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**Datasheet for the decision
of 23 March 2009**

Case Number: T 0867/06 - 3.5.02

Application Number: 01103671.2

Publication Number: 1130784

IPC: H03M 3/02

Language of the proceedings: EN

Title of invention:

Delta Sigma type A/D converter

Applicant:

Hitachi, Ltd., et al

Opponent:

-

Headword:

-

Relevant legal provisions:

EPC Art. 54, 82, 84, 123(2)

EPC R. 137(4)

Relevant legal provisions (EPC 1973):

-

Keyword:

"Main request - added subject-matter (yes)"

"Auxiliary requests I and Ia - novelty (no)"

"Auxiliary requests II and IIa - remittal for further prosecution (yes)"

Decisions cited:

G 0002/92

Catchword:

See points 5 and 6 of the reasons.



Case Number: T 0867/06 - 3.5.02

D E C I S I O N
of the Technical Board of Appeal 3.5.02
of 23 March 2009

Appellant:

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Decision under appeal:

**Decision of the Examining Division of the
European Patent Office posted 30 November 2005
refusing European application No. 01103671.2
pursuant to Article 97(1) EPC 1973.**

Composition of the Board:

Chairman: M. Ruggiu
Members: J.-M. Cannard
E. Lachacinski

Summary of Facts and Submissions

I. The appellant contests the decision of the examining division to refuse European patent application No. 01 103 671.2. The reason for the refusal was that the subject-matter of the claims of the actual request then on file did not involve an inventive step in the sense of Article 56 EPC.

II. The prior art document:

D4: US-A-5 241 310,

considered in the first instance, remains relevant to the present appeal.

III. With a letter dated 23 February 2009, the applicant filed sets of claims according to a main request and auxiliary requests I, Ia, II and IIa. Claim 1 of the main request reads as follows:

"A $\Delta\Sigma$ type AD converter comprising:

- a local D/A converter (29, 30, 31) having at least a first output voltage level V_H and a second output voltage level V_L ; an integrator integrating a difference of an input signal and an output of said local D/A converter (29, 30, 31);

- a comparator (22; 46) comparing the outputs of said integrator;

- means (28; 47) for varying the output of said local D/A converter depending upon an output of said comparator (22; 46); and

- switching means (29) for switching said first output voltage level VH and said second output voltage level VL of said local D/A converter (29, 30, 31),

characterized in that

a first voltage source (30) for outputting the first output voltage level VH and a second voltage source (31) for outputting the second output voltage level VL are provided, wherein

the output voltage of each of said first and second voltage sources (30, 31) can be set arbitrarily in order to set an input range of the AD converter."

Claim 1 according to the auxiliary request I differs from claim 1 of the main request in that the last feature of the claim "the output voltage of each of said first and second voltage sources (30, 31) can be set arbitrarily in order to set an input range of the AD converter" is amended to "the first and second output voltages of of (*sic*) said first and second voltage sources (30, 31) can be set arbitrarily in order to set a conversion range of the AD converter".

Claim 1 according to the auxiliary request Ia differs from claim 1 of the auxiliary request I in that the term "a conversion range" is amended to "an input range and a conversion range".

IV. Claim 1 according to the auxiliary request II reads as follows:

"A $\Delta\Sigma$ type AD converter comprising:

- a local D/A converter (58, 60) having at least a first output voltage level VH and a second output voltage level VL;

- two integrators (38) integrating a difference of an input signal and each output of said local D/A converters (58, 60),

- a comparator (46) comparing the outputs of said integrators;

- means (47) for varying the output of said local D/A converter depending upon an output of said comparator (46); and

- switching means (58, 60) for switching said first output voltage level VH of a first voltage source (59) and said second output voltage level VL of a second voltage source (61) having a first switching means (58) and a second switching means (60), wherein

the output voltage level of the first voltage source (59) is different from output voltage level of the second voltage source (61), and

the first output voltage level VH and the second output voltage level VL can be set arbitrarily according to a conversion range of the AD converter."

Claim 1 according to the auxiliary request IIa reads as follows:

"A $\Delta\Sigma$ type AD converter comprising:

- two local D/A converters (58, 60) having at least a first output voltage level VH and a second output voltage level VL;

- two integrators (38) integrating a difference of an input signal and each output of said local D/A converters (58, 60),

- a comparator (46) comparing the outputs of said integrators; and

- means (47) for varying the output of said local D/A converter depending upon an output of said comparator (46); wherein

- a switching means (58, 60) for switching said first output voltage level VH of a first voltage source (59) and said second output voltage level VL of a second voltage source (61), wherein

the output voltage level of the first switching means (58) is different from output voltage level of the second switching means (60), and the first output voltage level VH and the second output voltage level VL can be set arbitrarily according to a conversion range of the AD converter."

