

# Aluminum Capacitors Axial Miniature Range

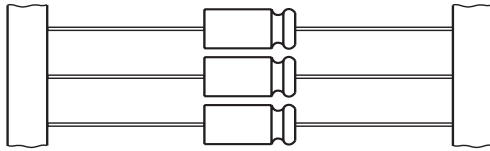
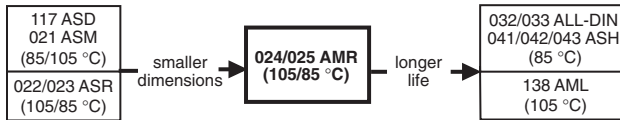


Fig.1 Component outlines.



## FEATURES

- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Axial leads, cylindrical aluminum case, insulated with a blue sleeve
- Mounting ring version not available in insulated form.
- Taped versions up to case  $\varnothing 16 \times 30$  mm available for automatic insertion
- High ripple current
- Lead (Pb)-free versions are RoHS compliant



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  $\mu\text{F}$ ).
- Tolerance on rated capacitance, code letter in accordance with IEC 60062 (M for  $\pm 20\%$ ).
- 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 (024/025).
- Country of origin.

QUICK REFERENCE DATA		
DESCRIPTION	VALUE	
	024	025
Nominal case sizes ( $\varnothing D \times L$ in mm)	12 $\times$ 25 to 30 $\times$ 50	
Rated capacitance range, $C_R$	220 to 47000 $\mu\text{F}$	10 to 1000 $\mu\text{F}$
Tolerance on $C_R$	$\pm 20\%$	
Rated voltage range, $U_R$	6.3 to 100 V	160 to 500 V
Category temperature range	-40 to +105 $^{\circ}\text{C}$	-40 to +85 $^{\circ}\text{C}$
Endurance test at upper category temperature	1000 hours	2000 hours
Useful life at 105 $^{\circ}\text{C}$	1500 hours	-
Useful life at 85 $^{\circ}\text{C}$	4500 hours	3000 hours
Useful life at 40 $^{\circ}\text{C}$ , 1.4 $\times I_R$ applied	140000 hours	90000 hours
Shelf life at 0 V	100 hours/105 $^{\circ}\text{C}$	100 hours/85 $^{\circ}\text{C}$
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 024 SERIES ( $\varnothing D \times L$ in mm)								
$C_R$ ( $\mu\text{F}$ )	$U_R$ (V)							
	6.3	10	16	25	40	50	63	100
220	-	-	-	-	-	-	-	12 $\times$ 30
330	-	-	-	-	-	-	12 $\times$ 25	16 $\times$ 30
470	-	-	-	-	-	-	12 $\times$ 25	16 $\times$ 40
680	-	-	-	-	12 $\times$ 25	12 $\times$ 30	16 $\times$ 30	18 $\times$ 40
1000	-	-	-	12 $\times$ 25	12 $\times$ 30	16 $\times$ 30	16 $\times$ 40	21 $\times$ 40
	-	-	-	-	-	-	18 $\times$ 30	-
1500	-	-	-	12 $\times$ 25	16 $\times$ 30	16 $\times$ 40	18 $\times$ 40	25 $\times$ 40
2200	-	12 $\times$ 25	12 $\times$ 30	16 $\times$ 30	16 $\times$ 40	18 $\times$ 40	21 $\times$ 40	25 $\times$ 50
	-	-	-	-	18 $\times$ 30	-	-	-
3300	12 $\times$ 25	12 $\times$ 30	16 $\times$ 30	16 $\times$ 40	18 $\times$ 40	21 $\times$ 40	25 $\times$ 40	30 $\times$ 50
4700	12 $\times$ 30	16 $\times$ 30	16 $\times$ 40	18 $\times$ 40	21 $\times$ 40	25 $\times$ 40	25 $\times$ 45	-

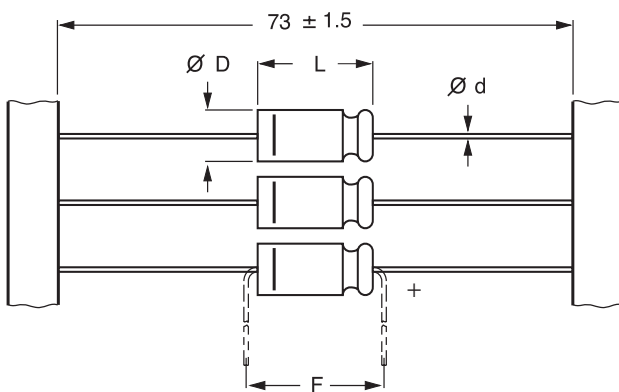
\* Pb containing terminations are not RoHS compliant, exemptions may apply

