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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte DARRYL TSCHIRHART, BENJAMIM TANG, and
EMIL TODOROV

Appeal 2018-008292
Application 14/726,009
Technology Center 2800

Before ADRIENE LEPIANE HANLON, ROMULO H. DELMENDO, and
JAMES C. HOUSEL, *Administrative Patent Judges*.

HANLON, *Administrative Patent Judge*.

DECISION ON APPEAL

A. STATEMENT OF THE CASE

The Appellant¹ filed an appeal under 35 U.S.C. § 134(a) from an Examiner's decision finally rejecting claims 1, 2, 6, 8–15, 19–22, 24, 25, and 27. Claims 3, 5, 16–18, and 26 are also pending but have been withdrawn from consideration. We have jurisdiction under 35 U.S.C. § 6(b).

We REVERSE.

¹ 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 Infineon Technologies Austria AG. Appeal Brief dated March 15, 2018 (“App. Br.”), at 2.

The claims on appeal are directed to a DC-DC converter. Claim 1, the sole independent claim on appeal, is reproduced below from the Claims Appendix to the Appeal Brief. The limitation at issue is italicized.

1. A DC-DC converter, comprising:
 - a substrate having opposing first and second sides;
 - a first discrete power stage transistor die attached to the first side of the substrate and comprising a high-side power transistor;
 - a second discrete power stage transistor die attached to the first side of the substrate and comprising a low-side power transistor electrically connected to the high-side power transistor to form an output phase of the DC-DC converter; and
 - an inductor attached to the first side of the substrate so as to electrically connect the output phase to a metal output trace on the substrate, the inductor at least partly covering at least one of the first and the second discrete power stage transistor dies,

wherein each discrete power stage transistor die that is at least partly covered by the inductor comprises a plurality of pins that are not covered by the inductor.

App. Br. 14.

The claims on appeal stand rejected as follows:

- (1) claims 1, 2, 6, 8, 10–15, 19, 21, 22, 24, and 25 under 35 U.S.C. § 103 as unpatentable over Yin et al.² in view of Ishii et al.;³
- (2) claims 9 and 20 under 35 U.S.C. § 103 as unpatentable over Yin in view of Ishii, and further in view of Shimada et al.;⁴ and
- (3) claim 27 under 35 U.S.C. § 103 as unpatentable over Yin in view of Ishii, and further in view of Jones et al.⁵

² US 2011/0228507 A1, published September 22, 2011 (“Yin”).

³ US 2016/0164417 A1, published June 9, 2016 (“Ishii”).

⁴ US 2009/0147541 A1, published June 11, 2009 (“Shimada”).

⁵ US 2014/0239472 A1, published August 28, 2014 (“Jones”).

B. DISCUSSION

The Examiner finds Yin discloses a DC-DC converter comprising, *inter alia*, first and second discrete power stage transistor dies 16 attached to a first side of a substrate and an inductor “at least partly covering at least one of the first and the second discrete power stage transistor dies.” Final Act. 3.⁶ Yin Figure 4, for example, shows inductor 68 *fully covering* first and second transistors 16. The Examiner concludes that “fully covered meets the limitation of at least partly covered” recited in claim 1. Final Act. 5.

The Examiner finds Yin “does not teach wherein each discrete power stage transistor die that is at least partly covered by the inductor comprises a plurality of pins that are not covered by the inductor” as recited in claim 1. Final Act. 3.

The Examiner finds Ishii discloses a DC-DC converter comprising, *inter alia*, switching transistors and an inductor “wherein some pins (wires coming out of pad from 32) of the transistor (32) are partly covered by the inductor (40).” Final Act. 4. In that regard, Ishii Figure 2A shows that a segment of each of the wires connecting transistors 31, 32 to controller IC chip 33 is not covered by inductor 40. The Examiner finds that the wires depicted in Ishii Figure 2A can be considered pins based on the broadest reasonable interpretation of the term “pin.” Final Act. 12.

Ishii discloses that “[t]he controller IC chip 33 is connected, *by wire bonding*, to the gates of the high-side switching transistor 31 and the low-side switching transistor 32.” Ishii ¶ 43 (emphasis added); *see also* App. Br. 6 (citing Ishii ¶ 43). The Appellant argues that “Ishii does not disclose or suggest . . . that any ‘wire bonding’ is a pin.” App. Br. 6.

⁶ Final Office Action dated October 11, 2017.

In response, the Examiner finds that the Appellant's "specification does not provide any specific definition of the claimed term 'PIN.'" ⁷ Ans. 4. ⁸ Therefore, the Examiner considers the term "'PIN'" to be

a conductive wire that is used for connecting input or output terminals of [a] semiconductor device to external components on a broadest reasonable interpretation. Thus, it is a reasonable interpretation to call the wires (bonding wires) of Ishii (Figures 1/2) connecting the transistors (31/32) with external device (33) as "pins" of the transistors.

Ans. 4.

The Examiner relies on paragraph 53 of Ananiev, ⁹ paragraph 63 of Han et al., ¹⁰ and paragraph 29 of Truax et al. ¹¹ to establish that "wires and pins are used interchangeably in prior arts." Final Act. 12; *see also* Advisory Act. 2 ¹² (relying on Ananiev, Han, and Truax to show that a pin and a bonding wire are used interchangeably); Ans. 5 (explaining that Ananiev, Han, and Truax were used to support the interpretation of the term "pin" as a conductive wire such as Ishii's bonding wire).

