MacBook Pro (13-inch, M1, 2020)

Repair Manual

Contents

Introduction

This manual includes technical instructions for replacing genuine Apple parts in Mac and is intended for individual technicians with the knowledge, experience, and tools required to repair electronic devices.

Important

- Read the entire manual first. If you're not comfortable performing the repairs as instructed in this manual, don't proceed.
- Always use the latest version of this document available at support.apple.com/en_US/manuals/mac+repair+manual.

Warning

Failure to follow the repair instructions or to use genuine Apple parts or proper tools may cause fire or other safety issues and lead to personal injury or death.

Caution

Failure to follow the repair instructions or to use genuine Apple parts or proper tools may damage the Mac, parts, or other property, or compromise the device's functionality.

Warranty information

Damage caused by repairs performed outside of Apple or the Apple Authorized Service Provider network is not covered by Apple's warranty or AppleCare plans. Such damage may cause future repairs to be subject to out-of-warranty costs or render the device ineligible for future repairs by Apple or Apple Authorized Service Providers.

Tools and parts

Ordering tools and parts

You can learn how to order genuine Apple parts and tools at support.apple.com/self-service-repair. During the purchase process, enter the manual ID **GBTWXF** to indicate that you've read this manual in its entirety and agree that you have the knowledge and experience to perform your intended repair.

Software tools

Apple Diagnostics can check your Mac for hardware issues.

A System Configuration step may be required at the end of your repair. System Configuration is a postrepair software tool that completes the repair for genuine Apple parts. Running System Configuration has a number of purposes that vary based on the part replaced.

What System Configuration does	Why it's important
Updates replacement logic board with device serial number	Replacement logic boards must be updated with your device's serial number to ensure that Apple Pay, FaceTime, iMessage, and iCloud services, such as Find My, can communicate safely and securely with your device.
Transfers factory calibration values	Certain parts like displays, cameras, and ambient light sensors have calibration values that are customized to each individual part during manufacturing. Transferring these values ensures maximum performance and quality after a repair.
Links Secure Enclave and biometric authentication parts	After repair of a logic board or a biometric authentication part (Touch ID), linking the biometric sensors to the Secure Enclave on the logic board is required to ensure device security.
Ensures repair integrity	After a hardware repair, software checks are performed to ensure repair integrity. Repair integrity means that a genuine Apple part has been correctly installed.
Assigns wireless region	To comply with regional communications regulations, a wireless region must be assigned to your logic board.
Updates firmware	Keeping firmware up to date ensures that the device has all the latest security and performance features.

System Configuration requires a strong Wi-Fi network capable of 1.0 Mbps download and upload speeds, with less than 400 ms latency and less than 2% packet loss. Estimated data usage to run System Configuration is 6–22 MB.

The device must be running the latest version of macOS and not a beta version.

Learn how to initiate the System Configuration process at support.apple.com/self-service-repair.

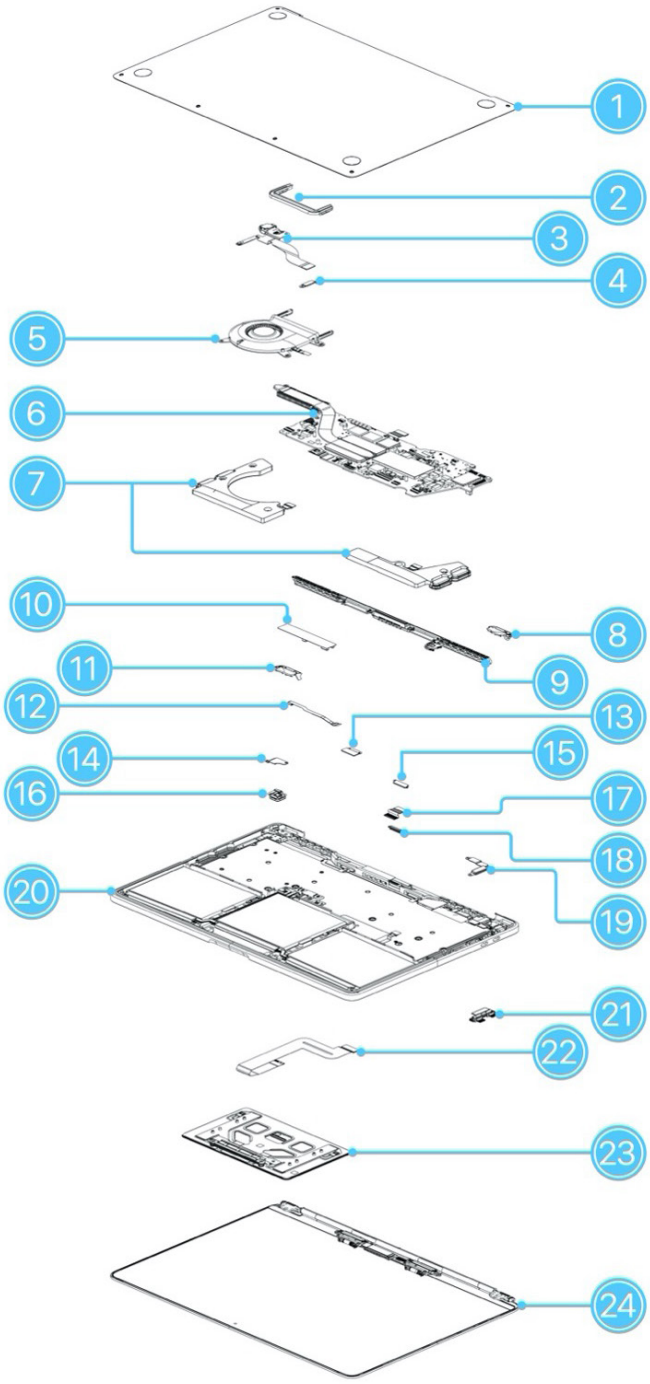
Alerts

Failure to follow alerts could result in fire, injury, data loss, or damage to the device, parts, or other property.

Danger	Instructions for reducing risk of electric shock and electrocution
Warning	Instructions for reducing risk of personal injury
Caution	Instructions for reducing risk of data loss or device hardware damage
Important	Supplemental information for successfully completing procedures; neither a Warning nor a Caution

Exploded View and Orderable Parts

This section shows parts, part names, and part numbers for MacBook Pro (13-inch, M1, 2020).



Part Name	Number
1. Bottom case	923-04714, space gray 923-04715, silver
2. Thermal duct	923-04186
3. Audio board	923-05048, space gray 923-05049, silver
4. Audio board connector cowling	923-05237
5. Fan	923-05206
6. Logic board	661-17057, M1, 8-core CPU, 8-core GPU, 8 GB, 256 GB 661-17058, M1, 8-core CPU, 8-core GPU, 8 GB, 512 GB 661-17059, M1, 8-core CPU, 8-core GPU, 8 GB, 1 TB 661-17060, M1, 8-core CPU, 8-core GPU, 8 GB, 2 TB 661-17061, M1, 8-core CPU, 8-core GPU, 16 GB, 256 GB 661-17062, M1, 8-core CPU, 8-core GPU, 16 GB, 512 GB 661-17063, M1, 8-core CPU, 8-core GPU, 16 GB, 1 TB 661-17064, M1, 8-core CPU, 8-core GPU, 16 GB, 2 TB
7. Speakers	923-04169
8. Right display hinge cover	923-04181
9. Vent/antenna module	923-05050
10. Battery management unit cover	923-04323
11. Left display hinge cover	923-04182
12. Battery management unit flex cable	923-01448
13. Trackpad connector cowling	923-05233
14. Touch ID board connector cowling	923-05234
15. Embedded DisplayPort connector cowling	923-05262
16. Touch ID board	661-18346
17. Embedded DisplayPort flex cable with connector cowling	923-05384
18. Embedded DisplayPort flex cable cowling	923-05235
19. L-shaped cowling	923-05261

Part Name	Number
20. Top case with battery and keyboard Read the Important alert below to ensure that you order the correct top case.	661-18432, space gray 661-18433, silver
21. Input/output board	923-05220
22. Trackpad flex cable	923-05236
23. Trackpad	661-18429, space gray 661-18430, silver
24. Display	661-17548, space gray 661-17549, silver
Part Name (Not Shown)	**Number**
Polyester film	923-04328
Touch ID board flexible cowling	923-04171

Important

The English (US) top case part number begins with 661. Other regional top case part numbers also begin with 661, but they include a language prefix. For example, the Italian top case part number begins with T661. To determine the correct language prefix, identify your keyboard language by country or region. Then identify the correct country code from the language prefix list below:

AB	Arabic	GR	Greek	RS	Russian
B	British	H	Norwegian Bokmal	S	Swedish
BG	Bulgarian	HB	Israeli	SF	Swiss French
C	Canadian French	IS	Icelandic	SL	Slovak
CH	Chinese (Pinyin)	J	Japanese	T	Italian
CR	Croatian	KH	Korean	TA	Chinese (Zhuyin)
CZ	Czech	LA	Latin America	TH	Thai
D	German	MG	Hungarian	TQ	Turkish-Q
DK	Danish	N	Dutch	TU	Turkish-F
E	Western Spanish	PO	Portuguese	Z	English International
F	French	RO	Romanian		

Screws

Caution

- Save undamaged screws and cowlings for reassembly.
- Note the location of screws and cowlings during removal. Then organize them to ensure that you reinstall them in the correct location.
- Both overtightened screws and loose screws can damage parts.

923-03540
Torx® T5

Speakers (5)

923-05199
Torx T3

eDP flex cable with connector cowling (2)

923-05200
Pentalobe

Bottom case, rear corners, space gray (2)

923-05201
Pentalobe

Bottom case, front corners, space gray (2)

923-05202
Pentalobe

Bottom case, middle, space gray (2)

923-05203
Pentalobe

Bottom case, rear corners, silver (2)

923-05204
Pentalobe

Bottom case, front corners, silver (2)

923-05205
Pentalobe

Bottom case, middle, silver (2)

923-05240
Torx T5

Logic board to top case, upper right (1)

923-05241
Torx T5

BMU (1)

923-05242
Torx T3

Audio board to top case (2)

923-05243
Torx T3

Display hinge covers (4)

923-05245
Torx T5

TCON board (4)

923-05246
Torx T3

eDP flex cable cowling (2)

923-05247
3 mm hex

Heat sink arm (1)

923-05249
Torx T5

I/O board (2)

923-05250
Torx T5

Logic board to top case, front (3)

923-05251
Torx T3

Spring tensioners (4)

923-05252
Torx T5

Logic board to antenna coaxial cable grounding clip (1)

923-05253
Torx T3

L-shaped cowling (3)
Touch ID board connector cowling, upper right (1)

923-05254
Torx T5

Trackpad connector cowling (2)

923-05255
Torx T5

Audio board connector cowling, rear (1)

923-05256
Torx T5

Audio board connector cowling, front (1)

923-05257
Torx T5

Trackpad, side (8)

923-05258
Torx T5

Fan (4)

923-05259
1IPR

Vent/antenna module (12)

923-05260
Torx T3

eDP connector cowling to TCON (2)

923-05263
Torx T3

Touch ID board connector cowling, lower left (1)

923-05264
Torx T3

Touch ID board flexible cowling, corners (4)

923-05265
Torx T3

Touch ID board flexible cowling, middle (2)

923-05266
Torx T8

Display hinges to top case (6)

923-05270
Torx T5

Trackpad, middle (2)

Tools

Tools with part numbers are available for purchase from the Self Service Repair Store. Tools without part numbers can be purchased from electronics supply retailers.

3 mm hex nut driver

923-02995
Adjustable torque driver (10–34 Ncm)

923-01322
Antenna tool

923-01318
Battery cover

076-00290
Bottom case removal kit[1]

Compressed air

923-01368
Cut-resistant gloves

EarPods with 3.5 mm headphone plug

ESD mat

ESD-safe cleaning solution

ESD-safe tweezers

ESD wrist strap with clip or plug

Ethanol wipes[2]

Fireproof enclosure

923-02998
Gap offset kit

Heat-resistant gloves

IPA wipes

922-1731
Kapton tape

923-01803
Keycap lever

Magnetizer

Microterry polishing cloth

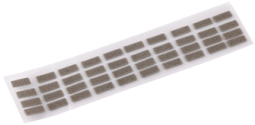
Needle-nose pliers

922-5065
Nylon probe (black stick)

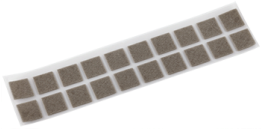
923-0731
Pentalobe screwdriver

Permanent marker

923-01800
Precut adhesive strips (1 x0.5)



923-01801
Precut adhesive strips (1x1)



Safety glasses with side shields

Sand[3]

Sand container[4]

Sticky notes (3 by 3 inches)

922-8252
Suction cups

923-0448
Torque driver
(blue, 0.65 kgf cm)

923-0247
Torx security bit

Torx T3 screwdriver

923-02996
Torx T5 bit

Torx T5 screwdriver

Torx T8 screwdriver

923-03032
Touch ID alignment kit

661-06670
USB-C charge cable

[1] The bottom case removal kit includes the bottom case fixture, C-clamps, and cut-resistant gloves.
[2] Ethanol wipes must contain at least 90% ethanol and no additives except isopropyl alcohol.
[3] Clean, dry, untreated sand (8–10 cups)
[4] Sand container (wide-mouthed, quick pour, nonbreakable plastic container with a flip-top lid)

Battery Safety

Warning

- This device contains a built-in lithium-ion rechargeable battery with soft battery cells. Battery safety is the number one concern when repairing a device with a built-in lithium-ion battery.
- Only technicians with the knowledge, experience, and tools required to repair electronic devices should replace a battery.
- Improper battery replacement, improper handling of parts, failure to discharge the battery before repair, or failure to follow the provided instructions could cause battery overheating, swelling, venting, leaking, or a battery thermal event. These events could result in fire, injury, death, data loss, or damage to the device, parts, or other property.
- To avoid these potentially harmful events, follow the battery safety guidelines and work in a safety-focused workspace with the tools listed below. It's important to be prepared for all possible outcomes.

How to set up a workspace for battery safety

Tools

- Clean, dry, untreated sand (8–10 cups)
- Sand container (wide-mouthed, quick pour, nonbreakable plastic container with a flip-top lid)
- Heat-resistant gloves
- Safety glasses with side shields
- ESD-safe cleaning solution
- Fireproof enclosure

Workspaces used to repair Apple devices should meet the following criteria:

- Nonflammable and electrostatic discharge (ESD)-safe work bench
- At least 2 feet away from paper and other combustible materials
- Sand container within reach (2 feet) on one side of the workspace, not above the workspace
- Adequate ventilation
- Within 20 feet of a fireproof enclosure. Don't store combustible or flammable materials in the enclosure. Ensure that the enclosure remains empty.

Warning

How to handle a battery thermal event

A battery thermal event is a rapid chemical chain reaction that occurs inside a battery cell. The energy stored in the battery is released suddenly, which can cause outgassing and fire. A battery thermal event can be triggered by physical damage to the battery, improper replacement or repair, or temperatures outside the battery's operating range.

Act immediately if you notice any of the following signs of a battery thermal event:

- The lithium-ion battery or a device that contains one begins to smoke or emit sparks or soot.
- The battery pouch suddenly and quickly puffs out.
- The lithium-ion battery or a device that contains one begins to emit hissing or popping sounds.

Do smother the battery or device immediately with plenty of clean, dry sand. Dump the sand all at once. Timing is critical — the faster you pour all the sand, the sooner the reaction will be contained.

Do contact local fire authorities if further assistance is needed.

Do leave the room for 30 minutes after the reaction is contained. Ventilate the area. Don't return until the area is clear of smoke.

Do wait 30 minutes before touching the device. Wear the heat-resistant gloves and safety glasses with side shields to remove the device from the sand. Then place the device into the fireproof enclosure. Leave it in the enclosure for at least 2 hours.

Do wipe the affected area with water first. Then wipe the area with an ESD-safe cleaning solution.

Do dispose of the damaged battery or device (including any debris removed from the sand) according to local environmental laws and guidelines.

How to handle batteries

Discharge the battery

Warning

Fully discharge the battery before you begin a repair. A discharged battery is less susceptible to a battery thermal event. If you can't determine the battery level, don't repair the device.

The following actions will help to discharge the battery:

- Disconnect the power cable.
- Increase display brightness to the highest setting.
- Turn on Wi-Fi and Bluetooth.
- Open the FaceTime app or Photo Booth app to turn on the camera.
- Play a video from the local drive or a streaming service.

Use a battery cover

Avoid damaging the battery by performing the following actions:

- Immediately after removing the bottom case, follow the instructions to attach the battery cover and disconnect the battery from the logic board.
- Always keep the battery cover on the battery when it's exposed.
- Only remove the battery cover immediately before you install the bottom case, unless otherwise instructed.

Best practices

- To avoid noxious fumes or a battery thermal event, don't puncture, strike, or crush a lithium-ion battery or a device that contains one.
- Keep your workspace clear of foreign objects and sharp materials.
- Be careful when using sharp tools near the battery.
- Don't leave loose screws, extra screws, or small parts inside the device.
- Don't use tools that conduct electricity.
- Don't throw or drop the battery.
- Don't expose the battery to excessive heat or sunlight, or temperatures outside the battery's operating range.
- Handle and dispose of waste batteries in accordance with local laws and regulations.

First Steps

Always perform the following steps before starting a repair:

- Back up the Mac.
- If replacing the logic board or Touch ID board, turn off Find My Mac. Choose Apple Menu > System Preferences > Apple ID. Select iCloud in the sidebar. Then deselect the Find My Mac checkbox. If you're unable to access the Apple menu, continue performing the following steps.
- Discharge the battery fully.
- Turn off the Mac.
- If you were unable to turn off Find My Mac from the Apple menu, go to iCloud.com/find on a different device. Select All Devices. Select the device you want to remove. Then select Remove from Account.
- Unplug the power cable from the electrical outlet. Keep the power cable unplugged while the device is being repaired.
- Disconnect all cables.
- Remove all cases and covers.
- Clear and clean your workspace.
- Put on an ESD wrist strap and attach it to a properly grounded ESD mat.

Caution

ESD (electrostatic discharge, or the release of static electricity) can damage electronic components.

Be aware of the following while performing a repair:

- The manual for this model may show images of other models, but the procedures are the same. Ensure that you use the correct tools for the model you're repairing.
- Take your time. Thoroughly read all instructions and alerts.
- Magnetizing the screwdrivers will make it easier to work with small screws.
- Use only Kapton tape to secure cables and keep them out of the way when removing and reinstalling parts.
- The end of each flex cable must align with its connector. Press the end of each flex cable to its connector until it clicks to ensure that it's secure.

Warning

Avoid damaging the battery by performing the following actions:

- Immediately after removing the bottom case, follow the instructions to attach the battery cover and disconnect the battery from the logic board.
- Always keep the battery cover on the battery when it’s exposed.
- Set aside all parts and screws removed during the repair and account for them at the end of the repair.
- Only remove the battery cover immediately before you install the bottom case, unless otherwise instructed.

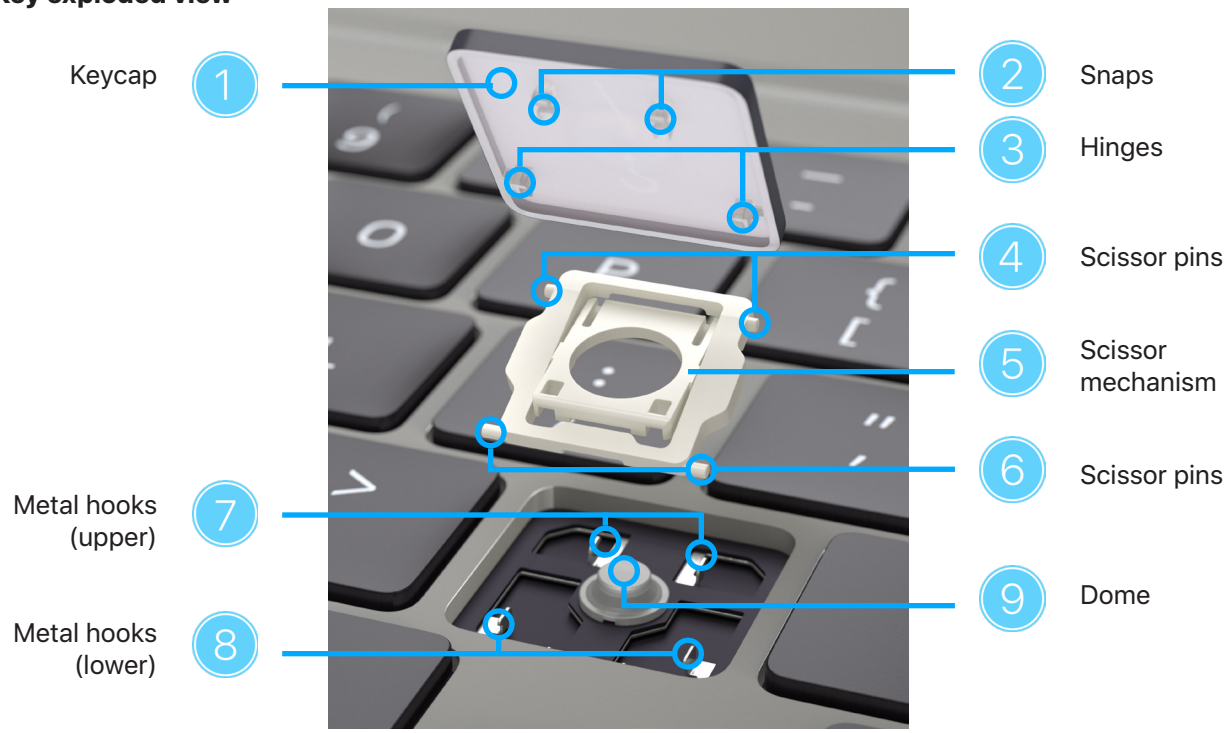
Keys

Before You Begin

Before you repair or replace a key, you need to:

- Know the different key parts — review the exploded view on this page.
- Identify your keyboard design.
- Identify which type of key you're replacing.
- Determine during the keycap removal procedure whether you need to also replace the key's scissor mechanism.

Key exploded view



Tools

- Compressed air
- ESD-safe tweezers
- Keycap lever (Some link bar keycaps require two keycap levers for removal)
- Microterry polishing cloth
- Needle-nose pliers
- Nylon probe (black stick)
- Precut adhesive strips (1x0.5)
- Precut adhesive strips (1x1)

Clean the keyboard thoroughly with compressed air before you replace a missing keycap or a keycap on an unresponsive key.

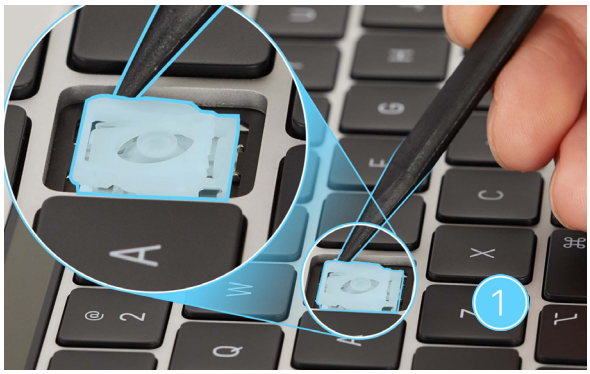
Caution

- The adhesive on the precut adhesive strips that you'll use to remove keycaps is very strong. If you accidentally place the keycap lever on the wrong keycap, you must remove and replace that keycap.
- An adhesive strip can be used only once. You must be replace the adhesive strip for every keycap removal.
- Always replace a keycap that you removed with a new one. Don't reuse keycaps.
- Use gentle pressure on the keycap to activate the adhesive. Don't bend the top case when you press the keycap lever onto the keycap.
- If a keycap replacement doesn't resolve the issue, replace the top case.

Important

Before you replace a keycap, inspect the scissor mechanism, the dome, and the metal hooks inside the well of the keycap:

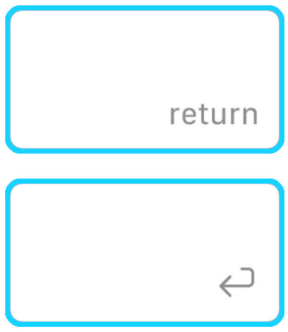
- Ensure that the scissor mechanism is installed in the well of the keycap. If not, install a replacement scissor mechanism.
- Use the black stick to gently move the scissor mechanism up and down (1). Verify that the scissor mechanism moves easily and lies flat when released. If it does not, replace the scissor mechanism.
- Press and release the dome (2) — it should spring back upright. If the dome is damaged or not centered, replace the top case.
- If a lower hook is bent (3), try to bend it back to a 90-degree angle.
- If an upper hook is bent (4), use needle-nose pliers to straighten it.
- If any lower hook or upper hook is broken or bent beyond repair, replace the top case.



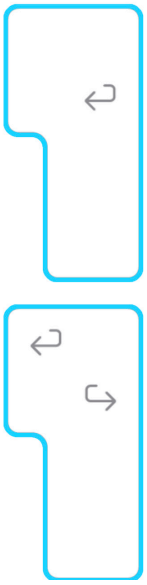
Keyboard Identification

Determine your keyboard design by comparing your Return key to the images:

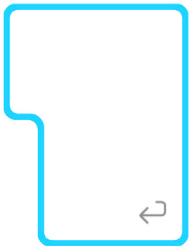
ANSI



ISO



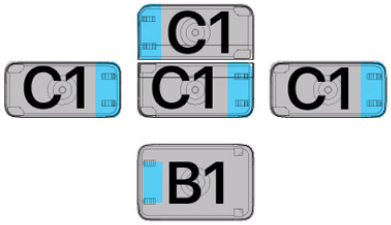
JIS



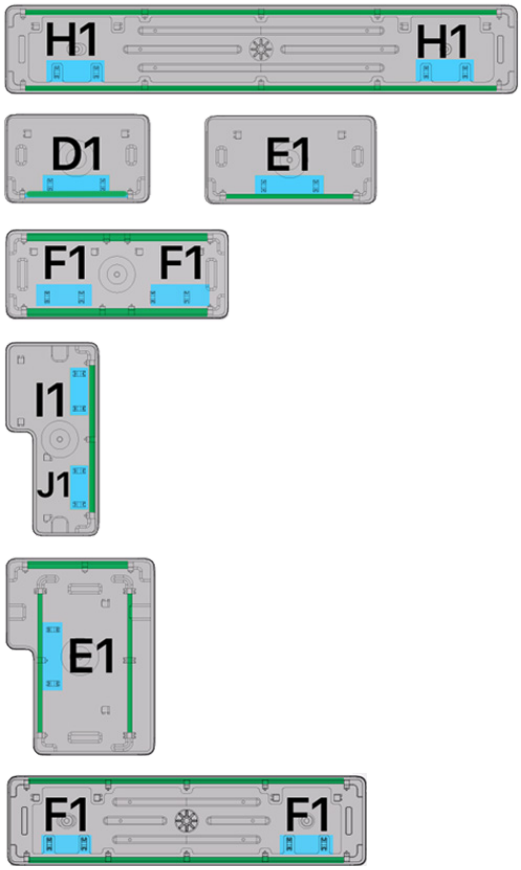
Key Identification

1x1 Keys

1x0.5 Keys



Link Bar Keys

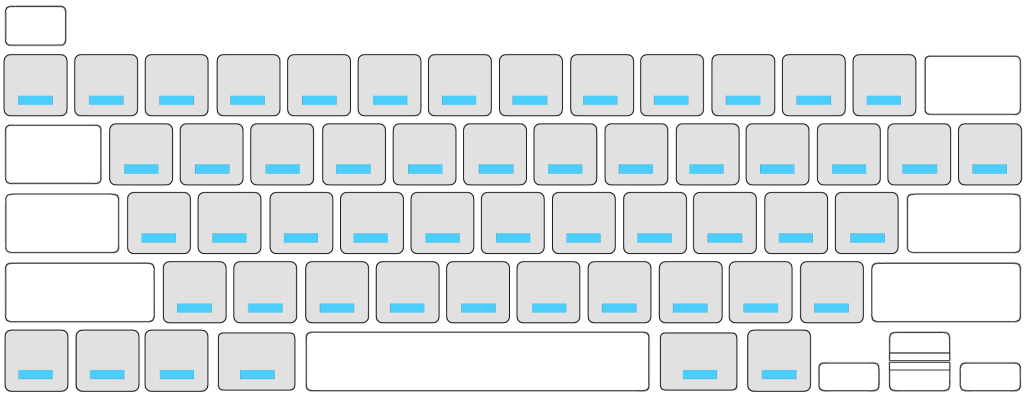


1x1 Keys

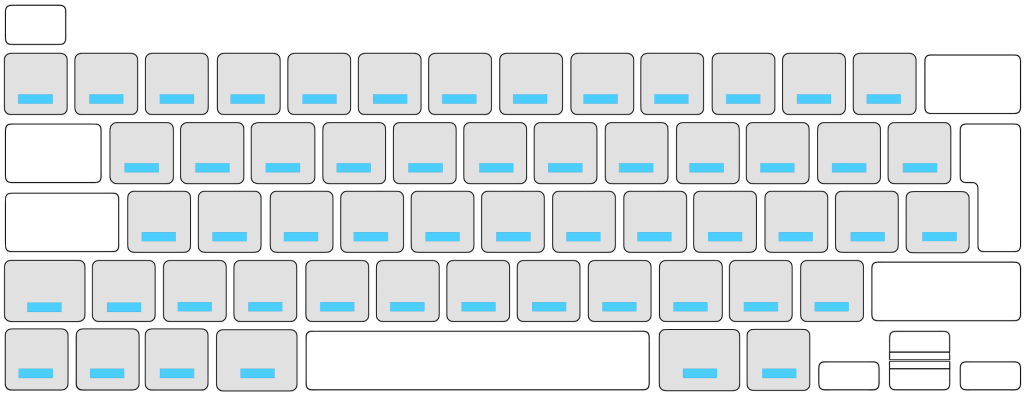
Maps

The 1x1 keys are highlighted, and the blue bars show the location of snaps.

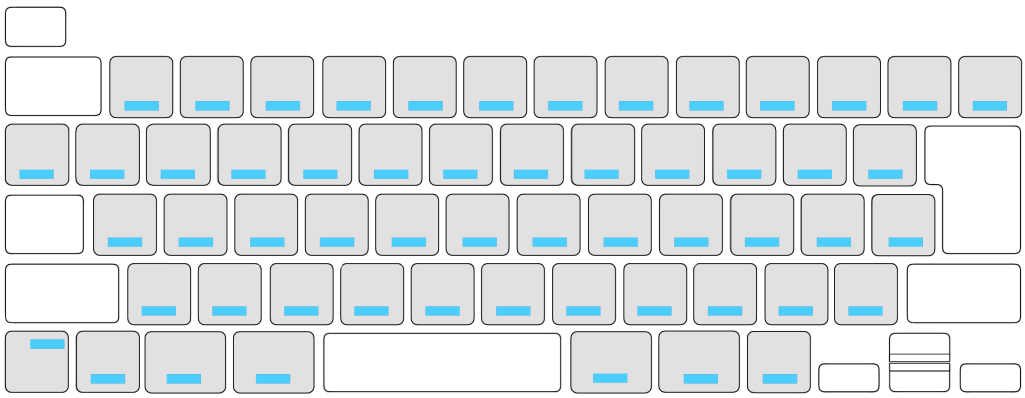
ANSI



ISO

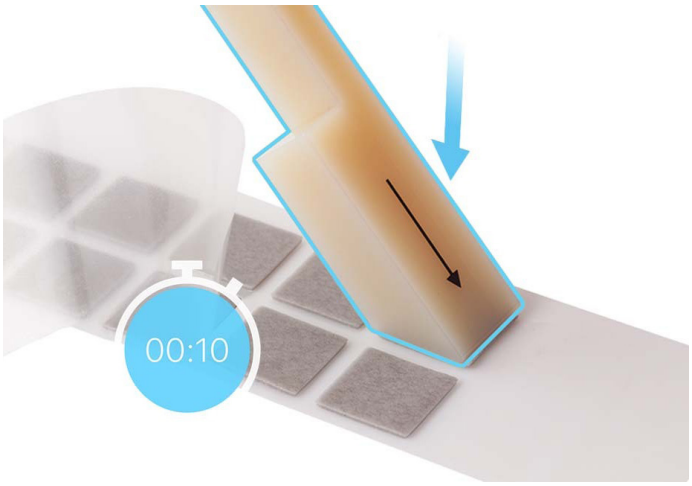


JIS



Removal

1. Peel the frosted liner from one side of the 1x1 precut adhesive strips. Press and hold the large end of the keycap lever on the adhesive for 10 seconds.



2. Lift the keycap lever and the adhesive to separate them from the white liner.

3. Lightly press the large end of the keycap lever and the adhesive onto the key.

Important

- The arrow on the lever must point to the hinged side of the keycap, which is opposite of the side that snaps onto the keyboard.
- Use the map for the 1x1 keys to identify the location of each snap.
- On the JIS keyboard, the snaps for the 1x1 Caps Lock key are on the display side of the keycap.

4. Hold the keycap lever on the key for 10 seconds to activate the adhesive.

5. Tilt up the keycap lever in the direction of the arrow until you feel the snaps release.

Caution

To avoid damaging the scissor mechanism, don't tilt up the keycap more than 20 degrees.

6. Lift the keycap off the keyboard.

7. Use the black stick to gently move the scissor mechanism up and down. Ensure that the scissor mechanism moves easily and lies flat when released. If it does not, replace the scissor mechanism.

8. Inspect the well of the keycap:
    - Use the black stick to press and release the dome through the top of the scissor mechanism — the dome should spring back upright. If the dome is damaged or not centered, replace the top case.
    - If a lower hook is bent, try to bend it back to a 90-degree angle.
    - If an upper hook is bent, use needle-nose pliers to straighten it.
    - If any lower hook or upper hook is broken or bent beyond repair, replace the top case.
9. Use compressed air to clean the well of the keycap.

    Note: If compressed air doesn't dislodge visible debris, use the black stick to gently dislodge it.

10. Remove the keycap and adhesive from the keycap lever. Discard the keycap and adhesive.

Reassembly

1. Gently push the hinged side of the replacement keycap into the hinged side of the well at a 15-degree angle until the hinges engage.

2. Gently press the top of the keycap to engage the snaps.

3. Tap the key repeatedly to check that it springs back each time. Compare the response of the replacement keycap with the response of the keycaps around it.

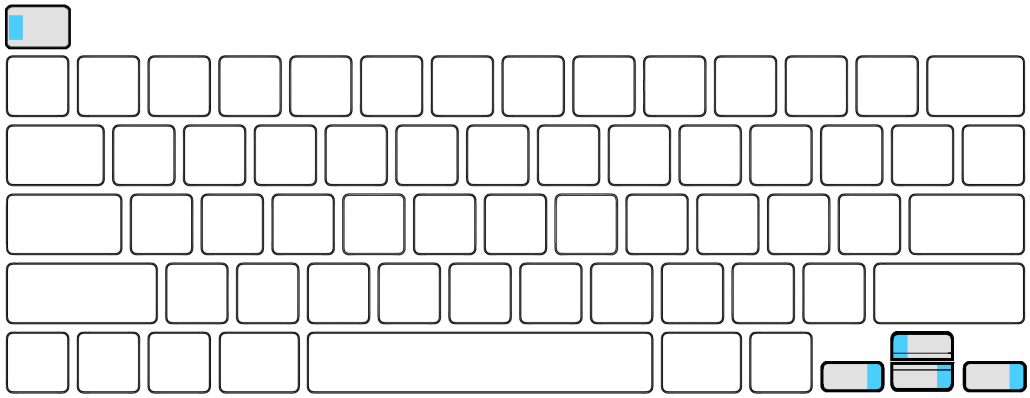
4. If the keycap doesn't appear to be correctly installed, repeat all removal and reassembly steps with a new keycap.

1x0.5 Keys

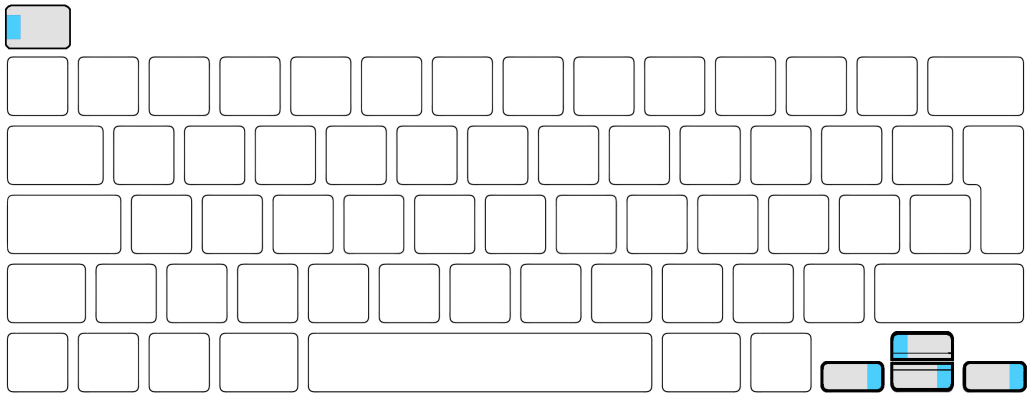
Maps

The Escape key and Arrow keys are highlighted, and the blue bars show the location of snaps.

