CAPACITORS, CHIP, TANTALUM,

SOLID ELECTROLYTE,

BASED ON TYPE 2213

ESCC Detail Specification No. 3011/006

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DCR No.	CHANGE DESCRIPTION
772	Specification upissued to incorporate editorial changes per DCR.

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1 GENERAL

1.1 SCOPE

This specification details the ratings, physical and electrical characteristics, test and inspection data for Capacitors, Chip, Tantalum, Solid Electrolyte, based on Type 2213. It shall be read in conjunction with ESCC Generic Specification No. 3011, the requirements of which are supplemented herein.

1.2 RANGE OF COMPONENTS

The range of capacitors covered by this specification is scheduled 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 capacitors 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 of the capacitors specified herein is shown in Figure 3.

2 APPLICABLE DOCUMENTS

The following document forms part of this specification and shall be read in conjunction with it:

(a) ESCC Generic Specification No. 3011 for Capacitors, Chip, Tantalum, Solid Electrolyte.

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) - RANGE OF COMPONENTS

Capacitance Value (µF)	Tolerance (± %)	Rated Voltage (U_R) (V)
1.5	10 and 20	50
2.2		50
3.3		40
4.7		25
6.8		20
10		16
15		10
22		6.3
23		4

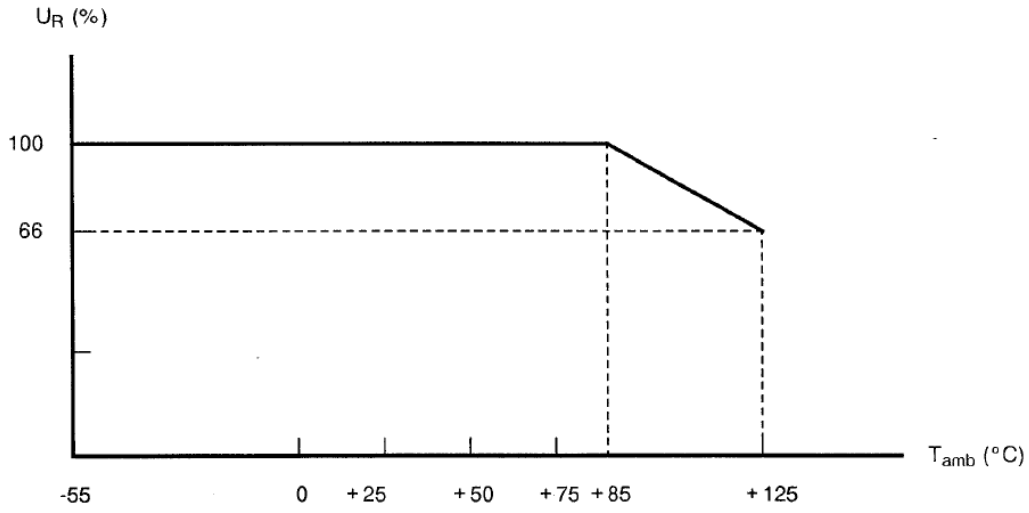
TABLE 1(b) - MAXIMUM RATINGS

No.	Characteristics	Symbol	Maximum Ratings	Units	Remarks
1	Rated DC Voltage	U_R	See Table 1(a)	V	Note 1
2	Surge Voltage (DC)	U_S	$1.3U_R$	V	
3	Operating Temperature Range	T_{op}	-55 to +125	ºC	T_{amb}
4	Storage Temperature Range	T_{stg}	-55 to +125	ºC	
5	Soldering Temperature	T_{sol}	+260	ºC	Soldering time: ≤ 10 seconds

