

Aluminum Capacitors



| QUICK REFERENCE DATA | |
|---|------------------------|
| DESCRIPTION | VALUE |
| Nominal case size (Ø D x L in mm) | 4 x 5.3 to 12.5 x 13.5 |
| Rated capacitance range, C _R | 0.10 µF to 2200 µF |
| Capacitance tolerance | ± 20 % |
| Rated voltage range | 6.3 V to 100 V |
| Category temperature range | - 40 °C to + 85 °C |
| Load life | 2000 h |
| Based on sectional specification | IEC 60384-4/EN 130300 |
| Climatic category IEC 60068 | 40/105/56 |

FEATURES

- Load life: 2000 h at 85 °C
- Miniature dimension
- High CU-product
- SMD style
- Polarized aluminum electrolytic capacitors
- Reflow soldering
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912


RoHS
COMPLIANT

APPLICATIONS

- General use
- Consumer electronics
- Low-headroom, height restricted low mass units
- Filtering, smoothing, coupling

PACKAGING

Supplied in blister tape.

| SELECTION CHART FOR C _R , U _R , AND RELEVANT NOMINAL CASE SIZES (Ø D x L in mm) | | | | | | | | |
|---|-------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| C _R (µF) | RATED VOLTAGE (V) | | | | | | | |
| | 6.3 | 10 | 16 | 25 | 35 | 50 | 63 | 100 |
| 0.10 | → | → | → | → | → | 4 x 5.3 | - | - |
| 0.22 | → | → | → | → | → | 4 x 5.3 | - | - |
| 0.33 | → | → | → | → | → | 4 x 5.3 | - | - |
| 0.47 | → | → | → | → | → | 4 x 5.3 | - | - |
| 1.0 | → | → | → | → | → | 4 x 5.3 | - | - |
| 2.2 | → | → | → | → | → | 4 x 5.3 | → | 5 x 5.3 |
| 3.3 | → | → | → | → | → | 4 x 5.3 | → | 6.3 x 5.8 |
| 4.7 | → | → | → | → | → | 5 x 5.3 | → | 6.3 x 5.8 |
| 10 | → | → | → | → | 4 x 5.3 | 5 x 5.3 | 6.3 x 5.8 | 8 x 10 |
| 22 | → | → | → | 5 x 5.3 | → | 6.3 x 5.3 | 8 x 6.2 | 8 x 10 |
| 33 | → | → | → | 5 x 5.3 | 6.3 x 5.3 | 6.3 x 7.7 | 8 x 10 | 10 x 10 |
| 47 | → | → | 5 x 5.3 | 6.3 x 5.3 | 8 x 6.2 | 8 x 10 | → | 10 x 10 |
| 68 | → | → | → | → | → | → | → | 12.5 x 13.5 |
| 100 | 5 x 5.3 | → | 6.3 x 5.3 | 8 x 6.2 | 8 x 10 | 10 x 10 | → | 12.5 x 13.5 |
| 220 | → | 8 x 6.2 | 6.3 x 7.7 | 8 x 10 | → | 10 x 10 | 12.5 x 13.5 | - |
| 330 | 6.3 x 7.7 | → | 8 x 10 | → | 10 x 10 | 12.5 x 13.5 | - | - |
| 470 | → | 8 x 10 | → | 10 x 10 | 12.5 x 13.5 | - | - | - |
| 1000 | 8 x 10 | 10 x 10 | → | 12.5 x 13.5 | - | - | - | - |
| 1500 | 10 x 10 | → | 12.5 x 13.5 | - | - | - | - | - |
| 2200 | → | 12.5 x 13.5 | - | - | - | - | - | - |

