



Page 1 of 16

**CAPACITORS, FIXED, CERAMIC DIELECTRIC,
TYPE I N2200, HIGH VOLTAGE 200V TO 5000V**

**BASED ON TYPES
TCF479S TO TCF485S, TCK479S TO TCK485S**

ESCC Detail Specification No. 3001/039

Issue 1	October 2018
---------	--------------



Document Custodian: European Space Agency – see <https://escies.org>

LEGAL DISCLAIMER AND COPYRIGHT

European Space Agency, Copyright © 2018. All rights reserved.

The European Space Agency disclaims any liability or responsibility, to any person or entity, with respect to any loss or damage caused, or alleged to be caused, directly or indirectly by the use and application of this ESCC publication.

This publication, without the prior permission of the European Space Agency and provided that it is not used for a commercial purpose, may be:

- copied in whole, in any medium, without alteration or modification.
- copied in part, in any medium, provided that the ESCC document identification, comprising the ESCC symbol, document number and document issue, is removed.

DOCUMENTATION CHANGE NOTICE

(Refer to <https://escies.org> for ESCC DCR content)

DCR No.	CHANGE DESCRIPTION

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
1.4.2	Component Type Variants and Range of Components	6
1.5	MAXIMUM RATINGS	9
1.6	PHYSICAL DIMENSIONS	10
1.6.1	Type TCF4**S - Variants 01, 03, 05, 07, 09, 11, 13	10
1.6.2	Type TCK4**S - Variants 02, 04, 06, 08, 10, 12, 14	11
1.7	FUNCTIONAL DIAGRAM	11
1.8	MATERIALS AND FINISHES	11
1.8.1	Case	11
1.8.2	Terminals	11
2	REQUIREMENTS	12
2.1	GENERAL	12
2.1.1	Deviations from the Generic Specification	12
2.2	MARKING	12
2.3	ROBUSTNESS OF TERMINATIONS	12
2.4	ELECTRICAL MEASUREMENTS AT ROOM, HIGH AND LOW TEMPERATURES	13
2.4.1	Room Temperature Electrical Measurements	13
2.4.2	High and Low Temperatures Electrical Measurements	14
2.5	INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS	14
2.6	BURN-IN	16

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: 3001xxx03682KM

- Detail Specification Reference: 3001xxx
- Component Type Variant Number: 03 (as required)
- Characteristic code: Capacitance Value (6.8nF): 682 (as required)
- Characteristic code: Capacitance Tolerance ($\pm 10\%$): K (as required)
- Rating code: Rated Voltage (1000V): M (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	XX0
XX 10^1	XX1
XX 10^2	XX2
XX 10^3	XX3
XX 10^4	XX4
XX 10^5	XX5

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

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

- (c) Rated Voltage expressed by the following codes:

Rated Voltage U_R (V)	Code Letter
200	G
500	L
1000	M
1500	X
2000	P
3000	R
4000	S
5000	T

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	Based on Type (Note 1)	Rated Voltage U_R (V)	Capacitance Range C_n (pF) (Note 2)	Weight Max (g)
01	TCF479S	200	120 to 120000	1
		500	56 to 27000	
		1000	47 to 6800	
		1500	33 to 3300	
		2000	33 to 1800	
		3000	27 to 680	
		4000	27 to 390	
02	TCK479S	200	120 to 120000	1
		500	56 to 27000	
		1000	47 to 6800	
		1500	33 to 3300	
		2000	33 to 1800	
		3000	27 to 680	
		4000	27 to 390	

Variant Number	Based on Type (Note 1)	Rated Voltage U_R (V)	Capacitance Range C_n (pF) (Note 2)	Weight Max (g)
03	TCF480S	200	1500 to 330000	1.3
		500	180 to 56000	
		1000	68 to 12000	
		1500	68 to 6800	
		2000	47 to 3900	
		3000	39 to 1800	
		4000	33 to 820	
		5000	33 to 560	
04	TCK480S	200	1500 to 330000	1.3
		500	180 to 56000	
		1000	68 to 12000	
		1500	68 to 6800	
		2000	47 to 3900	
		3000	39 to 1800	
		4000	33 to 820	
		5000	33 to 560	
05	TCF481S	200	2200 to 390000	3.1
		500	270 to 82000	
		1000	120 to 22000	
		2000	82 to 5600	
		3000	68 to 2200	
		4000	56 to 1200	
		5000	56 to 820	
06	TCK481S	200	2200 to 390000	3.1
		500	270 to 82000	
		1000	120 to 22000	
		2000	82 to 5600	
		3000	68 to 2200	
		4000	56 to 1200	
		5000	56 to 820	
07	TCF482S	200	5600 to 680000	4
		500	470 to 150000	
		1000	270 to 39000	
		2000	150 to 10000	
		3000	120 to 4700	
		4000	82 to 2200	
		5000	82 to 1500	

