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(54) **CONTROL OF LEDS**

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(73) Proprietor: **Esquisse**
4675 AP Sint Philipsland (NL)

(72) Inventor: **SNEUJINK, Laurentius, Gerhardus,
Maria**
NL-4675 AP Sint Philipsland (NL)

(74) Representative: **Grootsholten, Johannes A.M. et
al**
Arnold & Siedsma
Sweelinckplein 1
2517 GK Den Haag (NL)

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Description

[0001] The present invention relates to a method for controlling a light-emitting component, such as a LED, having a minimum active voltage on the one hand and a maximum operating voltage and current on the other.

[0002] A control signal for switch means is usually generated or deduced on the basis of a measured current signal. The supply or control voltage over a diode or a series of diodes is not taken into account at all here. This voltage must at all times lie preferably within a precisely determined range of minimum voltages in order to enable activation of the component, and a maximum voltage, also known as the forward voltage, and the corresponding current, which may not be exceeded so as not cause damage to the component. The components further also have a combination of a maximum current and a maximum voltage at which the heat generation can still be tolerated.

[0003] The publications US-2004/066.143 and "Electrical Design Considerations for SuperFlux LEDs" (2002-09, Lumileds Lighting, San Jose, CA, USA, XP002453166) describe possibilities of LEDs and are acknowledged her as prior art.

[0004] Particularly in applications in which a number of light-emitting components are connected in series with each other, the minimum and maximum voltages to be applied thereover must be increased a number of times equal to the number of components in the series connection. In addition, light-emitting components often display a fluctuation, depending on temperature etc., in the minimum and maximum forward voltage enabling it to come into or remain in operation without damage as a result of heat generation. The voltage over a component may for instance have to become higher to be able to make it operative as the temperature of this diode rises, particularly during operation thereof.

[0005] Particularly when a number of light-emitting components are connected in series, the overall voltage over such a series connection of components may display large fluctuations, partly depending on the temperature. In order to compensate for this, it is usual in the art for amplifiers to be used to adjust the supply or control voltage over the (series of) light-emitting components to the operating conditions thereof, and use is normally made for this purpose of linear amplifiers, booster amplifiers, buck amplifiers or combinations thereof. A voltage of 150 V may particularly be necessary in for instance a series connection of 35 LEDs. The fluctuations may vary up to as much as 20 V in the voltage to be applied over the series connection. This voltage must be modified to the conditions, in particular the temperature of the light-emitting components, and other properties thereof.

[0006] The present invention has for its object to obviate or at least to alleviate the above stated problems of the known art. Provided for this purpose are a method and a control which are distinguished from the known controls by the combinations of properties and measures defined in the independent claims.

[0007] The switch means are thus controlled on the basis of a power which is momentary and subject to conditions, without having to apply complex amplifications in combination with the power supply. This prevents the voltage having to be controlled separately, in particular the forward voltage, if switching takes place on the basis of current. This provides a high degree of freedom of design, and a voltage can here be applied over the (series of) light-emitting components which can be markedly higher than the usual forward voltage, without having to take into account variations in voltage induced by temperature difference. The choice of the supply voltage over the (series of) components can thus be high and constant, without difficult and complex amplifiers being required to adjust the voltages to be applied over the individual light-emitting components. The invention is thus based on the insight that the switching behaviour of the switch means entails the possibility of making the supply voltage so high that no adjustment is necessary with any fluctuations, dependent on temperature or other influences, in the minimum or maximum operating modes of the component.

[0008] By moreover switching on the basis of the power and not only on the basis of the current through the light-emitting components, predetermined light settings can be generated and held stable in simple manner.

[0009] A usual example of switching of the switch can for instance be based on pulse-width modulation as control signal for the switch.

[0010] It is noted that for control purposes in such a case use is not only made of the voltage over the LED but also of the current through the LED. The voltage over the LED displays variations in temperature which can have been or are caused by changes in RMS power consumption of the LED or by a change in the ambient temperature or other influences.

[0011] It is assumed here by way of example that the LED is supplied with its maximum allowed current, which is assumed in this example to equal 1A, and with a maximum allowed voltage V_f over the LED of for instance 3V. This means a power consumption of 3W. Because the LED becomes warm(er), its V_f rises. Since the current is held constant in most of the drivers, the power consumption will rise if V_f increases to 3.5V under the influence of a temperature increase. This results in a power consumption of 3.5W. The same applies vice versa. If the V_f is held constant the current will increase, and thereby also the power consumption.

