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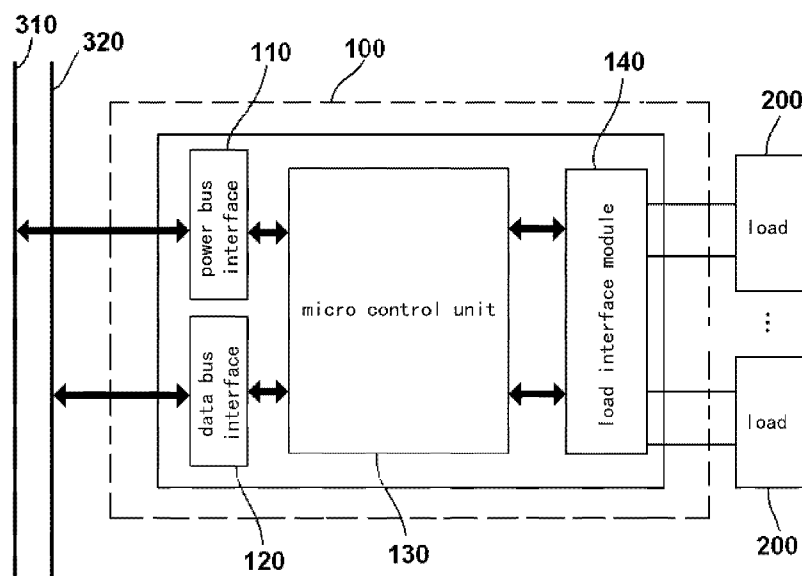


Fig. 1

(57) Abstract: The present invention discloses an intelligent connector includes: a bus interface module adapted to be connected to a bus in an electrical equipment; a load interface module adapted to be connected to respective loads in the electrical equipment; and a micro control unit connected between the bus interface module and the load interface module. The load interface module comprises a plurality of functional transition circuits each having a plurality of internal ports connected to the micro control unit and an external port adapted to be connected to the load and configured to change the function of the external port by changing the configuration of the plurality of internal ports, so that the same one external port is adapted to be connected to ports of loads with different functions. The function of the internal ports of the functional transition circuit may be changed by changing a program performed in the micro control unit, such that the function of the external port of the functional transition circuit may be changed.



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INTELLIGENT CONNECTOR

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of Chinese Patent Application No.CN201611047326.5 filed on November 11, 2016 in the State Intellectual Property Office of China, the whole disclosure of which is incorporated herein by reference.

TECHNICAL FIELD

Embodiments of the present invention relate to an intelligent connector adapted to connect a load in an electrical equipment to a bus in the electrical equipment.

DESCRIPTION OF THE RELATED ART

In the prior art, a control system for household appliance, such as, a washing machine, a refrigerator or the like, mostly employs a centralized control system, which has only one controller, and all of peripheral executing components and/or sensing components, such as, a valve, a sensor, a motor or the like, are directly connected to this controller. With regards to such centralized household appliances control system, all of control switches and sensor circuits are integrated into a main control board and connected to all loads in a manner of star-connection. As for some components having complicated control and concentrated functions, such as a variable frequency motor and a user display and control interface, they usually are achieved in a form of modules and communicated with others by serial ports. The modules themselves are electrically star-connected according to their functions.

This household appliance having the centralized control solution only controls and detects some given loads due to its poor extension and generality. Once the loads are changed, a main control board of the household appliance has to be designed again.

Further, with regards to this household appliance having the centralized control solution, once a certain electronic element is damaged, the whole main control board thereof has to be replaced, thereby causing a high maintenance cost.

SUMMARY

An objective of the present disclosure is to solve at least one aspect of the above mentioned problems and disadvantages existed in the prior art.

According to an objective of the present disclosure, there is provided an intelligent connector adapted to change the function of an external port connected to the load by changing the configuration of internal ports, so that the same one external port is adapted to be connected to ports of loads with different functions.

According to an aspect of the present disclosure, there is provided an intelligent connector, comprising: a bus interface module adapted to be connected to a bus in an electrical equipment; a load interface module adapted to be connected to respective loads in the electrical equipment; and a micro control unit connected between the bus interface module and the load interface module. The load interface module comprises a plurality of functional transition circuits each having a plurality of internal ports connected to the micro control unit and an external port adapted to be connected to the load and configured to change the function of the external port by changing the configuration of the plurality of internal ports, so that the same one external port is adapted to be connected to ports of loads with different functions.

According to an embodiment of the present disclosure, each of the plurality of the internal ports comprises a first internal port, a second internal port and a third internal port, the second internal port being connected to the external port. Each functional transition circuit comprises a first switch element, a gate of which is connected to the first internal port, and one of a source and a drain of which is connected to a power supply and the other of the source and the drain of which is connected to the external port; and a second switch element a gate of which is connected to the third internal port, and one of a source and a drain of which is grounded and the other of the source and the drain of which is connected to the external port. The other of the source and the drain of the first switch element is connected with the other of the source and the drain of the second switch element.

According to another embodiment of the present disclosure, each functional transition circuit further comprises a divider resistor one end of which is connected to a power supply and the other end of which is connected to the external port.

According to another embodiment of the present disclosure, each functional transition circuit further comprises a divider resistor one end of which is connected to the external port and the other end of which is grounded.

According to another embodiment of the present disclosure, the micro control unit is adapted to configure the functions of a plurality of internal ports of each functional transition circuit according to program performed in the micro control unit, so that the configurations of the plurality of internal ports of each functional transition circuit may be changed by updating the program.

According to another embodiment of the present disclosure, the external port of each functional transition circuit may be acted as any one of power supply port, pulse width modulation port, ground port, digital input port, digital output port, communication port and analog-digital converter port, so that the same one external port P_i is adapted to be connected to functional ports of different loads, or different functional ports of the same one load.

According to another embodiment of the present disclosure, when the first inner port, the second inner port and the third inner port of one of the functional transition circuits are configured as lower level, digital input port and lower level, respectively, the external port of the functional transition circuit is acted as the power supply port.

According to another embodiment of the present disclosure, when the first inner port, the second inner port and the third inner port of one of the functional transition circuits are configured as a pulse width modulation port, digital input port and lower level, respectively, the external port of the functional transition circuit is acted as the pulse width modulation port.

According to another embodiment of the present disclosure, when the first inner port, the second inner port and the third inner port of one of the functional transition circuits are configured as high level, digital input port and high level, respectively, the external port of the functional transition circuit is acted as the ground port.

According to another embodiment of the present disclosure, when the first inner port, the second inner port and the third inner port of one of the functional transition circuits are configured as high level, digital input port and lower level, respectively, the external port of the functional transition circuit is acted as the digital input port.

According to another embodiment of the present disclosure, when the first inner port, the second inner port and the third inner port of one of the functional transition circuits are configured as high level, digital output port and lower level, respectively, the external port of the functional transition circuit is acted as the digital output port.

According to another embodiment of the present disclosure, when the first inner port, the second inner port and the third inner port of one of the functional transition circuits are configured as a digital output port, digital input port and lower level, respectively, the external port of the functional transition circuit is acted as the digital output port.

According to another embodiment of the present disclosure, when the first inner port, the second inner port and the third inner port of one of the functional transition circuits are configured as high level, digital input port and digital output port, respectively, the external port of the functional transition circuit is acted as the digital output port.

According to another embodiment of the present disclosure, when the first inner port, the second inner port and the third inner port of one of the functional transition circuits are configured as high level, communication port and lower level, respectively, the external port of the functional transition circuit is acted as the communication port.

According to another embodiment of the present disclosure, when the first inner port, the second inner port and the third inner port of one of the functional transition circuits are configured as high level, analog-digital converter port and lower level, respectively, the external port of the functional transition circuit is acted as the analog-digital converter port.

According to another embodiment of the present disclosure, the bus interface module may comprise a power bus interface adapted to be connected with a power bus in the electrical equipment and a data bus interface adapted to be connected with the data bus in the electrical equipment.

According to another embodiment of the present disclosure, each functional transition circuits is adapted to change the function of the external port connected to the load by changing the configurations of the plurality of internal ports of the functional transition circuits, so that the same one external port is adapted to be connected to ports of loads with different functions.

Furthermore, in some embodiments of the present disclosure, the function of the external port of the functional transition circuit may be easily changed by changing the configurations of the internal ports of the functional transition circuits, without replacing hardware, so that the hardware of the intelligent connector has generality.

Other objectives and advantages of the present disclosure will become apparent from the following description of the present disclosure when taken in conjunction with the accompanying drawings, and may give a comprehensive understanding of the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other features of the present disclosure will become more apparent by describing in detail exemplary embodiments thereof with reference to the accompanying drawings, in which:

Fig.1 shows a schematic block diagram of a bus control system of an electrical equipment according to an embodiment of the present disclosure;

Fig. 2 shows a schematic block diagram of a load interface module in Fig. 1;

Fig.3 shows a schematic diagram of a functional transition circuit according to an embodiment of the present disclosure;

Fig.4 shows a schematic diagram of a functional transition circuit according to another embodiment of the present disclosure;

Figs.5A-5D show schematic diagrams illustrating two external ports of the load interface module as shown in Fig. 2 connected to different functional ports of an analog digital converter load;

Figs.6A-6D show schematic diagrams illustrating two external ports of the load interface module as shown in Fig. 2 connected to different functional ports of an actuator load; and

Figs.7A-7D show schematic diagrams illustrating two external ports of the load interface module as shown in Fig. 2 connected to different functional ports of a switch load.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The technical solution of the present disclosure will be described hereinafter in further detail with reference to embodiment, taken in conjunction with the accompanying drawings. In the specification, the same or similar reference numerals indicate the same or similar parts. The description of the embodiments of the present disclosure hereinafter with reference to the accompanying drawings is intended to explain the general inventive concept of the present disclosure, and should not be constructed as a limitation to the present disclosure.

In addition, in the following detailed description, for the sake of explanation, numerous specific details are set forth in order to provide a thorough understanding of the disclosed embodiments. It will be apparent, however, that one or more embodiments may also be practiced without these specific details. In other instances, well-known structures and devices are illustrated schematically in order to simplify the drawing.

