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Apple Service Source



MacBook Pro

20 February 2006

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# MacBook Pro

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Basics

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MacBook Pro



# General Information

## Product View



## Overview

The MacBook Pro is the first Mac notebook built upon the Intel Core Duo chip.

From the exterior, the MacBook Pro has a similar look to the previous aluminum PowerBook notebook computers. However, as far as major part compatibility only the power cord and power adapter AC plug are the same.

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## What's New

### Main service and feature differences from previous models:

- Intel Core Duo microprocessor architecture: 1.83GHz, 2.0GHz, and a 2.16GHz option
- Higher resolution 15.4-inch display, 1440 x 960, 114 dpi (previously 1280 x 854, 101 dpi)
- Supports DDR2 memory up to 2GB
- 128MB VRAM with dual link DVI option is now standard
- 9.5mm slot load SuperDrive (versus the previous 12.7mm)
- 80GB 5400 RPM hard drive standard
- 100GB/120GB 5400 RPM, 100GB 7200 RPM hard drive option
- No modem
- No FireWire 800 port
- No PC Card slot
- ExpressCard/34 expansion card slot
- Dual display latch
- AirPort and Bluetooth cards and antennas are separate and in different locations
- The AirPort Extreme antenna assembly is in the clutch cover
- Infrared sensor
- iSight camera built in
- MagSafe magnetic power connector

## New Parts and Procedures

### Main Logic Board

The major change is the Intel Core Duo design with the ATI Mobility Radeon x1600 graphics chip. The FireWire 800 port and S-video connector has been removed. Composite and S-video connection is still available using the optional Apple DVI to Video adapter. Clearly, this new logic board will not fit in any previous Mac notebook or vice versa.

The microprocessor is soldered to the main logic board. It is not upgradable.

To accompany these hardware changes, the boot architecture is now based on Extensible Firmware Interface (EFI). EFI replaces the Open Firmware (OF). Services provide by OF such as boot snag keys such as "C" for boot from optical, "N" for network boot, and "T" for Target Disk Mode are still available under EFI. The one change is the "D" key is used to launch Apple Hardware Test from the Mac OS X Install disc.

### Main battery

MacBook Pro uses a new battery pack. It built with lithium polymer battery cells. This technology is used with our iPod product line and the base chemistry is the same as the previous lithium ion cells. This battery pack uses the same controller as the PowerBook G4 (15-inch Double-layer SD). As such the battery calibration procedure is the same.

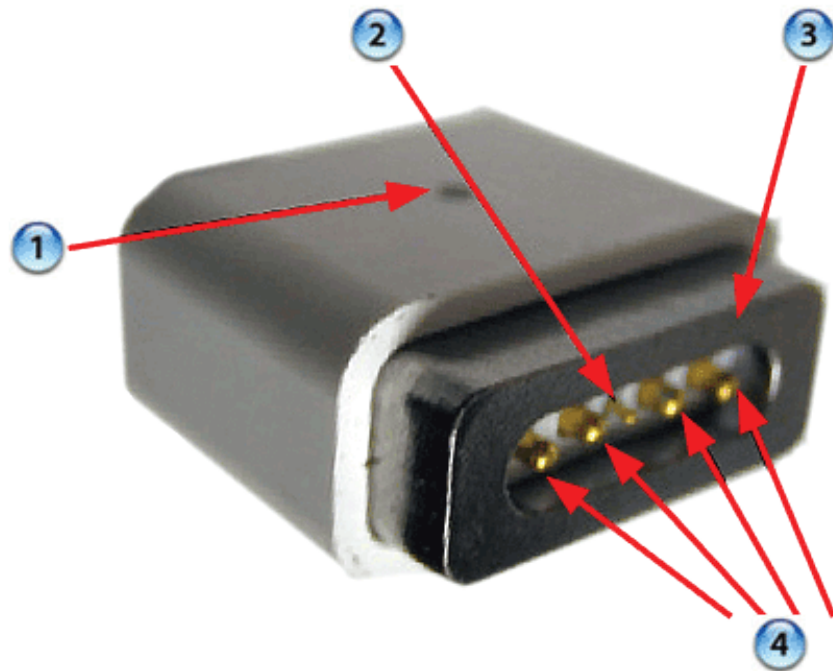
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## Power Adapter

The system was designed to use the new Apple 85-Watt Portable Power Adapter. This power adapter comes with the new MagSafe power connector. It is not compatible with any previous notebook computer.

The MagSafe connector consists of a magnet and an attraction plate. The magnet is placed within the computer. The attraction plate is part of the DC plug on the power adapter.

The DC plug consists of five pins. Each pin is spring loaded. The center pin is a sense pin (2). This center pin must make contact with the computer before power is applied. Power is carried on the remaining four pins. The outer pins are positive terminals, the inner pair are the return paths.



The pin pairs to either side of the sense pin are redundant. As such, the plug can be put in two ways. To support this design, the power LED (1) is on both side of the connector. The behavior of the LED is the same as before, amber for charging the battery, green for supplying power, but not to charge the battery.

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As the computer port has the magnet, as you are servicing the system it is recommended to put a piece of tape over the connector to avoid materials such as screws and washers to be inadvertently drawn into it.



### 15.4-inch Display

The MacBook Pro is the first Mac notebook to use the 15.4-inch size display. In addition, it is the brightness display used. As such, care must be exercised to avoid damaging the display panel. As you will see in the design, contact with the rear of the panel has been minimized. Do not put any new material such as tape on the back of the display panel nor press hard on it while handling it.

### Top Case

As the sleep magnet has been relocated to the side of the display bezel, the sleep sensor is now located to the right side of the top case just around the bottom of the perforated

### Keyboard

The keyboard is the same design as shipped with the PowerBook G4 (15-inch/17-inch Double Layer SD) except the flex cables. In particular, the keyboard backlight flex has changed. As such no other internal keyboard is compatible with MacBook Pro.

### Mass Storage (Hard drive and optical drive)

The hard drive has changed to a Serial ATA interface. This drive is new and previous PowerBook drives will not work in this system.

The optical drive is a 9.5mm high drive. Previously optical drive has 12.7mm height. As with previous designs, the drive should be flat in its compartment before fastening it down. This step ensures proper path for optical media to enter and exit the drive.

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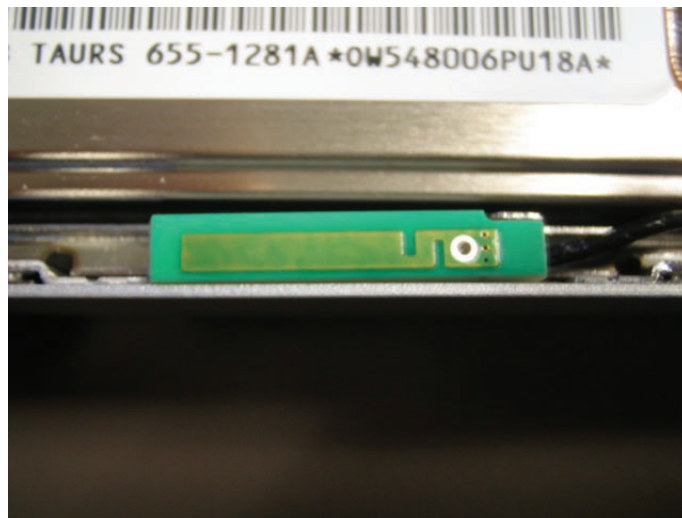
## AirPort Extreme

The AirPort Extreme card is a new card design. Unlike the most recent card, it does not support Bluetooth. It is the same form factor as used on the iMac (Spring 2006). However, there are two versions of these cards. We have structured our service parts to keep the two separate.

The AirPort antenna is no longer in the display housing. In the clutch barrel, there is a gray plastic insert. The AirPort antenna is underneath this plastic window.

## Bluetooth

Bluetooth has returned as a separate card. In addition, it has its own antenna. It is a little board which is placed in front of the hard drive near where the top case meets the bottom.



## Back up battery

The back battery is no longer a rechargeable. It only provides power to the real time clock and does not support system memory.

If you don't have a power adapter connected, when you swap a battery in a running system, it must be done from sleep. The system will shutdown when you remove the battery. When you power back up, it will boot up from hibernation.

## ExpressCard

ExpressCard has replaced the PCMCIA card cage. The ExpressCard standard supports two sizes cards, 34mm and 54mm width. MacBook Pro supports the 34mm standard.

Unlike the previous PCMCIA design, there is no eject button. The card itself is used to engage and disengage itself from the card cage. In some designs like Ethernet ExpressCard, the card sticks out beyond the card cage. It is easy to push on the card to release it. Other cards will be flush with the MacBook Pro enclosure and will take a little more care to pop out.

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## IR and the Apple Remote

Infrared port is placed on the front of the unit just to the right of the display latch button. This port is used in conjunction with the Apple Remote provided with each unit. It can be used to control Front Row software that manages your music, photos and videos. The remote can also be used to control other applications as well.



## iSight Camera

An iSight Camera has been built-in into the display bezel. It allows a user to capture video and take still photos. The green LED to the right of the camera is on when the camera is on.



Unlike the standalone iSight camera, the microphone is not integrated with the camera. It is located as previous Mac notebooks by left speaker.

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## Identifying the MacBook Pro

Below are views of the MacBook Pro, with identifying features.

**Left side:** MagSafe™ magnetic power connector.



**Right side:** No FireWire 800 port.



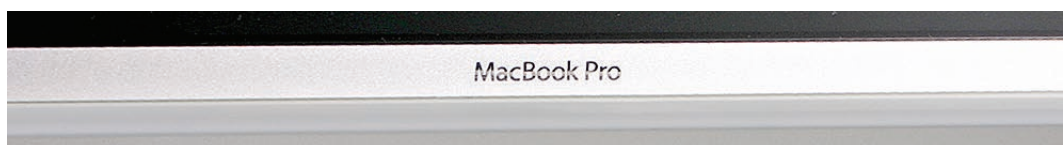
**Front:** Infrared sensor window.



**Rear:** Grey antenna window in the clutch cover.



**Display bezel:** MacBook Pro.

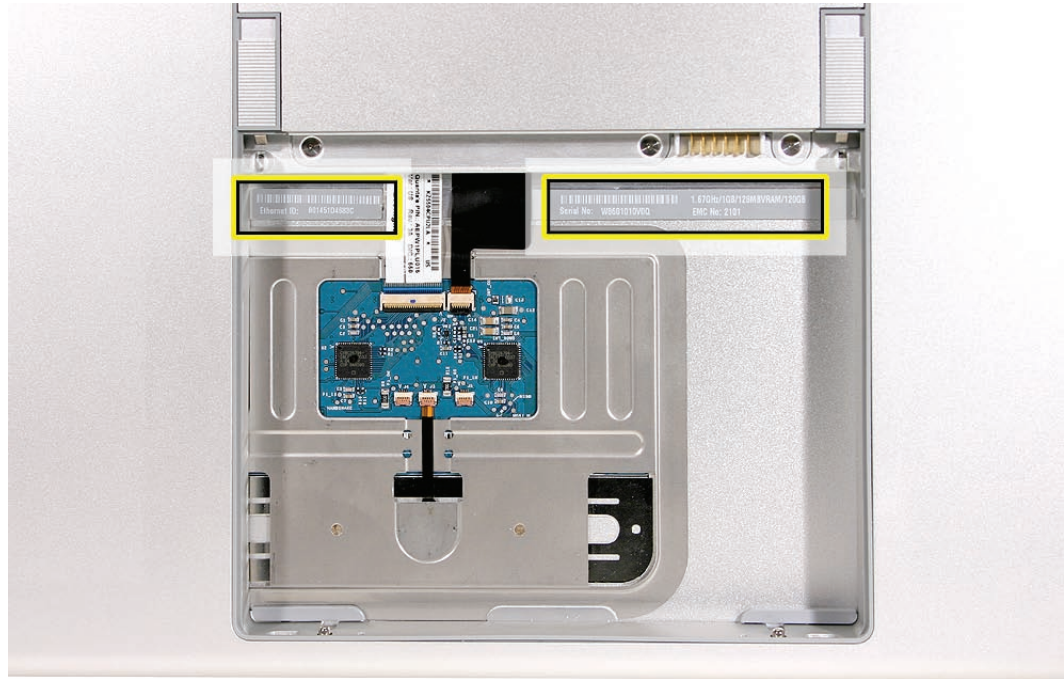




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## Serial Number and Ethernet ID

The Serial Number and Ethernet ID are located in the battery bay.



## Tools

This procedure requires the following tools:

- Clean non-marring work surface
- ESD wrist strap and mat
- Multi-compartment screw tray (such as a plastic ice cube tray)
- #0 Phillips screwdriver (magnetized)
- #1 Phillips screwdriver (magnetized)
- Torx T6 screwdriver (magnetized)
- 4 mm socket wrench
- Black stick (nylon probe 922-5065) (or other non-conductive nylon or plastic flat-blade tool)
- Razor knife
- Needle-point metal probe
- Needlenose pliers
- Tweezers
- Kapton tape (922-1731 (0.5-inch x 12-yard roll))
- Thermal grease (922-7144)
- Gasket kit (076-1206)
- Alcohol pads
- Fine-point felt-tip permanent marker
- Putty knife tool (922-6761)
- Apple Pro keyboard and mouse (for troubleshooting)

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## **Electrostatic Discharge (ESD)**

Use a properly grounded ESD wrist strap and mat when working on the inside of the computer.

## **Service Manual Note**

In this manual, graphics or photos are intended to help illustrate procedures or information only, and may show different levels of disassembly, board colors, configurations, or computer models, than your computer.

## **Kapton® Tape Note**

Kapton tape is used to secure cables and connectors where necessary.

During disassembly, note any Kapton tape use and locations—reapply in the same manner. Do not over apply or build up tape on top of old tape; space tolerances are tight and build up or extraneous use of tape may cause pressure on other components.

## **Cable Routing Note**

The MacBook Pro matches the same one-inch enclosure height established with the PowerBook G4 17-inch series of systems. More so than ever, the placement of parts and wiring is critical.

During disassembly, note cable routing. Reassemble in the same manner. Verify that cables do not route over components when they should route into lower positions or channels. Verify that the cables are not strained or applying pressure onto other components.

## **Screw Measurement Note**

All screw measurements given are the specified full length. Actual measured lengths may vary.

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Service Source



Take Apart  
MacBook Pro



# Foot




## Tools

This procedure requires the following tools:

- Foot kit
- Tweezers or needlenose pliers
- Soft cloth

## Preliminary Step

Before you begin, check the foot location that needs replacement and verify that the case plug is attached. Also verify that the case plug, and the case foot in the kit, match the pictures below.

Plug Area on Bottom Case	Matching Foot	Action
Missing case plug 	Not available for replacement	Replace the bottom case, or send to Apple Repair Center.
Case plug 	Case foot 	Continue with the procedure, matching the foot to the plug on the bottom case.

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## Procedure

**Warning: The glue used in this procedure can bond instantly to skin. Do not touch the glue. In the event of contact, review the safety instructions at the end of this document. For additional information, refer to the glue manufacturer:**

Elmer's Products, Inc.  
Columbus, OH. 43215-3799  
[www.krazyglue.com](http://www.krazyglue.com)

1. Place the computer upside down on a clean, lint-free cloth or other nonabrasive surface.
2. Select a foot from the kit. Verify that the case plug and case foot match (refer to the images shown in the table). Do not use a foot that does not match.
3. Make sure the plug area on the bottom case is clean. If any portion of the soft rubber foot remains, remove it so that only the hard plastic plug is visible.

**Important:** When positioning the foot, make sure the indents and bumps of the rubber foot match up and fit into the corresponding indents and bumps in the plug. This ensures a balanced and level fitting. (Note: The picture below is of a different foot than on the computer, and is for illustration only.)



- 
4. **Warning: GLUE IS AN EYE AND SKIN IRRITANT. BONDS SKIN INSTANTLY. Do not touch the glue at any time. Before opening the glue, review the safety instructions at the end of this document.**

**Important:** The glue tube included in the kit is sealed until first use. Do not break the seal until you are ready to use the glue. To break the seal, hold the tube upright and away from you. Place the hollow nozzle cap on the tube and tighten it all the way down. The tube is then ready to dispense the glue through the nozzle cap.



5. Apply one drop of glue to the plug on the bottom case. Do not spread the glue.
6. Using tweezers or needlenose pliers, carefully position the new foot so its textured surface fits into the inner ring of the plug.
7. Using the end of the tweezers or pliers—not your finger—lightly press and hold the foot in place for 30 seconds.



8. Before turning over the computer, allow the glue to set for at least 15 minutes.
9. Discard the tube of glue.

**SAFETY INSTRUCTIONS: GLUE IS AN EYE AND SKIN IRRITANT. BONDS SKIN INSTANTLY.** Contains ethyl cyanoacrylate. Avoid contact with skin and eyes. If eye or mouth contact occurs, hold eyelid or mouth open and rinse thoroughly but gently with water only for 15 minutes and **GET MEDICAL ATTENTION**. Liquid glue will sting eye temporarily. Solidified glue may irritate eye like a grain of sand and should be treated by an eye doctor. If skin bonding occurs, soak in acetone-based nail polish remover or warm soapy water and carefully peel or roll skin apart (do not pull). Contact through clothing may cause skin burn. If spilled on clothing, flush with cold water. Avoid prolonged breathing of vapors. Use with adequate ventilation. **KEEP OUT OF REACH OF CHILDREN.**



# Battery

## Tools

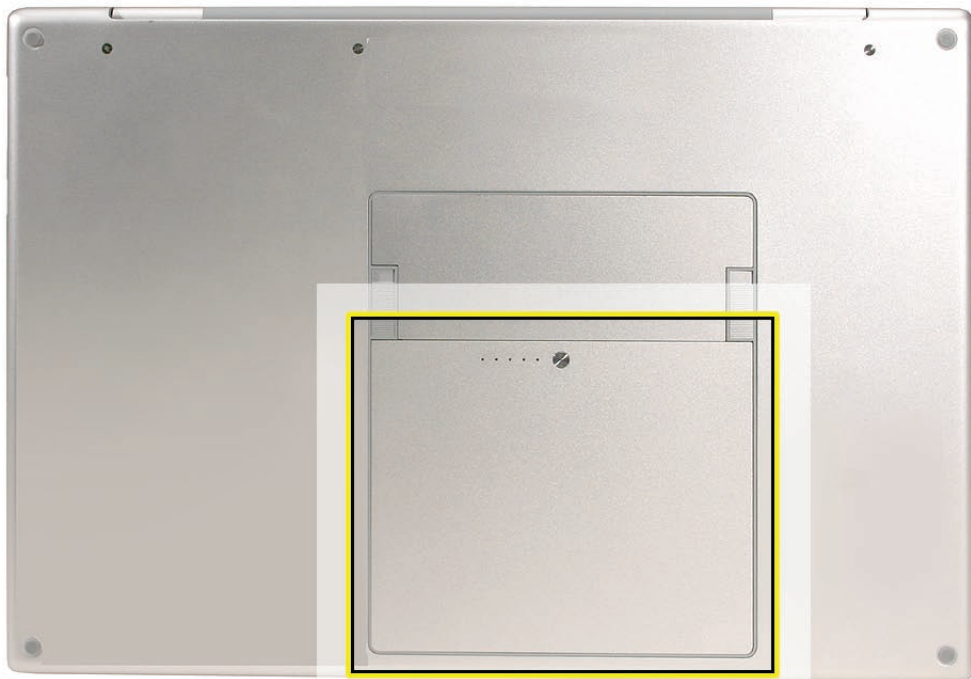
This procedure requires the following tools:

- Clean non-marring work surface

## Preliminary Steps

**Warning:** Always shut down the computer before opening it to avoid damaging its internal components or causing injury. After you shut down the computer, the internal components can be very hot. Let the computer cool down before continuing.

## Part Location

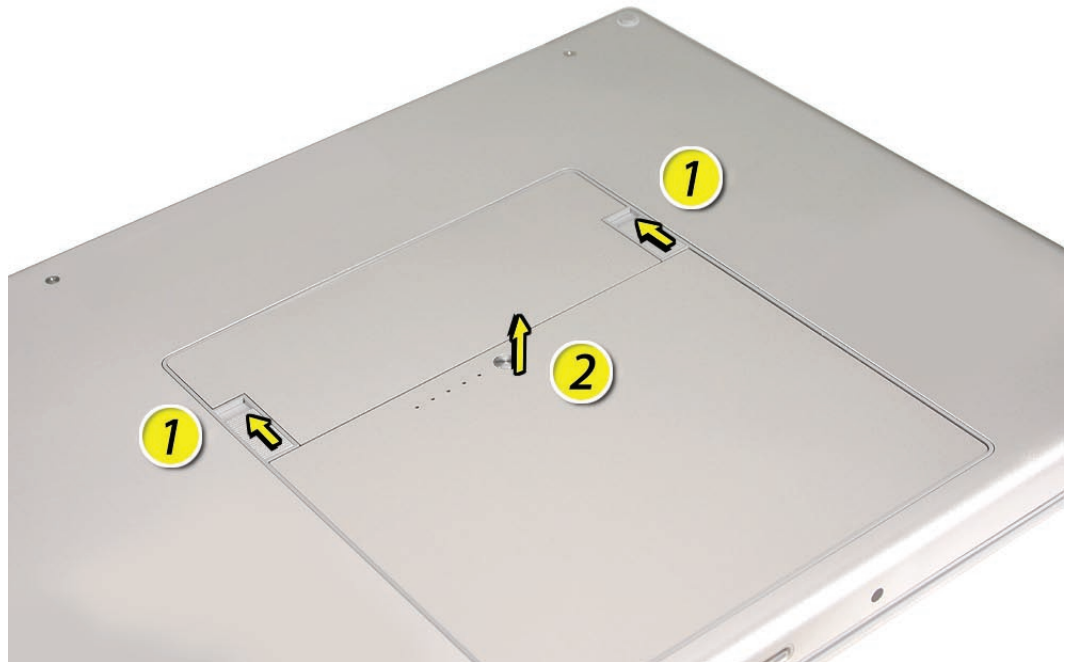


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## Procedure

**Warning: If the computer has been recently operating, allow it to cool down before performing this procedure.**

1. Shut down the computer.
2. Disconnect the power cord and any other cables connected to the computer.
3. Place the computer face down.
4. Slide both battery latches away and lift the battery out of the battery bay.







# Memory

## Tools

This procedure requires the following tools:

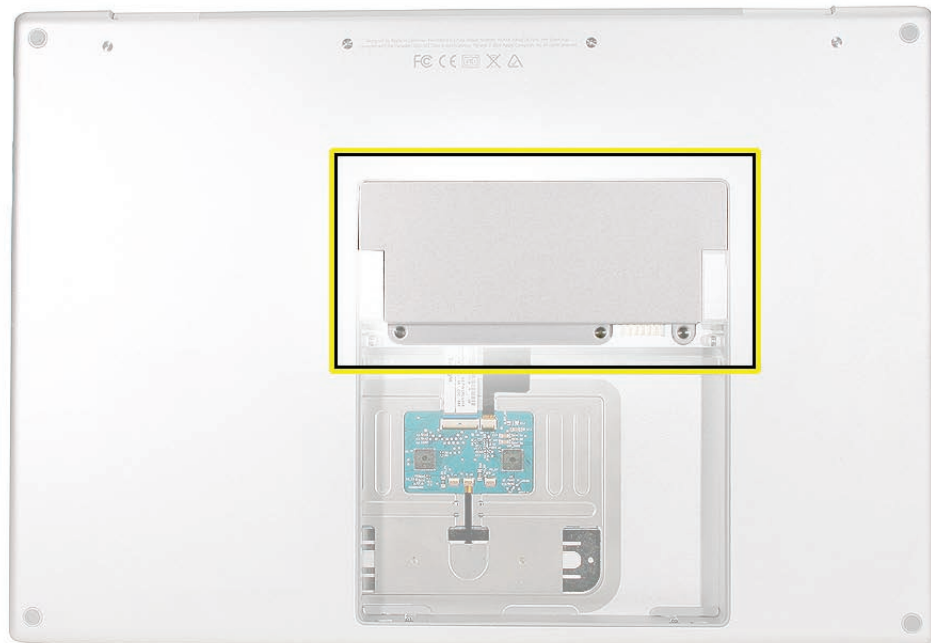
- #0 Phillips screwdriver (magnetized)
- Clean non-marring work surface
- ESD wrist strap and mat

## Preliminary Steps

Before you begin, remove the following:

- [Battery](#)

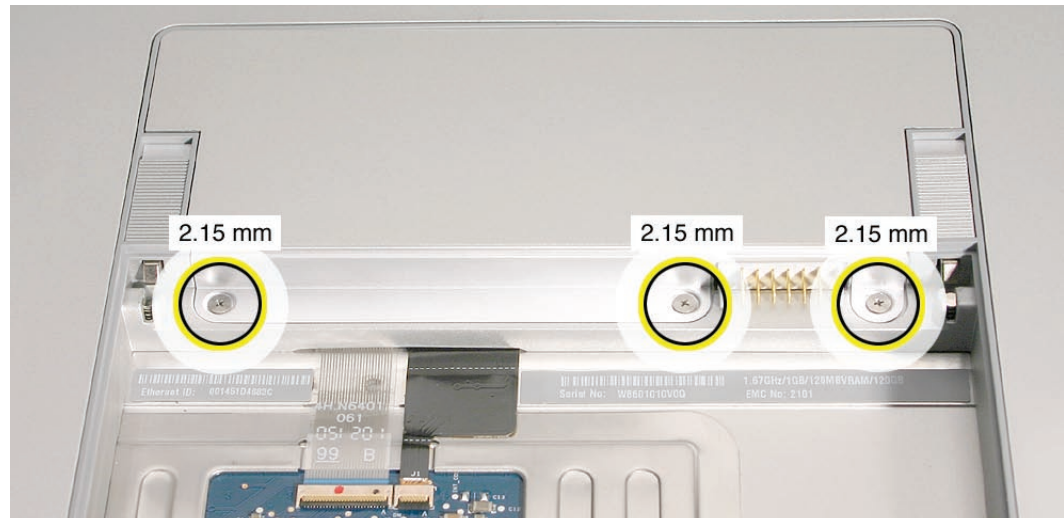
## Part Location



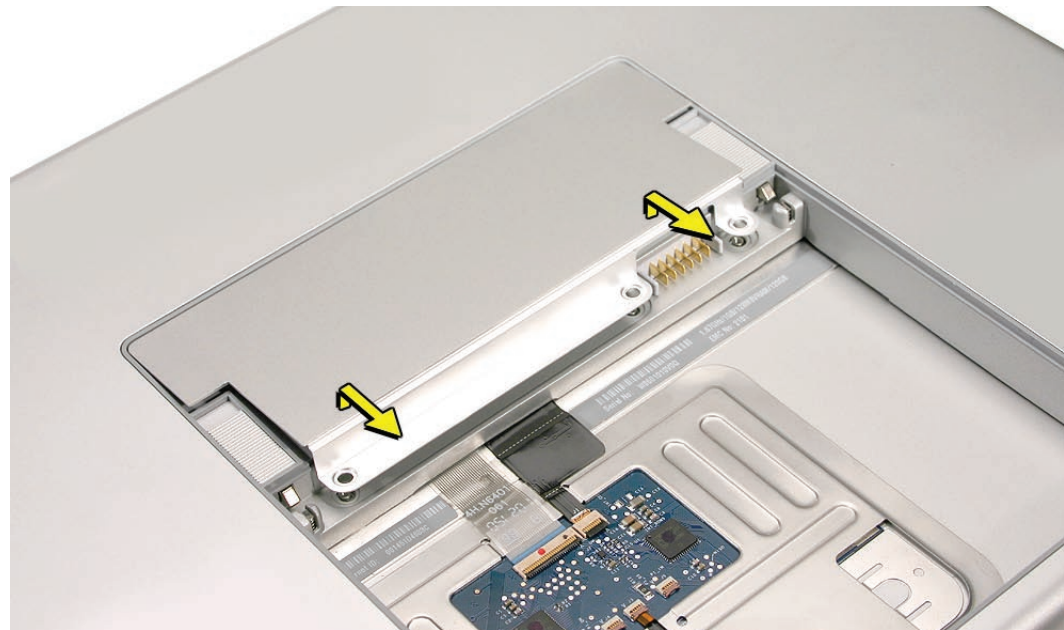
## Procedure

**Warning:** If the computer has been recently operating, allow it to cool down before performing this procedure.

1. Place the computer face down.
2. Remove the three screws from the memory door.



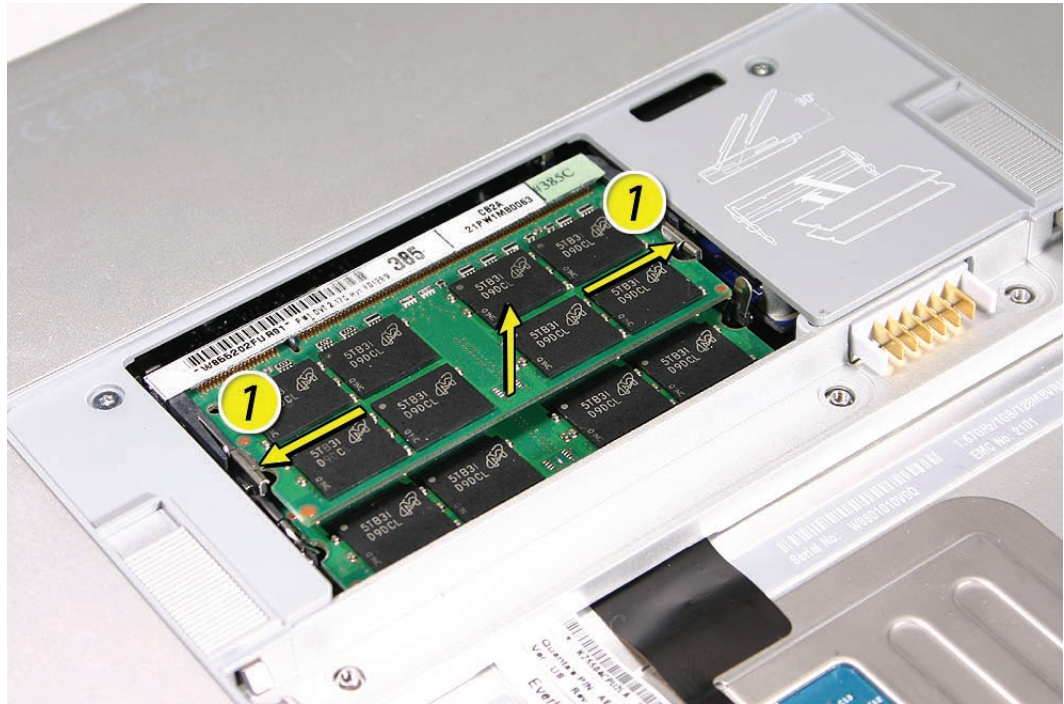
3. Remove the door, as shown.



### Notes:

- If only one memory card is installed, the factory installs it in the bottom memory slot.
- Memory must be removed from the top slot before removing from the bottom slot.

4. To remove memory cards, carefully spread the two locking tabs for the slot (top or bottom) away from the card on both sides and allow the card to pop up slightly.



5. Pull the card straight back and out of the memory slot.





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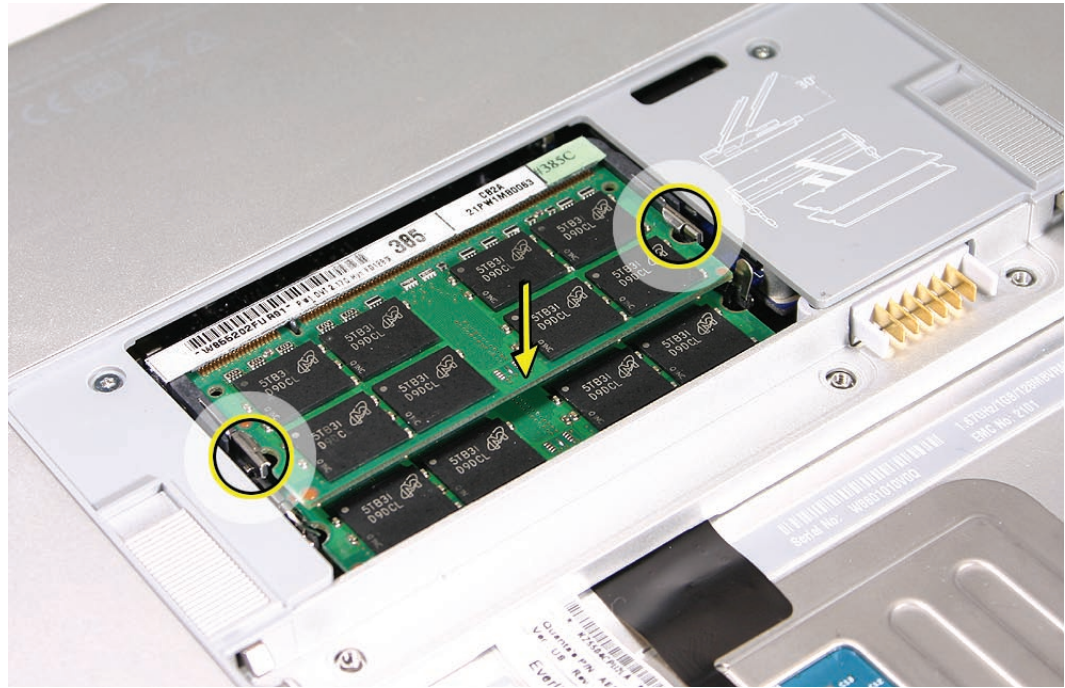
## Replacement Procedure

### Notes:

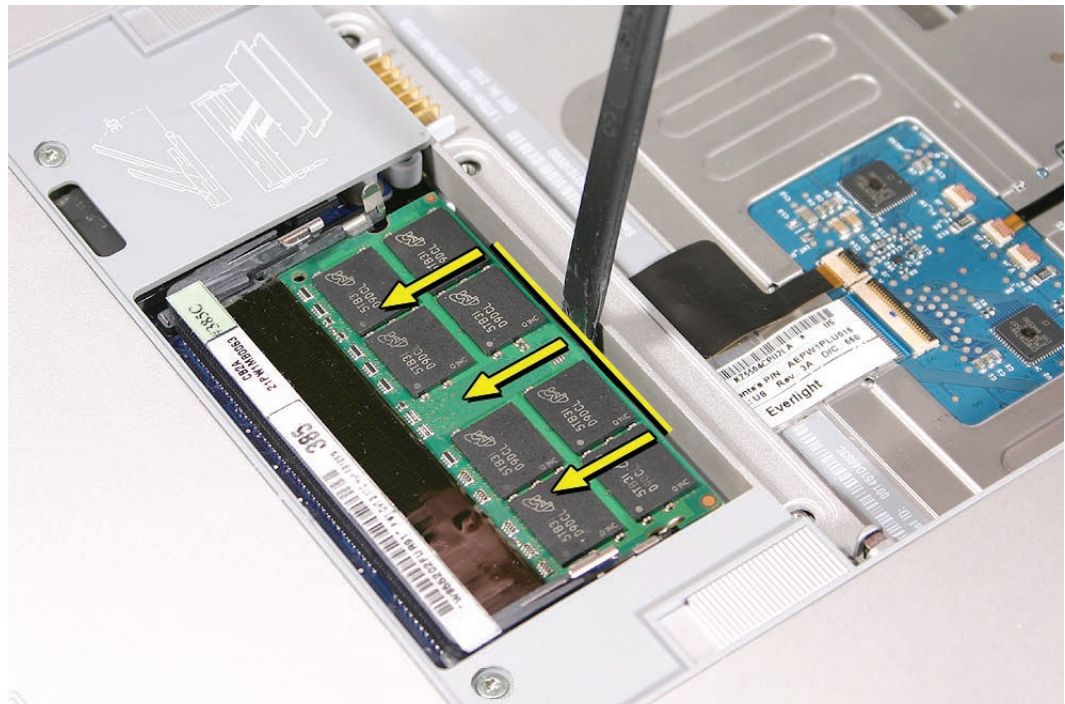
- DDR memory cards do not fit in this slot (different notch location).
  - If installing two cards, install into the bottom slot first.
  - When finished installing memory into the bottom slot, use a black stick leveraged against the frame to push the back of the card toward the slot to verify that the card is firmly seated.
  - Align the notch in the memory card with the tooth in the slot before inserting.
1. To install a memory card, insert the card at a 25-degree angle behind the locking tabs of the top slot.
  2. Firmly push the card straight into the slot until it is fully and securely seated along its length.  
**Note:** If the back of the card drops down before it is fully seated, raise it up enough to push it fully into the slot.



3. When the card is fully seated, push the card straight down until the tabs click onto both sides of the card, locking it into place.



4. To ensure that the memory cards are fully and securely seated, for the lower card, use a black stick leveraged against the frame to evenly push along the back of the card.



5. For the upper memory card, push with your thumbs to verify the card is fully seated.



6. Check that the cards are secured by the brackets on both sides.
7. Install the memory door.
8. Replace the battery.
9. **Use Apple System Profiler to verify that the memory is recognized. (Choose the menu bar Apple logo (🍏) > About This Mac, click More Info..., select the System Profile tab, open the Memory Overview.)**



# Top Case

## Tools

This procedure requires the following tools:

- #0 Phillips screwdriver (magnetized)
- Torx T6 screwdriver (magnetized)
- Black stick (nylon probe 922-5065) (or other non-conductive nylon or plastic flat-blade tool)
- Multi-compartment screw tray (such as a plastic ice cube tray)

## Preliminary Steps

Before you begin, remove the following:

- [Battery](#)
- [Memory Door](#)

## Part Location

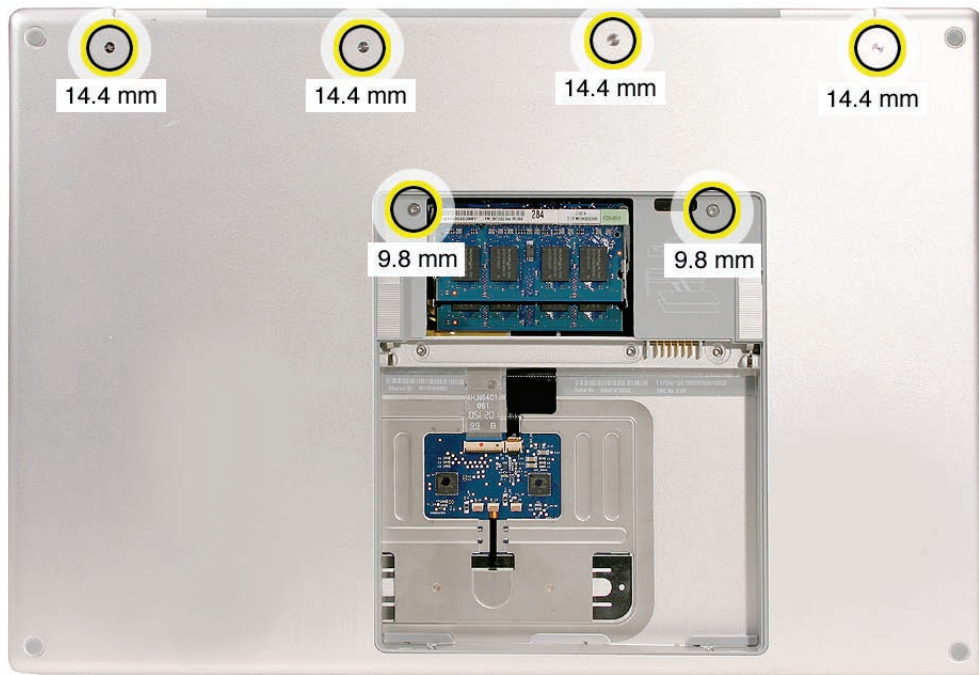




## Procedure

### Notes:

- If replacing the top case, once the top case is removed, use a razor knife to carefully lift and transfer the Serial Number and Ethernet ID labels to the replacement top case.
  - This procedure removes the top case and keyboard assembly. The keyboard is removable only after removing the top case.
1. Place the computer upside down.
  2. Remove the six screws shown.

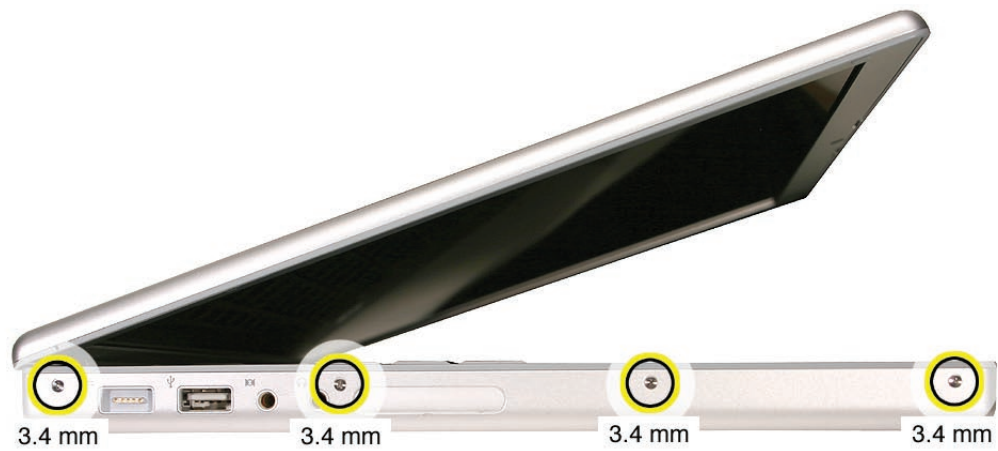


3. Rotate the computer and remove the two screws along the front of the battery bay.





- Remove the four screws from each side.



- Remove the two screws from the back edge.



6. Face the computer forward and open the display slightly past 90-degrees.
7. Use a black stick to loosen the top case along the rear of the left and right sides.



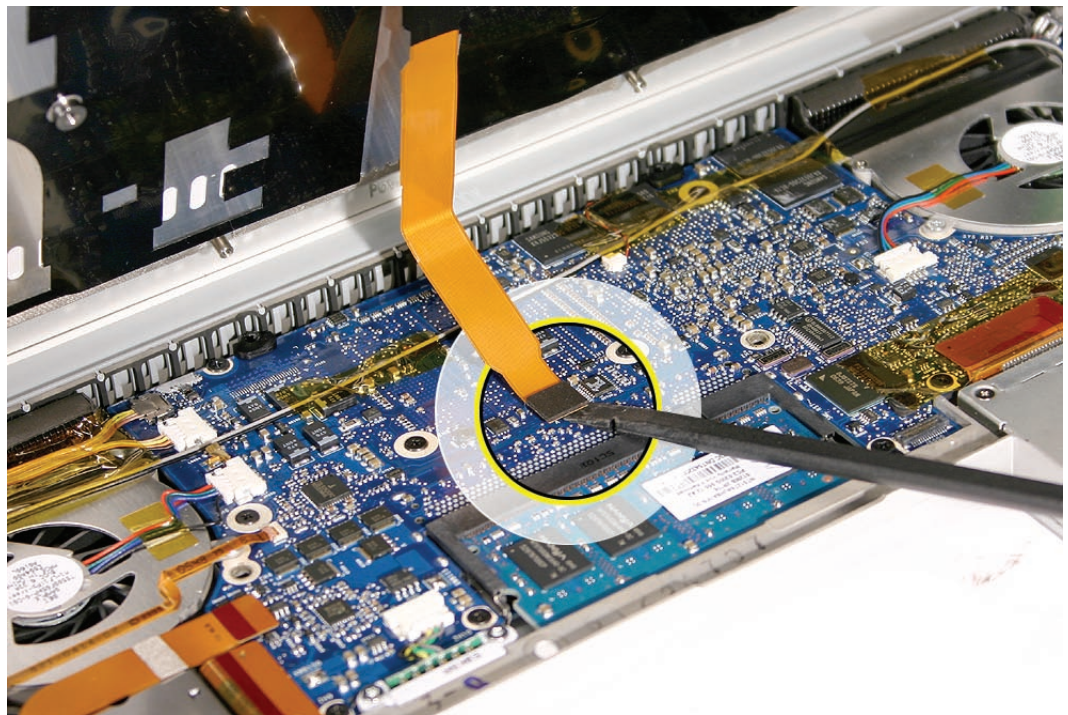
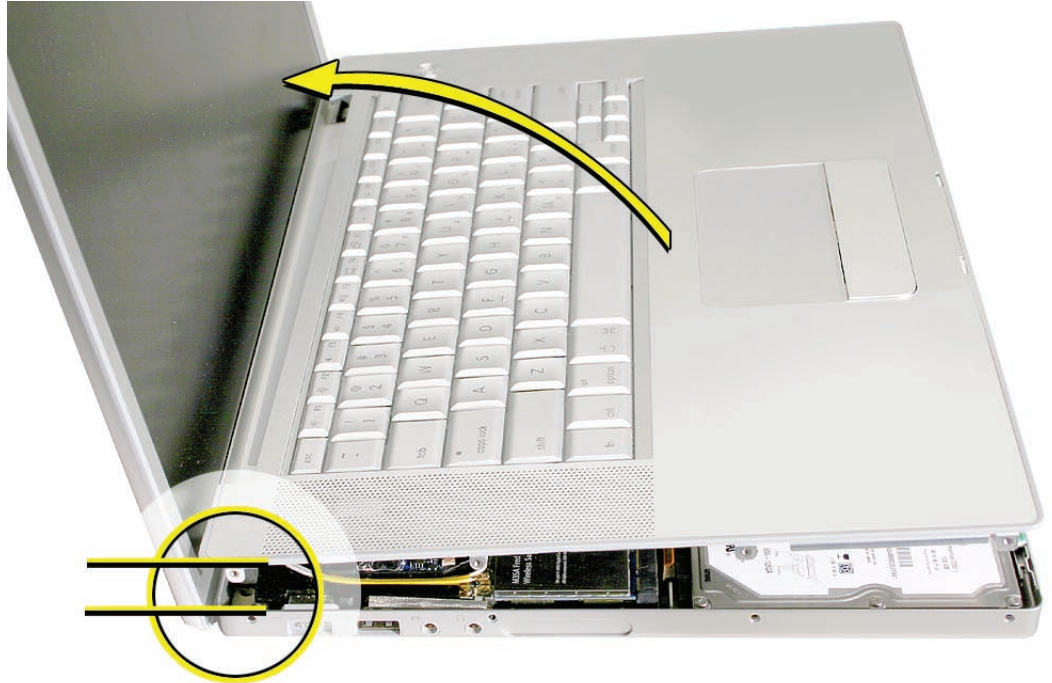
- 
8. Along the front, start at the left and slowly encourage the snaps and screw tabs (shown in graphic below) to release as you move right. A snapping noise as the snaps release is normal.



**Important:** Do not lift the case once it is free—it is still connected to the bottom case by the keyboard flex cable.



9. **Important:** To avoid bending screw tabs along the back edge of the top case, lift the top case slightly so that it does NOT touch the bottom case, then rotate the front of the case up and back until you can disconnect the keyboard flex cable from the logic board.

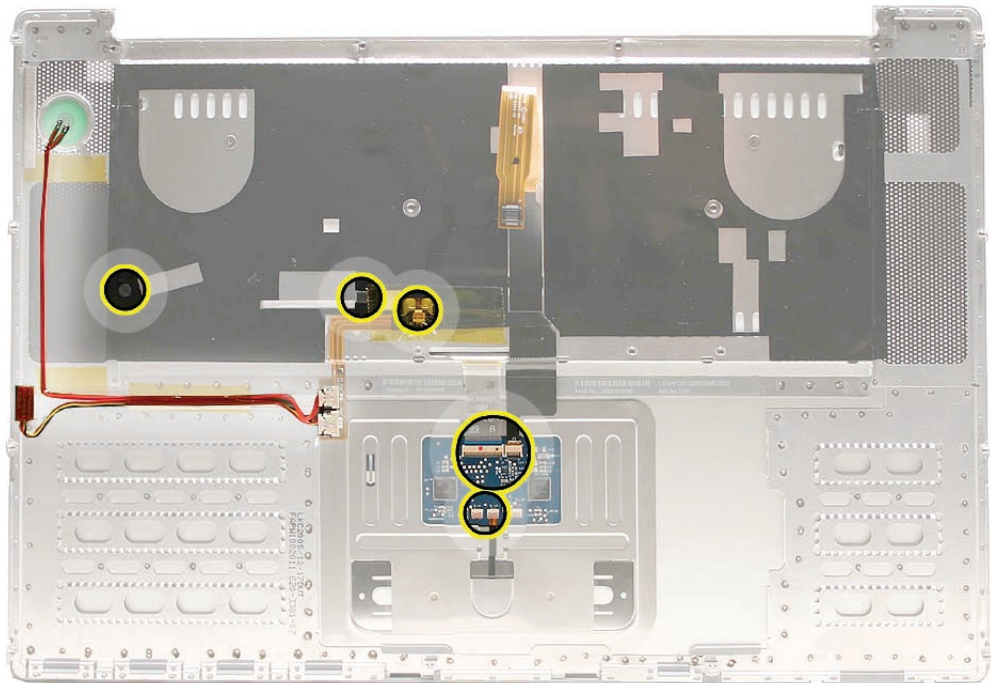


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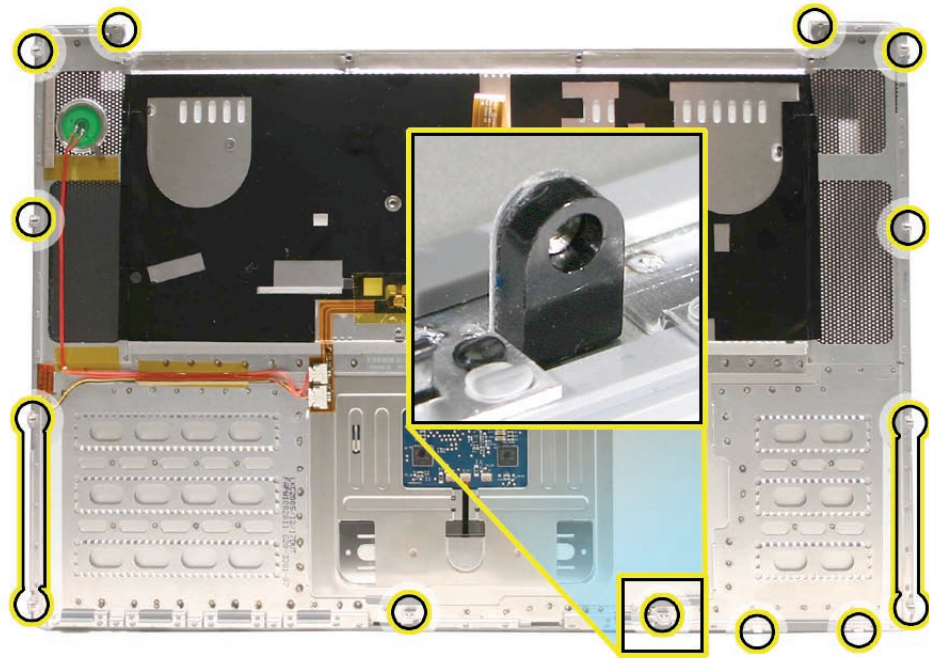
## Replacement Procedure

**Note:** If replacing the top case, remove the [keyboard](#) and transfer to the replacement top case.

1. Visually check to verify that all cables are connected and routed correctly with nothing raised up or incorrectly over a component.
2. Check perimeter wiring and cables around clutches to verify that they will not be caught or pinched by the top case during replacement.
3. On the computer, verify that all cables are secure and lay flat.
4. On the top case, check cable connections and routing.

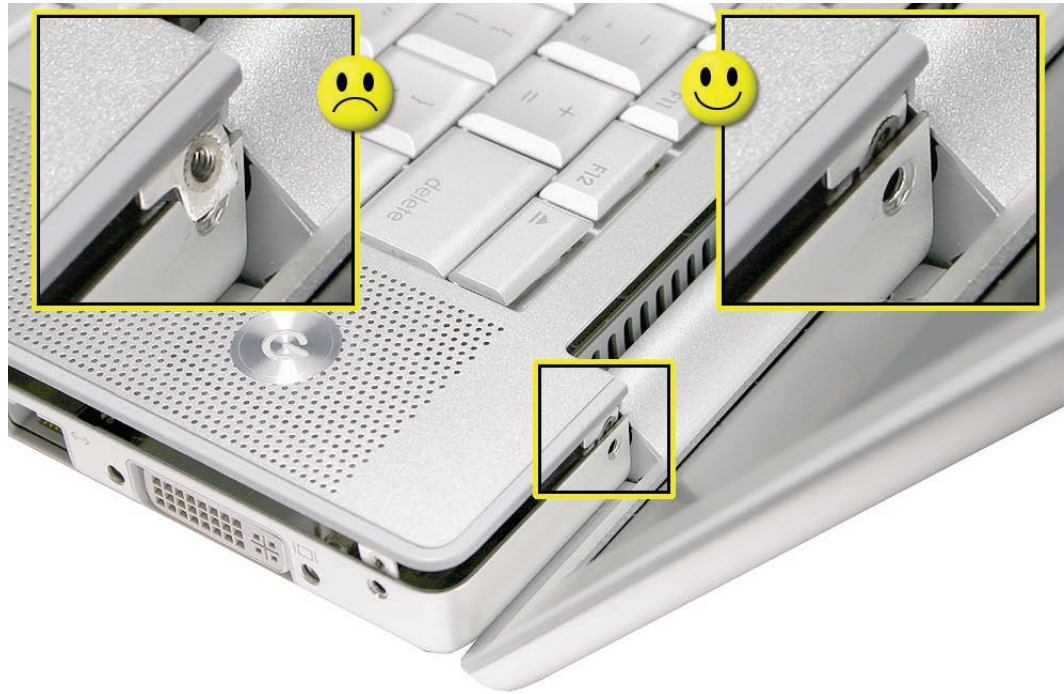


5. Check that the perimeter screw tabs and ribs are not bent.  
**Note:** The metal can quickly fatigue and break off. Be extremely careful to gently straighten tabs, if needed.
6. Verify that the plastic spacer is on the front screw tab, shown.

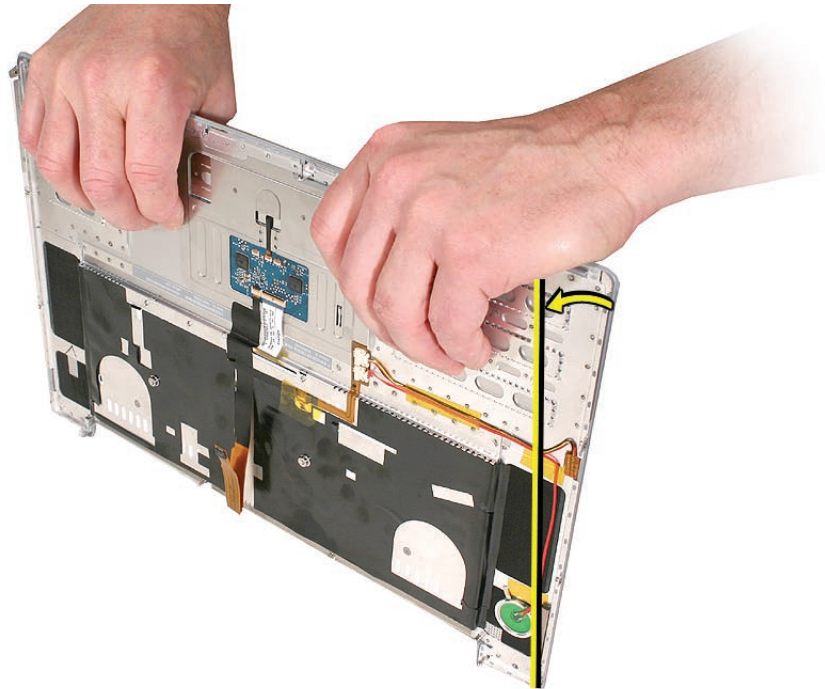




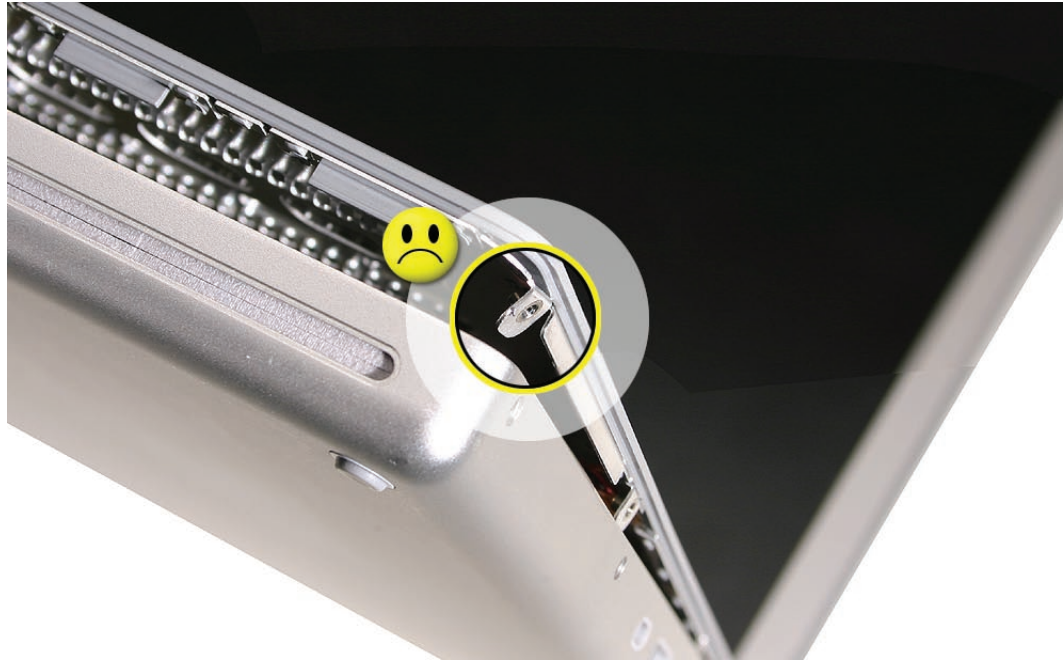
7. Verify that the screw tabs in back are straight and guide them inside the bottom case. Work your way around guiding the screw tabs into the bottom case along both sides.



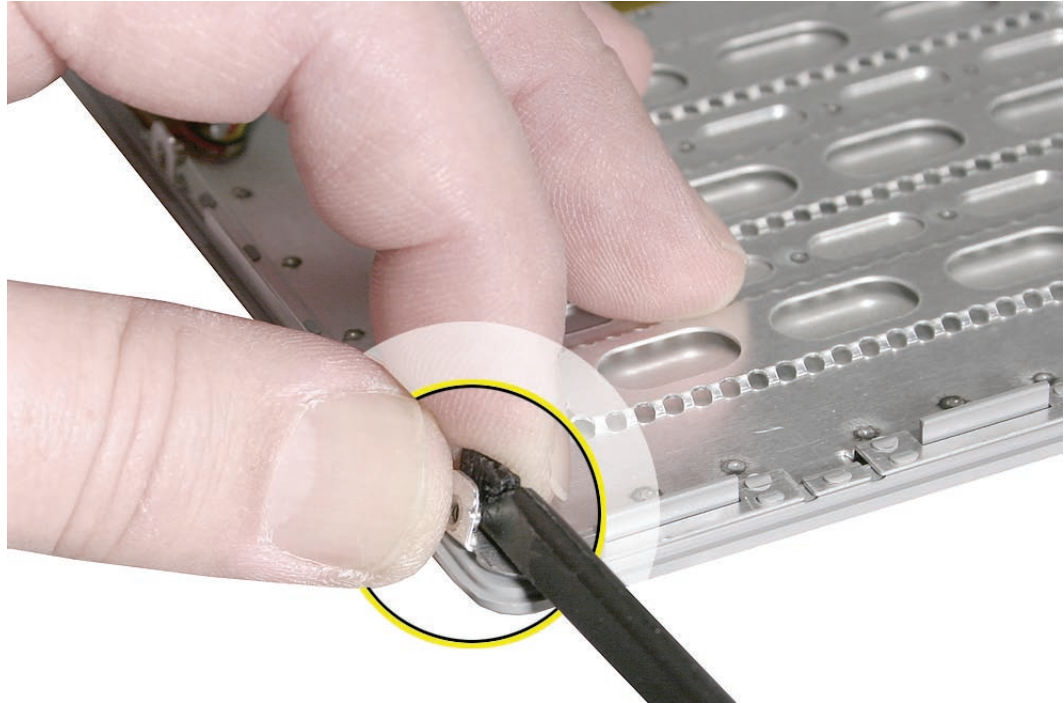
8. If the back screw tabs are bent out, straighten by pressing the edge of the case on a hard flat surface and rolling to vertical.



9. Any screw tabs that are not straight will not fit or accept screws correctly.



10. Use your finger and a black stick to carefully straighten bent screw tabs.





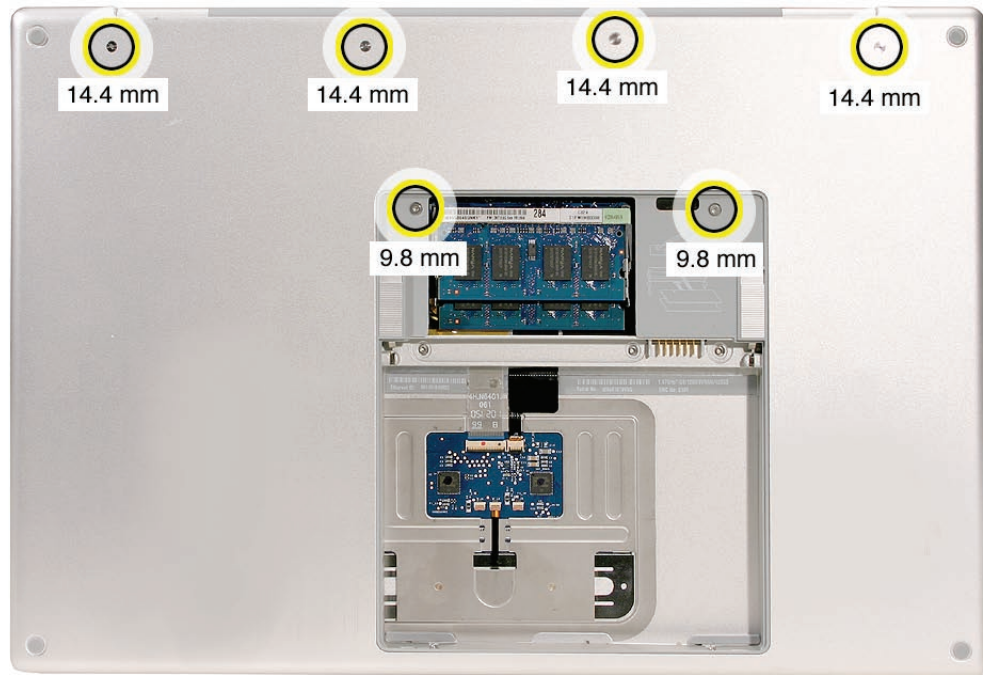
11. Connect the flex cable from the top case to the logic board.
12. Lift the top case off the bottom case slightly and rotate it down (verify that the keyboard cable stays connected and is folding properly) and align the corners.
13. Carefully pull or push tabs slightly, if needed. **Note:** Guarded, controlled pushing with your thumb may be helpful to finesse the tabs into place.
14. The two front screw tabs may need to be guided with a black stick through the battery bay.
15. Squeeze at the snap locations (shown below) along the front edge of the top case to verify that they are seated. The top case should lay flat along all sides and top, if not, make sure that cables and components are not interfering.



16. Reinstall the left and right side screws.  
**Important:** Do not insert screws into the DVI port screw holes. If they get stuck, it may require removing the logic board to dislodge.



