

Sectional specification: Fixed low power surface mounting (SMD) resistors

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EUROPEAN STANDARD

EN 140400

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Supersedes EN 140400:1996 + A1:2001

English version

**Sectional specification:
Fixed low power surface mount (SMD) resistors**

Spécification intermédiaire:
Résistances fixes à faible dissipation
pour montage en surface (CMS)

Rahmenspezifikation:
Oberflächenmontierbare Festwiderstände
(SMD) kleiner Belastbarkeit

iTeh STANDARD PREVIEW

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in two official versions (English, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

This European standard was prepared by the CENELEC Technical Committee CLC/TC 40XB, Resistors.

It is based, wherever possible, on the publications of the International Electrotechnical Commission and in particular on IEC 60115-8, Fixed resistors for use in electronic equipment.

This European Standard supersedes EN 140400:1996 + A1:2001.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 140400 on 2003-09-01.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2004-09-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2006-09-01

Annexes designated "normative" are part of the body of the standard.

Annexes designated "informative" are given for information only.

In this standard, Annexes A and C are normative and Annex B is informative.

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1 General

1.1 Scope

This sectional specification prescribes the preferred values for characteristics and ratings and also the inspection requirements for fixed surface mount resistors of assessed quality. These resistors generally have metallised connecting pads and are intended to be mounted directly on to substrates, for example hybrid integrated circuits or printed boards. It selects from the generic specification, EN 60115-1, the appropriate methods of test to be used in detail specifications derived from this specification.

Associated with this specification are one or more blank detail specifications each reference by an EN number. A blank detail specification which has been completed as specified in 1.2 of this specification forms a detail specification. Such detail specifications may be used for the grant of qualification approval to a resistor and for the performance of quality conformance inspection in accordance with the CECC system.

1.2 Information to be specified in the detail specification

Detail specifications shall be derived from the relevant blank detail specification.

Detail specifications shall not specify requirements inferior to those of the generic, sectional or blank detail specification. When more severe requirements are included, they shall be listed in a subclause of the detail specification and indicated in the test schedules, for example by an asterisk.

The following information shall be specified in each detail specification and the values quoted shall preferably be selected from those given in the appropriate clause of this document.

- a) Style and dimensions See 2.1.1 [SIST EN 140400:2004](https://standards.iteh.ai/catalog/standards/sist/aa253b87-3eab-4e34-99db-20483b7d2b1a/sist-en-140400-2004)
- b) Climatic category See 2.1.2 <https://standards.iteh.ai/catalog/standards/sist/aa253b87-3eab-4e34-99db-20483b7d2b1a/sist-en-140400-2004>

- c) Limits of resistance change after testing See 2.1.4

- d) Resistance range See 2.2.1

NOTE Where products approved to the detail specification may have different ranges, the following statement should be made:

The Register of Approval in each style is given in CECC 00 200.

- e) Tolerances on rated resistance See 2.2.2

NOTE Where products approved to the detail specification may have different ranges, the following statement should be made:

The Register of Approval in each style is given in CECC 00 200.

- f) Temperature characteristic of resistance See 2.1.3

The corresponding temperature coefficient of resistance may be quoted for information

For preferred combinations of temperature coefficient and tolerance on rated resistance see 2.2.7.

- g) Rated dissipation See 2.2.3.
The mounting conditions are as described in 2.3.3.
The information of the derating shall be given either in a diagram or in the form of a statement.
The detail specification shall state the maximum dissipation at temperatures other than 70 °C. All break points shall be verified by test.
- h) Limiting element voltage See 2.2.4.
- i) Insulation voltage (insulated styles only) See 2.2.17 of EN 60115-1 and 2.2.6
For small size resistors where the dimensions of the test jig given in 4.6 of EN 60115-1 are not adequate, they shall be specified in the detail specification.
- j) Insulation resistance (insulated styles only) See 2.2.5.
For small size resistors where the dimensions of the test jig given in 4.6 of EN 60115-1 are not adequate, they shall be specified in the detail specification.
- k) Marking Surface mount resistors are generally not marked on the body. However, if some marking is applied to the body, the resistor shall be marked with the rated resistance according to EN 60062, section 3 and as many of the remaining items listed in 2.4.1 of EN 60115-1. All the required information shall be marked on the package.
- l) Ordering information The detail specification shall specify that the following information is required when ordering resistors:
 - the number of the detail specification and style reference;
 - rated resistance according to EN 60062;
 - tolerance on rated resistance according to EN 60062;
 - temperature coefficient of resistance according to Table 2.

