



CAPACITORS, FIXED TANTALUM

SOLID ELECTROLYTE

BASED ON TYPE CTS21E

ESCC Generic Specification No. 3002/003

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1 **GENERAL**

1.1 **SCOPE**

This specification details the ratings, physical and electrical characteristics, test and inspection data for Capacitors, Fixed, Tantalum, Solid Electrolyte, based on Type CTS21E. It shall be read in conjunction with ESCC Generic Specification No. 3002, 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 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. 3002 for Capacitors, Fixed, 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. In addition, the following symbols are used:

V_T = Test Voltage.



TABLE 1(a) – RANGE OF COMPONENTS

(1) Rated Voltage (U _R) (V)	(2) Capacitance Value (C) (μF)	(3) Tolerance (±%)	DC Leakage Current (I _L)			(7) Dissipation Factor +25°C (%)	(8) ESR max 100kHz +25°C (mΩ)	(9) Ripple Current 100kHz +25°C (max) (A)	(10) Ripple Current 1.0kHz +25°C (max) (A)	(11) Case Size	(12) Max. Weight (g)
			(4) +25°C (μA)	(5) +85°C (μA)	(6) +125°C (μA)						
6.3	330	10, 20	20.8	208	260	12	45	3.9	2.4	C	4
6.3	390	10	24.6	246	307	12	40	4.1	2.6	C	4
6.3	470	10, 20	29.6	296	370	14	40	4.2	2.6	C	4
6.3	680	10, 20	42.8	428	535	18	35	5.2	4	D	7
6.3	820	10	51.7	517	646	18	30	5.2	4	D	7
6.3	1000	10, 20	63	630	787	22	30	5.7	4.1	D	7
10	220	10, 20	22	220	275	10	55	3.6	2.2	C	4
10	270	10	27	270	337	10	50	3.7	2.4	C	4
10	390	10	39	390	487	12	40	4.5	3.8	D	7
10	470	10, 20	47	470	587	14	40	4.5	3.8	D	7
10	560	10	56	560	700	14	35	4.8	3.9	D	7
16	150	10, 20	24	240	300	10	65	3.3	2	C	4
16	180	10	28.8	288	360	10	60	3.4	2.4	C	4
16	270	10	43.2	432	540	10	50	4.1	3.4	D	7
16	330	10, 20	52.8	528	660	12	45	4.3	3.8	D	7
20	100	10, 20	20	200	250	8.0	75	3	2.2	C	4
20	120	10	24	240	300	8.0	70	3.2	2.5	C	4
20	180	10	36	360	450	10	60	3.7	3.4	D	7
20	220	10	44	440	550	10	55	3.9	3.4	D	7
20	220	10	44	440	550	10	55	3.9	3.4	D	7
25	56	10	14	140	175	6	100	2.6	1.8	C	4
25	68	10, 20	17	170	212	6	95	2.7	2.2	C	4
25	82	10	20.5	205	256	6	85	2.9	2.2	C	4
25	150	10, 20	37.5	375	469	10	65	3.6	2.8	D	7
35	33	10, 20	11.5	115	144	5	130	2.3	1.4	C	4
35	39	10	13.6	136	170	5	120	2.4	1.7	C	4
35	47	10, 20	16.4	164	205	6	110	2.5	1.8	C	4



(1) Rated Voltage (U _R) (V)	(2) Capacitance Value (C) (μF)	(3) Tolerance (±%)	DC Leakage Current (I _L)			(7) Dissipation Factor +25°C (%)	(8) ESR max 100kHz +25°C (mΩ)	(9) Ripple Current 100kHz +25°C (max) (A)	(10) Ripple Current 1.0kHz +25°C (max) (A)	(11) Case Size	(12) Max. Weight (g)
			(4) +25°C (μA)	(5) +85°C (μA)	(6) +125°C (μA)						
35	56	10	19.6	196	245	6	100	2.9	2.2	D	7
35	68	10, 20	23.8	238	297	6	95	3	2.4	D	7
35	82	10	28.7	287	358	6	85	3.1	2.5	D	7
35	100	10, 20	35	350	437	8	75	3.3	2.5	D	7
35	120	10	42	420	525	8	70	3.5	2.8	D	7.5
50	22	10, 20	11	110	137	4	160	2.1	1.5	C	4
50	27	10	13.5	135	169	5	145	2.2	1.5	C	4
50	33	10, 20	16.5	165	206	5	130	2.5	1.9	D	7
50	39	10	19.5	195	244	5	120	2.6	2	D	7
50	47	10, 20	23.5	235	294	6	110	2.7	2.2	D	7
50	56	10	28	280	350	6	100	2.9	2.2	D	7
50	68	10, 20	34	340	425	6	95	3	2.4	D	7

