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(72) Inventor(s):
Xingming He
Cui Zhou

(73) Proprietor(s):
Tridonic GmbH & Co. KG
(Incorporated in Austria)
Färbergasse 15, 6851 Dornbirn, Austria

(74) Agent and/or Address for Service:
Dehns
St. Bride's House, 10 Salisbury Square, LONDON, EC4Y 8JD, United Kingdom

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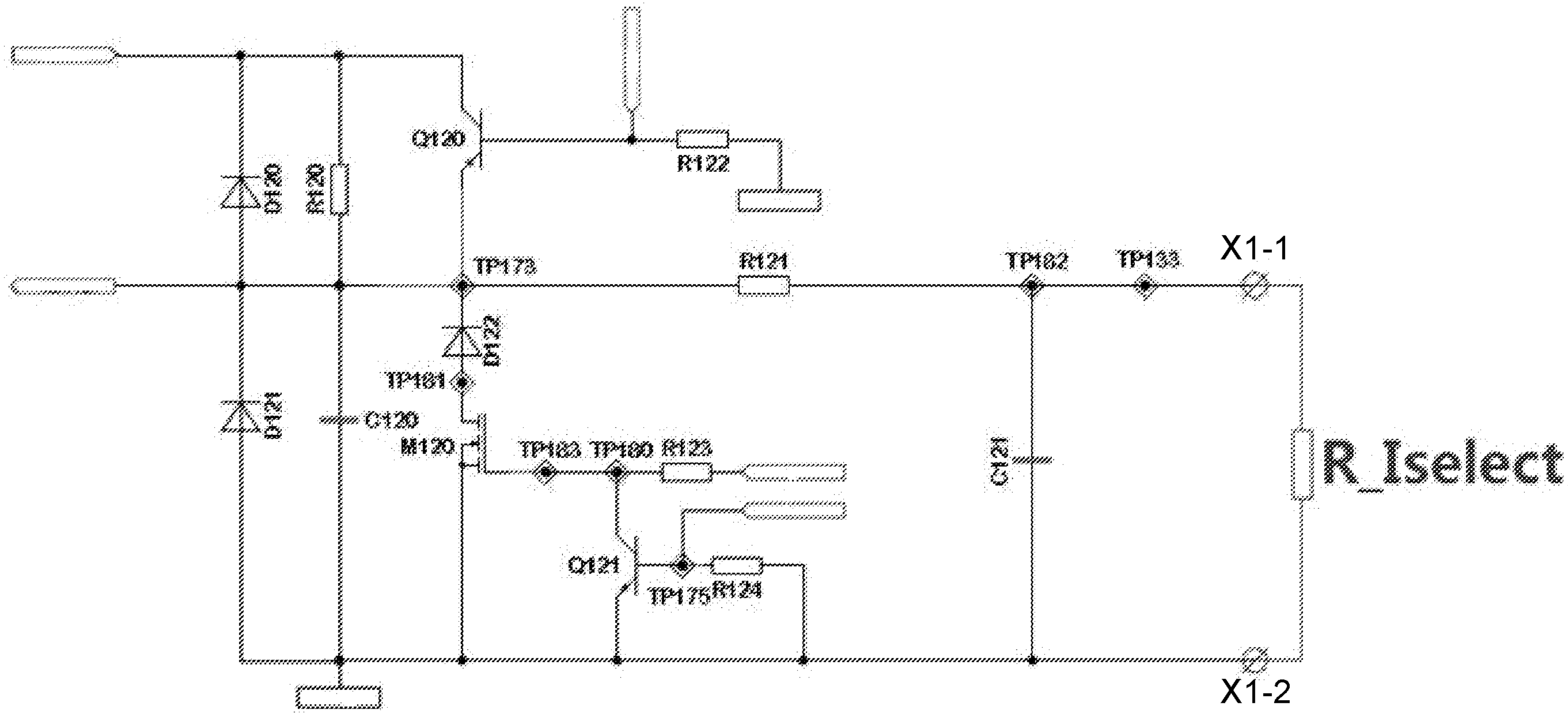
Q120
R122
D120
R120
TP173
R121
TP182
TP133
X1-1
D122
TP181
D121
C120
M120
TP183
TP180
R123
C121
R_Iselect
Q121
TP175
R124
X1-2

Fig.1 (a)

