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[Continued on next page]

(54) Title: CONSTRUCTION STRUCTURES AND MANUFACTURING PROCESSES FOR INTEGRATED CIRCUIT WAFER PROBE CARD ASSEMBLIES

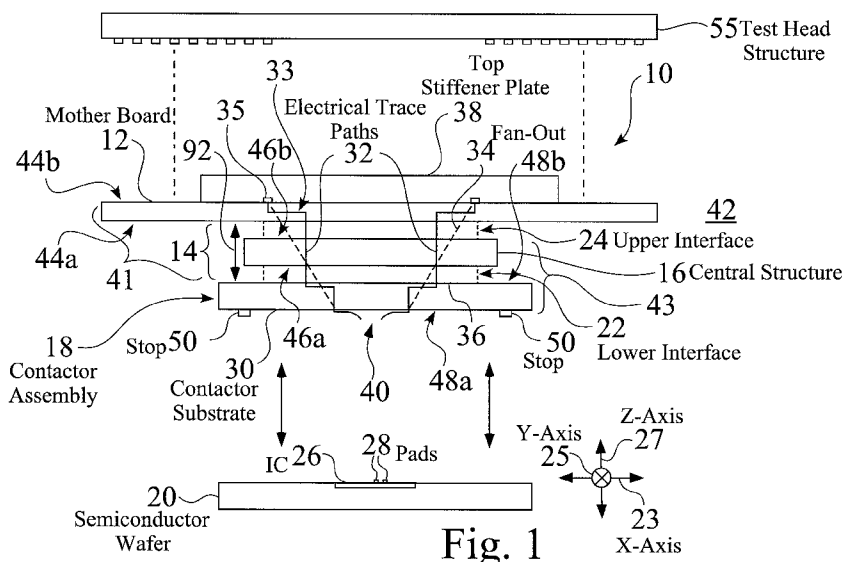


Fig. 1

(57) Abstract: Enhanced microfabricated spring contact structures and associated methods, e.g. such as for electrical contactors and interposers, comprise improvements to spring structures that extend from the substrate surface, and/or improvements to structures on or within the support substrate. Improved spring structures and processes comprise embodiments having selectively formed and etched, coated and/or plated regions, which are optionally further processed through planarization and/or annealment. Enhanced solder connections and associated processes provide a gap between substrates for componentry, and or improved manufacturing techniques using distributed spacers. Enhanced probe card assembly structures and processes provide improved planarization adjustment and thermal stability.

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European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, 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).

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## INTERNATIONAL SEARCH REPORT

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PCT/US2007/086394

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC(8) - H01R 12/00 (2008.04) USPC - 324/762 According to International Patent Classification (IPC) or to both national classification and IPC																									
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) IPC(8) - H01R 12/00 (2008.04) USPC - 324/754-762; 427/97.9,99.5,304-306,430.1,435-438,498; 439/65-75 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) USPTO EAST System (US, USPG-PUB, EPO, JPO, DERWENT), DialogPro, IEEEExplore, GoogleScholar																									
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>																									
<table border="1"> <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>X ---- Y --- A</td> <td>US 2004/0223309 A1 (HAEMER et al) 11 November 2004 (11.11.2004) entire document</td> <td>16-20, 23, 33 ---- 1-10, 21, 22, 24-30, 40-44 --- 31,32</td> </tr> <tr> <td>Y</td> <td>US 6,347,947 B1 (ONG) 19 February 2002 (19.02.2002) entire document</td> <td>1-10</td> </tr> <tr> <td>Y --- A</td> <td>US 5,944,537 A (SMITH et al) 31 August 1999 (31.08.1999) entire document</td> <td>11-14 --- 15</td> </tr> <tr> <td>Y</td> <td>US 6,476,626 B2 (ALDAZ et al) 05 November 2002 (05.11.2002) entire document</td> <td>11-14</td> </tr> <tr> <td>Y</td> <td>US 6,285,563 B1 (NELSON et al) 04 September 2001 (04.09.2001) entire document</td> <td>21, 22</td> </tr> <tr> <td>Y</td> <td>US 6,281,592 B1 (MURAYAMA) 28 August 2001 (28.08.2001) entire document</td> <td>24-30</td> </tr> <tr> <td>Y</td> <td>US 6,329,713 B1 (FARQUHAR et al) 11 December 2001 (11.12.2001) entire document</td> <td>27, 28</td> </tr> </tbody> </table>	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X ---- Y --- A	US 2004/0223309 A1 (HAEMER et al) 11 November 2004 (11.11.2004) entire document	16-20, 23, 33 ---- 1-10, 21, 22, 24-30, 40-44 --- 31,32	Y	US 6,347,947 B1 (ONG) 19 February 2002 (19.02.2002) entire document	1-10	Y --- A	US 5,944,537 A (SMITH et al) 31 August 1999 (31.08.1999) entire document	11-14 --- 15	Y	US 6,476,626 B2 (ALDAZ et al) 05 November 2002 (05.11.2002) entire document	11-14	Y	US 6,285,563 B1 (NELSON et al) 04 September 2001 (04.09.2001) entire document	21, 22	Y	US 6,281,592 B1 (MURAYAMA) 28 August 2001 (28.08.2001) entire document	24-30	Y	US 6,329,713 B1 (FARQUHAR et al) 11 December 2001 (11.12.2001) entire document	27, 28	<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/>
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* 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 21 July 2008	Date of mailing of the international search report <b>28 JUL 2008</b>																								
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: Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774																								

