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About This Guide

This guide includes technical instructions for replacing genuine Apple parts in Apple computers.

All genuine Apple parts and special tools are available to Apple-certified technicians at an Apple Store or at an Apple Authorized Service Provider as part of a repair. Find an Apple Store or an Apple Authorized Service Provider at support.apple.com/repair.

Apple’s warranty and any Apple-branded extended service contract, including AppleCare+ and AppleCare Protection Plan, do not cover service that is required due to the failure of parts that are neither supplied by Apple nor genuine Apple parts; or because the product has failed due to unauthorized modification or faulty installation, repair, or maintenance by any entity other than Apple or an Apple Authorized Service Provider.

Alerts

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<th>Description</th>
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<td>Instructions for reducing risk of electric shock and electrocution.</td>
</tr>
<tr>
<td>Warning</td>
<td>Instructions for reducing risk of personal injury.</td>
</tr>
<tr>
<td>Caution</td>
<td>Instructions for reducing risk of data loss or computer hardware damage.</td>
</tr>
<tr>
<td>Important</td>
<td>Supplemental information for successfully completing procedures; neither a Warning nor a Caution.</td>
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Exploded View

This section shows parts and part numbers for iMac (Retina 5K, 27-inch, 2019).
1. Display  
661-12558  

2. Very High Bond (VHB) Adhesive Strips  
076-00330, Display Starter Kit  
076-00332, Refill Kit  

3. Left Speaker (Pair)  
923-03072  

4. Right Speaker (Pair)  
923-03072  

5. Fan  
923-03071  

6. Hard Drive  
661-12544, 1TB  
661-12545, 2TB  
661-12546, 3TB  

7. Display Thermal Sensor Cable  
923-0310  

8. Embedded DisplayPort (eDP) Cable  
923-01668  

9. Left Hard Drive Bracket  
923-00086  

10. Right Hard Drive Bracket  
923-00087  

11. Power Signal Cable  
923-0311  

12. Hard Drive Data and Power Cable  
923-00664  

13. Logic Board  
661-12459, 3.0GHz 6-core Intel Core i5, Radeon Pro 570X, FCC  
661-12460, 3.0GHz 6-core Intel Core i5, Radeon Pro 570X, ETSI  
661-12461, 3.0GHz 6-core Intel Core i5, Radeon Pro 570X, ROW  
661-12463, 3.1GHz 6-core Intel Core i5, Radeon Pro 575X, FCC  
661-12464, 3.1GHz 6-core Intel Core i5, Radeon Pro 575X, ETSI  
661-12465, 3.1GHz 6-core Intel Core i5, Radeon Pro 575X, ROW  
661-12467, 3.7GHz 6-core Intel Core i5, Radeon Pro 580X, FCC  
661-12468, 3.7GHz 6-core Intel Core i5, Radeon Pro 580X, ETSI  
661-12469, 3.7GHz 6-core Intel Core i5, Radeon Pro 580X, ROW  
661-12471, 3.7GHz 6-core Intel Core i5, Radeon Pro Vega 48, FCC  
661-12472, 3.7GHz 6-core Intel Core i5, Radeon Pro Vega 48, ETSI  
661-12473, 3.7GHz 6-core Intel Core i5, Radeon Pro Vega 48, ROW  
661-12475, 3.6GHz 8-core Intel Core i9, Radeon Pro 575X, FCC  
661-12476, 3.6GHz 8-core Intel Core i9, Radeon Pro 575X, ETSI  
661-12477, 3.6GHz 8-core Intel Core i9, Radeon Pro 575X, ROW  
661-12479, 3.6GHz 8-core Intel Core i9, Radeon Pro 580X, FCC  
661-12480, 3.6GHz 8-core Intel Core i9, Radeon Pro 580X, ETSI
14. Bluetooth Antenna
923-00665

