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

BASED ON TYPE PM94S

ESCC Detail Specification No. 3006/024

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DCR No.	CHANGE DESCRIPTION
1393	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 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

1.4.2.1 Component Type Variants

Four Component Type Variants are defined in this specification with each Type Variant being a different size of surface mount package. See Para. 1.6 for details.

The surface mount package shall have a terminal finish of either '3' or '4' in accordance with the requirements of ESCC Basic Specification No. 23500.

1.4.2.2 Range of Components

The range of components applicable to this specification are as follows:

DC Rated Voltage (U_R) Max (V)	Capacitance Value (C) (µF) (Note 1)	AC Rated Current (I_{RA}) Max (Arms)	Available Type Variant (See Para. 1.6)	Dimension B Max (mm) (See Para. 1.6)	Weight Max (g)
50	2.2	1.3	01	6	1
50	2.7	1.6	01	6	1
50	3.3	1.9	01	6	1
50	3.9	2.3	01	8	1.3
50	4.7	2.8	01	8	1.3
50	4.7	1.4	02	6	1.6
50	5.6	3.3	01	10	1.7
50	5.6	1.7	02	6	1.6
50	6.8	4.1	01	10	1.7
50	6.8	2.1	02	6	1.6
50	6.8	1.9	03	6	2.2
50	8.2	4.9	01	12	1.9
50	8.2	2.5	02	8	2.1
50	8.2	2.3	03	6	2.2
50	10	6	01	12	2
50	10	3.1	02	8	2.1
50	10	2.9	03	6	2.2
50	10	2.6	04	6	2.7
50	12	3.7	02	8	2.1
50	12	3.4	03	6	2.2
50	12	3.1	04	6	2.7

DC Rated Voltage (U_R) Max (V)	Capacitance Value (C) (µF) (Note 1)	AC Rated Current (I_{RA}) Max (Arms)	Available Type Variant (See Para. 1.6)	Dimension B Max (mm) (See Para. 1.6)	Weight Max (g)
50	15	4.6	02	10	2.6
50	15	4.3	03	8	3
50	15	3.9	04	6	2.7
50	18	5.2	03	8	3
50	18	4.6	04	8	3.6
50	22	6.3	03	10	3.7
50	22	5.7	04	8	3.6
50	27	7.8	03	12	4.7
50	27	7	04	10	4.6
50	33	9.5	03	14	5.2
50	33	8.5	04	12	5.5
50	39	10	04	15	6.8
50	47	12.2	04	15	6.8
63	1.5	1.7	01	6	1
63	1.8	2.1	01	6	1
63	2.2	2.3	01	8	1.3
63	2.7	3.1	01	10	1.7
63	3.3	3.8	01	10	1.7
63	3.3	1.9	02	6	1.6
63	3.9	4.9	01	12	1.9
63	3.9	2.3	02	6	1.6
63	4.7	6	01	12	2
63	4.7	2.8	02	8	2.1
63	4.7	2.6	03	6	2.2
63	5.6	3.3	02	10	2.6
63	5.6	3.1	03	6	2.2
63	6.8	3.7	03	8	3
63	6.8	3.4	04	6	2.7
63	8.2	4.5	03	8	3
63	8.2	4	04	8	3.6
63	10	5.5	03	10	3.7
63	10	4.9	04	8	4.6
63	12	6.6	03	12	4.7
63	12	5.9	04	10	4.6
63	15	8.3	03	14	5.2
63	15	7.4	04	12	5.5
63	18	8.9	04	15	6.8
63	22	10.9	04	15	6.8
100	0.56	0.8	01	6	1
100	0.68	1	01	6	1

