

## Aluminum Electrolytic Capacitors, Power High Ripple Current, Screw Terminals



### LINKS TO ADDITIONAL RESOURCES

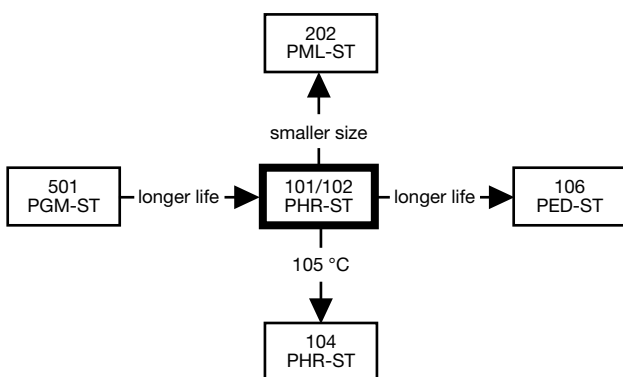


Fig. 1

| QUICK REFERENCE DATA                                  |                                                      |                |
|-------------------------------------------------------|------------------------------------------------------|----------------|
| DESCRIPTION                                           | VALUE                                                |                |
|                                                       | 101                                                  | 102            |
| Nominal case size (Ø D x L in mm)                     | 35 x 60 to 90 x 220                                  |                |
| Rated capacitance range (E6 series), C <sub>R</sub>   | 220 µF to 1 F                                        |                |
| Tolerance on C <sub>R</sub>                           | ± 20 %                                               |                |
| Rated voltage range, U <sub>R</sub>                   | 25 V to 100 V                                        | 200 V to 450 V |
| Category temperature range                            | -40 °C to +85 °C                                     |                |
| Endurance test at 85 °C                               | 2000 h                                               |                |
| Useful life at 85 °C                                  | 10 000 h<br>(D ≤ 50 mm)<br>15 000 h<br>(D ≥ 65 mm)   | 10 000 h       |
| Useful life at 40 °C,<br>1.4 x I <sub>R</sub> applied | 400 000 h<br>(D ≤ 50 mm)<br>600 000 h<br>(D ≥ 65 mm) | 400 000 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 / 056                                       |                |

### FEATURES

- Long useful life: 10 000 h to 15 000 h at +85 °C
- Low ESR
- Available in case sizes up to Ø 90 mm x 220 mm
- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Large types, cylindrical aluminum case, insulated with a blue sleeve
- Pressure relief in the sealing
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT

### APPLICATIONS

- Buffering and filtering
- Motor drives, inverters, UPS, and traction systems
- Pulsed power supplies

### MARKING

The capacitors are marked with the following information:

- Rated capacitance (in µF)
- Tolerance on rated capacitance, code letter in accordance with IEC 60062 (M for ± 20 %)
- Rated voltage (in V)
- Date code
- Name of manufacturer
- Code for factory of origin
- “-” sign to identify the negative terminal, visible from the top and side of the capacitor
- Ordering code (relevant part only)
- Climatic category in accordance with IEC 60068



| SELECTION CHART FOR $C_R$ , $U_R$ , AND RELEVANT NOMINAL CASE SIZES ( $\varnothing D \times L$ in mm) |           |          |          |          |          |          |          |          |          |          |
|-------------------------------------------------------------------------------------------------------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| $C_R$<br>( $\mu F$ )                                                                                  | $U_R$ (V) |          |          |          |          |          |          |          |          |          |
|                                                                                                       | 25        | 40       | 63       | 100      | 200      | 250      | 350      | 385      | 400      | 450      |
| 220                                                                                                   | -         | -        | -        | -        | -        | -        | -        | 35 x 60  | 35 x 60  | 35 x 60  |
| 330                                                                                                   | -         | -        | -        | -        | -        | -        | 35 x 60  | 35 x 80  | 35 x 60  | 35 x 80  |
|                                                                                                       | -         | -        | -        | -        | -        | -        | -        | -        | 35 x 80  | -        |
| 470                                                                                                   | -         | -        | -        | -        | -        | 35 x 60  | 35 x 80  | 35 x 80  | 35 x 80  | 35 x 105 |
|                                                                                                       | -         | -        | -        | -        | -        | -        | -        | -        | 35 x 105 | -        |
| 680                                                                                                   | -         | -        | -        | -        | 35 x 60  | 35 x 80  | 35 x 105 | 35 x 105 | 35 x 105 | 50 x 80  |
|                                                                                                       | -         | -        | -        | -        | -        | -        | -        | -        | 50 x 80  | -        |
| 1000                                                                                                  | -         | -        | -        | -        | 35 x 80  | 35 x 80  | 50 x 80  | 50 x 80  | 50 x 80  | 50 x 80  |
|                                                                                                       | -         | -        | -        | -        | 35 x 105 | 35 x 105 | -        | -        | 50 x 105 | 50 x 105 |
| 1500                                                                                                  | -         | -        | -        | -        | 35 x 105 | 35 x 105 | 50 x 80  | 50 x 105 | 50 x 105 | 50 x 105 |
|                                                                                                       | -         | -        | -        | -        | 50 x 80  | 50 x 80  | 50 x 105 | -        | -        | 65 x 105 |
| 2200                                                                                                  | -         | -        | -        | 35 x 60  | 50 x 80  | 50 x 80  | 50 x 105 | 65 x 105 | 65 x 105 | 65 x 105 |
|                                                                                                       | -         | -        | -        | -        | -        | 50 x 105 | 65 x 105 | -        | -        | 76 x 105 |
| 3300                                                                                                  | -         | -        | -        | 35 x 60  | 50 x 80  | 50 x 105 | 65 x 105 | 76 x 105 | 65 x 105 | 76 x 105 |
|                                                                                                       | -         | -        | -        | 35 x 80  | 50 x 105 | 65 x 105 | -        | -        | 76 x 105 | 76 x 146 |
| 4700                                                                                                  | -         | -        | 35 x 60  | 35 x 80  | 65 x 105 | 65 x 105 | 76 x 105 | 76 x 105 | 76 x 105 | 76 x 146 |
|                                                                                                       | -         | -        | -        | 35 x 105 | -        | 76 x 105 | 76 x 146 | 76 x 146 | 76 x 146 | -        |
| 5600                                                                                                  | -         | -        | -        | -        | -        | -        | -        | -        | -        | 76 x 146 |
| 6800                                                                                                  | -         | -        | 35 x 60  | 35 x 105 | 65 x 105 | 76 x 105 | 76 x 146 | 76 x 146 | 76 x 146 | 76 x 220 |
|                                                                                                       | -         | -        | 35 x 80  | 50 x 80  | 76 x 105 | 76 x 146 | -        | -        | -        | 90 x 146 |
| 10 000                                                                                                | -         | 35 x 60  | 35 x 80  | 50 x 80  | 76 x 105 | 76 x 105 | 76 x 220 | -        | 76 x 220 | 90 x 220 |
|                                                                                                       | -         | -        | 35 x 105 | 50 x 105 | 76 x 146 | 76 x 146 | 90 x 146 | -        | -        | -        |
| 15 000                                                                                                | 35 x 60   | 35 x 60  | 35 x 105 | 50 x 105 | 76 x 146 | 76 x 146 | 90 x 220 | -        | -        | -        |
|                                                                                                       | -         | 35 x 80  | 50 x 80  | -        | -        | -        | -        | -        | -        | -        |
| 22 000                                                                                                | 35 x 60   | 35 x 80  | 50 x 80  | 65 x 105 | 76 x 220 | 76 x 220 | -        | -        | -        | -        |
|                                                                                                       | -         | 50 x 80  | 50 x 105 | 76 x 105 | 90 x 146 | 90 x 146 | -        | -        | -        | -        |
| 33 000                                                                                                | 35 x 80   | 35 x 105 | 50 x 105 | 76 x 105 | 90 x 220 | 90 x 220 | -        | -        | -        | -        |
|                                                                                                       | 50 x 80   | 50 x 80  | 65 x 105 | 76 x 146 | -        | -        | -        | -        | -        | -        |
| 47 000                                                                                                | 35 x 105  | 50 x 80  | 65 x 105 | 76 x 146 | -        | -        | -        | -        | -        | -        |
|                                                                                                       | 50 x 80   | 50 x 105 | 76 x 105 | -        | -        | -        | -        | -        | -        | -        |
| 68 000                                                                                                | 50 x 80   | 50 x 105 | 76 x 105 | 76 x 146 | -        | -        | -        | -        | -        | -        |
|                                                                                                       | 50 x 105  | 65 x 105 | 76 x 146 | -        | -        | -        | -        | -        | -        | -        |
| 100 000                                                                                               | 50 x 105  | 65 x 105 | 76 x 146 | 76 x 220 | -        | -        | -        | -        | -        | -        |
|                                                                                                       | 65 x 105  | 76 x 105 | -        | 90 x 146 | -        | -        | -        | -        | -        | -        |
| 150 000                                                                                               | 65 x 105  | 76 x 105 | 76 x 146 | 90 x 220 | -        | -        | -        | -        | -        | -        |
|                                                                                                       | 76 x 105  | 76 x 146 | -        | -        | -        | -        | -        | -        | -        | -        |
| 220 000                                                                                               | 65 x 105  | 76 x 146 | 76 x 220 | -        | -        | -        | -        | -        | -        | -        |
|                                                                                                       | 76 x 105  | -        | 90 x 146 | -        | -        | -        | -        | -        | -        | -        |
| 330 000                                                                                               | 76 x 146  | 76 x 220 | 90 x 220 | -        | -        | -        | -        | -        | -        | -        |
|                                                                                                       | -         | 90 x 146 | -        | -        | -        | -        | -        | -        | -        | -        |
| 470 000                                                                                               | 76 x 220  | 90 x 220 | -        | -        | -        | -        | -        | -        | -        | -        |
|                                                                                                       | 90 x 146  | -        | -        | -        | -        | -        | -        | -        | -        | -        |
| 680 000                                                                                               | 76 x 220  | -        | -        | -        | -        | -        | -        | -        | -        | -        |
| 1 000 000                                                                                             | 90 x 220  | -        | -        | -        | -        | -        | -        | -        | -        | -        |

