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Datasheet for the decision of 24 April 2009

Case Number: T 0834/06 - 3.5.05

Application Number: 99912873.9

Publication Number: 1076969

IPC: H04L 25/02

Language of the proceedings: EN

Title of invention:
Autobauding with adjustment to a programmable baud rate

Applicant:
Advanced Micro Devices, Inc.

Headword:
Autobauding dependent on start bit size/AMD

Relevant legal provisions:
EPC Art. 123(2)

Relevant legal provisions (EPC 1973):
EPC Art. 56

Keyword:
Added subject-matter - Main request (yes)
Inventive step - First to third auxiliary requests (no)

Decisions cited:
-

Catchword:
-

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Case Number: T 0834/06 - 3.5.05

D E C I S I O N
of the Technical Board of Appeal 3.5.05
of 24 April 2009

Appellant: ADVANCED MICRO DEVICES, INC.
One AMD Place
Mail Stop 68
P.O. Box 3453
Sunnyvale CA 94088-3453 (US)

Representative: Brookes Batchellor LLP
102-108 Clerkenwell Road
London EC1M 5SA (GB)

Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 18 November 2005 refusing European application No. 99912873.9 pursuant to Article 97(1) EPC 1973.**

Composition of the Board:

Chairman: D. H. Rees
Members: M. Höhn
F. Blumer

Summary of Facts and Submissions

I. This appeal is against the decision of the examining division dispatched 18 November 2005, refusing European patent application No. 99912873.9 because of lack of an inventive step according to Article 56 EPC 1973.

II. In the notice of appeal filed with letter dated 15 December 2005 it was requested that the decision to refuse be set aside and that a European patent be granted. The grant of a European patent was requested on the basis of the claims according to a main request (claims 1 to 9) or an auxiliary request (claims 1 to 8), both submitted with the statement setting out the grounds of appeal dated 15 March 2006.

III. With a letter dated 15 June 2006 the appellant's representative requested that "any appeal hearing be held as close to 1.00pm as possible, to reduce costs to my client". With a letter dated 15 April 2008 oral proceedings were requested in case the objections on file were maintained or further objections were raised.

IV. A summons to oral proceedings to be held on 24 April 2009 was issued on 27 January 2009. In an annex accompanying the summons the following documents were mentioned:

D1: US 4 003 032 A,
D2: US 3 747 074 A,
D3: US 5 657 347 A.

The board expressed the preliminary opinion that the subject-matter of the independent claim 1 did not

fulfill the requirements of Article 84 EPC 1973, Article 123(2) EPC, Article 83 EPC 1973 and was considered obvious in the light of the disclosure of D3 and the skilled person's common general knowledge as described in the application or in the light of a combination of the teachings of D1 and D3 (Article 56 EPC 1973). The board gave its reasons for these objections and why the appellant's arguments were not convincing.

The board stated that the appellant's request that the hearing begin "as close to 1.00pm as possible" therefore could not be met, because it did not appear that this hearing could safely be assumed to require only half a day. However, the board offered to delay the beginning by an hour if this would be helpful.

V. With two separate letters dated 19 March 2009 the appellant filed two amended sets of claims 1 to 9 as a new main request and a new first auxiliary request together with arguments that these requests both involved an inventive step.

VI. Independent claim 1 according to the main request reads as follows:

"1. A method of automatic baud detection and of setting an asynchronous received transmitter [sic] (207) to a programmable baud rate, the asynchronous receiver/transmitter (207) including:
a baud divisor register (200) for storing a baud divisor; and
a plurality of baud divisor replacement registers (202) for storing a plurality of programmable baud divisor

thresholds and a plurality of programmable baud divisor replacements, the method including the steps of:
comparing a determined baud divisor to the plurality of programmable baud divisor thresholds; and
resetting the baud divisor to the programmable baud divisor replacement of a selected one of the baud divisor replacement registers based on a comparison between the determined baud divisor and the programmable baud divisor threshold of the selected baud divisor replacement register;
characterized by determining a baud divisor dependent on a start bit size but independent of start bit size inaccuracies, and wherein the first character of the data stream is not predetermined".

Independent claim 1 according to the first auxiliary request reads as follows:

"1. A method of automatic baud detection and of setting an asynchronous receiver/transmitter (207) to a programmable baud rate, the asynchronous receiver/transmitter (207) including:
a baud divisor register (200) for storing a baud divisor; and
a plurality of baud divisor replacement registers (202) for storing a plurality of programmable baud divisor thresholds and a plurality of programmable baud divisor replacements, the method including the steps of:
comparing a determined baud divisor to the plurality of programmable baud divisor thresholds; and
resetting the baud divisor to the programmable baud divisor replacement of a selected one of the baud divisor replacement registers based on a comparison between the determined baud divisor and the

programmable baud divisor threshold of the selected baud divisor replacement register;
characterized in that the programmed value of said programmable baud divisor threshold of the selected baud divisor replacement register is dependent on system dependent parameters".

