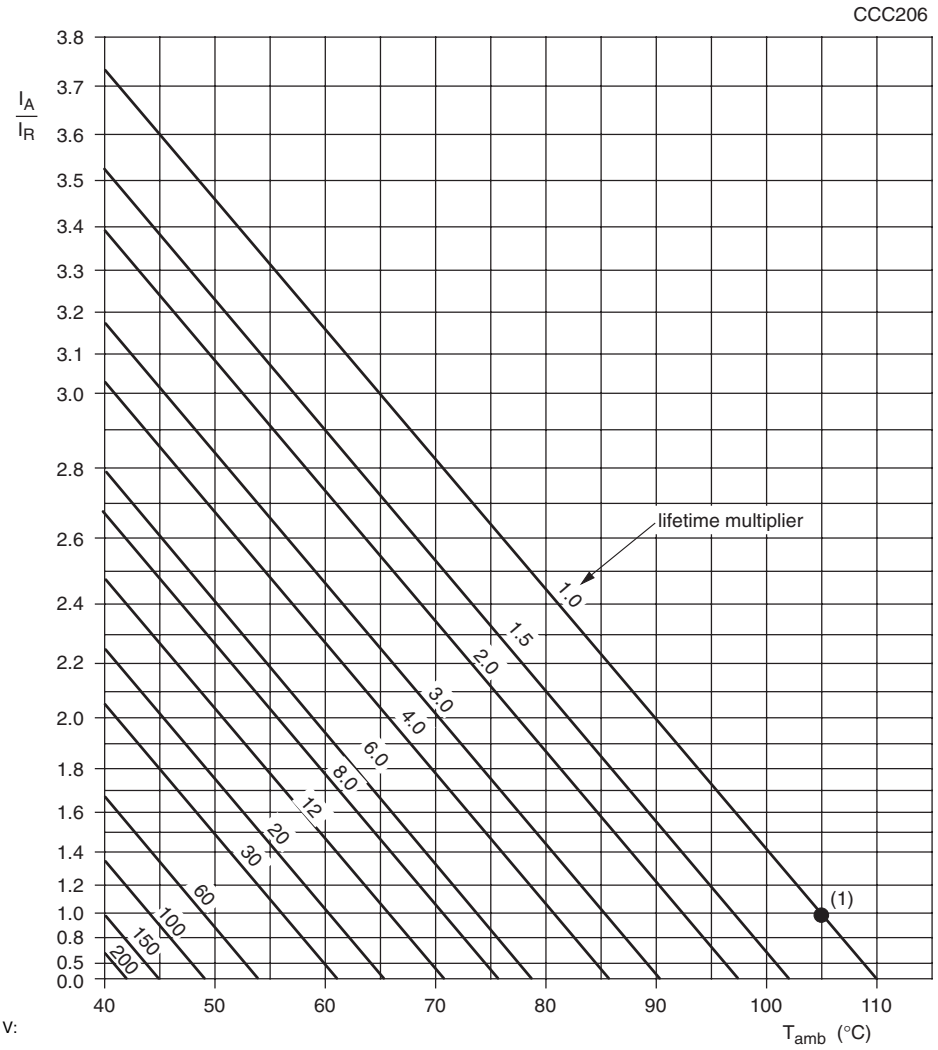
Table 5

LOW TEMPERATURE CHARACTERISTIC (AT 10 kHz)															
Tamb (°C)	U_R (V)[1]														
	6.3	10	16	25	40	50	63	100	160	250	350	385	400	450	500
- 25	1300	1000	860	440	330	270	200	160	1000	940	860	1800	1800	5000	5000
- 40	4800	3500	2400	1200	990	800	550	500	5000	4600	4200	6000	6000	10000	10000

Note

1. In practical operation the lower limit of the series resistance and impedance is given by the ohmic part of the contact points and the foil resistance values. Therefore it will not always be possible to achieve calculated values below 0.05 Ω.

