



iPhone 5 Teardown

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INTRODUCTION

Behold, the sixth generation of iPhone! We shall call it...iPhone 5! Buckle down for the iPhone 5 teardown: the biggest thing to happen to teardowns since teardowns.

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[video: <http://www.youtube.com/watch?v=nIUQfXwvQLc>]



TOOLS:

- [iPhone 4 5-Point Pentalobe Screwdriver](#) (1)
 - [Tweezers](#) (1)
 - [Phillips #000 Screwdriver](#) (1)
 - [Suction Handle](#) (1)
 - [Spudger](#) (1)
-

Step 1 — iPhone 5 Teardown



- The dawn of another day in the Land Down Under brings us what we've all been waiting for: the new iPhone 5!
- A big thanks to [MacFixit Australia](#) for letting us use their digs in Melbourne for this teardown. They stock Mac and iPhone upgrades/accessories, and also carry our .

Step 2



- The iPhone 5 is here, and it brought along the big guns.
 - 4" 1136x640 pixel (326 ppi) Retina display
 - Apple A6 system on a chip (SoC)
 - 8 megapixel iSight camera
 - 8-pin Lightning connector
 - 4G LTE connectivity
 - iOS 6

Step 3



- There won't be any mistaking an iPhone 5 for an iPhone 4 or 4S. A lot has changed on the outside of the iPhone.
- The most obvious alteration to the bottom of the phone is the exchange of the large 30-pin dock connector for the diminutive Lightning connector.
- The headphone jack is now on the bottom of the iPhone, right next to the updated ~~speaker~~ microphone grille—a series of holes rather than a mesh-covered slot.
- Other notable differences are the slate bezel, as opposed to the [invalid guide link] that wrapped around the 4S, and the chamfered edges between the bezel and the front/rear cases.

Step 4



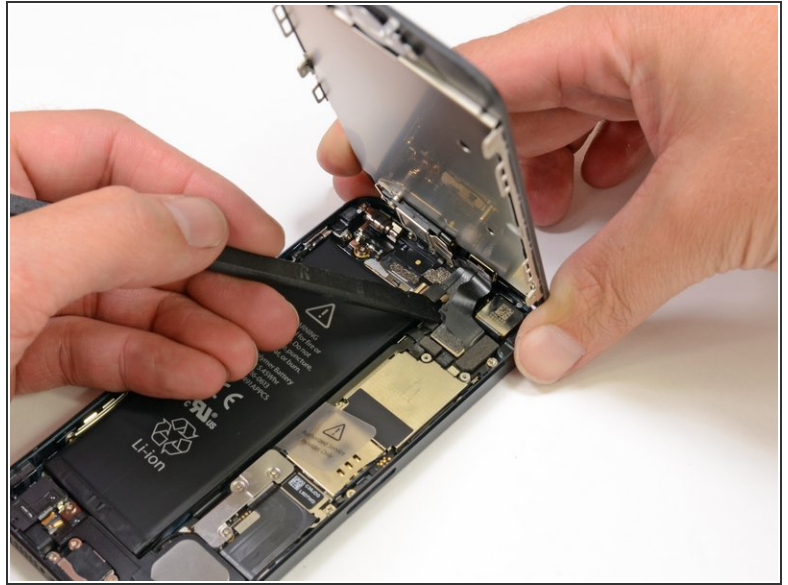
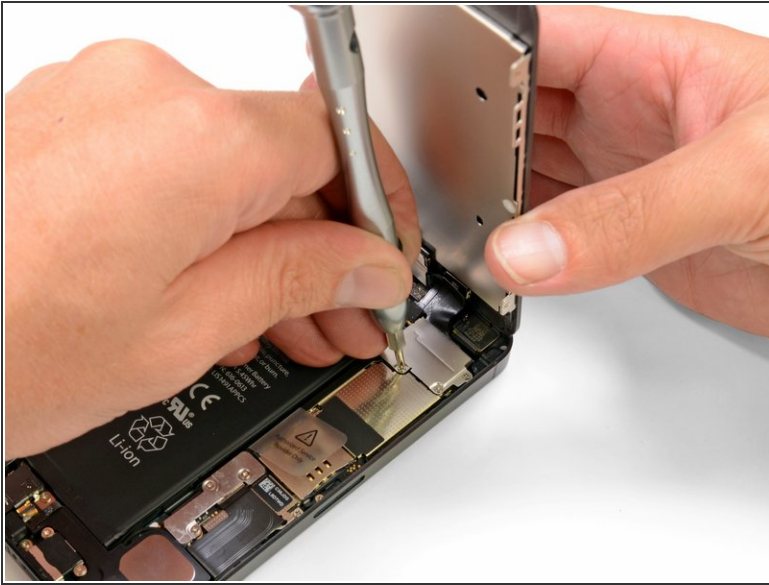
- Pesky pentalobe screws! Good thing our still work on them.
- It's incredibly convenient that Apple used the same pentalobe screwhead that they've been using for the past two years on the iPhone 4 and 4S. The screw shafts are slightly different from the screws in our , so we made a new !
- The unibody back case is reminiscent of the [invalid guide link], while still retaining the square (though now chamfered) edges of the iPhone 4.

Step 5



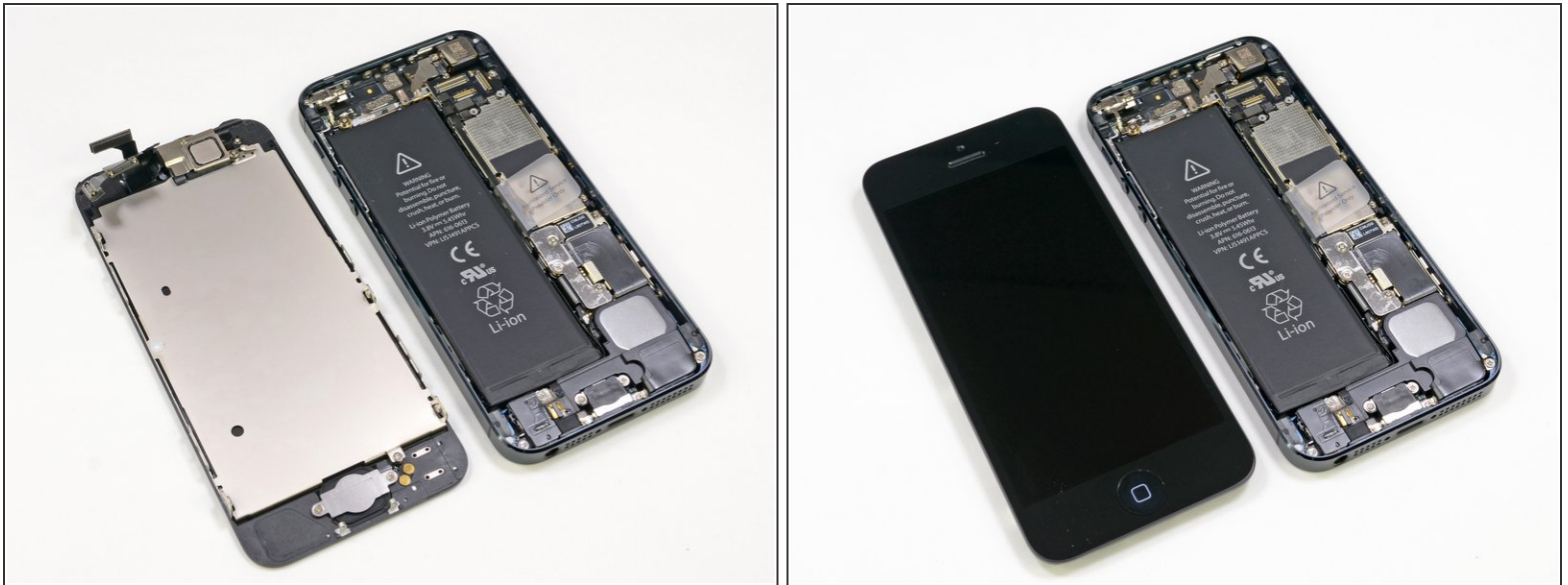
- What's this? A suction cup? We haven't needed a suction cup to get into an iPhone since the [invalid guide link]!
- Because the iPhone 5 is opened front-to-back, replacing a cracked screen is going to be easier than ever. *Thank you, Apple!*
- Compare this to the iPhone 4S, where it took [invalid guide link] to isolate the display assembly, and this iPhone may be the most repairable iPhone we've seen in a while.

