RESISTOR, FIXED, CHIP, THICK FILM

BASED ON TYPE CHPHR AND CHPFR

ESCC Detail Specification No. 4001/026

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DOCUMENTATION CHANGE NOTICE

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DCR No.	CHANGE DESCRIPTION
851	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 (for type CHPHR): 4001026012490F4

- Detail Specification Reference: 4001026
- Component Type Variant Number: 01 (01 to 10 as required)
- Characteristic code: Resistance Value (249Ω): 2490 (as required)
- Characteristic code: Resistance Tolerance (±1%): F (as required)
- Characteristic code: Temperature Coefficient (±100x10^{-6}/°C): 4 (as required)

Example (for type CHPFR): 400102611R2490F4

- Detail Specification Reference: 4001026
- Component Type Variant Number: 11 (11 to 20 as required)
- Failure Rate Level Letter: R (as applicable; see Note 1)
- Characteristic code: Resistance Value (249 Ω): 2490 (as required)
- Characteristic code: Resistance Tolerance (±1%): F (as required)
- Characteristic code: Temperature Coefficient (±100x10^{-6}/°C): 4 (as required)

NOTES

1. Failure rate level letter shall be as defined in ESCC Basic Specification No. 26000.

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
X.XX	XRXX
XX.X	XXRX
XXX	XXX0
XXX 10^{1}	XXX1
XXX 10^{2}	XXX2
XXX 10^{3}	XXX3
XXX 10^{4}	XXX4
XXX 10^{5}	XXX5

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

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

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

Temperature Coefficient (± $10^{-6}/^{o}C$)	Code
100	4
200	6

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	Type	Style (Note 1)	Resistance Range R_n (Note 2)		Tolerance (± %)	Temperature Coefficient TC ($\pm 10^{-6}/^{o}C$)	Critical Resistance (kΩ)	Terminal Material and Finish	Weight max (g)
			Min (Ω)	Max (MΩ)					
01	CHPHR	0603	1	10	1, 2, 5	100, 200	25	E4	0.002
02	CHPHR	0805	1	10	1, 2, 5	100, 200	50	E4	0.004
03	CHPHR	1206	1	10	1, 2, 5	100, 200	160	E4	0.008
04	CHPHR	2010	1	10	1, 2, 5	100, 200	180	E4	0.026
05	CHPHR	2512	1	10	1, 2, 5	100, 200	112.5	E4	0.042
06	CHPHR	0603	1	10	1, 2, 5	100, 200	25	E2	0.002
07	CHPHR	0805	1	10	1, 2, 5	100, 200	50	E2	0.004
08	CHPHR	1206	1	10	1, 2, 5	100, 200	160	E2	0.008
09	CHPHR	2010	1	10	1, 2, 5	100, 200	180	E2	0.026
10	CHPHR	2512	1	10	1, 2, 5	100, 200	112.5	E2	0.042

Variant Number	Type	Style (Note 1)	Resistance Range R_n (Note 2)		Tolerance (± %)	Temperature Coefficient TC ($\pm 10^{-6}/^{o}C$)	Critical Resistance (kΩ)	Terminal Material and Finish	Weight max (g)
			Min (Ω)	Max (MΩ)					
11	CHPFR	0603	1	10	1, 2, 5	100, 200	25	E4	0.002
12	CHPFR	0805	1	10	1, 2, 5	100, 200	50	E4	0.004
13	CHPFR	1206	1	10	1, 2, 5	100, 200	160	E4	0.008
14	CHPFR	2010	1	10	1, 2, 5	100, 200	180	E4	0.026
15	CHPFR	2512	1	10	1, 2, 5	100, 200	112.5	E4	0.042
16	CHPFR	0603	1	10	1, 2, 5	100, 200	25	E2	0.002
17	CHPFR	0805	1	10	1, 2, 5	100, 200	50	E2	0.004
18	CHPFR	1206	1	10	1, 2, 5	100, 200	160	E2	0.008
19	CHPFR	2010	1	10	1, 2, 5	100, 200	180	E2	0.026
20	CHPFR	2512	1	10	1, 2, 5	100, 200	112.5	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.

