



# MacBook Pro 15" Retina Display Mid 2012 Teardown

Tearing down the MacBook Pro with Retina Display

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## INTRODUCTION

### [I Am A on Reddit](#) with Kyle Wiens, iFixit's CEO, talking about the MacBook Pro with Retina Display!

This is it: The *Chosen One* of MacBook Pros. While other MBPs were gifted only the standard annual updates, this particular model was bestowed with a Retina display, a thinner profile, two Thunderbolt ports, a full sized HDMI port, and less annoying cooling fans. Apple claims that this is the "best computer Apple has ever made."

Apple may have already spilled the beans when it comes to what the inside of this MacBook Pro [looks like](#), but we aren't convinced. Join us today as we set out to see what is so significant about this special MacBook Pro.

Can't get enough teardown? Does an insatiable hunger for gadget guts burn in your belly? Want to be more I33t than your geek counterparts and know about the teardowns as soon as they're live? Follow [iFixit](#) on Twitter for the latest updates.

## TOOLS:

- [iFixit 6 Inch Metal Ruler \(1\)](#)
- [MacBook Pro and Air 5-Point Pentalobe Screwdriver \(1\)](#)
- [Tweezers \(1\)](#)
- [Phillips #00 Screwdriver \(1\)](#)
- [Spudger \(1\)](#)
- [T5 Torx Screwdriver \(1\)](#)
- [T8 Torx Screwdriver \(1\)](#)

## Step 1 — MacBook Pro 15" Retina Display Mid 2012 Teardown



- Everyone Mac enthusiasts don't have to wait months anymore to see what's inside the new MacBook Pro.
- What is it that's got everyone in the tech world buzzing?
  - 15.4" LED-backlit Retina display with IPS with a resolution of 2880 x 1800 at 220 ppi
  - Intel Ivy Bridge Core-i7 processor with Turbo Boost and Intel HD Graphics 4000
  - 8 GB 1600 MHz DDR3L RAM
  - NVIDIA GeForce GT 650M with 1 GB of GDDR5 VRAM

## Step 2



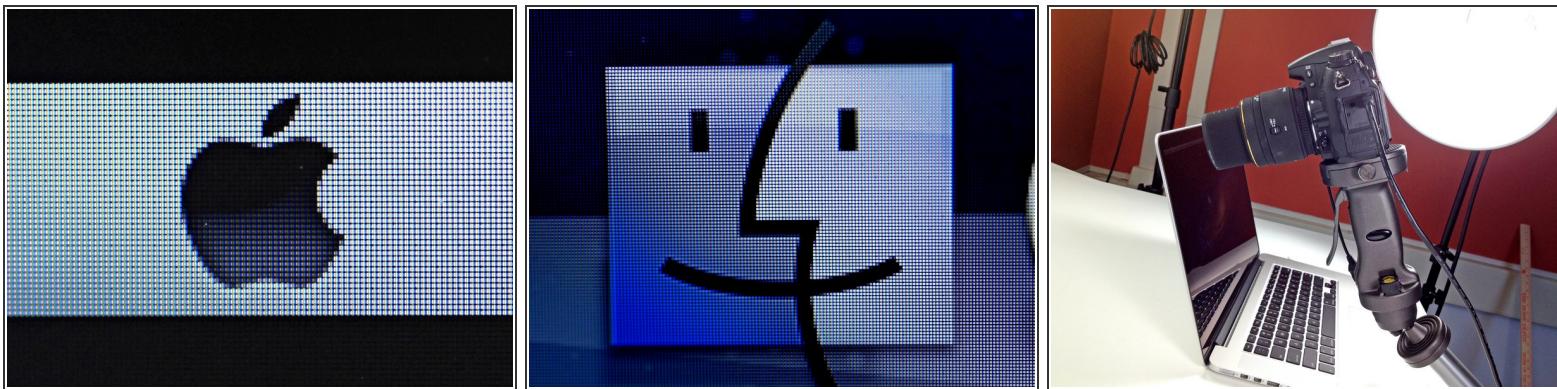
- A quick inspection of the side of the MacBook Pro with Retina display reveals loads of upgrades:
  - MagSafe 2
  - Two (!) Thunderbolt ports
  - The first of two USB 3.0 ports
  - A standard 3.5 mm headphone jack (boo)
- The right side of the MacBook houses an SD card reader, the second USB 3.0 port, and a full-size HDMI output.
- Both sides feature air induction vents for the new cooling system—but more on that later.

