

# DATA SHEET

DCS 0402; DCT 0603;

DCU 0805; DCA 1206

**Thick film flat chip resistors**

Product specification  
File under BCcomponents, BC08

2002 May 13

# Thick film flat chip resistors

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## FEATURES

- State of the art thick film technology
- Improved termination design
- Standard TC:  $\pm 100$  and  $\pm 200$  ppm/K
- Tight tolerance available:  $\pm 1\%$
- Sizes:
  - Imperial: 0402; 0603; 0805; 1206
  - Metric: RR 1005M; RR 1608M; RR 2012M; RR 3216M

## APPLICATIONS

- All general purpose applications
- Office automation equipment
- Consumer electronics.

## DESCRIPTION

**DCS 0402, DCT 0603, DCU 0805 and DCA 1206 thick film chip resistors are made for all general purpose applications. They are typically used in the production of office automation equipment and consumer electronics.**

The production is performed in a mass volume production

site. A thick film is screen printed on a high grade alumina ceramic substrate to form the resistive layer. Pre-contacts are printed on both sides of the substrate. The resistors are laser trimmed to the target value. The resistor elements are covered by glass and a protective coating combined for superior electrical, mechanical and climatic protection. The prepared terminations receive an electroplating of PbSn solder on nickel plating. A three or four digit code designates the nominal resistance value.

The result of the determined production is verified by a final test performed on 100% of the individual chip resistors. Only accepted products are laid directly into the paper tape according to **IEC 60286-3**.

The resistors are suitable for processing on automatic SMD assembly systems. They are suitable for automatic soldering using wave, reflow or vapour phase. The encapsulation is resistant to all cleaning solvents commonly used in the electronics industry, including alcohols, esters and aqueous solutions.

The resistors are tested in accordance with **EN 140000 (IEC 60115-1)** and **EN 140400 (IEC 60115-8)**.

This product family of thick film flat chip resistors is completed by **Zero Ohm Jumpers**.

**Thick film flat chip resistors****DCS 0402; DCT 0603;  
DCU 0805; DCA 1206****QUICK REFERENCE DATA**

| DESCRIPTION                                                                              | DCS 0402                                                | DCT 0603                                                | DCU 0805                    | DCA 1206                    |
|------------------------------------------------------------------------------------------|---------------------------------------------------------|---------------------------------------------------------|-----------------------------|-----------------------------|
| Metric size                                                                              | RR 1005M                                                | RR 1608M                                                | RR 2012M                    | RR 3216M                    |
| Resistance range                                                                         | 1 $\Omega$ to 3,3 M $\Omega$                            | 1 $\Omega$ to 22 M $\Omega$                             | 1 $\Omega$ to 22 M $\Omega$ | 1 $\Omega$ to 22 M $\Omega$ |
| Resistance tolerance                                                                     | $\pm 5\%$ ; $\pm 1\%$                                   |                                                         |                             |                             |
| Temperature coefficient                                                                  | -300/+500 ppm/K;<br>$\pm 300$ ppm/K;<br>$\pm 200$ ppm/K | -300/+500 ppm/K;<br>$\pm 200$ ppm/K;<br>$\pm 100$ ppm/K |                             |                             |
| Operation mode                                                                           | standard                                                | standard                                                | standard                    | standard                    |
| Climatic category (LCT/UCT/days)                                                         | 55/125/56                                               | 55/125/56                                               | 55/125/56                   | 55/125/56                   |
| Rated dissipation, $P_{70}$                                                              | 0,063 W                                                 | 0,1 W                                                   | 0,125 W                     | 0,25 W                      |
| Operating voltage, $U_{\max}$ AC/DC                                                      | 50 V                                                    | 50 V                                                    | 150 V                       | 200 V                       |
| Film temperature                                                                         | 125 $^{\circ}\text{C}$                                  | 125 $^{\circ}\text{C}$                                  | 125 $^{\circ}\text{C}$      | 125 $^{\circ}\text{C}$      |
| Max. resistance change at $P_{70}$<br>for resistance range,<br>$\Delta R/R$ max., after: | 10 $\Omega$ to 1 M $\Omega$                             | 10 $\Omega$ to 1 M $\Omega$                             | 10 $\Omega$ to 1 M $\Omega$ | 10 $\Omega$ to 1 M $\Omega$ |
|                                                                                          | 1 000 h                                                 | $\leq 3\%$                                              | $\leq 1,5\%$                | $\leq 1,5\%$                |
|                                                                                          | 8 000 h                                                 | $\leq 6\%$                                              | $\leq 3\%$                  | $\leq 3\%$                  |
| Specified lifetime                                                                       | 8000 h                                                  | 8000 h                                                  | 8000 h                      | 8000 h                      |
| Permissible voltage against ambient:                                                     |                                                         |                                                         |                             |                             |
| 1 minute                                                                                 | 75 V                                                    | 150 V                                                   | 150 V                       | 200 V                       |
| continuous                                                                               | 75 V                                                    | 75 V                                                    | 75 V                        | 75 V                        |