| DIMENSIONS in millimeters | | | | | | | | | |
|---------------------------|------------|------------|-----------|------------|------------|-----------|-----------|-----|-----|
| CASE SIZE CODE | D ± α | L ± α | A ± α | B ± α | C ± α | E ± α | R | N | P |
| BB | 4 ± 0.5 | 5.3 ± 0.2 | 1.9 ± 0.2 | 4.3 ± 0.2 | 4.3 ± 0.2 | 1.0 ± 0.2 | 0.5 ~ 0.8 | 0.3 | 0.5 |
| BC | 5 ± 0.5 | 5.3 ± 0.2 | 2.3 ± 0.2 | 5.3 ± 0.2 | 5.3 ± 0.2 | 1.4 ± 0.2 | 0.5 ~ 0.8 | 0.3 | 0.5 |
| BD | 6.3 ± 0.5 | 5.3 ± 0.3 | 2.4 ± 0.2 | 6.6 ± 0.2 | 6.6 ± 0.2 | 2.2 ± 0.2 | 0.5 ~ 0.8 | 0.3 | 0.5 |
| AD | 6.3 ± 0.5 | 5.8 ± 0.3 | 2.4 ± 0.2 | 6.6 ± 0.2 | 6.6 ± 0.2 | 2.2 ± 0.2 | 0.5 ~ 0.8 | 0.3 | 0.5 |
| BM | 6.3 ± 0.5 | 7.7 ± 0.4 | 2.4 ± 0.2 | 6.6 ± 0.2 | 6.6 ± 0.2 | 2.2 ± 0.2 | 0.5 ~ 0.8 | 0.3 | 0.5 |
| AE | 8 ± 0.5 | 6.2 ± 0.4 | 3.3 ± 0.2 | 8.3 ± 0.2 | 8.3 ± 0.2 | 2.3 ± 0.2 | 0.5 ~ 0.8 | 0.3 | 0.5 |
| AF | 8 ± 0.5 | 10 ± 0.5 | 2.9 ± 0.2 | 8.3 ± 0.2 | 8.3 ± 0.2 | 3.1 ± 0.2 | 0.8 ~ 1.1 | 0.3 | 0.5 |
| AG | 10 ± 0.5 | 10 ± 0.5 | 3.2 ± 0.2 | 10.3 ± 0.2 | 10.3 ± 0.2 | 4.5 ± 0.2 | 0.8 ~ 1.1 | 0.3 | 0.5 |
| AH | 12.5 ± 0.5 | 13.5 ± 0.5 | 4.6 ± 0.2 | 12.8 ± 0.2 | 12.8 ± 0.2 | 4.5 ± 0.2 | 1.1 ~ 1.4 | 0.3 | 0.5 |
| AK | 16 ± 0.5 | 16.5 ± 0.5 | 5.6 ± 0.2 | 16.8 ± 0.2 | 16.8 ± 0.2 | 6.5 ± 0.2 | 1.1 ~ 1.4 | 0.3 | 0.5 |

Technical drawings showing dimensions: Capacitance, Lot no., 22 A, 50, Voltage, Plastic platform, N max., Ø D ± α, L ± α, C ± α, Positive P max., A ± α, E ± α, B ± α, R, Negative.

| ELECTRICAL DATA | |
|-----------------|--|
| SYMBOL | DESCRIPTION |
| U_R | Rated voltage |
| C_R | Rated capacitance at 120 Hz |
| $\tan \delta$ | Max. dissipation factor at 120 Hz |
| R_{ESR} | Max. equivalent series resistance at 120 Hz |
| I_R | Rated alternating current at 120 Hz and upper category temperature |

Note

- Unless otherwise specified, all electrical values apply at $T_{amb} = 20^\circ\text{C}$, $P = 80\text{ kPa}$ to 120 kPa , $RH = 45\%$ to 75% .