## Step 3



- The new display assembly design left no room for the usual "MacBook Pro" logo on the slim bezel.
- There's plenty of room for the logo on the bottom of the computer, though. If no one believes that your computer is a real MacBook Pro, just pick it up and flip it over.
- All these upgrades earned this Pro a new model number: A1398.
- Go ahead and let that sink in for a minute; Apple finally introduced a new MacBook Pro model number! (It's the little things that make us happy.)

## Step 4



- What does an Apple logo or Finder icon made up of 220 pixels per inch look like up close?
  - A bunch of colored, square-ish dots, that's what.
- All joking aside, the resolution of this display really is incredible. There's no doubt that the cost to manufacture the Retina display is a big reason for the new MacBook Pro's \$2200 (starting) price tag.

## Step 5



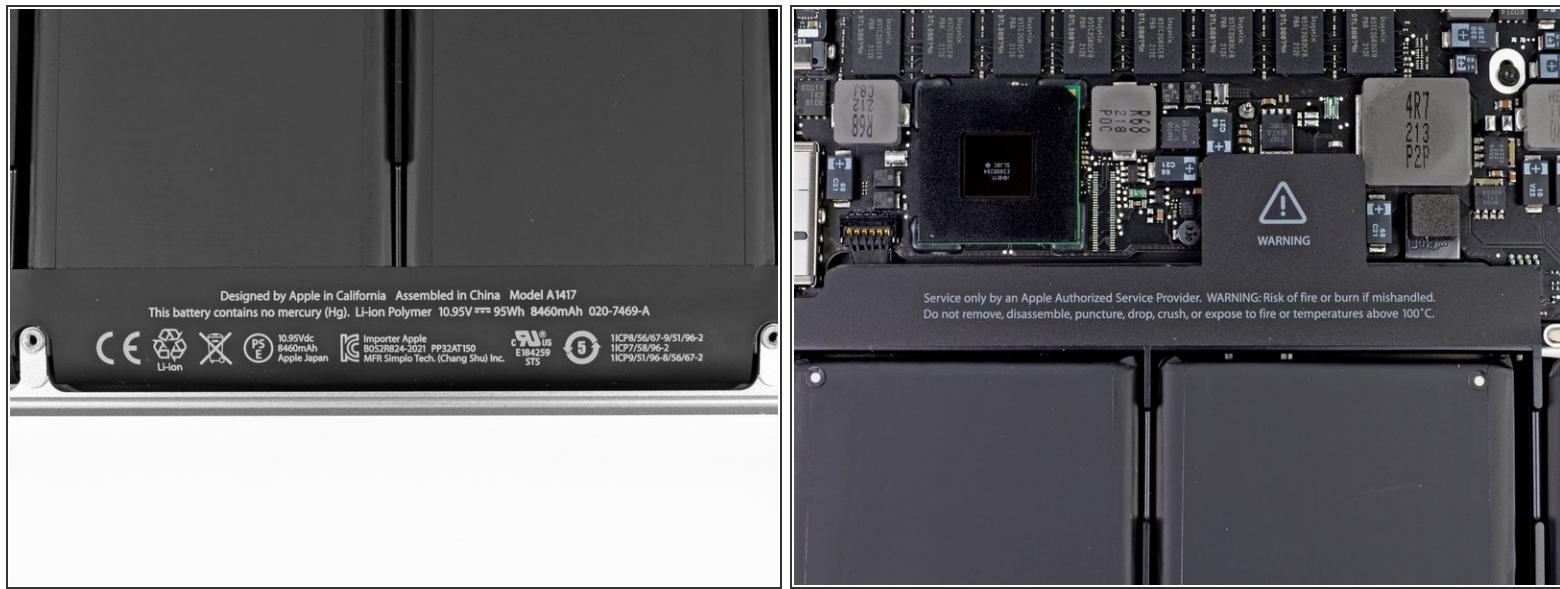
- We love a challenge, which is good news, because unlike previous generations of MacBook Pros, the MacBook Pro with Retina display is guarded by Apple's proprietary pentalobe screws.
- We work with bated breath as our [pentalobe screwdriver](#) sloughs off a stack of proprietary screws.
- Finally, we are in!