15. Middle Wi-Fi Antenna
923-00667

16. Lower Wi-Fi Antenna
923-00668

17. Memory
661-12453, 4GB
661-12454, 8GB
661-12455, 16GB

18. Power Supply
661-12714

19. Flash Storage Card
661-12548, 32GB
661-12549, 128GB
661-12550, 256GB
661-12551, 512GB
661-12552, 1TB
661-12553, 2TB

20. Mechanism
923-03066

21. Camera
923-001680

22. Camera Cable
923-03070

23. Chin Strap
923-01671

24. Rear Housing
923-03064

25. Memory Cover
923-03069

26. Stand
923-03067

Not Shown
Memory Cover Lock Mechanism, 923-01735
# Desktop Tools

**Note:** This chart includes tools for repairing multiple desktop computer models. You will not need to use all of the tools listed.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Model</th>
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<tbody>
<tr>
<td>923-02298</td>
<td>Access card</td>
<td>iMac Pro (2017)</td>
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<tr>
<td>076-1277</td>
<td>Display cleaning starter kit</td>
<td>iMac Pro (2017)</td>
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<tr>
<td>923-0735</td>
<td>Adjustable torque driver (0.3–1.2 Ncm)</td>
<td>iMac Pro (2017)</td>
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<tr>
<td>076-00375</td>
<td>Display refill kit</td>
<td>iMac Pro (2017)</td>
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<tr>
<td>923-01322</td>
<td>Antenna tool</td>
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<tr>
<td>076-00377</td>
<td>Display extension cable set</td>
<td>iMac Pro (2017)</td>
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<tr>
<td>076-1437</td>
<td>Display refill kit</td>
<td>iMac (21.5-inch, 2017)</td>
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<tr>
<td>076-1417</td>
<td>Display removal wheel kit</td>
<td>iMac Pro (2017)</td>
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<td>076-00374</td>
<td>Display starter kit</td>
<td>iMac Pro (2017)</td>
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<td>076-00330</td>
<td>Display starter kit</td>
<td>iMac (21.5-inch, 2017)</td>
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<tr>
<td>923-0416</td>
<td>Display support stand</td>
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<tr>
<td>922-9468</td>
<td>Electrostatic discharge (ESD) bag</td>
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<tr>
<td>ESD mat</td>
<td>ESD-safe tweezers</td>
<td>ESD wrist strap with clip or plug</td>
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<tr>
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<tr>
<td><img src="image1" alt="ESD mat" /></td>
<td><img src="image2" alt="ESD-safe tweezers" /></td>
<td><img src="image3" alt="ESD wrist strap with clip or plug" /></td>
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<th>Isopropyl alcohol (IPA) wipes</th>
<th>922-1731 Kapton tape</th>
<th>076-00376 Logic board service tray</th>
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<td><img src="image4" alt="Isopropyl alcohol (IPA) wipes" /></td>
<td><img src="image5" alt="922-1731 Kapton tape" /></td>
<td><img src="image6" alt="076-00376 Logic board service tray" /></td>
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<table>
<thead>
<tr>
<th>923-02217 Logic board stiffeners</th>
<th>922-5065 Nylon probe tool (black stick)</th>
<th>Painters tape</th>
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<tbody>
<tr>
<td><img src="image7" alt="Logic board stiffeners" /></td>
<td><img src="image8" alt="Nylon probe tool (black stick)" /></td>
<td><img src="image9" alt="Painters tape" /></td>
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<table>
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<th>Phillips PH2 bit</th>
<th>Phillips #00 screwdriver</th>
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<tbody>
<tr>
<td><img src="image10" alt="923-0189 Power supply cover" /></td>
<td><img src="image11" alt="Phillips PH2 bit" /></td>
<td><img src="image12" alt="Phillips #00 screwdriver" /></td>
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Ruler

Safety glasses

Suction cups

922-7144
Thermal compound syringe

076-1445
Thermal pad kit

Torx T4 screwdriver

922-8252
Suction cups

Torx T5 screwdriver

Torx T6 screwdriver

Torx T6 security bit

923-00304
Torx T6 security bit

Torx T8 screwdriver

923-0734
Torx T8 security bit

923-0740
Torx T10 bit
Desktop Tools

Torx T10 screwdriver

Torx T25 screwdriver

Trilobe driver, large #1

923-01806
Wireless card support tool

923-02218
Wireless card support tool

923-03086
Wireless card support tool

923-03085
Wireless card support tool

iMac (21.5-inch, 2017)
iMac Pro (2017)
iMac (Retina 4K, 21.5-inch, 2019)
iMac (Retina 5K, 27-inch, 2019)
## Screws

<table>
<thead>
<tr>
<th>Code</th>
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<tr>
<td>923-0304</td>
<td>T4</td>
<td>Bluetooth antenna (2), Middle Wi-Fi antenna (2), Lower Wi-Fi antenna (2)</td>
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<tr>
<td>923-0331</td>
<td>T8</td>
<td>Logic board (5), Power supply (2), Hard drive bracket (3)</td>
</tr>
<tr>
<td>923-0333</td>
<td>T10</td>
<td>Right speaker (2), Left speaker (2)</td>
</tr>
<tr>
<td>923-0334</td>
<td>T10</td>
<td>Mechanism (6)</td>
</tr>
<tr>
<td>923-0336</td>
<td>T8</td>
<td>Flash storage (1)</td>
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<tr>
<td>923-0338</td>
<td>Phillips #00</td>
<td>Chin strap (9)</td>
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<td>923-0395</td>
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<td>Heat sink (2)</td>
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<td>923-0396</td>
<td>T8</td>
<td>Power supply (2), Logic board (1)</td>
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<td>923-0399</td>
<td>T25 standoff</td>
<td>Power supply (1)</td>
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<td>923-0404</td>
<td>T5</td>
<td>Memory cover lock mechanism (4)</td>
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<tr>
<td>923-0520</td>
<td>T25 standoff</td>
<td>Power supply (1)</td>
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<tr>
<td>923-0521</td>
<td>T25 standoff</td>
<td>Hard drive bracket (1)</td>
</tr>
<tr>
<td>923-00529</td>
<td>T8</td>
<td>Stand (9)</td>
</tr>
<tr>
<td>923-00669</td>
<td>T10</td>
<td>Fan (3)</td>
</tr>
<tr>
<td>923-00767</td>
<td>T8</td>
<td>Logic board (1)</td>
</tr>
</tbody>
</table>
**923-01675**
T8 mounting pins
Hard drive (4)

**923-02294**
T5
Antenna cowling (2)
Display Cleaning

1. Clean the front of the display with a clean, damp, lint-free cloth.
   
   **Note:** Do not use IPA wipes to clean the display.

2. Polish the display with a microfiber polishing cloth.
Electrical Safety

⚠️ Danger

The power supply remains powered when the computer is plugged in whether or not the computer has been turned on. Use extreme caution when the display is removed. Avoid touching the logic board or power supply while the computer is plugged into an electrical outlet.