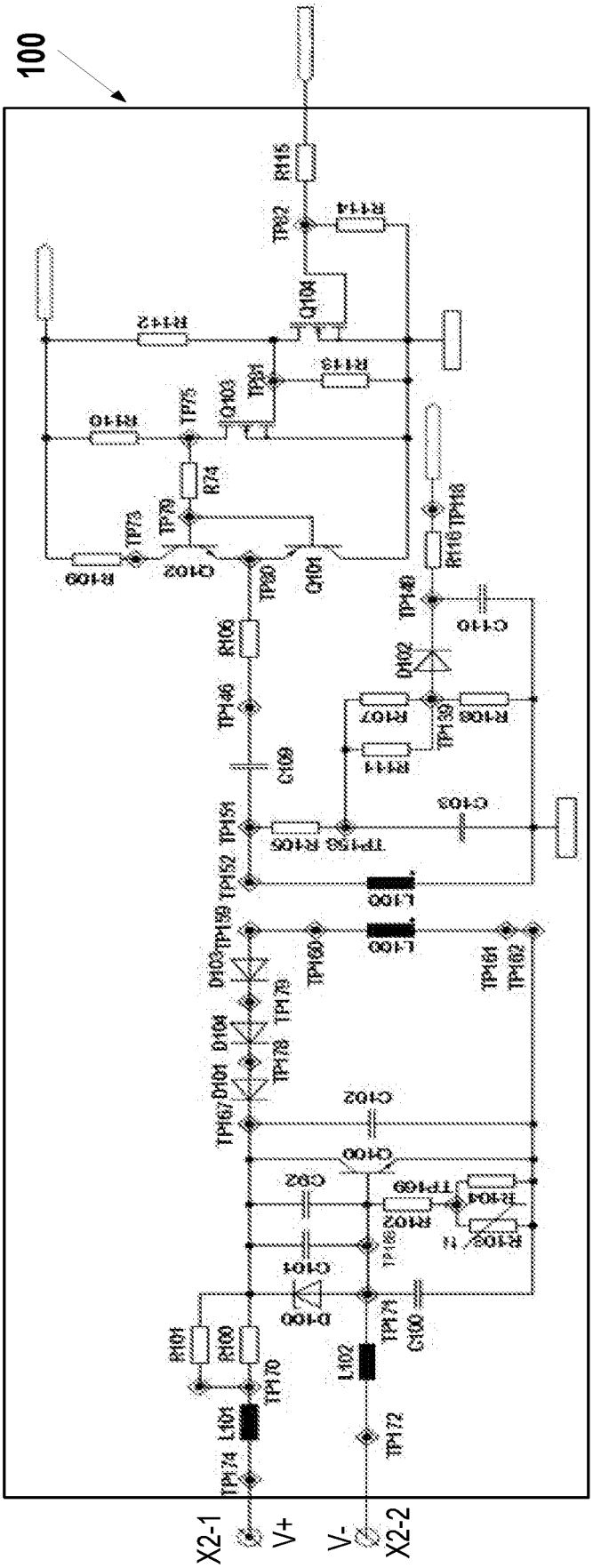

Fig 1 (b)

