

(51) International Patent Classification:
G06F 13/40 (2006.01)(21) International Application Number:
PCT/US2015/014001(22) International Filing Date:
30 January 2015 (30.01.2015)

(25) Filing Language: English

(26) Publication Language: English

(71) Applicant: **HEWLETT PACKARD ENTERPRISE DEVELOPMENT LP** [US/US]; 11445 Compaq Center Drive West, Houston, TX 77070 (US).(72) Inventors: **PRESTON, Dave**; 11445 Compaq Center Dr W, Houston, Texas 77070 (US). **GAIDE, Benjamin Thomas**; 11445 Compaq Center Dr W, Houston, Texas 77070 (US).(74) Agents: **SU, Benjamin** et al.; Hewlett Packard Enterprise, 3404 E. Harmony Road, Mail Stop 79, Fort Collins, CO 80528 (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, BN, 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, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, 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, ST, 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, KM, ML, MR, NE, SN, TD, TG).**Declarations under Rule 4.17:**

- as to the identity of the inventor (Rule 4.17(i))
- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))

Published:

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

(54) Title: CONNECTION TYPE DETECTION CIRCUIT

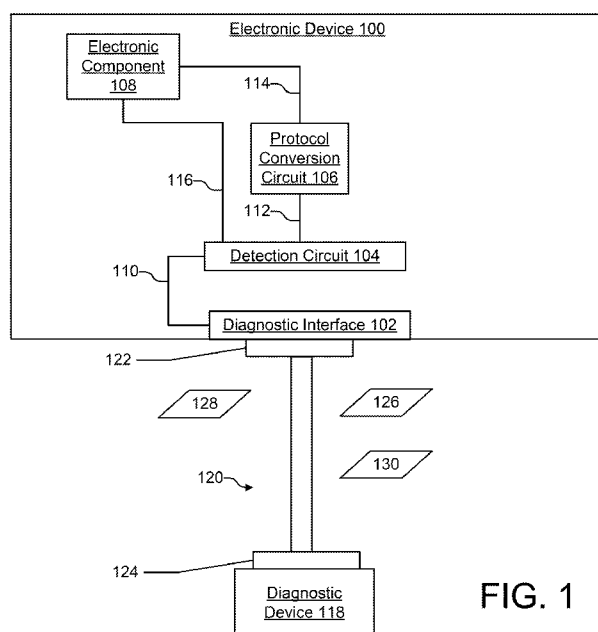


FIG. 1

(57) **Abstract:** An example electronic device includes a diagnostic interface to establish a connection with a diagnostic device via a host cable. The electronic device also includes a detection circuit coupled to the diagnostic interface. The electronic device further includes a protocol conversion circuit coupled to the detection circuit to convert a transmission protocol of data received via the diagnostic interface. The electronic device further includes an electronic component coupled to the detection circuit and coupled to the protocol conversion circuit. The detection circuit is to determine a connection type of the connection based on a detection of a power signal asserted to the diagnostic interface via the host cable and to select, based on the connection type, a data communication path between the electronic component and the diagnostic interface to route a diagnostic command.

CONNECTION TYPE DETECTION CIRCUIT

BACKGROUND

[0001] A computing device, such as server computer, may include a plurality of electronic components. For example, an electronic component may be a storage controller. Some electronic components may include self-debugging capabilities. Some electronic components may be debugged via another device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0002] Some examples of the present application are described with respect to the following figures:

[0003] FIG. 1 is a block diagram of an electronic device with a detection circuit to determine a connection type of a connection with a diagnostic device, according to an example;

[0004] FIG. 2 is a block diagram of an electronic device with a detection circuit to detect a universal serial bus (USB) connection with a diagnostic device, according to an example;

[0005] FIG. 3 is a block diagram of an electronic device with a detection circuit to detect a serial connection with a diagnostic device, according to an example; and

[0006] FIG. 4 is a flowchart illustrating a method of operation at an electronic device with a detection circuit to determine a connection type of a connection with a diagnostic device, according to another example, according to an example.

DETAILED DESCRIPTION

[0007] Some electronic components of an electronic device may be debugged via a diagnostic device external to the electronic device, such as a notebook computer. The electronic device may include a diagnostic interface to establish a connection with a diagnostic device so that an electronic component may communicate with the diagnostic device during debugging.

As an example, the diagnostic interface may be a serial interface. Some diagnostic devices may use a more recently developed communication interface, such as a universal serial bus (USB) interface, for debugging. To accommodate different diagnostic devices with different communication interfaces for debugging, an electronic device may include a plurality of diagnostic interfaces. However, the electronic device may have room on the chassis or enclosure to support a single diagnostic interface due to space restrictions. Thus, design complexity of the electronic device may be increased.

[0008] Examples described herein provide an electronic device with a detection circuit to determine a connection type of a connection with a diagnostic interface via a diagnostic interface. For example, an electronic device may include a diagnostic interface to establish a connection with a diagnostic device via a host cable. The electronic device may also include a detection circuit coupled to the diagnostic interface. The detection circuit may determine a connection type of the connection based on a detection of a power signal asserted to the diagnostic interface via the host cable. The detection circuit may also select, based on the connection type, a data communication path between the electronic component and the diagnostic interface to route a diagnostic command received from the diagnostic device. In this manner, examples described herein may reduce design complexity of an electronic device.