**SELECTION CHART FOR  $C_R$ ,  $U_R$  AND RELEVANT NOMINAL CASE SIZES FOR 024 SERIES ( $\varnothing D \times L$  in mm)**

$C_R$ ( $\mu F$ )	$U_R$ (V)							
	6.3	10	16	25	40	50	63	100
6800	16 × 30	16 × 40	18 × 40	21 × 40	25 × 40	25 × 50	30 × 45	–
10000	16 × 40	18 × 40	21 × 40	25 × 40	25 × 50	30 × 50	–	–
	–	–	–	–	30 × 40	–	–	–
15000	18 × 40	21 × 40	25 × 40	25 × 45	30 × 50	–	–	–
22000	21 × 40	25 × 40	25 × 50	30 × 45	–	–	–	–
33000	25 × 45	25 × 50	30 × 45	–	–	–	–	–
47000	30 × 40	30 × 50	–	–	–	–	–	–

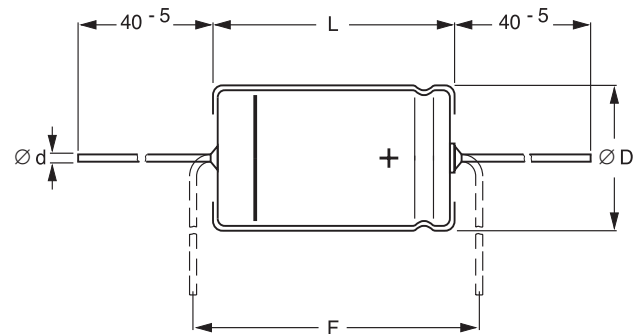
**SELECTION CHART FOR  $C_R$ ,  $U_R$  AND RELEVANT NOMINAL CASE SIZES FOR 025 SERIES ( $\varnothing D \times L$  in mm)**

$C_R$ ( $\mu F$ )	$U_R$ (V)							
	160	200	250	350	385	400	450	500
10	–	–	–	–	–	–	–	12 × 25
22	–	–	–	–	12 × 25	12 × 30	12 × 30	16 × 30
33	–	–	–	12 × 30	–	16 × 30	18 × 30	16 × 40
47	–	–	12 × 25	16 × 30	18 × 30	16 × 40	16 × 40	18 × 40
100	12 × 30	16 × 30	16 × 40	18 × 40	21 × 40	21 × 40	21 × 40	25 × 40
150	16 × 30	16 × 40	18 × 40	21 × 40	25 × 40	25 × 40	25 × 50	25 × 50
220	16 × 40	18 × 40	21 × 40	25 × 40	25 × 45	25 × 50	30 × 45	30 × 50
330	18 × 40	21 × 40	25 × 40	30 × 40	30 × 45	30 × 50	–	–
470	21 × 40	25 × 40	25 × 45	–	–	–	–	–
680	25 × 40	25 × 50	30 × 45	–	–	–	–	–
1000	30 × 40	30 × 50	–	–	–	–	–	–

**DIMENSIONS in millimeters AND AVAILABLE FORMS**


**Form BR:** Taped on reel.  
**Form BA:** Taped in box  
 (ammopack).

Fig.2 Forms BA and BR.



**Form AA:** Axial in box  
 case  $\varnothing D \times L = 12 \times 25$  to  $30 \times 50$  mm.

Fig.3 Form AA.

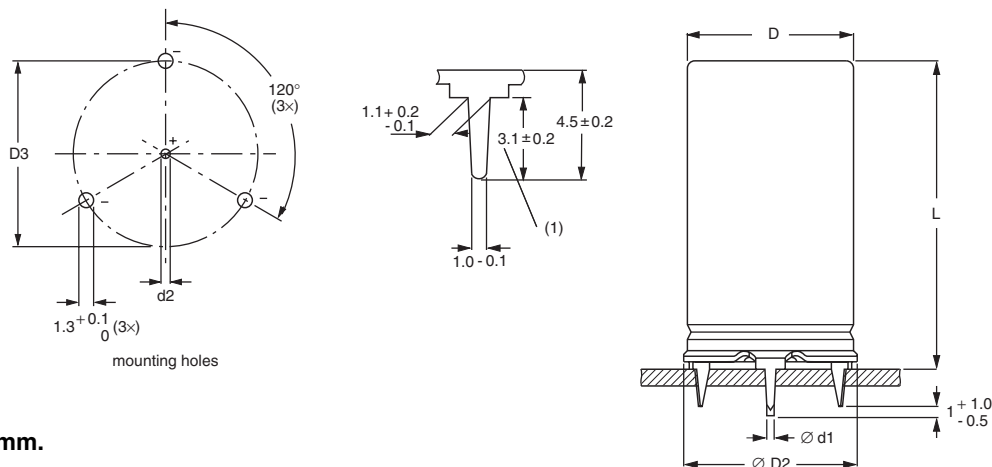
Table 1

AXIAL; DIMENSIONS in millimeters, MASS AND PACKAGING QUANTITIES								
NOMINAL CASE SIZE $\varnothing D \times L$	AXIAL: FORM AA, BA, and BR				MASS (g)	PACKAGING QUANTITIES		
	$\varnothing d$	$\varnothing D_{max}$	Lmax	Fmin		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**

- Detailed tape dimensions see section 'PACKAGING'.

