

# DATA SHEET

O21 ASM  
**Aluminum electrolytic capacitors**  
**Axial Standard Miniature**

Product specification  
Supersedes data of March 1998  
File under BCcomponents, BC01

2000 Jan 18

# Aluminum electrolytic capacitors

## Axial Standard Miniature

021 ASM

**FEATURES**

- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Axial leads, cylindrical aluminum case, insulated with a blue sleeve
- Mounting ring version (single ended) not insulated
- Charge and discharge proof
- Taped versions up to case  $\varnothing 15 \times 30$  mm available for automatic insertion
- Miniaturized, high CV-product per unit volume.

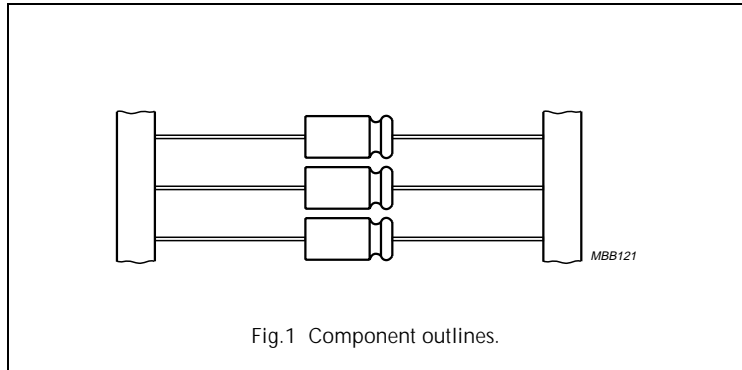
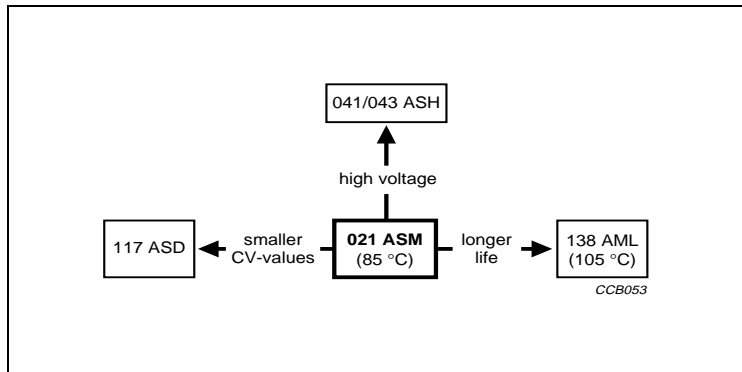


Fig.1 Component outlines.

**APPLICATIONS**

- General purpose, industrial, automotive, audio-video
- Coupling, decoupling, smoothing, filtering, buffering and timing
- Portable and mobile equipment (small size, low mass)
- Low mounting height boards, vibration and shock resistant.



**QUICK REFERENCE DATA**

| DESCRIPTION  | VALUE                 |                    |
|--|-----------------------|--------------------|
| Case sizes ( $\varnothing D_{nom} \times L_{nom}$ in mm) | 4.5 × 10 to 10 × 25   | 10 × 30 to 21 × 40 |
| Rated capacitance range, $C_R$                           | 0.47 to 15000 $\mu F$ |                    |
| Tolerance on $C_R$                                       | ±20%                  |                    |
| Rated voltage range, $U_R$                               | 6.3 to 100 V          |                    |
| Category temperature range                               | -40 to +85 °C         |                    |
| Endurance test at 85 °C:                                 |                       |                    |
| $U_R = 6.3$ to 25 V                                      | 1 000 hours           | 5 000 hours        |
| $U_R = 40$ to 100 V                                      | 2 000 hours           | 5 000 hours        |
| Useful life at 85 °C                                     | 2 500 hours           | 8 000 hours        |
| Useful life at 40 °C, $1.4 \times I_R$ applied           | 70 000 hours          | 200 000 hours      |
| Shelf life at 0 V, 85 °C                                 | 500 hours             | 500 hours          |
| Based on sectional specification                         | IEC 60384-4/EN130300  |                    |
| Climatic category IEC 60068                              | 40/085/56             |                    |

# Aluminum electrolytic capacitors

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**O21 ASM**

 Selection chart for  $C_R$ ,  $U_R$  and relevant nominal case sizes ( $\varnothing D \times L$  in mm)

 Preferred types in **bold**.

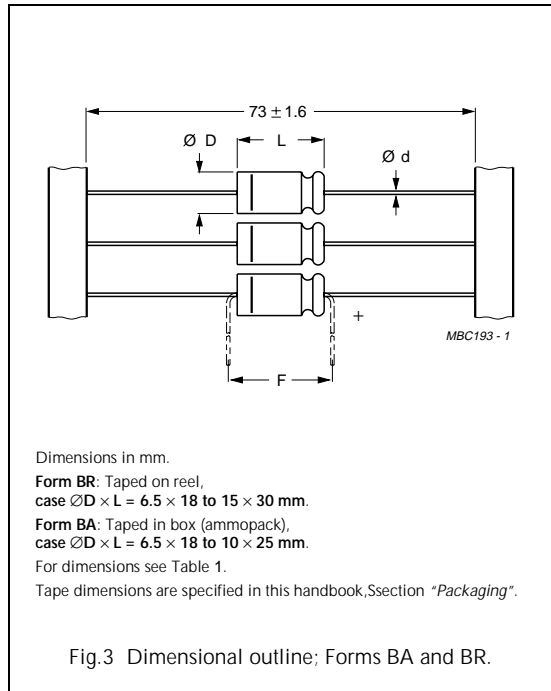
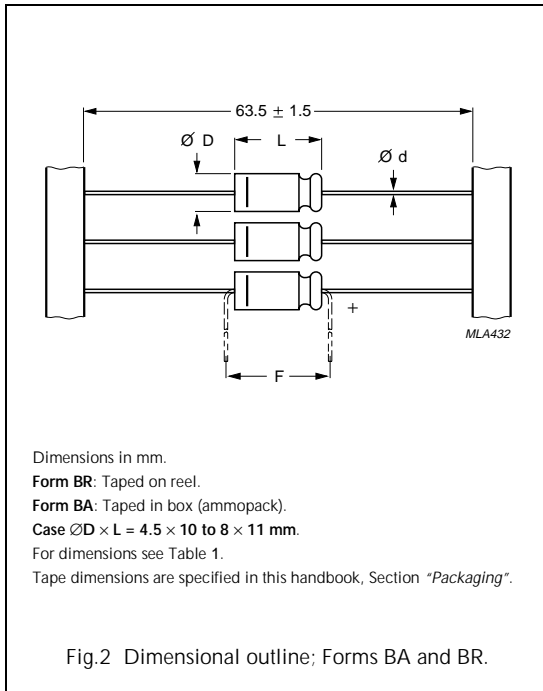
| $C_R$<br>( $\mu F$ ) | $U_R$ (V)     |                  |                  |                  |                  |                  |                  |
|----------------------|---------------|------------------|------------------|------------------|------------------|------------------|------------------|
|                      | 6.3           | 10               | 16               | 25               | 40               | 63               | 100              |
| 0.47                 | –             | –                | –                | –                | –                | 4.5 × 10         | –                |
| <b>1</b>             | –             | –                | –                | –                | –                | <b>4.5 × 10</b>  | 4.5 × 10         |
| <b>2.2</b>           | –             | –                | –                | –                | –                | <b>4.5 × 10</b>  | 4.5 × 10         |
| 3.3                  | –             | –                | –                | –                | –                | 4.5 × 10         | –                |
| <b>4.7</b>           | –             | –                | –                | –                | –                | <b>4.5 × 10</b>  | 4.5 × 10         |
| <b>10</b>            | –             | –                | –                | –                | –                | <b>4.5 × 10</b>  | 6 × 10           |
| 15                   | –             | –                | –                | –                | –                | 4.5 × 10         | 8 × 11           |
|                      | –             | –                | –                | –                | –                | –                | 6.5 × 18         |
| <b>22</b>            | –             | –                | –                | –                | <b>4.5 × 10</b>  | <b>6 × 10</b>    | 8 × 11           |
|                      | –             | –                | –                | –                | –                | –                | 6.5 × 18         |
| 33                   | –             | –                | –                | –                | –                | 6 × 10           | 6.5 × 18         |
| <b>47</b>            | –             | –                | –                | <b>4.5 × 10</b>  | <b>6 × 10</b>    | 8 × 11           | 8 × 18           |
|                      | –             | –                | –                | –                | –                | <b>6.5 × 18</b>  | –                |
| 68                   | –             | –                | 4.5 × 10         | –                | –                | 8 × 11           | 10 × 18          |
|                      | –             | –                | –                | –                | –                | 6.5 × 18         | –                |
| <b>100</b>           | –             | <b>4.5 × 10</b>  | –                | <b>6 × 10</b>    | 8 × 11           | <b>8 × 18</b>    | 10 × 25          |
|                      | –             | –                | –                | –                | <b>6.5 × 18</b>  | –                | <b>10 × 30</b>   |
| 150                  | –             | –                | 6 × 10           | 8 × 11           | 8 × 18           | 10 × 18          | 12.5 × 30        |
|                      | –             | –                | –                | 6.5 × 18         | –                | –                | –                |
| <b>220</b>           | –             | <b>6 × 10</b>    | 8 × 11           | <b>6.5 × 18</b>  | <b>10 × 18</b>   | 10 × 25          | <b>12.5 × 30</b> |
|                      | –             | –                | –                | –                | –                | <b>10 × 30</b>   | –                |
| 330                  | –             | 8 × 11           | 6.5 × 18         | 8 × 18           | 10 × 25          | 12.5 × 30        | 15 × 30          |
| <b>470</b>           | <b>8 × 11</b> | <b>6.5 × 18</b>  | 8 × 18           | <b>10 × 18</b>   | 10 × 25          | <b>12.5 × 30</b> | <b>18 × 30</b>   |
|                      | –             | –                | –                | –                | <b>10 × 30</b>   | –                | –                |
| 680                  | –             | 8 × 18           | 10 × 18          | 10 × 25          | 12.5 × 30        | 15 × 30          | 18 × 40          |
|                      | –             | –                | –                | 10 × 30          | –                | –                | –                |
| <b>1000</b>          | 8 × 18        | <b>10 × 18</b>   | <b>10 × 25</b>   | <b>12.5 × 30</b> | <b>12.5 × 30</b> | <b>18 × 30</b>   | <b>21 × 40</b>   |
|                      | –             | –                | <b>10 × 30</b>   | –                | –                | –                | –                |
| 1500                 | –             | 10 × 25          | 12.5 × 30        | 12.5 × 30        | 15 × 30          | 18 × 40          | –                |
|                      | –             | 10 × 30          | –                | –                | –                | –                | –                |
| <b>2200</b>          | 10 × 25       | <b>12.5 × 30</b> | <b>12.5 × 30</b> | <b>15 × 30</b>   | <b>18 × 30</b>   | <b>21 × 40</b>   | –                |
| 3300                 | –             | 12.5 × 30        | 15 × 30          | 18 × 30          | 18 × 40          | –                | –                |
| <b>4700</b>          | –             | <b>15 × 30</b>   | <b>18 × 30</b>   | <b>18 × 40</b>   | <b>21 × 40</b>   | –                | –                |
| 6800                 | –             | 18 × 30          | 18 × 40          | 21 × 40          | –                | –                | –                |
| <b>10000</b>         | –             | <b>18 × 40</b>   | <b>21 × 40</b>   | –                | –                | –                | –                |
| 15000                | –             | 21 × 40          | –                | –                | –                | –                | –                |

