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THERMISTORS

(THERMALLY SENSITIVE RESISTORS)

NTC, CHIP STYLE

BASED ON SERIES 196-XXX XAG-001

ESA/SCC Detail Specification No. 4006/012

space components
coordination group

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DOCUMENTATION CHANGE NOTICE

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APPENDICES (Applicable to specific Manufacturers only)
None.

1. GENERAL

1.1 SCOPE

This specification details the ratings, physical and electrical characteristics, test and inspection data for Thermistors, Thermally Sensitive Resistors, NTC, Chip Style, based on Series 196-XXX-XAG-001. It shall be read in conjunction with ESA/SCC Generic Specification No. 4006, the requirements of which are supplemented herein.

1.2 COMPONENT 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

The derating information, applicable to the thermistors specified herein, is shown in Figure 1.

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) ESA/SCC Generic Specification No. 4006, Thermistors (Resistors, Thermally Sensitive).

(b) IEC Publication No. 410, Sampling Plans and Procedures for Inspections by Attributes.

3. TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS

For the purpose of this specification, the terms, definitions, abbreviations, symbols and units specified in ESA/SCC 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	RESISTOR VALUE (Ω) (NOTE 1) (4)									
			−40°C	−20°C	0°C	+20°C	+25°C (NOTE 2)	+40°C	+60°C	+80°C	+100°C	+125°C
01, 14	196-101CAG	Min.	1k37	523R	225R	107R	90R0	53R7	28R8	16R5	10R0	-
		Max	1k93	700R	288R	132R	110R	67R5	37R5	22R1	13R8	-
02, 15	196-301CAG	Min.	4k12	1k57	675R	321R	270R	161R	86R5	49R6	30R1	-
		Max	5k79	2k10	864R	395R	330R	203R	112R	66R3	41R3	-
03, 16	196-501DAG	Min.	7k72	2k85	1k18	540R	450R	261R	135R	74R7	43R7	23R9
		Max	10k8	3k80	1k51	664R	550R	328R	176R	99R8	59R9	33R8
04, 17	196-102DAG	Min.	15k4	5k69	2k36	1k08	900R	522R	270R	149R	87R3	47R7
		Max	21k7	7k61	3k02	1k33	1k10	656R	351R	200R	120R	67R7
05, 18	196-202LAG	Min.	57k4	16k9	5k78	2k24	1k80	948R	438R	219R	117R	58R3
		Max	77k2	21k9	7k28	2k75	2k20	1k18	557R	284R	155R	78R4
06, 19	196-302LAG	Min.	86k1	25k3	8k67	3k36	2k70	1k42	657R	328R	176R	87R4
		Max	116k	32k9	10k9	4k13	3k30	1k77	836R	426R	232R	118R
07, 20	196-502LAG	Min.	143k	42k2	14k4	5k61	4k50	2k37	1k09	547R	293R	146R
		Max	193k	54k8	18k2	6k88	5k50	2k96	1k39	711R	387R	196R
08, 21	196-103LAG	Min.	287k	84k4	28k9	11k2	9k00	4k74	2k19	1k09	586R	291R
		Max	386k	110k	36k4	13k8	11k0	5k91	2k79	1k42	774R	392R
09, 22	196-203LAG	Min.	574k	169k	57k8	22k4	18k0	9k48	4k38	2k19	1k17	583R
		Max	772k	219k	72k8	27k5	22k0	11k8	5k57	2k84	1k55	784R
10, 23	196-303KAG	Min.	768k	238k	84k2	33k5	27k0	14k3	6k65	3k33	1k78	877R
		Max	1M05	311k	107k	41k2	33k0	17k9	8k51	4k35	2k37	1k19
11, 24	196-503QAG	Min.	1M68	469k	154k	56k8	45k0	22k6	9k78	4k61	2k33	1k08
		Max	2M39	634k	197k	69k9	55k0	28k5	12k8	6k23	3k24	1k56
12, 25	196-104QAC	Min.	3M35	937k	307k	114k	90k0	45k1	19k6	9k22	4k66	2k17
		Max	4M79	1M27	395k	140k	110k	57k0	25k6	12k5	6k48	3k11
13, 26	196-204CAG	Min.	6M70	1M87	614k	227k	180k	90k2	39k1	18k4	9k32	4k33
		Max	9M57	2M54	790k	280k	220k	114k	51k3	24k9	13k0	6k22

NOTES: See Page 7.

