

## Conductive Polymer Aluminum Capacitors SMD (Chip), Low Impedance

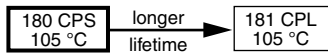


Fig. 1

| QUICK REFERENCE DATA                    |  |
|---|--|
| DESCRIPTION                             | VALUE                                    |
| Nominal case sizes (L x W x H in mm)    | 5.3 x 5.3 x 5.7<br>to 10.4 x 10.4 x 12.6 |
| Rated capacitance range, C <sub>R</sub> | 22 µF to 2700 µF                         |
| Tolerance on C <sub>R</sub>             | ± 20 %                                   |
| Rated voltage range, U <sub>R</sub>     | 2.5 V to 35 V                            |
| Category temperature range              | -55 °C to +105 °C                        |
| Endurance test at 105 °C                | 2000 h                                   |
| Useful life at 105 °C                   | 2500 h                                   |
| Shelf life at 0 V, 105 °C               | 1000 h                                   |
| Based on sectional specification        | IEC 60384-18 / CECC 32300                |
| Climatic category IEC 60068             | 55 / 105 / 56                            |

### FEATURES

- Useful life: up to 2500 h at 105 °C
- Very low ESR and highest ripple current
- SMD-version with base plate, lead (Pb)-free reflow solderable
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



### APPLICATIONS

- SMD technology, for high temperature reflow soldering
- Industrial and professional applications
- Telecommunications and IT
- Portable and mobile equipment

### MARKING

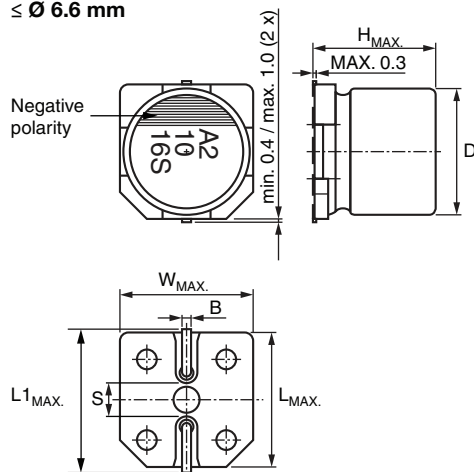
- Rated capacitance (in µF)
- Rated voltage (in V)
- Date code, in accordance with IEC 60062
- Blue mark or “-” sign indicating the cathode (the anode is identified by bevelled edges)
- Code indicating group number (S)