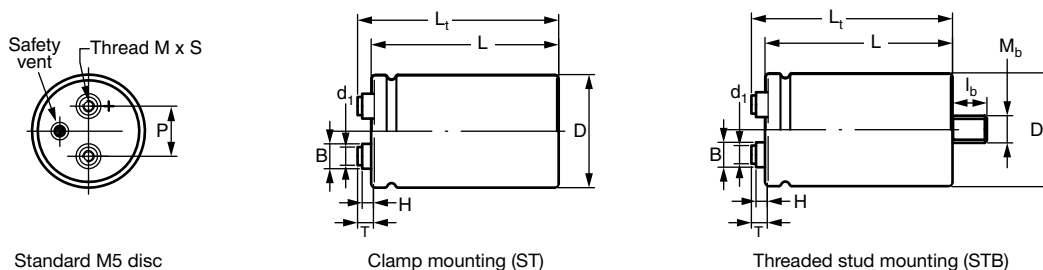
**DIMENSIONS** in millimeters **AND AVAILABLE FORMS**


Fig. 2A - Mechanical drawings for standard M5 disc versions.  
For details refer to Table 1

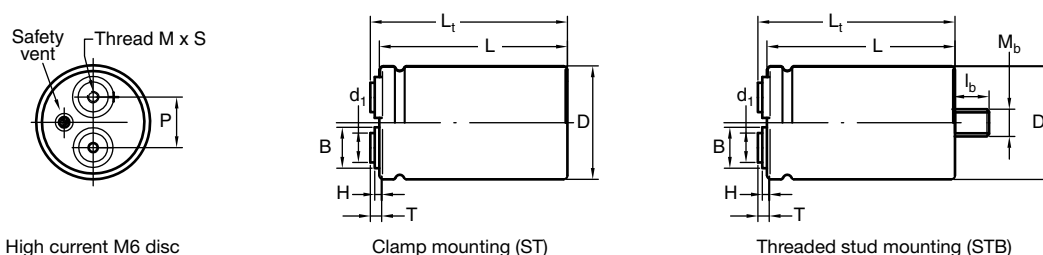


Fig. 2B - Mechanical drawings for high current M6 disc versions.  
For details refer to Table 1

**Notes**

- Maximum permissible torque which may be applied to the termination screws: 2 Nm for M5; 2.5 Nm for M6  
For accessories refer to document "Mounting Accessories", see [www.vishay.com/doc?28348](http://www.vishay.com/doc?28348)  
The capacitors are delivered with screws and washers
- High current disc with 1/4 28 UNF (US) thread is available on request

**Table 1**

| <b>DIMENSIONS</b> in millimeters <b>AND MASS</b> |         |           |             |           |             |             |             |             |               |    |       |       |               |          |
|--------------------------------------------------|---------|-----------|-------------|-----------|-------------|-------------|-------------|-------------|---------------|----|-------|-------|---------------|----------|
| DESIGN                                           | DRAWING | $L \pm 1$ | $L_t \pm 1$ | $D \pm 1$ | $P \pm 0.3$ | $T \pm 0.2$ | $H \pm 0.3$ | $B \pm 0.3$ | $d_1 \pm 0.1$ | M  | S - 0 | $M_b$ | $l_b \pm 0.1$ | MASS (g) |
| 35 x 60                                          | 2A      | 63.3      | 68.7        | 35.3      | 12.8        | 7           | 4.6         | 11          | 7.9           | M5 | 9.5   | M8    | 12            | 75       |
| 35 x 80                                          | 2A      | 81.3      | 86.7        | 35.3      | 12.8        | 7           | 4.6         | 11          | 7.9           | M5 | 9.5   | M8    | 12            | 95       |
| 35 x 105                                         | 2A      | 103.3     | 108.7       | 35.3      | 12.8        | 7           | 4.6         | 11          | 7.9           | M5 | 9.5   | M8    | 12            | 130      |
| 50 x 80                                          | 2A      | 82.8      | 88.8        | 51        | 22.2        | 7.1         | 4.8         | 11          | 7.9           | M5 | 9.5   | M12   | 16            | 200      |
| 50 x 105                                         | 2A      | 104.8     | 110.8       | 51        | 22.2        | 7.1         | 4.8         | 11          | 7.9           | M5 | 9.5   | M12   | 16            | 300      |
| 65 x 105                                         | 2A      | 104.8     | 110.7       | 65        | 28.5        | 7           | 4.6         | 11.9        | 7.9           | M5 | 9.5   | M12   | 16            | 480      |
| 65 x 105 HC                                      | 2B      | 104.8     | 109.2       | 65        | 28.5        | 5.5         | 3.5         | 18          | 13            | M6 | 8.5   | M12   | 16            | 480      |
| 76 x 105                                         | 2A      | 105.8     | 111.7       | 76.4      | 31.8        | 7           | 4.6         | 11.7        | 7.9           | M5 | 9.5   | M12   | 16            | 700      |
| 76 x 105 HC                                      | 2B      | 105.8     | 110.2       | 76.4      | 31.8        | 5.5         | 3.5         | 18.3        | 13            | M6 | 8.5   | M12   | 16            | 700      |
| 76 x 146                                         | 2A      | 145.8     | 151.7       | 76.4      | 31.8        | 7           | 4.6         | 11.7        | 7.9           | M5 | 9.5   | M12   | 16            | 1000     |
| 76 x 146 HC                                      | 2B      | 145.8     | 150.2       | 76.4      | 31.8        | 5.5         | 3.5         | 18.3        | 13            | M6 | 8.5   | M12   | 16            | 1000     |
| 76 x 220                                         | 2A      | 219.8     | 225.7       | 76.4      | 31.8        | 7           | 4.6         | 11.7        | 7.9           | M5 | 9.5   | M12   | 16            | 1500     |
| 76 x 220 HC                                      | 2B      | 219.8     | 224.2       | 76.4      | 31.8        | 5.5         | 3.5         | 18.3        | 13            | M6 | 8.5   | M12   | 16            | 1500     |
| 90 x 146 HC                                      | 2B      | 150.1     | 155.4       | 89.4      | 31.8        | 7.9         | 0           | 13          | 13            | M6 | 10    | M12   | 16            | 1300     |
| 90 x 220 HC                                      | 2B      | 218.1     | 223.4       | 89.4      | 31.8        | 7.9         | 0           | 13          | 13            | M6 | 10    | M12   | 16            | 2000     |

**PACKAGING QUANTITIES AND DIMENSIONS** in millimeters

| DESIGN      | PACKAGING QUANTITIES<br>(units per box) | CARDBOX DIMENSIONS<br>L x W x H |
|-------------|-----------------------------------------|---------------------------------|
| 35 x 60     | 50                                      | 377 x 375 x 88                  |
| 35 x 80     | 50                                      | 377 x 375 x 123                 |
| 35 x 105    | 50                                      | 377 x 375 x 129                 |
| 50 x 80     | 25                                      | 377 x 375 x 123                 |
| 50 x 105    | 25                                      | 377 x 375 x 129                 |
| 65 x 105    | 16                                      | 377 x 375 x 129                 |
| 65 x 105 HC | 16                                      | 377 x 375 x 129                 |
| 76 x 105    | 12                                      | 377 x 375 x 129                 |
| 76 x 105 HC | 12                                      | 377 x 375 x 129                 |
| 76 x 146    | 12                                      | 377 x 375 x 168                 |
| 76 x 146 HC | 12                                      | 377 x 375 x 168                 |
| 76 x 220    | 12                                      | 377 x 375 x 242                 |
| 76 x 220 HC | 12                                      | 377 x 375 x 242                 |
| 90 x 146 HC | 8                                       | 377 x 375 x 168                 |
| 90 x 220 HC | 8                                       | 377 x 375 x 242                 |

**Note**

- For bolt version holds:  
H cardboard box: + 10 mm

**ELECTRICAL DATA**

| SYMBOL   | DESCRIPTION                                       |
|----------|---------------------------------------------------|
| $C_R$    | Rated capacitance at 100 Hz, tolerance $\pm 20\%$ |
| $I_R$    | Rated RMS ripple current at 100 Hz, 85 °C         |
| $I_{L5}$ | Max. leakage current after 5 min at $U_R$         |
| ESR      | Max. equivalent series resistance at 100 Hz       |
| Z        | Max. impedance at 20 kHz                          |

**Note**

- Unless otherwise specified, all electrical values in Table 2 and 3 apply at  $T_{amb} = 20\text{ °C}$ ,  $P = 86\text{ kPa}$  to  $106\text{ kPa}$ ,  $RH = 45\%$  to  $75\%$

**ORDERING EXAMPLE**

Electrolytic capacitor 101 series

10 000  $\mu\text{F}$  / 40 V;  $\pm 20\%$ Nominal case size:  $\varnothing 35\text{ mm}$  x 60 mm;

