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(54) **LED dimmer device adapted for use in dimmer**

Zur Verwendung in einem Dimmer angepasste LED-Dimmervorrichtung

Dispositif de variateur à DEL adapté à l'utilisation dans un variateur

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(56) References cited:
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US-A1- 2005 231 133

EP 2 249 621 B1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to a dimmer device, and more particularly pertains to a LED dimmer device adapted for use in dimmer.

BACKGROUND OF THE INVENTION

[0002] Si-controlled dimmer and electro-transistor dimmer (for short dimmer) can adjust brightness of tungsten lamp. Referring to FIG. 1, on-time of dimmer 5 is determined by charging time of capacitance 9 of circuit, and therefore change conduction angle of sinusoidal alternating current non-sinusoidal waveforms, and thus change current of the tungsten lamp 10 so as to adjust brightness, which is defined as leading edge technology. As indicated in FIG. 1, dimmer 5 is connected with tungsten lamp 10 in series. Current passes through fuse 1, inductance 2, Potentiometer 7, resistance 8, capacitance 9, and tungsten lamp 10 to form a charging loop of charging capacitance 9. The charging time of the capacitance 9 is determined by resistance of the potentiometer 7. When charging of the capacitance 9 is finished after a predetermined time, the capacitance 9 triggers control end of the dimmer 5 via trigger diode 6 to make dimmer 5 conductive. Because the tungsten lamp 10 is resistance load, a voltage waveform 1 is consistent with current waveform 3 (referring to FIG. 2) after edge of dimmer, and the on-time is same as off-time. Therefore, the adjusting of brightness of the tungsten lamp 10 is achieved.

[0003] LED is energy-saving and new lamp. The power of LED is much smaller than tungsten lamp. LED is a low-voltage direct current element. LED lamp need to be equipped with a LED driving power supply so as to be drived to illuminate. LED driving-switch power supply is capacitive load and is not equipped with dimmer control circuit. When the tungsten lamp 10 is replaced by LED lamp with switch power supply, the on-time of the dimmer 5 is shorter than that of voltage (referring to FIG. 3). When there is no current passing through the dimmer 5, there is voltage existed between the resistance 7 and the capacitance 9. This voltage charges for the capacitance 9. When charging for a predetermined time, the dimmer 5 is triggered, the dimmer 5 is in on-time twice in a half-period. LED lamp flashes frequently because of intermittence of input of driving-switch power supply. Therefore, the dimmer cannot adjust brightness of LED lamp with Internal/Extemal Auto-switch

[0004] Therefore, a dimmer device adapted for use in dimmer is desired to overcome the above-described shortcomings.

[0005] Besides the above, US-A-2005/0231133 in its figures 8-10 shows a conventional light source power supply, which employs a power factor correction apparatus between the rectifier and the DC-DC converter for adjusting the waveform and phase of the input voltage. Besides, the DC-DC converter of the power supply has a feedback-control loop as a power supply controller to receive the converter's output voltage and provide a control signal to a switch so as to adjust the amount of energy transferred across the transformer of the converter in a given time period.

SUMMARY OF THE INVENTION

[0006] It is therefore an object of the present invention to provide a dimmer device adapted for use in dimmer.

[0007] The above object is achieved by the features of claim 1 of the present application.

[0008] In one aspect, the LED dimmer device according to the invention includes rectifier, voltage boost device, pre-voltage detection circuit and after-voltage detection circuit adapted for detecting voltage, master chip adapted for driving circuit and elements to work, elementary transformer and secondary transformer adapter for changing voltage, secondary rectifier adapted for rectifying and secondary filter capacitance circuit adapter for filtering, and secondary switch. The rectifier is adapted for transforming alternating current into direct current. The voltage boost device includes a metal oxide semiconductor field effect transistor used to make dimmer entering into a normal phase-cutting state. The master chip includes integrated comparing element used to compare voltage. The secondary switch is used to drive transformer primary and secondary circuits, secondary rectifier, secondary filter capacitance circuit so as to drive LED light source to illuminate.

[0009] In a further embodiment, the voltage booster device is adapted for enabling on-time current and on-time voltage of dimmer being in same phase mode, and having a relative lower peak value of current.

[0010] In a further embodiment , when the alternating current rectified, voltage of the pre-voltage detection circuit and the after voltage detection circuit are simultaneously inputted to an integrated comparing element of the master chip, which control frequency and duty-cycle of the voltage boost device to insure that a difference between the step-up voltage and the voltage elementarily rectified is maintained at 30 volt.

[0011] In a further embodiment , when the conducting angle of dimmer is changed, the voltage of the pre-voltage detection circuit changes correspondingly, which acts as standard voltage to control brightness changing and is inputted to the master chip to control frequency and duty-cycle of secondary switch, then the primary and secondary circuits of transformer, secondary rectifier and secondary filter circuit are driven so as to drive LED light source to illuminate.

[0012] the dimmer is any one of Si-controlled dimmer and electro-transistor dimmer.

[0013] In a further embodiment, the number of the LED light source is one or more, and the LED light source is single color or multi-color.

