



**CAPACITORS, FIXED, SURFACE MOUNT,
DC SELF-HEALING, NON-INDUCTIVE,
POLYTEREPHTHALATE DIELECTRIC**

BASED ON TYPE PM94S

ESCC Detail Specification No. 3006/024

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DCR No.	CHANGE DESCRIPTION
1315	Specification updated to incorporate changes per DCR.

TABLE OF CONTENTS

1	GENERAL	5
1.1	SCOPE	5
1.2	APPLICABLE DOCUMENTS	5
1.3	TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS	5
1.4	THE ESCC COMPONENT NUMBER AND COMPONENT TYPE VARIANTS	5
1.4.1	THE ESCC COMPONENT NUMBER	5
1.4.1.1	CHARACTERISTICS AND RATINGS CODES	5
1.4.2	COMPONENT TYPE VARIANTS AND RANGE OF COMPONENTS	6
1.5	MAXIMUM RATINGS	11
1.6	PHYSICAL DIMENSIONS AND TERMINAL IDENTIFICATION	12
1.7	FUNCTIONAL DIAGRAM	12
2	REQUIREMENTS	13
2.1	GENERAL	13
2.1.1	DEVIATIONS FROM THE GENERIC SPECIFICATION	13
2.1.1.1	DEVIATIONS FROM QUALIFICATION AND PERIODIC TESTS – CHART F4	13
2.2	MARKING	13
2.3	ROBUSTNESS OF TERMINATIONS	14
2.4	ELECTRICAL MEASUREMENTS AT ROOM, HIGH AND LOW TEMPERATURES	14
2.4.1	ROOM TEMPERATURE ELECTRICAL MEASUREMENTS	14
2.4.2	HIGH AND LOW TEMPERATURES ELECTRICAL MEASUREMENTS	15
2.5	INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS	15
2.6	BURN-IN CONDITIONS	17
	APPENDIX 'A'	18

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. [3006](#).

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: 300602402155KH

- Detail Specification Reference: 3006024
- Component Type Variant Number: 02 (as required)
- Characteristic code: Capacitance Value (1.5µF): 155 (as required)
- Characteristic code: Capacitance Tolerance (±10%): K (as required)
- Rating code: Rated Voltage (250V): H (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) Capacitance Value, C, expressed by means of the following codes in accordance with ESCC Basic Specification No. [21700](#). The unit quantity shall be picofarads (pF).

Capacitance Value C (pF)	Code
XX 10 ⁴	XX4
XX 10 ⁵	XX5
XX 10 ⁶	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) DC Rated Voltage, U_R , expressed by the following codes:

DC Rated Voltage U_R (V)	Code Letter
50	C
63	D
100	E
200	G
250	H
400	K

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:

Type Variant (Note 1)	Capacitance Value (C) (μ F)	Capacitance Tolerance (\pm %)	DC Rated Voltage (U_R) (V)	AC Rated Current (I_{RA}) (Arms)	Dimension B Max (mm) (Note 1)	Terminal Finish (Note 2)	Weight Max (g)
01	2.2	10, 20	50	1.3	6	3 or 4	1
	2.7	10		1.6	6		1
	3.3	10, 20		1.9	6		1
	3.9	10		2.3	8		1.3
	4.7	10, 20		2.8	8		1.3
	5.6	10		3.3	10		1.7
	6.8	10, 20		4.1	10		1.7
	8.2	10		4.9	12		1.9
	10	10, 20		6	12		2
	1.5	10, 20	63	1.7	6		1
	1.8	10		2.1	6		1
	2.2	10, 20		2.3	8		1.3
	2.7	10		3.1	10		1.7
	3.3	10, 20		3.8	10		1.7
	3.9	10		4.9	12		1.9
	4.7	10, 20		6	12		2
	0.56	10	100	0.8	6		1
	0.68	10, 20		1	6		1
	0.82	10		1.1	6		1
	1	10, 20		1.8	6		1
	1.2	10		1.8	8		1.3
	1.5	10, 20		2.2	8		1.3
	1.8	10		2.7	10		1.7
	2.2	10, 20		3.5	12		1.9