17. Install the bottom screws and the two screws near the memory.



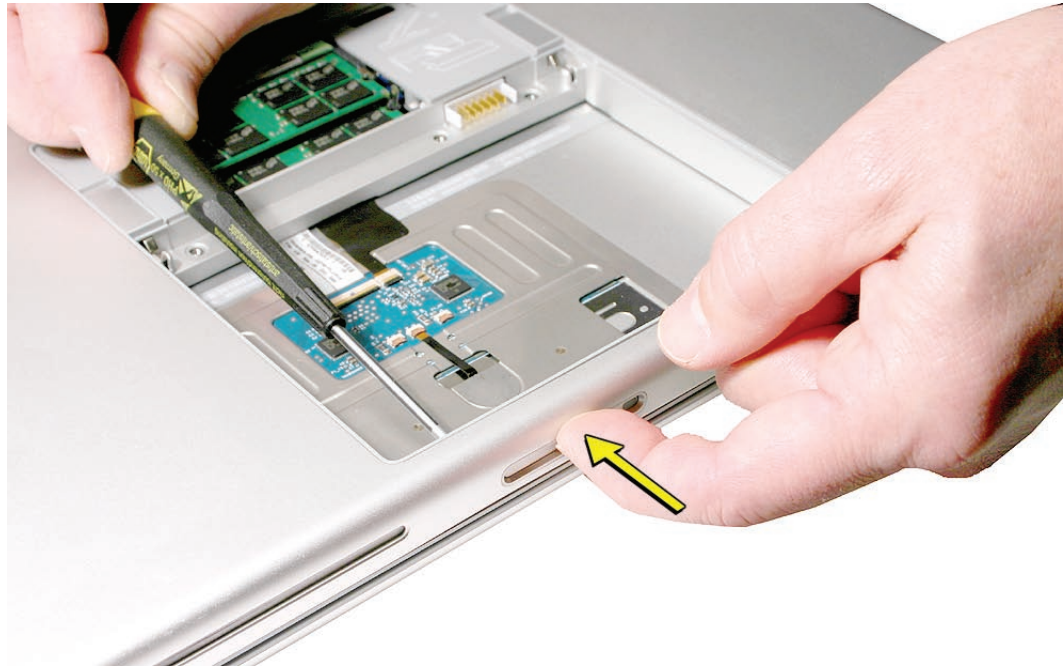
18. Install the two screws along the back.



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19. Install the two screws in the battery bay.

**Important:** For the screw shown, push in the display latch button while installing the screw.



20. Install the memory door and replace the battery.

21. Testing the computer should include:

- Powering on, checking the keyboard and trackpad function.
- Operate the computer in a darkened room to check for keyboard backlight function.



# Keyboard

## Tools

This procedure requires the following tools:

- #0 Phillips screwdriver (magnetized)
- Black stick (nylon probe 922-5065) (or other non-conductive nylon or plastic flat-blade tool)

## Preliminary Steps

Before you begin, remove the following:

- [Battery](#)
- [Top Case](#)

## Part Location

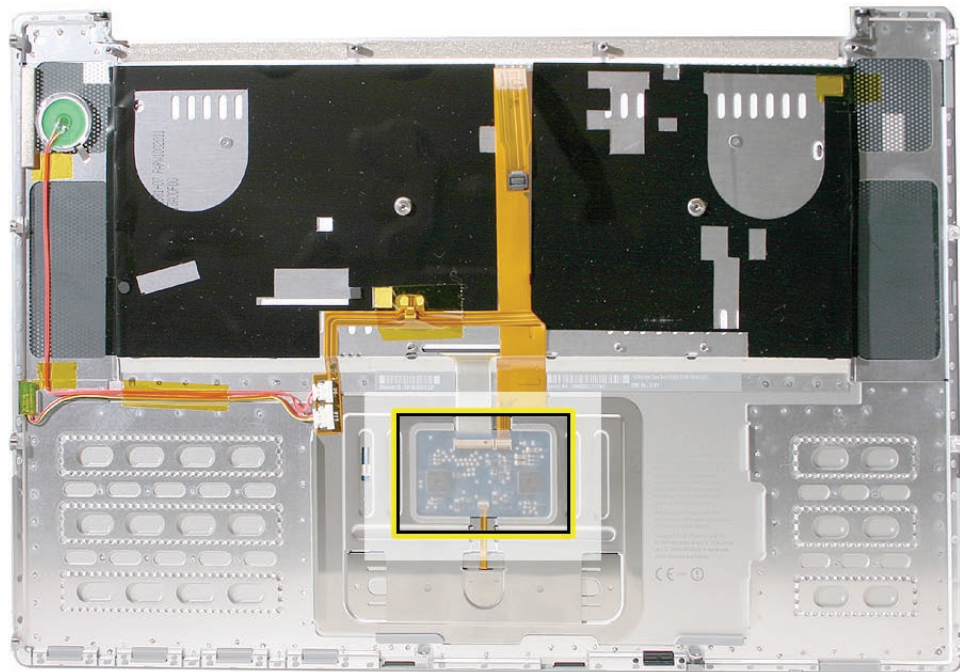


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## Procedure

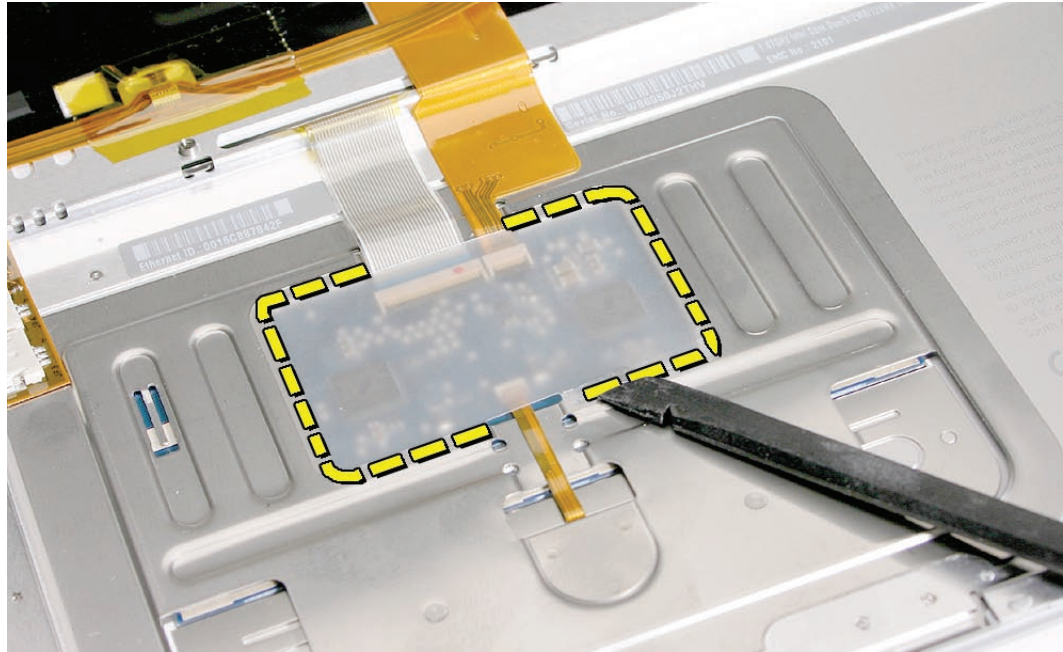
### Important Notes:

- The MacBook Pro keyboards are not interchangeable with previous models. Verify that the correct replacement keyboard is ordered, and/or top case if replacing.
  - The keyboard comes as a multi-layered assembly, and includes backlighting. Do not disassemble the keyboard assembly. Dust, fingerprints, or misalignment, can cause improper function and damage.
1. On a clean flat surface, turn the top case upside down.
  2. Locate the protective cover over flex cable connectors.

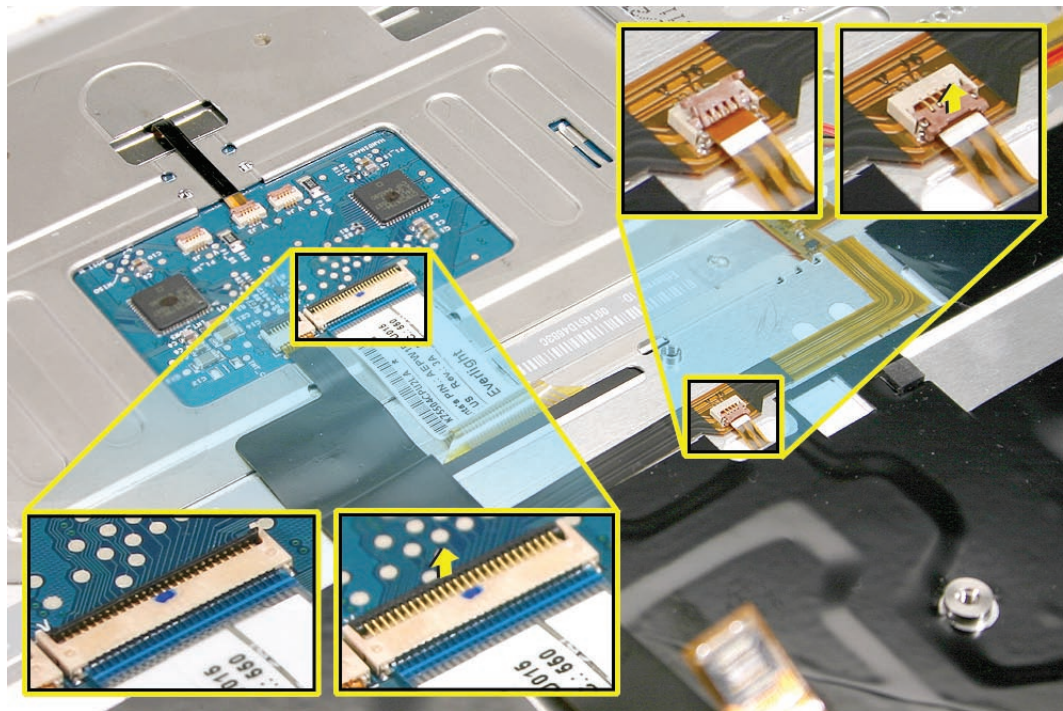




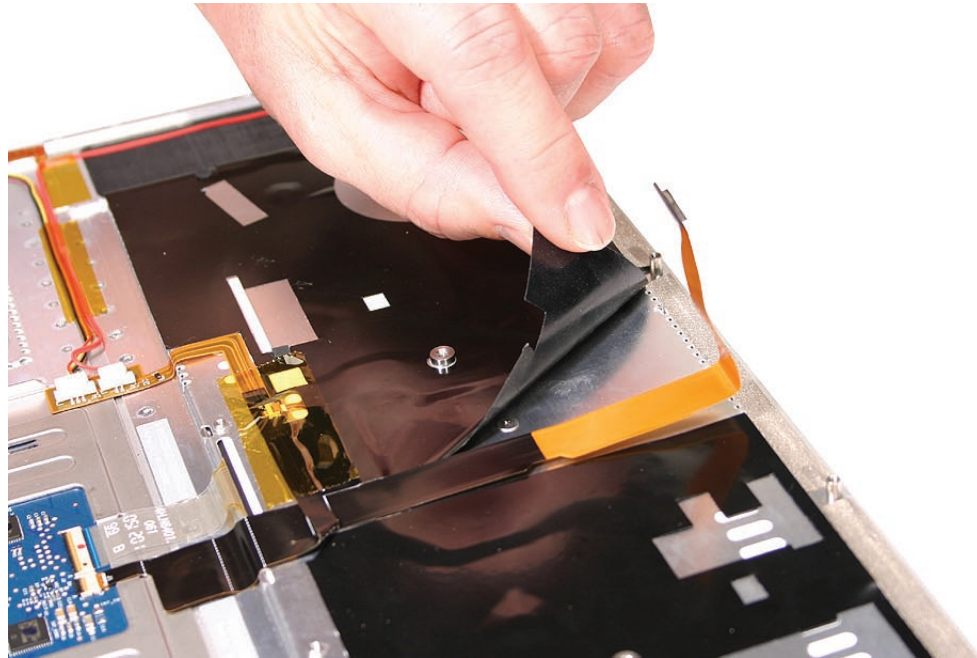
3. Carefully slide a black stick around the perimeter of the cover to release the adhesive.
4. Lift off the cover and set aside for reassembly. **Important:** Keep the cover and any residual adhesive on the top case clean.



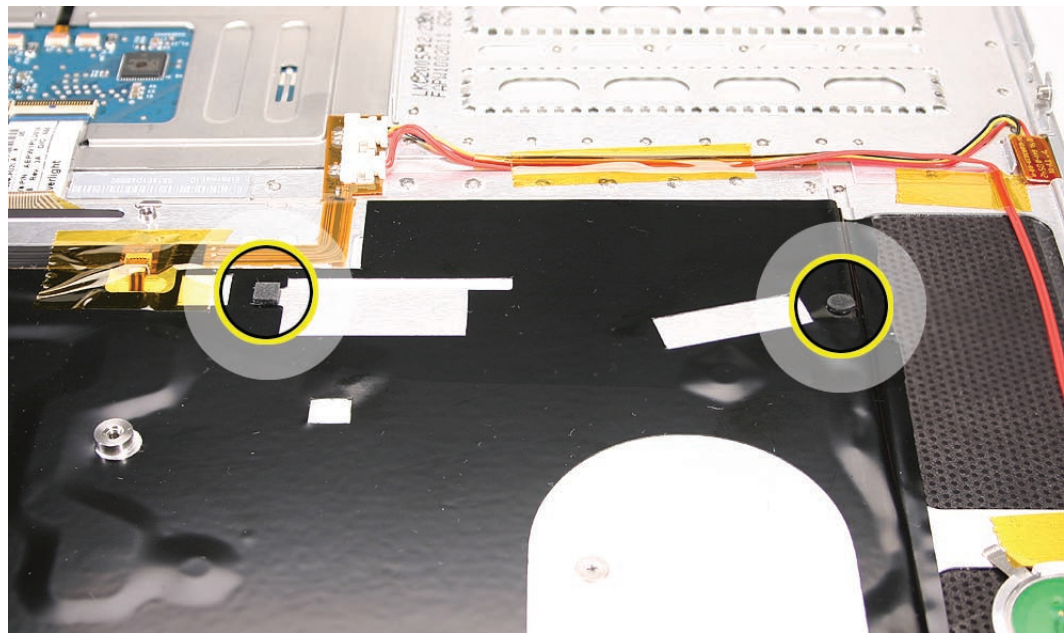
5. Rotate the top case and locate the two keyboard flex connectors shown below. Remove any Kapton tape, then very carefully lift the latches of the connectors to release the cables. **Important:** The connectors are delicate. If damaged, the top case must be replaced.



- Note the positioning, then carefully peel off the insulator film covering the back of the keyboard well. Reserve the film and keep it clean for reinstallation.  
**Important:** Use care at notches and narrow parts to avoid ripping the film.

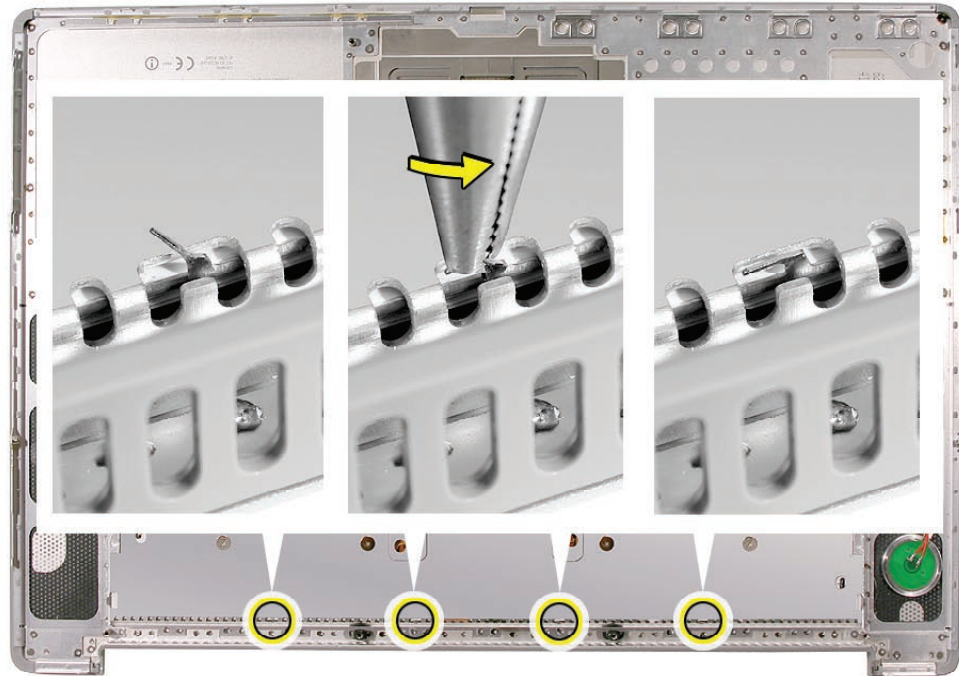


**Important:** Do not remove the rubber pads if not replacing the top case. If replacing the top case, transfer these to the same locations.

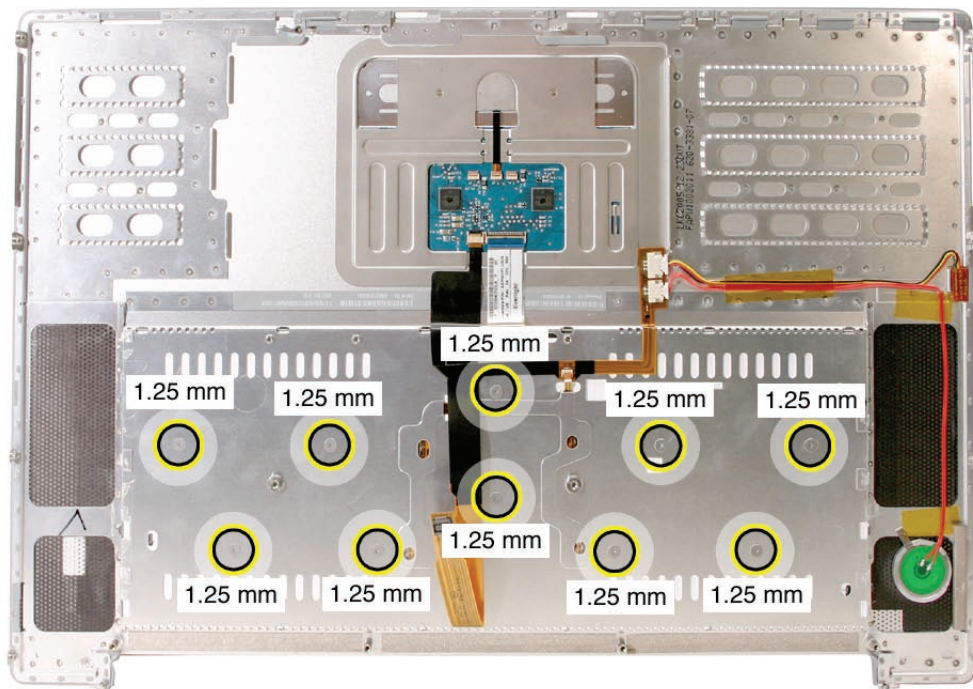




7. Use needlenose pliers to straighten the four bend-tabs located along the bottom edge, as shown. These tabs lock down and stiffen the top edge of the keyboard. **Important:** The bend-tabs are delicate. Bend them carefully to avoid damage. Avoid over-bending.

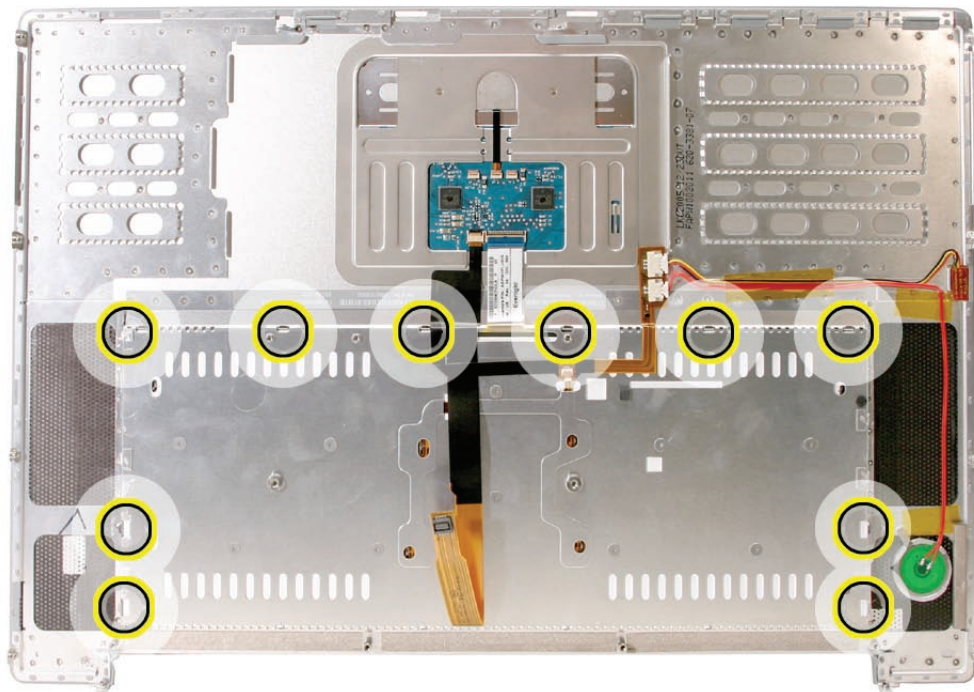


8. Remove the ten keyboard screws.





9. Note the six insert-tabs along the middle edge, and two on each side. The following procedures release these tabs so that the keyboard can be removed.



10. To prevent the keyboard from falling out, support it with your hand, and raise the top case up vertically. **Note:** The keyboard does not have adhesive under it, as in previous models.



- 
11. If needed, push through one of the top center keyboard screw holes, with the point of a black stick, to bow out the keyboard slightly.

**Important:** Ensure that the hole used is a screw hole, or damage to other sensitive components may result. A black stick is used to avoid damaging the screw boss threads—do not use a metal tool.



12. **Important:** During this procedure, do not allow the tabs or metal edge of the keyboard to scrape along the cosmetic surface of the top case, or damage can result.

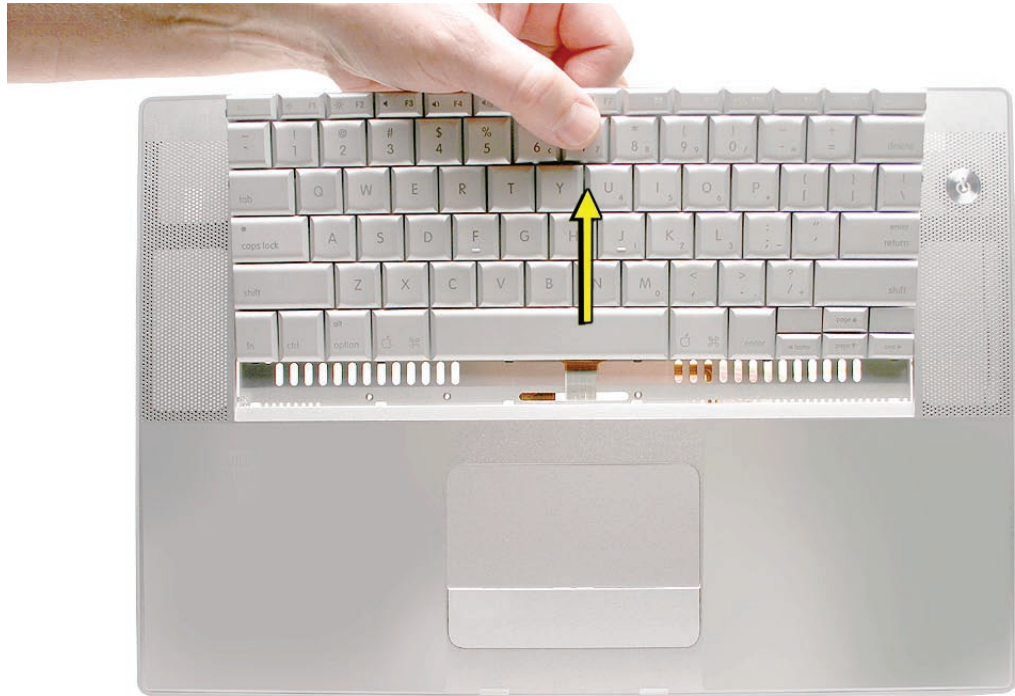


13. Use your finger to hold the bowed out keyboard. Continue to bow it out only enough for the tabs on one side of the keyboard to release cleanly. Repeat for the other side.  
**Important:** Do not bow the keyboard too much, or it may become permanently bent.





- 
14. Lift the keyboard up to release the tabs along the bottom edge and carefully thread out the flex cables.



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## Replacement Procedure

When replacing the keyboard, here are some key points to ensure:

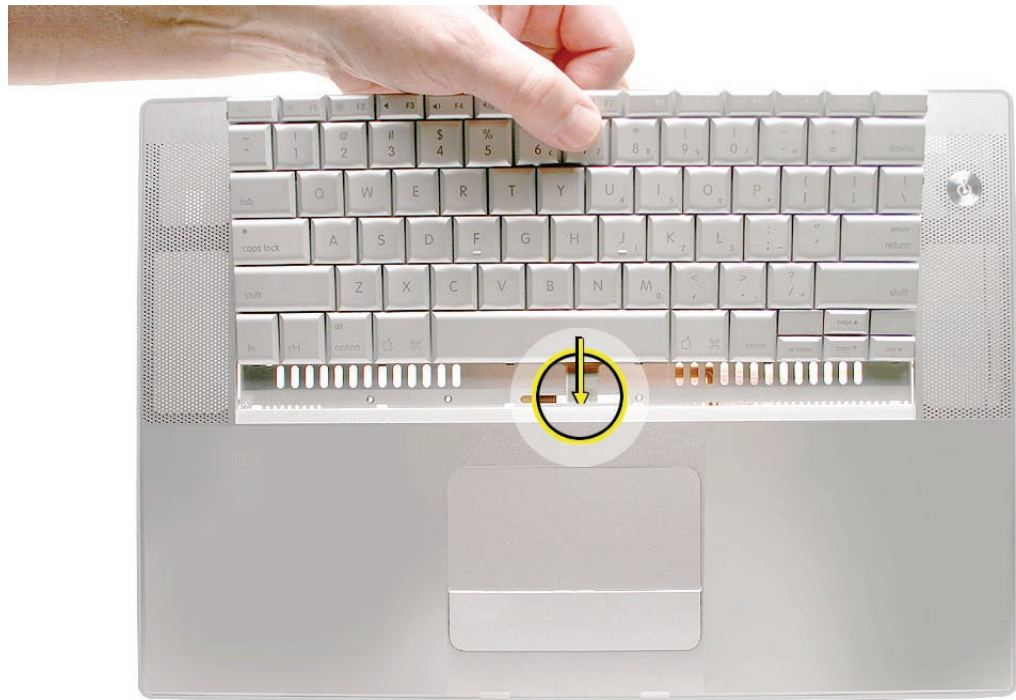
- Prevention of scratches to the cosmetics of the top case
- All tabs are properly seated
- Keyboard lays flat
- Cables not caught
- Bend-tabs are not damaged
- Screw holes align
- Cable connectors are not damaged and cables are secure
- Kapton tape is applied as before
- Insulator film is correctly installed

1. Before replacing or installing a replacement keyboard, verify that the four bend-tabs along the bottom edge of the keyboard, are straight and parallel with the bottom edge (two are shown close-up, below).

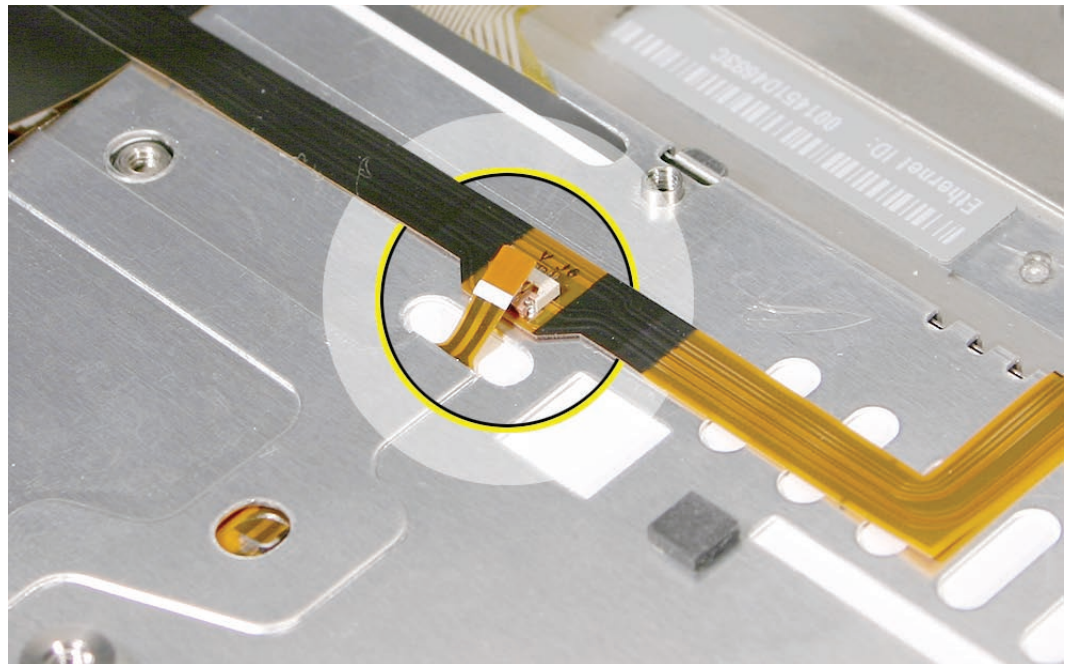
**Important:** Do not bend any other bend-tabs on the keyboard other than the four along the bottom. Other tabs hold the keyboard assembly together.



2. Guide the keyboard's flex cables through the slot in the top case, as shown. Make sure that they do not catch or bend behind the keyboard.



3. Verify that the small cable routes through the slot, as shown.



4. Lower the keyboard and seat all six tabs along the bottom, so that the keyboard sits flat and straight.



**Important:** During the next steps, do not allow the tabs or metal edge of the keyboard to scrape along the cosmetic surface of the top case, or damage can result.

5. While ensuring that the keyboard bottom stays straight and secure, hold the top of the keyboard in the middle, then with your other hand, bow in one side of the keyboard to engage the two tabs at the top into the top case.

**Important:** Do not bow the keyboard too much, or it may become permanently bent.



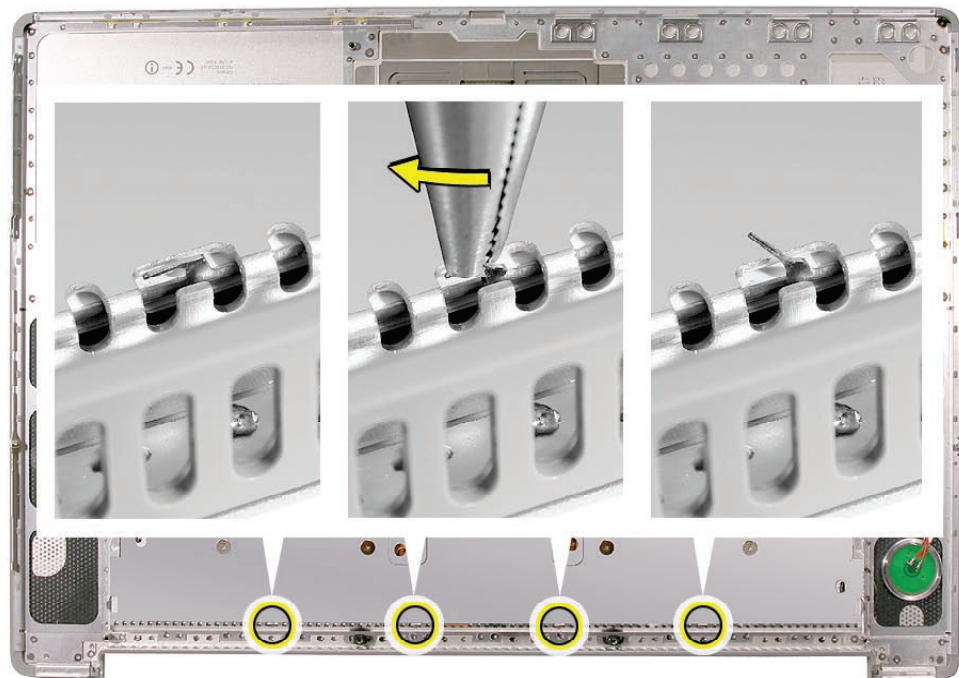


- 
6. Use the heel of your hand to hold in place the edge of the keyboard that was just inserted while holding the top of the keyboard with a finger on that hand, then use your other hand to help bow in the remaining side of the keyboard until it can be engaged.

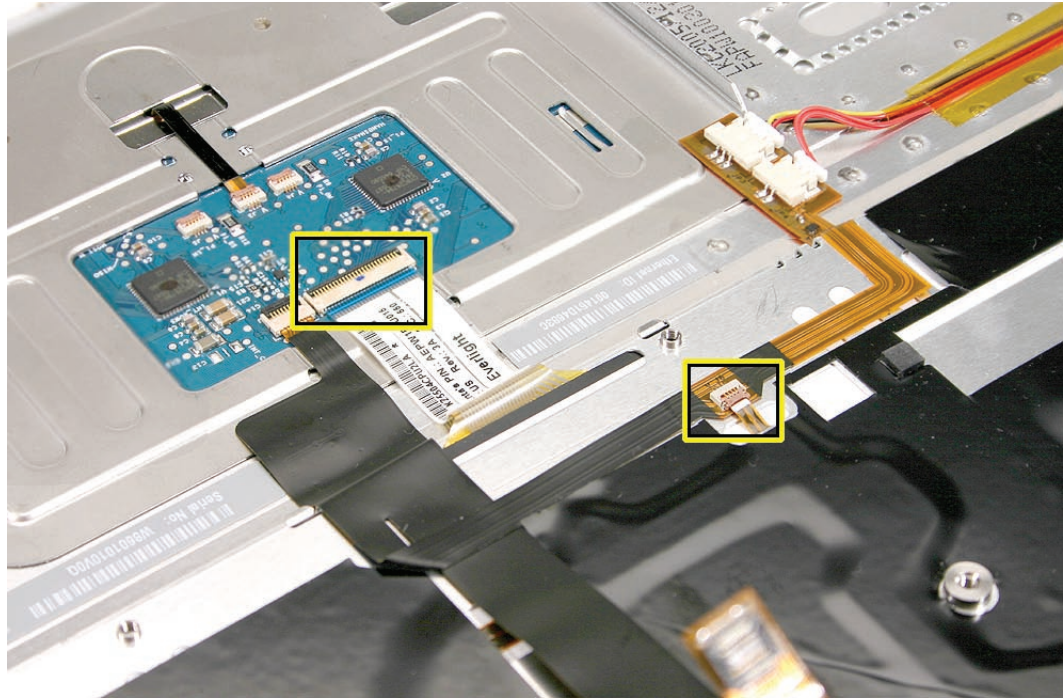




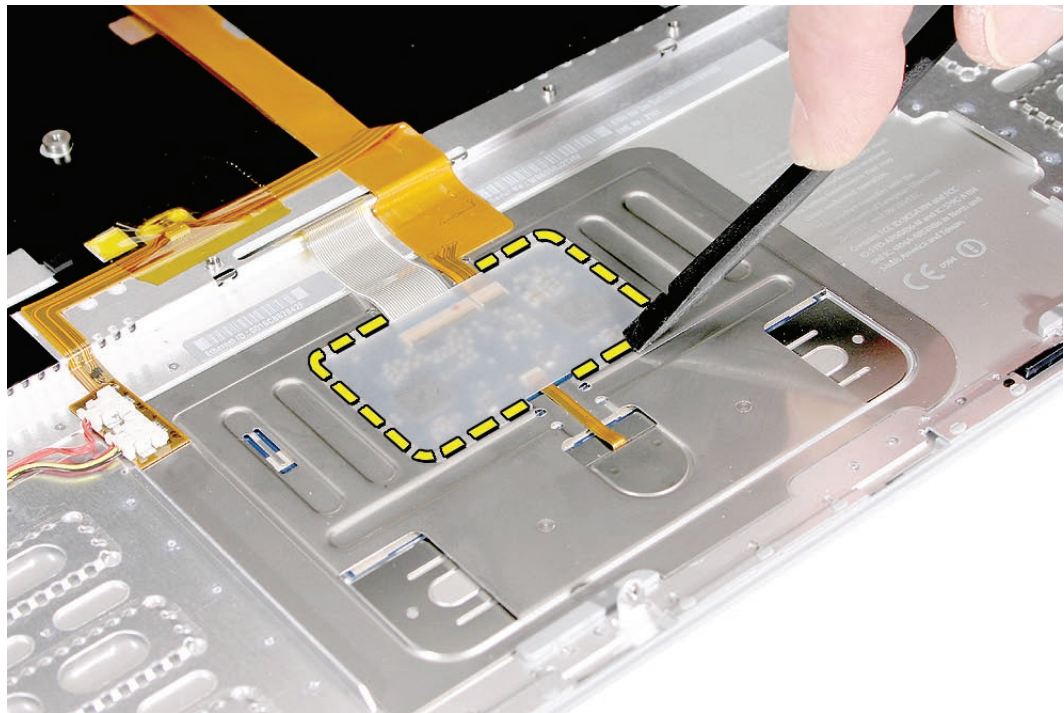
7. While supporting the keyboard in the top case, verify that the keyboard lays flat and that all the tabs have seated properly.  
**Note:** The keyboard will not sit flat if any of the tabs have not seated properly. If the side tabs are not seating or are binding, check the bottom edge of the keyboard to verify that all the tabs are seated and the bottom of the keyboard is straight.
8. Verify that the bend-tabs are not caught.
9. Lay the top case flat, and upside down.
10. Pull on the flex cables to verify that they are not bent or caught under the keyboard, and that they extend to their connectors.
11. Verify that the screw holes align with the screw bosses and install all ten keyboard screws, starting from the middle and work out.
12. Bend the four bend-tabs over the metal of the bottom case to secure the bottom edge of the keyboard.  
**Important:** The bend-tabs are delicate. Bend them carefully to avoid damage and no more than 90-degrees, or to, or within, any etch marks, if present. Avoid over bending.



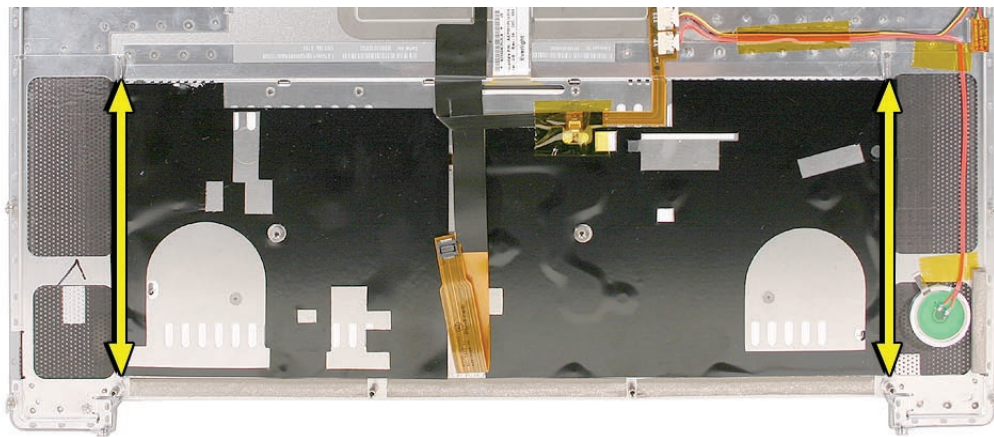
13. Insert the two flex cables into their connectors and secure. Verify that the cables are fully inserted and secured straight. Kapton tape will be applied to the small connector, later.



14. Reinstall the protective cover over the area shown. Line up the edges carefully with the residual adhesive, then carefully burnish down the edges to secure. (top case shown rotated)



15. Replace the insulator film in the same locations as they were removed. Ensure the holes in the film match up correctly with the screw bosses. Avoid wrinkles and bulges. If installing a replacement top case, use the new film if supplied.  
**Important:** The film must be installed in the same location to protect against contact and electrical shorting in certain areas and to allow contact with the EMI spring on the logic board.
16. Install Kapton tape to secure the small flex cable connector.
17. Verify that the rubber pads (mentioned earlier) are installed in the correct locations.
18. If the film extends over the edge of the keyboard well, run your finger along the edges to secure it to the top case.  
**Note:** Picture for illustration only. The insulator film may be different.



19. Reassemble the computer.
20. Testing the computer should include powering on, checking the keyboard and trackpad function.  
Operate the computer in a darkened room to check for keyboard backlight function, and light leakage around the perimeter of the keyboard, speaker grill openings and side ports.





# AirPort Extreme Card

## Tools

This procedure requires the following tools:

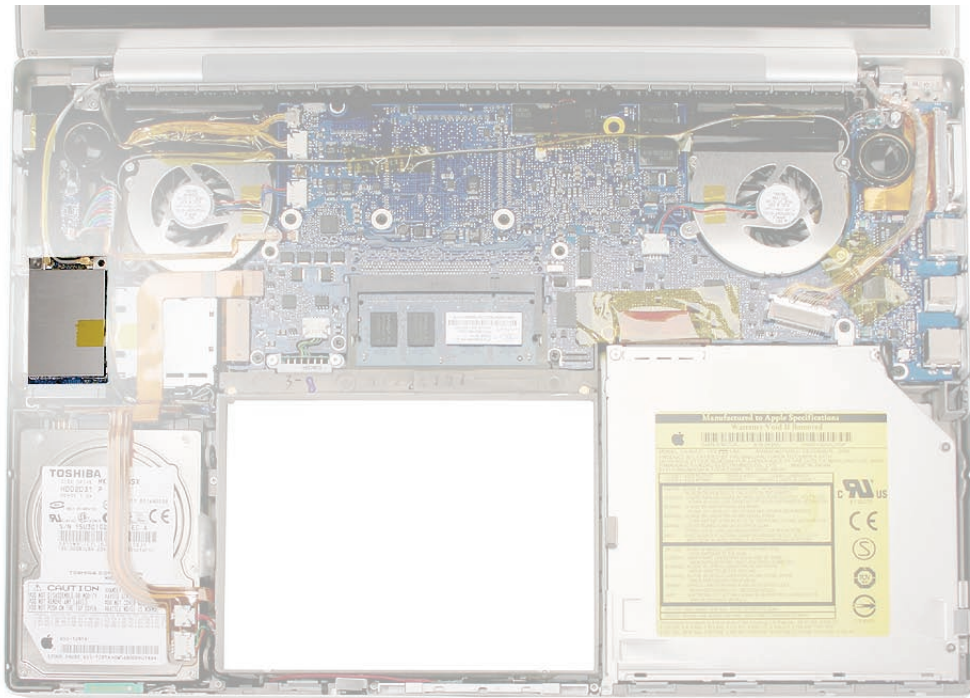
- #0 Phillips screwdriver (magnetized)
- Black stick (nylon probe 922-5065) (or other non-conductive nylon or plastic flat-blade tool)
- Kapton tape (922-1731 (0.5-inch x 12-yard roll))

## Preliminary Steps

Before you begin, remove the following:

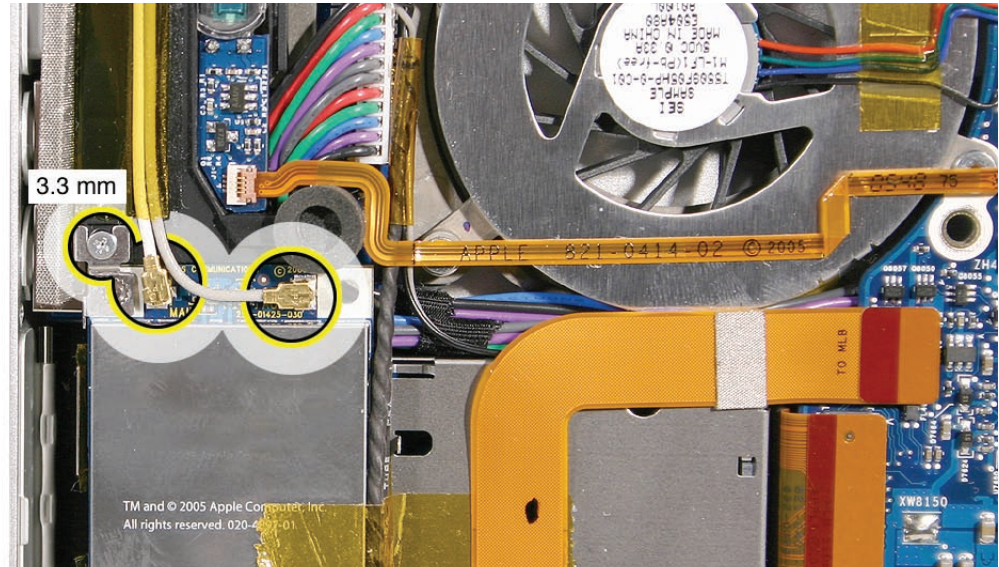
- [Battery](#)
- [Top Case](#)

## Part Location

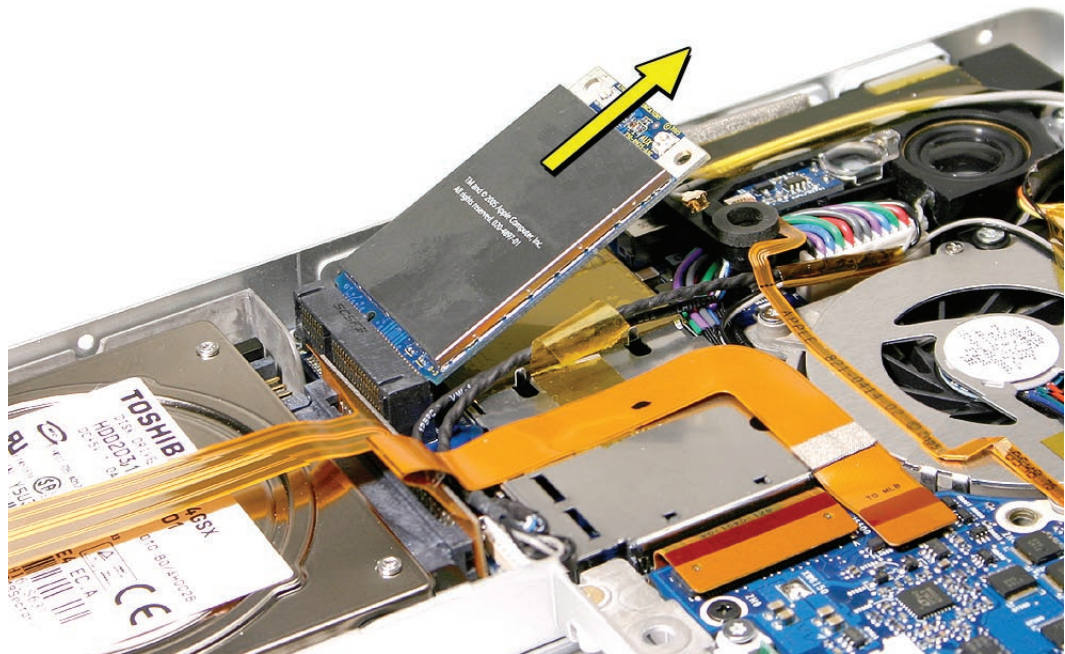


## Procedure

1. Remove two antenna connectors. Lift straight up.
2. Remove one screw and bracket. The card should rise up slightly.



3. Pull the card straight out.





- 
4. When installing the replacement card verify that the cables along side rest in the channel and do not get caught underneath.
  5. Verify that the antenna cables route flat in the channel on the left speaker and are secured with Kapton tape.
  6. Verify that the ambient light sensor flex cable is connected properly.
  7. Reassemble the computer.
  8. Testing should include AirPort function.



# Bluetooth Card

## Tools

This procedure requires the following tools:

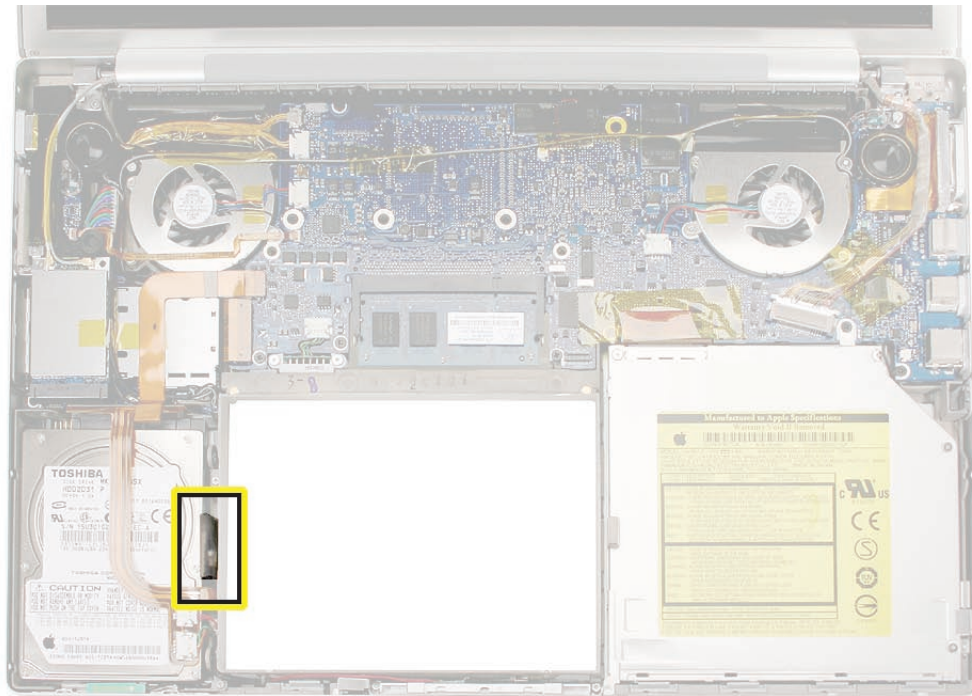
- Black stick (nylon probe 922-5065) (or other non-conductive nylon or plastic flat-blade tool)
- Razor knife
- Kapton tape (922-1731 (0.5-inch x 12-yard roll))

## Preliminary Steps

Before you begin, remove the following:

- [Battery](#)
- [Top Case](#)

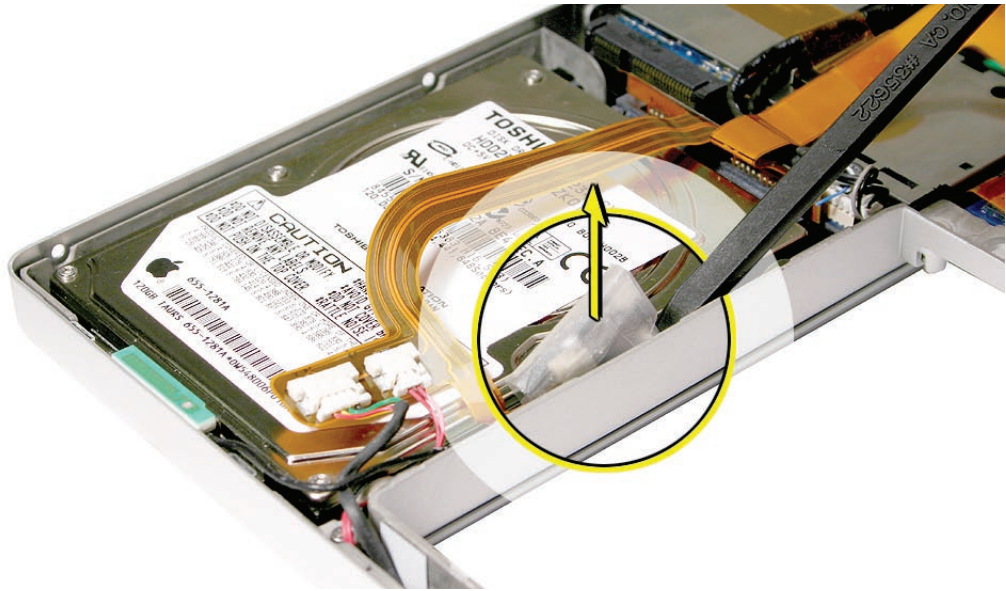
## Part Location



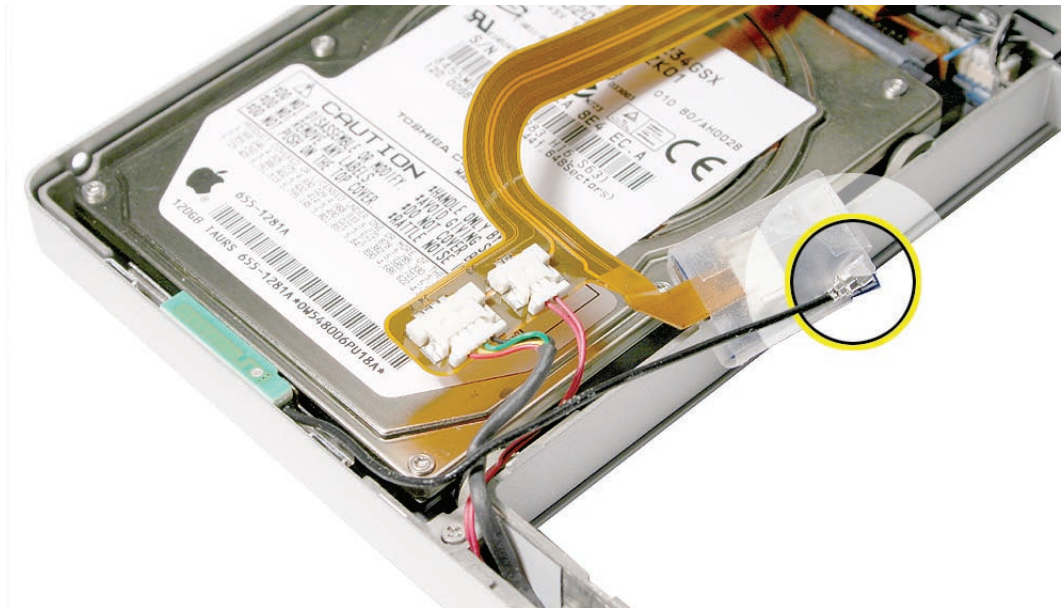
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## Procedure

1. Lift the bluetooth card assembly to access the antenna connector.

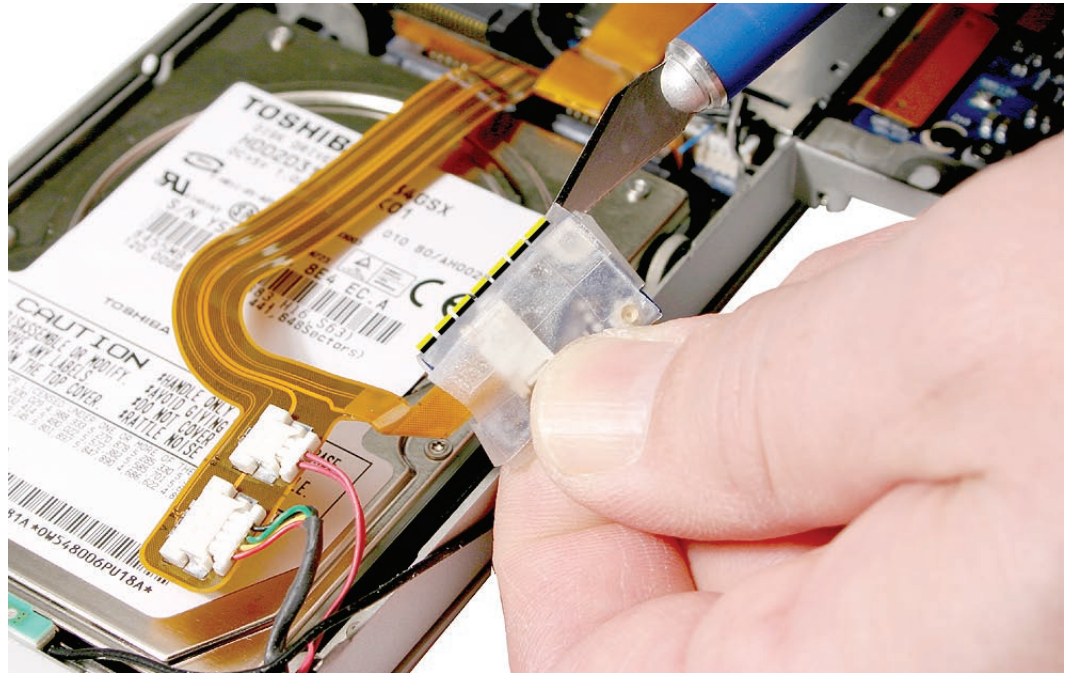


2. Disconnect the antenna cable connector. Pull straight up. If need, cut of the protective cover (as shown below).

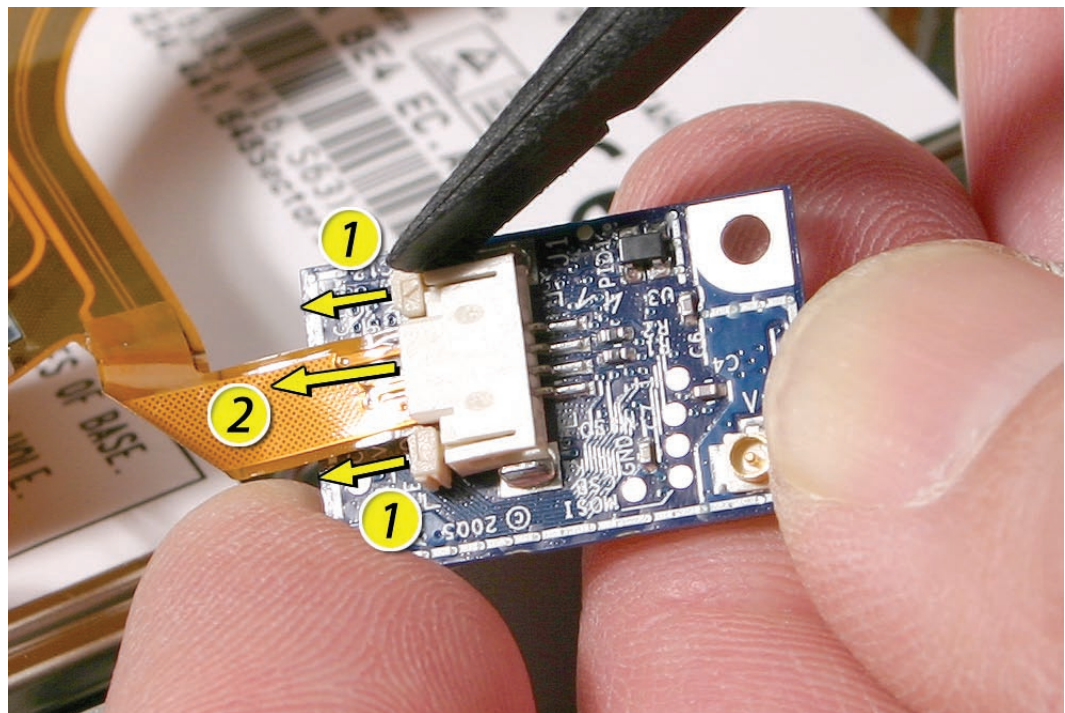




3. To access the flex cable connector, cut off the protective cover.  
**Replacement Note:** Reinstall the cover and secure with Kapton tape before reinstalling the board



4. Disconnect the flex cable as shown.





# Bluetooth Antenna

## Tools

This procedure requires the following tools:

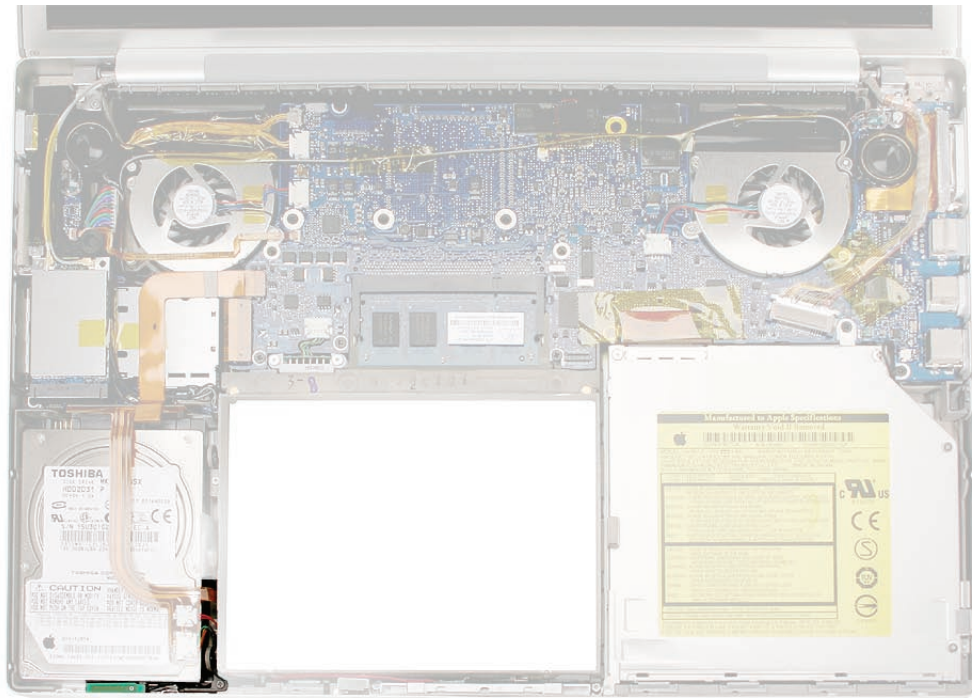
- Black stick (nylon probe 922-5065) (or other non-conductive nylon or plastic flat-blade tool)
- Razor knife
- Kapton tape (922-1731 (0.5-inch x 12-yard roll))

## Preliminary Steps

Before you begin, remove the following:

- [Battery](#)
- [Top Case](#)

## Part Location

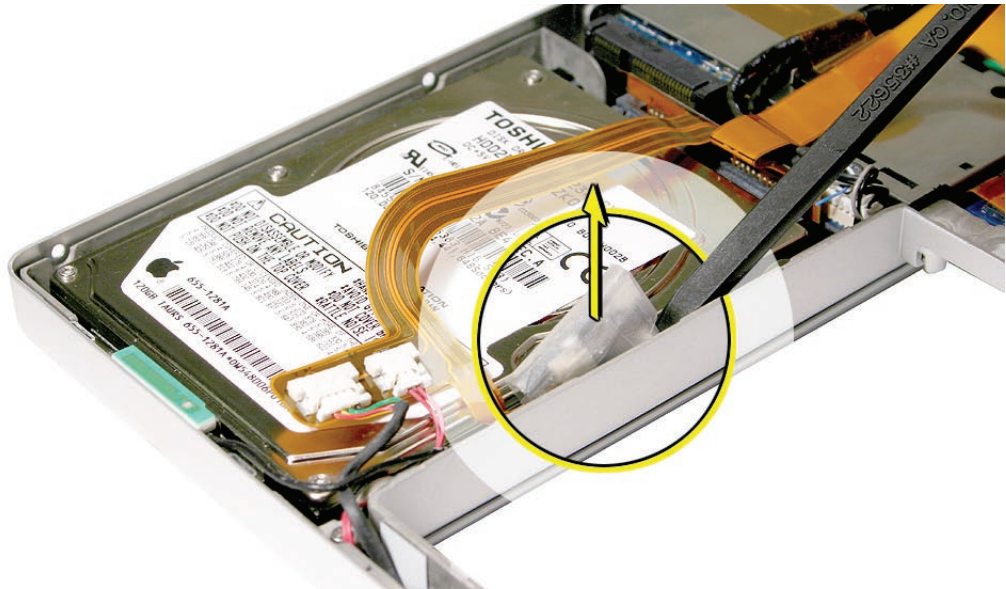




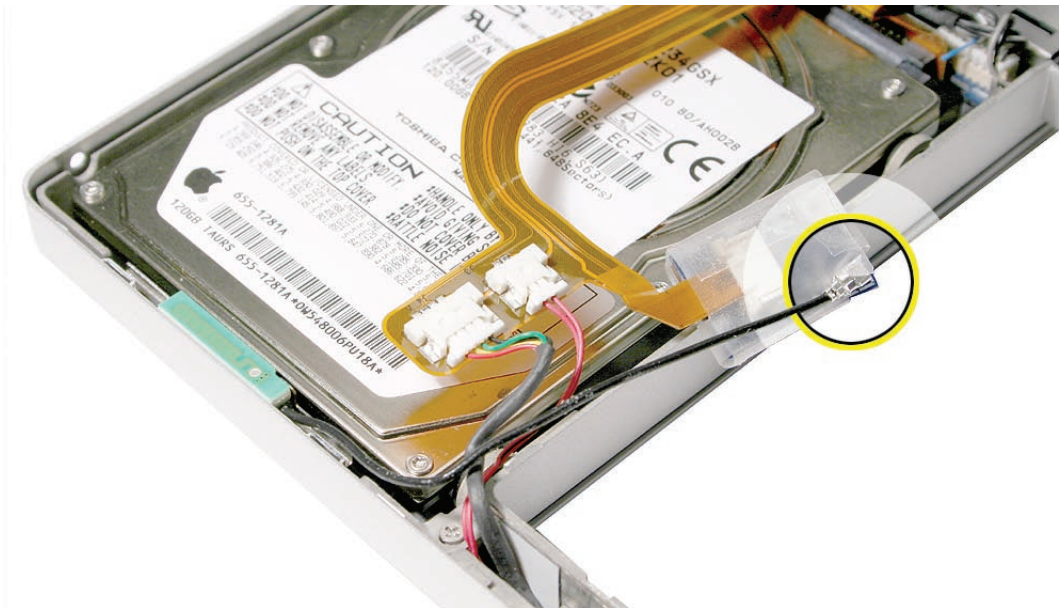
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## Procedure

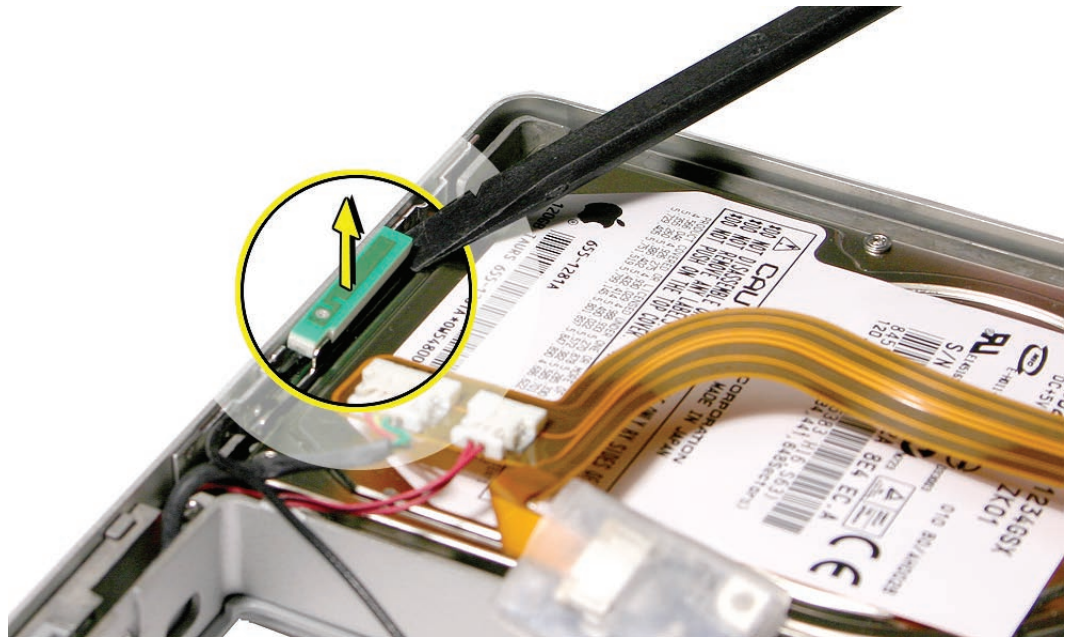
1. Lift the bluetooth card assembly to access the antenna connector.



