CAPACITORS, FIXED, CERAMIC DIELECTRIC, TYPE I, HIGH VOLTAGE, 1KV TO 5KV

BASED ON TYPES VR, CV AND CH

ESCC Detail Specification No. 3001/033

DRAFT

Issue 4 Draft A	October 2012

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DOCUMENTATION CHANGE NOTICE

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

DCR No.	CHANGE DESCRIPTION
TBD	Specification updated to incorporate editorial and technical 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: 300103301470K1R

- Detail Specification Reference: 3001033
- Component Type Variant Number: 01 (as required)
- Characteristic code: Capacitance Value (47pF): 470 (as required)
- Characteristic code: Capacitance Tolerance (±10%): K (as required)
- Characteristic code: Temperature Coefficient (±30 x10^{-6}/°C): 1
- Rating code: Rated Voltage (3kV): R (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 10^1	XX1
XX 10^2	XX2
XX 10^3	XX3
XX 10^4	XX4

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

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

(c) Temperature Coefficient expressed by the following code:

Temperature Coefficient (± 10^{-6}/°C)	Code
30	1

(d) Rated Voltage expressed by the following codes:

Rated Voltage (kV)	Code Letter
1	M
2	P
3	R
4	S
5	Z

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 (pF) (Note 4)					Weight Max (g)
	Case Type (Note 2)	Lead Type	No. of Leads	Lead Mat. & Fin. (Note 3)	Rated Voltage U_R = 1kV	Rated Voltage U_R = 2kV	Rated Voltage U_R = 3kV	Rated Voltage U_R =4kV	Rated Voltage U_R = 5kV	
01	VR30S	Leaded Radial	2	A3	390 to 2200	56 to 470	33 to 330	-	-	1
02	VR30	Leaded Radial	2	A3	2700 to 5600	560 to 1800	390 to 680	-	-	1
03	VR40	Leaded Radial	2	A3	6800 to 15000	2200 to 4700	820 to 1500	390 to 820	330 to 560	2
04	VR50	Leaded Radial	2	A3	18000 to 33000	5600 to 10000	1800 to 2700	1000 to 1800	680 to 1200	3
05	VR66	Leaded Radial	2	A3	39000 to 68000	12000 to 18000	3300 to 5600	2200 to 3300	1500 to 2200	5
06	VR84	Leaded Radial	2	A3	82000 to 100000	22000 to 39000	6800 to 12000	3900 to 6800	2700 to 4700	8
07	VR90	Leaded Radial	2	A3	120000 to 330000	47000 to 100000	15000 to 33000	8200 to 18000	5600 to 12000	19
08	CV41	Leaded Radial	2	A3	6800 to 15000	2200 to 4700	820 to 1500	390 to 820	330 to 560	2

Variant Number	Package Details (Note 1)				Capacitance Range C_n (pF) (Note 4)					Weight Max (g)
	Case Type (Note 2)	Lead Type	No. of Leads	Lead Mat. & Fin. (Note 3)	Rated Voltage U_R = 1kV	Rated Voltage U_R = 2kV	Rated Voltage U_R = 3kV	Rated Voltage U_R =4kV	Rated Voltage U_R = 5kV	
09	CH41	Straight DIL	6	N9	6800 to 15000	2200 to 4700	820 to 1500	390 to 820	330 to 560	2
10	CH41	L DIL	6	N9	6800 to 15000	2200 to 4700	820 to 1500	390 to 820	330 to 560	2
11	CV51	Leaded Radial	2	A3	18000 to 33000	5600 to 10000	1800 to 2700	1000 to 1800	680 to 1200	3
12	CH51	Straight DIL	8	N9	18000 to 33000	5600 to 10000	1800 to 2700	1000 to 1800	680 to 1200	3
13	CH51	L DIL	8	N9	18000 to 33000	5600 to 10000	1800 to 2700	1000 to 1800	680 to 1200	3
14	CV61	Leaded Radial	2	A3	39000 to 68000	12000 to 18000	3300 to 5600	2200 to 3300	1500 to 2200	5
15	CH61	Straight DIL	10	N9	39000 to 68000	12000 to 18000	3300 to 5600	2200 to 3300	1500 to 2200	5
16	CH61	L DIL	10	N9	39000 to 68000	12000 to 18000	3300 to 5600	2200 to 3300	1500 to 2200	5
17	CV76	Leaded Radial	2	A3	82000 to 100000	22000 to 39000	6800 to 12000	3900 to 6800	2700 to 4700	8
18	CH76	Straight DIL	12	N9	82000 to 100000	22000 to 39000	6800 to 12000	3900 to 6800	2700 to 4700	8
19	CH76	L DIL	12	N9	82000 to 100000	22000 to 39000	6800 to 12000	3900 to 6800	2700 to 4700	8
20	CV91	Leaded Radial	2	A3	120000 to 330000	47000 to 100000	15000 to 33000	8200 to 18000	5600 to 12000	19
21	CH91	Straight DIL	28	N9	120000 to 330000	47000 to 100000	15000 to 33000	8200 to 18000	5600 to 12000	19
22	CH91	L DIL	28	N9	120000 to 330000	47000 to 100000	15000 to 33000	8200 to 18000	5600 to 12000	19

