

Aluminum Electrolytic Capacitors Radial High Temperature Standard

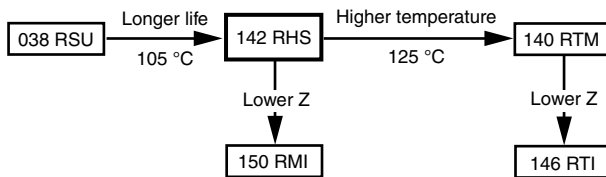
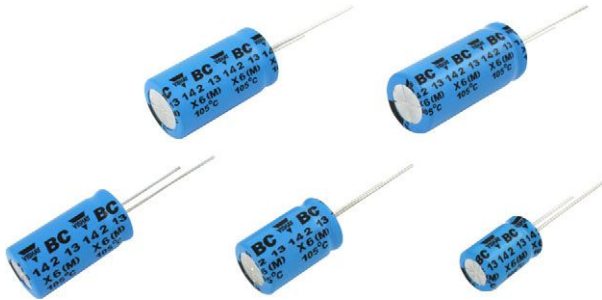


Fig. 1

| 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 _R | 1 µF to 22 000 µF |
| Tolerance on C _R | ± 20 % |
| Rated voltage range, U _R | 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 _R 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


**RoHS
COMPLIANT**

APPLICATIONS

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

MARKING

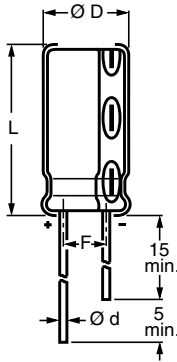
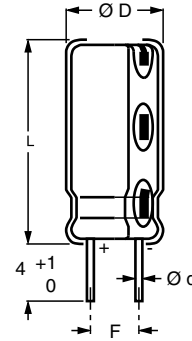
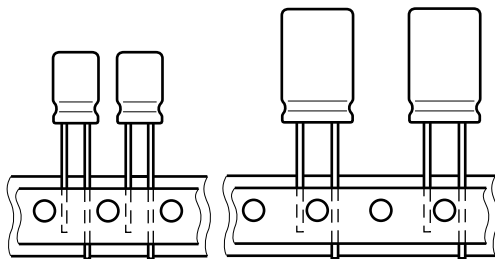
The capacitors are marked (where possible) with the following information:

- 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 _R , U _R , AND RELEVANT NOMINAL CASE SIZES (∅ D x L in mm) | | | | | | | |
|-------------------------------------------------------------------------------------------------------|--------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| C _R (µF) | U _R (V) | | | | | | |
| | 10 | 16 | 25 | 35 | 50 | 63 | 100 |
| 1.0 | → | → | → | → | → | 5 x 11 | - |
| 2.2 | → | → | → | → | → | → | 5 x 11 |
| 3.3 | → | → | → | → | → | 5 x 11 | - |
| 4.7 | → | → | → | → | → | 5 x 11 | 5 x 11 |
| | | | | | | | 6.3 x 11 |
| 6.8 | → | → | → | → | → | 5 x 11 | - |
| 10 | → | → | → | → | → | 5 x 11 | 6.3 x 11 |
| | | | | | | | 8 x 12 |
| 22 | → | → | → | → | 5 x 11 | 5 x 11 | 6.3 x 11 |
| | | | | | | 6.3 x 11 | 8 x 12 |
| 33 | → | → | 5 x 11 | → | 5 x 11 | 6.3 x 11 | 8 x 12 |
| | | | 10 x 12 | | | | |
| 47 | → | → | 5 x 11 | 5 x 11 | 6.3 x 11 | 6.3 x 11 | 10 x 16 |
| | | | 8 x 12 | | | | |
| 100 | → | 5 x 11 | 6.3 x 11 | 6.3 x 11 | 8 x 12 | 10 x 12 | 10 x 20 |
| 220 | 5 x 11 | 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 | 8 x 12 | 10 x 12 | 10 x 16 | 10 x 20 | 12.5 x 25 |
| | | | | | | | 16 x 25 |
| 470 | 6.3 x 11 | 8 x 12 | 10 x 12 | 10 x 16 | 10 x 20 | 12.5 x 20 | 16 x 31 |
| | 8 x 12 | 10 x 12 | | | 12.5 x 20 | | |
| 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 _R , U _R , AND RELEVANT NOMINAL CASE SIZES (∅ D x L in mm) | | | | | |
|-------------------------------------------------------------------------------------------------------|--------------------|-----------|-----------|-----------|-----------|
| C _R (µF) | U _R (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