ST version, standard M5 disc

Ordering code: MAL210117103E3

**Table 2****ELECTRICAL DATA AND ORDERING INFORMATION FOR 101 SERIES**

| $U_R$<br>(V) | $C_R$<br>100 Hz<br>( $\mu\text{F}$ ) | NOMINAL<br>CASE SIZE<br>$\varnothing D \times L$<br>(mm) | $I_R$<br>100 Hz<br>85 °C<br>(A) | $I_{L5}$<br>5 min<br>(mA) | ESR<br>MAX.<br>100 Hz<br>(m $\Omega$ ) | Z<br>MAX.<br>20 kHz<br>(m $\Omega$ ) | LIFE<br>CODE <sup>(1)</sup> | STANDARD M5 DISC                       |                                         | HIGH CURRENT M6 DISC                   |                                         |
|--------------|--------------------------------------|----------------------------------------------------------|---------------------------------|---------------------------|----------------------------------------|--------------------------------------|-----------------------------|----------------------------------------|-----------------------------------------|----------------------------------------|-----------------------------------------|
|              |                                      |                                                          |                                 |                           |                                        |                                      |                             | ST<br>ORDERING<br>CODE<br>MAL2101..... | STB<br>ORDERING<br>CODE<br>MAL2101..... | ST<br>ORDERING<br>CODE<br>MAL2101..... | STB<br>ORDERING<br>CODE<br>MAL2101..... |
| 25           | 15 000                               | 35 x 60                                                  | 7.7                             | 0.75                      | 29                                     | 22                                   | L1                          | 16153E3                                | 56153E3                                 | -                                      | -                                       |
|              | 22 000                               | 35 x 60                                                  | 8.3                             | 1.10                      | 27                                     | 22                                   | L1                          | 16223E3                                | 56223E3                                 | -                                      | -                                       |
|              | 33 000                               | 35 x 80                                                  | 9.0                             | 1.65                      | 19                                     | 17                                   | L1                          | 16333E3                                | 56333E3                                 | -                                      | -                                       |
|              | 33 000                               | 50 x 80                                                  | 10.0                            | 1.65                      | 17                                     | 14                                   | L1                          | 26333E3                                | 66333E3                                 | -                                      | -                                       |
|              | 47 000                               | 35 x 105                                                 | 12.1                            | 2.35                      | 15                                     | 13                                   | L1                          | 16473E3                                | 56473E3                                 | -                                      | -                                       |
|              | 47 000                               | 50 x 80                                                  | 14.8                            | 2.35                      | 12                                     | 10                                   | L1                          | 26473E3                                | 66473E3                                 | -                                      | -                                       |
|              | 68 000                               | 50 x 80                                                  | 12.8                            | 3.40                      | 15                                     | 13                                   | L1                          | 16683E3                                | 56683E3                                 | -                                      | -                                       |
|              | 68 000                               | 50 x 105                                                 | 17.1                            | 3.40                      | 9                                      | 8                                    | L1                          | 26683E3                                | 66683E3                                 | -                                      | -                                       |
|              | 100 000                              | 50 x 105                                                 | 14.7                            | 5.00                      | 12                                     | 11                                   | L1                          | 16104E3                                | 56104E3                                 | -                                      | -                                       |
|              | 100 000                              | 65 x 105                                                 | 19.6                            | 5.00                      | 7                                      | 6                                    | L2                          | 26104E3                                | 66104E3                                 | 46104E3                                | 86104E3                                 |
|              | 150 000                              | 65 x 105                                                 | 17.6                            | 7.50                      | 8                                      | 7                                    | L2                          | 16154E3                                | 56154E3                                 | 36154E3                                | 76154E3                                 |
|              | 150 000                              | 76 x 105                                                 | 21.4                            | 7.50                      | 6                                      | 5                                    | L2                          | 26154E3                                | 66154E3                                 | 46154E3                                | 86154E3                                 |
|              | 220 000                              | 65 x 105                                                 | 20.2                            | 11.0                      | 6                                      | 5                                    | L2                          | 16224E3                                | 56224E3                                 | 36224E3                                | 76224E3                                 |
|              | 220 000                              | 76 x 105                                                 | 22.5                            | 11.0                      | 6                                      | 5                                    | L2                          | 26224E3                                | 66224E3                                 | 46224E3                                | 86224E3                                 |
|              | 330 000                              | 76 x 146                                                 | 25.8                            | 16.5                      | 4                                      | 4                                    | L2                          | 26334E3                                | 66334E3                                 | 46334E3                                | 86334E3                                 |
|              | 470 000                              | 76 x 220                                                 | 29.9                            | 23.5                      | 5                                      | 5                                    | L2                          | 16474E3                                | 56474E3                                 | 36474E3                                | 76474E3                                 |
|              | 470 000                              | 90 x 146                                                 | 38.2                            | 23.5                      | 5                                      | 5                                    | L2                          | -                                      | -                                       | 46474E3                                | 86474E3                                 |
|              | 680 000                              | 76 x 220                                                 | 29.0                            | 34.0                      | 5                                      | 5                                    | L2                          | 16684E3                                | 56684E3                                 | 36684E3                                | 76684E3                                 |
|              | 1 000 000                            | 90 x 220                                                 | 46.6                            | 50.0                      | 5                                      | 5                                    | L2                          | -                                      | -                                       | 46105E3                                | 86105E3                                 |



