european space agency
agence spatiale européenne

Pages 1 to 18

CAPACITORS, FIXED, CHIPS, MULTIPLE LAYER, CERAMIC DIELECTRIC, HIGH FREQUENCY, TYPE I, BASED ON TYPE CHA

ESA/SCC Detail Specification No. 3009/035

space components
coordination group

Issue/Rev.	Date	Approved by	
		SCCG Chairman	ESA Director General or his Deputy
Issue 1	July 1998		

DOCUMENTATION CHANGE NOTICE

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.

TABLE OF CONTENTS

1. GENERAL

1.1 SCOPE

This specification details the ratings, physical and electrical characteristics, test and inspection data for Capacitors, Fixed, Chips, Multiple Layer, Ceramic Dielectric, High Frequency, Type I, based on Type CHA. It shall be read in conjunction with ESA/SCC Generic Specification No. 3009, the requirements of which are supplemented herein.

1.2 RANGE OF COMPONENTS

The range of capacitors covered by this specification is 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 capacitors specified herein, are scheduled in Table 1(b).

1.4 PARAMETER DERATING INFORMATION (FIGURE 1)

Not applicable.

1.5 PHYSICAL DIMENSIONS

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

1.6 FUNCTIONAL DIAGRAM

The functional diagram for the capacitors specified herein is shown in Figure 3.

2. APPLICABLE DOCUMENTS

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

(a) ESA/SCC Generic Specification No. 3009 for Capacitors, Fixed, Chips, Ceramic Dielectric, Types I and II.

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:-

TC = Temperature Coefficient.

V_T = Test Voltage.

TABLE 1(a) - RANGE OF COMPONENTS

(1) Capacitance (pF)	(2) Capacitance Tolerance (±)	(3) Temperature Coefficient (ppm/°C)
0.1	0.1 pF	100 ± 30
0.2	0.1 pF	
0.3	0.1, 0.25 pF	
0.4	0.1, 0.25, 0.5 pF	
0.5		
0.6		
0.7		
0.8		
0.9		
1.0		
1.1		
1.2		
1.3		
1.4		
1.5		
1.6		
1.7		
1.8		
1.9		
2.0		
2.1		
2.2		
2.4		
2.7		
3.0		
3.3		
3.6		
3.9		
4.3		
4.7		
5.1		
5.6		
6.2		
6.8	0.1, 0.25pF, 5-10-20%	
7.5		
8.2		
9.1		
10	1-2-5-10-20%	
11		
12		
13		
15		
16		
18		
20		
22		
24		
27		
30		

NOTES: See Page 7.

TABLE 1(a) - RANGE OF COMPONENTS (CONTINUED)

(1) Capacitance (pF)	(2) Capacitance Tolerance (±)	(3) Temperature Coefficient (ppm/°C)
33	1-2-5-10-20%	100 ± 30
36		
39		
43		
47		
51		
56		
62		
68		
75		
82		
91		
100		

NOTES

1. As specified in Para. 4.4.1 and Figure 2, these ranges are available in 5 Variants.

TABLE 1(b) - MAXIMUM RATINGS

No.	CHARACTERISTICS	SYMBOL	LIMITS	UNIT	REMARKS
1	Rated Voltage	U_R	50	V	
2	Operating Temperature Range	T_{op}	−55 to +125	°C	T_{amb} Without derating
3	Storage Temperature Range	T_{stg}	−55 to +125	°C	
4	Soldering Temperature	T_{sol}	+260	°C	Note 1

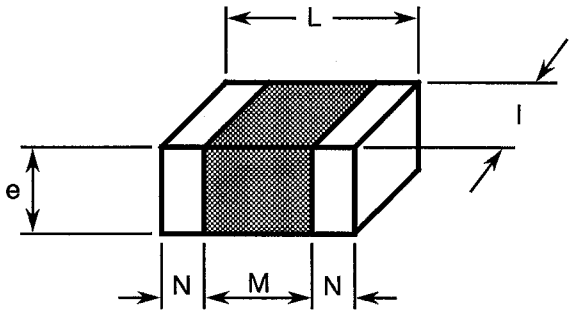
NOTES

1. Pre-heating at +150°C for 45 seconds, $t_{sol} \leq 10$ seconds.

FIGURE 1 - PARAMETER DERATING INFORMATION

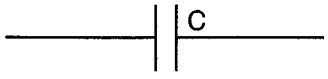
Not applicable.

