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Datasheet for the decision of 12 July 2011

Case Number: T 1056/08 - 3.5.05

Application Number: 04751265.2

Publication Number: 1618712

IPC: H04L 25/02

Language of the proceedings: EN

Title of invention:
Signal isolators using micro-transformers

Applicant:
Analog Devices, Inc.

Headword:
Digital signal isolator with single coil transformer/ANALOG DEVICES

Relevant legal provisions:
EPC Art. 56, 106, 107, 108, 114(1)

Keyword:
"Inventive step - no (sole request)"

Decisions cited:
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Catchword:
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Case Number: T 1056/08 - 3.5.05

D E C I S I O N
of the Technical Board of Appeal 3.5.05
of 12 July 2011

Appellant: Analog Devices, Inc.
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 30 January 2008 refusing European patent application No. 04751265.2 pursuant to Article 97(1) EPC 1973.**

Composition of the Board:

Chairman: A. Ritzka
Members: M. Höhn
F. Blumer

Summary of Facts and Submissions

I. This appeal is against the decision of the examining division, dispatched on 30 January 2008, refusing European patent application No. 04751265.2 for lack of inventive step (Article 56 EPC) having regard to the disclosure of

D1: US 5701037 A1 and
D2: EP 0307345 A1.

II. The notice of appeal was received on 28 March 2008. The appeal fee was paid on the same day. The statement setting out the grounds of appeal was received on 19 May 2008. The appellant requested that the appealed decision be set aside and that a patent be granted on the basis of the set of claims on which the decision under appeal was based, i.e. claims 1 to 15 as filed on 3 November 2007 incorporating the amendment requested by fax received on 30 November 2007.

III. A summons to oral proceedings to be held on 12 July 2011 was issued on 2 May 2011. In an annex accompanying the summons the board expressed the preliminary opinion that the subject-matter of independent claim 1 did not fulfil the requirements of Article 56 EPC in view of the prior art on file, i.e. D1 and D2 as well as

D3: US 5825259 A1,
D6: WO 02/073914 A1,
D7: EP 0917309 A2 and
D8: US 2003/0042571 A1.

Prior-art publication D8 was introduced into the proceedings by the board of its own motion in accordance with Article 114(1) EPC.

The board gave its reasons for the objection and stated that the appellant's arguments were not convincing.

IV. With a letter dated 8 June 2011 the appellant submitted two additional sets of claims 1 to 15 according to a first and a second auxiliary request, together with arguments that these claims fulfilled the requirements of Article 56 EPC.

V. Oral proceedings were held on 12 July 2011 during the course of which the appellant presented an amended independent claim 1.

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

VII. "1. A logic signal isolator system (200) comprising:
a micro-transformer (210) arranged in, partially in or on a semiconductor substrate and having a non-magnetic core, a primary winding (210A) and a secondary winding (210B)
a transmitter circuit (202) which drives said primary winding (210A) in response to a received logic signal, the primary winding and the transmitter being referenced to a first ground; and
a receiver circuit (250) coupled to the secondary winding (210B), the secondary winding having a [sic] two terminals, a first terminal being referenced to a second ground which is galvanically isolated from the first ground and a second terminal of said secondary

winding (210B) supplying to said receiver circuit (250) signals received in correspondence to the signals provided to the primary winding (210A), characterised in that:
the primary winding (210A) is referenced to the first ground at a first terminal thereof,
the transmitter circuit drives a second terminal of the primary winding,
the transmitter is arranged to generate in response to a first type of edge in the logic signal a signal of a first predetermined type, and in response to a second type of edge in the logic signal, a signal of a second predetermined type, wherein both the signal of the first predetermined type and the signal of the second predetermined type are distinguishable from each other and wherein the signals of the first type comprise multiple pulses in a predetermined pattern and the signals of the second type comprise one or more pulses in a different pattern, or the signals of the first type comprise pulses of a first duration and the signals of the second type comprise pulses of a second, distinguishable duration, and the signals are supplied to the second terminal of the primary winding (210A) and are of the same polarity, the receiver (250) comprising digital circuits responsive to distinguishable signals of the same polarity at the output of the secondary winding so as to reconstruct the received logic signal from the received signals."

VIII. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of claim 1 as filed during the oral proceedings before the board and claims 5-10 of the first auxiliary

request as filed with letter dated 8 June 2011. The appellant withdrew the further previous requests.

IX. After due deliberation the board announced its decision.

Reasons for the Decision

1. Admissibility

The appeal complies with the provisions of Articles 106 to 108 EPC (see Facts and Submissions, item II above). The appeal is therefore admissible.

2. Inventive step - Article 56 EPC

With the amendments made to independent claim 1 the focus of the claimed subject-matter has been shifted to digital signal isolation. Taking this into consideration, in the board's view D8 is to be regarded as the closest prior art since it also addresses a logic signal isolator system (see e.g. D8, paragraph [0042], first line and following paragraphs).

2.1 D8 discloses the use of a transformer without a magnetic core and which is regarded as a "micro-transformer" in the sense of the definition given on page 9, lines 16 to 18 of the published application. This transformer is arranged in or on a semiconductor substrate and comprises a primary and a secondary winding (see D8, figures 8 and 11 to 19). D8 shows a transmitter circuit connected to a first ground for driving the first winding of the transformer and a receiver circuit coupled to the secondary winding, the

secondary winding having two terminals of which one is connected to a second ground which is galvanically isolated from the first ground (see e.g. figures 1 and 8; paragraph [0040] of D8). The transformer generates two distinguishable types of signals DRIVEA and DRIVEB, one representing, i.e. coding, the rising edge of the digital signal to be transmitted, the other the falling edge (see e.g. paragraphs [0042] to [0046]). Signals DRIVEA and DRIVEB are distinguishable from each other as they appear on different lines and are of the same polarity (see figures 2 and 4 of D8). The receiver circuit comprises digital circuits (see e.g. figure 10 of D8) responsive to distinguishable signals at the output of the secondary winding so as to reconstruct the received digital signal from the received signals.