| <b>ELECTRICAL DATA AND ORDERING INFORMATION FOR 101 SERIES</b> |                                          |                                                   |                                                   |                                          |                                         |                                       |                                     |                                                  |                                                   |                                                  |                                                   |
|----------------------------------------------------------------|------------------------------------------|---------------------------------------------------|---------------------------------------------------|------------------------------------------|-----------------------------------------|---------------------------------------|-------------------------------------|--------------------------------------------------|---------------------------------------------------|--------------------------------------------------|---------------------------------------------------|
| <b>U<sub>R</sub><br/>(V)</b>                                   | <b>C<sub>R</sub><br/>100 Hz<br/>(μF)</b> | <b>NOMINAL<br/>CASE SIZE<br/>Ø D x L<br/>(mm)</b> | <b>I<sub>R</sub><br/>100 Hz<br/>85 °C<br/>(A)</b> | <b>I<sub>L5</sub><br/>5 min<br/>(mA)</b> | <b>ESR<br/>MAX.<br/>100 Hz<br/>(mΩ)</b> | <b>Z<br/>MAX.<br/>20 kHz<br/>(mΩ)</b> | <b>LIFE<br/>CODE <sup>(1)</sup></b> | <b>STANDARD M5 DISC</b>                          |                                                   | <b>HIGH CURRENT M6 DISC</b>                      |                                                   |
|                                                                |                                          |                                                   |                                                   |                                          |                                         |                                       |                                     | <b>ST<br/>ORDERING<br/>CODE<br/>MAL2101.....</b> | <b>STB<br/>ORDERING<br/>CODE<br/>MAL2101.....</b> | <b>ST<br/>ORDERING<br/>CODE<br/>MAL2101.....</b> | <b>STB<br/>ORDERING<br/>CODE<br/>MAL2101.....</b> |
| 40                                                             | 10 000                                   | 35 x 60                                           | 7.1                                               | 0.80                                     | 31                                      | 23                                    | L1                                  | 17103E3                                          | 57103E3                                           | -                                                | -                                                 |
|                                                                | 15 000                                   | 35 x 60                                           | 7.8                                               | 1.20                                     | 28                                      | 22                                    | L1                                  | 17153E3                                          | 57153E3                                           | -                                                | -                                                 |
|                                                                | 15 000                                   | 35 x 80                                           | 8.7                                               | 1.20                                     | 22                                      | 17                                    | L1                                  | 27153E3                                          | 67153E3                                           | -                                                | -                                                 |
|                                                                | 22 000                                   | 35 x 80                                           | 9.4                                               | 1.76                                     | 20                                      | 17                                    | L1                                  | 17223E3                                          | 57223E3                                           | -                                                | -                                                 |
|                                                                | 22 000                                   | 50 x 80                                           | 11.2                                              | 1.76                                     | 19                                      | 15                                    | L1                                  | 27223E3                                          | 67223E3                                           | -                                                | -                                                 |
|                                                                | 33 000                                   | 35 x 105                                          | 11.0                                              | 2.64                                     | 15                                      | 13                                    | L1                                  | 17333E3                                          | 57333E3                                           | -                                                | -                                                 |
|                                                                | 33 000                                   | 50 x 80                                           | 13.7                                              | 2.64                                     | 13                                      | 10                                    | L1                                  | 27333E3                                          | 67333E3                                           | -                                                | -                                                 |
|                                                                | 47 000                                   | 50 x 80                                           | 14.6                                              | 3.76                                     | 12                                      | 10                                    | L1                                  | 17473E3                                          | 57473E3                                           | -                                                | -                                                 |
|                                                                | 47 000                                   | 50 x 105                                          | 15.9                                              | 3.76                                     | 10                                      | 8                                     | L1                                  | 27473E3                                          | 67473E3                                           | -                                                | -                                                 |
|                                                                | 68 000                                   | 50 x 105                                          | 16.9                                              | 5.44                                     | 9                                       | 8                                     | L1                                  | 17683E3                                          | 57683E3                                           | -                                                | -                                                 |
|                                                                | 68 000                                   | 65 x 105                                          | 18.1                                              | 5.44                                     | 7                                       | 6                                     | L2                                  | 27683E3                                          | 67683E3                                           | 47683E3                                          | 87683E3                                           |
|                                                                | 100 000                                  | 65 x 105                                          | 19.2                                              | 8.0                                      | 7                                       | 6                                     | L2                                  | 17104E3                                          | 57104E3                                           | 37104E3                                          | 77104E3                                           |
|                                                                | 100 000                                  | 76 x 105                                          | 21.3                                              | 8.0                                      | 7                                       | 6                                     | L2                                  | 27104E3                                          | 67104E3                                           | 47104E3                                          | 87104E3                                           |
|                                                                | 150 000                                  | 76 x 105                                          | 20.5                                              | 12.0                                     | 7                                       | 6                                     | L2                                  | 17154E3                                          | 57154E3                                           | 37154E3                                          | 77154E3                                           |
|                                                                | 150 000                                  | 76 x 146                                          | 24.0                                              | 12.0                                     | 5                                       | 5                                     | L2                                  | 27154E3                                          | 67154E3                                           | 47154E3                                          | 87154E3                                           |
|                                                                | 220 000                                  | 76 x 146                                          | 24.5                                              | 17.6                                     | 5                                       | 5                                     | L2                                  | 27224E3                                          | 67224E3                                           | 47224E3                                          | 87224E3                                           |
|                                                                | 330 000                                  | 76 x 220                                          | 28.2                                              | 26.4                                     | 5                                       | 5                                     | L2                                  | 17334E3                                          | 57334E3                                           | 37334E3                                          | 77334E3                                           |
|                                                                | 330 000                                  | 90 x 146                                          | 38.6                                              | 26.4                                     | 5                                       | 5                                     | L2                                  | -                                                | -                                                 | 47334E3                                          | 87334E3                                           |
|                                                                | 470 000                                  | 90 x 220                                          | 41.5                                              | 37.6                                     | 5                                       | 5                                     | L2                                  | -                                                | -                                                 | 47474E3                                          | 87474E3                                           |
| 63                                                             | 4700                                     | 35 x 60                                           | 5.9                                               | 0.59                                     | 42                                      | 25                                    | L1                                  | 18472E3                                          | 58472E3                                           | -                                                | -                                                 |
|                                                                | 6800                                     | 35 x 60                                           | 6.6                                               | 0.86                                     | 38                                      | 25                                    | L1                                  | 18682E3                                          | 58682E3                                           | -                                                | -                                                 |
|                                                                | 6800                                     | 35 x 80                                           | 7.3                                               | 0.86                                     | 30                                      | 19                                    | L1                                  | 28682E3                                          | 68682E3                                           | -                                                | -                                                 |
|                                                                | 10 000                                   | 35 x 80                                           | 8.1                                               | 1.26                                     | 27                                      | 19                                    | L1                                  | 18103E3                                          | 58103E3                                           | -                                                | -                                                 |
|                                                                | 10 000                                   | 35 x 105                                          | 8.8                                               | 1.26                                     | 22                                      | 14                                    | L1                                  | 28103E3                                          | 68103E3                                           | -                                                | -                                                 |
|                                                                | 15 000                                   | 35 x 105                                          | 9.7                                               | 1.89                                     | 19                                      | 14                                    | L1                                  | 18153E3                                          | 58153E3                                           | -                                                | -                                                 |
|                                                                | 15 000                                   | 50 x 80                                           | 12.1                                              | 1.89                                     | 16                                      | 11                                    | L1                                  | 28153E3                                          | 68153E3                                           | -                                                | -                                                 |
|                                                                | 22 000                                   | 50 x 80                                           | 11.1                                              | 2.77                                     | 19                                      | 15                                    | L1                                  | 18223E3                                          | 58223E3                                           | -                                                | -                                                 |
|                                                                | 22 000                                   | 50 x 105                                          | 14.3                                              | 2.77                                     | 12                                      | 9                                     | L1                                  | 28223E3                                          | 68223E3                                           | -                                                | -                                                 |
|                                                                | 33 000                                   | 50 x 105                                          | 12.9                                              | 4.16                                     | 14                                      | 12                                    | L1                                  | 18333E3                                          | 58333E3                                           | -                                                | -                                                 |
|                                                                | 33 000                                   | 65 x 105                                          | 16.5                                              | 4.16                                     | 9                                       | 6                                     | L2                                  | 28333E3                                          | 68333E3                                           | 48333E3                                          | 88333E3                                           |
|                                                                | 47 000                                   | 65 x 105                                          | 15.6                                              | 5.92                                     | 10                                      | 8                                     | L2                                  | 18473E3                                          | 58473E3                                           | 38473E3                                          | 78473E3                                           |
|                                                                | 47 000                                   | 76 x 105                                          | 18.6                                              | 5.92                                     | 8                                       | 6                                     | L2                                  | 28473E3                                          | 68473E3                                           | 48473E3                                          | 88473E3                                           |
|                                                                | 68 000                                   | 76 x 105                                          | 20.0                                              | 8.57                                     | 7                                       | 6                                     | L2                                  | 18683E3                                          | 58683E3                                           | 38683E3                                          | 78683E3                                           |
|                                                                | 68 000                                   | 76 x 146                                          | 21.9                                              | 8.57                                     | 6                                       | 5                                     | L2                                  | 28683E3                                          | 68683E3                                           | 48683E3                                          | 88683E3                                           |
|                                                                | 100 000                                  | 76 x 146                                          | 23.4                                              | 12.6                                     | 5                                       | 5                                     | L2                                  | 28104E3                                          | 68104E3                                           | 48104E3                                          | 88104E3                                           |
|                                                                | 150 000                                  | 76 x 146                                          | 22.2                                              | 18.9                                     | 6                                       | 5                                     | L2                                  | 18154E3                                          | 58154E3                                           | 38154E3                                          | 78154E3                                           |
|                                                                | 220 000                                  | 76 x 220                                          | 27.0                                              | 27.7                                     | 5                                       | 5                                     | L2                                  | 18224E3                                          | 58224E3                                           | 38224E3                                          | 78224E3                                           |
|                                                                | 220 000                                  | 90 x 146                                          | 36.5                                              | 27.7                                     | 5                                       | 5                                     | L2                                  | -                                                | -                                                 | 48224E3                                          | 88224E3                                           |
|                                                                | 330 000                                  | 90 x 220                                          | 42.9                                              | 41.6                                     | 5                                       | 5                                     | L2                                  | -                                                | -                                                 | 48334E3                                          | 88334E3                                           |

**ELECTRICAL DATA AND ORDERING INFORMATION FOR 101 SERIES**

| U <sub>R</sub><br>(V) | C <sub>R</sub><br>100 Hz<br>(μF) | NOMINAL<br>CASE SIZE<br>Ø D x L<br>(mm) | I <sub>R</sub><br>100 Hz<br>85 °C<br>(A) | I <sub>L5</sub><br>5 min<br>(mA) | ESR<br>MAX.<br>100 Hz<br>(mΩ) | Z<br>MAX.<br>20 kHz<br>(mΩ) | LIFE<br>CODE <sup>(1)</sup> | STANDARD M5 DISC                       |                                         | HIGH CURRENT M6 DISC                   |                                         |
|-----------------------|----------------------------------|-----------------------------------------|------------------------------------------|----------------------------------|-------------------------------|-----------------------------|-----------------------------|----------------------------------------|-----------------------------------------|----------------------------------------|-----------------------------------------|
|                       |                                  |                                         |                                          |                                  |                               |                             |                             | ST<br>ORDERING<br>CODE<br>MAL2101..... | STB<br>ORDERING<br>CODE<br>MAL2101..... | ST<br>ORDERING<br>CODE<br>MAL2101..... | STB<br>ORDERING<br>CODE<br>MAL2101..... |
| 100                   | 2200                             | 35 x 60                                 | 5.2                                      | 0.44                             | 50                            | 29                          | L1                          | 19222E3                                | 59222E3                                 | -                                      | -                                       |
|                       | 3300                             | 35 x 60                                 | 6.0                                      | 0.66                             | 42                            | 27                          | L1                          | 19332E3                                | 59332E3                                 | -                                      | -                                       |
|                       | 3300                             | 35 x 80                                 | 6.6                                      | 0.66                             | 35                            | 21                          | L1                          | 29332E3                                | 69332E3                                 | -                                      | -                                       |
|                       | 4700                             | 35 x 80                                 | 7.3                                      | 0.94                             | 31                            | 20                          | L1                          | 19472E3                                | 59472E3                                 | -                                      | -                                       |
|                       | 4700                             | 35 x 105                                | 7.9                                      | 0.94                             | 26                            | 16                          | L1                          | 29472E3                                | 69472E3                                 | -                                      | -                                       |
|                       | 6800                             | 35 x 105                                | 8.8                                      | 1.36                             | 23                            | 15                          | L1                          | 19682E3                                | 59682E3                                 | -                                      | -                                       |
|                       | 6800                             | 50 x 80                                 | 10.9                                     | 1.36                             | 19                            | 12                          | L1                          | 29682E3                                | 69682E3                                 | -                                      | -                                       |
|                       | 10 000                           | 50 x 80                                 | 10.5                                     | 2.00                             | 21                            | 15                          | L1                          | 19103E3                                | 59103E3                                 | -                                      | -                                       |
|                       | 10 000                           | 50 x 105                                | 13.1                                     | 2.00                             | 14                            | 9                           | L1                          | 29103E3                                | 69103E3                                 | -                                      | -                                       |
|                       | 15 000                           | 50 x 105                                | 12.3                                     | 3.00                             | 16                            | 12                          | L1                          | 19153E3                                | 59153E3                                 | -                                      | -                                       |
|                       | 22 000                           | 65 x 105                                | 14.8                                     | 4.40                             | 11                            | 8                           | L2                          | 19223E3                                | 59223E3                                 | 39223E3                                | 79223E3                                 |
|                       | 22 000                           | 76 x 105                                | 17.4                                     | 4.40                             | 9                             | 6                           | L2                          | 29223E3                                | 69223E3                                 | 49223E3                                | 89223E3                                 |
|                       | 33 000                           | 76 x 105                                | 19.0                                     | 6.60                             | 8                             | 6                           | L2                          | 19333E3                                | 59333E3                                 | 39333E3                                | 79333E3                                 |
|                       | 33 000                           | 76 x 146                                | 20.7                                     | 6.60                             | 7                             | 5                           | L2                          | 29333E3                                | 69333E3                                 | 49333E3                                | 89333E3                                 |
|                       | 47 000                           | 76 x 146                                | 22.4                                     | 9.40                             | 6                             | 5                           | L2                          | 29473E3                                | 69473E3                                 | 49473E3                                | 89473E3                                 |
|                       | 68 000                           | 76 x 146                                | 25.6                                     | 13.6                             | 6                             | 5                           | L2                          | 19683E3                                | 59683E3                                 | 39683E3                                | 79683E3                                 |
|                       | 100 000                          | 76 x 220                                | 31.2                                     | 20.0                             | 5                             | 5                           | L2                          | 19104E3                                | 59104E3                                 | 39104E3                                | 79104E3                                 |
|                       | 100 000                          | 90 x 146                                | 41.5                                     | 20.0                             | 5                             | 5                           | L2                          | -                                      | -                                       | 49104E3                                | 89104E3                                 |
|                       | 150 000                          | 90 x 220                                | 49.1                                     | 30.0                             | 5                             | 5                           | L2                          | -                                      | -                                       | 49154E3                                | 89154E3                                 |