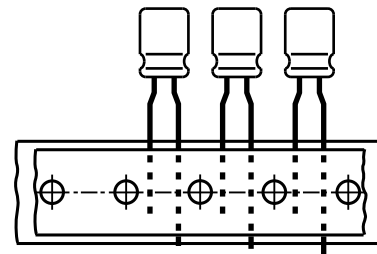
 Fig. 4 - Form TNA, Form TFA
Taped in box (ammopack), straight leads

 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

| DIMENSIONS in millimeters, MASS AND PACKAGING QUANTITIES | | | | | | | | | |
|----------------------------------------------------------|-----------|-----------------|------------------------|------------|---------------|----------------|----------------------|---------|---------------|
| 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 ± 0.5 | ≈ 0.4 | 5000 | - | 2000 |
| 6.3 x 11 | 12 | 0.5 | 6.8 | 12.5 | 2.5 ± 0.5 | ≈ 0.6 | 5000 | - | 2000 |
| 8 x 12 | 13 | 0.6 | 8.5 | 13.0 | 3.5 ± 0.5 | ≈ 1.1 | 5000 | - | 1000 |
| 10 x 12 | 14 | 0.6 | 10.5 | 13.5 | 5.0 ± 0.5 | ≈ 1.6 | 3000 | 1000 | 500 |
| 10 x 16 | 15 | 0.6 | 10.5 | 17.5 | 5.0 ± 0.5 | ≈ 1.9 | 2500 | 1000 | 500 |
| 10 x 20 | 16 | 0.6 | 10.5 | 22.0 | 5.0 ± 0.5 | ≈ 2.2 | 2000 | 800 | 500 |
| 12.5 x 20 | 17 | 0.6 | 13.0 | 22.0 | 5.0 ± 0.5 | ≈ 4.0 | 1500 | 400 | 300 |
| 12.5 x 25 | 18 | 0.6 | 13.0 | 27.0 | 5.0 ± 0.5 | ≈ 5.0 | 1000 | 400 | 300 |
| 16 x 20 | 19a | 0.8 | 16.5 | 22.0 | 7.5 ± 0.5 | ≈ 6.0 | 1000 | 200 | 200 |
| 16 x 25 | 19 | 0.8 | 16.5 | 27.0 | 7.5 ± 0.5 | ≈ 8.0 | 750 | 200 | 200 |
| 16 x 31 | 20 | 0.8 | 16.5 | 33.5 | 7.5 ± 0.5 | ≈ 9.0 | 600 | 200 | 200 |
| 16 x 35 | 21 | 0.8 | 16.5 | 37.5 | 7.5 ± 0.5 | ≈ 11.0 | 500 | 200 | - |
| 18 x 31 | 1831 | 0.8 | 18.5 | 33.5 | 7.5 ± 0.5 | ≈ 12.5 | 400 | 150 | - |
| 18 x 35 | 22 | 0.8 | 18.5 | 37.5 | 7.5 ± 0.5 | ≈ 14.5 | 400 | 150 | - |
| 18 x 40 | 23 | 0.8 | 18.5 | 42.0 | 7.5 ± 0.5 | ≈ 16.0 | 400 | 150 | - |

Note

- For detailed tape dimensions please refer to packaging information: www.vishay.com/doc?28360



| ELECTRICAL DATA | |
|-----------------|---------------------------------------------------------------------|
| SYMBOL | DESCRIPTION |
| C _R | Rated capacitance at 100 Hz, tolerance ± 20 % |
| I _R | Rated RMS ripple current at 100 Hz, 105 °C |
| I _{L2} | Max. leakage current after 2 min at U _R = 10 V to 100 V |
| I _{L5} | Max. leakage current after 5 min at U _R = 200 V to 450 V |
| tan δ | Max. dissipation factor at 100 Hz |