2. Disconnect the antenna cable connector. Pull straight up. If needed, cut of the protective cover.



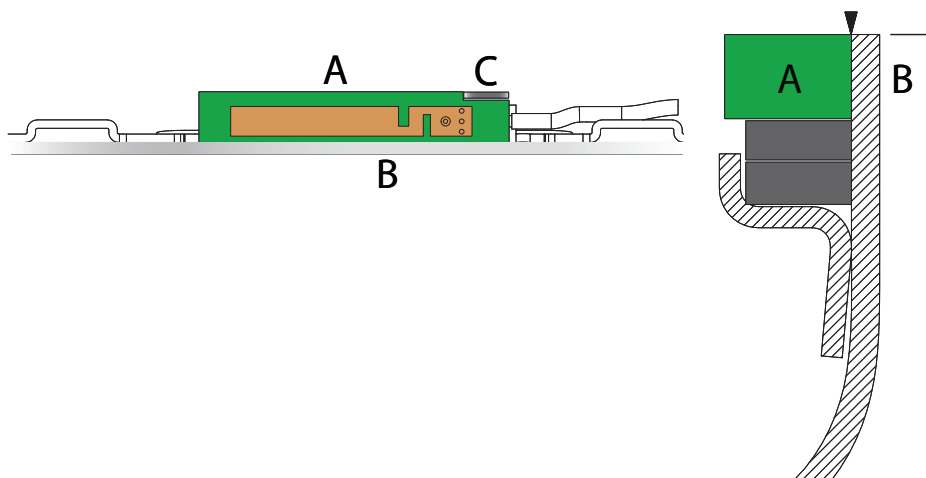
3. To remove the antenna, pry it up to release the adhesive.



## Replacement Procedure

### Notes:

- **Important:** The position of the bluetooth antenna board (A) in the bottom case (B) is critical to its function. Align the notch in the antenna board with the metal tab (C) then install the board flush with the bottom case inside face and level with the bottom case top edge. .



- On the bluetooth board, reinstall its protective cover and secure with Kapton tape before reinstalling.



# Infrared Board

## Tools

This procedure requires the following tools:

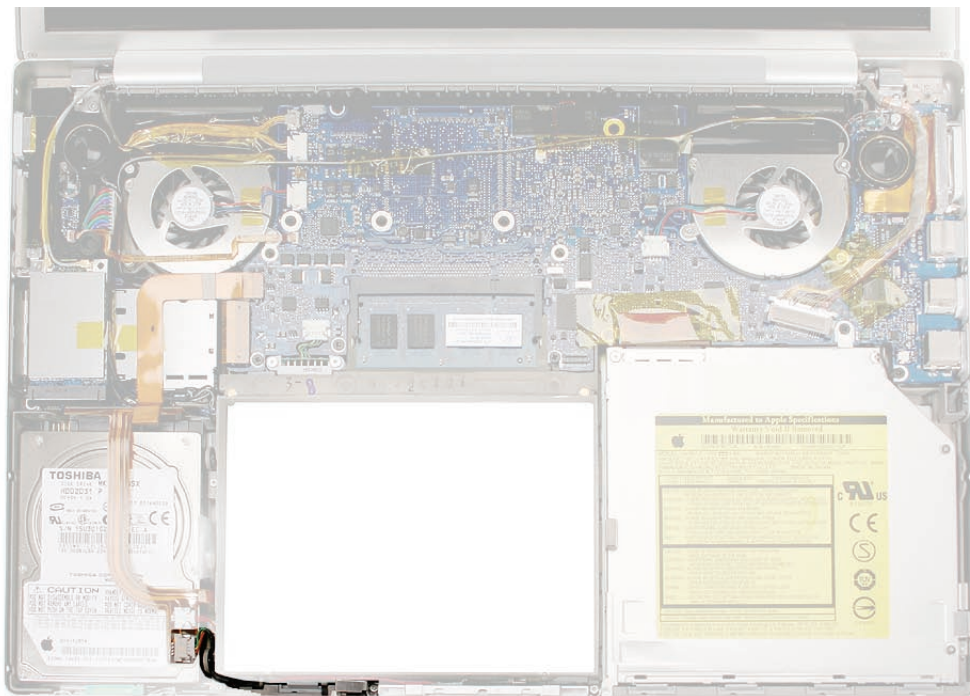
- Torx T6 screwdriver (magnetized)
- Black stick (nylon probe 922-5065) (or other non-conductive nylon or plastic flat-blade tool)

## Preliminary Steps

Before you begin, remove the following:

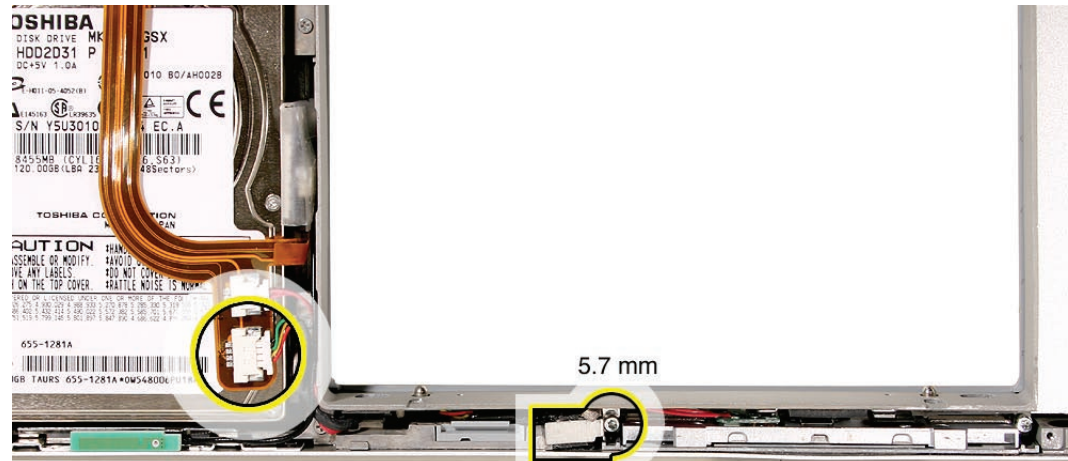
- [Battery](#)
- [Top Case](#)

## Part Location

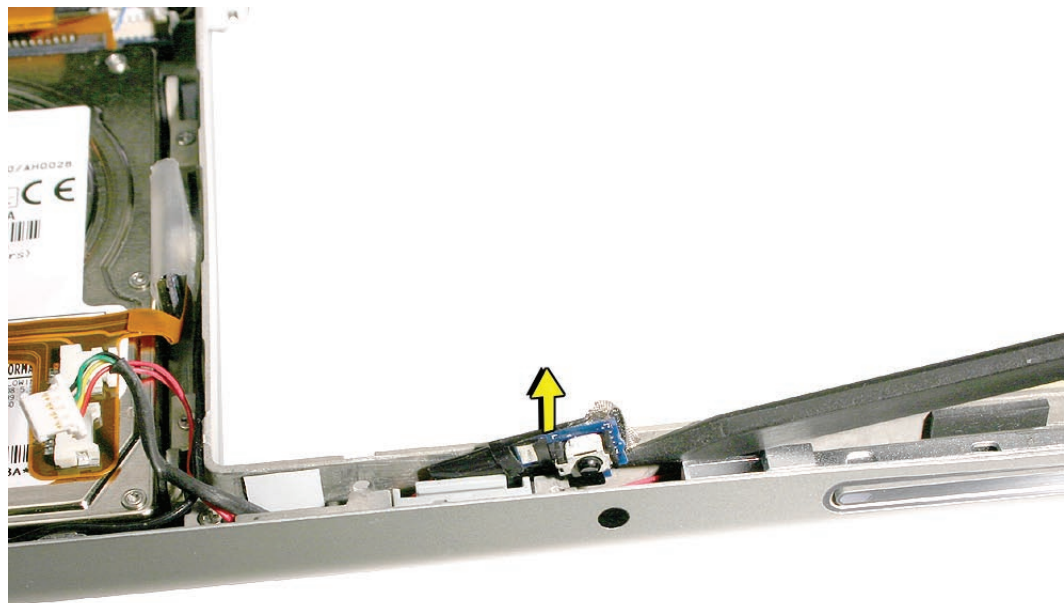


## Procedure

1. Remove the screw and bracket
2. Disconnect the cable.

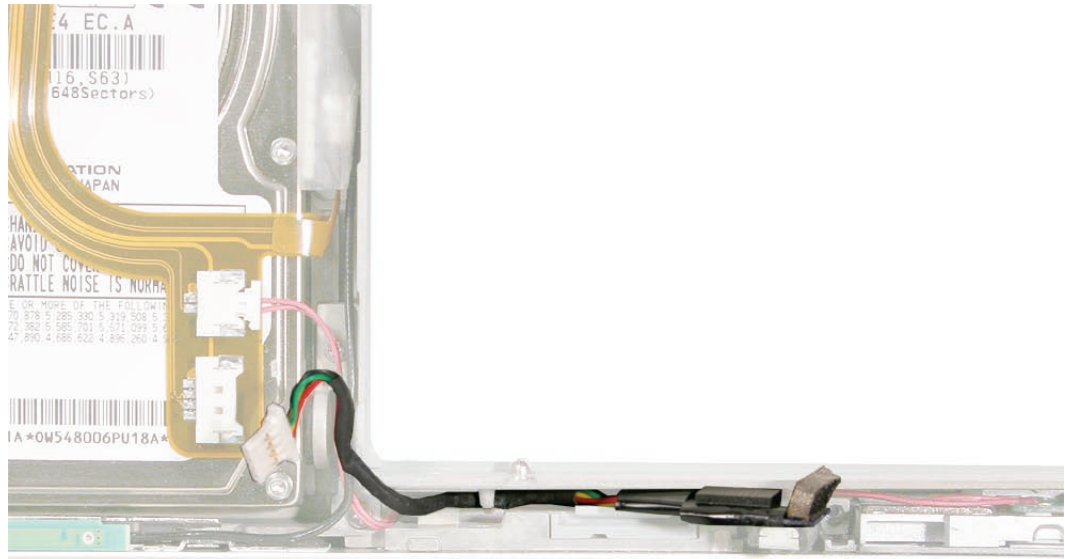


1. Lift out the infrared board. Lifting from both ends may be helpful. **Important:** Lift on the board only. Do NOT lift the infrared lens or sensor piece. It is secured to the main board with two wires and will bend out of alignment.



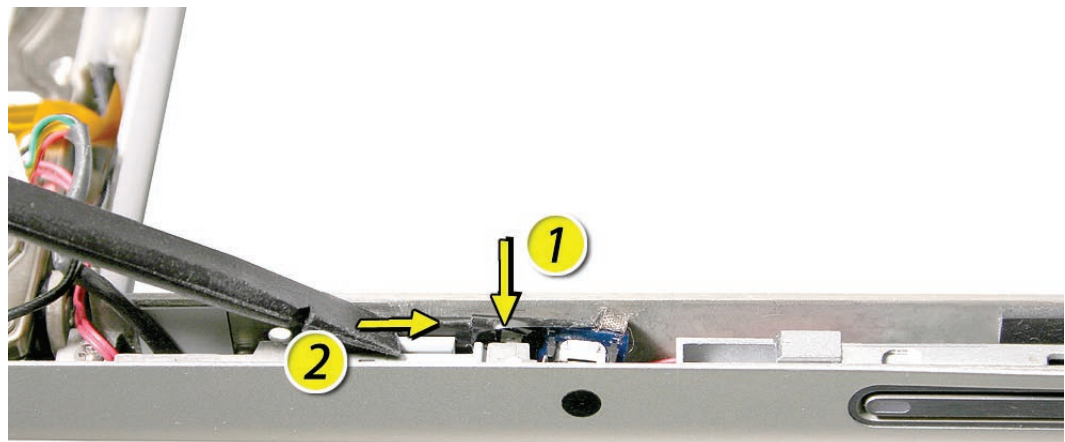


2. Note the cable routing and remove.



## Replacement Procedure

1. Route the cable.
2. To install, insert the board all the way into the channel, then push it forward until it stops and the infrared lens aligns with the window.  
**Important:** Push on the board only. Do NOT push on the infrared lens or sensor piece. It is secured to the main board with two wires and will bend out of alignment.



3. Connect the cable connector.





# Hard Drive

## Tools

This procedure requires the following tools:

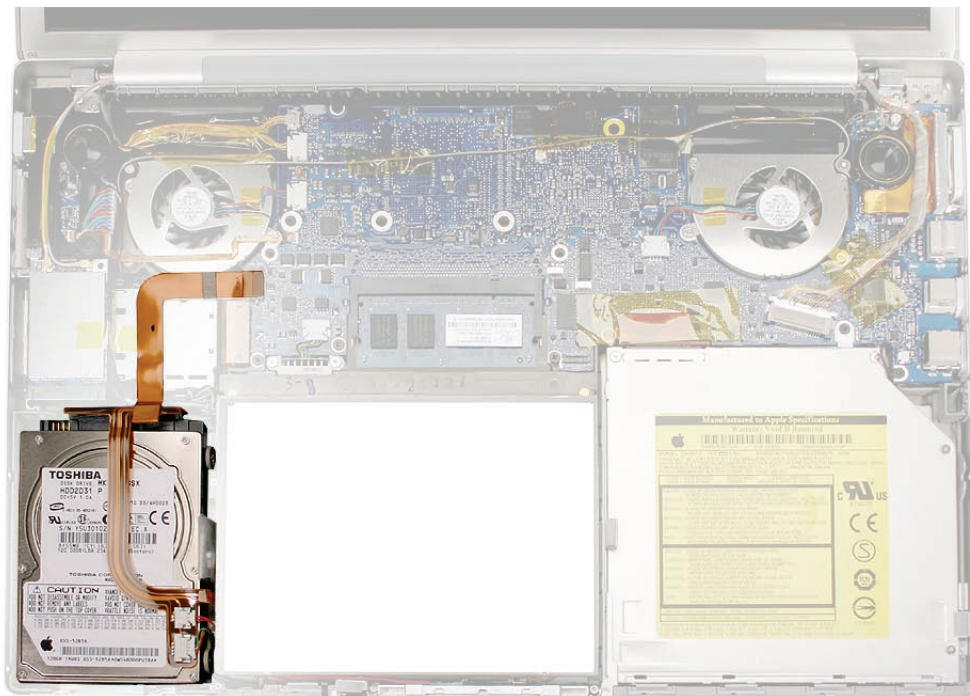
- #0 Phillips screwdriver (magnetized)
- Torx T6 screwdriver (magnetized)
- Black stick (nylon probe 922-5065) (or other non-conductive nylon or plastic flat-blade tool)
- Kapton tape (922-1731 (0.5-inch x 12-yard roll))

## Preliminary Steps

Before you begin, remove the following:

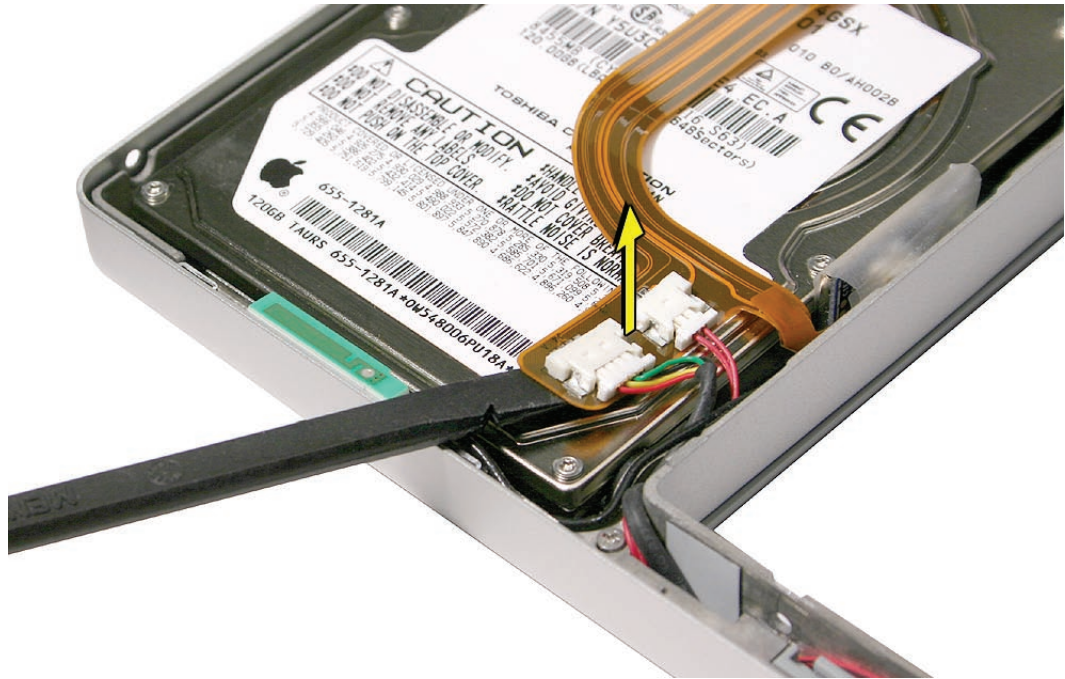
- [Battery](#)
- [Top Case](#)

## Part Location

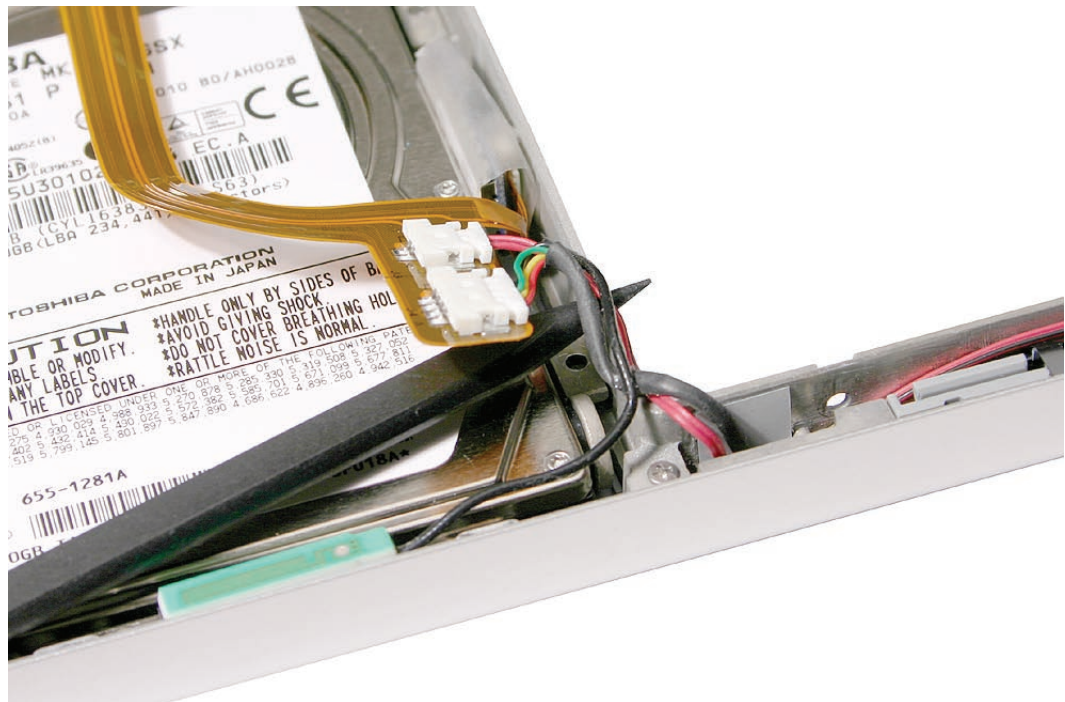


## Procedure

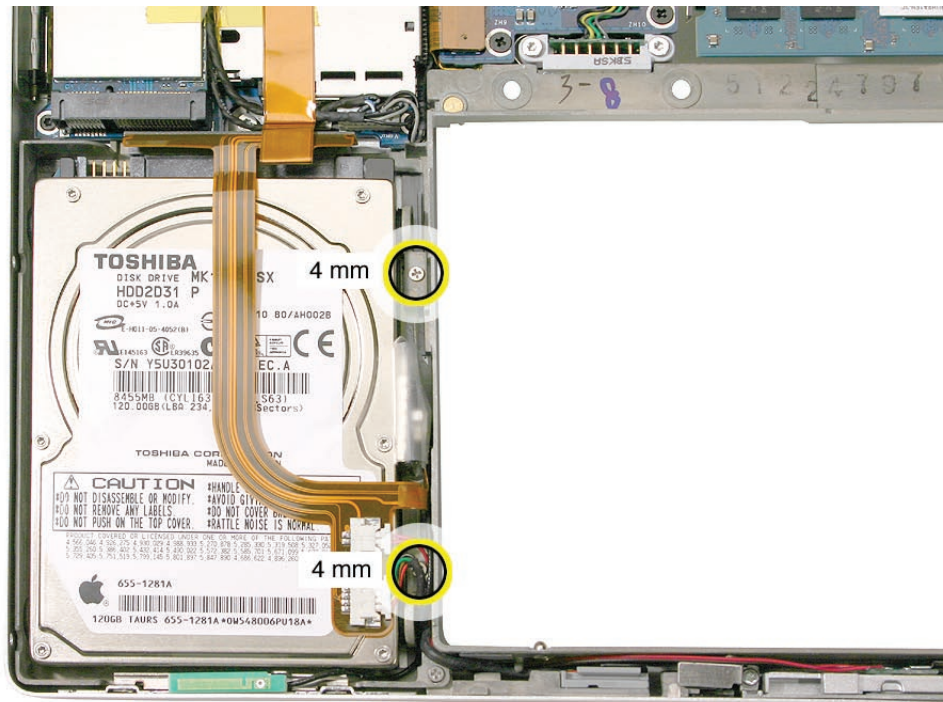
1. Carefully pry up the flex cable from the hard drive.



2. Lift up cabling to gain some clearance.



3. Remove the two screws from the drive holder.

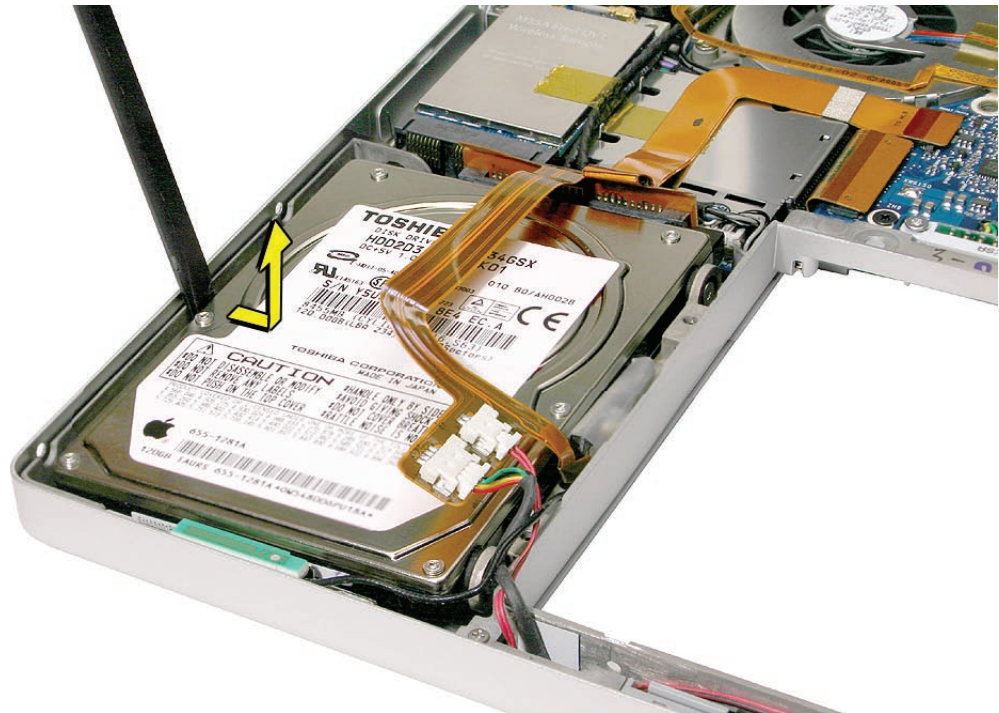


4. Lift the hard drive up slightly to allow it to move right.





5. Push the hard drive away from the left side to clear the rubber grommets, then lift up just enough to access its flex connector.



6. Carefully push off the flex cable connector to disconnect it from the hard drive.



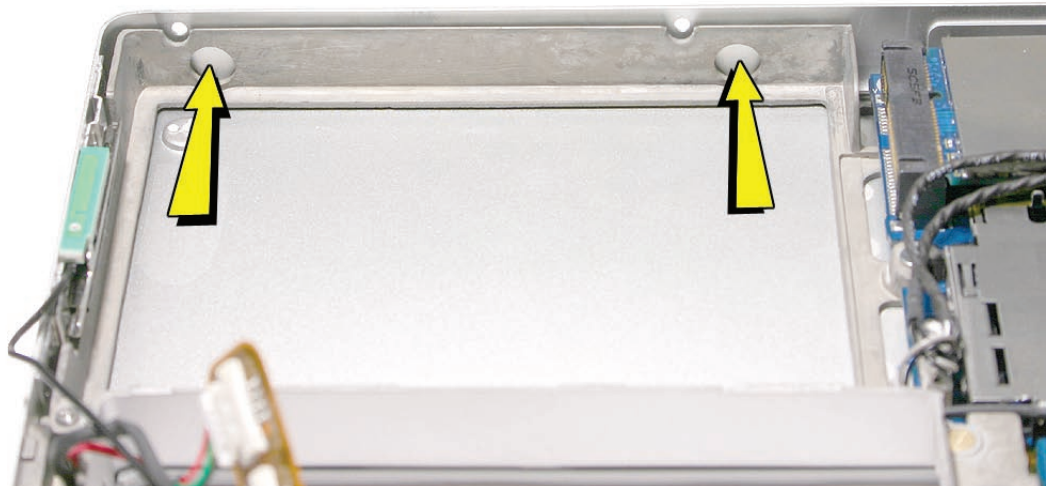


7. Transfer the rubber grommets and screws.

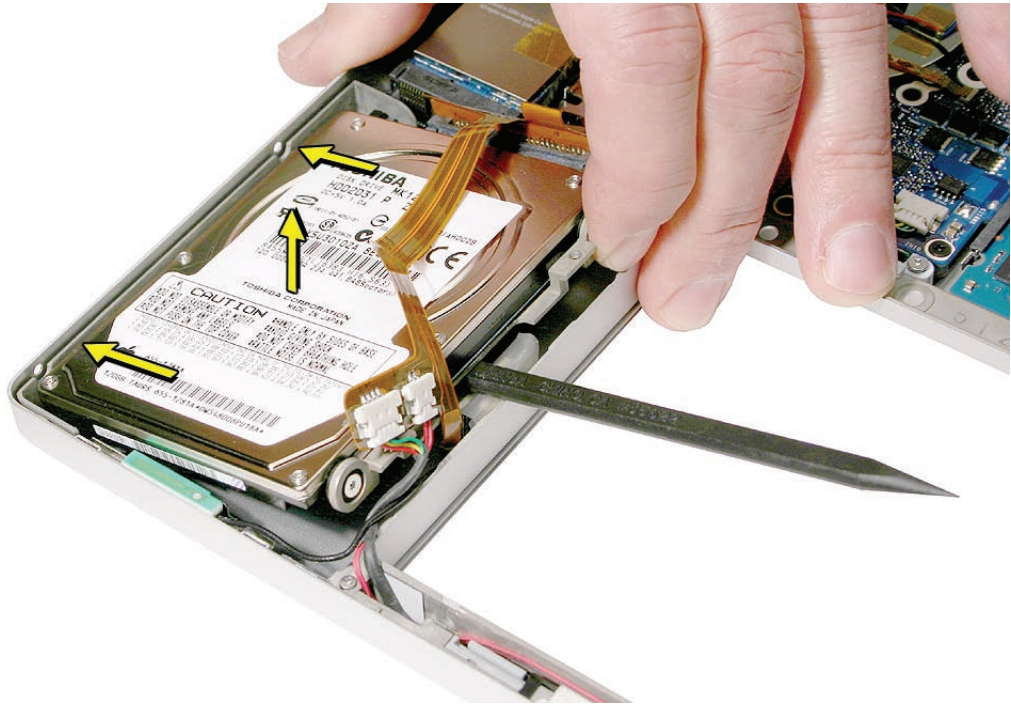


## Replacement Procedure

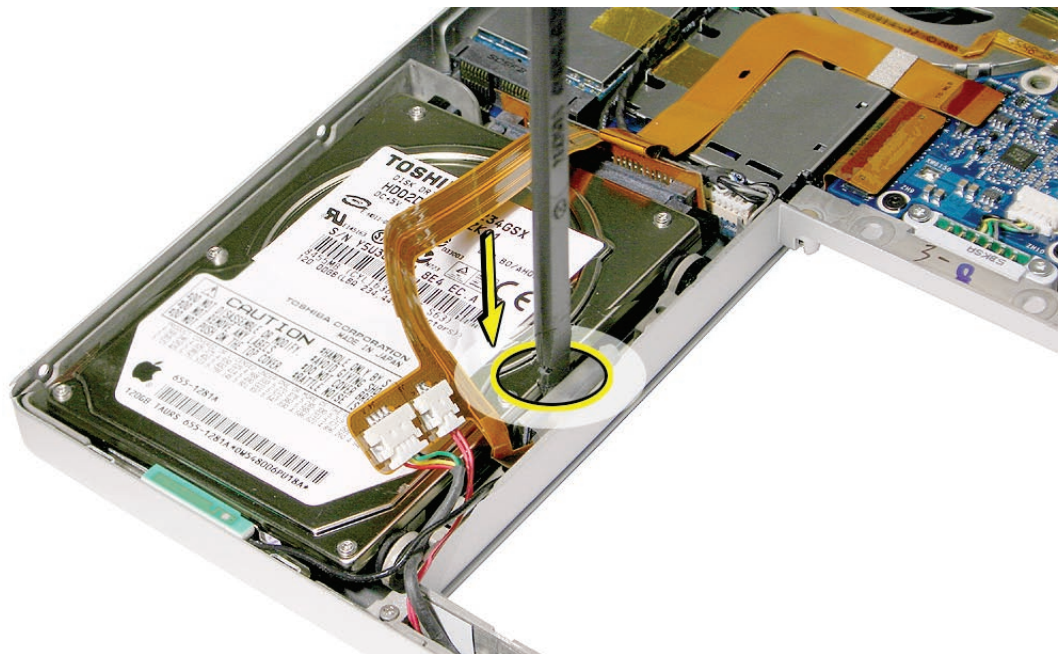
1. Make sure that the rubber grommets fit securely into the frame holes.



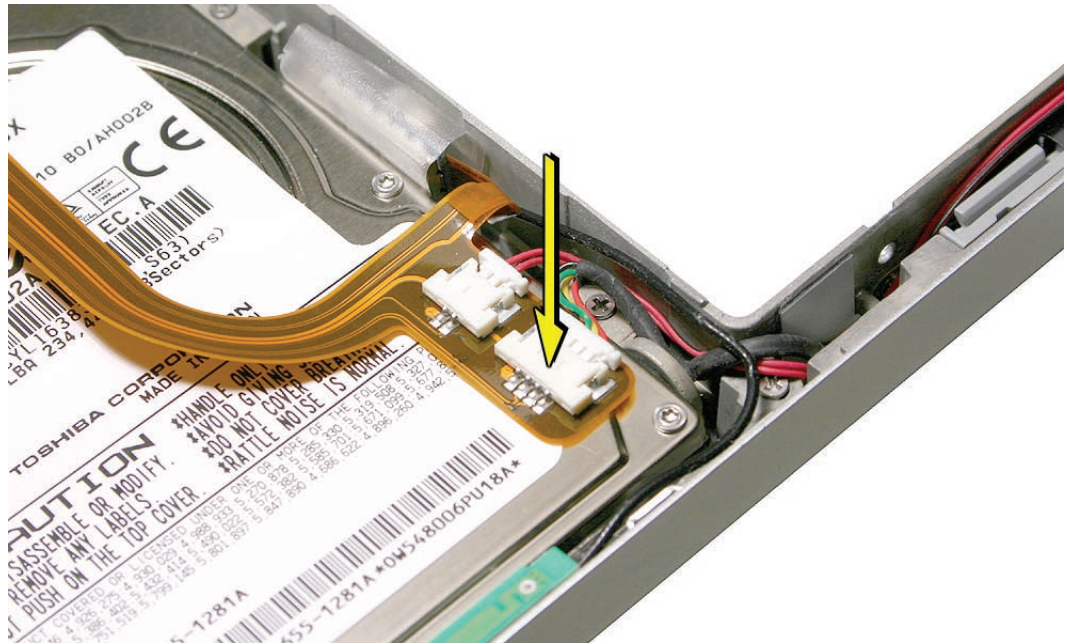
2. Use a black stick to lift the hard drive and guide the rubber grommets securely into the holes in the frame, while holding the bracket in place on the other grommets.



3. Use a black stick to guide the hard drive past the bluetooth card.



4. Press the flex cable to re-adhere it to the hard drive.







# Optical Drive

## Tools

This procedure requires the following tools:

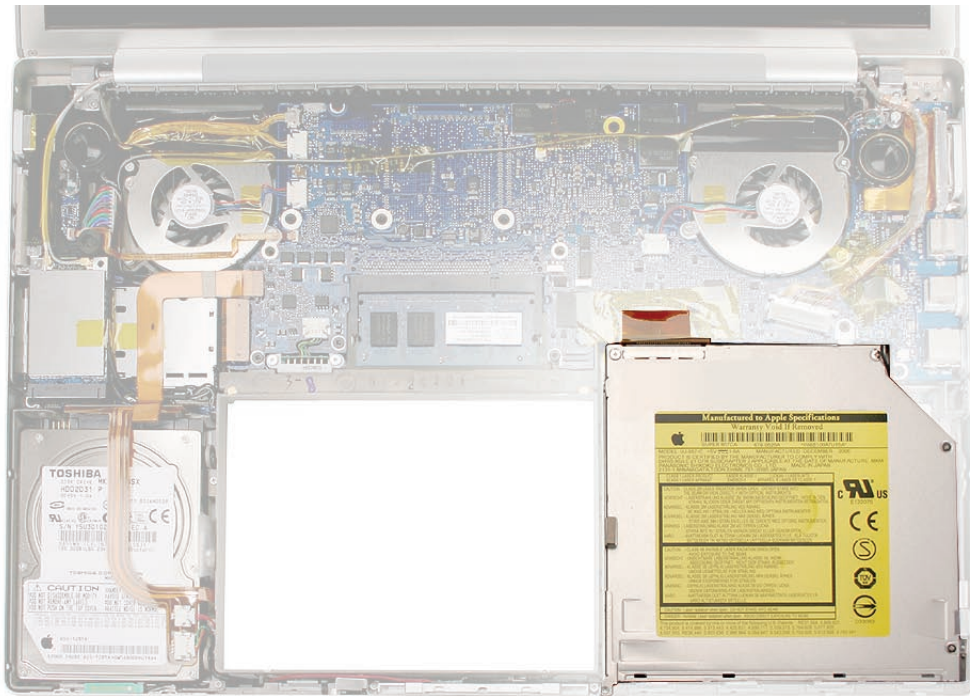
- #0 Phillips screwdriver (magnetized)
- Torx T6 screwdriver (magnetized)
- Black stick (nylon probe 922-5065) (or other non-conductive nylon or plastic flat-blade tool)

## Preliminary Steps

Before you begin, remove the following:

- [Battery](#)
- [Top Case](#)

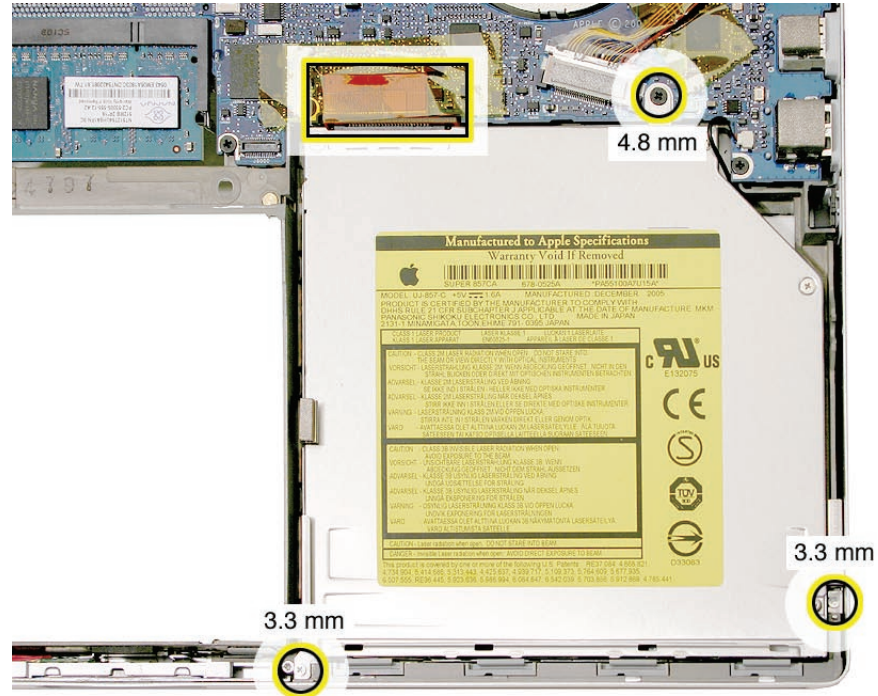
## Part Location



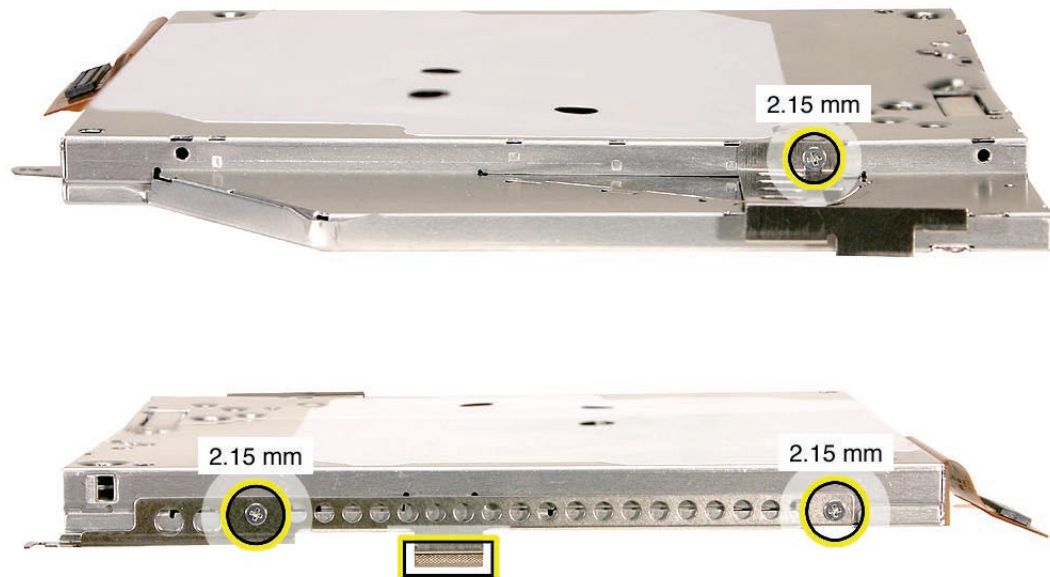


## Procedure

1. Disconnect the flex connector.
2. Remove three screws and lift out the drive.



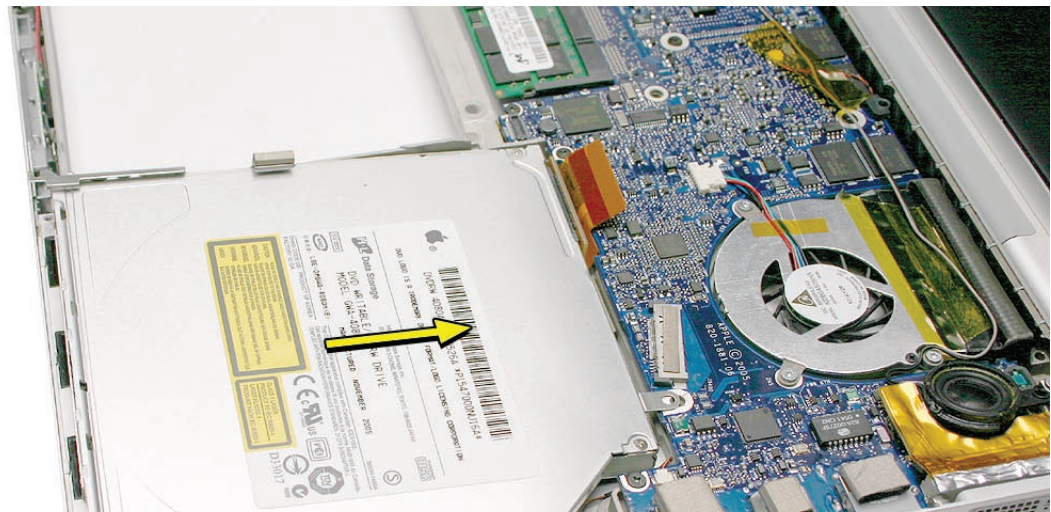
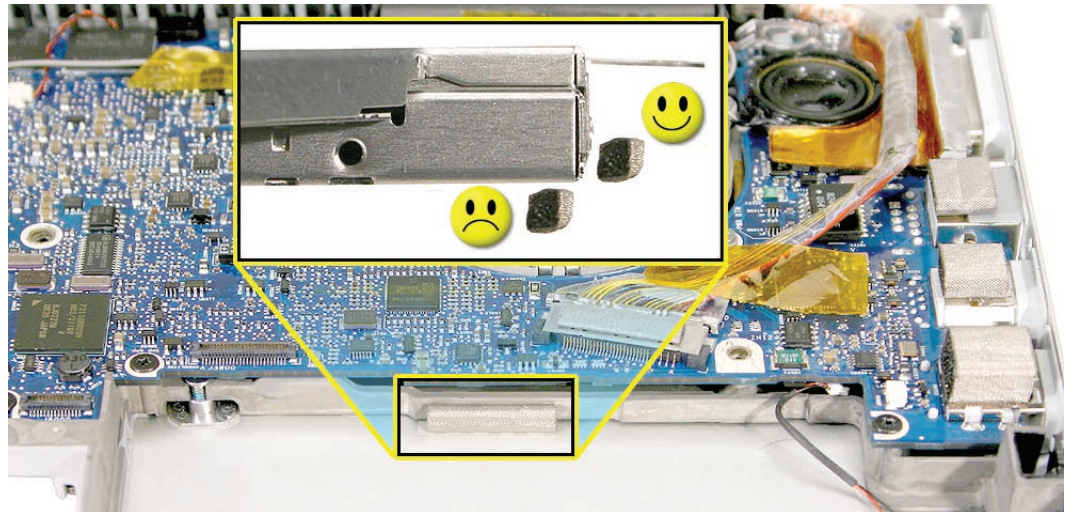
3. Transfer three brackets, including one EMI gasket, and flex cable to the replacement drive.





## Replacement Procedure

1. Verify that the EMI gasket is installed on the bottom case in the back of the drive bay.
2. **Important:** The optical drive must be installed so that it does not sit on top of the gasket. Insert the drive toward the logic board so that the gasket is pushed behind the drive.







# Backup Battery

## Tools

This procedure requires the following tools:

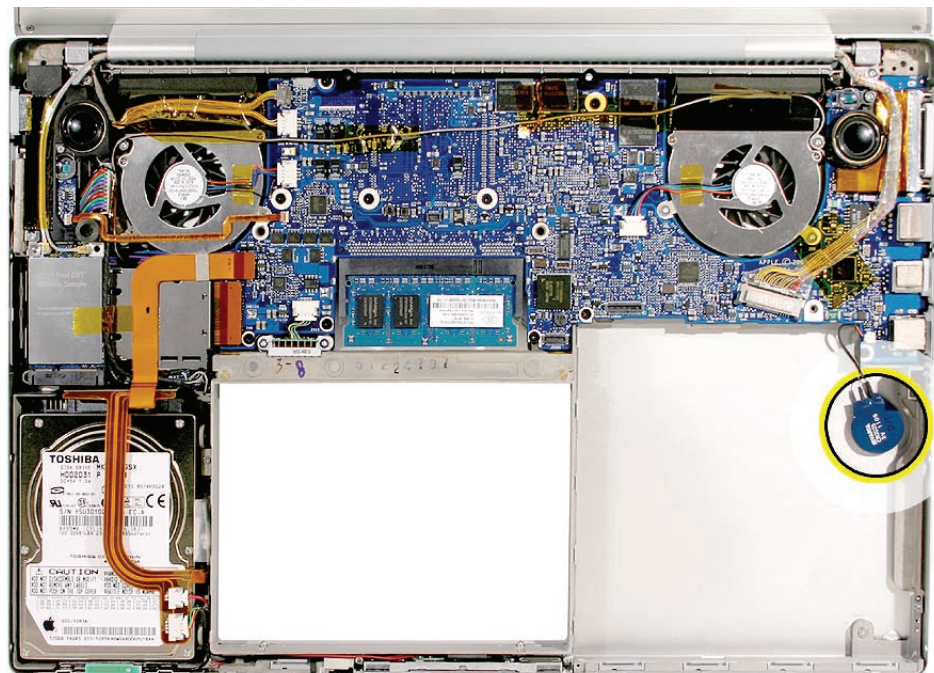
- #0 Phillips screwdriver (magnetized)
- Torx T6 screwdriver (magnetized)
- Needle-point metal probe
- Black stick (nylon probe 922-5065) (or other non-conductive nylon or plastic flat-blade tool)

## Preliminary Steps

Before you begin, remove the following:

- [Battery](#)
- [Top Case](#)
- [Optical Drive](#)

## Part Location

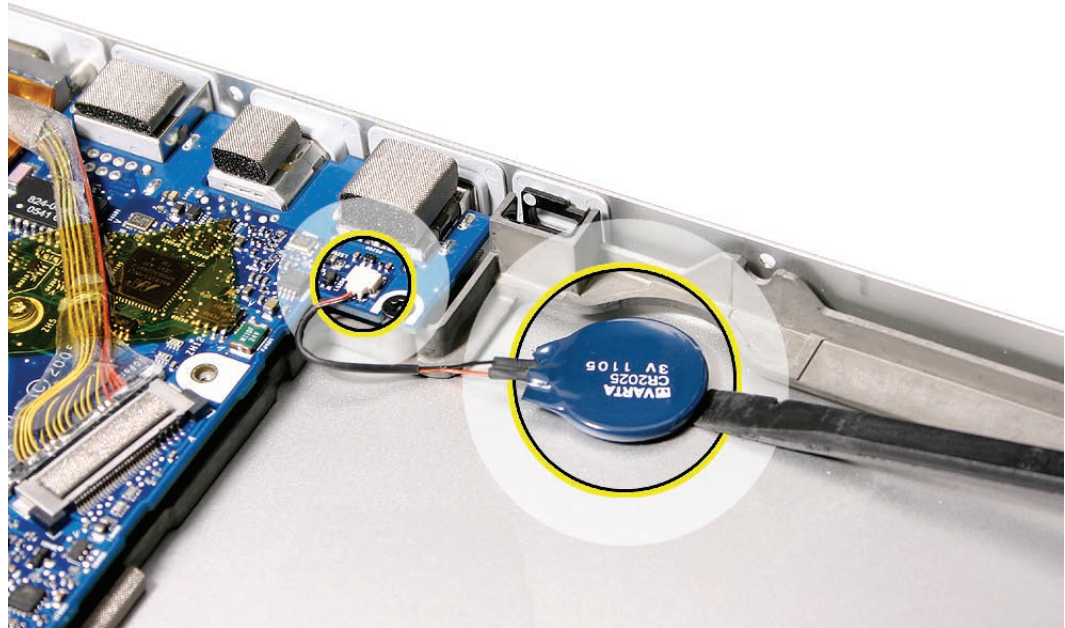




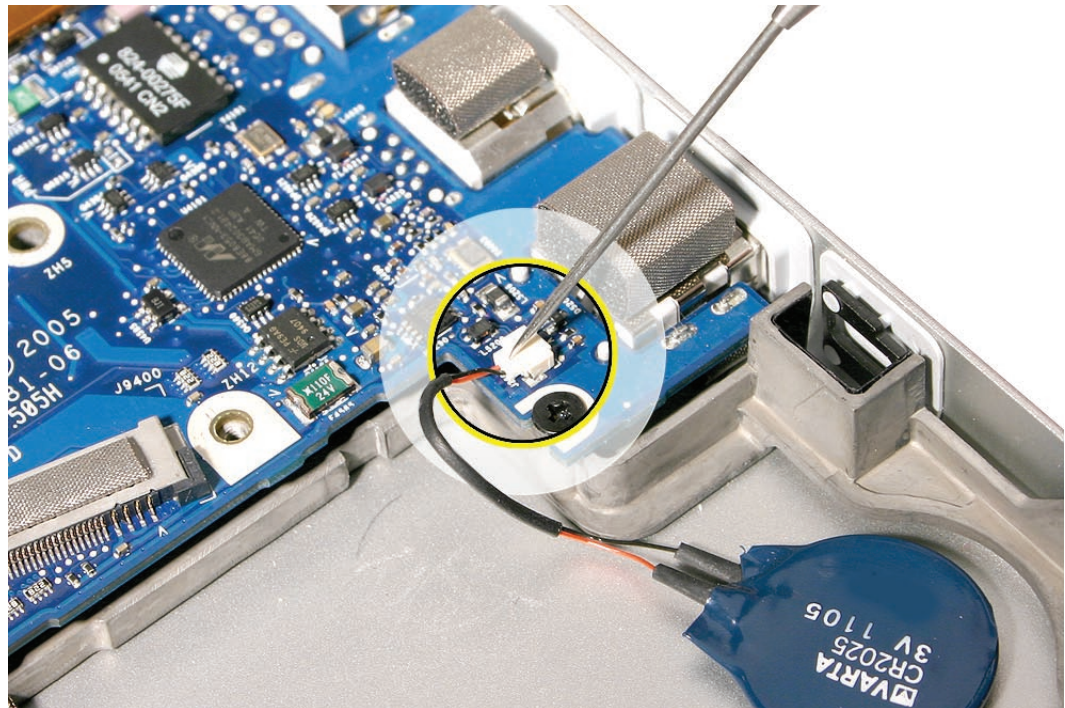
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## Procedure

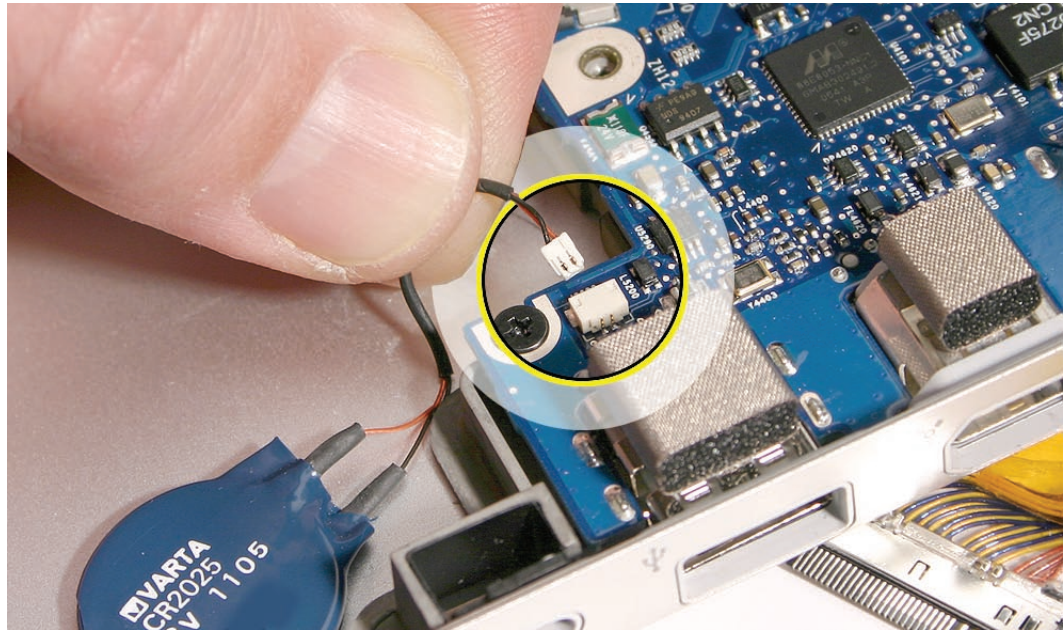
1. Disconnect the cable from the logic board.
2. Pry up the backup battery from the bottom case.



3. Disconnect the cable connector. **Note:** Using a metal needle-point probe may be helpful.



4. To install, remove the adhesive protector and press the backup battery into place in the same location that it was removed.
5. Connect the cable to the logic board.  
**Note:** The connector is keyed. For reinstalling, note its orientation, below.





# Ambient Light Sensors

## Tools

This procedure requires the following tools:

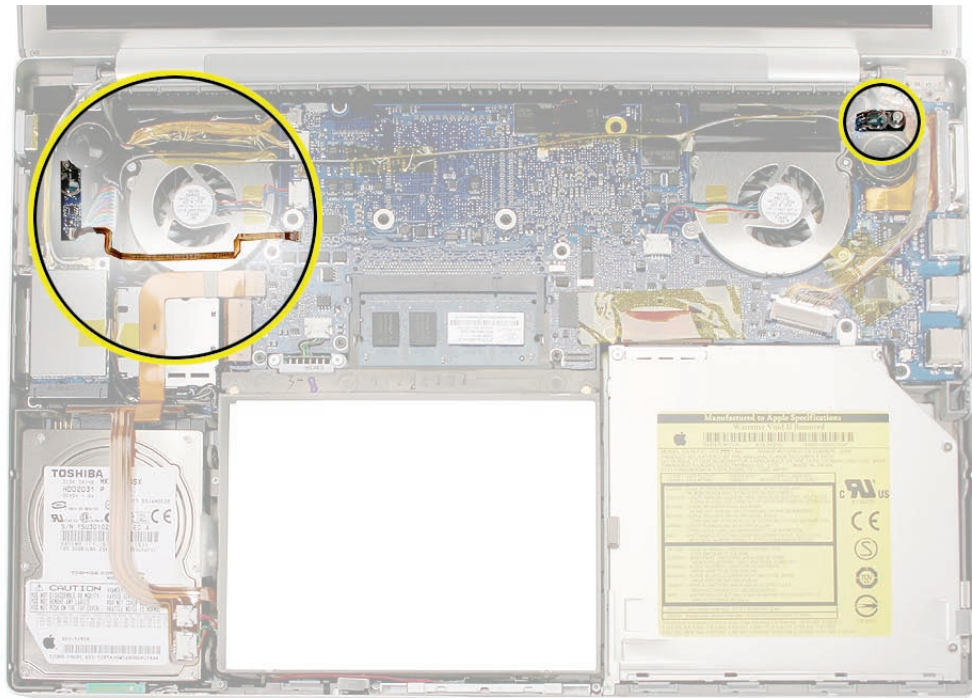
- #0 Phillips screwdriver (magnetized)
- Torx T6 screwdriver (magnetized)
- Black stick (nylon probe 922-5065) (or other non-conductive nylon or plastic flat-blade tool)

## Preliminary Steps

Before you begin, remove the following:

- [Battery](#)
- [Top Case](#)

## Part Location





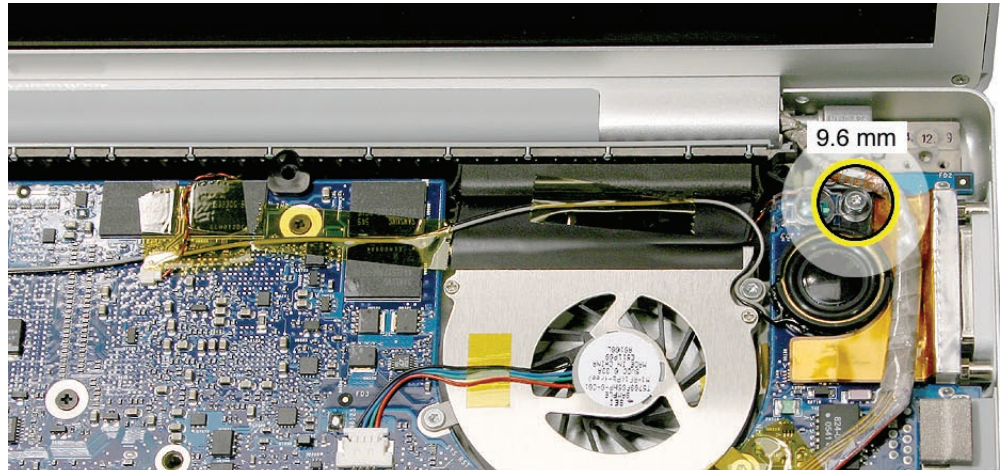
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## Procedure

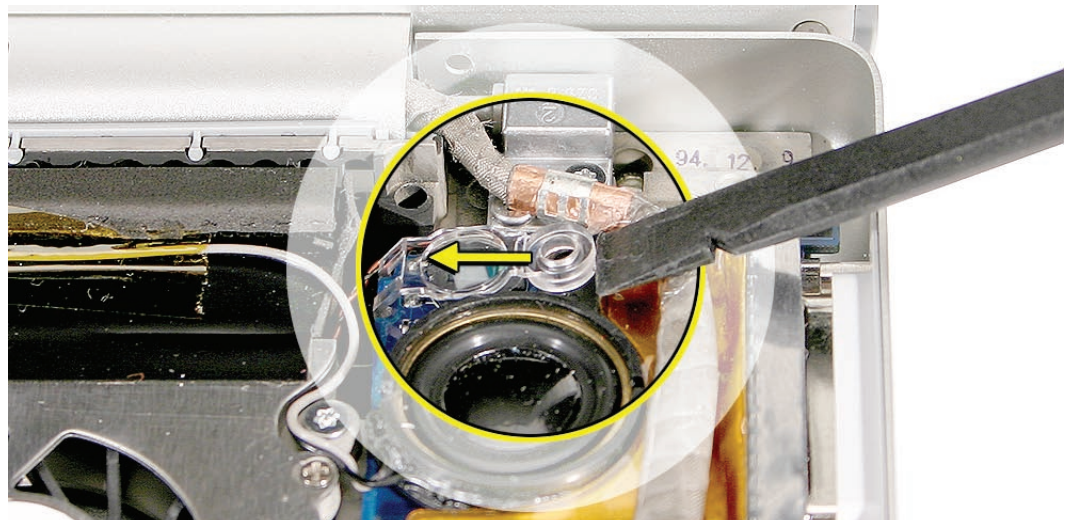
The right ambient light sensor is part of the logic board but has a removable dust cover. The left sensor is on a circuit board mounted to the left speaker.