Variant Number	Based on Type (Note 1)	Rated Voltage U_R (V)	Capacitance Range C_n (pF) (Note 2)	Weight Max (g)
08	TCK482S	200	5600 to 680000	4
		500	470 to 150000	
		1000	270 to 39000	
		2000	150 to 10000	
		3000	120 to 4700	
		4000	82 to 2200	
		5000	82 to 1500	
09	TCF483S	200	10000 to 1200000	5.2
		500	680 to 270000	
		1000	470 to 82000	
		2000	390 to 22000	
		3000	330 to 10000	
		4000	270 to 5600	
		5000	220 to 3300	
10	TCK483S	200	10000 to 1200000	5.2
		500	680 to 270000	
		1000	470 to 82000	
		2000	390 to 22000	
		3000	330 to 10000	
		4000	270 to 5600	
		5000	220 to 3300	
11	TCF484S	200	1000 to 1800000	8
		500	1800 to 330000	
		1000	1000 to 100000	
		2000	820 to 27000	
		3000	680 to 12000	
		4000	560 to 5600	
		5000	470 to 3900	
12	TCK484S	200	1000 to 1800000	8
		500	1800 to 330000	
		1000	1000 to 100000	
		2000	820 to 27000	
		3000	680 to 12000	
		4000	560 to 5600	
		5000	470 to 3900	

Variant Number	Based on Type (Note 1)	Rated Voltage U_R (V)	Capacitance Range C_n (pF) (Note 2)	Weight Max (g)
13	TCF485S	200	18000 to 3300000	11
		500	10000 to 680000	
		1000	1500 to 220000	
		2000	1200 to 56000	
		3000	1000 to 27000	
		4000	820 to 15000	
		5000	680 to 8200	
14	TCK485S	200	18000 to 3300000	11
		500	10000 to 680000	
		1000	1500 to 220000	
		2000	1200 to 56000	
		3000	1000 to 27000	
		4000	820 to 15000	
		5000	680 to 8200	

NOTES:

- See Para. 1.6.
- Available capacitance values and tolerances are as follows:
 - Tolerance: $\pm 10\%$; value series: E12
 - Tolerance: $\pm 20\%$; 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.

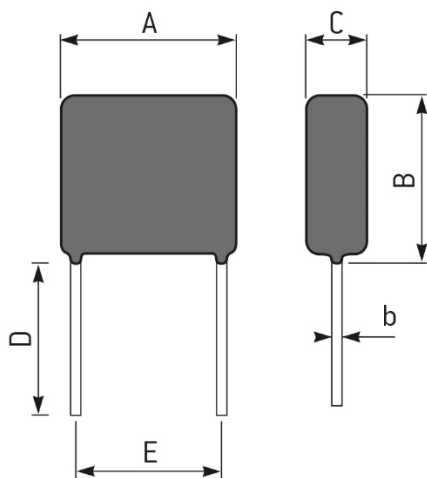
Characteristics	Symbols	Maximum Ratings	Units	Remarks
Rated Voltage	U_R	200, 500, 1000, 1500, 2000, 3000, 4000, 5000	V	Note 1
Operating Temperature Range	T_{op}	-55 to +125	$^{\circ}\text{C}$	Without derating. T_{amb}
Storage Temperature Range	T_{stg}	-55 to +125	$^{\circ}\text{C}$	
Soldering Temperature	T_{sol}	+260	$^{\circ}\text{C}$	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 Type TCF4**S - Variants 01, 03, 05, 07, 09, 11, 13

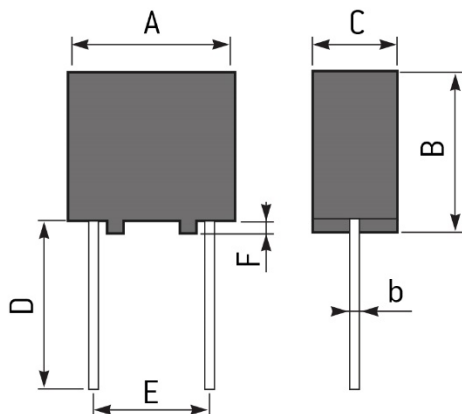


Variant Number	Dimensions (mm)								
	A Max	B Max	b (1)		C		D Min (1)	E (1)	
			Min	Max	Min	Max		Min	Max
01	6.5	6	0.55	0.66	3	7	12	4.58	5.58
03	8	9	0.55	0.66	3	7	12	4.58	5.58
05	10	8.9	0.75	0.88	3	7	12	7.12	8.12
07	10.5	11.5	0.75	0.88	3	7	12	9.66	10.66
09	14	14.5	0.75	0.88	3	7	12	12.2	13.2
11	17.5	14.5	0.75	0.88	3	7	12	14.74	15.74
13	20	19	0.75	0.88	3	7	12	17.3	18.3