# Aluminum electrolytic capacitors

## Axial Standard Miniature

**O21 ASM**

**MECHANICAL DATA, AVAILABLE FORMS AND PACKAGING QUANTITIES**



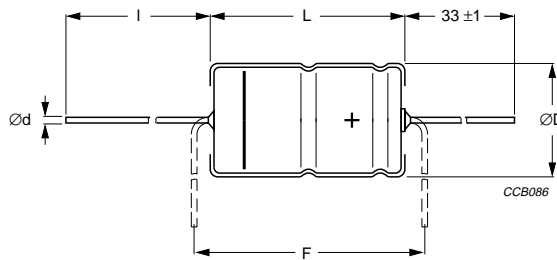
**Table 1 Axial;** physical dimensions, mass and packaging quantities; see Figs 2, 3 and 4

| NOMINAL CASE SIZE<br>$\varnothing D \times L$<br>(mm) | CASE CODE | AXIAL: FORM AA, BA, and BR |       |                               |                   |                   | MASS (g) | PACKAGING QUANTITIES |         |         |
|---|-----------|----------------------------|-------|-------------------------------|-------------------|-------------------|----------|----------------------|---------|---------|
|   |           | $\varnothing d$            | l     | $\varnothing D_{max}$<br>(mm) | $L_{max}$<br>(mm) | $F_{min}$<br>(mm) |          | FORM AA              | FORM BA | FORM BR |
| 4.5 × 10  | 2         | 0.6                        | –     | 5.0                           | 10.5              | 15                | ≈0.50    | –                    | 1000    | 3000    |
| 6 × 10  | 3         | 0.6                        | –     | 6.3                           | 10.5              | 15                | ≈0.70    | –                    | 1000    | 1000    |
| 8 × 11  | 5a        | 0.6                        | –     | 8.5                           | 11.5              | 15                | ≈1.1     | –                    | 500     | 500     |
| 6.5 × 18  | 4         | 0.8                        | –     | 6.9                           | 18.5              | 25                | ≈1.3     | –                    | 1000    | 1000    |
| 8 × 18  | 5         | 0.8                        | –     | 8.5                           | 18.5              | 25                | ≈1.7     | –                    | 500     | 500     |
| 10 × 18   | 6         | 0.8                        | –     | 10.5                          | 18.5              | 25                | ≈2.5     | –                    | 500     | 500     |
| 10 × 25   | 7         | 0.8                        | –     | 10.5                          | 25.0              | 30                | ≈3.3     | –                    | 500     | 500     |
| 10 × 30   | 00        | 0.8                        | 55 ±1 | 10.5                          | 30.5              | 35                | ≈4.8     | 200                  | –       | 500     |
| 12.5 × 30   | 01        | 0.8                        | 55 ±1 | 13.0                          | 30.5              | 35                | ≈7.4     | 200                  | –       | 400     |
| 15 × 30   | 02        | 0.8                        | 55 ±1 | 15.5                          | 30.5              | 35                | ≈11.7    | 200                  | –       | 250     |
| 18 × 30   | 03        | 0.8                        | 55 ±1 | 18.5                          | 30.5              | 35                | ≈12.9    | 200                  | –       | –       |
| 18 × 40   | 04        | 0.8                        | 34 ±1 | 18.5                          | 41.5              | 45                | ≈19.4    | 100                  | –       | –       |
| 21 × 40   | 05        | 0.8                        | 34 ±1 | 21.5                          | 41.5              | 45                | ≈24.7    | 100                  | –       | –       |

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Dimensions in mm.

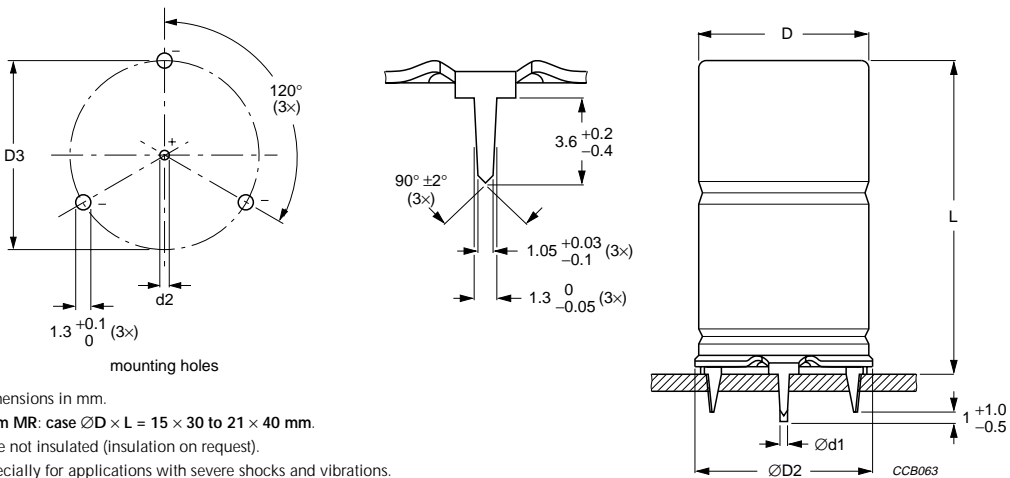
**Form AA:** Axial in box.

Case  $\text{ØD} \times \text{L} = 10 \times 30$  and  $21 \times 40$  mm.

For case  $\text{ØD} \times \text{L} = 18 \times 40$  and  $21 \times 40$  mm, the stated L may be exceeded by 0.7 mm.

For dimensions see Table 1.

Fig.4 Dimensional outline; Form AA.



Dimensions in mm.

**Form MR:** case  $\text{ØD} \times \text{L} = 15 \times 30$  to  $21 \times 40$  mm.

Case not insulated (insulation on request).

Especially for applications with severe shocks and vibrations.

For dimensions see Table 2.

Fig.5 Mounting hole diagram and outline; Form MR; single ended with mounting ring and pins.

**Table 2 Single ended;** mass and packaging quantities; see Fig.5

| NOMINAL CASE SIZE<br>$\text{ØD} \times \text{L}$<br>(mm) | CASE CODE | SINGLE ENDED WITH MOUNTING RING: FORM MR |                   |                                |           |                       | MASS (g) | PACKAGING QUANTITIES |
|--|-----------|--|-------------------|--------------------------------|-----------|-----------------------|----------|----------------------|
|  |           | $\text{Ød1}$ (mm)                        | $\text{Ød2}$ (mm) | $\text{ØD2}_{\text{max}}$ (mm) | D3 (mm)   | $L_{\text{max}}$ (mm) |          |                      |
| 15 × 30  | 02        | 0.8                                      | 1.0 +0.4          | 17.5                           | 16.5 ±0.2 | 33                    | ≈11.7    | 200                  |
| 18 × 30  | 03        | 0.8                                      | 1.0 +0.4          | 19.5                           | 18.5 ±0.2 | 33                    | ≈12.9    | 200                  |
| 18 × 40  | 04        | 0.8                                      | 1.0 +0.4          | 19.5                           | 18.5 ±0.2 | 45                    | ≈19.4    | 100                  |
| 21 × 40  | 05        | 0.8                                      | 1.0 +0.4          | 22.5                           | 21.5 ±0.2 | 45                    | ≈24.7    | 100                  |

**ELECTRICAL DATA AND ORDERING INFORMATION**

Unless otherwise specified, all electrical values in Table 3 apply at  $T_{amb} = 20\text{ °C}$ ,  $P = 86$  to  $106\text{ kPa}$ ,  $RH = 45$  to  $75\%$ .

| SYMBOL        | DESCRIPTION  |
|---------------|--|
| $C_R$         | rated capacitance at 100 Hz, tolerance $\pm 20\%$                                      |
| $I_R$         | rated RMS ripple current at 100 Hz, $85\text{ °C}$                                     |
| $I_{L1}$      | max. leakage current after 1 minute at $U_R$   |
| $I_{L5}$      | max. leakage current after 5 minutes at $U_R$  |
| $\tan \delta$ | max. dissipation factor at 100 Hz  |
| ESR           | equivalent series resistance at 100 Hz (calculated from $\tan \delta$ max. and $C_R$ ) |
| Z             | max. impedance at 10 kHz   |

**Ordering example**

Electrolytic capacitor 021 series

1000  $\mu\text{F}/16\text{ V}$ ;  $\pm 20\%$

Nominal case size:  $\varnothing 10 \times 25\text{ mm}$ ; Form BA

Catalogue number: 2222 021 90518.

**Table 3** Electrical data and ordering Information; preferred types in **bold**

| $U_R$<br>(V) | $C_R$<br>100 Hz<br>( $\mu\text{F}$ ) | NOMINAL<br>CASE SIZE<br>$\varnothing D \times L$<br>(mm) | CASE<br>CODE | $I_R$<br>100 H<br>z<br>$85\text{ °C}$<br>(mA) | $I_{L1}$<br>1 min<br>( $\mu\text{A}$ ) | $I_{L5}$<br>5 min<br>( $\mu\text{A}$ ) | $\tan \delta$<br>100 Hz | ESR<br>100 Hz<br>( $\Omega$ ) | Z<br>10 kHz<br>( $\Omega$ ) | CATALOGUE NUMBER 2222 ... .. |                             |                            |                             |
|--------------|--------------------------------------|--|--------------|---|--|--|-------------------------|-------------------------------|-----------------------------|------------------------------|-----------------------------|----------------------------|-----------------------------|
|              |                                      |  |              |   |  |  |                         |                               |                             | AXIAL                        |                             |                            | SINGLE ENDED                |
|              |                                      |  |              |   |  |  |                         |                               |                             | IN BOX<br>FORM AA            | TAPED<br>ON REEL<br>FORM BR | TAPED<br>IN BOX<br>FORM BA | MOUNTING<br>RING<br>FORM MR |
| 6.3          | <b>470</b>                           | <b>8 × 11</b>  | <b>5a</b>    | 260   | 22                                     | 10                                     | 0.25                    | 0.85                          | 0.64                        | –                            | 021 23471                   | <b>021 33471</b>           | –                           |
|              | 1000                                 | 8 × 18   | 5            | 440   | 42                                     | 17                                     | 0.25                    | 0.4                           | 0.5                         | –                            | 021 23102                   | 021 33102                  | –                           |
|              | 2200                                 | 10 × 25  | 7            | 710   | 87                                     | 32                                     | 0.29                    | 0.21                          | 0.16                        | –                            | 021 90588                   | 021 90589                  | –                           |
| 10           | <b>100</b>                           | <b>4.5 × 10</b>  | <b>2</b>     | 100   | 10                                     | 6                                      | 0.20                    | 3.2                           | 2.0                         | –                            | 021 24101                   | <b>021 34101</b>           | –                           |
|              | <b>220</b>                           | <b>6 × 10</b>  | <b>3</b>     | 160   | 17                                     | 8.4                                    | 0.20                    | 1.5                           | 0.91                        | –                            | 021 24221                   | <b>021 34221</b>           | –                           |
|              | 330                                  | 8 × 11   | 5a           | 230   | 24                                     | 11                                     | 0.20                    | 1.0                           | 0.61                        | –                            | 021 24331                   | 021 34331                  | –                           |
|              | <b>470</b>                           | <b>6.5 × 18</b>  | <b>4</b>     | 310   | 32                                     | 13                                     | 0.20                    | 0.68                          | 0.43                        | –                            | 021 24471                   | <b>021 34471</b>           | –                           |
|              | 680                                  | 8 × 18   | 5            | 400   | 45                                     | 18                                     | 0.20                    | 0.47                          | 0.29                        | –                            | 021 24681                   | 021 34681                  | –                           |
|              | <b>1000</b>                          | <b>10 × 18</b>   | <b>6</b>     | 550   | 64                                     | 24                                     | 0.20                    | 0.32                          | 0.20                        | –                            | 021 24102                   | <b>021 34102</b>           | –                           |
|              | 1500                                 | 10 × 25  | 7            | 690   | 94                                     | 34                                     | 0.23                    | 0.25                          | 0.18                        | –                            | 021 90524                   | 021 90525                  | –                           |
|              | 1500                                 | 10 × 30  | 00           | 740   | 94                                     | 34                                     | 0.23                    | 0.245                         | 0.18                        | 021 14152                    | 021 24152                   | –                          | –                           |
|              | <b>2200</b>                          | <b>12.5 × 30</b>   | <b>01</b>    | 980   | 136                                    | 48                                     | 0.25                    | 0.177                         | 0.095                       | <b>021 14222</b>             | <b>021 24222</b>            | –                          | –                           |
|              | 3300                                 | 12.5 × 30  | 01           | 1090  | 202                                    | 70                                     | 0.27                    | 0.128                         | 0.095                       | 021 14332                    | 021 24332                   | –                          | –                           |
|              | <b>4700</b>                          | <b>15 × 30</b>   | <b>02</b>    | 1320  | 286                                    | 98                                     | 0.29                    | 0.100                         | 0.07                        | <b>021 14472</b>             | <b>021 24472</b>            | –                          | <b>021 44472</b>            |
|              | 6800                                 | 18 × 30  | 03           | 1590  | 412                                    | 140                                    | 0.34                    | 0.079                         | 0.065                       | 021 14682                    | –                           | –                          | 021 44682                   |
|              | <b>10000</b>                         | <b>18 × 40</b>   | <b>04</b>    | 2090  | 604                                    | 204                                    | 0.40                    | 0.064                         | 0.04                        | <b>021 14103</b>             | –                           | –                          | <b>021 44103</b>            |
| 15000        | 21 × 40                              | 05   | 2250         | 904   | 304                                    | 0.50                                   | 0.054                   | 0.035                         | 021 14153                   | –                            | –                           | 021 44153                  |                             |

