# THERMISTORS (THERMALLY SENSITIVE RESISTORS), NTC, 4000 OHMS AT +25°C WITH A TEMPERATURE RANGE OF -55 TO +115°C BASED ON TYPE 4K3A356

## ESCC Detail Specification No. 4006/002


| | |
|---|---|
| Issue 3 | June 2013 |


Document Custodian: European Space Agency – see https://escies.org

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## DOCUMENTATION CHANGE NOTICE

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| DCR No. | CHANGE DESCRIPTION |
|---|---|
| 782 | Specification upissued to include editorial and technical changes per DCR.<br>Specification converted to MSWord. Changes in presentation are possible. |

**TABLE OF CONTENTS**

## 1 GENERAL

1.1 SCOPE

This specification details the ratings, physical and electrical characteristics, test and inspection data for Thermistors (Thermally Sensitive Resistors), NTC, 4000 Ohms at +25°C with a Temperature Range of -55 to +115°C, based on Type 4K3A356. It shall be read in conjunction with ESCC Generic Specification No. 4006, the requirements of which are supplemented herein.

1.2 TYPE VARIANTS

Variants of the basic type thermistors specified herein, which are also 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 thermistors specified herein, are as scheduled in Table 1(b).

1.4 PARAMETER DERATING INFORMATION (FIGURE 1)

Not applicable.

1.5 PHYSICAL DIMENSIONS

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

1.6 FUNCTIONAL DIAGRAM

The functional diagram for the thermistors 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. 4006, Thermistors (Resistors, Thermally Sensitive).
(b) IEC 60410, Sampling Procedures and Tables for Inspections by Attributes.
(c) MIL-STD-202, Test Methods for Electronic and Electrical Component Parts.

## 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. In addition, the following symbols are used:

NTC = Negative Temperature Coefficient.

$R_Z$ = Zero Power Resistance.

## TABLE 1(a) - TYPE VARIANTS

| (1) Variant | (2) Based On Type | (3) $R_Z$ (Note 1) | (4) Resistance/Temperature Characteristics (Note 2) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | -55°C | -40°C | -25°C | 0°C | +25°C | +50°C | +70°C | +100°C | +115°C |
| 01 | 4K3A356 | Nom. (Ω) | 408340 | 140400 | 53740 | 13240 | 4000 | 1428.4 | 688.5 | 263.20 | 172.00 |
| | | Tol. (± %) | 3.30 | 2.50 | 2.00 | 1.00 | 0.84 | 0.74 | 0.65 | 0.57 | 1.50 |

**NOTES:**
1. For test purposes, when zero power is dissipated and the ambient temperature is held as specified, the value is referred to as $R_Z$ (Zero Power Resistance).
2. The reference resistance is specified at +25°C.

## TABLE 1(b) - MAXIMUM RATINGS

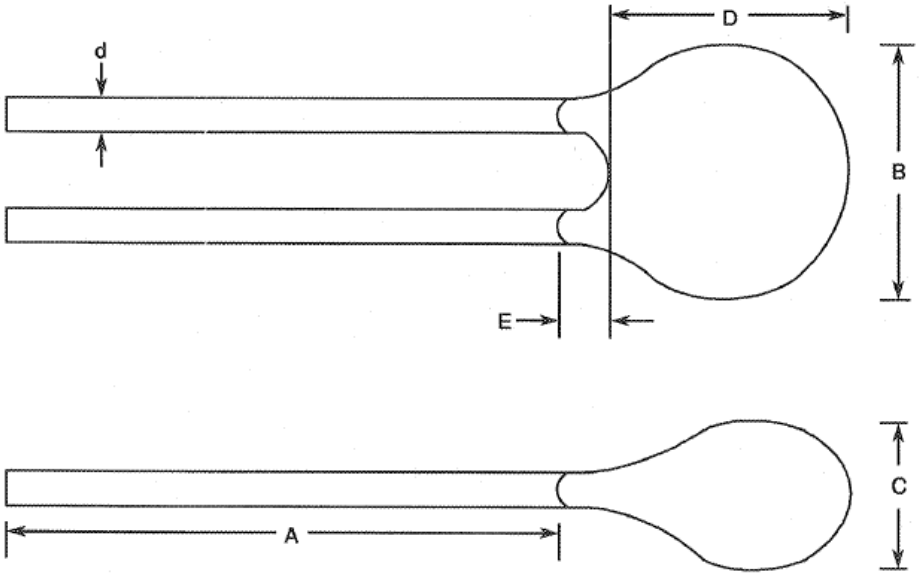
| No. | Characteristics | Symbol | Maximum Ratings | Unit | Remarks |
|---|---|---|---|---|---|
| 1 | Power Dissipation | $P_D$ | 2 | mW | Note 1 |
| 2 | Operating Temperature Range | $T_{op}$ | Note 2 | ºC | |
| 3 | Storage Temperature Range | $T_{stg}$ | Note 3 | ºC | |
| 4 | Soldering Temperature | $T_{sol}$ | +245 | ºC | Note 4 |