NOTES:

1. All leads.

1.6.2 Type TCK4**S - Variants 02, 04, 06, 08, 10, 12, 14



Variant Number	Dimensions (mm)										
	A		B		b (1)		C Max	D Min (1)	E (1)		F Min
	Min	Max	Min	Max	Min	Max			Min	Max	
02	6.7	7.7	4.5	5.5	0.55	0.66	5	12	4.58	5.58	0.2
04	7.5	8.5	7.5	8.5	0.55	0.66	5	12	4.58	5.58	0.2
06	10	11	8.5	9.5	0.75	0.88	8	12	7.12	8.12	0.2
08	12.5	13.5	11.5	12.5	0.75	0.88	8	12	9.66	10.66	0.2
10	14.5	15.5	13.5	14.5	0.75	0.88	8	12	12.2	13.2	0.2
12	17.5	18.5	15.5	16.5	0.75	0.88	8	12	14.74	15.74	0.2
14	19.5	20.5	18.5	19.5	0.75	0.88	8	12	17.3	18.3	0.2

NOTES:

1. All leads.

1.7 FUNCTIONAL DIAGRAM



1.8 MATERIALS AND FINISHES

1.8.1 Case

For Type TCF4**S, Variants 01, 03, 05, 07, 09, 11, 13, the case shall be varnished and epoxy coated.

For Type TCK4**S, Variants 02, 04, 06, 08, 10, 12, 14, the case shall be varnished and epoxy moulded.

1.8.2 Terminals

The lead material and finish shall be type A4 in accordance with the requirements of ESCC Basic Specification No. [23500](#).

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: On completion of testing, the components shall be visually examined and there shall be no evidence of damage.

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 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 terminations 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:

- Applicable test: Ua1 (tensile) only.
- Terminations tested: one randomly selected lead on each component of the specified sample.
- Applied force: 10N

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	C_A	ESCC No. 3001 $f = 1\text{kHz}$	10 20	$0.9C_n$ $0.8C_n$	$1.1C_n$ $1.2C_n$	pF
Tangent of Loss Angle	$\text{tg}\delta$	ESCC No. 3001 $f = 1\text{kHz}$ For $C_n \leq 50\text{pF}$ For $C_n > 50\text{pF}$	All	- -	Note 1 15×10^{-4}	-
Insulation Resistance (Dielectric)	R_{ID}	ESCC No. 3001 $C_n \leq 25000\text{pF}$ $C_n > 25000\text{pF}$	All	20 500	- -	$\text{G}\Omega$ $\text{G}\Omega.\text{nF}$
Insulation Resistance (Body Insulation)	R_{IB}	ESCC No. 3001 Note 2 $C_n \leq 25000\text{pF}$ $C_n > 25000\text{pF}$	All	20 500	- -	$\text{G}\Omega$ $\text{G}\Omega.\text{nF}$
Voltage Proof (Dielectric)	VP_D	ESCC No. 3001 For $U_R < 500\text{V}$ For $U_R = 500\text{V}$ For $500\text{V} < U_R \leq 1250\text{V}$ For $U_R > 1250\text{V}$	All	$2.5U_R$ $2U_R$ $1.5U_R$ $1.3U_R$	- - - -	V
Voltage Proof (Body Insulation)	VP_B	ESCC No. 3001 Note 3	All	1300	-	V

NOTES:

- For $C_n \leq 50\text{pF}$, $\text{tg}\delta < 1.5 \times (150/C_n + 7) \times 10^{-4}$, where the unit quantity for C_n is in pF.
- Guaranteed but not tested during Chart F3 of the Generic Specification; only tested during Chart F4 of the Generic Specification (see Para. 2.5 herein).
- 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.

