

**CIRCUIT BOARD ASSEMBLY WITH WIRE BONDED
CONNECTIONS EXTENDING THROUGH APERTURES
THEREIN**

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FIELD OF THE INVENTION

10 This invention in general relates to a circuit board assembly. The assembly has a circuit board with one or more silicon dies mounted on one side of the board, the dies have connection pads that are connected by wire bonded connections extending through apertures in the board to pads located on the other side of the board.

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BACKGROUND ART

20 When mounting silicon dies (often called silicon chips or integrated circuits) to a printed circuit board, soldering is often used to connect leads or pads of the dies to pads of the board. Such soldering is usually done by firstly applying a solder paste to pads of the board. The dies are then placed on the board such that their pads abut the solder paste that coats a respective pad of the board. A solder reflowing process is then conducted in which the solder paste is heated to melting point and then cooled to provide soldered joints that connect aligned respective pads of the board and dies. However, soldering faults may occur due to dry joints. Further, vibrations during fabrication may result in open or short circuits due to misaligned pads.

35 Wire bonded assemblies have been developed to overcome the problems associated with soldered joints. Wire bonded assemblies have dies that are firstly adhered to the circuit board such that their pads are facing away from the board. The pads of the dies are connected to

pads of the board by gold wire bonding connections. The gold wire bonding connections are then encapsulated in an epoxy which is then cured. A disadvantage of wire bonded assemblies is that the circuit board real estate (surface area) required is unnecessarily excessive. This is because the pads of the board must be located outside the periphery of the die. Accordingly, as market trends continuously move towards dies having more functionality and the need for smaller circuit boards, conventional wire bonded assemblies are becoming unacceptable for certain applications.

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SUMMARY OF THE INVENTION

It is an aim of the invention to overcome or alleviate at least one of the problems associated with circuit board assemblies or at least provide the public with a useful alternative.

According to one aspect of the invention there is provided a circuit board assembly comprising:

a circuit board having a plurality of apertures therein, said apertures providing communication between opposite sides of said circuit board;

at least one silicon die mounted to one of said sides, said die having connection pads wherein at least some of which have at least a portion thereof aligned with respective ones of said apertures;

a plurality of electrical connectors electrically associated with conductive tracks of said board, said connectors being on the other one of said sides, wherein at least some of said pads are coupled to a respective one of said connectors by a wire bonded connection passing through a respective one of said apertures.

Suitably, at least some of said connectors may be in direct alignment with a said die.

Preferably, all of said connectors may be in direct alignment with said die. Alternatively, at least some of said connectors can be in misalignment with said die.

Suitably, said connectors may be conductive pads.

10 Preferably, said connection pads may be in alignment with a respective one of said apertures.

Suitably, said connection pads may be disposed at least partly in a respective one of said apertures.

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Preferably, each said wire bonded connection can be encapsulated.

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BRIEF DESCRIPTION OF THE DRAWINGS

In order that the invention may be readily understood and put into practical affect, reference will now be made to preferred embodiments as illustrated with reference to the accompanying drawings in which:

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FIG. 1 is an underside view illustrating a first embodiment of part of a circuit board assembly in accordance with the invention;

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FIG. 2 is a cross sectional view through A-A' of the circuit board assembly of FIG. 1; and

FIG. 3 is a cross sectional view illustrating a second embodiment of part of a circuit board assembly in accordance with the invention.

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DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT OF THE
INVENTION

Referring to Figs. 1 and 2 there is illustrated a
5 first embodiment of part of a circuit board assembly 1
comprising a circuit board 2 having a plurality of
apertures 3 for providing communication between opposite
sides 4,5 of the circuit board 2. Assembly 1 also
includes a silicon die 6 mounted to side 5 by an adhesive.
10 Silicon die 6 has a number of electrodes or connection
pads 7 aligned with and disposed in apertures 3.