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

**Form MR: case**

$\varnothing D \times L = 16 \times 30$  to  $30 \times 50$  mm.

Table 2

MOUNTING RING; DIMENSIONS in millimeters, MASS AND PACKAGING QUANTITIES							
NOMINAL CASE SIZE $\varnothing D \times L$	MOUNTING RING: FORM MR					MASS (g)	PACKAGING QUANTITIES
	$\varnothing d1$	$\varnothing d2$	$\varnothing D2_{max}$	D3	Lmax		
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 <sup>(1)</sup>	1.0	1.2 +0.4	19.2	18.5 ±0.2	32	≈13	429
18 × 40 <sup>(1)</sup>	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**

- For MR versions with  $\varnothing 18$  mm, pin length is  $4.5 \pm 0.5$  mm; see Fig.4



ELECTRICAL DATA	
SYMBOL	DESCRIPTION
C <sub>R</sub>	rated capacitance at 100 Hz, tolerance ±20%
I <sub>R</sub>	rated RMS ripple current at 100 Hz, 105 °C, 6.3 to 100 V; 85 °C, 160 to 500 V
I <sub>L5</sub>	max. leakage current after 5 minutes at U <sub>R</sub>
Tan δ	max. dissipation factor at 100 Hz
ESR	max. equivalent series resistance at 100 Hz
Z	max. impedance at 10 kHz

**ORDERING EXAMPLE\***

Electrolytic capacitor 024/025 series

1000 µF/25 V; ±20%

Nominal case size: Ø12 × 25 mm; Form AA

Catalog number: 2222 024 16102.

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

**Note**

1. Unless otherwise specified, all electrical values in Tables 3 and 4 apply at T<sub>amb</sub> = 20 °C, P = 86 to 106 kPa, RH = 45 to 75%.

**Table 3**

ELECTRICAL DATA AND ORDERING INFORMATION FOR 024 SERIES											
U <sub>R</sub> (V)	C <sub>R</sub> 100 Hz (µF)	NOMINAL CASE SIZE ØD × L (mm)	I <sub>R</sub> 100 Hz 85 °C (mA)	I <sub>L5</sub> 5 min (µA)	TanΔ 100 Hz	ESR 100 Hz (Ω)	Z 10 kHz (W)	CATALOG NUMBER 2222 024 .....			
								AXIAL LOOSE IN BOX FORM AA	AXIAL TAPED ON REEL FORM BR	AXIAL TAPED IN BOX FORM BA	MOUNTING RING FORM MR
6.3	3300	12 × 25	1.10	45	0.33	0.170	0.120	13332	23332	33332	-
	4700	12 × 30	1.40	62	0.33	0.120	0.085	13472	23472	33472	-
	6800	16 × 30	1.70	89	0.36	0.095	0.065	13682	23682	33682	43682
	10000	16 × 40	2.20	129	0.36	0.065	<0.050	13103	-	-	43103
	15000	18 × 40	2.40	192	0.42	0.050	<0.050	13153	-	-	43153
	22000	21 × 40	2.40	280	0.53	0.045	<0.050	13223	-	-	43223
	33000	25 × 45	2.80	419	0.65	0.035	<0.050	13333	-	-	43333
	47000	30 × 40	3.20	595	0.75	0.030	<0.050	13473	-	-	43473
10	2200	12 × 25	1.00	47	0.26	0.205	0.140	14222	24222	34222	-
	3300	12 × 30	1.30	69	0.27	0.140	0.095	14332	24332	34332	-
	4700	16 × 30	1.60	97	0.28	0.105	0.070	14472	24472	34472	44472
	6800	16 × 40	2.10	139	0.28	0.700	0.050	14682	-	-	44682
	10000	18 × 40	2.30	203	0.31	0.055	<0.050	14103	-	-	44103
	15000	21 × 40	2.50	303	0.38	0.045	<0.050	14153	-	-	44153
	22000	25 × 40	2.50	443	0.53	0.045	<0.050	14223	-	-	44223
	33000	25 × 50	2.90	663	0.60	0.035	<0.050	14333	-	-	44333
47000	30 × 50	3.20	943	0.72	0.030	<0.050	14473	-	-	44473	
16	2200	12 × 30	1.10	73	0.21	0.160	0.105	15222	25222	35222	-
	3300	16 × 30	1.50	109	0.21	0.110	0.075	15332	25332	35332	45332
	4700	16 × 40	1.90	153	0.21	0.080	0.050	15472	-	-	45472
	6800	18 × 40	2.20	221	0.23	0.060	<0.050	15682	-	-	45682
	10000	21 × 40	2.40	323	0.27	0.050	<0.050	15103	-	-	45103
	15000	25 × 40	2.50	483	0.37	0.045	<0.050	15153	-	-	45153
	22000	25 × 50	3.00	707	0.41	0.035	<0.050	15223	-	-	45223
	33000	30 × 45	3.30	1059	0.49	0.030	<0.050	15333	-	-	45333
25	1000	12 × 25	0.65	53	0.14	0.220	0.130	16102	26102	36102	-
	1500	12 × 25	0.98	78	0.16	0.180	0.110	16152	26152	36152	-
	2200	16 × 30	1.20	113	0.16	0.213	0.075	16222	26222	36222	46222
	3300	16 × 40	1.80	168	0.16	0.085	0.055	16332	-	-	46332
	4700	18 × 40	2.10	238	0.17	0.065	<0.050	16472	-	-	46472
	6800	21 × 40	2.30	343	0.20	0.050	<0.050	16682	-	-	46682
	10000	25 × 40	2.50	503	0.26	0.045	<0.050	16103	-	-	46103
	15000	25 × 45	2.70	753	0.32	0.040	<0.050	16153	-	-	46153
22000	30 × 45	2.90	1103	0.40	0.035	<0.050	16223	-	-	46223	



