

NOTE: This disposition is nonprecedential.

## United States Court of Appeals for the Federal Circuit

2007-1572

LINEAR TECHNOLOGY CORPORATION,

Appellant,

v.

INTERNATIONAL TRADE COMMISSION,

Appellee,

and

ADVANCED ANALOGIC TECHNOLOGIES, INC.,

Intervenor.

Mark G. Davis, Weil, Gotshal & Manges LLP, of Washington, DC, argued for appellant. With him on the brief was Ronald J. Pabis. Of counsel on the brief were Natalia V. Blinkova, Amalie M. Weber, and Patricia E. Chow, McDermott, Will & Emery LLP, of Washington, DC. Of counsel were Jimmy M. Shin, McDermott, Will & Emery LLP, of Palo Alto, California, and Matthew G. Cunningham, of Washington, DC.

Paul M. Bartkowski, Attorney, Office of the General Counsel, United States International Trade Commission, of Washington, DC, argued for appellee. With him on the brief were James M. Lyons, General Counsel, and Wayne W. Herrington, Assistant General Counsel. Of counsel was Eric Frahm, Attorney-Advisor.

Andrew N. Thomases, Dechert LLP, of Mountain View, California, argued for intervenor. With him on the brief were Chris Scott Graham and Philip Barilovits. Of counsel were Jonathan Daniel Baker, Anthony B. Diepenbrock, III and Ayumi Urabe, of Mountain View, California, and Stephen J. Rosenman, of Washington, DC.

Appealed from: United States International Trade Commission

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Intervenor.

On appeal from the United States International Trade Commission in  
Investigation No. 337-TA-564.

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DECIDED: August 28, 2008

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Before MAYER, LOURIE, and SCHALL, Circuit Judges.

SCHALL, Circuit Judge.

## DECISION

Linear Technology Corp. (“Linear”) filed a complaint with the United States International Trade Commission (“the Commission”) under section 337 of the Tariff Act of 1930, 19 U.S.C. § 1337(a)(1)(B), alleging that Advanced Analogic Technologies, Inc. (“AATI”) imported and/or sold for importation certain electronic “charge pump DC/DC

converter” devices that infringed United States Patent No. 6,411,531 (“the ’531 patent”). See 71 Fed. Reg. 14545 (Int’l Trade Comm’n March 22, 2006) (Notice of Investigation). Linear now appeals the Commission’s final determination (1) that AATI’s imported AAT3113, AAT3141, and AAT3151 devices did not infringe asserted claims 4, 9, or 26 of the ’531 patent; (2) that AATI’s imported AAT3119 device did not infringe claim 9 of the ’531 patent;<sup>1</sup> (3) that Linear failed to satisfy the “domestic industry” requirement of section 337; (4) that claims 4 and 26 of the ’531 patent were invalid as anticipated by U.S. Patent No. 5,132,895 (“the ’895 patent”) to Kase; and (5) that claims 4, 9, and 26 of the ’531 patent were invalid as anticipated by U.S. Patent No. 5,680,300 (“the ’300 patent”) to Szepesi. Because substantial evidence supports the Commission’s determination that claims 4, 9, and 26 of the ’531 patent are invalid as anticipated by the ’300 patent, we affirm.

## DISCUSSION

### I.

The ’531 patent is entitled “Charge Pump DC/DC Converters with Reduced Input Noise.” A charge pump DC/DC converter is “a power supply circuit that provides a regulated output voltage to a load from an input voltage source.” ’531 patent col.1 ll.9–11. The ’531 patent is directed at a particular type of charge pump DC/DC converter that uses switches to alternately charge and discharge an intermediate storage capacitor. The concept of switching converters was well known at the time the application for the ’531 patent was filed. However, prior art switching converters had the disadvantage of “noise induced on the input voltage source due to fluctuations or

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<sup>1</sup> AATI did not contest the direct infringement of claims 4 and 26 by the AAT3119.

variations in the current drawn by the converter.” Id. col.1 ll.17–20. The invention of the ’531 patent was intended to reduce noise on the input voltage source by maintaining a “substantially constant input current.” Id. col.1 ll.36–48. Claim 4, and claim 1 from which it depends, are reproduced below.

