

## Aluminum Electrolytic Capacitors Radial Low Profile, 5 mm

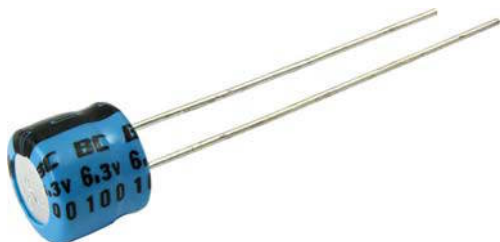


Fig. 1

### QUICK REFERENCE DATA

| DESCRIPTION                                        | VALUE                   |
|----------------------------------------------------|-------------------------|
| Nominal case sizes (Ø D x L in mm)                 | 4 x 5 to 6.3 x 5        |
| Rated capacitance range, C <sub>R</sub>            | 1.0 µF to 100 µF        |
| Tolerance on C <sub>R</sub>                        | ± 20 %                  |
| Rated voltage range, U <sub>R</sub>                | 6.3 V to 50 V           |
| Category temperature range                         | -40 °C to +85 °C        |
| Endurance test at 85 °C                            | 1000 h                  |
| Useful life at 85 °C                               | 1500 h                  |
| Useful life at 40 °C, 1.4 x I <sub>R</sub> applied | 40 000 h                |
| Shelf life at 0 V, 85 °C                           | 500 h                   |
| Based on sectional specification                   | IEC 60384-4 / EN 130300 |
| Climatic category IEC 60068                        | 40 / 085 / 56           |

### FEATURES

- Useful life: 1500 h at 85 °C
- Very low profile, 5 mm height
- Extremely miniaturized
- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Radial leads, cylindrical aluminum case, insulated with a blue sleeve
- Charge and discharge proof
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS  
COMPLIANT**

### APPLICATIONS

- General purpose, industrial, automotive and audio-video
- Coupling, decoupling, smoothing, filtering and timing
- High mounting density
- Portable and mobile equipment (very small size and very low mass), low profile equipment

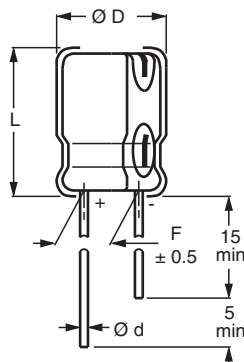
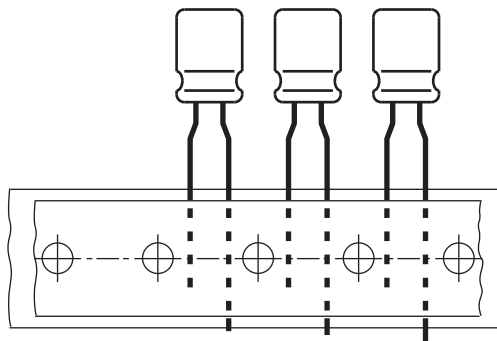
### MARKING

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

- Rated capacitance (in µF)
- Rated voltage (in V)
- Negative terminal identification
- Code indicating factory of origin
- Name of manufacturer
- Date code, in accordance with IEC 60062
- Series number (134)

### SELECTION CHART FOR C<sub>R</sub>, U<sub>R</sub>, AND RELEVANT NOMINAL CASE SIZES (Ø D x L in mm)

| C <sub>R</sub><br>(µF) | U <sub>R</sub> (V) |       |         |         |         |         |
|------------------------|--------------------|-------|---------|---------|---------|---------|
|                        | 6.3                | 10    | 16      | 25      | 35      | 50      |
| 1.0                    | -                  | -     | -       | -       | -       | 4 x 5   |
| 2.2                    | -                  | -     | -       | -       | -       | 4 x 5   |
| 3.3                    | -                  | -     | -       | -       | -       | 4 x 5   |
| 4.7                    | -                  | -     | -       | -       | 4 x 5   | 5 x 5   |
| 10                     | -                  | -     | 4 x 5   | -       | 5 x 5   | 6.3 x 5 |
| 22                     | 4 x 5              | -     | 5 x 5   | -       | 6.3 x 5 | -       |
| 33                     | -                  | 5 x 5 | -       | 6.3 x 5 | -       | -       |
| 47                     | 5 x 5              | -     | 6.3 x 5 | -       | -       | -       |
| 100                    | 6.3 x 5            | -     | -       | -       | -       | -       |

