Title: QUICK CONNECTION HEAT DISSIPATION SYSTEM FOR ELECTRONIC DEVICES, IN PARTICULAR MODULES COMPRISING PLURALITIES OF ELECTRONIC COMPONENTS, AND RELATED ASSEMBLING PROCESS

Abstract: The present invention concerns a quick connection heat dissipation system for electronic devices (7) comprising an electronic board (11) having two faces, on at least one of which one or more electronic components (9, 10) are mounted, the system comprising at least one heatsink element (8, 8') corresponding to said at least one face, characterised in that it comprises fastening mechanical means (14, 15, 16, 19) capable to resiliently keep said at least one heatsink element (8, 8') in contact onto said one or more electronic components (9, 10) mounted onto said at least one face. The present invention further concerns the related assembling process.
QUICK CONNECTION HEAT DISSIPATION SYSTEM FOR ELECTRONIC DEVICES, IN PARTICULAR MODULES COMPRISING PLURALITIES OF ELECTRONIC COMPONENTS, AND RELATED ASSEMBLING PROCESS

The present invention relates to a quick connection heat dissipation system for devices comprising electronic components, in particular memory components, preferably arranged in modules having a plurality of electronic components mounted onto electronic boards, that allows in a simple, efficient, reliable, and inexpensive way, to fasten one or more heatsinks to the electronic components, so as to further allow a simple and fast removal in case of maintenance of the components or of the same system.

The present invention further relates to the process for assembling the system, that allows a simple, fast, and inexpensive manufacture of the electronic devices of which the electronic components are parts onto which the system of heat dissipation is fastened.

It is known that electronic devices used in several apparatuses, such as for instance computers, radiotelephones, photocameras and digital video recorders, and audio players, presently have extremely reduced size. In particular, the electronic devices are often provided with memory modules provided with an electronic board onto which a plurality of memory electronic components are mounted and, possibly, other components such as microprocessors.

For instance, it is this the case of the so called DIMM (Dual Inline Memory Module, i.e. dual contact line module) modules, comprising an electronic board respective pluralities of single memory components (and possibly one or more processors) are mounted onto both sides of which, and in which contacts are present on both sides of the board.

In the following of the description reference will be mainly made to the memory DIMM modules. However, it should be understood that the invention may be used for any type of electronic device comprising one or more components mounted onto electronic boards, such as, for instance, SIMM (Single Inline Memory Module, i.e. single contact line module) and RIMM (Rambus® Inline Memory Module, i.e. Rambus® fast contact bus module) memory modules.

The plurality of the single components mounted onto a same memory board requires the presence of heatsink elements, also called
"heatsink", which allow to disperse the heat generated inside the electronic components during their operation, avoiding their overheating that would degrade performances and would reduce their "time-to-fault".

The maximum size in the x-y plane of the DIMM modules, i.e. the size of the electronic board onto which the single memory components are mounted, are limited to values established by manufacture standards. This entails that the heatsinks has to be mounted along the direction that is orthogonal to the plane of the electronic board, i.e. along the z direction.

However, this entails a series of drawbacks.

In fact, with reference to Figure 1, it may be observed that the DIMM module comprises the single memory components, schematically indicated by the reference numeral 1, mounted onto both sides of the electronic board 2, capable to insert into a base 3 that electrically connects the contacts of the board 2 with the contacts of a planar main electronic board 4 (onto which a plurality of bases for housing DIMM modules may be housed). Heatsinks 5 are then fastened onto the memory components 1 of both sides of the DIMM module, so that they are in physical contact with the memory components 1, in order to receive their heat to dissipate towards the outside for keeping the temperature of the components 1 below a maximum threshold.

In order that the heatsinks 5 may dissipate the heat of the components 1 in an efficient way, they must have sufficiently large size. By way of example, in case of tube heatsinks, such as the one shown in Figure 2, the minimum inner distance between the vertical walls 6 and 6' of the heatsink is equal to 2 mm, while the wall thickness is at least equal to 0,35 mm. Similar requirements must be satisfied also by the other types of heatsinks, such as for instance C-shaped heatsinks, possibly provided with conventional fin elements.

The conventional means, such as for instance pegs or pins, for mounting the heatsinks 5 onto the components 1 entails a significant increase of the whole size along the z direction of the DIMM module, which size arrives at exceeding 10 mm.

