Service Source

MacBook Pro

(15-inch Early 2008)

26 February 2008

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MacBook Pro
(15-inch Early 2008)

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Service Source

Basics

MacBook Pro (15-inch Early 2008)

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General Information

Product View

Overview

The MacBook Pro (15-inch Early 2008) ushers in a fourth generation of Apple's Intel-based professional notebook computers. Based on the new Intel Penryn chip, the architecture supports three clock speeds: 2.4GHz with a 3MB Shared L2 cache, 2.5GHz with a 6MB Shared L2 cache, and a configured-to-order 2.6GHz with a 6MB Shared L2 cache, the latter two with 512MB of VRAM. Two new larger hard drive sizes include 200GB/7200 RPM and 300GB/4200RPM.

This Leopard-native MacBook Pro incorporates the user-friendly multi-touch trackpad with pinch, swipe and rotate features. New Broadcomm-based communications include an 802.11n Airport card with 2-wire antenna and a Bluetooth 2.1 module.

At a glance, new keyboard icons (like the iMac and MacBook Air keyboard layout) differentiate this MacBook Pro from previous MacBook Pro 15-inch models. By becoming nearly Halogen-free, this line continues Apple's commitment to a "Greener Apple."

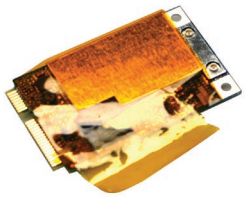
Main service and feature differences among 15-inch MacBook Pro models:

	MacBook Pro (15-inch Early 2008)	MacBook Pro (15-inch 2.4/2.2GHz + *Late 2007 2.6GHz CTO**)	MacBook Pro (15-inch Core 2 Duo)	MacBook Pro (original 15-inch & 15-inch Glossy)
Intro Date	February 26, 2008	June 5, 2007 / Nov 1, 2007	October 24, 2006	January 10, 2006
Micro-processor	2.5/2.4GHz Penryn, plus 2.6GHz CTO option	2.4/2.2GHz Core 2 Duo + **2.6GHz CTO (Late 2007)*	2.33/2.16GHz Core 2 Duo	2.16/2.0/1.83GHz Core Duo
L2 Cache	6MB / 3MB shared (1:1)	4MB shared (1:1)	4MB shared (1:1)	2MB shared (1:1)
Bus Speed	800 MHz	800 MHz	667 MHz	667 MHz
Max RAM	4 GB	4 GB	3 GB	2 GB
Hard Drive(s)	200GB, 5400 RPM, (2.2) 250GB, 5400 RPM (2.4) 200GB, 7200 RPM (CTO)	120GB, 5400 RPM (2.2) 160GB, 5400 RPM (2.4) 200GB, 4200 RPM (CTO) 160GB, 7200 RPM (CTO) **250GB, 5400 RPM (CTO)* **200GB, 7200 RPM (CTO)*	120GB, 5400 RPM (2.16) 160GB, 5400 RPM (2.33) 200GB, 4200 RPM (CTO)	80GB, 5400 RPM (1.83) 100GB, 5400 RPM (2.0) 120GB, 5400 RPM (2.16) 100GB, 7200 RPM (CTO)
Graphics Chip	NVIDIA GeForce 8600M GT	NVIDIA GeForce 8600M GT	ATI x1600	ATI x1600
Display	LED backlight	LED Backlight	CCFL Backlight	CCFL Backlight
Optical Drive	8x DVD Dual Layer Superdrive	8x DVD Dual Layer SuperDrive	6x DVD Dual Layer Superdrive	4x DVD Superdrive

New Parts and Procedures

AirPort Card

A new 802.11n Broadcomm AirPort card uses two antenna wires instead of three. Note that the card may have a Kapton shield covering as shown below.



Bluetooth 2.1

A new Broadcomm-based Bluetooth module upgrades the to Bluetooth 2.1.

USB Ports

USB ports are now high-current (1.1 amp) ports.

Halogen-free Components

New, environmentally friendly Halogen-free materials tend to be stiffer and less pliable, and thus require careful handling to avoid damage.

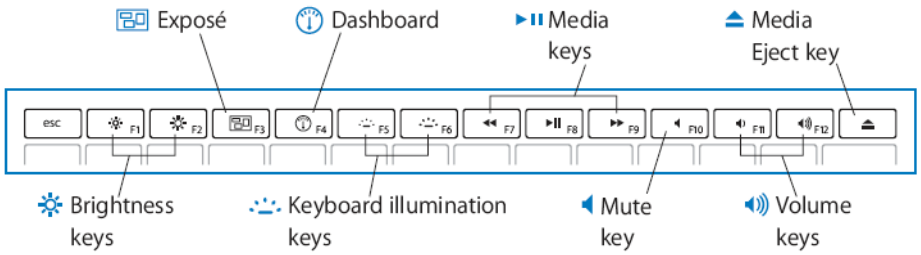
Keyboard Changes

The new keyboard layout on the MacBook Pro (15-inch Early 2008) differentiates it from all previous 15-inch MacBook Pro models.

MacBook Pro (15-inch original, Core 2 Duo and 2.4/2.2GHz) keyboard

MacBook Pro (15-inch Early 2008) keyboard

New keyboard features



Using the Multi-Touch Trackpad

Use the trackpad to move the pointer and to scroll, tap, double-tap, and drag. How far the pointer moves on screen is affected by how quickly you move your finger across the trackpad. To move the pointer a short distance, move your finger slowly across the trackpad; the faster you move your finger, the farther the pointer moves. To fine-tune the tracking speed and set other trackpad options, choose Apple > System Preferences, click Keyboard & Mouse, and then click Trackpad.

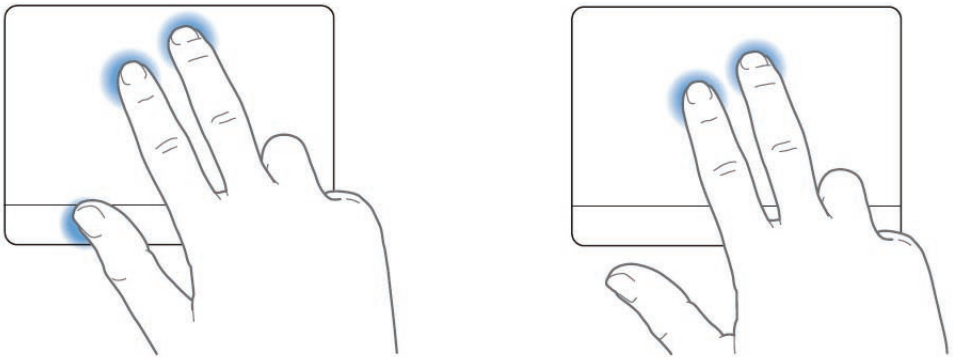
Existing trackpad tips and shortcuts

- *Forward deleting* deletes characters to the right of the insertion point. Pressing the **Delete** key deletes characters to the left of the insertion point.

  To forward delete, hold down the Function (fn) key while you press the Delete key.

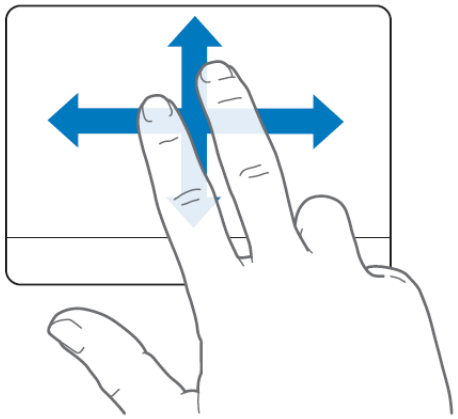
- *Secondary clicking* or "*right-clicking*" lets you access shortcut menu commands.

  To secondary click, place two fingers on the trackpad while clicking the trackpad button. If Tap to Click is enabled, just tap two fingers on the trackpad.



  You can also secondary click by holding down the Control key while you click.

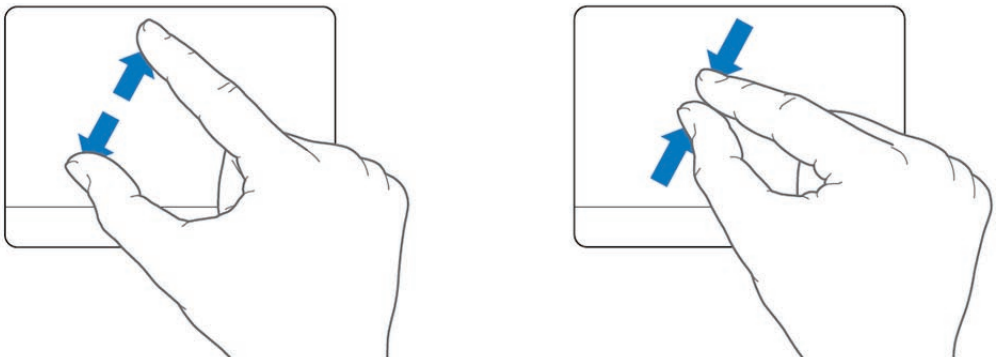
- *Two-finger scrolling* lets you drag to scroll quickly up, down, or sideways in the active window. This option is on by default.



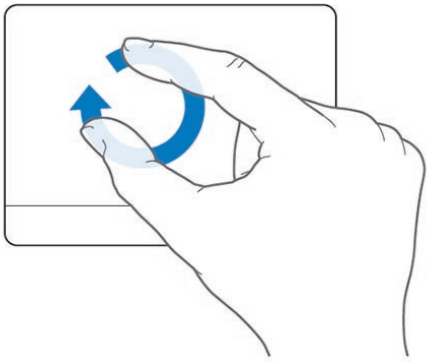
New trackpad gestures: pinching, rotating and swiping

The following trackpad gestures work in certain applications, such as Preview or iPhoto. For more information, choose Help > Mac Help and search for "trackpad."

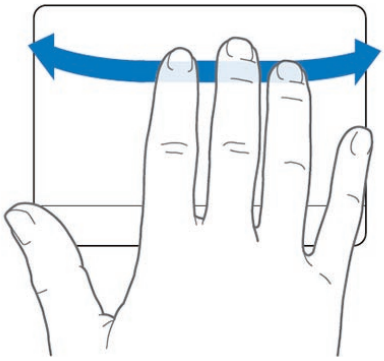
- *Two-finger pinching* lets you zoom in or out on PDFs, images, photos, and more.



- *Two-finger rotating* lets you rotate photos, pages, and more.



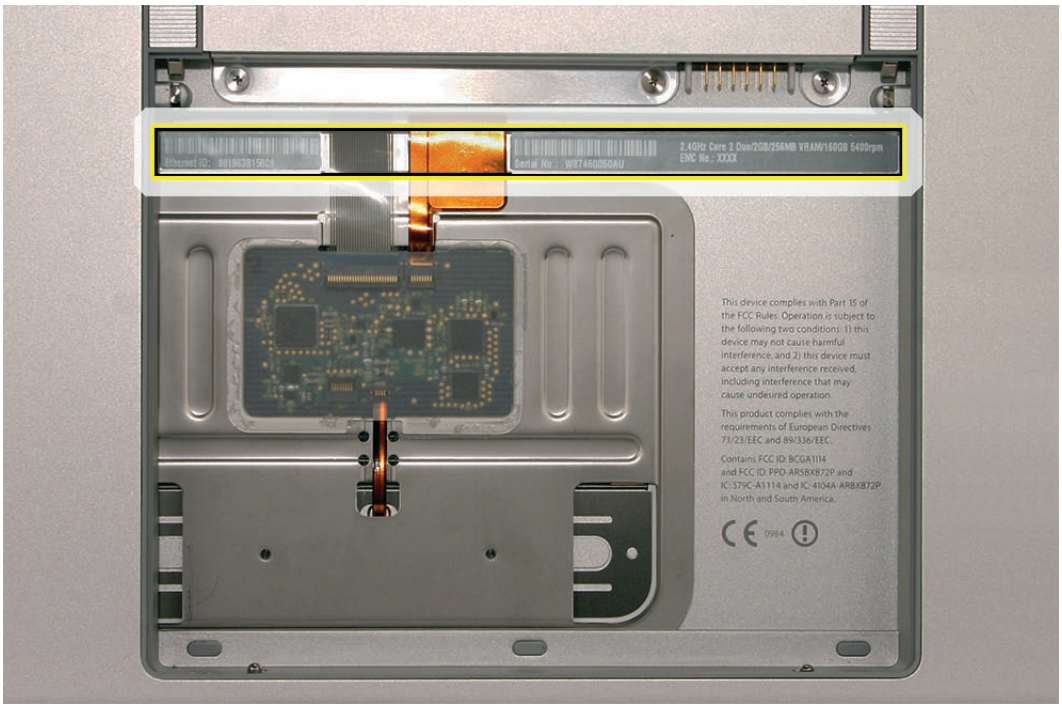
- *Three-finger swiping* lets you rapidly page through documents, move to the previous or next photo, and more.



Note: Using a multi-page document in Preview will allow you to practice all three features.

Serial Number and Ethernet ID

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



Tools

The takeapart procedure for the MacBook Pro (15-inch Early 2008) 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 (076-1279)
- Alcohol pads
- Fine-point felt-tip permanent marker
- Apple Pro keyboard and mouse (for troubleshooting)

Display Takeapart

The MacBook Pro (15-inch Early 2008) continues the whole display clamshell solution as the replacement part for any display failures or components contained within the clamshell.

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

With the MacBook Pro's one-inch enclosure height, 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.

Temperature Concerns

The customer may perceive this system to run hotter than previous models. However, the normal operating temperature is well within national and international safety standards. Still, customers may be concerned about the heat generated by their machine. To prevent an unnecessary repair, you can compare a customer's computer to a running model, if available, at your repair site.

For more information on temperature concerns and customer perception, refer to Knowledge Base article 30612: *Apple Portables: Operating Temperature*.

Service Source

Take Apart

MacBook Pro (15-inch Early 2008)

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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.

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

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 may be 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

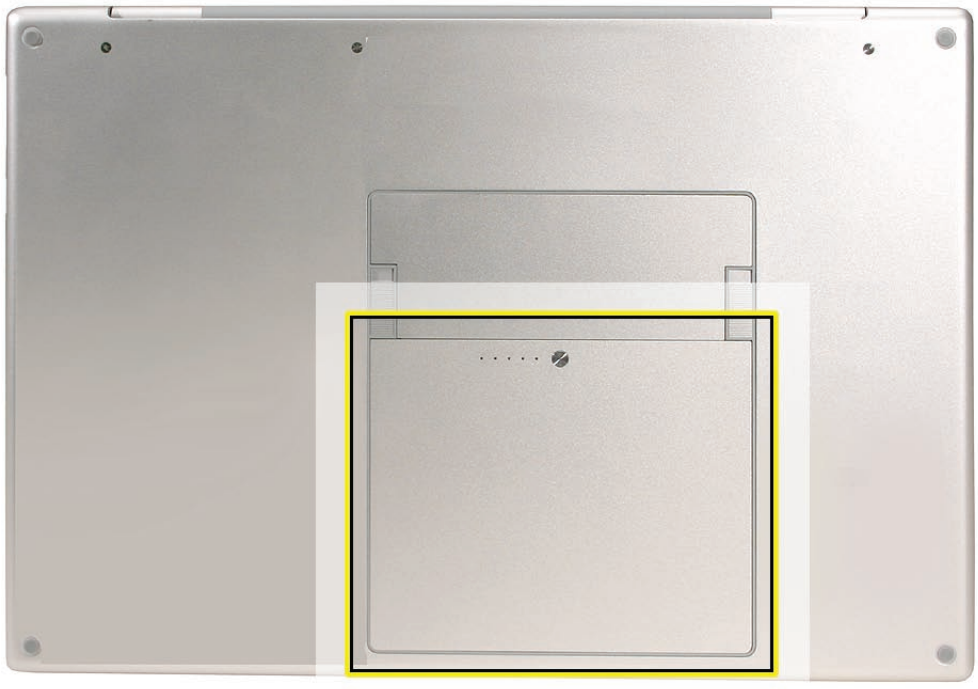
This procedure requires the following tools:

- 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.

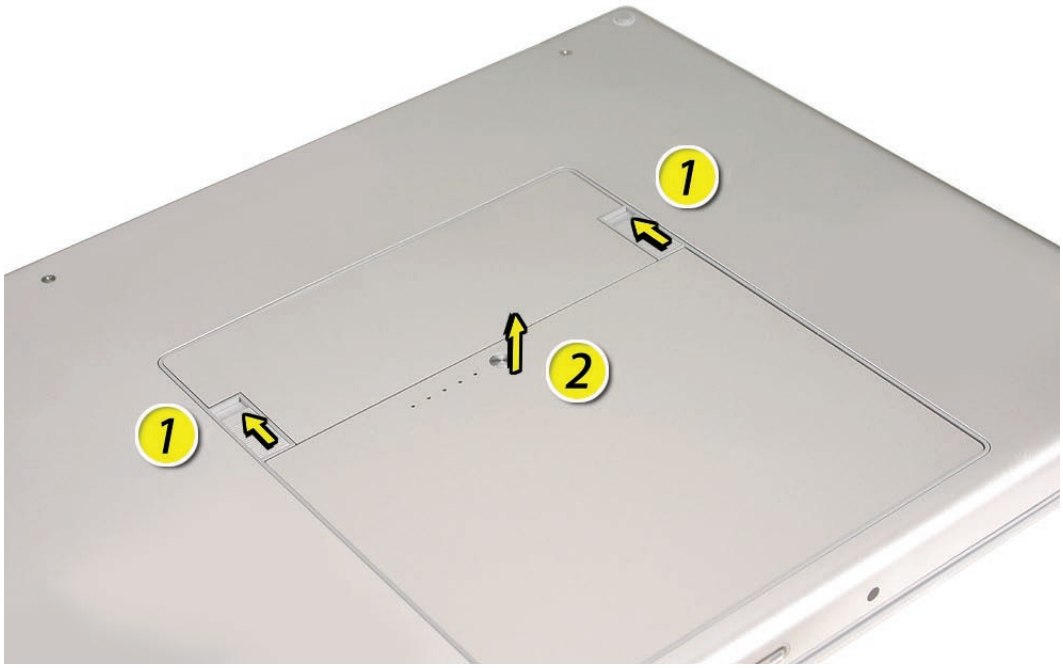
Part Location



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:

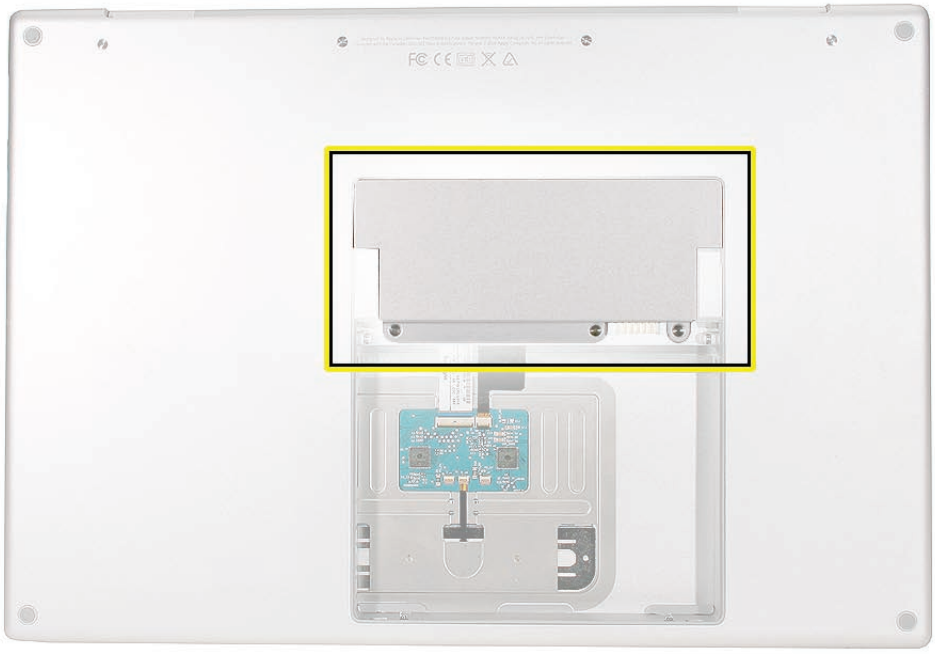
- #0 Phillips screwdriver (magnetized)
- Clean non-marring work surface
- ESD wrist strap and mat

Preliminary Steps

Before you begin, remove the following:

- Battery

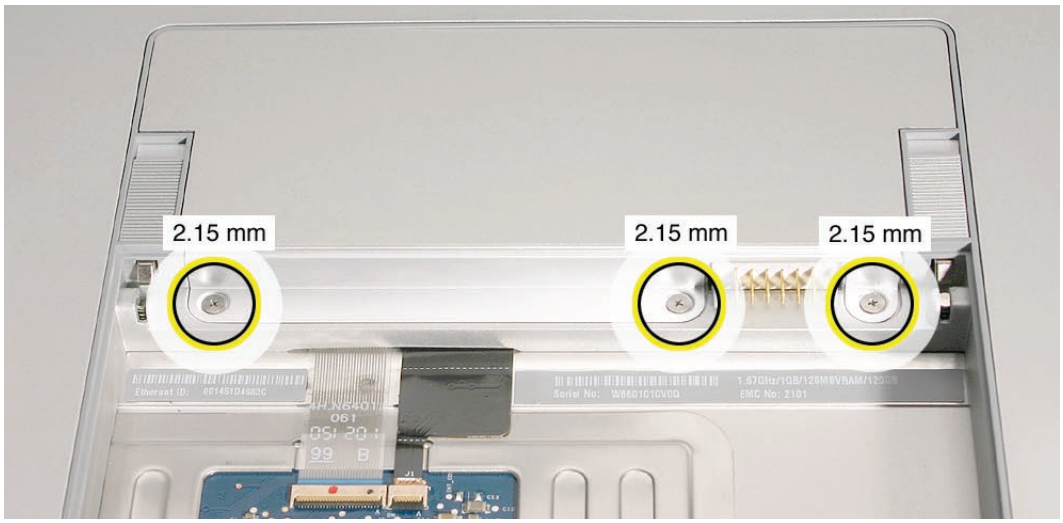
Part Location



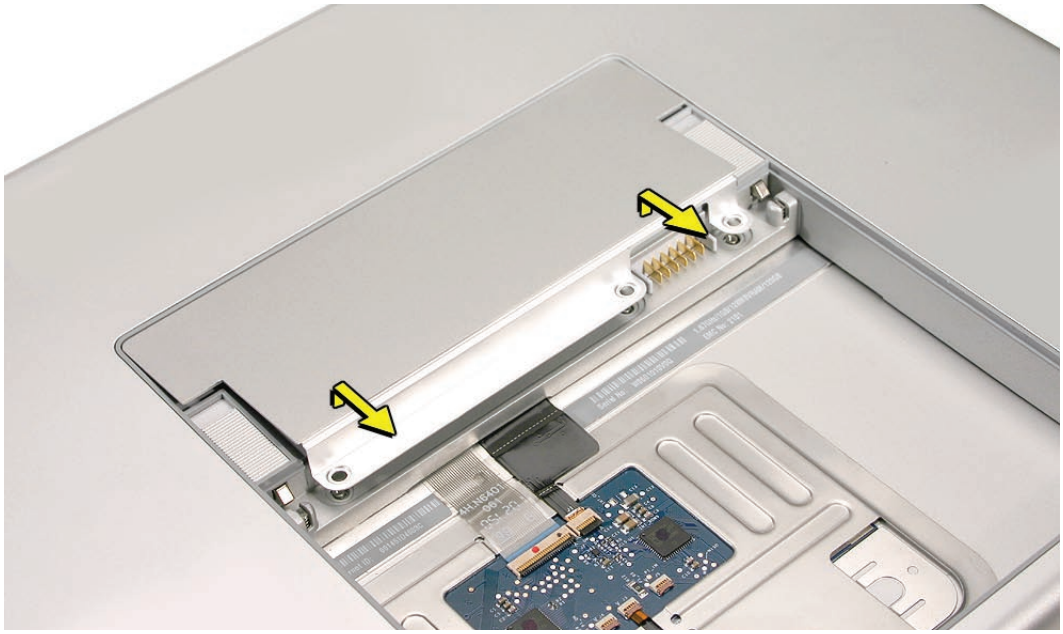
Procedure

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 Phillips screws from the memory door.



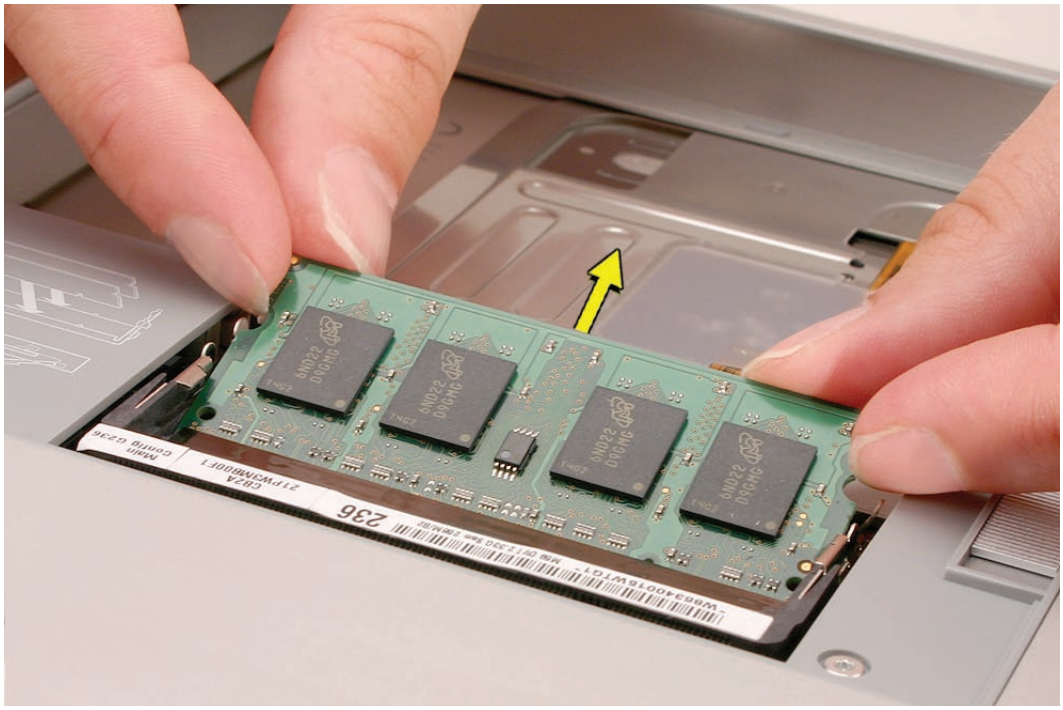
3. Remove the door, as shown.



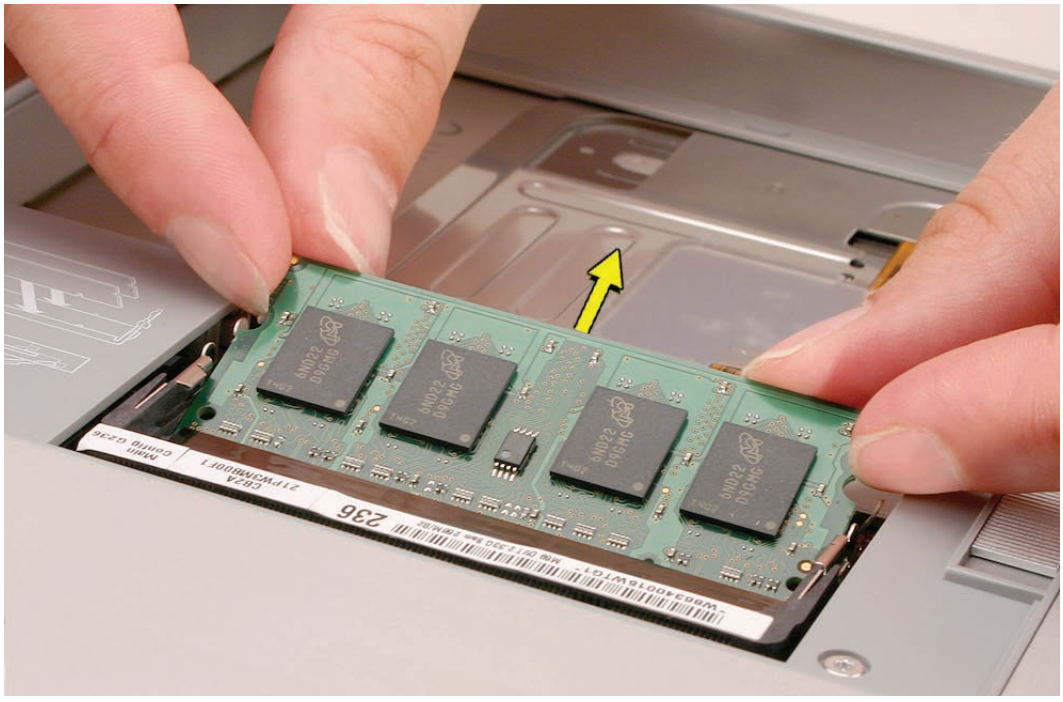
Notes:

- 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. Handle the memory card by the edges only, taking care not to touch the gold contacts.



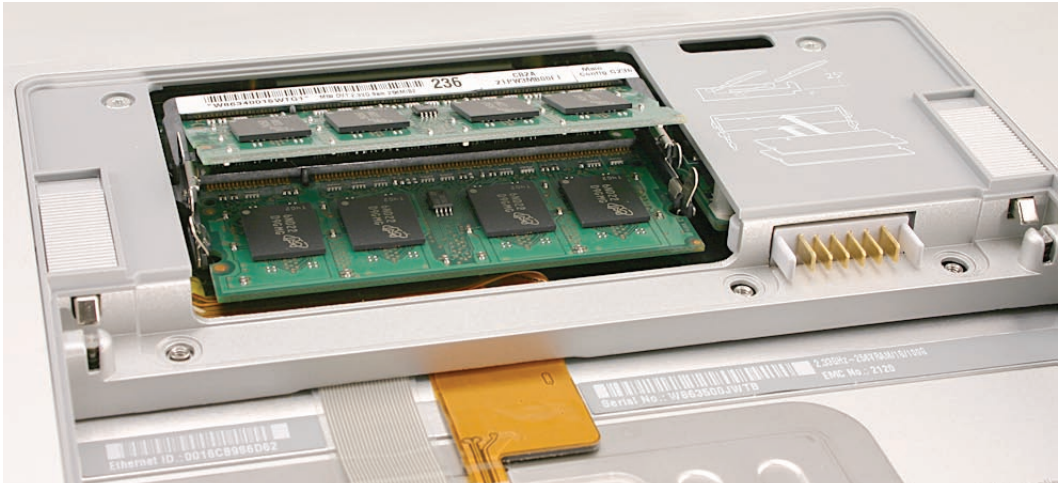
Replacement Procedure

Notes:

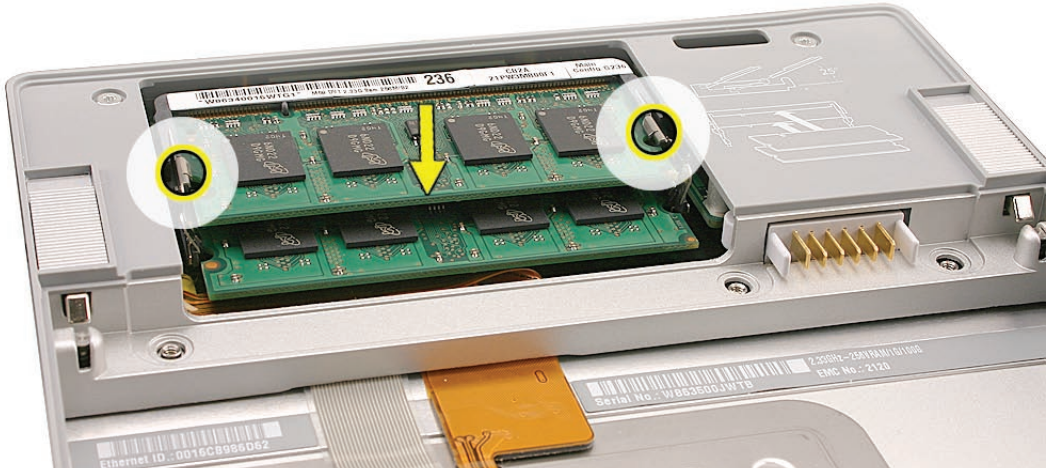
- DDR memory cards do not fit in this slot, only DDR2 (different notch location).
- If installing two cards, install the first card into the bottom slot before the top slot.
- Align the notch in the memory card with the tooth in the slot before inserting.

1. To install memory cards, insert them at a 30-degree angle.'

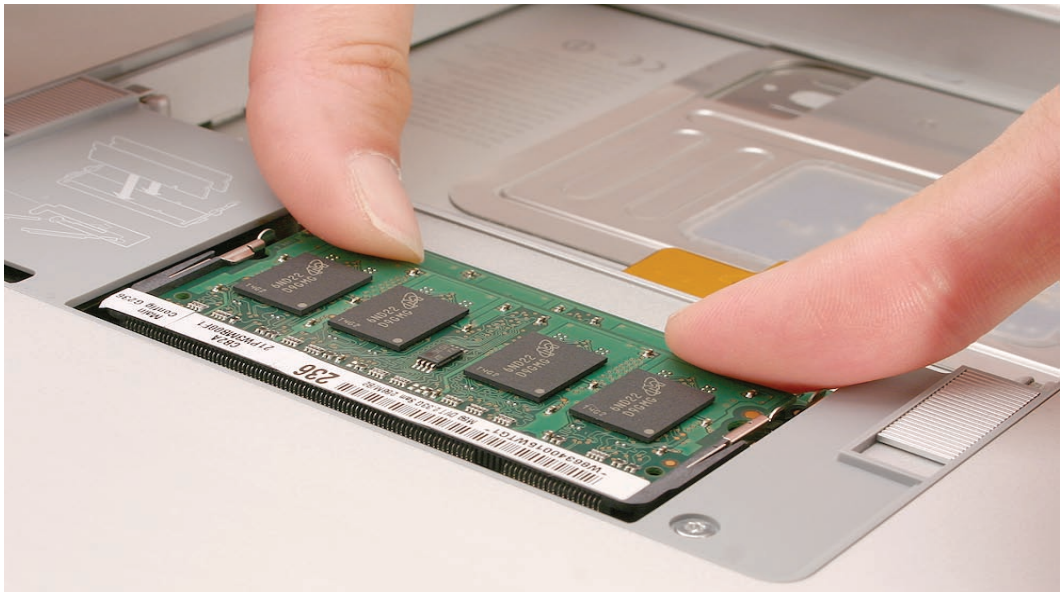
   Note: Insert the bottom card behind the locking tabs of the top slot.



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. Verify that the card is fully seated by pushing firmly with your thumbs.



5. Check that the cards are secured by the brackets on both sides.
6. Install the memory door.
7. Replace the battery.
8. **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

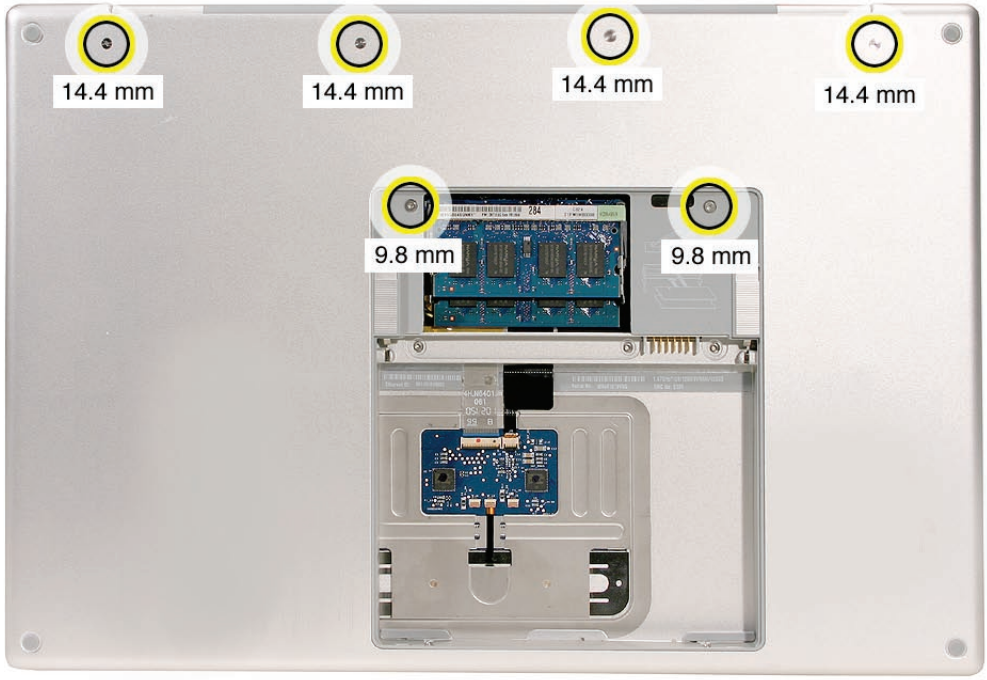
Notes:

- 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 on a soft, non-marring surface.
2. Remove the four Phillips and two Torx T6 screws shown.

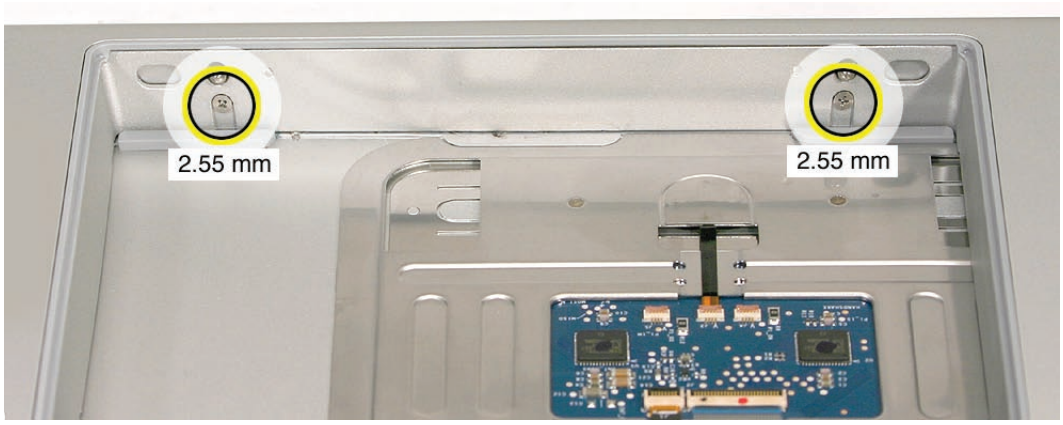
922-7309

922-7305



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

922-7203



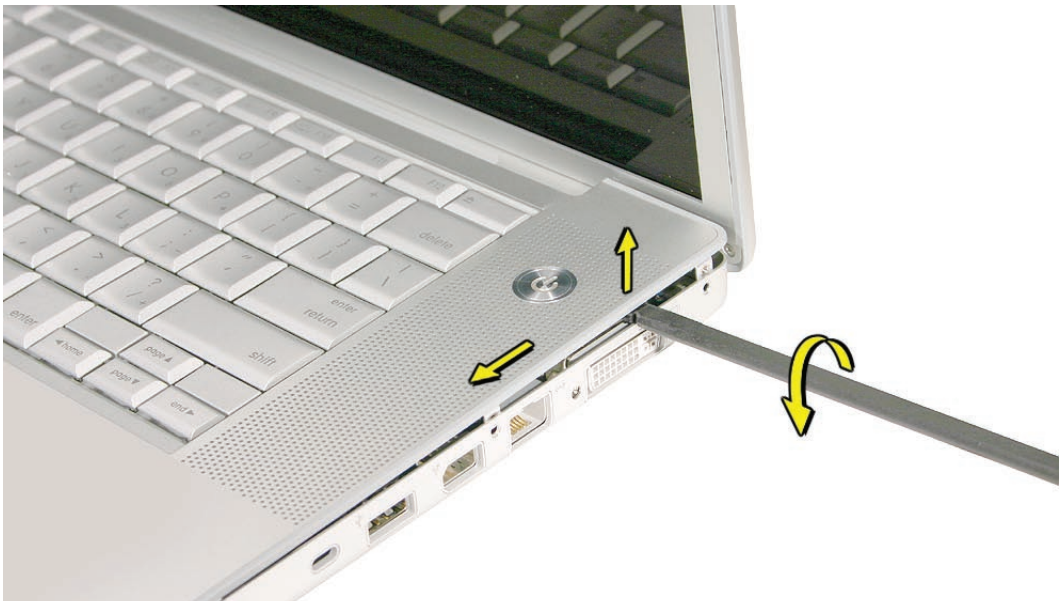
4. Remove the four Phillips screws from each side.

5. Remove the two Phillips screws from the back edge.

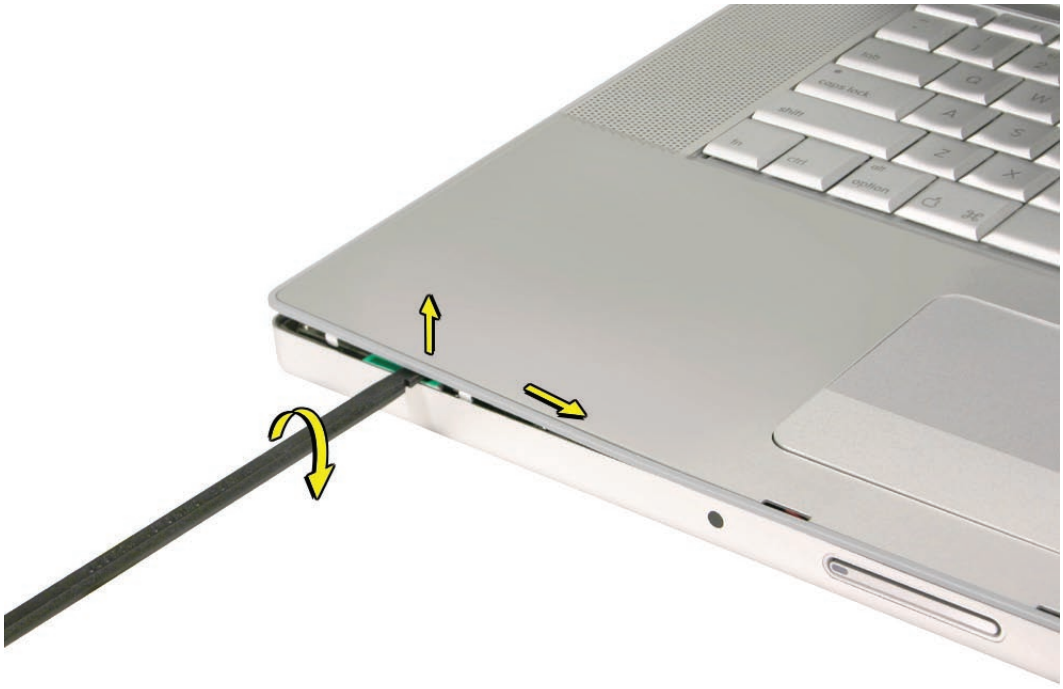
.

6. Face the computer toward you with the display open slightly past 90-degrees. Using your fingernails or the tips of your fingers, grasp just beneath the top case in the upper right and left corners. Lift upward a few inches, then work your hands around the top case toward the front, slowly lifting and encouraging the clips and screw tabs to release. A snapping noise when the clips release is normal.

Note: Take care to preserve the cosmetic integrity of the plastic beading around the edges of the top case. If using a black stick for leverage to get the clips to release, don't rotate the stick too much along the edges to avoid denting the soft plastic.

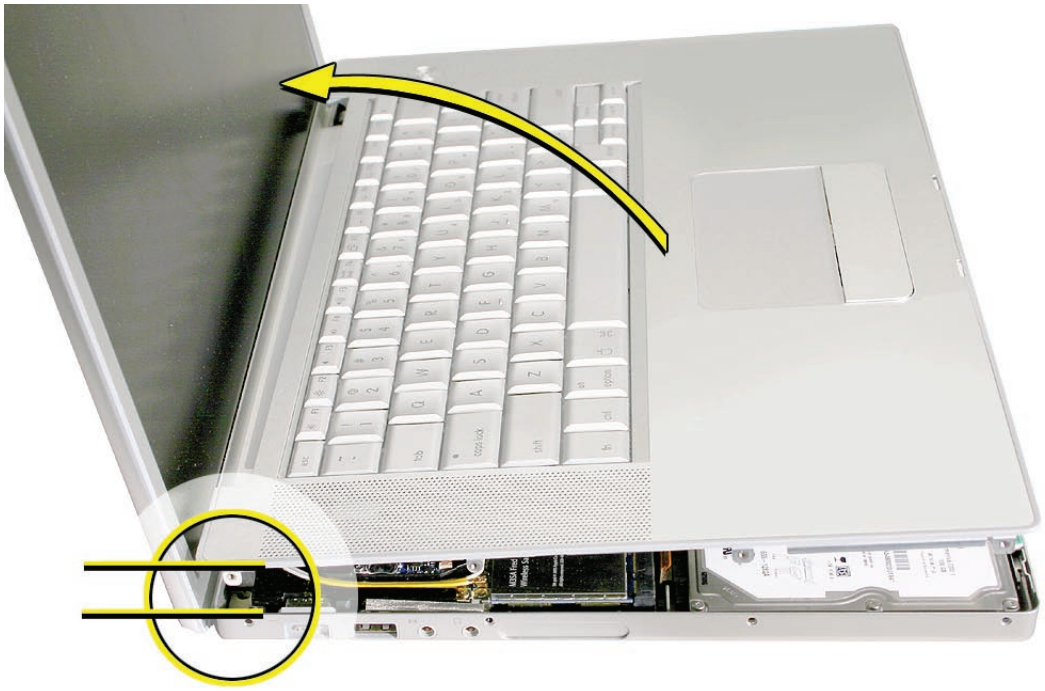


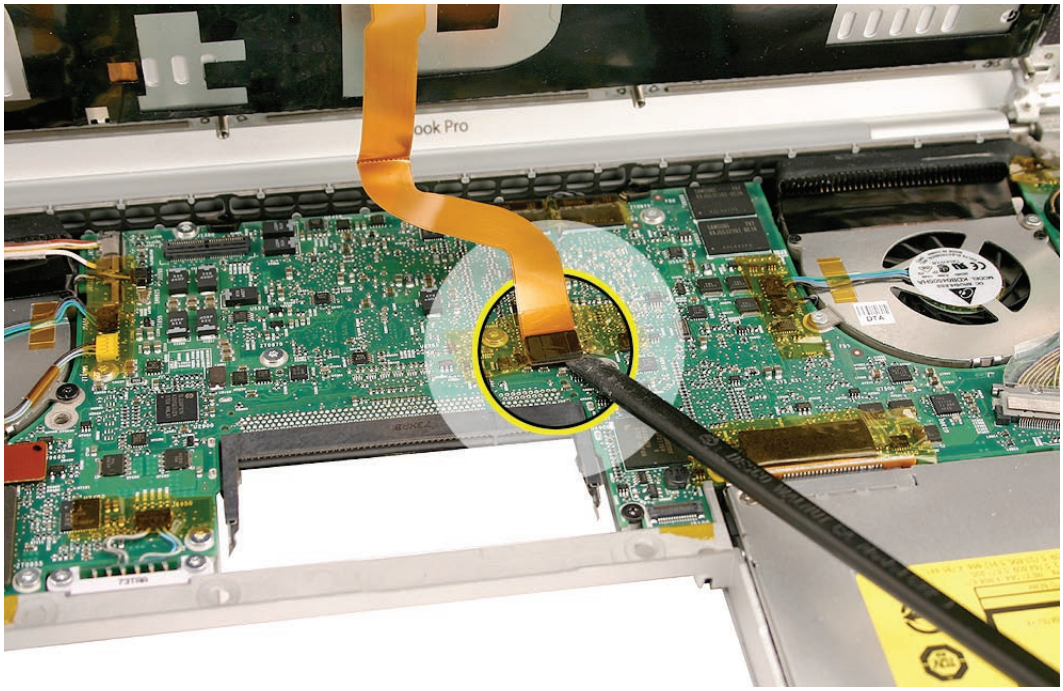
7. Along the front, start at the left and slowly encourage the snaps and screw tabs (shown in graphic below) to release as you move right. A snapping noise as the snaps release is normal. Again, take care to preserve the cosmetic integrity of the plastic beading around the edges by pulling up with your fingernails first. If a black stick is necessary to release the snaps, avoid too much rotation along the edges to keep from denting the soft plastic.



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

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.

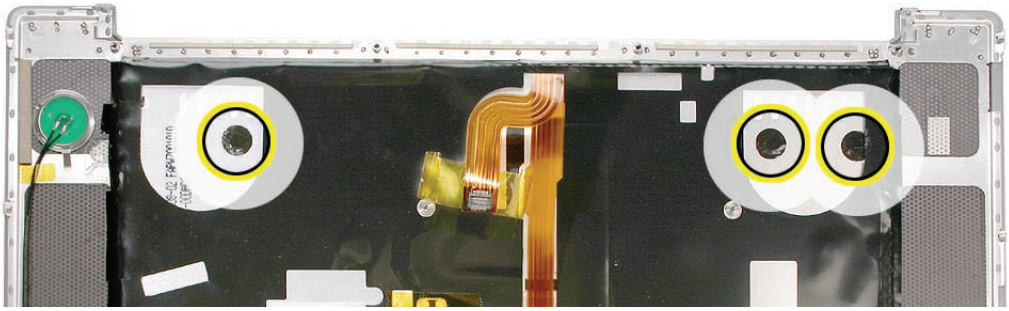




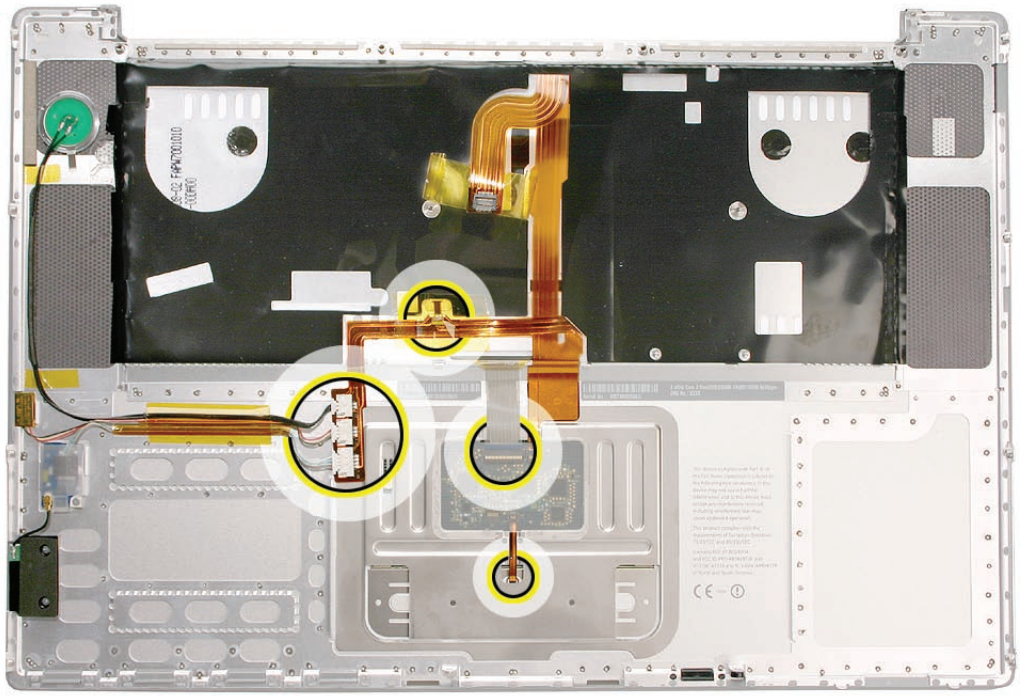
Replacement Procedure

Note: If replacing the top case, remove the keyboard and transfer to the replacement top case. (See keyboard section in next chapter for replacement instructions.)

Note: Unique identifiers for this top case include three circular black mylar dots over the keyboard screws.



