CAPACITORS, FIXED, DC SELF-HEALING, METALLISED FILM DIELECTRIC

BASED ON TYPE PM90S

ESCC Detail Specification No. 3006/020

Issue 5	June 2020

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DCR No.	CHANGE DESCRIPTION
1318	Specification updated to incorporate changes per DCR.

TABLE OF CONTENTS

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: 300602001155KH

- Detail Specification Reference: 3006020
- Component Type Variant Number: 01 (01 to 21, as required or as applicable)
- 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 10^3	XX3
XX 10^4	XX4
XX 10^5	XX5
XX 10^6	XX6
XX 10^7	XX7

(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
100	E
250	H
400	K
630	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:

Type Variant(s) (Note 1)	Capacitance Value C (µF) (Note 2)	DC Rated Voltage (U_R) (V)	AC Rated Current (I_{RA}) (A)	Weight Max (g)
01, 09, 17	8.2	50	3.1	4.9
	10		3.8	
	12		4	
	3.3	100	1.6	
	3.9		2	
	4.7		2.4	
	5.6		2.8	
	6.8		3.1	
	1	250	1.2	
	1.2		1.3	
	1.5		1.5	
	1.8		1.8	
	2.2		2.2	
	2.7		2.8	

Type Variant(s) (Note 1)	Capacitance Value C (µF) (Note 2)	DC Rated Voltage (U_R) (V)	AC Rated Current (I_{RA}) (A)	Weight Max (g)
01, 09, 17	0.39	400	1.1	4.9
	0.47		1.3	
	0.56			
	0.68		1.6	
	0.82		1.9	
	0.22	630	0.9	
	0.27		1.1	
02, 10, 18	15	50	5	6
	8.2	100	3.7	
	3.3	250	3.4	
	3.9		4	
	1	400	2.4	
	1.2		2.9	
	0.33	630	1.3	
	0.39		1.6	
03, 11, 19	18	50	6.9	9.5
	22		8.4	
	10	100	5.1	
	12		6.1	
	4.7	250	4.8	
	5.6		5.8	
	1.5	400	3.6	
	1.8		4.3	
	0.47	630	1.9	
	0.56		2.3	
	0.68		2.8	
04, 12, 20	27	50	10.4	13.6
	33		12.5	
	39			
	15	100	7.7	
	18		9.2	
	22		10.1	

Type Variant(s) (Note 1)	Capacitance Value C (µF) (Note 2)	DC Rated Voltage (U_R) (V)	AC Rated Current (I_{RA}) (A)	Weight Max (g)
04, 12, 20	6.8	250	7.5	13.6
	8.2		8.5	
	10		10.3	
	2.2	400	5.3	
	2.7		6	
	3.3		7.9	
	0.82	630	3.3	
	1		4.1	
	1.2		5	
05, 13, 21	47	50	12.5	20.4
	56			
	27	100		
	33			
	12	250	12.4	
	15		12.5	
	3.9	400	9.4	
	4.7		11.3	
	1.5	630	6.1	
	1.8		7.3	
06, 14	33	50	7.2	21.2
	39		8.5	
	47		10.3	
	18	100	6.3	
	22		7.7	
	33		11.4	
	6.8	250	4.6	
	10		6.7	
	12		8	
	2.2	400	3	
	3.3		4.5	
	4.7		6.4	
	1	630	2.2	
	1.5		3.3	
	1.8		4	

Type Variant(s) (Note 1)	Capacitance Value C (µF) (Note 2)	DC Rated Voltage (U_R) (V)	AC Rated Current (I_{RA}) (A)	Weight Max (g)
07, 15	68	50	15	37.3
	82			
	100			
	39	100	13.5	
	47		15	
	56			
	18	250	12	
	22		15	
	27			
	5.6	400	7.6	
	6.8		9.3	
	8.2		11.5	
	10		14	
	2.2	630	4.9	
	2.7		6	
	3.3		7.3	
	3.9		8.7	
08, 16	120	50	15	54.2
	150			
	68	100		
	82			
	100			
	33	250		
	39			
	12	400		
	15			
	4.7	630	10.3	
	5.6		12.5	

NOTES:

1. See Para. 1.6.
2. All Capacitance Values are available with tolerances of ±10% and ±20%.

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.