Step 6



- The display connector is held firmly to the logic board by a few simple Phillips screws.
- Our spudger makes quick work of prying up the display connector, and *poof!* the display is free.
- We're having [invalid guide link] flashbacks with the easily accessible display assembly.
- *Screen crackers and screen fixers rejoice!*

Step 7



- The iPhone 5 ditches its lid to show us all of the juicy bits inside.
- So, what can we see from here? A bigger battery? Antenna connections? A single speaker? Cameras? Vibrators? Home buttons?
- Never fear, our faithful iPhone delivers; we'll be sure to take a closer look at each of these components as we remove them.

Step 8



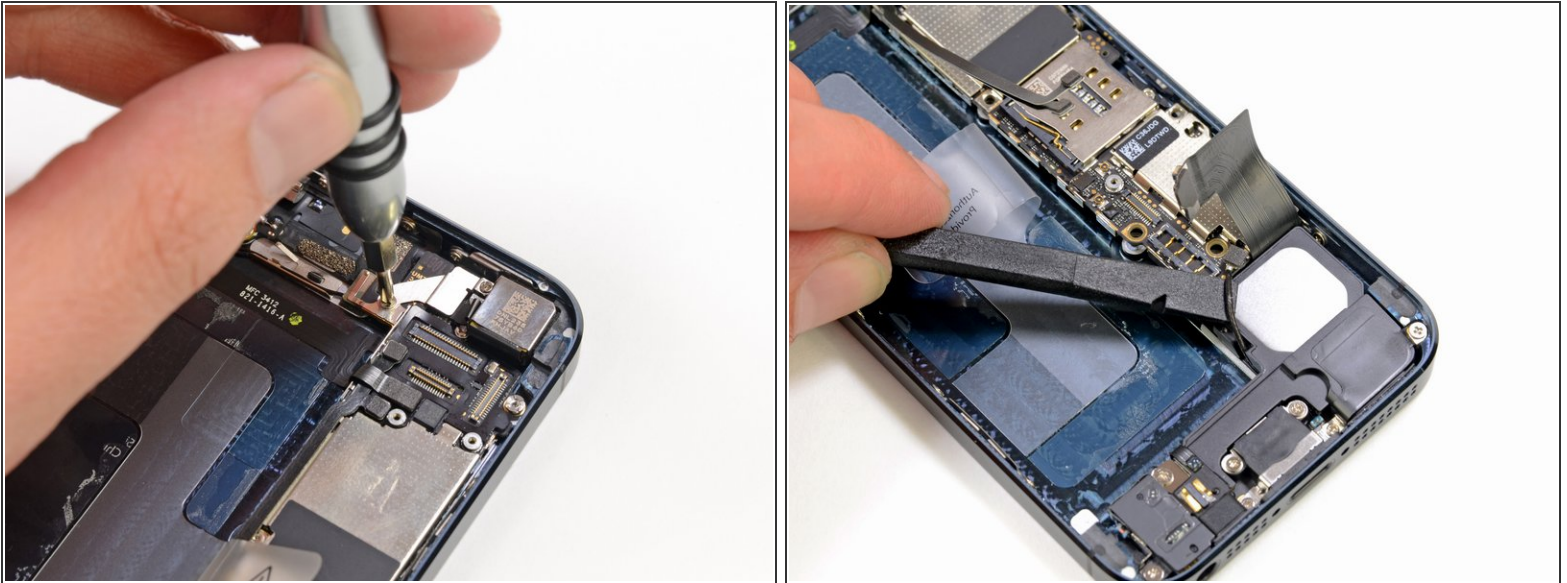
- As always, we disconnect the battery first to prevent electrifying anything, including ourselves, as we dig deeper.
- Three Phillips #000 screws and a metal bracket hold the battery connector to the logic board.
 - Hmm, this is beginning to feel [invalid guide link].
- ❗ In the 3GS, the display assembly was easy to take out, but the battery was a pain. In the 4 and 4S, the display assembly took 38 steps to remove, while the battery was a breeze. We like to think that Apple has started tailoring to our preferences in allowing us to remove both the display assembly **and** the battery in only a couple of steps.

Step 9



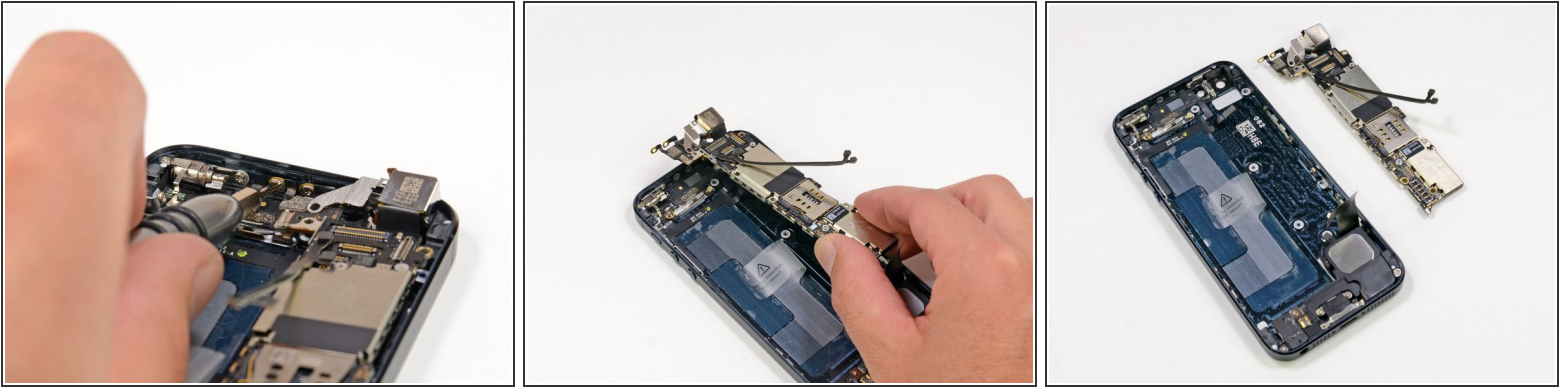
- We use the Battery removal tab to pull up the battery. Never try to pry soft pack batteries as this could lead to a thermal event!
- For the iPhone 5, Apple has switched to a different battery chemistry, with a higher voltage and slightly larger capacity than the iPhone 4S. Let's see how the battery specs stack up.
 - **iPhone 5 Battery:** 3.8V - 5.45Wh - 1440mAh. Talk time: Up to 8 hours on 3G. Standby time: Up to 225 hours.
 - **iPhone 4S Battery:** 3.7V - 5.3Wh - 1432mAh. Talk time: Up to 8 hours on 3G. Standby time: Up to 200 hours.
 - **Samsung Galaxy S III Battery:** 3.8V - 7.98Wh - 2100mAh. Talk time: Up to 11 hours 40 minutes on 3G. Standby time: Up to 790 hours.
- On the back of the battery we notice "MFR Sony," and "Cell made in Singapore." A bit of [googling](#) and it looks very likely that Sony is manufacturing this battery.