2.2 D8 discloses as a special embodiment the use of a signal isolator with a single transformer in which the primary winding is driven by the transmitter circuit and the secondary winding is used by the receiver circuit (see paragraphs [0046] and [0061] as well as figures 11 and 13 to 19). D8 suggests as "one satisfactory approach" (see paragraph [0046], line 4 onwards) that the DRIVEA and DRIVEB signals are applied to the opposite ends of the primary winding. D8 suggests various options for the receiver. According to one option, one end of the secondary winding is grounded and only the other end of the secondary winding is connected to the receiver circuit.

2.3 The subject-matter of claim 1 therefore differs from the disclosure of D8 in that one terminal of the primary winding is grounded to the first ground and in that the distinguishable signals generated by the

transmitter circuit are supplied to the second terminal of the primary winding, and in that the signals of the first type comprise multiple pulses in a predetermined pattern and the signals of the second type comprise one or more pulses in a different pattern, or the signals of the first type comprise pulses of a first duration and the signals of the second type comprise pulses of a second distinguishable duration.

The underlying objective technical problem can therefore be considered to be an alternative implementation of the transmitter side, i.e. as an alternative to the "one satisfactory approach" (see paragraph [0046], lines 4 and 5) of applying the DRIVEA and DRIVEB signals to the opposite ends of the primary winding of the transformer.

2.4 As it is common general knowledge that any primary winding has two opposite ends, the teaching of D8 that "one satisfactory approach may be to apply the DRIVEA and DRIVEB signals [,…,] to the opposite ends of the primary winding" (see paragraph [0046]) implies using only one terminal for driving the transformer with the distinguishable signals DRIVEA and DRIVEB, whereby the other terminal has to be grounded in order to drive the primary winding. In addition, the skilled person is motivated to do so in the light of the explicit teaching to connect the receiver circuit in the same manner (see last sentence of paragraph [0046]). Since D8 foresees separate grounds for the transmitter and the receiver, the skilled person would keep the first ground for the transmitter side, i.e. the primary winding.

2.5 Since the two terminals of the primary winding can no longer be used for distinguishing the signals DRIVEA and DRIVEB, the skilled person would understand that the distinguishable signals representing the rising and falling edges of the digital signal to be transmitted would have to be coded in a different way. The skilled reader of D8 is explicitly motivated when dealing with single transformer implementations to bring the distinguishable signals "into a format suitable for driving the primary winding of the transformer" (see paragraph [0061] of D8). This is a general coding problem which arises whenever the rising edge and falling edge of digital signals have to be transmitted using signals of the same polarity. The skilled person in the field of digital signal transmission knows from his general knowledge several coding schemes suitable for coding the rising edge and the falling edge of digital signals. In the digital field it was well known before the priority date of the present application to vary either the number of pulses or the duration of a pulse, since the amplitude cannot be varied in the digital environment. The board considers this to be basic knowledge in the field of digital signal transmission.

The same coding problem exists, for example, in the neighbouring field of optical signal isolators, as mentioned in the introductory portion of the present application and the knowledge of which the skilled person would consider when having a general coding problem to solve. In order to exemplify this common general knowledge, the appellant's attention is drawn to D7 which discloses converting the digital data signal from the terminal device to a series of optical

pulses, wherein a pair of optical pulses represents a rising edge of the digital data signal from the electronic device, while a single pulse represents the falling edge of the data signal (see abstract and figure 3 of D7). D7 further suggests that the double and single pulses are recognised by the receiver, and the digital data signal is reconstructed therefrom. Hence, D7 discloses the coding scheme according to the first alternative of the distinguishing feature that the signals of the first type comprise multiple pulses in a predetermined pattern and the signals of the second type comprise one or more pulses in a different pattern. The board does not see any technical hurdle or prejudice which the skilled person would have had to overcome when applying this basic knowledge in the coding of digital data to the single transformer digital signal isolator as suggested in paragraph [0046] of D8.

3. The appellant counter-argued that the skilled person, when trying to come up with an alternative solution to the objective technical problem, would rather end up with a circuit according to D2, which disclosed a single transformer solution with one terminal of the primary winding being referenced to ground and the other terminal being driven by the transmitter (see figure 1).

The board does not share this point of view, because the signal isolator as shown in figure 1 of D2 is not a digital signal isolator, as admitted by the appellant's representative during oral proceedings. However, the subject-matter of claim 1 is directed to a digital signal isolator. In addition, the skilled person would

not consider figure 1 of D2 as a possible solution to the objective technical problem, because according to the circuit shown in D2 the receiver side of the transformer, i.e. the secondary winding, is not grounded. This is in contrast to the closest prior art according to the embodiment described in paragraph [0046] of D8. The skilled person looking for a solution for the transmitter side according to the objective problem would try to avoid redesigning the receiver side because of the additional effort involved.
The appellant's argument therefore does not convince the board.

4. The board therefore judges that the solution of the objective problem according to independent claim 1 of the sole request is obvious with regard to the disclosure of D8 combined with the skilled person's common general knowledge as exemplified by the disclosure of D7.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar The Chair

K. Götz A. Ritzka