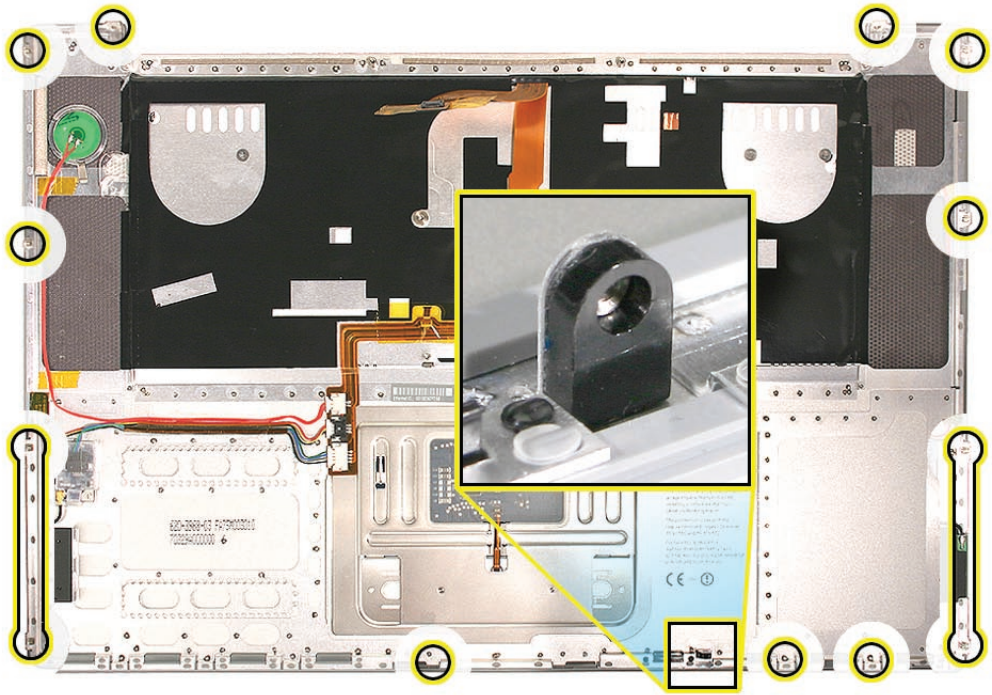
1. Visually check to verify that all cables are connected and routed correctly with nothing raised up or incorrectly placed over a component.
2. Check perimeter wiring and cables around clutches to verify that they will not be caught or pinched by the top case during replacement.
3. On the computer,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



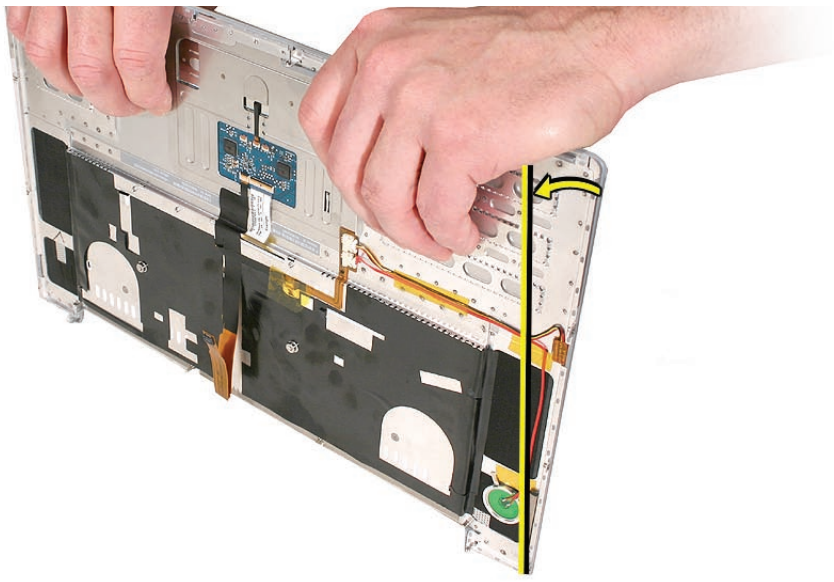
5. Check that the perimeter screw tabs and ribs are not bent.

   Note: The metal can quickly fatigue and break off. Be extremely careful to gently straighten tabs, if needed.

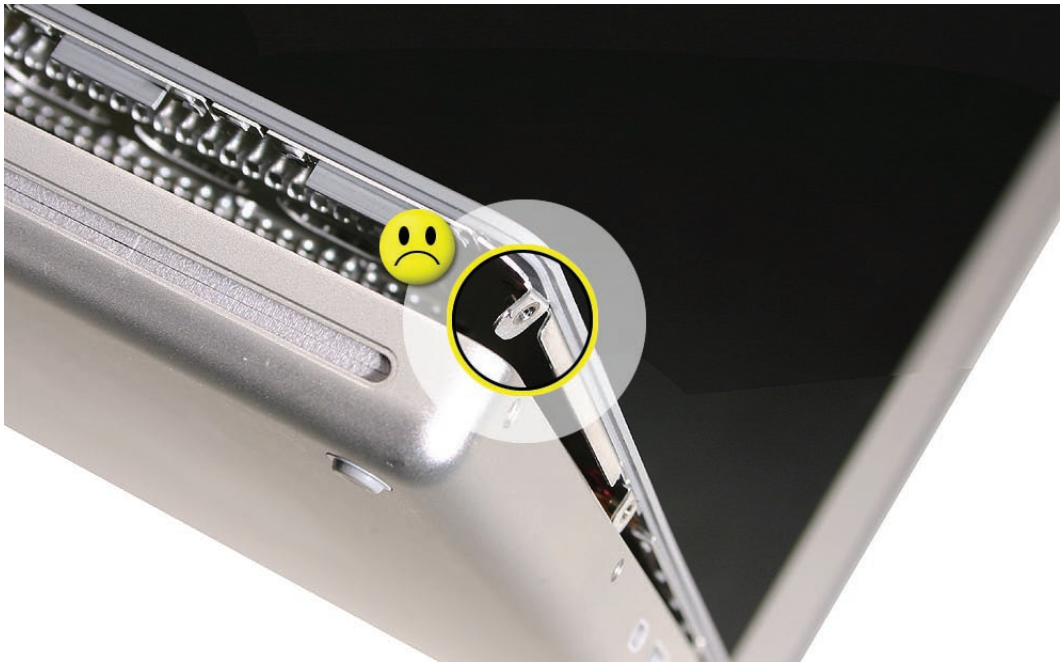
6. Verify that the plastic spacer is on the front screw tab, shown.



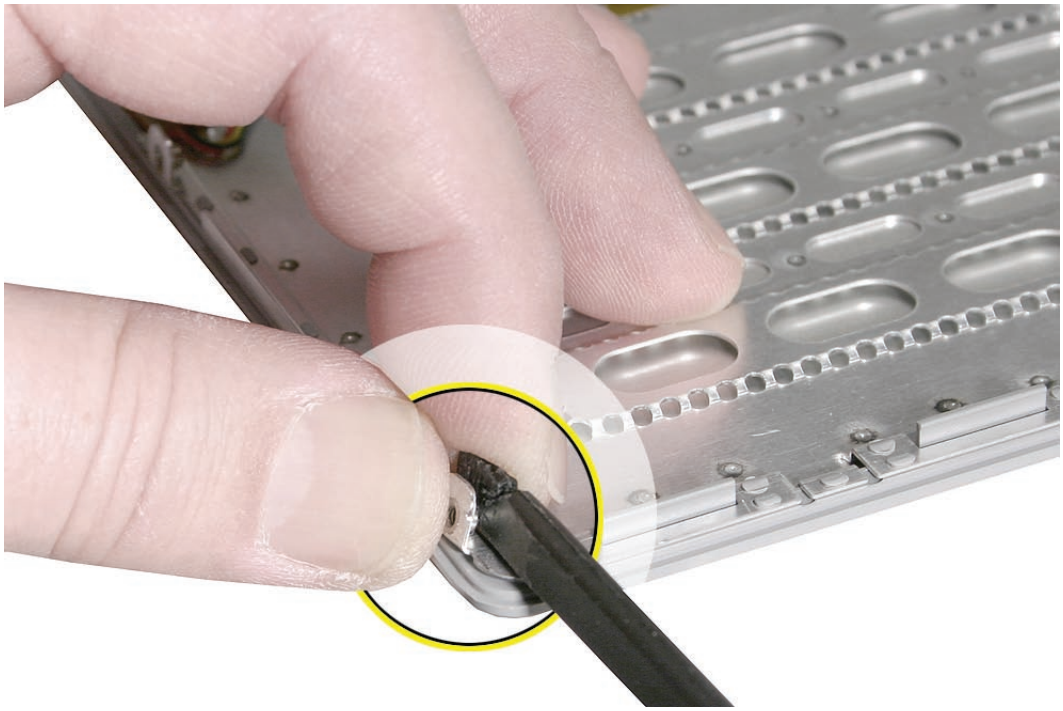
7. If the back screw tabs are bent out, straighten by pressing the edge of the case on a hard flat surface and rolling to vertical.



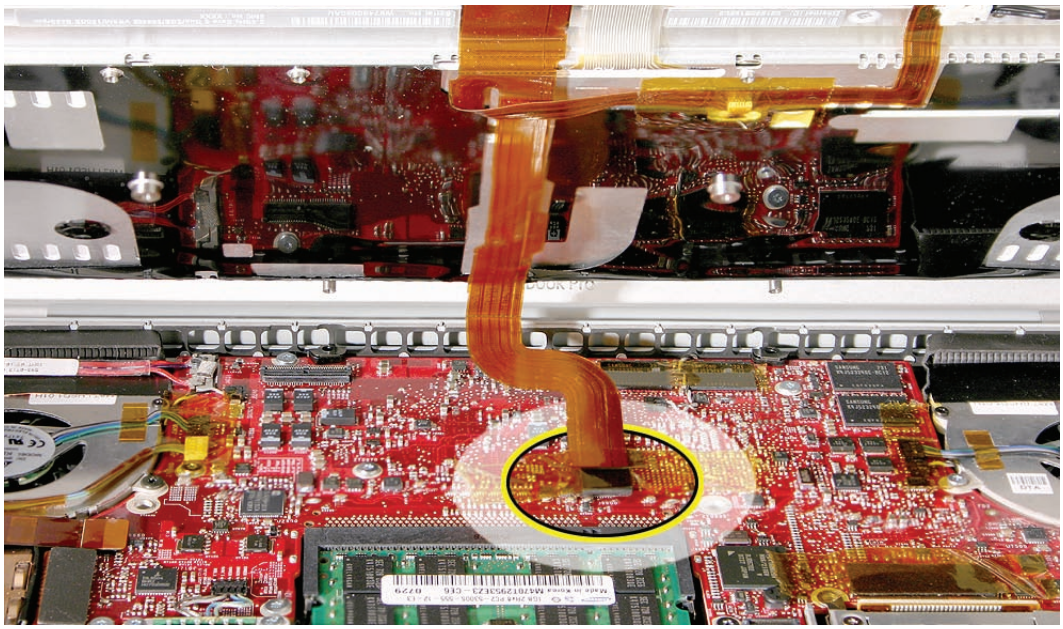
8. Any screw tabs that are not straight will not fit or accept screws correctly.



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

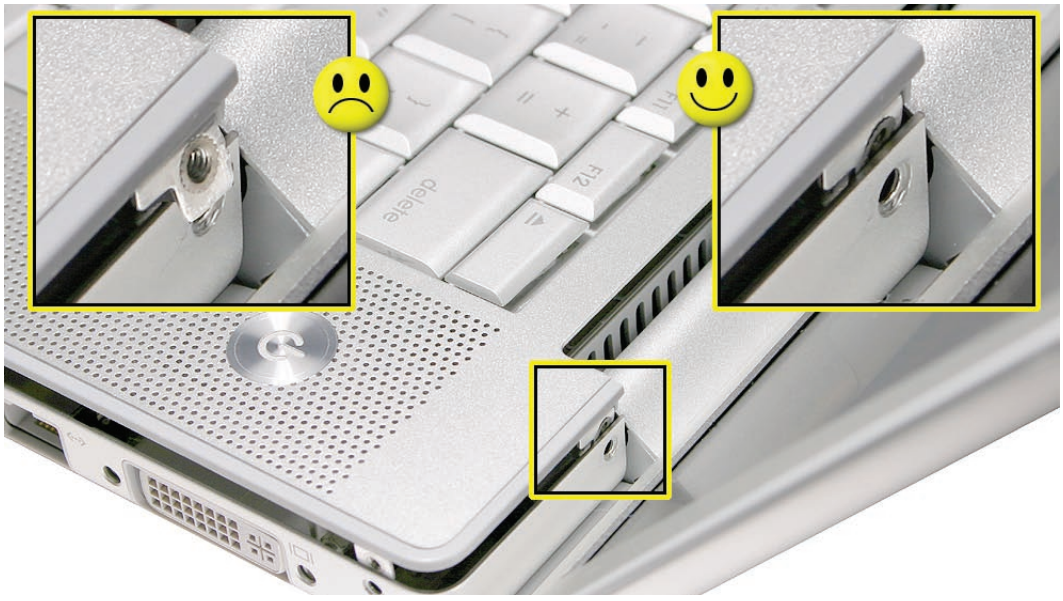


10. Connect the flex cable from the top case to the logic board.



11. 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.
12. Carefully pull or push tabs slightly, if needed.

    Note: Guarded, controlled pushing with your thumb may be helpful to gently finesse the tabs into place.
13. 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.

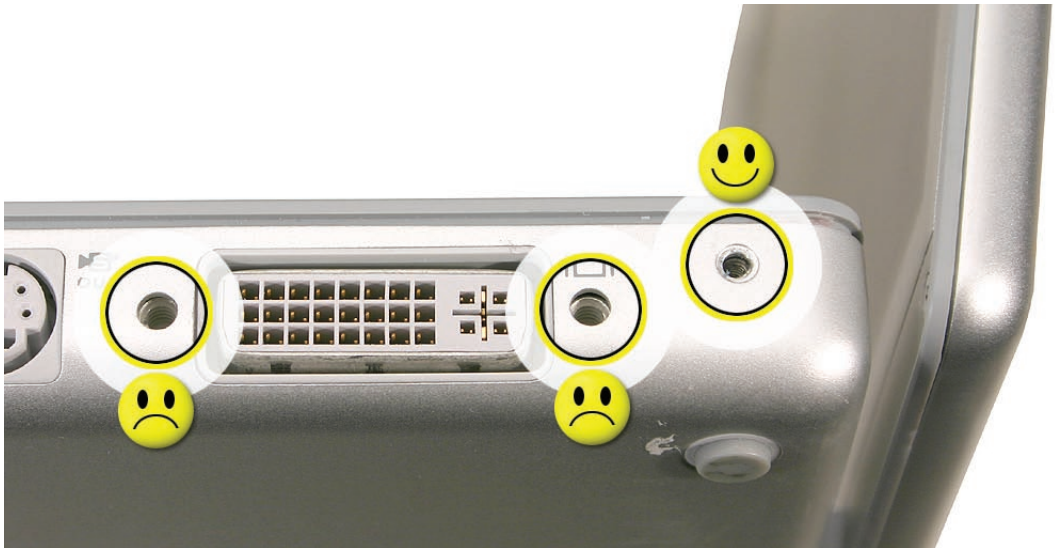


14. The two front screw tabs (shown below) may need to be guided with a black stick through the battery bay.

15. Squeeze at the five snap locations along the front edge of the top case (to the right of the screw tabs) to verify that the they are seated. You should hear five audible snaps when pressing down the front edge of the top case at these locations. The top case should lay flat along all sides and top; if not, make sure cables and components are not interfering.

16. To minimize any cosmetic gaps between the edges of the top and bottom case, firmly press down the top case with your fingers, squeezing the cases together at each location while installing the left and right side screws, especially toward the front of the computer.

    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. Using the flat end of a black stick to gently wedge the edge of the top case toward the bottom case to minimize gaps, install the two Phillips screws along the back.

922-6091

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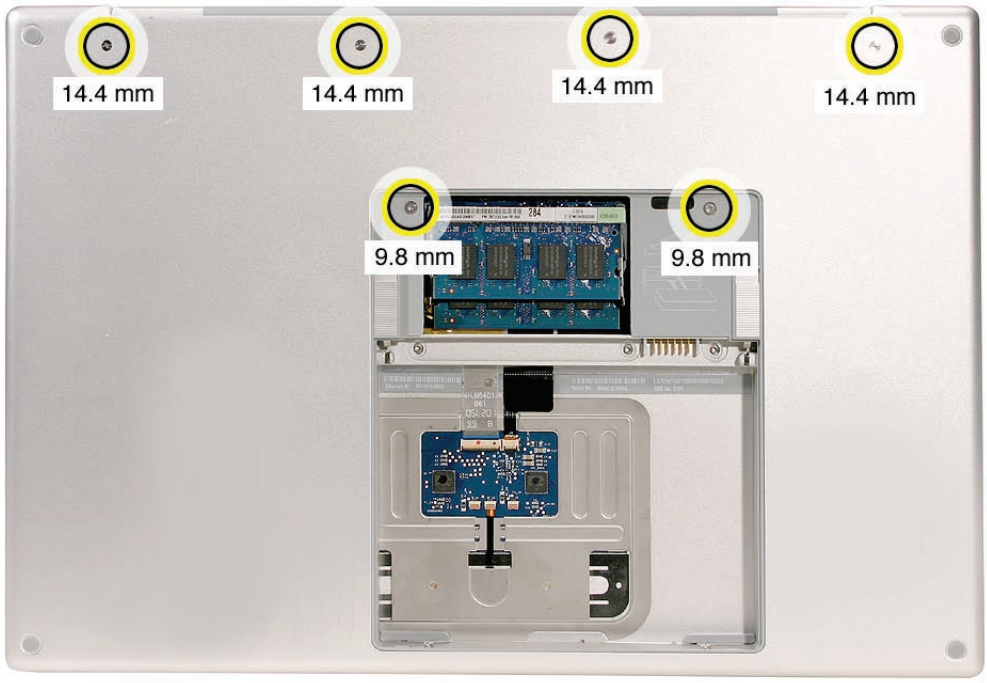
18. Install the bottom Phillips screws and the two Torx T6 screws near the memory chips.

922-7309

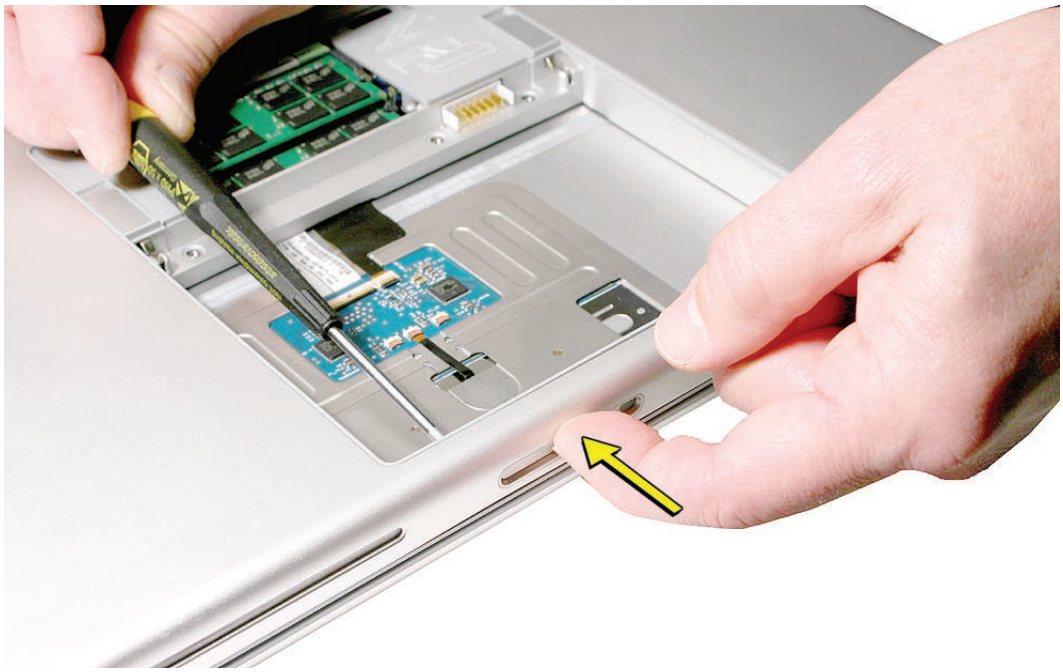
922-7305



19. Install the two Phillips screws in the battery bay.

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

922-7203



20. Check that the edges of the top case sit flush with the bottom case around the entire perimeter of the computer. If there are noticeable gaps, reinstall the top case taking extra care to secure top case top bottom when replacing the perimeter screws.

21. Install the memory door and replace the battery.

Quick Test

- Powering on, check the keyboard and trackpad function.
- Operate the computer in a darkened room to check for keyboard backlight function.
- Verify Bluetooth operation by checking that the it appears in either the Apple Menu bar or in the Apple System Profiler USB section.

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

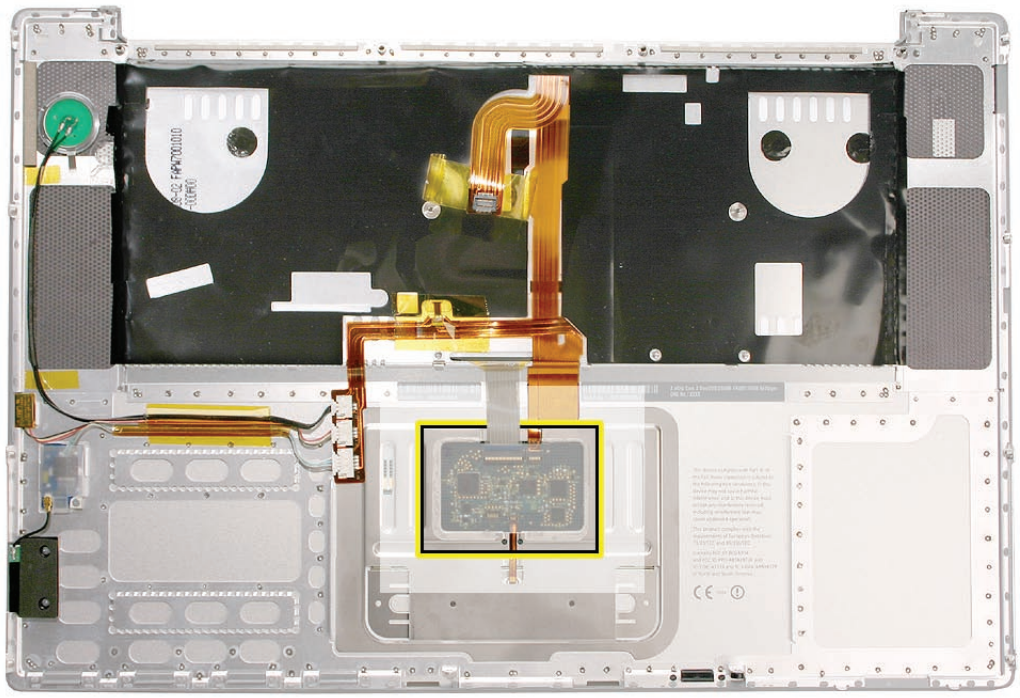
Part Location

Procedure

Important Notes:

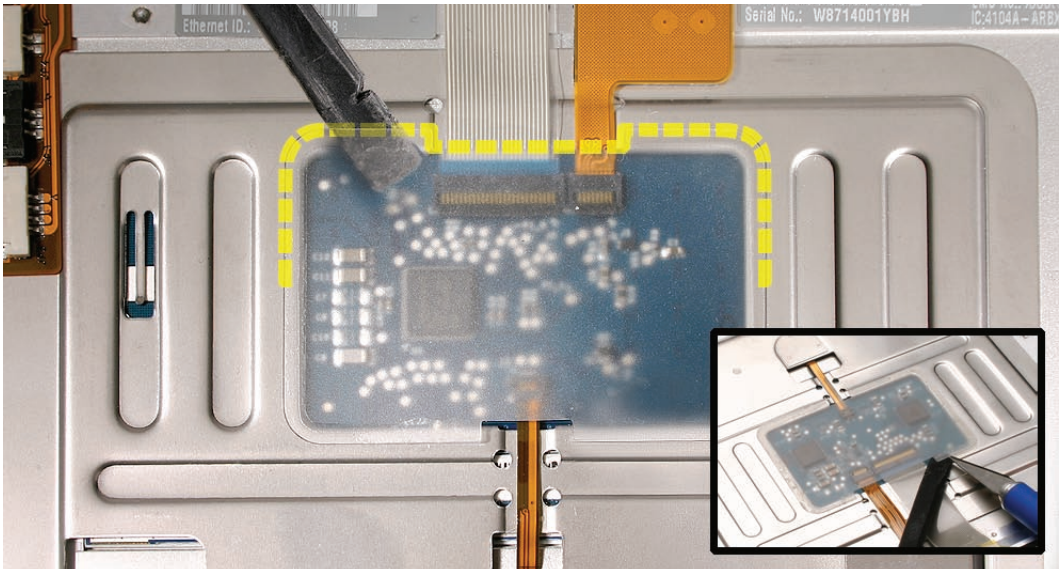
- The MacBook Pro (15-inch Early 2008) keyboard is not interchangeable with any previous models, including the original 15-inch MacBook Pro, Core 2 Duo and 2.4/2.2GHz. If replacing the keyboard, verify that the correct replacement keyboard and/or top case is ordered.
- The keyboard comes as a multi-layered assembly and includes backlighting. Do not disassemble the keyboard itself. Dust, fingerprints, or misalignment can cause improper function and damage to the assembly.

1. On a clean flat surface, turn the top case upside down.
2. Locate the protective cover over the flex cable connectors as shown below.

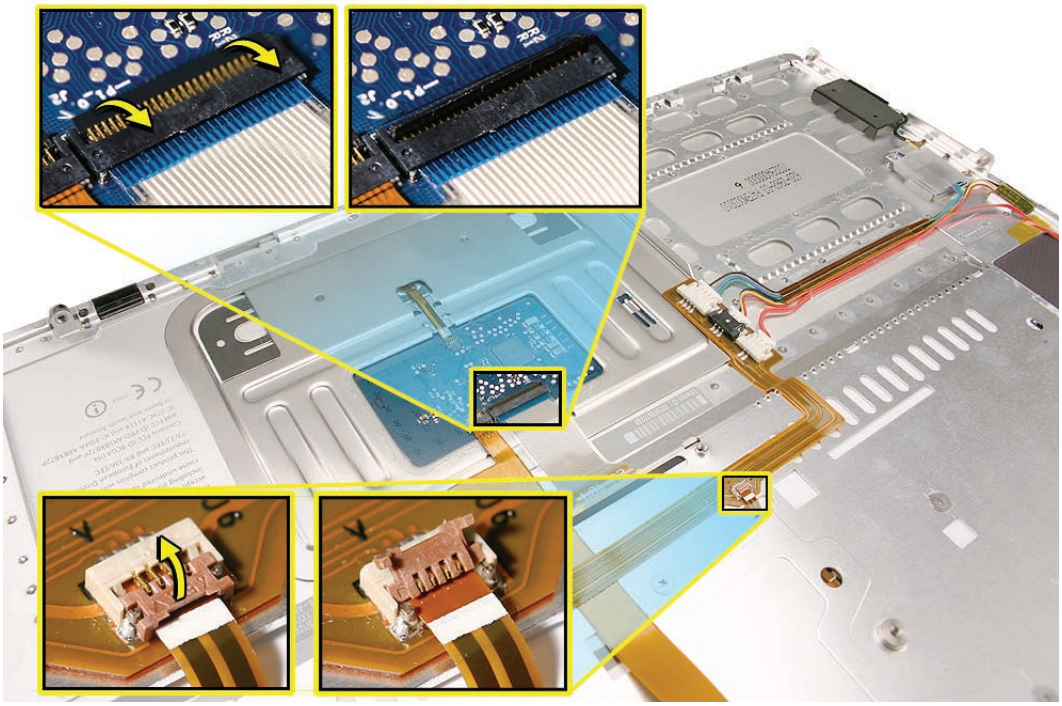


3. Rotate the top case to have the cable connectors facing you for better access. Carefully lift the perimeter of the cover nearest the cable connectors to release the adhesive. If necessary, use a razor knife to lift up the edge enough to slide in a black stick (see inset below).

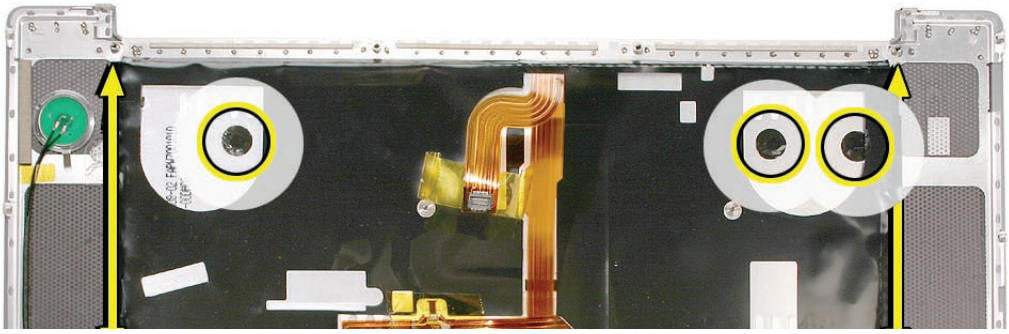
4. Gently lift and hold up that half of the cover with the black stick to provide adequate access to the connectors. **Important:** Keep the cover and its underlying adhesive clean and intact.



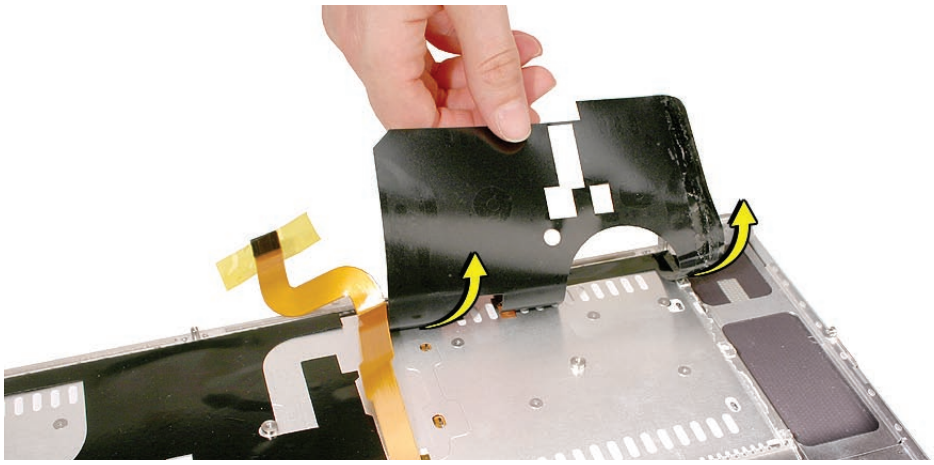
5. Remove any Kapton tape, then very carefully lift the latches of the connectors to release the cables. **Important:** The connectors are delicate. If damaged, the top case must be replaced.



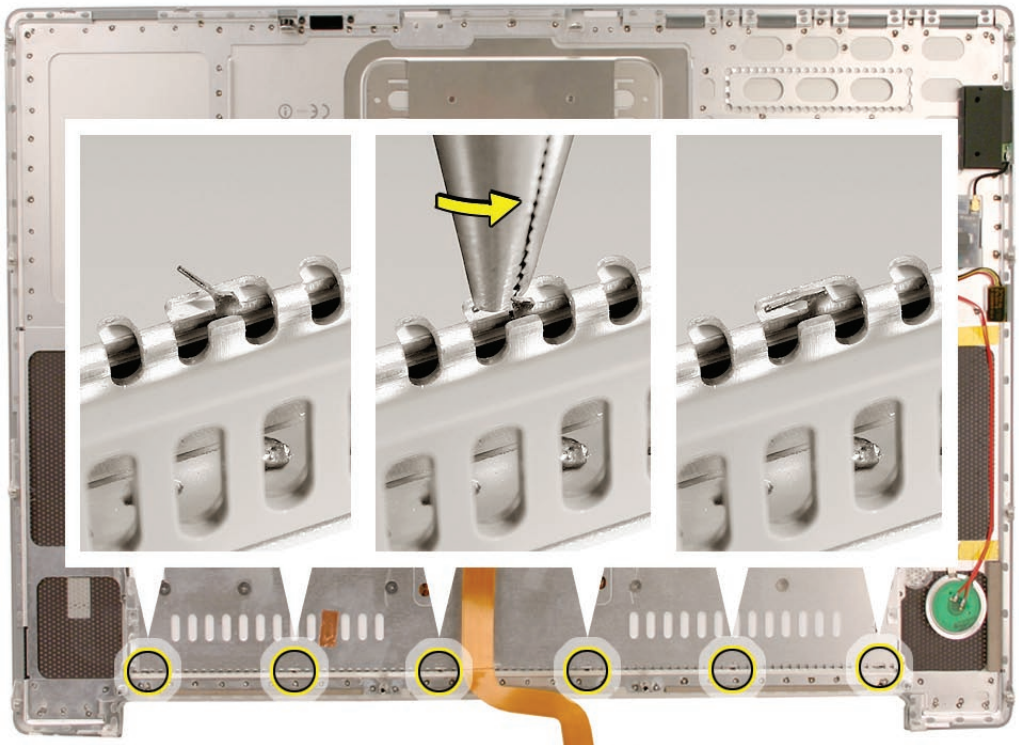
6. Note the positioning, then peel off the insulator film covering the back of the keyboard well, including mylar screw covers. Reserve the film and keep it clean for reinstallation.



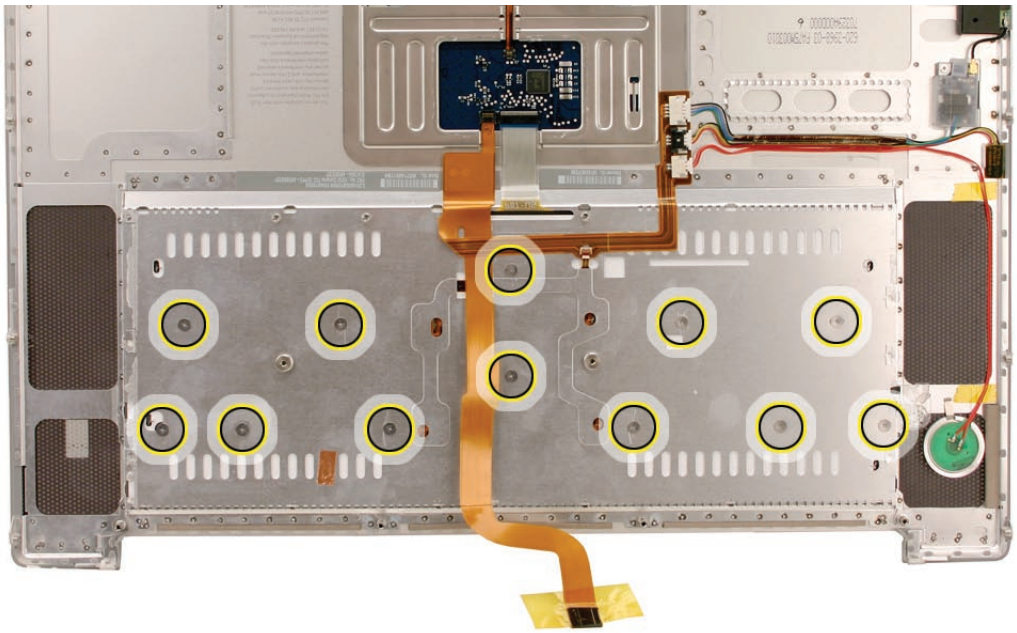
Important: Use care at the notches and narrow parts to avoid ripping or tearing the film.



7. Use needlenose pliers to gently straighten the six 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.



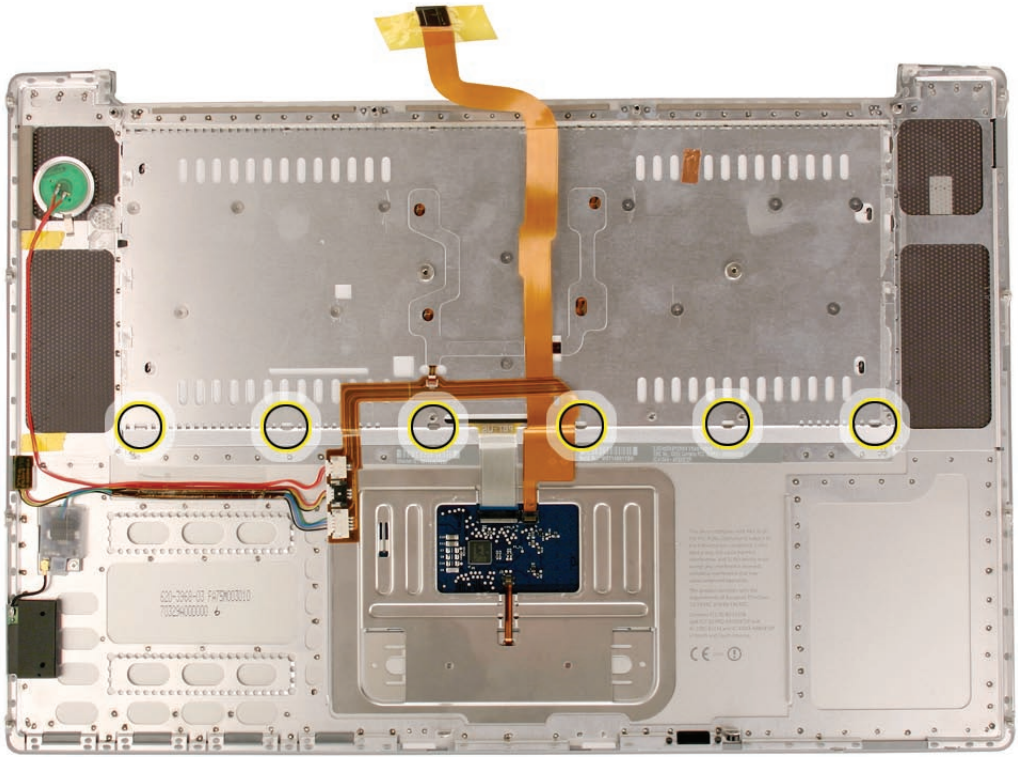
8. Remove the twelve Phillips #00 keyboard screws. Be sure to sandwich keyboard to top case when removing the final screws.



9. To prevent the keyboard from falling out, support it with your hand, and raise the top case up vertically. **Note:** This keyboard has no side tabs like previous models.

10. If you lean the top case toward you top first, the keyboard may simply fall into your hands.

11. Note the six insert-tabs along the bottom edge of the keyboard that tuck into the lower edge of the keyboard well.



12. Lift the keyboard up and away from the top case to release the tabs along the bottom edge and carefully thread out the flex cables. **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; otherwise damage can result.

Replacement Procedure

When replacing the keyboard, here are some key points to keep in mind:

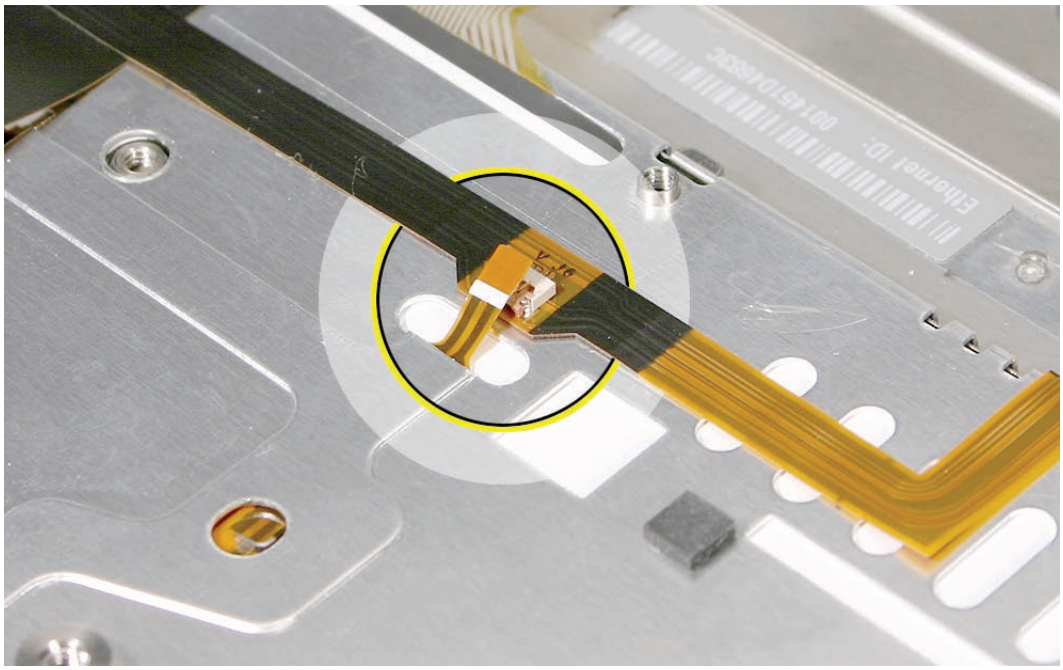
- Prevention of scratches to the cosmetics of the top case
- All tabs are properly seated
- Keyboard lays flat
- Bend-tabs are not damaged
- Screw holes align
- Cables are not caught
- Cable connectors are not damaged and cables are secure
- Kapton tape is applied as before
- Insulator film is correctly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

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

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

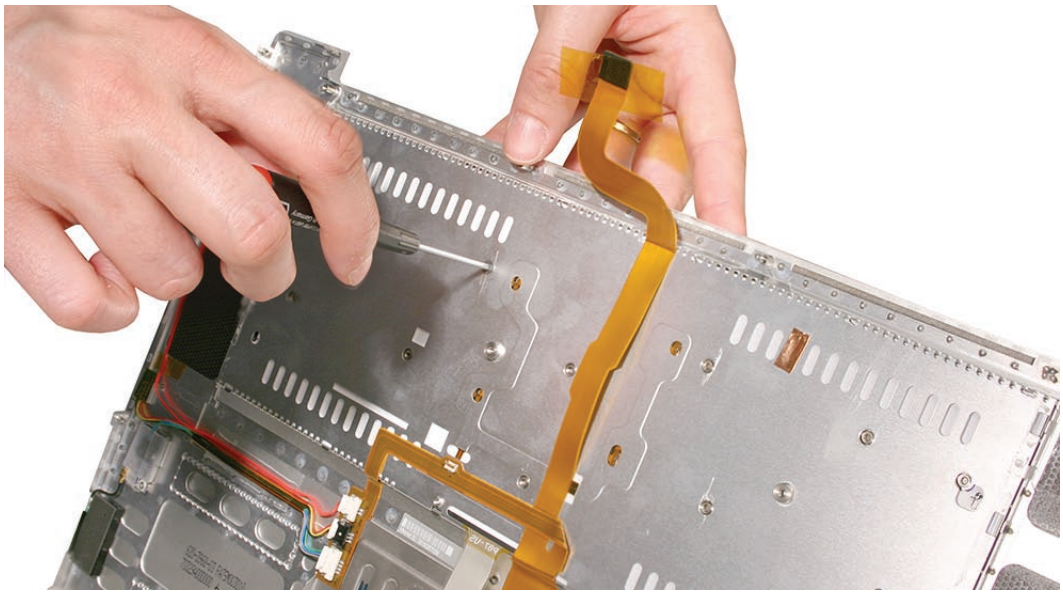
2. Guide the keyboard's flex cables through the slot in the top case, as shown. Make sure that they do not catch, bend or get pinched behind the keyboard.

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

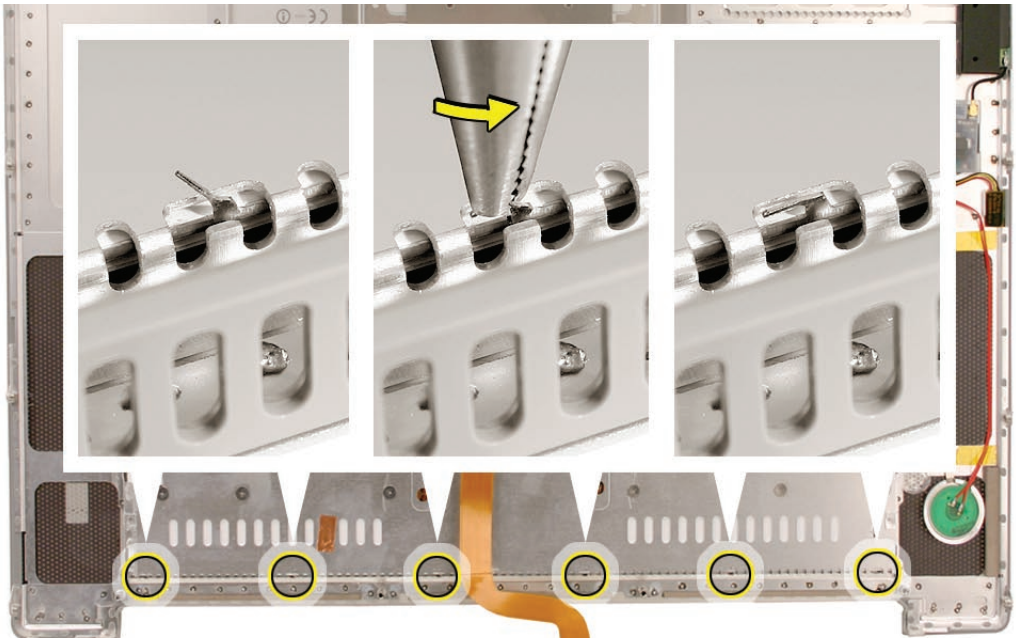


4. Lower the keyboard into the well and seat all six tabs along the bottom, so that the keyboard sits flat and straight.

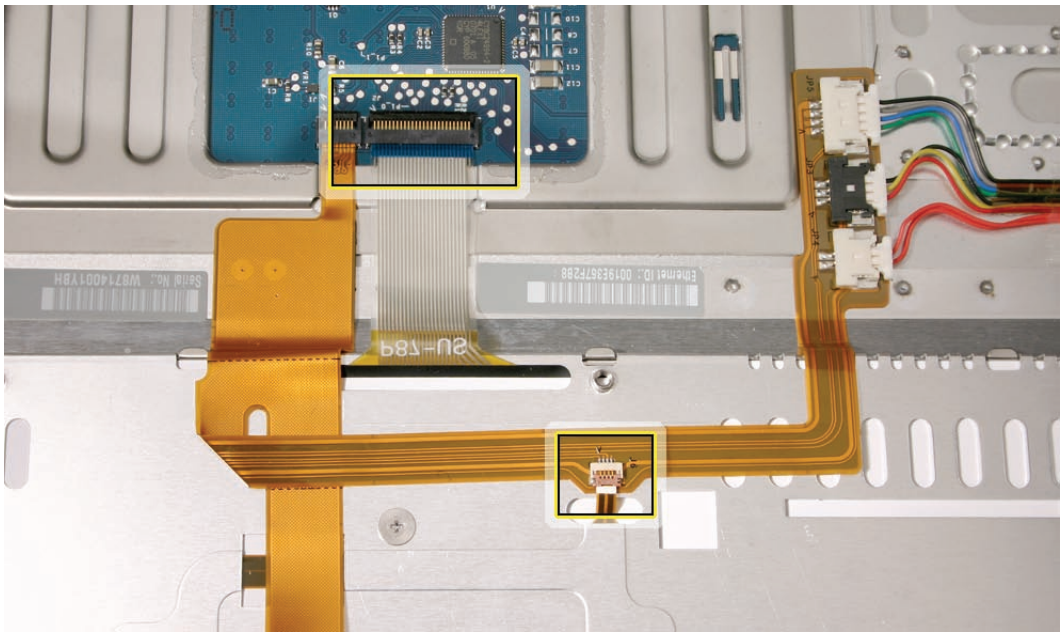
5. Verify that the bend-tabs are not caught.
6. Pull on the flex cables to verify that they are not bent or caught under the keyboard, and that they extend to their connectors.
7. Verify that the screw holes align with the screw bosses, and, holding the keyboard in place with your other hand, work outward from the middle to install all twelve keyboard screws.



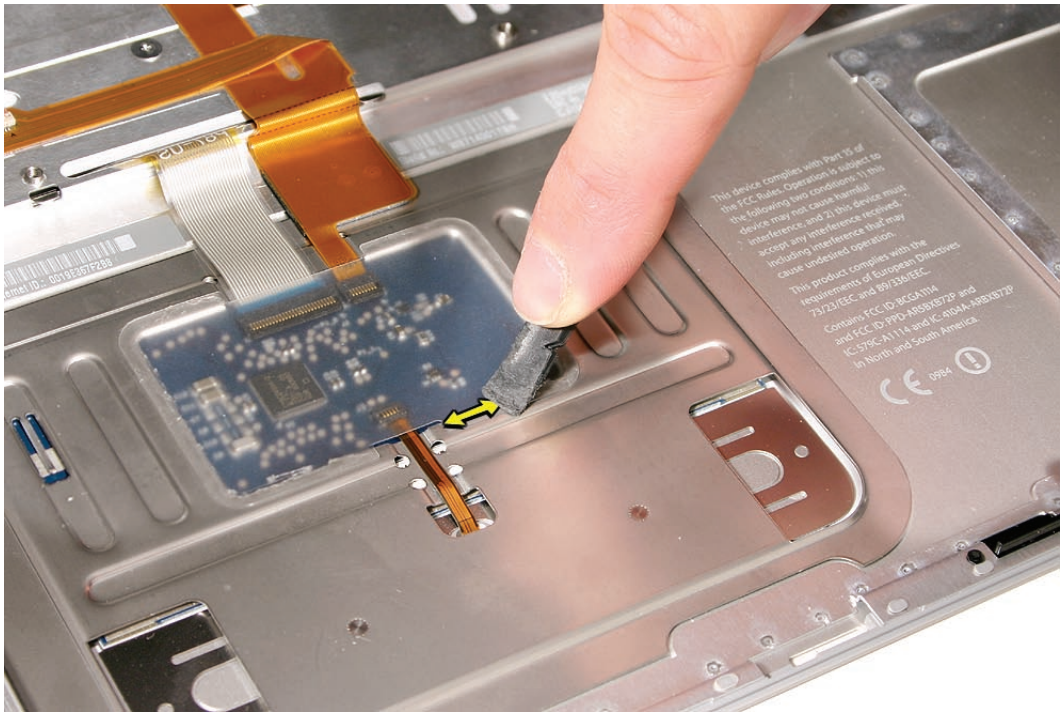
8. Bend the six bend-tabs over the metal of the top case to secure the edge of the keyboard. **Important:** The bend-tabs are delicate. Bend them carefully to avoid damage and no more than 90 degrees, or to, or within, any etch marks, if present. Avoid over-bending.



9. 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.



10. Reinstall the protective cover over the area shown. Carefully burnish down the edges to secure. (top case shown rotated)

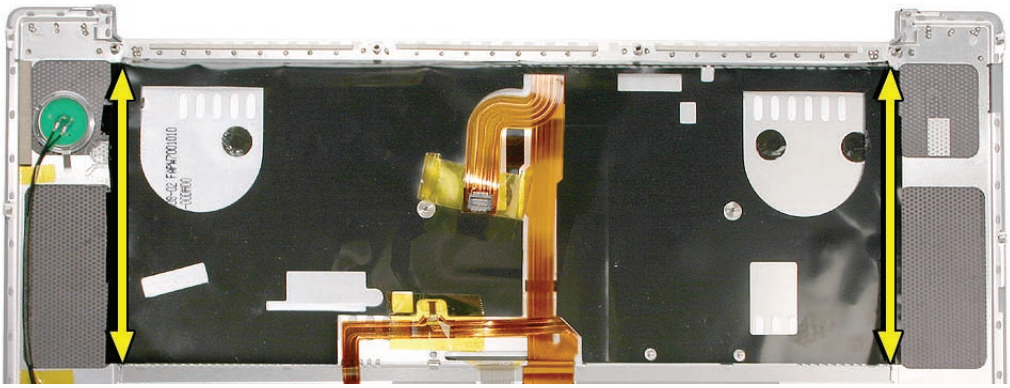


11. Replace the insulator film and mylar screw covers in the same locations from which they were removed. Ensure the holes in the film match up correctly with the screw bosses. Avoid wrinkles and bulges. If installing a replacement top case, use the new film if supplied.

    Important: The film must be installed in the same location to protect against contact and electrical shorting in certain areas as well as to allow connection with the EMI spring on the logic board.

12. Install Kapton tape to secure the small flex cable connector.

13. If the film extends over the edge of the keyboard well, run your finger along the edges to secure it to the top case.



14. Reassemble the computer.

Quick Test

- Turn on the unit, and check keyboard and trackpad function.
- Operate the computer in a darkened room to check for keyboard backlight function, as well as light leakage around the perimeter of the keyboard, speaker grill openings and side ports.

