

Teardown: Apple iPad Mini

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Since its **introduction of the iPad** nearly two and a half years ago, Apple has held onto the lion's share of the tablet market. In particular, Apple has managed to hold off all competitors that dared to mimic the 9.7-inch or 10.1-inch platform made famous by the iPad. As of October 23, Apple claims to have sold over 100 million units from their iPad family, with more 62.5 percent of the total tablets shipped in 2012 (according to IDC).

However, the new threat to Apple's dominance in the tablet space may not come from 9.7-inch and higher models. Surprisingly, Apple faces its largest competition in the tablet space from a form factor that, previously, Apple had not offered—the 7-inch model.

Approximately one year ago, Amazon shook the tablet landscape by introducing the first sub-\$200 tablet, the **Amazon Kindle Fire**. While many were skeptical of the online book vendor's foray into electronics, many others saw the move as a stroke of genius. By combining the vast library of online titles at its disposal, Amazon would be able to match the current industry leader, Apple, in the one area that Apple had a significant advantage over their other competitors—content.

With more than 6 million Kindle Fire units sold upon its release, another powerful player in Silicon Valley took notice. Despite being known as the search-engine leader, Google Inc. used its experience in previous electronics releases to introduce the Google Nexus 7, another sub-\$200 tablet featuring impressive specifications such as a quad-core processor and a rich display that was unexpected for that price point.



The introduction of these two devices, and subsequent improvements like the Kindle Fire HD, caught the attention of consumers with both devices selling in high volumes similar to that of their Apple counterparts. The Google Nexus 7 is expected to sell over 8 million units before the end of 2012.

With the 7-inch market growing at an exponential rate, it was only a matter of time before Apple would address this product segment. Despite Steve Jobs' protestations that 7-inch tablets were "Too big to compete with a smartphone; too small to compete with an iPad," on Oct. 23, Apple CEO Tim Cook introduced Apple's latest device, the iPad Mini.

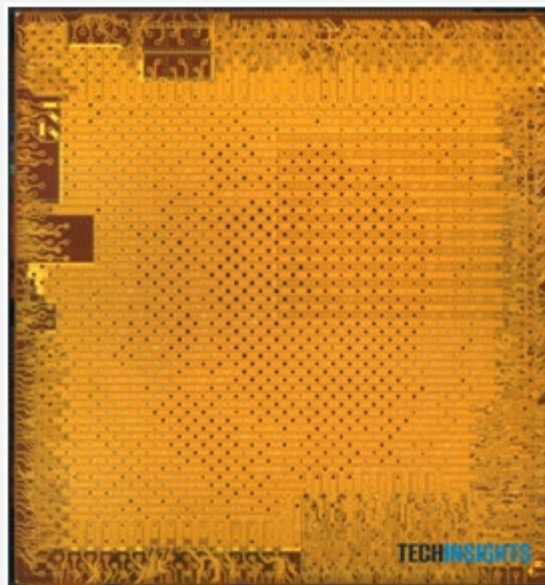
Featuring a 7.9-inch LCD display with 163 pixels-per-square-inch, the **iPad Mini** also boasts the use of the same A5 dual-core processor found within the iPad 2, WiFi-accessibility and the availability of an LTE-enabled model. The selection of a larger 7.9-inch screen was driven by Apple's designers, who felt that a 7.9-inch screen resulted in 25% increase in screen over their 7-inch counterparts, and would improve the user-experience of their iOS 6 operating system on the iPad Mini.

Inside the iPad Mini

Within moments of UBM TechInsights receiving the device, the most noticeable quality of it was its thickness and weight. Weighing in at 0.68 pounds and with a relative thickness of 7.2 millimeters, the **iPad Mini** is the lightest and thinnest 7-ish inch tablet that we've had a chance to analyze. Another noticeable quality of the iPad Mini was the resolution of the 7.9-inch screen. The iPad Mini features a 1,024 x 768 pixel LCD panel—similar to that of the iPad and the iPad 2—that correlates to 163 dpi, a far cry from the clarity of the retina display (and the 264 dpi resolution) found in the newer generation iPhones and the iPad 3.