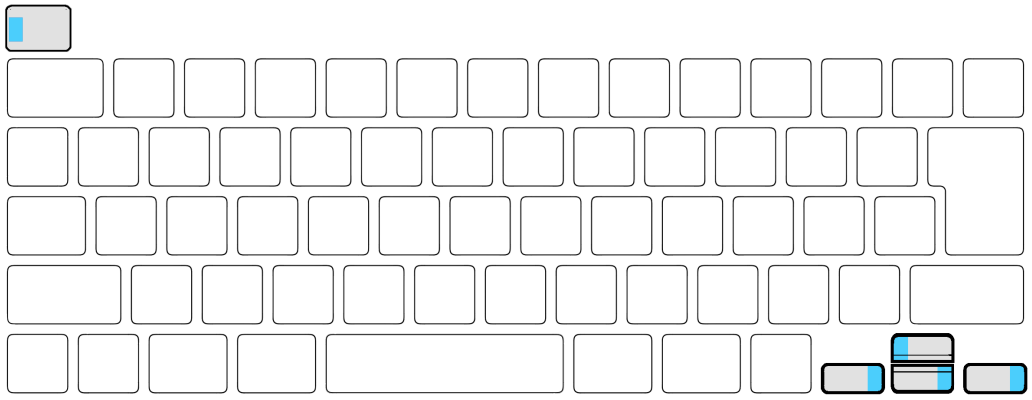
ANSI



ISO



JIS

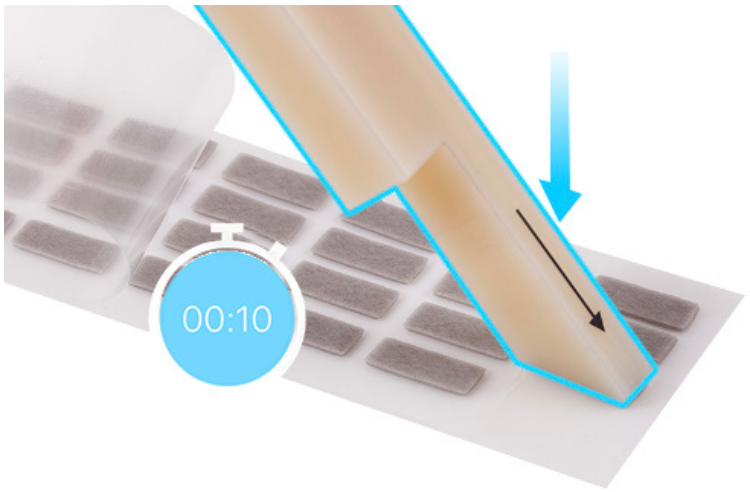


Removal

Important

- The hinges of the bottom-row arrow keys are on the left. Point the arrow on the keycap lever toward the left.
- The hinges of the Up Arrow key and Escape key are on the right. Point the keycap lever arrow toward the right.

1. Peel the frosted liner from one side of the 1x0.5 precut adhesive strips. Press and hold the small end of the keycap lever on the adhesive for 10 seconds.



2. Lift the keycap lever and the adhesive to separate them from the white liner.

3. Lightly press the small end of the keycap lever and the adhesive onto the key.

Important

Point the arrow on the lever toward the hinged side of the keycap, which is opposite of the side that snaps onto the keyboard. You can find the location of the snaps at the 1x0.5 Key Maps.

4. Hold the keycap lever on the key for 10 seconds to activate the adhesive.

5. Push the keycap lever toward the arrow and tilt up the lever until you feel the snaps release.

Caution

To avoid damaging the scissor mechanism, don't tilt up the keycap more than 20 degrees.

6. Push the keycap lever toward the hinge to release the keycap (1). Lift up the keycap lever to release the keycap from the snaps (2).

7. Inspect the scissor mechanism and well of the keycap:
   - Use the black stick to gently move the scissor mechanism up and down (1). Verify that the scissor mechanism moves easily and lies flat when released. If it does not, replace the scissor mechanism.
   - Use the black stick to press and release the dome through the top of the scissor mechanism — the dome should spring back upright. If the dome is damaged or not centered, replace the top case.
   - If a lower hook is bent, try to bend it back to a 90-degree angle.
   - If an upper hook is bent, use needle-nose pliers to straighten it.
   - If any lower hook or upper hook is broken or bent beyond repair, replace the top case.

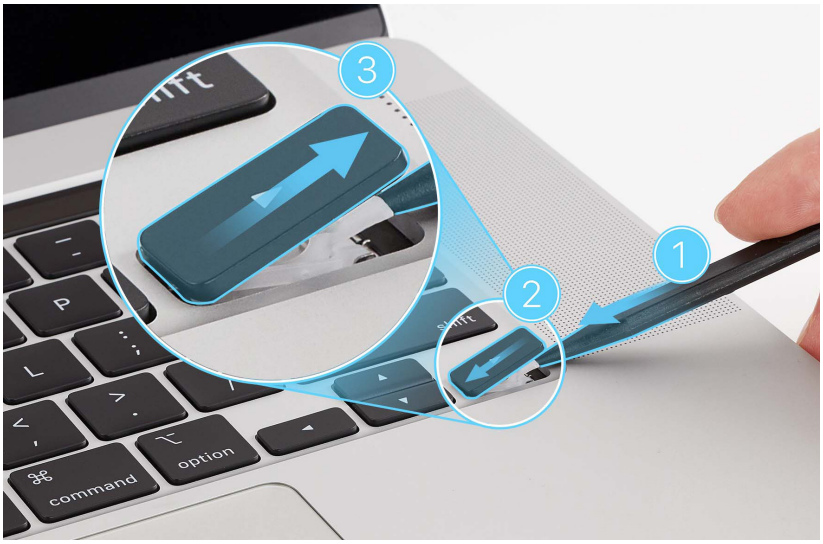
8. Use compressed air to clean the well of the keycap.

   Note: If compressed air doesn't dislodge visible debris, use the black stick to gently dislodge it.

9. Remove the keycap and adhesive from the keycap lever. Discard the keycap and adhesive.

Reassembly

1. Use the black stick to lift the scissor slightly (1). Insert the hinged side of the replacement keycap into the well at a 15-degree angle as shown (2). Slide the keycap back toward the snap to engage the hinge (3).



2. Remove the black stick and gently press the top of the keycap to engage the snaps.

3. Tap the key repeatedly to check that it springs back each time. Compare the response of the replacement keycap with the response of the keycaps around it.

4. If the keycap doesn't appear to be correctly installed, repeat all removal and reassembly steps with a new keycap.

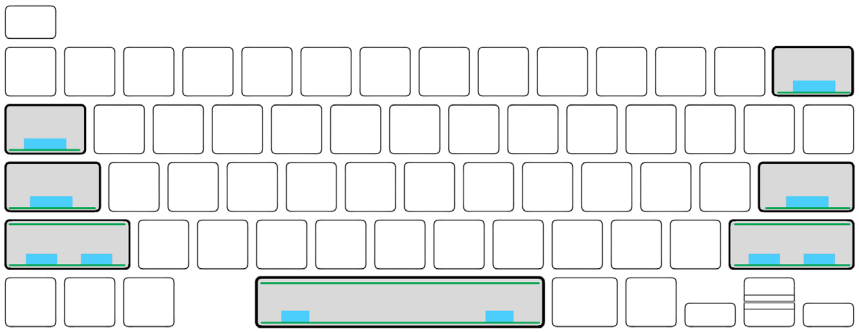
Link Bar Keys

Maps

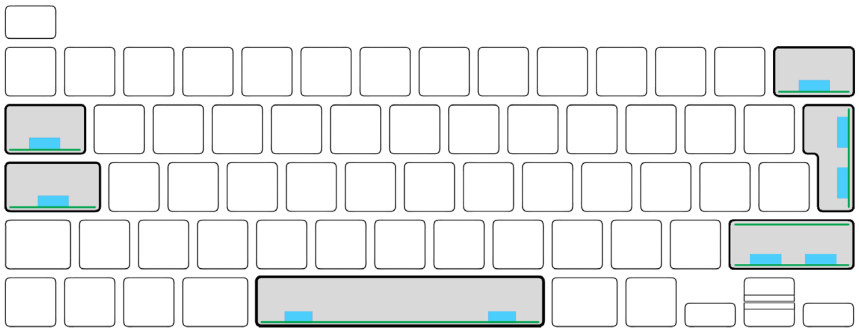
Link Bar keys are highlighted and include the following:

- Space Bar
- Shift
- Tab
- Delete
- Caps Lock
- Return

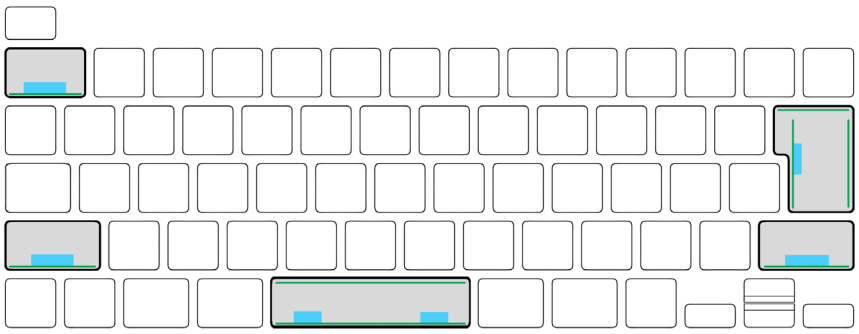
ANSI



ISO



JIS



Note:

- Blue bars show the location of snaps.
- Green lines show the location of link bars.

Removal

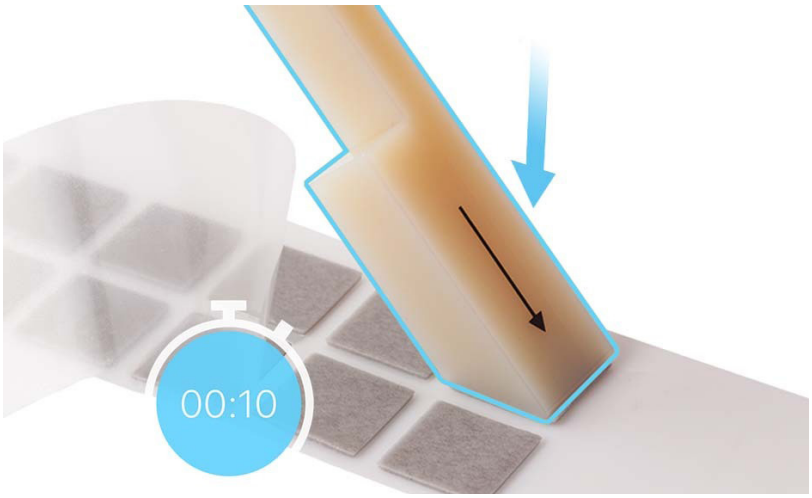
Important

Use two keycap levers for keys with two snaps. You can see these key types in the Link Bar Key Maps.

Note: This procedure shows the removal and reassembly of the Space bar, but the steps are the same whether a link bar key requires using one or two keycap levers. Notes and alerts describe how the procedures vary for the other types of link bar keys.

1. Identify the location of the snaps under the key that you need to replace using the Link Bar Key Maps.

2. Peel the frosted liner from one side of the 1x1 precut adhesive strips. Press and hold the large end of the keycap lever on the adhesive for 10 seconds. Lift the keycap lever and the adhesive to separate them from the white liner.



3. Place the keycap lever on its side. Repeat step 2 with the second keycap lever, then continue to step 4.

4. Align the keycap levers over the snaps.

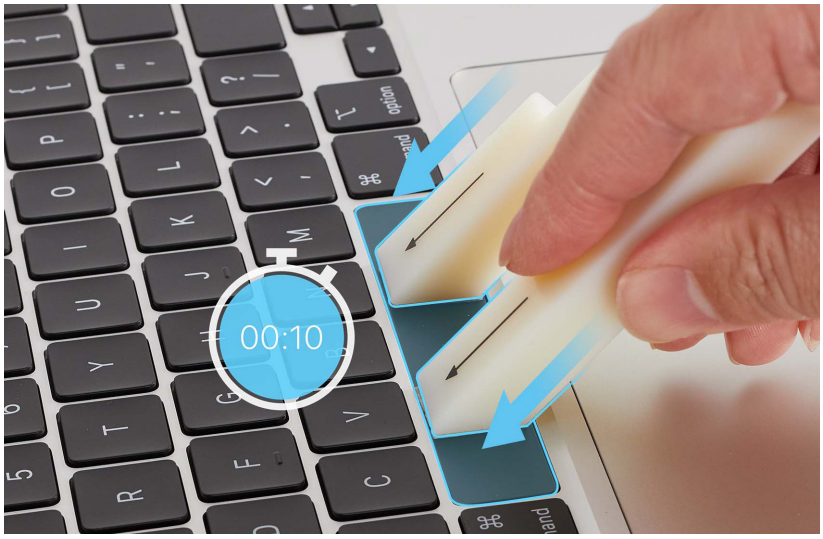
5. Lightly press the adhesive ends of the keycap levers onto the key.

Important

Point the arrow on a lever to the hinged side of the keycap, which is opposite of the side that snaps onto the keyboard. You can find the location of the snaps in the Link Bar Key Maps.

Note: The JIS Return key has three link bars and one side snap. Position the keycap lever so that the arrow points toward the link bar on the right side of the keyboard.

6. Hold the keycap levers and adhesive on the key for 10 seconds to activate the adhesive.



7. Tilt up the keycap levers in the direction of the arrows until you feel the snaps release.

Caution

For a key with one link bar, don't tilt up the keycap more than 20 degrees.

Important

The bottom link bar on larger keys might stick to the keycap during removal. If this happens, hold the two keycap levers and insert the black stick between the keycap and the bottom link bar. Use the black stick to release the link bar into the keycap well.

8. Remove the keycap.

9. Inspect the scissor mechanisms and keycap wells.
   - Use the black stick to gently move each scissor mechanism up and down. Verify that each scissor mechanism moves easily and lies flat when released. If it does not, replace the scissor mechanism.
   - Use the black stick to press and release each dome through the top of the scissor mechanism — a dome should spring back upright. If a dome is damaged or not centered, replace the top case.
   - If a lower hook is bent, try to bend it back to a 90-degree angle.
   - If an upper hook is bent, use needle-nose pliers to straighten it.
   - If any lower hook or upper hook is broken or bent beyond repair, replace the top case.

10. Use compressed air to clean the well of the keycap.

    Note: If compressed air doesn't dislodge visible debris, use a microterry polishing cloth to gently dislodge the debris.

11. Remove the keycap and adhesives from the keycap lever. Discard the keycap and adhesives.

Reassembly

Important

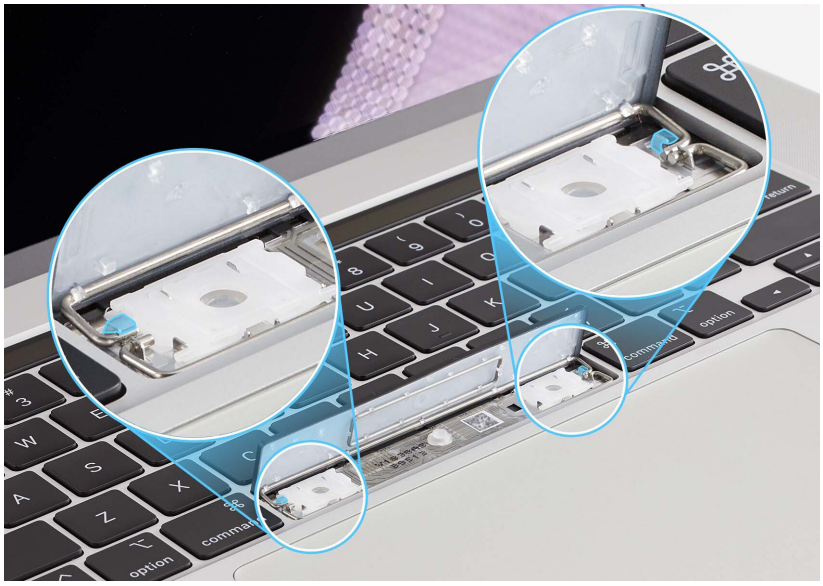
For the keycaps that have more than one link bar, check that the top link bar is preinstalled on the replacement keycap.

Note: On the JIS Return key, the link bar that fits into the right side of the keycap well is preinstalled.

1. Position the keycap in the well and insert the top link bar into the metal hooks that are on each side of the well.

Important

To reinstall the JIS Return key, insert the keycap into the right side of the well.



2. Push the keycap forward to set the top link bar in place.

3. Gently press the snaps and scissor mechanisms as shown to engage the keycap. You can find the snap locations in the Link Bar Key Maps.

   Note: For keys with one link bar, gently push the hinged side of the replacement keycap into the hinged side of the well at a 15-degree angle until the hinges engage. Then gently press the snap or snaps.

4. Tap the key repeatedly to verify that it springs back each time. If the keycap doesn't appear to be correctly installed, repeat all removal and reassembly steps with a new keycap.

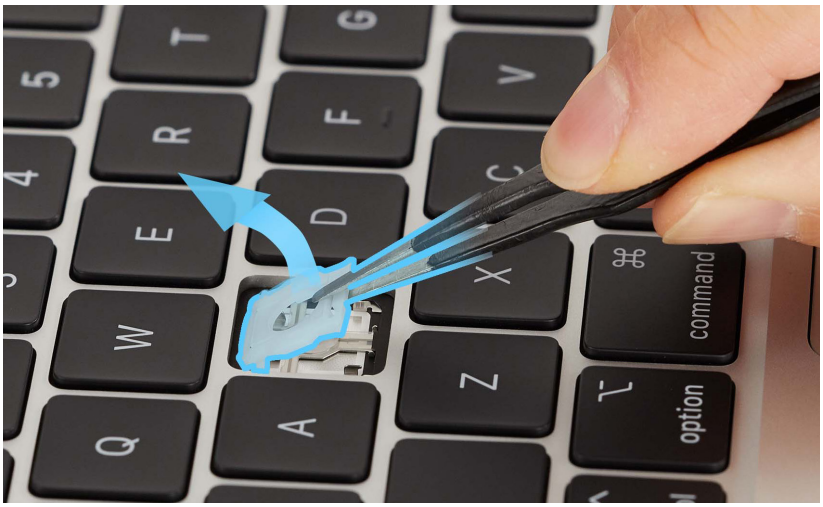
Scissor Mechanisms
Removal

Important

- Don’t remove a scissor mechanism unless it’s damaged. You can find the correct replacement in Scissor Mechanism Identification.
- Note the orientation of the scissor mechanism before you remove it.

1. Use the black stick to disengage the scissor pins from the lower hooks.

2. Use tweezers to lift the scissor mechanism out of the well.



3. Inspect the well of the keycap:
    - When you press and release the dome, it should spring back upright. If the dome is damaged or not centered, replace the top case.
    - If a lower hook is bent, try to bend it back to a 90-degree angle.
    - If an upper hook is bent, use needle-nose pliers to straighten it.
    - If any lower hook or upper hook is broken or bent beyond repair, replace the top case.

Reassembly

1. Use compressed air to clean the well of the keycap.

   Note: If compressed air doesn't dislodge visible debris, use the black stick to gently dislodge it.

2. Use ESD-safe tweezers to position the scissor in the well and engage the upper hooks.

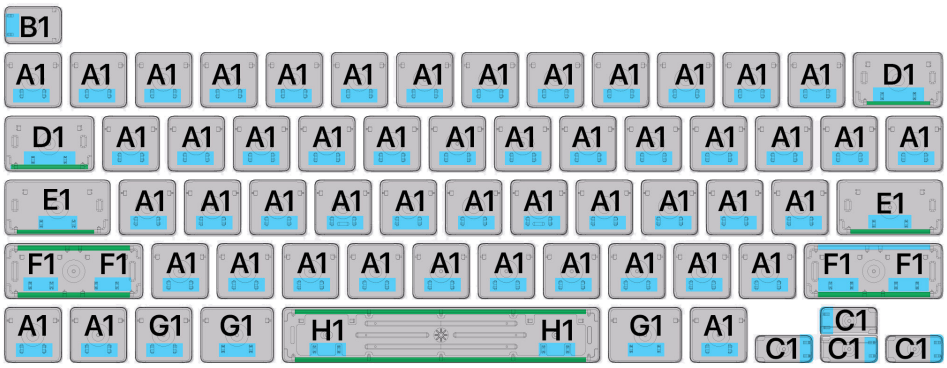
3. Use the black stick to engage the scissor pins with the lower hooks. The pin is engaged as shown (1). The pin is not engaged as shown (2).

4. Use the black stick to gently move the scissor mechanism up and down. Ensure that the scissor mechanism moves easily and lies flat when released.

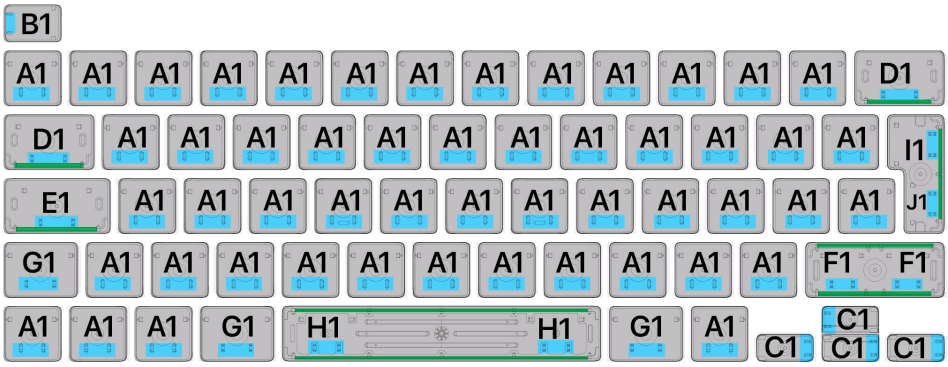
Keyboard Maps

Each symbol on the maps below corresponds to a symbol on the scissor mechanism identification chart and the scissor bag. Blue indicates where the snaps are located, and green indicates link bars.

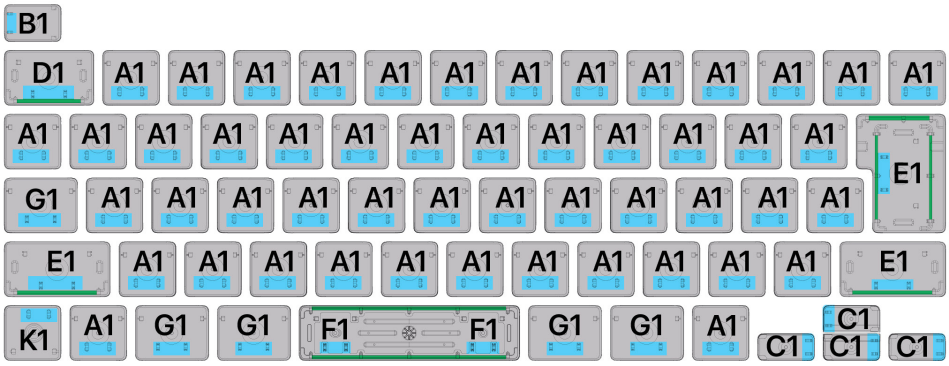
ANSI



ISO



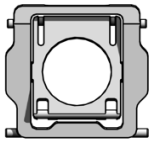
JIS



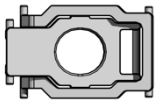
Scissor Mechanism Identification

Match the scissor mechanism to the label to identify the correct replacement. Don’t replace a scissor mechanism unless it’s broken.

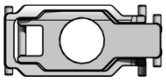
A1



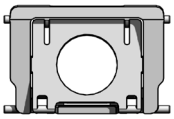
B1



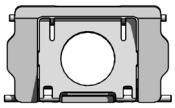
C1



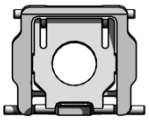
D1



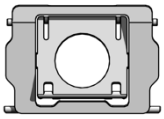
E1



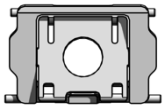
F1



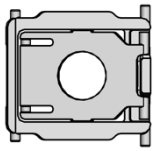
G1



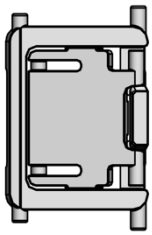
H1



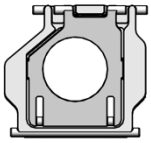
I1



J1



K1



Bottom Case

Before You Begin

Warning

Read Battery Safety and follow workspace and battery handling guidelines before you begin.

Tools

- Battery cover
- Bottom case fixture
- C-clamps
- Cut-resistant gloves
- ESD-safe tweezers
- Nylon probe (black stick)
- Pentalobe screwdriver
- Permanent marker
- Suction cups
- Torx T5 screwdriver

Important

This procedure requires a replacement battery management unit (BMU) cover.

Removal

1. Place the computer on a clean, flat surface with the bottom faceup.

2. Use the pentalobe screwdriver to remove the two long pentalobe screws from the rear corners of the bottom case.

   Note: The screw color is specific to your model.

   - Silver (923-05203)
   - Space gray (923-05200)

3. Use the pentalobe screwdriver to remove the two pentalobe screws from the front corners of the bottom case.

   Note: The screw color is specific to your model.

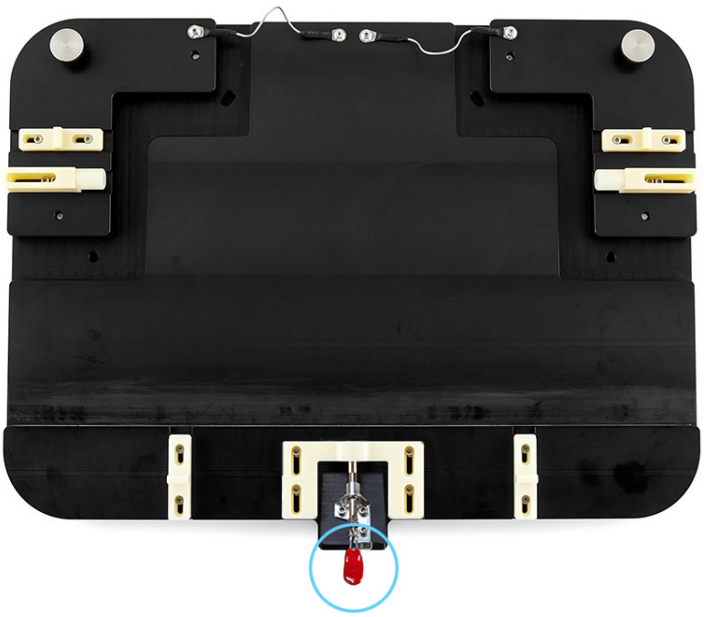
   - Silver (923-05204)
   - Space gray (923-05201)

4. Use the pentalobe screwdriver to remove the two short pentalobe screws from the middle of the bottom case.

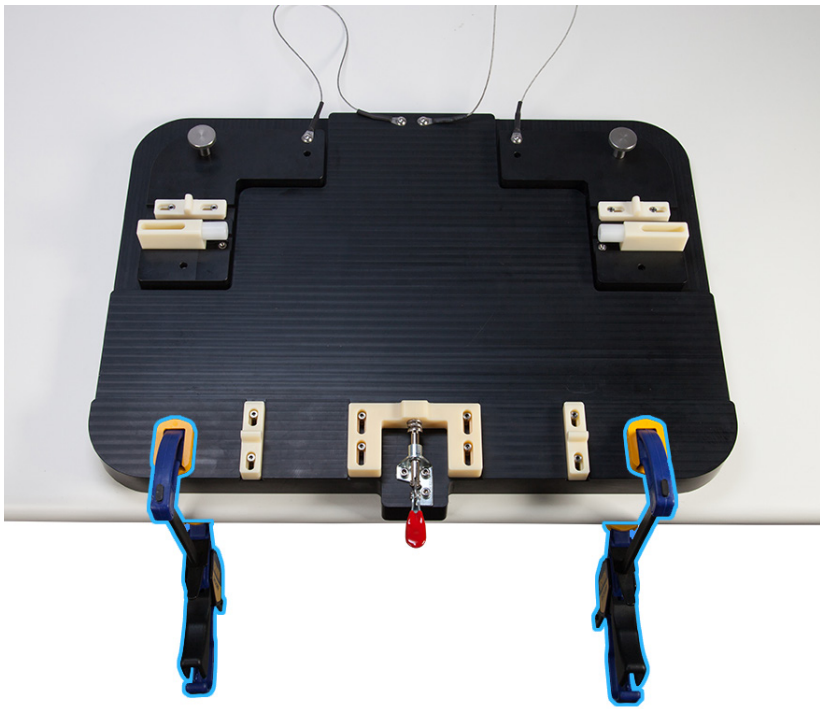
   Note: The screw color is specific to your model.

   - Silver (923-05205)
   - Space gray (923-05202)

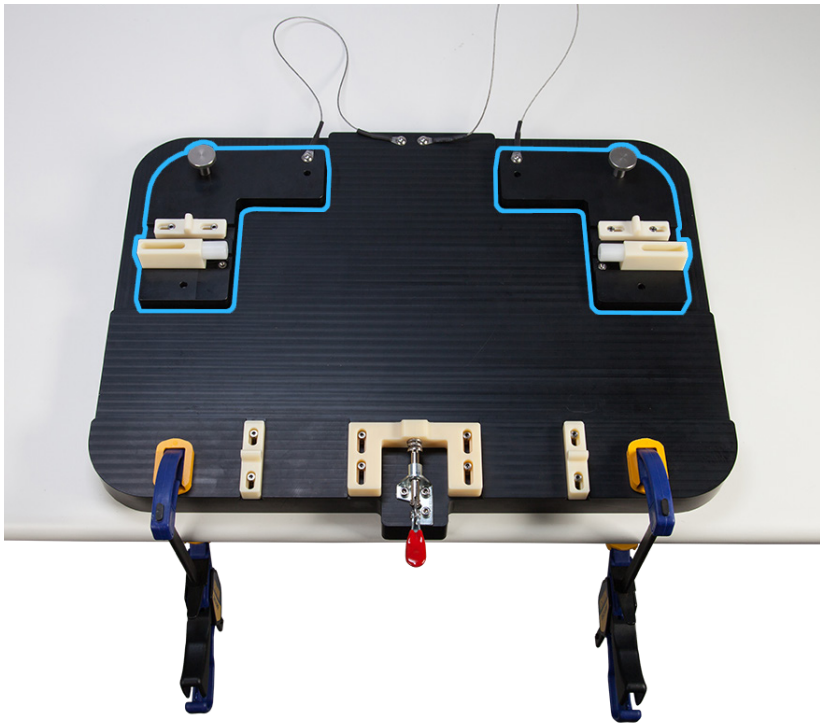
5. Position the bottom case fixture on a table with the red lever facing you.



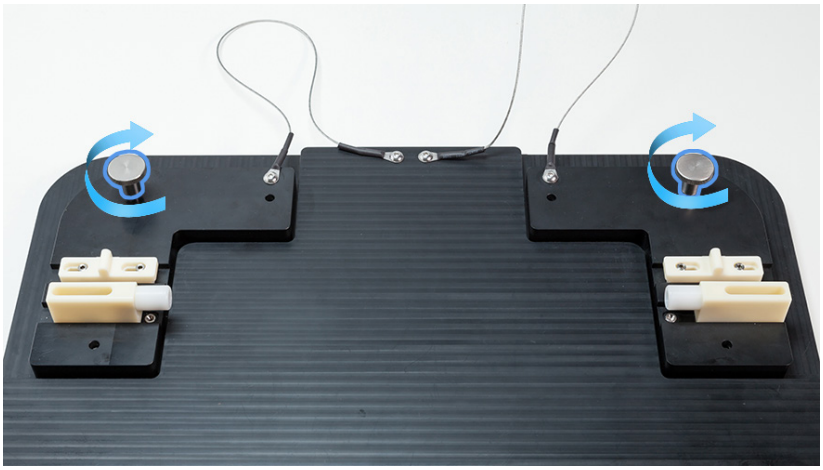
6. Place the two C-clamps on the bottom left and bottom right of the bottom case fixture. Ensure that the sliding bars of the C-clamps face down toward the floor. Squeeze the handles to tighten the C-clamps.



7. Position the corner braces inward.

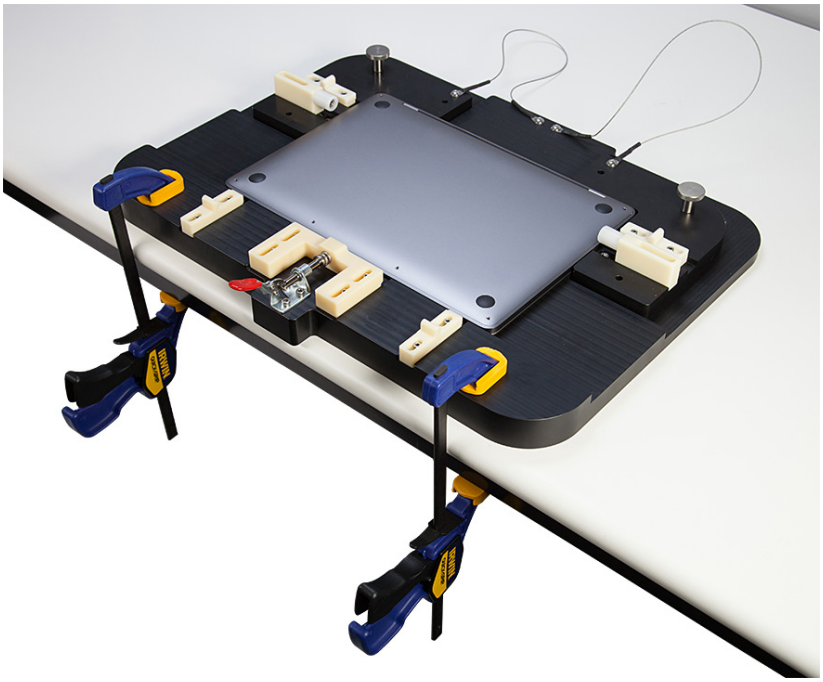


8. Tighten the silver thumbscrews.

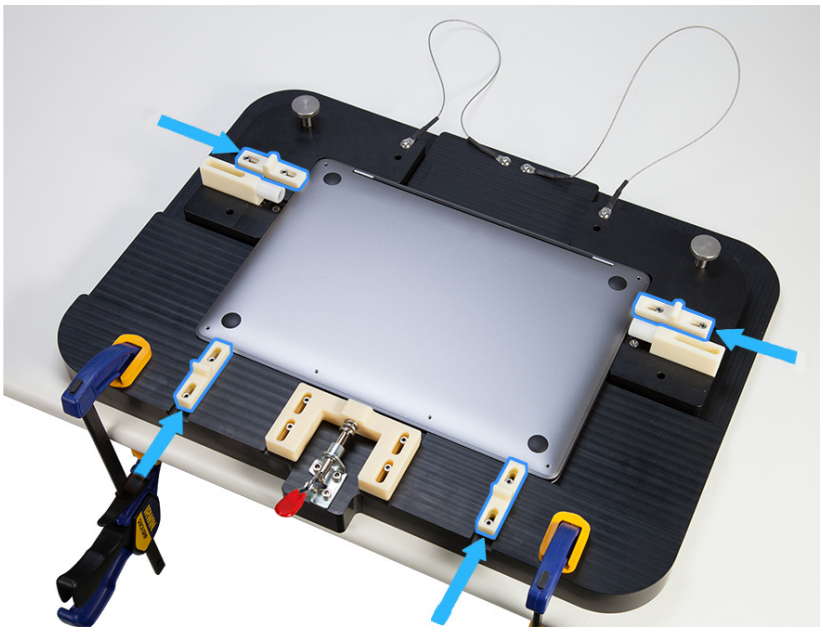


9. Ensure that all sliding locks and rollers are fully open and the red lever is flipped down.

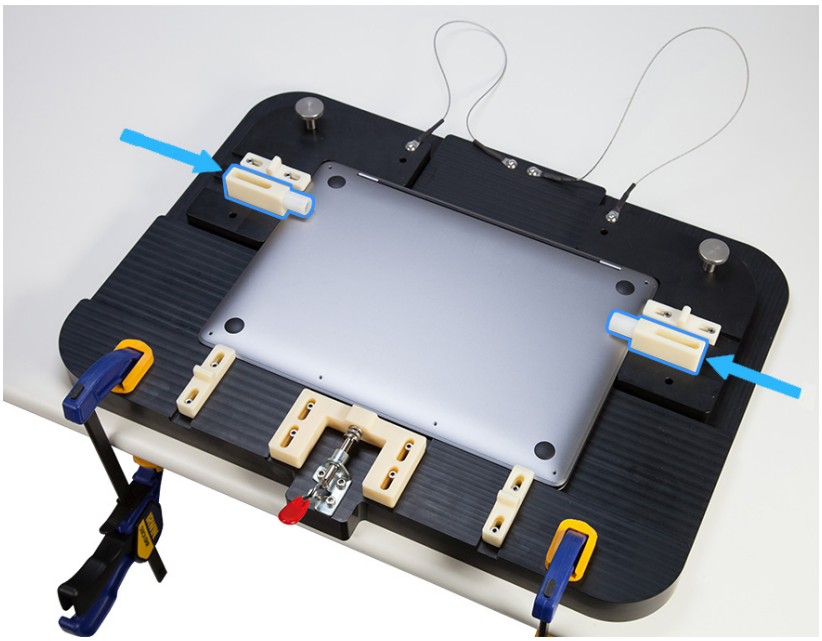
10. Place the computer in the bottom case fixture with the bottom faceup and the display hinge facing away from you.