NOTES:

1. See Physical Dimensions.
2. For Variants 01 to 07 (case type VR) the body shall be coated with epoxy resin. Variants 08 to 22 (case types CV & CH) 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: ±5%; value series: E12
   - Tolerance: ±10%; value series: E12
   - Tolerance: ±20%; value series: E12

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.

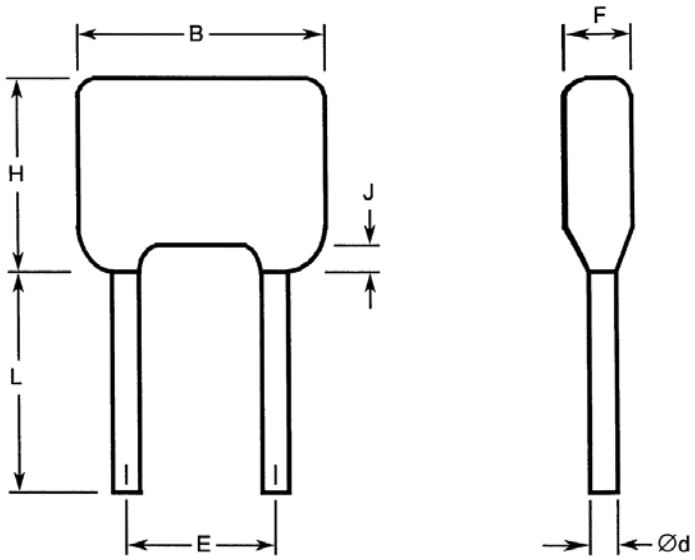
Characteristics	Symbols	Maximum Ratings	Units	Remarks
Rated Voltage	U_R	1, 2, 3, 4, 5	kV	Note 1
Operating Temperature Range	T_{op}	-55 to +125	°C	Without derating. T_{amb}
Storage Temperature Range	T_{stg}	-55 to +125	°C	
Soldering Temperature	T_{sol}	+260	°C	Note 2

NOTES:

1. As required; See Component Type Variants and Range of Components.
2. Duration 5 seconds maximum at a distance of not less than 1.5mm from the body and the same lead shall not be resoldered until 3 minutes have elapsed.

1.6 PHYSICAL DIMENSIONS

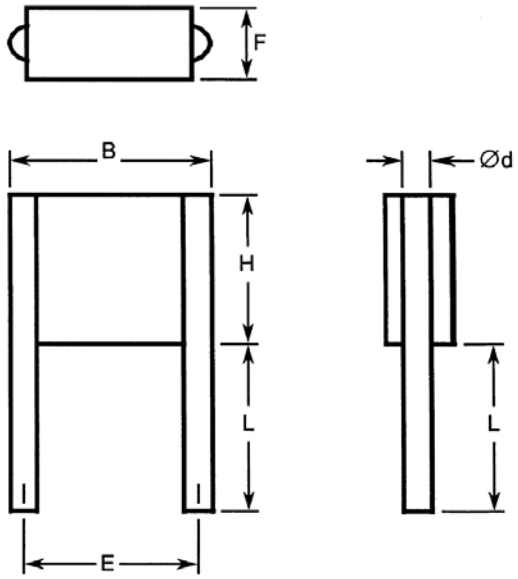
1.6.1 Case Type VR with Leaded Radial Leads



Variant Number	Case Type	Dimensions (mm)								
		B Max	Ød Note 1		E		F Max	H Max	J Max Note 1	L Min Note 1
			Min	Max	Min	Max				
01	VR30S	7.62	0.46	0.56	4.58	5.58	5	4.6	1.5	31.7
02	VR30	7.62	0.46	0.56	4.58	5.58	5	9.62	1.5	31.7
03	VR40	10.16	0.46	0.56	4.58	5.58	5	11.7	1.5	31.7
04	VR50	12.7	0.59	0.69	9.66	10.66	5.1	14.2	1.5	31.7
05	VR66	17.5	0.86	0.96	14.2	15.2	6.4	16.5	1.5	31.7
06	VR84	23.62	0.86	0.96	20.4	22	6.4	19.78	1.5	31.7
07	VR90	23.5	0.86	0.96	20.4	22	6.4	42	1.5	31.7

NOTES:
1. All leads.

