



**CAPACITORS, FIXED, MULTIPLE LAYER,  
CERAMIC DIELECTRIC, TYPE II**

**BASED ON TYPES CNC31, CNC32, CNC33 AND  
CNC34**

**ESCC Detail Specification No. 3001/037**

Issue 3	November 2017
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DCR No.	CHANGE DESCRIPTION
1028	Specification updated 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 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. [3001](#).

**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: 300103701225KA

- Detail Specification Reference: 3001037
- Component Type Variant Number: 01 (as required)
- Characteristic code: Capacitance Value (2.2µF): 225 (as required)
- Characteristic code: Capacitance Tolerance (±10%): K (as required)
- Rating code: Rated Voltage (25V): A (as required)

**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 Value,  $C_n$ , expressed by means of the following codes in accordance with ESCC Basic Specification No. [21700](#). The unit quantity shall be picofarad (pF).

Capacitance Value $C_n$ (pF)	Code
XX 10 <sup>5</sup>	XX5
XX 10 <sup>6</sup>	XX6

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

Tolerance (± %)	Code Letter
10	K
20	M

(c) Rated Voltage,  $U_R$ , expressed by the following codes:

Rated Voltage $U_R$ (V)	Code Letter
16	X
25	A

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	Package Details (Note 1)					Capacitance Range $C_n$ ( $\mu F$ ) (Note 4)		Weight Max (g)
	Type (Note 2)	Lead Type	Lead Mat. & Fin. (Note 3)	No. of Leads	Dim. H Max (mm)	Rated Voltage $U_R = 16V$	Rated Voltage $U_R = 25V$	
01	CNC31NE	N	A10	4	2.5	2.2 to 3.9	1.2 to 2.2	0.4
					4.8	4.7 to 6.8	2.7 to 4.7	0.8
					7	8.2 to 12	5.6 to 6.8	1.2
02	CNC32NE	N	A10	6	2.5	2.7 to 4.7	1.8 to 3.3	0.5
					4.8	5.6 to 10	3.9 to 5.6	1
					7	12 to 15	6.8 to 10	2
03	CNC33NE	N	A10	6	2.5	4.7 to 8.2	3.3 to 5.6	1
					4.8	10 to 15	6.8 to 10	2
					7	18 to 22	12 to 15	3
					9.5	27 to 33	18 to 22	4
04	CNC34NE	N	A10	8	2.5	8.2 to 15	5.6 to 10	2
					4.8	18 to 27	12 to 18	4
					7	33 to 47	22 to 27	6
					9.5	56 to 68	33 to 39	8
05	CNC31PE	P	A10	4	2.5	2.2 to 3.9	1.2 to 2.2	0.4
					4.8	4.7 to 6.8	2.7 to 4.7	0.8
					7	8.2 to 12	5.6 to 6.8	1.2
06	CNC32PE	P	A10	6	2.5	2.7 to 4.7	1.8 to 3.3	0.5
					4.8	5.6 to 10	3.9 to 5.6	1
					7	12 to 15	6.8 to 10	2
07	CNC33PE	P	A10	6	2.5	4.7 to 8.2	3.3 to 5.6	1
					4.8	10 to 15	6.8 to 10	2
					7	18 to 22	12 to 15	3
					9.5	27 to 33	18 to 22	4
08	CNC34PE	P	A10	8	2.5	8.2 to 15	5.6 to 10	2
					7	33 to 47	22 to 27	6
					9.5	56 to 68	33 to 39	8