According to a general technical concept of the present disclosure, there is provided an intelligent connector comprising: a bus interface module adapted to be connected to a bus in an electrical equipment; a load interface module adapted to be connected to loads in the electrical equipment; and a micro control unit connected between the bus interface module and the load interface module. The load interface module comprises a plurality of functional transition circuits each having a plurality of internal ports connected to the micro control unit and an external port adapted to be connected to the load configured to change the function of the external port by changing the configurations of the plurality of internal ports, so that the same one external port is adapted to be connected to ports of loads with different functions.

Fig.1 shows a schematic block diagram of a bus control system of an electrical equipment according to an embodiment of the present disclosure; and Fig. 2 shows a schematic block diagram of a load interface module in Fig. 1.

As shown in Figs. 1 and 2, in the illustrated embodiment, the bus control system may be applied to an electrical equipment, such as a household appliance. As shown in Fig. 1, the bus control system mainly comprises buses 310 and 320, a plurality of loads 200 and an intelligent connector 100 adapted to connect the plurality of loads 200 to the buses 310 and 320.

As shown in Figs. 1 and 2, in the illustrated embodiment, the intelligent connector mainly comprises: a bus interface module 110, 120 adapted to be connected to buses 310, 320 in the electrical equipment; a load interface module 140 adapted to be connected to loads 200 in the electrical equipment; and a micro control unit 130 connected between the bus interface modules 110, 120 and the load interface module 140.

In the illustrated embodiment, as shown in Figs 1 and 2, the bus interface modules 110 and 120 may comprise a power bus interface 110 connected with a power bus 310 in the electrical equipment and a data bus interface 120 adapted to be connected with the data bus 320 in the electrical equipment. The power bus 310 may be high voltage alternating current power bus, or lower voltage alternating current power bus.

As shown in Fig.2, in the illustrated embodiment, the load interface module 140 comprises a plurality of functional transition circuits 141 each having a plurality of internal ports C1, C2, C3 connected to the micro control unit 130 and an external port P_i ($i=1, 2, \dots, n$) adapted to be connected to the load 200.

In an embodiment of the present disclosure, as shown in Figs. 5A-5D, 6A-6D and 7A-7D, each functional transition circuits 141 is configured to change the function of the external port P_i by changing the configurations of the plurality of internal ports C1, C2, C3, so that the same one external port P_i is adapted to be connected to ports of loads with different functions.

Fig.3 shows a schematic diagram of a functional transition circuit 141 according to an embodiment of the present disclosure.

As shown in Figs. 2 and 3, in the illustrated embodiment, each functional transition circuits 141 has three internal ports C1, C2, C3, which are a first internal port C1, a second internal port C2 and a third internal port C3, respectively, wherein, the second internal port C2 is connected with the external port P_i .

As shown in Fig. 3, in the illustrated embodiment, each functional transition circuits 141 mainly comprises a first switch element Q1 and a second switch element Q2 each comprises a gate, a source and a drain. The gate of the first switch element Q1 is connected to the first internal port C1, one of the source and the drain of the first switch element Q1 is connected to a volt current condenser (VCC) or power supply, and the other of the source and the drain of the first switch element Q1 is connected to the external port P_i . The gate of the second switch element Q2 is connected to the third internal port C3, one of the source and the drain of the second switch element Q2 is grounded, and the other of the source and the drain of the second switch element Q2 is connected to the external port P_i . The other of the source and the drain of the first switch element Q1 is connected with the other of the source and the drain of the second switch element Q2.

As shown in Fig. 3, in the illustrated embodiment, each functional transition circuits 141 further comprises a divider resistor R one end of which is connected to the power supply VCC and the other end of which is connected to the external port P_i . In this way, the divider resistor R may be acted as a pull-up resistor of the functional transition circuit 141, and the functional transition circuit of Fig. 3 may be acted as a pull-up circuit.

Fig.4 shows a schematic diagram of a functional transition circuit according to another

embodiment of the present disclosure.

As shown in Figs. 2 and 4, in the illustrated embodiment, each functional transition circuits 141 has three internal ports C1, C2, C3, which are a first internal port C1, a second internal port C2, and a third internal port C3, respectively, wherein, the second internal port C2 is connected with the external port Pi.

As shown in Fig. 4, in the illustrated embodiment, each functional transition circuits 141 mainly comprises a first switch element Q1 and a second switch element Q2 each comprises a gate, a source and a drain. The gate of the first switch element Q1 is connected to the first internal port C1, one of the source and the drain of the first switch element Q1 is connected to a power supply VCC, and the other of the source and the drain of the first switch element Q1 is connected to the external port Pi. The gate of the second switch element Q2 is connected to the third internal port C3, one of the source and the drain of the second switch element Q2 is grounded, and the other of the source and the drain of the second switch element Q2 is connected to the external port Pi. The other of the source and the drain of the first switch element Q1 is connected with the other of the source and the drain of the second switch element Q2.

In an exemplary embodiment, the first switch element Q1 and the second switch element Q2 as shown in Figs. 3 and 4 each may comprise a transistor, for example, a Metal-Oxide-Semiconductor (MOS) transistor or a Field Effect Transistor (FET), for example, a Metal-Oxide-Semiconductor Field Effect Transistor (MOSFET).

As shown in Fig. 4, in the illustrated embodiment, each functional transition circuits 141 further comprises a divider resistor R one end of which is connected to the external port Pi and the other end of which is grounded. In this way, the divider resistor R may be a pull-down resistor of the functional transition circuit 141, and the functional transition circuit of Fig. 4 may be acted as a pull-down circuit.

As shown in Figs. 2, 3 and 4, in the illustrated embodiment, when the first inner port C1, the second inner port C2 and the third inner port C3 of one of the functional transition circuits 141 are configured as lower level (OFF), digital input port DI and lower level (OFF), respectively, the first switch element Q1 is turned on and the second switch element Q2 is turned off. In such a case, the external port Pi of the functional transition circuit 141 is acted as the power supply port VCC.

As shown in Figs. 2, 3 and 4, in the illustrated embodiment, when the first inner port C1, the second inner port C2 and the third inner port C3 of one of the functional transition circuits 141 are configured as a pulse width modulation port PWM, digital input port DI and lower level (OFF), respectively, the first switch element Q1 is turned on or is turned off periodically according to pulse width modulation signals of the pulse width modulation port PWM, and the second switch element Q2 is turned off. In such a case, the external port Pi of

the functional transition circuit 141 is acted as the pulse width modulation port PWM.

As shown in Figs. 2, 3 and 4, in the illustrated embodiment, when the first inner port C1, the second inner port C2 and the third inner port C3 of one of the functional transition circuits 141 are configured as high level (ON), digital input port DI and high level (ON), respectively, the first switch element Q1 is turned off and the second switch element Q2 is turned on. In such a case, the external port Pi of the functional transition circuit 141 is acted as the ground port GND.

As shown in Figs. 2, 3 and 4, in the illustrated embodiment, when the first inner port C1, the second inner port C2 and the third inner port C3 of one of the functional transition circuits 141 are configured as high level (ON), digital input port DI and lower level (OFF), respectively, the first switch element Q1 is turned off and the second switch element Q2 is turned off. In such a case, the external port Pi of the functional transition circuit 141 is acted as the digital input port DI.

As shown in Figs. 2, 3 and 4, in the illustrated embodiment, when the first inner port C1, the second inner port C2 and the third inner port C3 of one of the functional transition circuits 141 are configured as high level (ON), digital output port DO and lower level (OFF), respectively, the first switch element Q1 is turned off and the second switch element Q2 is turned off. In such a case, the external port Pi of the functional transition circuit 141 is acted as the digital output port DO.

As shown in Figs. 2, 3 and 4, in the illustrated embodiment, when the first inner port C1, the second inner port C2 and the third inner port C3 of one of the functional transition circuits 141 are configured as digital output port DO, digital input port DI and lower level (OFF), respectively, the second switch element Q2 is turned off. In such a case, the external port Pi of the functional transition circuit 141 is acted as the digital output port DO.

As shown in Figs. 2, 3 and 4, in the illustrated embodiment, when the first inner port C1, the second inner port C2 and the third inner port C3 of one of the functional transition circuit 141 are configured as high level (ON), digital input port DI and digital output port DO, respectively, the first switch element Q1 is turned off. In such a case, the external port Pi of the functional transition circuit 141 is acted as the digital output port DO.

As shown in Figs. 2, 3 and 4, in the illustrated embodiment, when the first inner port C1, the second inner port C2 and the third inner port C3 of one of the functional transition circuit 141 are configured as high level (ON), communication port URAT, IIC, SPI and lower level (OFF), respectively, the first switch element Q1 is turned off and the second switch element Q2 is turned off. In such a case, the external port Pi of the functional transition circuit 141 is acted as the communication port URAT, IIC, SPI.

As shown in Figs. 2, 3 and 4, in the illustrated embodiment, when the first inner port C1, the second inner port C2 and the third inner port C3 of one of the functional transition

circuit 141 are configured as high level (ON), analog-digital converter port ADC and lower level (OFF), respectively, the first switch element Q1 is turned off and the second switch element Q2 is turned off. In such a case, the external port Pi of the functional transition circuit 141 is acted as the analog-digital converter port ADC.

In one embodiment of the present disclosure, the micro control unit 130 is adapted to configure functions of the plurality of internal ports C1, C2, C3 of each functional transition circuits 141 according to pre-input program (including configuration data). With this arrangement, the configurations of the plurality of internal ports C1, C2, C3 of each functional transition circuits 141 may be changed by updating a program. Accordingly, in embodiments of the present disclosure, the function of the external port of the functional transition circuit may be easily changed only by changing a program for configuring the function of the internal port of the functional transition circuit, without replacing hardware. As a result, the whole intelligent connector has strong generality.

In an embodiment of the present disclosure, as shown in Figs 5A-5D, 6A-6D and 7A-7D, an external port Pi of each functional transition circuits 141 may be acted as any one of power supply port VCC, pulse width modulation port PWM, ground port GND, digital input port DI, digital output port DO, communication port URAT and analog-digital converter port ADC, so that the same one external port Pi is adapted to be connected to functional ports of different loads (such as, analog-digital converter load, actuator load, switch load, etc.), or different functional ports of the same one load.

Some applications of the intelligent connector according to the present disclosure will be explained hereinafter with reference to Figs. 5A-5D, 6A-6D and 7A-7D.

