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- (74) **Agent:** MOBARHAN, Ramin; Attn: International IP Administration, 5775 Morehouse Drive, San Diego, California 92121 (US).

- (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, CL, 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, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
- (84) **Designated States (unless otherwise indicated, for every kind of regional protection available):** ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, 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, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Declarations under Rule 4.17:**

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))

[Continued on next page]

(54) **Title:** BIAS CURRENT MONITOR AND CONTROL MECHANISM FOR AMPLIFIERS

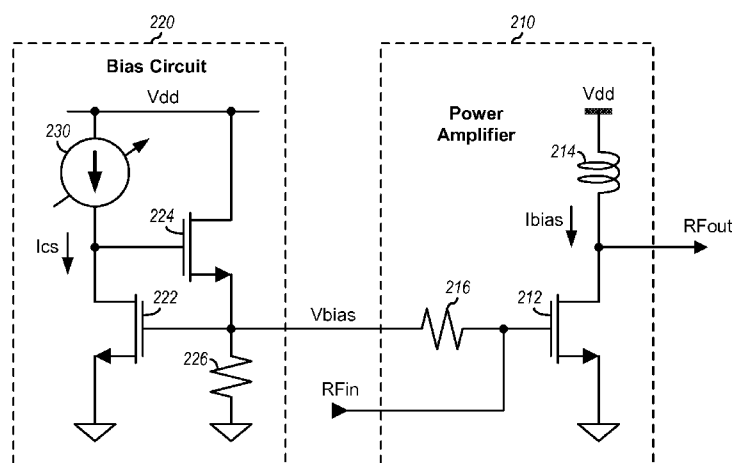


FIG. 2

(57) **Abstract:** Techniques for monitoring and controlling bias current of amplifiers are described. In an exemplary design, an apparatus may include an amplifier and a bias circuit. The amplifier may include at least one transistor coupled to an inductor. The bias circuit may generate at least one bias voltage for the at least one transistor in the amplifier to obtain a target bias current for the amplifier. The bias circuit may generate the at least one bias voltage based on a voltage across the inductor in the amplifier, or a current through a current mirror formed with one of the at least one transistor in the amplifier, or a gate-to-source voltage of one of the at least one transistor in the amplifier, or a voltage in a replica circuit replicating the amplifier, or a current applied to the amplifier with a switched mode power supply disabled.

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23 June 2011

- *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))*

# INTERNATIONAL SEARCH REPORT

International application No PCT/US2010/044033
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**A. CLASSIFICATION OF SUBJECT MATTER**  
 INV. H03F1/30 H03F3/189  
 ADD.  
 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)  
 H03F  
 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)  
 EP0-Internal

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	----- US 2006/066410 A1 (RAZAVI BEHZAD [US] ET AL) 30 March 2006 (2006-03-30) figure 2	1-3
X	----- EP 1 376 855 A2 (MOTOROLA INC [US]) 2 January 2004 (2004-01-02) figure 3	1-3
X	----- US 6 114 912 A (ASHBY KIRK B [US] ET AL) 5 September 2000 (2000-09-05) figure 4	1-3
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Further documents are listed in the continuation of Box C.       See patent family annex.

\* Special categories of cited documents :

<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"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</p> <p>"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</p> <p>"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.</p> <p>"&amp;" document member of the same patent family</p>
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Date of the actual completion of the international search  <p style="text-align: center; font-size: 1.2em;">20 April 2011</p>	Date of mailing of the international search report  <p style="text-align: center; font-size: 1.2em;">28/04/2011</p>
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer  <p style="text-align: center; font-size: 1.2em;">Kurzbaauer, Werner</p>
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## INTERNATIONAL SEARCH REPORT

International application No

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X	US 2004/263256 A1 (ISHIKAWA MAKOTO [JP] ET AL) 30 December 2004 (2004-12-30) the whole document -----	1-3
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International application No

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 9 307369 A (DENSO CORP) 28 November 1997 (1997-11-28) figure 1 abstract -----	18,30, 31,36,39
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# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2010/044033

## Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3.  Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1.  As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
  
2.  As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
  
3.  As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
  
4.  No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

### Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

## FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

## 1. claims: 1-3

An apparatus comprising:  
an amplifier comprising a first transistor; and a bias circuit comprising a second transistor coupled to the first transistor in the amplifier, the first and second transistors form a current mirror, the bias circuit generates a bias voltage for the first and second transistors to obtain a target bias current for the first transistor.

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## 2. claims: 4-8

An apparatus comprising:  
an amplifier comprising a transistor coupled to an inductor;  
a sensing circuit coupled to the inductor and to measure a voltage across the inductor; and  
a bias circuit coupled to the transistor and to generate a bias voltage for the transistor based on the measured voltage across the inductor to obtain a target bias current for the transistor.

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## 3. claims: 9-17

An apparatus comprising:  
an amplifier comprising first and second transistors coupled in a stack;  
a sensing circuit coupled to the second transistor in the amplifier and to measure a gate-to-source voltage,  $V_{gs}$ , of the second transistor; and  
a bias circuit coupled to at least one transistor among the first and second transistors and to generate at least one bias voltage for the at least one transistor based on the measured  $V_{gs}$  voltage of the second transistor to obtain a target bias current for the first and second transistors.

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## 4. claims: 18-21

An apparatus comprising:  
an amplifier comprising at least one transistor;  
a replica circuit comprising at least one transistor replicating the at least one transistor in the amplifier;  
and  
a feedback circuit coupled to the amplifier and the replica circuit and to sense a first voltage in the amplifier, to sense a second voltage in the replica circuit, and to generate a bias voltage for the amplifier based on the first and second voltages.

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**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

5. claims: 22-29

An apparatus comprising:  
an amplifier to amplify an input signal and provide an output signal;  
a switched mode power supply (SMPS) coupled to the amplifier and to receive a first supply voltage and provide a second supply voltage to the amplifier; and  
a bias circuit coupled to the amplifier and to generate a bias voltage for the amplifier to obtain a target bias current for the amplifier.

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6. claims: 30-39

A method of adjusting bias current generating at least one bias voltage for at least one transistor in an amplifier based on a measurement to obtain a target bias current for the amplifier and the corresponding apparatus.

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2010/044033

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