# Aluminum electrolytic capacitors

## Axial Standard Miniature

### O21 ASM

| U <sub>R</sub><br>(V) | C <sub>R</sub><br>100 Hz<br>(μF) | NOMINAL<br>CASE SIZE<br>∅D × L<br>(mm) | CASE<br>CODE | I <sub>R</sub><br>100 H<br>z<br>85 °C<br>(mA) | I <sub>L1</sub><br>1 min<br>(μA) | I <sub>L5</sub><br>5 min<br>(μA) | Tan δ<br>100 Hz | ESR<br>100 Hz<br>(Ω) | Z<br>10 kHz<br>(Ω) | CATALOGUE NUMBER 2222 ... .. |                             |                            |                             |
|-----------------------|----------------------------------|--|--------------|---|----------------------------------|----------------------------------|-----------------|----------------------|--------------------|------------------------------|-----------------------------|----------------------------|-----------------------------|
|                       |                                  |  |              |   |                                  |                                  |                 |                      |                    | AXIAL                        |                             |                            | SINGLE ENDED                |
|                       |                                  |  |              |   |                                  |                                  |                 |                      |                    | IN BOX<br>FORM AA            | TAPED<br>ON REEL<br>FORM BR | TAPED<br>IN BOX<br>FORM BA | MOUNTING<br>RING<br>FORM MR |
| 16                    | 68                               | 4.5 × 10                               | 2            | 90  | 11                               | 6.2                              | 0.16            | 3.8                  | 2.4                | –                            | 021 25689                   | 021 35689                  | –                           |
|                       | 150                              | 6 × 10                                 | 3            | 140   | 18                               | 8.8                              | 0.16            | 1.7                  | 1.1                | –                            | 021 25151                   | 021 35151                  | –                           |
|                       | 220                              | 8 × 11                                 | 5a           | 210   | 25                               | 11                               | 0.16            | 1.2                  | 0.73               | –                            | 021 25221                   | 021 35221                  | –                           |
|                       | 330                              | 6.5 × 18                               | 4            | 290   | 36                               | 15                               | 0.16            | 0.77                 | 0.48               | –                            | 021 25331                   | 021 35331                  | –                           |
|                       | 470                              | 8 × 18                                 | 5            | 380   | 49                               | 19                               | 0.16            | 0.55                 | 0.34               | –                            | 021 25471                   | 021 35471                  | –                           |
|                       | 680                              | 10 × 18                                | 6            | 500   | 69                               | 26                               | 0.16            | 0.38                 | 0.24               | –                            | 021 25681                   | 021 35681                  | –                           |
|                       | <b>1000</b>                      | <b>10 × 25</b>                         | <b>7</b>     | 660   | 100                              | 36                               | 0.16            | 0.26                 | 0.18               | –                            | 021 90517                   | <b>021 90518</b>           | –                           |
|                       | <b>1000</b>                      | <b>10 × 30</b>                         | <b>00</b>    | 700   | 100                              | 36                               | 0.16            | 0.260                | 0.175              | <b>021 15102</b>             | <b>021 25102</b>            | –                          | –                           |
|                       | 1500                             | 12.5 × 30                              | 01           | 950   | 148                              | 52                               | 0.19            | 0.205                | 0.095              | 021 15152                    | 021 25152                   | –                          | –                           |
|                       | <b>2200</b>                      | <b>12.5 × 30</b>                       | <b>01</b>    | 1040  | 216                              | 74                               | 0.21            | 0.150                | 0.095              | <b>021 15222</b>             | <b>021 25222</b>            | –                          | –                           |
|                       | 3300                             | 15 × 30                                | 02           | 1290  | 321                              | 110                              | 0.23            | 0.111                | 0.07               | 021 15332                    | 021 25332                   | –                          | 021 45332                   |
|                       | <b>4700</b>                      | <b>18 × 30</b>                         | <b>03</b>    | 1560  | 455                              | 154                              | 0.25            | 0.087                | 0.065              | <b>021 15472</b>             | –                           | –                          | <b>021 45472</b>            |
|                       | 6800                             | 18 × 40                                | 04           | 2040  | 656                              | 222                              | 0.30            | 0.070                | 0.04               | 021 15682                    | –                           | –                          | 021 45682                   |
| <b>10000</b>          | <b>21 × 40</b>                   | <b>05</b>                              | 2170         | 964   | 324                              | 0.36                             | 0.058           | 0.035                | <b>021 15103</b>   | –                            | –                           | <b>021 45103</b>           |                             |
| 25                    | <b>47</b>                        | <b>4.5 × 10</b>                        | <b>2</b>     | 80  | 11                               | 6.4                              | 0.14            | 4.8                  | 2.6                | –                            | 021 26479                   | <b>021 36479</b>           | –                           |
|                       | <b>100</b>                       | <b>6 × 10</b>                          | <b>3</b>     | 150   | 19                               | 9                                | 0.14            | 2.3                  | 1.2                | –                            | 021 26101                   | <b>021 36101</b>           | –                           |
|                       | 150                              | 8 × 11                                 | 5a           | 190   | 27                               | 12                               | 0.14            | 1.5                  | 0.80               | –                            | 021 90534                   | 021 90535                  | –                           |
|                       | 150                              | 6.5 × 18                               | 4            | 210   | 27                               | 12                               | 0.14            | 1.5                  | 0.80               | –                            | 021 26151                   | 021 36151                  | –                           |
|                       | <b>220</b>                       | <b>6.5 × 18</b>                        | <b>4</b>     | 250   | 37                               | 15                               | 0.14            | 1.0                  | 0.55               | –                            | 021 26221                   | <b>021 36221</b>           | –                           |
|                       | 330                              | 8 × 18                                 | 5            | 340   | 54                               | 21                               | 0.14            | 0.68                 | 0.36               | –                            | 021 26331                   | 021 36331                  | –                           |
|                       | <b>470</b>                       | <b>10 × 18</b>                         | <b>6</b>     | 450   | 75                               | 28                               | 0.14            | 0.48                 | 0.26               | –                            | 021 26471                   | <b>021 36471</b>           | –                           |
|                       | 680                              | 10 × 25                                | 7            | 560   | 106                              | 38                               | 0.14            | 0.33                 | 0.18               | –                            | 021 90527                   | 021 90528                  | –                           |
|                       | 680                              | 10 × 30                                | 00           | 640   | 106                              | 38                               | 0.14            | 0.323                | 0.175              | 021 16681                    | 021 26681                   | –                          | –                           |
|                       | <b>1000</b>                      | <b>12.5 × 30</b>                       | <b>01</b>    | 840   | 154                              | 54                               | 0.14            | 0.220                | 0.095              | <b>021 16102</b>             | <b>021 26102</b>            | –                          | –                           |
|                       | 1500                             | 12.5 × 30                              | 01           | 950   | 229                              | 79                               | 0.17            | 0.179                | 0.095              | 021 16152                    | 021 26152                   | –                          | –                           |
|                       | <b>2200</b>                      | <b>15 × 30</b>                         | <b>02</b>    | 1180  | 334                              | 114                              | 0.19            | 0.132                | 0.07               | <b>021 16222</b>             | <b>021 26222</b>            | –                          | <b>021 46222</b>            |
|                       | 3300                             | 18 × 30                                | 03           | 1470  | 499                              | 169                              | 0.21            | 0.099                | 0.065              | 021 16332                    | –                           | –                          | 021 46332                   |
| <b>4700</b>           | <b>18 × 40</b>                   | <b>04</b>                              | 1920         | 709   | 239                              | 0.23                             | 0.079           | 0.04                 | <b>021 16472</b>   | –                            | –                           | <b>021 46472</b>           |                             |
| 6800                  | 21 × 40                          | 05                                     | 2070         | 1024  | 344                              | 0.28                             | 0.064           | 0.035                | 021 16682          | –                            | –                           | 021 46682                  |                             |

