

**CPC****COOPERATIVE PATENT CLASSIFICATION****H01C****RESISTORS****NOTE**

In this subclass, the term "adjustable" means mechanically adjustable.

Variable resistors, the value of which is changed non-mechanically, e.g. by voltage or temperature, are classified in group [H01C 7/00](#).

**H01C 1/00****Details****H01C 1/01**

. Mounting; Supporting

**H01C 1/012**

.. the base extending along and imparting rigidity or reinforcement to the resistive element ([H01C 1/016](#) takes precedence; the resistive element being formed in two or more coils or loops as a spiral, helical or toroidal winding [H01C 3/18](#), [H01C 3/20](#); the resistive element being formed as one or more layers or coatings on a base [H01C 7/00](#))

**H01C 1/014**

.. the resistor being suspended between and being supported by two supporting sections ([H01C 1/016](#) takes precedence)

**H01C 1/016**

.. with compensation for resistor expansion or contraction

**H01C 1/02**

. Housing; Enclosing; Embedding; Filling the housing or enclosure

**H01C 1/022**

.. the housing or enclosure being openable or separable from the resistive element

**H01C 1/024**

.. the housing or enclosure being hermetically sealed ([H01C 1/028](#), [H01C 1/032](#), [H01C 1/034](#) take precedence)

**H01C 1/026**

... with gaseous or vacuum spacing between the resistive element and the housing or casing

**H01C 1/028**

.. the resistive element being embedded in insulation with outer enclosing sheath

**H01C 1/03**

... with powdered insulation

**H01C 1/032**

.. plural layers surrounding the resistive element ([H01C 1/028](#) takes precedence)

**H01C 1/034**

.. the housing or enclosure being formed as coating or mold without outer sheath ([H01C 1/032](#) takes precedence)

**H01C 1/036**

... on wound resistive element

**H01C 1/04**

. Arrangements of distinguishing marks, e.g. colour coding

**H01C 1/06**

. Electrostatic or electromagnetic shielding arrangements

**H01C 1/08**

. Cooling, heating or ventilating arrangements

**H01C 1/082**

.. using forced fluid flow

**H01C 1/084**

.. using self-cooling, e.g. fins, heat sinks

**H01C 1/12**

. Arrangements of current collectors

**H01C 1/125**

.. of fluid contacts

**H01C 1/14**

. Terminals or tapping points {or electrodes} specially adapted for resistors (in general [H01R](#)); Arrangements of terminals or tapping points {or electrodes} on resistors

**H01C 1/1406**

.. {Terminals or electrodes formed on resistive elements having positive temperature coefficient}

- H01C 1/1413 . . {Terminals or electrodes formed on resistive elements having negative temperature coefficient}
- H01C 1/142 . . the terminals or tapping points being coated on the resistive element
- H01C 1/144 . . the terminals or tapping points being welded or soldered
- H01C 1/146 . . the resistive element surrounding the terminal
- H01C 1/148 . . the terminals embracing or surrounding the resistive element ([H01C 1/142 takes precedence](#))
- H01C 1/16 . Resistor networks not otherwise provided for

### **H01C 3/00 Non-adjustable metal resistors made of wire or ribbon, e.g. coiled, woven or formed as grids**

- H01C 3/005 . {Metallic glasses therefor}
- H01C 3/02 . arranged or constructed for reducing self-induction, capacitance or variation with frequency
- H01C 3/04 . Iron-filament ballast resistors; Other resistors having variable temperature coefficient
- H01C 3/06 . Flexible or folding resistors, whereby such a resistor can be looped or collapsed upon itself
- H01C 3/08 . Dimension or characteristic of resistive element changing gradually or in discrete steps from one terminal to another
- H01C 3/10 . the resistive element having zig-zag or sinusoidal configuration
- H01C 3/12 . . Lying in one plane
- H01C 3/14 . the resistive element being formed in two or more coils or loops continuously wound as a spiral, helical or toroidal winding ([H01C 3/02 to H01C 3/12 take precedence](#))
- H01C 3/16 . . including two or more distinct wound elements or two or more winding patterns
- H01C 3/18 . . wound on a flat or ribbon base ([H01C 3/16 takes precedence](#))
- H01C 3/20 . . wound on cylindrical or prismatic base ([H01C 3/16 takes precedence](#))

