RESISTOR ARRAY, FIXED, SURFACE MOUNT, THIN FILM

BASED ON TYPE PRA HR

ESCC Detail Specification No. 4001/025

Issue 3	July 2008

Document Custodian: European Space Agency - see https://escies.org

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DCR No.	CHANGE DESCRIPTION
366, 375, 417	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, test and inspection data for a Resistor Array, 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

Variants of the basic type components and the range of components covered by this specification are 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 components specified herein, are as scheduled in Table 1(b).

1.4 PARAMETER DERATING INFORMATION

The parameter derating information applicable to the components specified herein is shown in Figure 1.

1.5 PHYSICAL DIMENSIONS

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

1.6 FUNCTIONAL DIAGRAM

The functional diagram of the components 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 for 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.

Table 1(a) - TYPE VRIANTS AND RANGE OF COMPONENTS

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

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

NOTES:

1. See Figure 2.
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. The critical resistance for each style is as follows:

Variant	Style	Critical Resistance (kΩ)
01 to 07, 22 to 28	PRA100	12.25
08 to 14, 29 to 35	PRA135	56.25
15 to 21, 36 to 42	PRA182	100

   Critical Resistance = $(U_L \times U_L)/Pn$
4. Any value(s) in the resistance range with 3 significant figures can be selected.
5. ±5 ppm/°C: if one or more resistors of the array is in the range: $100\Omega \leq R_n \leq 250\Omega$.
   ±3 ppm/°C: if all resistors of the array are higher than 250Ω.

Table 1(b) - MAXIMUM RATINGS

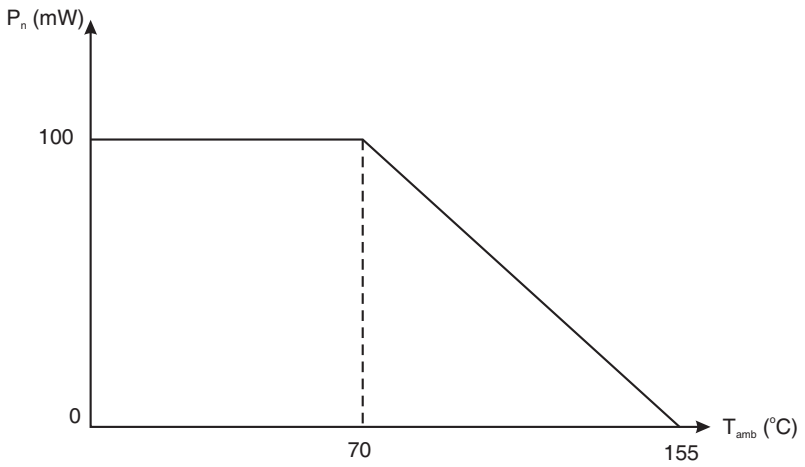
No.	Characteristics	Style (Note 1)	Symbol	Limits	Unit	Remarks
1	Rated Dissipation	PRA100 PRA135 PRA182	P_n	100 100 100	mW/resis-tor	See Figure 1

No.	Characteristics	Style (Note 1)	Symbol	Limits	Unit	Remarks
2	Limiting Element Voltage	PRA100 PRA135 PRA182	U_L	35 75 100	V	Per resistor
3	Rated Voltage	PRA100 PRA135 PRA182	U_R	$\sqrt{(P_n \times R_n)}$	V	Per resistor, Note 2
4	Insulation Voltage	PRA100 PRA135 PRA182	U_I	70 150 200	Vrms	Per resistor
5	Operating Temperature Range	PRA100 PRA135 PRA182	T_{op}	-55 to +155	^oC	-
6	Storage Temperature Range	PRA100 PRA135 PRA182	T_{stg}	-55 to +155	^oC	-
7	Soldering Temperature	PRA100 PRA135 PRA182	T_{sol}	+260	^oC	Note 3

NOTES:

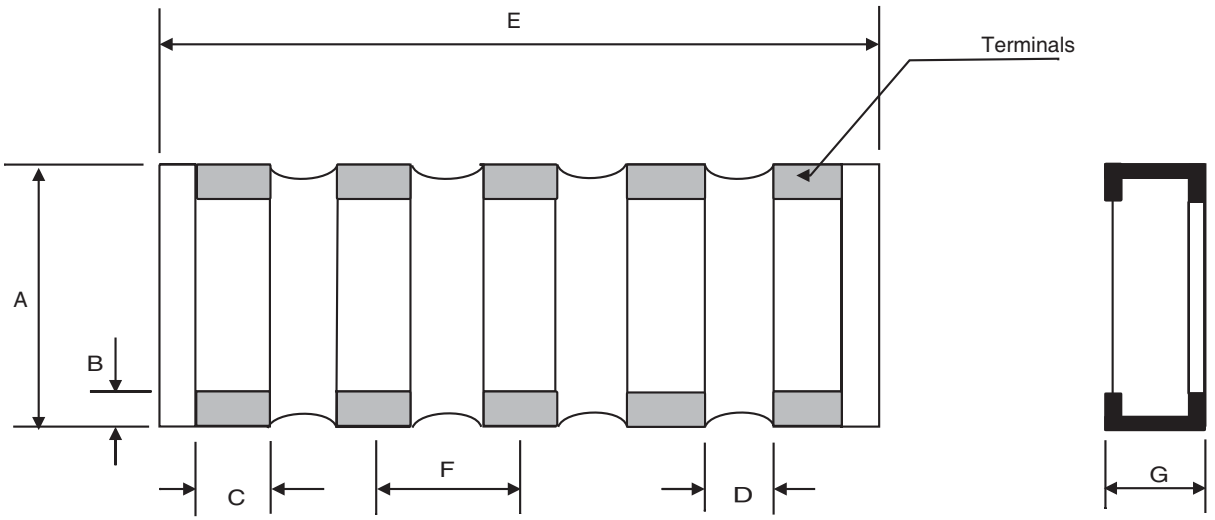
1. For variant number see Table 1(a).
2. Shall never exceed Limiting Element voltage. R_n=rated resistance.
3. Duration 10 seconds maximum.

FIGURE 1- PARAMETER DERATING INFORMATION



Rated Dissipation versus Temperature

FIGURE 2 - PHYSICAL DIMENSIONS

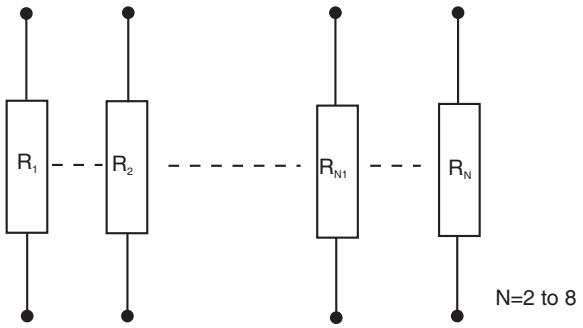


Variant	Style	Dimensions (mm)												
		A		B		C		D		G		F		E
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
01 to 07, 22 to 28	PRA100	1.5	1.8	0.2	0.6	0.5	0.8	0.2	0.3	0.38	0.58	0.95	1.05	Note 1
08 to 14, 29 to 35	PRA135	1.75	2.05	0.2	0.6	0.9	1.2	0.2	0.3	0.38	0.58	1.3	1.4	Note 1
15 to 21, 36 to 42	PRA182	2.9	3.2	0.2	0.6	1.15	1.45	0.2	0.3	0.38	0.58	1.77	1.87	Note 1

NOTES:

1. E=(NxF)±0.3mm, where N= number of resistors per array (N=2 to 8).

FIGURE 3 - FUNCTIONAL DIAGRAM



4. REQUIREMENTS

4.1 GENERAL

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

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 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. 9.1, Overload: Voltage on each resistor of the array = $\sqrt{(6.25P_n \times R_{min})}$ or $2U_L$, whichever is less (R_{min} is the lowest ohmic value on the array). Duration: 2 seconds minimum.
(b) Para. 9.2, Third Harmonic Control: Voltage on each resistor of the array = $\sqrt{(P_n \times R_{min})}$ or $2U_L$, whichever is less (R_{min} 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..

