

## Aluminum Electrolytic Capacitors Power Long Life 4-Terminal Snap-In

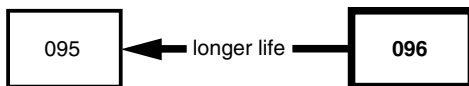


Fig. 1

| QUICK REFERENCE DATA                      |                             |
|---|-----------------------------|
| DESCRIPTION                               | VALUE                       |
| Nominal case size (D x L in mm)           | 35 x 50 to 45 x 100         |
| Rated capacitance range $C_R$             | 390 $\mu$ F to 2700 $\mu$ F |
| Tolerance on $C_R$                        | $\pm 20\%$                  |
| Rated voltage range, $U_R$                | 350 V to 500 V              |
| Category temperature range                | -40 °C to +85 °C            |
| Endurance test at 85 °C                   | 2000 h                      |
| Useful life at 85 °C                      | 5000 h                      |
| Useful life at 40 °C, 1.4 x $I_R$ applied | 200 000 h                   |
| Shelf life at 0 V, 85 °C                  | 1000 h                      |
| Max. RMS value of ripple voltage          | 12 V                        |
| Based on sectional specification          | IEC 60384-4 / EN130300      |
| Climatic category IEC 60068               | 40 / 085 / 56               |

### FEATURES

- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Large types, minimized dimensions, cylindrical aluminum case, insulated with a blue sleeve
- Pressure relief on the side of the aluminum case
- Very long useful life: 5000 h at 85 °C
- Temperature range up to 85 °C
- Keyed polarity
- Low ESR, high ripple current capability
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS  
COMPLIANT**

### APPLICATIONS

- Telecommunication and industrial systems
- Smoothing and filtering applications
- Switched mode power supplies
- Renewable energy power converters
- Energy storage in pulse systems
- For excellent mounting stability

### MARKING

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

- Rated capacitance (in  $\mu$ F)
- Tolerance code on rated capacitance, code letter in accordance with IEC 60062 (M for  $\pm 20\%$ )
- 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

| SELECTION CHART FOR $C_R$ , $U_R$ , AND RELEVANT NOMINAL CASE SIZES ( $\varnothing$ D x L in mm) |                               |                     |                                |                     |                                |                     |
|--|-------------------------------|---------------------|--------------------------------|---------------------|--------------------------------|---------------------|
| $C_R$<br>( $\mu$ F)  | $U_R$ (V)                     |                     |                                |                     |                                |                     |
|  | 350                           | 385                 | 400                            | 420                 | 450                            | 500                 |
| 390  | -                             | -                   | -                              | -                   | -                              | 35 x 60             |
| 470  | -                             | -                   | -                              | -                   | -                              | 35 x 70             |
| 560  | -                             | -                   | -                              | -                   | 35 x 60                        | 35 x 70<br>40 x 60  |
| 680  | -                             | 35 x 50<br>40 x 50  | 35 x 60<br>40 x 50             | 35 x 60<br>40 x 50  | 35 x 70<br>40 x 50             | 35 x 80<br>40 x 70  |
| 820  | 35 x 50<br>40 x 40            | 35 x 60<br>40 x 50  | 35 x 60<br>40 x 50             | 35 x 70<br>40 x 60  | 35 x 80<br>40 x 60             | 35 x 100<br>40 x 80 |
| 1000   | 35 x 60<br>40 x 50            | 35 x 70<br>40 x 60  | 35 x 70<br>40 x 60<br>45 x 50  | 35 x 80<br>40 x 60  | 35 x 100<br>40 x 70<br>45 x 60 | 40 x 100<br>45 x 70 |
| 1200   | 35 x 70<br>40 x 60            | 35 x 80<br>40 x 70  | 35 x 80<br>40 x 70<br>45 x 60  | 40 x 70             | 40 x 80<br>45 x 70             | 45 x 100            |
| 1500   | 35 x 80<br>40 x 70<br>45 x 60 | 40 x 80<br>45 x 60  | 35 x 100<br>40 x 80<br>45 x 70 | 40 x 100<br>45 x 70 | 40 x 100<br>45 x 80            | 45 x 100            |
| 1800   | 40 x 80<br>45 x 60            | 40 x 100<br>45 x 70 | 40 x 100<br>45 x 80            | 40 x 100<br>45 x 80 | 45 x 100                       | -                   |
| 2200   | 40 x 100<br>45 x 70           | 40 x 100            | 45 x 100                       | 45 x 100            | -                              | -                   |
| 2700   | 45 x 100                      | 45 x 100            | 45 x 100                       | -                   | -                              | -                   |

