



Pages 1 to 18

RESISTOR, FIXED, CHIP, THICK FILM

BASED ON TYPE CHP

ESCC Detail Specification No. 4001/026

| | |
|---------|-----------|
| Issue 2 | July 2008 |
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|---------|--|
| 339 | Specification upissued to incorporate editorial changes per DCR. |

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1. GENERAL

1.1 SCOPE

This specification details the ratings, physical and electrical characteristics, test and inspection data for a Resistor, Fixed, Chip, Thick Film based on type CHP. It shall be read in conjunction with ESCC Generic Specification No. 4001, the requirements of which are supplemented herein.

1.2 COMPONENT TYPE VARIANTS AND RANGE OF COMPONENTS

Variants of the basic type components and the range of components covered by this specification are given in Table 1(a).

1.3 MAXIMUM RATINGS

The maximum ratings, which shall not be exceeded at any time during use or storage, applicable to the components specified herein, are as scheduled in Table 1(b).

1.4 PARAMETER DERATING INFORMATION

The parameter derating information applicable to the components specified herein is shown in Figure 1.

1.5 PHYSICAL DIMENSIONS

The physical dimensions of the components specified herein are shown in Figure 2.

1.6 FUNCTIONAL DIAGRAM

The functional diagram of the components specified herein is shown in Figure 3.

2. APPLICABLE DOCUMENTS

The following documents form part of this specification and shall be read in conjunction with it:

- (a) ESCC Generic Specification No. 4001 for Resistors, Fixed, Film.

3. TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS

For the purpose of this specification, the terms, definitions, abbreviations, symbols and units specified in ESCC Basic specification No. 21300 shall apply.

Table 1(a) - TYPE VARIANTS AND RANGE OF COMPONENTS

| Variant | Style (Note 1) | Resistance Range R _n (Note 2) | | Tolerance (± %) (Note 2) | Temperature Coefficient TC (±10 ⁻⁶ /°C) (Note 2) | Critical Resistance (kΩ) | Weight max (g) |
|---------|-------------------|---|-------------|--------------------------------|--|--------------------------------|----------------------|
| | | Min (Ω) | Max (MΩ) | | | | |
| 01 | 0603 | 1 | 10 | 1, 2, 5 | 100, 200 | 25 | 0.002 |
| 02 | 0805 | 1 | 10 | 1, 2, 5 | 100, 200 | 50 | 0.004 |
| 03 | 1206 | 1 | 10 | 1, 2, 5 | 100, 200 | 160 | 0.008 |
| 04 | 2010 | 1 | 10 | 1, 2, 5 | 100, 200 | 180 | 0.026 |

| Variant | Style (Note 1) | Resistance Range R_n (Note 2) | | Tolerance (\pm %) (Note 2) | Temperature Coefficient TC ($\pm 10^{-6}/^{\circ}\text{C}$) (Note 2) | Critical Resistance (k Ω) | Weight max (g) |
|---------|-------------------|------------------------------------|----------------------|-------------------------------------|---|---|----------------------|
| | | Min (Ω) | Max (M Ω) | | | | |
| 05 | 2512 | 1 | 10 | 1, 2, 5 | 100, 200 | 112.5 | 0.042 |

NOTES:

1. See Figure 2
- 2.

| Resistance (Ω) | Value Series | Available Tolerance (\pm %) | Available Temperature Coefficient ($\pm 10^{-6}/^{\circ}\text{C}$) |
|----------------------------|---|-----------------------------------|---|
| $1 \leq R_n < 10$ | Any value in the resistance range to 3 significant figures | 2, 5 | 200 |
| $10 \leq R_n < 1\text{M}$ | | 1, 2, 5 | 100, 200 |
| $R_n \geq 1\text{M}$ | | 2, 5 | 200 |