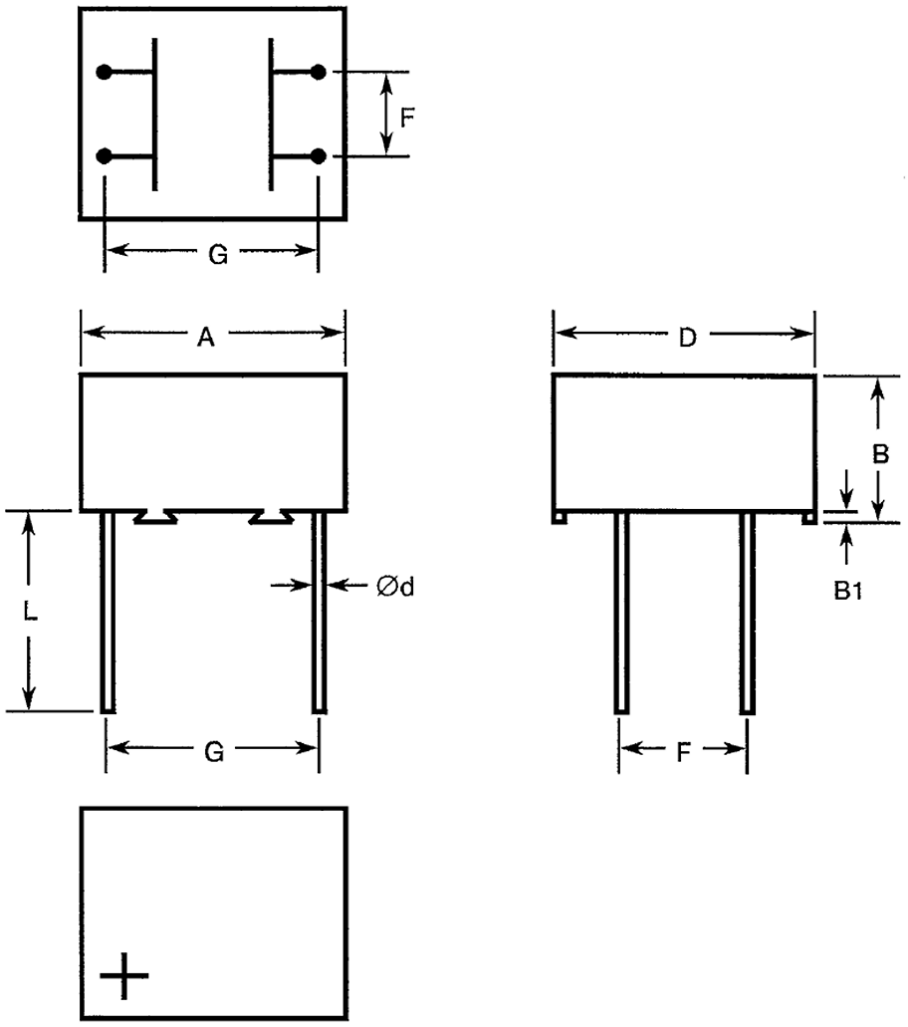
Characteristics	Symbols	Maximum Ratings	Units	Remarks
DC Rated Voltage	U_R	50, 100, 250, 400, 630	V	Note 1
AC Rated Voltage	U_A	35%U_R	Vrms	50/60Hz
AC Rated Current	I_{RA}	See Para. 1.4.2	Arms	50/60Hz
Operating Temperature Range	T_{op}	-55 to +100	°C	T_{amb}
Storage Temperature Range	T_{stg}	-55 to +100	°C	
Soldering Temperature	T_{sol}	+260	°C	Note 2

NOTES:

1. As required; See Para. 1.4.2.
2. Duration 5 seconds maximum at a distance of not less than 6mm from the case and the same lead shall not be resoldered until 3 minutes have elapsed.

