

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of: Jian-Hong Zeng, et al. Attorney Docket No.: 25808-0012IP1
U.S. Patent No.: 9,819,263
Issue Date: November 14, 2017
Appl. Serial No.: 15/286,542
Filing Date: October 5, 2016
Title: POWER CONVERTER AND METHOD FOR
MANUFACTURING THE SAME

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PETITION FOR *INTER PARTES* REVIEW OF UNITED STATES
PATENT NO. 9,819,263 PURSUANT TO 35 U.S.C. §§ 311–319,
37 C.F.R. § 42

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EXHIBITS

VICOR-1001	U.S. Patent No. 9,819,263 to Jian-Hong Zeng, et al. (“the ’263 Patent”)
VICOR-1002	The Prosecution History of the ’263 Patent (“the Prosecution History”)
VICOR-1003	Declaration and Curriculum Vitae of Dr. R. Jacob Baker, Ph.D., P.E.
VICOR-1004	Complaint, <i>Delta Electronics, Inc. v. Vicor Corporation</i> 6-23-cv-00726, W.D. Tex., filed October 23, 2023
VICOR-1005	United States Patent No. 10,264,664 to Vinciarelli et al. (“Vinciarelli-664”).
VICOR-1006	United States Patent No. 8,427,269 to Vinciarelli et al. (“Vinciarelli-269”).
VICOR-1007	United States Patent No. 7,361,844 to Vinciarelli et al. (“Vinciarelli-844”).
VICOR-1008	United States Patent Application Publication No. 2009/0175014 to Zeng et al. (“Zeng-014”).
VICOR-1009	United States Patent Application Publication No. 2014/0355218 to Vinciarelli et al. (“Vinciarelli-218”).
VICOR-1010	United States Patent No. 8,966,747 to Vinciarelli et al. (“Vinciarelli-747”)
VICOR-1011	Exhibit A to Patent Owner’s Infringement Contentions served on February 26, 2024 (“Infringement Contentions”)
VICOR-1012	U.S. Patent No. 6,934,166 to Vinciarelli et al. (“Vinciarelli-166”)

VICOR-1013

“Design Guide & Applications Manual for VI-200 and VI-J00 Family DC-DC Converters and Configurable Power Supplies,” Rev. 3.5, Vicor Corporation (2013) (“Design Guide”)

Vicor Corporation (“**Petitioner**” or “**Vicor**”) petitions for *Inter Partes*

Review (“**IPR**”) of claims 1-6 (“**the Challenged Claims**”) of U.S. Patent No.

9,819,263 (“**the ’263 Patent**”). Compelling evidence presented in this Petition

demonstrates at least a reasonable likelihood that Vicor will prevail with respect to

at least one of the Challenged Claims.

I. REQUIREMENTS FOR IPR

A. Grounds for Standing

Petitioner certifies that the ’263 Patent is available for IPR. This petition is being filed within one year of service of a complaint against Vicor and Vicor is not barred or estopped from requesting review of the Challenged Claims on the below-identified grounds.

B. Challenge and Relief Requested

Vicor requests an IPR of the Challenged Claims on the grounds noted below. Dr. Baker provides supporting testimony in his Declaration. VICOR-1003, ¶¶1-207.

Ground	Claim(s)	Statutory Basis
1A	1-6	§102: Anticipated by Vinciarelli-664 (USP 10,264,664)
1B	1-6	§103: Obvious over Vinciarelli-664 in view of Vinciarelli-269 (USP 8,427,269), Vinciarelli-844 (USP

Ground	Claim(s)	Statutory Basis
		7,361,844), and Vinciarelli-747 (USP 8,966,747)
1C	1-6	§103: Obvious over Vinciarelli-664 in view of Vinciarelli-269, Vinciarelli-844, Vinciarelli-747, and Zeng-014 (US App Pub 2009/0175014)
2	1-6	§103: Obvious over Vinciarelli-218 (US App Pub 2014/0355218) in view of Zeng-014
3	1-6	§103: Obvious over Zeng-014 in view of Vinciarelli-218

The '263 Patent has a filing date of October 5, 2016, and claims priority to a foreign application filed on October 9, 2015. Accordingly, the patent is to be reviewed pursuant to the AIA. Without conceding that the patent is entitled to the foreign priority date, this Petition will use the October 9, 2015 date as the Critical Date. As shown below, each reference pre-dates the '263 Patent's Critical Date.

Reference	Filing Date	Issue / Publication Date	Prior Art At Least Under
Vinciarelli-664	6/4/2015	4/16/2019	102(a)(2)
Vinciarelli-269	6/29/2009	4/23/2013	102(a)(1)
Vinciarelli-844	11/25/2002	4/22/2008	102(a)(1)
Vinciarelli-747	5/11/2011	3/3/2015	102(a)(1)

Reference	Filing Date	Issue / Publication Date	Prior Art At Least Under
Zeng-014	1/2/2009	7/9/2009	102(a)(1)
Vinciarelli-218	5/11/2012	12/4/2014	102(a)(1)

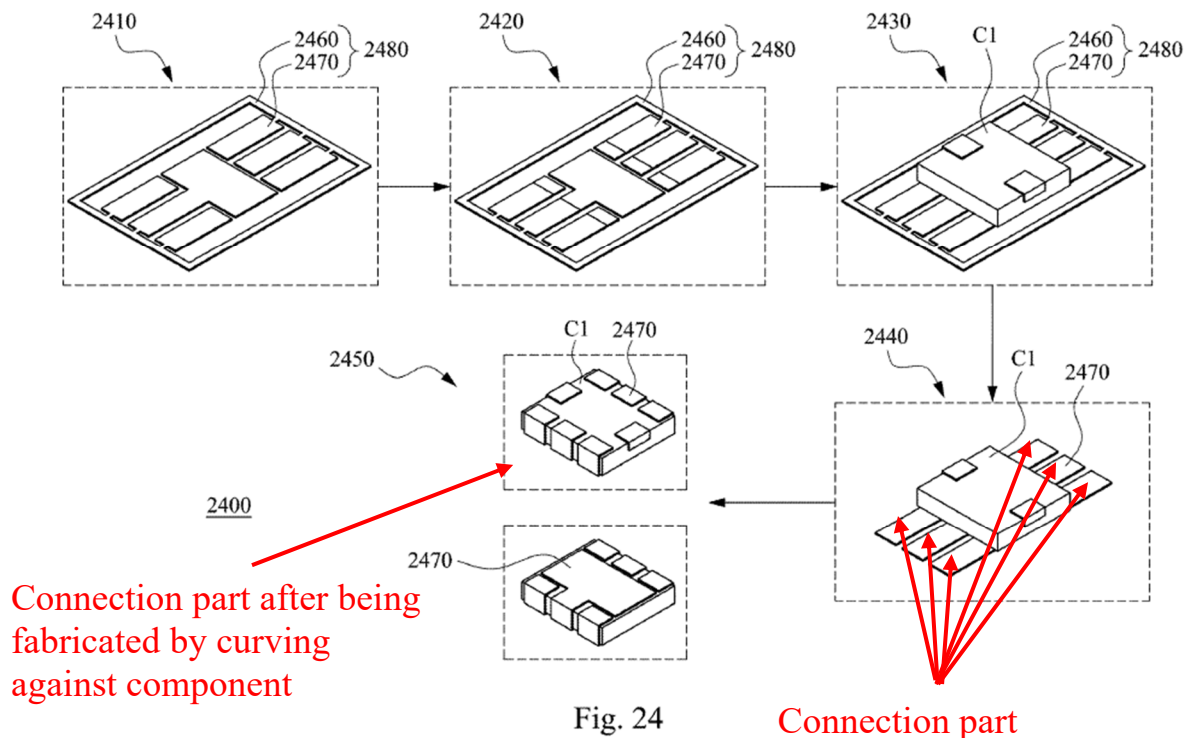
C. Claim Construction

- (i) “is fabricated by mechanical support of the first electronic component” (claim 1)

Claim 1 requires a “first electronic component” and a “connection part” and further recites “wherein the first connection part is fabricated by mechanical support of the first electronic component.” This is a product-by-process limitation because it specifies the method of fabrication and therefore is not entitled to patentable weight when evaluating patentability. *In re Thorpe*, 777 F.2d 695, 697 (Fed. Cir. 1985) (“The patentability of a product does not depend on its method of production.”); *Kamstrup A/S v. Axioma Metering UAB*, 43 F.4th 1374, 1382-83 (Fed. Cir. 2022) (“being cast in one piece” is a product-by-process limitation).

The “connection part” must be “fabricated by mechanical support” of an electrical component. VICOR-1003, ¶¶51-53. The meaning of this phrase is clear from the specification. The Summary section states that “[a]nother technical aspect of the present disclosure is a method for manufacture [of] a power converter” including the steps of “curving the connection part by mechanical support of the first electronic component to fix the connection part at the first electronic

component.” VICOR-1001, 2:11-18. This step is described again in connection with step 2330 of Figure 23: “curving the connection part by mechanical support of the first electronic component to fix the connection part at the first electronic component.” *Id.*, 10:48-50; *see also id.*, 11:1-4. The ’263 Patent further states that the power converter of Figure 1 may be made using “method 2300” such that “the connection parts P1 and P2 are fabricated by mechanical support of the first electronic component C1.” *Id.*, 11:19-27. Method 2300 is depicted in Figure 24, which clearly shows the connection parts being curved against the electronic component C1:



Thus, the claim term “fabricated by mechanical support of the first electronic component” should be construed to mean “is fabricated by curving a piece of metal against the first electronic component.”

All grounds apply this construction, because once construed as a product-by-process limitation, the limitation may be ignored in a patentability analysis.

(ii) Patent Owner’s Apparent Construction

The Grounds further apply Patent Owner’s Apparent Construction based on Patent Owner’s infringement allegations in the co-pending litigation.

Patent Owner filed a complaint for patent infringement in the Western District of Texas on October 23, 2023, accusing various Vicor products of infringing the ’263 Patent. Vicor-1004, p. 5-11. In Patent Owner’s preliminary infringement contentions (asserting claims 1, 2, 3, and 6), Patent Owner mapped the “connection part . . . wherein the first connection part is fabricated by mechanical support of the first electronic component” to read on a commercial embodiment of Vinciarelli-664. VICOR-1011, pp. 2-20. For example, Patent Owner accuses the following Vicor VTM:



VICOR-1011, p. 3. This accused VTM is similar to Figure 1 of Vinciarelli-664:

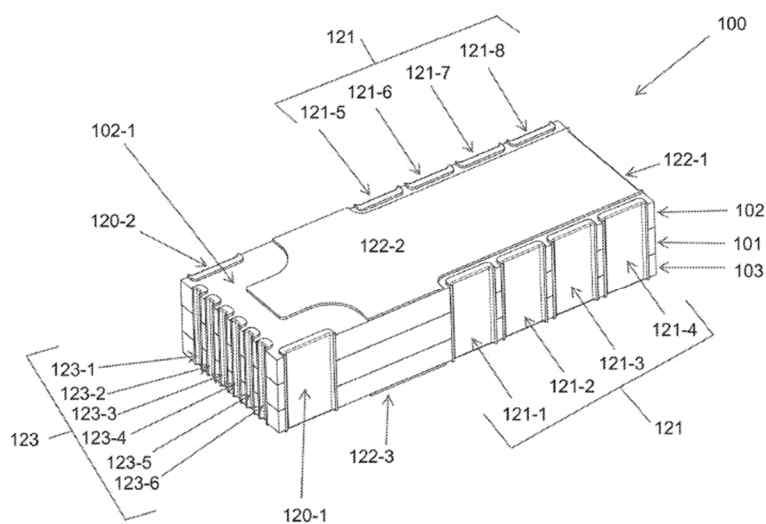
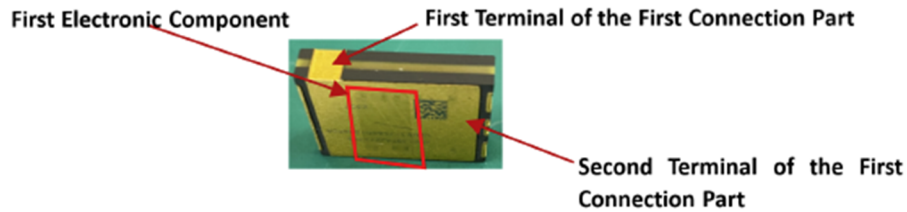


FIG. 1

For Limitation 1[g] (as the claim is mapped in this Petition) Patent Owner asserts:

The NBM2317S60D1580T0R provides that the first connection part is fabricated by mechanical support of the first electronic component, as illustrated by the product representation below.



Additionally, Figure 4 depicts a manufacturing process where “ChiPs are made and cut from a standard-size panel” and where “the first connection part is fabricated by mechanical support of the first electronic component.”

VICOR-1011, p. 14-16 (Patent Owner uses different claim limitation numbering).

The accused products are formed from a panel, plated with conductive material and then singulated to form individual units. Patent Owner identifies the “first electronic component” as a transformer core which is exposed at a surface of the device, and the “second terminal of the first connection part” as the conductive plating over the exposed transformer core. Based on this assertion, certain grounds of this Petition rely on Patent Owner’s Assumed Construction, which is a connection part that does not need to be a piece of metal that is curved against an electronic component. VICOR-1003, ¶¶54-56.

(iii) Remaining terms

All other claim terms should be construed according to the *Phillips* standard. See 37 C.F.R. § 42.100. The invalidity issues raised in this Petition may be resolved without any formal claim construction and without determining the

precise metes and bounds of the claims. VICOR-1003, ¶57.¹

D. Level of Ordinary Skill in the Art

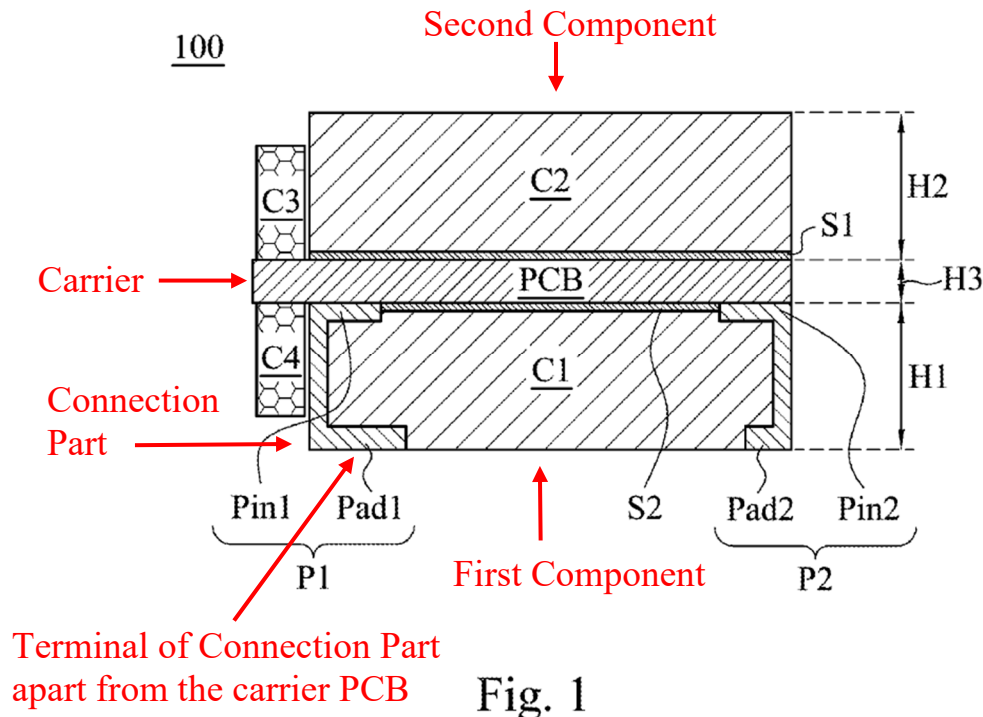
A person of ordinary skill in the art (a “skilled artisan”) relating to the subject matter of the ’263 Patent as of October 9, 2015 would have had (1) at least a bachelor’s degree in electrical engineering or a related field, and (2) at least two years of industry experience in power engineering. Additional graduate education could substitute for professional experience, and *vice versa*. *Id*; VICOR-1003, ¶41.

II. THE ’263 PATENT

A. Brief Description

The ’263 Patent is directed to “a power converter” that “includes a carrier, a first electronic component, a second electronic component, and a first connection part.” VICOR-1001, 1:62-65. The carrier may be a printed circuit board (“PCB”) and the electronic components are disposed at the bottom and top of the carrier, respectively. *Id.*, 4:1-6, 22-27, 28-32.

¹ Petitioner is not conceding that each claim satisfies all statutory requirements, nor waiving any arguments concerning indefiniteness or other grounds that may not be raised in an *inter partes* review proceeding.



As described in the specification, the “connection part” has two terminals. One terminal is connected to the bottom surface of the carrier and the other terminal is a bonding pad attached to a surface of a component mounted on the bottom of the carrier and at a location “apart from the carrier PCB.” *Id.*, 4:28-49. Finally, “[a]s can be seen from [Fig. 1], the carrier PCB can be disposed at 1/3 to 2/3 of the height of the power converter.” *Id.*

The patent uses the term “electronic component” to include “an entire electronic component, such as a MOSFET or an integrated circuit,” “an entire combination of electronic components, such as a power module,” and “may also include a part of a core of the magnetic element.” VICOR-1001, 11:52-67, 6:21-37; VICOR-1003, ¶¶58-63.

The “connection part” is formed using the process described in Figure 23 and illustrated in Figure 24. Metal contacts are curved against a component as shown.

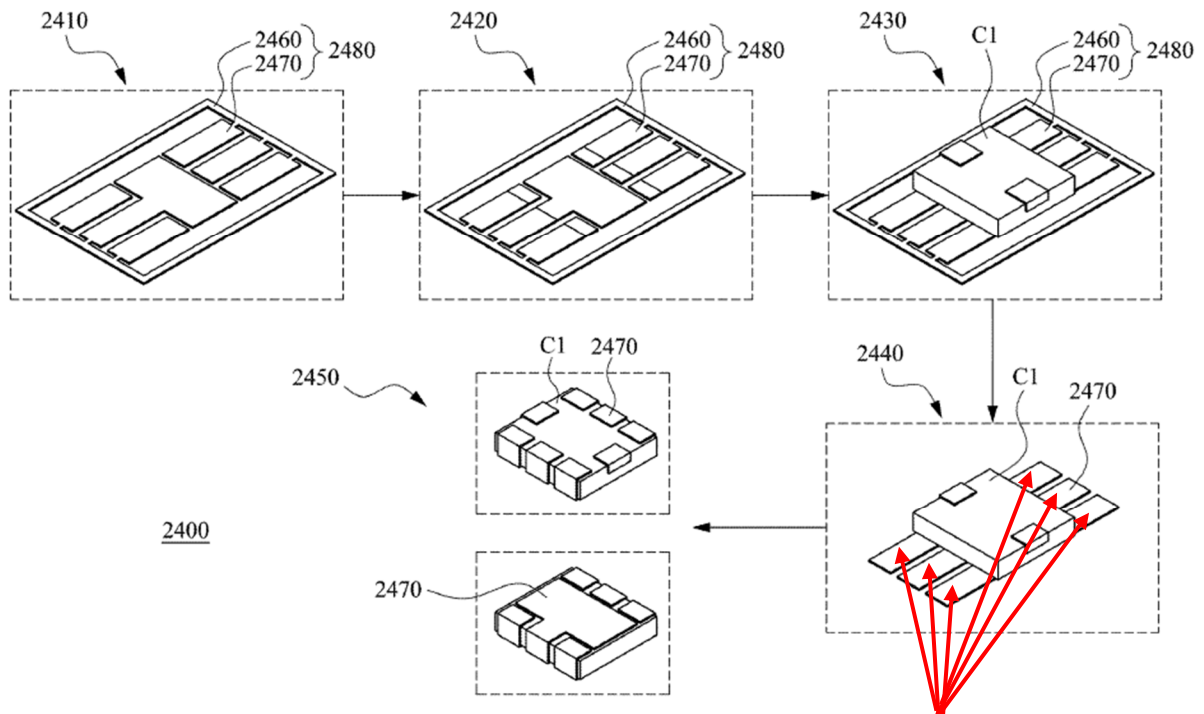


Fig. 24

Connection Parts

B. Prosecution History

Patent Owner did not cite Vinciarelli-664, which anticipates the Challenged Claims. Nor did the Examiner cite Vinciarelli-218, or issue a prior art rejection during the prosecution of the '263 Patent. The Examiner allowed the claims on the first office action. VICOR-1002, pp. 7-15. The Notice of Allowability included a Notice of References Cited that identified four references, including Zeng-014.

VICOR-1002, p. 16. However, Zeng-014 was not discussed or otherwise distinguished from the allowed claims.

III. THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. GROUND 1A – Claims 1-6 are Anticipated by Vinciarelli-664

Patent Owner has accused Vicor products as disclosed in Vinciarelli-664 of infringing the '263 Patent. Vinciarelli-664 anticipates the Challenged Claims.

Ground 1A relies on two alternative constructions for limitation 1[g]: the product-by-process construction and Patent Owner's Apparent Construction applied when asserting infringement. VICOR-1003, ¶.45.

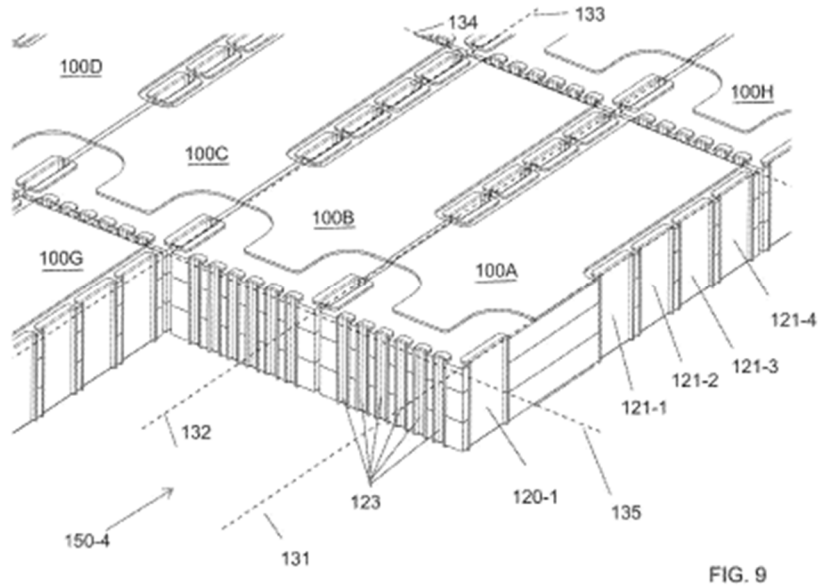
1. Summary of Vinciarelli-664

The terminal structure of the accused products is disclosed in Vicor's own prior art—namely, Vinciarelli-664. Similar to the accused products, Vinciarelli-664 discloses that “forming one or more conductive metal layers” can include “(a) applying a seed layer including conductive particles to the surfaces of the panel, and subsequently (b) plating a layer of metal onto the seed layer.” VICOR-1005, 2:50-53. Vinciarelli-664 specifically teaches that “areas covering the magnetic cores ... may be coated with electrically (and thermally) conductive material such as copper to provide electromagnetic shielding (e.g. for EMI reduction).” VICOR-1005, 7:13-18.

Vinciarelli-664, entitled “Method of Electrically Interconnecting Circuit

Assemblies,” concerns a method of making a power module by forming a panel of a plurality of power modules. Vinciarelli-664, Abstract.

Figure 9 depicts a portion of a panel of identical modules:



Once a module is cut from the panel (the cutting process is called “singulation”), the module has a plurality of electrical contacts that may be situated on all four sides of the module and extending to the top and bottom of the module as well.

Vinciarelli-664, 5:11-7:26, FIGs. 1, 2.

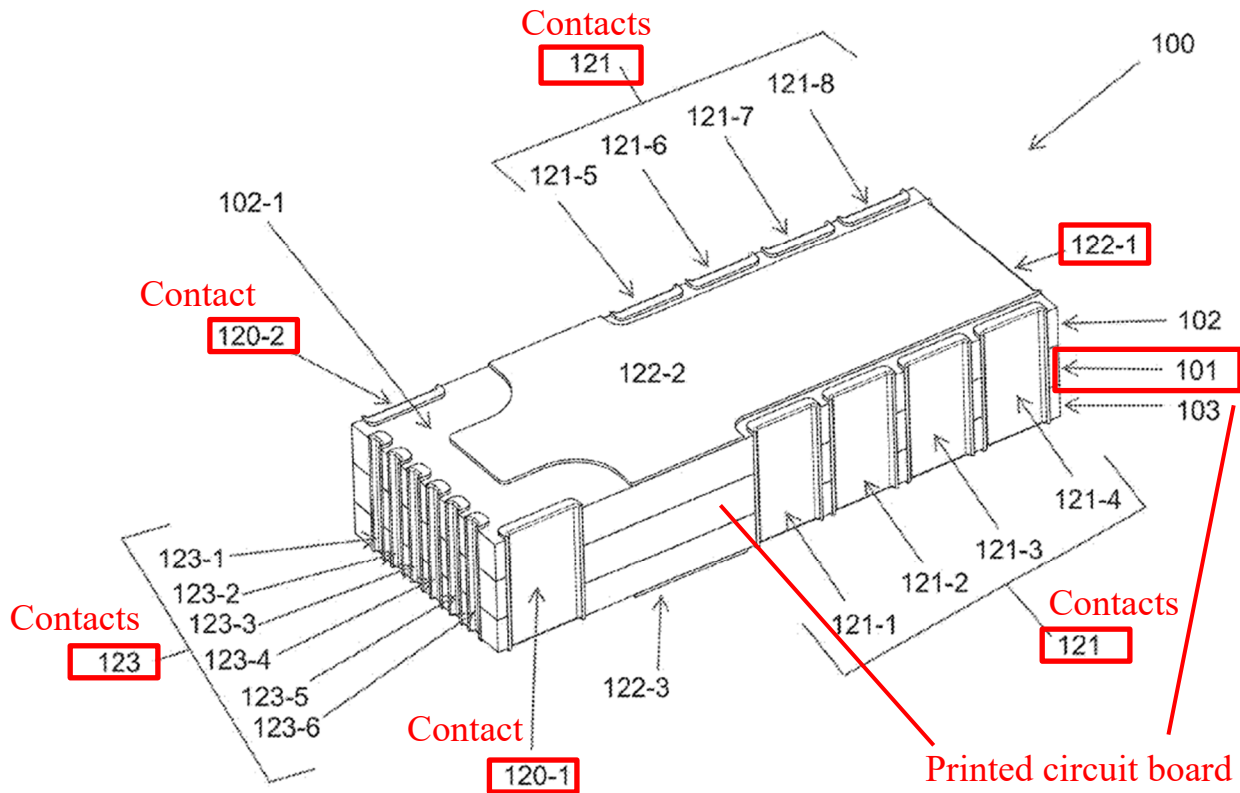


FIG. 1

As shown above in Figure 1 of Vinciarelli-664, the module has a “printed circuit board 101” in the center. The printed circuit board is “disposed between cured layers of encapsulant 102 and 103.” *Id.*, 6:15-27. The encapsulant layers 102 and 103 cover some or all of the components mounted to either side of the printed circuit board and can provide top and bottom smooth surfaces for stacking modules. *Id.*, 6:15-27, 10:21-37; VICOR-1003, 72.

