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Loza & Loza, LLP/Qualcomm 305 N. Second Ave., #127 Upland, CA 91786			LIAN, MANG TIN BIK	
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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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*Ex parte* JAMES THOMAS DOYLE, FARSHEED MAHMOUDI, and  
AMIRALI SHAYAN ARANI,

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Appeal 2018-008874  
Application 13/794,558  
Technology Center 2800

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Before CATHERINE Q. TIMM, MICHAEL P. COLAIANNI, and  
N. WHITNEY WILSON, *Administrative Patent Judges*.

COLAIANNI, *Administrative Patent Judge*.

DECISION ON APPEAL

Pursuant to 35 U.S.C. § 134(a), Appellant<sup>1</sup> appeals from the Examiner's decision to reject claims 1–4, 8, 9, 11, 13–17, 21, 22, 24, 26, 40–44, 46–51, 53–61, and 63–72. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

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<sup>1</sup> We use the word “Appellant” to refer to “applicant” as defined in 37 C.F.R. § 1.42. Appellant identifies the real party in interest as QUALCOMM Incorporated. Appeal Br. 2.

Appellant's invention is directed to structure having an in-substrate coupled inductor structure (Spec. ¶ 2; Claim 1).

Claim 1 is representative of the subject matter on appeal:

1. A structure, comprising:  
an inductor structure having  
    an electrically conductive first inductor winding,  
    first and second terminals integral with respective ends of  
the electrically conductive first inductor winding,  
    an electrically conductive second inductor winding, and  
    third and fourth terminals integral with respective ends of  
the electrically conductive second inductor winding;  
    a first substrate in which the electrically conductive first  
and second inductor windings are embedded and laterally co-  
planar therein, wherein the first and second terminals and the  
third and fourth terminals are through substrate vias (TSVs) with  
at least one of the TSV terminals and the end of each respective  
inductor winding forming an L-shape with a flat TSV terminal  
portion.

Appellant appeals the following rejections:

1. Claims 66, 69, and 72 are rejected under 35 U.S.C. § 112, ¶ 1 as failing to comply with the written description requirement.
2. Claims 1–4, 13–17, 26, 49–51, 53, 54, and 64–72<sup>2</sup> are rejected under 35 U.S.C. § 103(a) as unpatentable over Sin (US 2012/0068301 A1, published Mar. 22, 2012) in view of Tung

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<sup>2</sup> Examiner's rejection only lists claims 1–4, 13–17, 49–51, 53, and 54 as being rejected under § 103 over Sin in view of Tung and Hashemi (Final Act. 5). The body of the rejection, however, clearly specifies that claims 26 and 64–72 are rejected under the same combination of references (Final Act. 9, 10–12). We find the Examiner's omission of claims 26, and 64–72 from the statement of rejection is harmless error.

- (US 6,794,978 B2, issued Sept. 21, 2004) and Hashemi (US 6,512,285 B1, issued Jan. 28, 2003).
3. Claims 8, 9, 21, and 22 are rejected under 35 U.S.C. § 103(a) as unpatentable over Sin in view of Tung, Hashemi and Knott (US 2009/0079529 A1, published Mar. 26, 2009).
  4. Claims 11, 24, 55, and 56 are rejected under 35 U.S.C. § 103(a) as unpatentable over Sin in view of Tung, Hashemi, and Pan (US 2011/0215863 A1, published Sept. 8, 2011).
  5. Claims 40–43 are rejected under 35 U.S.C. § 103(a) as unpatentable over Sin in view of Tung, Hashemi, and Lin (US 2013/0075936 A1, published Mar. 28, 2013).
  6. Claim 44 is rejected under 35 U.S.C. § 103(a) as unpatentable over Sin in view of Tung, Hashemi, Lin, and Gardner (US 2010/0001826 A1, published Jan. 7, 2010).
  7. Claims 46–48, 59–61, and 63 are rejected under 35 U.S.C. § 103(a) as unpatentable over Sin in view of Tung and Pan.
  8. Claims 57 and 58 are rejected under 35 U.S.C. § 103(a) as unpatentable over Sin in view of Tung, Pan, and Hashemi.

