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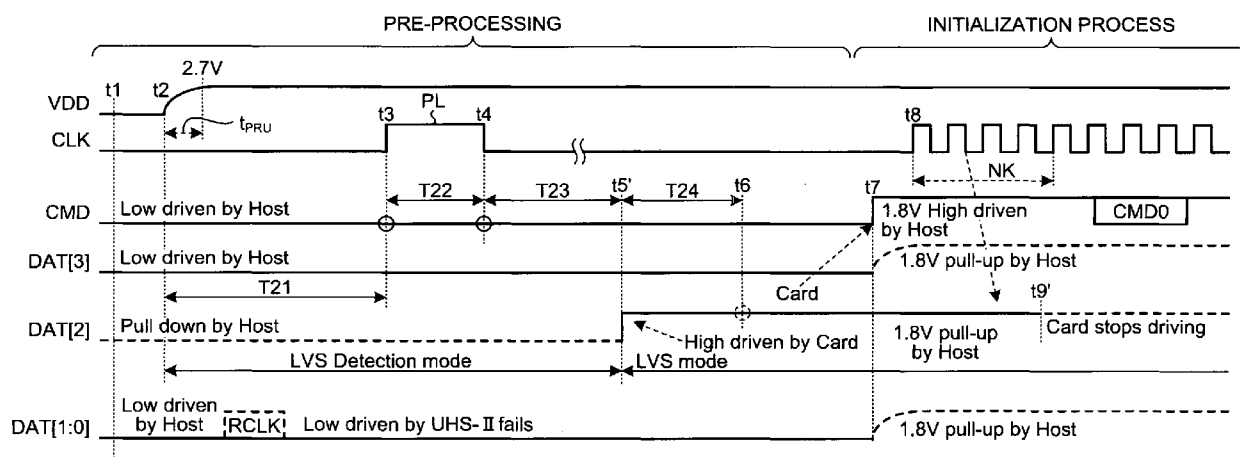
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(54) Title: HOST APPARATUS AND EXTENSION DEVICE

FIG.17



(57) Abstract: According to one embodiment, a first power-supply voltage is applied to I/O cells, an I/O cell connected to a clock terminal is initially set to a threshold of a second voltage signaling, an I/O cell connected to a command terminal and I/O cells connected to data terminals are initially set as an input, and when a clock control unit detects receipt of one clock pulse and a signal voltage control unit detects a host using the second voltage signaling, a signal voltage control unit drives the I/O cell of a first data terminal high level after a second power-supply voltage is applied to I/O cells and the threshold of a second voltage signaling is set to I/O cells of the clock, command and data terminals.

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AMENDED CLAIMS

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[Claim 1] (Amended) An extension device configured to be supplied with a first power-supply voltage from a host and communicate with the host via signals of a clock, a command/response, and data, by a first voltage signaling and a second voltage signaling lower than the first voltage signaling being usable for the communication as input/output signal levels of the signals, comprising:

a power/ground terminal configured to be supplied with power from the host;

a clock terminal configured to input the clock and be initially set to a threshold of the second voltage signaling;

a command terminal configured to receive the command and transmit the response;

a plurality of data terminals configured to perform input and output of the data;

an I/O cell unit connected to the clock terminal, the command terminal, and the data terminals;

a clock reception unit capable of determining the kind of a clock input into the clock terminal; and

a signal voltage control unit configured to control a signaling of the I/O cell unit,

wherein when the clock reception unit counts the number of clock pulses during a specific period of time, and

the signal voltage control unit sets the I/O cell unit as the second voltage signaling when the number of clock pulses counted by the clock reception unit is equal to or greater than a specific number, and sets the I/O cell unit as the first voltage signaling when the number of clock pulses counted by the clock reception unit is less than the specific number.

[Claim 2] (Canceled)

[Claim 3] (Amended) An extension device configured to be supplied with a first power-supply voltage from a host and communicate with the host via signals of a clock, a command/response, and data, by

a first voltage signaling and a second voltage signaling lower than the first voltage signaling being usable for the communication as input/output signal levels of the signals, comprising:

- a power/ground terminal configured to be supplied with power from the host;

- a clock terminal configured to input the clock and be initially set to a threshold of the second voltage signaling;

- a command terminal configured to receive the command and transmit the response;

- a plurality of data terminals configured to perform input and output of the data;

- an I/O cell unit connected to the clock terminal, the command terminal, and the data terminals;

- a clock reception unit capable of determining the kind of a clock input into the clock terminal; and

- a signal voltage control unit configured to control a signaling of the I/O cell unit,

- wherein the clock reception unit measures a pulse length of the clock pulse during the predetermined period of time, and

- the signal voltage control unit sets the I/O cell unit as the first voltage signaling when the measured pulse length of the clock pulse is smaller than a specific value, and sets the I/O cell unit as the second voltage signaling when the measured pulse length is equal to or greater than the specific value.