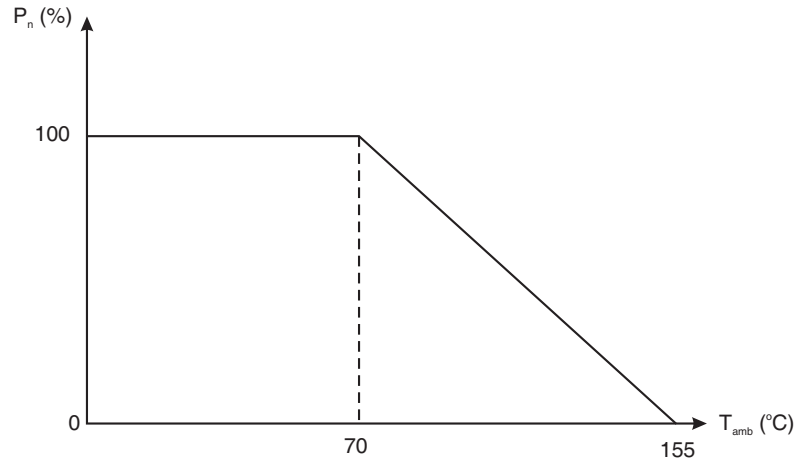
Table 1(b) - MAXIMUM RATINGS

| No. | Characteristics | Variant | Style | Symbol | Maximum Rating | Unit | Remarks |
|-----|-----------------------------|---------|-------|-----------|---------------------------|--------------------|-----------|
| 1 | Rated Dissipation | 01 | 0603 | P_n | 100 | mW | Note 1 |
| | | 02 | 0805 | | 200 | | |
| | | 03 | 1206 | | 250 | | |
| | | 04 | 2010 | | 500 | | |
| | | 05 | 2512 | | 800 | | |
| 2 | Limiting Element Voltage | 01 | 0603 | U_L | 50 | V | - |
| | | 02 | 0805 | | 100 | | |
| | | 03 | 1206 | | 200 | | |
| | | 04 | 2010 | | 300 | | |
| | | 05 | 2512 | | 300 | | |
| 3 | Rated Voltage | All | All | U_R | $\sqrt{(P_n \times R_n)}$ | V | Note 2 |
| 4 | Insulation Voltage | 01 | 0603 | U_I | 100 | V | - |
| | | 02 | 0805 | | 200 | | |
| | | 03 | 1206 | | 300 | | |
| | | 04 | 2010 | | 300 | | |
| | | 05 | 2512 | | 300 | | |
| 5 | Operating Temperature Range | All | All | T_{op} | -55 to +155 | $^{\circ}\text{C}$ | T_{amb} |
| 6 | Storage Temperature Range | All | All | T_{stg} | -55 to +155 | $^{\circ}\text{C}$ | - |
| 7 | Soldering Temperature | All | All | T_{sol} | +260 | $^{\circ}\text{C}$ | Note 3 |

NOTES:

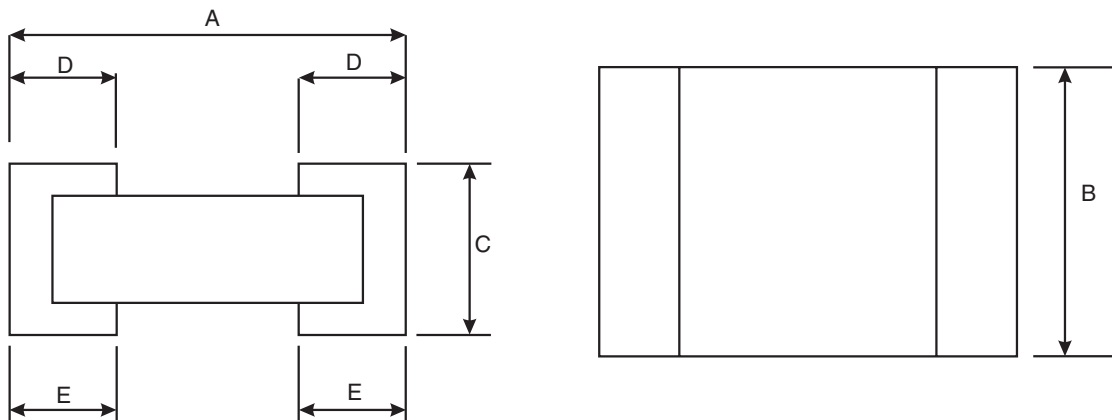
1. At $T_{amb} \leq +70^{\circ}\text{C}$. For derating at $T_{amb} > +70^{\circ}\text{C}$, see Figure 1.
2. Shall never exceed Limiting Element Voltage. R_n = rated resistance.
3. Duration 10 seconds maximum.