# Aluminum electrolytic capacitors

## Axial Standard Miniature

### 021 ASM

| U <sub>R</sub><br>(V) | C <sub>R</sub><br>100 Hz<br>(μF) | NOMINAL<br>CASE SIZE<br>∅D × L<br>(mm) | CASE<br>CODE | I <sub>R</sub><br>100 H<br>z<br>85 °C<br>(mA) | I <sub>L1</sub><br>1 min<br>(μA) | I <sub>L5</sub><br>5 min<br>(μA) | Tan δ<br>100 Hz | ESR<br>100 Hz<br>(Ω) | Z<br>10 kHz<br>(Ω) | CATALOGUE NUMBER 2222 ... .. |                             |                            |                             |
|-----------------------|----------------------------------|--|--------------|---|----------------------------------|----------------------------------|-----------------|----------------------|--------------------|------------------------------|-----------------------------|----------------------------|-----------------------------|
|                       |                                  |  |              |   |                                  |                                  |                 |                      |                    | AXIAL                        |                             |                            | SINGLE ENDED                |
|                       |                                  |  |              |   |                                  |                                  |                 |                      |                    | IN BOX<br>FORM AA            | TAPED<br>ON REEL<br>FORM BR | TAPED<br>IN BOX<br>FORM BA | MOUNTING<br>RING<br>FORM MR |
| 40                    | 22                               | 4.5 × 10                               | 2            | 60  | 9                                | 5.8                              | 0.11            | 8.0                  | 3.2                | –                            | 021 27229                   | <b>021 37229</b>           | –                           |
|                       | 47                               | 6 × 10                                 | 3            | 110   | 15                               | 7.8                              | 0.11            | 3.8                  | 1.5                | –                            | 021 27479                   | <b>021 37479</b>           | –                           |
|                       | 100                              | 8 × 11                                 | 5a           | 170   | 28                               | 12                               | 0.11            | 1.8                  | 0.70               | –                            | 021 90537                   | 021 90538                  | –                           |
|                       | 100                              | 6.5 × 18                               | 4            | 190   | 28                               | 12                               | 0.11            | 1.8                  | 0.70               | –                            | 021 27101                   | <b>021 37101</b>           | –                           |
|                       | 150                              | 8 × 18                                 | 5            | 250   | 40                               | 16                               | 0.11            | 1.1                  | 0.47               | –                            | 021 27151                   | 021 37151                  | –                           |
|                       | 220                              | 10 × 18                                | 6            | 330   | 57                               | 22                               | 0.11            | 0.8                  | 0.32               | –                            | 021 27221                   | <b>021 37221</b>           | –                           |
|                       | 330                              | 10 × 25                                | 7            | 430   | 83                               | 30                               | 0.11            | 0.53                 | 0.21               | –                            | 021 27331                   | 021 37331                  | –                           |
|                       | 470                              | 10 × 25                                | 7            | 520   | 117                              | 42                               | 0.11            | 0.37                 | 0.18               | –                            | 021 90514                   | 021 90515                  | –                           |
|                       | 470                              | 10 × 30                                | 00           | 590   | 117                              | 42                               | 0.12            | 0.404                | 0.175              | <b>021 17471</b>             | <b>021 27471</b>            | –                          | –                           |
|                       | 680                              | 12.5 × 30                              | 01           | 800   | 167                              | 58                               | 0.12            | 0.297                | 0.110              | 021 17681                    | 021 27681                   | –                          | –                           |
|                       | 1000                             | 12.5 × 30                              | 01           | 900   | 244                              | 84                               | 0.12            | 0.190                | 0.110              | <b>021 17102</b>             | <b>021 27102</b>            | –                          | –                           |
|                       | 1500                             | 15 × 30                                | 02           | 1120  | 364                              | 124                              | 0.15            | 0.159                | 0.07               | 021 17152                    | 021 27152                   | –                          | 021 47152                   |
|                       | 2200                             | 18 × 30                                | 03           | 1390  | 532                              | 180                              | 0.17            | 0.118                | 0.065              | <b>021 17222</b>             | –                           | –                          | <b>021 47222</b>            |
|                       | 3300                             | 18 × 40                                | 04           | 1810  | 796                              | 268                              | 0.19            | 0.090                | 0.04               | 021 17332                    | –                           | –                          | 021 47332                   |
| 4700                  | 21 × 40                          | 05                                     | 1940         | 1132  | 380                              | 0.21                             | 0.072           | 0.035                | <b>021 17472</b>   | –                            | –                           | <b>021 47472</b>           |                             |
| 63                    | 0.47                             | 4.5 × 10                               | 2            | 8   | 4.2                              | 4.1                              | 0.09            | 310                  | 120                | –                            | 021 28477                   | 021 38477                  | –                           |
|                       | 1                                | 4.5 × 10                               | 2            | 12  | 4.4                              | 4.1                              | 0.09            | 150                  | 55                 | –                            | 021 28108                   | <b>021 38108</b>           | –                           |
|                       | 2.2                              | 4.5 × 10                               | 2            | 21  | 4.8                              | 4.3                              | 0.09            | 65                   | 25                 | –                            | 021 28228                   | <b>021 38228</b>           | –                           |
|                       | 3.3                              | 4.5 × 10                               | 2            | 25  | 5.2                              | 4.4                              | 0.09            | 44                   | 17                 | –                            | 021 28338                   | 021 38338                  | –                           |
|                       | 4.7                              | 4.5 × 10                               | 2            | 31  | 5.8                              | 4.6                              | 0.09            | 31                   | 12                 | –                            | 021 28478                   | <b>021 38478</b>           | –                           |
|                       | 10                               | 4.5 × 10                               | 2            | 50  | 7.8                              | 5.3                              | 0.08            | 13                   | 5.5                | –                            | 021 28109                   | <b>021 38109</b>           | –                           |
|                       | 15                               | 4.5 × 10                               | 2            | 55  | 9.5                              | 5.9                              | 0.08            | 8.5                  | 3.7                | –                            | 021 28159                   | 021 38159                  | –                           |
|                       | 22                               | 6 × 10                                 | 3            | 90  | 12                               | 6.8                              | 0.08            | 5.8                  | 2.5                | –                            | 021 28229                   | <b>021 38229</b>           | –                           |
|                       | 33                               | 6 × 10                                 | 3            | 100   | 16                               | 8.2                              | 0.08            | 3.9                  | 1.7                | –                            | 021 28339                   | 021 38339                  | –                           |
|                       | 47                               | 8 × 11                                 | 5a           | 140   | 22                               | 10                               | 0.08            | 2.7                  | 1.2                | –                            | 021 90541                   | 021 90542                  | –                           |
|                       | 47                               | 6.5 × 18                               | 4            | 150   | 22                               | 10                               | 0.08            | 2.7                  | 1.2                | –                            | 021 28479                   | <b>021 38479</b>           | –                           |
|                       | 68                               | 8 × 11                                 | 5a           | 160   | 30                               | 13                               | 0.08            | 1.9                  | 0.81               | –                            | 021 90544                   | 021 90545                  | –                           |
|                       | 68                               | 6.5 × 18                               | 4            | 170   | 30                               | 13                               | 0.08            | 1.9                  | 0.81               | –                            | 021 28689                   | 021 38689                  | –                           |
|                       | 100                              | 8 × 18                                 | 5            | 250   | 42                               | 17                               | 0.08            | 1.3                  | 0.55               | –                            | 021 28101                   | <b>021 38101</b>           | –                           |



# Aluminum electrolytic capacitors

## Axial Standard Miniature

### O21 ASM

| U <sub>R</sub><br>(V) | C <sub>R</sub><br>100 Hz<br>(μF) | NOMINAL<br>CASE SIZE<br>∅D × L<br>(mm) | CASE<br>CODE | I <sub>R</sub><br>100 H<br>z<br>85 °C<br>(mA) | I <sub>L1</sub><br>1 min<br>(μA) | I <sub>L5</sub><br>5 min<br>(μA) | Tan δ<br>100 Hz | ESR<br>100 Hz<br>(Ω) | Z<br>10 kHz<br>(Ω) | CATALOGUE NUMBER 2222 ... .. |                             |                            |                             |
|-----------------------|----------------------------------|--|--------------|---|----------------------------------|----------------------------------|-----------------|----------------------|--------------------|------------------------------|-----------------------------|----------------------------|-----------------------------|
|                       |                                  |  |              |   |                                  |                                  |                 |                      |                    | AXIAL                        |                             |                            | SINGLE ENDED                |
|                       |                                  |  |              |   |                                  |                                  |                 |                      |                    | IN BOX<br>FORM AA            | TAPED<br>ON REEL<br>FORM BR | TAPED<br>IN BOX<br>FORM BA | MOUNTING<br>RING<br>FORM MR |
| 63                    | 150                              | 10 × 18                                | 6            | 320   | 61                               | 23                               | 0.08            | 0.85                 | 0.37               | –                            | 021 28151                   | 021 38151                  | –                           |
|                       | 220                              | 10 × 25                                | 7            | 430   | 88                               | 32                               | 0.08            | 0.60                 | 0.25               | –                            | 021 90511                   | 021 90512                  | –                           |
|                       | <b>220</b>                       | <b>10 × 30</b>                         | <b>00</b>    | 480   | 88                               | 32                               | 0.08            | 0.614                | 0.26               | <b>021 18221</b>             | <b>021 28221</b>            | –                          | –                           |
|                       | 330                              | 12.5 × 30                              | 01           | 610   | 129                              | 46                               | 0.08            | 0.409                | 0.19               | 021 18331                    | 021 28331                   | –                          | –                           |
|                       | <b>470</b>                       | <b>12.5 × 30</b>                       | <b>01</b>    | 700   | 182                              | 63                               | 0.08            | 0.287                | 0.13               | <b>021 18471</b>             | <b>021 28471</b>            | –                          | –                           |
|                       | 680                              | 15 × 30                                | 02           | 890   | 261                              | 90                               | 0.08            | 0.199                | 0.095              | 021 18681                    | 021 28681                   | –                          | 021 48681                   |
|                       | <b>1000</b>                      | <b>18 × 30</b>                         | <b>03</b>    | 1170  | 382                              | 130                              | 0.08            | 0.135                | 0.075              | <b>021 18102</b>             | –                           | –                          | <b>021 48102</b>            |
|                       | 1500                             | 18 × 40                                | 04           | 1530  | 571                              | 193                              | 0.11            | 0.122                | 0.045              | 021 18152                    | –                           | –                          | 021 48152                   |
|                       | <b>2200</b>                      | <b>21 × 40</b>                         | <b>05</b>    | 1780  | 836                              | 281                              | 0.13            | 0.099                | 0.040              | <b>021 18222</b>             | –                           | –                          | <b>021 48222</b>            |
| 100                   | 1                                | 4.5 × 10                               | 2            | 14  | 4.6                              | 4.2                              | 0.08            | 130                  | 90                 | –                            | 021 29108                   | 021 39108                  | –                           |
|                       | 2.2                              | 4.5 × 10                               | 2            | 20  | 5.3                              | 4.4                              | 0.08            | 58                   | 41                 | –                            | 021 29228                   | 021 39228                  | –                           |
|                       | 4.7                              | 4.5 × 10                               | 2            | 30  | 7                                | 4.9                              | 0.08            | 27                   | 19                 | –                            | 021 29478                   | 021 39478                  | –                           |
|                       | 10                               | 6 × 10                                 | 3            | 65  | 10                               | 6                                | 0.08            | 13                   | 9                  | –                            | 021 29109                   | 021 39109                  | –                           |
|                       | 15                               | 8 × 11                                 | 5a           | 77  | 13                               | 7                                | 0.08            | 8.5                  | 6                  | –                            | 021 90547                   | 021 90548                  | –                           |
|                       | 15                               | 6.5 × 18                               | 4            | 85  | 13                               | 7                                | 0.08            | 8.5                  | 6                  | –                            | 021 29159                   | 021 39159                  | –                           |
|                       | 22                               | 8 × 11                                 | 5a           | 95  | 17                               | 8.4                              | 0.08            | 5.8                  | 4.1                | –                            | 021 90551                   | 021 90552                  | –                           |
|                       | 22                               | 6.5 × 18                               | 4            | 100   | 17                               | 8.4                              | 0.08            | 5.8                  | 4.1                | –                            | 021 29229                   | 021 39229                  | –                           |
|                       | 33                               | 6.5 × 18                               | 4            | 120   | 24                               | 10.6                             | 0.08            | 3.9                  | 2.7                | –                            | 021 29339                   | 021 39339                  | –                           |
|                       | 47                               | 8 × 18                                 | 5            | 160   | 32                               | 13.4                             | 0.08            | 2.7                  | 1.9                | –                            | 021 29479                   | 021 39479                  | –                           |
|                       | 68                               | 10 × 18                                | 6            | 220   | 45                               | 17.6                             | 0.08            | 1.9                  | 1.3                | –                            | 021 29689                   | 021 39689                  | –                           |
|                       | 100                              | 10 × 25                                | 7            | 300   | 64                               | 24                               | 0.08            | 1.3                  | 0.9                | –                            | 021 90531                   | 021 90532                  | –                           |
|                       | <b>100</b>                       | <b>10 × 30</b>                         | <b>00</b>    | 340   | 64                               | 24                               | 0.07            | 1.150                | 1.0                | <b>021 19101</b>             | <b>021 29101</b>            | –                          | –                           |
|                       | 150                              | 12.5 × 30                              | 01           | 490   | 94                               | 34                               | 0.07            | 0.645                | 0.61               | 021 19151                    | 021 29151                   | –                          | –                           |
|                       | <b>220</b>                       | <b>12.5 × 30</b>                       | <b>01</b>    | 560   | 136                              | 48                               | 0.08            | 0.610                | 0.56               | <b>021 19221</b>             | <b>021 29221</b>            | –                          | –                           |
|                       | 330                              | 15 × 30                                | 02           | 740   | 202                              | 70                               | 0.09            | 0.420                | 0.40               | 021 19331                    | 021 29331                   | –                          | 021 49331                   |
|                       | <b>470</b>                       | <b>18 × 30</b>                         | <b>03</b>    | 980   | 286                              | 98                               | 0.09            | 0.310                | 0.29               | <b>021 19471</b>             | –                           | –                          | <b>021 49471</b>            |
|                       | 680                              | 18 × 40                                | 04           | 1260  | 412                              | 140                              | 0.09            | 0.195                | 0.18               | 021 19681                    | –                           | –                          | 021 49681                   |
|                       | <b>1000</b>                      | <b>21 × 40</b>                         | <b>05</b>    | 1470  | 604                              | 204                              | 0.10            | 0.160                | 0.15               | <b>021 19102</b>             | –                           | –                          | <b>021 49102</b>            |

