Apple Technician Guide

MacBook Pro (13-inch)

MacBook Pro (13-inch, Mid 2009)
MacBook Pro (13-inch, Mid 2010)

Updated: 2010-09-14

MacBook Pro (13-inch)

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Manual Updates

Updated 14 September 2010

Troubleshooting:
- General: Added new sections for Logic Board Power-On Pads (Mid 2009) and (Mid 2010)
- Symptom Charts: Startup and Power Issues: No Power and Mechanical: Reset/Power Button Stuck: Linked to new Logic Board Power-On Pads sections

Updated 16 August 2010

Troubleshooting:
- General: Revised instructions for resetting SMC.
- Symptom Charts: Startup and Power Issues: No Power:
  Revised Quick Check regarding Battery Diagnostic Utility;
  Revised step 11 regarding power-on pads for MacBook Pro (13-inch, Mid 2009).

Take Apart:
- Logic Board and Left Speaker: Added instruction if transferring left speaker to a new logic board, take care not to rip foam pads when removing speaker from old logic board.

Updated 7 June 2010

Troubleshooting:
- Symptom Charts: Communications: AirPort/Bluetooth: Defective Wireless Devices:
  Revised order of steps and added instruction to cycle display clamshell open/closed when testing and verifying AirPort issues.

Take Apart:
- Bottom Case, Camera Cable Guide, Display Clamshell: Added instruction to remove and discard Right Clutch EMI Gasket during any repair of a MacBook Pro (13-inch, Mid 2010).

Additional Procedures:
- Added section for Right Clutch EMI Gasket Removal (applies to MacBook Pro (13-inch, Mid 2010) only).

Views:
- Added screw diagrams for MacBook Pro (13-inch, Mid 2010).

Updated 14 May 2010

Basics:
- Added section for keycap replacement parts & procedures.

Troubleshooting:
- Symptom Charts: Input/Output Devices: Built-in Keyboard Does Not Work Properly, Symptom Charts: Input/Output Devices: Specific Keys Don't Work:
  - Modified for keycap replacement procedures.
- Moved SD Card sections from Input/Output Devices to Mass Storage.

Take Apart:
- Camera Cable Guide, Display Assembly: Added warning about camera cable routing at camera cable guide.

Updated 13 April 2010

Updated information throughout to add new model, MacBook Pro (13-inch, Mid 2010), and corresponding new part numbers and diagnostics versions.

Troubleshooting:
- General: Updated Functional Overview & Block Diagram for MacBook Pro (13-inch, Mid 2010)
- General: Updated info about Liquid Contact Indicators (LCI).
- General: Updated info about Clamshell Service Diagnostic (CSD).

Take Apart:
- Optical Drive: Procedure rewritten; no longer requires removal of right speaker.
- Logic Board: New images to clarify cable routing of microphone cable and MagSafe board cable on back side of logic board.

Views:
- Exploded Views: Updated part numbers for MacBook Pro (13-inch, Mid 2009); added new model, MacBook Pro (13-inch, Mid 2010)
- Internal Views: Added new section.

Updated 15 January 2010

Take Apart:
- Battery: Added battery label reminder

Updated 08 January 2010

Take Apart:
- Bottom Case: Updated 3-mm long screws to 922-8972

Views:
- Screw Location Diagrams: Bottom Case: Updated 3-mm long screws to 922-8972

Updated 21 December 2009

Take Apart:
- General Information: Connector Types on Logic Board: Revised camera cable gasket drawings
- Display Assembly: Revised camera cable gasket drawings

Troubleshooting:
- Symptom Charts: Startup and Power Issues: No Power: Added new step 10 in Deep Dive table as a reminder to check camera cable gasket

Updated 2 December 2009

Troubleshooting:
- General Troubleshooting: Added new section "Clamshell Service Diagnostic Read Me"
- Symptom Charts: Startup and Power Issues: Revised for Clamshell Service Diagnostic (CSD) considerations
- Symptom Charts: Communications: Revised for CSD considerations
- Symptom Charts: Display: Revised for CSD considerations

Updated 2 September 2009

Take Apart:
- Battery: Added battery screw part numbers to step 2

Views:
- Screw Location Diagrams: Main Modules: Added battery screw part numbers

Updated 17 August 2009

Troubleshooting:
- General Troubleshooting: Added section "Display Hinge Behavior".

Take Apart:
- Battery: Updated wording about warning label. When same battery is installed, keep same warning label attached to battery. (A new battery includes a new warning label.)

Updated 22 July 2009

Troubleshooting:
- General Troubleshooting: Replaced Troubleshooting Theory link with new reference.

Take Apart:
- Connector Types on Logic Board: Modified camera cable shim **Cautions**. If the camera cable shim is not replaced during reassembly, the camera cable could work loose, resulting in a short or no video. A replacement shim is now included with replacement logic boards.
- Tools: Removed flat-blade screwdriver; added tri-lobe screwdriver part number
- Battery: Added tri-lobe screwdriver part number

- Hard Drive: Added step to remove two additional screws before removing hard drive.
- Optical Drive, Display Assembly, and Logic Board: Added link to Connector Types.

Updated 19 June 2009

Take Apart:
- Tools: Corrected part number for thermal grease.

Updated 10 June 2009

Troubleshooting:
- Built-in Trackpad Does Not Work: Modified Deep Dive table for trackpad replacement
- Built-in Trackpad Does Not Track Properly: Modified Deep Dive table for trackpad replacement

Take Apart:
- Battery: Removal: Added "trackpad" to first note
- Trackpad: Added new section following Battery for trackpad replacement instructions

Apple Technician Guide introduced 08 June 2009

Feedback

We want your feedback to help improve this and future Technician Guides!

Please email any comments to:

smfeedback6@apple.com

Apple Technician Guide

Basics

MacBook Pro (13-inch)

Overview

The MacBook Pro (13-inch) features a higher-capacity, longer-lasting embedded battery, a high-speed FireWire 800 port, and an SD card slot for removable flash media.

The higher capacity battery must be serviced only by an Apple Authorized Service Provider. The customer must not attempt to remove or service this battery, and doing so may void their warranty.

Refer to the following site for available configurations of the MacBook Pro (13-inch, Mid 2009) and MacBook Pro (13-inch, Mid 2010): **http://support.apple.com/specs/**

Safety: Battery Precautions

This computer contains an internal-only battery that is serviceable by Apple-authorized service providers only. Tamper-proof screws are employed to prevent customers from attempting to remove it.

WARNING: **Every time you remove the bottom case, disconnect the battery cable from the logic board.**

WARNING: Because the battery is internal and connected to the logic board by a cable, it **MUST BE DISCONNECTED** before performing service procedures. If you fail to do so, live current from the battery will short circuit the components and render the logic board and/or LVDS cable unusable.
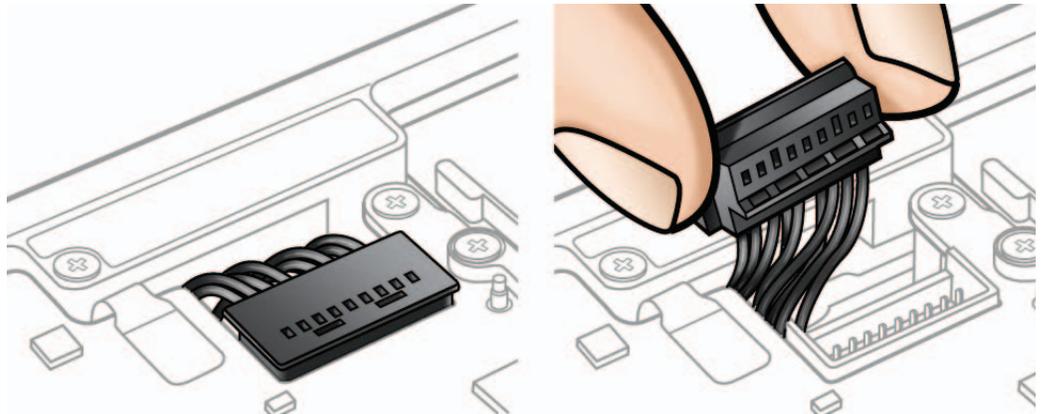
Serial Number Location

Turn over the computer to see the serial number etched on the bottom case near the hinge.
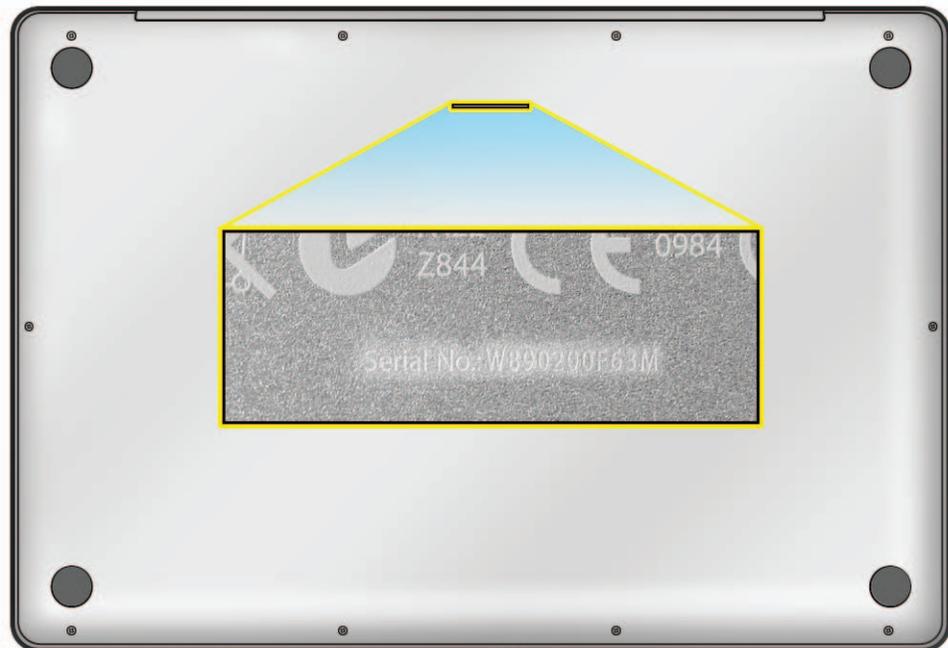
Transferring the Serial Number

When replacing a bottom case, retain the customer's bottom case until the repair is complete. Before installing the replacement bottom case, use a fine tip permanent marker to write the original serial number clearly and legibly in uppercase box letters directly onto the inside of the new bottom case.

CAUTION: Take great care in deciphering the small typeface of the etched serial number on the bottom case. You might need a magnifying glass to see it clearly. It is imperative that you transfer the correct alphanumeric characters. Keep in mind that Apple serial numbers always use the numbers 1 and 0 instead of the Roman letters "I" and "O."

Keycap Replacement

Service packages of 78 replacement keycaps are now available in the U.S. and Canada (U.S. version keyboard only) for designated MacBook and MacBook Pro computers. The packages allow you to replace individual keycaps rather than the entire top case.

There are four different keycap packages, based on the color of the key and the type of keyboard (version D and S).

Part number	Key color	Keyboard
922-9277	Black	Version D
922-9279	Black	Version S
922-9278	White	Version D
922-9280	White	Version S

For step-by-step instructions, refer to:
kBase #HT4002: "MacBook/MacBook Pro: Black Keycap Replacement"
kBase #HT4003: "MacBook: White Keycap Replacement"

For an overview of the differences among keycap procedures, refer to
kBase #HT4001: "MacBook/MacBook Pro: Keycap Replacement Matrix"

Note: You must be logged into GSX in order to view the articles above.

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Troubleshooting

MacBook Pro (13-inch)

General Troubleshooting

Update System Software & Firmware

Important: Ensure the correct version Mac OS X and latest software and firmware updates have been applied before you begin troubleshooting. Computers sometimes exhibit symptoms that indicate the wrong Mac OS X system software is installed.

Firmware is the name given to software that is written into memory circuits such as flash memory, that will hold the software code indefinitely, even when power is removed from the hardware. Firmware on Intel Mac computers is designed to be updated if necessary by running the Mac OS X Software Update check (available in the Apple () menu) while computer is connected to the Internet. For more information about firmware updates, refer to:
kBase # HT1557: About firmware updates for Intel-based Macs

Troubleshooting Theory

For general information on troubleshooting theory, go to GSX and find the Service Training course menu link. From there you can access the Troubleshooting Theory self-paced course.

Hardware vs. Software

For information on how to isolate a hardware issue from a software issue, refer to:
kBase #TS1388: Isolating issues in Mac OS X

For information on how to troubleshoot a software issue, refer to:
kBase #HT1199: Mac OS X: How to troubleshoot a software issue
kBase #TS1394: Mac OS X: Troubleshooting installation and software updates
kBase #HT2956: Troubleshooting Mac OS X installation from CD or DVD

Temperature Concerns

The normal operating temperature of this computer is well within national and international safety standards. Nevertheless, customers may be concerned about generated heat. To prevent an unneeded repair, you can compare a customer's computer to a similar running model, if available, at your repair site. For more information, refer to
kBase #HT1778: Apple Portables: Operating temperature

Functional Overview

Refer to this diagram for symptoms related to logic board connectors.
To rotate this page in Preview for easier viewing, go to Tools menu and choose "Rotate Left".

Right Clutch Camera Cable, with connections to AirPort, Bluetooth, Camera and Ambient Light Sensor:
- failing to communicate with any of these devices
- no keyboard backlight or display not dimming in low light while ALS is covered
- no startup (if shorted Airport cable)

Sata Optical Drive:
- no Optical Drive seen in System Profiler,
- no startup possible from bootable optical media

Sata Hard Drive + Sleep LED + Infrared (IR) Sensor:
- no HDD visible in system profiler
- no sleep led status
- no infrared reception
- no power on (if shorting SMC)

Trackpad + Trackpad Button + Trackpad Thermal Sensor:
- no cursor movement,
- no click action
- unit running slow (missing trackpad sensor input)

Keyboard + Power ON Button:
- no power on with keyboard
- dead keys

Keyboard Backlight:
- no keyboard backlight

Ram:
- no boot,
- freezes or kernel panic
- video artifacts

Battery:
- not running from battery only
- no power on (if incorrect power adapter is used)
- no battery seen in menubar
- fan running faster (high temperature from battery sensor)

Battery Indicator LEDs + Battery Level button + Magnetic Sleep Sensor:
- no battery level while charging
- no battery level shown when button pressed
- no sleep when clamshell closed,
- no video on internal display (sleep sensor stuck)

Microphone
- no input level from Internal Microphone sound input

Left Speaker
- no left sound,
- distorted left sound

Connectors located on the other side of the logic board:

Right Speaker + Subwoofer:
- no sound from right speaker or subwoofer
- distorted right or center sound

Fan :
- intermittent shutdown
- freezes
- fan running at full speed

LCD + Backlight:
- no internal LCD video
- no internal LCD backlight

MagSafe Connector (underneath logic board):
- no Power ON
- no Battery charge
- no LED light from MagSafe connector

Block Diagram, Mid 2009

Refer to this diagram to see how modules are interrelated.

Block Diagram, Mid 2010

Refer to this diagram to see how modules are interrelated.

Liquid Contact Indicators

To help discover accidental damage to the computer, the top case includes spill sensors called liquid contact indicators (LCI). The sensors are only visible when the bottom case and most of the modules have been removed. Normally represented by small white dots, the LCIs turn red when they have come in contact with liquid, such as an accidental spill.

MacBook Pro (13-inch, Mid 2010) has an extra LCI just below the trackpad set screw, which is not present in the MacBook Pro (13-inch, Mid 2009).

For more information, refer to
kBase #HT3400: About liquid contact indicators (LCI) on portable and desktop computers
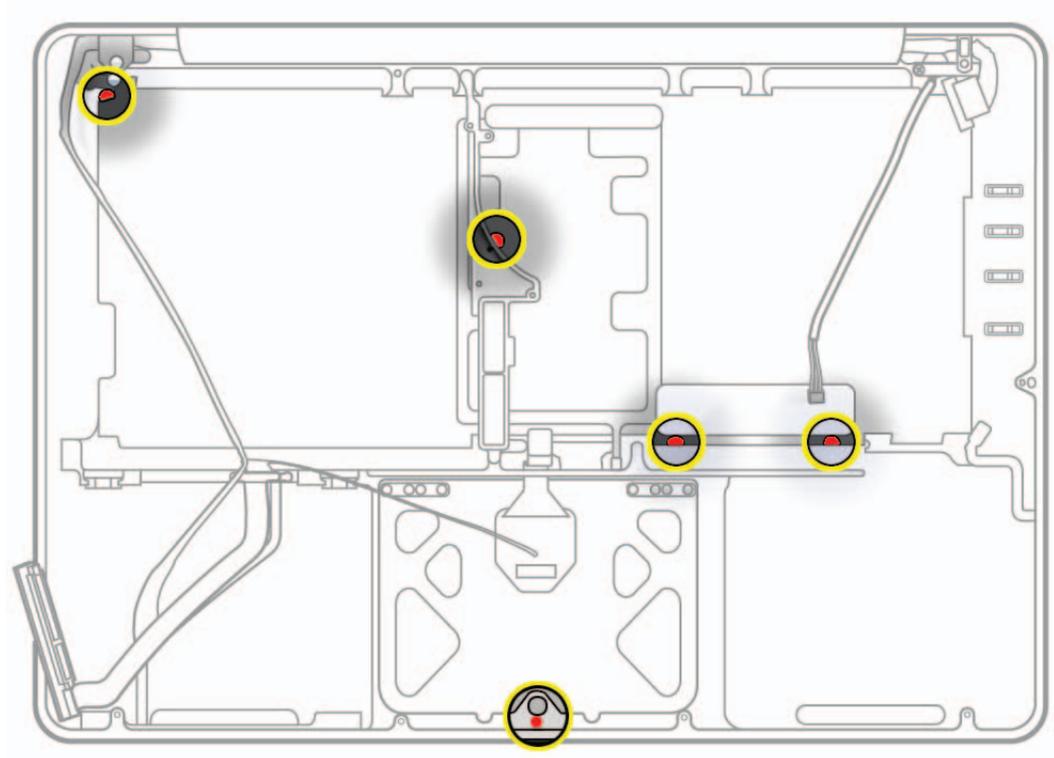
Logic Board Power-On Pads, Mid 2009

Note: See following page for location of pads in Mid 2010 model.

On the logic board of the MacBook Pro (13-inch, Mid 2009), there are two pads that can be shorted to power on the system. These pads are located above the trackpad flex cable connector and below the hard drive flex cable connector. The power-on pads are shiny, silver, square, and larger than the other (mostly round) silver pads nearby.

Important: Only short these two pads and no other pads, or you may damage the logic board. The tip of a T8 or T10 screwdriver is about the right size to touch these two pads, without touching other nearby components.
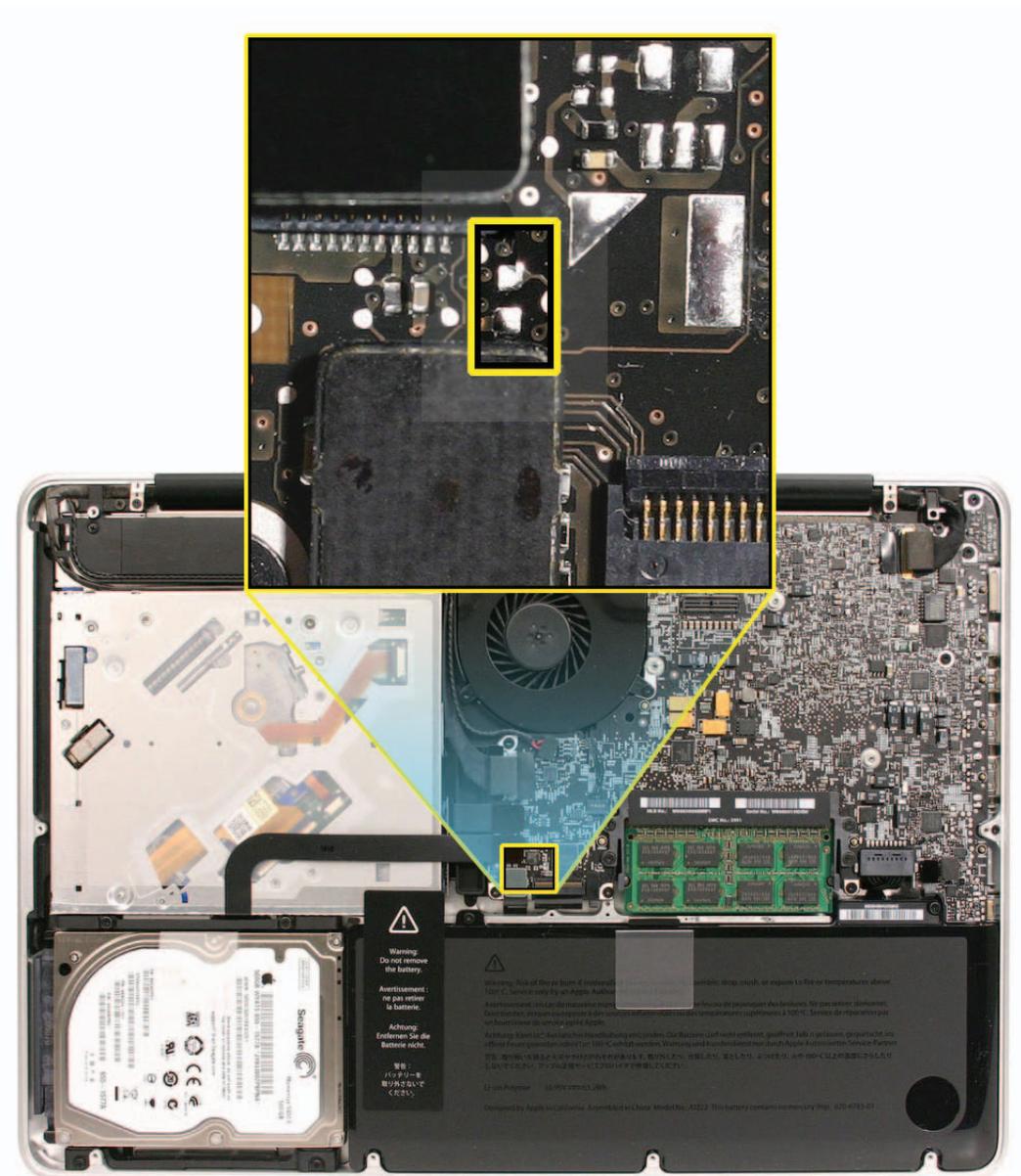
Logic Board Power-On Pads, Mid 2010

Note: See previous page for location of pads in Mid 2009 model.

On the logic board of the MacBook Pro (13-inch, Mid 2010), there are two pads that can be shorted to power on the system. These pads are located above the keyboard flex cable connector and to the right of the trackpad flex cable connector. The power-on pads are shiny, silver, square, and larger than most of the other silver pads nearby.

Important: Only short these two pads and no other pads, or you may damage the logic board. The tip of a T8 or T10 screwdriver is about the right size to touch these two pads, without touching other nearby components.

Common Reset Procedures

Resetting the System Management Controller (SMC)

The System Management Controller (SMC) is a chip on the logic board that controls all power functions. If the computer is experiencing any power issue, such as not starting up, not displaying video, sleep issues, or fan noise issues, resetting SMC may resolve it. To reset SMC:

1. If computer is on, turn it off by choosing Shut Down from the Apple (🍎) menu.

2. Connect power adapter to computer and to a working power source.

3. On built-in keyboard, press (left-side) Shift-Control-Option along with power button just once. **Important:** Use Shift-Control-Option keys on left side of keyboard.

    Note: When the LED on the MagSafe connector is orange/amber, resetting the SMC will change it to green for a few seconds, indicating that SMC was correctly reset.

4. Wait 5 seconds and press power button to start computer. **Note:** If bottom case is removed, you can alternately reset SMC by disconnecting both power adapter and main battery, and holding down power button for 5 seconds.

For more information, refer to:
kBase #HT3964: Intel-based Macs: Resetting the System Management Controller (SMC)

Resetting Parameter RAM (PRAM)

PRAM stores certain system and device settings in a location that Mac OS X can access quickly. Exactly which settings are stored in the computer's PRAM varies depending on the type of computer as well as the types of devices and drives connected. To reset PRAM:

1. If computer is on, turn it off by choosing Shut Down from Apple (🍎) menu.

2. Locate the following keys on the keyboard: Command, Option, P, and R. You will need to hold these keys down simultaneously in Step 4.
    Note: If keyboard does not have an Option key, use Alt key instead.

3. Press power button.

4. Immediately press and hold Command-Option-P-R keys.
    Important: You must press this key combination before the gray screen appears.

5. Hold down keys until computer restarts, and you hear startup chime a second time.

6. Release keys.

For more information, refer to:
kBase #HT1242: Mac OS X: What's stored in PRAM
kBase #HT1379: Resetting your Mac's PRAM and NVRAM

Starting Up in Safe Mode

Starting up into Safe Mode does several things that can help resolve software or directory issues that may exist on the startup volume. To start up in Safe Mode:

1. If computer is on, turn it off by choosing Shut Down from Apple () menu.

2. Press power button.

3. Immediately after you hear startup tone, press and hold Shift key.
   Note: The Shift key should be held as soon as possible after startup tone but not before.

4. Release Shift key when you see the screen with a gray Apple and progress indicator (looks like a spinning gear). Note that booting into Safe Mode will take longer than a normal startup. During startup, the words "Safe Boot" will appear on Mac OS X startup screen.

5. To leave Safe Mode, restart computer normally, without holding down any keys during startup.

For more information, refer to:
kBase #HT1564: Mac OS X: What is Safe Boot, Safe Mode?
kBase #TS1884: Safe Boot takes longer than normal startup

Apple Service Diagnostic (ASD)

Run Apple Service Diagnostic to determine if any of the thermal sensors are malfunctioning. When sensors fail, replace the corresponding part—logic board, battery, or top case. See chart below for correlation between error code and part.

Name	Location
TC0D	Logic board
TC0P	Logic board
Th1H	Logic board
TN0D	Logic board
Ts0P	Trackpad flex cable
TB0T	Battery
TB1T	Battery
TB2T	Battery
TB3T	Battery

Clamshell Service Diagnostic (CSD)

Clamshell Service Diagnostic (CSD) is a diagnostic tool that checks Apple's latest portable computers for the presence of AirPort, Bluetooth, LCD and Ambient Light Sensor (ALS) to assist you in quickly making a failure determination.

Troubleshooting benefits of using CSD include:
· Quick way (less than 1 minute) to determine whether clamshell-related modules (AirPort, Bluetooth, LCD and ALS) are electrically connected without taking apart the system.
· Results of CSD can help pinpoint if any clamshell cables may need to be reseated to logic board.
· Diagnostic results can help isolate a video or wireless issue to either clamshell or logic board, to avoid unnecessary replacements of these components.

In the MacBook Pro (13-inch), CSD checks for the presence of the computer's:
· AirPort
· Bluetooth
· LCD
· Ambient Light Sensor (ALS)

CSD does not check for the presence of the computer's:
· iSight camera
· externally connected hardware components (such as USB or FireWire devices)

CSD does not check for issues with the OS X or other software-related problems such as application or extension conflicts.

For more information, and to download CSD, refer to:
kBase #CP1100: Notebook Computer Clamshell Screening Process

LCD Display Pixel Anomalies

When displaying a single color over the screen area, the LCD panel might show one or more pixels that are not properly lit. To determine if 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, all-red, all-green, all-blue, or all-black display. Use the LCD Tester Diagnostic Utility to generate these patterns on the screen.

2. Using a jeweler's loupe, pocket microscope, or other magnifying device, identify and count each pixel anomaly:
    *   Bright subpixel anomaly = subpixel that is always on
    *   Dark subpixel anomaly = subpixel that is always off

3. The number of acceptable pixel anomalies for MacBook Pro (13-inch) is:

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

4. If the number of subpixel anomalies exceeds the acceptable number shown above, replace the LCD assembly. Numbers outside the acceptable range would be:

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

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

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

When speaking with customers, please use the following explanation:

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

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

Display Hinge Behavior

MacBook Pro models have a unique counterbalanced clutch system. The design provides a smooth, fluid feel when opening, closing, or positioning the display. The counterbalanced clutch system was designed so that when the display is vertical with respect to the ground, it will remain in place regardless of the angle of the base.

Moving display past vertical allows the hinges to release and the display to close. This is normal behavior and no repair is necessary. For more information, and to watch a video of normal hinge behavior, refer to **kBase #HT3304: MacBook Pro: Display hinge behavior**.

Symptom Charts

Follow steps in the order indicated below. If an action resolves the issue, retest system to verify.

Note: A compilation of Quick Check tables is available at:
http://service.info.apple.com/QRS/en/quickreference.pdf

Note: There is no silkscreen text on final production logic boards. The photos shown with test points are from pre-production units and are solely for reference.

Startup and Power Issues

No Power

Unlikely cause: display assembly, speakers, optical drive, hard drive

Quick Check

Symptom	Quick Check
No Power / Dead Unit • No power • No image • No startup chime • No fan or hard drive spin • No reset sound from optical drive • No sleep LED activity • No light if Caps Lock pressed • Non-operational	1. Verify AC power presence with MagSafe LED indicating on or charge state. 2. Verify battery status as being at least partly charged, and charging with AC power. 3. Reset SMC. 4. If any of the previous steps have restored power, run Battery Diagnostic Utility.

Deep Dive

Check	Result	Action	Code
1. Isolate peripherals as cause. Disconnect all peripherals and external devices and verify unit starts.	Yes	Suspect peripherals as cause. Reconnect each one at a time, verifying unit operation as external device is reinstalled.	
	No	Go to step 2.	

2. Reset SMC and verify unit starts. (Alternative hardware SMC reset can be forced by disconnecting for 1 minute AC and battery to remove all system power.) Can system start up after SMC reset?	Yes	Corrupt SMC state preventing power on. Issue resolved with SMC reset.	
	No	Go to step 3.	
3. Will system power up with battery only? Check battery level LED indicator for status of battery charge or battery use error. Inspect battery connector for burn marks or damaged pins if substituting a known-good battery to verify starting on battery.	Yes	System can start up from known-good battery -- user battery possibly at fault or needs to be charged. Continue to verify user battery then AC adapter use and battery charging. Go to step 4.	**P11**
	No	System will not power using known-good battery only. Go to step 5	
4. User battery may be run down, or not recognized. Verify user battery in a known-good system is recognized and accepting a charge. Confirm user battery is not consumed nor defective.	Yes	Battery is recognized, charging and health is good. Return to test unit with user battery and AC adapter power. Go to step 6.	
	No	Replace user battery for not charging (P10) or not recognized (P11). User to purchase a replacement battery if consumed.	**P10** or **P11**
5. Inspect battery cable connection at logic board and reseat if necessary. Replace cable if found damage or burned. Can the system power on from a charged battery with battery cable inspections or replacement?	Yes	Battery power restored, return to test unit with user battery and AC adapter power. Go to step 6.	
	No	Logic board is expected to power on with battery only. Inspect and test power button. Go to step 10.	
6. Inspect MagSafe power adapter. Verify AC adapter is correct wattage, compatible with product and works on known-good computer.	Yes	Power adapter is good. Go to step 7.	
	No	Release stuck pin or replace adapter due to wire damage, not working or burned pins.	**P14**

7. Inspect MagSafe port on computer for physical damage, debris or metal fragments attracted to magnetic connector. Is MagSafe connector clean and free from defects?	Yes	Go to step 8.	
	No	Clean port assembly. Replace MagSafe board if necessary.	**X03**
8. Verify adapter status LED turns on green then orange indicating power and battery charge in progress. A green LED can indicate a full battery, removal of battery or battery not recognized.	Yes	System starts and has power. MagSafe LED indicates power is flowing to logic board. Verify user battery will also charge. Review battery health to ensure user satisfaction.	**P11**
	No	AC power is down or battery is not charging. Go to step 9.	
9. Verify power from adapter is present on logic board. Remove system battery, use AC power only. Reseat or test known-good MagSafe cable to achieve power for logic board.	Yes	Logic board has power adapter energy to start system. MagSafe cable reseat or replacement resolved issue. If still no system power on indications, go to step 10.	**X03**
	No	AC adapter power not going to logic board power supplies. Replace logic board.	**M21**
10. Verify that the conductive foam gasket placed over the camera cable connector does not short any pins of the logic board connector.	Yes	Reseat foam gasket to prevent any contact with logic board connector pins.	
	No	Go to step 11.	
11. Test and inspect power button on top case. Stuck or open power button or keyboard disconnect can disable power on of system. Does system power on? If power button does not work, locate **Logic Board Power-On Pads** (**for Mid 2009** or **for Mid 2010**). Short pads to power up logic board. If power button is stuck, keyboard cable might need to be disconnected first before shorting pads.	Yes	Power button functional, issue resolved.	
		Power button works when keyboard cable is reseated.	
		Power button appears to be stuck, had to remove keyboard cable to power on. Replace top case for stuck power button.	**K05**
	No	No logic board power on when shorting power-on pads. Replace logic board.	**M01**

Won't Start Up

Unlikely cause: display assembly, speakers, fan, camera, microphone

Quick Check

Symptom	Quick Check
Power but no startup • No startup chime, some video activity, Apple logo, spinning gear • Startup chime with possible beep tones • Fan, hard drive spin or optical drive reset sound • Sleep LED is on , blinking or went out • Caps Lock LED toggles when pressed	1. Reset SMC. 2. Verify startup process passes initial memory checks – no beep errors or flashing sleep LED indicators. Display activity is starting up. 3. Clear PRAM. Verify starts up from user drive. 4. Connect known-good external bootable device and press Option (alt) key during startup then select external startup device to bring up system for diagnostics. 5. Verify presence and status of user hard drive. Use Disk Utility to repair drive and file permissions.

Deep Dive

Check	Result	Action	Code
1. Reset SMC and PRAM to set default startup device to internal hard disk drive.	Yes	User hard drive bootable, issue resolved with default settings.	
	No	System not starting up. Go to step 2.	
2. Is system indicating a memory error with repeated sleep LED 1 or 3 flash sequence and beep tones if sound is enabled?	Yes	Troubleshoot memory issues. Go to step 3.	
	No	Continue with startup sequence verification. Go to step 4.	
3. Reseat user memory and/or swap in known-good memory to isolate bad memory and replace defective parts.	Yes	User memory defective and replaced. Continue to verify startup process. Go to step 4.	**X02**
	No	Should known-good memory fail in one or more slots, replace logic board.	**M07**

4. Hold the Option (Alt) key during startup and verify there is a bootable hard drive shown in Startup Manager. Choose user hard drive. Does start up from this drive work?	Yes	System starting up from user hard drive. Startup issue resolved	
	No	User hard drive not present or does not start up from this drive. Continue to find bootable device. Go to step 5.	
5. Insert product OS install disc in optical drive. Install disc is bootable and should be present in Startup Manager. Can system start up from OS install disc?	Yes	Starts up from optical drive - user hard drive not yet bootable, go to step 8.	
	No	Computer has no internal bootable devices. Test external startup devices. Go to step 6.	
6. Boot from a known-good bootable copy of product OS on a USB drive or network server to start up and verify internal mass storage devices are available using System Profiler and Disk Utility.	Yes	System started up from external device and reports data regarding internal SATA devices. Go to step 7.	
	No	No startup devices available. Replace logic board.	**M02**
7. Troubleshoot optical drive and optical drive cable with cable reseat and known-good part substitutions. Is there a defective optical drive component to replace?	Yes	Cable reseat solved issue. Go to step 8.	
		Defective optical drive cable found and replaced. Go to step 8.	**X03**
		Defective optical drive found and replaced. Go to step 8.	**J03**
	No	Replace logic board.	**M19**
8. Use Disk Utility loaded from OS install disc to verify if hard drive is available on device list. Is user hard drive listed in Disk Utility?	Yes	User hard drive available for inspections and repair. Go to step 10.	
	No	Hard drive not present, troubleshoot hard drive and cable. Go to step 9.	

9. Troubleshoot hard drive and hard drive SATA cable with cable reseat and known-good part substitutions. If user hard drive, is there a defective hard drive component to replace?	Yes	Reseat of SATA cable now has user hard drive visible in Disk Utility, go to step 10.	
		Defective hard drive SATA cable found and replaced, now has user hard drive visible in Disk Utility, go to step 10.	**X03**
		Suspect user hard drive defective, attempt OS restore, go to step 10.	
	No	Known-good hard drive and known-good SATA cable used, still no hard drive present. Replace logic board.	**M19**
10. Boot system with Shift key down. Does it work?	Yes	Go to software troubleshooting article.	
	No	Go to step 11.	
11. Use Disk Utility to repair user hard drive and repair permissions if system OS found on hard drive. Is hard drive bootable after software repairs?	Yes	OS on user hard drive repaired, issue resolved.	
	No	Hard drive not bootable, perhaps missing OS, go to step 12.	
12. Use Disk Utility to partition user hard drive with one GUID partition then restore Mac OS from OS install disc. Is hard drive bootable after OS install?	Yes	User hard drive now starts up from new OS image, issue resolved.	
	No	Replace hard drive.	**H02**

Intermittent Shutdown

Unlikely cause: hard drive, optical drive

Troubleshooting Shutdown Causes

Always run the available Apple diagnostics to check for cause of the previous shutdown(s). Running ASD would also permit to isolate any abnormal value reading from a thermal, a voltage, or a current sensor, or from a fan speed meter.

Collect all available info from user on shut down occurrence details: periodicity, power state when issue happens, running applications, running time before shutdown.

Shutdown events could be categorized between four different types of causes.

1. User-related shut downs

A computer shut down event may be caused by user operation. Shuttting down the computer (by selecting the Shutdown menu, by keeping pressed the power button for at least 4 seconds, or by programming a timed shutdown in the Energy Saver preferences) should not be considered as a failure unless the power button or the magnetic sleep sensors are found to be defective, so the suggested steps for troubleshooting will be:
- to reset the SMC,
- to check Energy Saver preferences settings,
- to test top case button and magnetic sleep sensor operation and secure connection to logic board.

2. Activity-related system shut downs
- system could not succeed the standard shutdown process and had to force shutdown,
- an installed watchdog detected that an application did not respond within specified time (this watchdog can be enabled on Mac O X Server Energy Saver preferences)

These shut downs may be linked to system settings, devices drivers, applications or operating system freezes, so the suggested steps for troubleshooting will be:
- to check the system logs and activity monitor utility for clues on the freezing process,
- to check for available software and firmware updates for installed device drivers, applications, or operating system,
- to start the system from a known-good and up-to-date bootable drive for issue reproduction.

3. Power-related system shut downs
- External or battery power source was removed,
- Battery went empty while computer was on,
- Battery went empty while computer was asleep,

These shut downs are due to power management, poor connections or defective power sources so the suggested steps for troubleshooting will be:
- to reset SMC,
- to check secure AC cable, AC adapter and battery connections to logic board,
- to verify the battery and power adapter sources using the Notebook Battery and Adapter Diagnostic.

4. Hardware-related system shut downs
- one of the temperature sensors reached a specified temperature limit,
- one of the voltage sensors reached a specified voltage limit,
- one of the current sensors reached a specified current limit,

These shut downs are due to temperature, voltage, current, fan speed or other hardware-related sensor values getting out of range, so the suggested steps for troubleshooting will be:
- to check for all sensors connections and values using the Apple Service diagnostics and other available Apple Service utilities,
- to check for usage of Apple branded battery and power adapter,
- to check for abnormal battery temperature,

- to check for fan(s) operation,
- to check for cleanliness of the heat sink fins and the air flows,
- to check for correct seating of the heat sink on logic board and presence of thermal transfer material.

Quick Check

Symptom	Quick Check
Intermittent shutdown • Powers off during startup • Powers off with desktop use	1. Collect details from user on shutdown occurrence and system configuration when it happens (on battery, when running for a while, frequency of shutdowns, running applications, shutdown repeatability). If shutdown can be easily reproduced, check next steps: 2. Verify battery charge status 3. Check AC adapter MagSafe connector and connection with system 4. Reset SMC and PRAM 5. Start up with shift key down for safe mode 6. Startup from known-good bootable device 7. Run ASD for sensors + thermal tests

Deep Dive

Check	Result	Action	Code
1. Activity related shutdowns: Reset SMC and PRAM and verify that shutdown issue still happens.	Yes	Check with known-good bootable drive. Go to step 2.	
	No	Shutdown cause was related to SMC or PRAM programmed shutdown settings or corruption, and was resolved by reverting them to default settings.	
2. Booting from known-good bootable drive, verify that shutdown issue still happens.	Yes	Go to power-related shutdowns on step 3.	
	No	Shutdown events do not happen on known-good OS. Reinstall Mac OS on user hard drive, update OS with latest version and check if any firmware update is available.	

3. Power related shutdowns : verify that shutdown issue can ONLY be reproduced with user's battery and AC adapter.	Yes	Intermittent power issue means checking user's AC cable for intermittent connection, checking user's battery & AC adapter health.	
	No	Issue also happens with known-good battery and AC adapter. Go to step 4.	
4. Reset SMC and PRAM, then verify if shutdown symptoms does not happen anymore.	Yes	Shutdown cause was related to SMC or Pram settings or corruption, and was resolved by reverting them to default settings.	
	No	Shutdown event still occurs. Go to step 5.	
5. Check system running on battery only. Use known-good charged battery. Verify if shutdown/reset/sleep issues disappear when known-good battery is used without AC adapter.	Yes	Recharge user battery and retest. Check for user battery health in Apple System Profiler or run Apple Notebook Battery & Adapter utility, and replace battery if its health is reported bad or consumed.	**P09**
	No	Symptoms unchanged. Go to step 6.	
6. Check with known-good AC adapter source only Remove battery and use known-good AC adapter. Verify if the shutdown/reset/ sleep issues disappear with known-good adapter.	Yes	Faulty user's AC adapter. Replace user's AC adapter if AC cable and duckhead were confirmed good.	**P14**
	No	Symptoms unchanged. Go to step 7.	
7. Hardware-related shutdowns: Run ASD and verify if a sensor failure is reported.	Yes	-If a temperature or a fan sensor failure is reported, go to step 8	
		-If a voltage or a current sensor failure is reported in ASD w/known-good AC adapter and batteries, replace logic board.	**M23**
	No	Setup ASD to loop test suite for burn in tests and go to step 7. if no failure is found after burn in tests, return unit to user for no failure found.	

8. Verify if a thermal sensor or fan failure is reported in ASD.	Yes	-If fan not running failure, check for fan cable seating and retest. If same failure after retest replace fan with known-good fan and retest. If issue does not happen with known-good fan, replace user's fan. -If an over temp failure reported, check for cause of over temp, like obstructed vent, dust in heatsink fin, clogged fan and retest. If still failing replace part where sensor is located (logic board, battery, or trackpad) according to the sensor location table . Go to step 9.	**X22** **M23** **P17** **K99**
	No	Replace heatsink. Go to step 9.	**X10**
9. Isolate if issue solved Verify if shutdown/issue does not happen anymore after part exchange.	Yes	Issue resolved.	
	No	Replace logic board with corresponding symptom: -if for thermal error cause -if for other cause	**M18** **M08**

No Video/Bad Video

Unlikely cause: hard drive, optical drive, top case, battery, power adapter

Quick Check

Symptom	Quick Check
Power, but No Video • Power • No video • fan, hard drive spin, or optical drive reset sound • sleep LED is on or went on • light if Caps Lock pressed	**1.** Reset SMC. **2.** Reset PRAM. **3.** If no startup chime, verify with known-good memory. **4.** Verify with external monitor. **5.** Press Option key on startup.

Deep Dive

Check	Result	Action	Code
1. Characterize video issue Define whether the issue is a bad image with backlight OR no video issue. Verify whether some image even distorted is visible.	Yes	Bad image quality, go to step 5.	
	No	No image seen or no backlight, go to step 2.	
2. Isolate peripherals as cause: disconnect all peripherals, external devices, Express Card and display adapters if present and verify that video is displayed.	Yes	Suspect peripherals as cause. Reconnect one at a time, verifying unit operation at each stage.	
	No	Go to step 3.	
3. Adjust Brightness Power-on unit , attempt to adjust brightness to maximum using brightness (F1/F2) keys and verify that video is displayed.	Yes	Video displayed - Brightness set to minimum, panel backlight was inadvertently turned off. If backlight returns to low check for stuck F1 key on keyboard.	
	No	Go to step 4.	
4. Reset SMC and verify that system video is displayed.	Yes	Corrupt SMC state preventing video.	
	No	Go to step 5.	

5. Reset PRAM. If no action, use external keyboard with same sequence. Verify that system video is displayed.	Yes	Invalid or corrupt PRAM contents affecting video output.	
	No	Go to step 6.	
6. Connect external video: Connect known-good VGA/ DVI adapter to known-good display, press power button and close display to force main screen startup on external video. Verify that video is correct when displayed from external display.	Yes	Video correct on external display. Research available firmware and software updates, retest. If returning with software already updated, go to step 7.	
	No	Replace logic board with according symptom code: -no video -bad/distorted video	**M03** **M04**
7. Isolate LCD display detection: Disconnect external monitor and reopen display and restart unit. Verify that sleep LED indicator goes off after internal LCD has been detected.	Yes	Sleep LED goes off when LCD detected. -If still no video then Go to step 8, -If video present, but with defect, go to step 9.	
	No	Internal LCD not detected. Run Clamshell Service Diagnostic utility and check for LCD panel presence. If not found, reseat LVDS cable connection on logic board and retest. If sleep LED does not go off after cable is reseated, go to step 10.	
8. Check for sleep sensor condition. If display assembly sleep sensor is stuck in a closed state, video will appear on internal display temporarily, until the OS sleeps the system. Disconnect BIL/ sleep cable and restart unit without external display. Verify that system starts up with video on internal display stays on and does not go into sleep mode.	Yes	Sleep sensor was stuck or had shorted cable. Replace BIL/ sleep sensor cable.	**X13**
	No	Symptoms unchanged. Go to step 9.	

9. Check for No Backlight. Power on unit. Using a lamp or bright light source, verify that a faint image or Apple logo appears.	Yes	Logo image visible - check LVDS cable. Inspect cables for damage near clutches: - if damaged, replace display assembly and go to step 11 - if cable is not damaged, run Clamshell Service Diagnostic utility and check for LCD panel presence. If not found, reseat cable and retest, then go to step 11.	**L09**
	No	If symptom continues, go to step 10.	
10. Verify with Known good display assembly Connect known-good display assembly to system.	Yes	System is functioning with known-good display assembly Replace display assembly if following symptom reporting: - had no power issue - had incorrect/missing colors - had blank video - had distorted / blurred video - had vertical/horizontal lines - had noise/unstable flickering - had dim backlight - had bad spot(s)/pixels - had no backlight - could not change resolution	**L01** **L02** **L03** **L04** **L05** **L06** **L07** **L08** **L09** **L10**
	No	Symptoms unchanged - replace logic board.	**M03**
11. Verify with reseated LVDS cable or replaced display assembly Verify that unit now has video and backlight.	Yes	Issue was only due to damaged display assembly or unseated cable.	
	No	Display cable damaged the logic board. Replace logic board.	**M25**

Battery Isn't Recognized or Won't Charge

Unlikely cause: display assembly, speakers, optical drive, hard drive, trackpad

Quick Check

Symptom	Quick Check

Battery isn't recognized or won't charge
• AC adapter
• No MagSafe LED indicator
• No orange charge indication
• Battery status LEDs:
  - single chase
  - all flash
  - no LED
	1. Check battery level and test AC power.
	
	2. Reset SMC by pressing the (left) Shift-Control-Option keys along with the power button once.
	
	3. Test system, using Battery Diagnostic Utility.

Deep Dive

Check	Result	Action	Code
1. Does the MagSafe LED go green to orange/amber when connected to the system?	Yes	Battery is recognized and charging. Go to step 6.	
	No	LED is green, Battery may be full or not recognized. Go to step 2.	
		LED was on momentarily then went out. Go to No Power symptom table.	
2. When the Battery status button is pressed, did any of the lights come on?	Yes	Go to step 3.	
	No	Go to step 11.	
3. Does battery status indicate a fully charge battery with all LEDs on?	Yes	User battery charged, check health. Go to step 13.	
	No	Go to step 4.	
4. Does battery status indicate the battery is not recognized with a single LED on that chases back and forth 5 times?	Yes	Go to step 8 and tag battery as a possible P11 candidate.	**(P11)**
	No	Go to step 5.	
5. Does battery status indicate the battery is recognized but not charging with all LEDs blinking?	Yes	Go to step 8 and tag battery as a possible P10 candidate.	**(P10)**
	No	Go to step 6.	

6. Does battery status indicate battery charge and flash the next level 5 times?	Yes	User battery charging, check battery condition. Go to step 13.	
	No	Flashing first LED only, go to step 7.	
		No battery status LEDs on, go to step 11.	
7. Does battery status indicate a low battery with a LED flashing rapidly indicating initial charging of battery?	Yes	Allow user battery to charge to 1 LED on before checking battery condition. Go to step 13.	
	No	Go to step 8	
8. Test with a known-good battery. Is battery recognized and charging?	Yes	Replace user battery (P10 not charging or P11 not recognized).	**P10 or P11**
	No	Go to step 9.	
9. Inspect user battery contacts and battery cable connector for corrosion or obstructions.	Yes	Clear obstructions or replace the battery if cable is corroded and recheck.	**X03**
	No	Go to step 10.	
10. Reseat battery harness at logic board connector, and retest. Is battery recognized and charging?	Yes	Issue resolved by cable reseat. Check battery condition, go to step 13.	
	No	Replace logic board.	**M20**
11. Battery status LEDs not working - inspect button stuck or cable disconnect at logic board and reset SMC.	Yes	LED status now working. Go to step 3.	
	No	Go to step 12.	
12. Remove system battery and connect and test a known-good battery status indicator assembly. Do LEDs indicate a battery not recognized chase pattern?	Yes	Replace user battery LED indicator assembly. Go to step 3.	**X03**
	No	Replace logic board.	**M20**
13. Launch System Profiler and look in the Power section. Is the battery over 300 cycle counts?	Yes	Battery has been consumed, and user will need to purchase a replacement.	
	No	Go to step 14.	

14. Is battery still covered by warranty?	Yes	Go to step 16.	
	No	Battery warranty expired, go to step 15.	
15. Considering the age of the battery greater than one year old, is the health of the battery "Good" according to system profiler?	Yes	Battery is in good health and out of 1-year warranty coverage. Battery should continue to function until consumed.	
	No	Battery is consumed after warranty coverage. User to purchase a new battery.	
16. For batteries still covered by warranty, is the health of the battery "Good?"	Yes	Battery functioning normal. Go to step 17.	
	No	Battery has premature capacity loss. Replace user battery.	**P08**
17. With battery charge greater than 20% does battery support system operation without AC connected?	Yes	User battery is good.	
	No	Go to step 18.	
18. Test with a known-good battery. Does known-good battery support battery only operation?	Yes	Replace user battery for will not run system on battery alone.	**P12**
	No	Replace logic board.	**M20**

Kernel Panic/System Crashes

Unlikely cause: Battery, Power Adapter

Quick Check

Symptom	Quick Check
Memory Issues/Kernel panic and freezes • Display notice of system kernel panic during start up and desktop use. • System freeze during use. • System freeze upon wake from sleep.	1. Reset SMC and clear PRAM. 2. Remove suspect external devices. 3. Verify user memory is Apple-approved memory, and memory configuration matches memory installed. 4. Start up with shift key down for safe mode. 5. Startup from known-good bootable device. 6. Check panic.log info for crash cause. 7. Run AHT for sensors test.

Deep Dive

Check	Result	Action	Code
1. Isolate Peripherals as cause. Disconnect all peripherals, external devices, and display adapters if present	Yes	Suspect peripherals as cause. Reconnect one at a time, verifying unit operation at each stage.	
	No	Go to step 2.	
2. Reset SMC and clear PRAM then verify that unit starts without panic issues.	Yes	Issue resolved with default startup settings.	
	No	Go to step 3.	
3. Boot in Safe Mode with Shift key down, and check for recent kernel panic data in panic log. Open Panic.log file on hard drive and check for affected interface that crashed. If unit still crashes during startup, you will need to take out disk to a good system to access the file. Verify that kernel panic dependency is not with an I/O interface.	Yes	Kernel Panic is not a system I/O related device. Go to step 5.	
	No	I/O device related crash, go to step 4.	

4. Remove I/O device where possible to pinpoint faulty device: - Disconnect camera cable from display assembly (for AirPort, Bluetooth, camera, and ambient light sensor). Camera cable can be disconnected without affecting startup and test. - optical drive cable to isolate optical drive. - hard drive cable to isolate hard drive. Memory cards can be removed, relocated, or tested with known-good memory. Because system will run on one card, this is a useful test for finding bad memory or bad memory slot. If issue remains after testing I/O device, replace with known-good part(s) to confirm issue resolved.	Yes	System starts up when I/O device removed, replace affected I/O device or module containing it. If AirPort card presence is crashing system, replace AirPort card. If still issue, replace display assembly (for Bluetooth, camera, or cable damage). If optical drive presence is crashing system, replace optical drive cable and retest. If issue remains try with known-good optical drive. If still issue, replace optical drive. If hard drive presence is crashing system, replace hard drive cable and retest. If issue remains, try with known-good hard drive. If still issue, replace hard drive. Reseat memory or replace suspect memory with known-good memory.	**N13** **L14** **X03** **J03** **X03** **H01** **X01**
	No	Symptoms unchanged, go to step 5.	
5. Start up from optical drive or known-good OS. Attempt to start up with original or product OS install disc, or from an external hard drive with product OS installed, and verify that system starts without kernal panic.	Yes	Kernel panics cease running alternate OS. Run ASD/DiskUtility to repair and test hard drive. If repair attempts fail, repartition hard drive and reinstall OS. Replace hard drive if restore fails.	**H03**
	No	Symptoms unchanged, go to step 6.	
6. Disconnect display assembly and test with known-good display assembly. Verify that system now starts up without kernel panic/freeze.	Yes	Replace display assembly.	**L14**
	No	Go to step 7.	

7.	Check for thermal values and fan running speed Run ASD to check for fan and sensors test, and verify that ASD does not report any overtemp, failing sensor, or fan.	Yes	No thermal fail detected - Replace logic board with matching symptom: - If hang or freeze - If Kernel Panic/system crashes	**M05** **M06**
		No	If sensor test failed, reseat sensor connections on logic board and retest. If still failing, replace sensor or part where it is located (top case, display, other) : If top case sensor failed If display sensor failed If logic board sensor failed If fan test failed, replace fan. If overtemp , replace heatsink.	**X99** **L14** **M18** **X03** **X10**

Battery Run Time Too Short

Quick Check

Symptom	Quick Check
Battery Run Time Too Short • Battery runs out of power very quickly (less than two hours)	1. Check if the battery is covered under a repair extension program. Refer to **kBase #CP165: "SERVICE: Notebook Computer Battery and Adapter Screening Process"** 2. Verify no applications have runaway processes with the CPU. Refer to **kBase #TS1473:" Runaway applications can shorten battery runtime"** 3. Screen for short battery run time using **kBase #HT1446: "Apple Portables: Tips for maximizing your battery charge"**. If replaced for run time too short, regardless of warranty coverage, use symptom code **P09** if replaced.

Won't Run on Power Adapter Alone

Unlikely cause: RAM, display assembly, hard drive, optical drive, top case, speakers, camera, microphone

Quick Check

Symptom	Quick Check
Won't Run on Power Adapter Alone • Runs on battery but not on power adapter only.	1. Verify proper wattage adapter is being used. 2. Check for dirty or stuck pins on the MagSafe connectors, both on the adapter and the computer. 3. Connect the AC adapter to known-good power source. 4. Verify power cord or plug is properly attached to AC adapter and MagSafe cable is not damaged. 5. Reset SMC by pressing the (left) Shift-Control-Option keys along with the power button once.

Deep Dive

Check	Result	Action	Code
1. With battery removed, will a known-good AC adapter start up and run the system and show MagSafe LED status?	Yes	Confirm user's AC adapter as bad and replace.	**P14**
	No	Verify MagSafe board cable seating to logic board. Go to step 2.	
2. Does a known-good power adapter's LED light up either green or orange/amber?	Yes	SMC on logic board senses AC power adapter. Go to step 3	
	No	Replace the MagSafe board. Go to step 3.	
3. Does the unit run on known-good power adapter alone?	Yes	Issued resolved.	**X03**
	No	Replace logic board.	**M01**

Power Adapter Issue

Unlikely cause: logic board, RAM, display assembly, hard drive, optical drive, top case, speakers, camera, microphone

Quick Check

Symptom	Quick Check
Power Adapter Issue • No power • No Power LED • Non-operational • Stuck /broken pin	1. Connect AC adapters MagSafe connector to the computer. The LED on the connector should be green or orange/amber. 2. Verify power cord, or plug, is firmly attached to AC adapter. 3. Verify AC power source is supplying AC power. 4. Check for dirty or stuck pins on the MagSafe connectors, both on the adapter and the computer. Use and cleaning of power adapter with MagSafe 5. Reset SMC by pressing the (left) Shift-Control-Option keys along with the power button once.

Deep Dive

Check	Result	Action	Code
1. Verify that the MagSafe LED is green or orange/amber while connecting a known-good AC adapter on user system.	Yes	SMC on logic board senses AC power adapter and enabled power. Go to step 4.	
	No	Verify MagSafe interconnect board is connected to logic board. Go to step 2.	
2. Does the unit run on known-good AC power adapter only?	Yes	Issued resolved.	**P99**
	No	Replace the MagSafe interconnect board. Go to step 3.	
3. Verify the MagSafe LED is green or orange/amber while connecting known-good power adapter on user system.	Yes	Bad MagSafe interconnect board. Issue resolved.	**X03**
	No	Go to step 4.	
4. Does the user's power adapter have stuck or bent pins on the MagSafe connector?	Yes	Replace power adapter.	**P15**
	No	Go to step 5.	

5. Does the cable or duckhead have visible damage?	Yes	Replace cable or duckhead.	**P16**
	No	Go to step 6.	
6. Check that LED on MagSafe connector is displaying both green (if battery charged) and orange (when charging).	Yes	Verify adapter with known-good unit and user unit and troubleshoot source of error.	
	No	Replace power adapter.	**P03**

Noise / Hum / Vibration

Unlikely cause: RAM, display assembly, top case, camera, microphone, battery

Quick Check

Symptom	Quick Check
Noise / Hum / Vibration • Computer or AC adapter emits a noise or vibration.	1. Verify and reproduce the source of the noise from the computer / adapter with the user. 2. If the AC adapter is the source of the noise disconnect and try a known-good adapter (a small amount of hum or vibration is normal with AC adapters).

Deep Dive

Check	Result	Action	Code
1. Use of a known-good AC adapter eliminates the noise/vibration.	Yes	Replace AC adapter.	**P04**
	No	Go to step 2.	
2. Verify if the noise is heard through the speakers and / or headphones.	Yes	Go to step 3.	
	No	Go to step 4.	
3. Disconnect any peripheral devices, cards, or cables attached to the unit. Verify the noise is gone.	Yes	Check for possible ground loop.	
	No	Go to step 6.	

4. Locate the source of the noise. Is the noise from an optical drive?	Yes	Check with a different media disc. Possible issue with disc label or out of balance media. If not related to media, and noise is above normal level, replace optical drive.	**J04**
	No	Go to step 5.	
5. Is the noise from the hard drive?	Yes	It is normal for drives to produce noise when they spin up or the heads move. Replace drive if noise is above normal levels.	**H06**
	No	Go to step 6.	
6. Is the noise coming from the fan?	Yes	The fan(s) are generally running in a slow mode, but may accelerated when intensive processing is required (calculation, 3D gaming, or screen saver animation). If still beyond expected sound level, check for interference of fan with other mechanical element of system (foam, bracket, shield) before replacing a noisy fan.	**X03**
	No	Go to step 7.	**P04**
7. Noise maybe related to interference from other electrical devices operating near the computer, or on the same AC power source. Verify if noise is gone when operating in a different location on a different AC circuit.	Yes	Perhaps operating the unit with a surge suppressor will eliminate or reduce the noise. Change location of use or limit use of other device that is inducing the noise.	
	No	Replace logic board.	**M99**

Burnt Smell / Odor

Unlikely cause: enclosure

Quick Check

Symptom	Quick Check
Burnt Smell / Odor Computer or power adapter emits an odor or smell of smoke.	1. Disconnect the battery and AC adapter from the computer. 2. Attempt to identify the source of the odor. Visual clues are component damaged like capacitor chip popped or burn marks. 3. Check AirPort Card cable orientation.

Deep Dive

Check	Result	Action	Code
1. Has the source of the odor been identified.	Yes	Replace the affected part.	**P08**
	No	Go to step 2.	
2. Are any burn marks visible on components?	Yes	An improperly seated cable, damaged cable, or reversed AirPort Card connection can blow logic board components near the connector. Make sure you identify the cause before replacing the affected part.	**P08**
	No	Go to step 3.	
3. Refer to **Liquid Contact Indicators**. Are any sensors red?	Yes	For more information, refer to **kBase #HT3400: "About liquid contact indicators (LCI) on portable and desktop computers"**	
		Go to step 4.	

| 4. | Is the computer operating normally? | Yes | This could be related to normal operation. Also check for accidental damage cause using **kBase #CP161: "SERVICE: Determining and Quoting Accidental Damage.**" | |
| | | No | Please refer to best related troubleshooting section. If after inspecting the unit you feel there is a possible safety issue with computer or AC adapter, please notify Apple. | |

Battery Leaking or Swollen

Quick Check

Symptom	Quick Check
Battery Leaking or Swollen • Trackpad button does not work • Battery pack case has opened. • Bottom cover cannot be reinstalled	1. Check if the battery is covered under a repair extension program. 2. Refer to **kBase #CP165: "SERVICE: Notebook Computer Battery and Adapter Screening Process"** and use "Battery pack is visibly deformed" case under section 2E. Use symptom code **P13**.

Uncategorized Symptom

Quick Check

Symptom	Quick Check
Uncategorized Symptom • Unable to locate appropriate symptom code	1. Verify whether existing symptom code applies to the issue reported by the user. If not, document reported symptom and send feedback to **smfeedback6@apple.com** stating that a suitable symptom code could not be found.

Display

Display Anomalies

Quick Check

Symptom	Quick Check
Display Anomalies • Incorrect/missing colors • Distorted/blurred image • Pixel anomalies • Vertical/horizontal lines • Non-uniform brightness • Image flicker • Image persistence	**1.** Allow display to reach normal operating temperature for about 15 minutes before evaluating front-of-screen performance. **2.** Check display preferences for use of custom display profile. **3.** Check brightness setting. **4.** Check for Software Updates. **5.** Clean glass panel while checking for dust/debris. **6.** Go to Deep Dive: General

Deep Dive: General

Check	Result	Action	Code
1. Verify if user's issue is incorrect/missing colors.	Yes	Go to **Incorrect/Missing Colors Deep Dive**.	
	No	Go to step 2.	
2. Verify if user's issue is distorted/blurred image.	Yes	Go to **Distorted/Blurred Image Deep Dive**.	
	No	Go to step 3.	
3. Verify if user's issue is bright or dark pixel anomalies.	Yes	Go to **Pixel Anomalies Deep Dive**.	
	No	Go to step 4.	
4. Verify if user's issue is vertical or horizontal lines.	Yes	Go to **Vertical/Horizontal Lines Deep Dive**.	
	No	Go to step 5.	
5. Verify if user's issue is non-uniform brightness.	Yes	Go to **Non-uniform Brightness Deep Dive**.	
	No	LCD functioning OK.	

Deep Dive: Incorrect/Missing Colors

Check	Result	Action	Code
1. Verify display is listed in the System Profiler's Graphics/ Displays device tree.	Yes	This ensures color profile can be matched with LCD. Go to step 2.	
	No	Go to N09.	
2. Verify System Preferences Display Profile is valid for display being tested. Color profile should be set to Color LCD, user may have created an off-color calibration setting.	Yes	If display profile is valid and the colors are still incorrect or missing go to step 3.	
	No	Set System Preferences: Displays: Color to Color LCD and retest.	
3. Verify that the glass panel is free of contaminants.	Yes	Go to step 4.	
	No	Clean glass panel using approved method. Retest.	
4. Run Clamshell Service Diagnostic utility and check for LCD panel presence. If not found, reseat and verify LVDS cable is secure to the logic board. Are colors restored?	Yes	Loose cable connection. Issue resolved.	
	No	Go to step 5.	
5. Set desktop pattern in System Preferences to 'Solid Gray Light'. Verify if incorrect/missing color issue affects entire display.	Yes	Test a known-good display, go to step 7.	
	No	Go to step 6.	
6. Set up display under test side by side with another known good display showing the same image. Verify if issue is noticeably worse on the display being tested.	Yes	Test a known-good display, go to step 7	**L02**
	No	Small variations in color uniformity are normal and do not warrant replacement or repair of the display.	
7. Substitute a known-good display assembly to test logic board video output. Is normal video restored?	Yes	Replace display assembly.	**L02**
	No	Replace logic board.	**M04**

Deep Dive: Distorted/Blurred Image
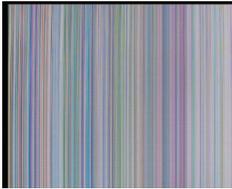
Check	Result	Action	Code
1. Sample image illustrates loss of LVDS data signals to LCD or a defective LCD panel. Inspect & reseat LVDS cable connection looking for damaged or bent pins. Is image restored with reseated cable connection?	Yes	Issue due to loose connection. Display issue resolved.	
	No	Go to step 2.	
		If logic board connector damage, replace logic board.	**M24**
2. Substitute a known good display clamshell to test logic board video output. Is normal video restored?	Yes	Replace display assembly.	**L04**
	No	Replace logic board.	**M04**

Deep Dive: Pixel Anomalies
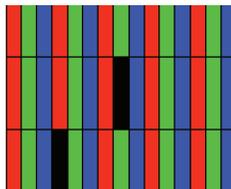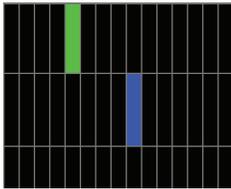
Check	Result	Action	Code
1. Determine if "defects" are dust/debris on surface of glass panel.	Yes	Clean glass panel.	
	No	Go to step 2.	
2. Determine if bright pixel defects exceed the acceptable number. See **kBase #HT1721: "About LCD display pixel anomalies"**	Yes	Replace display assembly.	**L08**
	No	LCD meets bright pixel defect specifications. Go to step 3.	
3. Determine if dark pixel defects exceed the acceptable number. See **kBase #HT1721: "About LCD display pixel anomalies"**	Yes	Replace display assembly.	**L08**
	No	LCD meets dark pixel defect specifications. Go to step 4.	
4. Determine if the combination of bright/dark pixel defects exceed the acceptable number. See **kBase #HT1721: "About LCD display pixel anomalies"**	Yes	Replace display assembly.	**L08**
	No	Explain to user that LCD is within specifications. Do not replace display assembly.	