To remove the right sensor's dust cover:

1. Remove the screw shown.



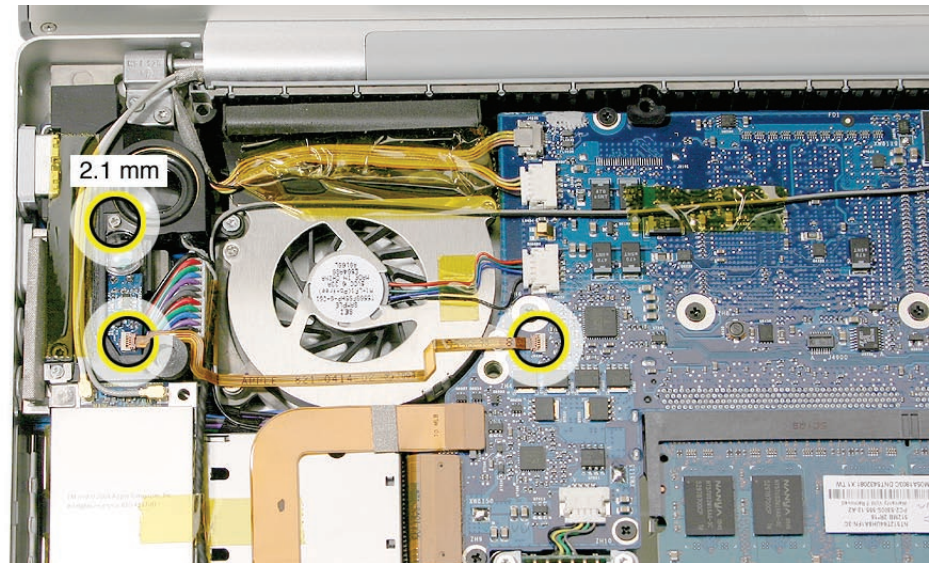
2. The cover catches under the logic board. Slide the cover to the left to disengage.



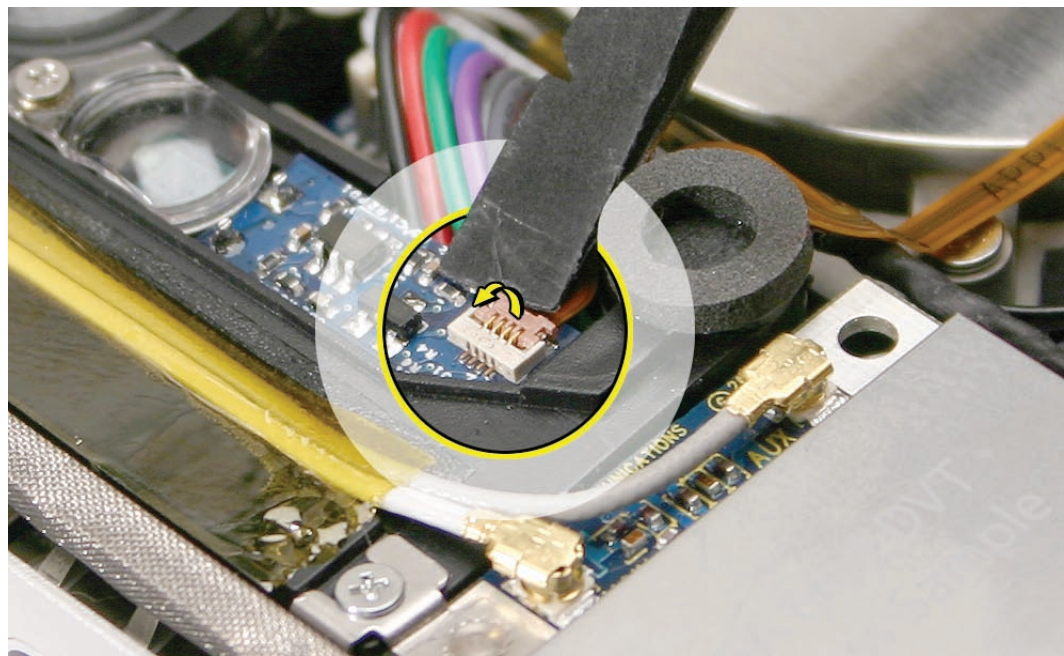


To remove the left ambient light sensor board:

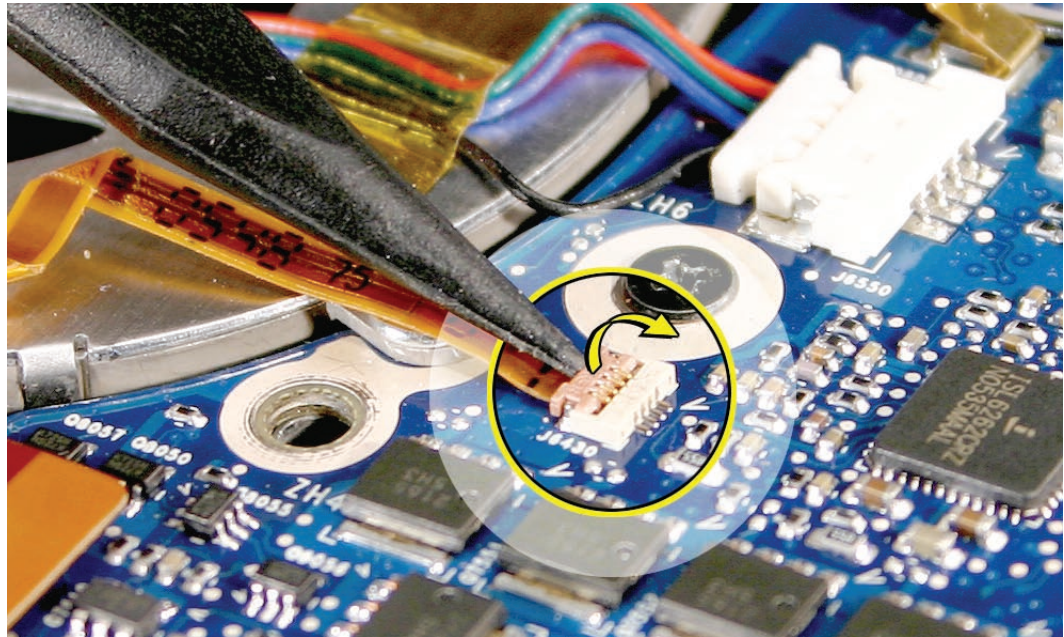
1. Remove the screw and dust cover.
2. Disconnect the flex connector on the sensor board (connector close-up shown below).
3. If replacing the flex cable, also disconnect it on the logic board (close-up shown below).  
**Warning: The connectors are very delicate. Breaking the connector mechanism on the logic board requires a replacement logic board!**



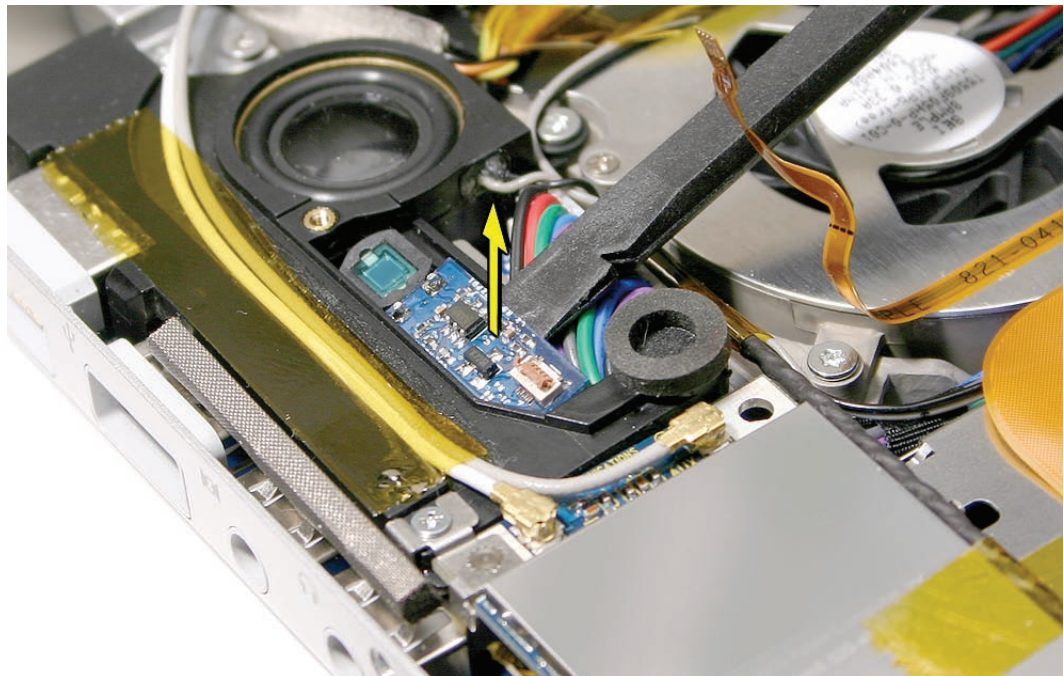
4. Carefully lift the flex connector latch on the sensor board and slide the cable out.



5. If removing the flex cable on the logic board, carefully lift the latch and remove the cable.  
**Warning: Breaking this connector mechanism requires a replacement logic board!**



6. Pry up the sensor board to release its adhesive and remove it from the speaker.







# Fans

## Tools

This procedure requires the following tools:

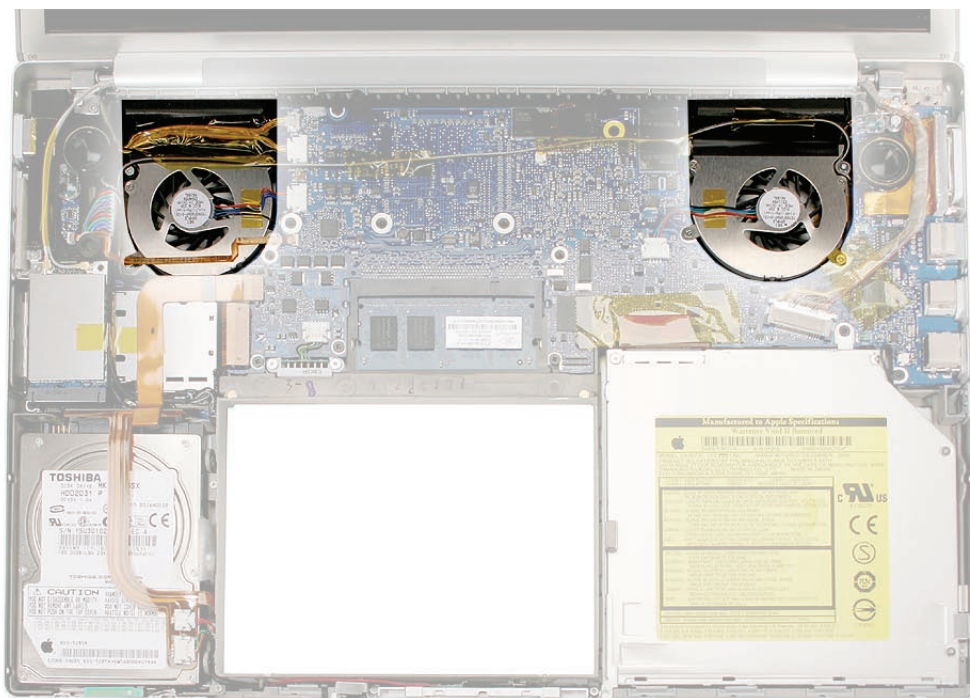
- Torx T6 screwdriver (magnetized)
- Black stick (nylon probe 922-5065) (or other non-conductive nylon or plastic flat-blade tool)
- Razor knife
- Kapton tape (922-1731 (0.5-inch x 12-yard roll))

## Preliminary Steps

Before you begin, remove the following:

- [Battery](#)
- [Top Case](#)

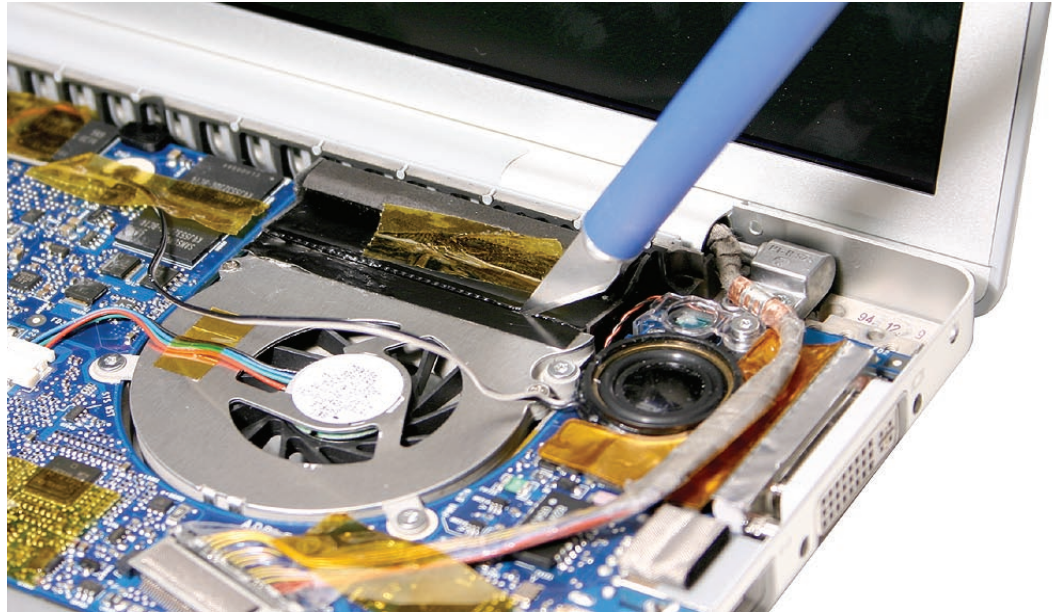
## Part Location



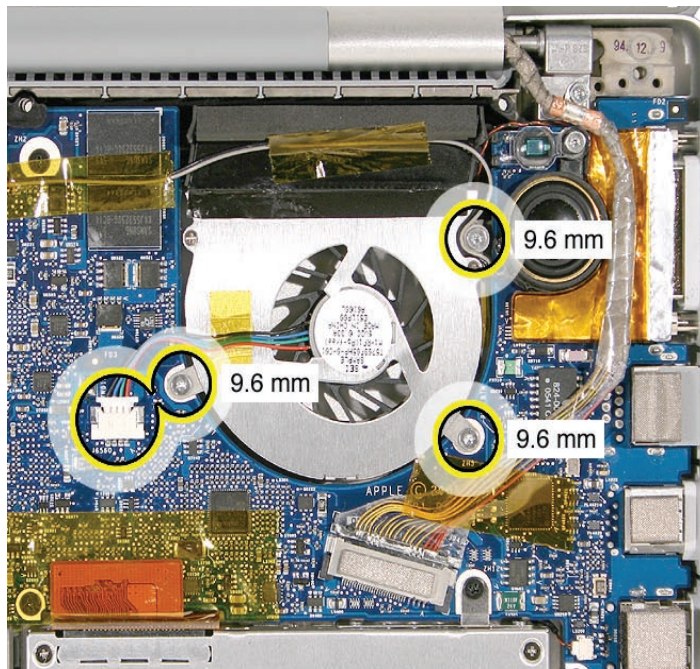
## Procedure

To remove the right fan:

1. Peel up any Kapton tape and move the speaker cable safely out of the way, then use a razor knife to cut the length of the tape at the seam between the fan cover and the fins.



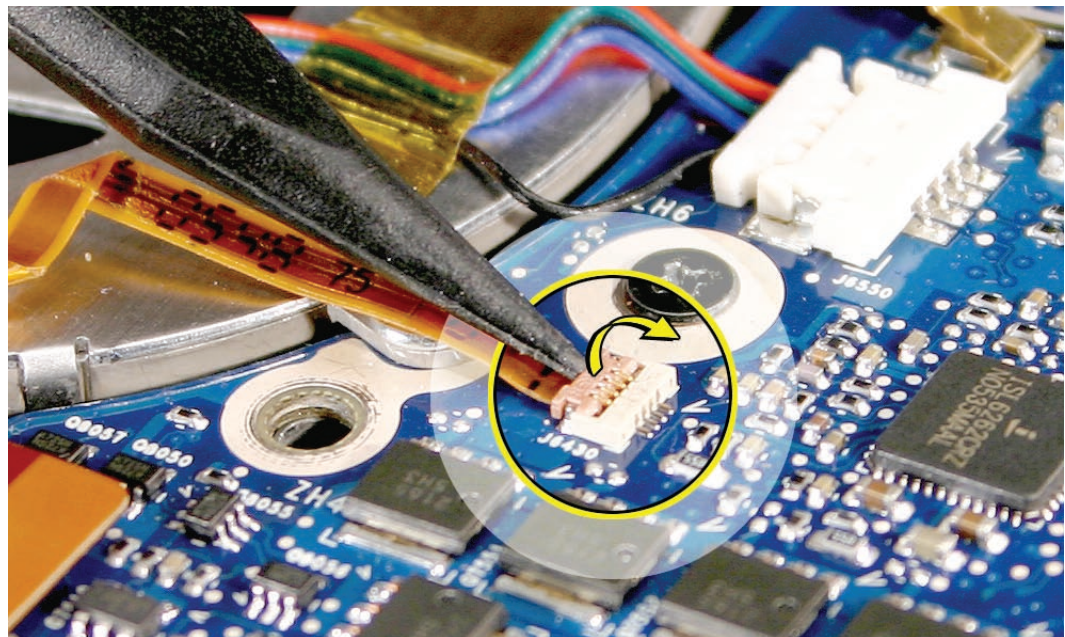
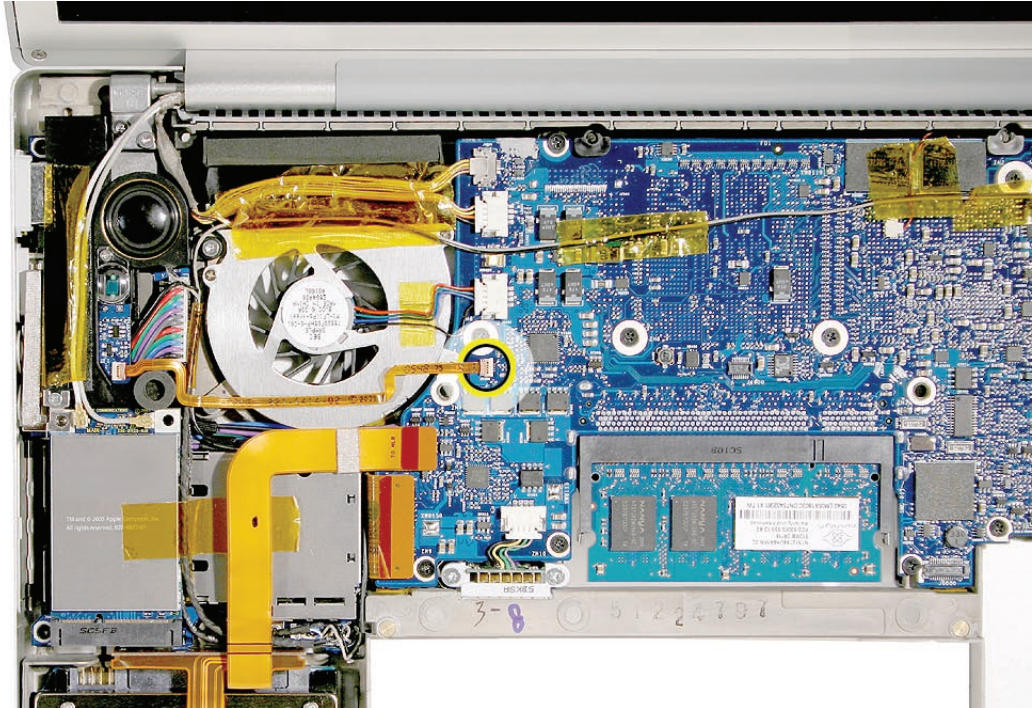
2. Disconnect the fan cable and remove three screws. Lift out the fan.





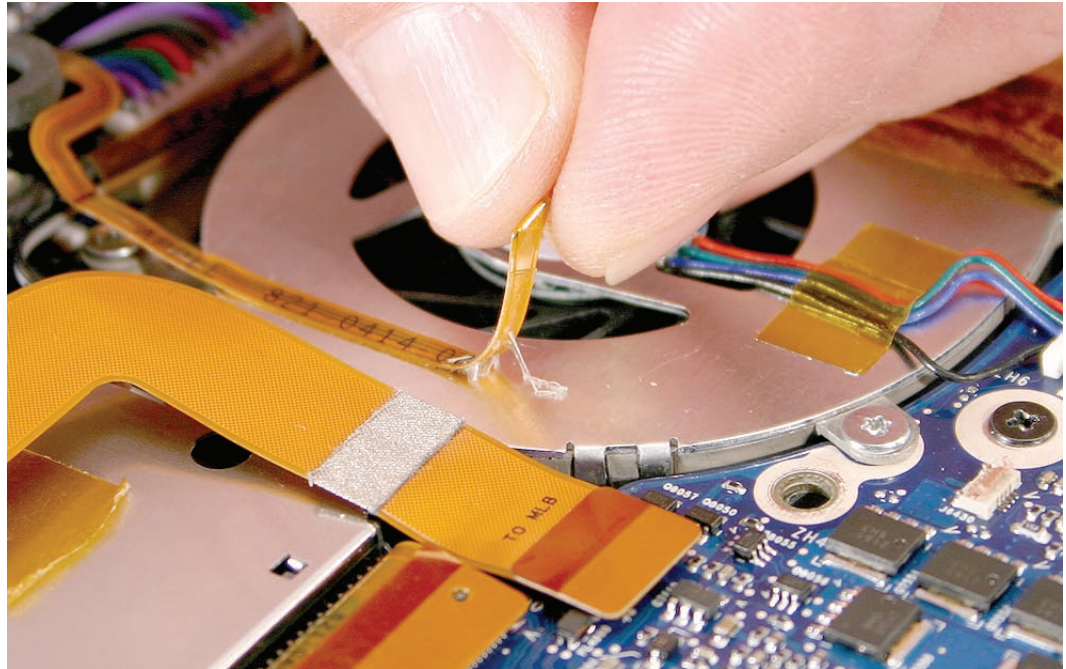
To remove the left fan:

1. Disconnect the ambient light sensor flex cable on the logic board (close-up shown below).  
**Warning: The connector is very delicate. Breaking the connector mechanism requires a replacement logic board!**

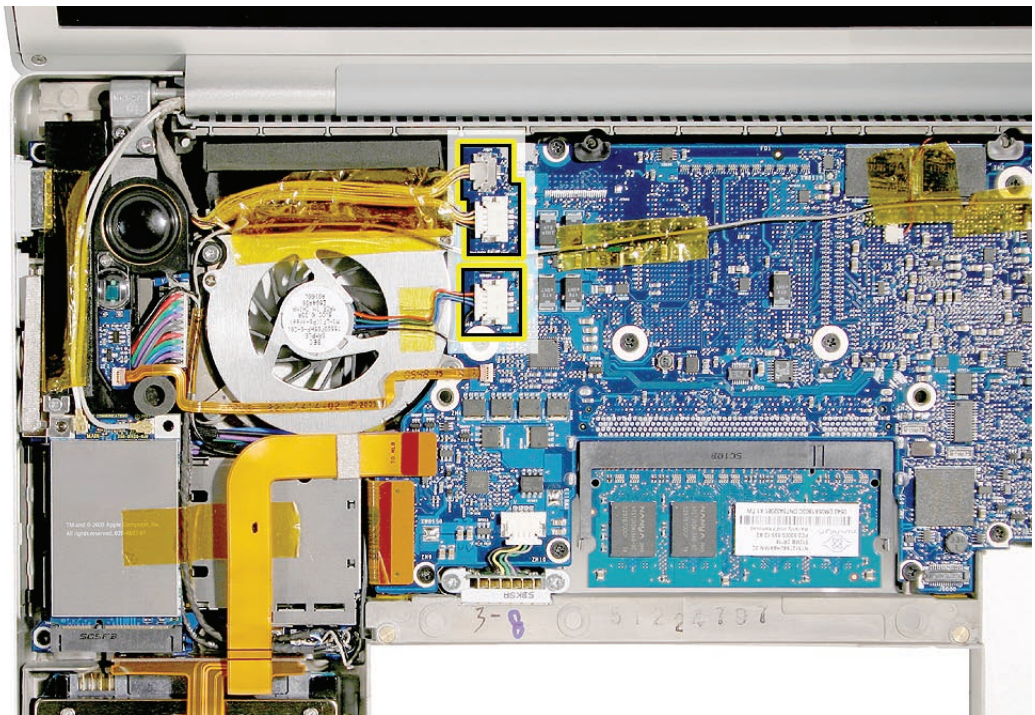




- Carefully peel the flex cable off the fan cover.

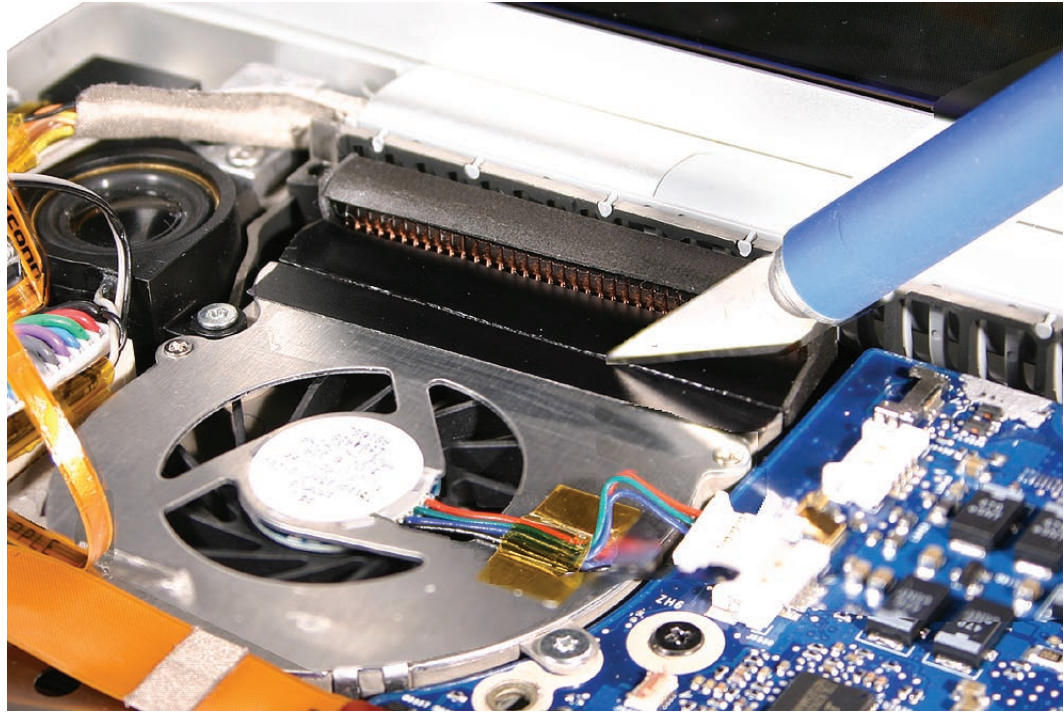


- Disconnect the cables shown, and move safely out of the way.

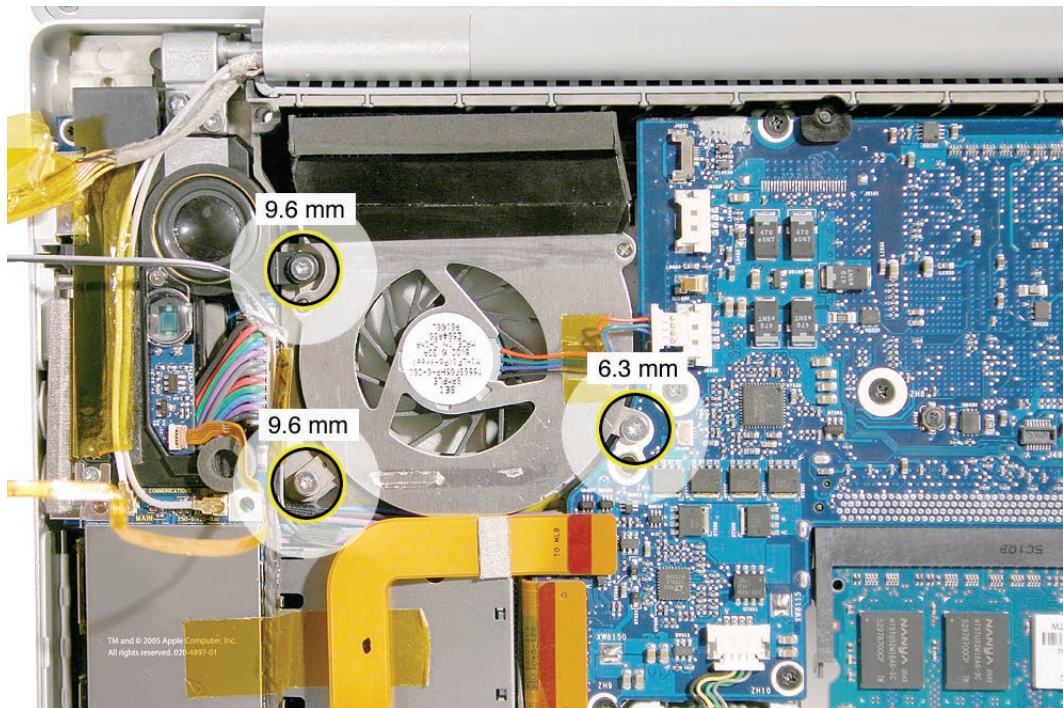




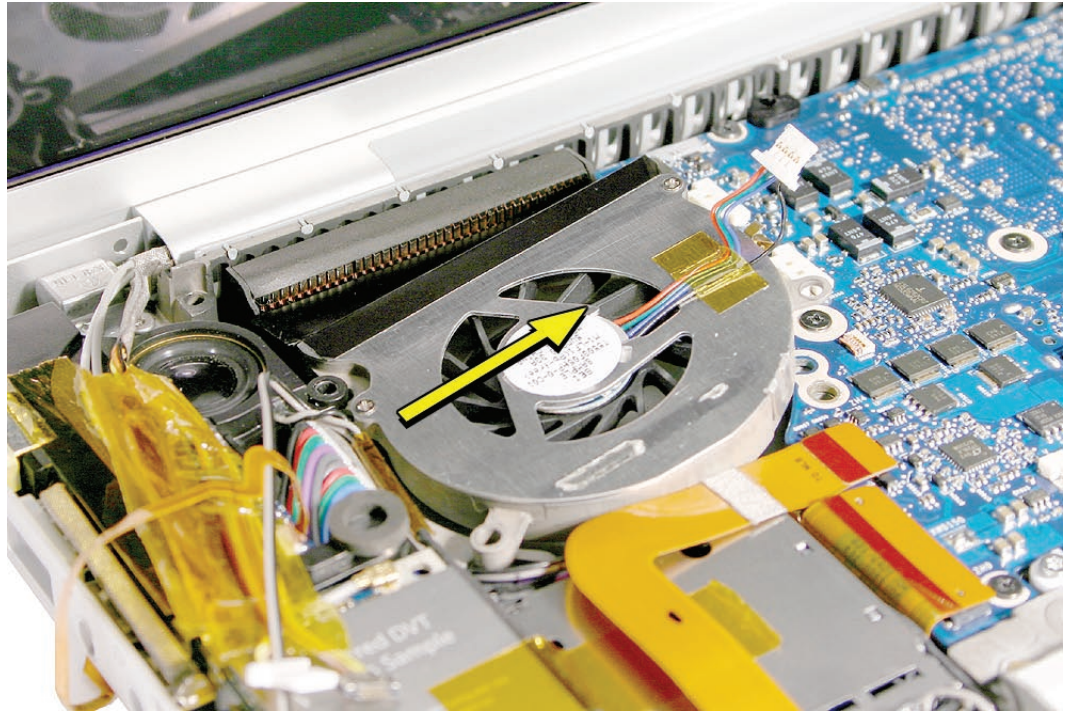
4. Use a razor knife to cut the length of the tape at the seam between the fan cover and the fins



5. Remove the three screws.



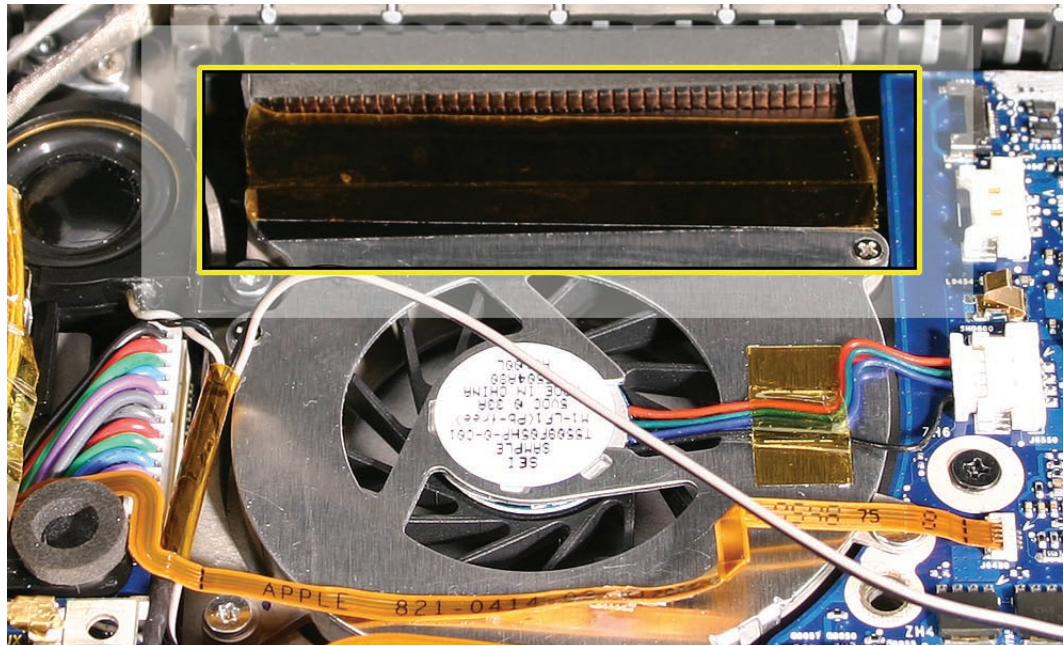
- Slide the fan out from under the left speaker screw tab.



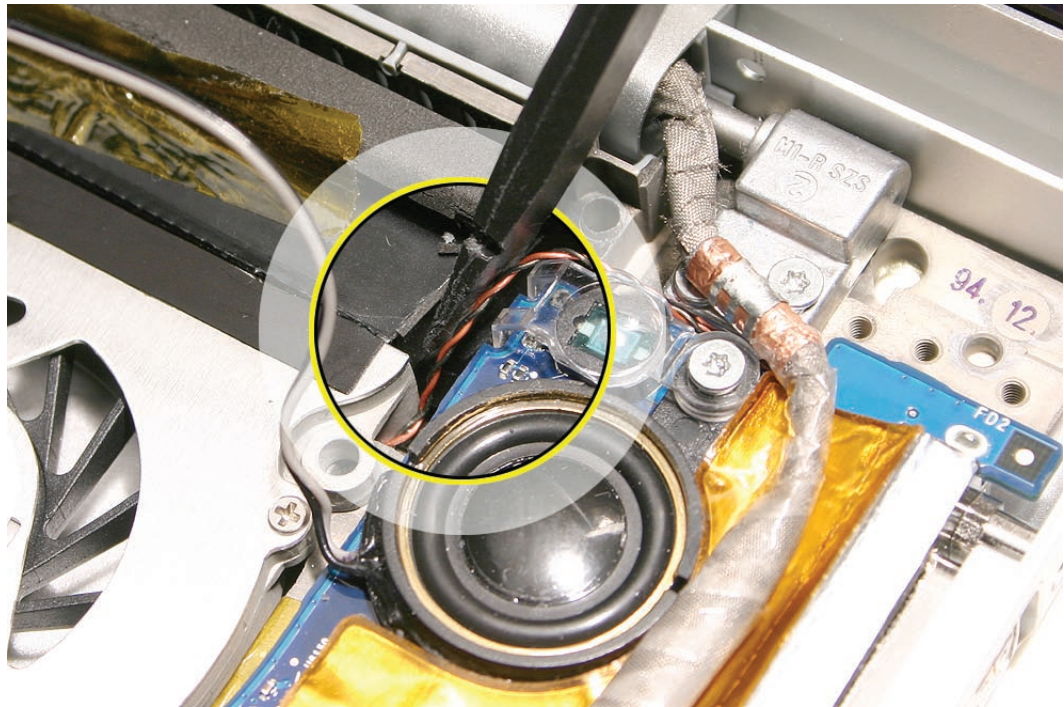


## Replacement Procedure

1. For both fans, after replacing, apply Kapton tape over the length of the cut tape, to seal.



2. Secure the ambient light sensor flex cable to the left fan cover with Kapton tape, if needed.
3. Verify that the thermal sensor cable is not caught under the right fan.





# Speakers

The right and left speakers are one assembly.

## Tools

This procedure requires the following tools:

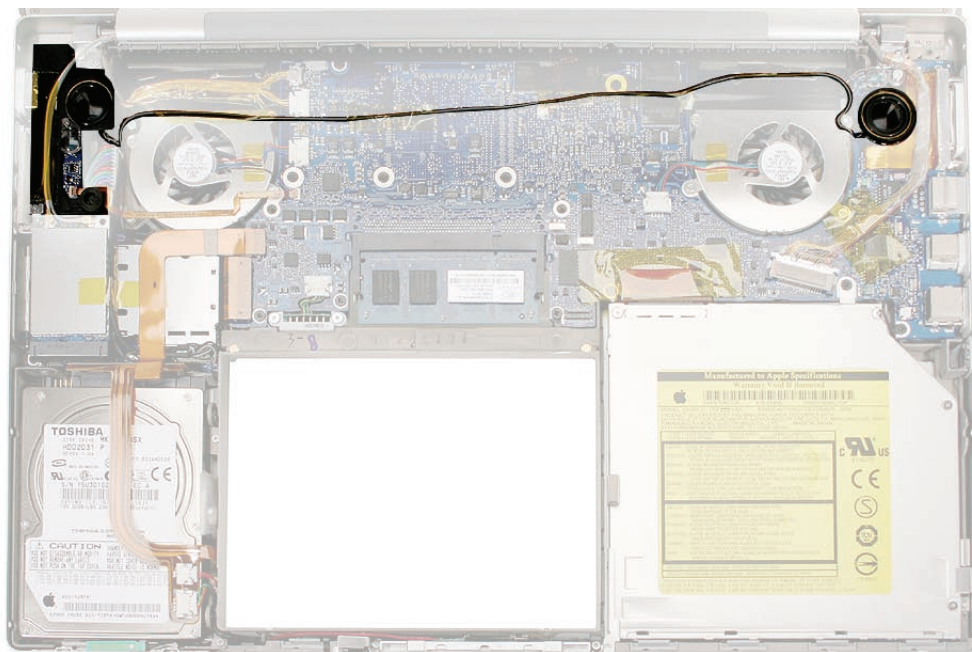
- #0 Phillips screwdriver (magnetized)
- Torx T6 screwdriver (magnetized)
- Black stick (nylon probe 922-5065) (or other non-conductive nylon or plastic flat-blade tool)
- Kapton tape (922-1731 (0.5-inch x 12-yard roll))

## Preliminary Steps

Before you begin, remove the following:

- [Battery](#)
- [Top Case](#)
- [AirPort Extreme Card](#) (for left speaker)
- [Right Ambient Light Sensor Lens](#) (for right speaker)

## Part Location

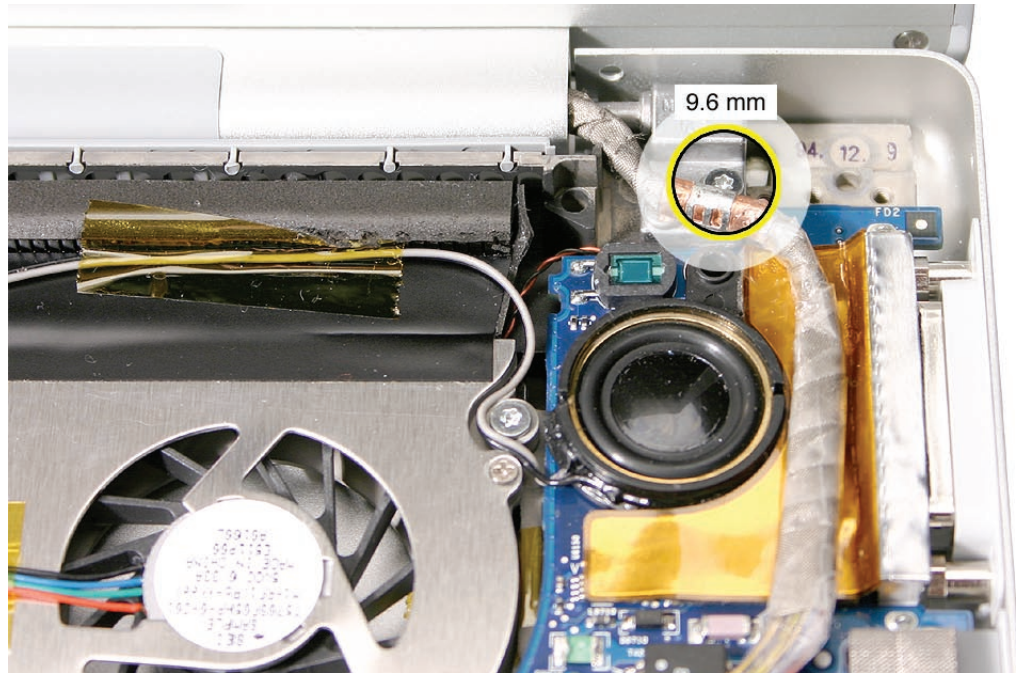




## Procedure

To remove the right speaker:

1. Remove the LVDS grounding strap screw to access the tape along the right side of the speaker.



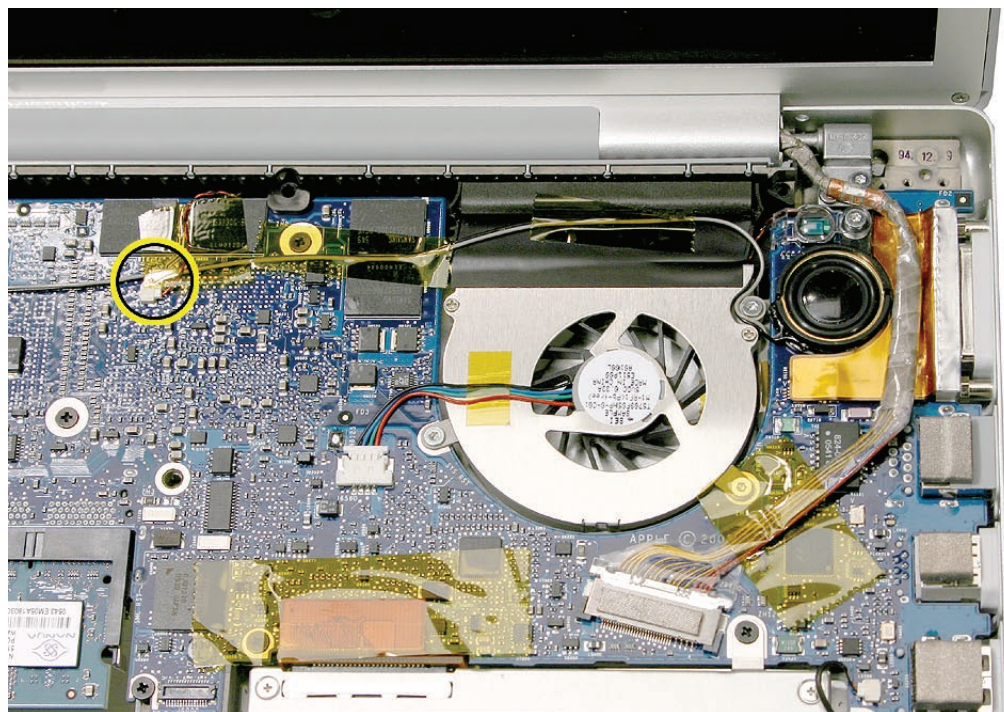
2. Pry up the tape next to the speaker to allow the speaker to rotate.



3. Push on the screw tab to rotate the speaker a short distance until it releases from the speaker chamber under the logic board. Lift out the speaker and move to the side.

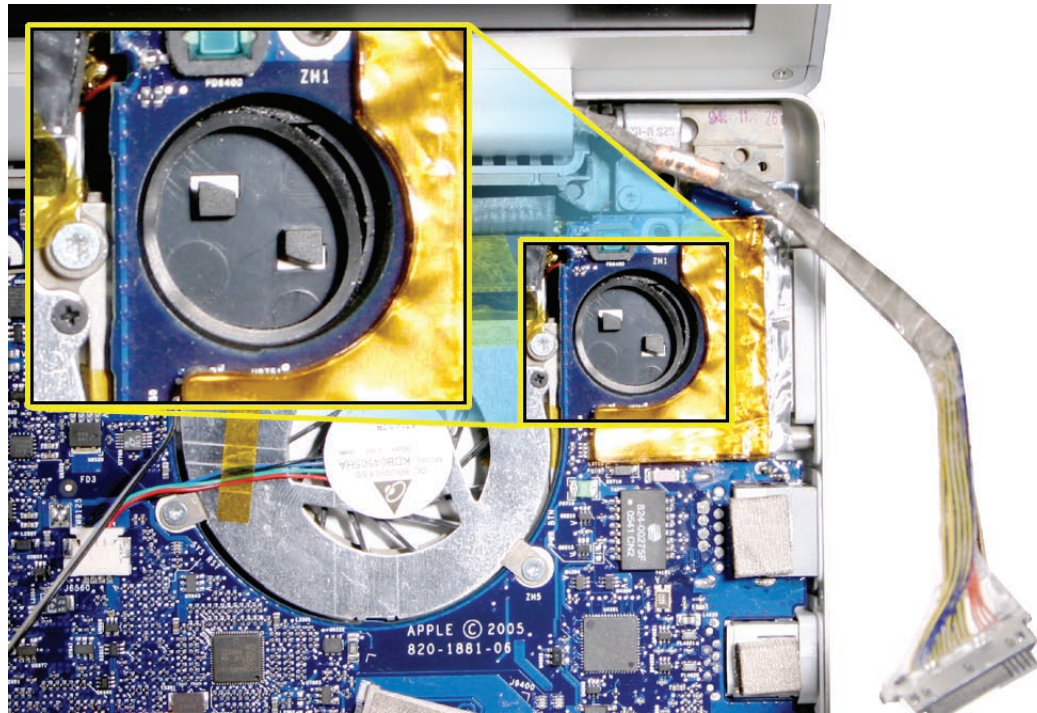


4. Disconnect the thermal sensor connector, shown, if its wire crosses over the speaker wire.





**Replacement Note:** Check the circle gasket in the lower speaker chamber and re-seat if needed.



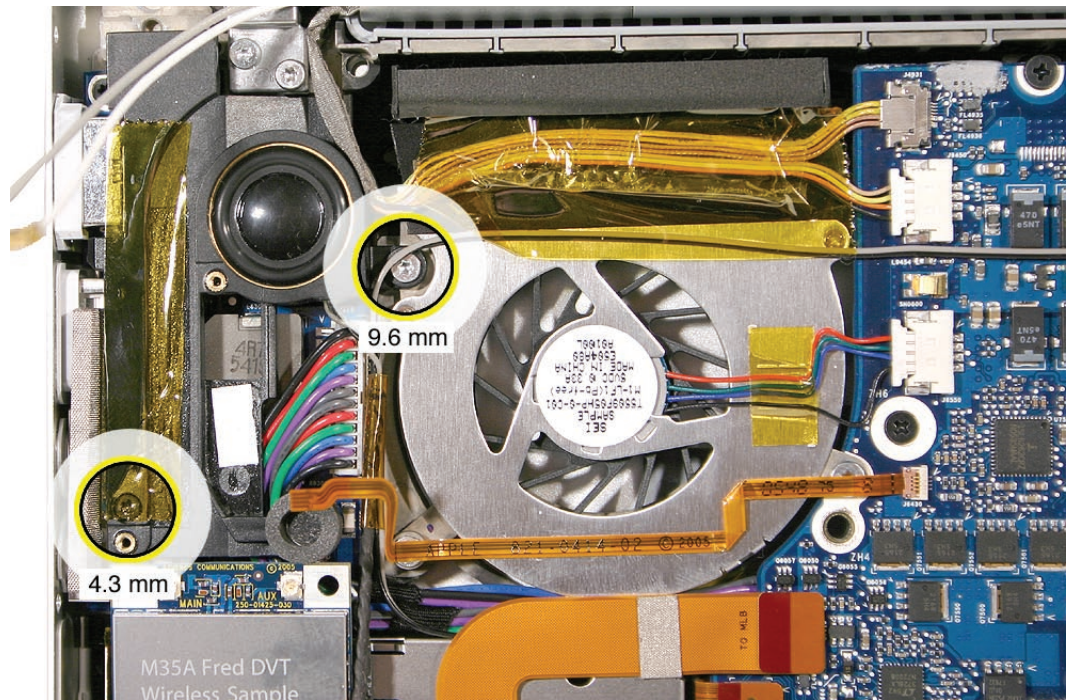
**Replacement Note:** Route the wires as shown.



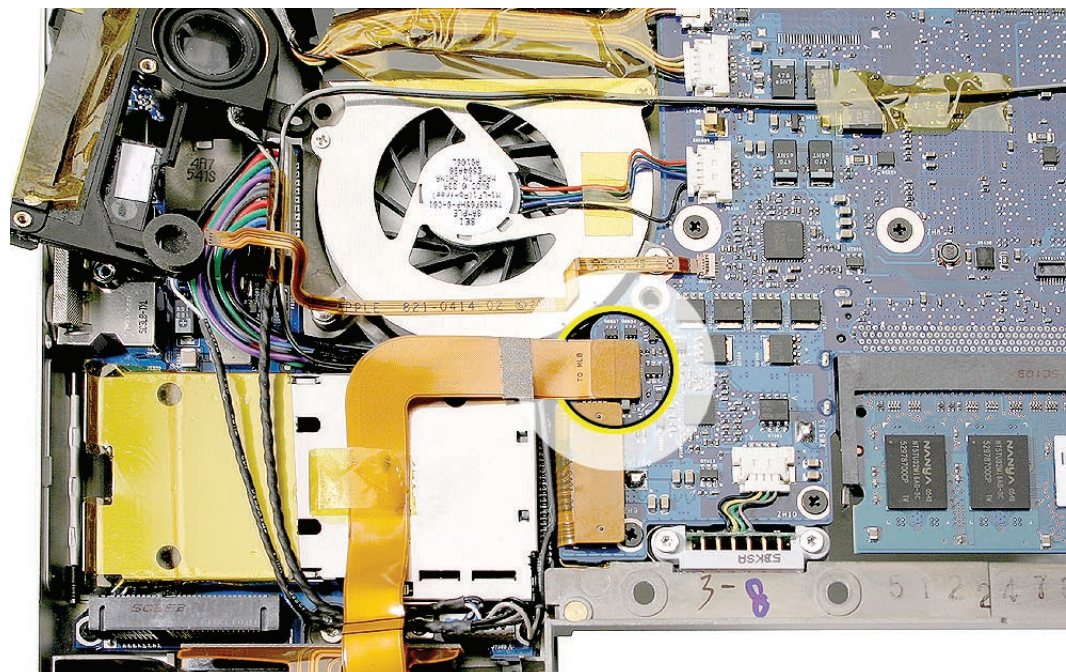


To remove the left speaker:

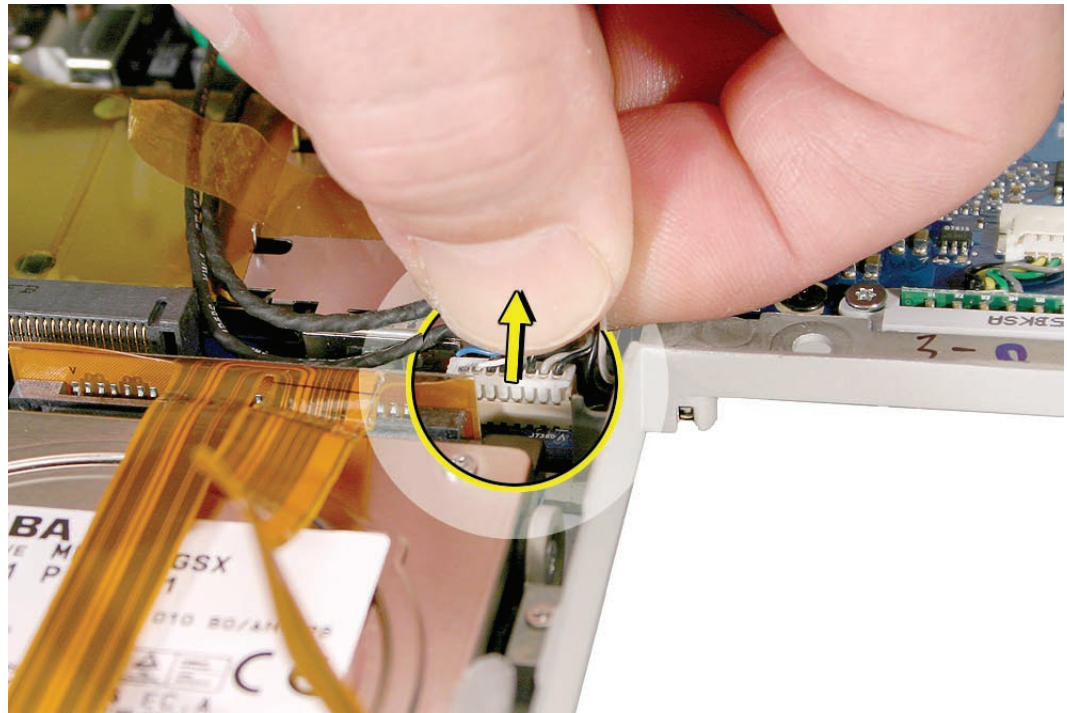
1. Remove two screws.



2. Disconnect the connector shown and lift the flex cable from the ExpressCard cage to gain access to the speaker cables and connector.



3. Note cable routing, then disconnect the speaker cable connector.







# Logic Board

## Tools

This procedure requires the following tools:

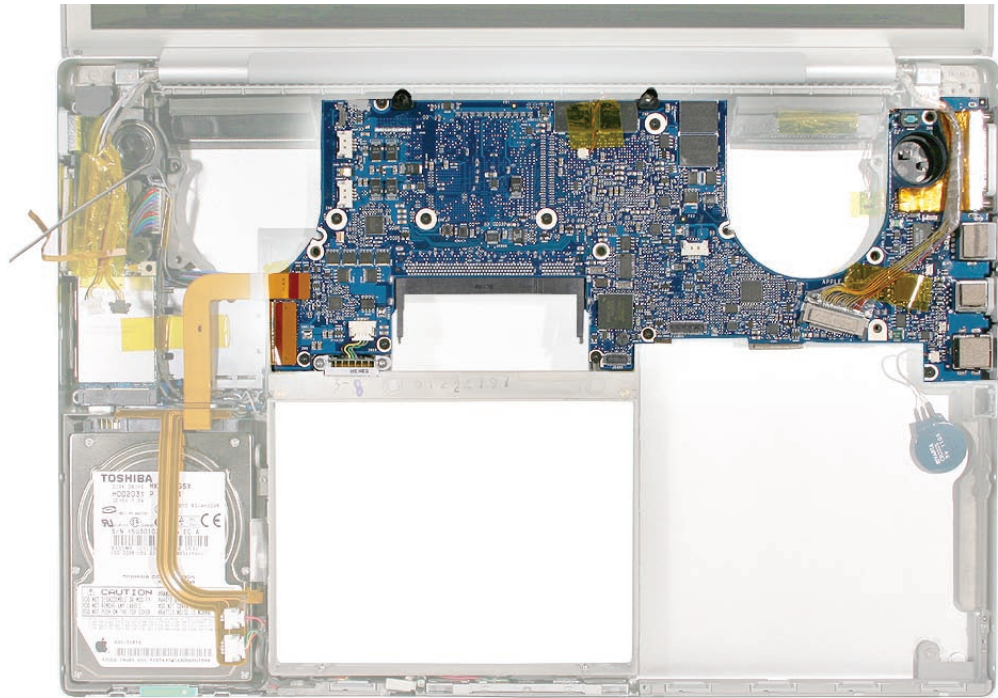
- #0 Phillips screwdriver (magnetized)
- Torx T6 screwdriver (magnetized)
- Black stick (nylon probe 922-5065) (or other non-conductive nylon or plastic flat-blade tool)
- Needle-point metal probe
- Multi-compartment screw tray (such as a plastic ice cube tray)
- Kapton tape (922-1731 (0.5-inch x 12-yard roll))
- Thermal grease (922-7144)
- Gasket kit (076-1206)
- Alcohol pads

## Preliminary Steps

Before you begin, remove the following:

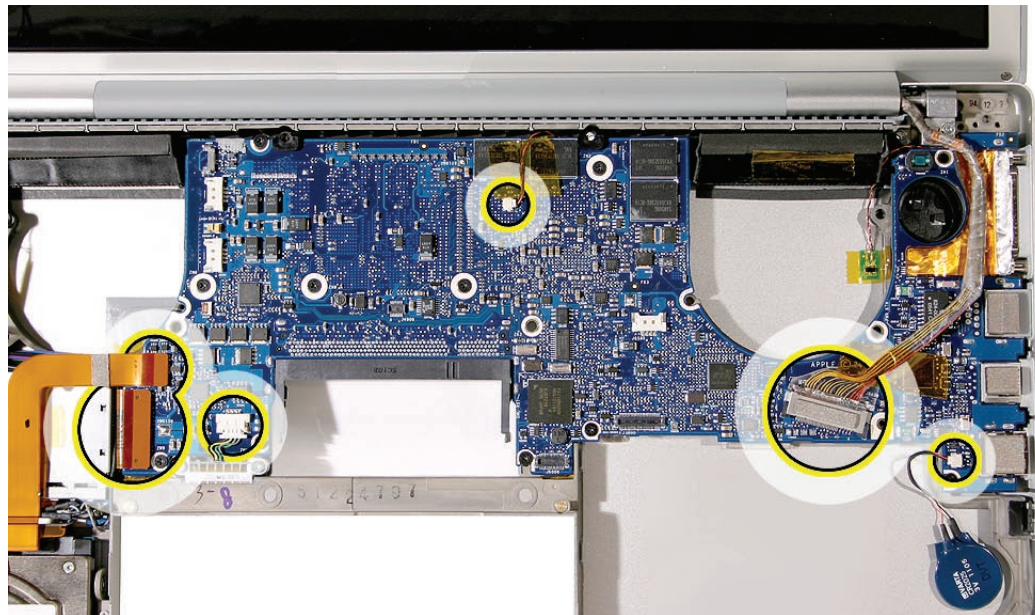
- [Battery](#)
- [Memory](#)
- [Top Case](#)
- [Right Speaker](#)
- [Fans](#)
- [Optical Drive](#)

## Part Location

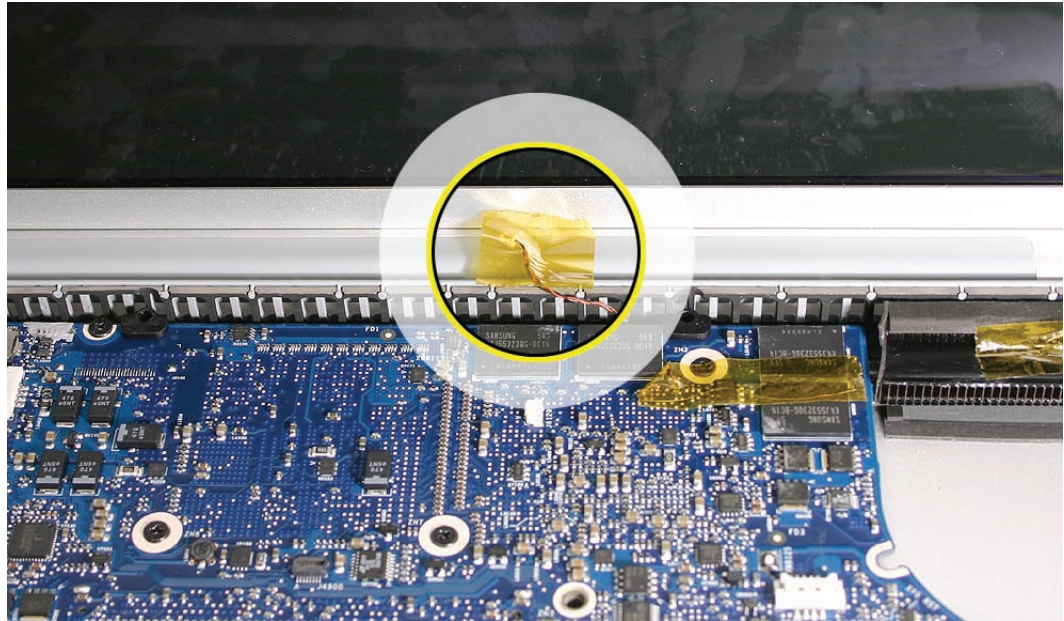


## Procedure

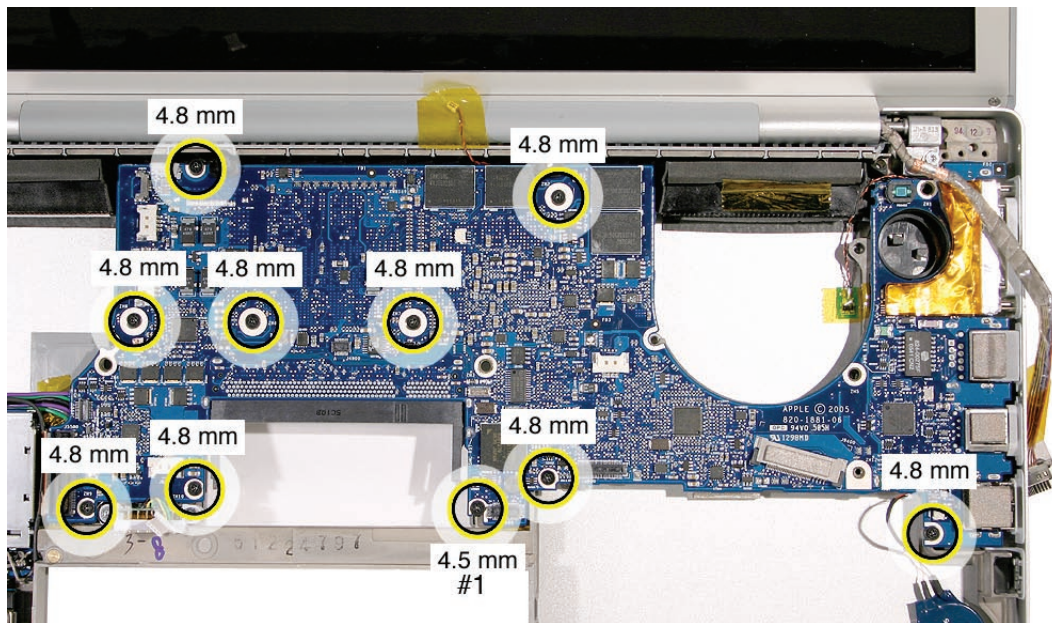
1. Disconnect the cables shown..



