



**CAPACITORS, LEADLESS SURFACE MOUNTED,
ORGANIC POLYMER TANTALUM, SOLID ELECTROLYTE,
ENCLOSED ANODE CONNECTION**

BASED ON TYPE TCS

ESCC Detail Specification No. 3012/006

Issue 5	April 2022
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DOCUMENTATION CHANGE NOTICE

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

DCR No.	CHANGE DESCRIPTION
1487	Specification upissued 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 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: 301200601337MA0015

- Detail Specification Reference: 3012006
- Component Type Variant Number: 01
- Characteristic code: Rated Capacitance (330µF): 337 (as required)
- Characteristic code: Capacitance Tolerance (±20%): M
- Rating code: DC Rated Voltage (10V): A (as required)
- Characteristic code: Maximum Equivalent Series Resistance (15mΩ): 0015

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 ⁶	XX6
XX 10 ⁷	XX7

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

Tolerance (± %)	Code
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
16	C
20	D
25	E
35	V

(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

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)	Capacitance Range C_n (μF) (Notes 2, 3)	DC Rated Voltage U_R (V) (Note 2)	Maximum Equivalent Series Resistance ESR ($m\Omega$) (Note 2)	Weight Max (g)
01	E (2917)	22 to 470	6.3 to 35	12, 15, 20, 25, 50	0.7

NOTES:

- See Para. 1.53.
- The following Rated Capacitance (C_n), DC Rated Voltage (U_R) and maximum Equivalent Series Resistance values (ESR) are available for Variant 01 (Case Code: E) (numbers indicate maximum ESR in $m\Omega$):

Capacitance C_n	DC Rated Voltage U_R					
	6.3V	10V	16V	20V	25V	35V
22 μF						50 $m\Omega$
33 μF					50 $m\Omega$	
68 μF				25 $m\Omega$		
150 μF			20 $m\Omega$			
220 μF		15 $m\Omega$	20 $m\Omega$			
330 μF	12 $m\Omega$	15 $m\Omega$				
470 μF	12 $m\Omega$					

- The following Capacitance Tolerance is available:
 - $\pm 20\%$ (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	$0.8 \times U_R$	V	
Ripple Current	I_{ripple}	See Note 2	mA	$f = 100\text{kHz}$, Note 3
Operating Temperature Range	T_{op}	-55 to +105	$^\circ\text{C}$	T_{amb}
Rated Temperature	T_R	+85	$^\circ\text{C}$	
Upper Category Temperature	T_C	+105	$^\circ\text{C}$	
Storage Temperature Range	T_{stg}	-55 to +105	$^\circ\text{C}$	Note 4
Soldering Temperature	T_{sol}	+260	$^\circ\text{C}$	Notes 4, 5

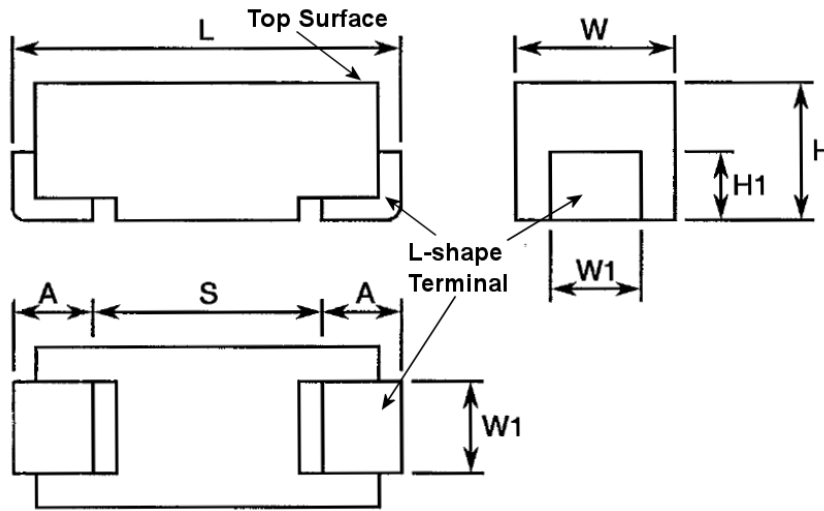
NOTES:

- At $T_{amb} \leq +85^\circ\text{C}$. For $T_{amb} > +85^\circ\text{C}$, derate linearly to U_C at $T_{amb} = +105^\circ\text{C}$.
- Maximum I_{ripple} , which depends on C_n and U_R , shall be as follows at $T_{amb} \leq +45^\circ\text{C}$ and $f = 100\text{kHz}$:

Capacitance C_n (μF)	DC Rated Voltage U_R (V)	Maximum Ripple Current I_{ripple} (A)
22	35	2.9
33	25	2.9
68	20	2.9
150	16	4
220	16	4
220	10	4
330	10	4
330	6.3	4
470	6.3	4

- At $T_{amb} \leq +45^\circ\text{C}$. For $+45^\circ\text{C} < T_{amb} \leq +85^\circ\text{C}$, derate maximum I_{ripple} linearly to $0.7I_{ripple}$ at $T_{amb} = +85^\circ\text{C}$. For $T_{amb} > +85^\circ\text{C}$, derate linearly to $0.47I_{ripple}$ at $T_{amb} = +105^\circ\text{C}$.
- These components are classified as Moisture Sensitivity Level 3 in accordance with J-STD-020. Components shall be delivered in moisture barrier bags with a desiccant and moisture indicator card. Components should be stored still contained within the moisture barrier bags in a non-condensating atmospheric environment of $T_{amb} \leq +40^\circ\text{C}$ and relative humidity $\text{RH} \leq 90\%$.
These components have a floor life of 168 hours at $T_{amb} \leq +30^\circ\text{C}$ and $\text{RH} \leq 60\%$.
- 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

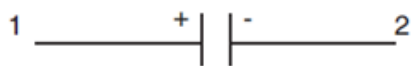


Variant Number	Case Code	Dimensions (mm)													
		L		H		H1		W		W1		A		S	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
01	E	7.1	7.5	-	4.3	0.7	-	4.2	4.5	2.2	2.6	1.1	1.6	4.4	-

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

1.8 MATERIALS AND FINISHES

1.8.1 Terminal Material and Finish

Terminal material and finish shall be type P17 in accordance with the requirements of ESCC Basic Specification No. [23500](#).

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 Testing - Chart F4

- (a) Para. 8.14, Surge Voltage: Data Points: In addition, Capacitance Change shall be measured on completion of testing.

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	$\pm 20\%$	$0.8C_n$	$1.2C_n$	μF
DC Leakage Current	I_L	ESCC No. 3012	All	-	$0.1C_n \times U_R$	μA
Dissipation Factor	DF	ESCC No. 3012	All	-	10	%
Equivalent Series Resistance	ESR	ESCC No. 3012	All	-	Note 1	$m\Omega$

NOTES:

- 1. See Para. 1.4.2, Note 2.

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 $T_{amb} = -55 (+3 -0)^{\circ}C$: $T_{amb} = +85 \pm 3^{\circ}C$: $T_{amb} = +105 (+0 -3)^{\circ}C$:	$\pm 20\%$ $\pm 20\%$ $\pm 20\%$	0.64C _n 0.8C _n 0.8C _n	1.2C _n 1.44C _n 1.56C _n	μF
DC Leakage Current	I _L	ESCC No. 3012 $T_{amb} = +85 \pm 3^{\circ}C, V = U_R \pm 2\%$: $T_{amb} = +105 (+0 -3)^{\circ}C, V = U_C \pm 2\%$:	All	- -	C _n x U _R C _n x U _C	μA
Dissipation Factor	DF	ESCC No. 3012 $T_{amb} = -55 (+3 -0)^{\circ}C$ For U _R < 10V: For U _R ≥ 10V: $T_{amb} = +85 \pm 3^{\circ}C$ For U _R < 10V: For U _R ≥ 10V: $T_{amb} = +105 (+0 -3)^{\circ}C$ For U _R < 10V: For U _R ≥ 10V:	All	- - - - - -	15 9 15 9 20 12	%
Equivalent Series Resistance	ESR	ESCC No. 3012 $T_{amb} = -55 (+3 -0)^{\circ}C$: $T_{amb} = +85 \pm 3^{\circ}C$: $T_{amb} = +105 (+0 -3)^{\circ}C$:	All	- - -	Note 3 Note 4 Note 4	%

NOTES:

1. 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.
2. Whichever is greater.
3. 2.5× the limit specified in Para. 2.3.1.
4. 1.5× 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 $T_{amb} = +22 \pm 3^{\circ}C$.