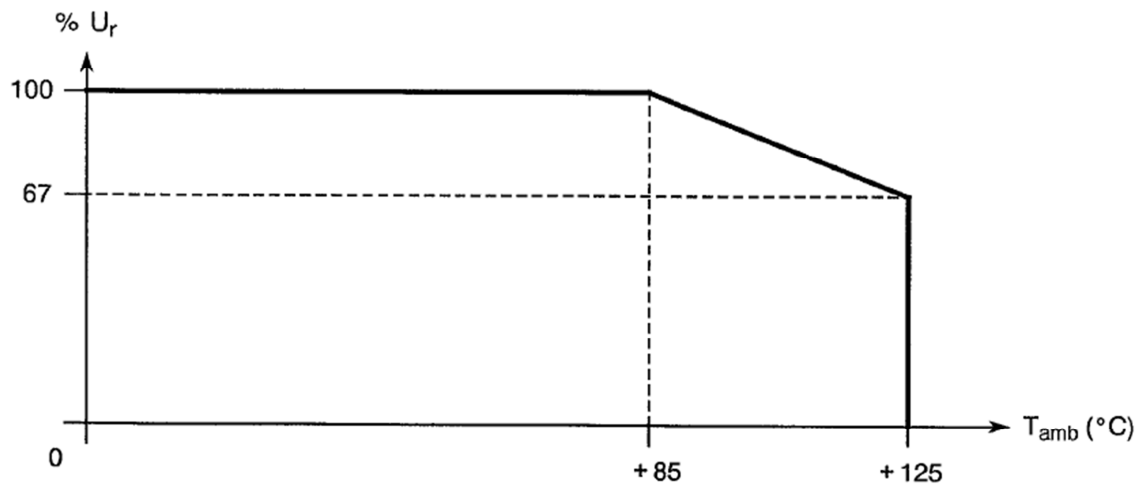
TABLE 1(b) - MAXIMUM RATINGS

No.	CHARACTERISTICS	SYMBOL	MAXIMUM RATINGS	UNIT	REMARKS
1	Rated Voltage	U_R	See Table 1(a)	V	Note 1
2	Operating Temperature Range	T_{op}	-55 to +125	°C	T_{amb}
3	Storage Temperature Range	T_{stg}	-55 to +125	°C	-
4	Soldering Temperature	T_{sol}	+240	°C	Note 2

NOTES

- At $T_{amb} \leq +85^\circ\text{C}$. For derating at $T_{amb} > +85^\circ\text{C}$, see Figure 1.
- Duration 5 seconds maximum at a distance of not less than 3mm from body on negative side and 3mm from eyelet on positive side.

FIGURE 1 - PARAMETER DERATING INFORMATION



Rated Voltage versus Temperature

FIGURE 1 – PARAMETER DERATING INFORMATION (CONTINUED)