The detail specification may include additional information (which is not normally required to be verified by the inspection procedure), such as circuit diagrams, curves, drawings and notes needed for the clarification of the detail specification.

2 Preferred characteristics, ratings and severities for environmental and overload tests

2.1 Preferred characteristics

The values given in detail specifications shall preferably be selected from the following:

2.1.1 Style and dimensions

The preferred styles and dimensions are given in Table 1.

Table 1 - Preferred styles for cylindrical (RC) and rectangular (RR) non wire-wound resistors

Inch	Style Metric	Dimensions			
		Length <i>L</i> mm	Diameter <i>D</i> mm	Width <i>W</i> mm	Height <i>H</i> mm
–	RC 1610M	1,6 + 0,1/-0,05	1,0 + 0,15/-0,05	–	–
–	RC 2012M	2,0 ± 0,1	1,25 + 0,2/-0,1	–	–
–	RC 2211M	2,2 + 0/-0,3	1,1 + 0/-0,1	–	–
–	RC 3715M ^a	3,7 + 0/-0,4	1,5 + 0,1/-0,3	–	–
–	RC 6123M ^b	6,1 + 0/-0,9	2,3 + 0,2/-0,4	–	–
RR 0201	RR 0603M	0,6 ± 0,05	–	0,3 ± 0,05	0,25 ± 0,1
RR 0402	RR 1005M	1,0 ± 0,05	–	0,5 ± 0,05	0,3 + 0,1/-0,05
RR 0603	RR 1608M	1,6 ± 0,1	–	0,85 ± 0,1	0,45 ± 0,1
RR 0805	RR 2012M	2,0 ± 0,1	–	1,25 ± 0,1	0,50 ± 0,1
RR 1206	RR 3216M	3,2 ± 0,2	–	1,6 ± 0,15	0,55 ± 0,1
RR 1210	RR 3225M	3,2 ± 0,2	–	2,5 ± 0,2	0,55 ± 0,1
RR 2010	RR 5025M	5,0 ± 0,2	–	2,5 ± 0,2	0,55 ± 0,2
RR 2512	RR 6332M	6,3 ± 0,2	–	3,2 ± 0,2	0,55 ± 0,2

^a Comparable IEC style: 3514 (L = 3,5 ± 0,2 mm; D = 1,4 ± 0,2 mm)
^b Comparable IEC style: 5922 (L = 5,9 ± 0,2 mm; D = 2,2 + 0,3/-0,2 mm)

2.1.2 Preferred climatic categories

The resistors covered by the document are classified into climatic categories according to the general rules given in EN 60068-1, Annex A.

The lower and upper category temperature and the duration of the damp heat, steady state test shall be chosen from the following:

- SIST EN 140400:2004
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- lower category temperature (LCT): -55 °C; -40 °C; 20 °C and -10 °C;
 - upper category temperature (UCT): +70 °C; +85 °C; +125 °C; +155 °C; +175 °C; +200 °C;
 - duration of damp heat, steady state test: 10 days; 21 days; 56 days.

The severities for the cold and dry heat tests are the lower and upper category temperatures. For some resistors, these temperatures will occur between two of the preferred temperatures given in EN 60068-2-1 or EN 60068-2-2. In this case, the nearest preferred temperature within the category temperature range of the resistors shall be chosen for this severity.

NOTE The climatic performance of the resistor is greatly influenced by the circuit board, the assembly method and the final coating.