Type Variant (Note 1)	Capacitance Value (C) (µF)	Capacitance Tolerance (± %)	DC Rated Voltage (U _R) (V)	AC Rated Current (I _{RA}) (Arms)	Dimension B Max (mm) (Note 1)	Terminal Finish (Note 2)	Weight Max (g)
01	0.33	10, 20	200	0.6	6	3 or 4	1
	0.39	10		0.8	6		1
	0.47	10, 20		1	6		1
	0.56	10		1.1	8		1.3
	0.68	10, 20		1.4	8		1.3
	0.82	10		1.7	10		1.7
	1	10, 20		2.1	12		1.9
	0.22	10, 20	250	0.8	6		1
	0.27	10		1.0	6		1
	0.33	10, 20		1.2	6		1
	0.39	10		1.4	8		1.3
	0.47	10, 20		1.7	8		1.3
	0.56	10		2	10		1.7
	0.68	10, 20		2.4	12		1.9
	0.1	10, 20	400	0.8	6		1
	0.12	10		1	8		1.3
	0.15	10, 20		1.2	8		1.3
	0.18	10		1.4	8		1.7
	0.22	10, 20		1.7	10		1.7
	02	4.7	10, 20	50	1.4		6
5.6		10	1.7		6	1.6	
6.8		10, 20	2.1		6	1.6	
8.2		10	2.5		8	2.1	
10		10, 20	3.1		8	2.1	
12		10	3.7		8	2.1	
15		10, 20	4.6		10	2.6	
3.3		10, 20	63	1.9	6	1.6	
3.9		10		2.3	6	1.6	
4.7		10, 20		2.8	8	2.1	
5.6		10		3.3	10	2.6	
1.5		10, 20	100	1.1	6	1.6	
1.8		10		1.4	6	1.6	
2.2		10, 20		1.7	6	1.6	
2.7		10		2.1	8	2.1	
3.3		10, 20		2.5	10	2.6	

Type Variant (Note 1)	Capacitance Value (C) (μF)	Capacitance Tolerance (± %)	DC Rated Voltage (U _R) (V)	AC Rated Current (I _{RA}) (Arms)	Dimension B Max (mm) (Note 1)	Terminal Finish (Note 2)	Weight Max (g)
02	0.82	10	200	0.8	6	3 or 4	1.6
	1	10, 20		1	6		1.6
	1.2	10		1.2	8		2.1
	1.5	10, 20		1.5	8		2.1
	1.8	10		1.8	10		2.6
	0.47	10, 20		250	0.8		6
	0.56	10	0.9		6		1.6
	0.68	10, 20	1.1		6		1.6
	0.82	10	1.3		8		2.1
	1	10, 20	1.6		8		2.1
	1.2	10	2		10		2.6
	1.5	10, 20	2.5	10	2.6		
	0.22	10, 20	400	0.8	6		1.6
	0.27	10		1	6		1.6
	0.33	10, 20		1.2	8		2.1
	0.39	10		1.4	8		2.1
	0.47	10, 20		1.7	10		2.6
	6.8	10, 20		50	1.9		6
8.2	10	2.3	6		2.2		
10	10, 20	2.9	6		2.2		
12	10	3.4	6		2.2		
15	10, 20	4.3	8		3		
18	10	5.2	8		3		
22	10, 20	6.3	10		3.7		
27	10	7.8	12		4.7		
33	10, 20	9.5	14		5.2		
4.7	10, 20	63	2.6		6	2.2	
5.6	10		3.1		6	2.2	
6.8	10, 20		3.7		8	3	
8.2	10		4.5		8	3	
10	10, 20		5.5		10	3.7	
12	10		6.6		12	4.7	
15	10, 20		8.3		14	5.2	