[0009] Referring now to the figures, FIG. 1 is a block diagram of an electronic device 100 with a detection circuit to determine a connection type of a connection with a diagnostic device, according to an example. Electronic device 100, for example, may be a web-based server, a local area network server, a cloud-based server, a notebook computer, a desktop computer, an all-in-one system, a tablet computing device, a mobile phone, an electronic book reader, or any other electronic device suitable for interfacing with a diagnostic interface to debug an electronic component internal to electronic device 100.

[0010] Electronic device 100 may include a diagnostic interface 102, a detection circuit 104, a protocol conversion circuit 106, and an electronic component 108. Diagnostic interface 102 may be a universal serial bus (USB)

connector. Diagnostic interface 102 may be a USB connector compatible any of the USB specifications. In some examples, diagnostic interface 102 may be a USB connector compatible with the USB 2.0 specification. In some examples, diagnostic interface 102 may be a USB connector compatible with the USB 3.1 specification.

[0011] Detection circuit 104 may be coupled to diagnostic interface 102 via an electrical connection 110. As described in more detail below, detection circuit 104 may detect a presence of a power signal in a pin of diagnostic interface 102. Based on the detected power signal, detection circuit 104 may set up a data communication path between diagnostic interface 102 and electronic component 108. Detection circuit 104 may be implemented as a switch using at least one logic gate.

[0012] Protocol conversion circuit 106 may be coupled to electronic component 108 via an electrical connection 112. Protocol conversion circuit 106 may be a circuit or device that converts data received from the USB protocol to a serial protocol, such as the Recommend Standard (RS)-232 protocol. Protocol conversion circuit 106 may be implemented using a processor or a microcontroller.

[0013] Electronic component 108 may be coupled to protocol conversion circuit 106 via an electrical connection 114. Electronic component 108 may be a device or a circuit that can be debugged using a diagnostic device external to electronic device 100. For example, electronic component 108 may be a storage array controller. As another example, electronic component 108 may be an enclosure management controller. Electronic component 108 may also be coupled to detection circuit 104 via an electrical connection 116. Electrical connections 110-116 may be implemented using metal wires or metal traces.

[0014] During a diagnostic operation, electronic device 100 may establish a connection with a diagnostic device 118 via diagnostic interface 102. Diagnostic interface 102 may receive a host cable 120 that is coupled to diagnostic device 118. Host cable 120 may include a first end 122 and a second end 124. In some examples, diagnostic device 118 may communicate with electronic component 108 via a serial interface (not shown).

in FIG. 1) of diagnostic device 118. Thus, first end 122 may be a USB connector and second end 124 may be a serial connector, such as a RS-232 connector. In some examples, diagnostic device 118 may communicate with electronic component 108 via a USB interface (not shown in FIG. 1) of diagnostic device 118. Thus, first end 122 and second end 124 may both be USB connectors.

[0015] In response to establishing the connection with diagnostic device 118, detection circuit 104 may detect a presence of a power signal 126 at diagnostic interface 102 to determine a connection type of the connection. The connection type may be a USB connection or a serial connection.

[0016] When diagnostic device 118 is to communicate with electronic component with the USB interface, diagnostic device 118 may assert power signal 126 to diagnostic interface 102 via host cable 120. Power signal 126 may correspond to a voltage signal having a particular voltage value. For example, power signal 126 may be a direct current voltage signal of at least 5 volts. As used herein, at least 5 volts may be 5 volts $\pm$ 0.25 volt or 5 volts $\pm$ 0.25 volt/-0.55 volt. It should be understood that power signal 126 may be a voltage signal having a non-zero voltage value.

[0017] In response to detecting power signal 126 is present at diagnostic interface 102, detection circuit 104 may determine that the connection type is a USB connection. Detection circuit 104 may select a first data communication path between electronic component 108 and diagnostic interface 102 to route data to and from electronic component 108. The first data communication path may include protocol conversion circuit 106 during routing of the data.

[0018] For example, diagnostic device 118 may transmit a diagnostic command 128 to electronic component 108 based on the USB protocol. Electronic device 100 may receive diagnostic command 128 via diagnostic interface 102. Detection circuit 104 may route diagnostic command 128 from diagnostic interface 102 to protocol conversion circuit 106 via electrical connections 110 and 112. Protocol conversion circuit 106 may receive diagnostic command 128 based on the USB protocol. Protocol conversion

circuit 106 may convert a transmission protocol of diagnostic command 128 from the USB protocol to the serial protocol. Protocol conversion circuit 106 may transmit diagnostic command 128 to electronic component 108 using a serial protocol, such as the RS-232 protocol, via electrical connection 114. In response to receiving diagnostic command 128, electronic component 108 may generate diagnostic data 130. Diagnostic data 130 may correspond to an operational status of electronic component 108, configuration information of electronic component 108, or a combination thereof.

[0019] Electronic component 108 may transmit diagnostic data 130 to diagnostic device 118 via the first data path. For example, electronic component 108 may transmit diagnostic data 130 to protocol conversion circuit 106 using the serial protocol. Protocol conversion circuit 106 may convert a transmission protocol from the serial protocol to the USB protocol. Protocol conversion circuit 106 may transmit diagnostic data 130 to detection circuit 104 using the USB protocol. Detection circuit 104 may route diagnostic data 130 to diagnostic device 118 via diagnostic interface 102 and host cable 120.

