RESISTORS, FIXED, CHIP, THICK FILM

BASED ON TYPE LHR

ESCC Detail Specification No. 4001/030

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DOCUMENTATION CHANGE NOTICE

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DCR No.	CHANGE DESCRIPTION
852	Specification upissued to incorporate 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. 4001.

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: 400103001R511G10

- Detail Specification Reference: 4001030
- Component Type Variant Number: 01 (01 to 10 as required)
- Characteristic code: Resistance Value (0.511Ω): R511 (as required)
- Characteristic code: Resistance Tolerance (±2%): G (as required)
- Characteristic code: Temperature Coefficient (±300x10^{-6}/°C): 10 (as required)

1.4.1.1 Characteristics and/or Ratings Codes

Characteristics and/or ratings to be codified as part of the ESCC Component Number shall be as follows:

(a) Resistance Value expressed by means of the following codes in accordance with ESCC Basic Specification No. 21700. The unit quantity shall be ohm (Ω):

Resistance Value (Ω)	Code
0.XXX	RXXX
X.XX	XRXX

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

Tolerance (± %)	Code Letter
1	F
2	G
3	H
5	J

(c) Temperature Coefficient expressed by the following codes in accordance with ESCC Basic Specification No. 21700:

Temperature Coefficient ($\pm 10^{-6}/^{o}C$)	Code
50	3
100	4
200	6
300	10

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	Style (Note 1)	Resistance Range R_n (Note 2)		Tolerance (± %)	Temperature Coefficient TC ($\pm 10^{-6}/^{o}C$)	Terminal Material and Finish	Weight max (g)
		Min (Ω)	Max (Ω)				
01	0603	0.1	9.99	1, 2, 3, 5	50, 100, 200, 300	E4	0.003
02	0805	0.1	9.99	1, 2, 3, 5	50, 100, 200, 300	E4	0.004
03	1206	0.1	9.99	1, 2, 3, 5	50, 100, 200, 300	E4	0.01
04	2010	0.1	9.99	1, 2, 3, 5	50, 100, 200, 300	E4	0.03
05	2512	0.1	9.99	1, 2, 3, 5	50, 100, 200, 300	E4	0.042

Variant Number	Style (Note 1)	Resistance Range R_n (Note 2)		Tolerance (± %)	Temperature Coefficient TC ($\pm 10^{-6}/^{o}C$)	Terminal Material and Finish	Weight max (g)
		Min (Ω)	Max (Ω)				
06	0603	0.1	9.99	1, 2, 3, 5	50, 100, 200, 300	E2	0.003
07	0805	0.1	9.99	1, 2, 3, 5	50, 100, 200, 300	E2	0.004
08	1206	0.1	9.99	1, 2, 3, 5	50, 100, 200, 300	E2	0.01
09	2010	0.1	9.99	1, 2, 3, 5	50, 100, 200, 300	E2	0.03
10	2512	0.1	9.99	1, 2, 3, 5	50, 100, 200, 300	E2	0.042

NOTES:
1. See Physical Dimensions.
2. Any resistance value in the resistance range, to 3 significant figures, is available.

1.5 MAXIMUM RATINGS

The maximum ratings shall not be exceeded at any time during use or storage.

