

## A little chip designed by Apple itself

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*Apple's A4 chip, which is used in the iPad.*

Sure, the screen is nice. But the iPad's most important component, at least for Apple's future, may be the A4, the fingernail-size chip at the tablet's heart.

With the A4, Apple has taken another step toward challenging the norms of the mobile device industry. Device makers typically buy their primary chips from specialized microprocessor companies. But for the iPad, Apple opted to design its own — creating unique bonds between the chip and Apple's software.

The do-it-yourself approach gives Apple the chance to build faster, more battery-friendly products than rivals and helps the company to keep product development secret.

But designing its own processors burdens Apple with additional engineering costs and potential product delays. It also forces the company to hire — and retain — experienced chip designers. Several who joined the company in 2008 after an acquisition have already left for a secretive start-up.

Though chip industry experts have yet to put the iPad through their customary rigorous tests, Apple's demonstrations left them underwhelmed.

"I don't see anything that looks that compelling," said Linley Gwennap, a chip analyst at the Linley Group. "It doesn't seem like something all that new, and, if it is, they are not getting far with it."

As he unveiled the iPad last week, Steven P. Jobs, Apple's chief executive, discussed the A4 with his customary hyperbolic flair. He heralded it as "the most advanced chip" Apple had ever used and said it was crucial to the iPad's speed, reliability and 10-hour battery life.

"We have an incredible group that does custom silicon at Apple," Mr. Jobs said, adding that the A4 has "everything in this one chip, and it screams." Apple declined to discuss details of the chip beyond what it had said publicly.

Apple bought its way into the chip business in 2008, acquiring the 150-employee start-up PA Semi. That company had been working on chips that could handle large volumes of data while consuming very low amounts of power.

PA Semi's engineers, most of them veterans from other chip companies in Silicon Valley, had just the type of expertise that a company making music players, laptops and phones would want.

Over all, the A4-powered iPad's battery life and speed seem similar to those of computers running on competing chips. A wave of tiny laptops known as smartbooks will arrive shortly after the iPad starts selling in March, running at the same speed as the iPad while offering up to 16 hours of battery life when playing video. These will run on chips designed by Nvidia and Qualcomm that have designs reminiscent of the A4.

Apple has a history of trying to ostentatiously best the competition. It promoted the MacBook Air, introduced in 2008, as the thinnest laptop ever. By building the A4 into the iPad, Apple appears to have bought a small lead over rivals — or at least kept pace with them — in this emerging class of mobile devices.

"From what we have seen so far, Apple's product seems to stack up evenly with the competition," said Dean McCarron, a chip analyst with Mercury Research. "Clearly, Apple is using their own metric for whatever 'best' is."

Apple's laptops and desktops run on Intel chips, while Samsung has been selling Apple the primary chips for the iPhone. Analysts believe Samsung is actually manufacturing the A4 as well, using a common industry design for the core of the chip, while Apple has tweaked other parts of the processor package to suit its needs.

Apple's other mobile devices like the iPhone and iPod Touch could conceivably all run on Apple-designed chips someday. Analysts point out that it often takes about two years for chip designers to create something from scratch, test it and have a finished product arrive from a factory.

Some of the chip engineers Apple gained in its purchase of PA Semi appear to have already left the company. According to partial records on the job networking site LinkedIn, at least half a dozen former PA Semi engineers have left Apple and turned up at a start-up called Agnilux, based in San Jose. The company was co-founded by one of PA's leading system architects, Mark Hayter.

Neither Mr. Hayter nor other onetime PA workers who left Apple for Agnilux were willing to discuss either company's plans. According to two people with knowledge of the two companies, who were unwilling to be named because the matter is delicate, some PA engineers left Apple a few months after the acquisition because they were given grants of Apple stock at an unattractive price.

Apple still appears committed to its chip plans. Even the analysts who dismiss the A4 as a "me too" product say Apple's decision to give it a name and discuss it so publicly indicates that custom chips are a priority.

"This is somewhere where Apple thinks it can make a unique product, and it definitely signals a new direction for them," said Nathan Brookwood, a chip analyst at Insight 64.

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