Featuring a top-to-bottom build reminiscent of other iPads, the deconstruction of the iPad Mini begins with the removal of the touchscreen glass that covers the LCD display. Once the metal housing plate of the display is removed, the main battery and main board of the iPad Mini becomes visible. The iPad's battery claims 10 hours of life and features specs such as 16.3 WHrs. Apple also claims it is its thinnest lithium-ion battery to date. However, size-wise, it closely resembles that of the iPad 3.

Once the main board is revealed, Apple's continued need to mark devices with their own Apple-branding (so as to hide design wins from analysis firms such as ourselves) is apparent. Noticeable socket wins are the memory components, the main processor and the some of the sensors. The main CPU is the 32-nm Apple A5 applications processor, manufactured by Samsung. This device was first seen as a single-core device in the third-generation Apple TV; however, a look at the die indicated two-cores. The dual-core version of the A5 at the 32-nm node was then incorporated into the iPad 2. Manufactured using a gate-first high-k/metal gate (HKMG) process, this version of the A5 has a die with an area of 69.7 mm² and a die thickness of 110 μm.



Die photo of the Apple A5--32-nm version.

Broadcom scores



Die marking of the Apple A5 – 32-nm version.

As shown in the past, Apple has a tendency to stay true to the semiconductor vendors that provide its products with parts. The Apple iPad Mini is no exception to this practice. Broadcom is the first major repeat design winner we see in the new iPad Mini.

Broadcom picked up three major design wins, two of which for their touchscreen controllers. The Broadcom BCM5976, which have been found in the iPad 3, the MacBook Air and the iPhone 5 has two sockets on the Mini. The other major design win comes for their four-in-one combo wireless chip, the BCM4334, which was also found in the Samsung Galaxy S3 and the iPhone 5. Below is an image of the Broadcom ICs we've analyzed using our de-encapsulation (decap) process:



Inside the Murata module containing the Broadcom BCM4334.

From a functional perspective, one has to wonder if Apple's decision to not use a retina-based display and a faster processor, like the A6 or the recently introduced A6X, was in line with their thinking of iterative improvements (i.e. giving people something to look forward to in the iPad Mini 2) or if it was a design decision as a faster processor and more vibrant display may put heavy demands on the 16.5Whr battery and jeopardize the characteristic of Apple products as energy-conserving electronics.

In terms of its design, the Apple iPad Mini takes advantage of Apple's previous design methodologies to create a product that Apple feels will address the growing consumer demand for 7-inch tablets. The Apple pessimist will point to the iPad Mini as half an iPad 2. But the Apple optimist will call the Mini a supersized iPod Touch. Consumers will decide if the \$329 price tag is worth the spend.

Minimalist packaging



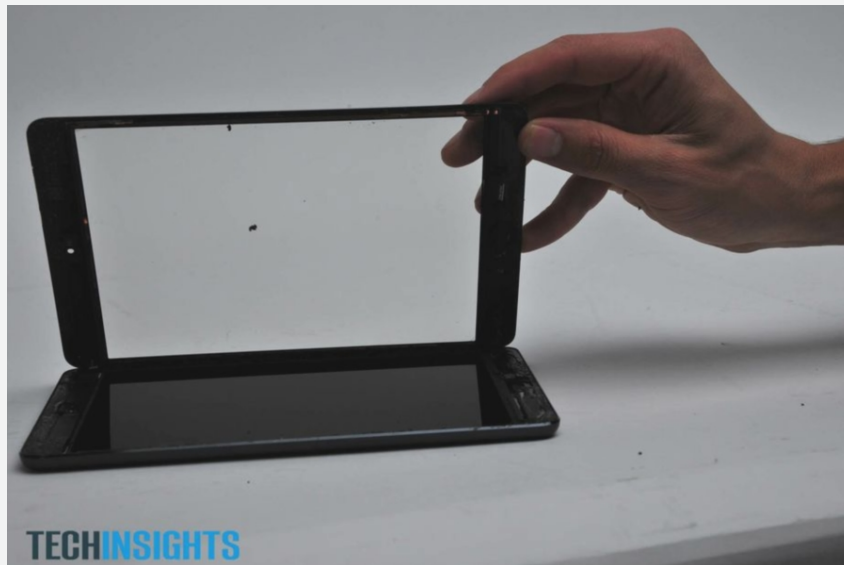
A look at the minimalist packaging of the Apple iPad Mini