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**Table 1** Temperature coefficient and resistance range

| DESCRIPTION     |           | RESISTANCE VALUE <sup>(1)</sup>        |                                        |                                        |                                        |
|-----------------|-----------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|
| T.C.            | TOLERANCE | DCS 0402                               | DCT 0603                               | DCU 0805                               | DCA 1206                               |
| ±400 ppm/K      | ±5%       | –                                      | 11 MΩ to 22 MΩ                         | 11 MΩ to 22 MΩ                         | 11 MΩ to 22 MΩ                         |
| ±300 ppm/K      | ±5%       | 1 kΩ to 3,3 MΩ                         | –                                      | –                                      | –                                      |
|                 | ±1%       | 1 kΩ to 1 MΩ                           | –                                      | –                                      | –                                      |
| –300/+500 ppm/K | ±5%       | 1 Ω to 9,76 Ω                          | 1 Ω to 9,76 Ω                          | 1 Ω to 9,76 Ω                          | 1 Ω to 9,76 Ω                          |
|                 | ±1%       | 1 Ω to 9,76 Ω                          | 1 Ω to 9,76 Ω                          | 1 Ω to 9,76 Ω                          | 1 Ω to 9,76 Ω                          |
| ±200 ppm/K      | ±5%       | 10 Ω to 976 Ω                          | 10 Ω to 10 MΩ                          | 10 Ω to 10 MΩ                          | 10 Ω to 10 MΩ                          |
|                 | ±1%       | 10 Ω to 976 Ω                          | –                                      | –                                      | –                                      |
| ±100 ppm/K      | ±1%       | –                                      | 10 Ω to 1 MΩ                           | 10 Ω to 1 MΩ                           | 10 Ω to 1 MΩ                           |
| Jumper          | –         | ≤ 50 mΩ;<br>$I_{\max} = 0,8 \text{ A}$ | ≤ 50 mΩ;<br>$I_{\max} = 0,8 \text{ A}$ | ≤ 50 mΩ;<br>$I_{\max} = 1,1 \text{ A}$ | ≤ 50 mΩ;<br>$I_{\max} = 1,6 \text{ A}$ |

## Note

- Resistance value to be selected from E24 series for 5% tolerance and from E24/E96 series for 1% tolerance .

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## ORDERING INFORMATION

Components may be ordered by using either a simple clear text ordering code, see "Type description and ordering code" or BCcomponents' unique 12NC.

### Numeric Ordering code (12NC)

- The resistors have a 12-digit ordering code starting with 2312.
- The subsequent 4 digits indicate the resistor type, specification and packaging; see Table 2.
- The remaining 4 digits indicate the resistance value:
  - The first 3 digits indicate the resistance value.
  - The last digit indicates the resistance decade in accordance with Table 3.