AirPort Extreme Card

Tools

This procedure requires the following tools:

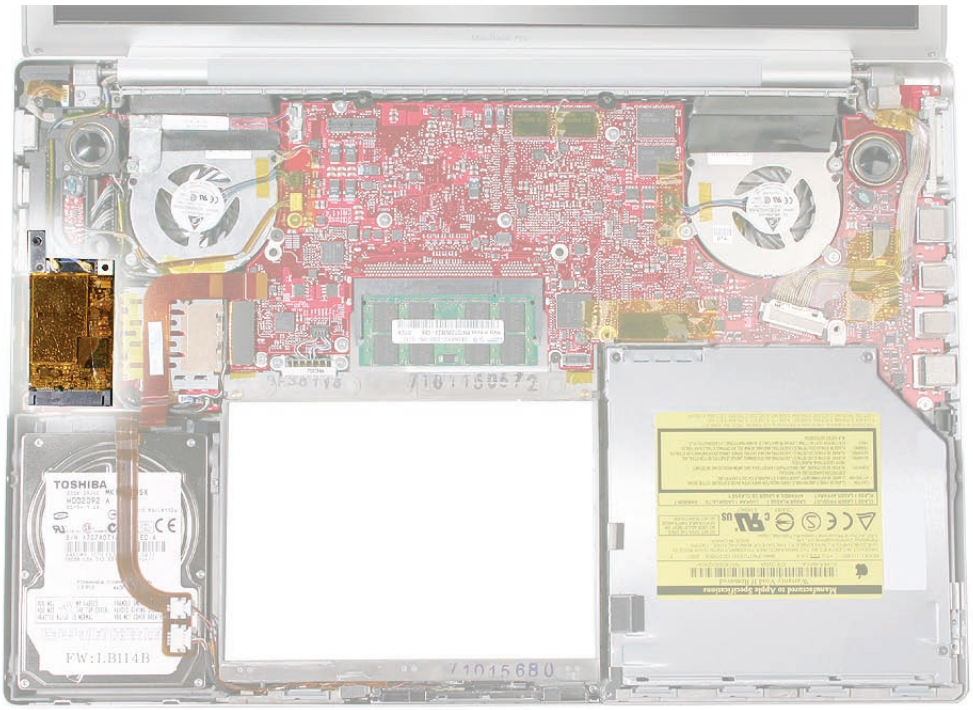
- Torx T6 screwdriver (magnetized)
- Black stick (nylon probe 922-5065) or other non-conductive nylon or plastic flat-blade tool
- Kapton tape (922-1731) (0.5-inch x 12-yard roll)

Preliminary Steps

Before you begin, remove the following:

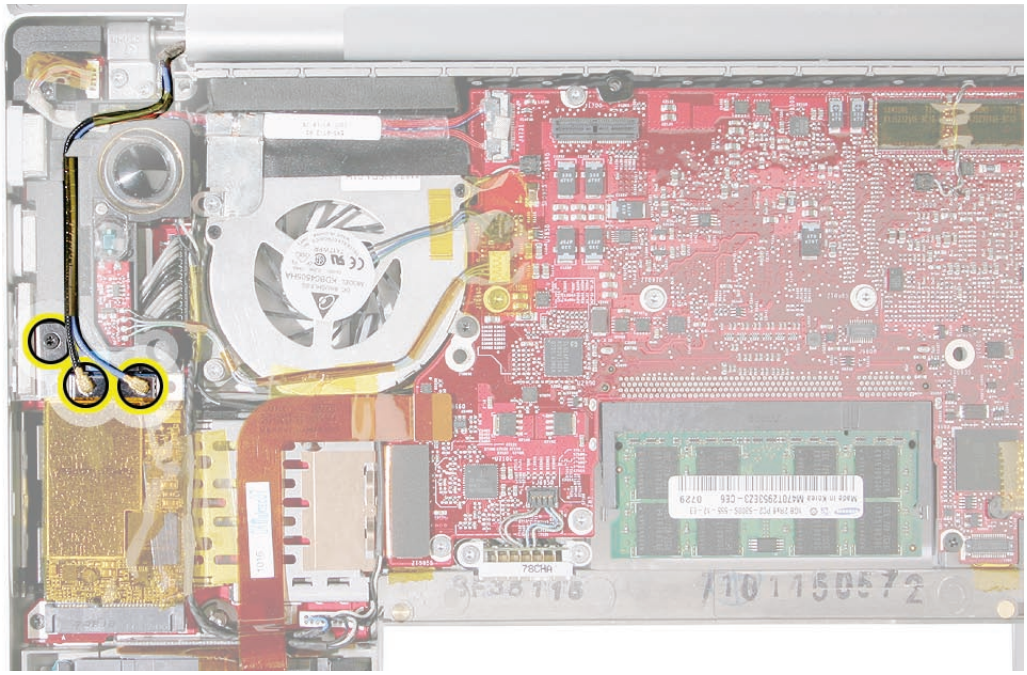
- Battery
- Top Case

Part Location

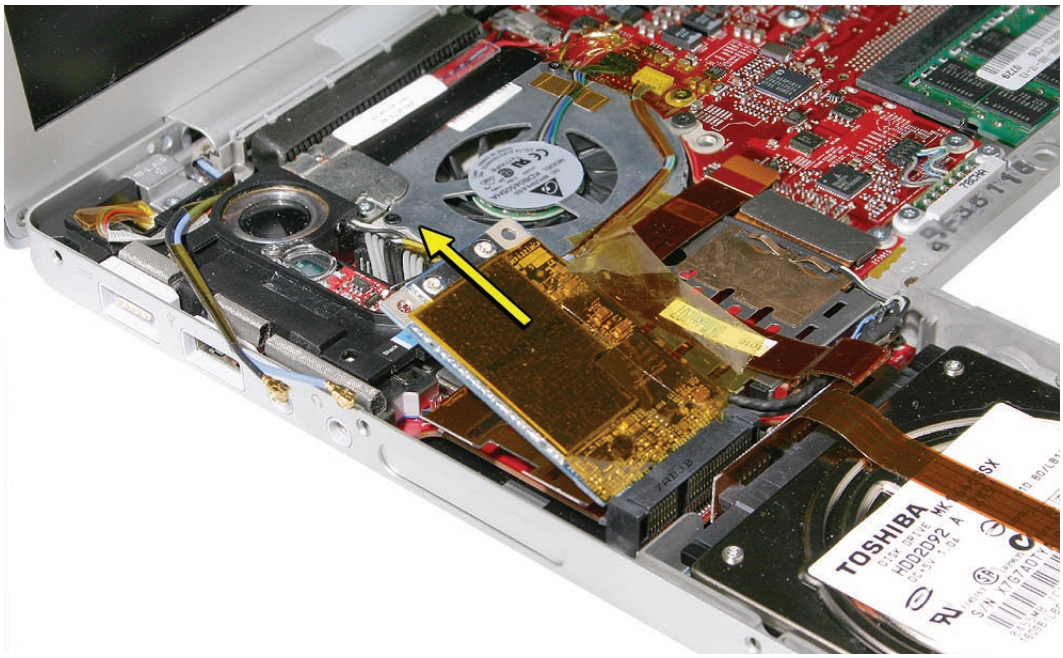


Procedure

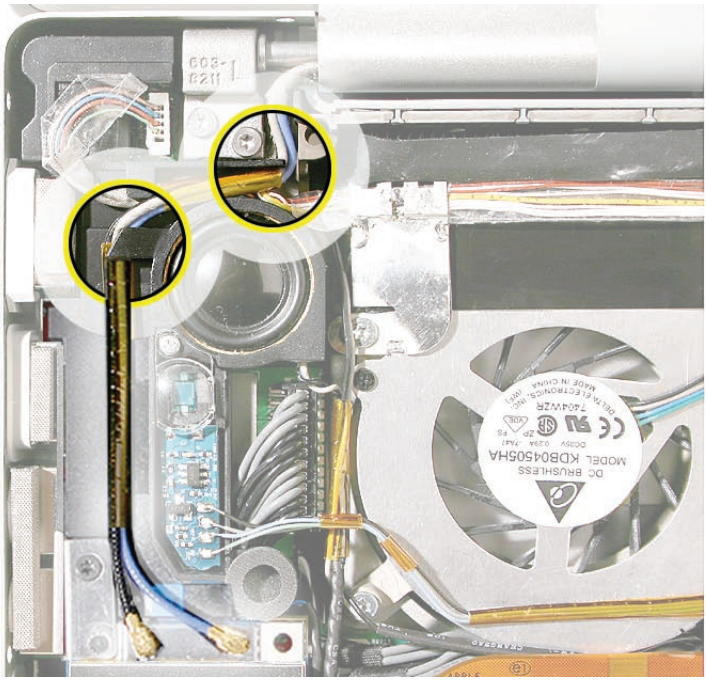
1. Disconnect the two antenna connectors, lifting straight up.
2. Remove the Torx T6 screw and bracket, and peel up any kapton tape holding down the Airport card, if present. Note the kapton tape may wrap around speaker cables on the right.



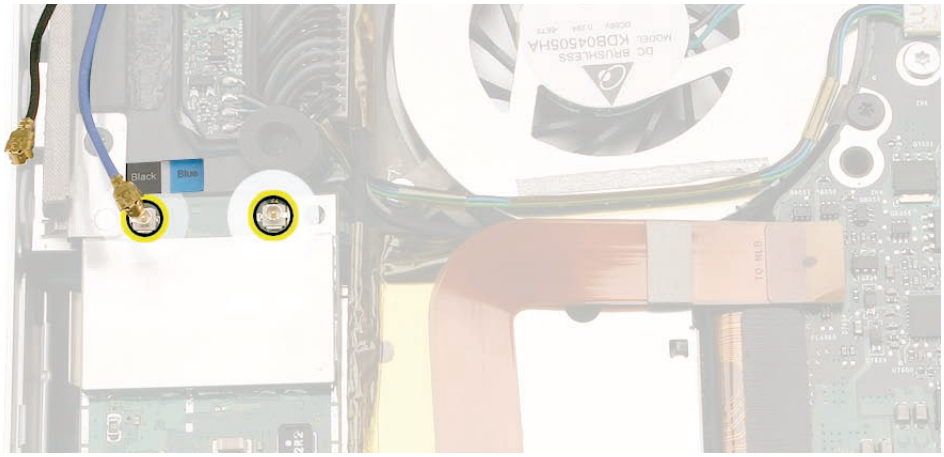
3. Once the card is freed from the bracket and tape, it should rise up slightly. Pull the card straight out of its socket at the angle shown below.



4. Verify that the antenna cables route flat in the channel and underneath the two brackets on the left speaker. Secure with Kapton tape, if necessary.



5. Connect each antenna cable to its respective terminal. Note that the color of each antenna cable corresponds with a matching color key located above the terminals.



6. Verify that the ambient light sensor flex cable is connected properly.
7. Reassemble the computer.

Quick Test

- Open up Apple System Profiler to make sure the Airport Extreme card is recognized under the AirPort Card tab in the Network section.

Bluetooth Card

Tools

This procedure requires the following tools:

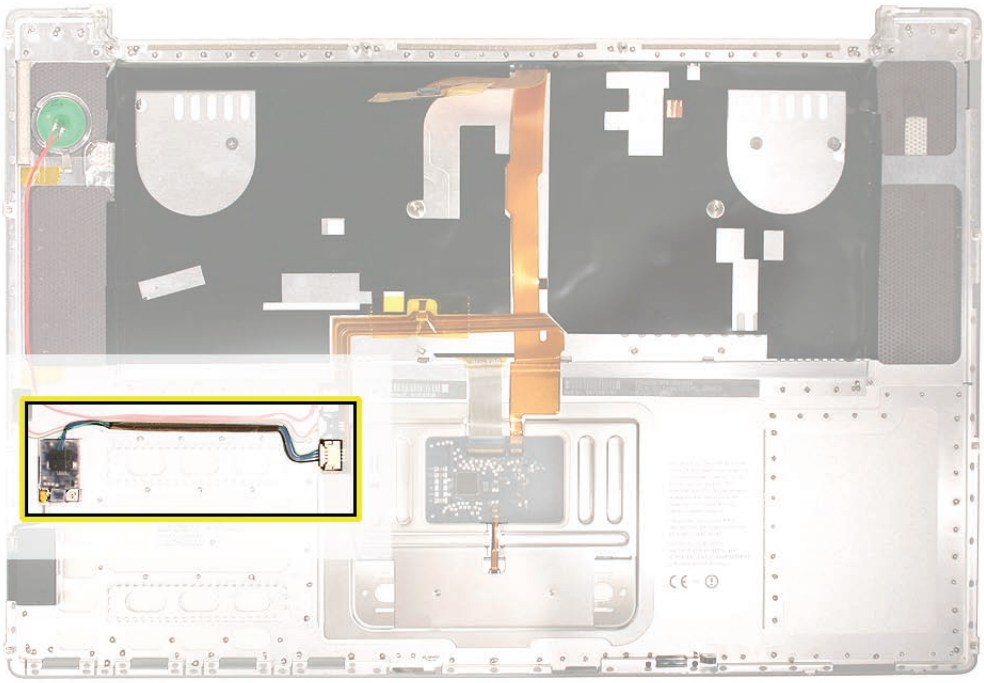
- #0 Phillips screwdriver (magnetized)
- Black stick (nylon probe 922-5065) or other non-conductive nylon or plastic flat-blade tool
- Kapton tape (922-1731) (0.5-inch x 12-yard roll)

Preliminary Steps

Before you begin, remove the following:

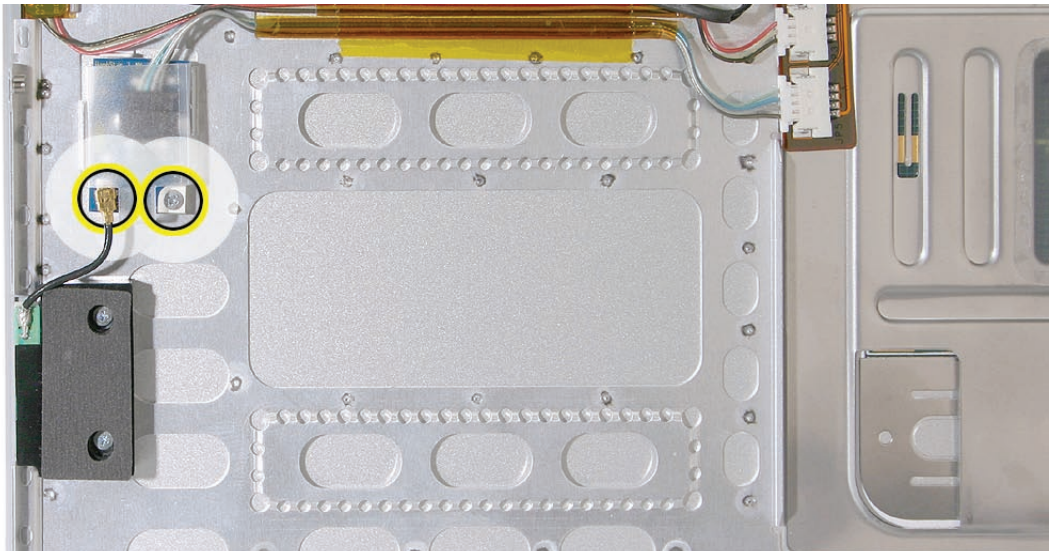
- Battery
- Top Case

Part Location

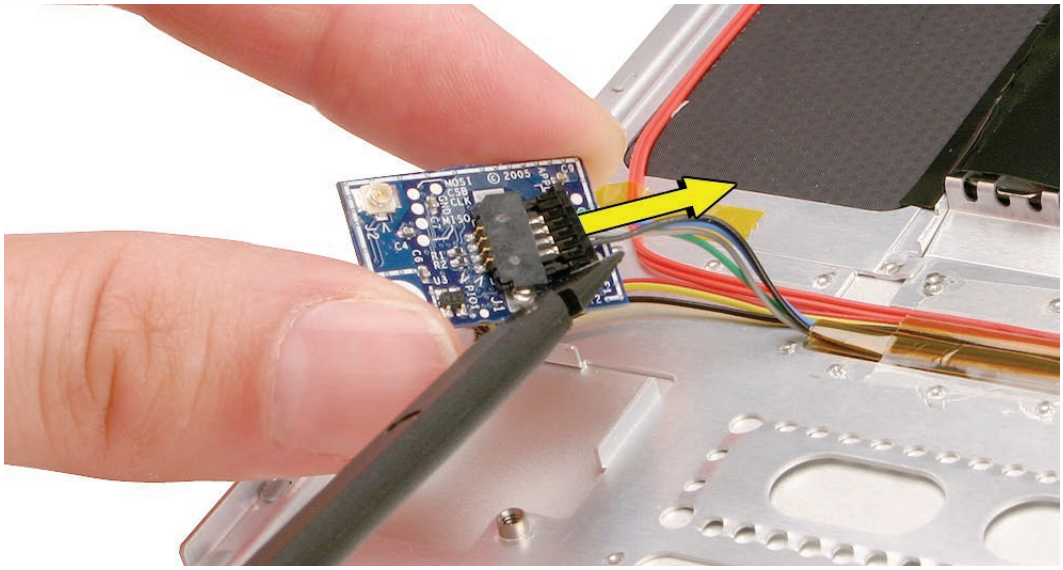


Procedure

1. Disconnect the Bluetooth antenna connector from the Bluetooth card, pulling straight up.
2. Remove one Phillips screw from the lower right corner of the Bluetooth card.



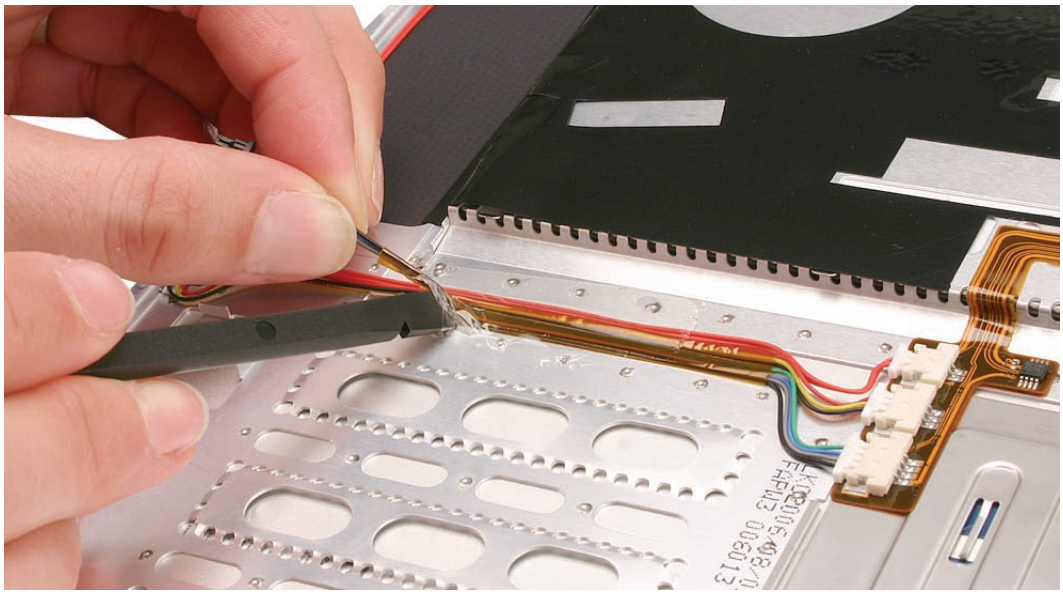
3. Remove the plastic protective cover by sliding it gently off the card, taking care to preserve its integrity for reuse. Set the cover aside to use with the replacement Bluetooth card.
4. Holding the Bluetooth card by its edges, use a black stick to disconnect the cable connector from the card as shown below.



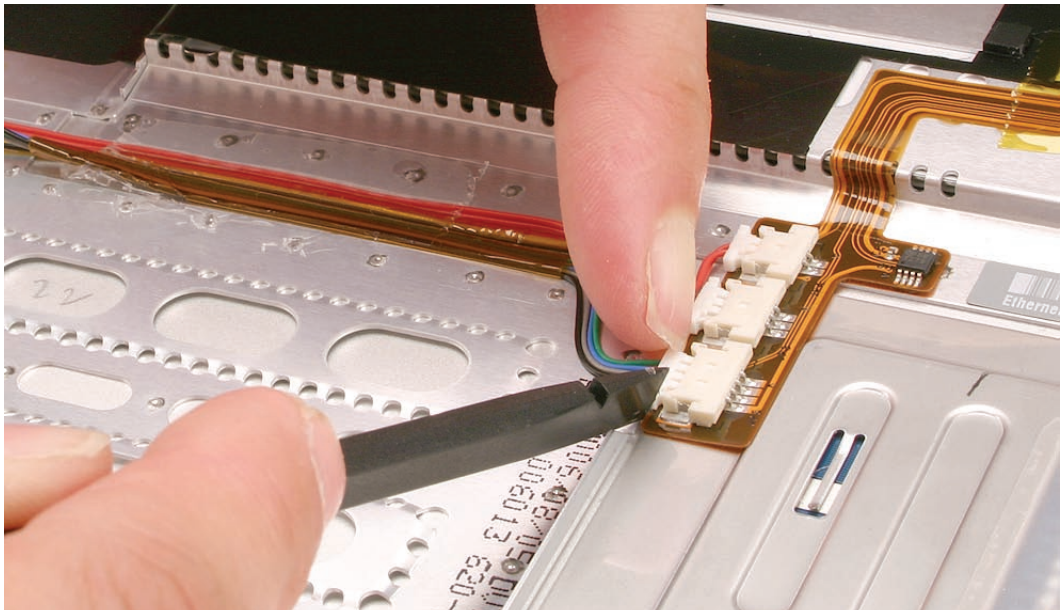
Replacement Note: Before attaching the new Bluetooth card to the top case, install the plastic cover retained from the old card over the replacement and secure with Kapton tape if necessary.

Replacing the Bluetooth cable

1. To remove or replace the Bluetooth cable, gently pry up adhesive using a black stick.



2. Disconnect the other end of the cable as shown.



Quick Check: Use Apple System Profiler to see if Bluetooth HCI appears under the USB Bus tab in the USB device section.

Bluetooth Antenna

Tools

This procedure requires the following tools:

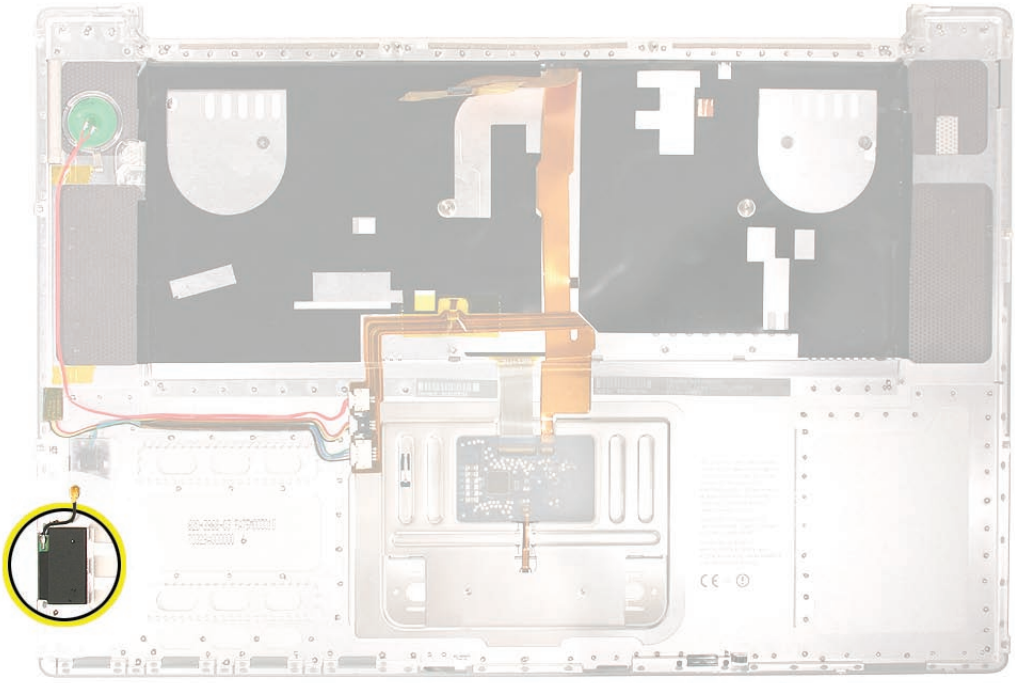
- #0 Phillips screwdriver (magnetized)
- Black stick (nylon probe 922-5065) or other non-conductive nylon or plastic flat-blade tool
- Razor knife
- Kapton tape (922-1731) (0.5-inch x 12-yard roll)

Preliminary Steps

Before you begin, remove the following:

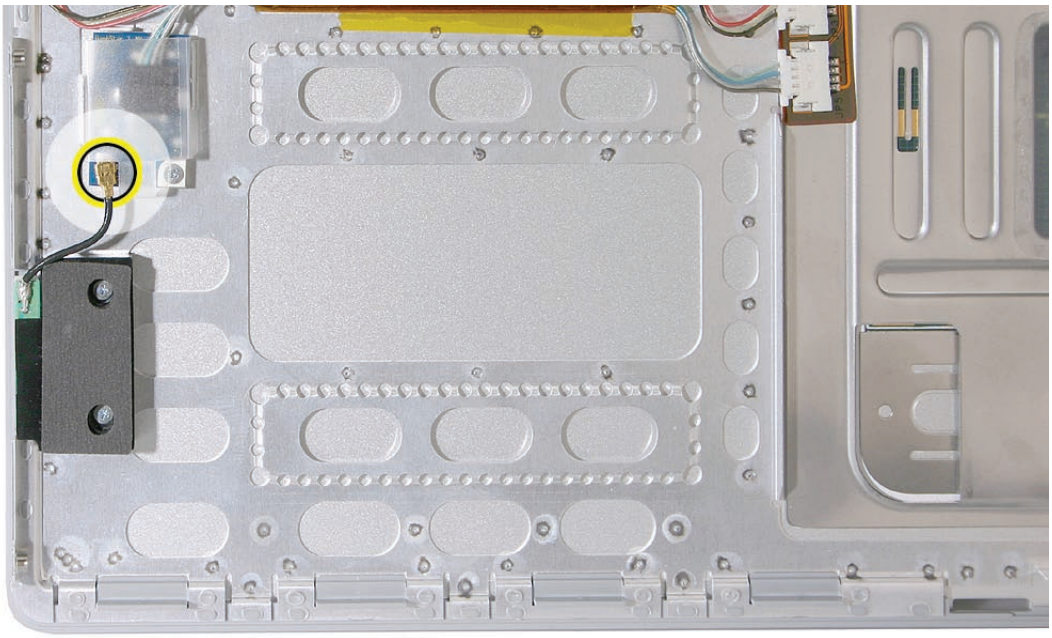
- Battery
- Top Case

Part Location

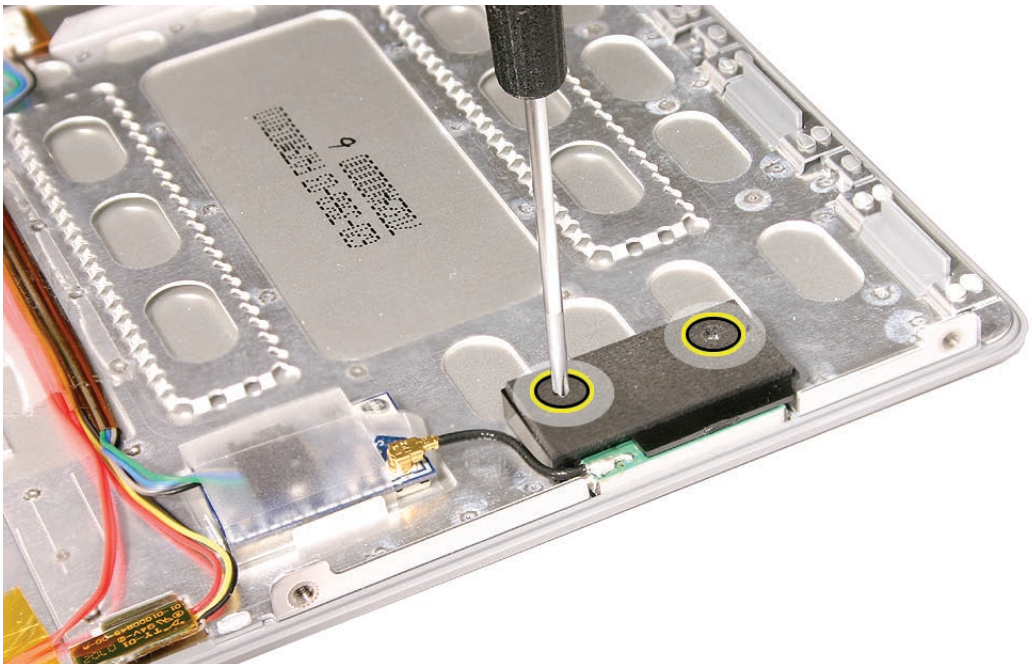


Procedure

1. Disconnect the Bluetooth antenna connector from the Bluetooth card, pulling straight up.

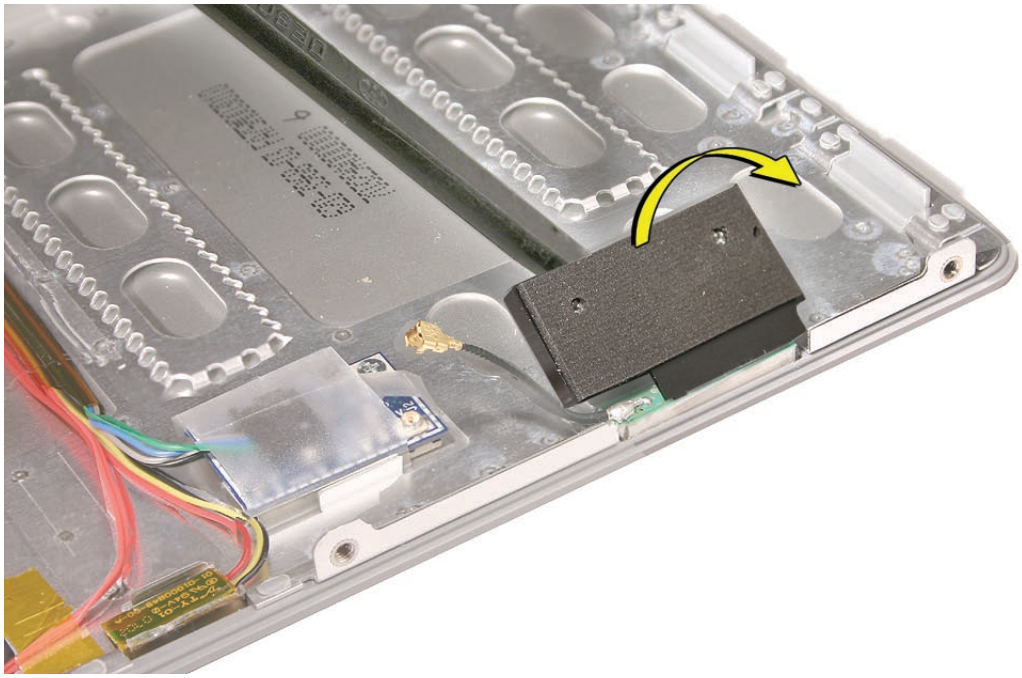


2. Remove two captured Phillips #0 screws from black plastic antenna shield which are accessible via screwdriver through two visible holes in the foam cover.

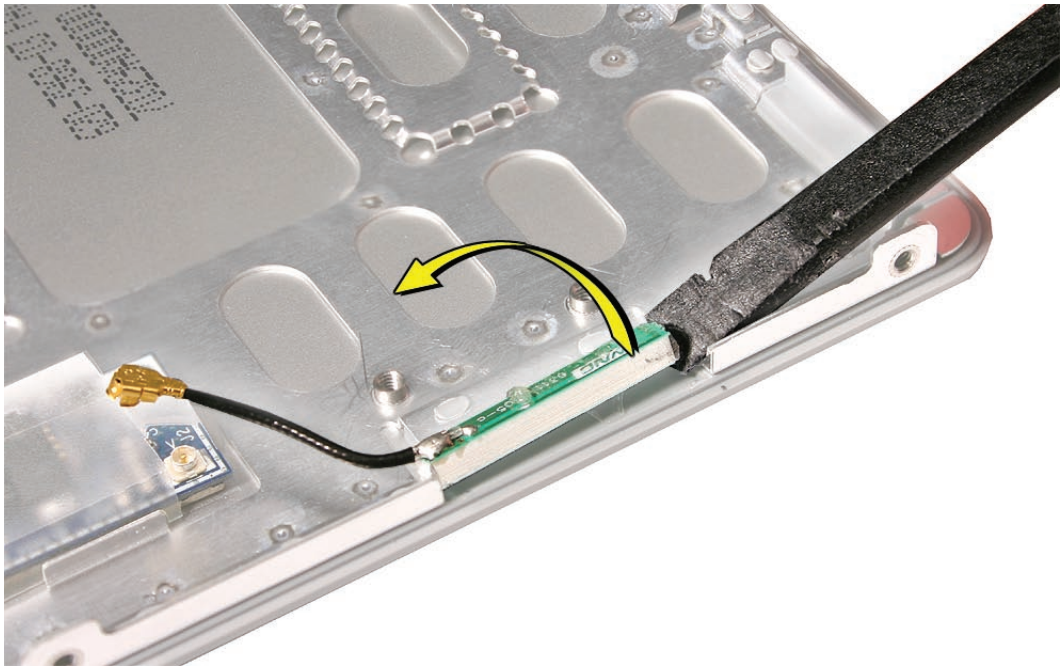


922-7202

3. Pry shield up from top case using a black stick, taking care to preserve adhesive underneath.



4. Use a black stick to remove the antenna, prying it up to release the adhesive.



Replacement Note: If you remove the Bluetooth board during antenna replacement, reapply its protective cover and secure with Kapton tape if necessary before reinstalling on the top case.

Infrared Board

Tools

This procedure requires the following tools:

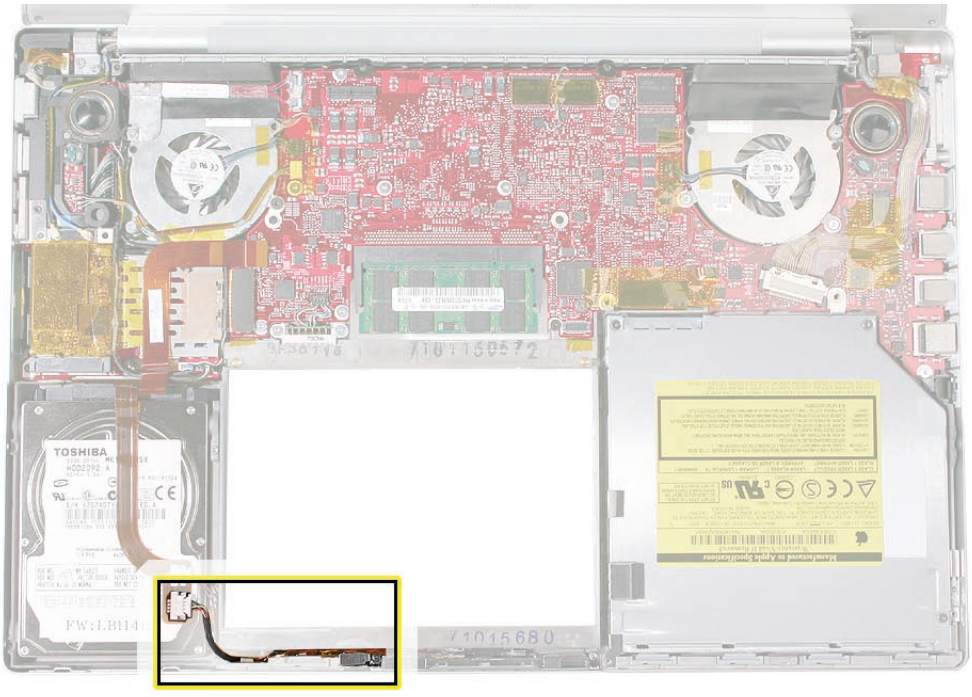
- Torx T6 screwdriver (magnetized)
- Black stick (nylon probe 922-5065) or other non-conductive nylon or plastic flat-blade tool

Preliminary Steps

Before you begin, remove the following:

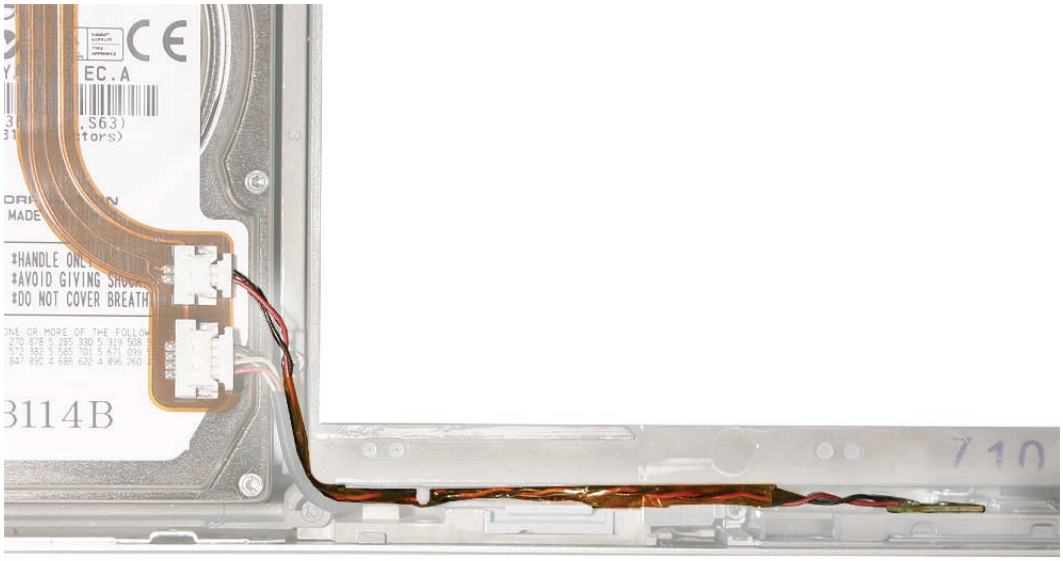
- Battery
- Top Case

Part Location

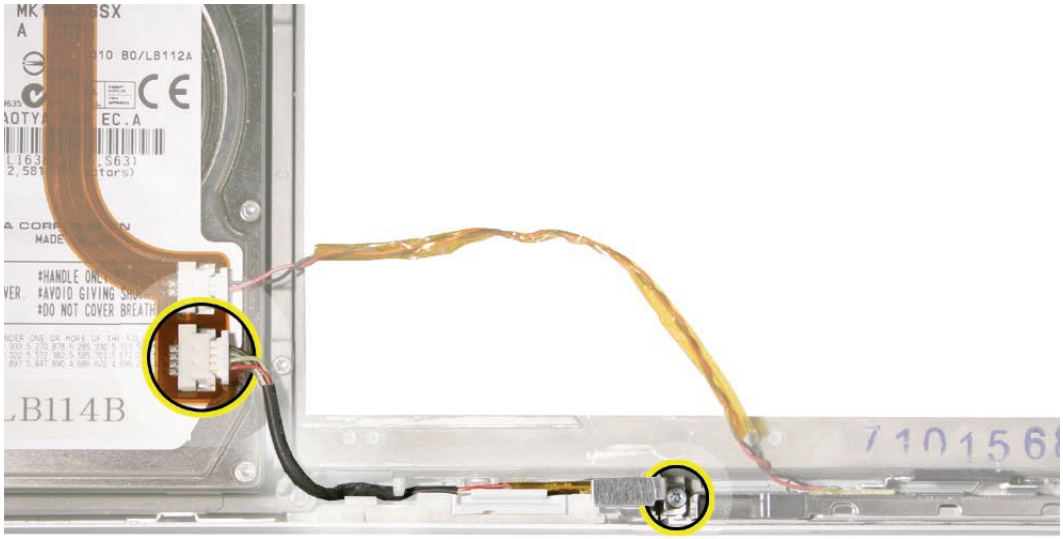


Procedure

1. Note the path and routing of the sleep light cable which sits above the IR cable (twisted red and black wire partially wrapped in Kapton tape). Gently lift the cable up and aside without disturbing either the sleep light connector or the sleep light board soldered to the frame.



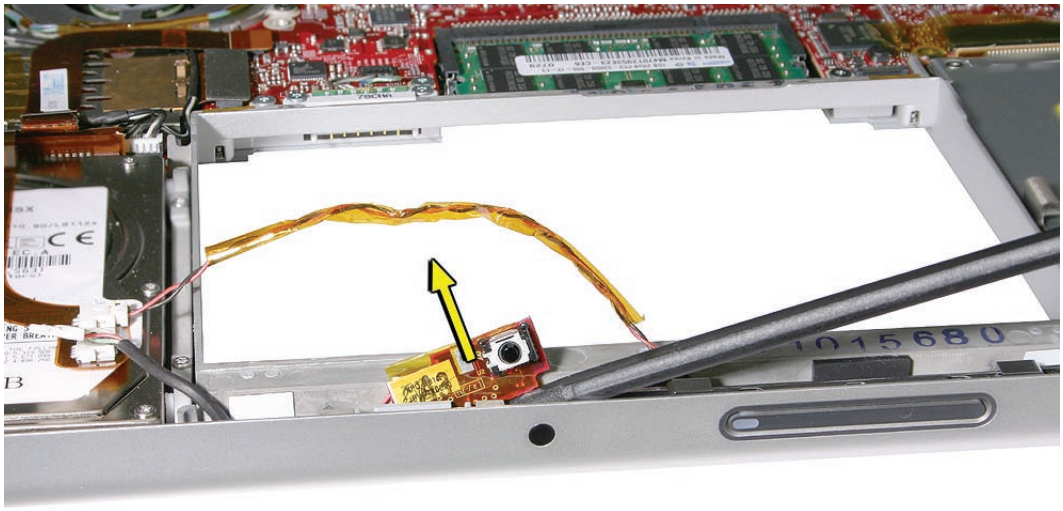
2. Disconnect the IR cable connector from the flex cable on the hard drive.
3. Remove the Torx T6 screw and bracket above the IR board.



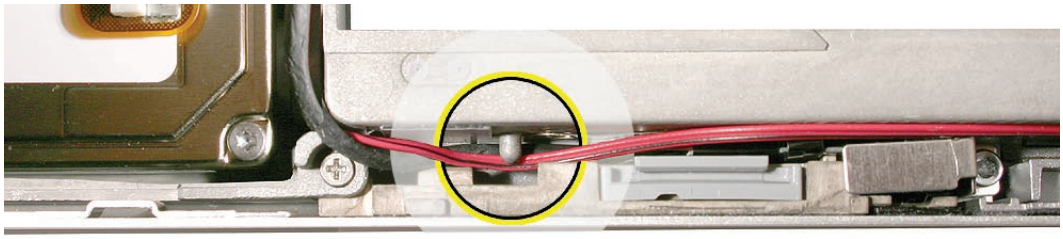
922-8008

4. Using a black stick, lift out the infrared board. Lifting from both ends may also 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.



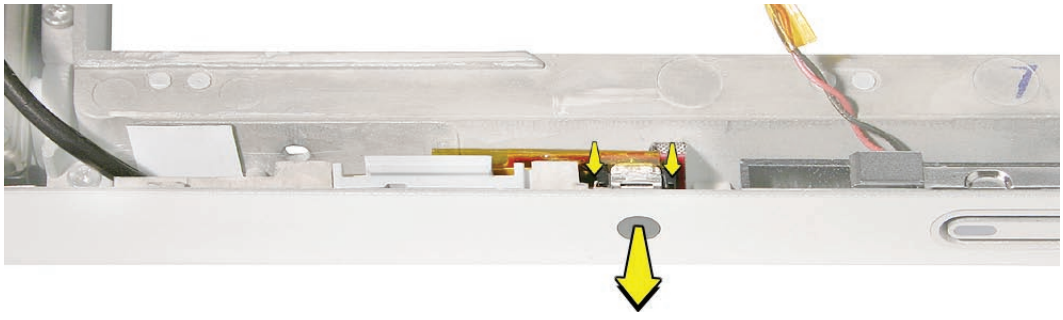
   Note: Be sure to slip the cable out from under the small peg in the frame.



Replacement Procedure

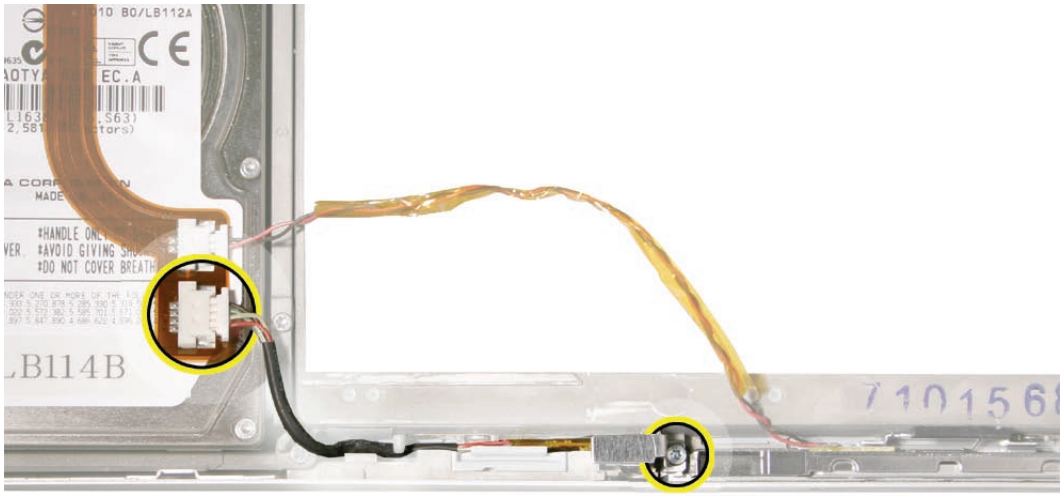
1. To install, insert the board all the way into the channel, then gently maneuver the board until the infrared lens aligns with the window.

   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.

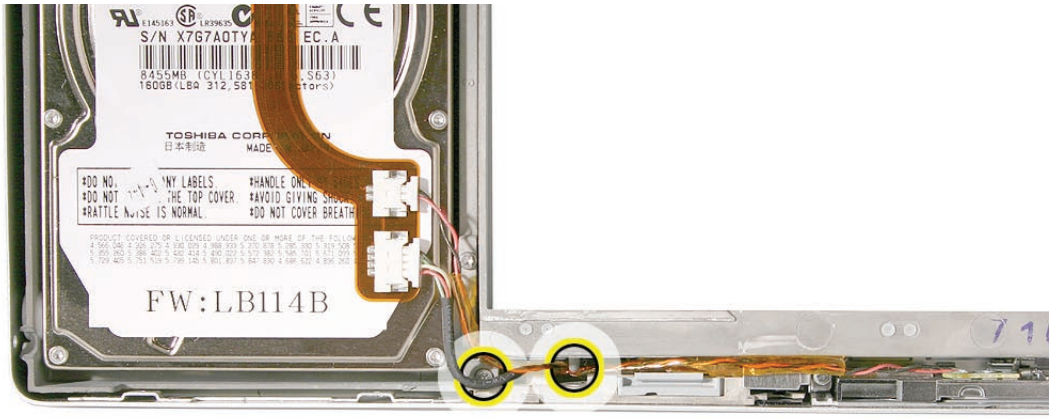


2. Connect the IR cable connector to the flex cable on the hard drive.
3. Reinstall the bracket and Torx T6 screw above the IR board.

922-8008



4. Route the IR and sleep light cables as shown below, making sure to tuck both cables under the peg on the frame.



Quick Test

- Open Apple System Profiler and check to see that IR Receiver appears under the USB Bus tab in the USB device section.

Hard Drive

Tools

This procedure requires the following tools:

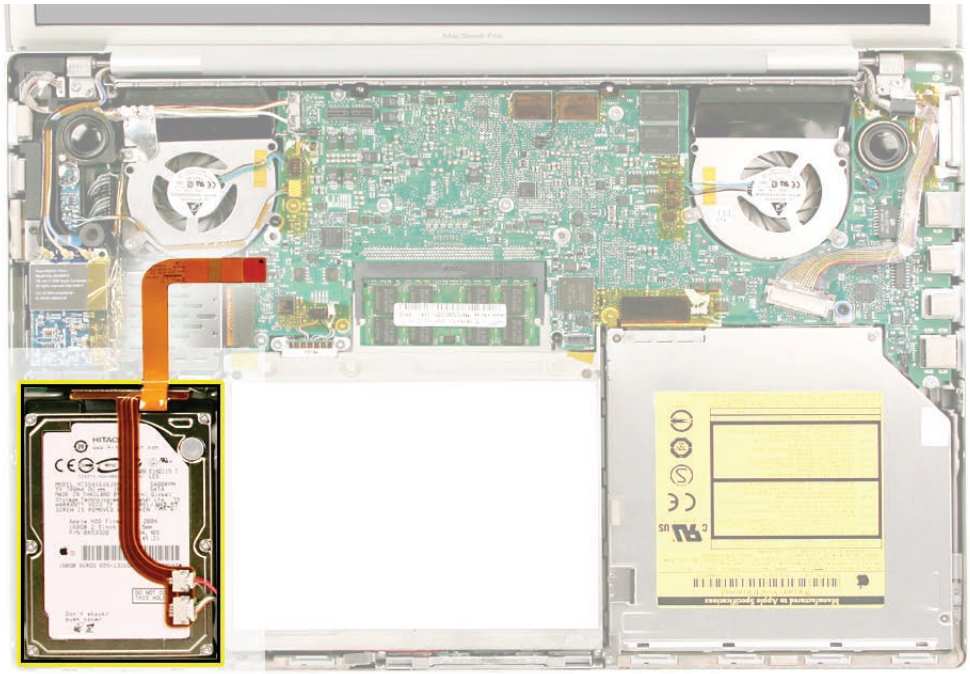
- #0 Phillips screwdriver (magnetized)
- Torx T6 screwdriver (magnetized)
- Black stick (nylon probe 922-5065) or other non-conductive nylon or plastic flat-blade tool
- Kapton tape (922-1731) (0.5-inch x 12-yard roll)

Preliminary Steps

Before you begin, remove the following:

- Battery
- Top Case

Part Location

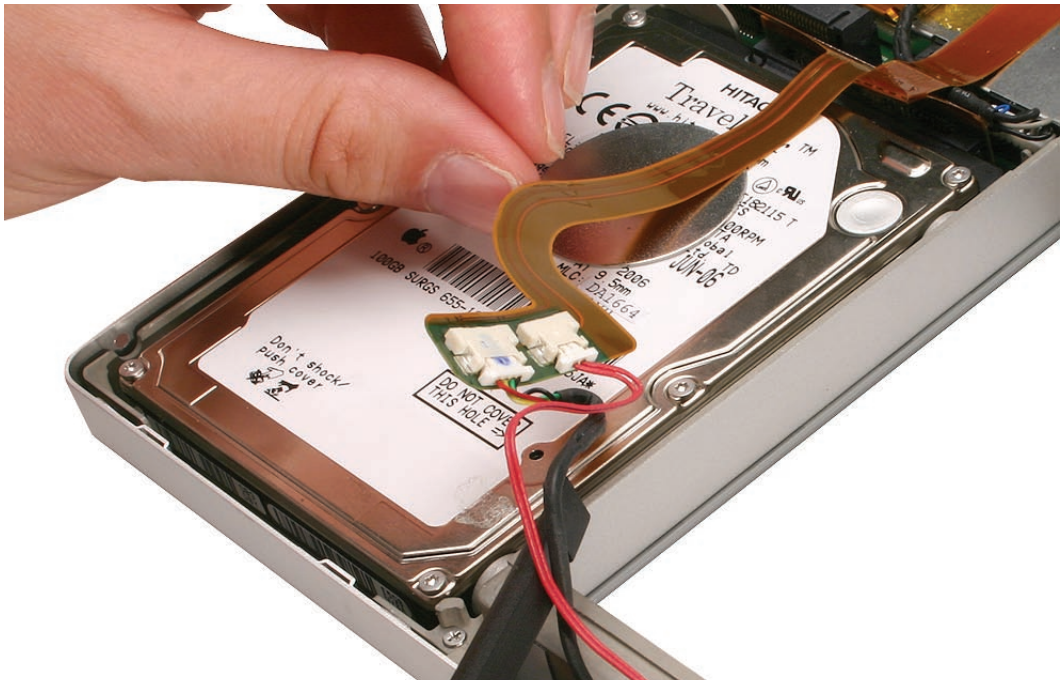


Procedure

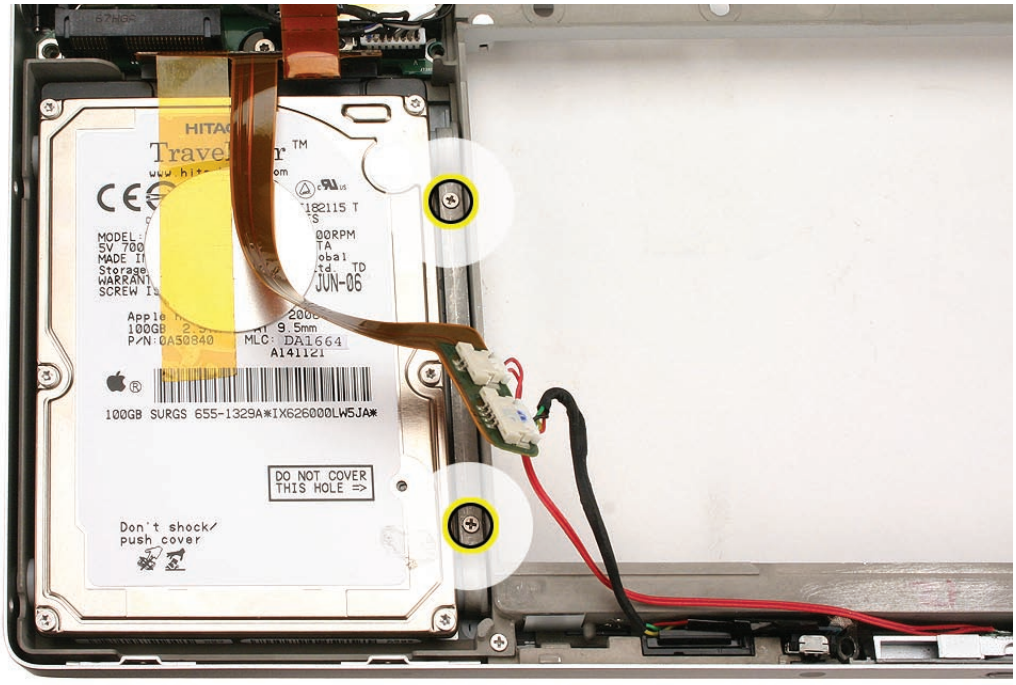
NOTE: Some hard drives may have a metal disk attached to them for vibration stabilization (as shown below) while other models may not.

