



**CAPACITORS, LEADLESS SURFACE MOUNTED,
TANTALUM, SOLID ELECTROLYTE,
LOW EQUIVALENT SERIES RESISTANCE
BASED ON TYPE TES
ESCC Detail Specification No. 3012/004**

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DOCUMENTATION CHANGE NOTICE

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DCR No.	CHANGE DESCRIPTION
1361	Specification upissued 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	6
1.5	MAXIMUM RATINGS	8
1.6	PHYSICAL DIMENSIONS AND TERMINAL IDENTIFICATION	10
1.7	FUNCTIONAL DIAGRAM	10
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	11
2.3.1	Room Temperature Electrical Measurements	11
2.3.2	High and Low Temperatures Electrical Measurements	12
2.4	INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS	13
	APPENDIX A	15

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 Component Type Variants and 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. [3012](#).

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: 301200401106KE0600

- Detail Specification Reference: 3012004
- Component Type Variant Number: 01 (as required)
- Characteristic code: Rated Capacitance (10µF): 106 (as required)
- Characteristic code: Capacitance Tolerance (±10%): K (as required)
- Rating code: DC Rated Voltage (25V): E (as required)
- Characteristic code: Maximum Equivalent Series Resistance (600mΩ): 0600

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, 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 (pF)	Code
XX 10 ⁵	XX5
XX 10 ⁶	XX6
XX 10 ⁷	XX7

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

Tolerance (± %)	Code
10	K
20	M

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

DC Rated Voltage U_R (V)	Code
6.3	J
10	A
12	B
16	C
20	D
25	E
35	V
50	T

(d) Equivalent Series Resistance maximum value, ESR, expressed by the following codes. The unit quantity shall be milliohm ($m\Omega$):

Maximum Equivalent Series Resistance ESR ($m\Omega$)	Code
XX	00XX
XXX	0XXX
XXXX	XXXX

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	Case Code (Style) (Note 1)	Terminal Material and Finish (Note 2)	Capacitance Range C_n (μF) (Notes 3, 4)	DC Rated Voltage U_R (V) (Note 3)	Maximum Equivalent Series Resistance ESR ($m\Omega$) (Note 2)	Weight Max (g)
01	A (1206)	G16	1 to 22	6.3 to 25	900 to 3000	0.1
02	B (1210)	G16	1 to 47	6.3 to 50	500 to 2000	0.2
03	C (2312)	P17	3.3 to 150	6.3 to 50	300 to 1000	0.3
04	D (2917)	P17	4.7 to 330	6.3 to 50	35 to 200	0.5
05	E (2917)	P17	33 to 470	6.3 to 35	30 to 65	0.7

NOTES:

1. See Para. 1.6.
2. Terminal material and finish shall in accordance with the requirements of ESCC Basic Specification No. [23500](#).

3. The following Rated Capacitance (C_n), DC Rated Voltage (U_R) and maximum Equivalent Series Resistance values (ESR) are available in the following cases (letters indicate Case Code; numbers indicate maximum ESR in $m\Omega$):

Capacitance C_n (μF)	DC Rated Voltage U_R							
	6.3V	10V	12V	16V	20V	25V	35V	50V
1						A 3000		B 2000
3.3					A 2500		B 1000	C 1000
4.7				A 2000		B 1000	C 600	D 200
10		A 1800			B 1000	C 600	D 120	
22	A 900			B 600	C 400		D 100	
33		B 650			C 300	D 65	E 65	
47	B 500			C 350	D 55	E 65		
100		C 200		D 55	E 45			
150	C 300	D 45		E 40				
220		D 35	E 35					
330	D 35	E 35						
470	E 30							

4. The following Capacitance Tolerances are available:

- $\pm 10\%$ (K)
- $\pm 20\%$ (M)

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.