FIGURE 2 - PHYSICAL DIMENSIONS



Dimensions (mm)				
	Variants 01-03-04		Variants 02-05	
	Min.	Max.	Min.	Max.
L	1.15	1.65	1.15	2.15
l	1.15	1.65	1.15	2.15
e	-	1.40	-	1.90
M	0.40	-	0.40	-
N	0.10	0.40	0.10	0.40

FIGURE 3 - FUNCTIONAL DIAGRAM



4. REQUIREMENTS

4.1 GENERAL

The complete requirements for procurement of the capacitors specified herein are stated in this specification and ESA/SCC Generic Specification No. 3009 for Capacitors, Fixed, Chips, Ceramic Dielectric, Types I and II. 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 are 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)

None.

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

None.

4.2.4 Deviations from Qualification Tests (Chart IV)

None.

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

None.

4.3 MECHANICAL REQUIREMENTS

4.3.1 Dimension Check

The dimensions of the capacitors specified herein shall be verified in accordance with the requirements set out in Para. 9.3 of ESA/SCC Generic Specification No. 3009 and they shall conform to those shown in Figure 2 of this specification.

4.3.2 Weight

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

4.3.3 Adhesion

The requirements for adhesion are specified in Para. 9.5 of ESA/SCC Generic Specification No. 3009.

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 capacitors 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 Terminations

Variant 01

The capacitors shall be terminated with AgPd pads.

Variant 02

The capacitors shall be terminated with AgPd with solder coating, 62Sn, 36Pb, 2.0Ag % for bath dipping to a maximum thickness of 120µm.

Variants 03

The capacitors shall be terminated with Au over Ni composition of 95 to 96%,
Ni thickness: min. 3.0µm, max. 7.0µm.
Au thickness: min. 0.6µm, max. 4.0µm.

Variant 04

The capacitors shall be terminated with Ni with solder coating, 90Sn, 10Pb %,
Ni thickness: min. 3.0µm, max. 7.0µm.
Solder thickness: min. 6.0µm, max. 12µm.

Variant 05

The capacitors shall be terminated with Ni with solder coating, Sn62, 36Pb, 2.0Ag % for bath dipping to a maximum thickness of 120µm.

4.4.2 Dielectric

Monolithic, ceramic or porcelain.

4.5 MARKING

4.5.1 General

The marking of all component delivered to this specification shall be in accordance with the requirments of ESA/SCC Basic Specification No. 21700 and the following paragraphs.

These components being too small to accommodate the marking as specified hereafter, the marking information in full shall accompany each component in its primary package. Such marking shall comprise:-

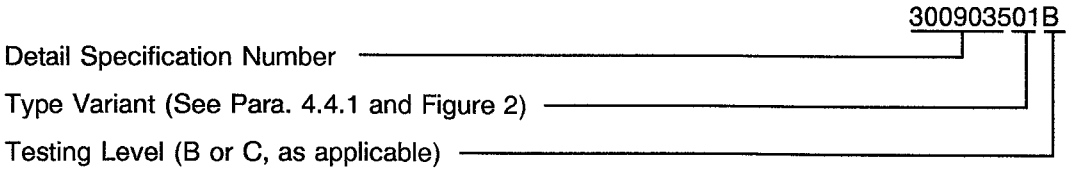
(a) The SCC Component Number.

(b) Characteristics and Ratings.

(c) Traceability Information.

4.5.2 The SCC Component Number

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



4.5.3 Electrical Characteristics and Ratings

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

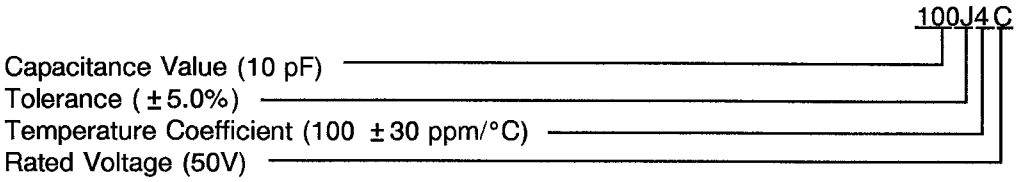
(a) Capacitance Value.

(b) Tolerance.

(c) Temperature Coefficient.

(d) Rated Voltage.

The information shall be constituted and marked as follows:-



4.5.3.1 Capacitance Values

The capacitance values shall be expressed by means of the following codes. The unit quantity for marking shall be picofarads.

Capacitance Value	Code
X.X	XCX
XX	XX0
XX10[1]	XX1

4.5.3.2 Tolerances

The tolerances on capacitance values shall be indicated by the code letters specified hereafter.