## Step 6



- The MacBook Pro's innards revealed for your pleasure. If you like details, check out the [gigantor version!](#)
- By the way, we don't just make awesome teardowns—**we sell parts. And tools! Lots and lots of tools.**
- Like this [handy-dandy electronics tool kit](#) that we used to take apart the new iPad. You know you want one. It'll pay for itself the first time you use it!
- We sell [Mac parts & upgrades](#), parts for [iPhone screen repair](#), kits for fixing the infamous [Xbox Red Ring of Death](#), and tons more.
- **We need your support** to continue building the [free repair manual](#) for everything in the world.

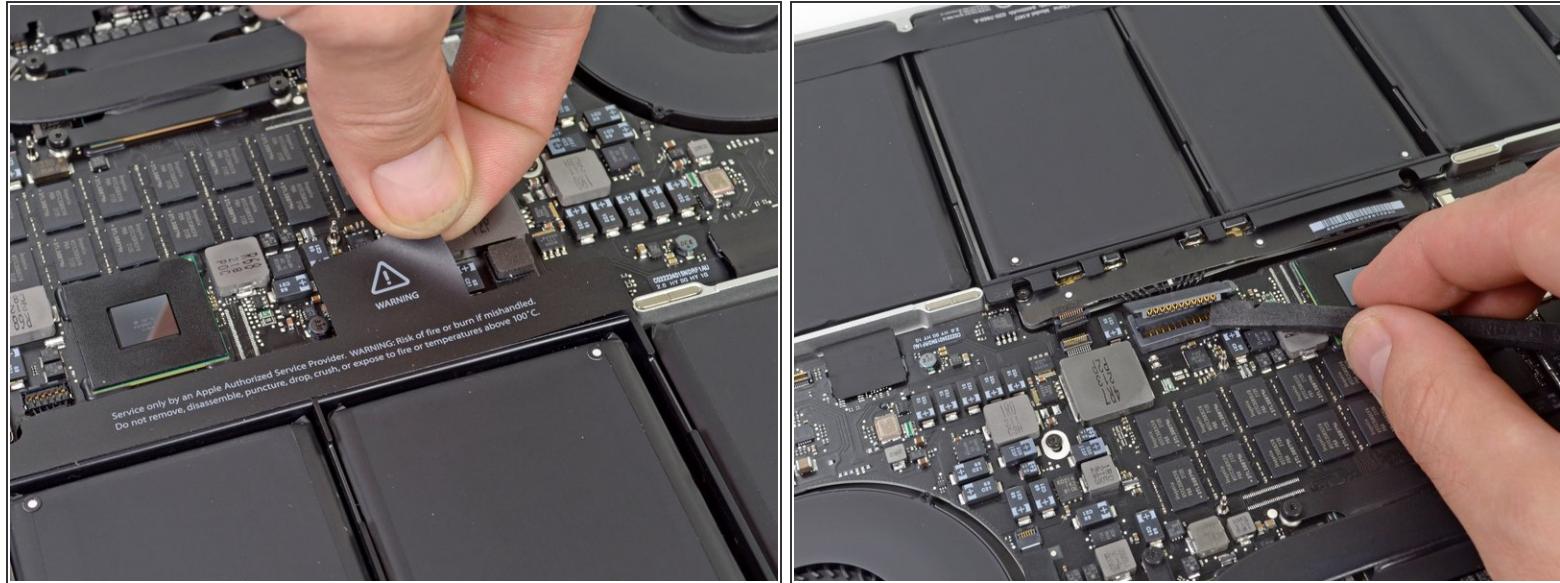
## Step 7



- The new battery packs quite a punch: 95 Wh at 10.95 V compared to [last year's puny 77.5 Wh](#).
- Two things haven't changed, though: the 7-hour battery life and the pestering reminder that Apple doesn't think you're qualified to service your own battery.