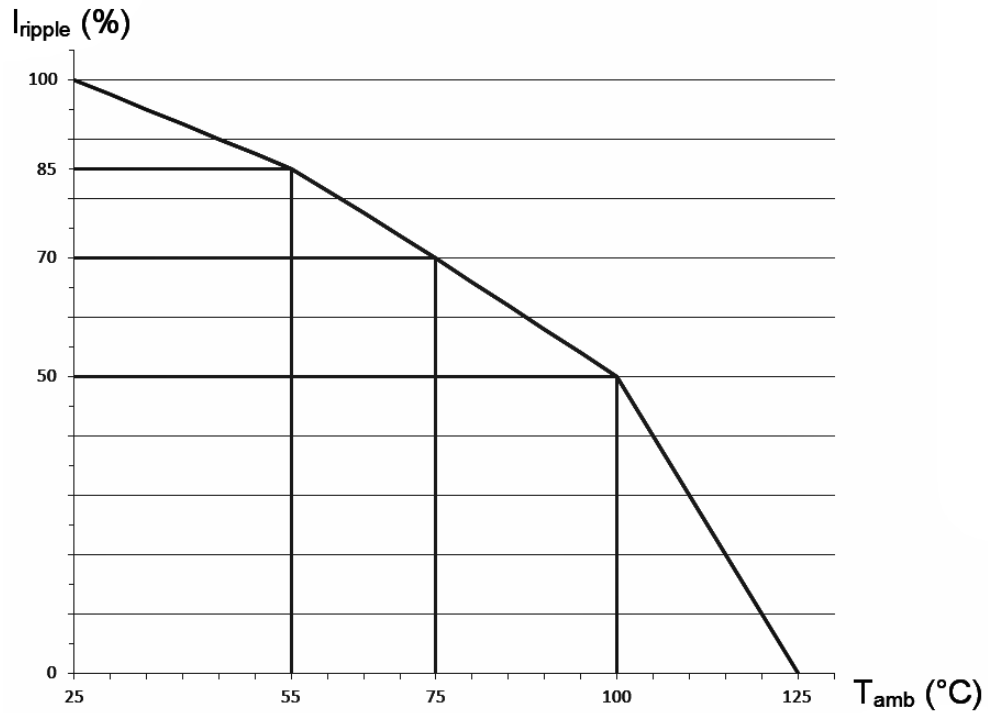
Characteristics	Symbols	Maximum Ratings	Units	Remarks
DC Rated Voltage	U_R	See Para. 1.4.1.1(d)	V	Note 1
DC Surge Voltage	U_S	$1.3 \times U_R$	V	$T_{amb} \leq +85^\circ\text{C}$
DC Category Voltage	U_C	$0.66 \times U_R$	V	
Ripple Current	I_{ripple}	See Note 2	mA	$f = 100\text{kHz}$, Note 3
Operating Temperature Range	T_{op}	-55 to +125	$^\circ\text{C}$	T_{amb}
Rated Temperature	T_R	+85	$^\circ\text{C}$	
Upper Category Temperature	T_C	+125	$^\circ\text{C}$	
Storage Temperature Range	T_{stg}	-55 to +125	$^\circ\text{C}$	
Soldering Temperature	T_{sol}	+260	$^\circ\text{C}$	Note 4

NOTES:

- At $T_{amb} \leq +85^\circ\text{C}$. For $T_{amb} > +85^\circ\text{C}$, derate linearly to U_C at $T_{amb} = +125^\circ\text{C}$.
- Maximum I_{ripple} , which depends on C_n and U_R , shall be as follows at $T_{amb} \leq +25^\circ\text{C}$ and $f = 100\text{kHz}$:

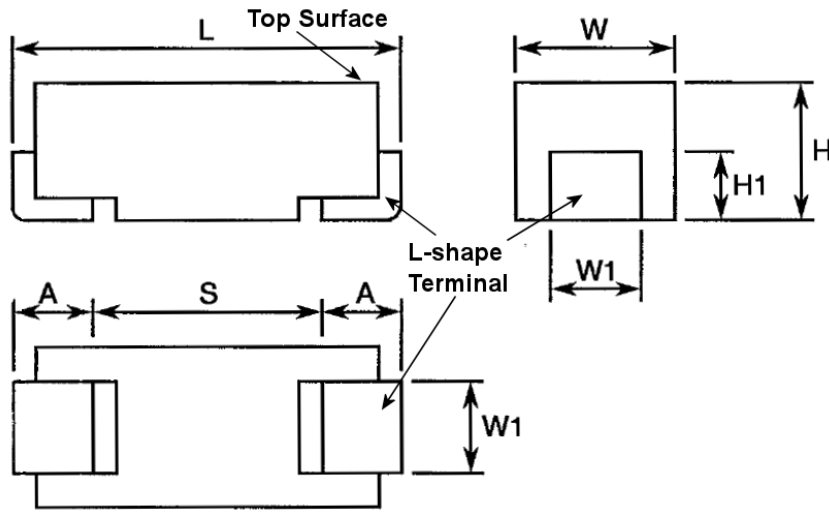
Capacitance C_n (μF)	Rated Voltage U_R (V)	Maximum Ripple Current I_{ripple} (mA)	Capacitance C_n (μF)	Rated Voltage U_R (V)	Maximum Ripple Current I_{ripple} (mA)
22	6.3	290	10	20	290
47	6.3	410	22	20	520
150	6.3	610	33	20	610
330	6.3	2700	47	20	2200
470	6.3	3000	100	20	2500
10	10	200	1	25	160
33	10	360	4.7	25	290
100	10	740	10	25	430
150	10	2400	33	25	2000
220	10	2700	47	25	2000
330	10	2800	3.3	35	290
220	12	2800	4.7	35	430
4.7	16	190	10	35	1500
22	16	380	22	35	1600
47	16	560	33	35	2000
100	16	2200	1	50	200
150	16	2600	3.3	50	330
3.3	20	170	4.7	50	1100

3. At $T_{amb} \leq +25^{\circ}\text{C}$. For $T_{amb} > +25^{\circ}\text{C}$, derate maximum I_{ripple} as follows:



4. Duration 5 seconds maximum for wave soldering and 10 seconds maximum for reflow soldering. The solderable area is the terminal pad and up to 1/3 the height of the L-shape terminal (see Para. 1.6).

1.6 PHYSICAL DIMENSIONS AND TERMINAL IDENTIFICATION

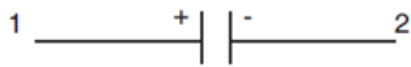


Variant Number	Case Code	Dimensions (mm)													
		L		H		H1		W		W1		A		S	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
01	A	3	3.4	-	1.8	0.7	-	1.5	1.8	1	1.4	0.6	1.1	1.1	-
02	B	3.3	3.7	-	2.1	0.7	-	2.7	3	2	2.4	0.6	1.1	1.4	-
03	C	5.8	6.2	-	2.8	0.7	-	3.1	3.4	2	2.4	1.1	1.6	2.9	-
04	D	7.1	7.5	-	3.1	0.7	-	4.2	4.5	2.2	2.6	1.1	1.6	4.4	-
05	E	7.1	7.5	-	4.3	0.7	-	4.2	4.5	2.2	2.6	1.1	1.6	4.4	-

NOTES:

- Terminal identification: The anode terminal shall be indicated by a polarity stripe marked on the top surface of the component. For qualified components, the ESCC qualified components symbol may be used to indicate the anode terminal.

1.7 FUNCTIONAL DIAGRAM



Terminal 1: Anode

Terminal 2: Cathode

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. The information to be marked shall be:

- (a) Terminal Identification (see Para. 1.6).
- (b) The ESCC qualified components symbol (for ESCC qualified components only).
- (c) The ESCC Component Number (see Para. 1.4.1).
- (d) 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	C	ESCC No. 3012	$\pm 10\%$ $\pm 20\%$	$0.9C_n$ $0.8C_n$	$1.1C_n$ $1.2C_n$	μF
DC Leakage Current	I_L	ESCC No. 3012	All	-	$0.01C_n \times U_R$ or (1) 1	μA
Dissipation Factor	DF	ESCC No. 3012 For $U_R < 10V$: For $U_R \geq 10V$:	All	- -	10 6	%
Equivalent Series Resistance	ESR	ESCC No. 3012	All	-	Note 2	$m\Omega$

NOTES:

- 1. Whichever is greater.
- 2. See Para. 1.4.2, Note 3.