Figs.5A-5D show schematic diagrams illustrating two external ports P1, P2 of the load interface module 140 of the intelligent connector 100 as shown in Fig. 2 connected to different functional ports of an analog digital converter load 200.

As shown in Fig. 5A, the two external ports P1, P2 of the load interface module 140 of the intelligent connector 100 may be connected to a power supply port VCC and an analog-digital converter port ADC of the analog digital converter load 200, respectively.

As shown in Fig. 5B, the two external ports P1, P2 of the load interface module 140 of the intelligent connector 100 may be connected to a ground port GND and the analog-digital converter port ADC of the analog digital converter load 200, respectively.

As shown in Fig. 5C, the two external ports P1, P2 of the load interface module 140 of the intelligent connector 100 may be connected to the analog-digital converter port ADC and a power supply port VCC of the analog digital converter load 200, respectively.

As shown in Fig. 5D, the two external ports P1, P2 of the load interface module 140 of the intelligent connector 100 may be connected to the analog-digital converter port ADC and the ground port GND of the analog digital converter load 200, respectively.

Figs.6A-6D show schematic diagrams illustrating two external ports P1, P2 of the load interface module 140 of the intelligent connector 100 as shown in Fig. 2 connected to different functional ports of an actuator load 200.

As shown in Fig. 6A, the two external ports P1, P2 of the load interface module 140 of the intelligent connector 100 may be connected to a power supply port VCC and a digital output port DO of the actuator load 200, respectively.

As shown in Fig. 6B, the two external ports P1, P2 of the load interface module 140 of the intelligent connector 100 may be connected to a ground port GND and the digital output port DO of the actuator load 200, respectively.

As shown in Fig. 6C, the two external ports P1, P2 of the load interface module 140 of the intelligent connector 100 may be connected to the digital output port DO and the power supply port VCC of the actuator load 200, respectively.

As shown in Fig. 6D, the two external ports P1, P2 of the load interface module 140 of the intelligent connector 100 may be connected to the digital output port DO and the ground port GND of the actuator load 200, respectively.

Figs.7A-7D show schematic diagrams illustrating two external ports P1, P2 of the load interface module 140 of the intelligent connector 100 as shown in Fig. 2 connected to different functional ports of a switch load 200.

As shown in Fig. 7A, the two external ports P1, P2 of the load interface module 140 of the intelligent connector 100 may be connected to a power supply VCC port and a digital input port DI of the switch load 200, respectively.

As shown in Fig. 7B, the two external ports P1, P2 of the load interface module 140 of the intelligent connector 100 may be connected to a ground port GND and the digital input port DI of the actuator load 200, respectively.

As shown in Fig. 7C, the two external ports P1, P2 of the load interface module 140 of the intelligent connector 100 may be connected to the digital input port DI and the power supply VCC of the actuator load 200, respectively.

As shown in Fig. 7D, the two external ports P1, P2 of the load interface module 140 of the intelligent connector 100 may be connected to the digital input port DI and the ground port GND of the actuator load 200, respectively.

It should be appreciated by those skilled in this art that the above embodiments are intended to be illustrative, modifications may be made to the above embodiments by those skilled in this art, and structures described in various embodiments may be freely combined without having structural or principle conflict.

Although the present disclosure has been described with reference to the attached drawings, the embodiments disclosed in the drawings is intended to illustrate the preferred embodiment of the present disclosure, but should not be constructed as a limitation to the

present disclosure.

Although several embodiments of the general concept of the present disclosure have been shown and described, it would be appreciated by those skilled in the art that various modifications may be made in these embodiments without departing from the principles and spirit of the disclosure, the scope of which is defined in the claims and their equivalents.

As used herein, term “comprising” or “having” should be understood as not excluding other elements or steps, and term “a” or “an” should be understood as not excluding plural elements or steps. In addition, any reference numeral in claims should not be understood as a limitation of the present disclosure.

What is claimed is,

1. An intelligent connector, comprising:

a bus interface module adapted to be connected to a bus in an electrical equipment;

a load interface module adapted to be connected to loads in the electrical equipment;
and

a micro control unit connected between the bus interface module and the load interface module,

wherein the load interface module comprises a plurality of functional transition circuits each having a plurality of internal ports connected to the micro control unit and an external port adapted to be connected to the load and configured to change the function of the external port by changing the configurations of the plurality of internal ports, so that the same one external port is adapted to be connected to ports of loads with different functions.

2. The intelligent connector according to claim 1, wherein,

each of the plurality of internal ports comprises a first internal port, a second internal port, and a third internal port, the second internal port being connected with the external port;
and

each functional transition circuit comprises:

a first switch element, a gate of the first switch element being connected to the first internal port, one of a source and a drain of the first switch element being connected to a power supply, and the other of the source and the drain of the first switch element being connected to the external port; and

a second switch element, a gate of the second switch element being connected to the third internal port, one of a source and a drain of the second switch element being grounded, and the other of the source and the drain of the second switch element being connected to the external port, and

wherein the other of the source and the drain of the first switch element is connected with the other of the source and the drain of the second switch element.

3. The intelligent connector according to claim 2, wherein,

each functional transition circuit further comprises a divider resistor one end of which is connected to the power supply and the other end of which is connected to the external port.

4. The intelligent connector according to claim 2, wherein,

each functional transition circuit further comprises a divider resistor one end of which

is connected to the external port and the other end of which is grounded.

5. The intelligent connector according to claim 1, wherein,

the micro control unit is adapted to configure the functions of the plurality of internal ports of each functional transition circuits according to a program performed in the micro control unit, so that configurations of the plurality of internal ports of each functional transition circuits are changed by updating the program.

6. The intelligent connector according to claim 2, wherein,

the external port of each functional transition circuits may be acted as any one of power supply port, pulse width modulation port, ground port, digital input port, digital output port, communication port and analog-digital converter port, so that the same one external port is adapted to be connected to functional ports of different loads, or different functional ports of the same one load.

7. The intelligent connector according to claim 6, wherein,

when the first inner port, the second inner port and the third inner port of one of the functional transition circuits are configured as lower level, digital input port and lower level, respectively, the external port of the functional transition circuit is acted as the power supply port.

8. The intelligent connector according to claim 6, wherein,

when the first inner port, the second inner port and the third inner port of one of the functional transition circuits are configured as a pulse width modulation port, digital input port and lower level, respectively, the external port of the functional transition circuit is acted as the pulse width modulation port.

9. The intelligent connector according to claim 6, wherein,

when the first inner port, the second inner port and the third inner port of one of the functional transition circuits are configured as high level, digital input port and high level, respectively, the external port of the functional transition circuit (141) is acted as the ground port.

10. The intelligent connector according to claim 6, wherein,

when the first inner port, the second inner port and the third inner port of one of the functional transition circuits are configured as high level, digital input port and lower level, respectively, the external port of the functional transition circuit is acted as the digital input

port.

11. The intelligent connector according to claim 6, wherein,

when the first inner port, the second inner port and the third inner port of one of the functional transition circuits are configured as high level, digital output port and lower level, respectively, the external port of the functional transition circuit is acted as the digital output port.

12. The intelligent connector according to claim 6, wherein,

when the first inner port, the second inner port and the third inner port of one of the functional transition circuits are configured as digital output port, digital input port and lower level, respectively, the external port of the functional transition circuit is acted as the digital output port.

13. The intelligent connector according to claim 6, wherein,

when the first inner port, the second inner port and the third inner port of one of the functional transition circuits are configured as high level, digital input port and digital output port, respectively, the external port of the functional transition circuit is acted as the digital output port.

14. The intelligent connector according to claim 6, wherein,

when the first inner port, the second inner port and the third inner port of one of the functional transition circuits are configured as high level, communication port and lower level, respectively, the external port of the functional transition circuit is acted as the communication port.

15. The intelligent connector according to claim 6, wherein,

when the first inner port, the second inner port and the third inner port of one of the functional transition circuits are configured as high level, analog-digital converter port and lower level, respectively, the external port of the functional transition circuit is acted as the analog-digital converter port.

16. The intelligent connector according to claim 1, wherein,

the bus interface modules may comprise a power bus interface adapted to be connected with the power bus in the electrical equipment and a data bus interface adapted to be connected with the data bus in the electrical equipment.

