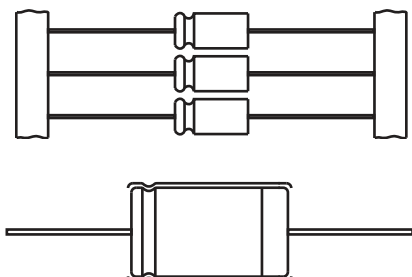




Aluminum Capacitors Axial Capacitor Style



FEATURES

- Long useful life: 3000 h at 105 °C
- Polarized aluminum electrolytic capacitors
- High ripple current capability
- Axial leads, insulated cylindrical aluminum case
- Charge/discharge proof
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT

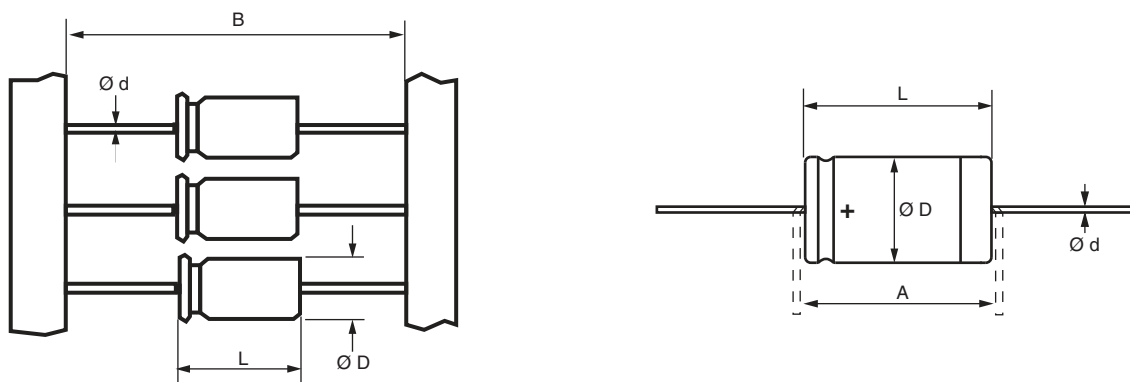
APPLICATIONS

- Industrial and automotive electronics, audio/video, telecommunication systems, power supply units
- Coupling, smoothing, filtering, buffering and timing

| QUICK REFERENCE DATA | | | |
|--|---------------------|--|--------------|
| DESCRIPTION | UNIT | LOW VOLTAGE | HIGH VOLTAGE |
| Nominal case size (Ø D x L) | mm | 6.5 x 18 to 10 x 25 | |
| Rated capacitance range C _R | µF | 4.7 to 470 | 22 |
| Capacitance tolerance | % | -10/+50 | |
| Rated voltage range | V | 16 to 100 | 160 |
| Category temperature range | °C | -40 to +105 | |
| Endurance test at upper category temp. | h | 2000 | |
| Useful life at 105 °C and I _R applied | h | 3000 | |
| Useful life at 85 °C and I _R applied | h | 11 000 | |
| Useful life at 40 °C and I _R applied | h | 330 000 | |
| Shelf life (0 V, 105 °C) | h | 100 | |
| Failure rate | 10 ⁻⁹ /h | ≤ 14 | |
| Based on sectional specification | | IEC 60384-4, EN 130300 | |
| Based on detailed specifications | | CECC 30301-003, CECC 30301-801 DIN 45910 Part 123, without quality assessment | |
| Climatic category IEC 60068 DIN 40040 | | 40/105/56 GMF | |

| SELECTION CHART FOR C _R , U _R , AND RELEVANT NOMINAL CASE SIZES (Ø D x L in mm) | | | | | | |
|---|--------------------|----------|----------|----------|----------|---------|
| C _R (µF) | U _R (V) | | | | | |
| | 16 | 25 | 40 | 63 | 100 | 160 |
| 4.7 | → | → | → | 6.5 x 18 | 6.5 x 18 | - |
| 10 | → | → | 6.5 x 18 | 8 x 18 | 8 x 18 | - |
| 22 | → | 6.5 x 18 | 8 x 18 | 8 x 18 | 10 x 18 | 10 x 25 |
| 47 | 6.5 x 18 | 8 x 18 | 8 x 18 | 10 x 18 | 10 x 25 | - |
| 100 | 8 x 18 | 10 x 18 | 10 x 18 | - | - | - |
| 220 | 10 x 18 | 10 x 25 | - | - | - | - |
| 470 | 10 x 25 | - | - | - | - | - |