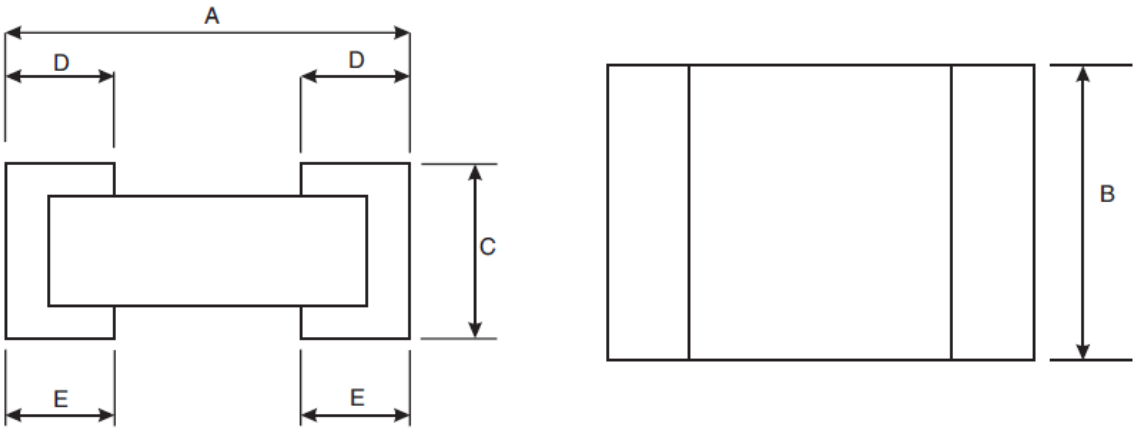
Maximum ratings shall only be exceeded during testing to the extent specified in this specification and when stipulated in Test Methods and Procedures of the ESCC Generic Specification.

Characteristics	Variant Number	Style	Symbols	Limits	Units	Remarks
Rated Dissipation	01, 06, 11, 16 02, 07, 12, 17 03, 08, 13, 18 04, 09, 14, 19 05, 10, 15, 20	0603 0805 1206 2010 2512	P_n	100 200 250 500 800	mW	Note 1
Limiting Element Voltage	01, 06, 11, 16 02, 07, 12, 17 03, 08, 13, 18 04, 09, 14, 19 05, 10, 15, 20	0603 0805 1206 2010 2512	U_L	50 100 200 300 300	V	-
Rated Voltage	All	All	U_R	$\sqrt{(P_n \times R_n)}$	V	Note 2
Isolation Voltage	01, 06, 11, 16 02, 07, 12, 17 03, 08, 13, 18 04, 09, 14, 19 05, 10, 15, 20	0603 0805 1206 2010 2512	U_I	100 200 300 300 300	V	-
Operating Temperature Range	All	All	T_{op}	-55 to +155	ºC	T_{amb}
Storage Temperature Range	All	All	T_{stg}	-55 to +155	ºC	-
Soldering Temperature	All	All	T_{sol}	+260	ºC	Note 3

NOTES:

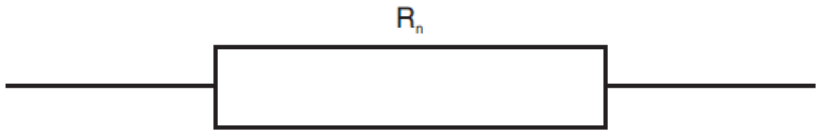
1. At $T_{amb} \leq +70$ ºC. For $T_{amb} > +70$ ºC derate linearly to 0W at $T_{amb} = +155$ ºC.
2. Shall never exceed Limiting Element Voltage. R_n = Rated Resistance.
3. Duration 10 seconds maximum.

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, 11, 16	0603	1.36	1.68	0.72	0.98	0.38	0.53	0.17	0.51	0.25	0.51
02, 07, 12, 17	0805	1.75	2.07	1.14	1.4	0.38	0.53	0.17	0.51	0.25	0.51
03, 08, 13, 18	1206	2.89	3.21	1.47	1.73	0.38	0.53	0.17	0.51	0.25	0.51
04, 09, 14, 19	2010	4.92	5.24	2.41	2.67	0.5	0.63	0.25	0.64	0.25	0.64
05, 10, 15, 20	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 Screening Tests (Chart F3)
(a) Para. 8.2, Non-Linearity: Not applicable.