DC Rated Voltage (U_R) Max (V)	Capacitance Value (C) (µF) (Note 1)	AC Rated Current (I_{RA}) Max (Arms)	Available Type Variant (See Para. 1.6)	Dimension B Max (mm) (See Para. 1.6)	Weight Max (g)
100	0.82	1.1	01	6	1
100	1	1.8	01	6	1
100	1.2	1.8	01	8	1.3
100	1.5	2.2	01	8	1.3
100	1.5	1.1	02	6	1.6
100	1.8	2.7	01	10	1.7
100	1.8	1.4	02	6	1.6
100	2.2	3.5	01	12	1.9
100	2.2	1.7	02	6	1.6
100	2.2	1.6	03	6	2.2
100	2.7	2.1	02	8	2.1
100	2.7	1.9	03	6	2.2
100	3.3	2.5	02	10	2.6
100	3.3	2.4	03	6	2.2
100	3.3	2.1	04	6	2.7
100	3.9	2.8	03	8	3
100	3.9	2.5	04	6	2.7
100	4.7	3.4	03	8	3
100	4.7	3	04	8	3.6
100	5.6	4	03	10	3.7
100	5.6	3.6	04	8	3.6
100	6.8	4.9	03	12	4.7
100	6.8	4.3	04	10	4.6
100	8.2	5.9	03	14	5.2
100	8.2	5.2	04	10	4.6
100	10	6.4	04	12	5.5
100	12	7.7	04	15	6.8
200	0.33	0.6	01	6	1
200	0.39	0.8	01	6	1
200	0.47	1	01	6	1
200	0.56	1.1	01	8	1.3
200	0.68	1.4	01	8	1.3
200	0.82	1.7	01	10	1.7
200	0.82	0.8	02	6	1.6
200	1	2.1	01	12	1.9
200	1	1	02	6	1.6
200	1.2	1.2	02	8	2.1
200	1.2	1.1	03	6	2.2
200	1.5	1.5	02	8	2.1
200	1.5	1.4	03	6	2.2

DC Rated Voltage (U_R) Max (V)	Capacitance Value (C) (µF) (Note 1)	AC Rated Current (I_{RA}) Max (Arms)	Available Type Variant (See Para. 1.6)	Dimension B Max (mm) (See Para. 1.6)	Weight Max (g)
200	1.8	1.8	02	10	2.6
200	1.8	1.7	03	8	3
200	1.8	1.6	04	6	2.7
200	2.2	2.1	03	8	3
200	2.2	2	04	6	2.7
200	2.7	2.6	03	10	3.7
200	2.7	2.4	04	8	3.6
200	3.3	3.2	03	10	3.7
200	3.3	3	04	10	4.6
200	3.9	3.8	03	12	4.7
200	3.9	3.5	04	10	4.6
200	4.7	4.6	03	14	5.2
200	4.7	4.3	04	12	5.5
200	5.6	5.1	04	15	6.8
250	0.22	0.8	01	6	1
250	0.27	1.0	01	6	1
250	0.33	1.2	01	6	1
250	0.39	1.4	01	8	1.3
250	0.47	1.7	01	8	1.3
250	0.47	0.8	02	6	1.6
250	0.56	2	01	10	1.7
250	0.56	0.9	02	6	1.6
250	0.68	2.4	01	12	1.9
250	0.68	1.1	02	6	1.6
250	0.82	1.3	02	8	2.1
250	1	1.6	02	8	2.1
250	1	1.5	03	6	2.2
250	1	1.3	04	6	2.7
250	1.2	2	02	10	2.6
250	1.2	1.8	03	8	3
250	1.2	1.6	04	6	2.7
250	1.5	2.5	02	10	2.6
250	1.5	2.3	03	8	3
250	1.5	2	04	6	2.7
250	1.8	2.7	03	10	3.7
250	1.8	2.4	04	8	3.6
250	2.2	3.4	03	10	3.7
250	2.2	3	04	8	3.6
250	2.7	4.1	03	12	4.7
250	2.7	3.6	04	10	4.6

