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**Datasheet for the decision  
of 12 January 2022**

**Case Number:** T 0885/17 - 3.5.05

**Application Number:** 09802251.0

**Publication Number:** 2380086

**IPC:** G06F13/40

**Language of the proceedings:** EN

**Title of invention:**

GENERIC BUFFER CIRCUITS AND METHODS FOR OUT OF BAND SIGNALING

**Applicant:**

Xilinx, Inc.

**Headword:**

Out of band signalling / Xilinx

**Relevant legal provisions:**

EPC Art. 123(2), 84  
RPBA 2020 Art. 13(1), 13(2)

**Keyword:**

Amendments - extension beyond the content of the application  
as filed (yes)  
Claims - clarity (no)  
Amendment after summons - 6th auxiliary request - exceptional  
circumstances (no) - taken into account (no)



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Case Number: T 0885/17 - 3.5.05

**D E C I S I O N**  
**of Technical Board of Appeal 3.5.05**  
**of 12 January 2022**

**Appellant:** Xilinx, Inc.  
(Applicant) 2100 Logic Drive  
San Jose, California 95124 (US)

**Representative:** Gibbs, Richard  
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**Decision under appeal:** **Decision of the Examining Division of the  
European Patent Office posted on 13 October 2016  
refusing European patent application No.  
09802251.0 pursuant to Article 97(2) EPC.**

**Composition of the Board:**

**Chair** A. Ritzka  
**Members:** N. H. Uhlmann  
F. Blumer

## Summary of Facts and Submissions

- I. The appellant appealed against the examining division's decision refusing the European patent application in suit.
- II. The examining division decided that the independent claims of the main request and the first to third auxiliary requests did not meet the requirements of Article 84 EPC. Furthermore, it decided that the fourth auxiliary request did not satisfy the requirements of Article 123(2) EPC. In an *obiter dictum* section, it held that the subject-matter of claim 1 of the main request and the first to third auxiliary requests did not involve an inventive step.
- III. The examining division made reference to the following documents:
- |    |                |
|----|----------------|
| D1 | US 2003/158991 |
| D2 | WO 2006/054226 |
| D3 | EP 1 132 827   |
| D4 | US 5 325 355   |
- IV. With the statement setting out the grounds of appeal, the appellant maintained the main request and the first to third auxiliary requests considered in the contested decision.
- V. The board summoned the appellant to oral proceedings.
- In a communication under Article 15(1) RPBA 2020, the board set out its provisional opinion on the case.
- VI. With a letter dated 18 December 2021, the appellant submitted fourth and fifth auxiliary requests.

VII. The appellant submitted a sixth auxiliary request during the oral proceedings before the board on 12 January 2022.

VIII. The appellant's final requests were that the decision under appeal be set aside and that a patent be granted on the basis of one of the following claim requests:

- main request and first, second and third auxiliary requests, all as filed with the statement setting out the grounds of appeal
- fourth and fifth auxiliary requests, both filed by letter dated 18 December 2021
- sixth auxiliary request, filed by email during the oral proceedings before the board on 12 January 2022

IX. Claim 1 of the main request reads as follows:

"An apparatus, comprising:

a differential signal interface for coupling a differential signal at a first frequency on a pair of opposite polarity signals (INN,IPP);

a differential signal receiver (11) coupled to the differential signal interface and outputting received data signals;

a first general purpose input buffer (13) for receiving an out of band signal at a second frequency lower than the first frequency, coupled to a first one (IPP) of the pair of opposite polarity signals (INN,IPP), and for receiving a reference voltage ( $V_{ref}$ ) which is different from a common mode voltage of the differential signal receiver (11), the first general purpose input buffer (13) having a first out of band signal output;

a second general purpose (15) input buffer for receiving the out of band signal at the second frequency, coupled to a second one (INN) of the pair of opposite polarity signals (INN,IPP), and for receiving the reference voltage ( $V_{ref}$ ), the second general purpose input buffer (15) having a second out of band signal output;

wherein the reference voltage ( $V_{ref}$ ) determines a threshold voltage for a differential voltage that indicates an out of band signal; and

wherein the out of band signal is received on the differential signal interface having a first tap point for extraction of a first out of band signal having a first voltage level and having a second tap point for extraction of a second out of band signal having a second voltage level, and the differential voltage of the first voltage level and the second voltage level of the pair of opposite polarity signals (INN,IPP) during out of band signalling is below the threshold voltage."