2.1.1.2 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, 11, 12, 13, 16, 17, 18)
1mm (Variants 04, 05, 09, 10, 14, 15, 19, 20)

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	0.99 R_n	1.02 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

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 = ±100 x 10^{-6}/ºC TC = ±200 x 10^{-6}/ºC	 -0.8 -1.6	 +0.8 +1.6	%
Resistance Change between +155 (+0 -3) º C and +22 ±3 ºC	$\Delta R_A/R_A$	Para. 8.3.1.1 TC = ±100 x 10^{-6}/ºC TC = ±200 x 10^{-6}/ºC	 -1.36 -2.72	 +1.36 +2.72	%

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					
Initial Measurement	Resistance	R_A	Record Values		
Final Measurement	Change in Resistance	$\Delta R_A/R_A$	± (0.25 + 0.05Ωx100/R_n)		%
Robustness of Terminations					
Initial Measurement	Resistance	R_A	Record Values		
Final Measurement	Change in Resistance	$\Delta R_A/R_A$	± (0.25 + 0.05Ωx100/R_n)		%
Resistance to Soldering Heat					
Initial Measurement	Resistance	R_A	Record Values		
Final Measurement	Change in Resistance	$\Delta R_A/R_A$	± (0.5 + 0.05Ωx100/R_n)		%
Solderability					
Initial Measurement	Resistance	R_A	Record Values		
Final Measurement	Change in Resistance	$\Delta R_A/R_A$	± (0.25 + 0.05Ωx100/R_n)		%
Climatic Sequence					
Initial Measurements (Procedure 1)	Resistance (after drying)	R_A	Record Values		
Final Measurements	Change in Resistance	$\Delta R_A/R_A$	± (1 + 0.05Ωx100/R_n)		%
	Insulation Resistance (V_T=100V)	R_I	1000	-	MΩ

Test Reference per ESCC No. 4001	Characteristics	Symbols	Limits		Units
			Min	Max	
Operating Life					
Initial Measurement (0 hour)	Resistance	R_A	Record Values		
Intermediate Measurements (1000 hours)	Change in Resistance Variants 01 to 10 Variants 11 to 20	$\Delta R_A/R_A$	 $\pm (1 + 0.05\Omega x100/R_n)$ $\pm (1.5 + 0.05\Omega x100/R_n)$		%
Intermediate/Final Measurements (2000 hours)	Change in Resistance Variants 01 to 10 Variants 11 to 20	$\Delta R_A/R_A$	 $\pm (1.5 + 0.05\Omega x100/R_n)$ $\pm (2.5 + 0.05\Omega x100/R_n)$		%
	Insulation Resistance (V_T=100V)	R_I	1000	-	MΩ
Final Measurements (8000 hours) (Note 1)	Change in Resistance	$\Delta R_A/R_A$	$\pm (5 + 0.05\Omega x100/R_n)$		%

NOTES:
1. Applicable to Failure Rate Endurance Testing only.

2.8 BURN-IN CONDITIONS

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

The conditions shall be as specified for Burn-in.

APPENDIX A
AGREED DEVIATIONS FOR VISHAY S.A. DIVISION SFERNICE (F)

Items Affected	Description of Deviations
Deviations from Generic Specification: Production Control (Chart F2) Qualification and Periodic Tests (Chart F4)	 Para. 5.2.1, Dimension Check: Guaranteed but not tested. Para. 8.1, Permanence of Marking: Not applicable.
Deviations from Generic Specification: Screening Tests (Chart F3)	For Variants 11 to 20, when failure rate level qualification approval in accordance with ESCC Basic Specification No. 26000 has been granted, the following deviations shall apply. Para. 8.1 (& Para. 2.3 herein), Overload: 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. Para. 8.4 (& Para. 2.8 herein), Burn-in: Not applicable.