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

**PRINTED WIRING**

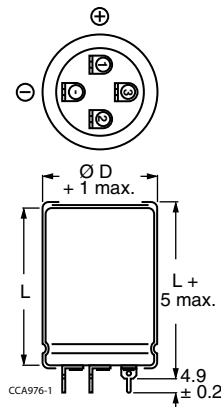


Fig. 2 - Printed wiring pin version  
(Case Ø D = 35 mm)

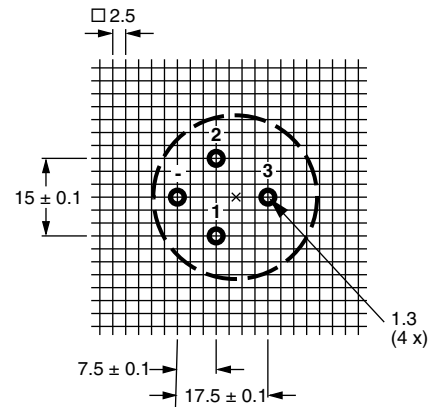


Fig. 3 - Mounting hole diagram viewed from component side  
(Case Ø D = 35 mm)

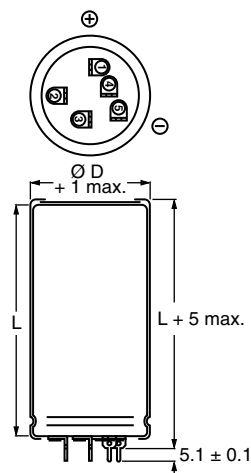


Fig. 4 - Printed wiring pin version  
(Case Ø D = 40 mm)

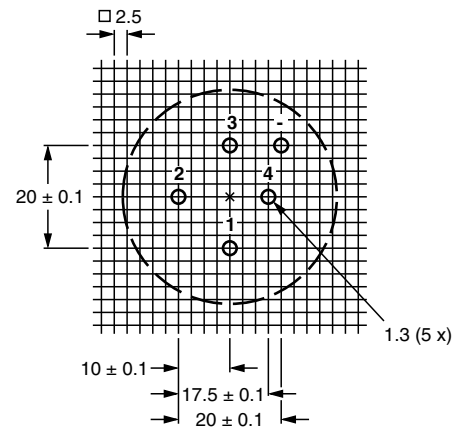
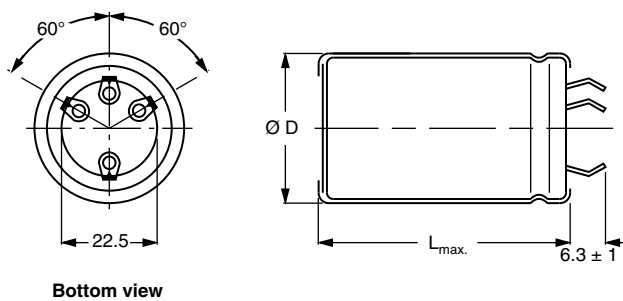