Deep Dive: Vertical/Horizontal Lines
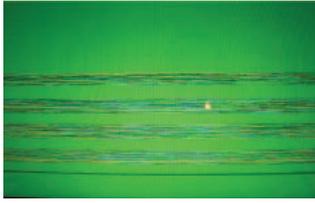
Check	Result	Action	Code
1. Horizontal lines may be related to a failing RAM module. Verify if video issue only happens AFTER the Apple logo and the spinning wheel has appeared.	Yes	Issue only happens AFTER Apple logo and spinning wheel appears. Go to step 2.	
	No	Issue happens since startup. Go to step 5.	
2. Start with shift key down (safe mode) to disable system extensions. Verify if issue still happens when booting in safe mode.	Yes	Go to step 5.	
	No	No video issue when booting in safe mode. Go to step 3.	
3. Isolate with only one memory module installed , then with the other one. Test with known-good memory. Verify that issue only happens with specific RAM module(s).	Yes	Replace affected RAM module.	**X02**
	No	Go to step 4	
4. Isolate with one known-good memory module installed in one of the memory slots. Repeat by testing in the other memory slot with known-good memory module. Verify that issue only happens with specific memory slot on logic board.	Yes	Replace logic board.	**M07**
	No	Go to step 5	
5. Run Clamshell Service Diagnostic utility and check for LCD panel presence. If not found, reseat the LVDS cable to the logic board video output. Is normal video restored?	Yes	Issue resolved by reseating loose LVDS cable.	
	No	Go to step 6	
6. Connect external compatible DisplayPort display (or DisplayPort adapter and display). Verify if correct video appears on external display.	Yes	Go to step 7.	
	No	Replace logic board.	**M04**
7. Substitute a known-good display assembly module to test logic board LVDS video output. Is normal video restored?	Yes	Replace display assembly module.	**L05**
	No	Replace logic board.	**M04**

Deep Dive: Non-uniform Brightness

Check	Result	Action	Code
1. Determine if brightness uniformity issue is visible after display has warmed up for 15 minutes.	Yes	Go to step 2.	
	No	Display backlight can take several minutes to stabilize.	
2. Check LVDS cable connection to logic board.	Yes	Reseat LVDS cable	
	No	Got to step 3	
3. Determine if variation in uniformity appears excessive when compared to another similar unit.	Yes	Replace display assembly.	**L07**
	No	Explain to user that LCD appears to meet specifications.	

Defective Camera / Built-in iSight Not Operating Correctly

Quick Check

Symptom	Quick Check
Defective Camera • Camera not detected • No green LED for camera • Excessive blooming • Poor white balance • Poor focus • Green image • Image distortion	1. Check for Software Updates. 2. Verify camera lens and glass panel are clear of contaminants.

Deep Dive

Check	Result	Action	Code
1. Launch System Profiler and confirm that "Built-in iSight" is listed under USB High-Speed Bus.	Yes	Camera recognized. Go to step 3	
	No	Go to step 2.	

2. Run Clamshell Service Diagnostic utility and check for all devices presence. If not found, inspect and reseat camera cable on logic board. Is iSight listed in System Profiler?	Yes	Camera recognized. Go to step 3.	
	No	Go to step 4.	
3. Launch PhotoBooth. Verify that camera's green LED is on and image appears normal.	Yes	Issue resolved.	
	No	Go to step 4.	
4. Substitute a known-good display assembly to test logic board camera connection. Is iSight camera operating properly?	Yes	Replace display assembly.	**X11**
	No	Replace logic board.	**M13**

Blank / No Video

Unlikely cause: Power adapter, speakers, optical drive, hard drive, fan, microphone, top case

Quick Check

Symptom	Quick Check
Blank / No Video • No video • No backlight	1. Check brightness setting 2. Attach known-good supported external display. 3. Boot from Mac OS X install disc that came with computer.

Deep Dive

Check	Result	Action	Code
1. Verify boot chime present when system restarted. Reset SMC and clear PRAM if necessary for proper start up. Is LCD video present?	Yes	Go to step 3.	
	No	Go to step 2.	
2. Connect known-good supported external display. Verify whether image appears on external display when system is booted.	Yes	External display detected by system. Go to step 3.	
	No	Go to No Video symptom code flow.	

3. Verify if LCD backlight is on by looking for faint glow from display when viewed in darkened room with brightness adjusted to full.	Yes	Video signal from system to external video is OK, LCD backlight is on. Go to step 5.	
	No	Go to step 4.	
4. Shine bright (low heat) flashlight into the front of LCD. Verify if an image is being displayed.	Yes	Image present but backlight is not on. Check logic board connections. Go to step 5.	
	No	Go to No Video symptom table.	
5. Run Clamshell Service Diagnostic utility and check for LCD panel presence. If not found, reseat and verify that the display connections to the logic board are secure. Verify if image is restored by reseating loose connections	Yes	Issue resolved.	
	No	Continue to test with known-good display assembly. Go to step 6.	
6. Verify LCD video works with a known-good display assembly.	Yes	Replace display assembly.	**L03**
	No	Go to No Video symptom table.	

Backlight Issue / No Backlight

Unlikely cause: Power adapter, battery, speaker, optical drive, hard drive, fan microphone, top case

Quick Check

Symptom	Quick Check
Backlight Issue / No Backlight • Display not illuminated • Flashing, unstable or non uniform background lighting • Poor backlight at some or all settings	1. Check that brightness setting is above minimum.

Deep Dive

Check	Result	Action	Code
1. Connect external display, clear PRAM to set brightness to default level and verify if Color LCD is listed in the System Profiler's Graphics/Displays device tree.	Yes	Display panel detected by system. Go to step 3.	
	No	Go to step 2.	
2. Run Clamshell Service Diagnostic utility and check for LCD panel presence. If not found, reseat the LVDS cable at the logic board. Repeat verification in System Profiler.	Yes	Display panel detected by system. Go to step 3.	
	No	Go to step 4.	
3. Darken room and verify backlight by detecting if any glow is emitted from the display	Yes	Backlight operating. Go to step 5.	
	No	Go to step 4.	
4. Swap memory with known-good memory to determine if video issue is RAM related.	Yes	Reseat or replace defective memory	**X01**
	No	Go to step 5.	
5. Inspect LVDS connectors and cable under magnification for pinched cables and damaged or bent pins. Do any of the connections appear to be defective?	Yes	Defective LVDS cable. Replace display assembly. Defective LVDS connector on logic board. Replace logic board.	**M25**
	No	If connections are OK and secure and the display is still blank, go to step 6.	
6. Substitute a known-good display clamshell to test logic board video output. Is backlight and display text back to normal?	Yes	Replace display assembly.	**L09**
	No	Poor or no backlight LED Driver power at logic board. Replace logic board.	**M25**

Noise / Unstable Flickering

Unlikely cause: Top case, battery

Quick Check

Symptom	Quick Check
Noise / Unstable Flickering • Image flicker • Audible noise	1. Verify known-good source sound file not causing speaker distortion.

Deep Dive

Check	Result	Action	Code
1. Verify if user's issue is due to video flickering coming from display.	Yes	Suspected flickering issue, go to step 2.	
	No	Audible noise issue, go to step 5.	
2. Verify display listed in the System Profiler's Graphics/ Displays device tree is not disappearing intermittently (refresh System Profiler to observe).	Yes	Power and LCD panel ID are OK. Go to step 3.	
	No	Go to No Video symptom code flow.	
3. Inspect and reseat the LVDS cable and camera cable connection between display and logic board. Also test if brightness setting is a contributing factor. Has flickering stopped?	Yes	Loose cable connection. Issue resolved.	
	No	Go to step 4.	
4. Substitute a known good display assembly to test logic board video output. Has flickering stopped?	Yes	Replace display assembly.	**L06**
	No	Replace logic board.	**M04**
5. Verify the source of the noise is the electrical as opposed to mechanical. Audio noise should not be a concern now that LCD components are all solid state devices including LED backlights.	Yes	Noises that are not audible from the normal user position are considered acceptable. Return unit to the user.	
	No	Noise from another source. Go to Noise/Hum/Vibration.	

Mechanical/Physical Damage

Quick Check

Symptom	Quick Check
Mechanical/Physical Damage • Broken glass • Broken hinge • Stripped screw/head • Stripped screw boss • Dent or scratch to chassis	1. Determine damage caused by user/technician environment, accidental damage, or abuse. 2. Inform user/technician the failures are not covered by Apple warranties. Refer to **http://www.apple.com/legal/warranty**

Cosmetic Defects

Quick Check

Symptom	Quick Check
Cosmetic Defects • Cracked LCD • Scorched or melted LCD • LCD impact damage	1. Determine damage caused by user/technician environment, accidental damage, or abuse. 2. Inform user/technician the failures are not covered by Apple warranties. Refer to **http://www.apple.com/legal/warranty**

Uncategorized Symptom

Quick Check

Symptom	Quick Check
Uncategorized Symptom • Unable to locate appropriate symptom code	1. Verify whether existing symptom code applies to the issue reported by the user. If not, document reported symptom and send feedback to **smfeedback6@apple.com** stating that a suitable symptom code could not be found.

Mass Storage

Hard Drive Read/Write Issue

Unlikely cause: LCD, speakers, fan, camera, microphone

Quick Check

Symptom	Quick Check
Hard Drive Read/Write Issue Bad Sector/Defective Drive Formatting Issue • Cannot save documents • Read/Write error message • Hang when accessing or saving data	1. Boot from Install DVD. Verify S.M.A.R.T. status of drive using Disk Utility. 2. Repair disk using Disk Utility. 3. Erase disk and reinstall Mac OS using Installer.

Deep Dive

Check	Result	Action	Code
1. Start up from Restore DVD and launch Disk Utility. Is hard drive available for Disk Utility to repair?	Yes	Go to step 2.	
	No	Go to step 3.	
2. Did Disk Utility mount and repair hard drive successfully? Reseat hard drive if necessary.	Yes	Restart computer. Go to step 6.	
	No	If computer has not been verified with a known-good hard drive, go to step 3; otherwise, go to step 7.	
3. Substitute a known-good bootable hard drive, does system start up to desktop?	Yes	Reinstall user's drive, go to step 2.	
	No	Continue to use known-good bootable hard drive to determine root cause. Go to step 4.	
4. After reseating hard drive SATA and logic board connections, does known-good hard drive boot to desktop?	Yes	Reinstall user's drive, go to step 2.	
	No	Suspect hard drive SATA cable, go to step 5.	

5. Replace hard drive SATA cable and retest with known-good hard drive.	Yes	Reinstall user's drive, go to step 2.	**X03**
	No	Replace logic board.	**M19**
6. Did user's hard drive start up successfully?	Yes	Issue resolved.	
	No	Repair or replace hard drive, go to step 7.	
7. Partition, erase & install Mac OS on user's hard drive. Did install complete without error and start up successfully?	Yes	Issue resolved	
	No	Hard drive appears to be defective, go to step 8.	
8. Replace user's hard drive. Does drive format correctly with a GUID partition map and install Mac OS without errors?	Yes	Issue resolved.	**H01**
	No	SATA cable verified or replaced and new hard drive installed, replace logic board.	**M19**

Hard Drive Not Recognized/Not Mounting

Unlikely cause: LCD, speakers, fan, camera, microphone, AirPort

Quick Check

Symptom	Quick Check
Hard Drive Not Recognized/ Mount **Drive No Boot** • Flashing question mark • Boots to grey screen • Boots to blue screen	**1.** Use a known-good mouse. Stuck mouse button will not allow boot. **2.** Boot from Install DVD. Verify S.M.A.R.T. status of drive using Disk Utility. **3.** Repair disk using Disk Utility. **4.** Erase disk and reinstall Mac OS using Installer.

Deep Dive

Check	Result	Action	Code
1. Boot from Restore DVD and launch Disk Utility. Is hard drive available for Disk Utility to repair?	Yes	Go to step 2.	
	No	Go to step 3.	

2. Did Disk Utility mount and repair hard drive successfully? Reseat hard drive if necessary.	Yes	Restart computer, go to step 6.	
	No	If computer has not been verified with a known-good hard drive, go to step 3; otherwise, go to step 7.	
3. Substitute a known-good bootable hard drive, does computer start up to desktop?	Yes	Install user drive, go to step 2.	
	No	Continue to use known-good bootable hard drive to determine root cause. Go to step 4.	
4. After reseating SATA and logic board connections, does known-good hard drive start up to desktop?	Yes	Install user drive, go to step 2.	
	No	Suspect hard drive SATA cable, go to step 5.	
5. Replace hard drive SATA cable and retest with known-good hard drive.	Yes	Install user drive, go to step 2.	**X03**
	No	Replace logic board.	**M19**
6. Did user's hard drive start up successfully?	Yes	Issue resolved.	
	No	Restore or replace user's hard drive, go to step 7.	
7. Partition, erase & install Mac OS on user's hard drive. Did install complete without error and start up successfully?	Yes	Issue resolved.	
	No	Hard drive appears to be defective. Go to step 8.	
8. Replace user's hard drive. Does drive format correctly with a GUID partition map and install Mac OS without errors?	Yes	Issue resolved.	**H01**
	No	SATA cable verified or replaced and new hard drive installed, replace logic board.	**M19**

Hard Drive Noisy

Unlikely cause: LCD, speakers, fan, camera, microphone

Quick Check

Symptom	Quick Check
Hard Drive Noisy • Noise during start up • Noise during operation • Noise when drive is copying or saving data	1. Start up from Install DVD. Verify S.M.A.R.T. status of hard drive using Disk Utility. 2. Repair disk using Disk Utility. 3. Check for reported noise and compare with **kBase #TS2354: Apple Portables: Hard drives and noise**

Deep Dive

Check	Result	Action	Code
1. Boot from Restore DVD and launch Disk Utility. Is hard drive available for Disk Utility to repair?	Yes	Go to step 2.	
	No	Replace hard drive or go to Drive not recognized/mount.	
2. Repair disk using Disk Utility and verify it completed successfully	Yes	Restart computer. Go to step 3.	
	No	Go to step 4.	
3. Is hard drive still noisy?	Yes	Remove hard drive and start up from external drive to test fan noise. Go to step 6.	
	No	Issue resolved.	
4. Erase disk and reinstall Mac OS using Installer. Did process complete?	Yes	Restart computer. Go to step 3.	
	No	Replace hard drive. Go to step 5.	**H06**
5. After installing new hard drive, do you still have drive noise?	Yes	Remove hard drive and start up from external drive to test fan noise. Go to step 6.	
	No	Issue resolved.	

6. After removing hard drive, verify if the system is still noisy.	Yes	Fan noise or optical drive noise likely to be the cause. See ODD Noisy table and Fan failures/Thermal issues table.	
	No	Go to step 7.	
7. Install a known-good hard drive and verify if the noise level is similar to user's hard drive.	Yes	Hard drive noise level is similar to a known-good drive and does not require replacement.	
	No	Replace hard drive. Go to step 5.	**H06**

Optical Drive Won't Accept/Reject Media

Unlikely cause: LCD, speakers, fan, camera, microphone

Quick Check

Symptom	Quick Check
Optical Drive Won't Accept/Reject Media • Cannot insert a disc into the drive • Cannot eject a disc placed into the drive	**1.** Use Apple System Profiler ATA section to see if the optical drive appears. If not, see Optical Drive Not Recognized., **2.** Restart computer and hold down mouse button or keyboard eject key to cycle optical drive. **3.** Inspect optical drive slot for obstructions

Deep Dive

Check	Result	Action	Code
1. Is optical drive listed in the device tree for serial-ATA devices in System Profiler?	Yes	Optical drive has power, inspect disc acceptance. Go to step 5.	
	No	Inspect hardware. Go to step 2.	

2. Verify all connections between logic board, flex cable, and optical drive are secure. Visually inspect cables and connectors for any debris, damage, or bent pins. Is optical drive now listed in System Profiler?	Yes	Optical drive has power, inspect disc acceptance. Go to step 5.	
	No	Replace any damaged cables and retest. If connections are good and with no visible cable damage, go to step 3.	**X03**
3. Disconnect user's optical drive by lifting SATA cable at logic board and connecting a known good optical drive assembly. Is optical drive now listed in System Profiler?	Yes	SATA port functional, reconnect user's optical drive & SATA cable. Go to step 4.	
	No	Replace logic board.	**M19**
4. Install and test user's optical drive with replacement SATA flex cable. Is optical drive now listed in System Profiler?	Yes	Cable change resolved issue.	**X03**
	No	Replace the optical drive. (Mechanical damage to optical drive, if found)	**J03** **(J06)**
5. Inspect optical drive slot for disc insert/eject. Is there clearance for disc use?	Yes	Go to step 6.	
	No	Replace damaged optical drive or system top case that interferes with disc use.	**J01** **(J05)** **X13**
6. Insert known-good disc and test user's optical drive for acceptance of disc. Does disc auto eject?	Yes	Replace the optical drive. (Mechanical damage to optical drive, if found)	**J03** **(J06)**
	No	Go to step 7.	
7. Does disc mount to desktop?	Yes	Go to step 8.	
	No	Go to Optical Drive Read/ Write Data Error symptom table.	
8. Does disc eject properly from optical drive?	Yes	Issue resolved.	
	No	Replace optical drive or top case that interferes with disc ejection.	**J02** **X13**
9. With replacement flex cable and interconnect board, is disc now recognized?	Yes	Issue resolved.	
	No	Replace optical drive. If drive has already been replaced, then replace logic board.	**J03**

Optical Drive Read/Write Data Error

Unlikely cause: LCD, speakers, fan, camera, microphone

Quick Check

Symptom	Quick Check
Optical Drive Read/Write Data Error • Errors when writing optical media. • Errors when reading optical media. • Hang when accessing or preparing to write data.	1. Test optical media in another drive of the same type in same type of machine to rule out media issue. 2. Check with known-good discs like the Install discs that came with the computer. 3. For write issues, check with known-good media that performs well in another computer and optical drive of the same type. 4. Check both CD and DVD media. If only one type of media is producing errors, there is a laser issue. (J99)

Deep Dive

Check	Result	Action	Code
1. Is media free to spin without optical drive scraping edge or surface of media?	Yes	Go to step 2.	
	No	Replace optical drive.	**J03**
2. Can optical drive read both CD and DVD known-good media?	Yes	Go to step 6.	
	No	Reading CD only or DVD only indicates laser issue, replace optical drive.	**J03**
		Optical drive cannot read any media reliably, go to step 3.	
3. Reseat cable connections at logic board and optical drive. Verify that media is now recognized and reads reliably.	Yes	Reseat resolved issue.	**X03**
	No	Go to step 4.	
4. Disconnect optical drive by lifting SATA cable at logic board and connecting a known-good optical drive. Verify that media is now recognized and reads reliably.	Yes	SATA port functional, reconnect user's optical drive & SATA cable. Go to step 5.	
	No	Replace logic board.	**M19**

5. Install and test with replacement optical drive SATA flex cable. Verify that media is now recognized and reads reliably.	Yes	Cable change resolved issue.	**X03**
	No	Replace the optical drive. (Mechanical damage to optical drive, if found)	**J03** **(J05)**
6. Test write data to compatible CD and DVD media. Verify burned media is recognized and reads reliably.	Yes	Issue resolved.	
	No	Replace the optical drive. (Mechanical damage to optical drive, if found)	**J03** **(J06)**

Optical Drive Not Recognized/Mount

Unlikely cause: LCD, speakers, fan, camera, microphone

Quick Check

Symptom	Quick Check
Optical Drive Not Recognized/ Mount • Discs inject and eject, but do not appear in Finder	**1.** Use Apple System Profiler ATA section to see if the optical drive appears. **2.** Serial-ATA section of Apple System Profiler will show any media inserted. **3.** Check Finder Preferences: General and make sure "CD's, DVD's and iPods" is checked under "Show these items on the Desktop." **4.** Check both CD and DVD media. If only one type of media is recognized, there might be a laser related issue. (J99)

Deep Dive

Check	Result	Action	Code
1. Is optical drive listed in the device tree for SATA devices in System Profiler?	Yes	Issue resolved.	
	No	Go to step 2.	
2. Verify all connections between logic board, flex cable, optical drive are secure. Visually inspect cables and connectors for any debris, damage, or bent pins. Is optical drive now listed in System Profiler?	Yes	Issue resolved.	
	No	Replace any damaged cables and retest. If connections are good and with no visible cable damage, go to step 3.	**X03**

3. Disconnect optical drive by lifting SATA cable at logic board and connecting a known-good drive. Is optical drive now listed in System Profiler?	Yes	SATA port functional, reconnect user's optical drive & SATA cable. Go to step 4.	
	No	Replace logic board.	**M19**
4. Install and test with replacement optical drive SATA flex cable. Is optical drive now listed in System Profiler?	Yes	Cable change resolved issue	**X03**
	No	Replace the optical drive. (Mechanical damage to optical drive, if found)	**J03 (J05)**

Optical Drive Noisy

Unlikely cause: LCD, speakers, fan, camera, microphone

Quick Check

Symptom	Quick Check
Optical Drive Noisy • Noise during boot • Noise during operation • Noise when drive is copying or writing data	1. Test optical media in another drive of the same type in same type of computer to rule out media issue. 2. Check with known-good discs. Install discs that came with the computer. 3. Check to see if noise occurs without media in the drive. If so, check for hard drive (H06) and fan (M18) caused noise.

Deep Dive

Check	Result	Action	Code
1. Is optical drive constantly seeking or cycling eject mechanism without an optical disc installed? Optical drive should perform only one reset sequence and rest idle, ready for media.	Yes	Continue and verify with media, go to step 2.	
	No	Replace optical drive if continuous activity occurs with no disc installed.	**J04**

2. Insert known good data CD. Is media free to spin without optical drive scraping edge or surface of media? Verify disc does not exceed maximum thickness specification.	Yes	Continue and verify with media, go to step 3.	
	No	Internal mechanical interference is affecting rotational spin of media, replace optical drive.	**J04**
3. Initial disc handling noise is normal. Disc spinning and head seek indicate disc is mounting to desktop. Seek noise should settle down once mounted. Is noise above normal and related to seek activity?	Yes	Replace optical drive.	**J04**
	No	Go to step 4.	
4. Disc spin should cease 30 seconds after mounting data CD on OS desktop. Is the noise related to disc spin?	Yes	Go to step 5.	
	No	Go to step 6.	
5. Remove the optical drive and check for the correct seating of the brackets on the optical drive and in the top case. Reinstall drive in unit and retest. Verify if drive is still noisy.	Yes	Go to step 6.	
	No	Issue resolved. Optical drive was not properly mounted in enclosure. (Possible physical damage to optical drive.)	**(J05)**
6. Eject known good data CD. Disc handling noise should be one pop of disc from motor hub and a motor gear sound driving disc out of optical drive. Is noise above normal and related to disc eject activity or multiple eject attempts?	Yes	Replace optical drive.	**J02**
	No	Go to step 7.	
7. Disc spin should cease 30 seconds after mounting data CD on desktop. Media may be mounting on a defective internal spindle hub. Is the noise related to disc spin?	Yes	Replace optical drive.	**J04**
	No	Noise does not appear to be related to optical drive.	

Optical Drive Not Performing to Specs

Unlikely cause: LCD, speakers, fan, camera, microphone

Quick Check

Symptom	Quick Check
Optical Drive Not Performing to Specs Read or write speeds slower than expected.	1. Test optical media in another drive of the same type in same type of computer to rule out media issue. 2. Check with known-good discs—Install discs that came with the computer. 3. For disc write issues, check with known-good media that performs well in another computer and drive of the same type. 4. Check both CD and DVD media. If only one type of media is producing errors, there might be a laser related issue. (J99)

Deep Dive

Check	Result	Action	Code
1. Can optical drive read both CD and DVD known-good media?	Yes	Go to step 5.	
	No	Reading CD only or DVD only indicates laser issue, replace optical drive.	**J03**
		Optical drive cannot read any media reliably. Go to step 2.	
2. Reseat cable connections at logic board and optical drive. Verify that media is now recognized and reads reliably.	Yes	Reseat resolved issue.	**X03**
	No	Go to step 3.	
3. Disconnect optical drive by lifting SATA cable at logic board and connecting a known-good drive. Verify that media is now recognized and reads reliably.	Yes	SATA port functional, reconnect user's optical drive & SATA cable. Go to step 4.	
	No	Replace logic board.	**M19**
4. Install and test with replacement optical drive SATA flex cable. Verify that media is now recognized and reads reliably.	Yes	Cable change resolved issue.	**X03**
	No	Replace optical drive. (Mechanical damage to optical drive, if found)	**J03** **(J05)**

| 5. Test write data to compatible CD and DVD media. Verify burned media is recognized and reads reliably. | Yes | Issue resolved. | |
| | No | Replace optical drive. (Mechanical damage to optical drive, if found) | **J03 (J06)** |

SD (Secure Digital) Memory Card Will Not Insert Into Slot

Unlikely cause: LCD, logic board, hard drive

Quick Check

Symptom	Quick Check
SD Memory Card will not insert into SD Slot • SD Memory Card does not fully seat into the slot • Slot door does not open completely	1. The SD memory card must be a 32 mm by 24 mm by 2.1 mm. You can also use thinner cards, such as MultiMediaCards (MMC). 2. Clear any obstruction in the slot.

Deep Dive

Check	Result	Action	Code
1. Check that a known-good SD card fits in slot.	Yes	Ask user to replace defective or out-of-spec SD card.	
	No	Loosen all logic board screws and insert known-good SD card again. Go to step 2.	
2. Does memory card now fit in SD slot?	Yes	Tighten back the logic board screws and go to step 3.	
	No	Replace logic board and retest.	**M17**
3. Does SD card now eject and insert without issue?	Yes	Issue resolved by logic board alignment.	
	No	Replace logic board. .	**M17**

SD (Secure Digital) Memory Card Not Recognized By System

Unlikely cause: LCD, logic board, optical drive, hard drive

Quick Check

Symptom	Quick Check
SD Memory Card is not recognized by the system. • Card does not show up on the desktop or in System Profiler	1. Check correct drivers are installed for the user's SD card type. Standard SD memory cards are supported by OS Software, but other may require specific driver software to be used. 2. Verify with known good SD Memory card that issue remains.

Deep Dive

Check	Result	Action	Code
1. Verify that SD card inserts correctly.	Yes	Go to step 2.	
	No	Go to SD Memory Card Will Not Insert Into Slot symptom table.	
2. Verify that the SD card shows up on the desktop or in System Profiler.	Yes	Go to step 3	
	No	Check that a known-good SD Memory card can read and write correctly on system. If yes, redirect user to SD card vendor for faulty/unsupported card. If no, replace logic board for damaged SD card slot.	**M17**
3. Unlock the user SD Card and verify that it can be read and written on system.	Yes	System is functional.	
	No	Check that a known-good SD Memory card can read and write correctly on system. If yes, redirect user to SD card vendor for faulty/unsupported card. If no, replace logic board for damaged SD card slot.	**M17**

Uncategorized Symptom

Quick Check

Symptom	Quick Check
Uncategorized Symptom • Unable to locate appropriate symptom code	Verify whether existing symptom code applies to the issue reported by the user. If not, document reported symptom and send feedback to **smfeedback6@ apple.com** stating that a suitable symptom code could not be found.

Communications

Ethernet Port/Device Issue

Unlikely cause: power adapter, battery, speakers, optical drive, hard drive, fan, camera, microphone, top case, display clamshell, AirPort card

Quick Check

Symptom	Quick Check
Ethernet Port/Device Issue • No Ethernet device present • Unable to access network resources • Ethernet device shows no connection • Ethernet device unable to get an IP address • Slow network performance	1. Check the network cable for damage, try a known good Ethernet cable – CAT5 or better recommended for 100Mbps+ connections. 2. Check Ethernet ports on Mac and wall/switch for dust, debris, damage or bent pins. 3. Ensure distance from networking infrastructure is less than 300 feet / 105 meters. 4. Verify port, cable and network hardware with a known good system. Isolate firewall, MAC address filtering or hardware access control devices. 5. Check system logs. Isolate OS by starting up from original OS install disc (10.6.x) or compatible known good OS.

Deep Dive

Check	Result	Action	Code
1. Visually inspect Ethernet connector to ensure all pins will make physical contact with CAT5 network cable.	Yes	Ethernet interface contacts are good. Go to step 2.	
	No	Pins are damaged or bent flat, replace logic board.	**M10**
2. Isolate OS by booting from original OS install disc. Verify Network Link status active by using Network Utility on install DVD. If Ethernet interface (en0) Link Status is inactive, recheck physical connect and link activity indicator on hub/switch.	Yes	Ethernet interface (en0) Link Status is active, go to step 3.	
	No	If connection is OK on known-good system, replace logic board.	**M10**

3.	Verify if IP address is listed for the Ethernet interface in System Preferences: Network. Connect computer to network with known-good DHCP IP allocation, ensuring static DHCP maps or filtering is not preventing address allocation. Note: DHCP allocation may not be instantaneous depending on network. Retest.	Yes	Go to step 4.	
		No	If connection is OK on known-good system, replace logic board.	**M10**
4.	Verify connection by using Network Utility to ping another connected computer on same subnet. Ensure target computer's IP address is valid, on same subnet and powered on. Ensure no MAC address filtering or hardware access control devices are present. Use a simple hub/switch environment.	Yes	Go to step 5.	
		No	If the symptoms do not change, replace the logic board.	**M10**
5.	Verify Ethernet performance and reliability by starting up from a known-good OS install, and downloading a large file from a web site or file server.	Yes	If there is no performance or connectivity issue isolated solely to system under test, the problem may be the network environment. No repair is necessary.	
		No	If there are connection dropouts or poor performance not seen on a known-good test system, replace logic board.	**M10**

AirPort/Bluetooth: Defective Wireless Devices

Unlikely cause: power adapter, battery, speakers, optical drive, hard drive, fan, microphone, top case

Caution: When testing an AirPort card connection, wait at least 5 seconds after shutdown before touching the camera cable connection to the logic board. Waiting less than that could damage the AirPort card.

Quick Check

Symptom	Quick Check
AirPort or Bluetooth: Defective Wireless Devices • Unable to join networks or pair devices • Card not available or recognized • Intermittent device or connection dropouts	1. Open System Preferences and make sure AirPort or Bluetooth is turned on and (for AirPort) that a network is selected. 2. Verify that correct OS is installed and all software and firmware updates have been run. 3. Check that base station is not using unsupported connection and encryption protocols. 4. Check for nearby interference sources such as microwave ovens or cordless phones. See **kBase #HT1365: AirPort and Bluetooth: Potential sources of interference for wireless devices and networks** 5. Check the number of users trying to use AirPort in the area for possible network congestion. 6. Isolate OS by booting from original install disc. Attempt to connect to base station (AirPort) or pair with wireless keyboard (Bluetooth). 7. Reset PRAM.

Deep Dive

Check	Result	Action	Code
1. Open System Profiler, check to see if AirPort and Bluetooth are recognized. Run Clamshell Service Diagnostic and check for all devices' presence.	Yes	(AirPort) Ensure MAC address filtering is not enabled on the base station. Go to step 2. (Bluetooth) Ensure target devices are set to discoverable.	
	No	AirPort and/or Bluetooth not recognized. Go to step 4.	

2. (AirPort) To help replicate intermittent AirPort issues, fully open and fully close the display clamshell 10-20 times, then check to see if AirPort is still recognized.	Yes	AirPort recognized. Go to step 3.	
	No	After cycling clamshell AirPort is no longer recognized, or system crashed during cycling. Go to step 4.	
3. (AirPort) Put unit to sleep and then wake it up. Is AirPort still recognized?	Yes	AirPort recognized. Intermittent issue not replicated. Continue testing and get more info from user.	
	No	AirPort not recognized. Go to step 4.	
4. Reseat camera cable connection to logic board. Retest, including fully opening and fully closing the display clamshell repeatedly, and verify if issue is resolved.	Yes	Loose logic board connection.	**N04**
	No	AirPort issue, go to step 5; Bluetooth issue, go to step 9.	
5. (AirPort) Verify the antenna connections to the AirPort card are not reversed or loose. Reseat antenna and I/O cable connections. **Note:** To minimize reassembly between troubleshooting steps, leave clutch barrel off, put system on pink foam triangle fixture, attach clamshell to top case using 1 clutch screw on each side, and connect an external display, keyboard and mouse.	Yes	Loose connections or crossed antenna. If AirPort card connection was found reversed, logic board may have been damaged and may need replacement.	**N04** **M11**
	No	If connectors are secure, antenna connections not reversed and show no signs of damage or wear, go to step 6.	
6. (AirPort) Try a known-good AirPort card. Retest, including gentle twisting of the camera cable near AirPort card to simulate clamshell cycling, and attempt a sleep/wake cycle, and verify if issue is resolved.	Yes	Replace AirPort card. Reassemble unit and perform 10-20 open/close cycles of clamshell.	**N12**
	No	Reinstall original AirPort card. Go to step 7.	
7. (AirPort) Try a known-good AirPort antenna. Retest, including gentle twisting of the camera cable near AirPort card to simulate clamshell cycling, and attempt a sleep/wake cycle, and verify if issue is resolved.	Yes	Replace AirPort antenna. Reassemble unit and perform 10-20 open/close cycles of clamshell.	**N14**
	No	Reinstall original AirPort antenna. Go to step 8.	

8. (AirPort) Try a known-good display clamshell if available. Retest, including gentle twisting of the camera cable near AirPort card to simulate clamshell cycling, and attempt a sleep/wake cycle, and verify if issue is resolved.	Yes	Replace display clamshell. Reassemble unit and perform 10-20 open/close cycles of clamshell. Remove EMI gasket (if present) below camera cable guide, above 3 clutch screws, to prevent strain damage to camera cable.	**L16**
	No	Reinstall original display clamshell. Replace logic board.	**M11**
9. (Bluetooth) Enable Bluetooth and try a known good display clamshell if available. Bluetooth circuitry in the clamshell is not accessible. Retest and verify if issue is resolved.	Yes	Replace display clamshell.	**L16**
	No	Replace logic board.	**M11**

No/Poor Wireless Signal

Unlikely cause: power adapter, battery, speakers, optical drive, hard drive, fan, microphone, top case

Quick Check

Symptom	Quick Check
No/Poor Wireless Signal • Unable to find networks • Intermittent connection dropouts • Slow transfer speeds	**1.** Check for nearby interference sources in the 2.4/5GHz range such as microwave ovens and cordless phones. See **kBase #HT1365: AirPort and Bluetooth: Potential sources of interference for wireless devices and networks** **2.** Check that computer is within base station range – move closer to base station. **3.** Base station checks: a. Base station is not set to low-power transmission mode b. Base station is not using unsupported connection and encryption protocols c. Check for possible Wi-Fi channel overlap (nearby base stations using adjacent channel) **4.** Isolate OS by booting from original OS install disc (10.6.x). Attempt to connect to base station.

Deep Dive

Check	Result	Action	Code
1. Open System Profiler, check to see if AirPort card is recognized under Network: AirPort Card.	Yes	Make sure all AirPort software and firmware updates have been applied. Ensure base station is not using MAC address filtering or creating a hidden network.	
	No	AirPort not detected, go to AirPort/Bluetooth: Defective Wireless Devices symptom.	

AirPort Card: Kernel Panic

Unlikely cause: power adapter, battery, speakers, optical drive, hard drive, fan, camera, microphone, top case

Quick Check

Symptom	Quick Check
AirPort Card: Kernel Panic • Kernel panic on boot • Kernel panic or freezing while attempting to connect to Wi-Fi networks • Kernel panic while transferring data on Wi-Fi networks.	**1.** Isolate OS by booting from original OS install disc. Attempt to connect to Wi-Fi network. **2.** Use Software Update to make sure all AirPort software and firmware updates have been applied.

Deep Dive

Check	Result	Action	Code
1. Ensure MAC address filtering is not enabled on the base station. Is kernel panic resolved?	Yes	Software issue.	
	No	Go to AirPort/Bluetooth: Defective Wireless Devices symptom.	

Wireless Performance Issue / Slow Connection

Unlikely cause: power adapter, battery, speakers, optical drive, hard drive, fan, microphone, top case

Quick Check

Symptom	Quick Check
Wireless Performance Issue / Slow Connection • Slow or stalled data transfers • Intermittent connection dropouts	1. Check for nearby interference sources in the 2.4/5GHz range such as microwave ovens or cordless phones. See **kBase #HT1365: AirPort and Bluetooth: Potential sources of interference for wireless devices and networks** 2. (AirPort) Check the number of users trying to use AirPort in the area for possible network congestion. Move closer to base station to improve signal reception. 3. (Bluetooth) Move devices closer together. 4. Check performance with a known-good system. 5. (AirPort) Wireless base station checks: a. Base station is not set to low-power transmission mode. b. Base station is not set to a slower protocol mode (802.11b). c. Check for possible Wi-Fi channel overlap (nearby base stations using adjacent channel). 6. Isolate OS by booting from original OS install disc. Attempt to connect to base station (AirPort) or pair with wireless keyboard (Bluetooth) 7. Use Software Update to make sure all AirPort and Bluetooth software and firmware updates have been applied.

Deep Dive

Check	Result	Action	Code
1. Inspect the display clutch barrel for damage. AirPort radio is in display clutch barrel area.	Yes	Record damage: Proceed to possibly repair damaged parts, go to step 2.	
	No	No visible damage, go to step 2.	

2. Turn off Bluetooth. Bluetooth circuitry in the clamshell is not accessible. Refer to **kBase #TS1809: "MacBook Air: Optimizing AirPort performance while using Bluetooth"** Retest AirPort performance. Is issue resolved?	Yes	Possible AirPort interference from the Bluetooth card. Change AirPort base station channel.	**N06**
	No	Go to AirPort/Bluetooth: Defective Wireless Devices symptom table.	

Wireless Input Device Loses Connection

Unlikely cause: display clamshell, speaker assembly, optical drive, hard drive

Quick Check

Symptom	Quick Check
Wireless Input Device Loses Connection	1. Check Bluetooth input device has fully charged batteries.

Deep Dive

Check	Result	Action	Code
1. System Profiler should list Bluetooth radio device under system hardware. Is Bluetooth device available?	Yes	Bluetooth radio present, verify Bluetooth preference settings, go to step 2.	
	No	Attempt Bluetooth repair, go to step 5.	
2. System Preferences has a Bluetooth panel. Ensure Bluetooth is on and discoverable. Are there any devices listed in pairing window?	Yes	Choose known-good device and establish a connection. Go to step 3.	
	No	Attempt Bluetooth repair, go to step 5.	
3. Ensure a known-good Bluetooth device is on, in close range and in discoverable mode. Is computer pairing with known-good device?	Yes	Pairing verified, connect with user's device, go to step 4.	
	No	Attempt Bluetooth repair, go to step 5.	

4.	Is computer pairing with user's Bluetooth device?	Yes	Connection established, continue testing for connection loss, go to step 7.	
		No	Check for software updates for both computer & device.	**K07**
5.	Run Clamshell Service Diagnostic utility and check for all devices presence. If not found, reseat camera cable on logic board. Is the Bluetooth radio present, on and pairing with a known-good device?	Yes	Loose cable connection.	**N04**
		No	Go to step 6.	
6.	Install and test a known-good display clamshell. Is the Bluetooth radio present, on and pairing with a known-good device?	Yes	Replace display clamshell.	**L16**
		No	Replace logic board.	**M11**
7.	Continue to actively test a known-good Bluetooth device to determine if there is a disconnect. Do not allow computer to sleep during this test. Is link lost during test?	Yes	Check for software update, 2.4 GHz radio interference or device low battery.	
		No	Known-good device passed, test with user's Bluetooth device.	
8.	Continue to test user's Bluetooth device to determine if there is a disconnect. Do not allow computer to sleep during this test. Is link lost during test? If link is lost during start up, turn on System Preferences: Bluetooth: Advanced: "Open Bluetooth Setup Assistant at start up when no input device is present".	Yes	Check for software update, 2.4 GHz radio interference, device low battery or user's device features list for explanation.	
		No	User's device not losing connection. Issue not repeatable or resolved.	

Wireless Input Device Doesn't Pair

Unlikely cause: display clamshell, logic board, optical drive, hard drive

Quick Check

Symptom	Quick Check
Wireless Input Device Doesn't Pair • Can't get the system to recognize the Bluetooth keyboard, mouse or trackpad	1. Check Bluetooth System Preference is set to Discoverable. 2. Check Bluetooth device has fully charged batteries. 3. Check for Bluetooth software updates for both the device and Mac OS X. 4. If the Bluetooth pairs with no problems, probe about potential interference issue at user's site.

Deep Dive

Check	Result	Action	Code
1. System Profiler should list Bluetooth radio device under system hardware. Is Bluetooth device available?	Yes	Bluetooth radio present, verify Bluetooth preference settings, go to step 2.	
	No	Attempt Bluetooth repair, go to step 5.	
2. System Preferences has a Bluetooth panel. Ensure Bluetooth is on and discoverable. Are there any devices listed in pairing window?	Yes	Choose known-good device and establish a connection. Go to step 3.	
	No	Attempt Bluetooth repair, go to step 5.	
3. Ensure a known-good Bluetooth device is on, in close range and discoverable mode, Is system pairing with known-good device?	Yes	Pairing verified, connect with user's device, go to step 4.	
	No	Attempt Bluetooth repair, go to step 5.	
4. Is Bluetooth pairing with user's Bluetooth device?	Yes	Issue resolved.	
	No	Check for SW update for both System and user device.	

5. Run Clamshell Service Diagnostic utility and check for all devices presence. If not found, reseat camera cable with logic board. Is the Bluetooth radio present, on and pairing with a known-good device?	Yes	Bad logic board connection. Issue resolved.	
	No	Go to step 6.	
6. Install and test a known good clamshell. Is the Bluetooth radio present, on and pairing with a known-good device?	Yes	Replace display clamshell.	**L16**
	No	Replace logic board. Optional step 7.	**M11**
7. With the logic board replacement, is the Bluetooth now pairing?	Yes	Bad logic board. Issue resolved.	**M11**
	No	All parts replaced. Try minimum configuration troubleshooting.	

Uncategorized Symptom

Quick Check

Symptom	Quick Check
Uncategorized Symptom • Unable to locate appropriate symptom code	1. Verify whether existing symptom code applies to the issue reported by the user. If not, document reported symptom and send feedback to **smfeedback6@apple.com** stating that a suitable symptom code could not be found.

Input/Output Devices

USB Port Does Not Recognize Known Devices

Unlikely cause: LCD, hard drive, optical drive

Quick Check

Symptom	Quick Check
USB Port does not recognize known devices • USB wired keyboard or mouse not recognized • USB flash drive not recognized	1. Check the for latest software update. 2. Use Apple System Profiler to verify the computer recognizes the USB bus. 3. Test port with known good Apple keyboard or mouse. 4. Verify any USB hubs have sufficient power.

Deep Dive

Check	Result	Action	Code
1. Reset SMC and clear PRAM. Was USB device recognized?	Yes	Issue resolved.	
	No	Go to step 2.	
2. Is USB device receiving power from USB port? Note: first device to need >500ma will get 1000ma, all others are limited to <500ma.	Yes	Go to step 3.	
	No	Replace logic board.	**M15**
3. Is the latest Mac-compatible USB software driver for this USB device installed?	Yes	Replace logic board.	**M15**
	No	Obtain Mac-compatible USB driver.	

FireWire Port Does Not Recognize Known Devices

Unlikely cause: LCD, logic board, optical drive, hard drive

Quick Check

Symptom	Quick Check
FireWire Port does not recognize known devices • Attached FireWire device, such as digital camera or mass storage drive, not recognized by system	1. Check for latest software update. 2. Use Apple System Profiler to verify computer recognizes FireWire bus. 3. Test port by connecting to another computer using FireWire Target Disk Mode. 4. Verify FireWire cable is good. 5. Verify a self powered FireWire device is getting power.

Deep Dive

Check	Result	Action	Code
1. Reset SMC and verify if FireWire port is recognized.	Yes	Issue resolved.	
	No	FireWire port is bad. Replace logic board.	**M12**

Built-in Keyboard Does Not Work Properly

Unlikely cause: LCD, hard drive, optical drive

Quick Check

Symptom	Quick Check
Built-in Keyboard Does Not Work Properly • Keystrokes not recognized • Locks up • Displayed characters don't match	1. In System Preferences: International: Input Menu, enable Keyboard Viewer. Select Show Keyboard Viewer from Input Menu in menu bar. Test keyboard. 2. Confirm correct keyboard layout is selected. 3. Update to the latest system software. 4. Press Caps Lock to see if light comes on, which would indicate at least a partial connection to logic board.

Deep Dive

Check	Result	Action	Code
1. If specific keys are not working, confirm if they are physically broken.	Yes	Refer to **kBase #HT4002: MacBook/MacBook Pro: Black Keycap Replacement**. If a keycap kit is available for this model, order kit and replace affected key(s). Go to step 4.	
		If a keycap kit is not available for this model, replace complete top case. Go to step 4.	**K01**
	No	Go to step 2.	
2. Reseat keyboard flex cable to logic board and verify that all keys are functional.	Yes	Issue resolved.	**X99**
	No	Go to step 3.	
3. Disconnect and verify that keyboard flex cable is in good condition (no delamination or torn cable end, no missing or cracked tracks).	Yes	Go to step 4.	
	No	Replace top case. Go to step 5.	**K01**
4. Reseat cable and check that flex cable end is fully inserted and aligned with connector on logic board, and that connector lock is closed. Verify that keyboard now functions properly. Reseat cable and verify with ASD that all keys are functional.	Yes	Issue resolved.	**K01**
	No	Replace top case. Go to step 5.	
5. Verify that all keys are functional using ASD.	Yes	Issue resolved.	**K01**
	No	Replace logic board.	**M15**

Specific Keys Don't Work

Unlikely cause: power adapter, battery, speakers, LCD, optical drive, hard drive, fan, microphone

Quick Check

Symptom	Quick Check
Specific Keys Don't Work • Keycap broken • Key switch broken • Sticky key • Key pressed not recognized	1. Determine if damage caused by user/technician environment, accidental damage, or abuse. 2. Inform user/technician the failures are not covered by Apple warranties. Refer to **http://www.apple.com/legal/warranty** 3. Inspect keycap to remove debris trapped under it. 4. If the keycap is loose, check if clasp is still intact and reattach it. 5. Refer to **kBase #HT4002: MacBook/MacBook Pro: Black Keycap Replacement**. If a keycap kit is available for this model, order kit and replace affected key(s). If a kit is not available, replace complete top case (code **K01**).

Built-in Trackpad Does Not Work

Quick Check

Symptom	Quick Check
Built-in Trackpad Does Not Work • Cursor does not move. • Select button of trackpad inoperable • Multiple touch features inoperable	1. Check for environmental factors such as humidity, hand lotion or jewelry. Check if user is touching the trackpad simultaneously with both hands. 2. Clean the trackpad surface (with the computer powered off) using a clean, dry, lint-free cloth. 3. Make sure all software and firmware updates have been applied.

Deep Dive

Check	Result	Action	Code
1. Can you see the trackpad continuously listed on USB in Apple System Profiler?	Yes	Go to step 5.	
	No	Go to step 2.	
2. Does trackpad look damaged? Verify trackpad alignment is proper and click-depth set screw is at factory setting.	Yes	Replace trackpad according to symptom found. - No mouse/trackpad response - Trackpad cursor not tracking properly - Trackpad button issues Go to step 6.	**K02** **K12** **K13**
	No	Go to step 3.	
3. Reseat the trackpad flex cable to the logic board. Does trackpad work now?	Yes	Loose cable. Issue resolved.	
	No	Go to step 4.	
4. Is the trackpad connector on the logic board damaged?	Yes	Replace logic board.	**M24**
	No	Go to step 5.	
5. In System Preferences: Universal Access, turn off special Keyboard and Mouse & Trackpad settings. Set for normal use, enable and test multiple touch features. Does trackpad work now?	Yes	Settings issue resolved.	
	No	Go to step 6.	
6. Does the select button click? Verify trackpad alignment is proper and click-depth set screw is at factory setting.	Yes	All trackpad issues resolved.	
	No	Go to step 7.	
7. Does a known-good trackpad work?	Yes	Replace trackpad according to symptom found. - No mouse/trackpad response - Trackpad cursor not tracking properly - Trackpad button issues	**K02** **K12** **K13**
	No	Replace logic board.	**M16**

Built-in Keyboard Has Dim or No Keyboard Backlight

Unlikely cause: LCD, hard drive, optical drive

Quick Check

Symptom	Quick Check
Built-in Keyboard Has Dim or No Backlight • In darkened room, keyboard backlight does not come on or is dim.	1. Make sure that the option "Illuminate keyboard in low light condition" is checked in Keyboard System Preferences. 2. Make sure that keyboard backlight is turned on and brightness turned up. 3. Block the ambient light sensor to simulate darkened room.

Deep Dive

Check	Result	Action	Code
1. Make sure that the option "Illuminate keyboard in low light condition" is checked in Keyboard System Preferences. Then cover the ambient light sensor, located to left of camera. Did the display dim?	Yes	Ambient light sensor is working. Go to step 4.	
	No	Go to step 2.	
2. Cover the ambient light sensor again. Did the keyboard backlight work?	Yes	Issue resolved.	
	No	Go to step 3.	
3. In the Apple System Profiler, can you see the AirPort and Bluetooth cards?	Yes	The light sensor connection to logic board is likely good. Replace display assembly.	**L14**
	No	Go to step 4.	
4. Reseat the keyboard backlight connection to the logic board. Does the keyboard backlight work now?	Yes	Issue resolved.	
	No	Go to step 5	
5. Measure the voltage between pin 4 and pin 2 of the keyboard backlight connector J5815. Is there voltage present with the running system in a dark room?	Yes	Replace top case.	**K10**
	No	Replace logic board.	**M99**
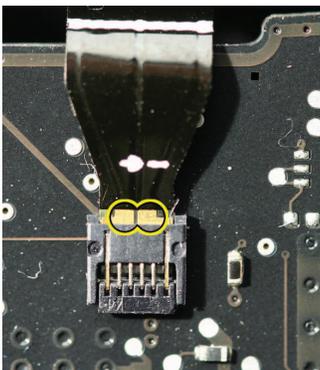
Built-in Keyboard Is Not Recognized

Unlikely cause: LCD, hard drive, optical drive

Quick Check

Symptom	Quick Check
Built-in Keyboard Is Not Recognized • Keystrokes not recognized	1. Reset SMC. 2. Press Caps Lock. If the Caps Lock light comes on that indicates at least a partial connection to the logic board. 3. In System Preferences: International: Input Menu, enable Keyboard Viewer. Select Show Keyboard Viewer from the Input Menu in the menu bar. Test the keyboard.

Deep Dive

Check	Result	Action	Code
1. In Apple System Profiler do you see "Apple Internal Keyboard/ Trackpad" listed under USB hardware devices?	Yes	Go to step 3.	
	No	Go to step 2.	
2. Reset SMC and verify if Apple Internal Keyboard/Trackpad is now seen in the USB devices list of Apple System Profiler.	Yes	Go to step 3.	
	No	Replace logic board.	**M15**
3. Disconnect and verify that keyboard flex cable is in good condition (no delamination or torn cable end, no missing or cracked tracks).	Yes	Go to step 4.	
	No	Go to Built-In Trackpad Does not Work symptom table.	
4. Reseat cable and check that flex cable end is fully inserted and aligned with connector on logic board, and that connector lock is closed. Verify that keyboard now functions properly.	Yes	Issue resolved.	
	No	Replace top case. Go to step 5.	**K11**
5. Verify that all keys are functional using ASD.	Yes	Issue resolved.	
	No	Replace logic board.	**M15**

Built-in Trackpad Does Not Track Properly

Unlikely cause: LCD, hard drive, optical drive

Quick Check

Symptom	Quick Check
Built-in Trackpad Does Not Track Properly • Cursor movement is random, uneven, or jumpy. • Cursor hangs or stalls along path.	1. Check for environmental factors such as humidity, hand lotion or jewelry. Check if user is touching the trackpad simultaneously with both hands. 2. Clean the trackpad surface (with the computer off) using a clean, dry, lint free cloth. 3. Make sure all software and firmware updates have been applied. 4. If the issue occurs when system is running from the power adapter, use a grounded power cord with the power adapter.

Deep Dive

Check	Result	Action	Code
1. Can you see the trackpad continuously listed under USB in Apple System Profiler?	Yes	Trackpad communicating to system. Go to step 5.	
	No	Go to step 2.	
2. Does the trackpad look damaged?	Yes	Replace trackpad. Go to step 6.	**K04**
	No	Go to step 3.	
3. Reseat the trackpad flex cable on the logic board. Does the trackpad work now?	Yes	Loose cable. Issue resolved.	
	No	Go to step 4.	
4. Is the trackpad connector on the logic board damaged?	Yes	Replace logic board.	**M24**
	No	Go to step 5.	
5. In System Preferences: Universal Access, turn off special Keyboard and Mouse & Trackpad settings. Does trackpad work now?	Yes	Settings issue resolved.	
	No	Go to step 6.	

6. Does a known-good trackpad work?	Yes	Replace trackpad according to symptom found. - No mouse/trackpad response - Trackpad cursor not tracking properly - Trackpad button issues	**K02** **K12** **K13**
	No	Replace logic board.	**M16**

Apple Remote Inoperable

Unlikely cause: LCD, hard drive, optical drive

Quick Check

Symptom	Quick Check
Apple Remote Inoperable • Remote is not recognized.	**1.** The computer is on and awake. **2.** Check with known-good remote on user's computer and the user's remote on known-good computer **3.** Remote is used within 30 feet of the computer and unobstructed line-of-sight to the IR window. **4.** Clean the IR window. **5.** Open System Preferences: Security pane. Verify that "Disable remote control infrared receiver" is not checked. **6.** In Security pane, if "Unpair" button is active, press it and pair the Apple Remote. See **kBase #HT1619: Pairing your Apple Remote with your computer**

Deep Dive

Check	Result	Action	Code
1. Open Photo Booth or iChat's Video Preview window. Point Apple Remote at the built-in iSight camera, press any button on the remote, and verify that (as seen through the camera) there is a faint blinking light on the remote.	Yes	Apple Remote is working. Go to step 2.	
	No	Replace the remote's battery. Go to step 2.	

2. Verify that you can pair the Apple Remote with a known-good system?	Yes	Go to step 3.	
	No	Replace the Apple Remote. Go to step 3.	**X04**
3. Go in Security settings of System Preferences. Uncheck the "Disable remote control infrared receiver" if checked, and verify that Apple Remote now works.	Yes	Issue resolved.	
	No	Check and reseat hard drive SATA/IR/Sleep LED cable connection at logic board. Go to step 4.	
4. Does the Apple Remote now work?	Yes	Issue resolved.	
	No	Replace hard drive SATA/IR/ Sleep LED cable. Go to step 5.	
5. Does the Apple Remote now work?	Yes	Issue resolved.	**K99**
	No	Replace logic board.	**M15**

Built-in Speaker Has No Audio

Unlikely cause: LCD, hard drive, optical drive

Quick Check

Symptom	Quick Check
Built-in Speaker Has No Audio Can't hear any audio from within the machine.	1. Make sure all software updates have been applied. 2. Check in System Preferences: Sound: Output that sound output is set to "Internal Speakers". 3. Use the F12 volume key to set the sound to maximum. 4. Reset PRAM.

Deep Dive

Check	Result	Action	Code
1. Check System Preferences: Sound: Output and verify that no external speakers, "Digital Out," or headphones are being reported connected when there is none present.	Yes	Audio-out port is not damaged. Go to step 3.	
	No	Go to step 2.	

2. With known-good headphone or speakers, plug in the audio output jack for several cycles. Verify that you get audio through external headphones/ speakers when connected.	Yes	Go to step 4.	
	No	Reseat the speaker connectors to logic board. Go to step 3.	
3. Verify that you now get audio through internal speakers .	Yes	Issue resolved.	
	No	Replace logic board.	**M09**
4. Disconnect known-good headphones or speakers. Verify that you now get audio through internal speakers.	Yes	Issue resolved.	
	No	Replace affected speaker(s).	**X08**

Distorted Sound from Internal Speaker

Unlikely cause: LCD, hard drive, optical drive

Quick Check

Symptom	Quick Check
Distorted Sound from Internal Speaker • Distorted audio	**1.** Reset PRAM. **2.** Adjust sound output and level in System Preferences: Sound: Output, and use the Balance to locate a left, right, or woofer speaker distortion source. **3.** Compare the same sound and same settings against another unit to make sure the sound is actually distorting.

Deep Dive

Check	Result	Action	Code
1. Comparing internal speakers with headphones, is the distortion on both headphones and speakers?	Yes	Audio source or gain issue. Reset PRAM, adjust sound level in System Preferences: Sound: Output, and retest with known-good audio source and external speakers. Go to step 5.	
	No	Internal speaker issue. Go to step 2.	

2. Use the Sound Output system preference to test the left and right speakers. If lower bass notes are distorted, right speaker/subwoofer may be defective. Are all speakers free of distortion, sounding clear and loud?	Yes	Issue resolved.	
	No	Adjust volume to test full range of volume settings. Go to step 3.	
3. Is affected speaker cable properly inserted and free from damage?	Yes	Go to step 4.	
	No	Reseat speaker cable or replace damaged speaker. Go to step 5.	**X09**
4. Is affected speaker membrane free from dust or debris, and speaker membrane is not deformed/damaged?	Yes	Go to step 5.	
	No	Clean any dust or debris. Go to step 5. If membrane is damaged, replace the bad speaker(s).	**X09**
5. Verify that speaker enclosure is not damaged, correctly installed in system, and does not create unneeded vibration when sound is played.	Yes	Speaker housing and installation is good. Go to step 6.	
	No	Properly install or replace affected speaker. Go to step 6.	
6. Verify that internal speakers no longer produce distorted sound.	Yes	Issue resolved.	**X09**
	No	Replace logic board.	**M09**

Uncategorized Symptom

Quick Check

Symptom	Quick Check
Uncategorized Symptom • Unable to locate appropriate symptom code	**1.** Verify whether existing symptom code applies to the issue reported by the user. If not, document reported symptom and send feedback to **smfeedback6@apple.com** stating that a suitable symptom code could not be found.

Mechanical Issues: Thermals and Enclosure

Reset/Power Button Stuck

Unlikely cause: LCD, hard drive, optical drive

Quick Check

Symptom	Quick Check
Reset/Power Button Stuck • System will not power on • System sounds bootROM unlock tone during startup • System automatically starts up repeatedly	1. Diagnose stuck button with SMC keyboard reset sequence 2. Check for issue occurrence on battery and on AC power 3. If on battery only, check battery using Battery Diagnostic Utility

Deep Dive

Check	Result	Action	Code
1. Reset SMC using keyboard 3 keys and power-on key. MagSafe LED can verify SMC reset. Momentary stop of battery charging will indicate SMC reset, orange LED will go green momentarily then return to orange.	Yes	Keyboard reset works while holding 3 keys and toggling power-on key, multiple press and release of power-on key works to show power-on key not stuck or fixed.	
	No	SMC keyboard reset not working, suggests power-on key is open circuit or stuck down. Go to step 2.	
2. Disconnect battery and AC power for 30 seconds to perform a manual SMC reset. Apply AC power. Does power-on key work when pressed?	Yes	SMC restored from power removal sequence. Power-on key now working properly.	
	No	Power-on key stuck or open. Go to step 3.	
3. Inspect keyboard flex cable for loose or damaged connections. Align and reseat to flex cable to ensure proper connections. Does power-on key now work correctly?	Yes	Cable reseat restored power-on key operation.	
	No	Power-on key still appears to be stuck or open. Go to step 4.	

	Result	Action	Code
4. Use conductive tool to assert power on by touching **Logic Board Power-On Pads** (**for Mid 2009** or **for Mid 2010**). Does system power on when shorting power-on pads?	Yes	System powers on suggesting top case power on key circuit is open. Replace top case for open power-on key.	**X14**
	No	Power-on key circuit appears to be closed suggesting a stuck power-on key. Go to step 5.	
5. Disconnect internal keyboard flex cable and short **Logic Board Power-On Pads** (**for Mid 2009** or **for Mid 2010**). Removing top case power-on key from circuit should free on-board switch to work properly.	Yes	On board power-on switch pads now starts the system. Replace top case due to stuck power-on key.	**X14**
	No	Go to No Power symptom table.	

System Runs Hot

Unlikely cause: LCD, hard drive, optical drive

Quick Check

Symptom	Quick Check
System Runs Hot • System feels very warm • Fan(s) not working • Fan(s) are full on	**1.** Verify the computer operating on a flat, hard surface and the vents are not blocked. **2.** Verify the computer is not running hotter than expected for normal operation. If possible, compare to a similarly configured computer. **3.** Reset SMC. **4.** Inspect fan performance **5.** Run thermal sensor test.

Deep Dive

Check	Result	Action	Code
1. Is the system running as expected (compared to similar system)?	Yes	Use **kBase #HT1778: Apple Portables: Operating Temperature** to inform user it is operating normally.	
	No	Go to step 2.	

2.	Are there runaway applications? Refer to **kBase #TS1473: Runaway applications can shorten battery runtime**	Yes	Check with vendor for compatibility and software update.	
		No	Go to step 3.	
3.	Fans are typically on at minimum speed. Perform SMC reset or remove all power for 15 minutes. Is the fan(s) running properly?	Yes	Go to step 5.	
		No	Fan(s) not running or always running at full speed. Go to step 4.	
4.	Reseat fan connection to logic board or test a known-good fan. Replace a fan that is not spinning or replace logic board that is not spinning a known-good fan. Is fan(s) working properly?	Yes	Reseating or replacing bad fan resolved issue. Replace logic board if it does not work with known-good fan.	**X99 or M18**
		No	Go to step 5.	
5.	Is heatsink installed properly with no damage to heat fins?	Yes	Go to step 7.	
		No	Replace missing screws or damaged heatsink. Go to step 6.	
6.	Is system running as expected?	Yes	Heatsink installed incorrectly. Issue resolved.	**X10**
		No	Go to step 7.	
7.	Heatsink thermal grease possibly missing or improperly installed during previous repair?	Yes	Replace heatsink or install thermal grease.	**X10**
		No	Go to step 8.	
8.	Reseat trackpad cable connection to logic board, and run test for sensor monitoring.	Yes	Reseating trackpad connection resolved issue.	
		No	Replace logic board if sensor error. Go to step 9.	**M23**
9.	After logic board replacement, is computer running as expected?	Yes	Bad logic board. Issue resolved.	**M23**
		No	Use minimum configuration troubleshooting to isolate issue.	

Uncategorized Symptom

Quick Check

Symptom	Quick Check
Uncategorized Symptom • Unable to locate appropriate symptom code	1. Verify whether existing symptom code applies to the issue reported by the user. If not, document reported symptom and send feedback to **smfeedback6@apple.com** stating that a suitable symptom code could not be found.

Apple Technician Guide

Take Apart

MacBook Pro (13-inch)

General Information

Connector Types on Logic Board

On the logic board are five types of connectors, each requiring special handling. Make sure you read these tips before disconnecting and installing the connectors.

Battery Connector

- Use black stick or fingernails to pull up evenly on sides of connector.
- Align connector over pins and press onto board when reconnecting.
- Do not pull wires.
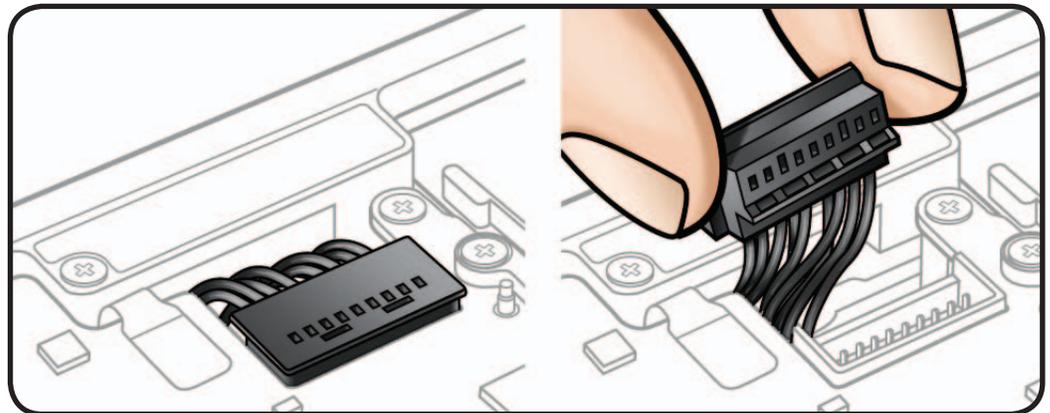
Low-Profile Solid Platform Flex

- Use black stick and gentle rocking motion to release tension to remove cable.
- Keep connector level to board and press evenly to install cable.

Examples:
- optical drive
- hard drive
- trackpad
- BIL
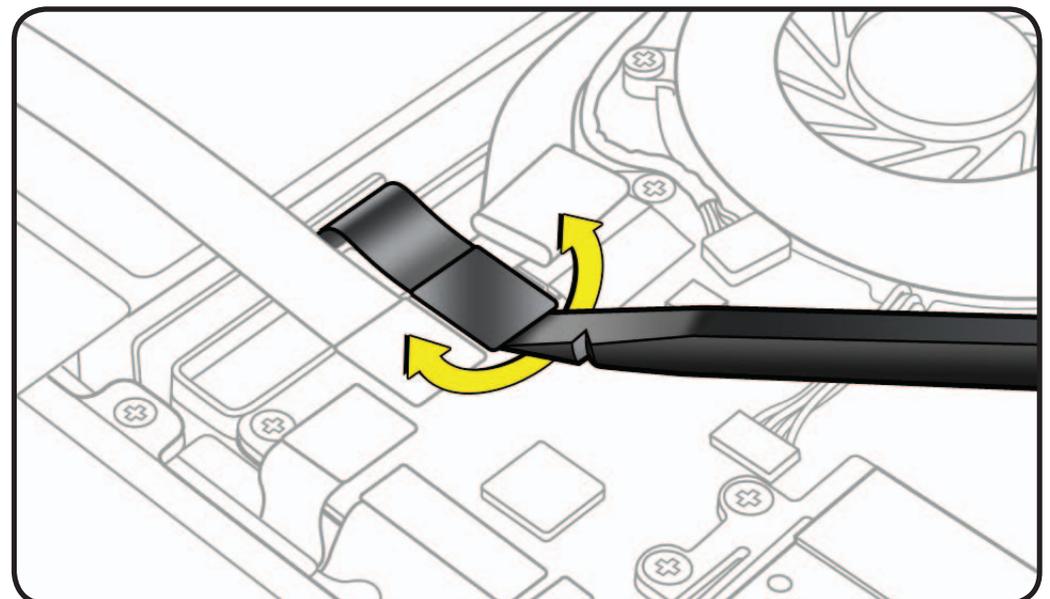
Vertical Insertion (JST)

- Use black stick under cable to remove.
- Keep connector level to board when disconnecting and reconnecting.
- Press evenly when reconnecting or connector can be tipped up and not fully seated.
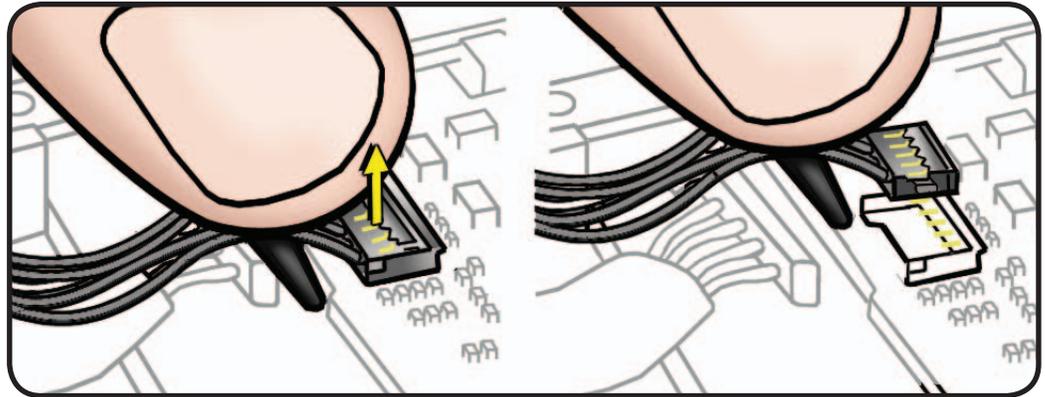
Examples:
- fan
- right speaker
- left speaker
- microphone

Locking Lever

- Flip up lever 90 degrees for cable removal.
- Slide connector into receptacle on same horizontal plane as logic board.
- Lock down lever after inserting cable.