# Aluminum electrolytic capacitors

## Axial Standard Miniature

# O21 ASM

### Additional electrical data

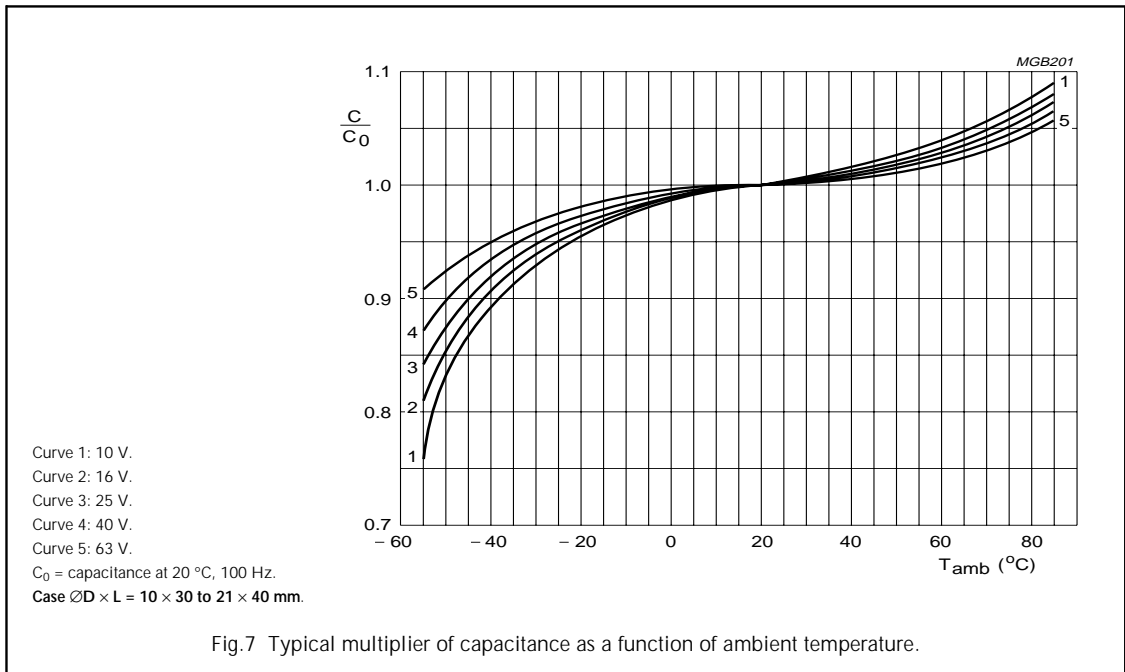
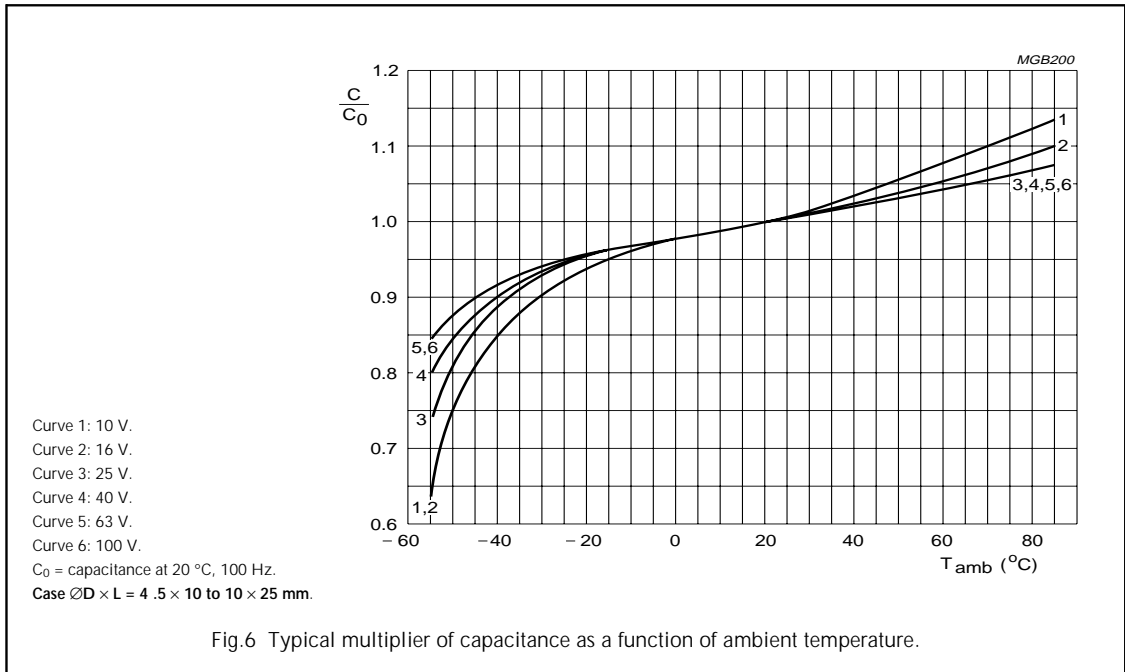
| PARAMETER                          | CONDITIONS  | VALUE   |              |
|------------------------------------|---|---|--------------|
|                                    |   | AXIAL   | SINGLE ENDED |
| <b>Voltage</b>                     |   |   |              |
| Surge voltage                      |   | $U_S \leq 1.15 \times U_R$                        |              |
| Reverse voltage                    |   | $U_{rev} \leq 1 \text{ V}$                        |              |
| <b>Current</b>                     |   |   |              |
| Leakage current                    | after 1 minute at $U_R$   | $I_{L1} \leq 0.006C_R \times U_R + 4 \mu\text{A}$ |              |
|                                    | after 5 minutes at $U_R$ :<br>$U_R = 6.3 \text{ V to } 100 \text{ V}$ | $I_{L5} \leq 0.002C_R \times U_R + 4 \mu\text{A}$ |              |
| <b>Inductance</b>                  |   |   |              |
| Equivalent series inductance (ESL) | case $\varnothing D \times L$ mm:                                     |   |              |
|                                    | 4.5 × 10  | typ. 10 nH  | –            |
|                                    | 6 × 10  | typ. 22 nH  | –            |
|                                    | 8 × 11  | typ. 85 nH  | –            |
|                                    | 6.5 × 18  | typ. 25 nH  | –            |
|                                    | 8 × 18  | typ. 40 nH  | –            |
|                                    | 10 × 18   | typ. 61 nH  | –            |
|                                    | 10 × 25   | typ. 38 nH  | –            |
|                                    | 10 × 30   | typ. 38 nH  | –            |
|                                    | 12.5 × 30   | typ. 46 nH  | –            |
|                                    | 15 × 30   | typ. 48 nH  | typ. 39 nH   |
|                                    | 18 × 30   | typ. 50 nH  | typ. 39 nH   |
|                                    | 18 × 40   | typ. 54 nH  | typ. 39 nH   |
| 21 × 40                            | typ. 59 nH  | typ. 39 nH  |              |

# Aluminum electrolytic capacitors

## Axial Standard Miniature

**O21 ASM**

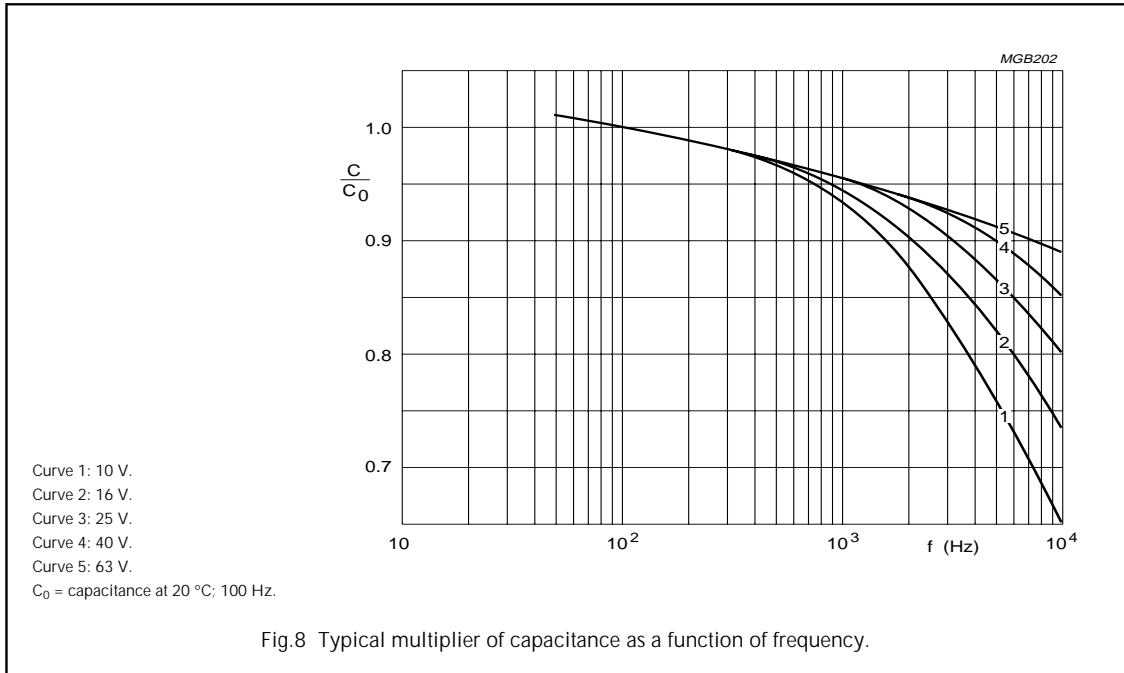
### Capacitance (C)