Using the heat gun



Using the heat gun to soften the adhesive around the touchscreen

Removing the touchscreen



Once the glue is soft, the touchscreen removes rather easily

Another look at backside of touchscreen



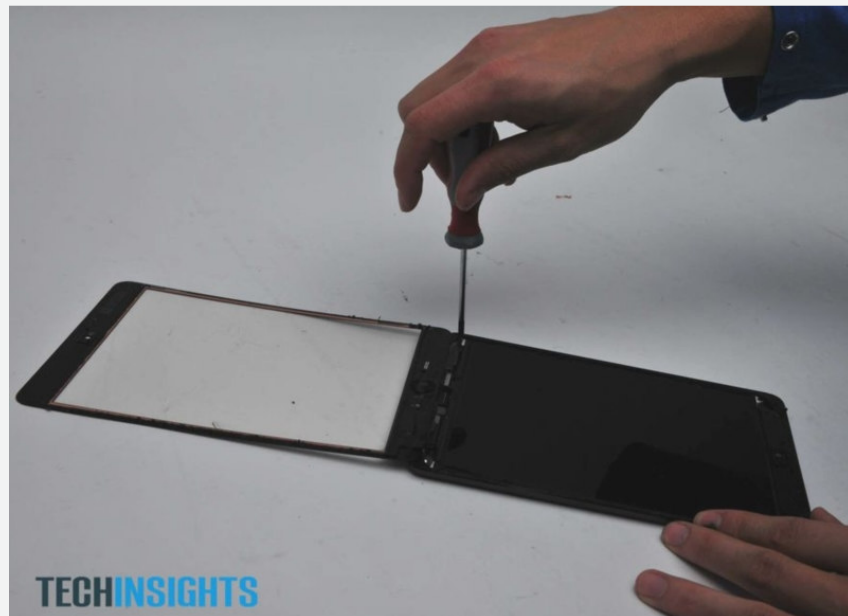
Another look at the backside of the touchscreen

Touchscreen and the LCD display



A look at the touchscreen and the LCD display

Removing the screws



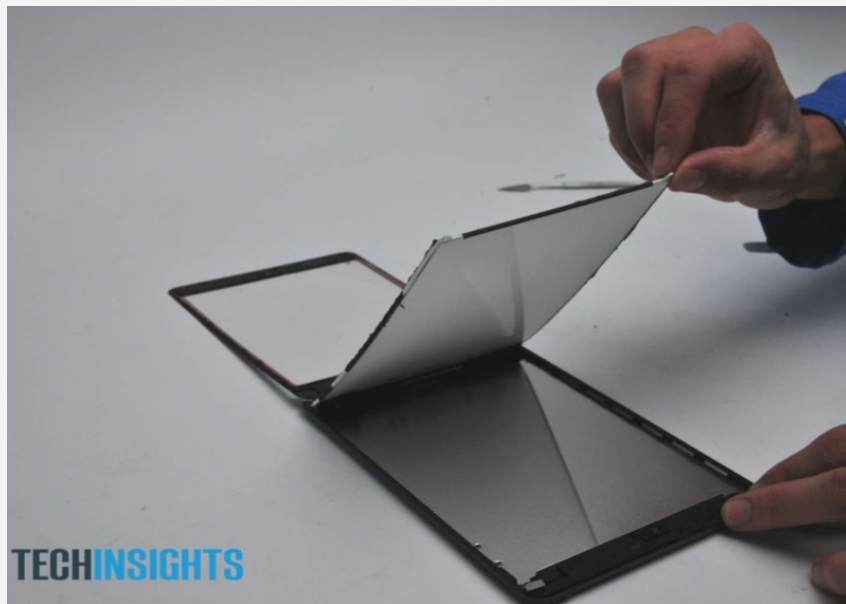
Removing the LCD display requires the removal of screws