[0012] The LED thus drifts gradually to a point where the power consumption of the LED is equal to the cooling capacity which corresponds to a temperature difference between the LED and its surroundings. This is possible because the V_f rises more slowly than the increase in the temperature difference.

[0013] It is the case here that:

$$V_f * I(LED) = m(LED) * MTC(LED) * \Delta T$$

(LED/surroundings)

[0014] in which m is the mass of the LED and MTC is the mass temperature coefficient, and ΔT is the temperature difference between the LED and its surroundings. It is the case herein that:

$$V_f / (\text{temperature difference LED/surroundings}) < 1$$

[0015] By now switching the LED in such a manner according to the invention, for instance with a pulse-width modulated control signal depending on $V_f \cdot I_{LED}$ (= P_{rms}), the LED can be held at a constant temperature.

[0016] The LED is initially switched on with a starting value. The values $V_f = 3V$ and $I_{LED} = 1A$ are kept to here. At these values it is the case the power is equal to $P_{rms} = 3W$. The LED heats up during operation and V_f rises to $3.5V$. I_{rms} must now maintain a value of $I_{rms} = 1A$ by means of pulse-width modulation of the switch means (for instance FET 17 in the exemplary embodiment to be described hereinbelow). At $V_f = 3.5V$ this results in a duty cycle of $3V/3.5V = 0.857\%$. I_{rms} thus then becomes $0.857A$, resulting in a P_{rms} of $3.5V * 0.857A = 3.0W$. Use is made here of a supply voltage which is the same as the V_f of the LED. In reality this is not the case and V_f will always follow the I_{rms} . I_{rms} changes due to temperature or supply voltage. Since V_f does not progress proportionally with the temperature, a voltage control for a LED is unusual.

[0017] It is hereby possible in the present invention to supply the LED with a voltage of about 3 times the maximum permissible V_f . This is the case because the dynamics of the control become so great due to the control on the basis of power rather than only on the basis of current or voltage.

[0018] If the supply voltage changes, in particular rises, the current through the LED will increase.

[0019] Known from US 2004 / 066.143 is a circuit in which the V_{rms} over the LEDs is held constant. It is thus not the P_{rms} which is kept constant (paragraph 0059: However, since the duty ratio of the supplied current is reduced as described above, the power consumed (P_{rms}) by the light source unit 30 can be kept approximately constant), but the V_{rms} . By controlling only on the basis of voltages between 13 and 18V - as disclosed in US-2004 / 066.143 - control is thus only possible in a small portion relative to the control range provided by the invention. Control thus does not take place here on the basis of power but of voltage. The power is controlled on the basis of the changing voltage, while I_{rms} does not remain the same due to the properties of a LED. It is thus found, for instance in the case of the temperature differences which can occur during use in for instance a car, that according to US 2004 / 066.143 control is carried out only very close to the V_f of the LEDs, and this value is certainly not exceeded. I_{rms} will thus drift when a factor of 2 or 3 above the 13V is supplied.

[0020] The basis or input for this control is thus voltage and not power. Even if the control behaviour of the control described in US 2004/066.143 is adapted to the properties of the LED, the control has a completely different configuration and operation.

[0021] All other LED drivers operate with a coil and control the voltage over the LEDs subject to the current through a measuring resistance. In US-2006/261752 a resistor R_s is arranged and in US-2003/076051 an R_3 is applied, while a current-dependent control (current value control terminal) is clearly also provided according to Fig. 2 in US-2006/0082538, with a resistor R_1 in Fig. 3 thereof. In WO-2005/009086 nothing is controlled at all, and the circuit moreover comprises a coil for increasing the voltage (boost converter).

[0022] There are also many other preferred embodiments within the scope of the present invention as defined in the main claim, which preferred embodiments are stated in the dependent claims.

[0023] A control according to the invention can thus have the feature that the control comprises a power supply to be connected to the light-emitting component and having a higher voltage value than a nominal voltage required for activating the light-emitting component. In this respect nominal voltage is understood to mean the forward voltage necessary to activate a light-emitting component. By selecting a supply voltage which is much higher than this nominal or forward voltage, or addition sum thereof in the case of a series of components, and switching the switch on the basis of the power consumed, an accurate control of the voltage over the individual light-emitting components, or in the combined case the series thereof, can be dispensed with. A much simpler power supply can thus be provided with a negligible increase in the complexity of the control. The power supply can otherwise form part of the control.

