CAPACITORS, FIXED, CHIPS, CERAMIC DIELECTRIC, TYPE I

BASED ON TYPE 0603

ESCC Detail Specification No. 3009037

Issue 1	April 2012

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

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DCR No.	CHANGE DESCRIPTION

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1. GENERAL

1.1 SCOPE

This specification details the ratings, physical and electrical characteristics, test and inspection data for Capacitors, Fixed, Chips, Ceramic Dielectric, Type I, based on Type 0603. It shall be read in conjunction with ESCC Generic Specification No. 3009, the requirements of which are supplemented herein.

1.2 COMPONENT TYPE VARIANTS AND RANGE OF COMPONENTS

The variants 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

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

(a) ESCC 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 ESCC Basic specification No. 21300 shall apply.

TABLE 1(a) – COMPONENT TYPE VARIANTS AND RANGE OF COMPONENTS

Variant Number	Style	Capacitance Range, Tolerance, Rated Voltage	Terminal Material and Finish		Weight Max (g)
			End Terminations	Termination Finish	
01	0603	Note 1	Ag/Pd	No finish	0.1
03	0603	Note 1	Ag/Pd/Pt	No finish	0.1
06	0603	Note 1	Ag + Ni barrier	Sn/Pb coating (Note 2)	0.1
08	0603	Note 1	Ag + Ni barrier	Au plating	0.1

NOTES:

1. Specified rated voltages, capacitance values and tolerances are as follows:

Rated Voltage U_R (V)	Capacitance Range C_n (pF)		Tolerance (±)	Value Series
	Min	Max		
200	1	9.53	0.25pF 0.5pF 1pF	E48 E24 E12
	10	100	1% 2% 5% 10%	E96 E48 E24 E12
100	1	9.53	0.25pF 0.5pF 1pF	E48 E24 E12
	10	330	1% 2% 5% 10%	E96 E48 E24 E12
50	0.5	9.53	0.25pF 0.5pF 1pF	E48 E24 E12
	10	560	1% 2% 5% 10%	E96 E48 E24 E12
25	10	1000	1% 2% 5% 10%	E96 E48 E24 E12
16	10	1500	1% 2% 5% 10%	E96 E48 E24 E12

2. Sn/Pb coating, near eutectic with minimum 10% Pb.

TABLE 1(b) – MAXIMUM RATINGS

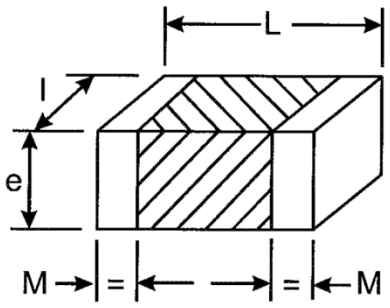
No.	Characteristics	Symbols	Maximum Ratings	Units	Remarks
1	Rated Voltage	U_R	16, 25, 50, 100, 200	V	Note 1
2	Operating Temperature Range	T_{op}	-55 to +125	°C	Without derating. T_{amb}
3	Storage Temperature Range	T_{stg}	-55 to +125	°C	
4	Soldering Temperature	T_{sol}	+260	°C	Note 2

NOTES:
1. As required; See Table 1(a).
2. Duration 10s maximum.

FIGURE 1 – PARAMETER INFORMATION

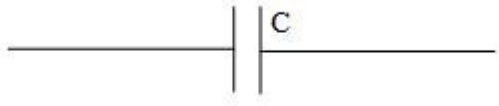
Not applicable

FIGURE 2 – PHYSICAL DIMENSIONS



Symbols	Dimensions (mm)	
	Min	Max
L	1.4	1.8
l	0.6	1
e	-	1
M	0.1	0.5

FIGURE 3 – FUNCTIONAL DIAGRAM



4. REQUIREMENTS

4.1 GENERAL

The complete requirements for procurement of the capacitors specified herein shall be as stated in this specification and ESCC 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 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. 9.4.4, Electrical Measurements at Room Temperature.

- Insulation Resistance: test duration shall be sufficient to verify the specified insulation resistance limit is met, up to 1 minute maximum.
- Voltage Proof: test duration shall be sufficient to verify no component breakdown or flash-over, up to 1 minute maximum.

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

(a) Para. 9.4.4, Electrical Measurements at Room Temperature.

