



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

BASED ON TYPE TCS

ESCC Detail Specification No. 3012/006

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1 GENERAL

1.1 SCOPE

This specification details the ratings, physical and electrical characteristics, test and inspection data for Capacitors, Leadless Surface Mounted, Organic Polymer Tantalum, Solid Electrolyte, Enclosed Anode Connection, based on Type TCS. It shall be read in conjunction with ESCC Generic Specification No. [3012](#), the requirements of which are supplemented herein.

1.2 COMPONENT TYPE VARIANTS AND RANGE OF COMPONENTS

The variants and the range of components covered by this specification are given in Table 1(a).

1.3 MAXIMUM RATINGS

The maximum ratings, which shall not be exceeded at any time during use or storage, applicable to the components specified herein, are as scheduled in Table 1(b).

1.4 PARAMETER DERATING INFORMATION

The parameter derating information applicable to the capacitors specified herein is shown in Figure 1.

1.5 PHYSICAL DIMENSIONS

The physical dimensions of the capacitors specified herein are shown in Figure 2.

1.6 FUNCTIONAL DIAGRAM

The functional diagram for the capacitors specified herein is shown in Figure 3.

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](#) for Capacitors, Leadless Surface Mounted, Tantalum, Solid Electrolyte, Enclosed Anode Connection.
- (b) IPC/JEDEC J-STD-020, Moisture/Reflow Sensitivity Classification for Nonhermetic Solid State Surface Mount Devices.

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.

TABLE 1(a) – COMPONENT TYPE VARIANTS AND RANGE OF COMPONENTS

Variant Number	Case Code (Style) (Note 1)	Capacitance Range C_n (μ F) (Notes 2, 3)	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 Figure 2.
- The following rated Capacitance (C_n), maximum Rated Voltage (U_R) and maximum Equivalent Series Resistance (ESR) values are available for Variant 01 (Case Code: E) (numbers indicate maximum ESR in $m\Omega$):

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

- The following Capacitance Tolerance is available:
 - $\pm 20\%$ (M)

TABLE 1(b) - MAXIMUM RATINGS

No.	Characteristics	Symbols	Maximum Ratings	Units	Remarks
1	Rated Voltage	U_R	See Table 1(a)	V	Note 1, See Figure 1(a)
2	Surge Voltage	U_S	$1.3 \times U_R$	V	$T_{amb} \leq +85^\circ\text{C}$
3	Category Voltage	U_C	$0.8 \times U_R$	V	
4	Ripple Current	I_{ripple}	See Note 2	A	$T_{amb} \leq +45^\circ\text{C}$, $f = 100\text{kHz}$, Note 3, See Figure 1(b)
5	Operating Temperature Range	T_{op}	-55 to +105	$^\circ\text{C}$	T_{amb}
6	Rated Temperature	T_R	+85	$^\circ\text{C}$	
7	Upper Category Temperature	T_C	+105	$^\circ\text{C}$	
8	Storage Temperature Range	T_{stg}	-55 to +105	$^\circ\text{C}$	Note 4
9	Soldering Temperature	T_{sol}	+260	$^\circ\text{C}$	Notes 4, 5

NOTES:

- At $T_{amb} \leq +85^\circ\text{C}$. For derating at $T_{amb} > +85^\circ\text{C}$, 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)	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

- For $+45^\circ\text{C} < T_{amb} \leq +85^\circ\text{C}$, derate 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.