[0024] In another preferred embodiment the power source is connected during use to at least two light-emitting components and has a higher voltage value which is as many times the nominal voltage of each of the light-emitting components as the number thereof. This is specific to the situation in which a series of light-emitting components is applied, each with its own temperature dependence which, as a result of the chosen control according to the present invention, does not result in a need for accurate setting and adjustment during the use of the forward or nominal voltage, but in

which a considerably higher supply voltage suffices.

[0025] In yet another preferred embodiment of the invention at least one of the control circuit, the measuring circuits, the multiplier and the conversion circuit is connected or can be connected to a power source for the purpose of providing an active power to the light-emitting components and to the control itself. The power supply for the light-emitting components thus also forms a power source for the control itself, whereby the configuration of the control according to the present invention can remain simple and wherein a separate power supply solely for the control can be dispensed with.

[0026] In yet another preferred embodiment use can be made of a conversion circuit with a separate input for entry of a synchronization signal. Changes through time in the light from the single or series of at least one light-emitting component can thus be brought about on the basis of the synchronization signal. To the extent that the synchronization signal can be taken into account in the control signal on the basis of the requirement as measured by the measuring circuit and calculated in the conversion circuit, lighting patterns which are very varied over time are possible with a synchronization signal to be separately provided and for which a specific input is thus provided in this embodiment.

[0027] In yet another preferred embodiment it is possible for the control to be manufactured in a chip without external components such as a coil. A coil is normally used in the prior art controls, which is and has been found to be unnecessary according to the present invention.

[0028] In yet another preferred embodiment it is possible for the control according to the invention to comprise a circuit for pulse-width modulation (PWM) in the conversion circuit. The use of a PWM circuit is per se known, although not in combination with the control of a pulse-width modulation circuit on the basis of measured powers and power indications, as is proposed according to the present invention.

[0029] In yet another preferred embodiment according to the present invention, control signals to be generated by the conversion circuit are pulsed with an arbitrary pulse shape. Use can be made for this purpose of diverse variants of usual PWM circuits, which are deemed to lie within the scope of the normal technical knowledge of the skilled person in the field, and of which no further description is therefore deemed necessary here and hereinbelow for the purpose of a full disclosure.

[0030] Various rise characteristics can be applied and the downward flank of the pulse shapes can also be adjusted as desired or required using per se known and usual PWM circuits, which can each have their own advantages or properties in combination with the present invention.

[0031] In another, final preferred embodiment according to the present invention the control has the feature that determining means are provided in order to determine the ratio between the active voltage over the at least one light-emitting diode and the voltage over a shunt resistance, and wherein this ratio can be entered into the conversion circuit. In this way an optimization of the operation of the control can be brought about in order to realize the best possible control of the light-emitting component or a series with diverse light-emitting components.

[0032] It is noted that, particularly due to the use of a supply voltage over the light-emitting component or components which is higher than the forward or nominal voltage necessary to activate the light-emitting component or components, light-emitting components can be controlled at greater distances with lower losses, particularly when the control is situated at the location of the light-emitting component or components and the power source for applying an operating voltage over the component or components is located at a distance. At a higher supply voltage relatively lower losses in any case occur along the length of the conductors to the light-emitting component or components.

[0033] The invention will be further elucidated hereinbelow on the basis of a single example of a possible embodiment as shown in the accompanying figures, in which similar or the same components and elements are designated with the same reference numerals, and in which:

Fig. 1 shows a schematic view of a part of a possible embodiment of a control according to the present invention; and Fig. 2 shows a schematic view of an additional part of a control in a possible embodiment according to the present invention.

[0034] Fig. 1 shows a part 1 of control in a possible embodiment of the present invention. Part 1 of the control in fig. 1 comprises two inputs 2, 3 for respectively the LED voltage and the LED current. Inputs 2, 3 are connected to respective amplifiers 5, 6, the outputs of which lead to a multiplier 4. The output of multiplier 4 leads to an adder circuit 8, where the output signal from multiplier 4 can be combined with a feedback signal relating to shifting of the frequency setting for the switch which acts on the light-emitting components, as will be further described hereinbelow with reference to fig. 2.

[0035] The output of the adder circuit is connected to one of the inputs of a differential circuit 10, wherein the other input of differential circuit 10 is connected to the output of differential circuit 10 in order to form a feedback loop. The output of differential circuit 10 forms part of a conversion circuit, together with the components shown in fig. 2, as part of the control according to the present invention. A signal is generated at the output of differential circuit 10, which signal can be carried to a PWM control 11 via a processing circuit 12, the output of which leads to an oscillator 13 in order to make the signal obtained from differential circuit 10 suitable for controlling oscillator 13 therewith on the basis of an operation performed thereon by processing circuit 12. It is otherwise possible, though not required, for oscillator 13 to

comprise a further input 14 for a synchronization signal. Such a synchronization signal can be used to switch LEDs or other light-emitting components on or off in a desired manner in a desired rhythm or otherwise. Fig. 2 shows a series connection of such light-emitting components 15, only two of which are explicitly shown in fig. 2.