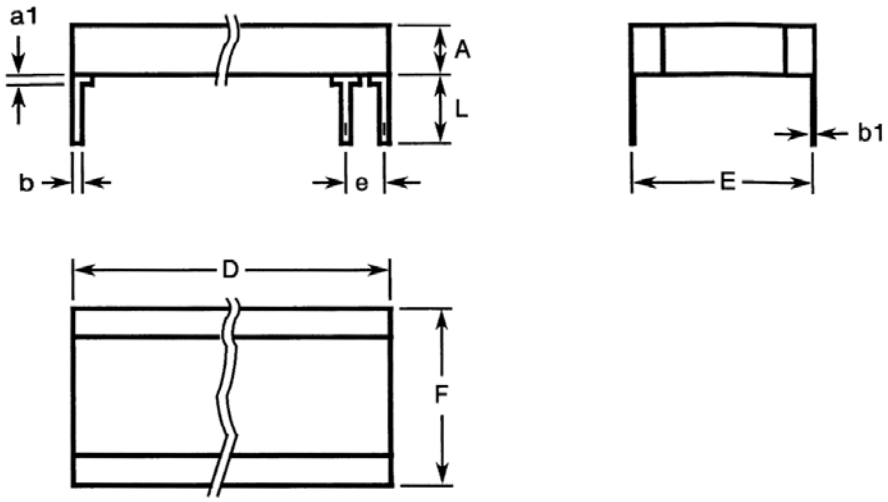
1.6.2 Case Type CV with Leaded Radial Leads



Variant Number	Case Type	Dimensions (mm)								
		B Max	Ød Note 1		E		F Max	H Max	L Note 1	
			Min	Max	Min	Max			Min	Max
08	CV41	10.6	0.65	0.75	7.7	8.7	3.8	8.7	22	28
11	CV51	11.9	0.85	0.95	9.66	10.66	3.8	10.7	22	28
14	CV61	16.5	0.85	0.95	14.74	15.74	3.8	13.6	22	28
17	CV76	22.7	0.85	0.95	20.4	22	3.8	16.6	22	28
20	CV91	22.7	1.15	1.25	20.4	22	3.8	40.6	22	28

NOTES:
1. All leads.

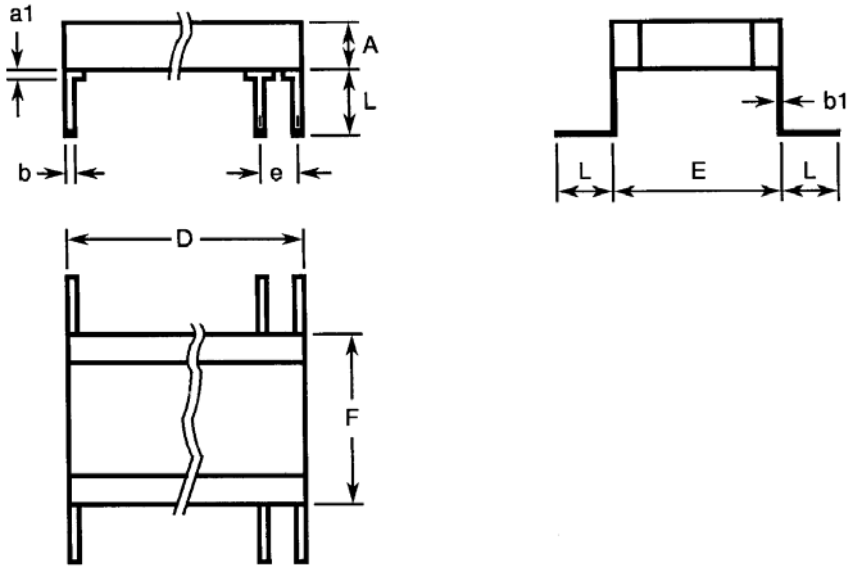
1.6.3 Case Type CH with Straight DIL Leads



