IEC 60393-6

Edition 2.0 2015-12

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Potentiometers for use in electronic equipment –
Part 6: Sectional specification – Surface mount preset potentiometers

Potentiomètres utilisés dans les équipements électroniques –
Partie 6: Spécification intermédiaire – Potentiomètres d'ajustement pour montage en surface

IEC 60393-6:2015-12(en-fr)

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International Standard IEC 60393-6 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment.

This second edition cancels and replaces the first edition published in 2003 and constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) revision of the information on the assessment level EZ (zero nonconforming);
b) complete editorial revision.

The text of this standard is based on the following documents:

FDIS	Report on voting
40/2409/FDIS	40/2424/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This International Standard is to be used in conjunction with IEC 60393-1:2008.

A list of all parts in the IEC 60363 series, published under the general title *Potentiometers for use in electronic equipment*, can be found on the IEC website.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

POTENTIOMETERS FOR USE IN ELECTRONIC EQUIPMENT –

Part 6: Sectional specification – Surface mount preset potentiometers

1 General

1.1 Scope

This part of IEC 60393 applies to surface mount preset potentiometers for use in electronic equipment.

This part of IEC 60393 prescribes preferred ratings and characteristics and selects from IEC 60393-1, the appropriate quality assessment procedures, tests and measuring methods, and it gives general performance requirements for this type of potentiometers.

This standard gives the minimum performance requirements and test severities.

1.2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60062, *Marking code for resistors and capacitors*

IEC 60068-1:2013, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-1:2007, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-2:2007, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

IEC 60068-2-58:2004, *Environmental testing – Part 2-58: Tests – Test Td: Test methods for solderability, resistance to dissolution of metallization and to soldering heat of surface mounting devices (SMD)*

IEC 60286-3, *Packaging of components for automatic handling – Part 3: Packaging of surface mount components on continuous tapes*

IEC 60393-1:2008, *Potentiometers for use in electronic equipment – Part 1: Generic specification*

IEC 61193-2:2007, *Quality assessment systems – Part 2: Selection and use of sampling plans for inspection of electronic components and packages*

1.3 Information to be given in a detail specification

1.3.1 General

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 information given in 1.3.2 and 1.3.4 may, for convenience, be presented in tabular form.

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

1.3.2 Outline drawing and dimensions

The detail specification shall incorporate an illustration of the surface mount preset potentiometer as aid to easy recognition and for comparison of the surface mount potentiometer with others.

Dimensions and their associated tolerances, which affect interchangeability and mounting, shall be given in the detail specification. All dimensions shall be stated in millimetres.

Normally the numerical values shall be given for the length, width and thickness of the body.

Where space is insufficient to show the detail dimensions required for inspection purposes, such dimensions shall appear on the drawing forming an annex to the detail specification.

Recommended land patterns shall be given in the detail specification.

When the outline drawing is other than described above, the detail specification shall state such dimensional information as will adequately describe the surface mount potentiometer.

1.3.3 Mounting

The detail specification shall specify the method of mounting to be applied for the voltage proof and the insulation resistance tests and for the application of the vibration and bump or shock tests. The potentiometers shall be mounted by their normal means, but the design may be such that special mounting fixtures are required. In this case, the detail specification shall describe the mounting fixtures and they shall be used for voltage proof and the insulation resistance tests and for application of the vibration and shock tests. For the latter tests the mounting shall be such that there shall be no parasitic vibration.

Mounting for test and measurement purpose (when required) shall be in accordance with IEC 60393-1:2008, 4.47.

1.3.4 Style

See IEC 60393-1:2008, 2.2.2.

The style shall be presented by a double letter code e.g. AB, which is arbitrarily chosen for each detail specification.

The style designation, therefore, has no meaning unless the number of the detail specification is also given.

1.3.5 Resistance law

The resistance law is generally not verified. If required, the detail specification shall prescribe the measuring points and the associated limits for the output ratio and shall specify the position of the corresponding tests in the test schedules.

1.3.6 Ratings and characteristics

1.3.6.1 General

The ratings and characteristics shall be in accordance with the relevant clauses of this specification together with the following:

1.3.6.2 Nominal total resistance range

See IEC 60393-1:2008, 2.3.2.

When products approved according to the detail specification have different ranges, the following statement should be added:

The range of values available in each style is given in the register of approvals, available for example on the website http://www.iecq.org/.

The qualified products list “QPL” style is given in the register of approvals, available, for example, on the website as stated above.