Ripple Current Multiplier

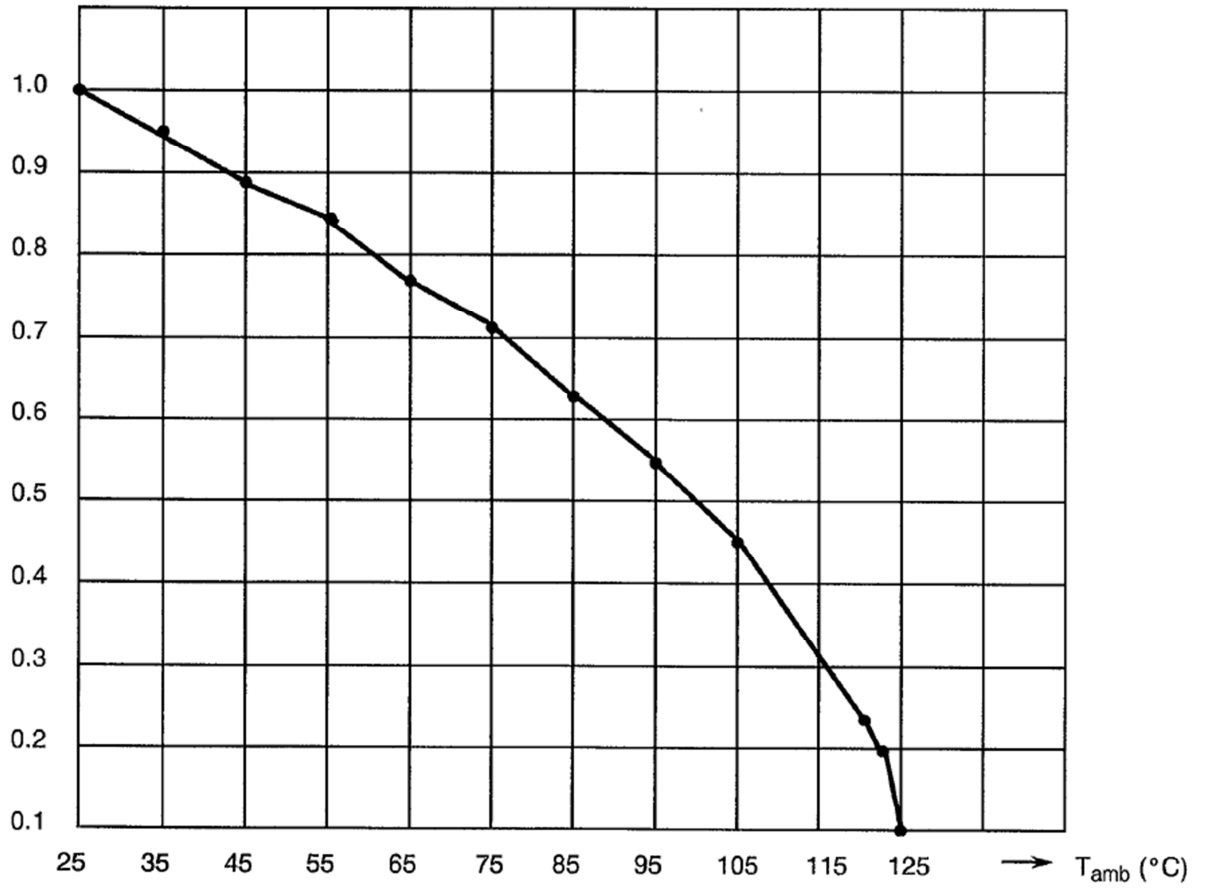
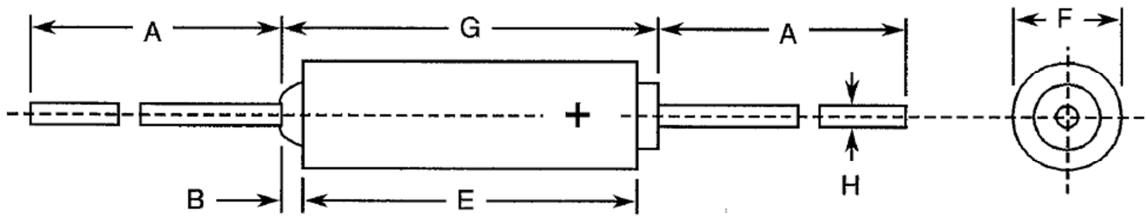
Ripple Current versus Temperature

FIGURE 2 - PHYSICAL DIMENSIONS

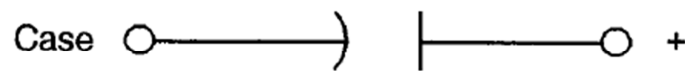


Case Size	Symbol	Millimetres	
		Min	Max
C	A	25	40
	B	-	2.4
	E	16.3	18.2
	F	6.96	7.75
	G	-	20.9
	H	0.58	0.69
D	A	25	40
	B	-	2.4
	E	18.9	20.8
	F	8.53	9.32
	G	-	23.4
	H	0.58	0.69

NOTES

1. The case insulation shall extend 0.4mm minimum beyond each end of the capacitor body. If a shrink-fitted insulation is used, it shall overlap the ends of the capacitor body.

