



The first chip-layout copying case

Just about a year ago, a San Diego federal jury returned a verdict of more than \$25 million for the plaintiff in the first chip-layout copying case decided so far—*Brooktree Corp. v. Advanced Micro Devices, Inc.* Congress passed the Semiconductor Chip Protection Act (SCPA) in 1984 to stop chip piracy. The law must have been effective in curbing chip piracy, because only two cases have been brought so far raising any substantial SCPA issue—Intel's suit against AMD over the 80287 coprocessor in 1990¹ and the Brooktree-AMD case.

In the Brooktree case, AMD asked the court either to grant a judgment in its favor, notwithstanding the jury's verdict, or to grant it a new trial. AMD's position was that no reasonable jury could have decided the case against AMD on the factual record made at trial. The judge denied those motions in December 1990 and left the jury's verdict intact. AMD then appealed the case to the US Court of Appeals for the Federal Circuit. That court will hear oral arguments this fall and will probably decide the case by early 1992.

Since this is the first judgment rendered under the new chip law, the trial court had to make some first decisions about what the new law means. AMD is challenging some of those decisions in its appeal. The appellate court will therefore provide the semiconductor industry with the first authoritative judicial interpretation of SPCA's meaning.

The dispute between Brooktree and AMD started in 1988 when AMD introduced its Am81C458 RAM/digital-analog converter (RAMDAC) chip as a lower priced substitute for Brooktree's Bt458 color-palette video chip. AMD claimed that it had reverse-engineered the design, but Brooktree cried "piracy."

Brooktree sued and then tried to get the court

to issue a preliminary injunction against AMD, which would have stopped AMD from selling its Am81C458 chips while the suit was pending. But the court found that Brooktree failed to show that it was sufficiently likely to prevail on the merits to justify the preliminary injunction. The court therefore allowed AMD to continue to sell its chips while the case worked its way through the judicial system. That 1988 result was reversed, however, after the jury found in Brooktree's favor in 1990.

One-cell controversy

A particularly interesting aspect of the controversy is that it is limited to only one cell of the RAMDAC chip—in fact, to two layers of that cell. According to Brooktree, the key element of the color-palette chip is its multiport static RAM (SRAM) cell, which has a layout that permits operation at the previously unheard-of speed of 125 MHz. Brooktree claims that AMD copied two of the nine layers of this cell, the active and polysilicon layers, and that this copying violated the SCPA.

Figures 1 to 4 show the disputed cell layers. Figure 1 shows the active layer of several SRAM cells within the Brooktree Bt458 chip, with a box surrounding one cell. Figure 2 is a similar depiction of AMD's Am81C458. Figure 3 shows the polysilicon layer of several SRAM cells within the Brooktree Bt458 chip, with a box around one cell. Figure 4 is a similar depiction of AMD's Am81C458.

At the trial, AMD claimed that the SCPA does not protect cells, and that it only protects entire chip layouts. That position is untenable and the court rejected it. Presumably, AMD will not even bother to appeal that issue, because the legislative history of the SCPA contains a number of

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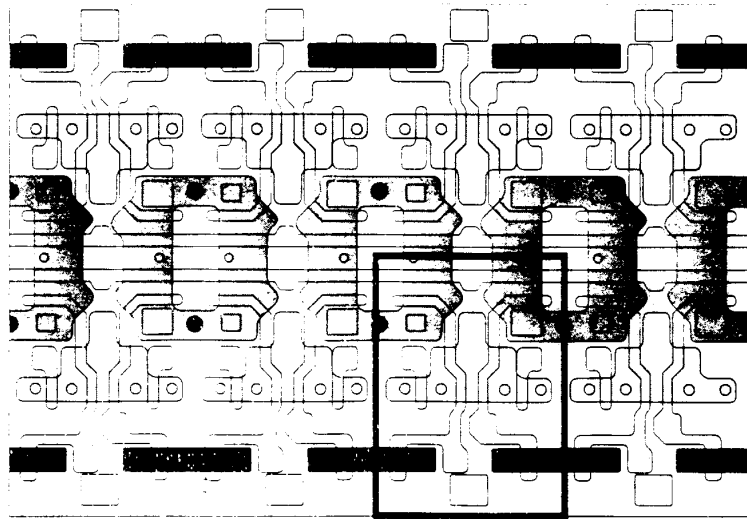


Figure 1. Active layer of the Brooktree Bt458 chip.

