



AirPods Teardown

Teardown of the Apple AirPods on December 19, 2016.

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INTRODUCTION

Apple [EarPods](#) were standard issue with iPhones released before the iPhone 7. So what happens when Apple releases a phone with no headphone jack? They release wireless headphones. Are the new Apple AirPods [worth the wait](#)? Only one way to find out. Ladies and gents, hold onto your headphones seats, it's teardown time!

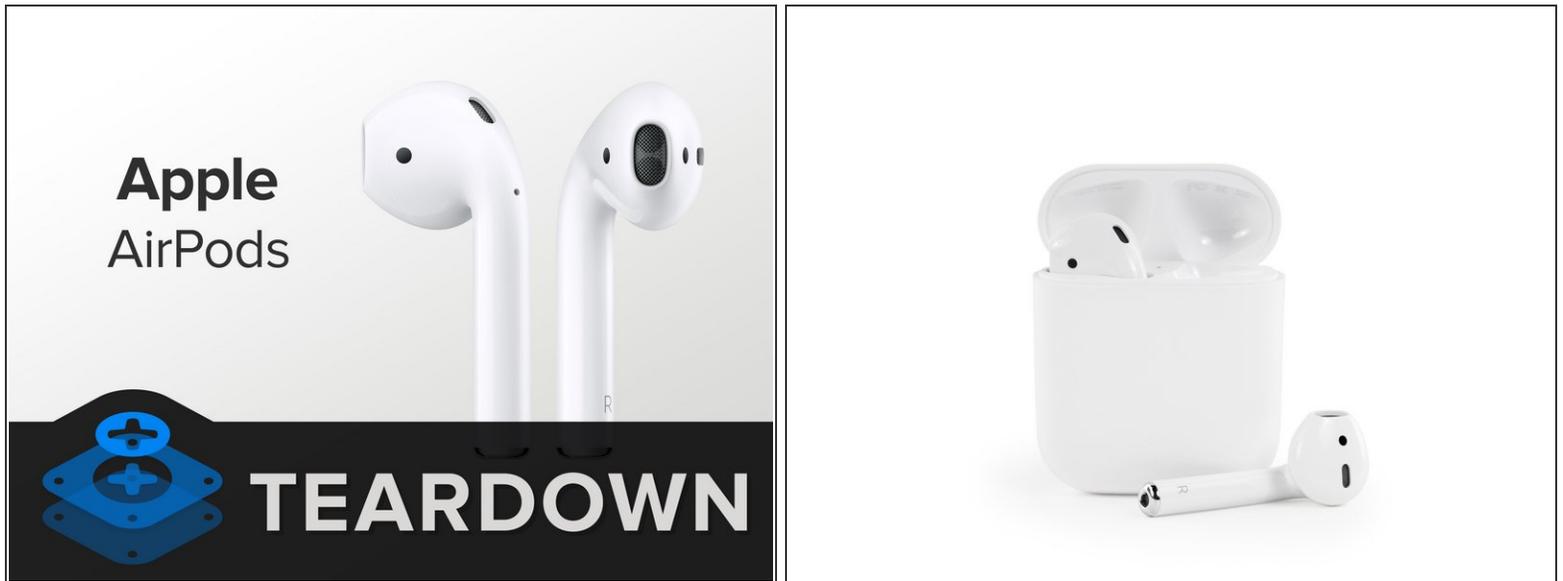
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[video: <https://www.youtube.com/watch?v=ahNUjteea8w>]

TOOLS:

- [Rotary Tool](#) (1)
 - [Tweezers](#) (1)
 - [Jimmy](#) (1)
 - [iOpener](#) (1)
 - [Precision Utility Knife](#) (1)
 - [Large Needle Nose Pliers](#) (1)
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Step 1 — AirPods Teardown



- Alright, we've got Apple's latest stocking stuffers on our teardown table, and it's time to see what they're made of. Here's the scoop so far:
 - Each AirPod weighs 0.14 oz (4 g), while the charging case weighs 1.34 oz (38 g)
 - Each AirPod measures in at 0.65" × 0.71" × 1.59" (16.5 mm × 18.0 mm × 40.5 mm) while the charging case measures in at 1.74" × 0.84" × 2.11" (44.3 mm × 21.3 mm × 53.5 mm)
 - Utilizes Bluetooth technology and Apple's new W1 chip for wireless connectivity
 - Uses microphones, optical sensors, and a motion accelerometer for in-ear detection
 - Beamforming microphones are coupled with an additional accelerometer in order to filter out unwanted noise
 - The AirPods alone can hold a charge up to 5 hours, while their charging case holds additional charge for up to 24 hours of listening time