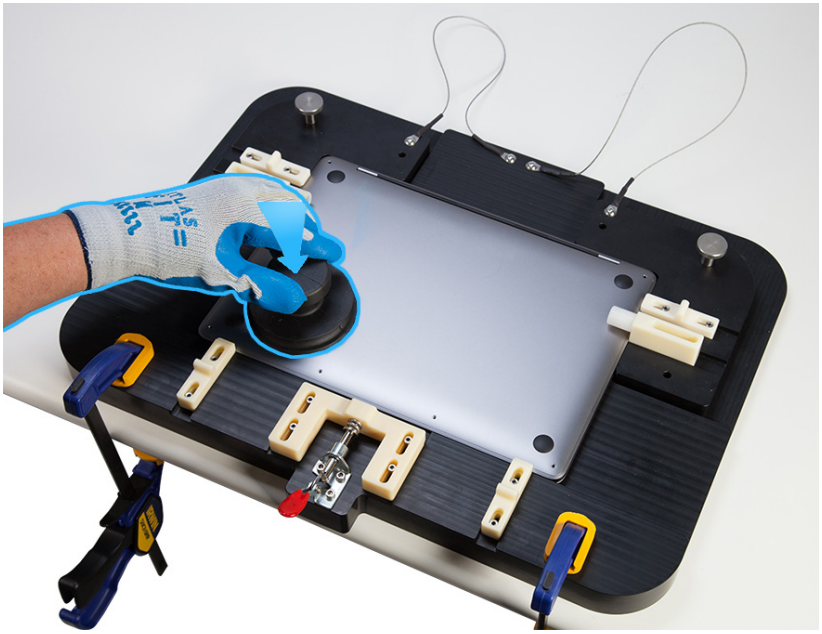
11. Push the four sliding locks inward to hold the computer in place.



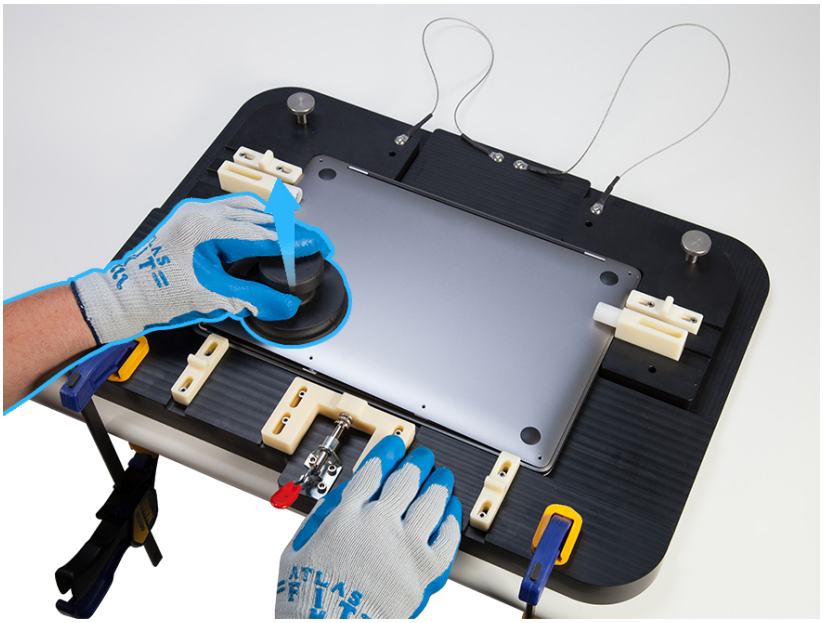
12. Press the two rollers inward.



13. Put on the gloves. Then press the suction cup to attach it to the lower left corner of the bottom case.

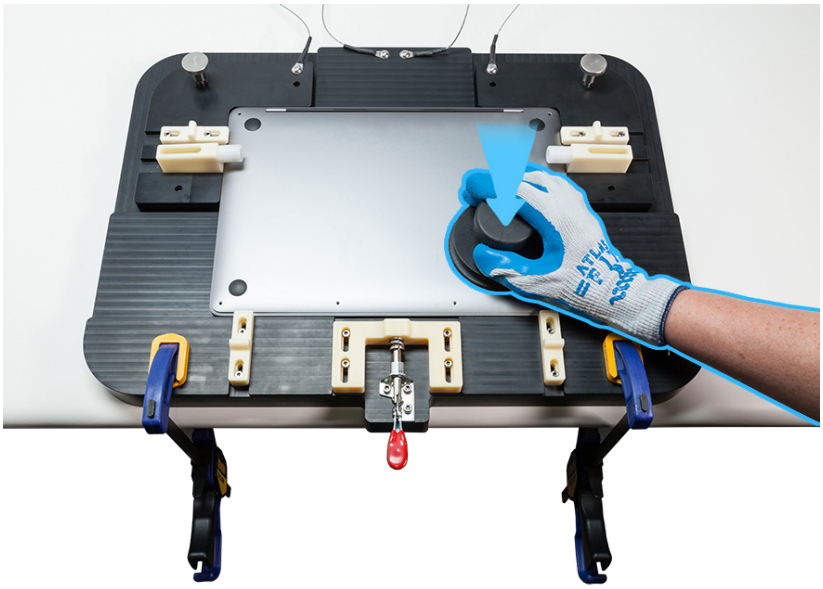


14. Four clips inside the bottom case attach it to the top case. Pull up the handle of the suction cup until you feel the two internal clips on the left release.



15. Lift up the edge of the suction cup to release it.

16. Move the suction cup to the lower right corner and press the top to attach it to the bottom case.



17. Pull up the handle of the suction cup until you feel the two internal clips on the right release.

18. Lift the edge of the suction cup to release it. Slightly lift the bottom case to create a narrow opening between the bottom case and top case on the side facing you.

Caution

Don’t lift the bottom case more than 0.5 inch.

19. Grasp the bottom case from both sides. Ensure that the opening doesn't exceed 0.5 inch.

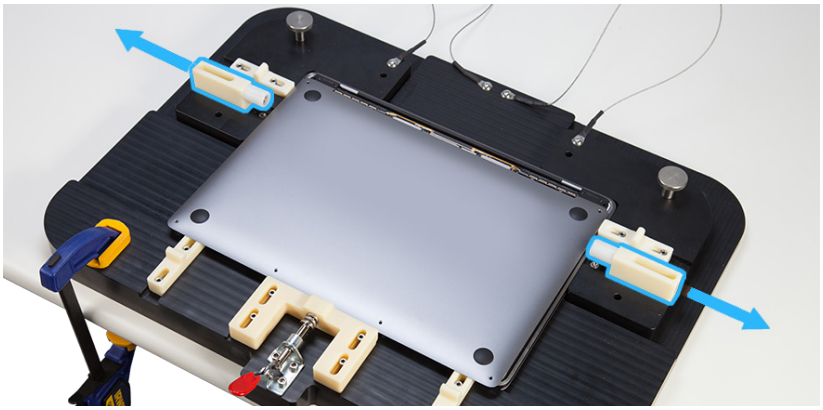
20. Apply gentle and steady force to pull the bottom case toward you less than 0.5 inch to disengage the spring fingers.

Caution

The spring fingers can release suddenly. When they disengage, don't allow the bottom case to drag over internal parts.

21. Rest the bottom case on the top case.

22. Remove the gloves and push the two rollers outward.

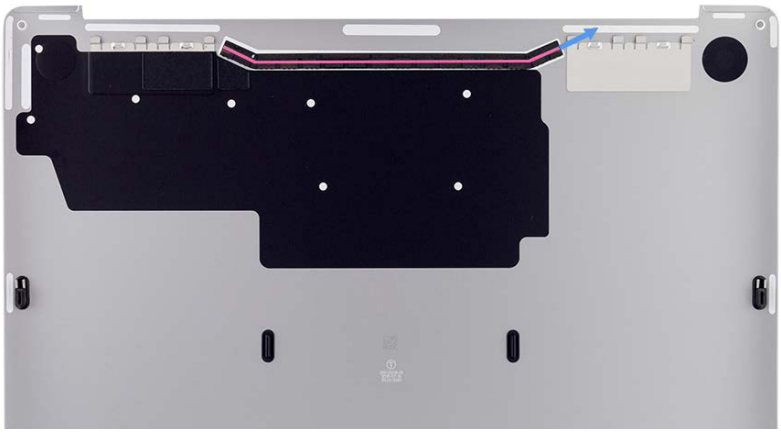


23. Lift the bottom case from the computer. Set the bottom case faceup on a clean, flat surface.

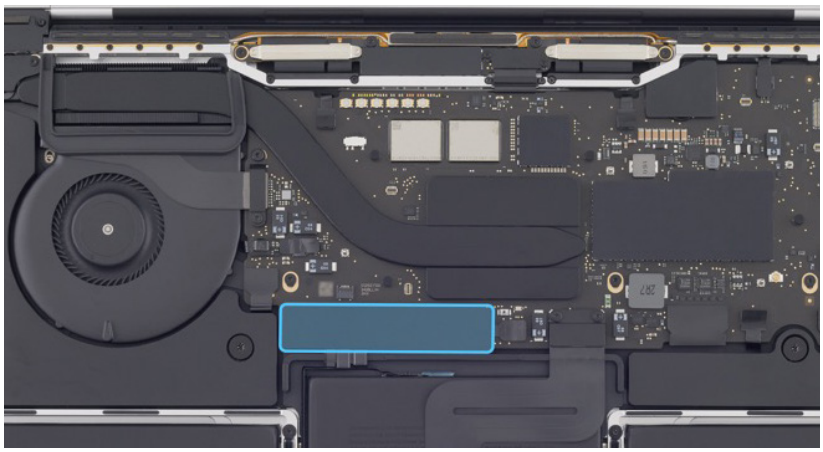
    Note: If you're replacing only the bottom case, skip to reassembly step 10.

Important

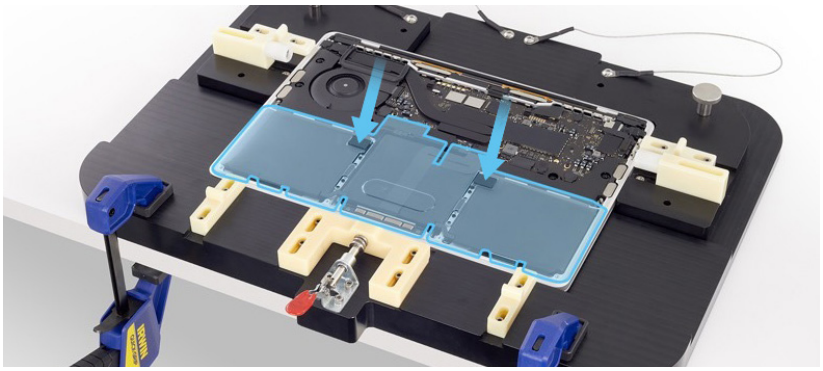
- If you're replacing the bottom case, keep the original bottom case until the repair is complete.
- Use a permanent marker to write the computer serial number on the inside of the replacement bottom case.
- A replacement bottom case may have a red tube in the airloops as shown. Grasp one end of the red tube and pull it out of the airloop gasket. Discard the red tube.



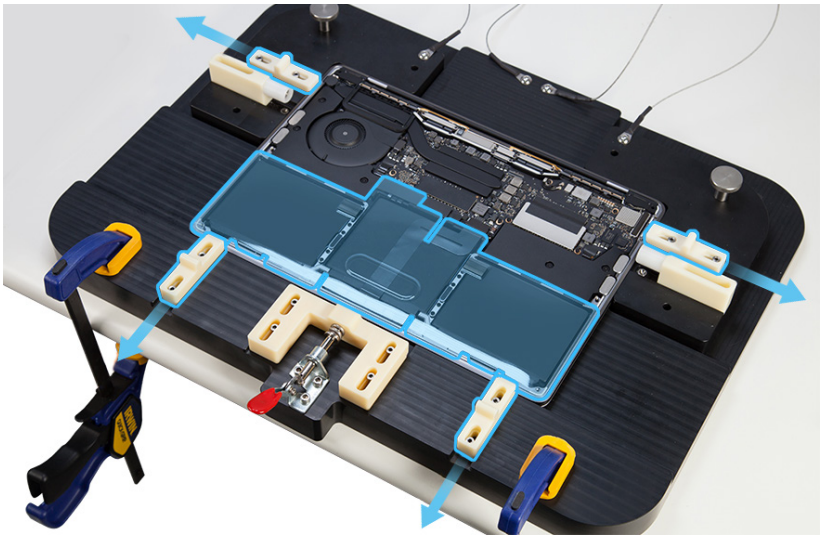
24. Lift the BMU cover off the BMU board. Discard the BMU cover.



25. Place the battery cover on the battery. Then press the black tabs into the clips on the top case until you feel a click.



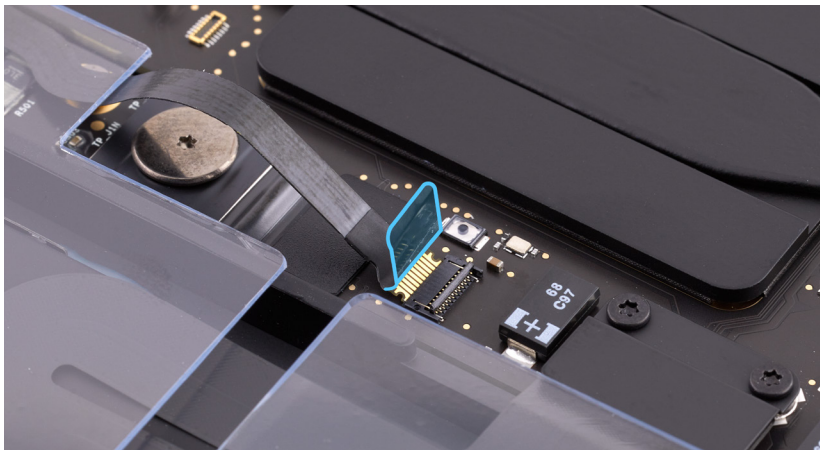
26. Push out the four sliding locks.



27. Lift the computer from the bottom case fixture.

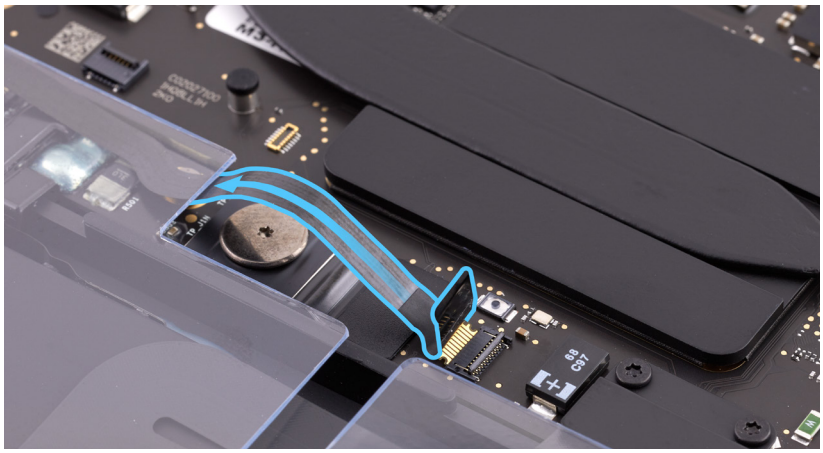
28. Place the computer on an ESD-safe surface.

29. Gently peel the polyester film tab off the locking lever of the BMU flex cable.

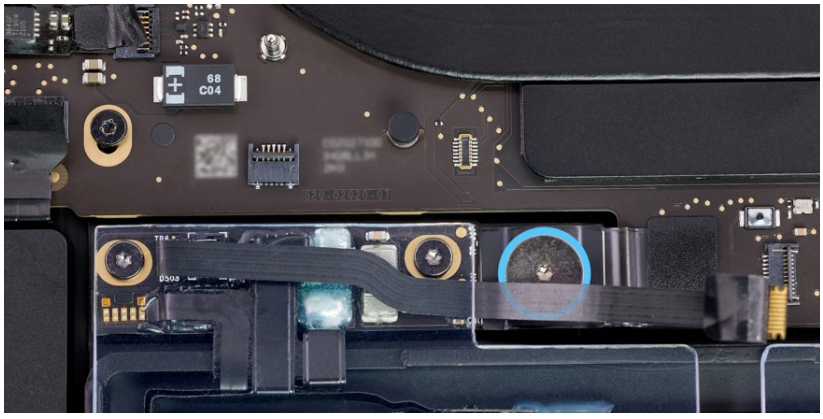


30. Use the flat end of a black stick to flip up the locking lever.

31. Use ESD-safe tweezers to gently grasp the end of the BMU flex cable and slide it out of the connector.

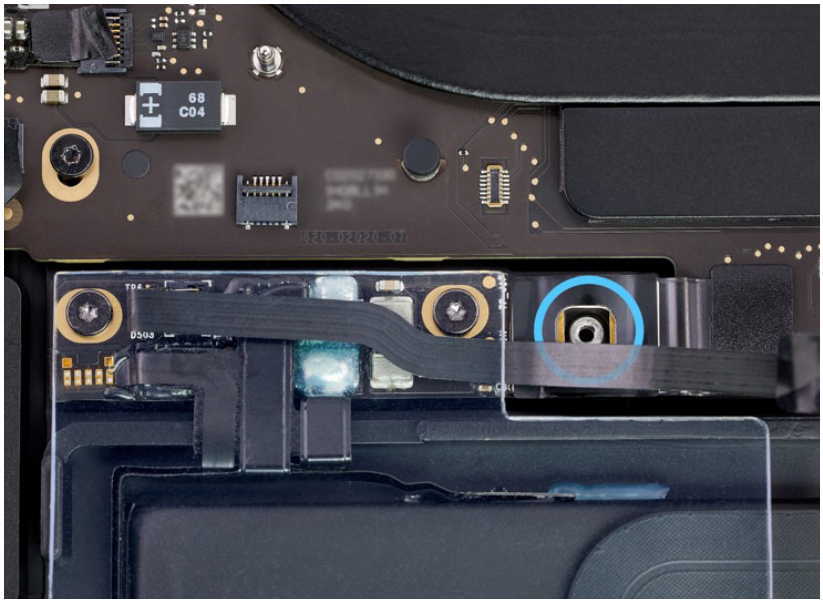


32. Use ESD-safe tweezers to gently move aside the BMU flex cable. Then use the T5 screwdriver to remove the T5 screw (923-05241) from the BMU.



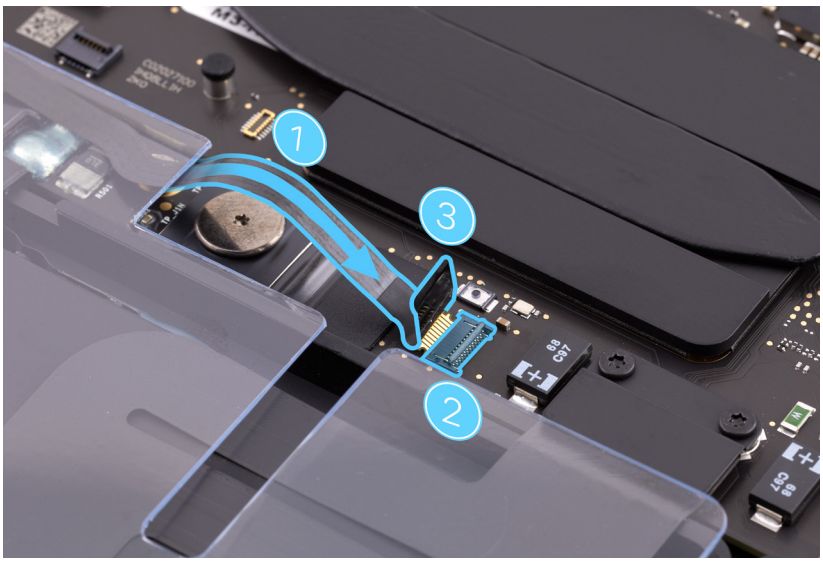
Reassembly

1. Move aside the BMU flex cable. Then use the T5 screwdriver to reinstall the T5 screw (923-05241) into the BMU.

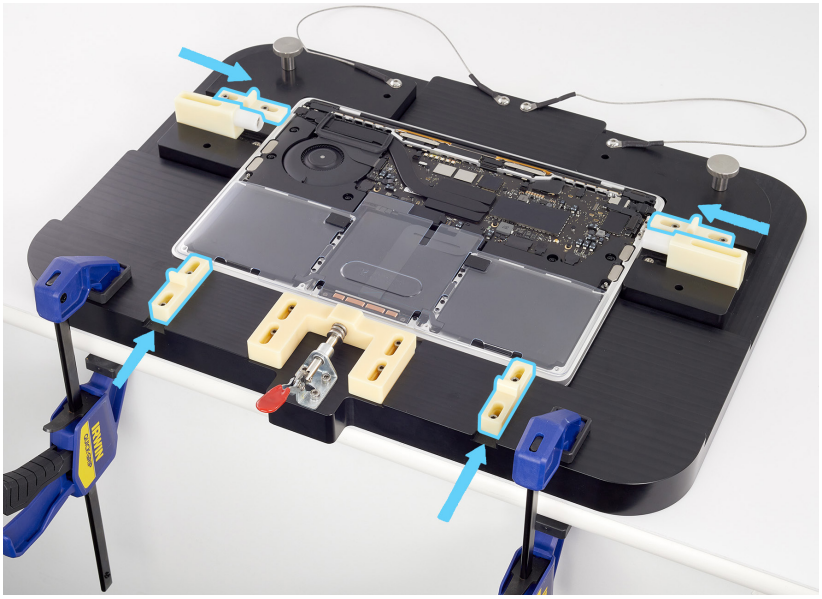


2. Slide the end of the BMU flex cable into the connector (1). Then flip down the locking lever (2).

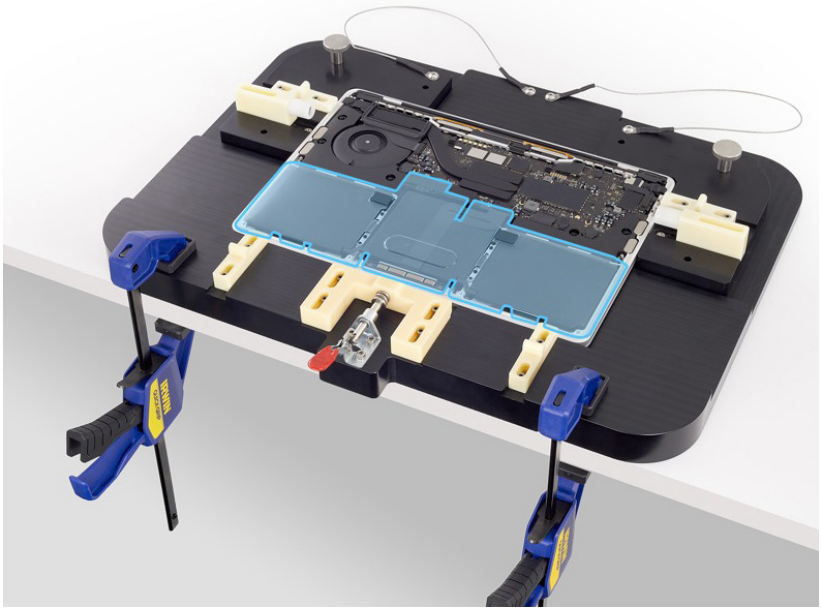
3. Press the polyester film tab to the locking lever (3).



4. Place the computer in the bottom case fixture. Ensure that the display hinge faces away from you.
5. Push the four sliding locks inward. Don't push the two rollers.

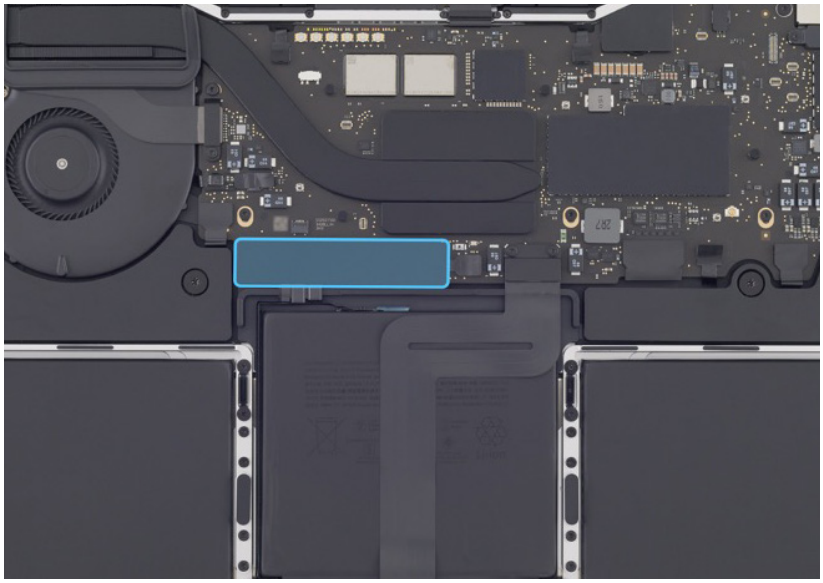


6. Hold the battery cover by the edges and lift it off the top case.

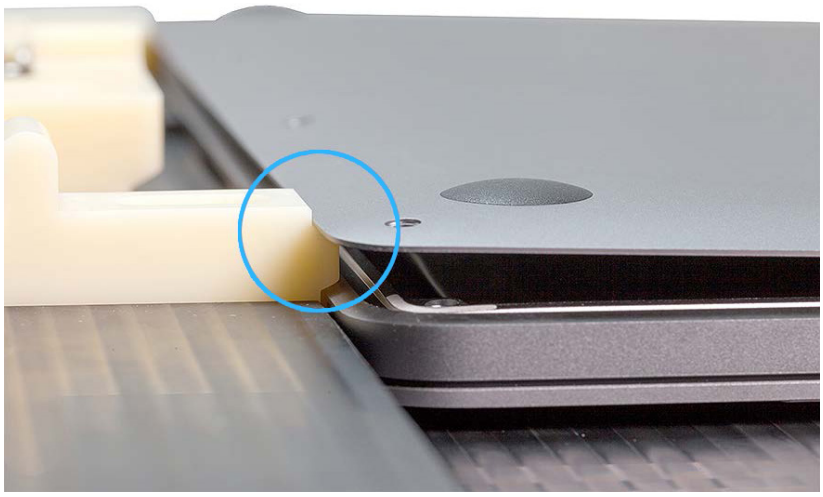


7. Use the black stick to remove any residual foam and adhesive on the BMU board.
8. Remove the adhesive backing from the replacement BMU cover.

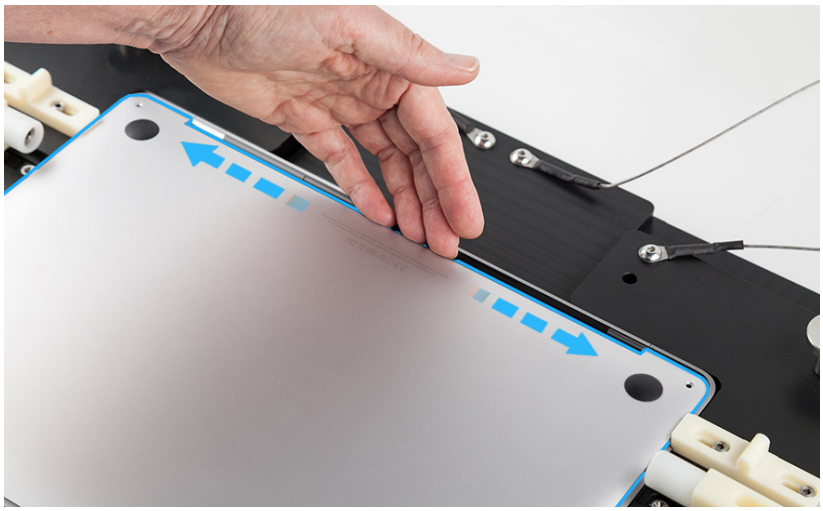
9. Press the BMU cover to the BMU flex cable.



10. Position the bottom case so that its front edge rests on the shelf of the lower two sliding locks.



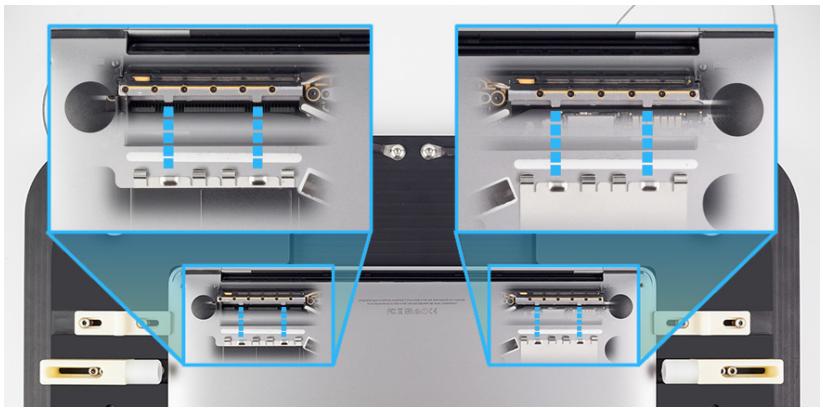
11. Align the back of the bottom case with the vent/antenna module. Ensure that the long edge of the bottom case is flush with the smooth plane of the vent/antenna module.



Important

There should be equal space where the bottom case and top case meet.

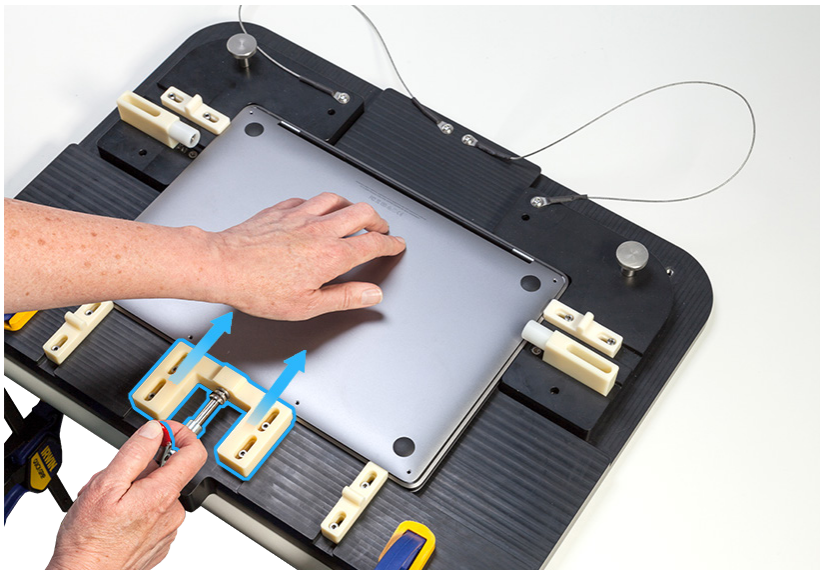
Note: Ensure that the two rows of spring fingers inside the bottom case align with the metal tabs on the vent/antenna module wall.



12. Lightly press the back center of the bottom case while slowly pushing up the red lever. Feel the spring fingers lock as you press the bottom case.

Caution

Pushing the red lever too far can bend the bottom case or damage the lever spring.



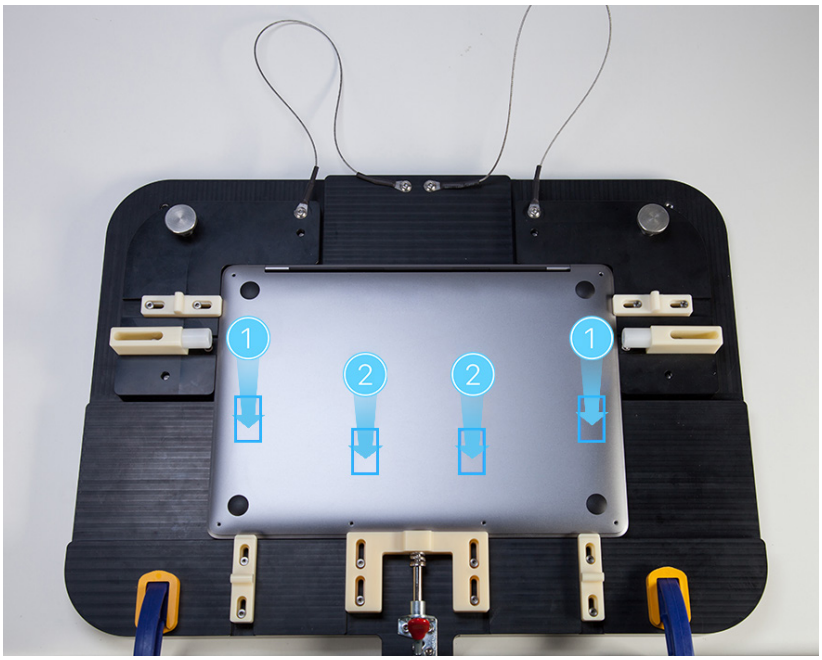
13. Flip down the lever as soon as the rear corners of the bottom case meet the rear corners of the top case.

14. Put on the gloves. Then use the gripping texture of the gloves to gently align the bottom case with the display hinge and top case.

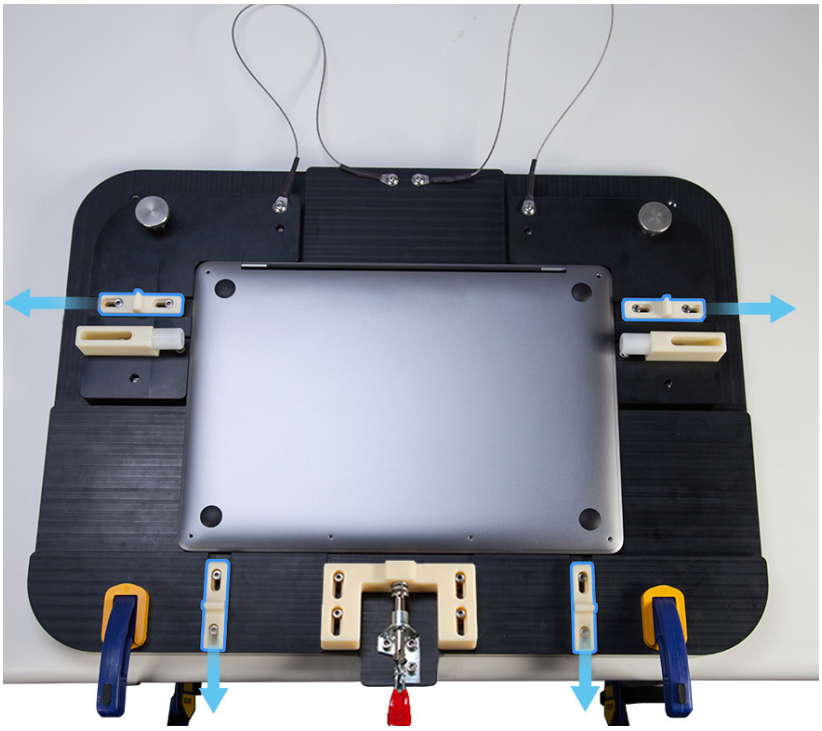
Important

If the bottom case doesn't align, pull it toward you to remove it. Then repeat steps 10 through 14.

15. Four clips inside the bottom case attach it to the top case. Press both sides of the bottom case simultaneously (1) until you feel the side clips snap into place. Then simultaneously press the two areas in the middle (2) to attach the two remaining internal clips.

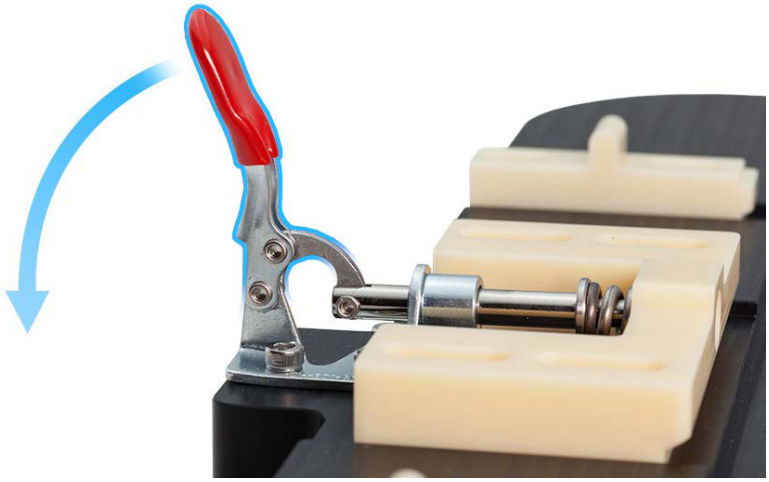


16. Push the four sliding locks outward.



17. Remove the computer from the bottom case fixture.

    Note: Ensure that the lever is down to protect its inner spring before storing the bottom case fixture.