FIGURE 1 – PARAMETER DERATING INFORMATION

FIGURE 1(a) – RATED VOLTAGE VERSUS AMBIENT TEMPERATURE

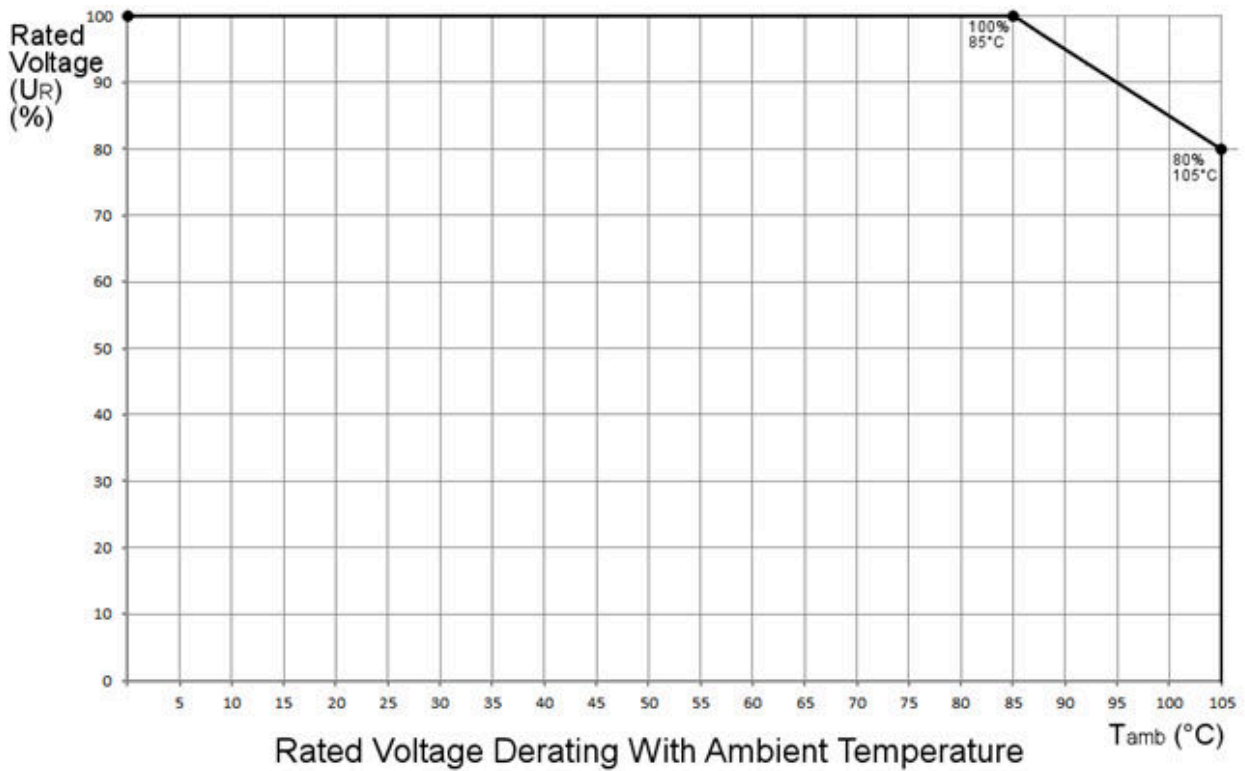


