United States Court of Appeals for the Federal Circuit

05-1129

MSTAR SEMICONDUCTOR, INC.,

Appellant,

v.

INTERNATIONAL TRADE COMMISSION,

Appellee,

and

GENESIS MICROCHIP (DELAWARE) INC.,

Intervenor.

DECIDED: May 25, 2006

Before LOURIE, Circuit Judge, CLEVENGER, Senior Circuit Judge, and BRYSON, Circuit Judge.

CLEVENGER, Senior Circuit Judge.

MStar Semiconductor, Inc. (MStar) appeals the determination of the International Trade Commission (Commission) finding that the importation of certain semiconductor devices known as "upscalers" infringed U.S. Patent No. 5,739,867 (the '867 patent), owned by Genesis Microchip (Delaware), Inc. (Genesis). In particular, MStar argues that the Commission erred in construing claim 1 of the patent. Because we agree with the Commission's construction of the disputed claim language, we affirm.

I

MStar appeals from two consolidated investigations of the Commission. The Commission instituted Investigation No. 337-TA-481 (the 481 Investigation) on October 18, 2002, based on Genesis's allegation that the importation of certain video display controllers infringed the '867 patent in violation of 19 U.S.C. § 1337. MStar was not named in the 481 Investigation. On October 20, 2003, the Administrative Law Judge (ALJ) concluded that the accused devices in the 481 Investigation did not infringe any of the asserted claims of '867 patent and that claims 1 and 9 of the '867 patent were invalid as anticipated. Certain Display Controllers with Upscaling Functionality and Products Containing Same, Inv. No. 337-TA-481 (Int'l Trade Comm'n, Oct. 20, 2003) (481 Initial Determination). On appeal, however, the Commission reversed certain aspects of the ALJ's claim construction and remanded the case to the ALJ to reassess infringement and invalidity in light of the new claim construction. Certain Display Controllers with Upscaling Functionality and Products Containing Same, Inv. No. 337-TA-481 (Int'l Trade Comm'n, Jan. 27, 2004) (481 Commission Decision). On May 20, 2004, in its decision on remand, the ALJ found that the accused devices did infringe the '867 patent. Certain Display Controllers with Upscaling Functionality and Products Containing Same, Inv. No. 337-TA-481 (Int'l Trade Comm'n, May 20, 2004) (481 Remand Initial Determination). This remand decision was then sent to the Commission for review.

In April 2003, while the 481 Investigation was pending, the Commission instituted Investigation No. 337-TA-491 (the 491 Investigation). MStar was not named in the initial complaint, but in June 2003, Genesis amended its complaint to assert, among

other claims, that MStar infringed certain claims of the '867 patent. Applying the Commission's claim construction from the 481 Investigation, the ALJ determined that the asserted claims were not invalid and that MStar infringed claim 1 and dependent claims 2, 9, and 33-36 of the '867 patent. Certain Display Controllers and Products Containing Same, Inv. No. 337-TA-491 (Int'l Trade Comm'n, April 14, 2004) (491 Initial Determination). On August 27, 2004, the Commission consolidated the 481 and 491 Investigations and issued an opinion addressing the 481 Remand Initial Determination and the 491 Initial Determination. Certain Display Controllers and Products Containing Same and Certain Display Controllers with Upscaling Functionality and Products Containing Same, Inv. Nos. 337-TA-481 and 337-TA-4981 (Int'l Trade Comm'n, Aug. 27, 2004) (Consolidated Commission Decision). With respect to the 491 Initial Determination, the Commission reversed the ALJ's decision on validity, holding that claims 1 and 9 of the '867 patent were invalid. However, the Commission affirmed the ALJ's determination that MStar's products infringed dependent claims 2 and 33-36 of the '867 patent. MStar now appeals the determination that it infringed dependent claims 2 and 33-36. We have jurisdiction pursuant to 28 U.S.C. § 1295(a)(6).

II

The patent at issue claims a method and a device for "upscaling," or increasing the resolution of a video image for display on a computer monitor. A video image consists of a series of still pictures, or image frames. Those images are comprised of rows, or scan lines, of dots of color, or pixels, which may be red, green or blue and are of varying intensity. The resolution of a picture refers to the number of scan lines and the number of pixels per scan line in that picture, such as 800x600; higher resolution

pictures are clearer and more detailed. Thus, a 800x600 resolution picture might be enlarged or "upscaled" to a 1024x768 resolution picture.