V. As announced with a letter faxed on 19 March 2009, the appellant did not attend the oral proceedings before the

Board held on 23 March 2009. The appellant had requested in writing that the decision under appeal be set aside and that a patent be granted on the basis of claim 1 of the main request filed with the letter dated 23 February 2009, subsidiarily on the basis of claim 1 of any of the auxiliary requests I, Ia, II and IIa, filed with the same letter. The appellant had further asked remittal to the first instance in case of uncertainty about whether the subject-matter of claim 1 according to auxiliary request II or auxiliary request IIa relates to searched subject-matter.

VI. The appellant's arguments can be summarized as follows:

The skilled person clearly derived from the original description, which stated "by arbitrarily setting the voltages of the reference voltage sources...", that there was no particular requirement, restriction or constraint for arbitrarily setting both voltage levels VH and VL, i.e. each of said voltage levels. The statement in the description implied that the voltages VH and VL could be set independently because any dependency between the voltages would correspond to a restriction, requirement or constraint on the voltage setting which contradicted the teaching of the original application. Furthermore, it was unambiguously derivable from the inverter circuits 62 and 63 comprised in the third example of converter described in the original application that the lower and upper conversion ranges of the AD converter could be determined independently. Claim 1 of the main request met the requirements of Article 123(2) EPC.

The subject-matter of Claim 1 of the main request was novel with respect to the cited prior art. Especially document D4 failed to disclose a $\Delta\Sigma$ type AD converter which comprised first and second voltage sources for respectively outputting first and second output voltage levels and in which the output voltage of said sources could be set arbitrarily in order to set an input range of the AD converter. In the converter shown in figure 3 of D4, a single bus 234 provided a single voltage level which corresponded to an absolute value of a time-varying reference voltage $|V(t)| = |-V(t)|$. Figure 2 of D4 did not show any voltage sources and the reference voltages $V(t)$ and $-V(t)$ which were supplied by two distinct buses 230 and 232 did not require two separate voltage sources. Moreover, the first reference voltage $V(t)$ and the second reference voltage $-V(t)$ could not be set arbitrarily because they had the same absolute value $|V(t)| = |-V(t)|$.

The cited prior art did not suggest the claimed $\Delta\Sigma$ type AD converter. In all the cited documents, in particular in D4, both reference voltages should be such that one of said voltages had to be set as the negative value of the second one. This particular constraint contradicted the teaching of the invention according to which both reference voltages could be set arbitrarily.

The last features incorporated in the auxiliary requests I and Ia were literally based on the passages of page 8, lines 15 to 19 and 2 to 4 of the original description and did not contravene Article 123(2) EPC. The auxiliary requests I and Ia met the requirements of Articles 54 and 56 EPC for the same reasons as the main request.

Reasons for the Decision

1. The appeal is admissible.

Main request - Inadmissible extension

2. Claim 1 of the main request differs *inter alia* from claim 1 of the application as originally filed by the additional feature "the output voltage of **each** of said first and second voltage sources (30, 31) can be set arbitrarily in order to set an input range of the AD converter" (emphasis added by the Board). This added feature covers setting the output voltage of the first source and the output voltage of the second source independently from each other and extends beyond the content of the originally filed application for the following reasons.

- 2.1 The $\Delta\Sigma$ type AD converter according to claim 1 of the main request has to be understood as comprising one local D/A converter with one output because this claim specifies "means (28; 47) for varying the output of said local D/A converter". The first example of converter described in the original application with reference to figure 1 is the only one which comprises one local D/A converter with one output (the output of the switch 29) and can provide a support for claim 1. It appears from the passages of page 3, lines 5 to 8; page 8, lines 2 to 4, 15 to 18 and 20 to 23 of the original description, that the terms "input range" and "conversion range" refer in the context of the invention to the same range of signals, and that the input range, i.e. the

conversion range, of the $\Delta\Sigma$ AD converter can be set arbitrarily by arbitrarily setting the voltage(s) of the reference voltage sources 30 and 31. However, the part of the description relating to the first example of converter neither states, nor is it directly and unambiguously derivable from it, that an output voltage of the first source and an output voltage of the second source can be set independently from each other.

- 2.2 More specifically, even if the description specifies in general that the input range of the first example of converter can be set arbitrarily, there is no specific disclosure that the voltage of **each** source 30, 31 can be set arbitrarily. Furthermore, the original application does not mention what kind of signals are inputted to the converter so that it is not possible to derive from the "setting of an optimal conversion range depending upon the input signal" (page 8, lines 20 to 23) that the first and second source voltages can be set independently from each other. Therefore, the amendments made to claim 1 of the main request contravene Article 123(2) EPC.

