

Aluminum Capacitors

Axial High Temperature

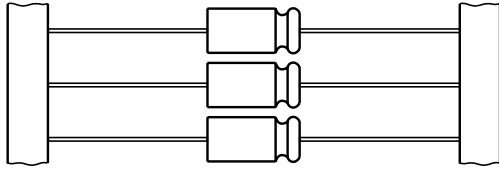
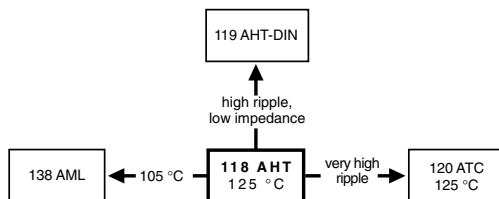


Fig.1 Component outlines



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 $\varnothing 15 \times 30$ mm available for automatic insertion.
- Charge and discharge proof.
- Extra long useful life: up to 8000 hours at 125 °C, high reliability.
- Extended temperature range: 125 °C (usable up to 150 °C)
- Miniaturized, high CV-product per unit volume.
- Lead (Pb)-free versions are RoHS compliant.


RoHS*
COMPLIANT

APPLICATIONS

- Automotive, industrial and telecommunication
- Smoothing, filtering, coupling, decoupling, timing
- For use after very long storage (10 years) without voltage applied
- Portable and mobile equipment (small size, low mass)
- Low mounting height boards, vibration and shock resistant
- Outdoor applications, e.g. aerial amplifiers

MARKING

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

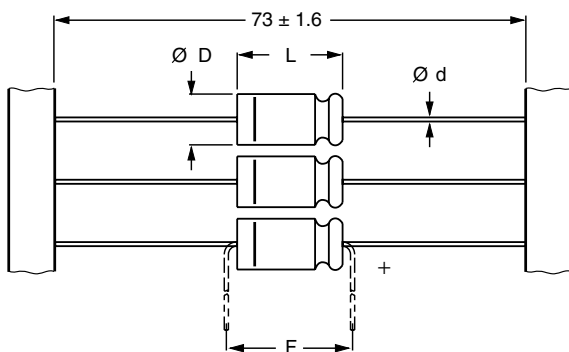
- Rated capacitance (in μF)
- Tolerance on rated capacitance, code letter in accordance with IEC 60062 (M for $\pm 20\%$)
- Rated voltage (in V) at 125 °C and 85 °C
- Date code, in accordance with IEC 60062
- Code indicating factory of origin
- Name of manufacturer
- Band to indicate the negative terminal
- '+' sign to identify the positive terminal
- Series number (118)

QUICK REFERENCE DATA		
DESCRIPTION	VALUE	
Nominal case sizes ($\varnothing D \times L$ in mm)	6.5 × 18 to 10 × 25	10 × 30 to 21 × 38
Rated capacitance range, C_R	1 to 10 000 μF	
Tolerance on C_R	$\pm 20\%$	
Rated voltage range, U_R	6.3 to 200 V	
Category temperature range	- 40 to +125 °C	- 55 to +125 °C
Endurance test at 150 °C (6.3 to 100 V)	500 hours	500 hours
Endurance test at 125 °C	2000 hours	3000 hours
Useful life at 125 °C	4000 hours	8000 hours
Useful life at 40 °C, 1.8 × I_R applied	500 000 hours	1 000 000 hours
Shelf life at 0 V, 125 °C:		
$U_R = 6.3$ to 63 V	500 hours	
$U_R = 100$ and 200 V	100 hours	
Based on sectional specification	IEC 60384-4/EN130300	
Climatic category IEC 60068	40/125/56	55/125/56

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

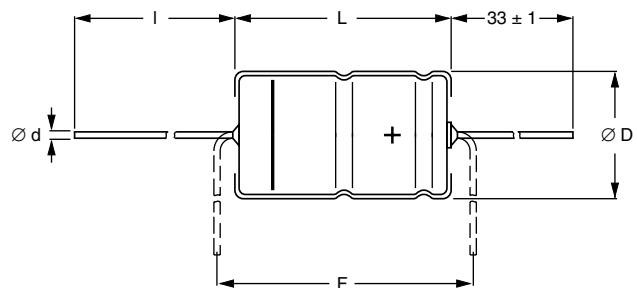
SELECTION CHART FOR C_R , U_R AND RELEVANT NOMINAL CASE SIZES ($\varnothing D \times L$ in mm)								
C_R (μF)	U_R (V)							
	6.3	10	16	25	40	63	100	200
1.0	-	-	-	-	-	6.5 × 18	-	-
2.2	-	-	-	-	-	6.5 × 18	-	6.5 × 18
4.7	-	-	-	-	-	6.5 × 18	6.5 × 18	8 × 18
10	-	-	-	-	-	6.5 × 18	6.5 × 18	10 × 25
15	-	-	-	-	-	-	-	10 × 30
22	-	-	-	-	-	6.5 × 18	8 × 18	12.5 × 30
33	-	-	-	-	-	-	10 × 25	15 × 30
47	-	-	-	-	6.5 × 18	8 × 18	10 × 25	18 × 30
	-	-	-	-	-	-	10 × 30	-
68	-	-	-	-	-	-	12.5 × 30	18 × 38
100	-	-	-	6.5 × 18	8 × 18	10 × 25	12.5 × 30	21 × 38
	-	-	-	-	-	10 × 30	-	-
150	-	-	-	-	10 × 18	12.5 × 30	15 × 30	-
220	-	6.5 × 18	8 × 18	10 × 18	10 × 25	12.5 × 30	18 × 30	-
	-	-	-	-	10 × 30	-	-	-
330	-	8 × 18	10 × 18	10 × 25	12.5 × 30	15 × 30	18 × 38	-
470	-	8 × 18	10 × 18	10 × 25	12.5 × 30	18 × 30	21 × 38	-
	-	-	-	10 × 30	-	-	-	-
680	-	-	10 × 30	12.5 × 30	15 × 30	18 × 38	-	-
1000	10 × 18	10 × 25	12.5 × 30	12.5 × 30	18 × 30	21 × 38	-	-
	-	10 × 30	-	-	-	-	-	-
1500	10 × 25	12.5 × 30	12.5 × 30	15 × 30	18 × 38	-	-	-
2200	-	12.5 × 30	15 × 30	18 × 30	21 × 38	-	-	-
3300	-	15 × 30	18 × 30	18 × 38	-	-	-	-
4700	-	18 × 30	18 × 38	21 × 38	-	-	-	-
6800	-	18 × 38	21 × 38	-	-	-	-	-
10000	-	21 × 38	-	-	-	-	-	-