 **Spoiler alert:** they might be [right](#).

## Step 8



- It's always a good idea to disconnect the battery when gutting your gadgets.
- While Apple seems to have an extensive warning label, it fails to mention potential shocks by failing to disconnect the battery during gadget surgery. Is it possible Apple wasn't expecting us?

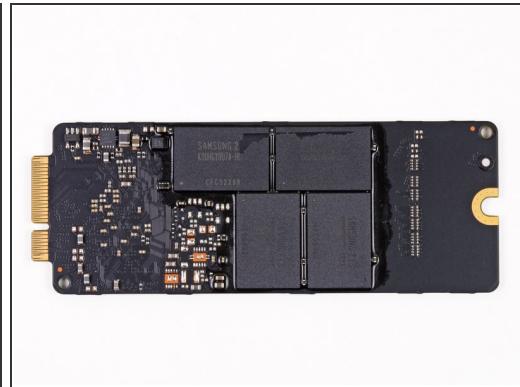
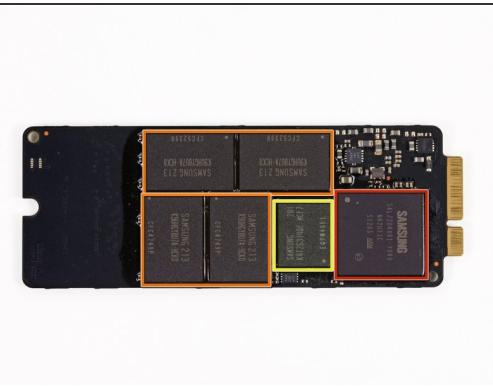
## Step 9



- *Great news.* The battery is no longer screwed into the machine.
- *Horrible News.* Apple chose to use the dreaded g-word: **glue**.

ⓘ We're going to move on to more accessible components first, and then come back to the battery.

## Step 10



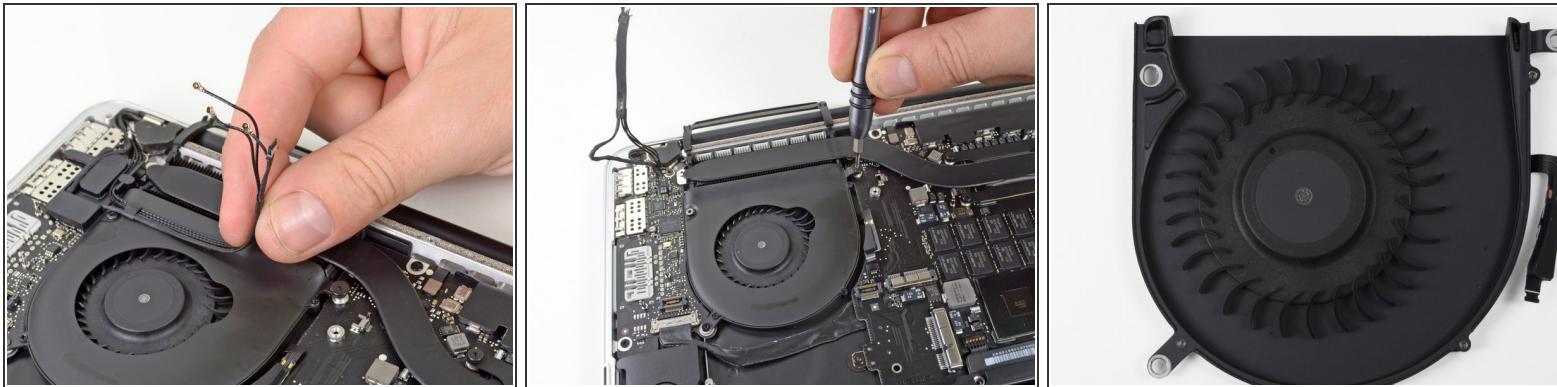
- Now we are getting to the good stuff, starting with the SSD. We found a 512 GB Samsung flash memory module.
- The chips are marked:
  - Samsung S4LJ204X01 3-core ARM SSD controller chip - revision seems newer than 830-series SSD
  - Samsung 213 K9UHGY8U7A 20nm MLC NAND chips
  - Samsung 201 K4T263140F 256MB DDR2-800 cache memory
- Proprietary flash memory is [nothing new](#) to Apple. It is, however, new to the MacBook Pro lineup.

