RESISTOR, FIXED, SURFACE MOUNT, THIN FILM, NON-HERMETICALLY SEALED

BASED ON TYPE TNPS

ESCC Detail Specification No. 4001/029

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DOCUMENTATION CHANGE NOTICE

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DCR No.	CHANGE DESCRIPTION
859	Specification upissued to incorporate editorial 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 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: 4001029012490F3

- Detail Specification Reference: 4001029
- Component Type Variant Number: 01 (as required)
- Characteristic code: Resistance Value (249Ω): 2490 (as required)
- Characteristic code: Resistance Tolerance (±1%): F (as required)
- Characteristic code: Temperature Coefficient (±50 x 10^{-6}/ºC): 3 (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
XX.X	XXRX
XXX	XXX0
XXX 10^1	XXX1
XXX 10^2	XXX2
XXX 10^3	XXX3
XXX 10^4	XXX4

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

Tolerance (± %)	Code Letter
0.1	B
0.5	D
1	F

(c) Temperature Coefficient

Temperature Coefficient expressed by the following codes:

Temperature Coefficient TC (± 10^{-6}/°C)	Code
15	1
25	2
50	3

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		Tolerance (± %)	Value Series	Temperature Coefficient TC (± 10^{-6}/°C)	Critical Resistance (kΩ)	Weight max (g)
		Min (Ω)	Max (MΩ)					
01	0603	10	0.221	0.1, 0.5, 1	E96	15, 25, 50	56.25	0.002
02	0805	10	0.422	0.1, 0.5, 1	E96	15, 25, 50	180	0.006
03	1206	10	1	0.1, 0.5, 1	E96	15, 25, 50	160	0.008

NOTES:

1. See Physical Dimensions.

1.5 MAXIMUM RATINGS

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

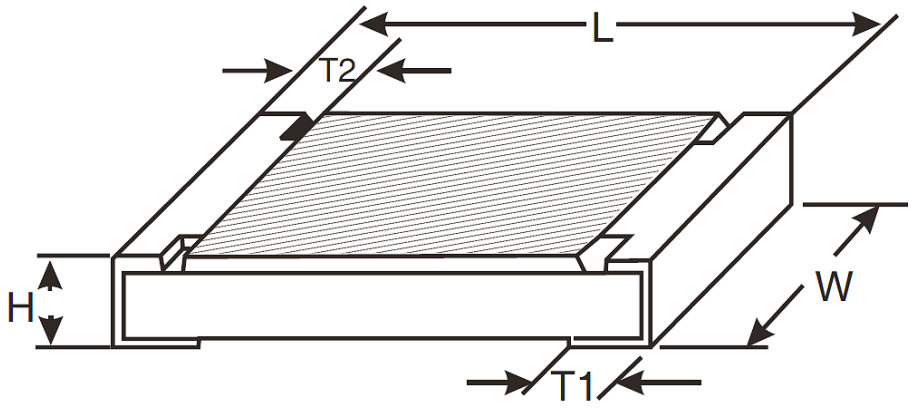
Maximum ratings shall only be exceeded during testing to the extent specified in this specification and when stipulated in Test Methods and Procedures of the ESCC Generic Specification.

Characteristics	Variant Number	Style	Symbols	Limits	Units	Remarks
Rated Dissipation	01 02 03	0603 0805 1206	P_n	100 125 250	mW	Note 1
Limiting Element Voltage	01 02 03	0603 0805 1206	U_L	75 150 200	V	-
Rated Voltage	All	All	U_R	$\sqrt{(P_n \times R_n)}$	V	Note 2
Isolation Voltage	01 02 03	0603 0805 1206	U_i	100 200 300	Vrms	-
Operating Temperature Range	All	All	T_{op}	-55 to +125	^oC	T_{amb}
Storage Temperature Range	All	All	T_{stg}	-55 to +125	^oC	-
Soldering Temperature	All	All	T_{sol}	+260	^oC	Note 3

NOTES:

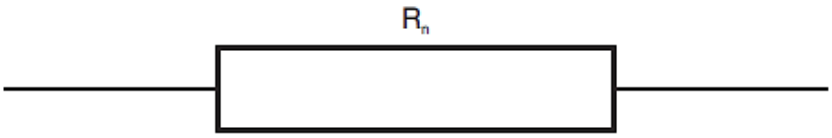
1. At $T_{amb} \leq +70$ ºC. For $T_{amb} > +70$ ºC, derate linearly to 0W at $T_{amb} = +125$ ºC.
2. Shall never exceed Limiting Element Voltage. R_n = rated resistance.
3. Duration 10 seconds maximum.

