



UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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*Ex parte* HYEON-SEAG KIM

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Appeal 2007-3980  
Application 10/382,560  
Technology Center 2800

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Decided: May 29, 2008

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Before MICHAEL R. FLEMING, *Chief Administrative Patent Judge*,  
KENNETH W. HAIRSTON, ALLEN R. MACDONALD, LINDA E.  
HORNER, and SCOTT R. BOALICK, *Administrative Patent Judges*.

MACDONALD, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF CASE

*Introduction*

Appellant appeals under 35 U.S.C. § 134 from a final rejection of claims 1, 3, 5, 7-9, 11, 13, and 21. We have jurisdiction under 35 U.S.C. § 6(b).

According to Appellant, the invention relates to interconnect structures in semiconductor devices. (Spec. 1:6-7).

*Exemplary Claim*

Exemplary independent claim 1 under appeal reads as follows:

Claim 1: An interconnect structure comprising:

- a) a top interconnect metal layer;
- b) at least one via electrically connected to said top interconnect metal layer;
- c) a bottom interconnect metal layer having at least one finger and a bottom layer width,
  - i) wherein said at least one via is electrically connected to said at least one finger,
  - ii) wherein said at least one finger has a finger width less than said bottom layer width and substantially equal to a minimum design rule width,
  - iii) wherein said at least one finger does not cause said bottom layer width to increase, and
  - iv) wherein a width ratio of said finger width to a width of said at least one via is reduced,
  - v) wherein a plurality of fingers have a plurality of associated finger widths, and
  - vi) wherein a combined finger width of said plurality of associated finger widths is less than said bottom layer width.

(Paragraph lettering and some formatting added).

*Prior Art*

The prior art relied upon by the Examiner in rejecting the claims on appeal is:

Kinoshita                    EP 0845808 A2     June 3, 1998

*Rejections*

The Examiner rejected claims 1, 3, 5, 7-9, 11, 13, and 21 under 35 U.S.C. § 112, second paragraph, as being indefinite (Ans. 3).

The Examiner rejected claims 1, 3, 5, 7-9, 11, 13, and 21 under 35 U.S.C. § 102(b) as being anticipated by Kinoshita (Ans. 4-6).<sup>1</sup>

*Appellant's Contentions*

Appellant contends that claims 1, 3, 5, 7-9, 11, 13, and 21 are not indefinite and that the Examiner erred in rejecting these claims because:

By specifying that the finger width of the at least one finger is substantially equal to a minimum design rule, it is reasonably *assumed* that a via that is connected to a finger having a finger width that is substantially equal to a minimum design rule width would not have a substantially narrower width compared to a via that is connected to a wider finger. Thus, by specifying that the finger width of the at least one finger is substantially equal to a minimum design rule, a reduction in the width ratio (i.e., an effective ratio) of finger width to via width (i.e. the width of the at least one via) is achieved compared to an *implied* interconnect structure that does not include at least one finger having a finger width that is substantially equal to a minimum design rule width.

(App. Br. 6-7) (emphasis added).

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<sup>1</sup> The Examiner's rejection mistakenly lists claim 12, which Appellant indicates has been cancelled (App. Br. 2), as being rejected.

*Examiner's Findings or Conclusions*

The Examiner concluded that claims 1, 3, 5, 7-9, 11, 13, and 21 are indefinite because the limitation “wherein a width ratio of the finger width to a width of the at least one via is reduced” is indefinite. (Ans. 3.) The Examiner found that “the claims have not set a specific or initial ‘width ratio’ so that the width ratio of the finger/via is reduced.” *Id.*

In support of this conclusion the Examiner reasoned at page 7 of the Answer as follows:

Assuming:  $W_f$  is the finger width and  $W_v$  is the via width, the width ratio  $R_w = W_f/W_v$ . The term “is reduced” indicate[s] a state of the ratio  $R_w$  being changed from larger to smaller.

The claims however, [do] not indicate what is the initial ratio  $R$  so that the  $R_w$  can be reduced [as compared to an initial ratio  $R$ ]. This is critical to one having ordinary skill in the art because [a] worker in the art should be able to determine a ratio reduction base[d] on some other ratio.

*Result*

We affirm.