FIGURE 1- PARAMETER DERATING INFORMATION

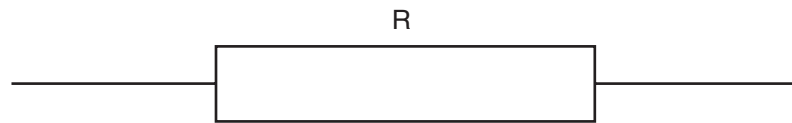


Rated Dissipation versus Temperature

FIGURE 2 - PHYSICAL DIMENSIONS



| Variant | Style | Dimensions (mm) | | | | | | | |
|---------|-------|-----------------|------|------|------|------|------|------|------|
| | | A | | B | | C | | D, E | |
| | | Min | Max | Min | Max | Min | Max | Min | Max |
| 01 | 0603 | 1.36 | 1.68 | 0.72 | 0.98 | 0.38 | 0.53 | 0.25 | 0.51 |
| 02 | 0805 | 1.75 | 2.07 | 1.14 | 1.4 | 0.38 | 0.53 | 0.25 | 0.51 |
| 03 | 1206 | 2.89 | 3.21 | 1.47 | 1.73 | 0.38 | 0.53 | 0.25 | 0.51 |
| 04 | 2010 | 4.92 | 5.24 | 2.41 | 2.67 | 0.5 | 0.63 | 0.25 | 0.64 |
| 05 | 2512 | 6.19 | 6.51 | 2.93 | 3.32 | 0.5 | 0.63 | 0.25 | 0.64 |

FIGURE 3 - FUNCTIONAL DIAGRAM

4. **REQUIREMENTS**

4.1 **GENERAL**

The complete requirements for procurement of the components specified herein are stated in this specification and ESCC Generic Specification No. 4001. Deviations from the Generic Specification, applicable to this specification only, are detailed in Para. 4.2.

Deviations from the Generic Specification and this Detail Specification, formally agreed with specific Manufacturers on the basis that the alternative requirements are equivalent to the ESCC requirements and do not affect the components' reliability, are listed in the appendices attached to this specification.

4.2 **DEVIATIONS FROM GENERIC SPECIFICATION**

4.2.1 **Deviations from Special In-process Controls**

None.

4.2.2 **Deviations from Final Production Tests (Chart II)**

- (a) Para. 9.1, Overload: Voltage $\sqrt{(6.25P_n \times R_n)}$ or $2U_L$, whichever is less.
Duration: 2 seconds minimum.
- (b) Para. 9.2, Third Harmonic Control or Current Noise: Not Applicable.

4.2.3 **Deviations from Burn-in and Electrical Measurements (Chart III)**

None.

4.2.4 **Deviations from Qualification Tests (Chart IV)**

- (a) Para. 9.1, Overload: Test conditions as Para. 4.2.2 (a)
- (b) Para. 9.13, Vibration: Not applicable

4.2.5 **Deviations from Lot Acceptance Tests (Chart V)**

- (a) Para. 9.13, Vibration: Not applicable

4.3 **MECHANICAL REQUIREMENTS**

4.3.1 **Dimension Check**

The dimensions of the components specified herein shall be verified in accordance with the requirements set out in Para. 9.4 of ESCC Generic Specification No. 4001 and they shall conform to those shown in Figure 2 of this specification.

4.3.2 Weight

The maximum weight of the components specified herein shall be as given in Table 1(a).

4.3.3 Robustness of Terminations

The requirements for the robustness of terminations test are specified in Para. 9.10.2 of ESCC Generic Specification No. 4001. The test conditions for Bend Strength of the End Face Plating shall be as follows:

| | |
|-----------------|-----------------------------|
| Number of bends | : 10 |
| Deflection | : 2mm (Variants 01, 02, 03) |
| | : 1mm (Variants 04, 05) |
| Duration | : 5 ± 1s |

4.4 MATERIALS AND FINISHES

The materials and finishes shall be as specified herein. Where a definite material is not specified, a material which will enable the components specified herein to meet the performance requirements of this specification shall be used. Acceptance or approval of any constituent material does not guarantee acceptance of the finished product.