Type Variant (Note 1)	Capacitance Value (C) (µF)	Capacitance Tolerance (± %)	DC Rated Voltage (U _R) (V)	AC Rated Current (I _{RA}) (Arms)	Dimension B Max (mm) (Note 1)	Terminal Finish (Note 2)	Weight Max (g)	
03	2.2	10, 20	100	1.6	6	3 or 4	2.2	
	2.7	10		1.9	6		2.2	
	3.3	10, 20		2.4	6		2.2	
	3.9	10		2.8	8		3	
	4.7	10, 20		3.4	8		3	
	5.6	10		4	10		3.7	
	6.8	10, 20		4.9	12		4.7	
	8.2	10		5.9	14		5.2	
	1.2	10		200	1.1		6	2.2
	1.5	10, 20	1.4		6		2.2	
	1.8	10	1.7		8		3	
	2.2	10, 20	2.1		8		3	
	2.7	10	2.6		10		3.7	
	3.3	10, 20	3.2		10		3.7	
	3.9	10	3.8		12		4.7	
	4.7	10, 20	4.6		14		5.2	
	1	10, 20	250		1.5		6	2.2
	1.2	10		1.8	8		3	
	1.5	10, 20		2.3	8		3	
	1.8	10		2.7	10		3.7	
	2.2	10, 20		3.4	10		3.7	
	2.7	10		4.1	12		4.7	
	3.3	10, 20		5	14		5.2	
	0.47	10, 20		400	1.6		6	2.2
	0.56	10			1.9		8	3
	0.68	10, 20	2.3		8		3	
	0.82	10	2.8		10		3.7	
	1	10, 20	3.4		12		4.7	
	1.2	10	4		14		5.2	
	04	10	10, 20	50	2.6		6	3 or 4
12		10	3.1		6	2.7		
15		10, 20	3.9		6	2.7		
18		10	4.6		8	3.6		
22		10, 20	5.7		8	3.6		
27		10	7		10	4.6		
33		10, 20	8.5		12	5.5		

Type Variant (Note 1)	Capacitance Value (C) (µF)	Capacitance Tolerance (± %)	DC Rated Voltage (U _R) (V)	AC Rated Current (I _{RA}) (Arms)	Dimension B Max (mm) (Note 1)	Terminal Finish (Note 2)	Weight Max (g)
04	39	10	50	10	15	3 or 4	6.8
	47	10, 20		12.2	15		6.8
	6.8	10, 20	63	3.4	6		2.7
	8.2	10		4	8		3.6
	10	10, 20		4.9	8		4.6
	12	10		5.9	10		4.6
	15	10, 20		7.4	12		5.5
	18	10		8.9	15		6.8
	22	10, 20		10.9	15		6.8
	3.3	10, 20		100	2.1		6
	3.9	10	2.5		6		2.7
	4.7	10, 20	3		8		3.6
	5.6	10	3.6		8	3.6	
	6.8	10, 20	4.3		10	4.6	
	8.2	10	5.2		10	4.6	
	10	10, 20	6.4		12	5.5	
	12	10	7.7		15	6.8	
	1.8	10	200	1.6	6	2.7	
	2.2	10, 20		2	6	2.7	
	2.7	10		2.4	8	3.6	
	3.3	10, 20		3	10	4.6	
	3.9	10		3.5	10	4.6	
	4.7	10, 20		4.3	12	5.5	
	5.6	10		5.1	15	6.8	
	1	10, 20		250	1.3	6	2.7
	1.2	10	1.6		6	2.7	
	1.5	10, 20	2		6	2.7	
	1.8	10	2.4		8	3.6	
	2.2	10, 20	3		8	3.6	
	2.7	10	3.6		10	4.6	
	3.3	10, 20	4.4		10	4.6	
	3.9	10	5.3		12	5.5	
	4.7	10, 20	6.3		15	6.8	

Type Variant (Note 1)	Capacitance Value (C) (μF)	Capacitance Tolerance (± %)	DC Rated Voltage (U _R) (V)	AC Rated Current (I _{RA}) (Arms)	Dimension B Max (mm) (Note 1)	Terminal Finish (Note 2)	Weight Max (g)
04	0.68	10, 20	400	2	6	3 or 4	2.7
	0.82	10		2.5	8		3.6
	1	10, 20		3	10		4.6
	1.2	10		3.6	10		4.6
	1.5	10, 20		4.5	12		5.5
	1.8	10		5.4	15		6.8

NOTES:

- See Para. 1.6.
- Terminal finishes shall be in accordance with the requirements of ESCC Basic Specification No. [23500](#).