1.3.6.3 Particular characteristics

Additional characteristics may be listed, when they are considered necessary to specify adequately the component for design and application purposes.

1.3.6.4 Soldering

The detail specification shall prescribe the test methods, severity and requirements applicable for the solderability and the resistance to soldering heat tests.

1.3.7 Marking

The detail specification shall specify the content of the marking on the surface mount preset potentiometer and on the package. Deviation from 1.4 shall be specifically stated.

Surface mount preset potentiometers are generally not marked on the body. If some marking can be applied, the surface mount preset potentiometer shall be clearly marked with the nominal total resistance and many of the remaining items in IEC 60393-1:2008, 2.4.

All items shall be marked on the package.

1.3.8 Ordering information

The detail specification shall indicate that the following information, in clear or in coded form, is required when ordering:

a) nominal total resistance and tolerance on nominal total resistanc;

b) number and issue reference of the detail specification and style reference.

1.3.9 Additional information (not for inspection purposes)

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

1.3.10 Packaging

If taping is applied, taping shall be in accordance with IEC 60286-3.

1.4 Marking

1.4.1 General

When coding is used for nominal total resistance, tolerance and date of manufacture, the method shall be selected from those given in IEC 60062.

The information given in the marking is normally selected from the following list; the relative importance of each item is indicated by position in the list:

a) nominal total resistance;
b) tolerance on nominal total resistance;
c) detail specification and style reference;
d) year and month (or week) of manufacture;
e) manufacturer's name and/or trademark;
f) manufacture's type designation.

1.4.2 Marking for potentiometers

The potentiometer shall be clearly marked a) and b) of 1.4.1 and with as many of the remaining items as is practicable. Any duplication of information in the marking of the potentiometer should be avoided.

1.4.3 Marking for packaging

The package containing the potentiometer(s) shall be clearly marked with all the information listed in 1.4.1 and below.

a) quantity
b) country origin

1.4.4 Additional marking

Any additional marking shall be applied in such a way that no confusion can arise.

2 Preferred ratings, characteristics and test severities

2.1 Preferred characteristics

2.1.1 General

The values given in the detail specification shall preferably be selected from the following.

2.1.2 Preferred climatic categories

The surface mount preset potentiometers covered by this standard are classified into climatic categories according to the general rules given in IEC 60068-1:2013, Annex A.

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

Lower category temperature: –65 °C, –55 °C, –40 °C, –25 °C and –10 °C

Upper category temperature: +70 °C, +85 °C, +100 °C, +125 °C and +155 °C

Duration of the damp heat, steady state test: 4, 10, 21 and 56 days.

The severities for the cold and dry heat tests are the lower and upper category temperatures respectively. Because of the construction of some surface mount preset potentiometers these temperatures will occur between two of the preferred temperatures given in IEC 60068-2-1:2007 and IEC 60068-2-2:2007. In this case, the nearest preferred temperature within the actual temperature range of the surface mount preset potentiometer shall be chosen for this severity.

2.1.3 Temperature coefficients and temperature characteristics of resistance

The preferred limits of change in resistance for the temperature characteristics of resistance are given in Table 1.

Each line in the table gives the preferred temperature coefficient and corresponding temperature characteristics for 20 °C to 70 °C and limits of change in resistance for the measurement of the temperature characteristics of resistance (see IEC 60393-1:2008, 4.14) on the basis of the category temperature ranges of 2.1.2.

Table 1 – Temperature coefficients and temperature characteristics of resistance

Temperature coefficients of resistance 10^{-6}/K	**Temperature characteristics of resistance** %	**Temperature characteristics of resistance (limits of resistance change in percentage change)** %							
		Reference temperature/ lower category temperature [b] °C				**Reference temperature/ upper category temperature** [b] °C			
20 °C / 70 °C		+20/–65	+20/–55	+20/–40	+20/–25	+20/+85[a]	+20/+100	+20/+125	+20/+155
±1 000	±5	±8,5	±7,5	±6	±4,5	±6,5	±8	±10,5	±13,5
±750	±3,75	±6,4	±5,63	±4,5	±3,38	±4,88	±6	±7,88	±10,13
±500	±2,5	±4,3	±3,75	±3	±2,25	±3,25	±4	±5,25	±6,75
±250	±1,25	±2,15	±1,88	±1,5	±1,13	±1,62	±2	±2,62	±3,38
±150	±0,75	±1,3	±1,15	±0,9	±0,68	±0,98	±1,2	±1,6	±2,05
±100	±0,5	±0,85	±0,75	±0,6	±0,45	±0,65	±0,8	±1,05	±1,35
±50	±0,25	±0,43	±0,375	±0,3	±0,23	±0,325	±0,4	±0,525	±0,675
±25	±0,125	±0,215	±0,188	±0,15	±0,113	±0,162	±0,2	±0,262	±0,34

[a] Potentiometers having an upper category temperature of +85 °C need not be measured between 20 °C and 70 °C.