FIGURE 1(b) – MAXIMUM RIPPLE CURRENT VERSUS AMBIENT TEMPERATURE

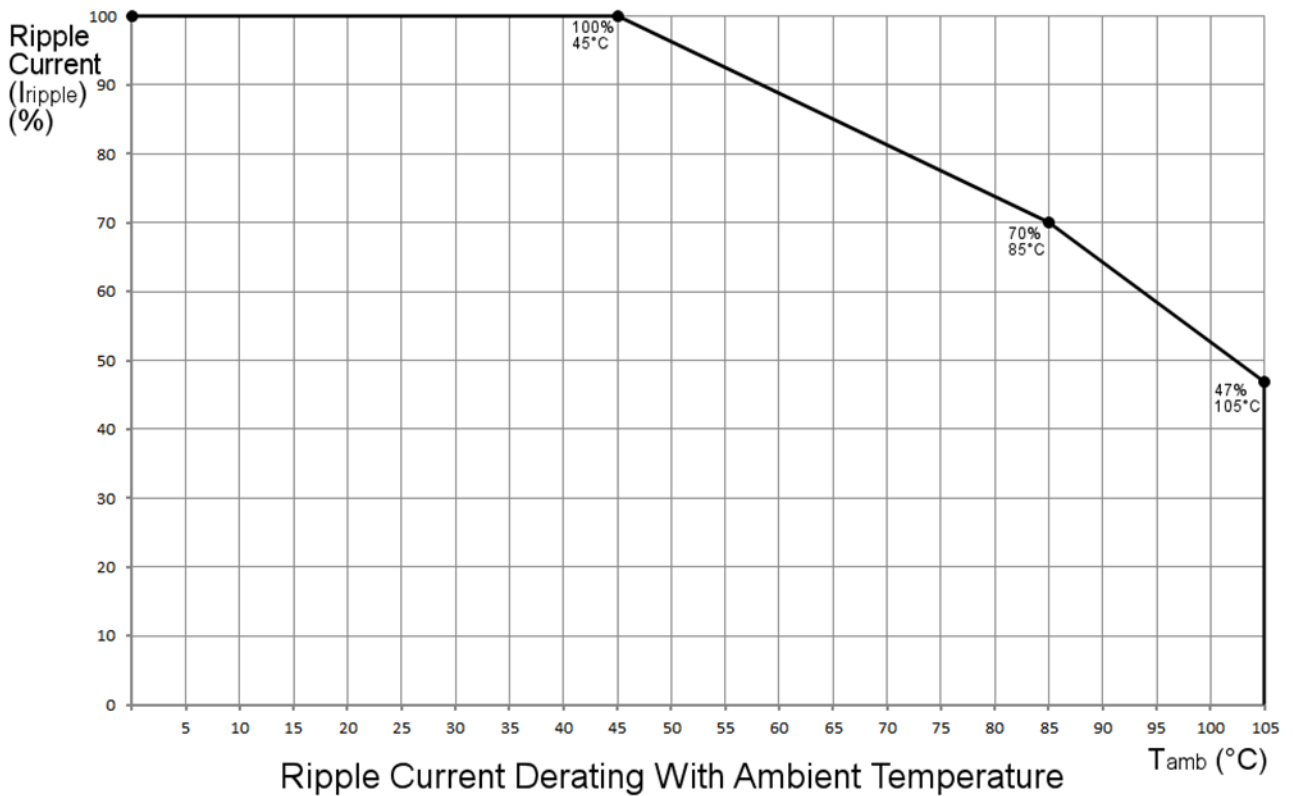
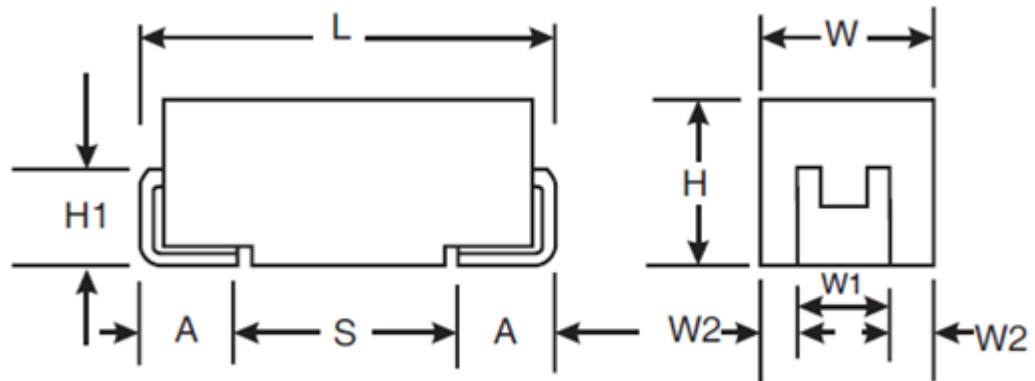
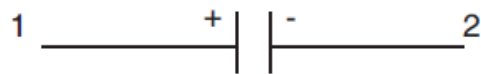


