



- (51) International Patent Classification:  
*B41J 2/32* (2006.01)      *H01L 51/56* (2006.01)
- (21) International Application Number:  
PCT/US2012/023862
- (22) International Filing Date:  
3 February 2012 (03.02.2012)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  
61/439,816      4 February 2011 (04.02.2011)      US  
13/154,419      6 June 2011 (06.06.2011)      US  
13/327,745      15 December 2011 (15.12.2011)      US
- (71) Applicant (for all designated States except US):  
**KATEEVA, INC.** [US/US]; Suite A, 1430 O'Brien Drive,  
Menlo Park, California 94025 (US).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): **GOLDA, Dariusz**  
[US/US]; Suite A, 1430 O'Brien Drive, Menlo Park, Cali-  
fornia 94025 (US). **KIM, Hyeun-Su** [KR/US]; Suite A,  
1430 O'Brien Drive, Menlo Park, California 94025 (US).  
**GASSEND, Valerie** [FR/US]; Suite A, 1430 O'Brien  
Drive, Menlo Park, California 94025 (US).
- (74) Agent: **FRAZIER, Jeffery, D.**; Suite A, 1430 O'Brien  
Drive, Menlo Park, CA 94025 (US).

- (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, MD, 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:  
31 January 2013

(54) Title: LOW-PROFILE MEMS THERMAL PRINTHEAD DIE HAVING BACKSIDE ELECTRICAL CONNECTIONS

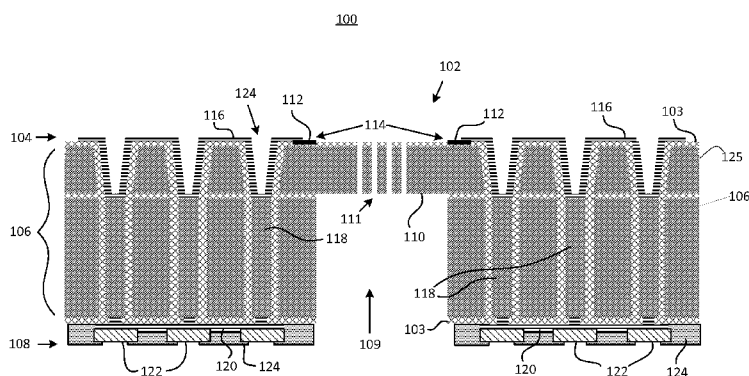


FIG.  
1

(57) Abstract: A thermal printhead die is formed from an SOI structure as a MEMS device. The die has a printing surface, a buried oxide layer, and a mounting surface opposite the printing surface. A plurality of ink delivery sites are formed on the printing surface, each site having an ink-receiving and ink-dispensing structure. An ohmic heater is formed adjacent to each structure, and an under-bump metallization (UBM) pad is formed on the mounting surface and is electrically connected to the ohmic heater, so that ink received by the ink-delivery site and electrically heated by the ohmic heater may be delivered to a substrate by sublimation. A through-silicon-via (TSV) plug may be formed through the thickness of the die and electrically coupled through the buried oxide layer from the ohmic heater to the UBM pad. Layers of interconnect metal may connect the ohmic heater to the UBM pad and to the TSV plug.



**A. CLASSIFICATION OF SUBJECT MATTER*****B41J 2/32(2006.01)i, H01L 51/56(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)

B41J 2/32; B41J 2/16; B05B 7/16; B41J 2/05; B41J 2/335

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) &amp; Keywords: "MEMS", "printhead", "heater", "UBM", "silicon"

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2008-221857 A (HEWLETT PACKARD COMPANY) 25 September 2008 See claims 1-9 and figures 4-5.	1-29
A	KR 10-2005-0072523 A (SAMSUNG ELECTRONICS CO., LTD.) 12 July 2005 See claims 1,4 and figures 6-7.	1-29
A	US 2008-0308037 A1 (BULOVIC VLADIMIR et al.) 18 December 2008 See abstract and claim 1.	1-29
A	JP 2008-000977 A (ROHM CO LTD) 10 January 2008 See claim 1 and figures 1-3.	1-29

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

\* 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 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

"&amp;" document member of the same patent family

Date of the actual completion of the international search

24 SEPTEMBER 2012 (24.09.2012)

Date of mailing of the international search report

**25 SEPTEMBER 2012 (25.09.2012)**

Name and mailing address of the ISA/KR

Korean Intellectual Property Office  
189 Cheongsu-ro, Seo-gu, Daejeon Metropolitan  
City, 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

