PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

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PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing *(day/month/year)*	**28 January 2019 (28.01.2019)**
Applicant's or agent's file reference P119358-PCT	**FOR FURTHER ACTION** See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2018/053590	**28 September 2018 (28.09.2018)**	29 September 2017 (29.09.2017)

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

G11C 16/26(2006.01)i, G11C 16/30(2006.01)i, G11C 16/04(2006.01)i

Applicant

INTEL CORPORATION

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.
For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/KR	Date of completion of this opinion	Authorized officer
International Application Division Korean Intellectual Property Office 189 Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea Facsimile No. +82-42-481-8578	28 January 2019 (28.01.2019)	BYUN, Sung Cheal Telephone No. +82-42-481-8262

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2018/053590

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of :

   ☒ the international application in the language in which it was filed

   ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

   a. ☐ forming part of the international application as filed:
      ☐ in the form of an Annex C/ST.25 text file.
      ☐ on paper or in the form of an image file.

   b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.

   c. ☐ furnished subsequent to the international filing date for the purposes of international search only:
      ☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).
      ☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

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Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-25	YES
	Claims	NONE	NO
Inventive step (IS)	Claims	NONE	YES
	Claims	1-25	NO
Industrial applicability (IA)	Claims	1-25	YES
	Claims	NONE	NO

2. Citations and explanations :

Reference is made to the following documents:

D1: US 2015-0029796 A1 (MYUNG-HOON CHOI et al.) 29 January 2015
D2: US 2017-0169893 A1 (INTERNATIONAL BUSINESS MACHINES CORPORATION) 15 June 2017

2.1 Novelty (PCT Article 33(2)) and Inventive Step (PCT Article 33(3))
The present invention relates to memory reading procedures.

2.1.1 Claims 1-10
2.1.1.1 Independent Claim 1
Claim 1 is an independent claim and relates to an apparatus.

D1, which is considered to be the closest prior art to the subject matter of claim 1, discloses a memory device (see paragraph [0192]; and figure 23 in D1) comprising:
a memory cell array (see paragraph [0192]; and figure 23 in D1); and a second control unit to use one of a plurality of offsets, to generate a read voltage, and an adding unit and a voltage level generating unit to generate an optimal voltage level of the read voltage used to perform a read operation (see paragraphs [0202]-[0204]; and figure 24 in D1).

Claim 1 differs from D1 in that this claim comprises a controller to: receive a first read command specifying a read voltage offset profile identifier; and identify a read voltage offset profile associated with the read voltage offset profile identifier, the read voltage offset profile comprising at least one read voltage offset. However, the aforementioned features can be easily derived by a person skilled in the art from the feature of D2 considering that a read command

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Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

A period mark in claim 19 is left out at the end of the sentence. Therefore, claim 19 does not meet the requirement of PCT Article 6.
(Note: The international search report and the written opinion have been established on the assumption that a period mark in claim 19 should be put at the end of the sentence.)

Supplemental Box

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includes an address of a set of memory cells to be read and an extended address that identifies which of second registers to use by a read voltage adjustment mechanism to adjust a read voltage (see claim 4 in D2), wherein the extended address is considered a Cell Voltage Distribution Disruption Event (CVDDE) offset used for applying the read voltage adjustment mechanism (see paragraph [0027]; and figure 1 in D2). Accordingly, claim 1 would have been obvious over D1 in view of D2. Therefore, claim 1 is novel under PCT Article 33(2), but lacks an inventive step under PCT Article 33(3).

2.1.1.2 Dependent Claims 2-10

The additional features of claims 2, 4-7 can be merely a matter of design option in view of the feature of D2 considering that a read command includes an address of a set of memory cells to be read and an extended address that identifies which of second registers to use by a read voltage adjustment mechanism to adjust a read voltage (see claim 4 in D2), wherein the extended address is considered a CVDDE offset used for applying the read voltage adjustment mechanism (see paragraph [0027]; and figure 1 in D2).

The additional feature of claim 3 can be easily conceived from the feature of D2 considering that an extended address contains a null value that indicates the extended address does not identify any of second registers, resulting in a read voltage adjustment mechanism not adjusting a read voltage due to CVDDE (see claim 5 in D2).

The additional feature of claim 8 can be easily derived from the feature of D1 considering that an offset storage unit may store a plurality of pre-defined offset voltages that may be equally defined with respect to different memory chips (see paragraph [0160]; and figure 16 in D1).

The additional feature of claim 9 can be easily derived from the feature of D1 considering that a threshold voltage of a memory cell may vary due to an access, such as a programming, erasing, or reading operation of the memory cell, repeatedly performed, and a high-temperature stress or a difference in temperatures when the programming/reading operation is performed (see paragraph [0099]; and figure 5 in D1).

The additional feature of claim 10 can be easily derived from the feature of D2 considering that a read command includes extended addressing bits that are used when a CVDDE has occurred to access registers that indicate an adjustment to read voltage that is needed to

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accommodate the CVDDE (see paragraph [0023] in D2).