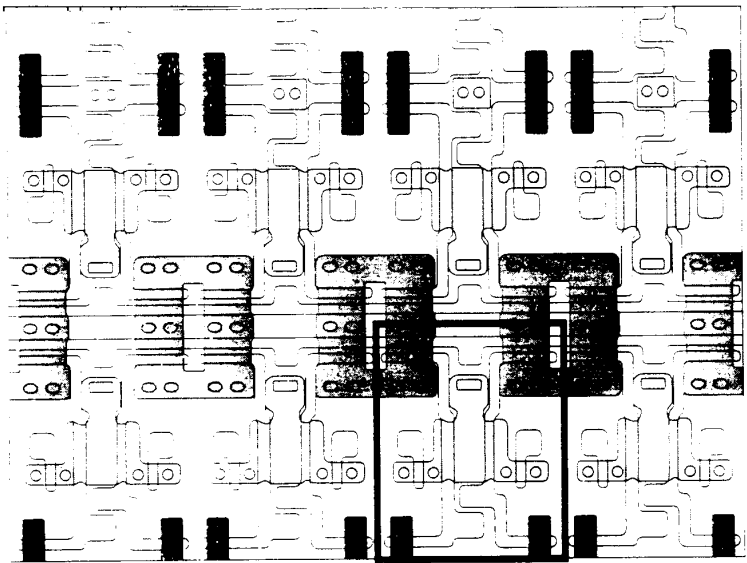


Figure 2. Active layer of the AMD Am81C458 chip.

statements that say the law intends to protect cells as well as whole chips. In this case, both companies replicated the 10-transistor SRAM cell about 6,000 times on the chips, accounting for

about 30 percent of the surface area and 80 percent of the total transistor count in the cell. More important, Brooktree claimed that the SRAM cells were "the heart and soul of the chip."

What "heart and soul" meant was not clear, but it certainly must have sounded impressive to the jury.

The issue of cell layers is more controversial. Nothing in the SCPA or its legislative history says that Congress wanted to protect layers of chips, as contrasted with whole chips, or to protect layers of cells. The committee reports speak of protecting material, or important, portions of a chip. But then the reports refer to counter and oscillator modules, and to cells from cell libraries (that is, to vertically partitioned portions of chips). They contain no statements about protecting portions of modules or cells (horizontally partitioned portions of chips). Therefore, it is open to AMD to contend on appeal that the jury had no valid basis to find against AMD in this case, because the evidence of similarity in the SRAM layouts was too sketchy.

Both parties dealt with the similarity issue by calling on the testimony of experts, each of whom the court said was credible. On some points, only one expert said anything. On others, the parties' experts contradicted one another (albeit "credibly"). The net legal effect was that the jury was free to choose between the factual points to which the parties' experts differed, but where only one expert discussed a point the jury was not free to find the opposite of what he said. To appreciate how that works, consider a case in which the plaintiff provides evidence to prove factual points A and B, and the defendant puts in contradictory evidence on point A, but nothing on B. The jury can then find either way on fact A, but it must find for the plaintiff on fact B because the only evidence before the jury on that point was the plaintiff's uncontroverted evidence. Uncontroverted evidence must be credited unless there are special circumstances.

Brooktree's evidence centered on the two layers pictured in Figures 1 to 4. Brooktree did not produce testimony that the other seven SRAM layers were

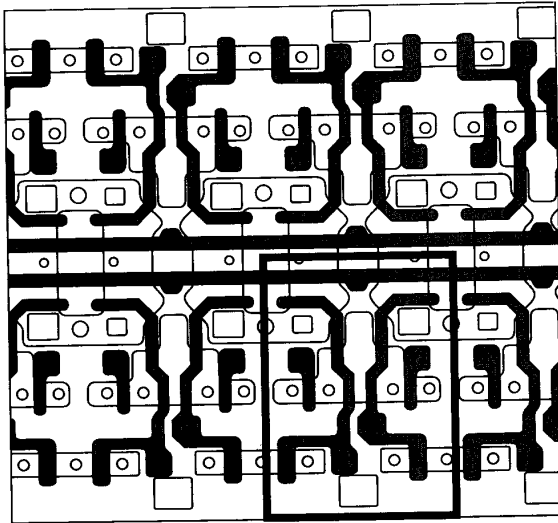


Figure 3. Polysilicon layer of the Brooktree Bt458 chip.

