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**Datasheet for the decision
of 20 November 2012**

Case Number: T 2406/09 - 3.4.01

Application Number: 04795430.0

Publication Number: 1678780

IPC: H01P 1/10, H01P 1/18

Language of the proceedings: EN

Title of invention:
Ferroelectric varactors suitable for capacitive shunt

Applicant:
UNIVERSITY OF DAYTON

Headword:
-

Relevant legal provisions:
EPC Art. 123(2)

Keyword:
"Added subject-matter (yes, both requests)"

Decisions cited:
-

Catchword:
-



Case Number: T 2406/09 - 3.4.01

D E C I S I O N
of the Technical Board of Appeal 3.4.01
of 20 November 2012

Appellant: UNIVERSITY OF DAYTON
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 16 July 2009
refusing European patent application
No. 04795430.0 pursuant to Article 97(2) EPC.

Composition of the Board:

Chairman: G. Assi
Members: H. Wolfrum
J. Geschwind

Summary of Facts and Submissions

- I. European patent application 04 795 430.0 (publication No. EP 1 678 780) was refused by a decision of the examining division dispatched on 16 July 2009 for the reason of lack of inventive step (Articles 52(1) and 56 EPC 1973) of the subject-matter of a main request and an auxiliary request then on file.
- II. The applicant lodged an appeal against the decision on 21 September 2009. The prescribed appeal fee was paid on the same day. A statement of grounds of appeal was filed on 11 November 2009.

The appellant requested that the decision be set aside and a patent be granted on the basis of the requests on which the contested decision is based, ie with respective sets of claims 1 to 26 filed as a main request and an auxiliary request with a letter dated 5 March 2009.

Furthermore, an auxiliary request for oral proceedings was made.

- III. On 31 May 2012 the appellant was summoned to oral proceedings to take place on 20 November 2012.

In a communication pursuant to Article 15(1) RPBA annexed to the summons to oral proceedings the Board pointed *inter alia* to problems of added subject-matter (Article 123(2) EPC) in the amendments made to the two requests on file.

- IV. The appellant did not comment on the Board's observations nor did it file any further amendments. Instead, the appellant informed the Board by letter of 18 October 2012 that the applicant would not be represented at the forthcoming oral proceedings. Moreover, the appellant requested that a decision be issued based on the arguments already submitted.
- V. Oral proceedings were held on 20 November 2012 in the absence of the appellant.
- VI. Independent claims 1 and 25 of the appellant's main request read as follows :

"1. A varactor shunt switch for microwave applications, the varactor shunt switch being switchable between an ON state and an OFF state and comprising:

- a high resistivity silicon layer (40);*
- a silicon oxide layer (35) on said high resistivity silicon layer (40);*
- a metallic layer (25) on said silicon oxide layer (35);*
- a tunable ferroelectric thin-film dielectric layer (20) on said metallic layer (25);*
- a top metal electrode (15) on said tunable ferroelectric thin-film dielectric layer (20), wherein said top metal electrode (15) defines a coplanar waveguide transmission line (10);*

characterized in that:

- the varactor shunt further comprises an adhesion layer (30) on said silicon oxide layer (25); and*
- said tunable ferroelectric thin-film dielectric layer (20) has a dielectric constant of greater or*

equal to about 200 at 10V dc bias in the ON state, a dielectric constant of 1200 at zero bias in the OFF state, and a thickness of about 400 nm."

"25. A method of fabricating a varactor shunt switch, wherein the varactor shunt switch is switchable between an ON state and an OFF state, the method comprising:

depositing an adhesion layer (30) on a high resistivity silicon substrate (40) by electron-beam deposition and lift-off photolithography;

depositing a metallic layer (25) on said adhesion layer (30) by sputtering and lift-off photolithography;

covering said metallic layer (25) with a layer of ferroelectric thin film (20) by RF sputtering, wherein said metallic layer (25) comprises at least two ground conductors and a shunt conductor;

topping said layer of ferroelectric thin film (20) with a top metal electrode (15) by sputtering and lift-off photolithography, wherein said top metal electrode (15) comprises at least two ground conductors (110) and a center conductor (100); and

capping said top metal electrode (15) with a coplanar waveguide transmission line (10) comprised of at least two ground conductors and a signal strip;

wherein said layer of ferroelectric thin-film (20) has a dielectric constant of greater or equal to about 200 at 10V dc bias in the ON state, a dielectric constant of 1200 at zero bias in the OFF state, and a thickness of about 400 nm."

Claims 1 to 24 and 26 are dependent claims.

Independent claims 1 and 25 of the auxiliary request differ from the corresponding claims of the main

request in that the expression "*greater or equal to about*" has been deleted from the respective last feature.

Reasons for the Decision

1. The appeal complies with the requirements of Articles 106 to 108 and Rule 99 EPC and is, therefore, admissible.
2. Amendments (Article 123(2) EPC)

In its observations annexed to the summons to oral proceedings, the Board expressed doubts as to a proper basis of disclosure for amendments made to the independent claims of each of the requests on file.

Given the fact that appellant did not comment on the Board's observations, the Board sees no reason to judge the matter differently.

2.1 Main request

Claim 1 of the main request on file is based on originally-filed claim 4, the wording of which was clarified and to which a number of parameters specifying the tunable ferroelectric thin-film dielectric layer were added.

- 2.1.1 The result of this amendment is a compilation of features which have been randomly picked from dispersed parts of the originally-filed application documents.

A layer thickness of 400 nm is indicated on page 5, line 21, and page 6, line 1, of the original description in the context of an example of a specific multi-layer switch structure, comprising for instance a ferroelectric thin film layer of a specific material (barium strontium titanium oxide) on top of a metallic layer of a specific material (platinum/gold) and of a specific thickness (500 nm), which metallic layer is deposited in turn on an adhesion layer of a specific material (titanium) and of a specific thickness (20 nm). This context is not preserved by claim 1 on file and there is no piece of information in the application documents as originally filed which would justify the claimed intermediate generalisation.

2.1.2 Moreover, there is no information present in the originally-filed application documents which correlates the claimed value of 400 nm for the thickness of the ferroelectric thin film with the claimed values (1200 and 200) of the dielectric constant.

These values can be found on page 9, lines 24 to 26, where they are referred to as "simulated optimized" values, however without any indication as to the associated dc bias in the OFF and ON state. A value of 10 V for the dc bias in the ON state is as such mentioned on page 10, lines 1 to 6, however for measurements, for which in turn no values of the dielectric constant are disclosed. That these measurements must have been made for values of the dielectric constant other than the "simulated optimized" values is immediately apparent from the fact that the dielectric tunability for the latter is 6 : 1,

instead of a tunability of 3.4 : 1 as reported for the measurements.

2.1.3 The above deficiencies apply with equal force to the subject-matter of claim 25 of the main request on file.

2.2 Auxiliary request

Claims 1 and 25 of the auxiliary request differ from respective claims 1 and 25 of the main request only in the deletion of the expression "*greater or equal to about*" which precedes in the independent claims of the main request the claimed value of the dielectric constant of 200 at 10V dc bias in the ON state.

This amendment does not remove the deficiencies of added subject-matter that are identified above for the main request.

2.3 For the above reasons, the Board has come to the conclusion that the appellant's requests on file do not comply with the requirement of Article 123(2) EPC.

The appellant's requests are therefore not allowable.

3. Although having been informed about the above deficiencies, the appellant did not present any further comments nor propose further amendment.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar

The Chairman

R. Schumacher

G. Assi