“Each of the signal contacts 123, input contact 120-1, and output contacts 121-1, 121-2, 121-3, and 121-4 may extend from a top surface of the top encapsulant to a bottom surface of the bottom encapsulant as shown.” VICOR-

1005, 11:29-33.

The bottom surface of the contacts may form conductive pads for electrically connecting the module to a customers printed circuit board, as shown in Figure 2.

VICOR-1005, 6:54-7:12.

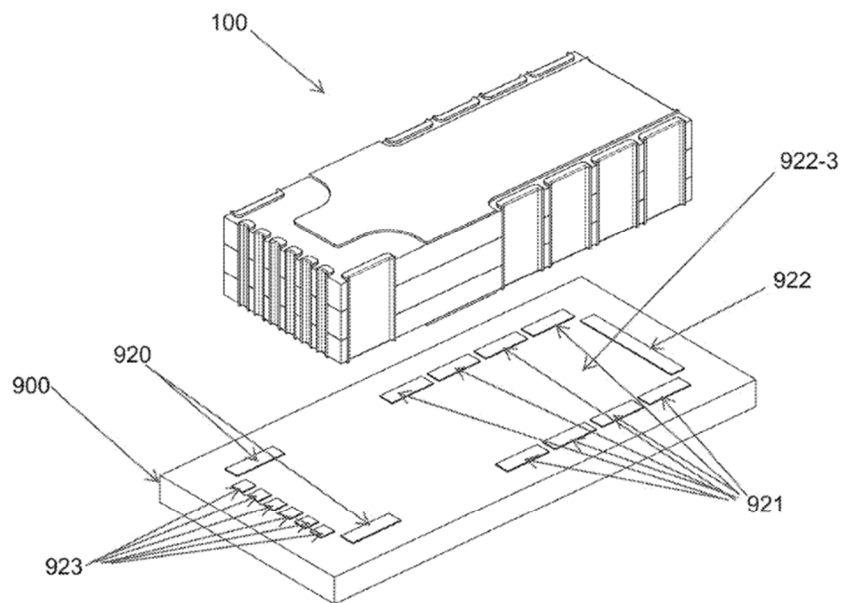
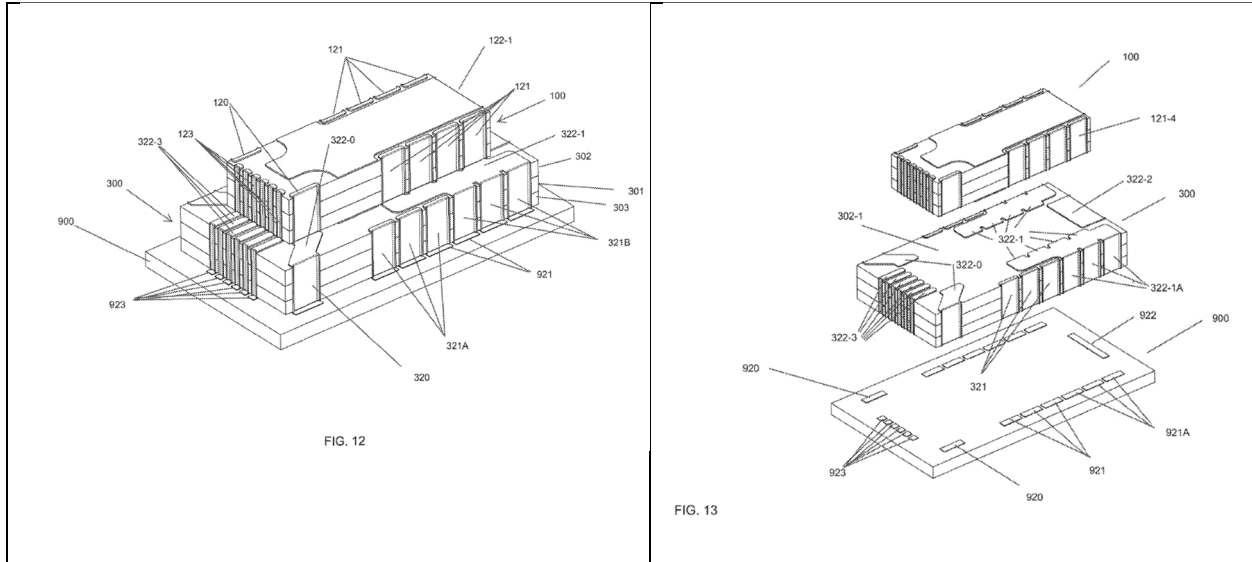


FIG. 2

Likewise, the top surface of the contacts may form conductive pads so that modules may be stacked, wherein the bottom of the upper module is electrically connected to the top of the lower module, as shown in Figures 12 and 13. VICOR-1005, 13:66-14:16; VICOR-1003, ¶¶65-72.



2. Claim 1

[1pre] **“A power converter, comprising:”**

Vinciarelli-664 discloses a power converter. VICOR-1003, ¶73. “This invention relates to the field of encapsulating electronic assemblies and more particularly to forming edge connections and other conductive features on and through encapsulated electronic assemblies including encapsulated **power converters**.”² VICOR-1005, 1:7-11; *see also* FIGs. 1-13, 5:11-50, *passim* (specification text describing each figure).

[1a] “a carrier, comprising: an upper surface; and a lower surface;

Vinciarelli-664 discloses a carrier (“**printed circuit board 101**”) that has an upper surface and a lower surface. VICOR-1003, ¶74.

² Emphasis added throughout unless otherwise stated

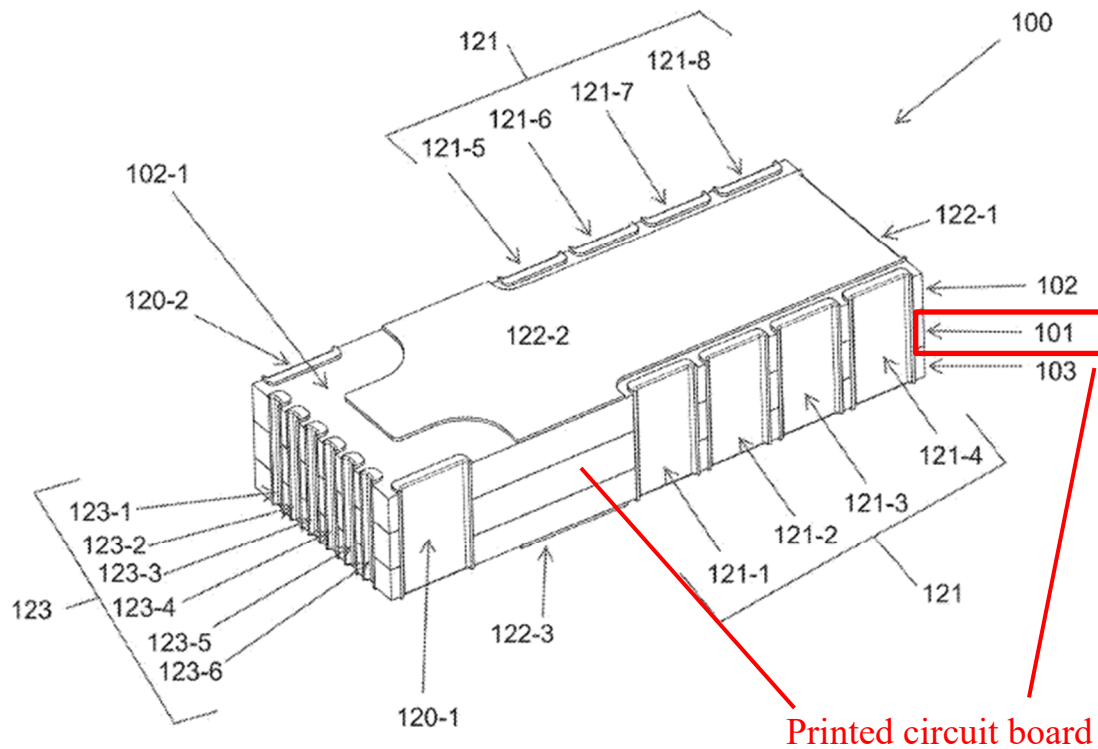


FIG. 1

The printed circuit board 101 can be a multilayer circuit board. VICOR-1005, 6:15-27. Printed circuit boards have a top and bottom surface. Components are mounted to the top and bottom surfaces of the printed circuit board 101. *Id.* The top and bottom surfaces of the printed circuit board in Fig. 1 are not visible because they are covered with encapsulant, but the sides of the printed circuit board are visible. VICOR-1005, 6:21-27; VICOR-1003, ¶75.

[1b] “a first electronic component disposed at the lower surface of the carrier; a second electronic component disposed at the upper surface of the carrier; and”

Vinciarelli-664 discloses a first electronic component disposed at the lower

surface of the carrier and a second electronic component disposed at the upper surface of the carrier. VICOR-1003, ¶76. “Because the encapsulant layers 102 and 103 cover the **components mounted on the printed circuit board 101**, the top surface of the encapsulant 102 and the bottom surface of the encapsulant 103 may provide smooth surfaces....” VICOR-1005, 6:21-27. A skilled artisan would have understood that the components are on both the upper and lower surface of the carrier (printed circuit board) for a few reasons.

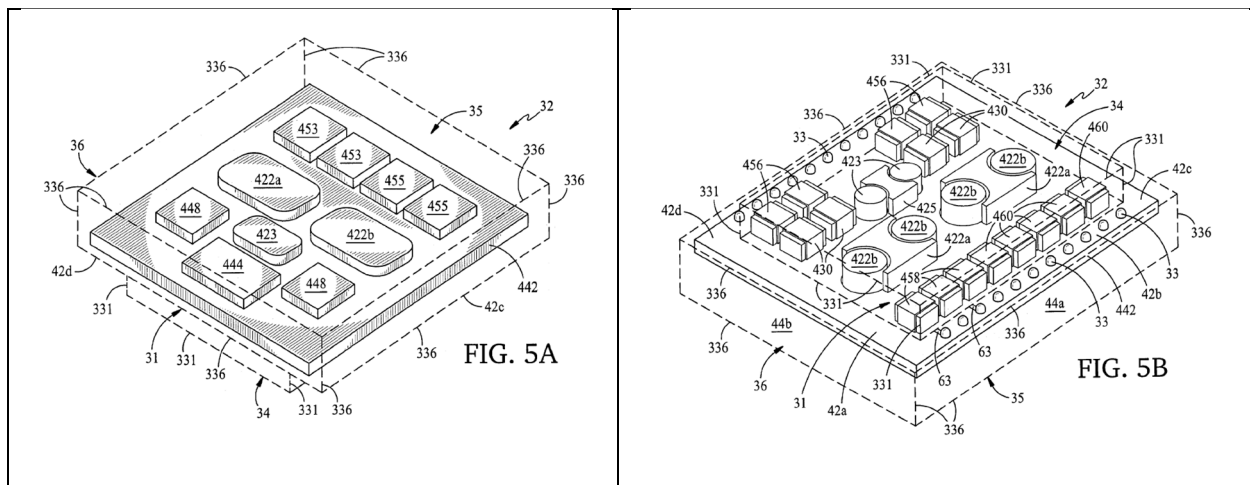
First, Vinciarelli-664 states that “layers 102 and 103 cover the components.” *Id.* Thus, layer 102 covers components disposed on the upper surface of the carrier (printed circuit board) and layer 103 covers components disposed on the lower surface of the carrier (printed circuit board). VICOR-1003, ¶77.

Second, Figure 1, for example, depicts a power converter with three layers. The middle layer is the printed circuit board 101. The upper and lower layers (102 and 103) are roughly equal in size thus suggesting to one of ordinary skill that components are mounted on both sides. VICOR-1003, ¶78.

Third, Vinciarelli-664 discloses embodiments that have “exposed magnetic cores” that “may be exposed at the top and bottom surfaces of the un-singulated modules.” VICOR-1005, 8:11-26; *see also id.*, 7:13-26. A skilled artisan would have understood that if the cores are exposed (prior to coating) at the top and bottom of the module, then they would be disposed at the top and bottom of the

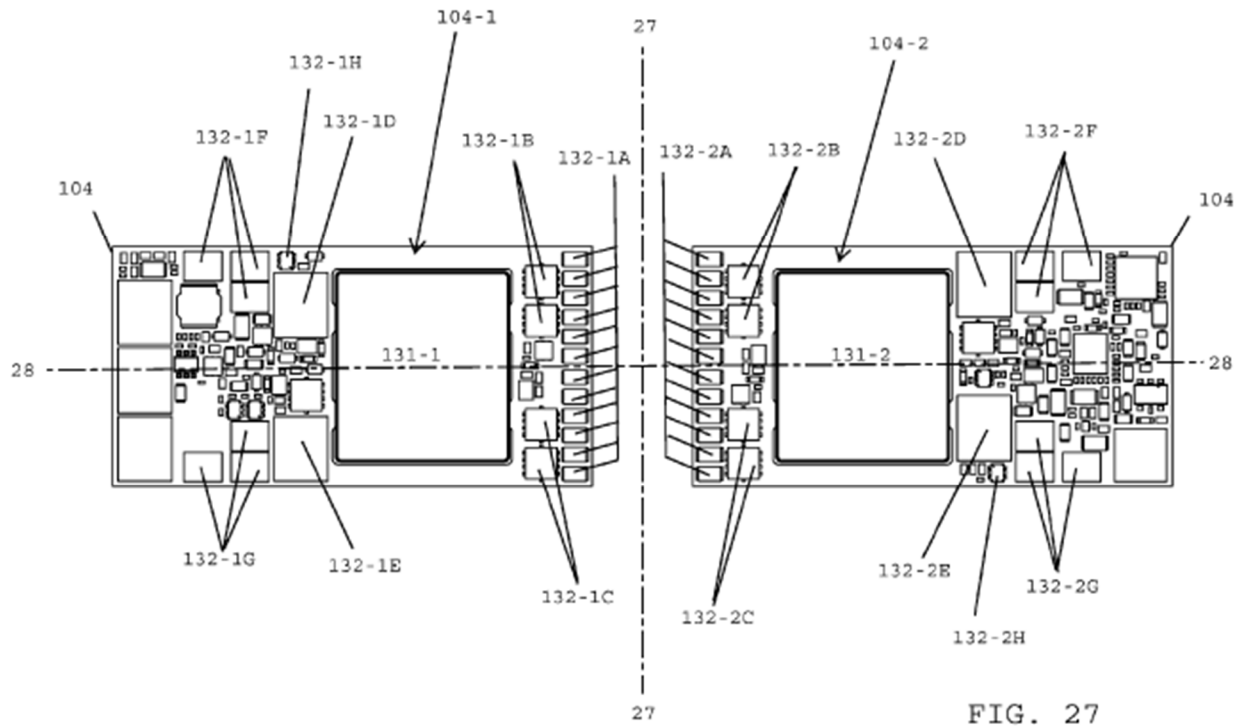
printed circuit board respectively. VICOR-1003, ¶¶79-80.

Fourth, Vinciarelli-664 incorporates Vinciarelli-844, Vinciarelli-269, and Vinciarelli-747 (VICOR-1005, 1:20-2:12) for their teachings concerning encapsulated power converters. Vinciarelli-844 discloses power converters with components mounted to the top and bottom of the printed circuit board. VICOR-1007, 11:6-15. Vinciarelli-884 also provides FIGS. 5A and 5B which “show top and bottom phantom perspective views of a power converter.” VICOR-1007, 9:43-45; VICOR-1003, ¶¶81-85.



VICOR-1007, FIGS. 5A, 5B.

Likewise, Vinciarelli-747 discloses a printed circuit board with components mounted on both sides. For example, FIG.27 depicts the top and bottom of the printed circuit board, in which certain components are mounted as mirror images of each other (such as the magnetic cores 131-1 and 131-2):



VICOR-1010, FIG. 27; *see also id.*, FIGs. 29, 32, 22:38-24:49.

Thus, Vinciarelli-269 discloses various options for the design of the inductive components and provides details concerning the construction of transformer cores used in the power converters. VICOR-1006, FIGS. 1, 2A, 2B, 5, 8, 9, 18A, 18B, 19A, and 19B (and text in the written description discussing the figures). And Vinciarelli-747 provides additional details concerning the printed circuit board used in the power converters. VICOR-1010, FIGs. 10A, 10B, and 11 (and the written description discussing the figures).

A skilled artisan would have understood, or at the very least, would have at once envisaged, that embodiments of the power converter contemplated by Vinciarelli-664 have one or more of the internal structures disclosed in the

incorporated patents or otherwise known in the art. VICOR-1003, ¶84; *see also Blue Calypso, LLC v. Groupon, Inc.*, 815 F.3d 1331, 1341 (Fed. Cir. 2016) (“a reference can anticipate a claim even if it ‘d[oes] not expressly spell out’ all the limitations arranged or combined as in the claim, if a person of skill in the art, reading the reference, would ‘at once envisage’ the claimed arrangement or combination”). Vinciarelli-664 states that its “field of invention” is the field of “encapsulating electronic assemblies and more particularly[,] [] forming edge connections and other conductive features on and through encapsulated electronic assemblies including encapsulated power converters.” VICOR-1005, 1:7-11. The detailed description immediately introduces the contacts and the external interface of the module and presumes that reader will consult the incorporated patents in the background for details concerning the internals of the module. For example, Vinciarelli-664 mentions that the module has a “printed circuit board 101” with “components mounted on the printed circuit board” and refers to the incorporated patents, and in particular the “Bar Code Patent” (Vinciarelli-747). VICOR-1005, 5:54-6:49, 7:34-42, 8:60-9:3, 1:60-67. A skilled artisan would understand that the “background” section which describes encapsulated electronic power converters provides incorporated disclosures to understand the internal components and structures of the power converters to be produced by the improved interconnect method of Vinciarelli-664. VICOR-1003, ¶84; *See Blue Calypso, LLC v.*

Groupon, Inc., 815 F.3d 1331, 1341 (Fed. Cir. 2016) (“a reference can anticipate a claim even if it ‘d[oes] not expressly spell out’ all the limitations arranged or combined as in the claim, if a person of skill in the art, reading the reference, would ‘at once envisage’ the claimed arrangement or combination”).

[1c] “a first connection part, comprising:”

Under Patent Owner’s Assumed Construction, Vinciarelli-664 discloses this limitation. VICOR-1003, ¶¶86-87. Like the accused products, Vinciarelli-664 discloses a “first connection part” because it discloses a conductive surface on the power converter (“contacts 120-1, 120-2, 121, and 122-1”). VICOR-1005, 5:55-6:27.

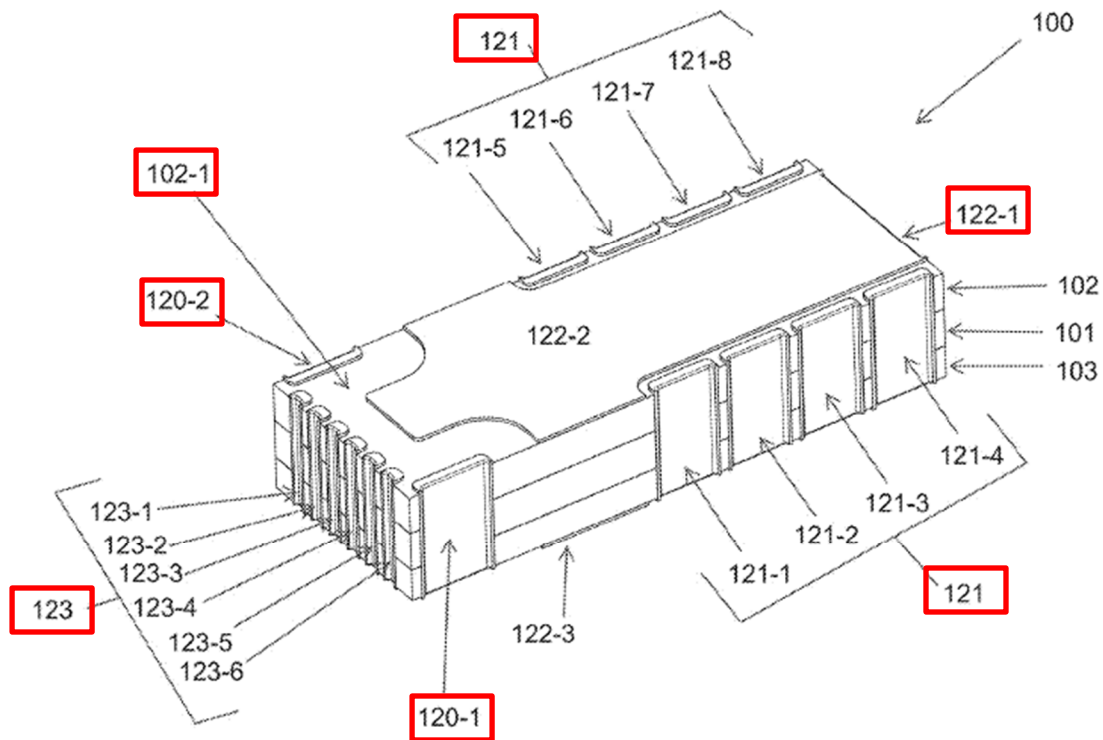


FIG. 1

For example, “[a]s shown, the common connection extends laterally along a substantial portion of one side of the module 100 forming contact 122-1 and also extends over much (e.g., 50% or more) of the top and bottom surfaces of the module forming shields 122-2 and 122-3 either or both of which may also be used to establish electrical connections thus increasing the surface area and current carrying capacity.” VICOR-1005, 6:3-9.

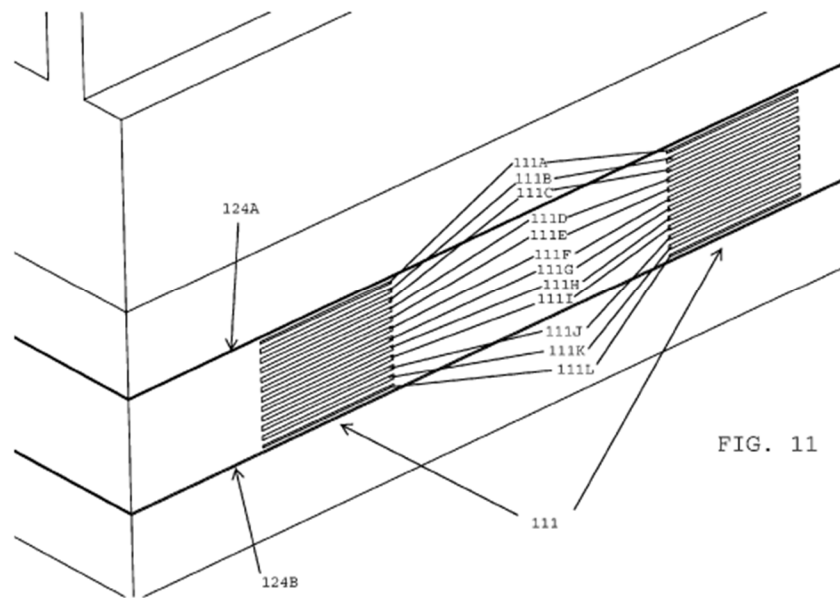
[1d] “a first terminal electrically coupled to the upper surface or the lower surface of the carrier; and”

Vinciarelli-664 discloses that the connection part of limitation [1c] (“contacts 120-1, 120-2, 121, and 122”) has terminals electrically coupled to the

upper or the lower surface of the carrier (printed circuit board) so that the components mounted to the upper and lower surfaces of the carrier (printed circuit board) may be connected to outside components. VICOR-1003, ¶¶88-96. For example, Vinciarelli-664 describes a “first modular package” with a “first circuit board” with a “perimeter edge having at least a first electrical contact electrically coupled to one or more conductive features embedded in the first circuit board.” VICOR-1005, 3:43-56. Vinciarelli-664 further states, “In the example of FIG. 1, the electrical connections extend from the bar codes up and down the sidewalls and onto selected portions of the top and top [sic] and bottom surfaces of the module. As shown, all four sidewalls and the top and bottom surfaces of module 100 have metallized contacts.” VICOR-1005, 6:56-61. It should be noted that the “upper surface” of the “carrier” is in the interior of the module and should not be confused with the upper surface of the module.