DIMENSIONS in millimeters AND AVAILABLE FORMS



Form BR: Taped on reel,
case $\varnothing D \times L = 6.5 \times 18$ to 15×30 mm
Form BA: Taped in box (ammopack),
case $\varnothing D \times L = 6.5 \times 18$ to 10×25 mm

Fig.2 Forms BA and BR



Form AA: Axial in box,
case $\varnothing D \times L = 10 \times 30$ to 21×38 mm

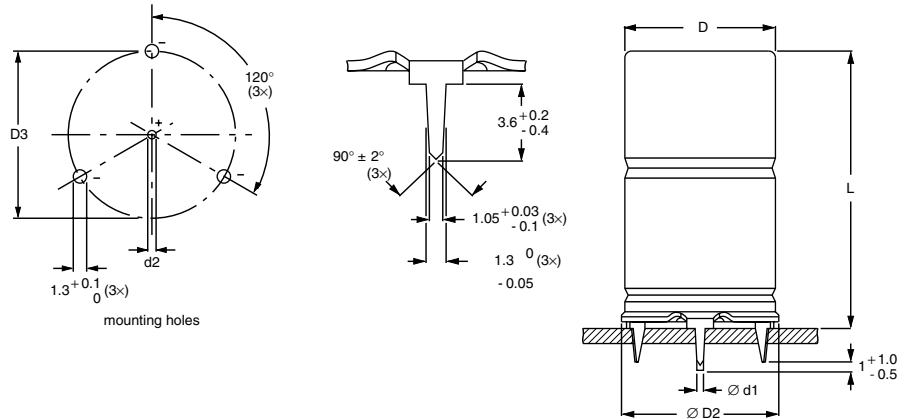
Fig.3 Form AA

Table 1

AXIAL; DIMENSIONS in millimeters, MASS AND PACKAGING QUANTITIES										
NOMINAL CASE SIZE $\varnothing D \times L$	CASE CODE	AXIAL: FORM AA, BA and BR					MASS (g)	PACKAGING QUANTITIES		
		$\varnothing d$	l	$\varnothing D_{max}$	L_{max}	F_{min}		FORM AA	FORM BA	FORM BR
6.5 × 18	4	0.8	-	6.9	18.5	25	≈ 1.3	-	1000	1000
8 × 18	5	0.8	-	8.5	18.5	25	≈ 1.7	-	500	500
10 × 18	6	0.8	-	10.5	18.5	25	≈ 2.5	-	500	500
10 × 25	7	0.8	-	10.5	25.0	30	≈ 3.3	-	500	500
10 × 30	00	0.8	55 ± 1	10.5	30.5	35	≈ 4.8	340	-	500
12.5 × 30	01	0.8	55 ± 1	13.0	30.5	35	≈ 7.4	260	-	400
15 × 30	02	0.8	55 ± 1	15.5	30.5	35	≈ 11.7	200	-	250
18 × 30	03	0.8	55 ± 1	18.5	30.5	35	≈ 12.9	120	-	-
18 × 38	04	0.8	34 ± 1	18.5	39.0	44	≈ 19.0	125	-	-
21 × 38	05	0.8	34 ± 1	21.5	39.0	44	≈ 24.0	100	-	-

Note

- Detailed tape dimensions see section 'PACKAGING'.

