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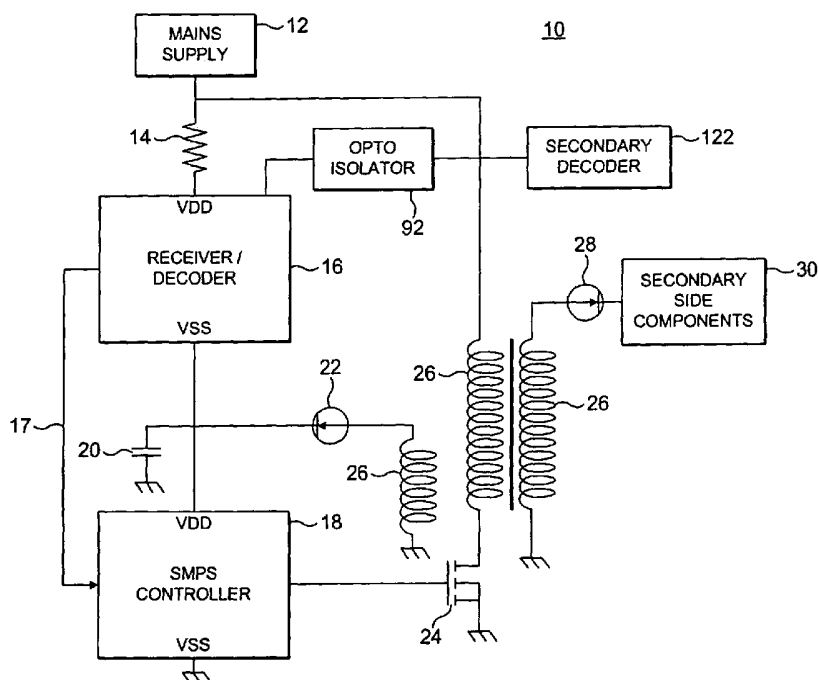
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(54) Title: A SYSTEM AND METHOD FOR REDUCING STANDBY POWER CONSUMPTION



(57) Abstract: The disclosed embodiments relate to a system and method for reducing standby power consumption in an electronic device. There is provided an electronic device (10) comprising receiver circuitry (16), and power supply control circuitry (18) coupled in series with the receiver circuitry (16), wherein a ground connection of the receiver circuitry (16) is coupled to a voltage supply connection of the power supply control circuitry (18).



For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

A SYSTEM AND METHOD FOR REDUCING STANDBY POWER CONSUMPTION

FIELD OF THE INVENTION

The present invention relates generally to reducing the standby power consumption of an electronic device. More specifically, the present invention relates to a system for reducing power consumption of a power supply control circuitry.

BACKGROUND OF THE INVENTION

This section is intended to introduce the reader to various aspects of art, which may be related to various aspects of the present invention that are described and/or claimed below. This discussion is believed to be helpful in providing the reader with background information to facilitate a better understanding of the various aspects of the present invention. Accordingly, it should be understood that these statements are to be read in this light, and not as admissions of prior art.

Historically, electronic devices, such as consumer electronics equipment, were powered "on" or powered "off" by mechanical or electromechanical switches. For example, a television could be turned on or turned off with a mechanical knob. Turning the mechanical knob from the off position to the on position connected two electrical contacts that electrically coupled a power supply to the television's display system.

Beginning in approximately 1980, however, power control for electronic devices, especially consumer electronics equipment, began to move away from mechanical switches towards transistor-based switches. Transistor-based switches can be turned on by applying a current to the transistor. Because transistor-based switches do not require physical movement, they greatly expanded the power control options for electronic devices. For example, with a transistor based switch, a television could turn itself on or off when it received an electronic command signal (e.g., a remote control signal). This electronic signal could be generated by a remote controlled unit, such as an infrared remote control or by a switch mounted on the television itself.

Electronic devices employing transistor-based switches comprise a receiver that is configured to receive a signal from a remote device. Because the receiver does not know when a command signal may be received, the receiver is typically configured to remain "on" even when the electronic device appears to be "off." This mode is referred to as "standby mode," and the power drawn during standby mode (i.e., the power for the receiver) is referred to as "standby power."

Reducing the standby power consumption of electronic devices is desirable.

10 SUMMARY OF THE INVENTION

Certain aspects commensurate in scope with the originally claimed invention are set forth below; however the invention may encompass a variety of aspects that may not be set forth below.