**Table 2** 12NC ordering code indicating resistor type and packaging

| DESCRIPTION |                                |           | ORDERING CODE 2312 ... .. |                      |                      |
|-------------|--------------------------------|-----------|---------------------------|----------------------|----------------------|
|             |                                |           | CARDBOARD TAPE ON REEL    |                      |                      |
| TYPE        | T.C.                           | TOL.      | PA<br>5000<br>units       | E0<br>10000<br>units | PW<br>20000<br>units |
| DCS 0402    | $\pm 200$ ppm/K <sup>(1)</sup> | $\pm 5\%$ | –                         | 364 1....            | –                    |
|             | $\pm 200$ ppm/K <sup>(1)</sup> | $\pm 1\%$ | –                         | 364 3....            | –                    |
|             | jumper                         | –         | –                         | 364 90001            | –                    |
| DCT 0603    | $\pm 200$ ppm/K <sup>(2)</sup> | $\pm 5\%$ | 304 1....                 | –                    | 309 1....            |
|             | $\pm 100$ ppm/K <sup>(2)</sup> | $\pm 1\%$ | 304 7....                 | –                    | 309 7....            |
|             | jumper                         | –         | 304 90001                 | –                    | 309 90001            |
| DCU 0805    | $\pm 200$ ppm/K <sup>(2)</sup> | $\pm 5\%$ | 324 1....                 | –                    | 329 1....            |
|             | $\pm 100$ ppm/K <sup>(2)</sup> | $\pm 1\%$ | 324 7....                 | –                    | 329 7....            |
|             | jumper                         | –         | 324 90001                 | –                    | 329 90001            |
| DCA 1206    | $\pm 200$ ppm/K <sup>(2)</sup> | $\pm 5\%$ | 344 1....                 | –                    | 349 1....            |
|             | $\pm 100$ ppm/K <sup>(2)</sup> | $\pm 1\%$ | 344 7....                 | –                    | 349 7....            |
|             | jumper                         | –         | 344 90001                 | –                    | 349 90001            |

### Notes

1.  $<10 \Omega$  T.C.  $-300/+500$  ppm/K;  $>1 \text{ k}\Omega$  T.C.  $\pm 300$  ppm/K
2.  $<10 \Omega$  T.C.  $-300/+500$  ppm/K;  $>10 \text{ M}\Omega$  T.C.  $\pm 400$  ppm/K

**Table 3** Last digit of 12NC indicating resistance decade

| RESISTANCE DECADE                            | LAST DIGIT |
|----------------------------------------------|------------|
| 1 to 9,99 $\Omega$                           | 8          |
| 10 to 99,9 $\Omega$                          | 9          |
| 100 to 999 $\Omega$                          | 1          |
| 1 $\text{k}\Omega$ to 9,99 $\text{k}\Omega$  | 2          |
| 10 $\text{k}\Omega$ to 99,9 $\text{k}\Omega$ | 3          |
| 100 $\text{k}\Omega$ to 999 $\text{k}\Omega$ | 4          |
| 1 $\text{M}\Omega$ to 9,99 $\text{M}\Omega$  | 5          |
| 10 $\text{M}\Omega$ to 99,9 $\text{M}\Omega$ | 6          |