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


Form MR: case $\varnothing D \times L = 15 \times 30$ to 21×38 mm
 Case not insulated (insulation on request)
 Especially for applications with severe shocks and vibrations

Table 2

MOUNTING RING; DIMENSIONS in millimeters, MASS AND PACKAGING QUANTITIES									
NOMINAL CASE SIZE $\varnothing D \times L$	CASE CODE	MOUNTING RING: FORM MR						MASS (g)	PACKAGING QUANTITIES
		$\varnothing d1$	$\varnothing d2$	$\varnothing D_{max}$	$\varnothing D2_{max}$	$D3$	L_{max}		
15 × 30	02	0.8	1.0 + 0.4	15.5	17.5	16.5 ± 0.2	33	≈ 8.6	200
18 × 30	03	0.8	1.0 + 0.4	18.5	19.5	18.5 ± 0.2	33	≈ 11.5	240
18 × 38	04	0.8	1.0 + 0.4	18.5	19.5	18.5 ± 0.2	42	≈ 14.0	100
21 × 38	05	0.8	1.0 + 0.4	21.5	22.5	21.5 ± 0.2	42	≈ 19.0	100

ELECTRICAL DATA	
C_R	rated capacitance at 100 Hz, tolerance ± 20 %
I_R	rated RMS ripple current at 100 Hz, 125 °C
I_{L1}	max. leakage current after 1 minute at U_R
I_{L5}	max. leakage current after 5 minutes at U_R
Tan δ	max. dissipation factor at 100 Hz
ESR	equivalent series resistance at 100 Hz (calculated from tan δ_{max} and C_R)
Z	max. impedance at 10 kHz

Note

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

ORDERING EXAMPLE*

Electrolytic capacitor 118 series
 1000 $\mu F/10$ V; ± 20 %
 Nominal case size: $\varnothing 10 \times 30$ mm; Form BR
 Catalog number: 2222 118 24102

* 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													
U _R (V)	C _R 100 Hz (μF)	NOMINAL CASE SIZE Ø D x L (mm)	CASE CODE	I _R 100 Hz 125 °C (mA)	L ₁ 1 MIN (μA)	L ₅ 5 MIN (μA)	TAN δ 100 Hz	ESR 100 Hz (Ω)	Z 10 kHz (Ω)	CATALOG NUMBER 2222			
										IN BOX FORM AA	TAPED ON REEL FORM BR	TAPED IN BOX FORM BA	MOUNTING RING FORM MR
6.3	1000	10 x 18	6	251	42	17	0.50	0.79	0.8	-	118 23102	118 33102	-
	1500	10 x 25	7	352	61	23	0.50	0.53	0.53	-	118 90502	118 90503	-
10	220	6.5 x 18	4	109	20	8.4	0.35	2.53	2.1	-	118 24221	118 34221	-
	330	8 x 18	5	150	24	11	0.35	1.69	1.4	-	118 24331	118 34331	-
	470	8 x 18	5	179	32	13	0.35	1.19	1.0	-	118 24471	118 34471	-
	1000	10 x 25	7	343	64	24	0.35	0.56	0.55	-	118 90504	118 90505	-
	1000	10 x 30	00	550	64	24	0.32	0.505	0.45	118 14102	118 24102	-	-
	1500	12.5 x 30	01	740	94	34	0.32	0.340	0.28	118 14152	118 24152	-	-
	2200	12.5 x 30	01	830	136	48	0.40	0.290	0.27	118 14222	118 24222	-	-
	3300	15 x 30	02	1070	202	70	0.40	0.190	0.18	118 14332	118 24332	-	118 44332
	4700	18 x 30	03	1350	286	98	0.46	0.155	0.15	118 14472	-	-	118 44472
	6800	18 x 38	04	1730	412	140	0.53	0.100	0.10	118 14682	-	-	118 44682
	10000	21 x 38	05	1860	604	200	0.53	0.084	0.10	118 14103	-	-	118 44103
16	220	8 x 18	5	145	25	11	0.25	1.81	1.5	-	118 25221	118 35221	-
	330	10 x 18	6	204	36	15	0.25	1.21	1.2	-	118 25331	118 35331	-
	470	10 x 18	6	243	49	19	0.25	0.85	0.83	-	118 25471	118 35471	-
	680	10 x 30	00	510	69	30	0.22	0.525	0.45	118 15681	118 25681	-	-
	1000	12.5 x 30	01	720	100	36	0.22	0.345	0.28	118 15102	118 90039	-	-
	1500	12.5 x 30	01	790	148	52	0.29	0.305	0.27	118 15152	118 25152	-	-
	2200	15 x 30	02	1010	215	74	0.29	0.205	0.18	118 15222	118 25222	-	118 45222
	3300	18 x 30	03	1300	321	110	0.34	0.165	0.15	118 15332	-	-	118 45332
	4700	18 x 38	04	1670	455	150	0.34	0.105	0.10	118 15472	-	-	118 45472
	6800	21 x 38	05	1790	657	220	0.38	0.088	0.10	118 15682	-	-	118 45682
25	100	6.5 x 18	4	102	20	9	0.18	2.86	2.3	-	118 26101	118 36101	-
	220	10 x 18	6	196	37	15	0.18	1.30	1.25	-	118 26221	118 36221	-
	330	10 x 25	7	274	54	21	0.18	0.87	0.82	-	118 26331	118 36331	-
	470	10 x 25	7	327	75	28	0.18	0.61	0.57	-	118 90508	118 90509	-
	470	10 x 30	00	490	75	28	0.18	0.61	0.50	118 16471	118 26471	-	-
	680	12.5 x 30	01	680	106	38	0.18	0.42	0.30	118 16681	118 26681	-	-
	1000	12.5 x 30	01	760	154	54	0.24	0.375	0.28	118 16102	118 26102	-	-
	1500	15 x 30	02	980	229	79	0.25	0.263	0.22	118 16152	118 26152	-	118 46152
	2200	18 x 30	03	1240	334	110	0.26	0.185	0.17	118 16222	-	-	118 46222
	3300	18 x 38	04	1610	499	170	0.26	0.12	0.11	118 16332	-	-	118 46332
	4700	21 x 38	05	1710	709	240	0.28	0.095	0.10	118 16472	-	-	118 46472
40	47	6.5 x 18	4	89.8	20	7.8	0.11	3.72	2.8	-	118 27479	118 37479	-
	100	8 x 18	5	147	28	12	0.11	1.75	1.3	-	118 27101	118 37101	-
	150	10 x 18	6	207	40	16	0.11	1.17	1.0	-	118 27151	118 37151	-
	220	10 x 25	7	287	57	22	0.11	0.80	0.68	-	118 90511	118 90512	-
	220	10 x 30	00	390	57	22	0.10	0.70	0.55	118 17221	118 27221	-	-
	330	12.5 x 30	01	570	83	30	0.10	0.43	0.33	118 17331	118 27331	-	-
	470	12.5 x 30	01	620	117	42	0.11	0.38	0.30	118 17471	118 27471	-	-



