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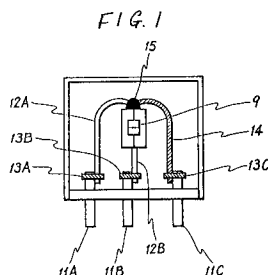
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KILBURN & STRODE 30 John Street
London WC1N 2DD(GB)(54) **SURGE-ABSORBING ELEMENT FOR PROTECTION AGAINST OVERVOLTAGE AND OVERCURRENT.**

(57) A surge-absorbing element with a function of protection from overvoltage and overcurrent in which a metal wire mechanically and elastically deformed and having high rigidity is joined with a low-melting metal to a terminal or to a lead wire of a gap-type or microgap-type surge-absorbing element. In case the surge-absorbing element generates heat due to overvoltage and overcurrent, the low-melting metal melts, the elastically deformed rigid metal wire separates from the terminal or lead wire, and the connection is broken. The rigid metal wire is connected in series with the surge-absorbing element and a device or a circuit that is to be protected.



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FIELD OF ART

The present invention relates to a surge absorbing component for protecting semiconductor circuit or a telephone line from a lightening surge and overvoltage or overcurrent, which can avoid firing and overheat of the circuit substrate, even when overvoltage or overcurrent is applied to the circuit.

BACKGROUND OF THE ART

A surge absorber is to protect an equipment such as a communication line, e.g. a telephone line for telephone and telecopier, and a line for a cable television and a cable radio and the like, as well as a device, e.g. semiconductor device, from a lightening surge.

A protection function of the surge absorber is to protect a communication device connecting communication lines when the communication line interconnects the source line to load overcurrent or overvoltage on the line, which will heat the breaker fuse wire so as to melt the wire, thereby opening the circuit to protect the equipment from the overcurrent and overvoltage. In the conventional surge absorber having function to protect from overcurrent and overvoltage, a low melting point metal wire is only surrounding the surge absorber within inorganic material housing. Connecting terminals are provided at the both of the ends of the inorganic material housing of the surge absorber.

Further, there have been published Japanese Patent Publication No. 63-205026/1988 and Japanese Patent Application No. 61-152703 as measures to resolve the case where the short-circuit with source occurs, which disclose a method of preventing overheat and fire of a surge absorbing element by contacting a low- melting point metal wire with the surface of a microgap surge absorbing element so that the heat generated by overvoltage or overcurrent charged in the surge absorbing element will melt easily and rapidly the low melting point wire, thereby, making to open the circuit. The structure of mounting the low melting point metal wire on the surface of the surge absorbing element is housed within a case of inorganic material.

In this structure, a temperature fuse or low melting point metal wire is mounted in contact with the surface of the surge absorbing element call protect the surge absorbing element and the equipment to be connected. The heat generated on the surface thereof by the overheat of the surge absorbing element will melt the fuse or low melting point metal wire, making to open the circuit. Therefore, the conventional structure will require complete melting down of the temperature fuse or the low melting point metal wire so as to made open the circuit. It takes relatively longer time to attain complete melting down of the fuse or the low melting point metal wire.

Such component of the conventional structure has three or four external terminals, and one or two terminals among these one are in form of wire, and then, the connecting position is unstable, and not easy to be assembled. Further, a cover glass tube which is disclosed in Japanese Patent Publication No. 63-205026/1988, will be naked and directly in contact with a substrate when assembled in the circuit. Therefore, when the overcurrent or overvoltage is continuously applied to the component, the surge absorbing element located within a hollow of a cover glass is heated and then the low melting point metal wire is broken by the heat generated in the surge absorbing element. The cover glass tube is heated through such phenomenon, so that the substrate as assembled within a hollow of cover glass is affected by such heat(exothermal and generating smoke) and in some cases would be fired.