18. Ensure that all sides of the bottom case align with all sides of the top case. If the cases are misaligned, begin again at removal step 8.

19. Use the pentalobe screwdriver to reinstall the two short pentalobe screws (1, 2) into the middle of the bottom case in the order shown.

    Note: Use the correct screw color for your model.

    - Silver (923-05205)
    - Space gray (923-05202)

20. Use the pentalobe screwdriver to reinstall the two long pentalobe screws (3, 4) into the rear corners of the bottom case in the order shown.

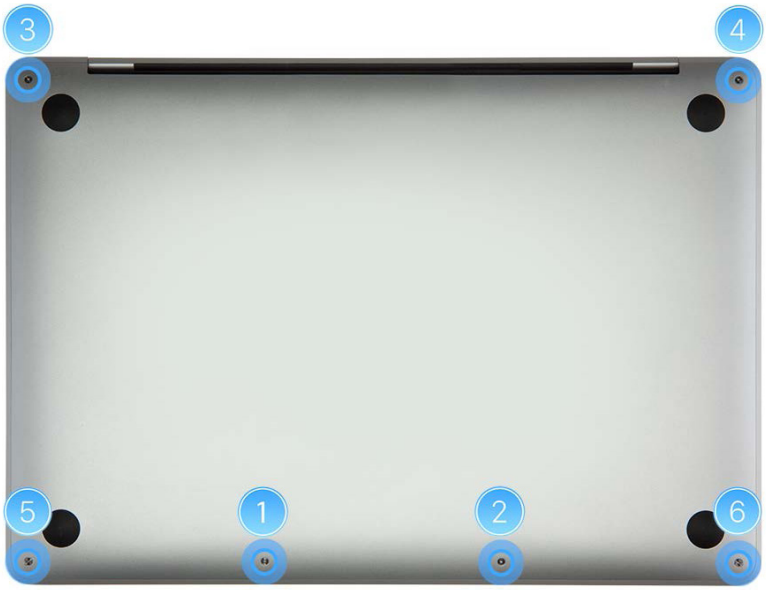
    Note: Use the correct screw color for your model.

    - Silver (923-05203)
    - Space gray (923-05200)

21. Use the pentalobe screwdriver to reinstall the two pentalobe screws (5, 6) into the front corners of the bottom case in the order shown.

    Note: Use the correct screw color for your model.

    - Silver (923-05204)
    - Space gray (923-05201)



Important

- System Configuration is required if you've installed a replacement display, logic board, Touch ID board, or top case.
- If you replaced the logic board, the computer will start up in Diagnostics mode until you complete System Configuration.
- If you replaced the Touch ID board, it will function only as a power button until you complete System Configuration.
- After you've completed all removal and reassembly steps, learn how to initiate the System Configuration process at https://support.apple.com/self-service-repair.

Battery Management Unit Flex Cable

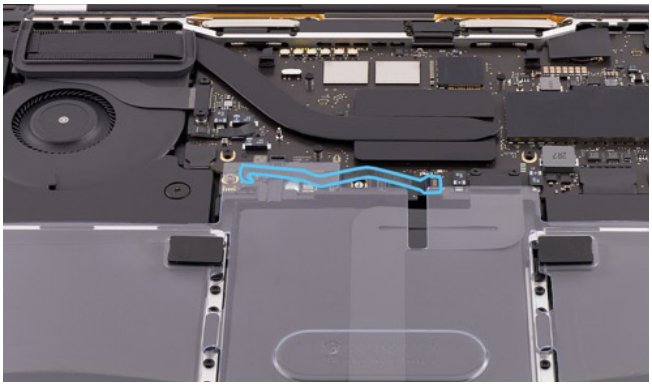
Before You Begin

Warning

Read Battery Safety and follow workspace and battery handling guidelines before you begin.

Remove the following part before you begin:

- Bottom case



Tools

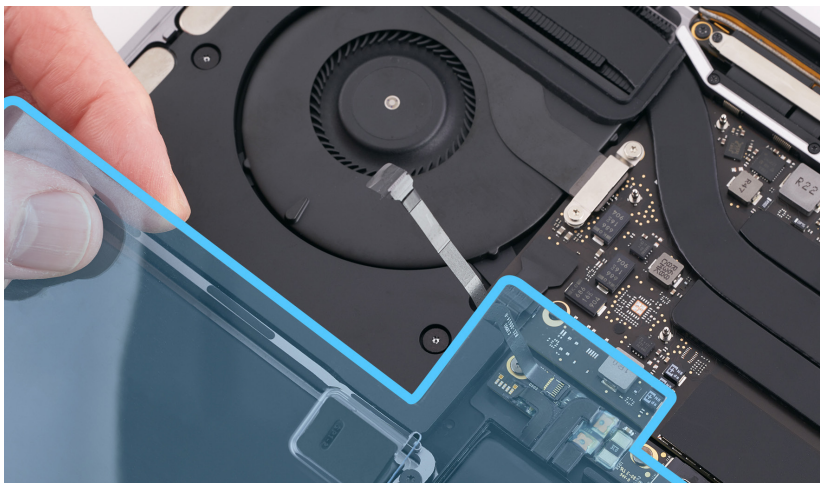
- ESD-safe tweezers
- Nylon probe (black stick)

Removal

Important

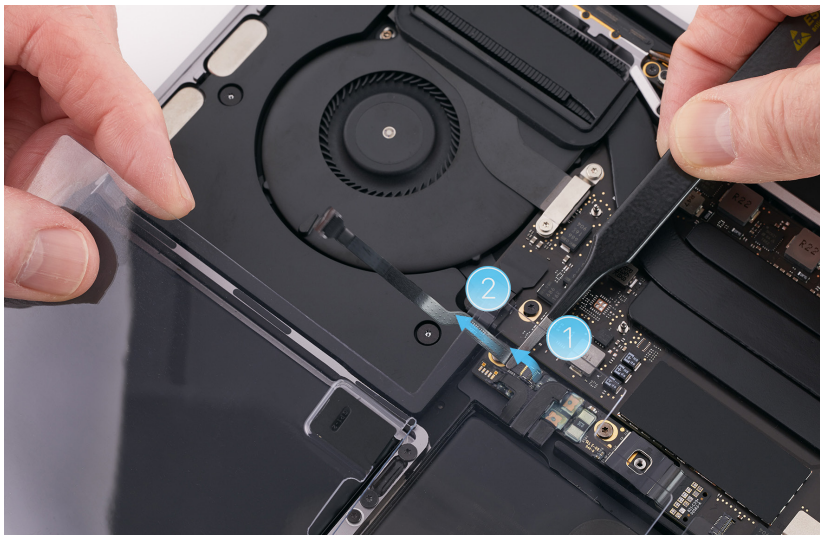
Replace the BMU flex cable if it's damaged.

1. Slightly lift the battery cover to access the BMU flex cable.



2. Peel the polyester film tab off the locking lever of the BMU flex cable. Then use ESD-safe tweezers to flip up the locking lever (1).

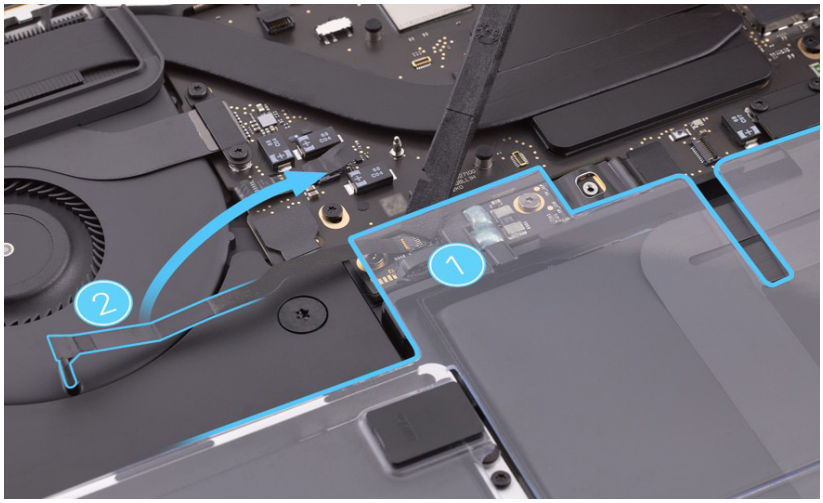
3. Gently slide the end of the BMU flex cable out of the connector (2).



Reassembly

1. Use ESD-safe tweezers to slide the end of the BMU flex cable into the connector.

2. Use the black stick to flip down the locking lever (1). Then slightly lift the battery cover and fold the BMU flex cable back toward the logic board (2).



Reinstall the following part to complete reassembly:

- Bottom case

Display Hinge Covers

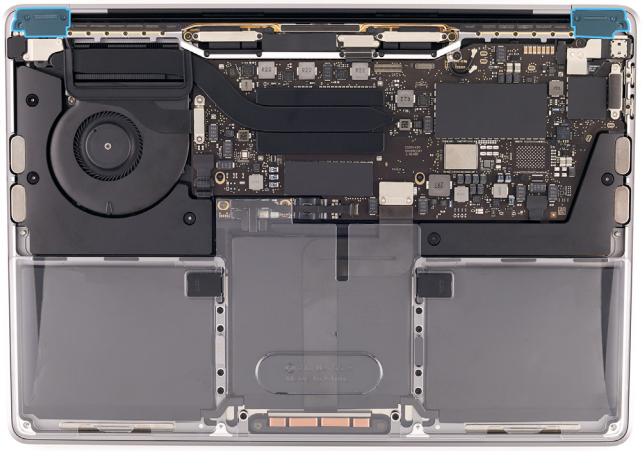
Before You Begin

Remove the following part before you begin:

- Bottom case

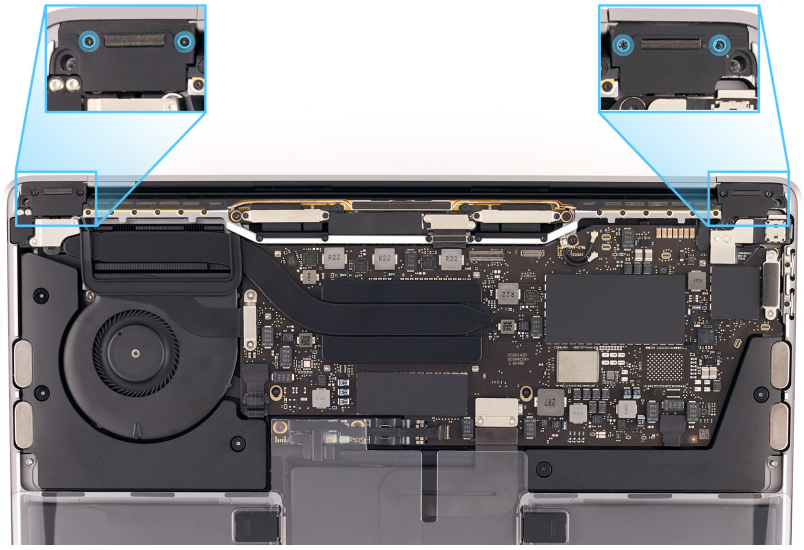
Tools

- Nylon probe (black stick)
- Torx T3 screwdriver



Removal

1. Use the T3 screwdriver to remove the two T3 screws (923-05243) from each display hinge cover.



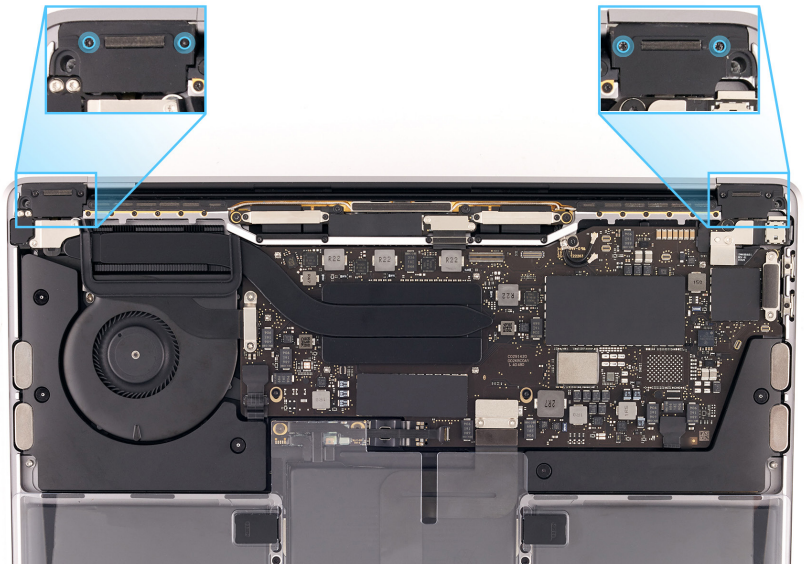
2. Use the black stick to remove the two display hinge covers from the top case.

Reassembly

1. Position the two display hinge covers in the top case.

> **Important**
>
> Ensure that the top edge of each display hinge cover sits under the top edge of the top case.

2. Use the T3 screwdriver to reinstall the two T3 screws (923-05243) into each display hinge cover.



Reinstall the following part to complete reassembly:

- Bottom case

Logic Board

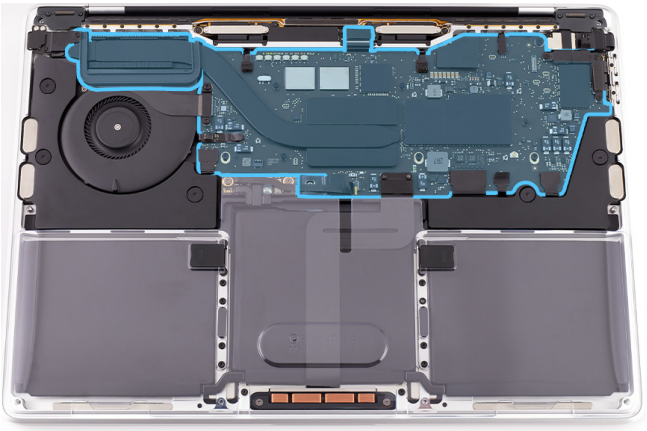
Before You Begin

Warning

Read Battery Safety before you begin.

Remove the following part before you begin:

- Bottom case



Tools

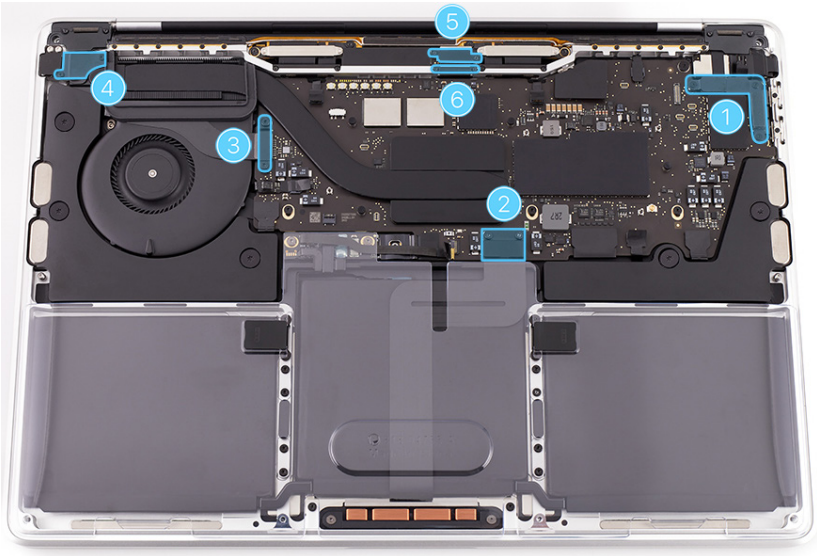
- 3 mm hex nut driver
- Antenna tool
- ESD-safe tweezers
- Nylon probe (black stick)
- Torx T3 screwdriver
- Torx T5 screwdriver

Important

- This procedure requires System Configuration. After you've completed all removal and reassembly steps, learn how to initiate the System Configuration process at support.apple.com/self-service-repair.
- If you're installing a replacement logic board, you must also install a replacement Touch ID board.
- This procedure requires a replacement polyester film.

Removal

1. Use the T3 screwdriver to remove nine T3 screws:
   - Three T3 screws (923-05253) from the L-shaped cowling (1)
   - Two T3 screws (923-05253, 923-05263) from the Touch ID board connector cowling (4)
   - Two T3 screws (923-05260) from the embedded Display Port (eDP) connector cowling (5)
   - Two T3 screws (923-05246) from the eDP flex cable cowling (6)



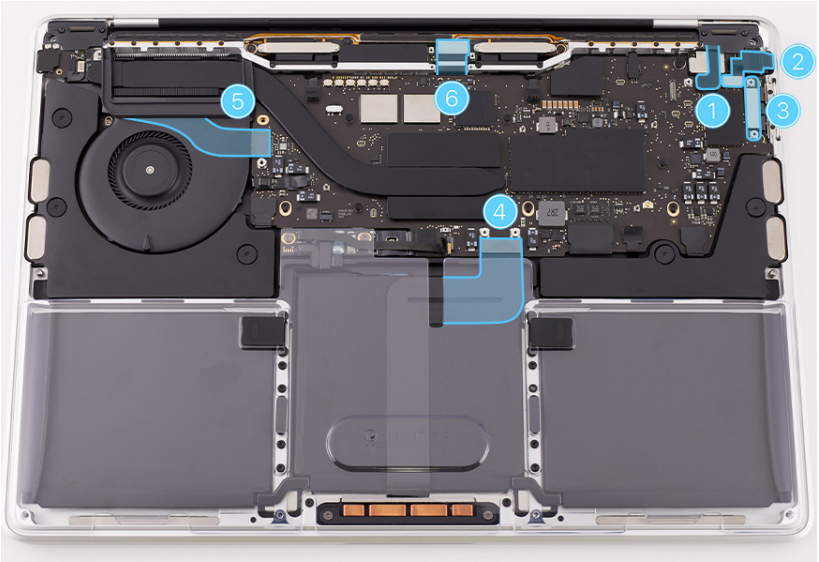
2. Use the T5 screwdriver to remove four T5 screws:
   - Two T5 screws (923-05254) from the trackpad connector cowling (2)
   - Two T5 screws (923-05255, 923-05256) from the audio board connector cowling (3)

Important

The audio board connector cowling has a deeper bend where the screw hole is closest to the heat sink arm. Note the orientation of the cowling for reinstallation.

3. Remove the following six cowlings and save them for reassembly:
   - L-shaped cowling (1)
   - Trackpad connector cowling (2)
   - Audio board connector cowling (3)
   - Touch ID board connector cowling (4)
   - eDP connector cowling (5)
   - eDP flex cable cowling (6)

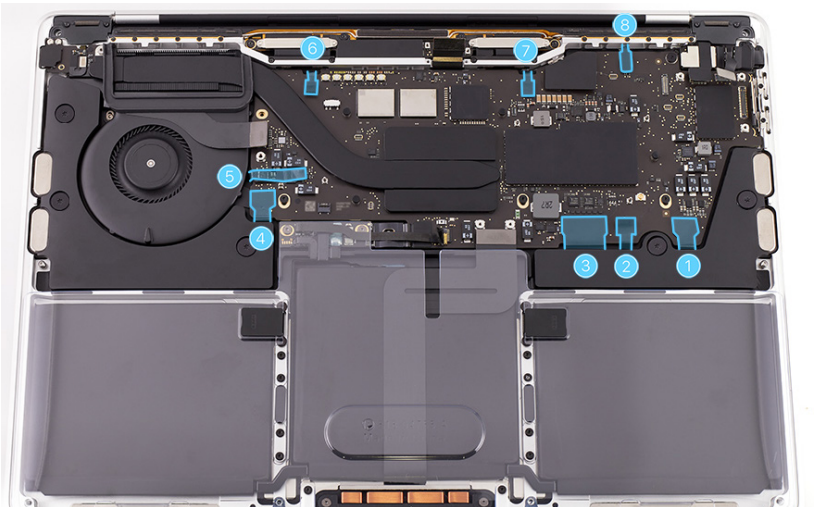
4. Lift the ends of the following five flex cables (1–5) off the connectors on the logic board and one flex cable (6) off the connector on the timing controller (TCON) board:
   - Touch Bar touch flex cable (1)
   - Touch Bar display flex cable (2)
   - Input/output (I/O) board flex cable (3)
   - Trackpad flex cable (4)
   - Audio board flex cable (5)
   - eDP flex cable with connector cowling (6)



Important

Slightly lift the battery cover and route the trackpad flex cable (4) through the battery cover slot. Fully reinstall the battery cover before continuing.

5. Peel the polyester film tabs from the following eight flex cables:
   - Left speaker flex cable (1)
   - Keyboard backlight power cord flex cable (2)
   - Keyboard flex cable (3)
   - Right speaker flex cable (4)
   - Fan flex cable (5)
   - Right keyboard backlight flex cable (6)
   - Left keyboard backlight flex cable (7)
   - Microphone flex cable (8)

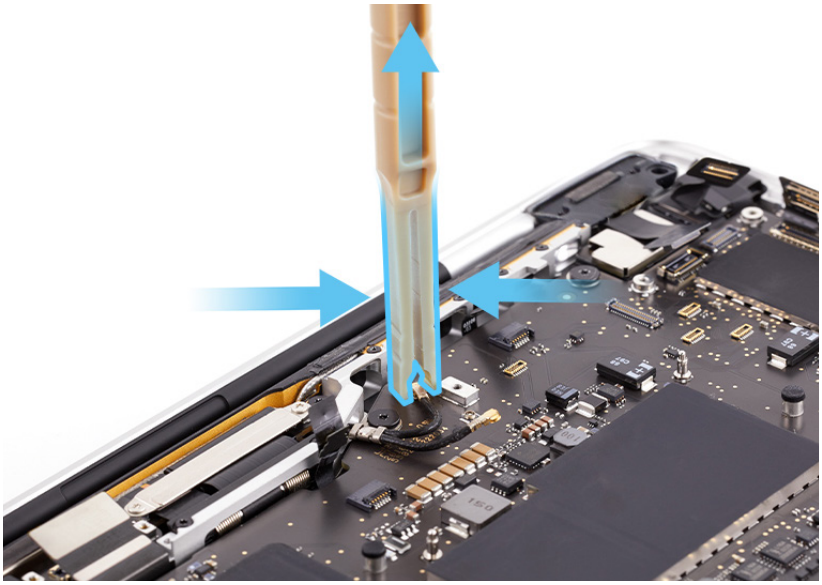


6. Use the black stick to flip up the locking levers of the following eight flex cables:
   - Left speaker flex cable (1)
   - Keyboard backlight power cord flex cable (2)
   - Keyboard flex cable (3)
   - Right speaker flex cable (4)
   - Fan flex cable (5)
   - Right keyboard backlight flex cable (6)
   - Left keyboard backlight flex cable (7)
   - Microphone flex cable (8)

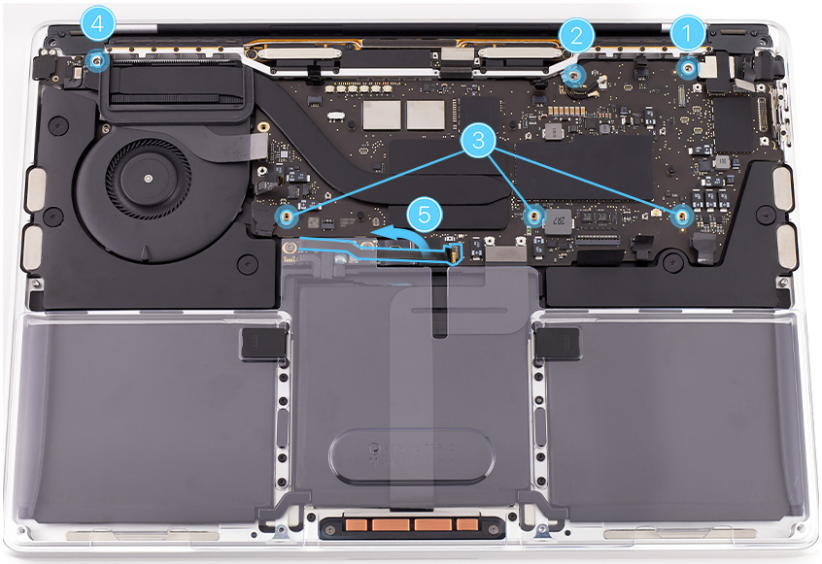
7. Slide the ends of the following eight flex cables from their connectors:
   - Left speaker flex cable (1)
   - Keyboard backlight power cord flex cable (2)
   - Keyboard flex cable (3)
   - Right speaker flex cable (4)
   - Fan flex cable (5)
   - Right keyboard backlight flex cable (6)
   - Left keyboard backlight flex cable (7)
   - Microphone flex cable (8)

8. Remove and discard the polyester film from the wireless antenna coaxial cables.

9. Use the antenna tool to lift the ends of the two antenna coaxial cables off the connectors.



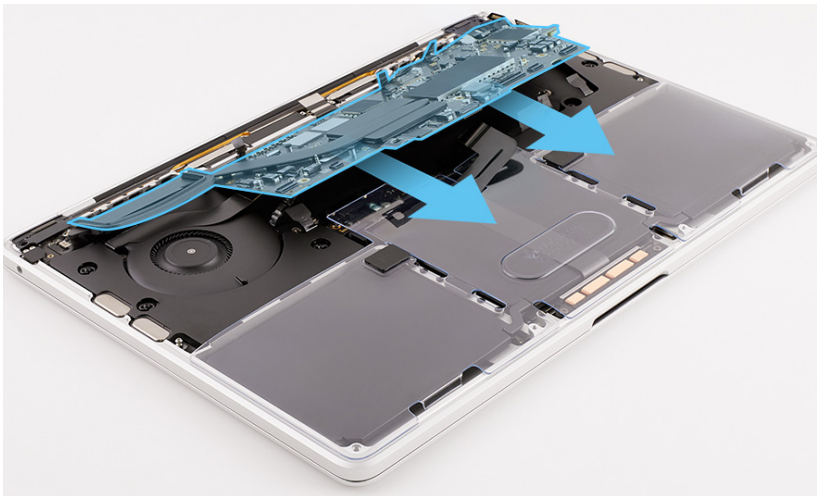
10. Use the T5 screwdriver to remove the five T5 screws (923-05240) (1), (923-05252) (2), (923-05250) (3) from the logic board.



11. Use the 3 mm hex nut driver to remove the 3 mm hex nut screw (923-05247) (4) from the heat sink arm.

12. Slightly lift the top edge of the battery cover and partially peel back the BMU flex cable (5). Fully reinstall the battery cover before continuing.

13. Gently lift up the edge of the logic board farthest from the display hinge. Then pull the logic board toward you and out of the top case. Move the cables out of the way as you remove the logic board.



Important

Note how the heat sink arm is positioned on the thermal duct for reassembly.

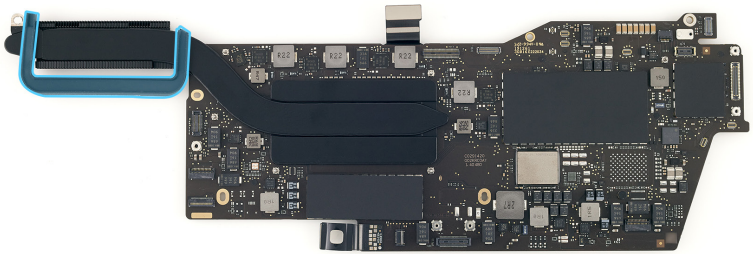
Reassembly

Important

If you're installing a replacement logic board, follow step 1. If you're reinstalling the existing logic board, skip to step 2.

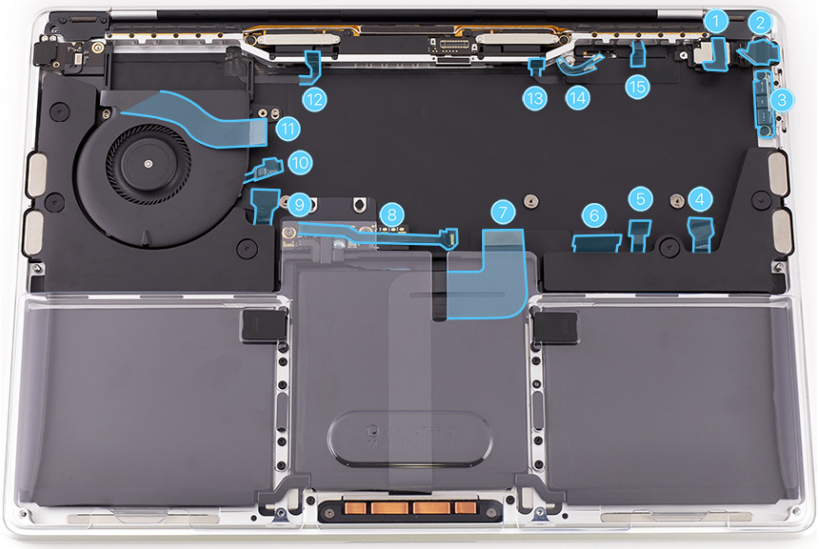
1. Remove the existing Touch ID board and install a replacement Touch ID board.

2. Ensure that the thermal duct is installed on the heat sink arm correctly.

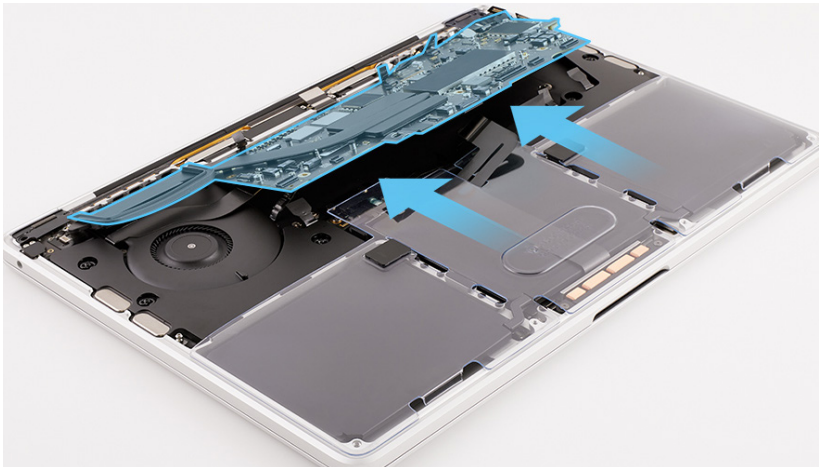


3. Before reinstalling the logic board, identify all 15 top case cables (1–15).

   Note: There are 16 cables total, but the eDP flex cable with connector cowling is attached to the logic board and isn't included in this image.

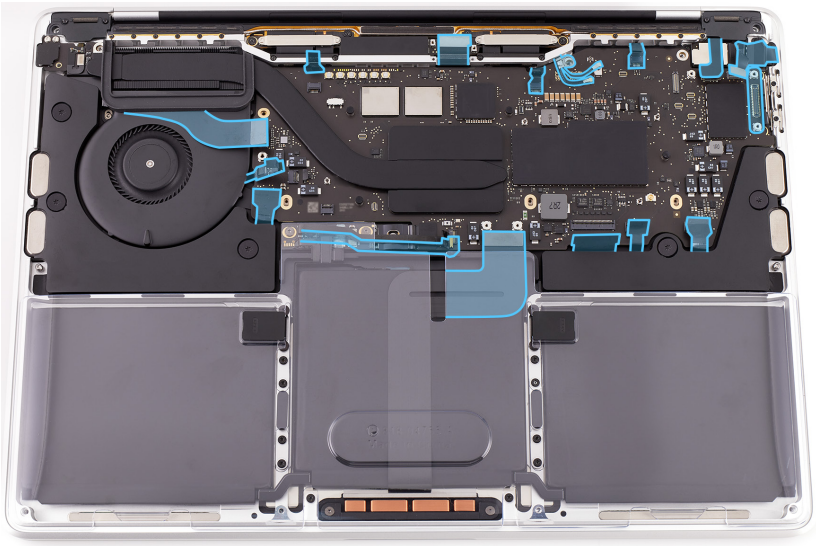


4. Hold the logic board by the edges. Tilt down the edge of the logic board closest to the display hinge. Then lower the rest of the logic board into the top case.

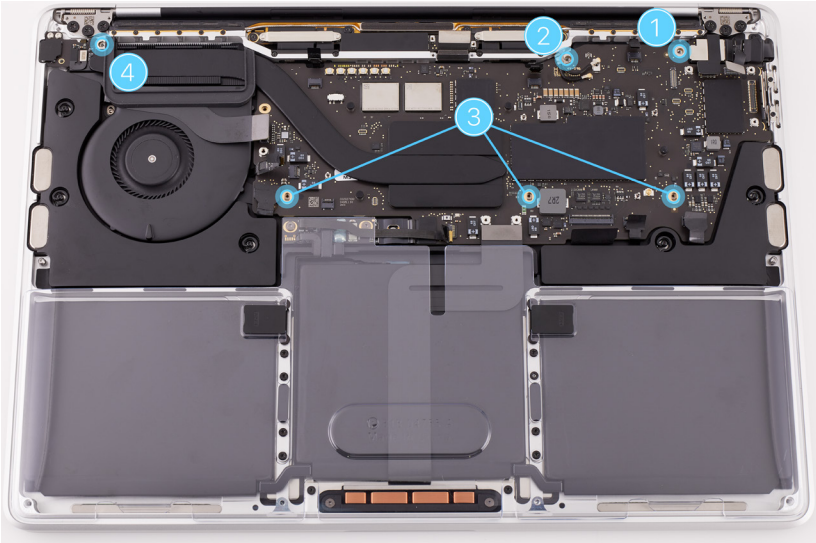


Caution

Ensure that no top case cables are caught under the logic board.



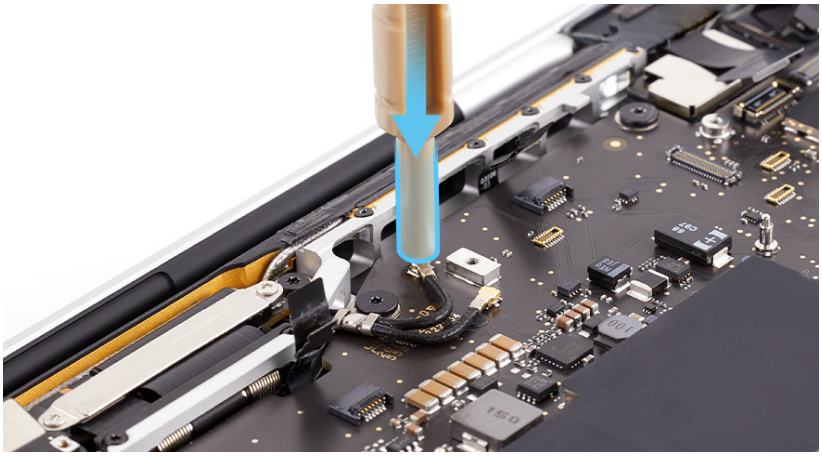
5. Use the T5 screwdriver to partially reinstall the five T5 screws (923-05240) (1), (923-05252) (2), (923-05250) (3) into the logic board.



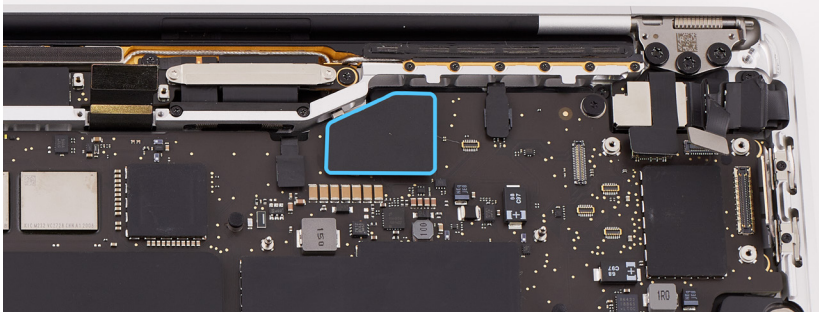
6. Use the 3 mm hex nut driver to partially reinstall the 3 mm hex nut screw (923-05247) (4) into the heat sink arm.

7. Use the T5 screwdriver to fully reinstall the five T5 screws. Then use the 3 mm hex nut driver to fully reinstall the 3 mm hex nut screw.