[0020] In response to detecting power signal 126 is absent at diagnostic interface 102, detection circuit 104 may determine that the connection type is a serial connection. For example, detection circuit 104 may detect a voltage signal of at least 5 volts at pin 1 of diagnostic interface when the connection type is the USB connection. Detection circuit 104 may not detect the voltage signal at pin 1 of diagnostic interface. Instead, detection circuit 104 may detect a grounded connection.

[0021] Detection circuit 104 may select a second data communication path between electronic component 108 and diagnostic interface 102 to route data to and from electronic component 108. The second data communication path may bypass conversion circuit 106 during routing of diagnostic command 128. For example, detection circuit 104 may route diagnostic command 128 from diagnostic interface 102 to electronic device via electrical connections 110 and 116. Similarly, detection circuit 104 may route diagnostic data 130 from electronic component 108 to diagnostic interface 102 via electrical connections 110 and 116. Thus, diagnostic command 128 nor diagnostic

data 130 may not be routed through protocol conversion circuit 106 when the connection type is the serial connection.

[0022] By automatically detecting the connection type upon receiving host cable 120, electronic device 100 may use a single diagnostic interface (e.g., diagnostic interface 102) to communicate with diagnostic devices with different communication interfaces (e.g., a USB interface or a serial interface) for debugging. Thus, design complexity of electronic device 100 may be reduced.

[0023] FIG. 2 is a block diagram of an electronic device 200 with a detection circuit to detect a USB connection with a diagnostic device, according to an example. Electronic device 200 may be used to implement electronic device 100 of FIG. 1. Electronic device 200 may include diagnostic interface 102, detection circuit 104, protocol conversion circuit 106, electronic component 108, and an electronic component 202. Although two electronic components are shown in FIG. 2, it should be understood that electronic device 200 may include any number of electronic components that may be tested via an external diagnostic device.

[0024] Diagnostic interface 102 may include a plurality of pins, such as pins 204-212. Detection circuit 104 may connect particular pins of diagnostic interface 102 to distinct electrical contacts of detection circuit 104 to determine a data communication path for electronic component 108 and/or 202.

[0025] As an example, during a diagnostic operation, diagnostic interface 102 may receive a host cable 214 to establish a USB connection with diagnostic device 216 that is similar to diagnostic device 118 of FIG. 1. Diagnostic device 216 may include a USB interface 218 to receive host cable 214. USB interface 218 may be implemented using a USB connector.

[0026] Diagnostic device 216 may assert power signal 126 to pin 204 of diagnostic interface 102 via USB interface 218. Detection circuit 104 may detect power signal 126 at pin 204. In response to detecting power signal 126, detection circuit 104 may determine that the connection with diagnostic device 216 is a USB connection. In response to determining that the

connection type is a USB connection, detection circuit 104 may connect pins 206 and 208 to electrical contacts 220 and 222 of detection circuit 104, respectively. Detection circuit 104 may also connect pins 210 and 212 to electrical contacts 224 and 226 of detection circuit, respectively. Electrical contacts 220, 222, 224, 226 may be coupled to protocol conversion circuit 106 via electrical connections 228, 230, 240, 242, respectively.

[0027] Diagnostic device 216 may transmit diagnostic command 128 to electronic component 108 as a differential signal using the USB protocol via USB interface 218. Detection circuit 104 may route diagnostic command 128 from pins 206 and 208 to protocol conversion circuit 106 via electrical contacts 220 and 222. A USB interface 232 of protocol conversion circuit 106 may receive diagnostic command 128 via electrical connections 228 and 230. USB interface 232 may be implemented using a USB connector. Protocol conversion circuit 106 may transmit diagnostic command 128 to electronic component 108 via a serial interface 234 of protocol conversion circuit. Serial interface 234 may be implemented using a universal asynchronous receiver/transmitter (UART). Electronic component 108 may receive diagnostic command 128 via an electrical connection 236 and/or an electrical connection 238 that are coupled to protocol conversion circuit 106.

[0028] Electronic component 108 may generate diagnostic data 130 in response to receiving diagnostic command 128. Electronic component 108 may transmit diagnostic data 130 to serial interface 234 using the serial protocol via electrical connection 236 and/or electrical connection 238. Electrical connections 236 and 238 may be coupled to electronic component 108. Protocol conversion circuit 106 may transmit diagnostic data 130 to detection circuit 104 via USB interface 232 using the USB protocol. Detection circuit 104 may receive diagnostic data 130 via electrical connections 228 and. Detection circuit 104 may route diagnostic data 130 to diagnostic device 216 via pins 206 and 208.

[0029] As another example, when diagnostic command 128 is destined for electronic component 202, diagnostic command 128 may be routed from pins 210 and 212 to USB interface 232 via electrical connections 240 and 242,

respectively. Serial interface 234 may transmit diagnostic command 128 to electronic component 202 via electrical connections 244 and 246.

[0030] Electronic component 202 may generate diagnostic data 248 in response to receiving diagnostic command 128. Electronic component 202 may transmit diagnostic data 248 to serial interface 234 using the serial protocol via electrical connections 244 and/or 246. Protocol conversion circuit 106 may transmit diagnostic data 248 to detection circuit 104 using the USB protocol via USB interface 232. Detection circuit 104 may receive diagnostic data 248 via electrical connections 240 and 242. Detection circuit 104 may route diagnostic data 248 to USB interface 218 via pins 210 and 212 and host cable 214. Diagnostic device 216 may receive diagnostic data 248 via USB interface 218.