[0036] Arranged in line with the series of LEDs 15 is a switch 16 which comprises a transistor 17, wherein the output signal of the PWM control acts on switch 16 in order to open or keep closed a current path as required.

[0037] A shunt resistance 18 is further arranged over the source and the drain of transistor 17. This shunt resistance 18 can be used to provide the various measurements which can be presented at input 2 or, additionally or alternatively, can otherwise also be inputted into part 1 of the control in fig. 1 at input 3. The shunt resistance can serve to measure the current and, in a possibly modified configuration, use can also be made hereof to measure the voltage. Connection 19 can be connected to a power source with a higher voltage value than the addition sum of the maximum voltage value for each of the LEDs 15.

[0038] It will be apparent that many alternative and additional embodiments will occur to the skilled person after examination of the foregoing. An arbitrary embodiment can thus be realized with a possible transistor other than the transistor shown in fig. 2. A shunt resistance is further arranged, although other constructions can also be used to measure various quantities. It is in any case important to note that a coil is no longer required in the control. The voltage on connection 19 can be made arbitrarily high, but not arbitrarily low. It is for instance undesirable to make the supply voltage at connection 19 lower than the sum of the forward or nominal voltages over each of the LEDs. Amplifiers 5 and 6 can provide a weighed product at the output of multiplication circuit 4. It is for instance possible to emphasize one of the current or the voltage more than the other. If desired, a current signal can thus be multiplied by a value other than the voltage signal supplied at input 3. Use can be made for this purpose of amplifiers 5 and 6. With a sufficiently stable operation of the control according to the present invention a feedback signal over line 7 can be omitted. Depending on the requirement, it is possible to dispense with an input 14 for entering any synchronization signal. It is however possible to realize desired patterns of switching LEDs on and off using such a synchronization signal. It is also possible here to switch on the basis of only measured currents and/or only measured voltages.

Claims

1. Method for controlling at least one light-emitting component (15), such as a light-emitting diode (LED), having a maximum operating voltage ($V_f(\max)$) and current ($I_f(\max)$) at which the component can be safely activated, which method comprises of:

- applying a supply voltage over the component (15) which is at least equal to a minimum voltage for activating the component (15);
- selectively switching the component (15) on and off;
- at least one of

- * measuring the current through the component (15) and generating a current signal, and
- * measuring the voltage over the component (15) and generating a voltage signal; and

- generating a control signal on the basis of at least one of the current signal and the voltage signal for the purpose of switching the component (15) on and off in accordance therewith, **characterized by**:
- applying over the component (15) a voltage higher than the maximum operating voltage $V_f(\max)$;
- generating a power indication using both the current signal and the voltage signal; and
- providing the control signal in a form of the power indication, and
- switching the component on the basis of the power indication.

2. Method as claimed in claim 1, wherein switching on and off of the component (15) comprises of: generating the control signal such that the sum of power supplied intermittently to the component (15) in switched-on mode is at most equal to the product of $V_f(\max) * I_f(\max)$.

3. Method as claimed in claim 1 or 2, wherein switching on and off of the component (15) comprises of: generating the control signal such that a temperature of the component (15) resulting from generation of heat is at most equal to a threshold value above which there is danger of damage to the component (15).

4. Control for at least one light-emitting component (15), such as a light-emitting diode (LED), having a maximum operating voltage ($V_f(\max)$) and current ($I_f(\max)$) at which the component (15) can be safely activated, comprising:

- a power source for the component (15);
- switching means (16) for activating the light-emitting component (15) at a frequency;
- at least one of

* a measuring circuit for measuring at least the current through the component (15) and providing a current signal to the control circuit, and
 * a measuring circuit for measuring at least the voltage over the component (15) for the purpose of providing a voltage signal to the control circuit,

- a conversion circuit (11, 12, 13) connected to the switching means (16) for providing to the switching means a switching frequency control signal corresponding to at least one of the current signal and the voltage signal,

characterized in that

the power source supplies a voltage higher than the maximum operating voltage $V_f(\max)$ over the component (15), wherein the conversion circuit comprises a generator (4) for generating a power indication using both the current signal and the voltage signal in order to provide the power indication to the conversion circuit (11, 12, 13) for providing the control signal to the switching means on the basis of the power indication.