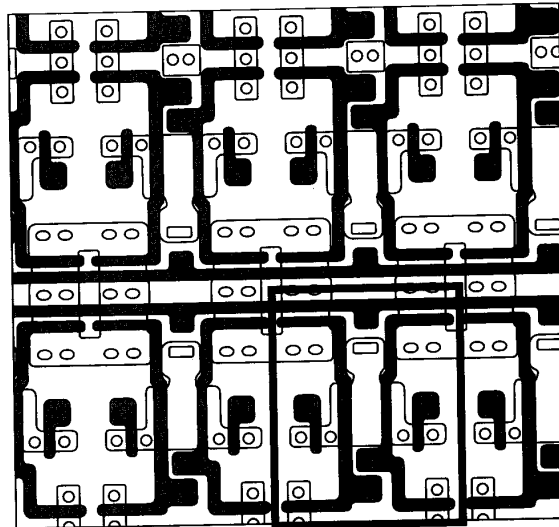


Figure 4. Polysilicon layer of AMD Am81C458 chip.

similar in layout. Brooktree's expert said that the Brooktree and AMD SRAM cells were "substantially similar" because the transistors were grouped together in the same way. He admitted, however, that there were differences. For example, one part of Brooktree's cell (Figure 1) has a 45-degree outpost jutting from its sides while AMD's cell (Figure 2) has straight sides. Brooktree's expert also conceded that additional differences existed in other layers, such as the source drain diffusion layers (not shown here). It does not appear that Brooktree presented any testimony that the cells of Figures 1-4 were not only "substantially similar" but also "substantially identical."

AMD's expert testified that the cells of Figures 1-4 were not substantially identical and were not even substantially similar. The testimony about lack of substantial similarity is immaterial, presumably, since it appears that the jury must have believed the testimony of Brooktree's expert that the cells were substantially similar. The testimony about lack of substantial identity, however, appears to be uncontroverted, since Brooktree's expert seems not to

have addressed the "substantially identical" issue at all. (I have not made a detailed enough study of the trial evidence to know whose version of "who struck John" to believe. I base my comments, therefore, on the limited information that was readily available, which compels frequent use of "seems" and "probably.")

AMD's expert pointed to differences in orientation of P-channel transistors (horizontal bands in Figure 1 versus vertical bands in Figure 2), different transistor sizes, an extra metal ground line in AMD's SRAM, and different P-well contacts. AMD's expert not only denied substantial similarity of the active and polysilicon layers but also denied substantial similarity in the P+ implant and other layers (on which Brooktree's expert apparently said nothing).

In addition to the testimony of the rival experts, the trial evidence included actual plots of the other layers. In theory, the jury might have decided whether the chips' other layers were substantially identical on its own. But that seems to make no sense. How can anyone but an expert understand

what is a material difference and what is a trivial difference in an SRAM layout? Without expert testimony on the layout, a jury (or judge, for that matter) is really helpless, except for the most clear cases. The SCPA's legislative history acknowledges that fact several times.

As I interpret the significance of the foregoing evidence, the upshot is that the record made at trial before the jury probably permitted the jury to make three findings.

First, the active and polysilicon layers were substantially similar, and presumably the jury so found. To the extent that the verdict relies on that finding, the court did not make a reversible error in letting the jury rely on it. The record would support a verdict based on such a finding.

Second, AMD's expert provided the only evidence on whether those layers were not only substantially similar but also substantially identical, and he denied it. Therefore, the jury was not entitled to find substantial identity in the active and polysilicon layers. To the extent, if any, that the verdict must rely on a jury finding of substantial

identity, the verdict is not supported.