DIMENSIONS in millimeters **AND AVAILABLE FORMS**



DIMENSIONS in millimeters, **MASS, PACKAGING, AND ORDERING CODE**

| CASE SIZE Ø D x L | LEAD Ø d | Ø D _{max.} | L _{max.} | A _{min.} | B | WEIGHT APPROX. (g) | PACKAGING, ENDING OF ORDERING CODE, QUANTITIES | | | |
|----------------------|-------------|---------------------|-------------------|-------------------|------------|--------------------------|---|--------|------------|--------|
| | | | | | | | TAPED ON REEL | | TAPED AMMO | |
| | | | | | | | CODE | PIECES | CODE | PIECES |
| 6.5 x 18 | 0.8 | 6.9 | 18.5 | 25 | 73.0 ± 1.6 | 1.3 | ..A0W | 1000 | ..B0W | 1000 |
| 8 x 18 | 0.8 | 8.5 | 18.5 | 25 | 73.0 ± 1.6 | 1.7 | ..A0W | 500 | ..B0W | 500 |
| 10 x 18 | 0.8 | 10.5 | 18.5 | 25 | 73.0 ± 1.6 | 2.5 | ..A0W | 500 | ..B0W | 500 |
| 10 x 25 | 0.8 | 10.5 | 25.5 | 30 | 73.0 ± 1.6 | 3.3 | ..A0W | 500 | ..B0W | 500 |

ELECTRICAL DATA

| SYMBOL | DESCRIPTION |
|------------------|---|
| C _R | Rated capacitance at 100 Hz |
| U _R | Rated voltage |
| tan δ | Max. dissipation factor at 100 Hz |
| R _{ESR} | Equivalent series resistance at 100 Hz (calculated from tan δ _{max.} and C _R) |
| Z | Max. impedance at 10 kHz |
| I _R | Rated alternating current (RMS) at 100 Hz and upper category temperature |
| T _a | Ambient temperature |
| T _{UC} | Upper category temperature |
| RH | Relative humidity |
| P | Ambient pressure |

Note

- Unless otherwise specified, all electrical values apply at T_a = 20 °C, P = 80 kPa to 106 kPa, RH = 45 % to 75 %.

ORDERING EXAMPLE

The following table gives the ordering number.

The 16th place of ordering code refers to packaging for axial lead capacitors:

MALAEBC00FL210J... EBC 1000 µF 63 V 8 x 18
 MALAEBC00FL210JA0W A = taped on reel
 MALAEBC00FL210JB0W B = taped ammo

Please see Dimensions table for available versions.