[Claim 4] (Canceled)

[Claim 5] (Amended) The extension device of claim 2, comprising a selector configured to select the first power-supply voltage or a second power-supply voltage lower than the first power-supply voltage and supply the selected power-supply voltage to the I/O cell unit, wherein

the signal voltage control unit controls the selector to supply the second power-supply voltage to the I/O cell unit as an initial setting, and controls the selector to supply the first power-supply voltage to the I/O cell unit, when the signal voltage control unit

sets the I/O cell unit to operate in the first voltage signaling.

[Claim 6] The extension device of claim 5, wherein the extension device is supplied with the second power-supply voltage from the host or generates the second power-supply voltage by a regulator from the first power-supply voltage.

[Claim 7] (Amended) The extension device of claim 2, wherein

when the signal voltage control unit sets the I/O cell unit to operate in the first voltage signaling, the first power-supply voltage is supplied to the I/O cell unit and an input threshold of the I/O cell unit is set according to the first voltage signaling, and

when the signal voltage control unit sets the I/O cell unit to operate in the second voltage signaling, the second power-supply voltage is supplied to I/O cell unit and the input threshold is set according to the second voltage signaling.

[Claim 8] (Amended) The extension device of claim 2, further comprising a command control unit configured to receive a command from the host and transmit a response to the command to the host via the command terminal, wherein

upon receipt of a voltage identification command, the command control unit reads information for identifying whether the current communication is carried out under the first voltage signaling or the second voltage signaling as information set to an argument of the voltage identification command, and when the extension device has no error and supports the signal voltage indicated by the argument, the command control unit returns a response under the same signal voltage as the signal voltage of the voltage identification command, and when the extension device has any error or does not support the signal voltage indicated by the argument, the command control unit returns no response.

[Claim 9] (Amended) The extension device of claim 2, comprising a device detection resistor connected between the first voltage power supply and the second data terminal and capable of being electrically disconnected, wherein

the extension device initially pulls up the second data terminal

via the device detection resistor, and

when the signal voltage control unit sets the I/O cell unit to operate in the second voltage signaling, the extension device electrically disconnects the device detection resistor from the second data terminal.

[Claim 10] (Amended) A host apparatus configured to supply a first power-supply voltage to a device and communicate with the device via signals of a clock, a command/response, and data, by a first voltage signaling and a second voltage signaling lower than the first voltage signaling being usable for the communication as input/output signal levels of the signals, comprising:

- a power/ground terminal configured to supply power to the device;

- a clock terminal configured to output the clock;

- a command terminal configured to transmit the command and receive the response;

- a plurality of data terminals configured to perform input and output of the data;

- an I/O cell unit connected to the clock terminal, the command terminal, and the data terminals; and

- a device detection unit configured to detect whether the device is communicable under the second voltage signaling, wherein

- the host apparatus initially sets the clock terminal, the command terminal, and the plurality of data terminals except a first data terminal to a Low level, and initially pulls down the first data terminal by the second voltage signaling via a resistor,

- the device detection unit outputs a first clock pulse to the clock terminal, and

- after a specific period of time is elapsed from the device detection unit outputs the first clock pulse to the clock terminal, when signal level of the first data terminal is inverted, the host apparatus starts initialization of the device, and when the signal level is not inverted, the host apparatus does not initialize the device.

[Claim 11] (Amended) The host apparatus of claim 10, wherein a pulse length of the first clock pulse is longer than a specific value that is longer than a pulse length of the clock at lowest frequency at the time of the initialization of the device.

[Claim 12] (Amended) The host apparatus of claim 10, further comprising a command control unit configured to issue a command to the device and receive a response to the command from the device via the command terminal, wherein

the host apparatus transmits to the device a voltage identification command in which information for identifying that the current communication is carried out under the second voltage signaling is set to an argument, and

when the host apparatus receives a response to the voltage identification command from the device, the host apparatus continues the initialization of the device, and when the host apparatus does not receives any response to the voltage identification command from the device, the host apparatus stops the initialization of the device and stops the supply of power to the device.

[Claim 13] (Amended) An extension device configured to be supplied with a first power-supply voltage from a host and communicate with the host via signals of a clock, a command/response, and data, by a first voltage signaling and a second voltage signaling lower than the first voltage signaling being usable for the communication as input/output signal levels of the signals, comprising:

a power/ground terminal configured to be supplied with power from the host;

a clock terminal configured to input the clock;

a command terminal configured to receive the command and transmit the response;

a plurality of data terminals configured to perform input and output of the data;

an I/O cell unit connected to the clock terminal, the command terminal, and the data terminals;

a clock reception unit capable of determining the kind of a clock

input into the clock terminal; and

a signal voltage control unit configured to control the levels of the input/output signals of the I/O cell unit and control a threshold for determining High/Low of the input signals, wherein

an I/O cell connected to the clock terminal is initially set to a threshold of the second voltage signaling,

an I/O cell connected to the command terminal and I/O cells connected to the data terminals are initially set to operate with the first voltage signaling as an input, and

when the clock reception unit detects receipt of one clock pulse, the signal voltage control unit drives the I/O cell of a first data terminal in a direction in which the voltage level of the first data terminal is inverted.