Examples:
- IR/SIL flex cable
- keyboard backlight
- keyboard
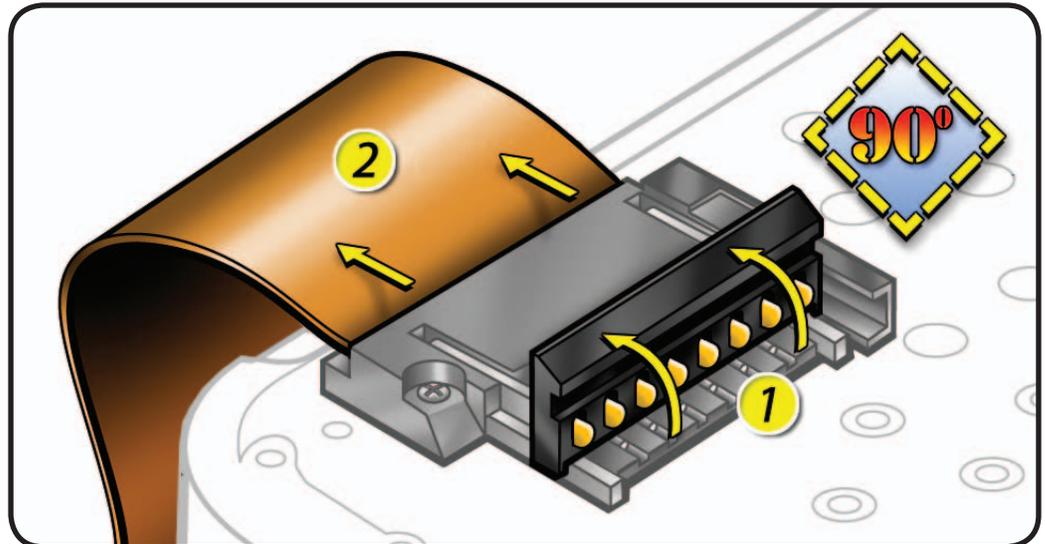
Caution: Use black stick to push keyboard flex cable **all the way** into connector to prevent "no power" symptoms.

Thin, Multi-Pin Horizontal Insert

- Use fingernails or tweezers to remove evenly.
- Slide connector into receptacle on same horizontal plane as board.

Examples shown:

- LVDS cable
- camera cable
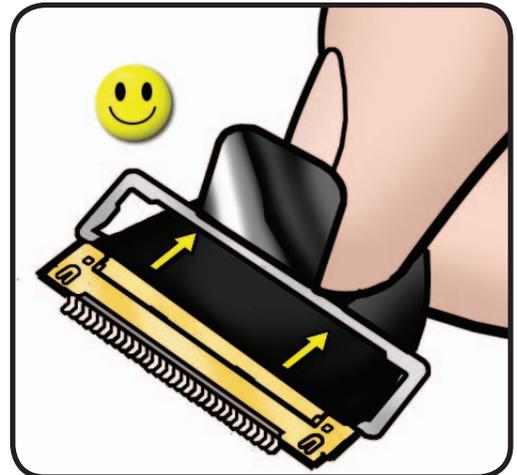
Caution: When disconnecting camera cable, remove gasket (922-8752) and shim (922-9450) **before** disconnecting cable.

Caution: Avoid touching adhesive side of shim; body oils degrade adhesive.
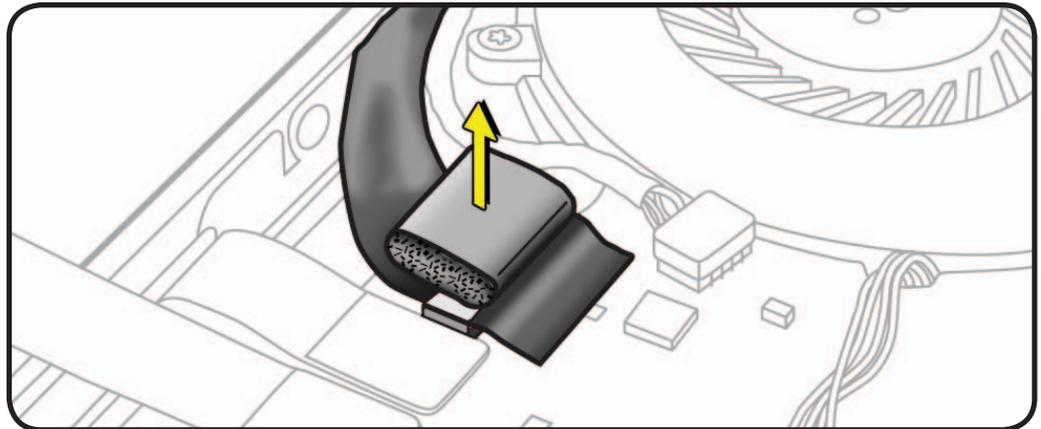
Replacement Caution: To prevent no video or a short to the logic board, be sure to place EMI gasket on camera cable—**positioned precisely where shown**—**after** cable is fully connected to logic board and shim is in place.
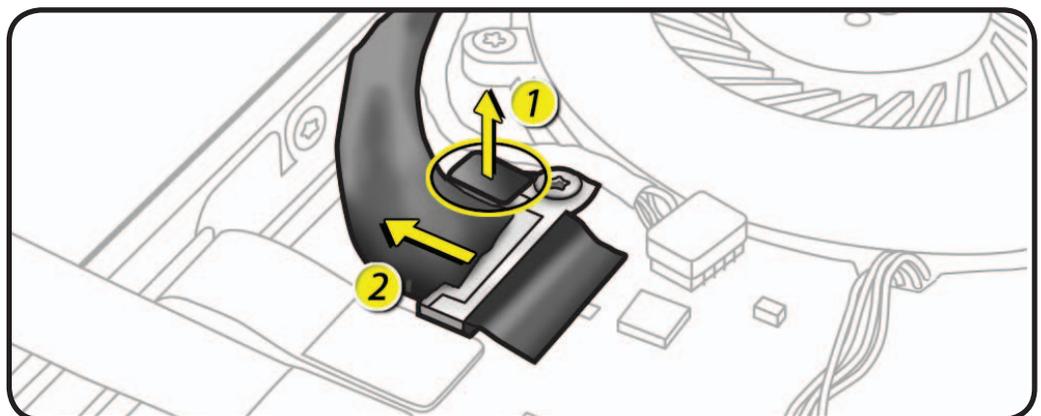
Tools

Caution: To prevent scratches or other cosmetic damage to the computer housing, use a soft cloth as a protective layer when removing and installing the external screws.

The following tools are required to service a MacBook Pro (13-inch):
- Clean, soft, lint-free cloth
- ESD-safe workstation, including an ESD mat and wrist or heel strap
- ESD bags (for storing ESD-sensitive parts while removed from unit)
- Phillips #00 screwdriver, magnetized
- Torx T6 screwdriver, magnetized
- Torx T8 screwdriver, magnetized
- Large tri-lobe #0 screwdriver (Apple part #922-8991)
- Black stick (nylon probe, Apple part #922-5065) or other nonconductive nylon or plastic flat-blade tool
- EMI-safe plastic or nylon tweezers for installing flex cables (optional)
- Thermal grease syringe (Apple part #922-7144)
- Alcohol wipes
- Kapton tape
- Permanent marking, felt-tip pen
- Pencil with eraser
- Foam wedge fixture for display assembly removal (Apple part #922-8779)
- Magnifying glass, for reading serial number etched on bottom case
- Digital volt meter (troubleshooting)

For more information about tools, refer to:
kBase #HT3452: Hand Tools for Desktop and Portable Repairs

For more information about ESD, refer to:
kBase #HT3451: Electrostatic Discharge Precautions and Myths
AppleCare Service Training: ESD Precautions

In addition, the following software programs are required for troubleshooting:
- **Apple Service Diagnostic (ASD)**
  for MacBook Pro (13-inch, Mid 2009): version 3S132 or later
  for MacBook Pro (13-inch, Mid 2010): version 3S136 or later
- **Apple Hardware Test (AHT)**
  for MacBook Pro (13-inch, Mid 2009): version 3A173 or later
  for MacBook Pro (13-inch, Mid 2010): version 3A192 or later
- **Notebook Battery and Adapter Diagnostic (NBAD)**
- **Clamshell Service Diagnostic (CSD)**

Icon Legend

The following icons are used in this chapter:

Icon	Meaning
	Warning or Caution
	Check that you do this
	Do not touch

Reassembly Steps

When no replacement steps listed, replace parts in exact reverse order of Removal procedure.

Note About Images in This Guide

Because a pre-production model was used for most images in this guide, you may notice small differences in appearance between the image pictured and the computer you are servicing. However, although appearance may differ, steps and sequence are the same unless noted.

Screw Sizes

All screw sizes shown are approximate and represent the total length of the screw.

Bottom Case

First Steps

- Shut down computer.
- Unplug all cables.
- Wait 10 minutes
- Put on ESD strap.
- Place computer face down on a clean, flat surface.
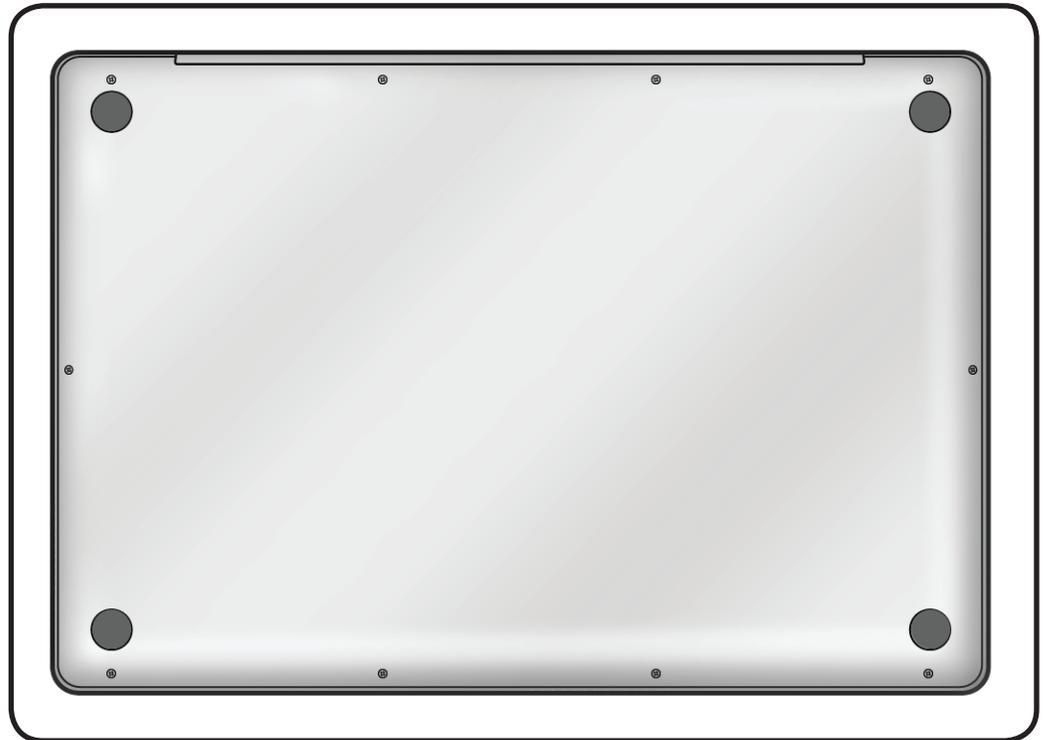
Tools

- ESD wrist strap
- Clean, soft, lint-free cloth
- Phillips #00 screwdriver, magnetized
- Black stick
- Magnifying glass
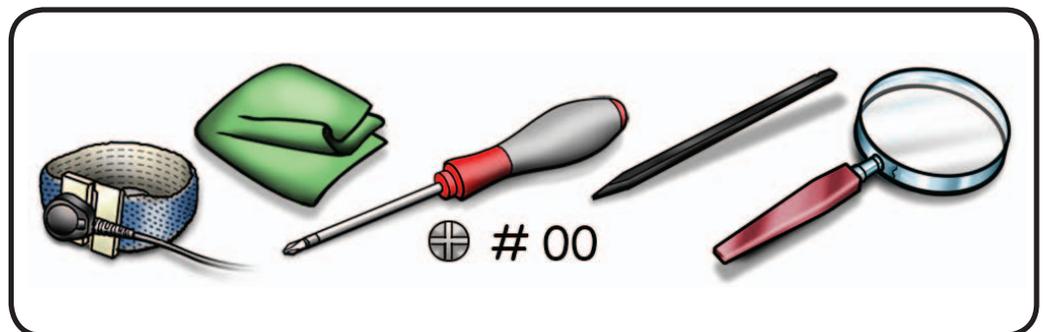
Removal

Caution: To prevent scratches, use a protective cloth when working with metal tools.
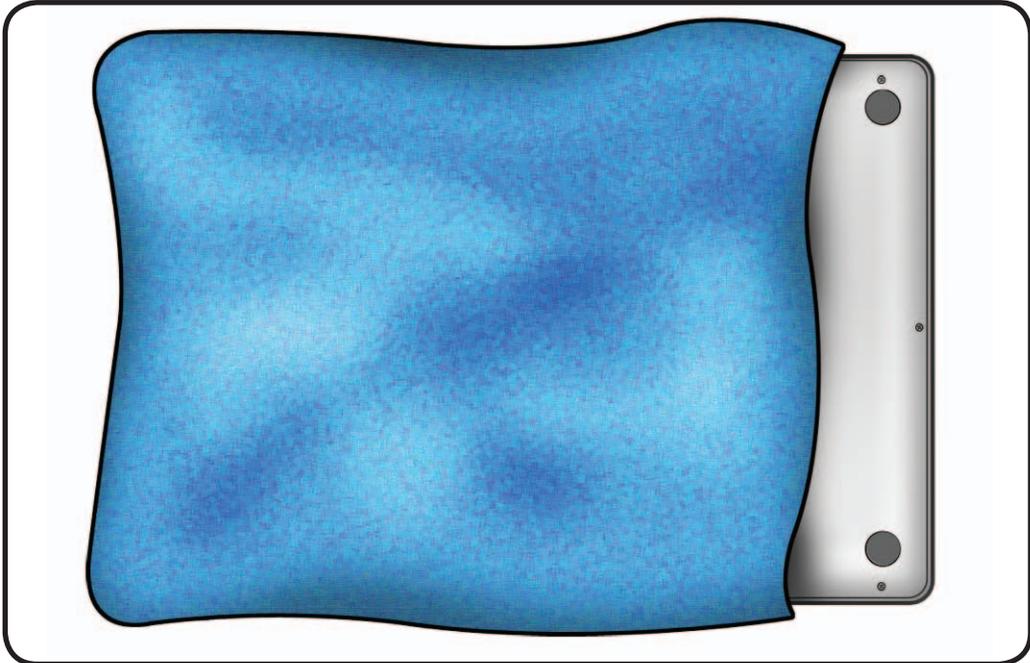
1 Remove Phillips #00 screws:

(3) 922-8666 (13.5mm)

(3) 922-8972 (3mm)

(4) 922-9522 (3mm shoulder)
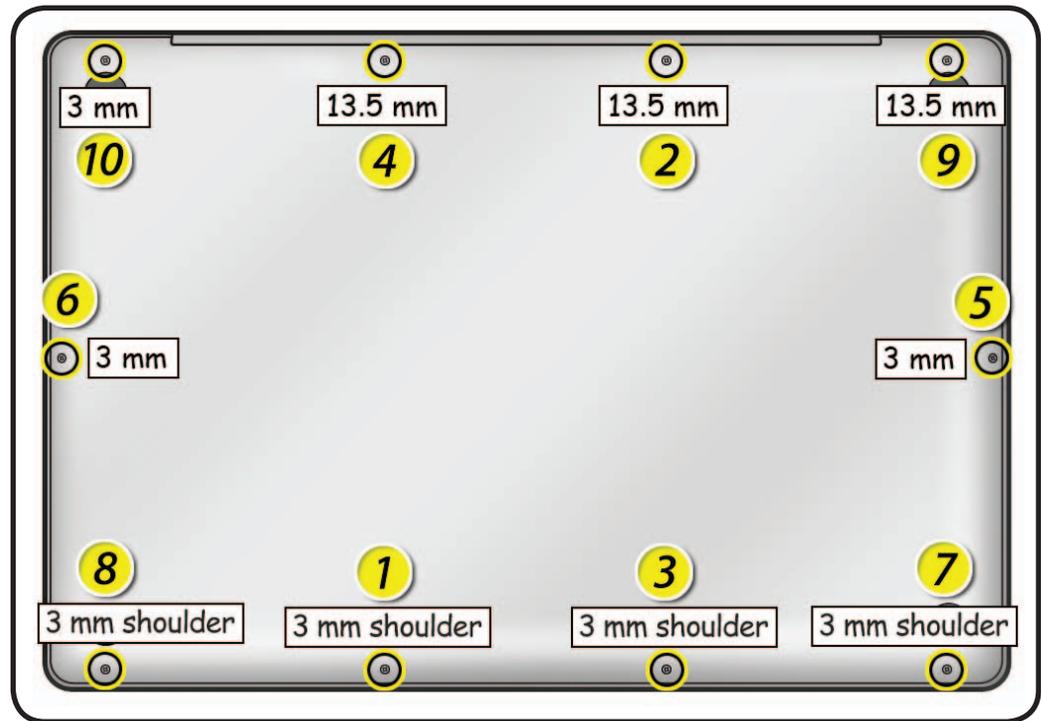
Important: Mid 2009 units may have (7) 922-8972 (3mm) screws and no shoulder screws. Inspect 3mm screws to determine if any are shoulder screws. If shoulder screws are present, be sure they are reinstalled into correct locations.

Important: Screws at sides and front of computer must be removed and installed at an angle.

Reassembly Note: Install screws in order shown. If sequence is not followed, bottom case might wobble when placed on level surface.

3 mm
13.5 mm
13.5 mm
13.5 mm
10
4
2
9
6
5
3 mm
3 mm
8
1
3
7
3 mm shoulder
3 mm shoulder
3 mm shoulder
3 mm shoulder
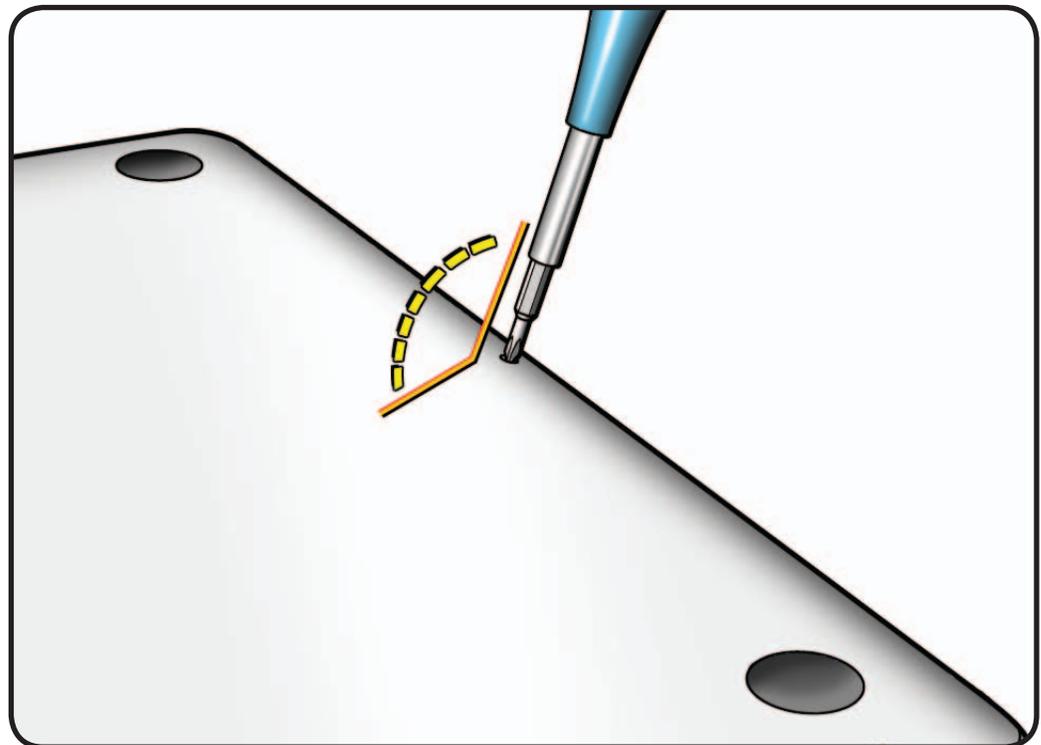
2 Loosen and remove bottom case.

Warning:
If performing any other repairs, be sure to disconnect battery cable.
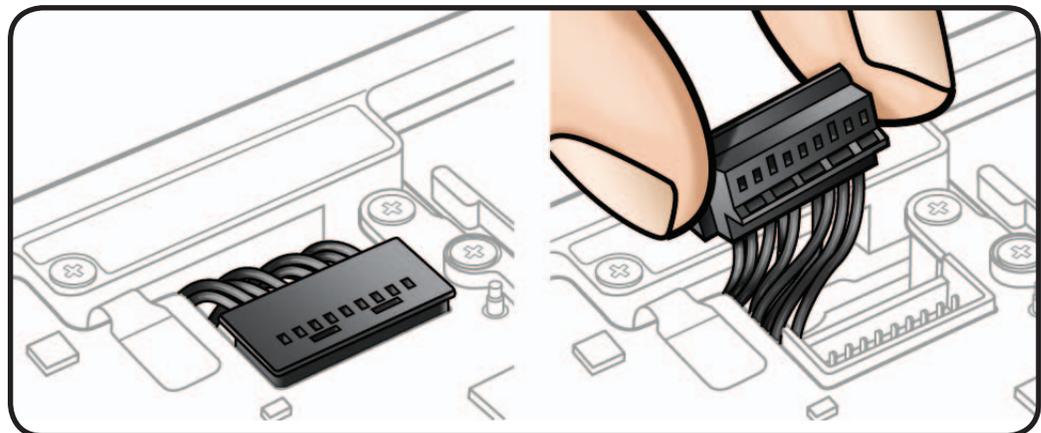
Important: For Mid 2010 model only: During any internal repair, remove and discard EMI gasket (if present) below camera cable guide covering 3 clutch screws.

See **Right Clutch EMI Gasket Removal** in Additional Procedures section for details.
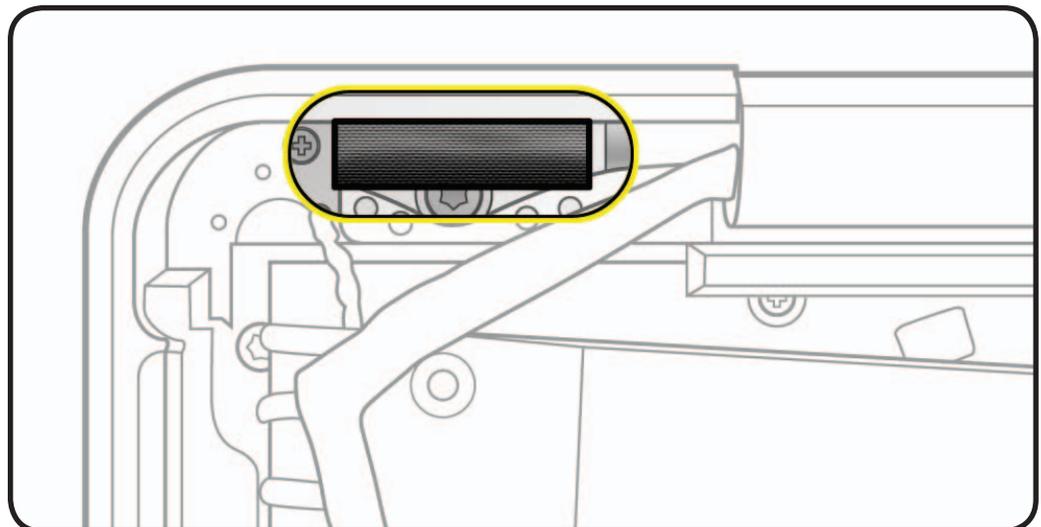
Replacement

1 When installing a new bottom case, retain original bottom case until repair is complete. Before installing replacement bottom case, write serial number on inside as shown here.

You might need a magnifying glass to read serial number on original bottom case. Refer to **Transferring the Serial Number**.
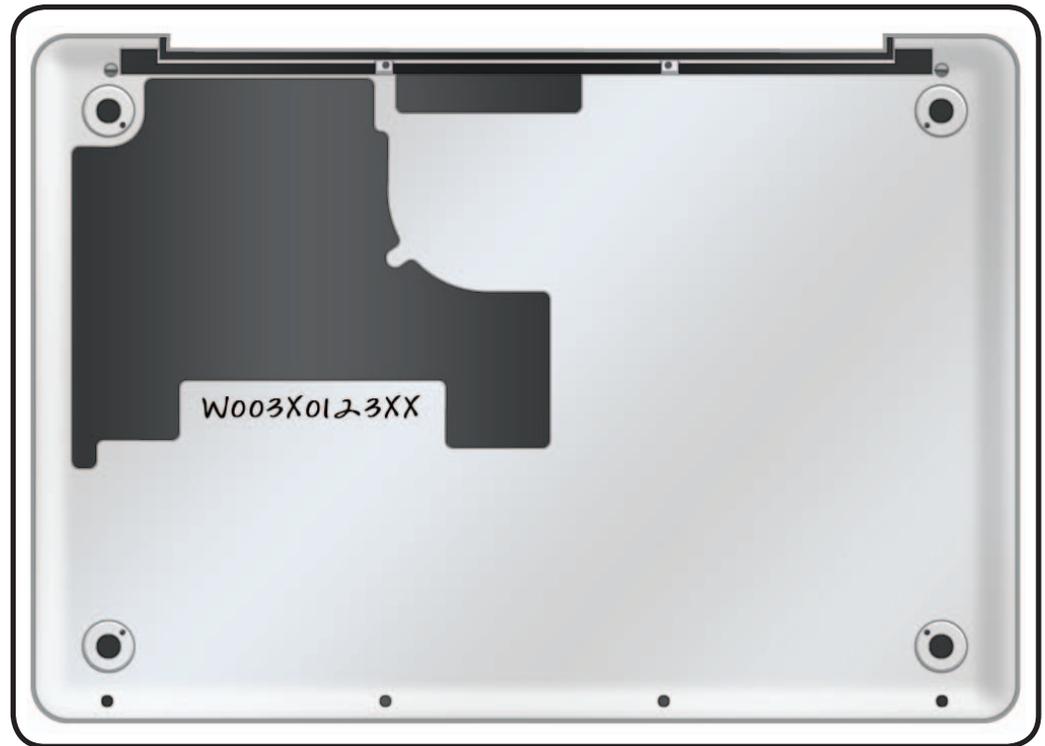
Battery

First Steps

Remove:
- Bottom Case

Important: Battery removal is only required when replacing the battery, BIL, trackpad, or top case. Other internal repairs require disconnecting the battery cable but not removing the battery.
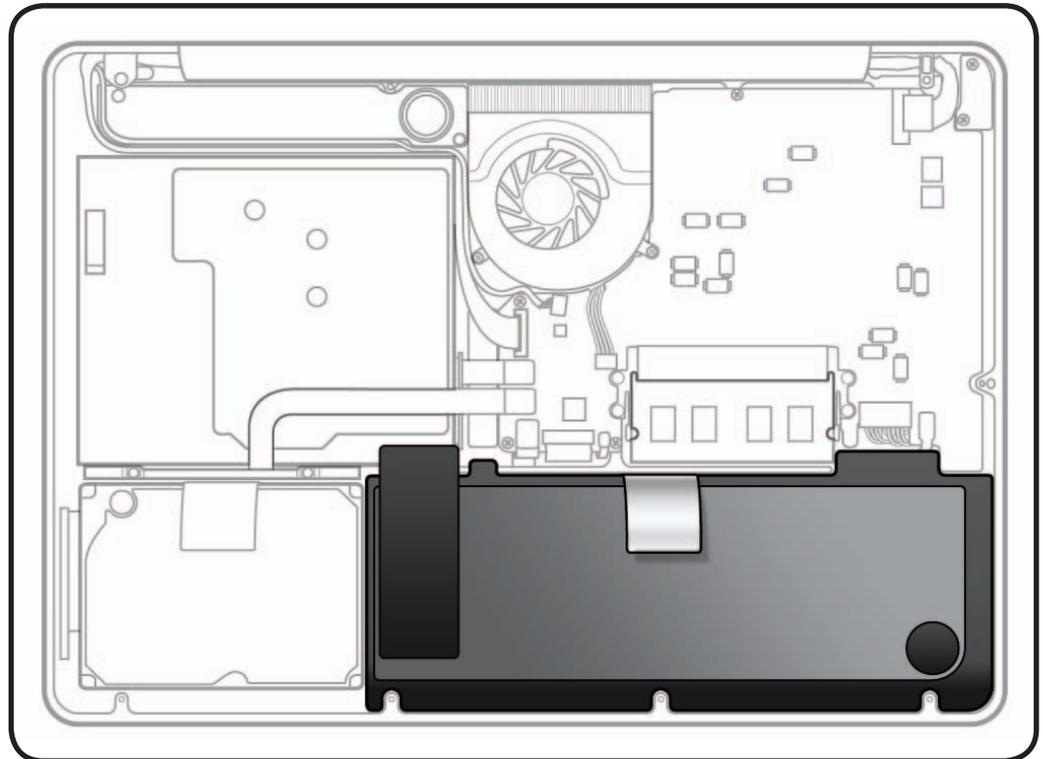
Tools

- ESD wrist strap
- Clean, soft, lint-free cloth
- Black stick
- Large tri-lobe #0 screwdriver (922-8991)
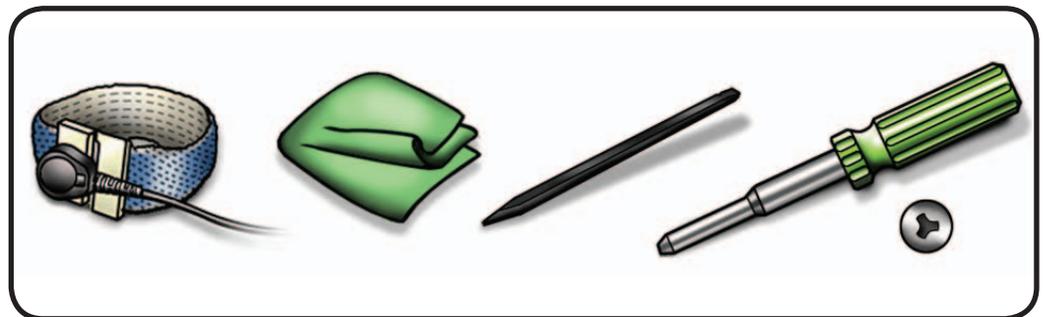
Removal

1 Use black stick or fingernails to evenly disconnect battery cable from logic board.
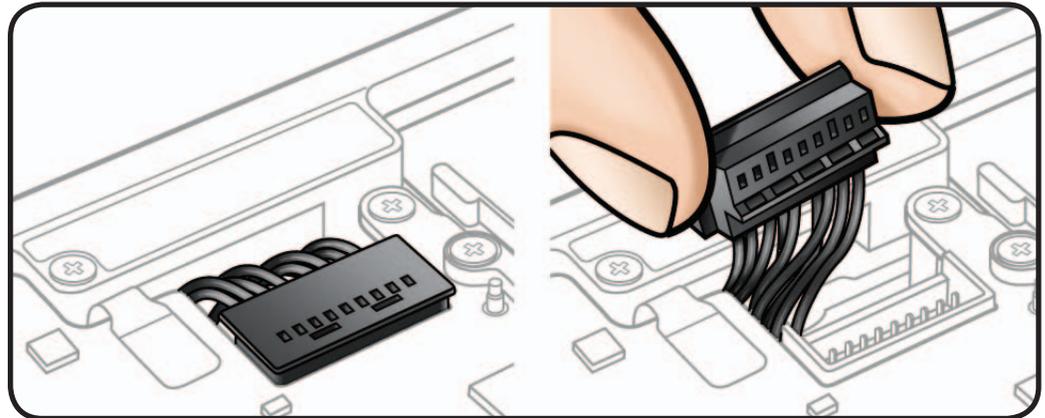
2 Remove tri-lobe #0 screws:

(1) 922-9227 (5.5mm)

(1) 922-9226 (13.5mm)

3 Peel up battery warning label from optical drive and midwall only.
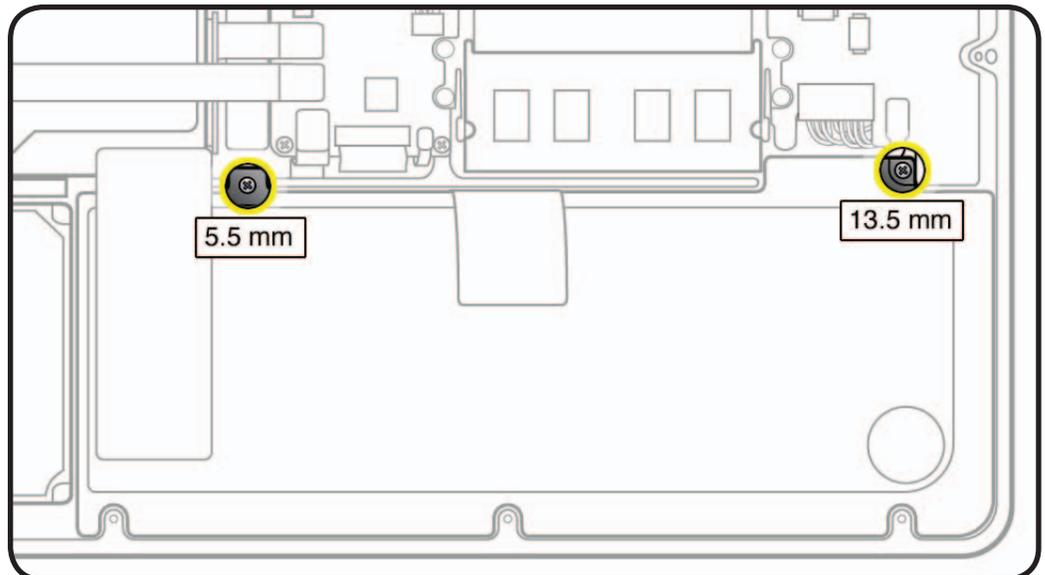
If same battery is to be reinstalled, keep warning label attached to battery. (Replacement battery includes new warning label.)

4 Use pull-tab to tilt up battery and remove from top case.
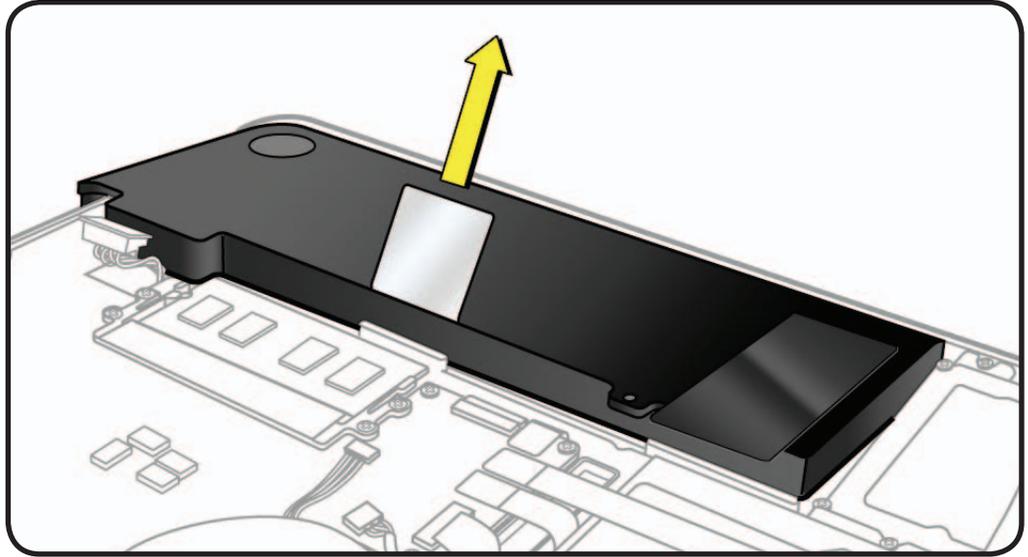
Warning:
Underside of battery has a nonconductive cover.
- Do not puncture or press on battery.
- Hold battery by edges only.
- If setting battery aside, make sure surface is clean—free of dust, dirt, screws, etc.

Warning:
If battery cover is punctured, do not re-use battery.
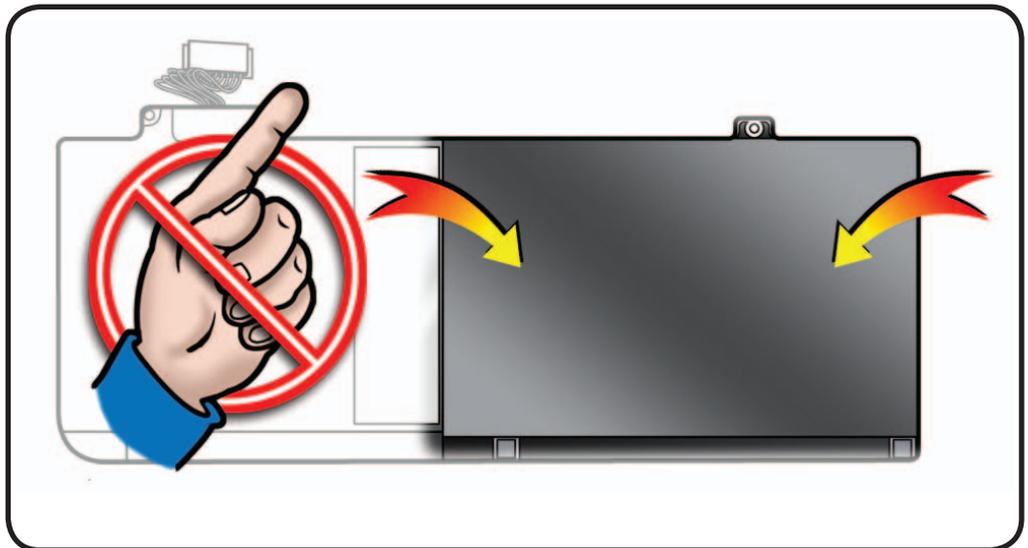
Reassembly

1 Slide front edge of battery under 3 tabs.

2 Install 2 screws (longer screw near cable connector).

Note: If installing new battery, attach battery warning label (refer to battery inbox instructions).
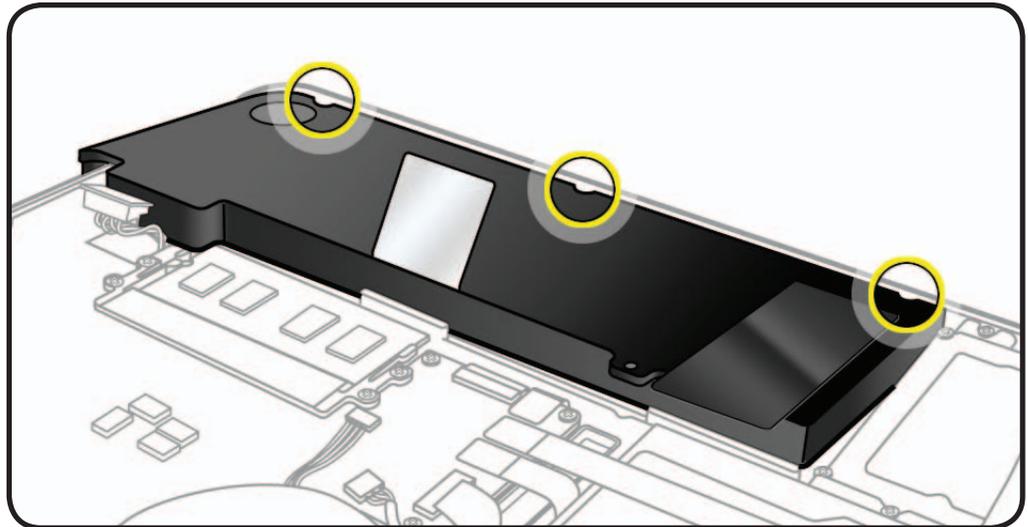
3 If performing other repairs, be sure to leave battery cable disconnected. Otherwise, align battery connector over pins, connect battery cable to logic board and reassemble computer.
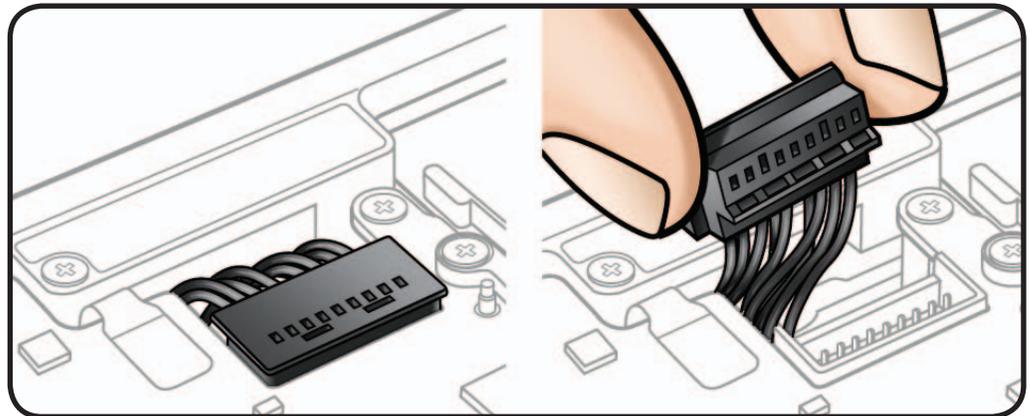
4 Press battery indicator light to check charge level.

Memory

First Steps

Remove:
- Bottom Case
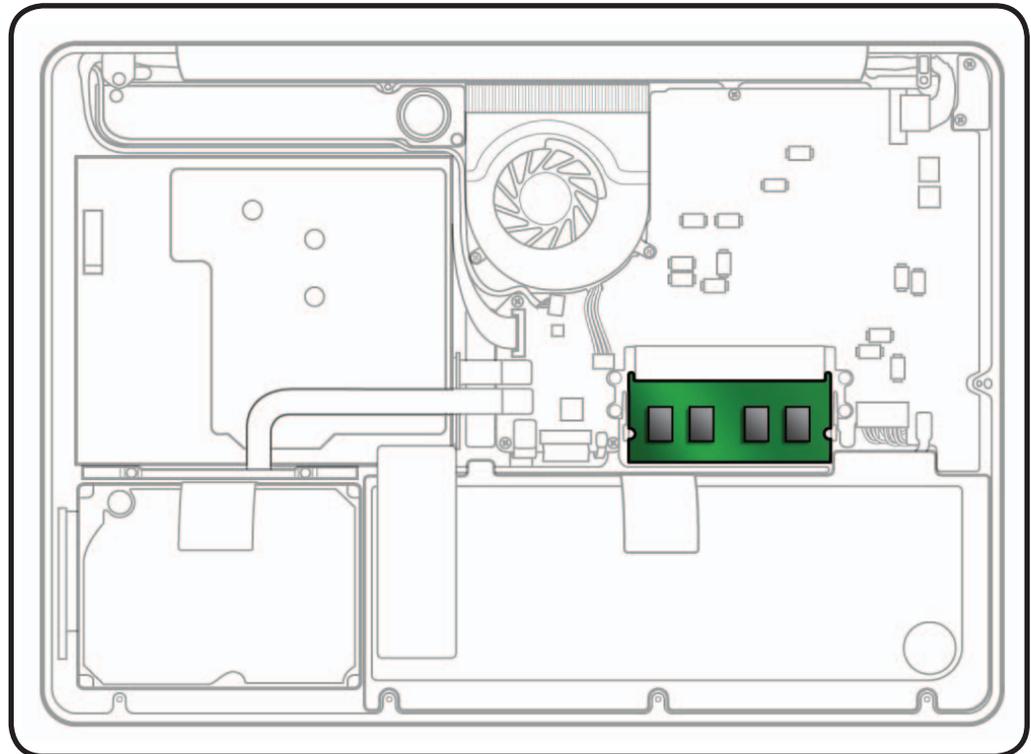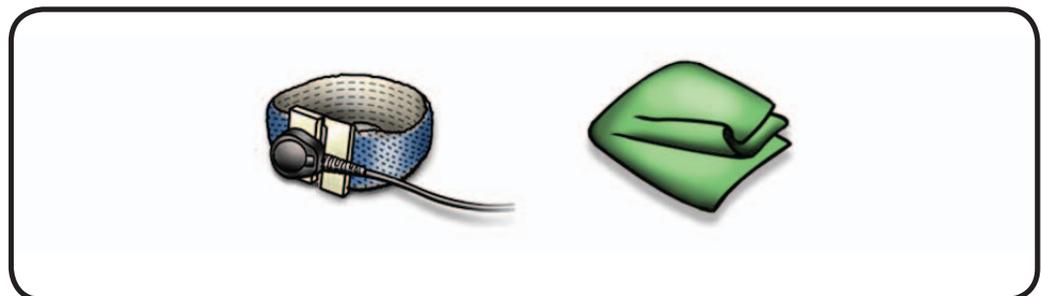
Tools

- ESD wrist strap
- Clean, soft, lint-free cloth

Removal

Before you begin this procedure, disconnect battery from logic board. Failure to do so could damage computer.
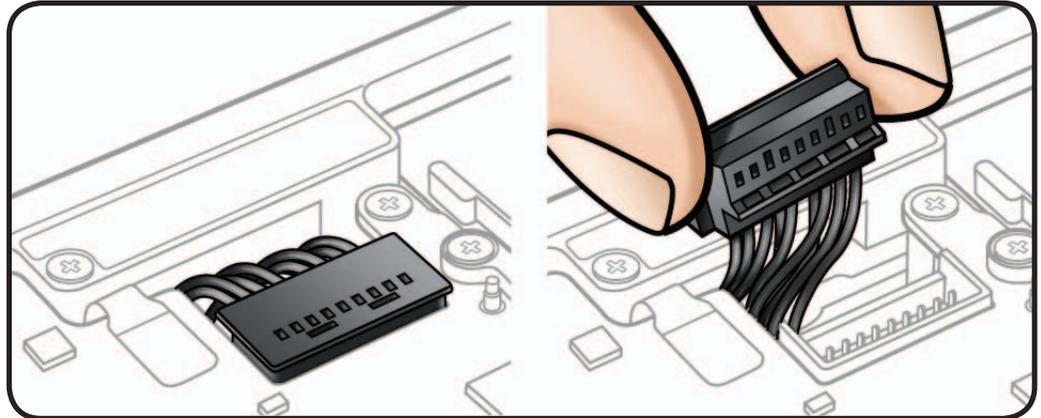
Memory modules must be:
- 30 mm (1.18 inches)
- 1 GB, 2 GB, or 4 GB
- 204-pin
- PC3-8500 DDR3, 1066 MHz RAM

The MacBook Pro (13-inch, Mid 2009) comes with a minimum of 2 GB (two 1 GB modules), and the MacBook Pro (13-inch, Mid 2010) comes with a minimum of 4 GB (two 2 GB modules) of 1066 MHz Double Data Rate 3 (DDR3) Synchronous Dynamic Random-Access Memory (SDRAM) installed. There are two slots that can accept SDRAM Small Outline Dual Inline Memory Modules (SO-DIMMs). The slots are stacked on the logic board under the bottom case. For best performance, memory should be installed as pairs with an identical memory module in each slot. The maximum memory for both models is 8 GB, with a 4 GB module installed in each slot.

1   Press out 2 ejection levers until memory card tilts up completely,
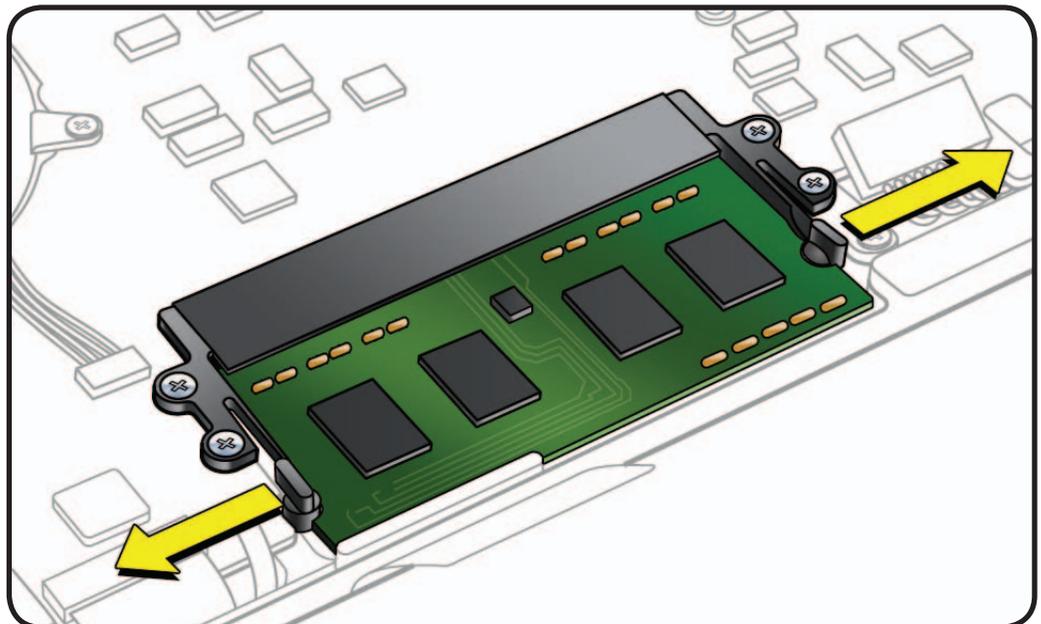
2 With memory card tilted up, make sure you can see the half-circle notches on either end of card. If not, press ejection levers again.

3 Pull out memory card.
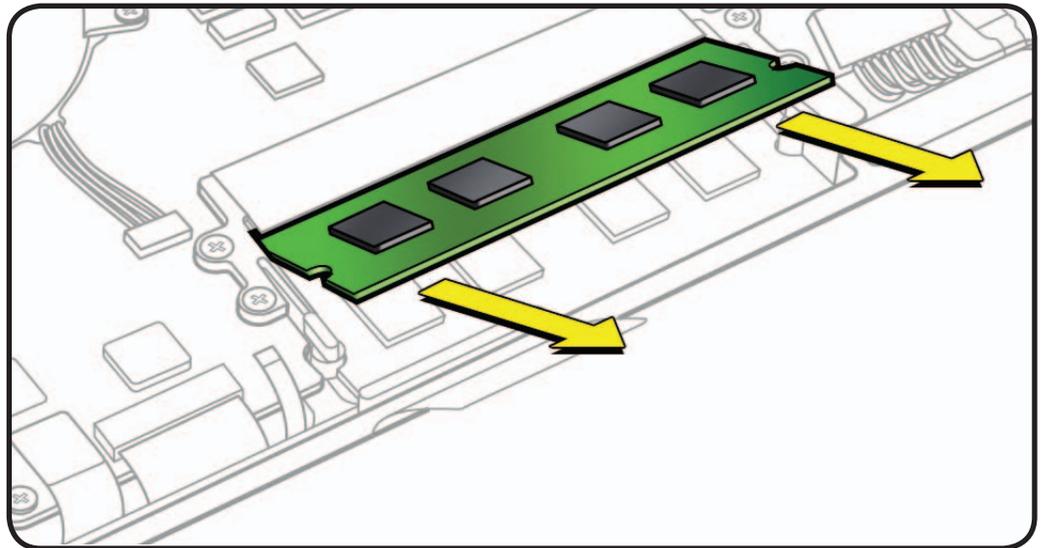
Important: Hold card by edges only. Do not touch gold connectors.

Note: Memory cards might have harmless white residue on gold connectors.
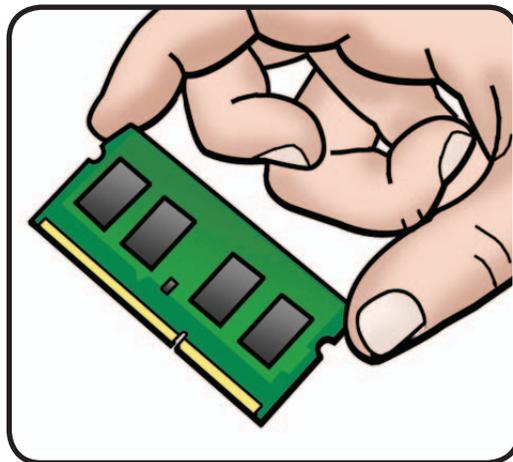
Replacement

1 Install memory cards at an angle, one at a time. If installing just one card, install it in lower slot.

Note: Memory cards might have harmless white residue on gold connectors.
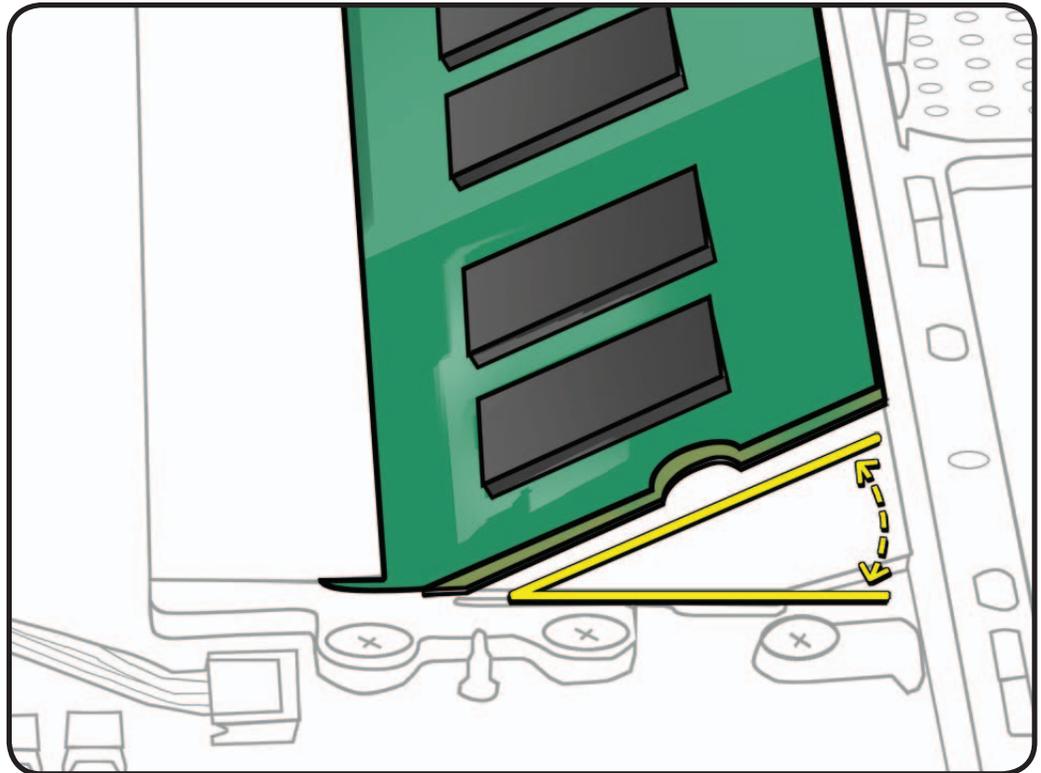
2 Press memory card down until levers click into place in the half-circle notches on either end of card.

3 If you installed additional memory, verify that computer recognizes it.
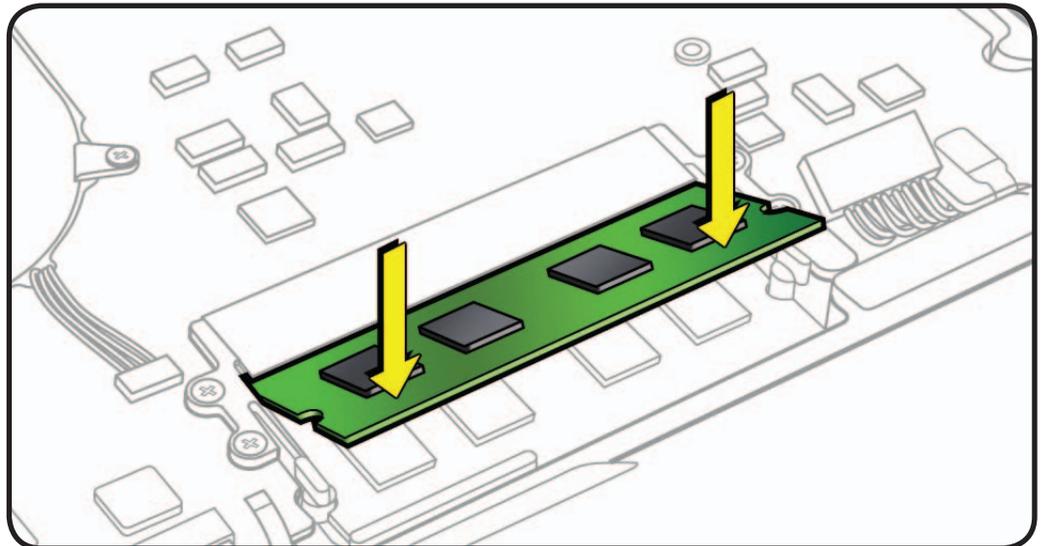
Rear Hard Drive Bracket
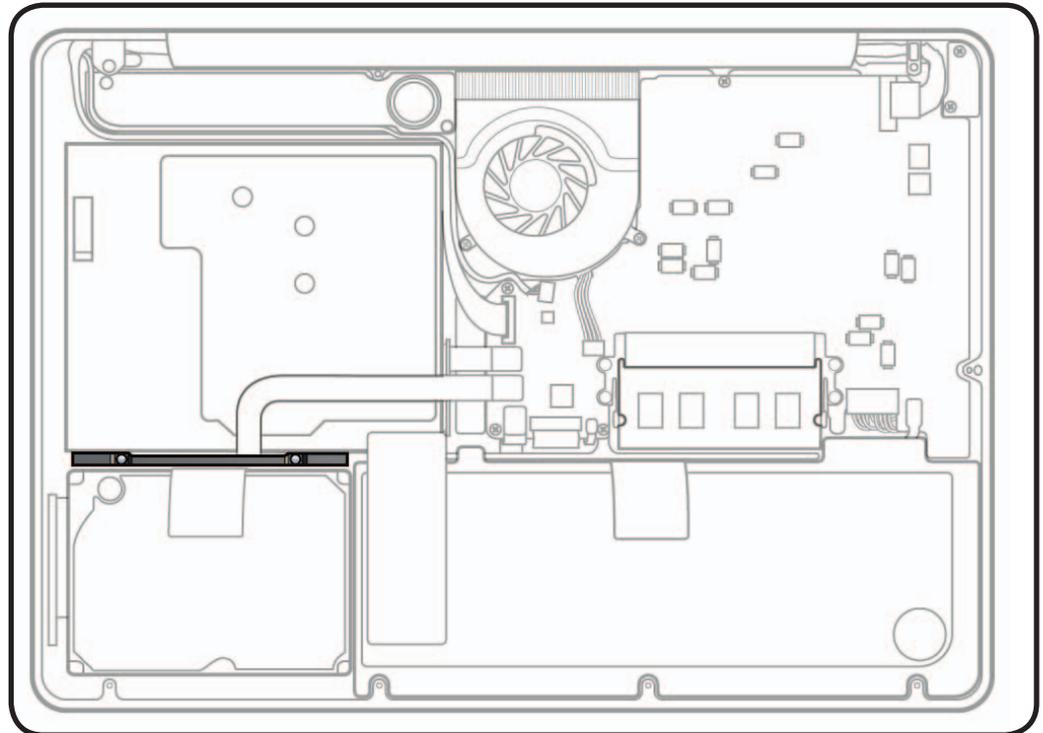
First Steps

Remove:
• Bottom Case

Tools

• ESD wrist strap
• Clean, soft, lint-free cloth
• Phillips #00 screwdriver, magnetized
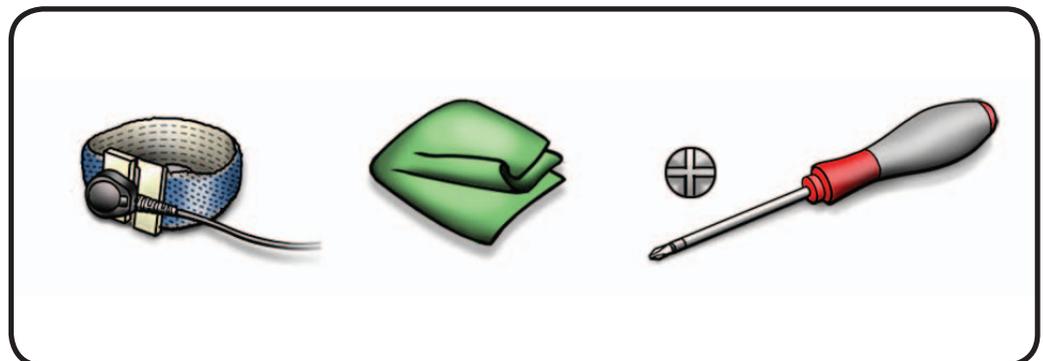
Removal

1 Loosen 2 Phillips #00 captive screws.
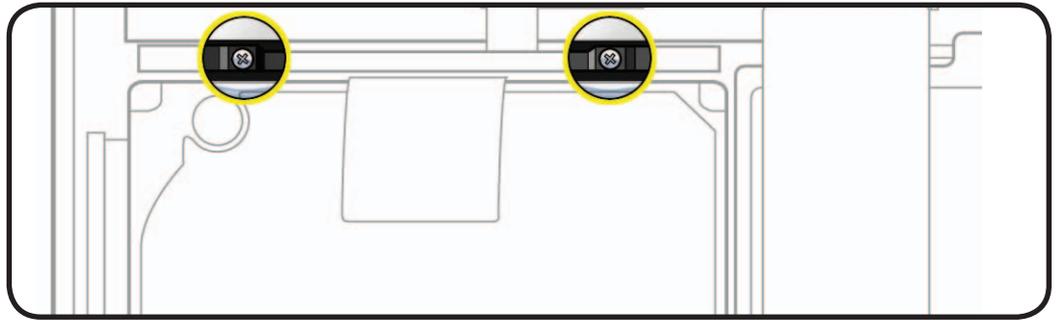
2 Lift out bracket.
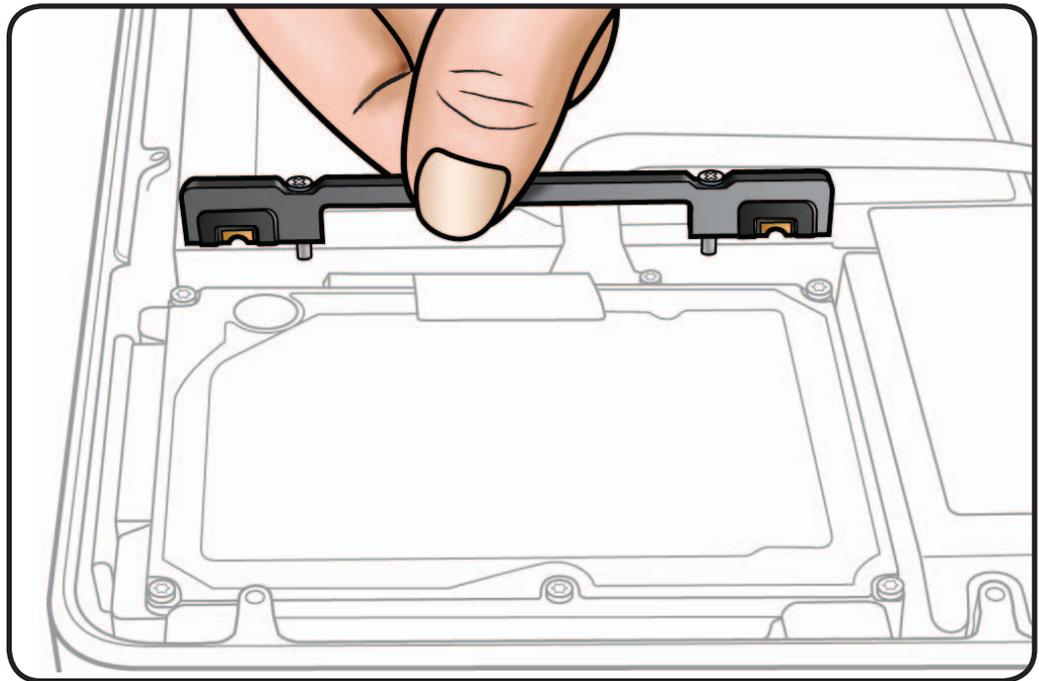
Reassembly Note:
Make sure 2 orange and black rubber grommets are included in bracket before installing it.
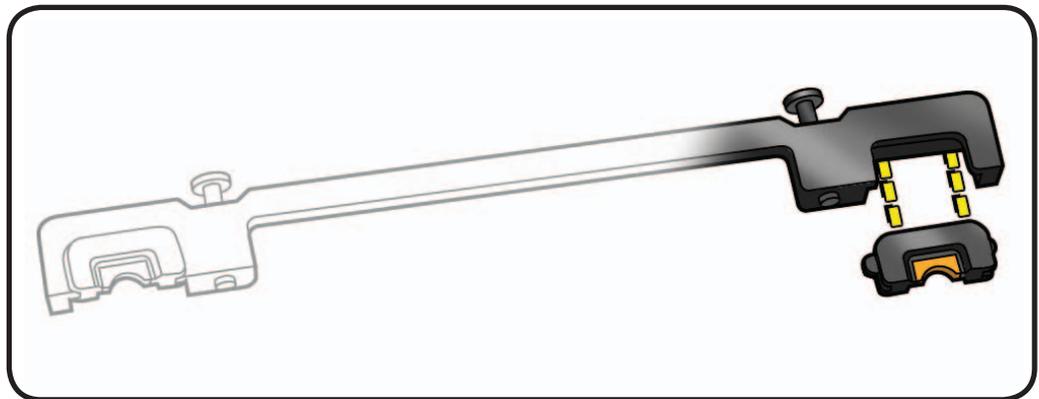
Hard Drive

First Steps

Remove
- Bottom Case
- Rear Hard Drive Bracket

Caution: Make sure data is backed up before removing hard drive.
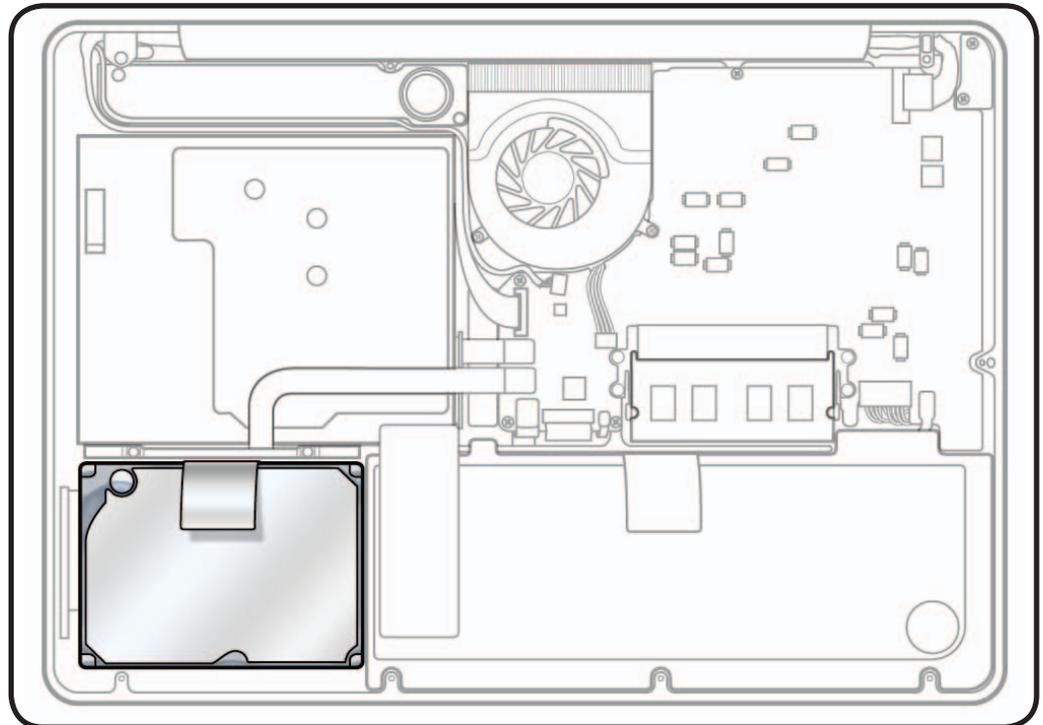
Tools

- ESD wrist strap
- Clean, soft, lint-free cloth
- Phillips #00 screwdriver, magnetized
- Torx T6 screwdriver, magnetized
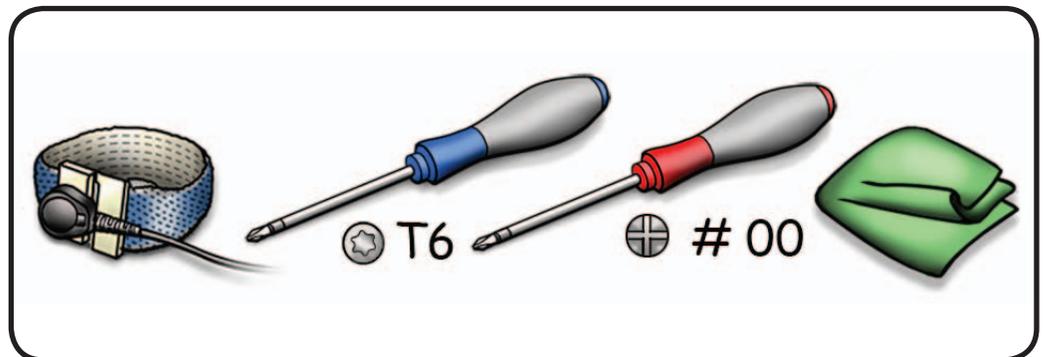
Removal

Before you begin this procedure, disconnect battery from logic board. Failure to do so could damage computer.
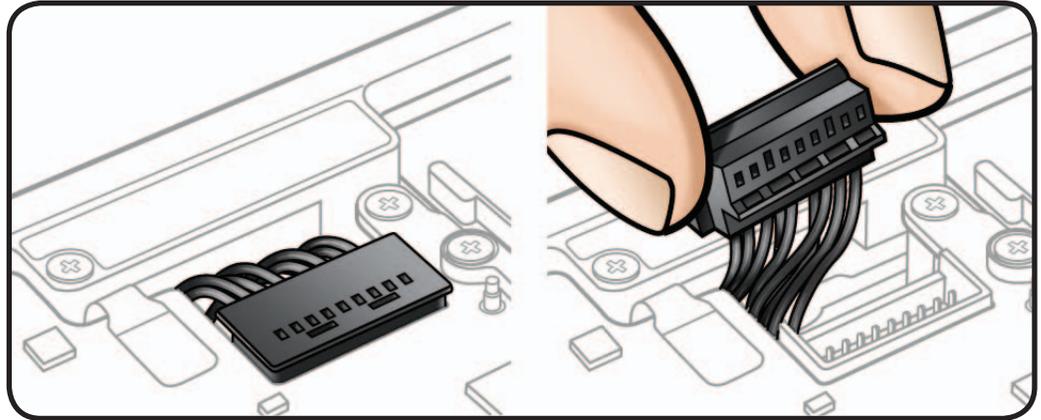
1 Make sure rear hard drive bracket has been removed.