**Note**<sup>(1)</sup> Determines the applicable row in the table "Endurance Test Duration and Useful Life"**Table 3****ELECTRICAL DATA AND ORDERING INFORMATION FOR 102 SERIES**

| U <sub>R</sub><br>(V) | C <sub>R</sub><br>100 Hz<br>(μF) | NOMINAL<br>CASE SIZE<br>Ø D x L<br>(mm) | I <sub>R</sub><br>100 Hz<br>85 °C<br>(A) | I <sub>L5</sub><br>5 min<br>(mA) | ESR<br>MAX.<br>100 Hz<br>(mΩ) | Z<br>MAX.<br>20 kHz<br>(mΩ) | LIFE<br>CODE <sup>(1)</sup> | STANDARD M5 DISC                       |                                         | HIGH CURRENT M6 DISC                   |                                         |
|-----------------------|----------------------------------|-----------------------------------------|------------------------------------------|----------------------------------|-------------------------------|-----------------------------|-----------------------------|----------------------------------------|-----------------------------------------|----------------------------------------|-----------------------------------------|
|                       |                                  |                                         |                                          |                                  |                               |                             |                             | ST<br>ORDERING<br>CODE<br>MAL2102..... | STB<br>ORDERING<br>CODE<br>MAL2102..... | ST<br>ORDERING<br>CODE<br>MAL2102..... | STB<br>ORDERING<br>CODE<br>MAL2102..... |
| 200                   | 680                              | 35 x 60                                 | 3.5                                      | 0.27                             | 207                           | 136                         | L1                          | 12681E3                                | 52681E3                                 | -                                      | -                                       |
|                       | 1000                             | 35 x 80                                 | 4.4                                      | 0.40                             | 144                           | 95                          | L1                          | 12102E3                                | 52102E3                                 | -                                      | -                                       |
|                       | 1000                             | 35 x 105                                | 4.7                                      | 0.40                             | 140                           | 91                          | L1                          | 22102E3                                | 62102E3                                 | -                                      | -                                       |
|                       | 1500                             | 35 x 105                                | 5.5                                      | 0.60                             | 100                           | 67                          | L1                          | 12152E3                                | 52152E3                                 | -                                      | -                                       |
|                       | 1500                             | 50 x 80                                 | 6.2                                      | 0.60                             | 106                           | 74                          | L1                          | 22152E3                                | 62152E3                                 | -                                      | -                                       |
|                       | 2200                             | 50 x 80                                 | 8.0                                      | 0.88                             | 67                            | 44                          | L1                          | 12222E3                                | 52222E3                                 | -                                      | -                                       |
|                       | 3300                             | 50 x 80                                 | 8.9                                      | 1.32                             | 50                            | 35                          | L1                          | 12332E3                                | 52332E3                                 | -                                      | -                                       |
|                       | 3300                             | 50 x 105                                | 9.9                                      | 1.32                             | 46                            | 32                          | L1                          | 22332E3                                | 62332E3                                 | -                                      | -                                       |
|                       | 4700                             | 65 x 105                                | 12.5                                     | 1.88                             | 37                            | 26                          | L1                          | 22472E3                                | 62472E3                                 | 42472E3                                | 82472E3                                 |
|                       | 6800                             | 65 x 105                                | 15.2                                     | 2.72                             | 25                            | 18                          | L1                          | 12682E3                                | 52682E3                                 | 32682E3                                | 72682E3                                 |
|                       | 6800                             | 76 x 105                                | 16.9                                     | 2.72                             | 25                            | 18                          | L1                          | 22682E3                                | 62682E3                                 | 42682E3                                | 82682E3                                 |
|                       | 10 000                           | 76 x 105                                | 19.9                                     | 4.00                             | 18                            | 13                          | L1                          | 12103E3                                | 52103E3                                 | 32103E3                                | 72103E3                                 |
|                       | 10 000                           | 76 x 146                                | 20.4                                     | 4.00                             | 18                            | 13                          | L1                          | 22103E3                                | 62103E3                                 | 42103E3                                | 82103E3                                 |
|                       | 15 000                           | 76 x 146                                | 24.1                                     | 6.00                             | 12                            | 9                           | L1                          | 12153E3                                | 52153E3                                 | 32153E3                                | 72153E3                                 |
|                       | 22 000                           | 76 x 220                                | 29.5                                     | 8.8                              | 9                             | 7                           | L1                          | 12223E3                                | 52223E3                                 | 32223E3                                | 72223E3                                 |
|                       | 22 000                           | 90 x 146                                | 34.1                                     | 8.8                              | 8                             | 6                           | L1                          | -                                      | -                                       | 42223E3                                | 82223E3                                 |
|                       | 33 000                           | 90 x 220                                | 41.7                                     | 13.2                             | 6                             | 5                           | L1                          | -                                      | -                                       | 42333E3                                | 82333E3                                 |