4.4.1 Case

The alumina substrate shall be covered with a suitable coating.

4.4.2 Terminations

The terminal material shall be Type E with Type 4 finish in accordance with the requirements of ESCC Basic Specification No. 23500.

4.5 MARKING

4.5.1 General

The marking of all components delivered to this specification shall be in accordance with the requirements of ESCC Basic Specification No. 21700 and the following paragraphs. When the component is too small to accommodate all of the marking specified, as much as space permits shall be marked and the marking information, in full, shall accompany each component in its primary package.

The information to be marked and the order of precedence, shall be as follows:

- (a) Electrical Characteristics and Ratings
- (b) The ESCC Component Number.
- (c) Traceability Information

4.5.2 Electrical Characteristics and Ratings

The electrical characteristics and ratings to be marked in the following order of precedence are:

- (a) Resistance Value (R_n)
- (b) Tolerance
- (c) Temperature Coefficient

The information shall be constituted and marked as follows:

Example: 2490F4

- Resistance Value (249Ω): 2490
- Tolerance (±1%): F
- Temperature Coefficient ($100 \times 10^{-6}/^{\circ}\text{C}$): 4

4.5.2.1 *Resistance Value*

The resistance value shall be expressed by means of the following codes. The unit quantity for marking shall be Ohms (Ω).

| Resistance Value (Ω) | Code |
|-------------------------------|------|
| X.XX | XRXX |
| XX.X | XXRX |
| XXX | XXX0 |
| XXX 10^1 | XXX1 |
| XXX 10^2 | XXX2 |
| XXX 10^3 | XXX3 |
| XXX 10^4 | XXX4 |
| XXX 10^5 | XXX5 |

For values of less than 100Ω the letter “R” is used to indicate the decimal point. When R is used all successive digits represent significant figures. For values of 100Ω and above the first 3 digits (X) represent significant figures and the last digit specifies the number of zeros to follow.

4.5.2.2 *Tolerance*

The tolerance on resistance value shall be indicated by the code letters specified hereafter.

| Tolerance (±%) | Code Letter |
|----------------|-------------|
| 1 | F |
| 2 | G |
| 5 | J |

4.5.2.3 *Temperature Coefficient*

The temperature coefficient shall be indicated by the numerical code specified hereafter.

| Temperature Coefficient ($\pm 10^{-6}/^{\circ}\text{C}$) | Code |
|--|------|
| 100 | 4 |
| 200 | 6 |

4.5.3 ESCC Component Number

The ESCC Component Number shall be constituted and marked as follows:

Example : 400102601B

- Detail Specification Reference : 4001026
- Component Type Variant Number : 01 (as required)
- Testing Level (B or C, as applicable)

4.5.4 Traceability Information

Each component shall be marked in respect of traceability information in accordance with the requirements of ESCC Basic Specification No. 21700.

4.6 ELECTRICAL MEASUREMENTS

4.6.1 Electrical Measurements at Room Temperature

The parameters to be measured at room temperature are scheduled in Table 2. Unless otherwise specified, measurements shall be performed at $T_{amb}=+22\pm 3^{\circ}\text{C}$.

4.6.2 Electrical Measurements at High and Low Temperatures

The parameters to be measured at high and low temperatures are scheduled in Table 3.

The distribution of the sample shall be as follows:

- 1/3 with lowest resistance value
- 1/3 with highest resistance value
- 1/3 with median resistance value or the critical resistance value if procured

of the procured range.

4.6.3 Circuits for Electrical Measurements (Figure 4)

Not applicable.

4.7 BURN-IN TESTS

4.7.1 Parameter Drift Values

The parameter drift values applicable to Burn-in are as specified in Table 4 of this specification. Unless otherwise stated, measurements shall be performed at $T_{amb}=+22\pm 3^{\circ}\text{C}$. The parameter drift values (Δ) applicable to the parameters scheduled shall not be exceeded. In addition to these drift value requirements for a given parameter, the appropriate limit values specified in Table 2 shall not be exceeded.

4.7.2 Conditions for Burn-in

The requirements for Burn-in are specified in Section 7 of ESCC Generic Specification No. 4001. The conditions for Burn-in shall be as specified in Table 5 of this specification.

