ESCC
European Space Components Coordination

Pages 1 to 22

RESISTOR ARRAYS, FIXED,

SURFACE MOUNT, THIN FILM

BASED ON TYPE PRA HR

ESCC Detail Specification No. 4001/025

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DCR No.	CHANGE DESCRIPTION
280	Specification updated to incorporate editorial and technical changes per DCR.

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APPENDICES (Applicable to specific Manufacturers only)
None.

1. GENERAL

1.1 SCOPE

This specification details the ratings, physical and electrical characteristics, test and inspection data for Resistor Arrays, Fixed, Surface Mount, Thin Film, based on Type PRA▮HR. It shall be read in conjunction with ESCC Generic Specification No. 4001, the requirements of which are supplemented herein.

1.2 COMPONENT TYPE VARIANTS AND RANGE OF COMPONENTS

The range of resistors covered by this specification is given in Table 1(a).

1.3 MAXIMUM RATINGS

The maximum ratings, which shall not be exceeded at any time during use or storage, applicable to the resistors specified herein, are as scheduled in Table 1(b).

1.4 PARAMETER DERATING INFORMATION

The parameter derating information applicable to the resistors specified herein is given in Figure 1.

1.5 PHYSICAL DIMENSIONS

The physical dimensions of the resistors specified herein, are shown in Figure 2.

1.6 FUNCTIONAL DIAGRAM

The functional diagram for the resistors specified herein, is shown in Figure 3.

1.7 HANDLING PRECAUTIONS

These devices are susceptible to damage by electrostatic discharge. Therefore, suitable precautions shall be employed for protection during all phases of manufacture, testing, packaging, shipment and any handling. These components are categorised as Class 2 with a Minimum Critical Path Failure Voltage of 2500V.

2. APPLICABLE DOCUMENTS

The following documents form part of this specification and shall be read in conjunction with it:-

(a) ESCC Generic Specification No. 4001, Resistors, Fixed, Film.

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. In addition, the following symbols are used:-

V_T = Test Voltage.
ΔT_R = Relative Tolerance
ΔTC_R = Relative Temperature Coefficient

TABLE 1(a) - RANGE OF COMPONENTS

Variant	Style (1)	Same (S) or Different (D) Ohmic Values (2)	Number of Resistors per Array	Resistance Range (3)		Tolerance (±%)		Temperature Coefficient ($\pm 10^{-6}$/°C)		Maximum Weight (g)
				Min. (Ω)	Max. (MΩ)	Absolute	Relative	Absolute	Relative (4)	
01	PRA100	S	2	100	0.2	0.1, 0.5, 1	0.05, 0.1	10	5, 3	0.006
02			3							0.009
03			4							0.012
04			5							0.015
05			6							0.018
06			7							0.021
07			8							0.024
08	PRA135	S	2	100	0.25	0.1, 0.5, 1	0.05, 0.1	10	5, 3	0.008
09			3							0.012
10			4							0.016
11			5							0.020
12			6							0.024
13			7							0.028
14			8							0.032
15	PRA182	S	2	100	1	0.1, 0.5, 1	0.05, 0.1	10	5, 3	0.02
16			3							0.03
17			4							0.04
18			5							0.05
19			6							0.06
20			7							0.07
21			8							0.08
22	PRA100	D	2	100	0.2	0.1, 0.5, 1	0.05, 0.1	10	5, 3	0.006
23			3							0.009
24			4							0.012
25			5							0.015
26			6							0.018
27			7							0.021
28			8							0.024

NOTES: See Page 8.

TABLE 1(a) - RANGE OF COMPONENTS (CONTINUED)

Variant	Style (1)	Same (S) or Different (D) Ohmic Values (2)	Number of Resistors per Array	Resistance Range (3)		Tolerance (±%)		Temperature Coefficient ($\pm 10^{-6}$/°C)		Maximum Weight (g)
				Min. (Ω)	Max. (MΩ)	Absolute	Relative	Absolute	Relative (4)	
29	PRA135	D	2	100	0.25	0.1, 0.5, 1	0.05, 0.1	10	5, 3	0.008
30			3							0.012
31			4							0.016
32			5							0.020
33			6							0.024
34			7							0.028
35			8							0.032
36	PRA182	D	2	100	1	0.1, 0.5, 1	0.05, 0.1	10	5, 3	0.02
37			3							0.03
38			4							0.04
39			5							0.05
40			6							0.06
41			7							0.07
42			8							0.08

NOTES:

1. The critical resistance for each style is as follows:

Style	Critical Resistance (kΩ)
PRA100	12.25
PRA135	56.25
PRA182	100

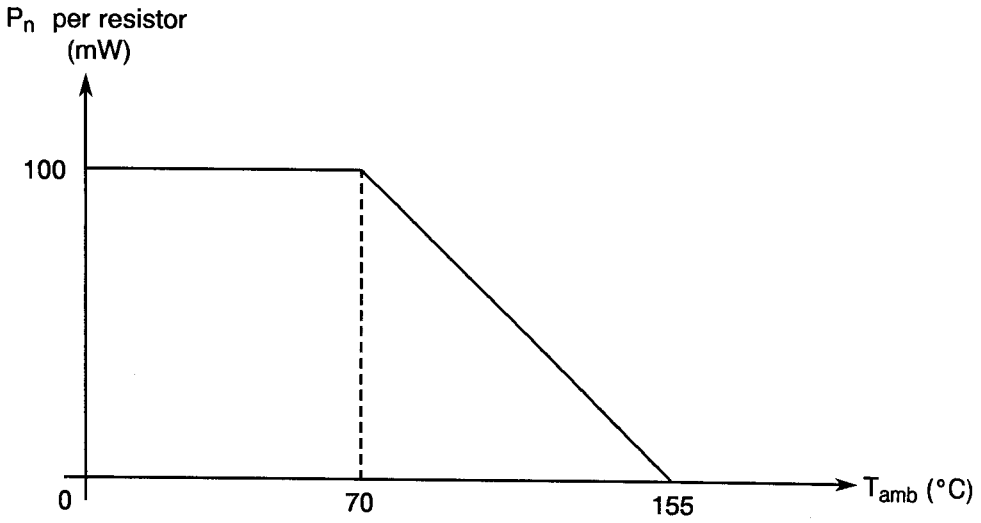
   Critical Resistance = $(U_L \times U_L)/Pn$.

2. For "D" types the array has at least two different ohmic values. The manufacturer will allocate a unique identifying "reference" number to represent the configuration as defined by the orderer.
3. Any value(s) in the resistance range can be selected.
4. ±5 ppm/°C: if one or more resistors of the array is in the range: 100Ω ≤R ≤ 250Ω.
   ±3 ppm/°C: if all resistors of the array are higher than 250Ω.

TABLE 1(b) - MAXIMUM RATINGS

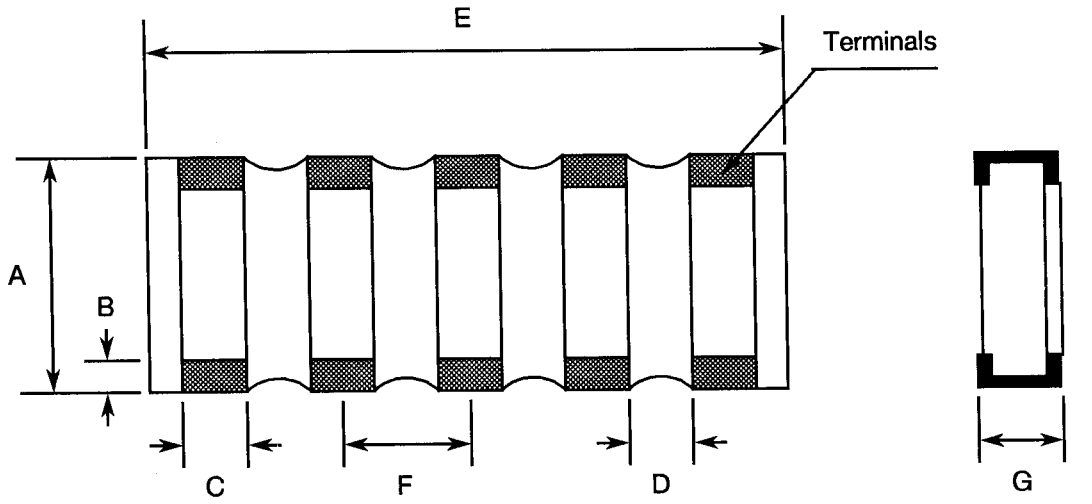
No.	Characteristics	Style	Symbol	Limits	Unit	Remarks
1	Rated Dissipation	PRA 100 PRA 135 PRA 182	P_n	0.1 0.1 0.1	W/resistor	See Figure 1
2	Limiting Element Voltage	PRA 100 PRA 135 PRA 182	U_L	35 75 100	V	Per resistor
3	Rated Voltage	PRA 100 PRA 135 PRA 182	U_R	$\sqrt{Pn \times Rn}$	V	Per resistor, and $\leq U_L$
4	Insulation Voltage	PRA 100 PRA 135 PRA 182	U_i	70 150 200	Vrms	Per resistor
5	Operating Temperature Range	PRA 100 PRA 135 PRA 182	T_{op}	−55 to +155	°C	-
6	Storage Temperature Range	PRA 100 PRA 135 PRA 182	T_{stg}	−55 to +155	°C	-
7	Soldering Temperature	PRA 100 PRA 135 PRA 182	T_{sol}	+260	°C	10s max

FIGURE 1 - PARAMETER DERATING INFORMATION



Rated Dissipation versus Temperature

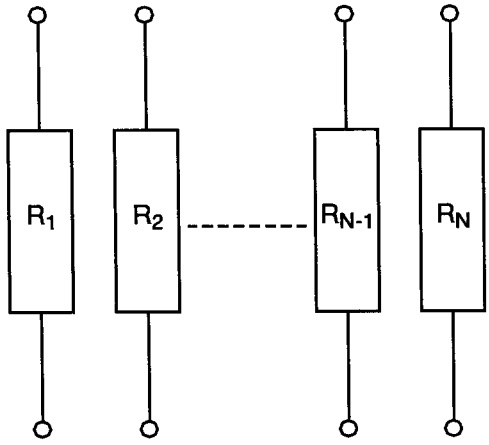
FIGURE 2 - PHYSICAL DIMENSIONS



Style	Millimetres												
	A		B		C		D		G		F		E
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
PRA 100	1.50	1.80	0.2	0.6	0.50	0.80	0.20	0.30	0.38	0.58	0.95	1.05	(1)
PRA 135	1.75	2.05	0.2	0.6	0.90	1.20	0.20	0.30	0.38	0.58	1.30	1.40	(1)
PRA 182	2.90	3.20	0.2	0.6	1.15	1.65	0.20	0.30	0.38	0.58	1.775	1.875	(1)