### PACKAGING

Supplied in blister tape on reel

| SELECTION CHART FOR $C_R$ , $U_R$ , AND RELEVANT NOMINAL CASE SIZES (L x W x H in mm) |                                    |                                   |                                     |                   |                                    |                    |                    |                    |
|---|------------------------------------|-----------------------------------|-------------------------------------|-------------------|------------------------------------|--------------------|--------------------|--------------------|
| $C_R$<br>( $\mu F$ )  | $U_R$ (V)                          |                                   |                                     |                   |                                    |                    |                    |                    |
|   | 2.5                                | 4.0                               | 6.3                                 | 10                | 16                                 | 20                 | 25                 | 35                 |
| 22  | →                                  | →                                 | →                                   | →                 | →                                  | →                  | →                  | 6.6 x 6.6 x 5.9    |
| 39  | →                                  | →                                 | →                                   | →                 | 5.3 x 5.3 x 5.7<br>6.6 x 6.6 x 5.9 | -                  | -                  | -                  |
| 56  | →                                  | →                                 | →                                   | →                 | →                                  | →                  | 6.6 x 6.6 x 5.9    | -                  |
| 68  | →                                  | →                                 | →                                   | 5.3 x 5.3 x 5.7   | 6.6 x 6.6 x 5.9                    | -                  | -                  | -                  |
| 82  | →                                  | →                                 | →                                   | →                 | →                                  | →                  | →                  | 8.4 x 8.4 x 12     |
| 100   | →                                  | →                                 | →                                   | →                 | 6.6 x 6.6 x 5.9                    | -                  | -                  | -                  |
| 120   | →                                  | →                                 | 5.3 x 5.3 x 5.7                     | 6.6 x 6.6 x 5.9   | →                                  | 6.6 x 6.6 x 5.9    | →                  | 10.4 x 10.4 x 12.6 |
| 150   | →                                  | 5.3 x 5.3 x 5.7                   | →                                   | 6.6 x 6.6 x 7.7   | 8.4 x 8.4 x 6.7                    | -                  | -                  | -                  |
| 180   | 5.3 x 5.3 x 5.7                    | →                                 | →                                   | →                 | →                                  | →                  | 8.4 x 8.4 x 12     | -                  |
| 220   | →                                  | →                                 | 6.6 x 6.6 x 5.9                     | →                 | 10.4 x 10.4 x 7.7                  | -                  | -                  | -                  |
| 270   | →                                  | 6.6 x 6.6 x 5.9                   | →                                   | →                 | 8.4 x 8.4 x 12                     | -                  | -                  | -                  |
| 330   | →                                  | 6.6 x 6.6 x 5.9                   | 6.6 x 6.6 x 5.9<br>6.6 x 6.6 x 7.7  | →                 | 10.4 x 10.4 x 12.6                 | →                  | 10.4 x 10.4 x 12.6 | -                  |
| 390   | 6.6 x 6.6 x 5.9                    | 6.6 x 6.6 x 7.7                   | 8.4 x 8.4 x 6.7                     | →                 | →                                  | 8.4 x 8.4 x 12     | -                  | -                  |
| 470   | →                                  | →                                 | →                                   | 10.4 x 10.4 x 7.7 | 10.4 x 10.4 x 12.6                 | -                  | -                  | -                  |
| 560   | 6.6 x 6.6 x 5.9<br>6.6 x 6.6 x 7.7 | 8.4 x 8.4 x 6.7<br>8.4 x 8.4 x 12 | →                                   | →                 | →                                  | 10.4 x 10.4 x 12.6 | -                  | -                  |
| 680   | 8.4 x 8.4 x 6.7                    | -                                 | -                                   | -                 | -                                  | -                  | -                  | -                  |
| 820   | 8.4 x 8.4 x 12                     | →                                 | 8.4 x 8.4 x 12<br>10.4 x 10.4 x 7.7 | →                 | 10.4 x 10.4 x 12.6                 | -                  | -                  | -                  |
| 1000  | →                                  | 10.4 x 10.4 x 7.7                 | -                                   | -                 | -                                  | -                  | -                  | -                  |
| 1200  | 10.4 x 10.4 x 7.7                  | 8.4 x 8.4 x 12                    | -                                   | -                 | -                                  | -                  | -                  | -                  |
| 1500  | 8.4 x 8.4 x 12                     | 8.4 x 8.4 x 12                    | 10.4 x 10.4 x 12.6                  | -                 | -                                  | -                  | -                  | -                  |
| 2200  | →                                  | 10.4 x 10.4 x 12.6                | -                                   | -                 | -                                  | -                  | -                  | -                  |
| 2700  | 10.4 x 10.4 x 12.6                 | -                                 | -                                   | -                 | -                                  | -                  | -                  | -                  |