RIPPLE CURRENT AND USEFUL LIFE



I_A = actual ripple current at 100 Hz

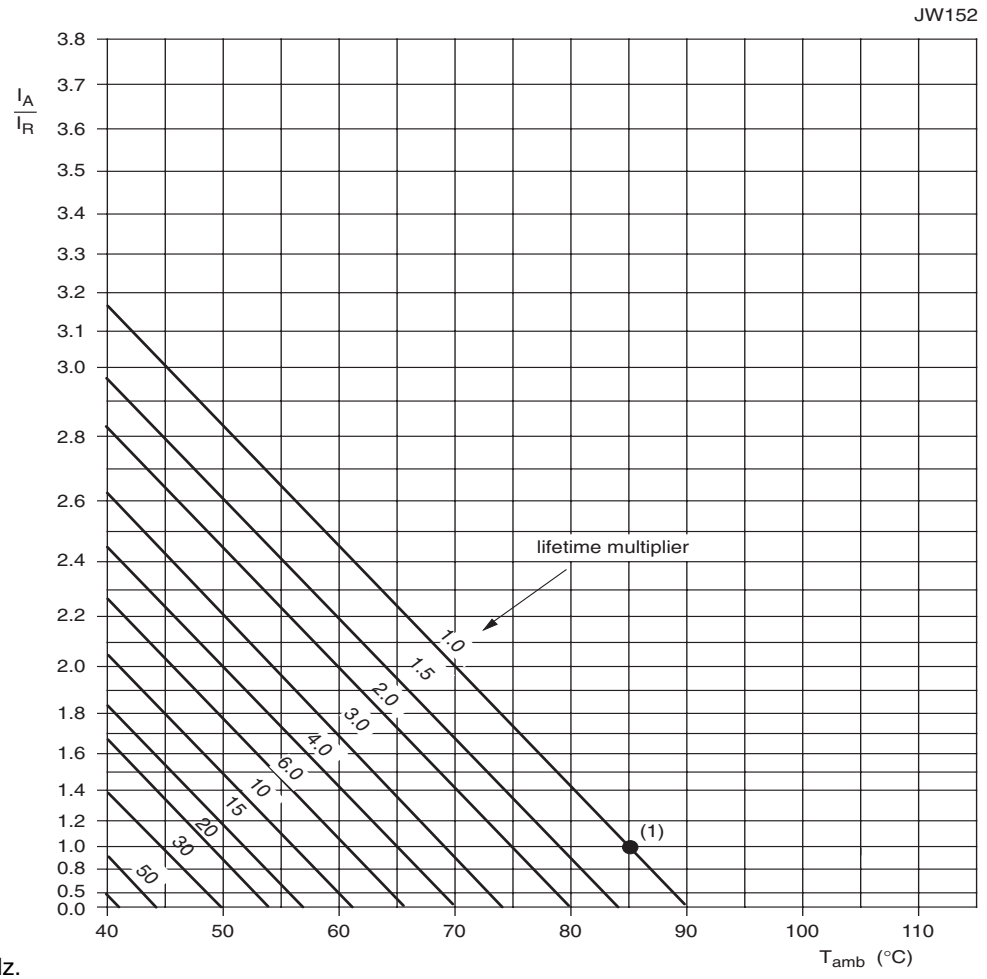
I_R = rated ripple current at 100 Hz, 105 °C

(1) Useful life at 105 °C and I_R applied: U_R = 6.3 to 100 V: 2000 hours

Fig.5 Multiplier of useful life as a function of ambient temperature and ripple current load

Table 6

MULTIPLIER OF RIPPLE CURRENT (I_R) AS A FUNCTION OF FREQUENCY			
FREQUENCY (Hz)	I_R MULTIPLIER		
	U_R = 6.3 to 16 V	U_R = 25 to 40 V	U_R = 50 to 100 V
50	0.95	0.90	0.85
100	1.00	1.00	1.00
300	1.07	1.12	1.20
1000	1.12	1.20	1.30
3000	1.15	1.25	1.35
≥ 10000	1.20	1.30	1.40



I_A = actual ripple current at 100 Hz.

I_R = rated ripple current at 100 Hz, 85 °C.

(1) Useful life at 85 °C and I_R applied: U_R = 160 to 500 V:

Fig.6 Multiplier of useful life as a function of ambient temperature and ripple current load.

Table 7

MULTIPLIER OF RIPPLE CURRENT (I_R) AS A FUNCTION OF FREQUENCY	
FREQUENCY (Hz)	**I_R MULTIPLIER**
	U_R = 160 to 500 V
50	0.85
100	1.00
300	1.20
1000	1.30
3000	1.35
≥ 10000	1.40

Table 8

TEST PROCEDURES AND REQUIREMENTS			
TEST		**PROCEDURE (quick reference)**	**REQUIREMENTS**
NAME OF TEST	**REFERENCE**		
Endurance	IEC 60384-4/ EN130300 subclause 4.13	T_{amb} = 105 °C; U_R applied; U_R = 6.3 to 100 V: 1000 hours T_{amb} = 85 °C; U_R applied; U_R = 160 to 500 V: 2000 hours	$U_R \leq 6.3$ V; $\Delta C/C$: + 25/- 40% $U_R > 6.3$ V; $\Delta C/C$: ± 30 % tan $\delta \leq 1.5 \times$ spec. limit $Z \leq 3 \times$ spec. limit $I_{L5} \leq$ spec. limit
Useful life	CECC 30301 subclause 1.8.1	T_{amb} = 105 °C; U_R applied; U_R = 6.3 to 100 V: 2000 hours T_{amb} = 85 °C; U_R and I_R applied; U_R = 160 to 500 V: 5000 hours	$U_R \leq 6.3$ V; $\Delta C/C$: + 45/- 50 % $U_R > 6.3$ V; $\Delta C/C$: ± 45 % tan $\delta \leq 3 \times$ spec. limit $Z \leq 3 \times$ spec. limit $I_{L5} \leq$ spec. limit no short or open circuit total failure percentage: ≤ 1 %
Shelf life (storage at high temperature)	IEC 60384-4/ EN130300 subclause 4.17	T_{amb} = 105 °C; no voltage applied; 100 hours, 6.3 to 100 V T_{amb} = 85 °C; no voltage applied; 100 hours, 160 to 500 V after test: U_R to be applied for 30 minutes, 24 to 48 hours before measurement	$\Delta C/C$, tan δ, Z: for requirements see 'Endurance test' above $I_{L5} \leq 2 \times$ spec. limit

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