



**CAPACITORS, FIXED, CHIPS, CERAMIC DIELECTRIC,  
TYPE II, WITH FLEXIBLE TERMINATIONS**

**BASED ON TYPES 0402 TO 2220**

**ESCC Detail Specification No. 3009/039**

Issue 3	March 2017
---------	------------



### **LEGAL DISCLAIMER AND COPYRIGHT**

European Space Agency, Copyright © 2017. All rights reserved.

The European Space Agency disclaims any liability or responsibility, to any person or entity, with respect to any loss or damage caused, or alleged to be caused, directly or indirectly by the use and application of this ESCC publication.

This publication, without the prior permission of the European Space Agency and provided that it is not used for a commercial purpose, may be:

- copied in whole, in any medium, without alteration or modification.
- copied in part, in any medium, provided that the ESCC document identification, comprising the ESCC symbol, document number and document issue, is removed.

**DOCUMENTATION CHANGE NOTICE**

(Refer to <https://escies.org> for ESCC DCR content)

DCR No.	CHANGE DESCRIPTION
1053	Specification updated to incorporate changes per DCR.

**TABLE OF CONTENTS**

1	GENERAL	5
1.1	SCOPE	5
1.2	APPLICABLE DOCUMENTS	5
1.3	TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS	5
1.4	THE ESCC COMPONENT NUMBER AND COMPONENT TYPE VARIANTS	5
1.4.1	The ESCC Component Number	5
1.4.2	Component Type Variants and Range of Components	7
1.5	MAXIMUM RATINGS	10
1.6	PHYSICAL DIMENSIONS	10
1.7	FUNCTIONAL DIAGRAM	11
2	REQUIREMENTS	11
2.1	GENERAL	11
2.1.1	Deviations from the Generic Specification	11
2.2	MARKING	11
2.3	ELECTRICAL MEASUREMENTS AT ROOM, HIGH AND LOW TEMPERATURES	12
2.3.1	Room Temperature Electrical Measurements	12
2.3.2	High and Low Temperatures Electrical Measurements	12
2.4	INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS	13
2.5	BURN-IN	14

## 1 GENERAL

### 1.1 SCOPE

This specification details the ratings, physical and electrical characteristics, and test and inspection data for the component type variants and/or the range of components specified below. It supplements the requirements of, and shall be read in conjunction with, the ESCC Generic Specification listed under Applicable Documents.

### 1.2 APPLICABLE DOCUMENTS

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

- (a) ESCC Generic Specification No. [3009](#).

### 1.3 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.

### 1.4 THE ESCC COMPONENT NUMBER AND COMPONENT TYPE VARIANTS

#### 1.4.1 The ESCC Component Number

The ESCC Component Number shall be constituted as follows:

Example: 300903901101KC

- Detail Specification Reference: 3009039
- Component Type Variant Number: 01 (as required)
- Characteristic code: Capacitance Value (100pF): 101 (as required)
- Characteristic code: Capacitance Tolerance ( $\pm 10\%$ ): K (as required)
- Rating code: Rated Voltage (50V): C (as required)

#### 1.4.1.1 *Characteristics and Ratings Codes*

Characteristics and ratings to be codified as part of the ESCC Component Number shall be as follows:

- (a) Rated Capacitance Value,  $C_n$ , expressed by means of the following codes in accordance with ESCC Basic Specification No. 21700. The unit quantity shall be picofarad (pF).