15 The disclosed embodiments relate to a system and method for reducing standby power consumption in an electronic device. There is provided an electronic device (10) comprising receiver circuitry (16), and power supply control circuitry (18) coupled in series with the receiver circuitry (16), wherein a ground connection of the receiver circuitry (16) is coupled to a voltage supply connection of the power supply control circuitry (18).

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

25 FIG. 1 is a block diagram of an electronic device configured to reduce standby power consumption in accordance with embodiments of the present invention; and

FIG. 2 is a schematic diagram of an electronic device configured to reduce standby power in accordance with embodiments of the present invention.

DETAILED DESCRIPTION

One or more specific embodiments of the present invention will be described below. Turning initially to FIG. 1, a block diagram of an electronic device configured

to reduce standby power consumption in accordance with embodiments of the present invention is illustrated and generally designated by the reference numeral 10. In one embodiment, the electronic device 10 is a television or other video display device. In alternate embodiments, the electronic device 10 can be a variety of consumer electronics including, but not limited to, video cassette recorders, digital video disk ("DVD") players, digital video recorders, audio or video receivers, computers, cameras, and so forth. In still other embodiments, the electronic device 10 may comprise remote activation systems, such as those routinely found in automobiles or security systems. Further, those of ordinary skill in the art will appreciate that the above recited embodiments are merely exemplary and thus, not intended to be exclusive.

As illustrated in FIG. 1, the electronic device 10 may comprise a mains supply 12. The mains supply 12 is configured to supply the operating power, for example 150 volts, for the electronic device 10. The mains supply 12 may be coupled to a current limiting resistor 14 or another current source (not shown). As will be described in greater detail below, the resistor 14 may be selected to draw sufficient current from the mains supply 12 to supply a receiver 16 and a switch mode power supply ("SMPS") controller 18, with operating power. In one embodiment, the receiver 16 is configured to receive a "power-on" command and to generate an "enable" signal 17 to a SMPS controller 18. In another embodiment, the receiver 16 may be configured to receive a command to switch from a first mode of operation to a second mode of operation. For example, the receiver 16 may receive a command to switch from a low power operating mode to a normal operating mode.

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In one embodiment, the receiver 16 comprises an infrared ("IR") receiver in combination with an on/off IR decoder for decoding the power-on signal received by the IR receiver. In an alternate embodiment (illustrated in FIG. 2), the receiver 16 may comprise an IR receiver in series with the SMPS controller 18 with the on/off IR decoder arrayed in parallel with the IR receiver. In this configuration, the on/off decoder is configured to generate the enable signal 17. In yet another embodiment, the receiver 16 is a radio frequency ("RF") receiver and an RF decoder. Lastly, in

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still other alternate embodiments, the receiver 16 may be configured to receive and decode other suitable forms of wired or wireless signals.

As illustrated in FIG. 1, the SMPS controller 18 is coupled in series between the receiver 16 and ground. As such, those of ordinary skill in the art will appreciate that the ground connection (VSS) on the receiver 16 is coupled to the supply connection (VDD) on the SMPS controller 18. Those of ordinary skill in the art will appreciate that this serial layout consumes less power than the conventional, parallel orientations, of the receiver 16 and the SMPS controller 18.

As illustrated, the electronic device 10 may also include a voltage reservoir formed by a capacitor 20 and a diode 22 coupled between the receiver 16 and the SMPS controller 18. When electronic device 10 is in the standby mode of operation, transformer 26 is in a non-energized state which reverse biases diode 22, thus allowing the voltage node connecting the VSS terminal of receiver 16, the VDD terminal of SMPS controller 18 and a terminal of capacitor 20 to be disconnected from the secondary winding of transformer 26. Next, the SMPS controller 18 may also be coupled to an insulated gate bipolar transistor ("IGBT") 24. In one embodiment, when the SMPS controller 18 receives the enable signal 17, the SMPS controller 18 is configured to enable the IGBT 24. Once enabled, the IGBT 24 activates the transformer 26 and allows power to pass through a diode 28 to secondary side components 30. Also when transformer 26 is activated, diode 22 is rendered conductive, thus establishing the VDD terminal of controller 18 at an operating potential established by the controller 18 and a secondary winding of transformer 26. Once the secondary side components 30 have been powered, user commands may pass directly from the receiver 16 to the secondary side components (i.e., normal, non-standby or run-mode operation) 30. In one embodiment, the secondary side comprises a microprocessor 122 configured to decode a variety of command signals besides the power-on command.