ELECTRICAL DATA AND ORDERING INFORMATION FOR 024 SERIES											
U <sub>R</sub> (V)	C <sub>R</sub> 100 Hz (μF)	NOMINAL CASE SIZE ∅D × L (mm)	I <sub>R</sub> 100 Hz 85 °C (mA)	I <sub>L5</sub> 5 min (μA)	TanΔ 100 Hz	ESR 100 Hz (Ω)	Z 10 kHz (W)	CATALOG NUMBER 2222 024 .....			
								AXIAL LOOSE IN BOX FORM AA	AXIAL TAPED ON REEL FORM BR	AXIAL TAPED IN BOX FORM BA	MOUNTING RING FORM MR
40	680	12 × 25	0.50	57	0.12	0.280	0.120	17681	27681	37681	–
	1000	12 × 30	0.86	83	0.12	0.195	0.105	17102	27102	37102	–
	1500	16 × 30	1.20	123	0.12	0.135	0.075	17152	27152	37152	47152
	2200	16 × 40	1.60	179	0.12	0.090	0.050	17222	–	–	47222
	2200	18 × 30	1.60	179	0.12	0.090	0.050	90001	–	–	90003
	3300	18 × 40	1.90	267	0.13	0.065	<0.050	17332	–	–	47332
	4700	21 × 40	2.20	379	0.15	0.055	<0.050	17472	–	–	47472
	6800	25 × 40	2.30	547	0.19	0.050	<0.050	17682	–	–	47682
	10000	25 × 50	2.80	803	0.21	0.030	<0.050	17103	–	–	47103
	10000	30 × 40	2.80	803	0.21	0.030	<0.050	90002	–	–	90004
	15000	30 × 50	2.80	1203	0.33	0.040	<0.050	17153	–	–	47153
50	680	12 × 30	0.74	71	0.11	0.270	0.150	11681	21681	31681	–
	1000	16 × 30	1.10	103	0.11	0.185	0.105	11102	21102	31102	41102
	1500	16 × 40	1.40	153	0.11	0.125	0.070	11152	–	–	41152
	2200	18 × 40	1.70	223	0.12	0.090	0.055	11222	–	–	41222
	3300	21 × 40	2.00	333	0.13	0.070	<0.050	11332	–	–	41332
	4700	25 × 40	2.30	473	0.16	0.060	<0.050	11472	–	–	41472
	6800	25 × 50	2.70	683	0.17	0.045	<0.050	11682	–	–	41682
	10000	30 × 50	2.80	1003	0.24	0.045	<0.050	11103	–	–	41103
	63	330	12 × 25	0.39	45	0.08	0.390	0.180	18331	28331	38331
470		12 × 25	0.60	62	0.10	0.340	0.160	18471	28471	38471	–
680		16 × 30	0.76	89	0.10	0.235	0.115	18681	28681	38681	48681
1000		16 × 40	1.10	129	0.10	0.165	0.080	18102	–	–	48102
1000		18 × 30	1.10	129	0.10	0.165	0.080	90005	–	–	90006
1500		18 × 40	1.40	192	0.10	0.115	0.055	18152	–	–	48152
2200		21 × 40	1.80	280	0.11	0.085	<0.050	18222	–	–	48222
3300		25 × 40	2.10	419	0.13	0.065	<0.050	18332	–	–	48332
4700		25 × 45	2.40	595	0.14	0.055	<0.050	18472	–	–	48472
6800		30 × 45	2.54	860	0.20	0.050	<0.050	18682	–	–	48682
100	220	12 × 30	0.37	47	0.09	1.655	0.205	19221	29221	39221	–
	330	16 × 30	0.56	69	0.09	0.440	0.140	19331	29331	39331	49331
	470	16 × 40	0.70	97	0.09	0.310	0.100	19471	–	–	49471
	680	18 × 40	0.91	139	0.09	0.220	0.070	19681	–	–	49681
	1000	21 × 40	1.20	203	0.09	0.155	0.055	19102	–	–	49102
	1500	25 × 40	1.50	303	0.10	0.115	<0.050	19152	–	–	49152
	2200	25 × 50	1.90	443	0.11	0.080	<0.050	19222	–	–	49222
	3300	30 × 50	2.30	663	0.13	0.065	<0.050	19332	–	–	49332