The “bar code” in Vinciarelli-664 is a collection of conductive paths from the components on the printed circuit board to the perimeter of the circuit board, such that the contacts at the perimeter resembles a bar code. Vinciarelli-664 incorporates Vinciarelli-747, which it refers to as the “Bar Code Patent.” VICOR-1005, 1:60-66. Incorporated Vinciarelli-747 explains that “conductive lands” are “formed along the cut line on a plurality of the conductive layers of the PCB [to] form a stack of conductive strips resembling a bar code after singulation.”

VICOR-1010, 15:55-59.



VICOR-1010, FIG. 11. Vinciarelli-747 explains that the “conductive lands” may be used in conjunction with “conductive vias” and “conductive through-holes.”

VICOR-1010, 16:25-55. In addition, “conductive vias [are] used to electrically connect the components on the PCB surfaces to internal conductive layers.”

VICOR-1010, 23:45-48. A skilled artisan would have recognized that the components on its printed circuit board are either surface mounted or through-hole mounted, as disclosed by the incorporated references. VICOR-1005, 2:3-12 (incorporating by reference “PM CIP” (which is U.S. App. No. 14/116,642, which is Vinciarelli-218, VICOR-1009, and defining it as one of a number of “Panel Mold Disclosures”). Vinciarelli-664 states that the “preferred processes for making the leadless modules build upon the panel molding processes described in

the Panel Mold Disclosures.” VICOR-1005, 7:28-30. And Vinciarelli-218 describes attaching components using “surface mount soldering.” VICOR-1009, [0176]. Moreover, a skilled artisan would have at once envisaged surface mounting as the typical way of attaching components by the Critical Date, and as an improvement over the older through-hole method. VICOR-1003, ¶91; *see also Blue Calypso*, 815 F.3d at 1341.

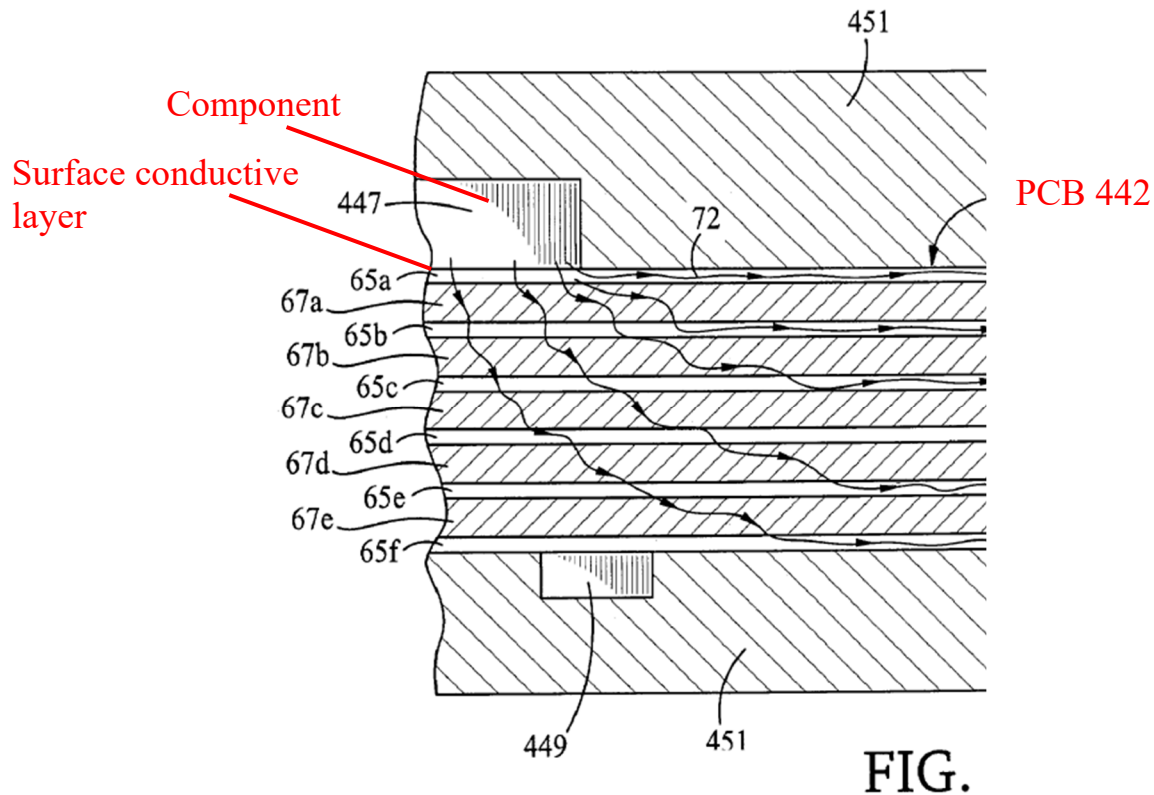
Thus, a skilled artisan would have understood that the conductive features are coupled to electrical contacts on the surfaces of the printed circuit board to provide power and signal paths to the electronic components mounted on the circuit board. Moreover, through-hole conductors likewise contact the surface of the printed circuit board as the through-hole pins descend into the printed circuit board. VICOR-1001, 4:40-43 (confirming through-hole devices use an insertion connection from a surface of the printed circuit board); VICOR-1003, ¶91.

Vinciarelli-664 also describes an embodiment in connection with FIG. 11 that has a “conductive shield 222-2 on the top of the module,” which may be “electrically [] connected to the common contacts 222-1” and have a “thermal conduit slot [that] may extend entirely through the panel to provide a thermal conduit that extends between the top and bottom surfaces.” VICOR-1005, 13:1-48. The slot may provide “electrical, connections between the substrate and the top and/or bottom conductive layers.” VICOR-1005, 13:1-48. A skilled artisan

would have understood that a “common” contact forms a common potential that, if not isolated, would be considered “ground” and would be coupled to various components in the power converter. VICOR-1003, ¶92.

Further, various options for printed circuit boards for power converters are disclosed in Vinciarelli-844, which is incorporated by reference for its teachings of the internals of encapsulated power converters. VICOR-1005, 1:20-37. A skilled artisan would understand that Vinciarelli-664 discloses through its incorporation of prior patents various internal structures that may be within the module, such as the structure of printed circuit boards and arrangements of components on the printed circuit boards. For example, Vinciarelli-844 discloses a power converter having “multilayer PCB 442 and circuit components (e.g., components 447, 449 **mounted on, respectively, the top and bottom surfaces of multilayer PCB 442**) encapsulated in thermally conductive epoxy 451.” VICOR-1007, 14:44-48 (emphasis added). The board (“PCB 442”) includes “conductive runs 65” that **“form connections between circuit components mounted on the top and bottom surfaces of the PCB 442** and between converter circuitry and interface contacts 33.” VICOR-1007, 14:50. As shown in FIG. 10 of Vinciarelli-844, conductive run 65a and conductive run 65f are on the top and bottom surface of the multilayer printed circuit board. In addition, a skilled artisan would further have understood that internal conductive runs are coupled to the top and bottom surfaces

of the PCB through vias to couple components mounted on the surface of the printed circuit board. At the very least, a skilled artisan reading Vinciarelli-664 would have at once envisaged a printed circuit board with power, ground, and signal traces that are coupled to the surface of the PCB and the module external interface. VICOR-1007, FIG. 10; VICOR-1003, ¶93. An excerpted portion of FIG. 10 from Vinciarelli-844 is reproduced below showing the structure of the PCB in the power converter:



A skilled artisan would have understood that the circuit board described in Vinciarelli-844 is exemplary of a circuit board that would be within the power

converter module of Vinciarelli-664. VICOR-1003, ¶96.

[1e] “a second terminal attached to a surface of the first electronic component apart from the carrier, wherein the second terminal of the first connection part is a bonding pad;”

Vinciarelli-664 discloses that the connection part of limitation [1c] (under Patent Owners Assumed Construction) (“contacts 120-1, 120-2, 121, and 122”) has a second terminal (the bottom end of each contact) attached to a surface of the first electronic component (which may be the collection of components on the bottom half of the module or one or more of the components on the bottom of the module). In some embodiments of Vinciarelli-664, the power converter uses “exposed core” transformers, meaning that the cores are not covered with encapsulant, but rather are at the same level as the surrounding encapsulant. VICOR-1005, 1:36-44, 8:11-26, 10:13-26. Each exposed core would be an exemplary electronic component. VICOR-1003, ¶¶97-102. As shown in FIGs. 2 and 3, a customer’s board has “conductive pads 920, 921, 922, and 923 arrange[] to mate with corresponding contacts 120, 121, 122, and 123 on module 100.” VICOR-1005, 6:62-7:6; FIGs. 2 and 3.

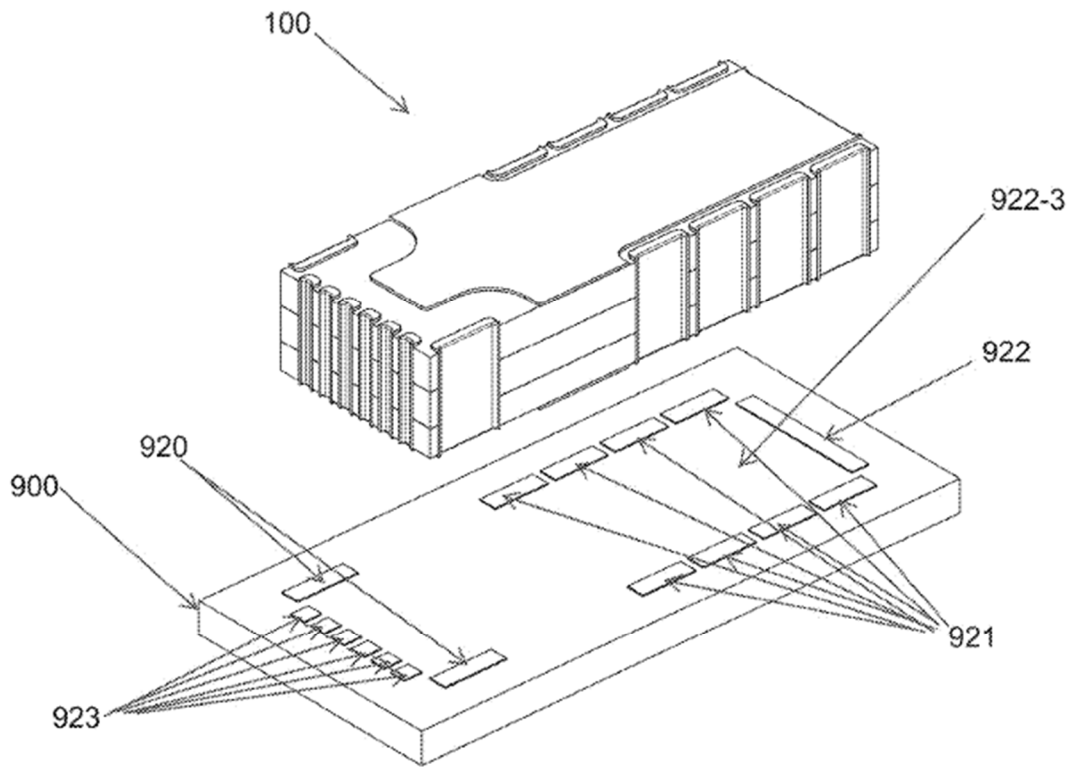


FIG. 2

A skilled artisan would have understood the bottom common contact would be comparable in size to the top contact to provide shielding. VICOR-1005, 13:50-52 (module has “top and bottom shields 122-2 and 122-3”). Just like the accused products, “portions of the top and bottom surfaces of the module 100, optionally including areas covering the magnetic cores (e.g., similar to 815C in FIG. 10 [an exposed core design]), may be coated with electrically (and thermally) conductive material such as copper to **provide electromagnetic shielding** (e.g. for EMI reduction), improve heat distribution over the large surfaces of the module . . . **and**

solder-mount options (e.g. shields/contacts 122-2 and 122-3 in FIG. 1)."

VICOR-1005, 7:13-23 (emphases added); VICOR-1003, ¶100.

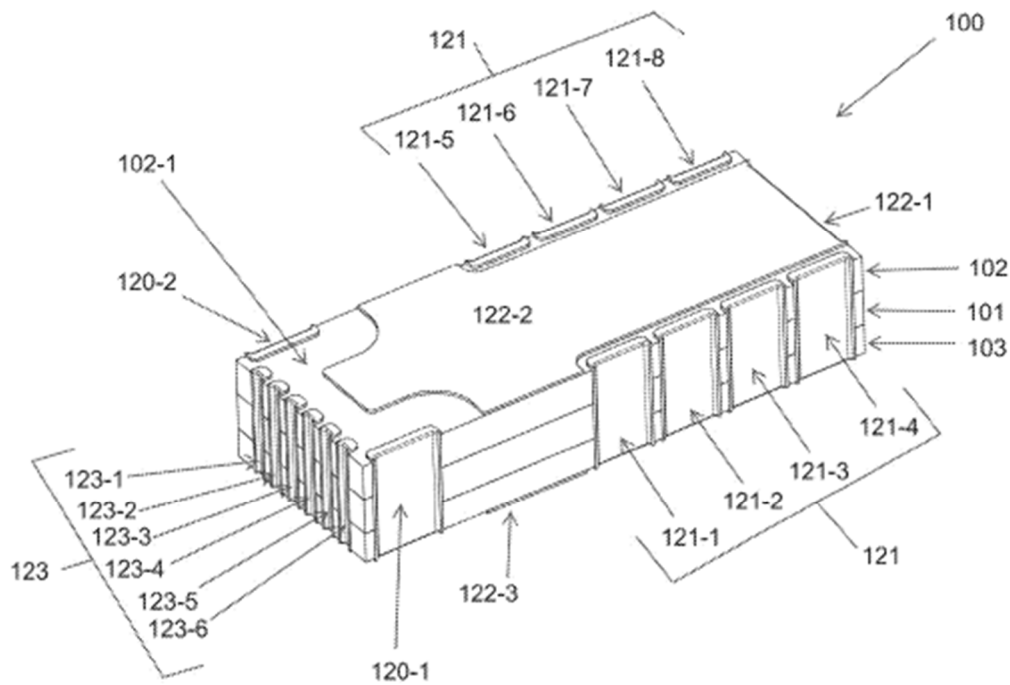


FIG. 1

Moreover, even if the module was not symmetrical on the top and bottom, the contacts attached to virtually the entire “top” surface of the module shown in FIG. 1 meet the claim because, as Vinciarelli-664 explains, the “top” **can be the bottom of the module (because the module may be used upside down)**. “The terms ‘top’ and ‘bottom’ are used to describe relative positions of items shown in the drawings. It is understood that the modules and devices described in this document

can be placed in various orientations such that, e.g., a ‘top surface’ may be facing downwards or sideways, and a ‘bottom surface’ may be facing upwards or sideways.” VICOR-1005, 14:67-15:5.

[1f] “wherein the carrier is disposed at $\frac{1}{3}$ to $\frac{2}{3}$ of a height of the power converter,”

Vinciarelli-664 discloses a power converter wherein the carrier (“printed circuit board 101”) is disposed in the middle of the power converter, which is at $\frac{1}{3}$ to $\frac{2}{3}$ the height of the power converter. VICOR-1005, 6:15-18; FIGs. 1, 11; VICOR-1003, ¶¶103-106. Even though patent drawings are not drawn to scale, and thus precise measurements cannot be determined, the figure clearly shows that the carrier is within the claimed range. *Ex parte Gengrinovich*, Appeal 2015-001194 (June 15, 2016) (drawings can be used to determine positional relationships, even if not precise proportions).

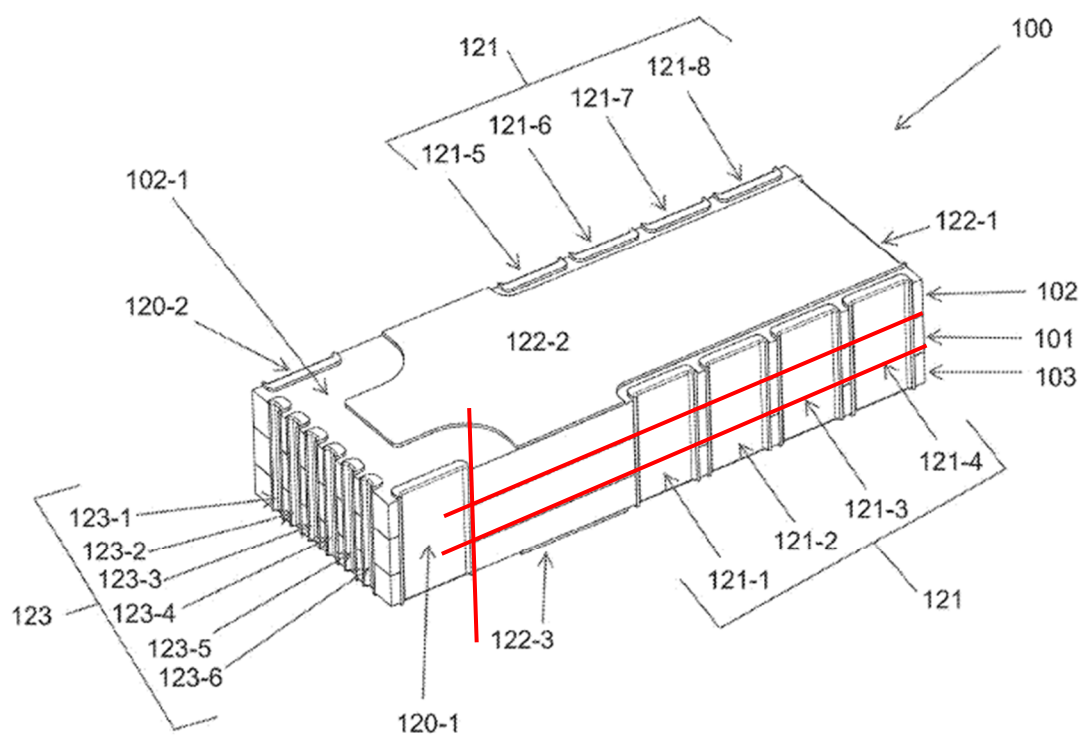


FIG. 1

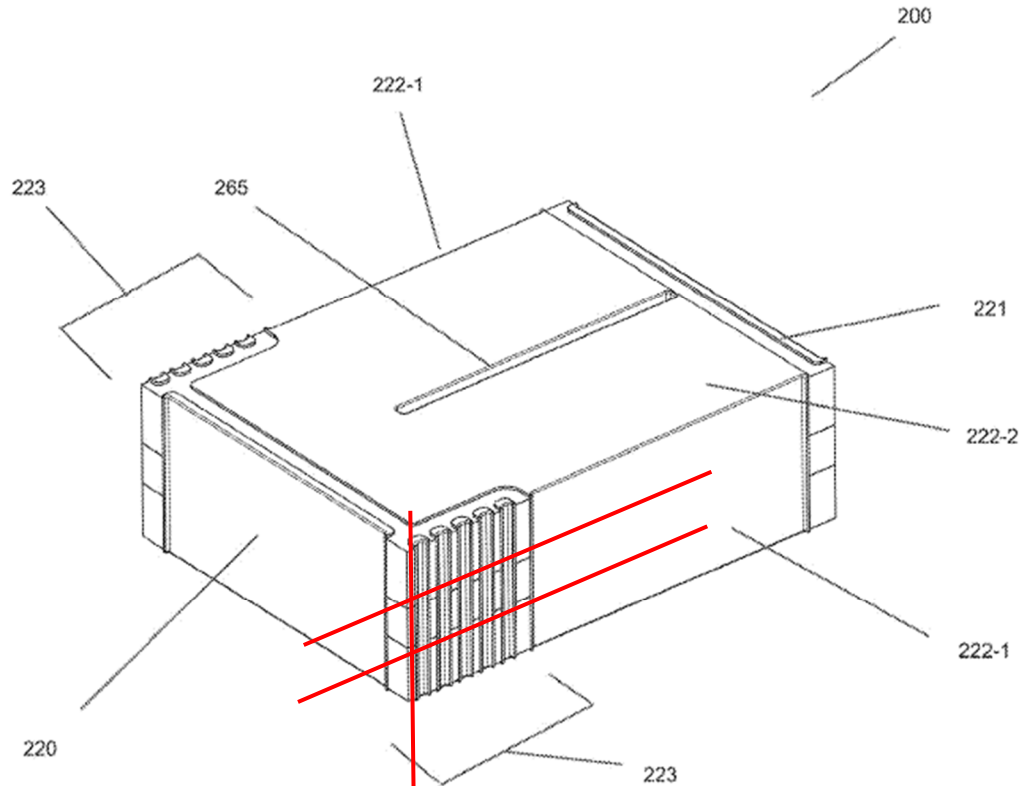


FIG. 11

In addition, Vinciarelli-664 discloses power converters that have “exposed cores” (cores not covered with encapsulant) that extend to the top and bottom of the encapsulating layers 102 and 103. VICOR-1005, 8:11-26, 7:13-26 (referring back to a prior design depicted in FIG. 10, discussed at 6:28-49). A skilled artisan would have understood that the circuit board in this embodiment is centered within the magnetic cores and thus disposed at $1/3$ to $2/3$ of a height of the power converter. VICOR-1003, ¶¶104.

For example, Vinciarelli-269 discloses the cross section of such a device. VICOR-1006, FIG. 9; VICOR-1003, ¶105. Vinciarelli-269 is incorporated by

reference into Vinciarelli-664 as an example of an encapsulated module with an exposed core structure. VICOR-1005, 1:37-44.

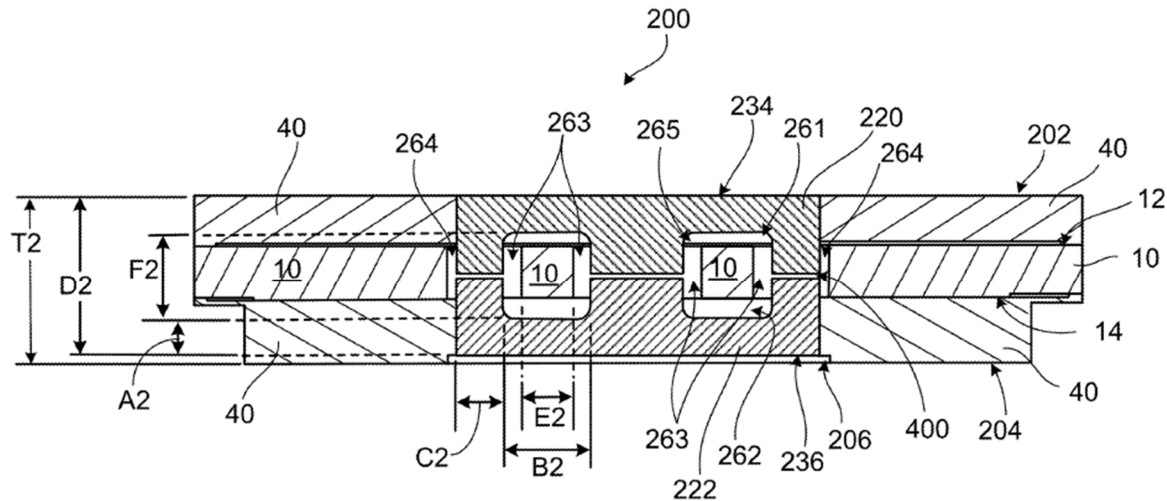


FIG. 9

In FIG. 9, T2 is the height of the power converter (referred to as a “thickness” in the reference), and the exposed cores place the printed circuit board in the middle of the power converter (disposed at half the height, which is between 1/3 and 2/3 the height of the power converter). FIG. 9 depicts D2 (the height of the exposed cores above a recess as almost the height of T2). Vinciarelli-269 explains that the “depth of the recess 206 may be reduced to zero,” thus making D2 equal to T2.

VICOR-1006, 9:40-56. Incorporated Vinciarelli-269 further confirms that transformers have “matching core halves” and thus the circuit board would be 1/2 way between them. VICOR-1006, FIGs. 1, 9, 18A, 18B, 8:25-29, 9:36-56; VICOR-1003, ¶106.

[1g] “and wherein the first connection part is fabricated by mechanical support of the first electronic component.”

Under the product-by-process construction, the element is not entitled to patentable weight. *Amgen Inc. v. F. Hoffman-La Roche Ltd.*, 580 F.3d 1340, 1369-70 (Fed. Cir. 2009).

If the Board finds that element [1g] is not a product-by-process limitation, then under Patent Owner’s Assumed Construction, Vinciarelli-664 discloses this limitation. VICOR-1003, ¶¶107-109. As previously explained, and as depicted in FIG. 1, the power converter module has numerous contacts that “extend vertically from the top surface of the cured encapsulant 102 to the bottom surface of the cured encapsulant 103.” VICOR-1005, 6:15-27, FIG. 1. Moreover, at least contact 122-2 in Fig. 1 covers the surface of any exposed core (the first electronic component) of the component, and thus would be mechanically supported by it under Patent Owner’s Assumed Construction.