FIG. 2 is schematic diagram of an exemplary electronic device 50 configured to reduce standby power consumption in accordance with embodiments of the present invention. For simplicity, like reference numerals have been used to

designate those features previously described in reference to FIG. 1. The electronic device 50 includes the mains supply 12. In the illustrated embodiment, the mains supply 12 comprises a plurality of power supply lines, also referred to as the "mains" 52, a plurality of switches 54 coupled to each of the mains 52, and a bridge circuit 56
5 for rectifying the power transmitted through the mains 52. The mains supply 12 may be coupled to a capacitor 58 for stabilizing the power generated by the mains supply 12. In one embodiment, the capacitor 58 comprises a 100 microfarad capacitor.

The capacitor 58 may be coupled to the resistor 14 which was described
10 above. In one embodiment, the resistor 14 comprises a 270 kilo Ohm ("kOhm") resistor that generates a current of 1.2 milliamps. The resistor 14 may be coupled to a light emitting diode ("LED") 60 that indicates current flow through the resistor 14.

As illustrated, the LED 60 may be coupled to the receiver 16, the diode 62,
15 and the capacitor 64. As described above, the receiver 16 is configured to receive at least a "power-on" signal or command from an external device, such as a remote control. In one embodiment, the receiver 16 comprises an IR receiver, such as a TSOP 11 Series IR receiver module produced by Vishay Semiconductors or an 8-bit AVR microcontroller produced by Atmel Corporation. Those of ordinary skill in the
20 art will appreciate that the diode 62 and the capacitor 64 may be configured to stabilize the voltage across the receiver 16. In one embodiment, the capacitor 64 is a 470 nanofarad ("nF") capacitor and the diode 62 is a 5V1 zener diode.

As illustrated in FIG. 2, the receiver 16 may be coupled to a capacitor 66 and
25 a diode 68. Those of ordinary skill in the art will appreciate that the capacitor 66 and the diode 68 are employed to clamp the voltage of the signal path via the capacitor 66 to a supply voltage (VDD) of an Infrared ("IR") decoder 76, because the receiver 16 and the IR decoder 76 are on different ground levels. The diode 68 may be coupled to a resistor 70, a zener diode 72, and a capacitor 74. The resistor 70, the
30 diode 72, and the capacitor 74 may be configured to provide the voltage VDD to the IR decoder 76. In one embodiment, the resistor 70 is a 22 kOhm resistor, the zener diode 72 is a 3V3 diode, and the capacitor 74 is a 1 microfarad capacitor. In this

embodiment, the resistor 70, the diode 72, and the capacitor 74 are configured to generate a voltage of 3.3 volts for the VDD input of the IR decoder 76.

The IR decoder 76 may be configured to receive an input from the receiver 16 and to determine whether that input comprises a power-on command. During standby mode, a transistor 86 is turned "on" by IR decoder 76 through resistor 84. If the output from the receiver 16 is a power-on command, the IR decoder 76 may switch "off" transistor 86 via resistor 84. In addition, the IR decoder 76 may switch on a transistor 90 via a resistor 88. As will be described in greater detail below, turning off the transistor 86 and enabling the transistor 90 may be part of a sequence of events that brings the electronic device 50 out of the standby mode. In one embodiment, the IR decoder 76 may also be coupled to a capacitor 78, a capacitor 80, and an oscillator 82. In one embodiment, the IR decoder 76 is a PIC 12F629 low power microcontroller, the resistor 84 is a 10 kOhm resistor, and the resistor 88 is a 10 kOhm resistor. Moreover, the capacitor 78 may comprise a 100 picofarad ("pF") capacitor, the capacitor 80 may comprise a 100 pF capacitor, and the oscillator 82 may comprise a low frequency (e.g., 100 kilohertz) oscillator. Further, while not illustrated in FIG. 2, those of ordinary skill in the art will appreciate that in alternate embodiments, the IR decoder 76 can either be integrated into the receiver 16 or arrayed in series between the receiver 16 and the SMPS controller 18.