#### FINDINGS OF FACT & ANALYSIS

##### *REJECTION (1): Written Description*

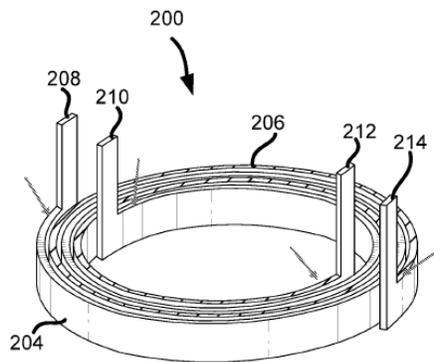
As stated above, the Examiner rejects claims 66, 69, and 72 under 35 U.S.C. § 112, ¶ 1 as failing to comply with the written description requirement.

Claim 66 depends from claim 1 and recites “wherein at least a portion of the at least one TSV terminal that forms part of the L-shape is curved to

match a curved shape of the end of its each respective inductor winding.”  
Claims 69 and 72 recite the same limitation and depend from claims 14 and 46, respectively.

The Examiner’s findings regarding the rejection of claims 66, 69, and 72 are located on page 4 of the Final Action. The Examiner finds that the Specification does not disclose, and Figure 2 of the drawings do not show, the L-shaped terminals being curved (Ans. 3). The Examiner finds that the L-shaped terminals as shown in Figure 2 are rectangular (Ans. 3).

Appellant argues that Figure 2 of the Specification shows that a portion of the curved inductor windings where the curved shape continues into the portion of the structure that forms the L-shape (and which forms the TSV terminals) (Appeal Br. 19). We agree. Figure 2, as annotated by Appellant on page 3 of the Reply Brief, shows that Appellant was in possession of a portion of the through substrate vias (TSV) terminal that forms part of the L-shape is curved to match a curved shape of the end of its each respective inductor winding as recited in claims 66, 69, and 72:



**FIG. 2**

Appellant’s annotated FIG. 2 shows, via the added arrows, the L-shaped terminals recited in the claims.

Figure 2 shows that at least a portion of the L-shaped terminal ends (208, 210, 212, 214) follow the curve of the inductor 204 or 206. The inner inductors 204 and 206 show lines getting closer together, which demonstrate that the structure is curved.

On this record, we reverse the Examiner's §112, ¶ 1 lack of written description rejection.

*Rejections (2) to (8): Obviousness*

The Examiner rejects claims 1–4, 13–17, 26, 49–51, 53, 54, and 64–72 under 35 U.S.C. § 103(a) as unpatentable over Sin in view of Tung and Hashemi (Rejection (2)). Appellant argues the claims under rejection (2) as a group. Therefore, we select claim 1 as representative of the group. 37 C.F.R. §41.37(c)(iv).

The Examiner adds various prior art references to reject further claims (Rejections (3) to (8)). Appellant's arguments regarding rejections (3) to (8) rely on arguments made regarding claim 1 or the independent claims 14 or 46 (Appeal Br. 25–27). Appellant's only argument regarding rejection (7) is that Pan does not cure the alleged deficiencies of Sin and Tung (Appeal Br. 27). Accordingly, the claims under rejections (3) to (8) will stand or fall with our analysis of the rejection of claim 1.

The Examiner's findings and conclusions regarding the teachings of Sin, Tung and Hashemi are located on pages 5 to 7 of the Final Action. The Examiner finds that Sin teaches the inductor structure but does not teach the end of the respective inductor winding forming an L-shape with a flat TSV terminal portion, a die on a first surface of the second substrate and wherein

the inductor structure is electrically coupled to the die (Final Act. 6). The Examiner finds that Tung teaches in Figure 3A a L-shaped terminal end with a flat TSV terminal portion 52b (Final Act. 6). The Examiner relies on Hashemi to teach placing an inductor on a second substrate with a die and electrically coupling the inductor to the die (Final Act. 6). The Examiner concludes that it would have been obvious to incorporate the L-shape with a flat TSV terminal portion as taught by Tung and the inductor structure electrically coupled to a die through the second substrate as taught by Hashemi to the inductor structure of Sin to facilitate manufacturing and or to meet space usage requirements (Final Act. 6).