[0031] FIG. 3 is a block diagram of electronic device 200 of FIG. 2 with detection circuit 104 to detect a serial connection with a diagnostic device, according to another example. During a diagnostic operation, electronic device 200 may establish a serial connection with a diagnostic device 302 via a host cable 304. Diagnostic interface 102 and a serial interface 306 of diagnostic device 302 may receive a respective end of host cable 304. Serial interface 306 may be implemented using a RS-232 connector.

[0032] A particular pin of serial interface 306 that is coupled to pin 204 via host cable 304 may be grounded. Detection circuit 104 may detect a grounded connection at pin 204. The grounded connection may indicate the absence of power signal 126 of FIGs. 1-2. Thus, detection circuit 104 may determine that the connection type of the connection with diagnostic device 302 is a serial connection.

[0033] In response to determining that the connection type is a serial connection, detection circuit 104 may connect pins 206 and 208 to electrical contacts 308 and 310 of detection circuit 104, respectively. Electrical contacts 308 and 310 may be coupled to electronic component 108 via electrical connections 316 and 318, respectively. Detection circuit 104 may also connect pins 210 and 212 to electrical contacts 312 and 314 of detection circuit 104, respectively. Electrical contacts 312 and 314 may be coupled to

electronic component 202 via electrical connections 320 and 322, respectively.

[0034] Diagnostic device 302 may transmit diagnostic command 128 to electronic component 108 and/or electronic component 202. When diagnostic command 128 is destined for electronic component 108, detection circuit 104 may route diagnostic command 128 from pin 206 and/or pin 208 to electronic component 108 via electrical contact 308 and/or 310. Detection circuit 104 may also route diagnostic data 130 from electronic component 108 to diagnostic device 216 via the same data communication path (e.g., electrical contact 308 and/or 310).

[0035] When diagnostic command 128 is destined for electronic component 202, detection circuit 104 may route diagnostic command 128 from pin 210 and/or pin 212 to electronic component 202 via electrical contact 312 and/or 314. Detection circuit 104 may also route diagnostic data 248 from electronic component 202 to diagnostic device 216 via the same data communication path (e.g., electrical contact 312 and/or 314).

[0036] FIG. 4 is a flowchart illustrating a method 400 of operation at an electronic device with a detection circuit to determine a connection type of a connection with a diagnostic device, according to another example, according to an example. Method 400 may be implemented using electronic device 100 of FIG. 1 and/or electronic device 200 of FIGs. 2-3. Method 400 includes establishing, at a diagnostic interface of an electronic device, a connection with a diagnostic device via a host cable connected to the diagnostic interface, at 402. For example, referring to FIG. 1, during a diagnostic operation, electronic device 100 may establish a connection with a diagnostic device 118 via diagnostic interface 102. Diagnostic interface 102 may receive a host cable 120 is that coupled to diagnostic device 118.

[0037] Method 400 also includes detecting, at a detection circuit of an electronic device, a presence of a power signal asserted to the diagnostic interface via the host cable, at 404. For example, referring to FIG. 1, when diagnostic device 118 is to communicate with electronic component with the USB interface, diagnostic device 118 may assert power signal 126 to

diagnostic interface 102 via host cable 120. In response to detecting power signal 126 is present at diagnostic interface 102, detection circuit 104 may determine that the connection type is a USB connection.

[0038] Method 400 further includes receiving, at the diagnostic interface, a diagnostic command from the diagnostic device via the connection, at 406. For example, referring to FIG. 1, electronic device 100 may receive diagnostic command 128 via diagnostic interface 102. Method 400 further includes in response to detecting that the power signal is absent, routing the diagnostic command from the diagnostic interface to an electronic component of the electronic device via the detection circuit, at 408. For example, referring to FIG. 1, in response to detecting power signal 126 is absent at diagnostic interface 102, detection circuit 104 may determine that the connection type is a serial connection. Detection circuit 104 may select a second data communication path between electronic component 108 and diagnostic interface 102 to route data to and from electronic component 108.

[0039] Method 400 further includes in response to detecting that the power signal is present, routing the diagnostic command from the diagnostic interface to a protocol conversion circuit of the electronic device via the detection circuit, at 410. For example, referring to FIG. 1, in response to detecting power signal 126 is present at diagnostic interface 102, detection circuit 104 may determine that the connection type is a USB connection. Detection circuit 104 may select a first data communication path between electronic component 108 and diagnostic interface 102 to route data to and from electronic component 108. The first data communication path may include protocol conversion circuit 106 during routing of the data.

[0040] The use of "comprising", "including" or "having" are synonymous and variations thereof herein are meant to be inclusive or open-ended and do not exclude additional unrecited elements or method steps.

Claims

What is claimed is:

1. An electronic device comprising:
a diagnostic interface to establish a connection with a diagnostic device
via a host cable;
a detection circuit coupled to the diagnostic interface;
a protocol conversion circuit coupled to the detection circuit to convert
a transmission protocol of data received via the diagnostic
interface; and
an electronic component coupled to the detection circuit and coupled to
the protocol conversion circuit, wherein the detection circuit is to:
determine a connection type of the connection based on a
detection of a power signal asserted to the diagnostic
interface via the host cable; and
select, based on the connection type, a data communication
path between the electronic component and the
diagnostic interface to route a diagnostic command
received from the diagnostic device.
2. The electronic device of claim 1, wherein the connection type is a
universal serial bus (USB) connection or a serial connection.
3. The electronic device of claim 1, wherein the diagnostic interface is a
universal serial bus (USB) connector.
4. The electronic device of claim 1, wherein the detection circuit is to:
in response to determining that the connection is a universal serial bus
(USB) connection, route the diagnostic command to the protocol
conversion circuit; and
in response to determining that the type the host cable is a serial
connection, route the diagnostic command to the electronic

component, wherein the protocol conversion circuit is bypassed during routing of the diagnostic command.