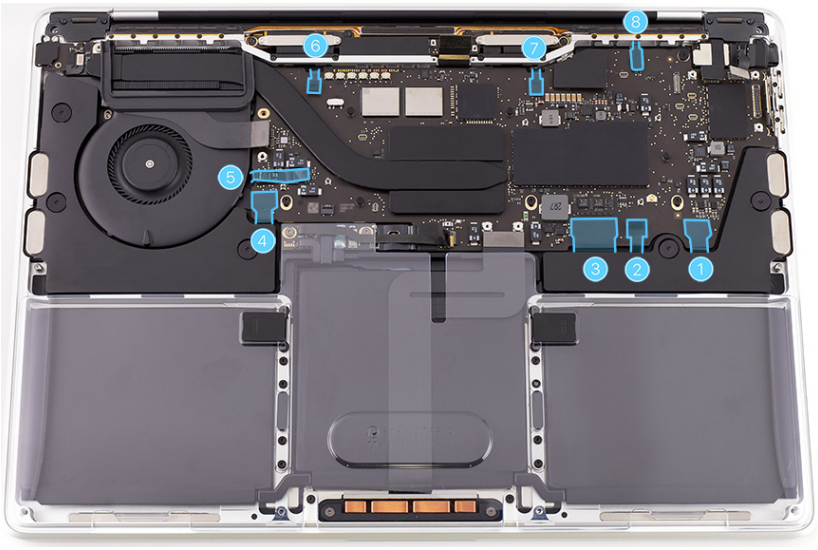
8. Use the blunt end of the antenna tool to press the ends of the two antenna coaxial cables to the connectors.



9. Adhere a replacement polyester film over the wireless antenna coaxial cables and T5 screw.



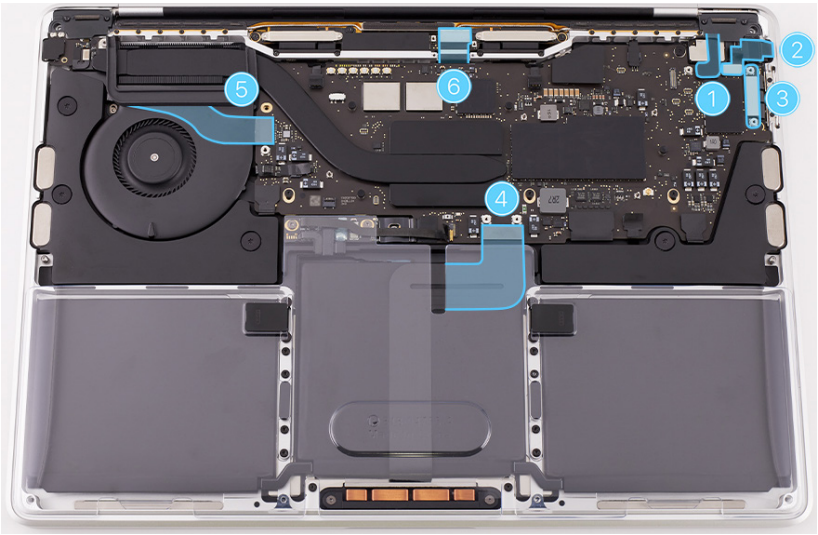
10. Slide the ends of the following eight flex cables (1–8) into the connectors:
    - Left speaker flex cable (1)
    - Keyboard backlight power cord flex cable (2)
    - Keyboard flex cable (3)
    - Right speaker flex cable (4)
    - Fan flex cable (5)
    - Right keyboard backlight flex cable (6)
    - Left keyboard backlight flex cable (7)
    - Microphone flex cable (8)



11. Use the flat end of the black stick to flip down the locking levers of the following eight flex cables:
    - Left speaker flex cable (1)
    - Keyboard backlight power cord flex cable (2)
    - Keyboard flex cable (3)
    - Right speaker flex cable (4)
    - Fan flex cable (5)
    - Right keyboard backlight flex cable (6)
    - Left keyboard backlight flex cable (7)
    - Microphone flex cable (8)

12. Press the polyester film tabs to the ends of the following eight flex cables:
    - Left speaker flex cable (1)
    - Keyboard backlight power cord flex cable (2)
    - Keyboard flex cable (3)
    - Right speaker flex cable (4)
    - Fan flex cable (5)
    - Right keyboard backlight flex cable (6)
    - Left keyboard backlight flex cable (7)
    - Microphone flex cable (8)

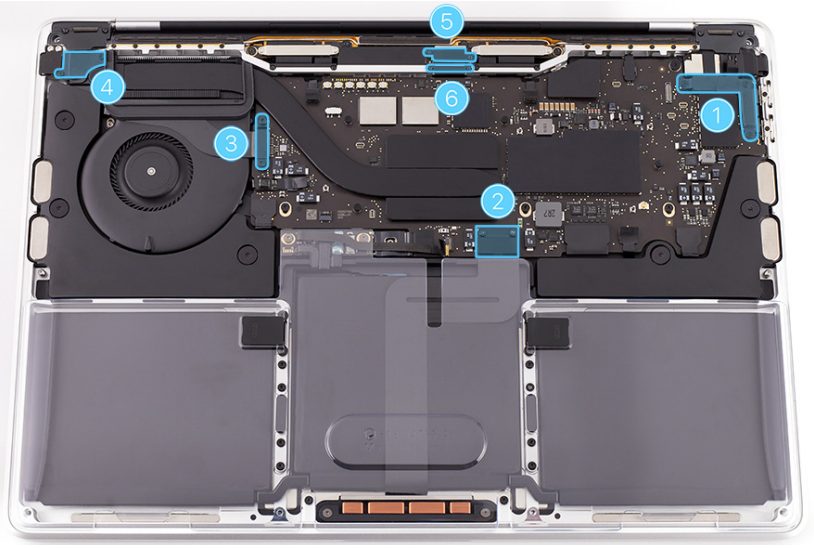
13. Press the ends of five flex cables (1–5) to the connectors on the logic board and one flex cable (6) to the connector on the TCON board:
    - Touch Bar touch flex cable (1)
    - Touch Bar display flex cable (2)
    - I/O board flex cable (3)
    - Trackpad flex cable (4)
    - Audio board flex cable (5)
    - eDP flex cable with connector cowling (6)



Important

Before you press the end of the trackpad flex cable (4) to the connector, slightly lift the battery cover and remove the cable from the slot. Fully reinstall the battery cover before continuing.

14. Reinstall the following six cowlings (1–6):
    - L-shaped cowling (1)
    - Trackpad connector cowling (2)
    - Audio board connector cowling (3)
    - Touch ID board connector cowling (4)
    - eDP connector cowling (5)
    - eDP flex cable cowling (6)



Important

Reinstall the audio board connector cowling (3) with the deeper bend closest to the heat sink arm.

15. Use the T3 screwdriver to reinstall the following nine T3 screws:
    - Three T3 screws (923-05253) into the L-shaped cowling (1)
    - Two T3 screws (923-05253, 923-05263) into the Touch ID board connector cowling (4)
    - Two T3 screws (923-05260) into the eDP connector cowling (5)
    - Two T3 screws (923-05246) into the eDP flex cable cowling (6)

16. Use the T5 screwdriver to reinstall the following four T5 screws:
    - Two T5 screws (923-05254) into the trackpad connector cowling (2)
    - Two T5 screws (923-05255, 923-05256) into the audio board connector cowling (3)

Reinstall the following part to complete reassembly:

- Bottom case

Important

After you've completed all removal and reassembly steps, learn how to initiate the System Configuration process at https://support.apple.com/self-service-repair.

Speakers

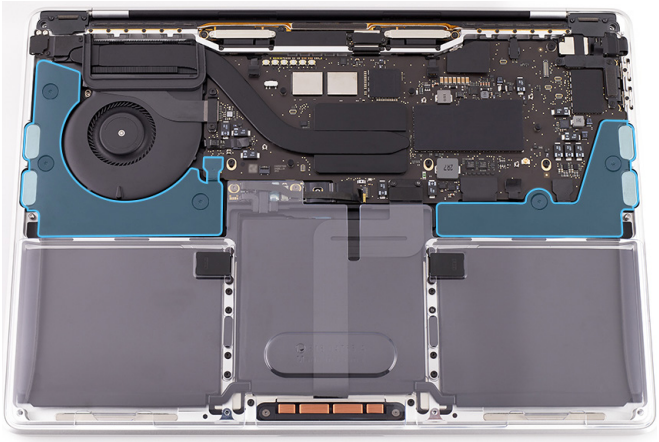
Before You Begin

Remove the following part before you begin:

- Bottom case

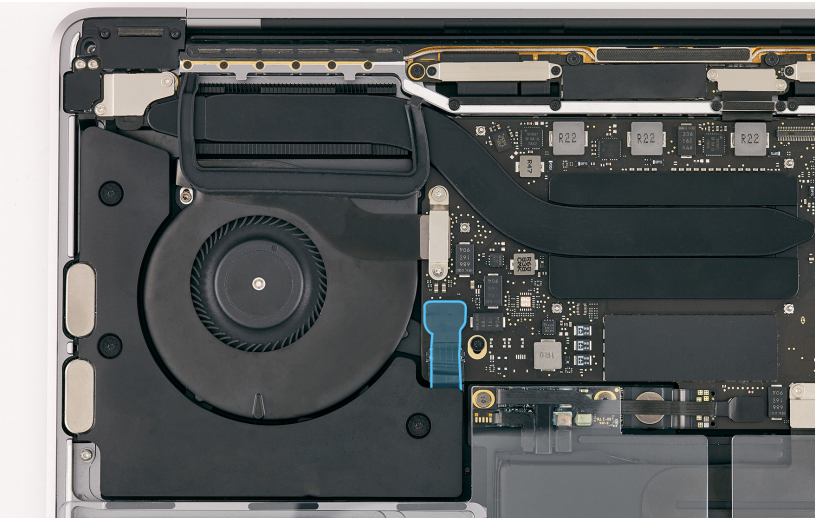
Tools

- Nylon probe (black stick)
- Torx T5 screwdriver



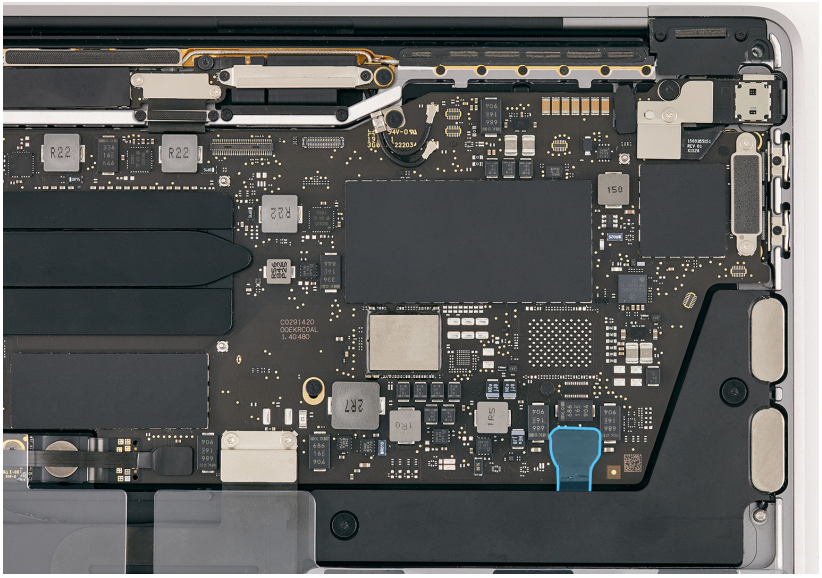
Removal

1. Gently peel back the polyester film tab on the right speaker flex cable.



2. Lift the end of the right speaker flex cable off the connector.

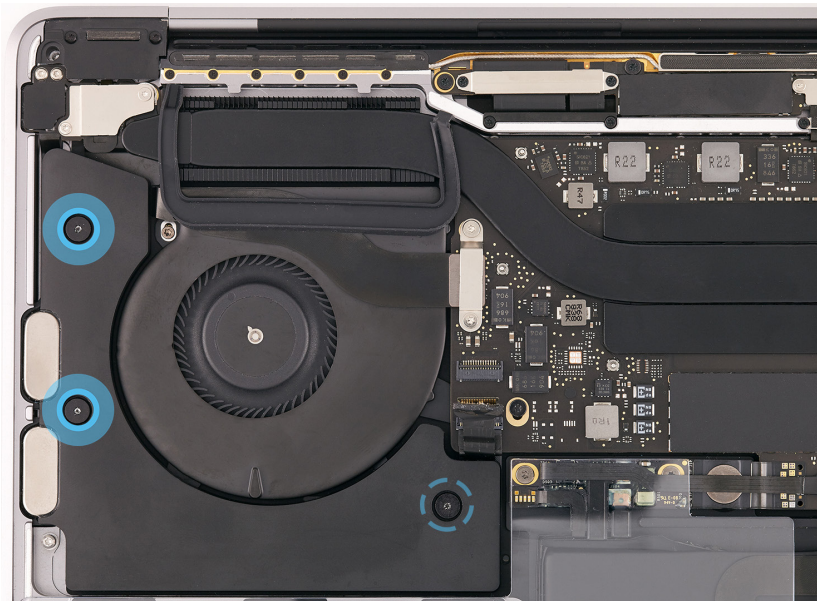
3. Gently peel back the polyester film tab on the left speaker flex cable.



4. Lift the end of the left speaker flex cable off the connector.

5. Use the T5 screwdriver to remove the three T5 screws (923-03540) from the right speaker.

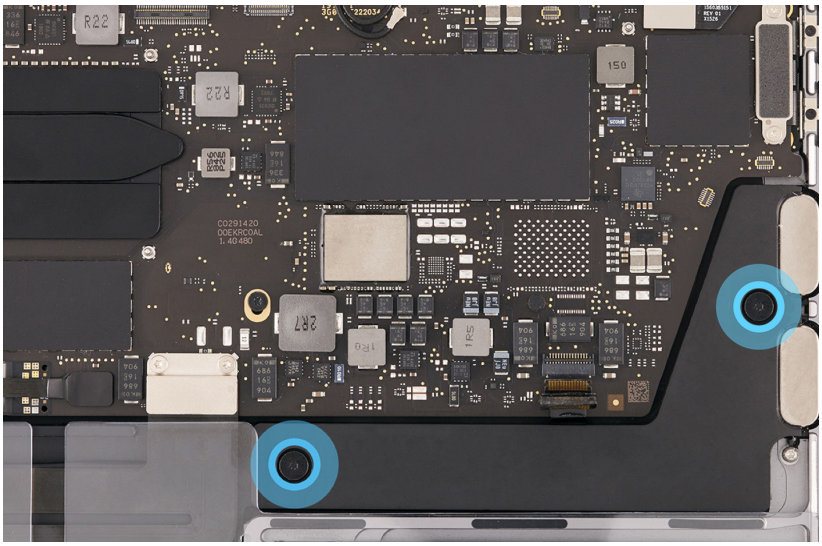
   Note: The screw in the bottom right corner is a captive screw.



Important

The screws may get stuck in the rubber gaskets. If they do, leave them in place. If you force the screws out, the gaskets can come out. If the gaskets come out of the speaker, use the black stick to push them back into the screw holes.

6. Use the T5 screwdriver to remove the two T5 screws (923-03540) from the left speaker.

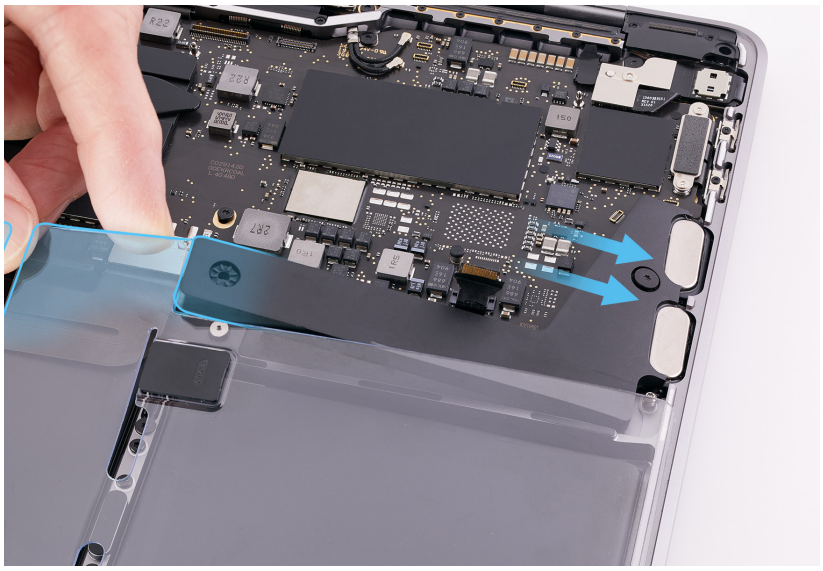


7. Hold the speakers by the inner edges and slide them out from underneath the lip of the top case.

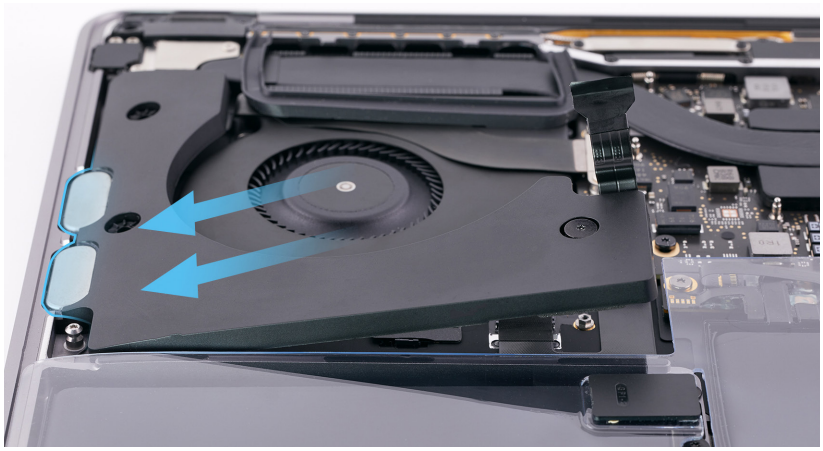
Reassembly

1. Hold the speakers by the inner edges. Tilt the speakers under the lip of the top case. Then lower each speaker into the top case.

Left speaker



Right speaker



2. Use the T5 screwdriver to reinstall the three T5 screws (923-03540) into the right speaker.

3. Use the T5 screwdriver to reinstall the two T5 screws (923-03540) into the left speaker.

4. Press the ends of both the left and right speaker flex cables to the connectors.

5. Press the polyester film tabs onto the left and right speaker flex cables.

Reinstall the following part to complete reassembly:

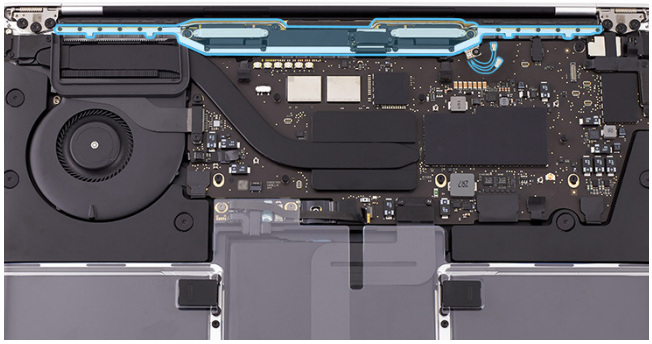
- Bottom case

Vent/Antenna Module

Before You Begin

Remove the following parts before you begin:

- Bottom case
- Display hinge covers



Tools

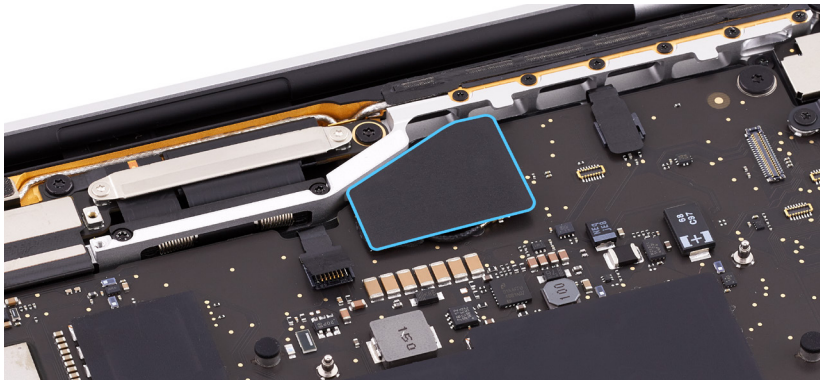
- Antenna tool
- Nylon probe (black stick)
- Torque driver (blue, 0.65 kgf cm)
- Torx security bit
- Torx T3 screwdriver
- Torx T5 screwdriver

Important

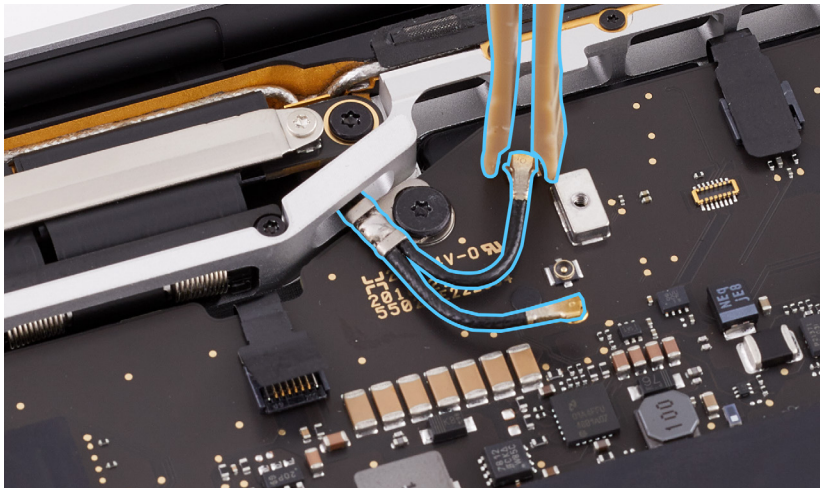
This procedure requires a replacement polyester film.

Removal

1. Peel off and discard the polyester film to access the antenna coaxial cables and T5 screw (923-05252).

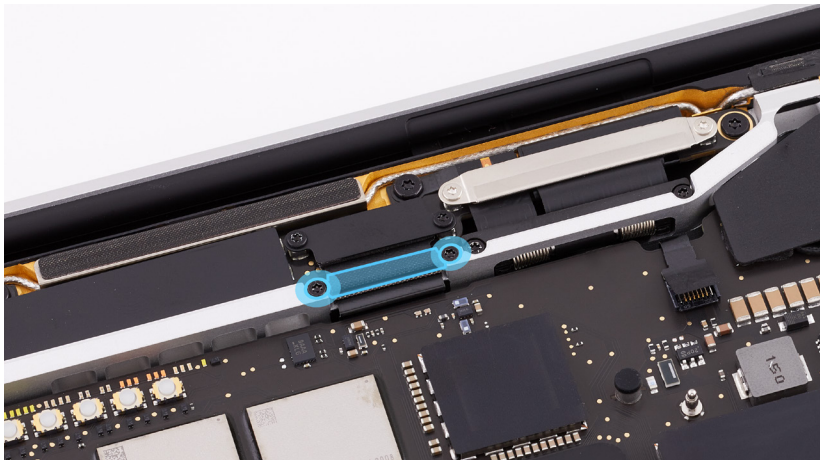


2. Use the antenna tool to lift the end of one antenna coaxial cable off the connector. Repeat the process on the other antenna coaxial cable.

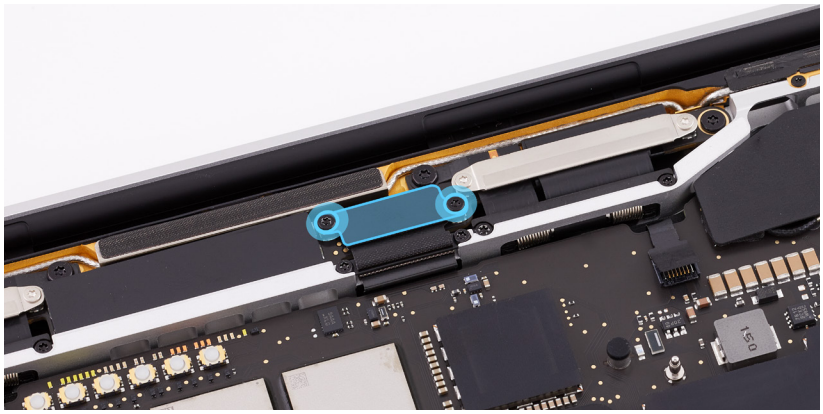


3. Use the T5 screwdriver to remove the T5 screw from the antenna coaxial cable grounding clip.

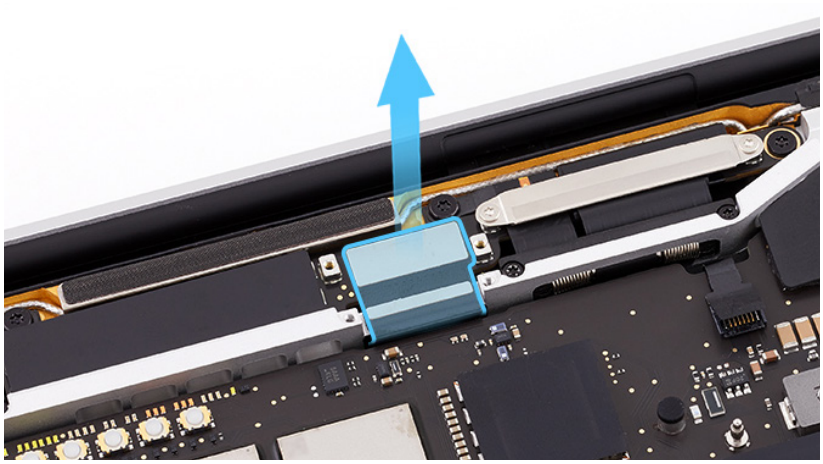
4. Use the T3 screwdriver to remove the two T3 screws (923-05246) from the eDP flex cable cowling. Remove the cowling and save it for reassembly.



5. Use the T3 screwdriver to remove the two T3 screws (923-05260) from the eDP connector cowling. Remove the cowling and save it for reassembly.

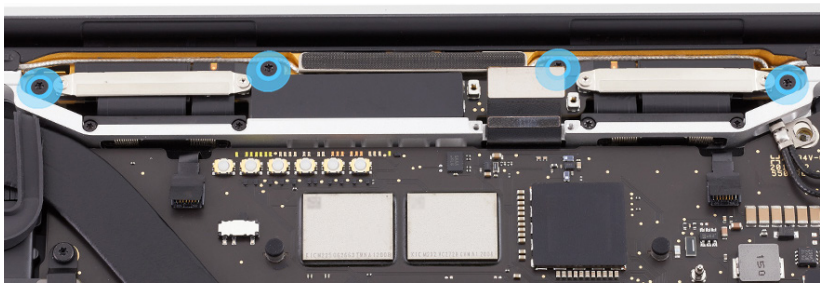


6. Lift the end of the eDP flex cable off the connector.

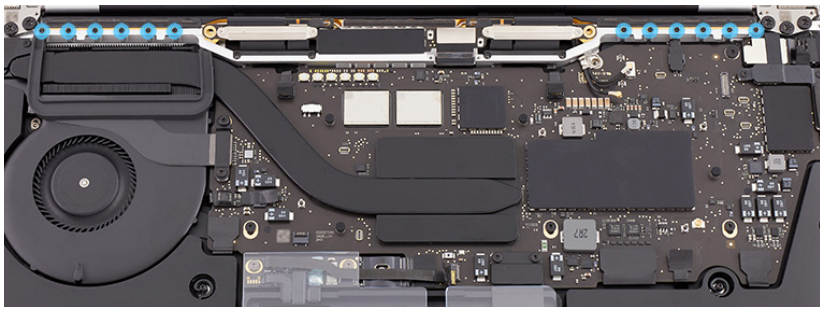


7. Use the T5 screwdriver to remove the four T5 screws (923-05245) from the TCON board.

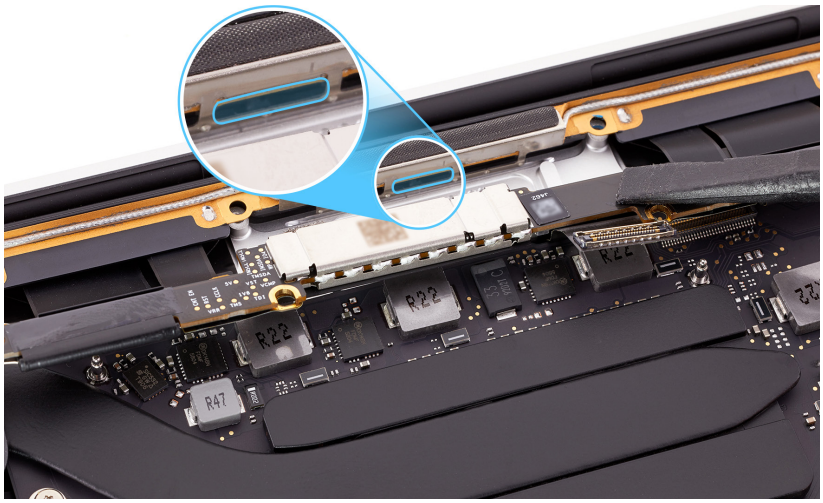
   Note: Removing the screws from the TCON board will give you access to the vent/antenna module. You can't remove the TCON board.



8. Use the blue torque driver and the Torx security bit to remove the 12 1IPR screws (923-05259) from the vent/antenna module.

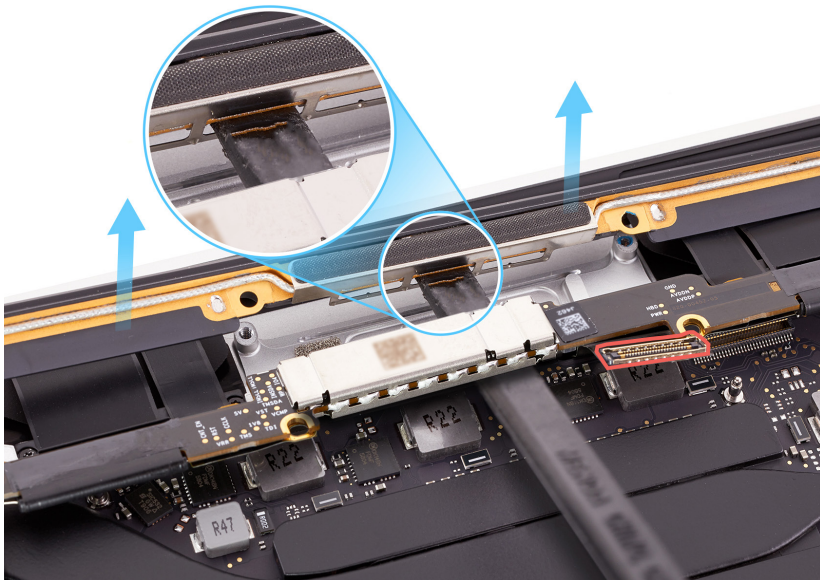


9. Support the TCON board as you tilt it toward the display hinge. Locate the middle vent slot opening to the left of the eDP cable.



10. Guide the flat end of the black stick under the TCON board. Insert the flat end of the black stick into the middle vent slot. Lean the middle of the black stick on the internal frame while pressing the end of the black stick to lift up the vent/antenna module.

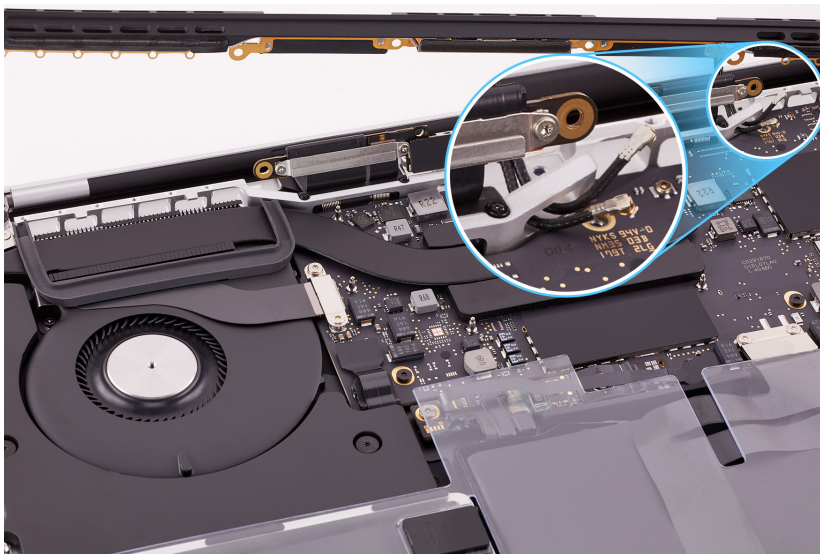
    Note: You may feel a slight click when the vent/antenna module unclips from the top case.



Caution

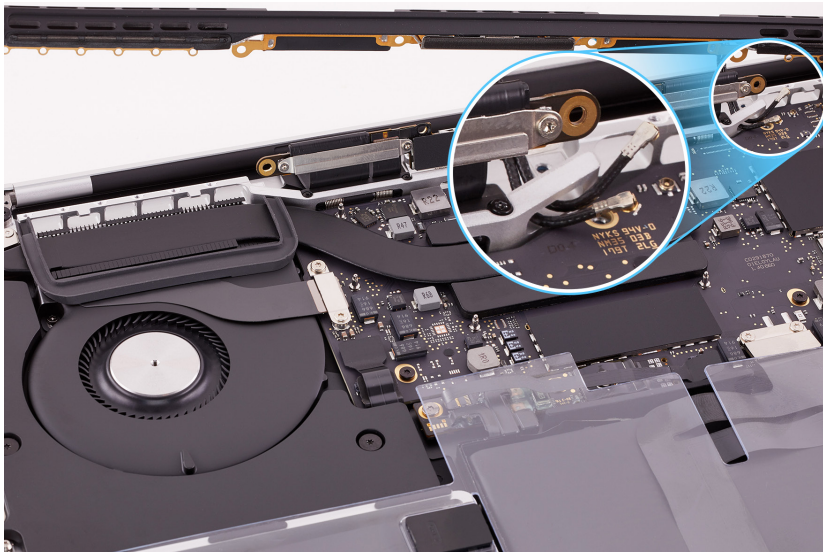
Avoid pressing the eDP cable. Gently support the vent/antenna module so you don't bend it.

11. As you remove the vent/antenna module, route the antenna coaxial cable grounding clip and the two antenna coaxial cables through the opening in the internal frame.



Reassembly

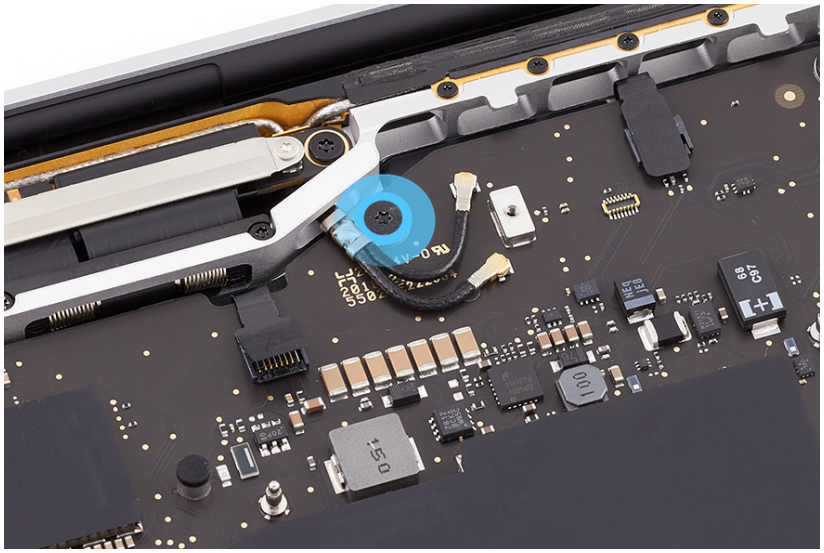
1. Reroute the two antenna coaxial cables and grounding clip through the opening in the internal frame.



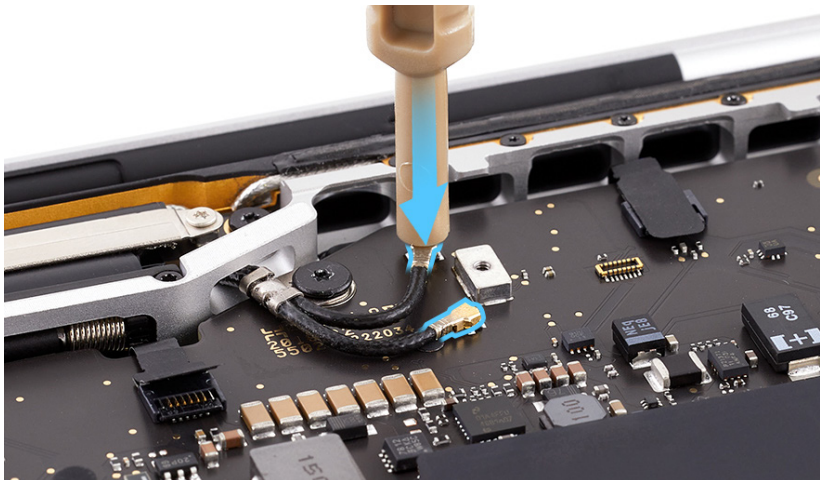
2. Position the vent/antenna module in the top case.

