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D E C I S I O N
of 25 June 2004

Case Number: T 0953/01 - 3.5.2

Application Number: 96907887.2

Publication Number: 0759229

IPC: H03F 3/72

Language of the proceedings: EN

Title of invention:
Low distortion differential transconductor output current mirror

Applicant:
LATTICE SEMICONDUCTOR CORPORATION

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 123(2)

Keyword:
"Amendments - added subject matter (yes)"

Decisions cited:
-

Catchword:
-

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Case Number: T 0953/01 - 3.5.2

D E C I S I O N
of the Technical Board of Appeal 3.5.2
of 25 June 2004

Appellant: LATTICE SEMICONDUCTOR CORPORATION
5555 N.E. Moore court
Hillsboro
Oregon 97124 (US)

Representative: Atkinson, Ralph
Atkinson Burrington
25 - 29 President Buildings
President Way
Sheffield S4 7UR (GB)

Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 6 February 2001 refusing European application No. 96907887.2 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: W. J. L. Wheeler
Members: F. Edlinger
B. J. Schachenmann

Summary of Facts and Submissions

I. The appeal is against the decision of the examining division refusing European patent application No. 96 907 887.2.

II. In the statement of grounds of appeal, the appellant proposed to amend the claims which were refused by the examining division and requested that the appeal be allowed and a patent be granted on the basis of claims 1 to 10 with inclusion of the specified amendments. As a first auxiliary request, it was requested that the appeal be allowed but on the basis that claim 1 was amended to include the limitations of amended claim 2 with amendments to claims 3 and 10 as detailed in the first request. As a second auxiliary request, it was requested that the appeal be allowed but on the basis that claim 1 was amended to include the limitations of amended claim 2 with amendments to claim 3 as detailed in the first request and amendment to claim 10 as specified in the statement of grounds of appeal. Oral proceedings were requested in the event that the Board would otherwise refuse the appeal.

III. Claim 1 of the main request is worded as follows:

"A current mirror for use at an output of a transconductor, said current mirror receiving an input current at an input current terminal and providing an output current proportional to the input current at an output current terminal, comprising:
a gain circuit (62) having a first input terminal, a second input terminal and an output terminal;

an input resistor (66) having a first input resistor terminal, a second input resistor terminal and a first resistance value, the first input resistor terminal being coupled to the first input terminal of said gain circuit and the second resistor terminal being coupled to a voltage;

an output resistance (R01, R02, R03) having a first output resistor terminal, a second output resistor terminal and a second resistance value, the first output resistance terminal being coupled to the second input terminal of said gain circuit via a feedback path and the second output resistance terminal being coupled to a voltage; and

an output transistor (64) having first and second current handling terminals and a control terminal, said control terminal being coupled to the output terminal of the gain circuit (62), the first current handling terminal being coupled to the first output resistance terminal and the second current handling terminal being coupled to the output current source;

characterised in that

said output resistance is a programmable output resistance (R01, R02, R03) having a programmable resistance value; and

the ratio of the input current to the output current is a ratio of the resistance of the input resistor to the resistance of the output resistance."

IV. Claim 10 of the main request and the first auxiliary request has the following wording.

"A transconductor for generating a differential current between first current mirror output terminal and second current mirror output terminal, responsive to a differential voltage operably impressed between input terminal of said first current mirror and input terminal of said second current mirror, wherein said first current mirror is configured in accordance with any of claims 1 to 9; and said second current mirror is configured in accordance with any of claims 1 to 9."

V. Claim 10 of the second auxiliary request is worded as follows:

"A transconductor for generating a differential current between first current mirror output terminal and second current mirror output terminal, responsive to a differential voltage operably impressed between first and second voltage input terminals, wherein said first current mirror is configured in accordance with any of claims 1 to 9; and said second current mirror is configured in accordance with any of claims 1 to 9."

VI. One of the reasons for refusal given in the contested decision was that claim 10 then on file specified subject-matter which extended beyond the content of the (international) application as published (Article 123(2) EPC) because claim 10 specified a differential voltage operably impressed between input terminals of the current mirrors, whereas the application as filed taught that a differential voltage was impressed

between the input terminals of the transconductor, see eg claim 14 and Figures 2 and 4 of the application.