After 168 (+24 -0) hours, the resistors shall be removed from the chamber and allowed to cool under normal atmospheric conditions for a minimum of 4 hours. They shall then be visually examined. There shall be no evidence of damage and marking shall still be legible.

4.7.3 Electrical Circuit for Burn-in

The circuit for use in performing the burn-in test is shown in Figure 5 of this specification.

Table 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE

| No. | Characteristics | Symbol | ESCC 4001 Test Method | Test Conditions | Tolerance (\pm %) | Limits | | Unit |
|-----|-----------------|--------|-----------------------|-----------------|----------------------|------------|------------|----------|
| | | | | | | Min | Max | |
| 1 | Resistance | R_A | Para. 9.5.1 | Para. 9.5.1 | 1 | 0.99 R_n | 1.01 R_n | Ω |
| | | | | | 2 | 0.98 R_n | 1.02 R_n | |
| | | | | | 5 | 0.95 R_n | 1.05 R_n | |

Table 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

| No. | Characteristics | Symbol | ESCC 4001 Test Method | Test Conditions (Note 1) | Limits | | Unit |
|-----|--|------------------|-----------------------|---|----------------|----------------|------|
| | | | | | Min | Max | |
| 2 | Resistance change between $-55 (+3-0)^\circ\text{C}$ and $+22 \pm 3^\circ\text{C}$ | $\Delta R_A/R_A$ | Para. 9.5.1 | Para. 9.5.1 TC = $\pm 100 \times 10^{-6}/^\circ\text{C}$ TC = $\pm 200 \times 10^{-6}/^\circ\text{C}$ | -0.8 -1.6 | +0.8 +1.6 | % |
| 3 | Resistance change between $+155 (+0 -3)^\circ\text{C}$ and $+22 \pm 3^\circ\text{C}$ | $\Delta R_A/R_A$ | Para. 9.5.1 | Para. 9.5.1 TC = $\pm 100 \times 10^{-6}/^\circ\text{C}$ TC = $\pm 200 \times 10^{-6}/^\circ\text{C}$ | -1.36 -2.72 | +1.36 +2.72 | % |

NOTES:

- The measurements shall be performed on a sample basis in accordance with special inspection Level S-3, Table IIA, AQL = 1% of IEC Publication No. 60410 on the total production lot. In addition, see Para. 4.6.2 for distribution of the sample.

FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS

Not applicable.

Table 4 - PARAMETER DRIFT VALUES

| No. | Characteristics | Symbol | Spec. and/or Test Method | Test Conditions | Change Limits (Δ) | Unit |
|-----|-------------------|------------------|--------------------------|-----------------|-----------------------------------|-------------------|
| 1 | Resistance Change | $\Delta R_A/R_A$ | As per Table 2 | As per Table 2 | ± 0.5 or (1) ± 0.05 | % Ω |

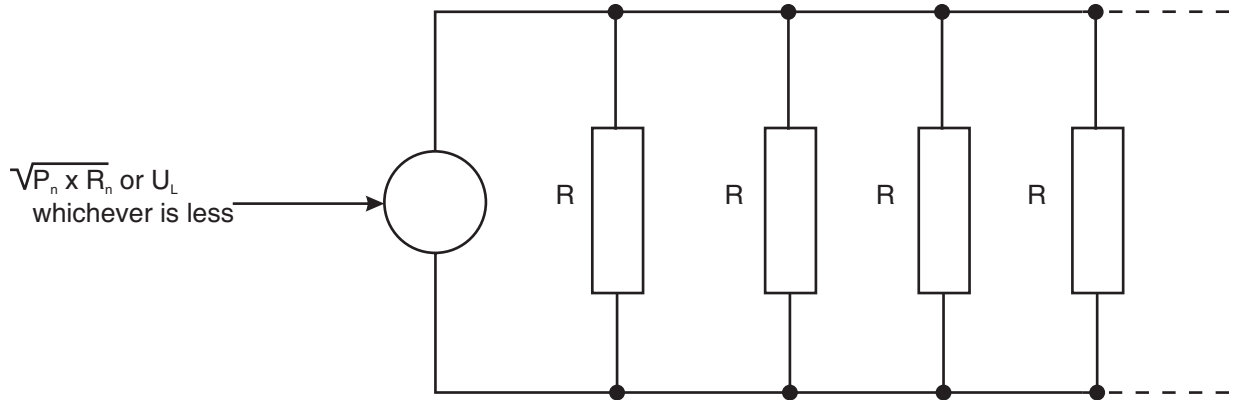
NOTES:

- Whichever is greater.