2 To protect hard drive flex cable, remove Phillips #00 screws (2) 922-9036 (1.5mm)
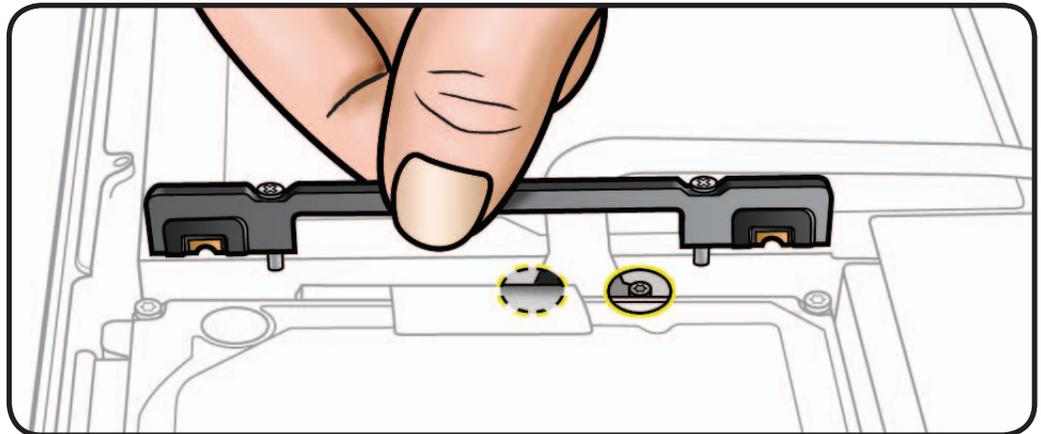
3 Use pull tab to tilt hard drive up.

Be careful not to pull too far or too fast. There is a delicate flex cable running underneath drive.
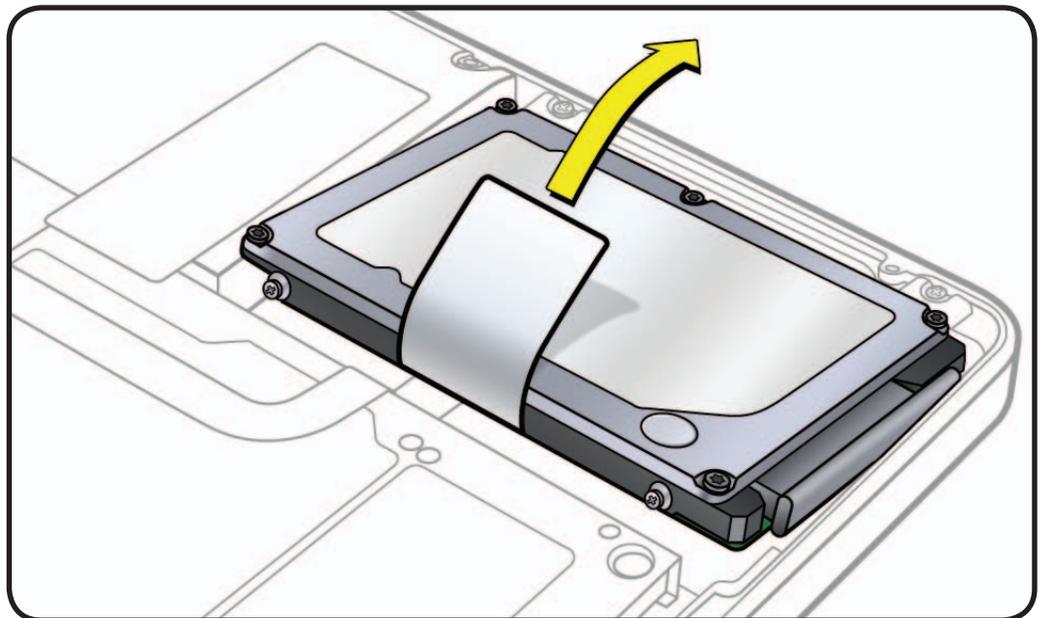
4 Note flex cable underneath hard drive. Be careful not to strain cable.

5 Disconnect hard drive flex cable connector.
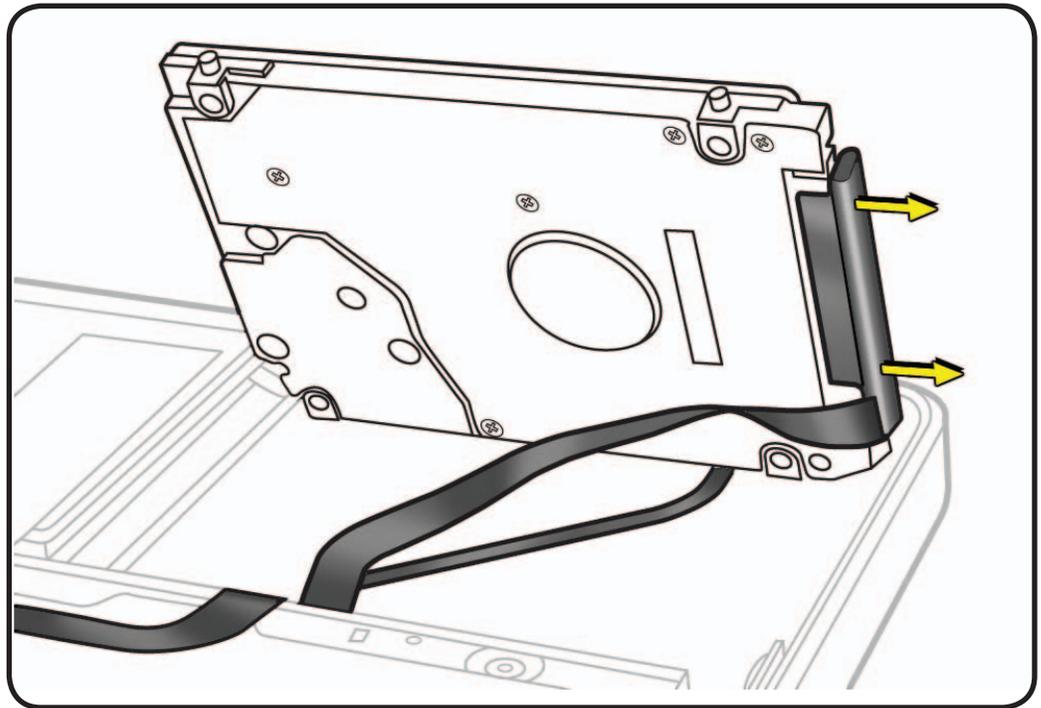
6 Follow safe handling of hard drive:
- Hold by sides only.
- Do not press drive.
- Do not touch connector.
- Do not touch circuitry.
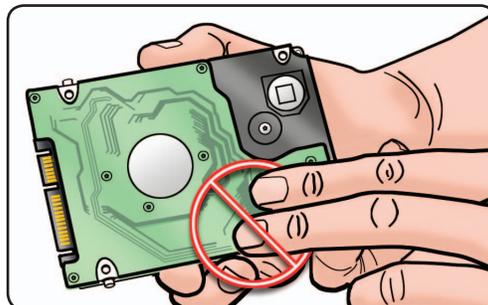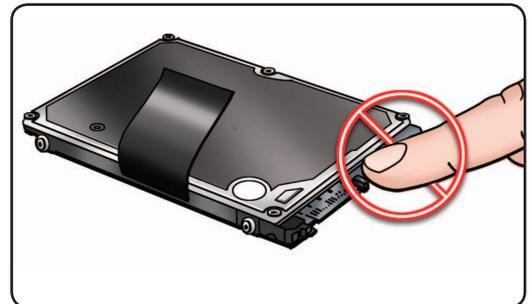
Replacement

1 Make sure 4 orange and black rubber grommets are installed in top case before installing hard drive.
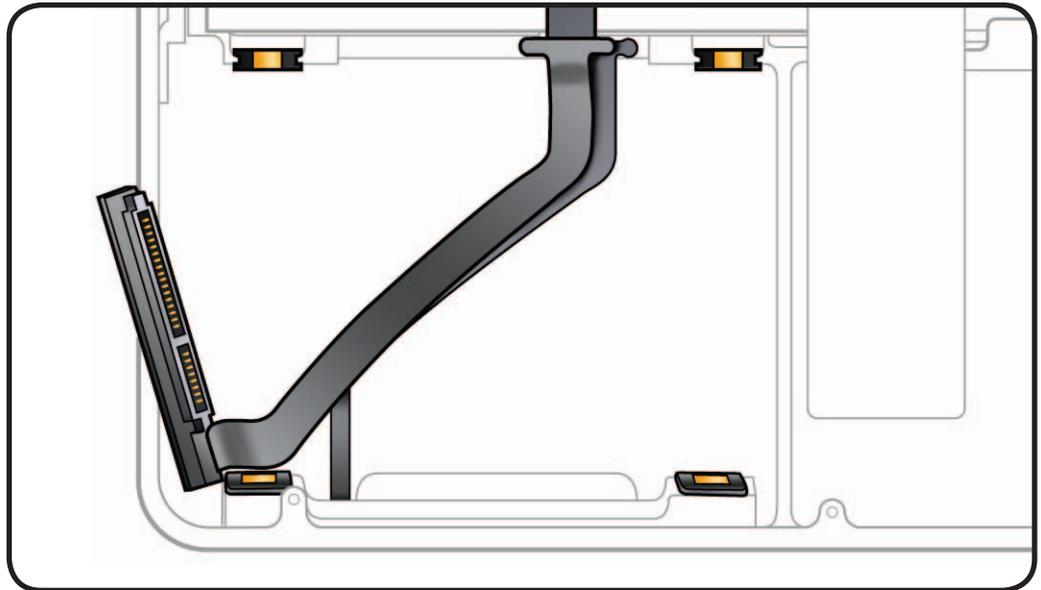
2 Make sure (4) T6 mounting screws are installed on drive.

Replacement drive should include mounting screws, but if not, transfer them from old drive.
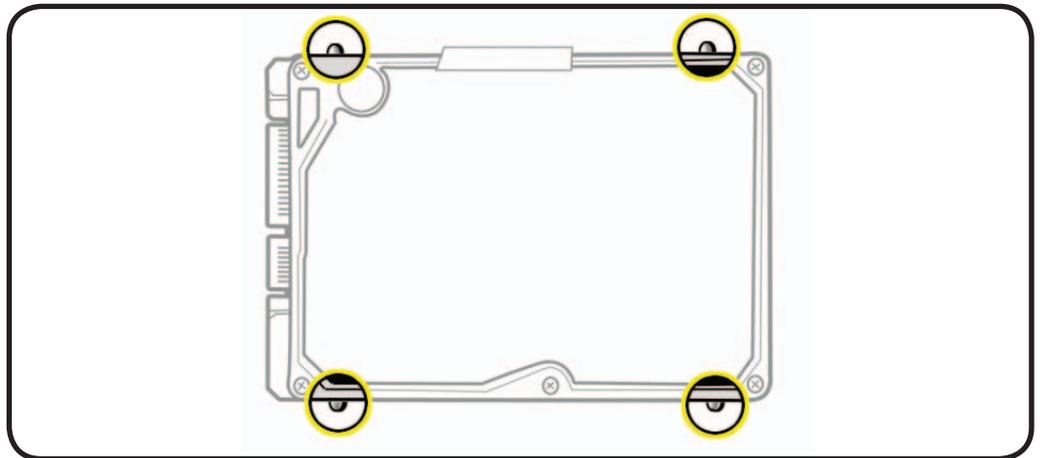
3 Attach flex cable connector and tilt hard drive into top case.

4 Install rear hard drive bracket and tighten captive screws.
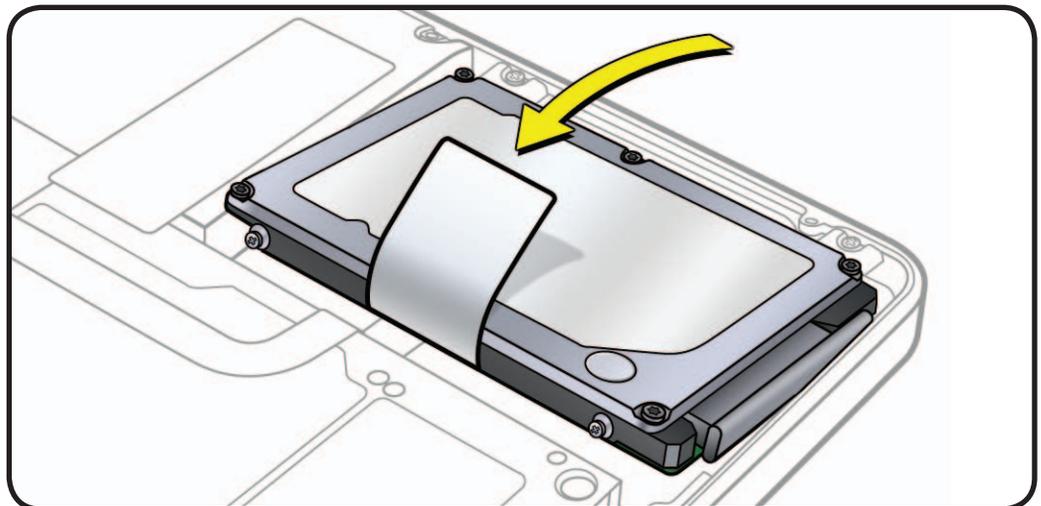
Reinstalling Software that Came with the Computer

Use software install discs that came with the computer to reinstall Mac OS X and any bundled applications. Choose either "Archive and Install," which saves existing files and settings, or "Erase and Install," which erases all data.

Important: Apple recommends backing up data before restoring software. Because the "Erase and Install" option erases the hard drive, you should back up essential files before installing Mac OS X and other applications. Apple is not responsible for any lost data.

Installing Mac OS X

To install Mac OS X, follow these steps:

1. Back up essential files.

2. Make sure power adapter is connected and plugged in to a powered wall outlet.

3. Insert Mac OS X Install DVD that came with the computer.

4. Double-click "Install Mac OS X".

5. Follow onscreen instructions.

    Note: To restore computer to original factory settings, click Options in the "Select a Destination" pane of the Installer, and then select "Erase and Install." If you choose "Erase and Install," you will see a message reminding you to use the Applications Install DVD to reinstall bundled applications that came with the computer.

6. When the installation is complete, click Restart.

7. Follow prompts in Setup Assistant to set up the user account.

Installing Applications

If you reinstall Mac OS X and select the "Erase and Install" option, you must reinstall bundled applications that came with the computer, such as the iLife applications.

To install applications that came with the computer, follow these steps:

1. Make sure power adapter is connected and plugged in to a powered wall outlet.

2. Insert the Applications Install DVD that came with the computer.

3. Double-click "Install Bundled Software".

4. Follow onscreen instructions.

5. When installation is complete, click Close.

Front Hard Drive Bracket

First Steps

Remove:
- Bottom Case
- Rear Hard Drive Bracket
- Hard Drive

Note: The front hard drive bracket includes a combination flex cable for:
- hard drive
- IR sensor/sleep LED indicator
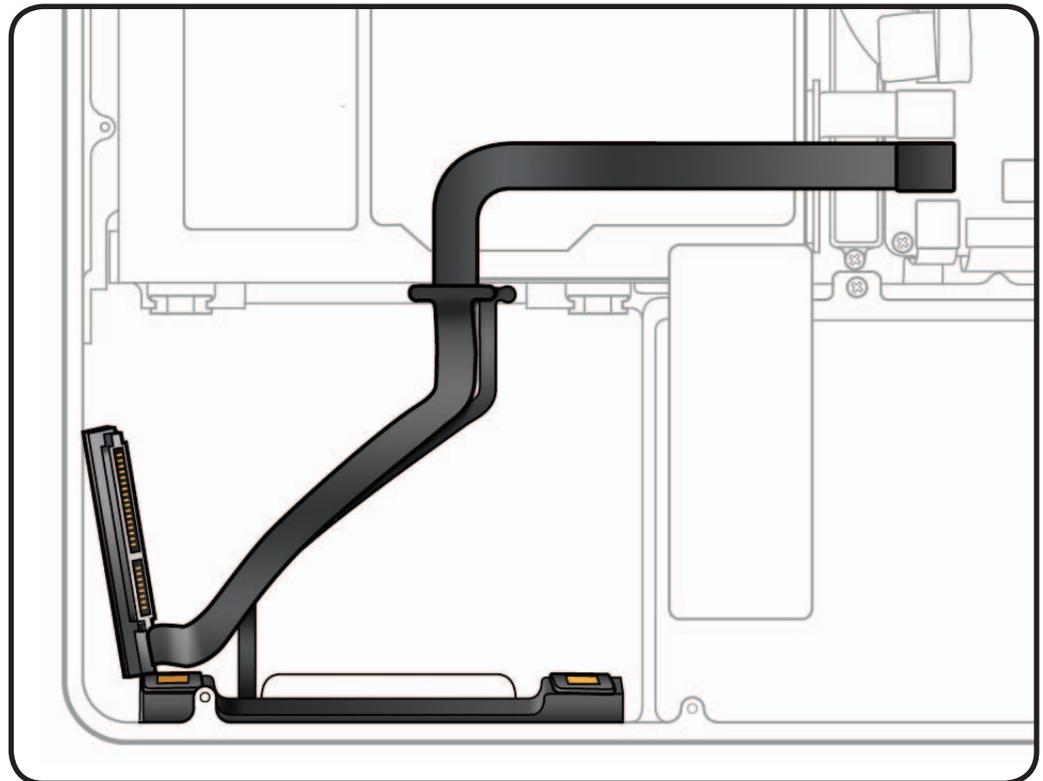
Tools

- ESD wrist strap
- Clean, soft, lint-free cloth
- Black stick
- Phillips #00 screwdriver, magnetized
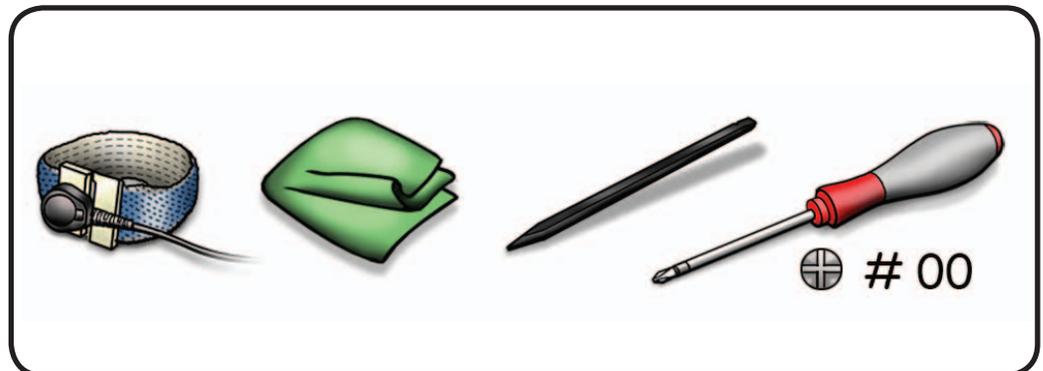
Removal

1 Disconnect cable from logic board.

2 Remove Phillips #00 screws at flex cable:
(2) 922-9036 (1.5mm)

3 Remove Phillips #00 screws at front hard drive bracket:
(2) 922-9105 (4mm)

4 Peel up IR sensor/ sleep LED cable from adhesive on top case.
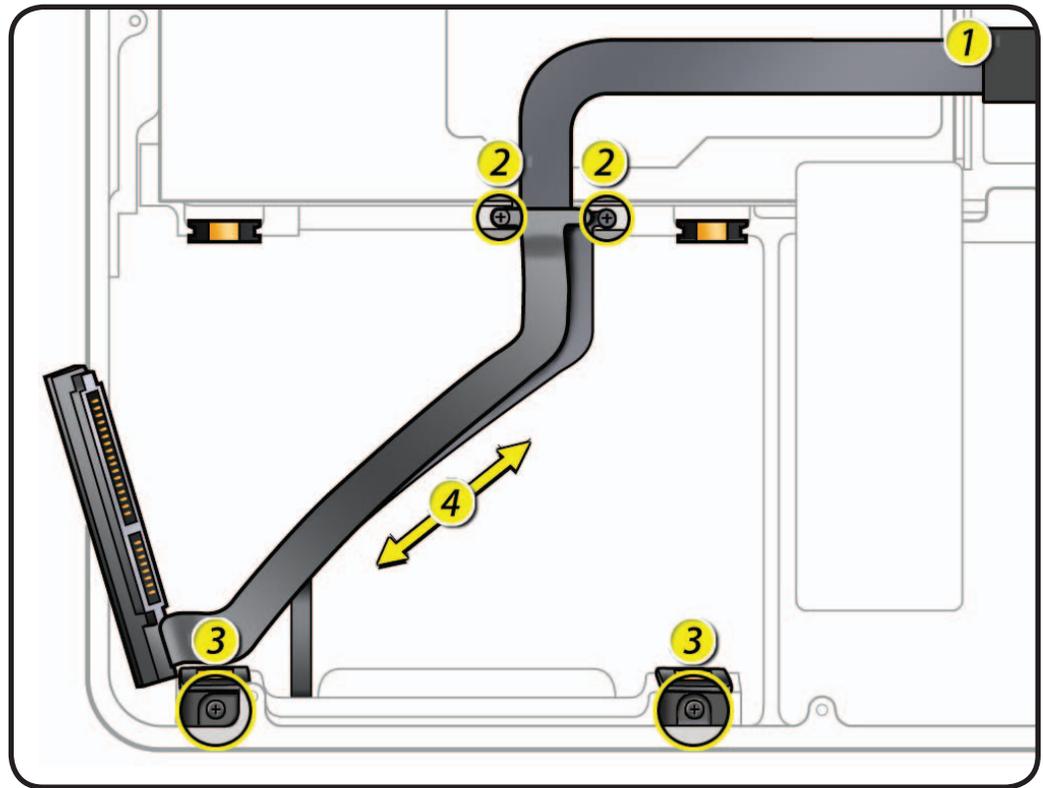
Replacement

1 Insert front hard drive bracket screws.

2 Press flex cable adhesive to top case.

3 Insert flex cable screws.

4 Attach flex cable to logic board.

Note: Press cable straight down when installing.
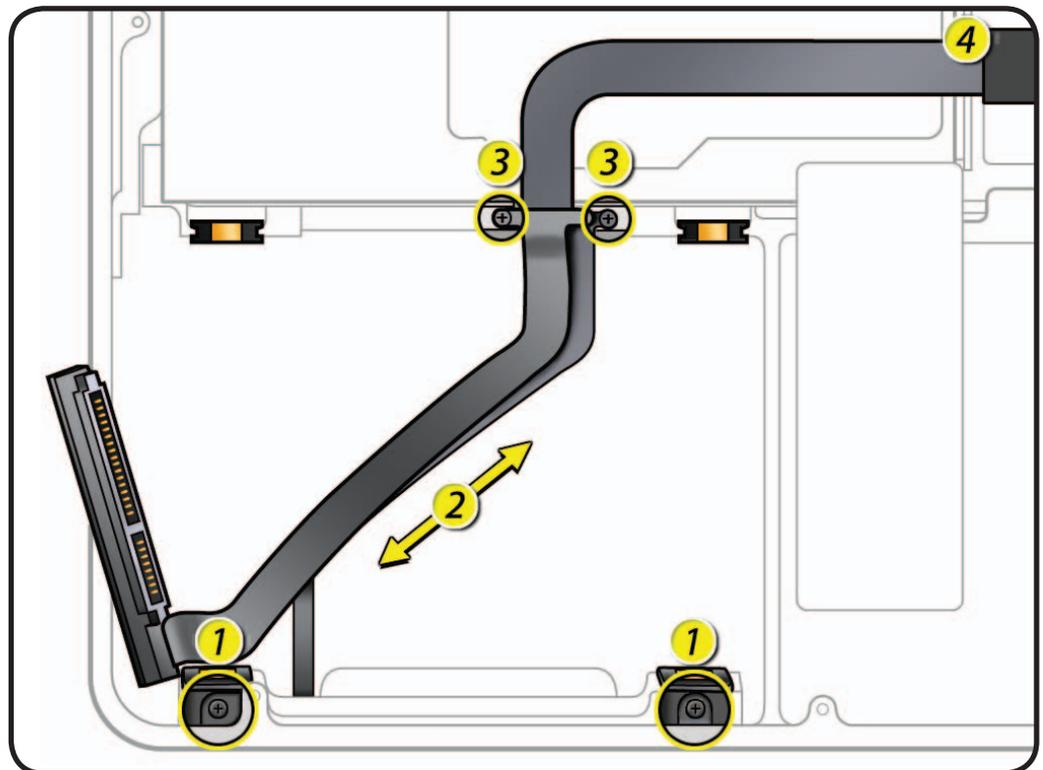
Optical Drive

First Steps
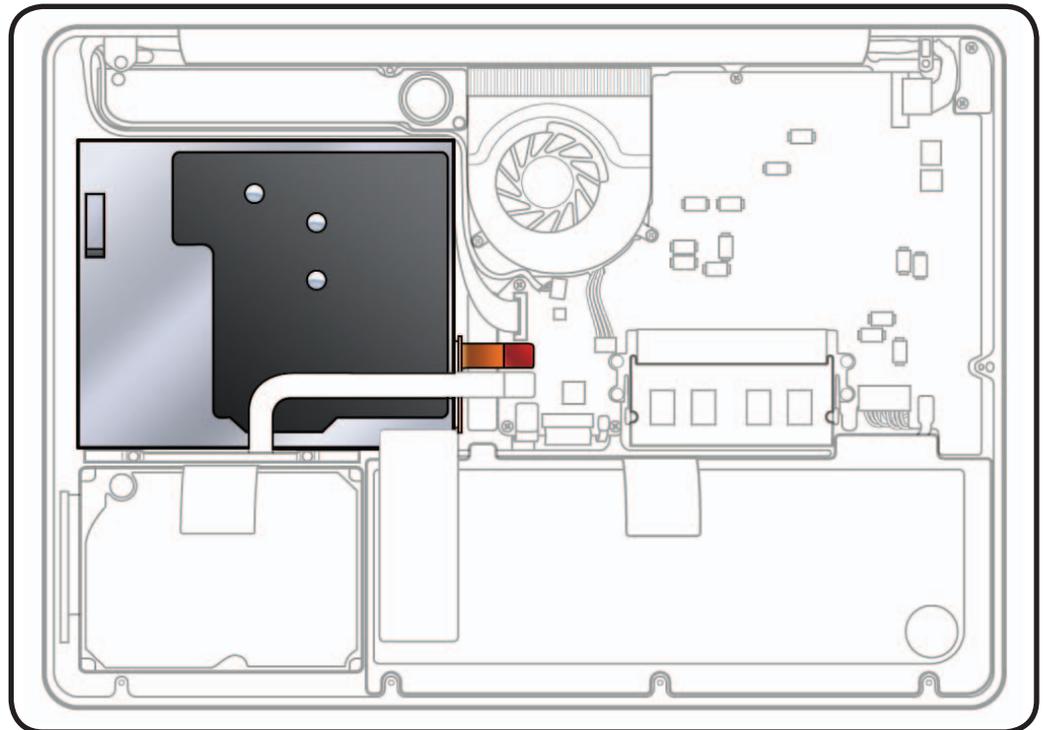
Remove:
- Bottom Case

Tools

- ESD wrist strap
- Clean, soft, lint-free cloth
- Black stick
- Phillips #00 screwdriver, magnetized
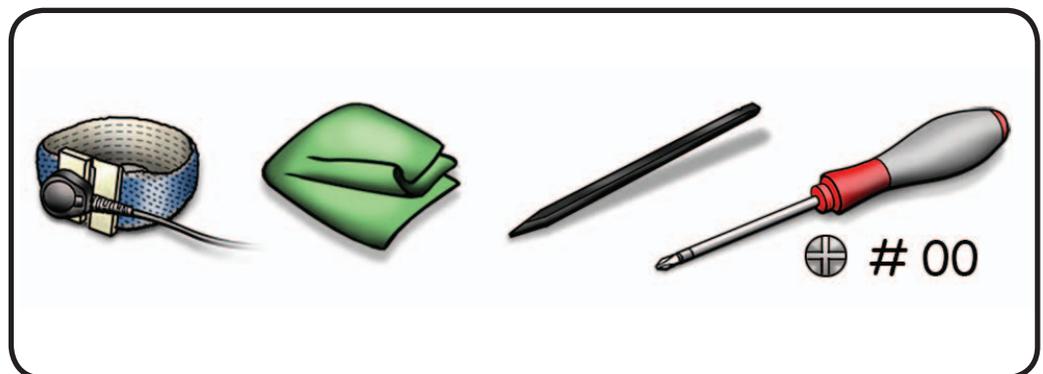
Removal

Before you begin this procedure, disconnect battery from logic board. Failure to do so could damage computer.
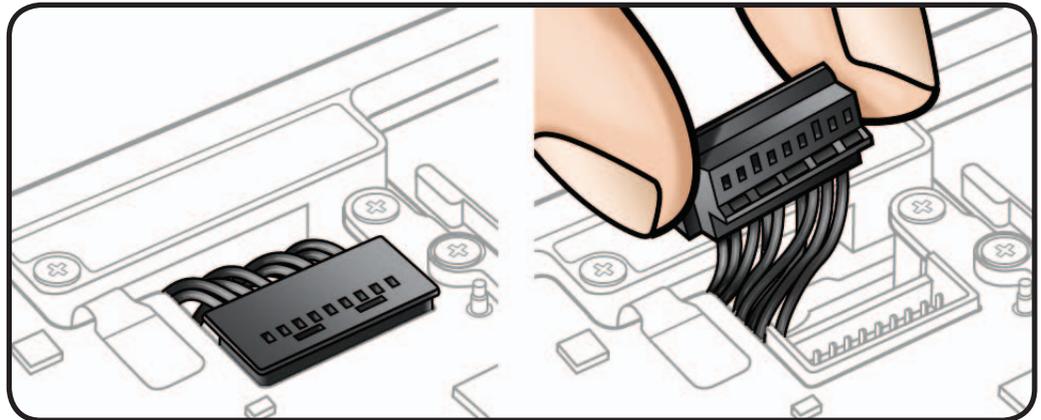
1 Remove Phillips #00 screws:
(3) 922-8662 (2.8mm)

2 Use black stick to carefully disconnect 2 flex cables from logic board:
- optical drive
- hard drive

Reassembly Note: Press cables straight down when installing.
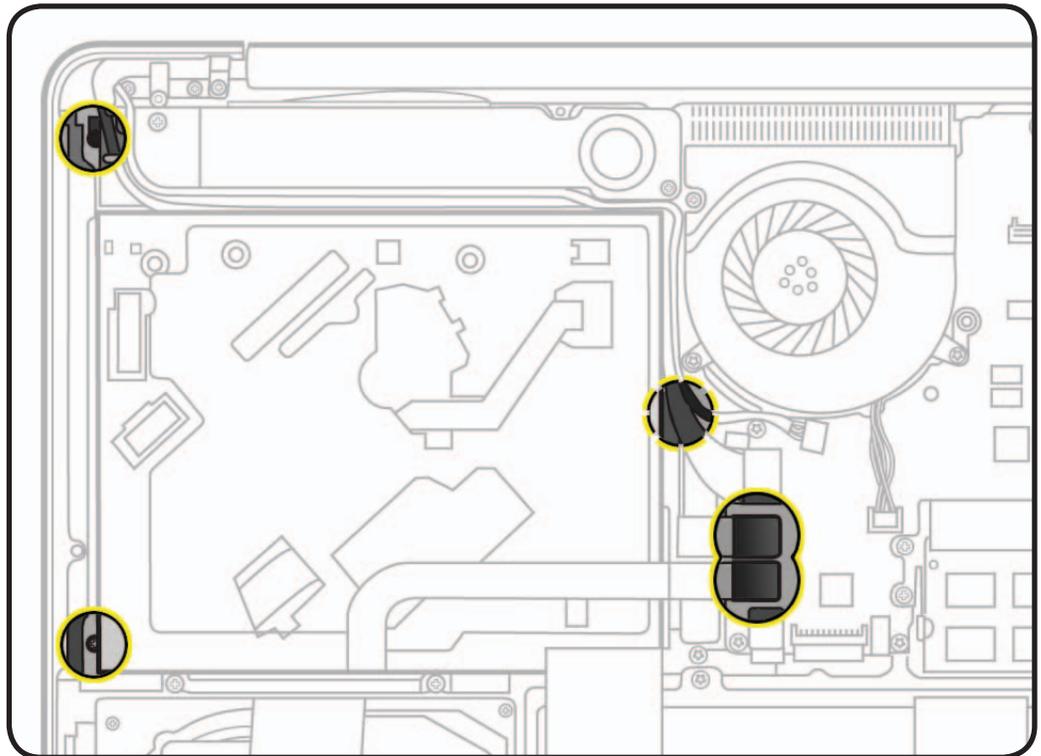
3 Rotate drive out from under subwoofer and remove from unit.

Replacement Note: If installing a new optical drive, transfer short flex cable from old drive to new drive.
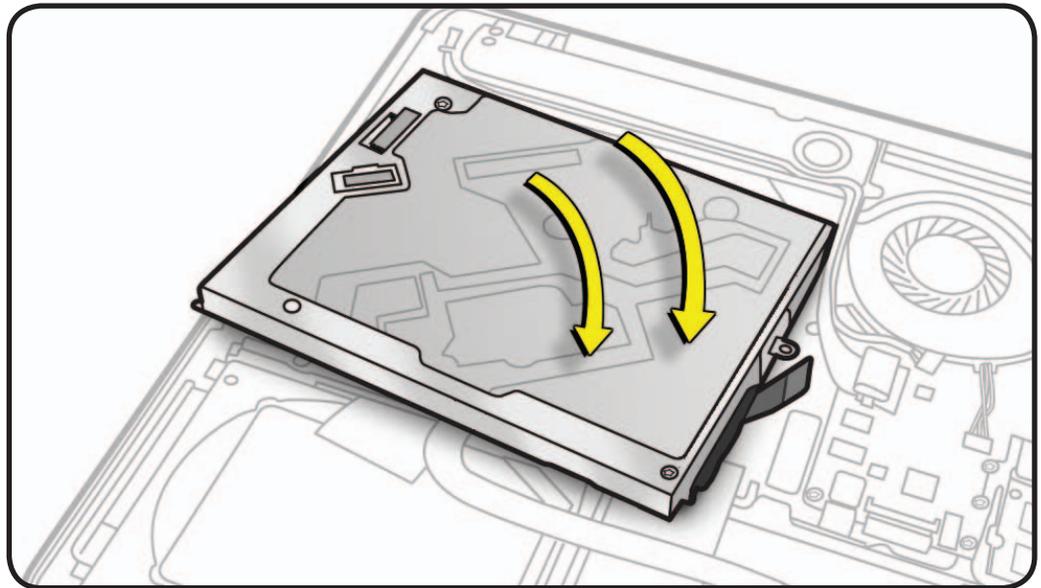
Important: Handle drive by sides only. Do not press or squeeze the top or bottom of optical drive

Important: Do not touch sensor on top case underneath optical drive.
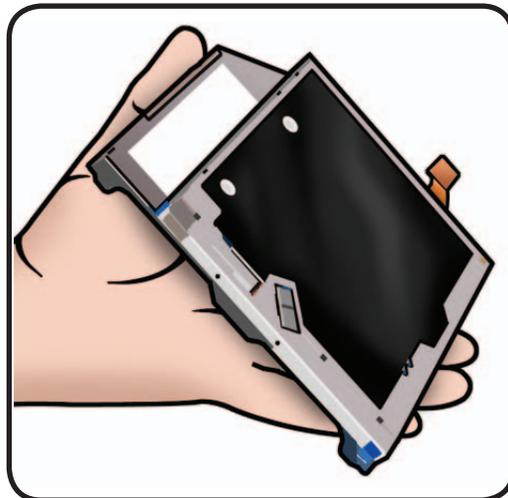
Optical Drive Flex Cable

First Steps

Remove:
- Bottom Case
- Optical Drive
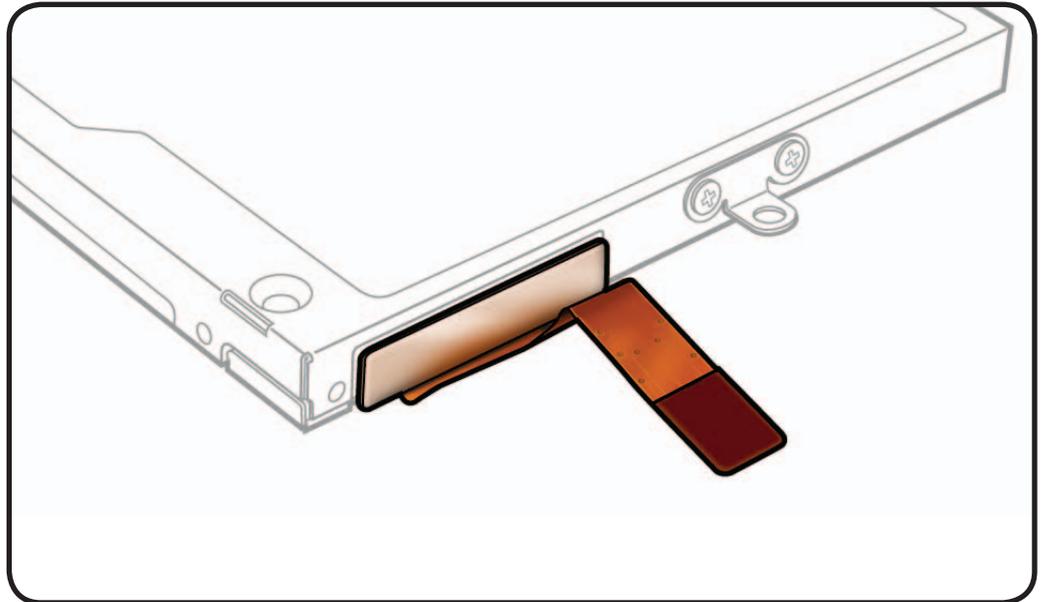
Tools

- ESD wrist strap
- Clean, soft, lint-free cloth
- Black stick
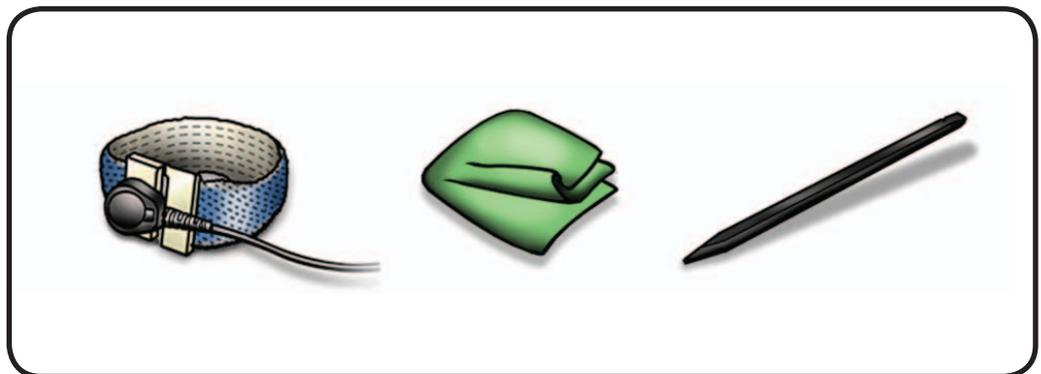
Removal

1 Handle optical drive by sides only.

2 Evenly disconnect flex cable from drive.
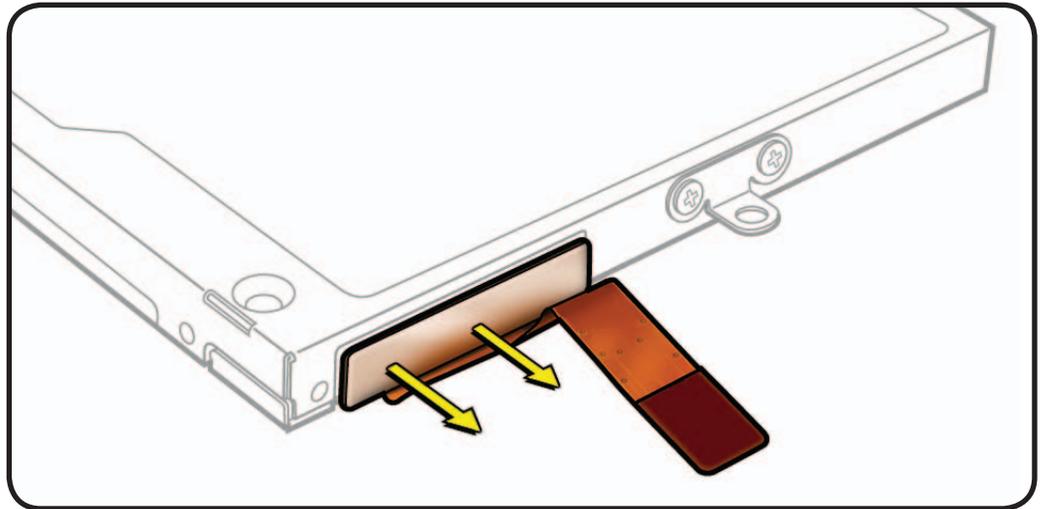
Right Speaker / Subwoofer

First Steps

Remove:
- Bottom Case
- Optical Drive

Caution: Do not touch soft speaker cones.
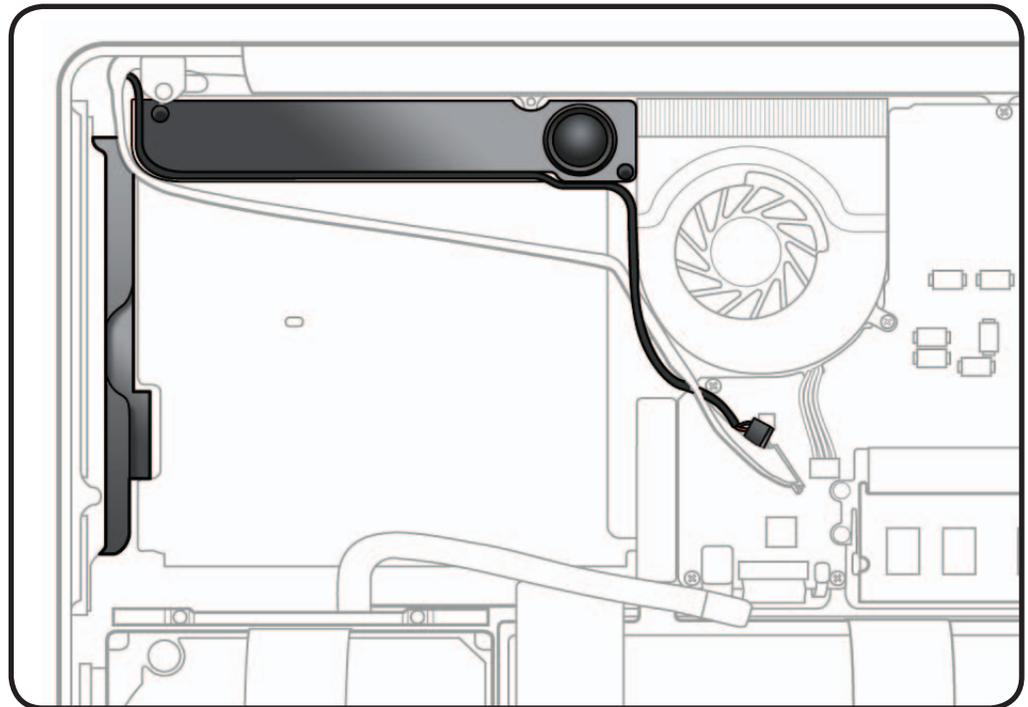
Tools

- ESD wrist strap
- Clean, soft, lint-free cloth
- Kapton tape
- Black stick
- Phillips #00 screwdriver, magnetized
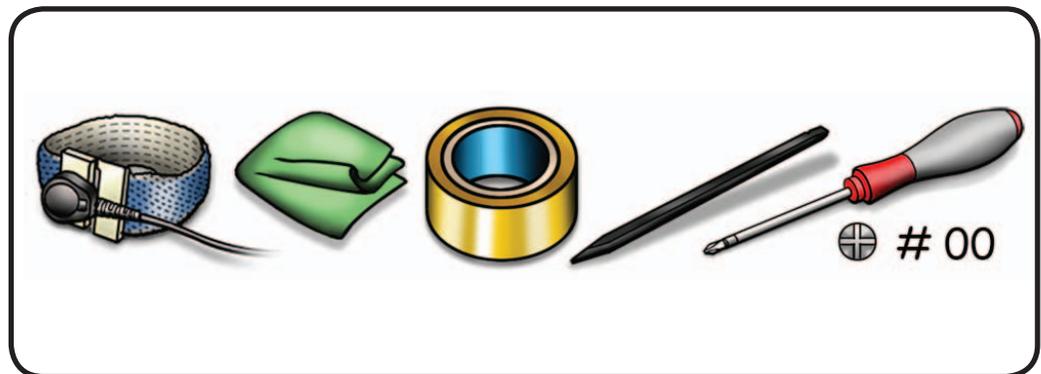
Removal

1 Remove Phillips #00
screws:

(1) 922-8650 (3.8mm)

(1) 922-8644 (4.9mm)

2 Disconnect cable from
logic board.
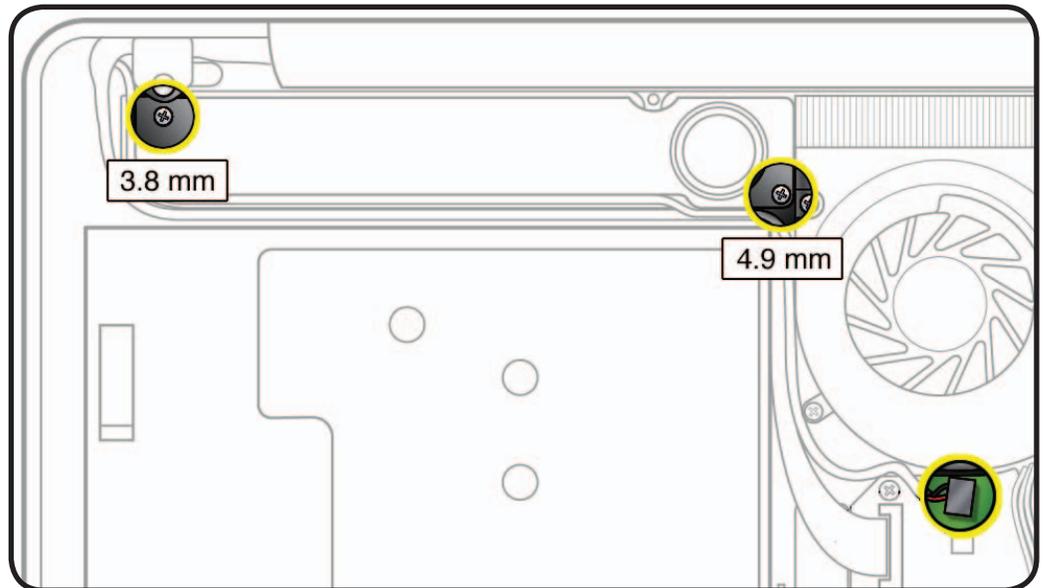
3 Break black tape to
free speaker cable
from top case.

Reassembly Note:
Apply Kapton tape.

3.8 mm

4.9 mm
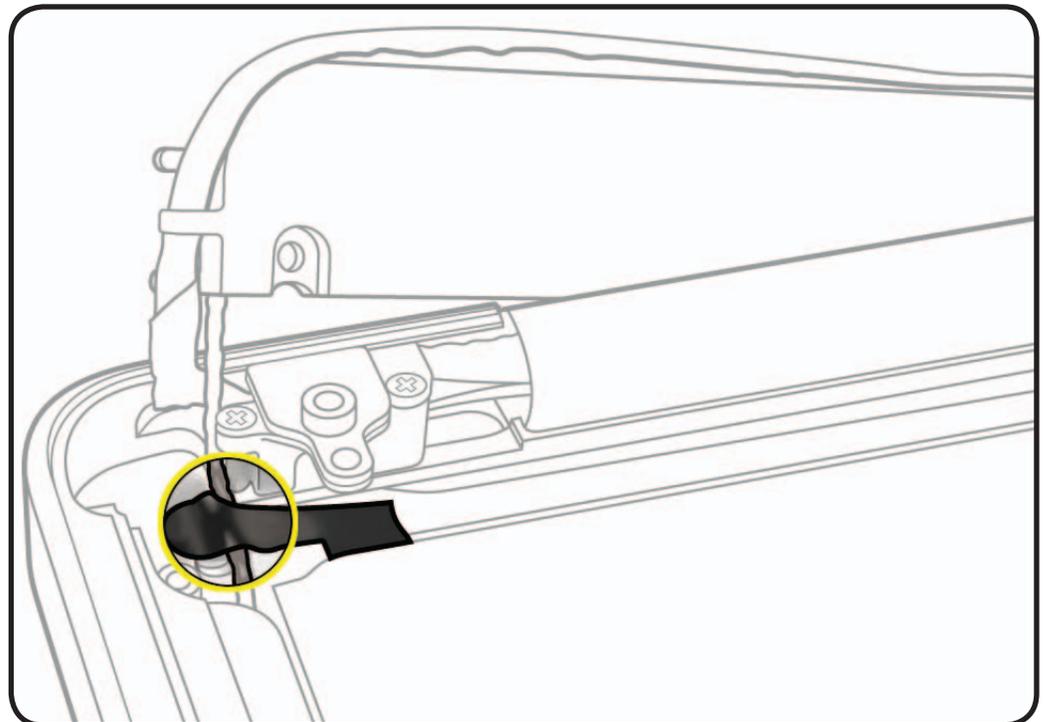
4 Pry up speaker body from top case to loosen adhesive.

5 Route speaker under display cable.
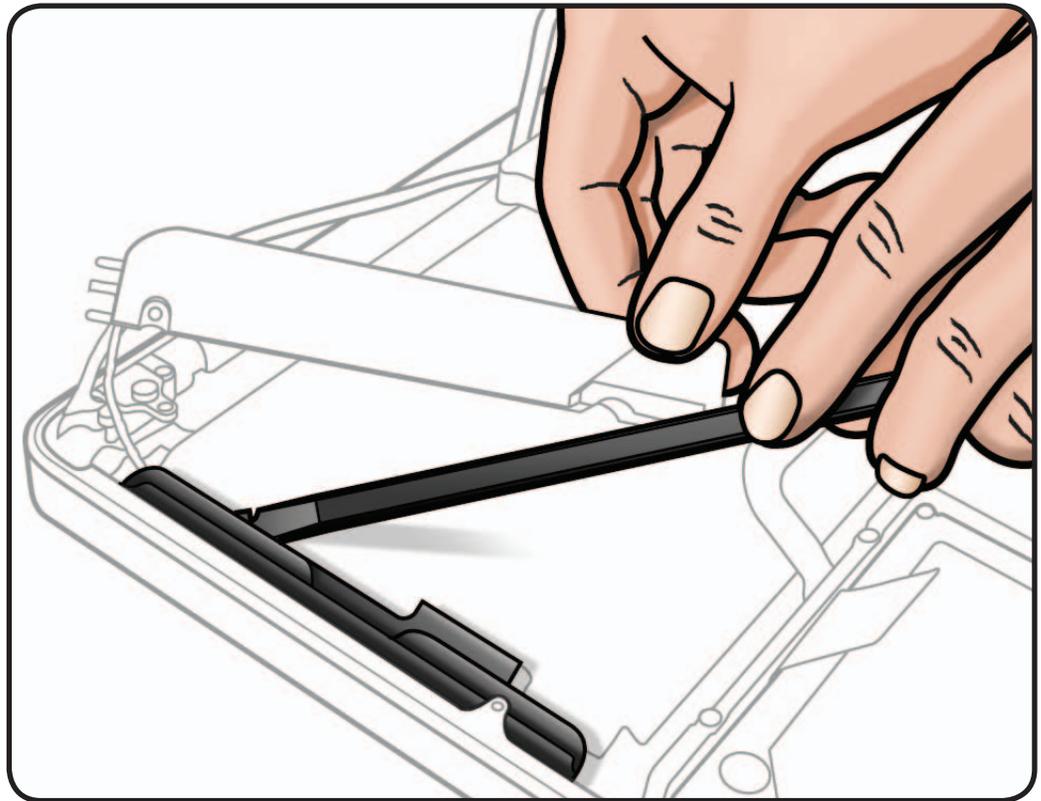
Replacement

1 Peel adhesive backing off speaker body and install in top case.

Trackpad

First Steps

Remove:
- Bottom Case
- Battery

Note: A replacement trackpad includes:
- (2) metal flexures
- (4) black Phillips #00 screws
- (4) silver Phillips #00 screws
- (1) T6 set screw
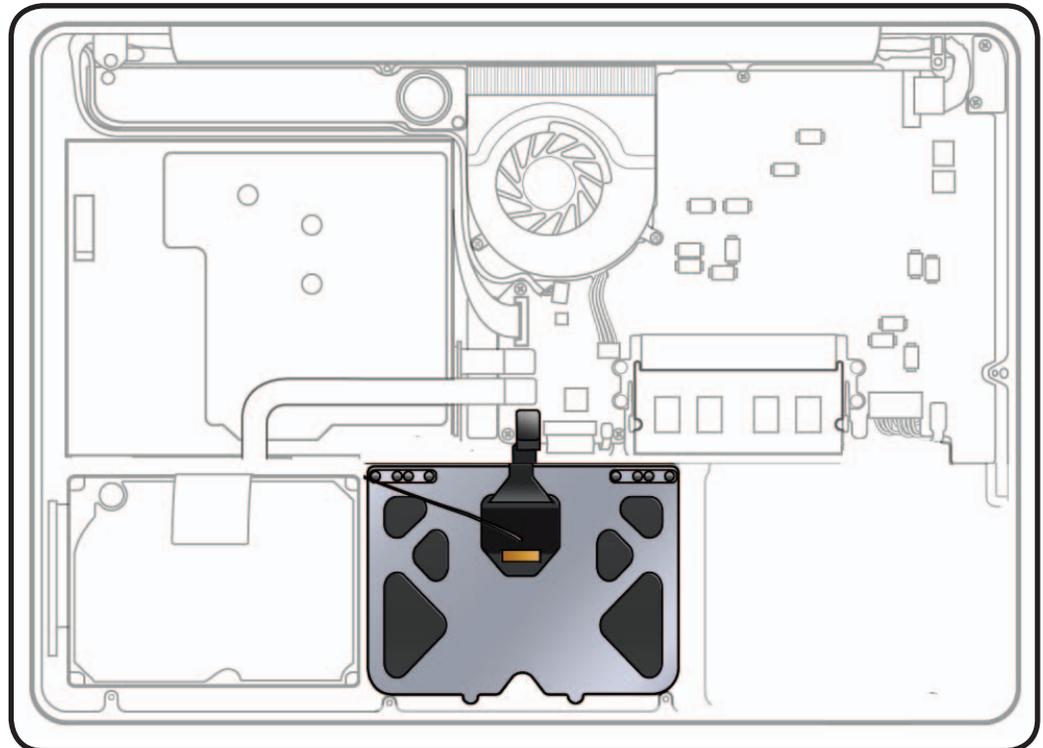
Tools

- ESD wrist strap
- Sticky (Post-it) notes
- Black stick
- Phillips #00 screwdriver, magnetized
- Torx T6 screwdriver, magnetized
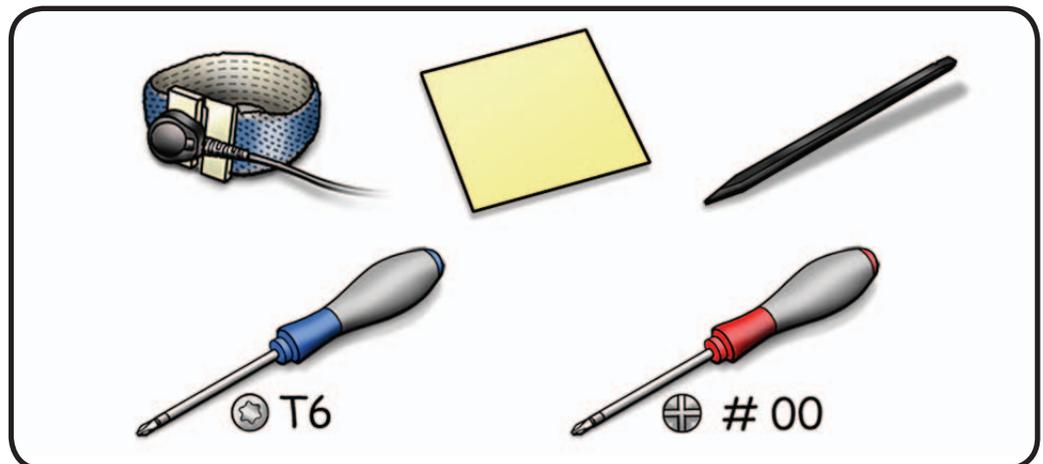
Removal

1 Disconnect trackpad flex cable from logic board.

2 Remove 8 Phillips #00 screws from flexures (4 black inner screws to top case; 4 silver outer screws to trackpad)

3 Remove 1 large T6 set screw.

4 Dispose of old screws; they do not hold securely if reused.

5 Remove 2 flexures (thin metal pieces) from top case.

6 Dispose of old flexures; they are matched to each individual trackpad by thickness.
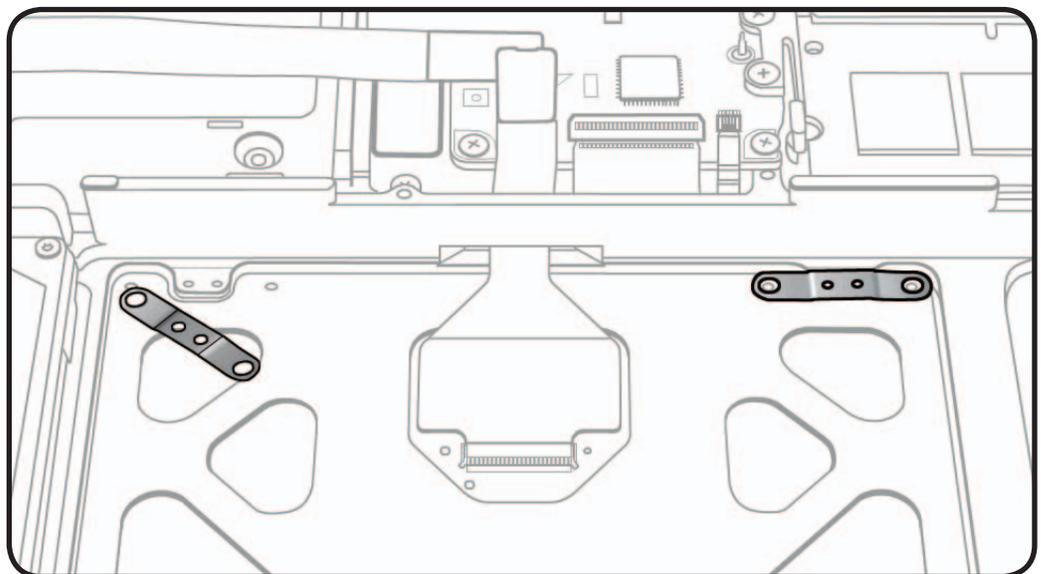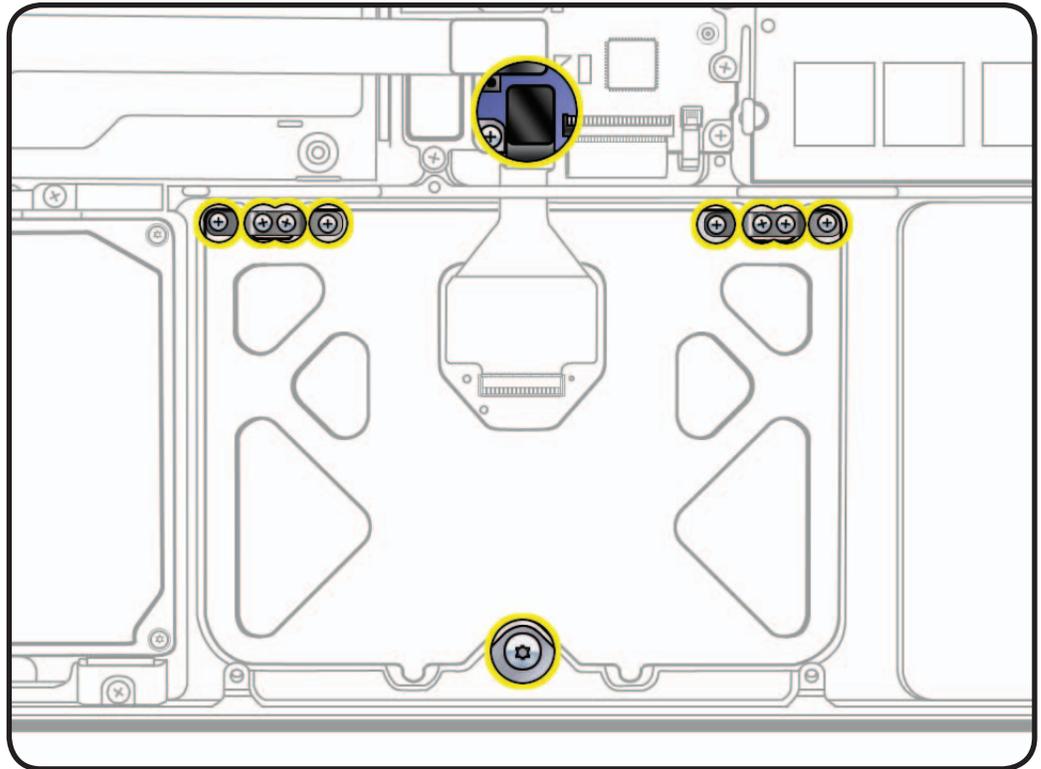
7 Hold trackpad and press down on edge closest to logic board.
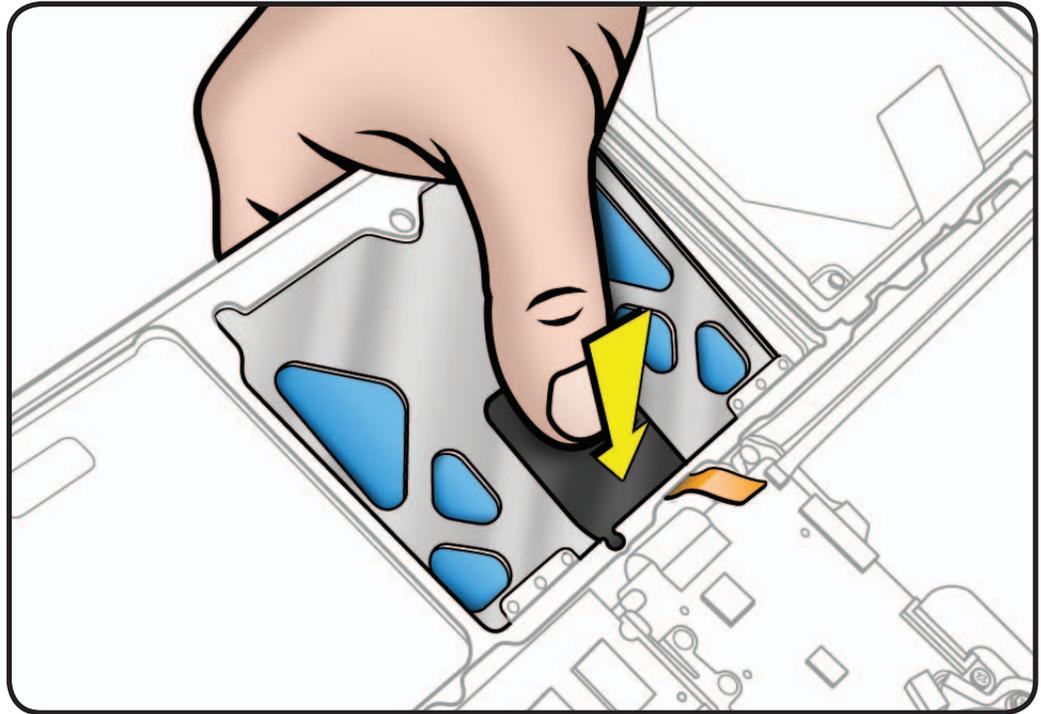
8 Slide trackpad down and back towards keyboard to clear supports in front edge of top case.
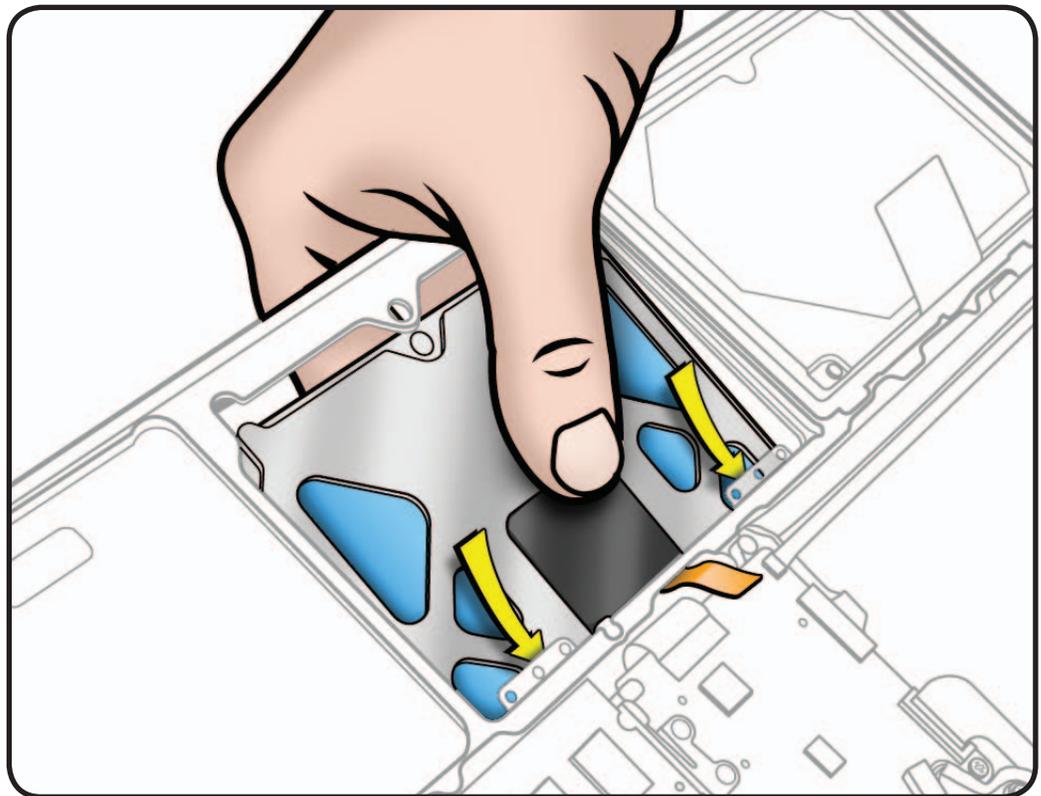
9 Remove trackpad from top case, taking care to route flex cable through hole.
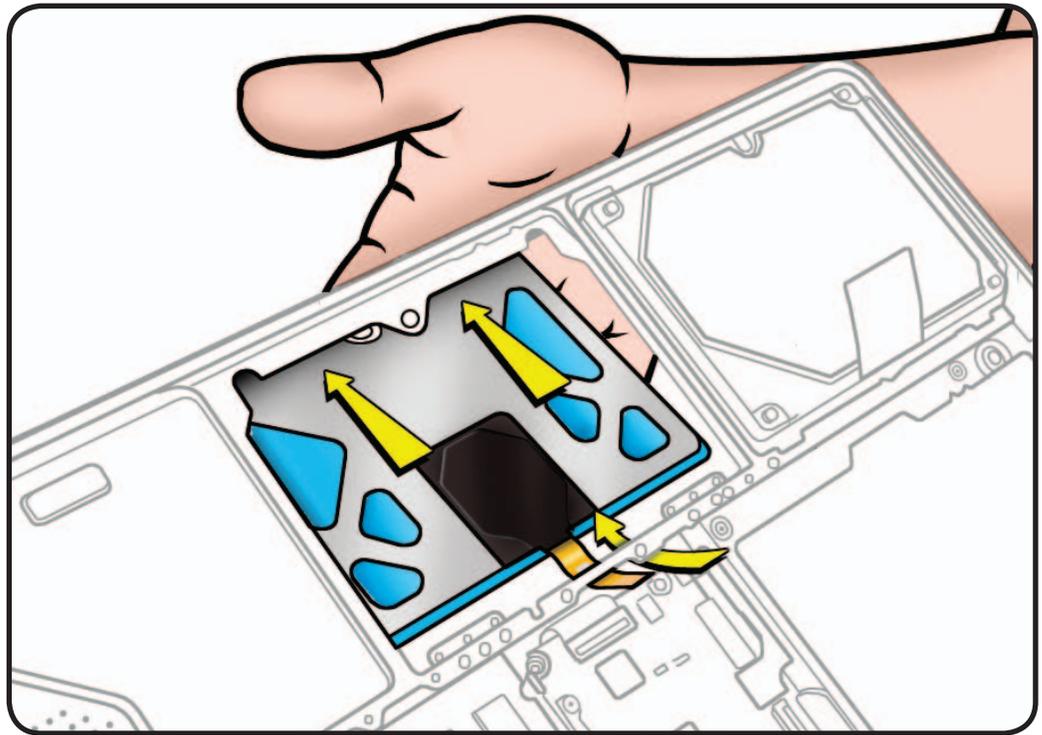
Replacement

Important: Dispose of old flexures and screws, and only use new ones included with trackpad kit.