Variant Number	Package Details (Note 1)					Capacitance Range C <sub>n</sub> (μF) (Note 4)		Weight Max (g)
	Type (Note 2)	Lead Type	Lead Mat. & Fin. (Note 3)	No. of Leads	Dim. H Max (mm)	Rated Voltage U <sub>R</sub> = 16V	Rated Voltage U <sub>R</sub> = 25V	
09	CNC31PLE	PL	A10	4	2.5	2.2 to 3.9	1.2 to 2.2	0.4
					4.8	4.7 to 6.8	2.7 to 4.7	0.8
					7	8.2 to 12	5.6 to 6.8	1.2
10	CNC32PLE	PL	A10	6	2.5	2.7 to 4.7	1.8 to 3.3	0.5
					4.8	5.6 to 10	3.9 to 5.6	1
					7	12 to 15	6.8 to 10	2
11	CNC33PLE	PL	A10	6	2.5	4.7 to 8.2	3.3 to 5.6	1
					4.8	10 to 15	6.8 to 10	2
					7	18 to 22	12 to 15	3
					9.5	27 to 33	18 to 22	4
12	CNC34PLE	PL	A10	8	2.5	8.2 to 15	5.6 to 10	2
					4.8	18 to 27	12 to 18	4
					7	33 to 47	22 to 27	6
					9.5	56 to 68	33 to 39	8
13	CNC31LE	L	A10	4	2.5	2.2 to 3.9	1.2 to 2.2	0.4
					4.8	4.7 to 6.8	2.7 to 4.7	0.8
					7	8.2 to 12	5.6 to 6.8	1.2
14	CNC32LE	L	A10	6	2.5	2.7 to 4.7	1.8 to 3.3	0.5
					4.8	5.6 to 10	3.9 to 5.6	1
					7	12 to 15	6.8 to 10	2
15	CNC33LE	L	A10	6	2.5	4.7 to 8.2	3.3 to 5.6	1
					4.8	10 to 15	6.8 to 10	2
					7	18 to 22	12 to 15	3
					9.5	27 to 33	18 to 22	4
16	CNC34LE	L	A10	8	2.5	8.2 to 15	5.6 to 10	2
					4.8	18 to 27	12 to 18	4
					7	33 to 47	22 to 27	6
					9.5	56 to 68	33 to 39	8

**NOTES:**

1. See Para. 1.6.
2. For Variants 01 to 04 the body shall be coated with varnish. Variants 05 to 16 are classified as non-insulated.
3. The lead materials and finishes shall be in accordance with the requirements of ESCC Basic Specification No. [23500](#).
4. Available capacitance values and tolerances are as follows:
  - Tolerance: ±10%; value series: E12
  - Tolerance: ±20%; value series: E6

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
Rated Voltage	$U_R$	16, 25	V	Note 1
Operating Temperature Range	$T_{op}$	-55 to +125	°C	Without derating. $T_{amb}$
Storage Temperature Range	$T_{stg}$	-55 to +125	°C	
Soldering Temperature	$T_{sol}$	+260	°C	Note 2

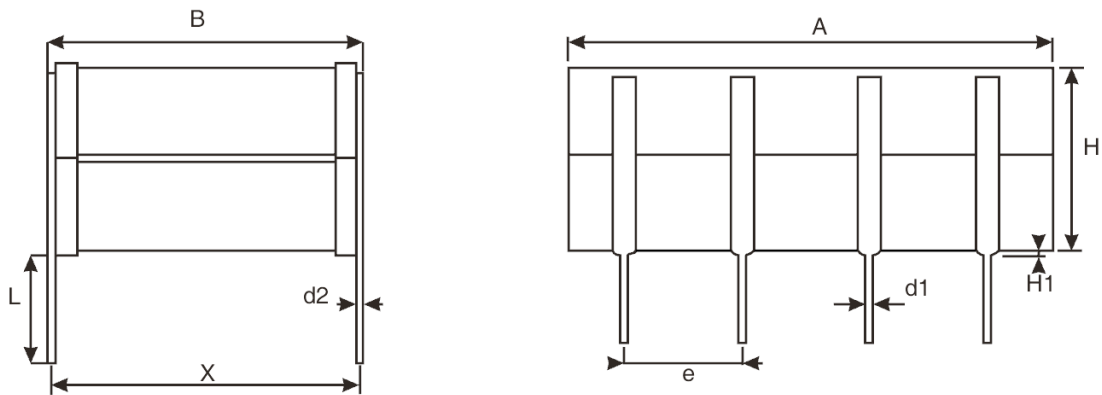
**NOTES:**

- As required; See Para. 1.4.2..
- Duration 10 seconds maximum and the same lead shall not be resoldered until 3 minutes have elapsed.