Table 4

ELECTRICAL DATA AND ORDERING INFORMATION FOR 025 SERIES											
U <sub>R</sub> (V)	C <sub>R</sub> 100 Hz (μF)	NOMINAL CASE SIZE ∅D × L (mm)	I <sub>R</sub> 100 Hz 85 °C (mA)	I <sub>L5</sub> 5 min (μA)	TanΔ 100 Hz	ESR 100 Hz (Ω)	Z 10 kHz (W)	CATALOG NUMBER 2222 025 .....			
								AXIAL LOOSE IN BOX FORM AA	AXIAL TAPED ON REEL FORM BR	AXIAL TAPED IN BOX FORM BA	MOUNTING RING FORM MR
160	100	12 × 30	0.42	250	0.07	1.120	0.485	11101	21101	31101	–
	150	16 × 30	0.61	370	0.07	0.745	0.330	11151	21151	31151	41151
	220	16 × 40	0.77	538	0.07	0.505	0.225	11221	–	–	41221
	330	18 × 40	1.00	802	0.08	0.385	0.155	11331	–	–	41331
	470	21 × 40	1.30	1138	0.08	0.270	0.115	11471	–	–	41471
	680	25 × 40	1.70	1642	0.08	0.185	0.090	11681	–	–	41681
	1000	30 × 40	2.10	2410	0.09	0.145	0.075	11102	–	–	41102