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 shall be 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 shall be as in Table 5(a).

4.3 MECHANICAL REQUIREMENTS

4.3.1 Dimension Check

The dimensions of the components specified herein shall be verified in accordance with the requirements

set out in Para. 9.4 of ESCC Generic Specification No. 4001 and they shall conform to those shown in Figure 2 of this specification.

4.3.2 Weight

The maximum weight of the components specified herein shall be as given in Table 1(a).

4.3.3 Robustness of Terminations

The requirements for the robustness of terminations test are specified in Para. 9.10.2 of ESCC Generic specification No. 4001. The test conditions for Bend Strength of the End Face Plating shall be as follows:

Number of bends	: 10
Deflection	: 2mm (all variants)
Duration	: 5 ± 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 coating.

4.4.2 Terminations

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

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 information 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 in the following order of precedence are:

(a) Resistance Value (R_n) 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:

Example: 1001FW1

- Resistance Value (1kΩ): 1001
- Tolerance (±1% Absolute, ±0.05% Relative): FW
- Temperature Coefficient (±10 x 10^{-6}/°C): 1

For Variants 22 to 42:

Example: 1229FW1

- Array Reference: 1229
- Tolerance (±1% Absolute, ±0.05% Relative): FW
- Temperature Coefficient (±10 x 10^{-6}/°C): 1

Refer to Para. 4.5.5 for the different marking configurations.

4.5.2.1 Resistance Value

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 (Ω)	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 Tolerance

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	F

4.5.2.4 Temperature Coefficient

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

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

4.5.3 ESCC Component Number

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

Example : 400102501B

- Detail Specification Reference : 4001025
- Component Type Variant Number : 01 (as required)
- Testing Level (B or C, as applicable)

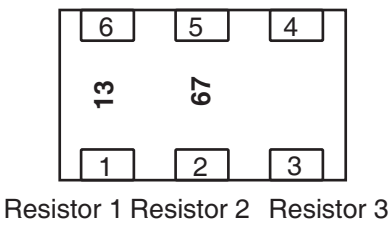
4.5.4 Traceability Information

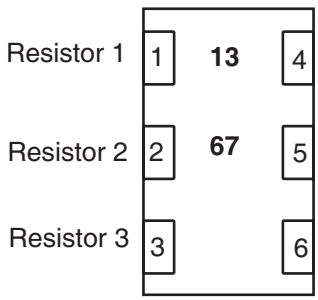
Each component shall be marked in respect of traceability information in accordance with the requirements of ESCC Basic Specification No. 21700.

4.5.5 Marking Rules and Orientation: Pin Out

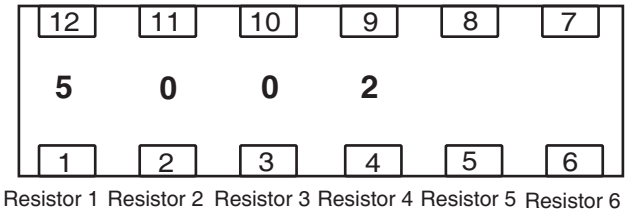
The 4-digit marking relates to the variant. for Variant 01 to 21 the marking directly gives the ohmic value of the resistors on the array, (see para. 4.5.2.1). for Variants 22 to 42 the marking represents the array reference that corresponds to specific requirements of the purchase order (see para. 4.5.2.2). 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:





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.



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, 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 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 as 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 parameters scheduled shall not be exceeded. In addition to these drift value requirements for a given parameter, the appropriate limit values specified in Table 2 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 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 shall then be visually examined. There shall 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) of this specification.