Take the following additional precautions:

- Never remove or install any parts while the computer is plugged into an electrical outlet.
- Always wait at least 2 minutes after unplugging the computer to allow the power supply and logic board time to discharge. You may then remove the display.
- Do not touch the logic board or power supply while the computer is plugged in.
- Do not touch the logic board or power supply before the 2-minute discharge wait time has passed.

Follow these steps before working on a computer with exposed, potentially energized parts:

- Remove all metal accessories, including rings and glasses, from your body, as they increase your risk of electric shock.
- Do not wear a cell phone or other signaling device.
- If the computer needs to be plugged in for indicator light checks or similar troubleshooting, do not wear an ESD wrist strap. Wearing ESD grounding systems while the computer is plugged in increases your risk of electric shock.
- Remain alert, focused on the work you are performing, and aware of the grounded objects near your body.
- Use tools as instructed for connecting or disconnecting cables to keep fingers away from potentially energized parts.
Broken Display

⚠️ Warning
If the display breaks and glass gets in your eye, perform the following steps:

- Immediately seek medical attention.
- Do not rub your eye.
- Do not wash your eye.
  Washing your eye can move the shard of glass and cause more damage.
- Keep your eye closed or loosely patch it to keep it still.

Handling a Broken Display

- The display glass is untempered and will break into pieces if mishandled. Removing the display requires special tools.
- Use safety glasses when removing a broken display.

Tools

- Display cleaning starter kit
- Safety glasses
- Packing tape
1. Put on safety glasses and cut-resistant gloves.

2. If the display is broken and is still attached to the rear housing, secure the broken glass with packing tape, and refer to the Display section.

3. Lay the display on a smooth, clean work surface.

4. Thoroughly cover the broken display with packing tape.
First Steps

Only Apple-certified technicians should repair Apple computers.

Always perform the following steps before starting a repair:

- Turn off the computer.
- Unplug the power cord from the electrical outlet.
- Disconnect all cables.
- Put on an ESD wrist strap and attach it to a properly grounded ESD mat.
Memory

Tools

- ESD wrist strap and mat
- Black stick
- Soft cloth
Steps for Removal

1. Place the computer facedown on a soft cloth to protect the display.

2. Press the small grey button located just above the AC power port to open the memory door.

3. Remove the door and turn it over to reveal a diagram of the memory cage levers and the dual inline memory module (DIMM) location.
4. Push the right and left levers outward to release the memory cage.

5. Pull the levers toward you to access the DIMM slots.

6. Pull up the DIMM and remove it from the slot. Note the location of the notch on the bottom of the DIMM as it must be the same during reinstallation.
Steps for Reassembly

1. Insert the DIMM into the slot with the notch correctly positioned and press until you feel it click into place.

   **Important**
   Ensure the DIMM is fully seated and has clicked into place. If the DIMM isn’t fully seated, the computer may not recognize the DIMM and may not turn on.

2. Push the memory cage levers back into the rear housing until they click into place.

3. Push the memory door into place until it’s flush with the rear housing.
Display

Tools

- Service wedge
- ESD bag
- Black stick
- Display removal tool and replacement wheels
- Safety glasses
- IPA wipes
- Silicone display roller
- Painters tape
- Clean, damp, lint-free cloth

The display is attached to the rear housing with VHB adhesive strips. Each VHB strip has one foam layer surrounded by two adhesive layers. To remove the display, you must use the display removal tool to cut the VHB strips. When you cut the VHB strips, you are cutting mostly through the foam layer. The display removal tool has replaceable wheels that you can use 5 to 10 times. If a wheel is nicked, you must replace it.
Steps for Removal

1. Place the service wedge on the stand with the stand hold covered. Rotate the computer so the display panel is facing you.

⚠️ Caution
Keep the service wedge in place for all procedures.

2. Insert the display removal tool at a 90-degree angle in the top left corner between the display and rear housing. Roll the tool across the top of the computer, avoiding the 3-inch area surrounding the camera.

⚠️ Caution
Failure to lift the tool out of the computer to avoid the camera could damage the display and the camera.
3. Continue to roll the tool around the top right corner and down the right side of the computer.

**Note:** Ensure the tool makes steady contact with the display and rear housing at the top corners.
4. Roll the tool around the top left corner and down the left side of the computer.

5. Roll the tool back and forth along the top and sides of the computer until the wheel moves with minimal resistance.

⚠️ Caution
Use the display removal tool only along the top and sides of the computer.
6. Insert the flat end of a black stick up to its notch between the display and rear housing. Slide the black stick along the edge to cut any remaining adhesive.

⚠️ Caution
Do not twist, pry, or insert the black stick past its notch. Forcing the black stick between the display and the rear housing may fracture the display.