| ELECTRICAL DATA AND ORDERING INFORMATION | | | | | | | |
|--|----------------------------------|---|-------------------------|-----------------------------------|----------------------------|--|------------------------------|
| U _R (V) | C _R 100 Hz (μF) | NOMINAL CASE SIZE Ø D x L (mm) | tan δ 100 Hz MAX. | R _{ESR} 100 Hz (Ω) | Z 10 kHz MAX. (Ω) | I _R 100 Hz T _{UC} (A) | CATALOG NUMBER MALA... |
| 16 | 47 | 6.5 x 18 | 0.14 | 4.7 | 2.6 | 0.095 | EBC00DL247DB0W |
| | 100 | 8 x 18 | 0.14 | 2.2 | 1.2 | 0.15 | EBC00FL310DB0W |
| | 220 | 10 x 18 | 0.14 | 1.0 | 0.55 | 0.25 | EBC00GL322DB0W |
| | 470 | 10 x 25 | 0.14 | 0.47 | 0.26 | 0.45 | EBC00GD347DB0W |
| 25 | 22 | 6.5 x 18 | 0.11 | 8.0 | 4.1 | 0.060 | EBC00DL222EB0W |
| | 47 | 8 x 18 | 0.11 | 3.7 | 1.9 | 0.11 | EBC00FL247EB0W |
| | 100 | 10 x 18 | 0.11 | 1.8 | 0.90 | 0.18 | EBC00GL310EB0W |
| | 220 | 10 x 25 | 0.11 | 0.80 | 0.40 | 0.34 | EBC00GD322EB0W |
| 40 | 10 | 6.5 x 18 | 0.10 | 16 | 7.5 | 0.046 | EBC00DL210GB0W |
| | 22 | 8 x 18 | 0.10 | 7.2 | 3.4 | 0.080 | EBC00FL222GB0W |
| | 47 | 8 x 18 | 0.09 | 3.0 | 1.6 | 0.12 | EBC00FL247GB0W |
| | 100 | 10 x 18 | 0.09 | 1.4 | 0.75 | 0.21 | EBC00GL310GB0W |
| 63 | 4.7 | 6.5 x 18 | 0.07 | 24 | 12 | 0.038 | EBC00DL147JB0W |
| | 10 | 8 x 18 | 0.07 | 11 | 5.5 | 0.064 | EBC00FL210JB0W |
| | 22 | 8 x 18 | 0.07 | 5.1 | 2.5 | 0.10 | EBC00FL222JB0W |
| | 47 | 10 x 18 | 0.07 | 2.4 | 1.2 | 0.17 | EBC00GL247JB0W |
| 100 | 4.7 | 6.5 x 18 | 0.06 | 20 | 9.6 | 0.048 | EBC00DL147LB0W |
| | 10 | 8 x 18 | 0.06 | 9.5 | 4.5 | 0.073 | EBC00FL210LB0W |
| | 22 | 10 x 18 | 0.06 | 4.3 | 2.0 | 0.13 | EBC00GL222LB0W |
| | 47 | 10 x 25 | 0.06 | 2.0 | 1.0 | 0.22 | EBC00GD247LB0W |
| 160 | 22 | 10 x 25 | 0.10 | 7.2 | 5.5 | 0.12 | EBC00GD222MB0W |

| ADDITIONAL ELECTRICAL DATA | | |
|----------------------------|--|---|
| PARAMETER | CONDITIONS | VALUE |
| Voltage | | |
| Surge voltage | U _R ≤ 100 V | U _s = 1.15 x U _R |
| | U _R ≥ 160 V | U _s = 1.10 x U _R |
| Reverse voltage | - | U _{rev} ≤ 1 V |
| Current | | |
| Leakage current | U _R ≤ 100 V U _R , 300 s U _R ≥ 160 V U _R , 300 s | I _{L/μA} ≤ 0.0015 x C _{R/μF} x U _{R/V} + 3 I _{L/μA} ≤ 0.0150 x C _{R/μF} x U _{R/V} + 10 |



LOW TEMPERATURE BEHAVIOUR

Table for the calculation of the maximum 10 kHz impedance at low temperatures:

$$Z(10\text{ kHz})[\Omega] = \frac{\text{Tabular value}}{C_R[\mu\text{F}]}$$

| T _a (°C) | RATED VOLTAGE (V) | | | | | |
|------------------------|-------------------|------|------|------|------|------|
| | 16 | 25 | 40 | 63 | 100 | 160 |
| -25 | 2250 | 1500 | 850 | 600 | 450 | 1000 |
| -40 | 5400 | 3600 | 2040 | 1440 | 1080 | 5000 |