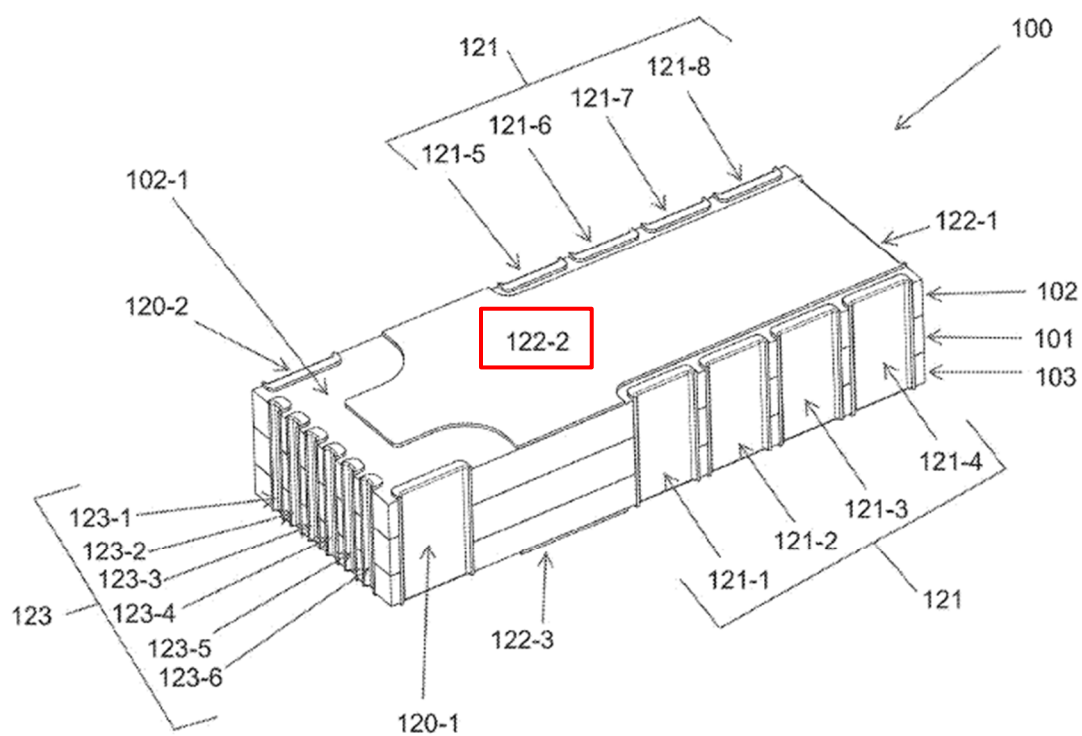


Figure 11 depicts a similar structure. VICOR-1005, 13:1-11, FIG. 11; VICOR-1003, ¶109.

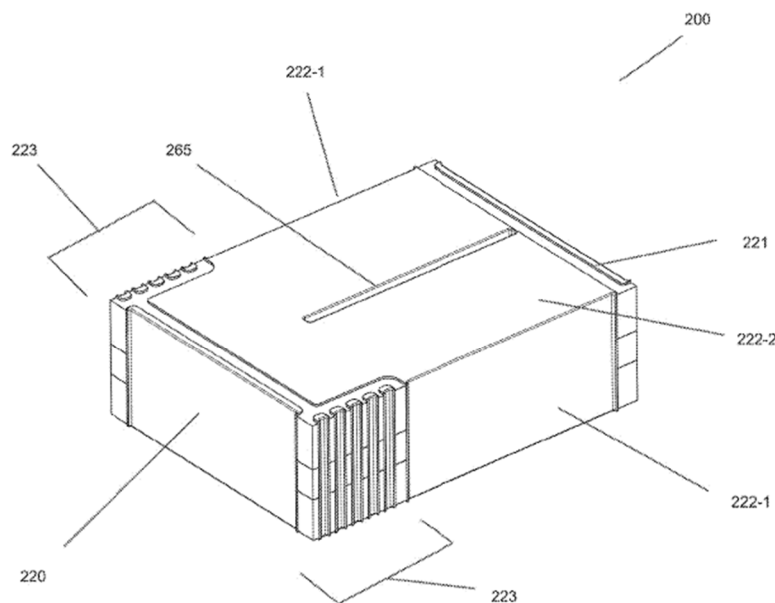


FIG. 11

As discussed in the summary for Vinciarelli-664 above, the contacts of Vinciarelli-664 are similar to the contacts identified by Patent Owner in its infringement contentions:

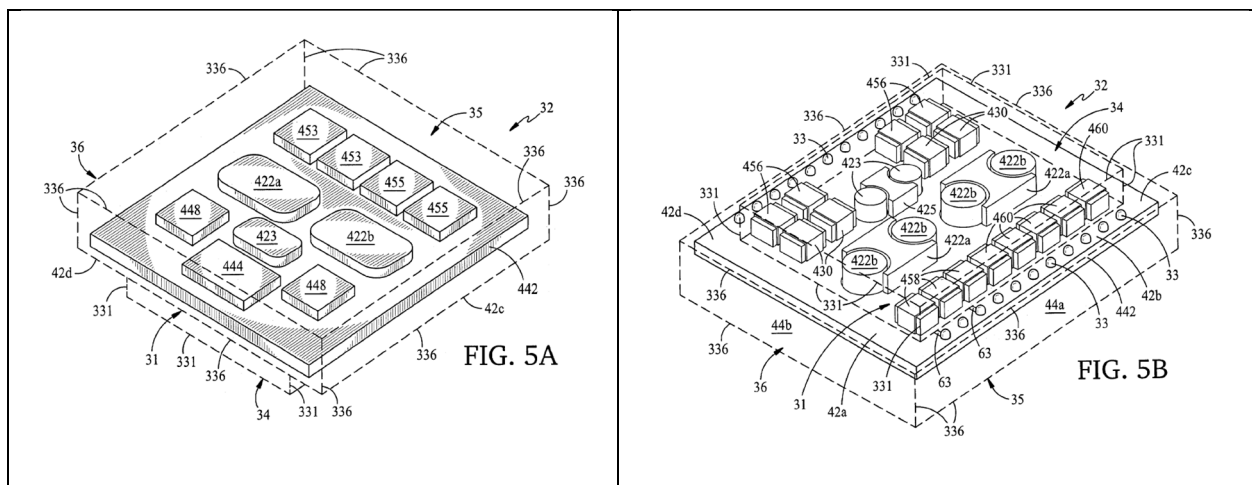


VICOR-1011, p. 4.

3. Claim 2

[2a] “The power converter of claim 1, further comprising a plurality of first electronic components and a plurality of second electronic components,”

Vinciarelli-664 discloses a power converter that comprises a plurality of first electronic components (the components mounted on the bottom surface of the printed circuit board) and a plurality of second electronic components (the components mounted on the top surface of the printed circuit board). VICOR-1003, ¶¶110-112. As discussed with regard to claim limitation [1b], a skilled artisan would have understood that the reference to “components” of a power converter in the specification of Vinciarelli-664 refers to multiple components mounted to both sides of the printed circuit board, as specifically discussed in the incorporated Vinciarelli-844 and Vinciarelli-747 patents. *See* discussion for limitation [1b].



VICOR-1007, FIGs. 5a, 5b (depicting two sides of an exemplary power converter

printed circuit board having multiple components on both sides). For example, FIG. 5 of Vinciarelli-747 depicts a panel of twelve modules, each which has a transformer core and numerous other components:

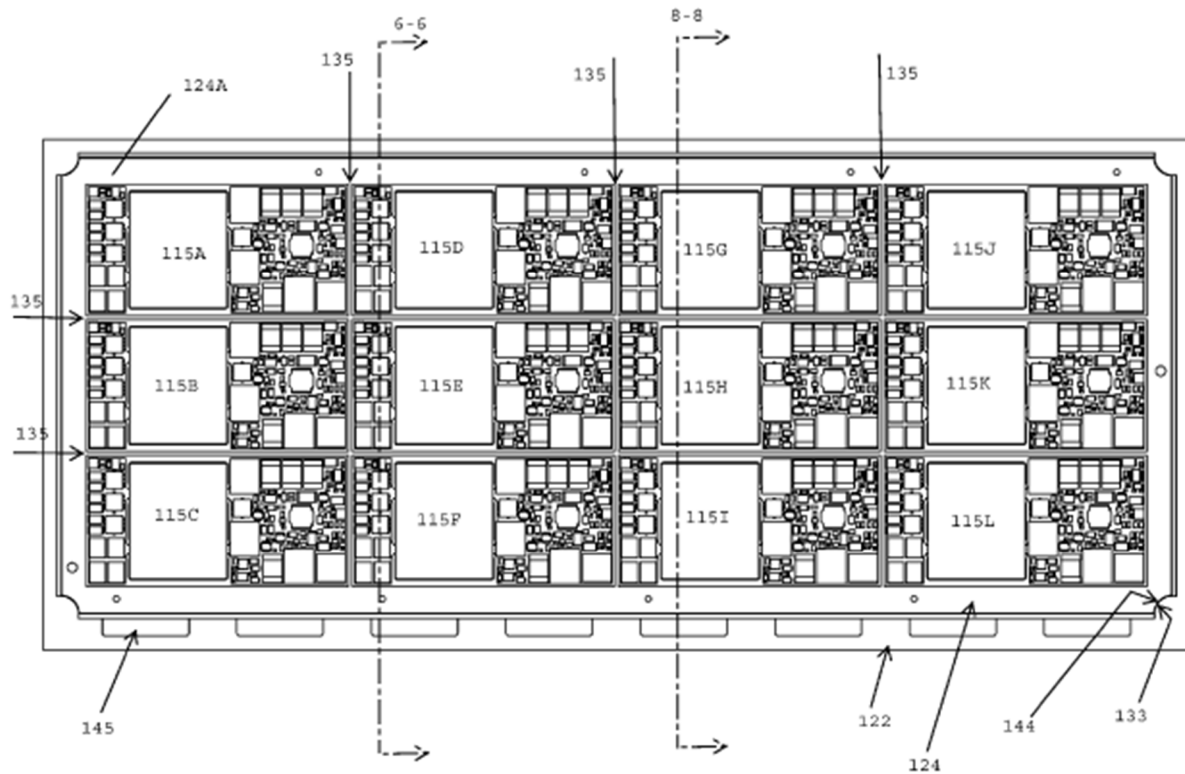


FIG. 5

Vinciarelli-1010, FIG. 5, 11:41-54.

Figure 6 provides a side view of three modules showing the symmetry of components on the top and bottom of the printed circuit board:

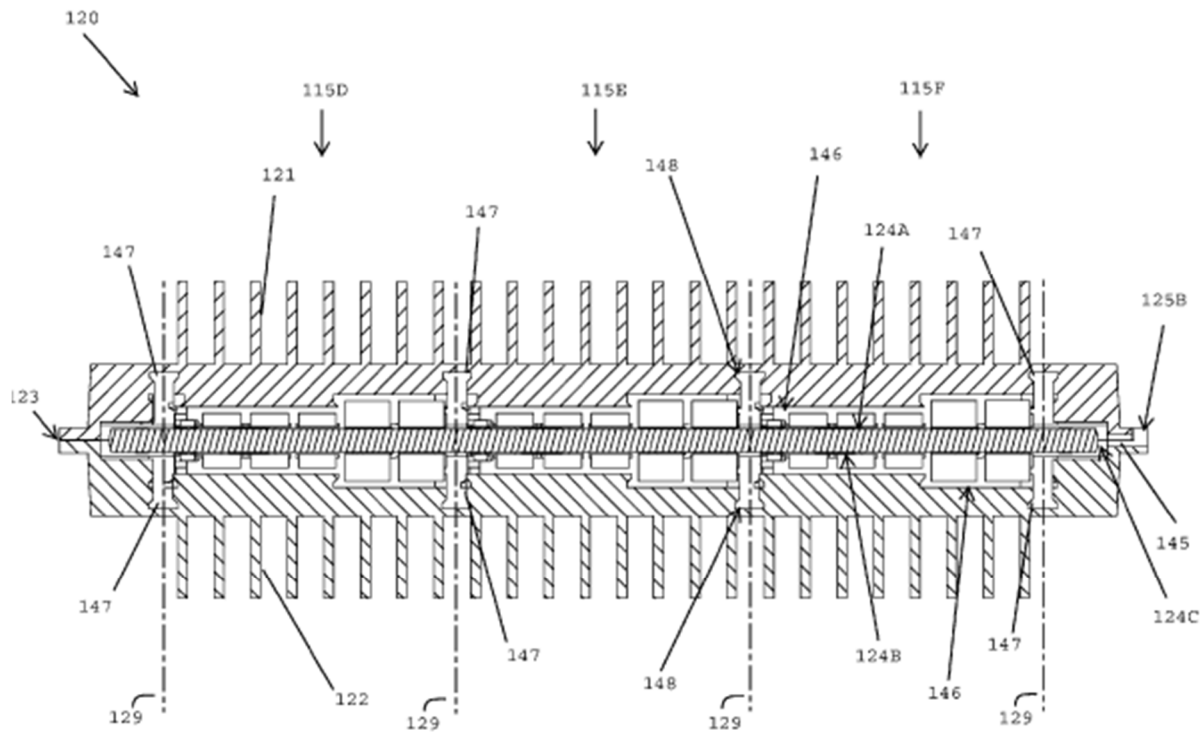


FIG. 6

Vinciarelli-1010, FIG. 6.

In addition, Vinciarelli-269, incorporated into Vinciarelli-664, explains that the transformers in exemplary power converters would have “active and passive components” and an “inductive component” which “may be a transformer, having top and bottom magnetically permeable core pieces 20, 22” mounted to the upper and lower surface of the board respectively. VICOR-1006, 5:63-6:10. The patent further refers to “exposed core package 200” with “two matching core halves 220, 222.” VICOR-1006, FIGs. 1, 9, 18A, 18B, 8:25-29, 9:36-56; VICOR-1003, ¶111.

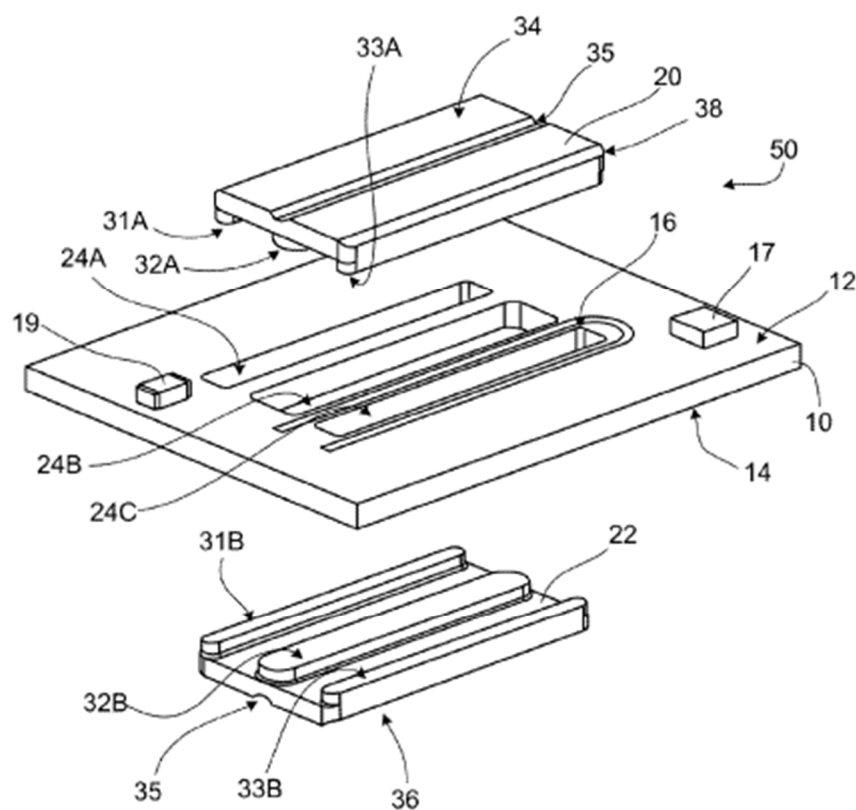


FIG. 1

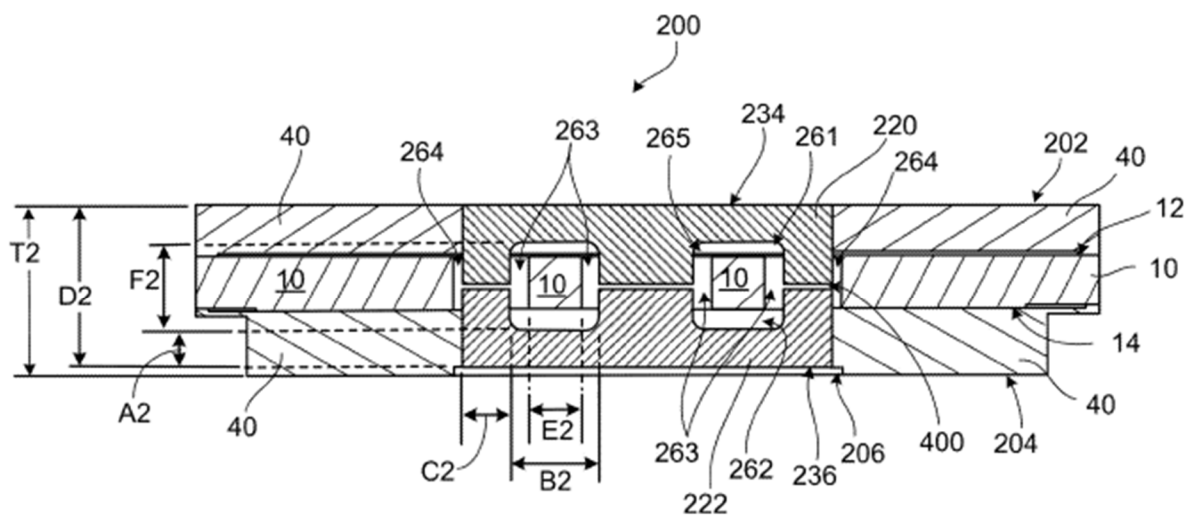


FIG. 9

[2b] “wherein a first height is defined as a vertical height between the highest one of the first electronic components and the lower surface of the carrier, a second height is defined as a vertical height between the highest one of the second electronic components and the upper surface of the carrier, and the height of the power converter is calculated by adding the first height, the second height and thickness of the carrier.”

Vinciarelli-664 discloses a power converter with the claimed dimensions. VICOR-1003, ¶¶113-114. The power converter has a first height defined in the claim as a vertical height between the tallest of the first electronic components and the lower surface of the carrier (*e.g.*, the lower exposed core discussed in limitations [1b], [1e], [1f], and [2a]). The power converter has a second height defined in the claim as a vertical height between the tallest of the second electronic components and the upper surface of the carrier (*e.g.*, the upper exposed core discussed in limitations [1b], [1e], [1f], and [2a]). The height of the power converter is thus calculated by adding the first height, the second height, and the thickness of the carrier, as shown in the following annotated FIG. 1 from Vinciarelli-664:

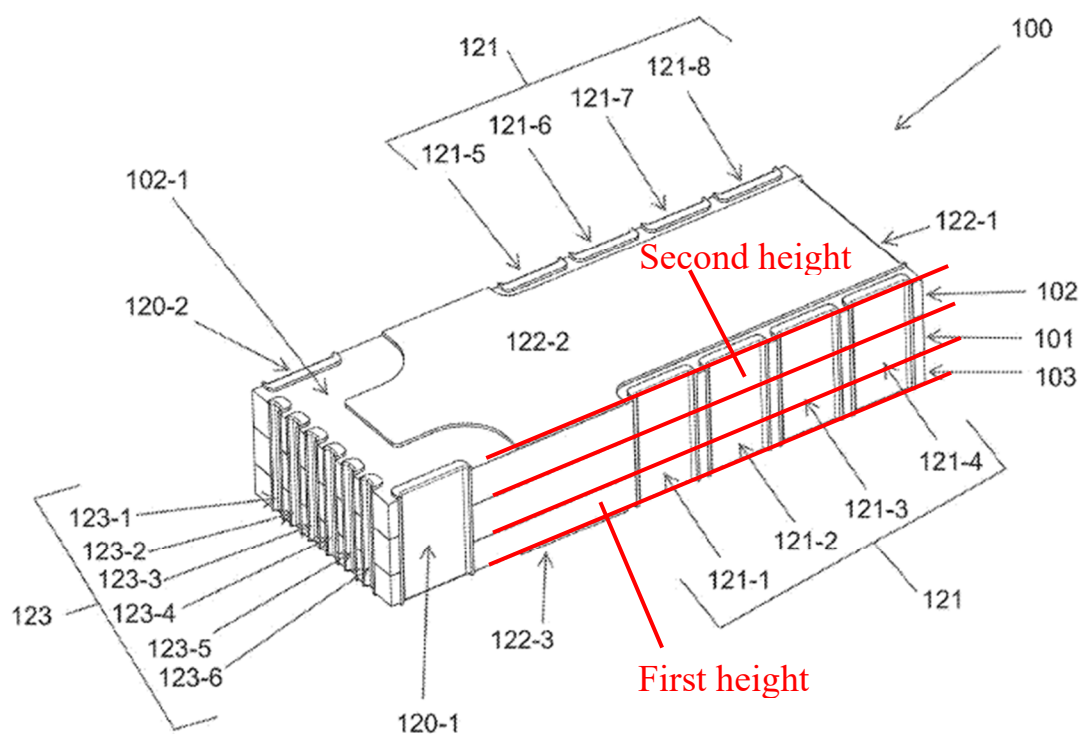


FIG. 1

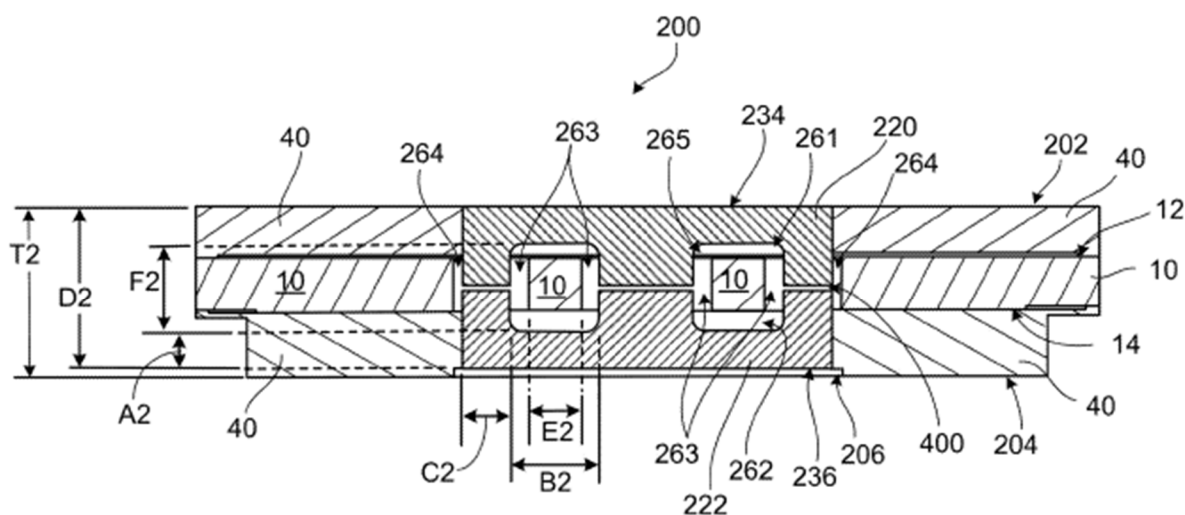


FIG. 9

VICOR-1003, ¶113.

4. Claim 3

[3] “The power converter of claim 1, wherein a height of the first electronic component is equal to a height of the second electronic component.”

Vinciarelli-664 discloses a power converter with exposed cores, and incorporates Vinciarelli-269 by reference, which discloses that the first electronic component (lower core piece) is equal to the height of the second electronic component (upper core piece). This relationship is suggested by the figures and confirmed by the reference to the core pieces being “matching core halves.” VICOR-1005, 1:37-44, 8:11-26, VICOR-1006, 8:28. Further, a skilled artisan would have understood that the core pieces would be essentially equal in height, and at a minimum would have envisaged such a structure. VICOR-1003, ¶115. *See also* discussion concerning the exposed cores for limitations [1b], [1e], [1f], [2a] and [2b].

5. Claim 4

[4] “The power converter of claim 1, wherein the first electronic component, the second electronic component and the carrier are used to form an inductive element, and the first electronic component and the second electronic component are respectively parts of a core of the inductive element.”

Vinciarelli-664 discloses a power converter with exposed cores, and incorporates Vinciarelli-269 by reference, which discloses more details concerning exposed core power converters. Vinciarelli-269 discloses a first electronic component (lower core piece), a second electronic component (upper core piece),

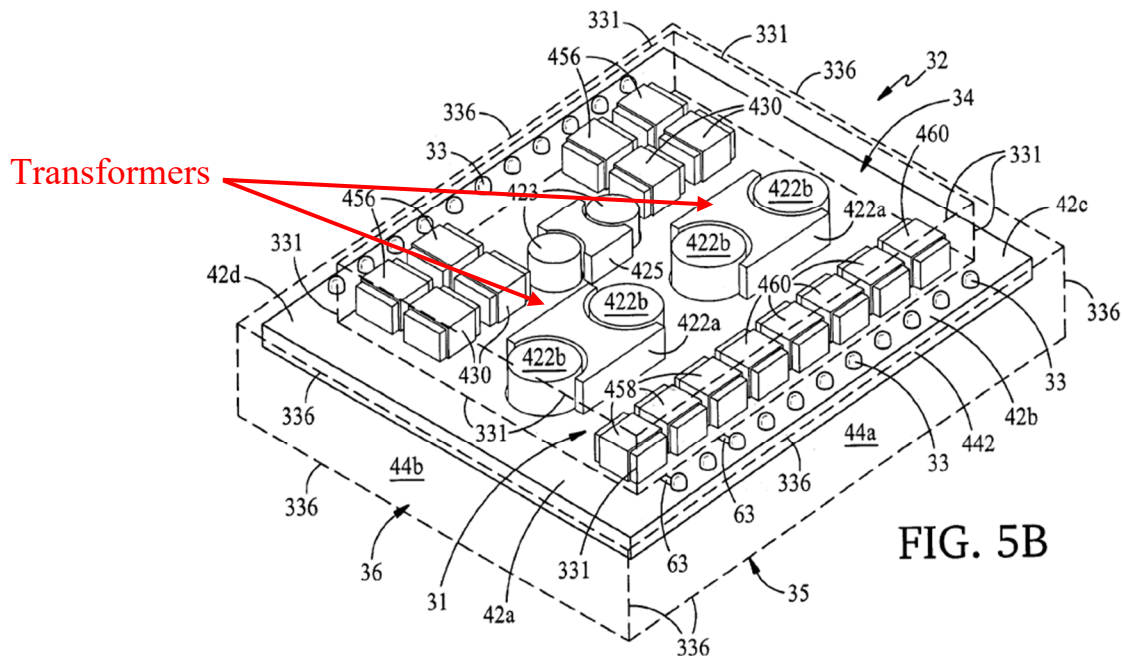
and a carrier (printed circuit board or “PCB” with transformer windings) are used to form an inductive element (e.g., a transformer), and the first electronic component and the second electronic component are respectively parts of a core of the inductive element: “The PCB assembly 50 is shown including an inductive component, which may be a transformer, having top and bottom magnetically permeable core pieces 20, 22 and one or more windings. The windings may be formed from conductive traces on one or more layers of PCB 10.” VICOR-1006, 6:2-7; *see also* VICOR-1005, 1:37-44, 8:11-26; VICOR-1006, 8:28; VICOR-1003, ¶116; *see also* discussion concerning the cores for limitations [1b], [1e], [1f], [2a], [2b], [4], and [6].