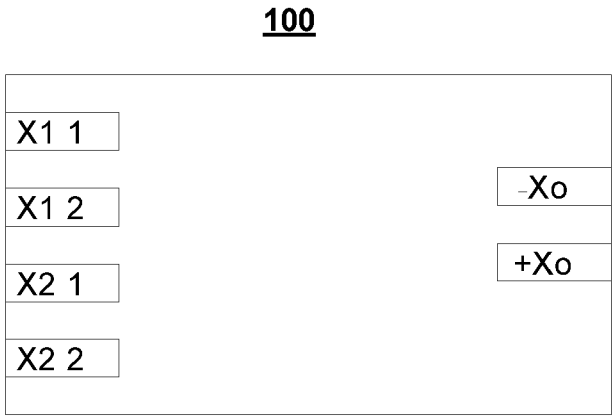
100
X1 1
X1 2
X2 1
X2 2
-Xo
+Xo

Fig. 2

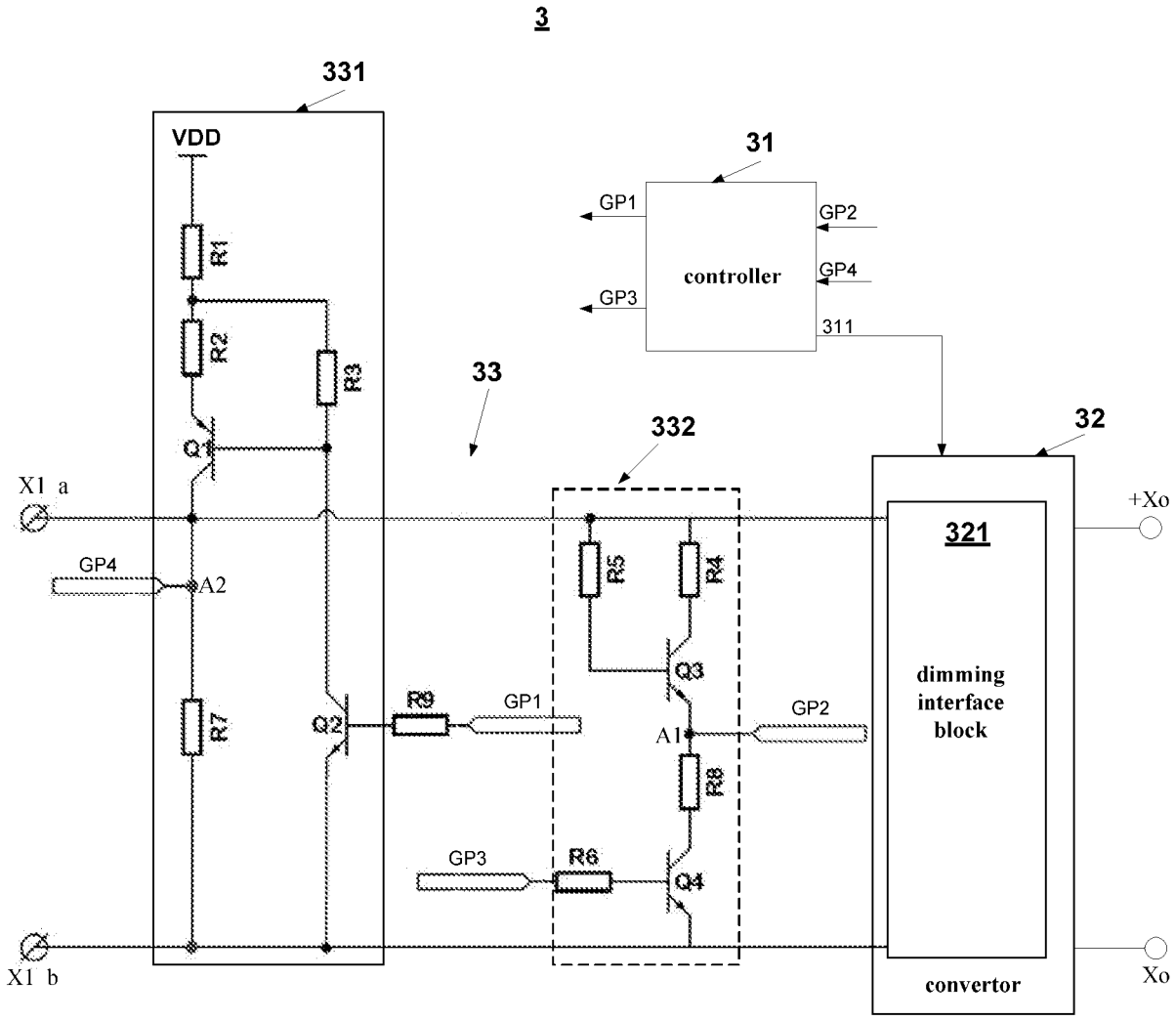
3
331
VDD
R1
R2
R3
Q1
31
GP1
GP2
GP3
GP4
controller
311
33
332
32
X1 a
GP4
A2
R7
Q2
R9
GP1
R5
R4
Q3
A1
GP2
R8
GP3
R6
Q4
321
dimming interface block
convertor
+Xo
Xo
X1 b

Fig. 3

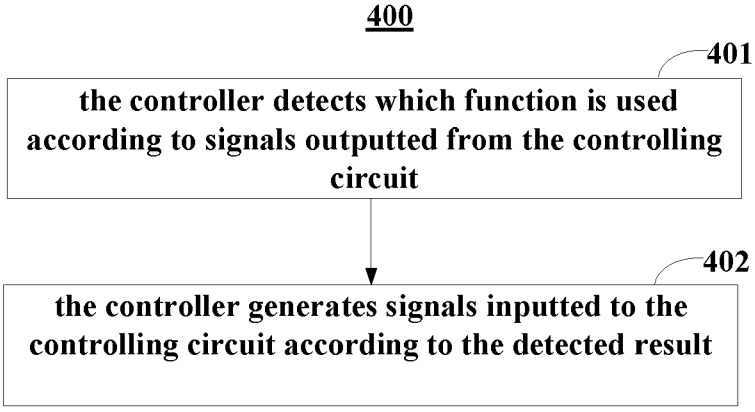
400
401
the controller detects which function is used according to signals outputted from the controlling circuit
402
the controller generates signals inputted to the controlling circuit according to the detected result

Fig. 4

POWER SUPPLY CIRCUIT, CONTROLLING METHOD AND LIGHTING DRIVER

TECHNICAL FIELD

[0001] Embodiments of the present disclosure generally relate to the field of power supply, and more particularly, to a power supply circuit, a controlling method and a lighting driver.