Independent claim 7 of both requests is directed to a corresponding receiver/transmitter.

VII. Oral proceedings were held on 24 April 2009 during the course of which the appellant filed amended independent claims 1 according to a second and third auxiliary request, and presented arguments in favour of an inventive step of the independent claims. The appellant requested that the decision under appeal be set aside and that a patent be granted in the basis of the main request or, subsidiarily, on the basis of the first auxiliary request, both requests filed by (separate) telefax letters on 20 March 2009, or, subsidiarily, on the basis of the second or third auxiliary requests, both filed during the oral proceedings before the board (with further amendments to the claims 2-9 and to the description in case of the second and third auxiliary request, as necessary).

VIII. Independent claim 1 according to the second auxiliary request reads as follows:

"1. A method of on-chip automatic baud detection and of setting an asynchronous received transmitter [sic] (207) to a programmable baud rate, the asynchronous receiver/transmitter (207) including:

a baud divisor register (200) for storing a baud divisor; and
a plurality of baud divisor replacement registers (202) for storing a plurality of programmable baud divisor thresholds and a plurality of programmable baud divisor replacements, the method including the steps of:
comparing a determined baud divisor to the plurality of programmable baud divisor thresholds; and
resetting the baud divisor to the programmable baud divisor replacement of a selected one of the baud divisor replacement registers based on a comparison between the determined baud divisor and the programmable baud divisor threshold of the selected baud divisor replacement register;
and then determining a baud divisor dependent on start bit size which is thereby independent of start bit size inaccuracies".

Independent claim 1 according to the third auxiliary request reads as follows:

"1. A method of on-chip automatic baud detection and of setting an asynchronous received transmitter [sic] (207) to a programmable baud rate, the asynchronous receiver/transmitter (207) including:
a baud divisor register (200) for storing a baud divisor; and
a plurality of baud divisor replacement registers (202) for storing a plurality of programmable baud divisor thresholds and a plurality of programmable baud divisor replacements, the method including the steps of:
comparing a determined baud divisor to the plurality of programmable baud divisor thresholds; and

resetting the baud divisor to the programmable baud divisor replacement of a selected one of the baud divisor replacement registers based on a comparison between the determined baud divisor and the programmable baud divisor threshold of the selected baud divisor replacement register;
and then determining a baud divisor dependent on a start bit size distorted by system dependent parameters".

IX. After deliberation the board announced its decision.

Reasons for the Decision

Main request

1. In the appeal proceedings independent claims 1 and 7 of the main request have been amended by introducing the additional feature that the first character of the data stream is not predetermined.

2. Article 123(2) EPC

The appellant has not identified any passage in the original application which explicitly discloses this feature. However the appellant argues that the fact that the determination of the baud divisor takes place immediately following the start bit of the first character, disclosed at least at p.7 l.20-21 and p.2 l.23-24 of the original application, necessarily means that the first character is not predetermined. The board does not agree. The first character could nevertheless be known or preset. Indeed, for a normal

signalling method as used in e.g. the 16550 UART mentioned in the application (see p. 3, l. 28), the size of the start bit can only be measured if the character received begins with a "1" bit. Otherwise there is no transition at the end of the start bit. Thus the first character must be predetermined to the extent that it can only belong to a subset of the full character set. The appellant accepts that the first two bits of a received signal must be predetermined but argues that this merely limits the first character; it does not mean the first character is predetermined (see letter dated 19 March 2009, p. 2, second paragraph of the main request). Be that as it may, this "limitation" illustrates that nothing in the application as filed precludes the possibility of the first character being predetermined. Thus, the subject-matter of independent claims 1 and 7, with the restriction that the first character of the data stream is not predetermined, does not fulfil the requirements of Article 123(2) EPC.

First auxiliary request

3. According to the introductory portion of the description of the present application, section "BACKGROUND ART" (see p. 1 and 2), it was known before the priority date to embed various communication features within a single chip, including an universal asynchronous receiver/transmitter UART, said UART having automatic baud detection (autobauding) based on automatically determining the baud rate from the length or size of a start bit of a data or character stream. In order to operate at a plurality of baud rates such as the standard baud rates in the industry (which have included 1200,2400,4800,9600,19.2K, 28.8K, 33.3K, 54K,

and 115K data transfer rates), the fixed clock rate is divided by a settable value, the "baud divisor", to produce the clock used for e.g. sampling the incoming signal at any particular baud rate (see p.2, l.4-5 of the application). In that it is settable, naturally the baud divisor is held in a register.