6. Claim 5

[5a] The power converter of claim 4, further comprising: a third electronic component and a fourth electronic component respectively disposed at the lower surface and the upper surface of the carrier;

Vinciarelli-664 discloses a power converter with exposed cores, and incorporates Vinciarelli-269 by reference, which discloses more details concerning exposed core power converters. Vinciarelli-269 discloses “power converter modules that include inductive components such as inductors and transformers.” VICOR-1005, 1:37-44, 8:11-26; VICOR-1006, 1:14-16. Vinciarelli-269 further states: “In the case of an electronic power converter module, the printed circuit assembly may include one **or more** inductive components, such as inductors and

transformers,” thus disclosing at least two inductors, two transformers, or one of each (or more). VICOR-1006, 1:27-29. As discussed in connection with claims 1 and 2, the transformer halves are disposed at the upper and lower surfaces of the carrier (printed circuit board). In addition, Vinciarelli-844, incorporated into Vinciarelli-664 discloses a power converter with two isolation transformers each with transformer core sets 422a and 422b. VICOR-1005, 1:30-37; VICOR-1007, FIGs. 5a and 5b, 11:15-17; VICOR-1003, ¶¶117-119.



[5b] wherein the third electronic component, the fourth electronic component and the carrier are used to form a transformer, and the third electronic component and the fourth electronic component are respectively parts of the core of the transformer.

Vinciarelli-664 discloses this limitation because the second transformer would be formed in the same general manner as the first, with PCB windings and

lower and upper core pieces. *See* discussion for claim 4. VICOR-1003, ¶120.

7. Claim 6

[6] The power converter of claim 1, wherein the first electronic component, the second electronic component and the carrier are used to form a transformer, and the first electronic component and the second electronic component are respectively parts of a core of the transformer.

Vinciarelli-664 discloses this limitation for the same reasons as provided for claim 4. Vinciarelli-664 teaches a module having “magnetic cores” on the top and bottom surfaces of the module, and that the cores may be “exposed.” VICOR-1005, 8:18-23. Additional details for the transformer is found in the incorporated references.

Incorporated Vinciarelli-269 teaches a transformer having core pieces on the top and bottom surfaces and windings formed in the PCB. (See discussion for claim [4]). The first electronic component is the lower transformer core (e.g., core piece 22 of Vinciarelli-269, FIG. 1, core piece 122 of Vinciarelli-269, FIG. 5, core piece 222 of Vinciarelli-269, FIGs. 8, 9, 18A, 18B, and core piece 522 of Vinciarelli-269, FIG. 19A and 19B. The second electronic component is the upper transformer core (e.g., core piece 20 of Vinciarelli-269, FIG. 1, core piece 120 of Vinciarelli-269, FIG. 5, core piece 220 of Vinciarelli-269, FIGs. 8, 9, 18A, and 18B, and core piece 520 of Vinciarelli-269, FIGs. 19A and 19B). The two core pieces are respectively parts of the core of the transformer, which is formed

together with windings in the PCB. See discussion for claim [4]. See VICOR-1006, FIGS. 1, 5, 8, 9, 18A, 18B, 19A, and 19B, and specification text describing the core pieces in those figures. Similar disclosures concerning transformers may be found in Vinciarelli-844 and Vinciarelli-747, although Vinciarelli-844 does not mention an “exposed” core and Vinciarelli-747 incorporates an “Exposed Core” patent but does not discuss it in detail. VICOR-1007, 11:15-23; VICOR-1010, 1:17-41. A skilled artisan would have understood that Vinciarelli-664 discloses the use of all the disclosed transformer structures as options, and contemplates the option of either covering or exposing the cores of the transformers. VICOR-1003, ¶¶121-122.

B. GROUND 1B – Claims 1-6 Would Have Been Obvious Over Vinciarelli-664 in view of The Incorporated Vicor Patents Vinciarelli-269, Vinciarelli-844, and Vinciarelli-747

Ground 1A demonstrated that each of claims 1-6 is anticipated by Vinciarelli-664 and three patents incorporated by reference into Vinciarelli-664 (Vinciarelli-269, Vinciarelli-844, and Vinciarelli-747). The same combination of elements used for Ground 1A further renders the Challenged Claims unpatentable as obvious. It would have been obvious to a skilled artisan to look to Vinciarelli-269, Vinciarelli-844, and Vinciarelli-747 to provide details concerning power converters that may be absent from Vinciarelli-664 for all the reasons discussed in Ground 1A. VICOR-1003, ¶¶123-132. See discussion for each claim in Ground

1A regarding the combination of Vinciarelli-664, Vinciarelli-269, Vinciarelli-844, and Vinciarelli-747.

A skilled artisan reviewing Vinciarelli-664's discussion of encapsulated power converters would have sought further information concerning the details of the internal structure of the power converter, such as the nature and placement of the "electronic components mounted to the substrate" (VICOR-1005, 2:16-20), the "components mounted on the printed circuit board 101" (VICOR-1005, 6:21-22), the placement and structure of the "magnetic cores" (VICOR-1005, 7:15, 8:20-21), and "ferrite cores" (VICOR-1005, 10:13-26), as well as the construction of the "bar code" feature (VICOR-1005, 6:58).

A skilled artisan would have (at a minimum) turned to the references discussing such features discussed in the background of Vinciarelli-664 for more information. There, Vinciarelli-664 states "[e]ncapsulated electronic power converters capable of being surface mount soldered to a customer motherboard are described in" Vinciarelli-844, "[e]ncapsulated electronic modules" with "magnetic core structure[s] are described in" Vinciarelli-269, and "forming electrical contacts, e.g., bar codes, along vertical edges of portions of the panels ... for establishing electrical connections to the circuitry inside each module are described in" Vinciarelli-747. VICOR-1005, 1:15-2:12.

A skilled artisan would also have been motivated to combine the references

because they are from the same company and have the same lead inventor, and all relate to encapsulated power converters. *See Ex Parte Mettke*, No. 5,602,905, 2008 WL 4448201, at *17 (B.P.A.I. Sept. 30, 2008).

A skilled artisan would have been further motivated to apply the teachings of Vinciarelli-844 to the power converter of Vinciarelli-664 because Vinciarelli-844 teaches techniques regarding “packaging [] and thermal management in power converters” that are applicable to Vinciarelli-664, and a skilled artisan would have recognized the benefits of applying the disclosed packaging techniques to reduce the size of the power converter and improve thermal performance. VICOR-1007, 1:6-8. In addition, electronic components are typically soldered to a surface of a printed circuit board. Thus, there are a finite number of predictable solutions to placement of components on a printed circuit board (either on top, on bottom, or both). *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 402-03, (2007); VICOR-1003, ¶¶123-127.

For example, Vinciarelli-844 teaches that power converter components may be placed on both sides of a circuit board: “A circuit board having a top surface and a bottom surface is provided and power conversion circuitry is arranged on the top and bottom surfaces of the circuit board with upper circuitry in a first region on the top surface of the circuit board, and lower circuitry in a second region on the bottom surface of the circuit board.” Vinciarelli-844, 6:45-50. In the combination,

a skilled artisan would turn to the incorporated references for teachings regarding the internals of the power converter, but would use the external interconnect technologies and panel forming techniques of Vinciarelli-664, which is the focus of Vinciarelli-644. VICOR-1003, ¶128. Each side of an exemplary circuit board is shown in Figure 5A and 5B of Vinciarelli-844. A skilled artisan would have recognized that the power converter may be made more compact by including components on each side of the power converter printed circuit board, and would have been motivated to include “transformer core sets 422a, 422b” in order to provide a compact transformer that uses the printed circuit board to provide the windings for the transformer. VICOR-1007, 11:8-26, FIGs. 5a and 5b.

A skilled artisan would have been further motivated to turn to Vinciarelli-269 for details concerning the designing of compact transformers for power converters and would provide transformers that have windings in the printed circuit board and transformer core halves above and below the windings. Vinciarelli-269, 2:10-33, FIGS. 1, 5, 8, 9, 18 (A, B), and 19 (A, B). Vinciarelli-269 explains that “[c]ores of the type shown in FIG. 1 are known in the field of planar magnetics and are commonly used in applications where size reduction is important.” Vinciarelli-269, 6:16-17; VICOR-1003, ¶129.

A skilled artisan would have been further motivated to turn to Vinciarelli-747 for details concerning the bar code interconnect feature referred to in

Vinciarelli-664. Vinciarelli-664 expressly incorporates “bar codes” into its embodiments (e.g., 6:50-61), and refers to Vinciarelli-747 as the “Bar Code Patent” (1:65-66). Vinciraelli-747 provides extensive teaching on the construction and use of bar codes for forming electrical connections. Vinciarelli-747, 15:23-17:2, Figs. 10A, 10B, 16, 18, 21-23; VICOR-1003, ¶130.

In addition, it would have been obvious to provide a carrier that “is disposed [] 1/3 to 2/3 of [the] height of the power converter” (limitation [1f]) even absent a specific disclosure because a skilled artisan would have been aware that it was typical to mount components on both sides of a printed circuit board and that it would be typical to distribute components such that there would be roughly equal size component on both sides. VICOR-1003, ¶129. Moreover, Vinciarelli-747 specifically discusses the advantages of symmetry when laying out a printed circuit board for a power converter. VICOR-1010, 22:46-24:49; VICOR-1003, ¶131.

A skilled artisan would have made the combination with a reasonable expectation of success because the panel and interconnect teachings of Vinciarelli-664 are applicable to prior art power converter circuits, such as the circuits shown in the incorporated patents, disclosing printed circuit boards with components (including transformer core halves) on each side of the circuit board, and Vinciarelli specifically contemplates a power converter with a circuit board in the center and components mounted on each side, which is then encapsulated to form a

module. VICOR-1003, ¶132.

C. GROUND 1C – Claims 1-6 Would Have Been Obvious Over Vinciarelli-664 in view of Vinciarelli-269, Viciarelli-844, Vinciarelli-747, and Zeng-014

This ground extends the analyses of Grounds 1A and 1B, but applies the prior art process recited in the product-by-process limitation [1g].

1. Overview of Zeng-014

Zeng-014 discloses adding a “connecting conductor” to an electronic component such as an inductor by curving (bending) electrical contacts against the surface of the component. As Zeng-014 states: “The connecting conductor is adapted to wrap a first surface of the inductive component.” VICOR-1008, Abstract, FIG. 4A. Specifically, in Zeng-014, a “first conductive layer 61 is bent in such a way that it wraps the first surface of the inductive component 62. Finally, an integrated structure 53 with a complete wrapped layer is formed.” VICOR-1008, [0062]. This is shown in FIG. 4A of Zeng-014, reproduced here:

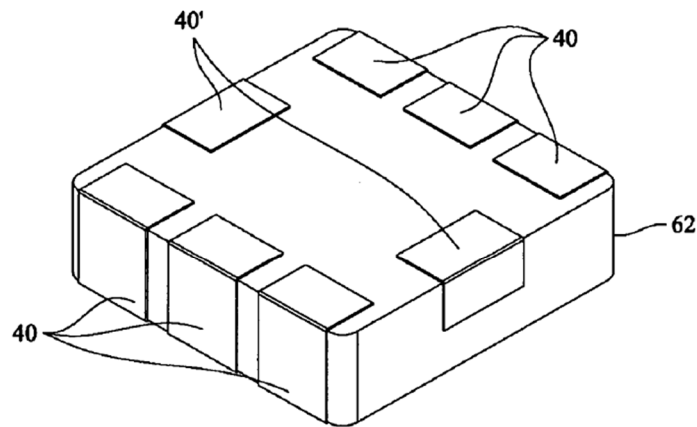
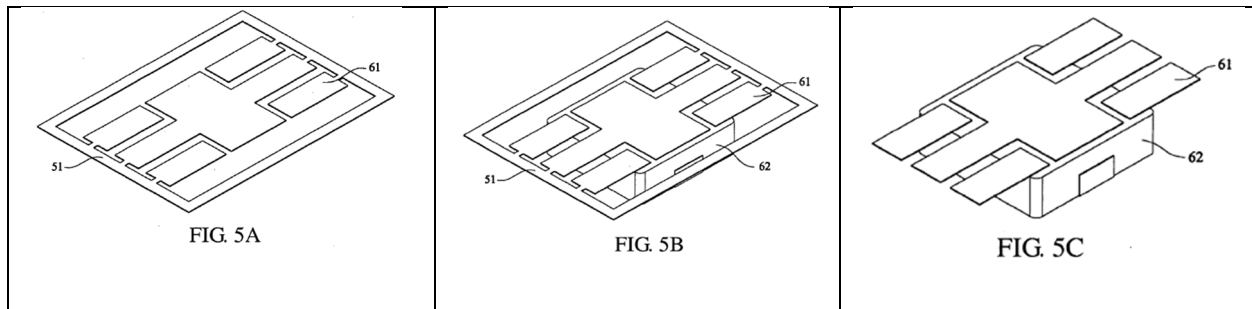
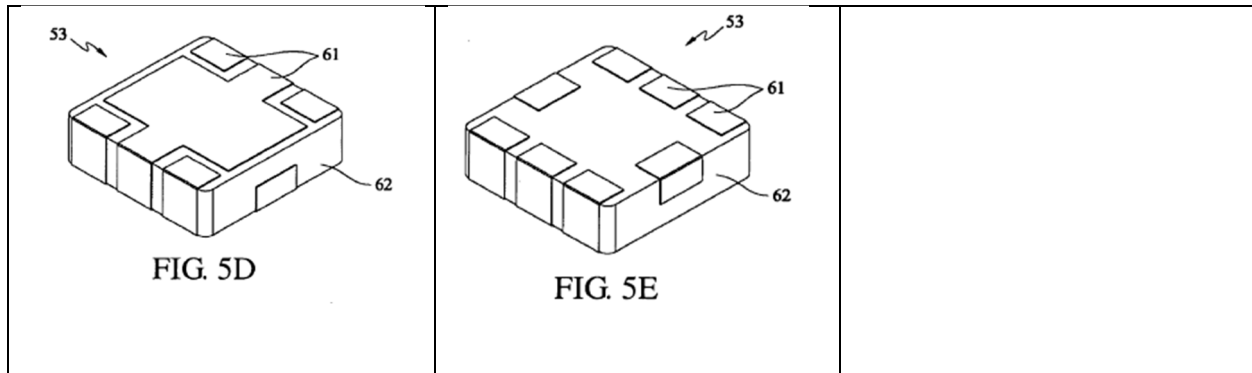


FIG. 4A

Although the illustrated component is an inductor, Zeng-014 states that the inductor is “for [the] purpose of illustration” and the disclosure “may be applied to other electronic component[s].” VICOR-1008, [0057].

The process of fabricating a curved connection part is depicted in FIGs. 5A-5E of Zeng-014:





VICOR1008, FIGs. 5A-5E, [0062]-[0063]; VICOR-1003, ¶¶133-135.

2. Claim 1

[1pre]-1[b]

See Ground 1A, [1pre]-[1b], Ground 1B. VICOR-1003, ¶126.

[1c] “a first connection part, comprising”

A skilled artisan would have been motivated to modify the contacts of Vinciarelli-664 to use a connection part that is formed by curving a contact against an electronic component. VICOR-1003, ¶¶137-146.

Vinciarelli-664 discloses contacts, including “contacts 120-1, 120-2, 121, and 122-1,” that are each “electrical contacts formed along a perimeter edge of the module.” VICOR-1005, 2:36-38, 5:55-6:14. The contacts are arranged to mate with corresponding contacts on a customer’s printed circuit board. VICOR-1005, 6:62-66.

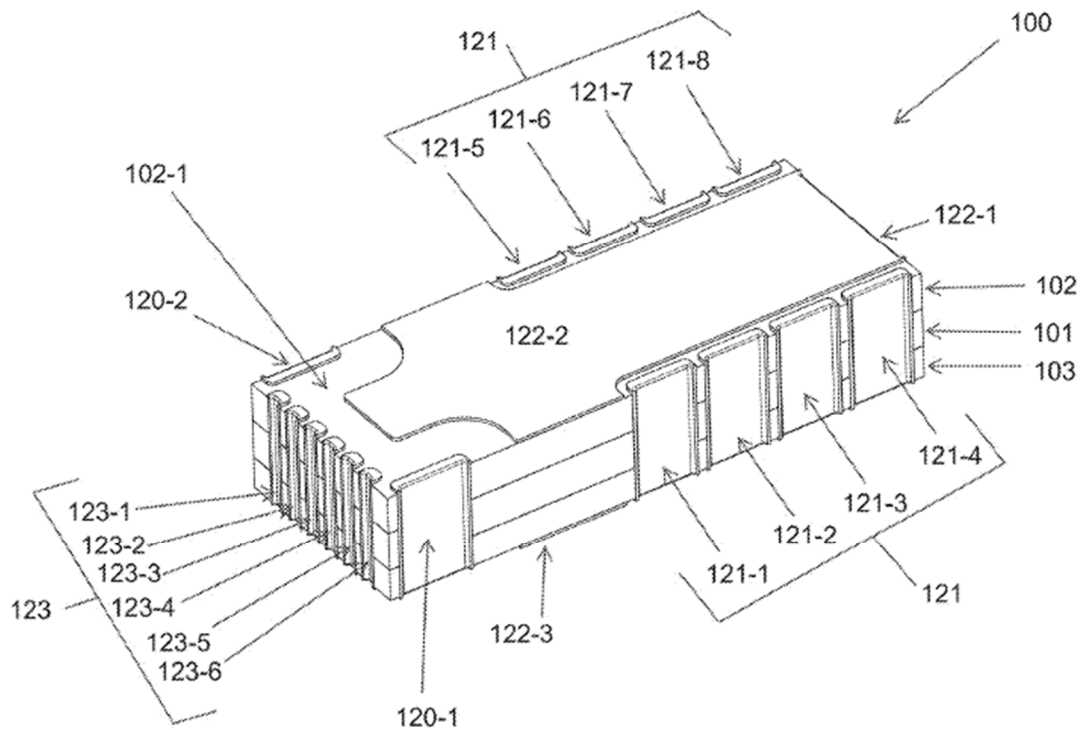


FIG. 1

See Ground 1A, [1c]; Ground 1B. The contacts disclosed in Vinciarelli-664 are conveniently formed before singulation such that the contacts are formed by cutting slots in a panel of converters and filling the slots with a conductive material. VICOR-1005, 7:28-55. The result after cutting of the panel is a singulated module with contacts.

The panel molding process disclosed in Vinciarelli-664 offers many advantages, one of which is that there is no need to attach and bend contacts against the module after it is cut from the panel. However, a skilled artisan would have been motivated to make various modifications to accommodate the available

manufacturing technologies and facilities, some of which may not be able to perform the process disclosed in Vinciarelli-664. Such a skilled artisan, for example, would recognize that some facilities could not reliably cut and metalize the slots in the panels. To accommodate such facilities, a skilled artisan would have been motivated to use well-known prior art techniques of adding contacts to the module after its creation. This modification would permit the manufacture of the power converter in a factory with available equipment and tooling. VICOR-1003, ¶140.

A skilled artisan working with manufacturing facilities seeking to use prior art techniques to add contacts to power converter modules would have been motivated to apply the teachings of Zeng-014 for a variety of reasons. VICOR-1003, ¶¶141-144. **First**, both Vinciarelli-664 and Zeng-014 concern methods of forming contacts for power converters, and more particularly, they both discuss small power converters that can deliver power at the point of load. VICOR-1005, 1:15-19; VICOR-1008, [0012]. Thus, a skilled artisan looking to adapt Vinciarelli-664 would look to Zeng-014 for contact ideas.

Second, both Vinciarelli-664 and Zeng-014 concern methods of forming contacts on power converters. Vinciarelli-664 concerns “the field of encapsulating electronic assemblies and more particularly to forming edge connections and other conductive features on and through encapsulated electronic assemblies including

encapsulated power converters.” VICOR-1005, 1:7-11. Zeng-014 also concerns encapsulated electronic assemblies such as inductive component 62 or “other electronic component such as an FET.” VICOR-1008, [0057]-[0059]. Zeng-014 teaches that an electronic component may be “wrapped with a first conductive layer 61 on an outer surface thereof” that has “a connecting conductor 40 and a pin conductor 40’.” *Id.* The wrapping method is depicted in Figures 5A through 5E, which depict the same curving of connectors against an electronic component that is disclosed and claimed in the ’263 Patent. *Cf.* VICOR-1008, FIGs. 5A-5E, [0062]-[0063]. Zeng-014 explains that in the structure shown in 5C, “the first conductive layer 61 is bent in such a way that it wraps the first surface of the inductive component 62. Finally, an integrated structure 53 with a complete wrapped layer is formed.” VICOR-1008, [0062]. The example wraps connecting conductors to a part that already has pin conductors, but Zeng-014 states that this is just exemplary. The result is shown in FIGs. 5D and 5E, where FIG. 5D shows a bottom view and FIG. 5E shows a top view.