5. Control as claimed in claim 4, wherein a power supplied to the component (15) is at most equal to the product of $V_f(\max) \cdot I_f(\max)$.

6. Control as claimed in claim 4 or 5, comprising a power source to be connected to the light-emitting component (15) and having a voltage value higher than a nominal voltage required for activating the light-emitting component (15).

7. Control as claimed in claim 6, wherein the power source is connected during use to at least two light-emitting components (15) and has a voltage value which is as many times the nominal voltage of each of the light-emitting components (15) as the number thereof.

8. Control as claimed in at least one of the foregoing claims 4-7, wherein at least one of the control circuit, the measuring circuits, the multiplier (4) and the conversion circuit (11, 12, 13) is connected or can be connected to a power source for the purpose of providing an active power to the light-emitting components (15) and to the control.

9. Control as claimed in at least one of the foregoing claims 4-8, wherein the conversion circuit comprises an input (14) for entry of a synchronization signal.

10. Control as claimed in at least one of the foregoing claims 4-9, which is manufactured in a chip without external components such as a coil.

11. Control as claimed in at least one of the foregoing claims 4-10, wherein the conversion circuit comprises a circuit (11) for pulse-width modulation (PWM).

12. Control as claimed in at least one of the foregoing claims 4-11, wherein control signals to be generated by the conversion circuit (11, 12, 13) are pulsed with an arbitrary pulse shape.

13. Control as claimed in at least one of the foregoing claims 4-12, wherein determining means are provided in order to determine the ratio between the active voltage over the at least one light-emitting diode and the voltage over a shunt resistance (18), and to enter this ratio into the conversion circuit (11, 12, 13).

Patentansprüche

1. Verfahren zum Steuern wenigstens einer lichtemittierenden Komponente (15), wie etwa einer lichtemittierenden Diode (LED), die eine maximale Betriebsspannung ($V_f(\max)$) und einen maximalen Betriebsstrom ($I_f(\max)$) hat, bei denen die Komponente sicher in Betrieb genommen werden kann, wobei das Verfahren Folgendes umfasst:

- Anwenden einer Versorgungsspannung auf die Komponente (15), die wenigstens gleich einer minimalen Spannung ist, um die Komponente (15) in Betrieb zu nehmen;
- selektives Ein- und Ausschalten der Komponente (15);

- wenigstens einen der folgenden Vorgänge:

- * Messen des Stroms durch die Komponente (15) und Erzeugen eines Stromsignals, und
- * Messen des Spannungsabfalls über die Komponente (15) und Erzeugen eines Spannungssignals; und

- Erzeugen eines Steuersignals auf Basis des Stromsignals und/oder des Spannungssignals, um die Komponente (15) in Übereinstimmung mit diesen Ein- und Auszuschalten, und durch Folgendes gekennzeichnet ist:

- Anwenden einer Spannung auf die Komponente (15), die höher ist als die maximale Betriebsspannung $V_f(\max)$;
- Erzeugen einer Leistungsangabe unter Verwendung sowohl des Stromsignals als auch des Spannungssignals; und
- Bereitstellen des Steuersignals in einer Form der Leistungsangabe, und
- Schalten der Komponente basierend auf der Leistungsangabe.

2. Verfahren nach Anspruch 1, wobei das Ein- und Ausschalten der Komponente (15) Folgendes umfasst: Erzeugen des Steuersignals derart, dass die Summe der Leistung, die im eingeschalteten Modus intermittierend der Komponente (15) zugeführt wird, höchstens gleich dem Produkt $V_f(\max) \cdot I_f(\max)$ ist.

3. Verfahren nach Anspruch 1 oder 2, wobei das Ein- und Ausschalten der Komponente (15) Folgendes umfasst: Erzeugen des Steuersignals derart, dass eine Temperatur der Komponente (15), die aus der Wärmezeugung resultiert, höchstens gleich einem Schwellwert ist, oberhalb dessen die Gefahr der Beschädigung der Komponente (15) besteht.

