Contents

3 About This Guide
4 Identification
5 Directive 2012/19/EU Annex VII Components
6 Safety Considerations
9 Recommended Tools
10 Disassembly Instructions
27 Material Categorization of Output Fractions
About This Guide

Apple Recycler Guides provide guidance for electronics recyclers on how to disassemble products to maximize recovery of resources. The guides provide step-by-step disassembly instructions and information on the material composition to help recyclers direct fractions to the appropriate material recycler.

To conserve important resources, we work to reduce the materials we use and aim to one day source only recycled or renewable materials in our products. A key path to reaching that goal is resource recovery from end-of-life electronics.

Disassembly procedures are intended to be performed only by trained electronics recycling professionals. The recycler is responsible for independently evaluating and ensuring compliance with all applicable environmental, health, and safety laws related to the work. These include but are not limited to laws relating to the management, handling, shipping, and disposal of the outputs of this work as waste and laws in place to ensure the health and safety of all employees who support this work.

For questions or feedback about this guide, email contactesci@apple.com.

**Note:** This guide may show images from other similar models, but the procedures are the same.
Identification

You can find the model number printed on the underside of the MacBook, near the regulatory markings.

Model number:

A1534
# Directive 2012/19/EU Annex VII Components

Directive 2012/19/EU Annex VII requirements apply to the following substances and components.

<table>
<thead>
<tr>
<th>Substance/Component</th>
<th>Apple Part Name</th>
<th>Removal Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Printed circuit board if the surface is greater than 10 square centimeters</td>
<td>Main logic board, battery logic board, trackpad, keyboard, data board assembly, and light-emitting diode (LED) logic board</td>
<td>Follow steps 1–20</td>
</tr>
<tr>
<td>External electric cables</td>
<td>Charge cable</td>
<td>Follow step 1</td>
</tr>
<tr>
<td>Battery</td>
<td>Lithium-ion polymer batteries</td>
<td>Follow steps 1–3</td>
</tr>
<tr>
<td>Cover glass and liquid crystal display (LCD) cell if the surface is greater than 100 square centimeters</td>
<td>LCD cell</td>
<td>Follow steps 1–16</td>
</tr>
<tr>
<td>No further substances or components as listed in Annex VII</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Safety Considerations

The recycler is responsible for independently evaluating all activities undertaken by its employees to perform or support the work and ensuring compliance with all applicable health and safety laws related to the work. These include but are not limited to laws relating to the health and safety of all employees who perform or support this work. The recycler is also responsible for evaluating the workspace and ensuring that the area in which the work is to be undertaken is designed using ergonomic best practices and meets all ergonomic requirements to ensure the protection of its employees.

Personal Protective Equipment

Personal protective equipment should be worn during the entire recycling process.

- Wear hand protection
- Wear eye protection
- Wear protective clothing
- Wear a mask
- Wear foot protection

Battery Safety

This product uses a lithium-ion polymer battery. Before beginning any disassembly work, ensure that a safe working procedure for handling lithium-ion batteries has been established, which could include discharging the batteries so that they can be more safely managed. The following considerations may also be included:

- Remove anything from your person that could conduct energy, such as jewelry and watches, to avoid electric shock to yourself or the logic board.
- To avoid the potential for thermal runaway and the release of potentially noxious fumes, don’t puncture, strike, or crush lithium-ion polymer batteries or devices powered by them.
- Don’t throw, drop, or bend the battery.
- Don’t expose the battery to excessive heat or sunlight.
- Don’t use tools that are sharp or conduct electricity.
- Keep your workspace clear of foreign objects and sharp materials.
- Dispose of batteries according to local environmental laws and guidelines.
Workspace safety guidelines

- Use heat-resistant gloves and safety glasses.
- Keep a sand dispenser within arm’s reach (2 feet or 0.6 m) on one side of the workstation, not above the workstation. The dispenser should be a wide-mouthed, quick-pour metal container with a flip-top lid or tray that contains 8–10 cups (1.9–2.4 L) of clean, dry, untreated sand.
- Keep the battery at least 2 feet (0.6 m) from paper and other combustible materials.
- Work in an area with adequate ventilation.

Handling a thermal runaway

If you notice any of the following signs, a thermal runaway is likely underway, and you should act immediately:

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

**Don’t** use water or an ABC/CO₂ fire extinguisher on a thermal runaway battery or a device containing one. Water and ABC/CO₂ fire extinguishers will not stop the reaction.

**Do** smother the battery or device immediately with plenty of clean, dry sand, dumped all at once. Timing is critical; the faster you pour all the sand, the faster the thermal runaway will stop.

**Do** leave the room for 30 minutes if the thermal runaway causes any irritation.

**Do** wait 30 minutes before touching the battery. Wear heat-resistant gloves and safety glasses to remove the battery from the sand, or use a touchless thermometer to measure the battery temperature. Only touch the battery when the event has finished.

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

LED Safety

Broken LEDs must be handled properly to ensure the safety of your employees and mitigate any hazards. Package broken LEDs in an appropriate container to properly manage the hazards associated with the materials and store only with compatible materials. All waste must be properly classified, packaged, and labeled in accordance with all relevant laws and regulations.
Hazard Warnings

- Rechargeable battery hazard
- Broken glass hazard
- Chemical exposure hazard
- Chemical inhalation hazard
Recommended Tools

- Flat surface scraper
- Long-nose pliers
- Miniature pry bar
- Nail-pulling screwdriver
- Phillips screwdriver
- Plastic pry bar
- Precision pick
- Torx T3 screwdriver
- Torx T5 screwdriver
- Torx T8 screwdriver
- Wire cutters
Disassembly Instructions

1. Remove the power adapter and the charge cable.

   » Ensure that the MacBook is turned off.