Table 5 - CONDITIONS FOR BURN-IN AND OPERATING LIFE

| No. | Characteristics | Symbol | Condition | Unit |
|-----|---------------------|-----------|---|------------------|
| 1 | Ambient Temperature | T_{amb} | $+70 \pm 3$ | $^\circ\text{C}$ |
| 2 | Test Voltage | V_T | $\sqrt{(P_n \times R_n)}$ or U_L whichever is less | V |

FIGURE 5 - ELECTRICAL CIRCUIT FOR BURN-IN AND OPERATING LIFE



4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESCC GENERIC SPECIFICATION NO. 4001)

The resistors shall be mounted as prescribed in ESCC Generic Specification No. 4001, Para. 9.20. The substrate material shall be glass polyimide, except for high and low temperature measurements where alumina is required.

4.8.1 Measurements and Inspections on Completion of Environmental Tests

The parameters to be measured and inspections to be performed on completion of environmental tests are scheduled in Table 6. Unless otherwise stated, the measurements shall be performed at $T_{amb}=+22\pm 3^{\circ}\text{C}$.

4.8.2 Measurements and Inspections at Intermediate Points During Endurance Tests

The parameters to be measured and inspections to be performed at intermediate points during endurance tests are scheduled in Table 6. Unless otherwise stated, the measurements shall be performed at $T_{amb}=+22\pm 3^{\circ}\text{C}$.

4.8.3 Measurements and Inspections on Completion of Endurance Tests

The parameters to be measured and inspections to be performed on completion of endurance tests are scheduled in Table 6. Unless otherwise stated, the measurements shall be performed at $T_{amb}=+22\pm 3^{\circ}\text{C}$.

4.8.4 Conditions for Operating Life

The requirements for operating life test are specified in Section 9 of ESCC Generic Specification No. 4001. The conditions for operating life testing shall be as specified in Table 5 of this specification.

4.8.5 Electrical Circuit for Operating Life (Figure 5)

The electrical circuit for use in performing the operating life test is shown in Figure 5 of this specification.

4.8.6 Conditions for High Temperature Storage Test (Part of Endurance Test)

The requirements for the high temperature storage test are specified in ESCC Generic Specification No. 4001. The conditions for high temperature storage shall be $T_{amb} = +155 (+0 -5)^{\circ}\text{C}$.

Table 6 - MEASUREMENTS AND INSPECTIONS ON COMPLETION OF ENVIRONMENTAL TESTS AND AT INTERMEDIATE POINTS AND ON COMPLETION OF ENDURANCE TESTING