Aluminum Capacitors
Axial High Temperature

Vishay BCcomponents

ELECTRICAL DATA AND ORDERING INFORMATION													
U _R (V)	C _R 100 Hz (μF)	NOMINAL CASE SIZE Ø D x L (mm)	CASE CODE	I _R 100 Hz 125 °C (mA)	I _{L1} 1 MIN (μA)	I _{L5} 5 MIN (μA)	TAN δ 100 Hz	ESR 100 Hz (Ω)	Z 10 kHz (Ω)	CATALOG NUMBER 2222			
										IN BOX FORM AA	TAPED ON REEL FORM BR	TAPED IN BOX FORM BA	MOUNTING RING FORM MR
40	680	15 x 30	02	810	167	58	0.11	0.255	0.23	118 17681	118 27681	-	118 47681
	1000	18 x 30	03	1070	244	84	0.13	0.205	0.18	118 17102	-	-	118 47102
	1500	18 x 38	04	1390	364	120	0.13	0.13	0.11	118 17152	-	-	118 47152
	2200	21 x 38	05	1540	532	180	0.15	0.105	0.10	118 17222	-	-	118 47222
63	1.0	6.5 x 18	4	16.4	20	4.1	0.07	110	22	-	118 28108	118 38108	-
	2.2	6.5 x 18	4	24.3	20	4.3	0.07	51	15	-	118 28228	118 38228	-
	4.7	6.5 x 18	4	35.6	20	4.6	0.07	24	8.9	-	118 28478	118 38478	-
	10	6.5 x 18	4	51.9	20	5.3	0.07	11	5.6	-	118 28109	118 38109	-
	22	6.5 x 18	4	77.0	20	6.8	0.07	5.1	3.2	-	118 28229	118 38229	-
	47	8 x 18	5	126	22	9.9	0.07	2.4	1.5	-	118 28479	118 38479	-
	100	10 x 25	7	243	42	17	0.07	1.1	0.7	-	118 90513	118 90514	-
	100	10 x 30	00	340	42	17	0.07	1.91	1.62	118 18101	118 28101	-	-
	150	12.5 x 30	01	490	61	23	0.07	1.00	0.79	118 18151	118 28151	-	-
	220	12.5 x 30	01	550	87	32	0.08	0.94	0.82	118 18221	118 28221	-	-
	330	15 x 30	02	730	129	46	0.09	0.63	0.56	118 18331	118 28331	-	118 48331
	470	18 x 30	03	970	182	63	0.09	0.44	0.39	118 18471	-	-	118 48471
	680	18 x 38	04	1230	261	90	0.09	0.30	0.26	118 18681	-	-	118 48681
1000	21 x 38	05	1400	383	130	0.10	0.16	0.20	118 18102	-	-	118 48102	
100	4.7	6.5 x 18	4	36	20	4.9	0.07	24	19	-	118 29478	118 39478	-
	10	6.5 x 18	4	52	20	6.0	0.07	11	9.0	-	118 29109	118 39109	-
	22	8 x 18	5	91	20	8.4	0.07	5.1	4.0	-	118 29229	118 39229	-
	33	10 x 25	7	140	24	11	0.07	3.4	2.7	-	118 29339	118 39339	-
	47	10 x 25	7	170	33	13	0.07	2.6	2.0	-	118 90535	118 90536	-
	47	10 x 30	00	240	33	13	0.08	2.6	2.0	118 19479	118 29479	-	-
	68	12.5 x 30	01	320	45	18	0.08	1.8	1.2	118 19689	118 29689	-	-
	100	12.5 x 30	01	380	64	24	0.09	1.4	1.15	118 19101	118 29101	-	-
	150	15 x 30	02	500	94	34	0.10	0.94	0.78	118 19151	118 29151	-	118 49151
	220	18 x 30	03	690	136	48	0.10	0.66	0.55	118 19221	-	-	118 49221
330	18 x 38	04	890	202	70	0.10	0.45	0.37	118 19331	-	-	118 49331	
470	21 x 38	05	1050	286	98	0.10	0.33	0.28	118 19471	-	-	118 49471	
200	2.2	6.5 x 18	4	27	20	4.9	0.06	44	23	-	118 90537	118 90538	-
	4.7	8 x 18	5	46	20	5.9	0.06	21	11	-	118 90539	118 90541	-
	10	10 x 25	7	85	20	8.0	0.06	9.4	5.0	-	118 90542	118 90543	-
	15	10 x 30	00	150	22	10	0.046	4.76	3.75	118 92159	118 90012	-	-
	22	12.5 x 30	01	210	31	13	0.046	3.17	2.22	118 92229	118 90013	-	-
	33	15 x 30	02	290	44	17	0.046	2.11	1.11	118 92339	118 90014	-	118 90002
	47	18 x 30	03	390	61	23	0.046	1.48	0.60	118 92479	-	-	118 90003
	68	18 x 38	04	500	86	31	0.046	1.02	0.42	118 92689	-	-	118 90004
	100	21 x 38	05	610	124	44	0.046	0.96	0.39	118 92101	-	-	118 90005