Assembly 1 also has a plurality of electrical
connectors in the form of conductive pads 8 electrically
15 associated with conductive tracks 9 located on side 4.
Conductive pads 8 are electrically coupled to connection
pads 7 by wire bonded connections 10 that pass through a
respective one of apertures 3. Wire bonded connections 10
are encapsulated in a transparent epoxy 11 to provide
20 mechanical protection. Epoxy 11 also provides
environmental protection for wire bonded connections 10,
conductive pads 8 and connection pads 7 by forming a
barrier to dust and moisture. If conventional surface
mounted components are also located on board 2, then epoxy
25 11 can be cured during reflowing.

The assembly 1 is fabricated by firstly automatically
applying an adhesive (by a stenciling machine) to an area
of side 5 adjacent apertures 3. The silicon die 6 is then
30 mounted to side 5 as illustrated in Figs 1 and 2 by a pick
and place machine. Both stenciling and mounting will be
apparent to a person skilled in the art and therefore do
not need a detailed explanation.

35 Conductive pads 8 are then electrically coupled to
pads 7 by conventional wire bonding techniques. The
resulting wire bonded connections 10 are then protected by

a transparent encapsulation of epoxy 11. As illustrated in Figs 1 and 2 some of the conductive pads 8 are in direct alignment with die 6 such connectors 8 are located directly underneath die 6. However, the four connectors 8 on the far right of assembly 1 are in misalignment with die 6.

Referring to Fig. 3 there is illustrated a second embodiment of part of a circuit board assembly 20 comprising a circuit board 2 having a plurality of apertures 3 for providing communication between opposite sides 4,5 of the circuit board 2. Circuit board assembly 20 is similar to circuit board assembly 1 and therefore identical components are identified by the same numerals. The major differences between circuit board 1 and 20 is that circuit board 20 has spacers 21 located at a periphery of die 6. Spacers 21 are adhered to board 2 and die 6, thereby mounting die 6 to board 2 such that connection pads 7 are aligned but not disposed in apertures 3.

Circuit board assembly 20 is fabricated in a similar way to assembly 1 with the exception of spacers 21 are adhered to board 2. An adhesive is then spread onto die abutment surfaces of the spacers 21 before mounting die 6. All other fabrication steps are the same as that for assembly 1. As illustrated, when fabrication is completed all of connectors 8 are indirect alignment with die 6, however, this need not be the case.

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Advantageously the present invention allows for a circuit board assembly which should be fabricated without the need for soldering of certain components such as silicon dies. This therefore overcomes the problems associated with soldering pads of a circuit board to leads or pads of a dies. Furthermore, the present invention also advantageously allows for a reduction in package size

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relative to other wire bonded circuit board assemblies that electrically couple pads of the board to die pads by wire bonding.

- 5 Although the invention has been described with reference to preferred embodiments it is to be understood that the invention is not restricted to any one of the embodiments described herein.

WE CLAIM:

1. A circuit board assembly comprising:
a circuit board having a plurality of apertures
5 therein, said apertures providing communication between
opposite sides of said circuit board;
at least one silicon die mounted to one of said
sides, said die having connection pads wherein at least
some of which have at least a portion thereof aligned with
10 respective ones of said apertures;
a plurality of electrical connectors electrically
associated with conductive tracks of said board, said
connectors being on the other one of said sides, wherein
at least some of said pads are coupled to a respective one
15 of said connectors by a wire bonded connection passing
through a respective one of said apertures.
2. A circuit board assembly as claimed in claim 1,
wherein at least some of said connectors are in direct
20 alignment with a said die.
3. A circuit board assembly as claimed in claim 1,
wherein all of said connectors are in direct alignment
with said die.
- 25 4. A circuit board assembly as claimed in claim 1 or
claim 2, wherein at least some of said connectors are in
misalignment with said die.
- 30 5. A circuit board assembly as claimed in any preceding
claim, wherein said connectors are conductive pads.
6. A circuit board assembly as claimed in any preceding
claim, wherein said connection pads are in alignment with
35 a respective one of said apertures.



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7. A circuit board assembly as claimed in any preceding claim, wherein said connection pads are disposed at least partly in a respective one of said apertures.
- 5 8. A circuit board assembly as claimed in any preceding claim, wherein each said wire bonded connection is encapsulated.
9. A circuit board assembly substantially as described
10 herein with reference to and as illustrated by the accompanying drawings.