2. Tape the thermal sensor cable to the display assembly to avoid forgetting it during assembly.

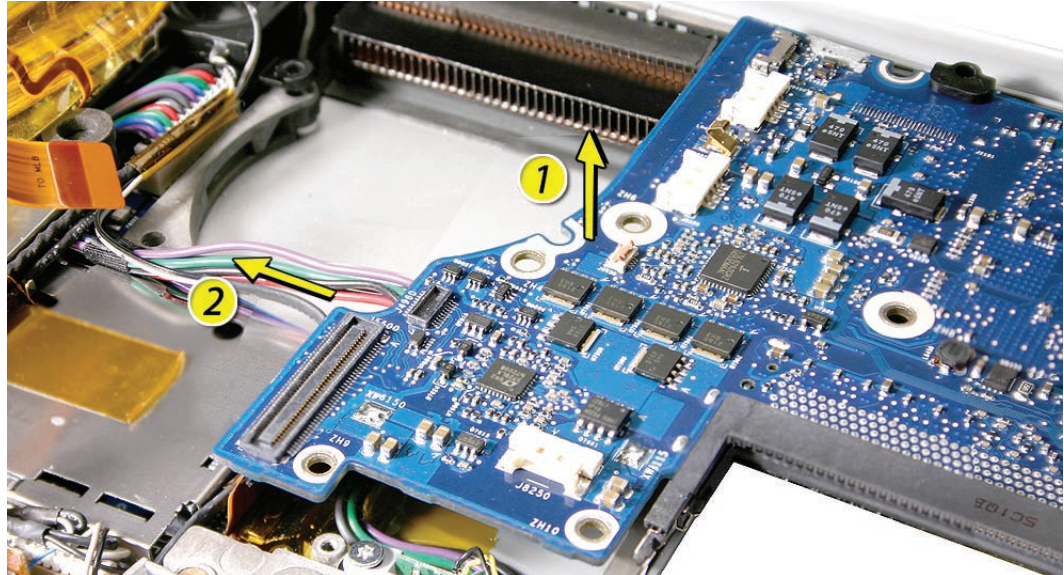


3. Remove the screws.

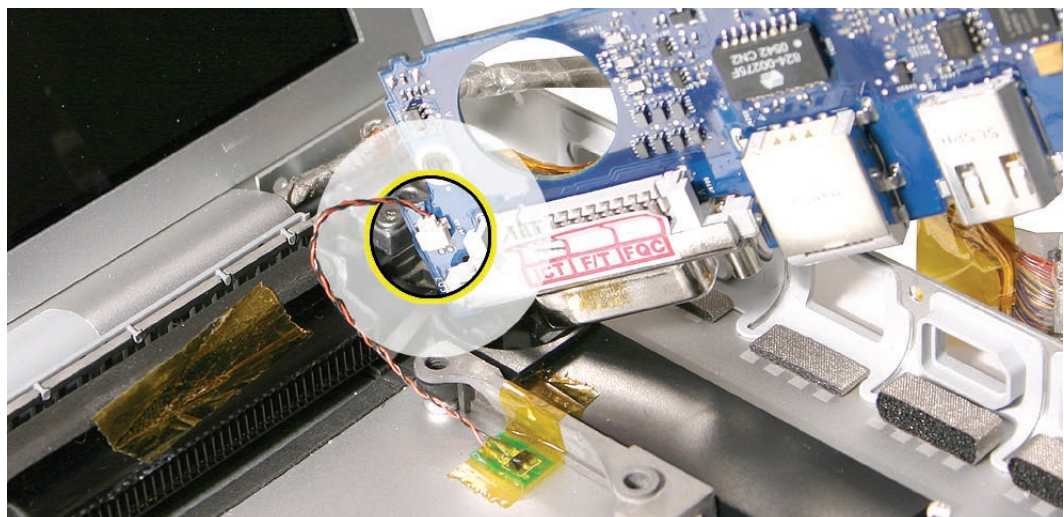




4. **Warning: Do NOT allow the logic board to flex at any time. Flexing the board can crack solder joints to components. Give special attention at the narrow neck of the fan cutout.**
5. From the left side of the board, slowly begin to lift the board, avoiding any flexing, until the thermal material on the three chips underneath releases. Do not lift the board further.  
**Note:** The thermal material should easily release. If not, verify that all screws and connectors have been removed.
6. Remove the connector under the board, shown. Do not remove the board just yet.

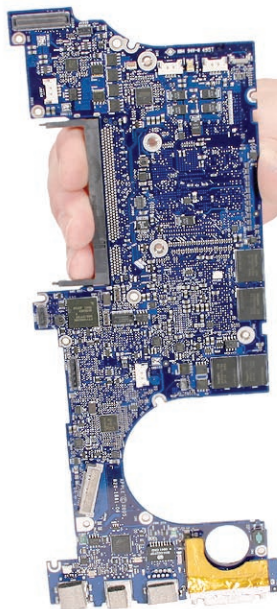


7. The board has one more cable that must be disconnected before it can be removed. Carefully lift the left side of the board, supporting the board along its sides as it lifts, and pivot along the ports side as you pull it just clear of the port openings.
8. Disconnect the thermal sensor cable.



- 
9. Remove the logic board.

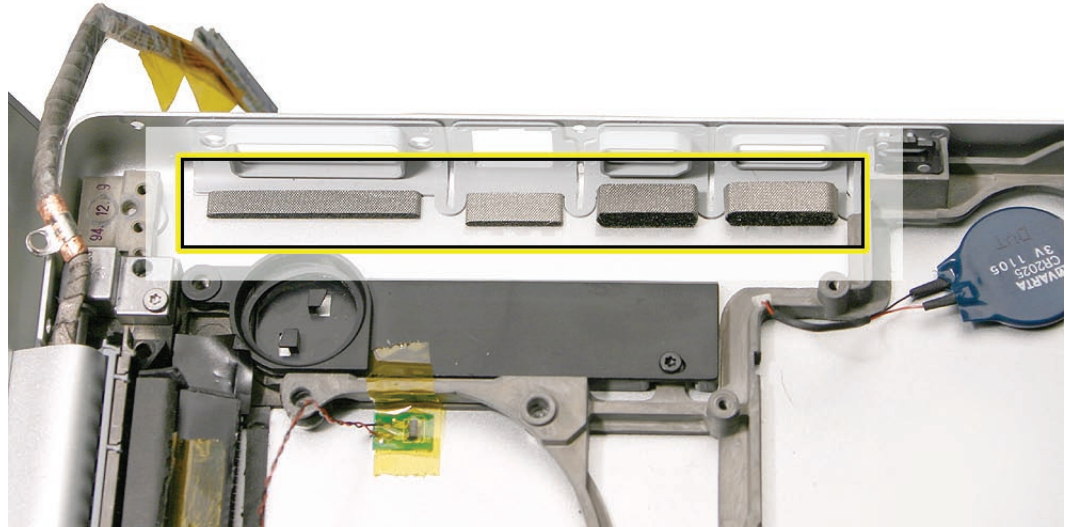
**Warning:** To avoid flexing the logic board, hold the board vertically along the wide sides. Do not hold the board by the ends or by the narrow neck at the fan cutout, or horizontally, as the board's weight can cause excessive flex.



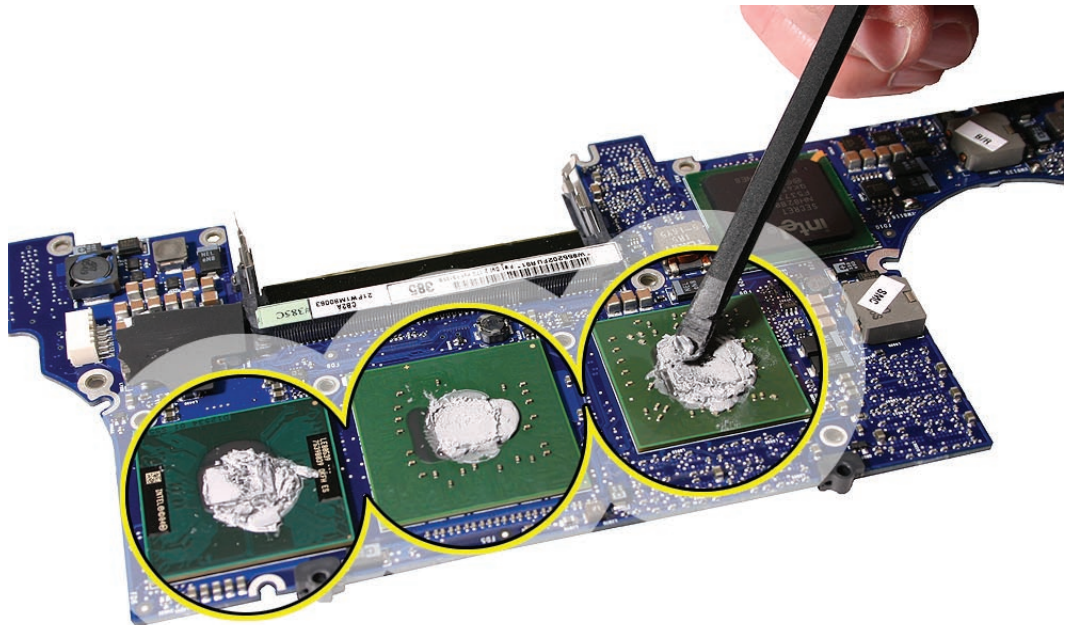
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## Replacement Procedure

1. Verify that the EMI gaskets are in place along the port openings on the bottom case.

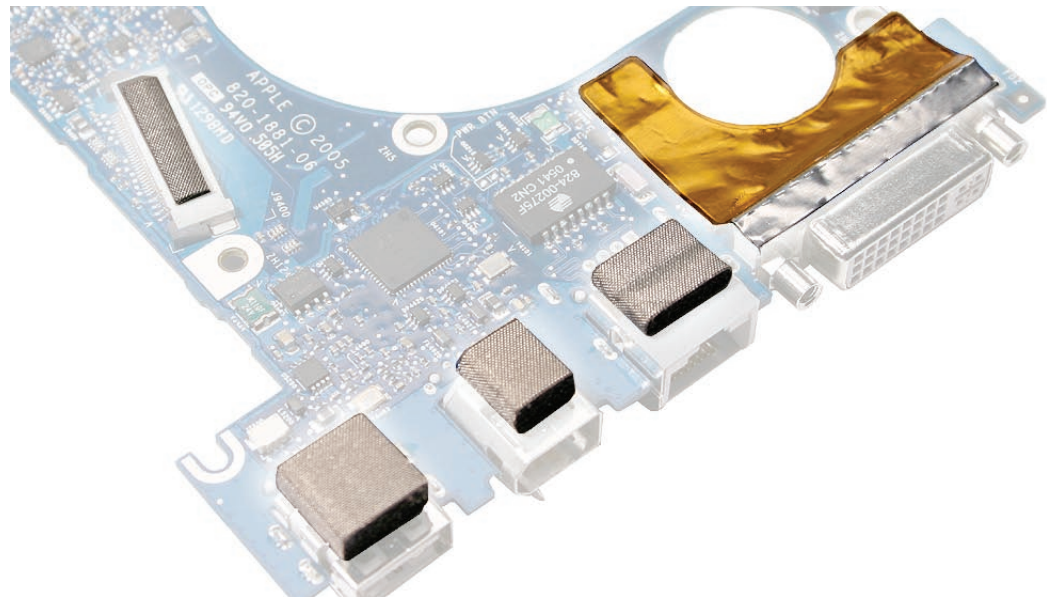


2. If replacing the logic board, transfer the two screw guides along top edge of the board.
3. If the logic board was removed to facilitate another procedure and will be reinstalled:
  - Use a black stick and alcohol wipes to clean the thermal grease from the three chips.**Important:** Use extreme care not to damage the chip or logic board components.

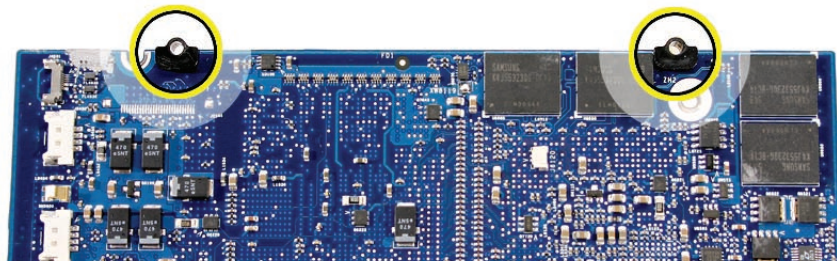




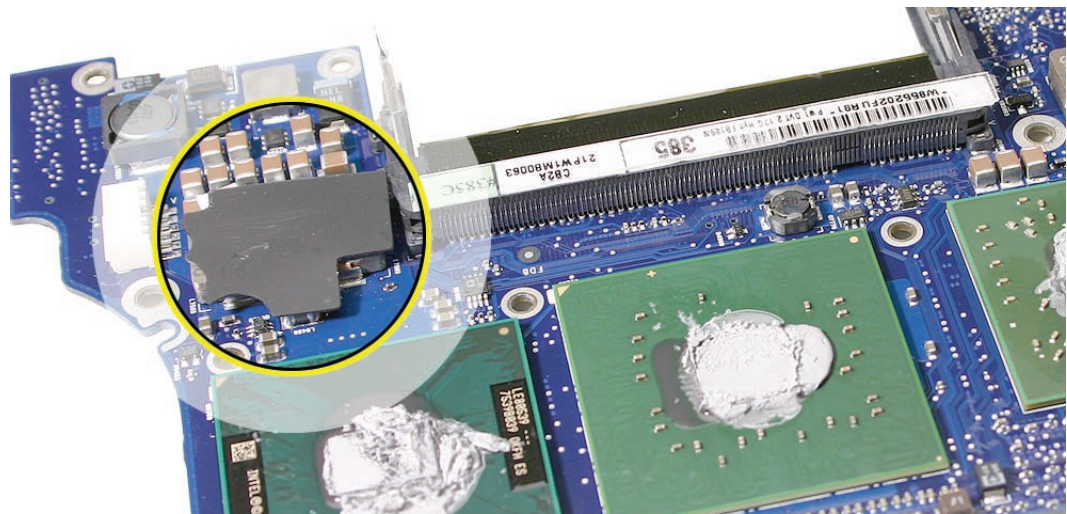
- Install EMI gaskets and tape on the ports from the gasket kit (076-1206)



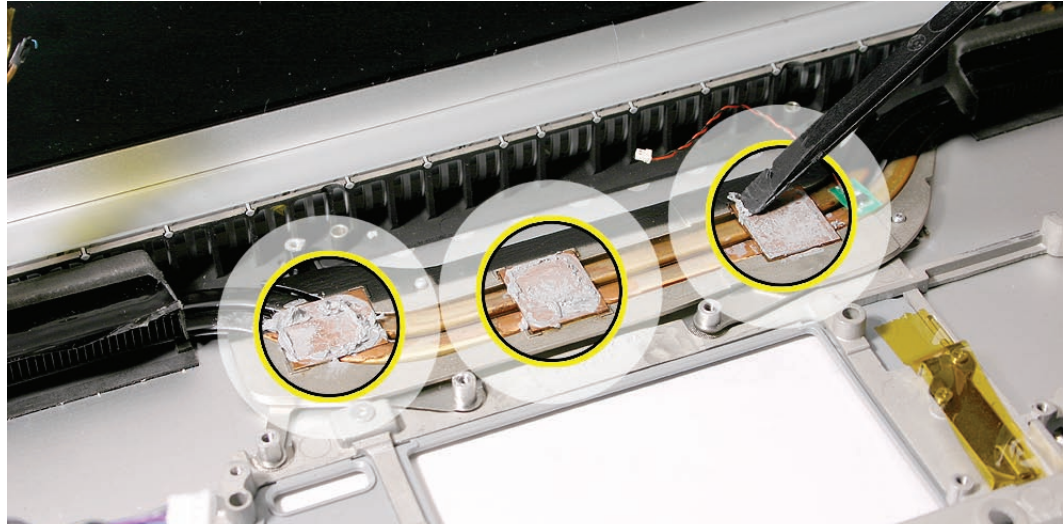
- Transfer the logic board sleeves to the replacement board, if needed.



4. • Transfer the cosmetic shield, if needed.

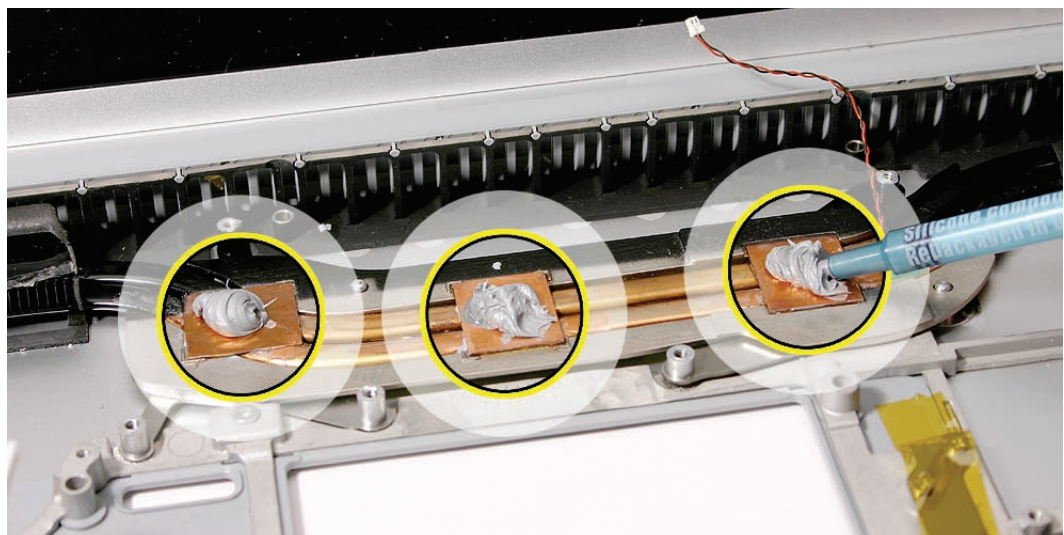


5. The thermal material must be replaced using the following procedures.  
**Warning: Whenever the logic board is separated from the heatsink, the thermal grease must be replaced. Failure to do so can cause the computer to overheat and be damaged.**
6. Use a black stick to remove as much thermal grease as possible from the heatsink.
7. Use an alcohol wipes to clean the mating surface.



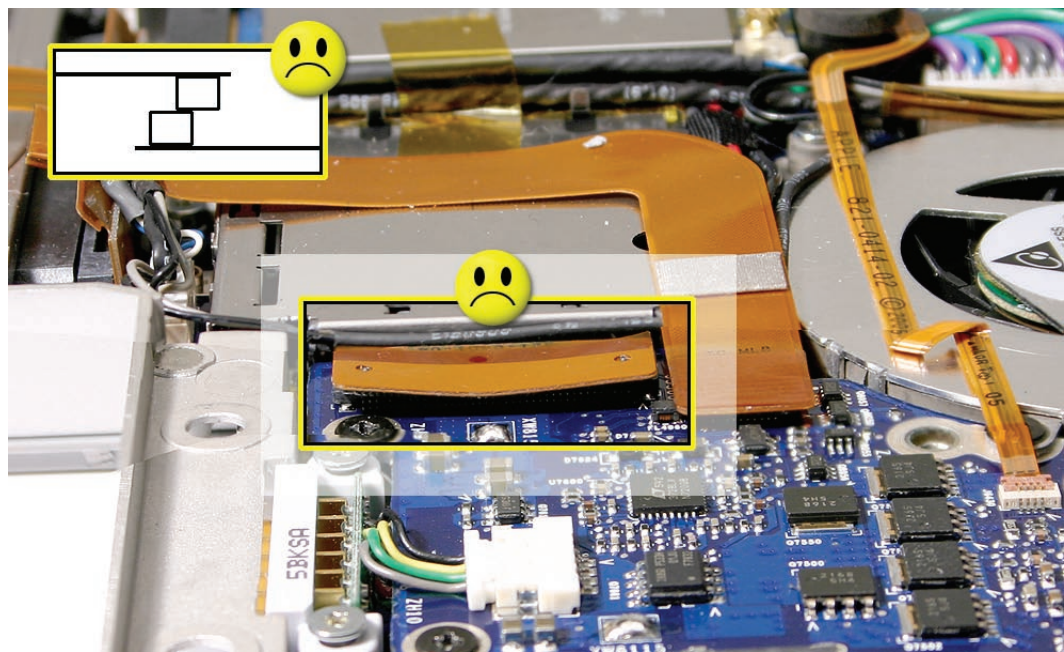
**Important: Avoid unnecessary contact with new thermal material, as dirt and body oils reduce the material's conductivity.**

8. Put a 0.2 - 0.3cc daub of thermal grease, in the center, on all three chip mating surfaces, as shown below.  
**Note:** One syringe of the thermal grease (922-7144) contains about 0.2 - 0.3 cubic centimeters (cc). So use one syringe per pad. If in doubt, use the picture below and apply a similar amount





9. When replacing the logic board:
  - Verify that the right speaker chamber is installed.
  - Verify that the two plastic screw guides are installed on the top of the board.
  - Connect the thermal sensor connector near the ports.
  - Guide the logic board's port side into the port openings on the bottom case.
  - While lowering the board, connect the cable under the board on the left side.
  - Verify that no cables are caught under the board when lowering into place.
10. Attach the logic board screws.
11. Verify that the ExpressCard cage flex connector is seated properly. If the connector on the flex is not lined up with the connector on the logic board, a bad connection with a characteristic bow, shown below, can occur.



12. Reassemble and test all ports, components and functions of the computer.

**Note:** After installing new thermal material, if you must briefly re-separate the logic board from the heatsink, it is OK to retain the same, new thermal material, as long as it is not handled excessively.





# Battery Cable Assembly

## Tools

This procedure requires the following tools:

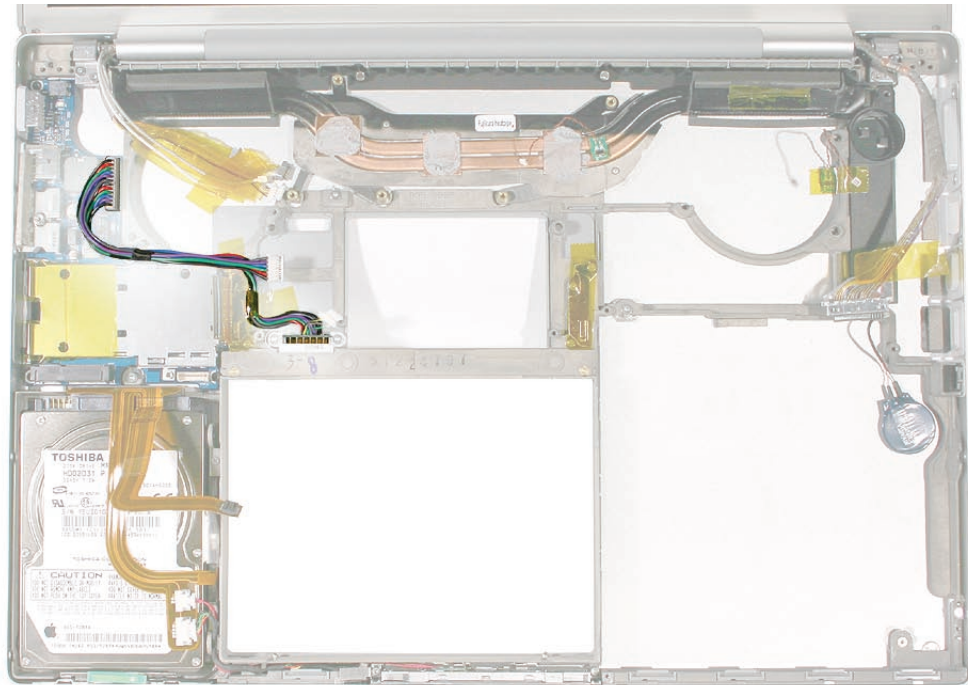
- Torx T6 screwdriver (magnetized)
- Black stick (nylon probe 922-5065) (or other non-conductive nylon or plastic flat-blade tool)

## Preliminary Steps

Before you begin, remove the following:

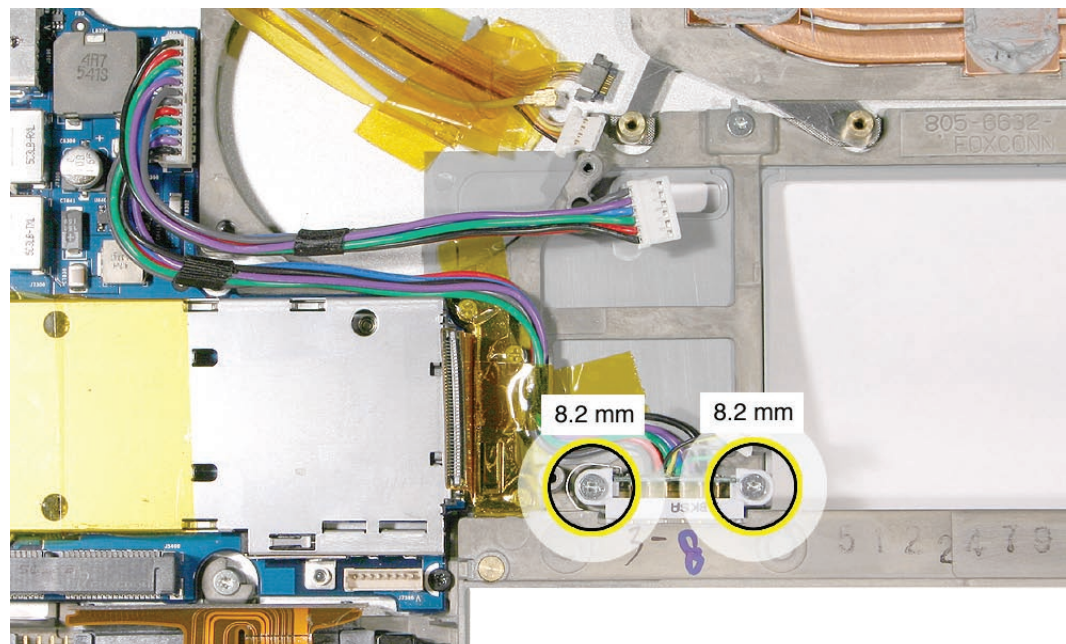
- [Battery](#)
- [Top Case](#)
- [AirPort Extreme Card](#)
- [Right Ambient Light Sensor Lens](#)
- [Speakers](#)
- [Fans](#)
- [Optical Drive](#)
- [Logic Board](#)

## Part Location

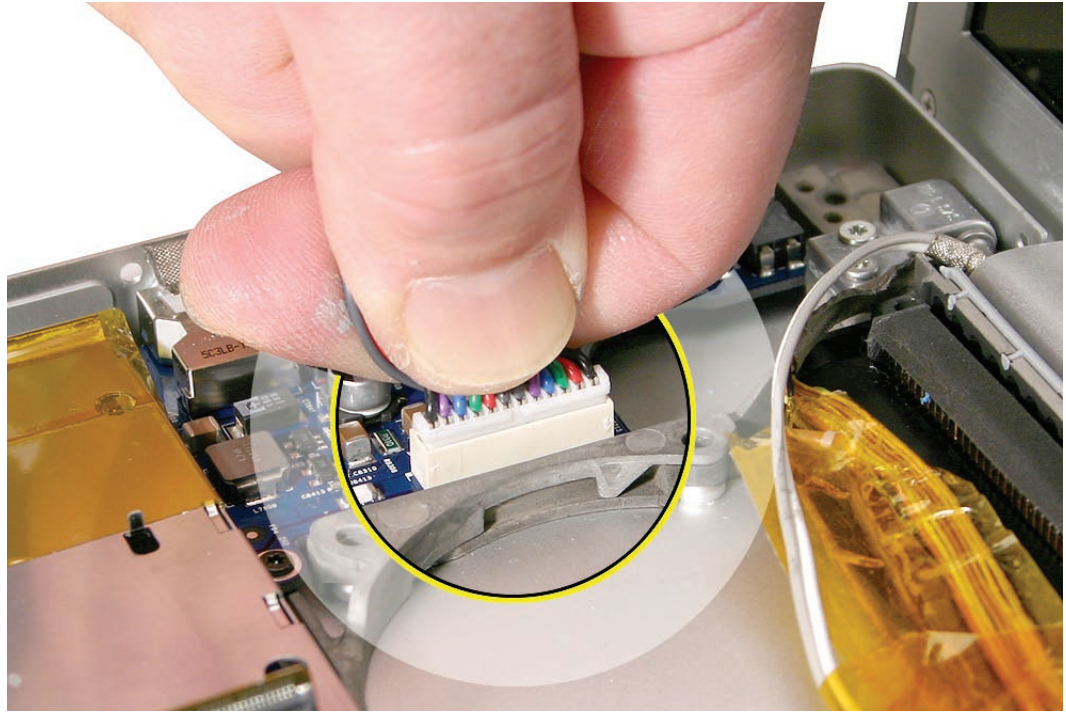


## Procedure

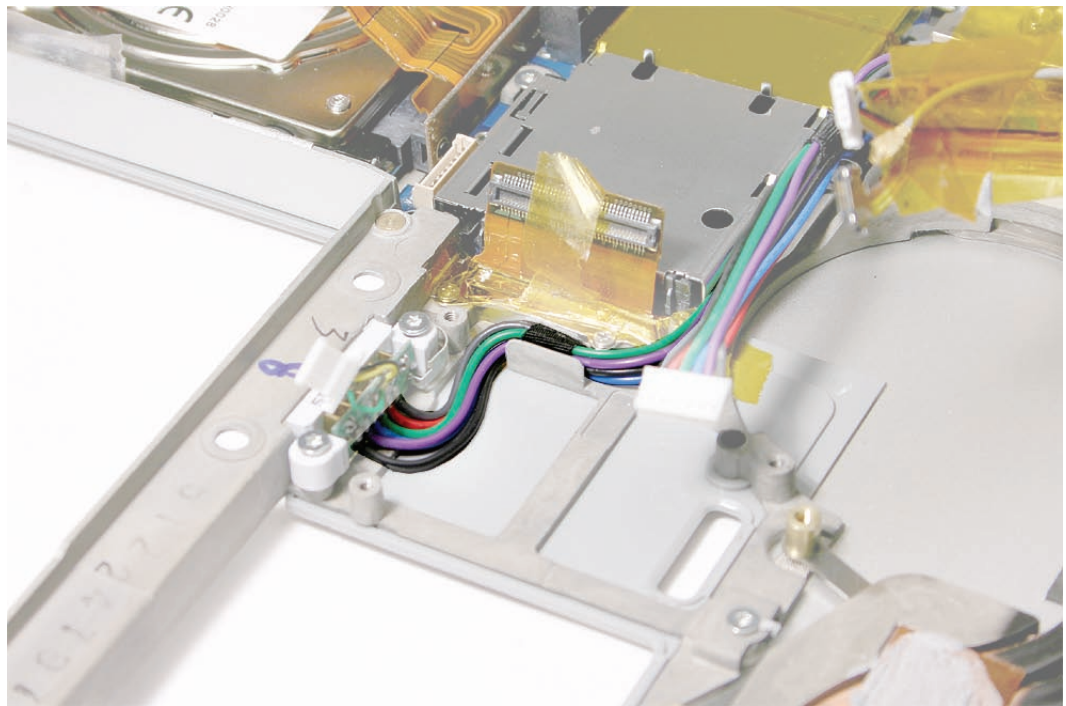
1. Remove the two screws..



2. Disconnect the connector on the DC-in/Sound board.



3. **Replacement Note:** Route cable as shown, and secure with Kapton tape in the channel.







# Thermal Sensors

## Tools

This procedure requires the following tools:

- Black stick (nylon probe 922-5065) (or other non-conductive nylon or plastic flat-blade tool)
- Razor knife
- Kapton tape (922-1731 (0.5-inch x 12-yard roll))
- Fine-point felt-tip permanent marker

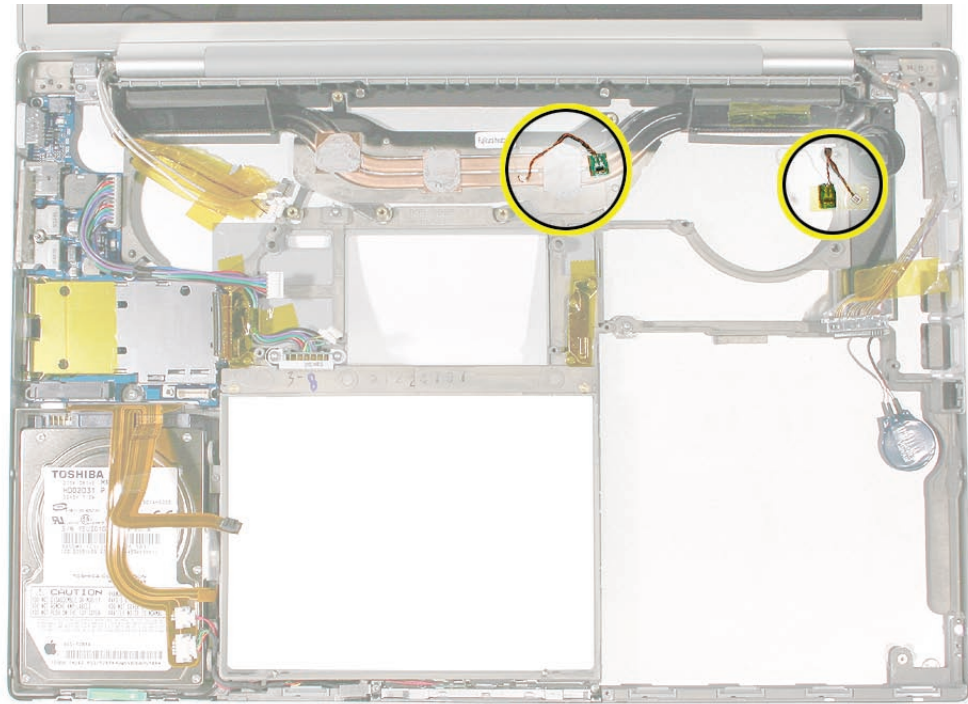
## Preliminary Steps

Before you begin, remove the following:

- [Battery](#)
- [Top Case](#)
- [Right Speaker](#)
- [Fans](#)
- [Optical Drive](#)
- [Logic Board](#)

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## Part Location



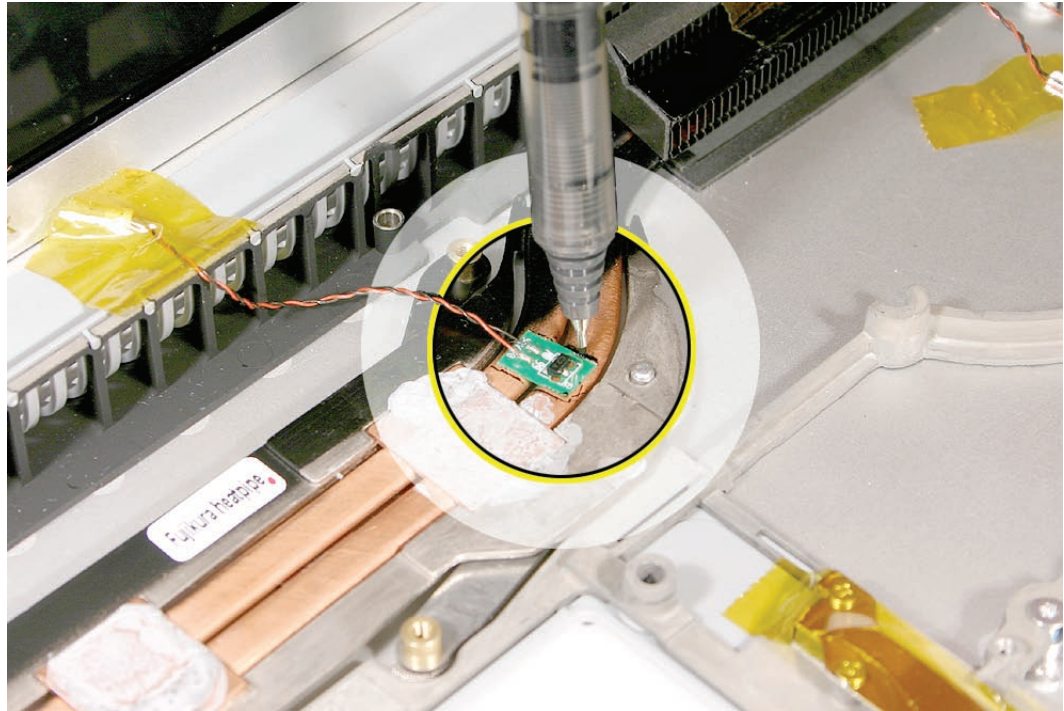
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## Procedure

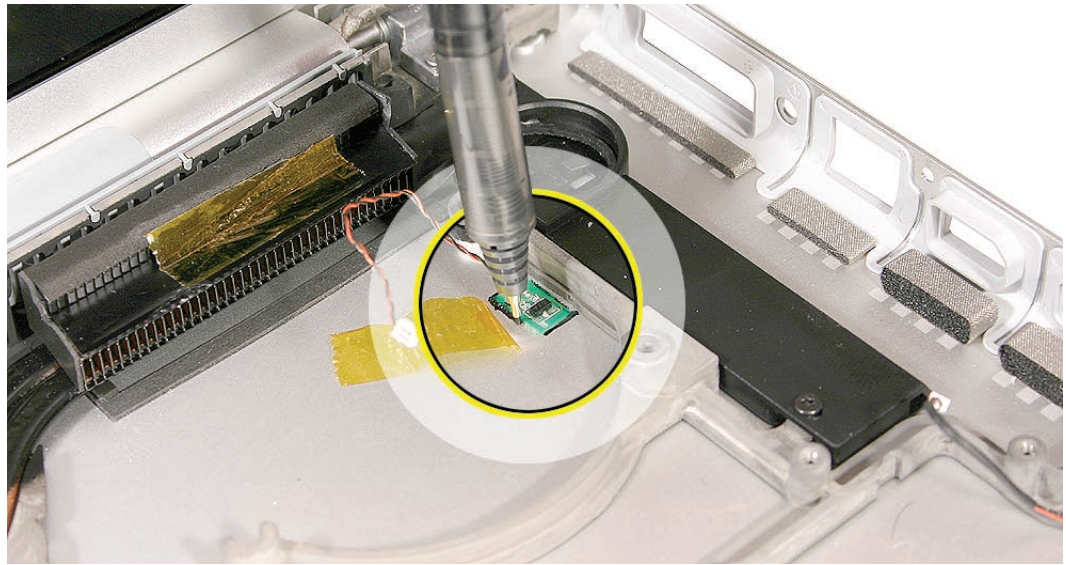
There are two thermal sensors, each requiring precise placement. One sensor is attached to the bottom case and one to the heatsink.

**Note:** The bottom case sensor has a 90 mm cable, and the heatsink sensor has a 60 mm cable.

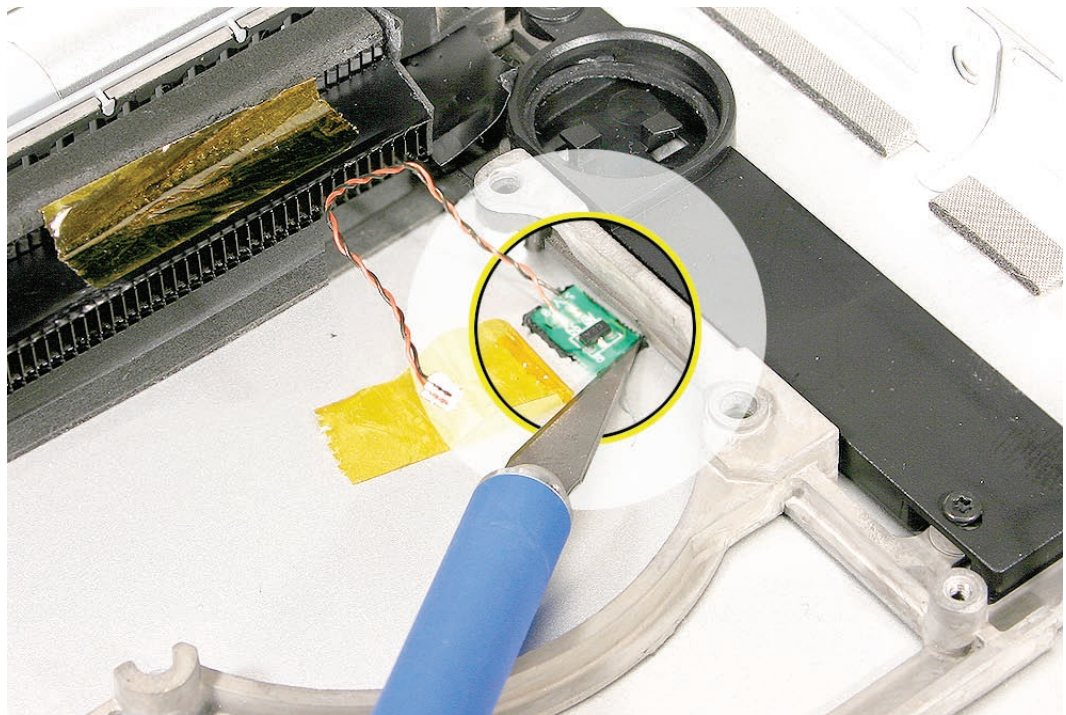
1. For either sensor, peel back any Kapton tape, then before removing the board, mark the outline of its position with a permanent fine-point felt-tip marker.







2. Pry up the sensor board with a razor knife.



3. Install the replacement sensors in the exact same location.
4. Replace any Kapton tape.



# Heatsink

## Tools

This procedure requires the following tools:

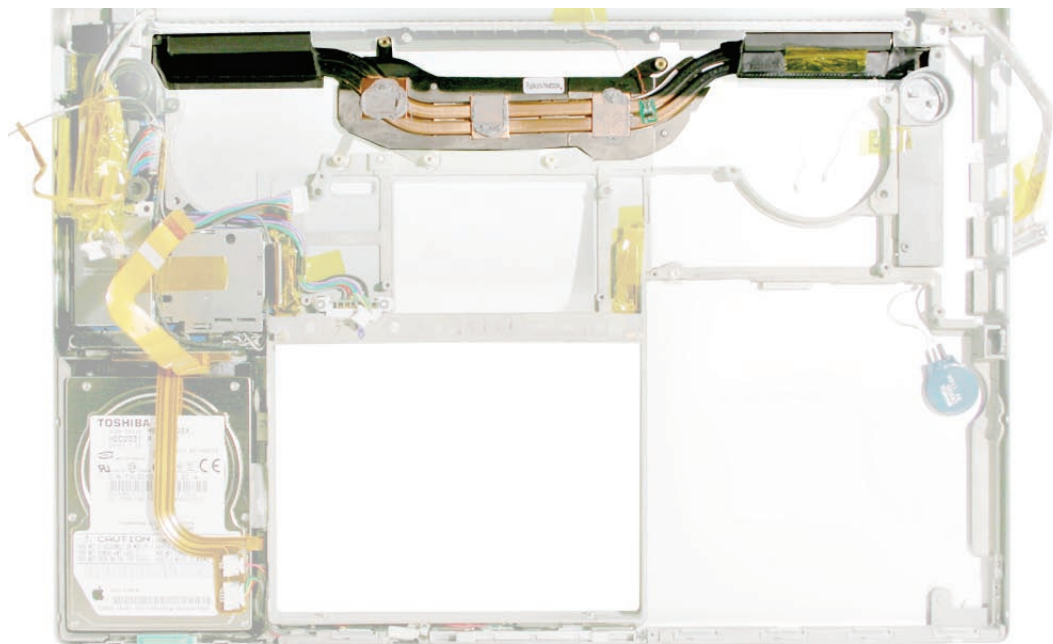
- Black stick (nylon probe 922-5065) (or other non-conductive nylon or plastic flat-blade tool)
- Thermal grease (922-7144)

## Preliminary Steps

Before you begin, remove the following:

- [Battery](#)
- [Top Case](#)
- [Right Speaker](#)
- [Right Ambient Light Sensor Lens](#)
- [Fans](#)
- [Optical Drive](#)
- [Logic Board](#)

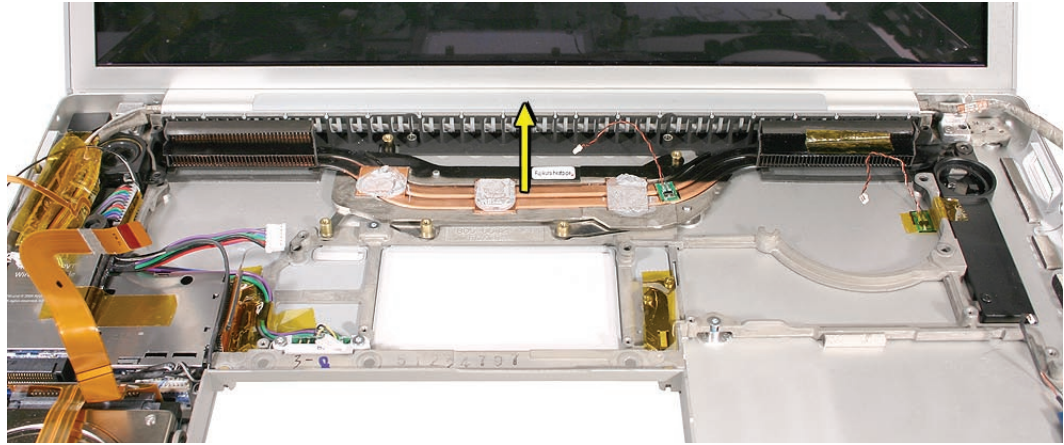
## Part Location



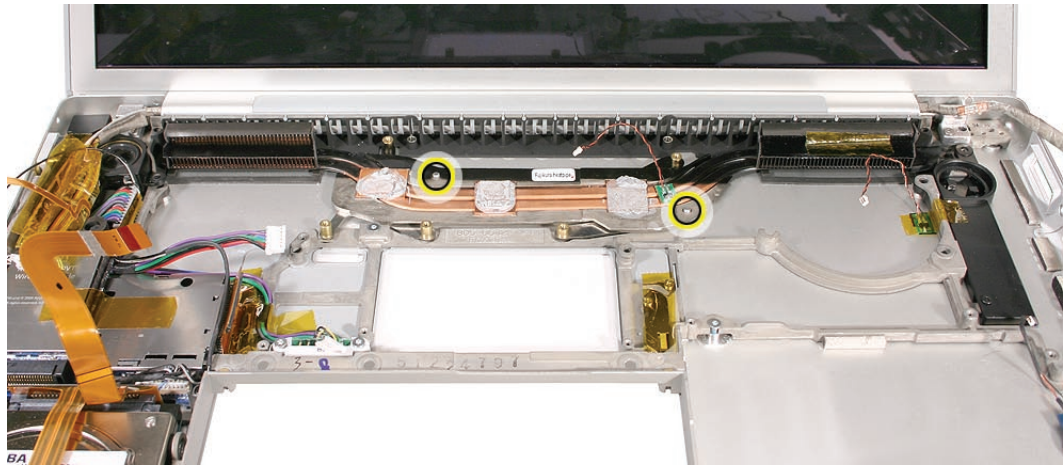
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## Procedure

1. Once the parts are removed in the preliminary steps, lift out the heatsink.



2. When installing the heatsink, make sure that it fits over the pins, shown, and lays flat.



3. Make sure to install new thermal grease as outlined in the logic board chapter.





# Right Speaker Chamber

## Tools

This procedure requires the following tools:

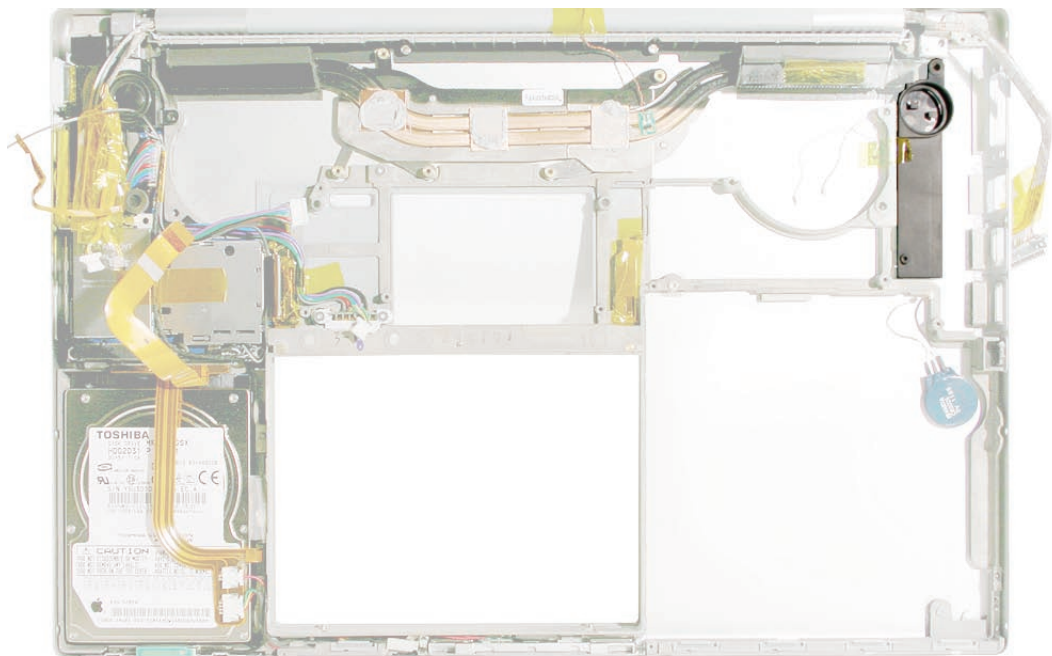
- Torx T6 screwdriver (magnetized)
- Black stick (nylon probe 922-5065) (or other non-conductive nylon or plastic flat-blade tool)

## Preliminary Steps

Before you begin, remove the following:

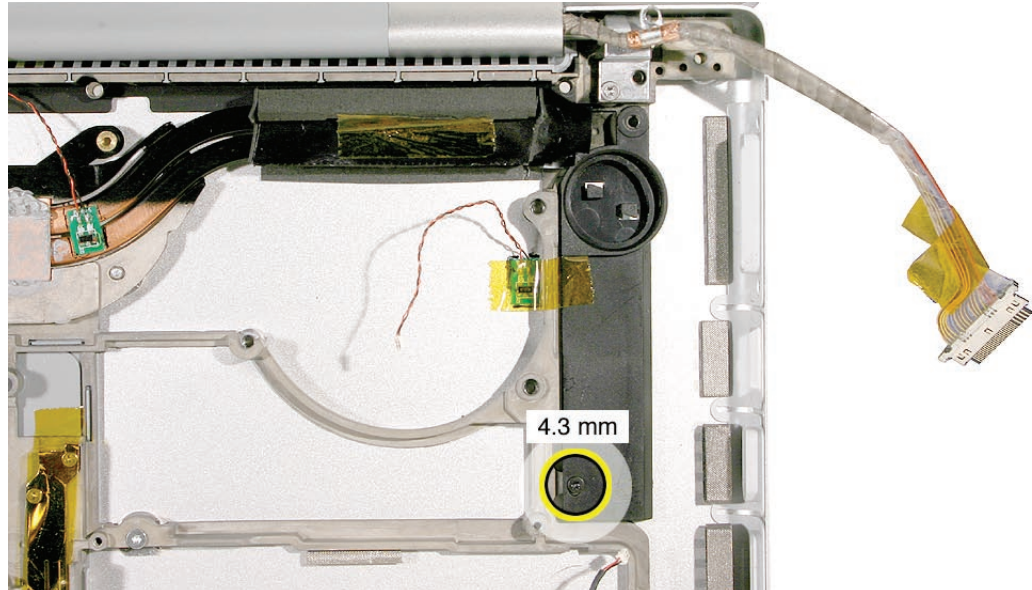
- [Battery](#)
- [Top Case](#)
- [Right Speaker](#)
- [Right Ambient Light Sensor Lens](#)
- [Fans](#)
- [Optical Drive](#)
- [Logic Board](#)

## Part Location

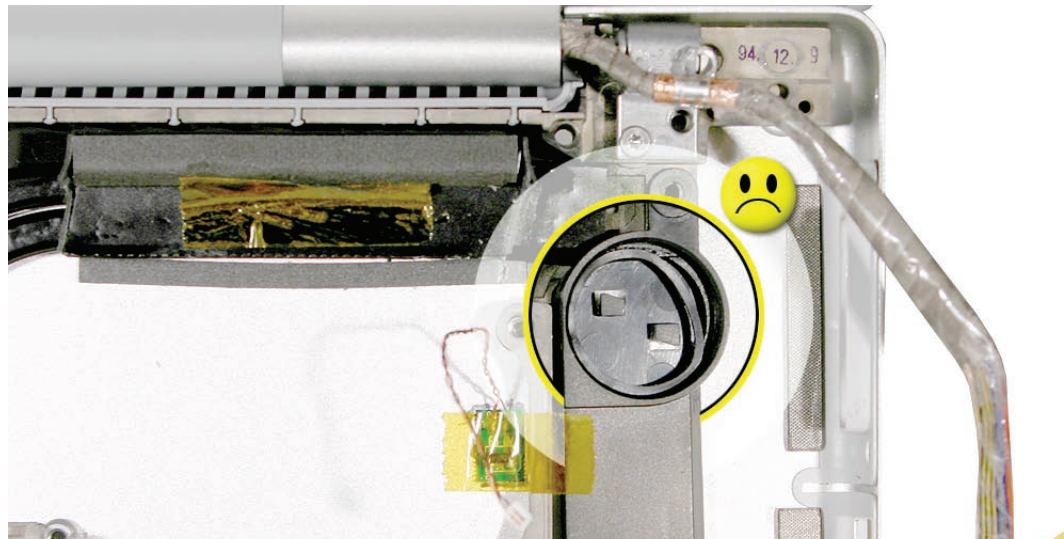


## Procedure

1. Remove the screw and lift out the speaker chamber. A light adhesive may be holding the chamber under the speaker holder.



2. When installing, adjust the gasket if needed so that it seats uniformly around the inside of the well.





## Left I/O Board

### Tools

This procedure requires the following tools:

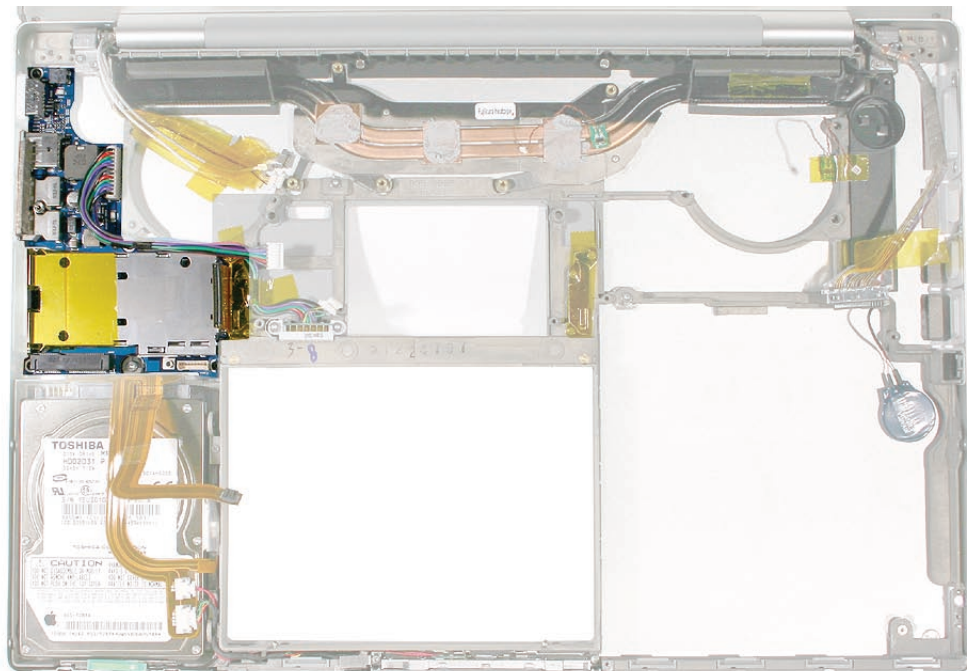
- Torx T6 screwdriver (magnetized)
- 4 mm socket wrench
- Black stick (nylon probe 922-5065) (or other non-conductive nylon or plastic flat-blade tool)

### Preliminary Steps

Before you begin, remove the following:

- [Battery](#)
- [Top Case](#)
- [AirPort Extreme Card](#)
- [Left Ambient Light Sensor](#)
- [Left Speaker](#)

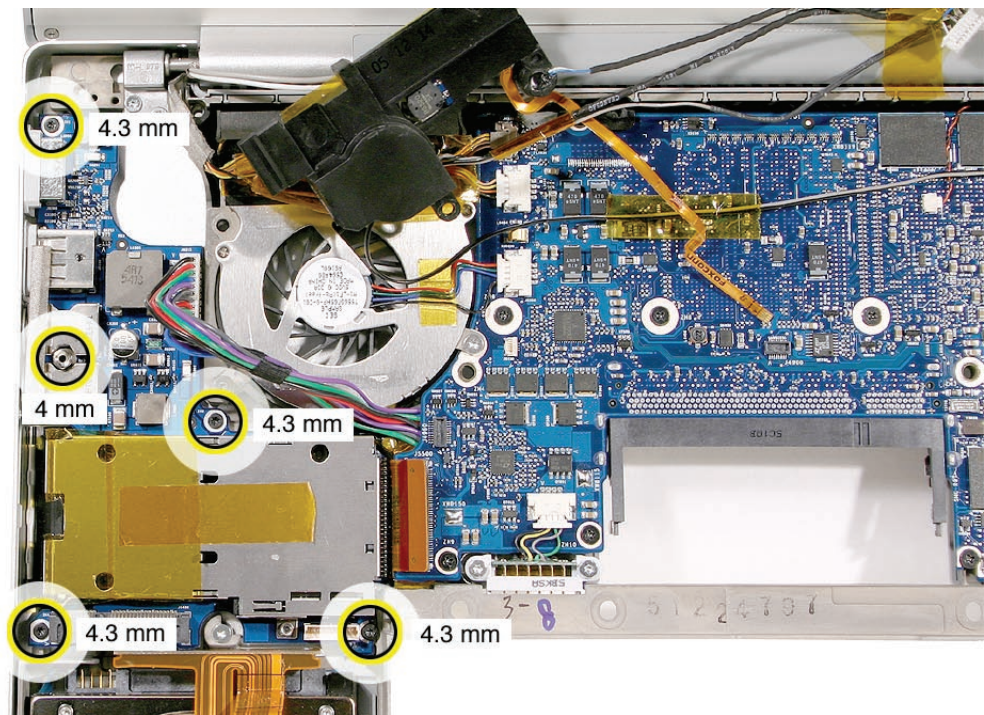
### Part Location



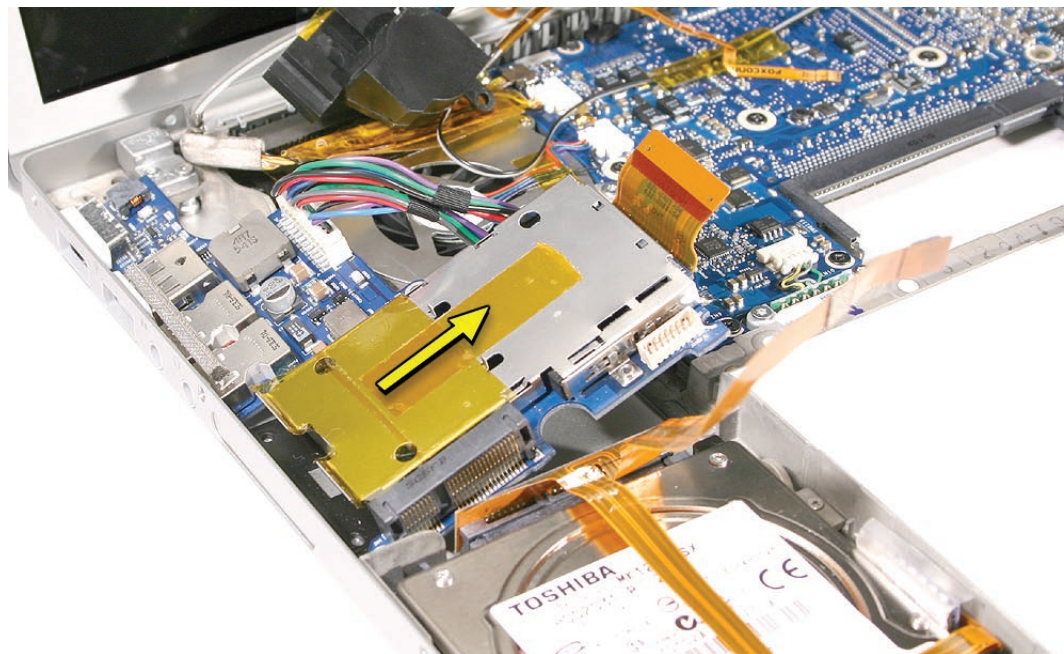


## Procedure

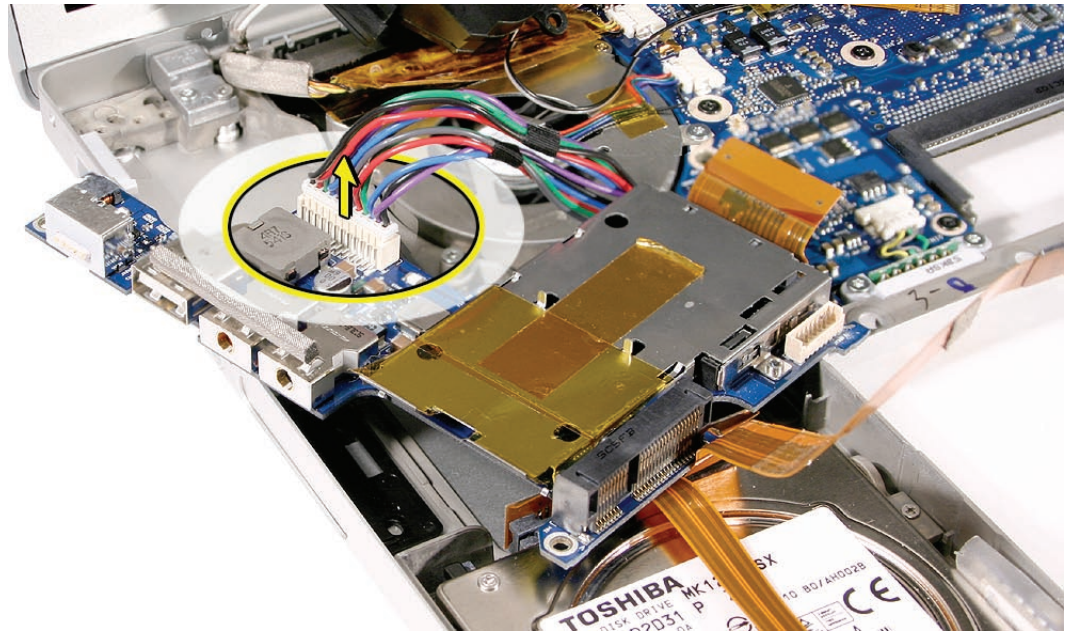
1. Remove the four screws and 4mm hex standoff.