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. 3002 for Capacitors, Fixed, Tantalum, Solid Electrolyte. Deviations from the Generic Specification, applicable to this specification only, are listed 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)

- (a) Para. 9.7.4, Electrical Measurements at Room Temperature:
- Dissipation factor and capacitance shall be measured at 1kHz \pm 50Hz.
 - ESR shall be measured as specified in Table 2.

4.2.3 Deviations from Burn-in Tests (Chart III)

- (a) Para. 9.7.3, Electrical Measurements at High and Low Temperatures:
- Shall be made on a sample basis as specified in Para. 4.6.2 of this specification.
- (b) Para. 9.7.4, Electrical Measurements at room Temperature:
- Dissipation factor and capacitance shall be measured at 1kHz \pm 50Hz.
 - ESR shall be measured as specified in Table 2.

4.2.4 Deviations from Qualification Tests (Chart IV)

An additional subgroup of 12 components shall be added to Chart IV (total 104 components). This subgroup shall be submitted to a ripple current test as follows:

The capacitors shall be mounted by their leads and placed in a still air enclosure at room temperature. A sinusoidal AC voltage (100kHz \pm 2kHz) shall be superimposed on 50% of rated DC voltage so that the peak voltages do not exceed the value of the rated DC voltage of the capacitor. Rated ripple current (see Column 9 of Table 1(a)) shall be applied continuously, except for measurement periods, for a duration of 240 hours.

The DC voltage shall be supplied by a regulated power supply, free from surges, having a low internal resistance, and shall be applied to each capacitor through a separate resistor. DC power supply regulation shall remain within \pm 2% or less. AC power supply shall be within \pm 5% of current with less than 10% distortion.

After testing, the capacitors shall be examined for evidence of mechanical damage and shall be measured in accordance with Table 2 of this specification.

1 failure is allowed for this subgroup.

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

An additional subgroup of 12 components shall be added to Level 1 (total of 34 components). This subgroup shall be submitted to a ripple current test as specified in Para. 4.2.4.

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. 9.4 of ESCC Generic Specification No. 3002 and they 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 as scheduled in Table 1(a).

4.3.3 Terminal Strength

The requirements for terminal strength testing are specified in Section 9 of ESCC Generic Specification No. 3002.

The test conditions shall be as follows:

- (a) Pull Force: 14 Newtons.

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

Metal, corrosion-resistant, hermetically sealed.

4.4.2 Lead Material and Finish

The lead material shall be Type 'E' with Type '3 or 4' finish in accordance with the requirements of ESCC Basic Specification No. 23500.

4.4.3 Sleeving

Sleeving shall be of a non-fungus nutrient material (cardboard shall not be used). The material shall not soften, creep or shrink to the extent that it causes any part of the cylindrical case to become uncovered at any test temperature specified herein. At any cross-section, the maximum thickness of the sleeving shall not exceed twice the minimum thickness of the sleeves.

4.5 MARKING

4.5.1 General

The marking of 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 as specified, as much as space permits shall be marked and the marking information, in full, shall accompany the component in its primary package.

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

- (a) Polarity.
- (b) The ESCC Component Number.
- (c) Electrical Characteristics and Ratings.
- (d) Traceability Information.

4.5.2 Polarity

Polarity shall be defined by a “+” on that end of the body of a capacitor where the positive lead protrudes (see Figure 2).

4.5.3 The ESCC Component Number

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

Example: 300200301B

- Detail Specification Number: 3002003
- Type Variant (see Note): 01
- Testing Level (B or C, as applicable): B

N.B.

Marking of the Type Variant Number is mandatory. No further reference to Type Variants is made in this specification.