- Insulation Resistance: test duration shall be sufficient to verify the specified insulation resistance limit is met, up to 1 minute maximum.
- Voltage Proof: test duration shall be sufficient to verify no component breakdown or flash-over, up to 1 minute maximum.

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 components specified herein shall be verified in accordance with the requirements set out in Para. 9.3 of ESCC Generic Specification No. 3009 and 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 Adhesion

The requirements for adhesion are specified in Para. 9.5 of ESCC 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 Terminal Material and Finish

The terminal material and finish shall be as specified in Table 1(a).

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) The ESCC qualified components symbol (for ESCC qualified components only).
(b) The ESCC Component Number.
(c) Electrical Characteristics and Ratings.
(d) Traceability Information

4.5.2 ESCC Component Number

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

Example: 300903701B

- Detail Specification Number: 3009037
- Type Variant (see Table 1(a)): 01
- Testing Level (B or C, as applicable): B

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) Rated Voltage.

The information shall be constituted and marked as follows:

Example: 1000KC

– Capacitance value (100pF): 1000
– Tolerance (±10%): K
– Rated Voltage (50V): C

4.5.3.1 Capacitance Value

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

Capacitance Value C_n (pF)	Code
X.XX	XCXX
XX.X	XXCX
XXX	XXX0
XXX 10^1	XXX1

4.5.3.2 Tolerance

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

Tolerance	Code Letter
±0.25pF	C
±0.5pF	D
±1pF	F
±1%	F
±2%	G
±5%	J
±10%	K

4.5.3.3 Rated Voltage

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

Rated Voltage U_R (V)	Code Letter
16	X
25	A
50	C
100	E
200	G

4.5.3.4 Traceability Information

Traceability information shall be marked 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} = +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. Unless otherwise specified the measurements shall be performed at T_{amb} = +125(+0 -5)°C and -55(+5 -0)°C respectively.

4.6.3 Circuits for Electrical Measurements

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±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 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. 3009. The conditions for Burn-in shall be as specified in Table 5 of this specification.

Upon completion of Burn-in, a recovery period of 24 hours minimum is necessary before performance of the end-measurements.

4.7.3 Electrical Circuit for Burn-in (Figure 5)

Not applicable

TABLE 2 – ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE

No.	Characteristics	Symbols	ESCC 3009 Test Conditions	Limits		Units	Remarks
				Min	Max		
1	Capacitance	C	Para. 9.4.1.1	See Table 1(a)		pF	
2	Tangent of Loss Angle	Tgδ	Para. 9.4.1.2	-	15×10^{-4}	-	For C_n >50pF Note 1
3	Insulation Resistance	Ri	Para. 9.4.1.3	100	-	GΩ	
4	Voltage Proof	VP	Para. 9.4.1.4	$2.5U_R$	-	V	

NOTES:

1. Limit applies for C_n > 50pF. For C_n ≤ 50pF, $Tg\delta < 1.5 \times \left(\frac{150}{Cn} + 7\right) \times 10^{-4}$ where the unit quantity for C_n is in pF.

TABLE 3 – ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

No.	Characteristics	Symbols	ESCC 3009 Test Conditions	Limits		Units	Remarks
				Min	Max		
3	Insulation Resistance	Ri	Para. 9.4.1.3 T_{amb} = +125(+0 -5)°C	10	-	GΩ	Notes 1 and 2
5(i)	Temperature Coefficient	TCC	Para. 9.11 Between -55°C and +20°C Between +20°C and +125°C	-30 -30	+30 +30	10^{-6}/°C	5 parts for each capacitance value. Notes 2, 4
5(ii)	Temperature Coefficient	TCC	Para. 9.11 Between +20°C and +125°C	-30	+30	10^{-6}/°C	5 parts for each dielectric lot. Notes 3, 4

NOTES:

1. Single sample. Inspection Level S3, AQL 2.5%.
2. Applicable to Level 'B' only.
3. Applicable to Level 'C' only.
4. In the event of any failure a 100% inspection may be performed. In the case of a 100% inspection, a 1% total percent defective is allowed.

FIGURE 4 – CIRCUIT FOR ELECTRICAL MEASUREMENTS

Not applicable.

TABLE 4 – PARAMETER DRIFT VALUES

No.	Characteristics	Symbols	Spec. and/or Test Method	Test Conditions	Change Limits (Δ)	Units
1	Capacitance Change	ΔC/C	As per Table 2	As per Table 2	±0.5 or (1) ±10	pF %

NOTES:
1. Whichever is greater.