3. Gently press the middle of the vent/antenna module until you feel a click.

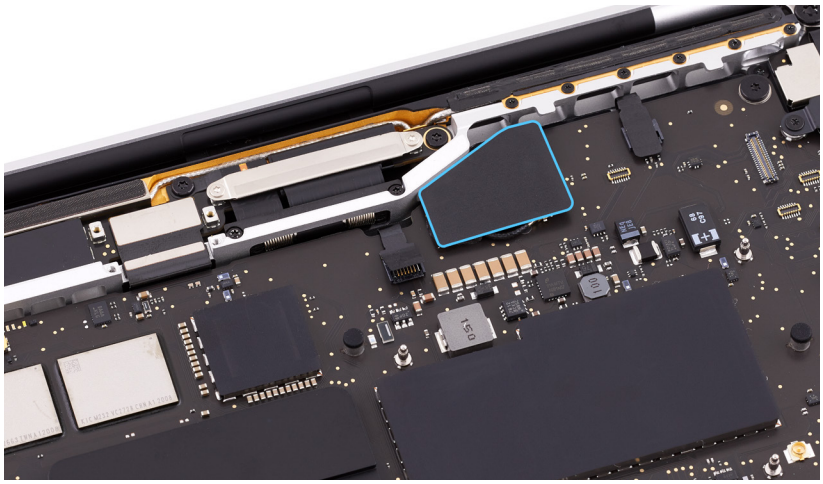
4. Use the T5 screwdriver to reinstall the T5 screw (923-05252) into the antenna coaxial cable grounding clip.



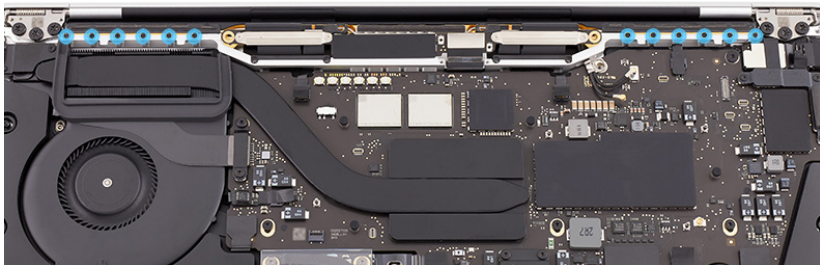
5. Position the ends of the antenna coaxial cables over the connectors. Use the blunt end of the antenna tool to press the ends of the antenna coaxial cables to the connectors.



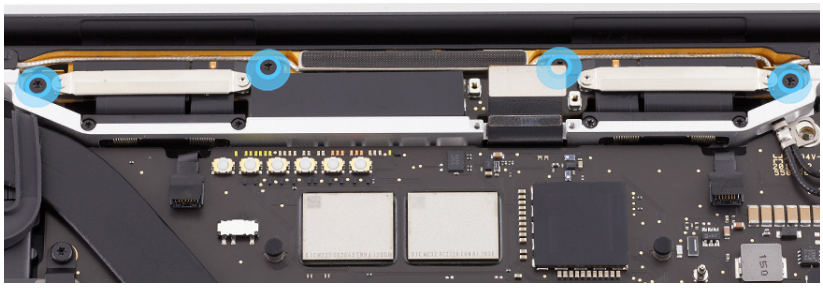
6. Adhere a replacement polyester film over the antenna coaxial cable and screw.



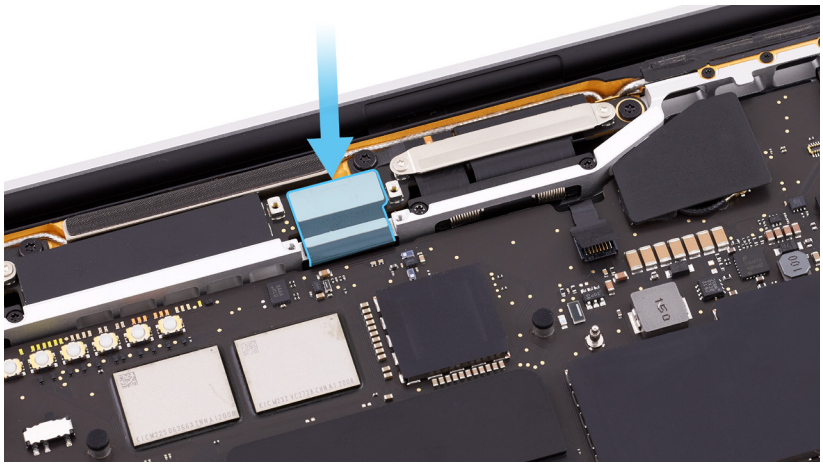
7. Use the blue torque driver and the Torx security bit to reinstall the 12 1IPR screws (923-05259) into the vent/antenna module. Turn each screw until the torque driver clicks.



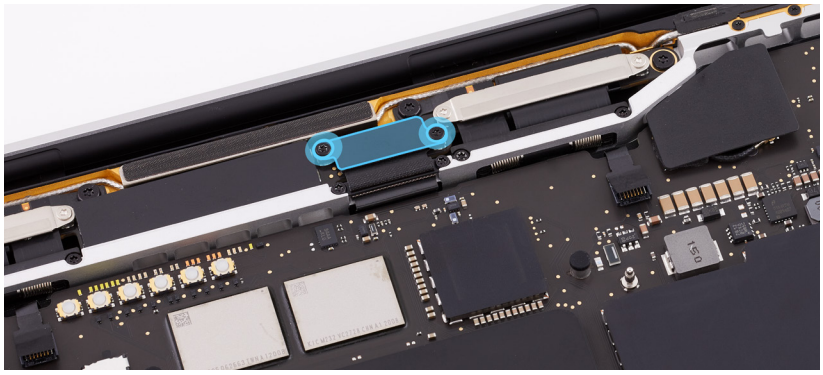
8. Use the T5 screwdriver to reinstall the four T5 screws (923-05245) into the TCON board.



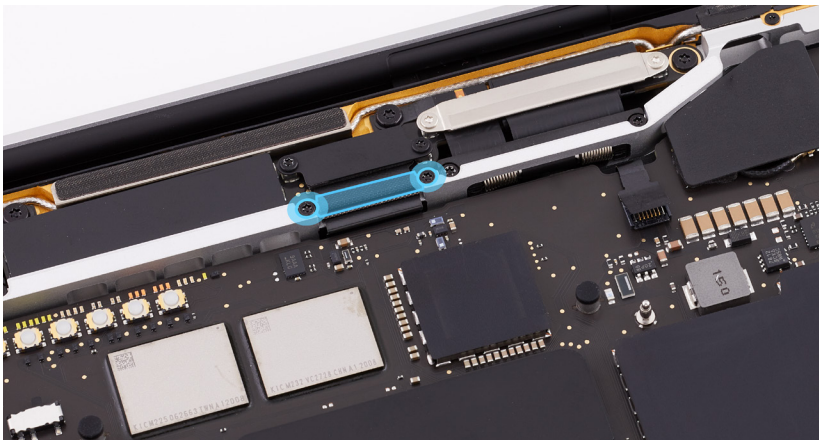
9. Press the end of the eDP flex cable with connector cowling to the connector.



10. Position the eDP connector cowling over the end of the flex cable. Then use the T3 screwdriver to reinstall the two T3 screws (923-05260) into the cowling.



11. Position the eDP flex cable cowling over the flex cable. Then use the T3 screwdriver to reinstall the two T3 screws (923-05246) into the cowling.



Reinstall the following parts to complete reassembly:

- Bottom case
- Display hinge covers

Display

Before You Begin

Remove the following parts before you begin:

- Bottom case
- Display hinge covers
- Vent/antenna module

Tools

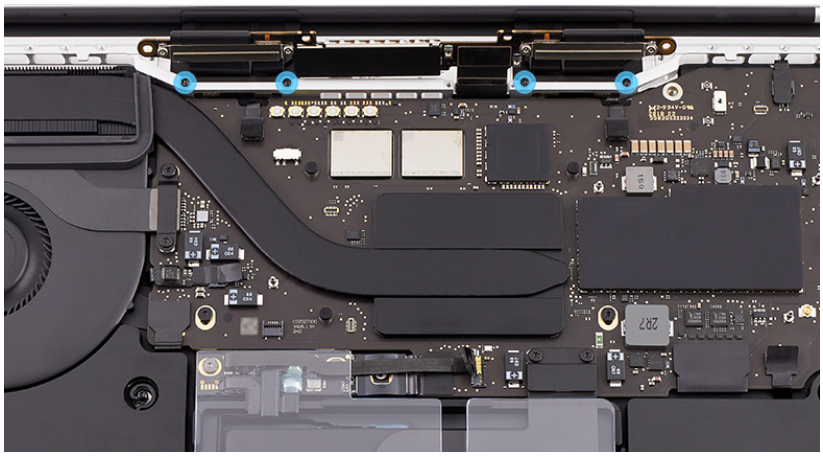
- Torx T3 screwdriver
- Torx T8 screwdriver

Important

This procedure requires System Configuration. After you've completed all removal and reassembly steps, learn how to initiate the System Configuration process at support.apple.com/self-service-repair.

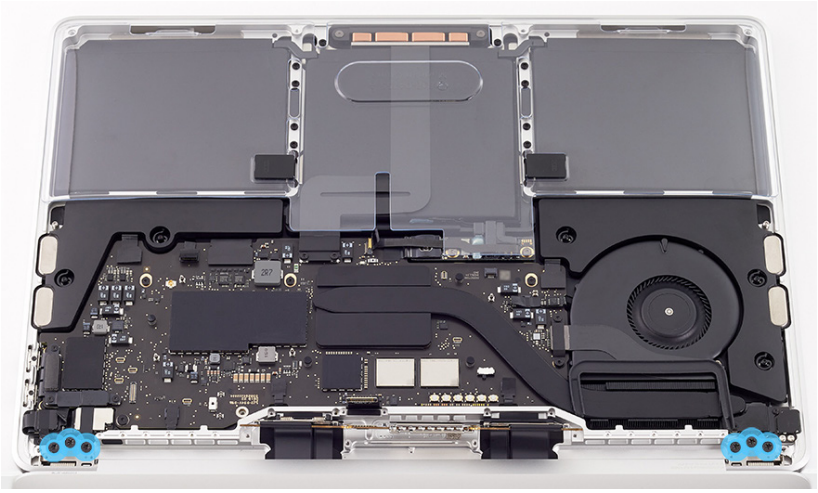
Removal

1. Use the T3 screwdriver to remove the four T3 screws (923-05251) from the two spring tensioners on the internal frame.

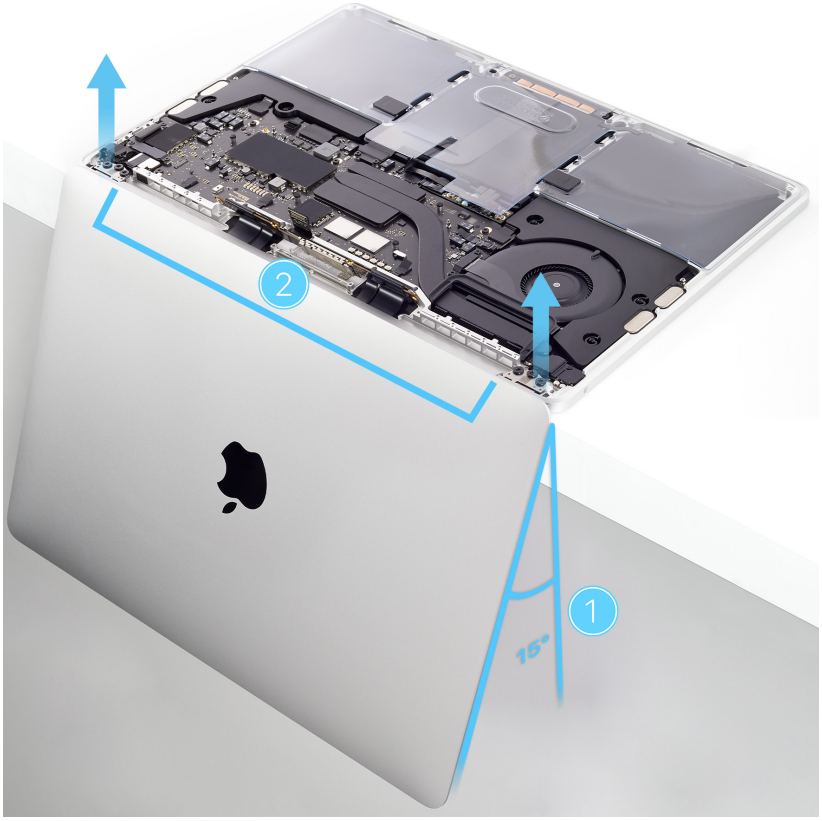


2. Open the computer and place it facedown on a clean surface with the display hanging down over the edge of the table.

3. Use the T8 screwdriver to remove the six T8 screws (923-05266) from the display hinges.



4. Pull the display toward you about 15 degrees (1). Lift the display up and ensure that the hinges clear the edge of the top case (2).



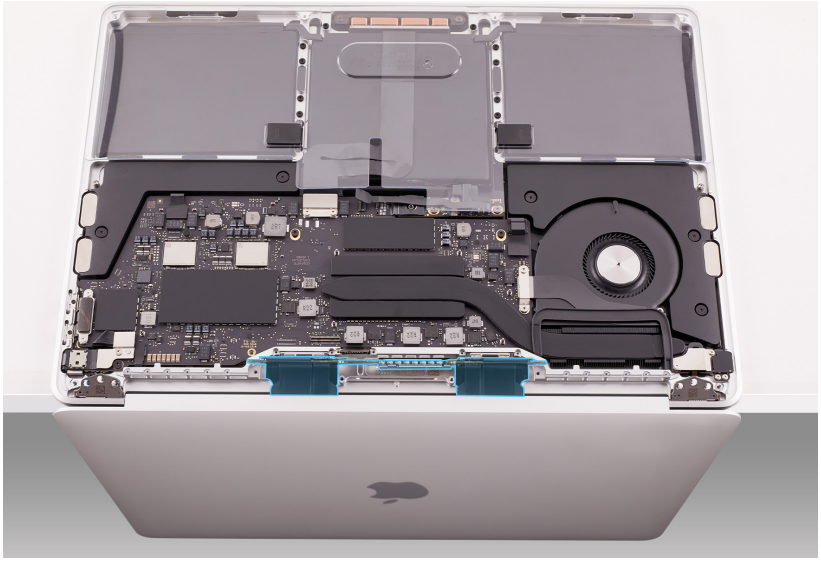
Reassembly

Important

Ensure that you remove all protective liners and tape from a replacement display.

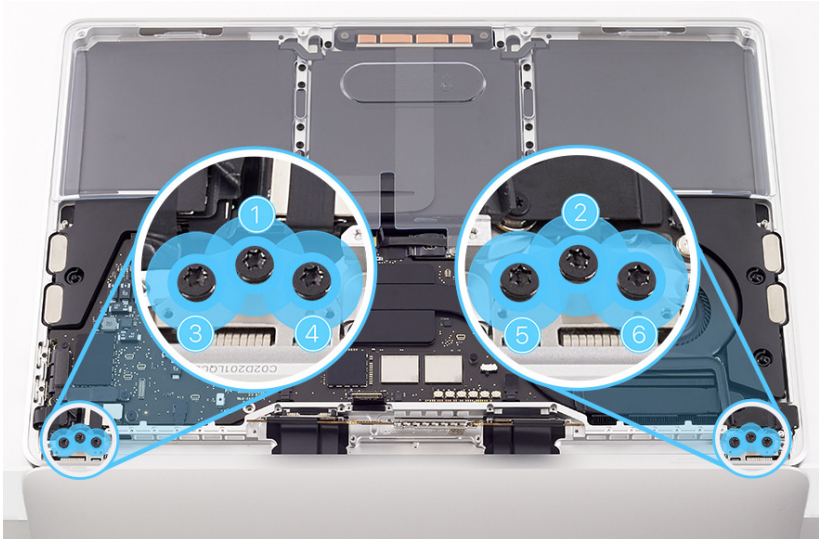
1. Place the display on the top case.

   Note: The display includes the TCON board and the spring tensioners.



2. Ensure that the TCON board and spring tensioners are inside the top case.

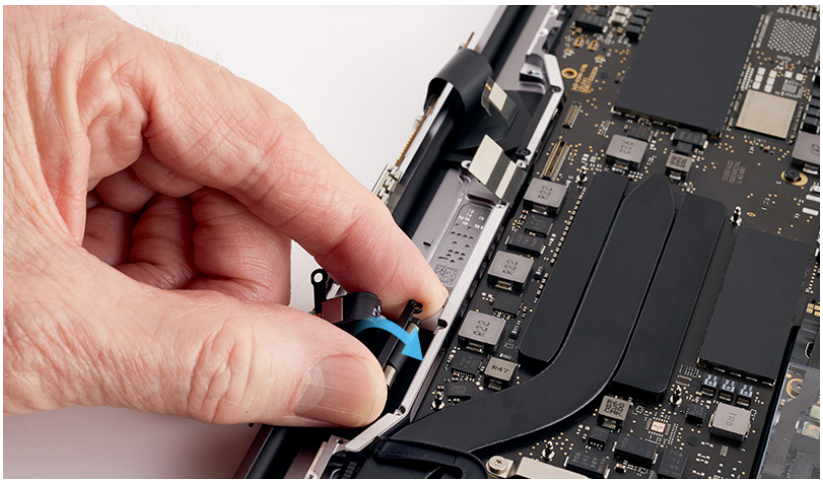
3. Use the T8 screwdriver to partially reinstall the six T8 screws (923-05266) into the display hinges in the order shown.



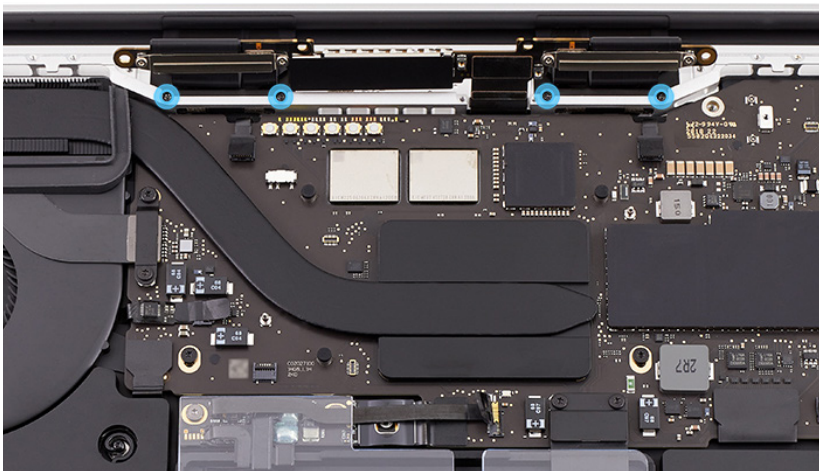
4. Close the display and adjust it until it's flush with the top case.

5. Use a T8 screwdriver to fully reinstall the six T8 screws into the display hinges.

6. Roll and tuck the body of each spring tensioner so it sits flush against the internal frame.



7. Use the T3 screwdriver to reinstall the four T3 screws (923-05251) into the two spring tensioners.



Reinstall the following parts to complete reassembly:

- Vent/antenna module
- Display hinge covers
- Bottom case

Important

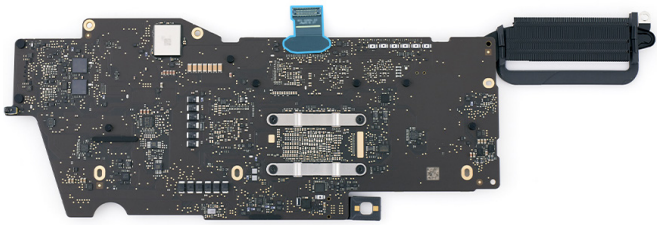
After you've completed all removal and reassembly steps, learn how to initiate the System Configuration process at https://support.apple.com/self-service-repair.

Embedded DisplayPort Flex Cable with Connector Cowling

Before You Begin

Remove the following parts before you begin:

- Bottom case
- Logic board

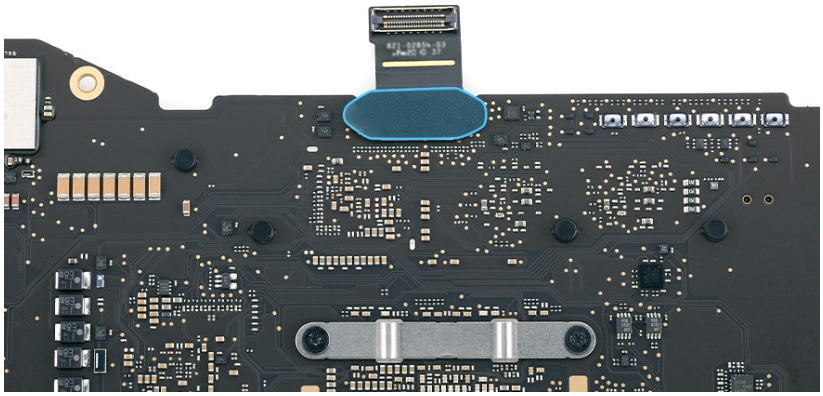


Tools

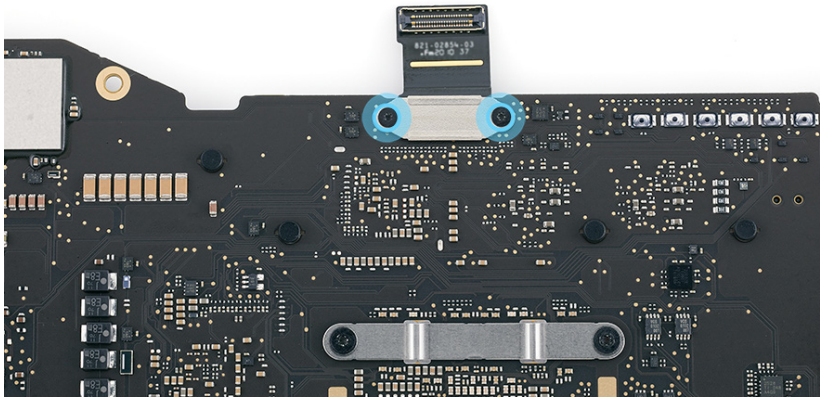
- Nylon probe (black stick)
- Torx T3 screwdriver

Removal

1. Peel back the polyester film tape from the eDP flex cable with connector cowling to access the two T3 screws (923-05199).



2. Use the T3 screwdriver to remove the two T3 screws from the eDP flex cable with connector cowling.

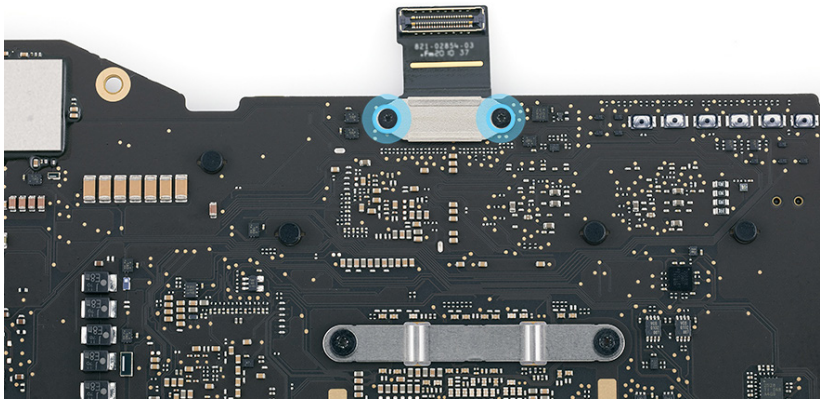


3. Use the flat end of the black stick to lift the end of the eDP flex cable with connector cowling off the connector.

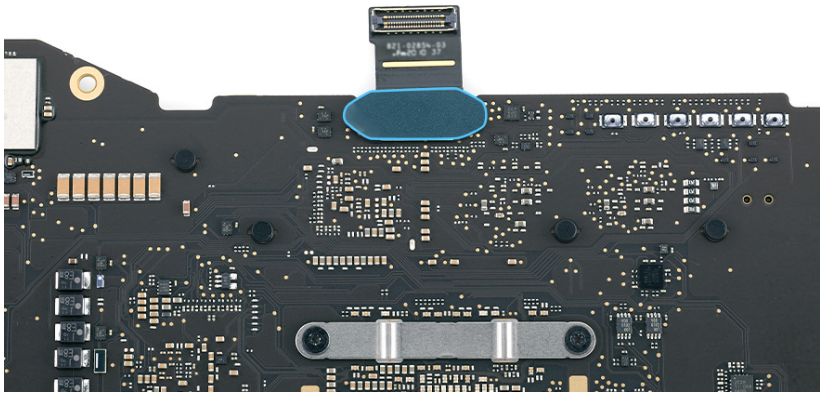
Reassembly

1. Press the end of the eDP flex cable with connector cowling to the connector.

2. Use the T3 screwdriver to reinstall the two T3 screws (923-05199) into the cowling.



3. Press the polyester film tape onto the screws.



Reinstall the following parts to complete reassembly:

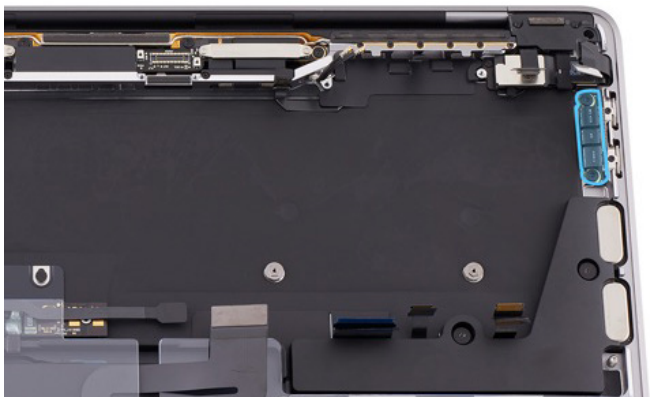
- Logic board
- Bottom case

Input/Output Board

Before You Begin

Remove the following parts before you begin:

- Bottom case
- Logic board

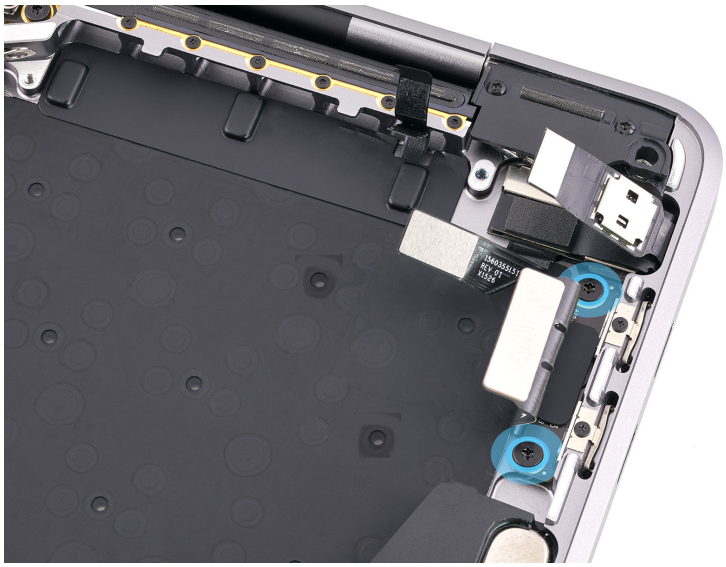


Tools

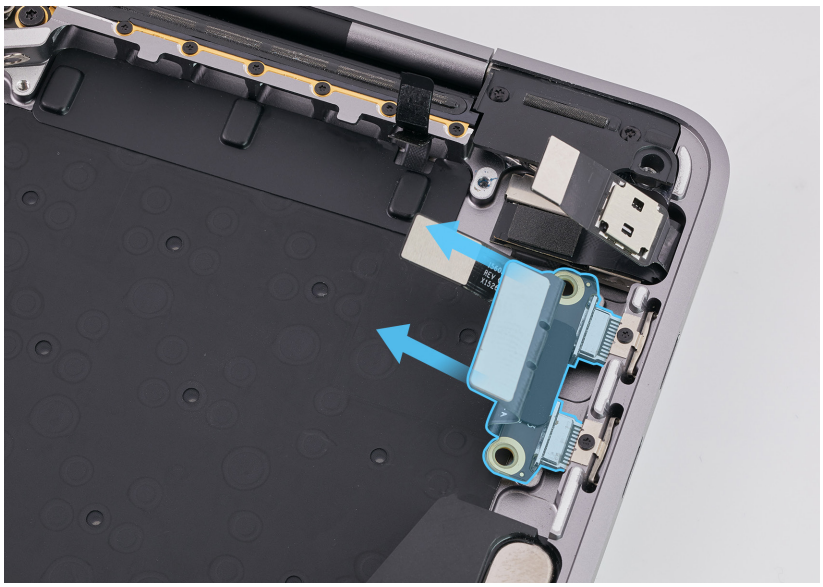
- Torx T5 screwdriver
- USB-C charge cable

Removal

1. Use the T5 screwdriver to remove the two T5 screws (923-05249) from the I/O board.

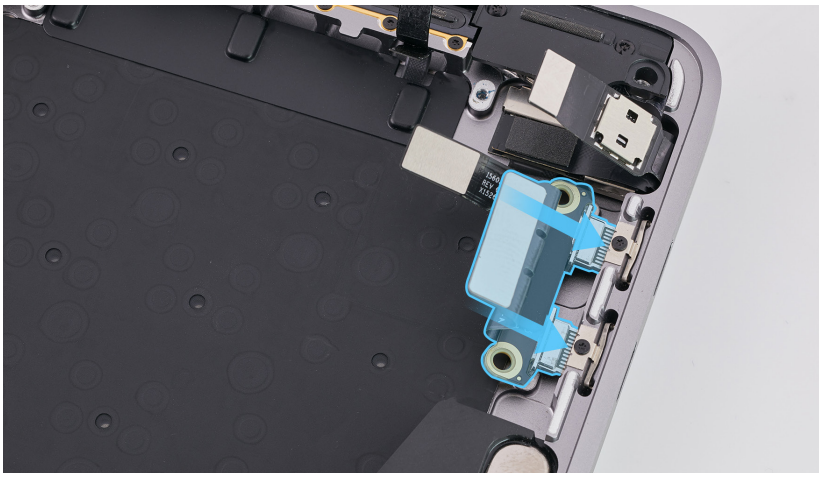


2. Hold the edges of the I/O board and gently slide it out of the ports.

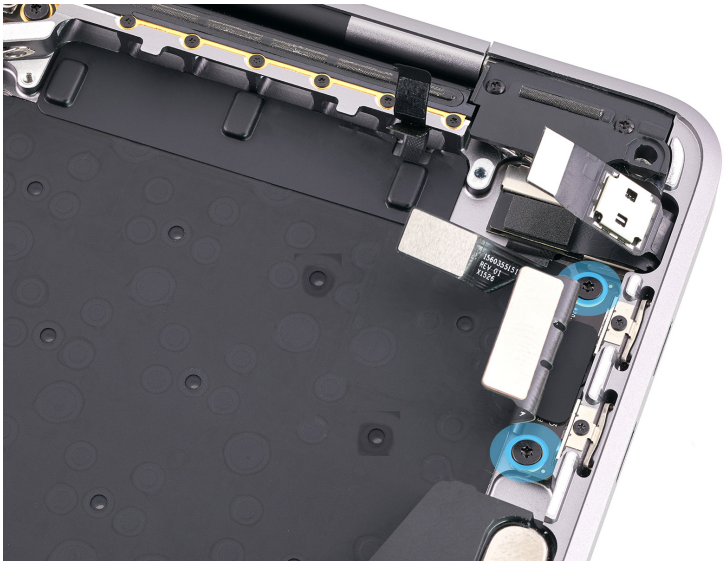


Reassembly

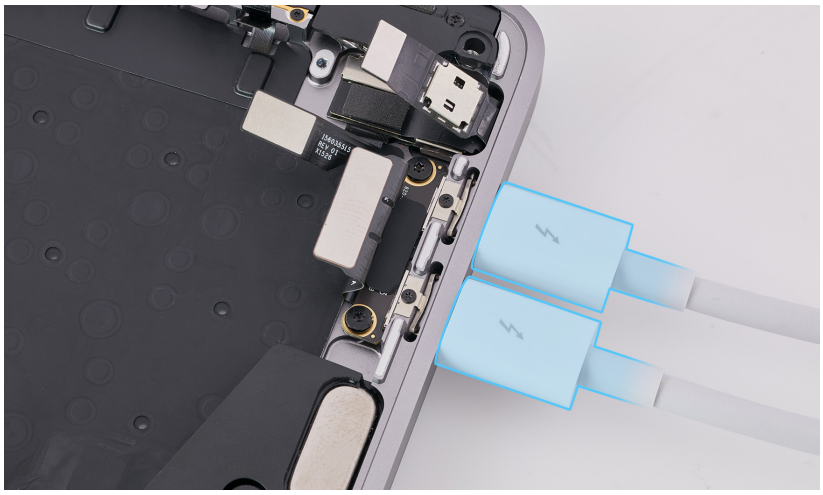
1. Slide the I/O board into the top case.



2. Use the T5 screwdriver to partially reinstall the two T5 screws (923-05249).



3. Plug both ends of the USB-C charge cable into the ports to ensure I/O board alignment. Adjust the alignment of the I/O board until the ends of the cable are easy to insert and remove.



Danger

Ensure that the USB-C charge cable is not plugged into an electrical outlet.

4. Keep the USB-C charge cable plugged into the ports. Then use the T5 screwdriver to fully reinstall the two T5 screws.

5. Unplug the USB-C charge cable from both ports.

Reinstall the following parts to complete reassembly:

- Logic board
- Bottom case

Trackpad and Trackpad Flex Cable

Before You Begin

Warning

Read Battery Safety and follow workspace and battery handling guidelines before you begin.

Remove the following parts before you begin:

- Bottom case
- Logic board

Tools

- Adjustable torque driver (10–34 Ncm)
- ESD-safe tweezers
- Gap offset kit
- Kapton tape
- Nylon probe (black stick)
- Sticky notes (3 by 3 inches)
- Torx T5 bit
- Torx T5 screwdriver

Important

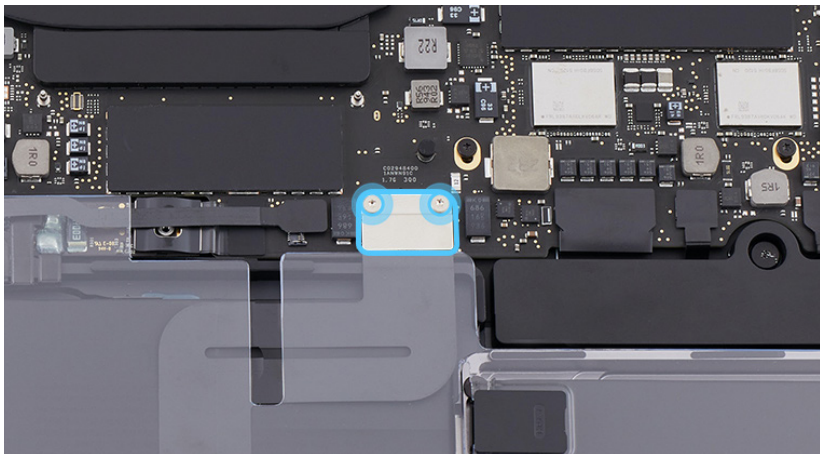
This procedure may require a trackpad shim kit, which only comes with a replacement trackpad. It's not a separate orderable part.

Removal

1. Open the display to a 90-degree angle. Place the computer on the edge of the table with the display hanging down.

2. Use the T5 screwdriver to remove the two T5 screws (923-05254) from the trackpad connector cowling.

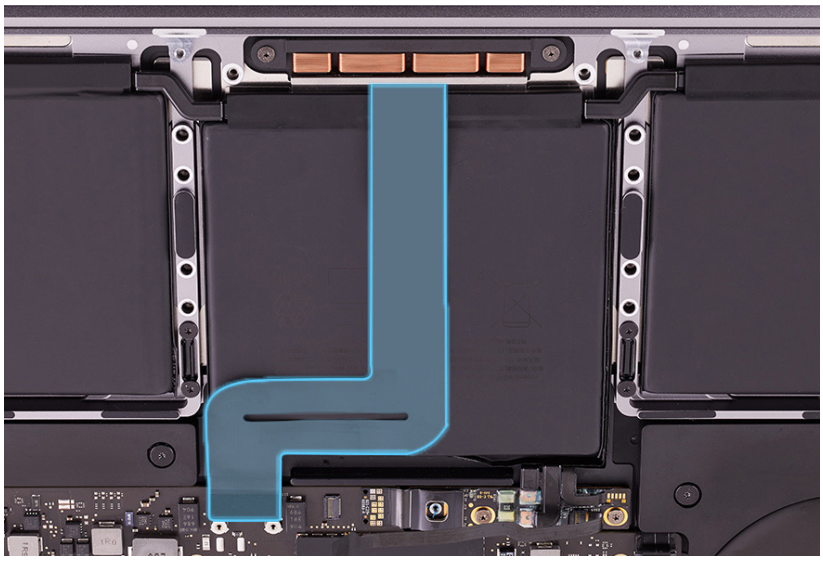
3. Lift the end of the trackpad flex cable off the connector.



