(54) Title: METHODS AND SYSTEMS FOR INSPECTION OF WAFERS AND RETICLES USING DESIGNER INTENT DATA

(57) Abstract: Methods and systems for inspection of wafers and reticles using designer intent data are provided. One computer-implemented method includes identifying nuisance defects on a wafer based on inspection data produced by inspection of a reticle, which is used to form a pattern on the wafer prior to inspection of the wafer. Another computer-implemented method includes detecting defects on a wafer by analyzing data generated by inspection of the wafer in combination with data representative of a reticle, which includes designations identifying different types of portions of the reticle. An additional computer-implemented method includes determining a property of a manufacturing process used to process a wafer based on defects that alter a characteristic of a device formed on the wafer. Further computer-implemented methods include altering or simulating one or more characteristics of a design of an integrated circuit based on data generated by inspection of a wafer.

(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, IT, LU, MC, NL, PL, PT, 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: 25 August 2005

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
   IPC 7  G03F1/00  G03F7/20  GO1N21/956

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)
   IPC 7  G03F  GO1N

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, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
</table>
| X        | ANONYMOUS: "Virtual Stepper"
          | INTERNET ARTICLE, [Online]
          | 15 April 2003 (2003-04-15), XPO02313695
          | Retrieved from the Internet:
          | URL: http://web.archive.org/web/20030415065
          | 148/http://www.synopsys.com/products/ntimr
          | g/virtual_stepper_ds.html>
          | [retrieved on 2005-01-28]                                                        | 1-4, 10, 11, 13       |
| Y        | the whole document                                                               | 5-9, 12, 14-16       |

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* 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 document but published on or after the international filing date
   * "L" document which may throw doubts on priority claim(s) or which is cited to estabilish 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 considered with one or more other such documents, such combination being obvious to a person skilled in the art.
* "S" document member of the same patent family

Date of the actual completion of the international search: 19 January 2005

Date of mailing of the international search report: 09.06.05

Name and mailing address of the ISA
   European Patent Office, P. B. 5818 Patentlaan 2
   NL-2280 HV Rijswijk
   Tel: (+31-70) 340-2004, Tx: 31 651 epo nl
   Fax: (+31-70) 340-3016

Authorized officer
   von Hentig, T
<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>US 6 513 151 B1 (PHAN KHOI ET AL) 28 January 2003 (2003-01-28) abstract; claim 4; figures 2,5,6 column 2 - column 3 column 5, line 31 - line 64 column 7, line 2 - line 26 column 8, line 37 - line 50 column 10, line 10 - line 26</td>
<td>5-9</td>
</tr>
</tbody>
</table>
## 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.: 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 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.:
   - 1-16

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.:
   - 1-16

**Remark on Protest**

- □ The additional search fees were accompanied by the applicant's protest.
- □ No protest accompanied the payment of additional search fees.
This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-16
   Identification of nuisance defects and their locations on a wafer, based on inspection data produced by inspecting a reticle

2. claims: 17-39
   Identification of critical portions on a wafer based on criticality and selection of specific parameters for wafer inspection

3. claims: 40-45
   Identification of bad dies on a wafer and determination of properties for the manufacturing process of the wafer

4. claims: 46-54
   Alteration of a design of an integrated circuit based on data generated by inspection of a wafer

5. claims: 55-56
   Storage medium for design data, process data and defect data

6. claims: 57-60
   Simulation of one or more characteristics of an integrated circuit based on data generated by inspecting a wafer during a manufacturing process

7. claims: 61-70
   Determination of placement of a pattern on a specimen based on data generated by inspection of the specimen

8. claims: 71-85
   Determination of a design significance of a defect detected on a reticle, a lithographic significance of the defect and determining an overall significance of the defect based on the latter significances
<table>
<thead>
<tr>
<th>Patent document cited in search report</th>
<th>Publication date</th>
<th>Patent family member(s)</th>
<th>Publication date</th>
</tr>
</thead>
<tbody>
<tr>
<td>US 6513151</td>
<td>28-01-2003</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 2003096436 A1</td>
<td>22-05-2003</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 6636064 B1</td>
<td>21-10-2003</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 6633174 B1</td>
<td>14-10-2003</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 6524873 B1</td>
<td>25-02-2003</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 6433561 B1</td>
<td>13-08-2002</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 6509197 B1</td>
<td>21-01-2003</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 6445199 B1</td>
<td>03-09-2002</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 6528818 B1</td>
<td>04-03-2003</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 6771866 B1</td>
<td>03-08-2004</td>
</tr>
</tbody>
</table>