2.1.3 Temperature characteristics and temperature coefficients of resistance

The limits of change in resistance for the temperature characteristic of resistance test are given in Table 2.

Each line in Table 2 gives the preferred temperature coefficient and corresponding temperature characteristic for 20 °C to 70 °C and limits of change in resistance for the measurement of temperature characteristic of resistance (4.8 of EN 60115-1) on the basis of the category temperature ranges for 2.1.2 of this document.

Table 2 - Permitted change of resistance

Temperature coefficient (ppm/K)	Code	Limit of resistance change (%)									
		LCT / Reference temperature (°C)					Reference temperature / UCT (°C)				
		-55 / 20	-40 / 20	-20 / 20	-10 / 20	20 / 70	20 / 85	20 / 125	20 / 155	20 / 175	20 / 200
± 250	A	± 1,875	± 1,5	± 1	± 0,75	± 1,25	± 1,625	± 2,625	± 3,375	± 3,875	± 4,5
± 100	B	± 0,750	± 0,6	± 0,4	± 0,30	± 0,50	± 0,650	± 1,050	± 1,350	± 1,550	± 1,8
± 50	C	± 0,375	± 0,3	± 0,2	± 0,15	± 0,25	± 0,325	± 0,525	± 0,675	± 0,775	± 0,9
± 25	D	± 0,188	± 0,15	± 0,1	± 0,075	± 0,125	± 0,163	± 0,263	± 0,338	± 0,388	± 0,45
± 15	E	± 0,113	± 0,09	± 0,06	± 0,045	± 0,075	± 0,098	± 0,158	± 0,203	± 0,233	± 0,27
± 10	F	± 0,075	± 0,060	± 0,04	± 0,030	± 0,050	± 0,065	± 0,105	± 0,135	± 0,155	± 0,18
± 5	G	± 0,038	± 0,030	± 0,02	± 0,015	± 0,025	± 0,033	± 0,053	± 0,068	± 0,078	± 0,09
± 2	H	± 0,015	± 0,012	± 0,008	± 0,006	± 0,010	± 0,013	± 0,021	± 0,027	± 0,031	± 0,036
± 1	J	± 0,008	± 0,006	± 0,004	± 0,003	± 0,005	± 0,007	± 0,011	± 0,014	± 0,016	± 0,018

NOTE 1 The combination reference temperature / UCT of 20 °C / 70 °C describes also the temperature characteristic.

NOTE 2 Resistors having an upper category temperature of +85 °C need not be measured between 20 °C and 70 °C.

NOTE 3 If measurements are required at additional temperatures, these shall be specified in the detail specification.

2.1.4 Limits of change of resistance

Table 3 lists preferred limits for resistance change for all tests listed in the heading. To classify the performance of resistors, they will be assigned to stability classes as listed below.

Table 3 - Limits of change of resistance

Stability class	EN 60115-1, 4.23 Climatic sequence 4.24 Damp heat, steady state 4.25.3 Endurance at upper category temperature	EN 60115-1, 4.25.1 Endurance at 70 °C SIST EN 140400:2004 https://standards.iteh.ai/catalog/standards/sist/aa253b87-3eab-4e34-99db-20483b7d2b1a/sist-en-140400-2004	EN 60115-1, 4.13 Overload 4.18 Resistance to soldering heat 4.19 Rapid change of temperature 4.22 Vibration 4.33 Substrate bending test
5	±(5 % R + 0,1 Ω)	±(5 % R + 0,1 Ω)	±(10 % R + 0,1 Ω)
2	±(2 % R + 0,1 Ω)	±(2 % R + 0,1 Ω)	±(5 % R + 0,1 Ω)
1	±(1 % R + 0,05 Ω)	±(1 % R + 0,05 Ω)	±(2 % R + 0,05 Ω)
0,5	±(0,5 % R + 0,05 Ω)	±(0,5 % R + 0,05 Ω)	±(1 % R + 0,05 Ω)
0,25	±(0,25 % R + 0,05 Ω)	±(0,25 % R + 0,05 Ω)	±(0,5 % R + 0,05 Ω)
0,1	±(0,1 % R + 0,02 Ω)	±(0,1 % R + 0,02 Ω)	±(0,25 % R + 0,02 Ω)
0,05	±(0,05 % R + 0,01 Ω)	±(0,05 % R + 0,01 Ω)	±(0,1 % R + 0,01 Ω)
0,025	±(0,025 % R + 0,01 Ω)	±(0,025 % R + 0,01 Ω)	±(0,05 % R + 0,01 Ω)