ISSUE(S)

Has Appellant established that the Examiner erred in rejecting claims 1, 3, 5, 7-9, 11, 13, and 21 under 35 U.S.C. § 112, second paragraph, as being indefinite?

## FINDINGS OF FACT

The following Findings of Fact (FF) are shown by a preponderance of the evidence.

### *Appellant's Admitted Prior Art*

1. “Figure 1A shows a top view of conventional interconnect structure 100 in a semiconductor die” (Spec. 5:13-14).
2. “As shown in Figure 1A, interconnect structure 100 includes bottom interconnect metal (‘ICM’) layer 112, vias 130 and 140 and top ICM layer 120” (Spec. 5:14-16).
3. “Width 160 of bottom ICM layer 112 is much greater than width 161 of via 130 . . .” (Spec. 5:20-21.)

### *Appellant's Invention*

4. Appellant indicates that:  

Figure 3D shows interconnect structure 310[,] formed in accordance with one embodiment of the present invention. As shown in Figure 3D, structure 310 includes top ICM layer 320, vias 332, 334, 336, 342, 344 and 346 and bottom ICM layer 312, where bottom ICM layer 312 comprises fingers 372, 374, 376, 382, 384 and 386. Bottom ICM layer 312 is electrically connected to top ICM layer 320 by vias 332, 334, 336, 342, 344 and 346. Specifically, fingers 372, 374, 376, 382, 384 and 386 are connected to vias 332, 334, 336, 342, 344 and 346, respectively.

(Spec. 8:7-13.)

5. “The present invention advantageously increases stress migration reliability by reducing the effective ratio of the width of the bottom ICM layer to via width, while substantially retaining the overall ICM

layer width to preserve its low resistance and its high current conduction capability.” (Spec. 8:14-17.)

6. “Referring to Figure 3D, bottom ICM layer 312 has bottom layer width 360. Fingers 372, 374 and 376 have finger widths 362, 364 and 366, respectively. Finger widths 362, 364 and 366 are each equal to slightly less than approximately one-third of bottom layer width 360.” (Spec. 8:17-20.)

7. “Moreover, a substantial portion of bottom ICM layer 312 has preserved its initial configuration, i.e. a substantial portion of bottom ICM layer 312 is not divided into fingers. However, the effective width of bottom ICM layer 312 in relation to via 332 is approximately equal to finger width 362.” (Spec. 8:20-9:2.)

8. “Moreover, the effective ratio of the width of bottom ICM layer 312, e.g. finger width 362, to via width, e.g. width of via 332, is significantly reduced, while approximately retaining the overall bottom ICM layer width because the sum of finger widths 362, 364 and 366 is approximately equal to bottom layer width 360.” (Spec. 9:2-5.)

9. “In comparison to the conventional interconnect structure 100 of Figure 1A, the embodiment of the present invention of Figure 3D, reduces the effective ratio of the width of bottom ICM layer 312, e.g. finger width 362, to a via width, e.g. widths of vias 362, 364 and 366, to approximately one-third of the ratio of bottom layer width 160 to via width 161.” (Spec. 9:9-13.)

10. “This reduction in the effective ratio of bottom layer width to via width advantageously increases stress migration reliability, which reduces void migration underneath vias.” (Spec. 9:13-15.)

11. “In sum, forming interconnect structures in the manner described above advantageously results in an ICM layer comprising fingers, which reduces the effective ratio of bottom layer width to via width.” (Spec. 9:16-18.)

#### PRINCIPLES OF LAW

Appellant has the burden on appeal to the Board to demonstrate error in the Examiner’s position. *See In re Kahn*, 441 F.3d 977, 985-86 (Fed. Cir. 2006).

#### *Claim Construction*

“Claims must be read in view of the specification, of which they are a part.” *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 979 (Fed. Cir. 1995) (en banc). “[D]uring examination proceedings, claims are given their broadest reasonable interpretation consistent with the specification.” *In re Hyatt*, 211 F.3d 1367, 1372 (Fed. Cir. 2000). “Moreover, limitations are not to be read into the claims from the specification.” *In re Van Geuns*, 988 F.2d 1181, 1184 (Fed. Cir. 1993) (citing *In re Zletz*, 893 F.2d 319, 321 (Fed. Cir. 1989)).