Step 2



- AirPods—featuring the electrifying Apple Egg!
 - On one end, this power-packed charging case is equipped with a Lightning connector to charge its battery.
 - At the other end, recessed deep within each AirPods housing, is a pair of contacts for charging the 'Pods respective onboard batteries.
 - Finally, at the top of the charge case, we spy a little status LED for notifying you when the triad of batteries is collectively out of juice.
- ⓘ You can see it all end-to-end if you have [X-ray](#) vision. Keep your eyes peeled for some deep scans of the AirPods throughout this teardown.

Step 3



- The charge case cover sports a new model number—A1602—and offers up some info on the case's overall power capacity: 398 mAh.
 - Performing our last teardown rites on the charge case, we take a quick peek at the setup button on the back. If Apple's highly-touted instant sync feature fails or isn't available, this button is here to save the day with a more traditional Bluetooth pairing process.
- i** Alright, no more wasting time. Let's get to the good stuff.

Step 4



- The earbuds are covered in dots: grilles for speaker action, microphone holes for those [noise-canceling](#) secondary mics, and black dots for IR proximity sensors.
- The 'Pods are individually labeled with separate model numbers—A1722 (left) and A1523 (right)—and FCC IDs, BCG-A1722 and BCG-1523.
- X-rays give us a peek at what's inside, some grilles, and that microphone, the rest is a mystery to unravel.

Step 5



- With no visible fasteners in sight, we resort to more aggressive tactics and apply some heat and knife action.
- After the application of heat, we try some [samurai slicing](#).
- In the interest of safety, we pull out an [opening pick](#) to finish the job. With a quick twist we separate the speaker portion of the earbud, and spy some internals.

Step 6



- Our journey in pursuit of electronics did not leave us disappointed. We reveal some tightly-packed components.
- As we begin to pull out the boards, cables, and other bits, we're reminded of a certain wearable repair nightmare (**cough** [Apple Watch](#) **cough**).
- If [jamming](#) complex components into a small [form factor](#) and sealing it with a copious amount of [glue](#) were a game, Apple would be [winning](#).
- That game now includes the world's cutest (and smallest?) [coaxial connector](#).
- Dangling off to the side is one of the two IR proximity sensors that the AirPods use to detect when it's in an ear.

Step 7



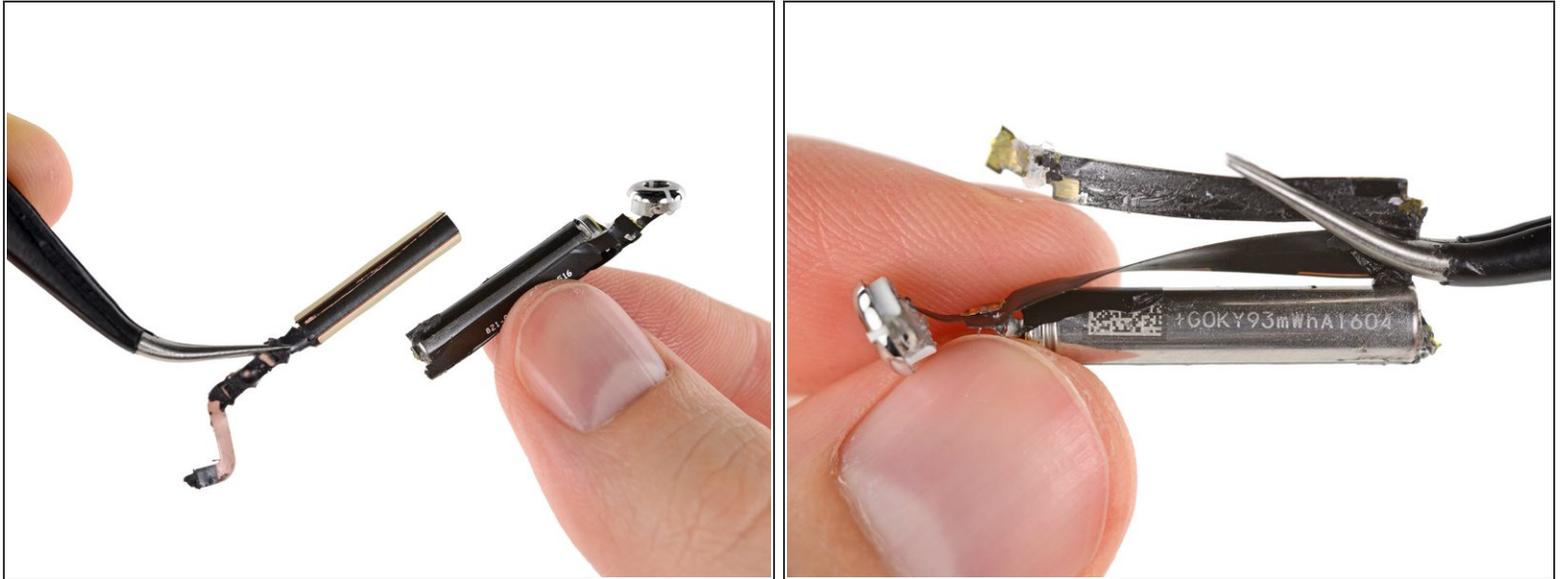
- At this point we're momentarily stymied—what remains in the earbud is a hot mess of cables and adhesive, and none of it seems particularly keen on coming out. So we turn to the stem, hoping for another entry point.
- Instead, we encounter a waterfall of glue.
 - That [shiny metal cap](#) provides contact points for charging the AirPods, and surrounds the primary microphone. Hidden behind and within the torrent of glue, we spy the end of the battery cable.
 - Ripping out the glue plug reveals the end of a teensy weensy battery, with teensy weensy spot welds. Looks like we won't be replacing these any time soon (or recycling them, ever).