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	0.999 R_n	1.001 R_n	Ω
					0.5	0.995 R_n	1.005 R_n	
					1	0.99 R_n	1.01 R_n	
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	$\Delta R_A/R_A$	Para. 9.5.1	Para. 9.5.1 Notes 1 and 2	-0.08	+0.08	%
4	Resistance Change between +155 (+0 -3)°C and +22 ± 3°C	$\Delta R_A/R_A$	Para. 9.5.1	Para. 9.5.1 Notes 1 and 2	-0.136	+0.136	%
5	Relative Temperature Coefficient -55 (+3 -0)°C	ΔTC_R	Para. 9.5.1	Para. 9.5.1 Notes 2 and 3	-3	+3	10^{-6}/°C
				Para. 9.5.1 Notes 2 and 3	-5	+5	
6	Relative Temperature Coefficient -155 (+3 -0)°C	ΔTC_R	Para. 9.5.1	Para. 9.5.1 Notes 2 and 3	-3	+3	10^{-6}/°C
				Para. 9.5.1 Notes 2 and 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% of IEC Publication No. 60410 on the total production lot. In addition,

see Para. 4.6.2 for distribution of the sample.

3. See Table 1(a) Note 5.

$$\Delta TC_R = Max\left[\frac{R_{A(T°)} - R_{A(T)}}{R_{A(T°)}} \bullet \frac{1}{(T° - T)}\right] - Min\left[\frac{R_{A(T°)} - R_{A(T)}}{R_{A(T°)}} \bullet \frac{1}{(T° - T)}\right]$$

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	$\Delta R_A/R_A$	As per Table 2	As per Table 2 Note 1	±0.05	%

NOTES:

1. The measurements are done on all the individual resistors in 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 Variants 22 to 42	V_T	 $\sqrt{(P_n \times R_n)}$ or U_L whichever is less $\sqrt{(P_n \times R_{min})}$ or U_L whichever is less	V

NOTES:

1. 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

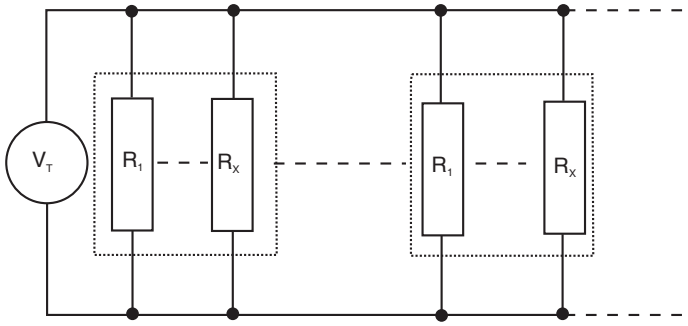


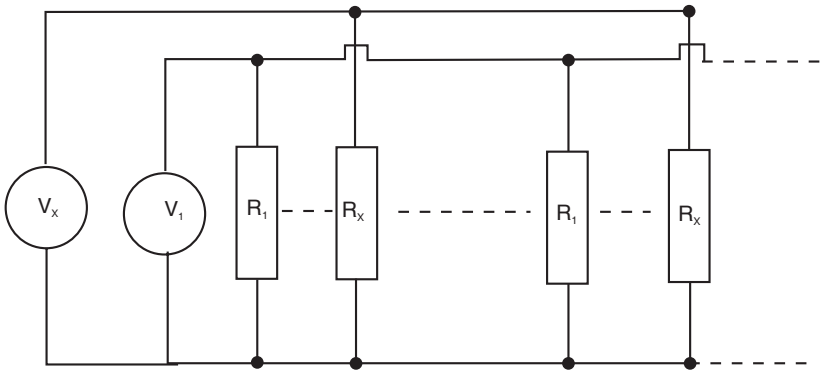
Table 5(b) - CONDITIONS FOR OPERATING LIFE

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

NOTES:

1. Each resistor is subjected to its own rated voltage (V_T=V...V_X).

FIGURE 5(b) - ELECTRICAL CIRCUIT FOR OPERATING LIFE



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. 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. 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 tests are scheduled in Table 6. Unless otherwise stated, the measurements shall be performed at T_{amb}=+22±3°C.

4.8.4 Conditions for Operating Life

The requirements for operating life test 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 (Figure 5(b))

The electrical circuit for use in performing the operating life test is shown in Figure 5(b) of this specification.