FIGURE 2 - PHYSICAL DIMENSIONS



Variant Number	Case Code	Dimensions (mm)												
		A		H	H1	L		S	W		W1		W2	
		Min	Max	Max	Min	Min	Max	Min	Min	Max	Min	Max	Min	Max
01	E	1.1	1.6	4.3	0.7	7.1	7.5	4.4	4.2	4.5	2.2	2.6	0.8	1.15

FIGURE 3 - FUNCTIONAL DIAGRAM



Terminal 1: Anode

Terminal 2: Cathode

4 REQUIREMENTS

4.1 GENERAL

The complete requirements for procurement of the components specified herein are stated in this specification and ESCC Generic Specification No. 3012. Deviations from the Generic Specification, applicable to this specification only, are detailed in Para. 4.2.

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 requirements and do not affect the components' reliability, are listed in the appendices attached to this specification.

4.2 DEVIATIONS FROM GENERIC SPECIFICATION

4.2.1 Deviations from Special In-Process Controls

None.

4.2.2 Deviations from Final Production Tests - Chart II

None.

4.2.3 Deviations from Burn-in and Electrical Measurements - Chart III

None.

4.2.4 Deviations from Qualification Tests - Chart IV

- (a) Para. 9.9, Mounting: Capacitance and Capacitance Change shall be measured in accordance with Table 6 herein. Capacitance Change shall be related to the initial measurement.
- (b) Para. 9.15 Surge Voltage: Final Measurements: In addition, Capacitance Change shall be measured in accordance with Table 6 herein.

4.2.5 Deviations from Lot Acceptance Tests - Chart V

- (a) Para. 9.9, Mounting: Capacitance and Capacitance Change shall be measured in accordance with Table 6 herein. Capacitance Change shall be related to the initial measurement.
- (b) Para. 9.15 Surge Voltage: Final Measurements: In addition, Capacitance Change shall be measured in accordance with Table 6 herein.

4.3 MECHANICAL REQUIREMENTS

4.3.1 Dimension Check

The dimensions of the components specified herein shall be verified in accordance with the requirements set out in Para. 9.6 of ESCC Generic Specification No. 3012 and they shall conform to those shown in Figure 2 of this specification.

4.3.2 Weight

The maximum weight of the components specified herein shall be as given in Table 1(a).

4.4 MATERIALS AND FINISHES

The materials and finishes shall be as specified herein. Where a definite material is not specified, a material which will enable the capacitors specified herein to meet the performance requirements of this specification shall be used. Acceptance or approval of any constituent material does not guarantee acceptance of the finished product.

4.4.1 Terminal Material and Finish

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

4.5 MARKING

4.5.1 General

The marking of all components delivered to this specification shall be in accordance with the requirements of ESCC Basic Specification No. 21700 and the following paragraphs. When the component is too small to accommodate all of the marking specified, as much as space permits shall be marked and the marking information, in full, shall accompany each component in its primary package.

The information to be marked and the order of precedence, shall be as follows:

- (a) Polarity Identification
- (b) The ESCC qualified components symbol (for ESCC qualified components only).
- (c) The ESCC Component Number.
- (d) Traceability Information.

4.5.2 Polarity Identification

The anode terminal shall be indicated by a polarity stripe marked on the top surface of the component.

4.5.3 The ESCC Component Number

The ESCC Component Number shall be constituted and marked as follows:

Example: 301200601B337MA0015

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

4.5.3.1 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 the following codes in accordance with ESCC Basic Specification No. 21700. The unit quantity shall be picofarad (pF).

Capacitance C_n (pF)	Code
XX10 ⁶	XX6
XX10 ⁷	XX7

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

Tolerance (± %)	Code
20	M

(c) Rated Voltage expressed by the following codes:

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 expressed by the following codes. The unit quantity shall be milliohm ($m\Omega$):

Equivalent Series Resistance ESR ($m\Omega$)	Code
XX	00XX

4.5.4 Traceability Information

Traceability information shall be marked in accordance with the requirements of ESCC Basic Specification No. [21700](#).