ELECTRICAL DATA AND ORDERING INFORMATION FOR 025 SERIES											
U <sub>R</sub> (V)	C <sub>R</sub> 100 Hz (μF)	NOMINAL CASE SIZE ∅D × L (mm)	I <sub>R</sub> 100 Hz 85 °C (mA)	I <sub>L5</sub> 5 min (μA)	TanΔ 100 Hz	ESR 100 Hz (Ω)	Z 10 kHz (W)	CATALOG NUMBER 2222 025 .....			
								AXIAL LOOSE IN BOX FORM AA	AXIAL TAPED ON REEL FORM BR	AXIAL TAPED IN BOX FORM BA	MOUNTING RING FORM MR
200	100	16 × 30	0.50	310	0.09	1.440	0.725	12101	22101	32101	42101
	150	16 × 40	0.65	460	0.09	0.955	0.485	12151	–	–	42151
	220	18 × 40	0.86	670	0.09	0.650	0.335	12221	–	–	42221
	330	21 × 40	1.20	1000	0.09	0.435	0.230	12331	–	–	42331
	470	25 × 40	1.50	1420	0.09	0.305	0.170	12471	–	–	42471
	680	25 × 50	1.90	2050	0.09	0.210	0.120	12681	–	–	42681
	1000	30 × 50	2.30	3010	0.10	0.160	0.095	12102	–	–	42102
250	47	12 × 25	0.29	186	0.09	3.050	1.230	13479	23479	33479	–
	100	16 × 40	0.53	385	0.09	1.440	0.580	13101	–	–	43101
	150	18 × 40	0.72	573	0.09	0.955	0.390	13151	–	–	43151
	220	21 × 40	0.97	835	0.09	0.650	0.270	13221	–	–	43221
	330	25 × 40	1.30	1248	0.09	0.435	0.190	13331	–	–	43331
	470	25 × 45	1.60	1773	0.09	0.305	0.140	13471	–	–	43471
	680	30 × 45	2.00	2560	0.09	0.210	0.105	13681	–	–	43681
350	33	12 × 30	0.24	183	0.10	4.830	3.050	15339	25339	35339	–
	47	16 × 30	0.35	257	0.10	3.390	2.150	15479	25479	35479	45479
	100	18 × 40	0.59	535	0.10	1.590	1.020	15101	–	–	45101
	150	21 × 40	0.80	798	0.10	1.060	0.685	15151	–	–	45151
	220	25 × 40	1.10	1165	0.10	0.725	0.475	15221	–	–	45221
	330	30 × 40	1.40	1743	0.10	0.485	0.335	15331	–	–	45331
385	22	12 × 25	0.19	137	0.09	6.520	4.000	18229	28229	38229	–
	47	18 × 30	0.38	281	0.09	3.050	1.880	18479	–	–	48479
	100	21 × 40	0.64	588	0.09	1.440	0.890	18101	–	–	48101
	150	25 × 40	0.88	876	0.09	0.955	0.600	18151	–	–	48151
	220	25 × 45	1.10	1281	0.09	0.650	0.415	18221	–	–	48221
	330	30 × 45	1.50	1916	0.09	0.435	0.290	18331	–	–	48331
400	22	12 × 30	0.19	142	0.12	8.690	6.110	16229	26229	36229	–
	33	16 × 30	0.28	208	0.12	5.790	4.080	16339	26339	36339	46339
	47	16 × 40	0.35	292	0.12	4.070	2.860	16479	–	–	46479
	100	21 × 40	0.63	610	0.12	1.910	1.360	16101	–	–	46101
	150	25 × 40	0.86	910	0.12	1.280	0.910	16151	–	–	46151
	220	25 × 50	1.10	1330	0.12	0.870	0.625	16221	–	–	46221
	330	30 × 50	1.50	1990	0.12	0.580	0.430	16331	–	–	46331
450	22	12 × 30	0.20	159	0.10	7.240	3.510	17229	27229	37229	–
	33	18 × 30	0.30	233	0.10	4.830	2.340	17339	–	–	47339
	47	16 × 40	0.37	327	0.10	3.390	1.650	17479	–	–	47479
	100	21 × 40	0.65	685	0.10	1.590	0.785	17101	–	–	47101
	150	25 × 50	0.91	1023	0.10	1.060	0.525	17151	–	–	47151
	220	30 × 45	1.20	1495	0.10	0.725	0.370	17221	–	–	47221
500	10	12 × 25	0.14	85	0.09	14.080	9.305	19109	29109	39109	–
	22	16 × 30	0.26	175	0.09	6.210	4.105	19229	29229	39229	49229
	33	16 × 40	0.35	258	0.09	4.140	2.740	19339	–	–	49339
	47	18 × 40	0.45	362	0.09	2.915	1.925	19479	–	–	49479
	100	25 × 40	0.81	760	0.09	1.385	0.920	19101	–	–	49101
	150	25 × 50	1.00	1135	0.09	0.925	0.615	19151	–	–	49151
	220	30 × 50	1.40	1660	0.09	0.645	0.435	19221	–	–	49221

ADDITIONAL ELECTRICAL DATA			
PARAMETER	CONDITIONS	VALUE	
<b>Voltage</b>			
Surge voltage	$\leq 100$ V versions versions	$U_s \leq 1.15 \times U_R$	
	$\geq 160$ V versions versions	$U_s \leq 1.10 \times U_R$	
Reverse voltage		$U_{rev} \leq 1$ V	
<b>Current</b>			
Leakage current	after 5 minutes at $U_R$ : $U_R \leq 100$ V	$I_{L5} \leq 0.002 C_R \times U_R + 3 \mu\text{A}$	
	$U_R > 100$ V	$I_{L5} \leq 0.0150 C_R \times U_R + 10 \mu\text{A}$	
<b>Inductance</b>			
Equivalent series inductance (ESL)	case $\varnothing D \times L$ 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 is for the calculation of the maximum 10 kHz impedance at low temperatures:  $Z(10 \text{ kHz}) [\Omega] = \frac{\text{tabular value}}{C_R [\mu\text{F}]}$

Table 5

LOW TEMPERATURE CHARACTERISTIC (AT 10 KHz)																
Tamb (°C)	UR (V) <sup>(1)</sup>															
	6.3	10	16	25	40	50	63	100	160	200	250	350	385	400	450	500
-25	2100	1600	1250	680	390	375	240	200	1000	1000	1000	1500	1800	2000	5000	5000
-40	7600	5700	3500	1870	1150	1106	650	500	5000	4600	4600	5000	6000	8000	10000	10000