As stated above, when the IR decoder 76 receives a signal indicative of a power-on command, the IR decoder 76 may disable the transistor 86. Once disabled, the transistor 86 allows normal run mode operation of the switch mode power supply by enabling the divider formed by resistors 96,98. Resistors 96,98 are chosen to bias controller 18 pin 3 into an active region. As illustrated in FIG. 2, the voltage divider created by the resistor 96 and the resistor 98 is coupled to a primary voltage monitoring input pin (illustrated as "ISNS") of the SMPS controller 18, and the resistor 100 and the capacitor 102 are coupled to a primary current input reference pin (illustrated as "PIS") of the SMPS controller 18 to stabilize foldback current limiting for higher mains voltages. Those of ordinary skill in the art will appreciate that applying voltages to each of these inputs enables the SMPS controller 18. In one embodiment, the resistor 96 comprises a 100 mega Ohm

resistor and the resistor 98 comprises a 105 kOhm resistor. In this configuration, the voltage divider formed by the resistor 96 and the resistor 98, may generate 1.7 volts on the ISNS input of the SMPS controller 18. In this embodiment, the resistor 100 may comprise a 1 mega Ohm resistor and the capacitor 102 may comprise a 1 nF capacitor.

As stated above, if the IR decoder 76 receives the signal indicative of a power-on command, the IR decoder 76 may enable the transistor 90. Once enabled, the transistor 90 may "open up" a path for current through the resistor 94 to an optocoupler 92. As described above, the IR decoder 76 may be configured to only decode the power-on command to reduce standby power consumption. Once powered on, however, the electronic device 10 may be configured to decode a variety of other suitable signals or commands. For this reason, once powered the optocoupler 92 serves as a pass-through for commands from the IR receiver 16 to another IR decoder 122 amongst the secondary side components. Unlike the IR decoder 76, the IR decoder 122 is configured to decode signals in addition to the power-on command. For example, IR decoder 122 may be configured to receive channel change commands or volume adjustments for a television. In one embodiment, the resistor 94 may comprise a 10 kOhm resistor. IR decoder 122 may be any of a number of control microprocessors or special purpose control decoders generally available.

Returning to the SMPS controller 18. The SMPS controller 18 may be any suitable form of power control microprocessor or microcontroller. In one embodiment, the SMPS controller 18 is a TDA 4605-3 Bipolar Integrated Circuit produced by Siemens Semiconductor. In another embodiment, the SMPS controller 18 is a FA1384X series power supply controller produced by Fuji Semiconductor.

The supply voltage input pin (illustrated as ("VDD") of the SMPS controller 18 may be coupled to the voltage reservoir formed by the capacitor 20 and the diode 22. In one embodiment, the capacitor 20 comprises a 47 microfarad capacitor. In addition, as illustrated in FIG. 2, the secondary voltage information pin (illustrated as "In") and the oscillator feedback input (illustrated as "Zer") of the SMPS controller 18

are coupled to resistors 106, 108, 110, 112, a diode 114, and capacitors 116 and 118. Those of ordinary skill in the art will appreciate that the resistors 106, 108, 110, the diode 114, and the capacitors 116 and 118 may be configured to produce a regulating input on the secondary voltage information pin and input isolation feedback on the oscillation feedback pin. In one embodiment, the resistor 106 comprises a 10 kOhm resistor, the resistor 108 comprises a 4 kOhm resistor, the resistor 110 comprises a 2 kOhm resistor, the capacitor 116 comprises a 4 NF capacitor, and the capacitor 118 comprises a 1 microfarad capacitor.

As described above, a voltage applied to the ISNS input of the SMPS controller 18 may enable the SMPS controller 18. The enabled SMPS controller 18 may generate a voltage/current from an output pin (illustrated as "out") across a resistor 120. This output voltage/current may enable the IGBT 24. Once the IGBT 24 is enabled, the secondary side transformer 26 begins to draw power from the mains supply 12. This power is passed across the transformer 26 via the diode 28 to the secondary side components 30, which enables the electronic device to function normally. In one embodiment, the resistor 120 comprises a 47 ohm resistor.

While the invention may be susceptible to various modifications and alternative forms, specific embodiments have been shown by way of example in the drawings and will be described in detail herein. However, it should be understood that the invention is not intended to be limited to the particular forms disclosed. Rather, the invention is to cover all modifications, equivalents and alternatives falling within the spirit and scope of the invention as defined by the following appended claims.