1.6 **PHYSICAL DIMENSIONS**

1.6.1 **Variants 01 to 04 (lead type N)**

(Variant 04 shown for illustrative purposes)



Variant Number	No. of Leads	Dimensions (mm)												
		A Max	B Max	d1 (Note 1)		d2 (Note 1)		e (Note 1)		H Max	H1 Max (Note 1)	L Min (Note 1)	X (Note 1)	
				Min	Max	Min	Max	Min	Max				Min	Max
01	4	6	7.5	0.4	0.6	0.2	0.3	2.49	2.59	Note 2	2.05	7.5	4.58	5.58
02	6	8	8	0.4	0.6	0.2	0.3	2.49	2.59	Note 2	2.05	7.5	7.12	8.12
03	6	9.2	10	0.4	0.6	0.2	0.3	2.49	2.59	Note 2	2.05	7.5	7.12	8.12
04	8	12	12.5	0.4	0.6	0.2	0.3	2.49	2.59	Note 2	2.05	7.5	9.66	10.66

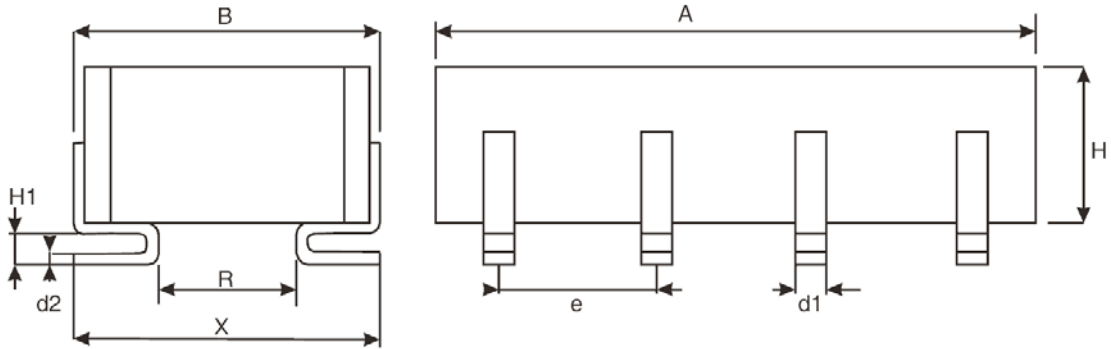
**NOTES:**

- All leads.
- See Para. 1.4.2 for dimension H.



1.6.2 Variants 05 to 08 (lead type P)

(Variant 08 shown for illustrative purposes)



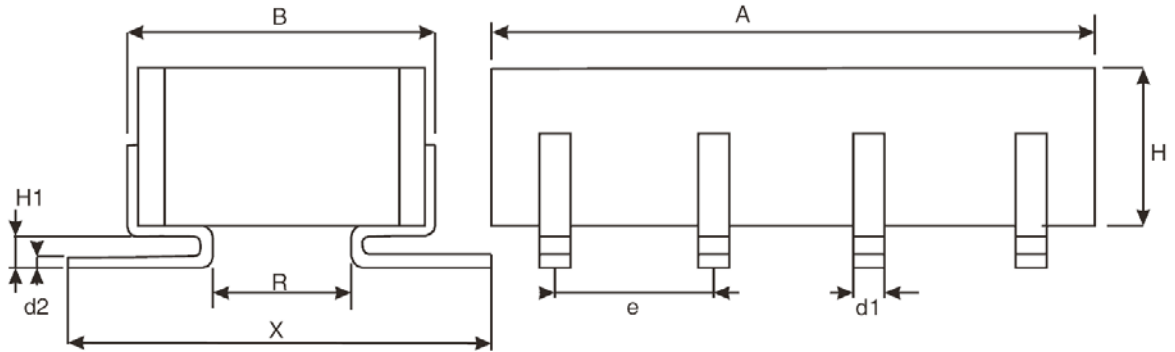
Variant Number	No. of Leads	Dimensions (mm)													
		A Max	B Max	d1 (Note 1)		d2 (Note 1)		e (Note 1)		H Max	H1 (Note 1)		R Min (Note 1)	X (Note 1)	
				Min	Max	Min	Max	Min	Max		Min	Max		Min	Max
05	4	6	7.5	0.4	0.6	0.2	0.3	2.49	2.59	Note 2	1.1	1.6	2.5	5.5	7.5
06	6	8	8	0.4	0.6	0.2	0.3	2.49	2.59	Note 2	1.1	1.6	2.5	6	8
07	6	9.2	10	0.4	0.6	0.2	0.3	2.49	2.59	Note 2	1.1	1.6	3.5	8	10
08	8	12	12.5	0.4	0.6	0.2	0.3	2.49	2.59	Note 2	1.1	1.6	5	9.5	12.5

