



- (51) **International Patent Classification:**
H01L 21/60 (2006.01) *H01L 23/488* (2006.01)
- (21) **International Application Number:**
PCT/US2012/040197
- (22) **International Filing Date:**
31 May 2012 (31.05.2012)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
61/491,757 31 May 2011 (31.05.2011) US
13/483,376 30 May 2012 (30.05.2012) US
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- (81) **Designated States (unless otherwise indicated, for every kind of national protection available):** AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
- (84) **Designated States (unless otherwise indicated, for every kind of regional protection available):** ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

- (88) **Date of publication of the international search report:**
11 April 2013

(54) **Title:** LOW VOID SOLDER JOINT FOR MULTIPLE REFLOW APPLICATIONS

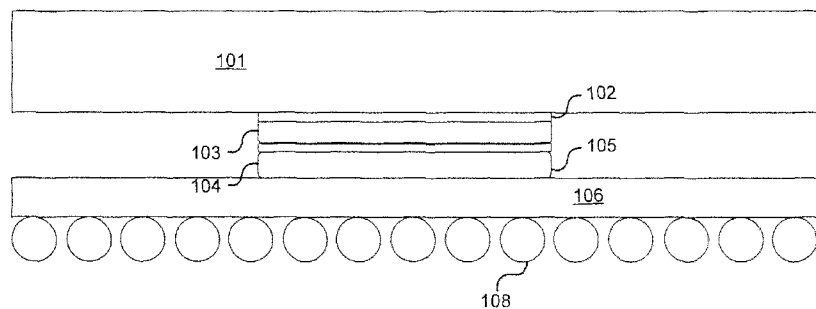


Fig. 1B

(57) **Abstract:** A method is provided for the forming of a metallic solder joint without a liquid flux to create a solder joint that has minimal voids and can be re flowed multiple times without void propagation. This process can be done for any solder alloy, and is most specifically used in the application of first level thermal interface in a IC or micro processor or BGA microprocessor.

WO 2012/166911 A3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/040197**A. CLASSIFICATION OF SUBJECT MATTER****H01L 21/60(2006.01)i, H01L 23/488(2006.01)i**

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)

H01L 21/60; H01L 21/50; B23K 5/213; B23K 35/12; H01L 23/12; H01L 23/02; H01L 21/00; B23K 31/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: solder,reflow,fluxless,no flux,temperature,inert,oxide reducing,heat spreader

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2007-0152321 A1 (WEI SHI et al.) 05 July 2007 See abstract; figures 1-12; paragraphs [0019]-[0036]	1-26
Y	US 2006-0258045 A1 (ISHIGURI MASAHICO et al.) 16 November 2006 See abstract; figure 11; paragraph [0076]	1-26
Y	US 2003-0019917 A1 (MASAHICO FURUNO et al.) 30 January 2003 See figures 8A-10C; paragraphs [0078]-[0093]	21-24
A	US 2007-0131737 A1 (RENAVIKAR MUKUL et al.) 14 June 2007 See abstract; figures 1, 3; paragraphs [0014]-[0040]	1-26

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

* Special categories of cited documents:

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"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

27 DECEMBER 2012 (27.12.2012)

Date of mailing of the international search report

28 DECEMBER 2012 (28.12.2012)

Name and mailing address of the ISA/KR

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Facsimile No. 82-42-472-7140

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2012/040197

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2007-0152321 A1	05.07.2007	None	
US 2006-0258045 A1	16.11.2006	CN 1627512 A JP 2005-175128 A KR 10-0636722 B1 KR 10-2005-0056865 A TW 251285 B US 2005-0140004 A1 US 7064436 B2	15.06.2005 30.06.2005 23.10.2006 16.06.2005 11.03.2006 30.06.2005 20.06.2006
US 2003-0019917 A1	30.01.2003	EP 1043766 A1 JP 11-163036 A JP W000-17923 A1 KR 10-0473432 B1 US 2004-0238602 A1 US 6742701 B2	11.10.2000 18.06.1999 30.03.2000 08.03.2005 02.12.2004 01.06.2004
US 2007-0131737 A1	14.06.2007	CN 101322232 A CN 101322232 B KR 10-2008-0066879 A KR 10-2011-0003560 A KR 10-2011-0134504 A WO 2007-067591 A2 WO 2007-067591 A3 WO 2007-067591 A3	10.12.2008 01.06.2011 16.07.2008 12.01.2011 14.12.2011 14.06.2007 02.08.2007 14.06.2007