ADDITIONAL ELECTRICAL DATA			
PARAMETER	CONDITIONS	VALUE	
		AXIAL	MOUNTING RING
Voltage			
Surge voltage		$U_s \leq 1.15 \times U_R$	
Reverse voltage		$U_{rev} \leq 1 \text{ V}$	
Current			
Leakage current	after 1 minute at U_R	$I_{L1} \leq 0.006 C_R \times U_R + 4 \mu\text{A}$ or $20 \mu\text{A}$ (whichever is greater)	
	after 5 minutes at U_R	$I_{L5} \leq 0.002 C_R \times U_R + 4 \mu\text{A}$	
Inductance			
Equivalent series inductance (ESL)	case $\varnothing D \times L$ mm:		
	6.5 × 18	typ. 15 nH	-
	8 × 18	typ. 35 nH	-
	10 × 18	typ. 69 nH	-
	10 × 25	typ. 38 nH	-
	10 × 30	typ. 38 nH	-
	12.5 × 30	typ. 46 nH	-
	15 × 30	typ. 48 nH	typ. 39 nH
	18 × 30	typ. 50 nH	typ. 39 nH
	18 × 38	typ. 54 nH	typ. 39 nH
21 × 38	typ. 59 nH	typ. 39 nH	

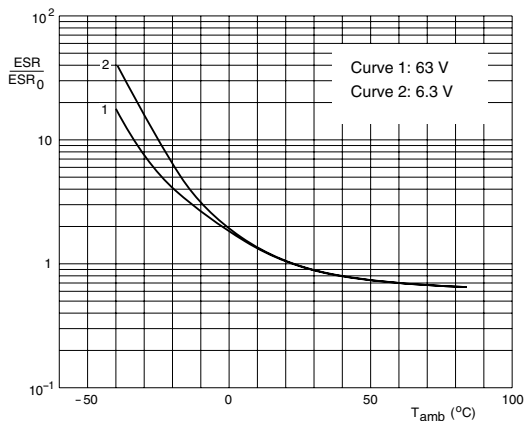
Table 4

OPERATING VALUES AT REDUCED AMBIENT TEMPERATURE										
SYMBOL	CONDITIONS	VALUES								UNIT
U_R	$T_{amb} > 85 \text{ to } 125 \text{ }^\circ\text{C}$	6.3	10	16	25	40	63	100	200	V
U_{R2}	$T_{amb} \leq 85 \text{ }^\circ\text{C}$	10	16	25	40	63	100	125	250	V

Note

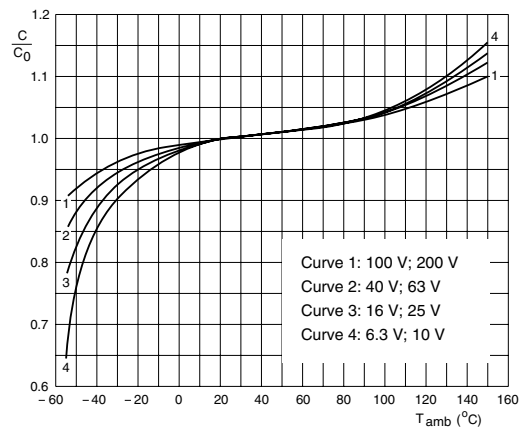
1. For applications at ambient temperatures of $\leq 85 \text{ }^\circ\text{C}$, the rated voltage (U_R) may be raised to U_{R2} .

CAPACITANCE (C)



Case $\varnothing D \times L = 6.5 \times 18$ to 10×25 mm
 C_0 = capacitance at $20 \text{ }^\circ\text{C}$, 100 Hz

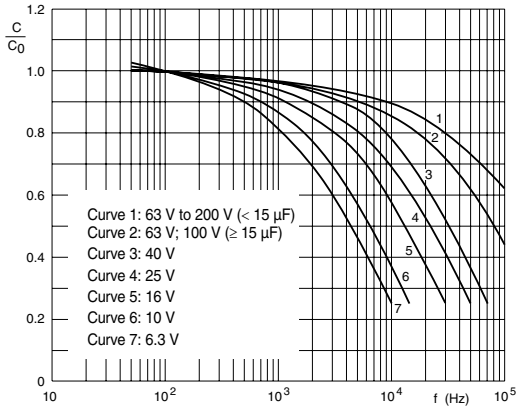
Fig.5 Typical multiplier of capacitance as a function of ambient temperature



