

Aluminum Electrolytic Capacitors

Power High Ripple Current Long Life Screw Terminals

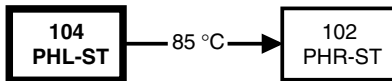


Fig. 1

| QUICK REFERENCE DATA | |
|---|-------------------------|
| DESCRIPTION | VALUE |
| Nominal case size (Ø D x L in mm) | 35 x 60 to 90 x 220 |
| Rated capacitance range (E6 series), C _R | 150 µF to 33 000 µF |
| Tolerance on C _R | ± 20 % |
| Rated voltage range, U _R | 200 V to 450 V |
| Category temperature range | -40 °C to +105 °C |
| Endurance test at 105 °C | 2000 h |
| Useful life at 105 °C | 5000 h |
| Shelf life at 0 V, 105 °C | 1000 h |
| Based on sectional specification | IEC 60384-4 / EN 130300 |
| Climatic category IEC 60068 | 40 / 105 / 56 |

FEATURES

- Long useful life: 5000 h at +105 °C
- High reliability
- 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
- Also available in bolt version (104 PHL-STB)
- Pressure relief in the sealing
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


**RoHS
COMPLIANT**

APPLICATIONS

- Telecom and industrial, high temperature systems
- Smoothing and filtering
- Standard and switched mode power supplies
- Energy storage in pulse systems
- Traction (subway, metro, light rail)

MARKING

The capacitors are marked with the following information:

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

| SELECTION CHART FOR C _R , U _R , AND RELEVANT NOMINAL CASE SIZES (Ø D x L in mm) | | | | | |
|---|--------------------|----------|----------|----------|----------|
| C _R (µF) | U _R (V) | | | | |
| | 200 | 250 | 350 | 400 | 450 |
| 150 | - | - | - | - | 35 x 60 |
| 220 | - | - | - | 35 x 60 | 35 x 80 |
| 330 | - | - | 35 x 60 | 35 x 80 | 35 x 105 |
| 470 | - | - | 35 x 80 | 35 x 80 | 50 x 80 |
| 680 | 35 x 60 | 35 x 60 | 35 x 105 | 50 x 80 | 50 x 105 |
| | 35 x 60 | 35 x 80 | 50 x 80 | 50 x 105 | 50 x 105 |
| 1000 | 35 x 80 | 35 x 105 | - | - | 65 x 105 |
| | 35 x 80 | - | - | - | - |
| 1500 | 35 x 80 | 35 x 105 | 50 x 105 | 50 x 105 | 65 x 105 |
| | 35 x 105 | 50 x 80 | - | 65 x 105 | 76 x 105 |
| 2200 | 35 x 105 | 50 x 80 | 65 x 105 | 65 x 105 | 76 x 105 |
| | 50 x 80 | 35 x 105 | - | 76 x 105 | 76 x 146 |
| 3300 | 50 x 80 | 50 x 105 | - | 76 x 105 | 76 x 146 |
| | 50 x 105 | 65 x 105 | - | 76 x 146 | - |

| SELECTION CHART FOR C_R, U_R, AND RELEVANT NOMINAL CASE SIZES ($\varnothing D \times L$ in mm) | | | | | |
|--|-----------|----------|----------|----------|----------|
| C_R (μF) | U_R (V) | | | | |
| | 200 | 250 | 350 | 400 | 450 |
| 4700 | 50 x 105 | 65 x 105 | - | 76 x 146 | 76 x 220 |
| | 65 x 105 | 76 x 105 | 76 x 146 | - | 90 x 146 |
| 6800 | 65 x 105 | 76 x 105 | 76 x 146 | 76 x 220 | 90 x 220 |
| | 76 x 105 | 76 x 146 | - | 90 x 146 | - |
| 10 000 | 76 x 105 | 76 x 146 | 76 x 220 | 90 x 220 | - |
| | 76 x 146 | - | 90 x 146 | - | - |
| 15 000 | 76 x 146 | 76 x 220 | 90 x 220 | - | - |
| | - | 90 x 146 | - | - | - |
| 22 000 | 76 x 220 | 90 x 220 | - | - | - |
| | 90 x 146 | - | - | - | - |
| 33 000 | 90 x 220 | - | - | - | - |