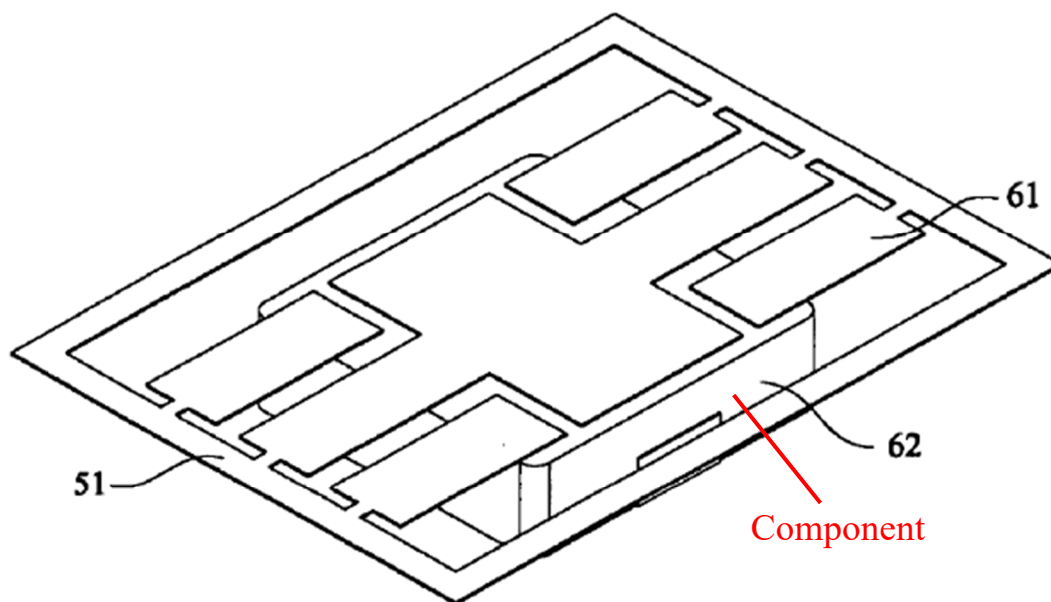


FIG. 5B

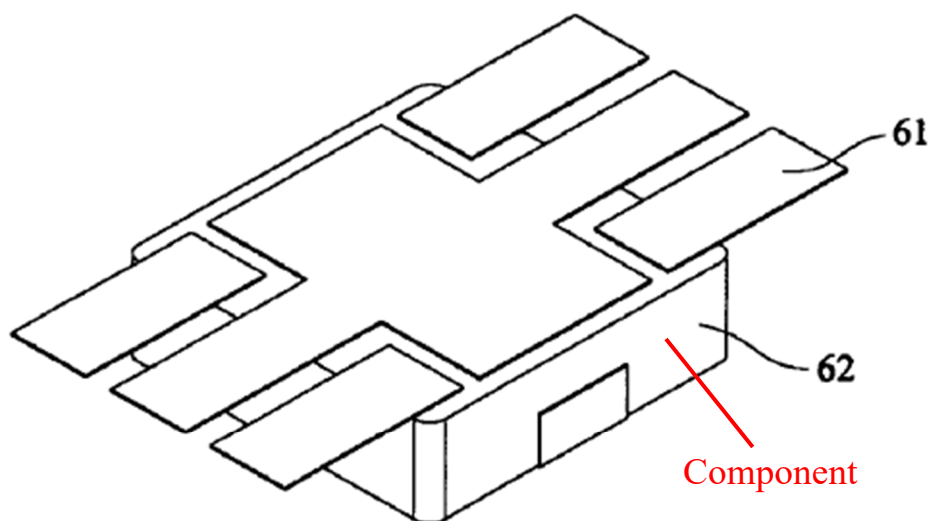


FIG. 5C

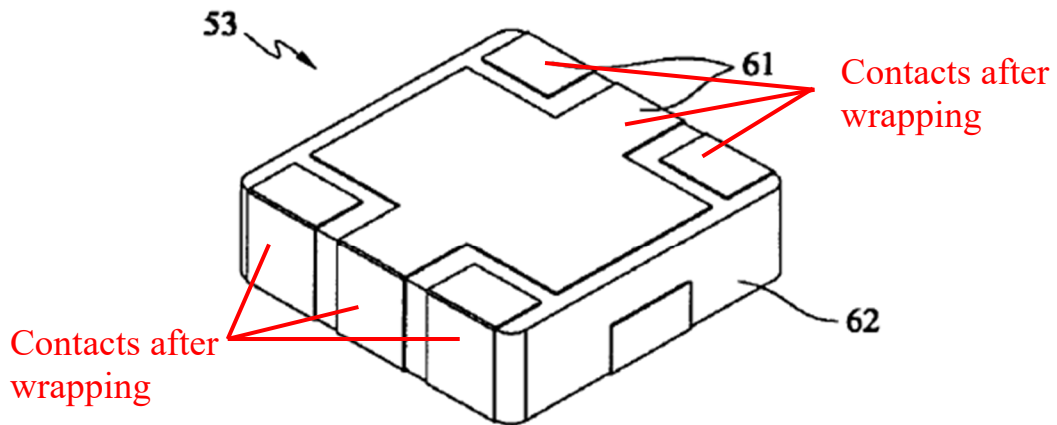


FIG. 5D

When the component shown in FIG. 5D is turned upside down, the contacts look as follows:

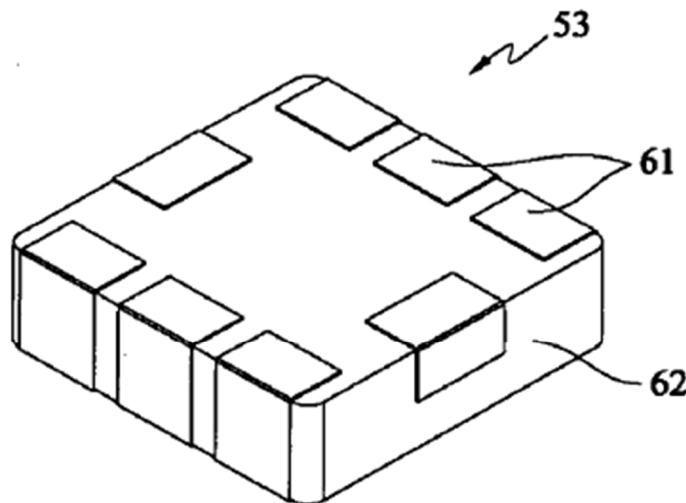


FIG. 5E

A skilled artisan would have recognized that the power converter module of Vinciarelli-664 is an electronic component to which Zeng-014's contact-wrapping

teachings could be applied. That is, the module produced by Vinciarelli-664 appears to the outside world to be an “electronic component.” That there are many internal components rather than a single inductor or a single MOSFET is immaterial. In the combination, a skilled artisan would modify the method of manufacture disclosed in Vinciarelli-664 to replace the process of cutting slots between the modules in the panel and filling the slots with conductive material, and instead apply the lead frame of Zeng-014 after the modules are singulated, and thus make the manufacturing process less sophisticated and more suitable for factories making prior art products. VICOR-1003, ¶143.

A skilled artisan would have had a reasonable expectation of success in making the combination because it is a simple mechanical modification well within the level of skill, and the use of lead frames was well-known in the art. VICOR-1003, ¶144.

[1d]-[1f]

See Ground 1A, [1d]-[1f]. Ground 1B. The analysis in that Ground applies with equal force here, with the understanding that the “connection part” is provided by the process in Zeng-014, using Zeng-014’s lead frame rather than the plated contacts of Vinciarelli-664. VICOR-1003, ¶¶145-146.

[1g] “and wherein the first connection part is fabricated by mechanical support of the first electronic component.”

The combination with Zeng-014 wraps the module of Vinciarelli-664 using a

lead frame and bending the contacts against the electronic component where the electronic component is considered to be either the plurality of encapsulated components mounted to the bottom of the circuit board in the module, one or more of the components mounted to the bottom of the circuit board, or the lower core of the transformer specifically such that the first connection part is fabricated by mechanical support of the first electronic component. As shown in FIG. 5D of Zeng-014, when Zeng-014 is applied to the module in Vinciarelli-664, virtually the entire top or bottom (depending on orientation) of the module would be covered by the “conductive layer 61” of Zeng-014, and thus the “first connection part” would cover and be supported by numerous components, and at the very least supported by the exposed lower transformer core. Further, because the ’263 Patent states that the “first electronic component” may “be an entire combination of electronic components” (VICOR-1001, 11:52-67), each of the parts of “conductive layer 61” curved against the bottom half of the module is being supported by the entire combination of components mounted to the lower side of the printed circuit board. VICOR-1003, ¶¶147-149.

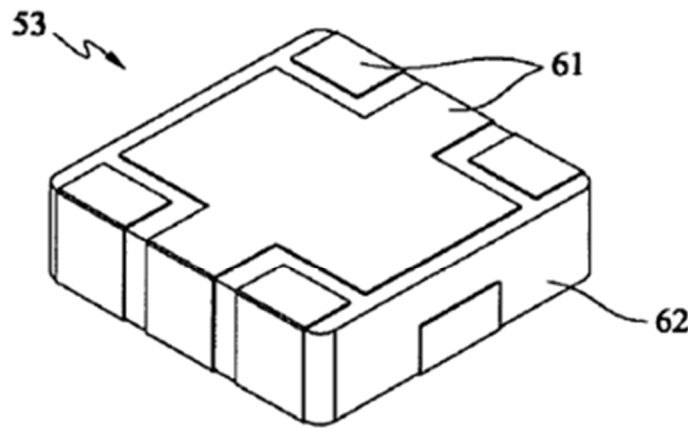


FIG. 5D

3. Claims 2-6

Claims 2-6 depend from claim 1, and concern internal features of the module. They are each unpatentable for the reasons discussed for claim 1 in this Ground in combination with the reasons discussed for each respective dependent claim in connection with Ground 1A. VICOR-1003, ¶150.

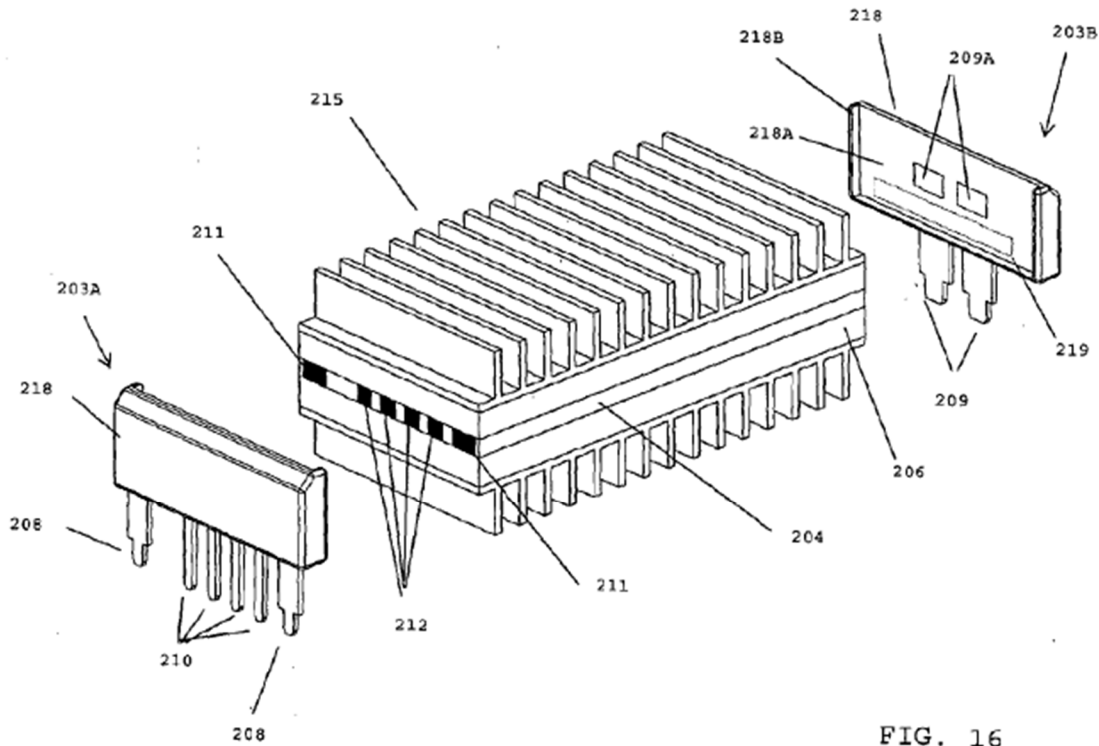
D. GROUND 2 – Claims 1-6 Would Have Been Obvious over Vinciarelli-218 in view of Zeng-014

1. Overview of Vinciarelli-218

Vinciarelli-218 is entitled “Panel-Molded Electronic Assemblies” and concerns a method for making a power converter by encapsulating components mounted to two sides of a printed circuit board to form a panel of power converter modules that are then “singulated” into individual modules. Like the accused products, contacts connecting the electronic components to the external world are

64

1009, [0026], [0028]. A “through-hole adapter” is depicted in FIGs. 15 and 16 that is “suitable for through hole mounting in a motherboard.” VICOR-1009, [0115].



Vinciarelli-218 discloses a surface mount adapter in FIG. 18, which has “solder pads” for connection to the module and terminals that curve under the module “to produce a surface-mount pad (e.g.,] 308D) for attachment, e.g.,] by surface-mount soldering, to a customer motherboard.” VICOR-1009, [120].

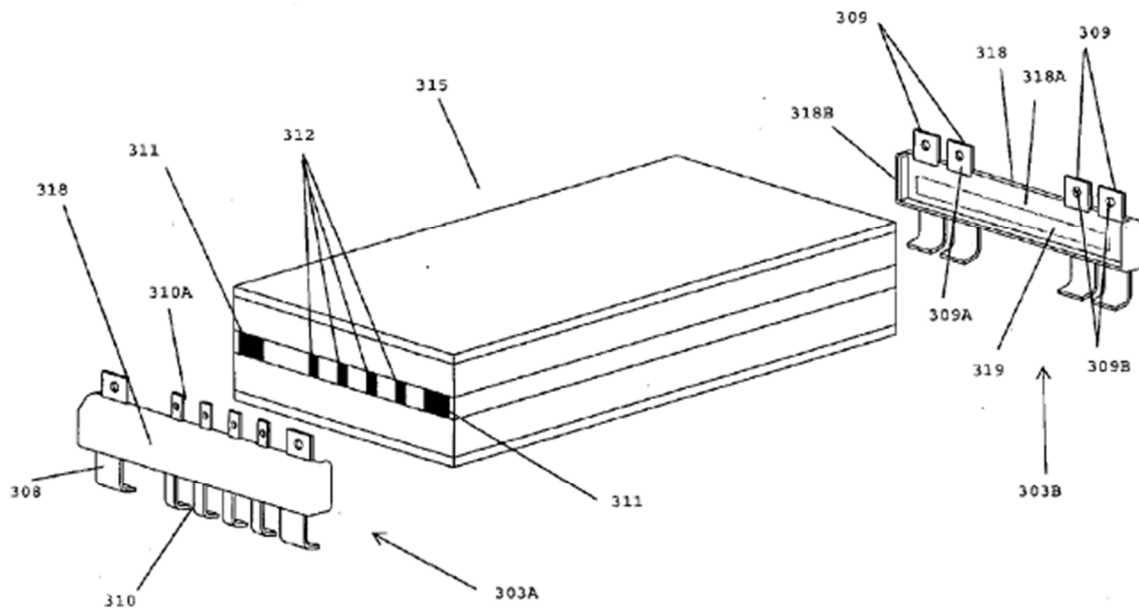


FIG. 18

Additional examples are provided. “The modules 100, 200, 300, and 400 discussed above in connection with FIGs. 1, and 15-20 are all examples in which connectors or adapters are mechanically and electrically connected to the interconnects on the singulated modules forming an integral modular component.” VICOR-1009, [0127]. Vinciarelli-218 further describes a “flush-mount technique.” VICOR-1009, [0131].

Vinciarelli-218 discloses that the heatsinks can be removed from any of the previously discussed embodiments in the patent such that “the top 815A and bottom 815B surfaces of the singulated module 815 are defined by the cured encapsulant 805, 806 in which the magnetic core surfaces 815C, 815D are exposed.” VICOR-1009, [0159]-[0160]; VICOR-1003, ¶¶141-154.

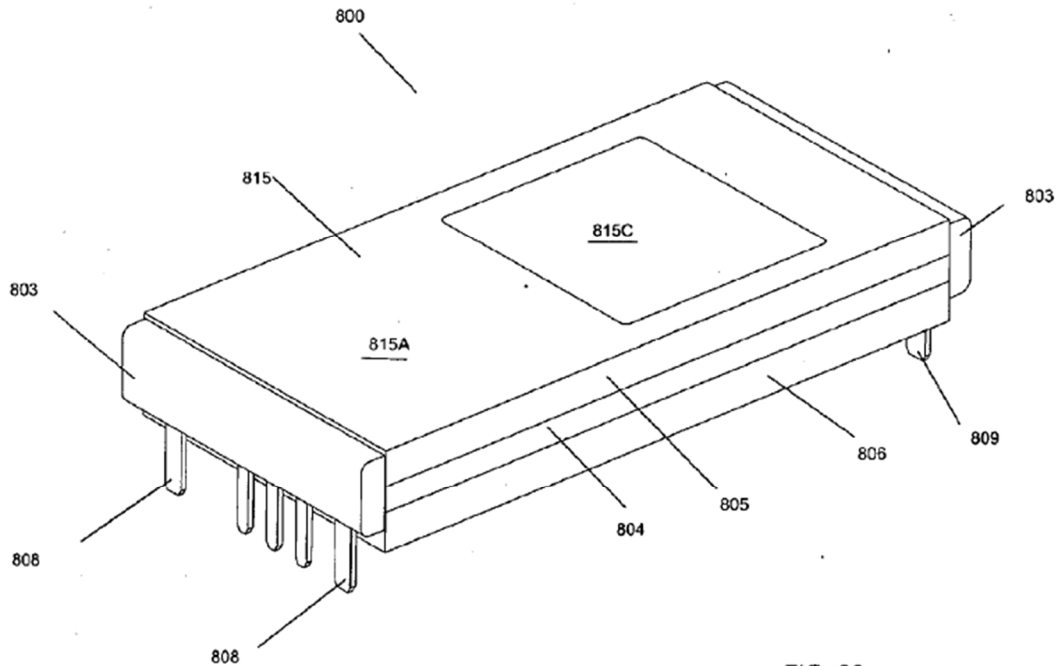


FIG. 33

2. Claim 1

[1pre] “A power converter, comprising:”

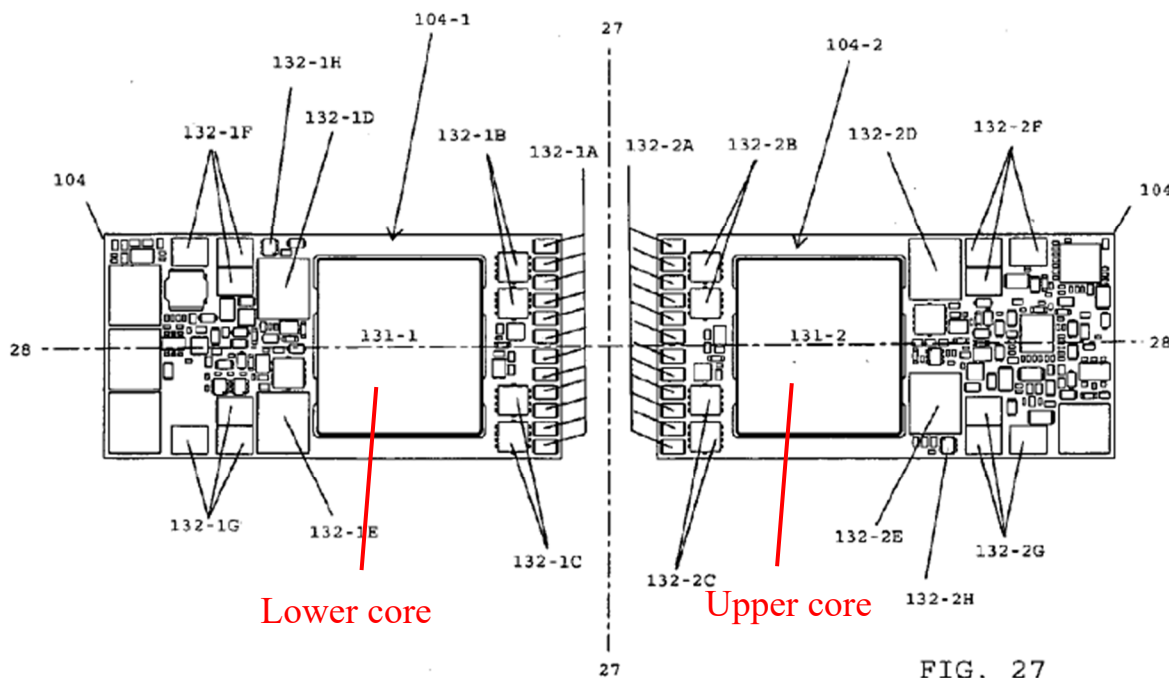
Vinciarelli-218 discloses a power converter. “This invention relates to the field of encapsulating electronic assemblies and more particularly to encapsulated power converters.” VICOR-1009, [0002]. *See* Overview of Vinciarelli-218 above. VICOR-1009, FIGs. 10, 16, 18, 33. [0004], [0021]-[0022]; VICOR-1003, ¶155.

[1a] “a carrier, comprising: an upper surface; and a lower surface;”

Vinciarelli-218 discloses a carrier (“a printed circuit board ‘PCB’”) that has an upper surface (“top surface”) and lower surface (“bottom surface”). VICOR-1009, [0021]; *see also* [0086]-[0087], [0107]-[0108]; VICOR-1003, ¶156.

[1b] “a first electronic component disposed at the lower surface of the carrier; a second electronic component disposed at the upper surface of the carrier; and”

Vinciarelli-218 discloses a first electrical component (one or more of the components at the lower surface of the carrier) disposed at the lower surface of the carrier, and a second electrical component (one or more of the components on the upper surface of the carrier) disposed at the upper surface of the carrier: “Many of the larger components may be distributed equally between both faces of PCB 104 as shown in FIG. 27” VICOR-1009, [0143]. Other components include “lower core 131-1” and “upper core 131-2.” VICOR-1009, [0100], [0179]; VICOR-1003, ¶¶157-158.

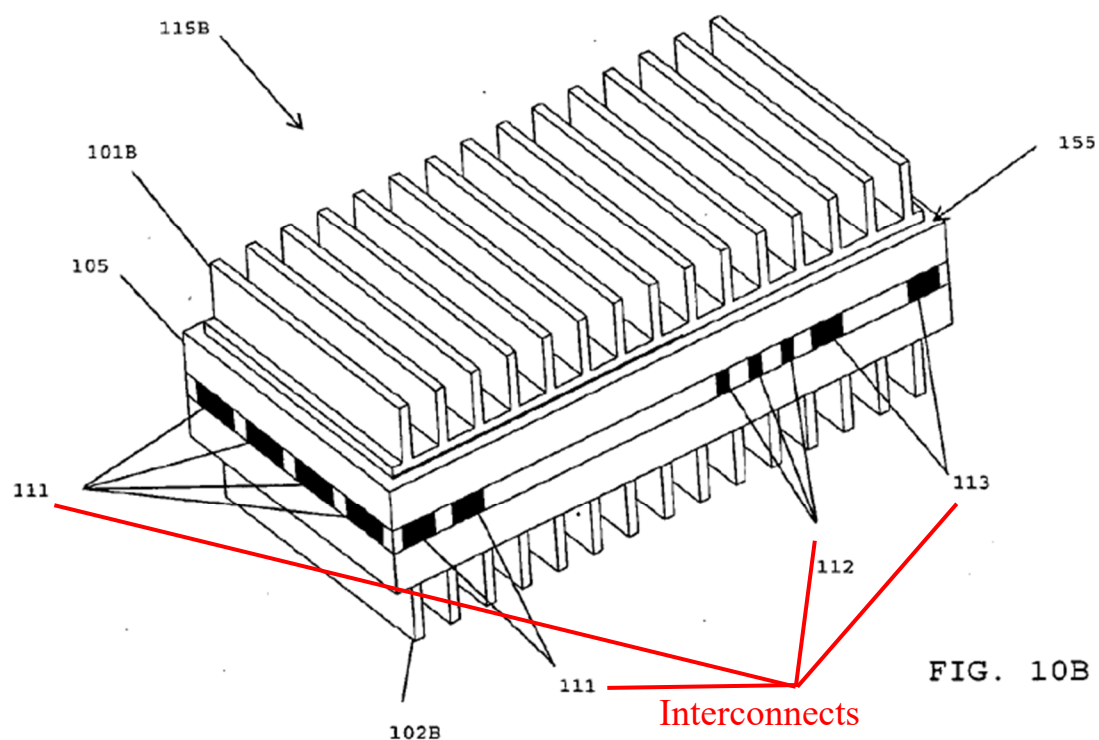


[1c] “a first connection part, comprising”

Vinciarelli-218 discloses contacts to connect the power converter module to other devices, but does not disclose forming the connection part by curving a piece of metal against an electronic component. It would have been obvious in view of Zeng-014 to use such a connection part with the modules of Vinciarelli-218.

VICOR-1003, ¶¶159-169.

Vinciarelli-218 discloses “exposed interconnects 111, 112, and 113” that as shown in FIG. 10A “are [] embedded in the edge of the PCB 104 along one of the edges 116 of the module 115.” VICOR-1009, [0108]; FIG. 10A, Figure 10B depicts a similar module, but with interconnects on multiple edges. VICOR-1009, FIG. 10B.



Vinciarelli-218 explains that the heatsink is optional in some applications and depicts a similar module without the heatsink in FIG. 33, and with through-hole adapters added:

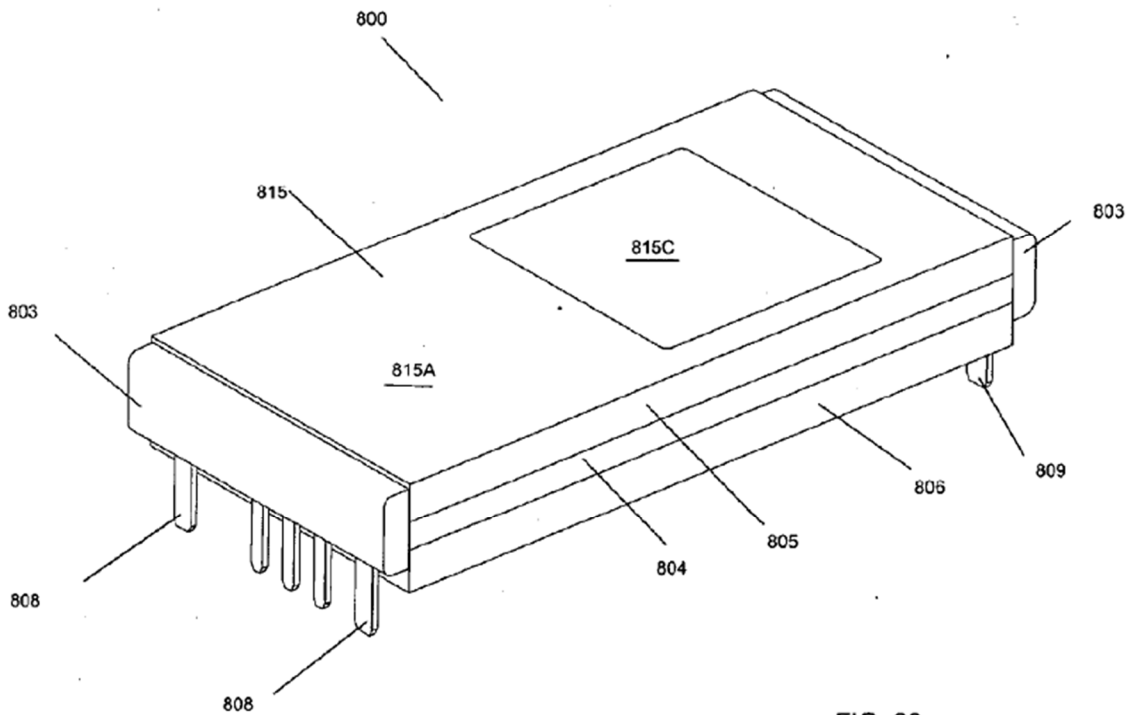


FIG. 33

VICOR-1009, FIG. 33, [0159]-[0160]. Vinciarelli-218 explains that “[l]ike the singulated modules with heat sinks, various types of connectors [and] adaptors may be coupled to the exposed interconnects 811, 812 at the edges of the singulated module 815.” VICOR-1009, [0160]. For example, connectors may be “formed for example by a precision metal stamping process. Initially, the terminal portions 808 may be coupled to a lead frame 808B as shown in FIGS. 35 and 36 forming a unitary unit for ease of assembly.” *Id.*

A skilled artisan would have been motivated to modify the lead frame process of Vinciarelli-218 to use the lead frame process of Zeng-014 to provide a compact surface mount version of the module. VICOR-1003, ¶¶162-169. **First,**

Vinciarelli-218 discloses many variations for the power converter module, including variations for contacts to external components, such as through-hole and surface mount options. VICOR-1009, FIGs. 15-26, 33-36. Vinciarelli-218 further discloses that it may be beneficial to have a module that is press-fit into a surface mount adapter or flush mounted to a motherboard. VICOR-1009, [0124]-[0125], [0130]-[0133]. Vinciarelli-218 further teaches the desirability of “decreasing [the] mounting area on [a] customer motherboard.” Zeng-014 addresses these issues. VICOR-1009, [0003].