ORDERING EXAMPLE

Electrolytic capacitor 142 series

470 µF / 25 V; ± 20 %

Nominal case size: Ø 10 mm x 12 mm; Form TFA

Ordering Code: MAL214236471E3

Note

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

Table 2

| ELECTRICAL DATA AND ORDERING INFORMATION | | | | | | | | | | | | | | |
|------------------------------------------|----------------------------------|-----------------------------------------|--------------------------------------------|----------------------------------|-----------------|-------------------|--------------------------|-----------|------------|-----------|----------------|-----------|-------------|-----------|
| U _R (V) | C _R 100 Hz (µF) | NOMINAL CASE SIZE Ø D x L (mm) | I _R 100 Hz 105 °C (mA) | I _{L2} 2 min (µA) | tan δ 100 Hz | FREQ. CODE (1) | ORDERING CODE MAL2142... | | | | | | | |
| | | | | | | | BULK PACKAGING | | | | TAPED AMMOPACK | | | |
| | | | | | | | LONG LEADS | | CUT LEADS | | | | | |
| | | | | | | | FORM CA | F (mm) | FORM CB | F (mm) | FORM TNA | F (mm) | FORM TFA | F (mm) |
| 10 | 220 | 5 x 11 | 115 | 22 | 0.20 | MF2 | 54221E3 | 2.0 | - | - | 74221E3 | 2.5 | 34221E3 | 5.0 |
| | 330 | 6.3 x 11 | 200 | 33 | 0.20 | MF2 | 54331E3 | 2.5 | - | - | 74331E3 | 2.5 | 34331E3 | 5.0 |
| | 470 | 6.3 x 11 | 204 | 47 | 0.20 | MF2 | 94475E3 | 2.5 | - | - | 94477E3 | 2.5 | 94473E3 | 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 | 8 x 12 | 310 | 75 | 0.16 | MF2 | 95475E3 | 3.5 | - | - | 95477E3 | 3.5 | 95473E3 | 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 | 33 | 5 x 11 | 68 | 8 | 0.14 | MF1 | 56339E3 | 2.0 | - | - | 76339E3 | 2.5 | 36339E3 | 5.0 |
| | 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 |
| | 330 | 8 x 12 | 310 | 82 | 0.14 | MF2 | 56331E3 | 3.5 | - | - | 76331E3 | 3.5 | 36331E3 | 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 _R (V) | C _R 100 Hz (μF) | NOMINAL CASE SIZE Ø D x L (mm) | I _R 100 Hz 105 °C (mA) | I _{L2} 2 min (μA) | tan δ 100 Hz | FREQ. CODE ⁽¹⁾ | 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) |
| 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 |
| | 33 | 5 x 11 | 90 | 16 | 0.10 | MF1 | 51339E3 | 2.0 | - | - | 71339E3 | 2.5 | 31339E3 | 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 | 10 x 20 | 530 | 235 | 0.10 | MF2 | 91475E3 | 5.0 | 91476E3 | 5.0 | - | - | 91473E3 | 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 | 1.0 | 5 x 11 | 13 | 3 | 0.09 | MF1 | 58108E3 | 2.0 | - | - | 78108E3 | 2.5 | 38108E3 | 5.0 |
| | 3.3 | 5 x 11 | 30 | 3 | 0.09 | MF1 | 58338E3 | 2.0 | - | - | 78338E3 | 2.5 | 38338E3 | 5.0 |
| | 4.7 | 5 x 11 | 36 | 3 | 0.09 | MF1 | 58478E3 | 2.0 | - | - | 78478E3 | 2.5 | 38478E3 | 5.0 |
| | 6.8 | 5 x 11 | 40 | 4 | 0.09 | MF1 | 58688E3 | 2.0 | - | - | 78688E3 | 2.5 | 38688E3 | 5.0 |
| | 10 | 5 x 11 | 54 | 6 | 0.09 | MF1 | 58109E3 | 2.0 | - | - | 78109E3 | 2.5 | 38109E3 | 5.0 |
| | 22 | 5 x 11 | 70 | 14 | 0.09 | MF1 | 98225E3 | 2.0 | - | - | 98227E3 | 2.5 | 98223E3 | 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 | 6.3 x 11 | 130 | 30 | 0.09 | MF1 | 98475E3 | 2.5 | - | - | 98477E3 | 2.5 | 98473E3 | 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 | - | - | - | - |