2.3.2 High and Low Temperatures Electrical Measurements

Characteristics	Symbols	Test Method and Conditions (Note 1)	Tolerance	Limits		Units
				Min	Max	
Capacitance	C	ESCC No. 3012 $T_{amb} = -55 (+3 -0)^{\circ}C$: $T_{amb} = +85 \pm 3^{\circ}C$: $T_{amb} = +125 (+0 -3)^{\circ}C$:	$\pm 10\%$ $\pm 20\%$ $\pm 10\%$ $\pm 20\%$ $\pm 10\%$ $\pm 20\%$	$0.81C_n$ $0.72C_n$ $0.9C_n$ $0.8C_n$ $0.9C_n$ $0.8C_n$	$1.1C_n$ $1.2C_n$ $1.21C_n$ $1.32C_n$ $1.232C_n$ $1.344C_n$	μF
DC Leakage Current	I_L	ESCC No. 3012 $T_{amb} = +85 \pm 3^{\circ}C, V = U_R \pm 2\%$: $T_{amb} = +125 (+0 -3)^{\circ}C, V = U_C \pm 2\%$:	All	-	$0.1C_n \times U_R$ or (2) 1 $0.125C_n \times U_R$ or (2) 1	μA
Dissipation Factor	DF	ESCC No. 3012 $T_{amb} = -55 (+3 -0)^{\circ}C$ For $U_R < 10V$: For $U_R \geq 10V$: $T_{amb} = +85 \pm 3^{\circ}C$ For $U_R < 10V$: For $U_R \geq 10V$: $T_{amb} = +125 (+0 -3)^{\circ}C$ For $U_R < 10V$: For $U_R \geq 10V$:	All	- - - - - -	15 9 15 9 20 12	%
Equivalent Series Resistance	ESR	ESCC No. 3012 $T_{amb} = -55 (+3 -0)^{\circ}C$: $T_{amb} = +85 \pm 3^{\circ}C$: $T_{amb} = +125 (+0 -3)^{\circ}C$:	All	- - -	Note 3 Note 4 Note 4	%

NOTES:

- Measurements shall be performed on a sample of 5 components from each manufacturing lot and each capacitance value with 0 failures allowed. In the event of any failure a 100% inspection may be performed.
- Whichever is greater.
- 2.5x the limit specified in Para. 2.3.1.
- 1.5x the limit specified in Para. 2.3.1.

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 Para. 2.3.1 Room Temperature Electrical Measurements.

Test Reference per ESCC No. 3012	Characteristics	Symbols	Limits		Units	
			Min	Max		
Mounting Initial Measurements	Capacitance	C	Note 1		μF	
	Final Measurements	Capacitance	C	Record Value		μF
		Capacitance Change	$\Delta\text{C}/\text{C}$	-5	+5	%
		DC Leakage Current	I_L	-	Note 1	μA
		Dissipation Factor	DF	-	Note 1	%
		Equivalent Series Resistance	ESR	-	Note 2	$\text{m}\Omega$
Robustness of Terminations Initial Measurements	Capacitance	C	Note 3		μF	
	Final Measurements	Capacitance	C	Record Value		μF
		Capacitance Change	$\Delta\text{C}/\text{C}$	-5	+5	% (3)
Rapid Change of Temperature Initial Measurements	Capacitance	C	Note 3		μF	
	Final Measurements	Capacitance	C	Record Value		μF
		Capacitance Change	$\Delta\text{C}/\text{C}$	-5	+5	% (3)
		DC Leakage Current	I_L	-	Note 1	μA
		Dissipation Factor	DF	-	Note 1	%
		Equivalent Series Resistance	ESR	-	Note 2	$\text{m}\Omega$
Vibration During Last Sweep Cycle	No intermittent contact $\geq 0.5\text{ms}$, arcing, or open/short circuits	-	-	-	-	
Climatic Sequence Initial Measurements	Capacitance	C	Note 3		μF	
	Dry Heat	DC Leakage Current (at $+125^{\circ}\text{C}$; U_C)	I_L	-	Note 4	μA
		Final Measurements	Capacitance	C	Record Value	
	Capacitance Change		$\Delta\text{C}/\text{C}$	-5	+5	% (3)
	DC Leakage Current		I_L	-	Note 1	μA
	Dissipation Factor		DF	-	Note 2	%
	Equivalent Series Resistance		ESR	-	Note 2	$\text{m}\Omega$
High and Low Temperature Stability	Step 1 (at $+22^{\circ}\text{C}$)	Note 1 (All Characteristics)	Note 1	Note 1		
	Step 2 (at -55°C)	Note 4 (All Characteristics)	Note 4	Note 4		
	Step 3 (at $+22^{\circ}\text{C}$)	Note 1 (All Characteristics)	Note 1	Note 1		
	Step 4 (at $+85^{\circ}\text{C}$)	Note 4 (All Characteristics)	Note 4	Note 4		
	Step 5 (at $+125^{\circ}\text{C}$)	Note 4 (All Characteristics)	Note 4	Note 4		
	Step 6 (at $+22^{\circ}\text{C}$)	Note 1 (All Characteristics)	Note 1	Note 1		