TABLE 1(a) - TYPE VARIANTS (CONTINUED)

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). The resistance tolerance of ±10% of the nominal value is included in the limits given.
2. The reference resistance is specified at +25°C.
3. For Variant termination information, see Para. 4.4.2.

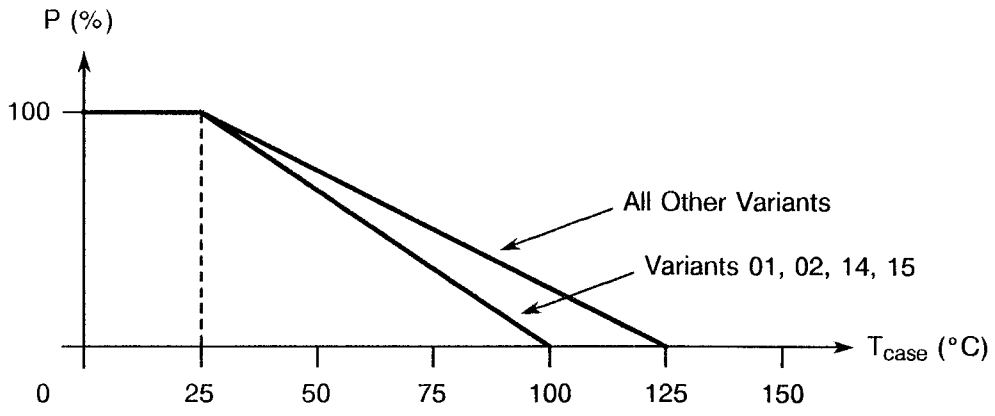
TABLE 1(b) - MAXIMUM RATINGS

No.	CHARACTERISTICS	SYMBOL	MAXIMUM RATINGS	UNIT	REMARKS
1	Power Dissipation	P_D	100	mW	Note 1
2	Operating Temperature Range Variants 01, 02, 14, 15 All Other Variants	T_{op}	 −40 to +100 −40 to +125	°C	
3	Storage Temperature Range	T_{stg}	−40 to +125	°C	
4	Soldering Temperature	T_{sol}	+220	°C	Note 2

NOTES

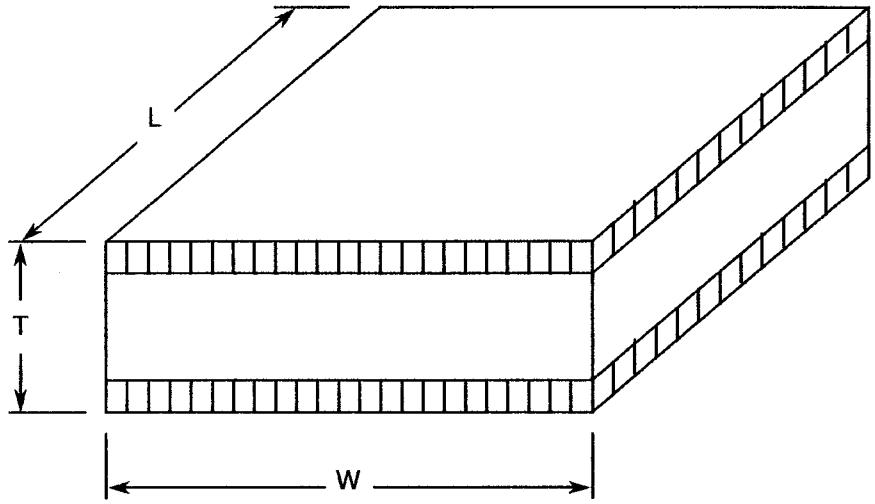
1. Only applicable if a heatsink is used. For $T_{case} \leq +25°C$. For derating at $T_{case} > +25°C$, see Figure 1.
2. Duration 1 second maximum and the same chip shall not be resoldered until 3 minutes have elapsed.

FIGURE 1 - PARAMETER DERATING INFORMATION



Power Dissipation versus Chip Temperature

FIGURE 2 - PHYSICAL DIMENSIONS



SYMBOL	MILLIMETRES		NOTES
	MIN.	MAX.	
L	1.02	2.03	For Variants 05 and 18
	1.02	1.71	For All Other Variants
T	0.26	1.02	
W	1.02	2.03	For Variants 05 and 18
	1.02	1.71	For All Other Variants

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 ESA/SCC 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 ESA/SCC 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. 9.19, Assembly: Not applicable.

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

(a) Para. 9.6, Radiographic Inspection: Not applicable.

4.2.4 Deviations from Qualification Tests (Chart IV)

(a) Para. 9.10, Dielectric Withstanding Voltage: Not applicable.