1.6 PHYSICAL DIMENSIONS AND TERMINAL IDENTIFICATION

1.6.1 Component Type Variants 01 to 08

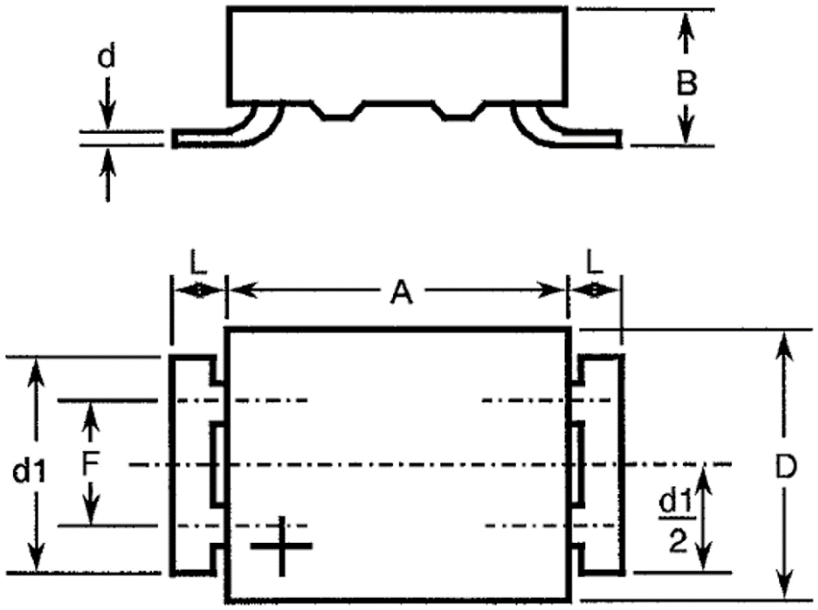


Type Variant	Dimensions (mm)												
	A		B Max.	B1 Min.	D		Ød		F		G		L Min.
	Min.	Max.			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
01	19.5	20.5	6.5	0.25	19.5	20.5	0.95	1.1	9.66	10.66	17.3	18.3	20
02	19.5	20.5	8	0.25	19.5	20.5	0.95	1.1	9.66	10.66	17.3	18.3	20
03	19.5	20.5	12.5	0.25	19.5	20.5	0.95	1.1	9.66	10.66	17.3	18.3	20
04	19.5	20.5	20	0.25	19.5	20.5	0.95	1.1	9.66	10.66	17.3	18.3	20
05	19.5	20.5	30	0.25	19.5	20.5	0.95	1.1	9.66	10.66	17.3	18.3	20
06	30.5	31.5	12.5	0.4	31.5	32.5	0.95	1.1	14.74	15.74	27.44	28.44	20
07	30.5	31.5	22	0.4	31.5	32.5	0.95	1.1	14.74	15.74	27.44	28.44	20
08	30.5	31.5	32	0.4	31.5	32.5	0.95	1.1	14.74	15.74	27.44	28.44	20

NOTES:

1. Terminal identification: A voltage polarity symbol shall be marked on the top of the body, as shown, to indicate the row of terminals which should be connected to the highest potential.

1.6.2 Component Type Variants 09 to 16

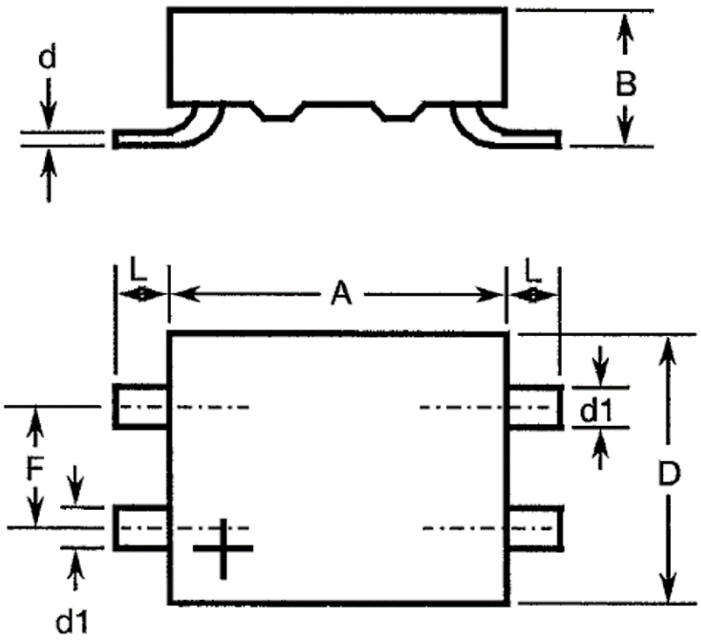


Type Variant	Dimensions (mm)												
	A		B		D		d Max.	d1		F		L	
	Min.	Max.	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.	Min.	Max.
09	19.5	20.5	6.5	7.5	19.5	20.5	0.3	14.5	15.5	9.5	10.5	2.75	3.25
10	19.5	20.5	8	9	19.5	20.5	0.3	14.5	15.5	9.5	10.5	2.75	3.25
11	19.5	20.5	12.5	13.5	19.5	20.5	0.3	14.5	15.5	9.5	10.5	2.75	3.25
12	19.5	20.5	20	21	19.5	20.5	0.3	14.5	15.5	9.5	10.5	2.75	3.25
13	19.5	20.5	30	31	19.5	20.5	0.3	14.5	15.5	9.5	10.5	2.75	3.25
14	30.5	31.5	12.5	13.5	31.5	32.5	0.3	23.5	24.5	14.5	15.5	2.75	3.25
15	30.5	31.5	22	23	31.5	32.5	0.3	23.5	24.5	14.5	15.5	2.75	3.25
16	30.5	31.5	32	33	31.5	32.5	0.3	23.5	24.5	14.5	15.5	2.75	3.25

NOTES:

1. Terminal identification: A voltage polarity symbol shall be marked on the top of the body, as shown, to indicate the row of terminals which should be connected to the highest potential.