ORDERING EXAMPLE

 ECA 33 $\mu\text{F}/25\text{ V}$, $\pm 20\%$, size 5 x 5.3 mm

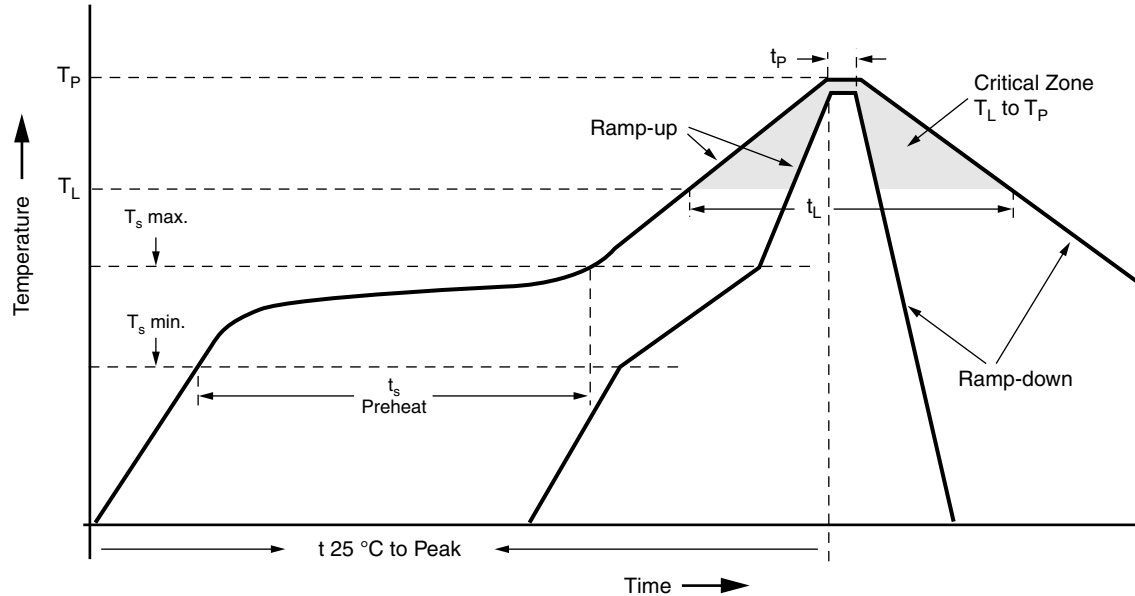
Ordering code: MALSECA00BC233EARK

For Standard Packaging Quantity (SPQ) and Minimum Order Quantity (MOQ) please refer to our price list or contact customer service.

| ELECTRICAL DATA AND ORDERING INFORMATION | | | | | | | |
|--|--------------------------------------|-----------------------------|-------------------------|-------------------------------------|-------------------------------|---------------|--------------------|
| U_R (V) | C_R 120 Hz (μF) | DIMENSIONS D x L (mm) | $\tan \delta$ 120 Hz | R_{ESR} 120 Hz (Ω) | I_R 120 Hz/85 °C (mA) | WEIGHT (g) | CATALOG NUMBER |
| 6.3 | 100 | 5 x 5.3 | 0.28 | 3.71 | 60 | 0.17 | MALSECA00BC310BARK |
| | 330 | 6.3 x 7.7 | 0.35 | 1.41 | 188 | 0.40 | MALSECA00BM333BARK |
| | 1000 | 8 x 10 | 0.35 | 0.46 | 370 | 1.00 | MALSECA00AF410BARK |
| | 1500 | 10 x 10 | 0.35 | 0.31 | 480 | 1.25 | MALSECA00AG415BARK |
| 10 | 220 | 8 x 6.2 | 0.24 | 1.45 | 175 | 0.55 | MALSECA00AE322CARK |
| | 470 | 8 x 10 | 0.24 | 0.68 | 290 | 1.00 | MALSECA00AF347CARK |
| | 1000 | 10 x 10 | 0.24 | 0.32 | 454 | 1.25 | MALSECA00AG410CARK |
| | 2200 | 12.5 x 13.5 | 0.24 | 0.14 | 960 | 2.50 | MALSECA00AH422CARK |