1 Align flexures onto top case.
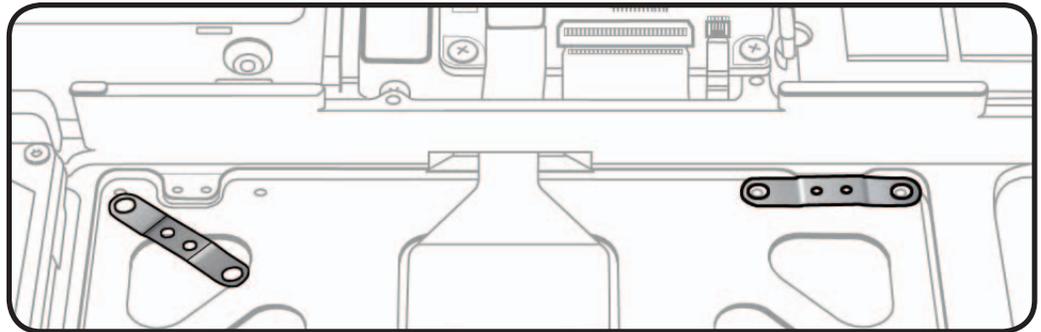
2 Install (2) black screws (1.2mm) in the center of each flexure in the order shown.

3 Use black stick to carefully route flex cable through guide hole.

4 Pivot trackpad into place, inserting front edge first.
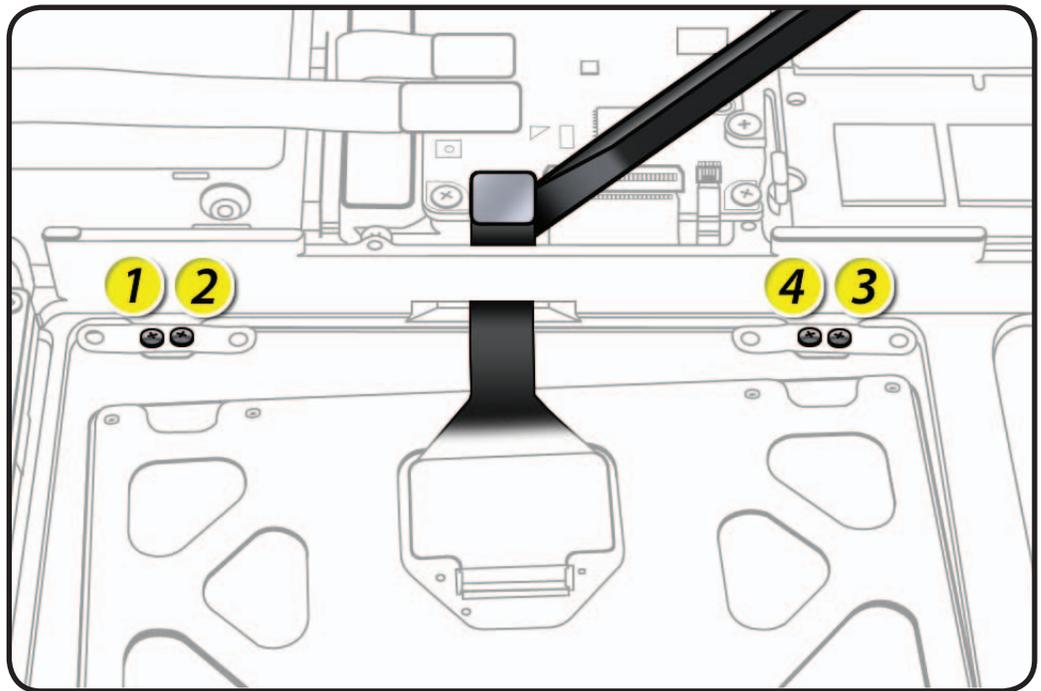
Important: Minimize rubbing edges of trackpad against top case while installing. This could cause tiny cracks to form on the trackpad.

5 Loosely insert (4) silver screws (0.9mm) into outer holes of flexures in order shown. Do not tighten yet.
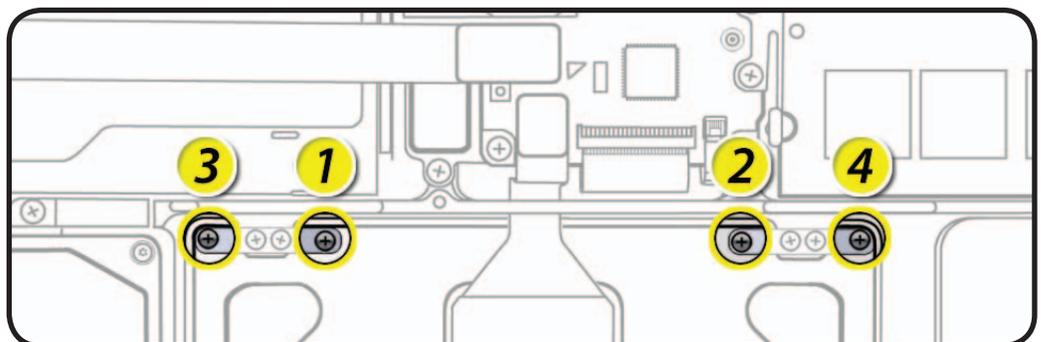
6 On the palm rest, insert one sticky (Post-It) note into gap on each of the four sides of trackpad.
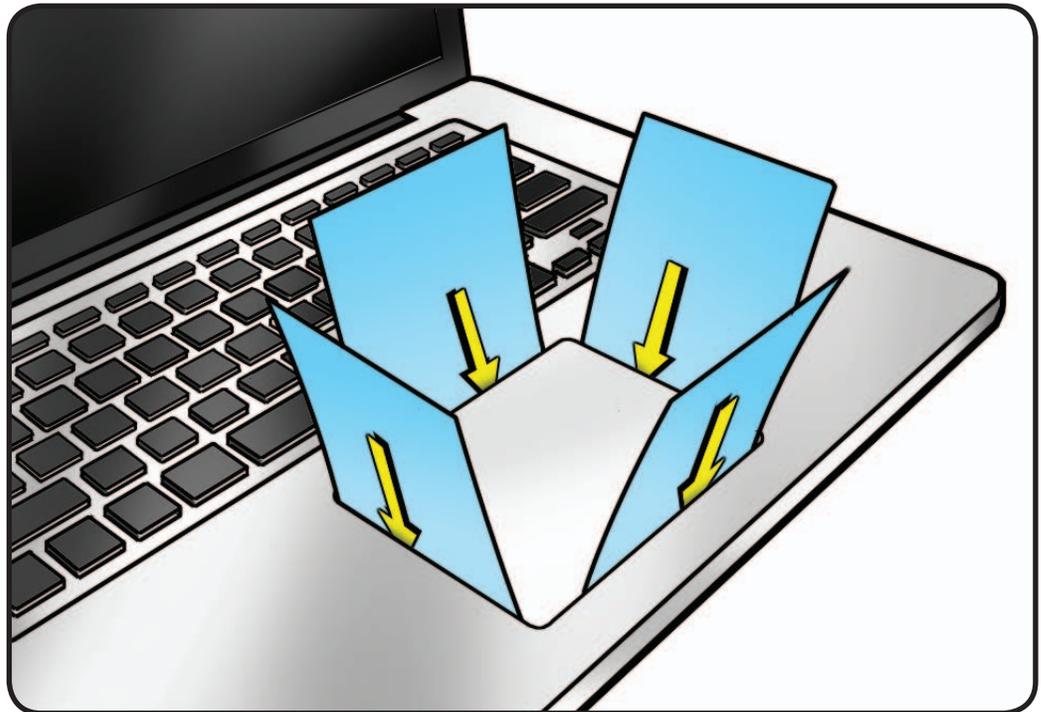
7 Fold sticky notes over so that top case can be laid flat.
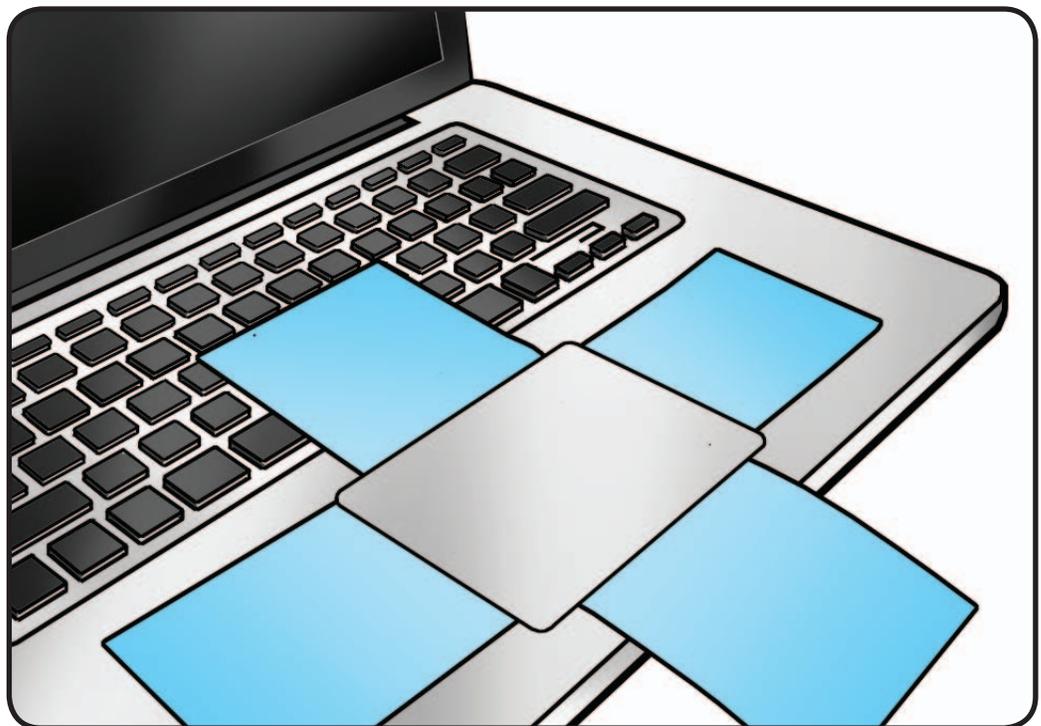
8 Tighten 4 silver outer screws at flexures.

9 Inspect that gaps between trackpad and top case are even on all sides. If not, loosen screws and adjust.
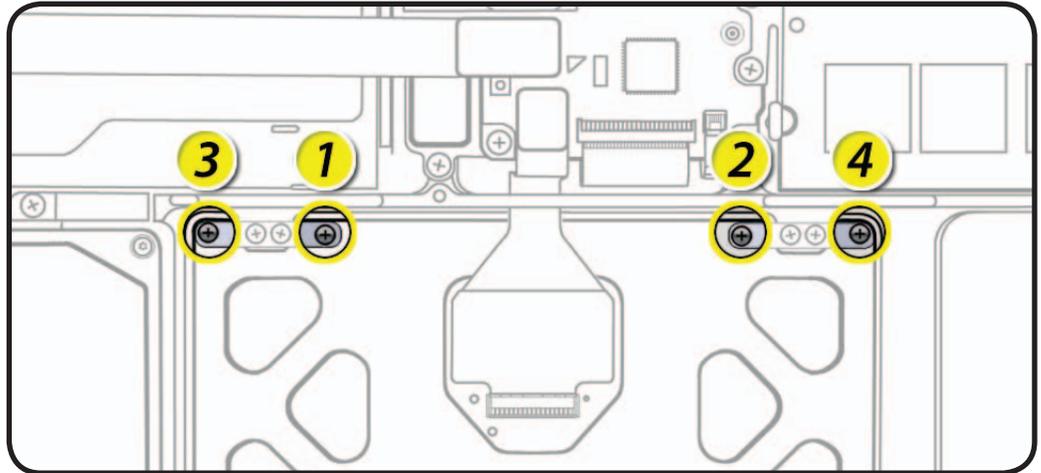
10 Connect flex cable to logic board.

11 Insert large T6 set screw.

12 Slowly turn set screw in small increments until trackpad has a normal clicking motion.
Important: Do not overtighten set screw or you may damage trackpad.
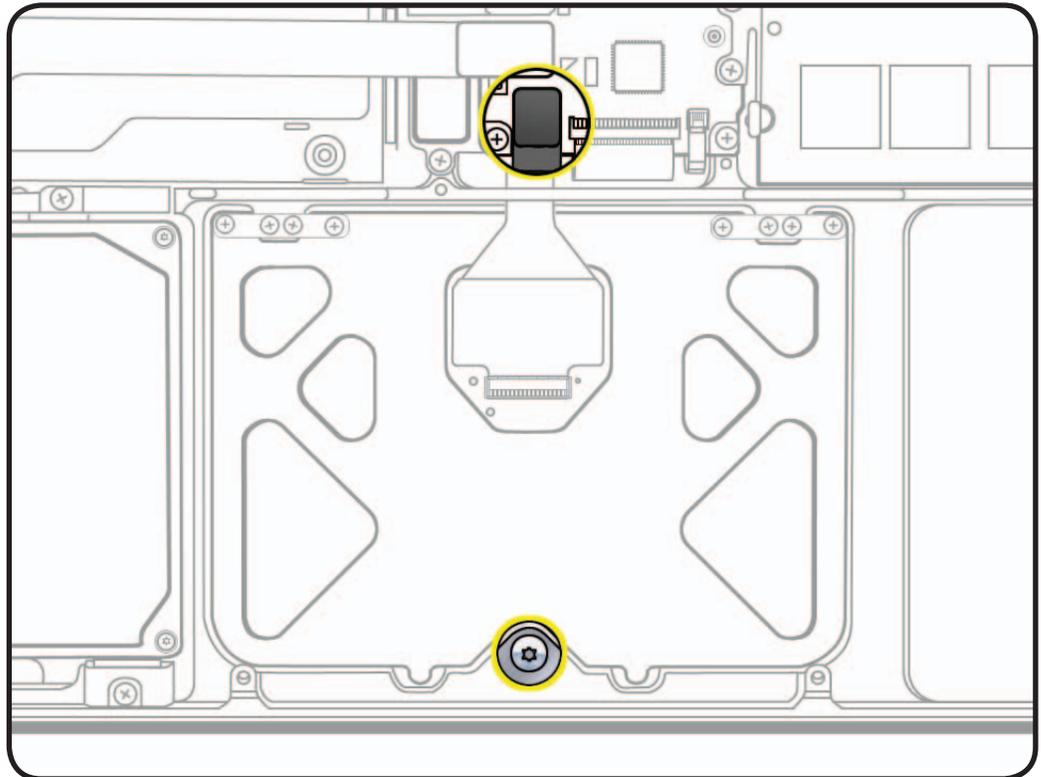
Camera Cable Guide

First Steps
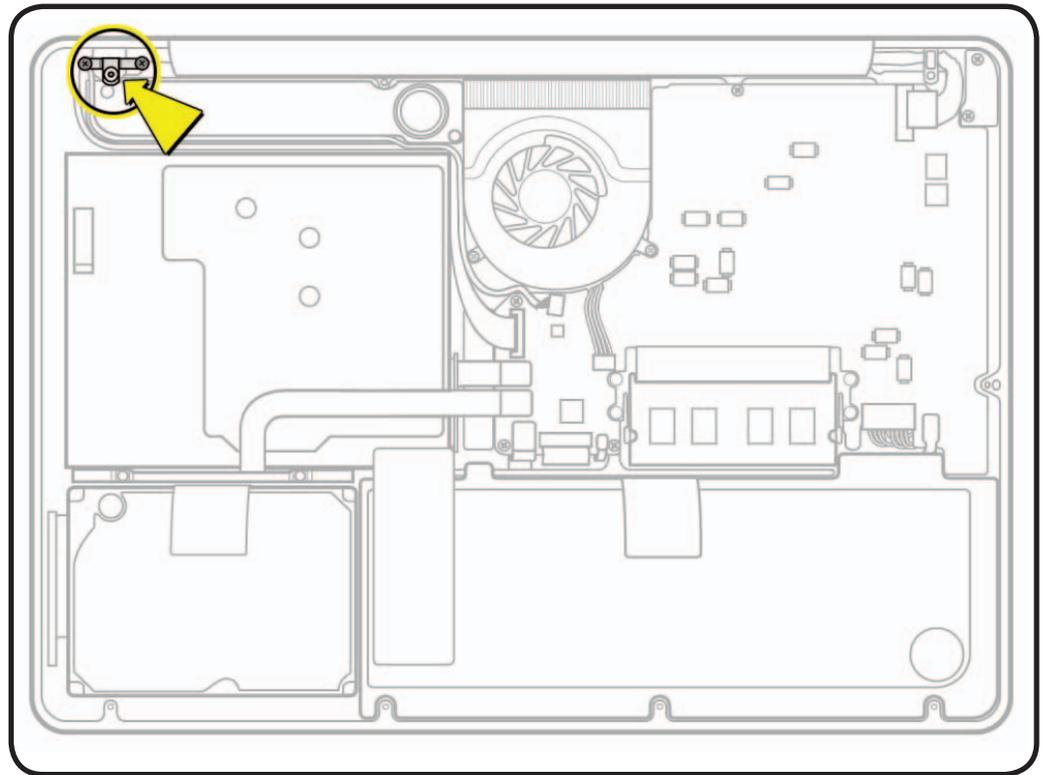
Remove:
• Bottom case

Tools

• ESD wrist strap
• Clean, soft, lint-free cloth
• Black stick
• Phillips #00 screwdriver, magnetized

Removal

1 Remove Phillips #00 screws:
(2) 922-9459 (8mm)

(1) 922-8650 (3.8mm) also secures subwoofer
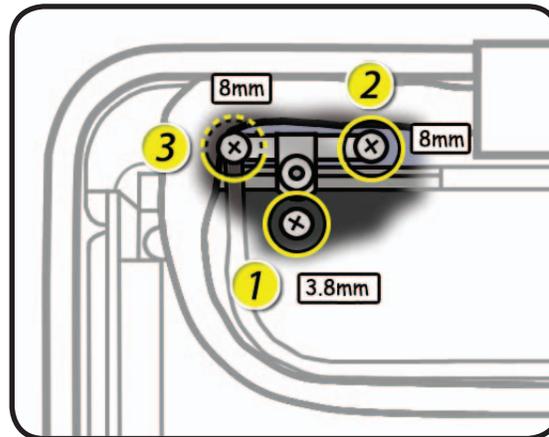
2 Use a black stick to tilt out camera cable guide.
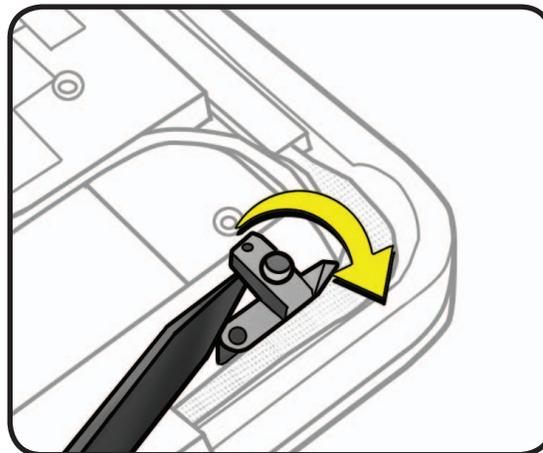
3 **Important:**
For Mid 2010 model only, remove and discard EMI gasket below camera cable guide covering 3 clutch screws.
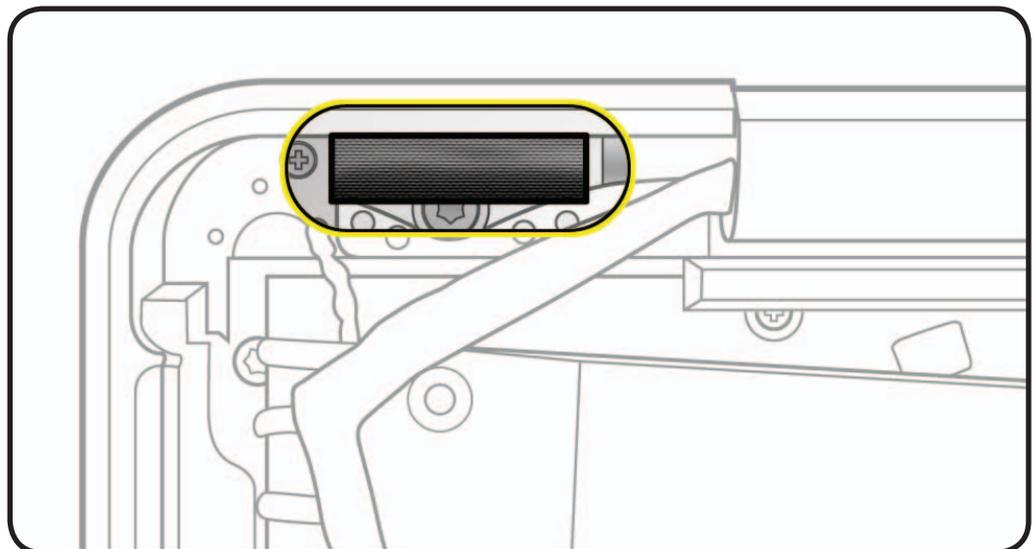
Reassembly

1 Install Phillips #00 screws in order shown: (2) 922-9459 (8mm)

(1) 922-8650 (3.8mm) also secures subwoofer
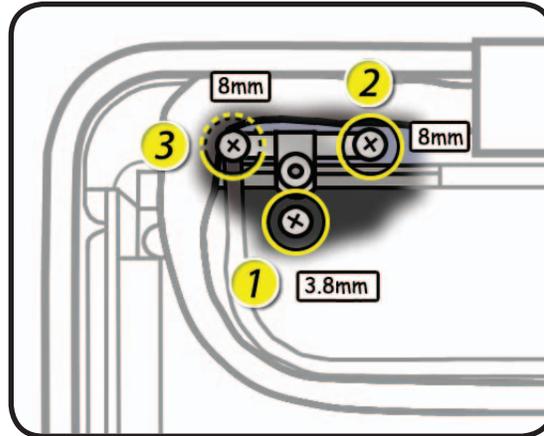
**Reassembly Notes
for Mid 2009 (left):**
Be sure to anchor camera cable ground tab under right screw.
for Mid 2010 (right):
Ground tab is attached to cable guide with a 4th screw, which never needs to be removed.
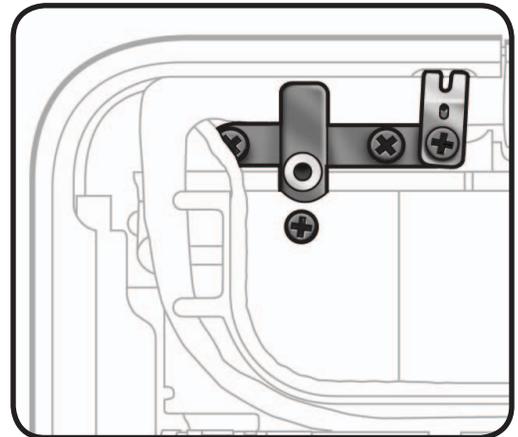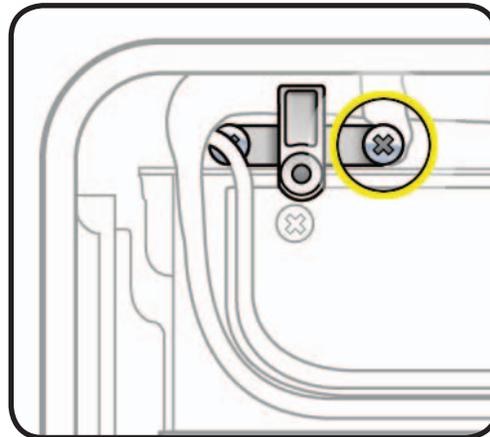
2 Make sure camera cable is properly routed over camera cable guide. Cable should not be wrapped around end of guide or cable could get strained and damaged during future hinge movement.
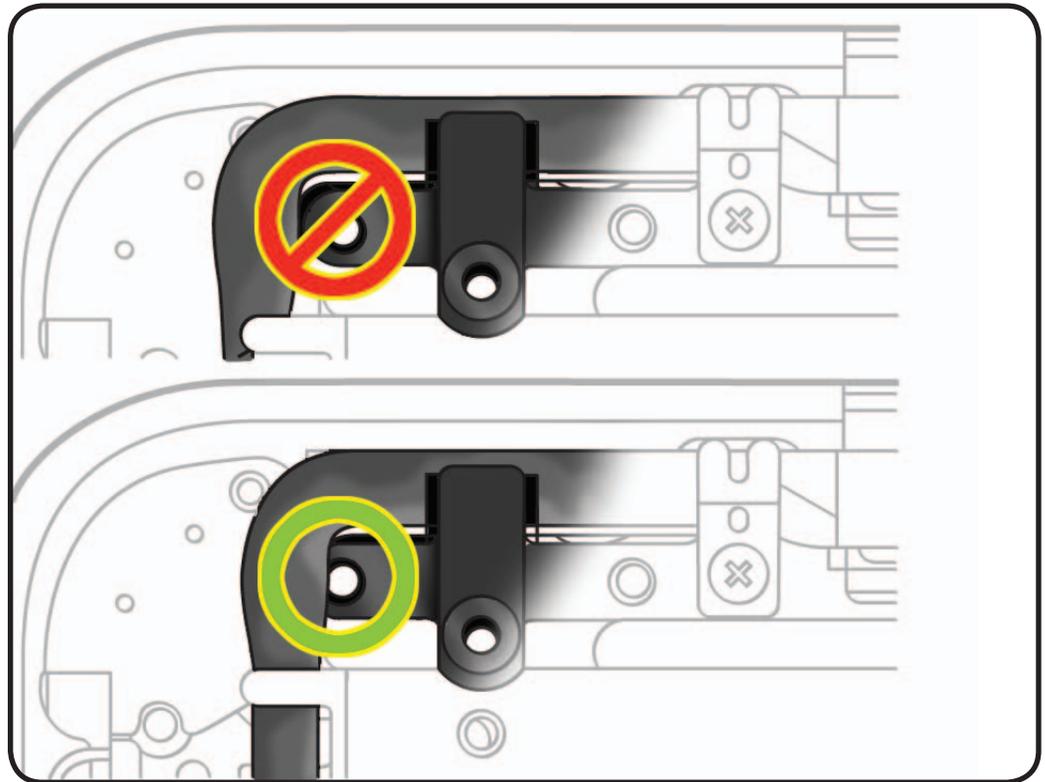
LVDS Cable Guide

First Steps
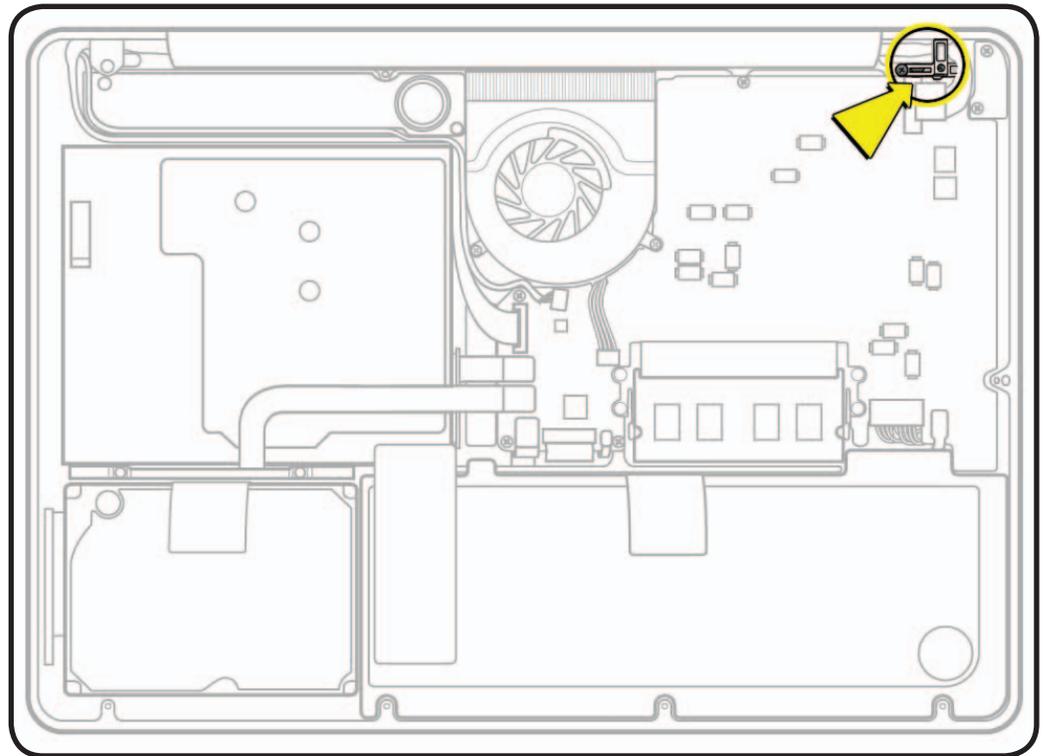
Remove:
• Bottom Case

Tools

• ESD wrist strap
• Clean, soft, lint-free cloth
• Phillips #00 screwdriver, magnetized
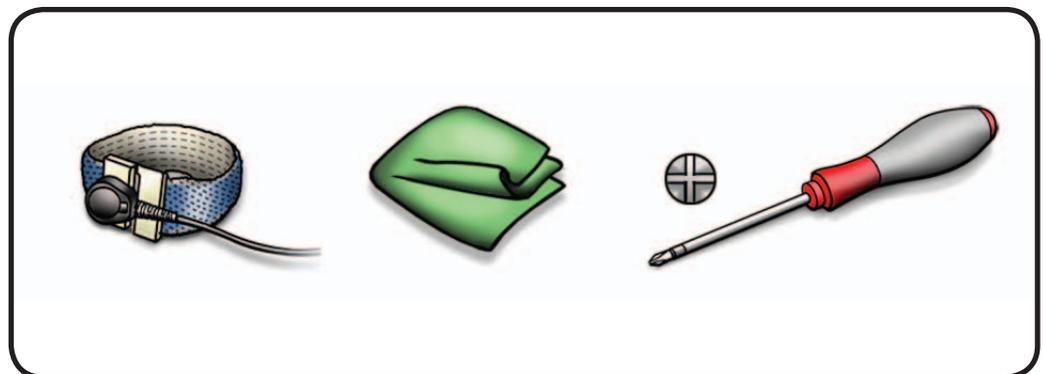
Removal

Remove Phillips #00
   screws:
     for Mid 2009
     (1) 922-9068 (7mm)
     for Mid 2010
     (1) 922-9458 (7mm)

     for both models
     (1) 922-8658 (5mm)
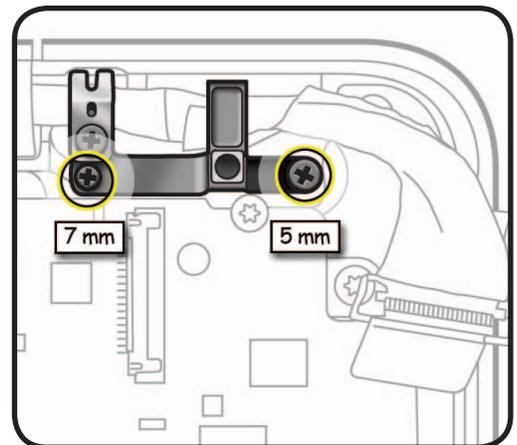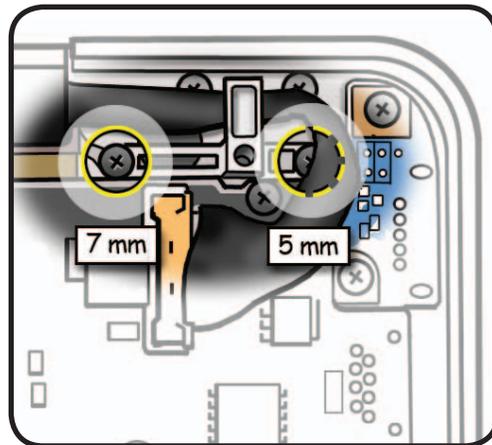
Note: Mid 2010 model
(shown at right) has a
ground tab attached with
a 3rd screw, which never
needs to be removed.

1 Lift out LVDS cable
   guide.

Reassembly Note:
Align locator pin to hole in
top case.
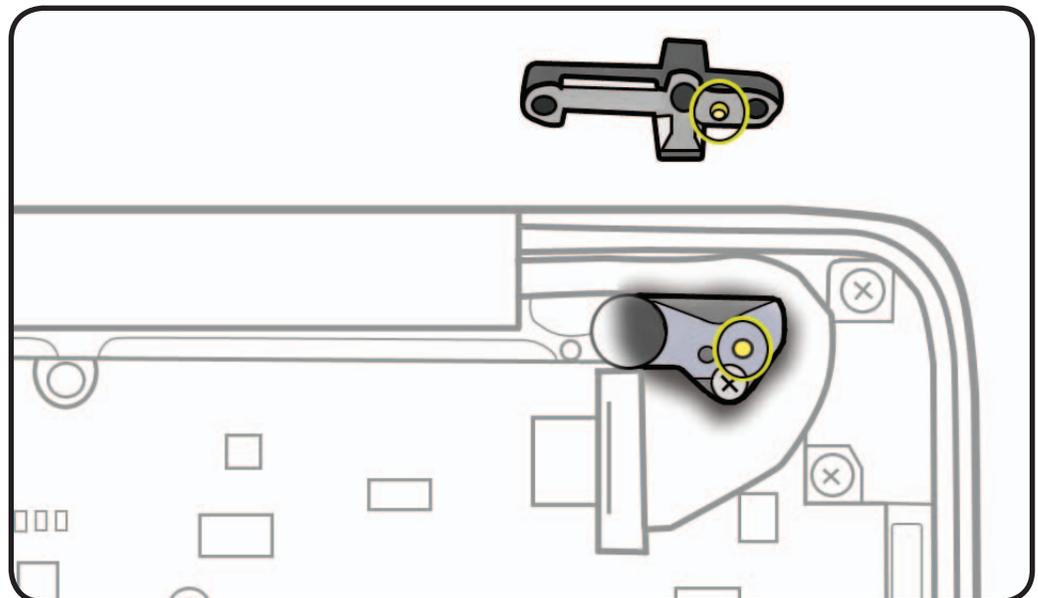
Display Clamshell

First Steps

Remove:
- Bottom Case
- Camera Cable Guide
- LVDS Cable Guide
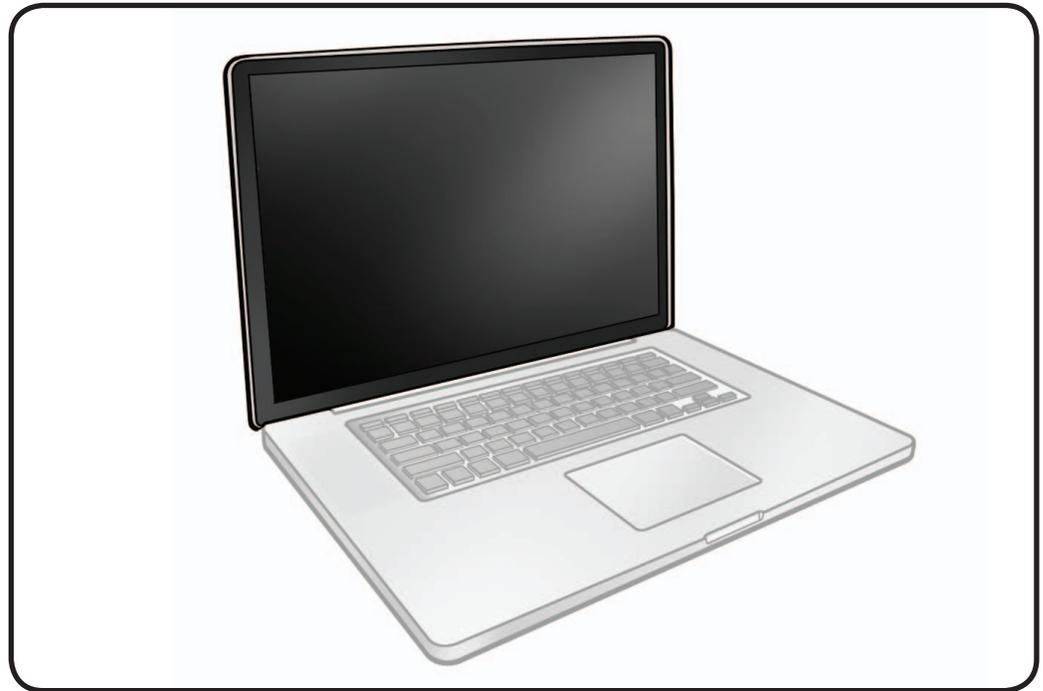
Tools

- ESD wrist strap
- Clean, soft, lint-free cloth
- Foam wedge fixture
- Phillips #00 screwdriver, magnetized
- Torx T6 screwdriver, magnetized
- Torx T8 screwdriver, magnetized
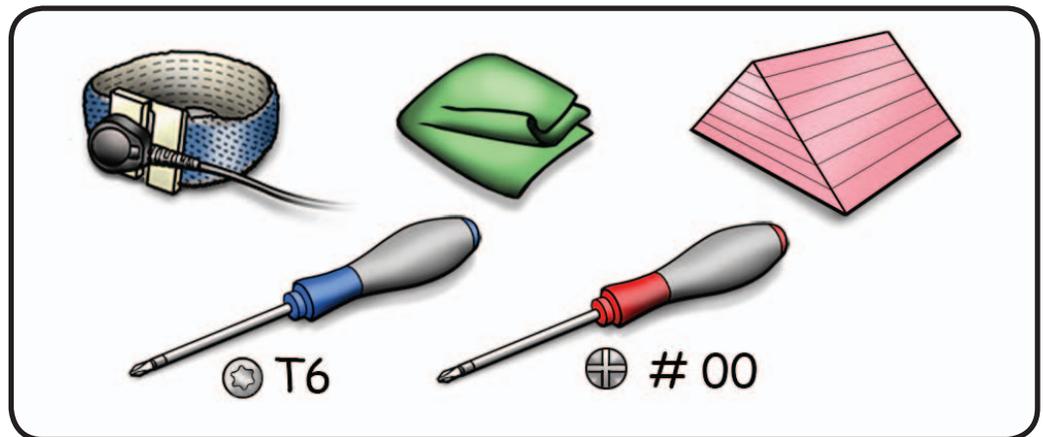
Removal

Before you begin this procedure, disconnect battery from logic board. Failure to do so could damage computer.
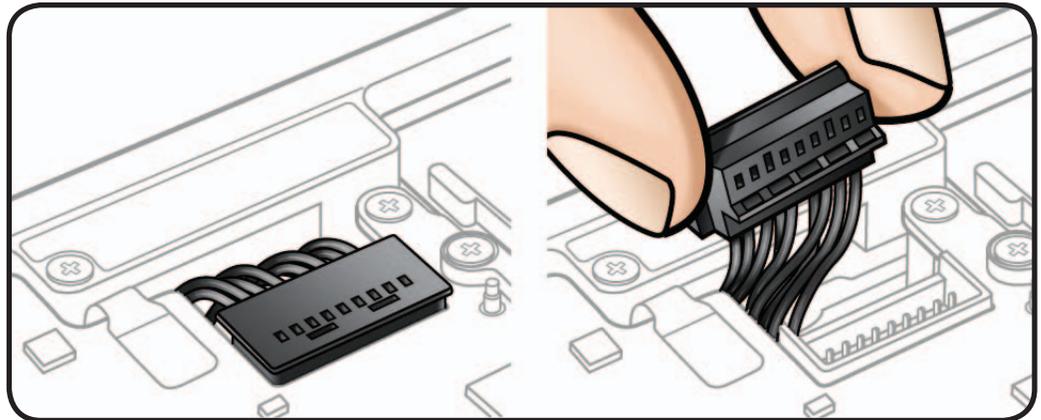
1 Locate camera cable connector on logic board.
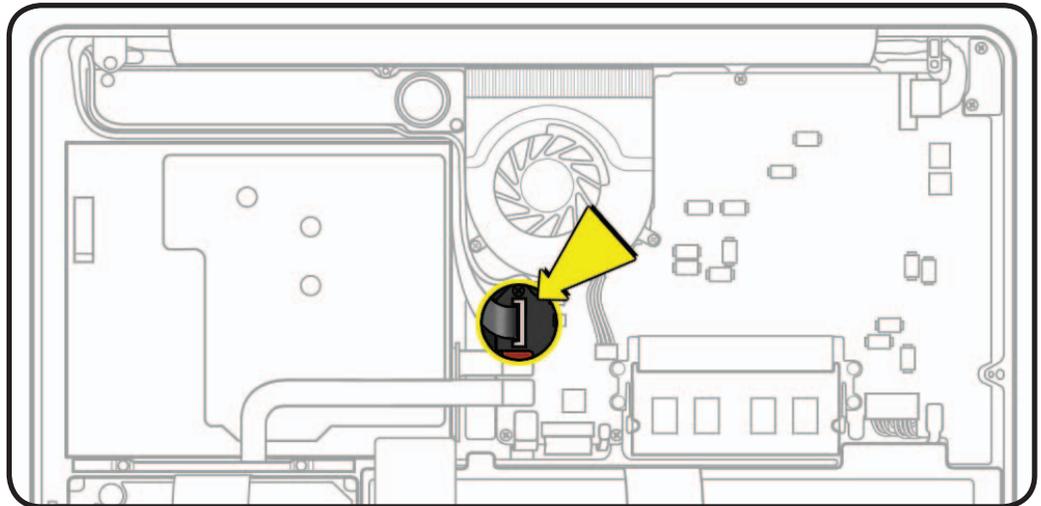
2 Peel EMI gasket (922-8752) off camera cable connector.

3 Remove shim (922-9450) and disconnect camera cable from logic board. Pull cable on same horizontal plane as logic board.
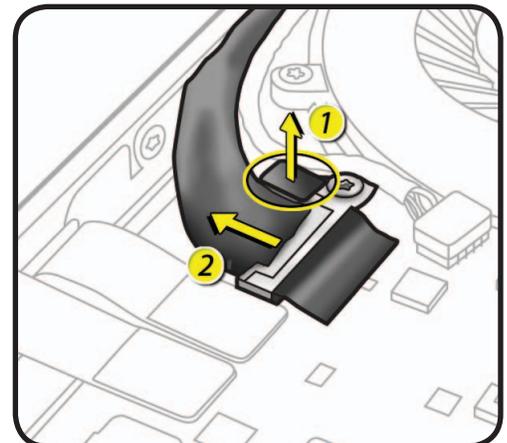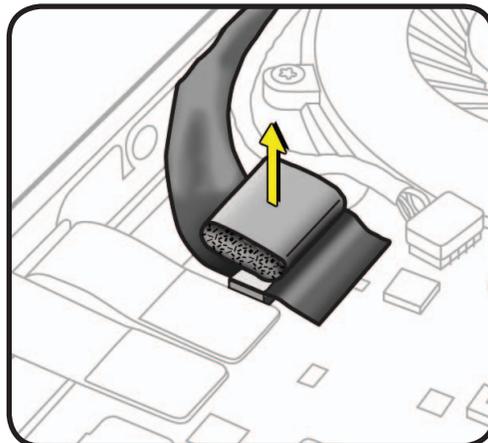
4 Locate LVDS cable connection to logic board.

5 Peel EMI gasket (922-8752) off LVDS cable connector, towards fan.
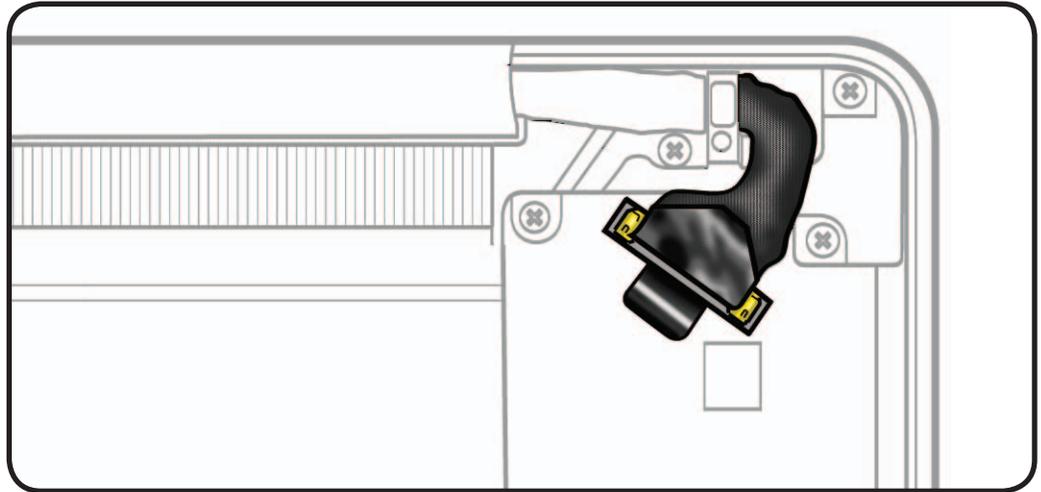
6 Disconnect LVDS cable: grasp black tab and gently swing LVDS lock bar up and back to unlock cable.
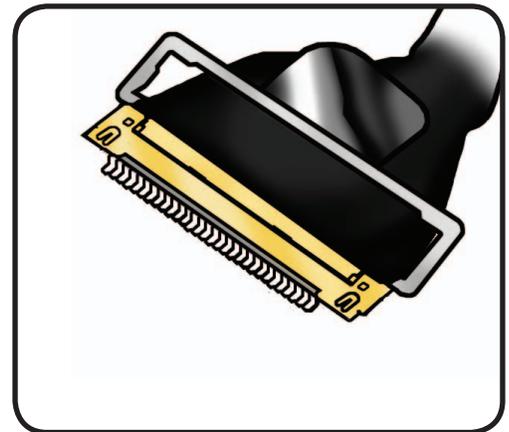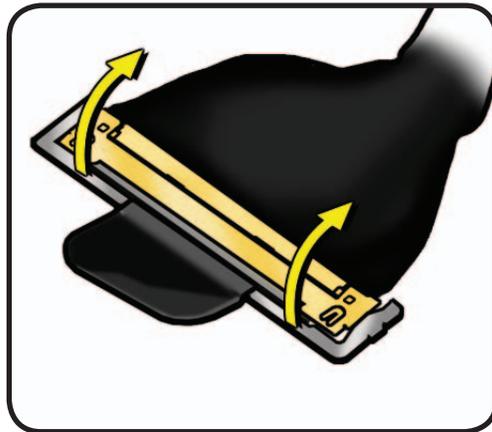
Caution: Do not pull on black tab or metal lock bar. Pulling on tab to remove LVDS cable will likely result in metal lock bar being torn off cable body. This bar is only to disengage lock from LVDS connector. A broken lock bar results in a display assembly replacement.

7 Slide cable out of connector by pulling cable. Do not pull black tab or lock bar.
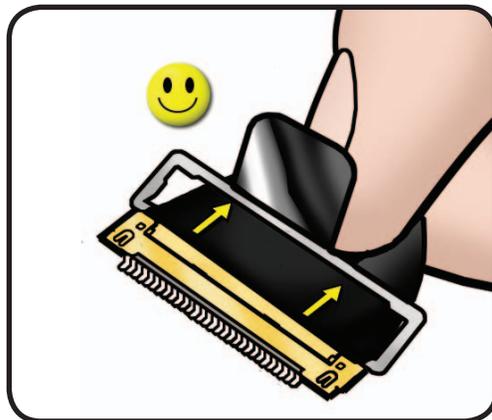
8 Open display to 90 degrees, and place unit on foam wedge service fixture.

9 **For Mid 2010 model only**, remove EMI gasket (922-9304) covering each set of 3 screws.

Important: Discard gasket (shown below) located near camera cable. On reassembly, only replace EMI gasket over screws located near LVDS cable.

10 Remove screws:
for Mid 2009: Torx 6 (6) 922-8970 (6.5mm)
for Mid 2010: Torx 8 (6) 922-9451 (6.5mm)

11 Separate display assembly from top case.

6.5 mm

6.5 mm
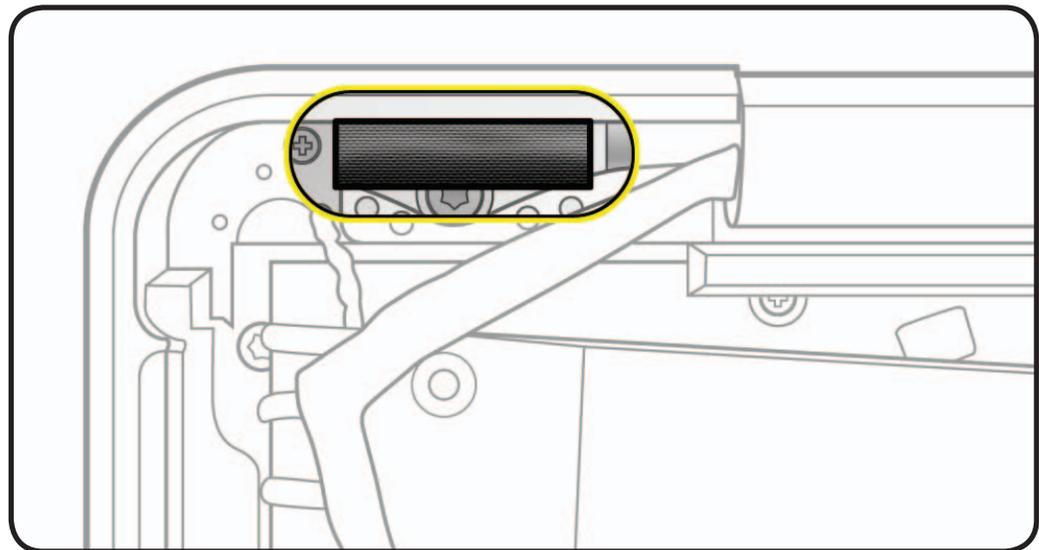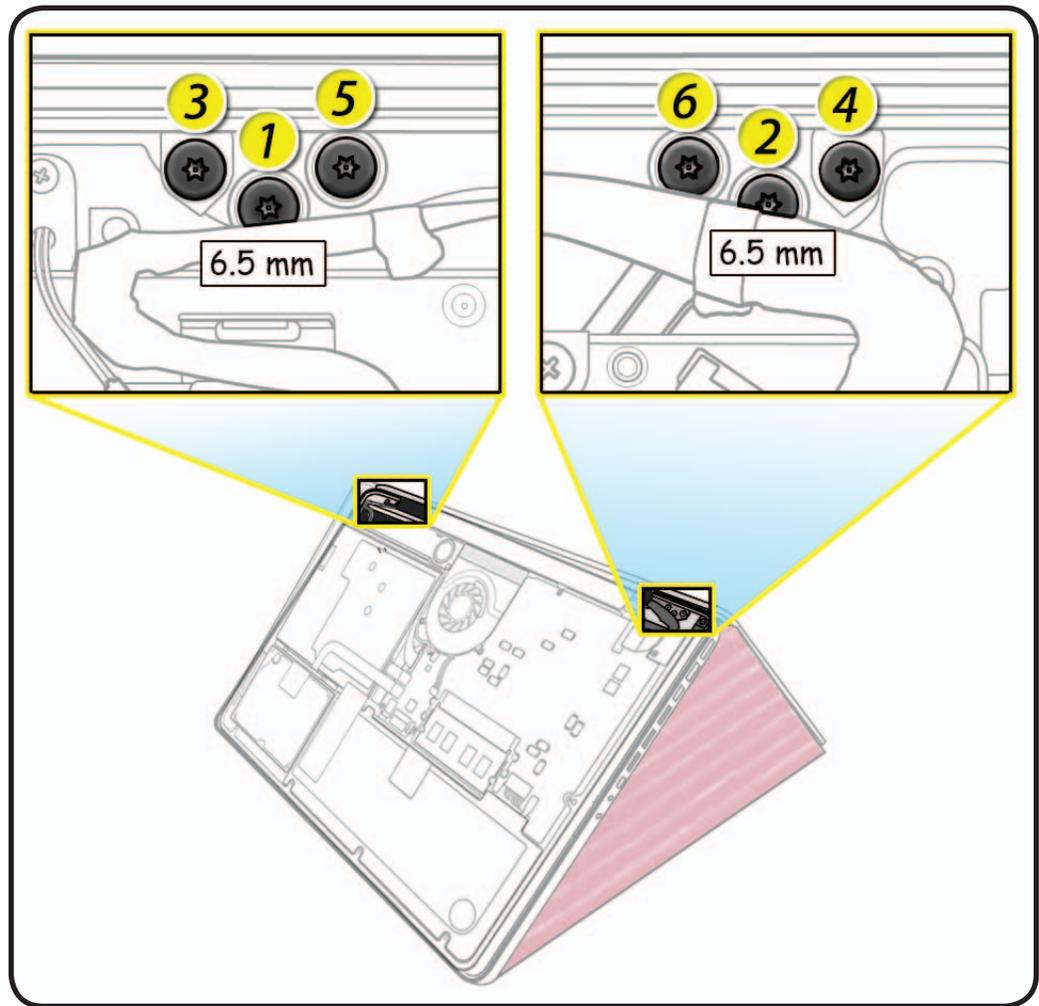
Replacement

Important: Before returning a display assembly, be sure to:
- remove **clutch cover**
- remove **AirPort Card** and transfer to new display assembly
- reinstall **clutch cover**
- remove and transfer protective film from replacement display to defective display

Important: Before installing a new display assembly, be sure to install **AirPort Card**. With unit assembled, test AirPort card for normal operation.
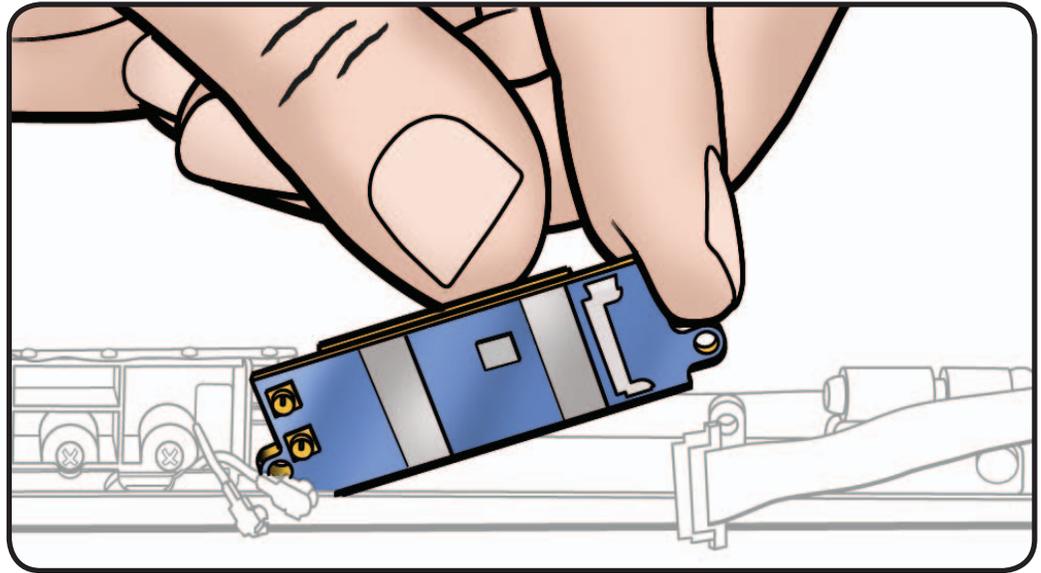
Aligning Display to Top Case

1 Place display on foam wedge service fixture.

2 Install only center screws:

3 Move computer from wedge, and carefully close display.
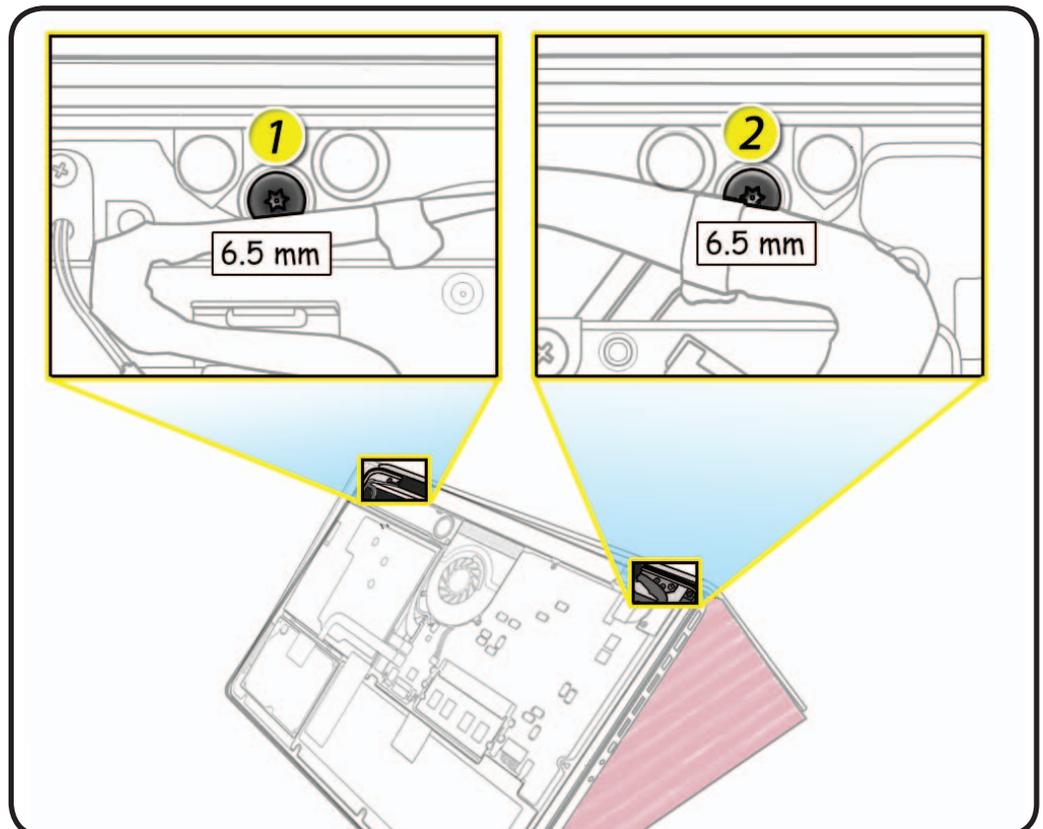
4 With computer closed and flat on table, check alignment where display meets top case. If necessary, slightly loosen 2 center screws, adjust alignment, and tighten screws.