Tolerance (±pF)	Code Letter
0.1	B
0.25	C
0.5	D

Tolerance (±%)	Code Letter
1.0	F
2.0	G
5.0	J
10	K
20	M

4.5.3.3 Temperature Coefficient

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

ppm/°C	Code Number
100 ± 30	4

4.5.3.4 Rated Voltage

The rated voltage shall be indicated by the code letters specified hereafter.

Rated Voltage (U_R) (V)	Code Letter
50	C

4.5.4 Traceability Information

Traceability information shall be marked in accordance with the requirements of ESA/SCC Basic Specification No. 21700.

(a) Manufacturing Date Code.

(b) Manufacturer's Name.

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 ± 3 °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

A circuit for use in performing the electrical measurements listed in Table 2 of this specification is shown in ESA/SCC Generic Specification No. 3009.

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} = +22 ± 3 °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. 3009. The conditions for burn-in shall be as specified in Table 5 of this specification.

On completion of burn-in, a recovery period of 24 ± 2 hours is necessary before performance of the end-measurements.

4.7.3 Electrical Circuits for Burn-in (Figure 5)

Not applicable.

TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE

No.	CHARACTERISTICS	SYMBOL	ESA/SCC 3009 TEST CONDITIONS	LIMITS		UNIT
				MIN.	MAX.	
1	Capacitance	C	Para. 9.4.1.1	Tolerance shown in Table 1(a)		-
2	Tangent of Loss Angle	$T_{g\delta}$	Para. 9.4.1.2	-	15	10^{-4}
3	Insulation Resistance	Ri	Para. 9.4.1.3	1 000	-	GΩ
4	Voltage Proof	VP	Para. 9.4.1.4	$2.5U_R$	-	V

TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

No.	CHARACTERISTICS	SYMBOL	ESA/SCC 3009 TEST CONDITIONS	LIMITS		UNIT	REMARKS
				MIN.	MAX.		
3	Insulation Resistance at +125 ± 3 °C	Ri	Para. 9.4.1.3	100	-	GΩ	Notes 1 and 2
5(i)	Temperature Coefficient	TC	Para. 9.11 Between −55 and +20 ± 2 °C Between +20 ± 2 and +125 °C	−70 −70	+130 +130	10^{-6}/°C	5 parts for each capacitance value Notes 2, 4 and 5
5(ii)	Temperature Coefficient	TC	Para. 9.11 Between +20 ± 2 and +125 °C	−70	+130	10^{-6}/°C	5 parts for each dielectric lot Notes 3, 4 and 5

NOTES

1. Single sample; Inspection Level S3; AQL = 2.5%.
2. Applicable to Level 'B' only.
3. Applicable to Level 'C' only.
4. The "Temperature Coefficient" test is not applicable to capacitance values equal to, or less than 20pF due to equipment limitations.
5. If 1 failure out of 5 parts, then test 100%.

   1.0% rejects maximum allowed in case of 100% testing.

TABLE 4 - PARAMETER DRIFT VALUES

No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITIONS	CHANGE LIMITS (Δ)	UNIT
1	Capacitance Change	$\frac{\Delta C}{C}$	ESA/SCC Gen. Spec. 3009	Paras. 9.4.2 and 9.4.1.1	± 0.5 ± 1.0	pF % Notes 1 and 2

NOTES

1. For all percentage tolerances, whichever is greater.
2. For pF tolerances, Δ = 0.1pF.

FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS

Not applicable.

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

No.	CHARACTERISTIC	SYMBOL	CONDITION	UNIT
1	Ambient Temperature	T_{amb}	+125	°C
2	Test Voltage	V_T	$2.0U_R$	V

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. 3009)

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 specified, measurements shall be performed at T_{amb} = +22±3 °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 specified, measurements shall be performed at T_{amb} = +22±3 °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 specified, measurements shall be performed at T_{amb} = +22±3 °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. 3009. The conditions for operating life testing shall be as specified in Table 5 for the Burn-in test.

4.8.5 Electrical Circuit for Operating Life Tests (Figure 5)

Not applicable.