| ELECTRICAL DATA AND ORDERING INFORMATION | | | | | | | |
|--|----------------------------------|-----------------------------|-----------------|-----------------------------------|--|---------------|--------------------|
| U _R (V) | C _R 120 Hz (μF) | DIMENSIONS D x L (mm) | tan δ 120 Hz | R _{ESR} 120 Hz (Ω) | I _R 120 Hz/85 °C (mA) | WEIGHT (g) | CATALOG NUMBER |
| 16 | 47 | 5 x 5.3 | 0.20 | 5.64 | 52 | 0.17 | MALSECA00BC247DARK |
| | 100 | 6.3 x 5.3 | 0.20 | 2.65 | 88 | 0.27 | MALSECA00BD310DARK |
| | 220 | 6.3 x 7.7 | 0.24 | 1.45 | 162 | 0.40 | MALSECA00BM322DARK |
| | 330 | 8 x 10 | 0.24 | 0.96 | 270 | 1.00 | MALSECA00AF333DARK |
| | 1500 | 12.5 x 13.5 | 0.24 | 0.21 | 870 | 2.50 | MALSECA00AH415DARK |
| 25 | 22 | 5 x 5.3 | 0.13 | 7.84 | 41 | 0.17 | MALSECA00BC222EARK |
| | 33 | 5 x 5.3 | 0.13 | 5.22 | 50 | 0.17 | MALSECA00BC233EARK |
| | 47 | 6.3 x 5.3 | 0.13 | 3.67 | 70 | 0.27 | MALSECA00BD247EARK |
| | 100 | 8 x 6.2 | 0.16 | 2.12 | 145 | 0.55 | MALSECA00AE310EARK |
| | 220 | 8 x 10 | 0.16 | 0.96 | 232 | 1.00 | MALSECA00AF322EARK |
| | 470 | 10 x 10 | 0.16 | 0.45 | 400 | 1.25 | MALSECA00AG347EARK |
| | 1000 | 12.5 x 13.5 | 0.16 | 0.21 | 820 | 2.50 | MALSECA00AH410EARK |
| 35 | 10 | 4 x 5.3 | 0.15 | 19.9 | 27 | 0.12 | MALSECA00BB210FARK |
| | 33 | 6.3 x 5.3 | 0.15 | 6.03 | 65 | 0.27 | MALSECA00BD233FARK |
| | 47 | 8 x 6.2 | 0.15 | 4.23 | 105 | 0.55 | MALSECA00AE247FARK |
| | 100 | 8 x 10 | 0.15 | 1.99 | 175 | 1.00 | MALSECA00AF310FARK |
| | 330 | 10 x 10 | 0.15 | 0.60 | 360 | 1.25 | MALSECA00AG333FARK |
| | 470 | 12.5 x 13.5 | 0.15 | 0.42 | 600 | 2.50 | MALSECA00AH347FARK |
| | 50 | 0.10 | 4 x 5.3 | 0.10 | 1326 | 3.2 | 0.12 |
| 0.22 | | 4 x 5.3 | 0.10 | 602.9 | 4.7 | 0.12 | MALSECA00BB022HARK |
| 0.33 | | 4 x 5.3 | 0.10 | 401.9 | 5.7 | 0.12 | MALSECA00BB033HARK |
| 0.47 | | 4 x 5.3 | 0.10 | 282.2 | 6.8 | 0.12 | MALSECA00BB047HARK |
| 1.0 | | 4 x 5.3 | 0.10 | 132.6 | 10 | 0.12 | MALSECA00BB110HARK |
| 2.2 | | 4 x 5.3 | 0.10 | 60.3 | 15 | 0.12 | MALSECA00BB122HARK |
| 3.3 | | 4 x 5.3 | 0.10 | 40.2 | 18 | 0.12 | MALSECA00BB133HARK |
| 4.7 | | 5 x 5.3 | 0.10 | 28.2 | 25 | 0.17 | MALSECA00BC147HARK |
| 10 | | 5 x 5.3 | 0.10 | 13.2 | 41 | 0.17 | MALSECA00BC210HARK |
| 22 | | 6.3 x 5.3 | 0.10 | 6.03 | 71 | 0.27 | MALSECA00BD222HARK |
| 33 | | 6.3 x 7.7 | 0.12 | 4.82 | 94 | 0.40 | MALSECA00BM233HARK |
| 47 | | 8 x 10 | 0.12 | 3.39 | 140 | 1.00 | MALSECA00AF247HARK |
| 100 | | 10 x 10 | 0.12 | 1.59 | 195 | 1.25 | MALSECA00AG310HARK |
| 220 | | 10 x 10 | 0.12 | 0.72 | 320 | 1.25 | MALSECA00AG322HARK |
| 330 | | 12.5 x 13.5 | 0.12 | 0.48 | 600 | 2.50 | MALSECA00AH333HARK |
| 63 | 10 | 6.3 x 5.8 | 0.12 | 15.9 | 46 | 0.30 | MALSECA00AD210JARK |
| | 22 | 8 x 6.2 | 0.12 | 7.23 | 96 | 0.55 | MALSECA00AE222JARK |
| | 33 | 8 x 10 | 0.12 | 4.82 | 117 | 1.00 | MALSECA00AF233JARK |
| | 220 | 12.5 x 13.5 | 0.12 | 0.72 | 550 | 2.50 | MALSECA00AH322JARK |
| 100 | 2.2 | 5 x 5.3 | 0.12 | 72.35 | 20 | 0.17 | MALSECA00BC122LARK |
| | 3.3 | 6.3 x 5.8 | 0.12 | 48.2 | 29 | 0.30 | MALSECA00AD133LARK |
| | 4.7 | 6.3 x 5.8 | 0.12 | 33.9 | 35 | 0.30 | MALSECA00AD147LARK |
| | 10 | 8 x 10 | 0.12 | 15.9 | 77 | 1.00 | MALSECA00AF210LARK |
| | 22 | 8 x 10 | 0.12 | 7.23 | 100 | 1.00 | MALSECA00AF222LARK |
| | 33 | 10 x 10 | 0.12 | 4.82 | 130 | 1.25 | MALSECA00AG233LARK |
| | 47 | 10 x 10 | 0.12 | 3.39 | 155 | 1.25 | MALSECA00AG247LARK |
| | 68 | 12.5 x 13.5 | 0.12 | 2.34 | 350 | 2.50 | MALSECA00AH268LARK |
| | 100 | 12.5 x 13.5 | 0.12 | 1.59 | 420 | 2.50 | MALSECA00AH310LARK |