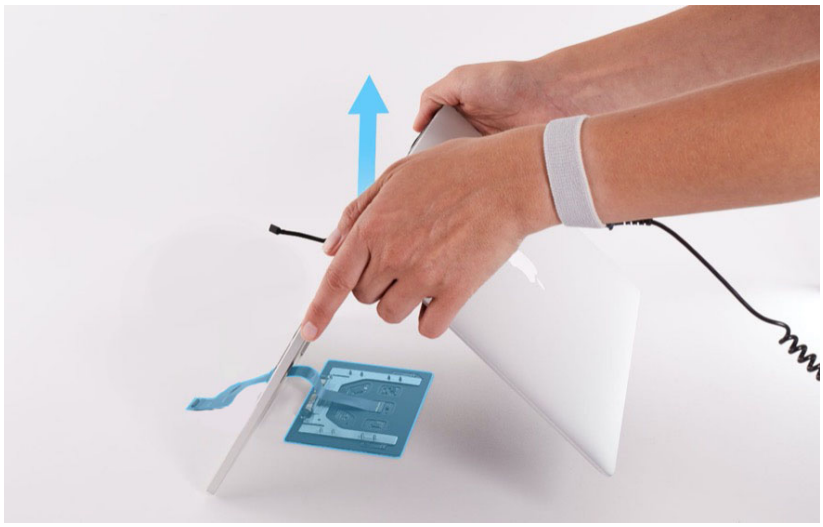
4. Use the T5 screwdriver to remove the eight T5 screws (923-05257) from the sides and the two T5 screws (923-05270) from the middle.

5. Hold the battery cover by the edges. Then lift it off the top case.

6. Gently peel the trackpad flex cable off the battery.



7. Lift the computer off the table and allow the trackpad flex cable to pass through the opening in the top case. Leave the trackpad flat on the table to keep the shims in place.

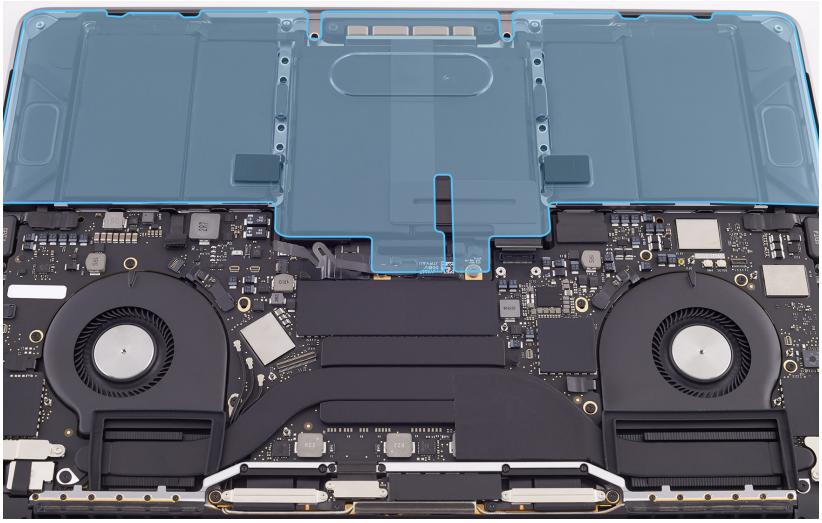


Important

If the shims fall out, they must be reinstalled in their original locations. If you can't determine the shims' original locations, replace them. A replacement shim kit is available only with a replacement trackpad.

8. Place the computer on the edge of the table with the display hanging down.

9. Place the battery cover on the battery. Then press the black tabs into the clips on the top case until you feel a click.



Important

If the trackpad flex cable is damaged, flip up the locking lever. Then slide the end of the flex cable out of the connector.

Reassembly

Important

- If necessary, install the replacement trackpad flex cable by sliding the end of the replacement flex cable into the connector on the trackpad. Then flip down the locking lever.
- If you're replacing the trackpad, follow reassembly step 1. If you're reinstalling the existing trackpad, skip to reassembly step 2.

1. Use ESD-safe tweezers to install replacement trackpad shims. Position four rectangular shims on the outer screw holes. Then position two circular shims on the middle screw holes.

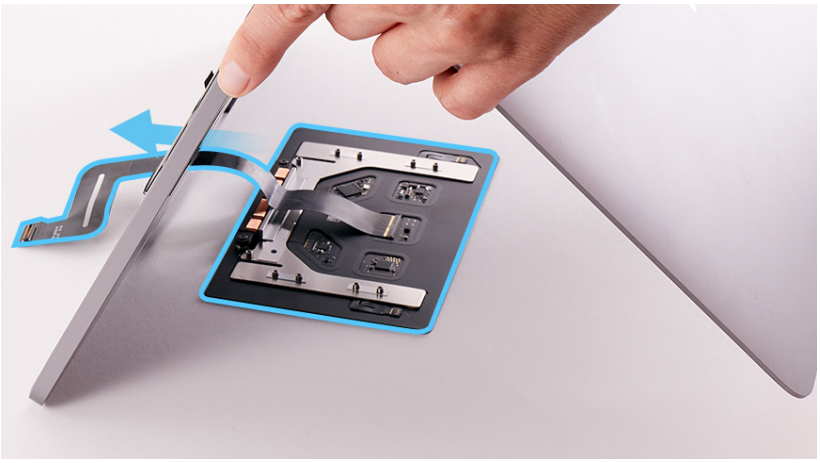
Important

A replacement trackpad comes with three sizes of shims (0.100 mm, 0.150 mm, and 0.175 mm). Start with the 0.150 mm shims. Use thinner or thicker shims to adjust alignment in step 13.

2. Hold the battery cover by the edges and lift it off the top case.

3. Ensure that the trackpad lies flat on the table with the trackpad flex cable extended away from you.

4. Route the trackpad flex cable back through the opening in the top case.

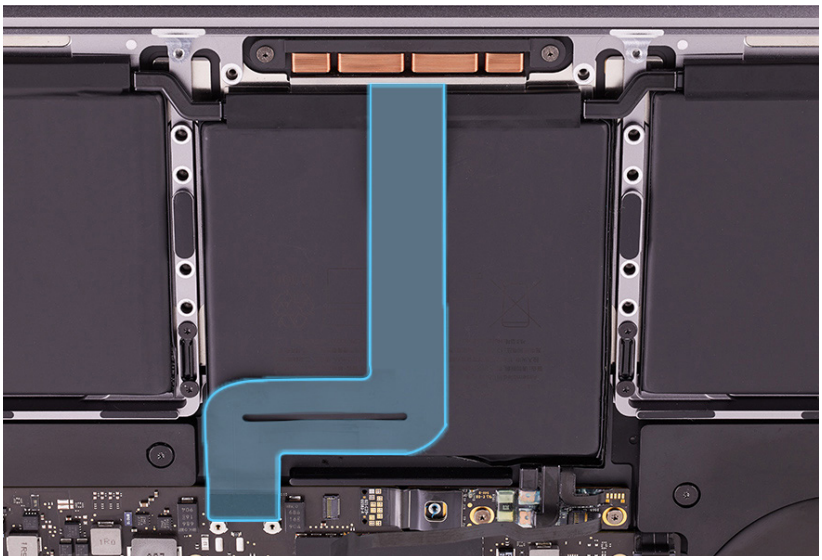


5. Slowly lower the computer over the trackpad and align the screw holes in the top case with the screw holes in the trackpad. Let the display hang over the table edge.

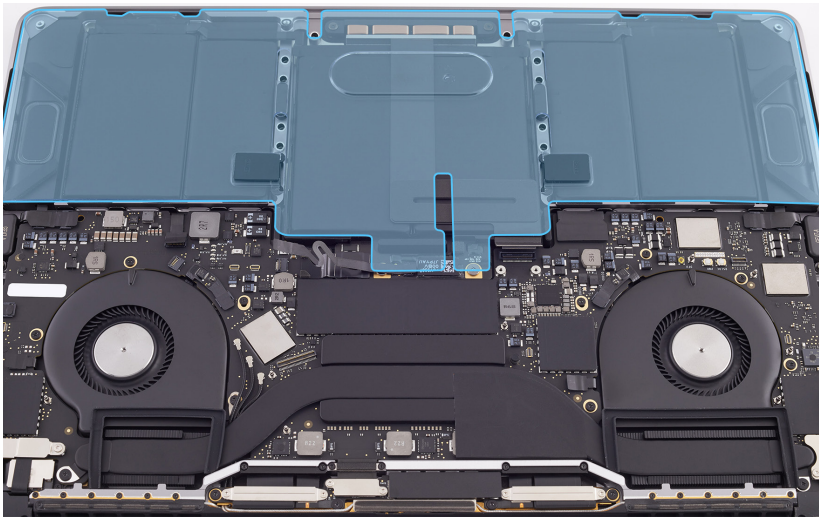
6. Lay the trackpad flex cable flat.

Important

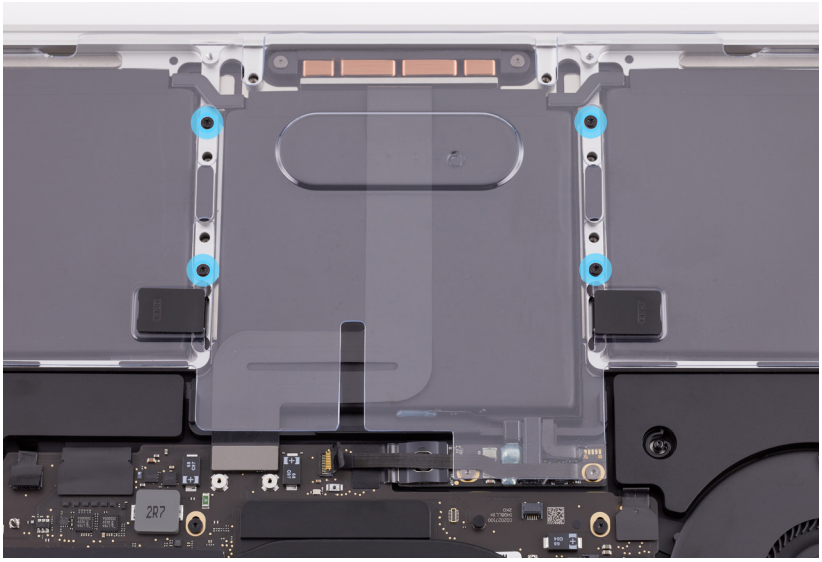
Don't adhere the trackpad flex cable to the battery yet.



7. Place the battery cover on the battery and press the black tabs into the clips on the top case until you feel a click.

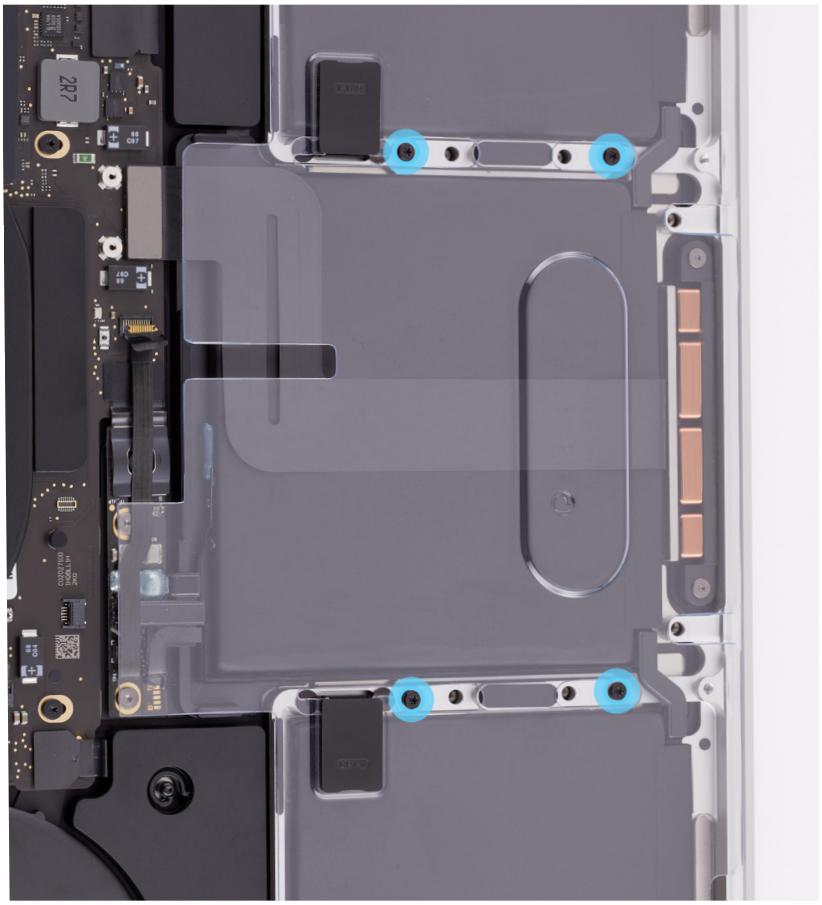


8. Use the T5 screwdriver to partially reinstall four side T5 screws (923-05257) into the outer screw holes to align the trackpad.



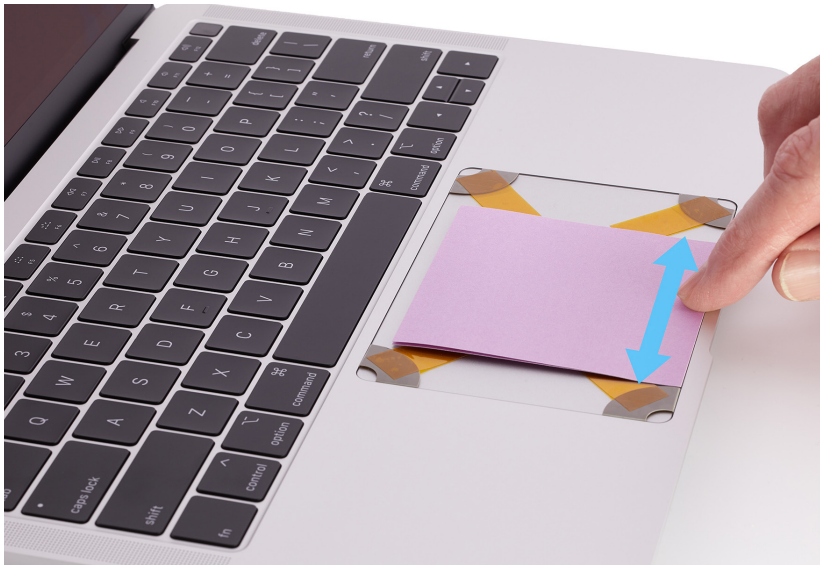
9. Turn over the computer. Insert one gap offset in each of the four corners of the trackpad. Secure each gap offset with a piece of Kapton tape.

10. Stand the computer on its side with the display still open. Use the T5 screwdriver to fully reinstall the four outer T5 screws.



11. Place the computer right side up. To verify the top of the trackpad is at the correct height, align one sticky note on the trackpad's top edge. Ensure that the sticky note is flush with the top case.

12. To verify that the bottom of the trackpad is at the correct height, align a stack of two sticky notes on the trackpad's bottom edge. Ensure that the two sticky notes are flush with the top case.



13. If the trackpad is at the correct height, continue to step 14. If the trackpad edges are higher or lower than the top case, remove the sticky notes, gap offsets, and Kapton tape. Place the computer on the edge of the table with the display hanging down. Use the T5 screwdriver to remove the four outer side T5 screws and repeat removal steps 4 through 8. Then follow reassembly steps 1 through 12.

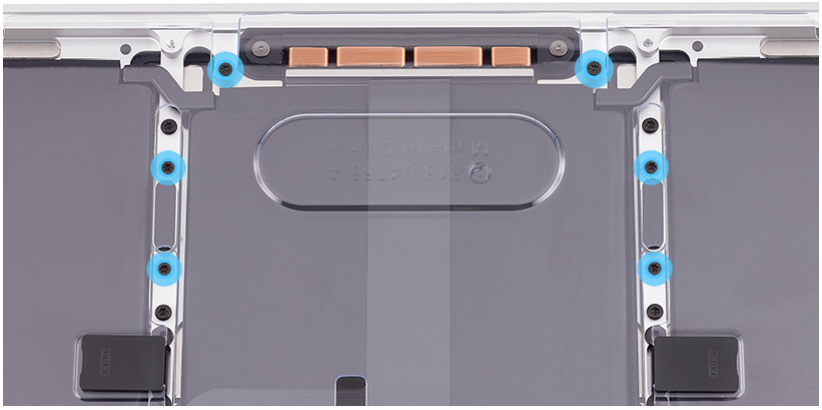
Important

- If the trackpad is higher than the top case, install the thinner 0.075 mm shims.
- If the trackpad is lower than the top case, install the thicker 0.175 mm shims.

14. Place the computer on the edge of the table with the display hanging down.

15. Insert the Torx T5 bit into the 10–34 Ncm adjustable torque driver. Set the torque value to 16 Ncm.

16. Use the adjustable torque driver and Torx T5 bit to partially reinstall the two middle T5 screws (923-05270) and the remaining four side T5 screws (923-05257).



17. Use the adjustable torque driver and Torx T5 bit to fully reinstall all 10 T5 screws to 16 Ncm.

18. Hold the battery cover by the edges and lift it off the top case.

19. Gently press along the trackpad flex cable to adhere it to the battery.

Important

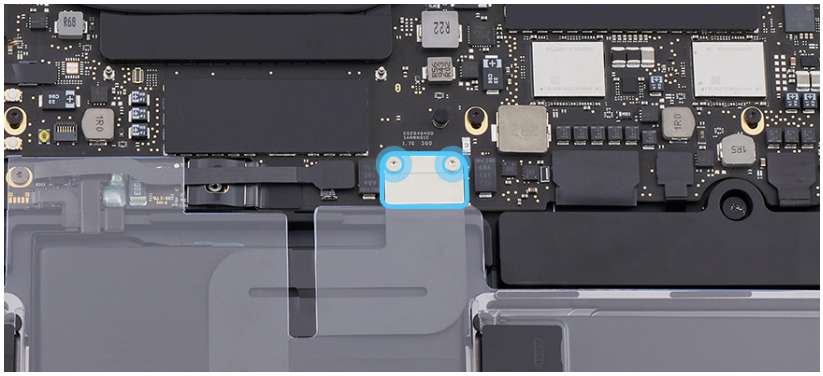
If you're installing a replacement trackpad flex cable, remove the adhesive backing before adhering the flex cable to the battery.

20. Place the battery cover on the battery and press the black tabs into the clips on the top case until you feel a click.

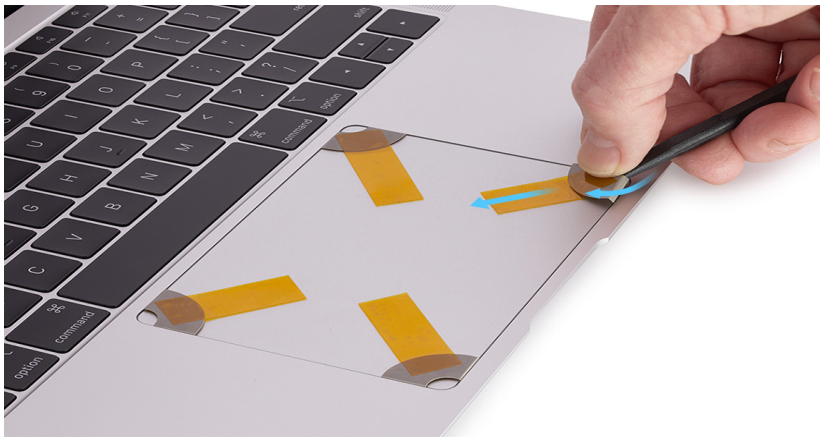
21. Press the end of the trackpad flex cable to the connector.

22. Position the trackpad connector cowling over the end of the trackpad flex cable.

23. Use the T5 screwdriver to reinstall the two T5 screws (923-05254) into the trackpad connector cowling.



24. Turn the computer over and use the flat end of the black stick to lift the gap offsets and the Kapton tape off the trackpad.



Reinstall the following parts to complete reassembly:

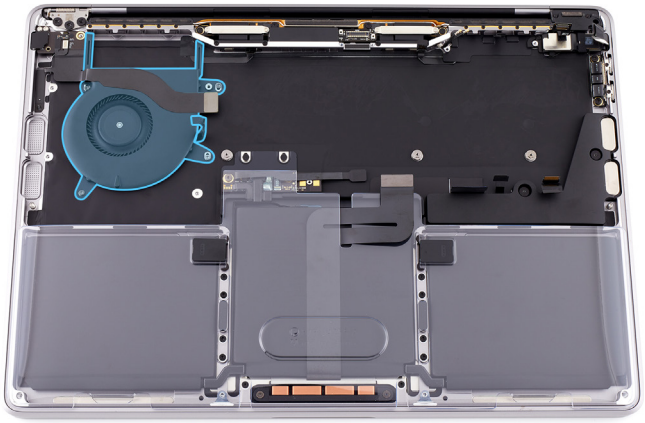
- Logic board
- Bottom case

Fan

Before You Begin

Remove the following parts before you begin:

- Bottom case
- Logic board
- Right speaker

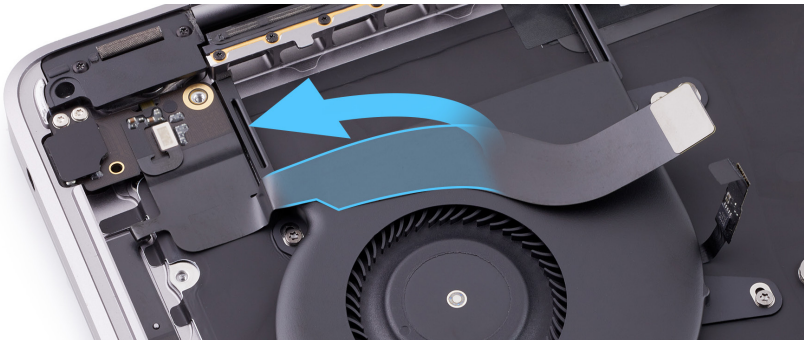


Tools

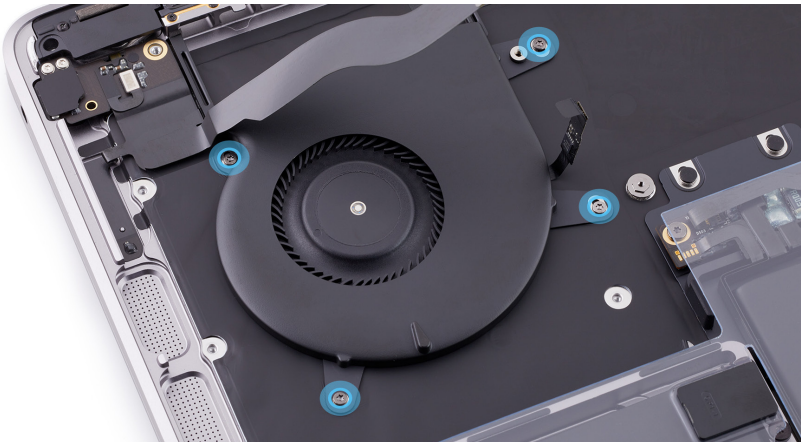
- Torx T5 screwdriver

Removal

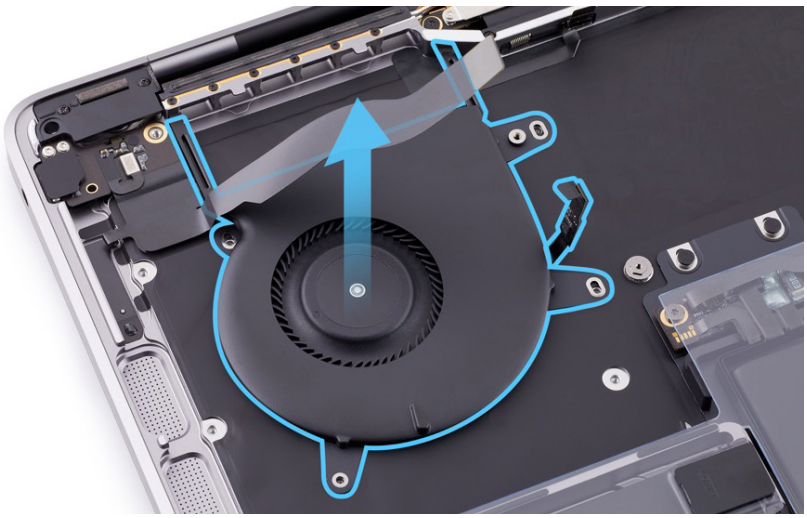
1. Peel the audio board flex cable off the fan.



2. Use the T5 screwdriver to remove the four T5 screws (923-05258) from the fan.



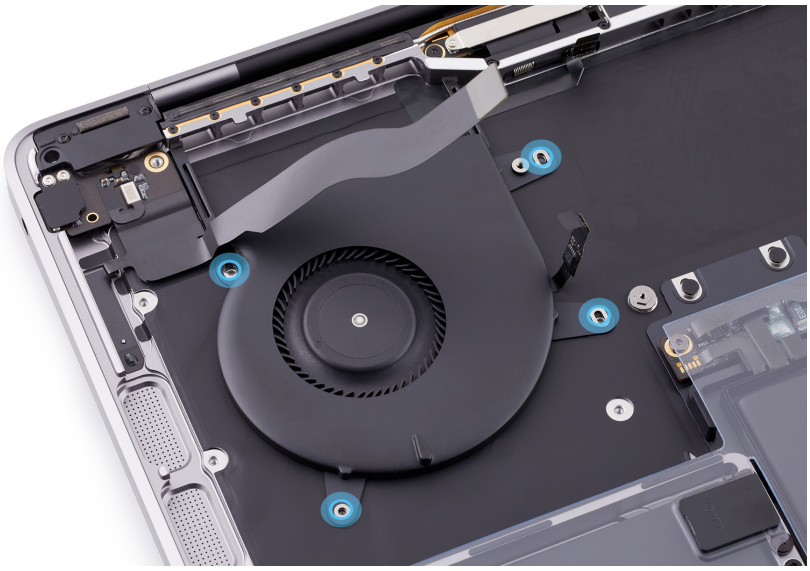
3. Remove the fan from the top case.



Reassembly

1. Position the fan in the top case.

2. Use the T5 screwdriver to reinstall the four T5 screws (923-05258) into the fan.



3. Press the audio board flex cable to adhere it to the fan.

Reinstall the following parts to complete reassembly:

- Right speaker
- Logic board
- Bottom case

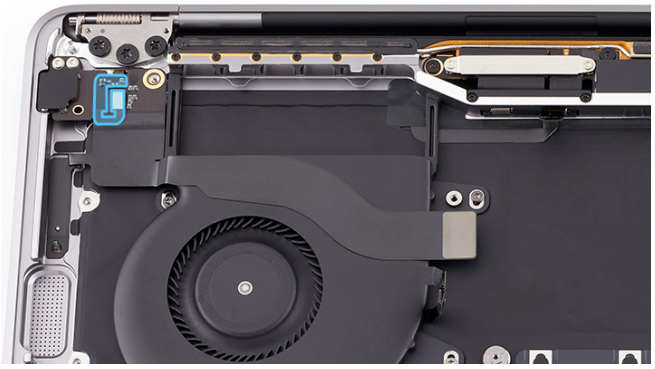
Touch ID Board

Before You Begin

Remove the following parts before you begin:

- Bottom case
- Logic board
- Right display hinge cover
- Right speaker

Note: To access the Touch ID board, first complete removal steps 1 through 3 of the audio board procedure.



Tools

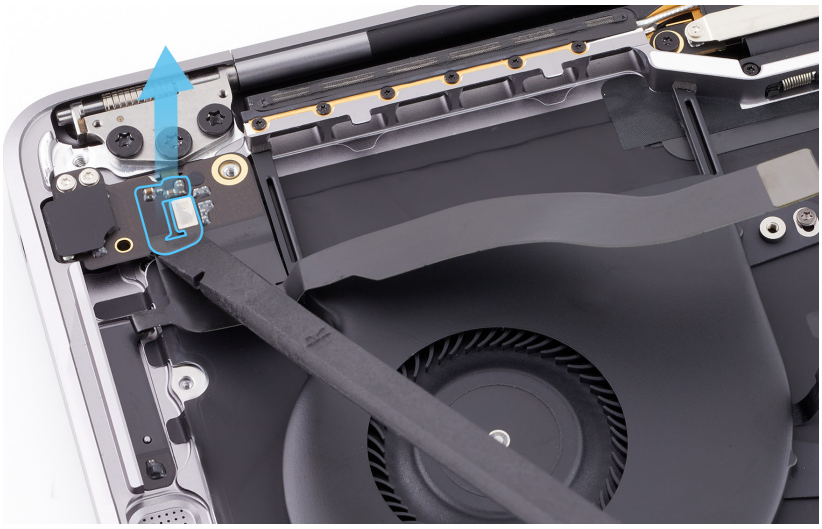
- EarPods with 3.5 mm headphone plug
- ESD-safe tweezers
- Kapton tape
- Nylon probe (black stick)
- Torx T3 screwdriver
- Touch ID alignment kit

Important

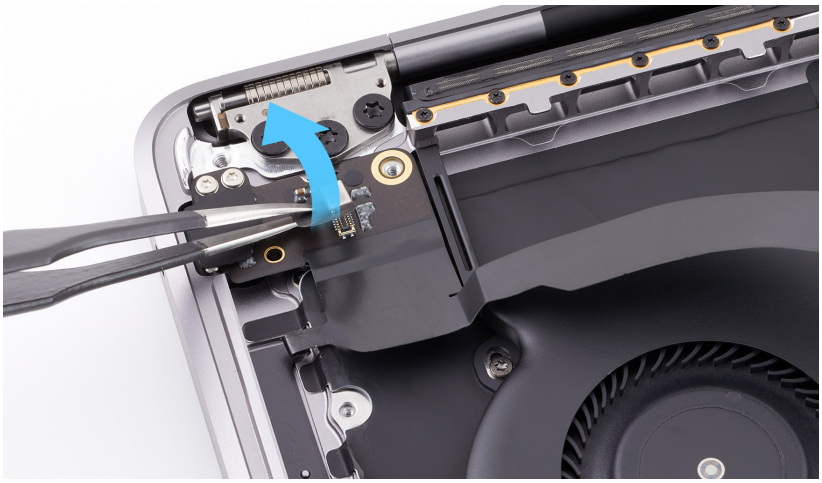
- This procedure requires System Configuration. After you've completed all removal and reassembly steps, learn how to initiate the System Configuration process at support.apple.com/self-service-repair.
- This procedure may require a Touch ID board shim kit, which only comes with a replacement Touch ID board. It's not a separate orderable part.

Removal

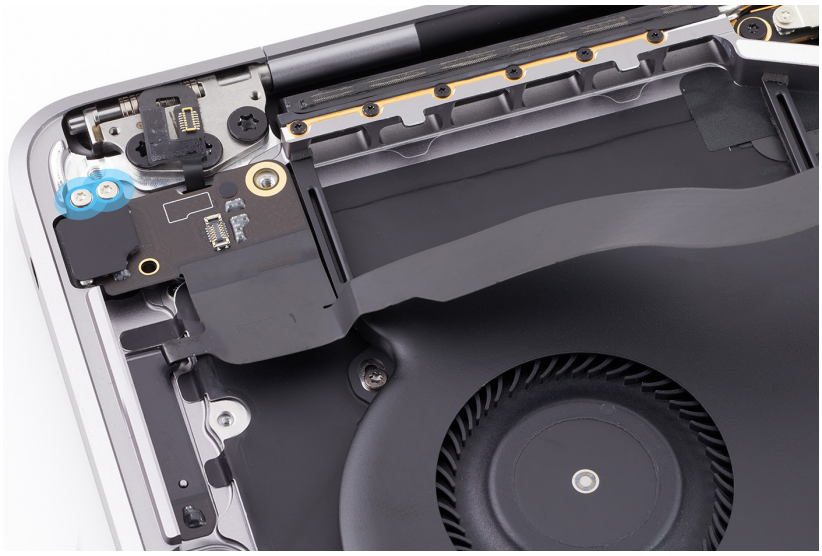
1. Use the black stick to lift the Touch ID board flex cable off the audio board.



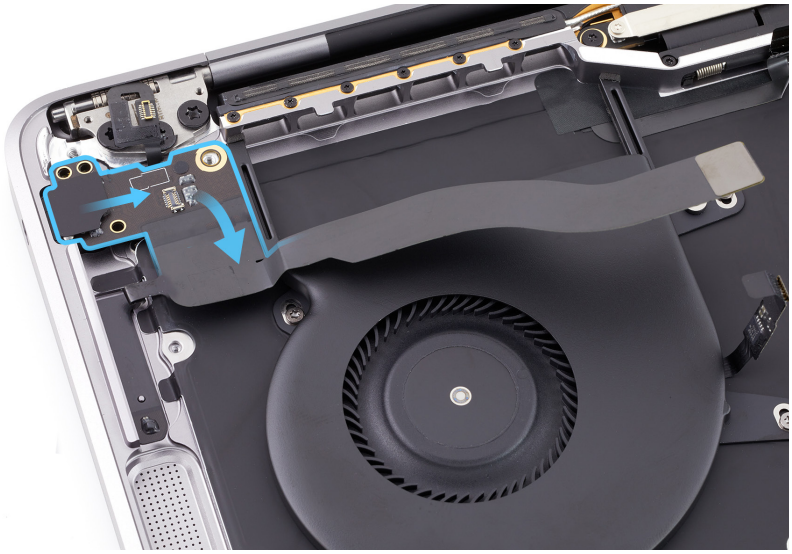
2. Use ESD-safe tweezers to loosen the adhesive on the Touch ID board flex cable.



3. Use the T3 screwdriver to remove the two T3 screws (923-05242) from the audio board.



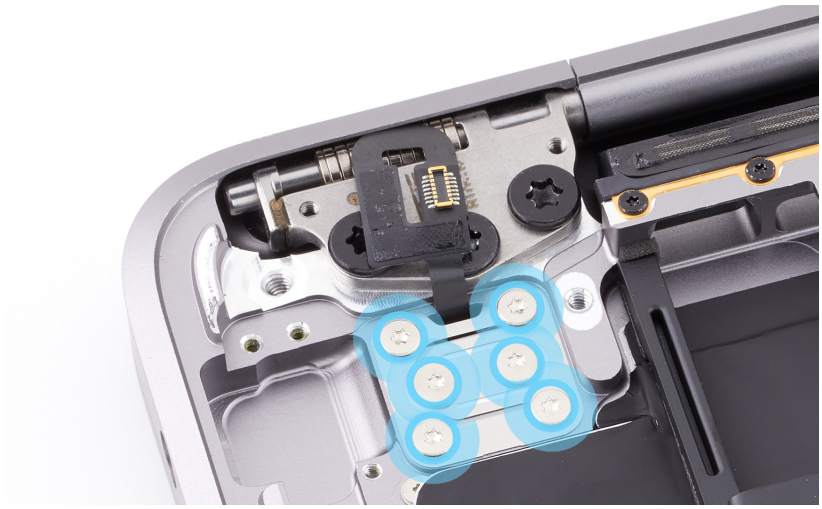
4. Lift the audio board out of the top case just enough to access the Touch ID board flexible cowling and screws.



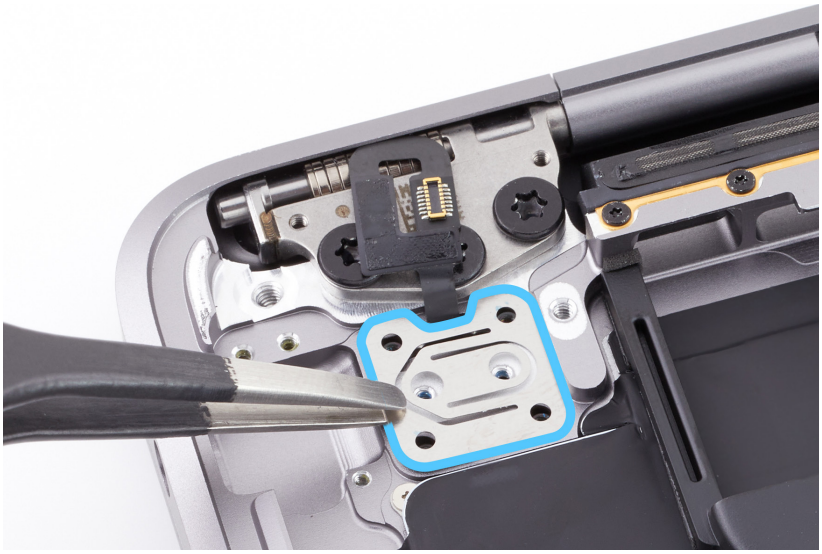
5. Use the T3 screwdriver to remove the six T3 screws from the Touch ID board flexible cowling:
   - (923-05264) (4) (corners)
   - (923-05265) (2) (middle)

Important

Note the location of the four corner screws and two middle screws and the orientation of the Touch ID board flexible cowling for reassembly.



6. Use ESD-safe tweezers to remove the Touch ID board flexible cowling from the top case. Save the cowling for reassembly.



7. Open the display and stand the computer on its side.

8. Support the Touch ID board as you route the Touch ID flex cable through the slot as shown. Remove the Touch ID board from the keyboard side of the top case.