BACKGROUND

[0002] This section introduces aspects that may facilitate better understanding of the present disclosure. Accordingly, the statements of this section are to be read in this light and are not to be understood as admissions about what is in the prior art or what is not in the prior art.

[0003] Nowadays, many LED power supplies have multiple functions. For example, the function may be current selecting function or dimming function.

[0004] As for current selecting function, multiple supply current level options can be provided, the supply current level is changed by adding an external resistor (e.g. R_Iselect) or by using a switch to select difference resistance values in the circuit. The current selecting function may be expressed as Iselect function.

[0005] As for dimming function, the range of input voltage may be 0V (or 1V)-10V, and the supply current of the power supply may be changed according to the input voltage.

SUMMARY

[0006] In power supplies having multiple functions, different functions may be allocated different input port to receive input signal.

[0007] For example, Fig. 1 is a partial circuit of a power supply with current selecting function and dimming function. Fig. 1 (a) is the partial circuit around the input port for current selecting function, Fig. 1 (b) is the partial circuit around the input port for

dimming function.

[0008] As shown in Fig. 1(a), a resistor R_Iselect is connected between a first set of input ports X1-1 and X1-2.

[0009] As shown in Fig. 1(b), input voltage pair V+ and V- is inputted via a second set of input ports X2-1 and X2-2. In Fig. 1(b), a dimming interface block 100 may be used to perform the dimming function.

[0010] Fig. 2 is a diagram of ports allocation of the power supply with current selecting function and dimming function. As shown in Fig. 2, there are two sets of input ports in the power supply 10: the first set of input ports X1-1 and X1-2 for current selecting function, and the second set of input ports X2-1 and X2-2 for dimming function. In addition, the power supply 10 may further have a set of output ports which are denoted as –Xo and +Xo.

[0011] Inventor of this disclosure found that: in power supplies having multiple functions, each function may occupy a set of ports, thus multiple sets of ports will occupy more space in the circuit, and the cost will be higher.

[0012] In general, embodiments of the present disclosure provide a power supply circuit, a controlling method and a lighting driver. In the embodiments, multiple functions share one set of input ports, a controlling circuit is provided for detecting which function is used, and corresponding controlling could be provided to perform the function. Therefore, the number of set of input ports reduces, space in the power supply circuit will be saved, and cost down will be brought.

[0013] In a first aspect, there is provided a power supply circuit, including:

[0014] a set of input ports, configured to comprise a first input port and a second input port, and be inputted input voltage or current;

[0015] a set of output ports, configured to output supply voltage or current;

[0016] a controller;

[0017] a convertor, configured to convert the input voltage or current into the supply

voltage or current, under the controlling of the controller, wherein, the convertor is able to perform at least two functions, the at least two functions comprises dimming function and current selecting (Iselect) function ; and

[0018] a controlling circuit, configured to be connected to the set of input ports and the controller, the controller is configured to detect which function is used according to signals outputted from the controlling circuit, and generate signals inputted to the controlling circuit according to the detecting result.

[0019] The power supply circuit is used to supply a lighting means, the current selecting function is used to choose correct supply current for the lighting means.

[0020] In an embodiment, the controlling circuit comprises:

[0021] a first circuit, configured to comprise: an current selecting resistor connected between the first input port and the second input port, a first transistor connected between VDD and the first input port, and a second transistor connected between base of the first resistor and the second input port; and

[0022] a second circuit, configured to comprise: a third transistor, a first resistor (R8), and a forth transistor connecting in series between the first input port and the second input port,

[0023] a first terminal of the controller connects to base of the second transistor,

[0024] a second terminal of the controller connects to a first connecting node between the third transistor and the first resistor;

[0025] a third terminal of the controller connects to base of the fourth transistor,

[0026] a fourth terminal of the controller connects to a second connecting node between the first transistor and the current selecting resistor.

[0027] In an embodiment, when the first terminal outputs low level signal and the third terminal outputs high level signal:

[0028] if the second terminal inputs high level signal, the controller determines the dimming function is used;

[0029] if the second terminal inputs low level signal, the controller determines the current selecting (Iselect) function is used.