[0014] According to the present invention, Si-control-

led dimmer and electro-transistor dimmer may adjust brightness of LED light source such that environment friendly LED is more widely applied. The dimmer device has good the brightness adjusting efficiency.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The components in the drawings are not necessarily drawn to scale, the emphasis instead being placed upon illustrating the principles of the present disclosure. Moreover, in the drawings, like reference numerals designate corresponding parts throughout several views, and all the views are schematic.

FIG. 1 is a conventional circuit principle view of Si-controlled dimmer adjusting brightness of tungsten lamp;

FIG. 2 is a schematic view of voltage waveform and current waveform when Si-controlled dimmer being edged in adjusting brightness of tungsten lamp, in which 1 designates input alternating voltage waveform, 3 designates input alternating current waveform ;

FIG. 3 is a schematic view of voltage waveform and current waveform when the tungsten lamp in FIG. 1 is replaced by LED lamp, in which 1 designates input alternating voltage, 3 designates input alternating current ;

FIG. 4 is a circuit principle view of according to a embodiment according to the present invention ;

FIG. 5 is a flow-chart of a dimmer device adapted for use in dimmer according a embodiment according to the present invention;

FIG. 6 is a schematic view of voltage and current waveform of a dimmer device adapted for use in dimmer according to a preferred embodiment according to the present invention;

FIG. 7 is a schematic view of voltage and current waveform of a dimmer device adapted for use in dimmer according to a preferred embodiment according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0016] The dimmer device adapted for use in dimmer will be described in detail with the following figures and embodiments. It is understood that the following detailed embodiments are used to explain the present invention, and not to limit the present invention.

[0017] Referring to FIG. 4 and FIG. 5, after being phase-cut by a dimmer, mains supply voltage is transformed into direct-current voltage via primary rectifier 1 and filter capacitance 2. The start-up resistance 9 firstly charges the master chip 10 so as to drive voltage boost device 5, 6, 7 to work. The voltage respectively detected by pre-voltage detection circuit 3, 4 and after-voltage detection circuit 11, 12 are simultaneously inputted to integrated comparator in the master chip 10 to compare, and then duty-cycle of metal oxide semiconductor field effect transistor (MOSFET) 7 of the step-up is adjusted to ensure that the voltage of step-up filter capacitance 8 is higher 30 volt-ampere than that of the filter capacitance 2. In addition, the peak value current of the adapter is relative low and has the same on-time as the voltage waveform. Furthermore, the power factor can be over 0.8. When the adapter is turn off, switch tubes of step-up circuit is always in high frequency switch working state. The charge path of trigger circuit of the adapter is maintained, the adapter can be triggered again and works normally, which can be seen from waveform shown in FIG. 6 and FIG. 7.

[0018] The secondary switch 14 is driven by the master chip 10 to work. When controlling the angle of the knob adapter, the pre-voltage detection circuit 3, 4 can detect change of voltage, which is also detection voltage of adapting information, and which is inputted to the master chip 10. Changing the duty-cycle of the secondary switch 14 adapts elementary charging current of the transformer. When the secondary switch 14 is turned off, energy of transformer obtained by charging discharges to transformer secondary circuit 23. After acted by the secondary rectifier 24 and the secondary filter capacitance 25, the LED is driven to illuminate. Therefore, the brightness and driving current of the LED is controlled by the adapter such that the Si-controlled dimmer and electro-transistor dimmer can adjust the LED light source.

[0019] Referring to FIG. 6, which shows a schematic view of voltage and current waveform of a dimmer device adapted for use in dimmer according to a preferred embodiment according to the present invention. In FIG. 6, 1 indicates waveform rectified by electro-transistor dimmer, and the Si-controlled is adjusted to a lowest controlling angle, and the voltage thereof is 164 VDC. 2 indicates voltage waveform of the capacitance after step-up, and maximum of voltage is 210 VDC. 3 indicates alternating current waveform, in which current and voltage are in same mode and in same on-time. Maximum of current is 360 MA. 4 indicates driving waveform of MOSFET, of which frequency is 63 KHZ, and of which duty-cycle is 32%.

[0020] Referring to FIG. 7, which shows a schematic view of voltage and current waveform of a dimmer device adapted for use in dimmer according to a preferred embodiment according to the present invention. In FIG. 6, 1 indicates waveform rectified by Si-controlled dimmer, and the Si-controlled is adjusted to a lowest controlling angle, and the voltage thereof is 184 VDC. 2 indicates voltage waveform of the capacitance after step-up, and maximum of voltage is 250 VDC. 3 indicates alternating current waveform, in which current and voltage are in

same phase mode and in same on-time. Maximum of current is 300 mA. 4 indicates driving waveform of MOSFET, of which frequency is 63 KHZ, and of which duty-cycle is 25%.

[0021] Finally, while various embodiments have been described and illustrated, the disclosure is not to be construed as being limited thereto. Various modifications can be made to the embodiments by those skilled in the art.