### ORDERING EXAMPLE

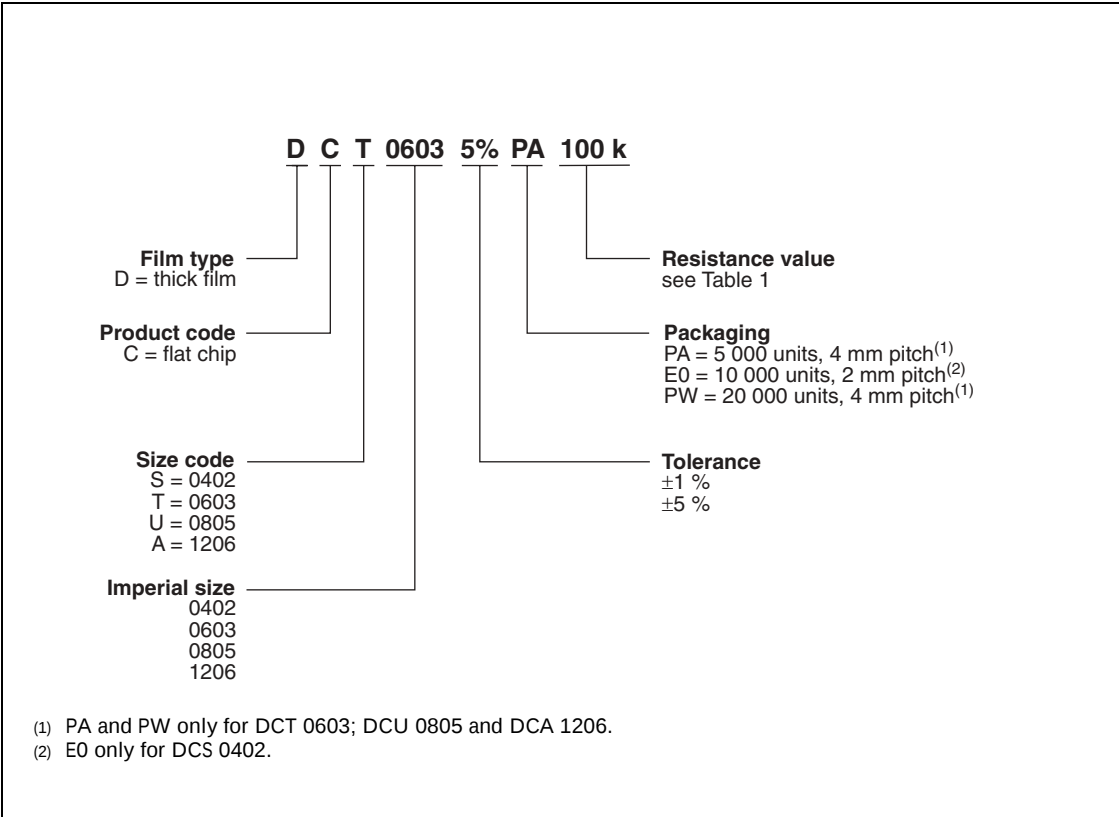
The ordering code of a DCT 0603 resistor, value 100  $\text{k}\Omega$  and TC 100 with  $\pm 1\%$  tolerance, supplied in cardboard tape of 20000 units per reel is: 2312 309 71004.

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Type description and ordering code

- We recommend that the clear text ordering code is used to minimize the possibility of errors in order handling.



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FUNCTIONAL DESCRIPTION

Derating

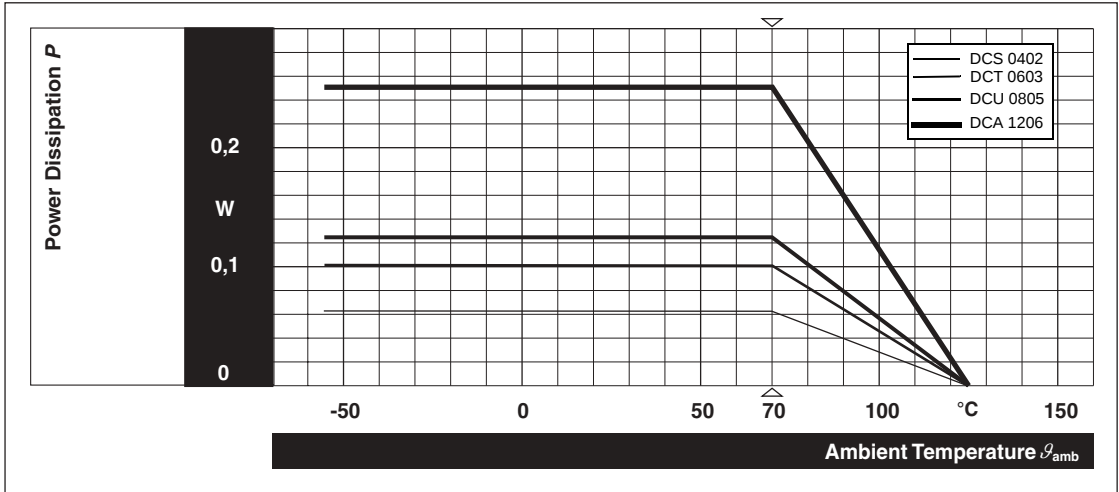


Fig.1 Derating, standard operation.