X. Claim 1 of the first auxiliary request is based on claim 1 of the main request and includes the following additional wording:

"a first termination network (T1) coupled to the first general purpose input buffer (13), wherein the first termination network (T1) allows for an attenuation of a first out of band signal;"

"a second termination network (T2) coupled to the second general purpose input buffer (15), wherein the second termination network (T2) allows for an attenuation of a second out of band signal;"

The last "wherein" clause is worded as follows:

"wherein the out of band signal is received on the differential signal interface having a first tap point for extraction of a first out of band signal having a first voltage level and having a second tap point for extraction of a second out of band signal having a second voltage level, and the differential voltage of the first voltage level and the second voltage level of the pair of opposite polarity signals (INN,IPP) during out of band signalling is below the threshold voltage."

XI. Claim 1 of the second auxiliary request is based on claim 1 of the first auxiliary request. The definitions of the termination networks read:

"a first termination network (T1) coupled to the first general purpose input buffer (13) and a first general purpose output buffer (14 );"

"a second termination network (T2) coupled to the second general purpose input buffer (15) and a second general purpose output buffer (12);"

XII. Claim 1 of the third auxiliary request is based on claim 1 of the second auxiliary request and includes the following further clause:

"wherein the first termination network allows for an attenuation of the first out of band signal and the second termination network allows for an attenuation of the second out of band signal"

XIII. Claim 1 of the fourth auxiliary request reads as follows:

"An apparatus, comprising:

a differential signal interface for coupling a differential signal at a first frequency on a pair of opposite polarity signals (INN,IPP);

a differential signal receiver (11) coupled to the differential signal interface and outputting received data signals;

a first general purpose input buffer (13) for receiving an out of band signal at a second frequency lower than the first frequency, coupled to a first one (IPP) of the pair of opposite polarity signals (INN,IPP), and for receiving a reference voltage ( $V_{ref}$ ) which is different from a common mode voltage of the differential signal receiver (11), the first general purpose input buffer (13) having a first out of band signal output;

a first termination network (T1) coupled to the first general purpose input buffer (13),

wherein the first termination network (T1) couples the first one (IPP) of the pair of opposite polarity (INN,IPP) signals to a first input (+) of the differential signal receiver (11), and has a first tap point for coupling the first general purpose input buffer (13) to the first one (IPP) of the pair of opposite polarity signals (INN,IPP);

a second general purpose (15) input buffer for receiving the out of band signal at the second frequency, coupled to a second one (INN) of the pair of opposite polarity signals (INN,IPP), and for receiving the reference voltage ( $V_{ref}$ ), the second general purpose input buffer (15) having a second out of band signal output;

a second termination network (T2) coupled to the second general purpose input buffer (15):

wherein the second termination network (T2) couples the second one (INN) of the pair of opposite polarity signals (INN,IPP) to a second input (-) of the

differential signal receiver (11), and has a second tap point for coupling the second general purpose input buffer (15) to the second one (INN) of the pair of opposite polarity signals (INN,IPP); wherein the reference voltage ( $V_{ref}$ ) determines a threshold voltage for a differential voltage that indicates an out of band signal; and

wherein the out of band signal is received on the differential signal interface having the first tap point and the second tap point for extraction of the out of band signal, and the differential voltage of the pair of opposite polarity signals (INN,IPP) during out of band signalling is below the threshold voltage; and

wherein the first and second termination networks provide transmission line termination, which allows attenuation of the differential signal and a reduction of the common mode voltage."

XIV. Claim 1 of the fifth auxiliary request is based on claim 1 of the fourth auxiliary request. The definitions of the termination networks read:

"a first termination network (T1) coupled to the first general purpose input buffer (13) and a first general purpose output buffer (14)"

"a second termination network (T2) coupled to the second general purpose input buffer (15) and a second general purpose output buffer (12)"

Claim 1 includes the following further clauses:

"wherein the first general purpose output buffer is coupled to the first one (IPP) of the pair of differential signals (INN,IPP) by the first termination network for transmitting the out of band signal at the second frequency"



"wherein the second general purpose output buffer (12) is coupled to the second one (INN) of the pair of differential signals (INN,IPP) by the second termination network for transmitting the out of band signal at the second frequency"

- XV. Claim 1 of the sixth auxiliary request is based on claim 1 of the fourth auxiliary request. The wording "opposite polarity signals (INN,IPP)" in the definitions of the differential-signal interface and of the first and second general-purpose buffers has been replaced with "normally opposite polarity signals (INN,IPP)".