Capacitance Value $C_n$ (pF)	Code
XX	XX0
XX 10 <sup>1</sup>	XX1
XX 10 <sup>2</sup>	XX2
XX 10 <sup>3</sup>	XX3
XX 10 <sup>4</sup>	XX4
XX 10 <sup>5</sup>	XX5

- (b) Capacitance Tolerance expressed by the following codes in accordance with ESCC Basic Specification No. 21700:

Tolerance ( $\pm$ %)	Code Letter
5	J
10	K
20	M

- (c) Rated Voltage,  $U_R$ , expressed by the following codes:

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

1.4.2 Component Type Variants and Range of Components

The component type variants and range of components applicable to this specification are as follows:

Variant Number	Style (Note 5)	Capacitance Range, Tolerance, Rated Voltage	Terminal Material and Finish		Weight Max (g)
			End Terminations	Termination Finish	
01	0603	See Note 1	Flexible + Ni barrier	Sn/Pb plating (Note 3)	0.1
02	0805	See Note 1	Flexible + Ni barrier	Sn/Pb plating (Note 3)	0.1
03	1206	See Note 1	Flexible + Ni barrier	Sn/Pb plating (Note 3)	0.15
04	1210	See Note 1	Flexible + Ni barrier	Sn/Pb plating (Note 3)	0.15
05	1812	See Note 1	Flexible + Ni barrier	Sn/Pb plating (Note 3)	0.2
06	2220	See Note 1	Flexible + Ni barrier	Sn/Pb plating (Note 3)	0.3
07	0603	See Note 1	Flexible + Ni barrier	Au plating (Note 2)	0.1
08	0805	See Note 1	Flexible + Ni barrier	Au plating (Note 2)	0.1
09	1206	See Note 1	Flexible + Ni barrier	Au plating (Note 2)	0.15
10	1210	See Note 1	Flexible + Ni barrier	Au plating (Note 2)	0.15
11	1812	See Note 1	Flexible + Ni barrier	Au plating (Note 2)	0.2
12	2220	See Note 1	Flexible + Ni barrier	Au plating (Note 2)	0.3
13 (Note 4)	0603	See Note 1	Flexible + Ni barrier	Sn/Pb plating (Note 3)	0.1
14 (Note 4)	0805	See Note 1	Flexible + Ni barrier	Sn/Pb plating (Note 3)	0.1
15 (Note 4)	1206	See Note 1	Flexible + Ni barrier	Sn/Pb plating (Note 3)	0.15
16 (Note 4)	1210	See Note 1	Flexible + Ni barrier	Sn/Pb plating (Note 3)	0.15
17 (Note 4)	1812	See Note 1	Flexible + Ni barrier	Sn/Pb plating (Note 3)	0.2
18 (Note 4)	2220	See Note 1	Flexible + Ni barrier	Sn/Pb plating (Note 3)	0.3
19 (Note 4)	0603	See Note 1	Flexible + Ni barrier	Au plating (Note 2)	0.1
20 (Note 4)	0805	See Note 1	Flexible + Ni barrier	Au plating (Note 2)	0.1
21 (Note 4)	1206	See Note 1	Flexible + Ni barrier	Au plating (Note 2)	0.15
22 (Note 4)	1210	See Note 1	Flexible + Ni barrier	Au plating (Note 2)	0.15
23 (Note 4)	1812	See Note 1	Flexible + Ni barrier	Au plating (Note 2)	0.2
24 (Note 4)	2220	See Note 1	Flexible + Ni barrier	Au plating (Note 2)	0.3
25 (Note 4)	0402	See Note 1	Flexible + Ni barrier	Sn/Pb plating (Note 3)	0.1
26 (Note 4)	0402	See Note 1	Flexible + Ni barrier	Au plating (Note 2)	0.1