Although the visible image on a computer screen is comprised of the rows of pixels, the data used to produce an image contains both active pixel data, which provides the information about the color and intensity of each visible pixel, and blanking pixel data, which controls the timing of active pixel data. In traditional cathode-ray-tube monitors (CRT monitors), images are created using an electron gun, which scans from side to side, placing electrons on the screen's phosphor layer to create visible pixels along a scan line. The active pixel data indicates the color and intensity of these pixels. At the end of a scan line, the electron gun sweeps back to the beginning of the next line, during which time no electrons are placed on the phosphor layer. The horizontal sweeps are known as the "horizontal retrace period" or "horizontal blanking period" and are directed by the horizontal blanking pixel data. After all the lines in the image are completed, the gun sweeps back to the beginning of the first line during the "vertical retrace period" or the "vertical blanking period," which is directed by the vertical blanking pixel data. Once the vertical retrace period is complete, the electron gun can begin to create a new image.

Most graphic controllers, which convert information from a computer into a frame of image data that a monitor can display, were designed to work with the image data used by a CRT monitor. Because flat panel monitors (FPMs) use a fundamentally different technology, a "display controller" converts image data suited for a CRT monitor so that the image can be displayed on the FPM. FPMs do not use an electron gun and phosphor screen. Rather, liquid crystal displays (LCDs) have a fixed number of pixels

with three active cells, red, green and blue.[1] Images are created by sending a small electrical charge to each pixel, which determines the color and intensity of the pixel. Because the number of pixels is set by the number of three-cell sets, the resolution of an FPM cannot change. If an image of smaller resolution is projected onto the screen, it will only take up a portion of the screen; an image with greater resolution will be cropped. Thus, upscaling is a crucial process in converting signals formatted for CRT monitors to the proper resolution required for an FPM.

In order to function properly, upscalers must avoid underflow and overflow, which occur when the image data flows into the display controller either more slowly or more quickly than it flows out. Traditionally, this problem was solved with excess memory; display controllers contained an external frame buffer, which stored the data for a complete image while all the mathematical computations required to upscale the image were calculated. The '867 patent, in contrast, is directed towards a method of upscaling that prevents underflow and overflow by regulating the timing of data flowing into the display controller (the input or source data) and the data flowing out of the display controller (the output or destination data), using an input clock signal (the first clock signal) and an output clock signal (the second clock signal), thus eliminating the need for an external frame buffer.

Specifically, representative claim 1 of the '867 patent claims:

> A method of upscaling a source image frame in both vertical and horizontal directions to generate a destination image frame, the source image frame including a plurality of source scan lines, with each of said plurality of source

[1] Although there is no physical retrace period involved with an FPM, because there is no electron gun, image data for FPMs enters the upscaler in the same format as image data for CRT monitors. Thus, it contains both active and blanking pixel data.

scan lines including a plurality of source pixel data, the destination image frame including a plurality of destination lines, each of said plurality of destination lines including a plurality of destination pixel data, said method comprising the steps of:

(a) receiving said plurality of source pixel data included in said source image frame using a first clock signal;
(b) generating a second clock signal;
(c) upscaling said source image frame in both vertical and horizontal directions to generate said plurality of destination pixel data representative of said destination image frame; and
(d) providing said plurality of destination pixel data representative of said destination image frame using said second clock signal,

wherein said second clock signal is generated to have a clock period such that the time to provide said plurality of destination pixel data is equal to a period to receive said source pixel data in said source image frame.

'867 patent, col. 21, l. 62 – col. 22, l. 18 (emphasis added).

This appeal centers on the "wherein" clause of claim 1, which states that "said second clock signal is generated to have a clock period such that the time to provide said plurality of destination pixel data is equal to a period to receive said source pixel data in said source image frame." In the 481 Investigation the Commission determined that the "generated . . . such that" limitation required only that a second clock signal be "generated so as to be consistent with an equality of the source image frame and destination image frame periods." 481 Commission Decision, slip op. at 14-16 (emphasis added).

Further, in the 481 Investigation, the ALJ had determined that the "equality" referenced in the claim language required that the period of time to input active pixel data must equal the period of time to output active pixel data. 481 Initial Determination, slip op. at 90. However, the Commission rejected this construction, determining that the phrase required an "equality of the periods to receive the source image frame and to provide the destination image frame." 481 Commission Decision, slip op. at 12.