5 Install remaining 4 screws in order shown while unit is still closed.

6.5 mm

6.5 mm
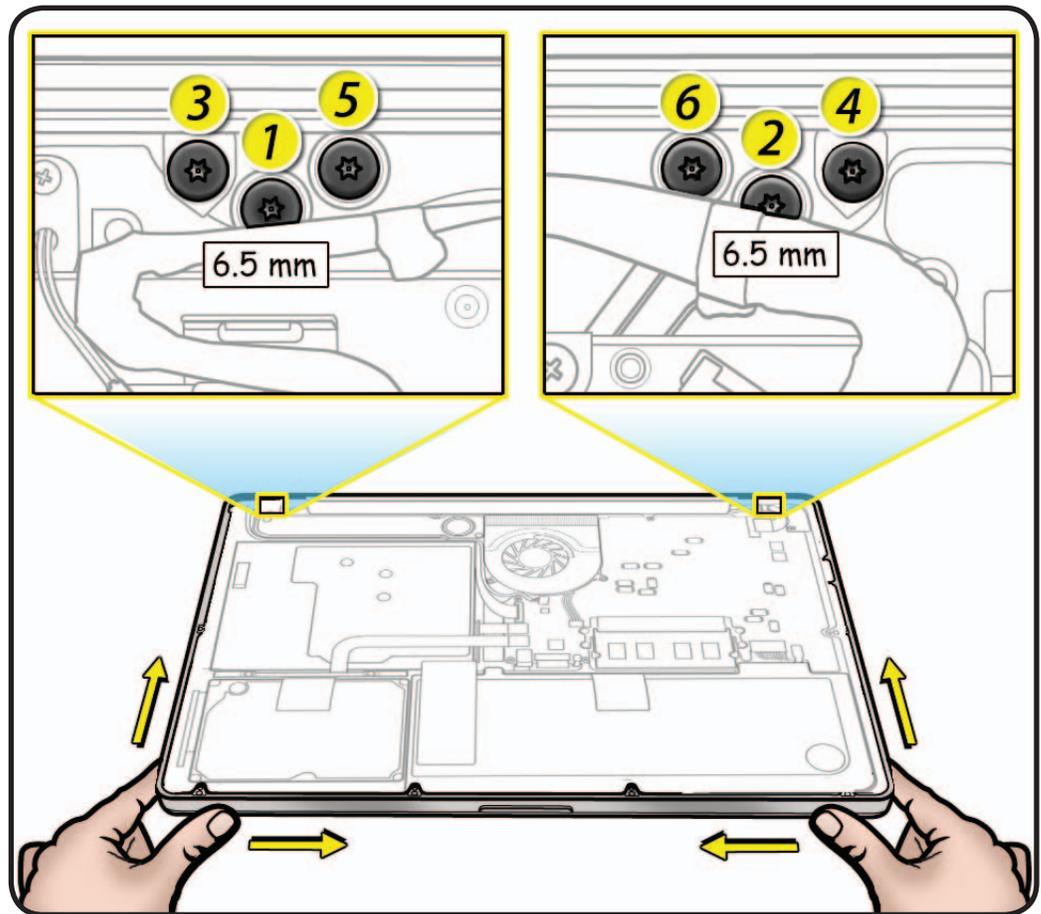
6 **For Mid 2010 model only**, reinstall EMI gasket (922-9304) over screws located near LVDS cable only. **Important:** DO NOT reinstall EMI gasket (shown here) near camera cable.
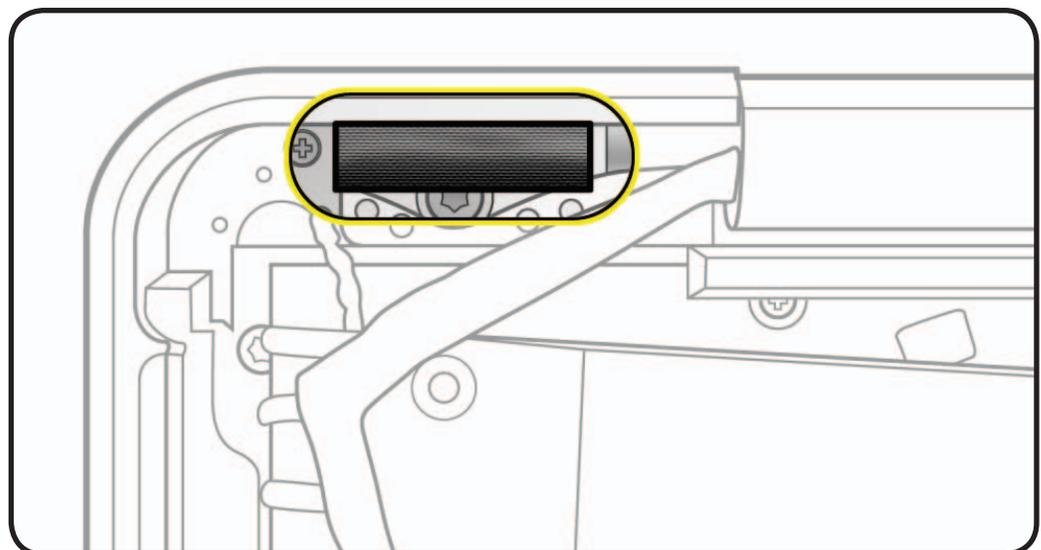
7 Make sure camera cable is properly routed over end of camera cable guide. Cable should not be wrapped around end of guide or cable could get strained and damaged during future hinge movement.
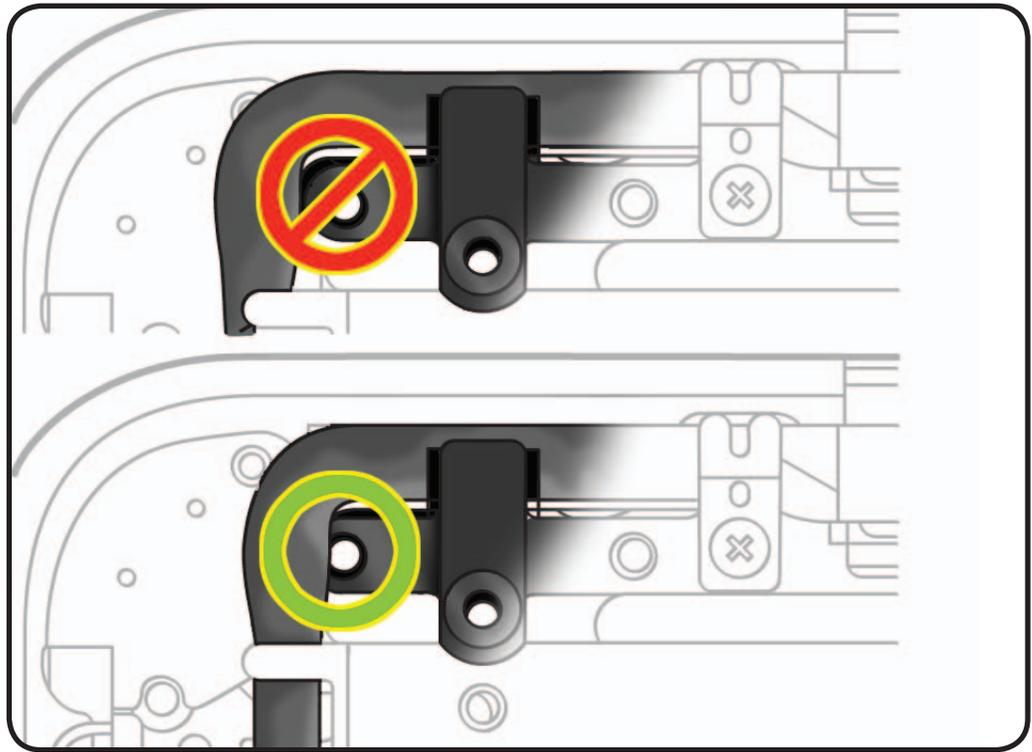
Reassembly Caution: When connecting LVDS and camera cables, make sure they are fully connected. For camera cable, place shim behind connector so it helps secure cable.

Reassembly Caution: To avoid a short to logic board, be sure to place EMI gasket on camera cable—positioned precisely where shown—**after** cable is fully connected to logic board and shim is in place.
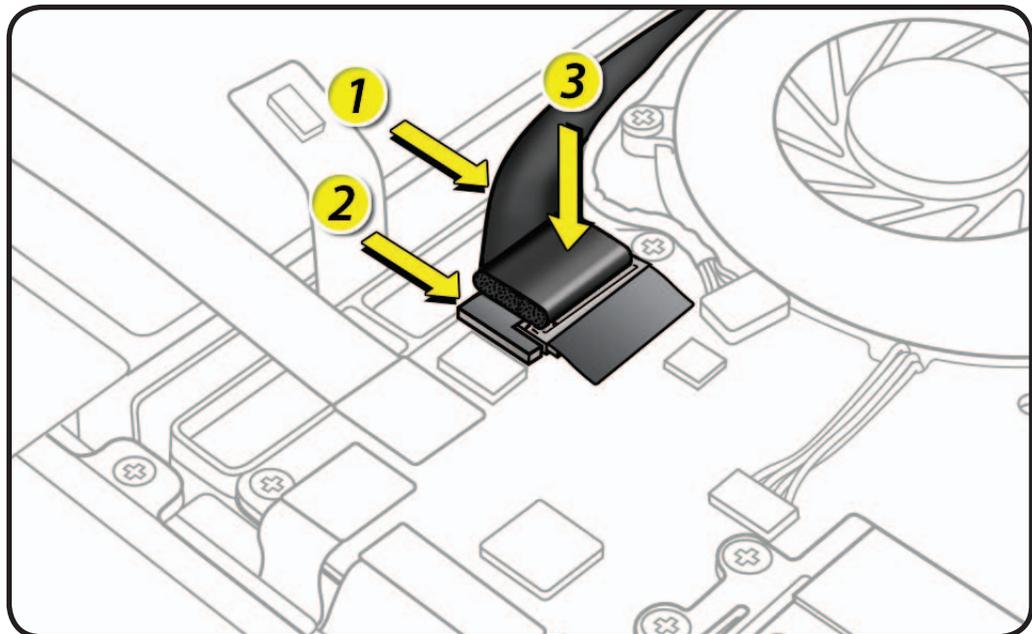
Display Hinge Behavior

MacBook Pro models have a unique counterbalanced clutch system which was designed so that when display is vertical with respect to the ground, it will remain in place regardless of the angle of the base.

Moving display past vertical allows hinges to release and display to close. This is normal behavior and no repair is necessary. For more information, and to watch a video of normal hinge behavior, refer to **kBase #HT3304: MacBook Pro: Display hinge behavior**.

Display Clutch Cover

First Steps

Remove:
- Bottom Case
- Camera Cable Guide
- LVDS Cable Guide
- Display Clamshell
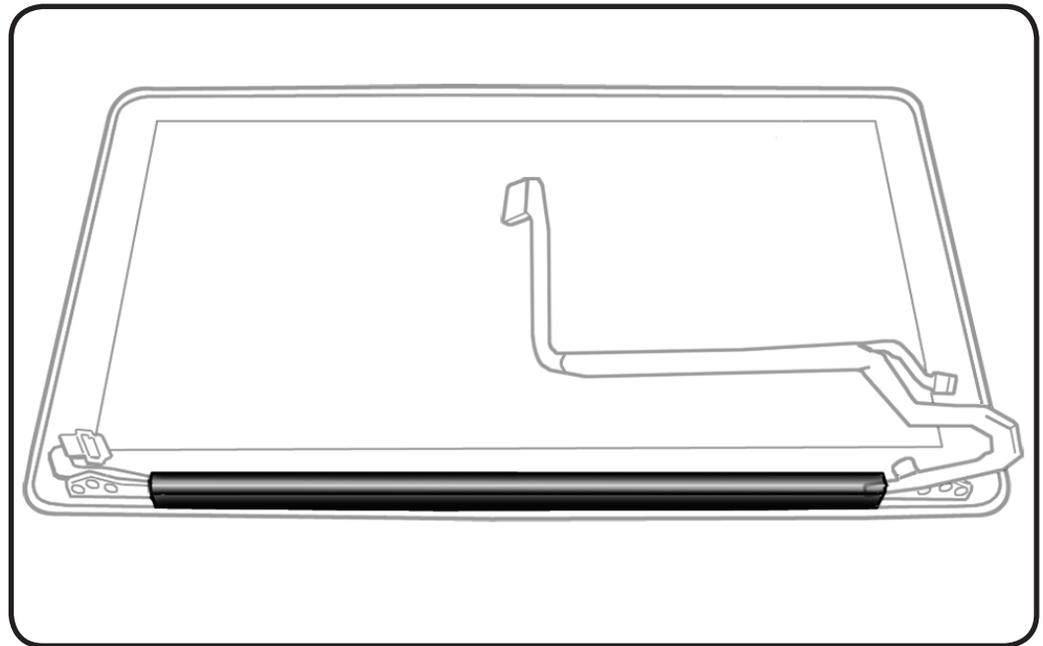
Tools

- ESD wrist strap
- Clean, soft, lint-free cloth
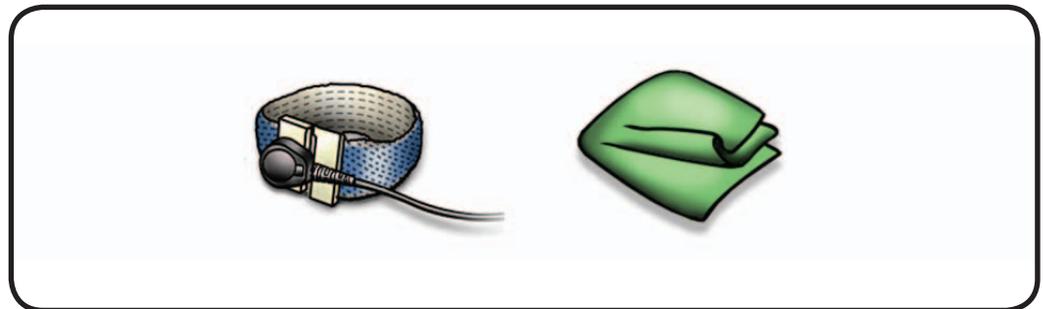
Removal

1 Cover display face with clean, soft cloth.
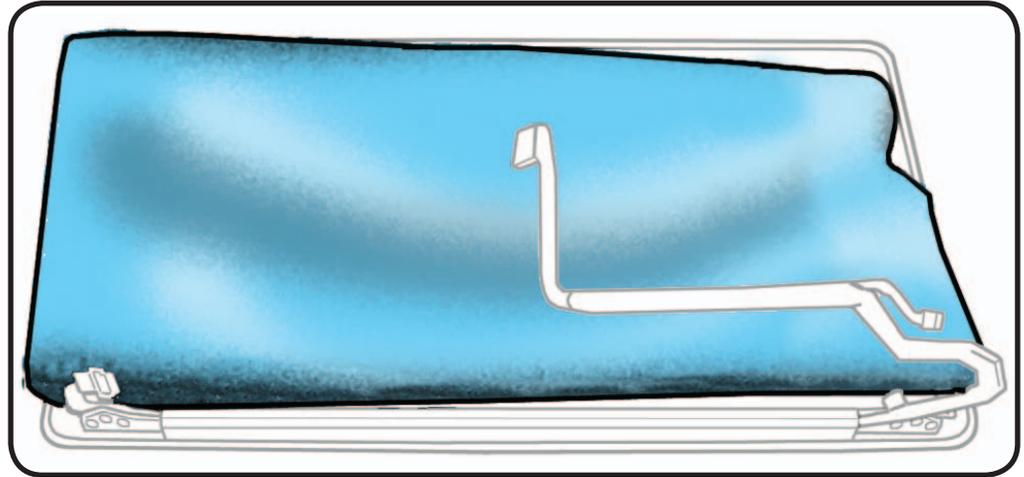
2 Holding left hinge, slide clutch cover 1/4 inch (6.35 mm) away from LVDS cable.
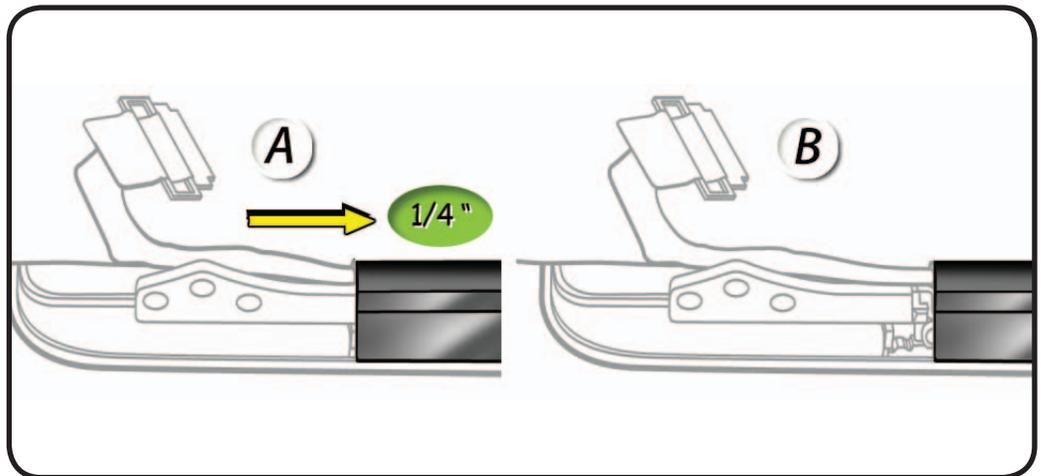
3 Press down on clutch cover to loosen hooks inside.

4 Tilt up end of clutch cover as you **roll it toward display face**.

5 Remove clutch cover.
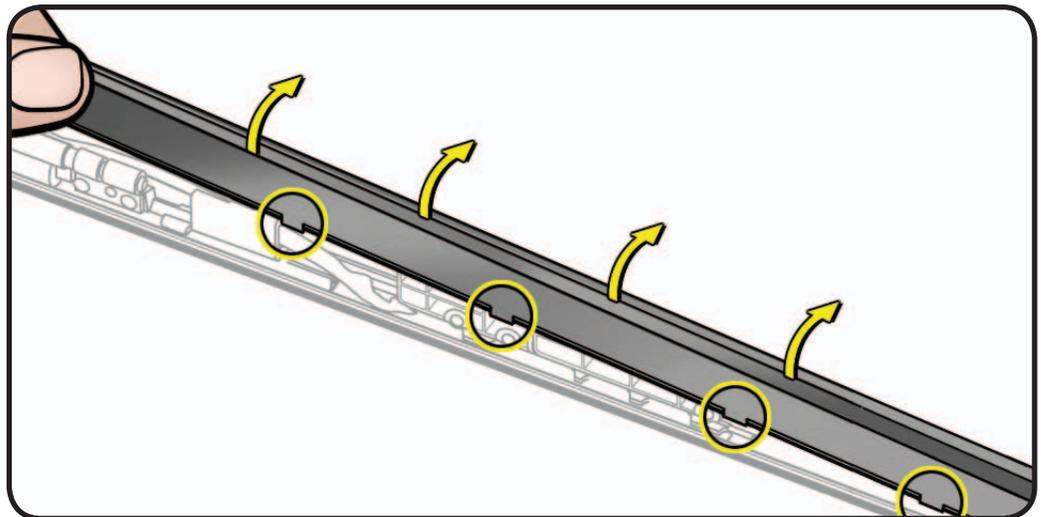
Replacement

1 Note shape of clutch cover:
- flat at bottom
- curved at top

2 Make sure flat edge is at bottom of display.
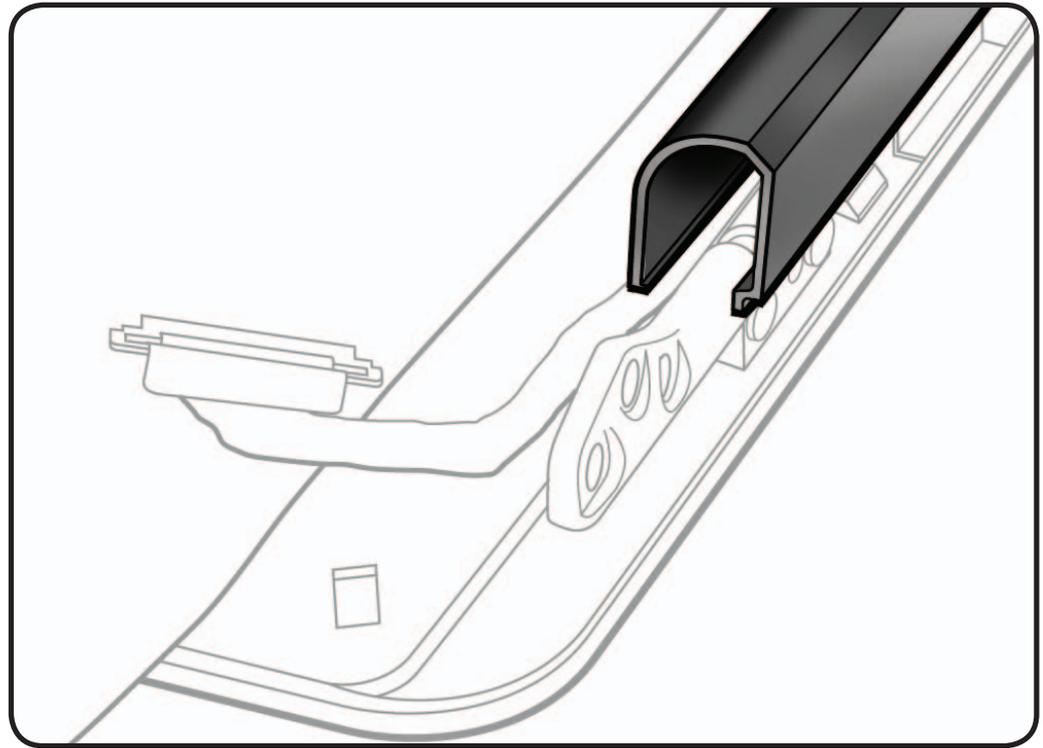
3 Tilt clutch cover onto end with longer cable.

4 Lower clutch cover onto display assembly.

5 Listen for snapping sound as hooks engage.

6 Check for good fit. Avoid:
- gaps
- bulges
- pinched cables
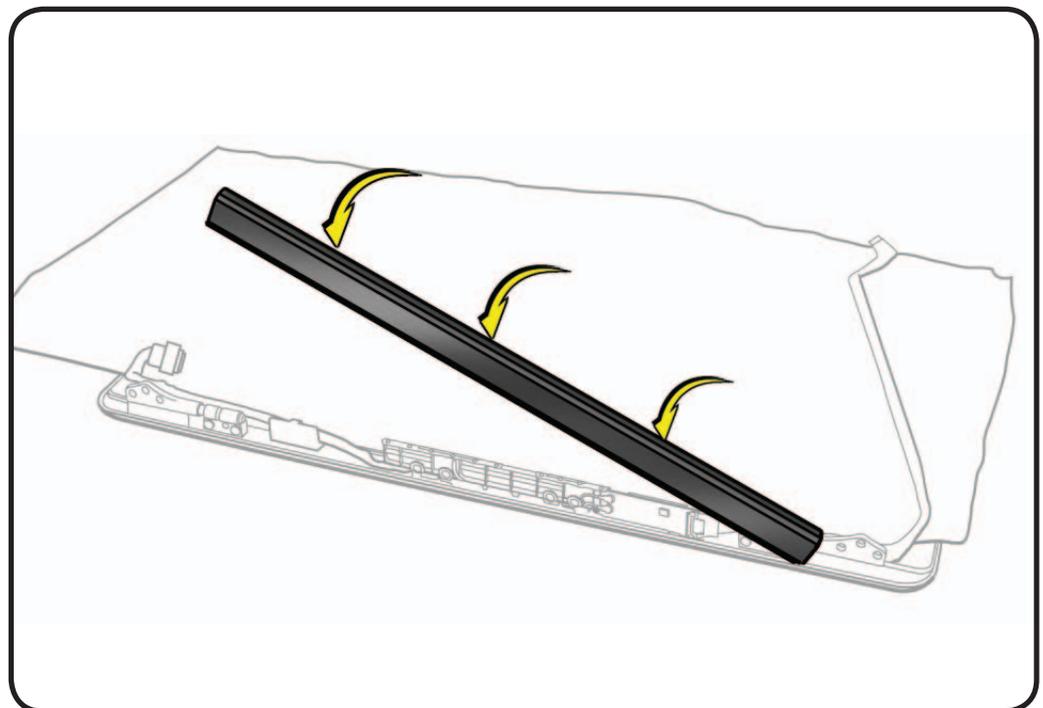
AirPort Card

First Steps

Remove:
- Bottom Case
- Camera Cable Guide
- LVDS Cable Guide
- Display Clamshell
- Display Clutch Cover
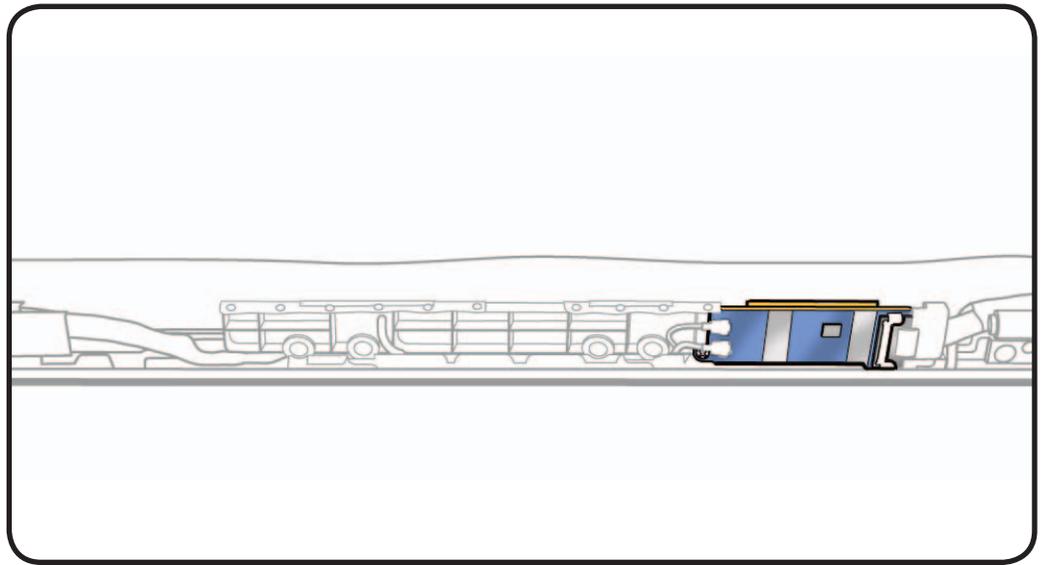
Tools

- ESD wrist strap
- Clean, soft, lint-free cloth
- Black stick
- Phillips #00 screwdriver, magnetized
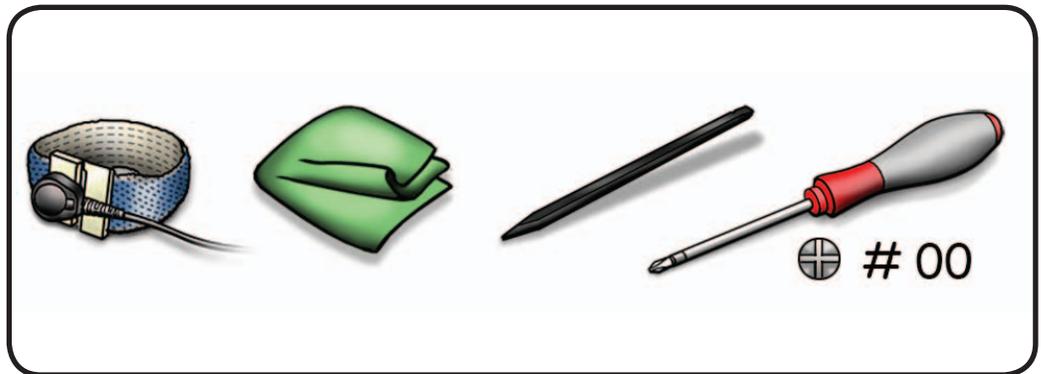
Removal

1 Cover display with clean, soft cloth.
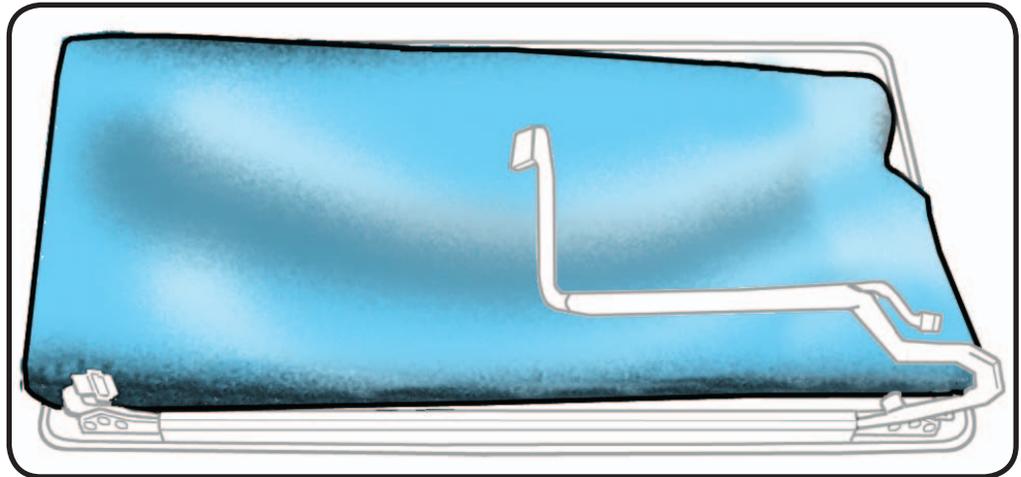
2 Remove Phillips #00 screw from cable clip: (1) 076-1326 (3.3mm)

Note the wide head on this screw.

3.3 mm
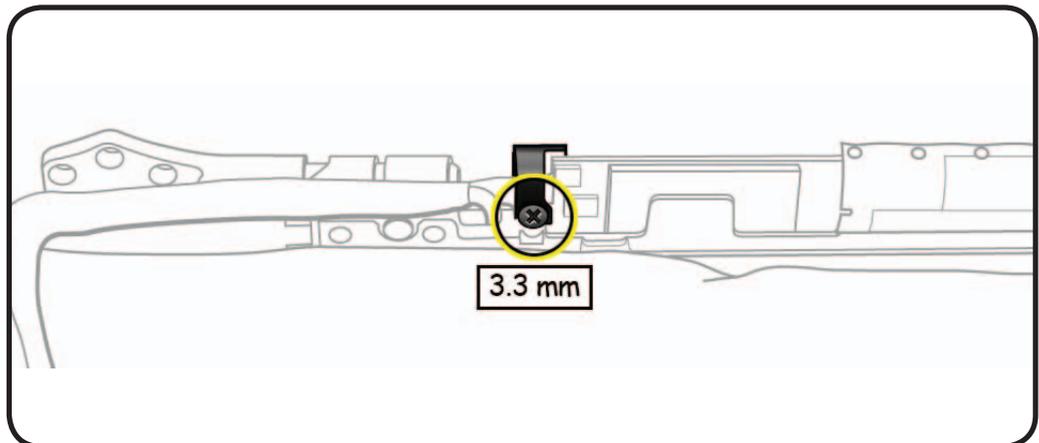
3 Remove cable clip (part of kit 076-1326)
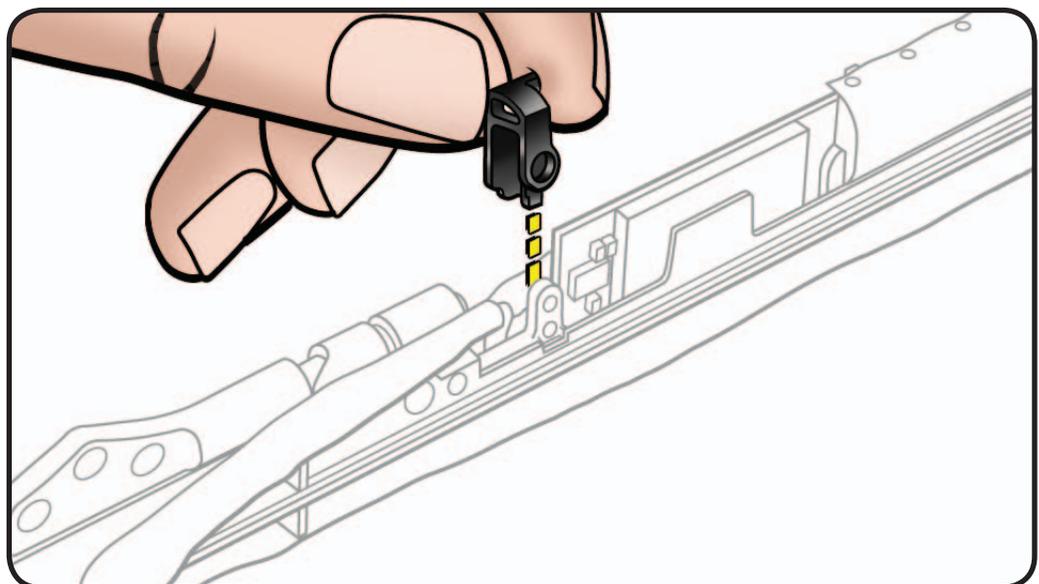
4 Disconnect 2 AirPort antenna cables.

Reassembly Note: Shorter cable is at bottom, closer to display.

5 Disconnect AirPort cable.

6 Remove Phillips #00 screws:
(2) 076-1326 (3mm)

7 Lift out AirPort Card.
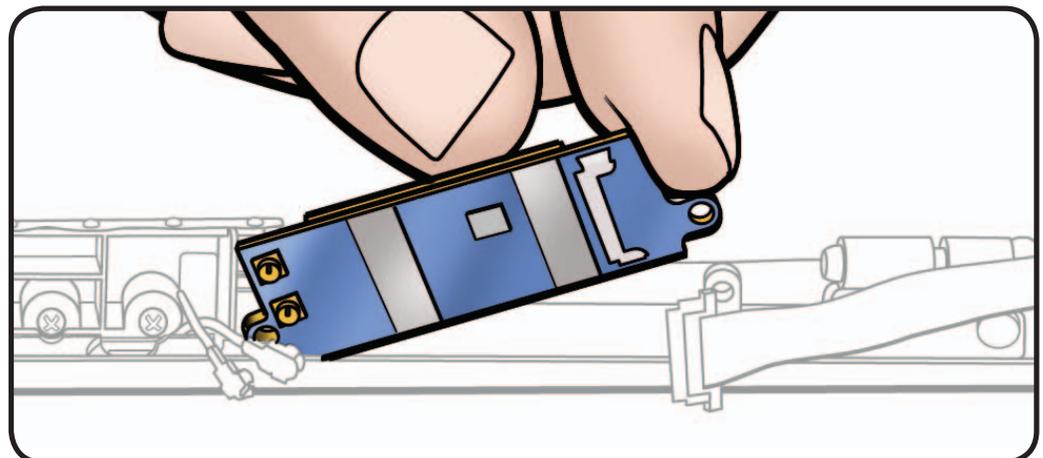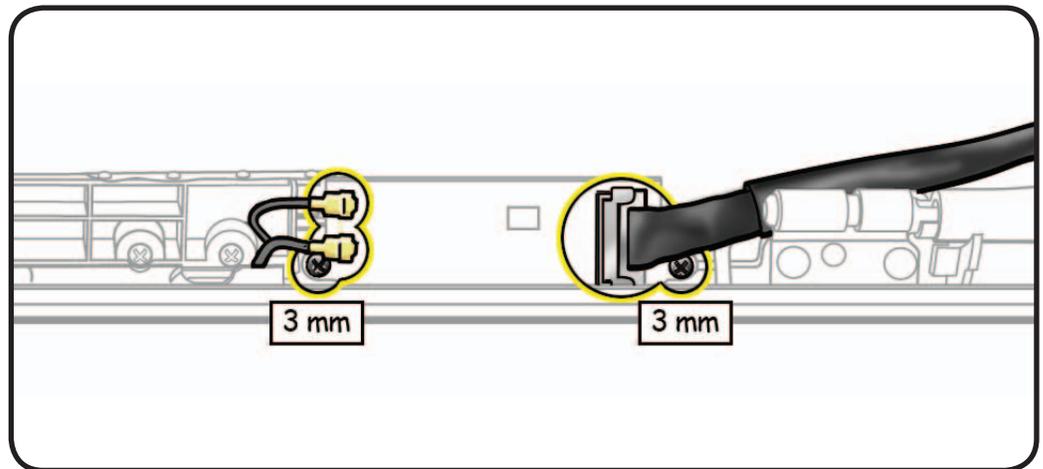
Replacement

1 Make sure thermal pad (part of kit 076-1326) is centered on AirPort Card within 4 corner guides. If pad sticks to display assembly tab, scrape it away.
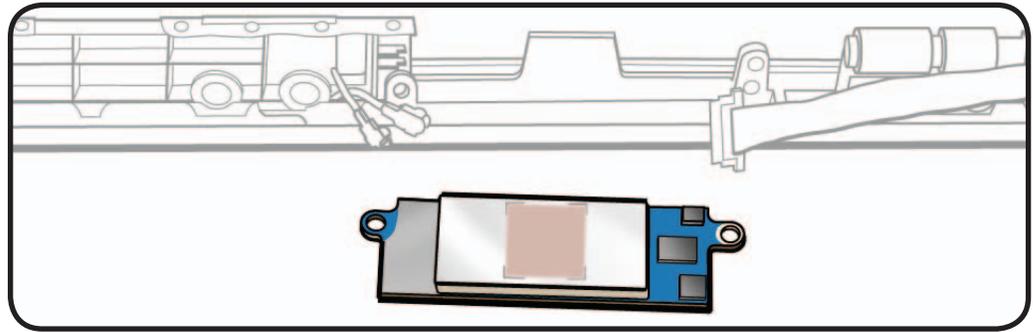
2 **Important**: Check AirPort cable installation. Make sure two "U" marks on end of cable are NOT facing up. Inserting cable with "U" marks facing up will cause logic board failure. Turn cable so unmarked side of cable is facing up when inserted into AirPort Card.
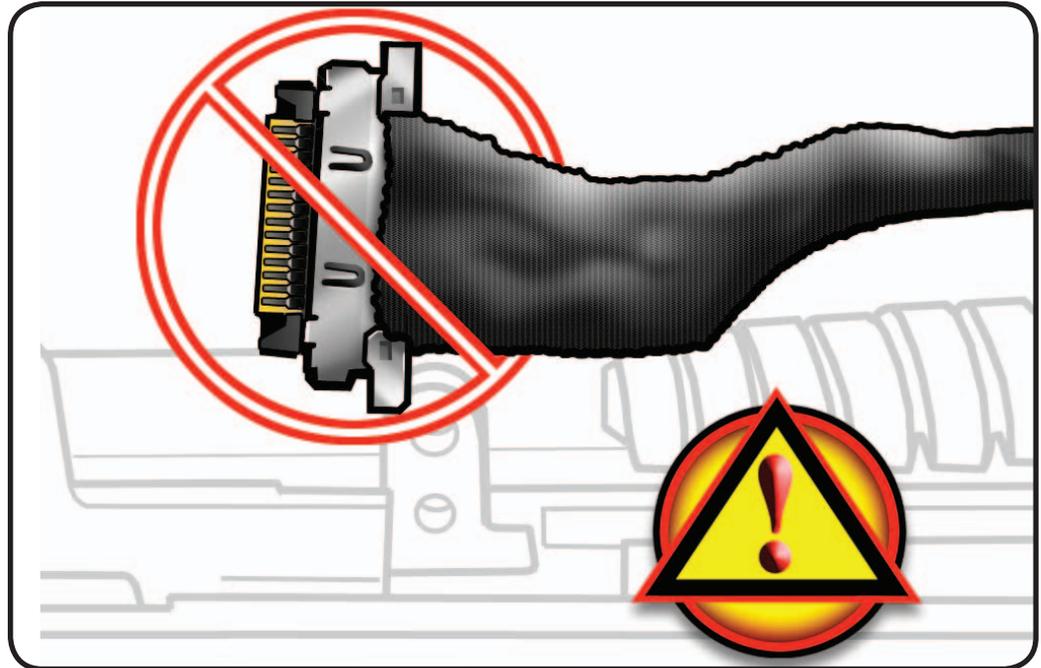
3 After installing remaining connectors and screws, be sure to install cable clip with wider head screw.
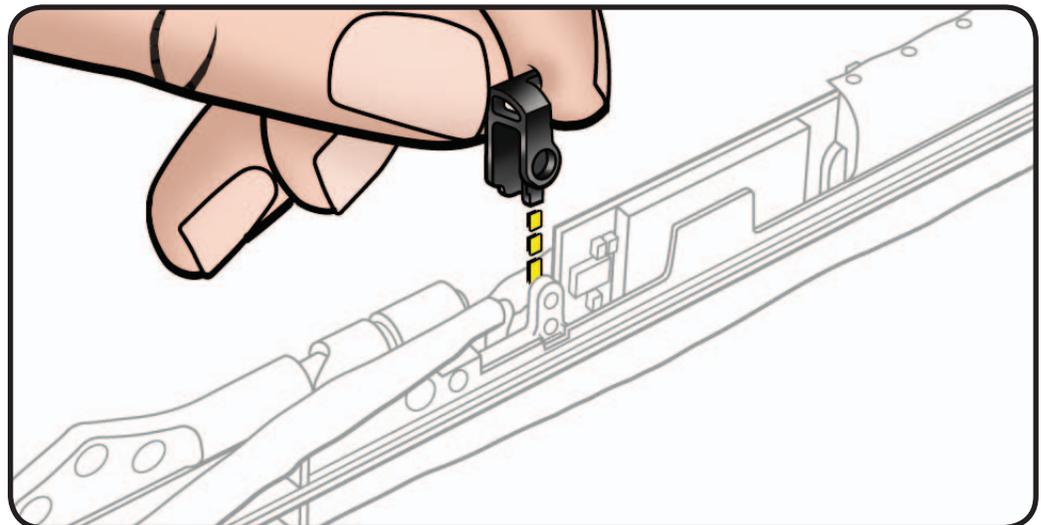
AirPort Antenna

First Steps

Remove:
- Bottom Case
- Camera Cable Guide
- LVDS Cable Guide
- Display Clamshell
- Display Clutch Cover
- AirPort Card
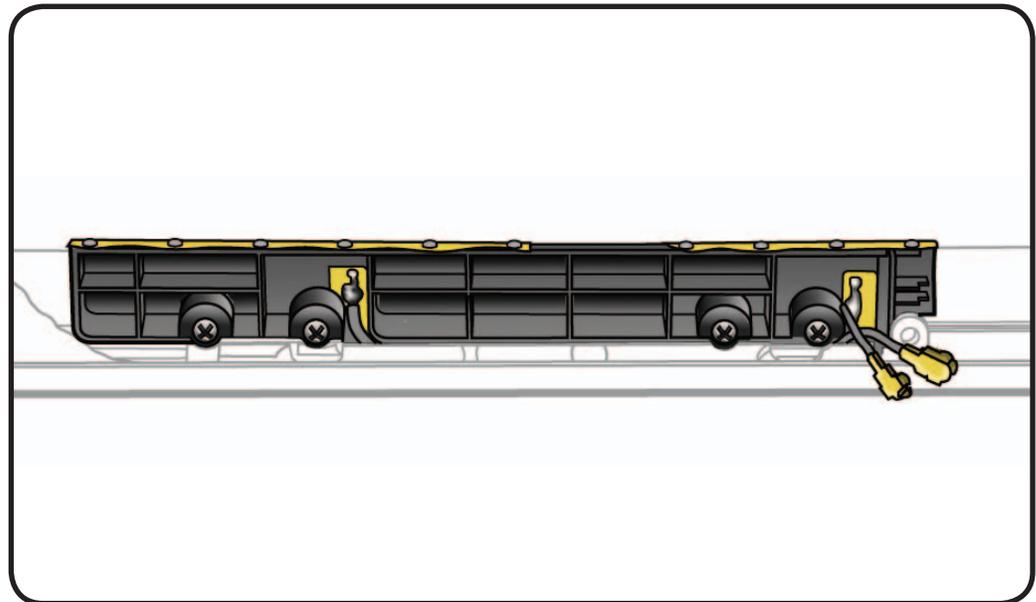
Tools

- ESD wrist strap
- Clean, soft, lint-free cloth
- Phillips #00 screwdriver, magnetized
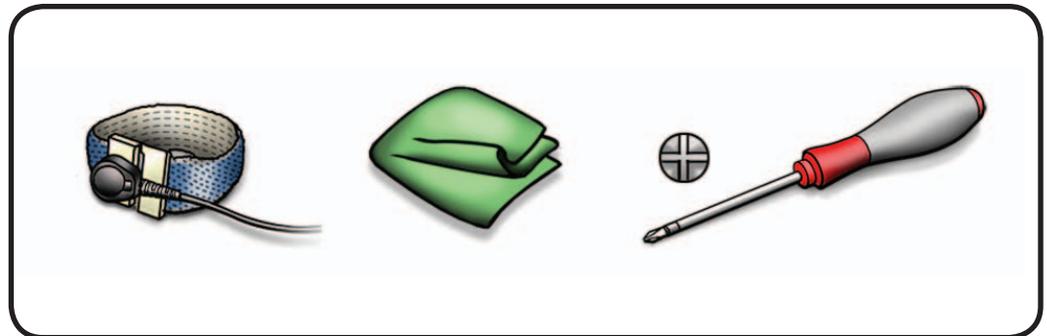
Removal

1 Remove Phillips #00
   screws:
   (4) 076-1326 (3mm)

Reassembly Note:
Install **outer** screws first,
then inner screws.

2 Lift out card.
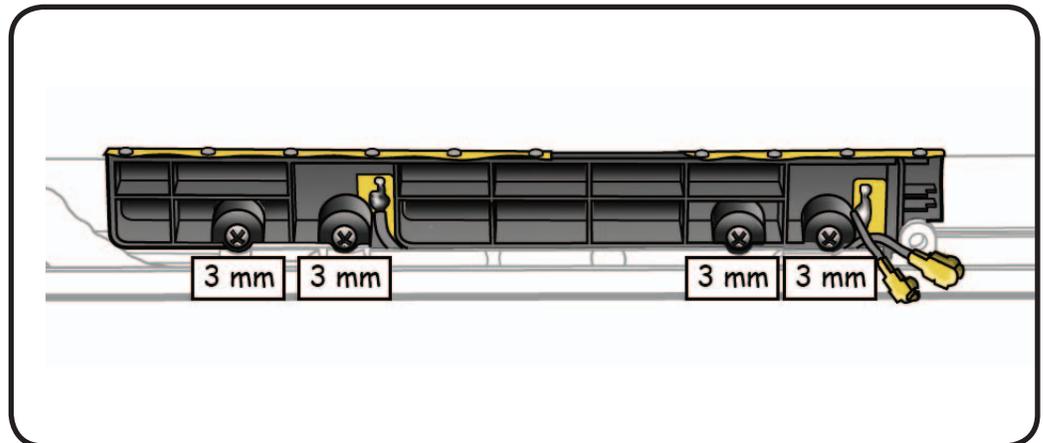
Reassembly Note:
Make sure AirPort antenna
cable is routed in its
channel.
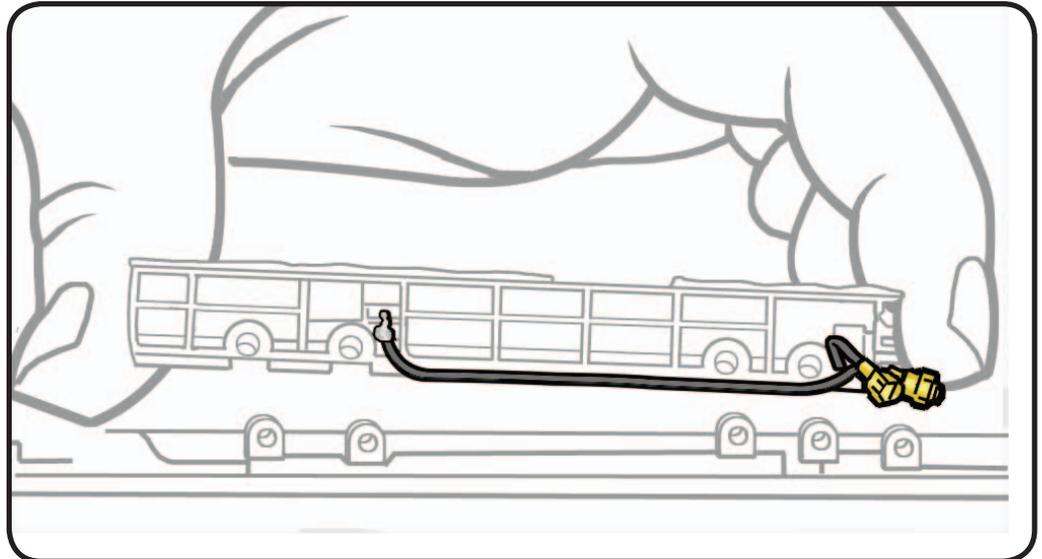
Fan

First Steps

Remove:
• Bottom Case
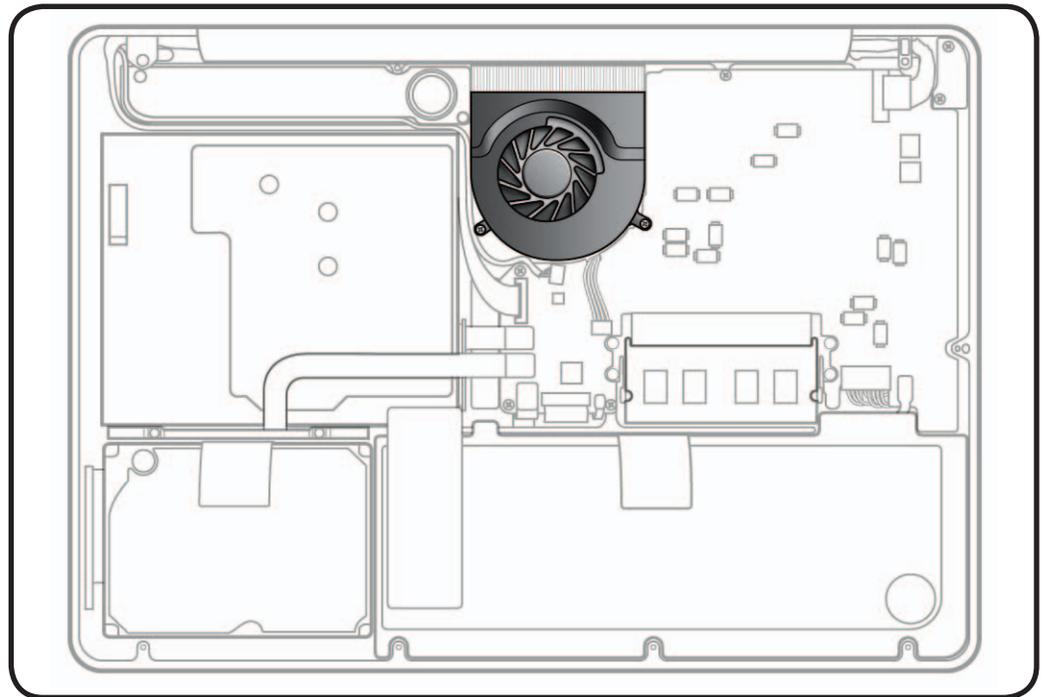
Tools

• ESD wrist strap
• Clean, soft, lint-free
  cloth
• Black stick
• Phillips #00 screwdriver,
  magnetized
• Torx T6 screwdriver,
  magnetized
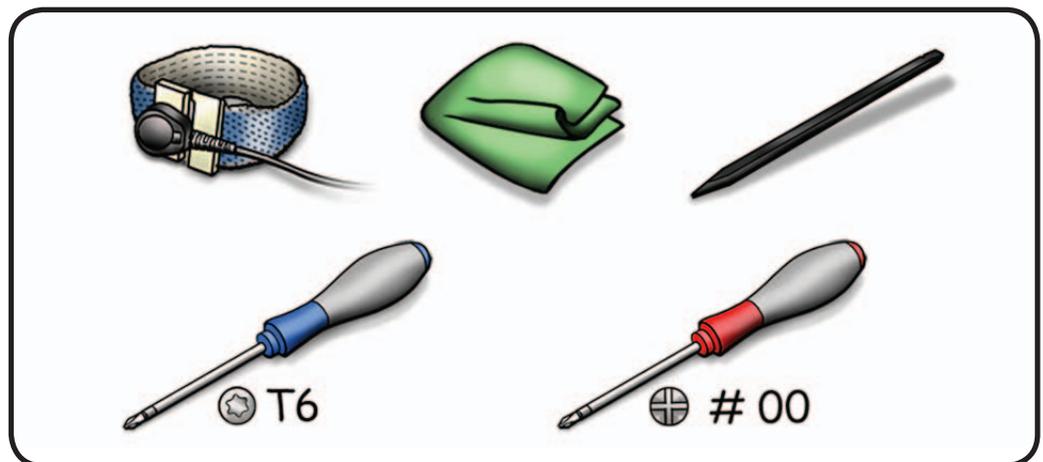
Removal

Before you begin this procedure, disconnect battery from logic board. Failure to do so could damage computer.
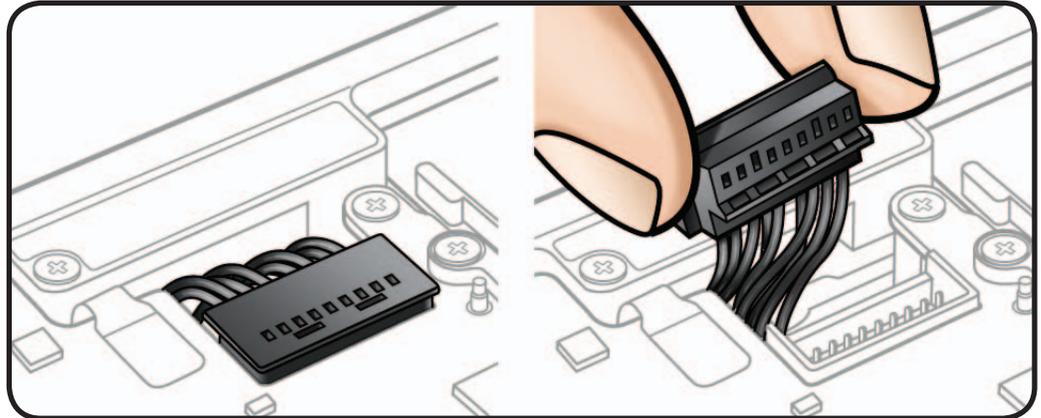
1 Use black stick to disconnect fan cable from logic board.

2 Remove screws:
Mid 2009: Phillips #00
(1) 922-8645 (6.5mm)
(1) 922-9077 (5.5mm)
(1) 922-8644 (4.5mm)
Mid 2010: Torx 6
(1) 922-9455 (6.5mm)

(2) 922-9454 (5mm)

6.5 mm

5.5 mm

4.5 mm
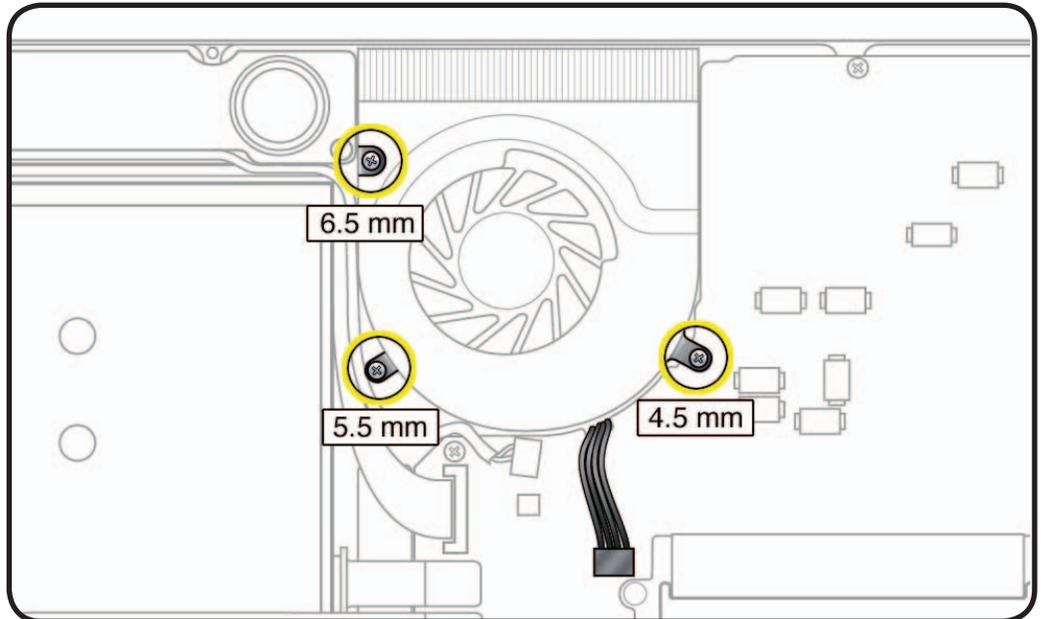
3 Tilt up fan and remove from unit.

Caution:
Do not touch heatsink.
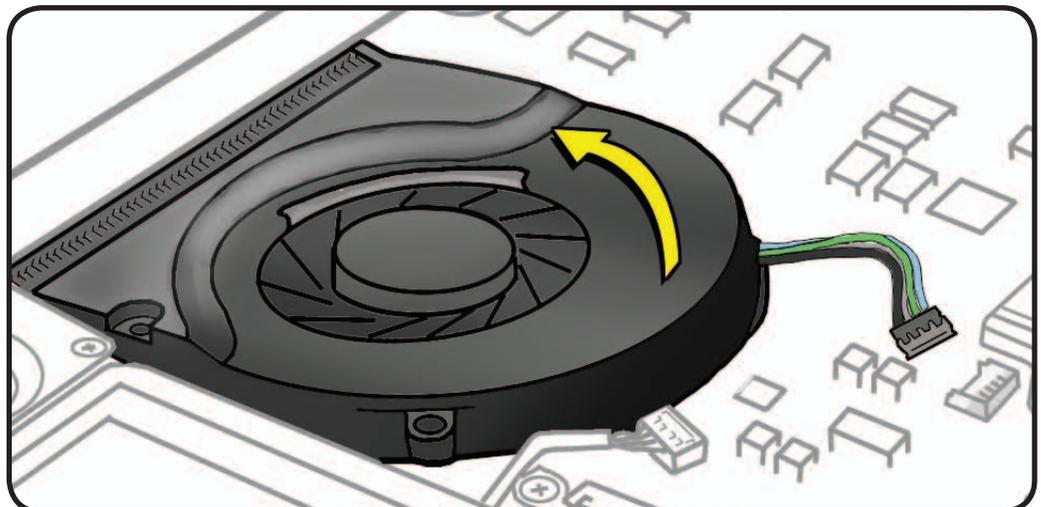
Logic Board

First Steps
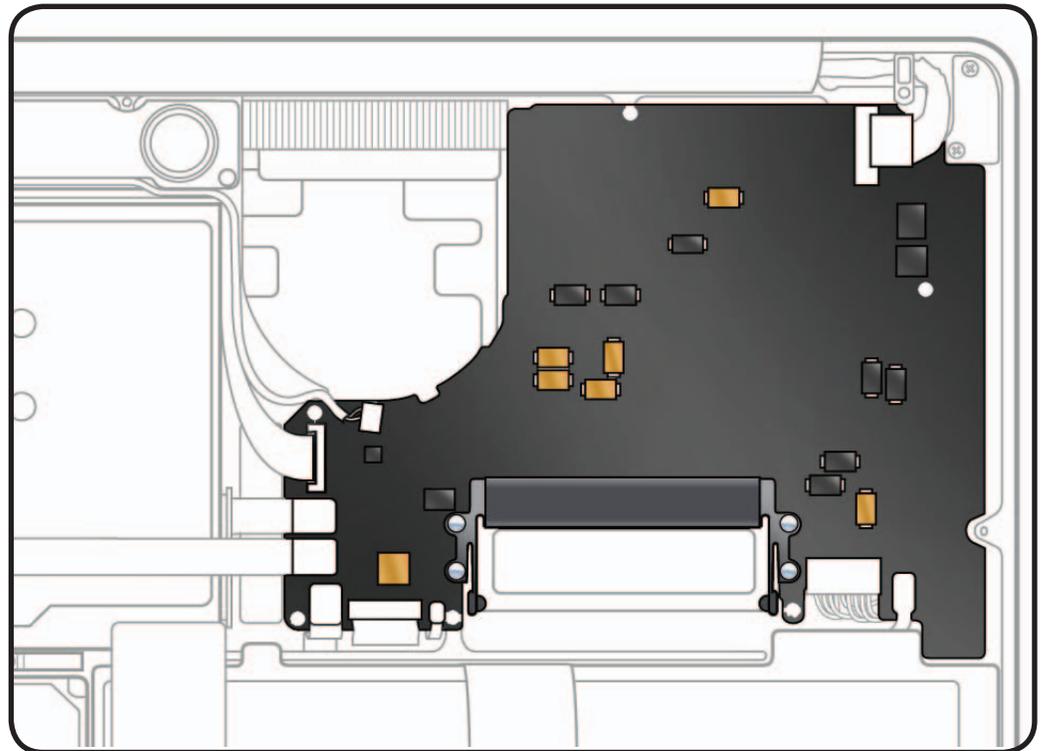
Remove:
- Bottom Case
- Memory
- Fan

Tools

- ESD wrist strap
- Clean, soft, lint-free cloth
- Black stick
- Phillips #00 screwdriver, magnetized
- Tweezers (optional)
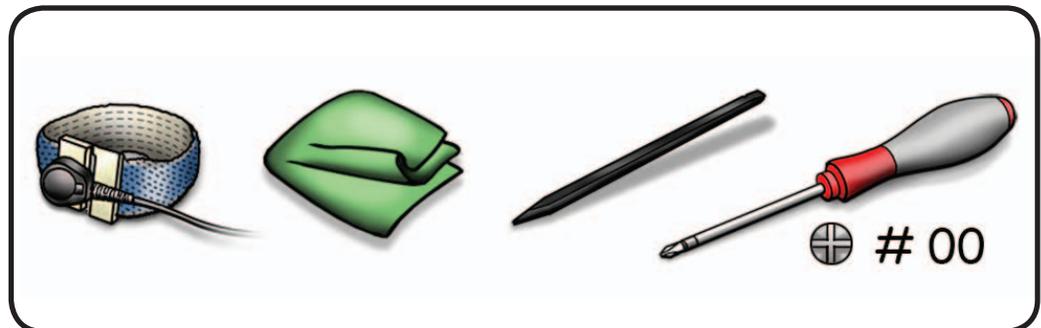
⊕ # 00

Removal

Before you begin this procedure, disconnect battery from logic board. Failure to do so could damage computer.

Caution: Refer to **Connector Types** for important shim details.
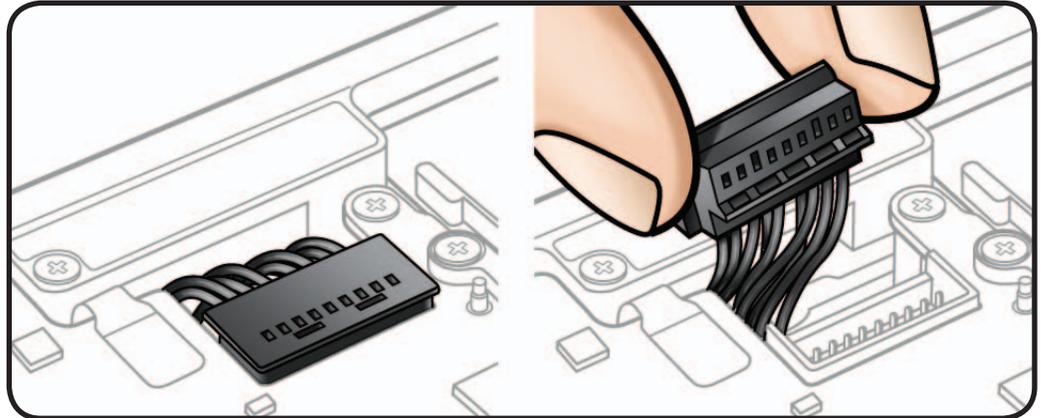
1 Disconnect 9 cables if they haven't already been disconnected:
- 2 locking lever
- 4 platform flex
- 2 low-profile horizontal
- 1 vertical insert

Note: You may use plastic tweezers to remove and reinstall locking lever flex cables.