| ELECTRICAL DATA AND ORDERING INFORMATION | | | | | | | | | | | | | | |
|------------------------------------------|----------------------------------|-----------------------------------------|--------------------------------------------|----------------------------------|-----------------|------------------------------|--------------------------|-----------|------------|-----------|----------------|-----------|-------------|-----------|
| U _R (V) | C _R 100 Hz (µF) | NOMINAL CASE SIZE Ø D x L (mm) | I _R 100 Hz 105 °C (mA) | I _{L2} 2 min (µA) | tan δ 100 Hz | FREQ. CODE ⁽¹⁾ | ORDERING CODE MAL2142... | | | | | | | |
| | | | | | | | BULK PACKAGING | | | | TAPED AMMOPACK | | | |
| | | | | | | | LONG LEADS | | CUT LEADS | | | | | |
| | | | | | | | FORM CA | F (mm) | FORM CB | F (mm) | FORM TNA | F (mm) | FORM TFA | F (mm) |
| 100 | 2.2 | 5 x 11 | 30 | 3 | 0.08 | MF1 | 59228E3 | 2.0 | - | - | 79228E3 | 2.5 | 39228E3 | 5.0 |
| | 4.7 | 5 x 11 | 36 | 5 | 0.08 | MF1 | 99475E3 | 2.0 | - | - | 99477E3 | 2.5 | 99473E3 | 5.0 |
| | 4.7 | 6.3 x 11 | 40 | 5 | 0.08 | MF1 | 59478E3 | 2.5 | - | - | 79478E3 | 2.5 | 39478E3 | 5.0 |
| | 10 | 6.3 x 11 | 54 | 10 | 0.08 | MF1 | 99105E3 | 2.5 | - | - | 99107E3 | 2.5 | 99103E3 | 5.0 |
| | 10 | 8 x 12 | 66 | 10 | 0.08 | MF1 | 59109E3 | 3.5 | - | - | 79109E3 | 3.5 | 39109E3 | 5.0 |
| | 22 | 6.3 x 11 | 93 | 22 | 0.08 | MF1 | 99225E3 | 2.5 | - | - | 99227E3 | 2.5 | 99223E3 | 5.0 |
| | 22 | 8 x 12 | 99 | 22 | 0.08 | MF1 | 59229E3 | 3.5 | - | - | 79229E3 | 3.5 | 39229E3 | 5.0 |
| | 33 | 8 x 12 | 130 | 33 | 0.08 | MF1 | 99395E3 | 3.5 | - | - | 99397E3 | 3.5 | 99393E3 | 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 | 12.5 x 25 | 400 | 330 | 0.08 | MF2 | 99315E3 | 5.0 | 99316E3 | 5.0 | - | - | 99313E3 | 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 | - | - | - | - | |
| 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_R) as a Function of Frequency”



| ADDITIONAL ELECTRICAL DATA | | |
|------------------------------------|-------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PARAMETER | CONDITIONS | VALUE |
| Voltage | | |
| Surge voltage | | $U_s \leq 1.15 \times U_R$ |
| Reverse voltage | | $U_{rev} \leq 1 \text{ V}$ |
| Current | | |
| Leakage current | After 2 min at $U_R = 10 \text{ V}$ to 100 V | $I_{L2} \leq 0.01 C_R \times U_R$ or $3 \mu\text{A}$, whichever is greater |
| | After 5 min at $U_R = 200 \text{ V}$ to 450 V | $I_{L5} \leq 0.03 C_R \times U_R + 15 \mu\text{A}$ ($C_R \times U_R \leq 1000$) $I_{L5} \leq 0.02 C_R \times U_R + 25 \mu\text{A}$ ($C_R \times U_R > 1000$) |
| Inductance | | |
| 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 |
| Resistance | | |
| 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)