[0030] In an embodiment, when the controller determines the dimming function is used,

[0031] after a first predetermined period of time, the controller outputs low level signal via the first terminal and outputs low level signal via the third terminal.

[0032] In an embodiment, when the controller determines the current select (Iselect) function is used,

[0033] after a second predetermined period of time, the controller detects current inputted via the fourth terminal, and controls the convertor to generate the supply current according to the detected current, so as to adjust the supply current.

[0034] In an embodiment, the power supply circuit further comprises:

[0035] a storage device, configured to store the supply current status.

[0036] In a second aspect, there is provided a controlling method of the power supply circuit of the first aspect. the controlling method comprises:

[0037] the controller detects which function is used according to signals outputted from the controlling circuit; and

[0038] the controller generates signals inputted to the controlling circuit according to the detecting result.

[0039] In an embodiment, the controller detects which function is used, comprises:

[0040] when the first terminal outputs low level signal and the third terminal outputs high level signal:

[0041] if the second terminal inputs high level signal, the controller determines the dimming function is used;

[0042] if the second terminal inputs low level signal, the controller determines the current selecting (Iselect) function is used.

[0043] In an embodiment, the controller generates signals inputted to the controlling circuit according to the detected result comprises:

[0044] when the controller determines the dimming function is used,

[0045] after a first predetermined period of time, the controller outputs low level signal via the first terminal and outputs low level signal via the third terminal.

[0046] In an embodiment, the controller generates signals inputted to the controlling circuit according to the detected result comprises:

[0047] when the controller determines the current select (Iselect) function is used,

[0048] after a second predetermined period of time, the controller detects current inputted via the fourth terminal, and controls the convertor to generate the supply current according to the detected current, so as to adjust the supply current.

[0049] In an embodiment, the method further comprises:

[0050] storing the supply current status in a storage device.

[0051] In a third aspect, there is provided a lighting driver, comprises the power supply circuit according to the first aspect of the disclosure.

[0052] According to various embodiments of the present disclosure, multiple functions share one set of input ports, a controlling circuit is provided for detecting which function is used, and corresponding controlling could be provided to perform the function. Therefore, the number of set of input ports reduces, space in the power supply circuit will be saved, and cost down will be brought.

BRIEF DESCRIPTION OF THE DRAWINGS

[0053] The above and other aspects, features, and benefits of various embodiments of the disclosure will become more fully apparent, by way of example, from the following detailed description with reference to the accompanying drawings, in which like reference numerals or letters are used to designate like or equivalent elements. The drawings are illustrated for facilitating better understanding of the embodiments of the disclosure and

not necessarily drawn to scale, in which:

[0054] Fig. 1 (a) is the partial circuit around the input port for current selecting function;

[0055] Fig. 1 (b) is the partial circuit around the input port for dimming function;

[0056] Fig. 2 is a diagram of ports allocation of the power supply with current selecting function and dimming function;

[0057] Fig. 3 is a diagram of a power supply circuit in accordance with an embodiment of the present disclosure;

[0058] Fig. 4 shows a flowchart of controlling method 400 of the power supply circuit.

DETAILED DESCRIPTION

[0059] The present disclosure will now be discussed with reference to several example embodiments. It should be understood that these embodiments are discussed only for the purpose of enabling those skilled persons in the art to better understand and thus implement the present disclosure, rather than suggesting any limitations on the scope of the present disclosure.

[0060] As used herein, the terms "first" and "second" refer to different elements. The singular forms "a" and "an" are intended to include the plural forms as well, unless the context clearly indicates otherwise. The terms "comprises," "comprising," "has," "having," "includes" and/or "including" as used herein, specify the presence of stated features, elements, and/or components and the like, but do not preclude the presence or addition of one or more other features, elements, components and/or combinations thereof. The term "based on" is to be read as "based at least in part on." The term "one embodiment" and "an embodiment" are to be read as "at least one embodiment." The term "another embodiment" is to be read as "at least one other embodiment." Other definitions, explicit and implicit, may be included below.

First aspect of embodiments

[0061] A power supply circuit is provided in a first embodiment. The power supply circuit is used to supply a lighting means, e.g. a LED.

[0062] Fig. 3 is a diagram of a power supply circuit in accordance with an embodiment of the present disclosure. As shown in Fig. 3, a power supply circuit 3 includes: a set of input ports X1_a and X1_b, a set of output ports –Xo and +Xo, a controller 31, a convertor 32 and a controlling circuit 33.