Important

- If the Touch ID board wasn't clicking properly before removal or the Touch ID shim falls out when you remove the Touch ID board, continue to removal step 9 to replace the Touch ID shim.
- Ensure that your work surface is clean. Under the Touch ID board is the Touch ID shim, which is a small circular part. If it falls, you can more easily find it on a clean surface.
- If you're using the existing Touch ID shim, skip to reassembly step 1.

9. Place the computer right side up. Spread the tips of the ESD-safe tweezers and use one tip to remove the shim from the circular recess under the Touch ID board.

   Note: The shim has a small amount of adhesive and may stick to the top case.

Reassembly

1. Place the computer right side up with the display still open.

> **Caution**
>
> Ensure that you place the computer on a clean surface to avoid damaging internal parts.

> **Important**
>
> If you're replacing the Touch ID shim, follow reassembly steps 2 through 4. If you're using the existing shim, skip to step 5.

2. Use ESD-safe tweezers to pick up the medium Touch ID shim from the shim kit.

   Note: The shim is black on the adhesive side and silver on the opposite side.

3. Align the Touch ID shim in the recessed circle in the top case with the adhesive side down.

4. Gently press the Touch ID shim to adhere it to the top case.

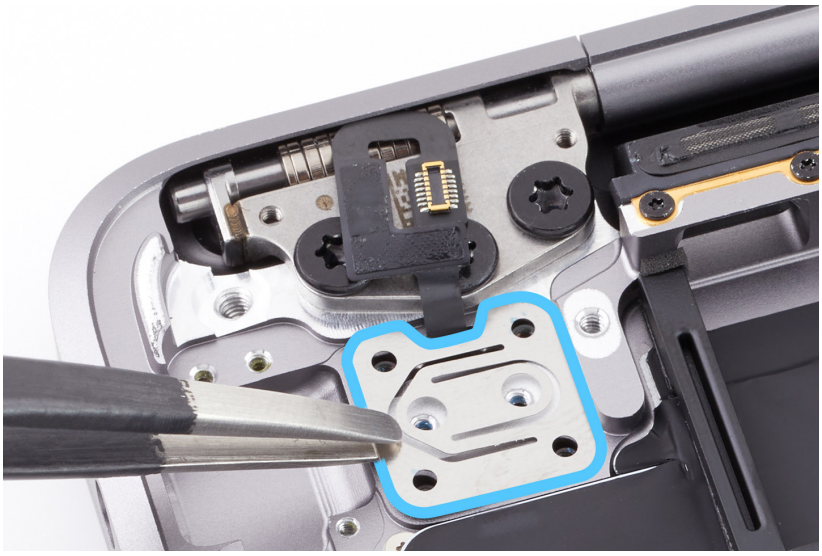
5. Set two Y-shaped alignment tools in the Touch ID opening in the top case as shown. Secure the Y-shaped tools in the corner edges with Kapton tape.

6. Stand the computer on its side.

7. Route the Touch ID board flex cable through the slot in the top case as shown. Then position the Touch ID board in the opening in the top case.

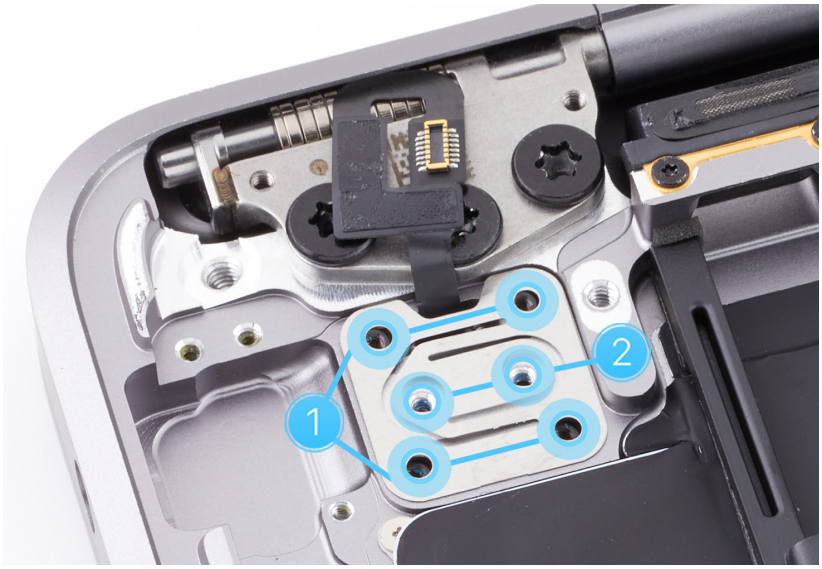
8. Hold the Touch ID button in place as you close the display. Then place the computer display-side down.

9. Use ESD-safe tweezers to position the Touch ID board flexible cowling as shown.



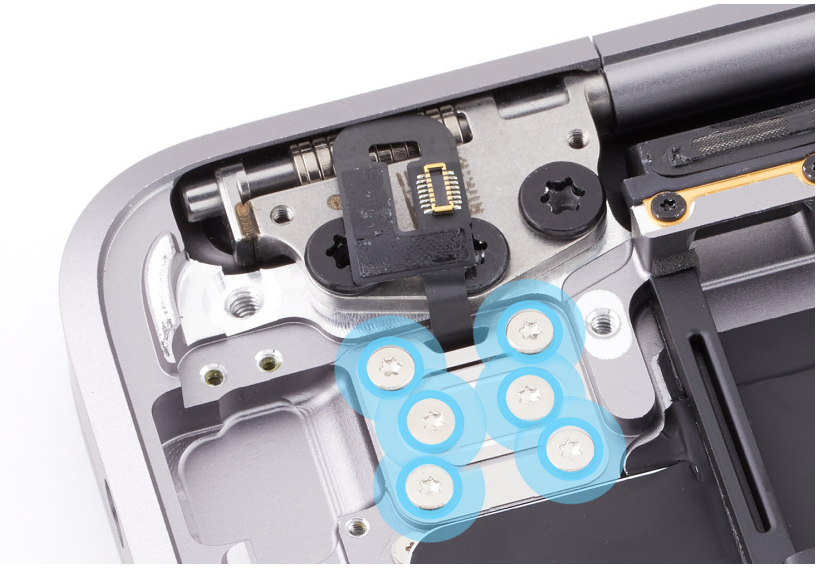
10. Use the T3 screwdriver to reinstall the four corner T3 screws (923-05264) (1). Then use the T3 screwdriver to partially reinstall the two middle T3 screws (923-05265) (2).

    Note: Screw color may vary.



11. Press the Touch ID button to ensure that you can feel it click.

12. Use the T3 screwdriver to fully reinstall the two middle screws. Then ensure that the Touch ID button still clicks when pressed.



Important

- If the Touch ID button feels too loose or doesn't click, repeat removal steps 1 through 5. Then repeat reassembly steps 1 through 12 with a larger Touch ID shim.
- If the Touch ID button feels too stiff or doesn't move, repeat removal steps 1 through 5. Then repeat reassembly steps 1 through 12 with a smaller Touch ID shim.

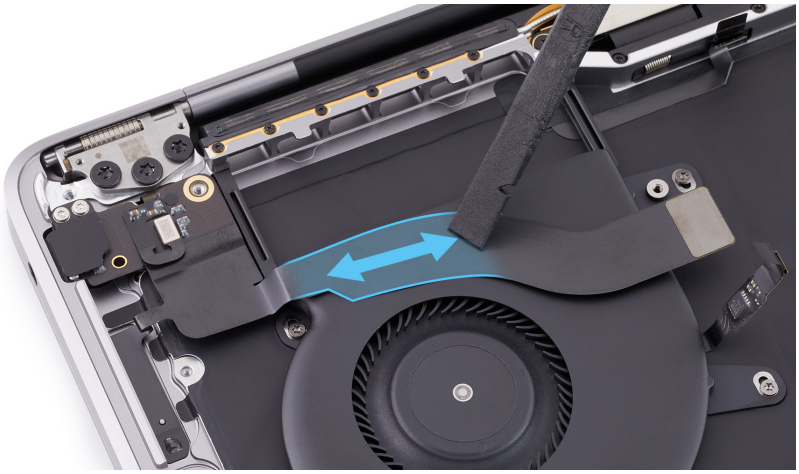
13. Place the computer right side up with the display open.

14. Remove the Kapton tape and Y-shaped alignment tools.

15. Look directly over the Touch ID sensor. The spaces on each side should appear equal, and the Touch ID sensor should align with the Touch Bar. If the gaps around the sides are unequal, repeat reassembly steps 5 through 14.

16. Complete audio board reassembly steps 2 through 8.

17. Gently run the flat end of the black stick along the length of the audio cable to adhere it to the fan.



Reinstall the following parts to complete reassembly:

- Right speaker
- Right display hinge cover
- Logic board
- Bottom case

Important

After you've completed all removal and reassembly steps, learn how to initiate the System Configuration process at https://support.apple.com/self-service-repair.

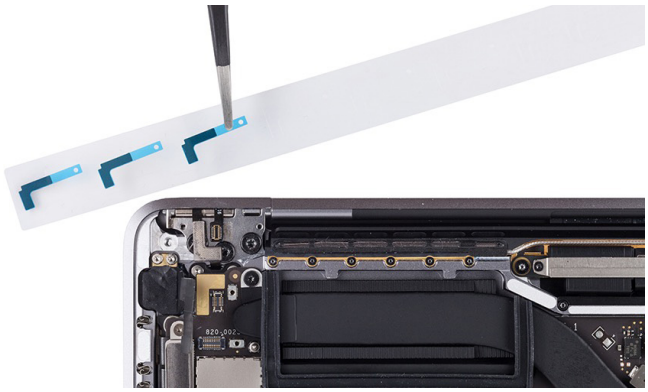
Touch ID Board Flex Cable Adhesive

Before You Begin

Remove the following parts before you begin:

- Bottom case
- Logic board
- Right display hinge cover
- Right speaker

Note: To access the Touch ID board flex cable, you must complete removal steps 1 through 5 of the audio board procedure.



Tools

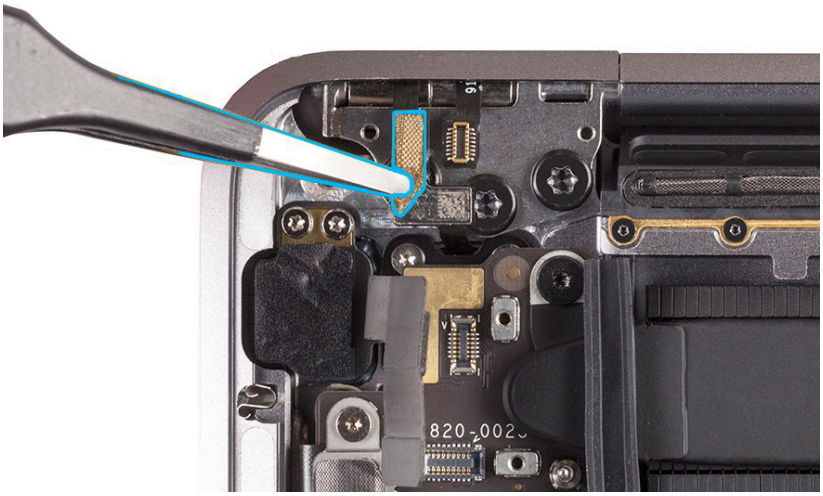
- ESD-safe tweezers
- Ethanol wipes or isopropyl alcohol (IPA) wipes
- Nylon probe (black stick)

Important

This procedure requires replacement Touch ID board flex cable adhesive.

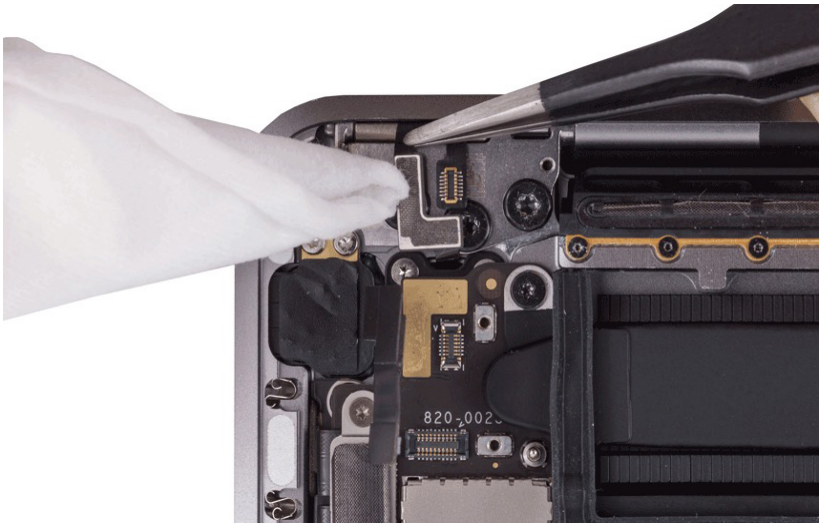
Removal

1. Use ESD-safe tweezers to gently peel and discard the adhesive from the Touch ID board flex cable.



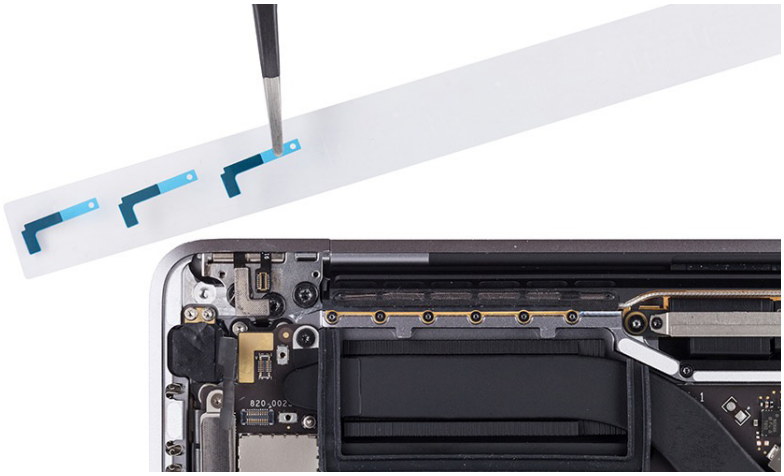
2. Use ethanol wipes or IPA wipes to gently remove any adhesive residue from the Touch ID board flex cable.

> **Caution**
>
> Avoid damaging the flex cable.



Reassembly

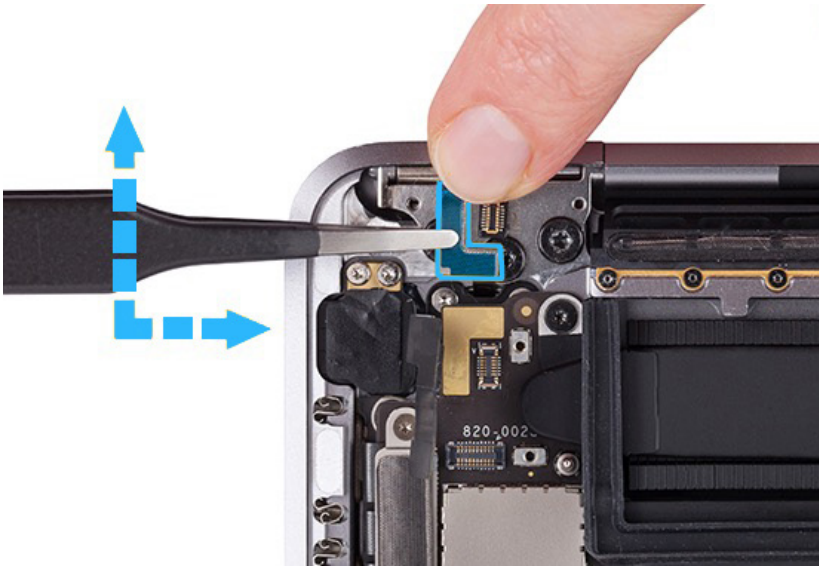
1. Use ESD-safe tweezers to grasp the light blue (non sticky) end of an L-shaped adhesive strip. Remove the strip from the sheet.



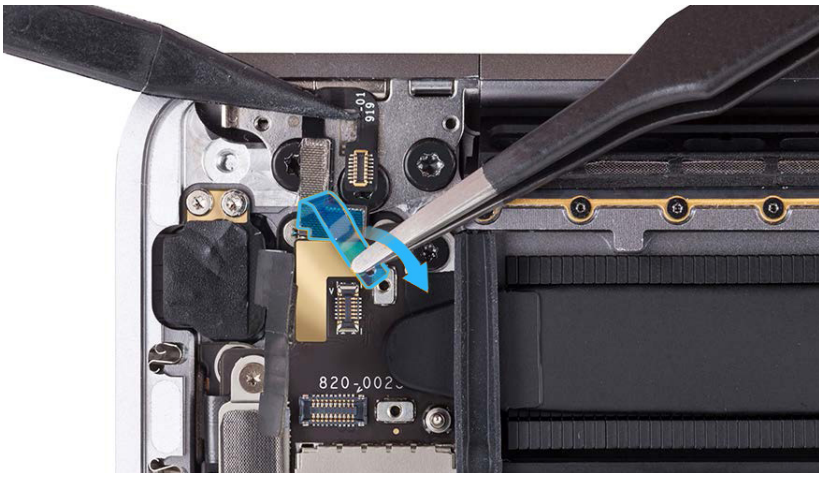
2. Center the adhesive on the L shape of the flex cable.

   Note: If the adhesive is off-center, peel back the adhesive and realign it on the Touch ID board flex cable.

3. Use ESD-safe tweezers to apply light pressure to one end of the adhesive. While holding it in place, rub the adhesive to secure it to the Touch ID board.

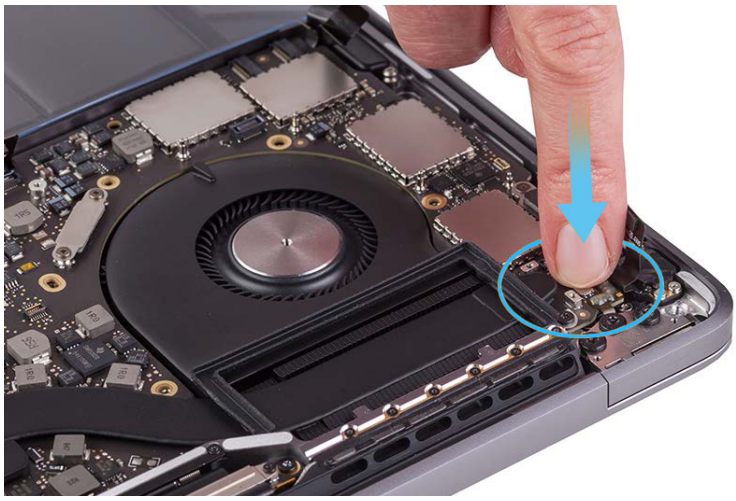


4. Use ESD-safe tweezers to remove the light blue backing from the adhesive.



5. Press the end of the Touch ID board flex cable to the connector. Then press on the cable to adhere it to the audio board.

6. Firmly press and hold the L-shaped section of the flex cable for 15 seconds.



Reinstall the following parts to complete reassembly:

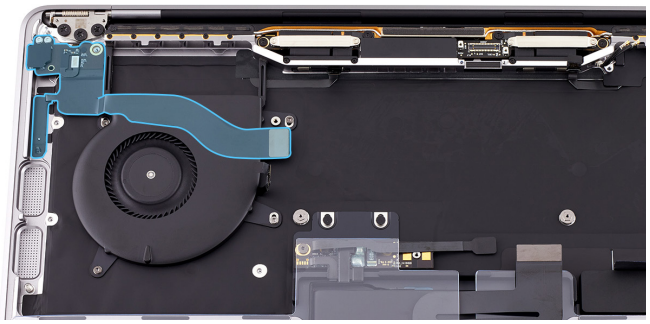
- Right speaker
- Right display hinge cover
- Logic board
- Bottom case

Audio Board

Before You Begin

Remove the following parts before you begin:

- Bottom case
- Logic board
- Right display hinge cover
- Right speaker



Tools

- EarPods with 3.5 mm headphone plug
- ESD-safe tweezers
- Nylon probe (black stick)
- Torx T3 screwdriver

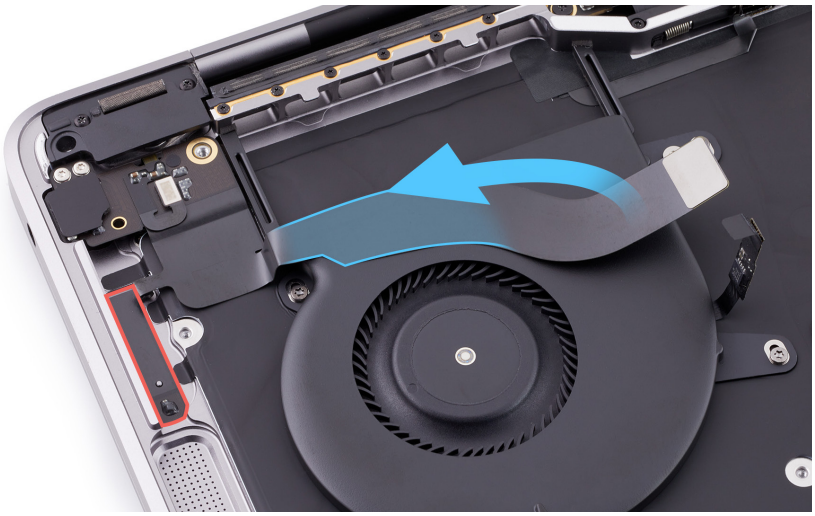
Important

This procedure requires a replacement audio board.

Removal

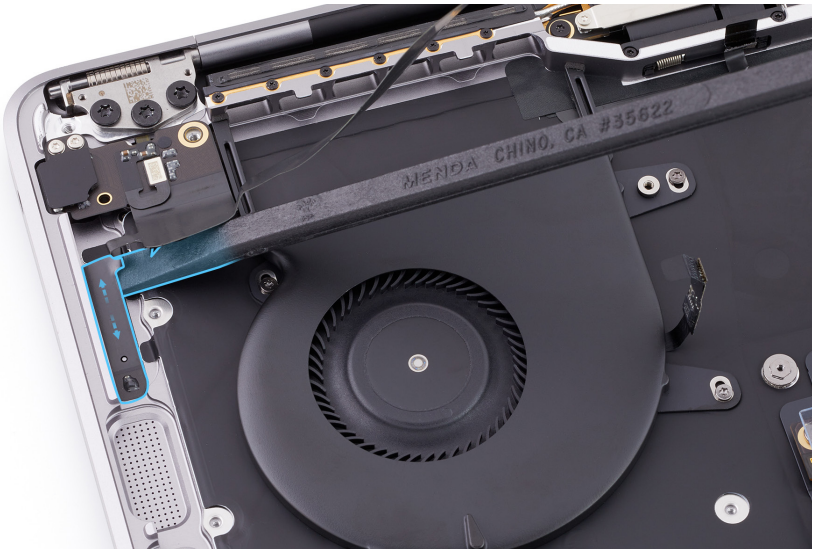
1. Gently peel the audio board cable off the fan.

> **Caution**
>
> Don't bend or crimp the open/close sensor cable that's adhered to the top case.

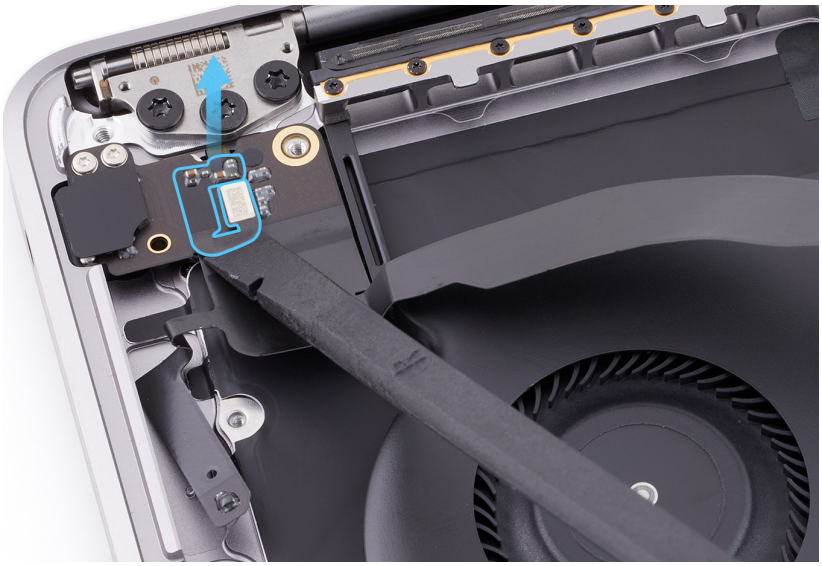


2. Run the flat end of the black stick under the open/close sensor cable to loosen the adhesive.

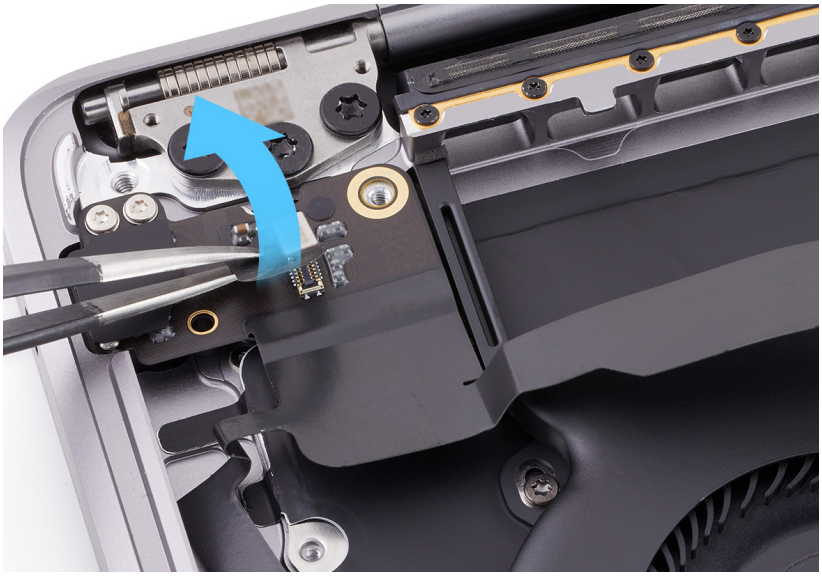
3. Lift the open/close sensor cable off the top case.



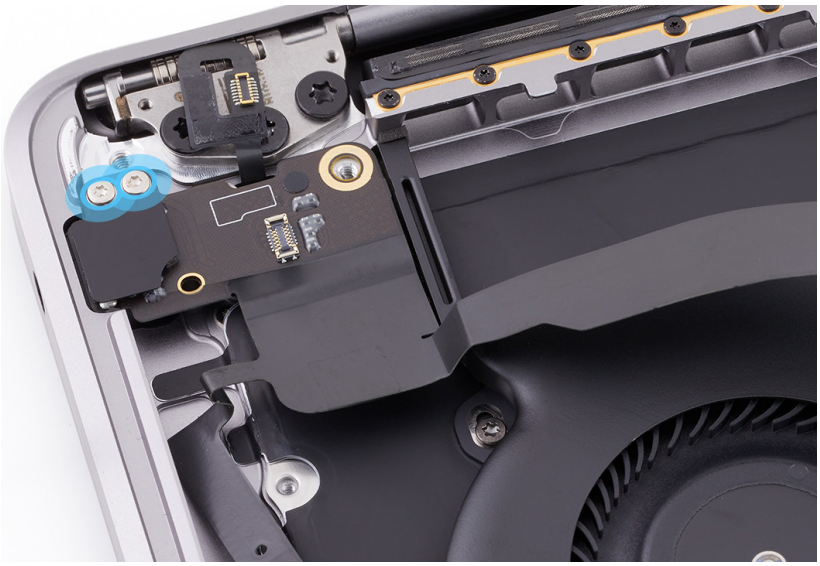
4. Lift the Touch ID board flex cable off the connector.



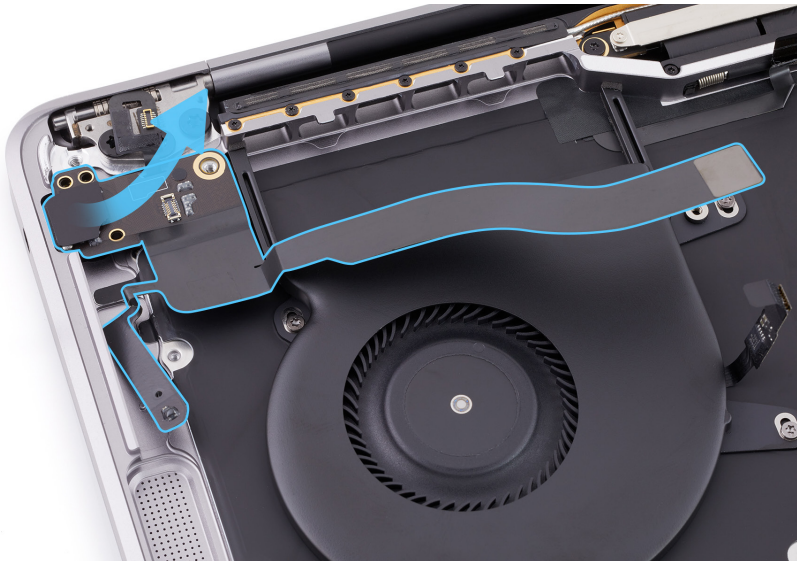
5. Use ESD-safe tweezers to loosen the Touch ID board flex cable adhesive.



6. Use the T3 screwdriver to remove the two T3 screws (923-05242) from the audio board.



7. Lift the audio board out of the top case. Discard the audio board.

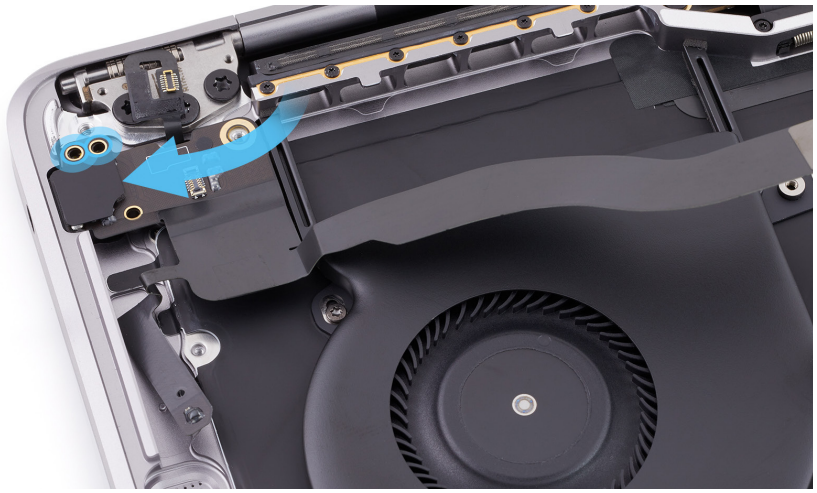


Reassembly

1. Use the black stick to remove any residual adhesive from the fan and top case.

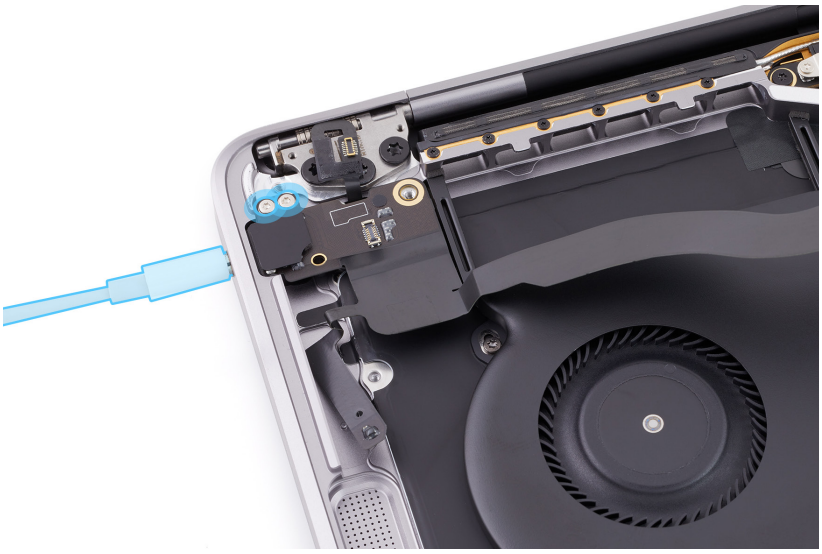
2. Position the replacement audio board in the top case.

3. Use the T3 screwdriver to partially reinstall the two T3 screws (923-05242) into the audio board.



4. Plug the EarPods into the 3.5 mm headphone jack to ensure audio board alignment. Adjust the alignment of the audio board until the plug is easy to insert and remove.

5. Use the T3 screwdriver to fully reinstall the T3 screws. Then unplug the EarPods.



6. Follow removal step 2 and all reassembly steps in Touch ID board flex cable adhesive before continuing to the next step.

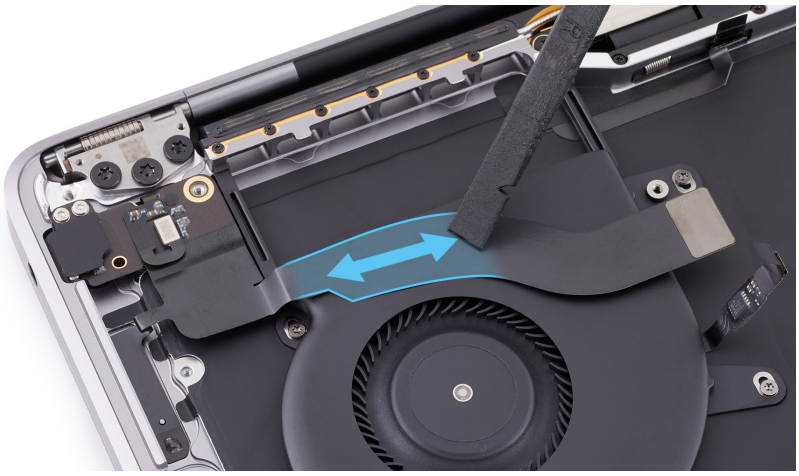
7. Peel the blue adhesive cover strip from the open/close sensor cable. Align the hole in the open/close sensor cable with the alignment pin in the top case.

8. Gently run the flat end of a black stick along the open/close sensor cable until you reach the alignment pin to adhere the cable to the top case.

Caution

Don't touch the open/close sensor at the end of the sensor cable. Stop at the alignment pin.

9. Peel the blue adhesive cover strip off the audio board cable. Then gently run the flat end of the black stick along the length of the audio cable to adhere it to the fan.



Reinstall the following parts to complete reassembly:

- Right speaker
- Right display hinge cover
- Logic board
- Bottom case

Top Case with Battery and Keyboard

Before You Begin

Warning

Read Battery Safety and follow workspace and battery handling guidelines before you begin.

Remove the following parts before you begin:

- Bottom case
- Logic board
- Input/output board
- Speakers
- Display hinge covers
- Vent/antenna module
- Display
- Audio board
- Touch ID board
- Fan
- Trackpad and trackpad flex cable

Tools

- No tools are required for this procedure.

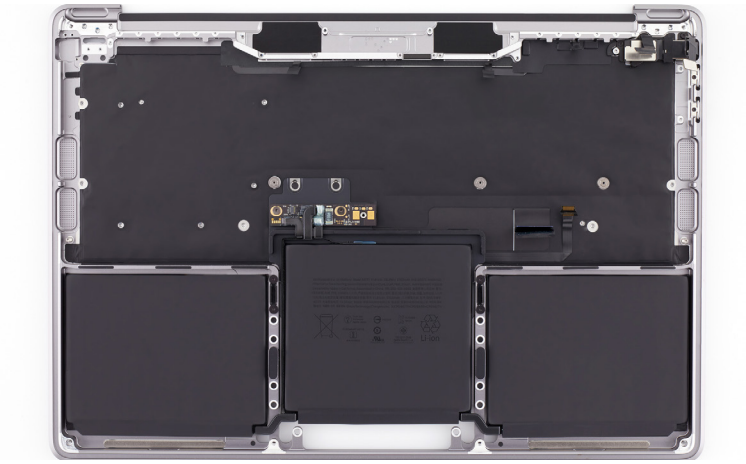
Important

- This procedure requires System Configuration. After you've completed all removal and reassembly steps, learn how to initiate the System Configuration process at support.apple.com/self-service-repair.
- If you install a replacement top case, you must replace the trackpad shims. The replacement shim kit is available only with a replacement trackpad.

Removal

There are no additional removal steps. The top case includes the following nonremovable parts:

- Battery
- BMU board
- Touch ID flex cables
- Microphone



Note: If you're replacing the top case, transfer the BMU flex cable to the replacement top case.

Reassembly

Reinstall the following parts to complete reassembly:

- Trackpad and trackpad flex cable
- Fan
- Touch ID board
- Audio board
- Display
- Vent/antenna module
- Display hinge covers
- Speakers
- Input/output board
- Logic board
- Bottom case

Important

After you've completed all removal and reassembly steps, learn how to initiate the System Configuration process at https://support.apple.com/self-service-repair.