2. Lift the board assembly and slide away from the port openings.

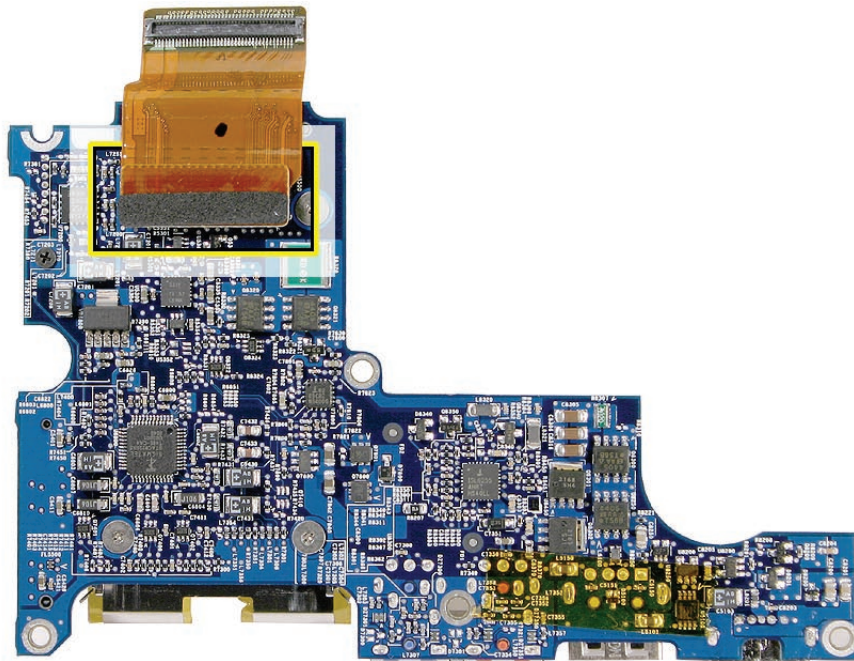


3. Disconnect the cable.



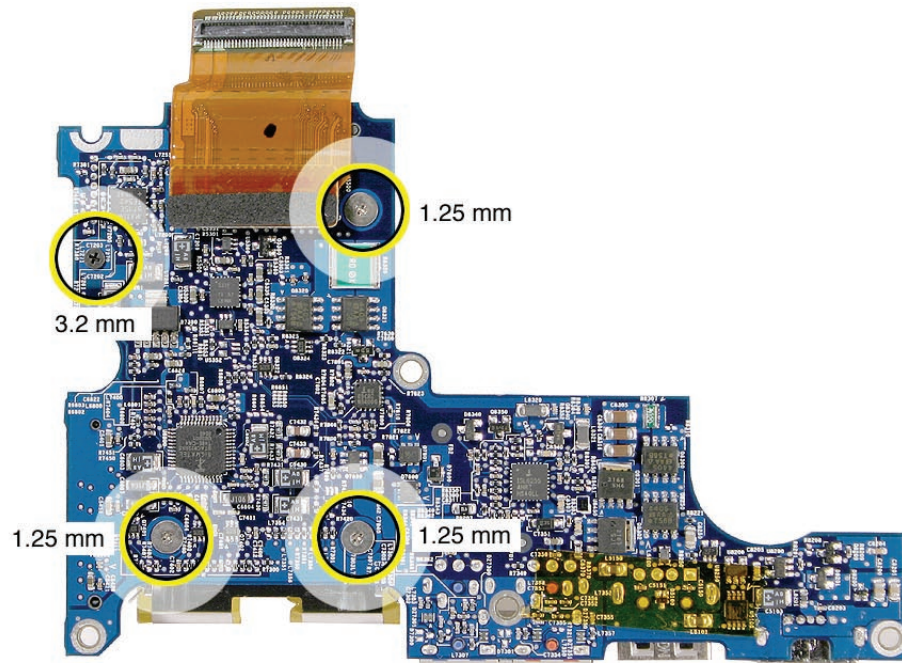
**Note:** The ExpressCard cage is attached to the left I/O board.

4. Disconnect the flex cable.

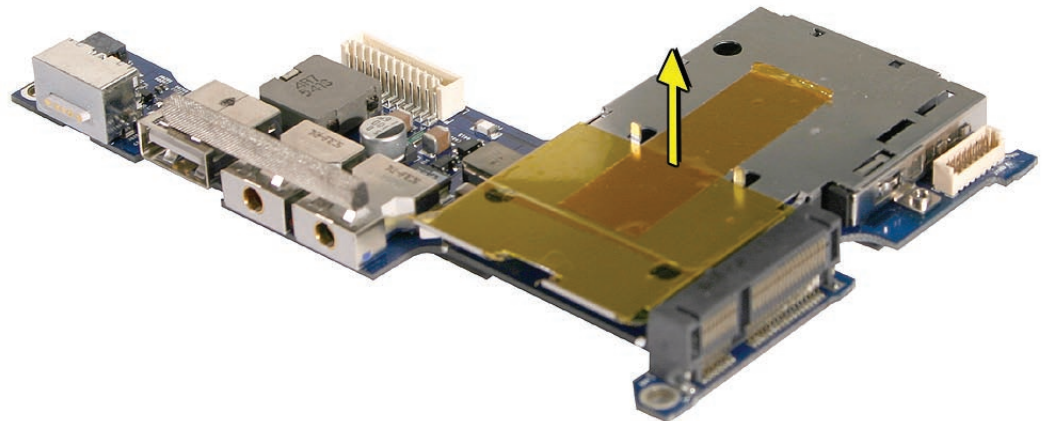




5. Remove the four screws.

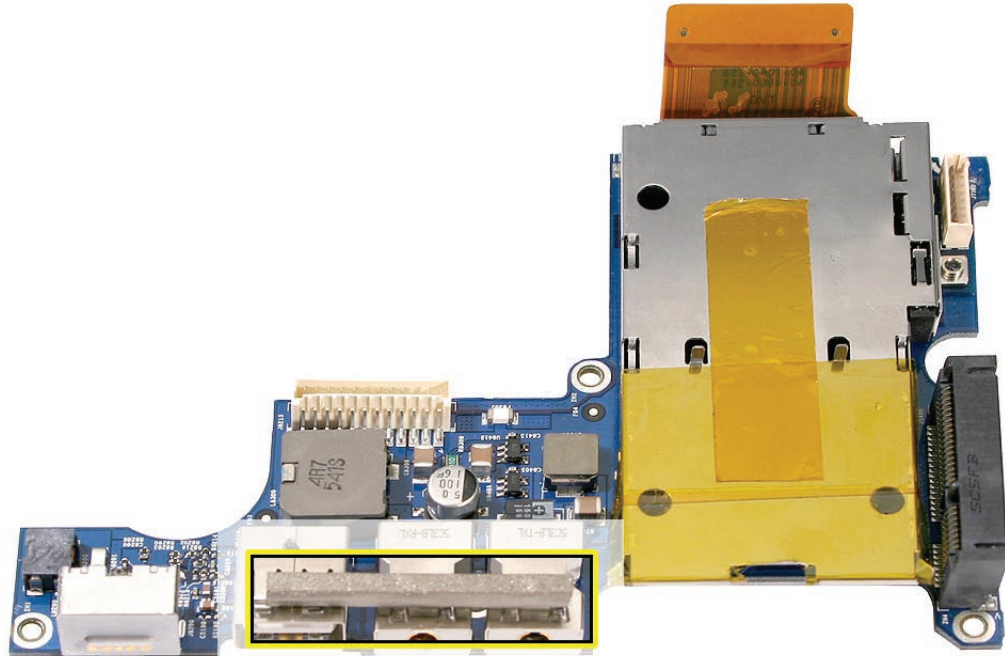


6. Lift off the card cage.

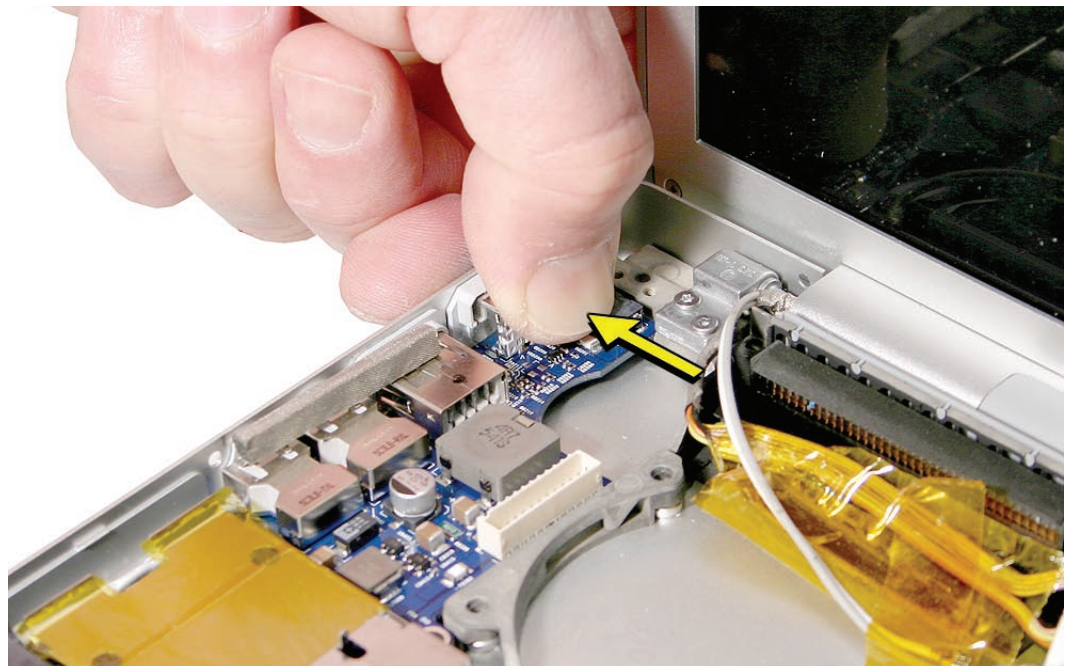




7. **Replacement Note:** Install the EMI gasket.



8. **Replacement Note:** When the board is in place and the ports are seated, hold the power adapter port tightly against the port opening while installing screws.



9. **Replacement Note:** After securing the board, exercise the ExpressCard slot door to verify clearance.



# ExpressCard Cage

## Tools

This procedure requires the following tools:

- #0 Phillips screwdriver (magnetized)

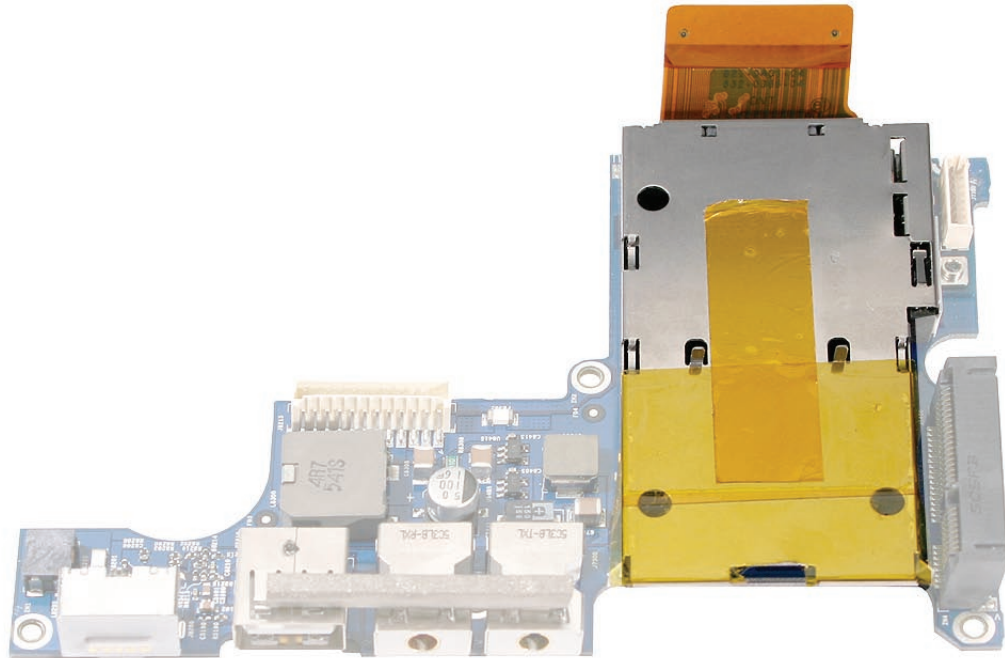
## Preliminary Steps

Before you begin, remove the following:

- [Battery](#)
- [Top Case](#)
- [AirPort Extreme Card](#)
- [Left Ambient Light Sensor](#)
- [Left Speaker](#)
- [Left I/O Board](#)

---

## Part Location



## Procedure

See the [Left I/O Board](#) chapter for removal of the ExpressCard cage.





# Bottom Case

## Tools

This procedure requires no tools.

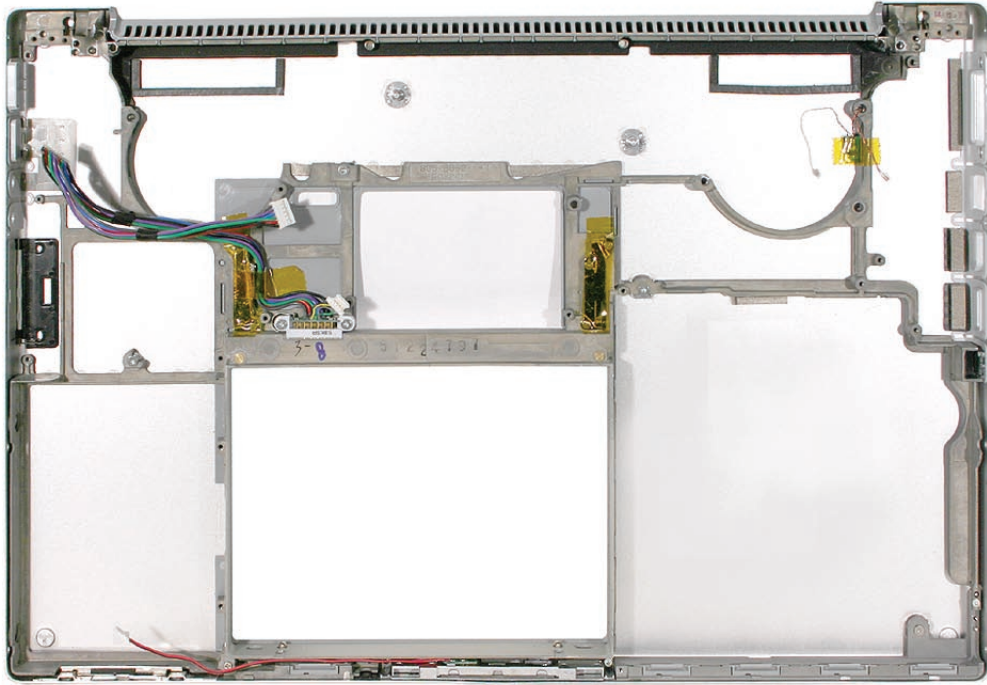
## Preliminary Steps

Before you begin, remove the following:

- [Battery](#)
- [Top Case](#)
- [AirPort Extreme Card](#)
- [Left Ambient Light Sensor](#)
- [Right Ambient Light Sensor Lens](#)
- [Speakers](#)
- [Fans](#)
- [Hard Drive](#)
- [Bluetooth](#)
- [Infrared Board](#)
- [Optical Drive](#)
- [Backup Battery](#)
- [Logic Board](#)
- [Left I/O Board](#)
- [Right Speaker Chamber](#)
- [Heatsink](#)
- [Display Assembly](#)

---

## Part Location



## Procedure

After the parts are removed in the preliminary steps, disconnect and remove the hard drive/ bluetooth/IR flex cable from the sleep LED cable. What's left is the bottom case..



# Display Assembly

## Tools

This procedure requires the following tools:

- Torx T6 screwdriver (magnetized)
- Black stick (nylon probe 922-5065) (or other non-conductive nylon or plastic flat-blade tool)

## Preliminary Steps

Before you begin, remove the following:

- [Battery](#)
- [Top Case](#)

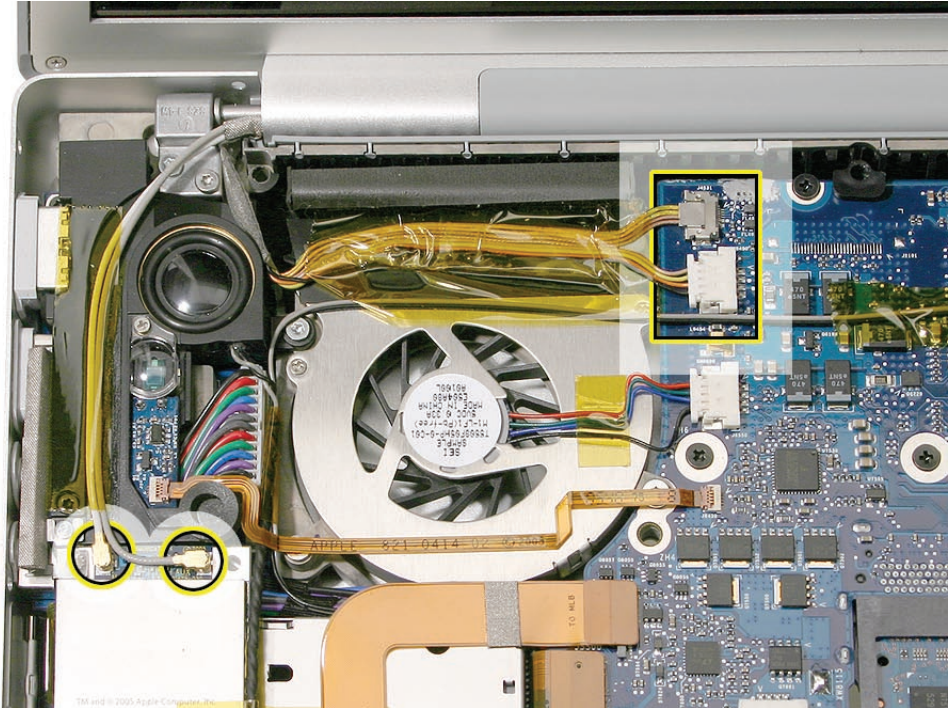
## Part Location



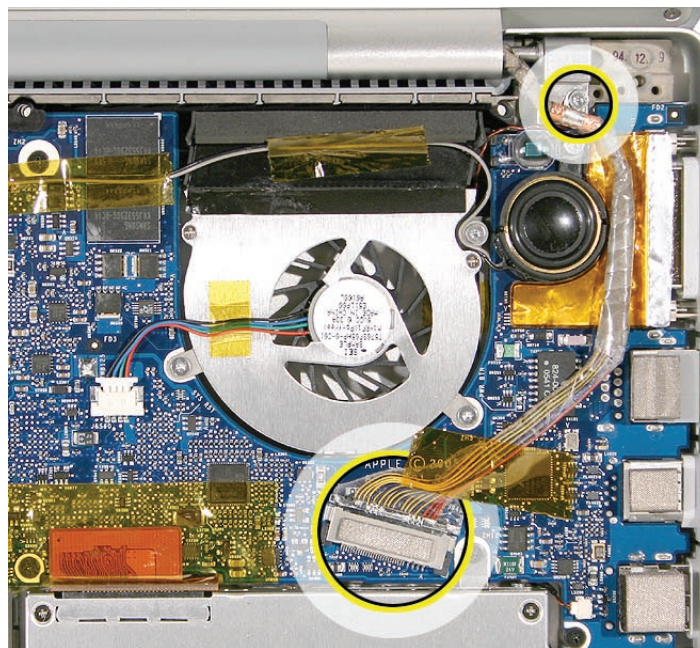


## Procedure

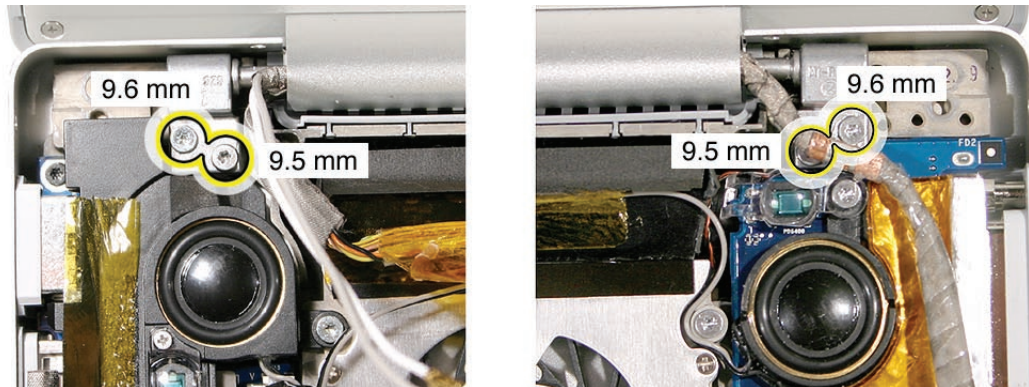
1. Disconnect two antenna connectors. Lift straight up. Peel up Kapton tape to free.
2. Disconnect two cable connectors.



3. Disconnect the LVDS cable.



4. Move the display to a 90-degree angle and remove the four clutch screws.  
**Important:** Support the display from falling over before removing the last screw.



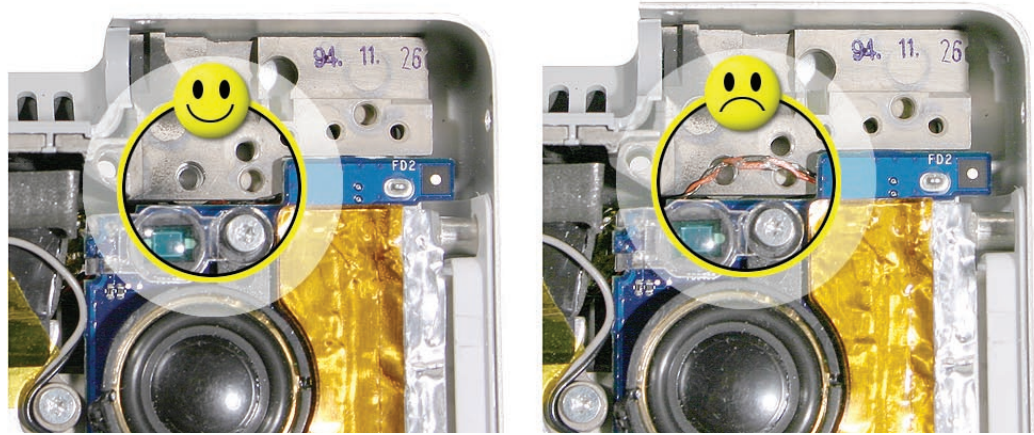
5. Lift the display straight up and off of the computer without catching wires.



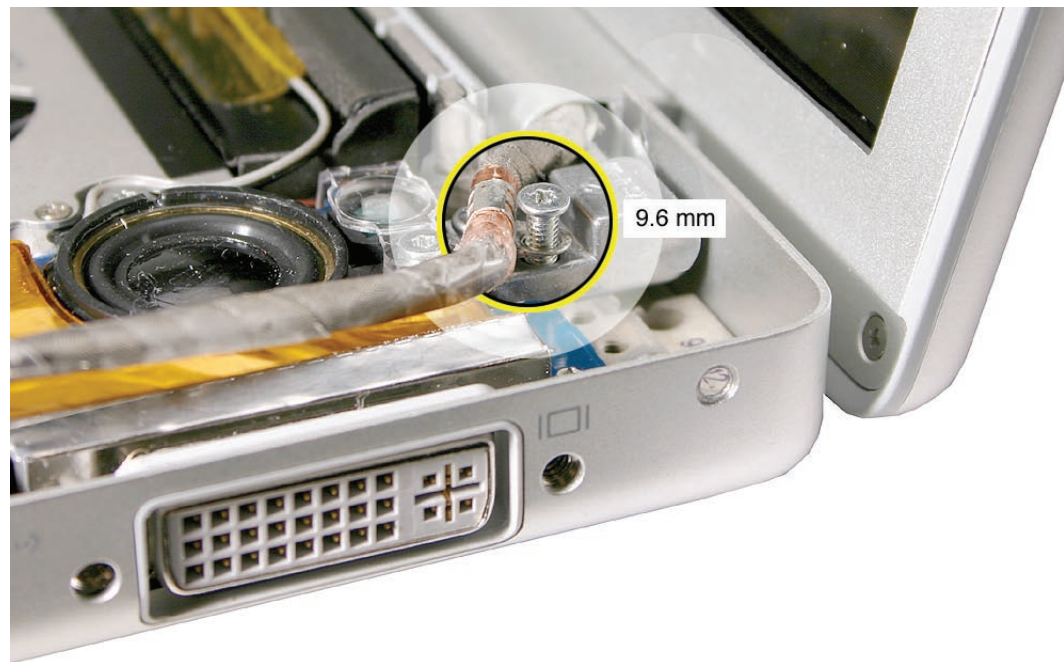


## Replacement Procedure

1. Before installing the display panel assembly, verify that all cables are routed out of the way.



2. Install the replacement display panel assembly.
3. Make sure to capture the LVDS cable grounding loop with the back screw.





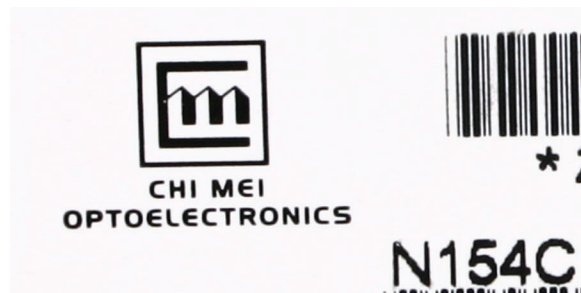
- 
4. Verify that the LVDS cable is secure and lays flat.
  5. Reassemble and test the computer.
  6. Testing the computer should include:
    - Testing that the display panel functions properly.
    - Use Apple System Profiler to check that the AirPort Extreme card is recognized, and test that AirPort Extreme is working.
    - Check the camera function.
    - Check that the trackpad and keyboard function properly.
    - Operate the computer in a darkened room to check for keyboard backlight function.



## Display Rear Housing

**Warning:** If replacing the Display Rear Housing, the correct housing must be ordered to match the installed [Display Panel](#), or damage can result.

Before ordering, remove the rear housing and check the manufacturer of the display panel, such as Samsung or Chi Mei—the name will be on a label somewhere on the back (examples shown below). Order the rear housing for the display panel manufacturer, only.



---

## Tools

This procedure requires the following tools:

- #0 Phillips screwdriver (magnetized)
- Black stick (nylon probe 922-5065) (or other non-conductive nylon or plastic flat-blade tool)

## Preliminary Steps

Before you begin, remove the following:

- [Battery](#)
- [Top Case](#)
- [Display Assembly](#)

## Part Location





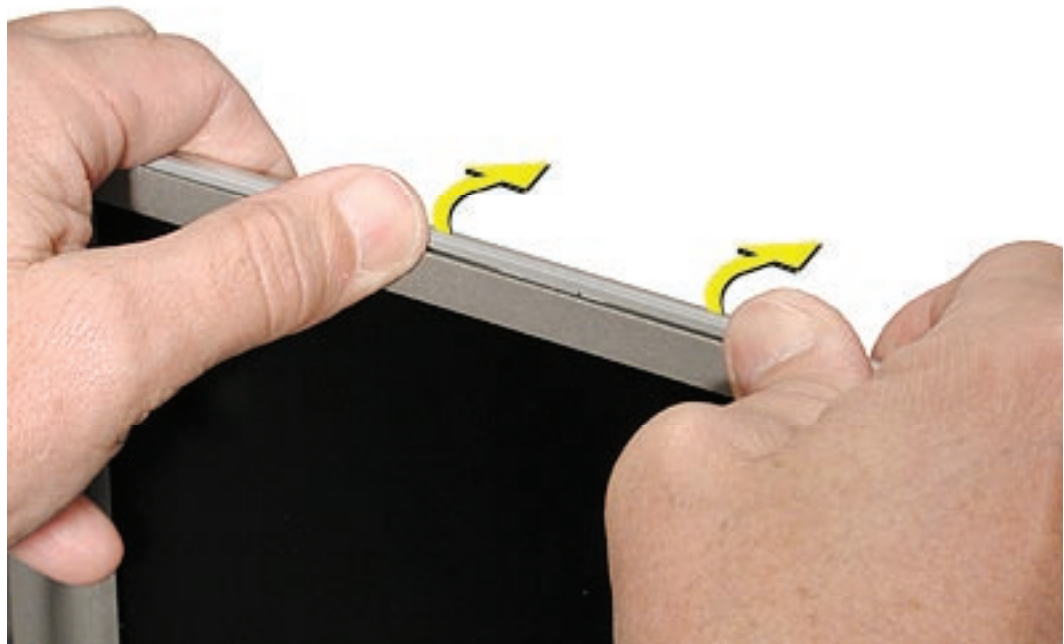
---

## Procedure

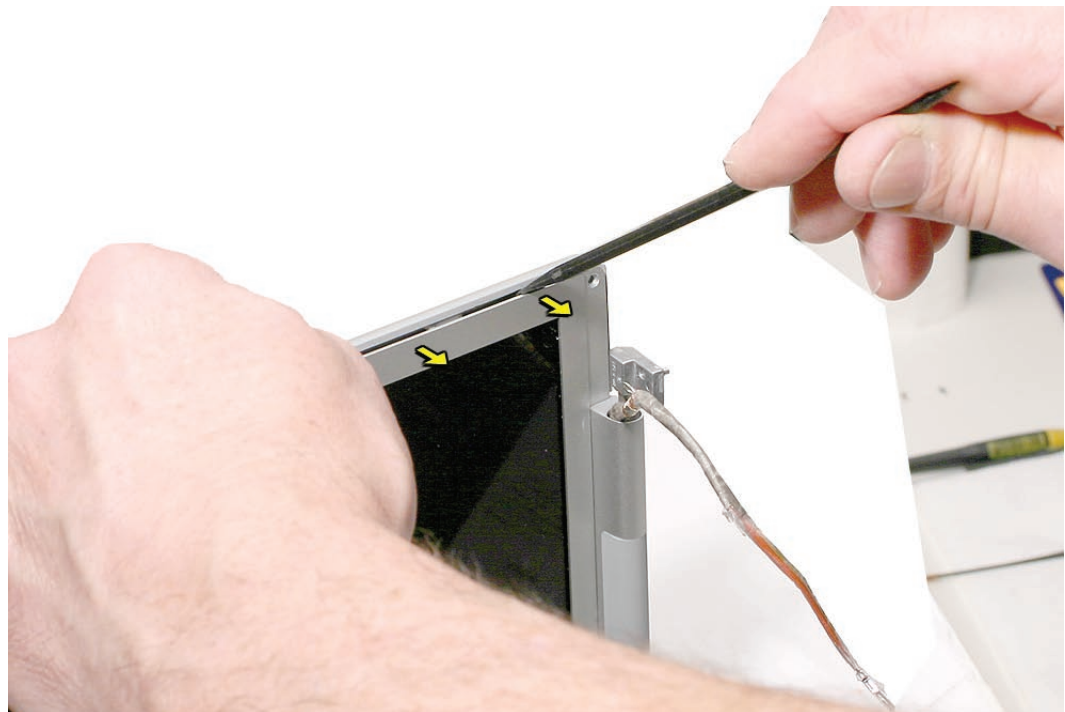
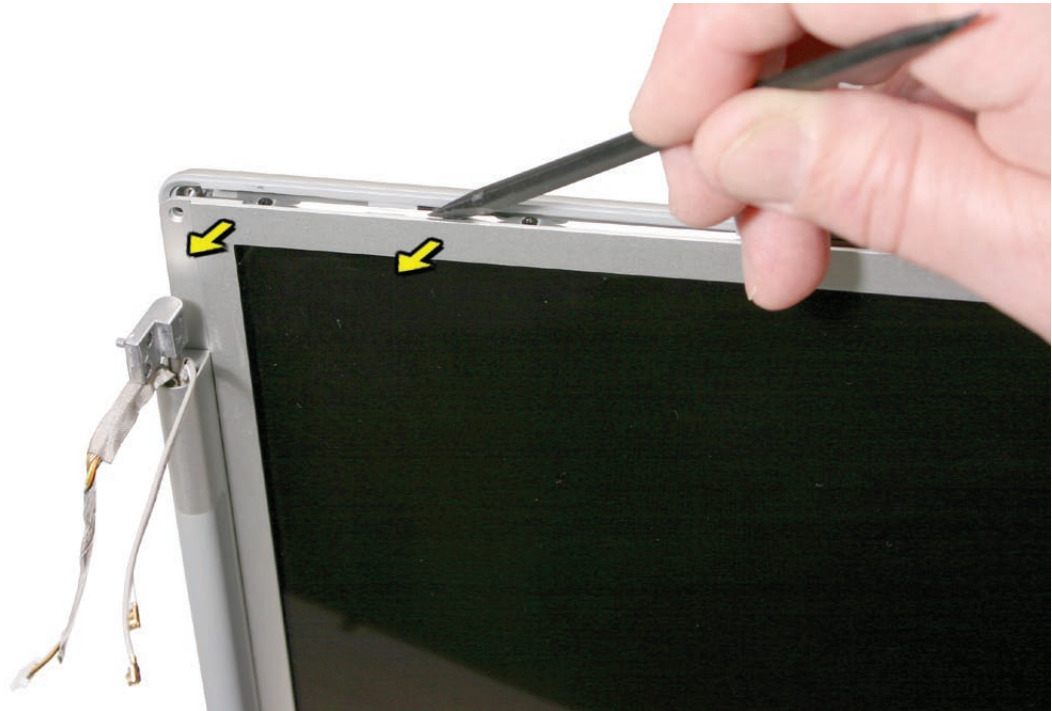
1. Remove two screws.



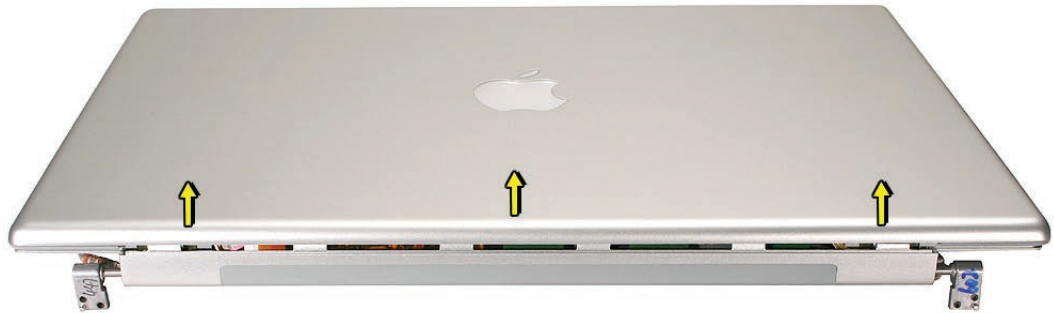
2. Hold the display assembly up on one side and firmly push (near the middle) with your thumbs on the edge bead to disengage the rear housing from tabs on the side of the bezel. **Note:** You will not fully disengage the housing from the bezel at this point.
3. Repeat this process on the other side of the display. **Note:** If one side will not release, work from the other side.



- 
4. Use a black stick to carefully work around the clutch-side corners on both sides.  
**Important:** The grey trim bead is part of the rear housing. Make sure to work the black stick on the correct side of the bead



- 
5. Lift up on the bottom of the display housing to completely release it from the clutch cover and bottom corners.



6. Once the clutch cover side is free, use a black stick to pry up the housing at the top of the assembly on both sides, then move it forward to free catches at the top, and lift off.



## Replacement Procedure

**Warning:** If replacing the Display Rear Housing, the correct housing must be ordered to match the installed Display Panel, or damage can result.

Before ordering, remove the rear housing and check the manufacturer of the display panel, such as Samsung or Chi Mei—the name will be on a label somewhere on the back (examples shown earlier). Order the rear housing for the display panel manufacturer, only.

Reassemble in the reverse sequence. Make sure the housing is securely snapped together on all sides.





# Display Hooks

## Tools

This procedure requires the following tools:

- #0 Phillips screwdriver (magnetized)

## Preliminary Steps

Before you begin, remove the following:

- [Battery](#)
- [Top Case](#)
- [Display Assembly](#)
- [Display Rear Housing](#)

## Part Location



---

## Procedure

1. Remove two screws for each hook mechanism.





# Sleep Magnet

## Tools

This procedure requires the following tools:

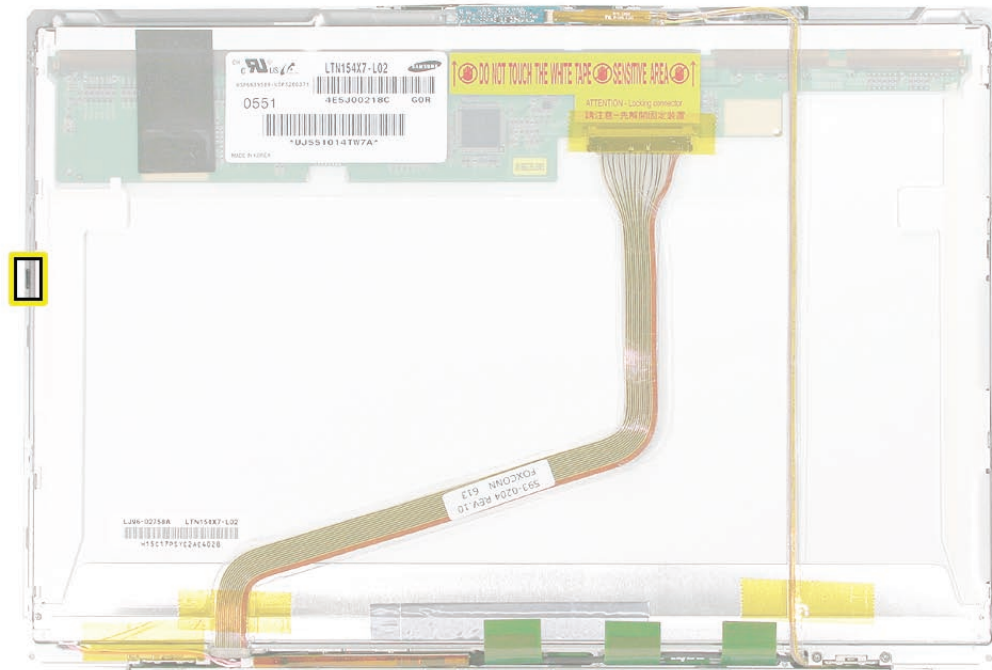
- #0 Phillips screwdriver (magnetized)

## Preliminary Steps

Before you begin, remove the following:

- [Battery](#)
- [Top Case](#)
- [Display Assembly](#)
- [Display Rear Housing](#)

## Part Location





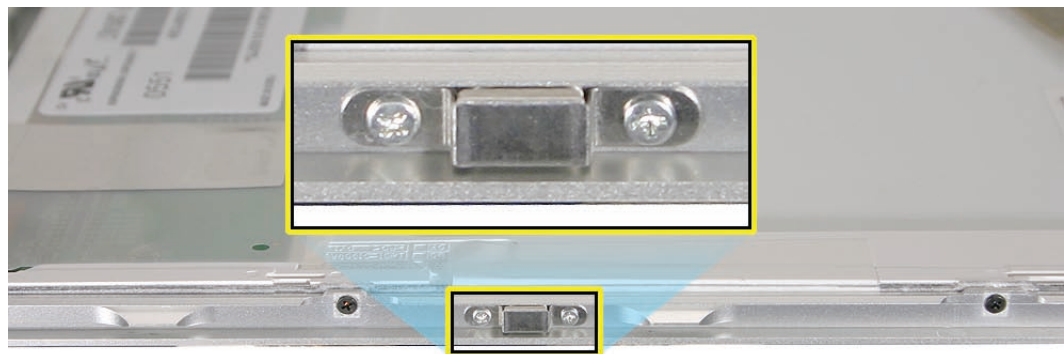
---

## Procedure

1. Remove two screws.
2. Remove the bracket and magnet.



3. **Replacement Note:** Make sure that the bracket's overhang is oriented away from the bezel to prevent the magnet from sliding out.





# Inverter Board

**Note:** The inverter cable is a separate assembly that includes the camera cable and can be removed by following the procedures in the [Clutch Cover](#) chapter.

## Tools

This procedure requires the following tools:

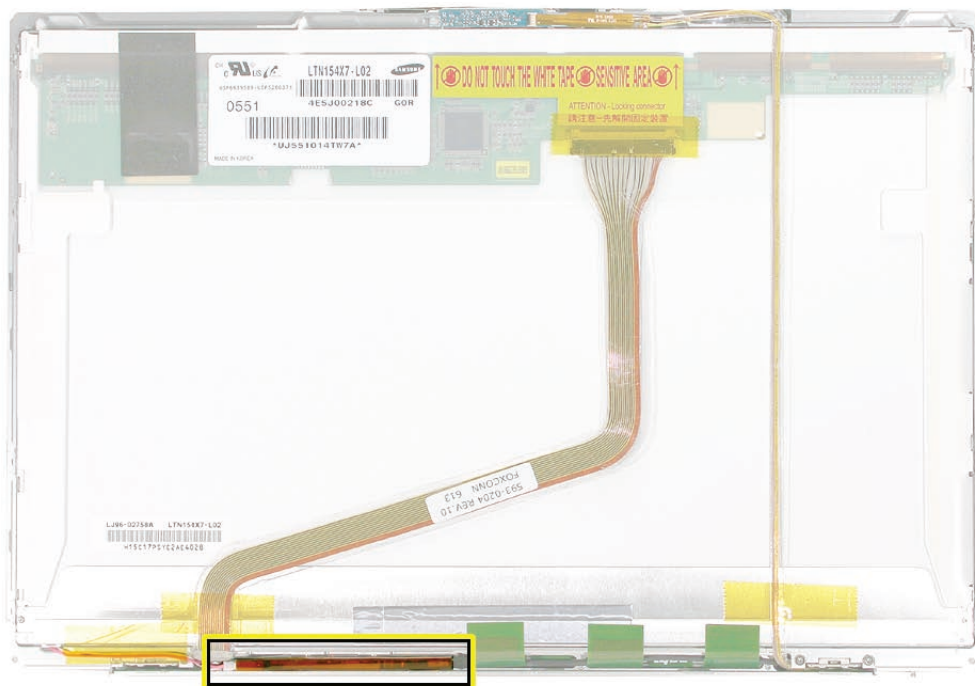
- Black stick (nylon probe 922-5065) (or other non-conductive nylon or plastic flat-blade tool)

## Preliminary Steps

Before you begin, remove the following:

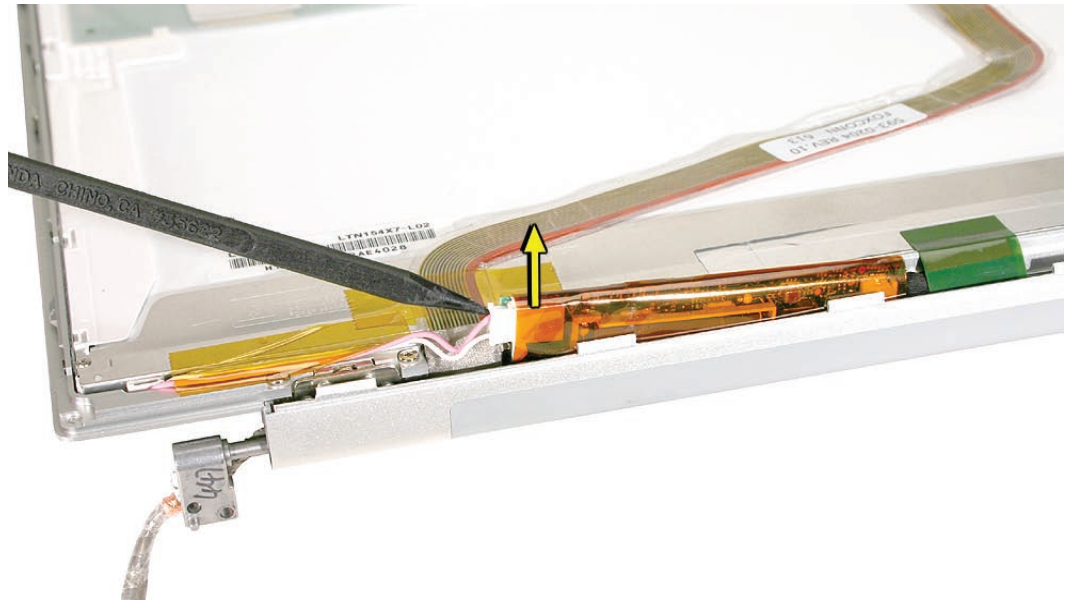
- [Battery](#)
- [Top Case](#)
- [Display Assembly](#)
- [Display Rear Housing](#)

## Part Location

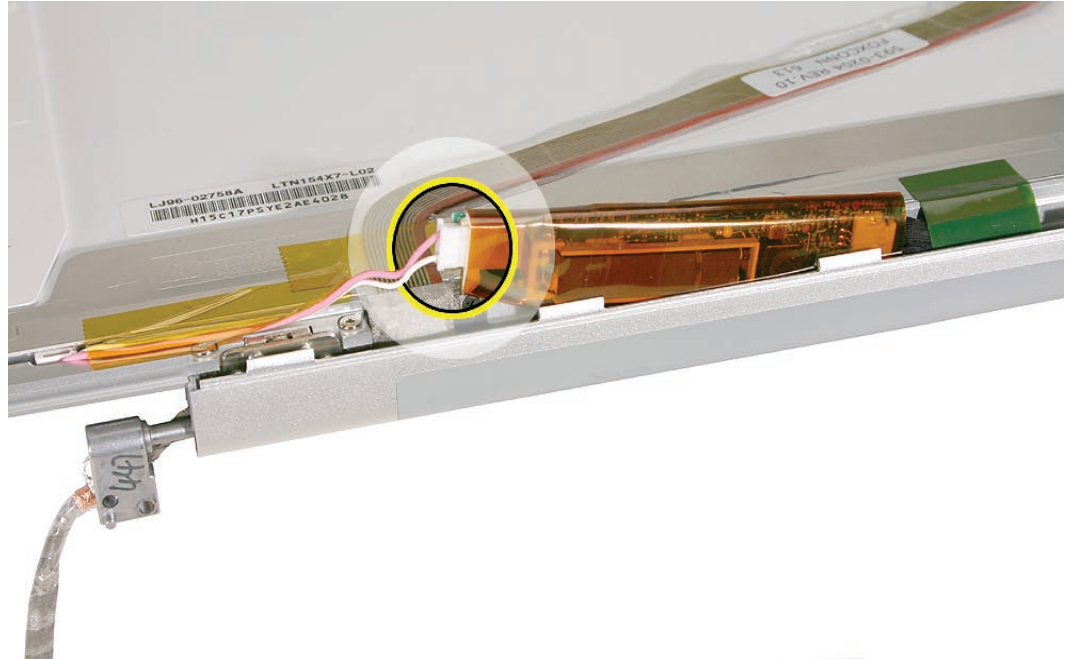


## Procedure

1. Lift the left side of the inverter.

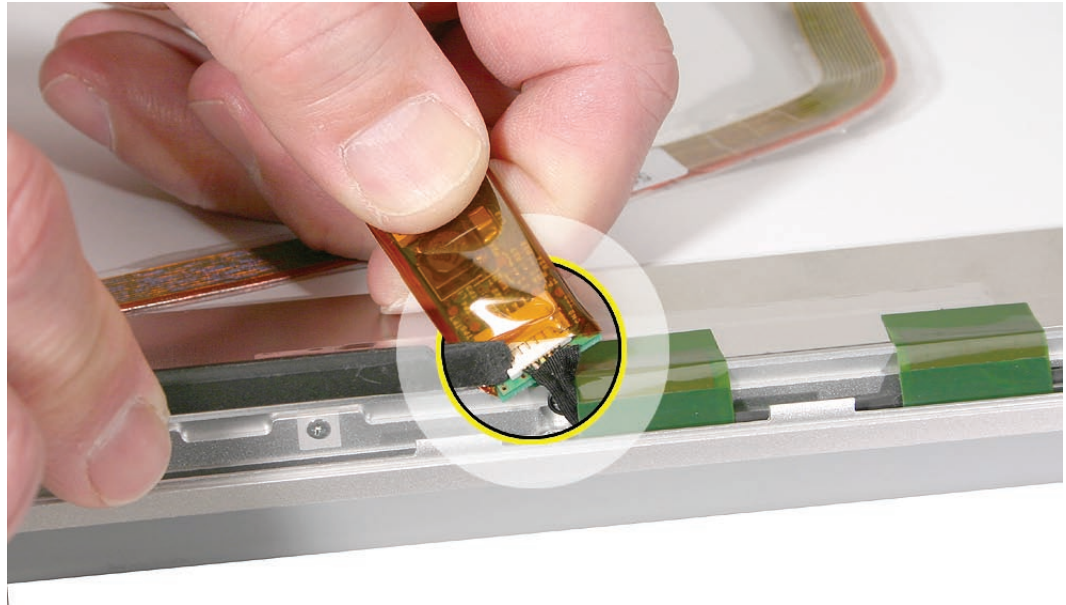


2. Disconnect the connector. Peel back Kapton tape as needed.





3. Lift the inverter and disconnect the connector.





# Clutch Cover

## Tools

This procedure requires the following tools:

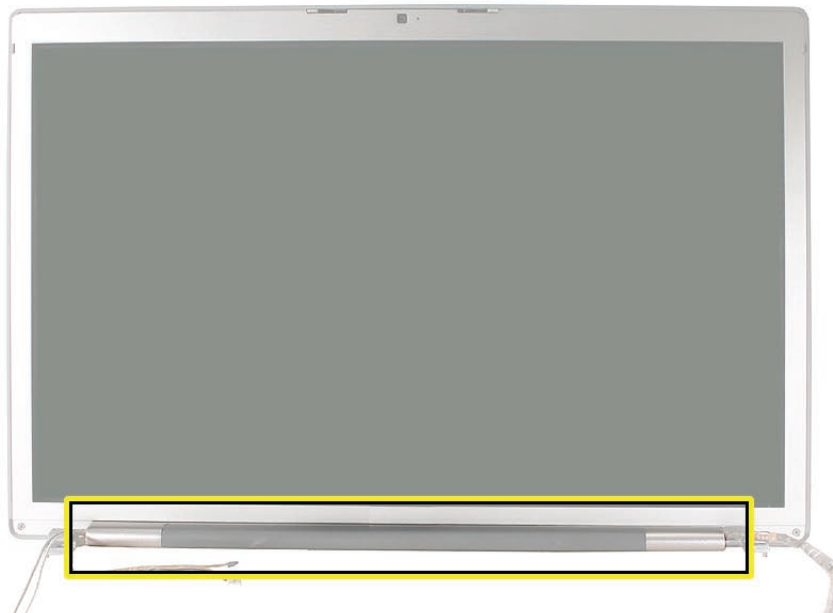
- #0 Phillips screwdriver (magnetized)
- Torx T6 screwdriver (magnetized)
- Black stick (nylon probe 922-5065) (or other non-conductive nylon or plastic flat-blade tool)
- Kapton tape (922-1731 (0.5-inch x 12-yard roll))

## Preliminary Steps

Before you begin, remove the following:

- [Battery](#)
- [Top Case](#)
- [Display Assembly](#)
- [Display Rear Housing](#)
- [Inverter Board](#)

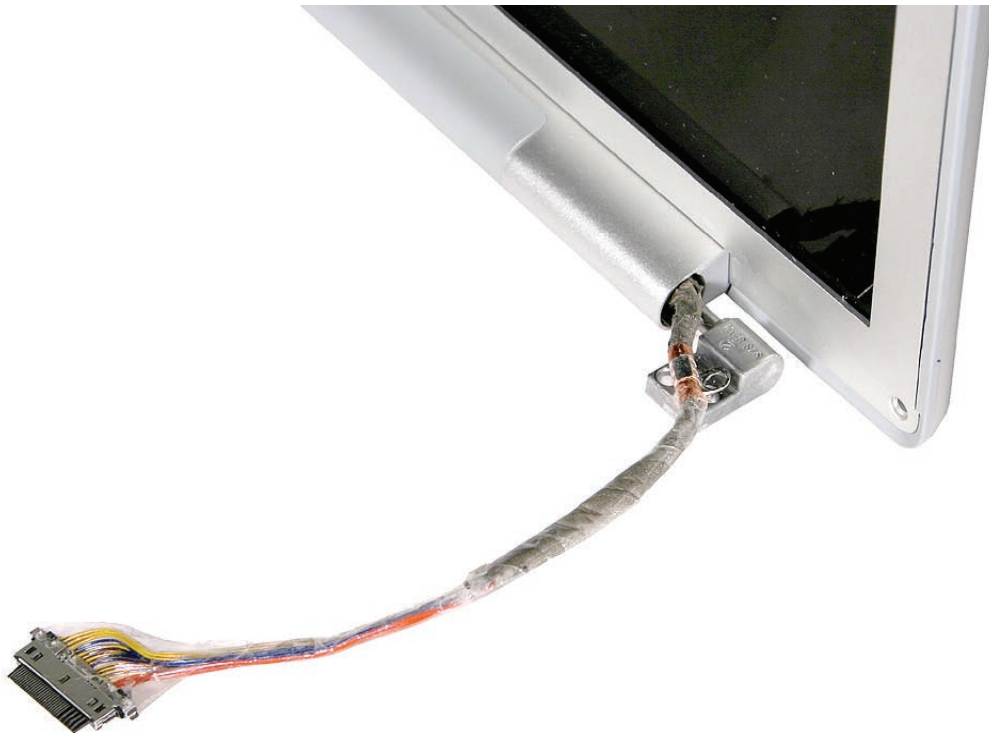
## Part Location



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## Procedure

Note the desired orientation of the cables coming out of both sides of the clutch cover.

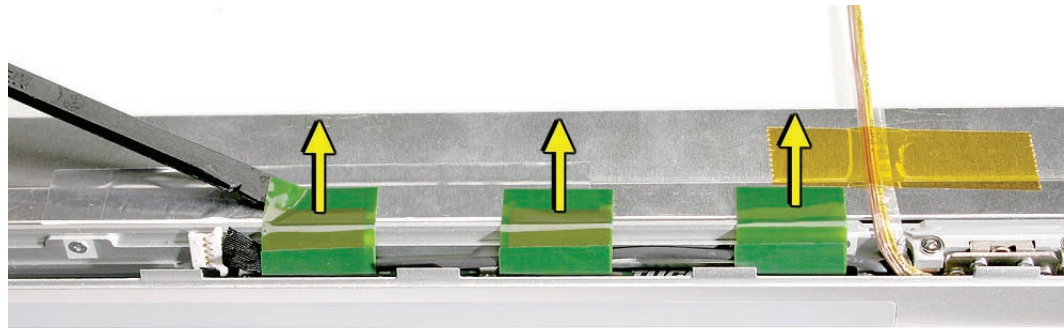




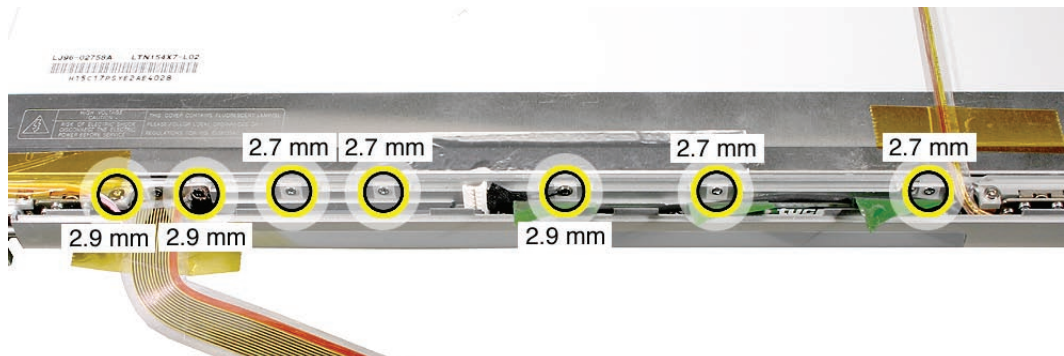
1. Disconnect the LVDS cable at the top of the display panel.
2. Peel back tape securing the LVDS cable to the display panel at the clutch cover and pull back the cable to gain access to the clutch cover screw behind it.



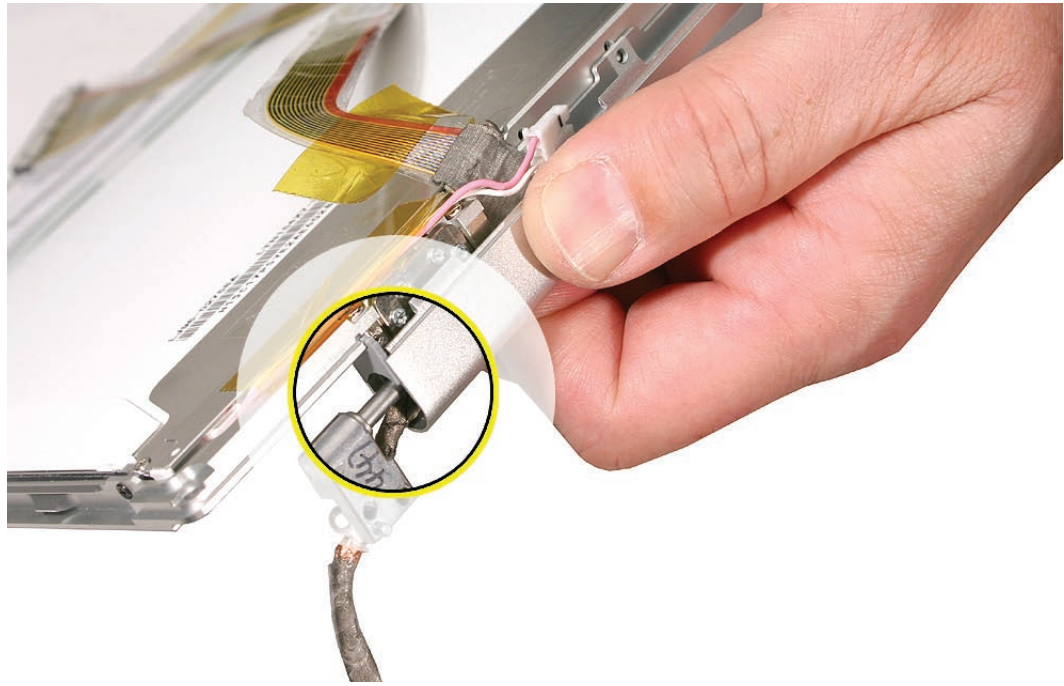
3. Peel up the antenna assembly tabs from the display panel to gain access to the clutch cover screws behind them.



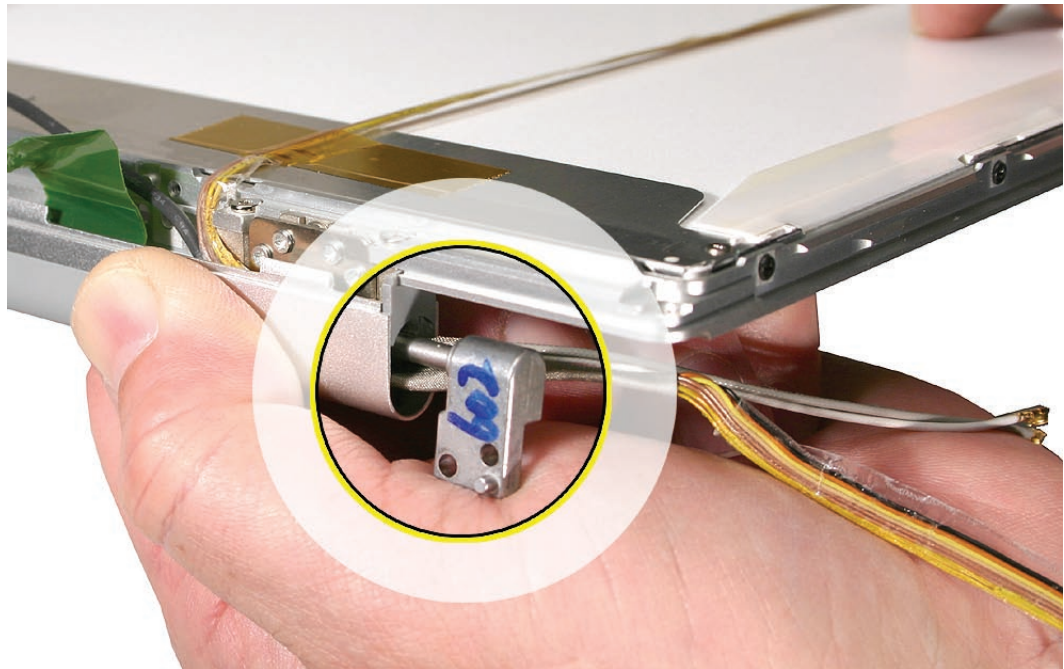
4. Remove the seven phillips #0 screws along the back side of the clutch cover. Note the location of the three black screws.



5. Grab the clutch cover at one end and carefully slide it straight down, slightly, away from the clutch. Do not remove the cover. Note the cable routing.



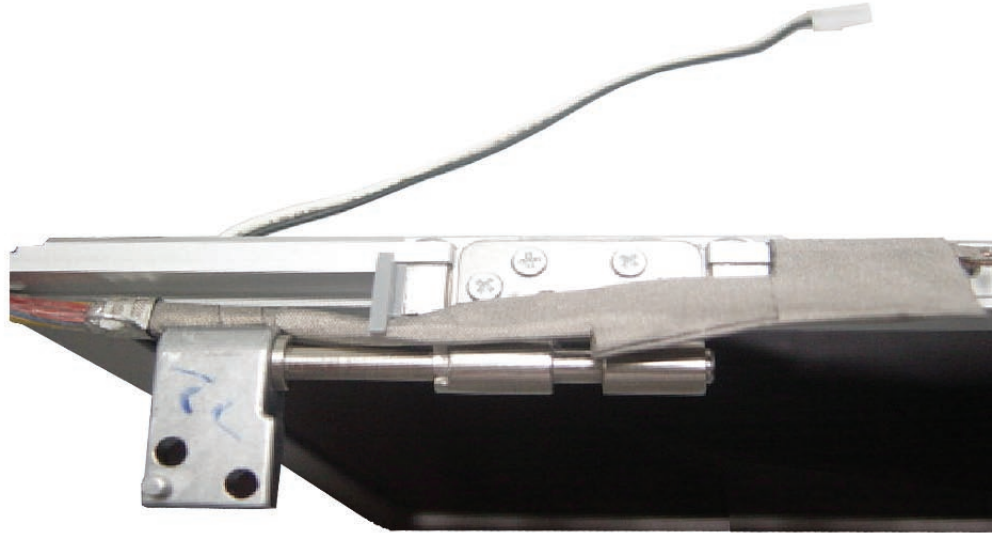
6. Grab the clutch cover at the other end and carefully slide it straight down, note the cable routing as you remove the cover, being careful not to catch any wires.



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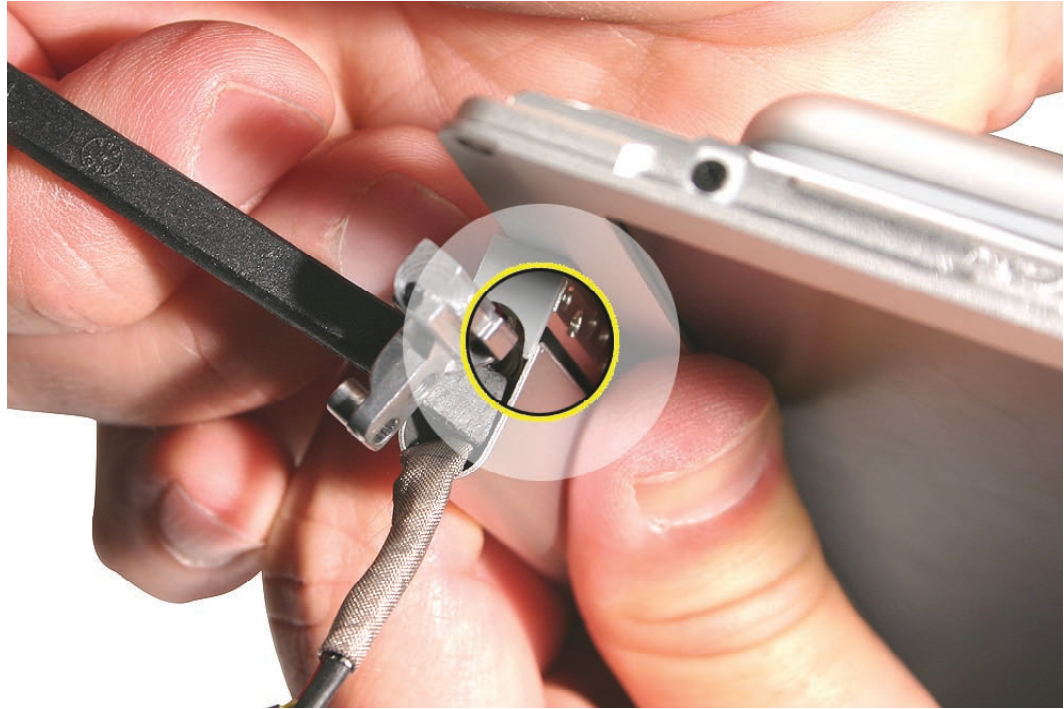
## Replacement Procedure

1. Route cables over clutches as shown, below.

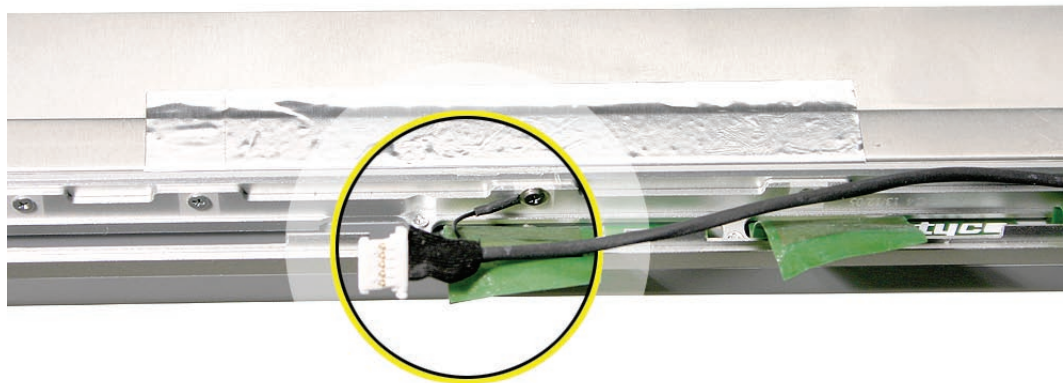




- Slide the clutch cover over the clutches, capturing the cables, without pinching. Verify that the ends are flush with the cosmetic end caps. Use a black stick if necessary to guide the ends of the clutch cover over the end caps.