   » Unplug the power adapter and remove the charge cable.
2. Carefully pry off the bottom case. To avoid damaging the batteries, only pry near the fastener attachments.

3. Inside the bottom case, carefully remove the six lithium-ion polymer batteries.

Rechargeable battery hazard
4. Pry off both speakers.

5. Pry off the main logic board.
6. Pull off the ribbon cable.

7. Pry off the battery logic board.
8. Cut off the battery cables on both sides.
9. Separate the display from the top case.

» Unscrew the four Torx T8 fasteners from the hinges.

» Unscrew the two Torx T5 fasteners from the top case logic board.
Pull the display away from the top case. Set the display aside.
10. Remove the headphone jack logic board by unscrewing the two Torx T5 fasteners.
11. Remove the USB-C logic board.

» Unscrew the two Torx T5 fasteners.

» Pull off the ribbon cable.
12. Remove the trackpad.

- Unscrew the five Torx T3 fasteners.
- Pull the ribbon cables off the trackpad.
13. Separate the keyboard and trackpad enclosure by breaking the top case in half.
14. Remove the keyboard sheet from behind the keyboard.

15. On the display, scrape off the display gasket.

⚠️ Broken glass hazard
16. Pry the LCD cell and display films away from the display.

- **Broken glass hazard**
- **Chemical exposure hazard**
17. Remove the camera with logic board.

» Unscrew the three Phillips fasteners.

» Pry off the camera with logic board.
18. Remove the data board assembly.

19. Remove the LED logic board.

⚠️ Chemical inhalation hazard
20. Remove the display logic board. Then pull off the ribbon cables.
21. Remove the magnets.

» Bend the display housing to pop up the four magnets.

» Pry off the magnets.
Material Categorization of Output Fractions

All outputs from this process must be managed, handled, and disposed of in accordance with applicable waste laws and regulations, including but not limited to the Waste Framework Directive and its national enactments in Europe.

<table>
<thead>
<tr>
<th>Fraction</th>
<th>Downstream Processing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aluminum</strong></td>
<td></td>
</tr>
<tr>
<td>Bottom case</td>
<td></td>
</tr>
<tr>
<td>Trackpad enclosure</td>
<td></td>
</tr>
<tr>
<td>Keyboard sheet</td>
<td></td>
</tr>
<tr>
<td>Display housing</td>
<td></td>
</tr>
<tr>
<td><strong>Primary Target Material</strong></td>
<td></td>
</tr>
<tr>
<td>Al</td>
<td></td>
</tr>
<tr>
<td><strong>Potential Additional Materials</strong></td>
<td></td>
</tr>
<tr>
<td>PL</td>
<td></td>
</tr>
<tr>
<td>Fraction</td>
<td>Downstream Processing</td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>Batteries</td>
<td>Primary Target Material</td>
</tr>
<tr>
<td>Lithium-ion polymer batteries</td>
<td>BT (Battery)</td>
</tr>
<tr>
<td>Ferrous</td>
<td>Primary Target Material</td>
</tr>
<tr>
<td>Fasteners (x18)</td>
<td>Fe (Ferrous)</td>
</tr>
<tr>
<td>Glass</td>
<td>Primary Target Material</td>
</tr>
<tr>
<td>LCD cell</td>
<td>GL (Glass)</td>
</tr>
<tr>
<td></td>
<td>Potential Additional Materials</td>
</tr>
<tr>
<td></td>
<td>ITO (Indium Tin Oxide)</td>
</tr>
<tr>
<td></td>
<td>PL (Plastics)</td>
</tr>
<tr>
<td>Fraction</td>
<td>Downstream Processing</td>
</tr>
<tr>
<td>---------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td><strong>Logic Boards</strong></td>
<td></td>
</tr>
<tr>
<td>Main logic board</td>
<td><strong>Primary Target Material</strong></td>
</tr>
<tr>
<td>Battery logic board</td>
<td><strong>PMs</strong></td>
</tr>
<tr>
<td>Headphone jack logic board</td>
<td></td>
</tr>
<tr>
<td>USB-C logic board</td>
<td><strong>Cu</strong></td>
</tr>
<tr>
<td>Trackpad</td>
<td><strong>Fe</strong></td>
</tr>
<tr>
<td>Keyboard</td>
<td><strong>PL</strong></td>
</tr>
</tbody>
</table>

**Potential Additional Materials**

- Cu (Copper)
- Fe (Ferrous)
- PL (Plastics)
<table>
<thead>
<tr>
<th>Fraction</th>
<th>Downstream Processing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logic Boards (cont.)</td>
<td></td>
</tr>
<tr>
<td>Camera with logic board</td>
<td></td>
</tr>
<tr>
<td>Data board assembly</td>
<td></td>
</tr>
<tr>
<td>LED logic board</td>
<td></td>
</tr>
<tr>
<td>Display logic board</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mixed Electronics</th>
<th>Primary Target Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power adapter</td>
<td>Cu</td>
</tr>
<tr>
<td>Charge cable</td>
<td>Fe</td>
</tr>
<tr>
<td>Battery cables</td>
<td>PL</td>
</tr>
</tbody>
</table>

Potential Additional Materials

Fe  
PL  
PMs
### Mixed Electronics (cont.)

- **Ribbon cables**

### Mixed Plastics

- **Display gasket**
- **Display films**

### Rare Earth Magnets

- **Speakers**
- **Magnets**

### Primary Target Material

- **Primary Target Material**
  - Rare Earth Elements (REE)

### Potential Additional Materials

- **Cu** (Copper)
- **Fe** (Ferrous)
- **PL** (Plastics)