Current noise

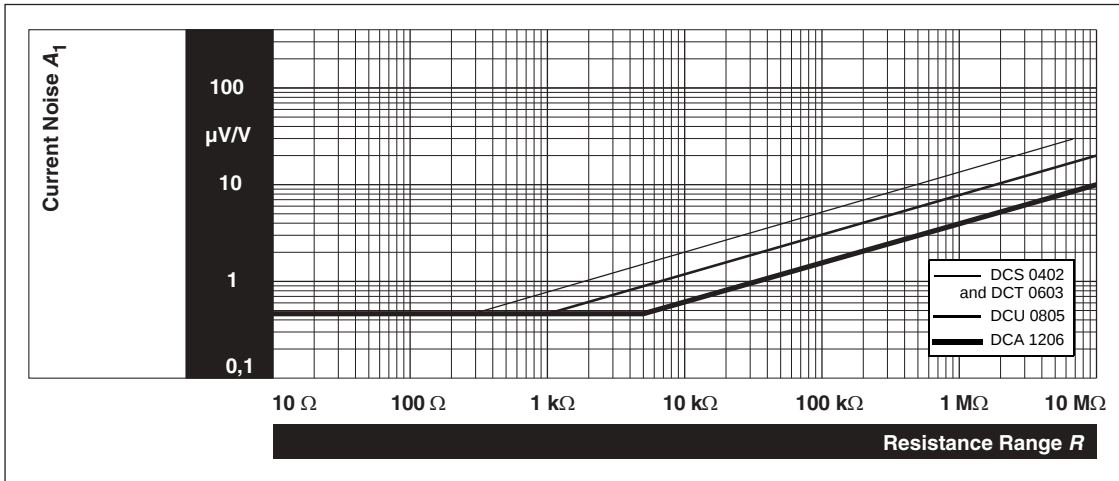


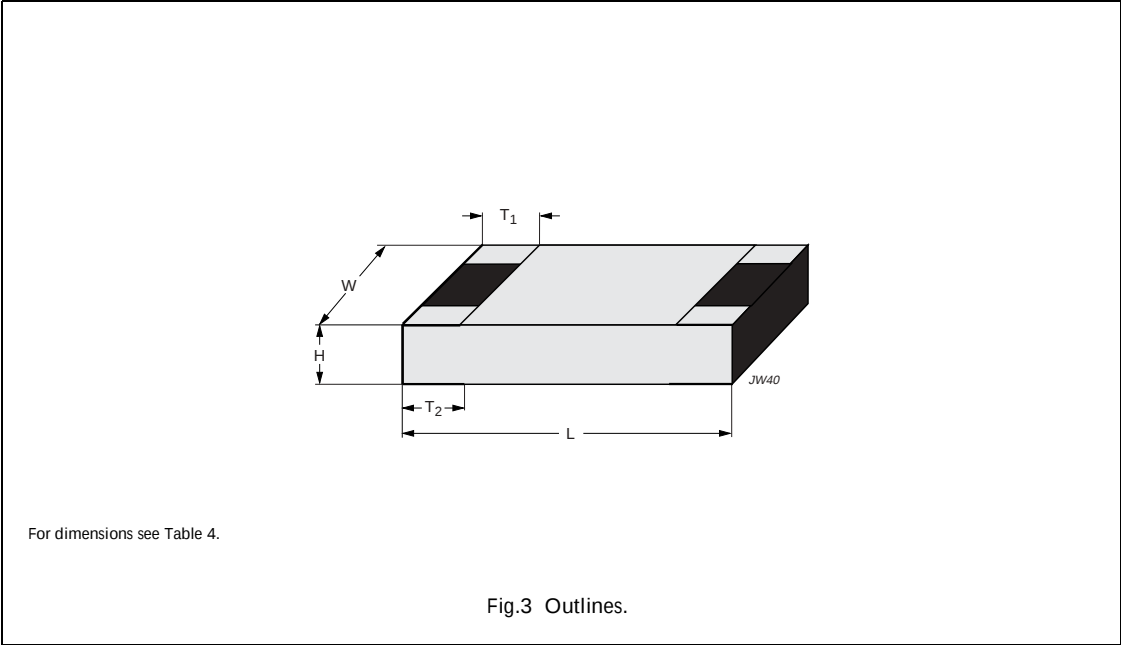
Fig.2 Current noise  $A_1$  in accordance with IEC 60195.

