

## Aluminum Electrolytic Capacitors Radial High Temperature Standard

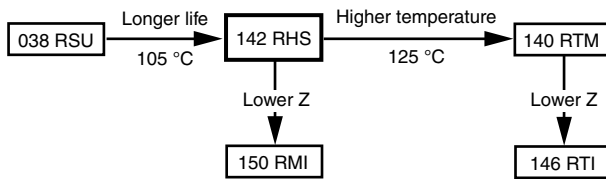
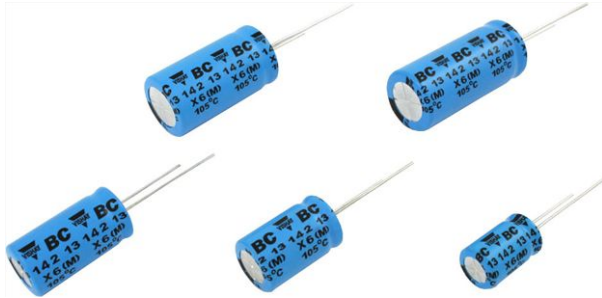


Fig. 1

QUICK REFERENCE DATA	
DESCRIPTION	VALUE
Nominal case sizes (Ø D x L in mm)	5 x 11 to 18 x 40
Rated capacitance range, C <sub>R</sub>	1 µF to 22 000 µF
Tolerance on C <sub>R</sub>	± 20 %
Rated voltage range, U <sub>R</sub>	10 V to 450 V
Category temperature range	-40 °C to +105 °C
Endurance test at 105 °C	2000 h
Useful life at 105 °C	2500 h
Useful life at 40 °C, 1.6 x I <sub>R</sub> applied	140 000 h
Shelf life at 0 V, 105 °C	1000 h
Based on sectional specification	IEC 60384-4 / EN130300
Climatic category IEC 60068	40 / 105 / 56

### FEATURES

- Useful life: 2500 h at 105 °C
- Miniaturized, high CV-product per unit volume
- Charge and discharge proof
- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Radial leads, cylindrical aluminum case, insulated with a blue sleeve
- Pressure relief for case Ø D ≥ 6.3 mm
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS  
COMPLIANT**

### APPLICATIONS

- Industrial, telecom and domestic appliances
- Decoupling, smoothing, filtering, buffering in SMPS
- Portable and mobile equipment (small size, low mass)

### MARKING

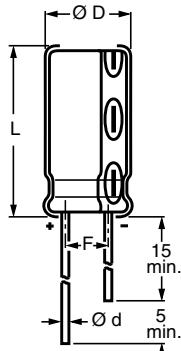
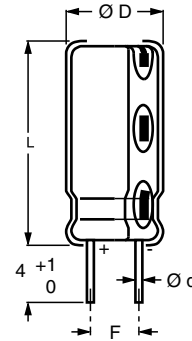
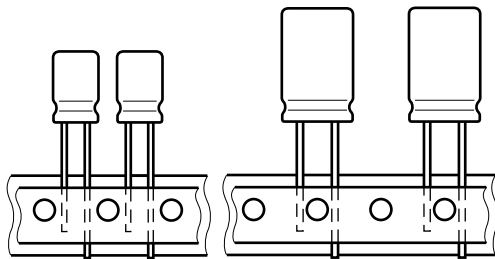
The capacitors are marked (where possible) with the following information:

- Rated capacitance (in µF)
- Tolerance on rated capacitance, code letter in accordance with IEC 60062 (M for ± 20 %)
- Rated voltage (in V)
- Date code, in accordance with IEC 60062
- Code indicating factory of origin
- Name or logo of manufacturer
- Negative terminal identification
- Series number (142)