4.5.4 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: 337KE

- Capacitance Value (330000000pF): 337
- Tolerance ($\pm 10\%$): K
- Rated Voltage (15V): E

4.5.4.1 *Capacitance Values*

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

Capacitance Value	Code
XX10 ⁵	XX5
XX10 ⁶	XX6
XX10 ⁷	XX7
XX10 ⁸	XX8

4.5.4.2 *Tolerances*

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

Tolerance (\pm %)	Code Letter
5	J
10	K
20	M

4.5.4.3 *Rated Voltage*

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

Rated Voltage (U_R) (V)	Code Letter
6.3	B
10	D
16	E
20	F
25	G
35	J
50	L

4.5.5 Traceability Information

Traceability information shall be marked in accordance with the requirements of ESCC Basic Specification No. 21700.

- (a) Manufacturing Date Code.
- (b) Serial Number.
- (c) Manufacturer's Name.

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 $T_{amb} = + 22 \pm 3$ °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. The AQL shall be 2.5% for each capacitance value. Each capacitance value shall be considered as constituting a complete lot. For qualification or lot acceptance testing, the sample size shall be as specified in ESCC Generic Specification No. 3002.

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 specified in Table 4 of this specification. Unless otherwise stated, measurements shall be performed at $T_{amb} = + 22 \pm 3^{\circ}\text{C}$. 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 value 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. 3002. The conditions for burn-in shall be as specified in Table 5 of this specification.

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

The power supply source shall be capable of 30 Amperes minimum and shall be applied without series resistors to the capacitors under test.

4.7.3 Electrical Circuit for Burn-in (Figure 5)

Not applicable.

TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE

No.	Characteristics	Symbol	ESCC 3002 Test Method	Test Conditions	Limits		Unit
					Min.	Max.	
1	Capacitance	C	Para. 9.7.1.1	$f = 1000 \pm 50 \text{ Hz}$ $V_p \leq 2.2 \text{ V}$ $V_m \leq 1 \text{ Vrms}$	Note 1		μF
2	DC Leakage Current	I_L	Para. 9.7.1.2	$V_m = U_R \pm 2 \%$ $R_S = 1 \text{ k}\Omega$	Note 2		μA
3	Dissipation Factor	DF	Para. 9.7.1.3	$f = 1000 \pm 50 \text{ Hz}$	Note 3		%
4	Equivalent Series Resistance	ESR	-	$f = 100 \pm 5 \text{ kHz}$ $V_p \leq 2.2 \text{ V}$ $V_{ac_{max}} = 0.5 \text{ Vrms}$	Note 4		$\text{m}\Omega$

NOTES

1. See Columns 2 and 3 of Table 1(a).
2. See Column 4 of Table 1(a).
3. See Column 7 of Table 1(a).
4. See Column 8 of Table 1(a).

TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

No.	Characteristics	Symbol	ESCC 3002 Test Method	Test Conditions	Limits		Unit
					Min.	Max.	
1	Capacitance Change	$\Delta C/C$	Para. 9.7.1.1	$f = 1000 \pm 50 \text{ Hz}$ $V_p \leq 2.2 \text{ V}$ $V_m \leq 1 \text{ Vrms}$ $T_{amb} = -55 \text{ }^\circ\text{C}$ $T_{amb} = +85 \text{ }^\circ\text{C}$ $T_{amb} = +125 \text{ }^\circ\text{C}$	-10 -8 -12	+10 +8 +12	%
2	DC Leakage Current	I_L	Para. 9.7.1.2	$R_S = 1 \text{ k}\Omega$ $T_{amb} = +85 \text{ }^\circ\text{C}$ $V_m = U_R \pm 2.0 \%$ $T_{amb} = +125 \text{ }^\circ\text{C}$ $V_m = 0.67 U_R$	Note 1 Note 2		μA
3	Dissipation Factor	DF	Para. 9.7.1.3	$f = 1000 \pm 50 \text{ Hz}$ $T_{amb} = -55 \text{ }^\circ\text{C}$ $T_{amb} = +85 \text{ }^\circ\text{C}$ $T_{amb} = +125 \text{ }^\circ\text{C}$	Note 3 Note 4 Note 4		%