NOTES:
1. E = (NxF) $\pm$0.2, with N = number of resistors per array (N = 2 to 8).

FIGURE 3 - FUNCTIONAL DIAGRAM



N = 2 to 8

4. REQUIREMENTS

4.1 GENERAL

The complete requirements for procurement of the resistors specified herein shall be as stated in this specification and ESCC Generic Specification No. 4001. Deviations from the Generic Specification, applicable to this specification only, are listed in Para. 4.2.

Deviations from the applicable Generic Specification and this Detail Specification, formally agreed with specific Manufacturers on the basis that the alternative requirements are equivalent to the ESCC requirements and do not affect the components' reliability, are listed in the appendices attached to this specification.

4.2 DEVIATIONS FROM GENERIC SPECIFICATION

4.2.1 Deviations from Special In-process Controls

None.

4.2.2 Deviations from Final Production Tests (Chart II)

(a) Para. 6.1, General: For Level C, Table 2 Electrical Measurements at Room Temperature shall be performed prior to Para. 9.1, Overload.

(b) Para. 9.1, Overload: Voltage on each resistor of the array = $\sqrt{6.25Pn \times Rmin}$ or $2U_L$, whichever is the less (Rmin is the lowest ohmic value on the array). Duration: 2 seconds.

(c) Para. 9.2, Third Harmonic Control: Voltage on each resistor of the array = $\sqrt{Pn \times Rmin}$ or U_L, whichever is the less (Rmin is the lowest ohmic value on the array).

4.2.3 Deviations from Burn-in and Electrical Measurements (Chart III)

(a) Para. 7.1, General: For Level B, Table 2 Electrical Measurements at Room Temperature Relative Tolerance shall be performed in the 0-hour and 168-hour measurements for burn-in.

(b) Para. 9.5.3, TCR measurements: Alumina substrate shall be used for mounting.

4.2.4 Deviations from Qualification Tests (Chart IV)

(a) Para. 9.1, Overload: Test conditions as Para. 4.2.2(a).

(b) Para. 9.13, Vibration: Not applicable.

(c) Para. 9.14, Climatic Sequence: Voltage applied during the Low Air Pressure test is as in Table 5(a).

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

(a) Para. 9.13, Vibration: Not applicable.

(b) Para. 9.14, Climatic Sequence: Voltage applied during the Low Air Pressure test is as in Table 5(a).

4.3 MECHANICAL REQUIREMENTS

4.3.1 Dimension Check

The dimensions of the resistor arrays specified herein shall conform to those shown in Figure 2.

4.3.2 Weight

The maximum weight of the resistor arrays specified herein shall be in conformance with those shown in Table 1(a).

4.3.3 Robustness of Terminations

Robustness of Terminations shall be performed according to:

(a) Para. 9.10.2 of ESCC Generic Specification No. 4001 for Adhesion

(b) IEC 60115-1, clause 4.33 for the Substrate Bending test, with the following conditions:

Number of bends: 10
Deflection: 2mm for all styles
Duration: 5s ± 1s
Orientation: Same orientations as for single resistor.

4.4 MATERIALS AND FINISHES

The materials and finishes shall be as specified herein. Where a definite material is not specified, a material which will enable the components specified herein to meet the performance requirements of this specification shall be used. Acceptance or approval of any constituent material does not guarantee acceptance of the finished product.

4.4.1 Case

The alumina substrate shall be covered with a suitable inorganic coating.

4.4.2 Terminations

Variants 01 to 42:

The lead material shall be Type "E" with Type 4 finish in accordance with the requirements of ESCC Basic Specification No. 23500.

4.4.3 Films

Films shall be uniformly deposited. They shall be free from blisters, thin spots, areas inadequately bonded to the core, discoloured spots or other blemishes likely to cause flaking.

4.5 MARKING

4.5.1 General

The marking of all components delivered to this specification shall be in accordance with the requirements of ESCC Basic Specification No. 21700 and the following paragraphs. When the component is too small to accommodate all of the marking specified, as much as space permits shall be marked, and the marking information, in full, shall accompany each component in its primary package.

The infomation to be marked and the order of precedence, shall be as follows:-

(a) Electrical Characteristics and Ratings.

(b) The ESCC Component Number.

(c) Traceability Information.