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

LIFETIME TABLE U_R ≤ 100 V

| INTERRELATION BETWEEN ALTERNATING CURRENT, AMBIENT TEMPERATURE, AND LIFETIME | | | | | | | | | | | | | | | | | | | | |
|---|------|------|------|------|--------|------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| I/I _R (frequency dependent) | | | | | | | LIFETIME MULTIPLIER L (depending on I/I _R and T _a) | | | | | | | | | | | | | |
| FREQUENCY [Hz] | | | | | | | AMBIENT TEMPERATURE T _a [°C] | | | | | | | | | | | | | |
| 50 | 100 | 250 | 500 | 1000 | > 2500 | 10 K | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 200 | 127 | 81 | 53 | 35 | 23 | 16 | 11 | 7.4 | 5.1 | 3.6 | 2.6 | 1.84 | 1.33 |
| 0.18 | 0.20 | 0.22 | 0.23 | 0.24 | 0.25 | 0.26 | 195 | 123 | 79 | 52 | 34 | 23 | 15 | 10 | 7.2 | 5.0 | 3.5 | 2.5 | 1.81 | 1.31 |
| 0.36 | 0.40 | 0.44 | 0.46 | 0.48 | 0.50 | 0.52 | 179 | 115 | 74 | 48 | 32 | 21 | 14 | 9.9 | 6.9 | 4.8 | 3.4 | 2.4 | 1.73 | 1.26 |
| 0.54 | 0.60 | 0.66 | 0.69 | 0.72 | 0.75 | 0.78 | 158 | 102 | 66 | 44 | 29 | 20 | 13 | 9.1 | 6.3 | 4.5 | 3.2 | 2.3 | 1.63 | 1.19 |
| 0.72 | 0.80 | 0.88 | 0.92 | 0.96 | 1.00 | 1.04 | 135 | 87 | 57 | 38 | 26 | 17 | 12 | 8.3 | 5.8 | 4.1 | 2.9 | 2.1 | 1.51 | 1.10 |
| 0.90 | 1.00 | 1.10 | 1.15 | 1.20 | 1.25 | 1.30 | 112 | 73 | 49 | 33 | 22 | 15 | 10 | 7.3 | 5.1 | 3.6 | 2.6 | 1.9 | 1.37 | 1.00 |
| 1.08 | 1.20 | 1.32 | 1.38 | 1.44 | 1.50 | 1.56 | 90 | 60 | 40 | 27 | 19 | 13 | 9.0 | 6.3 | 4.5 | 3.2 | 2.3 | 1.7 | 1.21 | |
| 1.26 | 1.40 | 1.54 | 1.61 | 1.68 | 1.75 | 1.82 | 70 | 47 | 32 | 22 | 15 | 11 | 7.5 | 5.3 | 3.8 | 2.7 | 2.0 | 1.4 | 1.06 | |
| 1.44 | 1.60 | 1.76 | 1.84 | 1.92 | 2.00 | 2.08 | 54 | 37 | 25 | 18 | 12 | 8.8 | 6.2 | 4.4 | 3.2 | 2.3 | 1.7 | 1.2 | | |
| 1.62 | 1.80 | 1.98 | 2.07 | 2.16 | 2.25 | 2.34 | 40 | 28 | 20 | 14 | 9.9 | 7.0 | 5.0 | 3.6 | 2.6 | 1.9 | 1.4 | 1.0 | | |
| 1.80 | 2.00 | 2.20 | 2.30 | 2.40 | 2.50 | 2.60 | 30 | 21 | 15 | 11 | 7.7 | 5.6 | 4.0 | 2.9 | 2.2 | 1.6 | 1.2 | | | |
| 1.98 | 2.20 | 2.42 | 2.53 | 2.64 | 2.75 | 2.86 | 22 | 16 | 11 | 8.2 | 6.0 | 4.3 | 3.2 | 2.3 | 1.7 | 1.3 | | | | |
| 2.16 | 2.40 | 2.64 | 2.76 | 2.88 | 3.00 | 3.12 | 16 | 11 | 8.4 | 6.1 | 4.5 | 3.3 | 2.5 | 1.8 | 1.4 | 1.0 | | | | |
| 2.34 | 2.60 | 2.86 | 2.99 | 3.12 | 3.25 | 3.38 | 11 | 8.3 | 6.1 | 4.6 | 3.4 | 2.5 | 1.9 | 1.4 | 1.1 | | | | | |
| 2.52 | 2.80 | 3.08 | 3.22 | 3.36 | 3.50 | 3.64 | 7.9 | 5.9 | 4.5 | 3.4 | 2.5 | 1.9 | 1.5 | 1.1 | | | | | | |
| 2.70 | 3.00 | 3.30 | 3.45 | 3.60 | 3.75 | 3.90 | 5.5 | 4.2 | 3.2 | 2.5 | 1.9 | 1.4 | 1.1 | | | | | | | |
| 2.88 | 3.20 | 3.52 | 3.68 | 3.84 | 4.00 | 4.16 | 3.9 | 3.0 | 2.3 | 1.8 | 1.4 | 1.1 | | | | | | | | |
| 3.06 | 3.40 | 3.74 | 3.91 | 4.08 | 4.25 | 4.42 | 2.7 | 2.1 | 1.6 | 1.3 | 1.0 | | | | | | | | | |
| 3.24 | 3.60 | 3.96 | 4.14 | 4.32 | 4.50 | 4.68 | 1.8 | 1.5 | 1.2 | | | | | | | | | | | |
| 3.42 | 3.80 | 4.18 | 4.37 | 4.56 | 4.75 | 4.94 | 1.3 | 1.0 | | | | | | | | | | | | |