Claims

1. A LED dimmer device adapted to be connected to a phase-cutting dimmer, comprising:

   a primary rectifier (1) adapted for converting an alternating current into a direct current;
   a voltage boost device (5-7) including a transistor (7) adapted to make the dimmer enter into a normal phase-cutting state;
   a pre-voltage detection circuit (3, 4) and an after-voltage detection circuit (11, 12) adapted for detecting an output voltage of the primary rectifier and an output voltage of the voltage boost device respectively;
   a master chip (10) adapted for driving circuits and elements of the device to work, the master chip including an integrated comparator adapted to compare voltages;
   a transformer including a primary circuit (13) and a secondary circuit (23), adapted for changing voltage, wherein the primary circuit (13) is connected to the output of the voltage boost device (5-7);
   a secondary rectifier (24) adapted for rectifying an output of said transformer;
   a secondary filter (25, 26) adapted for filtering the output of the transformer; and
   a secondary switch (14) adapted to driving said primary and secondary circuits of the transformer, the secondary rectifier and the secondary filter so as to be able to drive a LED light source to illuminate,
   characterised in that
   said transistor (7) of the voltage boost device (5-7) is a metal oxide semiconductor field effect transistor, and
   said master chip (10) is adapted for driving the secondary switch (14) based on the voltage detected by the pre-voltage detection circuit (3, 4).

2. The LED dimmer device of claim 1, wherein the voltage booster device is adapted for making an on-state current and an on-state voltage of the dimmer have same phase, and making the current have a relative lower peak value.

3. The LED dimmer device of claim 2, wherein after the alternating current is rectified, the device is adapted for simultaneously inputting the voltage detected by the pre-voltage detection circuit and the voltage detected by the after-voltage detection circuit to said integrated comparator of the master chip so as to control a frequency and a duty-cycle of the voltage boost device to insure that a difference between the stepped-up voltage and the voltage elementarily rectified is maintained at 30 volt.

4. The LED dimmer device of claim 3, wherein the device is adapted to a change in the conduction angle of the AC voltage of the phase cutting dimmer so that the voltage of the pre-voltage detection circuit changes correspondingly, which acting as a standard voltage for controlling a brightness change of the LED light source is adapted to be inputted to the master chip to control a frequency anda duty-cycle of the secondary switch such that the transformer, the secondary rectifier and the secondary Filter circuit are driven so as to be able to drive the LED light source to illuminate.

5. Dimmer including a LED dimmer device of claim 1, wherein the dimmer is any one of a Si-controlled dimmer and an electro-transistor dimmer.

6. LED assembly including the LED dimmer device of claim 1, wherein the LED light source comprises one or more LEDs, and the LED light source is single color or multi color.

Patentansprüche

1. Zum Betrieb mit einem Phasenabschnittsdimmer abgestimmte LED-Dimmervorrichtung, welche umfasst:

   einen für die Umwandlung von Wechselstrom zu Gleichstrom angepassten Primärgleichrichter (1);
   einen Spannungserhöher (5-7), welcher einen Transistor (7) beinhaltet, abgestimmt, um den Dimmer in einen normalen Phasenanschnitt-Betrieb kommen zu lassen;
   eine Eingangsspannungs-Detektorschaltung (3, 4) sowie eine Nachspannungs-Detektorschaltung (11, 12), abgestimmt für das Erkennen einer Spannung nach dem Primärgleichrichter beziehungsweise einer Spannung nach dem Spannungserhöher;
   einen für die Ansteuerung der Stromkreise und Elemente der Vorrichtung angepassten Masterchip (10), wobei der Masterchip einen integrierten Komparator beinhaltet, der ausgelegt ist auf das Abgleichen von Spannungen;
   einen Transformator, der einen Primärkreis (13)

und einen Sekundärkreis (23) beinhaltet, ausgelegt für eine Spannungsänderung, wobei der Primärkreis (13) verbunden ist mit dem Ausgang des Spannungserhöhers (5-7);
einen für die Gleichrichtung des Ausgangsstroms des besagten Transformators angepassten Sekundärgleichrichter (24);
einen für das Filtern des Ausgangsstroms des Transformators angepassten Sekundärfilter (25, 26);
und
einen Sekundärschalter (14), der ausgelegt ist auf den Betrieb des besagten Primär- und Sekundärkreises des Transformators, des Sekundärgleichrichters und des Sekundärfilters, sodass die LED-Lichtquelle zum Leuchten gebracht werden kann,
dadurch gekennzeichnet,
dass besagter Transistor (7) des Spannungserhöhers (5-7) ein Metall-Oxid-Halbleiter-Feldeffekttransistor ist, und
dass besagter Masterchip (10) ausgerichtet ist auf den Betrieb des Sekundärschalters (14), basierend auf der durch die Eingangsspannungs-Detektorschaltung (3, 4) erkannten Spannung.

2. Die LED-Dimmervorrichtung nach Anspruch 1, wobei der Spannungserhöher so ausgelegt ist, dass er bewirkt, dass Laststrom und Lastspannung des Dimmers die gleiche Phase haben, sowie dass der Spitzenwert des Stroms im Vergleich geringer ist.

3. Die LED-Dimmervorrichtung nach Anspruch 2, wobei nach Gleichrichtung des Wechselstroms die Vorrichtung ausgelegt ist auf das zeitgleiche Einspeisen der durch die Eingangsspannungs-Detektorschaltung erkannten Spannung sowie der durch die Detektorschaltung für die Spannung nach dem Spannungserhöher gemessenen Spannung in besagten integrierten Komparator des Masterchip, um dadurch Frequenz und Tastverhältnis des Spannungserhöhers so zu steuern, dass die Differenz zwischen der hochtransformierten Spannung und der elementar gleichgerichteten Spannung bei 30 Volt gehalten wird.