2.4.2 High and Low Temperatures Electrical Measurements

Characteristics	Symbols	Test Method and Conditions (Note 1)	Limits		Units
			Min	Max	
Insulation Resistance (Dielectric)	R_{ID}	ESCC No. 3001 $T_{amb} = +125 \pm 2^{\circ}\text{C}$ Note 2 $C_n \leq 25000\text{pF}$ $C_n > 25000\text{pF}$	2	-	$\text{G}\Omega$
			50	-	$\text{G}\Omega.\text{nF}$
Insulation Resistance (Body Insulation)	R_{IB}	ESCC No. 3001 $T_{amb} = +125 \pm 2^{\circ}\text{C}$ Note 2 $C_n \leq 25000\text{pF}$ $C_n > 25000\text{pF}$	2	-	$\text{G}\Omega$
			50	-	$\text{G}\Omega.\text{nF}$
Temperature Coefficient	TC	ESCC No. 3001 $T_{amb} = -55 \pm 2^{\circ}\text{C}, +20 \pm 2^{\circ}\text{C}, +125 \pm 2^{\circ}\text{C}$ Note 3	-2700	-1700	$10^{-6}/^{\circ}\text{C}$

NOTES:

- 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.
- Guaranteed but not tested during Chart F3 of the Generic Specification; only tested in Temperature Characterisation during Chart F4 of the Generic Specification (see Para. 2.5 herein).
- 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 $T_{amb} = +22 \pm 3^{\circ}\text{C}$.

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					
Initial Measurements	Capacitance	C _A	Note 1		
Final Measurements	Capacitance	C _A	Note 1		
	Change in Capacitance	ΔC _A /C _A	-3	+3	%
	Tangent of Loss Angle	tgδ	-	Note 2	

Test Reference per ESCC No. 3001	Characteristics	Symbols	Limits		Units	
			Min	Max		
Steady State Humidity Initial Measurements	Capacitance	C _A	Note 1		%	
Final Measurements (1000 hours)	Capacitance	C _A	Note 1			
	Change in Capacitance	ΔC _A /C _A	-3	+3		
	Tangent of Loss Angle	tgδ	-	Note 2		
	Insulation Resistance (Dielectric) (Note 3):					
	For C _n ≤ 25000pF	R _{ID}	2	-		GΩ
	For C _n > 25000pF	R _{ID}	50	-		GΩ.nF
	Insulation Resistance (Body Insulation) (Note 3):					
For C _n ≤ 25000pF	R _{IB}	2	-	GΩ		
For C _n > 25000pF	R _{IB}	50	-	GΩ.nF		
Operating Life Initial Measurements	Capacitance	C _A	Note 1		%	
Intermediate Measurements (1000 hours) (Note 4)	Capacitance	C _A	Note 1			
	Change in Capacitance	ΔC _A /C _A	-3	+3		
	Insulation Resistance (Dielectric):					
	For C _n ≤ 25000pF	R _{ID}	2	-		GΩ
	For C _n > 25000pF	R _{ID}	50	-		GΩ.nF
	Insulation Resistance (Body Insulation):					
	For C _n ≤ 25000pF	R _{IB}	2	-		GΩ
For C _n > 25000pF	R _{IB}	50	-	GΩ.nF		
Final Measurements (1000 or 2000 hours) (Note 5)	Capacitance	C _A	Note 1			%
	Change in Capacitance	ΔC _A /C _A	-3	+3		
	Tangent of Loss Angle	tgδ	-	Note 2		
	Insulation Resistance (Dielectric):					
	For C _n ≤ 25000pF	R _{ID}	2	-	GΩ	
	For C _n > 25000pF	R _{ID}	50	-	GΩ.nF	
	Insulation Resistance (Body Insulation):					
	For C _n ≤ 25000pF	R _{IB}	2	-	GΩ	
	For C _n > 25000pF	R _{IB}	50	-	GΩ.nF	
	Voltage Proof (Dielectric)	V _{PD}	Note 1			
Voltage Proof (Body Insulation)	V _{PB}	Note 1				
Temperature Characterisation	Insulation Resistance (Dielectric) at T _{amb} = +125 ±2°C	R _{ID}	Note 6			
	Insulation Resistance (Body Insulation) at T _{amb} = +125 ±2°C	R _{IB}	Note 6			
	Temperature Coefficient	TC	Note 6			

Test Reference per ESCC No. 3001	Characteristics	Symbols	Limits		Units
			Min	Max	
Resistance to Soldering Heat					
Initial Measurements	Capacitance	C_A	Note 1		
Final Measurements	Capacitance	C_A	Note 1		
	Change in Capacitance	$\Delta C_A / C_A$	-3	+3	%
	Insulation Resistance (Dielectric):				
	For $C_n \leq 25000\text{pF}$	R_{ID}	2	-	$G\Omega$
	For $C_n > 25000\text{pF}$	R_{ID}	50	-	$G\Omega.nF$

NOTES:

1. As specified in Para. 2.4.1 Room Temperature Electrical Measurements.
2. Twice the limit specified in Para. 2.4.1 Room Temperature Electrical Measurements.
3. Test conditions for Insulation Resistance shall be as specified in Steady State Humidity in the ESCC Generic Specification.
4. Intermediate measurements are optional at the Manufacturer's discretion.
5. 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.
6. 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.