Test Reference per ESCC No. 3012	Characteristics	Symbols	Limits		Units
			Min	Max	
Surge Voltage Final Measurements	Capacitance DC Leakage Current Dissipation Factor Equivalent Series Resistance	C I _L DF ESR	Note 1 - Note 1 - Note 1 - Note 1		μF μA % mΩ
Damp Heat, Steady State Initial Measurements	Capacitance	C	Note 3		μF
Final Measurements	Capacitance Capacitance Change DC Leakage Current Dissipation Factor Equivalent Series Resistance	C ΔC/C I _L DF ESR	Record Value -10 +10 - Note 5 - Note 6 - Note 2	μF % (3) μA % mΩ	
Operating Life Initial Measurements	Capacitance	C	Note 3		μF
Intermediate Measurements (250h and 1000h)(Note 8)	DC Leakage Current (at T1 = +85°C) DC Leakage Current (at T2 = +125°C)	I _L I _L	- Note 7 - Note 7	μA μA	
Intermediate Measurements (250h)(Note 9)	DC Leakage Current (at T1 = +85°C)	I _L	- Note 7	μA	
Final Measurements (1000h or 2000h)(Note 10)	Capacitance Capacitance Change DC Leakage Current Dissipation Factor Equivalent Series Resistance	C ΔC/C I _L DF ESR	Record Value -10 +10 - Note 2 - Note 1 - Note 2	μF % (3) μA % mΩ	

NOTES:

- As specified in Para. 2.3.1.
- 1.25× the limit specified in Para. 2.3.1.
- Capacitance measured during the final measurements during Mounting may be used as the initial measurement for other tests. In this case, Capacitance Change shall be referred to this initial measurement.
- As specified in Para. 2.3.2.
- 1.5× the limit specified in Para. 2.3.1.
- 1.2× the limit specified in Para. 2.3.1.
- 1.25× the limit specified in Para. 2.3.2.
- Applicable to Qualification Testing, and to Periodic Testing for renewal of qualification after lapse.
- Applicable to Periodic Testing for extension of qualification.
- 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.

APPENDIX A**AGREED DEVIATIONS FOR AVX CZECH REPUBLIC s.r.o (CZ)**

Items Affected	Description of Deviations
Para. 2.1.1, Deviations from the Generic Specification: Special In-Process Controls - Chart F2	Internal Visual Inspection: Need not be performed immediately prior to encapsulation but may be performed at various stages during production, as specified in the PID.
Para. 2.1.1, Deviations from the Generic Specification: Screening Tests - Chart F3, and Qualification and Periodic Testing - Chart F4	External Visual Inspection: Visible base material is permitted on the edges of terminals (there may be no plating on edges).