| <b>ELECTRICAL DATA AND ORDERING INFORMATION FOR 102 SERIES</b> |                                          |                                                   |                                                   |                                          |                                         |                                       |                                     |                                                  |                                                   |                                                  |                                                   |
|----------------------------------------------------------------|------------------------------------------|---------------------------------------------------|---------------------------------------------------|------------------------------------------|-----------------------------------------|---------------------------------------|-------------------------------------|--------------------------------------------------|---------------------------------------------------|--------------------------------------------------|---------------------------------------------------|
| <b>U<sub>R</sub><br/>(V)</b>                                   | <b>C<sub>R</sub><br/>100 Hz<br/>(μF)</b> | <b>NOMINAL<br/>CASE SIZE<br/>Ø D x L<br/>(mm)</b> | <b>I<sub>R</sub><br/>100 Hz<br/>85 °C<br/>(A)</b> | <b>I<sub>L5</sub><br/>5 min<br/>(mA)</b> | <b>ESR<br/>MAX.<br/>100 Hz<br/>(mΩ)</b> | <b>Z<br/>MAX.<br/>20 kHz<br/>(mΩ)</b> | <b>LIFE<br/>CODE <sup>(1)</sup></b> | <b>STANDARD M5 DISC</b>                          |                                                   | <b>HIGH CURRENT M6 DISC</b>                      |                                                   |
|                                                                |                                          |                                                   |                                                   |                                          |                                         |                                       |                                     | <b>ST<br/>ORDERING<br/>CODE<br/>MAL2102.....</b> | <b>STB<br/>ORDERING<br/>CODE<br/>MAL2102.....</b> | <b>ST<br/>ORDERING<br/>CODE<br/>MAL2102.....</b> | <b>STB<br/>ORDERING<br/>CODE<br/>MAL2102.....</b> |
| 250                                                            | 470                                      | 35 x 60                                           | 3.1                                               | 0.24                                     | 250                                     | 152                                   | L1                                  | 13471E3                                          | 53471E3                                           | -                                                | -                                                 |
|                                                                | 680                                      | 35 x 80                                           | 3.8                                               | 0.34                                     | 175                                     | 107                                   | L1                                  | 13681E3                                          | 53681E3                                           | -                                                | -                                                 |
|                                                                | 1000                                     | 35 x 80                                           | 4.4                                               | 0.50                                     | 128                                     | 82                                    | L1                                  | 13102E3                                          | 53102E3                                           | -                                                | -                                                 |
|                                                                | 1000                                     | 35 x 105                                          | 4.8                                               | 0.50                                     | 122                                     | 76                                    | L1                                  | 23102E3                                          | 63102E3                                           | -                                                | -                                                 |
|                                                                | 1500                                     | 35 x 105                                          | 5.4                                               | 0.75                                     | 90                                      | 58                                    | L1                                  | 13152E3                                          | 53152E3                                           | -                                                | -                                                 |
|                                                                | 1500                                     | 50 x 80                                           | 7.0                                               | 0.75                                     | 81                                      | 50                                    | L1                                  | 23152E3                                          | 63152E3                                           | -                                                | -                                                 |
|                                                                | 2200                                     | 50 x 80                                           | 8.0                                               | 1.10                                     | 60                                      | 39                                    | L1                                  | 13222E3                                          | 53222E3                                           | -                                                | -                                                 |
|                                                                | 2200                                     | 50 x 105                                          | 8.7                                               | 1.10                                     | 57                                      | 35                                    | L1                                  | 23222E3                                          | 63222E3                                           | -                                                | -                                                 |
|                                                                | 3300                                     | 50 x 105                                          | 9.8                                               | 1.65                                     | 42                                      | 28                                    | L1                                  | 13332E3                                          | 53332E3                                           | -                                                | -                                                 |
|                                                                | 3300                                     | 65 x 105                                          | 11.4                                              | 1.65                                     | 42                                      | 28                                    | L1                                  | 23332E3                                          | 63332E3                                           | 43332E3                                          | 83332E3                                           |
|                                                                | 4700                                     | 65 x 105                                          | 13.8                                              | 2.35                                     | 29                                      | 19                                    | L1                                  | 13472E3                                          | 53472E3                                           | 33472E3                                          | 73472E3                                           |
|                                                                | 4700                                     | 76 x 105                                          | 15.3                                              | 2.35                                     | 29                                      | 19                                    | L1                                  | 23472E3                                          | 63472E3                                           | 43472E3                                          | 83472E3                                           |
|                                                                | 6800                                     | 76 x 105                                          | 18.1                                              | 3.40                                     | 21                                      | 14                                    | L1                                  | 13682E3                                          | 53682E3                                           | 33682E3                                          | 73682E3                                           |
|                                                                | 6800                                     | 76 x 146                                          | 18.6                                              | 3.40                                     | 21                                      | 14                                    | L1                                  | 23682E3                                          | 63682E3                                           | 43682E3                                          | 83682E3                                           |
|                                                                | 10 000                                   | 76 x 105                                          | 19.3                                              | 5.00                                     | 17                                      | 12                                    | L1                                  | 13103E3                                          | 53103E3                                           | 33103E3                                          | 73103E3                                           |
|                                                                | 10 000                                   | 76 x 146                                          | 22.0                                              | 5.00                                     | 15                                      | 10                                    | L1                                  | 23103E3                                          | 63103E3                                           | 43103E3                                          | 83103E3                                           |
|                                                                | 15 000                                   | 76 x 146                                          | 23.3                                              | 7.5                                      | 12                                      | 10                                    | L1                                  | 13153E3                                          | 53153E3                                           | 33153E3                                          | 73153E3                                           |
|                                                                | 22 000                                   | 76 x 220                                          | 29.1                                              | 11.0                                     | 9                                       | 7                                     | L1                                  | 13223E3                                          | 53223E3                                           | 33223E3                                          | 73223E3                                           |
|                                                                | 22 000                                   | 90 x 146                                          | 35.3                                              | 11.0                                     | 7                                       | 5                                     | L1                                  | -                                                | -                                                 | 43223E3                                          | 83223E3                                           |
|                                                                | 33 000                                   | 90 x 220                                          | 43.2                                              | 16.5                                     | 5                                       | 5                                     | L1                                  | -                                                | -                                                 | 43333E3                                          | 83333E3                                           |
| 350                                                            | 330                                      | 35 x 60                                           | 2.5                                               | 0.23                                     | 435                                     | 305                                   | L1                                  | 15331E3                                          | 55331E3                                           | -                                                | -                                                 |
|                                                                | 470                                      | 35 x 80                                           | 3.1                                               | 0.33                                     | 308                                     | 216                                   | L1                                  | 25471E3                                          | 65471E3                                           | -                                                | -                                                 |
|                                                                | 680                                      | 35 x 105                                          | 3.8                                               | 0.48                                     | 216                                     | 152                                   | L1                                  | 25681E3                                          | 65681E3                                           | -                                                | -                                                 |
|                                                                | 1000                                     | 50 x 80                                           | 5.6                                               | 0.70                                     | 145                                     | 102                                   | L1                                  | 25102E3                                          | 65102E3                                           | -                                                | -                                                 |
|                                                                | 1500                                     | 50 x 80                                           | 6.5                                               | 1.05                                     | 102                                     | 74                                    | L1                                  | 15152E3                                          | 55152E3                                           | -                                                | -                                                 |
|                                                                | 1500                                     | 50 x 105                                          | 7.0                                               | 1.05                                     | 99                                      | 70                                    | L1                                  | 25152E3                                          | 65152E3                                           | -                                                | -                                                 |
|                                                                | 2200                                     | 50 x 105                                          | 8.0                                               | 1.54                                     | 72                                      | 52                                    | L1                                  | 15222E3                                          | 55222E3                                           | -                                                | -                                                 |
|                                                                | 2200                                     | 65 x 105                                          | 9.3                                               | 1.54                                     | 72                                      | 52                                    | L1                                  | 25222E3                                          | 65222E3                                           | 45222E3                                          | 85222E3                                           |
|                                                                | 3300                                     | 65 x 105                                          | 11.4                                              | 2.31                                     | 48                                      | 35                                    | L1                                  | 25332E3                                          | 65332E3                                           | 45332E3                                          | 85332E3                                           |
|                                                                | 4700                                     | 76 x 105                                          | 15.0                                              | 3.29                                     | 34                                      | 25                                    | L1                                  | 15472E3                                          | 55472E3                                           | 35472E3                                          | 75472E3                                           |
|                                                                | 4700                                     | 76 x 146                                          | 15.4                                              | 3.29                                     | 34                                      | 25                                    | L1                                  | 25472E3                                          | 65472E3                                           | 45472E3                                          | 85472E3                                           |
|                                                                | 6800                                     | 76 x 146                                          | 18.3                                              | 4.76                                     | 24                                      | 18                                    | L1                                  | 25682E3                                          | 65682E3                                           | 45682E3                                          | 85682E3                                           |
|                                                                | 10 000                                   | 76 x 220                                          | 23.2                                              | 7.0                                      | 15                                      | 12                                    | L1                                  | 15103E3                                          | 55103E3                                           | 35103E3                                          | 75103E3                                           |
|                                                                | 10 000                                   | 90 x 146                                          | 25.1                                              | 7.0                                      | 15                                      | 12                                    | L1                                  | -                                                | -                                                 | 45103E3                                          | 85103E3                                           |
|                                                                | 15 000                                   | 90 x 220                                          | 31.2                                              | 10.5                                     | 10                                      | 8                                     | L1                                  | -                                                | -                                                 | 45153E3                                          | 85153E3                                           |
| 385                                                            | 220                                      | 35 x 60                                           | 2.1                                               | 0.17                                     | 575                                     | 380                                   | L1                                  | 18221E3                                          | 58221E3                                           | -                                                | -                                                 |
|                                                                | 330                                      | 35 x 80                                           | 2.7                                               | 0.26                                     | 386                                     | 257                                   | L1                                  | 18331E3                                          | 58331E3                                           | -                                                | -                                                 |
|                                                                | 470                                      | 35 x 80                                           | 3.1                                               | 0.37                                     | 279                                     | 188                                   | L1                                  | 18471E3                                          | 58471E3                                           | -                                                | -                                                 |
|                                                                | 680                                      | 35 x 105                                          | 3.9                                               | 0.53                                     | 196                                     | 133                                   | L1                                  | 18681E3                                          | 58681E3                                           | -                                                | -                                                 |
|                                                                | 1000                                     | 50 x 80                                           | 5.6                                               | 0.77                                     | 132                                     | 89                                    | L1                                  | 18102E3                                          | 58102E3                                           | -                                                | -                                                 |
|                                                                | 1500                                     | 50 x 105                                          | 7.1                                               | 1.16                                     | 90                                      | 61                                    | L1                                  | 18152E3                                          | 58152E3                                           | -                                                | -                                                 |
|                                                                | 2200                                     | 65 x 105                                          | 10.0                                              | 1.70                                     | 61                                      | 42                                    | L1                                  | 18222E3                                          | 58222E3                                           | 38222E3                                          | 78222E3                                           |
|                                                                | 3300                                     | 76 x 105                                          | 13.4                                              | 2.55                                     | 42                                      | 29                                    | L1                                  | 18332E3                                          | 58332E3                                           | 38332E3                                          | 78332E3                                           |
|                                                                | 4700                                     | 76 x 105                                          | 15.0                                              | 3.62                                     | 31                                      | 22                                    | L1                                  | 18472E3                                          | 58472E3                                           | 38472E3                                          | 78472E3                                           |
|                                                                | 4700                                     | 76 x 146                                          | 16.3                                              | 3.62                                     | 29                                      | 20                                    | L1                                  | 28472E3                                          | 68472E3                                           | 48472E3                                          | 88472E3                                           |
|                                                                | 6800                                     | 76 x 146                                          | 18.3                                              | 5.24                                     | 22                                      | 16                                    | L1                                  | 18682E3                                          | 58682E3                                           | 38682E3                                          | 78682E3                                           |