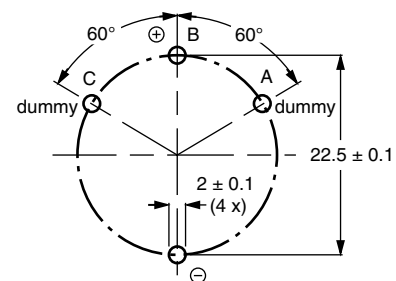
Fig. 5 - Mounting hole diagram viewed from component side  
(Case Ø D = 40 mm)

**FOUR TERMINAL SNAP-IN**



Bottom view

Fig. 6 - 4-Terminal snap-in



Dummy terminals (A and C) must be free from the electrical circuit

Fig. 7 - Mounting hole diagram

**Pin number 1 is the positive terminal. Pin “-” is the negative terminal.**

**Pin numbers 2, 3 and 4 (if present) should be free from the electrical circuit or connected to the minus terminal.**



Table 1

| DIMENSIONS in millimeters, MASS AND PACKAGING QUANTITIES |                     |                            |             |             |   |  |
|--|---------------------|----------------------------|-------------|-------------|---|--|
| NOMINAL CASE SIZE<br>Ø D x L                             | Ø D <sub>MAX.</sub> | 4T-SI<br>L <sub>max.</sub> | PW<br>L + 5 | MASS<br>(g) | PACKAGING QUANTITIES<br>(units per box) | CARDBOARD BOX<br>DIMENSIONS<br>L x W x H |
| 35 x 50  | 36                  | 52                         | 55          | 72          | 50                                      | 390 x 198 x 60                           |
| 35 x 60  | 36                  | 62                         | 65          | 91          | 50                                      | 390 x 198 x 70                           |
| 35 x 70  | 36                  | 72                         | 75          | 103         | 50                                      | 377 x 375 x 97                           |
| 35 x 80  | 36                  | 82                         | 85          | 115         | 50                                      | 377 x 375 x 107                          |
| 35 x 100   | 36                  | 102                        | 105         | 151         | 50                                      | 377 x 375 x 127                          |
| 40 x 40  | 41                  | 42                         | 45          | 70          | 50                                      | 440 x 223 x 60                           |
| 40 x 50  | 41                  | 52                         | 55          | 94          | 50                                      | 440 x 223 x 70                           |
| 40 x 60  | 41                  | 62                         | 65          | 118         | 25                                      | 230 x 230 x 80                           |
| 40 x 70  | 41                  | 72                         | 75          | 134         | 25                                      | 230 x 230 x 90                           |
| 40 x 80  | 41                  | 82                         | 85          | 150         | 25                                      | 230 x 230 x 100                          |
| 40 x 100   | 41                  | 102                        | 105         | 176         | 25                                      | 230 x 230 x 120                          |
| 45 x 40  | 46                  | 42                         | -           | 88          | 36                                      | TBD                                      |
| 45 x 50  | 46                  | 52                         | -           | 119         | 36                                      | 377 x 375 x 77                           |
| 45 x 60  | 46                  | 62                         | -           | 150         | 36                                      | 377 x 375 x 87                           |
| 45 x 70  | 46                  | 72                         | -           | 170         | 36                                      | 377 x 375 x 97                           |
| 45 x 80  | 46                  | 82                         | -           | 190         | 36                                      | 377 x 375 x 107                          |
| 45 x 100   | 46                  | 102                        | -           | 250         | 36                                      | 377 x 375 x 127                          |

| ELECTRICAL DATA |  |
|-----------------|--|
| SYMBOL          | DESCRIPTION  |
| C <sub>R</sub>  | Rated capacitance at 100 Hz                        |
| I <sub>R</sub>  | Rated RMS ripple current at 100 Hz and 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 10 kHz                           |

Note

- Unless otherwise specified, all electrical values in Table 2 apply at T<sub>amb</sub> = 20 °C, P = 86 kPa to 106 kPa, RH = 45 % to 75 %

ORDERING EXAMPLE

Electrolytic capacitor 096 series

820 µF / 385 V;

Printed wiring:

Ordering code: MAL2 096 18821 E3

Former 12NC: 2222 096 18821

4-terminal snap-in:

Ordering code: MAL2 096 68821 E3

Former 12NC: 2222 096 68821

Table 2

| ELECTRICAL DATA AND ORDERING INFORMATION |                                  |                                      |  |                                  |                       |                                     |                                |         |
|--|----------------------------------|--------------------------------------|--|----------------------------------|-----------------------|-------------------------------------|--------------------------------|---------|
| U <sub>R</sub><br>(V)                    | C <sub>R</sub><br>100 Hz<br>(µF) | NOMINAL 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>(µA) | ESR<br>100 Hz<br>(mΩ) | Z <sub>max.</sub><br>10 kHz<br>(mΩ) | CATALOG NUMBER<br>MAL2096..... |         |
|  |                                  |                                      |  |                                  |                       |                                     | 4T-SI                          | PW      |
| 350                                      | 820                              | 35 x 50                              | 4.0                                      | 578                              | 126                   | 82                                  | 15821E3                        | 65821E3 |
|  | 820                              | 40 x 40                              | 3.8                                      | 578                              | 134                   | 90                                  | 25821E3                        | 75821E3 |
|  | 1000                             | 35 x 60                              | 4.7                                      | 704                              | 104                   | 67                                  | 15102E3                        | 65102E3 |
|  | 1000                             | 40 x 50                              | 4.8                                      | 704                              | 108                   | 72                                  | 25102E3                        | 75102E3 |
|  | 1200                             | 35 x 70                              | 5.3                                      | 844                              | 87                    | 57                                  | 15122E3                        | 65122E3 |
|  | 1200                             | 40 x 60                              | 5.4                                      | 844                              | 90                    | 59                                  | 25122E3                        | 75122E3 |
|  | 1500                             | 35 x 80                              | 6.0                                      | 1054                             | 71                    | 47                                  | 15152E3                        | 65152E3 |
|  | 1500                             | 40 x 70                              | 6.2                                      | 1054                             | 73                    | 49                                  | 25152E3                        | 75152E3 |
|  | 1500                             | 45 x 60                              | 6.3                                      | 1054                             | 76                    | 52                                  | 35152E3                        | -       |
|  | 1800                             | 40 x 80                              | 6.9                                      | 1264                             | 62                    | 41                                  | 25182E3                        | 75182E3 |
|  | 1800                             | 45 x 60                              | 6.6                                      | 1264                             | 68                    | 48                                  | 35182E3                        | -       |
|  | 2200                             | 40 x 100                             | 8.2                                      | 1544                             | 51                    | 34                                  | 25222E3                        | 75222E3 |
|  | 2200                             | 45 x 70                              | 7.4                                      | 1544                             | 57                    | 41                                  | 35222E3                        | -       |
|  | 2700                             | 45 x 100                             | 9.2                                      | 1894                             | 44                    | 30                                  | 35272E3                        | -       |