DC Rated Voltage (U_R) Max (V)	Capacitance Value (C) (µF) (Note 1)	AC Rated Current (I_{RA}) Max (Arms)	Available Type Variant (See Para. 1.6)	Dimension B Max (mm) (See Para. 1.6)	Weight Max (g)
250	3.3	5	03	14	5.2
250	3.3	4.4	04	10	4.6
250	3.9	5.3	04	12	5.5
250	4.7	6.3	04	15	6.8
400	0.1	0.8	01	6	1
400	0.12	1	01	8	1.3
400	0.15	1.2	01	8	1.3
400	0.18	1.4	01	8	1.7
400	0.22	1.7	01	10	1.7
400	0.22	0.8	02	6	1.6
400	0.27	1	02	6	1.6
400	0.33	1.2	02	8	2.1
400	0.39	1.4	02	8	2.1
400	0.47	1.7	02	10	2.6
400	0.47	1.6	03	6	2.2
400	0.56	1.9	03	8	3
400	0.68	2.3	03	8	3
400	0.68	2	04	6	2.7
400	0.82	2.8	03	10	3.7
400	0.82	2.5	04	8	3.6
400	1	3.4	03	12	4.7
400	1	3	04	10	4.6
400	1.2	4	03	14	5.2
400	1.2	3.6	04	10	4.6
400	1.5	4.5	04	12	5.5
400	1.8	5.4	04	15	6.8

NOTES:

1. Two Capacitance Tolerances are available:
   - ±20% for E6 Series Capacitance Values
   - ±10% for E12 Series Capacitance Values

1.5 MAXIMUM RATINGS

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

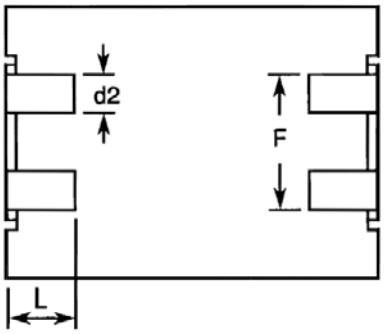
Maximum ratings shall only be exceeded during testing to the extent specified in this specification and when stipulated in Test Methods and Procedures of the ESCC Generic Specification.

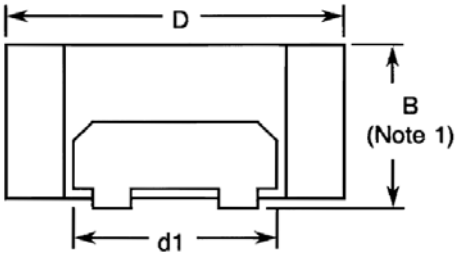
Characteristics	Symbols	Maximum Ratings	Units	Remarks
DC Rated Voltage	U_R	50, 63, 100, 200, 250, 400	V	Notes 1, 2
AC Rated Voltage	U_A	35%U_R	Vrms	50/60Hz
AC Rated Current	I_{RA}	See Para. 1.4.2.2	Arms	100kHz
Operating Temperature Range	T_{op}	-55 to +125	°C	T_{amb}
Storage Temperature Range	T_{stg}	-55 to +125	°C	
Soldering Temperature	T_{sol}	+215	°C	Note 3

NOTES:

1. As required; See Para. 1.4.2.2.
2. At $T_{amb} \leq +100°C$. For $T_{amb} > 100°C$, derate linearly to 80%U_R at $T_{amb} = +125°C$.
3. For reflow soldering:
   - Temperature: +215°C
   - Duration: 40 seconds maximum.

1.6 PHYSICAL DIMENSIONS AND TERMINAL IDENTIFICATION



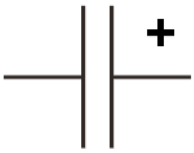


Type Variant	Dimensions (mm)									
	A Max	D Max	d1		d2		F		L	
			Min	Max	Min	Max	Min	Max	Min	Max
01	10.7	10.7	5.5	6.5	1.3	1.7	4.8	5.2	1.5	2.5
02	15.5	11.5	5.5	6.5	1.3	1.7	4.8	5.2	1.5	2.5
03	16.5	15.5	7.5	8.5	1.8	2.2	6.8	7.2	1.5	2.5
04	18.5	17	7.5	8.5	1.8	2.2	6.8	7.2	1.5	2.5

NOTES:

1. The limits of Dimension B are defined in Para. 1.4.2.2.
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 ±3°C
  - Immersion time: 3 ±0.3s
  - 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 ±3°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 Ua, 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).
2. Capacitance Value of the component plus the applicable Tolerance (see Para. 1.4.2.2).
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.

2.4.2 High and Low Temperatures Electrical Measurements

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

NOTES:

1. The measurements shall be performed on a sample of 6 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 ±2°C (reference point temperature).