SELECTION CHART FOR C <sub>R</sub> , U <sub>R</sub> , AND RELEVANT NOMINAL CASE SIZES (∅ D x L in mm)							
C <sub>R</sub> (μF)	U <sub>R</sub> (V)						
	10	16	25	35	50	63	100
1.0	→	→	→	→	→	→	→
2.2	→	→	→	→	→	→	5 x 11
4.7	→	→	→	→	→	5 x 11	6.3 x 11
10	→	→	→	→	→	5 x 11	8 x 12
22	→	→	→	→	5 x 11	6.3 x 11	8 x 12
33	→	→	→	→	→	6.3 x 11	10 x 12
47	→	→	5 x 11	5 x 11	6.3 x 11	8 x 12	10 x 16
100	→	5 x 11	6.3 x 11	6.3 x 11	8 x 12	10 x 12	10 x 20
220	→	6.3 x 11	8 x 12	8 x 12	10 x 12	10 x 16	12.5 x 25
330	6.3 x 11	8 x 12	→	10 x 12	10 x 16	10 x 20	16 x 25
470	8 x 12	10 x 12	10 x 12	10 x 16	12.5 x 20	12.5 x 20	16 x 31
1000	10 x 12	10 x 16	10 x 20	12.5 x 20	12.5 x 25	16 x 25	18 x 40
2200	10 x 20	12.5 x 20	12.5 x 25	16 x 25	16 x 35	18 x 40	-
3300	→	12.5 x 25	16 x 25	16 x 31	18 x 35	-	-
4700	12.5 x 25	16 x 25	16 x 31	18 x 35	-	-	-
6800	16 x 25	16 x 31	18 x 35	-	-	-	-
10 000	16 x 31	18 x 31	-	-	-	-	-
22 000	18 x 40	-	-	-	-	-	-

SELECTION CHART FOR C <sub>R</sub> , U <sub>R</sub> , AND RELEVANT NOMINAL CASE SIZES (∅ D x L in mm)					
C <sub>R</sub> (μF)	U <sub>R</sub> (V)				
	200	250	350	400	450
1.0	5 x 11	5 x 11	6.3 x 11	6.3 x 11	8 x 12
2.2	6.3 x 11	6.3 x 11	8 x 12	8 x 12	10 x 12
4.7	8 x 12	8 x 12	10 x 12	10 x 12	10 x 16
10	10 x 12	10 x 12	10 x 16	10 x 20	12.5 x 20
22	10 x 16	10 x 20	12.5 x 20	12.5 x 25	16 x 20
33	→	12.5 x 20	→	→	16 x 25
47	12.5 x 20	12.5 x 25	16 x 25	16 x 31	16 x 35
100	16 x 25	16 x 31	18 x 35	18 x 40	-
220	18 x 35	-	-	-	-

**DIMENSIONS in millimeters AND AVAILABLE FORMS**

 Fig. 2 - Form CA  
Long leads

 Fig. 3 - Form CB  
Cut leads


Dimensions of lead space F see Table 2

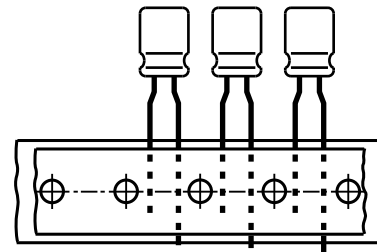
 Fig. 4 - Form TNA, Form TFA  
Taped in box (ammopack), straight leads

 Case  $\varnothing D = 5 \text{ mm to } 8 \text{ mm};$   
Lead space F is 5 mm

 Fig. 5 - Form TFA  
Taped in box (ammopack), formed leads

**Table 1**

<b>DIMENSIONS in millimeters, MASS AND PACKAGING QUANTITIES</b>									
NOMINAL CASE SIZE $\varnothing D \times L$	CASE CODE	$\varnothing d$	$\varnothing D_{max.}$	$L_{max.}$	F	MASS (g)	PACKAGING QUANTITIES		
							FORM CA	FORM CB	FORM TFA, TNA
5 x 11	11	0.5	5.5	12.5	$2.0 \pm 0.5$	$\approx 0.4$	5000	-	2000
6.3 x 11	12	0.5	6.8	12.5	$2.5 \pm 0.5$	$\approx 0.6$	5000	-	2000
8 x 12	13	0.6	8.5	13.0	$3.5 \pm 0.5$	$\approx 1.1$	5000	-	1000
10 x 12	14	0.6	10.5	13.5	$5.0 \pm 0.5$	$\approx 1.6$	3000	1000	500
10 x 16	15	0.6	10.5	17.5	$5.0 \pm 0.5$	$\approx 1.9$	2500	1000	500
10 x 20	16	0.6	10.5	22.0	$5.0 \pm 0.5$	$\approx 2.2$	2000	800	500
12.5 x 20	17	0.6	13.0	22.0	$5.0 \pm 0.5$	$\approx 4.0$	1500	400	300
12.5 x 25	18	0.6	13.0	27.0	$5.0 \pm 0.5$	$\approx 5.0$	1000	400	300
16 x 20	19a	0.8	16.5	22.0	$7.5 \pm 0.5$	$\approx 6.0$	1000	200	200
16 x 25	19	0.8	16.5	27.0	$7.5 \pm 0.5$	$\approx 8.0$	750	200	200
16 x 31	20	0.8	16.5	33.5	$7.5 \pm 0.5$	$\approx 9.0$	600	200	200
16 x 35	21	0.8	16.5	37.5	$7.5 \pm 0.5$	$\approx 11.0$	500	200	-
18 x 31	1831	0.8	18.5	33.5	$7.5 \pm 0.5$	$\approx 12.5$	400	150	-
18 x 35	22	0.8	18.5	37.5	$7.5 \pm 0.5$	$\approx 14.5$	400	150	-
18 x 40	23	0.8	18.5	42.0	$7.5 \pm 0.5$	$\approx 16.0$	400	150	-