CHO, Choon Geun

Telephone No. 82-42-481-8482



**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/US2012/023862**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2008-221857 A	25.09.2008	CN 1170680 C0	13.10.2004
		CN 1297815 A0	06.06.2001
		DE 69828734 D1	03.03.2005
		DE 69828734 T2	05.01.2006
		EP 0913261 A2	06.05.1999
		EP 0913261 A3	22.03.2000
		EP 0913261 B1	26.01.2005
		EP 1095773 A1	02.05.2001
		EP 1095773 B1	09.07.2003
		EP 1182037 A1	27.02.2002
		EP 1186416 A2	13.03.2002
		EP 1186416 A3	26.06.2002
		EP 1186416 B1	03.03.2004
		EP 1186417 A2	13.03.2002
		EP 1186417 A3	17.07.2002
		EP 1186417 B1	11.01.2006
		JP 03-432503 B2	23.05.2003
		JP 03-437963 B2	06.06.2003
		JP 04-202485 B2	24.12.2008
		JP 04-355777 B2	14.08.2009
		JP 04-533522 B2	18.06.2010
		JP 11-192705 A	21.07.1999
		JP 2001-130012 A	15.05.2001
		JP 2002-086695 A	26.03.2002
		JP 2002-086696 A	26.03.2002
		JP 2002-086735 A	26.03.2002
		JP 3432503 B2	04.08.2003
		JP 3437963 B2	18.08.2003
		JP 4355777 B2	04.11.2009
		JP 4533522 B2	01.09.2010
		KR 10-0496095 B1	26.09.2005
		KR 10-0657108 B1	12.12.2006
		KR 10-0805540 B1	20.02.2008
		TW 393406 A	11.06.2000
		TW 393406 B	11.06.2000
		TW 501979 A	11.09.2002
		TW 503181 A	21.09.2002
		US 06123410 A	26.09.2000
		US 2002-0015073 A1	07.02.2002
		US 2002-0018101 A1	14.02.2002
		US 2002-0030720 A1	14.03.2002
		US 2002-0033861 A1	21.03.2002
		US 2002-0051036 A1	02.05.2002
		US 2002-0122097 A1	05.09.2002
		US 2002-0180835 A1	05.12.2002
		US 2003-0007034 A1	09.01.2003
		US 2003-0048330 A1	13.03.2003
US 2003-0052944 A1	20.03.2003		
US 2003-0122898 A1	03.07.2003		

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/US2012/023862**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		US 2004-0046824 A1	11.03.2004
		US 2004-0100522 A1	27.05.2004
		US 2004-0113996 A1	17.06.2004
		US 2004-0165027 A1	26.08.2004
		US 6188414 B1	13.02.2001
		US 6250738 B1	26.06.2001
		US 6322206 B1	27.11.2001
		US 6325488 B1	04.12.2001
		US 6341845 B1	29.01.2002
		US 6350013 B1	26.02.2002
		US 6428145 B1	06.08.2002
		US 6435653 B1	20.08.2002
		US 6450614 B1	17.09.2002
		US 6454955 B1	24.09.2002
		US 6464333 B1	15.10.2002
		US 6508536 B1	21.01.2003
		US 6513907 B2	04.02.2003
		US 6523940 B2	25.02.2003
		US 6592205 B2	15.07.2003
		US 6648437 B2	18.11.2003
		US 6679596 B2	20.01.2004
		US 6692111 B2	17.02.2004
		US 6705705 B2	16.03.2004
		US 6733112 B2	11.05.2004
		US 6789878 B2	14.09.2004
		US 6935023 B2	30.08.2005
		US 6962406 B2	08.11.2005
		US 6997540 B2	14.02.2006
		US 7226156 B2	05.06.2007
KR 10-2005-0072523 A	12.07.2005	None	
US 2008-0308037 A1	18.12.2008	CA 2690388 A1	24.12.2008
		CA 2690392 A1	24.12.2008
		CA 2690396 A1	24.12.2008
		CN 101743125 A	16.06.2010
		CN 101754859 A	23.06.2010
		CN 101754861 A	23.06.2010
		EP 2155493 A1	24.02.2010
		EP 2155493 A4	11.08.2010
		EP 2155494 A1	24.02.2010
		EP 2155494 A4	11.08.2010
		EP 2155496 A2	24.02.2010
		EP 2155496 A4	11.08.2010
		JP 2010-533057 A	21.10.2010
		JP 2010-533349 A	21.10.2010
		JP 2010-534118 A	04.11.2010
		KR 10-2010-0021460 A	24.02.2010
		KR 10-2010-0029204 A	16.03.2010
		KR 10-2010-0038301 A	14.04.2010

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/US2012/023862**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		TW 200950975 A	16. 12. 2009
		TW 200950976 A	16. 12. 2009
		TW 200950979 A	16. 12. 2009
		US 2008-311289 A1	18. 12. 2008
		US 2008-311307 A1	18. 12. 2008
		US 2011-181644 A1	28. 07. 2011
		US 2011-267390 A1	03. 11. 2011
		US 2012-038705 A1	16. 02. 2012
		WO 2008-157395 A1	24. 12. 2008
		WO 2008-157410 A1	24. 12. 2008
		WO 2008-157420 A2	24. 12. 2008
		WO 2008-157420 A3	19. 02. 2009
JP 2008-000977 A	10. 01. 2008	CN 101466549 A	24. 06. 2009
		EP 2030795 A1	04. 03. 2009
		JP 2008-000947 A	10. 01. 2008
		US 2009-0174757 A1	09. 07. 2009
		US 7903132 B2	08. 03. 2011
		WO 2007-148663 A1	27. 12. 2007