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

The requirements for the high temperature storage test are specified in ESCC Generic Specification No. 4001. The conditions for high temperature storage shall be T_{amb} = +155 (+0 -5)°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 (Note 1)	Test Methods 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 Chart IV Resistance Relative Tolerance Final Measurements Visual Examination Chart II Resistance Relative Tolerance Chart IV Resistance Change Relative Tolerance	 Table 2 Item 1 Table 2 Item 2 After a recovery period of 1-2 hrs No evidence of damage and marking legible Table 2 item 1 Table 2 Item 2 Table 2 Item 1 Table 2 Item 2	 R_A ΔT_R - R_A ΔT_R $\Delta R_A/R_A$ ΔT_R	 Record Values Record Values - Table 2 Item 1 Table 2 Item 2 Note 4 Table 2 Item 2		 Ω % - Ω % % %
02	Seal Test (Hermetically Sealed only)	Para. 9.3	Not applicable	-	-	-	-	-
03	Insulation Resistance (Insulated only)	Para. 9.6	Final Measurements Insulation Resistance	 Para. 9.6.2 of ESCC 4001 (Note 2)	 R_i	 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

No.	ESCC Generic Spec. No. 4001		Measurements and Inspections		Symbol	Limits		Unit
	Environmental and Endurance Tests (Note 1)	Test Methods and Conditions	Identification	Conditions		Min	Max	
05	Voltage Proof	Para. 9.8.2	<u>During test</u>	1.4 x U_I for 60 ± 5 sec (Note 3)	-	-	-	-
			Visual Examination	No breakdown or flashover	-	-	-	-
06	Solderability	Para. 9.9 Procedure I	<u>Initial Measurements</u>	After Drying				
			Resistance	Table 2 item 1	R_A	Record Values		Ω
			Relative Tolerance	Table 2 Item 2	ΔT_R	Record Values		%
			<u>Final Measurements</u>	24 ± 4hrs after soldering				
			Resistance Change	Table 2 Item 1	$\Delta R_A/R_A$	Note 4		%
			Relative Tolerance	Table 2 Item 2	ΔT_R	Table 2 Item 2		%
07	Robustness of Terminations	Para. 9.10.2	-	After Mounting				
		Adhesion	<u>Initial Measurements</u>					
			Resistance	Table 2 Item 1	R_A	Record Values		Ω
			Relative Tolerance	Table 2 Item 2	ΔT_R	Record Values		%
			<u>Final Measurements</u>					
			Resistance Change	Table 2 Item 1	$\Delta R_A/R_A$	Note 4		%
			Relative Tolerance	Table 2 Item 2	ΔT_R	Table 2 Item 2		%
			Visual Examination	No damage, lifting, cracking or dry joints	-	-	-	-
		Bond Strength of End Plate Facing	<u>Initial Measurements</u>					
			Resistance	Table 2 Item 1	R_A	Record Values		Ω
			Relative Tolerance	Table 2 Item 2	ΔT_R	Record Values		%
			<u>Final Measurements</u>	Board in bent position				
			Resistance Change	Table 2 Item 1	$\Delta R_A/R_A$	Note 4		%
			Relative Tolerance	Table 2 Item 2	ΔT_R	Table 2 Item 2		%
			Visual Examination	No damage, lifting, cracking or dry joints	-	-	-	-
08	Resistance to Soldering Heat	Para. 9.11 Procedure I	<u>Initial Measurements</u>	After Drying				
			Resistance	Table 2 Item 1	R_A	Record Values		Ω
			Relative Tolerance	Table 2 Item 2	ΔT_R	Record Values		%
			<u>Final Measurements</u>					
			Visual Examination	No evidence of damage and marking legible	-	-		-
			Resistance Change	Table 2 Item 1	$\Delta R_A/R_A$	Note 4		%
			Relative Tolerance	Table 2 Item 2	ΔT_R	Table 2 Item 2		%
09	Rapid Change of Temperature	Para. 9.12	<u>Initial Measurements</u>					
			Resistance	Table 2 item 1	R_A	Record Values		Ω
			Relative Tolerance	Table 2 Item 2	ΔT_R	Record Values		%
			<u>Final Measurements</u>	After a recovery period of 1-2 hrs				-
			Visual Examination	No evidence of damage	-	-		
			Resistance Change	Table 2 Item 1	$\Delta R_A/R_A$	Note 4		%
			Relative Tolerance	Table 2 Item 2		Table 2 Item 2		%