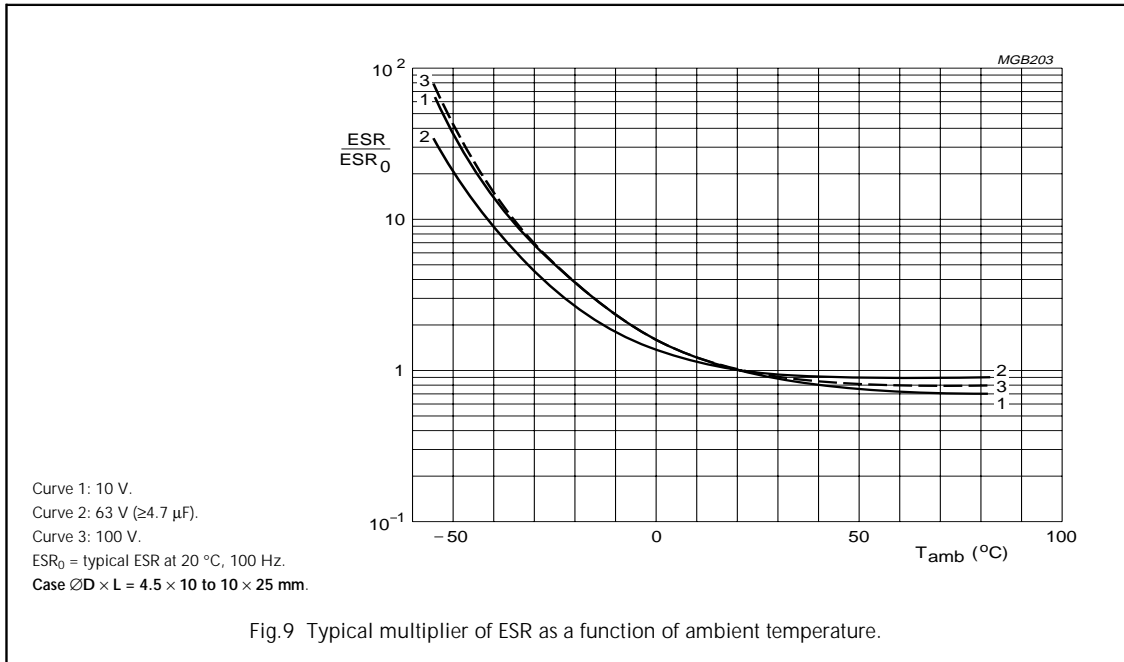
# Aluminum electrolytic capacitors

## Axial Standard Miniature

O21 ASM



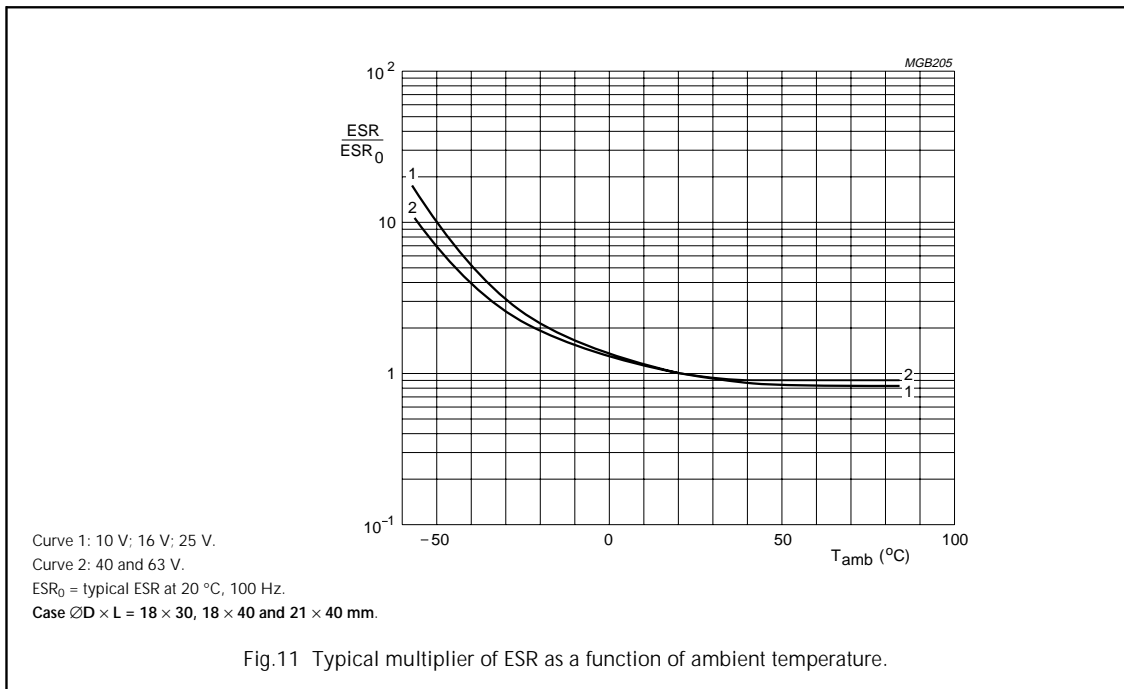
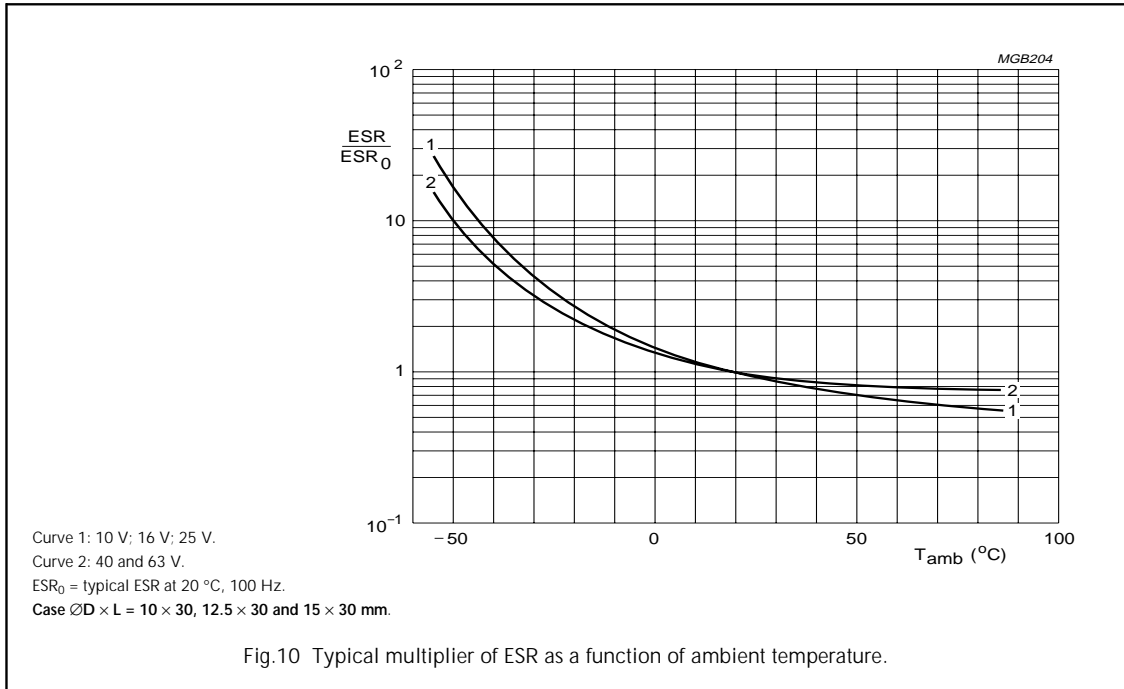
### Equivalent series resistance (ESR)



# Aluminum electrolytic capacitors

## Axial Standard Miniature

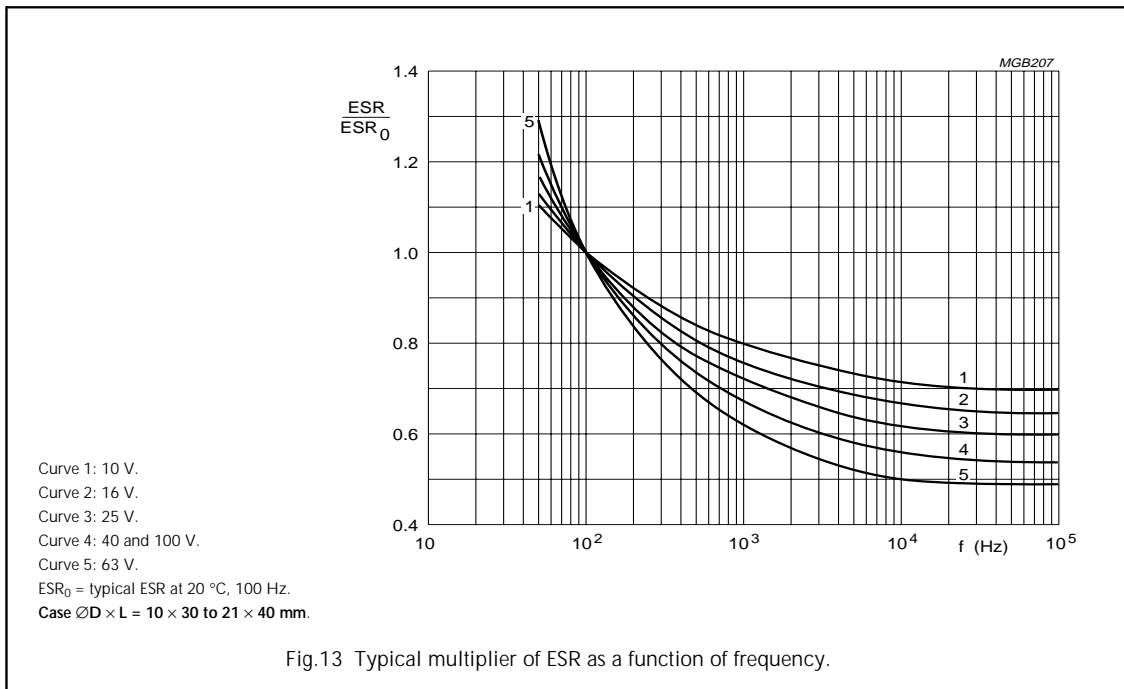
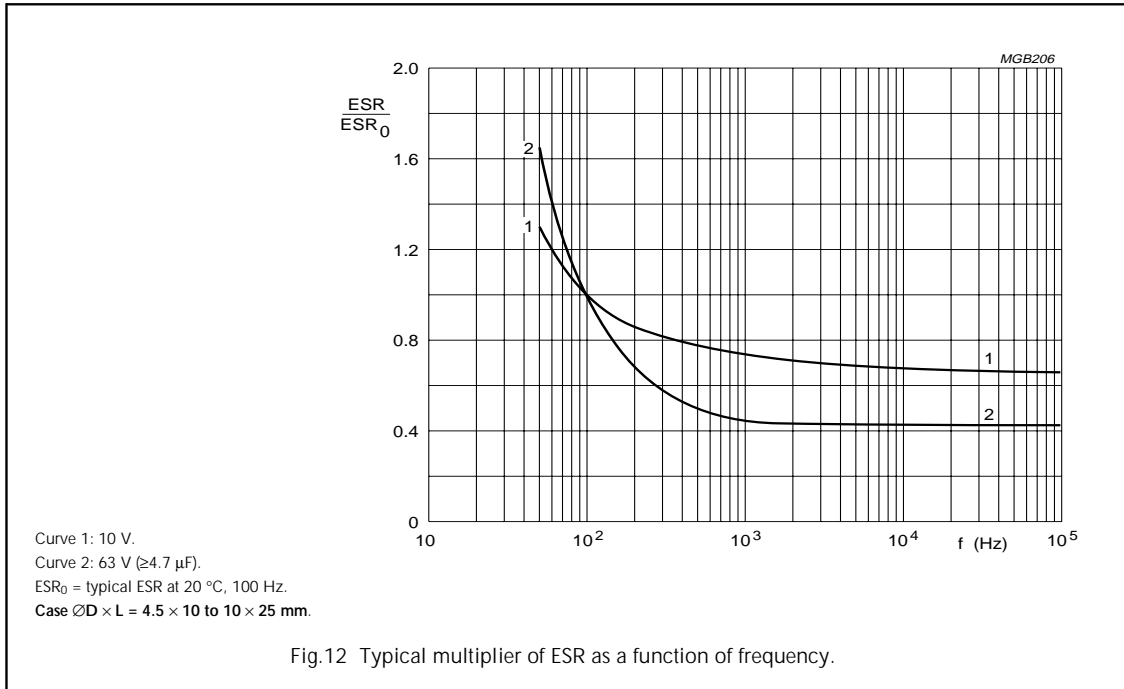
**O21 ASM**