4.5.2 Electrical Characteristics and Ratings

The electrical characteristics and ratings to be marked on the component in the following order of precedence are:-

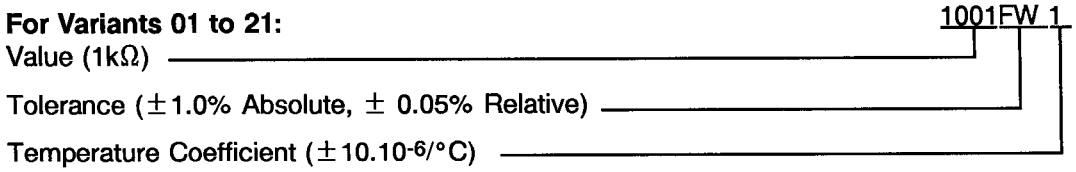
(a) Resistance Value or array reference.

(b) Tolerance (absolute and relative).

(c) Temperature Coefficient.

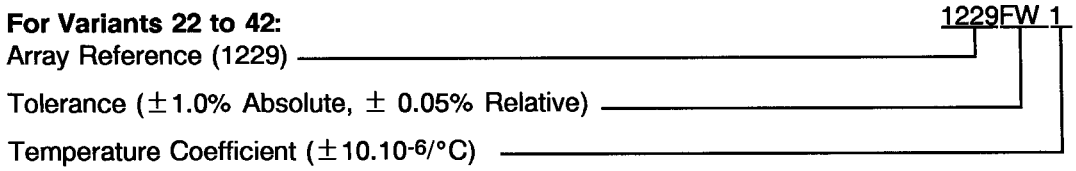
The information shall be constituted and marked as follows:

For Variants 01 to 21:



Refer to Para. 4.5.5 for the different marking configurations. The ohmic value code is defined in Para. 4.5.2.1.

For Variants 22 to 42:



Refer to Para. 4.5.5 for the different marking configurations.

4.5.2.1 Resistance Values

For types where all resistors in the array have the same resistance value the resistance value shall be expressed by means of the following codes. The unit quantity for marking shall be ohms (Ω).

Numerical Value	Code
XXX	XXX0
XXX.10^1	XXX1
XXX.10^2	XXX2
XXX.10^3	XXX3
XXX.10^4	XXX4

For numerical value, the first 3 digits (X) represent significant figures and the last digit specifies the number of zeros to follow.

4.5.2.2 Array Reference

For types where the resistors in the array have at least two different values the manufacturer will allocate a unique 4-digit reference code to represent and identify the specific configuration.

4.5.2.3 Tolerances

The absolute tolerances on resistance values and the relative tolerances between all resistance values on the array shall be indicated by the code letters specified hereafter.

Tolerance (%)	Code Letter
±0.05	W
±0.1	B
±0.5	D
±1.0	F

4.5.2.4 Temperature Coefficient

The temperature coefficient shall be indicated by the numerical codes specified hereafter.

Temperature Coefficient ($\pm 10^{-6}$/°C)	Code
10	1

4.5.3 The ESCC Component Number

Each primary packaging shall bear the ESCC Component Number which shall be constituted and marked as follows:

400102501B

Detail Specification Number

Type Variant (seeTable 1(a))

Testing Level (B or C, as applicable)

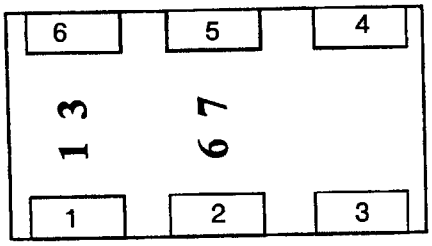
4.5.4 Traceability Information

Each primary packaging shall be marked in respect of traceability information in accordance with the requirements of ESCC Basic Specification No. 21700.

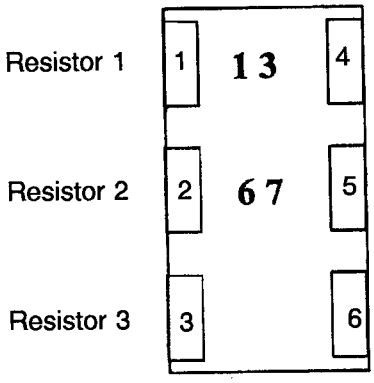
4.5.5 Marking Rules and Orientation: "Pin Out"

The 4-digit marking relates to the variant. For Variants 01 to 21 the marking directly gives the ohmic value of the resistors on the array, (see Para. 4.5.2.1). For Variants 22 to 42 the marking represents the array reference that corresponds to specific requirements of the purchase order. For symmetrical marking using reversible figures such as 0, 6 or 9, resistor 1 must be identified by an ink dot.

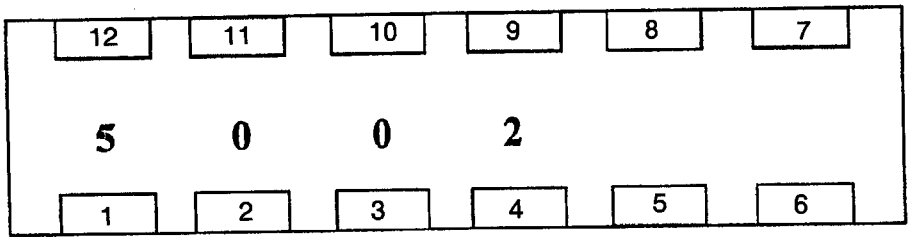
For arrays of 2 or 3 resistors, the marking only appears on the first 2 resistors on the array, see example below. The resistor 1 of the array is the "upper" resistor while reading the marking:



Resistor 1 Resistor 2 Resistor 3



For arrays with 4 to 8 resistors, the marking appears on the first 4 resistors of the array, see example below. The resistor 1 is on the left-hand of the array while reading the marking.