NOTES

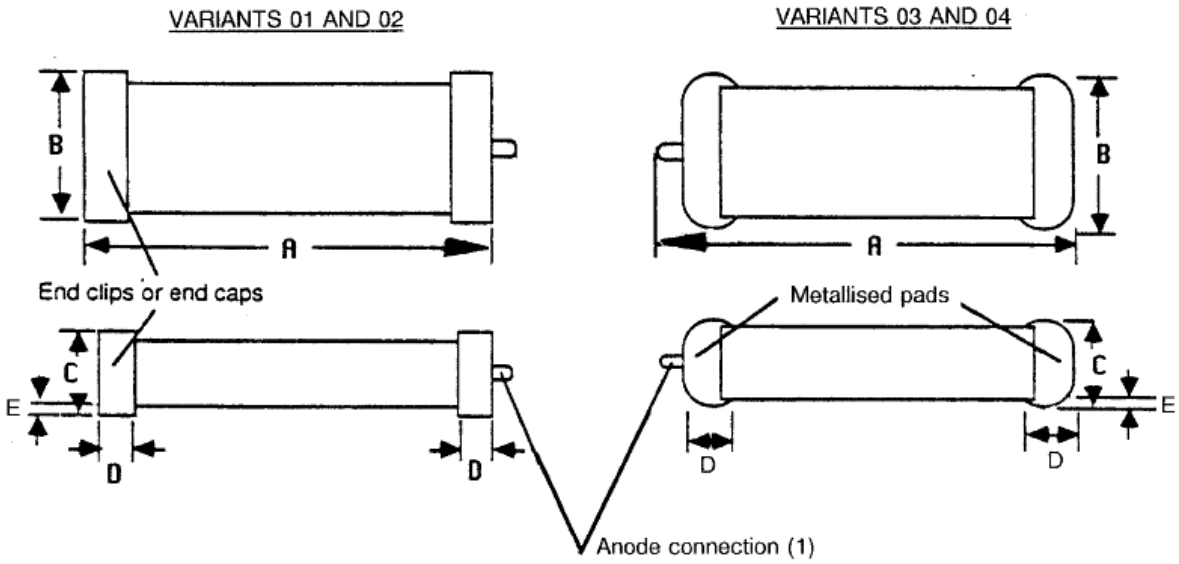
1. At T_{amb} ≤ +85 ºC. For derating at T_{amb} > +85 ºC, see Figure 1.

FIGURE 1 - PARAMETER DERATING INFORMATION



Rated Voltage versus Temperature

FIGURE 2 - PHYSICAL DIMENSIONS

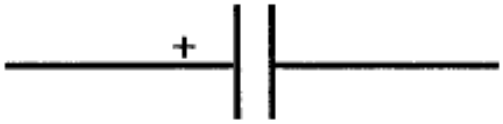


	Dimensions (mm)									
	A		B		C		D		E	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Variants 01 & 02	5.2	6	3	3.8	1.4	2.2	0.6	1.2	-	0.15
Variants 03 & 04	5.2	6.4	3	4.2	1.4	2.6	0.6	1.2	-	0.35

NOTES

1. The anode terminal shall be identified by the riser wire connection, which extends from the case by 0.4mm max.
2. For type variants 03 and 04, the measurement of the length will be performed including the riser wire.

FIGURE 3 - FUNCTIONAL DIAGRAM



4 REQUIREMENTS

4.1 GENERAL

The complete requirements for procurement of the capacitors specified herein are stated in this specification and ESCC Generic Specification No. 3011 for Capacitors, Chip, Tantalum, Solid Electrolyte. Deviations from the Generic Specification, applicable to this specification only, are detailed in Para 4.2.

Deviations from the applicable 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 Tests (Chart III)

None.

4.2.4 Deviations from Qualification Tests (Chart IV)

None.

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

None.

4.3 MECHANICAL REQUIREMENTS

4.3.1 Dimension Check

The dimensions of the capacitors specified herein shall be verified in accordance with the requirements set out in Para 9.3 of ESCC Generic Specification No. 3011 and shall conform to those shown in Figure 2 of this specification.

4.3.2 Weight

The maximum weight of the capacitors specified herein shall be 0.25 grammes.

4.3.3 Adhesion

The requirements for adhesion are specified in Para 9.5 of ESCC Generic Specification No. 3011.

4.3.4 Damp Heat (Steady State)

The requirements for damp heat (steady state) testing are specified in Section 9 of ESCC Generic Specification No. 3011. The duration of the test shall be 56 days.

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 Case

Not applicable.

4.4.2 Terminations

The capacitors shall be terminated in accordance with the requirements of ESCC Basic Specification No. 23500, as follows:

(a) Variant 01:
With clips or end caps Type 'E' with Type '2' finish.

(b) Variant 02:
With clips or end caps Type 'E' with Type '3' finish.