| ELECTRICAL DATA AND ORDERING INFORMATION |                                  |   |  |                                  |                       |                                     |                                |         |
|--|----------------------------------|---|--|----------------------------------|-----------------------|-------------------------------------|--------------------------------|---------|
| 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>(µA) | ESR<br>100 Hz<br>(mΩ) | Z <sub>max.</sub><br>10 kHz<br>(mΩ) | CATALOG NUMBER<br>MAL2096..... |         |
|  |                                  |   |  |                                  |                       |                                     | 4T-SI                          | PW      |
| 385                                      | 680                              | 35 x 50                                 | 3.7                                      | 528                              | 140                   | 88                                  | 18681E3                        | 68681E3 |
|  | 680                              | 40 x 50                                 | 4.2                                      | 528                              | 140                   | 87                                  | 28681E3                        | 78681E3 |
|  | 820                              | 35 x 60                                 | 4.4                                      | 635                              | 116                   | 73                                  | 18821E3                        | 68821E3 |
|  | 820                              | 40 x 50                                 | 4.5                                      | 635                              | 120                   | 76                                  | 28821E3                        | 78821E3 |
|  | 1000                             | 35 x 70                                 | 5.0                                      | 774                              | 96                    | 60                                  | 18102E3                        | 68102E3 |
|  | 1000                             | 40 x 60                                 | 5.1                                      | 774                              | 99                    | 63                                  | 28102E3                        | 78102E3 |
|  | 1200                             | 35 x 80                                 | 5.5                                      | 928                              | 81                    | 51                                  | 18122E3                        | 68122E3 |
|  | 1200                             | 40 x 70                                 | 5.7                                      | 928                              | 83                    | 53                                  | 28122E3                        | 78122E3 |
|  | 1500                             | 40 x 80                                 | 6.5                                      | 1159                             | 68                    | 43                                  | 28152E3                        | 78152E3 |
|  | 1500                             | 45 x 60                                 | 6.2                                      | 1159                             | 74                    | 50                                  | 38152E3                        | -       |
|  | 1800                             | 40 x 100                                | 7.7                                      | 1390                             | 56                    | 36                                  | 28182E3                        | 78182E3 |
|  | 1800                             | 45 x 70                                 | 7.0                                      | 1390                             | 62                    | 43                                  | 38182E3                        | -       |
|  | 2200                             | 40 x 100                                | 8.2                                      | 1698                             | 49                    | 32                                  | 28222E3                        | 78222E3 |
|  | 2700                             | 45 x 100                                | 9.1                                      | 2083                             | 43                    | 29                                  | 38272E3                        | -       |
| 400                                      | 680                              | 35 x 60                                 | 4.1                                      | 548                              | 134                   | 82                                  | 16681E3                        | 66681E3 |
|  | 680                              | 40 x 50                                 | 4.2                                      | 548                              | 138                   | 85                                  | 26681E3                        | 76681E3 |
|  | 820                              | 35 x 60                                 | 4.4                                      | 660                              | 114                   | 71                                  | 16821E3                        | 66821E3 |
|  | 820                              | 40 x 50                                 | 4.5                                      | 660                              | 119                   | 75                                  | 26821E3                        | 76821E3 |
|  | 1000                             | 35 x 70                                 | 5.0                                      | 804                              | 94                    | 59                                  | 16102E3                        | 66102E3 |
|  | 1000                             | 40 x 60                                 | 5.1                                      | 804                              | 97                    | 62                                  | 26102E3                        | 76102E3 |