It was common ground during oral proceedings that a UART and such a method for automatic baud detection was known before the priority date. The board considers this to be an appropriate choice of prior art as a starting point for determining whether the claimed subject-matter involves an inventive step.

4. The underlying problem according to the present invention is that autobauding may be subject to significant inaccuracies when an incoming data stream is distorted. If a start bit of a data stream is susceptible to line distortions and noise, the length of the start bit may become shorter or longer. The altered size of the start bit, which constitutes a sampling error, is then used to determine a baud divisor which is not correct.

5. In the embodiment described in the present application the baud divisor is first determined on a preliminary basis by using a simple mathematical formula relating the fixed clock rate and the size of a (start) bit as measured in clock pulses (see application p.7 l.5-8 and p.5 l.1-3). However the baud rate is known in advance to be one of a particular set of values (e.g. 33.3K, 54K, 115K - see p. 1, l.20-21) and so the preliminary value of the baud divisor is replaced by the "best guess" value corresponding to one of the predetermined

baud rates, thus accounting for inaccuracies in the detected bit size or "decoupling" said inaccuracies from the baud rate. The choice of the replacement value is determined by comparing the preliminary calculated value with a number of thresholds.

Inventive Step - Article 56 EPC 1973

6. The subject-matter of claim 1 of this request therefore differs from the known method for automatic baud detection as described in the application (see section 3 above):

- in that the UART includes a plurality of baud divisor replacement registers for storing a plurality of programmable baud divisor thresholds and a plurality of programmable baud divisor replacements, and
- in comparing the determined baud divisor to the plurality of programmable baud divisor thresholds, and
- in resetting the baud divisor to the programmable baud divisor replacement of a selected one of the baud divisor replacement registers based on a comparison between the determined baud divisor and the programmable baud divisor threshold of the selected baud divisor replacement register; and
- in that the programmed value of said programmable baud divisor threshold of the selected baud divisor replacement register is dependent on system dependent parameters.

7. When interpreting the last feature of the subject-matter of claim 1, which was introduced by amendment

with the letter dated 19 March 2009, the board considers that in the light of the disclosure on p. 6, l. 33-35 referred to by the appellant it specifies that the thresholds, i.e. the ranges, and the replacement values may be adjusted according to the needs of the system. The parameters mentioned however include at least some which relate to the system design, such as HSUART frequencies and baud rates, so that this step may be done before the method of autobauding as such is carried out and, hence, is considered as a step preparing the system for carrying out the claimed method.

8. When looking for a solution of the objective technical problem of noise and line distortion (see section 4 above), the skilled person would look into pertinent prior art document D3, which discloses determining a data transmission rate from the start bit length of the first character of a received command of which data transmission rates are detectable by counting the number of pulses of a reference clock contained in the start bit (see figures 4 and 6; col. 11, l. 43-49 of D3). In D3 the problem of noise and line distortion is addressed (col. 15, l. 26). According to D3, if a low level pulse other than the actual start bit is entered due to extraneous noise, for instance, the transmission rate detector outputs a false count. For this reason it is required to provide a judgment circuit for checking whether a signal fed into the input of the transmission rate detector is certainly the data signal (D3, col. 15, l. 24-33). However the necessity for such a judgment circuit may be eliminated by providing flexible ranges of counts of the pulses of the reference clock (see D3,

col. 15, l. 34-54 and Table 4), i.e. ranges of sizes of the start bit, as an alternative solution.

According to D3 sampling clocks corresponding to all the predetermined baud rates are generated and one is selected rather than a baud divisor value being set for a clock dividing process. However the board considers this difference only a matter of design choice - in D3 the sampling clocks corresponding to the set of baud rates chosen can be conveniently generated by means of different outputs of a binary counter (see D3, col. 16, l. 49 to col. 17, l. 5). This difference would not deter the skilled person from applying the teaching of D3 to set a single baud rate for a range of sizes of start bit to the prior art as specified in the introduction to the application. As according to the application using a settable baud divisor was a matter of common general knowledge (see application p. 2, l. 1-5), it is regarded to be within the capabilities of the skilled person to replace the multiple outputs and selector of D3 by a settable baud divisor.