1.6 PHYSICAL DIMENSIONS



Variant Number	Style	Dimensions (mm)							
		L		W		H		T1, T2	
		Min	Max	Min	Max	Min	Max	Min	Max
01	0603	1.5	1.7	0.75	0.95	0.35	0.55	0.1	0.5
02	0805	1.85	2.15	1.1	1.4	0.35	0.55	0.2	0.6
03	1206	3.05	3.35	1.45	1.75	0.45	0.65	0.25	0.75

1.7 FUNCTIONAL DIAGRAM



1.8 MATERIALS AND FINISHES

1.8.1 Case

The resistive element deposited on the alumina substrate shall be covered with a suitable coating.

1.8.2 Terminations

The components shall be terminated with tin-lead plating (minimum 6% lead) with nickel underplating.

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. 8.1 Overload: Not applicable.

(b) Para. 8.2, Non-Linearity: Not applicable.

(c) Para. 8.4 Burn-in:

Burn-in shall be replaced by an Overload test in accordance with Para. 8.1 of the Generic Specification with conditions as follows.

Measurement of Resistance shall be performed before and after application of the Overload in accordance with Room Temperature Electrical Measurements in the Detail Specification, with the results noted against component jig position. No recovery period is required prior to the measurement performed after application of the Overload. Resistance Change after application of the Overload shall be calculated on a GONOGO basis with the following drift limit applied.

Overload conditions:

- Ambient Temperature: +15 to +35 °C
- Test Voltage:
  - Variant 01: $\sqrt{(3R_n)}V$
  - Variant 02: $\sqrt{(4R_n)}V$
  - Variant 03: $\sqrt{(8R_n)}V$
- Duration: 1ms

Resistance Change drift limit: $\pm(0.05 + 0.01\Omega \times 100 / R_n)$ %

(d) Para. 6.4 Check for Lot Failure: Any Resistance Change failures after Overload shall be counted as limit failures.

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 ROBUSTNESS OF TERMINATIONS - SUBSTRATE BENDING TEST

The test conditions for the substrate bending test, as specified in the ESCC Generic Specification, shall be as follows:

Number of Bends : 10

Deflection : 2mm

Duration : 5 ±1 s

2.4 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 °C

Duration : 10 (+0 -1) s

2.5 ELECTRICAL MEASUREMENTS AT ROOM, HIGH AND LOW TEMPERATURES

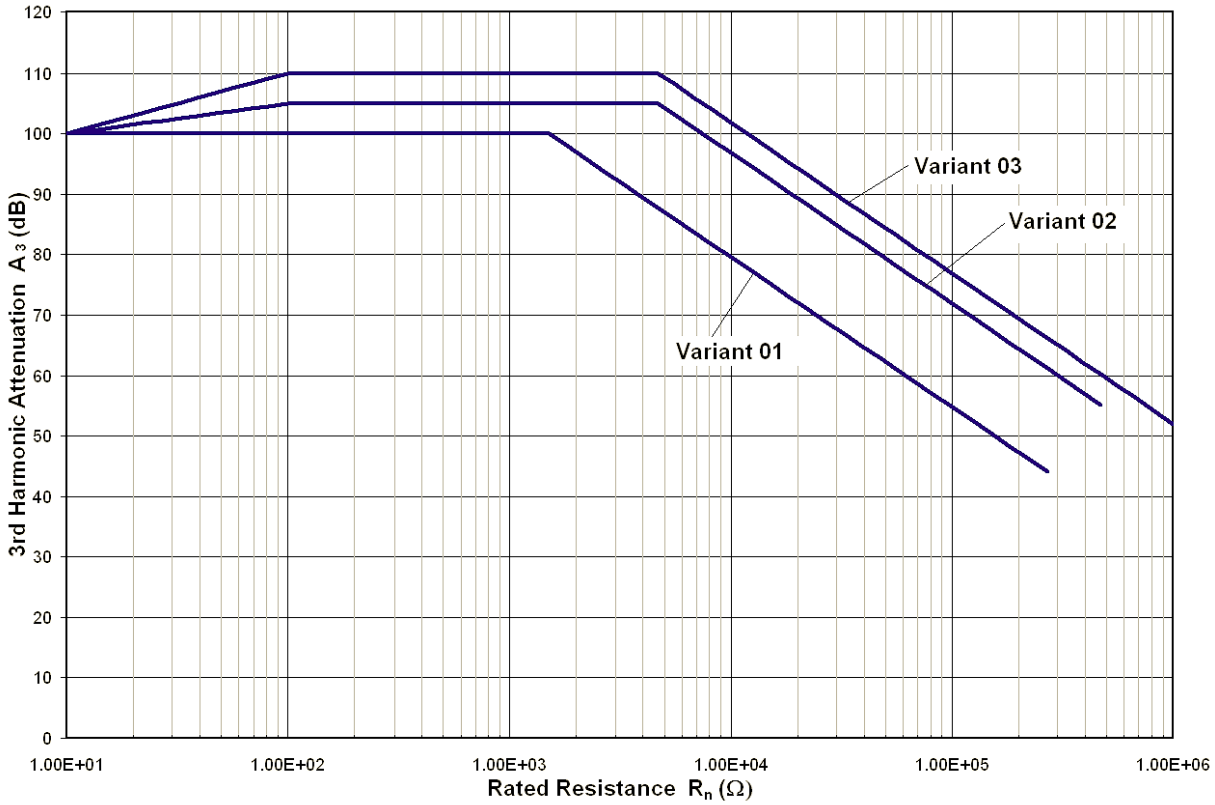
2.5.1 Room Temperature Electrical Measurements