1.5 **MAXIMUM RATINGS**

The maximum ratings shall not be exceeded at any time during use or storage.

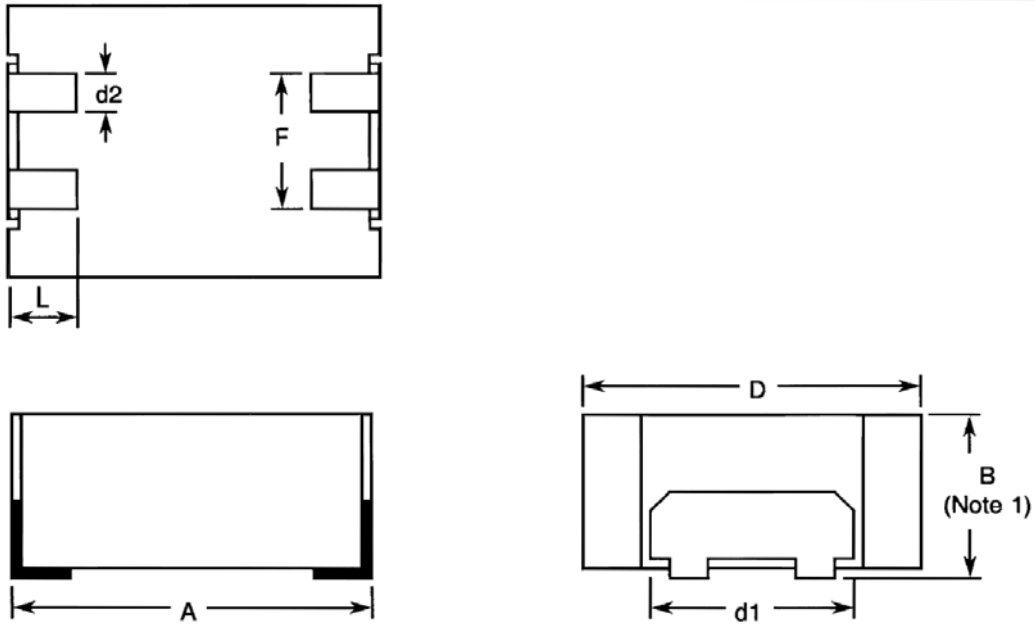
Maximum ratings shall only be exceeded during testing to the extent specified in this specification and when stipulated in Test Methods and Procedures of the ESCC Generic Specification.

Characteristics	Symbols	Maximum Ratings	Units	Remarks
DC Rated Voltage	U _R	50, 63, 100, 200, 250, 400	V	Notes 1, 2
AC Rated Voltage	U _A	35%U _R	V _{rms}	50/60Hz
AC Rated Current	I _{RA}	See Para. 1.4.2	Arms	100kHz
Operating Temperature Range	T _{op}	-55 to +125	°C	T _{amb}
Storage Temperature Range	T _{stg}	-55 to +125	°C	
Soldering Temperature	T _{sol}	+215	°C	Note 3

NOTES:

- As required; See Para. 1.4.2.
- At T_{amb} ≤ +100°C. For T_{amb} > 100°C, derate linearly to 80%U_R at T_{amb} = +125°C.
- For reflow soldering:
 - Temperature: +215°C
 - Duration: 40 seconds maximum.

1.6 PHYSICAL DIMENSIONS AND TERMINAL IDENTIFICATION

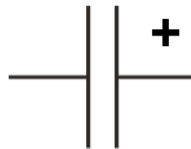


Type Variant	Dimensions (mm)									
	A Max	D Max	d1		d2		F		L	
			Min	Max	Min	Max	Min	Max	Min	Max
01	10.7	10.7	5.5	6.5	1.3	1.7	4.8	5.2	1.5	2.5
02	15.5	11.5	5.5	6.5	1.3	1.7	4.8	5.2	1.5	2.5
03	16.5	15.5	7.5	8.5	1.8	2.2	6.8	7.2	1.5	2.5
04	18.5	17	7.5	8.5	1.8	2.2	6.8	7.2	1.5	2.5

NOTES:

1. The limits of Dimension B are defined in Para. 1.4.2.
2. Terminal identification: A voltage polarity “+” symbol shall be marked on the top of the body to indicate the terminal which should be connected to the highest potential.