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MECHANICAL DATA

Outlines



**Table 4** Chip resistor types, mass and relevant physical dimensions; see Fig.3

| TYPE     | H<br>(mm)  | L<br>(mm)  | W<br>(mm)  | T <sub>1</sub><br>(mm) | T <sub>2</sub><br>(mm) | MASS<br>(mg) |
|----------|------------|------------|------------|------------------------|------------------------|--------------|
| DCS 0402 | 0,35 ±0,05 | 1,0 ±0,05  | 0,5 ±0,05  | 0,2 +0,15/-0,1         | 0,25 ±0,1              | 0,75         |
| DCT 0603 | 0,45 ±0,1  | 1,6 ±0,1   | 0,85 ±0,1  | 0,3 ±0,2               | 0,3 ±0,2               | 2,08         |
| DCU 0805 | 0,55 ±0,1  | 2,0 ±0,15  | 1,25 ±0,15 | 0,4 ±0,2               | 0,4 ±0,2               | 4,8          |
| DCA 1206 | 0,55 ±0,1  | 3,15 ±0,15 | 1,6 ±0,15  | 0,5 ±0,25              | 0,5 ±0,25              | 8,9          |

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## TESTS AND REQUIREMENTS

Essentially all tests are carried out in accordance with the following specifications:

EN 140000 / IEC 60115-1, Generic specification (includes tests)

EN 140400 / IEC 60115-1, Sectional specification (includes schedule for qualification approval)

The testing also covers most of the requirements specified by EIA/IS-703 and JIS-C-5202.

The tests are carried out in accordance with IEC 60068 and under standard atmospheric conditions in accordance with IEC 60068-1, 5.3. Climatic category LCT/UCT/56 (rated temperature range: Lower Category Temperature, Upper Category Temperature; damp heat, long term, 56 days) is valid.

Unless otherwise specified the following values apply:

Temperature: 15 °C to 35 °C

Relative humidity: 45% to 75%

Air pressure: 86 kPa to 106 kPa (860 mbar to 1 060 mbar).

For testing the components are mounted on a test board in accordance with IEC 60115-1, 4.31 unless otherwise specified.

In Table 5 the tests and requirements are listed with reference to the relevant clauses of IEC 60115-1 and IEC 60068-2; a short description of the test procedure is also given.

**Table 5** Test procedures and requirements

| IEC 60115-1<br>CLAUSE | IEC 60068-2<br>TEST<br>METHOD | TEST                                    | PROCEDURE                                                                                                        | REQUIREMENTS<br>PERMISSIBLE CHANGE ( $\Delta R/R$ )                   |                              |
|-----------------------|-------------------------------|-----------------------------------------|------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|------------------------------|
|                       |                               |                                         | stability for product types:                                                                                     |                                                                       |                              |
|                       |                               |                                         | <b>DCS 0402</b>                                                                                                  | –                                                                     | –                            |
|                       |                               |                                         | <b>DCT 0603</b>                                                                                                  | 10 $\Omega$ to 1 M $\Omega$                                           | <10 $\Omega$ ; >1 M $\Omega$ |
|                       |                               |                                         | <b>DCU 0805</b>                                                                                                  | 10 $\Omega$ to 1 M $\Omega$                                           | <10 $\Omega$ ; >1 M $\Omega$ |
|                       |                               |                                         | <b>DCA 1206</b>                                                                                                  | 10 $\Omega$ to 1 M $\Omega$                                           | <10 $\Omega$ ; >1 M $\Omega$ |
| 4.5                   | –                             | resistance                              |                                                                                                                  | $\pm 1\%$ ; $\pm 5\%$                                                 |                              |
| 4.8.4.2               | –                             | temperature coefficient                 | at 20 / LCT / 20 °C and 20 / UCT / 20 °C                                                                         | -300/+500 ppm/K; $\pm 300$ ppm/K;<br>$\pm 200$ ppm/K; $\pm 100$ ppm/K |                              |
| 4.25.1                | –                             | endurance                               | room temperature;<br>$U = \sqrt{P_{70} \times R}$ or<br>$U = U_{\max}$ ;<br>1,5 h on; 0,5 h off<br>70 °C; 1000 h | $\pm(1,5\% + 0,1 \Omega)$                                             | $\pm(3\% + 0,1 \Omega)$      |
| 4.25.3                | –                             | endurance at upper category temperature | 125 °C; 1000 h                                                                                                   | $\pm(1,5\% + 0,1 \Omega)$                                             | $\pm(3\% + 0,1 \Omega)$      |
| 4.24                  | 3 (Ca)                        | damp heat, steady state                 | 40 $\pm 2$ °C; 56 days;<br>93 $\pm 2/-3\%$ RH                                                                    | $\pm(1,5\% + 0,1 \Omega)$                                             | $\pm(3\% + 0,1 \Omega)$      |