4. Die LED-Dimmervorrichtung nach Anspruch 3, wobei das Gerät ausgelegt ist auf die Änderung des Einschaltwinkels der Wechselspannung des Phasenanschnittdimmers, sodass sich die Spannung an der Eingangsspannungs-Detektorschaltung entsprechend ändert, welche als Basisspannung für eine Helligkeitsänderung der LED-Lichtquelle dient und angepasst wird, um vom Masterchip eingelesen zu werden, um Frequenz und Tastverhältnis des Sekundärschalters zu steuern, sodass der Transformator, der Sekundärgleichrichter und der Sekundärfilter in einer Weise angesteuert werden, dass die LED-Lichtquelle zum Leuchten gebracht wird.

5. Dimmer, der eine LED-Dimmervorrichtung nach Anspruch 1 beinhaltet, wobei der Dimmer ein Si-gesteuerter Dimmer oder ein Elektrotransistor-Dimmer ist.

6. LED-Anordnung die eine LED-Dimmervorrichtung nach Anspruch 1 beinhaltet, wobei die LED-Lichtquelle eine oder mehrere LEDs aufweist, und die LED-Lichtquelle einfarbig oder mit Farbwechsel ist.

Revendications

1. Dispositif de variateur pour LED adapté à être connecté à un variateur à coupure de phase, comprenant :

un redresseur (1) principal adapté à convertir un courant alternatif en un courant continu ;
un dispositif (5-7) survolteur incluant un transistor (7) adapté à faire entrer le variateur dans un état normal de coupure de phase ;
un circuit (3, 4) de détection de pré-tension et un circuit (11, 12) de détection de post-tension adaptés à détecter une tension de sortie du redresseur principal et une tension de sortie du dispositif survolteur respectivement ;
une puce maître (10) adaptée à piloter des circuits et des éléments du dispositif pour les faire fonctionner, la puce maître incluant un comparateur intégré adapté à comparer des tensions ;
un transformateur incluant un circuit (13) principal et un circuit (23) secondaire, adaptés à changer une tension, dans lequel le circuit (13) principal est connecté à la sortie du dispositif (5-7) survolteur ;
un redresseur (24) secondaire adapté à redresser une sortie dudit transformateur ;
un filtre (25, 26) secondaire adapté à filtrer la sortie du transformateur ; et
un commutateur (14) secondaire adapté à piloter lesdits circuits principal et secondaire du transformateur, le redresseur secondaire et le filtre secondaire de façon à pouvoir piloter une source de lumière à LED afin qu'elle s'allume,
caractérisé en ce que
ledit transistor (7) du dispositif (5-7) survolteur est un transistor à effet de champ métal-oxyde semi-conducteur, et
ladite puce maître (10) est adaptée à piloter le commutateur (14) secondaire sur la base de la tension détectée par le circuit (3, 4) de détection de pré-tension.

2. Dispositif de variateur pour LED selon la revendication 1, dans lequel le dispositif survolteur est adapté

à faire en sorte qu'un courant à l'état passant et une tension à l'état passant du variateur aient une même phase, et à faire en sorte que le courant ait une valeur de pic relative plus basse.

3. Dispositif de variateur pour LED selon la revendication 2, dans lequel, après que le courant alternatif a été redressé, le dispositif est adapté à entrer simultanément la tension détectée par le circuit de détection de pré-tension et la tension détectée par le circuit de détection de post-tension dans ledit comparateur intégré de la puce maître de façon à commander une fréquence et un cycle de service du dispositif survolteur de façon à assurer qu'une différence entre la tension augmentée et la tension élémentairement redressée soit maintenue à 30 volts.

4. Dispositif de variateur pour LED selon la revendication 3, dans lequel le dispositif est adapté à un changement de l'angle de conduction de la tension de CA du variateur à coupure de phase de façon à ce que la tension du circuit de détection de pré-tension change de façon correspondante, laquelle, agissant comme une tension standard pour commander un changement de luminosité de la source de lumière à LED, est adaptée à être entrée dans la puce maître de façon à commander une fréquence et un cycle de service du commutateur secondaire, de façon à ce que les circuits du transformateur, du redresseur secondaire et du filtre secondaire soient pilotés afin de pouvoir piloter la source de lumière à LED afin qu'elle s'allume.

5. Variateur incluant un dispositif de variateur pour LED selon la revendication 1, dans lequel le variateur est l'un quelconque parmi un variateur commandé au silicium et un variateur à électro-transistor.

6. Ensemble à LED incluant le dispositif de variateur pour LED selon la revendication 1, dans lequel la source de lumière à LED comprend une ou plusieurs LED, et la source de lumière à LED est monochromatique ou polychromatique.