VII. The appellant argued as follows concerning the above objection under Article 123(2) EPC:

"The Examiner refers to published Claim 14 that reads:

'responsive to a differential voltage operably impressed between first and second voltage terminals.'

The above mentioned first and second terminals are interpreted by the Examiner to refer to the input terminals of the transconductor.

Figure 4 of the present application and the accompanying description discloses that a differential voltage is impressed between the input terminals of the transconductor.

However, the first input terminal of each current mirror is labelled with a voltage reference. The accompanying description discloses that the maximum value of the voltage at the input of each current mirror is controlled by the value of the first resistor within each current mirror and the value of the transconductor resistor. According to the present invention the first resistor comprises a resistor circuit.

Furthermore, it is disclosed that a differential current is generated at the output terminals of the transconductor. According to the disclosed equation from which the maximum value of the voltage at the

input of each current mirror can be calculated, it can be determined that a differential voltage is generated between the current mirror inputs.

It is therefore submitted that present Claim 10 does not contain subject matter which extends beyond the content of the application as published."

VIII. The Board sent a communication dated 8 March 2004 accompanying the invitation to oral proceedings. The wording of claim 10 was recited in the communication as set out under point IV above. The Board expressed the provisional opinion that claim 10 specified subject-matter extending beyond the content of the application as filed concerning the feature referred to at page 5, paragraph 2, of the contested decision ("differential voltage"), and that claim 10 seemed to cover combinations which were not disclosed in the application as filed because one of the current mirrors might be configured in accordance with one of the claims 1 to 9 and the other current mirror in accordance with another of these claims. Attention was also drawn to other defects, such as the incoherent use of the terms "output resistance" and "output resistor" (terminal) in claims 1 to 10 and the lack of reference signs which would help to increase the intelligibility of the claims (Rule 29(7) EPC).

IX. With a letter dated 22 April 2004, the Board was informed that the appellant did not wish to be represented at the oral proceedings and that the application might be allowed to lapse. A decision based on the present status of the file was therefore requested.

X. Oral proceedings were held on 25 June 2004 in the absence of the appellant.

Reasons for the Decision

1. The appeal is admissible.

2. Claim 10 of the main request and the first auxiliary request contains the feature "responsive to a differential voltage operably impressed between input terminal of said first current mirror and input terminal of said second current mirror". According to claim 10 of the second auxiliary request, the differential voltage is "operably impressed between first and second voltage input terminals" (of the claimed transconductor).

3. There is no explicit disclosure, in the application as filed and published under WO-A-96/27 238, of a differential voltage operably impressed between input terminals of the first and second current mirrors at the outputs of a transconductor. Claim 14 as filed specified "A transconductor for generating a differential current between first and second current mirror output terminals responsive to a differential voltage operably impressed between first and second voltage input terminals". In the circuit disclosed in Figure 4, the difference in the output currents I_L and I_R of the transconductor is "responsive" to the input differential voltage. Differential currents I_L and I_R are received at the input terminals (86, 88) of first and second current mirrors (60L, 60R) and provide

output currents which are proportional to the respective input currents and the input/output resistance ratio (see claim 1 to which claim 10 refers). It is true that input resistors (R1, $R1_L$, $R1_R$), which are elements of the current mirrors (Figures 3, 4 and 5), convert the input currents I_L, I_R into corresponding voltages VR_L, VR_R, but this is the reaction of the current mirrors to the input current signals, and, in the judgement of the Board, is not the same as impressing a differential voltage at the inputs of the current mirrors. Furthermore, a feature which was originally presented as essential (responsive to a differential voltage operably impressed between first and second voltage input terminals of the transconductor) is no longer mentioned in claim 10.

4. Claim 10 of each of the requests covers combinations where one of the current mirrors is configured in accordance with one of the claims 1 to 9 and the other current mirror is configured in accordance with another of these claims. No such combination is disclosed in the published application where each of the first and second current mirrors have the same configuration (see eg claim 14 and Figure 4 of the published application).

5. None of the requests can thus be granted because claim 10 of each request infringes Article 123(2) EPC. In these circumstances, the further defects mentioned in the Board's communication need not be dealt with in detail. Since, according to Article 113(2) EPC, the Board shall decide upon the patent application only in the text submitted to it, or agreed, by the applicant and since the applicant did not file any amendments and

was not represented at the oral proceedings, the appeal must be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

D. Sauter W. J. L. Wheeler