DISCLOSURE OF INVENTION

With the foregoing considerations in mind, the present invention contemplates the provision of an improved surge absorbing component.

with shorter time of making open the circuit. For the contemplated component, a metal with high stiffness modulus which has been elastically deformed is used to be mounted on the electrodes or the leads of the surge absorbing element, by using low melting point metal wire, and then, the heat generated by application of continuous overvoltage or overcurrent will melt the low melting point metal connecting the stiff metal wire and the lead of the element, and the metal wire with high stiffness which has been deformed will be returned to original shape, and thereby leaving rapidly the connection point (the lead of the element). Therefore, the protective surge absorbing component with rapid response can be attained, and then the safety of the surge absorbing component can be improved. That is, the structure of the present invention can enable to make open the circuit as soon as possible after the low melting point metal is melt, because the metal wire with high stiffness which has elastically deformed and fixed on the terminal of the element will be returned mechanically and rapidly into original shape, by its elasticity, at the time when the low

melting point metal is melt by the heat generated by the surge absorbing element when overvoltage or overcurrent is applied to.

"A surge absorbing component" hereinafter means "an equipment to avoid application of overvoltage and overcurrent by providing a gap or microgap on a portion of conductive thin film, such that discharge will occur through the gap or microgap, when overvoltage higher than optical level is applied on the gap or microgap, generating a branch flow for the overvoltage or overcurrent", and in ordinal structure, the conductive film having the gap or the microgap is enclosed and sealed in gas-charged tube. Therefore, it can be called a gap or microgap surge absorbing element. Hereinafter, "a surge absorbing component having protection function" means "a network or system including a surge absorbing element to protect a communication device connecting communication lines when the communication line interconnects the source line, with the combination with fuse and the other elements and component, so as to prevent overheat and fire due to the overcurrent or overvoltage on the line.

The resin base for the surge absorbing component can be made from resin such as epoxy resin and poly butadien type resin. Three terminal pins are mounted on the surface of the resin base. The terminal pins have the diameter of 0.5 to 1.0 mm and the length of about 10 mm. Further, the resin base has a structure on which an inorganic housing or cover glass tube can be fixed with its margin. Within the housing, a gap or microgap surge absorbing element, a metal wire with high stiffness which has been elastically deformed, and connected and fixed between the terminal of the element and the lead pin, the lead wires of the element are provided in enough space. The lead pins will fix the element and the deformed metal wire with high stiffness is fixed on one of the terminals or electrodes of the element, through low melting point metal.

The housing is fixed with resin, such that the heat from the gap or microgap surge absorbing device is prevented from conducting to the outside of the component. The metal wire with high stiffness which has been elastically deformed and each of the lead wires are fixed by binding or spot welding on each of the lead pins mounted on the resin base.

Therefore, the influence of the heat can be restrained within the space of the surge absorbing component of the function to protect from the overvoltage and overcurrent, and does not affect the outside of the component.

The efficiency of assembling the inventive surge absorbing component can be improved by using a predetermined number of the lead pins which are previously mounted or fixed on the resin base so as to assemble or fix the surge absorbing element within the component.

SIMPLE DESCRIPTION OF DRAWINGS

FIG. 1 shows schematically a sectional view of a surge absorbing component according to the present invention.

FIG. 2 shows schematically a circuit for a surge absorbing component according to the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

FIG. 1 shows schematically a sectional view of a surge absorbing component having protection function according to the present invention. There are provided a surge absorbing element 9, arranged in hollowed resin case 8 and on a resin base 10 to which the surge absorbing element 9 is mounted, and three lead pins 11A, 11B and 11C mounted on the resin base 10, and respective lead wires 12A and 12B connected to each of the terminals of the surge absorbing element 9, a phosphor bronze wire 14 which has been elastically deformed mounted on one of the terminals of the surge absorbing element 9 through solder 15.