Appellant argues that Tung is directed to high speed RF communication and requires a layered, planar, inductor whereas Sin's inductor is used in power modules (Appeal Br. 21). Appellant argues that Tung's feed-through via 52b is used to couple the inductive layer 50 to a ground layer 60, which is orthogonal to the inductor (Appeal Br. 23). Appellant argues that Tung's feed-through via 52b is not integral to the inductive layer 50 (Appeal Br. 23). Appellant argues that Tung's layered structure permits movement of the inductor layer relative to the ground layer to adjust inductive values (Appeal Br. 23). Appellant argues that there is no reason to combine Sin with Tung (Appeal Br. 23). Appellant contends that Sin does not disclose terminals that are integral with the respective ends of the electrically conductive windings (Appeal Br. 24). Appellant contends that Tung uses a trace inductor which would require a separate structure such as feed-through via 52b to couple the inductor coil from the surface of the substrate to other structures (Appeal Br. 24). Appellant argues that one skilled in the art would never incorporate the physical feed-through via 52b

structure of Tung designed for trace elements on the surface of a substrate into an embedded inductor configuration as disclosed in Sin (Appeal Br. 24). Appellant argues that Hashemi does not cure the deficiencies of Sin and Tung (Appeal Br. 24). Appellant contends that the combination of Sin, Tung and Hashemi is based on impermissible hindsight (Appeal Br. 25).

Contrary to Appellant's arguments, the Examiner finds that Sin teaches first, second, third, and fourth terminals (i.e., 306A and 306B) that are integral with respective ends of the electrically conductive first and second inductor windings (Final Act. 5). The Examiner defines integral as "consisting or composed of parts that together constitute a whole" (Ans. 4). Appellant does not challenge or dispute this definition (Reply Br. *generally*). Sin teaches that vias 306A and 306B are formed by depositing metal in the hole formed between the inductor and the top of the substrate (¶¶ 9, 42, 43, 50). The vias permit the induction coil to be connected to the other side of the substrate (¶ 34). The vias are coupled to the embedded inductors so as to connect the inductors the opposite surface of the substrate (¶¶ 34, 50). Tung shows that the feed-through via 52b connects the inductor 50 with other portions of the structure (col. 3, ll. 64-67). Therefore, once the vias are formed so that the vias electrically connect the inductor with the other surface, the via and inductor would be coupled to the inductor so that the via and inductor together constitute a whole inductor (i.e., the metal filled via is integral with the inductor).

The Examiner's rejection is based on using Tung's L-shaped arrangement of the feed-through via 52b and the inductor 50 as teaching of how Sin's via would have been coupled to the inductors. As noted above, Sin teaches forming vias to couple the inductors to the opposite side of the

substrate (¶¶ 9, 42, 43, 50). In light of Tung’s teaching on how to arrange a via and an inductor, it would have been obvious to implement Tung’s L-shaped via/inductor coupling with Sin’s via/inductor arrangement to facilitate manufacturing and meet space usage requirements as stated by the Examiner (Final Act. 6). The Examiner’s rejection is based on the teachings of the references, not impermissible hindsight.

Appellant’s arguments regarding Hashemi are misplaced as we do not find any reversible error or deficiencies in the Examiner’s combination of Sin and Tung (Appeal Br. 24). The Examiner cites Hashemi to teach that it is known to couple an inductor to second substrate having die to which the inductor is electrically coupled. Appellant argues that Hashemi teaches away from utilizing a discrete inductor but instead discloses an inductor package (Appeal Br. 24-25). Hashemi’s inductor package includes, however, an inductor on a substrate and electrically coupling the inductor to a capacitor or die on the substrate (col. 4, ll. 18-46). Hashemi does not discourage the combination of an inductor with a circuit structure.

On this record, we affirm the Examiner’s §103 rejections (2) to (8) listed above.

### CONCLUSION

In summary:

<b>Claims Rejected</b>	<b>Basis</b>	<b>Affirmed</b>	<b>Reversed</b>
66, 69, 72	§112, ¶ 1		66, 69, 72
1-4, 13-17, 26, 49-51, 53, 54, 64-72	§ 103 Sin, Tung, Hashemi	1-4, 13-17, 26, 49-51, 53, 54, 64-72	
8, 9, 21, 22	§ 103 Sin, Tung, Hashemi, Knott	8, 9, 21, 22	

<b>Claims Rejected</b>	<b>Basis</b>	<b>Affirmed</b>	<b>Reversed</b>
11, 24, 55, 56	§ 103 Sin, Tung, Hashemi, Pan	11, 24, 55, 56	
40-43	§ 103 Sin, Tung, Hashemi, Lin	40-43	
44	§ 103 Sin, Tung, Hashemi, Lin, Gardner	44	
46-48, 59-61, 63	§ 103 Sin, Tung, Pan	46-48, 59-61, 63	
57, 58	§ 103 Sin, Tung, Pan, Hashemi	57, 58	
<b>Overall Outcome</b>		1-4, 8, 9, 11, 13-17, 21, 22, 24, 26, 40-44, 46-51, 53-61, 63-72	

TIME PERIOD FOR RESPONSE

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

AFFIRMED