1. LVDS
2. right speaker
3. camera
4. optical drive
5. hard drive
6. trackpad
7. keyboard
8. keyboard backlight
9. fan
10. battery
11. BIL
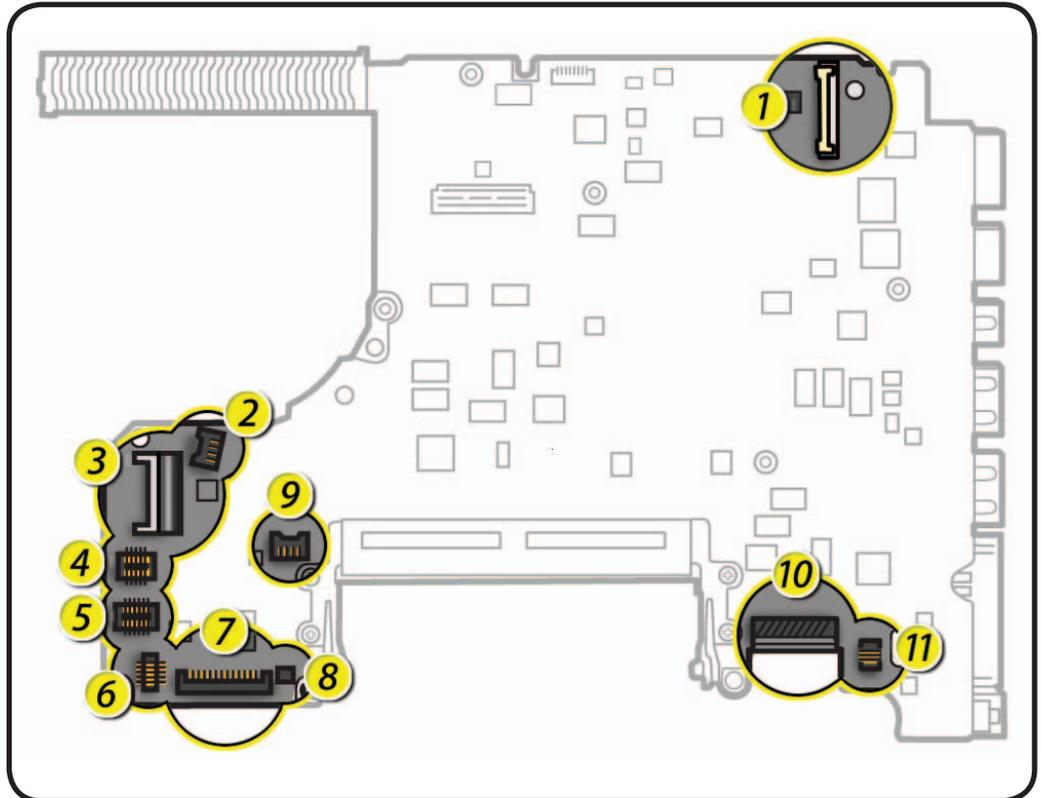
2 Remove screws:

Mid 2009: Phillips #00

(2) 922-9076 (4mm)

(5) 922-8663 (3mm)

Mid 2010: Torx 6

(2) 922-9452 (4mm)

(5) 922-9453 (3mm)

both models: Torx 6

(1) 922-8924 (3.1mm)

(1) 922-9524 front
screw bracket
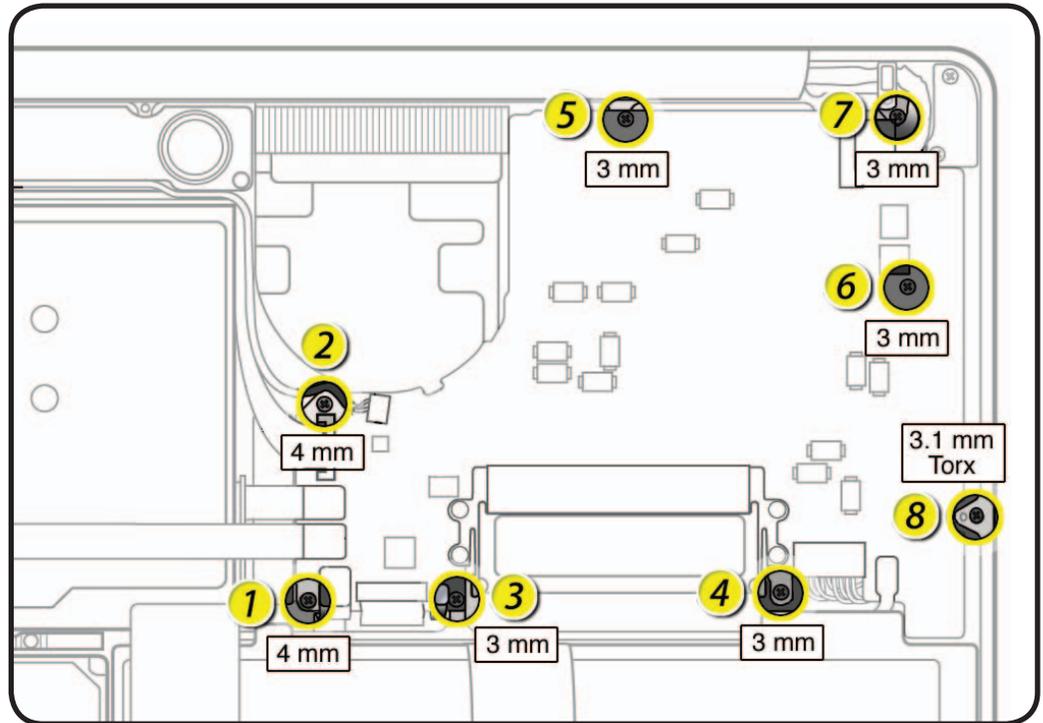
3 Tilt up left side of
board, and pivot logic
board away from ports.

Caution: Make sure
cables are not pinched.
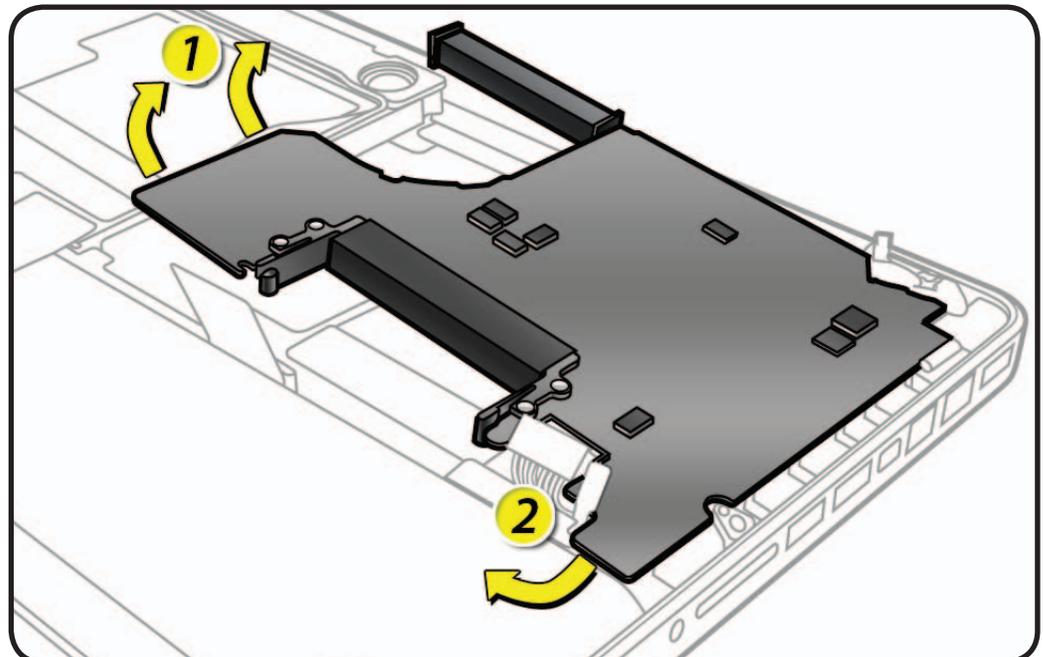
4 Tilt board vertically and locate on back side of logic board:
- microphone cable
- MagSafe board cable

Note: Microphone cable runs underneath left speaker cable. MagSafe cable wraps around microphone cable.

5 Disconnect cables and unroute microphone cable from speaker.

Caution: Be careful not to strain or pinch microphone cable.

Reassembly Note: If tape covers microphone connector, reapply tape or use Kapton tape.

6 If reinstalling same logic board, do not remove left speaker or heatsink.

If replacing logic board with a new one, transfer left speaker and heatsink. Take care not to rip foam pads on left speaker when removing from old logic board.
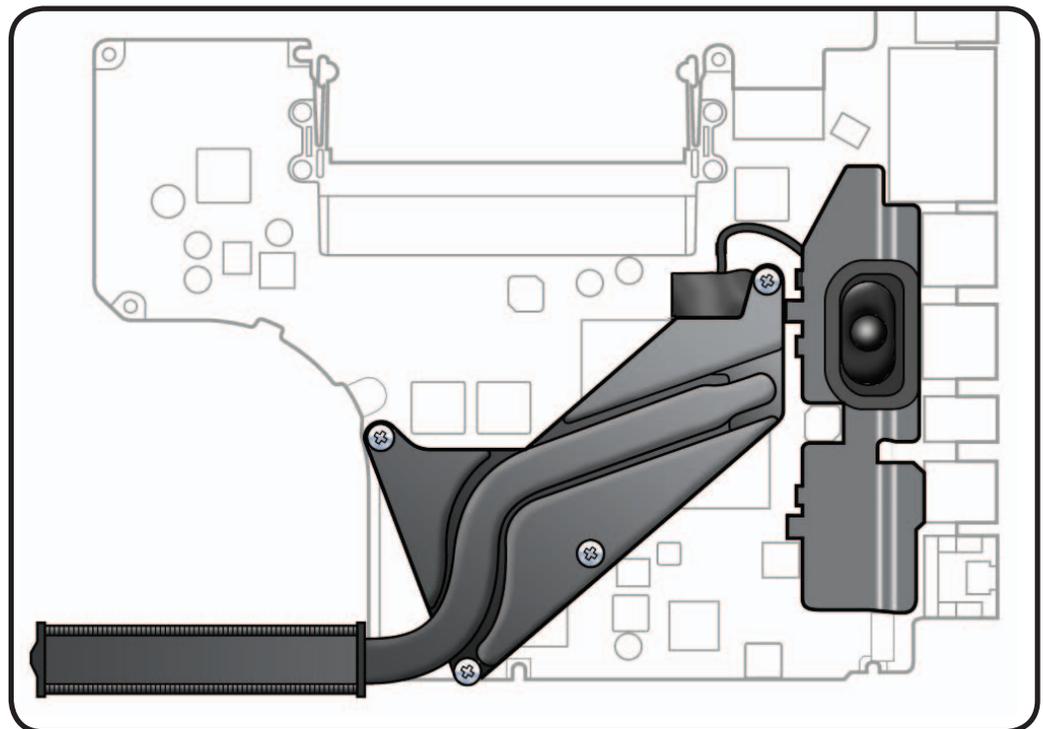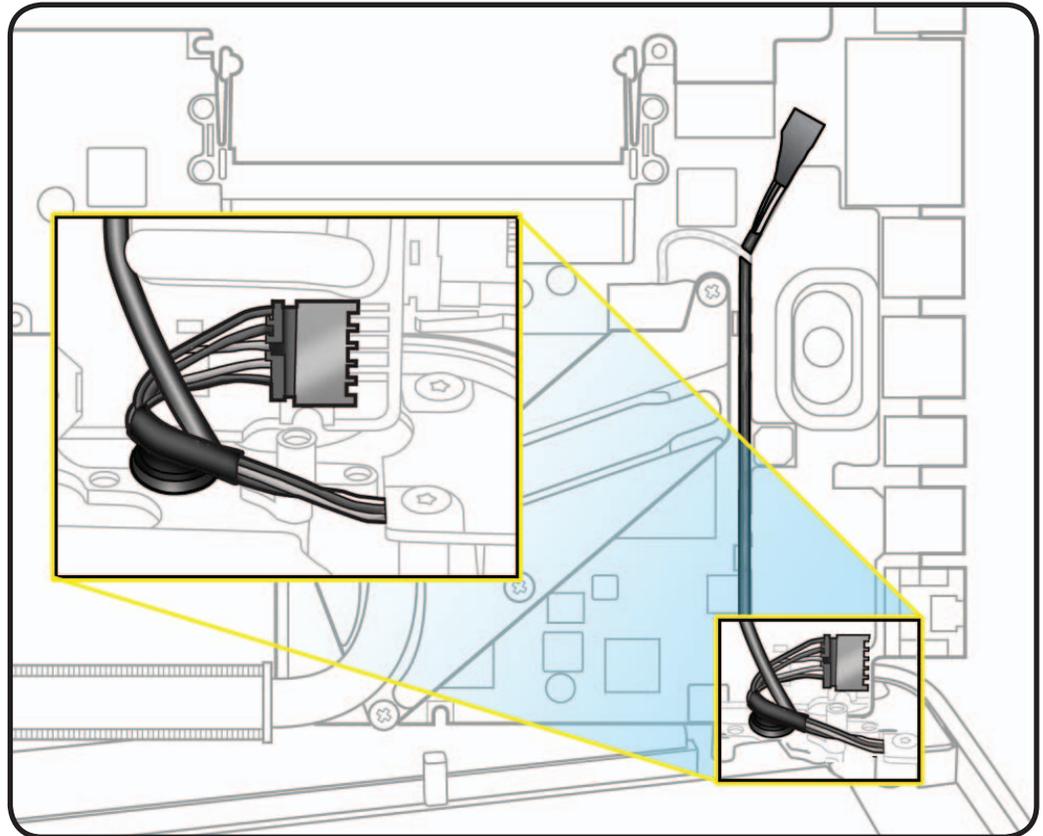
Replacement

1 On back side of logic board, connect:
- left speaker
- heatsink
- microphone cable
- MagSafe cable
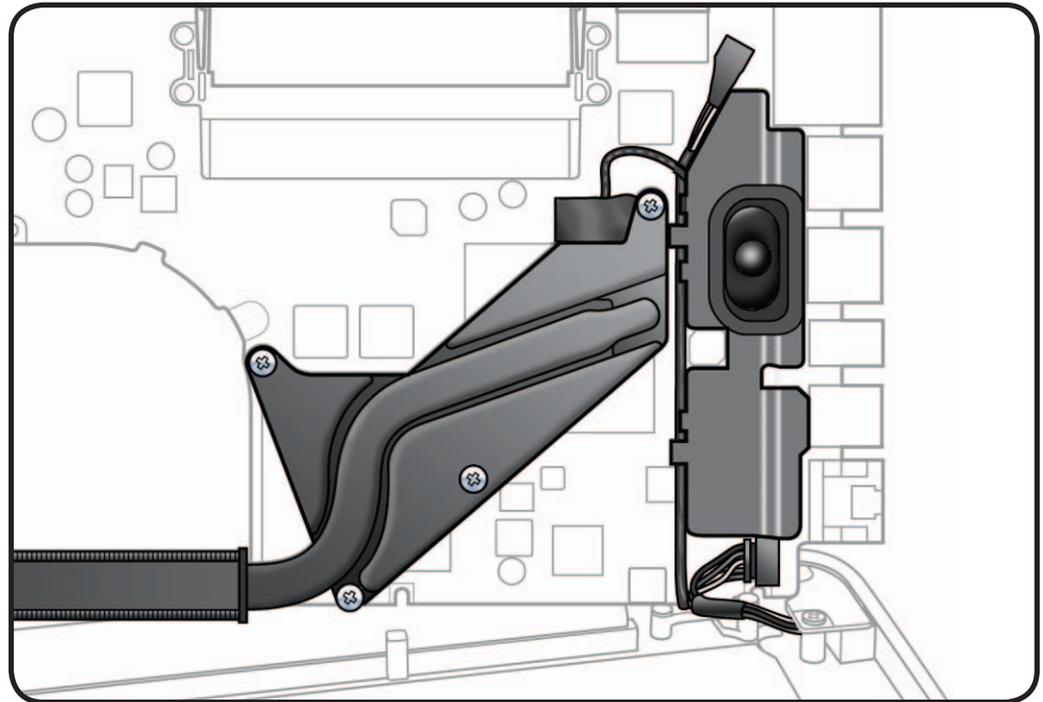
2 When tilting board into top case, make sure no cables are pinched.

3 Check that ports align with top case. Insert an SD card into SD slot to ensure proper alignment while tightening screws.
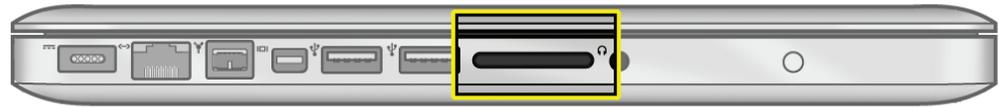
4 Install front screw bracket and screws in order shown.

5 — 3 mm
7 — 3 mm
6 — 3 mm
2 — 4 mm
3.1 mm Torx
8
1 — 4 mm
3 — 3 mm
4 — 3 mm
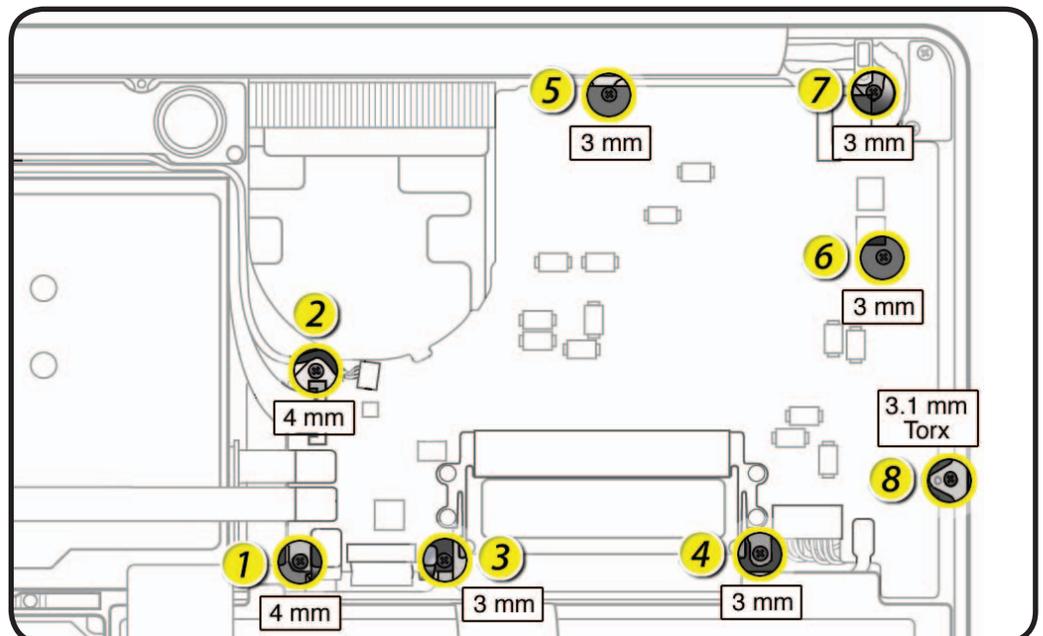
5 Connect available cables:

Caution: Refer to **Connector Types** for important cable connector details. Also see Display Clamshell section for details about LVDS and camera cable connectors.

Note: You may use plastic tweezers to reinstall locking lever flex cables.

1. LVDS
2. right speaker
3. camera
4. optical drive
5. hard drive
6. trackpad
7. keyboard
8. keyboard backlight
9. fan
10. battery
11. BIL

Note: Keyboard backlight flex cable connector is secured with a small black label (922-9460).
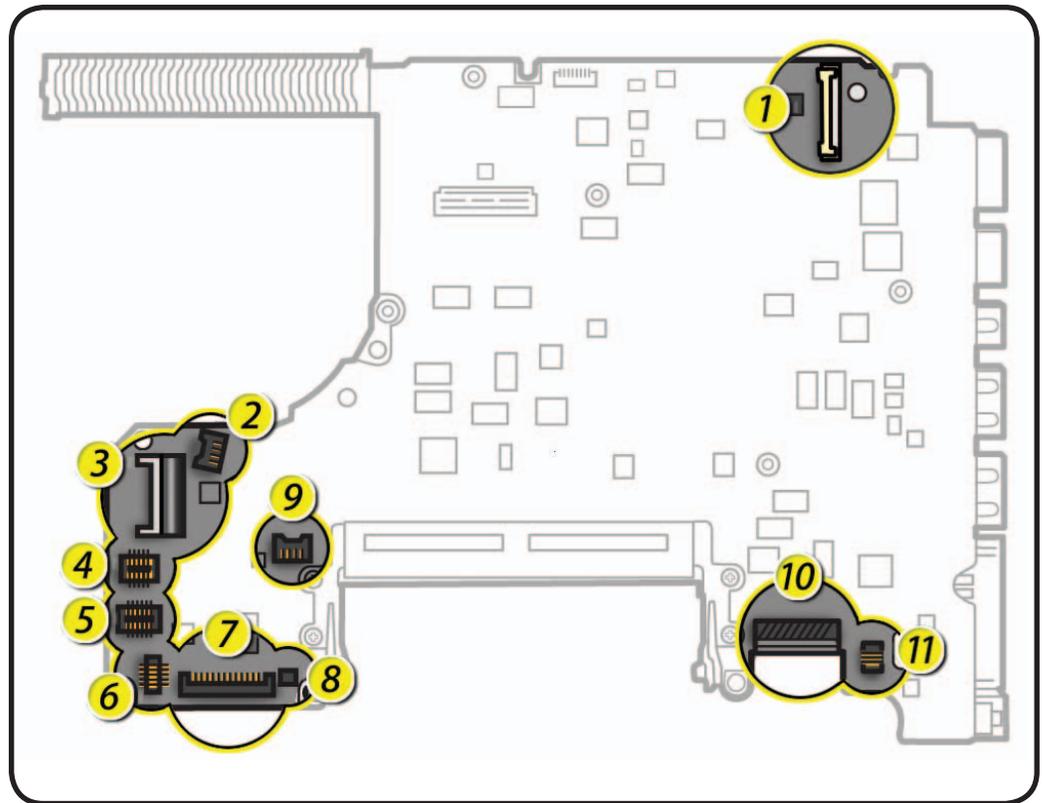
Left Speaker

First Steps

Remove:
- Bottom Case
- Memory
- Fan
- Logic Board

Note: Left Speaker is attached to bottom side of logic board.


Caution: Do not touch soft speaker cone. Do not touch heatsink or gold connectors.
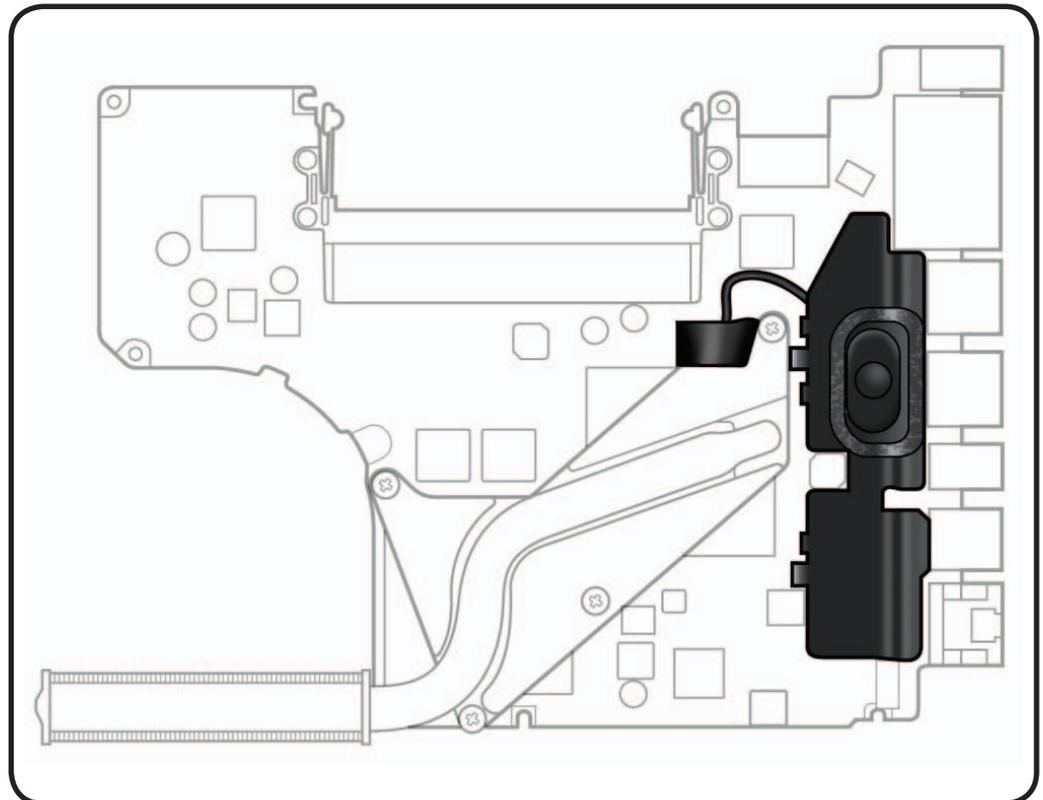
Tools

- ESD wrist strap
- Clean, soft, lint-free cloth
- Kapton tape
- Black stick
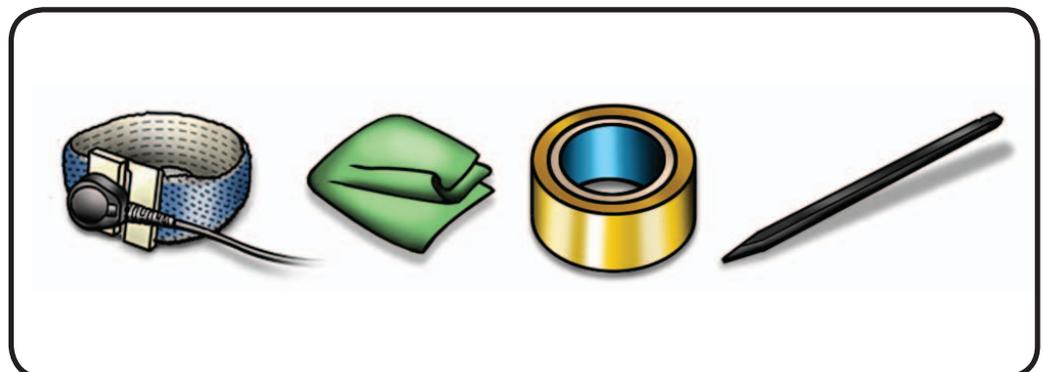
Removal

1 Disconnect speaker cable from logic board.

Reassembly Note: If tape covers speaker connector, reapply tape or use Kapton tape.

2 Use black stick to remove speaker body.

    Note: If transferring left speaker to a new logic board, take care not to rip foam pads when removing from old logic board.

3 Carefully scrape away foam pad remnants on logic board before installing a new replacement speaker.
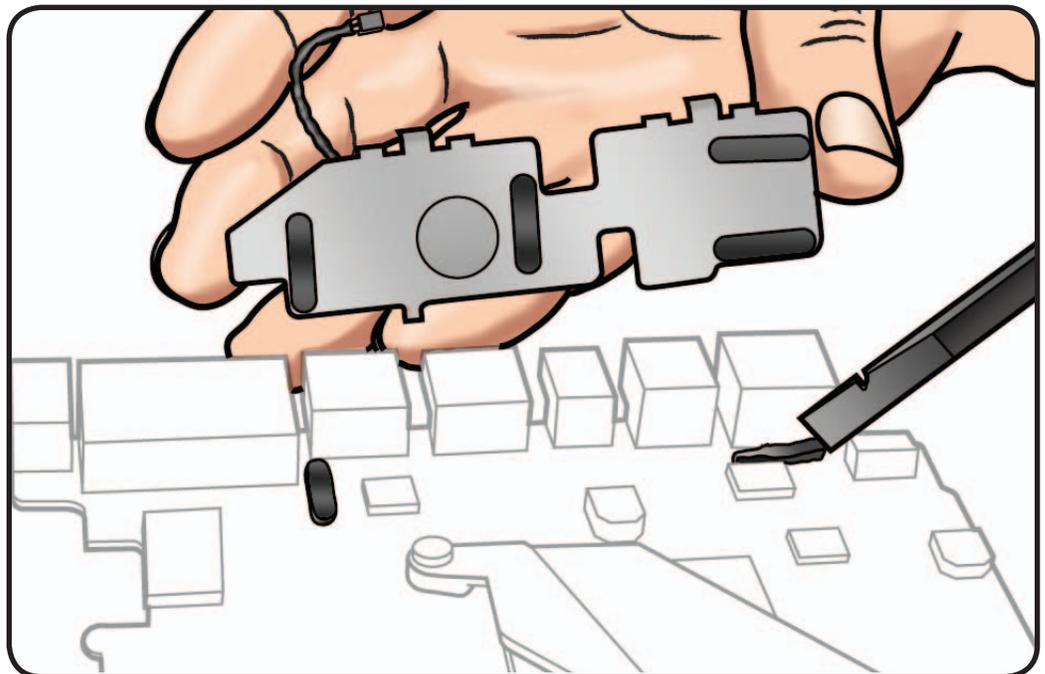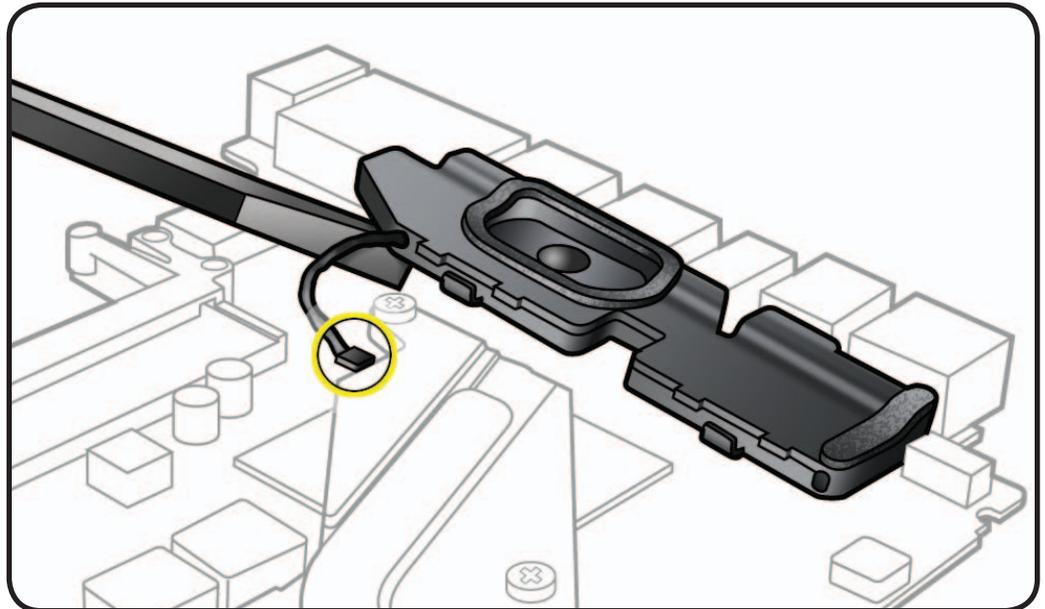
Replacement

1 Make sure left speaker and logic board are free of dust and plastic burrs.

2 If installing a new left speaker, remove paper backing from four foam pads and press speaker into place on back side of logic board.

3 Connect speaker cable to logic board and cover with black tape or Kapton tape.
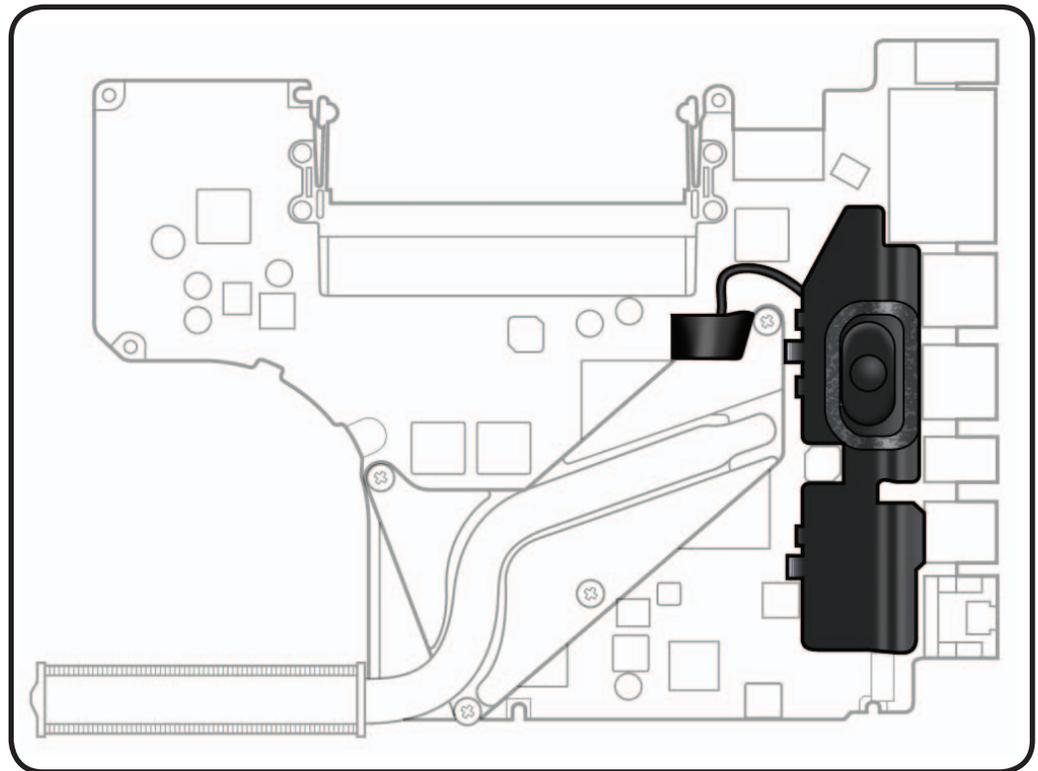
MagSafe Board

First Steps

Remove:
- Bottom Case
- Memory
- Fan
- Logic Board
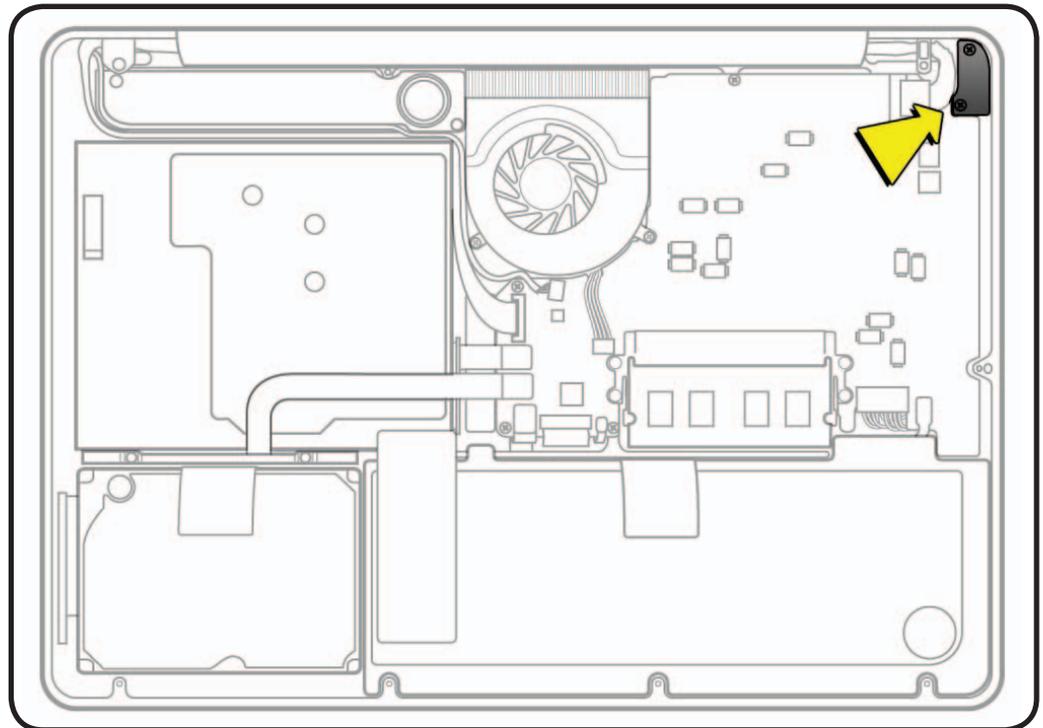
Tools

- ESD wrist strap
- Clean, soft, lint-free cloth
- Phillips #00 screwdriver, magnetized
- Torx 6 screwdriver, magnetized
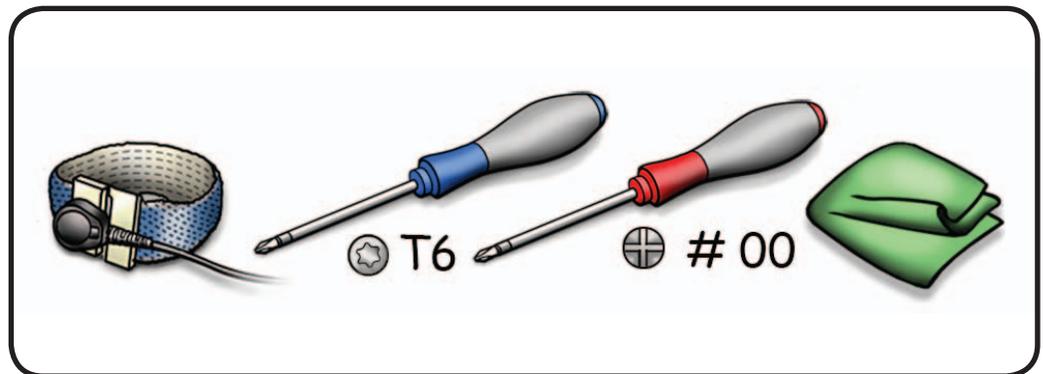
Removal

1 Remove screws:
<u>Mid 2009</u>: Phillips #00
(2) 922-8645 (7mm)
<u>Mid 2010</u>: Torx 6
(2) 922-9455 (7mm)

2 Tilt out MagSafe board and remove from top case.

7 mm

7 mm
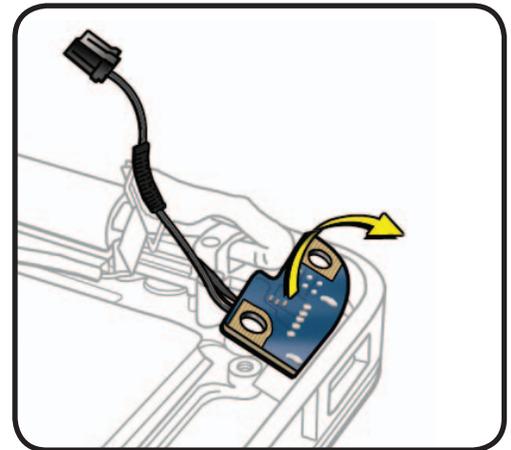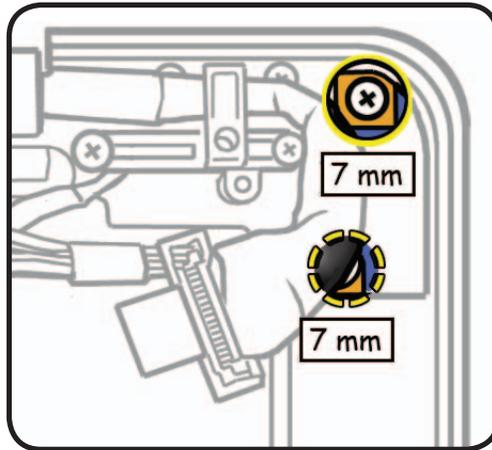
Reassembly

Important: Connect unplugged external power adapter cable to MagSafe port to make sure port stays completely aligned in top case.

Note: Install screws to MagSafe board before installing logic board.

Note: Make sure MagSafe cable is routed away from screw standoff, as shown.
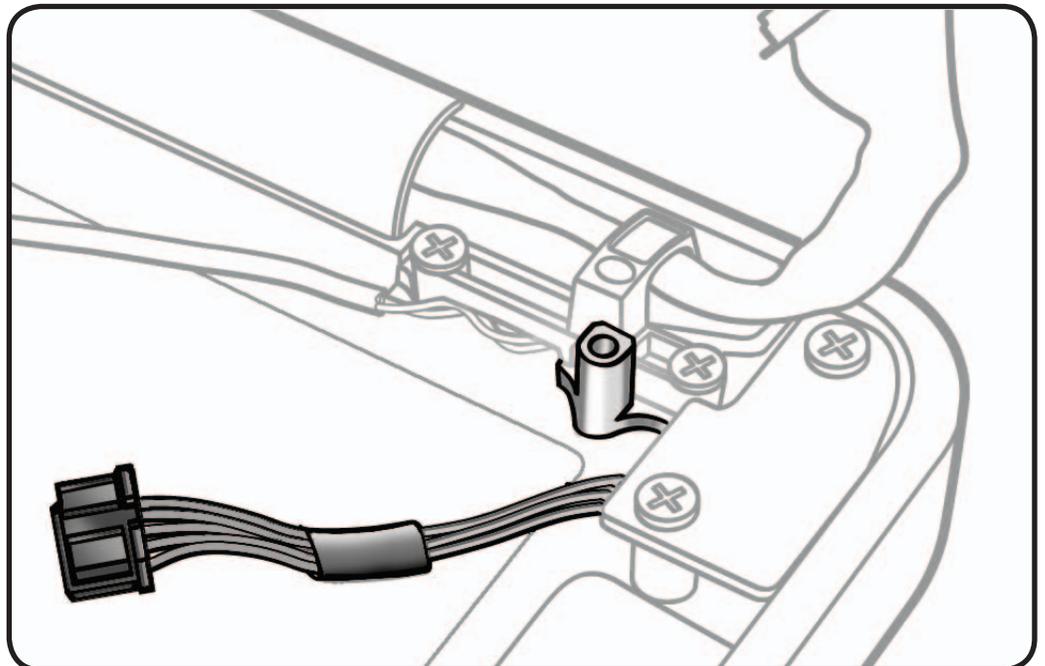
Heatsink

First Steps

Remove:
- Bottom Case
- Memory
- Fan
- Logic Board

Note: Heatsink is attached to bottom side of logic board.
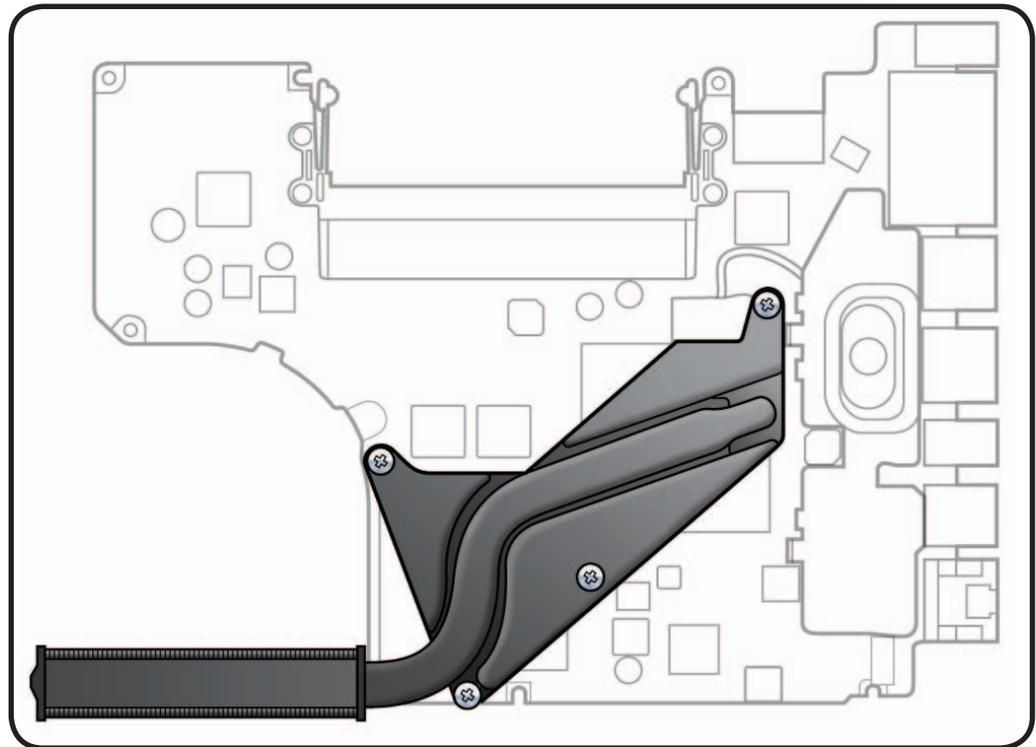
Tools

- ESD wrist strap
- Clean, soft, lint-free cloth
- Phillips #00 screwdriver, magnetized
- Alcohol pads
- Thermal grease syringe (922-7144)
- Black stick
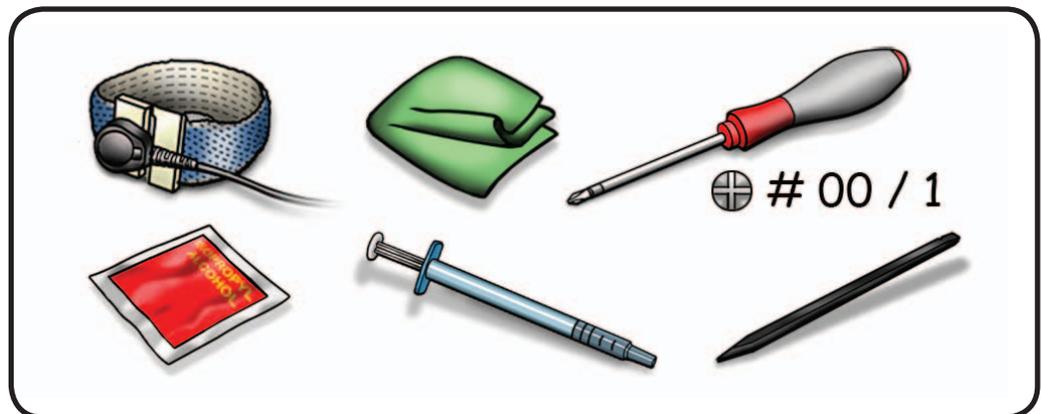
Removal

Caution: Do not grasp heatsink arm:

1 Remove Phillips #00 screws (with springs) in order shown: (4) 922-8799 (8.5mm)

Reassembly Note: Install screws 1/2 way first; then tighten in order shown.
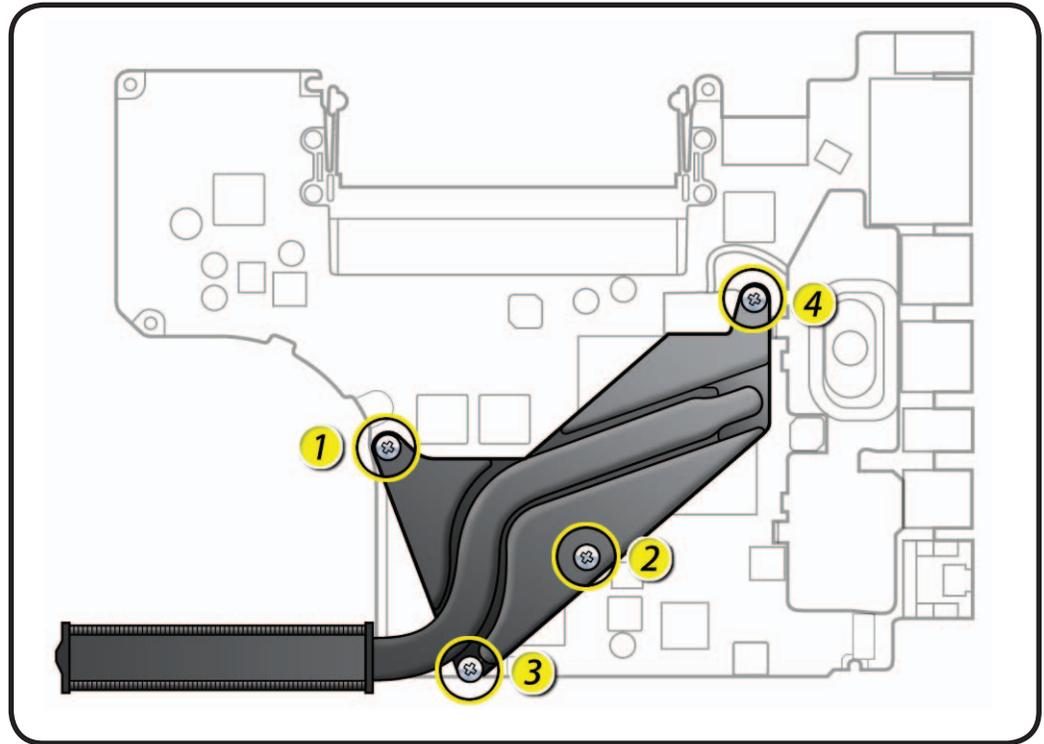
2 Keeping heatsink parallel to logic board, gently wiggle heatsink to loosen adhesive bond to logic board.

Caution: Do not pull heatsink.

3 Keeping heatsink level, lift heatsink away from logic board.
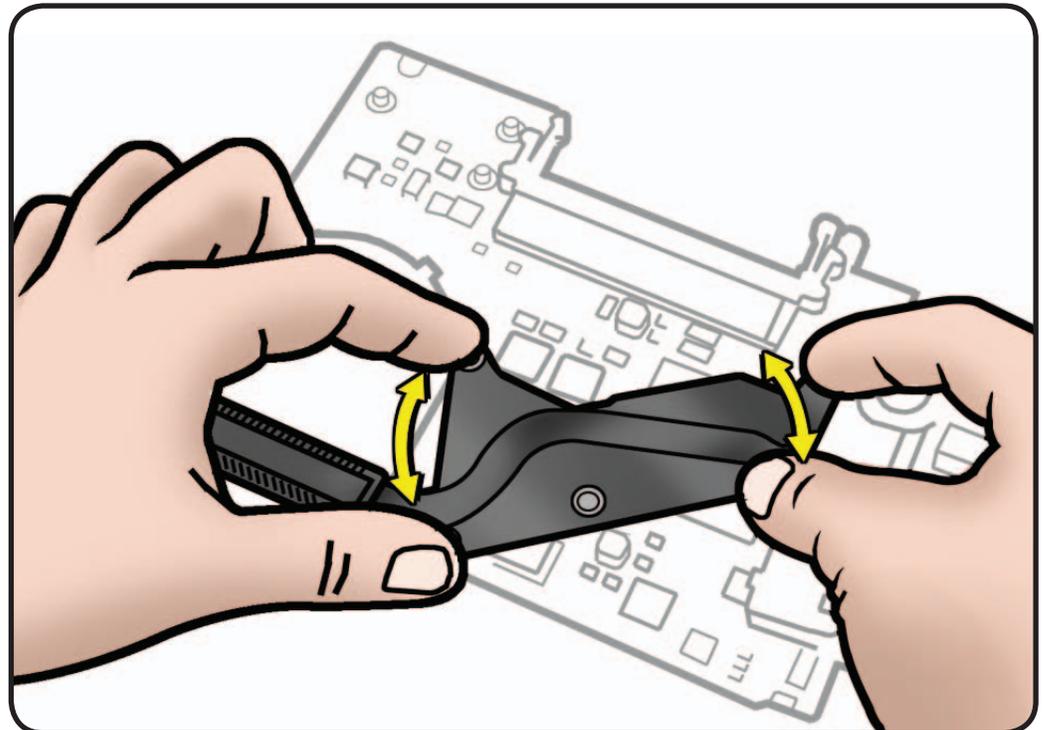
4 Scrape off thermal grease, and use alcohol pad to clean thermal pads and chips.
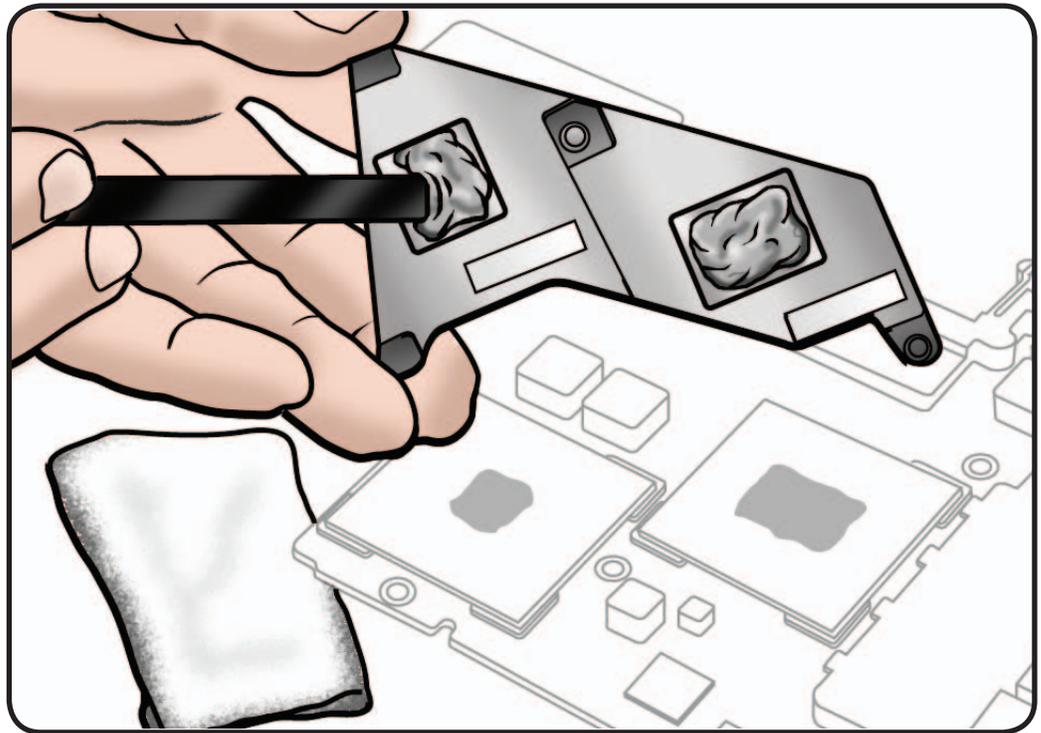
Replacement

Note: New heatsinks include pre-applied thermal grease. Follow steps 1-2 only if re-installing a heatsink.

1 Use a pen to mark the syringe in thirds.

Caution: Syringe (922-7144) contains enough thermal grease for 3 chips. Because this computer has only 2 chips, use only 2/3 of syringe contents.
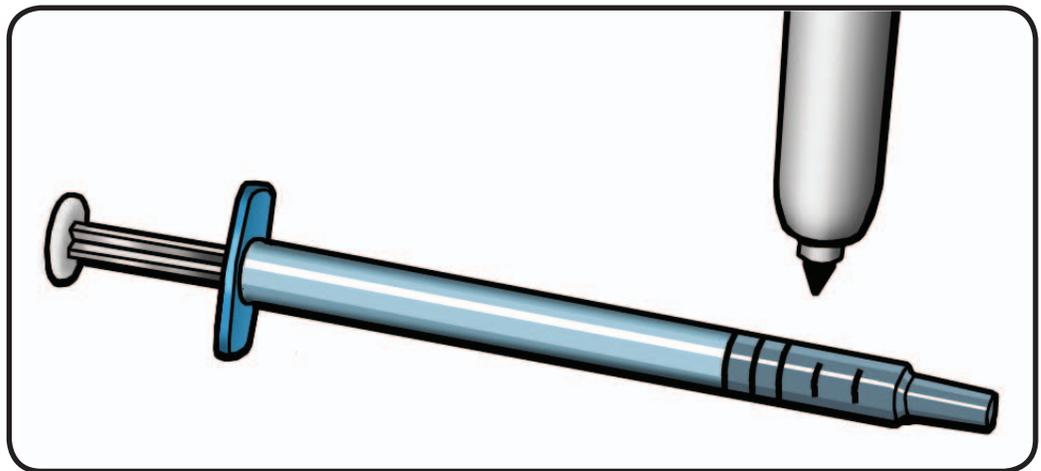
2 Inject 1/3 of grease on each chip.
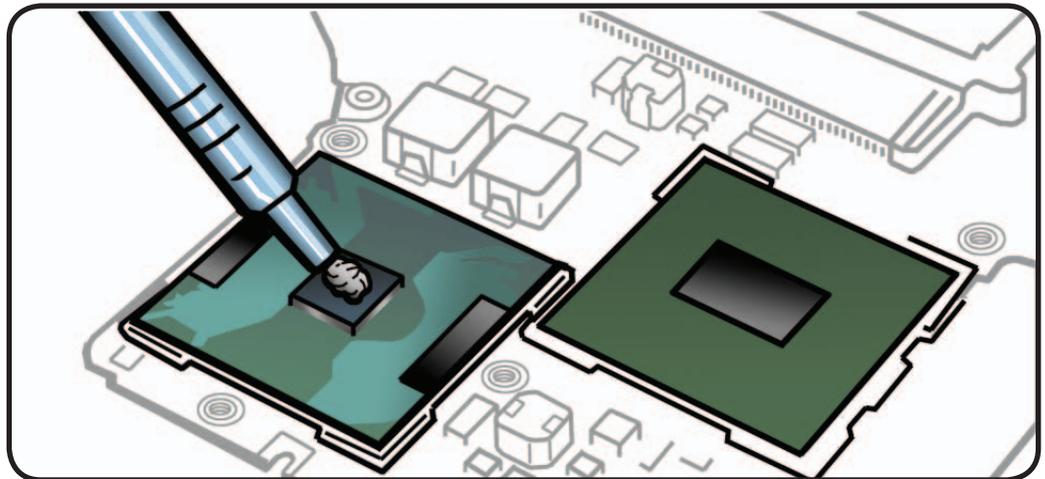
3 Lower heatsink over logic board.
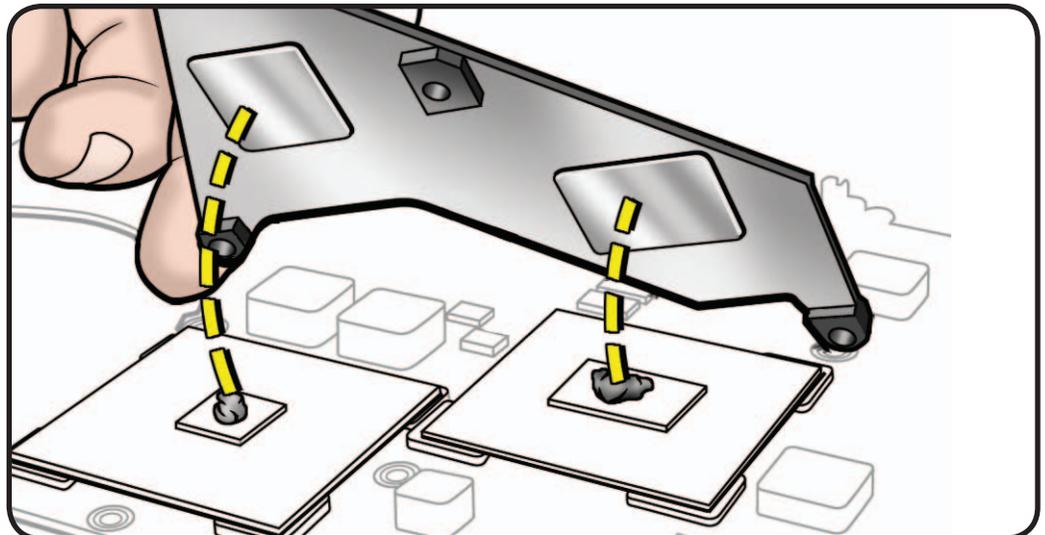
4 Install Phillips #00 screws (with springs) in order shown: (4) 922-8799 (8.5mm)

Reassembly Note: Install screws 1/2 way first; then tighten in order shown.
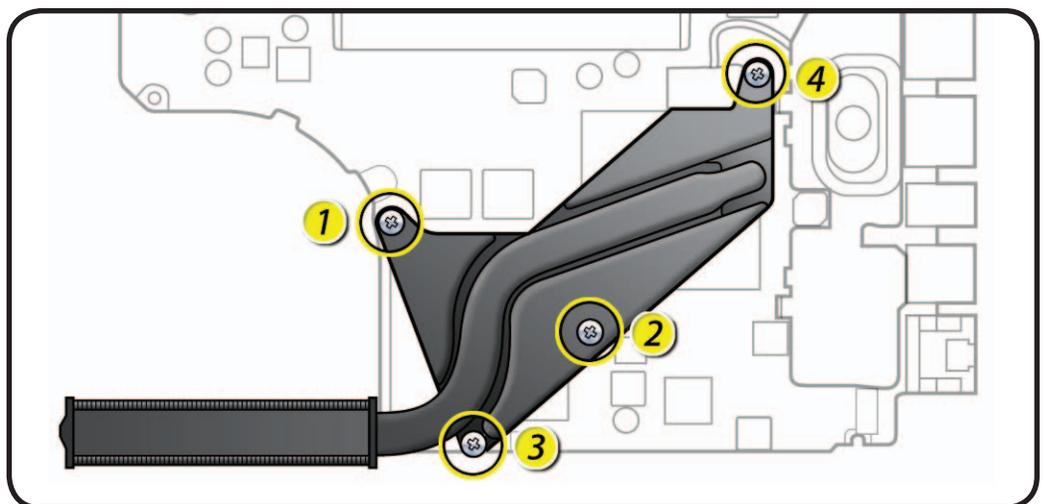
Microphone Cable

First Steps

Remove:
- Bottom Case
- Memory
- Fan
- Logic Board
- LVDS Cable Guide

Caution: Do not strain microphone cable.
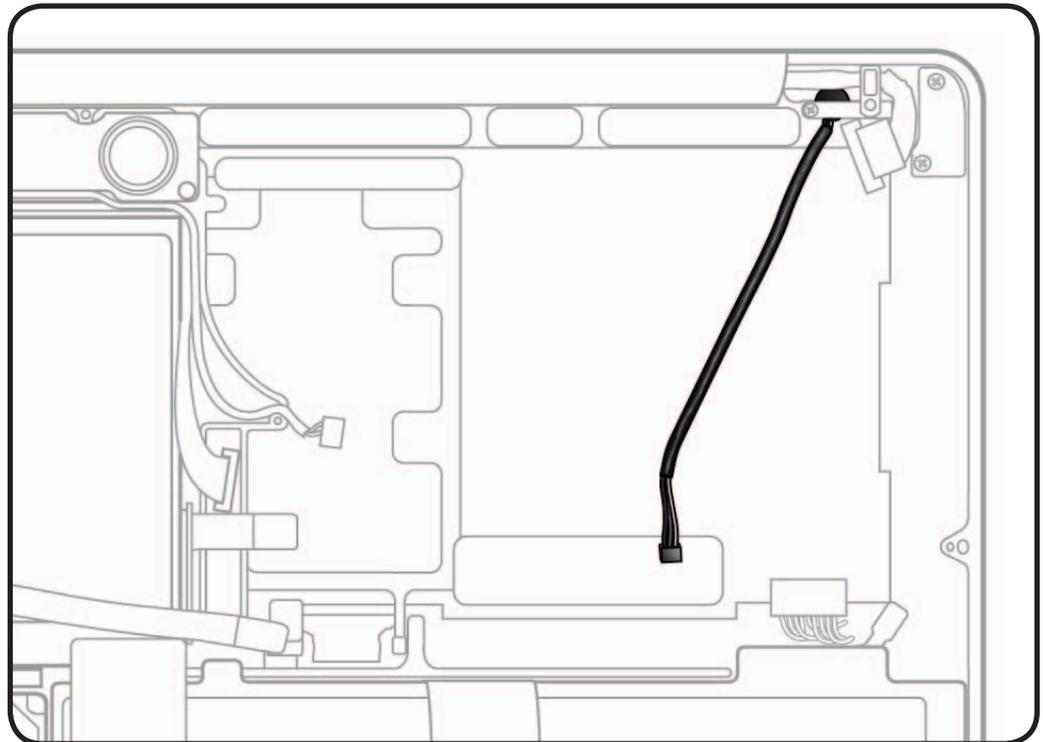
Tools

- ESD wrist strap
- Clean, soft, lint-free cloth
- Black stick
- Pencil with an eraser
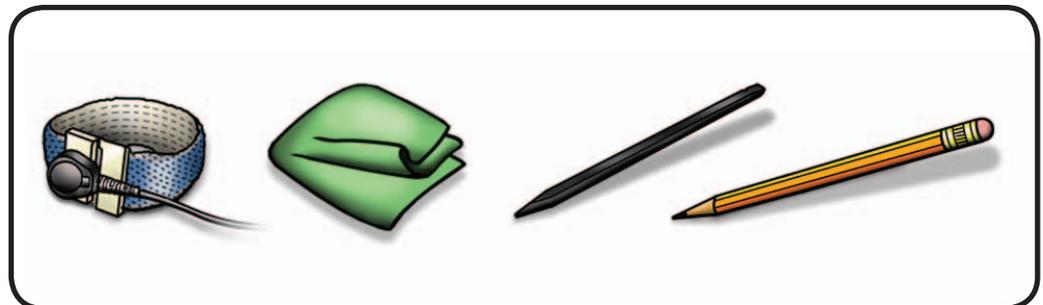
Removal

1 Use black stick to pry up microphone gasket.

2 Remove any adhesive remnants from top case.
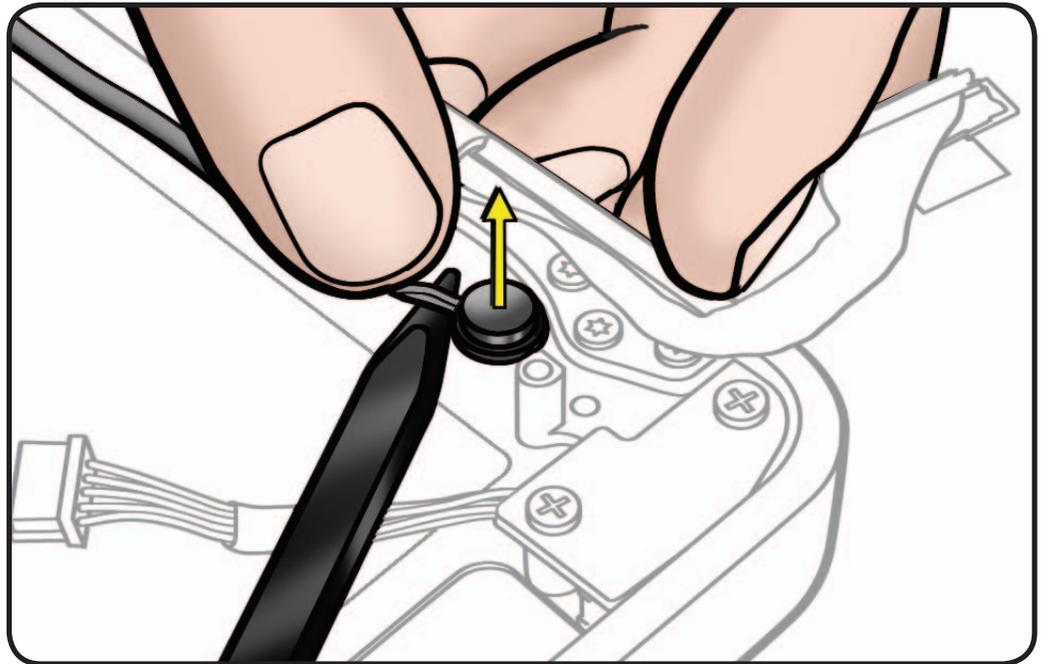
Replacement

1 Remove paper backing from gasket.

2 Use a pencil eraser to seat microphone gasket in top case.

   Note: An improperly seated microphone gasket could result in electronic noise.