The inventive surge absorbing component having protection function utilizes this feature of the metal wire with high stiffness modulus which has been elastically deformed, and which mounts the terminal or lead wire of the surge absorbing element. When the surge absorbing element is heated by application of overvoltage or overcurrent, the metal wire with high stiffness can be returned immediately after the low melting metal is melt, and thereby enabling rapidly making open the circuit, and at the same time, the elastic deformation of the metal wire with high stiffness will function to enforce to leave or to open the circuit by mechanical force.

The surge absorbing component having protection function can be used in a connector with a telephone line, a telecopier machine, and a telephone exchanging machine, in order to protect from a surge and overvoltage and overcurrent.

The present invention is further illustrated by the following example, but should not be interpreted for

the limitation of the invention.

EXAMPLE

FIG. 1 shows in sectional view a structure of an embodiment of the a surge absorbing component having protection function of the present invention.

Terminal pins 11A, 11B and 11C are mounted on a resin base 10, and then, a microgap surge absorbing element 9 (direct discharge initiating voltage = 300 V) is mounted by one of lead wire 12A which has been bent as shown in the drawings, and the other one of lead wire 12B, respective lead wires 12A and 12B are mounted on each of lead pins 11A and 11B through each of binders 13A and 13B so as to connect electrically, and fixed as shown in FIG. 1.

Then, a phosphorus bronze wire 14 is used as a metal wire with high stiffness, to connect the lead pin 11C by means of a binder 13C, and the other end of the phosphorus bronze wire 14 is bent by force as shown in FIG. 1, and fixed on the lead wire 12A of a microgap surge absorbing element 9, i.e. fixed on the terminal of the surge absorbing element by means of solder 15 as a low melting point metal, thereby forming electrical connection, and fixed. Further, the whole structure is surrounded by a resin cover 16. Then, the surge absorbing component having protection function can be obtained as shown FIG. 1, with three terminals.

The inventive surge absorbing component having protection function is assembled and is connected as shown in the circuit diagram of FIG. 2, a microgap surge absorbing element 9 and a metal wire with high stiffness 14 are assembled, and the telephone line 3 is connected so as to protect an equipment 2 from surge. Further, each of terminals 11A, 11B and 11C are positioned as shown in FIG. 2.

The above assembled surge absorbing component having protection function was tested by charging overvoltage, and the reference product was tested similarly. The result is described as below table 1.

Herein, the reference product has the above-mentioned conventional structure, i.e. a temperature fuse is mounted around the surface of the gap or microgap surge absorbing element, and will be melt down when heated, so that the protection function is provided.

Table 1

Applied Voltage	AC 600V	AC 600V	AC 600V	AC 600V	AC 600V	AC 600V
Applied Current	40 A	7 A	2.2 A	1 A	0.5 A	0.25 A

Result

Time of opening
the circuit

Inventive	15-25	0.2-0.4	1-2	2-4	3-5	3-10
Product	mm seconds					
Reference	15-25	0.2-0.4	3-6	6-10	10-30	20-50
	mm seconds					

It is apparent from Table 1 that the inventive product evidences significant improvement of the performance in range of lower current applied.

INDUSTRIAL UTILIZATION

The inventive surge absorbing component for protecting a communication line from overvoltage or overcurrent will provide relatively shorter time for making open the circuit in comparison with the reference product, by using a metal wire with high stiffness which has been elastically deformed, and therefore, enabling to discontinue rapidly the loading of overvoltage or overcurrent.

The metal wire with high stiffness which has been elastically deformed can be returned mechanically immediately after the overvoltage or overcurrent is applied, and then, the circuit for the surge absorbing

element is rapidly made to be open so as to protect the equipment.

Therefore, the inventive surge absorbing component with protection function can protect the equipment such as a telephone, telecopier, and telephone exchanger being connected to the line, from surge and overvoltage and overcurrent, then improving the operation performance of the surge absorbing component having protection function.