## Step 11



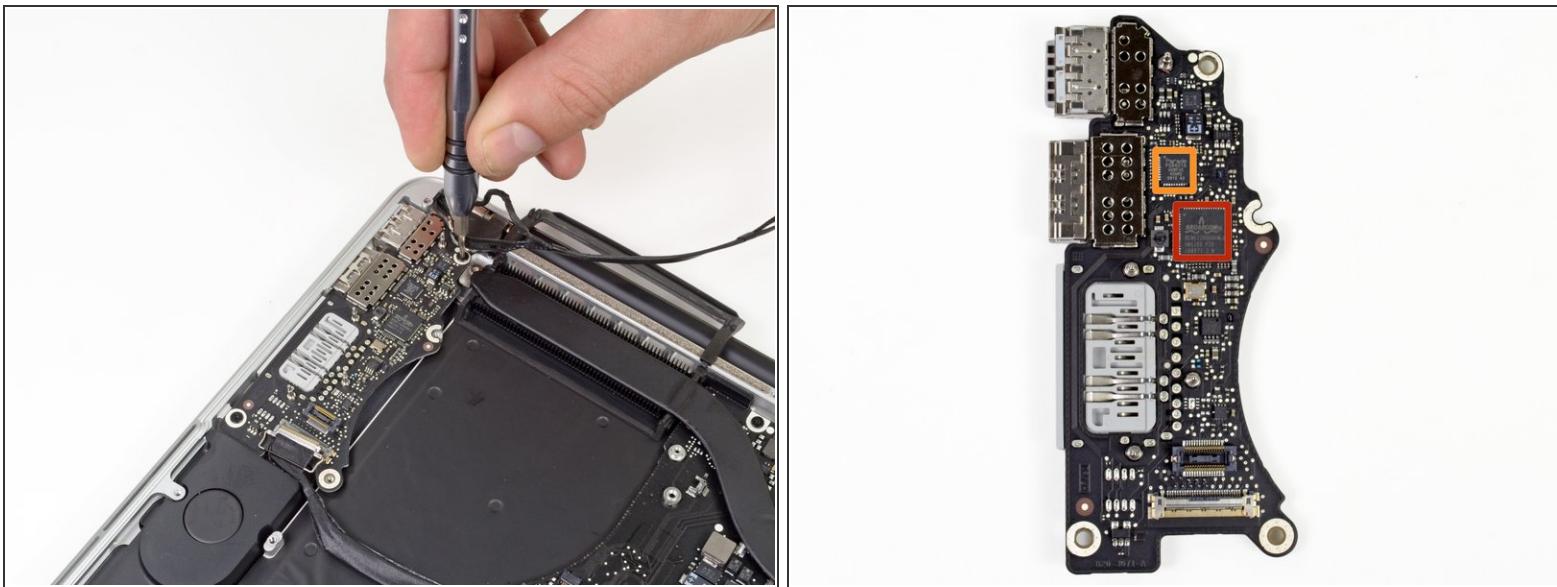
- At first, the AirPort card in the MacBook Pro looks very similar to the one that we pulled out of the [Mid 2012 MacBook Air](#).
- Closer inspection, however, reveals otherwise:
  - Broadcom [BCM4331](#) single-chip 802.11n dual-band wireless solution
  - Broadcom [BCM20702](#) single-chip Bluetooth 4.0 HCI solution with Bluetooth Low Energy (BLE) support
  - Skyworks WiFi [Block](#)
    - 2x[SE5515](#) Dual-Band FrontEnds
    - 2.4GHz [SE2598L](#) and 5GHz SE5019T transmit power amps
    - 2.4GHz [SKY65405](#) and 5GHz [SKY65404](#) reception low-noise amps