Furthermore, D3 discloses an automatic adjustment to a programmed baud rate compensating for an alteration of the start bit size because of line distortion or noise by providing a plurality of registers for storing a plurality of programmable counter thresholds (i.e. ranges) and a plurality of baud rate replacements (see D3, Table 4). This involves comparing the actual pulse count to the plurality of programmable thresholds (see D3, Table 4, left hand column), and resetting the baud rate to the replacement of a selected one of the baud rate replacement registers based on a comparison between the actual pulse count and the programmable

threshold of the selected baud rate replacement register (see D3, col. 15, l. 43-54 and col. 16, l. 54-55).

9. Thus, the solution according to the distinguishing features of claim 1 is considered obvious in the light of the teaching of D3 applied to the prior art as discussed in the application, and the subject-matter of claim 1 lacks an inventive step (Article 56 EPC 1973).

Second auxiliary request

10. Claim 1 of this request is distinguished from claim 1 of the preceding request in that it is directed to an "on-chip automatic baud detection" and in that the last feature has been replaced by "and then determining a baud divisor dependent on start bit size which is thereby independent of start bit size inaccuracies".

11. The term "and then" of the added feature is interpreted by the board as "thus" according to the intention to amend as indicated by the appellant during oral proceedings, because otherwise the order of steps would not make sense since the step of determining a baud divisor would take place only after comparing such a value to the divisor thresholds.

12. According to the analysis as described above (see section 3) it was known to determine a baud divisor dependent on the start bit size from the prior art as disclosed in the application.

13. When trying to solve the objective problem of line distortions and noise, the claimed feature that

determination of the baud divisor is dependent on a start bit size and is "thereby independent of start bit size inaccuracies" is considered not a limiting feature but rather an alleged effect of the claimed invention, as is implicitly acknowledged by the "thereby". This "feature" is therefore merely an effect of the rest of the features and does not have to be considered separately from the differences identified above.

14. Furthermore, it was known from the prior art as described in the application to integrate automatic baud detection on a single chip (see e.g. p. 1, l. 7-10). In the oral proceedings the appellant argued that the invention according to claim 1 related to on-chip communication, i.e. between parts of the chip. However, the board notes that the subject-matter of claim 1 is only directed to having all the components for autobauding integrated on a chip. Asynchronous communications normally take place between different chips, or indeed more usually between different systems. The components on a single chip normally share a single clock and, as a consequence, there is no need for synchronisation and autobauding in communications between the components.

15. The subject-matter of claim 1 of this request therefore differs from the prior art as described in the application in the same features as claim 1 of the first auxiliary request as presented in section 6 above except for the last feature which is no longer present. The subject-matter of claim 1 of this request is therefore considered obvious for the same reasons as set out for the first auxiliary request (see section 8 above).

16. The board does not agree with the appellant's point of view that, in the light of claim 1 being directed to an "on-chip automatic baud detection", the skilled person would not have looked into D3 because the disclosure referred to in this document does not deal with integrating communication functions in a chip, since the embodiment referred to in D3 deals only with a fax-to-fax transmission. Integration of systems into chips was a general trend in technology before the priority date of the application; this naturally involves starting from a known large scale technical solution and integrating the same principle into small scale chips.

Since D3 also addresses autobauding and determining a start bit size independent of start bit size inaccuracies (see D3, col. 11, l. 39-49 and col. 15, l. 19-43) the skilled person would have considered the teaching of D3 also when looking for a solution of the objective technical problem of line distortions and noise (D3, col. 15, l. 26) for an "on-chip automatic baud detection".

17. Thus, the subject-matter of claim 1 lacks an inventive step (Article 56 EPC 1973).

Third auxiliary request

18. The subject-matter of claim 1 of this request differs from that of claim 1 of the preceding request in that "which is thereby independent of start bit size inaccuracies" has been replaced by the start bit size being "distorted by system dependent parameters".

19. However, the board considers it inherent to every real line signal that such a signal including the start bit is affected by distortion which, of course depends on the design of the system. The added feature is therefore not considered part of the claimed technical solution to the objective technical problem, but rather an inherent phenomenon of the claimed subject-matter and part of the problem.

20. In addition, the fact that the start bit size is distorted by system dependent parameters was known from both the prior art as described in the application (see p. 2, l. 1-2 and l. 10-13 of the description; see also section 4 above) and prior art document D3 (see D3, col. 15, l. 26). The added feature therefore does not involve inventive activity.

21. Thus, the subject-matter of claim 1 of this request lacks an inventive step (Article 56 EPC 1973) for the same reasons as set out for the second auxiliary request.

22. Since none of the requests is allowable, the appeal has to be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar | The Chairman

K. Götz | D. H. Rees