|  | 1000                             | 45 x 50                                 | 5.1                                      | 804                              | 103                   | 67                                  | 36102E3                        | -       |
|  | 1200                             | 35 x 80                                 | 5.5                                      | 964                              | 80                    | 50                                  | 16122E3                        | 66122E3 |
|  | 1200                             | 40 x 70                                 | 5.7                                      | 964                              | 82                    | 52                                  | 26122E3                        | 76122E3 |
|  | 1200                             | 45 x 60                                 | 5.9                                      | 964                              | 85                    | 55                                  | 36122E3                        | -       |
|  | 1500                             | 35 x 100                                | 7.1                                      | 1204                             | 64                    | 40                                  | 16152E3                        | 66152E3 |
|  | 1500                             | 40 x 80                                 | 6.5                                      | 1204                             | 67                    | 43                                  | 26152E3                        | 76152E3 |
|  | 1500                             | 45 x 70                                 | 6.6                                      | 1204                             | 69                    | 46                                  | 36152E3                        | -       |
|  | 1800                             | 40 x 100                                | 7.7                                      | 1444                             | 56                    | 35                                  | 26182E3                        | 76182E3 |
|  | 1800                             | 45 x 80                                 | 7.3                                      | 1444                             | 59                    | 39                                  | 36182E3                        | -       |
|  | 2200                             | 45 x 100                                | 8.6                                      | 1764                             | 48                    | 32                                  | 36222E3                        | -       |
| 2700                                     | 45 x 100                         | 9.1                                     | 2164                                     | 42                               | 29                    | 36272E3                             | -                              |         |
| 420                                      | 680                              | 35 x 60                                 | 4.1                                      | 575                              | 137                   | 85                                  | 14681E3                        | 64681E3 |
|  | 680                              | 40 x 50                                 | 4.2                                      | 575                              | 141                   | 89                                  | 24681E3                        | 74681E3 |
|  | 820                              | 35 x 70                                 | 4.6                                      | 693                              | 114                   | 71                                  | 14821E3                        | 64821E3 |
|  | 820                              | 40 x 60                                 | 4.7                                      | 693                              | 117                   | 74                                  | 24821E3                        | 74821E3 |
|  | 1000                             | 35 x 80                                 | 5.1                                      | 844                              | 95                    | 59                                  | 14102E3                        | 64102E3 |
|  | 1000                             | 40 x 60                                 | 5.1                                      | 844                              | 100                   | 64                                  | 24102E3                        | 74102E3 |
|  | 1200                             | 40 x 70                                 | 5.7                                      | 1012                             | 84                    | 54                                  | 24122E3                        | 74122E3 |
|  | 1500                             | 40 x 100                                | 7.2                                      | 1264                             | 66                    | 42                                  | 24152E3                        | 74152E3 |
|  | 1500                             | 45 x 70                                 | 6.6                                      | 1264                             | 71                    | 48                                  | 34152E3                        | -       |
|  | 1800                             | 40 x 100                                | 7.6                                      | 1516                             | 57                    | 37                                  | 24182E3                        | 74182E3 |
|  | 1800                             | 45 x 80                                 | 7.2                                      | 1516                             | 60                    | 40                                  | 34182E3                        | -       |
|  | 2200                             | 45 x 100                                | 8.5                                      | 1852                             | 49                    | 33                                  | 34222E3                        | -       |



