

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



### LINKS TO ADDITIONAL RESOURCES

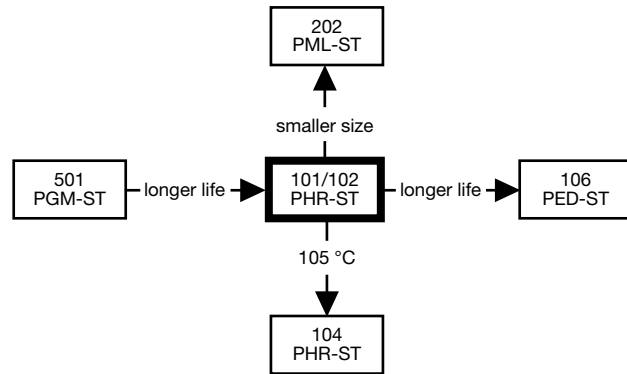


Fig. 1

| 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 (D ≤ 50 mm)<br>15 000 h (D ≥ 65 mm)   | 10 000 h       |
| Useful life at 40 °C, 1.4 x I <sub>R</sub> applied  | 400 000 h (D ≤ 50 mm)<br>600 000 h (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 <sub>R</sub> , U <sub>R</sub> , AND RELEVANT NOMINAL CASE SIZES (∅ D x L in mm) |                    |          |          |          |          |          |          |          |          |          |
|---|--------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| C <sub>R</sub><br>(μF)  | U <sub>R</sub> (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

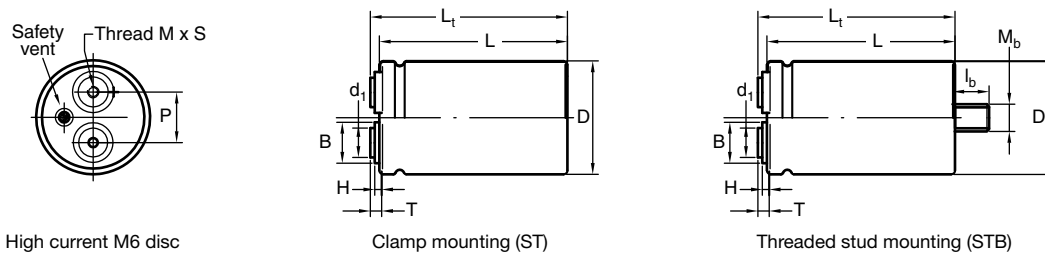


Fig. 2B - Mechanical drawings for high current M6 disc versions.  
For details refer to Table 1

### 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

| DIMENSIONS in millimeters AND MASS |         |       |                    |       |         |         |         |         |                      |    |       |                |                      |          |
|------------------------------------|---------|-------|--------------------|-------|---------|---------|---------|---------|----------------------|----|-------|----------------|----------------------|----------|
| DESIGN                             | DRAWING | L ± 1 | L <sub>t</sub> ± 1 | D ± 1 | P ± 0.3 | T ± 0.2 | H ± 0.3 | B ± 0.3 | d <sub>1</sub> ± 0.1 | M  | S - 0 | M <sub>b</sub> | l <sub>b</sub> ± 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 <sub>R</sub>  | Rated capacitance at 100 Hz, tolerance ± 20 %      |
| I <sub>R</sub>  | Rated RMS ripple current at 100 Hz, 85 °C          |
| I <sub>L5</sub> | Max. leakage current after 5 min at U <sub>R</sub> |
| 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<sub>amb</sub> = 20 °C, P = 86 kPa to 106 kPa, RH = 45 % to 75 %

**ORDERING EXAMPLE**

Electrolytic capacitor 101 series  
 10 000 µF / 40 V; ± 20 %  
 Nominal case size: Ø 35 mm x 60 mm;  
 ST version, standard M5 disc  
 Ordering code: MAL210117103E3

**Table 2**

| 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..... |
| 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                                |   |



| 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..... |
| 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