| No. | ESCC Generic Spec. No. 4001 | | Measurements and Inspections | | Symbol | Limits | | Unit | | | |
|---------------------------|--|---|--|---|--|--------------------|--|---------------------------------|--------|---|---|
| | Environmental and Endurance Tests (Note 1) | Test Methods and Conditions | Identification | Conditions | | Min | Max | | | | |
| 01 | Overload | Para. 9.1 and Paras 4.2.2 and 4.2.4 of this spec. | <u>Initial Measurements</u> | Table 2 Item 1 After a recovery period of 1-2 hrs No evidence of damage and marking legible | R _A | Record Values | | Ω | | | |
| | | | Resistance | | | | | | | | |
| | | | <u>Final Measurements</u> | | | | | | | | |
| | | | Visual Examination | | | | | | | | |
| | | | Chart II Resistance | Table 2 item 1 | R _A | Table 2 Item 1 | | Ω | | | |
| | | | Chart IV Resistance Change | Table 2 Item 1 | ΔR _A /R _A | Note 4 | | % | | | |
| 02 | Seal Test (Hermetically Sealed only) | Para. 9.3 | Not applicable | - | - | - | - | - | | | |
| 03 | Insulation Resistance (Insulated only) | Para. 9.6 | <u>Final Measurements</u> Insulation Resistance | Para. 9.6.2 of ESCC 4001 (Note 2) | R _i | 1000 | - | MΩ | | | |
| 04 | Temperature Coefficient | Para. 9.7 Procedure I | Temperature Coefficient | Para. 9.5.1 of ESCC 4001 | TC | -100 -200 | +100 +200 | 10 ⁻⁶ /°C | | | |
| 05 | Voltage Proof | Para. 9.8.2 | <u>During test</u> | 1.4 x U ₁ for 60 ± 5 sec (Note 3) | - | - | - | - | | | |
| | | | Visual Examination | No breakdown or flashover | - | - | - | - | | | |
| 06 | Solderability | Para. 9.9 Procedure I | <u>Initial Measurements</u> | After Drying Table 2 item 1 24 ± 4hrs after soldering Table 2 Item 1 | R _A | Record Values | | Ω | | | |
| | | | Resistance | | | | | | | | |
| | | | <u>Final Measurements</u> | | | | | | | | |
| | | | Resistance Change | | ΔR _A /R _A | Note 5 | | % | | | |
| 07 | Robustness of Terminations | Para. 9.10.2 | - | After Mounting | | | | | | | |
| | | | Adhesion | <u>Initial Measurements</u> | Table 2 Item 1 | R _A | Record Values | | Ω | | |
| | | | | Resistance | | | | | | | |
| | | | | <u>Final Measurements</u> | | | | | | | |
| | | | | | | Resistance Change | Table 2 Item 1 | ΔR _A /R _A | Note 5 | | % |
| | | | | | | Visual Examination | No damage, lifting, cracking or dry joints | - | - | - | - |
| | | | Bend Strength of End Plate Facing | <u>Initial Measurements</u> | Table 2 Item 1 Board in bent position | R _A | Record Values | | Ω | | |
| | | | | Resistance | | | | | | | |
| <u>Final Measurements</u> | | | | | | | | | | | |
| Resistance Change | Table 2 Item 1 | ΔR _A /R _A | | Note 5 | | | | | | % | |
| | | | Visual Examination | No damage, lifting, cracking or dry joints | - | - | - | - | | | |

| No. | ESCC Generic Spec. No. 4001 | | Measurements and Inspections | | Symbol | Limits | | Unit |
|--------------------|--|--|----------------------------------|---|------------------|---------------|-----|------------|
| | Environmental and Endurance Tests (Note 1) | Test Methods and Conditions | Identification | Conditions | | Min | Max | |
| 08 | Resistance to Soldering Heat | Para. 9.11 Procedure I | <u>Initial Measurements</u> | After Drying Table 2 Item 1 | R_A | Record Values | | Ω |
| | | | Resistance | | - | - | - | |
| | | | <u>Final Measurements</u> | No evidence of damage and marking legible | - | - | - | |
| | | | Visual Examination | | | | | |
| | | | Resistance Change | Table 2 Item 1 | $\Delta R_A/R_A$ | Note 4 | | % |
| 09 | Rapid Change of Temperature | Para. 9.12 | <u>Initial Measurements</u> | Table 2 item 1 | R_A | Record Values | | Ω |
| | | | Resistance | After a recovery period of 1-2 hrs | - | - | - | |
| | | | <u>Final Measurements</u> | No evidence of damage | - | - | - | |
| | | | Visual Examination | Table 2 Item 1 | - | - | - | |
| | | | Resistance Change | Table 2 Item 1 | $\Delta R_A/R_A$ | Note 5 | | % |
| 10 | Vibration | Para. 9.13 and Paras 4.2.4 and 4.2.5 of this spec. | Not applicable | - | - | - | - | - |
| 11 | Climatic Sequence | Para. 9.14 Procedure I | <u>Initial Measurements</u> | After Drying Table 2 Item 1 | R_A | Record Values | | Ω |
| | | | Resistance | Following completion of DC load test and after a recovery period of 1-2 hrs | - | - | - | |
| | | | <u>Final Measurements</u> | No evidence of damage and marking legible | - | - | - | |
| | | | Visual Examination | Table 2 Item 1 | - | - | - | |
| | | | Resistance Change | Para. 9.6 of ESCC 4001 (Note 2) | $\Delta R_A/R_A$ | Note 6 | | % |
| | | | Insulation Resistance | | R_i | 1000 | - | M Ω |
| 12 | Operating Life | Para. 9.15 Chart IV | <u>Initial Measurements</u> | Table 2 Item 1 | R_A | Record Values | | Ω |
| | | | Resistance | After a recovery period of 1-2 hrs | - | - | - | |
| | | | <u>Intermediate Measurements</u> | No evidence of damage | - | - | - | |
| | | | (1000 hrs) | Table 2 Item 1 | - | - | - | |
| | | | Visual Examination | | - | - | - | |
| | | | Resistance Change | Table 2, Item 1 | $\Delta R_A/R_A$ | Note 6 | | % |
| | | | <u>Final Measurements</u> | After a recovery period of 1-2 hrs | - | - | - | |
| | | | (2000 hrs) | No evidence of damage | - | - | - | |
| Visual Examination | Table 2, Item 1 | - | - | - | | | | |
| Resistance Change | Para. 9.6 of ESCC 4001 (Note 2) | $\Delta R_A/R_A$ | Note 7 | | % | | | |
| | | | Insulation Resistance | | R_i | 1000 | - | M Ω |