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

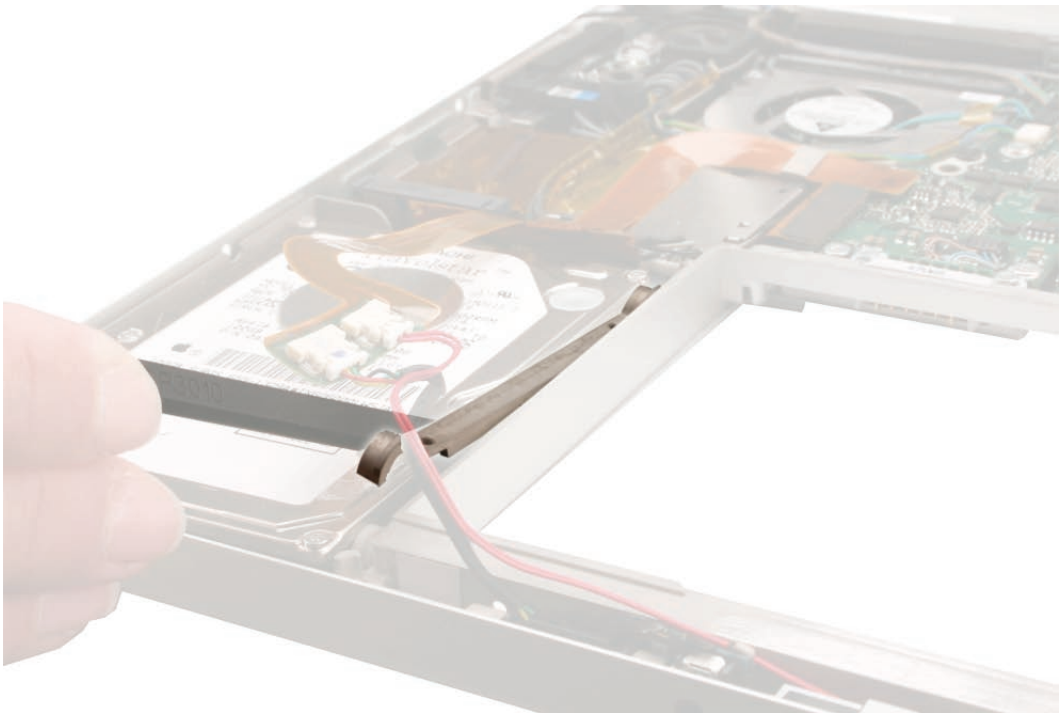
2. Lift up cabling to gain some clearance.



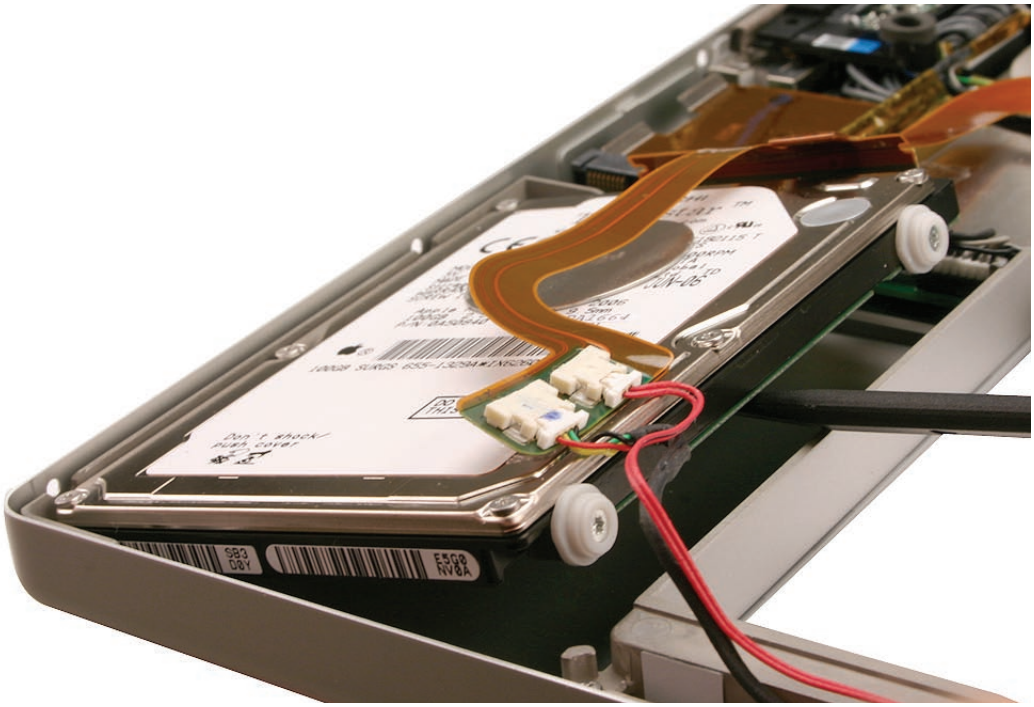
3. Remove the two Phillips #0 screws from the drive bracket.



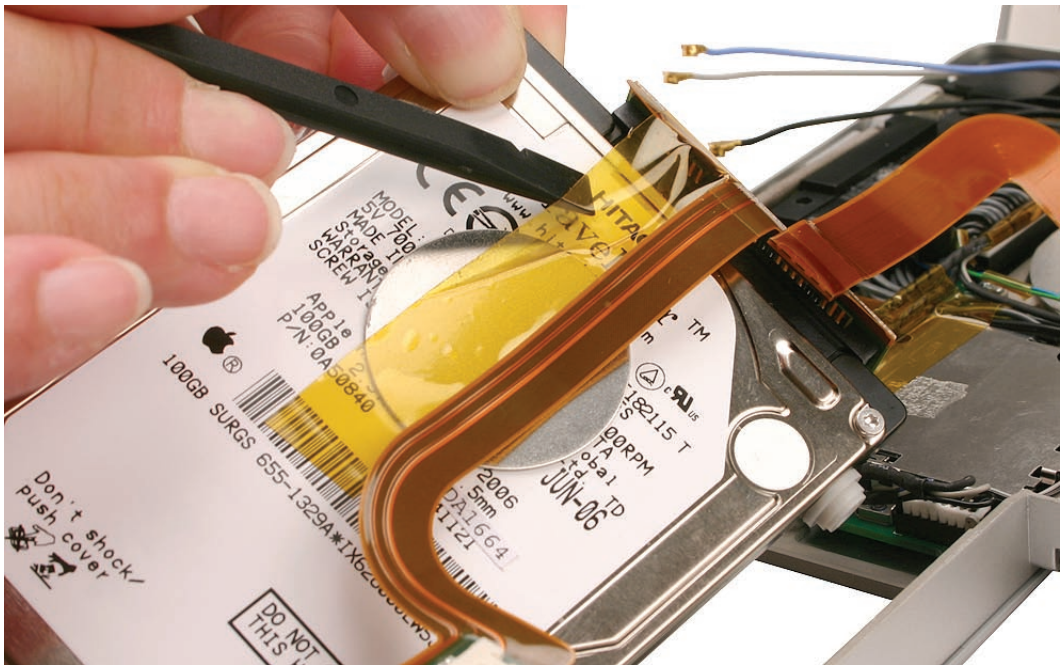
4. Remove the hard drive bracket.

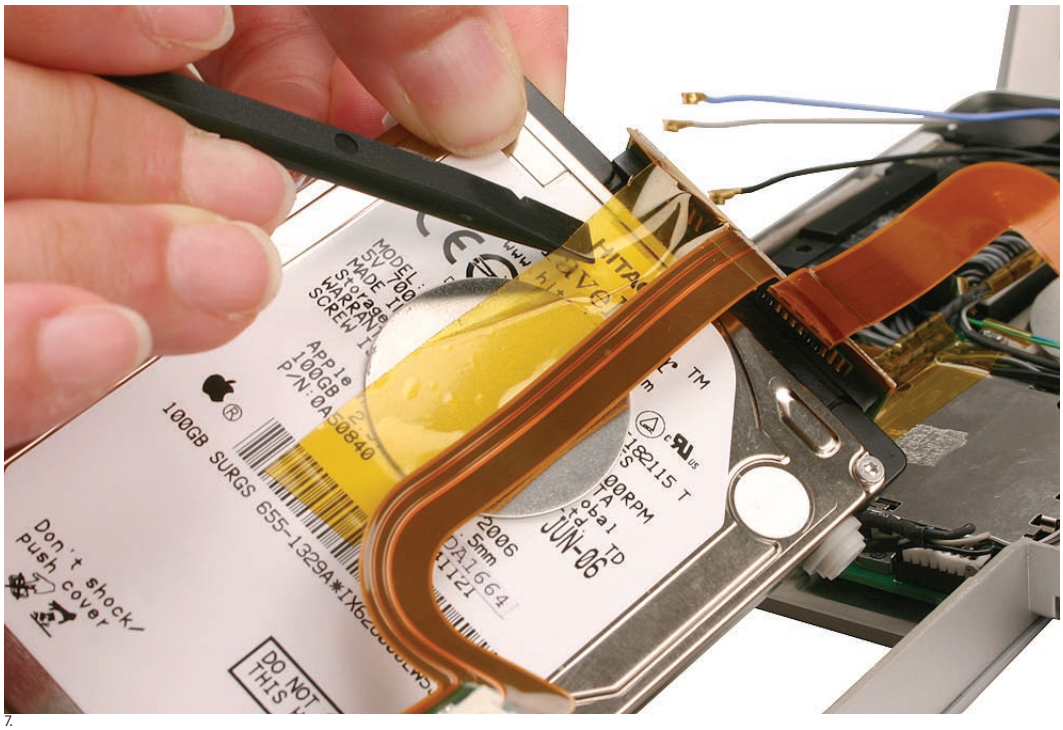


5. Using a black stick, tilt the hard drive up slightly on the right side; then work the hard drive out of its grommet wells on the left side and lift up just enough to access the flex connector.



6. If there is Kapton tape securing the flex connector, remove it very carefully to ensure that you don't damage the label. A damaged label voids the warranty of the hard drive. (Note that most hard drives may not have a vibration dampening disc like the one below.)

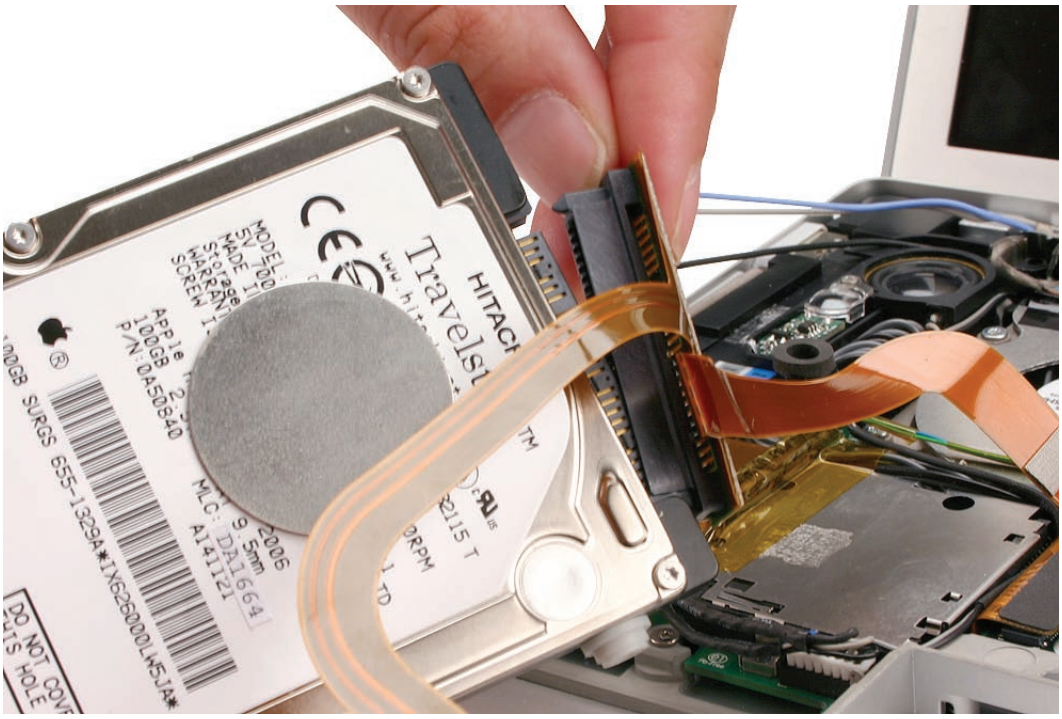




7.

8. Kapton tape may wrap all the way around the flex connector to the back side of the hard drive. If so, hold the hard drive by its sides to turn it over and release the Kapton tape.

9. Gently pry the flex connector from the hard drive.



Replacement Procedure

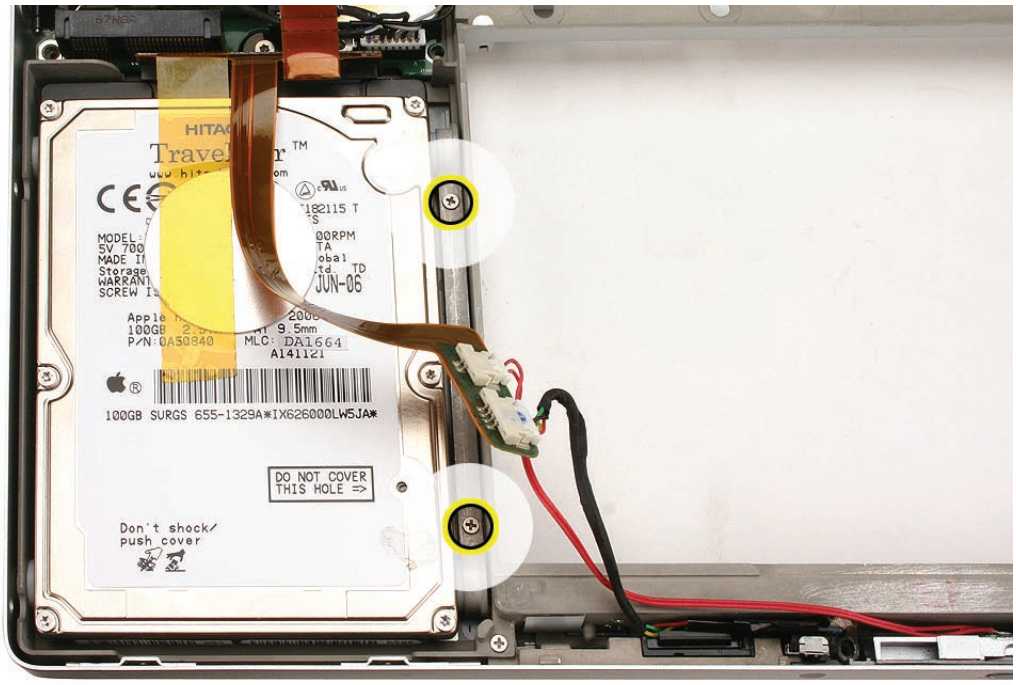
1. Transfer the rubber grommets and screws. Replace any Kapton tape around flex cable.

   NOTE: Some hard drives may have a metal disk attached to them for vibration stabilization. Do not transfer this disk if the replacement drive comes without one. If a replacement hard drive needs this metal disk, it will come preattached.

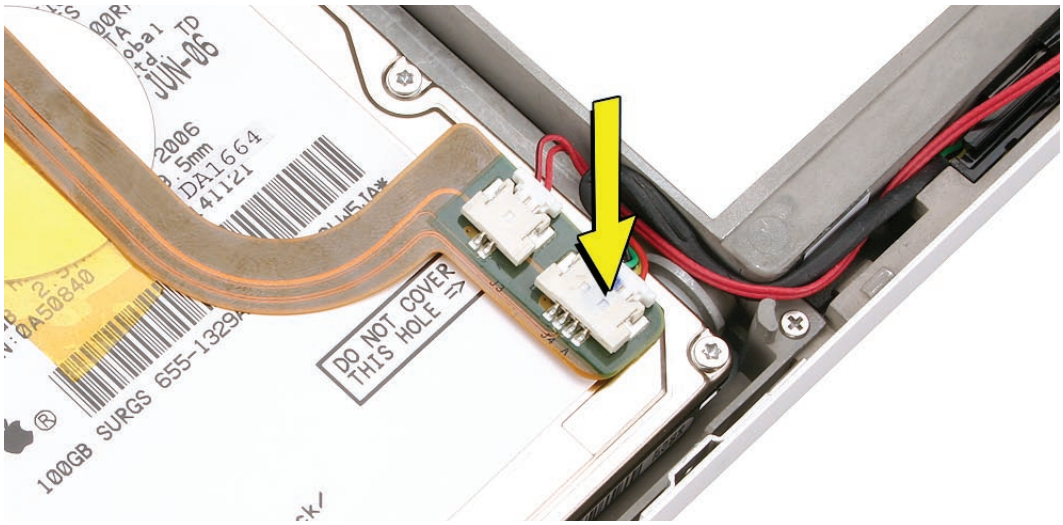
2. Tilting the hard drive as you insert it, tuck the screws on the left side of the hard drive into the grommets in the bottom case.

3. After lowering drive into place, replace bracket and screws.

922-8057

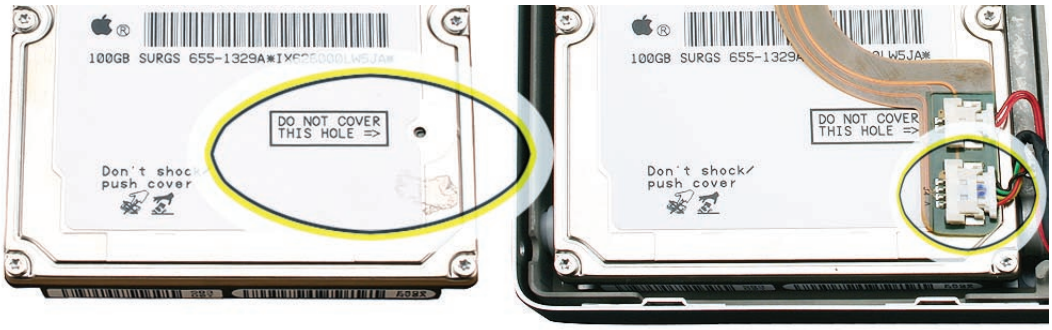


4. Make sure the flex cable is re-adhered to its spot under the infrared connector.



Note: Notice there may be a warning label that says **Do Not Cover This Hole** directly under the hard drive/IR flex cable. Not to worry. Because the vent hole is recessed, the upper portion of the flex cable end can cover the hole without actually blocking it.

However, be sure that the lower part of the flex cable (with the Infrared cable connector) is the portion that actually adheres to the hard drive. The sticky area should not cover the hole. In the shot below you can see where the adhesive residue is located.



Optical Drive

Tools

This procedure requires the following tools:

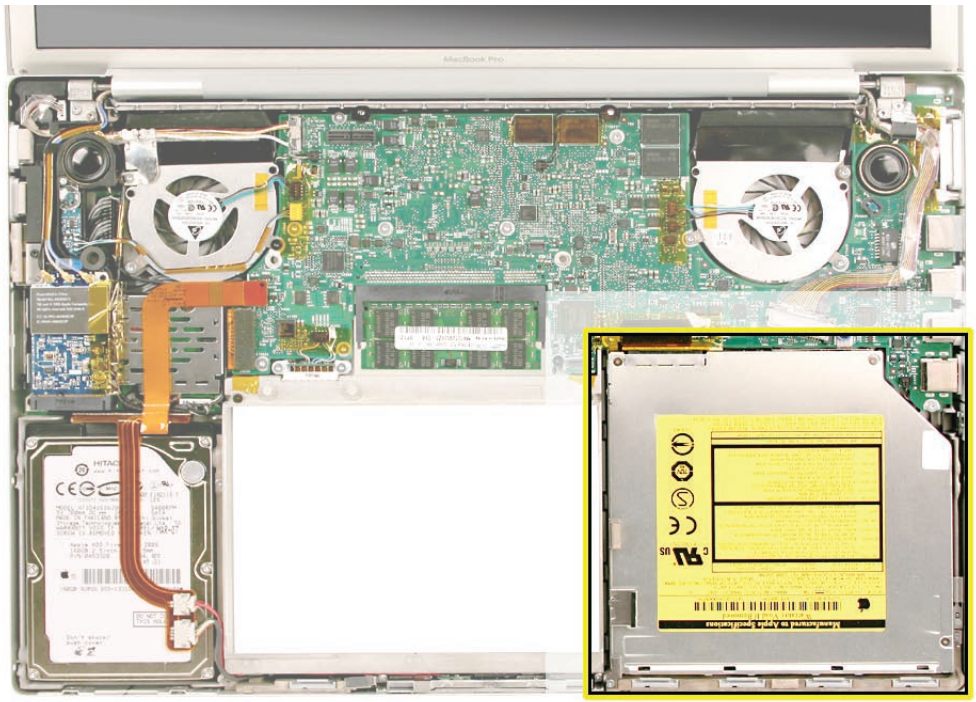
- #0 Phillips screwdriver (magnetized)
- Torx T6 screwdriver (magnetized)
- Black stick (nylon probe 922-5065) or other non-conductive nylon or plastic flat-blade tool

Preliminary Steps

Before you begin, remove the following:

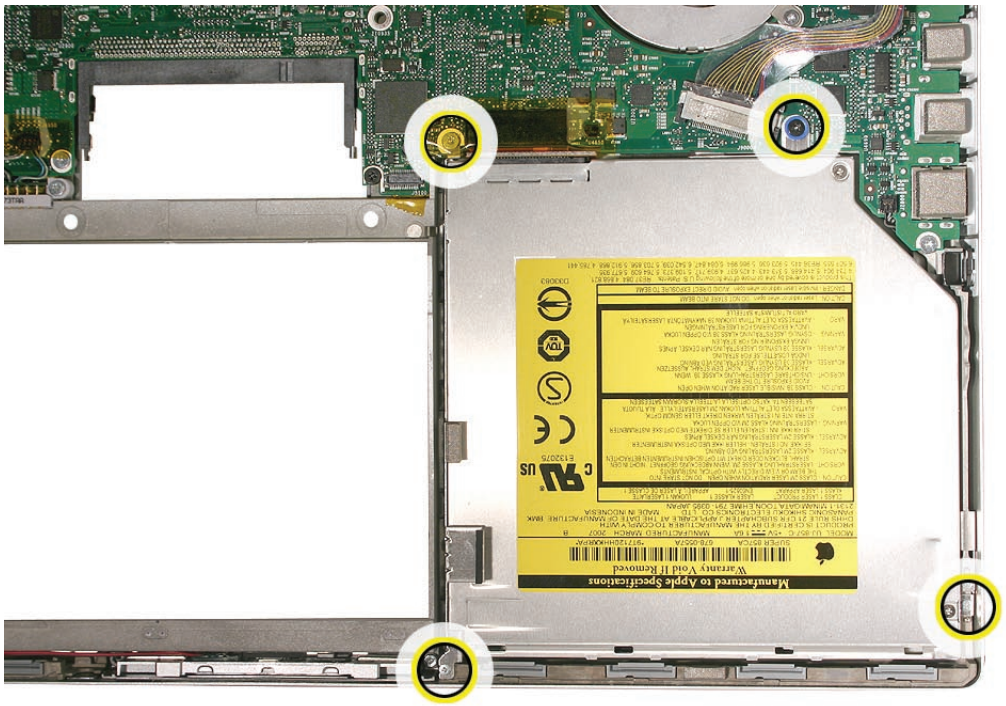
- Battery
- Top Case

Part Location



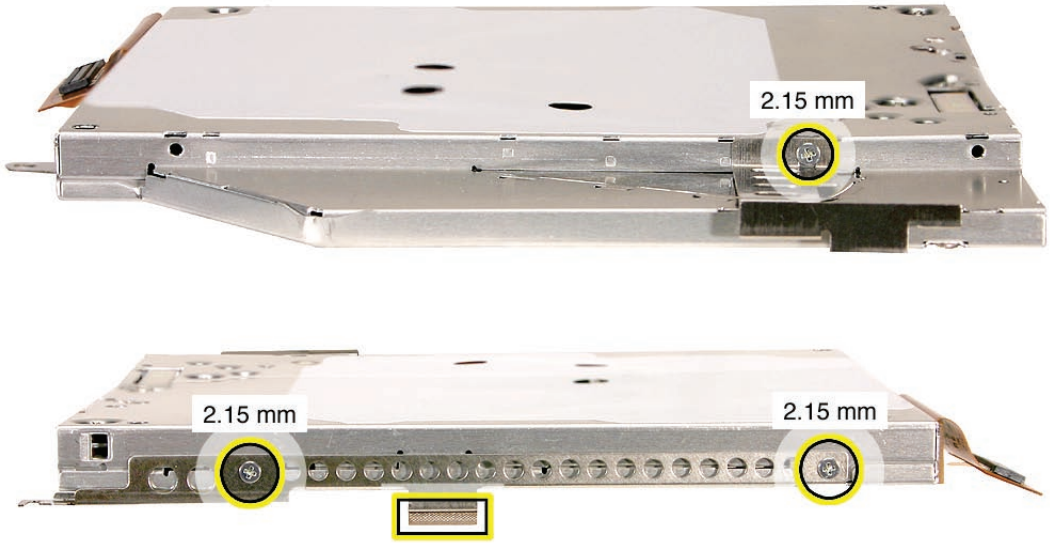
Procedure

1. Disconnect the flex connector, removing any Kapton tape securing it.
2. Remove two Phillips #0 screws on the main logic board (the one on the right with a blue washer) and the two smaller Phillips #00 screws near the frame. Lift out the drive by edges.



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

   * **Important**: See the subsequent section about handling slot-load optical drives.



922-6488

2.15 mm
2.15 mm

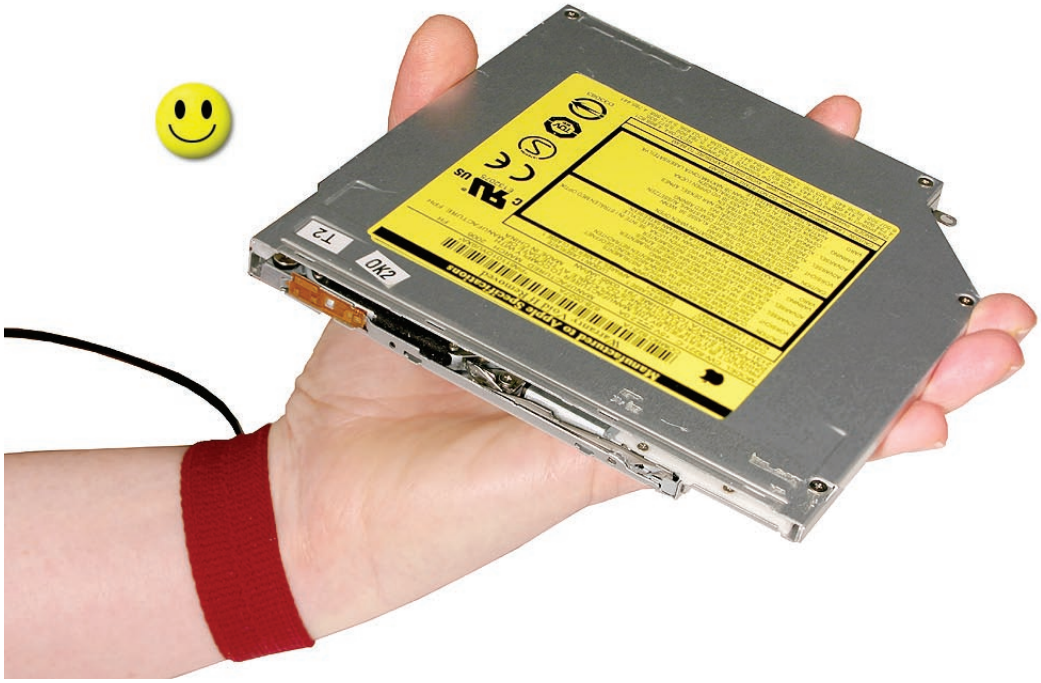
Manufactured to Apple Specifications
Warranty Void If Removed

Handling Slot-Load Optical Drives

Follow the instructions in this section carefully. This procedure shows how to handle slot-load optical drives when they are outside the computer.

- Observe ESD (electrostatic discharge) guidelines when handling optical drives.

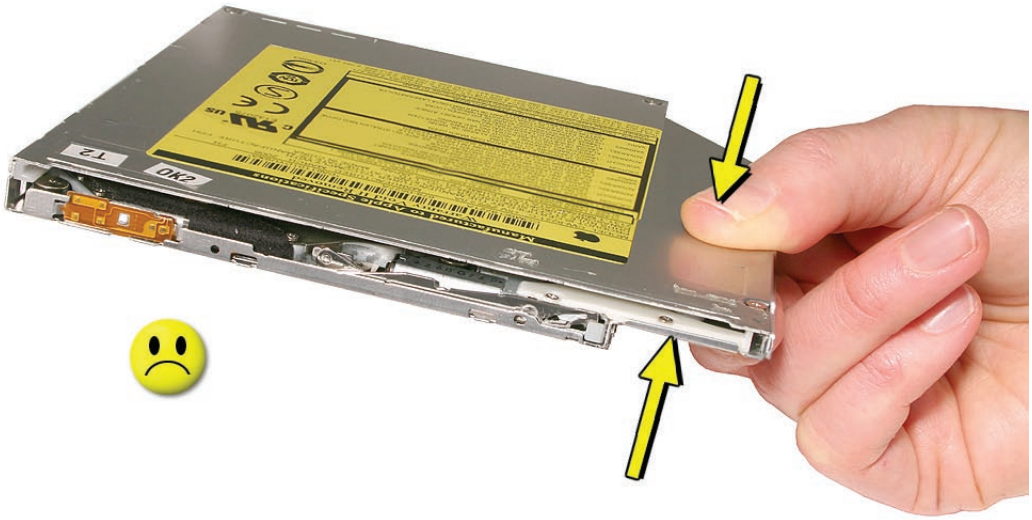
- Handle the drive only by the sides and back edge.



- Do not touch the front of the drive.

- Do not press on the drive or lift it by the top and bottom cover.

- Do not handle the drive by the gull wing edge only.



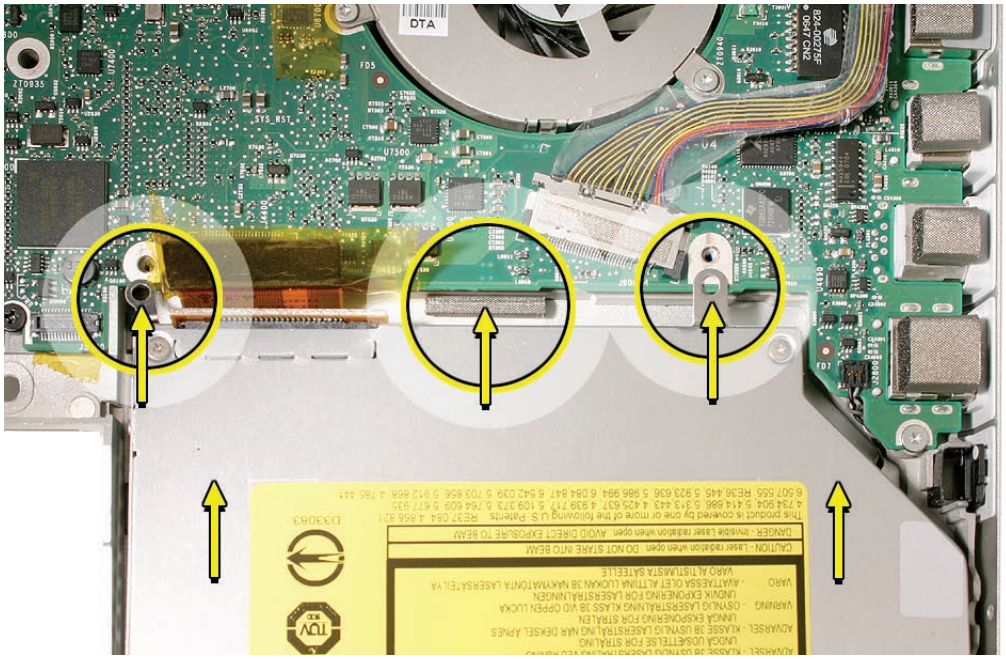
- When storing optical drives, use approved packaging boxes. Never stack loose drives.

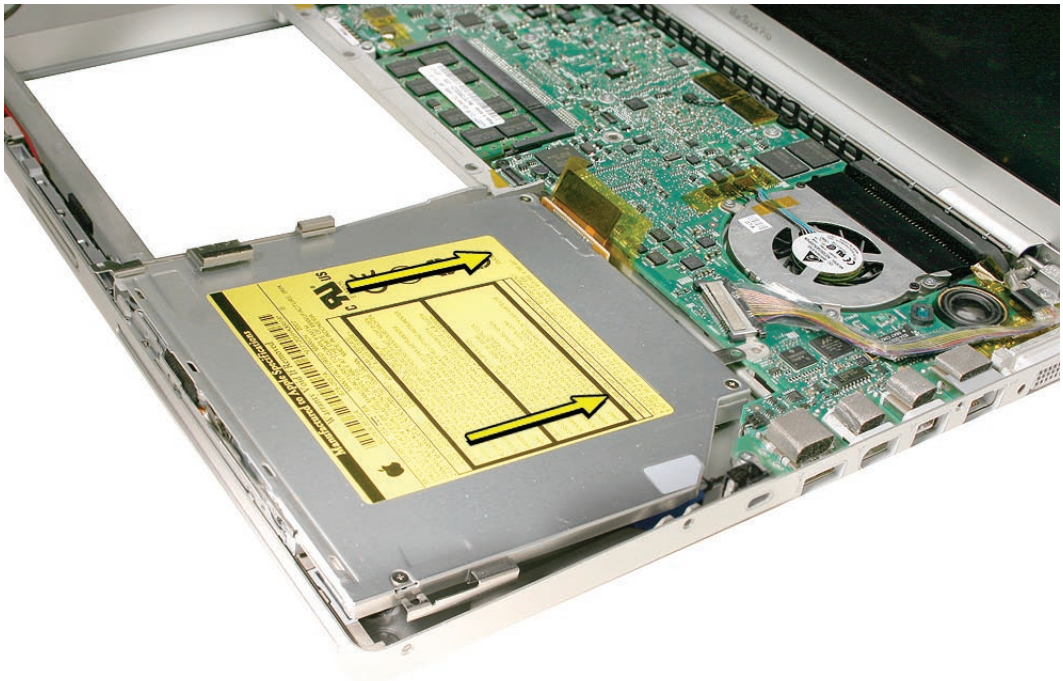
- When returning a defective optical drive, use the original packaging and an antistatic bag. Pack only one drive per box.

Replacement Procedure

1. Verify that the EMI gasket is installed on the bottom case in the back of the drive bay.

   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.





Removing a Stuck Disc from an Optical Drive

Important: This procedure applies only to 9.5-mm and 12.7-mm slot-load optical drives.

1. Remove the four identical screws that hold the top cover to the drive.

Note: You may need to remove a paper label to access one of the screws, as shown below.

2. Slide the top cover ~2 mm toward the back of the drive. Lift up the top cover to remove it.

3. Check the placement of the disc. It is either clamped to the turntable at the center of the disc, or it is wedged under one or more posts at the outer edge of the disc.
4. Holding the edge of the disc, press on the center clamp or hold the posts steady as you remove the disc from the drive.

   Important: Do not touch any key components located near the disc.

5. Replace the top cover on the drive so that the small hooks on the top cover fit into the slots on the bottom cover. Then slide the top cover into place.

6. Replace the four screws.
7. Install the replacement drive, and reassemble and test the computer.

Quick Test

- To check for proper mounting and loading, insert multiple known-good discs, preferably CDs and DVDs containing different types of media such as video, audio and data.

Backup Battery

Tools

This procedure requires the following tools:

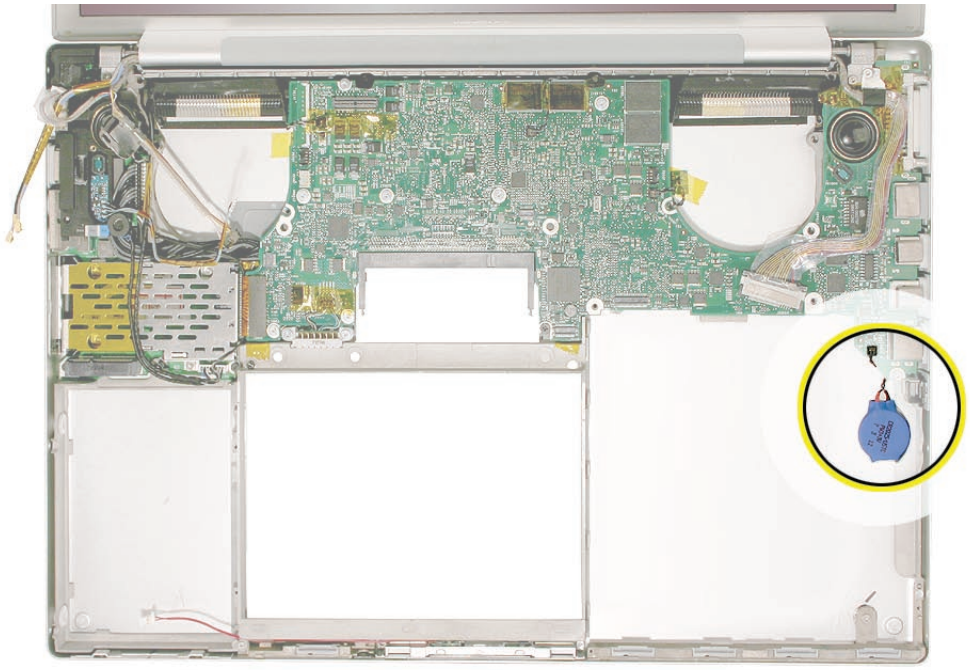
- Black stick (nylon probe 922-5065) or other non-conductive nylon or plastic flat-blade tool

Preliminary Steps

Before you begin, remove the following:

- Battery
- Top Case
- Optical Drive

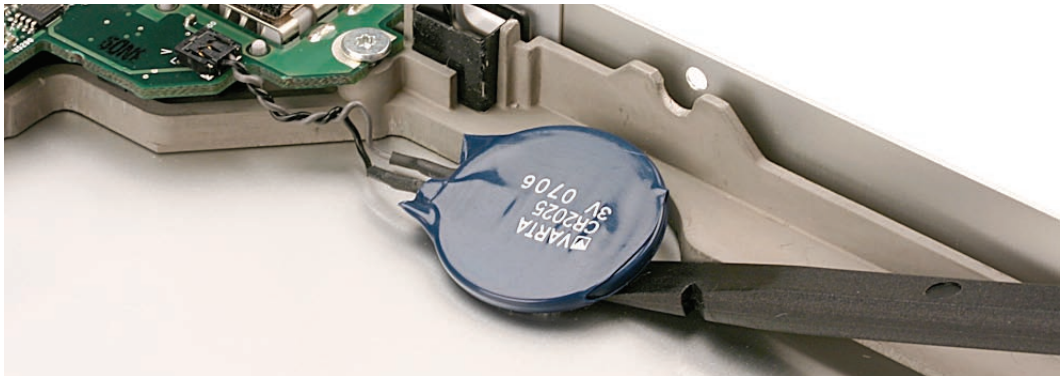
Part Location



Procedure

1. First note the cable routing. There is a notch in the logic board that allows you to tuck the cable underneath it and next to the frame during replacement.
2. Disconnect the JST cable connector from the logic board. (See next section for JST details.)

3. To remove the battery, use a black stick to pry it away from the bottom case, taking care to preserve the adhesive backing for reuse if necessary.



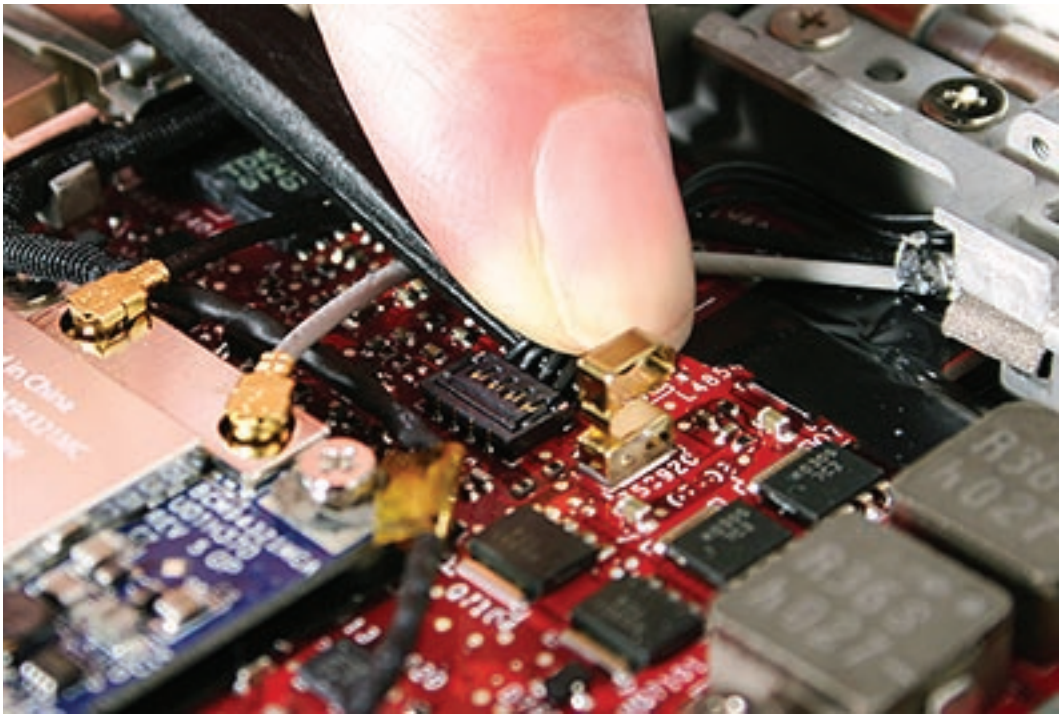
4. To install the replacement backup battery, remove the adhesive protector and press the backup battery into place in the same location from which the first battery was removed.
5. Connect the JST cable connector to the logic board. Check that it is fully seated.

Quick Test

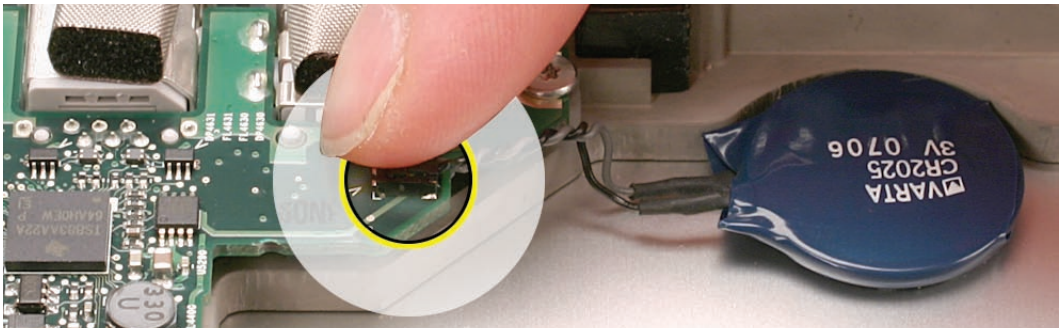
- Check the time. Remove both AC and battery power. Wait 10 minutes, then restart the computer to check that the system continues to keep accurate time.

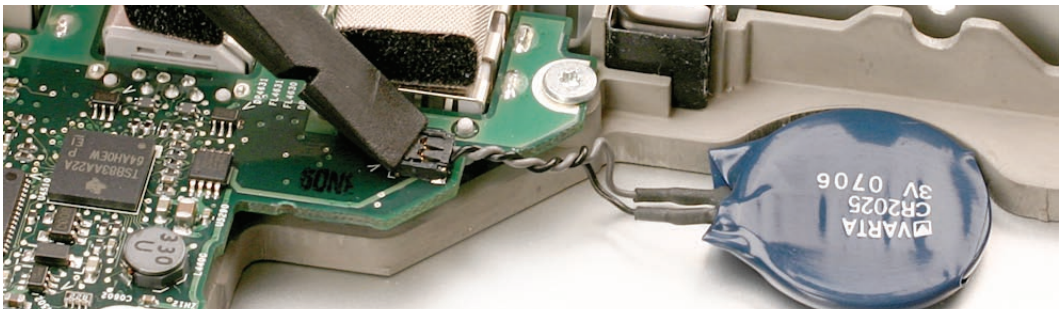
JST Connectors

1. To disconnect a JST connector, sandwich the connector firmly between a finger on top and a black stick under the cabling next to the connector, then lift (as in the animation below).



2. To re-seat or reconnect a JST connector, use a black stick or your finger to snap it into place, making sure the connector sits perfectly flat and flush with the sides of the connector well.





Note: Given a very keen eye, one way to distinguish the right side up of a JST connector is by looking for the word 'push' on the top side of the connector, as shown below.

Left Ambient Light Sensor

Tools

This procedure requires the following tools:

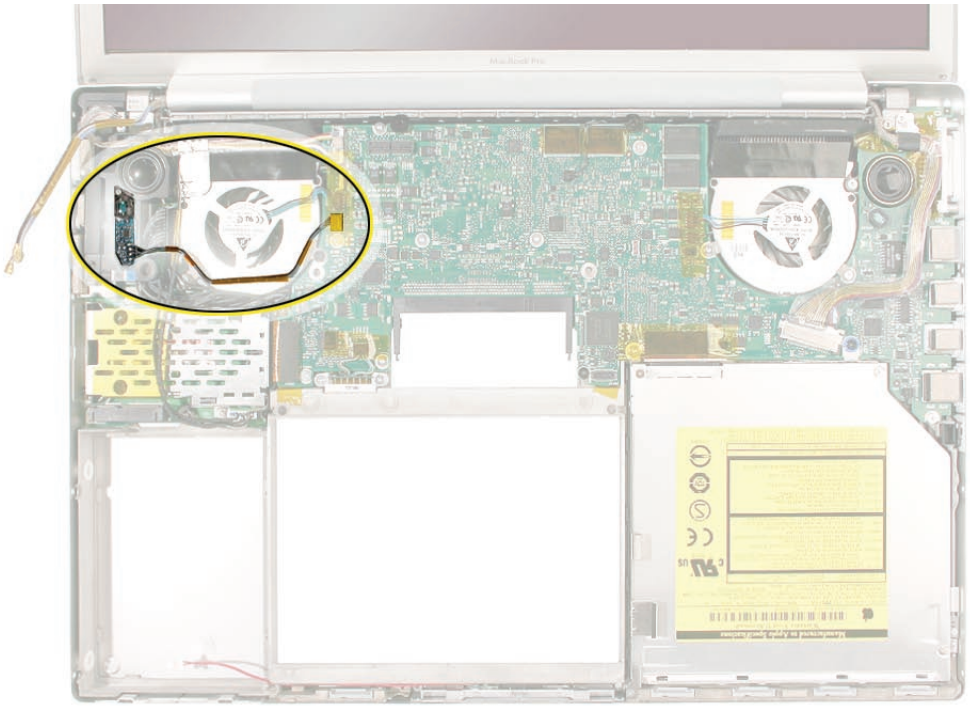
- #0 Phillips screwdriver (magnetized)
- Torx T6 screwdriver (magnetized)
- Black stick (nylon probe 922-5065) or other non-conductive nylon or plastic flat-blade tool

Preliminary Steps

Before you begin, remove the following:

- Battery
- Top Case

Part Location



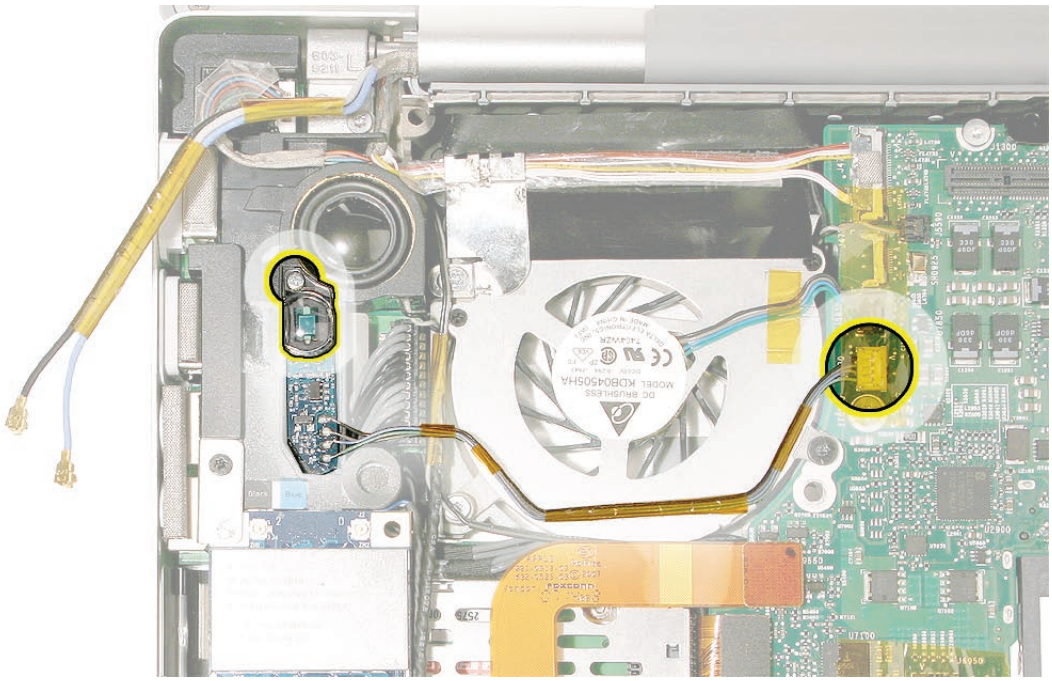
Procedure

The left ambient light sensor is on a separate circuit board mounted with adhesive to the left speaker. Its dust cover is secured with one screw.

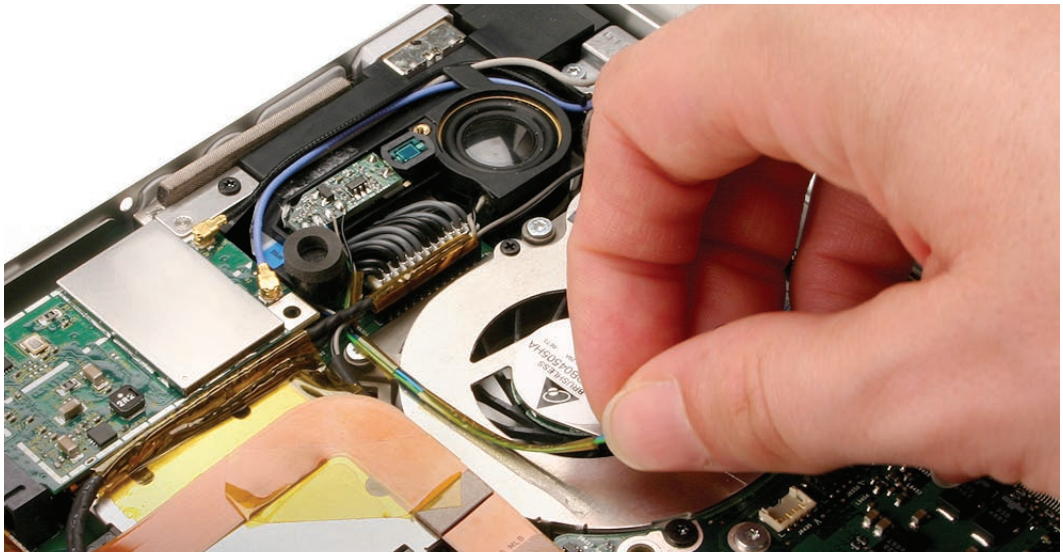
The right ambient light sensor is built into the main logic board. Its dust cover is adhered to the underside of the top case (see **Right ALS Cover**).