**NOTES:**
1. Never to be exceeded in the temperature measurement mode. The thermistors specified herein shall not be used in the self-heat mode.
2. See Column 4 of Table 1(a).
3. -55°C to the Maximum Operating Temperature in Column 4 of Table 1(a).
4. Duration 10 seconds maximum at a distance of not less than 10mm from the device body and the same lead shall not be resoldered until 3 minutes have elapsed.

## FIGURE 1 - PARAMETER DERATING INFORMATION

Not applicable.

**FIGURE 2 - PHYSICAL DIMENSIONS**

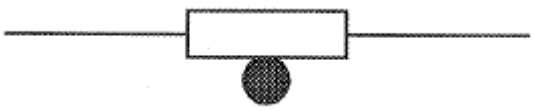



| Symbol | Millimetres | |
|---|---|---|
| | Min. | Max. |
| A | 50.8 | - |
| B | - | 2.29 |
| C | - | 2.29 |
| D | - | 3.5 |
| d | 0.23 | 0.28 |
| E | - | 1.6 |

**NOTES:**

1. The leads shall not be bent, or the means of fastening them cause bending in any direction within a distance of 15mm from the centre of the thermistor.
2. All dimensions are in millimetres.

**FIGURE 3 - FUNCTIONAL DIAGRAM**



## 4 REQUIREMENTS

### 4.1 GENERAL

The complete requirements for procurement of the thermistors specified herein are stated in this specification and ESCC Generic Specification No. 4006 for Thermistors (Resistors, Thermally Sensitive). Deviations from the Generic Specification, applicable to this specification only, are listed in Para. 4.2.

Deviations from the applicable 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) Thermal Shock: Test Condition 'C' except that the maximum temperature shall be the maximum operating temperature specified in Column 4 of Table 1(a) of this specification.

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

None.

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

(a) Thermal Shock: Test Condition 'C' except that the maximum temperature shall be the maximum operating temperature specified in Column 4 of Table 1(a) of this specification.
(b) Para. 9.3.1.2, Dissipation Constant: Not Applicable.
(c) Para. 9.15, Short Time Overload: Not Applicable.
(d) Para. 9.17, High Temperature Storage: Not Applicable.
(e) Para. 9.20, Permanence of Marking: Not Applicable.

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

(a) Thermal Shock: Test Condition 'C' except that the maximum temperature shall be the maximum operating temperature specified in Column 4 of Table 1(a) of this specification.
(b) Para. 9.20, Permanence of Marking: Not Applicable.

### 4.3 MECHANICAL REQUIREMENTS

#### 4.3.1 Dimension Check

The dimensions of the thermistors specified herein shall be verified in accordance with the requirements set out in Para. 9.4 of ESCC Generic Specification No. 4006 and they shall conform to those shown in Figure 2 of this specification.

#### 4.3.2 Weight

The maximum weight of the thermistors specified herein shall be 0.1 grammes.

4.3.3 Terminal Strength

The requirements for terminal strength testing are specified in Para. 9.13 of ESCC Generic Specification No. 4006. The test conditions shall be as follows:

Applied Force: 4.45 (+1.1, -0) N.
Duration: 5 seconds.

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 thermistors 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 thermistor shall be covered with an epoxy encapsulant.

4.4.2 Lead Material and Finish

The lead material shall be Type 'A' with Type '3' 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 the component in its primary package.

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

(a) The ESA Symbol, for qualified components only.
(b) The ESCC Component Number.
(c) Traceability Information.

4.5.2 The ESCC Component Number

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

Example: 400600201B

- Detail Specification Number: 4006002
- Type Variant (see Table 1(a)): 01
- Testing Level (B or C, as applicable): B

4.5.3 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, the measurements shall be performed at $T_{amb}$ = +25 ±0.01°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 temperature tolerance shall be ±0.01°C.

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 specified in Table 4 of this specification. Unless otherwise stated, measurements shall be performed at $T_{amb}$ = +25 ±0.01°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 value 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. 4006. The conditions for burn-in shall be as specified in Table 5 of this specification.