1.6.3 Component Type Variants 17 to 21

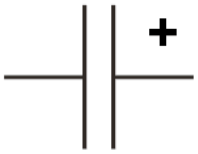


Type Variant	Dimensions (mm)												
	A		B		D		d Max.	d1		F		L	
	Min.	Max.	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.	Min.	Max.
17	19.5	20.5	6.5	7.5	19.5	20.5	0.3	2	3	9.5	10.5	2.75	3.25
18	19.5	20.5	8	9	19.5	20.5	0.3	2	3	9.5	10.5	2.75	3.25
19	19.5	20.5	12.5	13.5	19.5	20.5	0.3	2	3	9.5	10.5	2.75	3.25
20	19.5	20.5	20	21	19.5	20.5	0.3	2	3	9.5	10.5	2.75	3.25
21	19.5	20.5	30	31	19.5	20.5	0.3	2	3	9.5	10.5	2.75	3.25

NOTES:

1. Terminal identification: A voltage polarity symbol shall be marked on the top of the body, as shown, to indicate the row of terminals 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. For Component Type Variants 01 to 08 and 17 to 21, each row of terminals is connected internally to a single electrode.

1.8 MATERIALS AND FINISHES

1.8.1 Lead/Terminal Material
The lead/terminal material shall be Type A in accordance with the requirements of ESCC Basic Specification No. 23500.

1.8.2 Lead/Terminal Finish
The lead/terminal finish shall be 95% tin, remainder lead.

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) Operating Life: Test Condition (c), Applied voltage: $1.25 \times U_R$

(b) Robustness of Terminations: for Component Type Variants 09 to 21 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.

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) 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.

For Component Type Variants 01 to 08 the test conditions for Robustness of Terminations shall be as specified in the ESCC Generic Specification and as follows:

- Test Ua, tensile, with an applied force of 20N and a duration of 7.5 ±2.5s

All leads 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	-	10×10^{-3}	-
Insulation Resistance, Dielectric	R_I	ESCC No. 3006 C ≤ 0.33µF; U_R ≤ 100V U_R > 100V C > 0.33µF; U_R ≤ 100V U_R > 100V (Note 3)	 3750 7500 1250 2500	 - - - -	 MΩ 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 3)	-	V
Voltage Proof, Terminal-to-Case	VP_B	ESCC No. 3006 U_R = 50V U_R ≥ 100V (Note 3)	 200 2×U_R (Note 3)	 - -	 V 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. 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	ΔC/C	ESCC No. 3006 Test Frequency = 1kHz			
		T_{amb} = -55 ±2°C	-	-10 (Note 2)	%
		T_{amb} = +100 ±2°C	-	+8 (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 ±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 (Terminal-to-Terminal)	R_I			
	$C \leq 0.33\mu F$; $U_R \leq 100V$		Note 1	-	MΩ
	$U_R > 100V$		Note 1	-	MΩ
	$C > 0.33\mu F$; $U_R \leq 100V$		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			V
	U_R = 50V		Note 1	-	
	U_R ≥ 100V		Note 1	-	
	Insulation Resistance, Dielectric	R_I			
	C ≤ 0.33µF; U_R ≤ 100V		Note 4	-	MΩ
	U_R > 100V		Note 4	-	MΩ
	C > 0.33µF; U_R ≤ 100V		Note 4	-	MΩ.µF
	U_R > 100V		Note 4	-	MΩ.µF
	Insulation Resistance, Body Insulation	R_{IB}	Note 4	-	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 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 4	-	MΩ
	U_R > 100V		Note 4	-	MΩ
	C > 0.33µF; U_R ≤ 100V		Note 4	-	MΩ.µF
	U_R > 100V		Note 4	-	MΩ.µF
	Insulation Resistance, Body Insulation	R_{IB}	5	-	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. 50% of the limit specified in Para. 2.4.1.
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.

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.