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

NO.	ESA/SCC GENERIC SPECIFICATION NO. 3009		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS		UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN.	MAX.	
01	Mounting	Para. 9.15	**Final Examination**					
			Terminals	Good Tinning	-	-	-	
			Final Measurements					
			Capacitance	Table 2 Item 1	C	Record Values		pF
			Tangent of Loss Angle	Table 2 Item 2	$T_{g\delta}$	Table 2 Item 2		
			Insulation Resistance	Table 2 Item 3	Ri	Table 2 Item 3		
02	Adhesion	Para. 9.5	**Final Examination**					
			Visual Examination	Damage or loosening	-	-	-	
			Capacitance	Table 2 Item 1	C	Table 2 Item 1		
03	Solderability	Para. 9.6	**Final Examination**					
			Visual Examination	SCC No. 20400	-	-	-	-
04	Rapid Change of Temperature	Para. 9.7	**Initial Measurements**					
			Capacitance	Table 2 Item 1	C	Item 01 Value		pF
			Final Measurements	Recovery period 24 ± 2 hours				
			Visual Examination	No damage	-	-	-	
			Capacitance Change	Table 2 Item 1	$\frac{\Delta C}{C}$	−1.0	+1.0	pF or
						−1.0	+1.0	% (2)
			Tangent of Loss Angle	Table 2 Item 2	$T_{g\delta}$	-	(3)	10^{-4}
05	Climatic Test Sequence	Para. 9.8	**Initial Measurements**					
			Capacitance	Table 2 Item 1	C	Item 01 Value		pF
			Final Measurements	Recovery Period 1 to 24 hrs				
			Visual Inspection	SCC No. 20400	-	-	-	
			Capacitance Change	Table 2 Item 1	$\frac{\Delta C}{C}$	−1.0	+1.0	pF or
						−2.0	+2.0	% (2)
			Tangent of Loss Angle	Table 2 Item 2	$T_{g\delta}$	-	(3)	10^{-4}
			Insulation Resistance	Table 2 Item 3	Ri	2.5	-	GΩ
06	Damp Heat Steady State	Para. 9.9	**Initial Measurements**					
			Capacitance	Table 2 Item 1	C	Item 01 Value		pF
			Final Measurements	Recovery Period 6 to 24 ±2hrs				
			Visual Examination	No damage	-	-	-	
			Capacitance Change	Table 2 Item 1	$\frac{\Delta C}{C}$	−1.0	+1.0	pF or
						−2.0	+2.0	% (2)
			Tangent of Loss Angle	Table 2 Item 2	$T_{g\delta}$	-	(3)	10^{-4}
			Insulation Resistance	Table 2 Item 3	Ri	2.5	-	GΩ

NOTES

1. The tests in this table refer to either Chart IV or V and shall be used as applicable.
2. Whichever is greater.
3. Twice the values specified in Table 2 of this specification.

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

NO.	ESA/SCC GENERIC SPECIFICATION NO. 3009		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS		UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN.	MAX.	
07	Operating Life	Para. 9.10	**Initial Measurements**					
			Capacitance	Table 2 Item 1	C	Item 01 Value		pF
			Intermediate Measurements	To be performed at 1000 hrs (Chart IV) Recovery period 1 hour min				
			Capacitance Change	Table 2 Item 1	$\frac{\Delta C}{C}$	−1.0 −2.0	+1.0 +2.0	pF or % (2)
			Insulation Resistance	Table 2 Item 3	Ri	2.5	-	GΩ
			Final Measurements	Recovery period 24 ± 2 hours				
			Capacitance Change	Table 2 Item 1	$\frac{\Delta C}{C}$	−1.0 −2.0	+1.0 +2.0	pF or % (2)
			Tangent of Loss Angle	Table 2 Item 2	$T_{g\delta}$	-	(3)	10^{-4}
			Insulation Resistance	Table 2 Item 3	Ri	2.5	-	GΩ
			Voltage Proof	Table 2 Item 4	VP	Table 2 Item 4		
			Visual Examination	No damage	-	-	-	
08	Temperature Coefficient	Para. 9.11	Capacitance Changes	Table 3 Item 5(i) or 5(ii)	TC	Table 3 Item 5(i) or 5(ii)		10^{-6}/°C
09	Permanence of Marking	Para. 9.14	Visual Examination	Gen. 3009 Para. 9.14	-	Para. 9.14		

NOTES

1. The tests in this table refer to either Chart IV or V and shall be used as applicable.
2. Whichever is greater.
3. Twice the values specified in Table 2 of this specification.

APPENDIX 'A'

AGREED DEVIATIONS FOR TEKELEC (F)

ITEMS AFFECTED	DESCRIPTION OF DEVIATIONS
Para. 4.2.4	(a) Para. 9.9, Damp Heat Steady State : May be performed as follows: 15 pieces at 0V, 15 pieces biased at 5.0V and 15 pieces biased at U_R.
Paras. 4.2.4 and 4.2.5	(a) Para. 9.14, Permanence of Marking : May be omitted as the components are laser marked.