NOTES

1. See Column 5 of Table 1(a).
2. See Column 6 of Table 1(a).
3. Twice initial measured value at room temperature or limit of Column 7 of Table 1(a), whichever is greater.
4. 1.5x initial measured value at room temperature or limit of Column 7 of Table 1(a), whichever is 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
1	Capacitance Change	$\Delta C/C$	As per Table 2	As per Table 2	± 2	%
2	DC Leakage Current	I_L	As per Table 2	As per Table 2	Note 1	μA

NOTES

- Twice measured value or $+(25\% + 0.05\mu A)$ of limit value, whichever is smaller. Leakage currents $\leq 0.1\mu A$ are considered as $0.1\mu A$ value.

TABLE 5(a) - CONDITIONS FOR BURN-IN

No.	Characteristic	Symbol	Condition	Unit
1	Ambient Temperature	T_{amb}	$+85\pm 3$	$^{\circ}C$
2	Test Voltage	V_T	Rated voltage (Note 1)	V

NOTES

- See Column 1 of Table 1(a).

TABLE 5(b) - CONDITIONS FOR OPERATING LIFE TESTS

No.	Characteristic	Symbol	Condition	Unit
1	Ambient Temperature	T_{amb}	$+85\pm 3$ (1)	$^{\circ}C$
2	Ambient Temperature	T_{amb}	$+125$ (+0 -3) (2)	$^{\circ}C$

NOTES

- The test voltage shall be the rated voltage, see Column 1 of Table 1(a).
- The test voltage shall be the derated voltage, see Figure 1.

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. 3002)
- 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 $T_{amb} = +22 \pm 3 \text{ }^\circ\text{C}$.
- 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 $T_{amb} = +22 \pm 3 \text{ }^\circ\text{C}$.
- 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 $T_{amb} = +22 \pm 3 \text{ }^\circ\text{C}$.
- 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. 3002. 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. 3002		Measurements and Inspections		Symbols	Limits		Unit
	Environmental and Endurance Tests (1)	Test Method and Conditions	Identification	Conditions		Min.	Max.	
01	Thermal Shock	Para. 9.2	Thermal Shock	Table 1(b)	-	-	-	-
02	External Visual Inspection	Para. 9.3	Visual Inspection	Para. 9.3 of 3002	-	-	-	-
03	Seal Test	Para. 9.6	Visual Examination	Evidence of Leakage	-	-	-	-
04	Shock (Specified Pulse)	Para. 9.8 100% U _R	During Tests	Intermittent Contact, Arcing, Open or Short Circuits	-	-	-	-
			After Tests Visual Examination	Arcing, Breakdown or Mechanical Damage	-	-	-	-
05	Vibration	Para. 9.9 100% U _R	During Last Cycle	Intermittent Operation, Intermittent Contact or Open or Short Circuits	-	-	-	-
			After Tests Visual Examination	Evidence of Mechanical Damage	-	-	-	-
06	Thermal Shock and Immersion	Para. 9.10.1 Before tests, 15 minutes at standard atmospheric conditions Para 9.10.2	Initial Measurements Capacitance		C	Table 2 item 1		μF
				Within 30 minutes of final immersion				
			Capacitance Change	Table 2, Item 1	ΔC/C	-3	+3	%
			DC Leakage Current	Table 2, Item 2	I _L	Table 2 Item 2		μA
			Dissipation Factor	Table 2 Item 3	DF	Table 2 Item 3		%
			Equivalent Series Resistance	Table 2 Item 4	ESR	Table 2 Item 4		mΩ
	Visual Examination		Corrosion, Mechanical Damage and Marking		-	-		