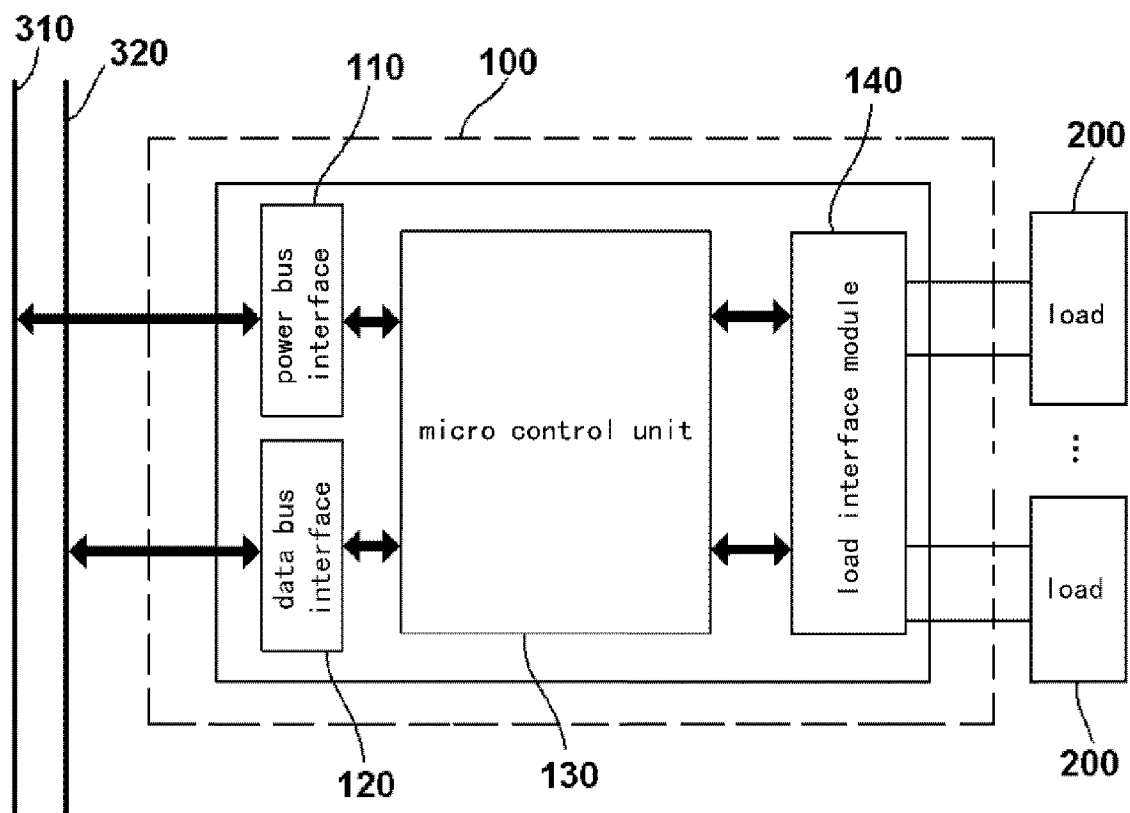


Fig. 1

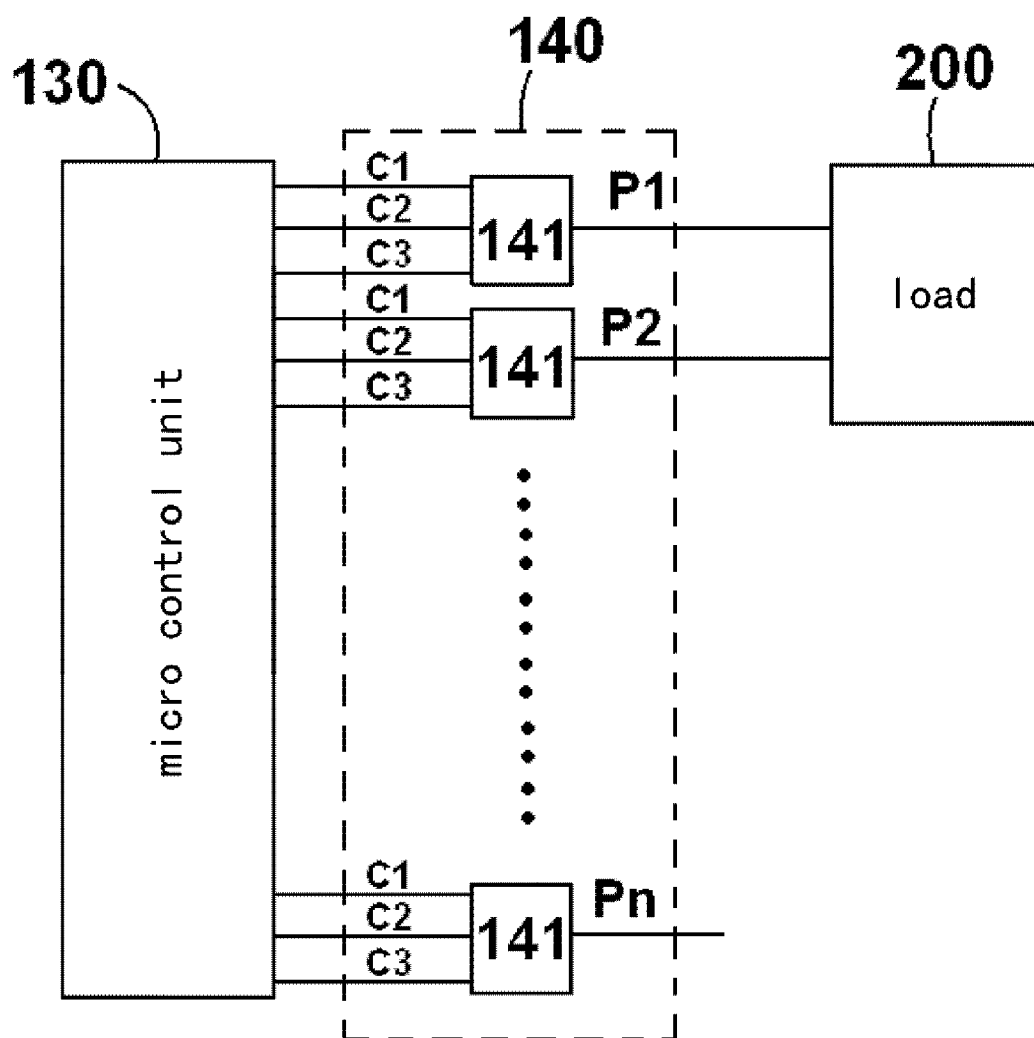


Fig. 2

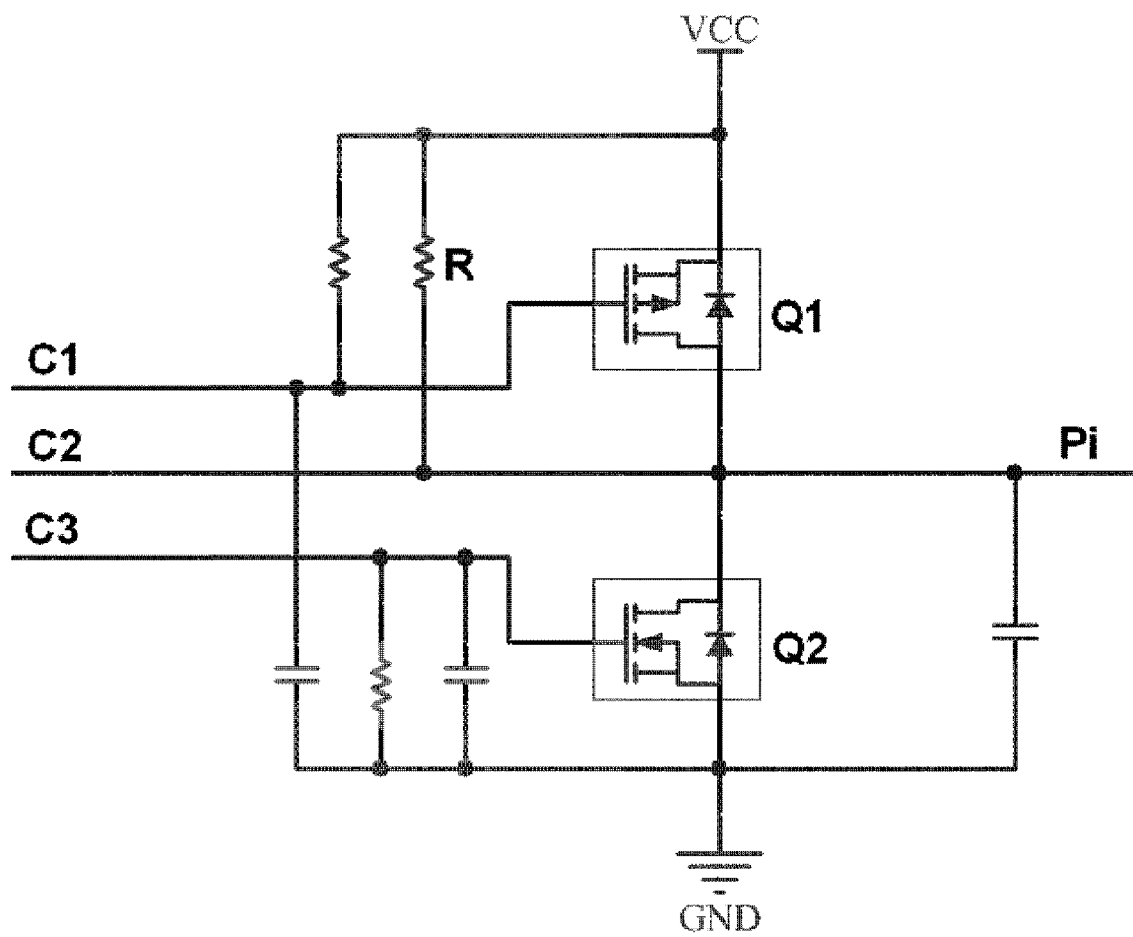


Fig. 3

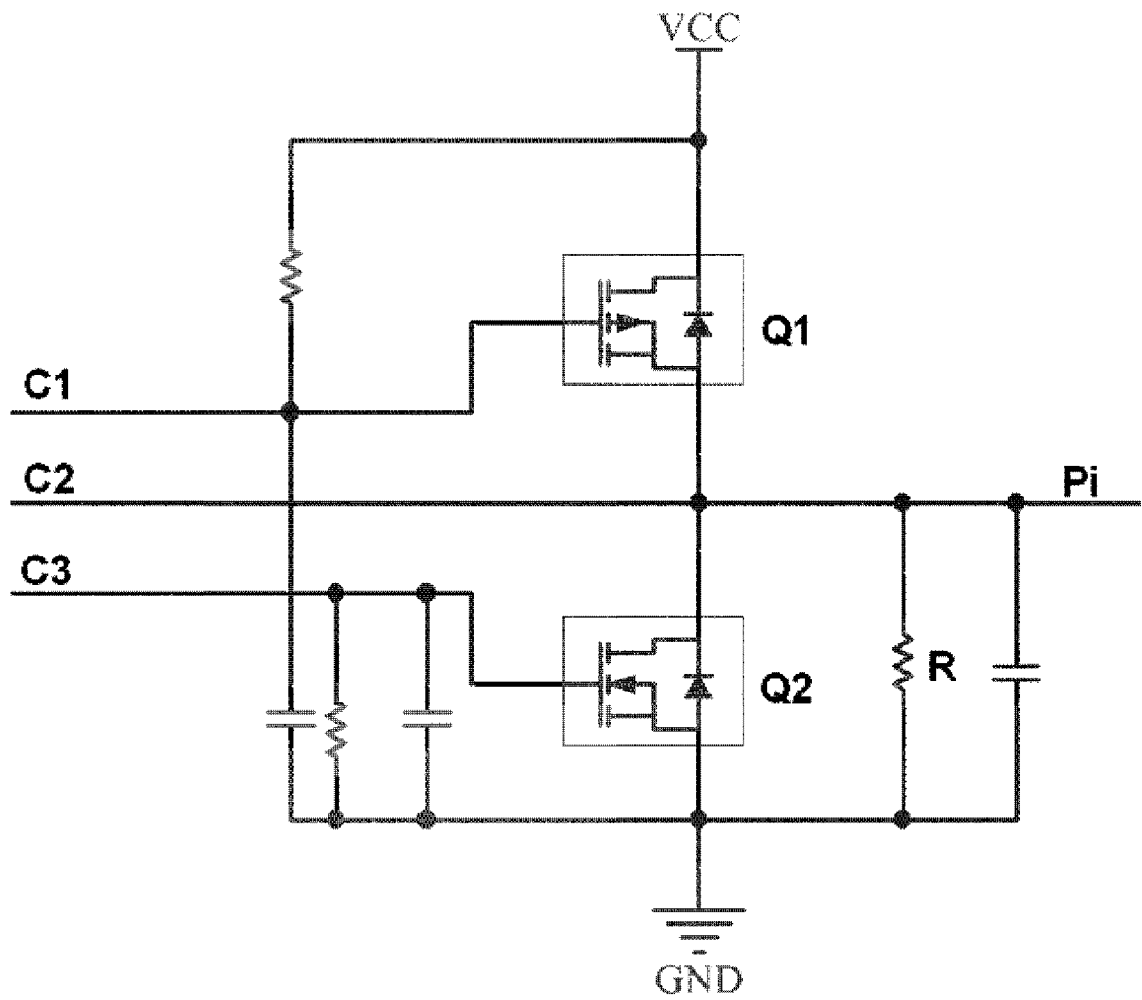


Fig. 4

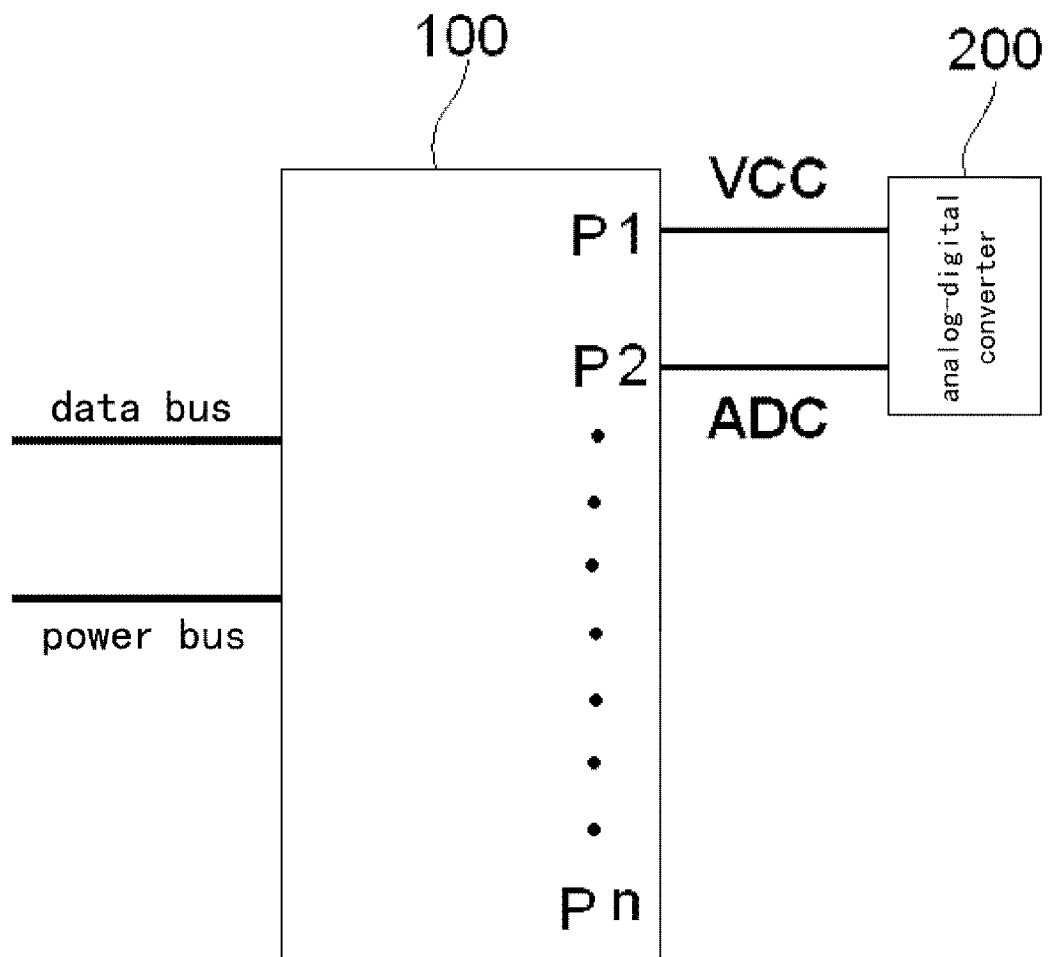


Fig. 5A

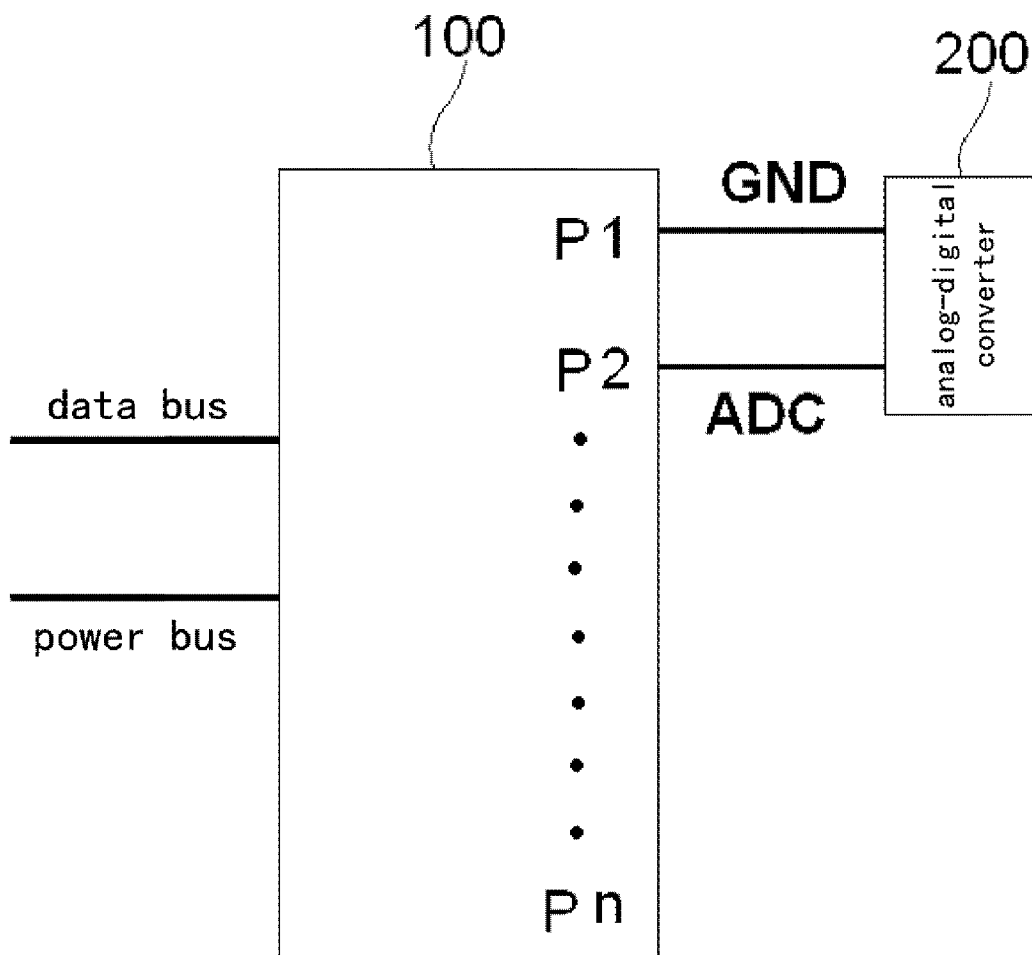


Fig. 5B

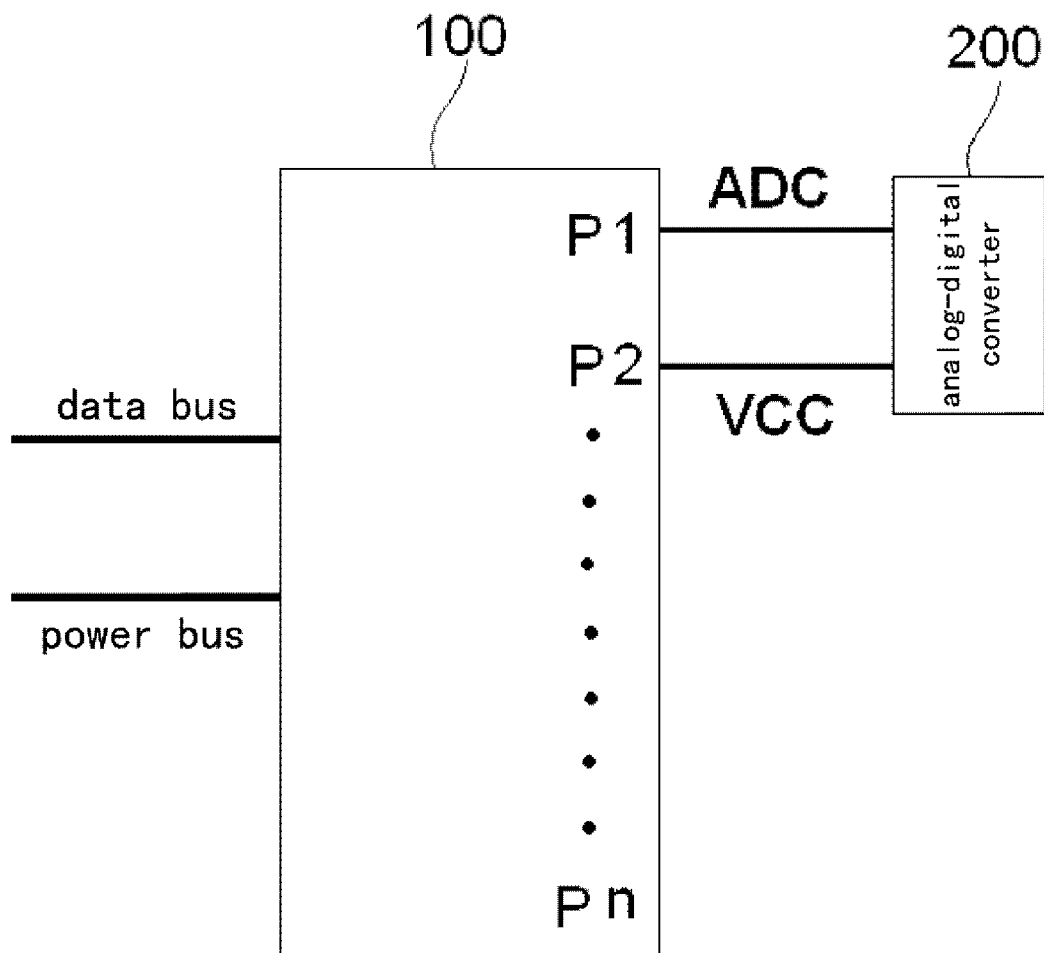


Fig. 50

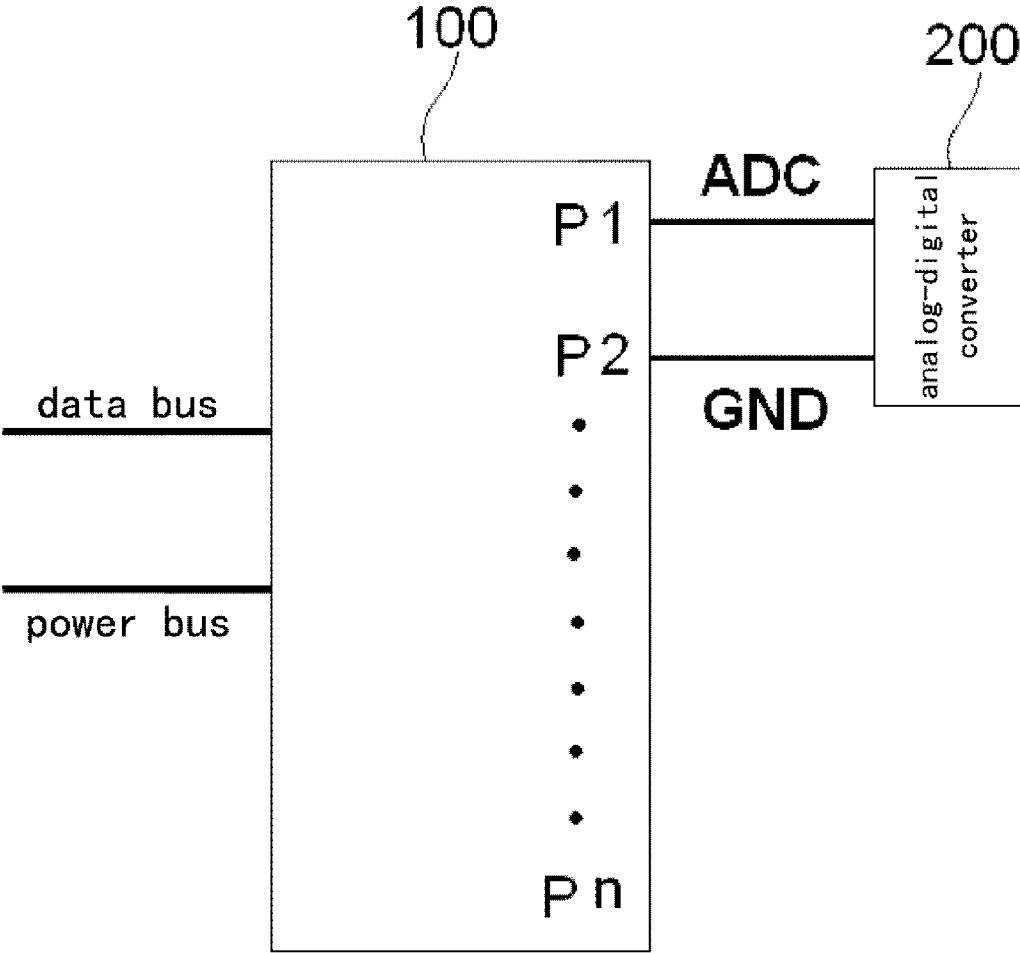


Fig. 5D

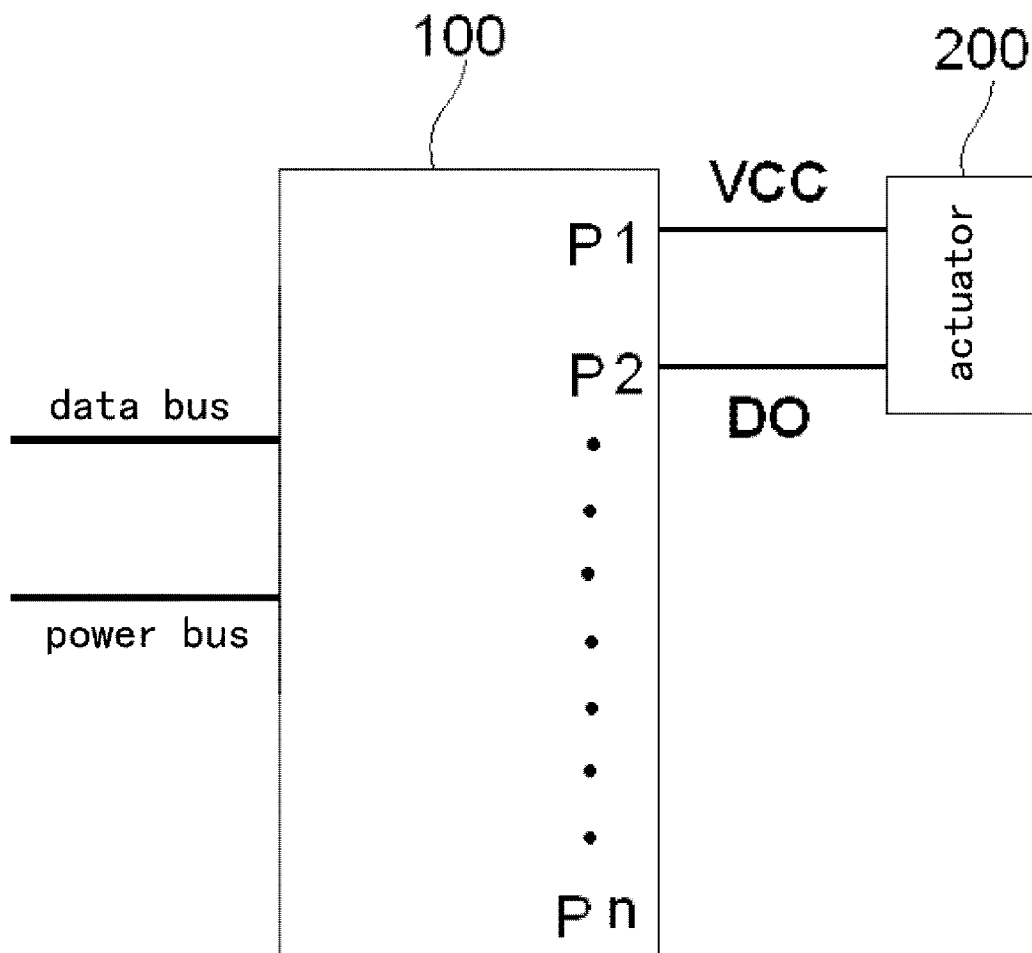