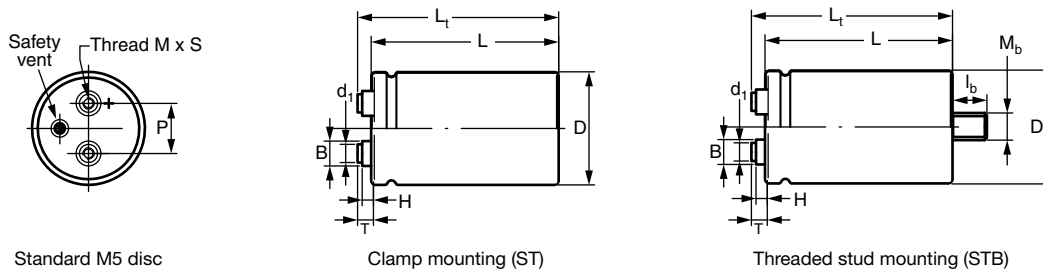
DIMENSIONS in millimeters AND AVAILABLE FORMS


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

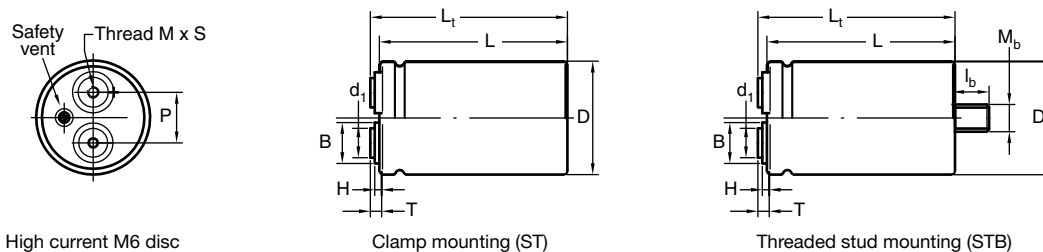


Fig. 2B - Mechanical drawings for high current M6 disc versions.
For details refer to Table 1

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
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 _t ± 1 | D ± 1 | P ± 0.3 | T ± 0.2 | H ± 0.3 | B ± 0.3 | D1 ± 0.1 | M | S - 0 | M _b | I _b ± 0.1 | MASS (g) |
| 35 x 60 | 2A | 63.3 | 68.7 | 35.3 | 12.8 | 7.0 | 4.6 | 11.0 | 7.9 | M5 | 9.5 | M8 | 12.0 | 75 |
| 35 x 80 | 2A | 81.3 | 86.7 | 35.3 | 12.8 | 7.0 | 4.6 | 11.0 | 7.9 | M5 | 9.5 | M8 | 12.0 | 95 |
| 35 x 105 | 2A | 103.3 | 108.7 | 35.3 | 12.8 | 7.0 | 4.6 | 11.0 | 7.9 | M5 | 9.5 | M8 | 12.0 | 130 |
| 50 x 80 | 2A | 82.8 | 88.8 | 51.0 | 22.2 | 7.1 | 4.8 | 11.0 | 7.9 | M5 | 9.5 | M12 | 16.0 | 200 |
| 50 x 105 | 2A | 104.8 | 110.8 | 51.0 | 22.2 | 7.1 | 4.8 | 11.0 | 7.9 | M5 | 9.5 | M12 | 16.0 | 300 |
| 65 x 105 | 2A | 104.8 | 110.7 | 65.0 | 28.5 | 7.0 | 4.6 | 11.9 | 7.9 | M5 | 9.5 | M12 | 16.0 | 480 |
| 65 x 105 HC | 2B | 104.8 | 109.2 | 65.0 | 28.5 | 5.5 | 3.5 | 18.0 | 13.0 | M6 | 8.5 | M12 | 16.0 | 480 |
| 76 x 105 | 2A | 105.8 | 111.7 | 76.4 | 31.8 | 7.0 | 4.6 | 11.7 | 7.9 | M5 | 9.5 | M12 | 16.0 | 700 |
| 76 x 105 HC | 2B | 105.8 | 110.2 | 76.4 | 31.8 | 5.5 | 3.5 | 18.3 | 13.0 | M6 | 8.5 | M12 | 16.0 | 700 |
| 76 x 146 | 2A | 145.8 | 151.7 | 76.4 | 31.8 | 7.0 | 4.6 | 11.7 | 7.9 | M5 | 9.5 | M12 | 16.0 | 1000 |
| 76 x 146 HC | 2B | 145.8 | 150.2 | 76.4 | 31.8 | 5.5 | 3.5 | 18.3 | 13.0 | M6 | 8.5 | M12 | 16.0 | 1000 |
| 76 x 220 | 2A | 219.8 | 225.7 | 76.4 | 31.8 | 7.0 | 4.6 | 11.7 | 7.9 | M5 | 9.5 | M12 | 16.0 | 1500 |
| 76 x 220 HC | 2B | 219.8 | 224.2 | 76.4 | 31.8 | 5.5 | 3.5 | 18.3 | 13.0 | M6 | 8.5 | M12 | 16.0 | 1500 |
| 90 x 146 HC | 2B | 150.1 | 155.4 | 89.4 | 31.8 | 7.9 | 0.0 | 13.0 | 13.0 | M6 | 10.0 | M12 | 16.0 | 1300 |
| 90 x 220 HC | 2B | 218.1 | 223.4 | 89.4 | 31.8 | 7.9 | 0.0 | 13.0 | 13.0 | M6 | 10.0 | M12 | 16.0 | 2000 |