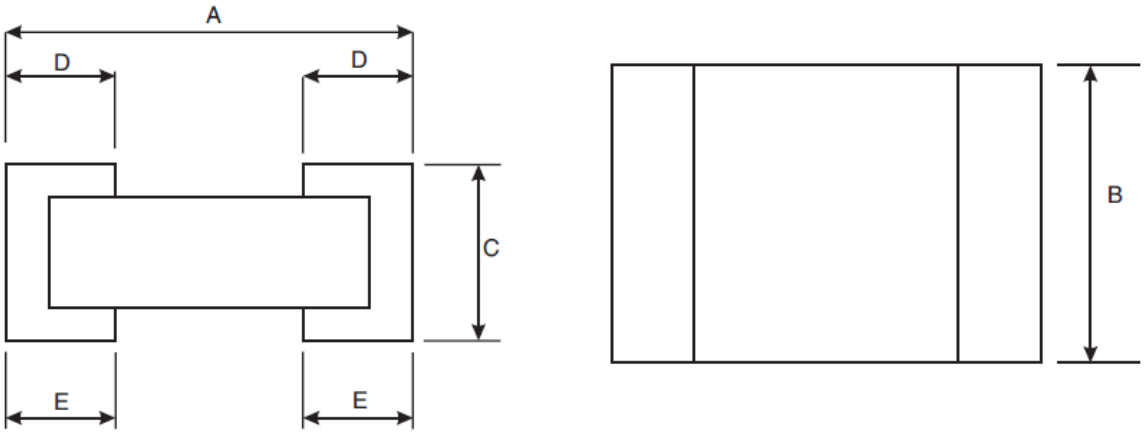
Maximum ratings shall only be exceeded during testing to the extent specified in this specification and when stipulated in Test Methods and Procedures of the ESCC Generic Specification.

Characteristics	Variant Number	Style	Symbols	Limits	Units	Remarks
Rated Dissipation	01, 06 02, 07 03, 08 04, 09 05, 10	0603 0805 1206 2010 2512	P_n	125 200 250 500 1000	mW	Note 1
Limiting Element Voltage	All	All	U_L	50	V	-
Rated Voltage	All	All	U_R	$\sqrt{(P_n \times R_n)}$	V	Note 2
Isolation Voltage	01, 06 02, 07 03, 08 04, 09 05, 10	0603 0805 1206 2010 2512	U_i	100 200 300 300 300	Vrms	-
Operating Temperature Range	All	All	T_{op}	-55 to +155	ºC	T_{amb}

Characteristics	Variant Number	Style	Symbols	Limits	Units	Remarks
Storage Temperature Range	All	All	T_{stg}	-55 to +155	ºC	-
Soldering Temperature	All	All	T_{sol}	+260	ºC	Note 3

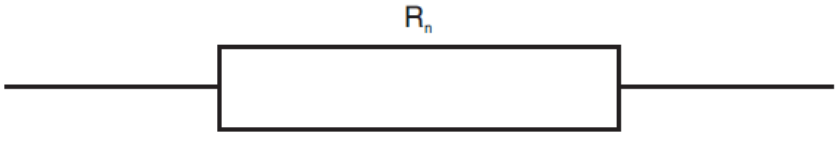
NOTES:
1. At $T_{amb} \leq +70$ ºC. For $T_{amb} > +70$ ºC derate linearly to 0W at $T_{amb} = +155$ ºC.
2. Shall never exceed Limiting Element Voltage. R_n = Rated Resistance.
3. Duration 10 seconds maximum.

1.6 PHYSICAL DIMENSIONS



Variant Number	Style	Dimensions (mm)									
		A		B		C		D		E	
		Min	Max	Min	Max	Min	Min	Min	Max	Min	Max
01, 06	0603	1.36	1.68	0.72	0.98	0.38	0.53	0.17	0.51	0.25	0.51
02, 07	0805	1.75	2.07	1.14	1.4	0.38	0.53	0.17	0.51	0.25	0.51
03, 08	1206	2.89	3.21	1.47	1.73	0.38	0.53	0.17	0.51	0.25	0.51
04, 09	2010	4.92	5.24	2.41	2.67	0.5	0.63	0.25	0.64	0.25	0.64
05, 10	2512	6.19	6.51	2.93	3.32	0.5	0.63	0.25	0.64	0.25	0.64

1.7 FUNCTIONAL DIAGRAM



1.8 MATERIALS AND FINISHES

1.8.1 Body
Each resistive element deposited on the alumina substrate shall be covered with a suitable coating.

1.8.2 Terminations
The terminal material and finish shall be as specified in Component Type Variants and Range of Components in accordance with the requirements of ESCC Basic Specification No. 23500.