Accordingly, claims 2-10 would have been obvious over D1 in view of D2. Therefore, claims 2-10 are novel under PCT Article 33(2), but lack an inventive step under PCT Article 33(3).

2.1.2 Claims 11-15

2.1.2.1 Independent Claim 11

Claim 11 is an independent claim and relates to a method. The features of claim 11 are substantially the same as those of claim 1. Accordingly, the same reasoning as in claim 1 could be applied to claim 11. Therefore, the subject matter of claim 11 is novel under PCT Article 33(2), but lacks an inventive step under PCT Article 33(3) as being obvious over D1 in view of D2.

2.1.2.2 Dependent Claims 12-15

The additional features of claims 12-15 are substantially the same as those of claims 2, 5, 8-9, respectively. Accordingly, the same reasoning as in claims 2, 5, 8-9 could be applied to claims 12-15. Therefore, claims 12-15 are novel under PCT Article 33(2), but lack an inventive step under PCT Article 33(3) as being obvious over D1 in view of D2.

2.1.3 Claims 16-20

2.1.3.1 Independent Claim 16

Claim 16 is an independent claim and relates to a system.

D1, which is considered to be the closest prior art to the subject matter of claim 16, discloses a memory system (see paragraph [0074]; and figure 1 in D1) comprising:
a memory controller and a memory device that may include a memory cell array (see paragraph [0074]; and figure 1 in D1); and a second control unit to use one of a plurality of offsets, to generate a read voltage, and an adding unit and a voltage level generating unit to generate an optimal voltage level of the read voltage used to perform a read operation (see paragraphs [0202]-[0204]; and figure 24 in D1).

Claim 16 differs from D1 in that this claim comprises a second controller to send a read command to a first controller, the read command specifying a read voltage offset profile identifier and an address of a memory array. However, the aforementioned feature can be

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easily derived by a person skilled in the art from the feature of D2 considering that a read command includes an address of a set of memory cells to be read and an extended address that identifies which of second registers to use by a read voltage adjustment mechanism to adjust a read voltage (see claim 4 in D2), wherein the extended address is considered a CVDDE offset used for applying the read voltage adjustment mechanism (see paragraph [0027]; and figure 1 in D2). Accordingly, claim 16 would have been obvious over D1 in view of D2. Therefore, claim 16 is novel under PCT Article 33(2), but lacks an inventive step under PCT Article 33(3).

2.1.3.2 Dependent Claims 17-20

The additional feature of claim 17 can be easily derived from the feature of D1 considering that a second control unit uses one of a plurality of offsets, generates a read voltage, and an adding unit and a voltage level generating unit generate an optimal voltage level of the read voltage used to perform a read operation (see paragraphs [0202]-[0204]; and figure 24 in D1).

The additional feature of claim 18 can be easily derived from the feature of D2 considering that a read command includes an address of a set of memory cells to be read and an extended address that identifies which of second registers to use by a read voltage adjustment mechanism to adjust a read voltage (see claim 4 in D2), wherein the extended address is considered a CVDDE offset used for applying the read voltage adjustment mechanism (see paragraph [0027]; and figure 1 in D2).

The additional feature of claim 19 can be easily derived from the feature of D1 considering that a memory device receives a read command from a memory controller, performs a read operation at a start voltage level, and provides read data to the memory controller (see paragraph [0149]; and figure 13 in D1).

The additional feature of claim 20 is virtually suggested by the feature of D1 considering that a computing system includes memory system containing a memory device and memory controller, and may be implemented as a personal computer (PC), or a portable electronic device, such as a notebook computer, a mobile phone, a personal digital assistant (PDA), a camera, or the like (see paragraph [0250]; and figure 33 in D1).

Accordingly, claims 17-20 would have been obvious over D1 in view of D2. Therefore, claims

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17-20 are novel under PCT Article 33(2), but lack an inventive step under PCT Article 33(3).

2.1.4 Claims 21-25

2.1.4.1 Independent Claim 21

Claim 21 is an independent claim and relates to a system. The features of claim 21 are substantially the same as those of claim 11. Accordingly, the same reasoning as in claim 11 could be applied to claim 21. Therefore, the subject matter of claim 21 is novel under PCT Article 33(2), but lacks an inventive step under PCT Article 33(3) as being obvious over D1 in view of D2.

2.1.4.2 Dependent Claims 22-25

The additional features of claims 22-25 are substantially the same as those of claims 12-15, respectively. Accordingly, the same reasoning as in claims 12-15 could be applied to claims 22-25. Therefore, claims 22-25 are novel under PCT Article 33(2), but lack an inventive step under PCT Article 33(3) as being obvious over D1 in view of D2.

2.2 Industrial Applicability

Claims 1-25 are industrially applicable under PCT Article 33(4).