

## PATENT COOPERATION TREATY

From the  
INTERNATIONAL SEARCHING AUTHORITY

# PCT

## WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To: LEE, Cheol Hee  2F, Woo Kyeong Bldg., 156-13 Samseong-dong, Kangnam-ku Seoul 135-090 Republic of Korea
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Date of mailing (day/month/year) <b>25 SEPTEMBER 2006 (25.09.2006)</b>
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Applicant's or agent's file reference S06-381PCT	<b>FOR FURTHER ACTION</b> See paragraph 2 below
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International application No. <b>PCT/KR2006/002482</b>	International filing date (day/month/year) <b>27 JUNE 2006 (27.06.2006)</b>	Priority date(day/month/year) 28 JUNE 2005 (28.06.2005)
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International Patent Classification (IPC) or both national classification and IPC  <b>H01L 27/146(2006.01)i</b>
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Applicant <b>SILICONFILE TECHNOLOGIES INC. et al</b>
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1. This opinion contains indications relating to the following items:
- Box No. I Basis of the opinion
  - Box No. II Priority
  - Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
  - Box No. IV Lack of unity of invention
  - Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
  - Box No. VI Certain documents cited
  - Box No. VII Certain defects in the international application
  - Box No. VIII Certain observations on the international application
2. **FURTHER ACTION**  
If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.
- If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.  
For further options, see Form PCT/ISA/220.
3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/KR  Korean Intellectual Property Office 920 Dunsan-dong, Seo-gu, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140	Date of completion of this opinion 25 SEPTEMBER 2006 (25.09.2006)	Authorized officer HWANG, Yun Koo Telephone No.82-42-481-5680
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**WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/KR2006/002482

**Box No. I Basis of this opinion**

1. With regard to the **language**, this opinion has been established on the basis of :

- the international application in the language in which it was filed
- a translation of the international application into \_\_\_\_\_, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

a. type of material

- a sequence listing
- table(s) related to the sequence listing

b. format of material

- on paper
- in electronic form

c. time of filing/furnishing

- contained in the international application as filed.
- filed together with the international application in electronic form.
- furnished subsequently to this Authority for the purposes of search.

3.  In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

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PCT/KR2006/002482

**Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-8	YES
	Claims	NONE	NO
Inventive step (IS)	Claims	NONE	YES
	Claims	1-8	NO
Industrial applicability (IA)	Claims	1-8	YES
	Claims	NONE	NO

2. Citations and explanations :

(1) The documents cited in the International Search Report :

D1 : US6486522 B1

D2 :A.R.Mirza, ' One Micron Precision, Wafer-Level Aligned Bonding for Interconnect, MEMS and Packaging Applications' in : 2000 Electronic Components and Technology Conference, PP 676-680. A

D3 : JP 2003-273343 A     D4 : US 06642081 B1

D1 discloses a light sensing system with high pixel fill factor comprising a light sensing element formed on a control circuit. The control circuit comprises several transistors such as a reset transistor, a select transistor.

The light sensing element and the control circuit can be connected through the via.

D2 discloses the technology about the wafer alignment using IR or an etched via hole for the electrical connection of the wafer level.

D3 discloses the manufacturing method of solid-state image sensing element wherein a photodiode receives light at the backside of the image sensing part comprising an interconnection part, and microlenses etc are also located on the backside of the image sensing part, and also discloses the technology of thinning the backside of the new wafer.

D4 discloses an interlocking conductor method for bonding wafers to produce stacked integrated circuits and thinning the backside of the new wafer.

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PCT/KR2006/002482

**Supplemental Box**

In case the space in any of the preceding boxes is not sufficient.

Continuation of :

BOX V. :

(2) Novelty and Inventive Step

Inventive step(Claims 1-8)

The invention in claim 1 relates to a separation type unit pixel having a 3D structure for an image sensor, comprising: a first wafer including a photodiode and a pad; a second wafer including a pixel array region in which transistors are arranged regularly, a peripheral circuit region, and a pad; a connecting means connecting the pad of the first wafer and the pad of the second wafer.

However, D1 also discloses these technical features such as a light sensing element formed on a control circuit.

D2 discloses the wafer alignment technology which can be applied to D1.

The invention in claim 2 is a separation type unit pixel having a 3D structure for an image sensor of claim 1, wherein the first wafer comprises a semiconductor material forming a photodiode; a first transparent buffer layer; a pad.

However, this technology is considered as the generally-used one for a person having ordinary skill in the art.

The invention in claim 3 relates to a unit pixel of claim 1, wherein the first wafer comprises a color filter, a microlens, a second transparent buffer layer.

However, this technology is considered to be obvious for a person having ordinary skill in the art, considering the structure of stacking the light sensing element on the control circuit. (For example, D3 discloses similar technical features compared with the claim 3 of the present invention. )

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PCT/KR2006/002482

**Supplemental Box**

In case the space in any of the preceding boxes is not sufficient.

Continuation of :

BOX V. :

The invention in claim 4-5 relates to a unit pixel of claim 1, wherein the second wafer comprises the pixel array region and the peripheral circuit region having several transistors or circuits.

However, this technology is considered as the generally-used one for a person having ordinary skill in the art.

Further, as the inventions in claims 6-7 relate to a manufacturing method of the unit pixel comprising the subject matters in the claim 1, 3 of the present invention, these are also considered to lack an inventive step.

Furthermore, as the invention in claim 8 relates to a manufacturing method of unit pixel of claim 6 etc, comprising the step for performing surface processing for thinning the backside of the first wafer.

However, this technology is considered as the generally-used one for a person having ordinary skill in the art(for example, D3-D4 discloses this technical feature).

In conclusion, the inventions in claims 1-8 are considered to lack an inventive step under PCT Article 33(3).

Novelty(Claims 1-8)

The inventions of claims 1-8 are considered to be novel under PCT Article 33(2) because these technical features of said claims 1-8 are not identical to the one of D1 to D4.

(3) Industrial Applicability

The present application is believed to be industrially applicable under PCT Article 33(4)