**NOTES:**

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

Variant Number	Style (Note 5)	Capacitance Range C <sub>n</sub> (pF)		Rated Voltage U <sub>R</sub> (V)	
		Min	Max		
01, 07	0603	10	1000	200	
02, 08	0805	330	3900		
03, 09	1206	470	12000		
04, 10	1210	2200	27000		
05, 11	1812	4700	47000		
06, 12	2220	10000	120000		
13, 19	0603	10	3900		
14, 20	0805	330	15000		
15, 21	1206	470	47000		
16, 22	1210	2200	100000		
17, 23	1812	4700	180000		
18, 24	2220	10000	470000		
01, 07	0603	10	2700		100
02, 08	0805	68	10000		
03, 09	1206	470	27000		
04, 10	1210	2200	56000		
05, 11	1812	3900	120000		
06, 12	2220	22000	270000		
13, 19	0603	10	12000		
14, 20	0805	68	47000		
15, 21	1206	470	120000		
16, 22	1210	2200	220000		
17, 23	1812	3900	470000		
18, 24	2220	22000	1000000		
25, 26	0402	68	3300	50	
01, 07	0603	10	10000		
02, 08	0805	100	56000		
03, 09	1206	470	82000		
04, 10	1210	2200	220000		
05, 11	1812	3900	470000		
06, 12	2220	22000	1200000		
13, 19	0603	10	22000		
14, 20	0805	100	100000		
15, 21	1206	470	180000		
16, 22	1210	2200	390000		
17, 23	1812	3900	820000		
18, 24	2220	22000	1800000		



Variant Number	Style (Note 5)	Capacitance Range C <sub>n</sub> (pF)		Rated Voltage U <sub>R</sub> (V)
		Min	Max	
25, 26	0402	68	5600	25
01, 07	0603	390	33000	
02, 08	0805	6800	150000	
03, 09	1206	10000	270000	
04, 10	1210	33000	560000	
05, 11	1812	100000	1200000	
06, 12	2220	150000	2200000	
13, 19	0603	390	33000	
14, 20	0805	6800	150000	
15, 21	1206	10000	270000	
16, 22	1210	33000	560000	
17, 23	1812	100000	1200000	
18, 24	2220	150000	2200000	
25, 26	0402	68	8200	
01, 07	0603	390	100000	
02, 08	0805	6800	390000	
03, 09	1206	10000	1000000	
04, 10	1210	33000	820000	
05, 11	1812	100000	1200000	
06, 12	2220	150000	2700000	
13, 19	0603	390	100000	
14, 20	0805	6800	390000	
15, 21	1206	10000	1000000	
16, 22	1210	33000	820000	
17, 23	1812	100000	1800000	
18, 24	2220	150000	3900000	
25, 26	0402	10	12000	10
01, 07	0603	10	120000	
02, 08	0805	68	470000	
03, 09	1206	470	1500000	
04, 10	1210	2200	2200000	

Capacitance Value C <sub>n</sub> (pF)	Tolerance (± %)	Value Series
10 to 3900000	5	E24
	10	E12
10 to 3300000	20	E6

- Any capacitance value in the capacitance range may be available on request.
2. Variants 07 to 12 and 19 to 24 and 26 are not suitable for solder assembly methods. They shall be assembled using glue or wire bond techniques.
  3. Sn/Pb plating with typically 60% Sn, 40% Pb.

4. Variants 13 to 24 have X7R dielectric; see High and Low Temperatures Electrical Measurements.
5. See Physical Dimensions.

1.5 MAXIMUM RATINGS

The maximum ratings shall not be exceeded at any time during use or storage.

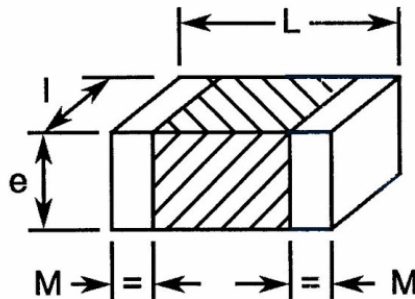
Maximum ratings shall only be exceeded during testing to the extent specified in this specification and when stipulated in Test Methods and Procedures of the ESCC Generic Specification.