Claims

1. A surge absorbing component with protection function for a semiconductor circuit or a communication (telephone) line to protect from overvoltage and overcurrent,

comprising;

a metal wire with high stiffness which has been mechanically and elastically deformed, fixed and mounted on a terminal or a lead of a gap or microgap surge absorbing element through a low melting point metal, such that when overvoltage or overcurrent is applied to heat said surge absorbing element, said low melting point metal is melt, thereby the metal wire with high stiffness being lifted from the terminal or lead connected, to open the circuit to connect to an equipment or a circuit to be protected, and said metal wire with high stiffness being connected in series to the equipment or the circuit to be protected.

2. The surge absorbing component according to claim 1, wherein said metal with high stiffness modulus is phosphor bronze.

3. The surge absorbing component according to claim 1, wherein said lower melting point metal wire is made of metal having the melting point below 400 °C, and particularly soldering metal.

FIG. 1

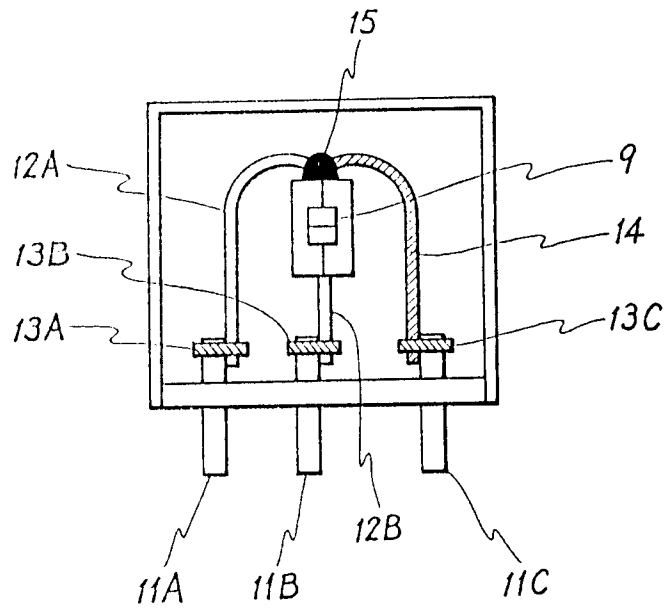
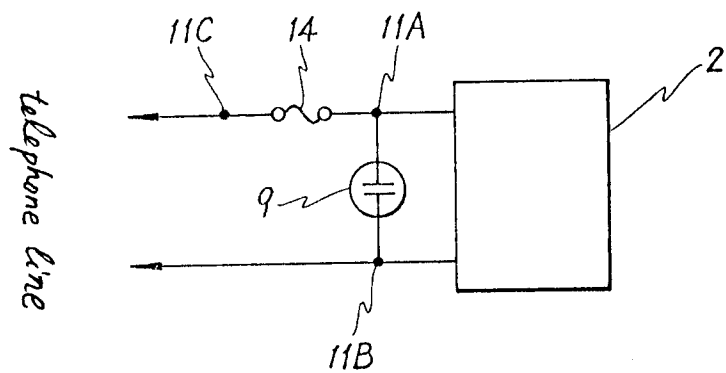


FIG. 2



INTERNATIONAL SEARCH REPORT

International Application No PCT/JP90/01006

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int. Cl ⁵ H01T1/14, 4/12		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC	H01T1/14, 4/12, H02H9/06	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
Jitsuyo Shinan Koho	1926 - 1990	
Kokai Jitsuyo Shinan Koho	1971 - 1990	
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹		
Category [*]	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
Y	JP, A, 1-176686 (Matsushita Electric Ind. Co., Ltd.), 13 July 1989 (13. 07. 89)	1, 2, 3
Y	JP, A, 63-11022 (Mitsubishi Mining & Cement Co., Ltd.), 18 January 1988 (18. 01. 88)	1, 2, 3
[*] Special categories of cited documents: ¹⁰ "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
August 17, 1990 (17. 08. 90)	September 3, 1990 (03. 09. 90)	
International Searching Authority	Signature of Authorized Officer	
Japanese Patent Office		