**Note**

- For detailed tape dimensions please refer to packaging information: [www.vishay.com/doc?28360](http://www.vishay.com/doc?28360)



ELECTRICAL DATA	
SYMBOL	DESCRIPTION
$C_R$	Rated capacitance at 100 Hz, tolerance $\pm 20\%$
$I_R$	Rated RMS ripple current at 100 Hz, 105 °C
$I_{L2}$	Max. leakage current after 2 min at $U_R = 10\text{ V}$ to 100 V
$I_{L5}$	Max. leakage current after 5 min at $U_R = 200\text{ V}$ to 450 V
$\tan \delta$	Max. dissipation factor at 100 Hz

**Note**

- Unless otherwise specified, all electrical values in Table 2 apply at  $T_{amb} = 20\text{ °C}$ ,  $P = 86\text{ kPa}$  to 106 kPa,  $RH = 45\%$  to 75 %.

**ORDERING EXAMPLE**

Electrolytic capacitor 142 series

470  $\mu\text{F}$  / 25 V;  $\pm 20\%$

Nominal case size:  $\varnothing 10\text{ mm} \times 12\text{ mm}$ ; Form TFA

Ordering Code: MAL214236471E3

Table 2

ELECTRICAL DATA AND ORDERING INFORMATION														
$U_R$ (V)	$C_R$ 100 Hz ( $\mu\text{F}$ )	NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	$I_R$ 100 Hz 105 °C (mA)	$I_{L2}$ 2 min ( $\mu\text{A}$ )	$\tan \delta$ 100 Hz	FREQ. CODE <sup>(1)</sup>	ORDERING CODE MAL2142...							
							BULK PACKAGING				TAPED AMMOPACK			
							LONG LEADS		CUT LEADS		FORM TNA		FORM TFA	
							FORM CA	F (mm)	FORM CB	F (mm)	FORM TNA	F (mm)	FORM TFA	F (mm)
10	330	6.3 x 11	200	33	0.20	MF2	54331E3	2.5	-	-	74331E3	2.5	34331E3	5.0
	470	8 x 12	290	47	0.20	MF2	54471E3	3.5	-	-	74471E3	3.5	34471E3	5.0
	1000	10 x 12	460	100	0.20	MF2	54102E3	5.0	64102E3	5.0	-	-	34102E3	5.0
	2200	10 x 20	760	220	0.22	MF3	54222E3	5.0	64222E3	5.0	-	-	34222E3	5.0
	4700	12.5 x 25	1260	470	0.26	MF3	54472E3	5.0	64472E3	5.0	-	-	34472E3	5.0
	6800	16 x 25	1690	680	0.28	MF3	54682E3	7.5	64682E3	7.5	-	-	34682E3	7.5
	10 000	16 x 31	2120	1000	0.30	MF3	54103E3	7.5	64103E3	7.5	-	-	34103E3	7.5
	22 000	18 x 40	3100	2200	0.32	MF3	54223E3	7.5	64223E3	7.5	-	-	-	-
16	100	5 x 11	110	16	0.16	MF2	55101E3	2.0	-	-	75101E3	2.5	35101E3	5.0
	220	6.3 x 11	190	35	0.16	MF2	55221E3	2.5	-	-	75221E3	2.5	35221E3	5.0
	330	8 x 12	270	53	0.16	MF2	55331E3	3.5	-	-	75331E3	3.5	35331E3	5.0
	470	10 x 12	370	75	0.16	MF2	55471E3	5.0	65471E3	5.0	-	-	35471E3	5.0
	1000	10 x 16	560	160	0.16	MF2	55102E3	5.0	65102E3	5.0	-	-	35102E3	5.0
	2200	12.5 x 20	920	352	0.18	MF3	55222E3	5.0	65222E3	5.0	-	-	35222E3	5.0
	3300	12.5 x 25	1170	528	0.20	MF3	55332E3	5.0	65332E3	5.0	-	-	35332E3	5.0
	4700	16 x 25	1480	752	0.22	MF3	55472E3	7.5	65472E3	7.5	-	-	35472E3	7.5
	6800	16 x 31	1930	1088	0.24	MF3	55682E3	7.5	65682E3	7.5	-	-	35682E3	7.5
	10 000	18 x 31	2330	1600	0.26	MF3	55103E3	7.5	65103E3	7.5	-	-	-	-
25	47	5 x 11	97	12	0.14	MF1	56479E3	2.0	-	-	76479E3	2.5	36479E3	5.0
	100	6.3 x 11	142	25	0.14	MF2	56101E3	2.5	-	-	76101E3	2.5	36101E3	5.0
	220	8 x 12	236	55	0.14	MF2	56221E3	3.5	-	-	76221E3	3.5	36221E3	5.0
	470	10 x 12	380	118	0.14	MF2	56471E3	5.0	66471E3	5.0	-	-	36471E3	5.0
	1000	10 x 20	680	250	0.14	MF2	56102E3	5.0	66102E3	5.0	-	-	36102E3	5.0
	2200	12.5 x 25	1110	550	0.16	MF3	56222E3	5.0	66222E3	5.0	-	-	36222E3	5.0
	3300	16 x 25	1440	825	0.18	MF3	56332E3	7.5	66332E3	7.5	-	-	36332E3	7.5
	4700	16 x 31	1710	1175	0.20	MF3	56472E3	7.5	66472E3	7.5	-	-	36472E3	7.5
	6800	18 x 35	2160	1700	0.22	MF3	56682E3	7.5	66682E3	7.5	-	-	-	-