**DIMENSIONS** in millimeters **AND AVAILABLE FORMS**

Fig. 2 - **Form CA:** Long leads


Case Ø D = 4 mm to 6.3 mm; pitch F = 5 mm

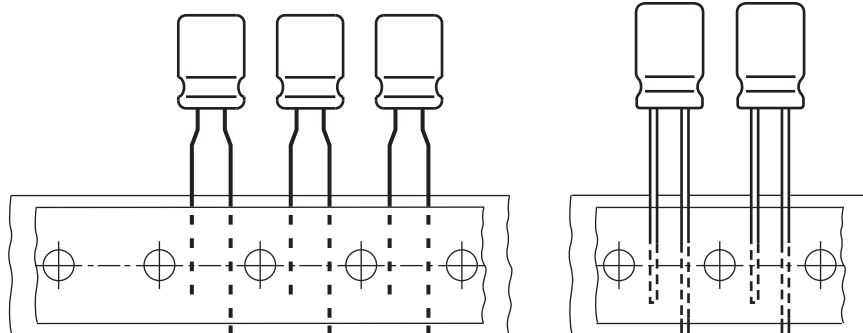
Fig. 3 - **Form TFA:** Taped in box (ammopack)

Pitch F = 2.5 mm  
Case Ø D = 4 mm to 6.3 mm

Fig. 4 - **Form TNA:** Taped in box (ammopack)

**Table 1**

| <b>DIMENSIONS</b> in millimeters <b>AND PACKAGING QUANTITIES</b> |              |      |                     |                   |           |                      |             |             |
|------------------------------------------------------------------|--------------|------|---------------------|-------------------|-----------|----------------------|-------------|-------------|
| NOMINAL CASE SIZE<br>Ø D x L                                     | CASE<br>CODE | Ø d  | Ø D <sub>max.</sub> | L <sub>max.</sub> | F         | PACKAGING QUANTITIES |             |             |
|                                                                  |              |      |                     |                   |           | FORM<br>CA           | FORM<br>TFA | FORM<br>TNA |
| 4 x 5                                                            | 53           | 0.45 | 4.5                 | 6.0               | 1.5 ± 0.5 | 2000                 | 2000        | 2000        |
| 5 x 5                                                            | 54           | 0.45 | 5.5                 | 6.0               | 2.0 ± 0.5 | 2000                 | 2000        | 2000        |
| 6.3 x 5                                                          | 55           | 0.45 | 6.8                 | 6.0               | 2.5 ± 0.5 | 2000                 | 2000        | 2000        |

**Note**

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

**ELECTRICAL DATA**

| SYMBOL        | DESCRIPTION                                       |
|---------------|---------------------------------------------------|
| $C_R$         | Rated capacitance at 120 Hz, tolerance $\pm 20\%$ |
| $I_R$         | Rated RMS ripple current at 120 Hz, 85 °C         |
| $I_{L2}$      | Max. leakage current after 2 min at $U_R$         |
| $\tan \delta$ | Max. dissipation factor at 120 Hz                 |
| Z             | Max. impedance at 100 kHz                         |