### **H01C 7/00 Non-adjustable resistors formed as one or more layers or coatings; Non-adjustable resistors made from powdered conducting material or powdered semi-conducting material with or without insulating material** ([consisting of loose powdered or granular material H01C 8/00; { measuring deformation in a solid state using the change in resistance formed by printed-circuit technique G01B 7/20; insulating materials H01B 3/00; passive thin-film or thick-film semiconductor or solid state devices H01L 27/00; resistors without a potential-jump or surface barrier specially adapted for integrated circuits, details thereof, multistep manufacturing processes therefor H01L 28/20}; resistors with a potential-jump barrier or surface barrier, e.g. field effect resistors H01L 29/00; semiconductor devices sensitive to electro-magnetic or corpuscular radiation, e.g. photoresistors, H01L 31/00; devices using superconductivity H01L 39/00; devices using galvanomagnetic or similar magnetic effects, e.g. magnetic-field-controlled resistors, H01L 43/00; solid state devices for rectifying, amplifying, oscillating or switching without a potential-jump barrier or surface barrier H01L 45/00; bulk negative resistance effect devices H01L 47/00; { ohmic resistance heating H05B 3/00; printed circuits H05K}](#)) **[m1112]**

- H01C 7/001 . {Mass resistors}
- H01C 7/003 . {Thick film resistors}
- H01C 7/005 . . {Polymer thick films}
- H01C 7/006 . {Thin film resistors}

- H01C 7/008 . {Thermistors ([H01C 7/02](#) to [H01C 7/06](#) take precedence)}
- H01C 7/02 . having positive temperature coefficient {(ceramics [C04B](#))}
- H01C 7/021 .. {formed as one or more layers or coatings}
- H01C 7/022 .. {mainly consisting of non-metallic substances ([H01C 7/021](#) takes precedence)}
- H01C 7/023 ... {containing oxides or oxidic compounds, e.g. ferrites}
- H01C 7/025 .... {Perovskites, e.g. titanates}
- H01C 7/026 .... {Vanadium oxides or oxidic compounds, e.g. VOx}
- H01C 7/027 .. {consisting of conducting or semi-conducting material dispersed in a non-conductive organic material}
- H01C 7/028 .. {consisting of organic substances}
- H01C 7/04 . having negative temperature coefficient {(thermometers using resistive elements [G01K 7/16](#))}
- H01C 7/041 .. {formed as one or more layers or coatings}
- H01C 7/042 .. {mainly consisting of inorganic non-metallic substances ([H01C 7/041](#) takes precedence)}

#### **NOTE**

In groups [H01C 7/043](#) to [H01C 7/049](#), in the absence of an indication to the contrary, classification is made in the last appropriate place

- H01C 7/043 ... {Oxides or oxidic compounds}
- H01C 7/044 .... {Zinc or cadmium oxide}
- H01C 7/045 .... {Perovskites, e.g. titanates}
- H01C 7/046 .... {Iron oxides or ferrites}
- H01C 7/047 .... {Vanadium oxides or oxidic compounds, e.g. VOx}
- H01C 7/048 ... {Carbon or carbides}
- H01C 7/049 .. {mainly consisting of organic or organo-metal substances ([H01C 7/041](#) takes precedence)}
- H01C 7/06 . including means to minimise changes in resistance with changes in temperature
- H01C 7/10 . voltage responsive, i.e. varistors
- H01C 7/1006 .. {Thick film varistors}
- H01C 7/1013 .. {Thin film varistors}
- H01C 7/102 .. Varistor boundary, e.g. surface layers ([H01C 7/12](#) takes precedence)
- H01C 7/105 .. Varistor cores ([H01C 7/12](#) takes precedence)
- H01C 7/108 ... Metal oxide
- H01C 7/112 .... ZnO type
- H01C 7/115 .... Titanium dioxide- or titanate type
- H01C 7/118 ... Carbide, e.g. SiC type
- H01C 7/12 .. Overvoltage protection resistors {(series resistors structurally associated with spark gaps [H01T 1/16](#))}
- H01C 7/123 ... {Arrangements for improving potential distribution}

H01C 7/126 . . . {Means for protecting against excessive pressure or for disconnecting in case of failure}

H01C 7/13 . current responsive

#### **NOTE**

Groups [H01C 7/02](#) to [H01C 7/13](#) take precedence over groups [H01C 7/18](#) to [H01C 7/22](#).