Step 10



- There are all kinds of metal-to-metal contacts inside the iPhone 5.
 - Spring contacts make for easy repairs, but mandate careful attention to cleaning all the parts before reassembly. Finger oils can get in the way of these metal contacts and cause frustrating component failures.
- This contact connects the metal frame around the front-facing camera to the frame around the rear-facing camera. Maybe this frame is some kind of an antenna? Only time will tell.
- Speaking of antennas, a spudger easily pries one end of an antenna connector off of the logic board near the battery.
 - In the iPhone 4S, this antenna location was reserved for the cellular antenna. We won't know for sure what this antenna's purpose is until we uncover more.

Step 11



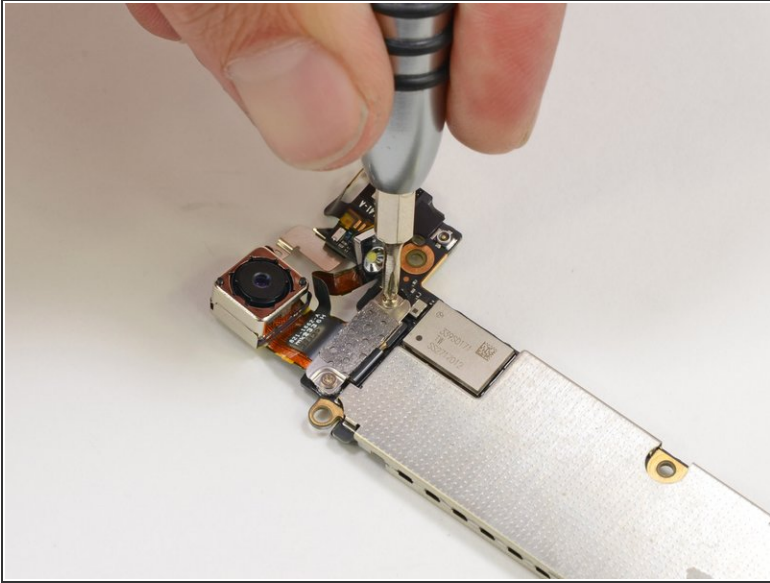
- Near the top of the case, we find a few antenna connectors firmly screwed to the inside of the case.
- Finally free of its constraints, we lift the logic board up out of the rear case.
- The logic board and 8 megapixel iSight camera come out together, leaving several components behind in the rear case—another win for modularity.
- +1 for repairability.

Step 12



- *They* (product placement engineers) said if we tech writers were good and we stayed late, we can have one beverage of choice when we finished the teardown.
- Then *they* promptly took the beverages away...
- ...and put them in the fridge!!!
- We A happy camperz.

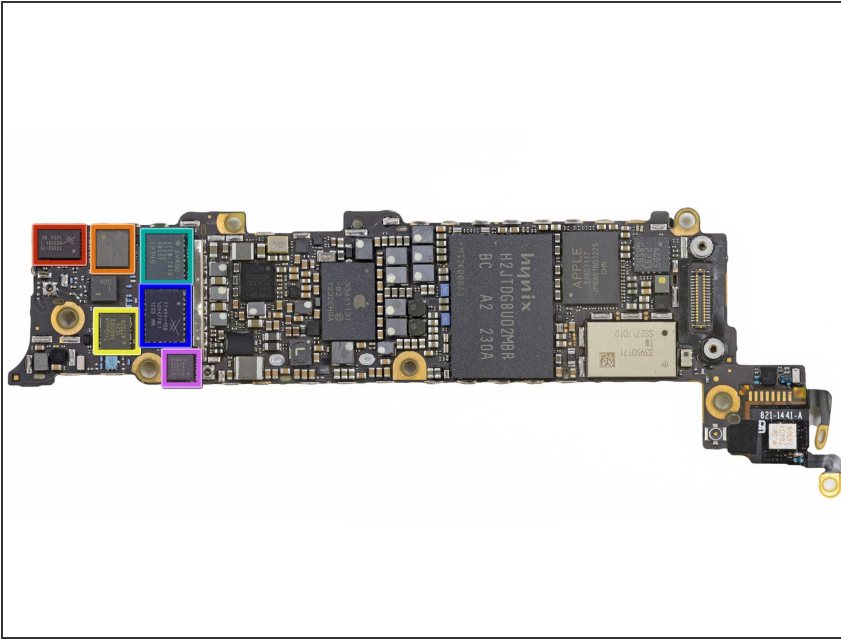
Step 13



- Many of the components that came out with the logic board are held in place with screws and brackets.
- Apparently, Apple is very concerned with making sure that all the connectors are firmly seated and won't rattle loose over time. Good on you, Apple.

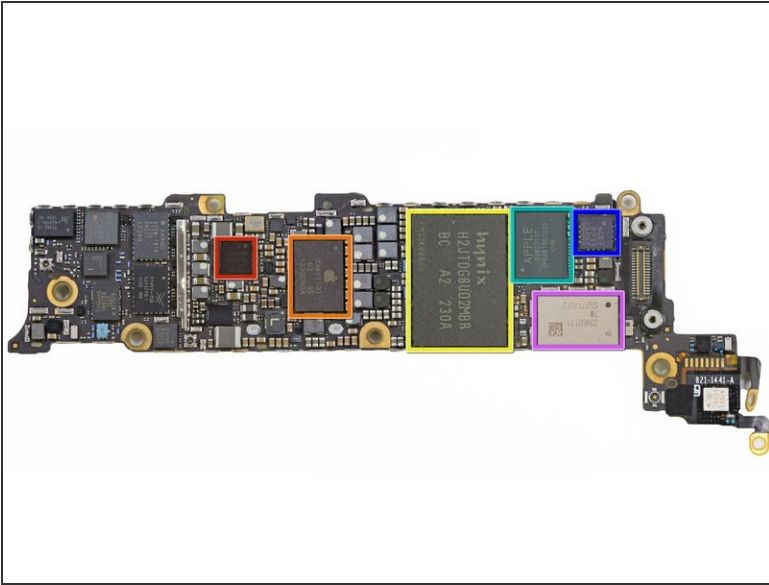
⚠ Before we go any further: A mega thanks to [Chipworks](#) for sticking around into the wee hours of the night and helping us identify the packages on the logic board. Their handiwork (along with ours!) can be seen below.