1. A method for regulating a voltage at an output node of a boost voltage regulator, the method comprising:

providing a first capacitor;

providing a first switch coupled between the first capacitor and the output node;

providing a second switch coupled to the first capacitor;

controlling the first and second switches to alternately charge the first capacitor from an input voltage and discharge the first capacitor to the output node;

monitoring the voltage at the output node to generate a control signal; and

controlling the current flowing through the first capacitor in response to the control signal when the first switch is closed.

4. The method of claim 1 further comprising:

controlling the current through the first capacitor in response to the control signal when the second switch is closed.

Although written in independent form, claim 9 is identical to claim 4, except that it specifically provides that the step recited in the final limitation is performed “by providing a variable resistance in series between the input voltage and the first capacitor when the second switch is closed.” Claim 26, and claim 23 from which it depends, are reproduced below.

23. A boost voltage regulator that regulates a voltage at an output node, comprising:

a first capacitor;

a first switch coupled between the first capacitor and the output node;

a second switch coupled to the first capacitor, wherein current alternately flows from an input voltage to the first capacitor and from the first capacitor to the output node;

feedback loop circuitry that monitors the voltage at the output node and generates a control signal; and

a transistor that controls the current flowing through the first switch in response to the control signal when the first switch is closed.

26. The regulator of claim 23 wherein:

the transistor controls the current through the second switch in response to the control signal when the second switch is closed.

Before the presiding administrative law judge (“ALJ”), the parties disputed whether the term “voltage regulator” in the preamble of claims 4, 9, and 26 should be regarded as a claim limitation. The ALJ concluded that “voltage regulator” is a limitation because it gives meaning to all of the asserted claims. In re Certain Voltage Regulators, Inv. No. 337-TA-564, slip op. at 30–31 (Int’l Trade Comm’n May 22, 2007) (“ALJ Initial Determination”) (citing In re Paulsen, 30 F.3d 1475, 1479 (Fed. Cir. 1994)). The parties also disputed the appropriate construction of “voltage regulator” in the event that it was determined to be a claim limitation. Relying upon the ’531 patent’s specification as well as extrinsic evidence, the ALJ construed “voltage regulator” as “a device that continuously maintains a constant output voltage at a predetermined, specified target value regardless of changes in input voltage or load current, so long as input voltage and load current are within the specified operating range for the device.”<sup>2</sup> Id. at 33–35.

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<sup>2</sup> The parties agree that a proper construction of “voltage regulator,” if it is a claim limitation, does not depend on the operating range—i.e., range of input voltages

With respect to infringement, the ALJ determined that AATI's devices did not have an output voltage that was "predetermined" and "constant." Id. at 65–68. Rather, the ALJ observed that tests performed by AATI's expert, Dr. Szepesi, demonstrated that the devices "have output voltages that vary greatly with changes in input voltage and load current." Id. at 66. Thus, the ALJ concluded that AATI's devices did not satisfy the "voltage regulator" requirement of the asserted claims. Likewise, the ALJ determined that Linear did not satisfy the "domestic industry" requirement of section 337 because its own device—the LTC3202—did not provide a constant, regulated output voltage over its specified range of operation. Id. at 111–14. Finally, the ALJ concluded that claims 4, 9, and 26 of the '531 patent were invalid as anticipated by both the '895 and '300 patents. Id. at 92–97.

On appeal, the Commission determined to review the sole issue of whether asserted claim 9 of the '531 patent was anticipated by the '895 patent to Kase. 72 Fed. Reg. 41774, 41775 (Int'l Trade Comm'n July 31, 2007) (Notice of Review). The Commission ended up taking no position on that issue, however, effectively vacating the ALJ's determination that claim 9 of the '531 patent was anticipated by the '895 patent. Id. The remainder of the ALJ's rulings with respect to the '531 patent were not reviewed and thereby became part of the Commission's final decision. See 19 C.F.R. § 210.42(h).

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and output currents—that is specified on a device's datasheet or "box specification." Therefore, although it is not entirely clear what was meant by the term "specified operating range," we do not interpret the Commission's construction of "voltage regulator" as being tied to the range of input voltages and output currents set forth on a device's datasheet or "box specification." We agree with the parties that such a construction of "voltage regulator" would not be correct.