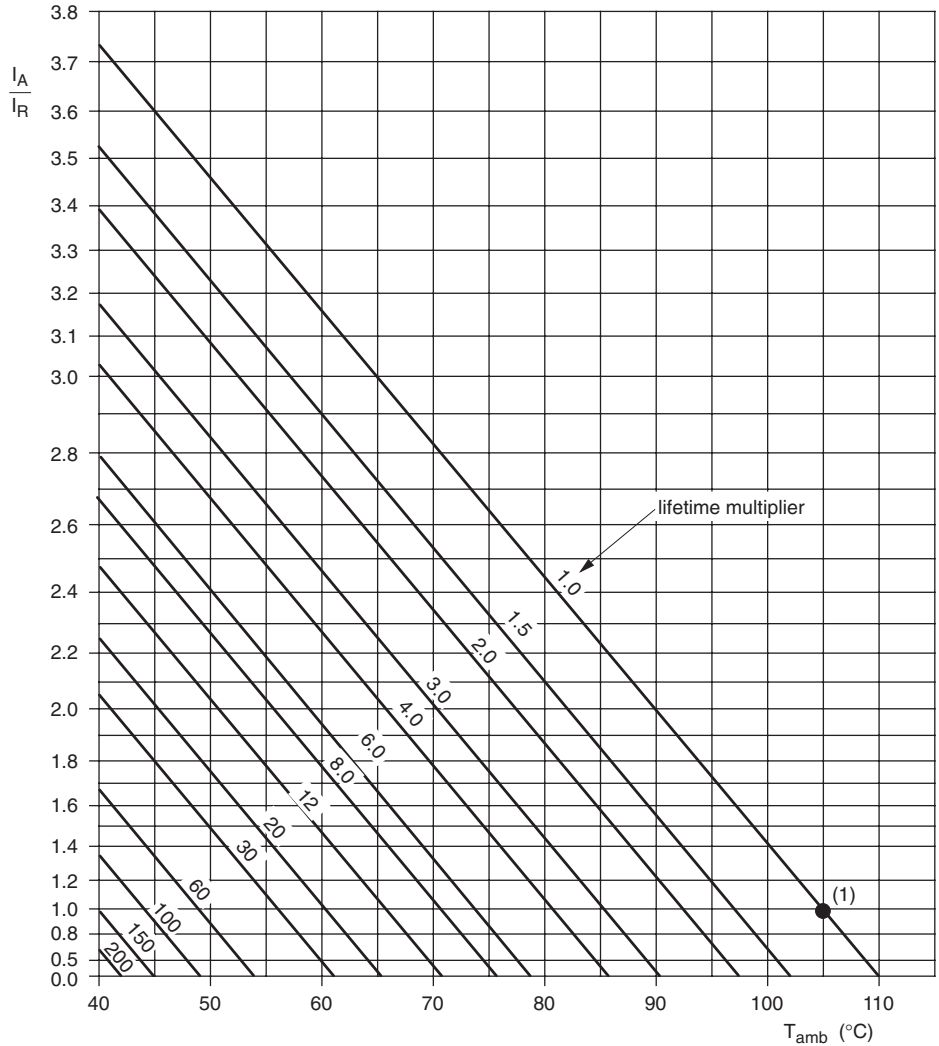
### Note

- 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  $\Omega$ .



**RIPPLE CURRENT AND USEFUL LIFE**

CCC206



$I_A$  = actual ripple current at 100 Hz.  
 $I_R$  = rated ripple current at 100 Hz, 105 °C.

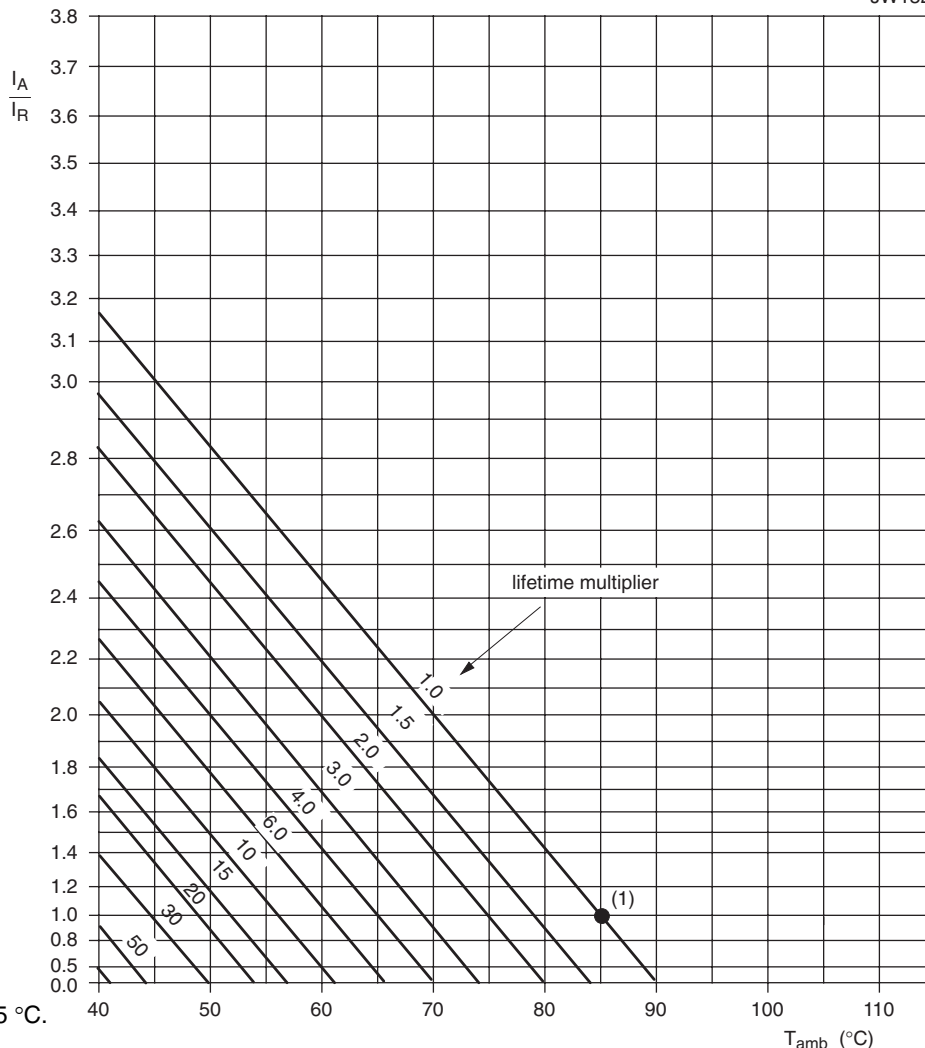
Fig.5 Multiplier of useful life as a function of ambient temperature and ripple current load.