[b] If measurements are required at additional temperatures, they shall be specified in the detail specification.

2.1.4 Limits for change in resistance or output voltage ratio

For each stability class the preferred limits for change in resistance or output voltage ratio in each of the tests listed in the heading of Table 2 are as indicated in the lines of the table.

Table 2 – Limits for change in resistance or output voltage ratio

Stability class %	4.38 Climatic sequence 4.39 Damp heat, steady state 4.40 Mechanical endurance 4.43.2 Electrical endurance at 70 °C 4.43.3 Electrical endurance at upper category temperature	4.34 Change of temperature	4.48 Shear (adhesion) 4.49 Substrate bending test 4.51 Resistance to soldering heat 4.35 Vibration 4.37 Shock	4.43.2 Electrical endurance at 70 °C 4.43.3 Electrical endurance at upper category temperature	4.22 Thrust and pull on shaft 4.34 Change of temperature	4.35 Vibration 4.37 Shock
	ΔR between terminals a and c [b]			ΔR between terminals a and b [b]	$\Delta \frac{U_{ab}}{U_{ac}}$ [a]	
10	±(10 % R +0,5 Ω)	±(5 % R +0,1 Ω)	±(5 % R +0,1 Ω)	±(15 %+0,5 Ω)	±5 %	±7,5 %
5	±(5 % R +0,1 Ω)	±(3 % R +0,1 Ω)	±(2 % R +0,1 Ω)	±(7,5 %+0,1 Ω)	±2 %	±3 %
3	±(3 % R +0,1 Ω)	±(2 % R +0,1 Ω)	±(1 % R +0,05 Ω)	±(5 %+0,1 Ω)	±1 %	±2 %
2	±(2 % R +0,1 Ω)	±(2 % R +0,1 Ω)	±(1 % R +0,05 Ω)	±(3 %+0,1 Ω)	±1 %	±2 %
The subclause numbers in the table refer to IEC 60393-1:2008.						

[a] The setting stability (change in the output voltage ratio) $\Delta \frac{U_{ab}}{U_{ac}}$ shall be expressed in percent of the total applied voltage.

[b] ΔR indicates the value of change in resistance.

2.1.5 Total mechanical travel

The preferred values shall be:

a) for single turn rotary surface mount preset potentiometers:
the angle shall be specified in the detail specification,

b) for lead screw actuated surface mount preset potentiometers:
2 to 22 turns.

2.2 Preferred values of ratings

2.2.1 General

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

2.2.2 Nominal total resistance

See IEC 60393-1:2008, 2.3.2.

2.2.3 Tolerances on nominal total resistance

The preferred tolerances on nominal total resistance are:

±30 %; ±25 %; ±20 % and ±10 %.

2.2.4 Rated dissipation (in the mounted state)

The preferred values of rated dissipation at 70 °C are

0,05 W, 0,063 W, 0,1 W, 0,125 W, 0,15 W, 0,2 W, 0,25 W, 0,3 W, 0,5 W, 0,75 W and 1 W.

The detail specification shall specify the conditions under which the rated dissipation applies.

The derated values of dissipation at temperatures in excess of 70 °C shall be as indicated by the curve as shown in Figure 1.