# Aluminum electrolytic capacitors

## Axial Standard Miniature

**O21 ASM**



# Aluminum electrolytic capacitors

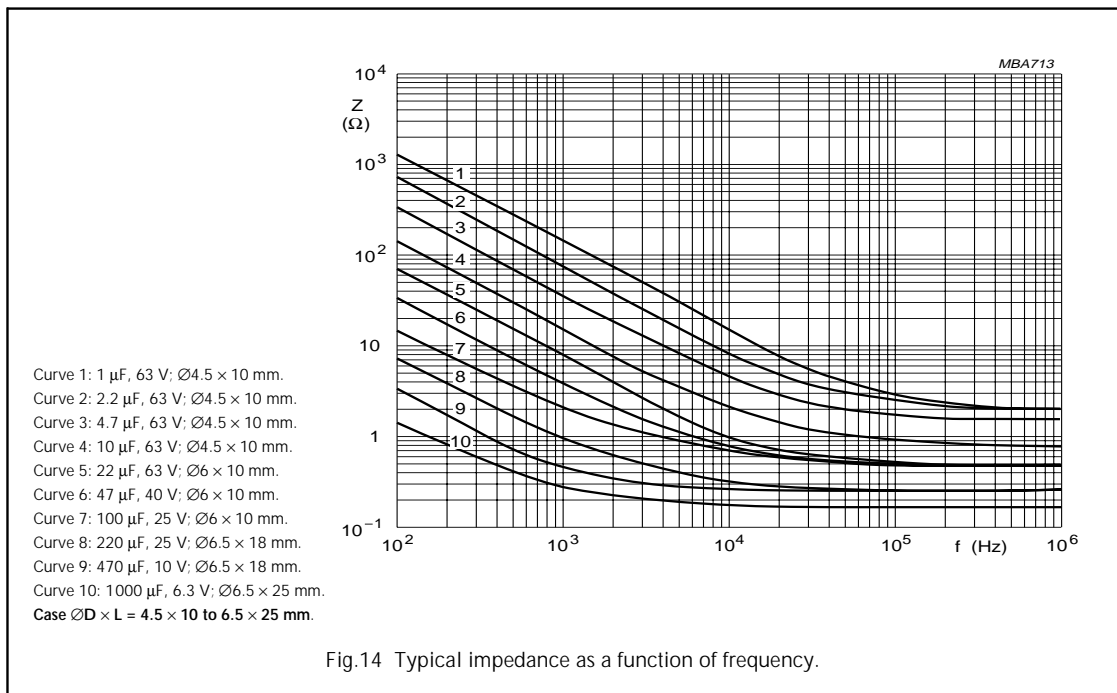
## Axial Standard Miniature

**O21 ASM**

### Impedance (Z)

**Table 4** Impedance × capacitance values (case ØD × L = 4.5 × 10 to 10 × 25 mm)

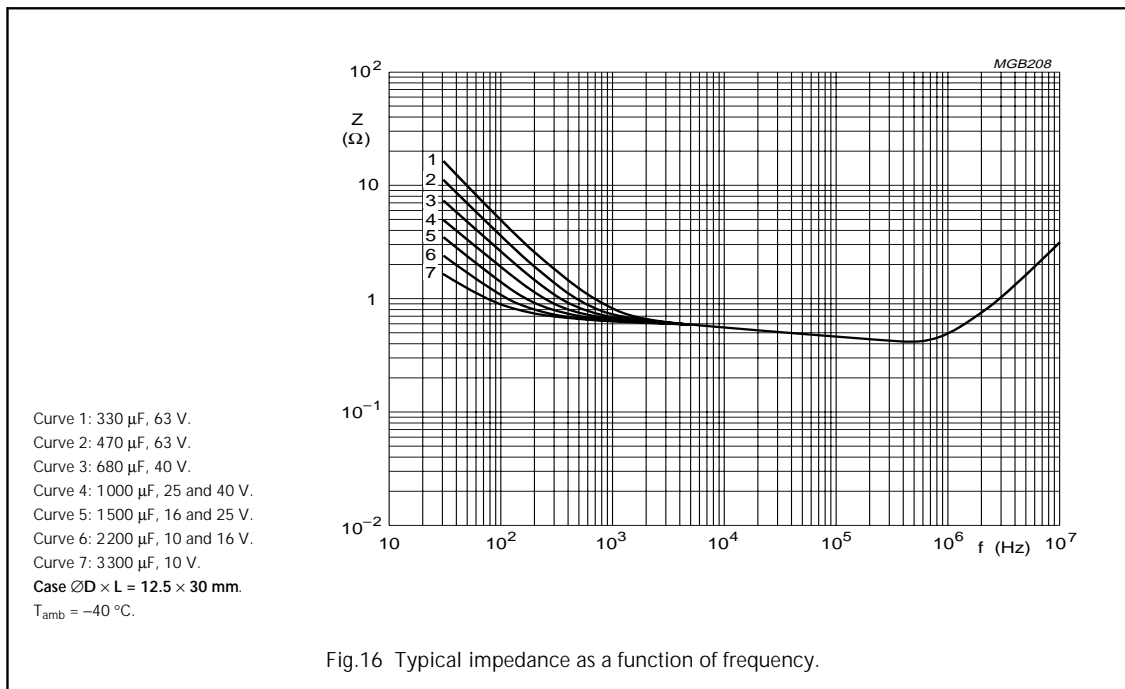
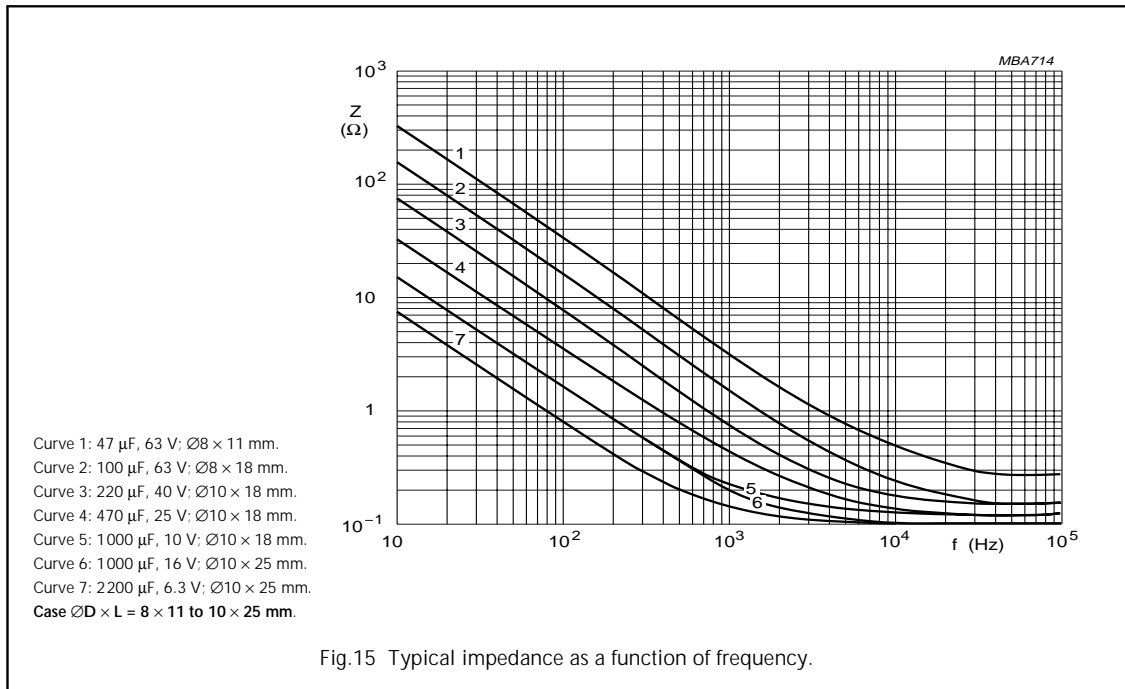
| T <sub>amb</sub> | Z × C <sub>R</sub> (Ω × μF) at 10 kHz |       |       |       |      |      |       |
|------------------|---------------------------------------|-------|-------|-------|------|------|-------|
|                  | 6.3 V                                 | 10 V  | 16 V  | 25 V  | 40 V | 63 V | 100 V |
| +20 °C           | ≤300                                  | ≤200  | ≤160  | ≤120  | ≤70  | ≤55  | ≤90   |
| -25 °C           | ≤2000                                 | ≤1200 | ≤750  | ≤560  | ≤300 | ≤180 | ≤600  |
| -40 °C           | ≤5500                                 | ≤3200 | ≤2000 | ≤1500 | ≤900 | ≤500 | ≤1600 |



# Aluminum electrolytic capacitors

## Axial Standard Miniature

**O21 ASM**

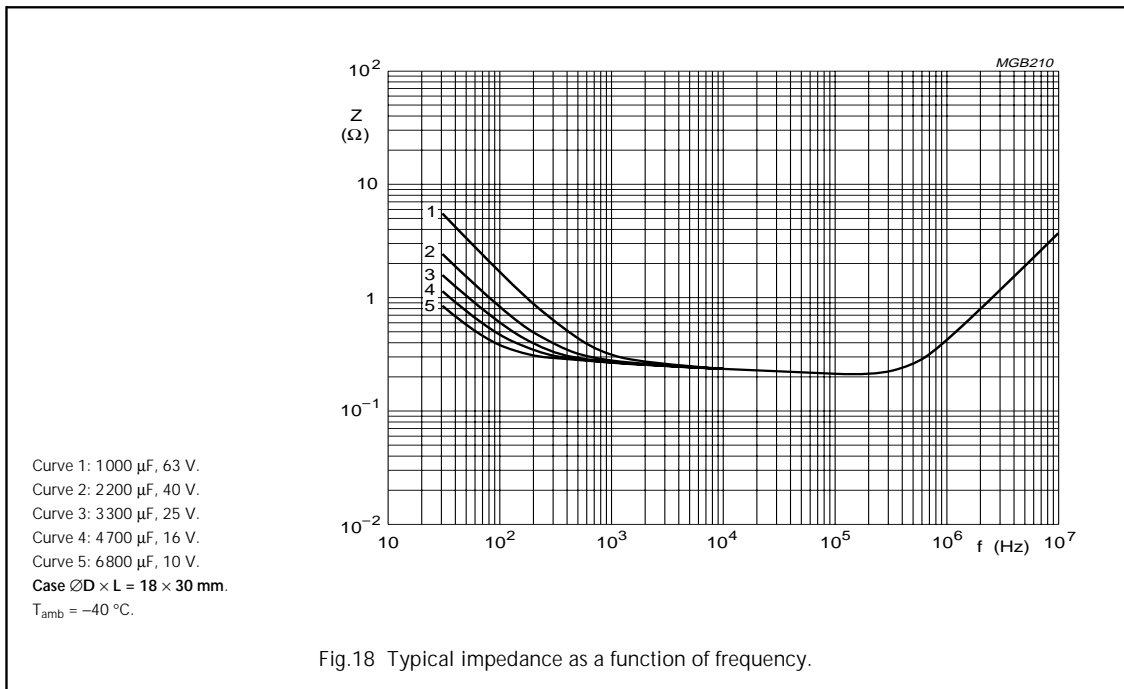
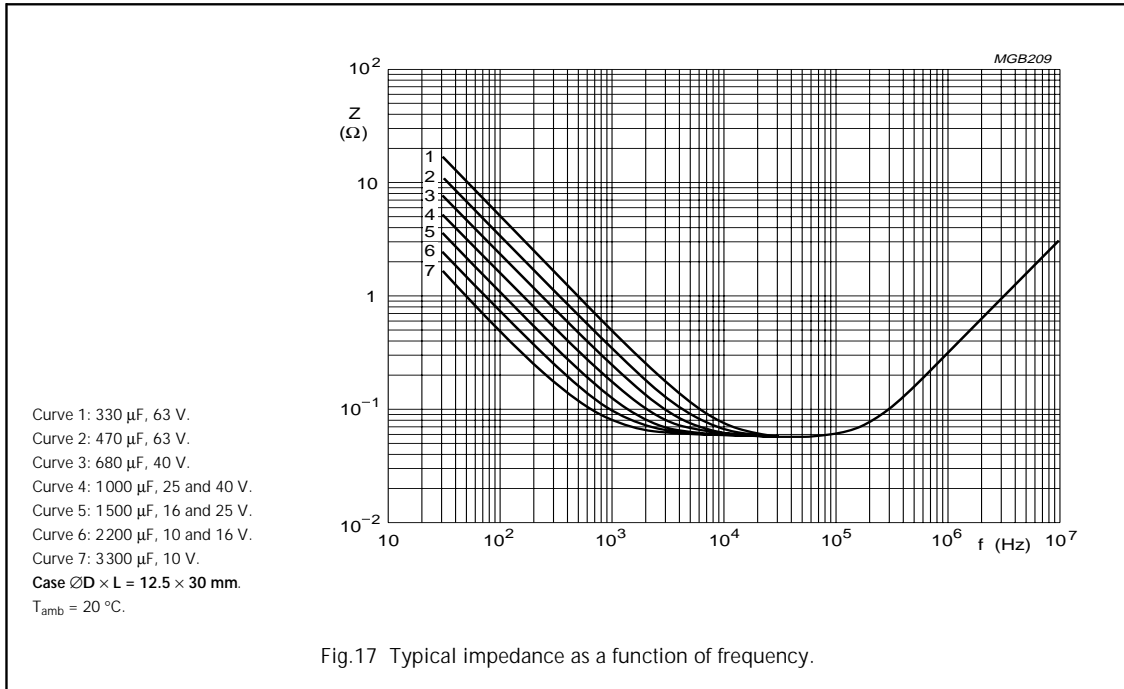




