Title: PROTECTION FOR MEMS CROSS-BAR SWITCH

Abstract: A protection system for a micro electro-mechanical system (MEMS) cross-bar switch (200) is described. Optical signals that are cross-connected by a NxN optical matrix switch are routed through alternative protection paths using protection switch elements (210, 220, 230). The protection switch elements (210, 220, 230) are incorporated as part of the silicon wafer based fabricated structure that forms the NxN optical matrix. The protection switch elements (210, 220, 230) enable the NxN optical matrix switch to recover from one or more failures in switch elements of the NxN optical matrix using alternative protection paths that have the same path length as the original optical path.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) : H04J 14/00, G02B 6/26, 6/42
US CL : 359/110,117,128; 385/16-18
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)
U.S. : 359/110,117,128; 385/16-18

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 practically, search terms used)
Please See Extra 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,E</td>
<td>US 6,097,859 A (SOLGAARD et al.) 01 August 2000, Fig.1-2,4.</td>
<td>8-9,15-16</td>
</tr>
<tr>
<td>Y,P</td>
<td>US 6,038,044 A (FEE et al.) 14 March 2000, Figs. 3-6.</td>
<td>8-9,15-16</td>
</tr>
<tr>
<td>A,P</td>
<td>US 5,960,133 A (TOMLINSON) 28 September 1999, see the whole document.</td>
<td>8</td>
</tr>
<tr>
<td>A,P</td>
<td>US 5,960,132 A (LIN) 28 September 1999, Fig.5.</td>
<td>8</td>
</tr>
<tr>
<td>A</td>
<td>US 5,325,224 A (LANG et al.) 28 June 1994, Fig.4.</td>
<td>8</td>
</tr>
</tbody>
</table>

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents: 'n' 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
'A' document defining the general state of the art which is not considered to be of particular relevance
'E' earlier document published on or after the international filing date
'L' document which may throw doubt 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

Date of the actual completion of the international search
27 OCTOBER 2000

Date of mailing of the international search report
08 NOV 2000

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Form PCT/ISA/210 (second sheet) (July 1998) ★
## INTERNATIONAL SEARCH REPORT

### Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international 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 II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

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

   Please See Extra Sheet.

1. [X] 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.:

### Remark on Protest

[ ] The additional search fees were accompanied by the applicant's protest.

[X] No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet(1)) (July 1998)
B. FIELDS SEARCHED
Electronic data bases consulted (Name of data base and where practicable terms used):

STN

search terms: optical switch, cross-bar switch, mems, optical fiber, mirror

BOX II. OBSERVATIONS WHERE UNITY OF INVENTION WAS LACKING
This ISA found multiple inventions as follows:

This application contains the following inventions or groups of inventions which are not so linked as to form a single inventive concept under PCT Rule 13.1. In order for all inventions to be searched, the appropriate additional search fees must be paid.

Group I, claim(s) 1-16, drawn to an optical cross-bar switch system.
Group II, claim(s) 17-18, drawn to a telecommunications network.

The inventions listed as Groups I-II do not relate to a single inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: The claims of these two groups are directed to different inventions which are not linked as to form a single general concept. The inventions are not linked in operation and perform completely different operations.