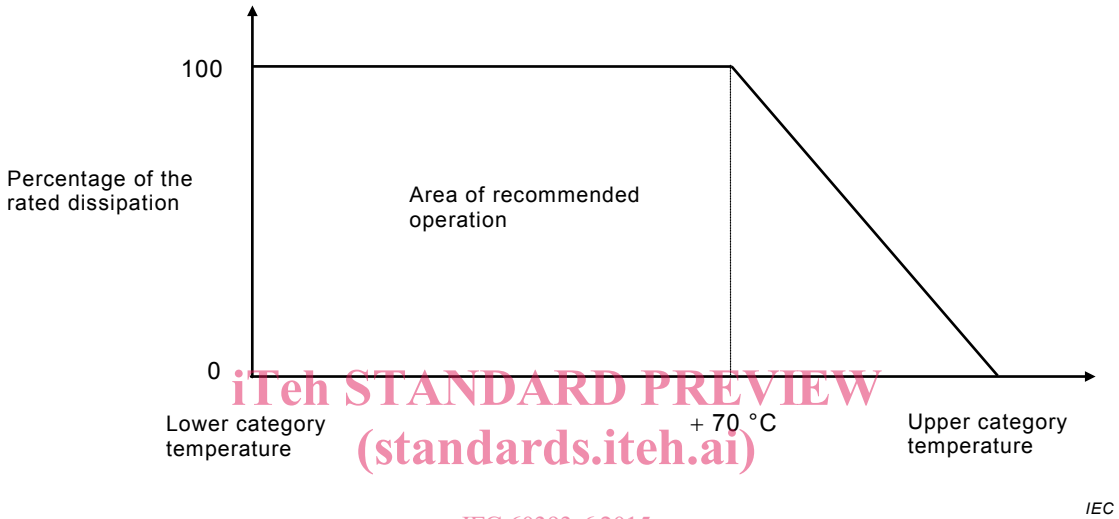

Figure 1 – Rated dissipation curve

A smaller (or larger) area of operation may be given in the detail specification. In this event the detail specification shall state the maximum allowable dissipation at temperatures other than 70 °C. All break points on the curve shall be verified by test.

An example of a derating curve having a smaller area of operation is given in Figure 2.

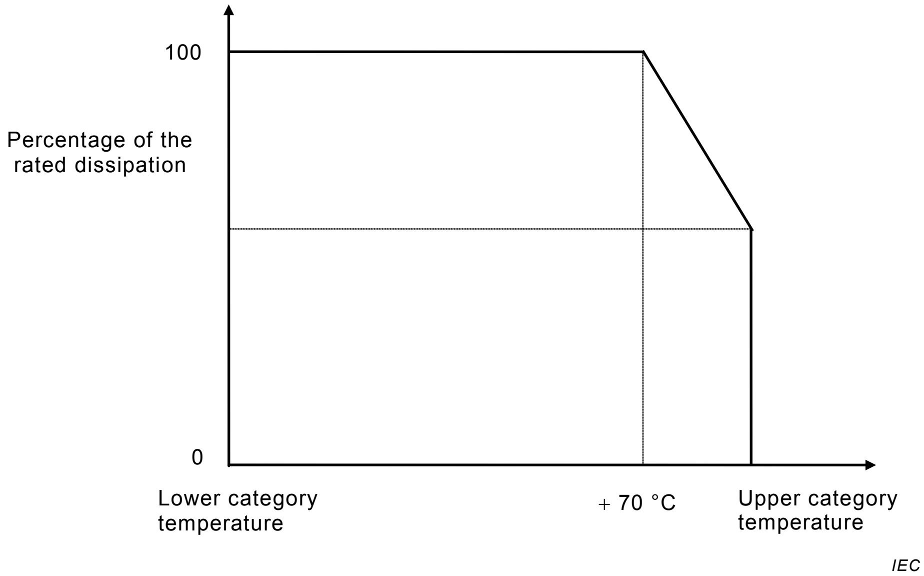

Figure 2 – Rated dissipation curve with smaller area of operation

2.2.5 Limiting element voltage

The preferred values of limiting element voltage d.c. or a.c. (r.m.s.) are

15 V, 30 V, 50 V, 75 V, 100 V, 125 V, 150 V, 200 V, 250 V and 300 V.

2.2.6 Insulation voltage (for insulated styles)

The detail specification shall prescribe the value of the insulation voltage, rounded off to the nearest 10 V. The numerical value of the insulation voltage shall be

normal air pressure: ≥1,42 times the limiting element voltage.

low air pressure (at 8 kPa): ≥two-thirds the value at normal air pressure.

2.2.7 Limits for insulation resistance (for insulated styles)

Unless otherwise specified in the detail specification the insulation resistance shall be not less than 1 GΩ after dry heat tests and 100 MΩ after humidity tests.

2.3 Preferred test severities

2.3.1 General

Test severities given in the detail specification shall preferably be selected from the following.

2.3.2 Drying

Procedure 1 of IEC 60393-1:2008, 4.3, shall be used.

2.3.3 Vibration

See IEC 60393-1:2008, 4.35, with the following details:

Frequency range: 10 Hz to 55 Hz, or
10 Hz to 500 Hz, or
10 Hz to 2 000 Hz.