# Aluminum electrolytic capacitors

## Axial Standard Miniature

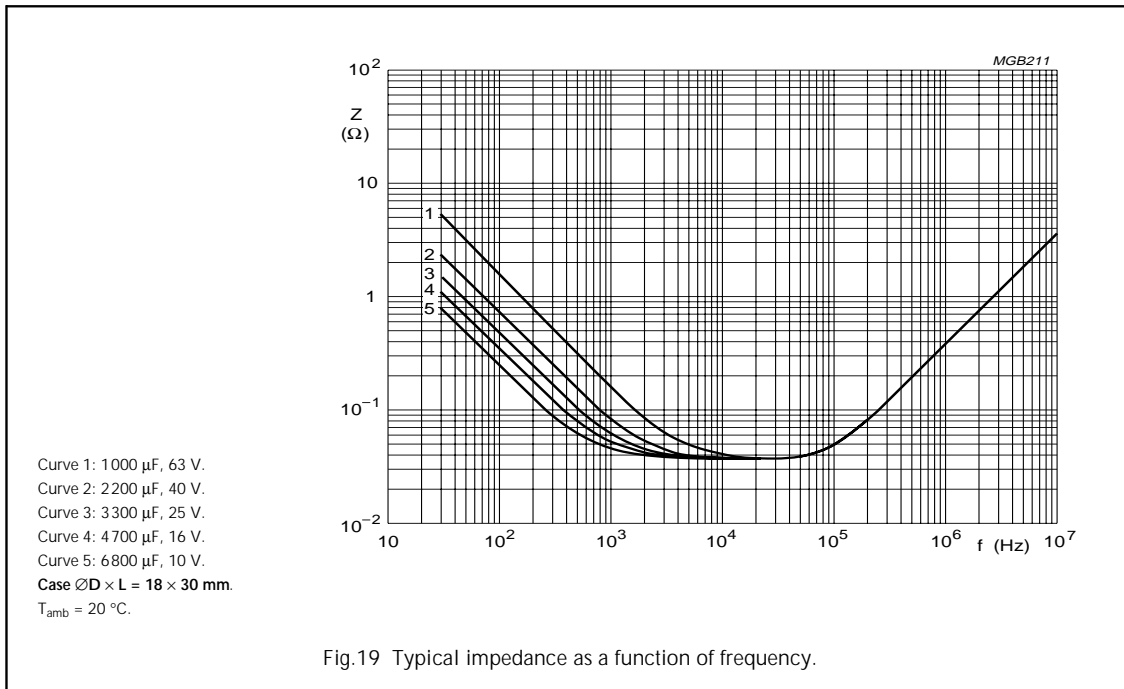
**021 ASM**



# Aluminum electrolytic capacitors

## Axial Standard Miniature

### O21 ASM



### MARKING

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

- Rated capacitance (in  $\mu\text{F}$ )
- Tolerance on nominal capacitance (in accordance with "IEC 60062")
- Rated voltage (in V)
- Group number (O21)
- Name of manufacturer
- Date code in accordance with "IEC 60062"
- Code for factory of origin
- Band to indicate the negative terminal
- '+' sign to identify the positive terminal (not for case sizes  $L < 18$  mm).

# Aluminum electrolytic capacitors

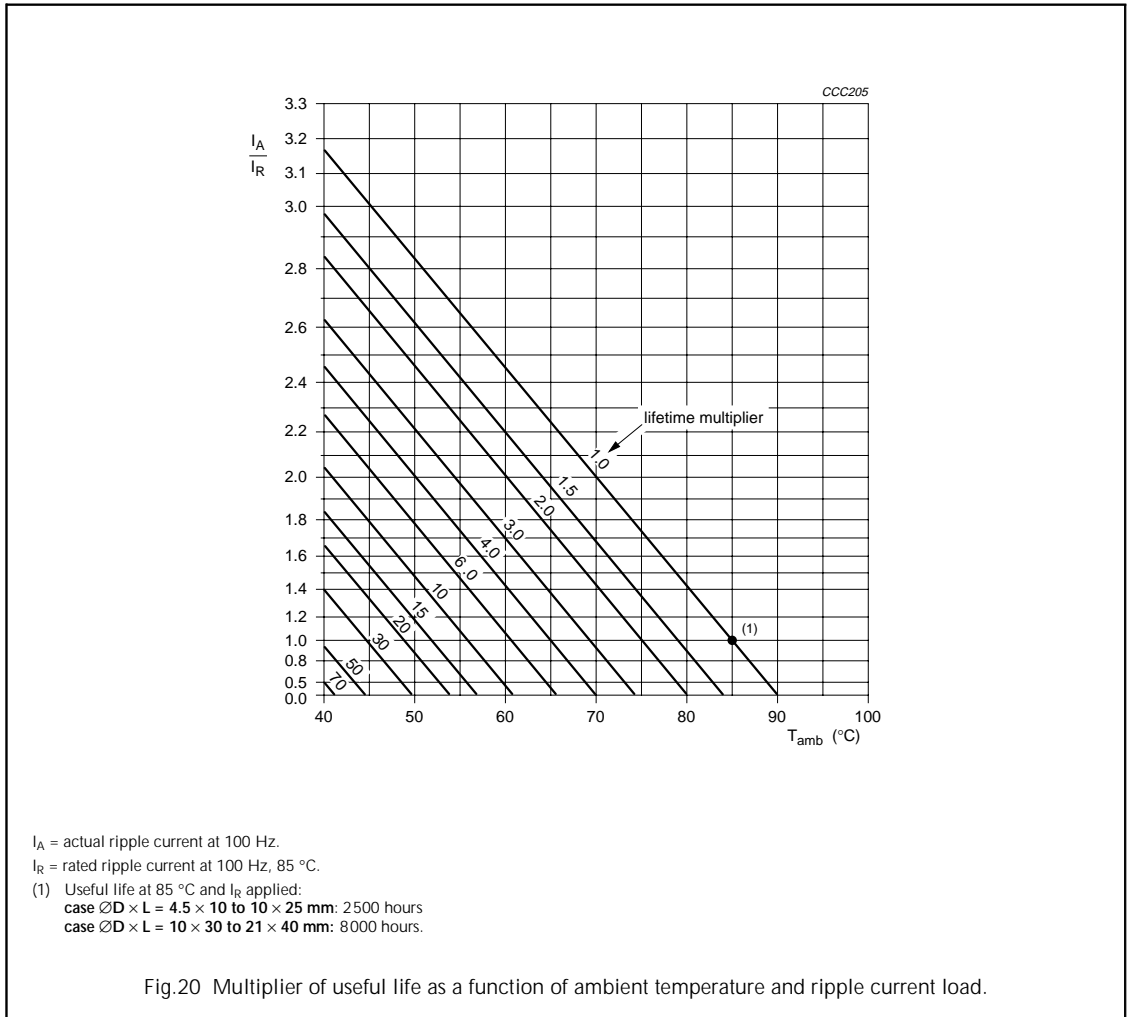
## Axial Standard Miniature

**021 ASM**

### RIPPLE CURRENT AND USEFUL LIFE

**Table 5** Multiplier of ripple current ( $I_R$ ) as a function of frequency

| FREQUENCY<br>(Hz) | $I_R$ MULTIPLIER      |                      |                       |
|-------------------|-----------------------|----------------------|-----------------------|
|                   | $U_R = 6.3$ to $16$ V | $U_R = 25$ to $40$ V | $U_R = 63$ to $100$ V |
| 50                | 0.95                  | 0.9                  | 0.85                  |
| 100               | 1                     | 1                    | 1                     |
| 300               | 1.07                  | 1.12                 | 1.2                   |
| 1000              | 1.12                  | 1.2                  | 1.3                   |
| 3000              | 1.15                  | 1.25                 | 1.35                  |
| $\geq 10000$      | 1.2                   | 1.3                  | 1.4                   |



# Aluminum electrolytic capacitors

## Axial Standard Miniature

**O21 ASM**

### SPECIFIC TESTS AND REQUIREMENTS

General tests and requirements are specified in this handbook, section "Tests and Requirements".

**Table 6** Test procedures and requirements

| TEST   |  | PROCEDURE<br>(quick reference)   | REQUIREMENTS   |
|--|--|--|--|
| NAME OF TEST                                   | REFERENCE                                  |  |  |
| Endurance                                      | IEC 60384-4/<br>EN130300<br>subclause 4.13 | $T_{amb} = 85\text{ °C}$ ; $U_R$ applied;<br>case $\varnothing D \times L = 4.5 \times 10$ to $10 \times 25$ mm:<br>$U_R = 6.3$ to $25$ V: 1000 hours;<br>$U_R = 40$ to $100$ V: 2000 hours;<br>case $\varnothing D \times L = 10 \times 30$ to $21 \times 40$ mm:<br>$U_R = 6.3$ to $100$ V: 5000 hours | $U_R \leq 6.3$ V; $\Delta C/C$ : +15/-30%<br>$U_R > 6.3$ V; $\Delta C/C$ : $\pm 15\%$<br>$\tan \delta \leq 1.3 \times$ spec. limit<br>$Z \leq 2 \times$ spec. limit<br>$I_{L5} \leq$ spec. limit   |
| Useful life                                    | CECC 30301<br>subclause 1.8.1              | $T_{amb} = 85\text{ °C}$ ; $U_R$ and $I_R$ applied;<br>case $\varnothing D \times L = 4.5 \times 10$ to $10 \times 25$ mm:<br>2500 hours;<br>case $\varnothing D \times L = 10 \times 30$ to $21 \times 40$ mm:<br>8000 hours  | $U_R \leq 6.3$ V; $\Delta C/C$ : +45/-50%<br>$U_R > 6.3$ V; $\Delta C/C$ : $\pm 45\%$<br>$\tan \delta \leq 3 \times$ spec. limit<br>$Z \leq 3 \times$ spec. limit<br>$I_{L5} \leq$ spec. limit<br>no short or open circuit<br>total failure percentage: $\leq 1\%$ |
| Shelf life<br>(storage at<br>high temperature) | IEC 60384-4/<br>EN130300<br>subclause 4.17 | $T_{amb} = 85\text{ °C}$ ; no voltage applied;<br>500 hours<br><br>after test: $U_R$ to be applied for 30 minutes,<br>24 to 48 hours before measurement  | $\Delta C/C$ , $\tan \delta$ , $Z$ :<br>for requirements<br>see 'Endurance test' above<br>$I_{L5} \leq 2 \times$ spec. limit   |