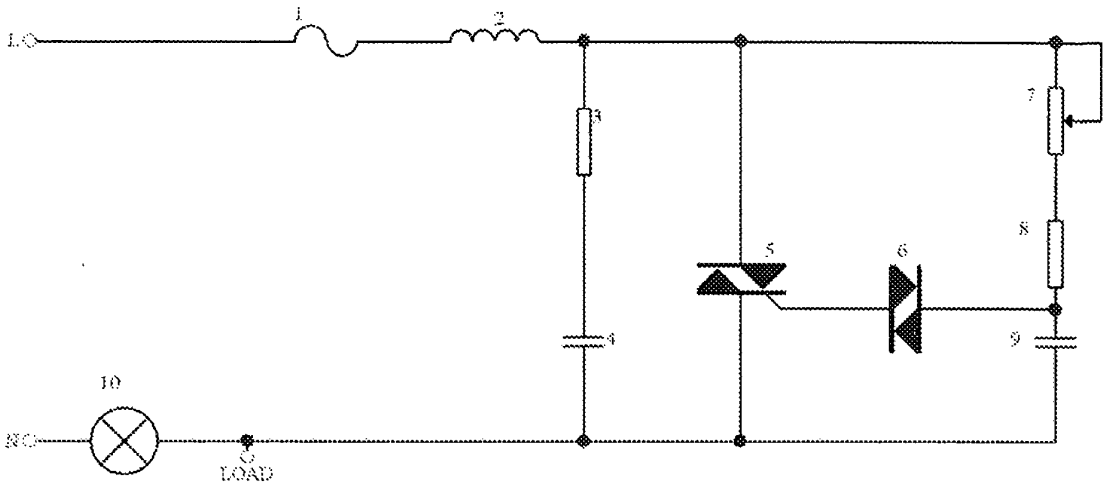
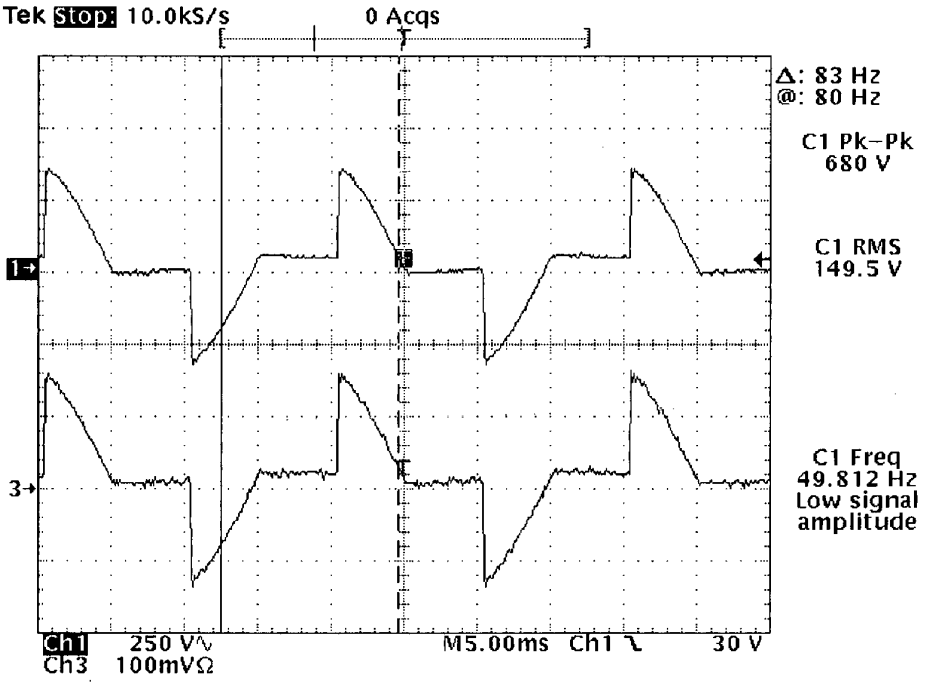

LC
1
2
3
4
5
6
7
8
9
10
NC
LOAD

FIG. 1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0 Acqs
Δ: 83 Hz
@: 80 Hz
C1 Pk-Pk
680 V
C1 RMS
149.5 V
C1 Freq
49.812 Hz
Low signal
amplitude
Ch1 250 V
Ch3 100mVΩ
M5.00ms Ch1 30 V