Step 14



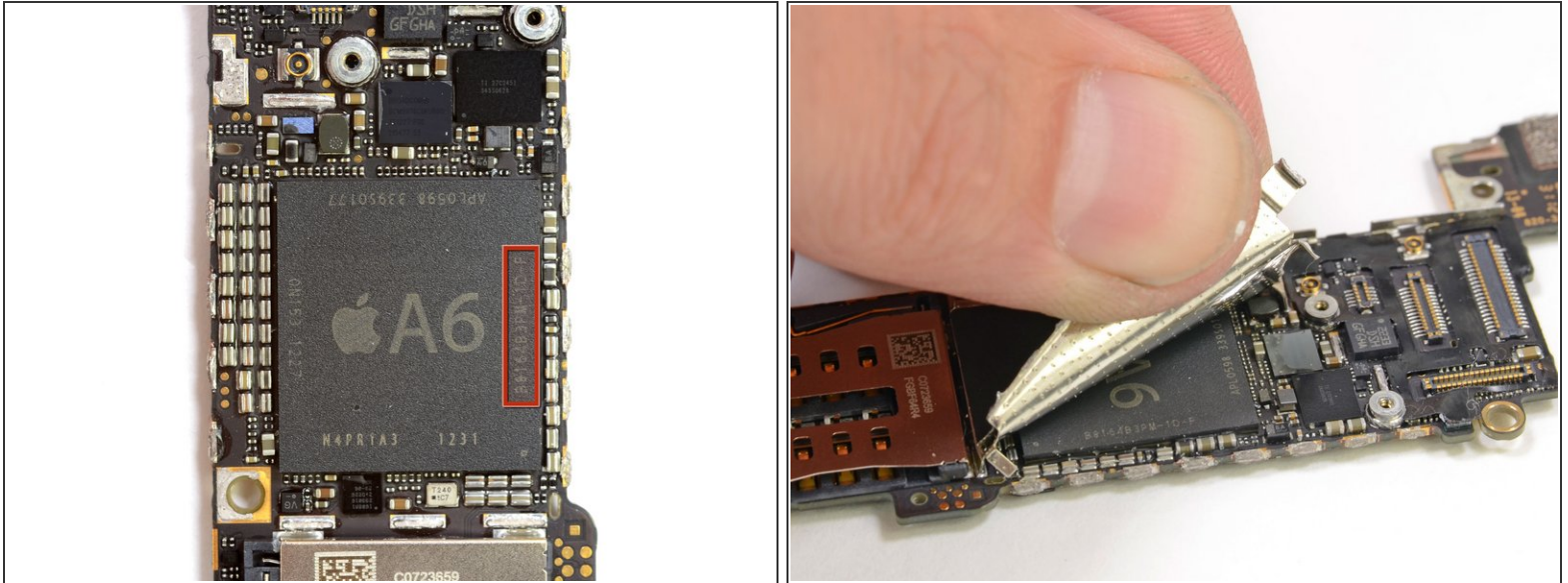
- The underside of the logic board is teeming with components.
- Skyworks 77352-15 GSM/GPRS/EDGE power amplifier module
- SWUA 147 228 is an RF antenna switch module
- Triquint 666083-1229 WCDMA / HSPA power amplifier / duplexer module for the UMTS band
- Avago AFEM-7813 dual-band LTE B1/B3 PA+FBAR duplexer module
- Skyworks 77491-158 CDMA power amplifier module
- Avago A5613 ACPM-5613 LTE band 13 power amplifier

Step 15



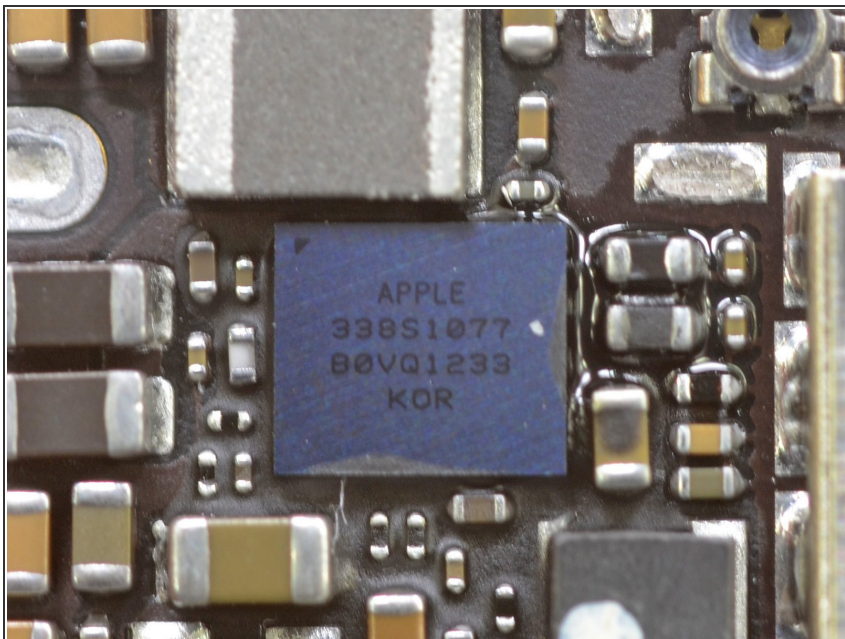
- More chips on the underside of the logic board:
 - Qualcomm PM8018 RF power management IC
 - Hynix H2JTDG2MBR 128 Gb (16 GB) NAND flash
 - Apple 338S1131 dialog power management IC*
 - Apple 338S1117 Cirrus Logic Class D Amplifiers. The die inside is a Cirrus Logic device (second image) but it does not look like the audio codec.
 - STMicroelectronics L3G4200D (AGD5/2235/G8SBI) low-power three-axis gyroscope—same as seen in the iPhone 4S, iPad 2, and other leading smart phones
 - Murata 339S0171 (based on Broadcom BCM4334) Wi-Fi module

Step 16



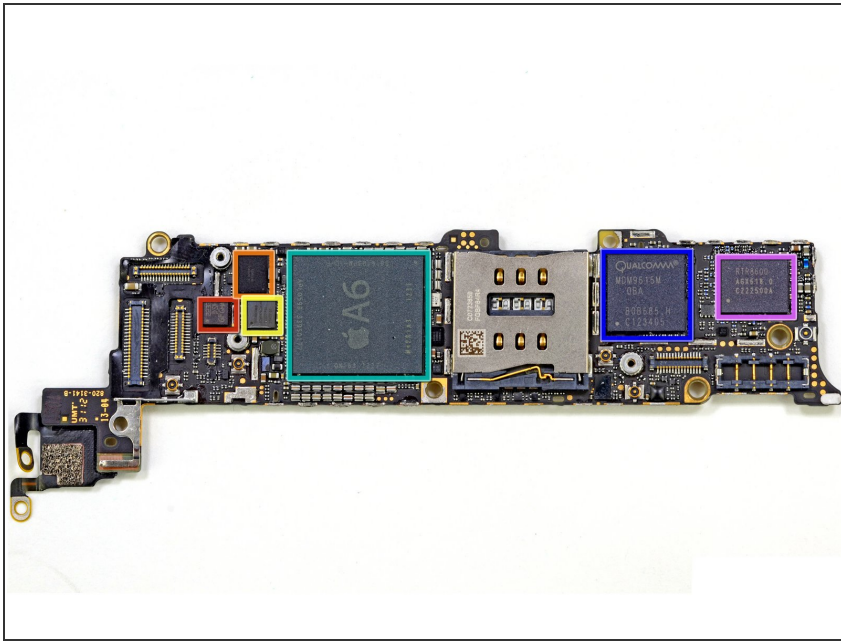
- Now for the plat de résistance: the A6 application processor.
- The A6 processor is the first Apple [System-on-Chip \(SoC\)](#) to use a custom design, based off the ARMv7 instruction set.
- Because the A6 is not an [ARM](#)-specific CPU design, this gives Apple the ability to tailor the A6 towards their needs.
- According to Chipworks, the B8164B3PM silkscreen label denotes 1GB *Elpida* LP DDR2 SDRAM.
 - Contrarily, the [infographic](#) presented during Apple's Keynote clearly showed *Samsung* RAM (K3PE7E700F) in the A6.
 - Not too long ago, Apple decided to [reduce the number of RAM chip orders](#) from Samsung. Time to invest in Elpida? Or is Samsung lurking in the next phone on the shelf? That's for you to decide.