The following wording has been added to the penultimate "wherein" clause:

"such that the first out of band signal output (OOBIPP) from the first general purpose input buffer (13) and the second out of band signal output (OOBINN) from the second general purpose input buffer (15) have the same voltage"

### **Reasons for the Decision**

1. The application in hand pertains to a method and an apparatus for receiving and transmitting out-of-band signals over a high-speed differential signalling interface having two lines. Serial data is transmitted using signals of opposite polarity. By way of example, the first of the two differential signals being positive and the second being negative might represent a logical "0" while the opposite case may represent a logical "1". Additionally, out-of-band data may be transmitted using the same voltage on both lines of the differential signalling interface. Out-of-band signals

are defined as signals with a differential voltage below a reference voltage  $V_{ref}$ .

### **Main request**

#### 2. Amendments

The amendments to the independent claims introduce added matter, contrary to the requirements of Article 123(2) EPC. Hence, the main request is not allowable.

#### 2.1 Claims 1 and 14 refer to a first and a second tap point. This feature is based on page 13, lines 21 to 24 of the description and Figure 5, items T1 and T2.

However, these passages clearly teach the following.

- (a) Termination networks (T networks T1 and T2) provide these tap points.
- (b) The tap points are connected to the respective input buffers 13 and 15.
- (c) The tap points are connected, via the termination networks, to the respective opposite-polarity signals IPP and INN.

There is no basis for adding the tap points to the independent claims without these features.

#### 2.2 The appellant argued that features (a) to (c) were not inextricably linked to the first and second tap points, referring to Figures 5 and 7 to 9, page 16, lines 10 to 20, and pages 12 and 13. It submitted further that in view of these passages the resistors and the termination networks were not always needed.

The board disagrees. First, the tap points are disclosed only in the passages referred to in point 2.1 above. Second, Figure 9 and page 16, lines 10 to 20 teach that the termination networks and the resistors may be eliminated. However, page 13, line 22 discloses

that the termination networks **provide** the tap points. Consequently, eliminating the termination networks would eliminate the claimed tap points.

### **First to third auxiliary requests**

#### 3. Amendments

The board holds that amended claim 1 does not meet the requirements of Article 123(2) EPC. Thus, these auxiliary requests are not allowable.

3.1 Claim 1 refers to a first and a second termination network. However, claim 1 does not set out any functional interrelationship between the tap points and the termination networks. Consequently, the arguments with regard to the main request (point 2. above) apply similarly.

3.2 The appellant did not submit any arguments in this regard specifically for the first to third auxiliary requests.

### **Fourth auxiliary request**

#### 4. Admission

This request addresses - and overcomes - the added-matter objections raised for the first time in the board's preliminary opinion under Article 15(1) RPBA 2020. Consequently, the board decided to admit it under Article 13(1) and (2) RPBA 2020.

#### 5. Amendments

The claims as amended meet the requirements of Article 123(2) EPC.

#### 6. Clarity

Claim 1 does not meet the requirements of Article 84 EPC.

- 6.1 The application in suit and the claimed apparatus deal with out-of-band signals.
- 6.2 According to claim 1 (page 21, lines 2 to 4 and 7 and 8), an out-of-band signal is present when the differential voltage is below a threshold voltage.
- 6.3 The differential voltage is the difference between the two opposite-polarity signals, i.e. IPP - INN. This difference must be below the threshold voltage for an out-of-band signal to be present (clean version of claim 1, page 21, lines 2 to 4 and 7 and 8).
- 6.4 The claimed first and second general-purpose input buffers receive the reference voltage, which determines the threshold voltage. However, none of them receives both opposite-polarity signals INN and IPP. Consequently, none of the buffers is able to ascertain if the differential voltage is below the threshold voltage and thus find out if an out-of-band signal is present. Instead, a buffer could at most compare the INN signal with the reference voltage, for example. According to claim 1, page 21, lines 2 to 4 and 7 and 8, however, the threshold voltage plays a role with regard to the differential voltage, not with regard to the INN (or IPP) signal. None of the further components of the claimed apparatus is able to ascertain if the differential voltage is below the threshold voltage either.
- 6.5 Claim 1 refers to the differential voltage of the pair of opposite-polarity signals (page 21, lines 7 and 8). However, the claimed apparatus does not comprise any components which deal with this differential voltage.
- 6.6 For these reasons, the technical significance of the differential voltage and the reference voltage in claim 1 is not clear.