4.6 ELECTRICAL MEASUREMENTS

4.6.1 Electrical Measurements at Room Temperature

The parameters to be measured at room temperature are scheduled in Table 2. Unless otherwise specified the measurements shall be performed at $T_{amb} = +22 \pm 3^\circ C$.

4.6.2 Electrical Measurements at High and Low Temperatures

The parameters to be measured at high and low temperatures are scheduled in Table 3.

4.6.3 Circuits for Electrical Measurements (Figure 4)

Not applicable.

4.7 BURN-IN TESTS

4.7.1 Parameter Drift Values

The parameter drift values applicable to Burn-in are as specified in Table 4 of this specification. Unless otherwise stated, measurements shall be performed at $T_{amb} = +22 \pm 3^\circ C$.

The parameter drift values (Δ) applicable to the parameters scheduled shall not be exceeded. In addition to these drift value requirements for a given parameter, the appropriate limit values specified in Table 2 shall not be exceeded.

4.7.2 Conditions for Burn-in

The requirements for Burn-in are specified in Section 7 of ESCC Generic Specification No. [3012](#). The conditions for Burn-in shall be as specified in Table 5 of this specification.

4.7.3 Electrical Circuit for Burn-in (Figure 5)

Not applicable

TABLE 2 – ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE

No.	Characteristics	Symbols	ESCC 3012 Test Method	Tolerance	Limits		Units
					Min	Max	
1	Capacitance	C	Para. 9.4.1.1	±20%	0.8C _n	1.2C _n	µF
2	DC Leakage Current	I _L	Para. 9.4.1.2	All	-	0.1C _n × U _R	µA
3	Dissipation Factor	DF	Para. 9.4.1.3	All	-	10	%
4	Equivalent Series Resistance	ESR	Para. 9.4.1.4	All	-	Note 1	mΩ

NOTES:

1. See Table 1(a) Note 2.

TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

No.	Characteristics	Symbols	ESCC 3012 Test Method	Test Conditions (Note 1)	Limits		Units
					Min	Max	
1	Capacitance Change	ΔC/C	Para. 9.4.1.1	T _{amb} = -55 (+3 -0)°C	-20	0	% (Note 2)
				T _{amb} = +85 ±3°C	0	+20	
				T _{amb} = +105 (+0 -3)°C	0	+30	
2	DC Leakage Current	I _L	Para. 9.4.1.2	T _{amb} = +85 ±3°C V = U _R ±2%	-	C _n × U _R	µA
				T _{amb} = +105 (+0 -3)°C V = U _C ±2%	-	C _n × U _C	
3	Dissipation Factor	DF	Para. 9.4.1.3	T _{amb} = -55 (+3 -0)°C	-	+50	% (Note 2)
				T _{amb} = +85 ±3°C	-	+50	
				T _{amb} = +105 (+0 -3)°C	-	+100	
4	Equivalent Series Resistance	ESR	Para. 9.4.1.4	T _{amb} = -55 (+3 -0)°C	-	+150	% (Note 2)
				T _{amb} = +85 ±3°C	-	+100	
				T _{amb} = +105 (+0 -3)°C	-	+100	

NOTES:

1. Inspection level II, single sampling, AQL 2.5% for each capacitance value. Each capacitance value shall be considered as constituting a complete lot.
2. Related to the value measured in Table 2.

TABLE 4 - PARAMETER DRIFT VALUES

No.	Characteristics	Symbols	Spec. and/or Test Method	Test Conditions	Change Limits (Δ)	Units
1	Capacitance Change	$\Delta C/C$	As per Table 2	As per Table 2	+10, -20	%
2	DC Leakage Current Change	ΔI_L	As per Table 2	As per Table 2	2 x initial value	μA

TABLE 5(a) – CONDITIONS FOR BURN-IN

No.	Characteristics	Symbols	Conditions	Units
1	Ambient Temperature	T_{amb}	+85 (+0 -3)	$^{\circ}C$
2	Test Voltage	V_T	U_R	V