Case $\varnothing D \times L = 10 \times 30$ to 21×38 mm
 C_0 = capacitance at $20 \text{ }^\circ\text{C}$, 100 Hz

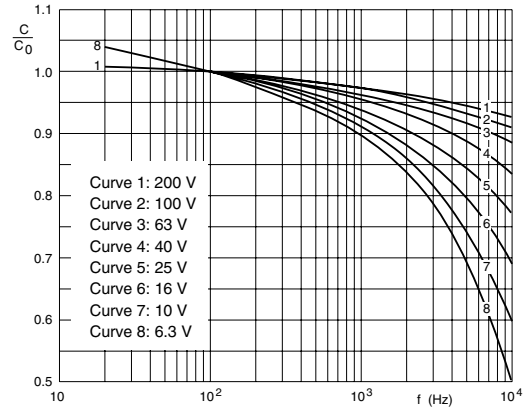
Fig.6 Typical multiplier of capacitance as a function of ambient temperature

CAPACITANCE (C)



Case $\varnothing D \times L = 6.5 \times 18$ to 10×25 mm
 C_0 = capacitance at 20 °C; 100 Hz

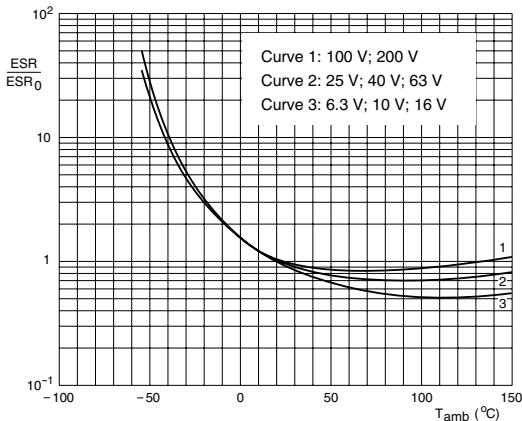
Fig.7 Typical multiplier of capacitance as a function of frequency



Case $\varnothing D \times L = 10 \times 30$ to 21×38 mm
 C_0 = capacitance at 20 °C; 100 Hz

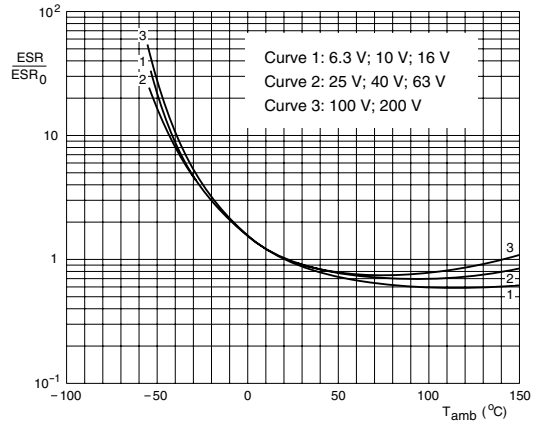
Fig.8 Typical multiplier of capacitance as a function of frequency

EQUIVALENT SERIES RESISTANCE (ESR)



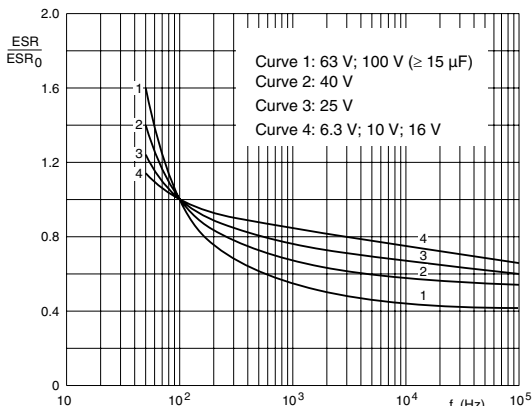
Case $\varnothing D \times L = 6.5 \times 18$ to 15×30 mm
 ESR_0 = typical at 20 °C; 100 Hz

Fig.9 Typical multiplier of ESR as a function of ambient temperature



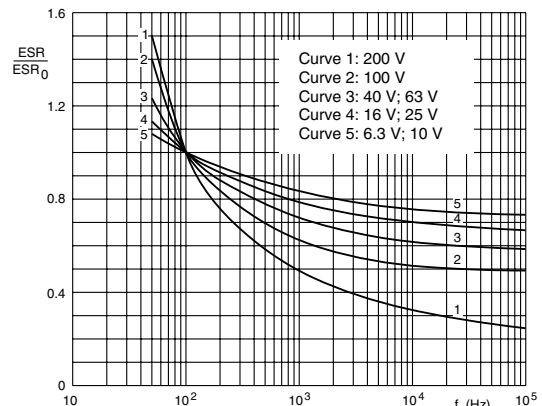
Case $\varnothing D \times L = 18 \times 30$ to 21×38 mm
 ESR_0 = typical at 20 °C; 100 Hz

Fig.10 Typical multiplier of ESR as a function of ambient temperature



Case $\varnothing D \times L = 6.5 \times 18$ to 10×25 mm
 ESR_0 = typical at 20 °C; 100 Hz

Fig.11 Typical multiplier of ESR as a function of frequency



Case $\varnothing D \times L = 10 \times 30$ to 21×38 mm
 ESR_0 = typical at 20 °C; 100 Hz

