

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
26 July 2007 (26.07.2007)

PCT

(10) International Publication Number  
**WO 2007/084879 A3**

(51) International Patent Classification:

*H01L 21/00* (2006.01)      *H01L 21/302* (2006.01)  
*H01L 21/44* (2006.01)      *H01L 21/306* (2006.01)  
*H01L 21/77* (2006.01)

(21) International Application Number:

PCT/US2007/060544

(22) International Filing Date: 15 January 2007 (15.01.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

11/275,542      13 January 2006 (13.01.2006)      US

(71) Applicant (for all designated States except US): INTERNATIONAL BUSINESS MACHINES CORPORATION [US/US]; New Orchard Road, Armonk, NY 10504 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **ERTURK, Mete** [CY/US]; 398 Lake Road, St. Albans, VT 05478 (US). **GROVES, Robert, A.** [US/US]; 27 Oak Crest Drive, Highland, NY 12528 (US). **JOHNSON, Jeffrey, B.** [US/US]; 15 Juniper Ridge Road, Essex Junction, VT 05452 (US). **JOSEPH, Alvin, J.** [IN/US]; 109 Coyote Lane, Williston, VT 05495 (US). **LIU, Qizhi** [CN/US];

124 Sandhill Road, #3, Essex Junction, VT 05452 (US). **SPROGIS, Edmund, J.** [US/US]; 35 Snyder Road, Underhill, VT 05489 (US). **STAMPER, Anthony, K.** [US/US]; 46 Evergreen Drive, Williston, VT 05495 (US).

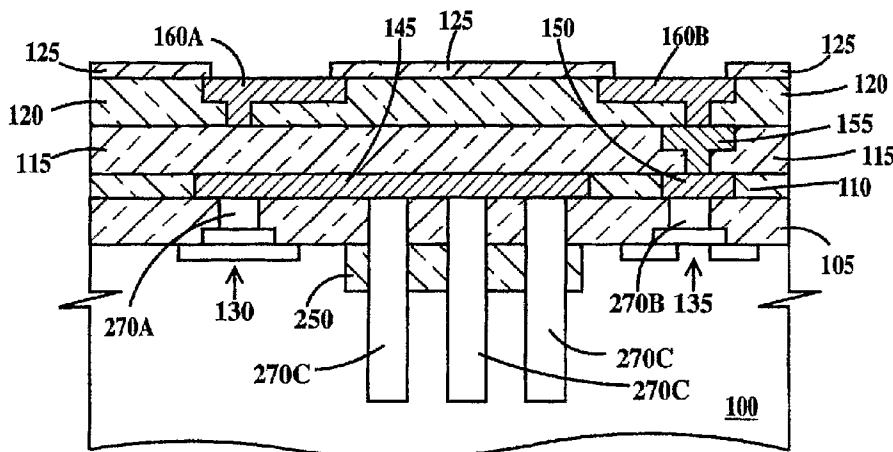
(74) Agent: **SABO, William, D.**; INTERNATIONAL BUSINESS MACHINES CORPORATION, INTELLECTUAL PROPERTY LAW -- ZIP 972E, 1000 River Street, Essex Junction, VT 05452 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT,

[Continued on next page]

(54) Title: LOW RESISTANCE AND INDUCTANCE BACKSIDE THROUGH VIAS AND METHODS OF FABRICATING SAME



(57) Abstract: A backside contact structure and method of fabricating the structure. The method includes: forming a dielectric isolation (250) in a substrate (100), the substrate (100) having a frontside and an opposing backside; forming a first dielectric layer (105) on the frontside of the substrate (100); forming a trench (265C) in the first dielectric layer (105), the trench (265C) aligned over and within a perimeter of the dielectric isolation (250) and extending to the dielectric isolation (250); extending the trench (265C) formed in the first dielectric layer (105) through the dielectric isolation (250) and into the substrate (100) to a depth (D1) less than a thickness of the substrate (100); filling the trench (265C) and co-planarizing a top surface of the trench (265C) with a top surface of the first dielectric layer (105) to form an electrically conductive through via (270C); and thinning the substrate (100) from a backside of the substrate (100) to expose the through via (270C).

WO 2007/084879 A3



---

RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA,  
GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Published:**

— *with international search report*

**(88) Date of publication of the international search report:**

21 February 2008

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 07/60544

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - H01L 21/00; H01L 21/44; H01L 21/77; H01L 21/302; H01L 21/306 (2007.10)

USPC - 438/652; 438/637; 438/295; 438/248; 257/E21.577; 257/E21.585

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)

USPC - 438/652; 438/637; 438/295; 438/248; 257/E21.577; 257/E21.585

IPC(8) - H01L 21/00; H01L 21/44; H01L 21/77; H01L 21/302; H01L 21/306 (2007.10)

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

Google Scholar: through via isolation dielectric

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

US-PTO WEST; Google: @pd < 20060113 and ((through adj1 via) and (backside adj1 contact))[bi]

@pd < 20060113 and (438/652 or 438/656 or 438/657)[ccls] and ((dielectric adj1 layer) and isolation and (tungsten or W) and ((titanium adj1 nitride) or TiN) and oxide and polysilicon and insulating)[bi]

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                     | Relevant to claim No. |
|-----------|--|-----------------------|
| Y         | US 2005/0253175 A1 (TADDIKEN) 17 November 2005 (17.11.2005), entire document, FIG 1A, 1B; para [0026]                  | 1-19                  |
| Y         | US 4,982,266 A (CHATTERJEE) 01 January 1991 (01.01.1991), entire document, FIG 10                                      | 1-19                  |
| Y         | US 6,916,704 B2 (GUTSCHE et al.) 12 July 2005 (12.07.2005), entire document, FIG 5, 6                                  | 6, 8, 16, 18          |
| Y         | US 6,100,200 A (VAN BUSKIRK et al.) 08 August 2000 (08.08.2000), entire document, FIG 3H, col 4, ln 8-9; col 5, ln 1-3 | 14-17                 |
| A         | US 2005/0164490 A1 (MORROW et al.) 28 July 2005 (28.07.2005), entire document, abstract, para [0043]                   | 1-19                  |

Further documents are listed in the continuation of Box C.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent 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 when the document is taken alone

"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

Date of the actual completion of the international search

08 November 2007 (08.11.2007)

Date of mailing of the international search report

06 DEC 2007

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents

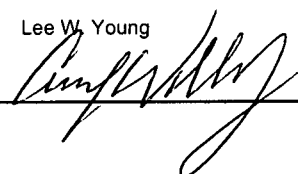
P.O. Box 1450, Alexandria, Virginia 22313-1450

Facsimile No. 571-273-3201

Authorized officer:

Lee W. Young

PCT Helpdesk: 571-272-4300  
PCT OSP: 571-272-7774



**INTERNATIONAL SEARCH REPORT**

International application No.

PCT/US 07/60544

**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3.  Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

This application contains claims directed to more than one species of the generic invention. These species are deemed to lack unity of invention because they are not so linked as to form a single general inventive concept under PCT Rule 13.1.

In order for more than one species to be examined, the appropriate additional examination fees must be paid. The species are as follows:

- Group 1: Fig. 5, 3 third embodiment
- Group 2: Fig. 1 first embodiment
- Group 3: Fig. 2 second embodiment
- Group 4: Fig. 6 fourth embodiment

(continued on the first extra sheet)

1.  As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
  
2.  As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
  
3.  As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
  
4.  No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:  
1-19

**Remark on Protest**

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.