Step 8



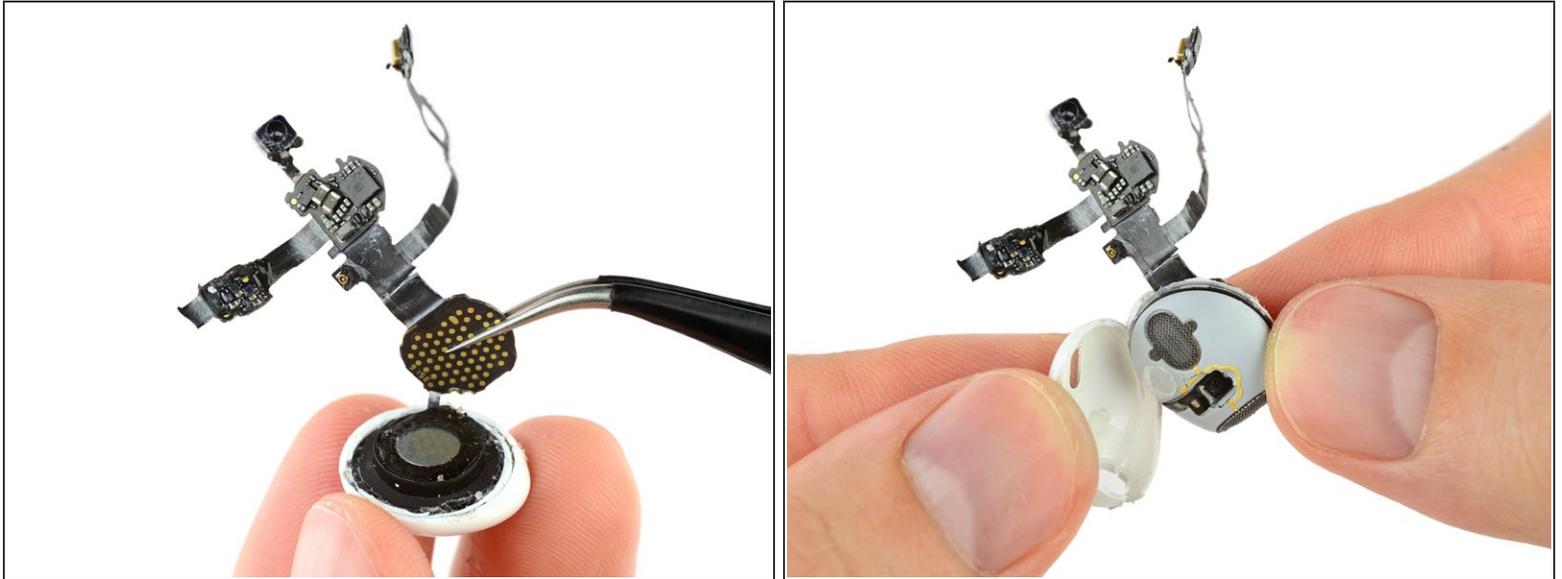
- Having exhausted the obvious entry points, we opt for the full surgical approach. *Nurse, hand me the [scalpel](#).*
- Lifting the membrane with surgical precision reveals what's likely an antenna laid over the heart battery.
- Okay, so we might not have the patience of a surgeon. The pliers come out, and we rip the rest of the casing off to get to the goodies.