Variant Number	Case Type	Dimensions (mm)													
		A Max	a1 Max Note 1	b Note 1		b1 Note 1		D Max	E Note 1		e Note 1		F Max	L Note 1	
				Min	Max	Min	Max		Min	Max	Min	Max		Min	Max
09	CH41	3.8	2	0.45	0.55	0.204	0.304	8.7	7.7	8.7	2.49	2.59	9.2	12	14
12	CH51	3.8	2	0.45	0.55	0.204	0.304	10.7	9.66	10.66	2.49	2.59	10.7	12	14
15	CH61	3.8	2	0.45	0.55	0.204	0.304	13.6	13.5	14.5	2.49	2.59	14.9	12	14
18	CH76	3.8	2	0.45	0.55	0.204	0.304	16.6	19.52	21.12	2.49	2.59	21.6	12	14
21	CH91	3.8	2	0.45	0.55	0.204	0.304	40.6	19.52	21.12	2.49	2.59	24	12	14

NOTES:
1. All leads.

1.6.4 Case Type CH with L DIL Leads



Variant Number	Case Type	Dimensions (mm)													
		A Max	a1 Max Note 1	b Note 1		b1 Note 1		D Max	E Note 1		e Note 1		F Max	L Note 1	
				Min	Max	Min	Max		Min	Max	Min	Max		Min	Max
10	CH41	3.8	2	0.45	0.55	0.204	0.304	8.7	7.7	8.7	2.49	2.59	9.2	2.04	3.04
13	CH51	3.8	2	0.45	0.55	0.204	0.304	10.7	9.66	10.66	2.49	2.59	10.7	2.04	3.04
16	CH61	3.8	2	0.45	0.55	0.204	0.304	13.6	13.5	14.5	2.49	2.59	14.9	2.04	3.04
19	CH76	3.8	2	0.45	0.55	0.204	0.304	16.6	19.52	21.12	2.49	2.59	21.6	2.04	3.04
22	CH91	3.8	2	0.45	0.55	0.204	0.304	40.6	19.52	21.12	2.49	2.59	24	2.04	3.04

NOTES:
1. All leads.

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 Special In-Process Controls (Chart F2)

(a) Robustness of Terminations: Shall be replaced with a lead peel test, performed on a sample of 5 components from each manufacturing lot with 0 failures allowed. The sample components shall be leaded but not encapsulated or coated. Where necessary, the leads of the component under test shall be bent through 90° in the plane of the joint such that a tensile force applied to the leads will result in a peeling force being applied to the leads' joint. A tensile force shall be applied evenly across the length on the capacitor terminal, to all leads on that side of the component together, until the lead joint peels. All leads shall be tested. The applied peeling force shall be as follows:
- For case types VR & CV: 8.9N minimum
- For case type CH: 22.25N minimum

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.
(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: a minimum of one randomly selected lead on each side of the component.
- Applied force:
  - For case types VR & CH: 5N minimum
  - For case type CV: 10N minimum

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	Tolerance (± %)	Limits		Units
				Min	Max	
Capacitance	C_A	ESCC No. 3001	5 10 20	$0.95C_n$ $0.9C_n$ $0.8C_n$	$1.05C_n$ $1.1C_n$ $1.2C_n$	pF
Tangent of Loss Angle	tgδ	ESCC No. 3001	All	-	10×10^{-4}	-
Insulation Resistance (Dielectric)	R_{ID}	ESCC No. 3001 $C_n \leq 10000pF$ $C_n > 10000pF$	All	 100 1000	 - -	 GΩ MΩ.µF
Insulation Resistance (Body Insulation)	R_{IB}	ESCC No. 3001 Case type VR only Note 2 $C_n \leq 10000pF$ $C_n > 10000pF$	All	 100 1000	 - -	 GΩ MΩ.µF
Voltage Proof (Dielectric)	VP_D	ESCC No. 3001 For U_R = 1000V For $U_R \geq$ 2000V	All	 $1.5U_R$ $1.3U_R$	 - -	V
Voltage Proof (Body Insulation)	VP_B	ESCC No. 3001 Case type VR only Note 2 For U_R = 1000V For $U_R \geq$ 2000V	All	 $1.5U_R$ $1.3U_R$	 - -	V

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. 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	
Temperature Coefficient	TC	ESCC No. 3001 Note 2	-30	+30	10^{-6}/°C

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. 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 ±3°C.

