(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
6 December 2012 (06.12.2012)

WIPO | PCT

(10) International Publication Number
WO 2012/164986 A3

(51) International Patent Classification:
G06F 7/58 (2006.01)

(21) International Application Number:
PCT/JP2012/054497

(22) International Filing Date:
17 February 2012 (17.02.2012)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2011-125282 3 June 2011 (03.06.2011) JP

(71) Applicant *(for all designated States except US)*: **KABUSHIKI KAISHA TOSHIBA** [JP/JP]; 1-1, Shibaura 1-chome, Minato-ku, Tokyo, 1058001 (JP).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **NAGAI, Yuji** [JP/JP]. **INOUE, Atsushi** [JP/JP]. **TAKEYAMA, Yoshikazu** [JP/JP].

(74) Agents: **KURATA, Masatoshi** et al.; c/o SUZUYE & SUZUYE, 1-12-9, Toranomon, Minato-ku, Tokyo, 1050001 (JP).

(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, 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))*

[Continued on next page]

(54) **Title**: SEMICONDUCTOR MEMORY DEVICE FOR PSEUDO-RANDOM NUMBER GENERATION

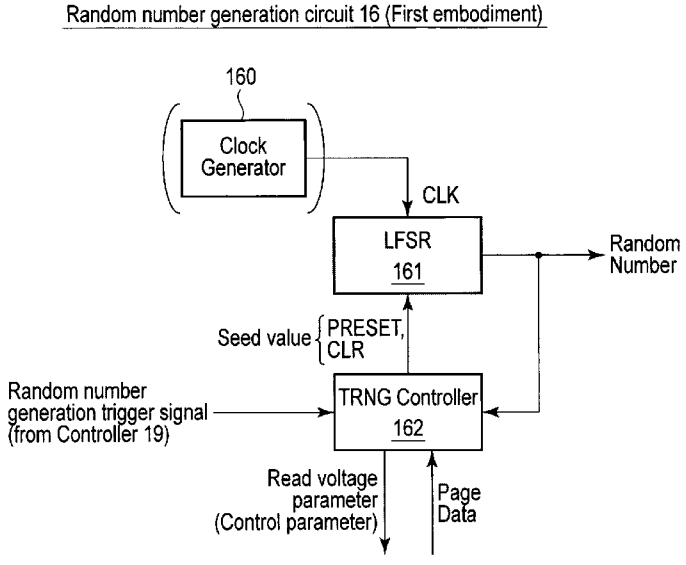


FIG. 11

(57) **Abstract**: According to one embodiment, a semiconductor memory device includes a memory cell array including a plurality of memory cells, a random number generation circuit configured to generate a random number, and a controller configured to control the memory cell array and the random number generation circuit. The random number generation circuit includes a random number control circuit configured to generate a random number parameter based on data which is read out from the memory cell by a generated control parameter, and a pseudo-random number generation circuit configured to generate the random number by using the random number parameter as a seed value.

WO 2012/164986 A3

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(88) Date of publication of the international search report:
28 March 2013

INTERNATIONAL SEARCH REPORT

International application No
PCT/JP2012/054497

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06F7/58
ADD.

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)
G06F

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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2007/130240 A1 (JANKE MARCUS [DE] ET AL) 7 June 2007 (2007-06-07) abstract page 2, paragraph 19 - page 4, paragraph 58 figures 4,5 -----	1-8
A	WO 2010/017320 A2 (CASSY HOLDINGS LLC [US]; ROSS PATRICK D [US]) 11 February 2010 (2010-02-11) abstract paragraph [0018] - paragraph [0027] paragraph [0084] - paragraph [0086] paragraph [0147]; claims 1-3 figures 3,4,13 ----- -/--	1-8

[X] Further documents are listed in the continuation of Box C.

[X] 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 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

Date of the actual completion of the international search	Date of mailing of the international search report
22 June 2012	14/01/2013

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Post, Katharina

2

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/JP2012/054497

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2 829 643 A1 (EVERBEE WIRELESS LTD [IL]) 14 March 2003 (2003-03-14) abstract figure 1	1-8
A	US 2007/266067 A1 (MATSUI MITSURU [JP]) 15 November 2007 (2007-11-15) abstract claims 1-3 figures 1,13,18,21,22	1-8

2

Form PCT/ISA/210 (continuation of second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2012/054497

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-8

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-8

the semiconductor memory device of claim 1, in which the random number control circuit comprises an accumulation circuit as specified in claim 2 executing an accumulation process on the read-out memory data

---

2. claims: 9-16

the semiconductor memory device of claim 1, in which the generated random number is fed back to the random number control circuit

---

3. claims: 17-20

the semiconductor memory device of claim 1 comprising an additional pseudo-random number generation circuit outputting a random number from an unspecified initial value

---

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/JP2012/054497

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2007130240 A1	07-06-2007	DE 102006028944 B3	13-09-2007
		US 2007130240 A1	07-06-2007
WO 2010017320 A2	11-02-2010	EP 2310937 A2	20-04-2011
		JP 2011530719 A	22-12-2011
		US 2010036900 A1	11-02-2010
		WO 2010017320 A2	11-02-2010
FR 2829643 A1	14-03-2003	NONE	
US 2007266067 A1	15-11-2007	CN 101040306 A	19-09-2007
		GB 2444567 A	11-06-2008
		JP 4718455 B2	06-07-2011
		US 2007266067 A1	15-11-2007
		WO 2007029330 A1	15-03-2007