5. The electronic device of claim 1, wherein the electronic component is to:

receive, during a diagnostic operation, the diagnostic command from the diagnostic device via the diagnostic interface; and
in response to the diagnostic command, transmit diagnostic data using a serial protocol.

6. The electronic device of claim 1, wherein the protocol conversion circuit includes:

a serial interface; and
a universal serial bus (USB) interface.

7. A method comprising:

establishing, at a diagnostic interface of an electronic device, a connection with a diagnostic device via a host cable connected to the diagnostic interface;
detecting, at a detection circuit of the electronic device, a presence of a power signal asserted to the diagnostic interface via the host cable;
receiving, at the diagnostic interface, a diagnostic command from the diagnostic device via the connection;
in response to detecting that the power signal is absent, routing the diagnostic command from the diagnostic interface to an electronic component of the electronic device via the detection circuit; and
in response to detecting that the power signal is present, routing the diagnostic command from the diagnostic interface to a protocol conversion circuit of the electronic device via the detection circuit.

8. The method of claim 7, wherein the protocol conversion circuit is bypassed during routing of the diagnostic command from the diagnostic interface to the electronic component via the detection circuit when the power signal is present.

9. The method of claim 7, wherein the power signal corresponds to a voltage signal of at least 5 volts.

10. The method of claim 7, further comprising:
in response to the diagnostic command, generating diagnostic data at the electronic component;
when the power signal is present:
transmitting the diagnostic data from the electronic component to the protocol conversion circuit using a serial protocol;
and
transmitting the diagnostic data from the protocol conversion circuit to the diagnostic device via the diagnostic interface using a universal serial bus (USB) protocol; and
when the power signal is absent, transmitting the diagnostic data from the electronic component to the diagnostic device via the diagnostic interface using the serial protocol.

11. The method of claim 10, wherein the diagnostic data corresponds to an operational status of the electronic device, configuration information of the electronic device, or a combination thereof.

12. A method comprising:
establishing, at a diagnostic interface of an electronic device, a connection with a diagnostic device via a host cable connected to the diagnostic interface;
receiving, at the diagnostic interface, a diagnostic command from the diagnostic device via the connection;

detecting, at a detection circuit of the electronic device, a presence of a power signal asserted to the diagnostic interface via the host cable;

in response to detecting that the power signal is absent, routing the diagnostic command from the diagnostic interface to an electronic component of the electronic device via the detection circuit; and

in response to detecting that the power signal is present:

routing the diagnostic command from the diagnostic interface to a protocol conversion circuit of the electronic device via the detection circuit;

receiving the diagnostic command at the protocol conversion circuit using a first protocol; and

transmitting the diagnostic command from the conversion circuit to the electronic component using a second protocol different from the first protocol.

13. The method of claim 12, wherein the protocol conversion circuit is bypassed during routing of the diagnostic command from the diagnostic interface to the electronic component when the power signal is present.

14. The method of claim 12, wherein the first protocol is a universal serial bus (USB) protocol, and wherein the second protocol is a serial protocol.

