(54) Title: METHOD FOR REDUCING DIELECTRIC OVERETCH USING A DIELECTRIC ETCH STOP AT A PLANAR SURFACE

(57) Abstract: A substantially planar surface coexposes conductive or semiconductor features (300) and a dielectric etch, stop material (120). A second dielectric material (107), different from the dielectric etch stop material, is deposited on the substantially planar surface. A selective etch etches a hole or trench in the second dielectric material, so that the etch stops on the conductive or semiconductor feature and the dielectric etch stop material. In a preferred embodiment the substantially planar surface is formed by filling gaps between the conductive or semiconductor features with a first dielectric (108) such, as oxide, recessing the oxide, filling with the dielectric etch stop material such as nitride, then planarizing to expose the nitride and the conductive or semiconductor features.
INTERNATIONAL SEARCH REPORT

International application No
PCT/US2006/010757

A. CLASSIFICATION OF SUBJECT MATTER

INV.  H01L21/768     H01L21/8246

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)
H01L

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)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tr>
<td>X</td>
<td>US 5 244 837 A (DENNISON ET AL) 14 September 1993 (1993-09-14) the whole document</td>
<td>1-5</td>
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<tr>
<td>X</td>
<td>US 5 612 254 A (MU ET AL) 18 March 1997 (1997-03-18) the whole document</td>
<td>1,2,4,5</td>
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<tr>
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<td>US 5 926 732 A (MATSUURA ET AL) 20 July 1999 (1999-07-20) the whole document</td>
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</table>

Further documents are listed in the continuation of Box C.

See patent family annex.

Date of the actual completion of the international search
7 July 2006

Date of mailing of the international search report
09.10.2006

Name and mailing address of the ISA
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Authorized officer
Boetticher, Harald
# INTERNATIONAL SEARCH REPORT

## Box 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.: 22-40  
   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:
   
   see FURTHER INFORMATION sheet PCT/ISA/210

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 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:

see additional 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 an additional fee, this Authority did not invite payment of any additional fee.

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.:

   1-5

### Remark on Protest

□ The additional search fees were accompanied by the applicant’s protest.

□ No protest accompanied the payment of additional search fees.
Continuation of Box II.2

Claims Nos.: 22-40

Firstly, it is obscure whether or not the method of claim 22 is intended to differ from the method of claim 1.

For claim 1, see in D1 = US-A-5 244 837, Fig. 7 and corresponding text, showing: forming a planar surface exposing conductive feature 68 and dielectric etch stop layer 56; depositing second dielectric fill 74 directly on the planar surface; etching a void 76 in the second dielectric fill 74, the etch being selective and stopping on etch stop 56.

For claim 22, see in D1 Figs. 10 to 13 and corresponding text: planar surface 55 exposes a pillar 65 (obviously, there may be further pillars) and first dielectric 54a; second dielectric material 54b is formed on surface 55; trenches 62, 64 are selectively etched into the second dielectric (see column 7 lines 18 to 22); first conductors 71 are formed in said trenches. Thus, claim 22 differs from claim 1 in that no etch stop layer is used. But claim 23 claims second and third dielectrics, which second dielectric is presumably the first dielectric of claim 22 and, due to the underlying third dielectric, would be a layer acting like an etch stop, so claim 22 would only differ from claim 1 in a lack of clarity due to omission of an essential feature. As long as the closest prior art for claim 22 is obscure (Fig. 7 or Figs. 10 to 12 of D1), a meaningful search is impossible.

Secondly, claim 36 is obscure in that it claims formation of a first memory level, but the claimed steps correspond to steps which are used in D1 to form a normal metallization, see Figs.10 to 13 of D1 (as to the vague feature of "bottom conductors" in claim 36, this is covered by areas 95 in said Figs. 10 to 13, and, as to the feature of a second memory level in claim 36, a second metallization level is obvious from "multilevel metallization" in D1 column 1 line 11).

- Since the features of claim 1 are known, there is no single general inventive concept under Rule 13.1 PCT, and further search fees for further searches could be asked for. But claims 22 and 36 are so vague that proper definition of the various inventions, necessary to justify further search fees, is not possible.

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.5), should the problems which led to the Article 17(2) declaration be overcome.
This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-5

   Reducing overetch by a dielectric etch stop, e.g. of silicon nitride, so etching through a second dielectric, e.g. of silicon dioxide, down to a planar surface, formed by the etch stop and conductive features, stops on the etch stop.

2. claims: 6,7,12-21

   Forming a planar surface by: etching a dielectric surrounding the conductive features to partially expose the conductive features, blanket depositing an etch stop layer, planarizing to form the planar surface.

3. claims: 8-11

   The conductive features are pillars, possibly diodes of a memory.
<table>
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<tr>
<th>Patent document cited in search report</th>
<th>Publication date</th>
<th>Patent family member(s)</th>
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<tr>
<td>US 5244837 A</td>
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