[Claim 14] (Amended) The extension device of claim 13, wherein, when the clock reception unit detects the receipt of the one clock pulse, the signal voltage control unit refers to signal voltage levels of a second data terminal or the command terminal, and sets the I/O cell unit to operate under the first voltage signaling when the signal voltage levels are High and to operate under the second voltage signaling when the signal voltage levels are Low.

[Claim 15] (Amended) The extension device of claim 13, wherein a pulse length of the one clock pulse is larger than a pulse length of a clock pulse that is continuously input into the clock terminal with a constant period.

[Claim 16] The extension device of claim 14, wherein, when the clock reception unit detects receipt of two or more clocks before the signal voltage control unit sets the signal voltage of the I/O cell unit, the signal voltage control unit sets the I/O cell unit to operate in the first signal voltage level.

[Claim 17] (Amended) The extension device of claim 13, comprising a circuit configured to measure length of a pulse applied to the clock terminal at the detection of the one clock pulse to determine that the one clock pulse is detected when the pulse length is larger than a predetermined value.

[Claim 18] (Amended) The extension device of claim 16, comprising a selector configured to select the first power-supply voltage or a second power-supply voltage lower than the first power-supply voltage and supply the same as power to the I/O cell unit, wherein

the signal voltage control unit controls the selector to supply the first power-supply voltage as an initial setting, and controls the selector to supply the second power-supply voltage when the I/O cell unit is set to operate under the second voltage signaling.

[Claim 19] The extension device of claim 18, wherein the extension device is supplied with the second power-supply voltage from the host or generates the second power-supply voltage by a regulator from the first power-supply voltage.

[Claim 20] (Amended) The extension device of claim 13, further comprising a command control unit configured to receive a command from the host and transmit a response to the command to the host via the command terminal, wherein

upon receipt of a voltage identification command, the command control unit reads information for identifying whether the current communication is carried out under the first voltage signaling or the second voltage signaling as information set to an argument of the voltage identification command, and when the extension device has no error and supports the signal voltage indicated by the argument, the command control unit returns a response under the same voltage signaling as the signal voltage of the voltage identification command, and when the extension device has any error or does not support the signal voltage indicated by the argument, the command control unit returns no response.

[Claim 21] (Canceled)

[Claim 22] (Canceled)

[Claim 23] (Canceled)

[Claim 24] (Canceled)

[Claim 25] (Canceled)

[Claim 26] (Amended) A host apparatus configured to supply a first power-supply voltage to a device and communicate with the device via

signals of a clock, a command/response, and data, a first voltage signaling and a second voltage signaling lower than the first voltage signaling being usable for the communication as input/output signal levels of the signals, comprising:

- a power/ground terminal configured to supply power to the device;

- a clock terminal configured to output the clock;

- a command terminal configured to transmit the command and receive the response;

- a plurality of data terminals configured to perform input and output of the data;

- an I/O cell unit connected to the clock terminal, the command terminal, and the data terminals; and

- a device detection unit configured to detect whether the device is communicable under the second voltage signaling, wherein

- the host apparatus initially sets the clock terminal, the command terminal, and the plurality of data terminals to a Low level,

- the device detection unit outputs a first clock pulse to the clock terminal, and pulls up or pulls down a first data terminal under the second voltage signaling via a resistor,

- the host apparatus starts initialization of the device when signal level of the first data terminal has been inverted after passage of a predetermined period of time, and

- the host apparatus does not initialize the device when the level of the first data terminal has not been changed.

[Claim 27] (Amended) The host apparatus of claim 26, wherein a pulse length of the first clock pulse is longer than a pulse length of the clock at lowest frequency at the time of the initialization of the device.

[Claim 28] (Amended) The host apparatus of claim 27, further comprising a command control unit configured to issue the command from the command terminal and receive a response to the command, wherein

- the host apparatus transmits to the device a voltage

identification command in which information for identifying that the current communication is carried out under the second voltage signaling is set to an argument, and

when receiving a response to the voltage identification command, the host apparatus continues the initialization of the device, and when receiving no response to the voltage identification command, the host apparatus stops the initialization of the device and stops the supply of power.

[Claim 29] (Canceled)

[Claim 30] (Canceled)

[Claim 31] (Canceled)

[Claim 32] (Canceled)