H01C 7/18 . comprising a plurality of layers stacked between terminals

H01C 7/20 . the resistive layer or coating being tapered

H01C 7/22 . Elongated resistive element being bent or curved, e.g. sinusoidal, helical

#### **H01C 8/00 Non-adjustable resistors consisting of loose powdered or granular conducting, or powdered or granular semi-conducting material**

H01C 8/02 . Coherers or like imperfect resistors for detecting electromagnetic waves

H01C 8/04 . Overvoltage protection resistors; Arresters

#### **H01C 10/00 Adjustable resistors**

H01C 10/005 . {Surface mountable, e.g. chip trimmer potentiometer}

H01C 10/02 . Liquid resistors

H01C 10/025 . . {Electrochemical variable resistors (trimming resistors by electrolytic treatment [H01C 17/2412](#), [H01C 17/262](#))}

H01C 10/04 . with specified mathematical relationship between movement of resistor actuating means and value of resistance, other than direct proportional relationship

H01C 10/06 . adjustable by short-circuiting different amounts of the resistive element

H01C 10/08 . . with intervening conducting structure between the resistive element and the short-circuiting means, e.g. taps

H01C 10/10 . adjustable by mechanical pressure of force

H01C 10/103 . . {by using means responding to magnetic or electric fields, e.g. by addition of magnetisable or piezoelectric particles to the resistive material, or by an electromagnetic actuator}

H01C 10/106 . . {on resistive material dispersed in an elastic material ([H01C 10/103](#) and [H01C 10/12](#) take precedence; for electric switches [H01H 1/029](#))}

H01C 10/12 . . by changing surface pressure between resistive masses or resistive and conductive masses, e.g. pile type

H01C 10/14 . adjustable by auxiliary driving means

H01C 10/16 . including plural resistive elements

H01C 10/18 . . including coarse and fine resistive elements

H01C 10/20 . . Contact structure or movable resistive elements being ganged

H01C 10/22 . resistive element dimensions changing gradually in one direction, e.g. tapered resistive element ([H01C 10/04](#) takes precedence)

H01C 10/23 . resistive element dimensions changing in a series of discrete, progressive steps

H01C 10/24 . the contact moving along turns of a helical resistive element, or vice versa

- H01C 10/26 . resistive element moving ([H01C 10/16](#), [H01C 10/24](#) take precedence)

**NOTE**

Groups [H01C 10/02](#) to [H01C 10/26](#) take precedence over groups [H01C 10/28](#) to [H01C 10/50](#).

- H01C 10/28 . the contact rocking or rolling along resistive element or taps
- H01C 10/30 . the contact sliding along resistive element
- H01C 10/301 .. {consisting of a wire wound resistor}
- H01C 10/303 ... {the resistor being coated, e.g. lubricated, conductive plastic coated, i.e. hybrid potentiometer}
- H01C 10/305 .. {consisting of a thick film}
- H01C 10/306 ... {Polymer thick film, i.e. PTF}
- H01C 10/308 .. {consisting of a thin film}
- H01C 10/32 .. the contact moving in an arcuate path
- H01C 10/34 ... the contact or the associated conducting structure riding on collector formed as a ring or portion thereof
- H01C 10/345 .... {the collector and resistive track being situated in 2 parallel planes}
- H01C 10/36 ... structurally combined with switching arrangements
- H01C 10/363 .... {by axial movement of the spindle, e.g. pull-push switch ([H01C 10/366](#) takes precedence)}
- H01C 10/366 .... {using an electromagnetic actuator}
- H01C 10/38 .. the contact moving along a straight path
- H01C 10/40 ... screw operated
- H01C 10/42 .... the contact bridging and sliding along resistive element and parallel conducting bar or collector
- H01C 10/44 ... the contact bridging and sliding along resistive element and parallel conducting bar or collector ([H01C 10/42](#) takes precedence)
- H01C 10/46 . Arrangements of fixed resistors with intervening connectors, e.g. taps ([H01C 10/28](#), [H01C 10/30](#) take precedence)
- H01C 10/48 .. including contact movable in an arcuate path
- H01C 10/50 . structurally combined with switching arrangements ([H01C 10/36](#) takes precedence)