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| IEC<br>60115-1<br>CLAUSE | IEC<br>60068-2<br>TEST<br>METHOD | TEST                         | PROCEDURE                                                                                        | REQUIREMENTS<br>PERMISSIBLE CHANGE ( $\Delta R/R$ )   |                                                 |
|--------------------------|----------------------------------|------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------|
|                          |                                  |                              | stability for product types:                                                                     |                                                       |                                                 |
|                          |                                  |                              | <b>DCS 0402</b>                                                                                  | –                                                     | –                                               |
|                          |                                  |                              | <b>DCT 0603</b>                                                                                  | 10 $\Omega$ to 1 M $\Omega$                           | <10 $\Omega$ ; >1 M $\Omega$                    |
|                          |                                  |                              | <b>DCU 0805</b>                                                                                  | 10 $\Omega$ to 1 M $\Omega$                           | <10 $\Omega$ ; >1 M $\Omega$                    |
|                          |                                  |                              | <b>DCA 1206</b>                                                                                  | 10 $\Omega$ to 1 M $\Omega$                           | <10 $\Omega$ ; >1 M $\Omega$                    |
| 4.23                     |                                  | climatic sequence:           |                                                                                                  |                                                       |                                                 |
| 4.23.2                   | 2 (Ba)                           | dry heat                     | 125 °C; 16 h                                                                                     |                                                       |                                                 |
| 4.23.3                   | 30 (Db)                          | damp heat, cyclic            | 55 °C; 24 h;<br>90 to 100 % RH;<br>1 cycle                                                       |                                                       |                                                 |
| 4.23.4                   | 1 (Aa)                           | cold                         | –55 °C; 2 h                                                                                      |                                                       |                                                 |
| 4.23.5                   | 13 (M)                           | low air pressure             | 8,5 kPa; 2 h;<br>15 to 35 °C                                                                     |                                                       |                                                 |
| 4.23.6                   | 30 (Db)                          | damp heat, cyclic            | 55 °C; 5 days;<br>95 to 100 % RH;<br>5 cycles                                                    | $\pm(1,5\% + 0,1 \Omega)$<br>no visible damage        | $\pm(3\% + 0,1 \Omega)$<br>no visible damage    |
| 4.13                     | –                                | short time overload          | room temperature;<br>$U = 2,5 \times \sqrt{P_{70}} \times R$ or<br>$U = 2 \times U_{\max}$ ; 5 s | $\pm(2\% + 0,1 \Omega)$<br>no visible damage          | $\pm(2\% + 0,1 \Omega)$<br>no visible damage    |
| 4.19                     | 14 (Na)                          | rapid change of temperature  | 30 minutes at LCT and<br>30 minutes at UCT;<br>5 cycles                                          | $\pm(1\% + 0,05 \Omega)$<br>no visible damage         | $\pm(1\% + 0,05 \Omega)$<br>no visible damage   |
| 4.29                     | 45 (XA)                          | component solvent resistance | isopropyl alcohol<br>+23 °C;<br>toothbrush method                                                | marking legible;<br>no visible damage                 |                                                 |
| 4.18.2                   | 20 (Tb)                          | resistance to soldering heat | unmounted components;<br>260 $\pm$ 5 °C; 10 $\pm$ 1 s                                            | $\pm(0,5\% + 0,05 \Omega)$<br>no visible damage       | $\pm(0,5\% + 0,05 \Omega)$<br>no visible damage |
| 4.17.2                   | 20 (Ta)                          | solderability                | +215 °C; 3 s<br>solder bath method                                                               | good tinning ( $\geq$ 95% covered); no visible damage |                                                 |
| 4.32                     | 21 (Ue <sub>3</sub> )            | shear (adhesion)             | 5 N; 10 s                                                                                        | no visible damage                                     |                                                 |
| 4.7                      | –                                | voltage proof                | $U_{\text{rms}} = 100 \text{ V}$ ; 60 s                                                          | no flashover or breakdown                             |                                                 |