4.7.3 Electrical Circuits for Burn-in (Figure 5)
Not applicable.

**TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE - DC PARAMETERS**

| No. | Characteristics | Symbol | ESCC 4006 Test Method And Conditions | Limits | | Unit |
|---|---|---|---|---|---|---|
| | | | | Min. | Max. | |
| 1 | Zero Power Resistance | $R_Z$ | Para. 9.3.1.1 | Note 1 | | Ω |
| 2 | Insulation Resistance | $R_I$ | Para. 9.3.1.4<br>$T_{amb}$ = +25 ±1°C<br>Note 2 | 100 | - | MΩ |
| 3 | Thermal Time Constant | KH | Para. 9.3.1.3<br>$T_{amb}$ = +25 ±1°C<br>In Still Air<br>Note 3 | - | 25 | Sec. |

**NOTES:**
1. See Column 4 of Table 1(a) for resistance values.
2. If more than 20 devices have to be measured, the test shall be performed on a sample basis in accordance with Level II, Single Sampling Plan for Normal Inspection, AQL = 1.0 of IEC 60410.
3. Test to be performed on 10 samples during Chart II only.

**TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES**

| No. | Characteristics | Symbol | ESCC 4006 Test Method And Conditions | Limits | | Unit |
|---|---|---|---|---|---|---|
| | | | | Min. | Max. | |
| 1 | Zero Power Resistance | $R_Z$ | Para. 9.3.1.1<br>At each specified temperature, over operating range | Note 1 | | Ω |

**NOTES:**
1. See Column 4 of Table 1(a) for resistance values.

## FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS

Not applicable.

## TABLE 4 - PARAMETER DRIFT VALUES

| No. | Characteristics | Symbol | Test Method And Conditions | Change Limits (Δ) | Unit |
|---|---|---|---|---|---|
| 1 | Zero Power Resistance Change | $\Delta R_Z/R_Z$ | As per Table 2 | ±0.2 | % |

## TABLE 5 - CONDITIONS FOR BURN-IN AND OPERATING LIFE TESTS

| No. | Characteristics | Symbol | Conditions | Unit |
|---|---|---|---|---|
| 1 | Ambient Temperature | $T_{amb}$ | Note 1<br>Note 2 | °C |
| 2 | Power Dissipation | $P_D$ | 2 | mW |

**NOTES:**

1. Maximum Operating Temperature specified in Column 4 of Table 1(a).
2. The Temperature Tolerance = (+0 -3°C).

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

Not applicable.

4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESCC GENERIC SPECIFICATION NO. 4006)

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 2. Unless otherwise stated, the measurements shall be performed at $T_{amb}$ = +25 ±0.01°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 $T_{amb}$ = +25 ±0.01°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 $T_{amb}$ = +25 ±0.01°C.

4.8.4 Conditions for Operating Life Tests (Part of Endurance Testing)
The requirements for operating life testing are specified in Section 9 of ESCC Generic Specification No. 4006. The conditions for operating life testing shall be as specified in Table 5 for the burn-in test.

4.8.5 Electrical Circuits for Operating Life Tests
Not applicable.

## 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. 4006 | | Measurements and Inspections | | Symbols | Limits | | Unit |
|---|---|---|---|---|---|---|---|---|
| | Environmental and Endurance Tests (1) | Test Method and Conditions | Identification | Conditions | | Min | Max | |
| 01 | Thermal Shock | Para. 9.2 (2) | - | - | - | - | - | - |
| 02 | Thermal Time Constant | Para. 9.3.1.3 in Still Air | **Initial Measurements** | | | | | |
| | | | Zero Power Resistance | 9.3.1.3(c) | $R_Z$ | Record Values | | Ω |
| | | | **Final Measurements** | | | | | |
| | | | Thermal Time Constant | 9.3.1.3(f) | KH | - | 25 | Sec. |
| 03 | External Visual Inspection | Para. 9.5 | ESCC 20500 | - | - | - | - | - |
| 04 | Shock (Specified Pulse) | Para. 9.7 | **Initial Measurements** | | | | | |
| | | | Zero Power Resistance | Table 2 Item 1 | $R_Z$ | Table 2 Item 1 | | Ω |
| | | | **During Shock** | | | | | |
| | | | Intermittent Contact | Open or short circuit | - | - | - | - |
| | | | **After Shock** | | | | | |
| | | | Zero Power Resistance Change | Table 2 Item 1 | $\Delta R_Z/R_Z$ | -2 | +2 | % |
| | | | Visual Examination | Evidence of damage | | - | - | - |
| 05 | Vibration | Para. 9.8 | **Initial Measurements** | | | | | |
| | | | Zero Power Resistance | Table 2 Item 1 | $R_Z$ | Table 2 Item 1 | | Ω |
| | | | **During Vibration** | | | | | |
| | | | Intermittent Contact | Open or Short Circuiting | - | - | - | - |
| | | | **After Vibration** | | | | | |
| | | | Zero Power Resistance Change | Table 2 Item 1 | $\Delta R_Z/R_Z$ | -2 | +2 | % |
| | | | Visual Examination | Evidence of damage | - | - | - | - |
| 06 | Immersion | Para. 9.9 | Visual Examination | Evidence of damage | - | - | - | - |
| 07 | Dielectric Withstanding Voltage | Para. 9.10 | **During Test** | | | | | |
| | | | Visual Examination | Evidence of breakdown or flashover | - | - | - | - |
| | | | **After Test** | | | | | |
| | | | Visual Examination | Evidence of damage, arcing or breakdown | - | - | - | - |
| 08 | Resistance to Soldering Heat | Para. 9.11 | **After Test** | After a recovery period of 24±4 hours | | | | |
| | | | Zero Power Resistance | Table 2 Item 1 | $R_Z$ | Table 2 Item 1 | | Ω |
| | | | Visual Examination | Evidence of damage | - | - | - | - |