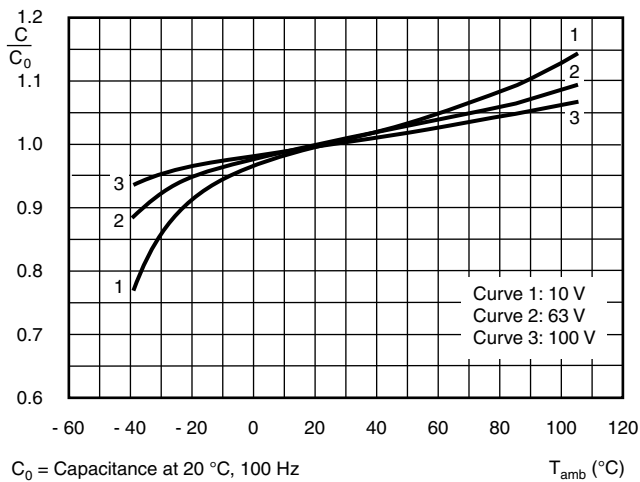


Fig. 6 - Typical multiplier of capacitance as a function of ambient temperature

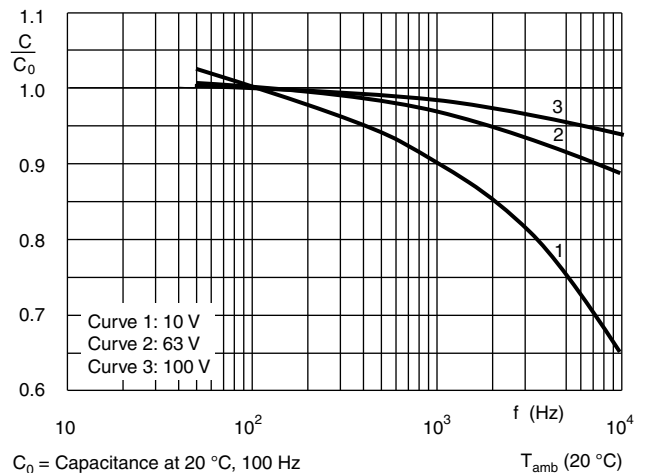


Fig. 7 - Typical multiplier of capacitance as a function of frequency

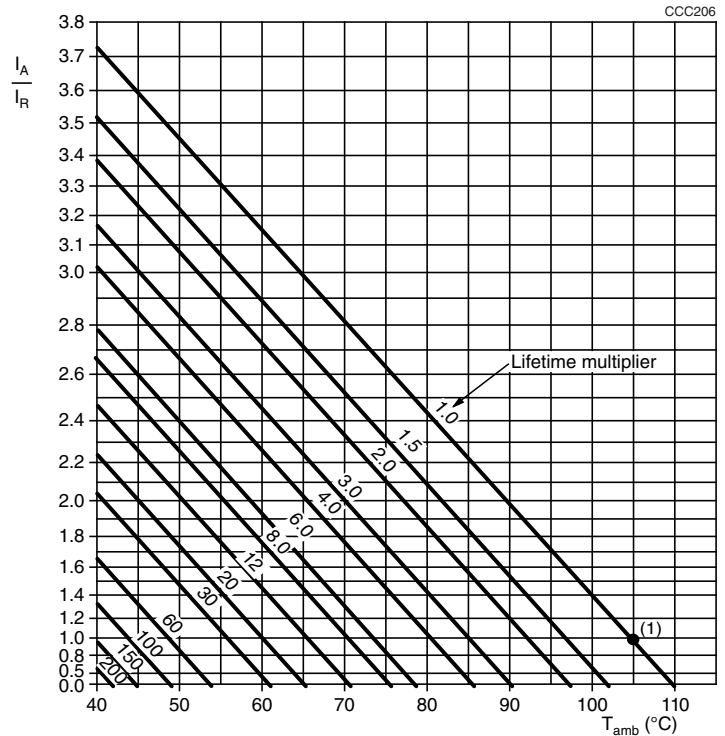
RIPPLE CURRENT AND USEFUL LIFE

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 °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.



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