(c) Variant 03:
With pads of Silver Loaded Epoxy Resin with Type '2' finish.

(d) Variant 04:
With pads of Silver Loaded Epoxy Resin with Type '3' finish.

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. These components being too small to accommodate the marking as specified hereafter, 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) The ESCC Component Number.
(b) Electrical Characteristics and Ratings.
(c) Traceability Information.

4.5.2 The ESCC Component Number

The ESCC component number shall be constituted and marked as follows:

Example: 301100601B

- Detail Specification Number: 3011006
- Type Variant (see Para 4.4.2): 01
- Testing Level (B or C, as applicable): B

4.5.3 Electrical Characteristics and Ratings

The electrical characteristics and ratings to be marked in the following order of precedence are:

(a) Capacitance value.
(b) Tolerance.
(c) Rated voltage.

The information shall be constituted and marked as follows:

Example: 155KK

- Capacitance value (1.5µF): 155
- Tolerance (±10%): K
- Rated voltage (50V): K

4.5.3.1 Capacitance

The capacitance values shall be expressed by means of the following codes. The unit quantity for marking shall be picofarads.

Capacitance Value	Code
$XX10^4$ $XX10^5$ $XX10^6$	XX4 XX5 XX6

4.5.3.2 Tolerance

The tolerance on capacitance values shall be indicated by the code letters specified hereafter.

Tolerance (%)	Code Letter
±10 ±20	K M

4.5.3.3 Rated Voltage

The rated voltage shall be indicated by the code letters specified hereafter.

Rated Voltage (V)	Code Letter
50 40 25 20 16 10 6.3 4	K J G F E D A M

4.5.4 Traceability Information

Traceability information shall be marked in accordance with the requirements of ESCC Basic Specification No. 21700. The information to be marked shall be as follows:

(a) Manufacturing date code.
(b) Serial number.
(c) Manufacturer's name.

4.5.5 Polarity

Polarity shall be indicated as given in Note 2 to Figure 2.

4.6 ELECTRICAL MEASUREMENTS

4.6.1 Electrical Measurements at Room Temperature

The parameters to be measured in respect of electrical characteristics are scheduled in Table 2. Unless otherwise specified, the measurements shall be performed at T_{amb} = +22±3 ºC.

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

Not applicable.

4.7 BURN-IN TESTS

4.7.1 Parameter Drift Values

The parameter drift values applicable to burn-in are specified in Table 4 of this specification. Unless otherwise specified, the measurements shall be performed at T_{amb} = +22±3 ºC. 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.

On completion of burn-in, a recovery period of 24±2 hours is necessary before the performance of the end measurements.

4.7.2 Conditions for Burn-in

The requirements for burn-in are specified in Section 7 of ESCC Generic Specification No. 3011. The conditions for burn-in shall be as specified in Table 5(a) of this specification.

4.7.3 Electrical Circuit for Burn-in (Figure 5)

Not applicable.

TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE

No.	Characteristics	Symbol	ESCC 3011 Test Method	Test Conditions	Limits			Unit	Remarks
					Min.	Max.			
1	Capacitance	C_n	Para. 9.4.1.1	$V_T \leq 0.5$Vrms V_P = 2.1 to 2.5V f = 100±5Hz or f = 120±5Hz	C_n -10 -20	C_n +10 +20		µF % %	See Table 1(a)
2	DC Leakage Current	I_L	Para. 9.4.1.2	$V_T = U_R$±2% Series Resistor = 1kΩ	-	(Note 1)		µA	
3	Dissipation Factor	DF	Para. 9.4.1.3	f = 100±5Hz or f = 120±5Hz	-	$C_n \leq$ 10µF 6	$C_n >$ 10µF 8	%	

NOTES

1. 0.01C x U_R or 1, whichever is the greater.

TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

No.	Characteristics	Symbol	ESCC 3011 Test Method	Test Conditions (Note 1)	Limits				Unit	Remarks
					Min.	Max.				
1	Capacitance	C_n	Para. 9.4.1.1	$V_T \leq 0.5$Vrms V_P = 2.1 to 2.5V f = 100±5Hz or f = 120±5Hz -55 °C, +85 °C +125 °C	C_n -10 -15	C_n +10 +15			µF % %	See Table 1(a)
2	DC Leakage Current	I_L	Para. 9.4.1.2	$V_T = U_R$±2% Series Resistor = 1kΩ +85 °C +125 °C	 - -	 (Note 2) (Note 3)			µA	
3	Dissipation Factor	DF	Para. 9.4.1.3	f = 100±5Hz or f = 120±5Hz -55 °C +85 °C, +125 °C	-	$C_n \leq$ 10µF 8 8	$C_n >$ 10µF $C_n <$ 22µF 10 8	$C_n \geq$ 22µF 12 10	%	

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. 0.1C x U_R or 10, whichever is the greater.
3. 0.12C x U_R or 12, whichever is the greater.

FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS

Not applicable

TABLE 4 - PARAMETER DRIFT VALUES

No	Characteristics	Symbol	Spec. and/or Test Method	Test Conditions	Change Limits (Δ)	Unit	Remarks
1	Capacitance	ΔC/C	As per Table 2	As per Table 2	±5	%	
2	DC Leakage Current	$\Delta I_L/I_L$	As per Table 2	As per Table 2	(Note 1)	%	Note 2

NOTES

1. Whichever is smaller from +200% of initial value or (+25% [+0.05µA]) of limit value given in Table 2.
2. Leakage currents less than 0.1µA are considered as 0.1µA value.

TABLE 5(a) - CONDITIONS FOR BURN-IN

No	Characteristics	Symbol	Limits	Unit
1	Ambient Temperature	T_{amb}	+ 125	ºC
2	Test Voltage	V_T	$0.66U_R$	V

TABLE 5(b) - CONDITIONS FOR OPERATING LIFE TESTS

No	Characteristics	Symbol	Limits	Unit
1	Ambient Temperature	T_{amb}	+85 +125	ºC
2	Test Voltage	V_T	Rated Voltage (1) Derated Voltage	V

NOTES

1. The test voltage shall be the rated voltage (see Table 1(a)) for T_{amb} = +85 °C and the derated voltage (see Figure 1) for T_{amb} = +125 °C.

FIGURE 5 - ELECTRICAL CIRCUIT FOR BURN-IN AND OPERATING LIFE TESTS

Not applicable

4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESCC GENERIC SPECIFICATION No. 3011)

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 testing are scheduled in Table 6. Unless otherwise specified, the measurements shall be performed at T_{amb} = +22±3 ºC.

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. The measurements shall be performed at the temperature specified for the test.

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 specified, the measurements shall be performed at T_{amb} = +22±3 ºC.

4.8.4 Conditions for Operating Life Tests (Part of Endurance Testing)

The requirements for operating life testing are specified in Section 9 of ESCC Generic Specification No. 3011. 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. 3011		Measurements And Inspections		Symbol	Limits		Unit
	Environmental And Endurance Tests (1)	Test Method And Conditions	Identification	Conditions		Min.	Max.	
01	Visual Inspection	Para. 9.1	Visual Inspection	ESCC 20400	-	-	-	-
02	Mounting on Substrates	Para. 9.2	**Final Measurements**					
			Capacitance	Table 2, Item 1	C	Table 2, Item 1 (2)		
			DC Leakage Current	Table 2, Item 2	I_L	Table 2, Item 2		
			Dissipation Factor	Table 3, Item 3	DF	Table 2, Item 3		
			Visual Examination	Good Tinning	-	-	-	
03	Adhesion	Para. 9.5	**Final Examination**					
			Visual Examination	no damage or loosening from substrate	-	-	-	
			Capacitance	Table 2, Item 1	C	Table 2, Item 1		
04	Solderability	Para. 9.6	Visual Examination	No damage	-	-	-	-
05	Rapid Change of Temperature	Para. 9.7	**Initial Measurements**					
			Capacitance	Table 2, Item 1 or value recorded in 02	C	Table 2, Item 1		
			Final Measurements	After 4 hours minimum recovery				
			Visual Examination	No corrosion, mechanical damage or obliteration of marking		-	-	
			Capacitance Change	Table 2, Item 1	ΔC/C	-5	+5	%
			DC Leakage Current	Table 2, Item 2	I_L	Table 2, Item 2		
			Dissipation Factor	Table 2, Item 3	DF	Table 2, Item 3		
06	Vibration	Para. 9.8	**Intermediate Measurements**	During last cycle				
			Electrical Measurements	Intermittent operation, intermittent contact, arcing, open or shorts	-	-	-	-
			Final Examination					
			Visual Examination	No damage	-	-	-	-
07	Shock or Bump	Para. 9.9	**Final Examination**					
			Visual Examination	No damage	-	-	-	-