**NOTES:**

1. All leads.
2. See Para. 1.4.2 for dimension H.

1.6.3 Variants 09 to 12 (lead type PL)

(Variant 12 shown for illustrative purposes)



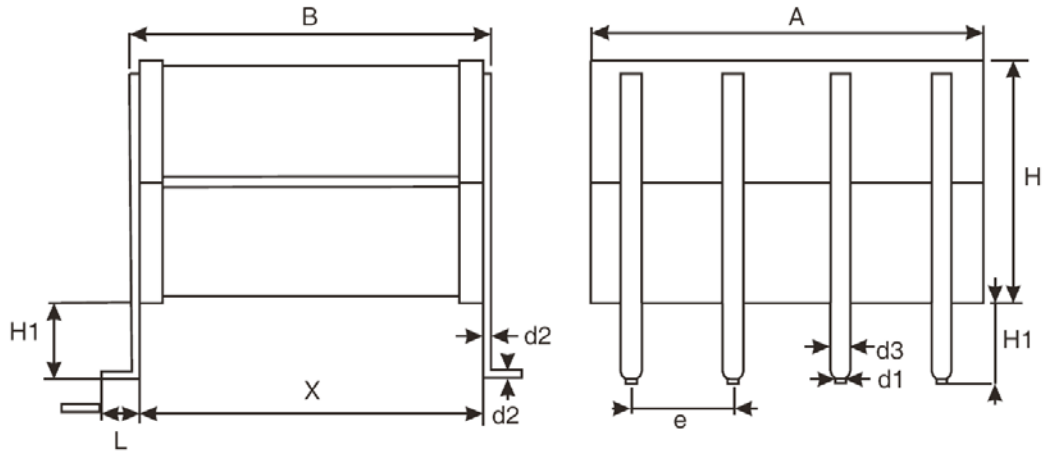
Variant Number	No. of Leads	Dimensions (mm)													
		A Max	B Max	d1 (Note 1)		d2 (Note 1)		e (Note 1)		H Max	H1 (Note 1)		R Min (Note 1)	X (Note 1)	
				Min	Max	Min	Max	Min	Max		Min	Max		Min	Max
09	4	6	7.5	0.4	0.6	0.2	0.3	2.49	2.59	Note 2	1.1	1.6	2.5	9.5	13.5
10	6	8	8	0.4	0.6	0.2	0.3	2.49	2.59	Note 2	1.1	1.6	2.5	10	14
11	6	9.2	10	0.4	0.6	0.2	0.3	2.49	2.59	Note 2	1.1	1.6	3.5	12	16
12	8	12	12.5	0.4	0.6	0.2	0.3	2.49	2.59	Note 2	1.1	1.6	5	13.5	18.5

**NOTES:**

1. All leads.
2. See Para. 1.4.2 for dimension H.

1.6.4 Variants 13 to 16 (lead type L)

(Variant 16 shown for illustrative purposes)



Variant Number	No. of Leads	Dimensions (mm)																
		A Max	B Max	d1 (Note 1)		d2 (Note 1)		d3 (Note 1)		e (Note 1)		H Max	H1 (Note 1)		L (Note 1)		X (Note 1)	
				Min	Max	Min	Max	Min	Max	Min	Max		Min	Max	Min	Max	Min	Max
13	4	6	7.5	0.4	0.6	0.2	0.3	0.9	1.1	2.49	2.59	Note 2	2	3	2	3	5	7
14	6	8	8	0.4	0.6	0.2	0.3	0.9	1.1	2.49	2.59	Note 2	2	3	2	3	5.5	7.5
15	6	9.2	10	0.4	0.6	0.2	0.3	0.9	1.1	2.49	2.59	Note 2	2	3	2	3	7.5	9.5
16	8	12	12.5	0.4	0.6	0.2	0.3	0.9	1.1	2.49	2.59	Note 2	2	3	2	3	10	12

**NOTES:**

1. All leads.
2. See Para. 1.4.2 for dimension H.

1.7 FUNCTIONAL DIAGRAM



**NOTES:**

1. All leads on each side of the component are connected to the same capacitor terminal.

## 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 Tests - Chart F4*

- (a) Resistance to Soldering Heat and Solderability:
  - For Variants 01 to 04: Immersion depth shall be between 2mm and 2.5mm from the body.
  - For Variants 05 to 16: Only the part of the leads designed to be soldered shall be tested.
- (b) Vibration: Prior to Vibration, the samples shall be mounted and glued on to a suitable substrate in order to avoid any stress. The samples shall be maintained on the substrate for all subsequent tests in the subgroup test sequence.