| No. | ESCC Generic Spec. No. 4006 | | Measurements and Inspections | | Symbols | Limits | | Unit |
|---|---|---|---|---|---|---|---|---|
| | Environmental and Endurance Tests (1) | Test Method and Conditions | Identification | Conditions | | Min | Max | |
| 09 | Moisture Resistance | Para. 9.12 | **Initial Measurements** | Not less than 1.5 hrs after removal from drying oven | | | | |
| | | | Zero Power Resistance | Table 2 Item 1 | $R_Z$ | Table 2 Item 1 | | Ω |
| | | | **Final Measurements** | Within 24 hrs of removal from 1.5 to 3.5 hr conditioning | | | | |
| | | | Zero Power Resistance Change | Table 2 Item 1 | $\Delta R_Z/R_Z$ | -2 | +2 | % |
| | | | Insulation Resistance | Table 2 Item 2 | $R_I$ | 100 | - | MΩ |
| 10 | Terminal Strength | Para. 9.13 | **Initial Measurements** | | | | | |
| | | | Zero Power Resistance | Table 2 Item 1 | $R_Z$ | Table 2 Item 1 | | Ω |
| | | | **Final Measurements** | | | | | |
| | | | Zero Power Resistance Change | Table 2 Item 1 | $\Delta R_Z/R_Z$ | -2 | +2 | % |
| | | | Visual Examination | Evidence of damage | - | - | - | - |
| 11 | Operating Life | Para. 9.14 | **Initial Measurements** | | | | | |
| | | | Zero Power Resistance | Table 2 Item 1 | $R_Z$ | Table 2 Item 1 | | Ω |
| | | | **Intermediate Measurements** | | | | | |
| | | | Zero Power Resistance Change | Table 2 Item 1 | $\Delta R_Z/R_Z$ | -2 | +2 | % |
| | | | Insulation Resistance | Table 2 Item 2 | $R_I$ | 100 | - | MΩ |
| | | | **Final Measurements** | | | | | |
| | | | Zero Power Resistance Change | Table 2 Item 1 | $\Delta R_Z/R_Z$ | -2 | +2 | % |
| | | | Insulation Resistance | Table 2 Item 2 | $R_I$ | 100 | - | MΩ |
| 12 | Low Temperature Storage | Para. 9.16 | **Initial Measurements** | | | | | |
| | | | Zero Power Resistance | Table 2 Item 1 | $R_Z$ | Table 2 Item 1 | | Ω |
| | | | **Final Measurements** | | | | | |
| | | | Zero Power Resistance Change | Table 2 Item 1 | $\Delta R_Z/R_Z$ | -2 | +2 | % |
| | | | Visual Examination | Evidence of damage | - | - | - | - |
| 13 | Solderability | Para. 9.18 | - | - | - | - | - | - |

**NOTES:**

1. The tests in this Table refer to either Chart IV or V and shall be used as applicable.
2. Thermal Shock Test Method and Conditions shall use the deviation of this specification as applicable.

## APPENDIX 'A'

AGREED DEVIATIONS FOR MEAS IRELAND (BETATHERM) LTD.

| ITEMS AFFECTED | DESCRIPTION OF DEVIATIONS |
|---|---|
| Para. 4.2.2 Deviations from Final Production Tests (Chart II) | Para. 9.3.1.4, Insulation Resistance<br>Insulation Resistance may be measured in accordance with MEAS Ireland (Betatherm) Ltd Specification Ref. MFG 12-49-00. |
| Para. 4.2.3 Deviations from Burn-in and Electrical Measurements (Chart III) | |
| Para. 4.2.4 Deviations from Qualification Tests (Chart IV) | |
| Para. 4.2.5 Deviations from Lot Acceptance Tests (Chart V) | |
| Table 5 – Conditions for Burn-in and Operating Life Tests | The Burn-in shall be performed without application of power, therefore the Power Dissipation ($P_D$) condition shall be 0W. |