**2-pin:**  
≤ Ø 6.6 mm



**2-pin:**  
≥ Ø 8.4 mm

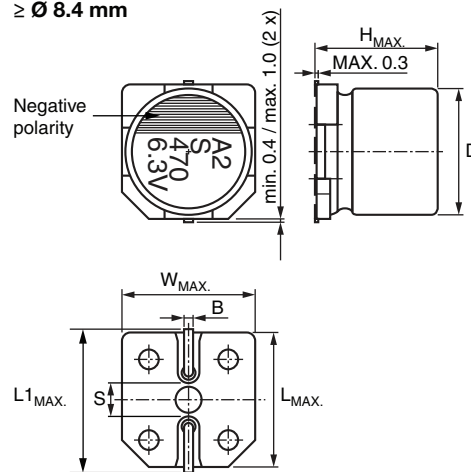


Fig. 2 - Dimensional outline

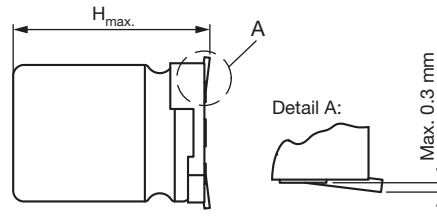


Fig. 3 - Coplanarity of pins

Table 1

| <b>DIMENSIONS</b> in millimeters <b>AND MASS</b> |           |                   |                   |                   |     |                   |     |                    |          |
|--|-----------|-------------------|-------------------|-------------------|-----|-------------------|-----|--------------------|----------|
| NOMINAL CASE SIZE<br>L x W x H                   | CASE CODE | L <sub>MAX.</sub> | W <sub>MAX.</sub> | H <sub>MAX.</sub> | Ø D | B <sub>MAX.</sub> | S   | L1 <sub>MAX.</sub> | MASS (g) |
| 5.3 x 5.3 x 5.7                                  | 0506      | 5.5               | 5.5               | 6.0               | 5.0 | 0.8               | 1.5 | 6.1                | ~ 0.15   |
| 6.6 x 6.6 x 5.9                                  | 0606      | 6.8               | 6.8               | 6.0               | 6.3 | 0.8               | 2.0 | 7.4                | ~ 0.25   |
| 6.6 x 6.6 x 7.7                                  | 0608      | 6.8               | 6.8               | 8.0               | 6.3 | 0.8               | 2.0 | 7.4                | ~ 0.4    |
| 8.4 x 8.4 x 6.7                                  | 0807      | 8.6               | 8.6               | 7.0               | 8.0 | 1.1               | 3.1 | 9.2                | ~ 0.5    |
| 8.4 x 8.4 x 12                                   | 0812      | 8.6               | 8.6               | 12.5              | 8.0 | 1.1               | 3.1 | 9.2                | ~ 0.8    |
| 10.4 x 10.4 x 7.7                                | 1008      | 10.6              | 10.6              | 8.0               | 10  | 1.3               | 4.7 | 11.2               | ~ 0.9    |
| 10.4 x 10.4 x 12.6                               | 1013      | 10.6              | 10.6              | 12.7              | 10  | 1.3               | 4.7 | 11.2               | ~ 1.3    |

Table 2

| <b>TAPE AND REEL DIMENSIONS</b> in millimeters, <b>PACKAGING QUANTITIES</b> |           |                         |                 |                                  |               |                                |
|---|-----------|-------------------------|-----------------|----------------------------------|---------------|--------------------------------|
| NOMINAL CASE SIZE<br>L x W x H  | CASE CODE | PITCH<br>P <sub>1</sub> | TAPE WIDTH<br>W | TAPE THICKNESS<br>T <sub>2</sub> | REEL DIAMETER | PACKAGING QUANTITY<br>PER REEL |
| 5.3 x 5.3 x 5.7   | 0506      | 12                      | 12              | 6.2                              | 380           | 1000                           |
| 6.6 x 6.6 x 5.9   | 0606      | 12                      | 16              | 6.2                              | 380           | 1000                           |
| 6.6 x 6.6 x 7.7   | 0608      | 12                      | 16              | 8.3                              | 380           | 900                            |
| 8.4 x 8.4 x 6.7   | 0807      | 12                      | 16              | 6.8                              | 380           | 1000                           |
| 8.4 x 8.4 x 12  | 0812      | 16                      | 16              | 13.0                             | 380           | 400                            |
| 10.4 x 10.4 x 7.7   | 1008      | 16                      | 24              | 10.0                             | 380           | 500                            |
| 10.4 x 10.4 x 12.6  | 1013      | 16                      | 24              | 14.0                             | 380           | 400                            |

**MOUNTING**

The capacitors are designed for automatic placement on to printed-circuit boards.

Optimum dimensions of soldering pads depend amongst others on soldering method, mounting accuracy, print layout and / or adjacent components.

For recommended soldering pad dimensions, refer to Fig. 4 and Table 3.

**SOLDERING**

Soldering conditions are defined by the curve, temperature versus time, where the temperature is that measured on the component during processing.

For maximum conditions refer to Fig. 5.

Any temperature versus time curve which does not exceed the specified maximum curves may be applied.

As a general principle, temperature and duration shall be the **minimum** necessary required to ensure good soldering connections. However, the specified maximum curves should never be exceeded.