ELECTRICAL DATA AND ORDERING INFORMATION														
U <sub>R</sub> (V)	C <sub>R</sub> 100 Hz (μF)	NOMINAL CASE SIZE Ø D x L (mm)	I <sub>R</sub> 100 Hz 105 °C (mA)	I <sub>L2</sub> 2 min (μA)	tan δ 100 Hz	FREQ. CODE <sup>(1)</sup>	ORDERING CODE MAL2142...							
							BULK PACKAGING				TAPED AMMOPACK			
							LONG LEADS		CUT LEADS		FORM TNA	F (mm)	FORM TFA	F (mm)
							FORM CA	F (mm)	FORM CB	F (mm)				
35	47	5 x 11	90	16	0.12	MF1	50479E3	2.0	-	-	70479E3	2.5	30479E3	5.0
	100	6.3 x 11	150	35	0.12	MF2	50101E3	2.5	-	-	70101E3	2.5	30101E3	5.0
	220	8 x 12	270	77	0.12	MF2	50221E3	3.5	-	-	70221E3	3.5	30221E3	5.0
	330	10 x 12	350	116	0.12	MF2	50331E3	5.0	60331E3	5.0	-	-	30331E3	5.0
	470	10 x 16	460	165	0.12	MF2	50471E3	5.0	60471E3	5.0	-	-	30471E3	5.0
	1000	12.5 x 20	810	350	0.12	MF2	50102E3	5.0	60102E3	5.0	-	-	30102E3	5.0
	2200	16 x 25	1260	770	0.14	MF3	50222E3	7.5	60222E3	7.5	-	-	30222E3	7.5
	3300	16 x 31	1420	1155	0.16	MF3	50332E3	7.5	60332E3	7.5	-	-	30332E3	7.5
	4700	18 x 35	1900	1645	0.18	MF3	50472E3	7.5	60472E3	7.5	-	-	-	-
50	22	5 x 11	78	11	0.10	MF1	51229E3	2.0	-	-	71229E3	2.5	31229E3	5.0
	47	6.3 x 11	120	24	0.10	MF1	51479E3	2.5	-	-	71479E3	2.5	31479E3	5.0
	100	8 x 12	188	50	0.10	MF2	51101E3	3.5	-	-	71101E3	3.5	31101E3	5.0
	220	10 x 12	240	110	0.10	MF2	51221E3	5.0	61221E3	5.0	-	-	31221E3	5.0
	330	10 x 16	410	165	0.10	MF2	51331E3	5.0	61331E3	5.0	-	-	31331E3	5.0
	470	12.5 x 20	530	235	0.10	MF2	51471E3	5.0	61471E3	5.0	-	-	31471E3	5.0
	1000	12.5 x 25	950	500	0.10	MF2	51102E3	5.0	61102E3	5.0	-	-	31102E3	5.0
	2200	16 x 35	1470	1100	0.12	MF3	51222E3	7.5	61222E3	7.5	-	-	-	-
	3300	18 x 35	1770	1650	0.14	MF3	51332E3	7.5	61332E3	7.5	-	-	-	-
63	4.7	5 x 11	36	3	0.09	MF1	58478E3	2.0	-	-	78478E3	2.5	38478E3	5.0
	10	5 x 11	54	6	0.09	MF1	58109E3	2.0	-	-	78109E3	2.5	38109E3	5.0
	22	6.3 x 11	86	14	0.09	MF1	58229E3	2.5	-	-	78229E3	2.5	38229E3	5.0
	33	6.3 x 11	100	21	0.09	MF1	58339E3	2.5	-	-	78339E3	2.5	38339E3	5.0
	47	8 x 12	141	30	0.09	MF1	58479E3	3.5	-	-	78479E3	3.5	38479E3	5.0
	100	10 x 12	235	63	0.09	MF2	58101E3	5.0	68101E3	5.0	-	-	38101E3	5.0
	220	10 x 16	335	139	0.09	MF2	58221E3	5.0	68221E3	5.0	-	-	38221E3	5.0
	330	10 x 20	510	208	0.09	MF2	58331E3	5.0	68331E3	5.0	-	-	38331E3	5.0
	470	12.5 x 20	640	296	0.09	MF2	58471E3	5.0	68471E3	5.0	-	-	38471E3	5.0
	1000	16 x 25	930	630	0.09	MF2	58102E3	7.5	68102E3	7.5	-	-	38102E3	7.5
2200	18 x 40	2340	1380	0.09	MF3	58222E3	7.5	68222E3	7.5	-	-	-	-	
100	2.2	5 x 11	30	3	0.08	MF1	59228E3	2.0	-	-	79228E3	2.5	39228E3	5.0
	4.7	6.3 x 11	40	5	0.08	MF1	59478E3	2.5	-	-	79478E3	2.5	39478E3	5.0
	10	8 x 12	66	10	0.08	MF1	59109E3	3.5	-	-	79109E3	3.5	39109E3	5.0
	22	8 x 12	99	22	0.08	MF1	59229E3	3.5	-	-	79229E3	3.5	39229E3	5.0
	33	10 x 12	148	33	0.08	MF1	59339E3	5.0	69339E3	5.0	-	-	39339E3	5.0
	47	10 x 16	180	47	0.08	MF1	59479E3	5.0	69479E3	5.0	-	-	39479E3	5.0
	100	10 x 20	265	100	0.08	MF2	59101E3	5.0	69101E3	5.0	-	-	39101E3	5.0
	220	12.5 x 25	440	220	0.08	MF2	59221E3	5.0	69221E3	5.0	-	-	39221E3	5.0
	330	16 x 25	540	330	0.08	MF2	59331E3	7.5	69331E3	7.5	-	-	39331E3	7.5
	470	16 x 31	715	470	0.08	MF2	59471E3	7.5	69471E3	7.5	-	-	39471E3	7.5
1000	18 x 40	985	1000	0.08	MF2	59102E3	7.5	69102E3	7.5	-	-	-	-	