Note

I_R 100 Hz alternating current [A] at upper category temperature T_{UC} taken from datasheet

I User current [A]

T_a Ambient temperature of capacitor [°C]

L Lifetime multiplier

Regard L as a function of ambient temperature (x-axis) and of current (y-axis); use the current-axis according to the frequency



LIFETIME TABLE $U_R > 100\text{ V}$

| INTERRELATION BETWEEN ALTERNATING CURRENT, AMBIENT TEMPERATURE, AND LIFETIME | | | | | | | | | | | | | | | | | | | | |
|---|------|------|------|------|--------|------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|-----|------|------|
| I/I_R (frequency dependent) | | | | | | | LIFETIME MULTIPLIER L (depending on I/I_R and T_a) | | | | | | | | | | | | | |
| FREQUENCY [Hz] | | | | | | | AMBIENT TEMPERATURE T_a [°C] | | | | | | | | | | | | | |
| 50 | 100 | 250 | 500 | 1000 | > 2500 | 10 K | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 200 | 127 | 81 | 53 | 35 | 23 | 16 | 11 | 7.4 | 5.1 | 3.6 | 2.6 | 1.84 | 1.33 |
| 0.17 | 0.20 | 0.23 | 0.25 | 0.26 | 0.27 | 0.28 | 194 | 123 | 79 | 52 | 34 | 23 | 15 | 10 | 7.2 | 5.0 | 3.5 | 2.5 | 1.81 | 1.31 |
| 0.34 | 0.40 | 0.46 | 0.50 | 0.52 | 0.54 | 0.56 | 178 | 114 | 74 | 48 | 32 | 21 | 14 | 9.9 | 6.9 | 4.8 | 3.4 | 2.4 | 1.73 | 1.26 |
| 0.51 | 0.60 | 0.70 | 0.74 | 0.78 | 0.80 | 0.84 | 158 | 102 | 66 | 44 | 29 | 20 | 13 | 9.1 | 6.3 | 4.5 | 3.2 | 2.3 | 1.63 | 1.19 |
| 0.68 | 0.80 | 0.93 | 0.99 | 1.04 | 1.07 | 1.12 | 133 | 87 | 57 | 38 | 26 | 17 | 12 | 8.3 | 5.8 | 4.1 | 2.9 | 2.1 | 1.51 | 1.10 |
| 0.85 | 1.00 | 1.16 | 1.24 | 1.30 | 1.34 | 1.40 | 110 | 73 | 49 | 33 | 22 | 15 | 11 | 7.3 | 5.1 | 3.6 | 2.6 | 1.9 | 1.37 | 1.00 |
| 1.02 | 1.20 | 1.39 | 1.49 | 1.56 | 1.61 | 1.68 | 88 | 59 | 40 | 27 | 19 | 13 | 9.0 | 6.3 | 4.5 | 3.2 | 2.3 | 1.7 | 1.21 | |
| 1.19 | 1.40 | 1.62 | 1.74 | 1.82 | 1.88 | 1.96 | 69 | 47 | 32 | 22 | 15 | 11 | 7.6 | 5.4 | 3.8 | 2.7 | 2.00 | 1.4 | 1.06 | |
| 1.36 | 1.60 | 1.86 | 1.98 | 2.08 | 2.14 | 2.24 | 53 | 37 | 26 | 18 | 12 | 8.8 | 6.2 | 4.5 | 3.2 | 2.3 | 1.7 | 1.2 | | |
| 1.53 | 1.80 | 2.09 | 2.23 | 2.34 | 2.41 | 2.52 | 40 | 28 | 20 | 14 | 9.9 | 7.1 | 5.1 | 3.7 | 2.7 | 1.9 | 1.4 | 1.0 | | |
| 1.70 | 2.00 | 2.32 | 2.48 | 2.60 | 2.68 | 2.80 | 30 | 21 | 15 | 11 | 7.8 | 5.6 | 4.1 | 3 | 2.2 | 1.6 | 1.2 | | | |
| 1.87 | 2.20 | 2.55 | 2.73 | 2.86 | 2.95 | 3.08 | 22 | 16 | 11 | 8.3 | 6.0 | 4.4 | 3.2 | 2.4 | 1.7 | 1.3 | | | | |
| 2.04 | 2.40 | 2.78 | 2.98 | 3.12 | 3.22 | 3.36 | 16 | 12 | 8.5 | 6.2 | 4.6 | 3.4 | 2.5 | 1.9 | 1.4 | 1.0 | | | | |
| 2.21 | 2.60 | 3.02 | 3.22 | 3.38 | 3.48 | 3.64 | 11 | 8.4 | 6.2 | 4.6 | 3.5 | 2.6 | 1.9 | 1.4 | 1.1 | | | | | |
| 2.38 | 2.80 | 3.25 | 3.47 | 3.64 | 3.75 | 3.92 | 8.0 | 6.0 | 4.5 | 3.4 | 2.6 | 1.9 | 1.5 | 1.1 | | | | | | |
| 2.55 | 3.00 | 3.48 | 3.72 | 3.90 | 4.02 | 4.20 | 5.6 | 4.3 | 3.3 | 2.5 | 1.9 | 1.4 | 1.1 | | | | | | | |
| 2.72 | 3.20 | 3.71 | 3.97 | 4.16 | 4.29 | 4.48 | 3.9 | 3.0 | 2.3 | 1.8 | 1.4 | 1.1 | | | | | | | | |
| 2.89 | 3.40 | 3.94 | 4.22 | 4.42 | 4.56 | 4.76 | 2.7 | 2.1 | 1.7 | 1.3 | 1.0 | | | | | | | | | |
| 3.06 | 3.60 | 4.18 | 4.46 | 4.68 | 4.82 | 5.04 | 1.9 | 1.5 | 1.2 | | | | | | | | | | | |
| 3.23 | 3.80 | 4.41 | 4.71 | 4.94 | 5.09 | 5.32 | 1.3 | 1.0 | | | | | | | | | | | | |