15. The method of claim 12, wherein the power signal corresponds to a voltage signal of at least 5 volts.

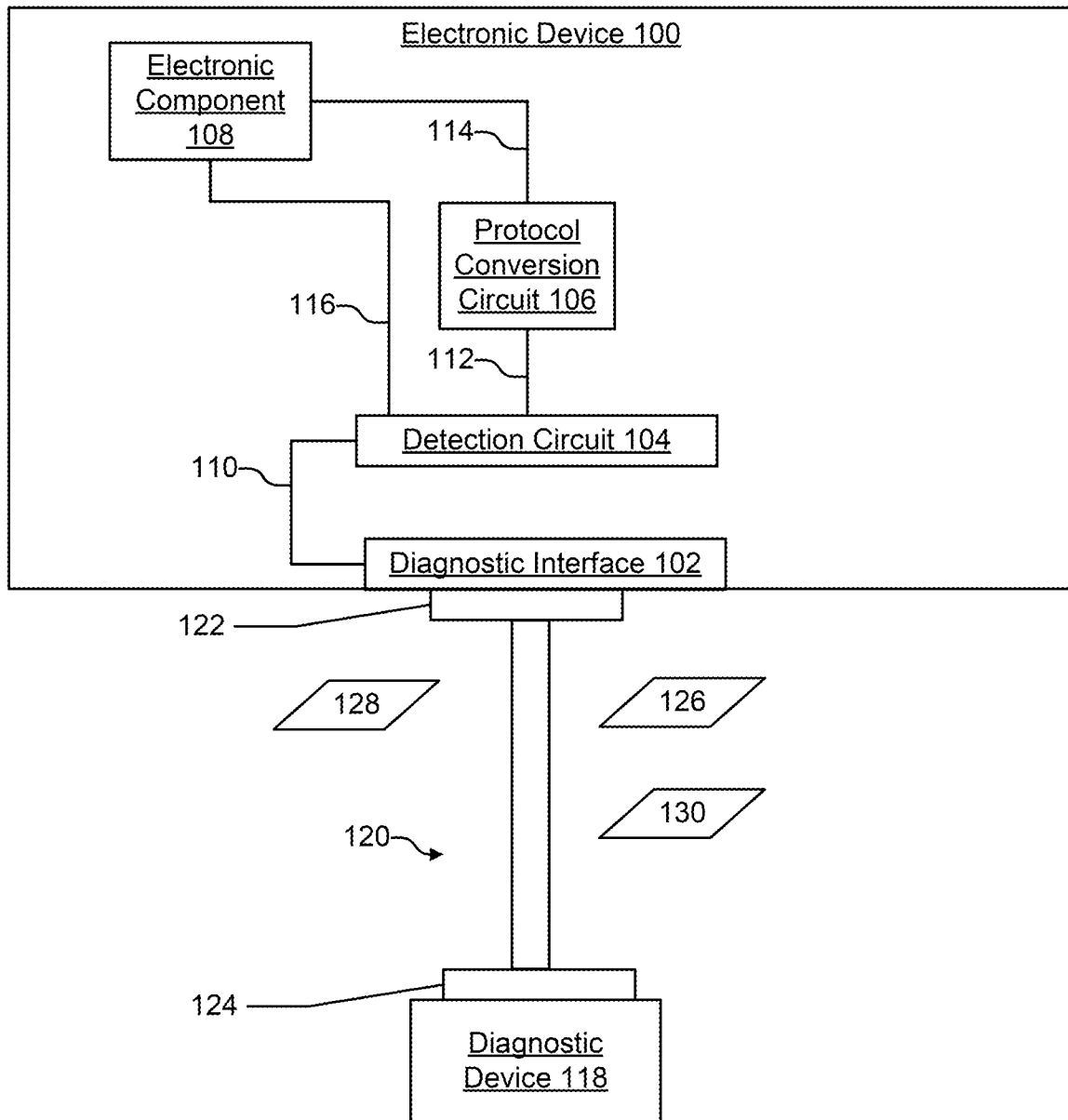


FIG. 1

2/4

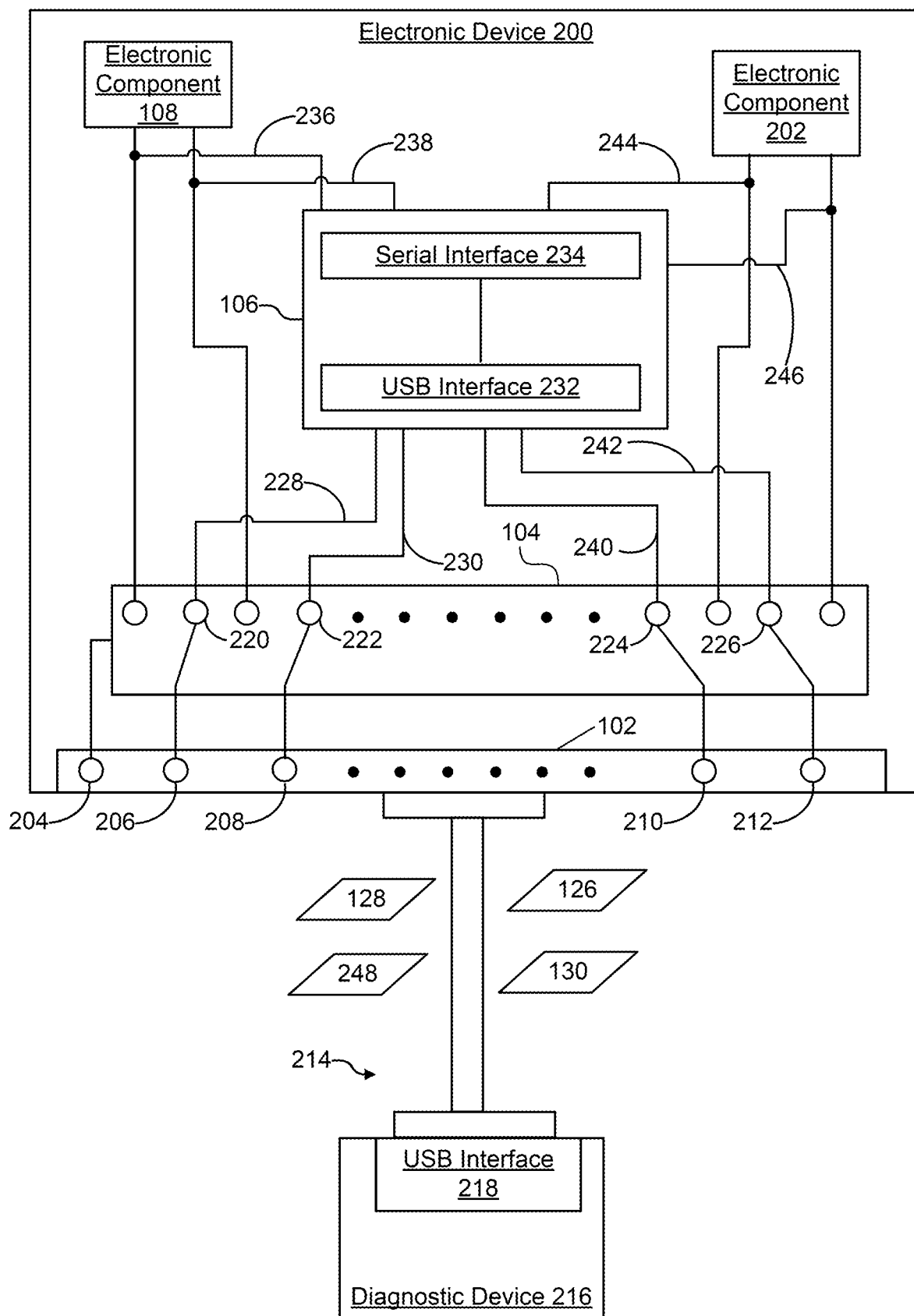


FIG. 2

3/4

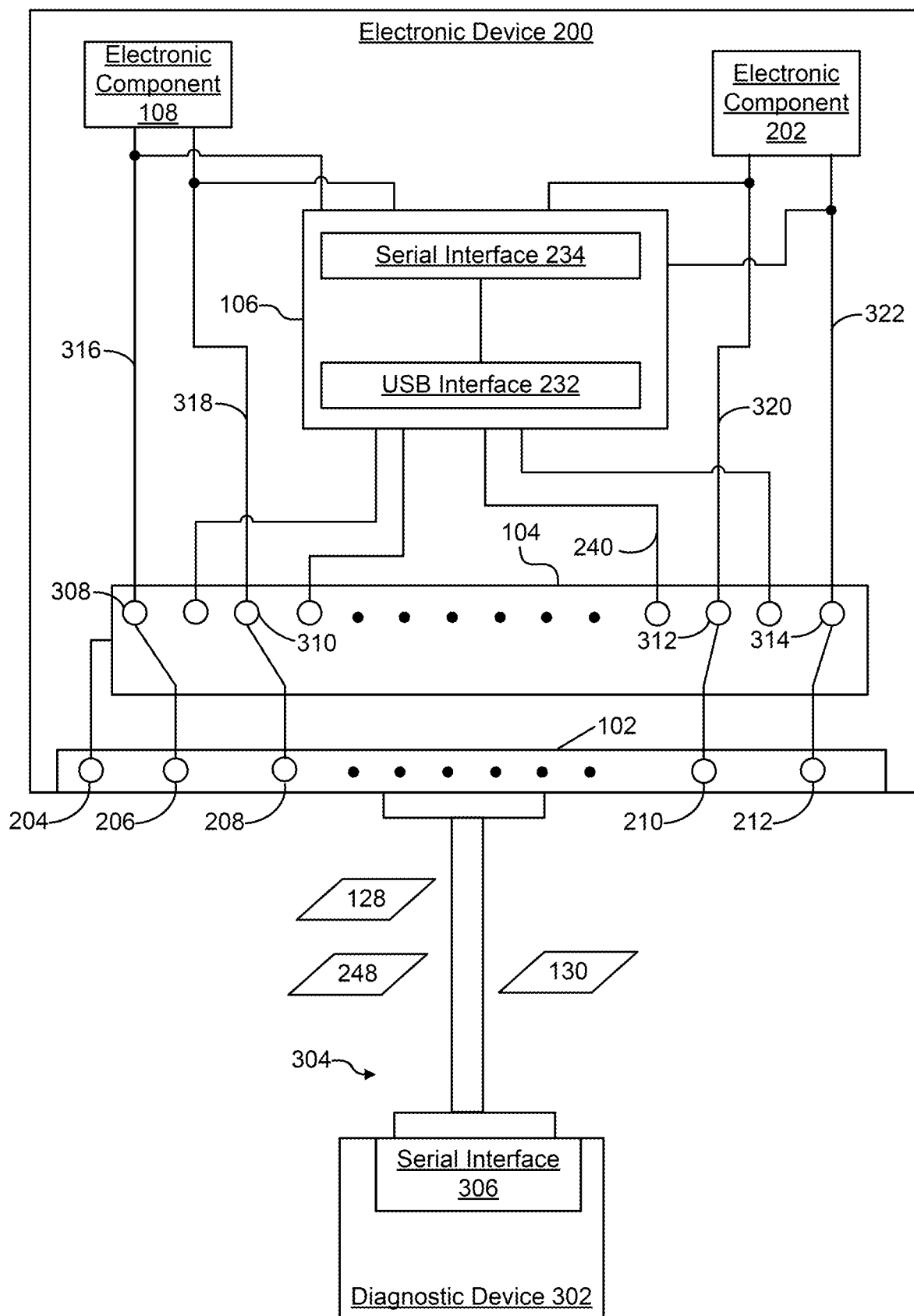


FIG. 3

4/4

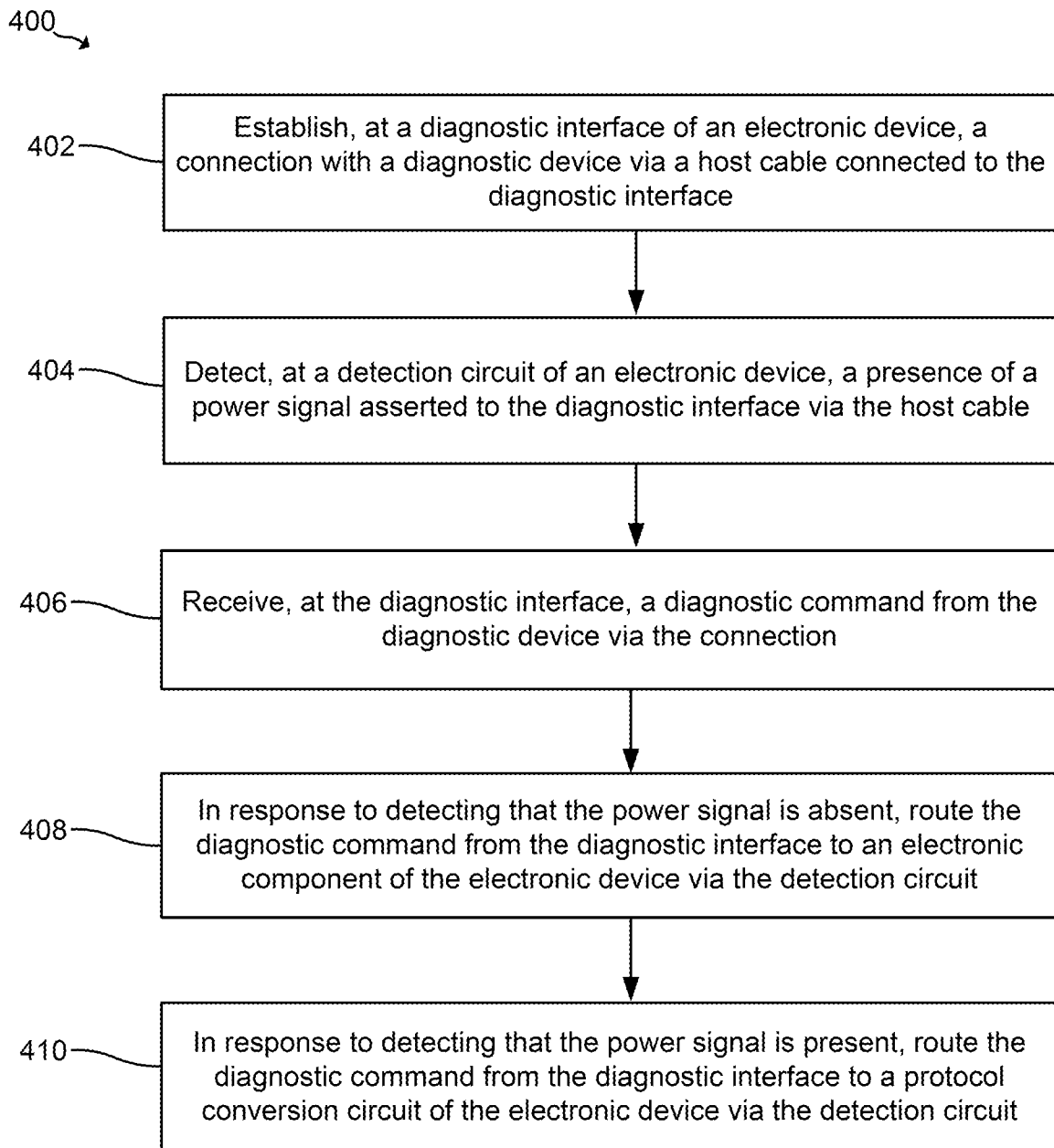


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2015/014001**A. CLASSIFICATION OF SUBJECT MATTER****G06F 13/40(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)

G06F 13/40; G06F 3/00; G06F 13/38; G06F 13/20; H02H 3/05; G06F 13/12

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: electronic, device, diagnostic, interface, usb, serial, connector, and similar terms.