TABLE 5(b) – CONDITIONS FOR OPERATING LIFE

No.	Characteristics	Symbols	Conditions	Units
1	Ambient Temperature 1	T_1	+85 (+0 -3)	$^{\circ}C$
2	Test Voltage 1	V_{T1}	U_R	V
3	Ambient Temperature 2	T_2	+105 (+0 -3)	$^{\circ}C$
4	Test Voltage 2	V_{T2}	U_C	V

4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESCC GENERIC SPECIFICATION No. 3012)

4.8.1 Measurements and Inspections on Completion of Environmental Tests

The parameters to be measured and inspections to be performed on completion of environmental tests are scheduled in Table 6. Unless otherwise stated, the measurements shall be performed at $T_{amb} = +22 \pm 3^{\circ}C$.

4.8.2 Measurements and Inspections at Intermediate Points During Endurance Tests

The parameters to be measured and inspections to be performed at intermediate points during endurance tests are scheduled in Table 6. Unless otherwise stated, the measurements shall be performed at $T_{amb} = +22 \pm 3^{\circ}C$.

4.8.3 Measurements and Inspections on Completion of Endurance Tests

The parameters to be measured and inspections to be performed on completion of endurance tests are scheduled in Table 6. Unless otherwise stated, the measurements shall be performed at $T_{amb} = +22 \pm 3^{\circ}C$.

4.8.4 Conditions for Operating Life (Part of Endurance Testing)

The requirements for Operating Life testing are specified in Section 9 of ESCC Generic Specification No. 3012. The conditions for Operating Life testing shall be as specified in Table 5(b) of this specification.

4.8.5 Electrical Circuit for Operating Life Tests (Figure 5)

Not applicable.

TABLE 6 - MEASUREMENTS AND INSPECTIONS ON COMPLETION OF ENVIRONMENTAL TESTS AND AT INTERMEDIATE POINTS AND ON COMPLETION OF ENDURANCE TESTING

No.	ESCC Generic Spec. No. 3012		Measurements and Inspections		Symbols	Limits		Units					
	Environmental and Endurance Tests (Note 1)	Test Methods and Conditions	Identification	Conditions		Min	Max						
01	Mounting	Para. 9.9	Initial Measurements	Table 2	C	Table 2		μF					
			Capacitance										
			Final Examination										
			Terminals						Good tinning	-	-	-	-
			Final Measurements										
			Capacitance						Table 2	C	Table 2		μF
			Capacitance Change						Table 2	ΔC/C	-5	+5	%
DC Leakage Current	Table 2	I _L	-	Table 2	μA								
Dissipation Factor	Table 2	DF	-	Table 2	%								
Equivalent Series Resistance	Table 2	ESR	-	1.25 x Table 2	mΩ								
02	Rapid Change of Temperature	Para. 9.3.2	Final Measurements	Recovery period of 4hrs min.									
			Visual Examination						No corrosion, no damage or obliteration of marking	-	-	-	-
			Capacitance Change						Table 2	ΔC/C	-20	+20	% (2)
			DC Leakage Current						Table 2	I _L	-	Table 2	μA
			Dissipation Factor						Table 2	DF	-	Table 2	%
			Equivalent Series Resistance						Table 2	ESR	-	5 x Table 2	mΩ
03	External Visual Inspection	Para. 9.5	Final Inspection	ESCC No. 20500	-	-	-	-					
04	Adhesion	Para. 9.10	Final Measurements	No damage or loosening from the substrate									
			Visual Examination										
			Capacitance Change	Table 2	ΔC/C	-10	+10	% (2)					
05	Vibration	Para. 9.11	Measurements during test	During Last Cycle No intermittent Contact > 0.5ms, arcing or open or shorts									
			Visual Examination										
			Final Examination	No damage	-	-	-	-					
06	Shock or Bump	Para. 9.12	Final Examination	No damage	-	-	-	-					