**ELECTRICAL DATA AND ORDERING INFORMATION FOR 102 SERIES**

| U <sub>R</sub><br>(V) | C <sub>R</sub><br>100 Hz<br>(μF) | NOMINAL<br>CASE SIZE<br>Ø D x L<br>(mm) | I <sub>R</sub><br>100 Hz<br>85 °C<br>(A) | I <sub>L5</sub><br>5 min<br>(mA) | ESR<br>MAX.<br>100 Hz<br>(mΩ) | Z<br>MAX.<br>20 kHz<br>(mΩ) | LIFE<br>CODE <sup>(1)</sup> | STANDARD M5 DISC                       |                                         | HIGH CURRENT M6 DISC                   |                                         |
|-----------------------|----------------------------------|-----------------------------------------|------------------------------------------|----------------------------------|-------------------------------|-----------------------------|-----------------------------|----------------------------------------|-----------------------------------------|----------------------------------------|-----------------------------------------|
|                       |                                  |                                         |                                          |                                  |                               |                             |                             | ST<br>ORDERING<br>CODE<br>MAL2102..... | STB<br>ORDERING<br>CODE<br>MAL2102..... | ST<br>ORDERING<br>CODE<br>MAL2102..... | STB<br>ORDERING<br>CODE<br>MAL2102..... |
| 400                   | 220                              | 35 x 60                                 | 2.1                                      | 0.18                             | 557                           | 363                         | L1                          | 16221E3                                | 56221E3                                 | -                                      | -                                       |
|                       | 330                              | 35 x 60                                 | 2.5                                      | 0.26                             | 383                           | 254                         | L1                          | 16331E3                                | 56331E3                                 | -                                      | -                                       |
|                       | 330                              | 35 x 80                                 | 2.7                                      | 0.26                             | 374                           | 245                         | L1                          | 26331E3                                | 66331E3                                 | -                                      | -                                       |
|                       | 470                              | 35 x 80                                 | 3.1                                      | 0.38                             | 271                           | 180                         | L1                          | 16471E3                                | 56471E3                                 | -                                      | -                                       |
|                       | 470                              | 35 x 105                                | 3.3                                      | 0.38                             | 265                           | 175                         | L1                          | 26471E3                                | 66471E3                                 | -                                      | -                                       |
|                       | 680                              | 35 x 105                                | 3.9                                      | 0.55                             | 191                           | 128                         | L1                          | 16681E3                                | 56681E3                                 | -                                      | -                                       |
|                       | 680                              | 50 x 80                                 | 4.5                                      | 0.54                             | 199                           | 136                         | L1                          | 26681E3                                | 66681E3                                 | -                                      | -                                       |
|                       | 1000                             | 50 x 80                                 | 5.7                                      | 0.80                             | 128                           | 86                          | L1                          | 16102E3                                | 56102E3                                 | -                                      | -                                       |
|                       | 1000                             | 50 x 105                                | 6.0                                      | 0.80                             | 125                           | 83                          | L1                          | 26102E3                                | 66102E3                                 | -                                      | -                                       |
|                       | 1500                             | 50 x 105                                | 7.1                                      | 1.20                             | 88                            | 59                          | L1                          | 26152E3                                | 66152E3                                 | -                                      | -                                       |
|                       | 2200                             | 65 x 105                                | 10.0                                     | 1.76                             | 60                            | 40                          | L1                          | 26222E3                                | 66222E3                                 | 46222E3                                | 86222E3                                 |
|                       | 3300                             | 65 x 105                                | 12.1                                     | 2.64                             | 40                            | 27                          | L1                          | 16332E3                                | 56332E3                                 | 36332E3                                | 76332E3                                 |
|                       | 3300                             | 76 x 105                                | 13.4                                     | 2.64                             | 40                            | 27                          | L1                          | 26332E3                                | 66332E3                                 | 46332E3                                | 86332E3                                 |
|                       | 4700                             | 76 x 105                                | 15.0                                     | 3.76                             | 31                            | 21                          | L1                          | 16472E3                                | 56472E3                                 | 36472E3                                | 76472E3                                 |
|                       | 4700                             | 76 x 146                                | 16.4                                     | 3.76                             | 28                            | 19                          | L1                          | 26472E3                                | 66472E3                                 | 46472E3                                | 86472E3                                 |
|                       | 6800                             | 76 x 146                                | 18.3                                     | 5.44                             | 22                            | 15                          | L1                          | 26682E3                                | 66682E3                                 | 46682E3                                | 86682E3                                 |
|                       | 10000                            | 76 x 220                                | 22.1                                     | 8.0                              | 14                            | 11                          | L1                          | 16103E3                                | 56103E3                                 | 36103E3                                | 76103E3                                 |
| 450                   | 220                              | 35 x 60                                 | 2.1                                      | 0.20                             | 503                           | 313                         | L1                          | 17221E3                                | 57221E3                                 | -                                      | -                                       |
|                       | 330                              | 35 x 80                                 | 2.7                                      | 0.30                             | 339                           | 212                         | L1                          | 27331E3                                | 67331E3                                 | -                                      | -                                       |
|                       | 470                              | 35 x 105                                | 3.4                                      | 0.42                             | 241                           | 151                         | L1                          | 27471E3                                | 67471E3                                 | -                                      | -                                       |
|                       | 680                              | 50 x 80                                 | 4.9                                      | 0.61                             | 159                           | 98                          | L1                          | 27681E3                                | 67681E3                                 | -                                      | -                                       |
|                       | 1000                             | 50 x 80                                 | 5.7                                      | 0.90                             | 118                           | 75                          | L1                          | 17102E3                                | 57102E3                                 | -                                      | -                                       |
|                       | 1000                             | 50 x 105                                | 6.1                                      | 0.90                             | 114                           | 72                          | L1                          | 27102E3                                | 67102E3                                 | -                                      | -                                       |
|                       | 1500                             | 50 x 105                                | 7.1                                      | 1.35                             | 81                            | 52                          | L1                          | 17152E3                                | 57152E3                                 | -                                      | -                                       |
|                       | 1500                             | 65 x 105                                | 8.3                                      | 1.35                             | 81                            | 52                          | L1                          | 27152E3                                | 67152E3                                 | 47152E3                                | 87152E3                                 |
|                       | 2200                             | 65 x 105                                | 10.1                                     | 1.98                             | 55                            | 35                          | L1                          | 17222E3                                | 57222E3                                 | 37222E3                                | 77222E3                                 |
|                       | 2200                             | 76 x 105                                | 11.2                                     | 1.98                             | 55                            | 35                          | L1                          | 27222E3                                | 67222E3                                 | 47222E3                                | 87222E3                                 |
|                       | 3300                             | 76 x 105                                | 13.5                                     | 2.97                             | 37                            | 24                          | L1                          | 17332E3                                | 57332E3                                 | 37332E3                                | 77332E3                                 |
|                       | 3300                             | 76 x 146                                | 13.9                                     | 2.97                             | 37                            | 24                          | L1                          | 27332E3                                | 67332E3                                 | 47332E3                                | 87332E3                                 |
|                       | 4700                             | 76 x 146                                | 16.4                                     | 4.23                             | 26                            | 17                          | L1                          | 17472E3                                | 57472E3                                 | 37472E3                                | 77472E3                                 |
|                       | 5600                             | 76 x 146                                | 17.3                                     | 5.04                             | 23                            | 15                          | L1                          | 17562E3                                | 57562E3                                 | 37562E3                                | 77562E3                                 |
|                       | 6800                             | 76 x 220                                | 19.8                                     | 6.1                              | 25                            | 20                          | L1                          | 17682E3                                | 57682E3                                 | 37682E3                                | 77682E3                                 |
|                       | 6800                             | 90 x 146                                | 21.3                                     | 6.1                              | 24                            | 19                          | L1                          | -                                      | -                                       | 47682E3                                | 87682E3                                 |
|                       | 10 000                           | 90 x 220                                | 26.5                                     | 9.0                              | 17                            | 14                          | L1                          | -                                      | -                                       | 47103E3                                | 87103E3                                 |

**Note**

(1) Determines the applicable row in the table "Endurance Test Duration and Useful Life"

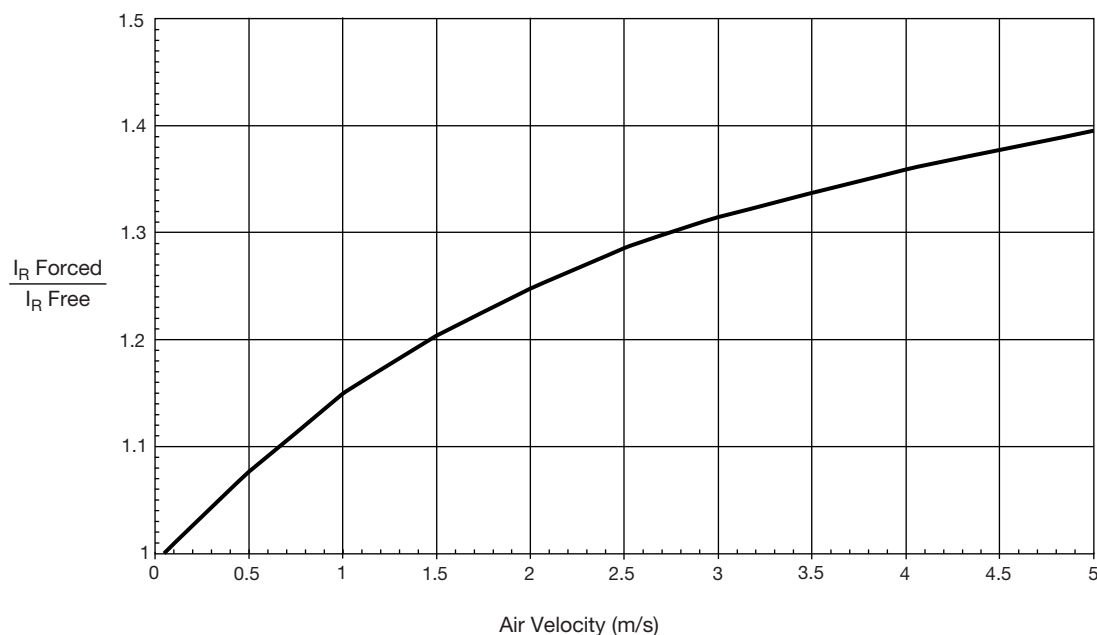
**ADDITIONAL ELECTRICAL DATA**

| PARAMETER                          | CONDITIONS                    | VALUE                                                   |
|------------------------------------|-------------------------------|---------------------------------------------------------|
| <b>Voltage</b>                     |                               |                                                         |
| Surge voltage                      | ≤ 250 V versions              | U <sub>S</sub> = 1.15 x U <sub>R</sub>                  |
| Reverse voltage                    | ≥ 350 V versions              | U <sub>S</sub> = 1.1 x U <sub>R</sub>                   |
|                                    |                               | U <sub>rev</sub> ≤ 1 V                                  |
| <b>Current</b>                     |                               |                                                         |
| Leakage current                    | After 1 min at U <sub>R</sub> | I <sub>L1</sub> ≤ 0.006 C <sub>R</sub> x U <sub>R</sub> |
|                                    | After 5 min at U <sub>R</sub> | I <sub>L5</sub> ≤ 0.002 C <sub>R</sub> x U <sub>R</sub> |
| <b>Inductance</b>                  |                               |                                                         |
| Equivalent series inductance (ESL) | Case Ø D = 35 mm              | Typ. 13 nH                                              |
|                                    | Case Ø D = 50 mm              | Typ. 16 nH                                              |
|                                    | Case Ø D = 65 mm              | Typ. 19 nH <sup>(1)</sup>                               |
|                                    | Case Ø D = 76 mm              | Typ. 20 nH <sup>(1)</sup>                               |
|                                    | Case Ø D = 90 mm              | Typ. 21 nH <sup>(1)</sup>                               |