| PACKAGING QUANTITIES AND DIMENSIONS in millimeters | | |
|--|--------------------------------------|------------------------------------|
| DESIGN | PACKAGING QUANTITIES (units per box) | CARDBOARD BOX DIMENSIONS 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 | 18 | 520 x 270 x 280 |
| 76 x 220 HC | 18 | 520 x 270 x 280 |
| 90 x 146 HC | 8 | 377 x 375 x 168 |
| 90 x 220 HC | 10 | 520 x 270 x 280 |

Note

- For STB version holds:
H of carbox box: + 10 mm

| ELECTRICAL DATA | |
|-----------------|--|
| SYMBOL | DESCRIPTION |
| C _R | Rated capacitance at 100 Hz, tolerance ± 20 % |
| I _R | Rated RMS ripple current at 100 Hz, 105 °C |
| I _{L5} | Max. leakage current after 5 min at U _R |
| ESR | Max. equivalent series resistance at 100 Hz |
| Z | Impedance at 20 kHz |

Note

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

ORDERING EXAMPLE

Electrolytic capacitor 104 PHL-ST series
 4700 µF / 250 V; ± 20 %
 Nominal case size: Ø 65 mm x 105 mm; ST version
 Ordering code: MAL2 104 13472 E3
 Former 12NC: 2222 104 13472