| No. | ESCC Generic Spec. No. 4001 | | Measurements and Inspections | | Symbol | Limits | | Unit |
|-----|--|-----------------------------|---|--|--|---|---|------|
| | Environmental and Endurance Tests (Note 1) | Test Methods and Conditions | Identification | Conditions | | Min | Max | |
| | | Para. 9.15 Chart V | <u>Initial Measurements</u> Resistance <u>Final Measurements</u> (1000 hrs) Visual Examination Resistance Change Insulation Resistance | Table 2 Item 1 After a recovery period of 1 -2 hrs No evidence of damage Table 2 Item 1 Para. 9.6 of ESCC 4001 (Note 2) | R_A - $\Delta R_A/R_A$ R_i | Record Values - Note 6 1000 - | Ω - % $M\Omega$ | |
| 13 | High Temperature Storage | Para. 9.16 | <u>Initial Measurements</u> Resistance <u>Intermediate</u> <u>Measurements</u> (1000 hrs) Visual Examination Resistance Change <u>Final Measurements</u> (2000 hrs) Visual Examination Resistance Change Insulation Resistance | Table 2 Item 1 After a recovery period of 1-2 hrs No evidence of damage Table 2 Item 1 After a recovery period of 1-2 hrs No evidence of damage Table 2 Item 1 Para. 9.6 of ESCC 4001 (Note 2) | R_A - $\Delta R_A/R_A$ - $\Delta R_A/R_A$ R_i | Record Values - Note 6 Note 7 1000 - | Ω - % - % $M\Omega$ | |
| 14 | Permanence of Marking | Para. 9.19 | - | - | - | - - | - | |

NOTES:

1. The tests in this Table refer to either Chart IV or V and shall be used as applicable.
2. Test Voltage: $V_T = 100V$
3. For value of U_i see Table 1(b) Item 4.
4. $\Delta R_A/R_A$ limit : $\pm(0.5 + 0.05\Omega \times 100/R_n)\%$
5. $\Delta R_A/R_A$ limit : $\pm(0.25 + 0.05\Omega \times 100/R_n)\%$
6. $\Delta R_A/R_A$ limit : $\pm(1 + 0.05\Omega \times 100/R_n)\%$
7. $\Delta R_A/R_A$ limit : $\pm(1.5 + 0.05\Omega \times 100/R_n)\%$

APPENDIX A**AGREED DEVIATIONS FOR VISHAY SFERNICE(F)**

| Items Affected | Description of Deviations |
|---|---|
| Deviations from Final Production Tests (Chart II) | Para. 9.4 Dimension Check: Guaranteed but not tested. |
| Deviations from Qualification Tests (Chart IV) | Para. 9.19 Permanence of Marking: Not applicable |
| Deviations from Lot Acceptance Tests (Chart V) | Para. 9.19 Permanence of Marking: Not applicable |