**Note**

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

Table 2

**ELECTRICAL DATA AND ORDERING INFORMATION**

| $U_R$<br>(V) | $C_R$<br>120 Hz<br>( $\mu\text{F}$ ) | NOMINAL<br>CASE SIZE<br>$\varnothing D \times L$<br>(mm) | $I_R$<br>120 Hz<br>85 °C<br>(mA) | $I_{L2}$<br>2 min<br>( $\mu\text{A}$ ) | $\tan \delta$<br>120 Hz | Z<br>100 kHz<br>( $\Omega$ ) | ORDERING CODE<br>MAL2134..... |           |                   |           |             |           |
|--------------|--------------------------------------|----------------------------------------------------------|----------------------------------|----------------------------------------|-------------------------|------------------------------|-------------------------------|-----------|-------------------|-----------|-------------|-----------|
|              |                                      |                                                          |                                  |                                        |                         |                              | BULK<br>LONG LEADS            |           | TAPED<br>AMMOPACK |           |             |           |
|              |                                      |                                                          |                                  |                                        |                         |                              | FORM<br>CA                    | F<br>(mm) | FORM<br>TFA       | F<br>(mm) | FORM<br>TNA | F<br>(mm) |
| 6.3          | 22                                   | 4 x 5                                                    | 23                               | 3                                      | 0.24                    | 11                           | 53229E3                       | 1.5       | 33229E3           | 5.0       | 73229E3     | 2.5       |
|              | 47                                   | 5 x 5                                                    | 38                               | 3                                      | 0.24                    | 5.2                          | 53479E3                       | 2.0       | 33479E3           | 5.0       | 73479E3     | 2.5       |
|              | 100                                  | 6.3 x 5                                                  | 60                               | 7                                      | 0.24                    | 3.4                          | 53101E3                       | 2.5       | 33101E3           | 5.0       | 73101E3     | 2.5       |
| 10           | 33                                   | 5 x 5                                                    | 35                               | 4                                      | 0.20                    | 6.0                          | 54339E3                       | 2.0       | 34339E3           | 5.0       | 74339E3     | 2.5       |
| 16           | 10                                   | 4 x 5                                                    | 20                               | 3                                      | 0.16                    | 12                           | 95105E3                       | 1.5       | 95103E3           | 5.0       | 95107E3     | 2.5       |
|              | 22                                   | 5 x 5                                                    | 32                               | 4                                      | 0.16                    | 6.4                          | 55229E3                       | 2.0       | 35229E3           | 5.0       | 75229E3     | 2.5       |
|              | 47                                   | 6.3 x 5                                                  | 50                               | 8                                      | 0.16                    | 4.2                          | 55479E3                       | 2.5       | 35479E3           | 5.0       | 75479E3     | 2.5       |
| 25           | 33                                   | 6.3 x 5                                                  | 45                               | 9                                      | 0.14                    | 4.6                          | 56339E3                       | 2.5       | 36339E3           | 5.0       | 76339E3     | 2.5       |
| 35           | 4.7                                  | 4 x 5                                                    | 15                               | 3                                      | 0.12                    | 27                           | 50478E3                       | 1.5       | 30478E3           | 5.0       | 70478E3     | 2.5       |
|              | 10                                   | 5 x 5                                                    | 25                               | 4                                      | 0.12                    | 17                           | 50109E3                       | 2.0       | 30109E3           | 5.0       | 70109E3     | 2.5       |
|              | 22                                   | 6.3 x 5                                                  | 40                               | 8                                      | 0.12                    | 11                           | 50229E3                       | 2.5       | 30229E3           | 5.0       | 70229E3     | 2.5       |
| 50           | 1.0                                  | 4 x 5                                                    | 7.5                              | 3                                      | 0.10                    | 28                           | 91105E3                       | 1.5       | 91103E3           | 5.0       | 91107E3     | 2.5       |
|              | 2.2                                  | 4 x 5                                                    | 12                               | 3                                      | 0.10                    | 26                           | 91225E3                       | 1.5       | 91223E3           | 5.0       | 91227E3     | 2.5       |
|              | 3.3                                  | 4 x 5                                                    | 14                               | 3                                      | 0.10                    | 25                           | 51338E3                       | 1.5       | 31338E3           | 5.0       | 71338E3     | 2.5       |
|              | 4.7                                  | 5 x 5                                                    | 19                               | 3                                      | 0.10                    | 22                           | 51478E3                       | 2.0       | 31478E3           | 5.0       | 71478E3     | 2.5       |
|              | 10                                   | 6.3 x 5                                                  | 29                               | 5                                      | 0.10                    | 14                           | 51109E3                       | 2.5       | 31109E3           | 5.0       | 71109E3     | 2.5       |

**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 $U_R$                                        | $I_{L2} \leq 0.01 C_R \times U_R$ or $3\text{ }\mu\text{A}$ (whichever is greater) |
| <b>Resistance</b>                  |                                                             |                                                                                    |
| Equivalent series resistance (ESR) | Calculated from $\tan \delta_{max}$ and $C_R$ (see Table 2) | $ESR = \tan \delta / 2 \pi f C_R$                                                  |

**RIPPLE CURRENT AND USEFUL LIFE**

Table 3

**ENDURANCE TEST DURATION AND USEFUL LIFE**

| ENDURANCE AT 85 °C (h) | USEFUL LIFE AT 85 °C (h) |
|------------------------|--------------------------|
| 1000                   | 1500                     |

**Note**

- Multiplier of useful life code: CCC205

**ORDERING EXAMPLE**

Electrolytic capacitor 134 series

22  $\mu\text{F}$  / 16 V;  $\pm 20\%$ Nominal case size:  $\varnothing 5\text{ mm} \times 5\text{ mm}$ ; form TFA