No.	ESCC Generic Spec. No. 4001		Measurements and Inspections		Symbol	Limits		Unit
	Environmental and Endurance Tests (Note 1)	Test Methods and Conditions	Identification	Conditions		Min	Max	
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	<u>Initial Measurements</u> Resistance Relative Tolerance <u>Final Measurements</u>	After Drying Table 2 Item 1 Table 2 Item 2 Following completion of DC load test and after a recovery period of 1-2 hrs	 R_A ΔT_R	 Record Values Record Values		 Ω %
			Visual Examination	No evidence of damage and marking legible	-	-	-	-
			Insulation Resistance	Para. 9.6 of ESCC 4001 (Note 2)	R_i	1000	-	MΩ
			Resistance Change Relative Tolerance	Table 2 Item 1 Table 2 Item 2	$\Delta R_A/R_A$ ΔT_R	Note 5 Table 2 Item 2		% %
12	Operating Life	Para. 9.15 Chart IV	<u>Initial Measurements</u> Resistance Relative Tolerance <u>Intermediate Measurements</u> (1000 hrs)	 Table 2 Item 1 Table 2 Item 2 After a recovery period of 1-2 hrs	 R_A ΔT_R	 Record Values Record Values		 Ω %
			Visual Examination	No evidence of damage	-	-	-	-
			Resistance Change Relative Tolerance	Table 2 Item 1 Table 2 Item 2	$\Delta R_A/R_A$ ΔT_R	Note 5 Table 2 Item 2		% %
			<u>Final Measurements</u> (2000 hrs) Visual Examination	After a recovery period of 1-2 hrs No evidence of damage	-	-	-	-
			Insulation Resistance	Para. 9.6 of ESCC 4001 (Note 2)	R_i	1000	-	MΩ
			Resistance Change Relative Tolerance	Table 2 Item 1 Table 2 Item 2	$\Delta R_A/R_A$ ΔT_R	Note 6 Table 2 Item 2		% %
		Para. 9.15 Chart V	<u>Initial Measurements</u> Resistance Relative Tolerance <u>Final Measurements</u> (1000 hrs)	 Table 2 Item 1 Table 2 Item 2 After a recovery period of 1 -2 hrs	 R_A ΔT_R	 Record Values Record Values		 Ω % -
			Visual Examination	No evidence of damage	-	-		%
			Insulation Resistance	Para. 9.6 of ESCC 4001, (Note 2)	R_i	1000	-	MΩ
			Resistance Change Relative Tolerance	Table 2 Item 1 Table 2 Item 2	$\Delta R_A/R_A$ ΔT_R	Note 5 Table 2 Item 2		% %

No.	ESCC Generic Spec. No. 4001		Measurements and Inspections		Symbol	Limits		Unit
	Environmental and Endurance Tests (Note 1)	Test Methods and Conditions	Identification	Conditions		Min	Max	
13	High Temperature Storage	Para. 9.16	Initial Measurements					
			Resistance	Table 2 Item 1	R_A	Record Values		Ω
			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	$\Delta R_A/R_A$	Note 5		%
			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 of ESCC 4001, (Note 2)	R_i	1000	-	MΩ
			Resistance Change	Table 2 Item 1	$\Delta R_A/R_A$	Note 6		%
			Relative Tolerance	Table 2 Item 2	ΔT_R	Table 2 Item 2		%
14	Permanence of Marking	Para. 9.19	Final Measurements					
			Visual Examination	No evidence of damage and marking legible	-	-	-	-

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.
4. $\Delta R_A/R_A$ limit: $\pm(0.05 + 0.05\Omega \times 100/R_n)\%$
5. $\Delta R_A/R_A$ limit: $\pm(0.1 + 0.05\Omega \times 100/R_n)\%$
6. $\Delta R_A/R_A$ limit: $\pm(0.15 + 0.05\Omega \times 100/R_n)\%$

APPENDIX A

AGREED DEVIATIONS FOR VISHAY SFERNICE(F)

Items Affected	Description of Deviations
Deviations from Final Production Tests (Chart II)	Para. 9.2 Third Harmonic Control and Current Noise This test is not applicable.