(1) 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                                 |



| 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..... |
| 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 x 1.3 x 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

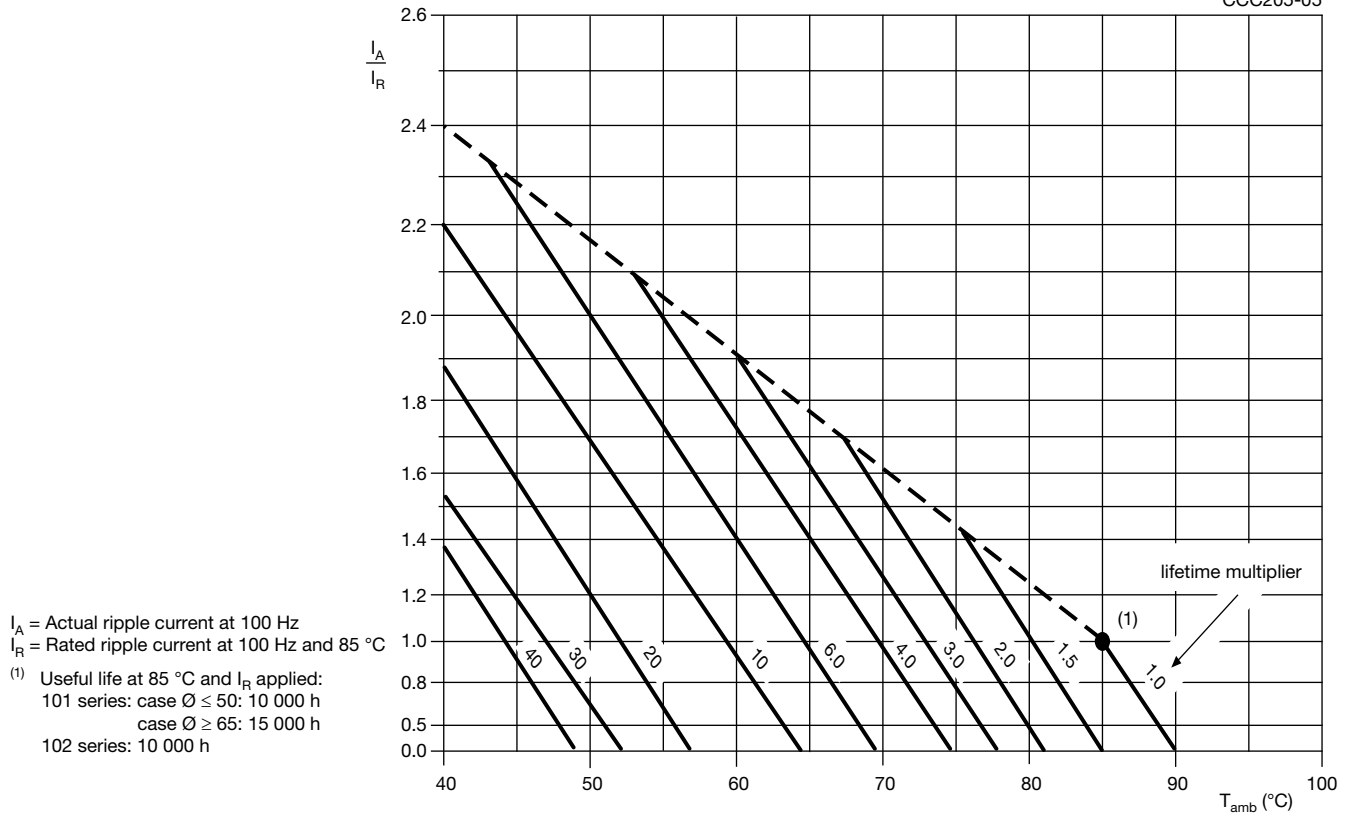


Fig. 4 - Multiplier of useful life as a function of ambient temperature and ripple current load

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.



## **Disclaimer**

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.