Moreover, such conventional mounting means does not ensure an efficient mechanical contact among the heatsinks 5 and the components 1, thus reducing the efficiency of the heat dissipation.

Furthermore, in case of maintenance of the electronic components of the DIMM module, the conventional mounting means does not allow a
simple and fast removal of the heatsinks 5.

Finally, the complexity of assembling the heatsinks 5 on the components 1, increases the manufacture and maintenance cost of the DIMM modules.

In this context, it is included the solution proposed according to the present invention, allowing all the aforementioned drawbacks to be solved. It is therefore an object of the present invention to allow heatsinks to be assembled in a simple, efficient, reliable, and inexpensive way on the electronic components, in particular memory components, preferably arranged in modules having a plurality of electronic components mounted onto electronic boards.

It is still an object of the present invention to make such assembly so as to further allow a simple and fast removal of the heatsinks in case of maintenance of the components or of the same system.

It is specific subject matter of the present invention a quick connection heat dissipation system for electronic devices comprising an electronic board having two faces, on at least one of which one or more electronic components are mounted, the system comprising at least one heatsink element corresponding to said at least one face, characterised in that it comprises fastening mechanical means capable to resiliently keep said at least one heatsink element in contact onto said one or more electronic components mounted onto said at least one face.

Preferably according to the invention, said fastening mechanical means comprises at least one clip that is substantially overturned U shaped.

Always according to the invention, said fastening mechanical means may be capable to interact with a corresponding seat of said at least one heatsink element so as to resiliently keep said at least one heatsink element in contact onto said one or more electronic components mounted onto said at least one face.

Still according to the invention, said at least one clip may comprise at least one side wall capable to insert into the corresponding seat of said at least one heatsink element.

Furthermore according to the invention, the corresponding seat of said at least one heatsink element comprises a gap created by a projection protruding from an inner surface of said at least one heatsink element that gets in contact with said one or more electronic components
mounted onto said at least one face.

Always according to the invention, said fastening mechanical means may be integrated with said at least one heatsink element.

Still according to the invention, said at least one heatsink element may be substantially tube shaped or substantially C-shaped.

Furthermore according to the invention, said at least one heatsink element may be provided with a finned element.

Always according to the invention, said one or more electronic components may be mounted only onto one face of the electronic board, the system comprising only one corresponding heatsink element.

Still according to the invention, the other face of the electronic board may be provided with a further seat with which said fastening mechanical means are capable to interact.

Furthermore according to the invention, said one or more electronic components may be mounted onto both faces of the electronic board, the system comprising two corresponding heatsink elements.

Always according to the invention, said one or more electronic components may comprise one or more memory components and/or one or more processors and/or one or more microcontrollers.

Still according to the invention, said one or more electronic components may belong to a single contact line memory module, or SIMM (Single Inline Memory Module) module, or to a dual contact line memory module, or DIMM (Dual Inline Memory Module) module, or to a Rambus® fast contact bus module, or RIMM (Rambus® Inline Memory Module) module.

It is still specific subject matter of the present invention a process for assembling a heat dissipation system as previously described, comprising the steps of;

- applying a heat conductor compound between an inner surface of said at least one heatsink element, that gets in contact with said one or more electronic components mounted onto said at least one face, and said one or more electronic components with which it gets in contact, and

- placing the inner surface of said at least one heatsink element and said one or more electronic components in contact with each other, the process being characterised in that at the end of such placing the fastening mechanical means resiliently keep said at least one heatsink
element in contact onto said one or more electronic components mounted
onto said at least one face.

Always according to the invention, the step of applying the heat
conductor compound may comprise:

- buttering the conductor compound onto the inner surface of said at
  least one heatsink element.

Still according to the invention, the step of applying the heat
conductor compound may comprise:

- buttering the conductor compound onto said one or more electronic
  components.

Furthermore according to the invention, the step of placing may
comprise:

- making said fastening mechanical means interact with said
  corresponding seat of said at least one heatsink element.