Step 17



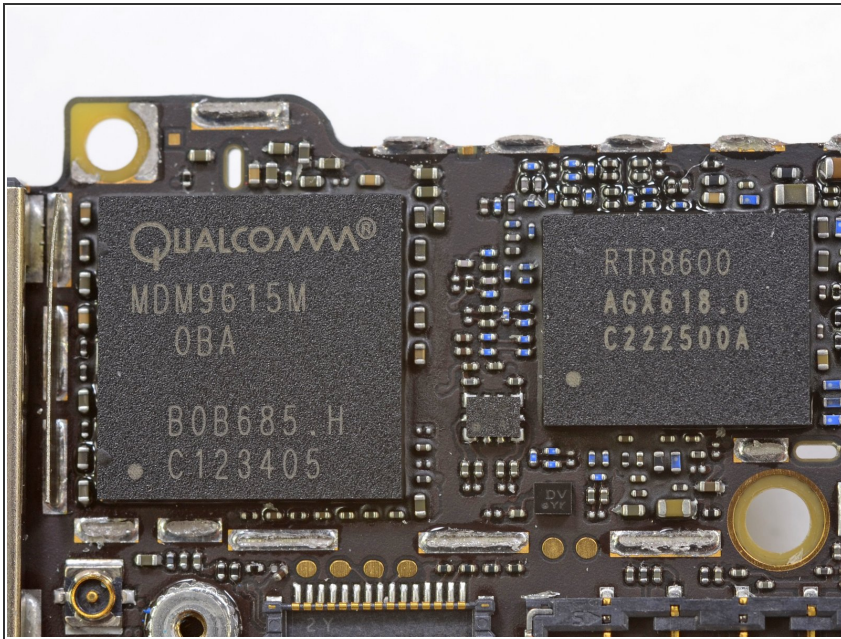
- Did someone ask for a close-up of the Apple 338S1077 Cirrus audio codec?
- What exactly does an audio codec do? In short, it's a single device that acts as both a digital-to-analog and analog-to-digital converter to properly encode and decode audio in and out signals.

Step 18



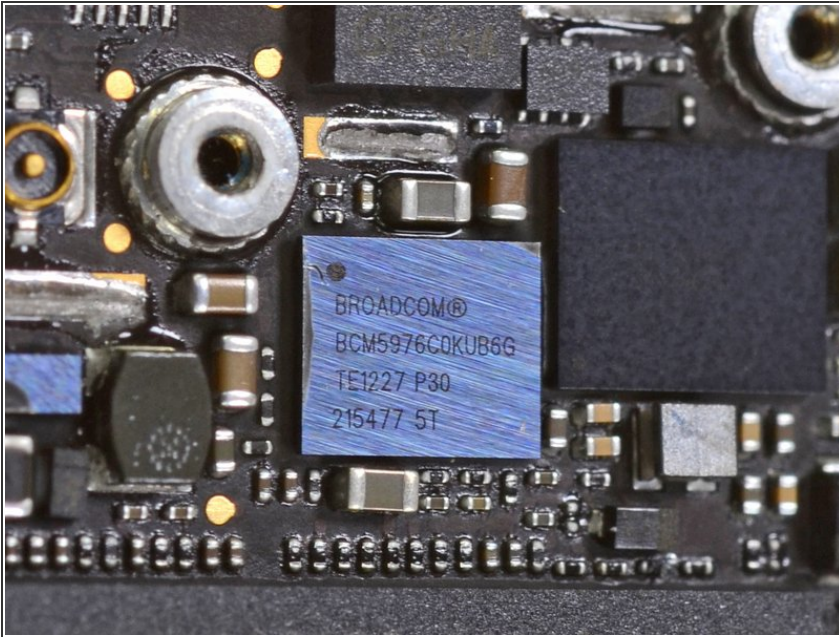
- Chips on a board. Kinda like ants on a log.
- STMicroelectronics LIS331DLH (2233/DSH/GFGHA) ultra low-power, high performance, three-axis linear accelerometer
- Texas Instruments 343S0628 touch screen SoC
- Broadcom BCM5976 touchscreen controller
 - ⓘ Rather than a single touchscreen controller, Apple went with a multi-chip solution to handle the larger screen size, à la iPad.
- Apple A6 application processor
- Qualcomm MDM9615M LTE modem
- Qualcomm RTR8600 Multi-band/mode RF transceiver, the same one found in the [Samsung Galaxy S III](#)

Step 19



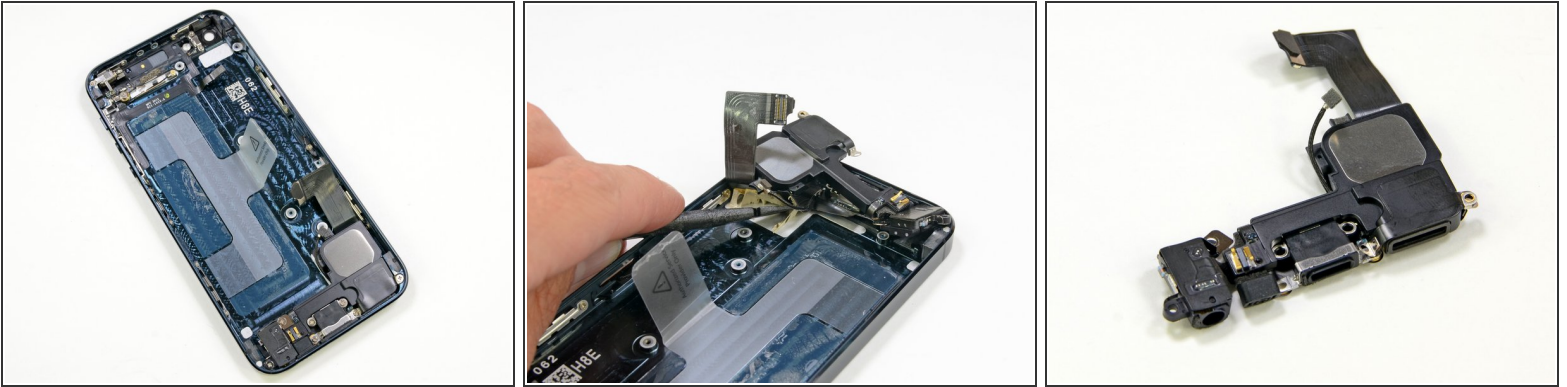
- An iPhone with 4G connectivity? It's more likely than you think.
- We can now confirm that the Qualcomm MDM9615M is the 4G [LTE](#) modem powering this new feature.
- ⓘ After being teased for over a year by Android bullies, the iPhone faithful finally have 4G LTE on their side. What will they do with this newfound power? Only time will tell.
- The Qualcomm MDM9615M is a 28 nm LTE ([FDD](#) and [TDD](#)), HSPA+, EV-DO Rev B, [TD-SCDMA](#) modem.
- The MDM9615 allows for [multi-spectrums](#), [multi-mode](#) LTE support. It is responsible for transmitting simultaneous voice and data transfer on LTE (provided the carrier has the infrastructure to allow simultaneous voice and data transfer.)
- We also find the Qualcomm RTR8600 multi-band/mode RF transceiver. The RTR8600 is paired alongside the MDM9615 to support various bands, including 5 [UMTS](#) bands, and over 5 LTE and 4 EDGE bands.

Step 20



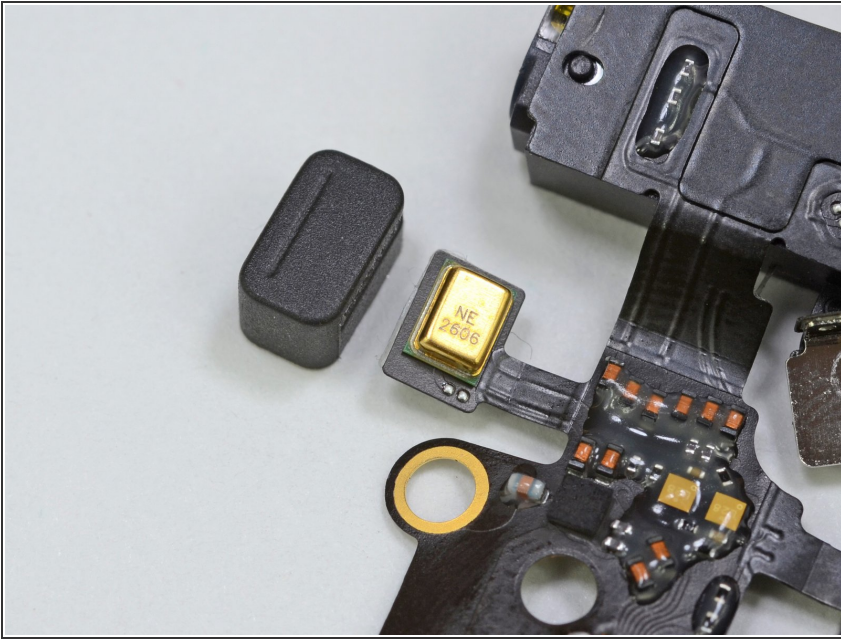
- Here's a closer look at the Broadcom BCM5976 trackpad controller.
- Apple used this same chip in the MacBook Air to control the trackpad. Here, it's working together with the Texas Instruments touchscreen controller to take care of touch inputs on the Retina display.