ELECTRICAL DATA AND ORDERING INFORMATION														
U <sub>R</sub> (V)	C <sub>R</sub> 100 Hz (μF)	NOMINAL CASE SIZE Ø D x L (mm)	I <sub>R</sub> 100 Hz 105 °C (mA)	I <sub>L2</sub> 2 min (μA)	tan δ 100 Hz	FREQ. CODE <sup>(1)</sup>	ORDERING CODE MAL2142...							
							BULK PACKAGING				TAPED AMMOPACK			
							LONG LEADS		CUT LEADS		FORM TNA		FORM TFA	
							FORM CA	F (mm)	FORM CB	F (mm)	FORM TNA	F (mm)	FORM TFA	F (mm)
200	1.0	5 x 11	18	21	0.14	MF1	52108E3	2.0	-	-	72108E3	2.5	32108E3	5.0
	2.2	6.3 x 11	30	28	0.14	MF1	52228E3	2.5	-	-	72228E3	2.5	32228E3	5.0
	4.7	8 x 12	54	43	0.14	MF1	52478E3	3.5	-	-	72478E3	3.5	32478E3	5.0
	10	10 x 12	94	65	0.14	MF1	52109E3	5.0	62109E3	5.0	-	-	32109E3	5.0
	22	10 x 16	142	113	0.14	MF1	52229E3	5.0	62229E3	5.0	-	-	32229E3	5.0
	47	12.5 x 20	250	213	0.14	MF1	52479E3	5.0	62479E3	5.0	-	-	32479E3	5.0
	100	16 x 25	485	425	0.14	MF2	52101E3	7.5	62101E3	7.5	-	-	32101E3	7.5
	220	18 x 35	835	905	0.14	MF2	52221E3	7.5	62221E3	7.5	-	-	-	-
250	1.0	5 x 11	16	23	0.17	MF1	51083E3	2.0	-	-	71083E3	2.5	31083E3	5.0
	2.2	6.3 x 11	35	32	0.17	MF1	52283E3	2.5	-	-	72283E3	2.5	32283E3	5.0
	4.7	8 x 12	60	50	0.17	MF1	54783E3	3.5	-	-	74783E3	3.5	34783E3	5.0
	10	10 x 12	92	75	0.17	MF1	51093E3	5.0	61093E3	5.0	-	-	31093E3	5.0
	22	10 x 20	215	135	0.17	MF1	52293E3	5.0	62293E3	5.0	-	-	32293E3	5.0
	33	12.5 x 20	315	190	0.17	MF1	53393E3	5.0	63393E3	5.0	-	-	33393E3	5.0
	47	12.5 x 25	350	260	0.17	MF1	54793E3	5.0	64793E3	5.0	-	-	34793E3	5.0
	100	16 x 31	530	525	0.17	MF2	51013E3	7.5	61013E3	7.5	-	-	31013E3	7.5
350	1.0	6.3 x 11	23	26	0.20	MF1	51085E3	2.5	-	-	71085E3	2.5	31085E3	5.0
	2.2	8 x 12	41	38	0.20	MF1	52285E3	3.5	-	-	72285E3	3.5	32285E3	5.0
	4.7	10 x 12	65	58	0.20	MF1	54785E3	5.0	64785E3	5.0	-	-	34785E3	5.0
	10	10 x 16	105	95	0.20	MF1	51095E3	5.0	61095E3	5.0	-	-	31095E3	5.0
	22	12.5 x 20	210	179	0.20	MF1	52295E3	5.0	62295E3	5.0	-	-	32295E3	5.0
	47	16 x 25	365	354	0.20	MF1	54795E3	7.5	64795E3	7.5	-	-	34795E3	7.5
	100	18 x 35	505	725	0.20	MF2	51015E3	7.5	61015E3	7.5	-	-	-	-
400	1.0	6.3 x 11	21	27	0.25	MF1	51086E3	2.5	-	-	71086E3	2.5	31086E3	5.0
	2.2	8 x 12	39	41	0.25	MF1	52286E3	3.5	-	-	72286E3	3.5	32286E3	5.0
	4.7	10 x 12	70	63	0.25	MF1	54786E3	5.0	64786E3	5.0	-	-	34786E3	5.0
	10	10 x 20	125	105	0.25	MF1	51096E3	5.0	61096E3	5.0	-	-	31096E3	5.0
	22	12.5 x 25	235	201	0.25	MF1	52296E3	5.0	62296E3	5.0	-	-	32296E3	5.0
	47	16 x 31	390	401	0.25	MF1	54796E3	7.5	64796E3	7.5	-	-	34796E3	7.5
	100	18 x 40	530	825	0.25	MF2	51016E3	7.5	61016E3	7.5	-	-	-	-
450	1.0	8 x 12	27	29	0.25	MF1	57108E3	3.5	-	-	77108E3	3.5	37108E3	5.0
	2.2	10 x 12	48	45	0.25	MF1	57228E3	5.0	67228E3	5.0	-	-	37228E3	5.0
	4.7	10 x 16	75	67	0.25	MF1	57478E3	5.0	67478E3	5.0	-	-	37478E3	5.0
	10	12.5 x 20	145	115	0.25	MF1	57109E3	5.0	67109E3	5.0	-	-	37109E3	5.0
	22	16 x 20	245	223	0.25	MF1	57229E3	7.5	67229E3	7.5	-	-	37229E3	7.5
	33	16 x 25	325	322	0.25	MF1	57339E3	7.5	67339E3	7.5	-	-	37339E3	7.5
	47	16 x 35	420	448	0.25	MF1	57479E3	7.5	67479E3	7.5	-	-	-	-