Ordering code: MAL213435229E3

Former 12NC: 2222 134 35229

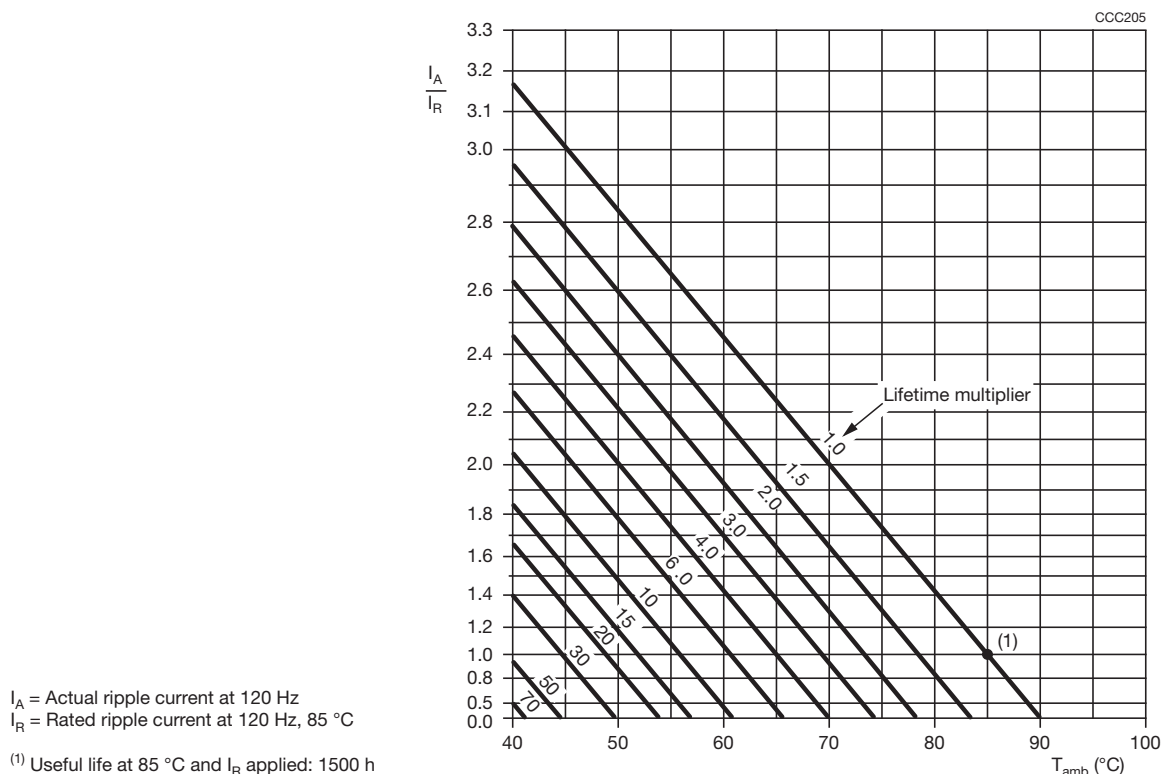


Fig. 5 - Multiplier of useful life as a function of ambient temperature and ripple current load

Table 4

| MULTIPLIER OF RIPPLE CURRENT ( $I_R$ ) AS A FUNCTION OF FREQUENCY |      |      |      |        |
|-------------------------------------------------------------------|------|------|------|--------|
| FREQUENCY (Hz)                                                    |      |      |      |        |
| 50                                                                | 120  | 400  | 800  | ≥ 2000 |
| $I_R$ MULTIPLIER                                                  |      |      |      |        |
| 0.60                                                              | 1.00 | 1.20 | 1.30 | 1.40   |

Table 5

| TEST PROCEDURES AND REQUIREMENTS               |                                               |                                                                                                                                           |                                                                                                                                                                                                                          |
|------------------------------------------------|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TEST                                           |                                               | PROCEDURE<br>(quick reference)                                                                                                            | REQUIREMENTS                                                                                                                                                                                                             |
| NAME OF TEST                                   | REFERENCE                                     |                                                                                                                                           |                                                                                                                                                                                                                          |
| Endurance                                      | IEC 60384-4 /<br>EN 130300,<br>subclause 4.13 | $T_{amb} = 85\text{ °C}$ ; $U_R$ applied;<br>1000 h                                                                                       | $\Delta C/C: \pm 20\%$<br>$\tan \delta \leq 2 \times \text{spec. limit}$<br>$I_{L2} \leq \text{spec. limit}$                                                                                                             |
| Useful life                                    | CECC 30301,<br>subclause 1.8.1                | $T_{amb} = 85\text{ °C}$ ; $U_R$ and $I_R$ applied;<br>1500 h                                                                             | $\Delta C/C: \pm 50\%$<br>$\tan \delta \leq 3 \times \text{spec. limit}$<br>$Z \leq 3 \times \text{spec. limit}$<br>$I_{L2} \leq \text{spec. limit}$<br>no short or open circuit<br>total failure percentage: $\leq 3\%$ |
| Shelf life<br>(storage at high<br>temperature) | IEC 60384-4 /<br>EN 130300,<br>subclause 4.17 | $T_{amb} = 85\text{ °C}$ ; no voltage applied;<br>500 h<br>After test: $U_R$ to be applied for 30 min, 24 h to 48 h<br>before measurement | $\Delta C/C, \tan \delta, Z$ :<br>For requirements<br>see "Endurance test" above<br>$I_{L2} \leq \text{spec. limit}$                                                                                                     |

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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