Table 6

<b>MULTIPLIER OF RIPPLE CURRENT (<math>I_R</math>) AS A FUNCTION OF FREQUENCY</b>			
<b>FREQUENCY (Hz)</b>	<b><math>I_R</math> MULTIPLIER</b>		
	<b><math>U_R = 6.3</math> to <math>16</math> V</b>	<b><math>U_R = 25</math> to <math>40</math> V</b>	<b><math>U_R = 50</math> to <math>100</math> V</b>
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
$\geq 10000$	1.20	1.30	1.40



JW152



$I_A$  = 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:

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
	$U_R = 160 \text{ to } 500 \text{ V}$
50	0.85
100	1.00
300	1.20
1000	1.30
3000	1.35
$\geq 10000$	1.40



Table 8

<b>TEST PROCEDURES AND REQUIREMENTS</b>			
<b>TEST</b>		<b>PROCEDURE (quick reference)</b>	<b>REQUIREMENTS</b>
<b>NAME OF TEST</b>	<b>REFERENCE</b>		
Endurance	IEC 60384-4/ EN130300 subclause 4.13	$T_{amb} = 105\text{ }^{\circ}\text{C}$ ; $U_R$ applied; $U_R = 6.3$ to $100\text{ V}$ : 1000 hours  $T_{amb} = 85\text{ }^{\circ}\text{C}$ ; $U_R$ applied; $U_R = 160$ to $500\text{ V}$ : 2000 hours	$U_R \leq 6.3\text{ V}$ ; $\Delta C/C$ : $+25/-40\%$  $U_R > 6.3\text{ V}$ ; $\Delta C/C$ : $\pm 30\%$  $\tan \delta \leq 1.5 \times \text{spec. limit}$  $Z \leq 3 \times \text{spec. limit}$  $I_{L5} \leq \text{spec. limit}$
Useful life	CECC 30301 subclause 1.8.1	$T_{amb} = 105\text{ }^{\circ}\text{C}$ ; $U_R$ applied; $U_R = 6.3$ to $100\text{ V}$ : 1500 hours  $T_{amb} = 85\text{ }^{\circ}\text{C}$ ; $U_R$ and $I_R$ applied; $U_R = 160$ to $500\text{ V}$ : 3000 hours	$U_R \leq 6.3\text{ V}$ ; $\Delta C/C$ : $+45/-50\%$  $U_R > 6.3\text{ V}$ ; $\Delta C/C$ : $\pm 45\%$  $\tan \delta \leq 3 \times \text{spec. limit}$  $Z \leq 3 \times \text{spec. limit}$  $I_{L5} \leq \text{spec. limit}$  no short or open circuit  total failure percentage: $\leq 1\%$
Shelf life (storage at high temperature)	IEC 60384-4/ EN130300 subclause 4.17	$T_{amb} = 105\text{ }^{\circ}\text{C}$ ; no voltage applied; 100 hours, $6.3$ to $100\text{ V}$  $T_{amb} = 85\text{ }^{\circ}\text{C}$ ; no voltage applied; 100 hours, $160$ to $500\text{ V}$  after test: $U_R$ to be applied for 30 minutes, 24 to 48 hours before measurement	$\Delta C/C$ , $\tan \delta$ , $Z$ : for requirements see 'Endurance test' above  $I_{L5} \leq 2 \times \text{spec. limit}$



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