Table 2

| ELECTRICAL DATA AND ORDERING INFORMATION | | | | | | | | | | |
|--|----------------------------------|--|---|----------------------------------|-------------------------------|-----------------------------|--|---|-------------------------------------|---|
| U _R (V) | C _R 100 Hz (μF) | NOMINAL CASE SIZE Ø D x L (mm) | I _R 100 Hz 105 °C (A) | I _{L5} 5 MIN (mA) | ESR MAX. 100 Hz (mΩ) | Z MAX. 20 kHz (mΩ) | STANDARD HIGH POST M5 DISC | | HIGH CURRENT M6 DISC | |
| | | | | | | | ST ORDERING CODE MAL2104..... | STB ORDERING CODE MAL2104..... | ST ORDERING CODE MAL2104..... | STB ORDERING CODE MAL2104..... |
| 200 | 680 | 35 x 60 | 2.9 | 0.28 | 197 | 117 | 12681E3 | 52681E3 | - | - |
| | 1000 | 35 x 60 | 3.3 | 0.40 | 148 | 94 | 12102E3 | 52102E3 | - | - |
| | 1000 | 35 x 80 | 3.7 | 0.40 | 137 | 83 | 22102E3 | 62102E3 | - | - |
| | 1500 | 35 x 80 | 4.1 | 0.60 | 102 | 66 | 12152E3 | 52152E3 | - | - |
| | 1500 | 35 x 105 | 4.6 | 0.60 | 95 | 59 | 22152E3 | 62152E3 | - | - |
| | 2200 | 35 x 105 | 5.0 | 0.88 | 74 | 49 | 12222E3 | 52222E3 | - | - |
| | 2200 | 50 x 80 | 6.7 | 0.88 | 63 | 39 | 22222E3 | 62222E3 | - | - |
| | 3300 | 50 x 80 | 8.2 | 1.32 | 42 | 26 | 12332E3 | 52332E3 | - | - |
| | 3300 | 50 x 105 | 8.2 | 1.32 | 44 | 28 | 22332E3 | 62332E3 | - | - |
| | 4700 | 50 x 105 | 9.9 | 1.88 | 31 | 19 | 12472E3 | 52472E3 | - | - |
| | 4700 | 65 x 105 | 11.6 | 1.88 | 31 | 19 | 22472E3 | 62472E3 | 42472E3 | 82472E3 |
| | 6800 | 65 x 105 | 13.7 | 2.72 | 22 | 14 | 12682E3 | 52682E3 | 32682E3 | 72682E3 |
| | 6800 | 76 x 105 | 15.2 | 2.72 | 22 | 14 | 22682E3 | 62682E3 | 42682E3 | 82682E3 |
| | 10 000 | 76 x 105 | 16.4 | 4.0 | 17 | 12 | 12103E3 | 52103E3 | 32103E3 | 72103E3 |
| | 10 000 | 76 x 146 | 16.9 | 4.0 | 17 | 12 | 22103E3 | 62103E3 | 42103E3 | 82103E3 |
| | 15 000 | 76 x 146 | 19.9 | 6.0 | 12 | 9 | 12153E3 | 52153E3 | 32153E3 | 72153E3 |
| | 22 000 | 76 x 220 | 24.6 | 8.8 | 9 | 7 | 12223E3 | 52223E3 | 32223E3 | 72223E3 |
| 22 000 | 90 x 146 | 28.5 | 8.8 | 8 | 6 | - | - | 42223E3 | 82223E3 | |
| 33 000 | 90 x 220 | 34.8 | 13.2 | 5 | 5 | - | - | 42333E3 | 82333E3 | |
| 250 | 680 | 35 x 60 | 2.9 | 0.34 | 176 | 99 | 13681E3 | 53681E3 | - | - |
| | 1000 | 35 x 80 | 3.7 | 0.50 | 123 | 70 | 13102E3 | 53102E3 | - | - |