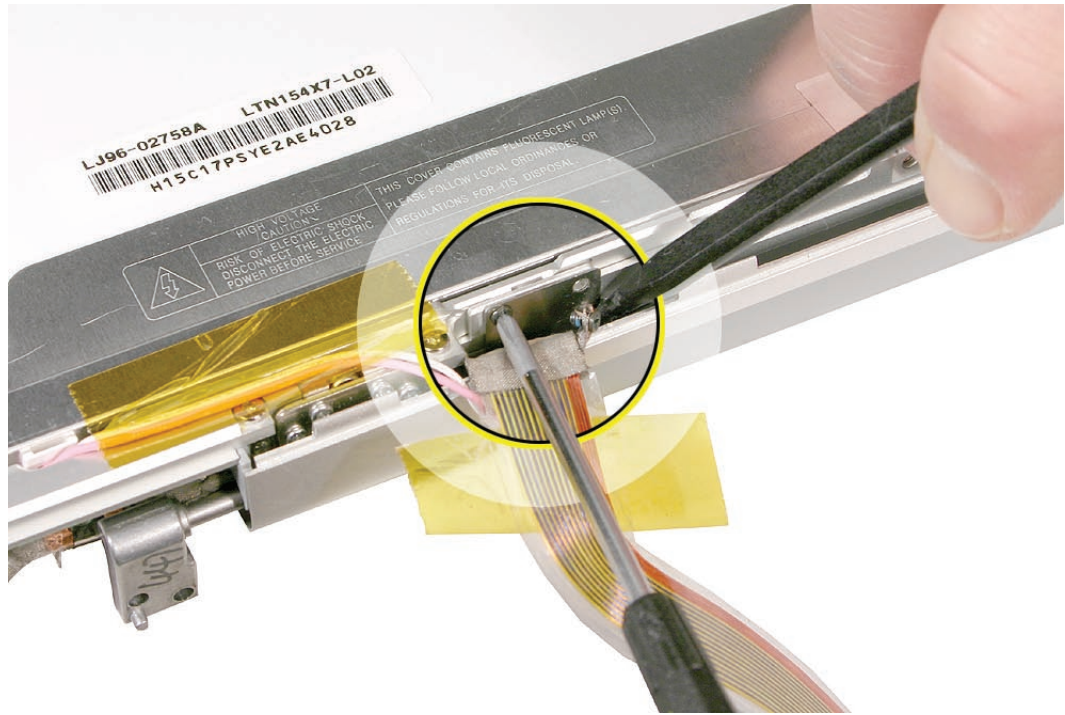


- Secure the ground loop on the right inverter cable with a black screw..

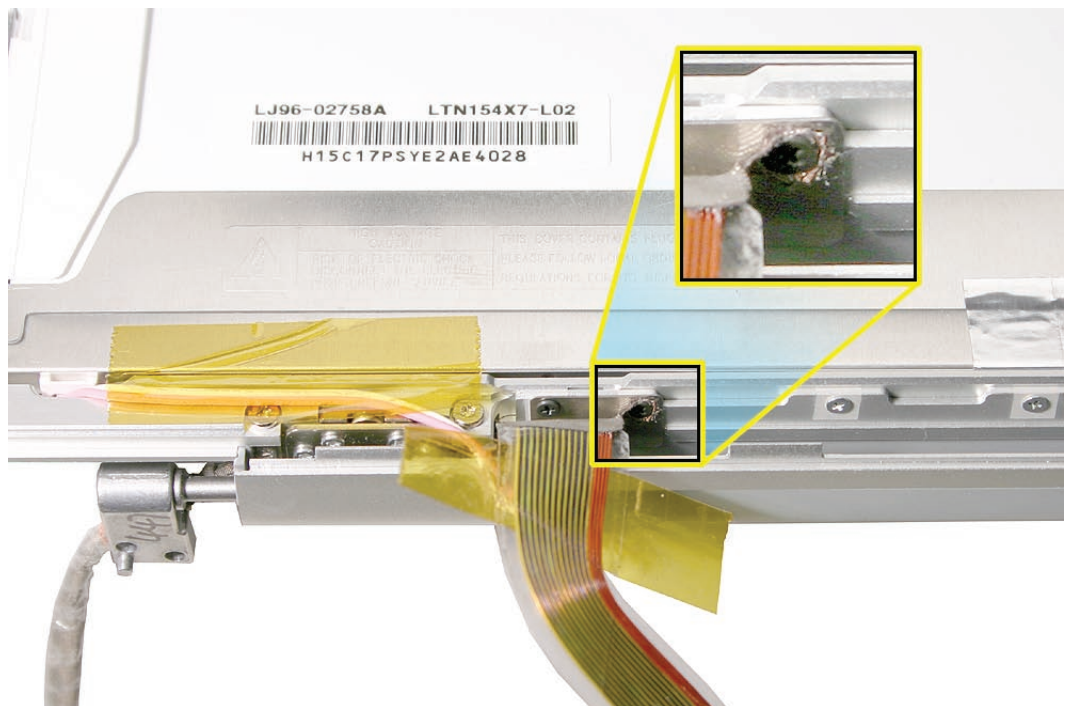




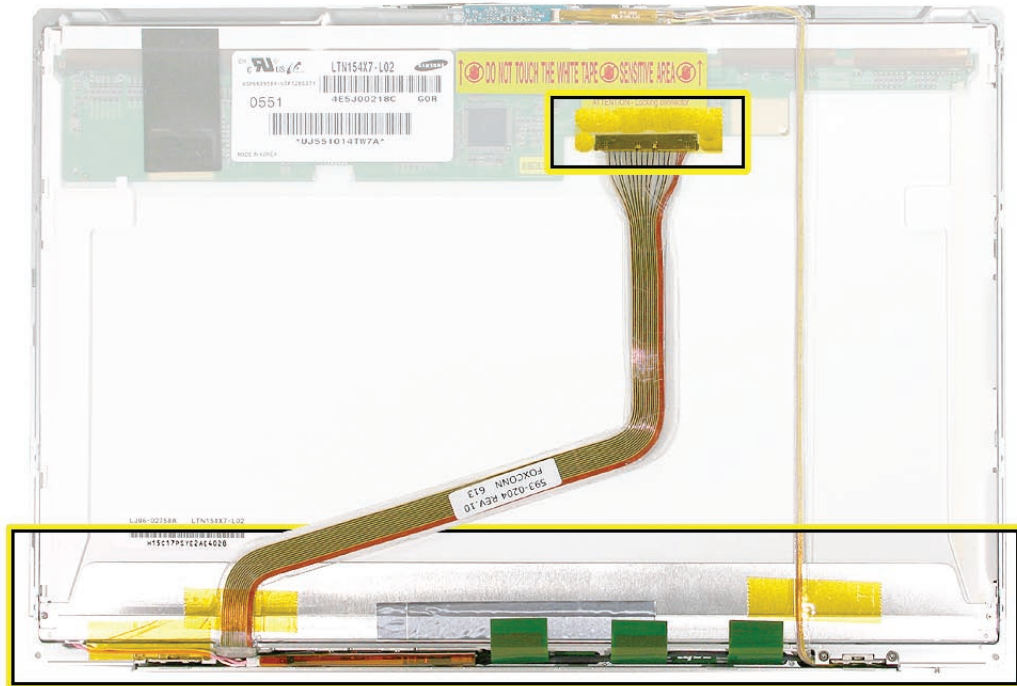
4. Install a black screw into the left hole of the LVDS cable plate.



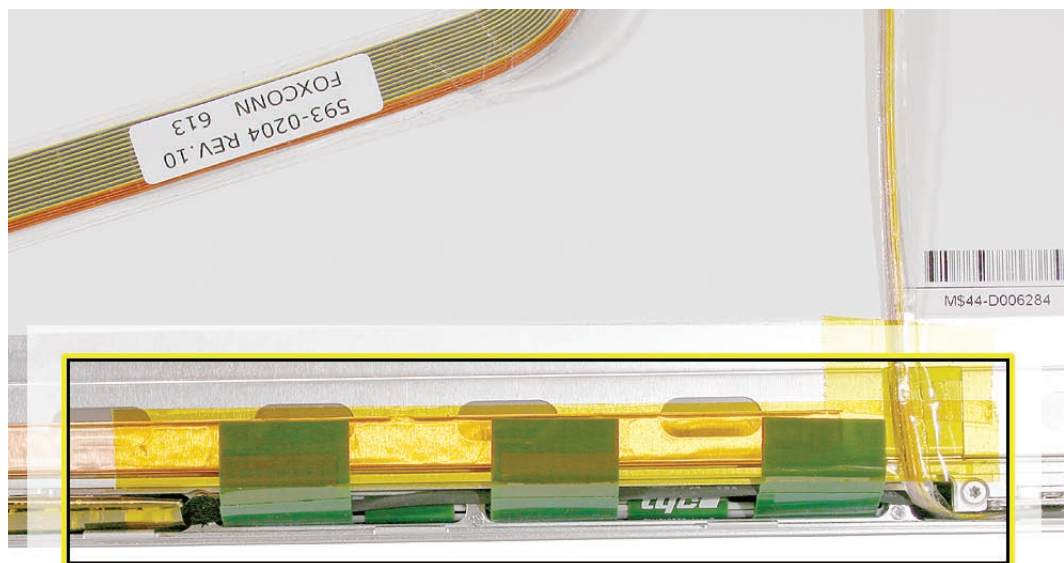
5. Capture the LVDS cable grounding tab with a black screw in the right hole.



6. Install the remaining screws to secure the clutch cover.
7. Secure the camera cable, LVDS cable (top and bottom) and inverter cable with Kapton tape.  
**Warning: Do not install tape on the back of the display panel, or damage can result.**



8. Fold down the antenna assembly tabs and secure with Kapton tape.





# LVDS Cable

## Tools

This procedure requires the following tools:

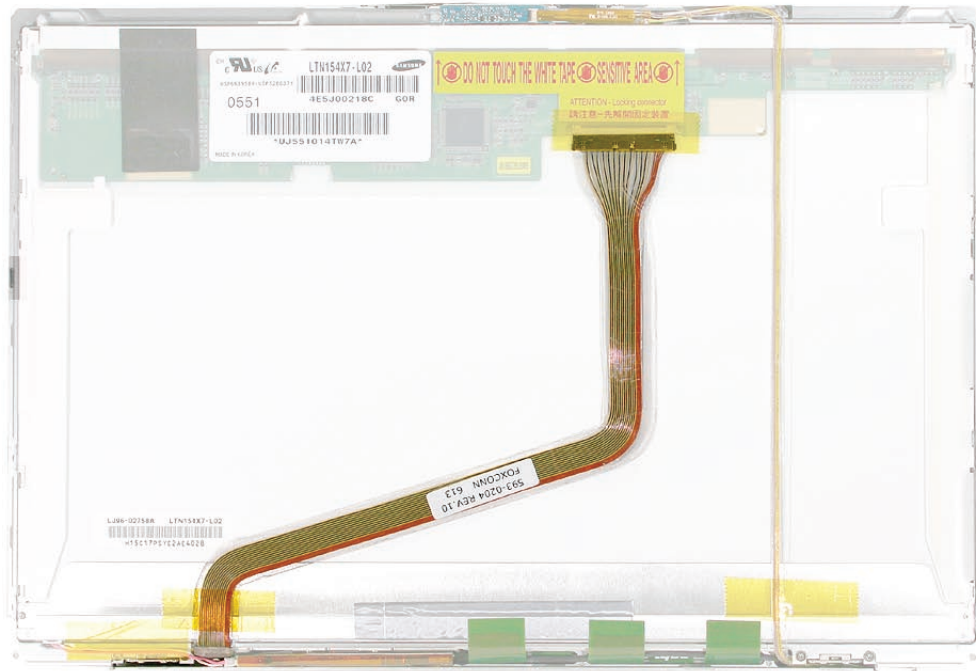
- #0 Phillips screwdriver (magnetized)
- Black stick (nylon probe 922-5065) (or other non-conductive nylon or plastic flat-blade tool)
- Kapton tape (922-1731 (0.5-inch x 12-yard roll))

## Preliminary Steps

Before you begin, remove the following:

- [Battery](#)
- [Top Case](#)
- [Display Assembly](#)
- [Display Rear Housing](#)
- [Inverter Board](#)
- [Clutch Cover](#)

## Part Location



## Procedure

After removing the clutch cover, the LVDS cable can be removed. See the Clutch Cover chapter for the replacement procedure.





# AirPort Extreme Antenna Assembly and Window

## Tools

This procedure requires the following tools:

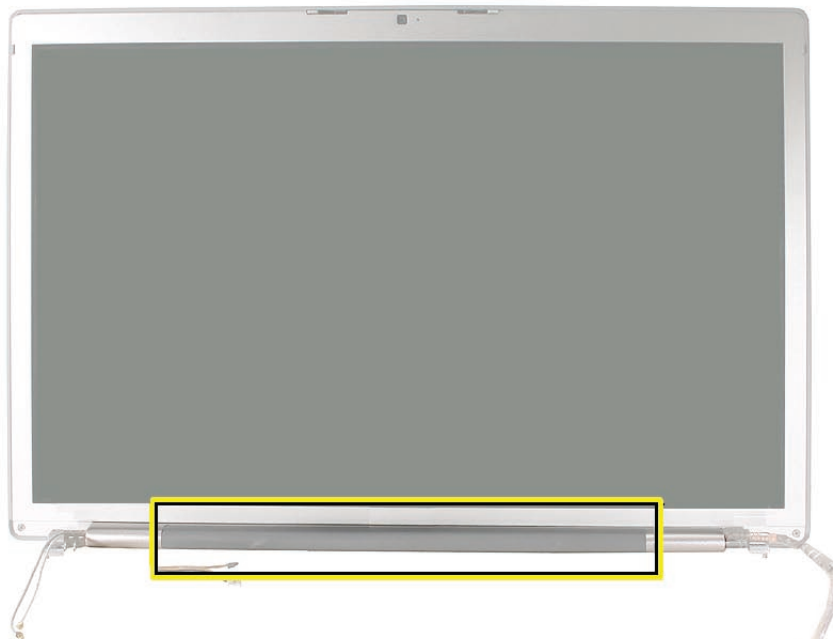
- #0 Phillips screwdriver (magnetized)

## Preliminary Steps

Before you begin, remove the following:

- [Battery](#)
- [Top Case](#)
- [Display Assembly](#)
- [Display Rear Housing](#)
- [Inverter Board](#)
- [Clutch Cover](#)

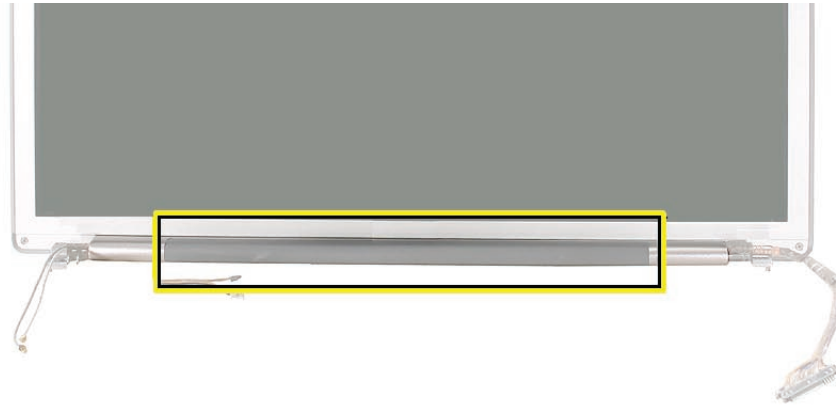
## Part Location



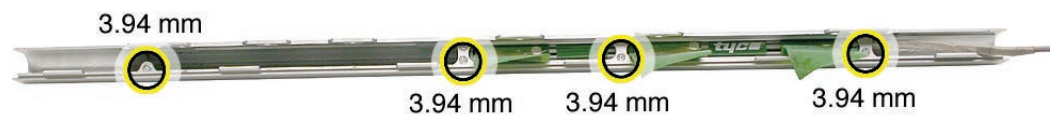
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## Procedure

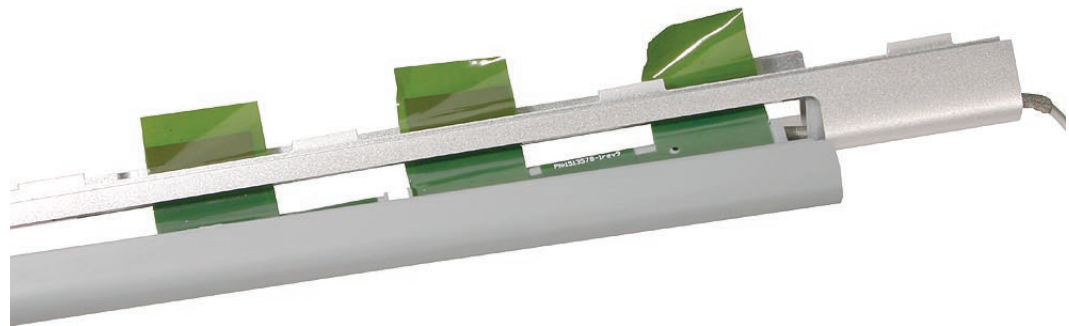
The Airport antenna window is the grey area of the clutch cover.



1. Once the clutch cover is removed, look down into the cover to locate five screws that secure the antenna window, and remove.



2. Slide the antenna window from the clutch cover, carefully guide out the cable, and remove the AirPort antenna assembly.



**Replacement Note:** Insert the antenna assembly into the keyed channel in the antenna window. Guide the cable into and out the end of the clutch cover as you slide the window onto the cover while guiding the tabs through the openings.



# Display Clutches

## Tools

This procedure requires the following tools:

- Torx T6 screwdriver (magnetized)

## Preliminary Steps

Before you begin, remove the following:

- [Battery](#)
- [Top Case](#)
- [Display Assembly](#)
- [Display Rear Housing](#)
- [Inverter Board](#)
- [Clutch Cover](#)

## Part Location

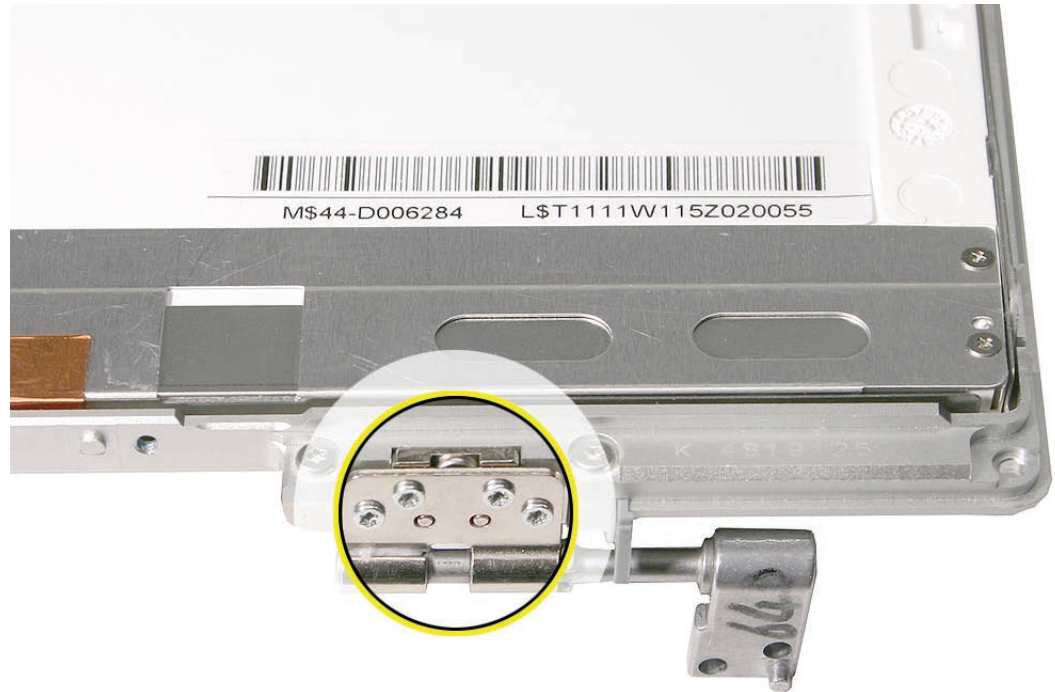


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## Procedure

**Important:** The clutches are not self-aligning. To maintain proper alignment, you will need to remove, install and align only one clutch at a time, using the following procedures.

1. With the rear housing and clutch cover removed, remove the screws on one clutch, only, to remove the clutch.

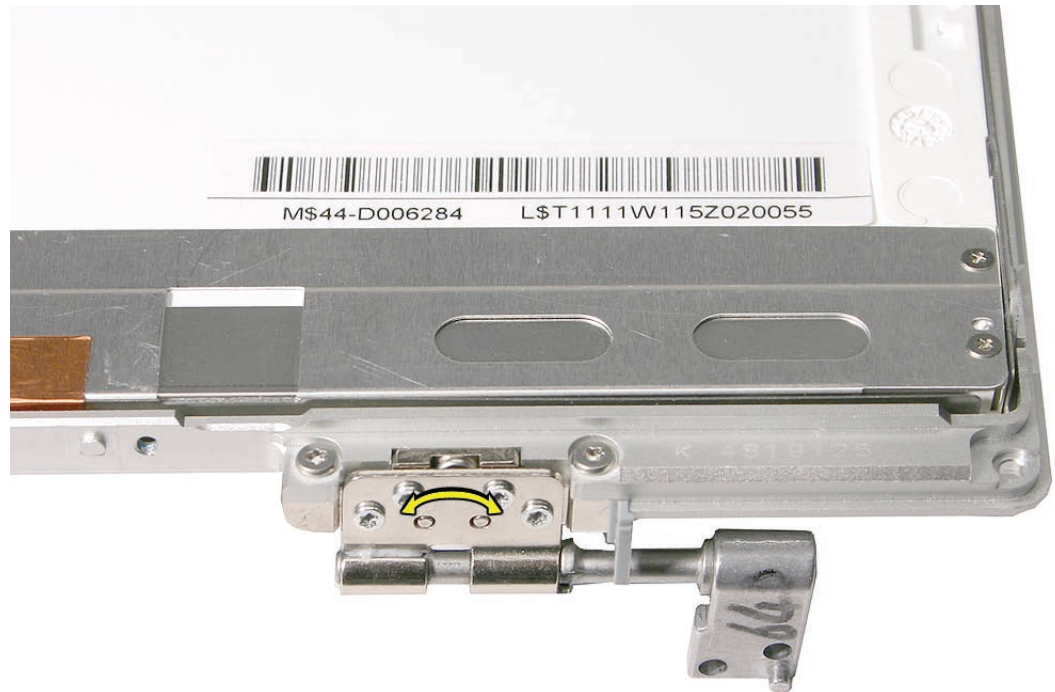


2. Adjust the replacement clutch so that it is straight, as shown.





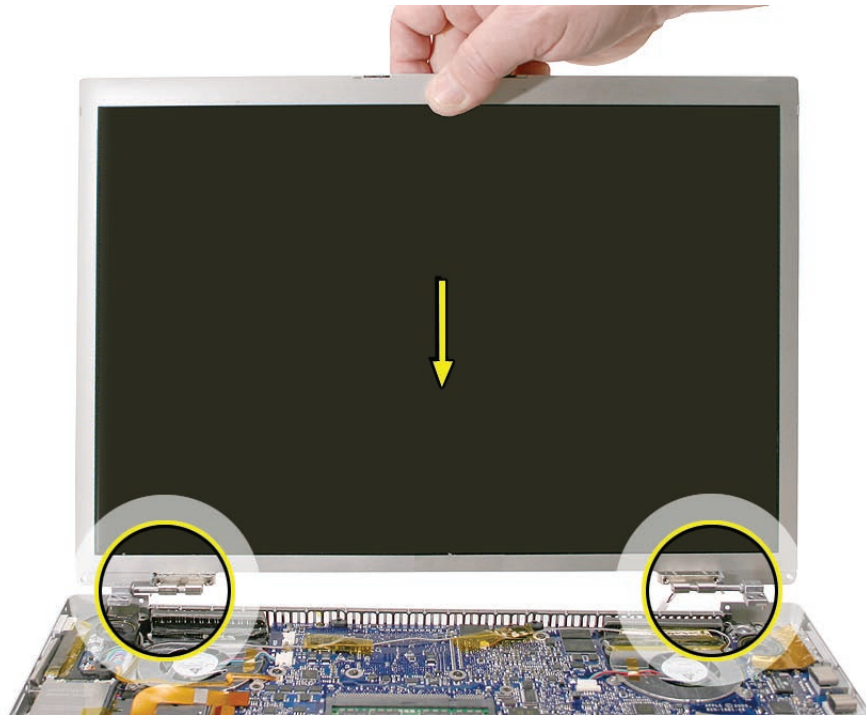
3. Install the replacement clutch so that it is flat against the clutch block, but do NOT tighten down the screws. You should be able to slide the clutch back and forth sideways, slightly, but not vertically.



4. Verify that cables are routed correctly and out of the way of the clutches.

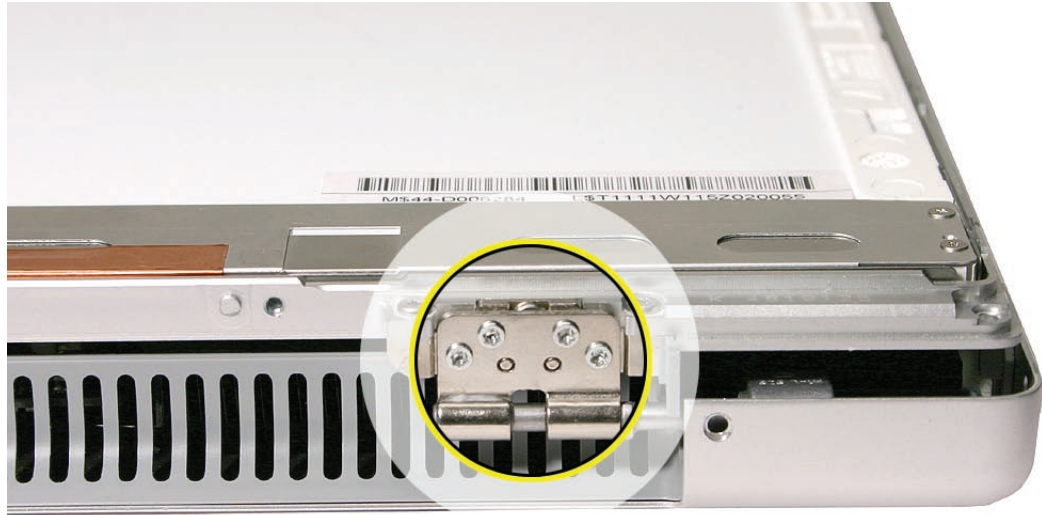


- 
5. Lower the display panel in place onto the bottom case assembly and first install and securely tighten the clutch screws for the clutch that was not replaced.



6. Install and securely tighten the screws for the clutch that was replaced.
7. Close the display panel. Verify that the display latches catch and function properly.
8. Verify that the display assembly appears centered and straight over the bottom case assembly.

- 
9. Turn the computer around and securely tighten the screws on the replaced clutch.



10. Open the display and verify the clutch and display latch function.
11. Remove the display assembly from the computer.
12. If replacing the other clutch, remove it and follow the same procedures to align and tighten.

**Replacement Note:** After reassembly, verify that the display is centered, straight, and the edges flush over the bottom case.



# Display Panel

**Warning:** Replacement Display Panels come with a manufacturer matched [Display Rear Housing](#)—both must be replaced at the same time, or damage can result.

## Tools

This procedure requires the following tools:

- #0 Phillips screwdriver (magnetized)
- Black stick (nylon probe 922-5065) (or other non-conductive nylon or plastic flat-blade tool)
- Putty knife (922-6761)
- Kapton tape (922-1731 (0.5-inch x 12-yard roll))

## Preliminary Steps

Before you begin, remove the following:

- [Battery](#)
- [Top Case](#)
- [Display Assembly](#)
- [Display Rear Housing](#)

**Note:** If replacing the display bezel, also remove the [clutch cover](#).

## Part Location





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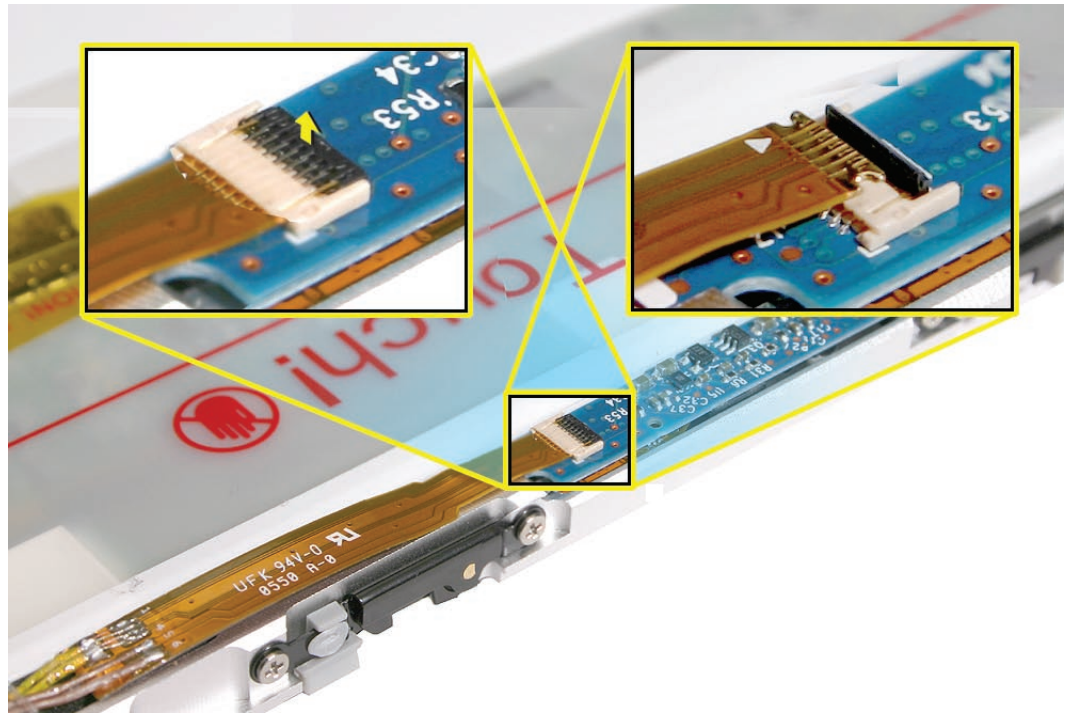
## Procedure

### Warnings:

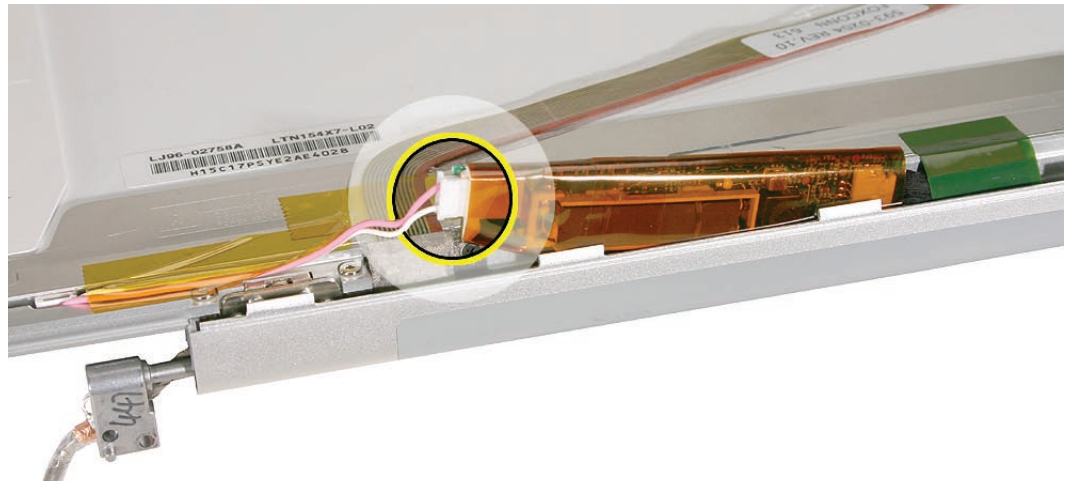
- Do not touch the back of the display panel where it says “Don’t Touch.” And, do not put pressure anywhere in the white center area of the back of the display panel.
  - Do not remove the camera board. It is pressure installed and part of the display bezel and is not replaceable separately.
1. If the clutch cover has been removed, skip to [removing the display panel side screws](#).
  2. Disconnect LVDS cable from display panel.



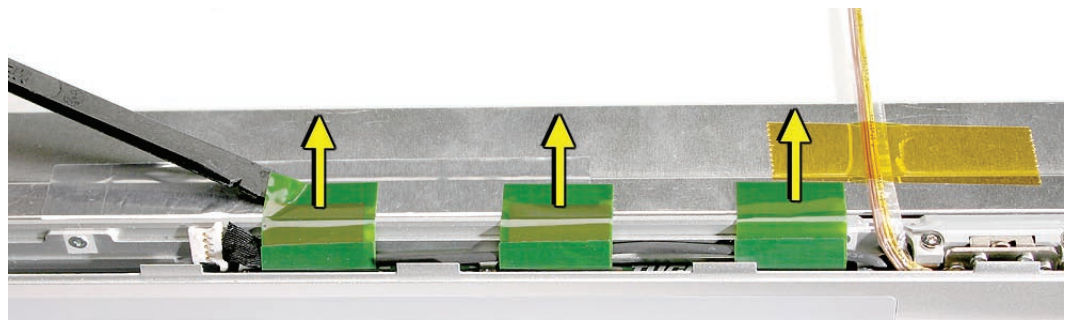
3. Disconnect the camera flex cable from the camera board and carefully lift off of the adhesive.



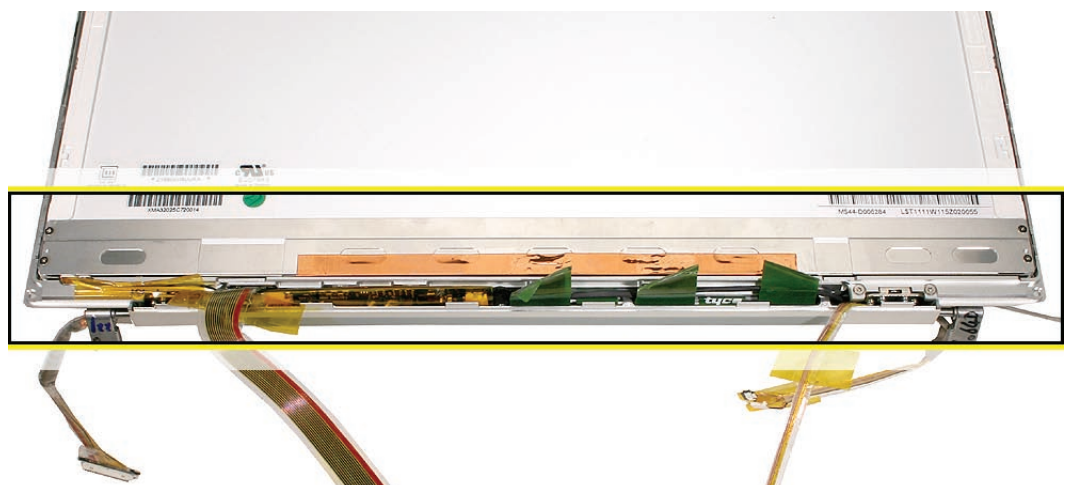
4. Lift the inverter and disconnect the left inverter cable.



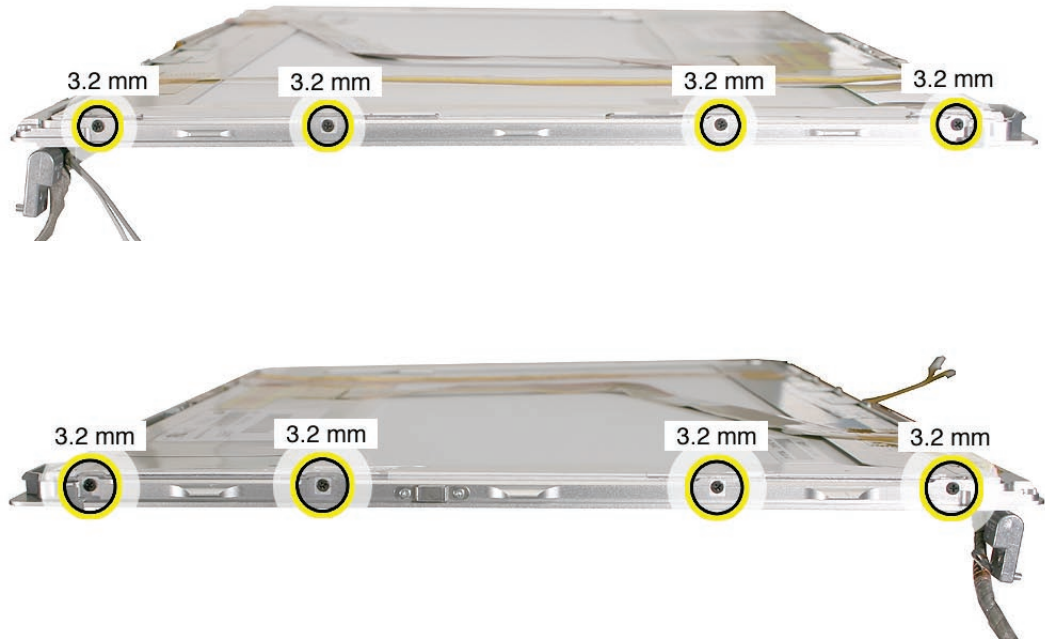
5. Peel up antenna assembly tabs.



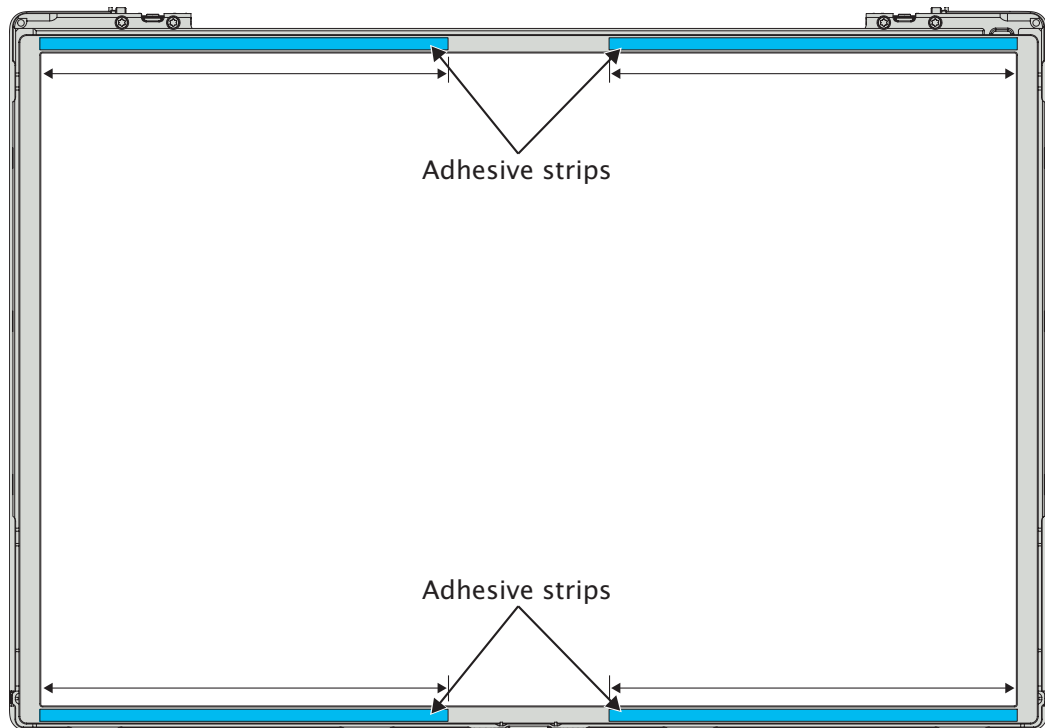
6. Peel back all Kapton tape from the inverter cable, LVDS cable, and camera cable.



7. Remove four screws from each side of the display assembly.

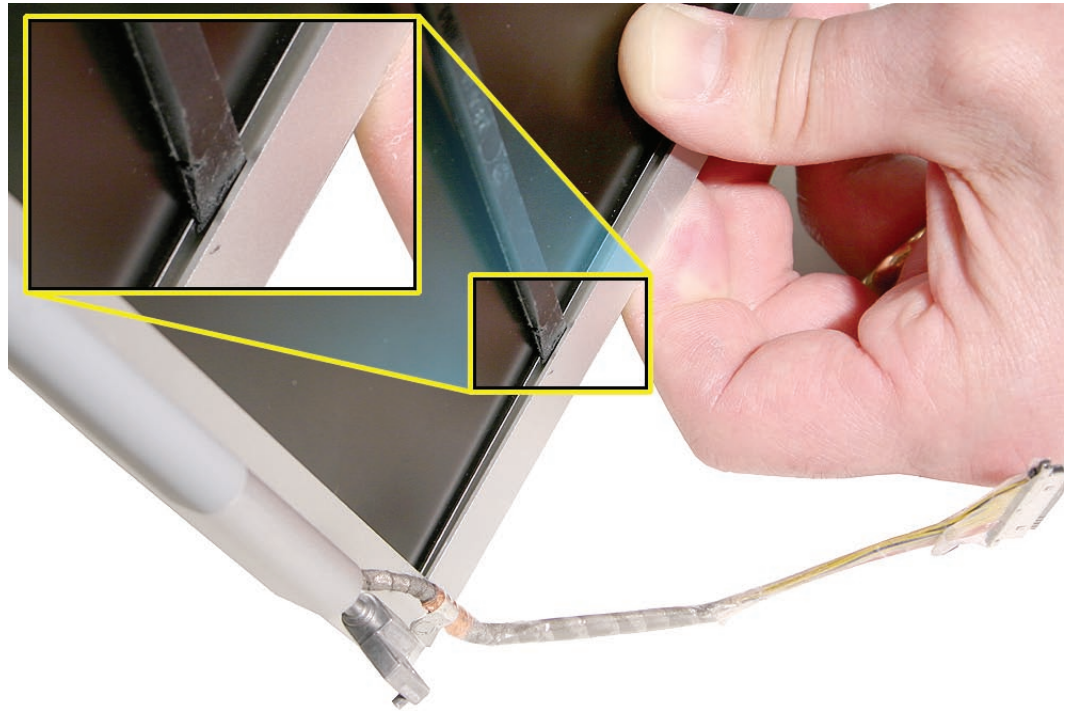


8. The following procedures disengage four adhesive strips, two along the bottom and two along the top of the inside of the bezel, securing the display panel.





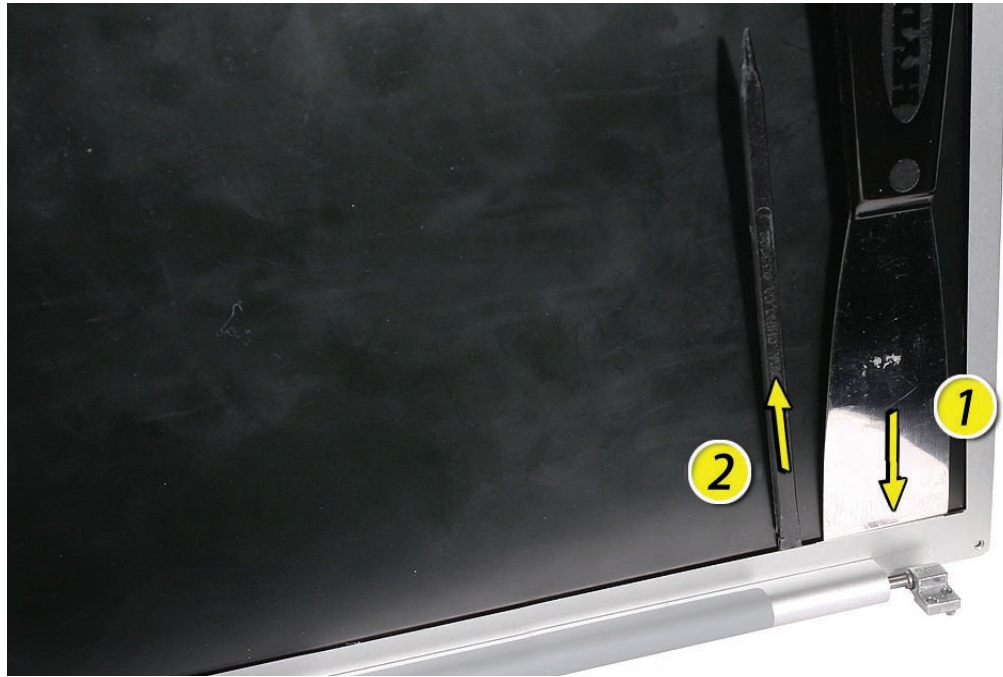
9. Push on the display panel slightly along the side near the bottom of the bezel to expose the display's metal frame. Insert a black stick between the inside of the bezel and the display's metal frame.



10. Slide the black stick around the corner to the bottom edge to begin to separate the adhesive until a putty knife can be inserted behind the black stick.



- 
11. Insert the putty knife all the way to the bottom of the bezel behind the black stick, and remove the black stick.

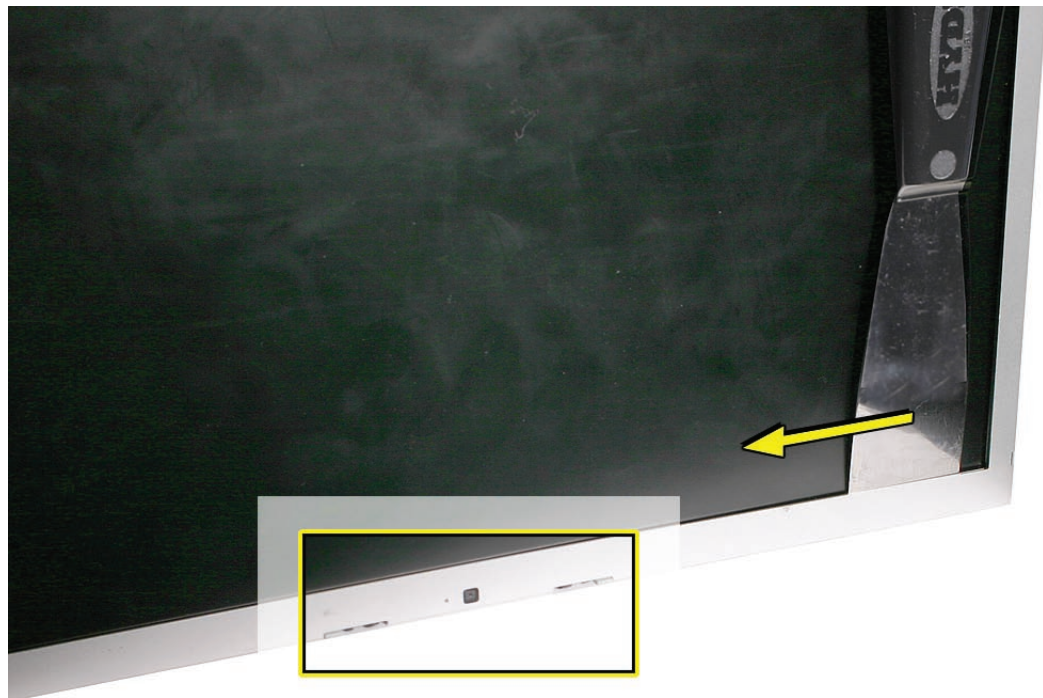


12. Hold the putty knife flat square against the bottom of the bezel and push it forward toward the middle of the bezel, separating the adhesive. Continue to the other side to separate the adhesive on the other side.



- 
13. Perform the same procedure on the bezel's top two strips of adhesive. Insert the black stick from the side, move it to the top, insert the putty knife and separate the adhesive on one side.
  14. At the middle of the bezel, near the camera, keep the putty knife flat and carefully pass the camera and board assembly area, then separate the other side.

**Warning: Be extremely careful at the center, where the camera and board assembly are located. Keep the putty knife flat while passing to the next adhesive strip, or damage can result.**



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## Replacement Procedure

**Warning:** Replacement Display Panels come with a manufacturer matched [Display Rear Housing](#)—both must be replaced at the same time, or damage can result.

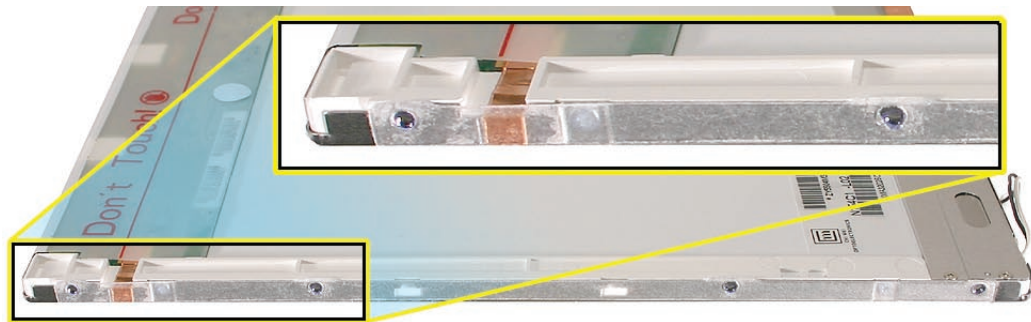
**Warning:** Do not touch the back of the display panel where it says “Don’t Touch.” And, do not put pressure anywhere in the white center area of the back of the display panel.

If reinstalling the display panel

1. Leave residual adhesive on the panel’s perimeter frame. Remove any clumps of adhesive.

If installing a replacement display panel

1. Install the two provided (clear plastic) shims onto the sides of the display panel. Carefully align the screw holes and apply straight. The straight edge goes on the display screen side (shown down here). Do not install if the shims are already installed on the panel.



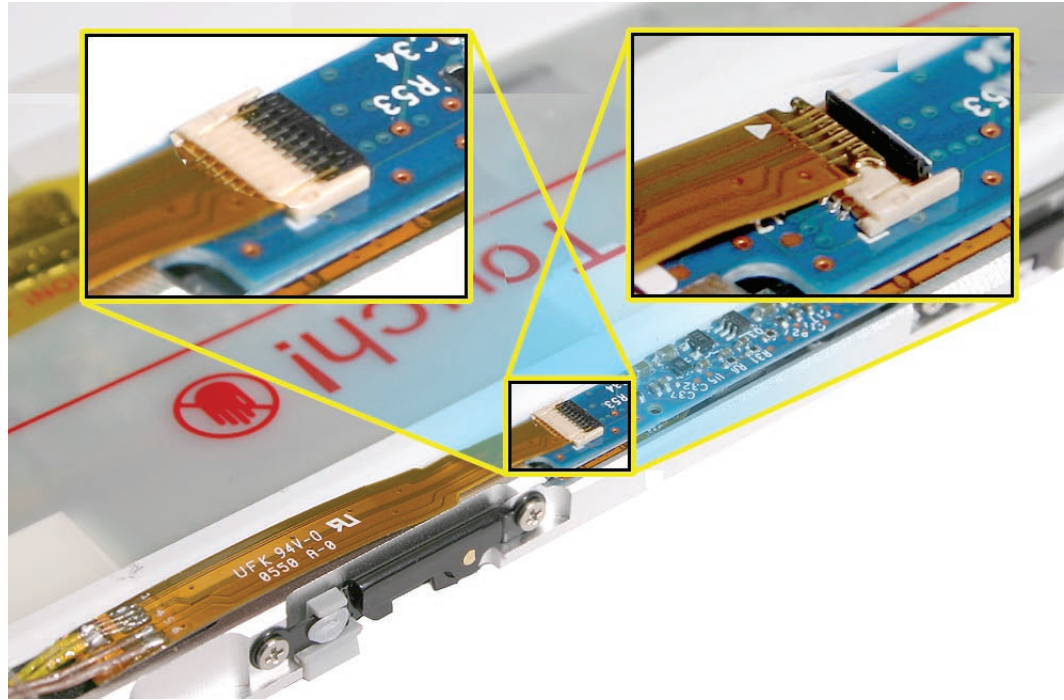
For bezel preparation

Refer to the [Display Bezel](#) chapter for preparation and installation of the bezel.

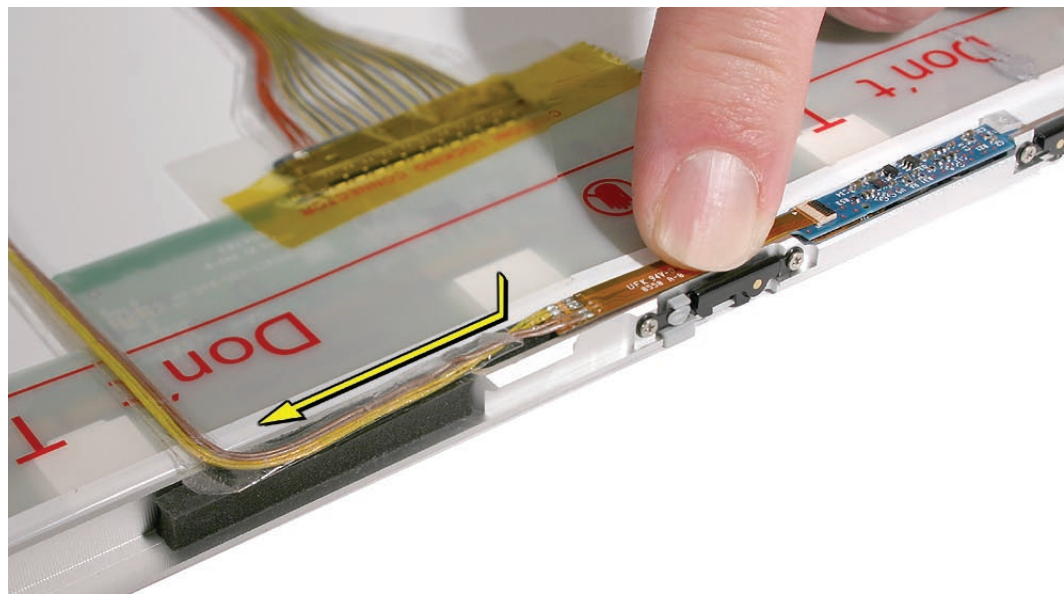


## Cable replacement

1. Connect the camera flex cable with the metal contacts facing up and the white arrowhead on the side next to the display panel.

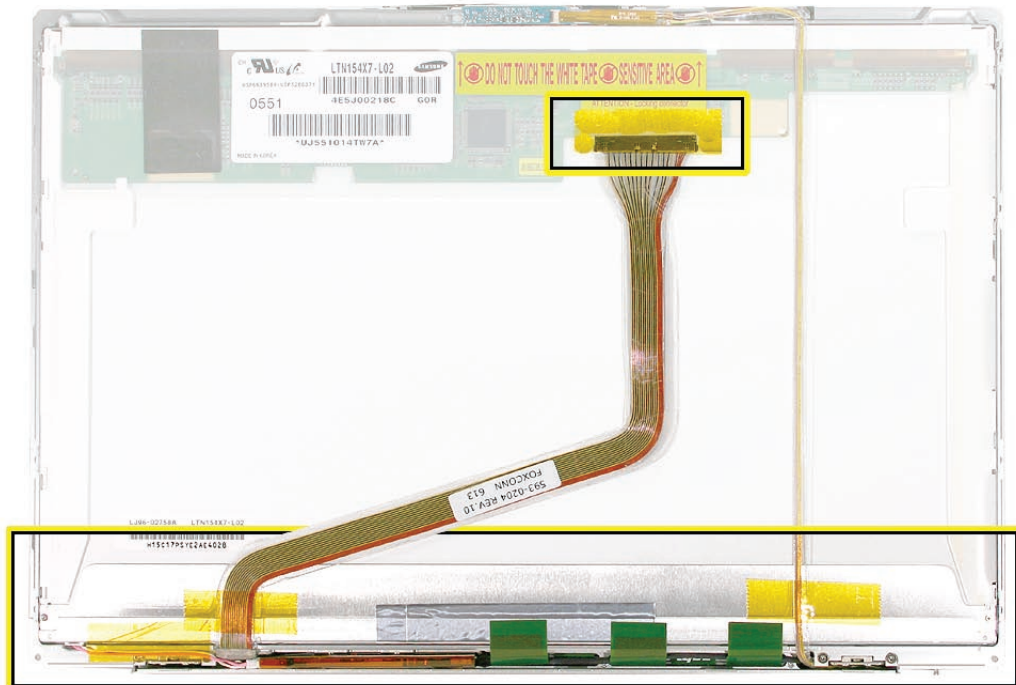


2. Hold the flex cable in place with your finger and use another finger to apply pressure to the cable to secure it to the foam, as shown by the arrow. If there isn't enough adhesive left on the foam to securely hold the cable, apply Kapton tape, as shown below.

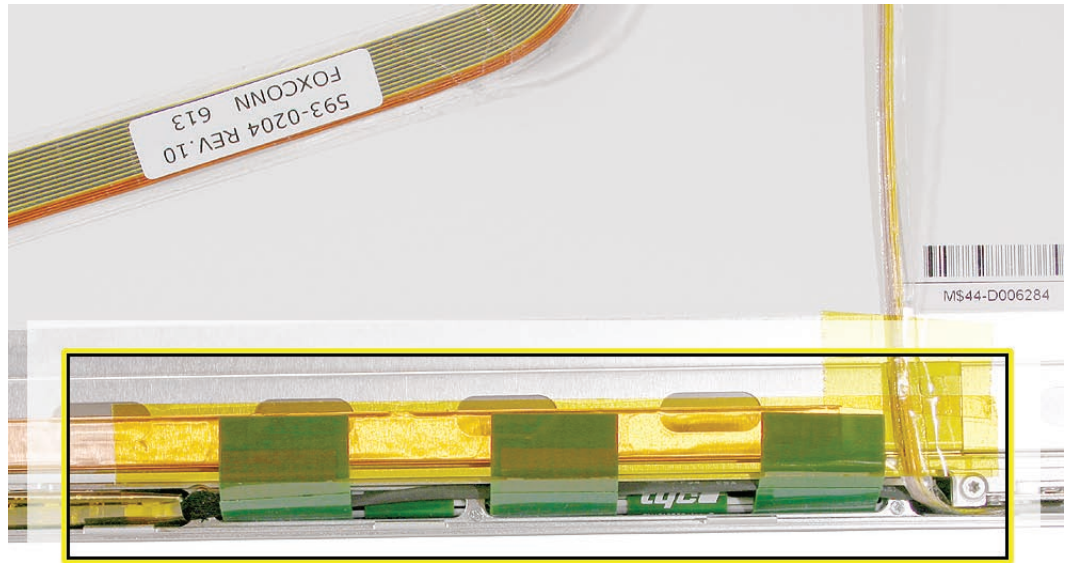




3. Connect the LVDS cable.
4. Apply Kapton tape to secure the inverter cable, LVDS cable (top and bottom), and camera cable.



5. Apply Kapton tape to the antenna assembly tabs to secure them to the display panel.





# Display Bezel

## Tools

These tools may be required for this procedure.

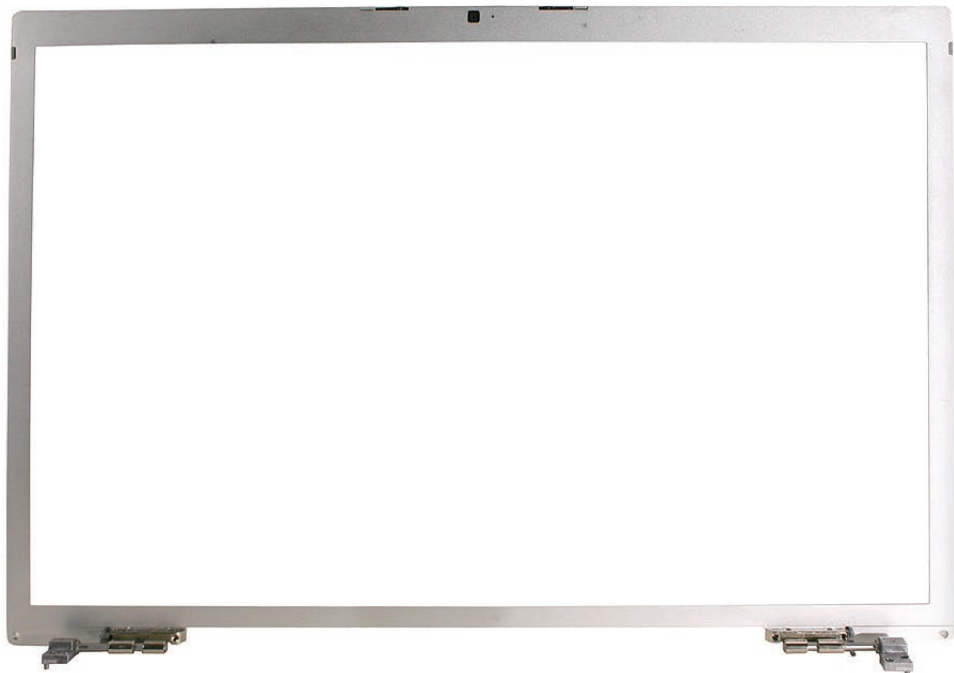
- #0 Phillips screwdriver (magnetized)
- Torx T6 screwdriver (magnetized)
- Black stick (nylon probe 922-5065) (or other non-conductive nylon or plastic flat-blade tool)

## Preliminary Steps

Before you begin, remove the following:

- [Battery](#)
- [Top Case](#)
- [Display Assembly](#)
- [Display Rear Housing](#)
- [Inverter Board](#)
- [Clutch Cover](#)
- [Display Panel](#)

## Part Location





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## Procedure

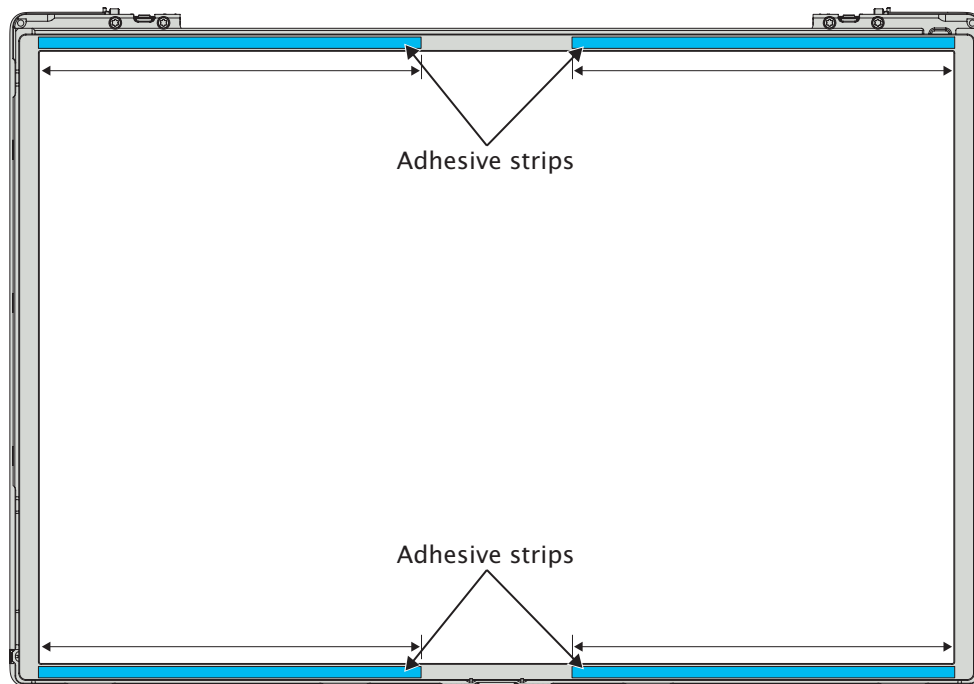
### Important:

- To prevent alignment issues, do NOT loosen or remove clutch screws to the bezel.
  - Avoid twisting the bezel and do not apply uneven pressure as it can be bent out of alignment.
1. With all preliminary steps performed, the bezel is the remaining part.