Use caution with the black stick along the antenna sections.
7. Separate the display from the top of the rear housing. If there is resistance, repeat steps 2 through 6.

8. Tilt the display open just enough for your hand to reach the cables connecting the display to the logic board.

⚠️ Caution
Do not attempt to remove the display. The bottom edge is still attached with display adhesive. Do not stress the display cables and connectors on the logic board when tilting the display open. If the connectors on the logic board are damaged, you will need to replace the logic board.
9. Disconnect the eDP cable (1) and the display backlight power cable (2).

**Note:** The display backlight power cable is part of the display and is not available separately.

10. Use your hand to support the display as you further tilt it toward you.
11. Locate the display adhesive tabs at the bottom corners of the display and pull each toward the center to release the display from the rear housing.

⚠️ Caution
If the display sticks to the rear housing, use a black stick to break the adhesive bond.

12. Pull the display from the rear housing and set it facedown on a soft cloth or the display support stand.
13. Use your fingers and the flat end of a black stick to remove any residual adhesive from the rear housing.

**Note:** Residual adhesive can be anywhere along the top, sides, and chin of the rear housing.
14. Use your fingers and the flat end of a black stick to peel residual adhesive outward from the top center of the display.

15. Use your fingers and the flat end of a black stick to peel residual adhesive upward from the bottom sides of the display.
16. Use an IPA wipe to remove any remaining adhesive from the rear housing and display edges. Allow the surfaces to dry for 1 minute.

**Caution**
Do not use IPA wipes on the display or to remove anything other than residual adhesive.

17. Recheck the display and rear housing for any residual adhesive.
**Steps for Reassembly**

1. Lay out the adhesive strips and inspect them for damage, wrinkles, or exposed sections. Damage can cause cosmetic gaps and leakage and weaken the bond.

**Note:** The adhesive strips have a foam layer with a removable liner on the underside and a clear plastic liner on the top side.
**Note:** Use the eight alignment holes on the top and sides of the rear housing to align the new display adhesive strips.

2. Use the pull tab on the back of the display adhesive strip to remove the top portion of the paper liner (1). Leave the remaining paper liner on the bottom portion of the strip (2).

3. Use the pointed end of a black stick to align the display adhesive strip on one side of the rear housing.

**Note:** The paper liner side faces the rear housing.
4. As you position the display adhesive, use the pull tab to peel the remaining paper liner from the underside of the display adhesive strip.

5. Use your finger to press the display adhesive strip into place on the rear housing.

**Important**

Do not remove the clear plastic liners from the top layer of the strip at this time.

6. Repeat steps 2 through 5 along the top inside edge and other side of the rear housing.
7. Use the two strips of display adhesive along the bottom edge. There are no guide holes on the display adhesive strips or along the bottom of the rear housing, so align the strips by hand.

**Note:** If a display adhesive strip does not line up correctly, remove it, clean the rear housing, and start again. Ensure there are no wrinkles or exposed sections on the strip.

8. Place the display on the chin of the rear housing. Align the display and ensure it is centered and seated.
9. Hold the display removal tool against the sides of the display to check the alignment. Adjust if necessary.

10. Anchor the display to the chin with a horizontal strip of painters tape. Place the tape along the chin, where the bottom of the display meets the rear housing.
11. Stand back to check the alignment of the display. If you can see the rear housing, adjust the display and recheck the alignment.

Incorrect alignment

Correct alignment
12. Anchor the display further with a vertical strip of painters tape on both ends of the horizontal strip.

13. Use one hand to tilt the display while steadying it with the other hand.

14. While continuing to steady the display with one hand, use the other hand to pull the release liners from the adhesive strips at the bottom and lower sides of the rear housing.

**Note:** Slowly pull the release liners so they do not tear.
15. Tilt up the display, leaving enough room to connect the eDP cable and the display backlight power cable to the logic board. Ensure the connectors are firmly seated.

**Important**

Do not stress the display cables and connectors on the logic board when tilting the display open. If the connectors are damaged, you will need to replace the logic board.

**Note:** The display backlight power cable is part of the display and is not available as a separate part.

16. Remove the remaining release liners from the top and sides of the rear housing. Then lean the display against the rear housing.
17. Use the silicone display roller to adhere the display adhesive strips to the glass. To prevent image quality issues, only roll upward.

18. Roll the silicone display roller along the top in a horizontal back-and-forth motion.

19. Clean the front of the display with a clean, damp, lint-free cloth.
   
   **Note:** Do not use IPA wipes to clean the display. Only use IPA wipes to remove any residual display adhesive.
Embedded DisplayPort (eDP) Cable

Remove the following part before you begin:

- Display

Tools

- ESD wrist strap and mat
- Black stick
Steps for Removal

1. Remove any tape securing the eDP cable to the display.

2. Use a black stick to flip the locking bar on the eDP cable.

3. Gently pull the eDP cable out of the connector.
Steps for Reassembly

1. Reinsert the eDP cable into the connector on the display. Flip the locking bar and press the pull tab to secure the cable.

2. Replace any tape that you removed from the eDP cable.

   Note: Press the area of the cable with the adhesive to secure the cable to the display.

