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

BASED ON TYPE TCS

ESCC Detail Specification No. 3012/006

Issue 6	July 2024

Document Custodian: European Space Agency – see https://escies.org

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DCR No.	CHANGE DESCRIPTION
1671	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
4	G
6.3	J
10	A
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 (mΩ):

Maximum Equivalent Series Resistance ESR (mΩ)	Code
XX	00XX
XXX	0XXX

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 (mΩ) (Note 2)	Weight Max (g)
01	E (2917)	15 to 680	4 to 50	12, 15, 20, 25, 50, 75, 100	0.7

NOTES:

1. See Para. 1.6.
2. 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 mΩ):

Capacitance C_n	DC Rated Voltage U_R							
	4V	6.3V	10V	16V	20V	25V	35V	50V
15µF								100mΩ
22µF							50mΩ	75mΩ
33µF						50mΩ	50mΩ	
47µF						50mΩ		
68µF					25mΩ			
100µF					25mΩ			
150µF				20mΩ				
220µF			15mΩ	20mΩ				
330µF		12mΩ	15mΩ					
470µF	12mΩ	12mΩ						
680µF	12mΩ							

3. The following Capacitance Tolerance is available:
   - ±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(c)	V	Note 1
DC Surge Voltage	U_S	1.3 x U_R	V	$T_{amb} \leq +85°C$
DC Category Voltage	U_C	0.8 x U_R	V	
Ripple Current	I_{ripple}	See Note 2	mA	f = 100kHz, Note 3
Operating Temperature Range	T_{op}	-55 to +105	°C	T_{amb}
Rated Temperature	T_R	+85	°C	
Upper Category Temperature	T_C	+105	°C	
Storage Temperature Range	T_{stg}	-55 to +105	°C	Note 4
Soldering Temperature	T_{sol}	+260	°C	Notes 4, 5

NOTES:

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

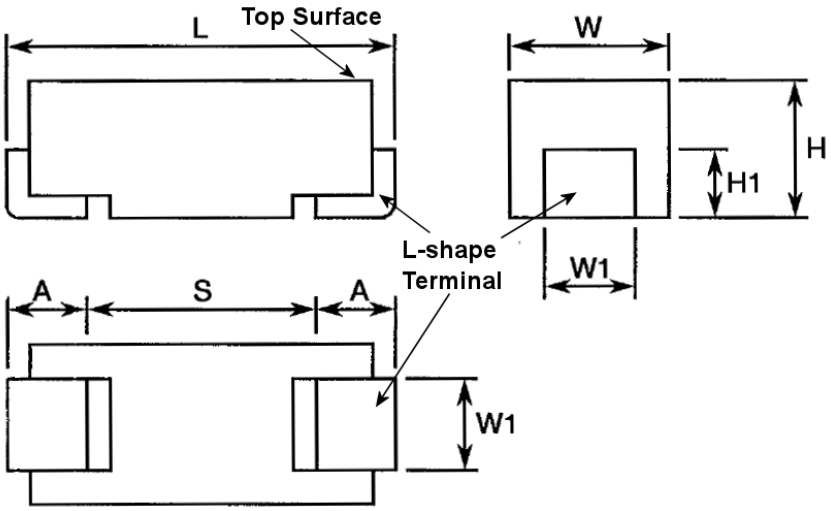
Capacitance C_n (µF)	DC Rated Voltage U_R (V)	Maximum Ripple Current I_{ripple} (A)
15	50	2
22	35	2.9
22	50	2.3
33	25	2.9
33	35	2.9
47	25	2.9
68	20	4
100	20	4
150	16	4.5
220	16	4.5
220	10	5.2
330	10	5.2
330	6.3	5.8
470	4	5.8
470	6.3	5.8
680	4	5.8

3. At $T_{amb} \leq +45°C$. For $+45°C < T_{amb} \leq +85°C$, derate maximum I_{ripple} linearly to $0.7I_{ripple}$ at $T_{amb} = +85°C$. For $T_{amb} > +85°C$, derate linearly to $0.47I_{ripple}$ at $T_{amb} = +105°C$.

4. 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 $T_{amb} \leq +40°C$ and relative humidity RH ≤ 90%.
These components have a floor life of 168 hours at $T_{amb} \leq +30°C$ and RH ≤ 60%.

5. 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

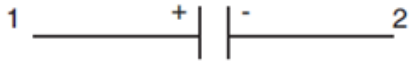


Variant Number	Case Code	Dimensions (mm)													
		L		H		H1		W		W1		A		S	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
01	E	7.1	7.5	-	4.3	0.7	-	4.2	4.5	2.2	2.6	1.1	1.6	4.4	-

NOTES:

1. 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 ±3°C.

Characteristics	Symbols	Test Method and Conditions	Tolerance	Limits		Units
				Min	Max	
Capacitance	C	ESCC No. 3012	±20%	$0.8C_n$	$1.2C_n$	µF
DC Leakage Current	I_L	ESCC No. 3012	All	-	$0.1C_n$ x U_R	µA
Dissipation Factor	DF	ESCC No. 3012	All	-	10	%
Equivalent Series Resistance	ESR	ESCC No. 3012	All	-	Note 1	mΩ