Second, for those applications that do not require heat sinks and will not overheat by stacking, the skilled artisan would turn to Zeng-014 given Zeng-014’s teaching that board space can be saved by using Zeng-014’s connection part to “stack” external components on the component using the connection part.

VICOR-1008, Abstract, [0013]. For example, a skilled artisan would have reason to stack power converters when operating them in parallel to increase power output or to provide input or output capacitors at the power converter. VICOR-1003, ¶163 (discussing VICOR-1012 and VICOR-1013).

Third, a skilled artisan would have recognized that Zeng-014’s connection part provides surface mountable flush mounting identified as desirable in Vinciarelli-218 without the need for a surface mount adapter.

Fourth, Zeng-014 teaches that the inductor in the figures “is only for

purpose[s] of illustration, and in practice, the technology disclosed in this invention may be applied to other electronic component[s].” VICOR-1008, [0057]. Thus, a skilled artisan would have recognized Zeng-014’s applicability to the power converter modules of Vinciarelli-218, which are electronic components having a general form factor similar to the box-like inductor component of Zeng-014.

Fifth, Vinciarelli-218 and Zeng-014 both concern improvements to small power converters to provide increased “power density” and decreasing the circuit board “area” used by the power converters. VICOR-1009, [0003], VICOR-1008, [0003], [0008], [0010], [0065]. A skilled artisan would thus turn to both references given their common concerns to apply beneficial features of each reference.

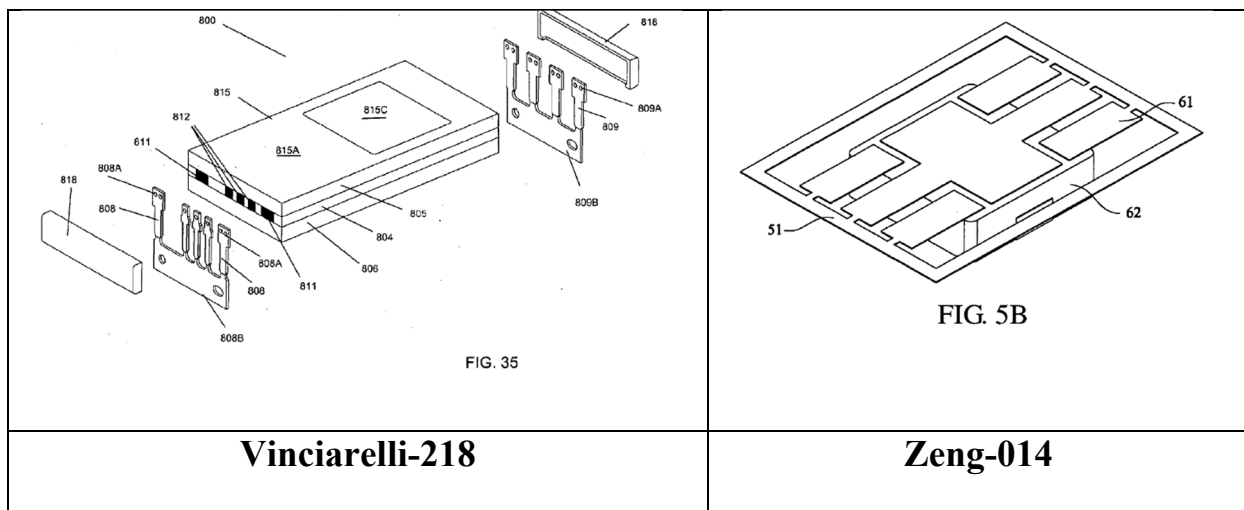
A skilled artisan applying the teachings of Zeng-014 to Vinciarelli-218 would have been motivated to reduce the space used by the contact adapters of Vinciarelli-218 by applying Zeng-014’s lead frame to the module of Vinciarelli-218 and curving the contacts against the module such that the modules form a unitary structure with contact surfaces on the top, bottom, and sides of the module, as taught by Zeng-014. One example of how this modification would be performed can be illustrated by FIG. 35 of Vinciarelli-218 and FIGs 5A-E of Zeng-014. FIG. 35 of Vinciarelli-218 depicts a module with PCB edge contacts 812 that are mated with contacts on lead frames 808B and 809B. In the combination, the lead frames in Vinciarelli-218 would be replaced by the lead frame in Zeng-014

and the lead would be curved over module 800 from the bottom to the top.

VICOR-1009, FIG. 36, [0160]; VICOR-1008, FIGs. 5A-5E, [0062]-[0064];

VICOR-1003, ¶¶167-168. Vinciarelli-218 does not have surface mount conductors and thus in the combination, Zeng-014's pre-existing pin conductors would be ignored. The skilled artisan would recognize that the conductive layer 61 would provide contacts to the interconnects and that the conductive layer and interconnects would each be adjusted as necessary to make the desired electrical contacts.

A skilled artisan would have had a reasonable expectation of success making this modification because it is a simple mechanical modification well within the level of ordinary skill, and the use of lead frames to interconnect electronic components was well-known in the art. VICOR-1003, ¶169.



[1d] “a first terminal electrically coupled to the upper surface or the lower surface of the carrier; and”

Vinciarelli-218 discloses a first terminal (exposed interconnects such as “exposed interconnects 811, 812” of FIG. 35 and “exposed interconnect features, e.g. 111A through 111L” and “exposed interconnects 111, 112, 113” of FIGs 10A, 10B, and 11) electrically coupled to the upper surface of the lower surface of the carrier. VICOR-1009, [0108]-[0111], [0160]; VICOR-1003, ¶¶170-171.

Vinciarelli-218 explains that the exposed interconnects may be in the form of “conductive lands,” “buried conductive vias located along the cut line,” or “conductive through-holes.” VICOR-1009, [0109]-[0110]. The conductive features may “form interconnects extending through the thickness of the PCB **from top surface to bottom surface** providing generally half-cylindrical interconnects.” VICOR-1009, [0110] (emphasis added).

The components on the PCB surfaces may be surface mounted. VICOR-1009, [0176] (describing attaching components to PCB in Figs. 43-44 by “surface mount soldering”). Thus, a skilled artisan would have understood that the conductive features are coupled to electrical contacts on the surfaces of the printed circuit board to provide power and signal paths to the electronic components mounted on the circuit board. In addition, it would have been obvious to a skilled artisan to use surface mount technology because there were generally two ways to mount a component to a printed circuit board—either through-hole or surface

mount and surface mount was the newer and preferred technology. VICOR-1003, ¶171.

In the combination with Zeng-014, the contact point between the exposed interconnects and the Zeng-014 “connection part” forms the first terminal.

VICOR-1003, ¶171.

[1e] “a second terminal attached to a surface of the first electronic component apart from the carrier, wherein the second terminal of the first connection part is a bonding pad;”

Vinciarelli-218 in combination with Zeng-014 discloses a second terminal attached to a surface of the first electronic component (Zeng-014’s “conductive layer 61” with “pin 40”). VICOR-1008, [0058]. In the combination, the conductive layer 61 of Zeng would contact the exposed interconnects of the printed circuit board of the power converter module of Vinciarelli-218 to form a “connection part.” The conductive layer would be separated into different conductive paths from the various exposed interconnects (the “first terminals”) to the surface of the module to form multiple second terminals attached to a surface of the first electronic component apart from the carrier wherein the second terminal of the first connection part is a bonding pad. That is, the second terminal would be used to mount the power converter to a motherboard or other structure. The first electronic component is a combination of components mounted to the bottom of the circuit board, or it could be any one or more of the components that are under

the conductive layer 61 in the combination. For example, the first electronic component may be the exposed transformer core 815D. As shown in FIG. 5D of Zeng-014, the conductive layer 61 may cover virtually the entire lower surface of the device. *See, e.g.*, VICOR-1009, FIGs. 35-36; VICOR-1008, FIGs 5A-5E; VICOR-1003, ¶¶172-174.

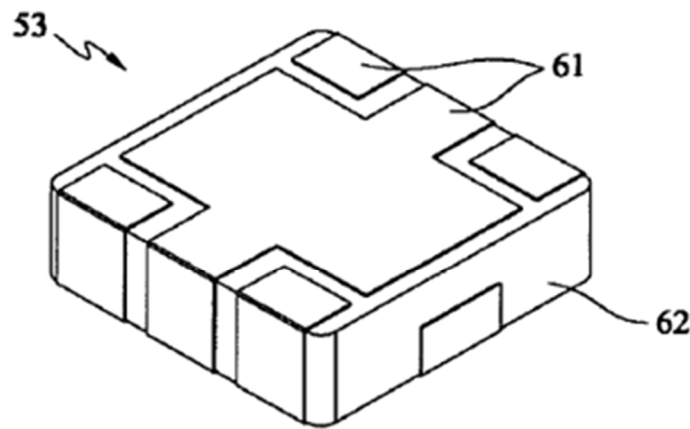


FIG. 5D

VICOR-1008, FIG. 5E.

[1f] “wherein the carrier is disposed at $\frac{1}{3}$ to $\frac{2}{3}$ of a height of the power converter,”

Vinciarelli-218 discloses a power converter wherein the carrier (“printed circuit board”) is disposed at $\frac{1}{3}$ to $\frac{2}{3}$ of the height of the power converter. As previously discussed in Ground 1, an exposed core power converter would have two matching cores, one on either side of the printed circuit board, and thus

positioning the printed circuit board at $\frac{1}{2}$ the height of the power converter. *See* Ground 1A, claim 1; VICOR-1003, ¶¶175-178.

As depicted in FIGs. 33-36, the power converters in that embodiment have exposed cores and three layers. The middle layer is layer 804, which although not identified by number in the specification is the printed circuit board (similar to PCB 204 and PCB 304 (VICOR-1009, [0115], [0119])). Layers 805 and 806 are the “cured encapsulant” layers that are above and below the circuit board on which components are disposed. The encapsulant is at the same height as each transformer core such that “the magnetic core surfaces 815C, 815D are exposed.” VICOR-1009, [0159]. As shown in the figure (although it is not drawn to scale), the printed circuit board is mounted in the middle of the power converter. VICOR-1009, FIG. 34; VICOR-1003, ¶176.

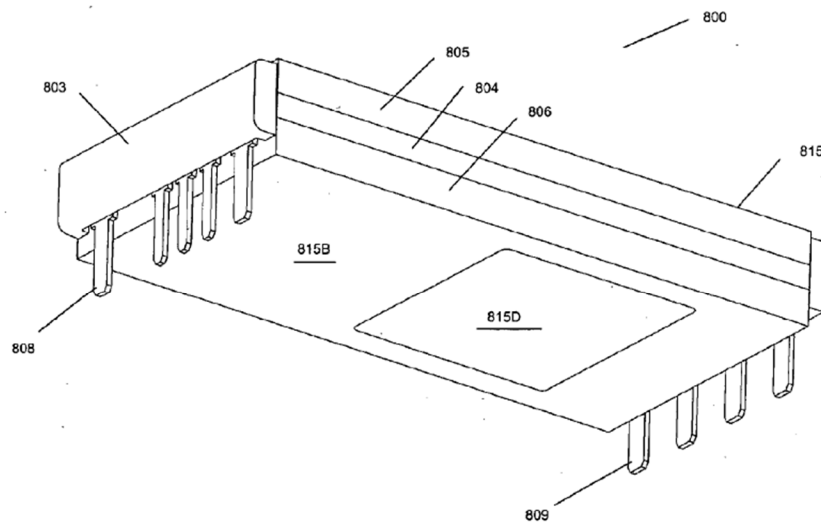
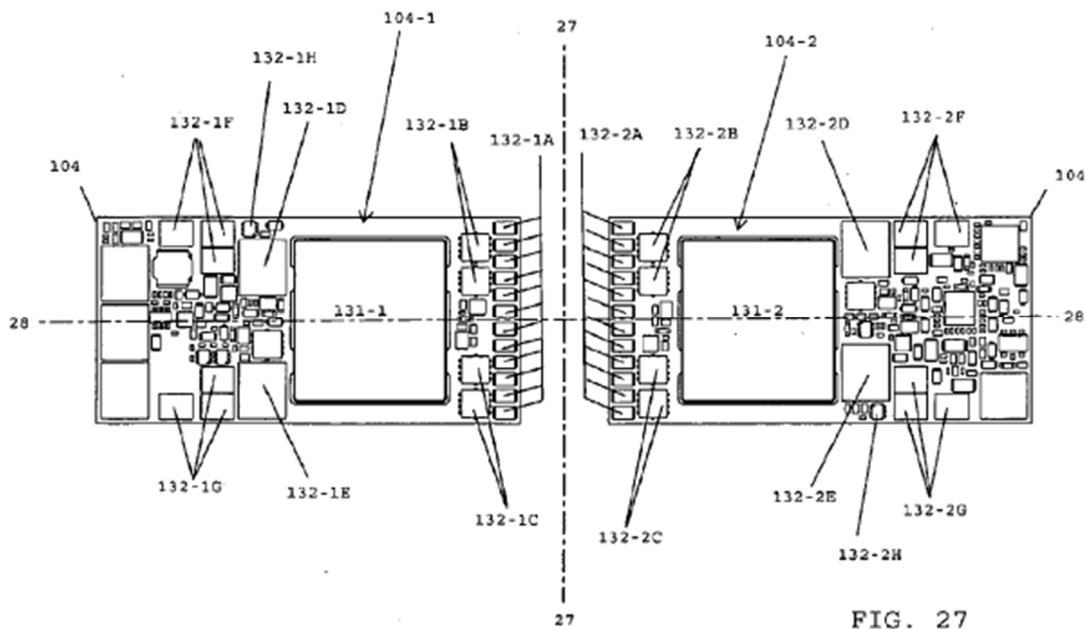


FIG. 34

In addition, Vinciarelli-218 states that power converters may have “Symmetrical Distribution Between PCB Surfaces” and “[m]any of the larger components may be distributed equally between both faces of PCB 104 as shown in FIG. 27.” Vicor-1009, [0142]-[0143], FIG. 27.



A skilled artisan would have understood that in the exposed core embodiments of Vinciarelli-218, the power converter would generally be twice the height of each core piece above the printed circuit board plus the width of the printed circuit board. At the very least, it would have been obvious based on the disclosures in Vinciarelli-218 to place the circuit board within the range of 1/3 to 2/3 of the height of the power converter, at least because Vinciarelli-218 discloses the value of symmetry in placing components on either side of the printed circuit

board. VICOR-1009, FIG. 27, [0140]-[0151], [0159], [0168], [0174]; VICOR-1003, ¶178.

[1g] “and wherein the first connection part is fabricated by mechanical support of the first electronic component.”

Vinciarelli-218 in combination with Zeng-014 discloses a power converter wherein the first connection part is fabricated by mechanical support of the first electronic component. *See* discussion for claim limitation [1c] regarding the connection part. VICOR-1003, ¶¶179-180. In the combination, the first connection part (the conductive layer 61 of Zeng-041) is applied to the module of Vinciarelli-218 (such as module 800 in FIGs. 33-36), with the contacts of those figures replaced with the lead frame process of Zeng-014. In the combination, the first connection part is curved against the power converter and its components, and is thus curved against the “first electronic component.” For example, the first electronic component may comprise all the components mounted to the bottom of the printed circuit board, or one or more of such components. The first electronic component may comprise the lower transformer core piece identified as 815D in FIGs 33-36 or as 131-1 in FIG. 27.

In the combination, the first connection part (conductive layer 61 from Zeng-014) is attached to the bottom of the power converter at various locations and curved up and against the sides of the power converter module and its electronic components. VICOR-1008, [0062]-[0064]. *See* discussion regarding forming the

Zeng-014 connection part against the module in Vinciarelli-664 in Ground 1C, which applies with equal force to this module. The support would be provided even if a thin insulative layer was placed between the exposed cores and some or all of the conductive layer 61. VICOR-1003, ¶180.

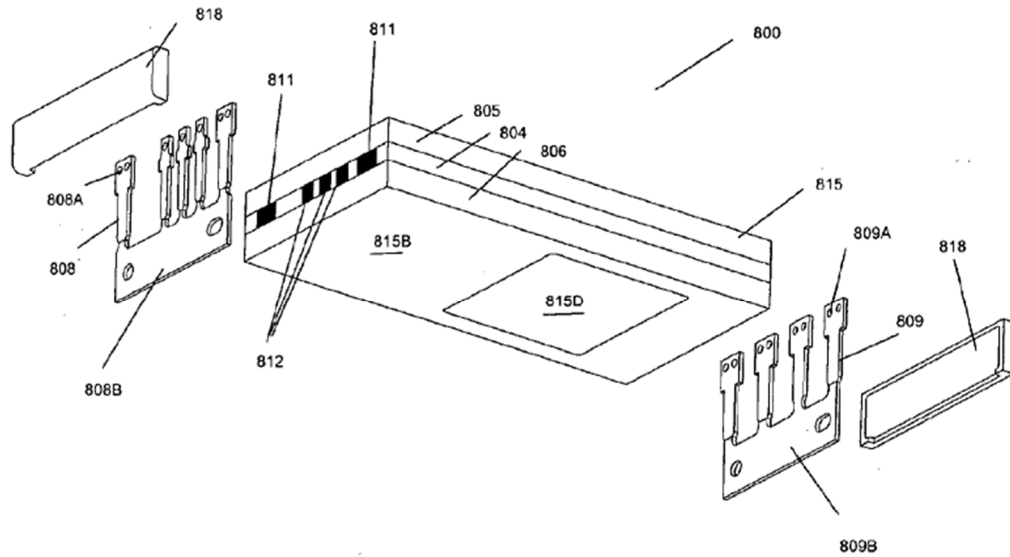


FIG. 36

VICOR-1009, FIG. 36

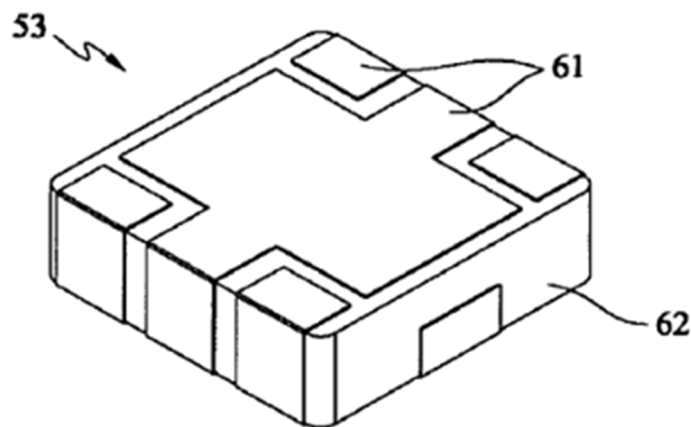


FIG. 5D

VICOR-1008, FIG. 5E.

3. Claim 2

[2a] “The power converter of claim 1, further comprising a plurality of first electronic components and a plurality of second electronic components,”

Vinciarelli-218 discloses a plurality of first electronic components (the components mounted to the bottom of the printed circuit board) and a plurality of second electronic components (the components mounted to the top of the printed circuit board). *See, e.g.*, VICOR-1009, FIG. 27. *See* discussion for Ground 2, claim limitations [1a], [1b], [1f], and [1g]; VICOR-1003, ¶181.

[2b] “wherein a first height”

Vinciarelli-218 discloses a power converter with the claimed dimensions. The power converter has a first height defined as a vertical height of the tallest of the first electronic components and the lower surface of the carrier (e.g., the lower exposed core discussed in limitations [1b], [1e], [1f], and [2a]). The power converter has a second height defined as a vertical height of the tallest of the second electronic components and the upper surface of the carrier (e.g., the upper exposed core discussed in limitations [1b], [1e], [1f], and [2a]). The height of the power converter is thus calculated by adding the first height, the second height and the thickness of the carrier. VICOR-1003, ¶182.

4. Claim 3

[3] “The power converter of claim 1, wherein a height of the first electronic component is equal to a height of the second electronic component.”

Vinciarelli-218 discloses power converters with exposed cores wherein the height of the first electronic component (lower core piece) is equal to the height of the second electronic component (upper core piece). A skilled artisan would have understood that the upper and lower core pieces for a transformer would be the same size. *See* discussion for Ground 2, limitations [1b], [1e], [1f], [2a] and [2b]; VICOR-1003, ¶183.

In addition, a skilled artisan would have been motivated to make the top and bottom of the power converter symmetrical (and therefore meet this limitation) to provide for shared pins and symmetrical heat dissipation as described in Vinciarelli-747, incorporated by reference into Vinciarelli-218, and would have had a reasonable expectation of success in making a symmetrical power converter. VICOR-1010, 23:27-24:49. VICOR-1003, ¶183.

5. Claim 4

[4] “The power converter of claim 1, wherein....”

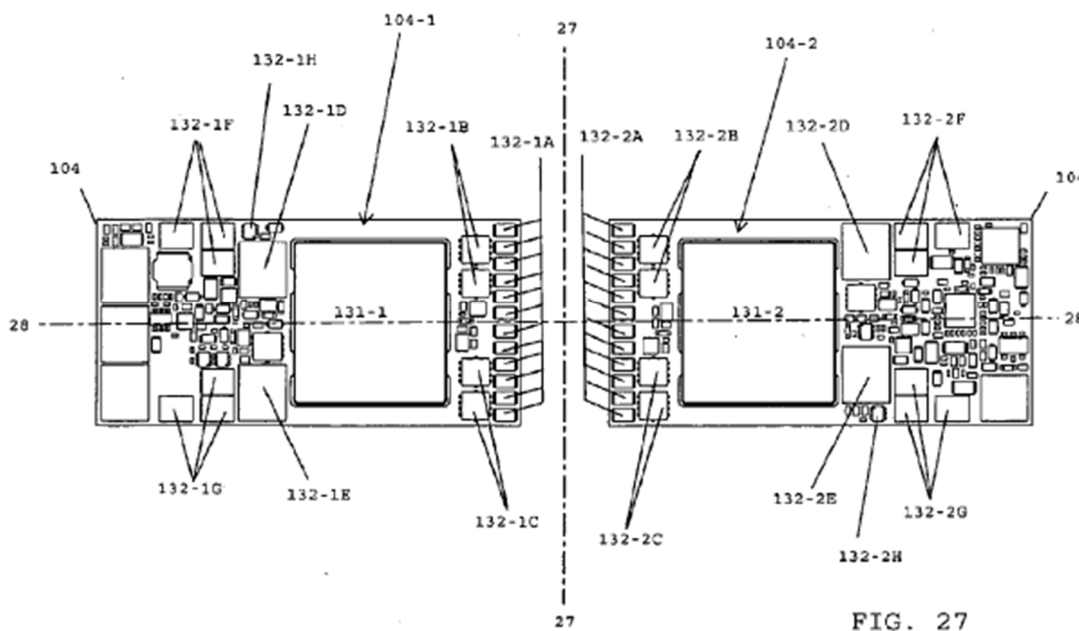
Vinciarelli-218 discloses a first electronic component (lower core piece 131-1), a second electronic component (upper core piece 131-2) and a carrier (printed circuit board with “a winding formed by traces in one or more [] [] conductive layers in the PCB”). VICOR-1009, [0020]-[0021], [0100], [0159]-[0160]. The

structure forms a transformer where the first and second electronic components are parts of the core of the inductive element. *See also* discussion concerning the cores for Ground 2, limitations [1b], [1e], [1f], [2a], [2b], [4], and [6]. VICOR-1003, ¶184.

6. Claim 5

[5a] The power converter of claim 4, further comprising: a third electronic component and a fourth electronic component respectively disposed at the lower surface and the upper surface of the carrier;

Vinciarelli-218 discloses a power converter with a third and fourth electronic component respectively disposed on the lower and upper surface of the carrier, as depicted in FIG. 27. VICOR-1009, FIG. 27, [0140]-[0143]; VICOR-1003, ¶¶185-187.



Moreover, a skilled artisan would have known that many power converters

contained multiple inductive elements, including power converters containing at least two transformers or at least one transformer and at least one inductor. A skilled artisan would further have understood that an inductor would be formed in the same manner as the transformer shown in FIG. 27 of Vinciarelli-218, except that the inductor would have a single winding instead of primary and secondary windings. VICOR-1003, ¶186.

In addition, Vinciarelli-218 incorporates Vinciarelli-844 for examples of “[e]ncapsulated electronic power converters capable of being surface mount soldered to a customer motherboard.” VICOR-1009, [0004]. As discussed in connection with Ground 1, Vinciarelli-844 depicts a power converter with multiple transformers. VICOR-1007, FIGs. 5a and 5b, 11:15-17. *See* Ground 1, claims 4 and 6, Ground 2, claim 4; VICOR-1003, ¶187.

[5b] wherein the third electronic component, the fourth electronic component and the carrier are used to form a transformer, and the third electronic component and the fourth electronic component are respectively parts of the core of the transformer.

Vinciarelli-218 discloses this limitation because the second transformer would be formed in the same general manner as the first, with PCB windings and lower and upper core pieces. *See* discussion for Ground 1, claim 4, and Ground 2, claim 4; VICOR-1003, ¶188.

7. Claim 6

[6] The power converter of claim 1, wherein the first electronic component, the second electronic component and the carrier are used to form a transformer, and the first electronic component and the second electronic component are respectively parts of a core of the transformer.