## II.

On appeal, Linear argues that the Commission's claim construction was erroneous. Linear contends that the preamble term "voltage regulator" is not a limitation of the asserted claims, and that the Commission misconstrued "voltage regulator" even if it is determined to be a claim limitation. In addition, Linear argues that the Commission's factual determinations regarding infringement, domestic industry, and anticipation are not supported by substantial evidence.

With respect to claim construction, Linear first contends that the preamble term "voltage regulator" is not a limitation of the asserted claims. According to Linear, a preamble term is limiting if (1) the preamble provides an antecedent basis for a term in the body of the claim, C.R. Bard, Inc. v. M3 Sys., Inc., 157 F.3d 1340, 1350 (Fed. Cir. 1998), or (2) there is clear reliance on the preamble during prosecution to distinguish the invention from the prior art, Intirtool, Ltd. v. Texar Corp., 369 F.3d 1289, 1295 (Fed. Cir. 2004). Linear contends that neither is the case here.

In addition, Linear argues that the Commission misconstrued "voltage regulator" even if it is a claim limitation. According to Linear, the Commission's construction improperly relies upon the operating range—i.e., the range of input voltages and output currents—specified on a device's accompanying datasheet or "box specification." Linear explains that the claims, specification, and prosecution history of the '531 patent do not refer to datasheets. In addition, Linear contends that a potential infringer could avoid liability under the Commission's construction merely by changing the numbers listed on its product's datasheet. According to Linear, "a skilled artisan reading the specification would understand a voltage regulator to denote a circuit topology capable

of delivering a predetermined output voltage under appropriate conditions.” Linear further argues that the “predetermined” output voltage need not be a single, fixed, constant voltage. Rather, a skilled artisan “would understand that it may be desirable to design a circuit that provides varying voltage outputs.”

With respect to anticipation of the asserted claims, Linear argues that two limitations are not disclosed in the ’300 patent. First, Linear briefly contends that the circuit disclosed in the ’300 patent is not a “voltage regulator” under the Commission’s narrow construction because AATI cannot prove that it necessarily provides a single output voltage throughout its operating range. Second, Linear argues that the ’300 patent does not disclose control of the circuit’s input current during both phases of the charge pump cycle—i.e., during both charging and discharging of the intermediate capacitor.<sup>3</sup> According to Linear, the ’300 patent only discloses control of input current during the discharge phase.

Finally, Linear also contends that the Commission’s determinations regarding anticipation by the ’895 patent, infringement, and domestic industry are not supported by substantial evidence. Because we affirm based upon anticipation by the ’300 patent, however, we need not reach these additional issues.

### III.

Anticipation is a question of fact. Gen. Elec. Co. v. Nintendo Co., Ltd., 179 F.3d 1350, 1353 (Fed. Cir. 1999). We review the Commission’s factual findings under the substantial evidence standard. 19 U.S.C. § 1337(c); 5 U.S.C. § 706(2)(E). Thus, we review for substantial evidence the Commission’s determination that claims 4, 9, and 26

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<sup>3</sup> Claims 4, 9, and 26 of the ’531 patent require control of input current during both the charge and discharge phases of the charge pump cycle.



of the '531 patent are anticipated by the prior art '300 patent. Substantial evidence is “such relevant evidence as a reasonable mind might accept as adequate to support a conclusion.” Enercon GmbH v. Int’l Trade Comm’n, 151 F.3d 1376, 1381 (Fed. Cir. 1998) (quoting Consol. Edison Co. v. Nat’l Labor Relations Bd., 305 U.S. 197, 229 (1938)). It is “more than a mere scintilla,” Consol. Edison, 305 U.S. at 229, but “something less than the weight of the evidence,” Consolo v. Fed. Maritime Comm’n, 383 U.S. 607, 619–20 (1966). Importantly, “the possibility of drawing two inconsistent conclusions from the evidence does not prevent an administrative agency’s finding from being supported by substantial evidence.” Id. (citation omitted).

