



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

**BASED ON TYPES 0603 TO 2220**

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

Issue 2	November 2015
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DCR No.	CHANGE DESCRIPTION
928	Specification updated to incorporate changes per DCR.

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## 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 $10^1$	XX1
XX $10^2$	XX2
XX $10^3$	XX3
XX $10^4$	XX4
XX $10^5$	XX5

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

Tolerance (± %)	Code Letter
5	J
10	K
20	M

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

Rated Voltage (V)	Code Letter
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

**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		
01, 07	0603	10	10000	50	
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		
01, 07	0603	390	22000	25	
02, 08	0805	6800	100000		
03, 09	1206	10000	180000		
04, 10	1210	33000	330000		
05, 11	1812	100000	680000		
06, 12	2220	150000	1500000		
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		
01, 07	0603	390	33000		16
02, 08	0805	6800	150000		
03, 09	1206	10000	27000		
04, 10	1210	33000	560000		
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		

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 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.

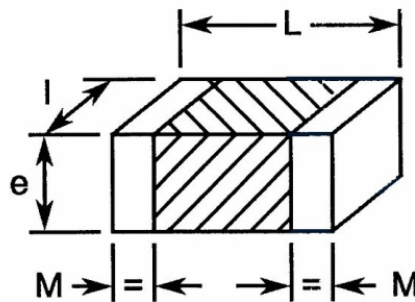
Maximum ratings shall only be exceeded during testing to the extent specified in this specification and when stipulated in Test Methods and Procedures of the ESCC Generic Specification.

Characteristics	Symbols	Maximum Ratings	Units	Remarks
Rated Voltage	$U_R$	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:**

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

1.6 PHYSICAL DIMENSIONS



Symbols	Dimensions (mm)											
	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
L	1.45	1.75	1.7	2.3	2.95	3.45	2.8	3.6	4	5	5.2	6.2
I	0.65	0.95	1.05	1.45	1.45	1.75	2.2	2.8	2.8	3.6	4.5	5.5
e	-	1	-	1.8	-	2.3	-	2.3	-	2.8	-	2.8
M	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.

### 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 10 20	$0.95C_n$ $0.9C_n$ $0.8C_n$	$1.05C_n$ $1.1C_n$ $1.2C_n$	pF
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 1000	- -	G $\Omega$ 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: Variants 13 to 24:	-20 -30 Note 3	+20 +20	%

**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  $T_{amb} = +22 \pm 3^{\circ}\text{C}$ .

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	$C_A$ $\text{tg}\delta$ $R_I$	Record Values -   $250 \times 10^{-4}$ Note 1		-
Rapid Change of Temperature Initial Measurements	Capacitance	$C_A$	Notes 1, 2		
Final Measurements	Capacitance Change in Capacitance Tangent of Loss Angle	$C_A$ $\Delta C_A / C_A$ $\text{tg}\delta$	-10 -	+10 $500 \times 10^{-4}$	%
Steady State Humidity (85/85) Initial Measurements	Capacitance	$C_A$	Note 1		
Final Measurements (1000 hours)	Capacitance Change in Capacitance Tangent of Loss Angle Insulation Resistance (Note 3): For $C_n \leq 10000\text{pF}$ For $C_n > 10000\text{pF}$	$C_A$ $\Delta C_A / C_A$ $\text{tg}\delta$ $R_I$ $R_I$	-10 -	+10 $500 \times 10^{-4}$ - -	%   GΩ GΩ.nF

Test Reference per ESCC No. 3009	Characteristics	Symbols	Limits		Units
			Min	Max	
Operating Life Initial Measurements	Capacitance	$C_A$	Notes 1, 2		
Intermediate Measurements (1000 hours) (Note 4)	Capacitance	$C_A$	Note 1		
	Change in Capacitance	$\Delta C_A/C_A$	-15	+15	%
	Insulation Resistance: For $C_n \leq 10000\text{pF}$	$R_I$	10	-	$G\Omega$
	For $C_n > 10000\text{pF}$	$R_I$	100	-	$G\Omega.nF$
Final Measurements (1000 or 2000 hours) (Note 5)	Capacitance	$C_A$	Note 1		
	Change in Capacitance	$\Delta C_A/C_A$	-15	+15	%
	Tangent of Loss Angle	$tg\delta$	-	$500 \times 10^{-4}$	
	Insulation Resistance: For $C_n \leq 10000\text{pF}$	$R_I$	10	-	$G\Omega$
	For $C_n > 10000\text{pF}$	$R_I$	100	-	$G\Omega.nF$
	Voltage Proof	VP	$2.5U_R$	-	V
Capacitance-Temperature Characteristics	Temperature Characteristic	TC	Note 6		
Robustness of Terminations Final Measurements	Capacitance	$C_A$	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.