| | 1000 | 35 x 105 | 4.0 | 0.50 | 116 | 63 | 23102E3 | 63102E3 | - | - |
| | 1500 | 35 x 105 | 4.5 | 0.75 | 86 | 51 | 13152E3 | 53152E3 | - | - |
| | 1500 | 50 x 80 | 5.9 | 0.75 | 76 | 41 | 23152E3 | 63152E3 | - | - |
| | 2200 | 50 x 80 | 6.6 | 1.10 | 58 | 34 | 13222E3 | 53222E3 | - | - |
| | 2200 | 50 x 105 | 7.3 | 1.10 | 54 | 30 | 23222E3 | 63222E3 | - | - |
| | 3300 | 50 x 105 | 8.9 | 1.65 | 36 | 20 | 13332E3 | 53332E3 | - | - |
| | 3300 | 65 x 105 | 10.4 | 1.65 | 36 | 20 | 23332E3 | 63332E3 | 43332E3 | 83332E3 |
| | 4700 | 65 x 105 | 11.4 | 2.35 | 28 | 17 | 13472E3 | 53472E3 | 33472E3 | 73472E3 |
| | 4700 | 76 x 105 | 12.7 | 2.35 | 28 | 17 | 23472E3 | 63472E3 | 43472E3 | 83472E3 |
| | 6800 | 76 x 105 | 15.0 | 3.40 | 20 | 12 | 13682E3 | 53682E3 | 33682E3 | 73682E3 |
| | 6800 | 76 x 146 | 15.4 | 3.40 | 20 | 12 | 23682E3 | 63682E3 | 43682E3 | 83682E3 |
| | 10 000 | 76 x 146 | 18.2 | 5.0 | 14 | 9 | 13103E3 | 53103E3 | 33103E3 | 73103E3 |
| | 15 000 | 76 x 220 | 22.7 | 7.5 | 10 | 7 | 13153E3 | 53153E3 | 33153E3 | 73153E3 |
| 15 000 | 90 x 146 | 25.8 | 7.5 | 9 | 6 | - | - | 43153E3 | 83153E3 | |
| 22 000 | 90 x 220 | 30.4 | 11.0 | 7 | 5 | - | - | 43223E3 | 83223E3 | |
| 350 | 330 | 35 x 60 | 2.1 | 0.26 | 396 | 243 | 15331E3 | 55331E3 | - | - |
| | 470 | 35 x 80 | 2.6 | 0.33 | 280 | 172 | 15471E3 | 55471E3 | - | - |
| | 680 | 35 x 105 | 3.2 | 0.48 | 197 | 122 | 15681E3 | 55681E3 | - | - |
| | 1000 | 50 x 80 | 4.7 | 0.70 | 132 | 82 | 15102E3 | 55102E3 | - | - |
| | 1500 | 50 x 105 | 5.9 | 1.05 | 90 | 57 | 15152E3 | 55152E3 | - | - |
| | 2200 | 65 x 105 | 8.4 | 1.54 | 61 | 38 | 15222E3 | 55222E3 | 35222E3 | 75222E3 |
| | 3300 | 65 x 105 | 10.1 | 2.31 | 42 | 26 | 15332E3 | 55332E3 | 35332E3 | 75332E3 |
| | 3300 | 76 x 105 | 11.2 | 2.31 | 42 | 26 | 25332E3 | 65332E3 | 45332E3 | 85332E3 |
| | 4700 | 76 x 105 | 12.6 | 3.29 | 32 | 21 | 15472E3 | 55472E3 | 35472E3 | 75472E3 |
| | 4700 | 76 x 146 | 13.7 | 3.29 | 30 | 19 | 25472E3 | 65472E3 | 45472E3 | 85472E3 |
| | 6800 | 76 x 146 | 15.4 | 4.76 | 22 | 15 | 15682E3 | 55682E3 | 35682E3 | 75682E3 |
| | 10 000 | 76 x 220 | 18.5 | 7.0 | 20 | 18 | 15103E3 | 55103E3 | 35103E3 | 75103E3 |
| | 10 000 | 90 x 146 | 20.5 | 7.0 | 19 | 17 | - | - | 45103E3 | 85103E3 |
| | 15 000 | 90 x 220 | 25.6 | 10.5 | 13 | 12 | - | - | 45153E3 | 85153E3 |