The Appellant argues that the additional art relied on by the Examiner "does not show that 'wire bonding' and 'pins' are equivalent" but rather "describes such elements as alternatives to each other." App. Br. 8. The Appellant's argument is persuasive of reversible error.

⁷ Referring to Figure 4B, the Appellant discloses that "the pins 326 of each discrete high-side transistor die 306, 308 . . . remain uncovered by the inductor 310 [and] can be visually inspected without interference from the inductor 310." Spec. ¶ 28.

⁸ Examiner's Answer dated June 15, 2018.

⁹ US 2015/0194374 A1, published July 9, 2015 ("Ananiev").

¹⁰ US 2015/0311655 A1, published October 29, 2015 ("Han").

¹¹ US 2016/0163631 A1, published June 9, 2016 ("Truax").

¹² Advisory Action dated January 5, 2018.

Turning to the prior art relied on by the Examiner, paragraph 53 of Ananiev states that “each of the terminal pins 122 of the package 120 is designed here as a curved *wire-shaped* copper structure” (emphasis added). The Appellant argues that such wording suggests that the terminal pins 122 are not necessarily wires because “[o]ne would typically not describe a wire as ‘wire-shaped.’” App. Br. 9.

Moreover, the Appellant directs our attention to paragraphs 28 and 54 of Ananiev which describe “pins” and “bonding wires” as different elements. App. Br. 9. In that regard, Ananiev discloses that “electronic chip(s) may be electronically coupled with the *terminal pins* through *bonding wires*.” Ananiev ¶ 28 (emphasis added). Likewise, Ananiev describes “terminal pins 122” and “bonding wires 152” (Ananiev ¶ 54) and Ananiev Figure 1 depicts pins 122 and bonding wires 152 as different elements.

Paragraph 63 of Han states that “the terms ‘lands’, ‘contact lands’, and like may refer to any type of electrical connection such as a lead, wire, pin, and/or any other like device that can enable an electrical connection.” The Appellant argues that Han, in paragraph 63, merely “lists leads, wires, pins, etc. as alternatives for providing an electrical connection” and “describes ‘contact pins’ 113 and ‘wirings’ 115 as different elements.” App. Br. 10 (emphasis omitted); *see also* Han Fig. 1 (depicting pins 113 and wirings 115 as different elements).

Finally, paragraph 29 of Truax states that “input/output pins 150 can comprise metal wires (e.g., coated copper wires, tinned copper wires or any other suitable electrically conductive wire)” and refers to pins 150 as “leads or external connectors.” The Appellant argues that Truax does not equate wiring bonding with pins 150, but rather describes pins 150 and bonding wires 191 as different elements. App. Br. 10–11. Indeed, Truax discloses that pin 150 can be electrically connected to wire bond pad 141 and wire bond pad 141, in turn, can be *wire*

bonded via wire 191 to chip 210. Truax ¶¶ 29, 32; *see also* Truax Fig. 3A (depicting pin 150 and wire 191 as different elements).

Based on the foregoing, a preponderance of the evidence of record establishes that one of ordinary skill in the art would not have understood that the term “pins,” as recited in claim 1, and the term “wire bonding,” as disclosed in Ishii, refer to the same structural element. Therefore, the Examiner has failed to show that the DC-DC converter recited in claim 1 is rendered obvious by the combination of Yin and Ishii.

The Examiner has also failed to show that either Shimada or Jones cures the deficiency in the combination of Yin and Ishii identified above. Notably, the Examiner relies on Jones to show that a plurality of pins (318) of two MOSFETs (306, 308) are not covered by a semiconductor die (302). Final Act. 11. However, the Appellant argues that the semiconductor die (302) is not an inductor as claimed, and for that reason, Jones does not disclose or suggest the claimed feature missing from Yin (i.e., a transistor die comprising a plurality of pins that are not covered by *an inductor*). App. Br. 12.

In response, the Examiner concludes that it would have been obvious to one of ordinary skill in the art “to use an arrangement in the DC-DC converter of YIN . . . so that a plurality of pins of the high-side power transistor die are not covered by the inductor, wherein . . . such an arrangement provides a good heat dissipation of the power transistors.” Ans. 8–9.

The Appellant argues that the Examiner “does not provide a citation regarding this being a goal within the cited art, or explain[] why such a goal would be obvious to one skilled in the art.” Reply Br. 6.¹³ Indeed, the Examiner does not

¹³ Reply Brief dated August 15, 2018.

direct us to any evidence or provide any technical reasoning showing that, at the time of the Appellant’s invention, one of ordinary skill in the art would have known that not covering the pins of Yin’s transistors 16 with an inductor, as claimed, would provide good heat dissipation of transistors 16. *See In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) (“rejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness”).

For the reasons set forth above, the obviousness rejections on appeal are not sustained.

C. CONCLUSION

The Examiner’s decision is reversed.

In summary:

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
1, 2, 6, 8, 10–15, 19, 21, 22, 24, 25	103	Yin, Ishii		1, 2, 6, 8, 10–15, 19, 21, 22, 24, 25
9, 20	103	Yin, Ishii, Shimada		9, 20
27	103	Yin, Ishii, Jones		27
Overall Outcome				1, 2, 6, 8–15, 19–22, 24, 25, 27

REVERSED