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	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	
3rd Harmonic Attenuation	A_3	IEC Publication No. 60440 Note 1	All	Note 2	-	dB
Insulation Resistance	R_I	Para. 8.3.1.2 V = 100V Note 3	All	1000	-	MΩ

NOTES:

1. Measurement of 3rd Harmonic Attenuation may be performed at the same time as the electrical measurements immediately after application of Overload during Screening Tests.
2. The minimum limit shall be as follows:



3. Guaranteed but not tested during Screening Tests.

2.5.2 High and Low Temperatures Electrical Measurements

Characteristics	Symbols	ESCC 4001 Test Method and Conditions		Limits		Units
				Min	Max	
Resistance Change between -55 (+3 -0) °C and +22 ±3 °C	$\Delta R_A/R_A$	Para. 8.3.1.1 Note 1	TC = ±15 x 10^{-6}/°C TC = ±25 x 10^{-6}/°C TC = ±50 x 10^{-6}/°C	-0.12 -0.2 -0.4	+0.12 +0.2 +0.4	%
Resistance Change between +125 (+0 -3) °C and +22 ±3 °C	$\Delta R_A/R_A$	Para. 8.3.1.1 Note 1	TC = ±15 x 10^{-6}/°C TC = ±25 x 10^{-6}/°C TC = ±50 x 10^{-6}/°C	-0.159 -0.265 -0.53	+0.159 +0.265 +0.53	%

NOTES:

1. The measurements shall be performed on a sample of 5 components selected from the total production lot. The sample may be mounted as specified in the ESCC Generic Specification but then shall not form part of the delivery lot as mounting is considered to be destructive.

2.6 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	$\Delta R_A/R_A$	±(0.1+0.01Ω x 100/R_n)		%
Robustness of Terminations					
Initial Measurement	Resistance	R_A	Record Values		
Final Measurement	Change in Resistance	$\Delta R_A/R_A$	±(0.05+0.01Ω x 100/R_n)		%
Resistance to Soldering Heat					
Initial Measurement	Resistance	R_A	Record Values		
Final Measurement	Change in Resistance	$\Delta R_A/R_A$	±(0.02+0.01Ω x 100/R_n)		%
Solderability					
Initial Measurement	Resistance	R_A	Record Values		
Final Measurement	Change in Resistance	$\Delta R_A/R_A$	±(0.02+0.01Ω x 100/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+0.02Ω x 100/R_n)		%
	Insulation Resistance	R_I	1000	-	MΩ
Operating Life					
Initial Measurement (0 hour)	Resistance	R_A	Record Values		
Intermediate Measurements (1000 hours)	Change in Resistance	$\Delta R_A/R_A$	±(0.05+0.01Ω x 100/R_n)		%
Final Measurements (2000 hours)	Change in Resistance	$\Delta R_A/R_A$	±(0.1+0.02Ω x 100/R_n)		%
	Insulation Resistance	R_I	1000	-	MΩ

2.7 OPERATING LIFE CONDITIONS

Characteristics	Symbol	Condition	Unit
Ambient Temperature	T_{amb}	+70 ±3	°C
Test Voltage	V_T	$\sqrt{(P_n \times R_n)}$ or U_L, whichever is less	V