### 2.2 MARKING

The marking shall be in accordance with the requirements of ESCC Basic Specification No. [21700](#) and as follows.

The information to be marked on the component or the primary package shall be:

- (a) The ESCC qualified components symbol (for ESCC qualified components only).
- (b) The ESCC Component Number (see Para. 1.4.1).
- (c) Traceability information.

### 2.3 ROBUSTNESS OF TERMINATIONS

The leads of these devices are classified as rigid.

The test conditions for Robustness of Terminations shall be as specified in the ESCC Generic Specification and as follows:

For Variants 01 to 04:

- Applicable test: Ua1 (tensile) only.
- Leads tested: a minimum of one randomly selected lead on each side of the component.
- Applied force: 5N

For Variants 05 to 16:

- Applicable test: Ue3 (shear) only.
- Pushing force: 10N for 10s

2.4 ELECTRICAL MEASUREMENTS AT ROOM, HIGH AND LOW TEMPERATURES  
 Electrical measurements shall be performed at room, high and low temperatures.

2.4.1 Room Temperature Electrical Measurements  
 The measurements shall be performed at  $T_{amb} = +22 \pm 3^{\circ}\text{C}$ .

Characteristics	Symbols	Test Method and Conditions	Tolerance ( $\pm$ %)	Limits		Units
				Min	Max	
Capacitance (Note 1)	C <sub>A</sub>	ESCC No. 3001	10	0.9C <sub>n</sub>	1.1C <sub>n</sub>	$\mu\text{F}$
			20	0.8C <sub>n</sub>	1.2C <sub>n</sub>	
Tangent of Loss Angle	tg $\delta$	ESCC No. 3001	All	-	250 $\times 10^{-4}$	-
Insulation Resistance (Dielectric)	R <sub>ID</sub>	ESCC No. 3001	All	1000	-	G $\Omega$ .nF
Insulation Resistance (Body Insulation)	R <sub>IB</sub>	ESCC No. 3001 Variants 01 to 04 only Note 2	All	1000	-	G $\Omega$ .nF
Voltage Proof (Dielectric)	VP <sub>D</sub>	ESCC No. 3001	All	2.5U <sub>R</sub>	-	V
Voltage Proof (Body Insulation)	VP <sub>B</sub>	ESCC No. 3001 Variants 01 to 04 only Note 2	All	2.5U <sub>R</sub>	-	V

**NOTES:**

1. Capacitance limits may be adjusted to take into account capacitance ageing, as specified in the Generic Specification.
2. The measurements shall be performed on a sample of 5 components from each manufacturing lot with 0 failures allowed. In the event of any failure a 100% inspection may be performed. In the case of a 100% inspection, a 1% total percent defective is allowed.

2.4.2 High and Low Temperatures Electrical Measurements

Characteristics	Symbols	Test Method and Conditions (Note 1)	Limits		Units
			Min	Max	
Insulation Resistance (Dielectric)	R <sub>ID</sub>	ESCC No. 3001 T <sub>amb</sub> = +125 ±2°C Note 2	100	-	GΩ.nF
Insulation Resistance (Body Insulation)	R <sub>IB</sub>	ESCC No. 3001 T <sub>amb</sub> = +125 ±2°C Variants 01 to 04 only Note 2	100	-	GΩ.nF
Temperature Characteristic	TC	ESCC No. 3001 T <sub>amb</sub> = -55 ±2°C, +20 ±2°C, +125 ±2°C Note 3 For V <sub>T</sub> = no voltage applied For V <sub>T</sub> = U <sub>R</sub>	-20	+20	%
			-50	+30	

**NOTES:**

1. The measurements shall be performed on a sample of 5 components from each manufacturing lot with 0 failures allowed. In the event of any failure a 100% inspection may be performed.
2. Guaranteed but not tested during Chart F3 of the Generic Specification; only tested in Temperature Characterisation during Chart F4 of the Generic Specification.
3. In the case of a 100% inspection, a 1% total percent defective is allowed.

2.5 INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS

Unless otherwise specified, the measurements shall be performed at T<sub>amb</sub> = +22 ±3°C.