“The first step in any invalidity analysis is claim construction, an issue of law this court reviews de novo.” Akamai Techs., Inc. v. Cable & Wireless Internet Services, Inc., 344 F.3d 1186, 1192 (Fed. Cir. 2003) (citing Cybor Corp. v. FAS Techs., Inc., 138 F.3d 1448, 1456 (Fed. Cir. 1998) (en banc)). Here, however, we need not engage in a lengthy discussion regarding how “voltage regulator” should be construed—i.e., whether “voltage regulator” is a limitation of the asserted claims and, if so, the meaning of that term. That is because substantial evidence supports the conclusion that the '300 patent discloses a “voltage regulator” under all proposed constructions—even the more restrictive construction adopted by the Commission.<sup>4</sup>

The '300 patent is entitled “Regulated Charge Pump DC/DC Converter” (emphasis added). The preferred embodiment uses four switches to achieve the voltage conversion, by alternately charging and discharging an intermediate storage

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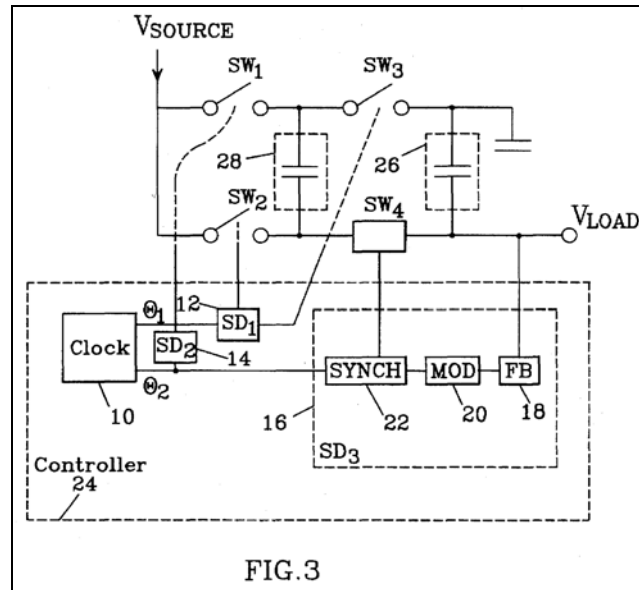
<sup>4</sup> Of course, we would not need to consider whether the '300 patent discloses a “voltage regulator” if the preamble term “voltage regulator” is not a limitation of the asserted claims.

capacitor. The patent instructs that at least one of the switches functions as a variable resistor, wherein the resistance is modulated via feedback as a function of the output voltage. '300 patent col.3 ll.20–37. The feedback/modulation scheme is designed to “regulate” the output voltage at a useful, predetermined value. See id. col.3 ll.41–45 (“The new charge pump voltage converter can be used in electronic processing systems to accept power at a standard voltage from a power source and convert it to another voltage for use by circuits which require non-standard voltage . . .”). Further, when the patent describes “regulating” the output voltage, it is clearly referring to maintaining the output voltage at a single value despite certain fluctuations in the input voltage and/or output current. Id. col.2 ll.14–17. Thus, we conclude that the '300 patent discloses a “voltage regulator,” even under the Commission’s more restrictive interpretation requiring “a constant output voltage at a predetermined, specified target value regardless of changes in input voltage or load current.”<sup>5</sup> ALJ Initial Determination at 35. By extension, the disclosure of the '300 patent also meets the broader definition of “voltage regulator” advanced by Linear, under which the predetermined output voltage need not be a single, fixed, constant voltage.

In addition, we conclude that substantial evidence supports the Commission’s determination that the '300 patent discloses control of input current during both phases of the charge pump cycle. Figure 3 of the '300 patent depicts an embodiment of the inventive voltage converter.

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<sup>5</sup> Prior art patents are presumed enabling for purposes of anticipation, including both claimed and unclaimed material. Amgen Inc. v. Hoechst Marion Roussel, Inc., 314 F.3d 1313, 1354–55 (Fed. Cir. 2003). Although the presumption may be overcome with evidence to the contrary, Linear has made no attempt to present such evidence here.



Referring to Figure 3, four switches— $SW_1$ ,  $SW_2$ ,  $SW_3$ , and  $SW_4$ —are used to achieve the voltage conversion. Switch drivers  $SD_1$ ,  $SD_2$ , and  $SD_3$  control the operation of the four switches. During the first phase of the clock  $\theta_1$  (the charge phase),  $SD_1$  drives  $SW_2$  and  $SW_3$  to an “on” state, while  $SD_2$  drives  $SW_1$  to an “off” state and  $SD_3$  drives  $SW_4$  to an “off” state. ’300 patent col.5 ll.28–32. During the second phase of the clock  $\theta_2$  (the discharge phase),  $SD_1$  drives  $SW_2$  and  $SW_3$  to an “off” state, while  $SD_2$  drives  $SD_1$  to an “on” state and  $SD_3$  provides  $SW_4$  with a “modulated drive voltage.” Id. col.5 ll.28–39. The level of the “modulated drive voltage” provided by  $SD_3$  is a function of the output voltage  $V_{LOAD}$ , thereby enabling regulation of the output voltage via feedback.

