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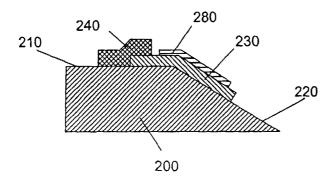
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(54) Title: SOLDER ON A SLOPED SURFACE



(57) Abstract: A method for depositing a solder layer (280) or solder bump on a sloped surface (220). The method includes etching a sloped surface on a planar semiconductor substrate (200), depositing a solder-wettable layer (230) on the sloped surface, masking the wettabler layer with a coating layer (240) to control the position of the solder deposition, and using an organic film (250) to prevent the solder from being deposited at regions not above either the wettable layer or the coating layer. Also, a semiconductor device structure on which a solder layer or solder bump is formed exclusively on a

sloped surface.

INTERNATIONAL SEARCH REPORT



A. CLASSIFICATION OF SUBJECT MATTER IPC 7 H05K3/34

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

 $\begin{array}{ccc} \text{Minimum documentation searched (classification system followed by classification symbols)} \\ IPC & 7 & H01L & H05K \end{array}$

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT						
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.				
Х	US 2002/028338 A1 (LI JIAN ET AL) 7 March 2002 (2002-03-07) abstract; figures 2-4 paragraph '0002!	1,6,7				
A	paragraph '0017! - paragraph '0020!	4,10				
X	US 5 736 456 A (AKRAM ET AL) 7 April 1998 (1998-04-07) abstract; figures 1-4 column 3, line 49 - line 63 column 4, line 8 - line 23 column 5, line 66 - column 6, line 16 column 6, line 37 - line 40	1,6,7				
Α		4,10				

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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 document 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
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Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer Deconinck, E

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International Application No PO/US2004/006912

C (Continue	ation) DOCUMENTS CONSIDERED TO BE RELEVANT	F ST /032004/000912
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 360 142 A (CARPENTER ET AL)	1 6 7
^	23 November 1982 (1982-11-23) abstract; figures 1,2	1,6,7
A	column 3, line 22 - column 4, line 31	4,10
A	US 5 880 017 A (SCHWIEBERT ET AL) 9 March 1999 (1999-03-09) cited in the application * cited by applicant * abstract; figures 1,4 column 3, line 49 - line 51 column 4, line 59 - column 5, line 2 column 6, line 40 - line 43 column 9, line 29 - line 40 column 10, line 26 - line 38	1,2,4,6, 7,9,10
X	US 5 492 235 A (CRAFTS ET AL) 20 February 1996 (1996-02-20) abstract; figures 1-3 column 2, line 36 - line 40	1,6-8
Α	column 4, line 5 - line 49	5,10

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No PS/US2004/006912

Patent document cited in search report	Publication date		Patent family member(s)	Publication date
US 2002028338 A1	07-03-2002	US AU DE GB WO	6312830 B1 7883100 A 10084995 TO 2370417 A ,B 0117013 A2	06-11-2001 26-03-2001 31-10-2002 26-06-2002 08-03-2001
US 5736456 A	07-04-1998	US US US US US US US US US US US US	6072236 A 2002086513 A1 6083820 A 2002185749 A1 2003194854 A1 6211052 B1 6316839 B1 2001016408 A1 5851911 A 5903058 A 6147413 A 2002000673 A1 6124634 A 6358833 B1 2001007372 A1 6207548 B1	06-06-2000 04-07-2002 04-07-2000 12-12-2002 16-10-2003 03-04-2001 13-11-2001 23-08-2001 22-12-1998 11-05-1999 14-11-2000 03-01-2002 26-09-2000 19-03-2002 12-07-2001 27-03-2001
US 4360142 A	23-11-1982	US CA DE EP IT JP JP	4290079 A 1139008 A1 3072031 D1 0021139 A2 1148836 B 1490494 C 56007452 A 59043092 B	15-09-1981 04-01-1983 22-10-1987 07-01-1981 03-12-1986 07-04-1989 26-01-1981 19-10-1984
US 5880017 A	09-03-1999	US CN EP JP US US	5539153 A 1159077 A ,C 0697727 A2 8172259 A 5586715 A 5672542 A	23-07-1996 10-09-1997 21-02-1996 02-07-1996 24-12-1996 30-09-1997
US 5492235 A	20-02-1996	WO AU DE GB	9722989 A1 4641496 A 19581952 TO 2322970 A ,B	26-06-1997 14-07-1997 05-11-1998 09-09-1998