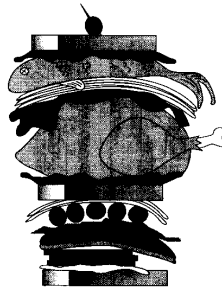
Finally, AMD's expert also presented the only comprehensible evidence on the other seven layers (P+ implant and so on), and he denied even substantial similarity. Therefore, the jury was entitled only to find a lack of substantial similarity in the other seven layers. To the extent, if any, that the verdict must be based on a finding that the other seven layers were substantially similar, the verdict is not supported by the evidence.

Where does all of that get us?

On the basis of these points, the appellate court may find two issues are important.

First, the plaintiff in this kind of case must prove, at a minimum, substantial similarity of a relevant part of a chip layout. Otherwise, the case should never go to the jury. In fact, the defendant should not even be obliged to put on a defensive case. The case should be dismissed at the close of the plaintiff's proof, because that proof is inadequate to justify a verdict for the plaintiff. Thus, if the legally relevant part of a chip layout must be, at least, all layers of a cell and cannot just be two out of nine layers of a cell, Brooktree's proof may not have entitled Brooktree to get to the jury. On the other hand, maybe two layers out of nine are enough, for example, for the jury to conclude that the layers were of major importance (remember that "heart and soul of the chip" business?). In that case, maybe Brooktree proved enough substantial similarity to get to the jury or at least require AMD to provide a defense.

I am not going to try to give you a definitive answer to the question, "Which standard about layers is right under the SCPA?" Resolving such issues is what makes for appeals and horse races. Instead, you might ponder whether a bacon, lettuce, tomato, and mayonnaise on rye sandwich is substantially identical, substantially similar, or neither, to an anchovy,



salami, tomato, and mayo on rye sandwich. The question is not wholly free from doubt. The better view seems to be that the SCPA does not contemplate basing infringement on a partial selection of strata—as contrasted with all strata—of a given cell or module. Nonetheless, a serious argument can be made on the other side of the issue.

A second issue that the appellate court may consider important is whether the two SRAM cells were similar enough to meet the requirements of a case involving reverse engineering. Say that the SCPA's legislative history tells us (and the court so stated in its opinion denying a preliminary injunction in this case) that the threshold evidentiary criteria for a case of reverse engineering are met. Then the legal test for infringement depends on whether the layouts are "substantially identical." That test calls for a closer similarity than the ordinary "substantial similarity" test involves. It means not just "a lot of similarity," but similarity in all but immaterial or trivial respects.

Therefore, *if* AMD met the threshold requirements for a case of reverse engineering, it probably should have prevailed—contrary to the San Diego jury's verdict for the hometown team. The italicized "if" in the first sentence is a very big "if." Whether AMD met the threshold and other requirements for the defense of reverse engineering is the next major issue in this case.

Sweat of the brow

The first and basic requirement for the defense of reverse engineering to

apply in a case of infringement of mask work rights is that the accused infringer expended a great deal of time, effort, and money in studying and redesigning the chip. This is a "sweat of the brow" test. The SCPA wants to make second comers expend their own sweat of the brow, preferably (although not necessarily) developing enhancements in the course of their efforts. The SCPA, at the very least, wants to keep second comers from blatantly purloining (or plagiarizing) the fruits of the first comer's efforts. Typically, the best evidence of sweat of the brow is a paper trail of records showing (nonmythical) man-months spent, payroll, computer simulations, and other types of work documentation constituting the alleged reverse engineering.

In this case, AMD showed a big stack of paper. Brooktree challenged the stack's significance, however, on the ground that AMD spent most of its effort in chasing down a blind alley (a fewer-than-10-transistor version of the SRAM cell, which did not work). The court suggested, in denying AMD's motion for a new trial and judgment notwithstanding the verdict, that the jury may have considered that AMD's reverse-engineering efforts were not the kind that count under the SCPA. That is a possibility. Maybe the jury thought that time and effort spent on a "snipe hunt" does not count. If that view prevails on appeal, it would not matter that Brooktree failed to supply evidence of substantial identity, for that legal test becomes relevant only after the defendant passes the threshold test.