| ELECTRICAL DATA AND ORDERING INFORMATION |                                  |   |  |                                  |                       |                                     |                                |         |
|--|----------------------------------|---|--|----------------------------------|-----------------------|-------------------------------------|--------------------------------|---------|
| 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>(µA) | ESR<br>100 Hz<br>(mΩ) | Z <sub>max.</sub><br>10 kHz<br>(mΩ) | CATALOG NUMBER<br>MAL2096..... |         |
|  |                                  |   |  |                                  |                       |                                     | 4T-SI                          | PW      |
| 450                                      | 560                              | 35 x 60                                 | 3.8                                      | 508                              | 155                   | 94                                  | 17561E3                        | 67561E3 |
|  | 680                              | 35 x 70                                 | 4.2                                      | 616                              | 129                   | 78                                  | 17681E3                        | 67681E3 |
|  | 680                              | 40 x 50                                 | 4.2                                      | 616                              | 136                   | 85                                  | 27681E3                        | 77681E3 |
|  | 820                              | 35 x 80                                 | 4.8                                      | 742                              | 108                   | 66                                  | 17821E3                        | 67821E3 |
|  | 820                              | 40 x 60                                 | 4.7                                      | 742                              | 112                   | 70                                  | 27821E3                        | 77821E3 |
|  | 1000                             | 35 x 100                                | 6.0                                      | 904                              | 89                    | 54                                  | 17102E3                        | 67102E3 |
|  | 1000                             | 40 x 70                                 | 5.3                                      | 904                              | 93                    | 58                                  | 27102E3                        | 77102E3 |
|  | 1000                             | 45 x 60                                 | 5.5                                      | 904                              | 97                    | 62                                  | 37102E3                        | -       |
|  | 1200                             | 40 x 80                                 | 6.0                                      | 1084                             | 78                    | 49                                  | 27122E3                        | 77122E3 |
|  | 1200                             | 45 x 70                                 | 6.1                                      | 1084                             | 81                    | 52                                  | 37122E3                        | -       |
|  | 1500                             | 40 x 100                                | 7.2                                      | 1354                             | 63                    | 39                                  | 27152E3                        | 77152E3 |
|  | 1500                             | 45 x 80                                 | 6.8                                      | 1354                             | 67                    | 43                                  | 37152E3                        | -       |
|  | 1800                             | 45 x 100                                | 8.0                                      | 1624                             | 55                    | 35                                  | 37182E3                        | -       |
| 500                                      | 390                              | 35 x 60                                 | 2.9                                      | 394                              | 475                   | 421                                 | 19391E3                        | 69391E3 |
|  | 470                              | 35 x 70                                 | 3.3                                      | 474                              | 395                   | 350                                 | 19471E3                        | 69471E3 |
|  | 560                              | 35 x 70                                 | 3.6                                      | 564                              | 333                   | 296                                 | 19561E3                        | 69561E3 |
|  | 560                              | 40 x 60                                 | 3.7                                      | 564                              | 336                   | 299                                 | 29561E3                        | 79561E3 |
|  | 680                              | 35 x 80                                 | 4.1                                      | 684                              | 275                   | 245                                 | 19681E3                        | 69681E3 |
|  | 680                              | 40 x 70                                 | 4.2                                      | 684                              | 277                   | 247                                 | 29681E3                        | 79681E3 |
|  | 820                              | 35 x 100                                | 5.1                                      | 824                              | 229                   | 203                                 | 19821E3                        | 69821E3 |
|  | 820                              | 40 x 80                                 | 4.7                                      | 824                              | 231                   | 206                                 | 29821E3                        | 79821E3 |
|  | 1000                             | 40 x 100                                | 5.6                                      | 1004                             | 189                   | 169                                 | 29102E3                        | 79102E3 |
|  | 1000                             | 45 x 70                                 | 5.3                                      | 1004                             | 195                   | 176                                 | 39102E3                        | -       |
|  | 1200                             | 45 x 100                                | 6.4                                      | 1204                             | 160                   | 144                                 | 39122E3                        | -       |
|  | 1500                             | 45 x 100                                | 7.0                                      | 1504                             | 131                   | 118                                 | 39152E3                        | -       |

