



**CAPACITORS, FIXED, CHIPS, BASE METAL  
ELECTRODE, CERAMIC DIELECTRIC, TYPE II**

**BASED ON TYPES 0402 TO 2220**

**ESCC Detail Specification No. 3009/041**

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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: 300904101472KC

- Detail Specification Reference: 3009041
- Component Type Variant Number: 01 (as required)
- Characteristic code: Capacitance Value (4700pF): 472 (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 10 <sup>2</sup>	XX2
XX 10 <sup>3</sup>	XX3
XX 10 <sup>4</sup>	XX4
XX 10 <sup>5</sup>	XX5
XX 10 <sup>6</sup>	XX6

- (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
16	X
25	A
50	C
100	E

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 3)	Capacitance Range, Tolerance, Rated Voltage	Terminal Material and Finish		Weight Max (g)
			End Terminations	Termination Finish	
01	0402	See Note 1	Copper and Silver loaded epoxy + Ni barrier	Sn/Pb plating (Note 2)	0.01
02	0603	See Note 1	Copper and Silver loaded epoxy + Ni barrier	Sn/Pb plating (Note 2)	0.02
03	0805	See Note 1	Copper and Silver loaded epoxy + Ni barrier	Sn/Pb plating (Note 2)	0.04
04	1206	See Note 1	Copper and Silver loaded epoxy + Ni barrier	Sn/Pb plating (Note 2)	0.08
05	1210	See Note 1	Copper and Silver loaded epoxy + Ni barrier	Sn/Pb plating (Note 2)	0.15
06	1812	See Note 1	Copper and Silver loaded epoxy + Ni barrier	Sn/Pb plating (Note 2)	0.3
07	2220	See Note 1	Copper and Silver loaded epoxy + Ni barrier	Sn/Pb plating (Note 2)	0.45

**NOTES:**

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

Variant Number	Style (Note 3)	Capacitance Range C <sub>n</sub> (pF)		Tolerance (± %)	Value Series	Rated Voltage U <sub>R</sub> (V)
		Min	Max			
01	0402	2200	10000	5, 10, 20	E12	100
02	0603	2200	18000			
03	0805	4700	100000			
04	1206	18000	390000			
05	1210	47000	820000			
06	1812	150000	2200000			
07	2220	560000	4700000			
01	0402	2200	27000	5, 10, 20	E12	50
02	0603	2200	150000			
03	0805	4700	470000			
04	1206	18000	1000000			
05	1210	47000	1000000			
06	1812	150000	4700000			
07	2220	560000	10000000			
01	0402	2200	33000	5, 10, 20	E12	25
02	0603	2200	180000			
03	0805	4700	1000000			
04	1206	18000	2200000			
05	1210	47000	1000000			
06	1812	150000	8200000			
07	2220	560000	22000000			
01	0402	2200	33000	5, 10, 20	E12	16
02	0603	2200	180000			
03	0805	4700	1000000			
04	1206	18000	2200000			
05	1210	47000	1000000			
06	1812	150000	8200000			
07	2220	560000	22000000			

2. Sn/Pb coating with minimum 10% Pb.
3. See Para. 1.6.

1.5 MAXIMUM RATINGS

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

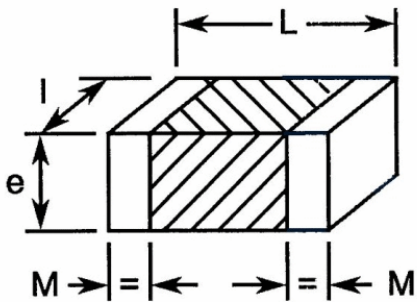
Maximum ratings shall only be exceeded during testing to the extent specified in this specification and when stipulated in Test Methods and Procedures of the ESCC Generic Specification.

Characteristics	Symbols	Maximum Ratings	Units	Remarks
Rated Voltage	$U_R$	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 Variant 01		Style 0603 Variant 02		Style 0805 Variant 03		Style 1206 Variant 04		Style 1210 Variant 05		Style 1812 Variant 06		Style 2220 Variant 07	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
L	0.9	1.15	1.45	1.75	1.8	2.2	3	3.4	3	3.4	4.2	4.8	5.3	6.1
I	0.4	0.6	0.65	0.95	1.05	1.45	1.4	1.8	2.3	2.7	3	3.4	4.6	5.4
e	-	0.6	-	1	-	1.52	-	1.8	-	2.8	-	2.8	-	2.8
M	0.1	0.4	0.2	0.5	0.25	0.75	0.25	0.75	0.25	0.75	0.25	0.95	0.25	1.03

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**

None.