Linear concedes that this modulation of  $SW_4$ ’s drive voltage as a function of output voltage satisfies the limitation of the asserted claims requiring control of input current during the discharge phase. It argues, however, that the ’300 patent does not disclose control of input current during both the charge and discharge phases, as required by the asserted claims of the ’531 patent. In other words, Linear contends that

the '300 patent does not disclose a circuit wherein the drive voltage to SW<sub>2</sub> and/or SW<sub>3</sub> is modulated during the charge phase and the drive voltage to SW<sub>1</sub> and/or SW<sub>4</sub> is modulated during the discharge phase. We do not agree.

First, like the Commission, we note the statement in the specification that “although in the embodiments disclosed the switches SW<sub>1</sub>, SW<sub>2</sub> and SW<sub>3</sub> are conventionally driven, and the switch SW<sub>4</sub> is driven in response to feedback from the charge pump output, any of the switches SW<sub>1</sub>, SW<sub>2</sub>, SW<sub>3</sub> or SW<sub>4</sub> may be driven in response to feedback from the output.” Id. col.7 ll.30–35 (emphasis added). From this statement, it is clear that the '300 patent expressly indicates that input current may be controlled during the charge phase (by modulating SW<sub>2</sub> or SW<sub>3</sub>) as well as the discharge phase (by modulating SW<sub>1</sub> or SW<sub>4</sub>). Linear contends, though, that this statement is inapposite because, by using the disjunctive term “or,” the patent merely indicates that any one of SW<sub>1</sub>–SW<sub>4</sub> may be modulated, not that multiple switches may be modulated. Thus, Linear argues that the statement merely discloses control of input current during the charge phase or the discharge phase, not both phases. In fact, Linear argues that modulating more than one switch would be contrary to the patent’s stated goal of saving charge pump space, as it would require replication of the SD<sub>3</sub> feedback/modulation circuitry.

Contrary to Linear’s argument, however, we note that the '300 patent does not teach away from modulating multiple switches within the same circuit design. Indeed, it expressly provides in the discussion of Figure 3: “In the illustrated preferred implementation only one switch, SW<sub>4</sub>, is ‘modulated’ in the fashion described in relation to switch driver SD<sub>3</sub> 16 of FIG. 3. However, SW<sub>1</sub> and SW<sub>4</sub> may both be driven in such a

manner, or SW<sub>1</sub> alone may be driven in that fashion.” Id. col.5 ll.20–24 (emphasis added). Linear responds that switches SW<sub>1</sub> and SW<sub>4</sub> are both active during the discharge phase of the charge pump cycle. Thus, according to Linear, the fact that the patent discloses modulation of SW<sub>1</sub> and SW<sub>4</sub> does not necessarily mean that it discloses modulation during both phases of the charge pump cycle. Regardless, we think that at a minimum the patent’s disclosure that both SW<sub>1</sub> and SW<sub>4</sub> may be modulated contradicts Linear’s arguments (1) that the disjunctive use of “or” in column 7 indicates that only one of the four switches may be modulated and (2) that modulating multiple switches would violate the patent’s purported goal of saving space. See also id. col.3 ll.17–40 (stating that “at least one” of the switches is driven with a modulated signal), claims 1–22 (same).

Any further ambiguity with respect to the statement in column 7 is resolved by the patent’s discussion of Figure 1. The “Detailed Description of the Invention” of the ’300 patent begins with a discussion of Figure 1, shown below.