| ELECTRICAL DATA AND ORDERING INFORMATION | | | | | | | | | | |
|--|----------------------------------|--|---|----------------------------------|-------------------------------|-----------------------------|--|---|-------------------------------------|---|
| U _R (V) | C _R 100 Hz (μF) | NOMINAL CASE SIZE Ø D x L (mm) | I _R 100 Hz 105 °C (A) | I _{L5} 5 MIN (mA) | ESR MAX. 100 Hz (mΩ) | Z MAX. 20 kHz (mΩ) | STANDARD HIGH POST M5 DISC | | HIGH CURRENT M6 DISC | |
| | | | | | | | ST ORDERING CODE MAL2104..... | STB ORDERING CODE MAL2104..... | ST ORDERING CODE MAL2104..... | STB ORDERING CODE MAL2104..... |
| 400 | 220 | 35 x 60 | 1.8 | 0.18 | 519 | 290 | 16221E3 | 56221E3 | - | - |
| | 330 | 35 x 80 | 2.3 | 0.27 | 349 | 196 | 16331E3 | 56331E3 | - | - |
| | 470 | 35 x 80 | 2.6 | 0.38 | 254 | 148 | 16471E3 | 56471E3 | - | - |
| | 680 | 50 x 80 | 4.1 | 0.55 | 170 | 96 | 26681E3 | 66681E3 | - | - |
| | 1000 | 50 x 105 | 5.1 | 0.80 | 117 | 67 | 16102E3 | 56102E3 | - | - |
| | 1500 | 50 x 105 | 6.0 | 1.20 | 83 | 49 | 16152E3 | 56152E3 | - | - |
| | 1500 | 65 x 105 | 6.9 | 1.20 | 83 | 49 | 26152E3 | 66152E3 | 46152E3 | 86152E3 |
| | 2200 | 65 x 105 | 8.4 | 1.76 | 56 | 33 | 16222E3 | 56222E3 | 36222E3 | 76222E3 |
| | 2200 | 76 x 105 | 9.4 | 1.76 | 56 | 33 | 26222E3 | 66222E3 | 46222E3 | 86222E3 |
| | 3300 | 76 x 105 | 11.3 | 2.64 | 38 | 23 | 16332E3 | 56332E3 | 36332E3 | 76332E3 |
| | 3300 | 76 x 146 | 11.6 | 2.64 | 38 | 23 | 26332E3 | 66332E3 | 46332E3 | 86332E3 |
| | 4700 | 76 x 146 | 13.8 | 3.76 | 27 | 17 | 16472E3 | 56472E3 | 36472E3 | 76472E3 |
| | 6800 | 76 x 220 | 16.5 | 5.4 | 25 | 20 | 16682E3 | 56682E3 | 36682E3 | 76682E3 |
| | 6800 | 90 x 146 | 17.7 | 5.4 | 25 | 20 | - | - | 46682E3 | 86682E3 |
| | 10 000 | 90 x 220 | 22.1 | 8.0 | 17 | 14 | - | - | 46103E3 | 86103E3 |
| 450 | 150 | 35 x 60 | 1.5 | 0.14 | 735 | 404 | 17151E3 | 57151E3 | - | - |
| | 220 | 35 x 80 | 1.9 | 0.20 | 503 | 278 | 17221E3 | 57221E3 | - | - |
| | 330 | 35 x 105 | 2.4 | 0.30 | 339 | 189 | 17331E3 | 57331E3 | - | - |
| | 470 | 50 x 80 | 3.3 | 0.43 | 253 | 148 | 17471E3 | 57471E3 | - | - |
| | 680 | 50 x 105 | 4.3 | 0.62 | 165 | 92 | 17681E3 | 57681E3 | - | - |
| | 1000 | 50 x 105 | 5.1 | 0.90 | 117 | 67 | 17102E3 | 57102E3 | - | - |
| | 1000 | 65 x 105 | 5.9 | 0.90 | 116 | 66 | 27102E3 | 67102E3 | 47102E3 | 87102E3 |
| | 1500 | 65 x 105 | 7.3 | 1.35 | 77 | 44 | 17152E3 | 57152E3 | 37152E3 | 77152E3 |
| | 1500 | 76 x 105 | 8.1 | 1.35 | 77 | 44 | 27152E3 | 67152E3 | 47152E3 | 87152E3 |
| | 2200 | 76 x 105 | 9.7 | 1.98 | 53 | 31 | 17222E3 | 57222E3 | 37222E3 | 77222E3 |
| | 2200 | 76 x 146 | 10.0 | 1.98 | 53 | 31 | 27222E3 | 67222E3 | 47222E3 | 87222E3 |
| | 3300 | 76 x 146 | 12.1 | 2.97 | 36 | 21 | 17332E3 | 57332E3 | 37332E3 | 77332E3 |
| | 4700 | 76 x 220 | 14.1 | 4.2 | 33 | 25 | 17472E3 | 57472E3 | 37472E3 | 77472E3 |
| | 4700 | 90 x 146 | 15.3 | 4.2 | 31 | 24 | - | - | 47472E3 | 87472E3 |
| 6800 | 90 x 220 | 18.9 | 6.1 | 22 | 17 | - | - | 47682E3 | 87682E3 | |