FIG. 2

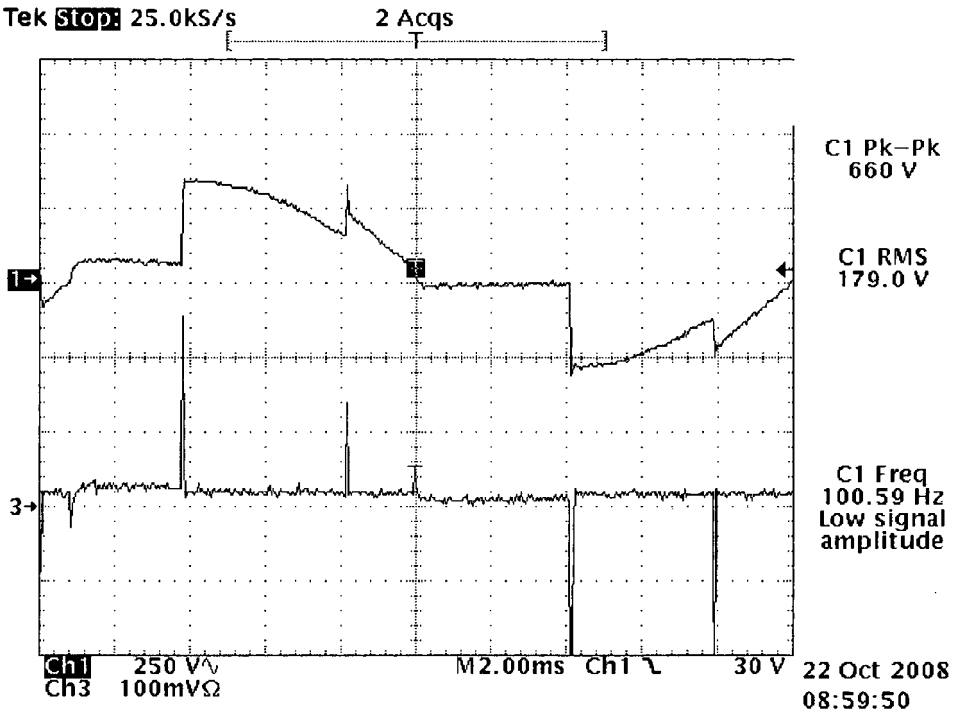

Tek Stop: 25.0kS/s
2 Acqs
C1 Pk-Pk
660 V
C1 RMS
179.0 V
C1 Freq
100.59 Hz
Low signal
amplitude
Ch1 250 V
Ch3 100mVΩ
M2.00ms Ch1 30 V
22 Oct 2008
08:59:50