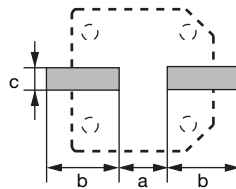


Fig. 4 - Recommended soldering pad dimensions

Table 3

| <b>RECOMMENDED SOLDERING PAD DIMENSIONS</b> in millimeters |          |          |          |
|--|----------|----------|----------|
| <b>CASE CODE</b>   | <b>a</b> | <b>b</b> | <b>c</b> |
| 0506   | 1.4      | 3.0      | 1.6      |
| 0606   | 1.9      | 3.5      | 1.6      |
| 0608   | 1.9      | 3.5      | 1.6      |
| 0807   | 3.0      | 3.5      | 2.5      |
| 0812   | 3.0      | 3.5      | 2.5      |
| 1008   | 4.0      | 4.0      | 2.5      |
| 1013   | 4.0      | 4.0      | 2.5      |

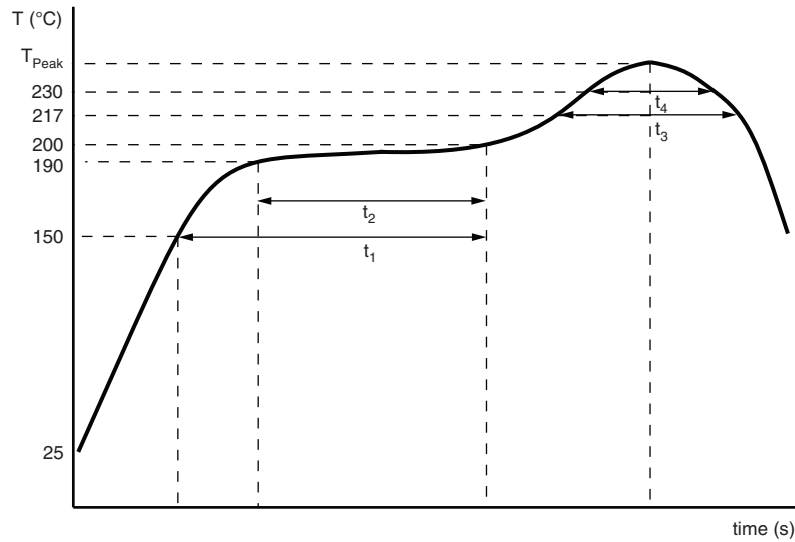
**ADVANCED SOLDERING PROFILE FOR LEAD (Pb)-FREE REFLOW PROCESS**


Fig. 5 - Maximum temperature load during reflow soldering

**Table 4**

| <b>REFLOW SOLDERING CONDITIONS</b> for MAL2180xxxxxE3 |                                   |
|---|-----------------------------------|
| <b>PROFILE FEATURES</b>                               | <b>CASE CODE<br/>0506 TO 1013</b> |
| Max. time from 25 °C to $T_{Peak}$                    | 300 s                             |
| Max. ramp-up rate to 150 °C                           | 3 K/s                             |
| Max. time from 150 °C to 200 °C ( $t_1$ )             | 150 s                             |
| Max. time from 190 °C to 200 °C ( $t_2$ )             | 110 s                             |
| Ramp up rate from 200 °C to $T_{Peak}$                | 0.5 K/s to 3 K/s                  |
| Max. time above $T_{Liquidus}$ (217 °C) ( $t_3$ )     | 90 s                              |
| Max. time above 230 °C ( $t_4$ )                      | 70 s                              |
| Peak temperature $T_{Peak}$                           | 260 °C                            |
| Max. time above $T_{Peak}$ minus 5 °C                 | 40 s                              |
| Ramp-down rate from $T_{Liquidus}$                    | 3 K/s to 6 K/s                    |

**Note**

- Temperature measuring point on top of the case and on terminals



| ELECTRICAL DATA |   |
|-----------------|---|
| SYMBOL          | DESCRIPTION                                       |
| $C_R$           | Rated capacitance at 100 Hz, tolerance $\pm 20\%$ |
| $I_R$           | Rated RMS ripple current at 100 kHz, 105 °C       |
| $I_{L2}$        | Max. leakage current after 2 min at $U_R$         |
| $\tan \delta$   | Max. dissipation factor at 100 Hz                 |
| Z               | Max. impedance at 100 kHz                         |

**Note**

- Unless otherwise specified, all electrical values in Table 5 apply at  $T_{amb} = 20\text{ °C}$ ,  $P = 86\text{ kPa}$  to  $106\text{ kPa}$ ,  $RH = 45\%$  to  $75\%$