REFLOW SOLDERING CONDITIONS FOR SMD ALUMINUM ELECTROLYTIC CAPACITORS


| PROFILE FEATURE | | | |
|---|---------------------|---------------|---------------|
| | SOLDERING CONDITION | | |
| | Ø 4 TO Ø 10 | Ø 12.5 | Ø 16 |
| Average ramp-up rate (T_L to T_P) | 3 °C/s max. | 3 °C/s max. | |
| Preheat | | | |
| Temperature min. (T_s min.) | 150 °C | 150 °C | |
| Temperature max. (T_s max.) | 200 °C | 200 °C | |
| Time (T_s min. to T_s max.) | 60 s to 150 s | 40 s to 120 s | 40 s to 100 s |
| T_s max. to T_L | | | |
| Ramp-up rate | 3 °C/s max. | 3 °C/s max. | |
| Time maintained above | | | |
| Temperature (T_L) | 217 °C | 217 °C | |
| Time (t_L) | 60 s to 90 s | 40 s to 60 s | |
| Peak/classification temperature (T_P) | 250 °C | 240 °C | 230 °C |
| Time within 5 °C of actual peak temperature (T_P) | 10 s max. | 10 s max. | |
| Ramp-down rate | 3 °C/s max. | 3 °C/s max. | |
| Time 25 °C to peak temperature | 8 min max. | 8 min max. | |

| RESISTANCE TO SOLDERING HEAT | |
|------------------------------|------------------------------------|
| Leakage current | Less than specified value |
| Capacitance value | Within ± 10 % of initial value |
| $\tan \delta$ | Less than specified value |

| LOW TEMPERATURE BEHAVIOR (at 120 Hz) | | | | | | | | |
|--------------------------------------|-------------------|----|----|----|----|----|----|-----|
| IMPEDANCE RATIO (Z) T2/(Z) T1 | RATED VOLTAGE (V) | | | | | | | |
| | 6.3 | 10 | 16 | 25 | 35 | 50 | 63 | 100 |
| T2/T1 | | | | | | | | |
| - 25 °C/+ 20 °C | 5 | 4 | 3 | 2 | 2 | 2 | 2 | 2 |
| - 40 °C/+ 20 °C | 10 | 8 | 6 | 4 | 3 | 3 | 3 | 3 |



| ADDITIONAL ELECTRICAL DATA | | |
|---|--|---|
| PARAMETER | CONDITIONS | VALUE |
| Current | | |
| Leakage current (Test conditions: U_R , 20 °C) | After 2 min at U_R | $I_{L2} \leq 0.01 \times C_R \times U_R$ or 3 μ A for $U_R \leq 100$ V (whichever is greater) |
| Resistance | | |
| Equivalent series resistance (ESR) | Calculated from $\tan \delta_{\max}$. | $ESR = \tan \delta / 2 \pi f C_R$ |

| MULTIPLIER OF RIPPLE CURRENT (I_R) AS A FUNCTION OF FREQUENCY | |
|---|---------------------------------------|
| FREQUENCY (Hz) | I_R MULTIPLIER FOR $U_R \leq 100$ V |
| 50 | 0.70 |
| 120 | 1.00 |
| 300 | 1.17 |
| 1000 | 1.36 |
| $\geq 10\ 000$ | 1.50 |

| TEST PROCEDURES AND REQUIREMENTS | | |
|----------------------------------|---|--|
| TEST | PROCEDURE (quick reference) | REQUIREMENTS |
| Load life | $T_{\text{amb}} = 85$ °C U_R and I_R applied After 2000 h | $\Delta C/C: \pm 20$ % of initial value $I_L \leq$ spec. limit $\tan \delta \leq 2 \times$ spec. limit |
| Shelf life | No voltage applied After 1000 h After test: U_R to be applied for 30 min 24 to 48 h before measurement | $\Delta C/C: \pm 20$ % of initial value $I_L \leq$ spec. limit $\tan \delta \leq 2 \times$ spec. limit |



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