Characteristics	Symbols	Maximum Ratings	Units	Remarks
Rated Voltage	$U_R$	10, 16, 25, 50, 100, 200	V	Note 1
Operating Temperature Range	$T_{op}$	-55 to +125	°C	Without derating. $T_{amb}$
Storage Temperature Range	$T_{stg}$	-55 to +125	°C	
Soldering Temperature	$T_{sol}$	+260	°C	Note 2

**NOTES:**

1. As required; See Component Type Variants and Range of Components.
2. Duration 10 seconds maximum.

1.6 PHYSICAL DIMENSIONS



Symbols	Dimensions (mm)													
	Style 0402 Variants 25, 26		Style 0603 Variants 01, 07, 13, 19		Style 0805 Variants 02, 08, 14, 20		Style 1206 Variants 03, 09, 15, 21		Style 1210 Variants 04, 10, 16, 22		Style 1812 Variants 05, 11, 17, 23		Style 2220 Variants 06, 12, 18, 24	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
L	0.9	1.1	1.4	1.8	1.7	2.3	2.95	3.45	2.8	3.6	4	5	5.2	6.2
I	0.4	0.6	0.6	1	1.05	1.45	1.45	1.75	2.2	2.8	2.8	3.6	4.5	5.5
e	-	0.6	-	1	-	1.8	-	2.3	-	2.3	-	2.8	-	2.8
M	0.1	0.3	0.1	0.5	0.1	0.75	0.2	0.75	0.2	1	0.2	1	0.2	1

## 1.7 FUNCTIONAL DIAGRAM



## 2 REQUIREMENTS

### 2.1 GENERAL

The complete requirements for procurement of the components specified herein are as stated in this specification and the ESCC Generic Specification. Permitted deviations from the Generic Specification, applicable to this specification only, are listed below.

Permitted 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 requirement and do not affect the component's reliability, are listed in the appendices attached to this specification.

#### 2.1.1 Deviations from the Generic Specification

##### 2.1.1.1 *Deviations from Qualification and Periodic Tests (Chart F4)*

(a) Solderability: not applicable to Variants 07 to 12 and 19 to 24 and 26.

### 2.2 MARKING

The marking shall be in accordance with the requirements of ESCC Basic Specification No. [21700](#) and as follows.

The information to be marked on the component or its primary package shall be:

- (a) The ESCC qualified components symbol (for ESCC qualified components only).
- (b) The ESCC Component Number.
- (c) Traceability information.

2.3 ELECTRICAL MEASUREMENTS AT ROOM, HIGH AND LOW TEMPERATURES

Electrical measurements shall be performed at room, high and low temperatures.

2.3.1 Room Temperature Electrical Measurements

The measurements shall be performed at  $T_{amb} = +22 \pm 3^{\circ}\text{C}$ .

Characteristics	Symbols	Test Method and Conditions	Tolerance ( $\pm$ %)	Limits		Units
				Min	Max	
Capacitance (Note 1)	$C_A$	ESCC No. 3009	5	$0.95C_n$	$1.05C_n$	pF
			10	$0.9C_n$	$1.1C_n$	
			20	$0.8C_n$	$1.2C_n$	
Tangent of Loss Angle	$\text{tg}\delta$	ESCC No. 3009	All	-	$250 \times 10^{-4}$	-
Insulation Resistance	$R_i$	ESCC No. 3009 For $C_n \leq 10000\text{pF}$ For $C_n > 10000\text{pF}$	All	100	-	G $\Omega$
				1000	-	G $\Omega$ .nF
Voltage Proof	VP	ESCC No. 3009	All	$2.5U_R$	-	V

**NOTES:**

1. Capacitance limits may be adjusted to take into account capacitance ageing, as specified in the Generic Specification.

2.3.2 High and Low Temperatures Electrical Measurements

Characteristics	Symbols	Test Method and Conditions (Note 1)	Limits		Units
			Min	Max	
Temperature Characteristic	TC	ESCC No. 3009 $T_{amb} = -55 \pm 2^{\circ}\text{C}, +20 \pm 2^{\circ}\text{C}, +125 \pm 2^{\circ}\text{C}$ Note 2 For $V_T = \text{no voltage applied}$ : All Variants:  For $V_T = U_R$ : Variants 01 to 12, 25 and 26: Variants 13 to 24:	-20	+20	%
			-30	+20	
			Note 3		

**NOTES:**

1. The measurements shall be performed on a sample of 5 components from each manufacturing lot with 0 failures allowed. In the event of any failure a 100% inspection may be performed.
2. In the case of a 100% inspection, a 1% total percent defective is allowed.
3. X7R dielectric. Temperature Characteristic for  $V_T = U_R$  is typically -60%. Temperature Characteristic measurements with rated voltage applied are not required.