Step 21



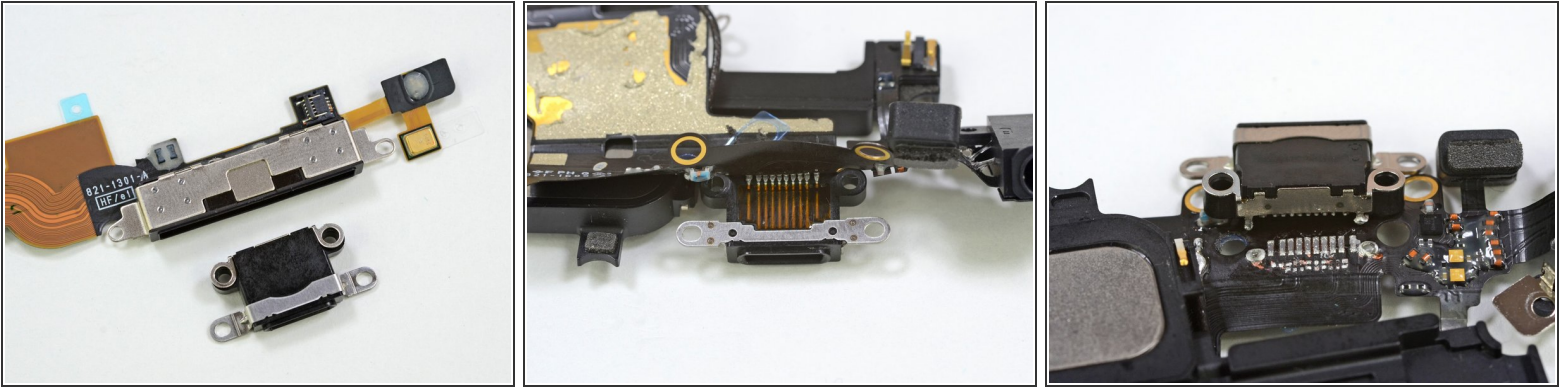
- After completely dissecting the logic board, we turn our attention back to the rear case.
- Not even a healthy heap of adhesive can stand up to our mighty spudger!
- The Lightning connector assembly, which includes the headphone jack, loudspeaker, and lower microphone, comes out next.
- It appears that the Wi-Fi antenna is also embedded into the assembly. The iPhone 5 now includes support for 2.4 GHz and 5 GHz.
- Antennas are sized to be fractions of full wavelengths, so the 1.23" of a quarter 2.4 GHz wave is close enough to the 1.18" of a half 5 GHz wave that a single antenna can serve both frequencies.

Step 22



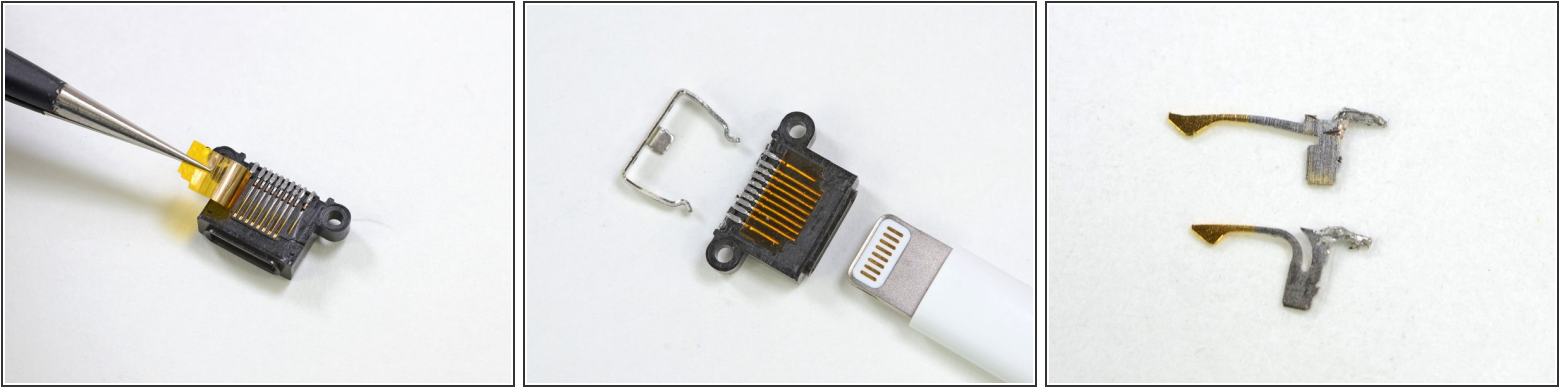
- The first of [three microphones](#) comes out of the iPhone 5 along with the Lightning connector assembly.
- It is safe to assume that the microphone located at the bottom front of the device is used for voice commands and voice calls.
- ① The other two microphones remain in the device, for now, waiting towards the top of the phone.

Step 23



- The Lightning connector looks like it could be [swallowed](#) by the the 30-pin dock connector.
- Here we can clearly see the eight leads in the new Lightning connector.
 - While there hasn't been any official word on the pin-out for the Lightning connector, we can confidently say that two of them will be used for power and ground. As for the other six, well, that's anyone's guess.
 - **Update:** We now know what the [pin-out](#) of the Lightning connector is.
- Apple claims that the Lightning connector is all digital. However, they also claim that the iPhone 5 supports analog audio-out and VGA video, indicating that there may be some kind of digital-to-analog conversion going on inside the cable.

Step 24



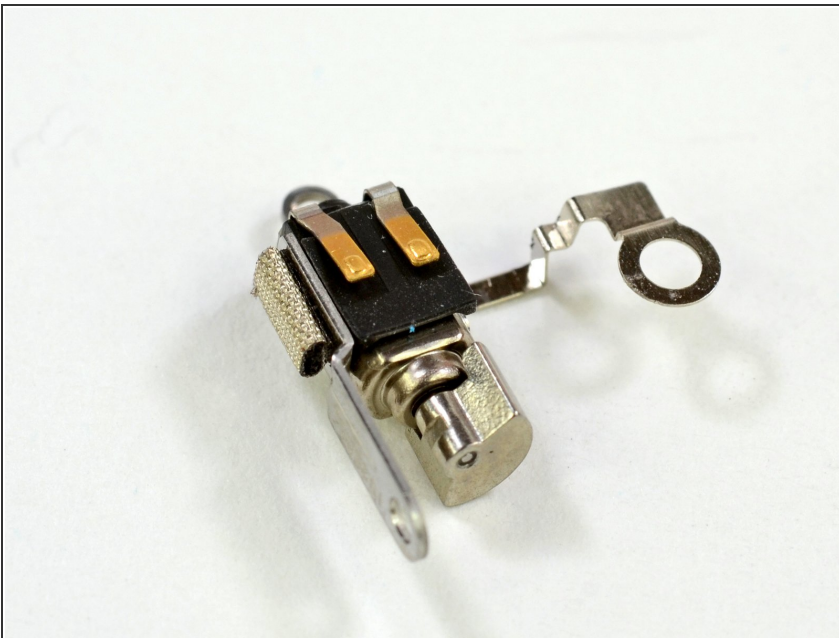
- Further investigation into the Lightning connector shows a neat array of pins and a clip to hold the cable in place.
- As can be seen in the 2nd high res picture, there are two outermost pins that are inset from the others. This is standard practice to insure that all other signals and power are connected before the ground or power (depending if Apple decided to supply power via the outer metal shield or ground).
- Normal practice is to connect signals and ground first and then the power is applied via the shorter pins. Time will tell and someone with a DVM as to which is the power (pin or shell).
- Each pin (shown in the third picture) is springy and gold plated on the end to ensure good conductivity between the Lightning cable and the socket.