CLAIMS

1. An apparatus comprising:
means (18) for controlling a power supply (18-26), wherein the controlling
5 means (18) is responsive to a control signal for selecting a first mode of
operation or a second mode of operation; and
means (16) for providing said control signal, wherein the controlling means
(18) and the providing means (16) are arranged in series.
- 10 2. The apparatus of claim 1, wherein the providing means (16) comprises an
infrared receiver.
3. The apparatus of claim 1, wherein a supply current to the controlling means
(18) at least partially flows through the providing means (16) when the power supply
15 (18-26) is in one of the operating modes.
4. The apparatus of claim 1, wherein the first mode of operation comprises a low
power state.
- 20 5. The apparatus of claim 4, wherein the second mode of operation comprises a
full power state.
6. The apparatus of claim 1, wherein the controlling means (18) comprises a
power supply microcontroller.
- 25 7. An electronic device (10) comprising:
remote control signal receiver circuitry (16); and
power supply control circuitry (18) coupled in series with the receiver circuitry
(16), wherein a ground connection of the receiver circuitry (16) is
30 coupled to a voltage supply connection of the power supply control
circuitry (18).

8. The electronic device of claim 7, wherein the receiver circuitry (16) comprises an infrared receiver.

5 9. The electronic device of claim 8, wherein the receiver circuitry (16) comprises an infrared decoder.

10. The electronic device of claim 7, comprising an infrared decoder (76) coupled in parallel with the power supply control circuitry (18), wherein the infrared decoder (76) is configured to decode a power-on command.

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11. The electronic device of claim 10, wherein the infrared decoder (76) is configured to enable the power supply control circuitry (18) when the infrared decoder (76) decodes the power-on command.

15 12. The electronic device of claim 10, wherein the infrared decoder (76) is configured to ignore any commands except the power-on command.

13. The electronic device of claim 7, comprising secondary side components (30) coupled to the power supply control circuitry (18), wherein the secondary side
20 components (30) comprise a video display.

14. The electronic device of claim 7, wherein the electronic device (10) comprises a television system.

25 15. The electronic device of claim 7, wherein the receiver circuitry (16) comprises a radio frequency receiver.

16. A method comprising:
receiving a current at a receiver (16);
transmitting the current from the receiver (16) to a power supply controller
5 (18) via a series connection with the receiver (16);
receiving an electronic command signal indicative of a user request for the
power supply controller (18) at the receiver (16);
decoding the electronic command signal; and
transmitting the decoded electronic command signal to power supply
10 controller (18).

17. The method of claim 16, wherein receiving the current comprises receiving
the current at an infrared receiver.

15 18. The method of claim 17, wherein decoding the electronic command signal
comprises decoding the electronic command signal with an infrared decoder (76).

19. The method of claim 16, wherein receiving the current comprises receiving
less than 1.2 milliamps of current.

20 20. The method of claim 16, wherein receiving the electronic command signal
comprises receiving a power-on command.

21. The method of claim 20, wherein the electronic command signals are
25 transmitted to a secondary decoder for decoding commands other than said power-
on command.