Resistor 1 Resistor 2 Resistor 3 Resistor 4 Resistor 5 Resistor 6

4.6 ELECTRICAL MEASUREMENTS

4.6.1 Electrical Measurements at Room Temperature

The parameters to be measured at room temperature are scheduled in Table 2. Unless otherwise specified, the measurements shall be performed at T_{amb} = +22±3 °C.

4.6.2 Electrical Measurements at High and Low Temperatures

The parameters to be measured on a sample basis at high and low temperatures are scheduled in Table 3.

The distribution of the sample shall be as follows:

- 1/3 with the lowest individual resistance value.
- 1/3 with the highest individual resistance value.
- 1/3 with the median individual resistance value or the critical resistance value if procured, of the procured range.

4.6.3 Circuits for Electrical Measurements (Figure 4)

Not applicable.

4.7 BURN-IN TESTS

4.7.1 Parameter Drift Values

The parameter drift values applicable to burn-in are specified in Table 4 of this specification. Unless otherwise stated, measurements shall be performed at T_{amb} = +22±3°C. The parameter drift values (Δ) applicable to the parameter scheduled shall not be exceeded. In addition to these drift value requirements, the appropriate limit value specified in Table 2 for a given parameter shall not be exceeded.

4.7.2 Conditions for Burn-in

The requirements for burn-in are specified in Section 7 of ESCC Generic Specification No. 4001. The conditions for burn-in shall be as specified in Table 5(a) of this specification.

After 168(+24 -0) hours, the resistors shall be removed from the chamber and allowed to cool under normal atmospheric conditions for a minimum of 4 hours. They should then be visually examined. There should be no evidence of damage and marking shall still be legible.

4.7.3 Electrical Circuit for Burn-in

The circuit for use in performing the burn-in test is shown in Figure 5(a).

TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE

No.	Characteristics	Symbol	ESCC 4001 Test Method	Test Conditions	Tolerance (±%)	Limits		Unit
						Min.	Max.	
1	Resistance	R_A	Para. 9.5.1	Para. 9.5.1 Note 1	0.1 0.5 1.0	0.999 R_n 0.995 R_n 0.99 R_n	1.001 R_n 1.005 R_n 1.01 R_n	Ω
2	Relative Tolerance	ΔT_R	Para. 9.5.1	Para. 9.5.1 Note 2	0.05 0.1	-0.05 -0.1	+0.05 +0.1	%

NOTES:

1. The measurements are done on all the individual resistors of the array.
2. $$\Delta T_R = Max\left[\frac{R_A - R_n}{R_n}\right] - Min\left[\frac{R_A - R_n}{R_n}\right]$$

   The calculations are done between all the resistor pairs of the array.

TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

No.	Characteristics	Symbol	ESCC 4001 Test Method	Test Conditions	Limits		Unit
					Min.	Max.	
3	Resistance Change between −55(+3−0) °C and +22±3 °C	$\frac{\Delta R_A}{R_A}$	Para. 9.5.1	Para. 9.5.1 Notes 1 and 2	-0.077	+0.077	%
4	Resistance Change between +155(+3−0) °C and +22±3 °C	$\frac{\Delta R_A}{R_A}$	Para. 9.5.1	Para. 9.5.1 Notes 1 and 2	-0.133	+0.133	%
5	Relative Temperature Coefficient -55 (+3 -0)°C	ΔTC_R	Para. 9.5.1	Para. 9.5.1 Note 3	-3	+3	10^{-6}/°C
				Para. 9.5.1 Note 3	-5	+5	
6	Relative Temperature Coefficient -155 (+3 -0)°C	ΔTC_R	Para. 9.5.1	Para. 9.5.1 Note 3	-3	+3	10^{-6}/°C
				Para. 9.5.1 Note 3	-5	+5	

NOTES

1. The measurements are done on all the individual resistors of the array.
2. The measurements shall be performed on a sample basis in accordance with Special Inspection Level S-3, Table IIA, AQL = 1.0% of IEC Publication No. 60410 on the total production lot. In addition, see Para. 4.6.2 for distribution of the sample.
3. $$\Delta TC_R = Max\left[\frac{R_{A(T^o)} - R_{A(T)}}{R_{A(T^o)}} * \frac{1}{(T^o - T)}\right] - Min\left[\frac{R_{A(T^o)} - R_{A(T)}}{R_{A(T^o)}} * \frac{1}{(T^o - T)}\right]$$

   The calculations are done between all the resistor pairs of the array.
   (T^o) is the reference temperature of the test method (+22 ±3°C).
   (T) is the high (+155(+0 -3)°C) or the low (-55 (+3 -0)°C) testing temperature.

FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS

Not applicable.