No.	ESCC Generic Spec. No. 3012		Measurements and Inspections		Symbols	Limits		Units	
	Environmental and Endurance Tests (Note 1)	Test Methods and Conditions	Identification	Conditions		Min	Max		
07	Climatic Sequence	Para. 9.13	Intermediate Measurements	During Dry Heat					
			DC Leakage Current	Table 3 (Note 3)	I_L	-	Table 3	μA	
			Final Measurements	After recovery of 1 to 24hrs					
			External Visual Inspection	ESCC No. 20500	-	-	-	-	-
			Capacitance Change	Table 2	$\Delta C/C$	-5	+5	% (2)	
			DC Leakage Current	Table 2	I_L	-	Table 2	μA	
			Dissipation Factor	Table 2	DF	-	2 x Table 2	%	
		Equivalent Series Resistance	Table 2	ESR	-	2 x Table 2	m Ω		
08	High and Low Temperature Stability	Para. 9.14	Measurements during test						
			Electrical Measurements	Tables 2 & 3		Tables 2 & 3			
09	Surge Voltage (Note 4)	Para. 9.15	Final Measurements						
			Capacitance Change	Table 2	$\Delta C/C$	-30	+20	% (2)	
			DC Leakage Current	Table 2	I_L	-	Table 2	μA	
			Dissipation Factor	Table 2	DF	-	1.25 x Table 2	%	
		Equivalent Series Resistance	Table 2	ESR	-	1.25 x Table 2	m Ω		
10	Damp Heat Steady State	Para. 9.16	Final Measurements	After recovery of 1 to 2hrs					
			Visual Examination	No damage	-	-	-	-	
			Capacitance Change	Table 2	$\Delta C/C$	-5	+35	% (2)	
			DC Leakage Current	Table 2	I_L	-	5 x Table 2	μA	
			Dissipation Factor	Table 2	DF	-	2 x Table 2	%	
		Equivalent Series Resistance	Table 2	ESR	-	2 x Table 2	m Ω		

No.	ESCC Generic Spec. No. 3012	Measurements and Inspections		Symbols	Limits		Units	
		Environmental and Endurance Tests (Note 1)	Test Methods and Conditions		Identification	Conditions		Min
11	Operating Life	Para. 9.17	Intermediate Measurements DC Leakage Current Final Measurements	At 250 and 1000hrs Table 3 (Note 3) At 1000 or 2000hrs and after recovery of 1 to 2hrs Table 2 Table 2 Table 2 Table 2 No damage	I_L $\Delta C/C$ I_L DF ESR -	- -20 - - - -	1.25 x Table 3 +10 1.25 x Table 2 Table 2 2 x Table 2 -	μA % (2) μA % m Ω -
12	Permanence of Marking	Para. 9.18	Final Examination Visual Examination	ESCC No. 24800	-	-	-	-
13	Solderability	Para. 9.19	Final Examination Visual Examination	ESCC No. 3012 Para. 9.19.3 and no damage	-	-	-	-

NOTES:

1. The tests in this Table refer to either Chart IV or V and shall be used as applicable.
2. Referred to the initial measurement recorded during the final measurements during Mounting.
3. While still at the high temperature.
4. For Surge Voltage during Chart IV, Capacitance shall be measured prior to the test and used as the initial measurement.

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

ITEMS AFFECTED	DESCRIPTION OF DEVIATIONS
Deviations from Final Production Tests (Chart II)	Para. 9.1, Internal Visual Inspection: Shall not be performed. Para. 9.5, External Visual Inspection: Visible base material is permitted on the edges of terminations (there is no plating on edges).
Deviations from Burn-in and Electrical Measurements (Chart III)	Para. 9.5, External Visual Inspection: Visible base material is permitted on the edges of terminations (there is no plating on edges).
Deviations from Qualification Tests (Chart IV)	Para. 9.5, External Visual Inspection: Visible base material is permitted on the edges of terminations (there is no plating on edges).
Deviations from Lot Acceptance Tests (Chart V)	Para. 9.5, External Visual Inspection: Visible base material is permitted on the edges of terminations (there is no plating on edges).