The present invention will now be described, by way of illustration
and not by way of limitation, according to its preferred embodiments, by
particularly referring to the Figures of the enclosed drawings, in which:

Figure 1 schematically shows a conventional heatsink system
applied to a DIMM module;

Figure 2 shows an heatsink element according to the prior art;

Figure 3 shows a perspective view of a preferred embodiment of
the dissipation system according to the invention applied to a DIMM
module in a first exploded configuration;

Figure 4 shows a perspective view of the system of Figure 3 in a
second partially closed configuration;

Figure 5 shows a perspective view of the system of Figure 3 in a
third closed configuration;

Figure 6 shows a perspective view of a particular of the system of
Figure 5;

Figures 7-11 show the steps of the preferred embodiment of the
process for assembling the heat dissipation system according to the
invention;

Figures 12a and 12b show two perspective views of a heatsink
element usable in the heat dissipation system according to the invention;

Figure 13 shows a side view of a second embodiment of the
dissipation system according to the invention in three configurations; and

Figure 14 shows a perspective view of the dissipation system of
Figure 13 applied to a DIMM module.

In the Figures, alike elements are indicated by same reference numbers.

With reference to Figures 3-6, it may be observed a DIMM module 7 provided with a preferred embodiment of the heat dissipation system according to the invention. In particular, the DIMM module 7 comprises a plurality of memory components 9 and integrated circuit components 9 (for instance, processors and/or microcontrollers) mounted onto both faces of an electronic board 11.

The dissipation system of Figures 3-6 comprises a pair of shaped heatsink elements 8, an internal inner surface 12 of which is able to get in touch with the electronic components 9 and 10 mounted onto a corresponding face of the board 11, while the outer surface 13 of the heatsink elements 8 is advantageously provided with fins. The heatsink system of Figure 3-6 further comprises a clip 14, that is substantially overturned U shaped, the two parallel walls 15 of which are capable to insert into two respective coupling seats 16 which are present on the inner surfaces 12 of the heatsink elements 8. In particular, the seats 16 preferably have the shape of gaps created by projections which protrude from the inner surface 12 of the heatsink elements 8.

As better shown in Figures 5 and 6, the clip 14 and the coupling seats 16 are shaped and have size in such a way that, when they are applied to the DIMM module 7, the clip resiliently couples to the heatsink elements 8 so that these exert light pressure on the electronic components 9 and 10, with which they thus remain in stable contact.

In the following, the preferred embodiment of the process for assembling the heat dissipation system according to the invention on an electronic device, in particular a DIMM module, is described in detail.

First of all, as shown in Figure 7, a heat conductor compound 17, also called "heat compound" or "thermal compound", is buttered onto the inner surface 12 of a first heatsink element 8. The conductor compound 17, preferably silicone and metallic oxide based, such as zinc oxide, is applied for removing the air that is present among the heatsink element 8 and the electronic components 9 and 10 with which it gets in contact, in order to promote the maximum heat transfer from these ones to the former.

Afterwards, the DIMM module is placed onto the inner surface 12
of the first heatsink element 8, so that the electronic components mounted onto a first face of the DIMM module electronic board are in contact with the same.

Then, as shown in Figure 8, the conductor compound 17 is applied onto the electronic components 9 and 10 which are mounted onto the second face of the DIMM module electronic board 11.

Afterwards, the second heatsink element is placed onto the electronic components which are mounted onto the second face of the DIMM module electronic board, so that the inner surface of the second heatsink element is in contact with these components. Advantageously, the coupling seats 16 which are present onto the inner surfaces of the heatsink elements comprise a tongue capable to assume a closing position, in which it exerts light pressure onto the electronic components which are in contact with the corresponding heatsink element.

Then, as shown in Figures 9 and 10, the clip 14 is applied, so that its side walls 15 insert into the coupling seats 16 of the two heatsink elements 8.

Finally, as shown in Figure 11, further finned heatsink elements 18 may be inserted into the C-shaped heatsink elements 8, in correspondence with the outer surface of these ones.

The dissipation system according to the invention is extremely flexible, since it may use differently shaped heatsink elements, which are made according to any technique, for instance through extrusion or thin metallic plate shaping. By way of example and not by way of limitation, the heatsink elements may be tube shaped, as the one shown in Figure 2, or, as shown in Figures 12a and 12b, they may comprise a C-shaped heat diffuser 8’ capable to house a finned element 18 (as the one shown in Figure 11).