Unless otherwise specified the test methods and test conditions shall be as per the corresponding test defined in 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	$\Delta C_A/C_A$	-1	+1	%
	Tangent of Loss Angle	tgδ	-	20×10^{-4}	-
Resistance to Soldering Heat					
Initial Measurements	Capacitance	C_A	Note 1		
Final Measurements	Capacitance	C_A	Note 1		
	Change in Capacitance	$\Delta C_A/C_A$	-1	+1	%
	Insulation Resistance (Dielectric)	R_{ID}	Note 1		
	Insulation Resistance (Body Insulation)(Note 2)	R_{IB}	Note 1		
Climatic Test Sequence					
Initial Measurements	Capacitance	C_A	Note 1		
Final Measurements	Capacitance	C_A	Note 1		
	Change in Capacitance	$\Delta C_A/C_A$	-2	+2	%
	Tangent of Loss Angle	tgδ	-	20×10^{-4}	-
	Insulation Resistance (Dielectric):	R_{ID}			
	$C_n \leq 10000$pF		10	-	GΩ
	$C_n > 10000$pF		100	-	MΩ.µF
	Insulation Resistance (Body Insulation)(Note 2):	R_{IB}			
	$C_n \leq 10000$pF		10	-	GΩ
	$C_n > 10000$pF		100	-	MΩ.µF
	Voltage Proof (Body Insulation)(Note 2)	V_{PB}	Note 1		

Test Reference per ESCC No. 3001	Characteristics	Symbols	Limits		Units
			Min	Max	
Damp Heat Steady State					
Initial Measurements	Capacitance	C_A	Note 1		
Final Measurements	Capacitance	C_A	Note 1		
	Change in Capacitance	$\Delta C_A/C_A$	-2	+2	%
	Tangent of Loss Angle	tgδ	-	20×10^{-4}	-
	Insulation Resistance (Dielectric):	R_{ID}			
	$C_n \leq 10000pF$		10	-	GΩ
	$C_n > 10000pF$		100	-	MΩ.μF
	Insulation Resistance (Body Insulation)(Note 2):	R_{IB}			
	$C_n \leq 10000pF$		10	-	GΩ
	$C_n > 10000pF$		100	-	MΩ.μF
	Voltage Proof (Body Insulation)(Note 2)	V_{PB}	Note 1		
Operating Life					
Initial Measurements	Capacitance	C_A	Note 1		
Intermediate Measurements (1000 hours)	Capacitance	C_A	Note 1		
	Change in Capacitance	$\Delta C_A/C_A$	-3	+3	%
	Insulation Resistance (Dielectric):	R_{ID}			
	$C_n \leq 10000pF$		10	-	GΩ
	$C_n > 10000pF$		100	-	MΩ.μF
	Insulation Resistance (Body Insulation)(Note 2):	R_{IB}			
	$C_n \leq 10000pF$		10	-	GΩ
	$C_n > 10000pF$		100	-	MΩ.μF
Final Measurements (2000 hours)	Capacitance	C_A	Note 1		
	Change in Capacitance	$\Delta C_A/C_A$	-3	+3	%
	Tangent of Loss Angle	tgδ	-	20×10^{-4}	-
	Insulation Resistance (Dielectric):	R_{ID}			
	$C_n \leq 10000pF$		10	-	GΩ
	$C_n > 10000pF$		100	-	MΩ.μF
	Insulation Resistance (Body Insulation)(Note 2):	R_{IB}			
	$C_n \leq 10000pF$		10	-	GΩ
	$C_n > 10000pF$		100	-	MΩ.μF
	Voltage Proof (Dielectric)	V_{PD}	Note 1		
	Voltage Proof (Body Insulation)(Note 2)	V_{PB}	Note 1		
Capacitance-Temperature Characteristics	Temperature Cofficient	TC	Note 3		

NOTES:
1. As specified in Room Temperature Electrical Measurements.
2. Case type VR only.
3. As specified in 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:

1. 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 AVX LTD (GB)

Items Affected	Description of Deviations
Deviations from Generic Specification: Special In-Process Controls (Chart F2)	Microsection Inspection: may be performed using AVX inspection document as per PID.
	Internal Visual Inspection: may be performed using AVX inspection document as per PID.
Deviations from Generic Specification: Screening (Chart F3)	External Visual Inspection: may be performed using AVX inspection document as per PID.
Deviations from Generic Specification: Qualification and Periodic Tests (Chart F4)	External Visual Inspection: may be performed using AVX inspection document as per PID.