4. Steuerung für wenigstens eine lichtemittierende Komponente (15), wie etwa eine lichtemittierende Diode (LED), die eine maximale Betriebsspannung ($V_f(\max)$) und einen maximalen Betriebsstrom ($I_f(\max)$) hat, bei denen die Komponente (15) sicher in Betrieb genommen werden kann, Folgendes umfassend:

- eine Elektrizitätsquelle für die Komponente (15);
- ein Schaltmittel (16), um die lichtemittierende Komponente (15) mit einer Frequenz in Betrieb zu nehmen;
- wenigstens eines der folgenden Mittel:

- * eine Messschaltung zum Messen wenigstens des Stroms durch die Komponente (15) und zum Bereitstellen eines Stromsignals an die Steuerschaltung, und
- * eine Messschaltung zum Messen wenigstens des Spannungsabfalls über die Komponente (15), um für die Steuerschaltung ein Spannungssignal bereitzustellen,

- eine Wandlerschaltung (11, 12, 13), die mit dem Schaltmittel (16) verbunden ist, um für das Schaltmittel ein Schaltfrequenz-Steuersignal bereitzustellen, das dem Stromsignal und/oder dem Spannungssignal entspricht,

dadurch gekennzeichnet, dass

die Elektrizitätsquelle eine Spannung liefert, die höher ist als die maximale Betriebsspannung $V_f(\max)$ der Komponente (15), wobei die Wandlerschaltung einen Geber (4) zum Erzeugen einer Leistungsangabe umfasst, und dies unter Verwendung sowohl des Stromsignals als auch des Spannungssignals, um die Leistungsangabe für die Wandlerschaltung (11, 12, 13) bereitzustellen, um auf Basis der Leistungsangabe das Steuersignal für das Schaltmittel bereitzustellen.

5. Steuerung nach Anspruch 4, wobei eine der Komponente (15) zugeführte Leistung höchstens gleich dem Produkt $V_f(\max) \cdot I_f(\max)$ ist.

6. Steuerung nach Anspruch 4 oder 5, die eine Elektrizitätsquelle umfasst, die mit der lichtemittierenden Komponente (15) verbunden wird und die einen Spannungswert hat, der höher ist als eine Nennspannung, die erforderlich ist, um die lichtemittierende Komponente (15) in Betrieb zu nehmen.

7. Steuerung nach Anspruch 6, wobei die Elektrizitätsquelle während des Einsatzes mit wenigstens zwei lichtemittierenden Komponenten (15) verbunden ist und einen Spannungswert hat, der ein solches Vielfaches der Nennspannung jeder der lichtemittierenden Komponenten (15) beträgt, wie deren Anzahl ist.

8. Steuerung nach einem der vorhergehenden Ansprüche 4 bis 7, wobei von der Steuerschaltung, den Messschal-

tungen, dem Multiplizierer (4) und der Wandlerschaltung (11, 12, 13) wenigstens eine mit einer Elektrizitätsquelle verbunden ist oder verbunden werden kann, um für die lichtemittierenden Komponenten (15) und die Steuerung eine wirksame Leistung bereitzustellen.

9. Steuerung nach einem der vorhergehenden Ansprüche 4 bis 8, wobei die Wandlerschaltung einen Eingang (14) zur Eingabe eines Synchronisationssignals umfasst.
10. Steuerung nach einem der vorhergehenden Ansprüche 4 bis 9, die auf einem Chip und ohne externe Komponenten, wie eine Spule, hergestellt ist.
11. Steuerung nach einem der vorhergehenden Ansprüche 4 bis 10, wobei die Wandlerschaltung eine Schaltung (11) zur Pulsweitenmodulation (PWM) umfasst.
12. Steuerung nach einem der vorhergehenden Ansprüche 4 bis 11, wobei von der Wandlerschaltung (11, 12, 13) zu erzeugende Steuersignale mit einer beliebigen Impulsform gepulst sind.
13. Steuerung nach einem der vorhergehenden Ansprüche 4 bis 12, wobei ein Bestimmungsmittel bereitgestellt wird, um das Verhältnis zwischen dem wirksamen Spannungsabfall über die wenigstens eine lichtemittierende Diode und dem Spannungsabfall über einen Nebenschlusswiderstand (18) zu bestimmen und um dieses Verhältnis in die Wandlerschaltung (11, 12, 13) einzugeben.