Fig. 6A

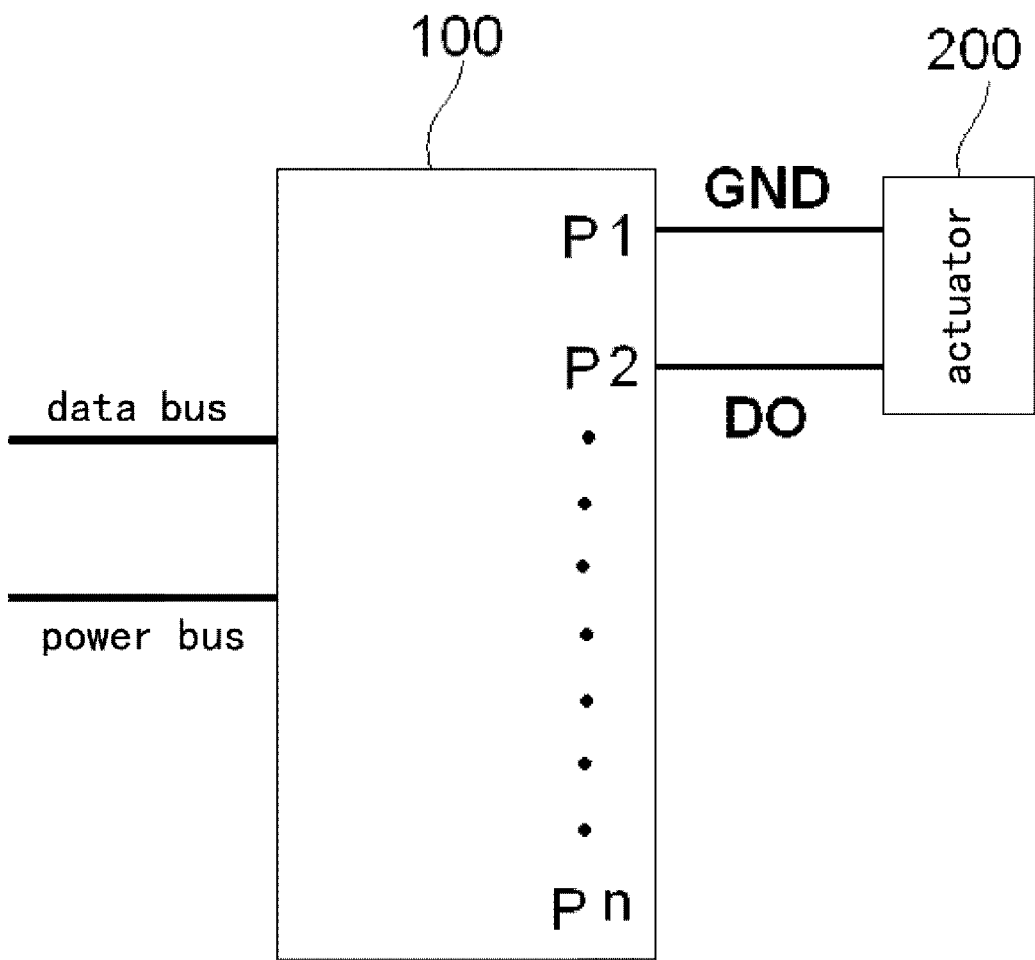


Fig. 6B

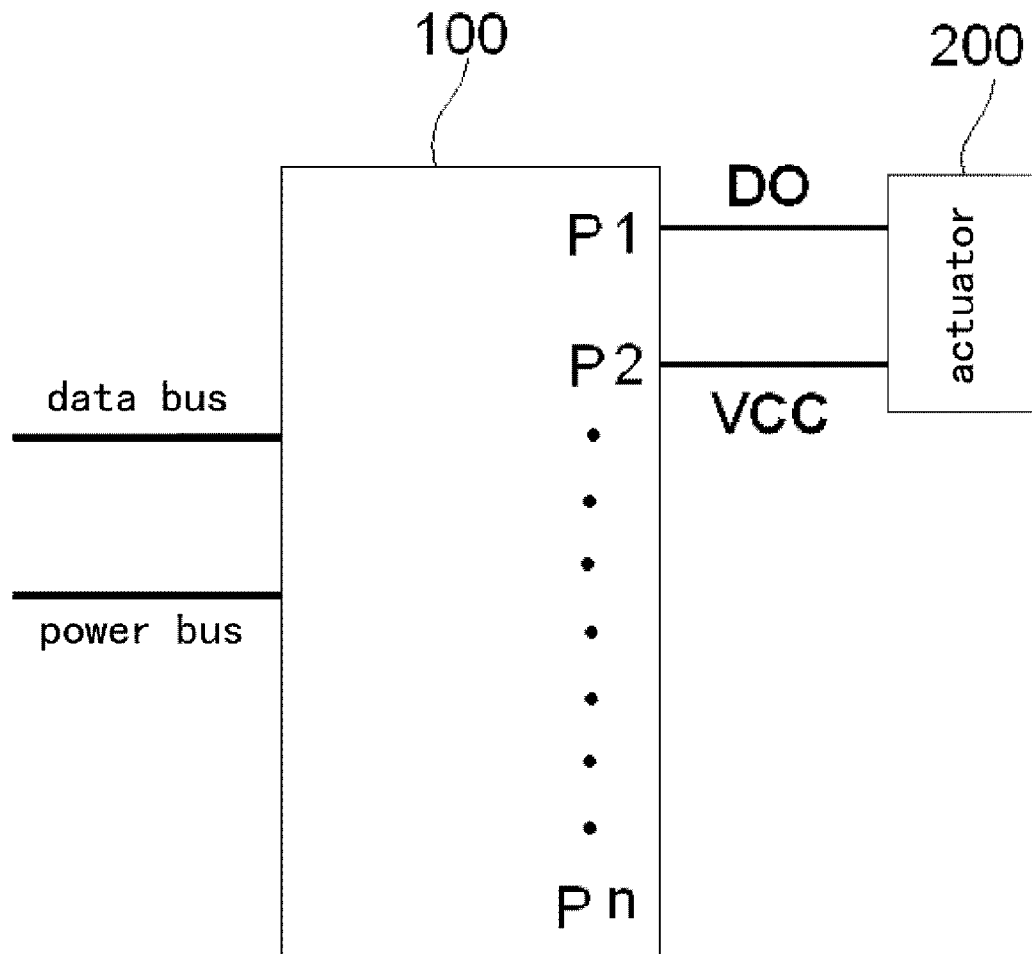


Fig. 60

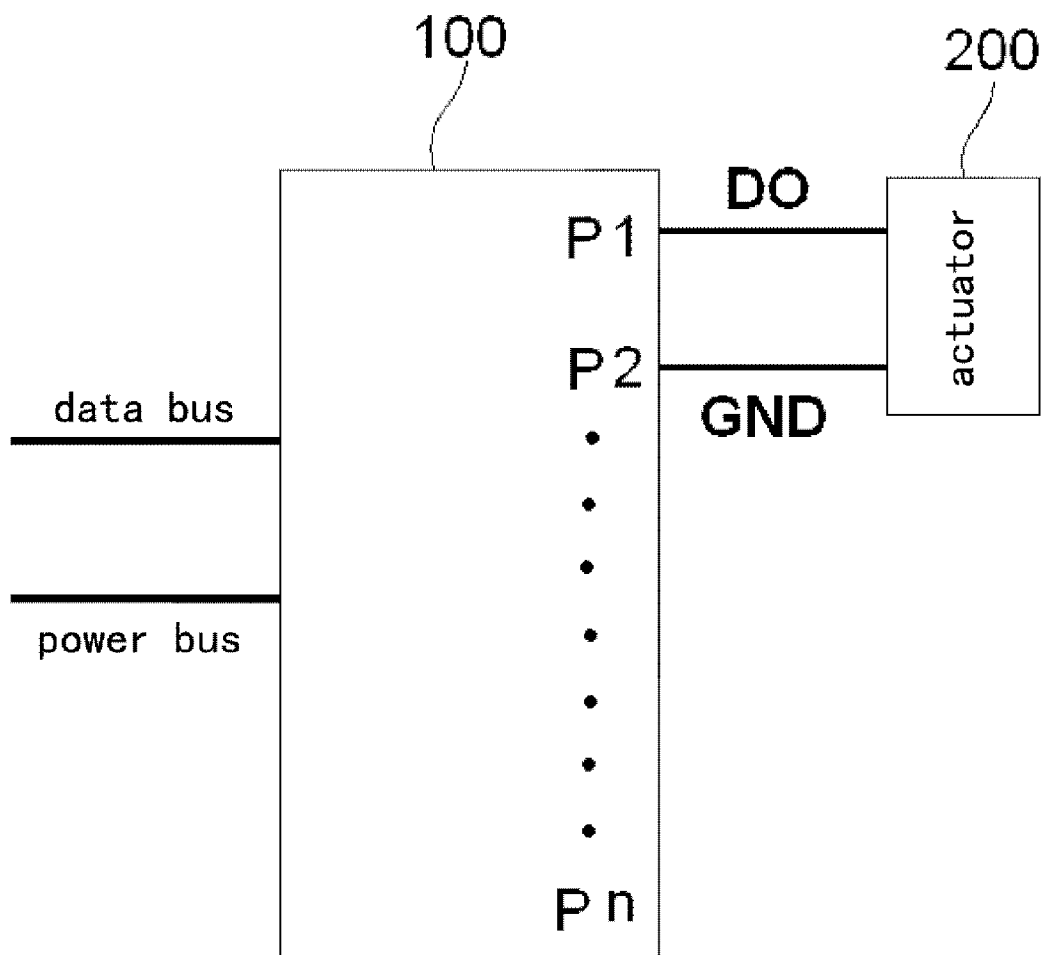


Fig. 6D

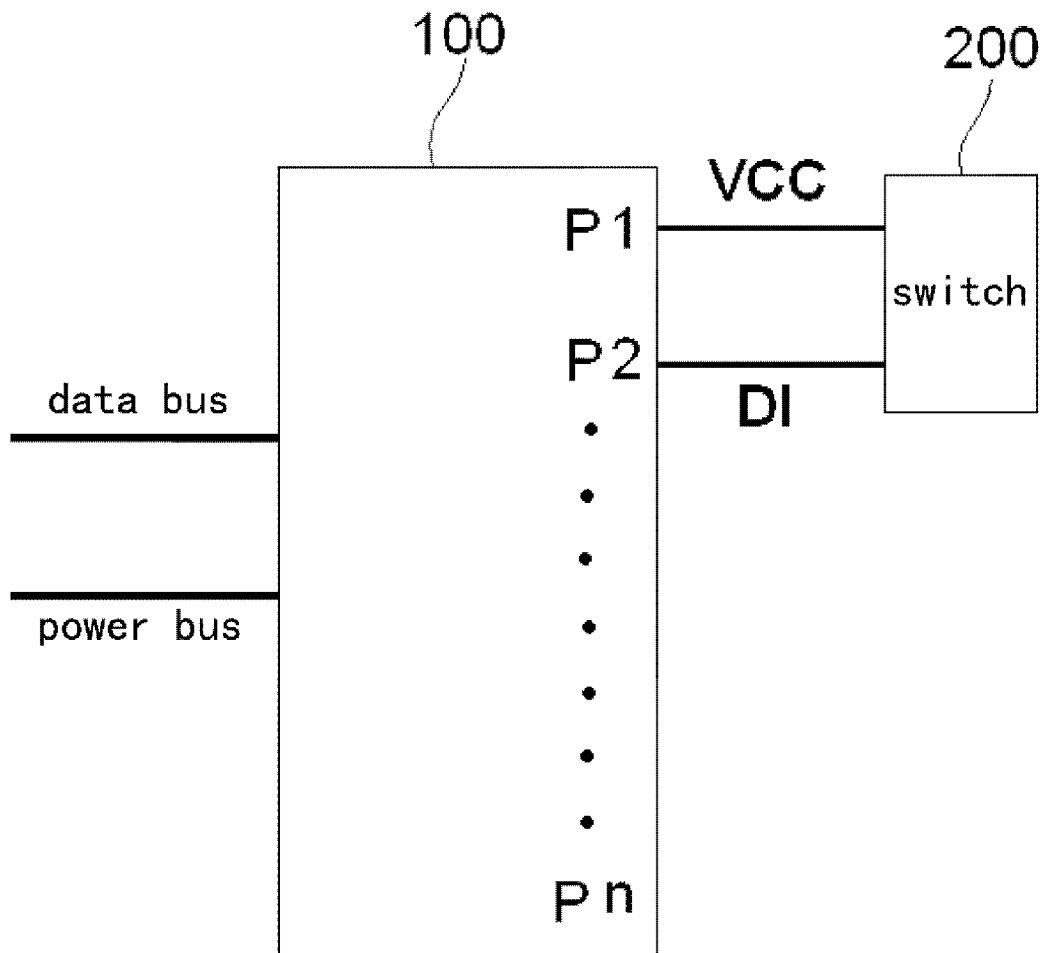


Fig. 7A

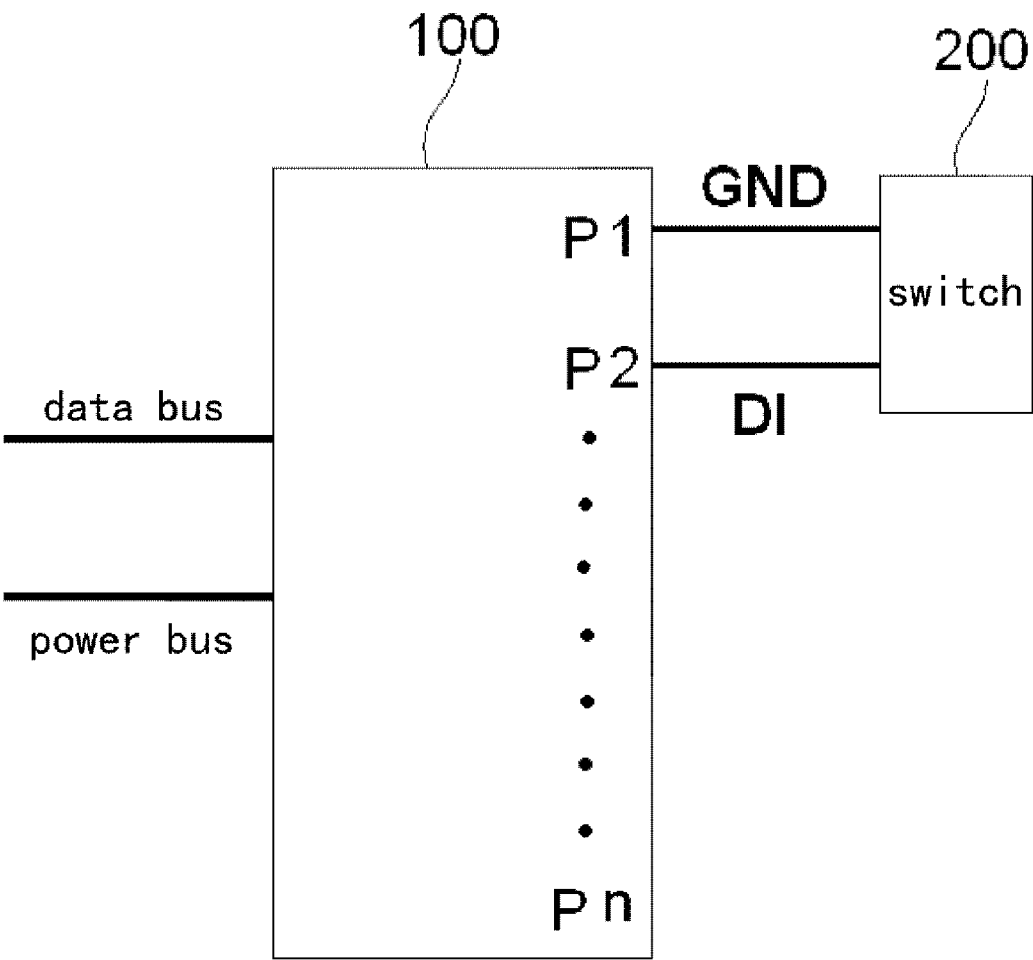


Fig. 7B

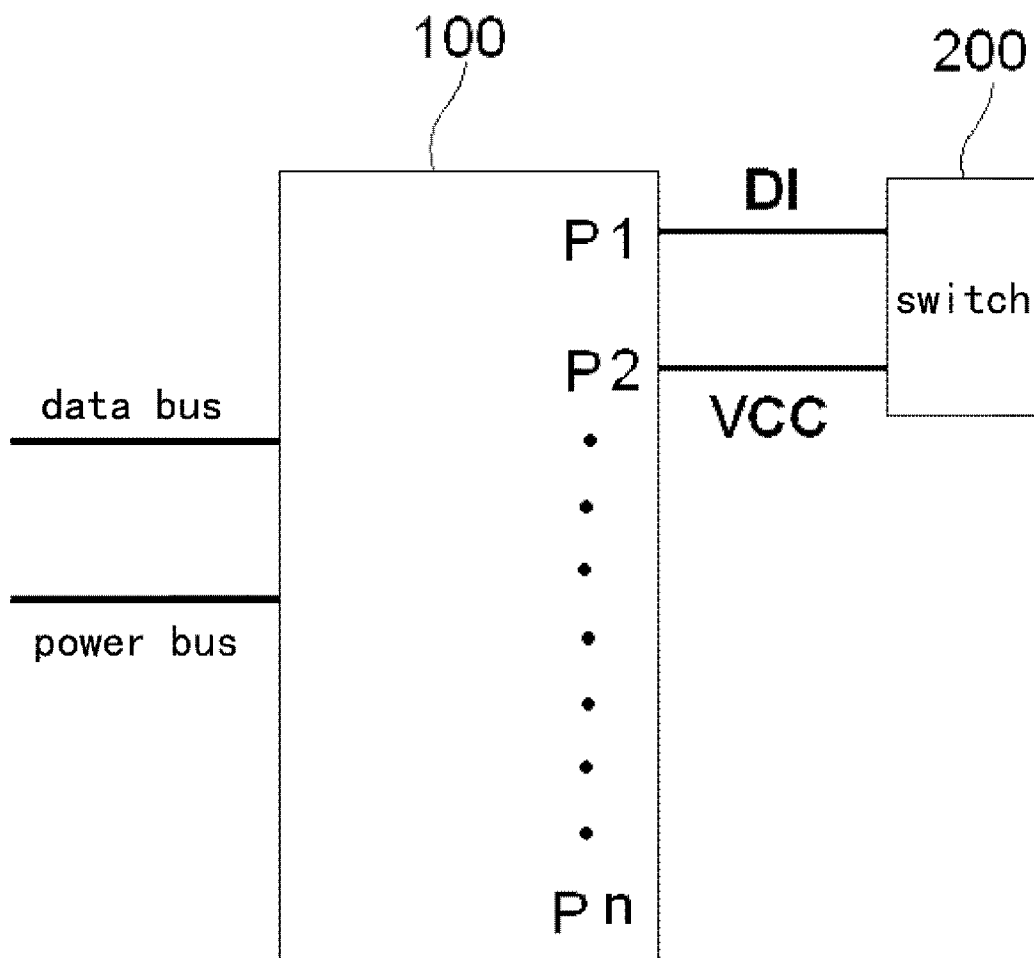


Fig. 70

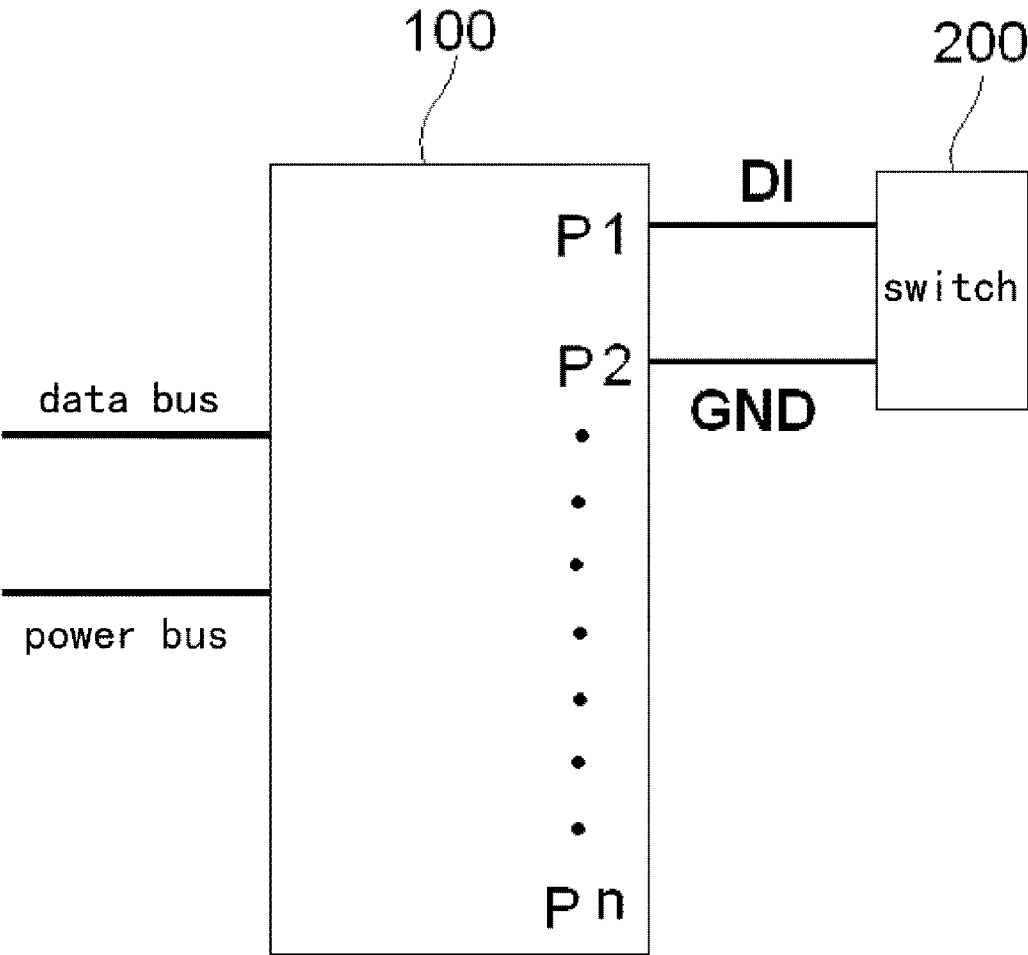


Fig. 7D

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2017/057051

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04L12/40
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)
H04L G05B H01R

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 2006/155900 A1 (SAGUES PAUL [US] ET AL) 13 July 2006 (2006-07-13) abstract paragraph [0003] paragraph [0005] paragraph [0012] - paragraph [0015] paragraph [0018] paragraph [0038] - paragraph [0040] paragraph [0042] - paragraph [0048] paragraph [0070] paragraph [0073] figures 5, 6 ----- -/-	1-16



Further documents are listed in the continuation of Box C.



See patent family annex.

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"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

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"&" document member of the same patent family

Date of the actual completion of the international search

14 December 2017

Date of mailing of the international search report

02/01/2018

Name and mailing address of the ISA/

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Authorized officer

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INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2017/057051

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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International application No

PCT/IB2017/057051

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			WO 2017055982 A1 06-04-2017