Table 5

| ELECTRICAL DATA AND ORDERING INFORMATION |                            |   |                                    |  |                         |                                       |                             |
|--|----------------------------|---|------------------------------------|--|-------------------------|---------------------------------------|-----------------------------|
| $U_R$<br>(V)                             | $C_R$<br>( $\mu\text{F}$ ) | NOMINAL<br>CASE SIZE<br>L x W x H<br>(mm) | $I_R$<br>105 °C<br>100 kHz<br>(mA) | $I_{L2}$<br>2 min<br>( $\mu\text{A}$ ) | $\tan \delta$<br>100 Hz | Z<br>100 kHz<br>20 °C<br>( $\Omega$ ) | ORDERING CODE<br>MAL2180... |
| 2.5                                      | 180                        | 5.3 x 5.3 x 5.7                           | 2800                               | 300                                    | 0.12                    | 0.019                                 | 97251E3                     |
|  | 390                        | 6.6 x 6.6 x 5.9                           | 3160                               | 300                                    | 0.12                    | 0.014                                 | 97253E3                     |
|  | 560                        | 6.6 x 6.6 x 5.9                           | 3500                               | 300                                    | 0.12                    | 0.016                                 | 97254E3                     |
|  | 560                        | 6.6 x 6.6 x 7.7                           | 4200                               | 420                                    | 0.12                    | 0.009                                 | 97255E3                     |
|  | 680                        | 8.4 x 8.4 x 6.7                           | 3370                               | 500                                    | 0.12                    | 0.020                                 | 97256E3                     |
|  | 820                        | 8.4 x 8.4 x 12                            | 5380                               | 500                                    | 0.12                    | 0.009                                 | 97257E3                     |
|  | 1200                       | 10.4 x 10.4 x 7.7                         | 4450                               | 600                                    | 0.15                    | 0.013                                 | 97258E3                     |
|  | 1500                       | 8.4 x 8.4 x 12                            | 5150                               | 750                                    | 0.12                    | 0.012                                 | 97259E3                     |
| 4  | 2700                       | 10.4 x 10.4 x 12.6                        | 5600                               | 1350                                   | 0.15                    | 0.009                                 | 97261E3                     |
|  | 150                        | 5.3 x 5.3 x 5.7                           | 2730                               | 300                                    | 0.12                    | 0.020                                 | 97701E3                     |
|  | 270                        | 6.6 x 6.6 x 5.9                           | 3160                               | 300                                    | 0.12                    | 0.015                                 | 97702E3                     |
|  | 330                        | 6.6 x 6.6 x 5.9                           | 3160                               | 300                                    | 0.12                    | 0.015                                 | 97703E3                     |
|  | 390                        | 6.6 x 6.6 x 7.7                           | 4200                               | 468                                    | 0.12                    | 0.009                                 | 97704E3                     |
|  | 560                        | 8.4 x 8.4 x 6.7                           | 3220                               | 500                                    | 0.12                    | 0.022                                 | 97705E3                     |
|  | 560                        | 8.4 x 8.4 x 12                            | 5380                               | 500                                    | 0.15                    | 0.009                                 | 97706E3                     |
|  | 1000                       | 10.4 x 10.4 x 7.7                         | 4300                               | 800                                    | 0.12                    | 0.014                                 | 97707E3                     |
|  | 1200                       | 8.4 x 8.4 x 12                            | 4700                               | 960                                    | 0.15                    | 0.012                                 | 97708E3                     |
|  | 1500                       | 8.4 x 8.4 x 12                            | 4700                               | 1200                                   | 0.15                    | 0.012                                 | 97709E3                     |
| 6.3                                      | 2200                       | 10.4 x 10.4 x 12.6                        | 5700                               | 1760                                   | 0.15                    | 0.009                                 | 97711E3                     |
|  | 120                        | 5.3 x 5.3 x 5.7                           | 2660                               | 300                                    | 0.12                    | 0.021                                 | 97301E3                     |
|  | 220                        | 6.6 x 6.6 x 5.9                           | 3160                               | 300                                    | 0.12                    | 0.015                                 | 97303E3                     |
|  | 330                        | 6.6 x 6.6 x 5.9                           | 3390                               | 415                                    | 0.12                    | 0.017                                 | 97304E3                     |
|  | 330                        | 6.6 x 6.6 x 7.7                           | 4200                               | 623                                    | 0.12                    | 0.009                                 | 97305E3                     |
|  | 390                        | 8.4 x 8.4 x 6.7                           | 3220                               | 491                                    | 0.12                    | 0.022                                 | 97306E3                     |
|  | 820                        | 8.4 x 8.4 x 12                            | 4700                               | 1033                                   | 0.15                    | 0.013                                 | 97307E3                     |
|  | 820                        | 10.4 x 10.4 x 7.7                         | 4300                               | 1033                                   | 0.12                    | 0.014                                 | 97308E3                     |
| 10                                       | 1500                       | 10.4 x 10.4 x 12.6                        | 5560                               | 1890                                   | 0.15                    | 0.010                                 | 97309E3                     |
|  | 68                         | 5.3 x 5.3 x 5.7                           | 2540                               | 300                                    | 0.12                    | 0.023                                 | 97401E3                     |
|  | 120                        | 6.6 x 6.6 x 5.9                           | 2600                               | 300                                    | 0.12                    | 0.022                                 | 97402E3                     |
|  | 150                        | 6.6 x 6.6 x 7.7                           | 2800                               | 450                                    | 0.12                    | 0.015                                 | 97403E3                     |
|  | 270                        | 8.4 x 8.4 x 6.7                           | 3220                               | 500                                    | 0.12                    | 0.022                                 | 97404E3                     |
| 470                                      | 10.4 x 10.4 x 7.7          | 3800                                      | 940                                | 0.12                                   | 0.019                   | 97405E3                               |                             |