Step 9



- With the plastic casing off, we're able to peel that long antenna from the battery.
- Finding the antenna here explains a bit about the AirPods' design. That hanging boom is for more than just balance—it's also to improve reception.
- Digging deeper under more glued-on cables and tape, we find some markings etched into the battery. Looks like this is a 93 *milliwatt* hour battery—equivalent to a little over 1% of the charge capacity in an [iPhone 7](#).

Step 10



- Pulling up the complex flexible circuit reveals a golden array! They look like test points, but the cluster isn't labeled.
- ⓘ If these are test points, then locating the proper one will be harder than finding [Waldo when he's singing with his candy cane companions](#).
- The cable weaves into an intricate speaker assembly that houses a proximity sensor and some antenna lines.

Step 11



- We bust out our microscope to get a look at these tiny chip markings:
 - Apple 343500130 is suspected to be the [W1](#) wireless communication chip
 - Cypress [CY8C4146FN](#) programmable system on a chip
 - Maxim [MAX98730EWJ](#) low power stereo audio codec
 - Texas Instruments [TPS62743](#) 300 mA DC-DC buck converters
 - Bosch Sensortec BMA282 accelerometer
 - STMicroelectronics accelerometer/gyroscope
 - Likely some sort of serial flash memory

Step 12



- AirPods pretty well destroyed, we turn to their seamless-looking case...
- [Jimmy](#) proves to be too nice a guy to open our stubborn charging case.
- So we grab something with a little [more tooth](#). *Don't worry, you'll only feel a sliiight pressure ...*
 - Fair warning: this is not the safest way to do this. But the dentist told us we only bled because we haven't been flossing.
 - We're finally able to pull the cabley 'pod holder out of the main case, revealing some internals—namely a hefty battery.

Step 13



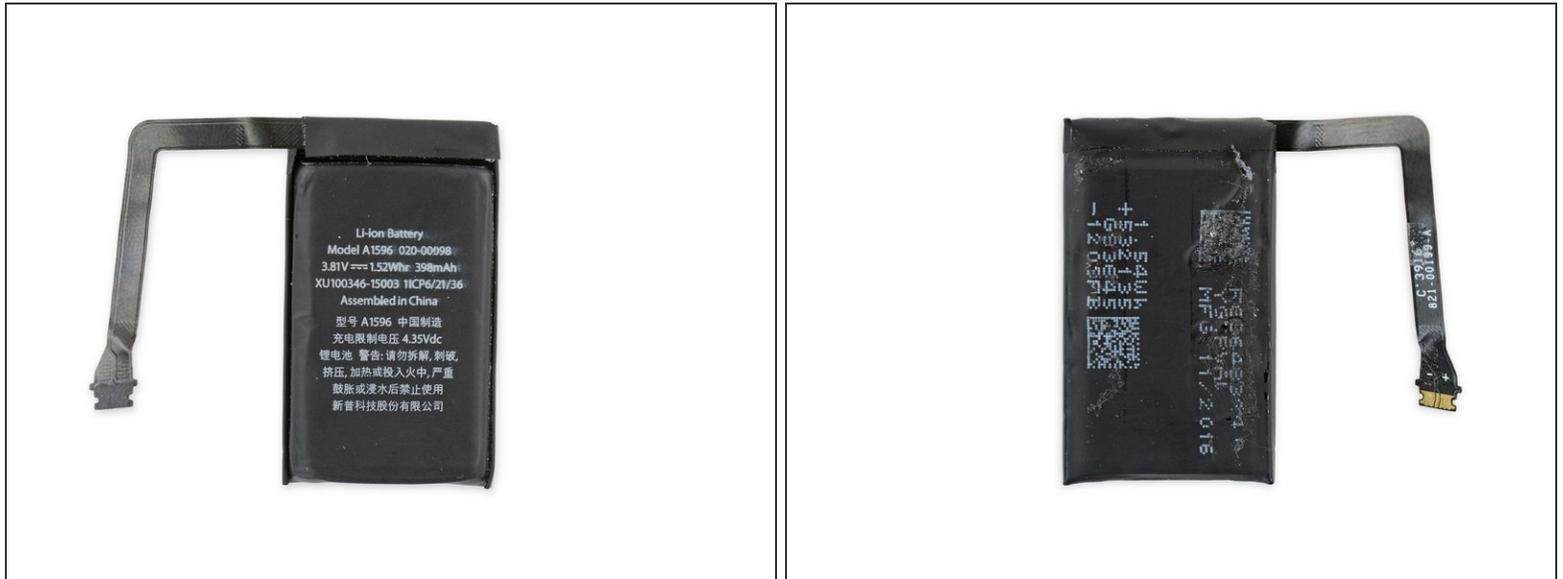
- With the cable pod removed, but still connected by a tangle of ribbon cables, we pull off that status LED.
- With some more dental fortitude, we're able to separate AirPods tubes from the charging bracket, freeing them from the cable spaghetti.
- And while we're at it, we wrestle the head off the capsule, pulling the hinge mechanism out of its gooey green slot.

