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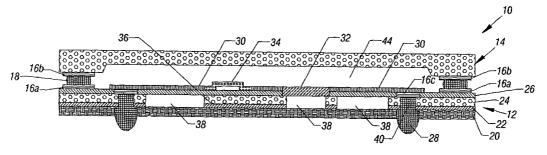
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(54) Title: PACKAGING MICROELECTROMECHANICAL STRUCTURES



(57) Abstract: A microelectromechanical system (32) may be enclosed in a hermetic cavity (44) defined by joined, first and second semiconductor structures (14, 12). The joined structures (14, 12) may be sealed by a soldier sealing ring (18), which extends completely around the cavity (44). One of the semiconductor structures (14, 12) may have the system (32) formed thereon and an open area (38) may be formed from the underside of the structure (14, 12) and may be closed by covering with a suitable film (20) in one embodiment.





## INTERNATIONAL SEARCH REPORT

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# A. CLASSIFICATION OF SUBJECT MATTER IPC 7 B81C3/00

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 B81B B81C

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, INSPEC, PAJ

Category °	Citation of document, with indication, where appropriate, of t	Relevant to claim No.	
x	BROWN A R ET AL: "Micromachir micropackaged filter banks and bandpass filters", WIRELESS COMMUNICATIONS CONFERENCE, 199 PROCEEDINGS BOULDER, CO, USA 1997, NEW YORK, NY, USA, IEEE, 193-197 XP010245585 ISBN: 0-7803-4194-5 figure 2	d tunable 97., 11-13 AUG.	1-10, 21-30
X	EP 0 994 330 A (SENSONOR ASA) 19 April 2000 (2000-04-19) figure 15	-/	11-20
χ Fur	ther documents are listed in the continuation of box C.	X Patent family members are liste	ed in annex.
"A" docum consi "E" earlier filing "L" docum which citatic "O" docum other "P" docum	ategories of cited documents:  nent defining the general state of the art which is not idered to be of particular relevance document but published on or after the international date ent which may throw doubts on priority claim(s) or in is cited to establish the publication date of another on or other special reason (as specified) nent referring to an oral disclosure, use, exhibition or means ent published prior to the international filing date but than the priority date claimed	<ul> <li>"T" later document published after the in or priority date and not in conflict wis cited to understand the principle or invention</li> <li>"X" document of particular relevance; the cannot be considered novel or cannot have an inventive step when the cannot be considered to involve an document is combined with one or ments, such combination being obvin the art.</li> <li>"&amp;" document member of the same pate</li> </ul>	th the application but theory underlying the e claimed invention not be considered to document is taken alone e claimed invention inventive step when the more other such docu- rious to a person skilled
Date of the	e actual completion of the international search	Date of mailing of the international s	search report
	16 January 2004	03/02/2004	
:	to danuary 2004		