2 REQUIREMENTS

2.1 GENERAL
The complete requirements for procurement of the components specified herein are as stated in this specification and the ESCC Generic Specification. Permitted deviations from the Generic Specification, applicable to this specification only, are listed below.

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

2.1.1 Deviations from the Generic Specification

2.1.1.1 Deviations from Qualification and Periodic Tests (Chart F4)
(a) Para. 8.9, Vibration: Not applicable.

2.2 MARKING
The marking of all components delivered to this specification shall be in accordance with the requirements of ESCC Basic Specification No. 21700. 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) The ESCC qualified components symbol (for ESCC qualified components only).
(b) The ESCC Component Number.
(c) Traceability information.

2.3 OVERLOAD
The test conditions for Overload, tested as specified in the ESCC Generic Specification, shall be as follows:

Voltage: $\sqrt{(6.25P_n x R_n)}$ or $2U_L$, whichever is less.

Duration: 2s minimum.

2.4 ROBUSTNESS OF TERMINATIONS - SUBSTRATE BENDING TEST

The test conditions for the Substrate Bending Test, tested as specified in the ESCC Generic Specification, shall be as follows:

Number of bends: 10

Deflection: 2mm (Variants 01, 02, 03, 06, 07, 08)
1mm (Variants 04, 05, 09, 10)

Duration: 5 ±1s

2.5 RESISTANCE TO SOLDERING HEAT

The test conditions for Resistance to Soldering Heat, tested as specified in the ESCC Generic Specification, shall be as follows:

Temperature: 260 ºC

Duration: 10 (+0 -1) s

2.6 ELECTRICAL MEASUREMENTS AT ROOM, HIGH AND LOW TEMPERATURES

2.6.1 Room Temperature Electrical Measurements

The measurements shall be performed at T_{amb} = +22 ±3 ºC.

Characteristics	Symbols	ESCC 4001 Test Method and Conditions	Tolerance (± %)	Limits		Units
				Min	Max	
Resistance	R_A	Para. 8.3.1.1	1	0.99 R_n	1.01 R_n	Ω
			2	0.98 R_n	1.02 R_n	
			3	0.97 R_n	1.03 R_n	
			5	0.95 R_n	1.05 R_n	
Insulation Resistance	R_I	Para. 8.3.1.2 V=100V Note 1	All	1000	-	MΩ

NOTES:

1. Guaranteed but not tested during Screening Tests.

2.6.2 High and Low Temperatures Electrical Measurements

The components shall be mounted as specified in the ESCC Generic Specification.

Characteristics	Symbols	ESCC 4001 Test Method and Conditions (Note 1)	Limits		Units
			Min	Max	
Resistance Change between -55 (+3 -0) ºC and +22 ±3 ºC	$\Delta R_A/R_A$	Para. 8.3.1.1			%
		TC = ±50 x 10^{-6}/ºC	-0.4	+0.4	
		TC = ±100 x 10^{-6}/ºC	-0.8	+0.8	
		TC = ±200 x 10^{-6}/ºC	-1.6	+1.6	
		TC = ±300 x 10^{-6}/ºC	-2.4	+2.4	
Resistance Change between +155 (+0 -3) º C and +22 ±3 ºC	$\Delta R_A/R_A$	Para. 8.3.1.1			%
		TC = ±50 x 10^{-6}/ºC	-0.68	+0.68	
		TC = ±100 x 10^{-6}/ºC	-1.36	+1.36	
		TC = ±200 x 10^{-6}/ºC	-2.72	+2.72	
		TC = ±300 x 10^{-6}/ºC	-4.08	+4.08	

NOTES:

1. The measurements shall be performed on a sample of 5 components selected from the total production lot.

2.7 INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS

The components shall be mounted as specified in the ESCC Generic Specification.