(b) Para. 9.20, Permanence of Marking: Not applicable.

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

(a) Para. 9.10, Dielectric Withstanding Voltage: Not applicable.

(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 ESA/SCC 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 0.3 grammes.

4.3.3 Terminal Strength

Not applicable.

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

Not applicable.

4.4.2 Termination Finishes

The termination finish shall be as follows:-
Variants 01 to 13 : Oxide bonded thick film gold, 0.005 to 0.010 mm.
Variants 14 to 26 : Thick film silver, 0.013 to 0.026 mm.

4.5 MARKING

4.5.1 General

The marking of all components delivered to this specification shall be in accordance with the requirements of ESA/SCC 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.

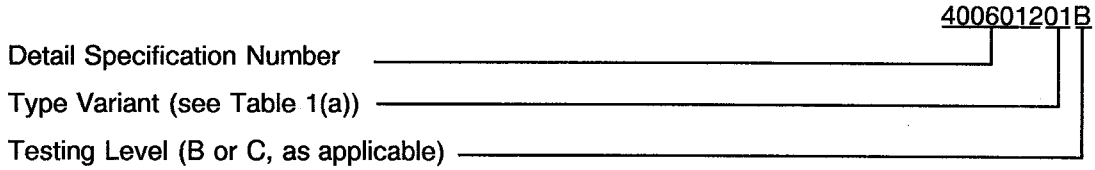
The information to be marked and the order of precedence, shall be as follows:-

(a) The SCC Component Number.

(b) Traceability Information.

4.5.2 The SCC Component Number

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



4.5.3 Traceability Information

Each component shall be marked in respect of traceability information in accordance with the requirements of ESA/SCC 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 $T_{amb} = +25 \pm 0.05$ °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.

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 $T_{amb} = +25 \pm 0.05$ °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 ESA/SCC 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 - d.c. PARAMETERS

No.	CHARACTERISTICS	SYMBOL	ESA/SCC 4006 TEST METHOD AND CONDITION	LIMITS		UNIT
				MIN.	MAX.	
1	Zero Power Resistance	R_Z	Para. 9.3.1.1 T_{amb} = +25°C	Table 1(a)		Ω
2	Dissipation Constant in Still Air	K_{DISS}	Para. 9.3.1.2 Note 1	0.5	-	mW/°C
3	Thermal Time Constant in Still Air	KH	Para. 9.3.1.3 Note 1	-	10	sec

NOTES

1. If more than 20 devices have to be measured, the test shall be performed on a sample basis in accordance with Level II, Table IIA, AQL = 1.0% of IEC Publication No. 410.

TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

No.	CHARACTERISTICS	SYMBOL	ESA/SCC 4006 TEST METHOD AND CONDITION (NOTE 1)	LIMITS		UNIT
				MIN.	MAX.	
1	Zero Power Resistance	R_Z	Para. 9.3.1.1 At each specified temperature, over operating range	Table 1(a)		Ω

NOTES

1. If more than 20 devices have to be measured, the test shall be performed on a sample basis in accordance with Level II, Table IIA, AQL = 1.0% of IEC Publication No. 410.

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	Zero Power Resistance	$\frac{\Delta R_Z}{R_Z}$	As per Table 2	As per Table 2	±2.0	%

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

No.	CHARACTERISTICS	SYMBOL	CONDITION	UNIT
1	Ambient Temperature Variants 01, 02, 14, 15 All Other Variants	T_{amb}	 +100(+0−3) +125(+0−3)	°C
2	Power Dissipation	P_D	No Load	-

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

Not applicable.

4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESA/SCC 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 $T_{amb} = +25 \pm 0.05$ °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 $T_{amb} = +25 \pm 0.05$ °C.

4.8.2 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 $T_{amb} = +25 \pm 0.05$ °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 ESA/SCC 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 AT INTERMEDIATE POINTS AND ON COMPLETION OF ENDURANCE TESTING