FIG. 3

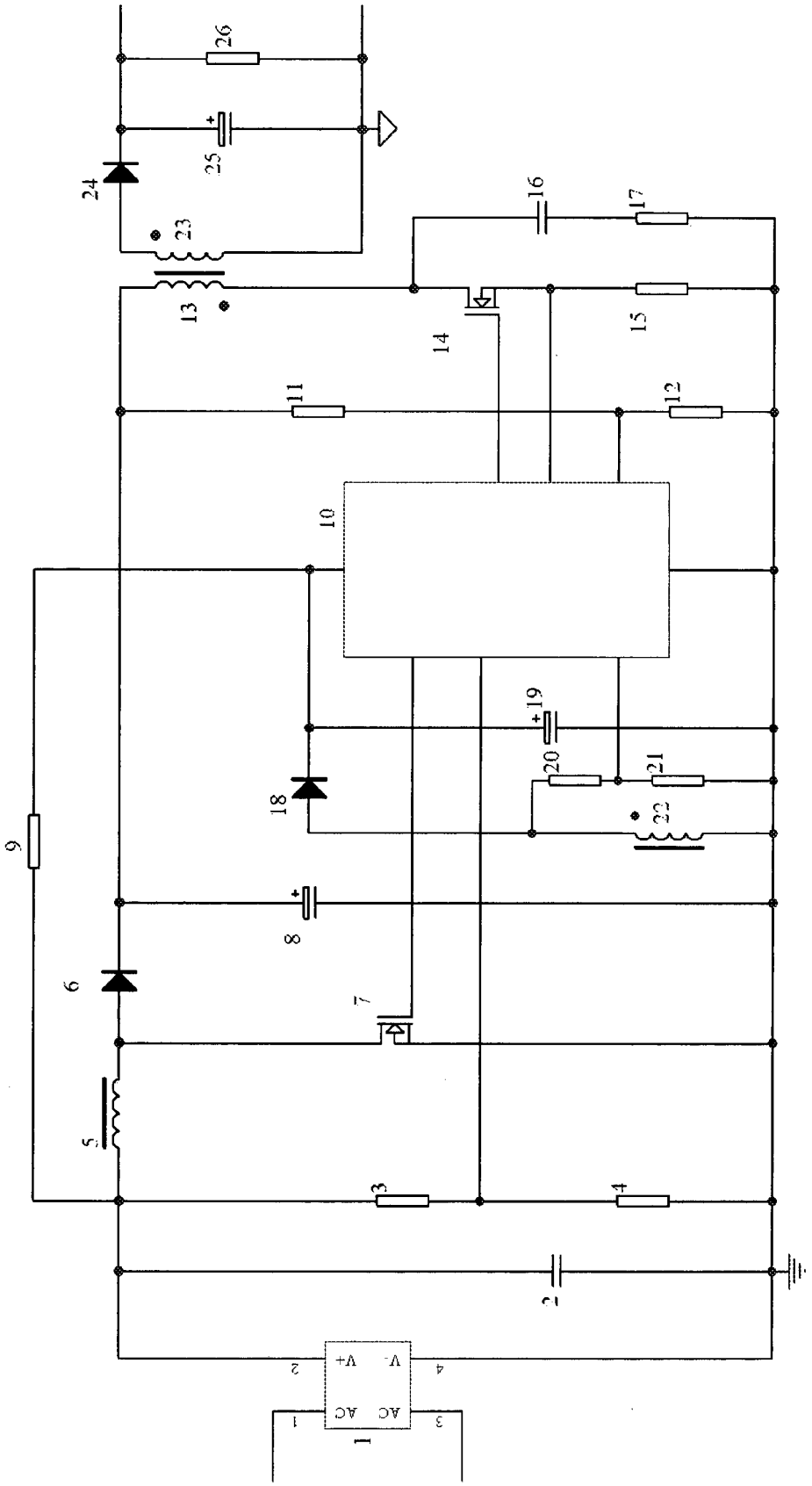


FIG. 4

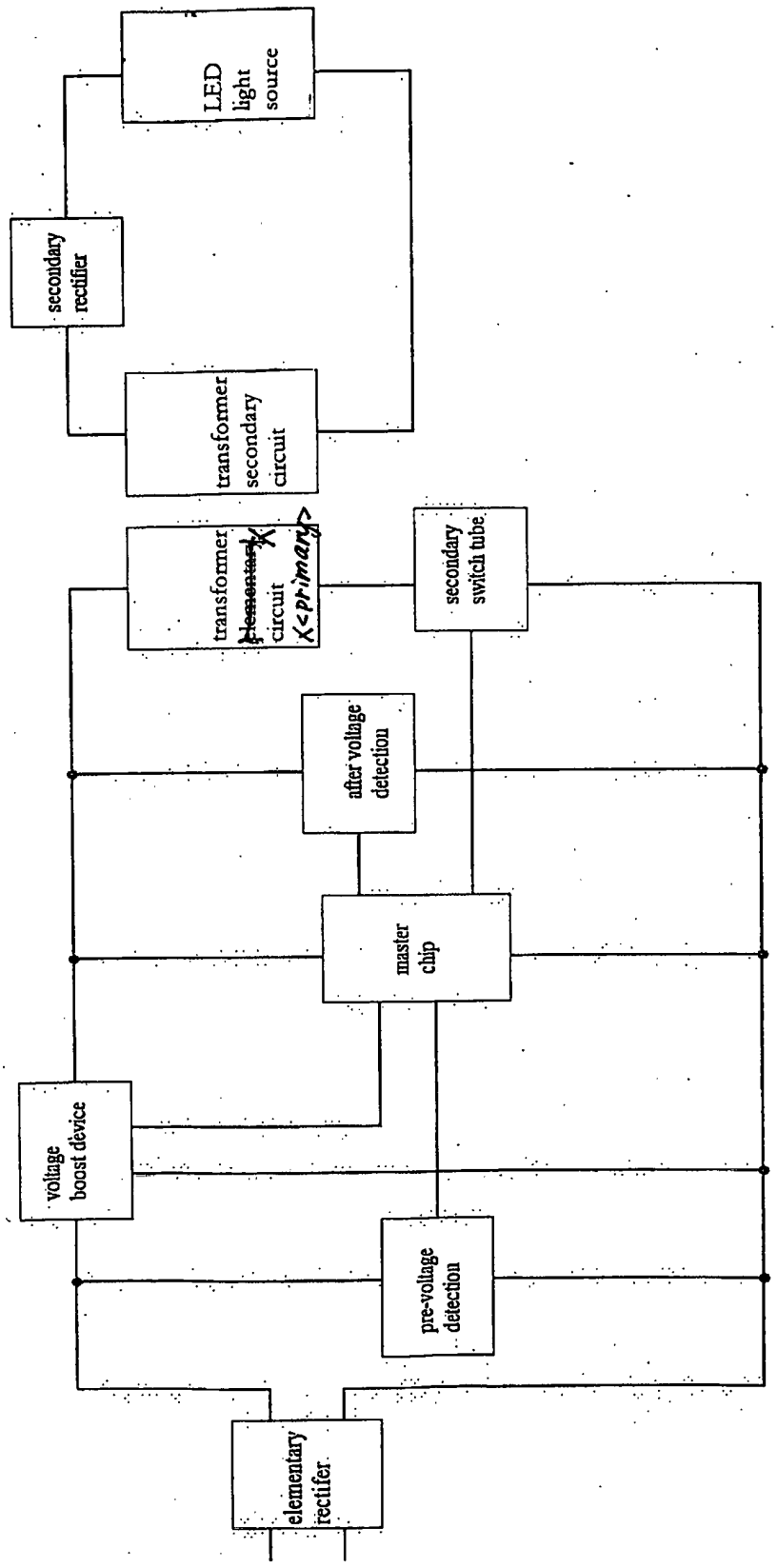
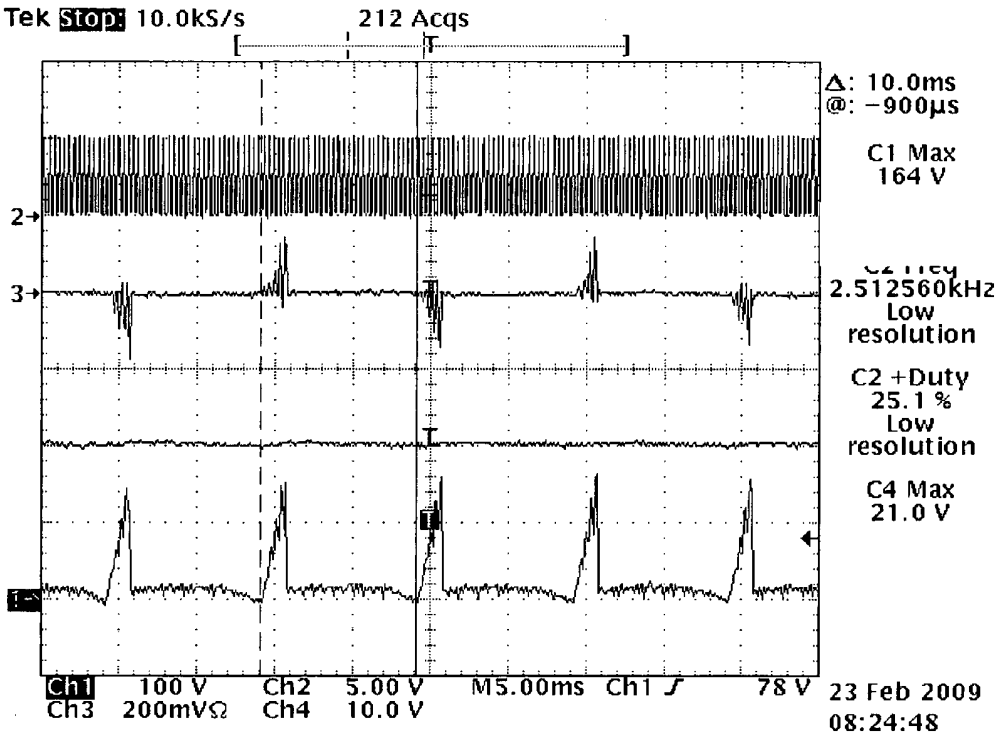