Vinciarelli-218 discloses this limitation for the same reasons as provided for claim 4. The first electronic component is the lower transformer core and the second electronic component is the upper transformer core, and the carrier contains the windings for the transformer. *See discussion* for Ground 1, claim 4 and Ground 2, claim 4. VICOR-1003, ¶189.

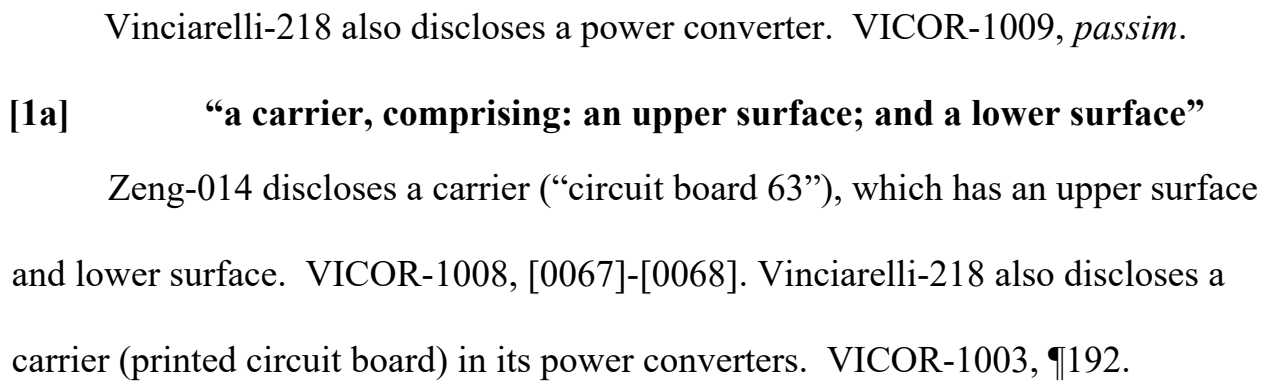
E. GROUND 3 – Claims 1-6 Would Have Been Obvious over Zeng-014 in view of Vinciarelli-218

1. The Zeng-014 / Vinciarelli-218 Combination

For this Ground, a skilled artisan would start with Zeng-014 and improve the generic power converter of Zeng-014 by packaging it as a single cuboid module as taught by Vinciarelli-218 and wrapped as in Zeng-014. VICOR-1008, FIGs. 5A-5E, 6A, 6B, [0062]-[0067]. The skilled artisan would recognize that the combination would be implemented in a variety of ways, and thus for example would include implementations with Zeng-014's generic buck converter and also include implementations using the power converters of Vinciarelli-218. VICOR-1003, ¶190.

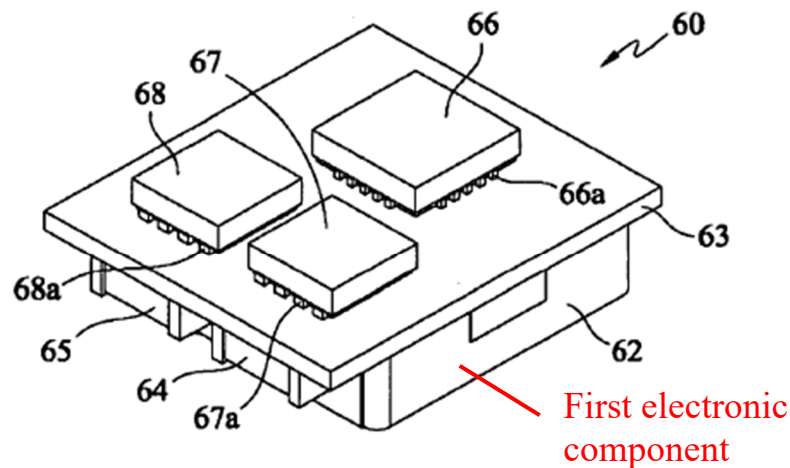
2. Claim 1

[1pre] “A power converter, comprising:”



[1b] “a first electronic component disposed at the lower surface of the carrier; a second electronic component disposed at the upper surface of the carrier; and”

Zeng-014 disclose a first electronic component (“inductor 62” shown in FIG. 6A) on the lower surface and a second electronic component (e.g., “electronic component 66” in FIG. 6B). The orientation of the device in the figures does not matter. By turning the device upside down, “upper” and “lower” are swapped. VICOR-1008, FIGs. 6A and 6B, [0067]-[0068]; VICOR-1003, ¶193.



[1c] “a first connection part, comprising:”

Zeng-014 discloses a first connection part (“conductive layer 61” on inductor 62). VICOR-1008, [0064]-[0066]; VICOR-1003, ¶194.

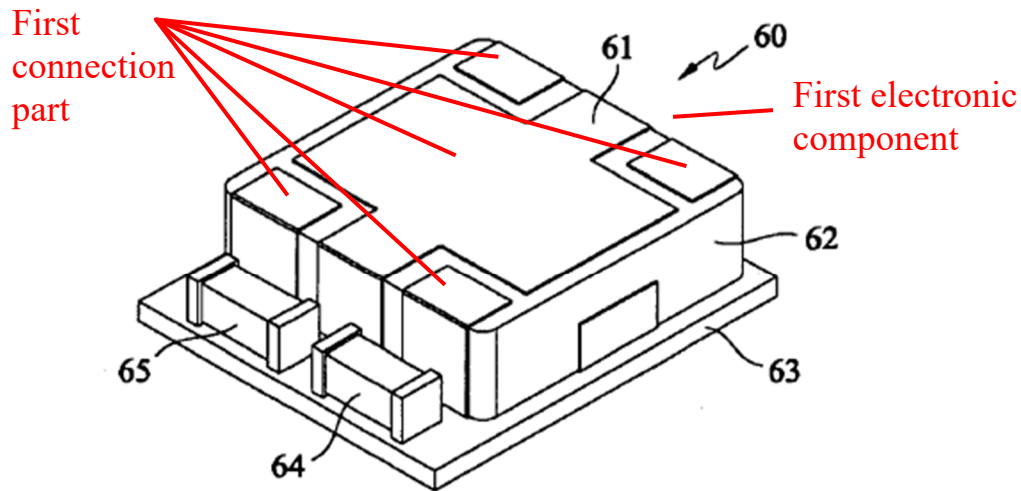


FIG. 6A

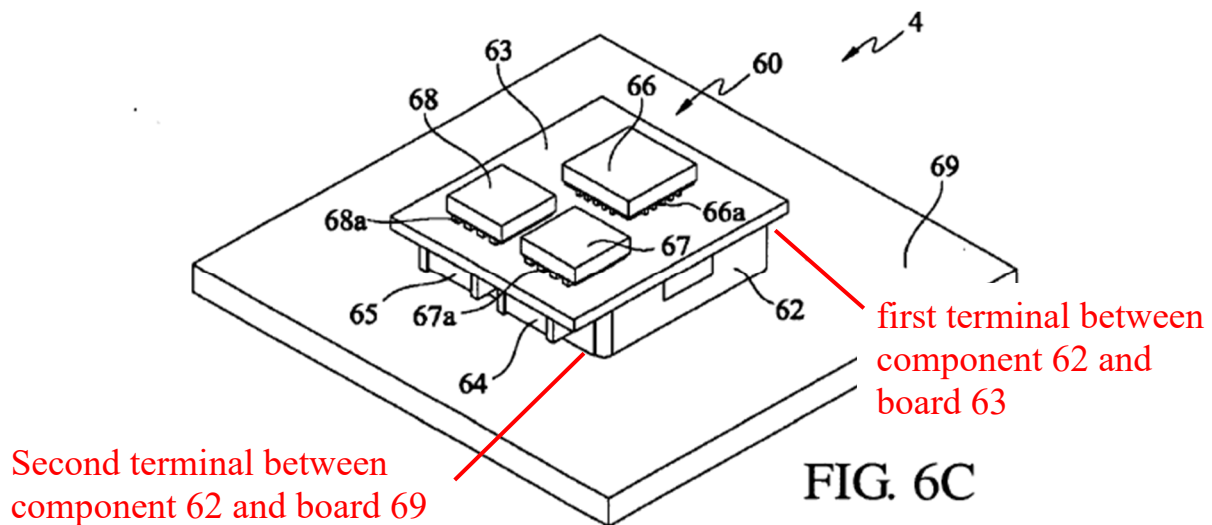
[1d] “a first terminal electrically coupled to the upper surface or the lower surface of the carrier; and”

Zeng-014 discloses a first terminal (portion of “conductive layer 61” facing “circuit board 63”) coupled to the lower surface of the carrier (“circuit board 63”). VICOR-1008, [0058], [0065]-[0069], [0085]-[0086], FIGs. 6A and 6B; FIGs. 8A and 8B, 9A and 9B and 10; VICOR-1003, ¶195.

[1e] “a second terminal attached to a surface of the first electronic component apart from the carrier, wherein the second terminal of the first connection part is a bonding pad;

Zeng-014 discloses a second terminal (opposite side of “conductive layer 61” from the first terminal) attached to the surface of the inductor 62, wherein the second terminal is a bonding pad to which other components may be connected. In FIG. 6C, “the first circuit board 69 is electrically connected with the DC to DC converter 60 through the connecting conductor 40 wrapping the first surface of the

inductive component.” VICOR-1008, [0067], FIG. 6C. The second terminal is a bonding pad because it is bonded to circuit board 69 for electrical connection to circuit board 69. Zeng-014 provides additional examples for the connection part and its second terminal in connection with FIGs. 8A, 8B, 9A, 9B, and 10. VICOR-1008, [0085]-[0088]; VICOR-1003, ¶¶196.



[1f] “wherein the carrier is disposed at $\frac{1}{3}$ to $\frac{2}{3}$ of a height of the power converter,”

Zeng-014 in combination with Vinciarelli-218 discloses this limitation. A skilled artisan would have been motivated to modify Zeng-014 based on the teachings of Vinciarelli-218 for multiple reasons. VICOR-1003, ¶¶197-204.

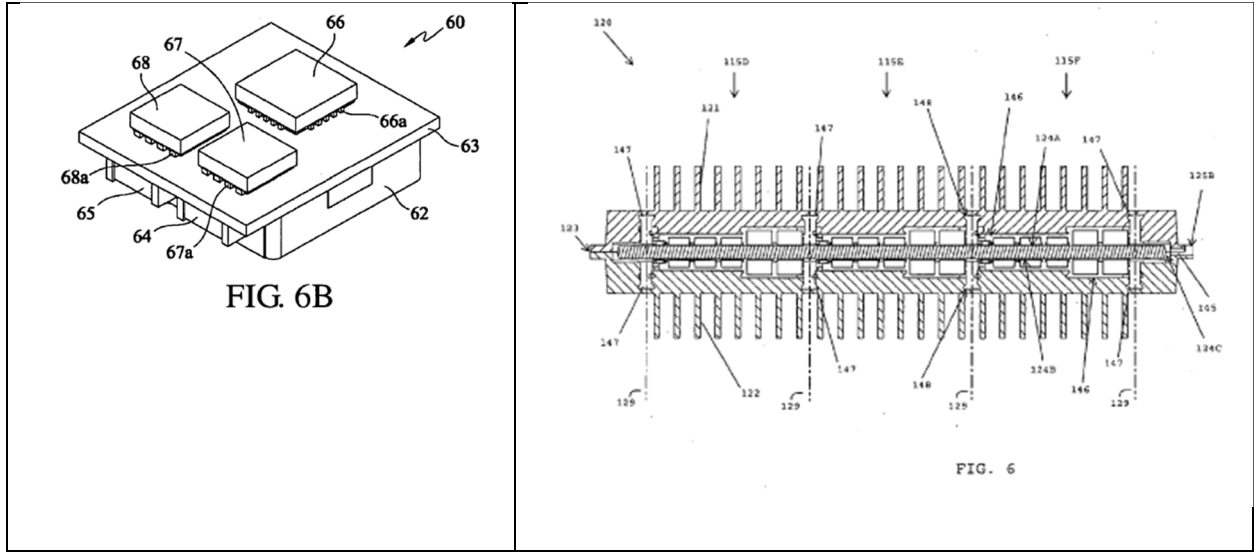
First, Zeng-014 and Vinciarelli-218 each concern small power converters, including those that may be placed near the point of load. Thus, a skilled artisan reading Zeng-014 would have looked to Vinciarelli-218 for potential improvements.

Second, Zeng-014 discloses a power converter module with an internal circuit board 63 that may be mounted to a customer's circuit board. Vinciarelli-218 discloses an improvement to such a module by encapsulating the components to make a cuboid shaped module that provide ease of manufacturing, produce a multiplicity of modules at a time, and that may be of a small size and surface mounted to a customer board. VICOR-1009, [0004], [0086].

Third, Vinciarelli-218's module further provides the numerous contact surfaces ("exposed interconnects"), and thus would maintain the advantages provided by Zeng-014. VICOR-1009, [0108], FIG. 10A, 10B; Zeng-014, [0087]-[0088].

Fourth, Vinciarelli-218 discloses that conductors may be brought to the edge of the printed circuit board, thus easily allowing the external conductive layer to be electrically coupled to components within the module through the printed circuit board. VICOR-1009, [0018], [0028], [0115]-[0129].

A skilled artisan would thus have been motivated based on the teachings of Vinciarelli-218 to package the DC to DC converter 60 of Zeng-014 within an encapsulated module as proposed by Vinciarelli-218—from the form factor on the left below to the form factor on the right:



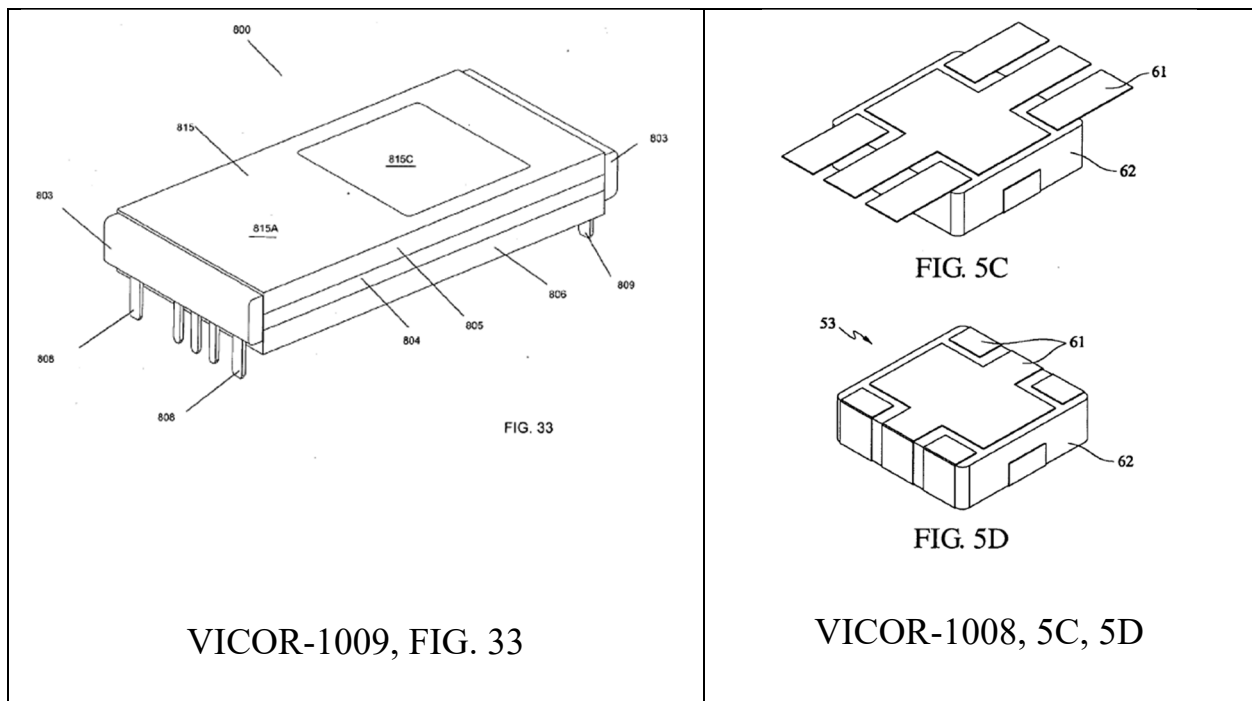
Zeng-014, FIG. 6B, Vinciarelli-218, FIG. 6.

In the combination, the DC to DC converter would have a carrier (printed circuit board) placed at 1/2 the height of the power converter and thus disposed at 1/3 to 2/3 of the height of the power converter. As explained in Vinciarelli-218, the power converter is designed such that the components are symmetrical on the top and bottom of the converter. VICOR-1009, [0142]-[0143], [0147]-[0151]. VICOR-1003, ¶203.

A skilled artisan would have had a reasonable expectation of success because the combination involves the mechanical repackaging of power converter components using a known technique (the technique of Vinciarelli-218) that would apply to a variety of known power converter topologies and components. VICOR-1003, ¶204.

[1g] “and wherein the first connection part is fabricated by mechanical support of the first electronic component.”

Zeng-014 discloses the connection part (“conductive layer 61”) is fabricated by curving the metal layer against the component. Zeng-014, [0062]-[0063]. In the combination, the entire power converter would take a shape similar to the module of FIG. 33 of Vinciarelli-218 without the adapter and instead with the Zeng-014 conductive layer 61, which would be applied to the entire module rather than one component. A skilled artisan would have recognized that the DC to DC converter module of Zeng-014 as modified by the module teachings of Vinciarelli-218 is an “electronic component” well suited for the conductive layer 61 of Zeng-014. VICOR-1003, ¶205.



3. Claims 2-6

In the combination of Zeng-014 and Vinciarelli-218, each of the limitations of claims 2-6 are provided by Vinciarelli-218. Each of these claims adds limitations concerning internal components of the power converter. Zeng-014 discloses an interconnect structure for a generic power converter and illustrates the concept with a generic “buck converter,” comprising an inductor, two switch elements, an output capacitor, and a control chip. VICOR-1008, [0006]. Zeng-014’s disclosure is applicable, however, to improve other power converters, and in particular “POL DC to DC converters” which “all suffer from the oversized overall volume and the low power density due to the pin arrangement in the conventional package.” Zeng-014, [0011]. Thus a skilled artisan would understand Zeng-014 to teach applying its module package concept to many types of power converters and thus the extension of Zeng-014 to the entire power converter would apply to the power converters of Vinciarelli-218, including transformer-based power converters. VICOR-1009, [0003]-[0004], [0020], [00147]-[0148]; VICOR-1003, ¶206.

In the proposed combination for claims 2-6, the “pin arrangement” of Zeng-014 (using curving a “conduction layer 61” over a component package) is applied to the power converter modules of Vinciarelli-218 using the internals of the power modules of Vinciarelli-218 and coupling the printed circuit board of Vinciarelli-218 to the “conduction layer 61” of Zeng-014 in the manner taught by Vinciarelli-

218 (via the exposed edge of the printed circuit board). Accordingly, the discussion of Vinciarelli-218 in Ground 1A with respect to claims 2-6 applies with equal force to the combination of Vinciarelli-218 and Zeng-014 presented in this ground. The analysis concerning the internals of the power converter need not change by the change of external connection from that of Vinciarelli-218 to the “conductive layer 61” of Zeng-014; VICOR-1003, ¶207.

IV. PTAB DISCRETION SHOULD NOT PRECLUDE INSTITUTION

A. 35 U.S.C. §325(d) – *Advanced Bionics*

Advanced Bionics and the *Becton* factors strongly favor institution. *Adv. Bionics LLC v. MED-EL Elektromedizinische Gerate GmbH*, IPR2019-01469, Paper 6, 2020 WL 740292 (P.T.A.B. Feb. 13, 2020) (“*Advanced Bionics*”) (precedential); *Becton, Dickinson and Co. v. B. Braun Melsungen AG*, IPR2017-01586, Paper 8, 2017 WL 6405100 (P.T.A.B. Dec. 15 2017) (“*Becton*”) (precedential).

Patent Owner did not cite Vinciarelli-664 or Vinciarelli-218. The Examiner did not consider Vinciarelli-664 or Vinciarelli-218 nor issue a prior art rejection in the prosecution of the ’263 Patent. *See, generally*, VICOR-1002. The Examiner cited Zeng-014 along with three other references, but made no comment about the art in an Office Action or Notice of Allowability. VICOR-1002, 7-16. The examiner did not consider the combinations that include Zeng-014 in this Petition, and specifically did not consider the Vicor’s prior art cited in this Petition in which

power converters formed in panels and molded to resemble an electronic component.

Accordingly, neither condition of the first prong of the *Advanced Bionics* framework is met, and there is no need to reach the second prong to resolve against discretionary denial under Section 325(d). *See, e.g., Oticon Medical AB et. al. v. Cochlear Ltd.*, IPR2019-00975, Paper 15 at 20, 2019 WL 5237817, at *8 (P.T.A.B. Oct. 16, 2019) (precedential) (“There is new, noncumulative prior art asserted in the Petition...[f]or at least this reason, we determine not to exercise our discretion under § 325(d)”).

For at least the above-noted reasons, Petitioner respectfully submits that discretionary denial is unwarranted, and that the Board should instead institute IPR based on the instant Petition’s grounds.

B. 35 U.S.C. §314(a) – *Fintiv*

The grounds presented in this Petition strongly favor institution, even under the *Fintiv* framework, as clarified by the interim guidance to the PTAB from Director Vidal, dated June 21, 2022.

Factor 1 (Stay)—Neither party has requested a stay, but Petitioner intends to seek a stay, and thus this factor tends to weigh against discretionary denial.

Factor 2 (Trial Date)—Patent Owner filed its Complaint on October 23, 2023, and no trial date has been set in the co-pending litigation (the “Litigation”).

The median time to trial in the Western District of Texas is over two years. *See* Table C.5 (Period ending March 31, 2023),

<https://www.uscourts.gov/statistics/table/c-5/federal-judicial-caseload-statistics/2023/03/31>. This proceeding is expected to be resolved in 18 months,

and thus this factor weighs against discretionary denial.

Factor 3 (Investment)—The bulk of the investment in the Litigation has yet to occur. Claim construction has not yet begun, and a Markman hearing has been scheduled for September 23, 2024. By the time of institution in this proceeding, the co-pending litigation will be at a posture where “much of the district court’s investment relates to ancillary matters untethered to the validity issue itself.” *Sand Revolution II, LLC, v. Cont’l Intermodal Grp. – Trucking LLC*, IPR2019-01393, Paper 24 at 10-11, 2020 WL 3273334, at *4 (P.T.A.B. June 16, 2020).

Factor 4 (Overlap)—The factual overlap between this proceeding and the litigation should be minimal because Petitioner has system art that cannot be presented in this Proceeding. Petitioner stipulates that should institution be granted, it will not raise in the Litigation the same grounds as presented in this proceeding. *See Sand Revolution*, Paper 24 at 11-12, 2020 WL 3273334, at *5. Factor 4 thus weighs against discretionary denial.

Factor 6 (Merits and Other Circumstances)—The compelling merits presented in this Petition alone justifies institution in the public interest and

outweighs any alleged inefficiencies due to the parallel litigation. Petitioner is presenting this petition within 5 months of the filing of the Complaint in the co-pending litigation (and only 3.5 months after service), and has diligently developed the grounds presented against the Challenged Claims.

V. CONCLUSION AND FEES

The Challenged Claims are unpatentable. Petitioner authorizes charge of fees to Deposit Account 06-1050.

VI. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8(a)(1)

A. Real Party-In-Interest Under 37 C.F.R. § 42.8(b)(1)

Vicor Corporation is the real party-in-interest.

B. Related Matters Under 37 C.F.R. § 42.8(b)(2)

The '263 Patent is the subject of a civil action, *Delta Electronics, Inc. v. Vicor Corporation* 6-23-cv-00726, W.D. Tex., filed October 23, 2023 (VICOR-1004). Petitioner is not aware of any other disclaimers, reexamination certificates, or IPR petitions addressing the '263 Patent.

Petitioner is also filing today IPR petitions in IPR2024-00706 and IPR2024-00715 against U.S. Patent No. 10,877,534 (each challenging different sets of claims). The inventor of the '534 patent is also the lead inventor on the '263 patent, and the patents have overlapping subject matter. The '534 patent is being asserted in *Delta Electronics, Inc. v. Vicor Corporation* 1-23-cv-01246, D. Del., filed November 1, 2023, and amended on January 26, 2024.

Petitioner is also filing today an IPR petition in IPR2024-00704 that challenges claims in U.S. Patent No. 8,711,580. The '580 patent is being asserted in the same Delaware civil action as the '534 patent,

C. Lead And Back-Up Counsel Under 37 C.F.R. § 42.8(b)(3)

Petitioner provides the following designation of counsel.

Lead Counsel	Backup counsel
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D. Service Information

Please address all correspondence and service to the address listed above.

Petitioner consents to electronic service by email at IPR25808-0012IP1@fr.com (referencing No. 25808-0012IP1 and cc'ing PTABInbound@fr.com, katz@fr.com, kolodney@fr.com and oconnor@fr.com).

Respectfully submitted,

Dated March 25, 2024

/Steven R. Katz/

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(Control No. IPR2024-00705)

Attorneys for Petitioner

CERTIFICATION UNDER 37 CFR § 42.24

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petition for *Inter Partes* Review is no more than 13,891 words, which is less than the 14,000 allowed under 37 CFR § 42.24.

Dated March 25, 2024

/Steven R. Katz/

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR §§ 42.6(e)(4)(i) *et seq.* and 42.105(b), the undersigned certifies that on March 25, 2024, a complete and entire copy of this Petition for *Inter Partes* Review and all supporting exhibits were provided by Federal Express, to the Patent Owner, by serving the correspondence address of record as follows:

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