No.	ESCC Generic Spec. No. 3002		Measurements and Inspections		Symbols	Limits		Unit
	Environmental and Endurance Tests (1)	Test Method and Conditions	Identification	Conditions		Min.	Max.	
07	Resistance to Soldering Heat	Para. 9.11	Initial Measurements Capacitance Capacitance Change DC Leakage Current Dissipation Factor Equivalent Series Resistance	Table 2, item 1 After 10 minutes minimum Table 2, Item 1 Table 2, Item 2 Table 2, Item 3 Table 2, Item 4	C $\Delta C/C$ I_L DF ESR	Table 2 item 1 -2 +2 Table 2 Item 2 Table 2 Item 3 Table 2 Item 4	μF % μA % m Ω	
08	Solderability	Para. 9.12	Visual Examination	MIL-STD-202 Method 208 Solid Wire Termination Criteria	-	-	-	-
09	Terminal Strength	Para. 9.13 and Para. 4.3.3 of this specification	Visual Examination	Loosening or Damage to Terminals				
10	Moisture Resistance	Para. 9.14	Initial Measurements Capacitance Final Measurements Capacitance Change DC Leakage Current Dissipation Factor Equivalent Series Resistance Visual Examination	Table 2, item 1 Within 2 to 6 hours Table 2, Item 1 Table 2, Item 2 Table 2, Item 3 Table 2, Item 4 Corrosion, Mechanical Damage and Marking	C $\Delta C/C$ I_L DF ESR -	Table 2 item 1 -2 +2 Table 2 Item 2 Table 2 Item 3 Table 2 Item 4 - -	μF % μA % m Ω -	
11	High and Low Temperature Stability	Para. 9.15	Initial Measurements Capacitance Final Measurements Capacitance Change DC Leakage Current Dissipation Factor	Table 3, Item 1 Table 3, Item 1 Table 3, Item 2 Table 3, Item 3	C $\Delta C/C$ I_L DF	Table 3 item 1 Table 3 Item 1 Table 3 Item 2 Table 3 Item 3	μF μF μA %	
12	Surge Voltage	Para. 9.16 and Table 1(a) of this specification	Initial Measurements Capacitance After Final Cycle Capacitance Change DC Leakage Current Dissipation Factor	Table 2, Item 1 Table 2, Item 1 Table 2, Item 2 Table 2 Item 3	C $\Delta C/C$ I_L DF	Table 2 item 1 -2 +2 Table 2 Item 2 Table 2 Item 3	μF % μA %	

No.	ESCC Generic Spec. No. 3002		Measurements and Inspections		Symbols	Limits		Unit
	Environmental and Endurance Tests (1)	Test Method and Conditions	Identification	Conditions		Min.	Max.	
13	Sleeving	Para. 9.17 Para. 9.17.1 1 minute ±15 seconds Para. 9.17.2 1 minute (+15 -0) seconds	Voltage Proof	2000V	I _L	-	20	μA
			Leakage Current Insulation Resistance	500±50V	R _i	10 ⁴	-	MΩ
14	Operating Life	Para. 9.18	Initial Measurements					
			Capacitance	Table 2, Item 1	C	Table 2 Item 1		μF
			DC Leakage Current	Table 2, Item 2	I _L	Table 2 Item 2		μA
			Dissipation Factor	Table 2, Item 3	DF	Table 2 Item 3		%
			Equivalent Series Resistance	Table 2, Item 4	ESR	Table 2 Item 4		mΩ
			Intermediate Measurements					
			DC Leakage Current	Table 3, Item 2	I _L	Table 3 Item 2		μA
			Final Measurements					
			Capacitance Change	Table 2, Item 1	ΔC/C	-2	+2	%
			DC Leakage Current	Table 2, Item 2	I _L	Table 2 Item 2		μA
			Dissipation Factor	Table 2, Item 3	DF	Table 2 Item 3		%
			Equivalent Series Resistance	Table 2, Item 4	ESR	Table 2 Item 4		mΩ
			Sleeving Voltage Proof Leakage Current	Para. 9.17.1 2000V	I _L	-	20	μA
			Visual Examination	Mechanical Damage	-	-	-	-
15	Ripple Current		Visual Examination	Mechanical Damage	-	-	-	-
			Capacitance	Table 2, Item 1	C	Table 2 Item 1		μF
			DC Leakage Current	Table 2, Item 2	I _L	Table 2 Item 2		μA
			Dissipation Factor	Table 2, Item 3	DF	Table 2 Item 3		%
			Equivalent Series Resistance	Table 2, Item 4	ESR	Table 2 Item 4		mΩ

NOTES

- The tests in this Table refer to either Chart IV or V and shall be used as applicable.