Step 14



- The heavily-armored charging case proves to be a formidable foe, inflicting some damage on our weary teardowners. Desperate times call for desperate Dremel usage.
- What lies beneath the impenetrable sheath? A battery does! It is tucked into a cozy slot within the ~~iron~~ polycarbonate fortress.
 - ⓘ And in case you noticed, yes, half of the status LED flex cable did [fall behind](#).
- Upon removal, we spot the [secret ooze](#) adhesive that was fighting us—and we spot a single cable connecting the battery to the logic board of the charging case.
 - ⓘ Oh look, a ZIF connector! At least recyclers won't have to break out a soldering iron after shedding blood, sweat, and tears to tear through the outer casing.

Step 15



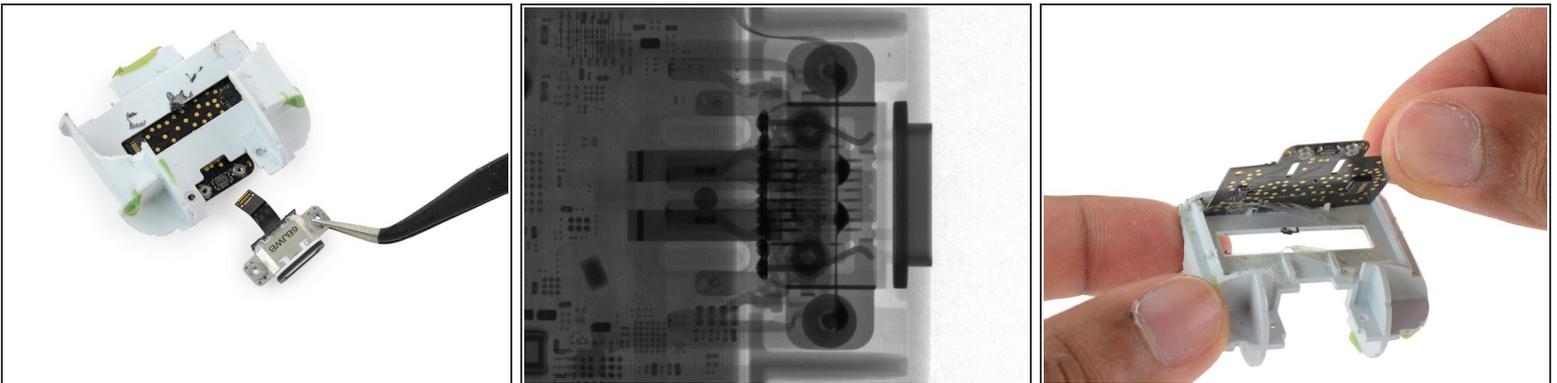
- Safely shucking the casing finally gives us a good look at the biggest battery of the day.
 - ⓘ Spoiler alert: it's still *tiny*.
- This 3.81 V, 1.52 Wh lithium-ion cell has roughly 16 times the power capacity of the ones we dug out of the AirPods' stems—meaning you should be able to top them up at least a few times between case charges.
- ⓘ For the sake of scorekeeping, the battery in the Apple Pencil weighs in at [0.329 Wh](#), and the Series 2 Apple Watch sports a [1.03 Wh](#) cell—so this is technically the *biggest* tiny battery we've recently encountered.