**ORDERING EXAMPLE**

Conductive polymer 180 CPS series

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

Nominal case size: 6.6 mm x 6.6 mm x 5.9 mm; taped on reel

Ordering code: MAL218097504E3



| ELECTRICAL DATA AND ORDERING INFORMATION |                        |   |   |                                  |                 |                              |                             |
|--|------------------------|---|---|----------------------------------|-----------------|------------------------------|-----------------------------|
| U <sub>R</sub><br>(V)                    | C <sub>R</sub><br>(μF) | NOMINAL<br>CASE SIZE<br>L x W x H<br>(mm) | I <sub>R</sub><br>105 °C<br>100 kHz<br>(mA) | I <sub>L2</sub><br>2 min<br>(μA) | tan δ<br>100 Hz | Z<br>100 kHz<br>20 °C<br>(Ω) | ORDERING CODE<br>MAL2180... |
| 16                                       | 39                     | 5.3 x 5.3 x 5.7                           | 2350  | 300                              | 0.12            | 0.020                        | 97501E3                     |
|  | 39                     | 6.6 x 6.6 x 5.9                           | 2460  | 300                              | 0.12            | 0.024                        | 97502E3                     |
|  | 68                     | 6.6 x 6.6 x 5.9                           | 2440  | 300                              | 0.12            | 0.025                        | 97503E3                     |
|  | 100                    | 6.6 x 6.6 x 5.9                           | 2490  | 320                              | 0.12            | 0.024                        | 97504E3                     |
|  | 150                    | 8.4 x 8.4 x 6.7                           | 3220  | 500                              | 0.12            | 0.022                        | 97505E3                     |
|  | 220                    | 10.4 x 10.4 x 7.7                         | 3450  | 704                              | 0.12            | 0.022                        | 97506E3                     |
|  | 270                    | 8.4 x 8.4 x 12                            | 4850  | 864                              | 0.15            | 0.012                        | 97507E3                     |
|  | 330                    | 10.4 x 10.4 x 12.6                        | 5300  | 1056                             | 0.15            | 0.012                        | 97508E3                     |
|  | 470                    | 10.4 x 10.4 x 12.6                        | 6100  | 1504                             | 0.15            | 0.010                        | 97509E3                     |
| 20                                       | 120                    | 6.6 x 6.6 x 5.9                           | 3200  | 480                              | 0.12            | 0.025                        | 97201E3                     |
|  | 390                    | 8.4 x 8.4 x 12                            | 4950  | 1560                             | 0.12            | 0.014                        | 97202E3                     |
|  | 560                    | 10.4 x 10.4 x 12.6                        | 5600  | 2240                             | 0.12            | 0.012                        | 97203E3                     |
| 25                                       | 56                     | 6.6 x 6.6 x 5.9                           | 2800  | 280                              | 0.12            | 0.030                        | 97601E3                     |
|  | 180                    | 8.4 x 8.4 x 12                            | 4650  | 900                              | 0.12            | 0.016                        | 97602E3                     |
|  | 330                    | 10.4 x 10.4 x 12.6                        | 5000  | 1650                             | 0.12            | 0.014                        | 97603E3                     |
| 35                                       | 22                     | 6.6 x 6.6 x 5.9                           | 2600  | 154                              | 0.12            | 0.035                        | 97001E3                     |
|  | 82                     | 8.4 x 8.4 x 12                            | 4000  | 574                              | 0.12            | 0.020                        | 97002E3                     |
|  | 120                    | 10.4 x 10.4 x 12.6                        | 4400  | 840                              | 0.12            | 0.018                        | 97003E3                     |