| ADDITIONAL ELECTRICAL DATA | | |
|------------------------------------|-------------------------------|--|
| PARAMETER | CONDITIONS | VALUE |
| Voltage | | |
| Surge voltage | ≤ 250 V versions | U _s = 1.15 x U _R |
| | ≥ 350 V versions | U _s = 1.1 x U _R |
| Reverse voltage | | U _{rev} ≤ 1 V |
| Current | | |
| Leakage current | After 1 min at U _R | I _{L1} ≤ 0.006 C _R x U _R + 4 μA |
| | After 5 min at U _R | I _{L5} ≤ 0.002 C _R x U _R + 4 μA |
| Inductance | | |
| 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 ⁽¹⁾ |
| | Case Ø D = 76 mm | Typ. 20 nH ⁽¹⁾ |
| | Case Ø D = 90 mm | Typ. 21 nH ⁽¹⁾ |

Note

⁽¹⁾ Low ESL designs available on request

RIPPLE CURRENT AND USEFUL LIFE

Table 3

| ENDURANCE TEST DURATION AND USEFUL LIFE | |
|---|---------------------------|
| ENDURANCE AT 105 °C (h) | USEFUL LIFE AT 105 °C (h) |
| 2000 | 5000 |

Note

- Multiplier of useful life code: CCC206-5

CCC206-5



I_A = Actual ripple current at 100 Hz
 I_R = Actual ripple current at 100 Hz and 105 °C
 With an absolute maximum of 50 A at 105 °C

(1) Useful life at 105 °C and I_R applied: 5000 h

Fig. 3 - Multiplier of useful life as a function of ambient temperature and ripple current load

Table 4

| MULTIPLIER OF RIPPLE CURRENT (I_R) AS A FUNCTION OF FREQUENCY | | | | | |
|---|------|------|------|------|--------|
| FREQUENCY (Hz) | | | | | |
| 50 | 100 | 200 | 400 | 1000 | 10 000 |
| I_R MULTIPLIER | | | | | |
| 0.90 | 1.00 | 1.20 | 1.30 | 1.40 | 1.50 |



Table 5

| TEST PROCEDURES AND REQUIREMENTS | | | |
|--|--|---|---|
| TEST | | PROCEDURE (quick reference) | REQUIREMENTS |
| NAME OF TEST | REFERENCE | | |
| Endurance | IEC 60384-4 / EN 130300 subclause 4.13 | $T_{amb} = 105\text{ }^{\circ}\text{C}$; U_R applied; 2000 h | $\Delta C/C: \pm 10\%$ $ESR \leq 1.3 \times \text{spec. limit}$ $Z \leq 2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ |
| Useful life | CECC 30301 subclause 4.13 | $T_{amb} = 105\text{ }^{\circ}\text{C}$; U_R and I_R applied; 5000 h | $\Delta C/C: \pm 30\%$ $ESR \leq 3 \times \text{spec. limit}$ $Z \leq 3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ no short or open circuit, no visible damage total failure percentage $\leq 3\%$ |
| Shelf life (storage at high temperature) | IEC 60384-4 / EN 130300 subclause 4.17 | $T_{amb} = 105\text{ }^{\circ}\text{C}$; no voltage applied; 1000 h after test: U_R to be applied for 30 min, 24 h to 48 h before measurement | $\Delta C/C: \pm 10\%$ $ESR \leq 1.2 \times \text{spec. limit}$ $I_{L5} \leq 2 \times \text{spec. limit}$ |

Statements about product lifetime are based on calculations and internal testing. They should only be interpreted as estimations. Also due to external factors, the lifetime in the field application may deviate from the calculated lifetime. In general, nothing stated herein shall be construed as a guarantee of durability.



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