1.7 FUNCTIONAL DIAGRAM



NOTES:

1. These capacitors are not polarised; however, marking includes the voltage polarity symbol (see Para. 1.6) which should be respected in use.

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) Mounting:

Prior to the commencement of Chart F4 Subgroups 1A, 1B, 1C and 2, components may be mounted on a suitable substrate in accordance with IEC Publication No. 60384-1, Clause 4.33. After mounting, a force of 10N shall be applied normal to a line joining the terminals and in a plane parallel to the substrate for a duration of 10s. There shall be no evidence of damage or loosening of the components from the substrate.
- (b) Operating Life:
 - Test Condition (c), Applied voltage: $1.25 \times U_R$
- (c) Solderability shall be performed in accordance with IEC Publication No. 60068-2-58. The following details shall apply:
 - Test Conditions:
 - Temperature: $+215 \pm 3^\circ\text{C}$
 - Immersion time: $3 \pm 0.3\text{s}$
 - Immersion distance: 1mm minimum, 2mm maximum.
- (d) Resistance to Soldering Heat shall be performed in accordance with IEC Publication No. 60068-2-58. The following details shall apply:
 - Test Conditions:
 - Temperature: $+215 \pm 3^\circ\text{C}$
 - Immersion time: 40s
 - Immersion distance: 1mm minimum, 2mm maximum.
 - Data Points: As defined in Resistance to Soldering Heat in the Generic Specification.

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 its primary package 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 **ROBUSTNESS OF TERMINATIONS**

The terminals of the components are rigid.

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

- Test U_a, with an applied force of 10N and a duration of 10 ±1s.

Both terminals of the component shall be tested.

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 ±3°C.

Characteristics	Symbols	Test Method and Conditions	Limits		Units
			Min	Max	
Capacitance	C	ESCC No. 3006 Test Frequency = 1kHz	Note 1	Note 2	µF
Tangent of Loss Angle	tgδ	ESCC No. 3006 Test Frequency = 1kHz	-	100×10 ⁻⁴	-
Insulation Resistance, Dielectric	R _I	ESCC No. 3006 C ≤ 0.33µF; U _R > 100V C > 0.33µF; U _R > 100V U _R ≤ 100V (Notes 3, 4)	7500 2500 1250	- - -	MΩ MΩ.µF MΩ.µF
Insulation Resistance, Body Insulation	R _{IB}	ESCC No. 3006	50	-	GΩ
Voltage Proof, Terminal-to-Terminal	VP	ESCC No. 3006	1.6×U _R (Note 4)	-	V
Voltage Proof, Terminal-to-Case	VP _B	ESCC No. 3006	1.6×U _R (Note 4)	-	V

NOTES:

1. Capacitance Value of the component minus the applicable Tolerance (see Para. 1.4.2).
2. Capacitance Value of the component plus the applicable Tolerance (see Para. 1.4.2).
3. Measuring voltage applied during Insulation Resistance shall be as follows:
 - For U_R ≤ 100V: V = U_R
 - For 100V < U_R < 500V: V = 100V
4. For the applicable Rated Voltage (U_R) see Para. 1.4.2.

2.4.2 High and Low Temperatures Electrical Measurements

Characteristics	Symbols	Test Method and Conditions (Note 1)	Limits		Units
			Min	Max	
Temperature Coefficient	$\Delta C/C$	ESCC No. 3006 Test Frequency = 1kHz $T_{amb} = -55 \pm 2^{\circ}C$	-	-10 (Note 2)	%
		$T_{amb} = +125 \pm 2^{\circ}C$	-	+18 (Note 2)	%

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. The Temperature Coefficient limits are with respect to the capacitance at $+22 \pm 2^{\circ}C$ (reference point temperature).

2.5 INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS

Unless otherwise specified, the measurements shall be performed at $T_{amb} = +22 \pm 3^{\circ}C$.