To remove the left ambient light sensor board:

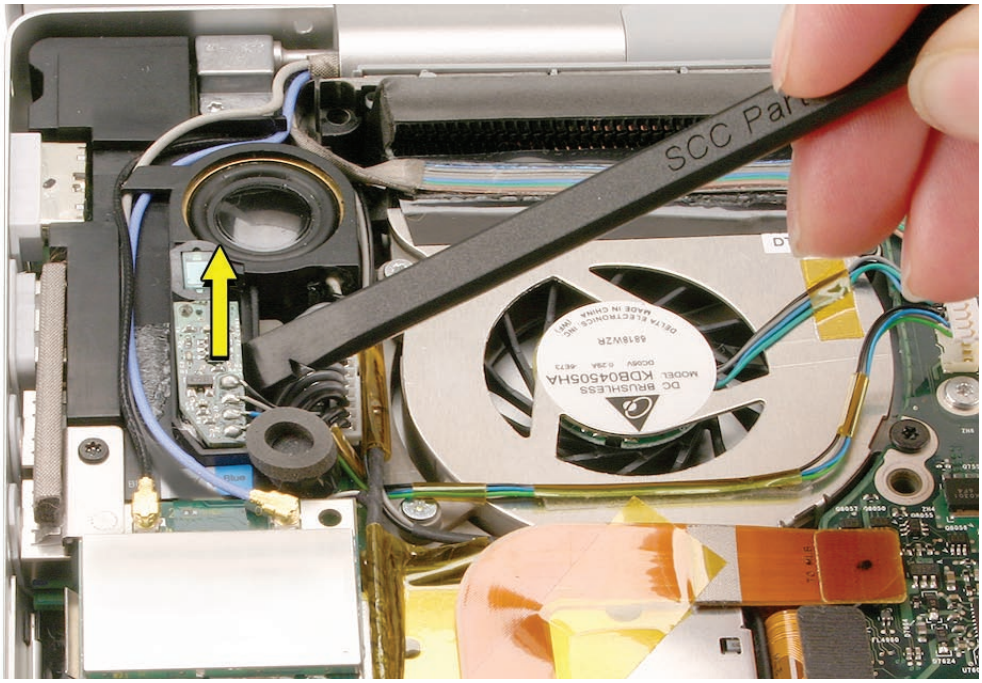
1. Remove the Phillips screw and dust cover.
2. Disconnect the **JST connector** on the logic board to the right of the fan.



3. Peel the ALS cable away from the fan, taking care to preserve the adhesive for future use.



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



Reinstallation Note: When reinstalling the dust cover, carefully blow off any dust and gently clean the lens with a soft, lint-free cloth if necessary.

Right ALS Dust Cover

Tools

This procedure requires the following tools:

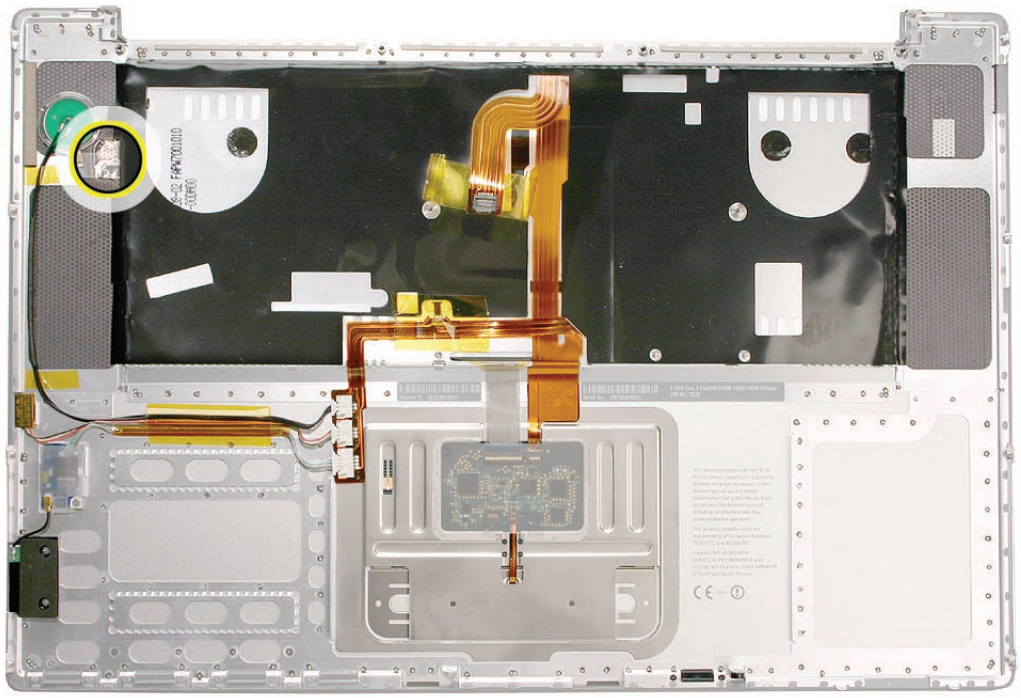
- Black stick (nylon probe 922-5065) or other non-conductive nylon or plastic flat-blade tool

Preliminary Steps

Before you begin, remove the following:

- Battery
- Top Case

Part Location



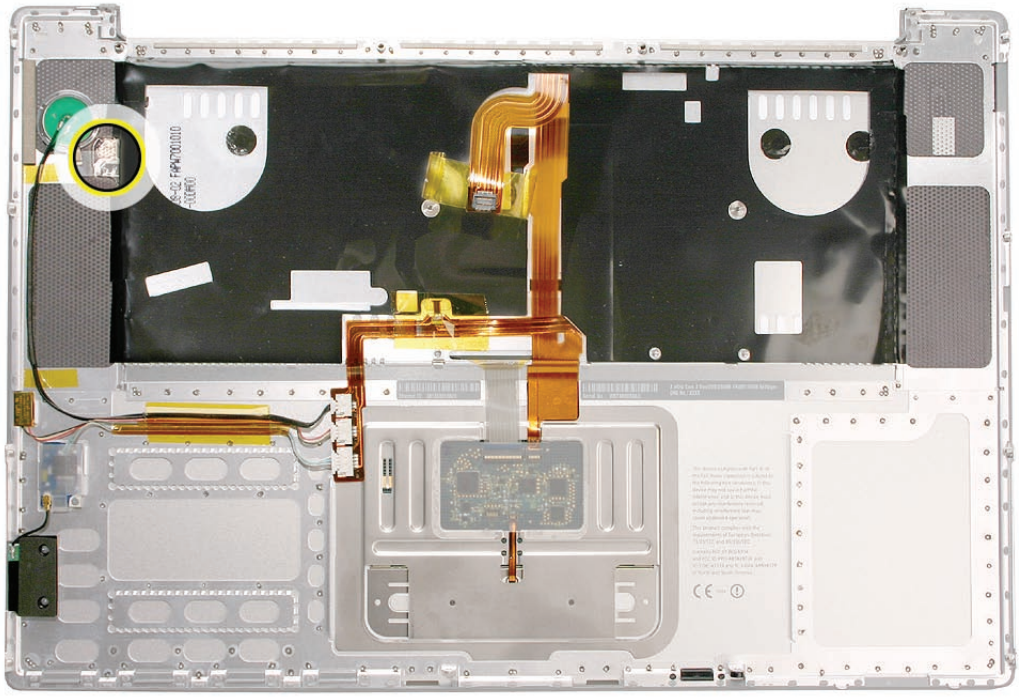
Procedure

The right ambient light sensor is part of the logic board. Its dust cover is now mounted on the underside of the top case.

The left sensor is on a circuit board mounted to the left speaker (see **Left Ambient Light Sensor**).

To replace the right sensor's dust cover:

1. Peel away dust cover from the top case and transfer as necessary.



Reinstallation Note: When reinstalling the dust cover, carefully blow off any dust and gently clean the lens with a soft, lint-free cloth if necessary.

Fans

Tools

This procedure requires the following tools:

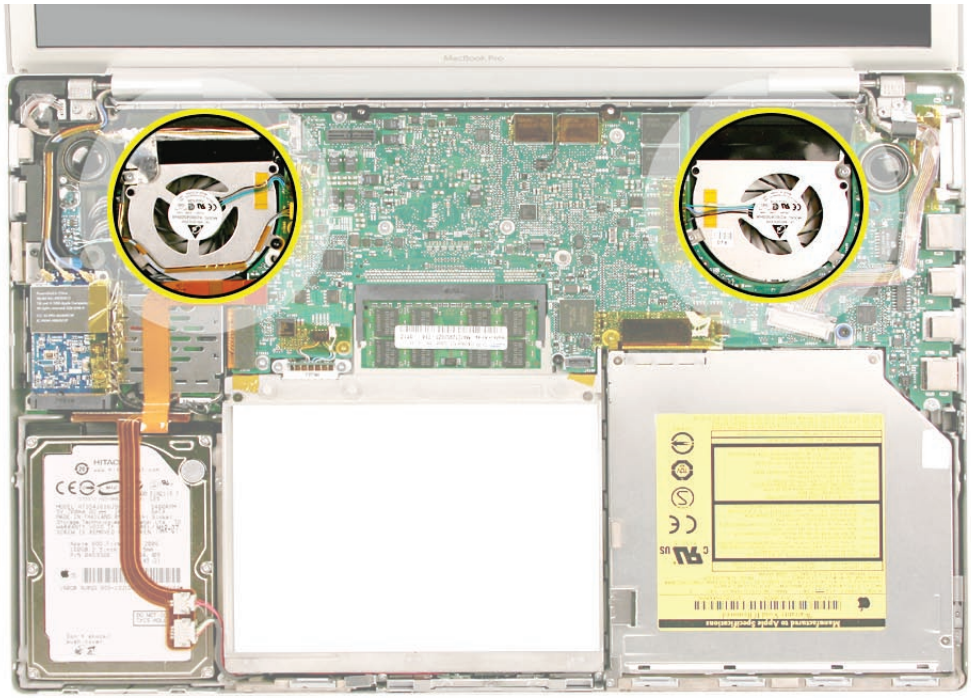
- Torx T6 screwdriver (magnetized)
- Black stick (nylon probe 922-5065) or other non-conductive nylon or plastic flat-blade tool
- Razor knife
- Kapton tape (922-1731) (0.5-inch x 12-yard roll)

Preliminary Steps

Before you begin, remove the following:

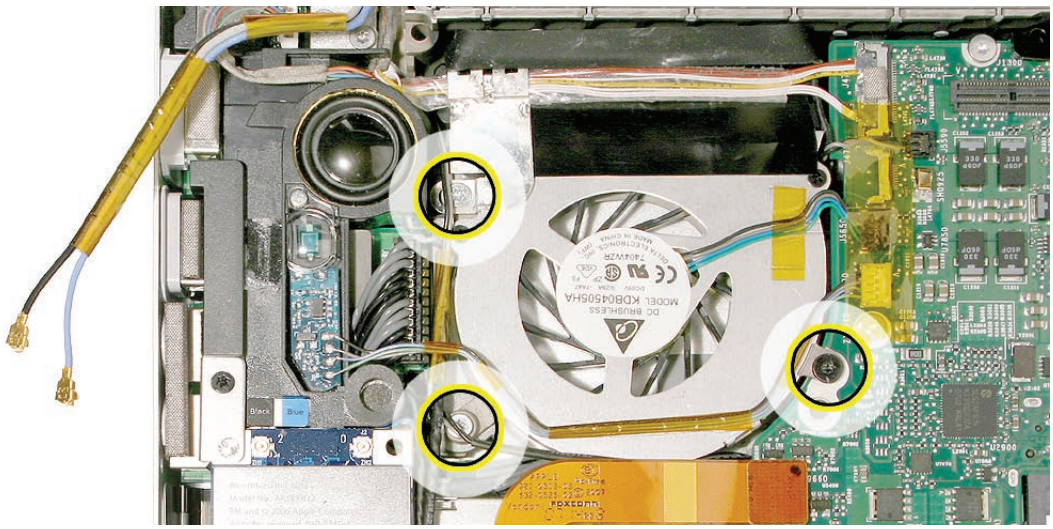
- Battery
- Top Case

Part Location

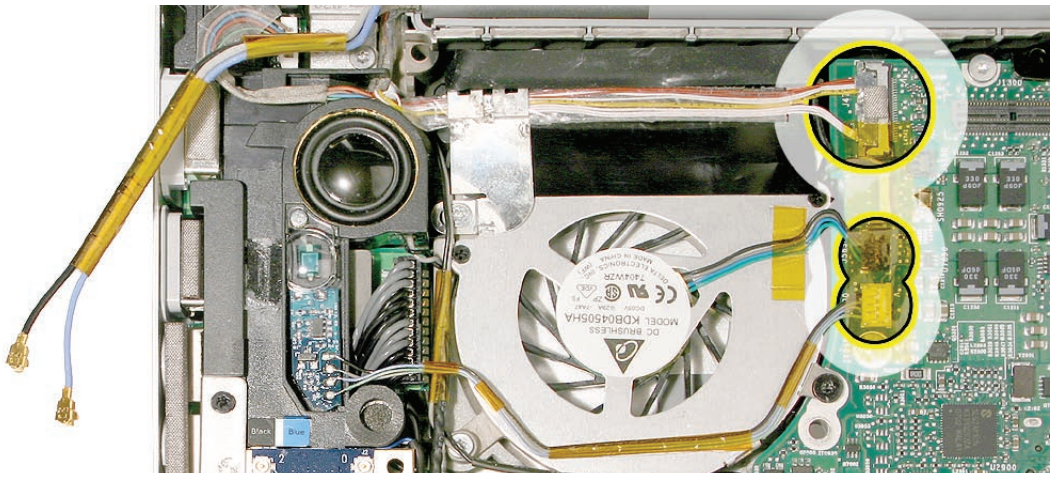


To remove the left fan:

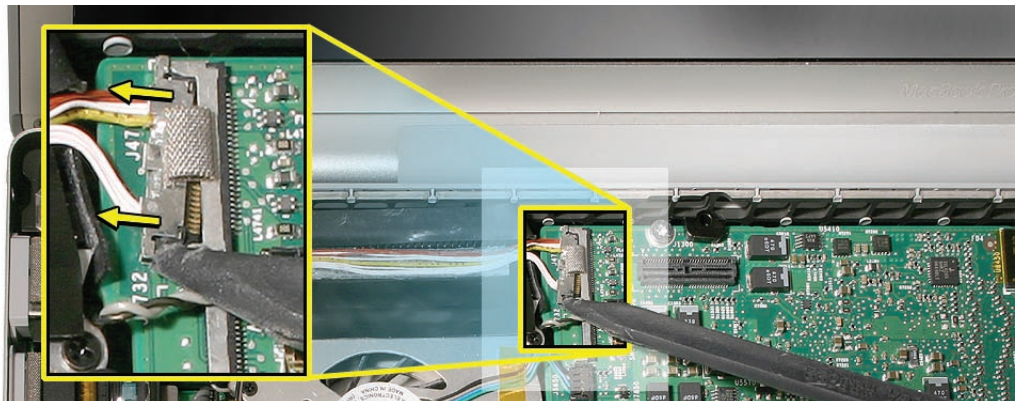
1. Remove three Torx T6 screws. Note the black screw in the right lower corner.



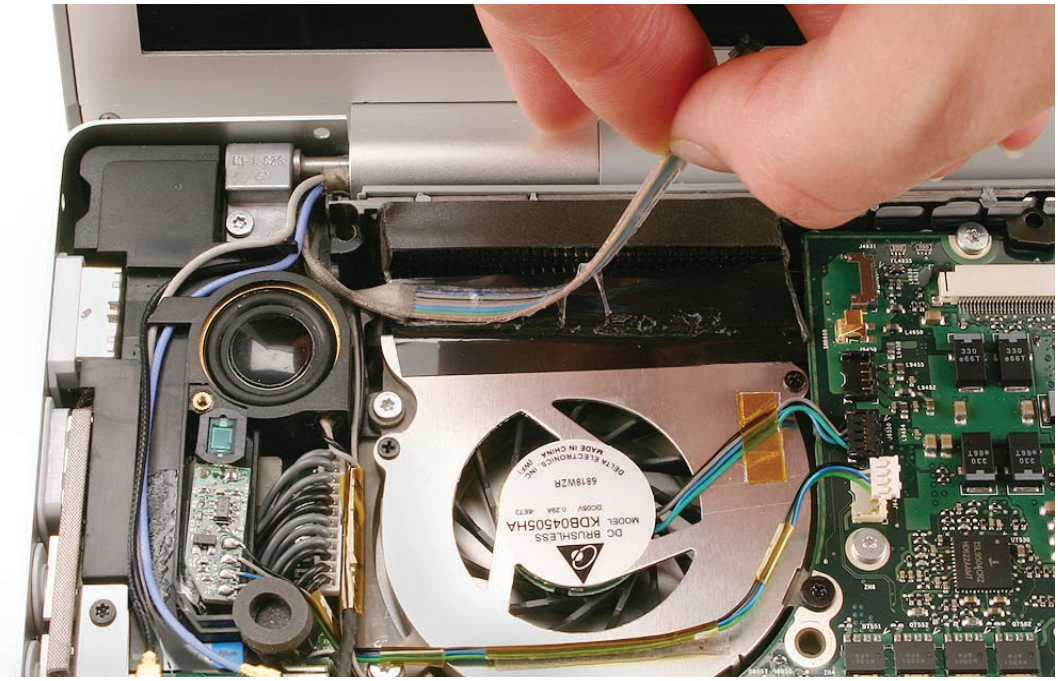
2. Disconnect the three cable connectors, the lower two being **JST connectors**.



3. The top connector must be guided out laterally to the left with a black stick as shown below.

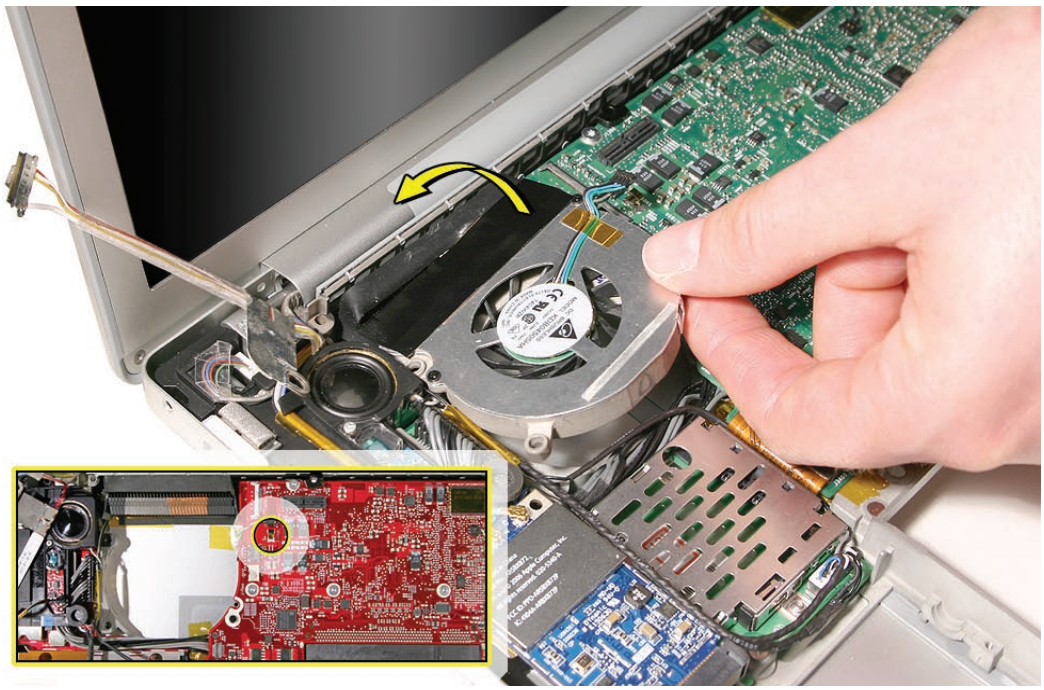


4. Carefully peel the flex cable off the fan cover.



5. Lift the fan up and to the left, carefully peeling the tape away from the heatsink, preserving it for reuse. Work the fan's upper left screw bracket out from under the left speaker bracket.

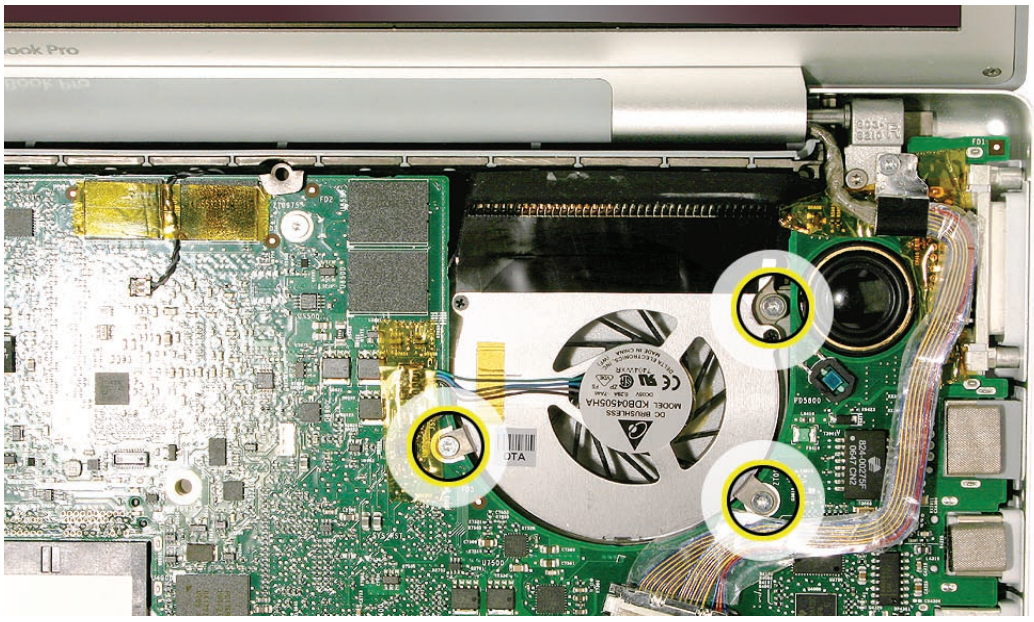
   Note: Avoid damage to the gold spring on the logic board to the right of the fan (see inset).



To remove the right fan:

1. Remove the three Torx T6 screws shown below.

922-7307

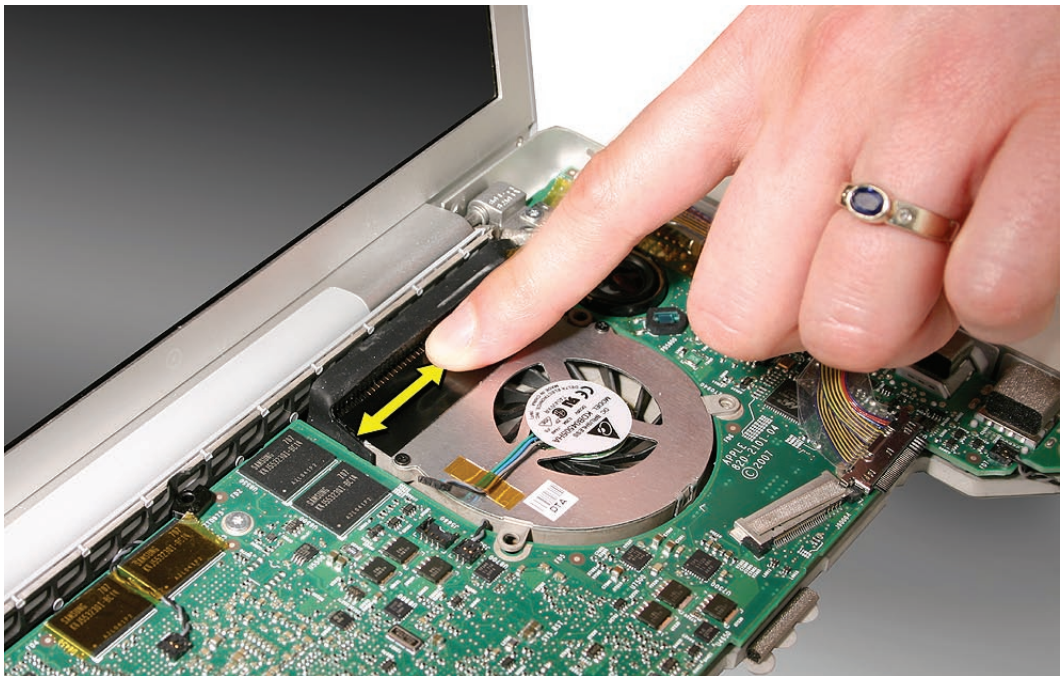


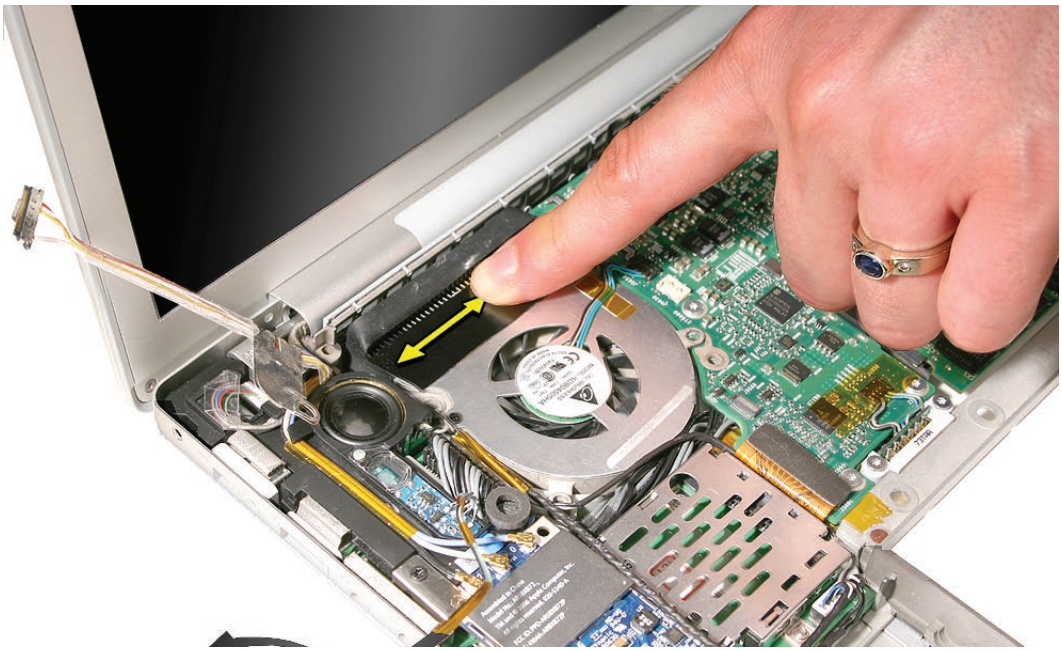
2. Remove any Kapton tape, if necessary, and disconnect the fan cable **JST connector** shown below by holding the cable just next to the connector and gently tugging straight up.

3. Lift the fan up and to the right, carefully peeling the tape away from the heatsink, preserving the tape for reuse during reinstallation.

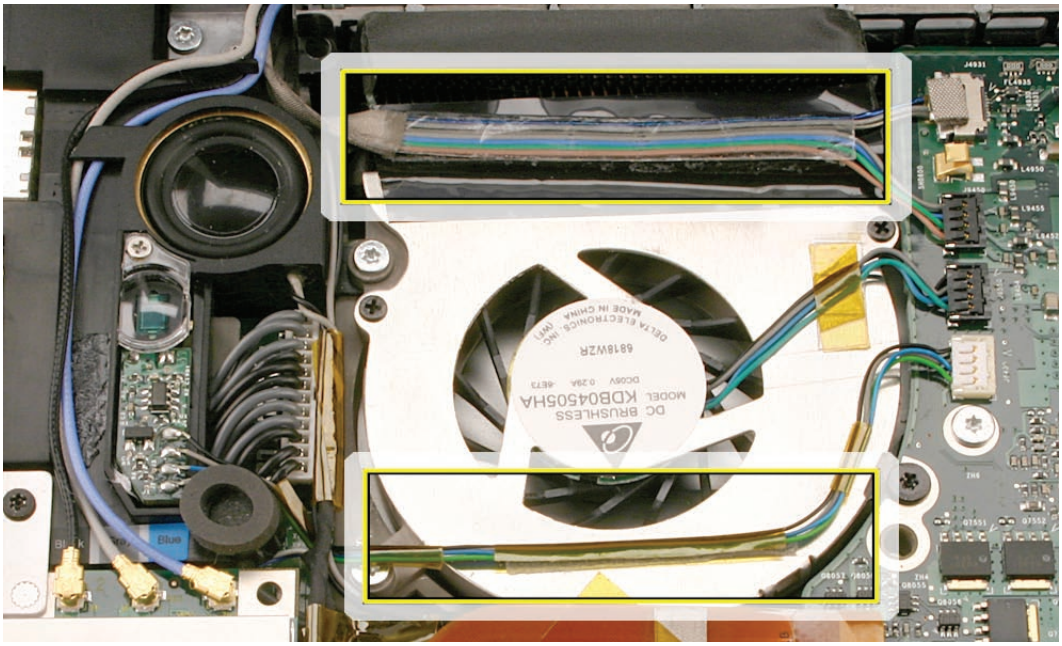
Replacement Notes

1. After replacing either fan, position the tape directly over the heatsink fins in the fan's previous position and press firmly along the length of the tape to seal it to the heatsink.





2. If needed, apply Kapton tape to secure the iSight camera and inverter cable bundle (top) and the ambient light sensor cable bundle (bottom) to the left fan.



Logic Board

Tools

This procedure requires the following tools:

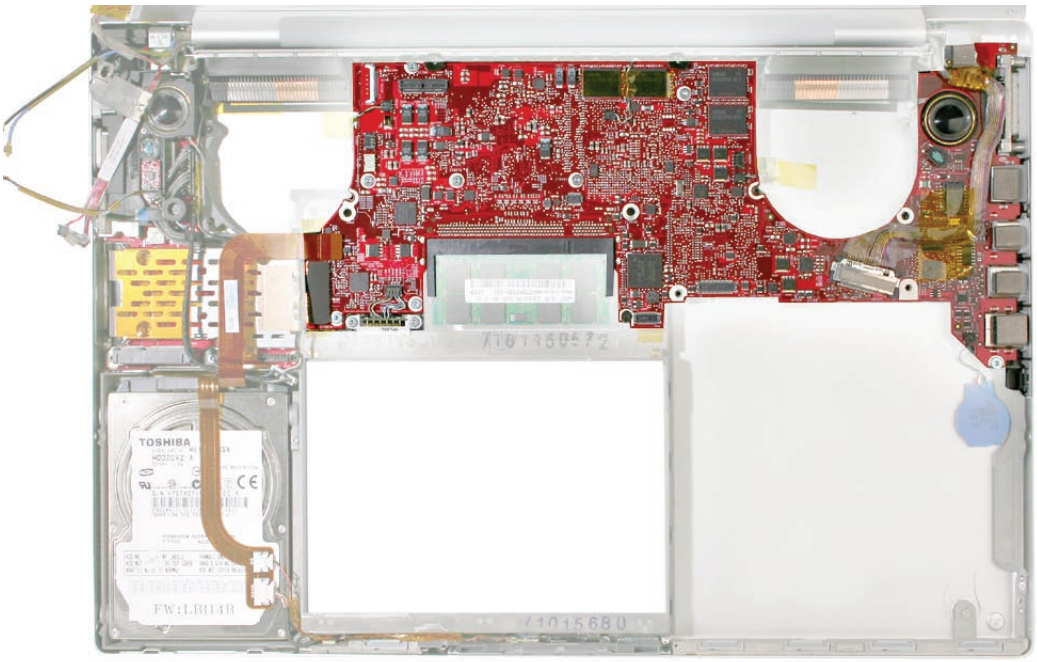
- #0 Phillips screwdriver (magnetized)
- Torx T6 screwdriver (magnetized)
- Black stick (nylon probe 922-5065) or other non-conductive nylon or plastic flat-blade tool
- Multi-compartment screw tray (such as a plastic ice cube tray)
- Kapton tape (922-1731) (0.5-inch x 12-yard roll)
- Thermal grease (922-7144)
- Gasket kit (076-1238)
- Alcohol pads

Preliminary Steps

Before you begin, remove the following:

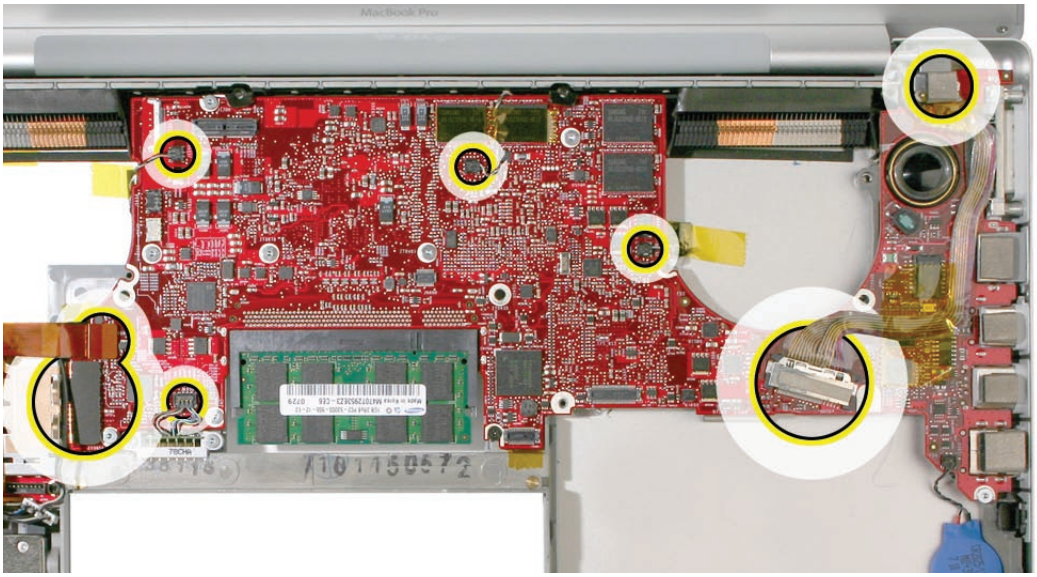
- Battery
- Memory
- Top Case
- Fans
- Optical Drive

Part Location

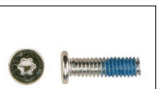


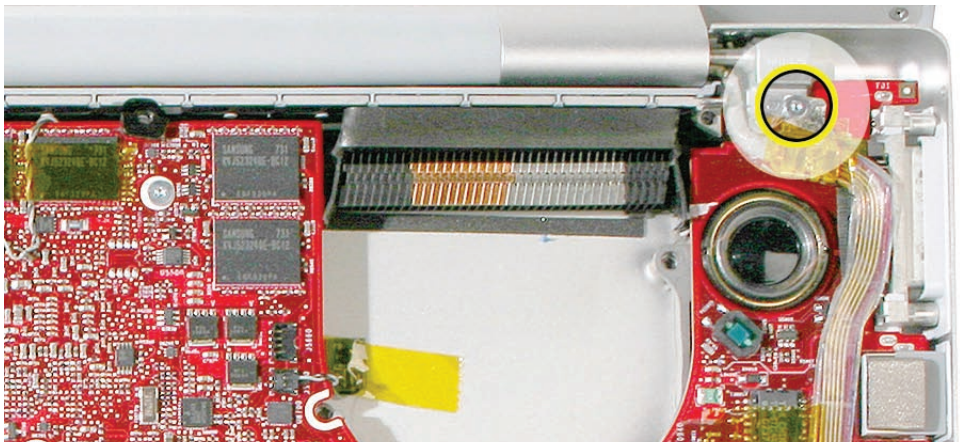
Procedure

1. Remove the small square EMI gasket adhered to the LVDS ground screw (upper right).
2. Disconnect the cables shown below. Clockwise from bottom left: left I/O board connector, hard drive connector, three thermal sensor connectors, and the LVDS cable connector.



3. Remove the Torx T6 screw that secures the ground clip for the LVDS cable.

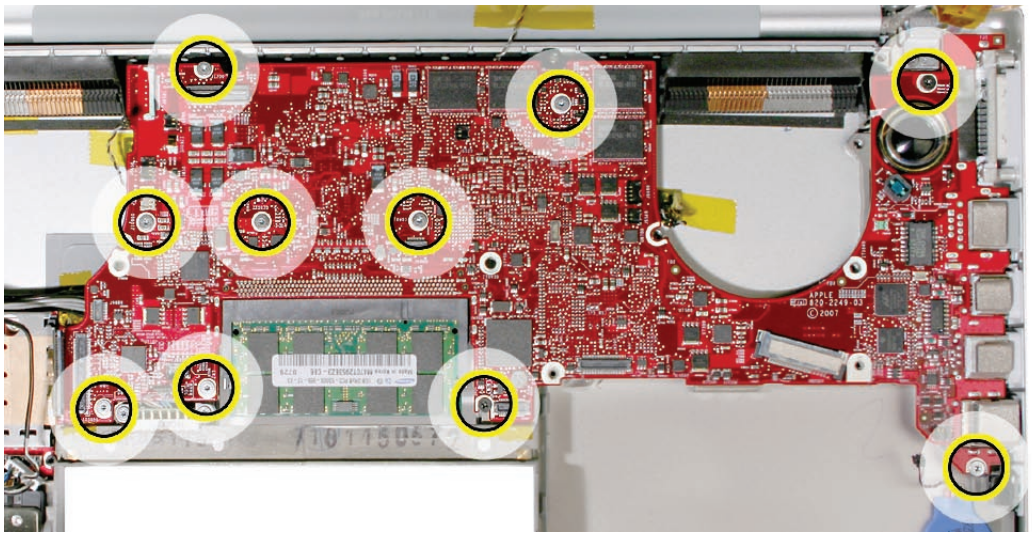

922-7307



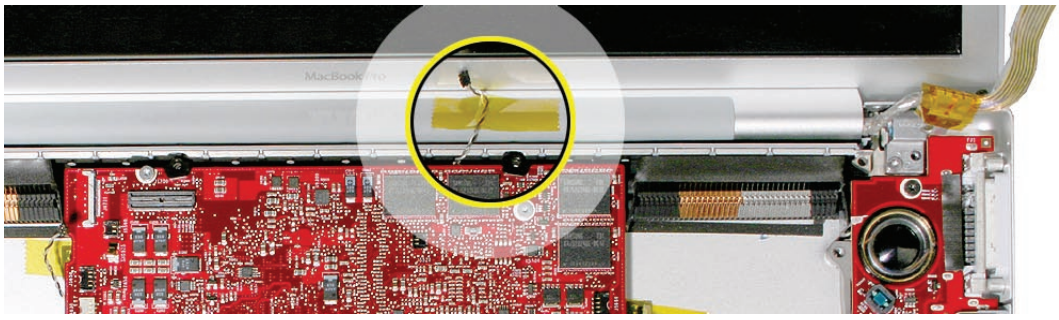
4. Remove eight silver Torx T6 screws, one black Torx T6 (upper right) and one black Phillips screw (just to the right of the memory slots).

922-7262

922-7311



5. Tape the thermal sensor cable to the display assembly to avoid trapping it under the logic board and forgetting it during reassembly.

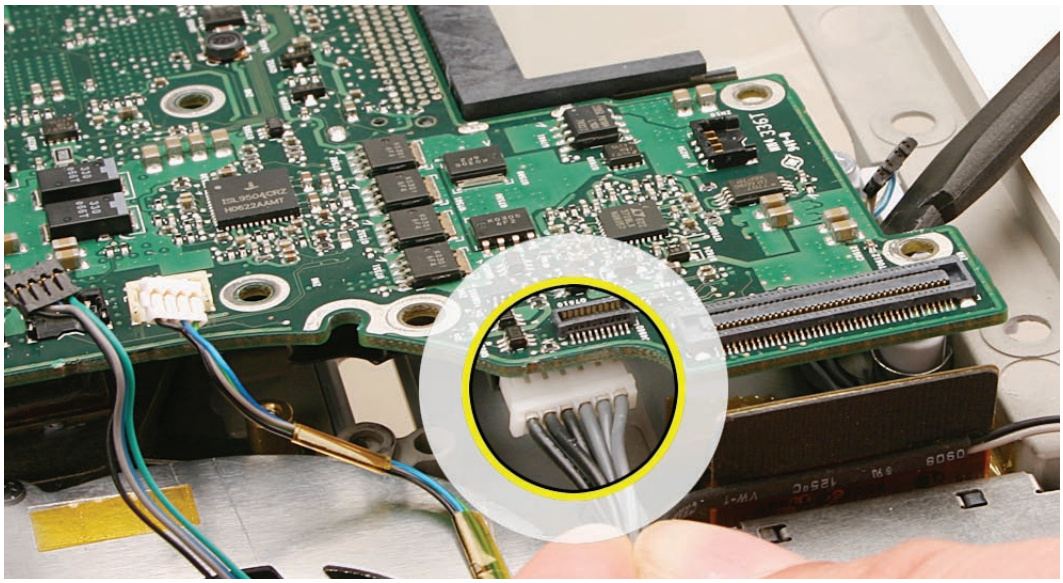


6. **Warning: Do NOT allow the logic board to flex at any time. Flexing the board can crack solder joints to components. Give special attention at the narrow neck of the fan cutout.**

7. 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.

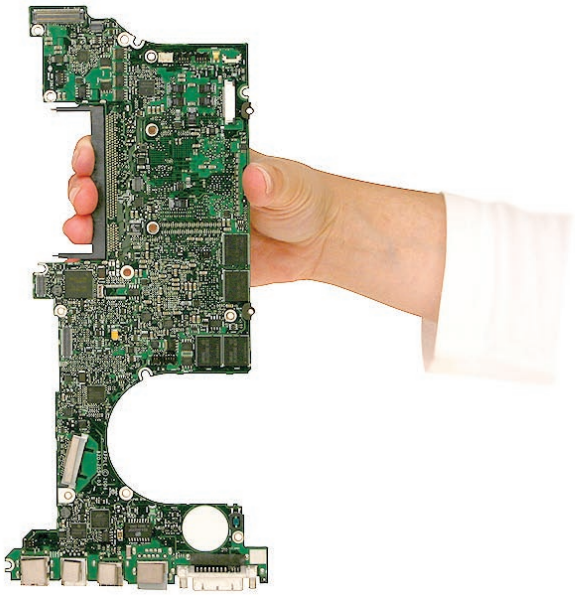
   Note: The thermal material should easily release. If not, verify that all screws and connectors have been removed.

8. Remove the connector under the board, shown.



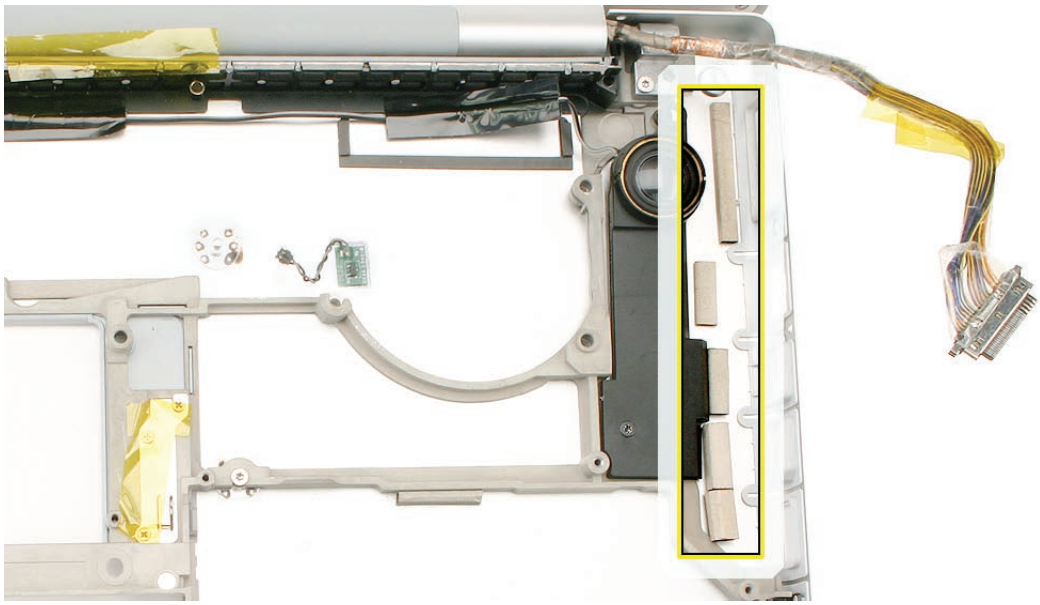
9. Remove the logic board.

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

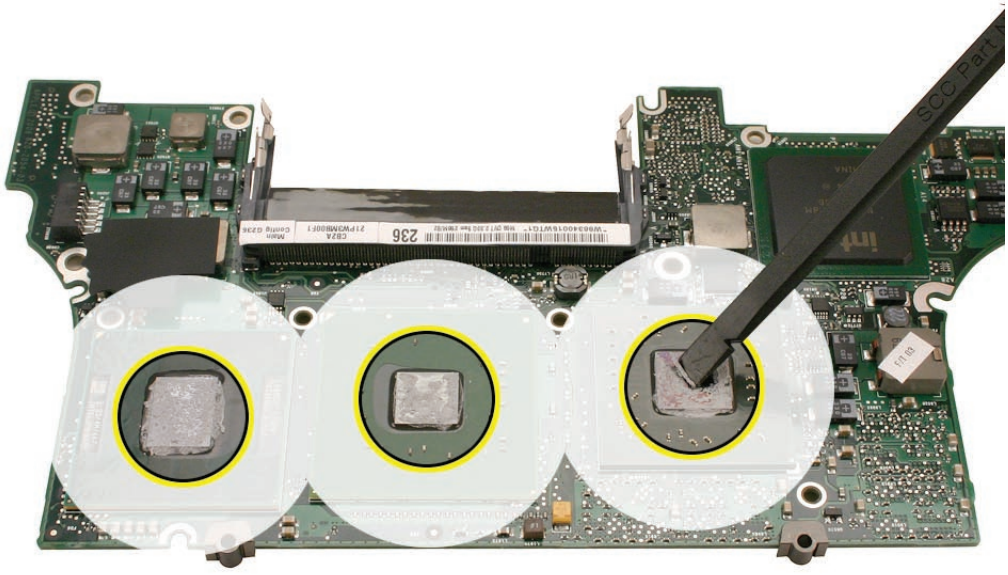


Replacement Procedure

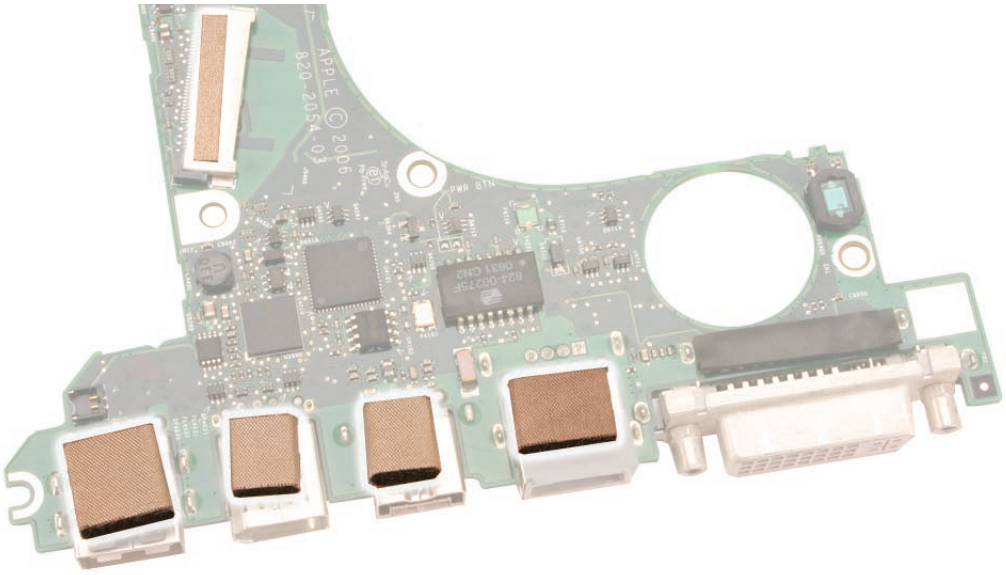
1. Verify that the EMI gaskets are in place along the port openings on the bottom case.



2. If the existing logic board was removed to facilitate another procedure and will be reinstalled, the old thermal material must be removed from both the logic board and the heatsink, and new thermal material will be applied. See step 5 for reapplication instructions.
   - Use a black stick and alcohol wipes to clean the old thermal grease from the three chips.
   - **Important:** Use extreme care not to damage the chip or logic board components.



3. Install EMI gaskets and tape on the ports from the gasket kit (076-1261).



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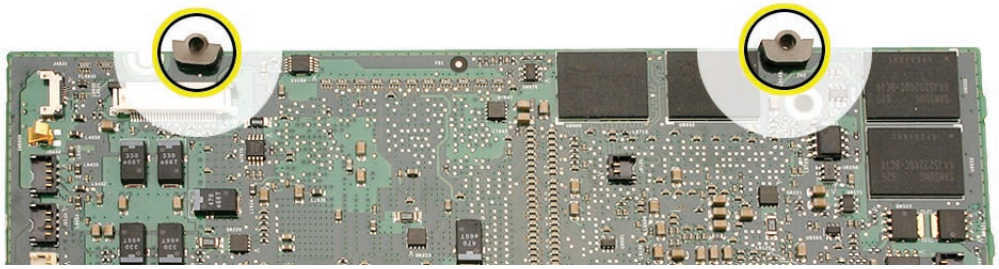
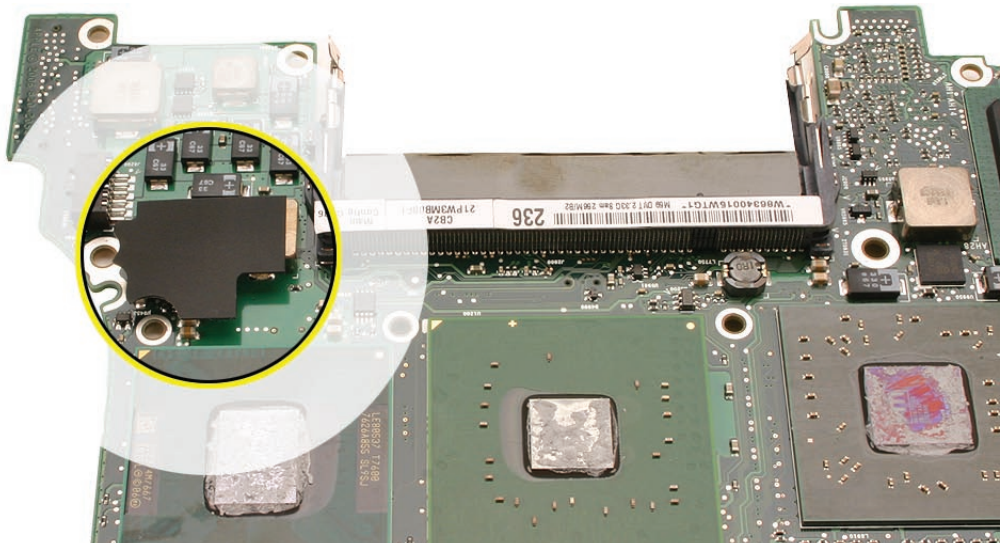
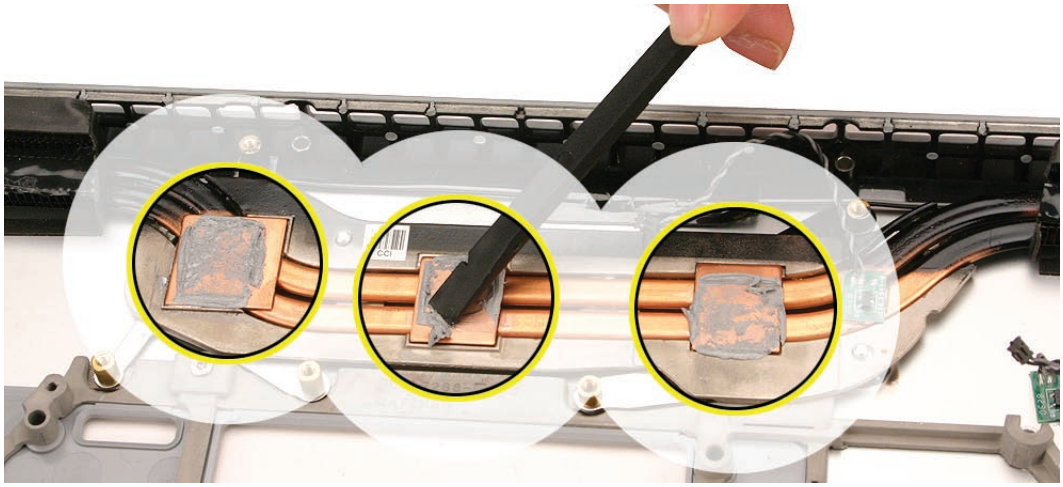
- Transfer the logic board sleeves (922-7538) to the replacement board, if needed.