Step 25



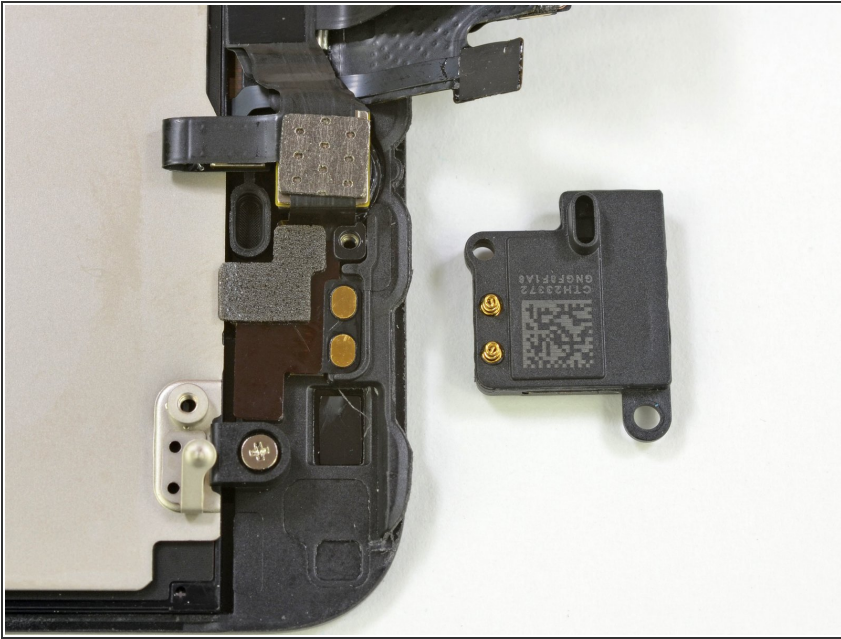
- Even with several components remaining, the back case is impressively light.
- Using a high tech, advanced precision scale, we conclude that the entire rear case of the iPhone 5 weighs only slightly more than just the glass rear panel of the 4S.

Step 26



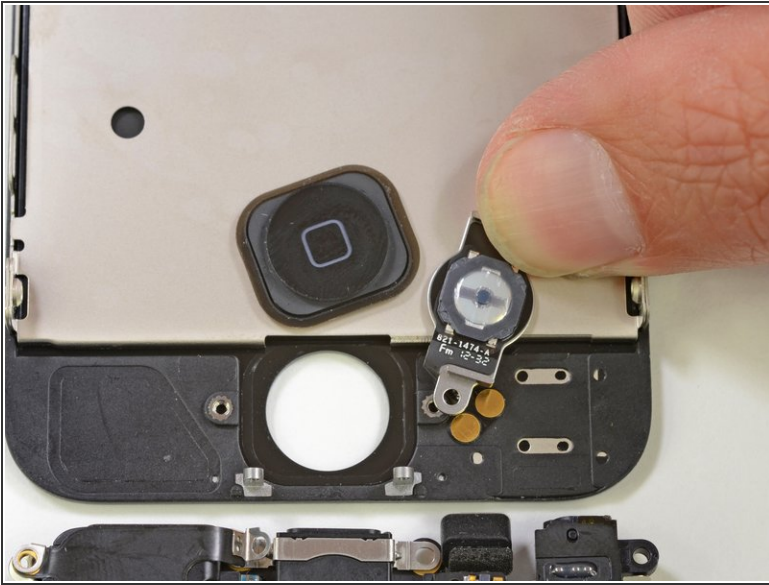
- Pressure contacts on the vibrator motor mean that replacing it doesn't require soldering or prying up small connectors.
- Unlike the [invalid guide link], which used a linear-oscillating vibrator, Apple has gone back to a rotational motor with a counterweight.
- ❗ We praised Apple in the past for going with the quieter and less annoying linear oscillating vibrator (Which is made by Samsung), but now we're [scratching our heads](#) as to why they went back.

Step 27



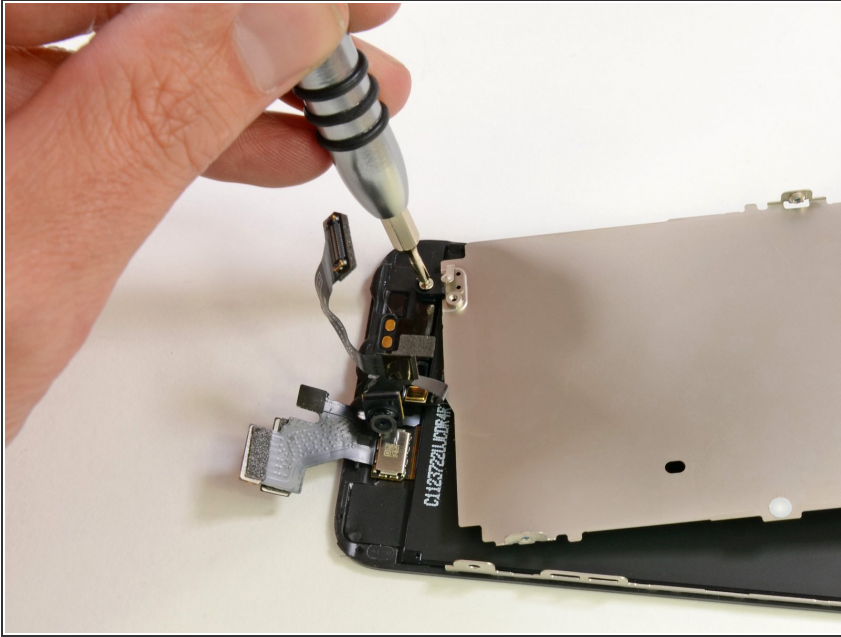
- The ear speaker comes out easily with two screws and connects to the display assembly with spring contacts.
- The speaker in the iPhone 4S was adhered to the fragile power button ribbon cable and required [invalid guide link] to remove. Now it pops right off the display assembly—another hooray for repairability!

Step 28



- Apple's newest iteration of its classic home button sports an integrated metal support bracket, which we hope will greatly strengthen the oft-used switch.
- Many iPhone 4 and 4S users have experienced the woes of a faulty home button, but haven't been brave enough to attempt the repair. This new design should not only increase longevity, but also make replacing the home button a lot less of a hassle.
- A side-by-side comparison of the iPhone 4 and iPhone 5 display assemblies. The iPhone 4s has an integrated home button.