No.	ESA/SCC GENERIC SPEC. No. 4006		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS		UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN.	MAX.	
01	Thermal Shock	Para. 9.2	-	-	-	-	-	-
02	Dissipation Constant	Para. 9.3.1.2	**Initial Measurements** Zero Power Resistance **Final Measurements** Dissipation Constant	 Para. 9.3.1.2(c) Para. 9.3.1.2(g)	 R_Z K_{DISS}	 Record Values Table 2 Item 2		 Ω -
03	Thermal Time Constant	Para. 9.3.1.3	**Initial Measurements** Zero Power Resistance **Final Measurements** Thermal Time Constant	 Para. 9.3.1.3(c) Para. 9.3.1.3(f)	 R_Z KH	 Record Values Table 2 Item 3		 Ω -
04	External Visual Inspection	Para. 9.3	ESA/SCC 20500	-	-	-	-	-
05	Shock (Specified Pulse)	Para. 9.7	**Initial Measurements** Zero Power Resistance **During Shock** Intermittent Contact **After Shock** Zero Power Resistance Change Visual Examination	 Table 2 Item 1 Open or Short Circuiting Table 2 Item 1 -	 R_Z - $\Delta R_Z/R_Z$ -	 Table 2 Item 1 - -2.0 -	 - +2.0 -	 - % -
06	Vibration	Para. 9.8	**Initial Measurements** Zero Power Resistance **During Vibration** Intermittent Contact **After Vibration** Zero Power Resistance Change Visual Examination	 Table 2 Item 1 Open or Short Circuiting Table 2 Item 1 -	 R_Z - $\Delta R_Z/R_Z$ -	 Table 2 Item 1 - -2.0 -	 - +2.0 -	 - % -
07	Immersion	Para. 9.9	Visual Examination	-	-	-	-	-
08	Dielectric Withstanding Voltage	Para. 9.10 and Para. 4.2.4 of this spec.	Not applicable	-	-	-	-	-
09	Resistance to Soldering Heat	Para. 9.11	**After Test** Zero Power Resistance Visual Examination	After a recovery period of 24 ± 4 hrs Table 2 Item 1 -	 R_Z -	 Table 2 Item 1 -	 -	 -

NOTES

1. The tests in this Table refer to either Chart IV or V and shall be used as applicable.
2. At −40°C, +25°C and +125°C only, except for Variants 01, 02, 14 and 15 where measurement shall be performed at −40°C, +25°C and +100°C only.

TABLE 6 - MEASUREMENTS AND INSPECTIONS AT INTERMEDIATE POINTS AND ON COMPLETION OF ENDURANCE TESTING (CONT'D)

No.	ESA/SCC GENERIC SPEC. No. 4006		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS		UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN.	MAX.	
10	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		
			Final Measurements	Within 24 hrs of removal from 1.5 to 3.5 hr conditioning				
			Zero Power Resistance Change	Table 2 Item 1	$\Delta R_Z/R_Z$	−2.0	+2.0	%
			Insulation Resistance	Not applicable	-	-	-	-
11	Terminal Strength	Para. 9.13 and Para. 4.3.3 of this spec.	Not applicable	-	-	-	-	-
12	Operating Life	Para. 9.14	**Initial Measurements**					
			Zero Power Resistance	Table 3 Item 1 (2)	R_Z	Table 3 Item 1		
			Intermediate Measurements					
			Zero Power Resistance Change	Table 3 Item 1 (2)	$\Delta R_Z/R_Z$	−2.0	+2.0	%
			Insulation Resistance	Not applicable	-	-	-	-
			Final Measurements					
			Zero Power Resistance Change	Table 3 Item 1 (2)	$\Delta R_Z/R_Z$	−2.0	+2.0	%
			Insulation Resistance	Not applicable	-	-	-	-
13	Short Time Load	Para. 9.15	Zero Power Resistance	Table 2 Item 1	R_Z	Table 2 Item 1		
			Visual Examination	-	-	-	-	-
14	Low Temperature Storage	Para. 9.16	**Initial Measurements**					
			Zero Power Resistance	Table 2 Item 1	R_Z	Table 2 Item 1		
			Final Measurements					
			Zero Power Resistance Change	Table 2 Item 1	$\Delta R_Z/R_Z$	−2.0	+2.0	%
			Visual Examination	-	-	-	-	-
15	High Temperature Storage	Para. 9.17	**Initial Measurements**					
			Zero Power Resistance	Table 2 Item 1	R_Z	Table 2 Item 1		
			Intermediate Measurements					
			Zero Power Resistance Change	Table 2 Item 1	$\Delta R_Z/R_Z$	−2.0	+2.0	%
			Insulation Resistance	Not applicable	-	-	-	-
			Final Measurements					
			Zero Power Resistance Change	Table 2 Item 1	$\Delta R_Z/R_Z$	−2.0	+2.0	%
			Insulation Resistance	Not applicable	-	-	-	-
16	Solderability	Para. 9.18	-	-	-	-	-	-
17	Permanence of Marking	Para. 9.20 and Para. 4.2.4 of this spec.	Not applicable	-	-	-	-	-

NOTES: See Page 15.