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(54) Title: SELF-POWERED FUNCTIONAL DEVICE USING ON-CHIP POWER GENERATION

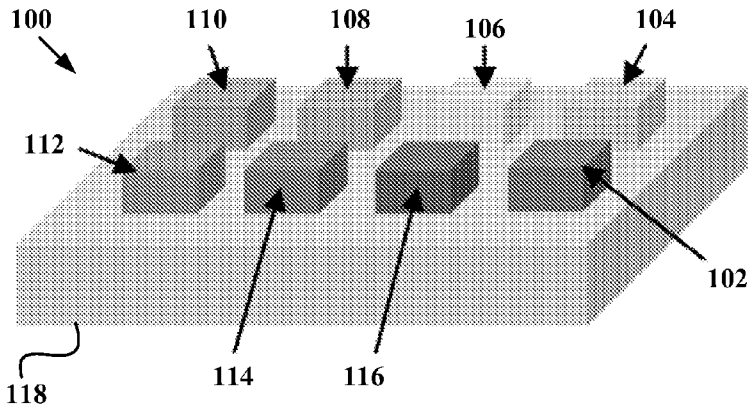

FIG. 1

(57) Abstract: An apparatus, system, and method for a self-powered device (100) using on-chip power generation. In some embodiments, the apparatus includes a substrate (118), a power generation module (114, 106, 110, 112) on the substrate, and a power storage module (108) on the substrate. The power generation module may include a thermoelectric generator (106) made of bismuth telluride.

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
INV. H01M8/16 H01M16/00 H01L31/00 H01L35/00 H01L35/32
H01L41/00 H01M10/42 H01M10/46 H02N2/18 B81B3/00
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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)
H01M H01L

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 practicable, 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.
X	US 5 644 207 A (LEW ARK L [US] ET AL) 1 July 1997 (1997-07-01) figure 12 column 2, line 29 - line 54 column 3, line 37 - column 4, line 12 column 6, line 41 - line 67 -----	1-17
X	WO 03/106966 A2 (THERASENSE INC [US]) 24 December 2003 (2003-12-24) page 8, paragraph 36 - page 9, paragraph 38 page 10, paragraph 42 page 30, paragraph 101 - page 31, paragraph 103 -----	1-17

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

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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 2008/035258 A2 (KONINKL PHILIPS ELECTRONICS NV [NL] ; PIJNENBURG REMCO H W [NL] ; NOTTEN) 27 March 2008 (2008-03-27) page 2, line 10 - line 30 page 3, line 17 - line 30 page 5, line 17 - line 27 page 7, line 12 - line 25	1,2,8, 15,16
X	US 2010/076714 A1 (DISCENZO FREDERICK M [US]) 25 March 2010 (2010-03-25) figure 8 page 7, paragraph 87 page 9, paragraph 104 - page 11, paragraph 120	1-4,6-17
X	WO 2007/070634 A2 (WISPI NET [US] ; MORRIS DOUGLAS ANTHONY [US] ; KELLY DAVE [US] ; KOHL PAUL) 21 June 2007 (2007-06-21) page 3, paragraph 26 page 24, paragraph 87 - page 26, paragraph 95	1,2,4,8, 15
X	WO 2009/015331 A1 (TRULITE INC [US] ; PEARSON KEN [US] ; BRYDON CHRIS [US] ; WANG GUANGDE [U) 29 January 2009 (2009-01-29) page 3, line 31 - page 4, line 34 page 8, line 15 - page 12, line 8 page 19, line 31 - page 20, line 2	1,2,4-8, 15-17
X	WO 2010/010520 A2 (NXP BV [NL] ; KOCHUPURACKAL JINESH BALAKRISHNA PILLAI [NL] ; KLOOTWIJK J) 28 January 2010 (2010-01-28) page 2, line 16 - line 18 page 3, line 6 - line 14	1,2,7,15
A	US 2008/043304 A1 (STALFORD HAROLD L [US]) 21 February 2008 (2008-02-21) page 2, paragraph 23 - paragraph 26 page 3, paragraph 33 - paragraph 36	1-17
A	STRASSER M ET AL: "Micromachined CMOS thermoelectric generators as on-chip power supply" , SENSORS AND ACTUATORS A, ELSEVIER SEQUOIA S.A. , LAUSANNE, CH, vol . 114, no. 2-3 , 1 September 2004 (2004-09-01) , pages 362-370, XP004534498, ISSN: 0924-4247 , DOI : 10.1016/J.SNA.2003.11.039 the whole document	1-17

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2011/044875

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2010/173228 Al (WALLACE GORDON GEORGE [AU] ET AL) 8 July 2010 (2010-07-08) page 2, paragraph 27 - paragraph 30 page 2, paragraph 34 page 5, paragraph 89 - paragraph 94 -----	1,8-14
T	M. M. HUSSAIN ET AL: "Self-powered integrated systems-on-chip (energy chip)", PROCEEDINGS OF SPIE, 1 January 2010 (2010-01-01), pages 767914-767914-7, XP55030549, ISSN: 0277-786X, DOI: 10.1117/12.850811 the whole document -----	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2011/044875

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5644207 A	01-07-1997	NONE	
WO 03106966 A2	24-12-2003	AU 2003269820 A1	31-12-2003
		US 2008044721 A1	21-02-2008
		US 2008118782 A1	22-05-2008
		WO 03106966 A2	24-12-2003
WO 2008035258 A2	27-03-2008	CN 101517803 A	26-08-2009
		EP 2067205 A2	10-06-2009
		JP 2010504609 A	12-02-2010
		RU 2009114713 A	27-10-2010
		WO 2008035258 A2	27-03-2008
US 2010076714 A1	25-03-2010	NONE	
WO 2007070634 A2	21-06-2007	EP 1961063 A2	27-08-2008
		KR 20080077605 A	25-08-2008
		US 2009092862 A1	09-04-2009
		WO 2007070634 A2	21-06-2007
W0 2009015331 A1	29-01-2009	AU 2008279082 A1	29-01-2009
		CA 2732060 A1	29-01-2009
		CN 101855769 A	06-10-2010
		EP 2181477 A1	05-05-2010
		KR 20100061453 A	07-06-2010
		US 2009076661 A1	19-03-2009
		W0 2009015331 A1	29-01-2009
W0 2010010520 A2	28-01-2010	CN 102099917 A	15-06-2011
		EP 2308091 A2	13-04-2011
		US 2011128727 A1	02-06-2011
		WO 2010010520 A2	28-01-2010
US 2008043304 A1	21-02-2008	NONE	
us 2010173228 A1	08-07-2010	NONE	