Reinstall the following part to complete reassembly:

- Display
Display Thermal Sensor Cable

Remove the following part before you begin:

- Display

Tools

- ESD wrist strap and mat
- Black stick
**Steps for Removal**

1. Remove any tape that secures the display thermal sensor cable to the display. Save the tape for reuse.

2. Use the pointed end of a black stick to gently push the display thermal sensor cable out of its connector.

3. Use a black stick to peel off the square sensor board from the display.
Steps for Reassembly

1. Peel the adhesive liner from the replacement thermal sensor board and adhere the board to the back of the display.

2. Reinsert the thermal sensor cable into the connector on the display.

3. Secure the thermal sensor board and cable with tape.

Reinstall the following part to complete reassembly:

- Display
Camera

Remove the following part before you begin:

- Display

Tools

- ESD wrist strap and mat
- Torx T5 screwdriver
- Black stick
Steps for Removal

1. Use a black stick to flip the locking bar on the camera cable. Pull the camera cable straight out from the connector on the camera board.

2. Remove the two T5 screws from the camera board.

3. If the camera cable needs to be replaced, use a black stick to flip the locking bar on the camera cable. Pull the camera cable straight out from the connector on the logic board.
Steps for Reassembly

1. Reinstall the two T5 screws in the camera board. **Note:** If installing a replacement camera, remove the protective film covering the lens.

2. Reinsert the camera cable in the camera board connector. Flip the locking bar to secure the cable.

3. If the camera cable was replaced then connect the camera cable to the logic board connector. Flip the lock bar closed to secure the cable.

Reinstall the following part to complete reassembly:

- Display
Fan

Remove the following part before you begin:

- Display

Tools

- ESD wrist strap and mat
- Torx T10 screwdriver
- Black stick
Steps for Removal

1. Use a black stick to disconnect the fan cable from the logic board.

2. Remove the three T10 screws from the fan.

3. Peel back the top edge of the black Mylar shield to loosen it from the fan.
Steps for Reassembly

1. Reconnect the fan cable to the logic board.

2. Reinstall the three T10 screws in the fan.

Reinstall the following part to complete reassembly:

- Display
Hard Drive

Remove the following parts before you begin:

- Display
- Chin strap
- Left speaker

Tools

- ESD wrist strap and mat
- Torx T8 screwdriver
Steps for Removal

1. While supporting the hard drive with one hand, remove the two T8 screws from the left mounting bracket. Remove the left mounting bracket.

2. Slide the hard drive out of the rubber grommets on the right mounting bracket and disconnect the hard drive data and power cable.
Steps for Reassembly

1. Reconnect the hard drive data and power cable. Ensure that the cable lies flat under the hard drive.

2. Align the hard drive mounting pins with the rubber grommets on the right mounting bracket. Reinstall the left hard drive bracket and reinstall the two T8 screws.

Reinstall the following parts to complete reassembly:

- [Left speaker](#)
- [Chin strap](#)
- [Display](#)
Chin Strap

Remove the following part before you begin:

- Display

Tools

- ESD wrist strap and mat
- Phillips #00 screwdriver
- Black stick
Steps for Removal

1. Remove the nine Phillips #00 screws from the chin.

2. Remove the chin strap and set it aside for reuse.
Steps for Reassembly

1. Reinsert the chin strap in the rear housing with the screw holes facing outward and the airloops facing up.

2. Use a black stick to press the chin strap against the front frame.

3. Reinstall the nine Phillips #00 screws in the chin strap.

Reinstall the following part to complete reassembly:

- Display
Left Speaker

Remove the following parts before you begin:

- Display
- Chin strap

Important
You must replace speakers in pairs. If you replace the left speaker, you must also replace the right speaker. For removal and reassembly instructions, refer to the Right Speaker section.

Tools

- ESD wrist strap and mat
- Torx T10 screwdriver
- Black stick
- Sticky notes
Steps for Removal

1. Use a black stick to disconnect the power button cable from the power supply.

⚠️ Caution
The power button cable is part of the rear housing. If the cable breaks, you will need to replace the rear housing.

2. Remove the two T10 screws from the speaker.

Note: The screws tighten into rubber grommets and may remain in the screw holes when you remove the speaker.

3. Slightly tilt the speaker forward (1). Then partially lift the speaker until the power button cable is visible (2).

⚠️ Caution
Carefully handle the speaker to avoid damaging the power button cable.
4. Gently remove the power button cable from the channel on the bottom and side of the speaker.

5. Tilt the speaker to the left.
6. Disconnect the speaker cable from the logic board and pull it from under the right hard drive mounting bracket. Lift the speaker out of the rear housing.
Steps for Reassembly

1. Support the hard drive with one hand. Remove the two T10 screws from the left mounting bracket. Remove the bracket.

2. Slide the hard drive out of the right mounting bracket and disconnect the hard drive data and power cable.

3. Reroute the power button cable in the channel on the bottom and side of the speaker.
4. Reroute the speaker cable under the right hard drive mounting bracket and connect it to the logic board.

5. Slide the hard drive into the right mounting bracket while connecting the hard drive data and power cable to the hard drive.