TABLE 4 - PARAMETER DRIFT VALUES

No.	Characteristics	Symbol	Spec. and/or Test Method	Test Conditions	Change Limits (Δ)	Unit
1	Resistance change	$\frac{\Delta R_A}{R_A}$	As per Table 2	As per Table 2 Note 1	±0.05	%

NOTES:
1. The measurements are done on all the individual resistors of the array.

TABLE 5(a) - CONDITIONS FOR BURN-IN

No.	Characteristics	Symbol	Condition	Unit
1	Ambient Temperature	T_{amb}	+70 ±5	°C
2	Test Voltage Variants 01 to 21	V_T	$\sqrt{P_n \times R_n}$ or U_L, whichever is less	V
	Variants 22 to 42		$\sqrt{P_n \times R_{min}}$ or U_L, whichever is less	

NOTE:
V_T is applied to each individual resistor. R_{min} is the lowest ohmic value of the array.

FIGURE 5(a) - ELECTRICAL CIRCUIT FOR BURN-IN

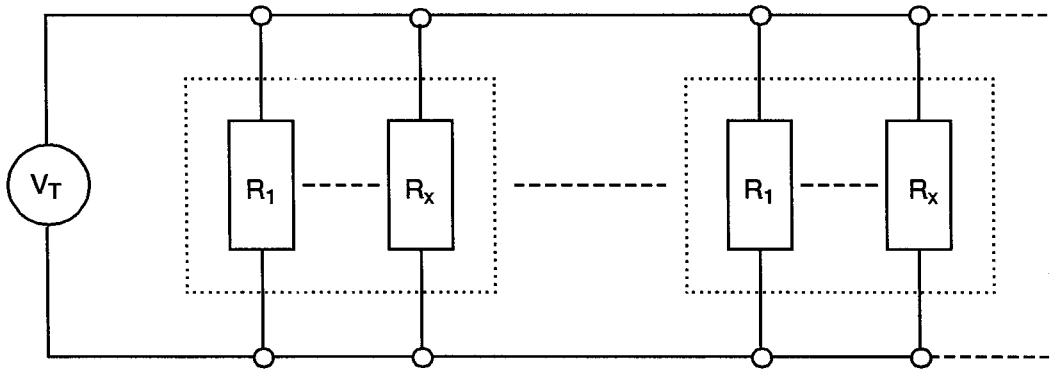
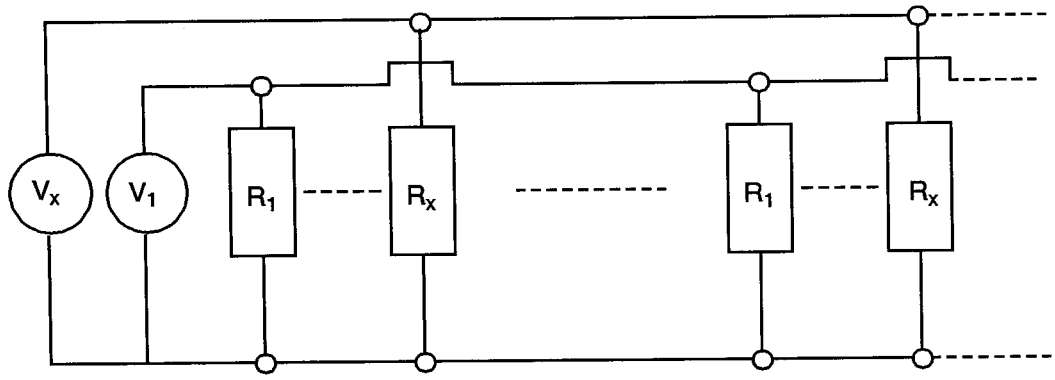


TABLE 5(b) - CONDITIONS FOR OPERATING LIFE TEST

No.	Characteristics	Symbol	Condition	Unit
1	Ambient Temperature	T_{amb}	+70 ±5	°C
2	Test Voltage	V_T	$\sqrt{P_n \times R_n}$ or U_L, whichever is less	V

NOTE:
Each resistor is subjected to its own rated voltage ($V_T = V_1 \ldots V_x$).

FIGURE 5(b) - ELECTRICAL CIRCUIT FOR OPERATING LIFE TEST



4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESCC GENERIC SPECIFICATION No. 4001)

The resistors shall be mounted as prescribed in ESCC Generic Specification No. 4001, Para. 9.20. The substrate material shall be glass polyimide, except for high and low temperature measurements where alumina is required.

4.8.1 Measurements and Inspections on Completion of Environmental Tests

The parameters to be measured and inspections to be performed on completion of environmental tests are scheduled in Table 6 of this specification. Unless otherwise stated, the measurements shall be performed at T_{amb} = +22±3 °C.

4.8.2 Measurements and Inspections at Intermediate Points during Endurance Tests

The parameters to be measured and inspections to be performed at intermediate points during endurance tests are scheduled in Table 6 of this specification. Unless otherwise stated, the measurements shall be performed at T_{amb} = +22±3 °C.

4.8.3 Measurements and Inspections on Completion of Endurance Tests

The parameters to be measured and inspections to be performed on completion of endurance testing are scheduled in Table 6 of this specification. Unless otherwise stated, the measurements shall be performed at T_{amb} = +22±3 °C.