- Transfer the cosmetic shield, if needed.



4. Use a black stick to remove as much old thermal grease as possible from the heatsink.
5. Use an alcohol wipe to clean the mating surfaces.

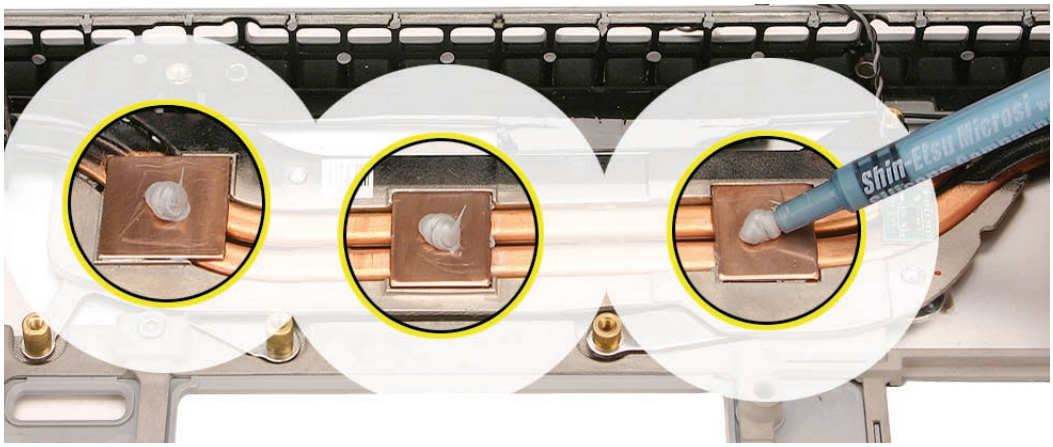


6. Note the contents of the syringe of the replacement thermal grease.

   Important: One syringe (922-7144) contains 0.3 to 0.35 cubic centimeters (cc) of thermal grease. That is enough for 0.1 to 0.12 cc of grease per chip for up to three chips. Use one-third of the syringe contents per chip. Using a felt-tip pen, mark the 1/3 points on the syringe before applying the first dab.

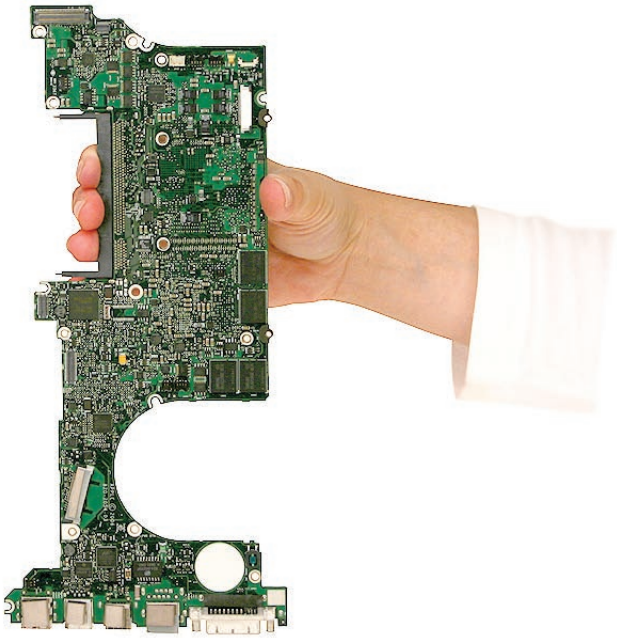
Important: Avoid unnecessary contact with new thermal material, as dirt and body oils reduce the material's conductivity.

7. Put a 0.1 - 0.12cc dab of thermal grease in the center of each chip mating surface, as shown.

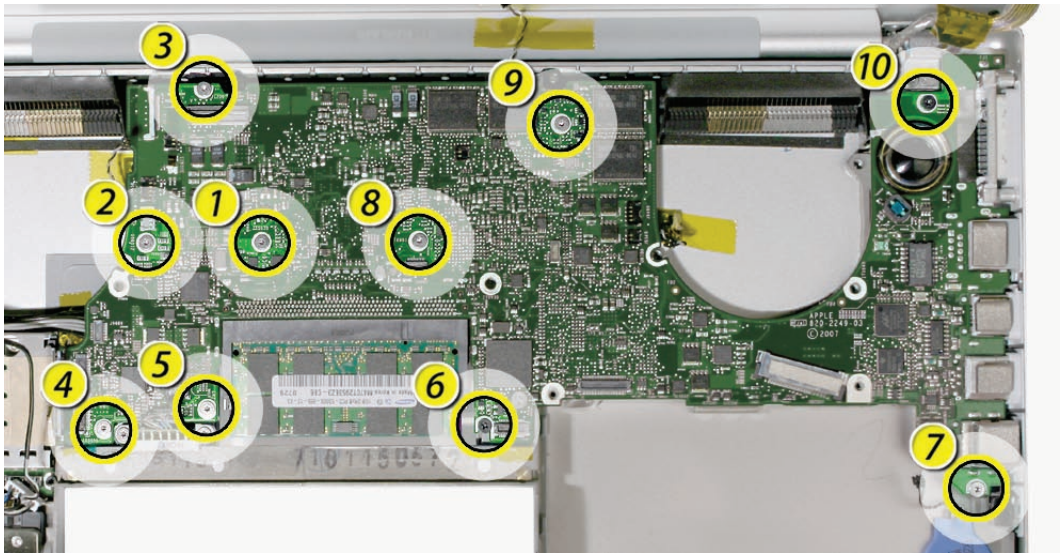


8. When replacing the logic board:
   - Verify that the two plastic screw guides are installed on the top of the board.
   - Guide the logic board's port side into the port openings on the bottom case.
   - Carefully lower the board over the right speaker, being aware of its exact placement to avoid breakage along the delicate area where it narrows to the left side of the speaker.
   - 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 it into place.

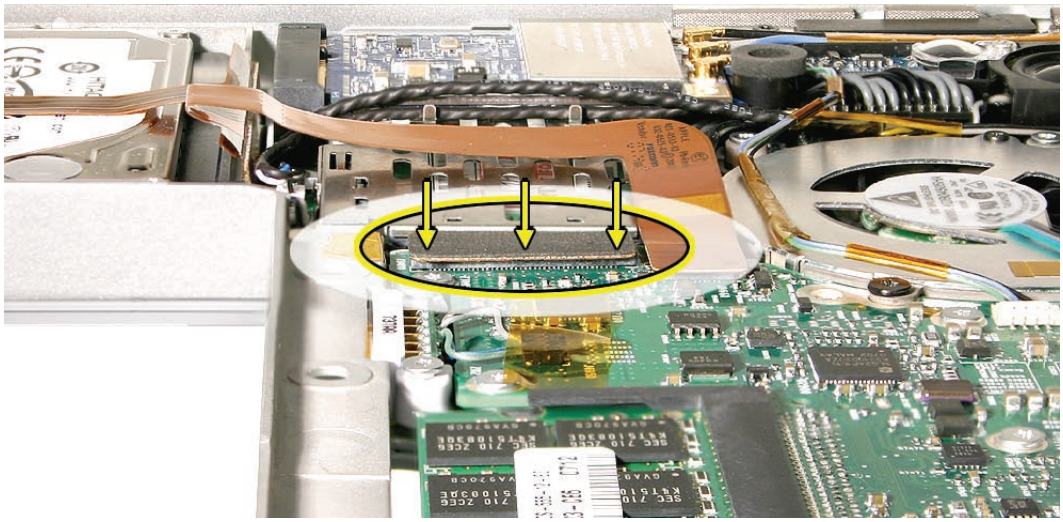
Warning: To avoid flexing the logic board, hold the board vertically along the wide sides. Do not hold the board by the ends or by the narrow neck at the fan cutout, or horizontally, as the board's weight can cause excessive flex**.**



9. Install the logic board screws in the order shown below.



10. Verify that the ExpressCard cage flex connector is seated properly.



11. 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 acceptable to retain the same new thermal material, as long as the material is not handled excessively.

Battery Cable Assembly

Tools

This procedure requires the following tools:

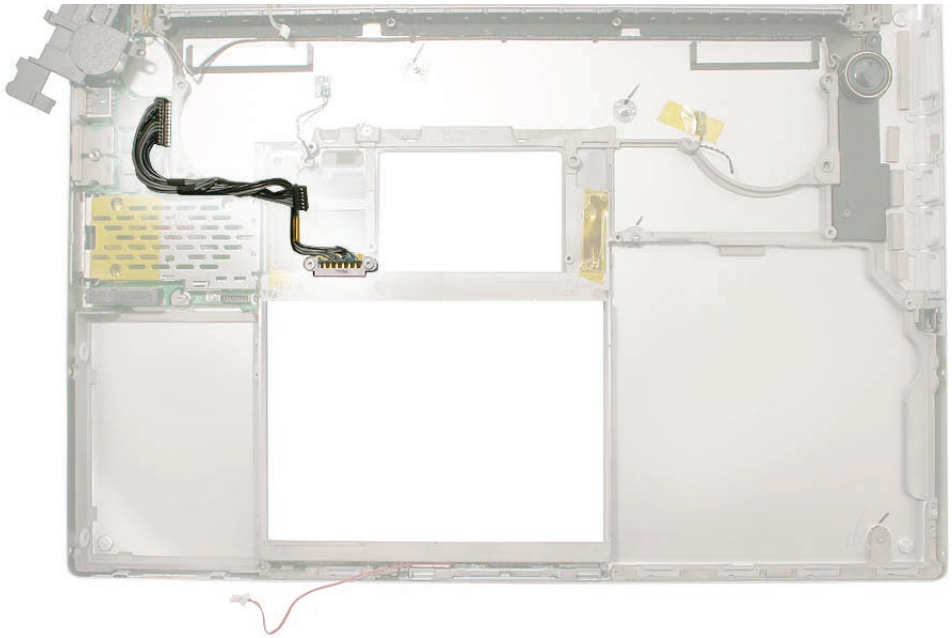
- Torx T6 screwdriver (magnetized)
- Black stick (nylon probe 922-5065) or other non-conductive nylon or plastic flat-blade tool

Preliminary Steps

Before you begin, remove the following:

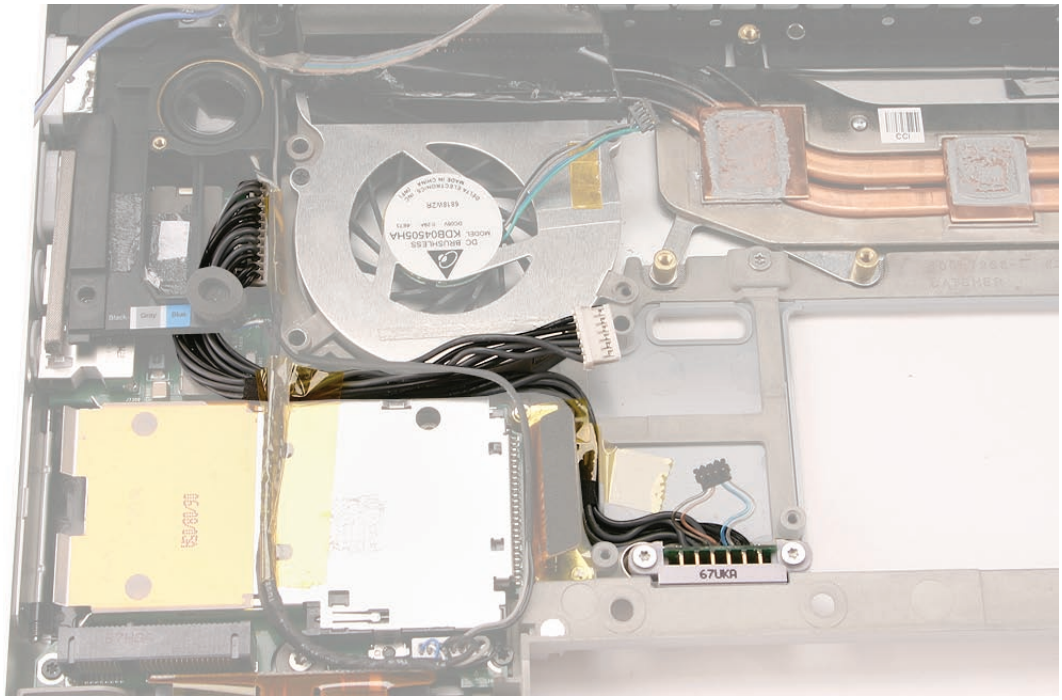
- Battery
- Top Case
- AirPort Extreme Card
- Speakers
- Fans
- Optical Drive
- Logic Board

Part Location



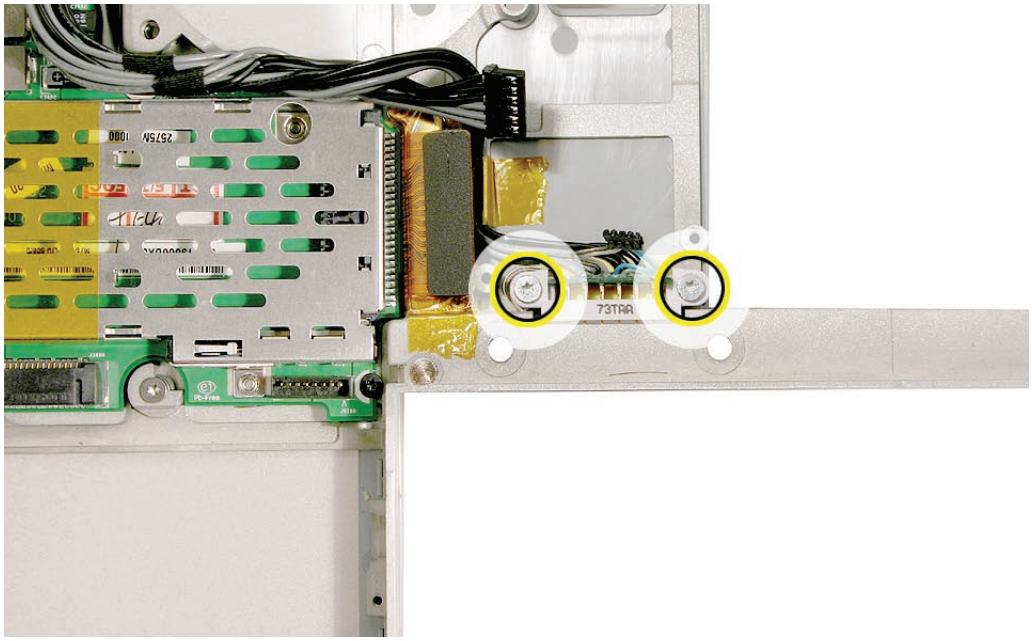
Procedure

Take note of cable routing before removal and replacement.

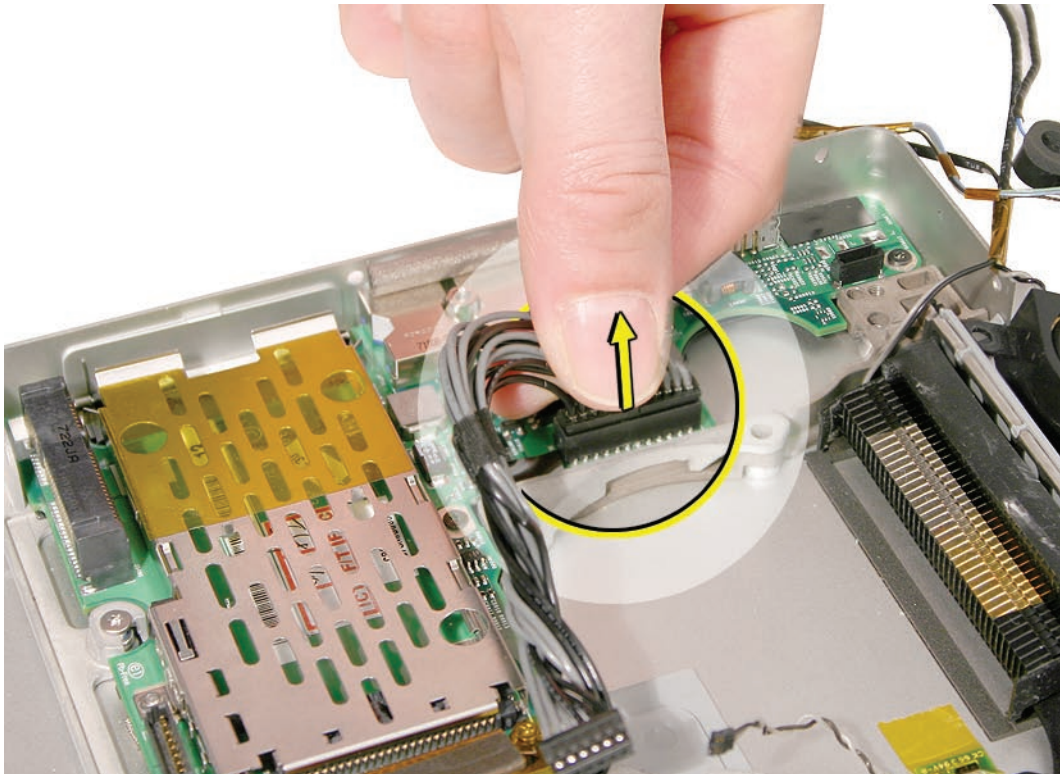


1. Remove the two 8.5mm Torx T6 shoulder screws.

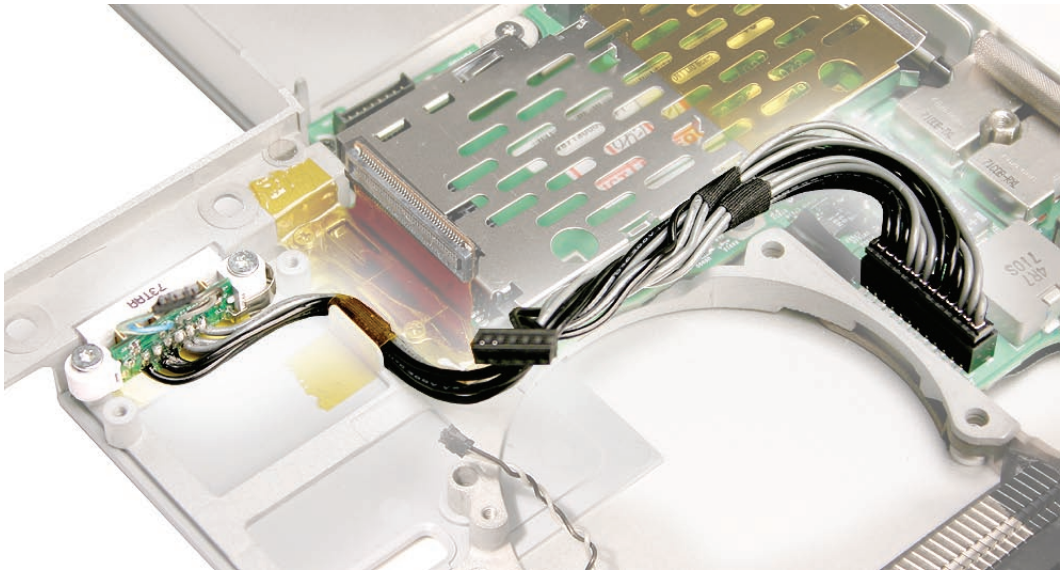
922-7182



2. Disconnect the connector on the left I/O board.



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



Heatsink

Tools

This procedure requires the following tools:

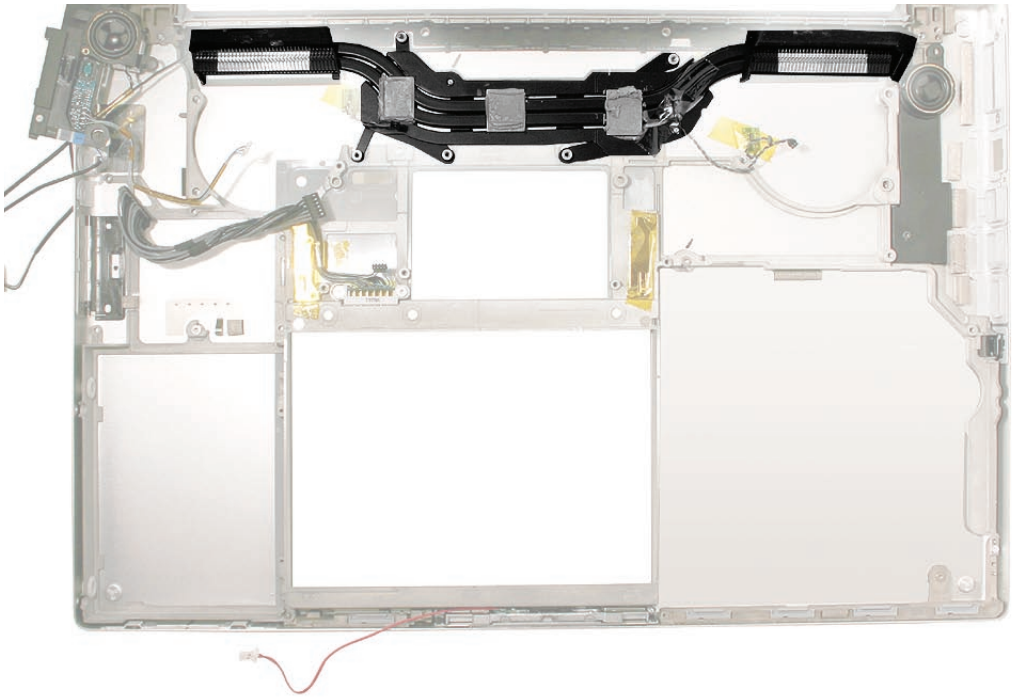
- Black stick (nylon probe 922-5065) or other non-conductive nylon or plastic flat-blade tool
- Thermal grease (922-7144)

Preliminary Steps

Before you begin, remove the following:

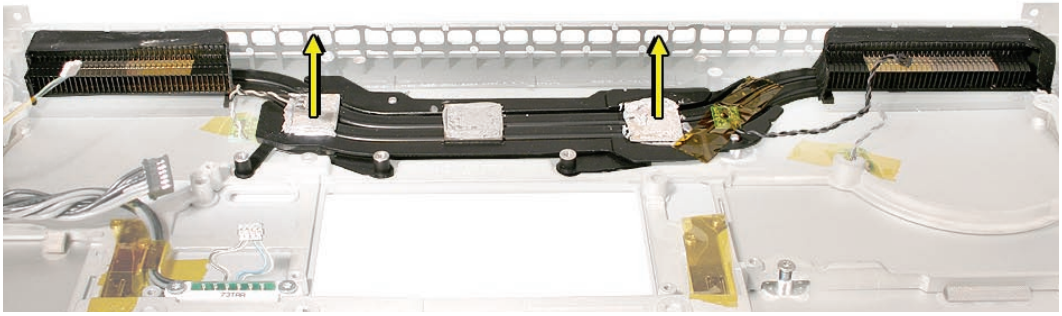
- Battery
- Top Case
- Fans
- Optical Drive
- Logic Board

Part Location

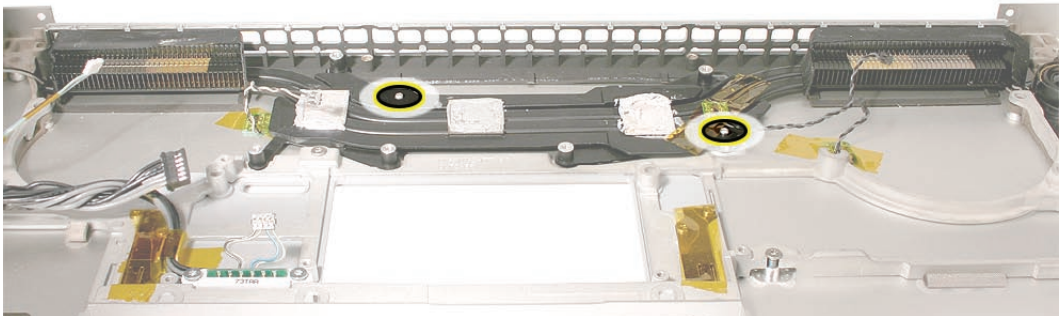


Procedure

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 below, and lays flat.



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

Thermal Sensors

Tools

This procedure requires the following tools:

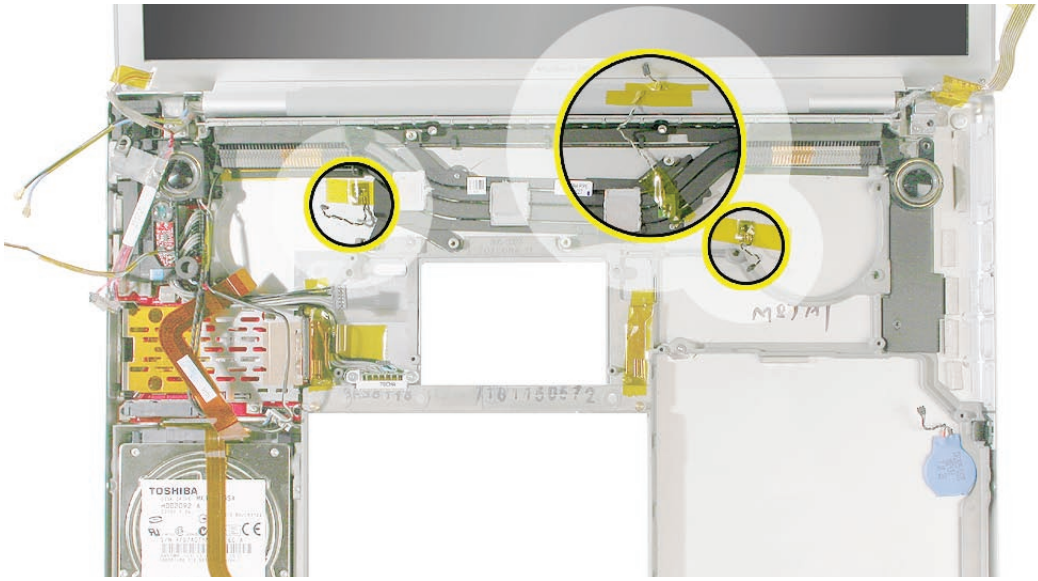
- Black stick (nylon probe 922-5065) or other non-conductive nylon or plastic flat-blade tool
- Razor knife
- Kapton tape (922-1731) (0.5-inch x 12-yard roll)
- Fine-point felt-tip permanent marker

Preliminary Steps

Before you begin, remove the following:

- Battery
- Top Case
- Speakers
- Optical Drive
- Fans
- Logic Board
- Heatsink (for left-most sensor on bottom case)

Part Location

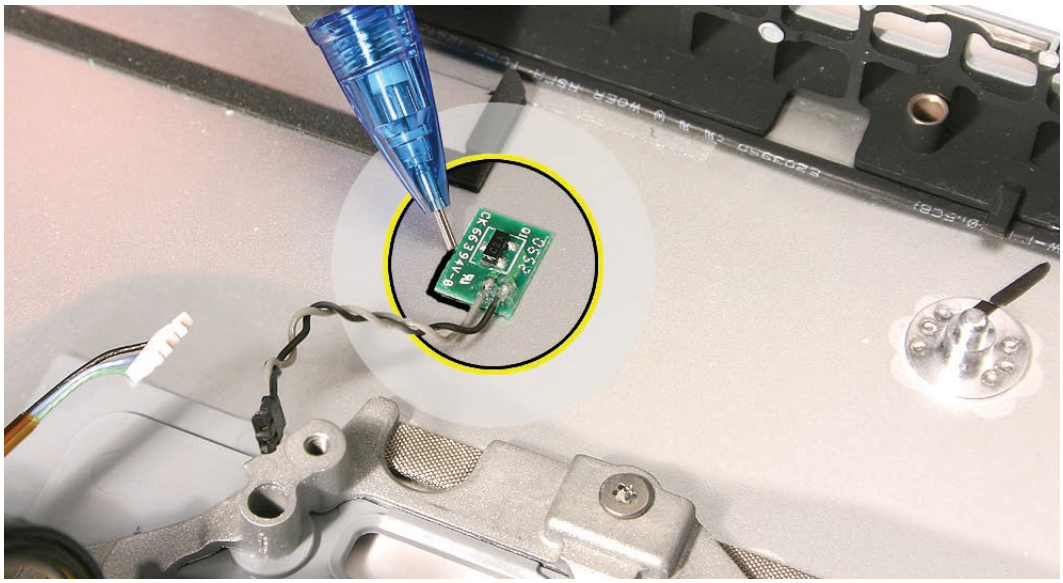


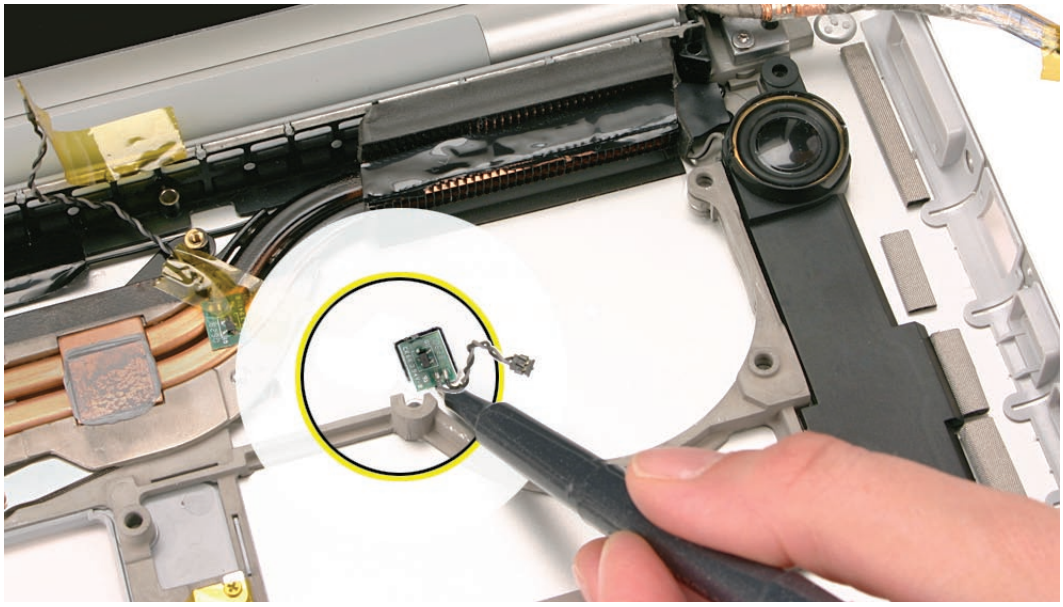
Procedure

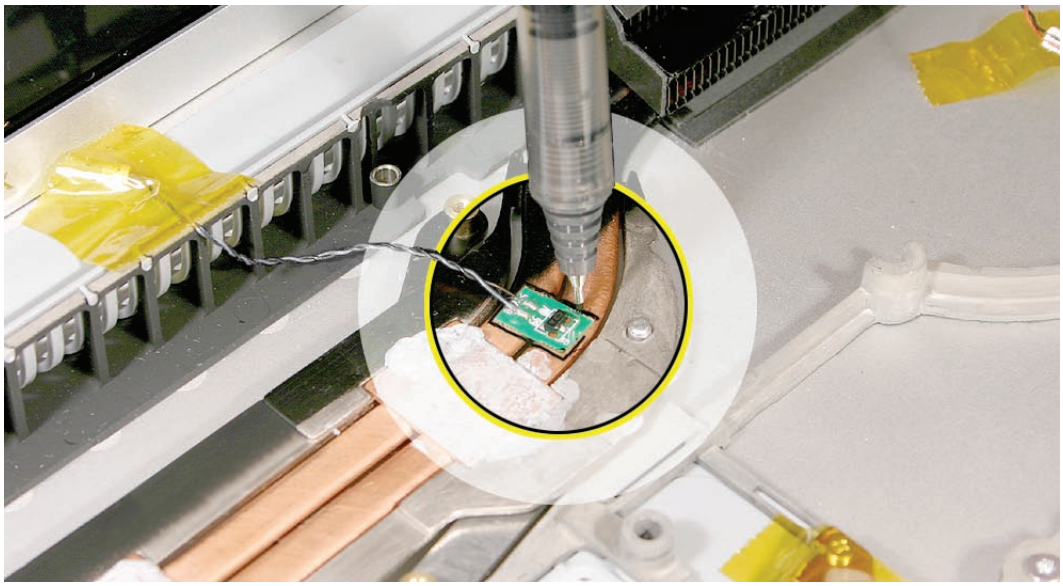
There are three thermal sensors, each requiring precise placement. Two sensors are attached to the bottom case near each fan and one to the heatsink.

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

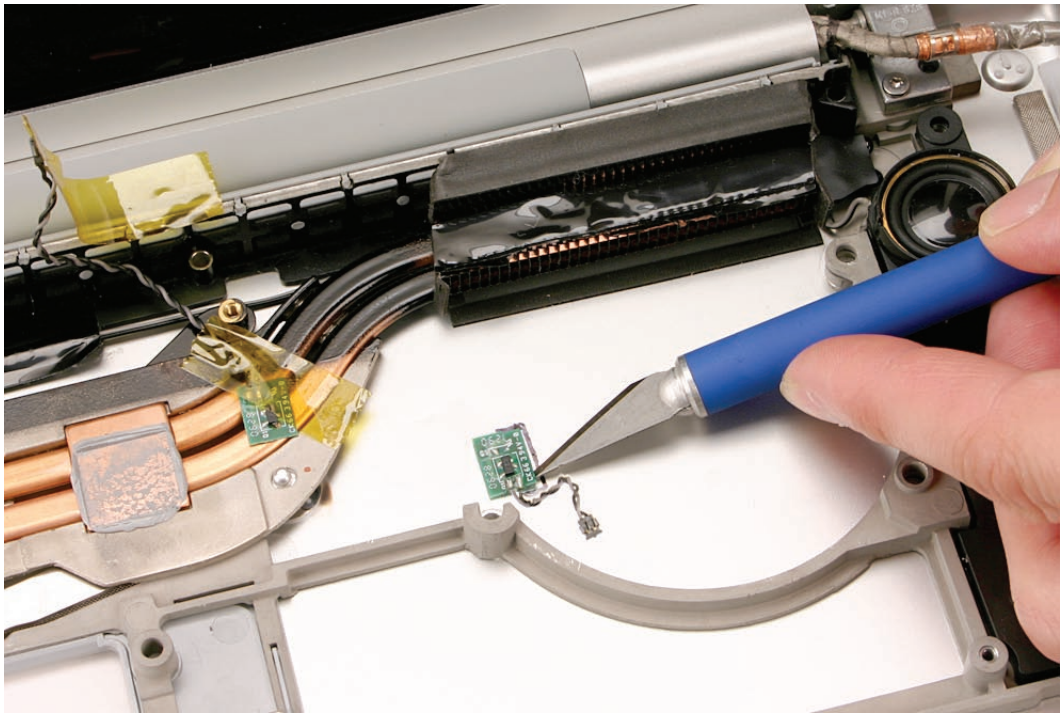
   Note: Be sure to note the orientation of the 'tail' of each thermal sensor before removal.







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



2. Install the replacement sensors in the exact same location. (**Note**: Be sure to reinstall each thermal sensor in the proper orientation, with the 'tail' facing in the correct direction.)
3. Replace any Kapton tape.

Speakers

The right and left speakers are one assembly.

Tools

This procedure requires the following tools:

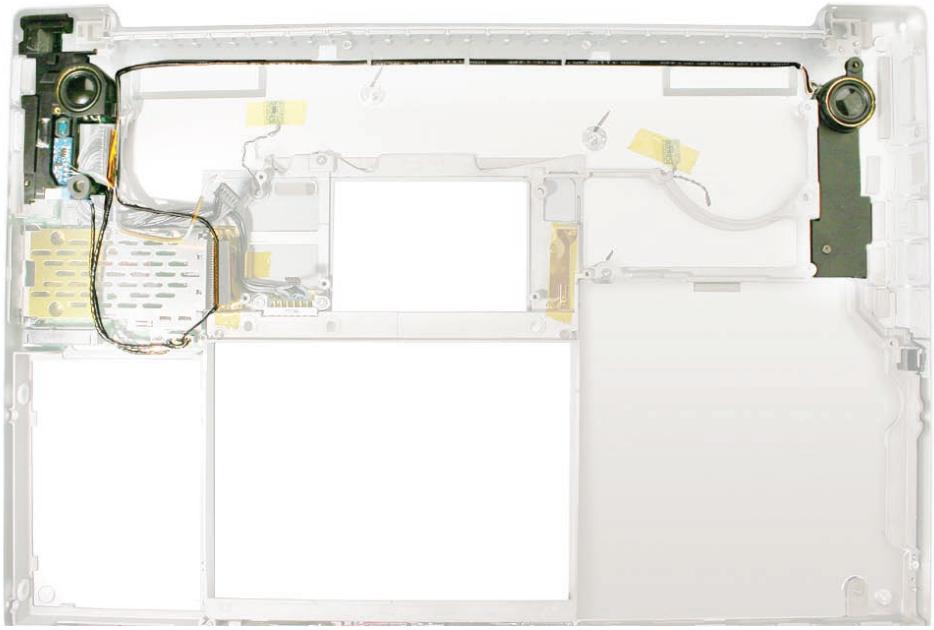
- #0 Phillips screwdriver (magnetized)
- Torx T6 screwdriver (magnetized)
- Black stick (nylon probe 922-5065) or other non-conductive nylon or plastic flat-blade tool
- Kapton tape (922-1731) (0.5-inch x 12-yard roll)

Preliminary Steps

Before you begin, remove the following:

- Battery
- Top Case
- AirPort Extreme Card (for left and/or right speakers)
- Logic Board (for right speaker)
- Heatsink (for right speaker)

Part Location



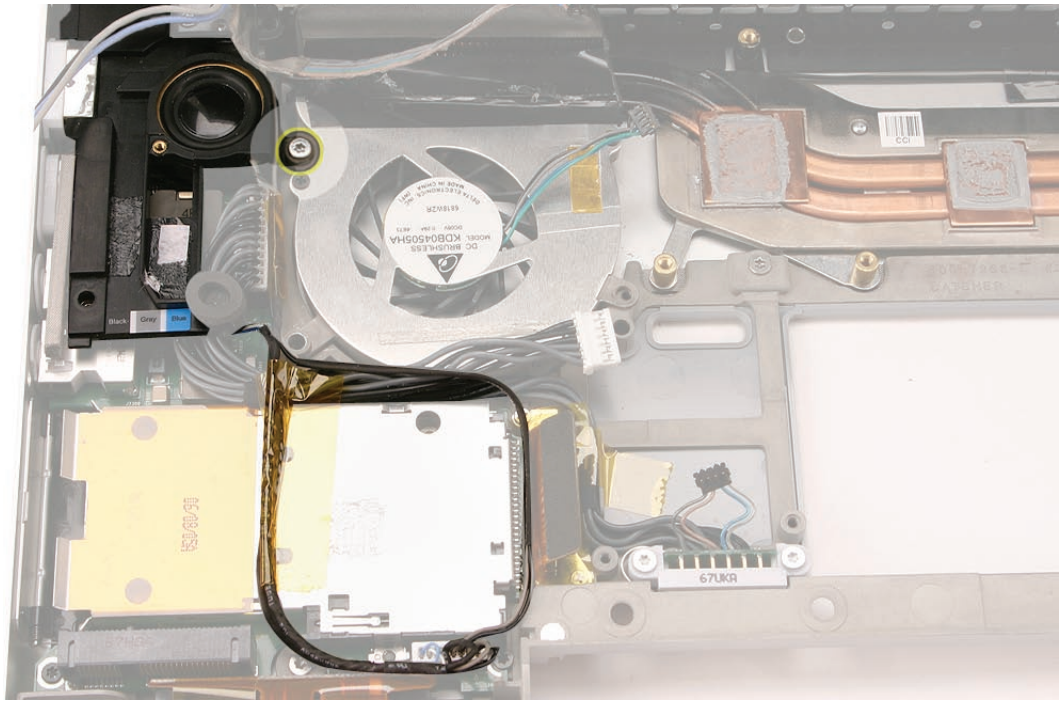
Procedure

Note: Some photo details below may differ slightly from the model or state of repair of the MacBook Pro you are repairing; however, the procedure itself remains consistent for this model.

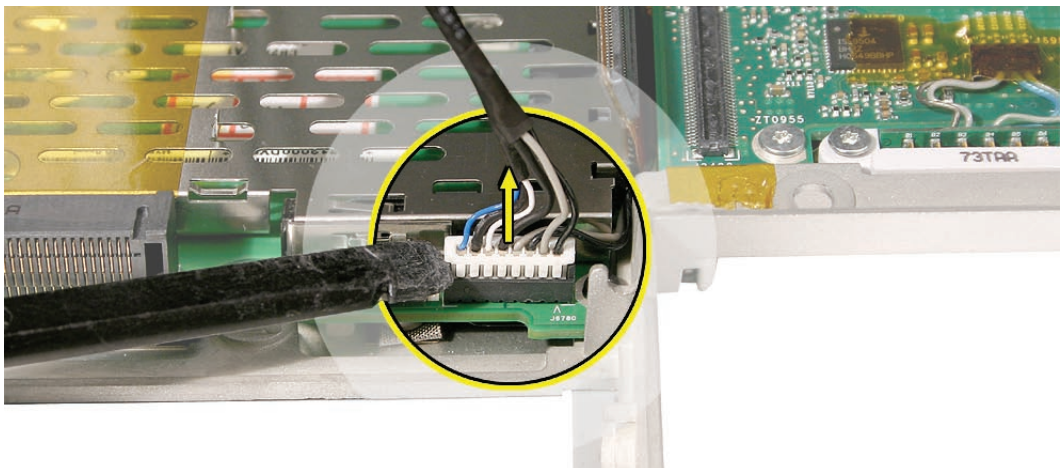
To remove the left speaker:

1. Remove the Torx T6 screw from the upper left of the fan. Carefully note the cable routing.

922-7307

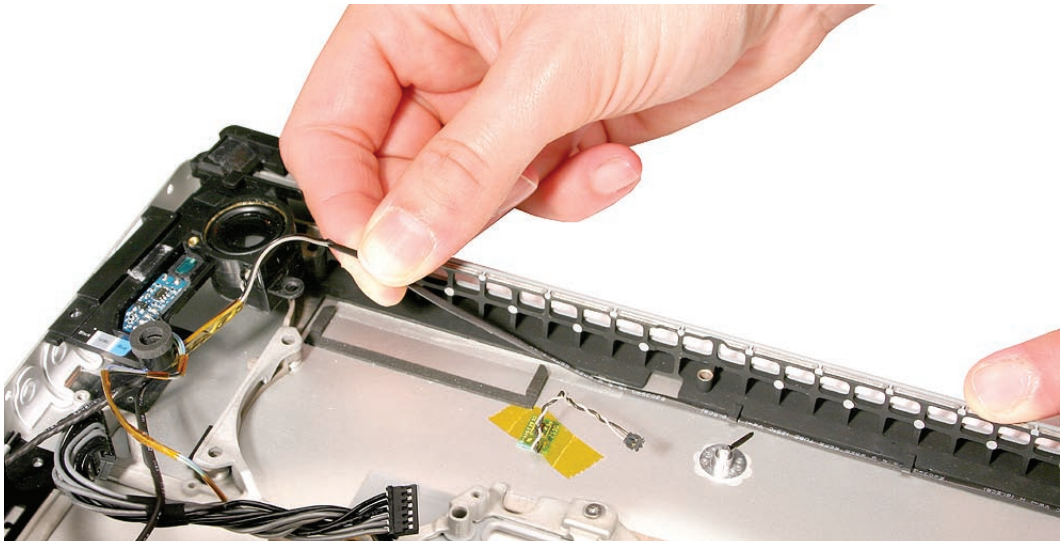


2. If present, disconnect the hard drive flex connector and lift the flex cable from the ExpressCard cage to gain access to the speaker cables and connector.
3. Note cable routing, then disconnect the speaker cable connector.

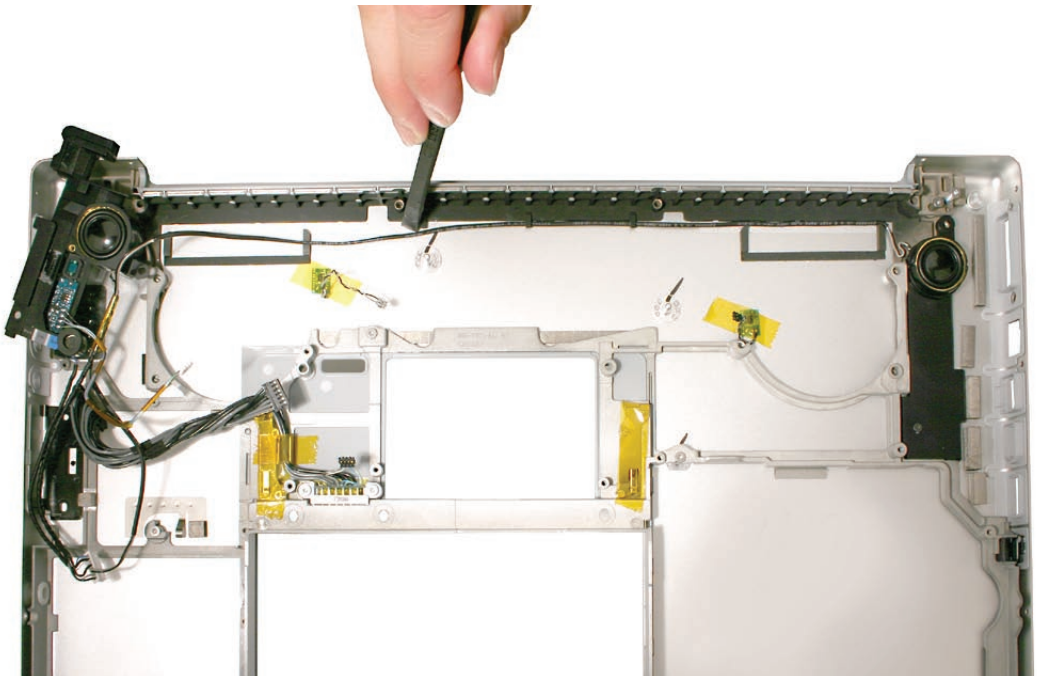


To remove the right speaker:

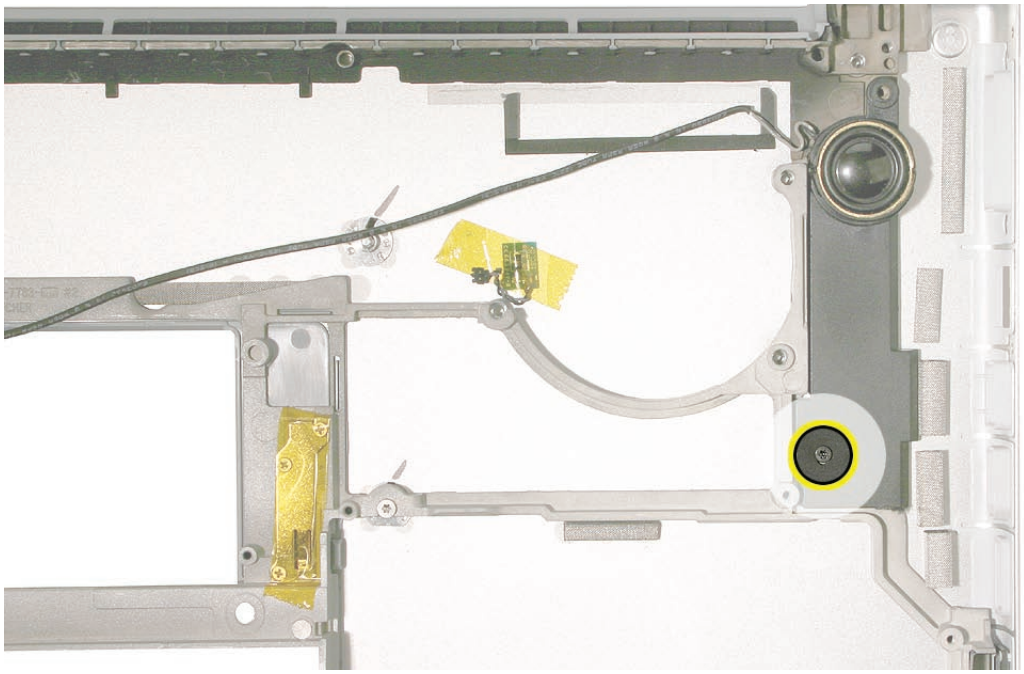
1. Remove all components listed on the first page of this chapter. (Note that the display need not be removed to remove the speakers.)
2. Gently begin to pull the first few inches of speaker wire leading from the left speaker to the right away from the adhesive on the left side of the bottom case.



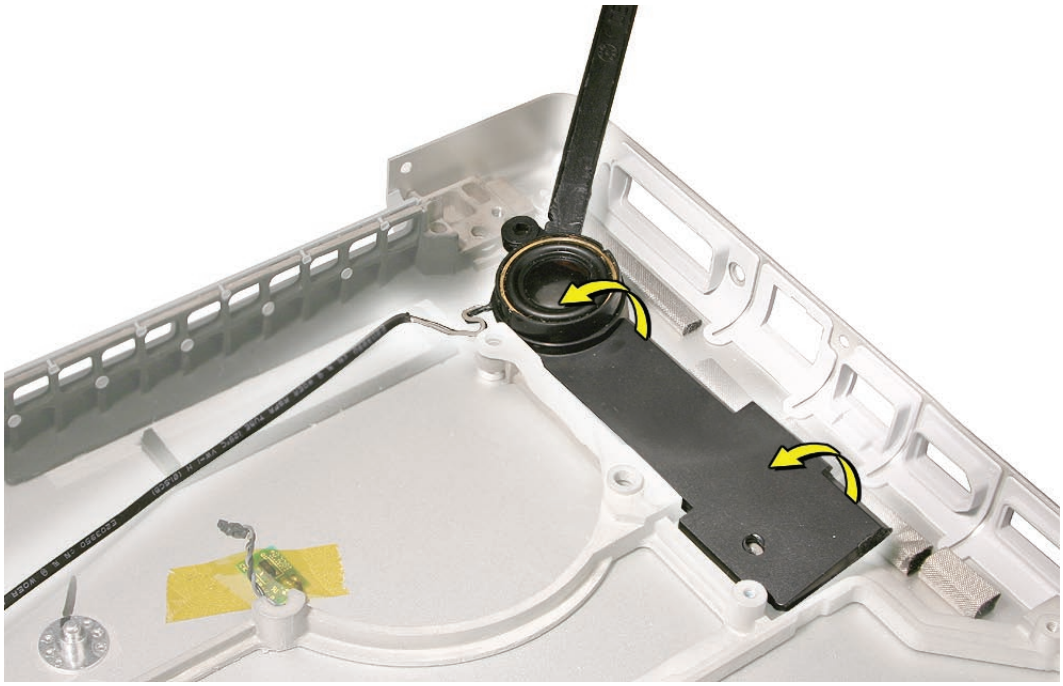
3. Use a black stick to carefully pry the wire out from under the brackets securing the wire to the rear of the bottom case. Push out and down to avoid nicking the wire's insulation.



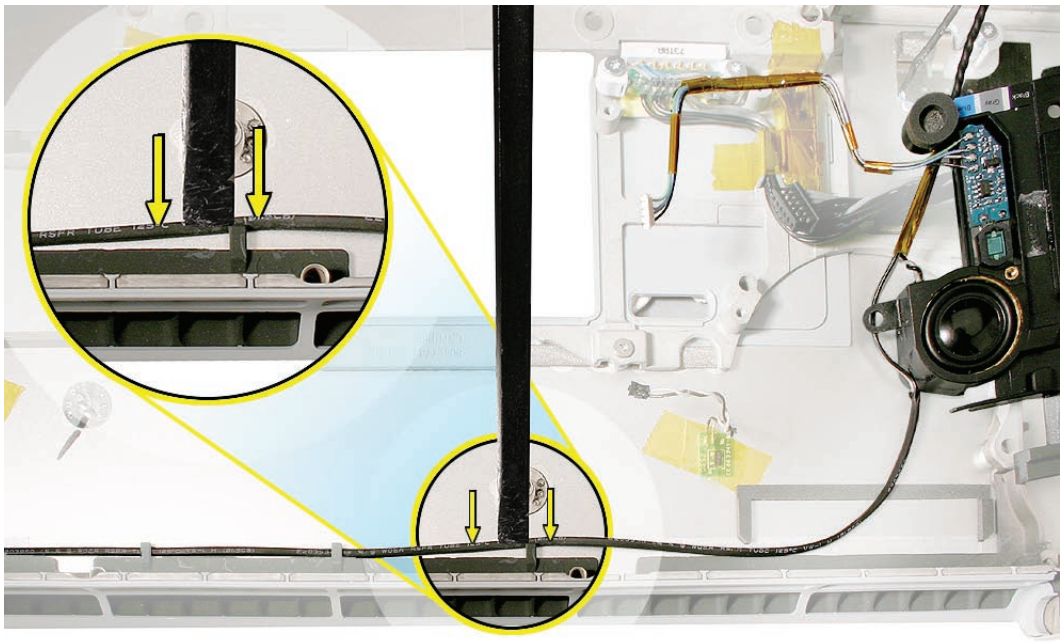
4. Remove the Torx T6 screw and lift the speaker away from bottom case.