6. Slide the left mounting bracket onto the hard drive and secure the bracket to the rear housing with the two T10 screws.
7. Fully insert the left speaker in the chin (1) and reinstall it in the rear housing (2).

8. Connect the power button cable to the power supply.

9. Partially reinstall the two T10 screws in the left speaker.
10. Stack 18 individual sticky notes to make a 1.85 mm shim. Insert the shim between the speaker and hard drive. Tighten the speaker screws, then remove the shim.

Reinstall the following parts to complete reassembly:

- Chin strap
- Display
Right Speaker

Remove the following parts before you begin:

- Display
- Chin strap

Important
You must replace speakers in pairs. If you replace the right speaker, you must also replace the left speaker. Refer to the Left Speaker section for left speaker removal and reassembly instructions.

Tools

- ESD wrist strap and mat
- Torx T10 screwdriver
- Black stick
Steps for Removal

1. Unscrew the two T10 screws from the speaker.  
   **Note:** The screws tighten into rubber grommets and may remain in the screw holes when the speaker is removed.

2. Slightly tilt the speaker forward.
3. Disconnect the speaker cable from the logic board. Lift the speaker out of the rear housing.
Steps for Reassembly

1. Partially reinsert the speaker into the rear housing.

2. Reconnect the speaker cable to the logic board and tuck the speaker cable under the logic board.
3. Reinstall the two T10 screws in the right speaker.

Reinstall the following parts to complete reassembly:

- Chin strap
- Display
Power Supply

Remove the following parts before you begin:

- Display
- Chin strap
- Left speaker
- Hard drive

⚠️ Danger

The power supply remains powered when the computer is plugged in whether or not the computer has been turned on. Use extreme caution when the display is removed. Avoid touching the logic board or power supply while the computer is plugged into an electrical outlet.

Take the following additional precautions:

- Never remove or install any parts while the computer is plugged into an electrical outlet.
- Always wait at least 2 minutes after unplugging the computer to allow the power supply and logic board time to discharge. You may then remove the display.
- Do not touch the logic board or power supply while the computer is plugged in, or after the computer has been unplugged but before discharge wait time has passed.
- Do not touch the logic board or power supply before the 2-minute discharge wait time has passed.

Tools

- ESD wrist strap and mat
- Torx T8 screwdriver
Steps for Removal

1. Disconnect the power supply signal cable from the top right corner of the power supply and the logic board.

2. Remove the four T8 screws from the power supply.

⚠️ Caution

When performing step 3, do not rotate the power supply toward the logic board as it could damage parts of the logic board.
3. Slide the power supply slightly to the left. Pinch the clip on the rear side of the DC cable connector and pull it to disconnect the cable.

⚠️ **Caution**
This is a tight connection. Pinch and pull hard on the connector, but not on the cable.

4. Slightly tilt the power supply forward to disconnect the AC cable. Pinch the clip on the rear of the connector and pull to disconnect.

5. Lift the power supply out of the rear housing.
Steps for Reassembly

1. Lower the power supply into the rear housing and reconnect the AC cable.

2. Reconnect the DC cable to the logic board. Check that the cable is securely connected.
3. Reinstall the four T8 screws in the power supply. First reinstall the two long screws at the top. Then reinstall the two shorter screws at the bottom, near the chin.

4. Reconnect the power supply signal cable to the power supply and logic board.

Reinstall the following parts to complete reassembly:

- Hard drive
- Left speaker
- Chin strap
- Display
Logic Board

Remove the following parts before you begin:

- Display
- Fan
- Chin strap
- Right speaker
- Left speaker
- Hard drive
- Power supply

Tools

- ESD wrist strap and mat
- Torx T4 screwdriver
- Torx T5 screwdriver
- Torx T8 screwdriver
- Torx T10 screwdriver
- Torx T25 screwdriver
- Black stick
- Wireless card support tool
- Antenna tool or ESD-safe tweezers
- Apple Thunderbolt Cable, USB-C cable, or SD card
Steps for Removal

1. Disconnect the following cables from the logic board:
   - Camera cable
   - Audio cable
   - Microphone flex cable

   **Caution**
   Do not damage the microphone flex cable. A broken microphone flex cable requires a rear housing replacement.

2. Tape the microphone flex cable to the front of the chin.

   **Caution**
   Do not crimp the flex cable.
3. Grasp the wireless card support tool handle, lower the tool onto the logic board, and slide it behind the antenna connectors.

**Note:** Keep the tool installed whenever removing the antenna cowling screws or disconnecting the antennas.

![Image](image1.png)

**Caution**

Avoid the coin cell battery when inserting the tool.

![Image](image2.png)

4. Remove the two T5 screws from the antenna cowling. Set the cowling aside for reuse.

![Image](image3.png)
5. Use the antenna tool to disconnect the antennas from the logic board.

6. Remove the wireless card support tool.

7. Remove the nine screws and one standoff from the logic board. Completely unscrew, but do not remove, the T8 captive screw from the center of the logic board. Refer to the following list and image for details:
   - 1 = T8 short screw, four
   - 2 = T8 medium long screw, one
   - 3 = T8 long screw, two
   - 4 = T10 short shoulder screw, two
   - 5 = T25 standoff, one
   - Power supply unit (PSU) standoff (with shorter thread)
   - 6 = T8 captive screw, one (remains attached)
8. Remove the one T8 screw from the right hard drive bracket. Rotate the bracket to the left to free the hard drive cable.