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				µF
		T_{amb} = -55 (+3 -0)°C:	±20%	$0.64C_n$	$1.2C_n$	
		T_{amb} = +85 ±3°C:	±20%	$0.8C_n$	$1.44C_n$	
		T_{amb} = +105 (+0 -3)°C:	±20%	$0.8C_n$	$1.56C_n$	
DC Leakage Current	I_L	ESCC No. 3012	All			µA
		T_{amb} = +85 ±3°C, V = U_R ±2%:		-	C_n x U_R	
		T_{amb} = +105 (+0 -3)°C, V = U_C ±2%:		-	C_n x Uc	
Dissipation Factor	DF	ESCC No. 3012	All			%
		T_{amb} = -55 (+3 -0)°C				
		For U_R < 10V:		-	15	
		For U_R ≥ 10V:		-	9	
		T_{amb} = +85 ±3°C				
		For U_R < 10V:		-	15	
		For U_R ≥ 10V:		-	9	
		T_{amb} = +105 (+0 -3)°C				
		For U_R < 10V:		-	20	
		For U_R ≥ 10V:		-	12	
Equivalent Series Resistance	ESR	ESCC No. 3012	All			%
		T_{amb} = -55 (+3 -0)°C:		-	Note 3	
		T_{amb} = +85 ±3°C:		-	Note 4	
		T_{amb} = +105 (+0 -3)°C:		-	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 ±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. 3012	Characteristics	Symbols	Limits		Units
			Min	Max	
Mounting					
Initial Measurements	Capacitance	C	Note 1		µF
Final Measurements	Capacitance	C	Record Value		µF
	Capacitance Change	ΔC/C	-5	+5	%
	DC Leakage Current	I_L	Note 1		µA
	Dissipation Factor	DF	Note 1		%
	Equivalent Series Resistance	ESR	Note 2		mΩ
Robustness of Terminations					
Initial Measurements	Capacitance	C	Record Value, Note 3		µF
Final Measurements	Capacitance	C	Record Value		µF
	Capacitance Change	ΔC/C	-10	+10	% (3)
Rapid Change of Temperature					
Initial Measurements	Capacitance	C	Record Value, Note 3		µF
Final Measurements	Capacitance	C	Record Value		µF
	Capacitance Change	ΔC/C	-20	+20	% (3)
	DC Leakage Current	I_L	Note 1		µA
	Dissipation Factor	DF	Note 1		%
	Equivalent Series Resistance	ESR	Note 4		mΩ
Vibration					
During Last Sweep Cycle	No intermittent contact ≥ 0.5ms, arcing, or open/short circuits	-	-	-	-
Climatic Sequence					
Initial Measurements	Capacitance	C	Record Value, Note 3		µF
Dry Heat	DC Leakage Current (at +125°C; U_C)	I_L	- Note 5		µA
Final Measurements	Capacitance	C	Record Value		µF
	Capacitance Change	ΔC/C	-5	+5	% (3)
	DC Leakage Current	I_L	Note 1		µA
	Dissipation Factor	DF	Note 6		%
	Equivalent Series Resistance	ESR	Note 6		mΩ

Test Reference per ESCC No. 3012	Characteristics	Symbols	Limits		Units
			Min	Max	
High and Low Temperature Stability					
Step 1 (at +22°C)	Capacitance	C	Record Value, Note 3		µF
	DC Leakage Current	I_L	Notes 1, 3		µA
	Dissipation Factor	DF	Notes 1, 3		%
	Equivalent Series Resistance	ESR	Notes 2, 3		mΩ
Step 2 (at -55°C)	Capacitance	C	Note 5		µF
	DC Leakage Current	I_L	Note 5		µA
	Dissipation Factor	DF	Note 5		%
	Equivalent Series Resistance	ESR	Note 5		mΩ
Step 3 (at +22°C)	Capacitance	C	Record Value		µF
	Capacitance Change from Step 1	ΔC/C	-5	+5	%
	DC Leakage Current	I_L	Note 1		µA
	Dissipation Factor	DF	Note 1		%
	Equivalent Series Resistance	ESR	Note 2		mΩ
Step 4 (at +85°C)	Capacitance	C	Note 5		µF
	DC Leakage Current	I_L	Note 5		µA
	Dissipation Factor	DF	Note 5		%
	Equivalent Series Resistance	ESR	Note 5		mΩ
Step 5 (at +125°C)	Capacitance	C	Note 5		µF
	DC Leakage Current	I_L	Note 5		µA
	Dissipation Factor	DF	Note 5		%
	Equivalent Series Resistance	ESR	Note 5		mΩ
Step 6 (at +22°C)	Capacitance	C	Record Value		µF
	Capacitance Change from Step 1	ΔC/C	-5	+5	%
	DC Leakage Current	I_L	Note 1		µA
	Dissipation Factor	DF	Note 1		%
	Equivalent Series Resistance	ESR	Note 2		mΩ
Surge Voltage					
Initial Measurements	Capacitance	C	Record Value, Note 3		µF
Final Measurements	Capacitance	C	Record Value		µF
	Capacitance Change	ΔC/C	-30	+20	% (3)
	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	Capacitance	C	Record Value, Note 3		µF
Final Measurements	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

Test Reference per ESCC No. 3012	Characteristics	Symbols	Limits		Units
			Min	Max	
Operating Life					
Initial Measurements	Capacitance	C	Record Value, Note 3		µF
Intermediate Measurements (250h and 1000h)(Note 8)	DC Leakage Current (at T1 = +85°C)	I_L	Note 7		µA
	DC Leakage Current (at T2 = +125°C)	I_L	Note 7		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	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:

1. As specified in Para. 2.3.1.
2. 1.25× the limit specified in Para. 2.3.1.
3. Component characteristic measurements (as applicable) recorded during the final measurements during Mounting may be used for this test. In this case, Capacitance Change for this test shall be referred to the final Capacitance measurement during Mounting.
4. 5× the limit specified in Para. 2.3.1.
5. As specified in Para. 2.3.2.
6. 2× the limit specified in Para. 2.3.1.
7. 1.25× the limit specified in Para. 2.3.2.
8. Applicable to Qualification Testing, and to Periodic Testing for renewal of qualification after lapse.
9. Applicable to Periodic Testing for extension of qualification.
10. 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).