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2014-0244869 A1 (DELL PRODUCTS, LP) 28 August 2014 See paragraphs [0001], [0012]-[0013], and [0015]-[0016]; claims 1, 4, and 12; and figures 1-3.	1-15
Y	US 6,732,301 B1 (JOHN A. LANDRY et al.) 04 May 2004 See column 3, lines 12-43; column 5, lines 36-41; and figures 1 and 3.	1-15
A	US 2012-0311219 A1 (WANRAN MA et al.) 06 December 2012 See paragraphs [0023]-[0032] and figures 4-5.	1-15
A	US 2002-0156950 A1 (THIAM WAH LOH et al.) 24 October 2002 See paragraphs [0020]-[0032] and figures 2-4.	1-15
A	US 2011-0296060 A1 (PAUL MYCHALOWYCH et al.) 01 December 2011 See paragraphs [0026]-[0074] and figures 1-3.	1-15



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 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

28 October 2015 (28.10.2015)

Date of mailing of the international search report

29 October 2015 (29.10.2015)

Name and mailing address of the ISA/KR

International Application Division
Korean Intellectual Property Office
189 Cheongsu-ro, Seo-gu, Daejeon Metropolitan City, 35208,
Republic of Korea

Facsimile No. +82-42-472-7140

Authorized officer

NHO, Ji Myong

Telephone No. +82-42-481-8528



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2015/014001

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2014-0244869 A1	28/08/2014	None	
US 6732301 B1	04/05/2004	None	
US 2012-0311219 A1	06/12/2012	CA 2836481 A1 EP 2715551 A1 US 8671237 B2 WO 2012-166845 A1	06/12/2012 09/04/2014 11/03/2014 06/12/2012
US 2002-0156950 A1	24/10/2002	None	
US 2011-0296060 A1	01/12/2011	US 2009-307392 A1	10/12/2009