9. Slowly tilt the logic board forward, avoiding contact with the front chin. When the input/output (I/O) ports on the back of logic board are clear of the rear housing standoffs, lift the logic board up and out of the rear housing.

⚠️ Caution

Pay special attention to the areas in the images below when handling the logic board. Mishandling the logic board can damage chips and circuits. Components that accidentally touch the rear housing may damage the computer and keep it from operating correctly.
Steps for Reassembly

1. If you are installing a replacement logic board, transfer the following parts from the existing logic board:
   - Hard drive data and power cable
   - Memory
   - Power supply signal cable
   - Flash storage (if present)

2. Insert the logic board into the rear housing.
3. Align the I/O ports with the openings on the rear housing. Partially reinstall the 11 screws in the order shown to keep the logic board in place:
   - 1 = T8 short screw, four
   - 2 = T8 medium long screw, one
   - 3 = T8 long screw, two
   - 4 = T10 short shoulder screw, two
   - 5 = T25 standoff, one
   - PSU standoff (with shorter thread)
   - 6 = T8 captive screw, one (remains attached)

   **Note:** Do not fully tighten the screws at this point.

4. Place the hard drive cable behind the right hard drive bracket and rotate the bracket into place. Reinstall the one T8 screw in the right hard drive bracket.
5. Reconnect the following cables to the logic board:
   - Camera cable
   - Audio cable
   - Microphone flex cable

   **Note:** Be careful not to damage the microphone flex cable when removing the tape.

6. Plug in an Apple Thunderbolt Cable or USB-cable or insert an SD card into the logic board to ensure it aligns with the rear housing.

7. Fully tighten the 11 screws in the logic board.
8. Use the flat side of the antenna tool to reconnect the antennas to the logic board. If necessary, use ESD-safe tweezers to align the antennas over the connectors.

9. Engage the teeth of the antenna cowling at an angle. Then position the cowling over the antenna connectors to reinstall it.
10. Remove the wireless card support tool from the rear housing.

Reinstall the following parts to complete reassembly:

- Power supply
- Hard drive
- Left speaker
- Right speaker
- Chin strap
- Fan
- Display
Hard Drive Data and Power Cable

Remove the following parts before you begin:

- Display
- Fan
- Chin strap
- Right speaker
- Left speaker
- Hard drive
- Power supply
- Logic board

Tools

- ESD wrist strap and mat
Steps for Removal

1. Pinch the metal clip on the hard drive data cable connector to release the cable from the logic board.

2. Gently pull up the hard drive power cable connector to disconnect the cable from the logic board.
Steps for Reassembly

1. Reinsert the hard drive power and hard drive data connectors into the logic board.

2. Press the cable to readhere it to the heat sink. A replacement cable comes with new adhesive. If replacing the cable, remove the adhesive liner and press the cable with the adhesive facedown to adhere it to the heat sink.

Reinstall the following parts to complete reassembly:

- Logic board
- Power supply
- Hard drive
- Left speaker
- Right speaker
- Chin strap
- Fan
- Display
Flash Storage Card

Remove the following parts before you begin:

- Display
- Fan
- Chin strap
- Right speaker
- Left speaker
- Hard drive
- Power supply
- Logic board

Tools

- ESD wrist strap and mat
- Torx T8 screwdriver
Steps for Removal

1. Remove the T8 screw from the flash storage card.

   **Note:** The flash storage card is on the back of the logic board.

2. Gently pull the flash storage card straight out of the connector.

   **Caution**
   Do not lift the flash storage card at an angle when removing it from the connector. If you damage the connector, you must replace the logic board.
Steps for Reassembly

1. Reinsert the flash storage card straight into the connector on the back of the logic board.

2. Reinstall the T8 screw.

Reinstall the following parts to complete reassembly:

- Logic board
- Power supply
- Hard drive
- Left speaker
- Right speaker
- Chin strap
- Fan
- Display
Battery

Remove the following parts before you begin:

- Display
- Fan
- Chin strap
- Right speaker
- Left speaker
- Hard drive
- Power supply
- Logic board

Tools

- ESD wrist strap and mat
Steps for Removal

1. Grasp the battery with two fingers. Push it toward the metal clip and pull it up from the socket to remove it.
Steps for Reassembly

⚠️ Warning
If you incorrectly reinstall a battery or replace the battery with an incorrect one, you risk explosion. Dispose of used batteries according to local environmental laws and guidelines.

1. Ensure the battery socket is open and free of dust.

2. Reinsert the battery into the socket with the negative side (no markings) facing the metal clip.

Reinstall the following parts to complete reassembly:

- Logic board
- Power supply
- Hard drive
- Left speaker
- Right speaker
- Chin strap
- Fan
- Display
Bluetooth and Wi-Fi Antennas

Remove the following parts before you begin:

- Display
- Chin strap
- Right speaker

Tools

- ESD wrist strap and mat
- Torx T4 screwdriver
- Torx T5 screwdriver
- Wireless card support tool
- Antenna tool
- Black stick
The procedure is the same for all three antennas. Refer to the following list and image to determine the location and cable routing of the antenna you intend to replace:

- Bluetooth antenna (1)
- Middle Wi-Fi antenna (2)
- Lower Wi-Fi antenna (3)

**Steps for Removal**

1. Grasp the wireless card support tool handle, lower the tool onto the logic board, and slide it behind the antenna connectors.