Step 29



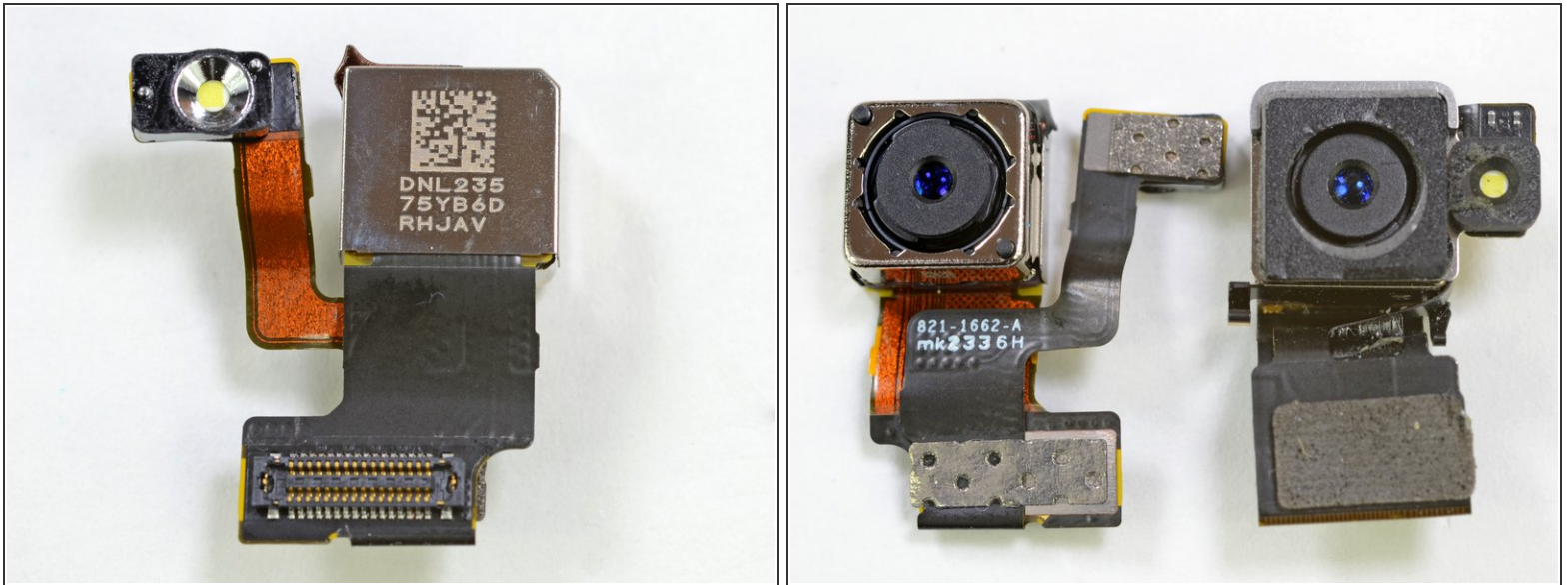
- What first appeared to be part of the LCD assembly is easily removed after the turn of a few screws.
- This plate is likely used for shielding and heat dissipation. The spring contact near the screw suggests that the plate could also be used for grounding.
- We've had some inquiries if this shield was made of [Liquidmetal](#). Sorry to disappoint, folks, but it doesn't seem to be that alloy. The plate has the same resistance of stainless steel and is slightly magnetic, just like stainless steel.

Step 30



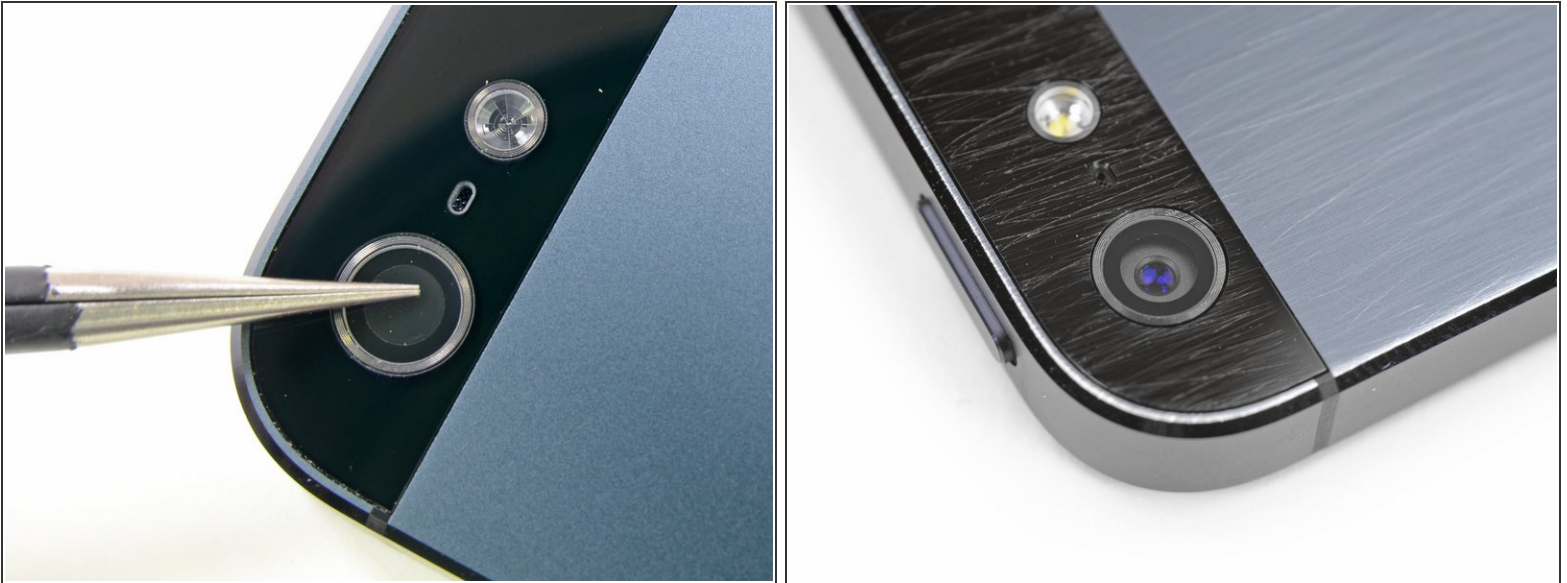
- Based on a user request, we looked into the concerns about "[Scuff Gate](#)," the fear that the black coating scuffs off too easily.
- We found that the side is pretty tough, but the chamfered edge can be susceptible to scuffing, making for a shiny streak on the side.
- Moral of this story: be careful, or get a case. Or be free like the wind and just don't care.

Step 31



- One of the iPhone 5's biggest selling points was the updated 8 megapixel iSight camera.
- Although it's hard to see many differences between this camera and last year's model on the outside, Sony made some significant upgrades, including improved low light performance and 40% faster image capture. iPhone 5 camera is on the left.
- Will your pictures be [this good](#)? That depends—will you take the time to snap photos of something besides [your dinner](#)?

Step 32



- Apple was very proud of the fact that they are using a sapphire crystal in their new-and-improved camera.
- Since sapphire is such a [hard](#) material, it would be sensible that the outermost element of the camera is made of sapphire.
 - We tried scratching the clear cover with a pair of and the lens remained scratch-free.
 - While this doesn't confirm that the protective cover is made from sapphire crystal, it *does* mean that it is quite hard and scratch resistant.
- After giving it some thought, we decided that a few passes with a pair of tweezers wasn't a sufficiently thorough scratch test for the camera lens coating.
- The rear case of the iPhone 5 doesn't hold up well to a [barrage of sandpaper and keys](#), but the lens cover remains crystal clear. Wow.

Step 33



- We have found them! Just as Apple promised, there are more microphones residing in the top of the device.
- First, we find the front facing top microphone, presumably for FaceTime and speakerphone capabilities.
- And on the back? It's [starting to look like a triple microphone!](#) The rear-facing microphone partners up with the rear-facing camera for recording video, and is also used for canceling out background noise when on calls.

Step 34



REPAIRABILITY SCORE:



- iPhone 5 Repairability: **7 out of 10** (10 is easiest to repair)
- We're quite happy that the glass/display is the first thing that comes off the iPhone 5. The majority of iPhone repairs are due to a shattered front glass.
- The battery comes out with a bit of prying once the front panel is removed.
- The iPhone 5 still uses Pentalobe screws on the exterior, making it more difficult to open the device.
- The front glass, digitizer, and LCD are all one component, thereby increasing cost of repair.
- Lots of smaller components are soldered to one ribbon cable, increasing the cost of repairing just one component.