TABLE 5 – CONDITIONS FOR BURN-IN AND OPERATING TESTS

No.	Characteristics	Symbols	Conditions	Units
1	Ambient Temperature	T_{amb}	+125(+0 -3)	°C
2	Test Voltage	V_T	$2U_R$	V

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

Not applicable.

4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESCC 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 stated, the 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 stated, the 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 stated, the measurements shall be performed at T_{amb} = +22±3°C.

4.8.4 Conditions for Operating Life (Part of Endurance Testing)
The requirements for Operating Life testing are specified in Section 9 of ESCC 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.	ESCC Generic Spec. N° 3009		Measurements And Inspections		Symbols	Limits		Units
	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	Tgδ	Table 2 Item 2		-
			Insulation Resistance	Table 2 Item 3	Ri	Table 2 Item 3		GΩ
02	Adhesion	Para. 9.5	**Final Examination**					
			Visual Examination	Damage or loosening	-	-	-	-
			Capacitance	Table 2 Item 1	C	Table 2 Item 1		pF
03	Solderability	Para. 9.6	**Final Examination** Visual Examination	Para. 9.6.	-	-	-	-

No.	ESCC Generic Spec. N° 3009		Measurements And Inspections		Symbols	Limits		Units
	Environmental And Endurance Tests (1)	Test Method And Conditions	Identification	Conditions		Min.	Max.	
04	Rapid Change of Temperature	Para. 9.7	**Initial Measurements**					
			Capacitance	Table 2 Item 1	C	Item 1 Value		pF
			Final Measurements	Recovery period 24±2 hours				
			Visual Examination	No damage	-	-	-	-
			Capacitance Change	Table 2 Item 1	$\frac{\Delta C}{C}$	-1 -1	+1 +1	pF or % (2)
			Tangent of Loss Angle	Table 2 Item 2	Tgδ	-	(3)	-
05	Climatic Test Sequence	Para. 9.8	**Initial Measurements**					
			Capacitance	Table 2 Item 1	C	Item 1 Value		pF
			Final Measurements	Recovery period 1 to 24 hours				
			Visual Inspection	Para. 9.8.6	-	-	-	-
			Capacitance Change	Table 2 Item 1	$\frac{\Delta C}{C}$	-1 -2	+1 +2	pF or % (2)
			Tangent of Loss Angle	Table 2 Item 2	Tgδ	-	(3)	-
			Insulation Resistance	Table 2 Item 3	Ri	10	-	GΩ
06	Damp Heat Steady State	Para. 9.9	**Initial Measurements**					
			Capacitance	Table 2 Item 1	C	Item 1 Value		pF
			Final Measurements	Recovery period 6 to 24 hours				
			Visual Inspection	No damage	-	-	-	-
			Capacitance Change	Table 2 Item 1	$\frac{\Delta C}{C}$	-1 -2	+1 +2	pF or % (2)
			Tangent of Loss Angle	Table 2 Item 2	Tgδ	-	(3)	-
			Insulation Resistance	Table 2 Item 3	Ri	10	-	GΩ

No.	ESCC Generic Spec. N° 3009		Measurements And Inspections		Symbols	Limits		Units
	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 1 Value		pF
			Intermediate Measurements (@1000hours Chart IV)	Recovery period 1 hour min				
			Capacitance Change	Table 2 Item 1	$\frac{\Delta C}{C}$	-1 -3	+1 +3	pF or % (2)
			Insulation Resistance	Table 2 Item 3	Ri	10	-	GΩ
			Final Measurements	Recovery period 24±2 hours				
			Capacitance Change	Table 2 Item 1	$\frac{\Delta C}{C}$	-1 -3	+1 +3	pF or % (2)
			Tangent of Loss Angle	Table 2 Item 2	Tgδ	-	(3)	-
			Insulation Resistance	Table 2 Item 3	Ri	10	-	GΩ
			Voltage Proof	Table 2 Item 4	VP	Table 2 Item 4		V
			Visual Examination	No damage	-	-	-	-
08	Temperature Coefficient	Para. 9.11	Capacitance Changes	Table 3 Item 5(i) or 5(ii)	TCC	Table 3 Item 5(i) or 5(ii)		10^{-6}/°C

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 value specified in Table 2.