| ADDITIONAL ELECTRICAL DATA         |                               |  |
|------------------------------------|-------------------------------|--|
| PARAMETER                          | CONDITIONS                    | VALUE  |
| <b>Voltage</b>                     |                               |  |
| Surge voltage                      | ≥ 350 V versions              | U <sub>s</sub> = 1.1 x U <sub>R</sub>                          |
| Reverse voltage                    |                               | U <sub>rev</sub> ≤ 1   |
| <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> + 4 µA |
|                                    | After 5 min at U <sub>R</sub> | I <sub>L5</sub> ≤ 0.002 C <sub>R</sub> x U <sub>R</sub> + 4 µA |
| <b>Inductance</b>                  |                               |  |
| Equivalent series inductance (ESL) | All case sizes                | Ca. 20 nH  |

**RIPPLE CURRENT AND USEFUL LIFE**

Table 3

| ENDURANCE TEST DURATION AND USEFUL LIFE |                          |
|---|--------------------------|
| ENDURANCE AT 85 °C (h)                  | USEFUL LIFE AT 85 °C (h) |
| 2000                                    | 5000                     |

**Note**

- Multiplier of useful life code: CCC205-05

CCC205-05

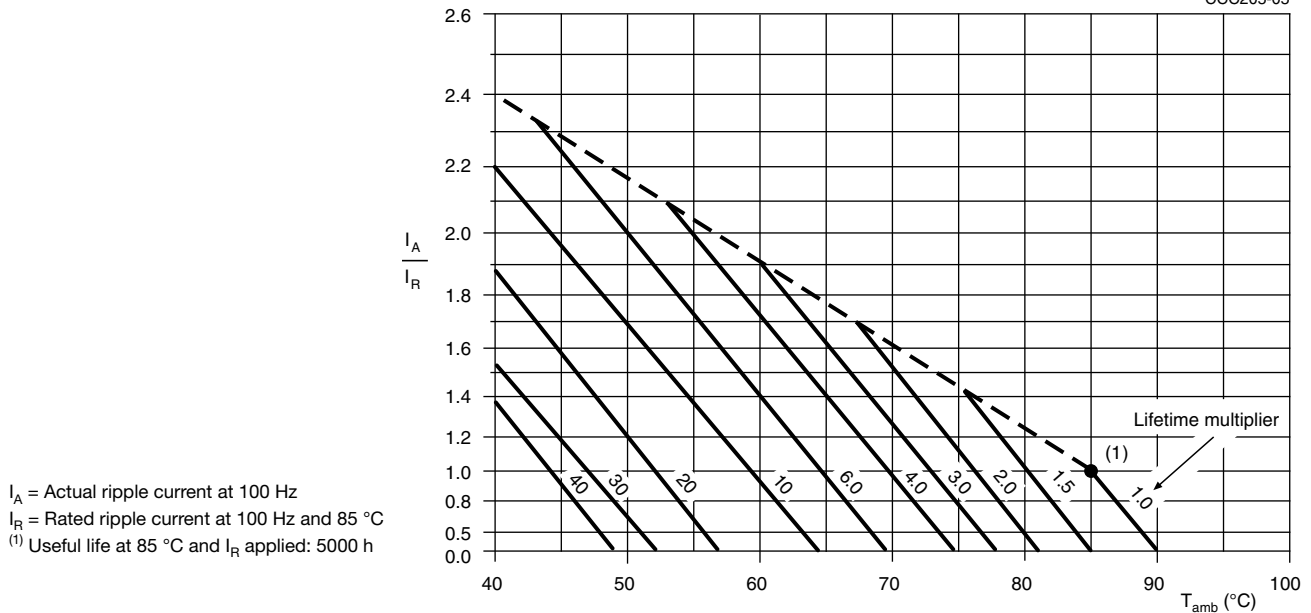


Fig. 8 - Multiplier of useful life as a function of ambient temperature and ripple current load

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  |     |     |     |      |        |
| 0.9   | 1.0 | 1.2 | 1.3 | 1.4  | 1.5    |

Table 5

| TEST PROCEDURES AND REQUIREMENTS |                                       |   |   |
|----------------------------------|---------------------------------------|---|---|
| TEST                             |                                       | PROCEDURE (quick reference)   | REQUIREMENTS  |
| NAME OF TEST                     | REFERENCE                             |   |   |
| Endurance                        | IEC 60384-4 / EN130300 subclause 4.13 | $T_{amb} = 85\text{ °C}$ ; $U_R$ applied<br>2000 h  | $\Delta C/C: \pm 10\%$<br>ESR $\leq 1.3 \times$ spec. limit<br>$Z \leq 2 \times$ spec. limit<br>$I_{L5} \leq$ spec. limit   |
| Useful life                      | CECC 30301 subclause 4.13             | $T_{amb} = 85\text{ °C}$ ; $U_R$ and $I_R$ applied;<br>5000 h   | $\Delta C/C: \pm 30\%$<br>ESR $\leq 3 \times$ spec. limit<br>$Z \leq 3 \times$ spec. limit<br>$I_{L5} \leq$ spec. limit<br>no short or open circuit,<br>no visible damage<br>total failure percentage: $\leq 3\%$ |
| Shelf life                       | IEC 60384-4 / EN130300 subclause 4.17 | $T_{amb} = 85\text{ °C}$ ; no voltage applied;<br>1000 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>ESR $\leq 1.2 \times$ spec. limit<br>$I_{L5} \leq 2 \times$ 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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