**Note:** Keep the tool installed whenever removing the antenna cowling screws or disconnecting the antennas.
**Caution**

Avoid the coin cell battery when inserting the tool.

2. Remove the two T5 screws from the antenna cowling. Set the cowling aside for reuse.

3. Use the antenna tool to disconnect the antenna.
4. Use a black stick or your fingers to gently remove the antenna cable tape from the rear housing.

5. Remove the two T4 screws from the antenna.

6. Remove the antenna from the rear housing.
Steps for Reassembly

1. Reinstall the two T4 screws in the antenna.

2. Adhere the antenna cable tape to the rear housing.

3. Align the bracket holes with the screw bosses on the logic board.

4. Use the blunt end of the antenna tool to reconnect the antenna to the logic board.
5. Insert the antenna cowling at an angle to engage the teeth in the slots. Then position the antenna cowling over the connectors to reinstall it.

6. Reinstall the two T5 screws in the antenna cowling.
7. Remove the wireless card support tool.

8. Use a black stick to open any flattened loops in the airloop gasket.

**Reinstall the following parts to complete reassembly:**

- [Right speaker](#)
- [Chin strap](#)
- [Display](#)
Memory Cover Lock Mechanism

Remove the following parts before you begin:

- Display
- Fan
- Chin strap
- Right speaker
- Left speaker
- Hard drive
- Power supply
- Logic board

Tools

- ESD wrist strap and mat
- Torx T5 screwdriver
Steps for Removal

1. Remove the four T5 screws from the memory cover lock mechanism.

2. Lift the memory cover lock mechanism out of the rear housing.
Steps for Reassembly

1. Reinsert the memory cover lock mechanism in the rear housing. Line up the screw holes.

2. Reinstall the four T5 screws in the memory cover lock mechanism.

Reinstall the following parts to complete reassembly:

- Logic board
- Power supply
- Hard drive
- Left speaker
- Right speaker
- Chin strap
- Fan
- Display
Stand

Remove the following parts before you begin:

- Display
- Fan
- Chin strap
- Right speaker
- Left speaker
- Hard drive
- Power supply
- Logic board

Tools

- ESD wrist strap and mat
- Torx T8 screwdriver
Steps for Removal

1. Remove the nine T8 screws from the mechanism in the order shown.

2. Lift the rear housing off of the stand.
Steps for Reassembly

1. Align the two pins on the stand with the pin holes on the mechanism.

2. Reinstall the nine T8 screws in the mechanism in the order shown.

Reinstall the following parts to complete reassembly:

- Logic board
- Power supply
- Hard drive
- Left speaker
- Right speaker
- Chin strap
- Fan
- Display
Mechanism

Remove the following parts before you begin:

- Display
- Fan
- Chin strap
- Right speaker
- Left speaker
- Hard drive
- Power supply
- Logic board
- Stand

Tools

- ESD wrist strap and mat
- Torx T10 screwdriver
- Display support stand
**Steps for Removal**

1. Place the rear housing in the display support stand.

2. Remove the six T10 screws from the mechanism.

3. Lift the mechanism off of the rear housing.
Steps for Reassembly

1. Position the mechanism in the rear housing.

2. Reinstall the six T10 screws in the order shown.

   **Important**
   Ensure the mechanism is fully seated after tightening the screws to avoid hinge noise.

Reinstall the following parts to complete reassembly:

- Stand
- Logic board
- Power supply
- Hard drive
- Left speaker
- Right speaker
- Chin strap
- Fan
- Display
Rear Housing

Remove the following parts before you begin:

- Display
- Fan
- Camera
- Chin strap
- Right speaker
- Left speaker
- Hard drive
- Bluetooth and Wi-Fi antennas
- Power supply
- Logic board
- Stand

**Note:** After you have removed the parts listed above, the rear housing is the only remaining part.

**Tools**

- ESD wrist strap and mat
The rear housing includes the following removable parts, which are available separately:

- Mechanism
- Mechanism screws
- Memory cover
- Memory cover lock mechanism
- Memory cover lock mechanism screws
- Chin strap
- Chin strap screws
- T25 power supply standoff screw
- Hard drive bracket standoff screw

The rear housing includes the following nonremovable parts, which are not available separately:

- Wi-Fi antenna (in silver circle behind Apple logo)
- Microphone flex cable
- Audio input jack and cable
- Power button and cable
- AC inlet
- Airloop gasket


⚠️ **Caution**
Always handle the rear housing with two hands: one hand on the lower left corner and one hand on the lower right corner. Mishandling the rear housing could bend the aluminum and cause alignment issues.

**Reinstall the following parts to complete reassembly:**
- Stand
- Logic board
- Power supply
- Bluetooth and Wi-Fi antennas
- Hard drive
- Left speaker
- Right speaker
- Chin strap
- Camera
- Fan
- Display