In particular, as shown in Figure 12a, the shape of the clip coupling seat 16, that protrudes inside, allows the heatsink element 8 (or its C-shaped heat diffuser 8’) to get in contact also with the electronic integrated circuit components 9 different from the memory components 9 (for instance, processors and/or microcontrollers), the seat being advantageously located in correspondence with such components 10, as shown in Figure 6.

Moreover, the shape of the heatsink elements 8, which are advantageously provided with gaps, bends, and projections down the
longest dimension, provides the same with a very high flexural strength. As a consequence, although the clip 14 is substantially located in a limited, preferably central, area of the heatsink element, the pressure applied by the same clip 14 is sufficient to ensure an efficient contact of the heatsink element with all the electronic components 9 and 10 mounted onto the corresponding face of the DIMM module electronic board 11.

With reference to Figures 13 and 14, a second embodiment of the dissipation system 19 according to the invention may be observed, in which the elastic coupling clip and the heatsink elements are integrated with each other.

In particular, such embodiment of the dissipation system 19, that is made up of an elastic central clip 14 integrated with two side tube-shaped heatsink elements 8, is shown in Figures 13a, 13b and 13c in three distinct configurations, respectively a rest configuration, an open configuration, and an assembling configuration.

Figure 14 shows the system 19 when assembled (according to configuration of Figure 13c) on a DIMM module, of which the electronic board 11 is visible. In particular, the system 19 is shaped so as to be provided with two lower side longitudinal walls 20, which lean substantially orthogonally against the electronic board 11 of the device on which the system 19 is assembled. Moreover, each side heatsink element 8 is provided, on the inner wall getting in contact with the electronic components of the device on which the system 19 is assembled, with two end plates 21 allowing the system 19 to be easily placed, preventing it from longitudinally shifting with respect to the electronic device on which it is assembled.

The process for assembling the second embodiment of the heat dissipation system 19 according to the invention on an electronic device, in particular a DIMM module, provides that the heat conductor compound is buttered onto the electronic components of the electronic device with which the two side heatsink elements 8 will get in contact.

Afterwards, the system 19 is opened (as in Figure 13b), by placing the side heatsink elements 8 apart for allowing the electronic device to be inserted between them, and it is then applied onto the electronic components with which it must get in contact, letting the heatsink elements 8 tend to turn back to the rest position until the two lower side longitudinal walls 20 and the end plates 21 touch the device electronic board 11.
Obviously, the system is sized so that in these assembling configuration (shown in Figure 13c) the two heatsink elements are in contact with the device electronic components.

Other embodiments of the dissipation system according to the invention, which are similar to the two ones shown in Figures 3-6 and 13-14, respectively, may be provided with only one heatsink element, for instance for application to the SIMM modules.

The advantages offered by the quick connection heat dissipation system according to the invention are considerable.

First of all, it allows to meet all the size requirements.

Moreover, the dissipation system according to the invention allows the heatsink elements to be efficiently and reliably kept in contact with the electronic components of which it dissipates the heat.

Furthermore, the dissipation system according to the invention is fasten to the electronic devices by means of a simple, fast, and inexpensive process.

Still, the dissipation system according to the invention allows a simple and fast removal in case of maintenance of the components or of the same system, by disconnecting the clip.

Also, the dissipation system according to the invention is compatible with several types of heatsink elements, being configurable according to the needs.

The preferred embodiments have been above described and some modifications of this invention have been suggested, but it should be understood that those skilled in the art can make variations and changes, without so departing from the related scope of protection, as defined by the following claims.
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CLAIMS

1. Quick connection heat dissipation system for electronic devices (7) comprising an electronic board (11) having two faces, on at least one of which one or more electronic components (9, 10) are mounted, the system comprising at least one heatsink element (8, 8') corresponding to said at least one face, characterised in that it comprises fastening mechanical means (14, 15, 16, 19) capable to resiliently keep said at least one heatsink element (8, 8') in contact onto said one or more electronic components (9, 10) mounted onto said at least one face.

2. System according to claim 1, characterised in that said fastening mechanical means comprises at least one clip (14) that is substantially overturned U shaped.

3. System according to claim 1 or 2, characterised in that said fastening mechanical means are capable to interact with a corresponding seat (16) of said at least one heatsink element (8, 8') so as to resiliently keep said at least one heatsink element (8, 8') in contact onto said one or more electronic components (9, 10) mounted onto said at least one face.