**Note**

(1) Low ESL designs available on request



**RIPPLE CURRENT AND USEFUL LIFE**

Fig. 3 - Multiplier of ripple current ( $I_R$ ) as a function of air flow

| MAXIMUM RIPPLE CURRENT            |           |                                   |       |
|-----------------------------------|-----------|-----------------------------------|-------|
| PARAMETER                         | CONDITION | MAXIMUM RIPPLE CURRENT MULTIPLIER | VALUE |
| Ambient temperature ( $T_{amb}$ ) | 70 °C     | From nomogram; see Fig. 4         | 1.6   |
| Operating frequency (f)           | 400 Hz    | From frequency; see Table 4       | 1.3   |
| Air flow                          | 2 m/s     | From air flow; see Fig. 3         | 1.25  |

**Note**

- Calculation example for 102 series. Maximum ripple current multiplier =  $1.6 \times 1.3 \times 1.25 = 2.6$

**Table 4**

| ENDURANCE TEST DURATION AND USEFUL LIFE |                        |                          |
|-----------------------------------------|------------------------|--------------------------|
| LIFE CODE                               | ENDURANCE AT 85 °C (h) | USEFUL LIFE AT 85 °C (h) |
| L1                                      | 2000                   | 10 000                   |
| L2                                      | 2000                   | 15 000                   |

**Note**

- Multiplier of useful life code: CCC205-05

CCC205-05

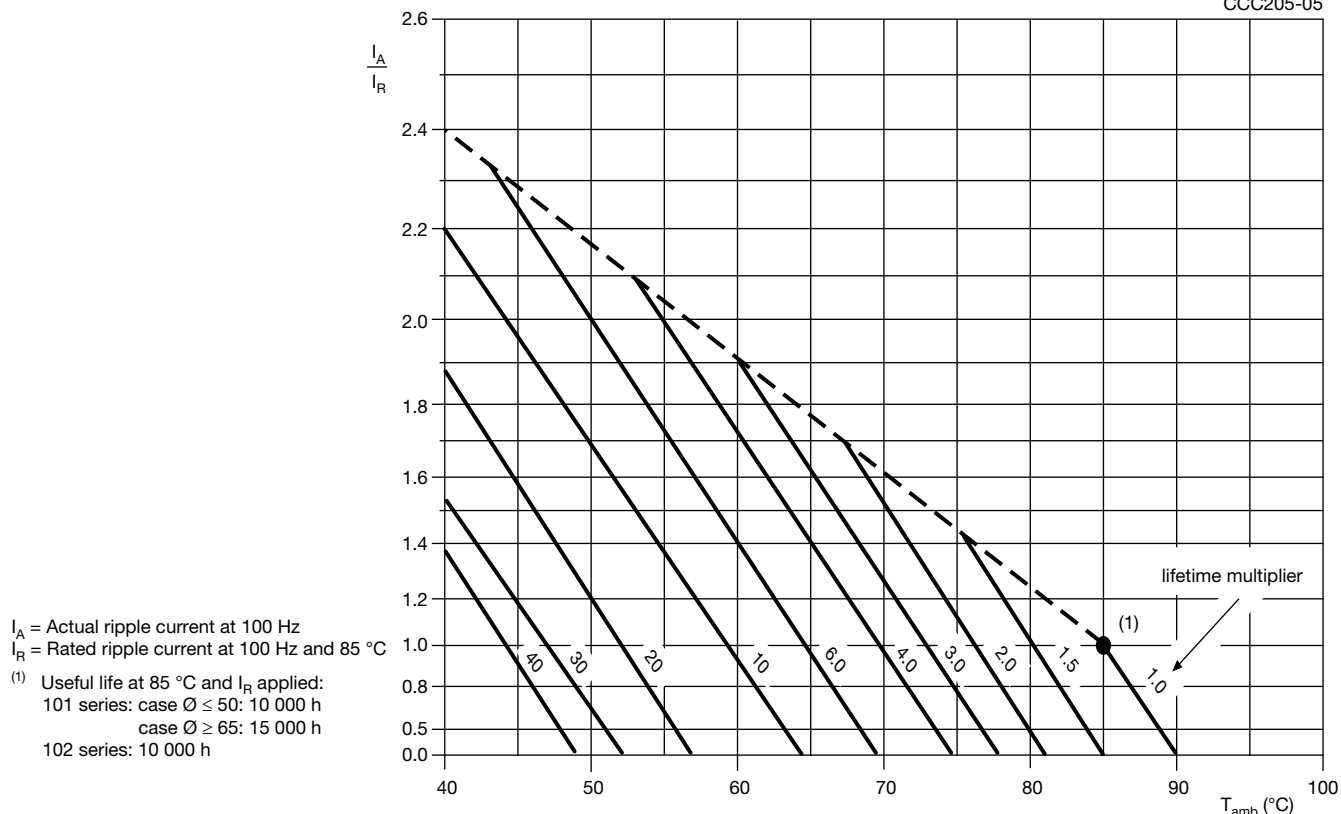


Fig. 4 - Multiplier of useful life as a function of ambient temperature and ripple current load

Table 5

| MULTIPLIER OF RIPPLE CURRENT ( $I_R$ ) AS A FUNCTION OF FREQUENCY |                  |      |      |      |      |        |
|-------------------------------------------------------------------|------------------|------|------|------|------|--------|
| $U_R$<br>(V)                                                      | FREQUENCY (Hz)   |      |      |      |      |        |
|                                                                   | 50               | 100  | 200  | 400  | 1000 | 10 000 |
|                                                                   | $I_R$ MULTIPLIER |      |      |      |      |        |
| 25                                                                | 0.85             | 1.00 | 1.10 | 1.15 | 1.20 | 1.30   |
| 40                                                                | 0.85             | 1.00 | 1.10 | 1.15 | 1.20 | 1.30   |
| 63                                                                | 0.85             | 1.00 | 1.10 | 1.15 | 1.20 | 1.30   |
| 100                                                               | 0.85             | 1.00 | 1.10 | 1.15 | 1.20 | 1.30   |
| 200                                                               | 0.90             | 1.00 | 1.20 | 1.30 | 1.40 | 1.50   |
| 250                                                               | 0.90             | 1.00 | 1.20 | 1.30 | 1.40 | 1.50   |
| 350                                                               | 0.90             | 1.00 | 1.20 | 1.30 | 1.40 | 1.50   |
| 385                                                               | 0.90             | 1.00 | 1.20 | 1.30 | 1.40 | 1.50   |
| 400                                                               | 0.90             | 1.00 | 1.20 | 1.30 | 1.40 | 1.50   |
| 450                                                               | 0.90             | 1.00 | 1.20 | 1.30 | 1.40 | 1.50   |



Table 6

| 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 | $T_{amb} = 85\text{ }^{\circ}\text{C}$ ; $U_R$ applied;<br>2000 h                                                                                                                                        | $U_R \leq 100\text{ V}$ ; $\Delta C/C: \pm 15\%$<br>$U_R > 100\text{ V}$ ; $\Delta C/C: \pm 10\%$<br>$\tan \delta \leq 1.3 \times \text{spec. limit}$<br>$Z \leq 2 \times \text{spec. limit}$<br>$I_{L5} \leq \text{spec. limit}$                                                                                                                                                           |
| Useful life                                    | CECC 30301<br>subclause 1.8.1                | $T_{amb} = 85\text{ }^{\circ}\text{C}$ ; $U_R$ and $I_R$ applied<br><br>101 series:<br>case $\varnothing D \leq 50$ : 10 000 h<br>case $\varnothing D \geq 65$ : 15 000 h<br><br>102 series:<br>10 000 h | $U_R \leq 100\text{ V}$ ; $\Delta C/C: \pm 45\%$<br>$U_R > 100\text{ V}$ ; $\Delta C/C: \pm 30\%$<br>$\tan \delta \leq 3 \times \text{spec. limit}$<br>$Z \leq 3 \times \text{spec. limit}$<br>$I_{L5} \leq \text{spec. limit}$<br>no short or open circuit,<br>no visible damage<br>Total failure percentage:<br>$U_R \leq 100\text{ V}$ ; $\leq 1\%$<br>$U_R > 100\text{ V}$ ; $\leq 3\%$ |
| Shelf life<br>(storage at<br>high temperature) | IEC 60384-4 /<br>EN 130300<br>subclause 4.17 | $T_{amb} = 85\text{ }^{\circ}\text{C}$ ; no voltage applied;<br>500 h<br><br>After test: $U_R$ to be applied for 30 min,<br>24 h to 48 h before measurement                                              | $\Delta C/C: \pm 10\%$<br>$\tan \delta \leq 1.2 \times \text{spec. limit}$<br>$I_{L5} \leq 2 \times \text{spec. limit}$                                                                                                                                                                                                                                                                     |

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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