Separating the LCD display



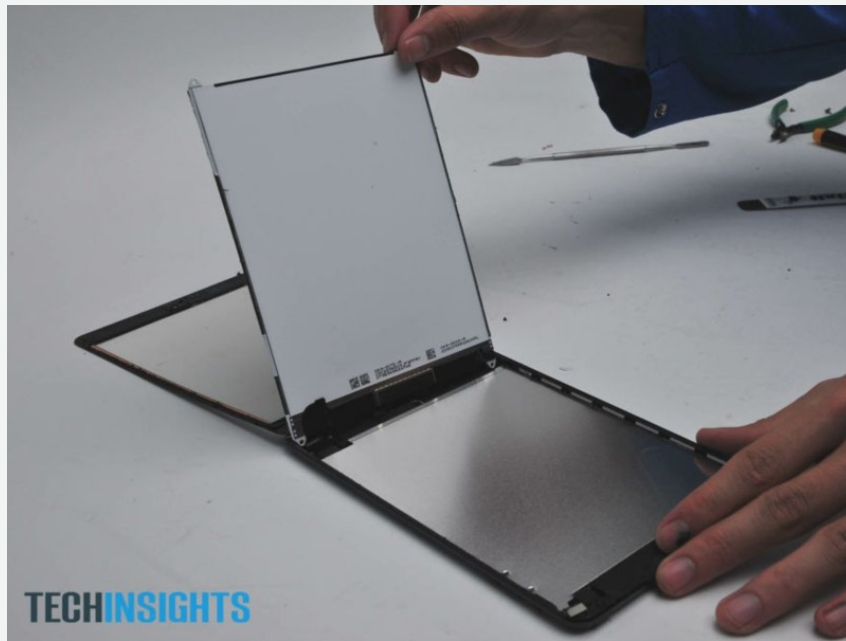
Separating the LCD display from the metal enclosure

Another look



Another look at the LCD separated

LCD completely removed



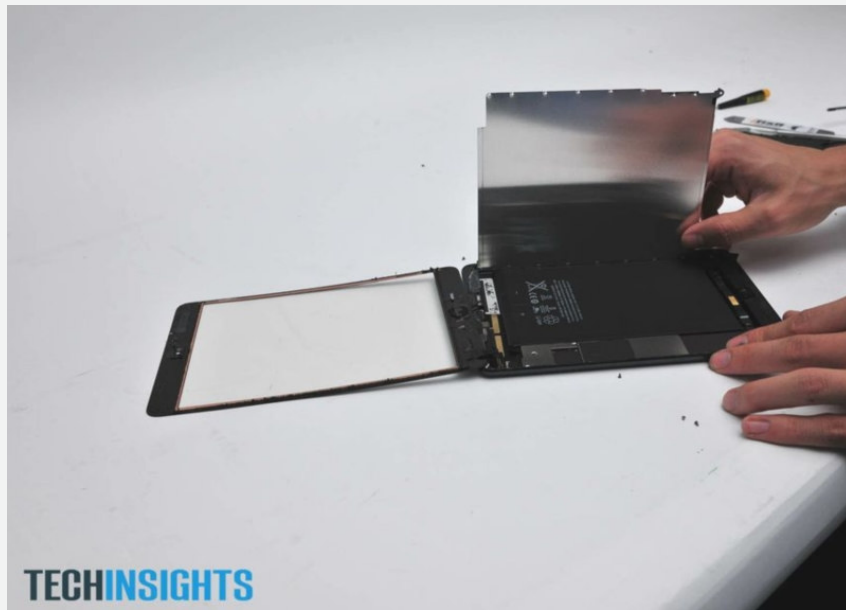
The LCD completely removed from the iPad Mini