Revendications

1. Procédé destiné à commander au moins un composant électroluminescent (15), tel qu'une diode électroluminescente (LED), qui présente une tension ($V_f(\max)$) et un courant ($I_f(\max)$) de fonctionnement maximum sous lesquels le composant peut être activé sans risque, le procédé comprenant :
 - l'application sur le composant (15) d'une tension d'alimentation qui est au moins égale à une tension minimum pour activer le composant (15) ;
 - la commutation sélective du composant (15) en service et hors service ;
 - l'une au moins de :
 - la mesure du courant circulant dans le composant (15) et la génération d'un signal de courant ; et
 - la mesure de la tension sur le composant (15) et la génération d'un signal de tension ; et
 - la génération d'un signal de commande sur la base de l'un au moins du signal de courant et du signal de tension afin de commuter le composant (15) en service et hors service selon celui-ci, **caractérisé par** :
 - l'application sur le composant (15) d'une tension supérieure à la tension de fonctionnement maximum $V_f(\max)$;
 - la génération d'une indication de puissance en utilisant à la fois le signal de courant et le signal de tension ; et
 - la fourniture du signal de commande sous la forme d'une indication de puissance ; et
 - la commutation du composant sur la base de l'indication de puissance.
2. Procédé selon la revendication 1, dans lequel la commutation en service et hors service du composant (15) comprend :
 - la génération du signal de commande de sorte que la somme de la puissance fournie de manière intermittente au composant (15) dans le mode en service soit au plus égale au produit $V_f(\max) * I_f(\max)$.
3. Procédé selon la revendication 1 ou 2, dans lequel la commutation en service et hors service du composant (15) comprend :
 - la génération du signal de commande de sorte qu'une température du composant (15) résultant d'un dégagement de chaleur soit au plus égale à une valeur de seuil au-dessus de laquelle il y a un risque d'endommager le composant (15).
4. Commande pour un composant électroluminescent (15) au moins, tel qu'une diode électroluminescente (LED), qui présente une tension ($V_f(\max)$) et un courant ($I_f(\max)$) de fonctionnement maximum sous lesquels le composant

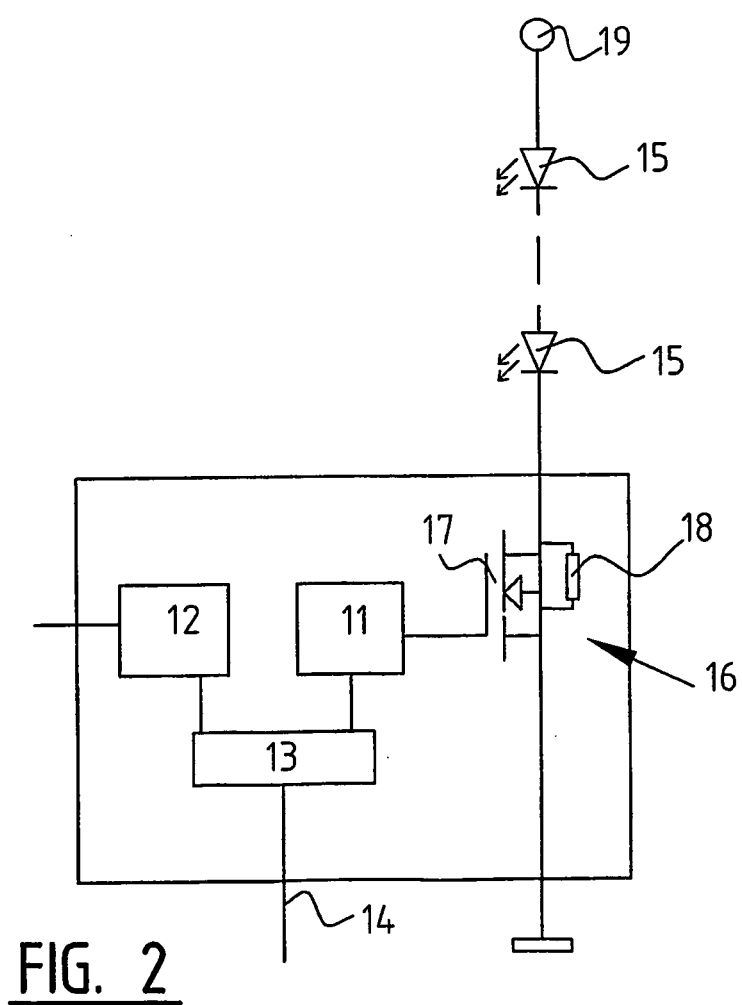
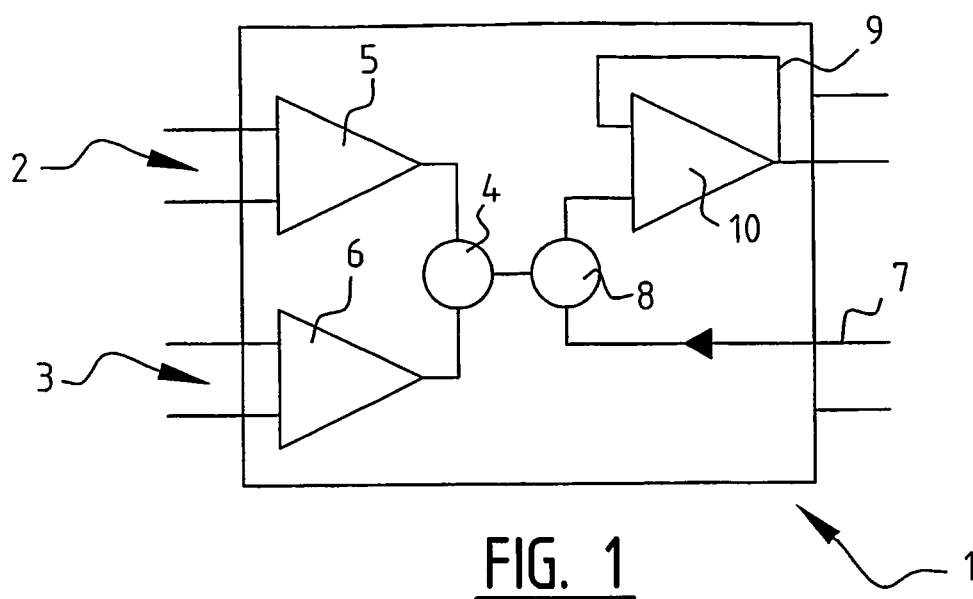
(15) peut être activé sans risque, comprenant :