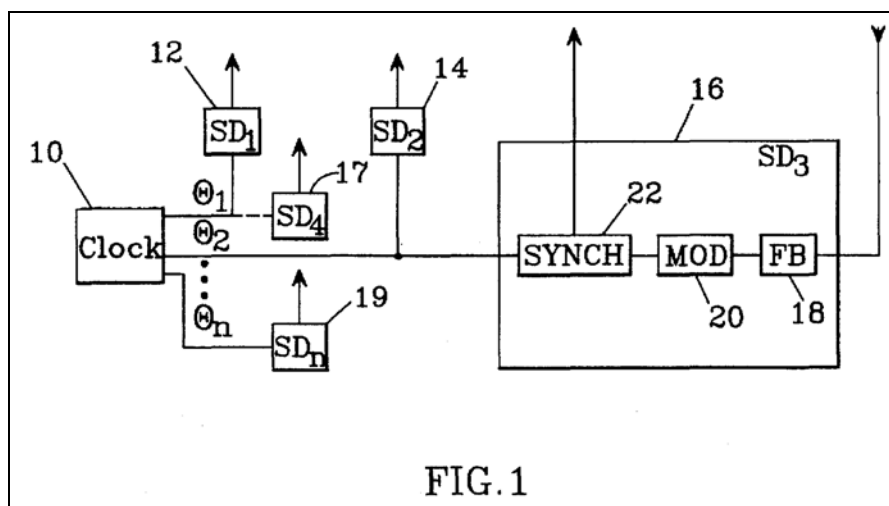


Figure 1 is a block diagram that illustrates the switch controller of the patented invention—i.e., the basic components used to control the operation of the switches. Id.

col.4 ll.9–10. The patent instructs that in the typical arrangement, SD<sub>3</sub> provides a modulated drive signal to one of the switches (e.g., SW<sub>4</sub> in Figure 3), and the remainder of the switches are conventionally driven by SD<sub>1</sub> and SD<sub>2</sub>. See id. col.4 ll.9–43. Accordingly, only SD<sub>3</sub> is depicted in Figure 1 as containing the additional circuitry required for switch modulation—i.e., feedback block 18, modulation block 20, and synchronization block 22. The patent also expressly states, however, that the typical arrangement of switches and switch drivers may be modified.

Furthermore, additional switch drivers SD<sub>4</sub> 17 like SD<sub>3</sub> 16 could be employed during any of the clock phases  $\theta_1$ – $\theta_n$  to provide additional modulated drive signals. However, for the sake of clarity, further FIG.s, and discussions related to those FIG.s, will illustrate two-phase implementations which employ one modulated switch driver such as switch driver SD<sub>3</sub> 16.

Id. col.4 ll.44–49 (emphases added). In other words, after describing the modulated drive signal provided by SD<sub>3</sub>, the patent states that any of the other switch drivers, including SD<sub>4</sub>, may be modified to provide “additional” modulated drive signals in the same manner as SD<sub>3</sub>. We think that the word “additional” conveys an understanding that both SD<sub>4</sub> and SD<sub>3</sub> may be modulated within the same circuit design. At a minimum, the Commission’s interpretation of the passage in that way, see ALJ Initial Determination at 96–97, was not unreasonable. Further, Figure 1 depicts SD<sub>4</sub> and SD<sub>3</sub> as being active during the charge ( $\theta_1$ ) and discharge ( $\theta_2$ ) phases, respectively. Therefore, we conclude that the ’300 patent—particularly Figure 1 and its accompanying text—may be reasonably interpreted as disclosing control of input current during both the charge and discharge phases of the charge pump cycle.<sup>6</sup>

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<sup>6</sup> In its reply brief, Linear contends that AATI’s citation to the ’300 patent col.4 ll.44–49 is a “newly-crafted argument” that should not be considered because it is being raised for the first time on appeal. We note, however, that Dr. Szepesi was

Because substantial evidence supports the Commission's determination that claims 4, 9, and 26 are anticipated by the '300 patent, we affirm.

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clearly questioned about the passage at the hearing before the ALJ, and he stated that it supported his opinion that the '300 patent discloses control of input current during both phases of the charge pump cycle.

Yes, it teaches two things, one, that there clearly can be more than one modulated switch driver. It also teaches that these modulated switch drivers can be on different phases, so one can be maybe on the charge phase, and one can be [on the] released charge phase or more of them, it clearly discloses there can be any phases and any number of them.

Hearing Tr. at 1377. In addition, both the passage and Dr. Szepesi's testimony about it were cited in the ALJ's discussion of anticipation with respect to the '300 patent. ALJ Initial Determination at 96–97.