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

BASED ON TYPES 0402 TO 2220

ESCC Detail Specification No. 3009/039

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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: 300903901102KC

- Detail Specification Reference: 3009039
- Component Type Variant Number: 01 (as required)
- Characteristic code: Capacitance Value (1000pF): 102 (as required)
- Characteristic code: Capacitance Tolerance (±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, 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
500	L
1000	M

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	0402	See Note 1	Flexible + Ni barrier	Sn/Pb plating (Note 3)	0.1
26	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_n (pF)		Rated Voltage U_R (V)
		Min	Max	
04, 10, 16, 22	1812	470	12000	1000
05, 11, 17, 23	2220	470	27000	
02, 08, 14, 20	0805	330	3900	500
03, 09, 15, 21	1206	390	12000	
04, 10, 16, 22	1210	1000	22000	
05, 11, 17, 23	1812	470	56000	
06, 12, 18, 24	2220	470	100000	
01, 07, 13, 19	0603	100	3900	200
02, 08, 14, 20	0805	330	15000	
03, 09, 15, 21	1206	390	39000	
04, 10, 16, 22	1210	1000	100000	
05, 11, 17, 23	1812	470	150000	
06, 12, 18, 24	2220	470	390000	
01, 07, 13, 19	0603	270	12000	100
02, 08, 14, 20	0805	1000	47000	
03, 09, 15, 21	1206	1800	120000	
04, 10, 16, 22	1210	2200	220000	
05, 11, 17, 23	1812	3900	470000	
06, 12, 18, 24	2220	22000	1000000	
25, 26	0402	120	3300	50
01, 07, 13, 19	0603	270	22000	
02, 08, 14, 20	0805	1000	100000	
03, 09, 15, 21	1206	1800	180000	
04, 10, 16, 22	1210	2200	390000	
05, 11, 17, 23	1812	3900	820000	
06, 12, 18, 24	2220	22000	1800000	
25, 26	0402	120	5600	25
01, 07, 13, 19	0603	270	33000	
02, 08, 14, 20	0805	1000	150000	
03, 09, 15, 21	1206	1800	270000	
04, 10, 16, 22	1210	2200	560000	
05, 11, 17, 23	1812	3900	1200000	
06, 12, 18, 24	2220	22000	2200000	
25, 26	0402	120	8200	16
01, 07, 13, 19	0603	270	100000	
02, 08, 14, 20	0805	1000	390000	
03, 09, 15, 21	1206	1800	1000000	
04, 10, 16, 22	1210	2200	820000	
05, 11, 17, 23	1812	3900	1800000	
06, 12, 18, 24	2220	22000	3900000	

Variant Number	Style (Note 5)	Capacitance Range C_n (pF)		Rated Voltage U_R (V)
		Min	Max	
25, 26	0402	120	12000	10
01, 07, 13, 19	0603	270	180000	
02, 08, 14, 20	0805	1000	470000	
03, 09, 15, 21	1206	1800	1500000	
04, 10, 16, 22	1210	2200	2200000	

Available Capacitance values for each Rated Voltage are as defined by the E6 to E24 series; however, any capacitance value within each specified capacitance range may be available on request.

Capacitance tolerances available are: 5% 10% 20%.

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 Para. 2.3.2 High and Low Temperatures Electrical Measurements.
5. See Para. 1.6.

1.5 MAXIMUM RATINGS

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

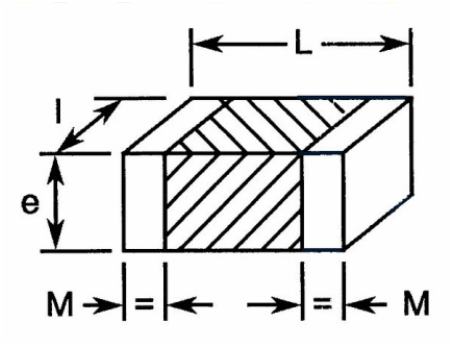
Maximum ratings shall only be exceeded during testing to the extent specified in this specification and when stipulated in Test Methods and Procedures of the ESCC Generic Specification.

Characteristics	Symbols	Maximum Ratings	Units	Remarks
Rated Voltage	U_R	10, 16, 25, 50, 100	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 Para. 1.4.2.
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
l	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 (see Para. 1.4.1).

(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 ±3°C.

Characteristics	Symbols	Test Method and Conditions	Tolerance (± %)	Limits		Units
				Min	Max	
Capacitance (Note 1)	C_A	ESCC No. 3009				pF
			5	$0.95C_n$	$1.05C_n$	
			10	$0.9C_n$	$1.1C_n$	
			20	$0.8C_n$	$1.2C_n$	
Tangent of Loss Angle	tgδ	ESCC No. 3009	All	-	250×10^{-4}	-
Insulation Resistance	R_I	ESCC No. 3009	All			
		For $C_n \leq 10000$pF		100	-	GΩ
		For $C_n > 10000$pF		1000	-	GΩ.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	
Insulation Resistance	R_I	ESCC No. 3009 T_{amb} = +125 ±2°C Note 2			
		For $C_n \leq$ 10000pF	10	-	GΩ
		For $C_n >$ 10000pF	100	-	GΩ.nF
Temperature Characteristic	TC	ESCC No. 3009 T_{amb} = -55 ±2°C, +20 ±2°C, +125 ±2°C Note 3			%
		For V_T = no voltage applied: All Variants:	-20	+20	
		For $V_T = U_R$: Variants 01 to 12, 25 and 26:	-30	+20	
		Variants 13 to 24:	Note 4		

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. Guaranteed but not tested during Chart F3 of the Generic Specification; only tested in Temperature Characterisation during Chart F4 of the Generic Specification.
3. In the case of a 100% inspection, a 1% total percent defective is allowed.
4. 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 ±3°C.

Unless otherwise specified the test methods and test conditions shall be as per the corresponding test defined in Para. 2.3.1 Room Temperature Electrical Measurements.

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

Test Reference per ESCC No. 3009	Characteristics	Symbols	Limits		Units
			Min	Max	
Temperature Characterisation	Insulation Resistance at T_{amb} = +125 ±2°C	R_I	Note 6		
	Temperature Characteristic	TC	Note 6		
Robustness of Terminations Final Measurements	Capacitance	C_A	Note 1		

NOTES:

1. As specified in Para. 2.3.1 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 Para. 2.3.2 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.

APPENDIX A

AGREED DEVIATIONS FOR EXXELIA TECHNOLOGIES (F)

Items Affected	Description of Deviations
Para. 2.1.1 Deviations from the Generic Specification: Screening Tests - Chart F3	Burn-in: Due to the use of components of varying designs to cover the available range of components as listed in REP005 (ESCC QPL), for any particular component, the Applied Voltage for Burn-in shall be as specified in the PID as agreed with the ESCC Executive, with a minimum value of 2 times the Rated Voltage (DC).