## Step 12



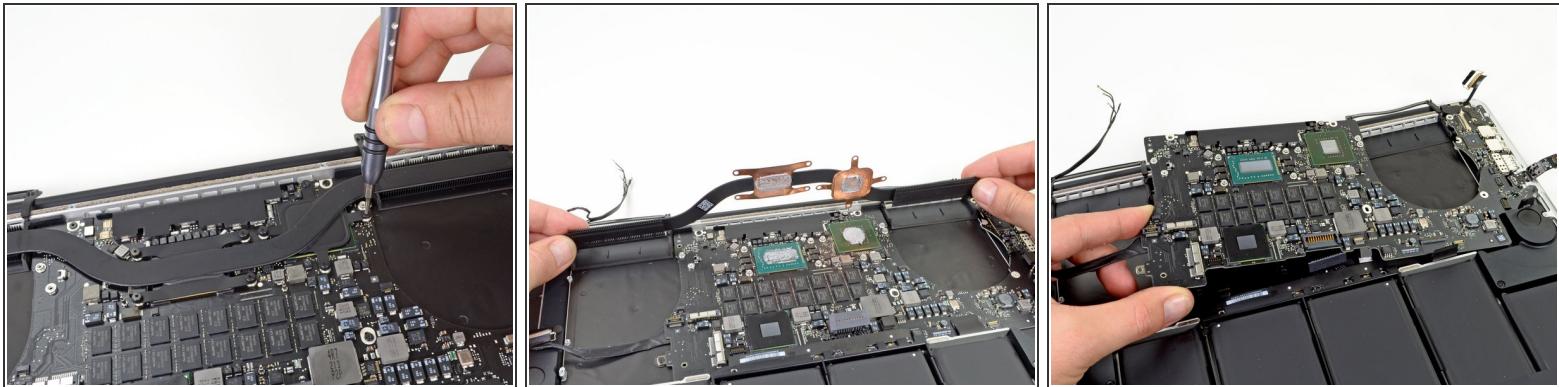
- A bracket, some antenna cables, a few screws, and finally we get to the crème de la crème, the fan with asymmetric blade spacing.
- We jumped at calling the fan inside the [Mid-2012 MacBook Air 13"](#) "asymmetrical," but when compared to the fan inside this MacBook Pro, the Air's fan is definitely more [periodic](#).
- Theoretically, the asymmetry spreads the noise produced over multiple frequencies, making it less noticeable.
- This fan has been mentioned in almost all press on the MacBook Pro with Retina display. We are surprised at how much attention a minor blade spacing change is getting. It is nevertheless a testament to how much attention Apple puts on minor details overlooked by the rest of the industry, all for the comfort of the end user.