4.8.4 Conditions for Operating Life Tests (Part of Endurance Testing)

The requirements for operating life testing are specified in Section 9 of ESCC Generic Specification No. 4001. The conditions for operating life testing shall be as specified in Table 5(b) of this specification.

4.8.5 Electrical Circuit for Operating Life Tests

Circuit for use in performing the operating life tests are shown in Figure 5(b) of this specification.

4.8.6 Conditions for High Temperature Storage Test (Part of Endurance Testing)

The requirements for the high temperature storage test are specified in ESCC Generic Specification No. 4001. The conditions for high temperature storage shall be at T_{amb} = +155(+0 -5) °C. Unless otherwise stated, electrical measurements shall be performed at T_{amb} = +22±3 °C.

TABLE 6 - MEASUREMENTS AND INSPECTIONS ON COMPLETION OF ENVIRONMENTAL TESTS AND AT INTERMEDIATE POINTS AND ON COMPLETION OF ENDURANCE TESTING

No.	ESCC GENERIC SPEC. No. 4001		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS		UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN.	MAX.	
01	Overload	Para. 9.1 and Paras. 4.2.2 and 4.2.4 of this spec.	**Initial Measurements** Resistance Relative Tolerance **Final Measurements** Visual Examination Resistance Change Relative Tolerance	 Table 2 Item 1 Table 2 Item 2 After a recovery period of 1-2 hours No evidence of damage and marking legible Table 2 Item 1 Table 2 Item 2	 R_A ΔT_R - $\Delta R_A/R_A$ ΔT_R	 Record Values Record Values - $\pm(0.05+\frac{0.05\Omega \times 100}{Rn})$ Table 2 Item 2	 - -	 - % %
02	Seal Test (Hermetically Sealed only)	Para. 9.3	Not applicable					
03	Insualtion Resistance (Insulated only)	Para. 9.6	**Final Measurements** Insulation Resistance	Para. 9.6.2 of ESCC 4001 (2)	Ri	1000	-	MΩ
04	Temperature Coefficient	Para. 9.7 Procedure I	Temperature Coefficient Relative TC	Para. 9.5.1 of ESCC 4001	TC ΔTC_R	-10 Table 3 Items 5 & 6	+10	10^{-6}/°C
05	Voltage Proof	Para. 9.8	**During Test** Visual Examination	$1.4xU_i$ (3) for 60 ± 5 sec No breakdown or flashover	-	-	-	-
06	Solderability	Para. 9.9 Procedure I	**Initial Measurements** Resistance Relative Tolerance **Final Measurements** Resistance Change Relative Tolerance	After Drying Table 2 Item 1 Table 2 Item 2 24 ± 4 hrs after soldering Table 2 Item 1 Table 2 Item 2	 R_A ΔT_R $\Delta R_A/R_A$ ΔT_R	 Record Values Record Values $\pm(0.05+\frac{0.05\Omega \times 100}{Rn})$ Table 2 Item 2	 	 % %
07	Robustness of Terminations	Adhesion Para. 9.10.2	**Initial Measurements** Resistance Relative Tolerance **Final Measurements** Resistance Change Relative Tolerance	After mounting Table 2 Item 1 Table 2 Item 2 Table 2 Item 1 Table 2 Item 2	 R_A ΔT_R $\Delta R_A/R_A$ ΔT_R	 Record Values Record Values $\pm(0.05+\frac{0.05\Omega \times 100}{Rn})$ Table 2 Item 2	 	 % %
		Substrate Bending Test, Para. 4.3.3 of this specification	Visual Examination **Initial Measurements** Resistance Relative Tolerance **Final Measurements** Resistance Change Relative Tolerance Visual Examination	No damage, lifting, cracking or dry joints Table 2 Item 1 Table 2 Item 2 Board in bent position Table 2 Item 1 Table 2 Item 2 No damage, lifting, cracking or dry joints	- R_A ΔT_R $\Delta R_A/R_A$ ΔT_R -	- Record Values Record Values $\pm(0.05+\frac{0.05\Omega \times 100}{Rn})$ Table 2 Item 2 -	- -	- -

NOTES: See Page 21.

TABLE 6 - MEASUREMENTS AND INSPECTIONS ON COMPLETION OF ENVIRONMENTAL TESTS AND AT INTERMEDIATE POINTS AND ON COMPLETION OF ENDURANCE TESTING (CONT'D)