- une source d'alimentation pour le composant (15) ;
- des moyens de commutation (16) destinés à activer le composant électroluminescent (15) à une fréquence ;
- l'un au moins :
 - d'un circuit de mesure destiné à mesurer au moins le courant circulant dans le composant (15) et à fournir un signal de courant au circuit de commande ; et
 - d'un circuit de mesure destiné à mesurer au moins la tension sur le composant (15) afin de fournir un signal de tension au circuit de commande ;
- un circuit de conversion (11, 12, 13) connecté aux moyens de commutation (16) destiné à fournir aux moyens de commutation un signal de commande de fréquence de commutation correspondant à l'un au moins du signal de courant et du signal de tension ;

caractérisé en ce que :

la source d'alimentation fournit une tension supérieure à la tension de fonctionnement maximum $V_f(\max)$ sur le composant (15), dans laquelle le circuit de conversion comprend un générateur (4) destiné à générer une indication de puissance en utilisant à la fois le signal de courant et le signal de tension afin de fournir l'indication de puissance au circuit de conversion (11, 12, 13) pour fournir le signal de commande aux moyens de commutation sur la base de l'indication de puissance.

5. Commande selon la revendication 4, dans laquelle une puissance fournie au composant (15) est au plus égale au produit $V_f(\max) * I_f(\max)$.
6. Commande selon la revendication 4 ou 5, comprenant une source d'alimentation à connecter au composant électroluminescent (15) et présentant une valeur de tension supérieure à la tension nominale requise pour activer le composant électroluminescent (15).
7. Commande selon la revendication 6, dans laquelle la source d'alimentation est connectée au cours de l'utilisation à deux composants électroluminescents (15) au moins et présente une valeur de tension qui est égale à autant de fois la tension nominale de chacun des composants électroluminescents (15) qu'il y a de composants électroluminescents.
8. Commande selon au moins l'une des revendications précédentes 4 à 7, dans laquelle l'un au moins du circuit de commande, des circuits de mesure, du multiplicateur (4) et du circuit de conversion (11, 12, 13), est connecté ou peut être connecté à une source d'alimentation afin de fournir une puissance active aux composants électroluminescents (15) et à la commande.
9. Commande selon au moins l'une des revendications précédentes 4 à 8, dans laquelle le circuit de conversion comprend une entrée (14) destinée à l'entrée d'un signal de synchronisation.
10. Commande selon au moins l'une des revendications précédentes 4 à 9, fabriquée sous la forme d'une puce sans composants extérieurs tels qu'une bobine.
11. Commande selon au moins l'une des revendications précédentes 4 à 10, dans laquelle le circuit de conversion comprend un circuit (11) de modulation de largeur d'impulsions (MLI).
12. Commande selon au moins l'une des revendications précédentes 4 à 11, dans laquelle les signaux de commande devant être générés par le circuit de conversion (11, 12, 13) sont pulsés avec une forme d'impulsion arbitraire.
13. Commande selon au moins l'une des revendications précédentes 4 à 12, dans laquelle des moyens de détermination sont prévus pour déterminer le rapport entre la tension active sur la au moins une diode électroluminescente et la tension sur une résistance de shunt (18), et pour entrer ce rapport dans le circuit de conversion (11, 12, 13).



REFERENCES CITED IN THE DESCRIPTION

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