[0063] In the embodiment, the set of input ports includes a first input port X1_a and a second input port X1_b, and the set of input ports will be inputted input voltage or current.

[0064] The set of output ports –Xo and +Xo will output supply voltage Vout or current Iout.

[0065] The convertor 32 will be configured to convert the input voltage or current into the supply voltage or current, under the controlling of the controller 31.

[0066] The convertor 32 is able to perform at least two functions, the at least two functions may include a first function and a second function. In the embodiment, the first function and the second function could be dimming function and current selecting (Iselect) function, respectively. The dimming function is used to output supply voltage according to the input voltage. The current selecting function is used to choose correct supply current for the lighting means. However, this embodiment could not limited thereto, the first function and the second function could be other kind of function.

[0067] In the embodiment, the convertor 32 may include a dimming interface block 321, which is used to performing the dimming function. The dimming interface block 321 may have the same structure as the dimming interface block 100 in Fig. 1(b).

[0068] In the embodiment, the convertor 32 may further include a flyback converter or resonant halfbridge converter or LLC converter.

[0069] In the embodiment, the controlling circuit 33 may be configured to be connected to the set of input ports and the controller 31. The controller 31 is further

configured to detect which function is used according to signals outputted from the controlling circuit 33, and generate signals inputted to the controlling circuit 33 according to the detecting result.

[0070] According to the embodiments, multiple functions of the power supply may share one set of input ports, a controlling circuit is provided for detecting which function is used, and corresponding controlling could be provided to perform the function. Therefore, the number of set of input ports reduces, space in the power supply circuit will be saved, and cost down will be brought.

[0071] As shown in Fig. 3, the controlling circuit 33 may include: a first circuit 331 and a second circuit 332.

[0072] As shown in Fig. 3, the first circuit 331 includes: an current selecting resistor R7, a first transistor Q1, and a second transistor Q2.

[0073] In the embodiment, the current selecting resistor R7 is connected between the first input port X1_a and the second input port X1_a. The first transistor Q1 is connected between a power port VDD of the power supply circuit 3 and the first input port X1_a. The second transistor Q2 is connected between base of the first resistor Q1 and the second input port X1_b.

[0074] In addition, the first circuit 331 may further include resistors R1, R2 and R3, their functions can be referred to the prior art.

[0075] As shown in Fig. 3, the second circuit 332 includes: a third transistor Q3, a first resistor R8, and a forth transistor Q4 connecting in series between the first input port X1_a and the second input port X1_b.

[0076] In addition, the second circuit 332 may further include resistors R4, R5 and R6, their functions can be referred to the prior art.

[0077] In the embodiment, Q2, Q3 and Q4 may be NPN bipolar transistors, Q1 may be PNP bipolar transistor. However, the embodiment may not be limited there to, transistors Q1~Q4 may be other kind of transistors.

[0078] As shown in Fig. 3, the controller 31 has at least 4 terminals. A first terminal GP1 of the controller 31 connects to base of the second transistor Q2; a second terminal GP2 of the controller 31 connects to a first connecting node A1 between the third transistor Q3 and the first resistor R8; a third terminal GP3 of the controller 31 connects to base of the fourth transistor Q4; a fourth terminal GP4 of the controller 31 connects to a second connecting node A2 between the first transistor Q1 and the current selecting resistor R7.

[0079] In general, the first terminal GP1 and the third terminal GP3 are used for outputting signals from the controller 31 to the controlling circuit 33, and the second terminal GP2 and the fourth terminal GP4 are used for inputting signals from the controlling circuit 33 to the controller 31.

[0080] In addition, the controller 31 may further have a terminal 311, which is used to output a controlling signal to the convertor 32 for the convertor 32 performing the converting.

[0081] In the embodiment, when the first terminal GP1 outputs low level signal and the third terminal GP3 outputs high level signal: if the second terminal GP2 inputs high level signal, the controller 31 determines the dimming function is used in the converter 32; if the second terminal GP2 inputs low level signal, the controller 31 determines the current selecting (e.g. Iselect) function is used in the converter 32.

[0082] In the embodiment, when the controller 31 determines the dimming function is used, after a first predetermined period of time, the controller 31 may output low level signal via the first terminal GP1 and output low level signal via the third terminal GP3, thus the first circuit 331 and the second circuit 332 are open, so that the effect of the first circuit 331 and the second circuit 332 on the dimming function can be avoided. In addition, the power consumption of the controlling circuit 33 will be reduced.

[0083] In the embodiment, the dimming function could be performed by the dimming interface block 321.