No.	ESCC GENERIC SPEC. No. 4001		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS		UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN.	MAX.	
08	Resistance to Soldering Heat	Para. 9.11 Procedure I	**Initial Measurements** Resistance Relative Tolerance **Final Measurements**	After drying Table 2 Item 1 Table 2 Item 2	 R_A ΔT_R	 Record Values Record Values		
			Visual Examination	No evidence of damage and marking legible After 24 ± 4 hours	-	-	-	-
			Resistance Change	Table 2 Item 1	$\Delta R_A/R_A$	$\pm (0.05 + \frac{0.05\Omega \times 100}{Rn})$		%
			Relative Tolerance	Table 2 Item 2	ΔT_R	Table 2 Item 2		%
09	Rapid Change of Temperature	Para. 9.12	**Initial Measurements** Resistance Relative Tolerance **Final Measurements**	 Table 2 Item 1 Table 2 Item 2 After a recovery period of 1-2 hrs	 R_A ΔT_R	 Record Values Record Values		
			Visual Examination	No evidence of damage	-	-	-	-
			Resistance Change	Table 2 Item 1	$\Delta R_A/R_A$	$\pm (0.05 + \frac{0.05\Omega \times 100}{Rn})$		%
			Relative Tolerance	Table 2 Item 2	ΔT_R	Table 2 Item 2		%
10	Vibration	Para. 9.13 and Paras. 4.2.4 and 4.2.5 of this spec.	Not applicable					
11	Climatic Sequence	Para. 9.14 Procedure I	**Initial Measurements** Resistance Relative Tolerance **Final Measurements**	After Drying Table 2 Item 1 Table 2 Item 2 Following completion of D.C. load test and after a recovery period of 1-2 hrs	 R_A ΔT_R	 Record Values Record Values		
			Visual Examination	No evidence of damage and marking legible	-	-	-	-
			Insulation Resistance	Para. 9.6.2 of ESCC 4001 (2)	Ri	1000	-	MΩ
			Resistance Change	Table 2 Item 1	$\Delta R_A/R_A$	$\pm (0.1 + \frac{0.05\Omega \times 100}{Rn})$		%
			Relative Tolerance	Table 2 Item 2	ΔT_R	Table 2 Item 2		%

NOTES: See Page 22.

TABLE 6 - MEASUREMENTS AND INSPECTIONS ON COMPLETION OF ENVIRONMENTAL TESTS AND AT INTERMEDIATE POINTS AND ON COMPLETION OF ENDURANCE TESTING (CONT'D)

No.	ESCC GENERIC SPEC. No. 4001		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS		UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN.	MAX.	
12	Operating Life	Para. 9.15 Chart IV	**Initial Measurements** Resistance	Table 2 Item 1	R_A	Record Values		
			Relative Tolerance	Table 2 Item 2	ΔT_R	Record Values		
			Intermediate Measurements (1000 hrs)	After a recovery period of 1-2 hrs				
			Visual Examination	No evidence of damage	-	-	-	-
			Resistance Change	Table 2 Item 1	$\Delta R_A/R_A$	$\pm(0.1+\frac{0.05\Omega \times 100}{Rn})$		%
			Relative Tolerance	Table 2 Item 2	ΔT_R	Table 2 Item 2		%
			Final Measurements (2000 hrs)	After a recovery period of 1-2 hrs				
			Visual Examination	No evidence of damage	-	-	-	-
			Insulation Resistance	Para. 9.6.2 of ESCC 4001 (2)	Ri	1000	-	MΩ
			Resistance Change	Table 2 Item 1	$\Delta R_A/R_A$	$\pm(0.15+\frac{0.05\Omega \times 100}{Rn})$		%
			Relative Tolerance	Table 2 Item 2	ΔT_R	Table 2 Item 2		%
		Para. 9.15 Chart V	**Initial Measurements** Resistance	Table 2 Item 1	R_A	Record Values		
			Relative Tolerance	Table 2 Item 2	ΔT_R	Record Values		
			Final Measurements (1000 hrs)	After a recovery period of 1-2 hrs				
			Visual Examination	No evidence of damage	-	-	-	-
			Insulation Resistance	Para. 9.6.2 of ESCC 4001 (2)	Ri	1000	-	MΩ
			Resistance Change	Table 2 Item 1	$\Delta R_A/R_A$	$\pm(0.1+\frac{0.05\Omega \times 100}{Rn})$		%
			Relative Tolerance	Table 2 Item 2	ΔT_R	Table 2 Item 2		%
13	High Temperature Storage	Para. 9.16	**Initial Measurements** Resistance	Table 2 Item 1	R_A	Record Values		
			Relative Tolerance	Table 2 Item 2	ΔT_R	Record Values		
			Intermediate Measurements (1000 hrs)	After a recovery period of 1-2 hrs				
			Visual Examination	No evidence of damage	-	-	-	-
			Resistance Change	Table 2 Item 1	$\Delta R_A/R_A$	$\pm(0.1+\frac{0.05\Omega \times 100}{Rn})$		%
			Relative Tolerance	Table 2 Item 2	ΔT_R	Table 2 Item 2		%
			Final Measurements (2000 hrs)	After recovery period of 1-2 hrs				
			Visual Examination	No evidence of damage	-	-	-	-
			Insulation Resistance	Para. 9.6.2 of ESCC 4001 (2)	Ri	1000	-	MΩ
			Resistance Change	Table 2 Item 1	$\Delta R_A/R_A$	$\pm(0.15+\frac{0.05\Omega \times 100}{Rn})$		%
			Relative Tolerance	Table 2 Item 2	ΔT_R	Table 2 Item 2		%
14	Permanence of Marking	Para. 9.19	**Final Measurements** Visual Examination	No corrosion or abliteration of marking	-	-	-	-

NOTES:

1. The tests in this Table refer to either Chart IV or V and shall be used as applicable.
2. Test Voltage: V_T = 100V.
3. For value of U_i, see Table 1(b), Item 4.