Unless otherwise specified, the measurements shall be performed at T_{amb} = +22 ±3 ºC.

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. 4001	Characteristics	Symbols	Limits		Units
			Min	Max	
Rapid Change of Temperature	Resistance	R_A	Record Values		
	Change in Resistance	$\Delta R_A/R_A$	± (0.05 + 0.05Ωx100/R_n)		%
Robustness of Terminations	Resistance	R_A	Record Values		
	Change in Resistance	$\Delta R_A/R_A$	± (0.05 + 0.05Ωx100/R_n)		%
Resistance to Soldering Heat	Resistance	R_A	Record Values		
	Change in Resistance	$\Delta R_A/R_A$	± (0.05 + 0.05Ωx100/R_n)		%

Test Reference per ESCC No. 4001	Characteristics	Symbols	Limits		Units
			Min	Max	
Solderability	Resistance	R_A	Record Values		
	Change in Resistance	$\Delta R_A/R_A$	± (0.05 + 0.05Ωx100/R_n)		%
Climatic Sequence					
Initial Measurements (Procedure 1)	Resistance (after drying)	R_A	Record Values		
Final Measurements	Change in Resistance	$\Delta R_A/R_A$	± (0.1 + 0.05Ωx100/R_n)		%
	Insulation Resistance (V_T=100V)	R_I	1000	-	MΩ
Operating Life					
Initial Measurement (0 hour)	Resistance	R_A	Record Values		
Intermediate Measurements (1000 hours)	Change in Resistance	$\Delta R_A/R_A$	± (2 + 0.05Ωx100/R_n)		%
Final Measurements (2000 hours)	Change in Resistance	$\Delta R_A/R_A$	± (2 + 0.05Ωx100/R_n)		%
	Insulation Resistance (V_T=100V)	R_I	1000	-	MΩ

2.8 BURN-IN CONDITIONS

Characteristics	Symbols	Test Conditions	Units
Ambient Temperature	T_{amb}	+155 (+0 -5)	ºC
Test Voltage	V_T	No Bias	V

NOTES:

1. After Burn-in, the components shall be removed from the chamber and allowed to cool under normal atmospheric conditions for a minimum of 4 hours.

2.9 OPERATING LIFE CONDITIONS

Characteristics	Symbols	Test Conditions	Units
Ambient Temperature	T_{amb}	+70 ±3	ºC
Test Voltage	V_T	$\sqrt{(P_n x R_n)}$ or U_L (whichever is less)	V

NOTES:

1. After Operating Life, the components shall be removed from the chamber and allowed to cool under normal atmospheric conditions for a minimum of 4 hours.

APPENDIX 'A'

AGREED DEVIATIONS FOR VISHAY S.A. Division Sfernice (F)

Items Affected	Description of Deviations
Deviations from Generic Specification:	
Special In-Process Controls (Chart F2)	Para. 5.2.1, Dimension Check: Guaranteed but not tested.
Screening Tests (Chart F3)	Para. 8.2, Non-Linearity: Not applicable.
Qualification and Periodic Tests (Chart F4)	Para. 8.15, Permanence of Marking: Not applicable.
Deviations from Generic Specification:	
Screening Tests (Chart F3)	Para. 8.1 (& Para. 2.3 herein), Overload: Resistance and Change in Resistance shall be measured on a GONOGO basis, in accordance with Room Temperature Electrical Measurements in the Detail Specification, both before and after the test. Change in Resistance shall be related to the initial measurements. The limit for Change in Resistance shall be: $\Delta R_A/R_A = \pm(0.05 + 0.05\Omega \times 100/R_n)\%$ max.
High and Low Temperatures Electrical Measurements	All tests at high and low temperatures are guaranteed but not tested based on temperature coefficient measurements performed on each wafer at +25ºC and +75ºC in accordance with VISHAY specification CM-SF-00210.