[0084] The first predetermined period of time could be 10ms as an example.

[0085] In the embodiment, when the controller 31 determines the current select (Iselect) function is used in the converter 32, the controller 31 may continue to output low level signal via the first terminal GP1 and output high level signal via the third terminal GP3. After a second predetermined period of time, the controller 31 detects current inputted via the fourth terminal GP4, and controls the convertor 32 to generate the supply current according to the detected current, so as to adjust the supply current, therefore the current select (Iselect) function can be performed. Within the supply current range, the supply current is related to the resistance of the current selecting resistor R7.

[0086] The second predetermined period of time could be 10ms as an example.

[0087] In the embodiment, the power supply circuit 3 may further include a storage device (not shown). When the controller 31 determines the current select (Iselect) function is used in the converter 32, the storage device may store the supply current status. The storage device may be EEPROM.

[0088] As can be seen from the above embodiments, multiple functions can share one set of input ports, e.g. Iselect function and dimming function share a set of input port, thus one set of ports can be saved, the space of the circuit can be reduced, and cost down can be brought. In addition, the controlling circuit 33 can work as a multifunction multiplexing circuit, which can save some common components, thus cost savings can be realized.

Second aspect of embodiments

[0089] A controlling method of a power supply circuit is provided in this aspect. The power supply circuit of the first aspect of embodiments is provided in an embodiment. The same contents as those in the first aspect of embodiments are omitted.

[0090] Fig. 4 shows a flowchart of controlling method 400 of the power supply circuit.

[0091] As shown in Fig. 4, the method 400 includes:

[0092] Block 301: the controller detects which function is used according to signals outputted from the controlling circuit;

[0093] Block 302: the controller generates signals inputted to the controlling circuit according to the detected result.

[0094] In the embodiment, the block 301 may include:

[0095] when the first terminal outputs low level signal and the third terminal outputs high level signal: if the second terminal inputs high level signal, the controller determines the dimming function is used; if the second terminal inputs low level signal, the controller determines the current selecting (Iselect) function is used.

[0096] In the embodiment, the block 302 mayinclude:

[0097] when the controller determines the dimming function is used, after a first predetermined period of time, the controller outputs low level signal via the first terminal and outputs low level signal via the third terminal.

[0098] In the embodiment, the block 302 may include:

[0099] when the controller determines the current select (Iselect) function is used, after a second predetermined period of time, the controller detects current inputted via the fourth terminal, and controls the convertor to generate the supply current according to the detected current, so as to adjust the supply current.

[00100] In addition, the block 302 may further include:

[00101] when the controller determines the current select (Iselect) function is used, storing the supply current status in a storage device.

[00102] As can be seen from the above embodiments, multiple functions can share one set of input ports, e.g. Iselect function and dimming function share a set of input port, thus one set of ports can be saved, the space of the circuit can be reduced, and cost down can be brought. In addition, the controlling circuit 33 can work as a multifunction multiplexing circuit, which can save some common components, thus cost savings can be realized.

Third aspect of embodiments

[00103] A lighting driver is provided in an embodiment. The lighting driver includes the power supply circuit according to the first aspect of embodiments.

[00104] In the embodiment, multiple functions can share one set of input ports, thus one set of ports can be saved, the space of the circuit can be reduced, and cost down can be brought. In addition, the controlling circuit 33 can work as a multifunction multiplexing circuit, which can save some common components, thus cost savings can be realized. Therefore, size and cost of the lighting driver can be reduced.

[00105] Further, while operations are depicted in a particular order, this should not be understood as requiring that such operations be performed in the particular order shown or in sequential order, or that all illustrated operations be performed, to achieve desirable results. In certain circumstances, multitasking and parallel processing may be advantageous. Likewise, while several specific implementation details are contained in the above discussions, these should not be construed as limitations on the scope of the present disclosure, but rather as descriptions of features that may be specific to particular embodiments. Certain features that are described in the context of separate embodiments may also be implemented in combination in a single embodiment. Conversely, various features that are described in the context of a single embodiment may also be implemented in multiple embodiments separately or in any suitable sub-combination.

[00106] Although the present disclosure has been described in language specific to structural features and/or methodological acts, it is to be understood that the present disclosure defined in the appended claims is not necessarily limited to the specific features or acts described above. Rather, the specific features and acts described above are disclosed as example forms of implementing the claims.