2.5 INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS

Unless otherwise specified, the measurements shall be performed at T_{amb} = +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. 3006	Characteristics	Symbols	Limits		Units
			Min	Max	
Resistance to Soldering Heat					
Initial Measurements	Capacitance	C	Note 1		µF
Final Measurements	Capacitance	C	Note 1		µF
	Change in Capacitance	ΔC/C	-3	+3	%
	Insulation Resistance, Dielectric	R_I			
	C ≤ 0.33µF; U_R > 100V		Note 1	-	MΩ
	C > 0.33µF; U_R > 100V		Note 1	-	MΩ.µF
	U_R ≤ 100V		Note 1	-	MΩ.µF
	Tangent of Loss Angle	tgδ	-	Note 1	-
Temperature Coefficient	Temperature Coefficient (Note 2)	ΔC/C	Note 3		%
Rapid Change of Temperature					
Initial Measurements	Capacitance	C	Note 1		µF
Final Measurements	Capacitance	C	Note 1		µF
	Change in Capacitance	ΔC/C	-3	+3	%
	Tangent of Loss Angle	tgδ	-	Note 1	-

Test Reference per ESCC No. 3006	Characteristics	Symbols	Limits		Units
			Min	Max	
Climatic Sequence					
Initial Measurements	Capacitance	C	Note 1		µF
Final Measurements	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			
	$C \leq 0.33\mu F$; $U_R > 100V$		Note 6	-	MΩ
	$C > 0.33\mu F$; $U_R > 100V$		Note 6	-	MΩ.µF
	$U_R \leq 100V$		Note 6	-	MΩ.µF
	Insulation Resistance, Body Insulation	R_{IB}	Note 6	-	GΩ
Operating Life					
Initial Measurements	Capacitance	C	Note 1		µF
Intermediate Measurements (1000 hours)	Capacitance	C	Note 1		µF
	Change in Capacitance	ΔC/C	-5	+5	%
Final Measurements (1000 or 2000 hours) (Note 7)	Capacitance	C	Note 1		µF
	Change in Capacitance	ΔC/C	-5	+5	%
	Tangent of Loss Angle	tgδ	-	Note 4	-
	Insulation Resistance, Dielectric	R_I			
	$C \leq 0.33\mu F$; $U_R > 100V$		Note 6	-	MΩ
	$C > 0.33\mu F$; $U_R > 100V$		Note 6	-	MΩ.µF
	$U_R \leq 100V$		Note 6	-	MΩ.µF
	Insulation Resistance, Body Insulation	R_{IB}	Note 6	-	GΩ

NOTES:

1. As specified in Para. 2.4.1.
2. The test method and test conditions shall be as specified in Para. 2.4.2.
3. As specified in Para. 2.4.2.
4. 2× the limit specified in Para. 2.4.1.
5. $1.6 \times U_R$ or 200V, whichever is greater. For the applicable Rated Voltage (U_R) see Para. 1.4.2.2.
6. 50% of the limit specified in Para. 2.4.1.
7. 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. 1.4.2.2.

APPENDIX 'A'

AGREED DEVIATIONS FOR EXXELIA TECHNOLOGIES (F)

Items Affected	Description of Deviations
Para. 2.1.1, Deviations from the Generic Specification: Deviations from Screening Tests – Chart F3	All procurement lots shall have 100% Serialisation carried out at any point during Chart F3 testing prior to the performance of High and Low Temperatures Electrical Measurements.
	If a particular lot is required to undergo testing in accordance with Chart F4, then the Temperature Coefficient measurements, made during High and Low Temperatures Electrical Measurements on a sample of 6 randomly-selected serialised capacitors, shall be Read-and-Record measurements. See "Deviations from Qualification and Periodic Tests – Chart F4" below.
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 ±1s. The components shall then be examined and there shall be no evidence of damage or loosening of the components from the substrate.
	The Temperature Coefficient testing specified in Subgroup 2B of Chart F4 may not be performed. In instances when Temperature Coefficient testing per Subgroup 2B of Chart F4 is not performed, the Read-and-Record measurements data obtained during High and Low Temperature Electrical Measurements (part of Chart F3, Screening Tests) shall be submitted instead.