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. 3006	Characteristics	Symbols	Limits		Units
			Min	Max	
Resistance to Soldering Heat Initial Measurements Final Measurements	Capacitance	C	Note 1		μF
	Capacitance	C	Note 1		μF
	Change in Capacitance	$\Delta C/C$	-3	+3	%
	Insulation Resistance, Dielectric	R_i			
	$C \leq 0.33\mu F; U_R > 100V$		Note 1	-	M Ω
	$C > 0.33\mu F; U_R > 100V$ $U_R \leq 100V$		Note 1	-	M $\Omega \cdot \mu F$
	Tangent of Loss Angle	$tg\delta$	-	Note 1	-
Temperature Coefficient	Temperature Coefficient (Note 2)	$\Delta C/C$	Note 3		%
Rapid Change of Temperature Initial Measurements Final Measurements	Capacitance	C	Note 1		μF
	Capacitance	C	Note 1		μF
	Change in Capacitance	$\Delta C/C$	-3	+3	%
	Tangent of Loss Angle	$tg\delta$	-	Note 1	-

Test Reference per ESCC No. 3006	Characteristics	Symbols	Limits		Units
			Min	Max	
Climatic Sequence Initial Measurements Final Measurements	Capacitance	C	Note 1		μF
	Capacitance	C	Note 1		μF
	Change in Capacitance	ΔC/C	-3	+3	%
	Tangent of Loss Angle	tgδ	-	Note 4	-
	Voltage Proof, Terminal-to-Terminal	VP	Note 1	-	V
	Voltage Proof, Terminal-to-Case	VP _B	Note 5	-	V
	Insulation Resistance, Dielectric	R _I			
	C ≤ 0.33μF; U _R > 100V		Note 6	-	MΩ
	C > 0.33μF; U _R > 100V		Note 6	-	MΩ.μF
	U _R ≤ 100V		Note 6	-	MΩ.μF
Insulation Resistance, Body Insulation	R _{IB}	Note 6	-	GΩ	
Operating Life Initial Measurements Intermediate Measurements (1000 hours) Final Measurements (1000 or 2000 hours) (Note 7)	Capacitance	C	Note 1		μF
	Capacitance	C	Note 1		μF
	Change in Capacitance	ΔC/C	-5	+5	%
	Capacitance	C	Note 1		μF
	Change in Capacitance	ΔC/C	-5	+5	%
	Tangent of Loss Angle	tgδ	-	Note 4	-
	Insulation Resistance, Dielectric	R _I			
	C ≤ 0.33μF; U _R > 100V		Note 6	-	MΩ
	C > 0.33μF; U _R > 100V		Note 6	-	MΩ.μF
	U _R ≤ 100V		Note 6	-	MΩ.μF
Insulation Resistance, Body Insulation	R _{IB}	Note 6	-	GΩ	

NOTES:

- As specified in Para. 2.4.1.
- The test method and test conditions shall be as specified in Para. 2.4.2.
- As specified in Para. 2.4.2.
- 2x the limit specified in Para. 2.4.1.
- 1.6xU_R or 200V, whichever is greater. For the applicable Rated Voltage (U_R) see Para. 1.4.2.
- 50% of the limit specified in Para. 2.4.1.
- 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.

2.6

BURN-IN CONDITIONS

Characteristics	Symbols	Conditions (Note 1)	Units
Ambient Temperature	T_{amb}	+100 (+0 -5)	°C
Test Voltage	V_T	1.25× U_R (Note 2)	V

NOTES:

1. On completion of Burn-in the components shall be removed from the burn-in chamber and allowed to cool, under normal atmospheric conditions, for recovery for 24 ±2 hours.
2. For the applicable Rated Voltage (U_R) see Para. 1.4.2.

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

Items Affected	Description of Deviations
Para. 2.1.1.1, Deviations from Qualification and Periodic Tests – Chart F4	Robustness of Terminations shall be performed as follows: The components shall be mounted on a suitable substrate. After mounting, examination shall be made for good tinning as evidenced by flowing of the solder with wetting of the terminations. A force of 10N shall be applied normal to the line joining the terminals and in a plane parallel to the substrate, for a duration of 10 ± 1 s. The components shall then be examined and there shall be no evidence of damage or loosening of the components from the substrate.