## **INTERNATIONAL SEARCH REPORT**

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT					
	Relevant to claim No.				
MAYER F ET AL: "Flip-chip packaging for smart MEMS", SMART STRUCTURES AND MATERIALS 1998: SMART ELECTRONICS AND MEMS, SAN DIEGO, CA, USA, 2-4 MARCH 1998, PROCEEDINGS OF THE SPIE - THE INTERNATIONAL SOCIETY FOR OPTICAL ENGINEERING, 1998, SPIE-INT. SOC. OPT. ENG, USA, PAGE(S) 183 - 193 XP001157226 ISSN: 0277-786X	11				
rigule 11	15				
MARKUS K W ET AL: "SMART MEMS: FLIP CHIP INTEGRATION OF MEMS AND ELECTRONICS", PROCEEDINGS OF THE SPIE, SPIE, BELLINGHAM, VA, US, VOL. 2448, PAGE(S) 82-92 XP001039856 ISSN: 0277-786X figures 1,5	2,3				
DRAYTON R F ET AL: "ADVANCED MONOLITHIC PACKAGING CONCEPTS FOR HIGH PERFORMANCE CIRCUITS AND ANTENNAS", 1996 IEEE MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM DIGEST. SAN FRANCISCO, JUNE 17 - 21, 1996, IEEE MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM DIGEST, NEW YORK, IEEE, US, VOL. VOL. 3, PAGE(S) 1615-1618 XP000720652 ISBN: 0-7803-3247-4 page 1615, right-hand column, paragraph 4	5,6				
US 2001/055836 A1 (KUNDA TOMOHITO) 27 December 2001 (2001-12-27) figure 3A	7,13,14, 23,24				
US 6 140 144 A (MASSOUD-ANSARI SONBOL ET AL) 31 October 2000 (2000-10-31) column 7, line 21-29; figure 2F	7,13,14, 23,24				
HEUNG-WOO PARK ET AL: "Packaging of the RF-MEMS switch", DESIGN, CHARACTERIZATION, AND PACKAGING FOR MEMS AND MICROELECTRONICS II, ADELAIDE, SA, AUSTRALIA, 17-19 DEC. 2001, PROCEEDINGS OF THE SPIE - THE INTERNATIONAL SOCIETY FOR OPTICAL ENGINEERING, 2001, SPIE-INT. SOC. OPT. ENG, USA, PAGE(S) 234 - 243 XP001157230 ISSN: 0277-786X page 239, paragraph 2 -page 240; figure 1 figure 1	15-30				
	Chatton of document, with indication, where appropriate, of the relevant passages  MAYER F ET AL: "Flip-chip packaging for smart MEMS", SMART STRUCTURES AND MATERIALS 1998: SMART ELECTRONICS AND MEMS, SAN DIEGO, CA, USA, 2-4 MARCH 1998, PROCEEDINGS OF THE SPIE - THE INTERNATIONAL SOCIETY FOR OPTICAL ENGINEERING, 1998, SPIE-INT. SOC. OPT. ENG, USA, PAGE(S) 183 - 193 XP001157226 ISSN: 0277-786X figure 11  MARKUS K W ET AL: "SMART MEMS: FLIP CHIP INTEGRATION OF MEMS AND ELECTRONICS", PROCEEDINGS OF THE SPIE, SPIE, BELLINGHAM, VA, US, VOL. 2448, PAGE(S) 82-92 XP001039856 ISSN: 0277-786X figures 1,5  DRAYTON R F ET AL: "ADVANCED MONOLITHIC PACKAGING CONCEPTS FOR HIGH PERFORMANCE CIRCUITS AND ANTENNAS", 1996 IEEE MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM DIGEST. SAN FRANCISCO, JUNE 17 - 21, 1996, IEEE MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM DIGEST, NEW YORK, IEEE, US, VOL. VOL. 3, PAGE(S) 1615-1618 XP000720652 ISBN: 0-7803-3247-4 page 1615, right-hand column, paragraph 4  US 2001/055836 A1 (KUNDA TOMOHITO) 27 December 2001 (2001-12-27) figure 3A  US 6 140 144 A (MASSOUD-ANSARI SONBOL ET AL) 31 October 2000 (2000-10-31) column 7, line 21-29; figure 2F  HEUNG-WOO PARK ET AL: "Packaging of the RF-MEMS switch", DESIGN, CHARACTERIZATION, AND PACKAGING FOR MEMS AND MICROELECTRONICS II, ADELAIDE, SA, AUSTRALIA, 17-19 DEC. 2001, PROCEEDINGS OF THE SPIE - THE INTERNATIONAL SOCIETY FOR OPTICAL ENGINEERING, 2001, SPIE-INT. SOC. OPT. ENG, USA, PAGE(S) 234 - 243 XP001157230 ISSN: 0277-786X page 239, paragraph 2 -page 240; figure 1				

# INTERNATIONAL SEARCH REPORT

Information on patent family members

Internation plication No PCT/US 03/09620

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
EP 0994330	A	19-04-2000	EP BR CN JP KR US	0994330 A1 9904435 A 1250871 A 2000155030 A 2000028948 A 6319729 B1	19-04-2000 24-10-2000 19-04-2000 06-06-2000 25-05-2000 20-11-2001
US 2001055836	A1	27-12-2001	JP DE	2002005951 A 10130131 A1	09-01-2002 03-01-2002
US 6140144	Α	31-10-2000	AU WO	4053697 A 9805935 A1	25-02-1998 12-02-1998