Fig.12 Typical multiplier of ESR as a function of frequency



IMPEDANCE (Z)

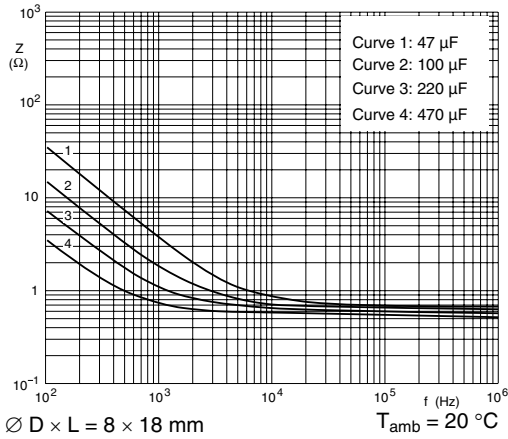


Fig.13 Typical impedance as a function of frequency

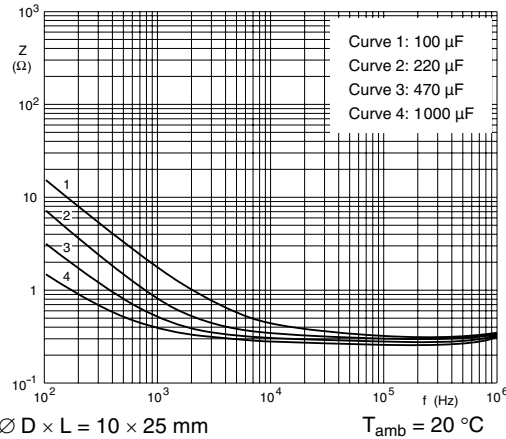


Fig.14 Typical impedance as a function of frequency

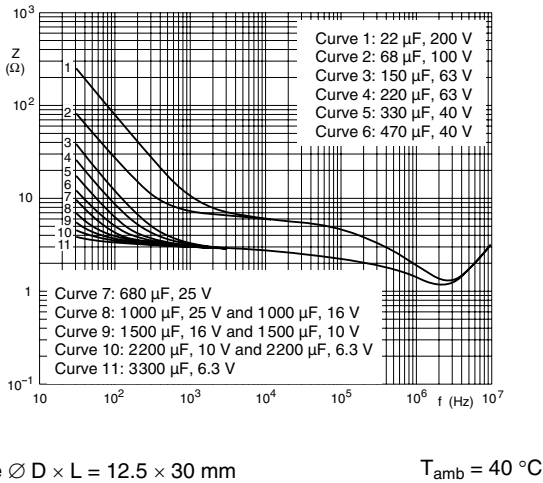


Fig.15 Typical impedance as a function of frequency

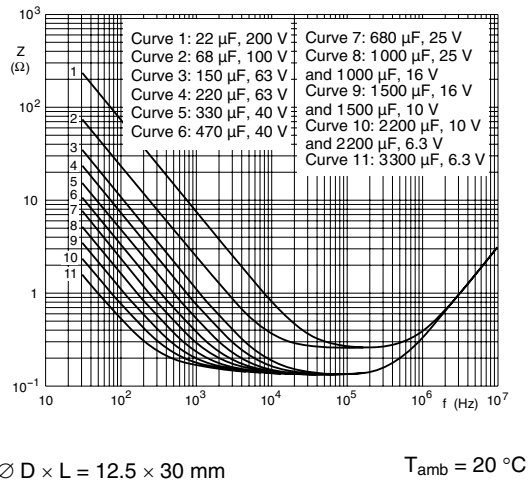


Fig.16 Typical impedance as a function of frequency

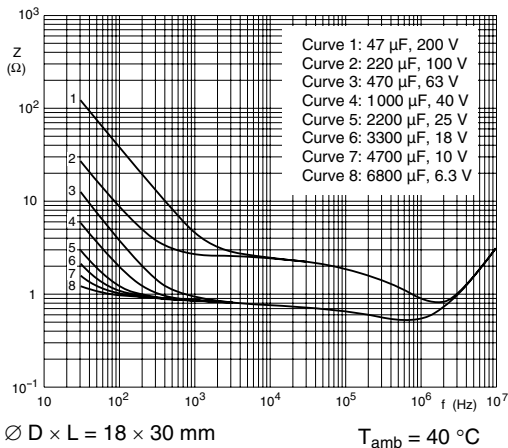


Fig.17 Typical impedance as a function of frequency

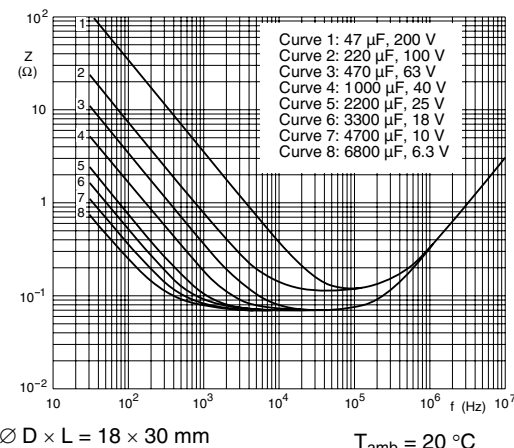
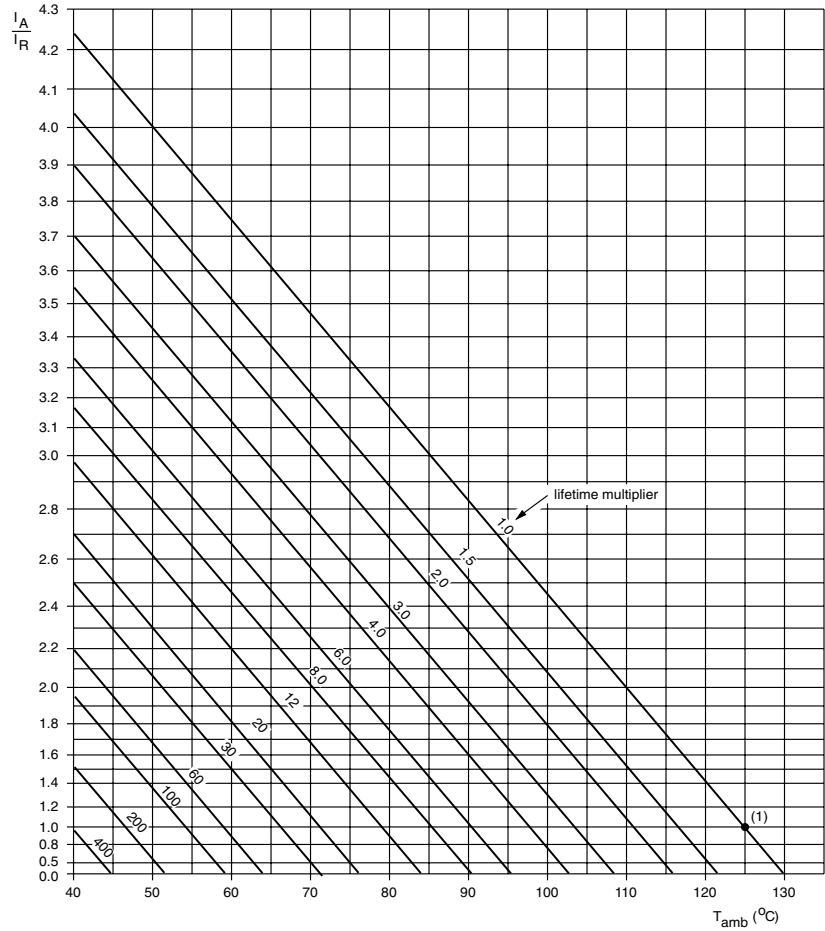


Fig.18 Typical impedance as a function of frequency

RIPPLE CURRENT AND USEFUL LIFE

MBC242



I_A = actual ripple current at 100 Hz
 I_R = rated ripple current at 100 Hz, 125 °C
 (1) Useful life at 125 °C and I_R applied:
 case $\varnothing D \times L = 6.5 \times 18$ to 10×25 mm: 4000 hours
 case $\varnothing D \times L = 10 \times 30$ to 21×38 mm: 8000 hours

Fig.19 Multiplier of useful life as a function of ambient temperature and ripple current load

Table 5

MULTIPLIER OF RIPPLE CURRENT (I_R) AS A FUNCTION OF FREQUENCY			
FREQUENCY (Hz)	I_R MULTIPLIER		
	$U_R = 6.3$ to 25 V	$U_R = 40$ to 63 V	$U_R = 100$ to 200 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
$\geq 10\ 000$	1.20	1.30	1.40

Table 6

TEST PROCEDURES AND REQUIREMENTS			