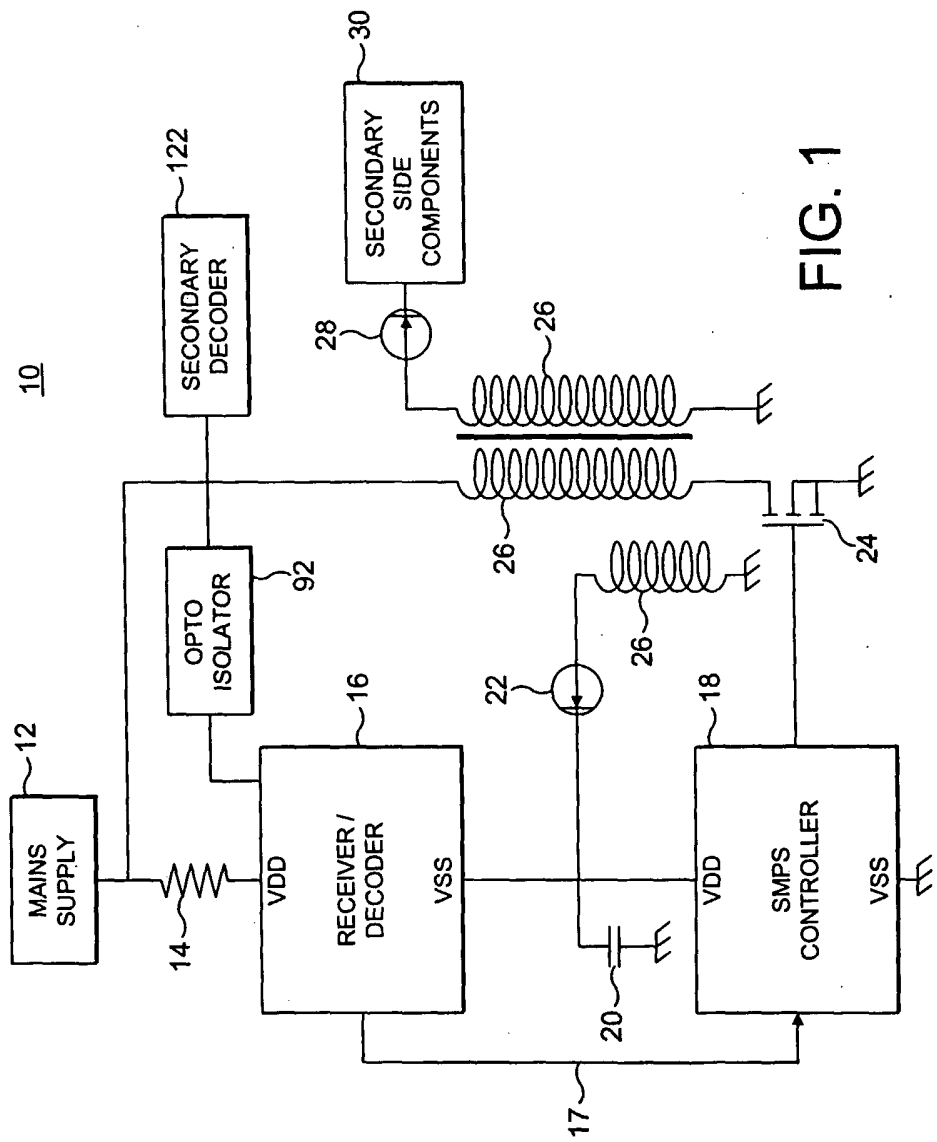


FIG. 1

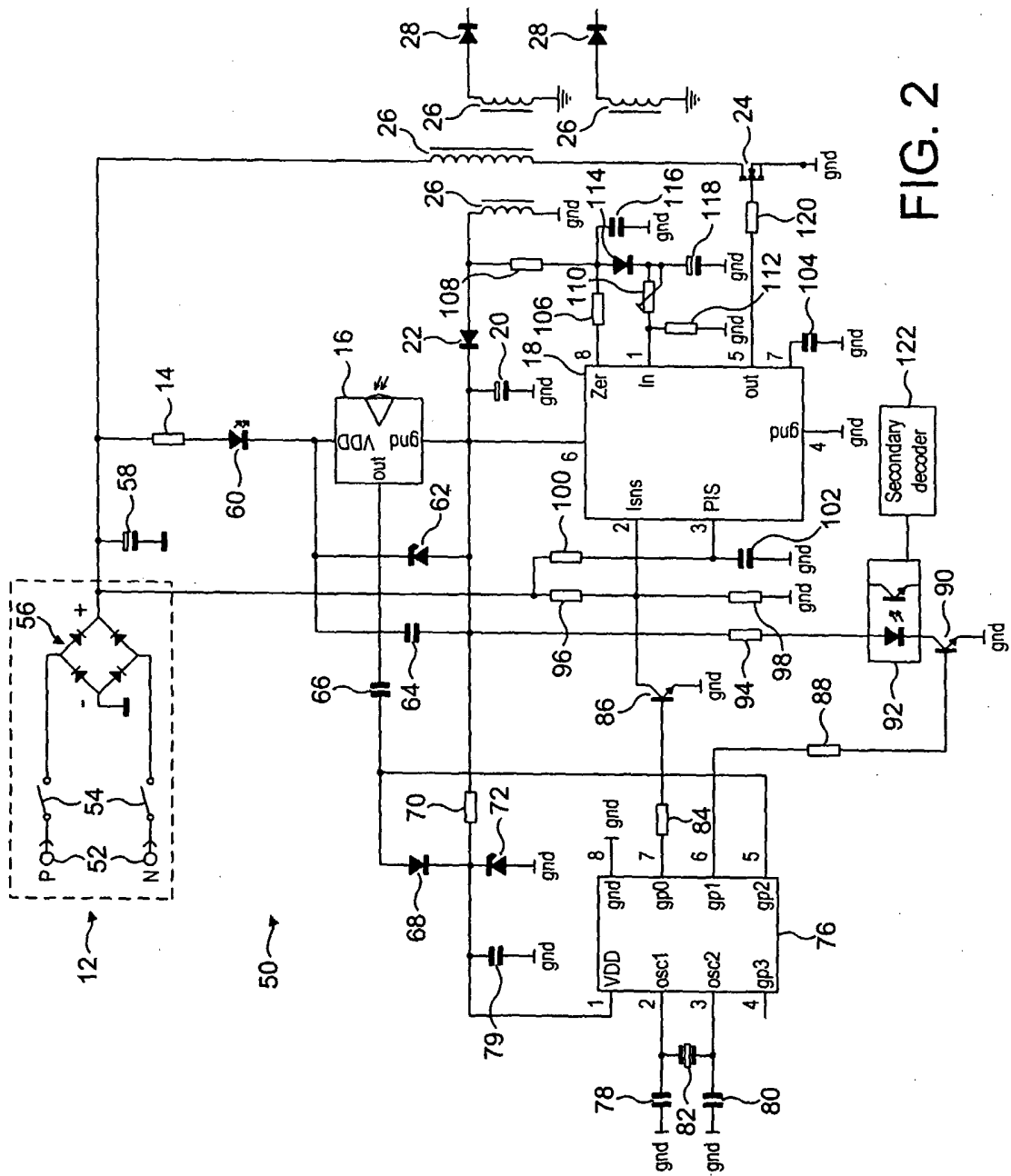


FIG. 2

INTERNATIONAL SEARCH REPORT

IB2005/002138

A. CLASSIFICATION OF SUBJECT MATTER
H02J9/00

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

B. FIELDS SEARCHEDMinimum documentation searched (classification system followed by classification symbols)
H02J

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 practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 414 475 A (TRZYNA ET AL) 9 May 1995 (1995-05-09)	1, 3-6, 16, 18-21
Y	column 1, paragraph 1 - column 3, paragraph 2; figure 1; example 12	2, 17-21
Y	US 5 636 288 A (BONNEVILLE ET AL) 3 June 1997 (1997-06-03)	2, 17, 18, 20, 21
Y	column 1, paragraph 2 - paragraph 3	
Y	DE 195 45 659 A1 (DEUTSCHE THOMSON-BRANDT GMBH, 78048 VILLINGEN-SCHWENNINGEN, DE) 12 June 1997 (1997-06-12)	19
A	paragraph '0057!	
	US 2003/214819 A1 (NAKAGAWA SHIN) 20 November 2003 (2003-11-20)	1-21
	the whole document	
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Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

° Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