2.2 Preferred values of ratings

The following values are preferred values to be used in the detail specification.

2.2.1 Rated resistance

See EN 60115-1, 2.3.2. and 0 Ω (Jumper).

2.2.2 Tolerances on rated resistance

The preferred tolerances on rated resistance are:

$\pm 10\%$; $\pm 5\%$; $\pm 2\%$; $\pm 1\%$; $\pm 0,5\%$; $\pm 0,25\%$; $\pm 0,1\%$; $\pm 0,05\%$; $\pm 0,02\%$; $\pm 0,01\%$; 0/-30%; 0/-20%; 0/-10% or 20 m Ω

NOTE 1 20 m Ω is intended to be used as the maximum residual resistance value for 0 Ω resistors.

NOTE 2 Asymmetric tolerances (e.g. 0/-20%) are intended to be used for laser trimmable resistors.

2.2.3 Rated dissipation (in the mounted state)

The preferred values of rated dissipation are:

0,016 W; 0,032 W; 0,05 W; 0,063 W; 0,1 W; 0,125 W; 0,25 W; 0,4 W; 0,5 W; 1 W; 2 W; 3 W

2.2.4 Limiting element voltage

The preferred values of limiting element voltage are:

12,5 V; 25 V; 50 V; 75 V; 100 V; 150 V; 200 V; 250 V; 300 V and 350 V d.c. or a.c.

2.2.5 Insulation resistance (insulated styles only)

The insulation resistance shall be not less than 1 G Ω after dry heat tests and not less than 100 M Ω after climatic tests.

2.2.6 Insulation voltage (insulated styles only)

The preferred values of insulation voltage are:

75 V; 100 V; 200 V; 300 V and 500 V d.c. or a.c. (peak).

2.2.7 Combinations of tolerance on rated resistance and temperature coefficient

The preferred combinations of tolerance on rated resistance and temperature coefficient are:

TC250 / 5%; TC100 / 1%; TC50 / 1%; TC25 / 0,5%; TC25 / 0,1%; TC15 / 0,1%

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NOTE TC250 = ± 250 ppm/K

2.3 Preferred test severities for environmental and overload tests

The severities given in detail specifications shall preferably be chosen from the following:

2.3.1 Drying

Procedure I of 4.3 of EN 60115-1 shall be used.

2.3.2 Overload (in the mounted state)

According to EN 60115-1, 4.13 with the following details:

Applied voltage: The detail specification shall state the applied voltage. Preferred values are $U = \sqrt{6,25 \cdot P_{70} \cdot R}$ or $U = 2 \cdot U_{\max}$, whichever is the less severe.

Duration: The detail specification shall state the load duration. Preferred values are 0,5 s; 1 s; 2 s; 5 s; 10 s. This time shall be fixed in such a way, that the maximum element temperature is $50\text{ }^{\circ}\text{C} \pm 20\text{ }^{\circ}\text{C}$ above the upper category temperature.

Mounting: See 2.3.3.