## Replacement Procedure

### If reinstalling the bezel

1. Leave residual adhesive on the bezel's interior. Remove any clumps of adhesive.



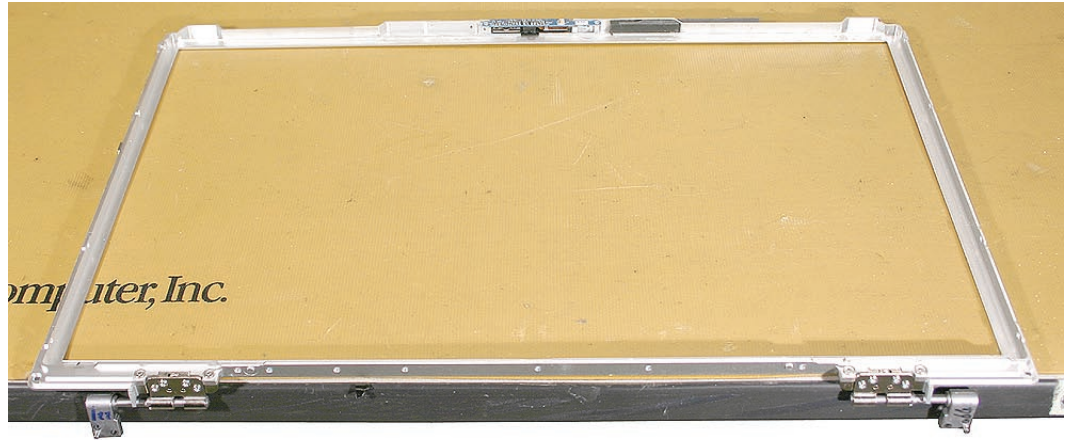
### If installing a replacement bezel

1. If not installed, transfer the following to the replacement bezel:
  - Sleep magnet and bracket
  - Camera board and flex cable assembly
  - Clutches (see the [Display Clutches](#) chapter for installation)
2. Remove the adhesive backing along the top and bottom inside bezel edges.

---

## To install the bezel

1. Place the bezel (a previous model shown) face down on a table with the clutches positioned over the edge.



### Important:

- If installing a replacement display panel, verify that two spacers are installed (see Display Panel chapter).
- Handle the display panel by the edges only. Avoid pressure on the back of the panel. Holding the sides of the display panel and the sides of the bezel, carefully align the panel over the inner edges of the bezel.



2. Lower the display panel and press its outside edges and the bezel into place.

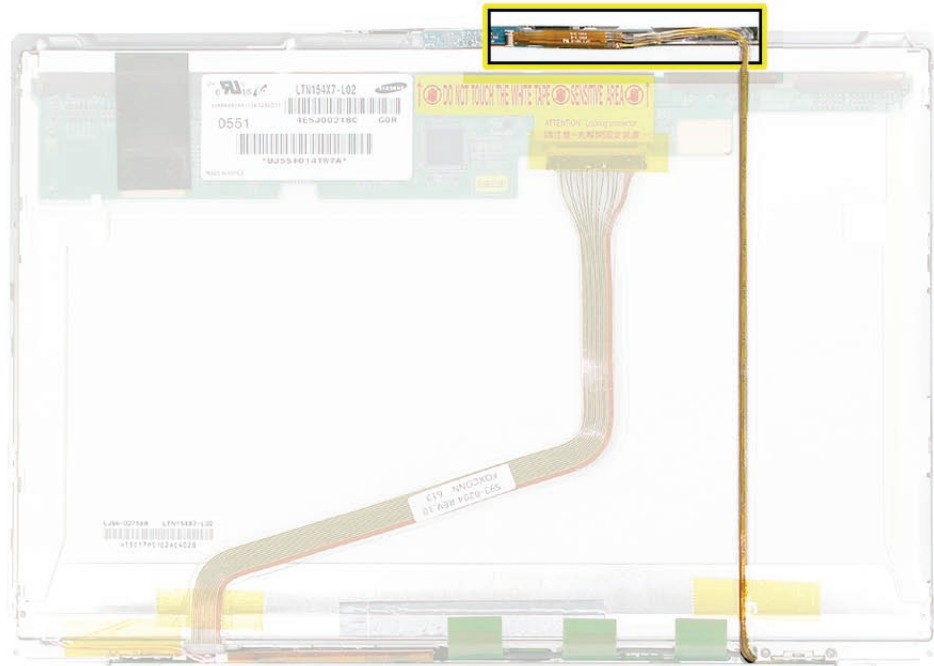


## Camera

The camera is part of the display bezel assembly and is not replaceable separately. See the [Display Bezel](#) and the [Display Panel](#) chapters for procedures to remove the display bezel.

The camera cable is an assembly that includes the inverter cable and can be removed separately by following the procedures in the [Display Panel](#) and [Clutch Cover](#) chapters.

### Part Location



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Apple Service Source



Troubleshooting

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MacBook Pro





## General Information

### Wire and Flex Cables

With the very thin enclosure design and dispersed circuit board, a large number of flex cables are used in this computer. In addition, there are a variety of wire cable harnesses as well. Many of these cables carry multiple types of signals.

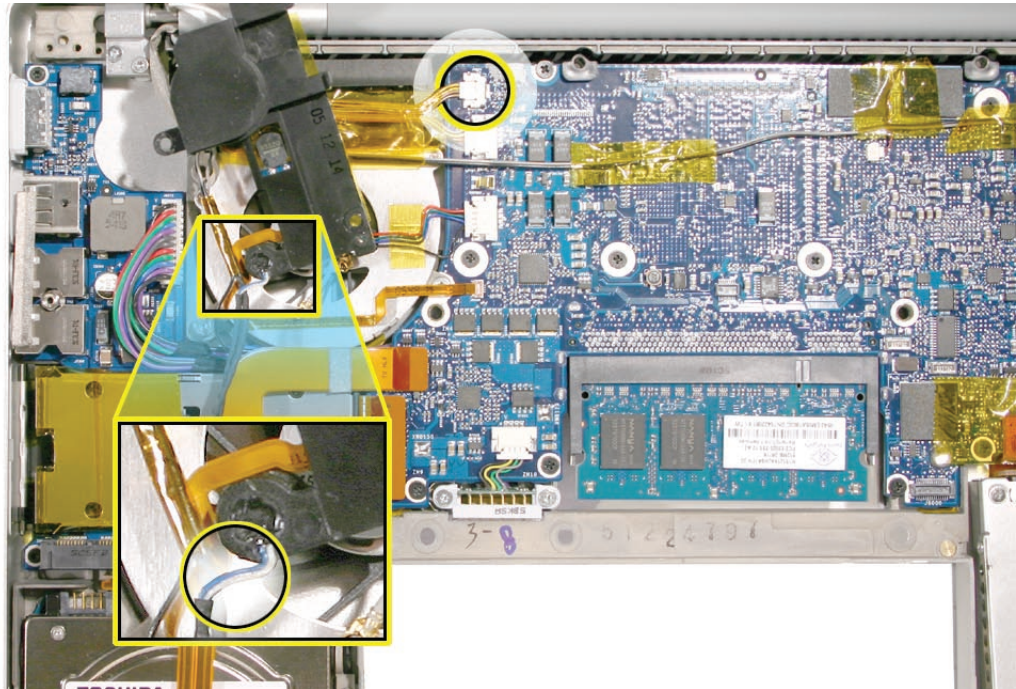
Here is a list of the cables and the signals that run across them. If you notice a group of functions not working, it is likely that the cable is not properly inserted or the connector is damaged.

Cable or Flex Cable	Signal(s) Running Through It
SuperDrive flex	SuperDrive data, power, and control signals (cable select info)
Left I/O board flex	Audio in and out left USB ExpressCard data
Power Button cable	Power-on signal
Infrared Cable	Infrared Power and data
Hard drive flex	Hard drive power and data Sleep LED power Infrared power and data Bluetooth power and data
Sleep LED cable	Power to sleep LED
Ambient Light Sensor (left) flex	Left ALS power and data
Main battery connector wire harness (to logic board and Left I/O board)	Power adapter DC power to battery pack and main logic board
Speaker Assembly cable	Left speaker audio Right speaker audio Internal microphone audio
Trackpad flex	Trackpad data and power Power on button Keyboard backlight power Sleep sense signal Keyboard data
Bluetooth antenna cable assembly	Bluetooth radio signal
Video signal cable	Video power and signal from iSight camera
AirPort Extreme antenna cable	AirPort Radio signal
Left fan cable	Power/control for left fan
Right fan cable	Power/control for right fan
Inverter cable (to logic board)	Display backlight control

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## Microphone and Camera wires

The following photo shows the microphone wires located on the left speaker, and the camera connector located on the logic board.



## Hardware Diagnostics

AppleCare offers two diagnostics for MacBook Pro. Apple Hardware Test (AHT) is shipped with every machine and targeted for end-users to troubleshoot their machine. Apple Service Diagnostics (ASD) is offered to Service Providers for more in-depth troubleshooting.

Both applications are available for download from Knowledge Base article 112125: Service Diagnostics Matrix.

### Apple Hardware Test (AHT) 3A107

#### Notes:

- AHT 3A107 is not backwards compatible with previous Macintosh notebook computers.
- Starting with MacBook Pro, the Apple Hardware Test version numbering changed. All Apple Hardware Tests will be number sequentially starting with the prefix "3A." This approach will provide each AHT release a unique version number and eliminate confusion between the same version across different product lines.

#### AHT on the DVD follow these steps:

1. Insert the DVD named "MacBook Pro Mac OS X Install Disc 1" that came with your computer.

2. Hold down “D” and restart the computer.
3. Follow the on-screen instructions.

**Note:** Previously, the option key was held down to boot into a boot picker. You are no longer able to see the AHT volume using boot picker.

## Apple Service Diagnostic (ASD) 3S101

### Notes:

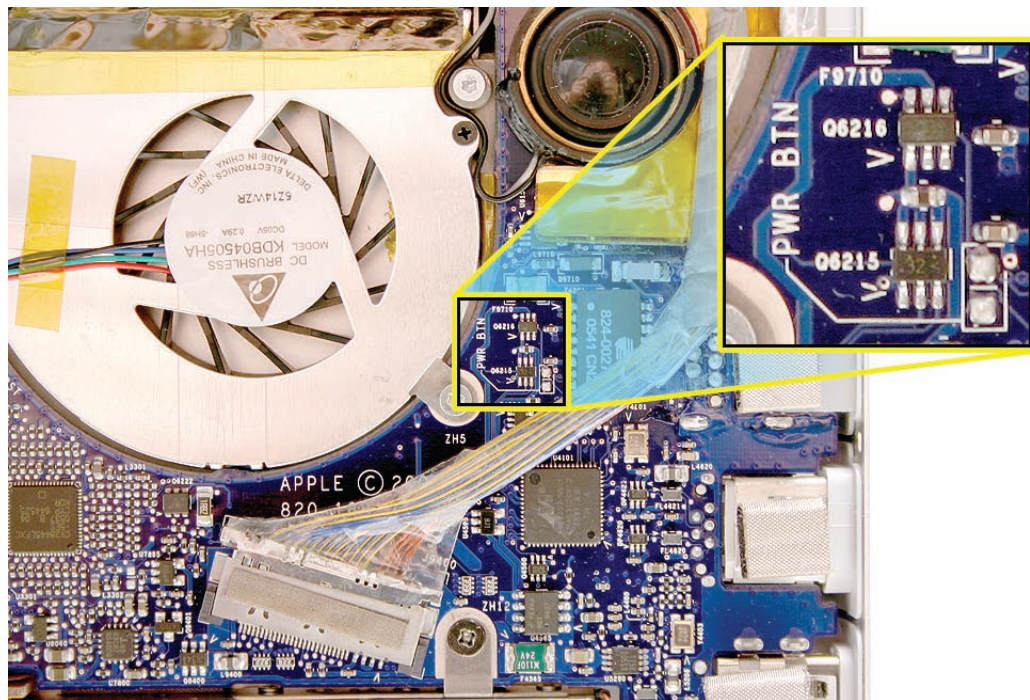
- ASD 3S101 is not backwards compatible with previous Macintosh notebook computers.
- Starting with MacBook Pro, like AHT the Apple Service Diagnostic version numbering changed. All ASD will be number sequentially starting with the prefix “3S.” This approach will provide each ASD release a unique version number and eliminate confusion between the same version across different product lines.

## Troubleshooting Aids and Tips

### Power Button pads on logic board

With the top case removed, the power button is disconnected. Instead of having to reconnect the top case to turn on the system, there are two pads on the logic board that can be shorted across (with a tool like a flat blade screwdriver) to act as the power button.

These pads are located near the edge of the logic board, just above center of the hard drive. It is marked POWER BUTTON. The pads are separated with a vertical white line.



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## Resetting the Power Manager (SMC)

Power management is now handled by a chip called SMC. Previously, it was handled by the Power Management Unit (SMC). To reset the SMC:

1. If the computer is on, turn it off.
2. Disconnect the power adapter and remove the main battery.
3. Hold the power button down for five seconds, then release.
4. Install the main battery and connect the power adapter.
5. Press the power button to restart the computer.

## System powered test using Caps lock LED

There are situations when the system is giving indications that it is shut down (no sleep light, no hard drive access, screen is dark, no fan, and so on). However, the logic board may still be running. In this case, the logic board is drawing power and generating heat.

**Warning: In this situation, if the computer is put in an enclosed environment like a carrying bag, the computer can overheat.**

Check this situation by pressing the caps lock key. If the LED glows, the power manager is running on the logic board. After pressing the caps lock key and perhaps other methods of waking it up fails, including closing the lid to go to sleep and try waking again, hold the power button down for six seconds to force a shut down of the computer. Restart the system to check if it boots up normally.

**Note:** Previously when the keyboard was connected directly to the power manager this method worked under all conditions, however as a USB device, the OS may be hung and the keyboard cannot respond. So if the caps lock light does not come on, the computer may be drawing power. If in doubt, hold the power button down for six seconds to force a shut down of the computer.



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## Software Troubleshooting Tips and Tools

### Mac OS X 10.4.5 or later only

Starting with the MacBook Pro, the system requires Intel compatible system file. The system software has to be Mac OS X 10.4.5 or later.

### Login window and account

Mac OS X requires at least one user account to be established. This is the Administrator's account. By default, the Accounts system preference pane has the "Log in automatically [Admin's name]" check. This automatic login setting allows the system to boot into the Finder without having a log-in prompt. However, if this box is not checked, you will need a password to get to the Finder. In addition, you will need to create a user account after you re-install system software.

### Customer forgot password

If the customer forgot the password for the computer:

1. Insert the MacBook Pro Mac OS X Install Disc 1 DVD.
2. Restart the computer while holding down the C key on the keyboard.
3. When the installer appears, chose Reset Password under the Installer Utilities menu
4. Follow the on-screen instructions.

### Safe Mode

Safe Mode is the state Mac OS X is in after a Safe Boot. A Safe Boot is a special way to start Mac OS X when troubleshooting. Starting up into Safe Mode does three things to simplify the startup and operation of your computer:

1. It forces a directory check of the startup (boot) volume. It is identical to using Disk Utility's Repair Disk or the `fsck -fy` terminal command.
2. It loads only required kernel extensions (some of the items in `/System/Library/Extensions`).
3. It disables all fonts other than those in `/System/Library/Fonts`
4. It moves to the Trash all font caches normally stored in `/Library/Caches/com.apple.ATS/(uid)/`, where (uid) is a user ID number such as 501.
5. It disables all startup items and any Login Items.

To start up into Safe Mode (to Safe Boot), do this:

1. Be sure the computer is shut down.
2. Press the power button.
3. Immediately after you hear the startup tone, press and hold the Shift key.  
**Note:** The Shift key should be held as soon as possible after the startup tone but not before.

- 
4. Release the Shift key when you see the screen the gray Apple and progress indicator (looks like a spinning gear). During the startup, you will see “Safe Boot” on the Mac OS X startup screen. To leave Safe Mode, restart the computer normally, without holding any keys during startup.

### Knowledge Base Articles

These troubleshooting articles can be searched from <http://www.apple.com/support>.

107392 What is Safe Boot, Safe Mode?

107394 Safe Boot Takes Longer Than Normal Startup

106692 Mac OS X: Troubleshooting Installation and Software Updates

106693 Mac OS X: Troubleshooting Installation From CD-ROM

## Application compatibility

With the transition to Intel Core Duo microprocessors, previous applications written for the PowerPC microprocessor have to be re-compiled to be able to work directly with this new microprocessor chip. As with other microprocessor transitions, Apple has formed bridges for users and developers to aid in the changes, Universal binary and Rosetta.

## Universal Binary

Universal binary is a Mac OS X application created by a developer who modifies and recompiles an application so it runs natively on either a PowerPC-based or Intel-based Mac. This application can run on older systems and the new MacBook Pro.

A universal binary application can work directly with the Core Duo microprocessor. As discussed in the following section, older non-native PowerPC applications can still run on MacBook Pro, but requires a Mac OS X technology called Rosetta to translate for the Core Duo processor.

Universal binary applications are marked with the following logo:



## Rosetta

Rosetta is a Mac OS X technology which allows PowerPC application to run on an Intel-based Mac. Rosetta works behind the scenes to translate an existing, native, non-Universal application (one that was designed to run natively a PowerPC-based Mac, not a Classic application – see note) so that it can run on an Intel-based Mac—all you have to do is double-click the application!

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**Note:** The Classic (Mac OS 9) application do not run on MacBook Pro. Recommend customers to upgrade to Mac OS X versions.

**Knowledge Base Articles**

These troubleshooting articles can be searched from <http://www.apple.com/support>.

303207 Intel-based Mac: How to tell if an application is Universal

303129 Intel-based Mac: Forcing a universal application to run with Rosetta

303137 Intel-based Mac: Do Classic applications work?



# Hardware Symptoms

## How to Use the Symptom Charts

The Symptom Charts included in this chapter will help you diagnose specific symptoms related to the product.

In this release, a section is dedicated to the normal start up of the Intel-based MacBook Pro with dedicated chart to identify and troubleshoot “no power, no video” and “power, no video” symptoms.

The steps to solve a symptom are listed sequentially. You might not need to perform every step before the symptom is solved. Start with the first step, and then test for the symptom. If the symptom persists, replace any modules you removed, go to the next step, and test again. Continue down the list until the symptom is solved.

## Startup

### Startup Sequence

The Intel-based MacBook Pro starts up very much like the previous professional Macintosh notebook computers. If power is available to the system, after pushing the power on button, the system will start to boot up.

- The screen will stay dark. The sleep LED will glow solid. This will last a few seconds.
- As the system boots, a Power-on test will be performed. See Error Codes listed below for failure results.
- If the system is not muted, you will hear a boot beep. The backlight will turn on and the sleep LED will turn off.
- The screen is gray in color. The Apple logo will appear and then the turning gear will appear.
- The desktop pattern will show up, as well as the menu bar start populating.

### No Power, No Video

#### **The computer will not power on (no fan movement, hard drive spin up and display is not lit)**

1. Remove any connected peripherals and eject any ExpressCard.
2. Check that the battery has enough charge to start the computer by pressing the button next to the LEDs on the battery. At least one LED must light solid (not flashing).
3. Connect a known-good Apple 85W Portable Power Adapter and power cord or plug to a known-good power outlet; make sure the DC plug is properly inserted. The DC plug should light up, if not, replace left I/O board. If not go to the troubleshooting, MagSafe connector.



- 
4. Try powering up without the battery installed. If it boots, replace battery connector cable.
  5. Reset the power manager. See new procedures under the “Resetting the Power Manager” heading in the Hardware Troubleshooting Tools and Tips section.  
**Warning: Resetting the power manager will permanently remove a RAM disk, if present, and all of its contents. You will also need to reset the date and time (using the Date & Time system preference pane).**
  6. Boot up the system and check the sleep indicator. If it turns on solid and turns off, the main logic board is getting power and completing the boot cycle. If no video appears, there is an issue turning the video turn-on or system software is corrupted. Try booting off the Mac OS X Install DVD. If the light does not turn off, the boot cycle is not being complete. This may be caused by the hard drive not being seen by the system, system software corrupted or possibly a hardware issue.
  7. Press Caps Lock key to see if key light comes on. If it does, hold power button down for six seconds to shut down the computer and restart.
  8. If it still doesn't start, verify power button cable is connected properly to top case flex cable assembly and that the flex cable is connected correctly to the logic board, if power button is not functioning correctly or damaged, replace the top case.
  9. Disconnect keyboard completely. Inspect connectors. Restart with keyboard disconnected.
  10. Remove any additional RAM.
  11. Try removing the AirPort Extreme card from its socket and start the computer. If it starts, shut it down and check the flex cable connector and the connector on the logic board and replace the damaged parts.
  12. Reseat these flex cables:
    - Left I/O flex cable
    - Hard drive flex cable (will boot to flashing folder)
    - Optical drive flex cable
    - Trackpad flex cable
  13. If the computer starts up, inspect the flex cable connector and its connector on the logic board for damage and replace the damaged parts.
  14. Try known-good Left I/O board.
  15. Replace logic board.

---

## Error Codes

The computer automatically performs a power-on self test when it is turned on after being fully shut down (not a restart). This section describes what to do if beeps are heard during the startup. When this occurs, the sleep LED will stay on—occasionally flashes.

MacBook Pro relies on a combination of tones and blinking sleep LED to display Power On Self Test (POST) error codes.

If the computer detects no SDRAM (Synchronous Dynamic Random Access Memory, also referred to as RAM) or the RAM installed does not meet the appropriate specifications, the screen will remain black but the power LED on the front of the computer will blink once per second to signal the error. This error condition may be due to physically damaged RAM, installing the incorrect type of RAM, or not having RAM installed.

Some RAM may appear to pass the Power-On-Self-Test (POST) but still cannot be used by the operating system. In this case, the computer will display a gray screen, sound three tones and blink the power LED on the front of the computer three times, pause, and repeat the blinking until the computer is turned off.

### **Related Knowledge Base articles:**

303083: Intel-based Mac Power On Self Test RAM error codes

Blue screen appears (a spinning disc cursor may also be visible),  
Prohibitory Sign appears,  
Restart dialog box appears (Mac OS X 10.2 kernel panic window), or Gray screen during startup



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You need to restart your computer. Hold down the Power button for several seconds or press the Restart button.

Veillez redémarrer votre ordinateur. Maintenez la touche de démarrage enfoncée pendant plusieurs secondes ou bien appuyez sur le bouton de réinitialisation.

Sie müssen Ihren Computer neu starten. Halten Sie dazu die Einschalttaste einige Sekunden gedrückt oder drücken Sie die Neustart-Taste.

コンピュータを再起動する必要があります。パワーボタンを数秒間押し続けるか、リセットボタンを押してください。

#### Kernel Panic dialog box

1. Make sure all external devices are disconnected and any ExpressCard ejected. If kernel panic goes away, troubleshoot the external device by reconnecting each device until the panic occurs.
2. If there are two RAM cards installed in the expansion slots, remove the top card and restart.
  - If symptom repeats, replace bottom card with known-good RAM card.
  - If symptom does not repeat, replace top RAM card with known-good RAM card and restart.

For assistance in software troubleshooting, go to Knowledge Base article 106464: Mac OS X: Troubleshooting a Startup Issue.

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## Flashing question mark appears on the screen

**Note:** This system will only boot the Mac OS X system that shipped with this computer or later. It does not support booting into Mac OS 9.

1. Start up from the MacBook Pro Mac OS X Install Disc 1 DVD that came with the computer (hold down the “C” key during restart).
2. When the Installer opens, from the Installer menu under Utilities, select Disk Utility.
3. When the Disk Utility opens, on the left hand side, all disk and volumes are listed. If you don't see the internal hard drive, the system is not recognizing it. Skip to the next step. Otherwise, select the internal hard drive icon and follow the instructions under the First Aid tab to verify the hard disk, and repair if needed. Restart the computer.
4. If the hard drive is not recognized, check the hard drive flex cable for damaged connectors (connector peeled off the flex cable, for example), and if bad replace the hard drive flex cable.
5. Reseat the hard drive flex cable. If still not recognized, replace the hard drive.  
**Important:** If the computer is under warranty and data recovery is required, refer to Knowledge Base article 31077: DriveSavers: Hard Drive Data Recovery & Warranty Implications, for important information.
6. Reinstall system software using the MacBook Pro Mac OS X Install 1 disc.  
**Note:** Don't forget to install both the Mac OS X and software.

For assistance in software troubleshooting, go to Knowledge Base article  
88410: SMART: A Brief Description  
152349: Mac OS X 10.3: Replacing a disk before it fails

Computer begins to power up, the fans and hard drive are spinning, pressing caps lock key and LED turns on, but there is no startup chime or video

1. Reset the power manager. See new procedures under the “Resetting the Power Manager Unit (SMC)” heading in the Hardware Troubleshooting Tools and Tips section.  
**Warning: Resetting the power manager will permanently remove a RAM disk, if present, and all of its contents. You will also need to reset the date and time (using the Date & Time system preferences pane).**
2. Check all cable and flex connections to the logic board. Try restarting.
3. Replace the logic board.



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## System shuts down intermittently

1. Disconnect all external peripherals and eject any ExpressCard.
2. Make sure a known-good fully charged battery is fully inserted. Check that the battery latch is fully engaged and is not broken or getting caught before fully catching. Check battery connection to logic board.
3. Make a visual inspection of the battery connector in the battery bay. Make sure all blades are visible and not bend. If damaged replace the battery connector.
4. Make sure system is not over heating, the air vents are clear and unit was not used on a soft surface.
5. Check that the fan cables are connected and the fans are operational.
6. Make sure all feet are still on the system bottom. If not, order foot replacement kit.
7. Check that the thermal material between the heat exchanger and logic board is in contact with both by unscrewing the logic board screws and gently pulling up on the left side of the board to verify resistance caused by adhesion from the thermal material. If not, new thermal materials for the processor, control ASIC, and video chip must be reinstalled (see Logic Board Take Apart chapter).
8. Remove the battery and connect known-good 85W power adapter and power cord or plug to a known-good power outlet; make sure the DC plug is properly seated. The DC plug should light up, used the MagSafe troubleshooting section.
9. Verify left I/O board cable is securely connected and cable shows no signs of wear.
10. Try known-good left I/O board.
11. Replace the logic board.

## System shuts down almost immediately after startup

1. Disconnect all external peripherals and eject any ExpressCard.
2. Make sure a known-good battery is fully inserted. Check battery charge and make sure that at least two LED charge indicators light, otherwise connect the adapter. The adapter should light when plugged in. If not, troubleshoot the MagSafe connection
3. After charging for a while, if battery does not seem to charge, or if charged up but quickly discharges, replace the battery. Verify known-good battery.
4. Check battery connection to logic board, and check wire attachment to connectors.
5. Just before the system shuts down, the sleep LED briefly comes on, check the two thermocouple connections to the main logic board. They should be fully seated and no damage to the wiring. If the thermocouple is damaged replace the thermocouple.
6. If known-good battery does not charge, replace left I/O board.
7. Replace the logic board.

---

## Application Quits, Kernel panic or other booting problems

1. If a specific application quits, replace the application. Verify the application is compatible with OS X.
2. Clear parameter RAM. Hold down Command-Option-P-R during startup until you hear a second startup chime.
3. Run Disk Utility from the Software Install and Restore DVD.
4. Perform a clean install of system software with the software install and restore disc that came with the computer. Note: Restore disc images are available at <http://service.info.apple.com>. Select "Disc Images."
5. Reboot system.
6. Run Apple Service Diagnostic in loop mode (Control-L) for an extended time to test the memory. If the test finds bad memory, replace the DIMMs one at a time and test until all bad DIMMs are replaced with known-good modules.
7. Replace the logic board.

## AirPort Extreme

**Note:** The AirPort Extreme card is now separated from the Bluetooth module. In addition, the AirPort antenna is now in the clutch barrel behind the gray plastic window. The Bluetooth antenna is now separate from AirPort and mount just in front of the hard drive.

### AirPort Extreme not recognized

1. In Mac OS X, use Software Update in system preferences or see the Apple Software Updates web page to make sure the latest version of AirPort Extreme software is installed.
2. Restart the computer.
3. Open AirPort in system preferences and make sure AirPort is on and Base Station is selected.
4. Reseat the AirPort Extreme card in its slot.
5. Remove and reinstall the AirPort Extreme software.
6. Replace with known-good AirPort Extreme card.
7. Replace left I/O board.
8. Replace the main logic board.

### AirPort connection is slow

1. Move computer closer to AirPort Base Station or other AirPort device.
2. Check how many users are trying to use AirPort in the area. Too many users are accessing network at the same time causing heavy network traffic. To improve network connection speed, add additional AirPort Base Stations.

- 
3. Check for other changes in the environment that may cause interference with the AirPort signal.
  4. Use Software Update in system preferences or see the Apple Software Updates web page to make sure the latest version of AirPort Extreme software is installed.
  5. Restart the computer.
  6. Check the AirPort Extreme antenna connection to the AirPort Extreme Card.
  7. Reseat the AirPort Extreme card in its slot.
  8. Replace with known-good AirPort Extreme w/ Bluetooth card.
  9. Check AirPort Extreme antenna wire coming from clutch barrel for nicked insulator or crimped wire. If bad, replace the AirPort Extreme antenna in the clutch barrel.
  10. Replace left I/O board.
  11. Replace the main logic board.

## Battery

### Battery will not pop up

1. Flip over the unit and slide the battery latches.
2. If the battery does not pop up, use a small plastic flat-blade tool to pry up the battery around the battery latch.
3. Try a new battery.
4. Verify proper latch operation, by exercising the latch. If it does not move smoothly or evenly, replace the bottom case.
5. If the latch does exercise correctly, verify that the customer is not installing the battery with excessive force or the body of the battery has not been deformed around its perimeter.  
**Warning: If the battery plastic housing has been damaged, or the two halves of the housing have separated, the battery is unsafe for use.**  
**Note:** If there is no sign of abuse (dents, scratch marks) replace the battery under warranty.

### The battery won't charge

1. Remove any externally connected peripherals.
2. Try known-good power outlet.
3. Connect known-good 85W power adapter and power cord or plug; make sure the DC plug is properly inserted. The DC plug should light up, if not, troubleshoot the MagSafe connection. If the power adapter light is green, turn over the computer and press the battery button. The battery lights should glow green and stay on if the power adapter is operating correctly.
4. Try known-good battery. If it charges, replace the battery. If doesn't charge, check the battery connector and its connection to the logic board.

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5. Replace the battery connector assembly (requires removing the logic board).
  6. Reset the power manager. See new procedures under the “Resetting the Power Manager Unit (SMC)” heading in the Hardware Troubleshooting Tools and Tips section.
  7. **Warning:** Resetting the power manager will permanently remove a RAM disk, if present, and all of its contents. You will also need to reset the date and time (using the Date & Time system preference pane).
  8. Make sure the left I/O cable is firmly connected. Look for damaged insulation or wires.
  9. Replace left I/O power cable.
  10. Replace left I/O board.
  11. Replace logic board.

### Battery won't charge completely

If the battery appears to stop charging between 95 and 99 percent, this is normal operation. Refer to Knowledge Base article 88344: PowerBook G4, iBook: battery does not show full charge in Mac OS X.

### Short battery life

Three categories to consider:

- There is a system issue (not the battery).
  - If you have the customer's power adapter, plug it into a known good outlet and verify that it can charge the system. Also make sure it is the correct 85W adapter.
  - Plug a known good 85W adapter into a known good outlet. Verify that the DC connector is fully seated into the computer.
  - Check whether the customer's system is setup for heavy battery power use (AirPort on, optical media always in drive, Energy Savings set to Highest Performance, etc.)
  - Test the computer with all third-party devices (printers, hubs, third-party keyboard or mouse) removed.
  - Reset the power manager. See new procedures under the “Resetting the Power Manager Unit (SMC)” heading in the Hardware Troubleshooting Tools and Tips section.
- The battery needs calibration, or it is nearing the end of its useful life.
  - Calibration should be done when you first use the battery, and every few months after. It allows the battery to properly calculate how much power is left in the battery.
  - The battery is a consumable part. It can be charged and discharged only so many cycles before it becomes depleted and can no longer hold a charge.
  - **Note:** The battery calibration procedure is as follows:
    1. Plug in the power adapter and fully charge your battery until the light on the power adapter plug changes to green and the onscreen meter in the menu bar indicates that the battery is fully charged.
    2. Allow the battery to rest in the fully charged state for two hours or longer. You may use your computer during this time as long as the adapter is plugged in.



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3. Disconnect the power adapter with the computer on and start running it from the battery. You may use your computer during this time. When your battery gets low, you will see the low battery warning dialog on the screen.
  4. Continue to keep your computer turned on until it goes to sleep. Save all your work and close all applications when the battery gets low and before the system goes to sleep.
  5. Turn off the computer or allow it to sleep for five hours or longer.
  6. Connect the power adapter and leave it connected until the battery is fully charged again.
- The battery has a defect.
    - Symptoms include, but are not limited to, a relative new battery that will not charge at all, reports an “X” in the menu bar icon, status light on its case that will not go out. In the first two cases, the battery may need calibration—try this first. In addition, after troubleshooting at the system level, if it is demonstrated that the battery is causing abrupt shut-downs or goes to sleep without warning, the battery can be considered severely degraded and follow the criteria below.
    - **Warranty Note:** If the battery was purchased (either with the computer or as a standalone part) in the last 90 days and exhibits severely degraded performance (as defined above) provide an in-warranty replacement. If the battery was purchased between the last 90 to 365 days, have the customer calibrate their battery. If after recalibration, the battery still exhibits severely degraded performance, then provide an in-warranty replacement. If the battery was purchased more than 365 days ago, the customer will need to purchase a new battery.

**Useful Knowledge Base articles:**

86440, PowerBook, iBook: Battery Life, for tips on extending battery life and explanations of some concepts of battery use.

86284, Calibrating your computer's battery for best performance

## Bluetooth

**Note:** Unlike the previous PowerBook G4 (15-inch Double-Layer SD), the AirPort Extreme and Bluetooth 2.0 functions are on separate cards.

Bluetooth system preferences does not show up under Hardware system preferences

1. Check for software/firmware updates on the web.
2. Check the Bluetooth card flex cable. Make sure the cable is not damaged and fully seated.
3. Check the hard drive flex to main logic board.
4. Replace the Bluetooth card
5. Replace the hard drive flex
6. Replace the logic board.

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## Bluetooth Card not recognized by other devices

1. Open Bluetooth in system preferences and make sure under the Settings tab that Discoverable is checked.
2. Make sure the Bluetooth antenna is properly installed.
3. Check the Bluetooth antenna is connected to Bluetooth card.
4. Replace with known-good Bluetooth card.
5. Replace logic board.

## Display

### Display latch not working

**Note:** When the display is being closed, two latch hooks in the top of the display housing should be magnetically pulled down through the slots in the top case and secured by the latch mechanism. When the latch button is pushed, the hook should release and retract into the display housing.

1. See the Latch Adjustment chapter in the Adjustments section of this service manual to verify the latch mechanism and latch hook operation and make adjustments, if necessary.
2. If the latch hook is broken, replace the display latch hook assembly.

### When displaying a single color over the screen area, the LCD panel shows one or more pixels that are not properly lit

To determine whether or not the display has an acceptable number of pixel anomalies, follow the steps below:

1. Set the display image to one of the following colors: all-white display, all-red display, all-green display, or all-blue display. Knowledge Base article 112125: Service Diagnostics Matrix, has the LCD Tester Diagnostic Utility that will generate these patterns on the screen.
2. Using a jeweler's loupe, pocket microscope, or other magnifying device, identify and count each pixel anomaly:
  - Bright subpixel anomaly = subpixel that is always on
  - Dark subpixel anomaly = subpixel that is always off
3. The number of acceptable pixel anomalies for this system is:

#### Acceptable Number of Subpixel Anomalies

Bright	Up to 3
Dark	Up to 5
Combination	Up to 7

4. If the number of subpixel anomalies exceeds the acceptable number listed in the above chart, replace the display panel assembly.

## Replace

Bright	4 or more
Dark	6 or more
Combination	8 or more

5. If the number of subpixel anomalies is acceptable, explain to the customer that the pixel anomalies are within specifications, and no repair is necessary.

**Important:** Do not release the specifications to customers. Instead, inform them that a certain number of subpixel anomalies are considered acceptable, and these factors apply to all manufacturers using LCD technology—not just Apple products.

When speaking with customers, please use the following explanation:

Active-matrix LCD technology uses rows and columns of addressable locations (pixels) that render text and images on screen. Each pixel location has three separate subpixels (red, green, and blue) that allow the image to be rendered in full color. Each subpixel has a corresponding transistor responsible for turning the subpixel on or off.

There are typically millions of these subpixels on an LCD display. For example, the LCD panel used in the Apple Cinema HD display is made up of 2.3 million pixels and 6.9 million red, green, and blue subpixels. Occasionally, a transistor does not work perfectly, which may result in the affected subpixel being turned on (bright) or turned off (dark). With the millions of subpixels on a display, it is quite possible to have a low number of faulty transistors on an LCD. Therefore, a certain number of subpixel anomalies are considered acceptable. Rejecting all but perfect LCD panels would significantly increase the retail price for products using LCD displays. These factors apply to all manufacturers using LCD technology—not just Apple products.

## ExpressCard/34

### ExpressCard will not insert into the ExpressCard slot

1. Make sure the ExpressCard is 34mm in width. The ExpressCard standard allows for 54mm cards which will not fit in this slot.
2. Make sure the ExpressCard is right side up (cards are keyed and cannot be inserted upside down).
3. Verify the ExpressCard is not warped or damaged in any way; if so replace the card.
4. Try a different ExpressCard.
5. Carefully raise the ExpressCard slot cover and check for a foreign object inside the slot.
6. If the slot cover is preventing the card from being inserted, re-seat the ExpressCard on the left I/O board by making sure the cage is closer to the main logic board. The door catch on the top of the ExpressCard mechanism.
7. Replace ExpressCard cage.

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## ExpressCard does not mount to the desktop

1. Make sure the ExpressCard has its drivers installed.
2. Check if a known-good ExpressCard works in this slot. The ExpressCard may be bad.
3. Check the Left I/O Board flex cable connection to the logic board.
4. Replace the ExpressCard cage.
5. Replace the left I/O flex cable.
6. Replace the logic board.

## Hard Drive

### Internal hard drive will not initialize:

1. Make sure the hard drive is a cable select drive set as a master (0).
2. Start up from the MacBook Pro Mac OS X install Disk 1 disc that came with the computer (hold down the "C" key during restart).
3. When the Installer opens, from the Installer menu, select Open Disk Utility.
4. If the hard drive is recognized, format it under the Erase tab.
5. If the hard drive is not recognized, reseal the hard drive flex cable, or replace if needed.
6. If still not recognized, replace the hard drive.
7. Reinstall system software using the MacBook Pro Mac OS X Install Disc 1 which came with the system.

**Important:** If the computer is under warranty and data recovery is required, refer to Knowledge Base article 31077: DriveSavers: Hard Drive Data Recovery & Warranty Implications, for important information.

## IR Remote

Remote won't communicate with system applications such as iTunes or iPhoto, or with the optical drive.

Make sure of the following when using the Apple Remote:

- You are within 30 feet of the front of the computer.
- You have an unobstructed line-of-sight to the front of the computer.
- You are pointing the lens end of the Apple Remote directly at the front of the computer.
- The computer is powered on and awake.
- The "Disable remote control infrared receiver" checkbox in the Security pane of System Preferences is NOT checked.

Make sure the active application works with Apple Remote. Apple Remote uses Front Row, and from Front Row it can access DVD Player, iPhoto, iTunes, and QuickTime Player.



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- Make sure the remote is paired with the computer. Access the System Preferences/Security pane and check “Unpair” if available. Close the Security pane, and re-pair the Apple Remote with the computer. See Knowledge Base article 302545.
1. Use a digital camera to test your Apple Remote.

If you have a digital camera or DV camera with an LCD display, you can use it to see if your Apple Remote is emitting a signal. Infrared beams are invisible to the human eye, but most digital cameras and video cameras use Charged-Coupled Device (CCD) chips or image sensors that are sensitive to infrared light.

To use a camera to test your Apple Remote, follow these steps:

    - Turn on your digital camera or DV camera and remove any lens cover.
    - Point your Apple Remote toward the display latch button.
    - Press and hold the Menu button on the remote while looking at your camera’s LCD display.
    - If you see a faint blinking light coming from the Apple Remote in the camera’s LCD, then the remote is working properly.
    - If you don’t see any blinking light in the camera’s LCD, replace the battery in your Apple Remote and then test it again with your computer
  2. Replace Apple Remote.

302543: How to replace the Apple Remote battery”

## IR Sensor/Receiver

Supported applications do not respond to input from the remote control.

- Make sure “Disable remote control infrared receiver” checkbox is not checked.
  - If “Unpair” is available in the Security pane of System Preferences, another Apple Remote may be paired to the computer (pairing allows only one Apple Remote to control the computer). To delete a pairing between the remote and the MacBook Pro, click Unpair. (You may have to enter your Administrator password to make changes in the Security pane.)
1. Perform the checks above under “IR Remote” to verify that the Apple Remote is functioning correctly, and retest.
  2. Verify that the IR Sensor can be seen in the Apple System Profiler. Open the Apple System Profiler and click on the “USB” section. You should see the following listed:

If you don’t see it, replace the IR board and retest.

**Yes:** Problem resolved.

**No:** Replace the IR sensor board and retest. Refer to the “IR Board” procedure in Take Apart.

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## Built-in iSight Camera

The built-in camera is not recognized.

1. Boot the MacBook Pro to the desktop and launch iChat AV. Note: You do not need to be connected to a network to use iChat AV to troubleshoot. Verify that the correct versions of Mac OS X and iChat AV are installed. Reinstall or update software as needed.
2. Open the iChat AV preferences and click on the 'Video' icon. Verify whether the camera is recognized by the iChat AV software. Is the camera recognized?
3. Check the camera connection to main logic board.
4. Replace the camera (part of display bezel).

### Camera image quality poor

- Verify that the lens assembly for the iSight camera is clean. Fingerprints and other contaminants can affect image quality. Clean the lens using a lint free lens cleaning cloth being while being careful not to scratch the lens. Verify that there is sufficient lighting to produce a good quality image.
- Lighting which is comparable to that found in a well lit office will product a good quality image. If possible, avoid having a brightly lit background. Diffused lighting is preferred over direct lighting. Launch iChat AV and open the iChat AV preferences. Click on the 'Video' tab. Is the video quality acceptable?

**Yes:** The camera is functioning normally. The image quality problems may be caused by bandwidth limitations when using iChat over the internet. Instruct the customer to use the iChat AV connection doctor feature to verify that there is sufficient bandwidth to have a video iChat session without a significant degradation of image quality.

**No:** The camera may not be functioning normally. Replace display bezel and retest.

### Camera recognized but no audio

1. Open the System Preferences window and click on Sound. Verify that the built in internal microphone has been selected as the device for sound input. Verify that the volume settings (on the slider bar) are appropriate.
2. Launch iChat AV and open the iChat AV preferences. Click on the 'Video' icon. Speak into the microphone while monitoring the microphone level indicator. If line meter responds, it was a settings problem.
3. Check speaker assembly (includes the microphone) is plugged in.
4. Replace the speaker assembly

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## Audio Quality Poor

The camera is recognized but the built-in microphone's audio quality is poor.

1. Open the System Preferences window and click on Sound.
  - Verify that the internal microphone has been selected as the sound input port.
  - Verify that the input volume settings are appropriate. Use the volume level meter to verify settings.
2. Open iMovie and create a new project. Click on the Audio button and record a sound sample. If audio quality is fine, it was a settings problem.
3. Check the speaker assembly (includes the microphone) is plugged in.
4. Replace the speaker assembly.

## Keyboard

### No response from any key on keyboard

1. Remove any connected peripherals and eject any ExpressCard.
2. If only numbers shows up, check if NUM lock (F6) is engaged.
3. Attach an external USB keyboard, if it doesn't work, go to step 6.
4. Turn off the computer. Check the keyboard flex cable connection to the trackpad, and the trackpad flex cable connection to the main logic board (especially check the connectors for damage).
5. Start up from the MacBook Pro Mac OS X Install 1 DVD that came with the computer (hold down the "C" key during restart, if possible) to verify that it is not a software problem.
6. Replace keyboard.
7. Replace top case.
8. Replace logic board.

### No keyboard illumination

1. Go to Keyboard system preference pane and make sure the "Illuminate keyboard in low light conditions" check box is checked. Try using system in a dimly lit environment.  
**Note:** The keyboard illumination is not bright enough to be seen in most well lit spaces. In order to view the key being illuminated, the ambient light needs to be dim.
2. Check the keyboard backlight cable connection to the top case flex, if bad, replace the top case.
3. Replace keyboard
4. Replace the left ambient light sensor.
5. Replace logic board.

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Keyboard is partially illuminated.

1. Check the keyboard backlight cable connection to the top case flex if bad replace the top case.
2. Replace keyboard.

## Microphone

The microphone is not working

1. Check the Sound system preference pane and verify the selection under the Input tab is for the built-in microphone.
2. Check the signal level and level meter and adjust the gain.
3. Reset PRAM (Press the power button, then hold down the Option-Command-P-R keys until you hear the startup chime at least one additional time after the initial startup chime).  
**Warning: Resetting the PRAM will permanently remove a RAM disk, if present and all of its contents. You will also need to reset the date and time (using the Date & Time system preference pane).**
4. If there is no sound output from the internal speaker as well as the microphone not working, verify cable connections.
5. Replace the speaker assembly (which contains the microphone).
6. Replace Left I/O flex cable.
7. Replace the Left I/O board.
8. Replace the logic board.

## Modem (External)

**Note:** MacBook Pro does not have an built-in modem. Apple offers an optional external USB Modem.

No modem dial tone

1. Check that the correct modem is selected in the Network Port Configuration section of the Network system preferences.
2. Verify known-good analog (not digital) telephone line.
3. Verify known-good RJ-11 telephone cable.
4. Verify RJ-11 cable is not plugged into Ethernet port (should not be physically possible with this MacBook Pro).
5. Verify RJ-11 telephone cable is firmly installed in the modem port.
6. Inspect RJ-11 connector for pin damage. If damaged replace modem.



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7. Open Apple System Profiler, and under the Hardware tab look at USB . It should show the modem presence by indicating Apple External Modem.. If not visible, start checking modem USB connection.
  8. Replace the external modem.
  9. Replace logic board.

#### Modem does not respond (can hear dial tone)

1. Check that the correct modem is selected in the Network Port Configuration section of the Network system preferences.
2. Check modem application is properly configured.
3. Open Apple System Profiler, and under the Software tab look at Extensions. Check to see that the MotorolaSM56K and AppleI2SModem Family files are listed and loaded. If not, restart the system and check again. If still not visible replace system software.
4. Open Apple System Profiler, and under the Hardware tab look at USB . It should show the modem presence by indicating Apple External Modem.. If not visible, start checking modem USB connection.
5. Replace Apple External Modem.
6. Replace logic board.

#### Modem intermittently disconnects or low performance

1. Verify known-good RJ-11 telephone cable (for example, the retaining clip is not broken off) and it is firmly installed when used. If telephone cable is bad, replace it.
2. Ask if issue happens with only one particular phone line, but not another. The problem may be an issue with that particular phone line. Under bad line condition, try setting the modem script to start with a slower connect rate such as "Apple Internal 56K Modem (v.34)."
3. If the customer indicates the system disconnects under very high CPU loads such as burning DVDs and/or working with video editing software such as Final Cut Pro, try connecting the modem without any application running and see how the modem performs. Use Knowledge Base article 106642: "Mac OS X: Using Apple PPP Test Server" to test the modem. If OK, ask the customer if the task of connecting the modem can be done separately or with less applications running simultaneously.
4. Replace Apple USB modem.
5. Replace the logic board.

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## Optical Drive

### Optical Drive not recognized

1. Make sure the optical drive is a cable select drive set as a slave (1).
2. Make sure the optical drive flex cable is undamaged and properly installed. If bad, replace.
3. Replace optical drive.

### The optical drive does not accept CD or DVD disc (mechanical failure)

1. Verify disc is not warped and is a 12 cm circular disc.
2. Check that a small disc is not stuck inside, or other foreign objects. Remove drive from system to extract disc.
3. Verify disc is pushed almost all the way into the slot.
4. Check the optical drive flex cable.
5. Replace optical drive.

### The optical drive does not eject CD or DVD disc

1. Verify disc is not in use by quitting any applications that may be using the disc.
2. Press and hold Media Eject key at top right corner of keyboard. If that does not work, hold down Function (fn) key and Media Eject key.
3. Drag disc icon to trash or select it and press Command-E.
4. Choose Restart from Apple menu while holding down trackpad button.
5. Reseat the optical drive mechanism. Make sure the drive is biased toward the back of the computer.
6. Replace optical drive. (See “How to remove a stuck disc from the optical drive” heading of the Optical Drive chapter in the Take Apart section of this manual.)

### The disc icon does not show up on desktop, or a dialog box appears to initialize disc, when inserting a read-only disc

1. Verify the correct type of disc is being used.
2. Use Software Update system preference pane to check if there is updated firmware.
3. Try cleaning the disc. If it is dirty or scratched, it may not mount.
4. Try a different disc.
5. Replace optical drive cable.
6. Replace optical drive.

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## Difficulty writing to optical media

1. Verify the correct type of disc is being used.
2. Try a different brand or speed of CD-R disc.  
**Note:** Some brands of 24x or 32x CD-R media may not work with the SuperDrive.  
**Note:** There are two factors in the ability for the optical drive to write to media.
  - First, there are varying qualities of blank optical media. Some media are made to such low specifications that the ability for the drive to write to it is marginal. There are variations in optical media even under the same brand. Some brands source their optical media from a variety of manufacturers, so there may be variations in the quality.
  - Second, an optical drive that supports writing to a CD-R/RW or DVD-R/RW disc requires a special writing algorithm for discs from different disc manufacturers. There are hundreds of disc manufacturers, it is impossible to implement writing algorithms for each disc manufacturer. Usually, drive manufacturers implement special writing algorithms for discs from major disc manufacturers. For discs that are not supported by the drive with special writing algorithms, the drive will use a generic writing algorithm to write the disc. In this case, the writability and readability may not be optimal.
3. Replace optical drive flex cable.
4. Replace optical drive.

## Ports

### A USB port is not recognizing devices

1. Completely shut down, then press the power button to start the computer.
2. Use Software Update system preferences to verify that the latest software is installed.
3. For USB, test ports with an Apple keyboard or mouse. If the left port is not recognized check the Left I/O flex cable's condition and connection.
4. If the USB flex cable is fine, replace the Left I/O board for the left USB port or the main logic board for the right port.
5. Use Apple System Profiler to verify that the computer is recognizing the bus. If not replace the logic board.

### A USB device not recognized by computer

**Note:** If you are trying to use a serial device with a USB/Serial adapter, check with the manufacturer of the adapter for compatibility.

1. Completely shut down, then press the power button to start the computer.
2. Verify current driver for the device is installed.
3. If a camera, turn on camera after initiating download with camera application.
4. Try the other USB port.

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5. Try different USB device on same port.
  6. Eliminate chain by plugging in only one peripheral.
  7. Try known-good Apple USB keyboard or mouse to verify the port is working properly. If the left port is bad, check the Left I/O board flex cable and connections. If the right port is bad, check the backup battery flex cable and connections.
  8. If the Left I/O flex cable is fine, replace the Left I/O board for the left USB port.
  9. Replace logic board.

### A FireWire port is not recognizing devices

**Note:** In FireWire Target Disk Mode, MacBook Pro cannot be mounted on systems with Mac OS X 10.3.9 or earlier. Refer to Knowledge Base article 303118, Intel-based Macs: About using Target Disk Mode with Mac OS X 10.3.9 or earlier.

1. Test the FireWire port by connecting to another computer using FireWire Target Disk Mode. Refer to Knowledge Base article 58583: How to Use FireWire Target Disk Mode.
2. Verify that drivers are installed properly for third party, if needed.
3. Make sure the cable is firmly attached.
4. Try a different cable.
5. If self powered make sure that the power supply is connected and device's LED indicates that it is getting power.
6. Replace logic board.

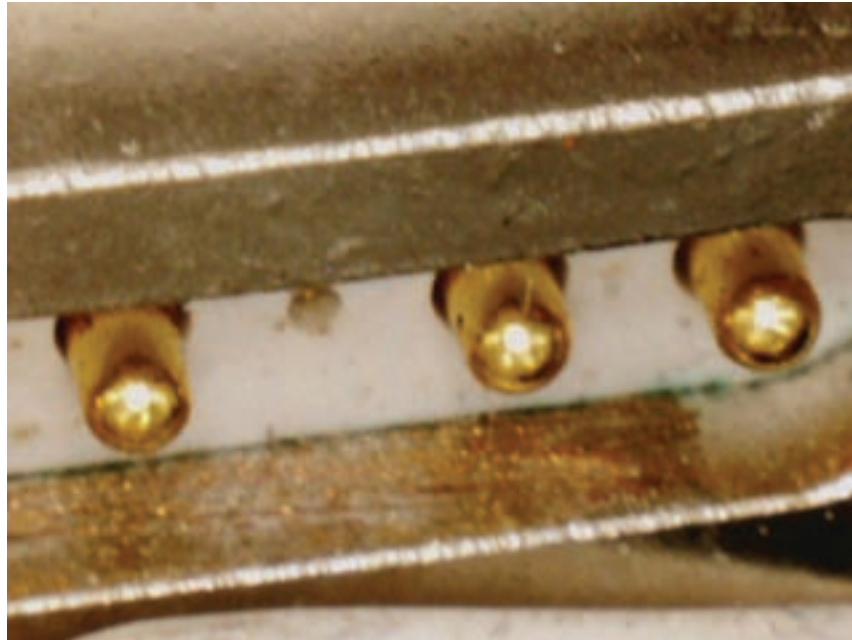


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## Power Adapter

The power adapter LED does not turn on

1. Confirm the power adapter is connected to a known good outlet.
2. Try replacing the AC plug or the AC power cord. If the adapter works replace the appropriate plug or cord.
3. Check the pins in the power adapter DC plug for pins stuck down.



If pins are stuck down, try cleaning the contact

Debris removal should be done with a soft, non-electrostatic generating (non-plastic bristle) brush. A tool such as a cotton swab may introduce foreign material that will cause the pins to seize up. If the pin has become stuck, try working the pin to release it.

4. If LED on the DC cord does not turn on, there may be contamination in the computer port. The contact pins can be dirty. It can be cleaned with a soft brush. Do not use liquid.

In addition, foreign material may be pulled in which covers the contacts or prevents the DC plug to seat enough for the sense pin to connect to the system.



5. Check if pins are missing or bent. Replace the power adapter
6. Check the power port on the computer for contamination which prevents the pins to make contact. It can be cleaned with a soft brush. Do not use liquid.  
In addition, foreign material may be pulled in which covers the contacts or prevents the DC plug to seat enough for the sense pin to connect to the system.
7. Remove the battery and connect the power adapter. If the adapter turns on and boots the system, replace the left I/O board.

## Sound

No sound heard and the Speakers section of the Sound system preference pane indicates that an external device is plugged in (to the headphone jack or USB ports)

1. If there is nothing plugged into the headphone jack or USB ports, under the Output tab of the Sound system preference pane should be set to the internal speakers.
2. If not, and if nothing is plugged in, try plugging in headphones or external speakers. Restart the computer. Remove the device.
3. Reset PRAM (Press the power button, then hold down the Option-Command-P-R keys until you hear the startup chime at least one additional time after the initial startup chime).  
**Warning: Resetting the PRAM will permanently remove a RAM disk, if present, and all of its contents. You will also need to reset the date and time (using the Date & Time system preferences pane).**
4. If the system continues to indicate a phantom device plugged into the system replace , left I/O board.
5. Replace logic board.

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## No sound from speaker(s)

1. Use the Software Update system preference pane to verify that the latest audio update has been installed.
2. Press the F3 key (with the fn key pressed and not pressed) to verify that mute mode is not enabled.
3. Press the F4 or F5 key (with the fn key pressed and not pressed) to check the volume setting.
4. Verify no external speakers or headphones are plugged in.
5. Check the speakers tab on the Sound control panel to confirm that the software is correctly seeing that there are no external speakers or headphones connected.
6. Shutdown computer and restart.
7. Reset PRAM (Press the power button, then hold down the Option-Command-P-R keys until you hear the startup chime at least one additional time after the initial startup chime).  
**Warning: Resetting the PRAM will permanently remove a RAM disk, if present, and all of its contents. You will also need to reset the date and time (using the Date & Time system preference pane).**
8. Verify that the speaker cable is connected properly to left I/O board.
9. Check speaker cable. Verify left and right cable connections.
10. Check with headphones or external speaker, if audio is heard, replace speaker assembly.
11. Replace left I/O flex cable.
12. Replace left I/O board.
13. Replace the logic board.

## Distorted sound from speakers

1. Verify sound is correct with external speakers/headphones. If sound is correct, check speaker wire and connections.
2. In Sound system preference pane, check balance.
3. Compare same sound with two different units to make sure that sound is actually distorted.
4. Check speaker wire. If damaged, replace speaker assembly.
5. If the distortion is coming from the right speaker with sound balance shifted toward the left, remove the right speaker. Check the gasket in the speaker housing, if the gasket is deformed, move the gasket back into a circular shape. If gasket cannot be fixed, replace the housing. You need to order the speaker assembly.
6. Replace left I/O board.
7. Replace left I/O flex cable.
8. Replace logic board.

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## Trackpad

### The cursor does not move when you are using trackpad

1. Verify that no USB device is connected.
2. Boot from the Software Install and Restore DVD to verify that it is not a software problem. If the trackpad works, restore the system software.
3. Reset the power manager. See new procedures under the "Resetting the Power Manager Unit (SMC)" heading in the Hardware Troubleshooting Tools and Tips section.
4. Check trackpad flex cable connection to the logic board.
5. Replace top case.
6. Replace logic board.

### The cursor intermittently does not move or moves erratically

#### Notes:

- User must touch with the surface of only one finger at a time and point directly down on the trackpad surface.
  - When running Apple Hardware Test or Apple Service Diagnostic, the trackpad will respond in very small movements of the cursor. This behavior is normal.
1. Clean trackpad surface (with computer off, using a non-static-inducing material).
  2. Completely shut down, then press the power button to start the computer.
  3. Reset the power manager. See new procedures under the "Resetting the Power Manager Unit (SMC)" heading in the Hardware Troubleshooting Tools and Tips section.
  4. Make sure power adapter is using the ac power cord, not the duckhead. Check if the intermittent behavior goes away. If it does, it should be recommended to use the ac cord which provides a ground path for static to go.
  5. Disconnect the power adapter, and run on battery power only. If problem goes away, replace power adapter.
  6. Place the MacBook Pro Mac OS X Install 1 Disc in the optical disc drive, press the start button and hold down the "C" key. Check the cursor movement, to see if the problem is software.
  7. Check trackpad flex cable connection to the logic board.
  8. Replace top case.
  9. Replace logic board.



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## Video

### No display, or dim display, but computer appears to operate correctly

1. Remove any connected peripherals.
2. Make sure F1 key is not stuck down.
3. Press the F2 key (with the fn key pressed and not pressed) to increase the screen brightness settings.
4. Reboot the computer—hold down the Control and Command keys and press the Power button to restart the computer. Or, press and hold the Power button for 5 to 10 seconds to shut down the computer, then press the Power button to restart. Let the system run for an hour, so the panel can warm up.
5. Verify inverter cable and LVDS cable connections are seated properly and that the cables are not damaged.
6. Replace inverter board.
7. Replace the display rear housing (which includes the inverter cable assembly, or replace separately if available).
8. Replace LCD panel.
9. Replace logic board.

### Computer appears to work, but no video on external device connected to the S-video/Composite port of the optional DVI to Video Adapter

1. The device must be connected to the S-video/composite port while the MacBook Pro is sleeping or off for the device to be recognized.
2. Verify monitor that is used in testing is known-good and is supported by this computer.
3. Try different DVI to Video Adapter.
4. Replace logic board.

### No video on an external VGA device connected to the external monitor (DVI) port

1. Verify monitor that is used in testing is known-good and is supported by this computer.
2. Try another DVI-to-VGA adapter cable.
3. Restart the computer and test again.
4. Replace logic board.

### No display, or dim display, but can display external video

1. Remove any connected peripherals.
2. Try adjusting the brightness using the F2 function key.

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3. Open Display system preference panel and check brightness. If works, replace keyboard.
  4. Check connection of the inverter cable to the main logic board.
  5. Check inverter cable connection to the inverter board and the inverter to the LCD cable connection.
  6. Replace inverter board.
  7. Replace display rear housing (which includes the inverter cable assembly, or replace separately if available)
  8. Replace display panel.
  9. Replace logic board.

#### Display has repetitive patterns or shifted color pattern

1. Check for the latest System software update
2. Check the LVDS connection is fully seated on the logic board.
3. Replace the logic board.

#### Display has permanent vertical or horizontal lines.

1. Check for the latest System software update
2. Replace display panel.
3. Replace logic board.

## Misc. Symptoms

#### The Date and Time settings reset all the time

**Note:** Resetting the power manager or PRAM resets the date and time. The MacBook Pro uses a non-rechargeable lithium battery.

1. Do a backup battery test:
  - Set the date and time.
  - Perform a Shut Down from the Apple menu.
  - Remove the main battery and disconnect the power adapter for 10 minutes.
  - Connect the power adapter, insert the battery, and power on the computer.
  - If the date and time were lost the backup battery may be dead or discharged.
  - Remove the main battery from the unit and leave the PowerBook plugged in for at least 5 hours.
2. Replace backup battery.
3. Replace the logic board.

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## Feet came off the bottom case

Replace the missing foot.

## Sleep LED does not come on when lid is closed

1. Put the computer to sleep using the menu option. If the sleep LED goes on, there is a problem with sensing the closed display. If the LED does not go on, skip to step 3.
2. With the display housing removed, check the sleep magnet location on the LCD panel: (See the LCD Panel chapter in the Take Apart section of this manual.)
  - If it is not positioned correctly, reposition it. Polarity makes a difference.
  - If the magnet is missing, replace it with a new magnet.
3. Check that the sleep LED is plugged into the logic board.
4. Connect a USB mouse. Short the power on pads on the logic board to boot the system and use the mouse to sleep from the menu. Measure the voltage at the LED connector. If power is present, replace bottom case.
5. Replace logic board.

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Apple Service Source



Views  
MacBook Pro