## Step 13



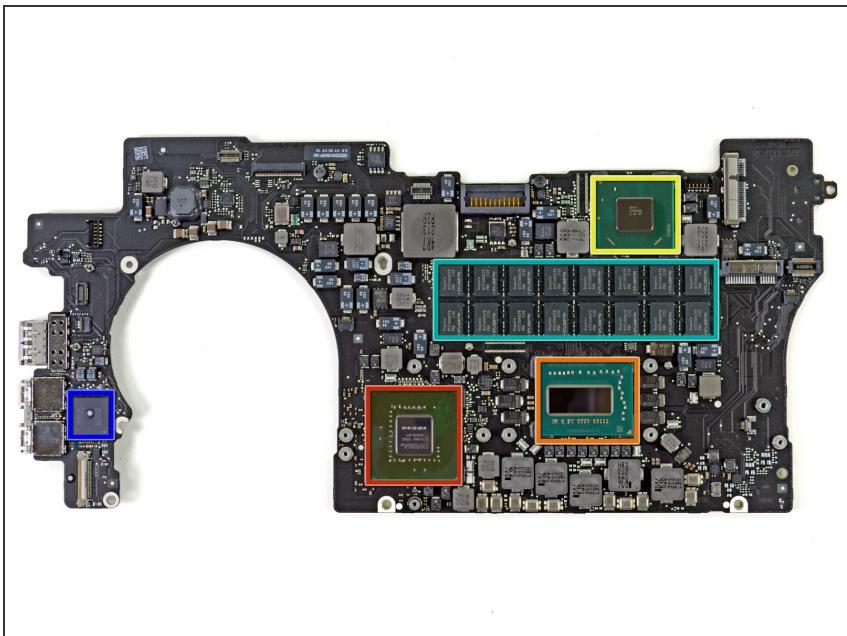
- Next up is the I/O board that plays host to one of the two USB 3.0 ports and the SD card reader.
- We love that this Pro has USB 3.0 ports on both sides. At last we resolved the issues of cables that are 12.5" too short and thumb drives, mouse dongles, and [USB toys](#) that are a centimeter too wide.
- The I/O board also plays host to a Broadcom [BCM57100](#) series Gigabit Ethernet + Memory Card reader controller. The Ethernet controller is accessible through the separately-sold Thunderbolt adapter.
- ParadeTech [PS8401A](#) HDMI Jitter Cleaning 3 Gbps HDMI repeater

## Step 14



- The next piece out is the processor and GPU heat sink and exhaust air vent assembly.
  - ★ By pushing the air through a restriction before it gets to the outermost vents, you introduce an additional pressure drop (due to fluid shear stress at the walls) that accelerates the air and pushes it out of the computer faster.
- With that last obstacle out of the way, the logic board comes out fairly effortlessly.

## Step 15



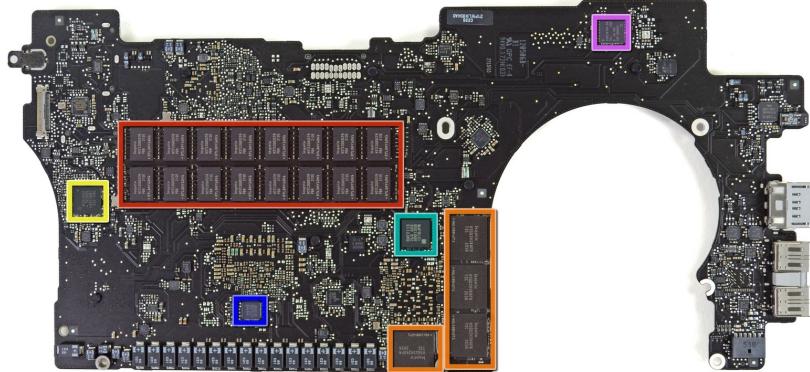
- Major players on the front of the logic board include:
  - NVIDIA [GeForce GT 650M](#) GPU
  - Intel [Core-i7 3720QM](#) 2.6 GHz processor (Turbo Boost up to 3.6 GHz) with Intel Graphics HD 4000.
  - What appears to be an Intel E208B284 Platform Controller Hub
  - Hynix [H5TC2G83CFR](#) DDR3L SDRAM
  - Intel DSL3510L Thunderbolt controller

## Step 16



- By the way: we also make software for teaching people to do things. [\*\*Dozuki\*\*](#) makes it easy to create vibrant how-to manuals.
- Dozuki is great for:
  - [\*\*Standardized work instructions\*\*](#): improve quality by documenting how to get things done, one step at a time.
  - [\*\*Building product support sites\*\*](#): make your customers love you by teaching them how to do amazing things.
  - [\*\*Training and e-learning software\*\*](#): we've used Dozuki to teach over ten million people to repair electronics.
  - [\*\*Online community platform\*\*](#): build a knowledge base of expert knowledge with Answers, the Q&A engine that drives the popular [iFixit Answers](#).

