

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

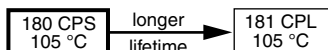


Fig. 1


**RoHS**  
COMPLIANT

### 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  $\mu\text{F}$ )
- 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)

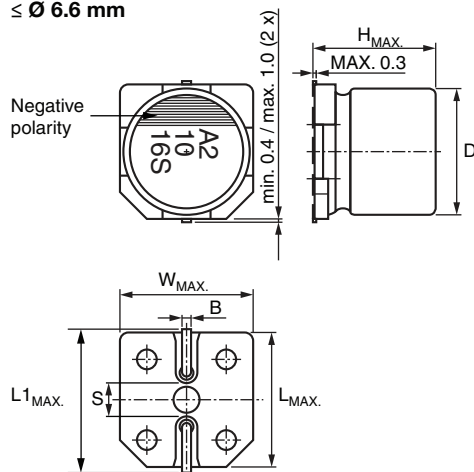
### PACKAGING

Supplied in blister tape on reel

| QUICK REFERENCE DATA                    |                                          |
|-----------------------------------------|------------------------------------------|
| DESCRIPTION                             | VALUE                                    |
| Nominal case sizes<br>(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, $C_R$          | 22 $\mu\text{F}$ to 2700 $\mu\text{F}$   |
| Tolerance on $C_R$                      | $\pm 20 \%$                              |
| Rated voltage range, $U_R$              | 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<br>specification     | IEC 60384-18 / CECC 32300                |
| Climatic category IEC 60068             | 55/105/56                                |

| 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

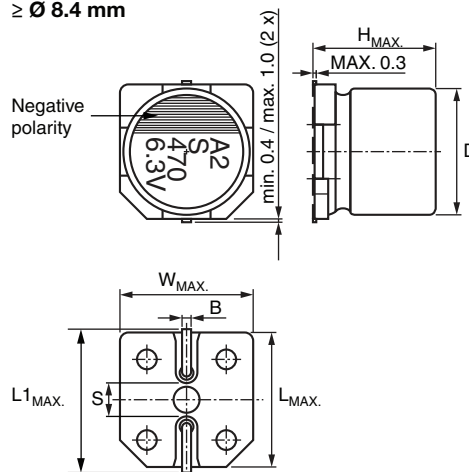


Fig. 2 - Dimensional outline

Table 1

| <b>DIMENSIONS</b> in millimeters <b>AND MASS</b> |              |                   |                   |                   |     |                   |     |                    |             |
|--------------------------------------------------|--------------|-------------------|-------------------|-------------------|-----|-------------------|-----|--------------------|-------------|
| NOMINAL<br>CASE SIZE<br>L x W x H                | CASE<br>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<br>(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<br>CASE SIZE<br>L x W x H                                           | CASE<br>CODE | PITCH<br>P <sub>1</sub> | TAPE WIDTH<br>W | TAPE<br>THICKNESS<br>T <sub>2</sub> | REEL DIAMETER | PACKAGING<br>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           | 1000                              |
| 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. 3 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. 4.

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.

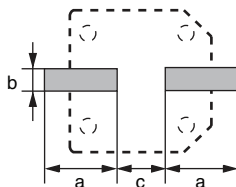
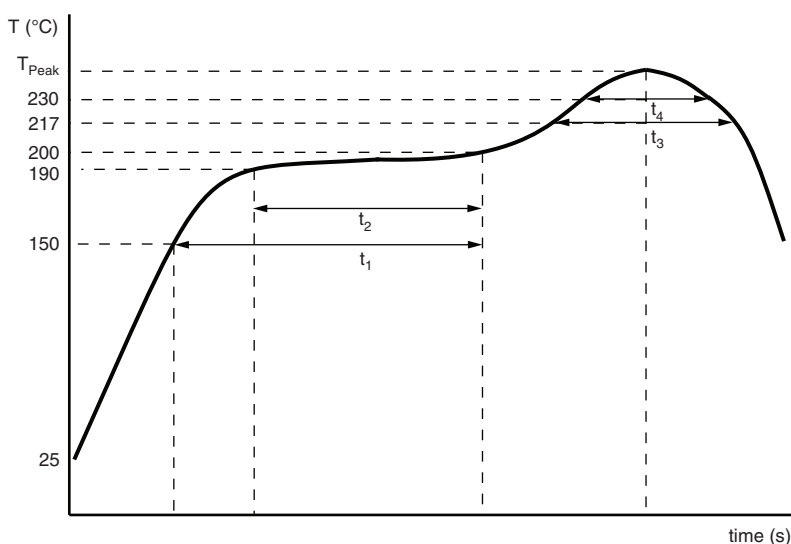


Fig. 3 - Recommended soldering pad dimensions

**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. 4 - 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                     |
|                                          | 2700                       | 10.4 x 10.4 x 12.6                        | 5600                               | 1350                                   | 0.15                    | 0.009                                   | 97261E3                     |
| 4                                        | 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                     |
|                                          | 1500                       | 10.4 x 10.4 x 12.6                        | 5560                               | 1890                                   | 0.15                    | 0.010                                   | 97309E3                     |
| 10                                       | 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                     |
|                                          | 820                    | 10.4 x 10.4 x 12.6                        | 5400                                        | 2624                             | 0.12            | 0.012                        | 97511E3                     |
| 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                                  |
| Voltage                           |                                                       |                                        |
| 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**

| <b>TEST PROCEDURES AND REQUIREMENTS</b>        |                                                 |                                                                                                                                                                   |                                                                                                               |
|------------------------------------------------|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| <b>TEST</b>                                    |                                                 | <b>PROCEDURE<br/>(quick reference)</b>                                                                                                                            | <b>REQUIREMENTS</b>                                                                                           |
| <b>NAME OF TEST</b>                            | <b>REFERENCE</b>                                |                                                                                                                                                                   |                                                                                                               |
| Mounting                                       | IEC 60384-18,<br>subclause 4.3                  | Shall be performed prior to tests mentioned below;<br>reflow soldering;<br>for maximum temperature load<br>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 /<br>CECC 32300,<br>subclause 4.15 | $T_{\text{amb}} = 105 \text{ }^{\circ}\text{C}$ ; $U_R$ applied;<br>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,<br>subclause 1.8.1                  | $T_{\text{amb}} = 105 \text{ }^{\circ}\text{C}$ ; $U_R$ and $I_R$ applied;<br>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<br>temperature) | IEC 60384-18 /<br>CECC 32300,<br>subclause 4.17 | $T_{\text{amb}} = 105 \text{ }^{\circ}\text{C}$ ; no voltage applied;<br>1000 h<br>after test: $U_R$ to be applied for 30 min,<br>24 h to 48 h before measurement | For requirements<br>see "Endurance test" above                                                                |



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