## ANALYSIS

(A)

### *35 U.S.C. § 112, Second Paragraph*

Appellant argues that the Examiner has erred because, as set forth in “*Appellant’s Contentions*” *supra*, “claims 1, 3, 5, 7-9, 11, 13, and 21 meet the requirements of 35 U.S.C. § 112, second paragraph.” (App. Br. 7.)

We disagree. Juxtaposed to the Examiner’s reasoning that there must be an “initial ratio R” (i.e., some initial baseline ratio) for purposes of comparison is Appellant’s contention that “it is reasonably *assumed* that a via [v1] that is connected to a finger [f1] having a finger width that is substantially equal to a minimum design rule width would not have a substantially narrower width compared to a via [v2] that is connected to a wider finger [f2].” (Emphasis added.) However, Appellant presents no factual basis for this assumption. Also, the assumption hinges on a requirement that the widths of v1 and v2 be similar (not substantially narrower). We find no rational basis for this. To the contrary, as much as the width of f2 is greater compared to the width of f1, we see no reason that the width of v2 cannot also be greater as compared to the width of v1. Thus, under such a condition, the “width ratio” would be held constant, rather than being reduced by going from a wider finger f2 to a narrower finger f1.

The second part of Appellant’s contention that “a reduction in the width ratio (i.e., an effective ratio) of finger width to via width (i.e. the width of the at least one via) is achieved compared to an *implied* interconnect structure that does not include at least one finger having a finger width that



is substantially equal to a minimum design rule width” fails for the same reason discussed above.

We also note that Appellant’s Specification is quite specific that the reduction of the ratio of the finger width to via width is in comparison to the conventional interconnect structure 100 of the prior art (See FF 1-3, and 9) (i.e., the prior art forms the baseline), not in comparison to some *implied* interconnect structure. Further, it appears that Appellant’s disclosed invention hinges on a requirement that the width of a via in the invention be similar to the width of a via in the prior art (FF 3) (what Appellant phrases in their arguments as not substantially narrower). Yet both the Specification and claims are silent as to this requirement. It is clear to us from Appellant’s argument that they had something in mind with respect to the vias that we do not find conveyed by the language of the claim. Without some guidance to the artisan about the baseline ratio (what the Examiner terms as the “initial ratio R”) to which the claimed “width ratio” is being compared, we agree with the Examiner that the claim is indefinite.

Therefore, for the reasons above, Appellant has not established that the Examiner erred with respect to this rejection of claims 1, 3, 5, 7-9, 11, 13, and 21 under § 112, second paragraph.

(B)

*35 U.S.C. § 102*

We do not reach the merits of the Examiner’s rejection under 35 U.S.C. § 102 or the merits of the Kinoshita reference at this time. Rather, we reverse *pro forma* the outstanding rejection under 35 U.S.C. § 102 because the appealed claims fail to satisfy the requirements of the second

paragraph of 35 U.S.C. § 112. Before a proper review of the prior art rejection can be performed, the subject matter encompassed by the claims on appeal must be reasonably understood without resort to speculation.

Presently, speculation and conjecture must be utilized by us and by the artisan inasmuch as the claims on appeal do not adequately reflect what the disclosed invention is under the second paragraph of 35 U.S.C. § 112. *See In re Steele*, 305 F.2d 859, 862 (CCPA 1962) (A prior art rejection cannot be sustained if the hypothetical person of ordinary skill in the art would have to make speculative assumptions concerning the meaning of claim language.); *See also In re Wilson*, 424 F.2d 1382, 1385 (CCPA 1970) (“If no reasonably definite meaning can be ascribed to certain terms in the claim, the subject matter does not become obvious-the claim becomes indefinite.”).

#### CONCLUSIONS OF LAW

(1) Appellant has failed to establish that the Examiner erred in rejecting claims 1, 3, 5, 7-9, 11, 13, and 21 as being unpatentable under 35 U.S.C. § 112, second paragraph, as being indefinite.

(2) Claims 1, 3, 5, 7-9, 11, 13, and 21 are not patentable.

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DECISION

The Examiner's rejection of claims 1, 3, 5, 7-9, 11, 13, and 21 under 35 U.S.C. § 112, second paragraph, is affirmed.

The Examiner's rejection of claims 1, 3, 5, 7-9, 11, 13, and 21 under 35 U.S.C. § 102 is reversed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

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