Step 16



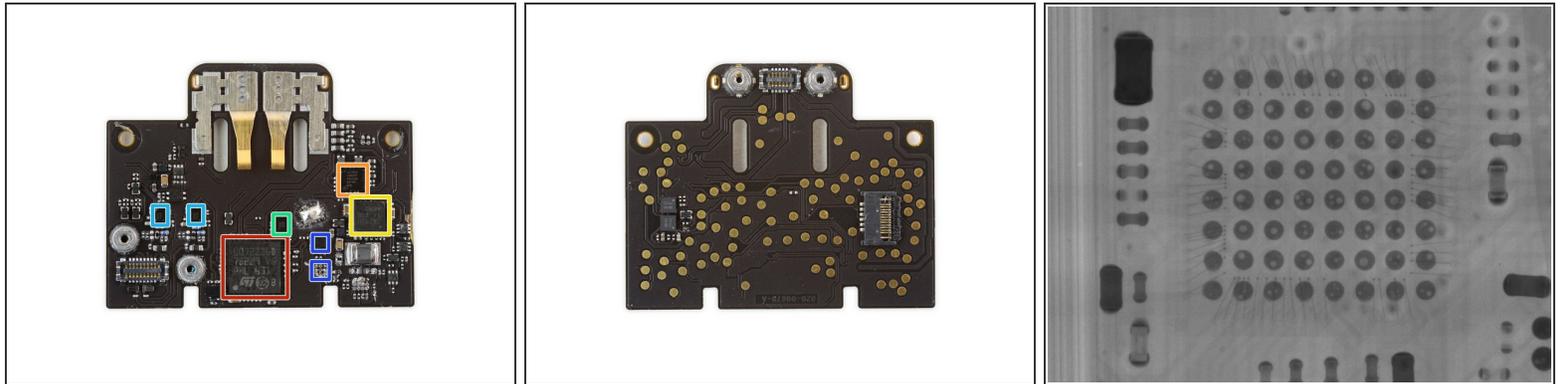
- The sync button is a self-contained li'l clicky dude, with contacts that match up to some spring contacts on the main board.
- ⓘ Electrical switches can be complicated. This one, however, probably isn't. It is likely a [pushbutton switch](#). A press of the button closes the circuit and lets current flow. This current will flow into the circuit and be interpreted as input. We told you it was simple.

Step 17



- We loosen a pair of Phillips screws to access the Lightning connector, pop its press connector off the back of the logic board, and seconds later it's free to leave this plastic mess behind.
- Luckily, the Lightning port is modular—so if you wear your port out, all you have to do is utterly destroy the case to replace that component.
- ⓘ The logic board is secured with a lot of sticky tape.

Step 18



- Let us take a look at what silicon is so heavily guarded by the charging case:
 - STMicroelectronics [STM32L072](#) ARM [Cortex-M0+](#) MCU
 - ⓘ Our X-ray imagery shows some quality issues in this chip's solder joints. Empty spaces, known as voiding, could be evidence of low quality standards, or a rushed product release. Could issues with the AirPods case be what delayed release?
 - NXP Semiconductor [CBTL1610A3](#) charging/port controller IC (as seen in iPhones 6s and SE and both iPad Pro models)
 - Texas Instruments [BQ24232](#) power management IC
 - Maxim Integrated [MAX9028](#) 1.8 V comparator
 - AMS [AS3441](#) power and communication interface (likely)
 - Probably ON Semiconductor regulators

Step 19



- Blood, sweat, and lots of glue later, we give you:
 - A pile of 'pod parts...
 - and a collection of case components.
 - Every single one of the amazing X-ray images in this teardown comes to you by way of our ingenious friends at [Creative Electron](#). Hi guys!
- 📌 **Update:** One of our overseas contributors found a clever way to open the charging case far less destructively, by first [deforming it with a vise](#). If you've got a dead battery and nothing to lose, give it a try!

Step 20 — Final Thoughts

REPAIRABILITY SCORE:



- AirPods repairability score: **0 out of 10** (10 is the easiest to repair). Here's why:
 - Accessing any case component is impossible without destroying the outer casing.
 - Glue is the only external fastener used in the case or earbuds.