combination
not
permitted

Note

- I_R 100 Hz alternating current [A] at upper category temperature T_{UC} taken from datasheet
 - I User current [A]
 - T_a Ambient temperature of capacitor [°C]
 - L Lifetime multiplier
- Regard L as a function of ambient temperature (x-axis) and of current (y-axis); use the current-axis according to the frequency

TEST PROCEDURES AND REQUIREMENTS

| TEST | | PROCEDURE (quick reference) | REQUIREMENTS |
|--|---|---|--|
| NAME OF TEST | REFERENCE | | |
| Endurance | IEC 60384-4/ EN 130300 subclause 4.13 | T _A = 105 °C; U _R applied 2000 h | -15 % ≤ ΔC/C ≤ 15 % tan δ ≤ 1.3 x spec. limit Z ≤ 2 x spec. limit I _L (300 s) ≤ spec. limit |
| Useful life | CECC 30301 subclause 1.8.1 | T _A = 105 °C; U _R and I _R applied 16 V ≤ U _R ≤ 100 V Cases 6.5 x 8 to 10 x 25: 3000 h 160 V ≤ U _R Cases 6.5 x 8 to 10 x 25: 3000 h | -45 % ≤ ΔC/C ≤ 45 % tan δ ≤ 3 x spec. limit Z ≤ 3 x spec. limit I _L (300 s) ≤ spec. limit No short or open circuit Total failure percentage: ≤ 1 % |
| Shelf life (storage at high temperature) | IEC 60384-4/ EN 130300 subclause 4.17 | T _A = 105 °C; no voltage applied 100 h After test: U _R to be applied for 30 min 24 h o 48 h before measurement | -15 % ≤ ΔC/C ≤ 15 % tan δ ≤ 1.3 x spec. limit Z ≤ 2 x spec. limit I _L (300 s) ≤ 2 x spec. limit |



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