6.7 In the statement of grounds of appeal, the appellant submitted that the input buffers received the out-of-band signals during out-of-band signalling but did not respond to the high-frequency multi-gigabit signalling.

The board is not persuaded. According to claim 1, the general-purpose input buffers are coupled to the opposite-polarity signals INN, IPP. These claimed general-purpose buffers do not exhibit any frequency-dependent properties. Furthermore, in its letter dated 6 August 2014, page 2, fourth paragraph, the appellant stated that "there is no teaching that the detection of out of band signals is based upon the frequency of the out of band signals".

6.8 The appellant argued that the differential voltage being below the threshold set by the  $V_{ref}$  during out-of-band signalling was used to trigger the out-of-band data recovery by the input buffers.

However, as explained above, none of the claimed components is able to deal with the differential voltage. Hence, it is not clear how this trigger would come about.

6.9 The appellant submitted that if the signal output (e.g. a series of transitions between a high and low level as depicted in Figure 5) from the first buffer was the same or nearly the same as the signal output from the second buffer, then this indicated out-of-band signalling.

This argument is not convincing. None of the components of the claimed apparatus is able to determine if the output of the first buffer is the same as the output of the second buffer.

6.10 The appellant argued further that the differential voltage did not need to be "calculated" to put the

invention into effect. All that needed to be ascertained was that both signals of the differential signal inputs INN and IPP were, for example, both above or both below the threshold level.

The board is not persuaded. Out-of-band signals are defined in claim 1 by reference to the threshold voltage. The fact that claim 1 does not include any components for ascertaining if the differential voltage is below the threshold voltage is at the core of the clarity problems.

Even if, for the sake of argument, it were sufficient to ascertain that **both** signals of the differential signal are above the threshold, the claimed apparatus does not comprise any means for doing so.

6.11 The appellant pointed to page 2, lines 15 to 18, page 8, lines 24 to 27 and page 14, lines 13 to 17 of the description. However, these passages merely specify the condition when an out-of-band signal is present (see point 6.3 above).

6.12 For these reasons, claim 1 does not meet the requirements of Article 84 EPC. Consequently, the fourth auxiliary request is not allowable.

#### **Fifth auxiliary request**

##### 7. Admission

This request addresses - and overcomes - the added-matter objections raised for the first time in the board's preliminary opinion under Article 15(1) RPBA 2020. Consequently, the board decided to admit it under Article 13(1) and (2) RPBA 2020.

##### 8. Amendments

The claims as amended meet the requirements of Article 123(2) EPC.

9. Clarity

Claim 1 does not meet the requirements of Article 84 EPC for the same reasons as given for the fourth auxiliary request (point 6. above).

The appellant did not submit any further arguments for this auxiliary request.

Consequently, the fifth auxiliary request is not allowable.

**Sixth auxiliary request**

10. Admission

10.1 The sixth auxiliary request was submitted late in the course of the oral proceedings before the board. Claim 1 includes amendments stemming from the description.

10.2 The appellant argued that the late submission was triggered by a new argument raised by the board, namely that an essential feature was missing in claim 1. Furthermore, the appellant submitted that it had realised that the differential voltage was a key feature of the invention.

10.3 The board holds that no exceptional circumstances are apparent. The clarity problems relating to the differential voltage were the main reason for refusing the application (sections 12 and 14.1 of the decision under appeal). This finding in the impugned decision was confirmed by the board in its preliminary opinion under Article 15(1) RPBA 2020. The board provided more detailed explanations in this regard but did not raise any new clarity objection.

10.4 Furthermore, the amendments to claim 1 of the sixth auxiliary request do not, *prima facie*, overcome the clarity objections raised with regard to claim 1 of the

fourth auxiliary request. In particular, the added "such that" clause does not resolve the clarity issues at least for the reasons set out in point 6.9 above.

10.5 For these reasons, the sixth auxiliary request is not taken into account, under Article 13(1) and (2) RPBA 2020.

11. Conclusion

Since there is no allowable request, the appeal must be dismissed.

## Order

### **For these reasons it is decided that:**

The appeal is dismissed.

The Registrar:

The Chair:



K. Götz-Wein

A. Ritzka

Decision electronically authenticated