Auxiliary request I - Lack of novelty

3. Document D4 discloses an $\Delta\Sigma$ type AD converter which comprises all the features specified in claim 1 of the auxiliary request I:
- 3.1 D4 explicitly discloses (figure 2; column 4, line 58 to column 5, line 24):
- a local D/A converter 208 having at least a first output voltage level and a second output voltage level

(reference voltages $+V(t)$ and $-V(t)$); an integrator 203 integrating a difference (differential summer 202) of an input signal and an output of said local D/A converter 208;

- a comparator 206 comparing the outputs of said integrator 203 (a direct coupling of the comparator with the integrator output is not required by the claim);

- means (switch 208) for varying the output of said local D/A converter depending upon an output of said comparator 206; and

- switching means 208 for switching said first output voltage level $+V(t)$ and said second output voltage level $-V(t)$ of said local D/A converter 238.

3.2 A first voltage source for outputting the first output voltage level $+V(t)$ and a second voltage source for outputting the second output voltage level $-V(t)$ are necessarily provided in D4 for generating the reference voltages $+V(t)$ and $-V(t)$, even if said voltages have the same magnitude (absolute value).

3.3 In D4, the reference output voltages $+V(t)$ and $-V(t)$ are set in order to adapt an input range of the AD converter to the time-varying input signals. As the original application (see page 3, lines 5 to 8) specifies that the converter "can arbitrarily set conversion range to permit setting of an optimal conversion range depending upon the input signal", no difference can be seen between the arbitrary setting of the source voltages specified in claim 1 and the setting of the reference voltages of D4. Furthermore, the last feature of claim 1

cannot be understood as restricted to output voltages of first and second sources which are set independently from each other (see *supra* 2.1 and 2.2). The claimed output voltages are thus anticipated by the reference voltages $V(t)$ and $-V(t)$ disclosed in D4, even if these reference voltages have the same magnitude.

Accordingly, the subject-matter of claim 1 according to the auxiliary request I lacks novelty (Article 54 EPC).

Auxiliary request Ia

4. Claim 1 of the auxiliary request Ia differs from claim 1 of the auxiliary request I in that the term "conversion range" is amended to "an input range and a conversion range". The terms "input range" and "conversion range" have the same meaning in the context of the invention, as appears for instance from page 3, lines 5 to 8 (see *supra* 2.1 and 2.2). Thus, the amendment made to claim 1 of the auxiliary request Ia introduces in the claim redundant terms which render the scope of the claim unclear (Article 84 EPC). Moreover, the subject-matter of claim 1 of the auxiliary request Ia, which covers a converter identical to the one specified in claim 1 of the auxiliary request I, lacks novelty for the foregoing reasons (*supra* 3 to 3.3).

Auxiliary requests II and IIa

5. The $\Delta\Sigma$ AD converters specified in the set of independent claims 1 to 4 as originally filed all comprise an integrator, which integrates a difference of an input signal and an output of a local D/A converter, and means for varying the output of said D/A converter. By

contrast, claim 1 of the auxiliary request II relates to a $\Delta\Sigma$ AD converter which comprises two integrators 38 which integrate a difference of an input signal and each output of the local D/A converter. Thus, claim 1 of the auxiliary request II seems to be based on the second and third embodiments described in the application with reference to figures 2 and 4 and to include at least a feature, i.e. a second integrator, which is not specified in the original claims. Moreover, the search report has not been drawn up for the original independent claims 2 to 4 which were considered lacking unity. In the circumstances, it is not clear to the Board whether claim 1 of the auxiliary request II relates to searched or unsearched subject-matter.

6. According to Rule 137(4) EPC 2000, amended claims may not relate to unsearched subject-matter which does not combine with the originally claimed invention or group of inventions to form a single general inventive concept. Moreover, an applicant who fails to pay the further search fees for a non unitary application cannot pursue that application for the subject-matter in respect of which no search fees have been paid (G 2/92, OJ 1993, 591). Accordingly, the Board is not in a position to decide whether the subject-matter specified in the auxiliary request II can be pursued in the present application. In any case, claim 1 of auxiliary request II includes substantial amendments which require further substantive examination. The same considerations apply to auxiliary request IIa. In such circumstances, the Board finds it appropriate to remit the case to the department of first instance for further prosecution (Article 111(1) EPC).

7. The Board notes that the examining division has not examined whether the objection of lack of unity raised by the search division was well founded. In order to avoid a possible misunderstanding, the Board wishes to make clear that it has not examined whether the original application does comply or not with the requirement of unity of Article 82 EPC, as objected by the search division. The Board has also not examined whether the claims of auxiliary requests II and IIa comply with the requirements of Article 123(2) EPC.

Order

For these reasons it is decided that :

1. The decision under appeal is set aside.
2. The case is remitted to the first instance for further prosecution.

The Registrar:

The Chairman:

U. Bultmann

M. Ruggiu