On the other hand, that may be a wrong view as a matter of law. The court assumed that this was a factual question to be decided by the jury. It is unclear, however, whether the SCPA's concept of reverse engineering allows otherwise qualifying time, effort, and money (sweat of the brow) to be disregarded simply because it is based on an erroneous design concept. It may be that as a matter of law, mak

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ing mistakes (trial and error) is part of the reverse-engineering process and has to be expected. In other technological fields, such as research and development of drugs and herbicides, profits from successful inventions pay for unsuccessful work. Drilling dry holes is something that comes with the territory, and the cost of failures has to be factored into the rate of return.

If this concept prevails on appeal, the judge's comment that maybe the jury thought AMD's reverse-engineering efforts were not the kind that counted under SPCA would be legal error, for AMD would have unquestionably shown an investment of sweat quality. Once that test was met, the substantial identity test would be triggered. If the evidence placed before the jury did not show substantial identity, as the previous summary suggests, it would seem to follow that Brooktree failed to overcome AMD's defense case.

Original mask works?

A final wrinkle adds more confusion. In addition to requiring a record of substantial toil and effort (sweat of the brow), and absence of substantial identity, the SCPA says the reverse-engineering defense is established only when the result of the reverse-engineering study is "an original mask work." Does that mean just that a chip must be more than trivially different from the original chip? Or does that mean, for example, that the second chip must contain enhancements?

The legislative history of the SCPA suggests that creation of enhancements (smaller die, higher yield, less noise sensitivity, and so on) is one of the benefits of reverse engineering. But the SCPA does not demand success in providing enhancements. Thus, a defendant that shows that its chip contains enhancements will probably win on the reverse-engineering issue. On the other hand, a defendant who failed to show

any enhancements would not necessarily lose. In this case, AMD claimed that some features that it put into the Am81C458 were enhancements over Brooktree's Bt458. (I do not know whether Brooktree controverted these claims.) The record in this case does not make it possible to determine what the jury thought of the enhancement claims. I think that it is not possible, therefore, to decide the case on whether AMD proved that it enhanced its version of the chip.

If proof of enhancements is a key fact, several other inquiries must be made. First, suppose that the appellate court considers enhancements indispensable. Apparently, AMD's expert claimed that AMD had enhancements and described what they were. If Brooktree failed to controvert that testimony in any way, the jury should have been obliged to believe that AMD had enhancements. To the extent, if any, that the jury verdict must rest on a finding of no enhancement, the verdict is unsupported. If Brooktree's expert testified that the enhancements were of no value or nonexistent, however, the jury was free to believe one expert or the other. Then, the jury verdict cannot be faulted because of the enhancement issue.

Second, suppose that the appellate court considers enhancements not a necessary element of a reverse-engineering defense. Then, how the parties asked the judge to instruct the jury on this point and what he said becomes important. If he told the jury that enhancements were necessary, over AMD's objection, his instruction would be erroneous and, quite likely, justify a reversal. If neither party asked the judge to instruct the jury on enhancements, and he did not, the appellate court will not probably find a legal error that justifies reversal of the judgment. (If you don't ask for something at trial, usually you can't complain later about its absence.)

Determining the originality of a mask work may also mean more than just a

rote change in the layout. Such a rote change might be a mere adaptation of the layout in the light of new design rules (such as using 0.8-micrometer line width instead of 1.2-micrometer line width, or a change in minimum radius of curvature at corners), or an arbitrary swapping of the locations of two elements. A nonrote change would certainly occur in the case of an enhancement.

Probably, the appellate court cannot deal with an issue this subtle, unless it has been properly framed in the record by the testimony of experts. That does not appear to have happened in this case, since Brooktree's counsel merely asked his expert whether he considered AMD's design "an original," and he said, "no." No doubt AMD's expert gave the same kind of conclusory "yes" answer to the same kind of question somewhere else in the trial record.

One possible way for the appellate court to avoid this issue is to observe that reverse engineering is an affirmative defense, meaning that the defendant must prove all elements of it at trial. If "original mask work" means something more than nontrivial differences, it is the defendant's responsibility to enter evidence on the issue. If the record contains no such evidence, the defendant is simply out of luck, because of its failure to prove what it was obliged to prove.

Reference

1. *Intel Corp v. Advanced Micro Devices, Inc.*, No. C90-20237-WAI, N.D. Cal. (complaint filed 1990).

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