WHAT IS CLAIMED IS:

1. A power supply circuit, comprising:

a set of input ports, configured to comprise a first input port and a second input port, and be inputted input voltage or current;

a set of output ports, configured to output supply voltage or current;

a controller;

a convertor, configured to convert the input voltage or current into the supply voltage or current, under the controlling of the controller, wherein, the convertor is able to perform at least two functions, the at least two functions comprises dimming function and current selecting (Iselect) function; and

a controlling circuit, configured to be connected to the set of input ports and the controller,

the controller is configured to detect which function is used according to signals outputted from the controlling circuit, and generate signals inputted to the controlling circuit according to the detecting result,

the power supply circuit is used to supply a lighting means, the current selecting function is used to choose correct supply current for the lighting means.

2.The power supply circuit according to claim 1, wherein,

the controlling circuit comprises:

a first circuit, configured to comprise: an current selecting resistor connected between the first input port and the second input port, a first transistor connected between VDD and the first input port, and a second transistor connected between base of the first resistor and the second input port; and

a second circuit, configured to comprise: a third transistor, a first resistor (R8), and a forth transistor connecting in series between the first input port and the second input port,

a first terminal of the controller connects to base of the second transistor,

a second terminal of the controller connects to a first connecting node between the

third transistor and the first resistor;

a third terminal of the controller connects to base of the fourth transistor,

a fourth terminal of the controller connects to a second connecting node between the first transistor and the current selecting resistor.

3.The power supply circuit according to claim 2, wherein,

when the first terminal outputs low level signal and the third terminal outputs high level signal:

if the second terminal inputs high level signal, the controller determines the dimming function is used;

if the second terminal inputs low level signal, the controller determines the current selecting (Iselect) function is used.

4.The power supply circuit according to claim 3, wherein,

when the controller determines the dimming function is used，

after a first predetermined period of time, the controller outputs low level signal via the first terminal and outputs low level signal via the third terminal.

5.The power supply circuit according to claim 3, wherein,

when the controller determines the current select (Iselect) function is used，

after a second predetermined period of time, the controller detects current inputted via the fourth terminal, and controls the convertor to generate the supply current according to the detected current, so as to adjust the supply current.

6.The power supply circuit according to claim 5, wherein,

the power supply circuit further comprises:

a storage device, configured to store the supply current status.

7. A lighting driver, comprising the power supply circuit according to any one of claim 1 to claim 6.

8. A controlling method of a power supply circuit, the power supply circuit comprising:

a set of input ports, configured to comprise a first input port and a second input port, and be inputted input voltage or current;

a set of output ports, configured to output supply voltage or current;

a controller;

a convertor, configured to convert the input voltage or current into the supply voltage or current, under the controlling of the controller, wherein, the convertor is able to perform at least two functions, the at least two functions comprises dimming function and current selecting (Iselect) function ; and

a controlling circuit, configured to be connected to the input ports and the controller,

the controlling method comprises:

the controller detects which function is used according to signals outputted from the controlling circuit; and

the controller generates signals inputted to the controlling circuit according to the detecting result.

9.The controlling method according to claim 8, wherein,

the controlling circuit comprises:

a first circuit, configured to comprise: an current selecting resistor connected between the first input port and the second input port, a first transistor connected between VDD and the first input port, and a second transistor connected between base of the first resistor and the second input port; and

a second circuit, configured to comprise: a third transistor, a first resistor (R8), and a forth transistor connecting in series between the first input port and the second input port,

a first terminal of the controller connects to base of the second transistor,

a second terminal of the controller connects to a first connecting node between the third transistor and the first resistor;

a third terminal of the controller connects to base of the fourth transistor,

a fourth terminal of the controller connects to a second connecting node between the first transistor and the current selecting resistor.

10. The controlling method according to claim 8, the controller detects which function is used, comprises:

when the first terminal outputs low level signal and the third terminal outputs high

level signal:

if the second terminal inputs high level signal, the controller determines the dimming function is used;

if the second terminal inputs low level signal, the controller determines the current selecting (Iselect) function is used.

11. The controlling method according to claim 10, wherein, the controller generates signals inputted to the controlling circuit according to the detected result comprises:

when the controller determines the dimming function is used，

after a first predetermined period of time, the controller outputs low level signal via the first terminal and outputs low level signal via the third terminal.

12. The controlling method according to claim 10, wherein, the controller generates signals inputted to the controlling circuit according to the detected result comprises:

when the controller determines the current select (Iselect) function is used，

after a second predetermined period of time, the controller detects current inputted via the fourth terminal, and controls the convertor to generate the supply current according to the detected current, so as to adjust the supply current.

13. The controlling method according to claim 10, wherein, the method further comprises:

storing the supply current status in a storage device.