Note

(1) Determines the applicable row in the table “Multiplier of Ripple Current (I<sub>R</sub>) as a Function of Frequency”



ADDITIONAL ELECTRICAL DATA		
PARAMETER	CONDITIONS	VALUE
<b>Voltage</b>		
Surge voltage		$U_s \leq 1.15 \times U_R$
Reverse voltage		$U_{rev} \leq 1 \text{ V}$
<b>Current</b>		
Leakage current	After 2 min at $U_R = 10 \text{ V to } 100 \text{ V}$	$I_{L2} \leq 0.01 C_R \times U_R \text{ or } 3 \mu\text{A, whichever is greater}$
	After 5 min at $U_R = 200 \text{ V to } 450 \text{ V}$	$I_{L5} \leq 0.03 C_R \times U_R + 15 \mu\text{A} (C_R \times U_R \leq 1000)$ $I_{L5} \leq 0.02 C_R \times U_R + 25 \mu\text{A} (C_R \times U_R > 1000)$
<b>Inductance</b>		
Equivalent series inductance (ESL)	Case $\varnothing D \leq 8 \text{ mm}$	Typ. 13 nH
	Case $\varnothing D = 10 \text{ mm}$	Typ. 16 nH
	Case $\varnothing D \geq 12.5 \text{ mm}$	Typ. 18 nH
<b>Resistance</b>		
Equivalent series resistance (ESR)	Calculated from $\tan \delta_{max}$ and $C_R$ (see Table 2)	$ESR = \tan \delta / 2 \pi f C_R$