Unless otherwise specified the test methods and test conditions shall be as per the corresponding test defined in Para. 2.4.1 Room Temperature Electrical Measurements.

Test Reference per ESCC No. 3001	Characteristics	Symbols	Limits		Units
			Min	Max	
Rapid Change of Temperature	Capacitance	C <sub>A</sub>	Note 1		
Initial Measurements					
Final Measurements	Capacitance	C <sub>A</sub>	Note 1		%
	Change in Capacitance	ΔC <sub>A</sub> /C <sub>A</sub>	-15	+15	
	Tangent of Loss Angle	tgδ	-	250 ×10 <sup>-4</sup>	

Test Reference per ESCC No. 3001	Characteristics	Symbols	Limits		Units
			Min	Max	
Steady State Humidity Initial Measurements  Final Measurements	Capacitance	$C_A$	Note 1		
	Capacitance	$C_A$	Note 1		
	Change in Capacitance	$\Delta C_A/C_A$	-10	+10	%
	Tangent of Loss Angle	$tg\delta$	-	$250 \times 10^{-4}$	-
	Insulation Resistance (Dielectric) (Note 2)	$R_{ID}$	30	-	GΩ.nF
	Insulation Resistance (Body Insulation) (Notes 2, 3)	$R_{IB}$	30	-	GΩ.nF
Operating Life Initial Measurements  Intermediate Measurements (1000 hours) (Note 4)  Final Measurements (1000 or 2000 hours) (Note 5)	Capacitance	$C_A$	Note 1		
	Capacitance	$C_A$	Note 1		
	Change in Capacitance	$\Delta C_A/C_A$	-15	+15	%
	Insulation Resistance (Dielectric)	$R_{ID}$	100	-	GΩ.nF
	Insulation Resistance (Body Insulation) (Note 3)	$R_{IB}$	100	-	GΩ.nF
	Capacitance	$C_A$	Note 1		
	Change in Capacitance	$\Delta C_A/C_A$	-20	+20	%
	Tangent of Loss Angle	$tg\delta$	-	$250 \times 10^{-4}$	-
	Insulation Resistance (Dielectric)	$R_{ID}$	100	-	GΩ.nF
	Insulation Resistance (Body Insulation) (Note 3)	$R_{IB}$	100	-	GΩ.nF
	Voltage Proof (Dielectric)	$VP_D$	$2.5U_R$	-	V
Voltage Proof (Body Insulation) (Note 3)	$VP_B$	$2.5U_R$	-	V	
Temperature Characterisation	Insulation Resistance (Dielectric) at $T_{amb} = +125 \pm 2^\circ C$	$R_{ID}$	Note 5		
	Insulation Resistance (Body Insulation) at $T_{amb} = +125 \pm 2^\circ C$ (Note 3)	$R_{IB}$	Note 5		
	Temperature Characteristic	TC	Note 5		

Test Reference per ESCC No. 3001	Characteristics	Symbols	Limits		Units
			Min	Max	
Resistance to Soldering Heat					
Initial Measurements	Capacitance	C <sub>A</sub>	Note 1		
Final Measurements	Capacitance	C <sub>A</sub>	Note 1		
	Change in Capacitance	$\Delta C_A / C_A$	-15	+15	%
	Insulation Resistance (Dielectric)	R <sub>ID</sub>	1000	-	GΩ.nF
	Insulation Resistance (Body Insulation) (Note 3)	R <sub>IB</sub>	1000	-	GΩ.nF

**NOTES:**

- As specified in Para. 2.4.1 Room Temperature Electrical Measurements.
- Test conditions for Insulation Resistance shall be as specified in Steady State Humidity in the ESCC Generic Specification.
- Variants 01 to 04 only.
- Intermediate measurements are optional at the Manufacturer's discretion.
- 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.
- As specified in Para. 2.4.2 High and Low Temperatures Electrical Measurements.

2.6

**BURN-IN**

The requirements for Burn-in are specified in the ESCC Generic Specification. The following conditions shall also apply:

- After Burn-in, the components shall be removed from the chamber and allowed to cool under normal atmospheric conditions for recovery for 24 hours minimum.



**APPENDIX A****AGREED DEVIATIONS FOR EXXELIA TECHNOLOGIES (F)**

Items Affected	Description of Deviations
Para. 2.1.1 Deviations from the Generic Specification: Special In-Process Controls - Chart F2	Robustness of Terminations shall not be performed