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- *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

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INTERNATIONAL SEARCH REPORT

IB2005/002138

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6 043 994 A (KELLER ET AL) 28 March 2000 (2000-03-28) the whole document -----	1-21
A	US 2002/012258 A1 (NAGAI TOMOYUKI ET AL) 31 January 2002 (2002-01-31) the whole document -----	1-21

INTERNATIONAL SEARCH REPORT

IB2005/002138

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 5414475	A	09-05-1995	NONE		
US 5636288	A	03-06-1997	CA	2142644 C	26-11-1996
DE 19545659	A1	12-06-1997	NONE		
US 2003214819	A1	20-11-2003	NONE		
US 6043994	A	28-03-2000	AU	4880397 A	03-06-1998
			AU	4880497 A	03-06-1998
			CN	1238096 A	08-12-1999
			CN	1238097 A	08-12-1999
			DE	19782104 T0	11-05-2000
			DE	69719060 D1	20-03-2003
			DE	69719060 T2	23-10-2003
			EP	0938812 A1	01-09-1999
			WO	9821885 A1	22-05-1998
			WO	9821886 A1	22-05-1998
			JP	2001516519 T	25-09-2001
			JP	2001516520 T	25-09-2001
			TW	391138 B	21-05-2000
			US	6144566 A	07-11-2000
US 2002012258	A1	31-01-2002	JP	2002026812 A	25-01-2002