



(51) International Patent Classification:

G09G 3/32 (2006.01) G09G 3/36 (2006.01)
G09G 3/14 (2006.01) H05B 37/02 (2006.01)
G02F 1/133 (2006.01)

Shiloh, Irvine, CA 92620 (US). **KAMEYA, Andrew, M.** [US/US]; 48 Ascension, Irvine, CA 92612 (US).

(21) International Application Number:

PCT/US2009/035284

(74) Agents: **KING, Robert, L.** et al.; 7700 W. Parmer Lane, Md: TX32/PL02, Austin, TX 78729 (US).

(22) International Filing Date:

26 February 2009 (26.02.2009)

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

61/036,053 12 March 2008 (12.03.2008) US
12/056,237 26 March 2008 (26.03.2008) US

(71) Applicant (for all designated States except US): **FREESCALE SEMICONDUCTOR INC.** [US/US]; 6501 William Cannon Drive West, Austin, TX 78735 (US).

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **ZHAO, Bin** [US/US]; 14 Figaro, Irvine, CA 92606 (US). **CORNISH, Jack, W.** [US/US]; 24 Celonova Place, Foothill Ranch, CA 92610 (US). **HORNG, Brian, B.** [US/US]; 7 Garnet, Irvine, CA 92620 (US). **LEE, Victor, K.** [US/US]; 14

[Continued on next page]

(54) Title: LED DRIVER WITH DYNAMIC POWER MANAGEMENT

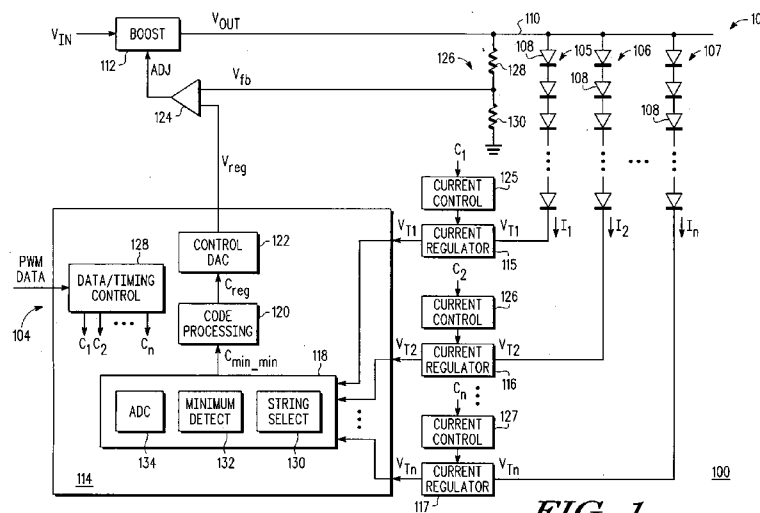


FIG. 1

(57) Abstract: Power management in a light emitting diode (LED) system (100) having a plurality of LED strings (102) is disclosed. A voltage source provides an output voltage to drive the LED strings (102). An LED driver (114) monitors the tail voltages of the active LED strings to identify the minimum, or lowest, tail voltage and adjusts the output voltage of the voltage source based on the lowest tail voltage. The LED driver (114) can adjust the output voltage so as to maintain the lowest tail voltage at or near a predetermined threshold voltage so as to ensure that the output voltage is sufficient to properly drive each active LED string with a regulated current in view of pulse width modulation (PWM) performance requirements without excessive power consumption.

WO 2009/114279 A3



Published:

(88) Date of publication of the international search report:

17 December 2009

- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

A. CLASSIFICATION OF SUBJECT MATTER*G09G 3/32(2006.01)i, G09G 3/14(2006.01)i, G02F 1/133(2006.01)i, G09G 3/36(2006.01)i, H05B 37/02(2006.01)i*

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 8 : G09G, H05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Utility models and applications for Utility Models since 1975

Japanese Utility models and applications for Utility Models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keyword: LED, light emitting diode, minimum, lowest, voltage, detect, sens*, and similar terms

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2003332624 A (ROHM CO. LTD.) 21 November 2003 see the abstract, paragraphs [0019]-[0055], figures 1-2.	12-14
A		1-11, 15-20
A	US 20080054815 A1 (SRIDHAR V. KOTIKALAPOODI et al.) 06 March 2008 see the abstract, paragraphs [0025]-[0036], figures 3-5.	1-20
A	US 20040233144 A1 (WILLIAM E. RADER et al.) 25 November 2004 see the abstract, paragraphs [0019]-[0049], figure 2.	1-20
A	JP 2005116199 A (AL-AID CORP., SHARP KABUSHIKI KAISHA) 28 April 2005 see the abstract, paragraphs <11>-<39>, figures 1-5.	1-20

 Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:

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

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of 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

28 OCTOBER 2009 (28.10.2009)

Date of mailing of the international search report

28 OCTOBER 2009 (28.10.2009)

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
Government Complex-Daejeon, 139 Seonsa-ro, Seo-
gu, Daejeon 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

CHO, Ki Duck

Telephone No. 82-42-481-8363



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2009/035284

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2003-332624 A	21.11.2003	CN 1522472 A0	18.08.2004
		CN 100352070 C	28.11.2007
		EP 1503430 A1	02.02.2005
		JP 4177022 B2	05.11.2008
		KR 10-2005-0003971 A	12.01.2005
		TW 226032 B	01.01.2005
		TW 226032 A	01.01.2005
		US 2004-0208011 A1	21.10.2004
		US 06822403 B2	23.11.2004
		WO 2003-096436 A1	20.11.2003
US 2008-054815 A1	06.03.2008	None	
US 2004-0233144 A1	25.11.2004	US 2005-0088207 A1	28.04.2005
		US 06836157 B2	28.12.2004
		US 07459959 B2	02.12.2008
JP 2005-116199 A	28.04.2005	US 07436378 B2	14.10.2008
		US 2005-0104542 A1	19.05.2005