Another look at the LCD



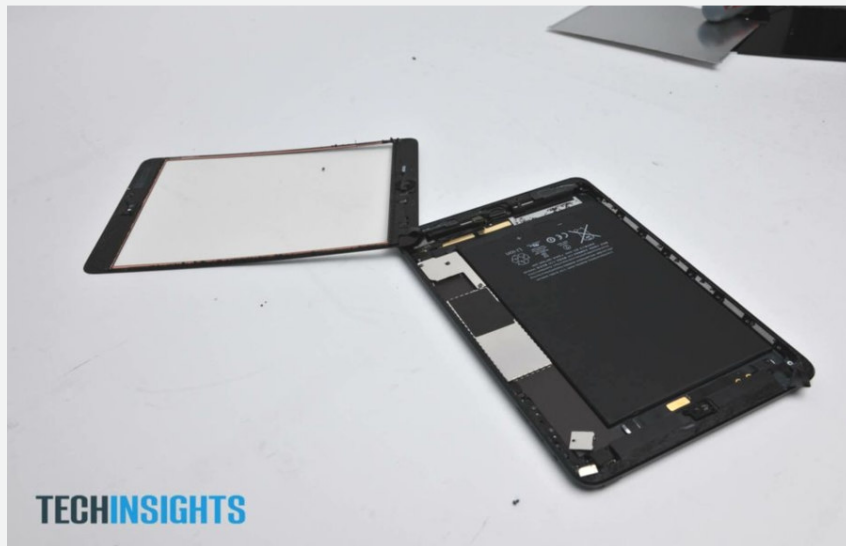
Another look at the LCD panel separate from the iPad Mini

Removing the metal enclosure



Removing the metal enclosure from the iPad Mini reveals the battery and the main board

Main board, battery

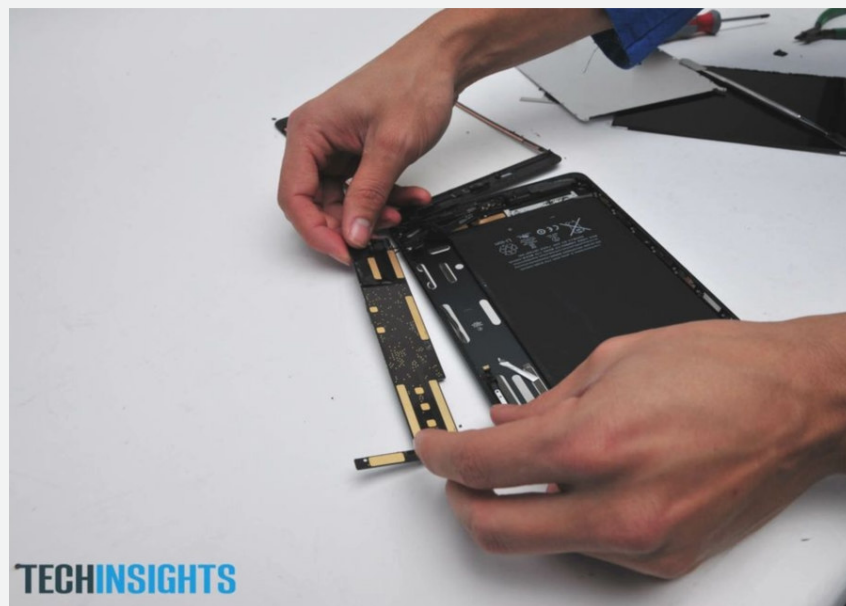


The main board and battery

Brute force required



Main board separated



The main board separated from the iPad Mini

Since the main board is glued to the iPad Mini's back, it requires brute force for its removal

The iPad Mini in pieces



The iPad Mini in pieces