**H01C 11/00 Non-adjustable liquid resistors**

**H01C 13/00 Resistors not provided for elsewhere**

- H01C 13/02 . Structural combinations of resistors ([impedance networks per se H03H](#))

**H01C 17/00 Apparatus or processes specially adapted for manufacturing resistors (providing fillings for housings or enclosures [H01C 1/02](#); reducing insulation surrounding a resistor to powder [H01C 1/03](#); manufacture of thermally variable resistors [H01C 7/02](#), [H01C 7/04](#))**

- H01C 17/003 . {using lithography, e.g. photolithography (lithographic compositions and processing in general [G03F](#))}
- H01C 17/006 . {adapted for manufacturing resistor chips}
- H01C 17/02 . adapted for manufacturing resistors with envelope or housing

H01C 17/04	. adapted for winding the resistive element
H01C 17/06	. adapted for coating resistive material on a base
H01C 17/065	.. by thick film techniques, e.g. serigraphy
H01C 17/06506	... {Precursor compositions therefor, e.g. pastes, inks, glass frits}
H01C 17/06513	.... {characterised by the resistive component}
H01C 17/0652	..... {containing carbon or carbides}
H01C 17/06526	..... {composed of metals}
H01C 17/06533	..... {composed of oxides}
H01C 17/0654	..... {Oxides of the platinum group}
H01C 17/06546	..... {Oxides of zinc or cadmium}
H01C 17/06553	..... {composed of a combination of metals and oxides}
H01C 17/0656	..... {composed of silicides ( <a href="#">H01C 17/0652</a> takes precedence)}
H01C 17/06566	..... {composed of borides ( <a href="#">H01C 17/0652</a> takes precedence)}
H01C 17/06573	.... {characterised by the permanent binder}
H01C 17/0658	..... {composed of inorganic material}
H01C 17/06586	..... {composed of organic material}
H01C 17/06593	.... {characterised by the temporary binder}
H01C 17/07	.. by resistor foil bonding, e.g. cladding
H01C 17/075	.. by thin film techniques ( <a href="#">H01C 17/20</a> takes precedence)}
H01C 17/08	... by vapour deposition
H01C 17/10	... by flame spraying
H01C 17/12	... by sputtering
H01C 17/14	... by chemical deposition
H01C 17/16	.... using electric current
H01C 17/18	.... without using electric current
H01C 17/20	.. by pyrolytic processes
H01C 17/22	. adapted for trimming
H01C 17/23	.. by opening or closing resistor geometric tracks of predetermined resistive values, {e.g. snapistors}
H01C 17/232	.. Adjusting the temperature coefficient; Adjusting value of resistance by adjusting temperature coefficient of resistance
H01C 17/235	.. Initial adjustment of potentiometer parts for calibration
H01C 17/24	.. by removing or adding resistive material ( <a href="#">H01C 17/23</a> , <a href="#">H01C 17/232</a> , <a href="#">H01C 17/235</a> take precedence)
H01C 17/2404	... {by charged particle impact e.g. by electron or ion beam milling, sputtering, plasma etching}
H01C 17/2408	... {by pulsed voltage erosion, e.g. spark erosion}
H01C 17/2412	... {by electrolytic treatment e.g. electroplating (for anodic oxydation <a href="#">H01C 17/262</a> )}
H01C 17/2416	... {by chemical etching}
H01C 17/242	... by laser {(trimming by laser in general <a href="#">B23K 26/0003</a> )}

- H01C 17/245 . . . by mechanical means, e.g. sand blasting, cutting, ultrasonic treatment
- H01C 17/26 . . by converting resistive material
- H01C 17/262 . . . {by electrolytic treatment, e.g. anodic oxydation}
- H01C 17/265 . . . {by chemical or thermal treatment, e.g. oxydation, reduction, annealing (etching [H01C 17/2416](#))}
- H01C 17/267 . . . . {by passage of voltage pulses or electric current}
- H01C 17/28 . . adapted for applying terminals
- H01C 17/281 . . {by thick film techniques}
- H01C 17/283 . . . {Precursor compositions therefor, e.g. pastes, inks, glass frits}
- H01C 17/285 . . . . {applied to zinc or cadmium oxide resistors}
- H01C 17/286 . . . . {applied to  $\text{TiO}_2$  or titanate resistors}
- H01C 17/288 . . {by thin film techniques}
- H01C 17/30 . . adapted for baking