4. System according to claim 3, when dependent on claim 2, characterised in that said at least one clip (14) comprises at least one side wall (15) capable to insert into the corresponding seat (16) of said at least one heatsink element (8, 8').

5. System according to claim 3 or 4, characterised in that the corresponding seat (16) of said at least one heatsink element (8, 8') comprises a gap created by a projection protruding from an inner surface (12) of said at least one heatsink element (8, 8') that gets in contact with said one or more electronic components (9, 10) mounted onto said at least one face,

6. System according to claim 1 or 2, characterised in that said fastening mechanical means are integrated with said at least one heatsink element (8, 8').

7. System according to any one of the preceding claims, characterised in that said at least one heatsink element (8, 8') is substantially tube shaped.

8. System according to any one of claims 1 to 6, characterised in that said at least one heatsink element (8, 8') is substantially C-shaped.

9. System according to any one of the preceding claims, characterised in that said at least one heatsink element (8, 8') is provided
11
with a finned element (18).

10. System according to any one of the preceding claims, characterised in that said one or more electronic components (9, 10) are mounted only onto one face of the electronic board (11), the system comprising only one corresponding heatsink element (8, 8').

11. System according to claim 10, characterised in that the other face of the electronic board (11) is provided with a further seat with which said fastening mechanical means (14, 15) are capable to interact.

12. System according to any one of claims 1 to 9, characterised in that said one or more electronic components (9, 10) are mounted onto both faces of the electronic board (11), the system comprising two corresponding heatsink elements (8, 8').

13. System according to any one of the preceding claims, characterised in that said one or more electronic components comprise one or more memory components (9) and/or one or more processors and/or one or more microcontrollers.

14. System according to claim 13, when dependent on claim 10, characterised in that said one or more electronic components belong to a single contact line memory module, or SIMM (Single Inline Memory Module) module.

15. System according to claim 13, when dependent on claim 12, characterised in that said one or more electronic components belong to a dual contact line memory module, or DIMM (Dual Inline Memory Module) module, or to a Rambus® fast contact bus module, or RIMM (Rambus® Inline Memory Module) module.

16. Process for assembling a heat dissipation system according to any one of claims 1 to 15, comprising the steps of:
- applying a heat conductor compound (17) between an inner surface (12) of said at least one heatsink element (8, 8'), that gets in contact with said one or more electronic components (9, 10) mounted onto said at least one face, and said one or more electronic components (9, 10) with which it gets in contact, and
- placing the inner surface (12) of said at least one heatsink element (8, 8') and said one or more electronic components (9, 10) in contact with each other,
the process being characterised in that at the end of such placing the fastening mechanical means (14, 15, 16, 19) resiliently keep said at least
12
one heatsink element (8, 8') in contact onto said one or more electronic components (9, 10) mounted onto said at least one face.

17. Process according to claim 16, characterised in that the step of applying the heat conductor compound (17) comprises:
5  - buttering the conductor compound onto the inner surface (12) of said at least one heatsink element (8, 8').

18. Process according to claim 16 or 17, characterised in that the step of applying the heat conductor compound (17) comprises:
5  - buttering the conductor compound onto said one or more electronic components (9, 10).

19. Process according to any one of claims 16 to 18, characterised in that the heat dissipation system is the system according to any one of claims 3 to 5, and in that the step of placing comprises:
5  - making said fastening mechanical means (14, 15) interact with said corresponding seat (16) of said at least one heatsink element (8, 8').
Fig. 14
A. CLASSIFICATION OF SUBJECT MATTER

INV. H05K7/20 H05K7/14

According to International Patent Classification (IPC) or to both national classification and IPC.

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H05K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched.

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<th>Relevant to claim No</th>
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<td>US 4 563 725 A (KIRBY ET AL) 7 January 1986 (1986-01-07) column 6, line 25 - column 8, line 45 figures 1-3</td>
<td>1-3, 12, 16</td>
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<td>X</td>
<td>US 5 966 287 A (LOFLAND ET AL) 12 October 1999 (1999-10-12) column 1, line 7 - line 25 column 2, line 41 - column 3, line 49; figures 1-3</td>
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Further documents are listed in the continuation of Box C

See patent family annex

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Date of the actual completion of the international search
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