In the 491 Investigation, the parties disputed the meaning of "image frame;" Genesis contended that an "image frame" contains both active and blanking pixel data, while MStar contended that an "image frame" only contains active and horizontal blanking pixel data. However, the ALJ agreed with Genesis that the "equality" referenced in the claim language "mean[t] an equality of full frame periods." 491 Initial Determination, slip op. at 110. That is, the period of time required to input all the active pixel data, horizontal blanking pixel data and vertical blanking pixel data associated with an image must equal the amount of time required output all the active pixel data, horizontal blanking pixel data and vertical blanking pixel data associated with an image. The ALJ determined that, under such a construction, "it is undisputed that the accused chips maintain an equality of equal source and destination image frame periods" and that the "wherein" clause was met by the accused devices. Id., slip op at. 148. The Commission agreed with the ALJ's construction of the "wherein" clause and its infringement analysis. Consolidated Commission Decision, slip op. at 45-46.

On appeal, MStar argues that the decision below misconstrued these two aspects of the "wherein" clause of claim 1. First, MStar argues that the phrase "generated . . . such that" requires that the second clock signal "cause" the required equality. Further, MStar argues that the "equality" of periods refers to the period required to input and output active pixel data and horizontal blanking pixel data, but not vertical blanking pixel data. MStar argues that if it is correct with regard to either aspect of the construction of claim 1, it does not infringe. However, MStar does not appeal the Commission's infringement analysis under the claim construction that the Commission adopted.

III

We review legal conclusions of the ITC de novo SKF USA, Inc. v. U.S. Int'l Trade Comm'n, 423 F.3d 1307, 1312 (Fed. Cir. 2005) (citing 5 U.S.C. § 706(2)(A) (2000); Checkpoint Sys. v. U.S. Int'l Trade Comm'n, 54 F.3d 756, 760 (Fed. Cir. 1995)). As claim construction is a question of law, Cybor Corp. v. FAS Techs. Inc., 138 F.3d 1448, 1451 (Fed. Cir. 1998), we review the Commission's claim construction without deference.

The '867 patent requires that the upscaler have a second clock signal "wherein said second clock signal is generated to have a clock period such that the time to provide said plurality of destination pixel data is equal to a period to receive said source pixel data in said source image frame." Noting that the conjunction "such that" is defined as "having a quality to a degree to be indicated," see Merriam-Webster's Collegiate Dictionary 1176 (10th ed. 1997), the ALJ found during the 481 Investigation that "the plain language of the claim requires generation of a second clock consistent with an equality of active periods but does not require synchronization of the first and second clocks or 'locking the clocks' using a PLL [phase-locked loop]. It merely requires . . . that the second clock, on average, is set so that the period to receive the source pixel data is equal to the period to provide the destination pixel data." 481 Initial Determination, slip op. at 100. The Commission adopted this construction, determining that the "generated . . . such that" limitation requires only that a second clock signal be "generated so as to be consistent with an equality of the source image frame and destination image frame periods." 481 Commission Decision, slip op. at 14-16 (emphasis added). For the 491 Investigation, both the ALJ and Commission adopted

that same construction. 491 Initial Determination, slip op. at 109-10; Consolidated Comission Decision, slip op. at 30-40.

MStar argues that this claim construction was in error. In its initial brief to this court, MStar emphasized that the "generated . . . such that" language required that the second clock "cause" the claimed equality by being "locked" to the first clock. As such, MStar argued that the '867 patent discloses only one method for causing equality, "the use of a second signal tightly synchronized to the first clock signal," and cited portions of the specification describing how the source and destination clocks might be locked and the formula used to lock the signals.

In response, Genesis argued that signal-lock was merely a preferred embodiment. Further, Genesis noted that if claim 1 requires that the two clock signals are locked, claim 10 is redundant, as it contains only one additional limitation, that the "second clock is locked to said first clock signal in a proportion." '867 patent, col. 22, ll. 54-55. In its reply brief to this court, MStar disclaimed the argument that claim 1 requires signal-lock. MStar argued that the claim language only requires that the second signal "cause" the equality and that it does not require that the signals be locked.

