NEW APPROACH FOR MULTILEVEL MRROM

A method of providing a multilevel programmed Mask ROM that begins by fabricating an unprogrammed mask ROM. The transistors in the mask ROM array are programmed with one of a plurality of threshold voltages using low concentration ion implantation. The method minimizes the leakage current during reading of the array from at least the transistors programmed with a first level threshold voltage. Minimization of leakage current includes biasing at least the first level threshold voltage programmed transistors by applying a negative voltage to the gates of those transistors, implanting at least standard ion implantation dosages in regions surrounding the first level threshold voltage programmed transistors, or by selecting an inhibiting source voltage that substantially eliminates leakage current from at least the first level threshold voltage programmed transistors and then reading the array by applying the inhibiting source voltage to the sources and the inhibiting source voltage plus approximately 1.2V to the drains of the transistors.
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**
- IPC(7) : H01L 21/8236
- US CL : 438/278,174,290

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)

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 practicable, search terms used)
Please See Continuation Sheet

**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>
<tbody>
<tr>
<td>Y</td>
<td>US 4,080,718 A (RICHMAN) 28 March 1978, (28/03/78) column 1, lines 10-50, column 3, lines 58-67, column 4, lines 1-67 column 5, lines 1-67.</td>
<td>1-7</td>
</tr>
<tr>
<td>Y, &amp;</td>
<td>US 4,600,933 A (RICHMAN) 15 July 1986, (15/07/86) complete document.</td>
<td>1-7</td>
</tr>
<tr>
<td>Y</td>
<td>JP 07-142613 A (OKI ELECTRIC IND CO LTD) 02 June 1995, (02/06/95) ALL.</td>
<td>1-7</td>
</tr>
</tbody>
</table>

**Further documents are listed in the continuation of Box C.**

**Documents Considered to be Relevant**
- **A** document defining the general state of the art which is not considered to be of particular relevance
- **E** earlier application or patent 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
- **A** document member of the same patent family

**Date of the actual completion of the international search**
10 February 2001 (10.02.2001)

**Date of mailing of the international search report**
26 MAR 2001

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Form PCT/ISA/210 (second sheet) (July 1998)
Continuation of B. FIELDS SEARCHED Item 3: CAS ONLINE
search terms: implant$, ROM, threshold, voltage, program$