No.	ESCC Generic Spec. No. 3011		Measurements And Inspections		Symbol	Limits		Unit
	Environmental And Endurance Tests (1)	Test Method And Conditions	Identification	Conditions		Min.	Max.	
08	Climatic Sequence	Para. 9.10	**Initial Measurements**					
			Capacitance	Value recorded in 02	C	Table 2, Item 1		
	Dry Heat	Para. 9.10.2	**Intermediate Measurements**	At High Temperature				
			Capacitance Change	Table 3, item 1	ΔC/C	Table 3, item 1		
			DC Leakage Current	Table 3, Item 2	I_L	Table 3, Item 2		
	Cold Test	Para. 9.10.4	**Intermediate Measurements**	At Low Temperature				
			Capacitance Change	Table 3, item 1	ΔC/C	Table 3, item 1		
	Damp Heat	Para. 9.10.6	**Final Measurements**	Recovery period 1 to 24 hours				
			Visual Inspection	Gen. 3011, Para. 9.10.7	-	-	-	-
			Capacitance Change	Table 2, item 1	ΔC/C	-10	+10	%
			DC Leakage Current	Table 2, item 2	I_L	Table 2, Item 2		
			Dissipation Factor	Table 2, Item 3	DF	-	Note 3	
09	Damp Heat, Steady State	Para. 9.11 and Para. 4.3.4 of this spec.	**Initial Measurements**					
			Capacitance	Value recorded in 02	C	Table 2, item 1		
			Final Measurements	Recovery Period 6 to 24 ± 2 hours				
			Visual Examination	No damage	-	-	-	-
			Capacitance Change	Table 2, item 1	ΔC/C	-10	+10	%
			DC Leakage Current	Table 2, item 2	I_L	Table 2, Item 2		
			Dissipation Factor	Table 2, Item 3	DF	-	Note 3	
10	High and Low Temperature Stability	Para. 9.12	Capacitance Change	Table 3, Item 1	ΔC/C	Table 3, Item 1		
			DC Leakage Current at all but Step 2	Table 3, item 2	I_L	Table 3, Item 2		
			Dissipation Factor	Table 3, Item 3	DF	Table 3, Item 3		
11	Surge Voltage	Para. 9.13	**Final Measurements**	After temperature stabilisation				
			Capacitance	Table 2, Item 1	C	Table 2, item 1		
			DC Leakage Current	Table 2, item 2	I_L	Table 2, Item 2		
			Dissipation Factor	Table 2, Item 3	DF	Table 2, Item 3		

No.	ESCC Generic Spec. No. 3011		Measurements And Inspections		Symbol	Limits		Unit
	Environmental And Endurance Tests (1)	Test Method And Conditions	Identification	Conditions		Min.	Max.	
12	Operating Life	Para. 9.15	**Initial Measurements**					
			Capacitance	Value recorded in 02	C	Table 2, item 1		
			DC Leakage Current	Table 2, item 2	I_L	Table 2, Item 2		
			Dissipation Factor	Table 2, Item 3	DF	Table 2, Item 3		
			Intermediate Measurements	at 250 and 1000 hours				
				At High Temperature				
			DC Leakage Current	Table 3, Item 2	I_L	Table 3, Item 2		
			Final Measurements	At 1000 and 2000 hours and after 24 hours recovery				
			Capacitance Change	Table 2, Item 1	ΔC/C	-5	+5	%
			DC Leakage Current	Table 2, Item 2	I_L	Table 2, Item 2		
			Dissipation Factor	Table 2, Item 3	DF	Table 2, item 3		
			Visual Examination	No damage	-	-	-	-
13	Permanence of Marking	Para. 9.17	**Final Examination**					
			Visual Examination	ESCC No. 24800	-	-	-	-

NOTES

1. The tests in this Table refer to either Chart IV or V and shall be used as applicable.
2. Value to be recorded.
3. 1.2 x value specified in Table 2 Item 3.