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	$\Delta C/C$	-5	+5	%
		DC Leakage Current	I_L	-	Note 1	μA
		Dissipation Factor	DF	-	Note 1	%
		Equivalent Series Resistance	ESR	-	Note 2	$m\Omega$
Robustness of Terminations Initial Measurements	Capacitance	C	Note 3		μF	
	Final Measurements	Capacitance	C	Record	Value	μF
		Capacitance Change	$\Delta C/C$	-10	+10	% (3)
Rapid Change of Temperature Initial Measurements	Capacitance	C	Note 3		μF	
	Final Measurements	Capacitance	C	Record	Value	μF
		Capacitance Change	$\Delta C/C$	-20	+20	% (3)
		DC Leakage Current	I_L	-	Note 1	μA
		Dissipation Factor	DF	-	Note 1	%
		Equivalent Series Resistance	ESR	-	Note 4	$m\Omega$
Vibration During Last Sweep Cycle	No intermittent contact $\geq 0.5ms$, arcing, or open/short circuits	-	-	-	-	
Climatic Sequence Initial Measurements	Capacitance	C	Note 3		μF	
	Dry Heat	DC Leakage Current (at $+105^{\circ}C$; U_C)	I_L	-	Note 5	μA
		Final Measurements	Capacitance	C	Record	Value
	Capacitance Change		$\Delta C/C$	-5	+5	% (3)
	DC Leakage Current		I_L	-	Note 1	μA
	Dissipation Factor		DF	-	Note 6	%
	Equivalent Series Resistance		ESR	-	Note 6	$m\Omega$
High and Low Temperature Stability	Step 1 (at $+22^{\circ}C$)	Note 1 (All Characteristics)	Note 1	Note 1		
	Step 2 (at $-55^{\circ}C$)	Note 5 (All Characteristics)	Note 5	Note 5		
	Step 3 (at $+22^{\circ}C$)	Note 1 (All Characteristics)	Note 1	Note 1		
	Step 4 (at $+85^{\circ}C$)	Note 5 (All Characteristics)	Note 5	Note 5		
	Step 5 (at $+125^{\circ}C$)	Note 5 (All Characteristics)	Note 5	Note 5		
	Step 6 (at $+22^{\circ}C$)	Note 1 (All Characteristics)	Note 1	Note 1		

Test Reference per ESCC No. 3012	Characteristics	Symbols	Limits		Units
			Min	Max	
Surge Voltage Initial Measurements Final Measurements	Capacitance	C	Note 1		μF
	Capacitance	C	Record Value		μF
	Capacitance Change	ΔC/C	-30	+20	%
	DC Leakage Current	I _L	-	Note 1	μA
	Dissipation Factor	DF	-	Note 2	%
	Equivalent Series Resistance	ESR	-	Note 2	mΩ
Damp Heat, Steady State Initial Measurements Final Measurements	Capacitance	C	Note 3		μF
	Capacitance	C	Record Value		μF
	Capacitance Change	ΔC/C	-5	+35	% (3)
	DC Leakage Current	I _L	-	Note 4	μA
	Dissipation Factor	DF	-	Note 6	%
	Equivalent Series Resistance	ESR	-	Note 6	mΩ
Operating Life Initial Measurements Intermediate Measurements (250h and 1000h)(Note 8) Intermediate Measurements (250h)(Note 9) Final Measurements (1000h or 2000h)(Note 10)	Capacitance	C	Note 3		μF
	DC Leakage Current (at T1 = +85°C)	I _L	-	Note 7	μA
	DC Leakage Current (at T2 = +105°C)	I _L	-	Note 7	μA
	DC Leakage Current (at T1 = +85°C)	I _L	-	Note 7	μA
	Capacitance	C	Record Value		μF
	Capacitance Change	ΔC/C	-20	+10	% (3)
	DC Leakage Current	I _L	-	Note 2	μA
	Dissipation Factor	DF	-	Note 1	%
	Equivalent Series Resistance	ESR	-	Note 6	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.
- 5× the limit specified in Para. 2.3.1.
- As specified in Para. 2.3.2.
- 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 KYOCERA AVX COMPONENTS s.r.o. (CZ)**

Items Affected	Description of Deviations
Para. 2.1.1, Deviations from the Generic Specification: Deviations from 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: Deviations from Screening Tests - Chart F3, Deviations from 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).