Table 6

| ADDITIONAL ELECTRICAL DATA        |   |  |
|-----------------------------------|---|--|
| PARAMETER                         | CONDITIONS  | VALUE                                  |
| <b>Voltage</b>                    |   |  |
| Surge voltage for short periods   | IEC 60384-18, subclause 4.14                          | U <sub>s</sub> ≤ 1.15 x U <sub>R</sub> |
| Reverse voltage for short periods | IEC 60384-18, subclause 4.16; T <sub>A</sub> ≤ 105 °C | U <sub>rev</sub> ≤ 1 V                 |

**USEFUL LIFE AND ENDURANCE**

Table 7

| ENDURANCE TEST AND USEFUL LIFE |             |                              |                            |                           |                           |                           |
|--------------------------------|-------------|------------------------------|----------------------------|---------------------------|---------------------------|---------------------------|
| SERIES                         | CASE CODE   | USEFUL LIFE<br>AT 105 °C (h) | ENDURANCE<br>AT 105 °C (h) | ENDURANCE<br>AT 95 °C (h) | ENDURANCE<br>AT 85 °C (h) | ENDURANCE<br>AT 75 °C (h) |
| 180 CPS                        | 0506 - 1013 | 2500                         | 2000                       | 6000                      | 20 000                    | 63 000                    |

Endurance can be calculated by formula below:

$$L_r = L_0 \times 10^{\frac{T_0 - T_r}{20}}$$

L<sub>r</sub>: estimated lifetime (h)

L<sub>0</sub>: base lifetime specified at maximum operating temperature with applied the DC voltage (h)

T<sub>0</sub>: rated maximum operating temperature (°C)

T<sub>r</sub>: actual ambient temperature (°C)



Table 8

| TEST PROCEDURES AND REQUIREMENTS            |   |   |  |
|---|---|---|--|
| TEST  |   | PROCEDURE<br>(quick reference)  | REQUIREMENTS   |
| NAME OF TEST                                | REFERENCE                                 |   |  |
| Mounting                                    | IEC 60384-18, subclause 4.3               | Shall be performed prior to tests mentioned below; reflow soldering; for maximum temperature load refer to chapter "Mounting"                     | $\Delta C/C: \pm 5\%$<br>$\tan \delta \leq \text{spec. limit}$<br>$I_{L2} \leq \text{spec. limit}$           |
| Endurance                                   | IEC 60384-18 / CECC 32300, subclause 4.15 | $T_{amb} = 105\text{ }^\circ\text{C}$ ; $U_R$ applied; for test duration see Table 7  | $\Delta C/C: \pm 20\%$<br>$\tan \delta \leq 2 \times \text{spec. limit}$<br>$I_{L2} \leq \text{spec. limit}$ |
| Useful life                                 | CECC 30301, subclause 1.8.1               | $T_{amb} = 105\text{ }^\circ\text{C}$ ; $U_R$ and $I_R$ applied; for test duration see Table 7  | $\Delta C/C: \pm 30\%$<br>$\tan \delta \leq 3 \times \text{spec. limit}$<br>$I_{L2} \leq \text{spec. limit}$ |
| Shelf life<br>(storage at high temperature) | IEC 60384-18 / CECC 32300, subclause 4.17 | $T_{amb} = 105\text{ }^\circ\text{C}$ ; no voltage applied; 1000 h<br>after test: $U_R$ to be applied for 30 min, 24 h to 48 h before measurement | For requirements see "Endurance test" above  |

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.

Vishay products are not designed for use in life-saving or life-sustaining applications or any application in which the failure of the Vishay product could result in personal injury or death unless specifically qualified in writing by Vishay. 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.