Note: A light adhesive may be securing the speaker in place. Use a black stick to gently pry the speaker away from the bottom case.



Replacement note: While tucking speaker wire under the bracket in the back of the bottom case, use a black stick to wedge the bracket slightly upward while sliding the wire underneath to avoid cutting the wire's insulation. Make sure the speaker wire is pushed all the way under each bracket in the rear of the bottom case to keep it from interfering with the reinstallation of the heatsink.



Left I/O Board

Tools

This procedure requires the following tools:

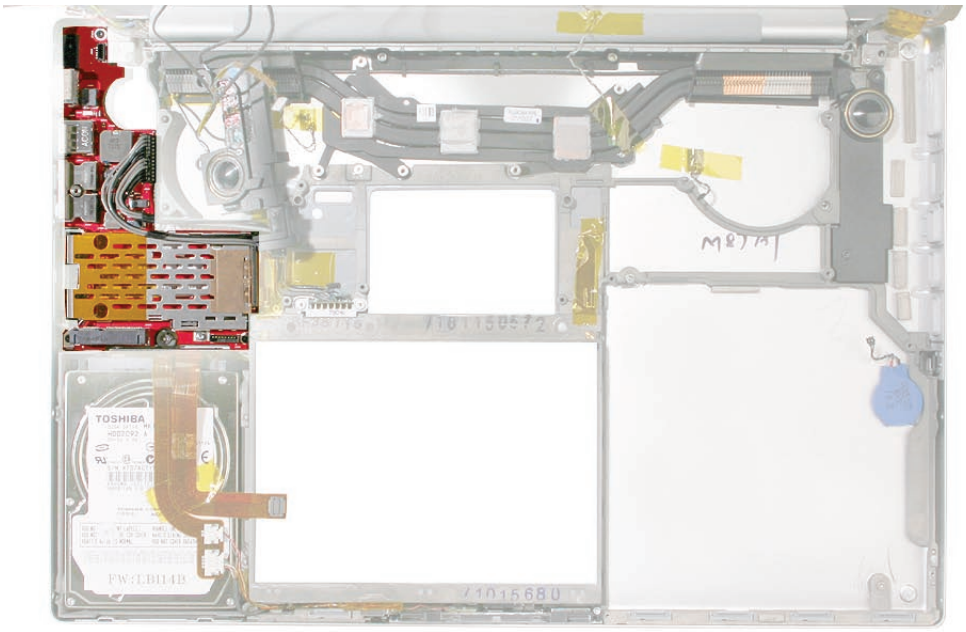
- Torx T6 screwdriver (magnetized)
- 4 mm socket wrench
- Black stick (nylon probe 922-5065) or other non-conductive nylon or plastic flat-blade tool

Preliminary Steps

Before you begin, remove the following:

- Battery
- Top Case
- AirPort Extreme Card
- Left Ambient Light Sensor (just the JST cable on the logic board side)
- Left Speaker

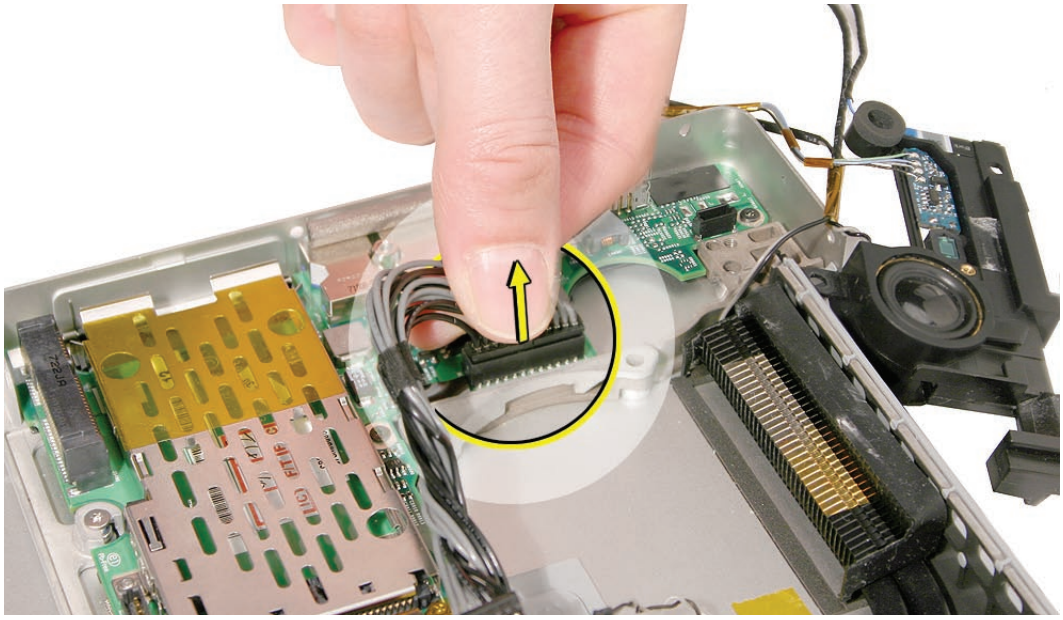
Part Location



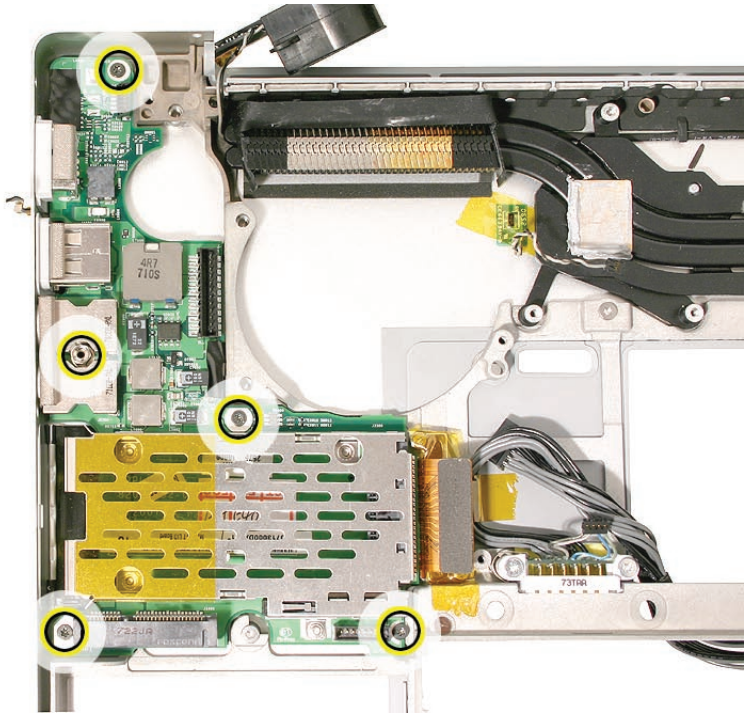
Procedure

1. Disconnect the battery cable.

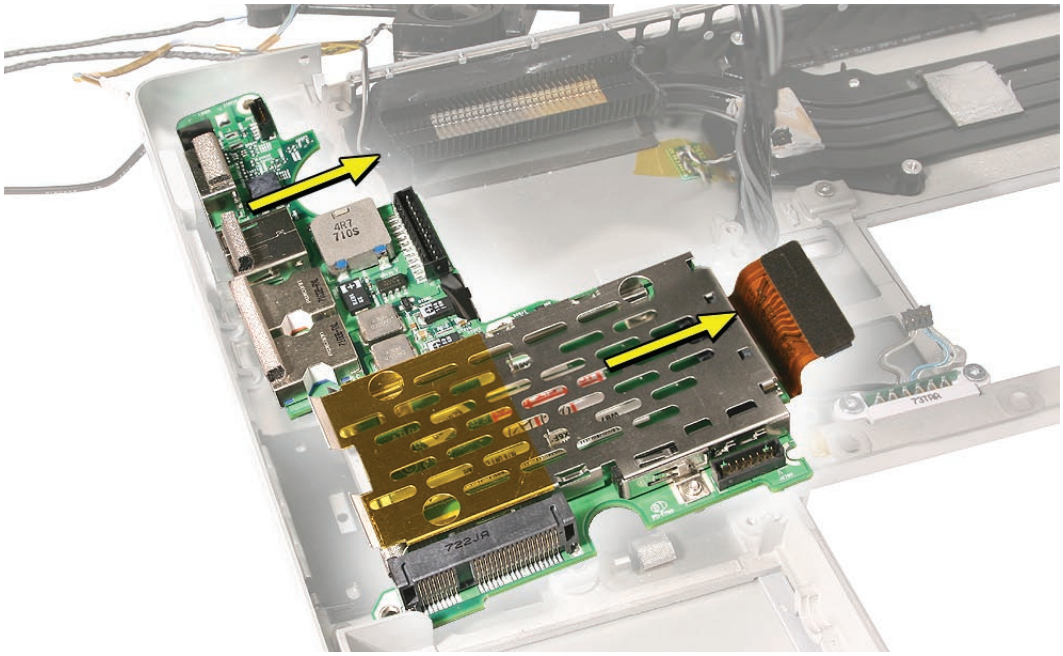
   Note: The ExpressCard cage is attached to the left I/O board.



2. Remove the four 4.2mm Torx T6 screws and single 4mm hex standoff.

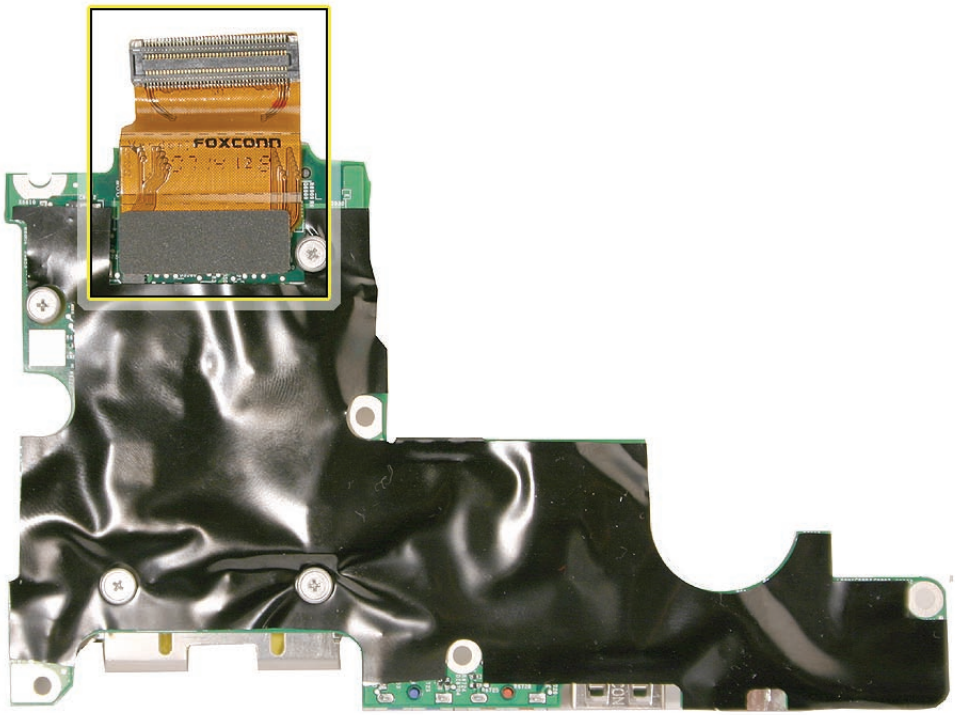


3. Lift the board assembly from the right side and slide away from the port openings.



4. Disconnect the flex cable.

Note: The new left I/O board for the MacBook Pro (Early 2008) now has EMI mylar film on the bottom of the board. Leave the film in place.

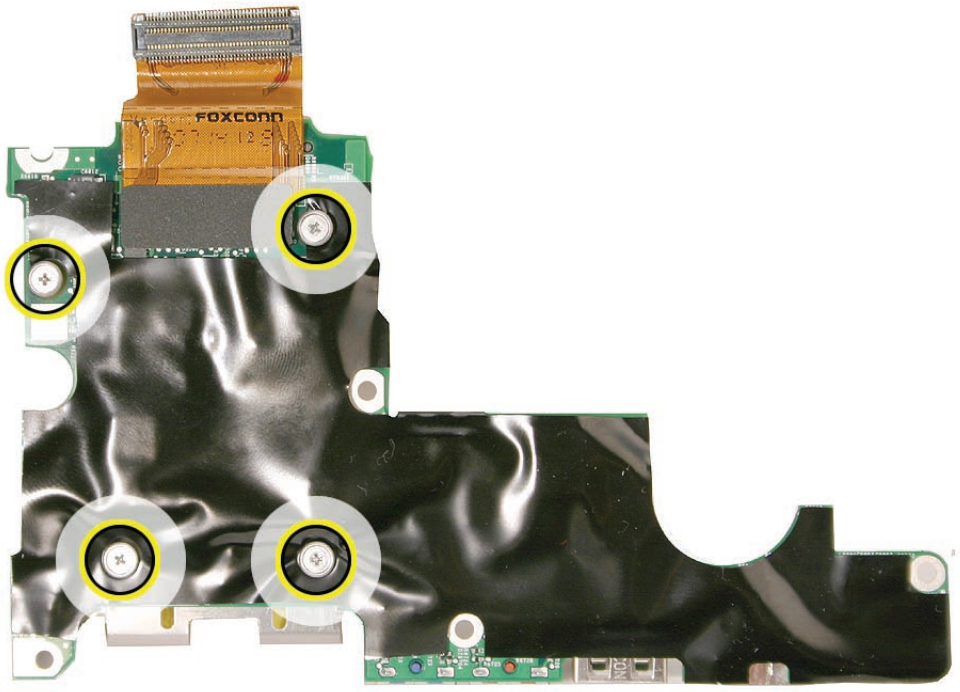


5. Remove the four screws.

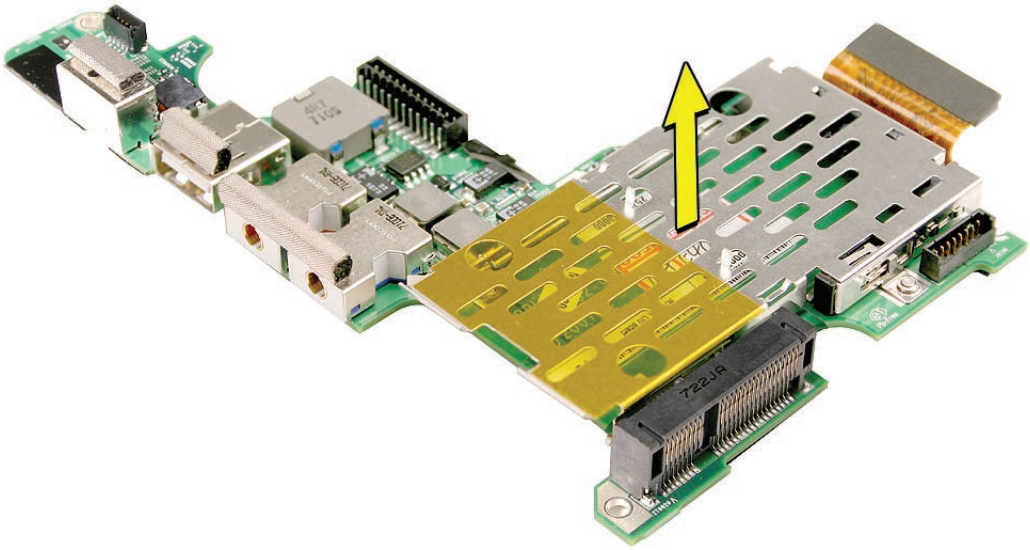
922-8145

922-8146

922-8147

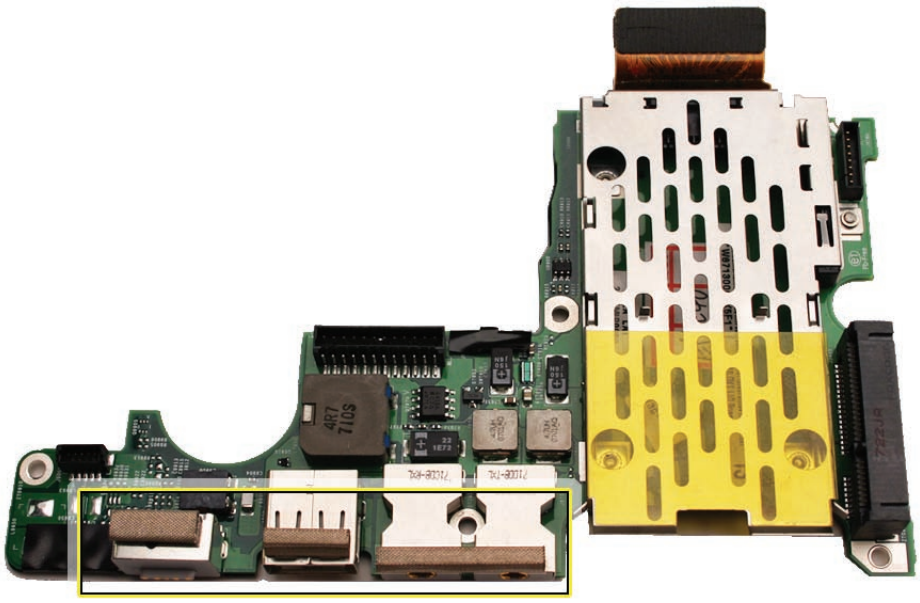


6. Lift off the card cage.

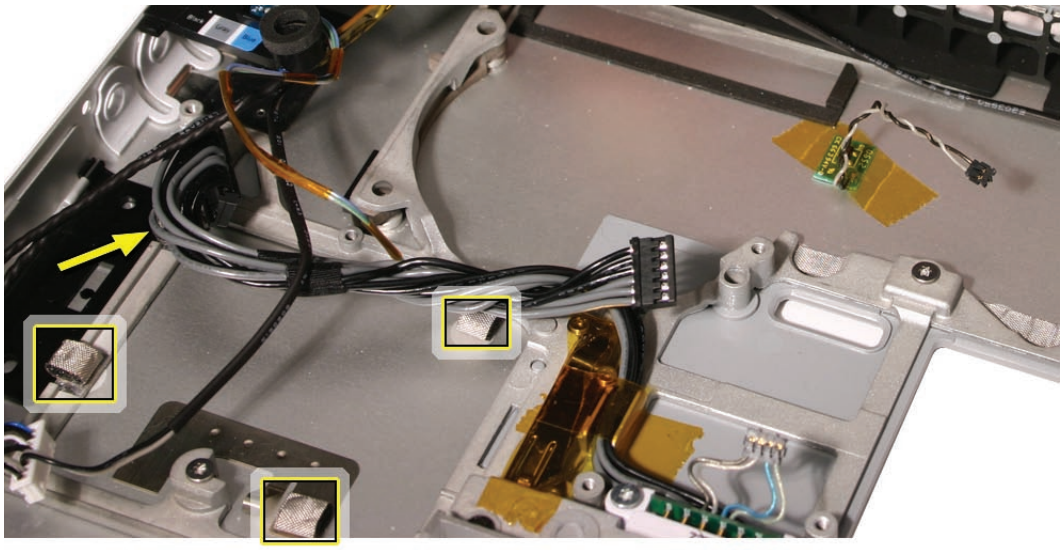


7. **Replacement Note:** Transfer the three EMI gaskets from the old card.

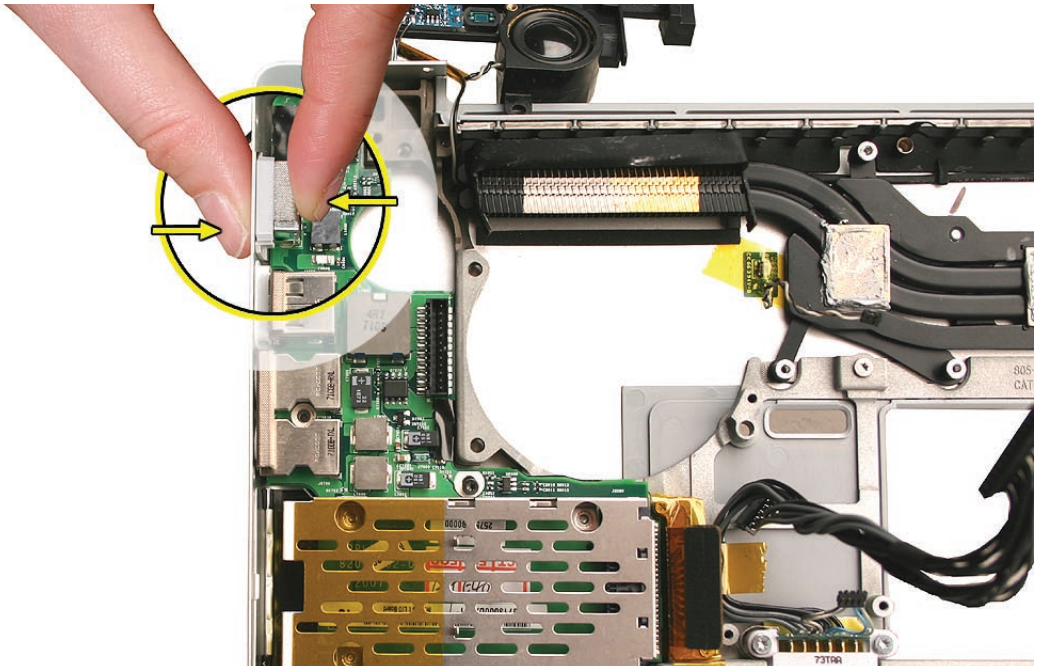
   Important: Also transfer any other gaskets present on the ExpressCard cage, whether replacing the cage or the left I/O board.



Replacement Note: Make sure the four gaskets on the bottom case that make contact with the four screws on the underside of the ExpressCard cage are intact.



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.



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

ExpressCard Cage

Tools

This procedure requires the following tools:

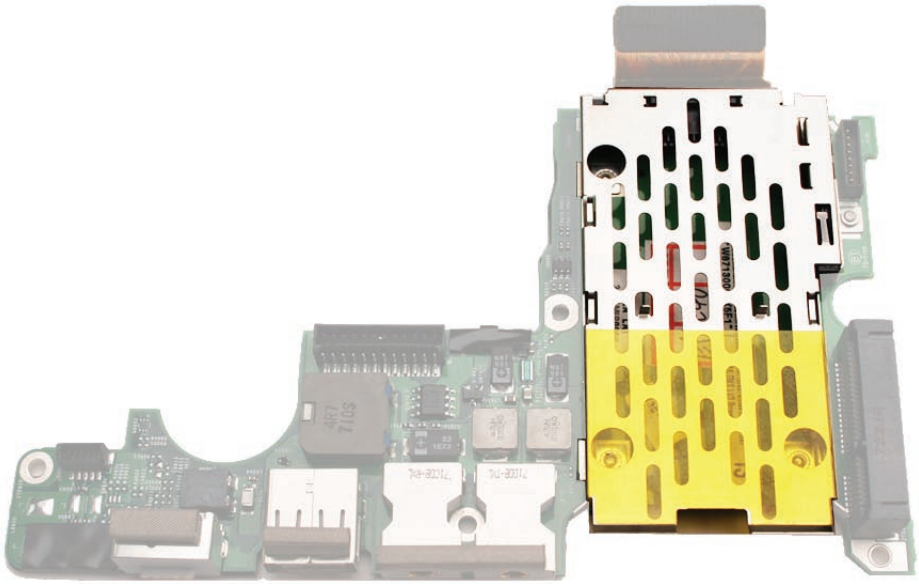
- #0 Phillips screwdriver (magnetized)

Preliminary Steps

Before you begin, remove the following:

- Battery
- Top Case
- AirPort Extreme Card
- Left Ambient Light Sensor (just the JST cable on the logic board side)
- 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

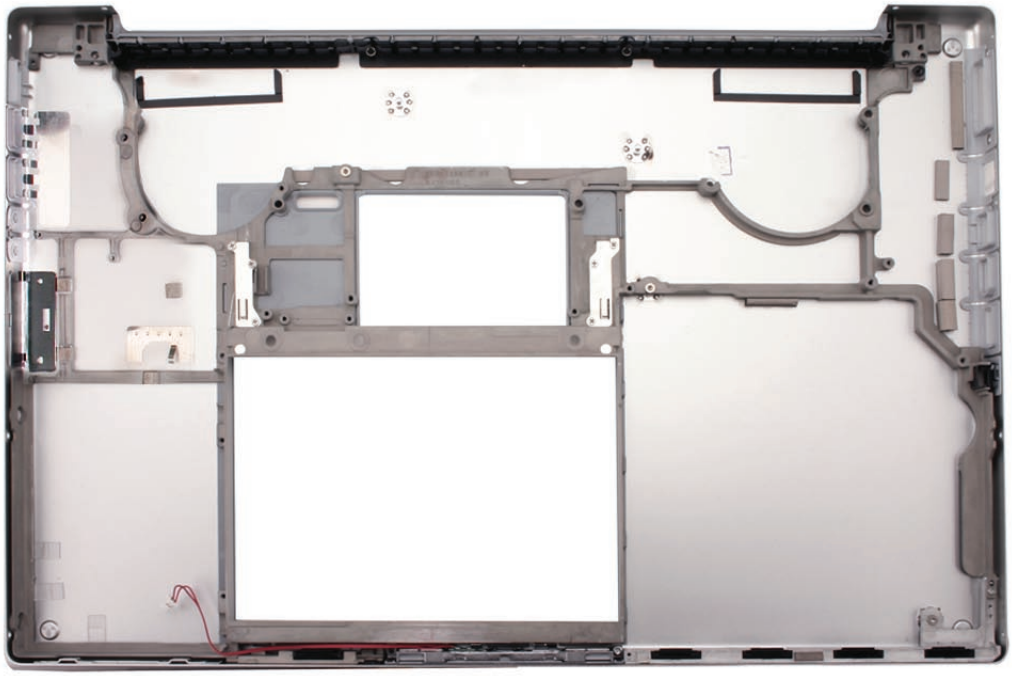
This procedure requires no tools.

Preliminary Steps

Before you begin, remove the following:

- Battery
- Top Case
- AirPort Extreme Card
- Left Ambient Light Sensor (just the JST cable on the logic board side)
- Left Speaker
- Hard Drive
- Infrared Board
- Optical Drive
- Fans
- Backup Battery
- Logic Board
- Left I/O Board
- Heatsink
- Right Speaker
- Display Assembly
- Bottom Case Thermal Sensors

Part Location



Procedure

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

Note: When replacing the bottom case, make sure to transfer any corresponding gaskets that are not included in the replacement part.

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

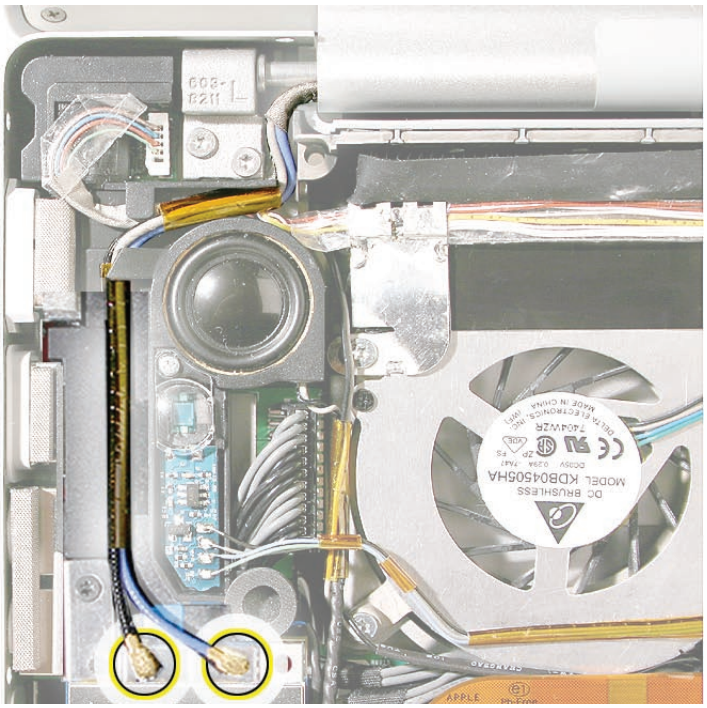
Before you begin, remove the following:

- Battery
- Top Case

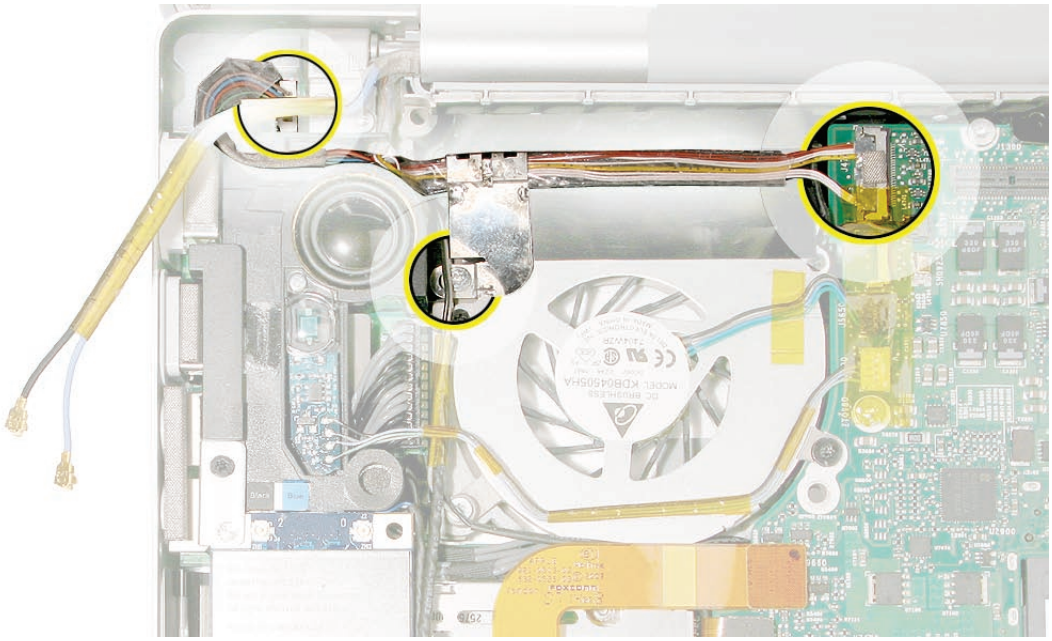
Part Location

Procedure

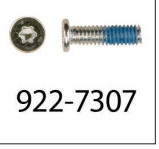
1. Disconnect three antenna connectors. Lift straight up. Peel up any Kapton tape to free.

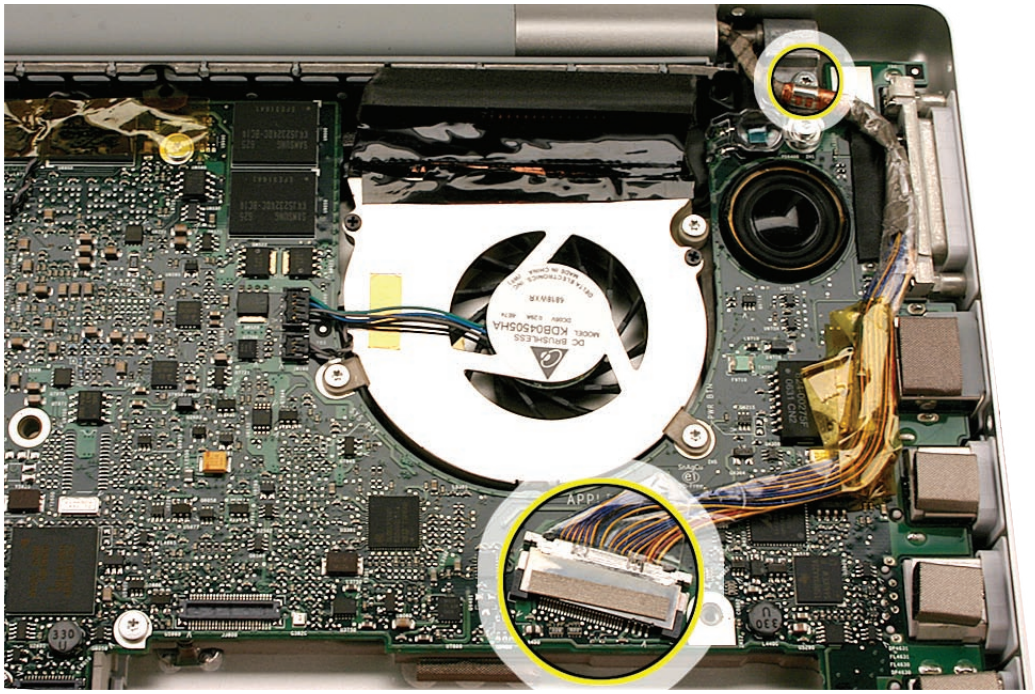


2. Disconnect the DC-to-DC (backlight) cable connector in the left corner. Remove the screw securing the iSight camera cable and disconnect the cable connector to the right of the fan.

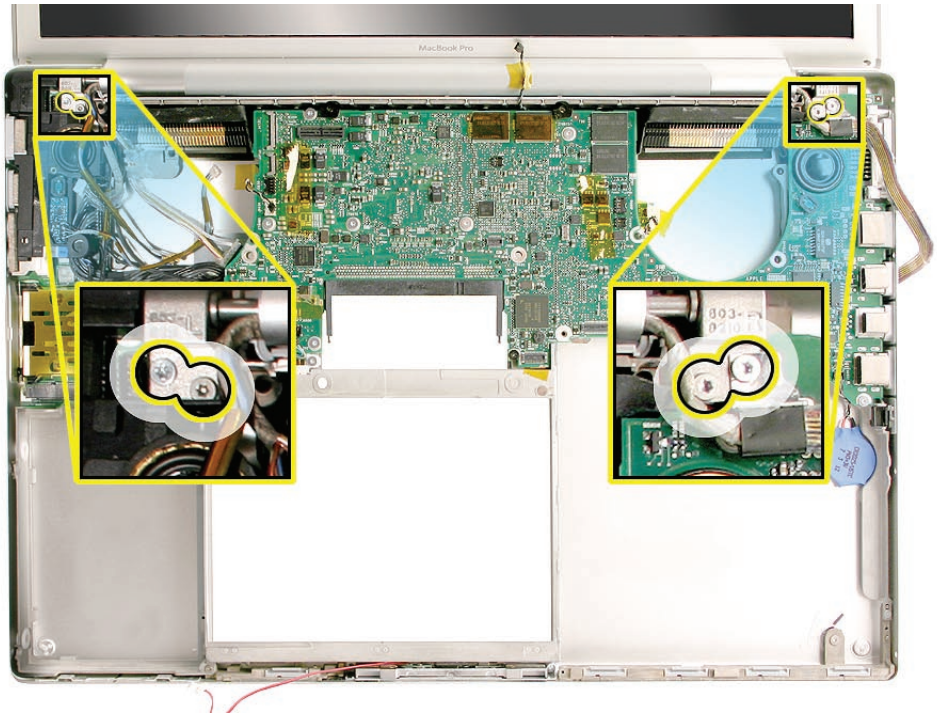


3. Disconnect the LVDS cable.





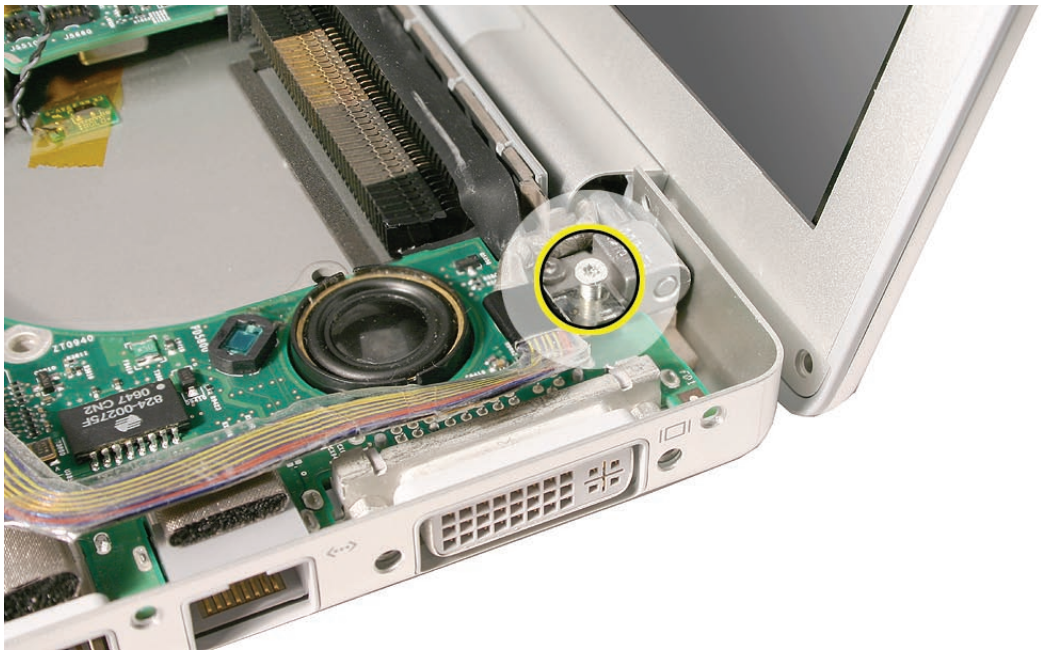
4. Move the display to a 90-degree angle and remove the four clutch screws.
Note: The 9.5mm shoulder screws are located toward the inside of the machine.
Important: Support the display from falling over before removing the last screw.



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

Replacement Procedure

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

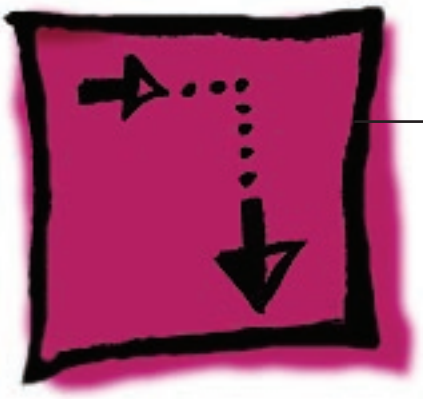


3. Verify that the LVDS cable is secure and lays flat.
4. Reassemble and test the computer.

Quick Test

- Test 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.

Service Source



Adjustments

MacBook Pro (15-inch Early 2008)

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Latch Adjustment

Overview

To secure the display to the top case, the MacBook Pro uses a latch assembly that consists of two parts—a latch mechanism under the top case (actually attached to the bottom case frame) and two swinging latch hooks inside the display assembly clamshell. As the unit is closed, magnets inside the latch mechanism pull the metal latch hooks down into the bottom case, and an overhang on the latch mechanism clasps the hooks to the frame.

If the display does not properly latch to the top case, fails to remain closed, or pops up without the display release button being pushed, you can make adjustments to the latch hooks that may correct the issue. Alternately, you can send the computer to an Apple Repair Center for service.

Tools

This procedure requires the following tools:

- Black stick (or other non-marring nylon or plastic pointed tool)
- Magnet

Preliminary Steps

Warning: While performing the following procedures, take note of the position of the hooks as they are drawn out of the display housing and down into the slots in the top case. Any adjustments to these hooks must be very slight to stay within the slot on the top case.

Before performing the latch adjustment, test the current operation of the latches:

1. Push the display down to about two inches from the top case. Then push the display very slowly until it just touches the top case, and immediately release.

   If working properly, the latches should secure the display to the top case throughout the following tests:

   - Pounding firmly on the table top, to the left and right of the computer.
   - Pulling up on the sides of the display.

   Repeat the above procedures several times to verify proper operation of the latches.

2. Whether or not the latches functioned properly during testing, use the following procedures to achieve or to verify proper latching function.

Procedure

Note: The latch mechanism under the top case of the computer has a small amount of right and left play (less than 1 mm), and can shift during normal operation.

The following procedures will test the latching function with the latch mechanism at its maximum right and left positions, and the latch hooks will be very slightly adjusted, as necessary.

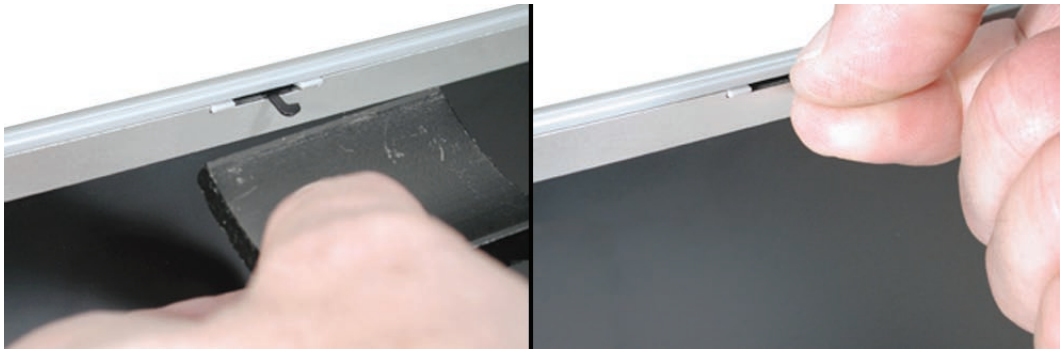
Important: The latch hook metal can become brittle and break if it is bent too much, especially if it is over-bent and bent back. Work carefully and with due restraint to avoid over-bending the latch hook. If the latch hook breaks, new latch hooks will need to be ordered and replaced.

1. Open the display and note the edges of the latch mechanism underneath the top case, shown below, just to the right and left of the latch release button. This mechanism catches both left and right latch hooks on the display assembly.

2. Use a black stick to push the latch mechanism, at the location shown below, to move it to the left as needed (less than 1 mm) or its corresponding location on the left side of the latch release button to move it right (less than 1 mm).

3. Perform the testing procedures in step 1 of the Preliminary Steps, above.
4. If the latch functions properly, skip to step 6; otherwise, if either or both latch hooks require an adjustment, refer to the following steps.
5. If the latch mechanism does not function properly, adjust the latch hook(s) as follows:

   Open the display to a 90-degree angle and use a magnet to draw the latch hook out. Tightly grasp it between your thumb and forefinger as close to the display as possible, as shown.



   Carefully exert a very slight controlled downward pressure on the latch hook.

   Important: Do not push only with your thumb. Hold the latch hook tightly between your thumb and forefinger to support the latch hook and prevent too much bending force.
6. Release the latch hook, adjust the other latch hook as needed, and perform the latch tests as before. Continue the above procedure until both latches function properly.
7. Again, if needed, use a black stick to push on the latch mechanism, as shown below, to adjust it slightly left or right (no more than 1 mm) or to re-center the mechanism over the latch release button.

8. Repeat the previous latch closing tests, and latch hook adjustment if needed, until the latch works properly in this position.

Service Source

Troubleshooting

MacBook Pro (15-inch Early 2008)

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General Information

Wire and Flex Cables

Because of its thin enclosure design and dispersed circuit board, the MacBook Pro utilizes a multitude of flex cables and wire cable harnesses. Many of these cables carry multiple signals.

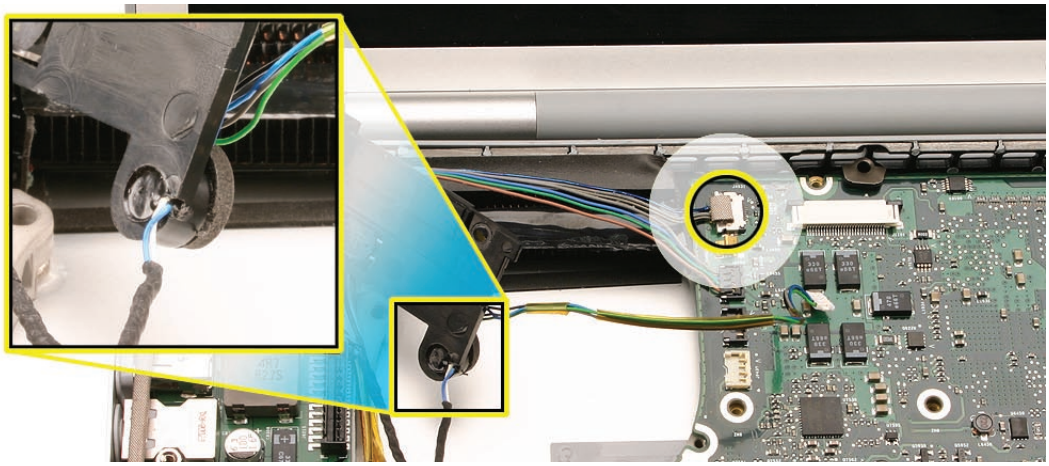
Here is a list of the cables and the signals that run across them. If you notice a group of functions not working, it is likely that the cable is not properly inserted or the connector is damaged.

Cable or Flex Cable	Signal(s) Running Through It
SuperDrive flex	SuperDrive data, power, and control signals (cable select info)
Hard drive flex	Hard drive power and data Sleep LED power Infrared power and data
Left I/O board flex	Audio in and out Left and right speaker Built-in microphone Left USB (2 ports) ExpressCard data Airport power and data LED backlight brightness control
Power button cable	Power-on signal
Infrared cable	Infrared 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	Battery power to main logic board Power adapter power to battery and system
Speaker assembly cable	Left speaker audio Right speaker audio
Trackpad flex	Trackpad data and power Power-on button Keyboard backlight power Sleep sense signal Keyboard data Bluetooth power and data
Bluetooth antenna cable assembly	Bluetooth radio signal
Internal microphone	Microphone input
AirPort Extreme antenna cable (2 wires)	AirPort radio signal
Left fan cable	Power/control for left fan

Cable or Flex Cable	Signal(s) Running Through It
Right fan cable	Power/control for right fan
DC-to-DC cable (to left I/O board)	Display backlight control
iSight video signal cable	Video power and signal from iSight camera
LVDS cable	Video data
Backlight power and control cable	Display brightness (CCFL or LED)
Thermal sensors (bottom case (2), heatsink)	Internal temperature data

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 (15-inch Early 2008). 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 Kbase article 112125: Service Diagnostics Matrix.

Apple Hardware Test (AHT) 3A134

Note: AHT version numbers may change as diagnostics are updated.

To use Apple Hardware Test on the hard drive:

1. Disconnect all external devices from the computer except the power adapter.
2. Restart the computer while holding down the D key. (Apple Hardware Test resides on its own partition on the internal hard drive.)
3. When the AHT chooser screen appears, select the language for your location.

4. Press the Return key or click the right arrow button.
5. When the Apple Hardware Test main screen appears (after about 45 seconds), follow the on-screen instructions.
6. If Apple Hardware Test detects an issue, it displays an error code. Make a note of the error code before pursuing support options. If Apple Hardware Test doesn't detect a hardware issue, the issue may be software related.

If this method is not successful, use AHT from the MacBook Pro OS X Install DVD..

To use AHT from the DVD:

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.

Apple Service Diagnostic (ASD) 3S121

Note: ASD version numbers may change as diagnostics are updated.

Important: Unlike versions of ASD previously available for the MacBook Pro, ASD version 3S121 requires installation onto an external USB hard drive.

Installing Apple Service Diagnostic on a USB hard drive:

1. Connect the external USB hard drive to your Macintosh.
2. Open Disk Utility (located in /Applications/Utilities).
3. Select the external USB hard drive.
4. Click the Partition tab to prepare the drive to be partitioned into two volumes, as follows:
   - For ASD (OS), the partition size must be 5.4GB or larger. Name this volume ASD OS 3S121.
   - For ASD (EFI), the partition size must be 20MB or larger. Name this volume ASD EFI 3S121.
5. Click on Options and select GUID Partition Table as the partition scheme.
6. Click Partition to partition the hard drive.
7. In the Finder, double-click on the ASD 3S121.dmg file to mount the image. Within it are two disk images, one for EFI, ASD EFI 3S121.dmg, and one for OS X, ASD OS 3S121.dmg volume.
8. In Disk Utility, select the volume on the USB hard drive named "ASD OS 3S121."
9. Click on the Restore tab.
10. For Source, select the ASD OS 3S121 disk image by either dragging the icon for the disk image to the Source window, or selecting it by clicking on the Image... button.

    Note: Image ASD OS 3S121.dmg should be unmounted before restoring it to the hard drive.
11. For Destination, drag the icon for the volume ASD OS 3S121 from the left-hand column to the Destination window.

12. Click the Restore button to start the installation.
13. In Disk Utility, select the volume on the USB hard drive named ASD EFI 3S121.
14. Click on the Restore tab
15. For Source, select the ASD EFI disk image by either dragging the icon for the disk image to the Source window, or selecting it by clicking on the Image button.

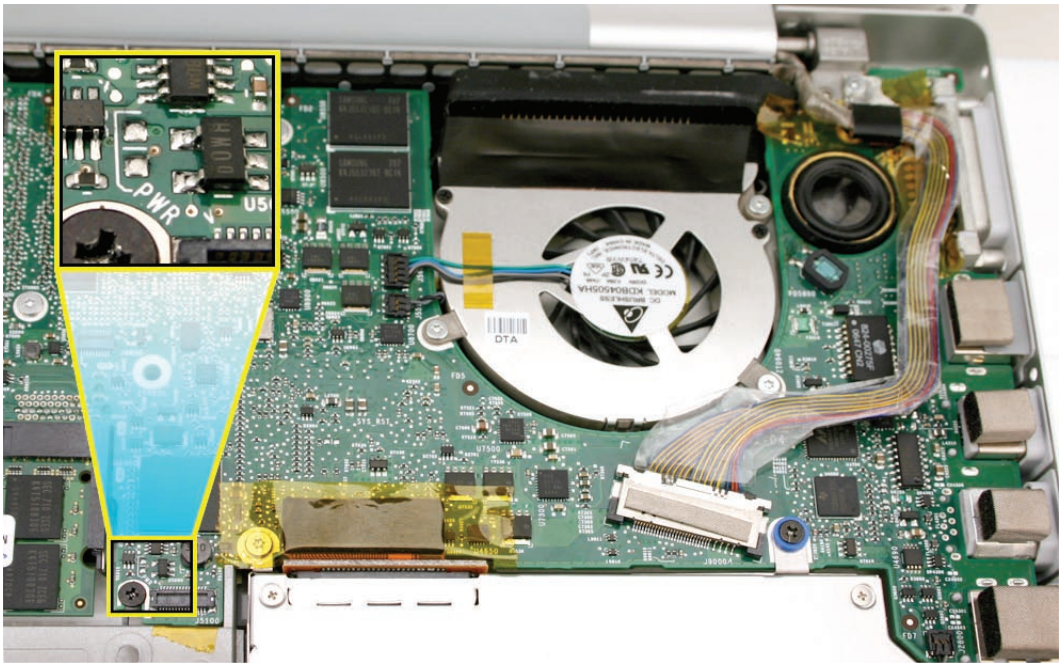
    Note: Image ASD EFI 3S1121.dmg should be unmounted before restoring it to the hard drive.
16. For Destination, drag the icon for the volume ASD EFI 3S121 from the left-hand column to the Destination window.
17. Click the Restore button to start the installation.

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 lower edge of the logic board between the RAM slots and the upper left corner of the optical drive. The two pads are separated with a horizontal white line and bracketed by another line that leads to the marker "PWR." See photo below with magnified inset.



Resetting the Power Manager (SMC)

Power management is handled by a chip called the SMC (System Management Controller).

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.

Display off and sleep indicator light on

When the system is running but the video is not illuminated (for example, briefly upon startup, or when energy saver dims the video while the system is still awake), the sleep indicator light remains on. This feedback is to alert the user that the system is not shut down. It is possible, however, that this signal may fail if the system has crashed. As such, you can use the next test to see if power is present in an apparently "off" system.

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 active. In this case, the logic board is drawing power and generating heat.

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

You can potentially verify this situation by pressing the Caps Lock key. If the LED glows, the power manager is actively running on the logic board. If pressing the Caps Lock key or other attempts to wake the machine have failed (including closing the lid to put it to sleep and reopening it to wake it), hold the power button down for six seconds to force a shutdown of the computer. Restart the system to check that it starts up normally.

Note: Given that the keyboard in MacBook Pro is a USB device, it may not respond if the operating system has crashed. Thus, despite the fact that the caps lock LED does not light up, the computer may still be drawing power. If in doubt, hold the power button down for six seconds to force a shutdown of the computer.

MacBook Pro Firmware Updates

Firmware is software that is written into memory circuits that can retain software code indefinitely, even when power is not available to the hardware. Firmware on Intel-based Mac computers is designed to be updated if necessary through a software update.

EFI and SMC firmware is stored on the MacBook Pro's logic board. EFI firmware updates update

the Boot ROM, and SMC Updates update the System Management Controller firmware. The SMC manages fans and other environmental parameters that are independent of the Boot ROM.

