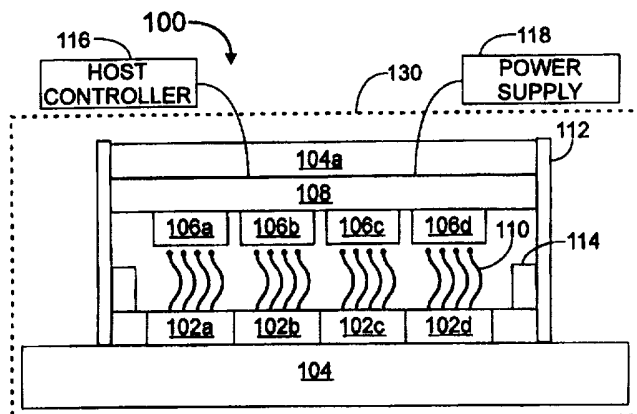




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : G01R 1/073, 1/067, 31/316	A3	(11) International Publication Number: WO 97/43656 (43) International Publication Date: 20 November 1997 (20.11.97)
(21) International Application Number: PCT/US97/08604 (22) International Filing Date: 15 May 1997 (15.05.97) (30) Priority Data: 60/005,189 17 May 1996 (17.05.96) US PCT/US96/08107 24 May 1996 (24.05.96) WO (34) Countries for which the regional or international application was filed: US et al. 60/020,869 27 June 1996 (27.06.96) US 60/024,405 22 August 1996 (22.08.96) US 60/024,555 26 August 1996 (26.08.96) US 60/030,697 13 November 1996 (13.11.96) US 60/032,666 13 December 1996 (13.12.96) US 60/034,053 31 December 1996 (31.12.96) US 08/784,862 15 January 1997 (15.01.97) US 08/788,740 24 January 1997 (24.01.97) US 08/802,054 18 February 1997 (18.02.97) US 08/819,464 17 March 1997 (17.03.97) US 08/852,152 6 May 1997 (06.05.97) US (71) Applicant: FORMFACTOR, INC. [US/US]; 5666 La Ribera Street, Livermore, CA 94550 (US).		(72) Inventors: KHANDROS, Igor, Y.; 25 Haciendas Road, Orinda, CA 94563 (US). PEDERSEN, David, V.; 6 Sterling Lane, Scotts Valley, CA 95066 (US). (74) Agent: LINDEN, Gerald, E.; Suite 300, 2716 South Chickasaw Trail, Orlando, FL 32829 (US). (81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, UZ, VN, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i> (88) Date of publication of the international search report: 12 March 1998 (12.03.98)

(54) Title: WAFER-LEVEL BURN-IN AND TEST



(57) Abstract

Techniques for performing wafer-level burn-in and test of semiconductor devices include a test substrate having active electronic components such as ASICs mounted to an interconnection substrate or incorporated therein, metallic spring contact element effecting interconnections between the ASICs and a plurality of devices-under-test (DUTs) on a wafer-under-test (WUT), all disposed in a vacuum vessel so that the ASICs can be operated at temperatures independent from and significantly lower than the burn-in temperature of the DUTs. The spring contact elements may be mounted to either the DUTs or to the ASICs, and may fan out to relax tolerance constraints on aligning and interconnecting the ASICs and the DUTs. A significant reduction in interconnect count and consequent simplification of the interconnection substrate is realized because the ASICs are capable of receiving a plurality of signals for testing the DUTs over relatively few signal lines from a host controller and promulgating these signals over the relatively many interconnections between the ASICs and the DUTs. The ASICs can also generate at least a portion of these signals in response to control signals from the host controller. Physical alignment techniques are also described. Micromachined indentations on the front surface of the ASICs ensure capturing free ends of the spring contact elements. Micromachined features on the back surface of the ASICs and the front surface of the interconnection substrate to which they are mounted facilitate precise alignment of a plurality of ASICs on the support substrate.

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INTERNATIONAL SEARCH REPORT

Inter. Patent Application No

PCT/US 97/08604

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 6 G01R1/073 G01R1/067 G01R31/316

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 6 G01R

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	-/--	

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

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Date of the actual completion of the international search

6 January 1998

Date of mailing of the international search report

15. 01. 98.

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INTERNATIONAL SEARCH REPORT

International Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 91 12706 A (LEEDY) 22 August 1991	1-4,8,9, 17,20, 23-26, 28,29, 32,57,58
Y		7,18-22, 41-44,46
A	see page 3, line 9-12 see page 5, line 33 - page 6, line 14 see page 12, line 15-23 see page 14, line 3 - page 15, line 8 see page 15, line 16-36 see page 16, line 2-26 see page 19, line 24 - page 21, line 1 see page 22, line 18-35 see page 31, line 15 - page 32, line 5 see page 51, line 10 - page 52, line 24; figures 4A,4B,13-15 see figure 32 ---	31
X	DE 90 04 562 U (ATG ELECTRONIC) 19 July 1990	1-4,8, 17,20, 23-26, 28,29, 31,32, 51-55
Y	see page 2, line 19 - page 27 see page 6, line 1-31 see page 7, line 33 - page 8, line 9 see page 10, line 12 - page 11, line 25 see page 15, line 5 - line 7 see page 25, line 19 - line 22 see page 46, line 15 - line 35 see page 51, line 24 - line 35; figures 14-16D, see page 58 ---	10,11
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A	see abstract see page 5, line 50 - page 6, line 7 see page 7, line 7 - line 22; claim 2; figures 3,5,6 see page 10, line 24 - line 51 ---	7,13,16, 17
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A	see column 1, line 6 - line 14 see column 3, line 4 - column 4, line 6 see column 4, line 65 - column 5, line 17 see column 6, line 7 - line 11; figure 2 --- -/--	1-3, 17-19, 41-44, 46,51,57

INTERNATIONAL SEARCH REPORT

International Application No

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 97/08604

Box I Observations where certain claims were found unsearchable (Continuation of item 1 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 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:

see continuation 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.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
- No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International Application No. PCT/ US 97/08604

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

1. claims 1-15,17-32,41-46,51-60:
method for providing test signals to a DUT over common few lines as part of the wafer burn in and test
2. claims 16,33-40:
method for burning in semiconductor devices maintaining the DUT and the test substrate at different independent temperatures
3. claims 47,48:
performing burn-in with the DUT and the test substrate disposed in vacuum
4. claims 49,50:
method for aligning a plurality of electronic components to an interconnection substrate

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