**CAPACITANCE (C)**

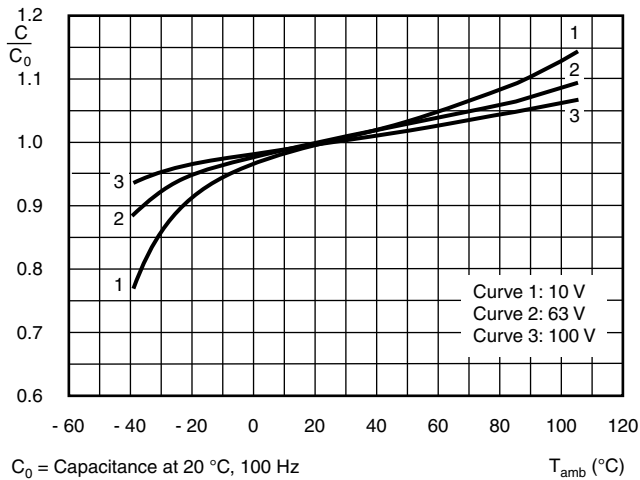


Fig. 6 - Typical multiplier of capacitance as a function of ambient temperature

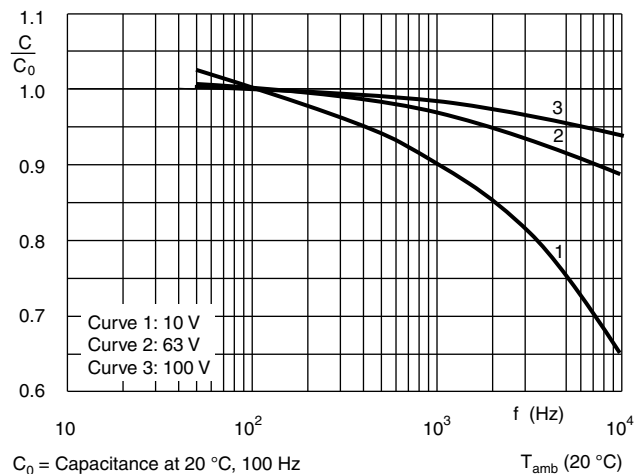


Fig. 7 - Typical multiplier of capacitance as a function of frequency

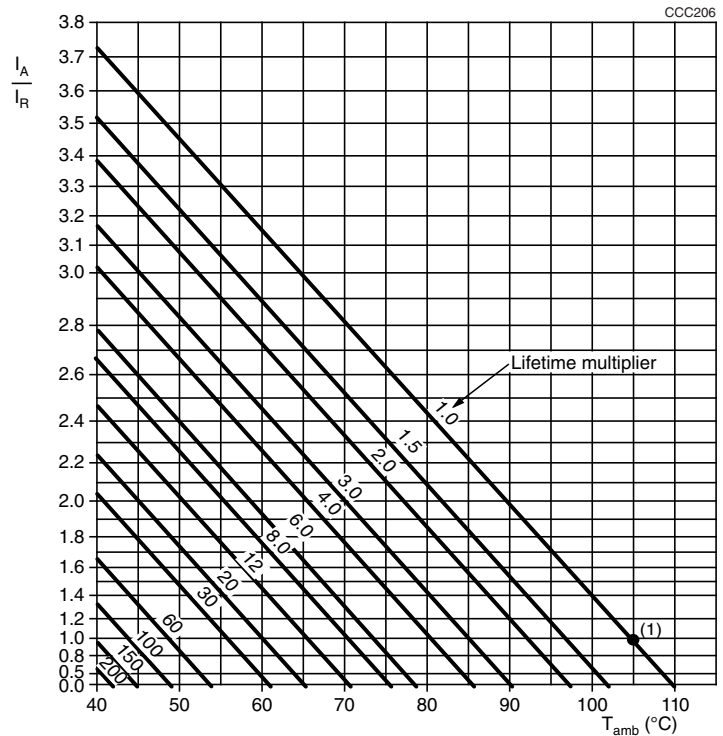
**RIPPLE CURRENT AND USEFUL LIFE**

Table 3

ENDURANCE TEST DURATION AND USEFUL LIFE	
ENDURANCE AT 105 °C (h)	USEFUL LIFE AT 105 °C (h)
2000	2500

**Note**

- Multiplier of useful life code: CCC206



$I_A$  = Actual ripple current at 100 Hz, 105 °C  
 $I_R$  = Rated ripple current at 100 Hz, 105 °C

(1) Useful life at 105 °C and  $I_R$  applied

Fig. 8 - Multiplier of useful life as a function of ambient temperature and ripple current load

Table 4

MULTIPLIER OF RIPPLE CURRENT ( $I_R$ ) AS A FUNCTION OF FREQUENCY					
FREQ. CODE	FREQUENCY (Hz)				
	50	100	500	1000	≥ 10 000
	$I_R$ MULTIPLIER				
MF1	0.70	1.00	1.30	1.40	1.50
MF2	0.75	1.00	1.20	1.30	1.35
MF3	0.80	1.00	1.10	1.12	1.15

Table 5

TEST PROCEDURES AND REQUIREMENTS			
TEST		PROCEDURE (quick reference)	REQUIREMENTS
NAME OF TEST	REFERENCE		
Endurance	IEC 60384-4 / EN130300 subclause 4.13	$T_{amb} = 105\text{ °C}$ ; $U_R$ applied; 2000 h	$\Delta C/C: \pm 20\%$ $\tan \delta \leq 2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$
Useful life	CECC 30301 subclause 1.8.1	$T_{amb} = 105\text{ °C}$ ; $U_R$ and $I_R$ applied; 2500 h	$\Delta C/C: \pm 30\%$ $\tan \delta \leq 3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ no short or open circuit total failure percentage: $\leq 1\%$
Shelf life (storage at high temperature)	IEC 60384-4 / EN130300 subclause 4.17	$T_{amb} = 105\text{ °C}$ ; no voltage applied; 1000 h After test: $U_R$ to be applied for 30 min, 24 h to 48 h before measurement	$\Delta C/C: \pm 20\%$ $\tan \delta \leq 2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$
Surge	IEC 60384-4 / EN130300 subclause 4.14	From source of $1.15 \times U_R$ : $RC = 0.1\text{ s} \pm 0.05\text{ s}$ ; 1000 cycles of 30 s on, 330 s off, at $105\text{ °C}$	$\Delta C/C: \pm 25\%$ $\tan \delta \leq 1.5 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$

Statements about product lifetime are based on calculations and internal testing. They should only be interpreted as estimations. Also due to external factors, the lifetime in the field application may deviate from the calculated lifetime. In general, nothing stated herein shall be construed as a guarantee of durability.





## Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.