LED light source
secondary rectifier
transformer secondary circuit
transformer primary circuit
secondary switch tube
after voltage detection
master chip
voltage boost device
pre-voltage detection
elementary rectifier

FIG. 5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212 Acqs
Δ: 10.0ms
@: −900µs
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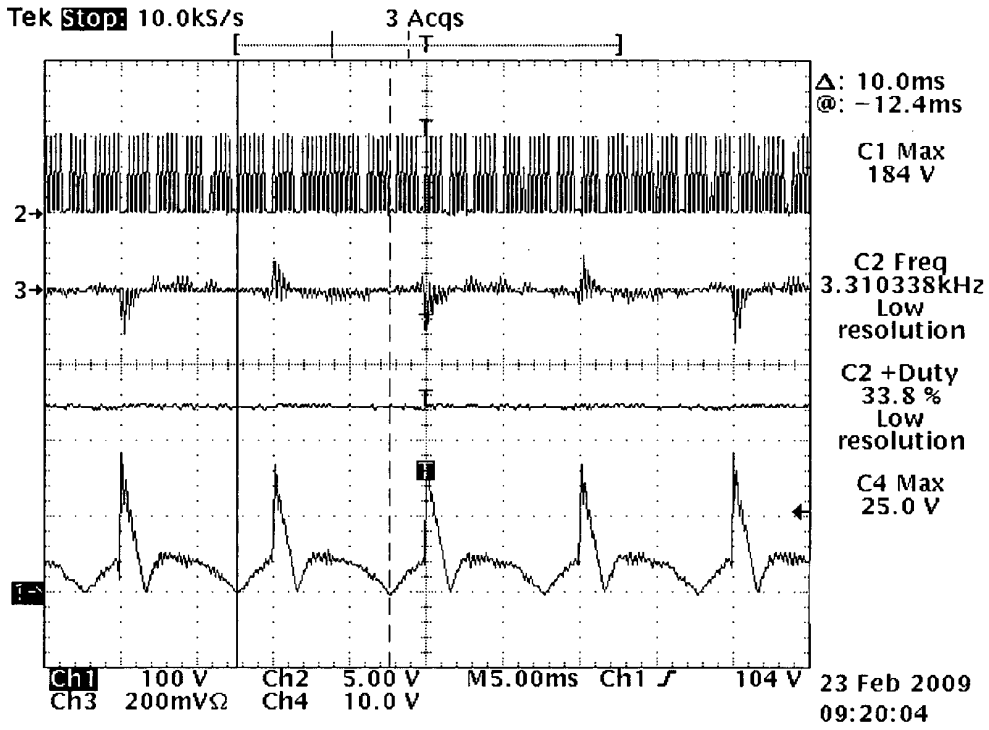
164 V
2.512560kHz
Low
resolution
C2 +Duty
25.1 %
Low
resolution
C4 Max
21.0 V
Ch1 100 V Ch2 5.00 V M5.00ms Ch1 ƒ 78 V
Ch3 200mVΩ Ch4 10.0 V
23 Feb 2009
08:24:48

FIG. 6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3 Acqs
Δ: 10.0ms
@: −12.4ms
C1 Max
184 V
C2 Freq
3.310338kHz
Low
resolution
C2 +Duty
33.8 %
Low
resolution
C4 Max
25.0 V
Ch1 100 V Ch2 5.00 V M5.00ms Ch1 104 V
Ch3 200mVΩ Ch4 10.0 V
23 Feb 2009
09:20:04

FIG. 7

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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