2.3.3 Mounting of components

Surface mount resistors shall be mounted on a test board with soldering pads as shown in Figure 1:

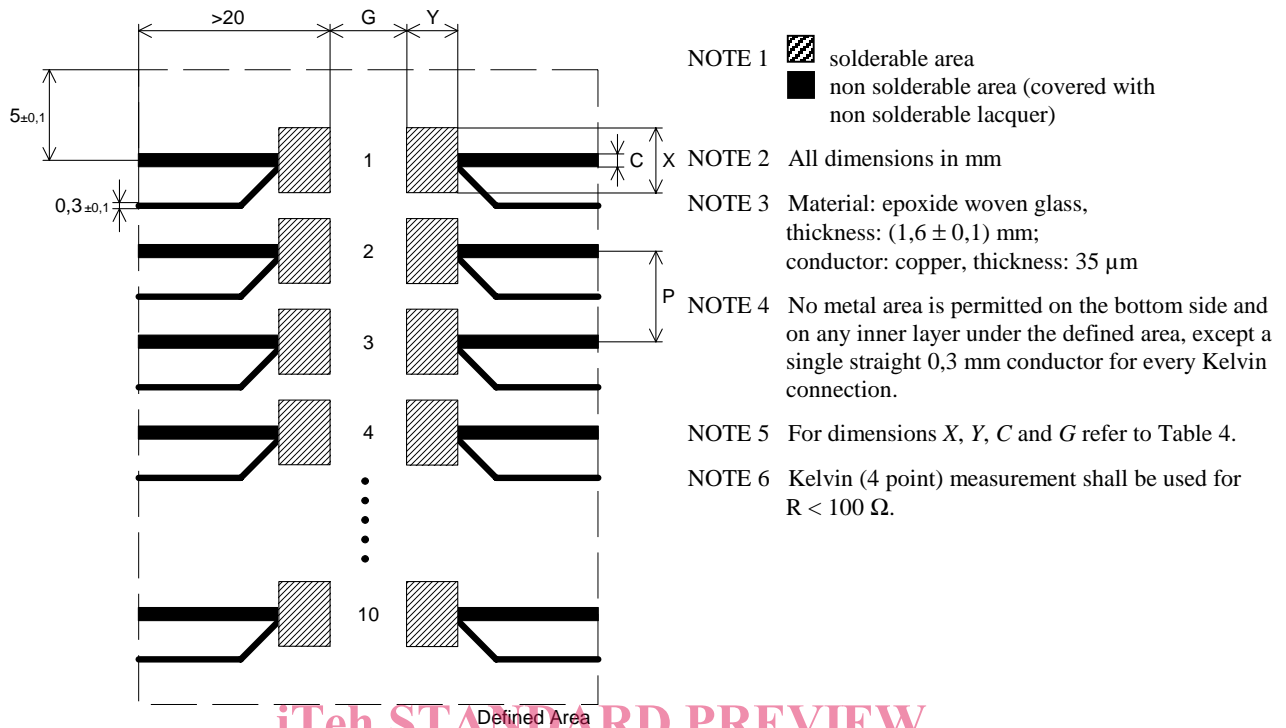


Figure 1 - Basic layout for mechanical, environmental and electrical tests

Table 4 - Soldering pad dimensions

Style	X mm	Y mm	G mm	P mm	C mm
RR 0603M	Under preparation				
RR 1005M	0,7	0,9	0,4	5,0	0,3
RR 1608M	1,0	1,1	0,6	5,0	0,5
RR 2012M, RC 2211M	1,5	1,3	0,6	5,0	2,0
RR 3216M, RC 3715M	2,0	1,6	1,5	5,0	2,0
RR 3225M	2,7	1,6	1,5	10,0	2,0
RR 5025M, RC 6123M	2,7	1,8	2,6	10,0	5,0
RR 6332M	3,4	1,8	3,8	10,0	5,0

Tolerance on dimensions: $\pm 0,1$ mm for styles larger than RR1608M, $\pm 0,05$ mm for styles RR1608M and smaller.

If necessary, the detail specification may provide a different material specification and basic layout.

3 Quality assessment procedures

3.1 General

See also EN 60115-1, 3.

3.1.1 Structurally similar components

See EN 60115-1, 3.4.

Structurally similar components are permitted to be used only for failure rate evaluation and determination.