However, MStar failed to explain how its claim construction, which would require that the second clock signal be generated so as to "cause" the equality of the frame periods, differs in any meaningful way from the Commission's claim construction, which requires that the second clock signal be generated so as to be "consistent" with an equality of the source and destination image frame periods. Both claim constructions require a logical relationship between the second clock signal and the claimed equality

without specifying precisely how that logical relationship should work. Further, MStar does not demonstrate how the Commission's claim construction is broader than its proferred claim construction; MStar does not point to any embodiment of the invention that would fall within the "consistent" claim construction, but not within the "causation" claim construction.

Finally, contrary to MStar's arguments, the Commission's claim construction does not read the "generated . . . such that" limitation out of the claim language. MStar argues that if the second clock signal need only be consistent with the claimed equality, the wherein clause could simply read "wherein the time to provide said plurality of destination pixel data is equal to a period to receive said source pixel data in said source image frame." However, as noted above, the "consistent" claim construction requires a logical relationship between the second clock signal and the equality of time periods. Thus, under the Commission's claim construction, it is not sufficient that the time periods are equal, as MStar contends; rather, there must be a logical relationship of some sort between the second clock signal and the equality of the time periods.

MStar also argues that the Commission erred in construing the "equality" limitation. Claim 1 requires that "said second clock signal is generated to have a clock period such that the time to provide said plurality of destination pixel data is equal to a period to receive said source pixel data in said source image frame." '867 patent, col. 22, ll. 15-18. In the 481 Investigation, the Commission determined that this required an "equality of the periods to receive the source image frame and to provide the destination image frame." 481 Commission Decision, slip. op. at 9. The ALJ adopted the same construction for the 491 Investigation, although the parties disputed the meaning of

"image frame." However, both the ALJ and the Commission agreed with Genesis that this construction "mean[t] an equality of full frame periods," i.e., there must be equality of the periods of time to input and output active pixel data, horizontal blanking pixel data and vertical blanking pixel data.

On appeal, MStar argues that the "period to provide said plurality of destination pixel data" (which is "representative of said destination image frame") should not include the time to provide vertical blanking pixel data. First of all, MStar notes that the ALJ had construed the phrase "pixel data" as used elsewhere in the claim language to include only active pixel data, and not blanking pixel data. Thus, MStar argues that the "period to provide said plurality of destination pixel data" only includes the time to provide active pixel data. However, MStar concedes that because horizontal blanking pixel data is interspersed between active pixel data, the "period to provide said plurality of destination pixel data" must include the time period to provide both active pixel data and horizontal blanking pixel data. In other words, it is impossible to determine the period to input or output the active pixel data of an image frame without including the time to provide the horizontal blanking pixel data. However, because vertical blanking pixel data is at the end of an image frame, after all the active pixels, it is possible to time the input or output of active pixel data and horizontal blanking pixel data without including vertical blanking pixel data. Thus, MStar proposes a construction that would include the time to provide active pixel data and horizontal blanking pixel data, but not vertical blanking pixel data.

Not only is such a construction strained, but it also ignores the fact that the claim language refers to the "period to provide said plurality of destination pixel data," which is

"representative of said destination image frame." MStar argues that because "pixel data" as used elsewhere refers only to active pixel data, the "destination pixel data . . . representative of said destination image frame" must include only active pixel data. However, while the blanking pixel data is not visible on the monitors, it is part of the "destination image frame" as it affects the timing of the pixel data flow. Indeed, MStar concedes that "upscalers must recognize the fact of vertical blanking lines." Appellant's Reply Br. at 21. In response to the charge that its construction of the claim is "technologically implausible," MStar argues to no avail "that upscalers must operate in a given way does not mean that the claim language must cover that [necessary] operation." Id. Finally, we note that the whole specification refers to equal frame rates (i.e., frames per second in versus frames per second out). The specification does not teach that the inventor or one skilled in the art would seek to measure the strained subset advanced by MStar.

Thus, because vertical blanking pixel data is necessary to make an image appear on the screen properly, the "destination pixel data" which is "representative of said destination image frame" must include active pixel data, horizontal blanking pixel data and vertical blanking pixel data. MStar has failed to show any error in the Commission's claim construction. We agree with the Commission's construction of the "wherein" clause of claim 1 of the '867 patent.

MStar does not dispute that, under the Commission's claim construction, the accused devices infringe the '867 patent. We therefore affirm.