## Step 17



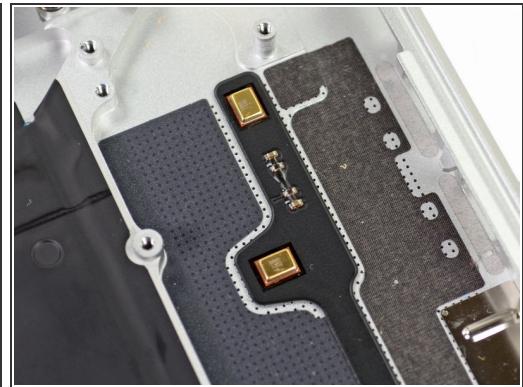
- The back of the logic board revealed:
  - Hynix [H5TC2G83CFR](#) DDR3L SDRAM 2Gbit 1600MHz chips
  - Hynix [H5GQ2H24AFR](#) - 2.5GHz 2Gbit GDDR5 memory chips
  - Texas Instruments [Stellaris LM4FS1AH](#) microcontroller with integrated ARM core
  - Renesas [R4F2113](#) H8S series CISC MCU
  - Maxim MAX15119 Apple-specific IMVP7 CPU/GPU power controller
  - Cypress Semiconductor [CY8C24794-24L](#) - a Programmable SoC

## Step 18



- The headphone jack is held in place pretty snugly, but that doesn't stop us.
- This is where you plug in headphones or speakers. We're not sure why you wouldn't want to share the magic of Apple's specially-engineered speaker system, though...

## Step 19



- ...and right on cue, out come the speakers.
- Apple claims that their custom speakers make the most of "every cubic millimeter" inside the MacBook Pro. For \$2200, we sure hope that they wouldn't be plug-and-play.
- The dual DXEC02 bottom-port Knowles MEMS microphones (with Job Id/Tape Numbers) lie underneath (or on top of?) the left speaker assembly. They use an "adaptive beam-forming algorithm" to cancel out background noise to make it easier to ~~talk to your computer~~ make calls via Skype and improve the speech recognition performance.

## Step 20



- A few cables and hefty display hinge screws hold the display assembly in place, but not for long.
- The Retina display LCD is situated in the display assembly, and it's not going anywhere. Chances are if anything related to the display goes bad, you'll be replacing the whole kit'n'caboodle.
- *(i)* Don't forget that the display assembly also includes the FaceTime Camera, WiFi antennas, and Bluetooth antennas.

## Step 21



- Someone really did not want the battery in the MacBook Pro to come out of the upper case.
- We tried valiantly with our [iFixit 6 Inch Metal Ruler](#) to free the battery from its aluminum confines, but to no avail. Rather than risk puncturing a lithium-polymer battery cell, we left the power source in place.
- To complicate matters further, the TrackPad cable lies underneath the battery. Attempting to pry the battery off the upper case could easily sever the fragile cable, which would be bad.

## Step 22



- MacBook Pro with Retina Display 15" Mid 2012 Repairability Score: **1 out of 10** (10 is easiest to repair).
- Proprietary pentalobe screws prevent you from gaining access to anything inside.
- As in the MacBook Air, the RAM is soldered to the logic board. Max out at 16GB now, or forever hold your peace—you can't upgrade.
- The proprietary SSD isn't upgradeable either (yet), as it is similar but not identical to the one in the Air. It is a separate daughter card, and we're hopeful we can offer an upgrade in the near future.
- The lithium-polymer battery is glued rather than screwed into the case, which increases the chances that it'll break during disassembly. The battery also covers the trackpad cable, which tremendously increases the chance that the user will shear the cable in the battery removal process.
- The display assembly is completely fused, and there's no glass protecting it. If anything ever fails inside the display, you will need to replace the entire extremely expensive assembly.