TEST		PROCEDURE (quick reference)	REQUIREMENTS
NAME OF TEST	REFERENCE		
Endurance	IEC 60384-4/ EN130300 subclause 4.13	$T_{amb} = 125\text{ }^{\circ}\text{C}$; U_R applied; case sizes: 6.5 × 18 to 10 × 25 mm: 2000 hours; 10 × 30 to 21 × 38 mm: 3000 hours	$U_R \leq 6.3\text{ V}$; $\Delta C/C$: + 15/- 30 % $U_R > 6.3\text{ V}$; $\Delta C/C$: $\pm 15\%$ $\tan \delta \leq 1.3 \times \text{spec. limit}$ $Z \leq 2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$
Useful life	CECC 30301 subclause 1.8.1	$T_{amb} = 125\text{ }^{\circ}\text{C}$; U_R and I_R applied; case $\varnothing D \times L = 6.5 \times 18$ to 10×25 mm: 4000 hours; case $\varnothing D \times L = 10 \times 30$ to 21×38 mm: 8000 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: $\leq 1\%$ (200 V $\leq 3\%$)
Shelf life (storage at high temperature)	IEC 60384-4/ EN130300 subclause 4.17	$T_{amb} = 125\text{ }^{\circ}\text{C}$; no voltage applied; $U_R = 6.3$ to 63 V : 500 hours; $U_R = 100$ and 200 V : 100 hours 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 $I_{L5} \leq 2 \times \text{spec. limit}$
Reverse voltage	IEC 60384-4/ EN130300 subclause 4.15	$T_{amb} = 125\text{ }^{\circ}\text{C}$: 125 hours at $U = -1\text{ V}$ followed by 125 hours at U_R	$\Delta C/C$: $\pm 20\%$ $\tan \delta \leq \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$



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