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

Characteristics	Symbols	Test Method and Conditions	Tolerance (± %)	Limits		Units
				Min	Max	
Capacitance (Note 1)	C <sub>A</sub>	ESCC No. 3009	5 10 20	0.95C <sub>n</sub> 0.9C <sub>n</sub> 0.8C <sub>n</sub>	1.05C <sub>n</sub> 1.1C <sub>n</sub> 1.2C <sub>n</sub>	pF
Tangent of Loss Angle	tgδ	ESCC No. 3009 For U <sub>R</sub> = 50V, 100V For U <sub>R</sub> = 16V, 25V	All	- -	250 x10 <sup>-4</sup> 300 x10 <sup>-4</sup>	- -
Insulation Resistance	R <sub>I</sub>	ESCC No. 3009 For C <sub>n</sub> ≤ 10000pF For C <sub>n</sub> > 10000pF	All	100 1000	- -	GΩ GΩ.nF
Voltage Proof	VP	ESCC No. 3009	All	2.5U <sub>R</sub>	-	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 <sub>i</sub>	ESCC No. 3009 T <sub>amb</sub> = +125 ±2°C Note 2			
		For C <sub>n</sub> ≤ 10000pF For C <sub>n</sub> > 10000pF	10 100	- -	GΩ GΩ.nF
Temperature Characteristic	TC	ESCC No. 3009 T <sub>amb</sub> = -55 ±2°C, +20 ±2°C, +125 ±2°C Note 3			%
		For V <sub>T</sub> = no voltage applied For V <sub>T</sub> = U <sub>R</sub>	-15 Note 4	+15	

**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<sub>T</sub> = U<sub>R</sub> 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 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	$tg\delta$	Note 1		
	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	$tg\delta$	Note 3		
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	$tg\delta$	Note 3		
	Insulation Resistance (Note 4):				
	For $C_n \leq 10000pF$	$R_I$	10	-	$G\Omega$
	For $C_n > 10000pF$	$R_I$	100	-	$G\Omega.nF$

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 5)	Capacitance	$C_A$	Note 1		
	Change in Capacitance	$\Delta C_A/C_A$	-10	+10	%
	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 6)	Capacitance	$C_A$	Note 1		
	Change in Capacitance	$\Delta C_A/C_A$	-10	+10	%
	Tangent of Loss Angle	$tg\delta$	Note 3		
	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
Temperature Characterisation	Insulation Resistance at $T_{amb} = +125 \pm 2^\circ\text{C}$	$R_I$	Note 7		
	Temperature Characteristic	TC	Note 7		
Robustness of Terminations					
Final Measurements	Capacitance	$C_A$	Note 1		

**NOTES:**

- As specified in Para. 2.3.1 Room Temperature Electrical Measurements.
- Capacitance values recorded during the final measurements of the previous test may be used as initial measurements.
- Twice the limit specified in Para. 2.3.1 Room Temperature Electrical Measurements.
- Test conditions for Insulation Resistance shall be as specified in Steady State Humidity in the ESCC Generic Specification.
- Intermediate measurements are optional at the Manufacturer's discretion.
- 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.
- 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 AVX LTD (NI)**

Items Affected	Description of Deviations
Para. 2.1.1 Deviations from the Generic Specification: Screening Tests - Chart F3	Voltage Proof: For AVX components specified with rated voltage $U_R = 16V$ , code letter X, the Voltage Proof test voltage during electrical measurements shall be $V = 62.5V$
	Burn-in: For AVX components specified with rated voltage $U_R = 16V$ , code letter X, the applied voltage during Burn-in shall be $V = 50V$
Para. 2.1.1 Deviations from the Generic Specification: Qualification and Periodic Tests - Chart F4	Voltage Proof: For AVX components specified with rated voltage $U_R = 16V$ , code letter X, the Voltage Proof test voltage during electrical measurements shall be $V = 62.5V$
	Operating Life: For AVX components specified with rated voltage $U_R = 16V$ , code letter X, the applied voltage during Operating Life shall be $V = 50V$
Para. 2.3.1 Room Temperature Electrical Measurements	Voltage Proof: For AVX components specified with rated voltage $U_R = 16V$ , code letter X, the Voltage Proof limit $VP = 62.5V$ minimum, shall apply.