Firmware symptoms can be easily mistaken for hardware issues (e.g. overheating issues, fan noise issues, etc.). Always check both EFI and SMC firmware versions and update if necessary before replacing any hardware components in the MacBook Pro.

The following lists describe the type of symptoms that may be resolved by updating the EFI and SMC firmware in the MacBook Pro.

Symptoms that may be resolved by updating EFI firmware:

- L2 Cache reporting as bad
- Boot Camp not booting into Windows
- Built-in FireWire has GUID zero if ExpressCard FireWire is present at boot
- Auto-reboot after wake from sleep
- Stuck in Target Disk Mode upon restart
- Cannot eject media (various conditions)
- Bad media taking too long to eject (including holding mouse button down at startup taking minutes to eject)
- Auto-reboot after wake from sleep

Symptoms that may be resolved by updating SMC firmware:

- Status LEDS on battery do not light until the pack has charged for approximately 10 minutes
- Unusual fan behavior and thermal management issues

Please follow the steps outlined in Knowledge Base article 303364 About firmware updates for Intel-based Macs to perform an EFI and/or SMC firmware update.

Information about firmware versions for Intel Macs can be found in Knowledge Base article 303880 Mac OS X: Firmware Updates for Intel-based Macs.

Software Troubleshooting Tips and Tools

Mac OS X 10.5.2 [build 9C2018] or later only

All MacBook Pros, including the MacBook Pro (15-inch Early 2008), require an Intel-compatible Mac OS. Make sure all software updates are applied before starting troubleshooting.

Login window and account

Mac OS X requires at least one user account to be established—the Administrator's account. By default, the Accounts system preference pane has the "Log in automatically [Admin's name]" checked. This automatic login setting allows the system to boot into the Finder without having a login 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 reinstall 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 Boot is a special diagnostic way to start Mac OS X when troubleshooting. Safe Mode is the state Mac OS X is in after a Safe Boot. Starting up in Safe Mode does five things to simplify the startup process and operation of the computer:

- It forces a directory check of the startup (boot) volume. It is identical to using Disk Utility's Repair Disc or the fsck –fy terminal command.
- It loads only required kernel extensions (some of the items in /System/Library/Extensions).
- It disables all fonts other than those in /System/Library/Fonts
- 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.
- 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 with the gray Apple and progress indicator (looks like a spinning gear). After startup, the words "**Safe Boot**" appear in red letters under the Apple logo on the Mac OS X login screen.

   Note: The Safe Boot process takes longer than normal startup. It can be quite long (several minutes) depending on the time it takes to check and repair the directory (if needed).
5. To exit Safe Mode, restart the computer normally, without holding down any keys at 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

Troubleshooting Steps

You should perform the first few steps of troubleshooting regardless of whether there is a repairable problem or damage.

Gather Information

Gather the normal information about the problem. (If you are not familiar with the normal information to gather, or any of the other steps, see General Troubleshooting Theory.)

Verify the Problem

Verify that the symptom exists as the customer reports it.

Try Quick Fixes

Special quick fixes that apply to this computer include:

- Familiarize yourself with the unit's normal operating temperature (see Knowledge Base document 30612)
- Make sure cable connectors are fully seated
- Reset the SMC. (See Knowledge Base document 303319).

For more details, see the Symptom Charts section.

Run Diagnostics

The following diagnostic tools are available for this product:

- Apple Hardware Test
- Apple Service Diagnostic

See Knowledge Base document 112125, "Service Diagnostic Matrix", to download the appropriate disc image.

Try Systematic Fault Isolation

There are no special systematic fault isolation techniques for this product.

Research

If you have not located the trouble following the steps thus far, try researching the symptoms. Research resources include:

- Symptom Charts section of this manual
- GSX
  gsx.apple.com
  Enter serial number and click Coverage Check
- Service Source
  service.info.apple.com
  Check Quick Links and/or Technical Resources
  Check options under appropriate Product Service pop-up menu
- Product support page
  service.info.apple.com
  Choose MacBook Support Page from the appropriate Product Service pop-up menu
- Knowledge Base
  search.info.apple.com
- Self-paced service training
  service.info.apple.com
  Choose Service Training from the Product Service pop-up menu

Escalate

Follow the practices and policies of your business or agency.

Repair or Replace

Once you locate the trouble, you will most likely need to repair the unit, or mail it in to an AppleCare Repair Center, depending on the service strategy in your region. Be sure to include the CompTIA code, the troubleshooting steps you performed, and the results in the Service Instructions section of GCRM and/or GSX.

If the symptoms point to a component on the logic board, use the block diagram at the end of this chapter to help determine whether you need to replace the entire logic board.

Verify the Repair

To verify the repair:

1. Attempt to recreate the original symptoms. You should not be able to. (If you can, return to the beginning of the troubleshooting flowchart.)
2. Perform the preventive maintenance tasks for this product. For this computer this includes only cleaning the display and case.

Inform the User

Include in the case notes all that you have done. The customer may like a copy of any diagnostic reports.

Important: For any unit you send on to a repair center, include the CompTIA code, symptoms, steps to reproduce, and troubleshooting steps you have completed thus far in the Service Instructions section of GCRM and/or GSX. (Service Instructions are also known as FAI notes.)

Complete Administrative Tasks

There are no particular administrative tasks for this product, other than those required by the internal policies of your business or agency.

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.

The steps to solve a symptom are listed sequentially. You might not need to perform every step before the symptom is resolved. 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 resolved.

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 from the battery and/or AC power adapter, pushing the power button will boot the system and begin the boot process.

- The screen will stay dark. The sleep LED will glow solid. This will last a few seconds.
- As the system boots, a power-on self test (POST) will be performed. See *POST Error Codes* listed later 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 will turn gray. 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 sleep light, no fan movement, no hard drive spin-up, no Caps Lock LED illumination when pressed, and no display illumination).

Note: After each step, check that the system is not supplying power to the logic board. If you see the sleep LED come on or the Caps Lock LED illuminate when the key is pressed, then the system is indeed drawing power. In this case, hold down the power button for six seconds to insure the system is shut down before working on the machine. At this point, the issue is no longer a "No Power, No Video" problem. Move on to the *Power, but No Video* troubleshooting section.

Note: Examine the display carefully. An image may be barely present on the screen, but with no backlight clearly illuminating the image. In this case, the system is working properly except for the backlight. Use the *Display: Dim Video* troubleshooting section to resolve this issue.

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 (on the bottom of the machine). At least one LED must light solid (not flashing). Make sure the battery is fully seated.
3. Connect a known-good Apple 85W Portable Power Adapter and power cord or plug to a known-good power outlet. If the DC plug is properly inserted, the LED should light up; if not, go to the *MagSafe connector* troubleshooting section.
4. Try powering up without the battery installed. If it boots, try a known-good battery. If it does not boot, replace the battery connector cable.

   Note: With the MacBook Pro (15-inch Early 2008), unlike previous models, if you use the MacBook Apple 60W Portable Power Adapter to power the system, the battery will need a minimum charge to be able to boot the system. If the battery is fully depleted and no 85W adapter is available, allow the battery to charge first before turning on the system.
5. Reset the SMC (power manager) as described in "Resetting the System Management Controller (SMC)" under "Troubleshooting Tips and Tricks" in the previous section.
6. Try to power 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. Go to the *Power, but No Video* troubleshooting section.
7. Verify that the power button cable is connected properly to the top case flex cable assembly and that the flex cable is connected correctly to the logic board. Try turning on the system.
8. Disconnect the keyboard completely. Inspect the connectors. With the keyboard disconnected, restart the system using the on-board startup jumper pads. If it boots, replace top case.
9. Remove any additional RAM.
10. 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.
11. Re-seat these flex cables:
    - Left I/O flex cable
    - Hard drive flex cable (will boot to flashing folder if not connected or corrupt)
    - Optical drive flex cable
    - Trackpad flex cable
    - Display LVDS cable
    - Thermal sensor cables
12. If the computer starts up, inspect any suspect flex cable connectors and their terminals on the logic board for damage and replace any damaged parts.
13. Replace the left I/O board.)
14. Replace the logic board.

Power-On Self Test (POST) 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 you hear beeps during startup. When this occurs, the sleep LED will stay on, occasionally flashing.

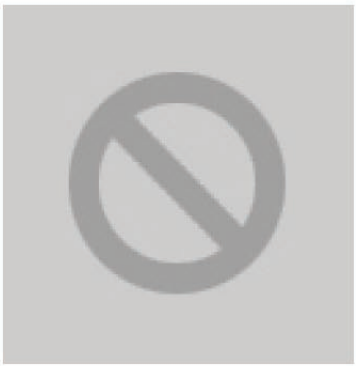
MacBook Pro relies on a combination of tones and blinking sleep LEDs to display power-on self test (POST) error codes.

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, the incorrect type of RAM, or not having any RAM installed.

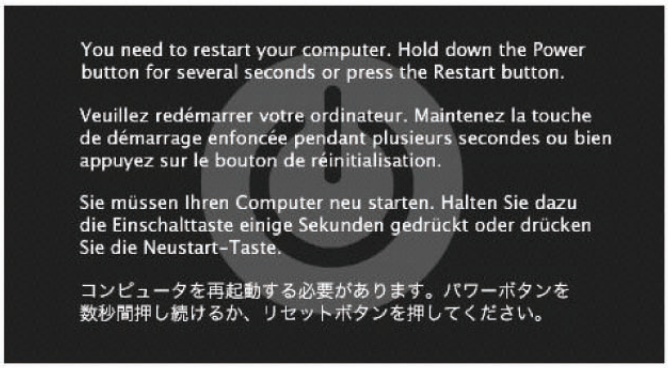
Some RAM may appear to pass the power-on self test (POST) but still cannot be addressed by the operating system. In this case, the computer will display a gray screen, sound three tones and blink the power LED on the front of the computer three times, pause, and repeat the blinking until the computer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

Related Knowledge Base articles:
303083: Intel-based Mac Power On Self Test RAM error codes
303363: Intel-based Mac: Startup sequence and error codes, symbols

Blue screen appears (a spinning disc cursor may also be visible), Prohibitory Sign appears (a), Kernel Panic dialog box appears (b), or Gray screen during startup



a) Prohibitory sign



b) Kernel panic dialog box

1. Make sure all external devices are disconnected and any ExpressCard has been ejected. If the 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.

Flashing question mark appears on the screen

Note: This system will only boot with the version of 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, select Disk Utility from the Installer menu under Utilities.
3. When Disk Utility opens, all mounted disk and volumes will be listed on the left hand side. 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 Disk Utility is unable to repair a persistent directory issue or corrupt file information, consult the following articles for possible solutions:
   - 106214: Using Disk Utility and fsck to resolve startup issues or perform disk maintenance
   - 25770: Handling "overlapped extent allocation" errors reported by Disk Utility or fsck
   - 302411: Disk Utility reports "Underlying task reported failure" when repairing a volume
5. If the hard drive is still not recognized, refer to the Internal Hard Drive Not Recognized troubleshooting section.
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 system and application software.

For further assistance in software troubleshooting, go to Knowledge Base article:

- 58042: A flashing question mark appears when you start your Mac
- 88410: SMART: A Brief Description

Power, but No Video (Computer begins to power up, the fans and hard drive spin, the Caps Lock key lights up when pressed, but there is no startup chime or video.)

Note: Examine the display carefully. An image may be barely present on the screen, but with no backlight clearly illuminating the image. In this case, the system is working properly except for the backlight. Use the *Display: Dim Video* troubleshooting section to resolve this issue.

1. Reset the SMC (power manager) as described in "Resetting the System Management Controller (SMC)" under "Troubleshooting Tips and Tricks" in the previous section.
2. Try connecting an external display to check for intact video signal. If external video appears, check the system for any pending software or firmware updates and update accordingly.
3. Verify that the LVDS cable connection is properly seated to its connector on the logic board and that the cables are not damaged.
4. Replace the display assembly.
5. Check all cable and flex connections to the logic board. Try restarting.
6. Replace the logic board.

System shuts down intermittently

1. Disconnect all external peripherals and eject any ExpressCard.
2. Consult system.log for possible shutdown error codes using Console (in Utilities folder).

Shutdown Code	Potential Indication, Issue and/or Fix
3	Normal behavior... power button was pressed for more than four seconds to force shutdown.
-5	Normal behavior... regular shutdown
-60	Try charging battery.
-70	Replace top case.
-72	1) replace heatsink sensor 2) reapply thermal paste 3) replace heatsink
-74	1) swap battery for KGB battery 2) replace battery
-78	Charger circuit on logic board... 1) try swapping for KGB left I/O board... replace if necessary 2) replace logic board
-82	Test thermal sensor JST connectors for improper seating or damage. Replace thermal sensor(s). See *Thermal Sensor* take apart section.

3. Make sure a known-good fully charged battery is fully inserted. Check that the battery latch is fully engaged and functional. Check the battery connection to logic board.
4. Make a visual inspection of the battery connector in the battery bay. The battery connector should allow for some play to align to the battery terminals. Make sure all blades are visible and not bent. If damaged, replace the battery connector.
5. Make sure the system is not overheating, the air vents are clear, and the unit was not being used on a soft surface.
6. Make sure all feet are still on the bottom case. If not, order foot replacement kit.
7. Check that the fan cables are connected and the fans are operational.
8. Remove the battery and connect a known-good 85W power adapter and power cord or plug to a known-good power source. If the DC plug is properly seated, the LED should light up. If not, consult the *MagSafe power adapter* troubleshooting section.
9. Verify that all three thermal sensor connectors are well seated to the logic board and that there is no damage to any of the cables.
10. Run ASD diagnostics to determine if any of the thermal sensors are not functioning correctly. Replace any failing sensors. See chart below for correlation between error code and part.

Name	Location
TC0D, TC0P, TG0P, TG0T, TG0D, Th0H	Main logic board
TB0T	Main battery
TW0P	AirPort Extreme Card
Tm0P	Left I/O board

Ts0P	Top case
Th1H	Thermal sensor on heatsink
TG0H	Bottom case thermal sensor near right fan
Th2H	Bottom case thermal sensor near left fan

11. Verify that the left I/O board cable is securely connected and shows no signs of wear.
12. Try known-good left I/O board.
13. Check that the thermal material between the heat exchanger and logic board is in contact by unscrewing the logic board screws and gently pulling up on the left side of the board to verify resistance caused by adhesion of the thermal material. If not, reinstall new thermal material for the processor, system controller, and video chips (see Logic Board Take apart).
14. 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 up; otherwise connect the adapter. The adapter LED should light when plugged in. If not, consult the *MagSafe power adapter* section for further troubleshooting.
3. After charging for a while, if the battery does not seem to charge, or if it is charged up but quickly discharges, replace the battery. Verify with a known-good battery.
4. Check battery connection to logic board, and check wire attachment to connectors.
5. If just before the system shuts down, the sleep LED briefly comes on, check the three thermal sensor connections to the main logic board. They should be fully seated with no damage to the wiring. If any thermal sensor is damaged, replace it.
6. If a known-good battery does not charge, replace the 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 that the application is compatible with OS X.
2. Reset PRAM. (After restart, hold down the Command-Option-P-R keys until you hear the startup chime at least one additional time after the initial 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."
5. Reboot the system.
6. Run Apple Service Diagnostic (ASD) 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 separate from the Bluetooth module, the AirPort antenna is in the clutch barrel behind the gray plastic window, and the Bluetooth module and antenna are mounted underneath the top case.

AirPort Extreme card is 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. Reset PRAM. (After restart, hold down the Command-Option-P-R keys until you hear the startup chime at least one additional time after the initial startup chime).
3. Open AirPort in System Preferences and make sure AirPort is on and Base Station is selected.
4. Re-seat 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 the AirPort Base Station or other AirPort device.
2. Check the number of users trying to use AirPort in the area. Too many users accessing the network at the same time can cause 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. For more information, consult these Knowledge Base articles: 58543: AirPort: Potential sources of interference., 307289: MacBook Air: Optimizing AirPort Performance while using Bluetooth, and 307296: MacBook Air: Optimize Wireless Communications when using an External Display
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. Make sure each connector is securely connected and placed in the proper order.
7. Re-seat the AirPort Extreme card in its slot.
8. Replace with known-good AirPort Extreme card.

9. Check AirPort Extreme antenna wires coming from clutch barrel for nicked insulator or crimped wire. If damaged, replace the display assembly.
10. Check the left I/O flex cable for proper seating on both the left I/O board and logic board.
11. Replace the left I/O board.
12. Replace the main logic board.

Battery

Warranty Note: If the battery is determined to be the root cause of the customer issue, see Kbase article 500644: Portable Computer Battery Screening Process for Apple Service Providers to determine if the battery can be replaced under the one-year limited warranty.

Before troubleshooting battery-specific issues, make sure to check Software Update in the System Preferences or see the Apple Software Updates web page for battery-related software updates.

Battery will not pop up

1. Flip over the unit and slide the battery latches to their full extent.
2. If the battery does not pop up, use a small plastic flat-blade tool to pry up the battery around the battery latch. If the battery is swollen, replace the battery. See below.
3. Try a new battery.
4. Verify proper latch operation by exercising the latch. If it does not move smoothly or evenly, try disassembling the battery latch. Check that the spring held between the latch cover and the battery latch pin is intact.
5. Replace the bottom case.
6. 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.

Swollen battery

1. Symptom(s):
   - The computer may not run off battery power alone
   - The computer wobbles and won't sit flat on a flat surface
   - The trackpad button is continually pressed and doesn't release (in this case, test by removing the battery to see if the trackpad button functionality returns).
   - A swollen battery can expand and cause the battery case to break open, exposing cells. Use care and common sense when handling a battery with exposed cells.
2. If the bulged battery will not release/come out of the unit, try removing the top case to help release the battery.

3. Replace the battery.

For more information and visual examples, consult Knowledge Base article 303922: MacBook, MacBook Pro (15-inch), or MacBook Pro (17-inch) with swollen battery.

The battery won't charge

1. Remove any externally connected peripherals.
2. Try a known-good power outlet.
3. Connect a known-good MagSafe 85W power adapter with power cord or plug. If the DC plug is properly inserted, the LED should light up. If not, troubleshoot the *MagSafe connection* and power adapter. If the LED 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 a known-good battery. If it charges, replace the battery. If doesn't charge, check the battery connector and its connection to the logic board.
5. Reset the SMC (power manager) as described in "Resetting the System Management Controller (SMC)" under "Troubleshooting Tips and Tricks" in the previous section.
6. Make sure the left I/O cable is firmly connected. Look for damaged insulation or wires.
7. Replace the battery connector assembly (requires removing the logic board).
8. Replace left I/O power cable.
9. Replace the left I/O board.
10. 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: Apple portable computer's battery does not show a full charge in Mac OS X.

Short battery life

Three categories to consider:

1. 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 set up for heavy battery power use (AirPort on, optical media always in drive, Energy Savings set to Highest Performance, etc).
    - Use Activity Monitor to check for any runaway applications. Stop any runaway processes.
    - Test the computer with all third-party devices (printers, hubs, third-party keyboard or mouse) removed.

2. Reset the SMC (power manager) as described in "Resetting the System Management Controller (SMC)" under "Troubleshooting Tips and Tricks" in the previous section.

3. 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:

   a. Plug in the power adapter and fully charge your battery until the light on the power adapter plug changes to green and the on-screen meter in the menu bar indicates that the battery is fully charged.

   b. 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.

   c. 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.

   d. Continue to keep your computer turned on until it goes to sleep.
   Note: Save all your work and close all applications when the battery gets low, before the system goes to sleep.

   e. Turn off the computer or allow it to sleep for five hours or longer.

   f. Connect the power adapter and leave it connected until the battery is fully recharged again.

3. The battery has a defect.
   - Symptoms include, but are not limited to, a relatively new battery that will not charge at all, reports an "X" in the menu bar icon, or a 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 at the beginning of this section.

Useful Knowledge Base articles:
- 86440: Apple Portables: Battery life
- 86284: Calibrating your computer's battery for best performance
- 304301: MacBook and MacBook Pro: Battery not recognized after being fully drained

Bluetooth

Bluetooth system preference pane does not show up under hardware section of System Preferences

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

Bluetooth card not recognized by other devices

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

Display

Display latch not working

Note: As 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.

See *Latch Adjustment* chapter for more information on adjusting the latch mechanism.

If one or both of the latch hooks are 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

Acceptable Number of Subpixel Anomalies

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

3. 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

4. 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 general ExpressCard standard does allow for 54mm cards which will not fit in this slot.
2. Make sure the ExpressCard is oriented right side up (cards are keyed and cannot be inserted upside down).
3. Verify that 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, the door may be catching on the top of the ExpressCard mechanism. Adjust the position of ExpressCard cage on the left I/O board by making sure the cage is closer to the main logic board.
7. Re-seat the ExpressCard cage.
8. If the ExpressCard cage is damaged, replace it.
9. Replace the left I/O board.

ExpressCard does not mount to the desktop

1. Make sure the correct drivers are installed for that ExpressCard.
2. Check to see 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. Try inserting the card without the ExpressCard cage installed on the left I/O board. If the card is recognized, reinstall the ExpressCard cage with the card in place to ensure the card cage properly aligns to the connector on the left I/O board.
5. Replace the left I/O flex cable.
6. Replace the left I/O board.
7. 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.

To format a blank hard drive:

- Boot from the MacBook Pro Mac OS X Install Disc 1 which came with the system (hold down "C" key while booting).
- Select the desired language.
- Select Disk Utility, under the Utilities menu.
- Click the Erase tab.
- Select the hard drive in the Source pane.
- Verify that Mac OS Extended (Journaled) is selected.
- Click Erase.

5. Continue using the MacBook Pro Mac OS X Install Disc 1 to install the system software.
6. Restart the computer and run Software Update and install updates. Continue to run Software Update until no more updates are listed.

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

System boots to flashing question mark:

Refer to the previous *Flashing Question Mark* section for tools to troubleshoot this issue.

Internal hard drive not recognized:

1. Boot from the MacBook Pro Mac OS X Install Disc 1 which came with the system (hold down "C" key while booting).
2. If not the primary boot volume, use Apple System Profiler to check under 'Hardware: Serial-ATA' option to see if the system recognizes the hard drive hardware.
3. Check the SMART status. If the status is 'About to Fail' or 'Failing,' replace the hard drive.
4. Re-seat the hard drive flex cable.
5. Check the hard drive flex cable for damaged connectors (a connector peeled off the flex cable, for example); if damaged, replace the hard drive flex cable.
6. If still not recognized, replace the hard drive.
7. Replace the logic board.
8. Reinstall system software using the MacBook Pro Mac OS X Install Disc 1.

   Note: Don't forget to install both the Mac OS X system and application software.

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

Apple 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 (infrared) 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" check box in the Security pane of System Preferences is NOT checked.

1. 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.

2. 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: Pairing your Apple Remote with your computer.

3. 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.

4. Replace the Apple Remote battery. See Knowledge Base article 302543: How to replace the Apple Remote battery.

5. Replace the Apple Remote.

Infrared Board

Note: Infrared transmission loses strength in daylight. If the remote control is being used near a bright window or outdoors, the system may not respond.

Supported applications do not respond to input from the remote control

1. Make sure "Disable remote control infrared receiver" check box is not checked.
2. 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 preference pane.)

   For further instruction, consult Knowledge Base article 302545: Pairing your Apple Remote with your computer.
3. Perform the checks above under "Apple Remote" to verify that the Apple Remote is functioning correctly, and then retest.
4. Check that the infrared board cable is connected to the hard drive flex and infrared board.
5. Verify that the infrared sensor can be seen in Apple System Profiler. Open Apple System Profiler and check to see that IR Receiver appears under the USB Bus tab in the USB device section. If you don't see it, replace the infrared board and retest.
6. Replace the hard drive flex and retest.
7. Replace the logic board.

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 that the camera is recognized by the iChat AV software. Is the camera recognized?
3. Check the camera connection to main logic board. Try re-seating the connector.
4. Check the camera connection from the logic board to the camera board (in the display assembly). Try re-seating the connector.
5. Replace the display assembly.

Camera image quality poor

1. 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 careful not to scratch the lens. Verify that there is sufficient lighting to produce a good

quality image.

2. 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. Continue troubleshooting.

3. Check the flex connections from camera to camera board in the display assembly. Try re-seating the connectors.

4. Replace display assembly 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 sound input port.
   - Use the volume level meter to verify that the input volume settings 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. Reset PRAM. (After restart, hold down the Command-Option-P-R keys until you hear the startup chime at least one additional time after the initial startup chime).

4. Check that the speaker/microphone connector is plugged in.

5. Check that the left I/O flex cable connector is properly seated on the logic board.

6. Replace the speaker assembly.

7. Replace the left I/O board.

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.
   - Use the volume level meter to verify that the input volume settings are appropriate.

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 that the speaker/microphone connector is plugged in.

4. Replace the speaker assembly.

5. Replace the left I/O board.

Keyboard

No response from keys on the keyboard

1. Remove any connected peripherals and eject any ExpressCard.
2. If only numbers show up, check if NUM lock (F6) is engaged. **Note**: This step does not apply to MacBook Pro (15-inch Early 2008).
3. Go to Apple System Profiler and look under the USB Bus tab in the USB device section. If you see Apple internal keyboard / trackpad, go to step 6.
4. Attach an external USB keyboard. If the external keyboard doesn't work, go to step 6.
5. Turn off the computer. Check the keyboard flex cable connection to the trackpad and the trackpad flex cable connection to the main logic board (also check connectors for damage).
6. 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.
7. Replace the keyboard.
8. Replace the top case.
9. Replace the logic board.

No keyboard illumination

1. Go to the Keyboard system preference pane and make sure the "Illuminate keyboard in low light conditions" check box is checked. Cover the left and right speaker grills with your hands. **Note:** The keyboard illumination is not bright enough to be seen in most well lit spaces. In order to view the keys being illuminated, the ambient light needs to be dim.
2. Check the keyboard backlight flex cable connection to the top case flex cable.
3. Replace the keyboard.
4. Replace the top case.
5. Replace the left ALS board.
6. Replace the logic board.

Keyboard is partially illuminated.

1. Check the keyboard backlight cable connection to the top case flex.
2. Replace the keyboard.
3. Replace the top case.

Microphone

The microphone is not working

1. Check the Sound system preference pane and verify that the selection under the Input tab is built-in microphone.
2. Check the signal level and level meter and adjust the gain.
3. Reset PRAM. (After restart, hold down the Command-Option-P-R keys until you hear the startup chime at least one additional time after the initial startup chime).
4. If there is no sound output from the internal speaker nor is the microphone working, verify all cable connections.
5. Check the left I/O flex connection to the logic board.
6. Replace the speaker assembly.
7. Replace the left I/O flex cable.
8. Replace the left I/O board.
9. Replace the logic board.

Modem (External)

Note: MacBook Pro does not have a 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.
7. Open Apple System Profiler, and look for Apple External Modem in the USB Device Tree under the Hardware tab. If it does not appear, check the modem USB connection.
8. Update the system software.
9. Try a known-good Apple USB modem in all USB ports. If it does not work in either of the two left USB ports, replace the left I/O board. If it does not work in the right USB port, replace the 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 that the 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 look for Apple External Modem in the USB Device Tree under the Hardware tab. If it does not appear, check the modem USB connection.
5. Replace the Apple USB Modem.
6. Replace the 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 check that it is firmly installed when used. If telephone cable is bad, replace it.
2. If the issue happens with only one particular phone line, but not another, the problem may be an issue with that phone line. Under bad line conditions, 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, suggest to the customer to use the modem with less applications running simultaneously.
4. Replace the Apple USB modem.
5. Replace the logic board.

Optical Drive

Optical drive not recognized

1. Make sure the optical drive is a cable select drive set as a slave (1).
2. Reset PRAM. (After restart, hold down the Command-Option-P-R keys until you hear the startup chime at least one additional time after the initial startup chime).
3. Make sure the optical drive flex cable is undamaged and properly installed. If damaged, replace the flex cable.
4. Replace the optical drive.

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

1. Verify that the media is not warped and is a standard 12 cm circular disc.
2. Check for a small (non-standard) disc or other foreign object stuck inside. Remove the optical drive from the system to extract a stuck disc. See *Removing a stuck disk* in the optical drive chapter of the take apart section.
3. Verify that the disc is pushed almost all the way into the slot.
4. Check that the optical drive flex cable is undamaged and properly installed. If damaged, try replacing the flex cable.
5. Replace the optical drive.

The optical drive does not eject CD or DVD discs

1. Verify that the 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 then Media Eject key. If that does not work, hold down Function (fn) key and Media Eject key simultaneously.
3. Drag the disc icon to trash, or select it and press Command-E.
4. Choose Restart from Apple menu while holding down trackpad button during startup.
5. Check the optical drive flex cable for proper connection to the logic board.
6. Re-seat the optical drive mechanism. Make sure the drive is oriented toward the back of the computer, and that all four corners are seated, so that the drive sits flat in its bay.
7. Replace the optical drive.

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

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

Difficulty writing to optical media

1. Verify that 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. Use the Software Update system preference pane to check for updated drivers or firmware.
4. Replace the optical drive flex cable.
5. Replace the optical drive.

Ports

A USB port is not recognizing devices

1. Shut down the computer; then press the power button to start the computer.
2. Use Software Update system preferences to verify that the latest software is installed.
3. Test the ports with a known-good Apple keyboard or mouse.
4. Use Apple System Profiler to verify that the computer is recognizing the bus.
5. If the left port is not recognized, check the left I/O flex cable's condition and connection.
6. If the right port is not recognized, check the backup battery flex cable and connections.
7. If the left I/O flex cable is intact and well-seated, and the left USB port is still not recognized, replace the left I/O board.
8. If the backup battery flex cable and connections are intact and well seated, and the right USB port is still not recognized, replace the main 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. Shut down the computer; then press the power button to start the computer.
2. Verify that the current driver for the device is installed.
3. If the device is a camera, turn on the camera only after initiating the download with the camera application.

4. Try the other USB port.
5. Try a different USB device on same port.
6. Eliminate any device chains by plugging in only one peripheral.
7. Test the USB ports with a known-good Apple USB keyboard or mouse.
8. If the left port is not recognized, check the left I/O board flex cable and connections.
9. If the right port is not recognized, check the backup battery flex cable and connections.
10. If the left I/O flex cable is intact and well-seated, and the left USB port is still not recognized, replace the left I/O board.
11. If the backup battery flex cable and connections are intact and well seated, and the right USB port is still not recognized, replace the main logic board.

A FireWire port is not recognizing devices

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 the correct drivers are properly installed for third party devices, if needed.
3. Make sure the FireWire cable is firmly attached.
4. Try a known-good FireWire cable.
5. If the device is self-powered, make sure that the power supply is connected and the device's LED indicates it is getting power.
6. Replace the logic board.

MagSafe 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 AC power cord. If the adapter works, replace the plug or cord.
3. Check if pins are missing or bent. If so, replace the power adapter.
   - Check the pins in the power adapter's DC plug for pins that are stuck down.
   - If pins are stuck down, check for debris blocking one or more pins. Carefully clear the pins with metal tweezers. If necessary, clean the pins as described below.
   - If the pins appear OK, but the LED on the MagSafe connector does not light up, clean the pins as directed in Kbase article 303240: Use and cleaning of power adapter with MagSafe connector.
4. Remove the battery and connect the power adapter. If the adapter turns on and boots the system, replace the logic board.

Sound

No sound is audible but the Speakers section of the Sound system preference pane indicates 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, 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. (After restart, hold down the Command-Option-P-R keys until you hear the startup chime at least one additional time after the initial startup chime).
4. If the system continues to indicate a phantom device is plugged into the system, replace the left I/O board.
5. Replace the logic board.

No sound from speaker(s)

1. Use Software Update to verify that the latest audio update has been installed.
2. Press F10 (with the fn key pressed and then not pressed) to verify that mute mode is not enabled.
3. Press F11 or F12 (with the fn key pressed and not pressed) to check the volume setting.
4. Verify that 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 detecting that there are no external speakers or headphones connected. If so, use the previous troubleshooting procedure.
6. Shut down the computer and restart.
7. Reset PRAM. (After restart, hold down the Command-Option-P-R keys until you hear the startup chime at least one additional time after the initial startup chime).
8. Verify that the speaker cable is properly connected to the left I/O board.
9. Check the speaker cable. Verify left and right cable connections.
10. Verify sound output with known-good headphones or external speakers. If audio is heard, replace the speaker assembly.
11. Replace the left I/O flex cable.
12. Replace the left I/O board.
13. Replace the logic board.

Distorted sound from speakers

1. Verify that the sound quality is normal with known-good external speakers/headphones. If the sound quality is normal, check the speaker wire and connections.

2. In the Sound system preference pane, check the balance.
3. Compare the same sound and same settings with two different units to make sure that sound is actually distorted. If abnormal, replace the speaker assembly.
4. Check the speaker wire. If damaged, replace the speaker assembly.
5. Replace the left I/O flex cable.
6. Replace the left I/O board.
7. Replace the logic board.

Trackpad

The cursor does not move when you are using the trackpad

1. Verify that no USB device is connected.
2. Boot from the Software Install and Restore DVD to verify that the issue is not software related. If the trackpad works, restore the system software.
3. Reset the SMC (power manager) as described in "Resetting the System Management Controller (SMC)" under "Troubleshooting Tips and Tricks" in the previous section.
4. Check the trackpad flex cable connection to the logic board.
5. Replace the top case.
6. Replace the logic board.

The cursor intermittently stalls or moves erratically

Notes:

- The user must touch with the surface of the trackpad with 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.
- When using an AC power adapter, you may need to have a three prong ground to eliminate noise coming from the AC outlet. If a grounding plug is not available, instruct the customer to have their palms touching the top case while using the trackpad.

1. Clean the trackpad surface (with the computer off) using a non-static-inducing material.
2. Shut down the system, then press the power button to start the computer.
3. Reset the SMC (power manager) as described in "Resetting the System Management Controller (SMC)" under "Troubleshooting Tips and Tricks" in the previous section.
4. Make sure the power adapter is connected to a known-good outlet using the AC power cord, not the duckhead. If the intermittent behavior goes away, recommend using the AC cord to provide a grounding path for static.
5. 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.

6. Check the trackpad flex cable connection to the logic board.
7. Replace the top case.
8. Replace the logic board.

Video

No video, but computer appears to operate correctly

See *Power, but No Video* section under the Startup section at the beginning of this chapter.

Dim display, but computer appears to operate correctly

1. Remove any connected peripherals.
2. Make sure the F1 key is not stuck down.
3. Press the F2 key (with the fn key pressed and not pressed) to increase the screen brightness.
4. Open Display system preference panel and check brightness. If works, replace keyboard.
5. Shut down the computer and restart.
6. Reset PRAM. (After restart, hold down the Command-Option-P-R keys until you hear the startup chime at least one additional time after the initial startup chime).
7. Try connecting an external display to check for intact video signal. If no external video appears, skip to step 10 below. Otherwise proceed to next step.
8. Verify that the left I/O flex cable and DC-to-DC cable connections are seated properly and that the cables are not damaged.
9. Replace the DC-to-DC board.
10. Replace the left I/O board.
11. Replace the display assembly.
12. Replace logic board.

Computer appears to work, but there is no video on an 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 that the test monitor being used is a known-good device supported by this computer.
3. Try a different DVI-to-Video Adapter.
4. Replace the logic board.

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

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

Display has repetitive patterns or shifting color pattern

1. Check for the latest system software update.
2. Check that the LVDS connection is fully seated on the logic board.
3. Hook up an external display. If the external video displays the mirrored image correctly, replace the display assembly.
4. Replace the logic board.

Display has permanent vertical or horizontal lines.

1. Check for the latest System software update
2. Hook up an external display. If the external video displays the mirrored image correctly, replace the display assembly.
3. Check that the LVDS connection is fully seated on the logic board.
4. Replace the logic board.

Miscellaneous Symptoms

The Date and Time settings reset repeatedly

Note: Resetting the power manager and/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 main battery from the unit and leave it plugged in for at least 5 hours.
2. Replace the backup battery.
3. Replace the logic board.

Feet came off the bottom case

Replace the missing foot or feet.

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, the computer is not detecting a closed display. If the LED does not go on, skip to step 3.
2. Place a magnet over the sleep sensor board in the top case. If the system goes to sleep, replace the magnet in the display housing.
3. Check that the sleep sensor in the top case is plugged in.
4. Check that the sleep LED is plugged into the logic board.
5. Connect a USB mouse. Short the power on pads on the logic board to boot the system and use the mouse to put the system to sleep from the menu. Measure the voltage at the LED connector. If power is present, replace the bottom case.
6. Replace the logic board.

Unit unusually hot

This computer runs hotter than previous models. However, the normal operating temperature is well within national and international safety standards. Nevertheless, customers may be concerned about the unit overheating. To prevent an unneeded repair, you can compare a customer's computer to a running model, if available, at your repair site.

1. Verify that the customer uses the computer while it is placed on a flat, hard surface.
2. Verify that the computer is hotter than expected for normal operation. If possible, compare how hot the computer case feels with how hot the case of a running display model feels.
3. If the computer is running at a temperature comparable to the test model, refer the customer Knowledge Base article 30612: Apple Portables: Operating Temperature
4. Use Activity Monitor to check for runaway applications.
5. Check the processor speed.
6. Is the processor speed running at the setting the customer set?

   Yes: Continue with the next step.

   No: The computer could be overheating. The operating system will automatically reduce the processor speed if the computer starts to get too hot. Continue with the next step.
7. Check for a failed fan.
8. Can you hear the fan running?

   Yes: Continue with the next step.

   No: This computer has only one fan. If the unit feels too hot and you do not hear a fan running or cannot feel the air venting over the top of the keyboard, the fan may have failed. Proceed to the Take Apart procedure for replacing the fan.
9. Check for misplaced or inadequate thermal grease.

   Each processor chip should have .01 to .12 cc (one-third of a single syringe) of grease on it.

It should look completely covered. See the *Heatsink* chapter of the Take Apart section for complete details.

10. Is the thermal grease applied in the right places and in the right amount, according to the service manual?

    Yes: You have eliminated all the immediately known potential causes of an unusually hot unit. Proceed to the Systematic Fault Isolation step of the troubleshooting flowchart.

    No: Apply the thermal grease correctly, according to the instructions in the service manual then proceed to the Verify Repair step of the troubleshooting flowchart.

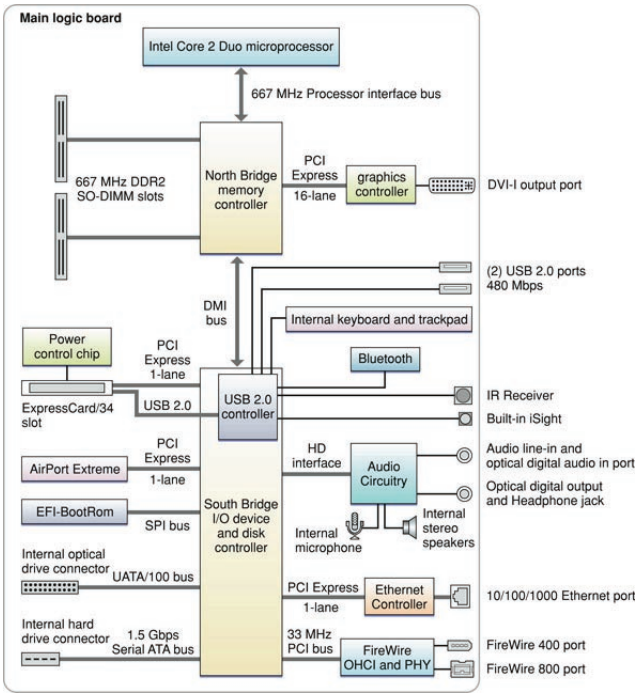
For more information on the operating temperature of Apple portable computers, see Knowledge Base article 30612: Apple Portables: Operating Temperature.

Architecture

The architecture of the MacBook Pro is based on the Intel Penryn microprocessor and two integrated circuits (ICs): the North Bridge memory controller and the South Bridge I/O controller, connected to each other by a Direct Media Interface (DMI) bus. The North Bridge IC provides the bridging functionality among the processor, the memory system, the DMI bus, and the 16-lane PCI Express bus to the graphics controller. The South Bridge IC supports these components:

- Ultra ATA/100 bus for the optical drive (running at UATA/66)
- A 1.5 Gbps Serial ATA (SATA) bus for the hard disk drive
- 1-lane PCI Express link for the AirPort Extreme module, 1 for Ethernet, and 1 for ExpressCard
- SPI bus, direct memory access bus to the boot ROM
- USB 2.0 controller, which in turn supports the Bluetooth module, IR receiver, built-in iSight camera, built-in trackpad and keyboard, ExpressCard 34 mm slot, and 2 USB 2.0 ports
- Channel to the audio subsystem
- 33MHz, 32-bit internal PCI bus to the FireWire 400 (1394a) and FireWire 800 (1394b)
- Direct Media Interface (DMI) bus

Figure 1 provides a simplified block diagram of the North Bridge and South Bridge ICs and the buses that connect them together.



Service Source

Views

MacBook Pro (15-inch Early 2008)

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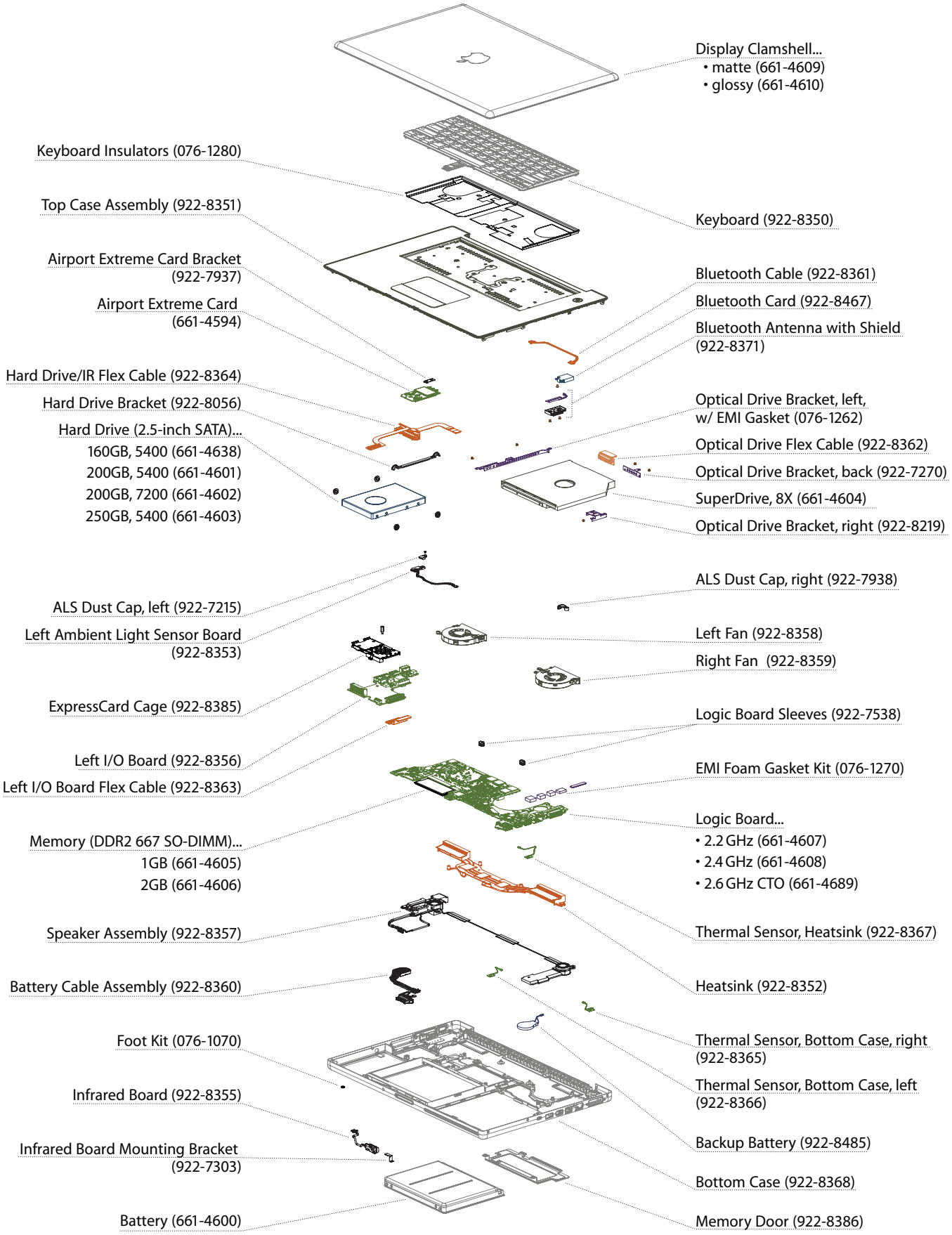
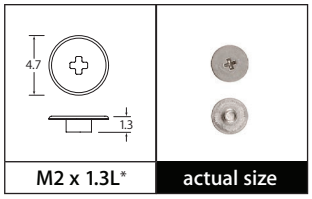
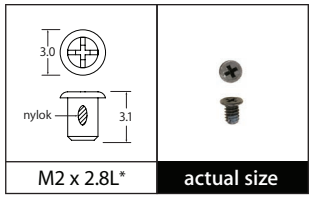
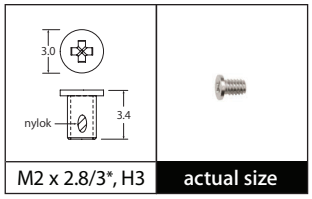
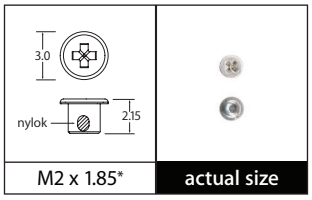
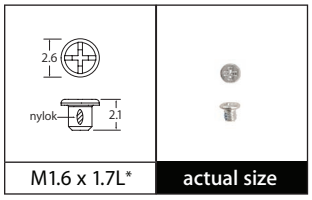
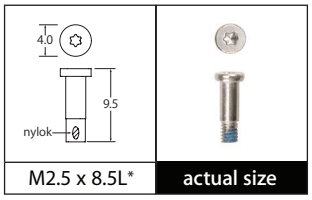
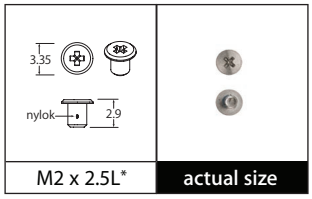
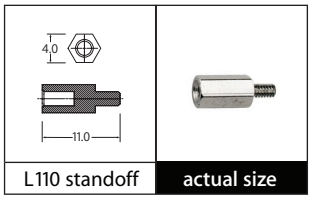
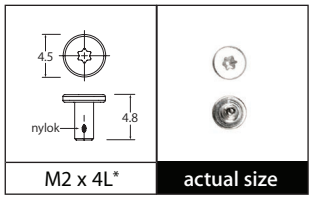
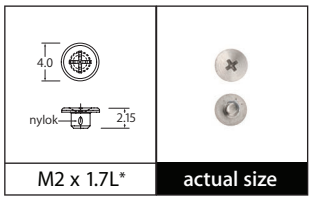
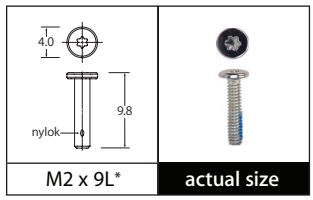
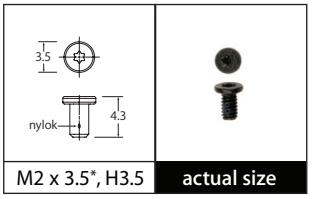
MacBook Pro (15-inch Early 2008) Exploded View

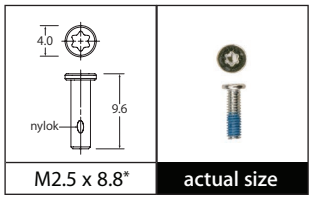
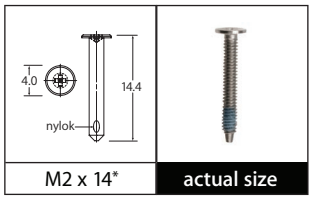
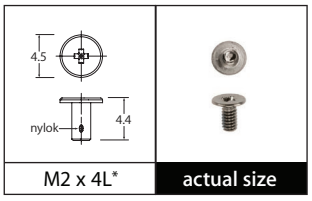
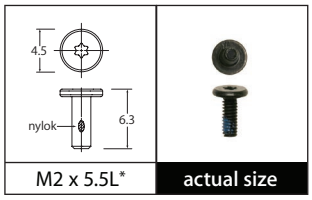
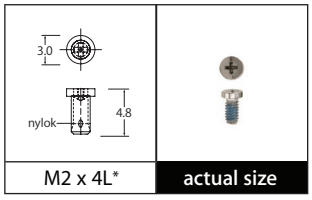
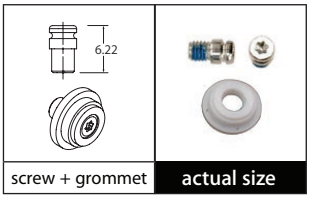
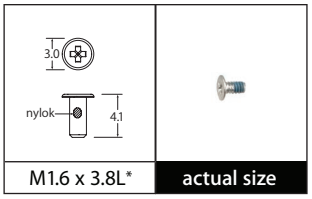
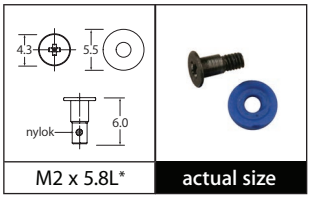
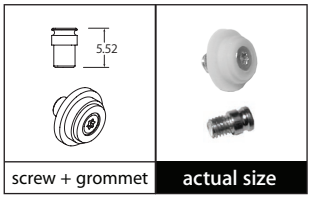
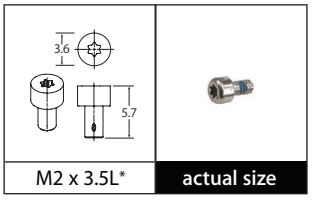
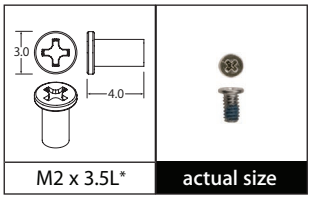
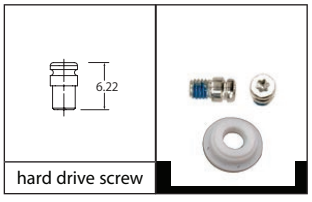


Screw Chart

922-5838 **Phillips**  keyboard	**922-6090** **Phillips**  ALS, optical drive, display	**922-6091** **Phillips**  bottom case (left, right, back)
922-6488 **Phillips #0**  optical drive brackets	**922-7101** **Phillips**  left ALS dust cap, latch hooks	**922-7182** **Torx T6**  display, clutch blocks, battery cable assembly
922-7203 **Phillips**  top case to internal frame inside the battery well	**922-7204** **4mm Hex Bolt**  left I/O board	**922-7262** **Torx T6**  main logic board
922-7284 **Phillips**  RAM door to bottom case	**922-7305** **Torx T6**  under RAM door to top case	**922-7306** **Torx T6**  Airport card bracket, both speakers, left I/O board

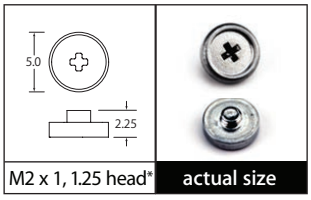
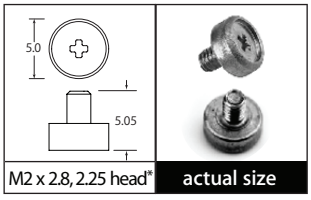
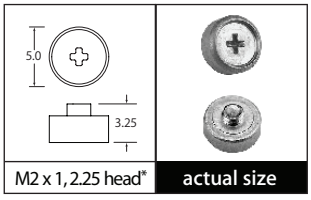
**This screw specification is thread and shank only. See CAD diagram above it for full screw length (including head).*

Screw Chart

922-7307 **Torx T6**  fans, LVDS cable, display	**922-7309** **Phillips**  bottom / top case	**922-7310** **Phillips**  left dust cap, display hooks
922-7311 **Torx T6**  left fan on lower right side	**922-7345** **Phillips**  display rear housing	**922-7941** **Torx T6**  hard drive screws
922-7943 **Phillips**  optical drive to frame	**922-7946** **Phillips**  optical drive screw w/ washer	**922-7978** **Torx T6**  HDD screw + grommet, right
922-8008 **Torx T6**  infrared mounting bracket	**922-8057** **Torx T6**  hard drive bracket	**922-8148** **Phillips**  hard drive screw

**This screw specification is thread and shank only. See CAD diagram above it for full screw length (including head).*

Screw Chart

922-8145 Phillips	922-8146 Phillips	922-8147 Phillips
		
ExpressCard cage	ExpressCard cage	ExpressCard cage

**This screw specification is thread and shank only. See CAD diagram above it for full screw length (including head).*