2.4 INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS

Unless otherwise specified, the measurements shall be performed at  $T_{amb} = +22 \pm 3^{\circ}C$ .

Unless otherwise specified the test methods and test conditions shall be as per the corresponding test defined in Room Temperature Electrical Measurements.

Test Reference per ESCC No. 3009	Characteristics	Symbols	Limits		Units
			Min	Max	
Mounting Final Measurements	Capacitance Tangent of Loss Angle Insulation Resistance	$C_A$ $tg\delta$ $R_I$	Record Values -   $250 \times 10^{-4}$ Note 1		-
Rapid Change of Temperature Initial Measurements Final Measurements	Capacitance Capacitance Change in Capacitance Tangent of Loss Angle	$C_A$ $C_A$ $\Delta C_A/C_A$ $tg\delta$	Notes 1, 2 Note 1 -10   +10 -   $500 \times 10^{-4}$		%
Steady State Humidity (85/85) Initial Measurements Final Measurements (1000 hours)	Capacitance Capacitance Change in Capacitance Tangent of Loss Angle Insulation Resistance (Note 3): For $C_n \leq 10000pF$ For $C_n > 10000pF$	$C_A$ $C_A$ $\Delta C_A/C_A$ $tg\delta$ $R_I$ $R_I$	Note 1 Note 1 -10   +10 -   $500 \times 10^{-4}$ 3   - 30   -		% GΩ GΩ.nF
Operating Life Initial Measurements Intermediate Measurements (1000 hours) (Note 4) Final Measurements (1000 or 2000 hours) (Note 5)	Capacitance Capacitance Change in Capacitance Insulation Resistance: For $C_n \leq 10000pF$ For $C_n > 10000pF$ Capacitance Change in Capacitance Tangent of Loss Angle Insulation Resistance: For $C_n \leq 10000pF$ For $C_n > 10000pF$ Voltage Proof	$C_A$ $C_A$ $\Delta C_A/C_A$ $R_I$ $R_I$ $C_A$ $\Delta C_A/C_A$ $tg\delta$ $R_I$ $R_I$ VP	Notes 1, 2 Note 1 -15   +15 10   - 100   - Note 1 -15   +15 -   $500 \times 10^{-4}$ 10   - 100   - 2.5U <sub>R</sub>   -		% GΩ GΩ.nF GΩ GΩ.nF V

Test Reference per ESCC No. 3009	Characteristics	Symbols	Limits		Units
			Min	Max	
Capacitance-Temperature Characteristics	Temperature Characteristic	TC	Note 6		
Robustness of Terminations Final Measurements	Capacitance	C <sub>A</sub>	Note 1		

**NOTES:**

1. As specified in Room Temperature Electrical Measurements.
2. Capacitance values recorded during Mounting may be used as initial measurements.
3. Test conditions for Insulation Resistance shall be as specified in Steady State Humidity in the ESCC Generic Specification.
4. Intermediate measurements are optional at the Manufacturer's discretion.
5. 1000 hours is applicable to Periodic Testing for extension of qualification. 2000 hours is applicable to Qualification Testing, and to Periodic Testing for renewal of qualification after lapse.
6. As specified in High and Low Temperatures Electrical Measurements.

2.5 **BURN-IN**

The requirements for Burn-in are specified in the ESCC Generic Specification. The following conditions shall also apply:

- After Burn-in, the components shall be removed from the chamber and allowed to cool under normal atmospheric conditions for recovery for 24 hours minimum.