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2007/086394

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6,245,444 B1 (MARCUS et al) 12 June 2001 (12.06.2001) entire document	34-44
Y	US 4,000,045 A (ROTZOW) 28 December 1976 (28.12.1976) entire document	34-39
Y	US 6,428,673 B1 (RITZDORF et al) 06 August 2002 (06.08.2002) entire document	42
A	US 6,917,525 B2 (MOK et al) 12 July 2005 (12.07.2005) entire document	1-44
A	US 6,624,648 B2 (ELDRIDGE et al) 23 September 2003 (23.09.2003) entire document	1-44

INTERNATIONAL SEARCH REPORT

International application No.

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**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:

See 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.:

**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.

INTERNATIONAL SEARCH REPORT

International application No.

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Continuation of Box III.

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

Group I (Claims 1-10) drawn to a structure or process including a connection structure for a probe chip assembly with at least two solder regions with different melting points.

Group II (Claims 11-15) drawn to a method including constraining the tips of elastic core members using spacers and controllably heating the core members through repeated cycles of deflection and plastic deformation.

Group III (Claims 16-33) drawn to a probe card assembly or process including a motherboard and a daughter card in which a plurality of mechanical connectors provide for adjustable distance between the motherboard and daughter card or between a stiffener and a central structure.

Group IV (Claims 34-39) drawn to a process including plating immersed spring probes.

Group V (Claims 40-44) drawn to a process including steps of sputtering, plating, and stripping spring structures.

The inventions listed as Groups I, II, III, IV and V do not relate to a single general 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 special technical feature of the Group I invention: at least two solder regions with different melting points as claimed therein is not present in the invention of Groups II, III, IV or V. The special technical feature of the Group II invention: constraining the tips of elastic core members using spacers and controllably heating the core members through repeated cycles of deflection and plastic deformation as claimed therein is not present in the invention of Groups I, III, IV or V. The special technical feature of the Group III invention: a plurality of mechanical connectors which provide for adjustable distance between the motherboard and daughter card or between a stiffener and a central structure as claimed therein is not present in the invention of Groups I, II, IV or V. The special technical feature of the Group IV invention: a process including plating immersed spring probes as claimed therein is not present in the invention of Groups I, II, III or V. The special technical feature of the Group V invention: a process including steps of sputtering, plating, and stripping spring structures as claimed therein is not present in the invention of Groups I, II, III or IV.

While some of the groups are related in terms of reciting probe chips this is not novel and thus not a unifying feature (see Mok US 6,917,525). While groups IV and V both cite plating steps they are divergent in that group IV involves immersion plating while group V deals with plating in combination with sputtering and stripping (spring plating alone is not a unifying feature since it was known to the prior art (see for example US 6,624,648 column 13, lines 13-22).

Since none of the special technical features of the Group I, II, III, IV or V inventions are found in more than one of the inventions, unity of invention is lacking.