3 Make sure microphone cable is not pinched when installing LVDS cable guide.

**4** To route microphone cable, refer to Logic Board section.
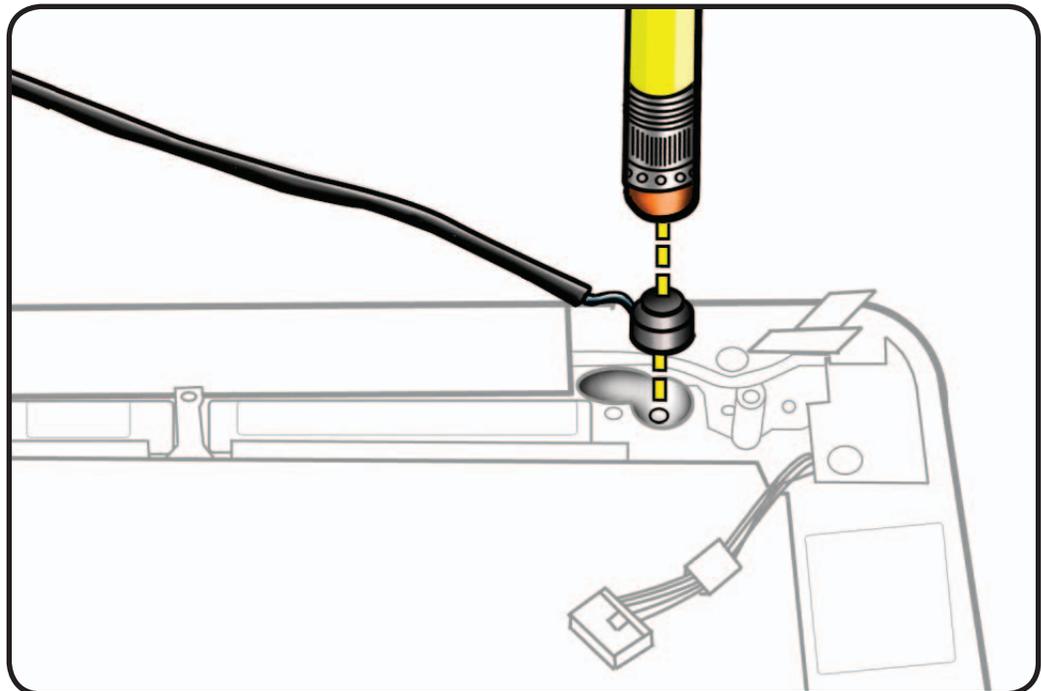
# Sleep Sensor / Battery Indicator Light (BIL)

First Steps

Remove:

- Bottom Case
- Battery
- Memory
- Fan
- Logic Board
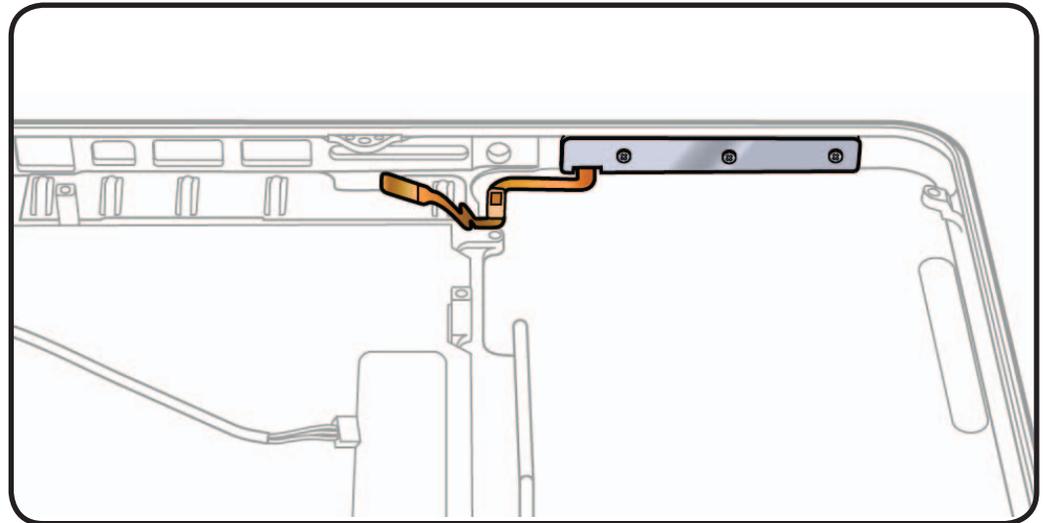
Tools

- ESD wrist strap
- Clean, soft, lint-free cloth
- Phillips #00 screwdriver, magnetized
- Piece of tape
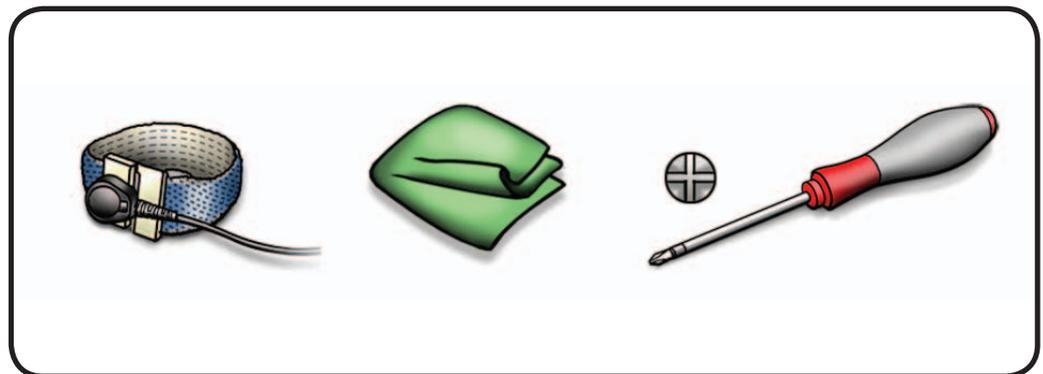
Removal

1 Place tape over BIL button on outside of top case, to prevent it from falling out.
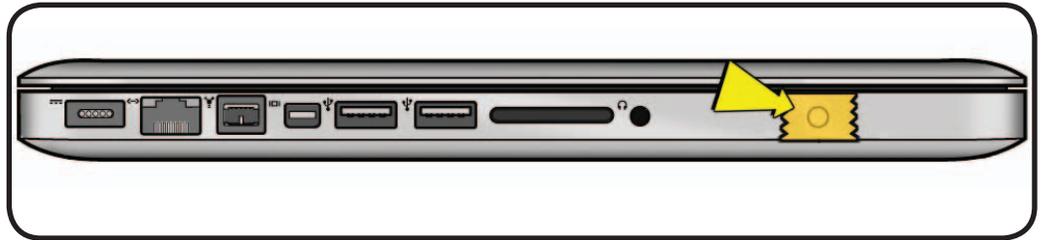
**2** Remove Phillips #00 screws:
(3) 922-9069 (2mm)

Replacement Note: Install screws in order shown.
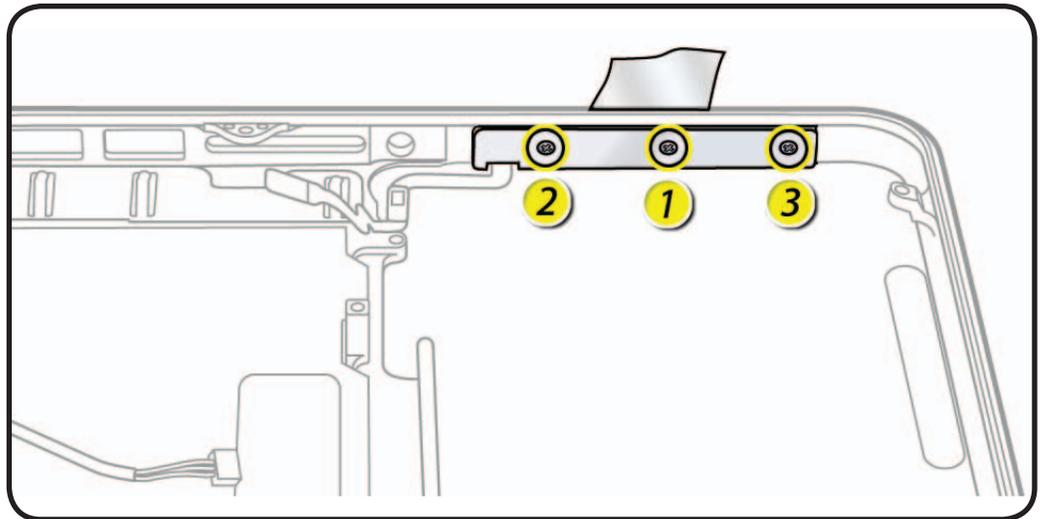
3 Peel up cable adhesive and remove BIL board from top case.
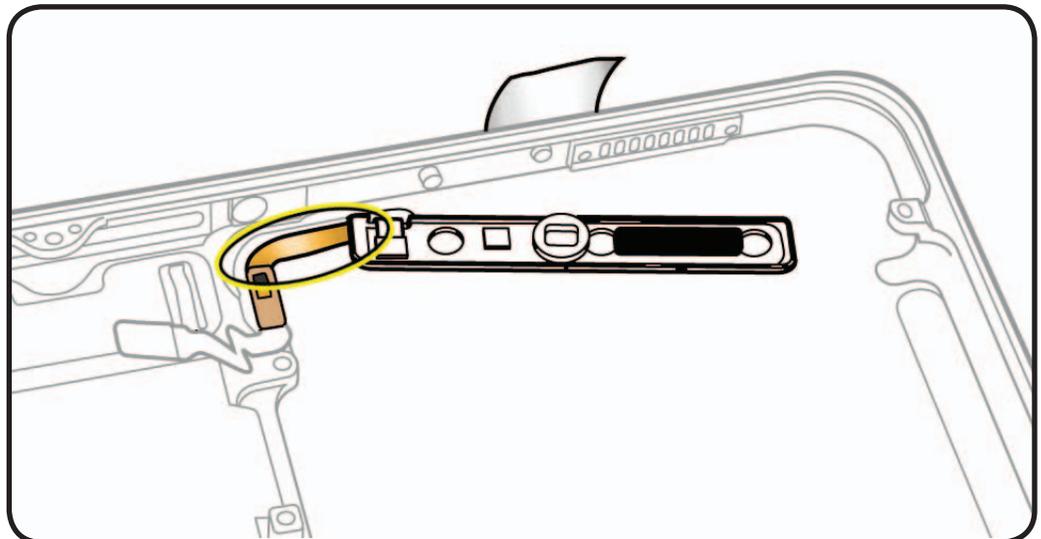
Reassembly Note:

Before replacing the BIL board, check that:

- long rubber gasket is assembled on top of the LED row
- BIL button is installed in the top case
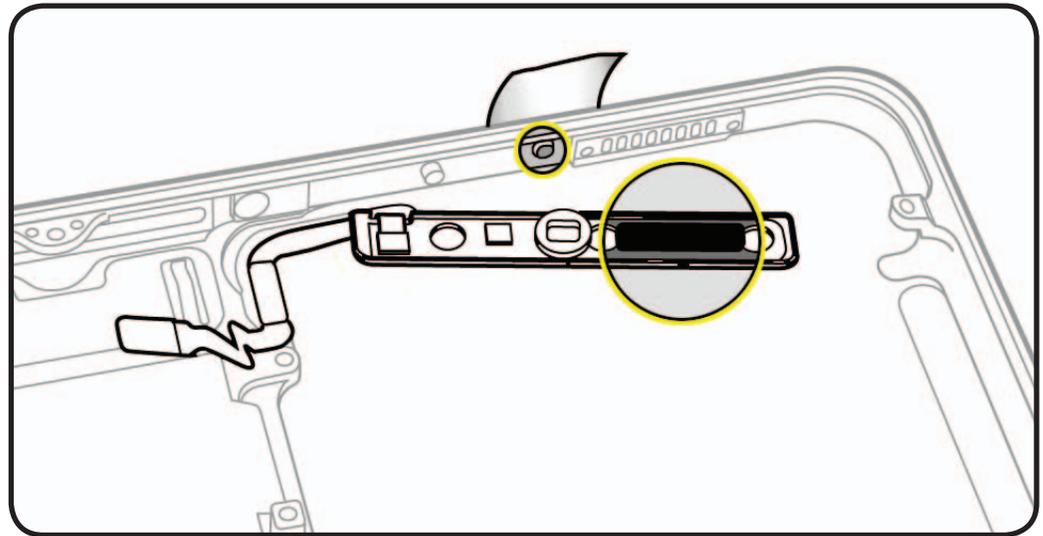
Center Bracket

First Steps

Remove:
- Bottom Case
- Memory
- Optical Drive
- Right Speaker
  *(just remove screw
  holding Right Speaker
  to Center Bracket)*
- Fan
- Logic Board
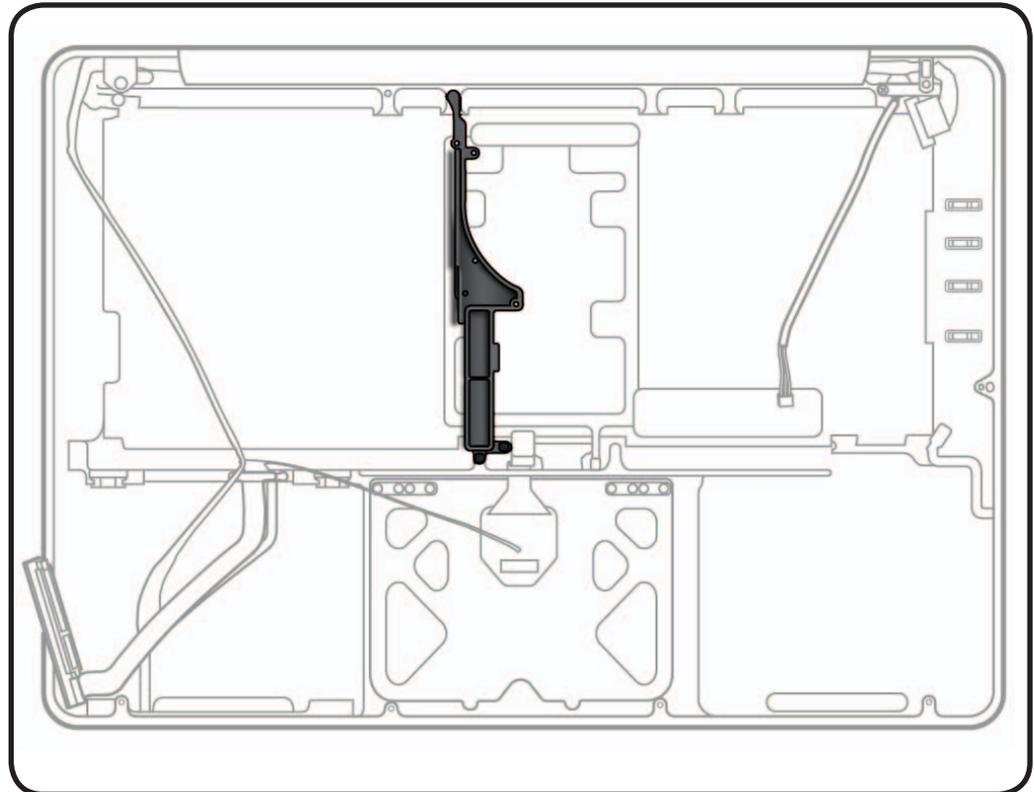
Tools

- ESD wrist strap
- Clean, soft, lint-free
  cloth
- Phillips #00 screwdriver,
  magnetic
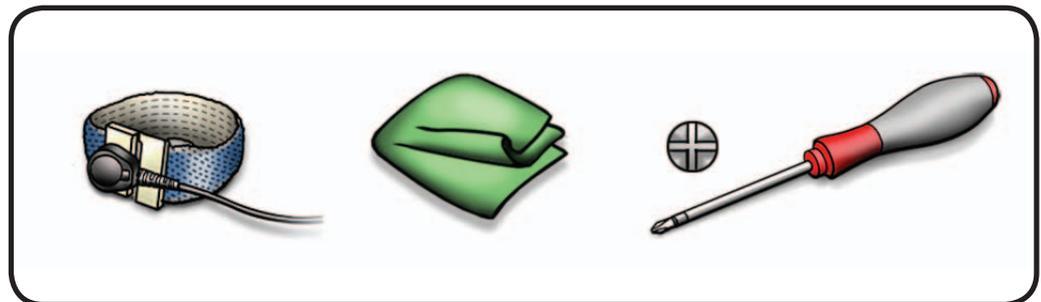
Removal

1 Remove Phillips #00 screws:

(1) 922-8648 (10mm)

(1) 922-8644 (5mm)

2 Remove center bracket from top case.
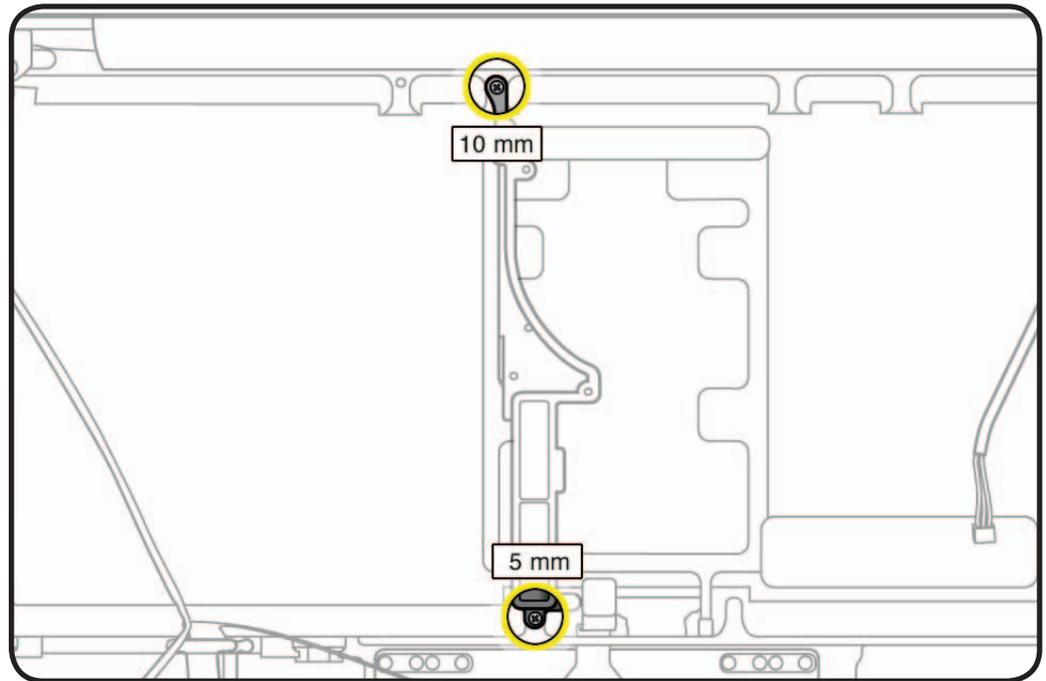
Top Case

First Steps

Remove:
- Bottom Case
- Battery
- Memory
- Rear Hard Drive Bracket
- Hard Drive
- Optical Drive
- Right Speaker/ Subwoofer
- Camera Cable Guide
- LVDS Cable Guide
- Display Clamshell
- Fan
- Logic Board
- MagSafe Board
- Microphone Cable
- Center Bracket
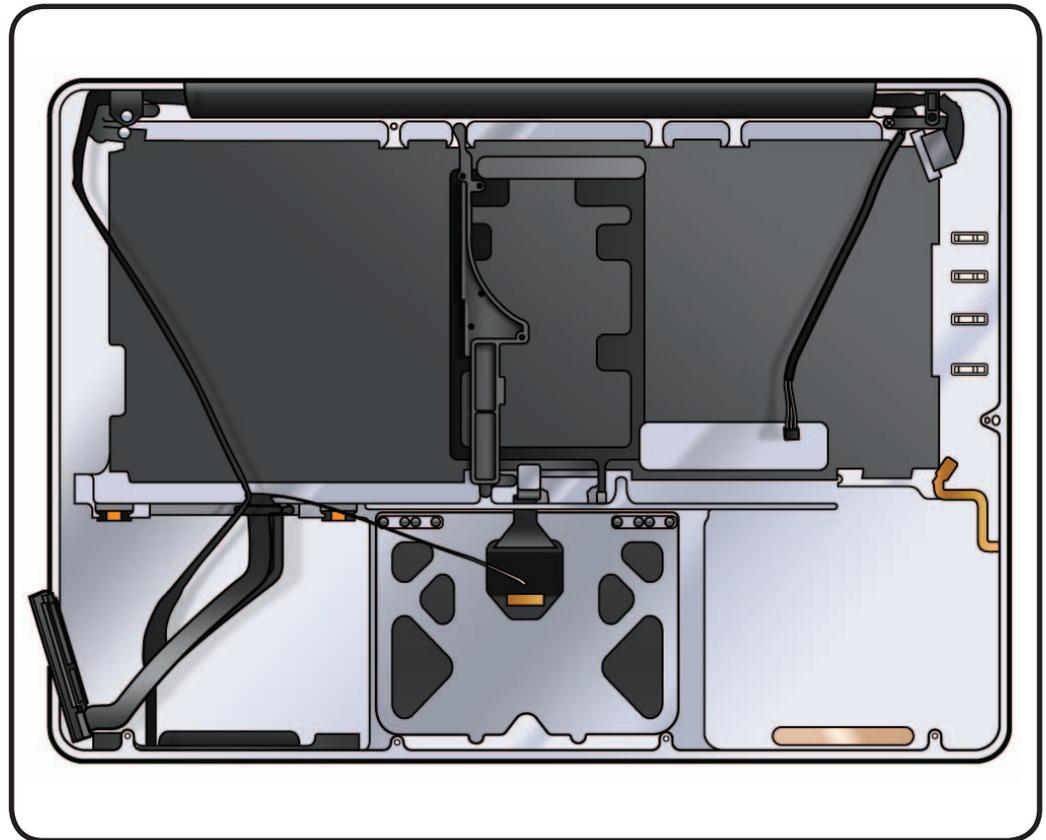
Tools

No tools are required for this procedure.

With the first steps completed, top case is the remaining part.

A replacement top case includes the following parts, which are also available separately:
- trackpad
- front hard drive bracket with IR/sleep/HD cable
- sleep sensor/battery indicator light (BIL)
- display clutch cover

Replacement Note: Before assembling unit, be sure to first transfer the following parts from old top case to replacement top case:
- center bracket
- microphone cable
- MagSafe board
- right speaker / subwoofer

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Additional Procedures

MacBook Pro (13-inch)

Right Clutch EMI Gasket Removal

First Steps

Remove:
- Bottom Case
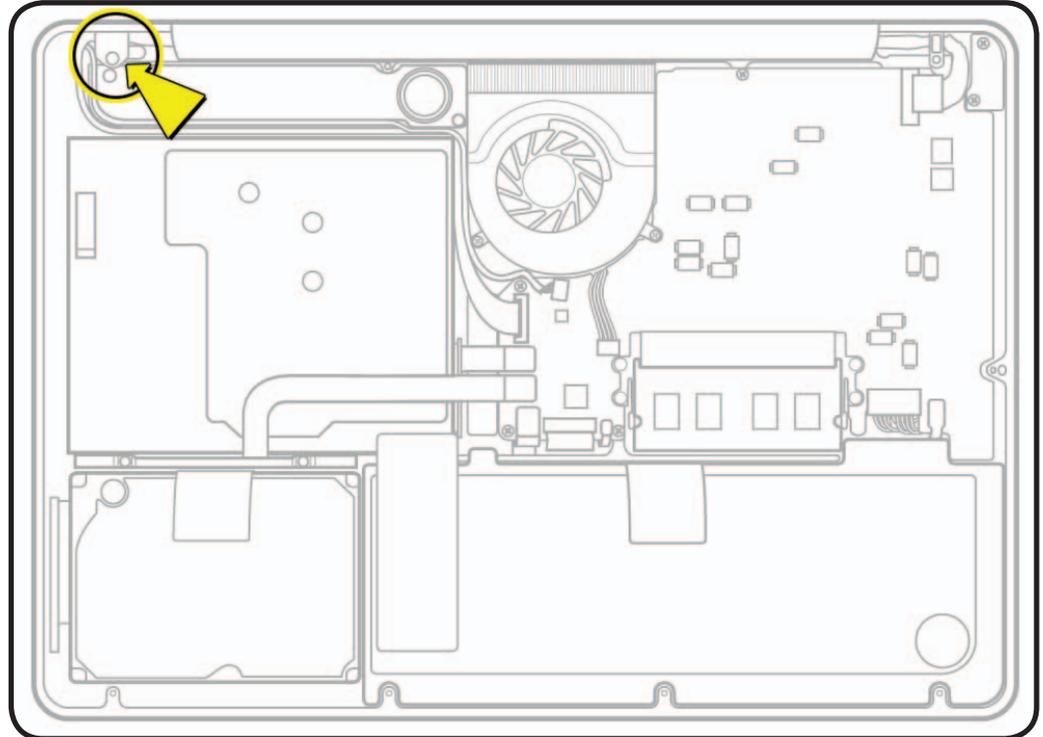
Tools

- ESD wrist strap
- Clean, soft, lint-free cloth
- Black stick
- Phillips #00 screwdriver, magnetized
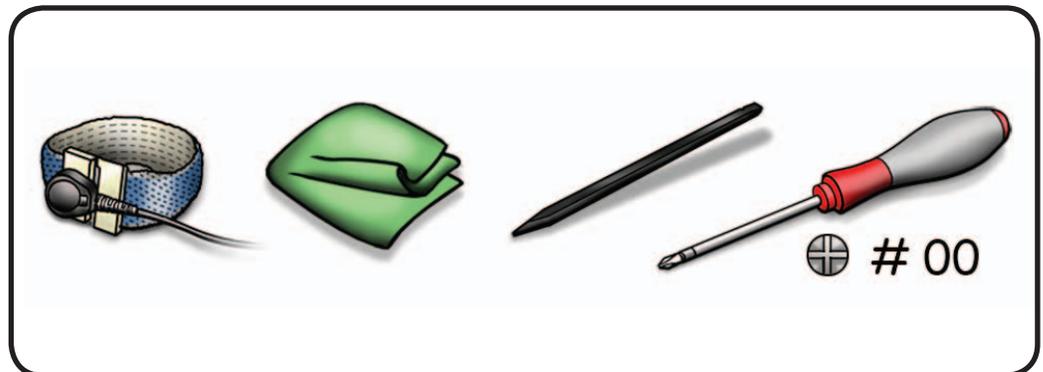
Removal

Before you begin this procedure, disconnect battery from logic board. Failure to do so could damage computer.
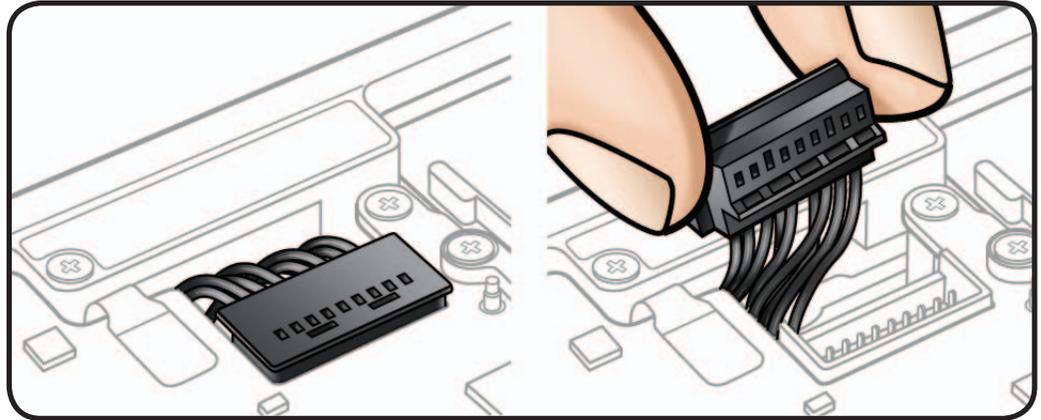
1 Locate camera cable connector on logic board.
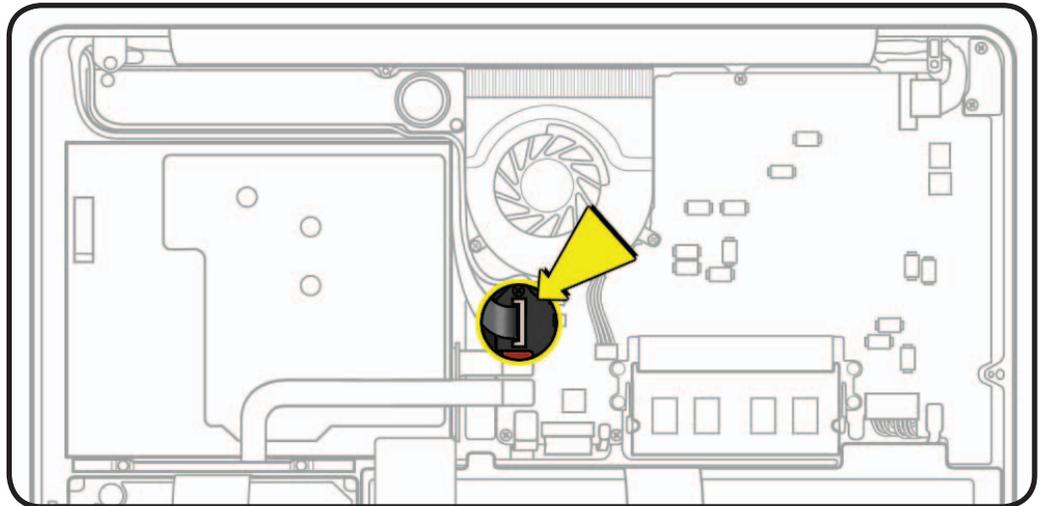
2 Peel EMI gasket (922-8752) off camera cable connector.

3 Remove shim (922-9450) and disconnect camera cable from logic board. Pull cable on same horizontal plane as logic board.
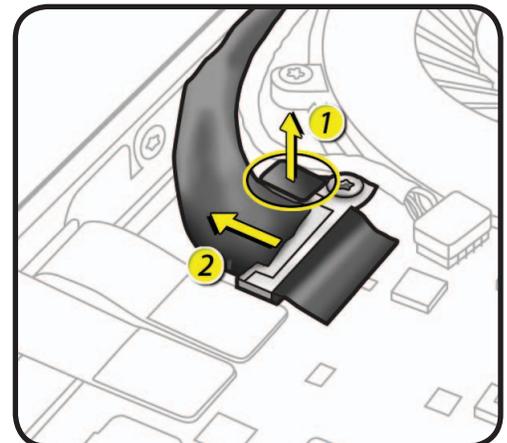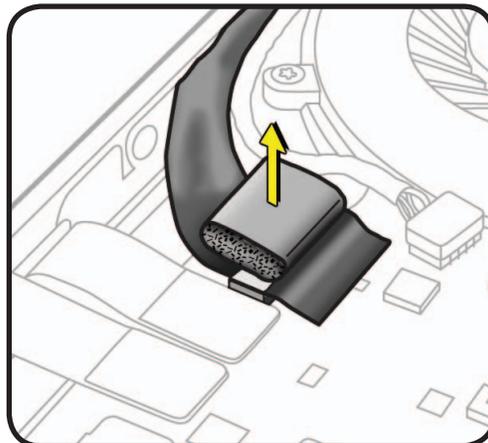
4 On subwoofer, remove Phillips #00 screws:
(1) 922-8650 (3.8mm)

(1) 922-8644 (4.9mm)

5 Disconnect speaker cable from logic board and rotate speaker towards optical drive.
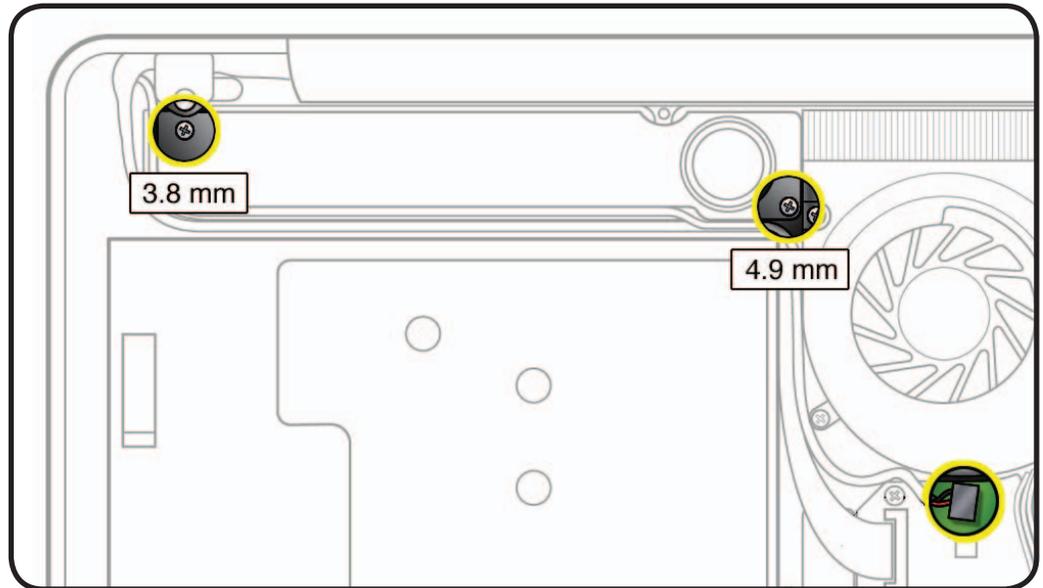
6 On camera cable guide, remove Phillips #00 screws:
(2) 922-9459 (8mm)
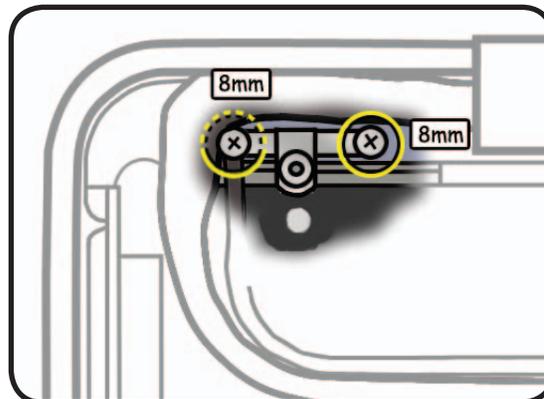
7 Use a black stick to tilt out camera cable guide.
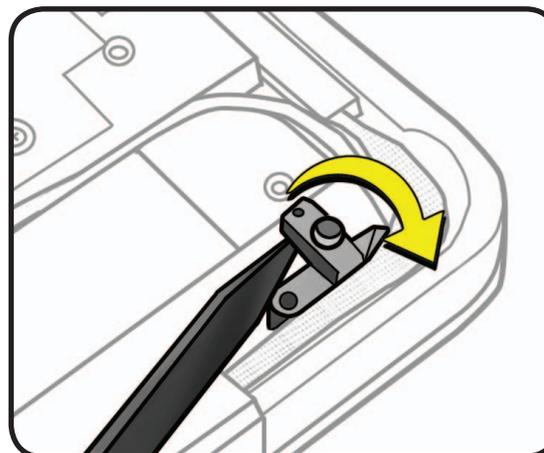
8 Gently move camera cable out of the way to expose EMI gasket covering right clutch screws.

9 Remove and discard EMI gasket.
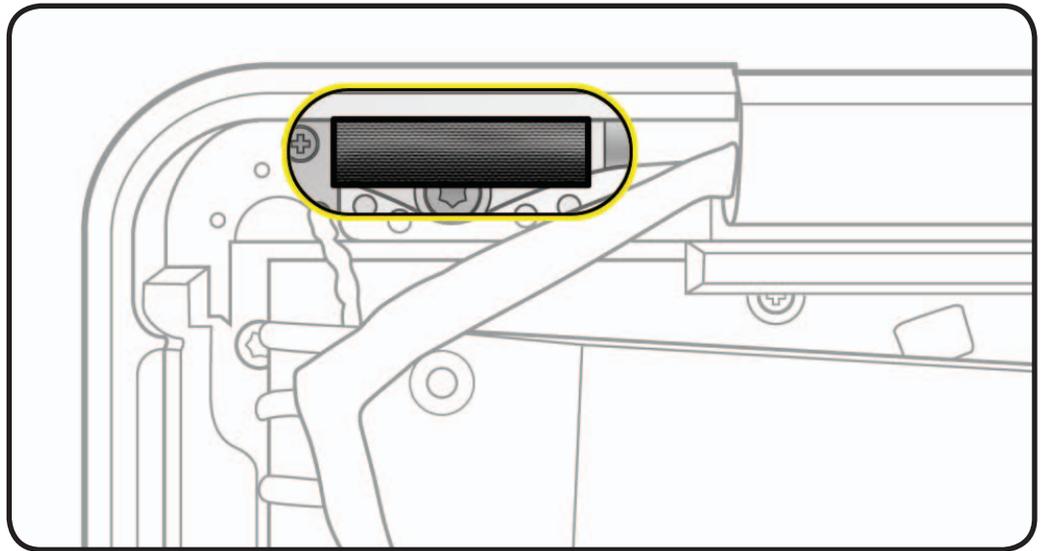
Reassembly Note
Camera cable should be routed as shown under camera cable guide, and under the silver grounding tab.
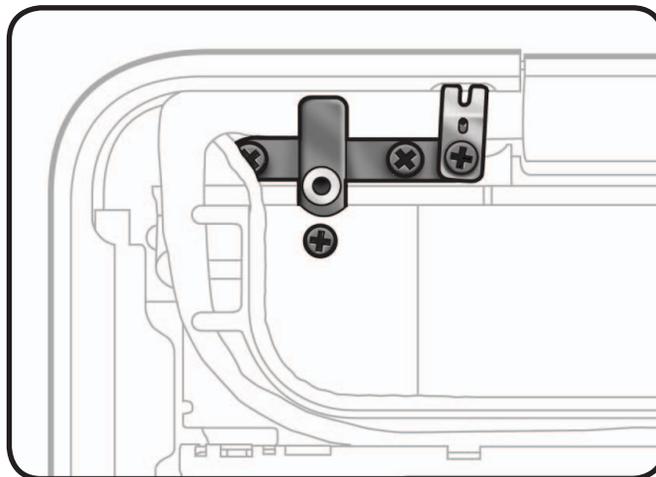
Reassembly Caution:
Make sure camera cable is properly routed over the end of camera cable guide. Cable should not be wrapped around end of guide or cable could get strained and damaged during future hinge movement.
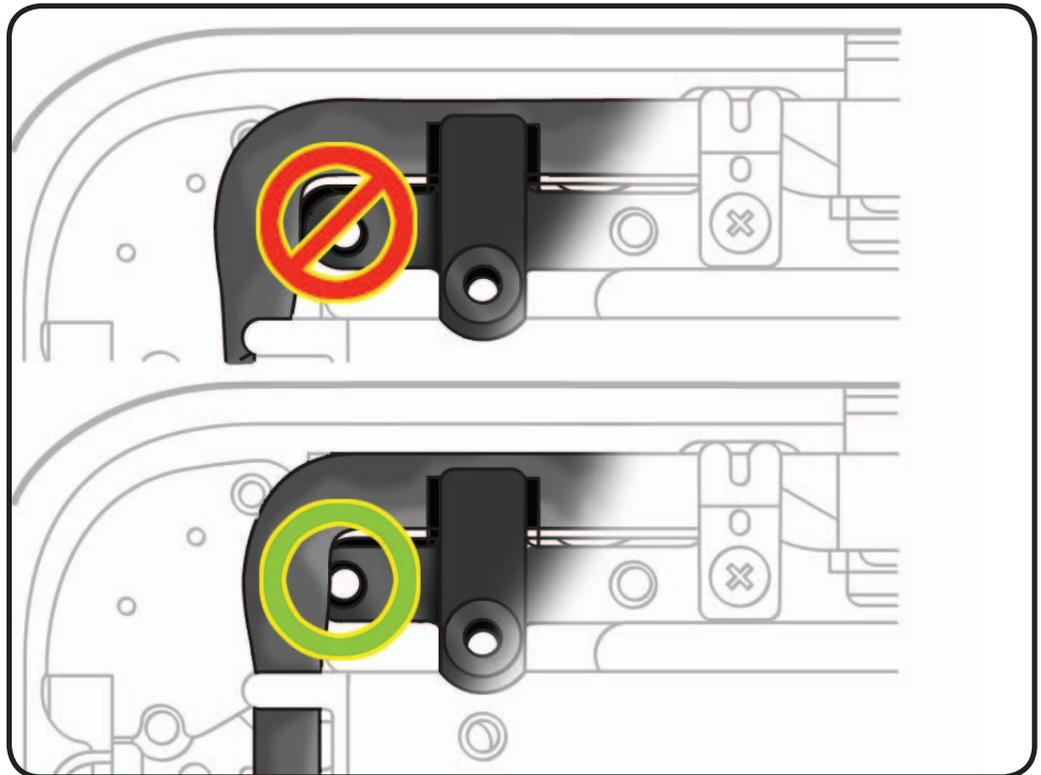
Reassembly Caution:
When connecting camera cable, make sure it is fully connected. Place shim behind connector so it helps secure cable.

Reassembly Caution:
To avoid a short to logic board, be sure to place EMI gasket on camera cable—positioned precisely where shown—**after** cable is fully connected to logic board and shim is in place.

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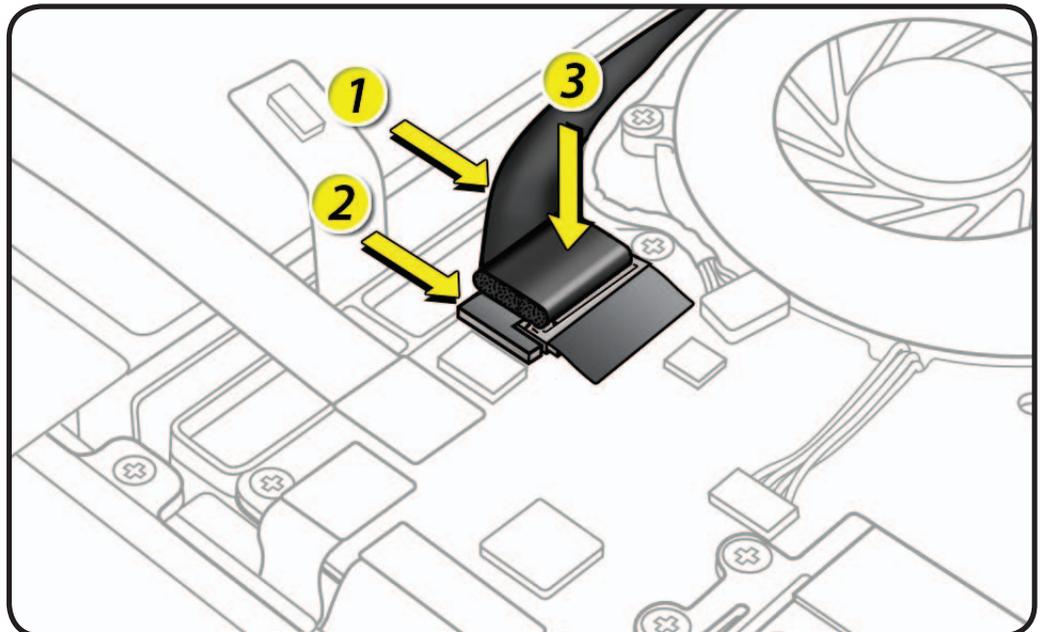
Views

MacBook Pro (13-inch)

Exploded Views

Main Assembly (Mid 2009), 1 of 2

Housing,
Bottom Case
922-9064

Battery, Lithium Ion
661-5229, US/Canada
FE661-5557, Far East
J661-5557, Japan
ZM661-5557, International

Bracket, Rear Hard Drive
922-9065

Hard Drive
661-5159, 160 GB, 5400
661-5160, 250 GB, 5400
661-5161, 320 GB, 5400
661-5162, 500 GB, 5400
661-5163, 128 GB, SSD
661-5164, 256 GB, SSD

Bracket,
Front Hard Drive,
with IR/Sleep/HD Cable
922-9062

Optical Drive, Super
661-5165

Cable, Optical Drive Flex
922-9060

Right Speaker/Subwoofer
922-9057

Guide, Camera Cable
922-8636

Guide, LVDS Cable
922-9067

Fan
661-4946

Board, Logic
661-5230, 2.26 GHz
661-5231, 2.53 GHz

Memory
SDRAM, DDR3
1066, SO-DIMM
661-5225, 1 GB
661-5226, 2 GB
661-5227, 4 GB

Heatsink
661-5234

Left Speaker
922-9058

Microphone Cable
922-9059

Board, MagSafe,
with Cable
661-5235

Bracket, Center
922-9066
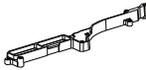
Sleep Sensor/
Battery Indicator Light
922-9061
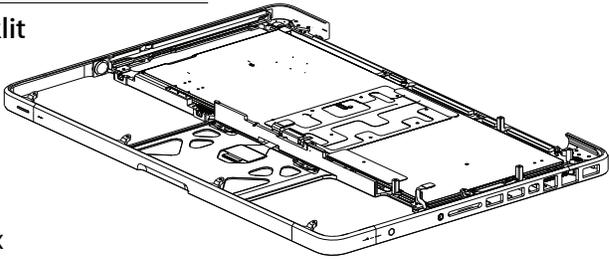
Housing, Top Case
with Keyboard, Backlit
661-5233, US
Note: Regional
top cases have
same base part#,
but include a
language code prefix
(i.e., F661-5223 for French)

Button, Battery
Indicator LED
922-8792

Trackpad
922-9063

Display Assembly (Mid 2009)

Clutch Cover, Display, Pkg of 5
922-9091
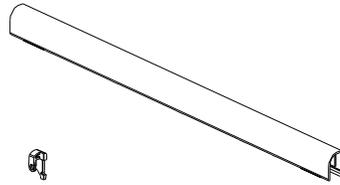
Clip, AirPort Antenna
(part of AirPort Card Kit 076-1326)

Card, AirPort Extreme
661-4766, US/Canada/Latin America
B661-4766, UK/Europe
J661-4766, Japan
KH661-4766, Korea
PA661-4766, Pacific Rim
Z661-4766, International

Antenna, AirPort
922-8782
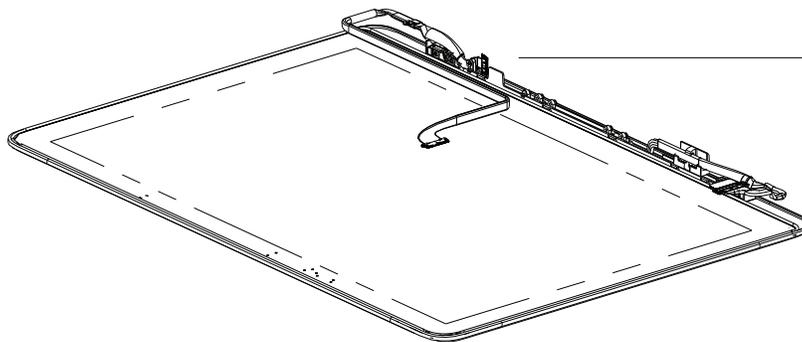
Display Clamshell,
Glossy
661-5232

Main Assembly (Mid 2010), 1 of 2

Housing,
Bottom Case
922-9447

Battery, Lithium Ion
661-5557, US/Canada
FE661-5557, Far East
J661-5557, Japan
ZM661-5557, International

Bracket, Rear Hard Drive
922-9065

Hard Drive
661-5496, 5400, 250 GB
661-5497, 5400, 320 GB
661-5498, 5400, 500 GB
661-5499, SSD, 128 GB
661-5500, SSD, 256 GB
661-5501, SSD, 512 GB

Bracket,
Front Hard Drive,
with IR/Sleep/HD Cable
922-9062

Optical Drive, Super
661-5502

Cable, Optical Drive Flex
922-9060

Right Speaker/Subwoofer
922-9057

Guide, Camera Cable
922-9449

Guide, LVDS Cable
922-9448

Fan
922-8620

Board, Logic
661-5559, 2.40 GHz
661-5560, 2.66 GHz

Memory
SDRAM, DDR3
1066, SO-DIMM
661-5556, 2 GB
661-5595, 4 GB

Heatsink
922-9446

Not Pictured:
Gasket, EMI, LVDS
922-8752
Shim, Camera Cable
922-9449
Label, Keyboard Backlight Flex Cable
922-9460
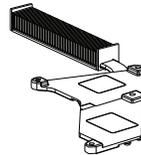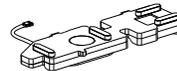
Left Speaker
922-9445

Microphone Cable
922-9059

Board, MagSafe,
with Cable
922-9307

Bracket, Center
922-9066
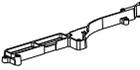
Sleep Sensor/
Battery Indicator Light
922-9523
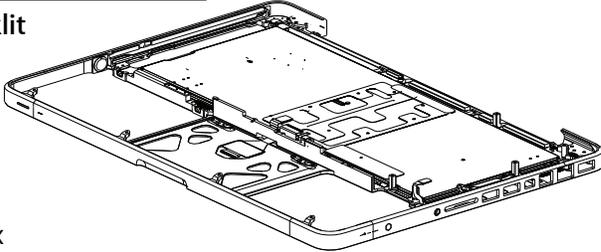
Housing, Top Case
with Keyboard, Backlit
661-5561, US
Note: Regional
top cases have
same base part#,
but include a
language code prefix
(i.e., F661-5561 for French)

Trackpad
922-9525

Display Assembly (Mid 2010)

Clutch Cover, Display, Pkg of 5 ———————
922-9091

Clip, AirPort Antenna ———————————
(part of AirPort Card Kit 076-1326)

Card, AirPort Extreme ———————————
661-5593, US/Canada/Latin America
J661-5593, Japan
KH661-5593, Korea
PA661-5593, Pacific Rim
Z661-5593, UK/Europe
ZM661-5593, Rest of World
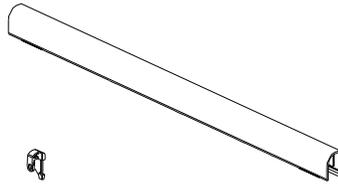
Not Pictured:
Gasket, EMI, Clutch
922-9304

Antenna, AirPort
922-8782
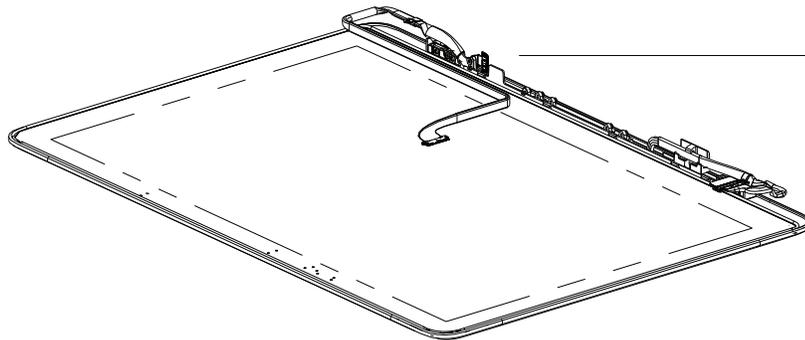
Display Clamshell,
Glossy
661-5558

Screw Location Diagrams

Mid 2009: Bottom Case

All screw sizes shown are approximate and represent the total length of the screw.

922-8666
M2 x 0.4 x 13.5

922-8972
M2 x 0.4 x 3
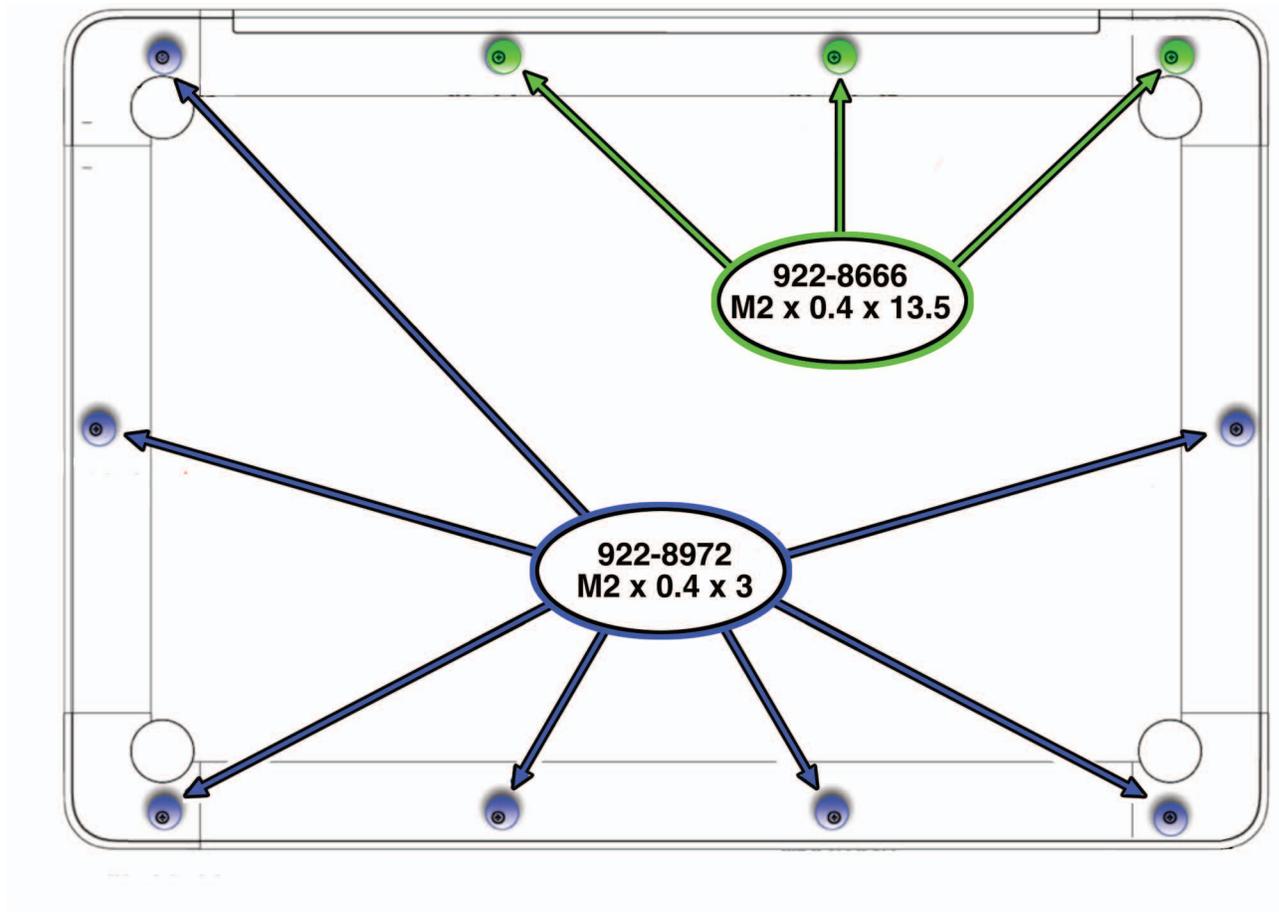
Mid 2009: Main Modules

All screw sizes shown are approximate and represent the total length of the screw.

B

M2 x 0.4 x 4

M2 x 0.4 x 12.5
Trilobe

922-9076   **922-9226**

C

M2 x 0.4 x 4

M2 x 0.4 x 5.1
Trilobe

922-9227   **922-9076**

922-8650   **922-8644**   **922-8645**   **922-8644**

M2 x 0.4 x 2.5

M2 x 0.4 x 3.5

M2 x 0.4 x 4.5

M2 x 0.4 x 3   M2 x 0.4 x 3

B

M2 x 0.4 x 6.5

922-9077

M2 x 0.4 x 3

M2 x 0.4 x 5.5   M2 x 0.4 x 4

M2 x 0.4 x 2.5   M2 x 0.4 x 4.5

922-8662

M2 x 0.4 x 2.5

M2 x 0.4
Captured

M2 x 0.4
Captured

M2 x 0.4 x 3

C

B

922-9076   **922-8663**

922-9078
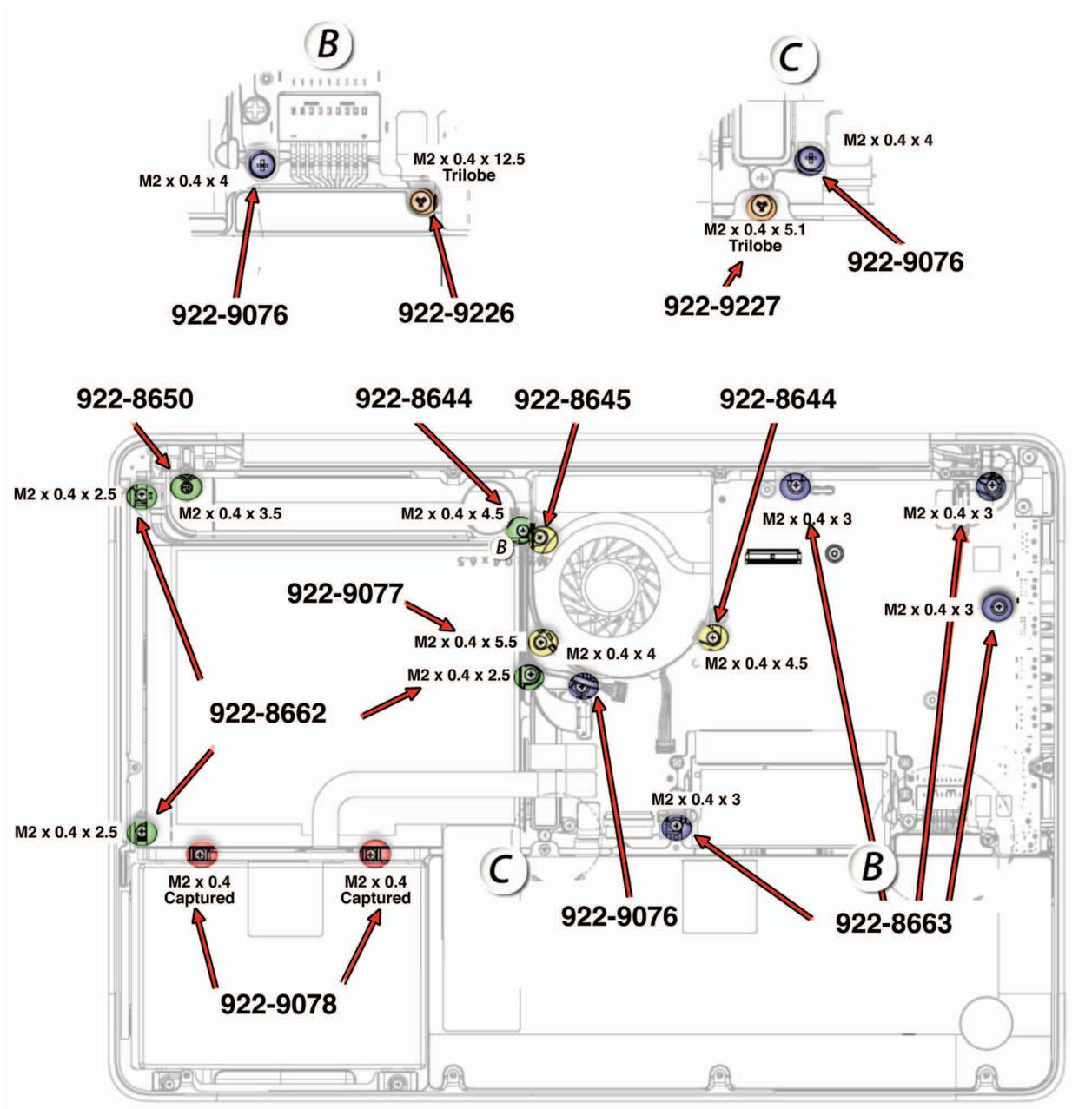
Mid 2009: Display Clamshell

All screw sizes shown are approximate and represent the total length of the screw.

M2 x 0.4 x 5

M2 x 0.4 x 5

M2 x 0.4 x 6.5

M2 x 0.4 x 8

922-xxxx

922-9068

922-8658

ALL CLUTCH SCREWS
M2.5 x 0.45 x 5.3

922-8970

ALL CLUTCH SCREWS
M2.5 x 0.45 x 5.3
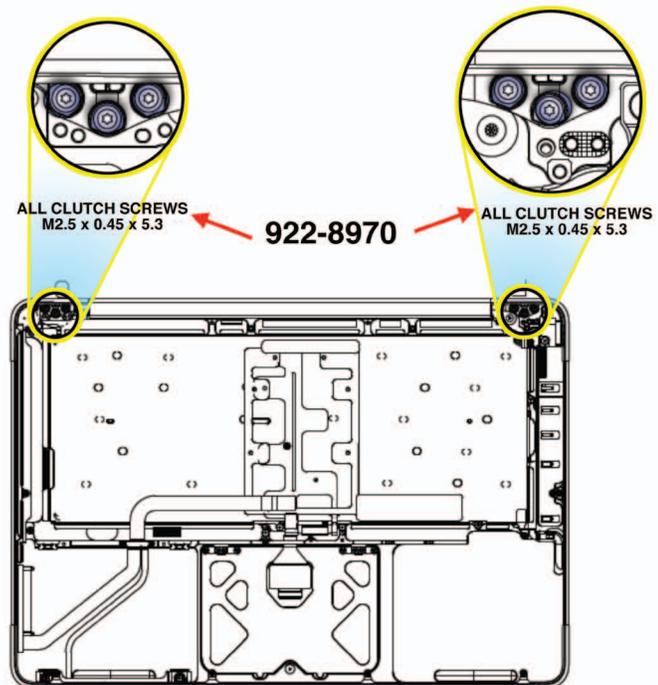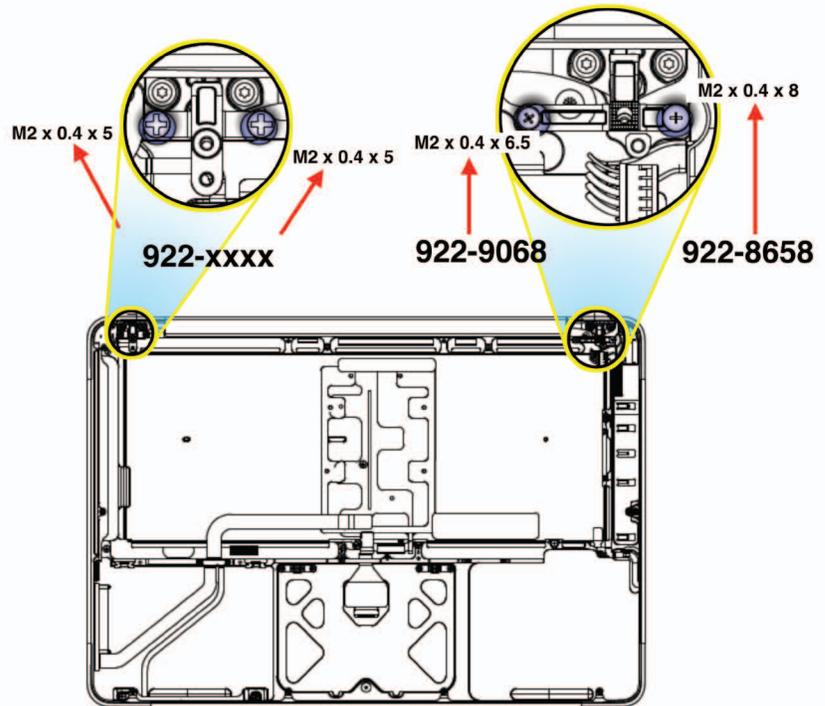
Mid 2010: Bottom Case

Screws are documented for the MacBook Pro (13-inch, Mid 2010) in each Take Apart chapter. These diagrams are a reference for most of the major modules. For information about a screw not pictured in these diagrams, please consult the appropriate Take Apart chapter.

All screw sizes shown are approximate and represent the total length of the screw.
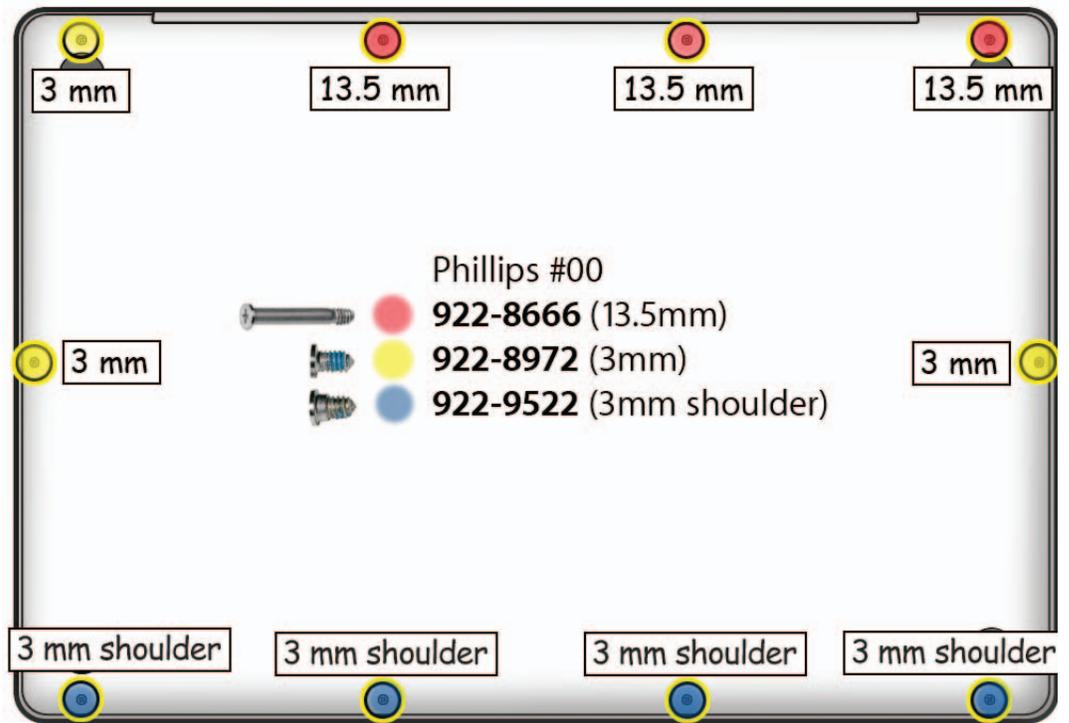
Mid 2010: Optical Drive, Speaker, Fan

Phillips #00
- 922-8662 (2.8mm)
- 922-8644 (4.9mm)
- 922-8650 (3.8mm)
- 922-9459 (8mm)

Torx 6
- 922-9455 (6.5mm)
- 922-9454 (5mm)
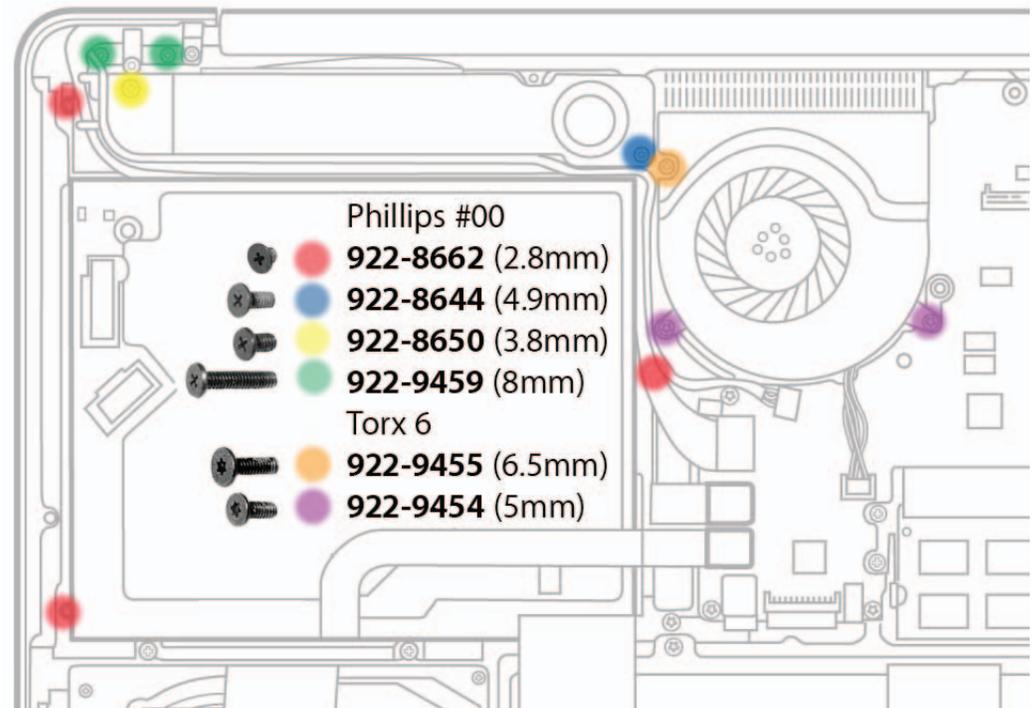
Mid 2010: Front Hard Drive Bracket

Phillips #00
- 922-9036 (1.5mm)
- 922-9105 (4mm)
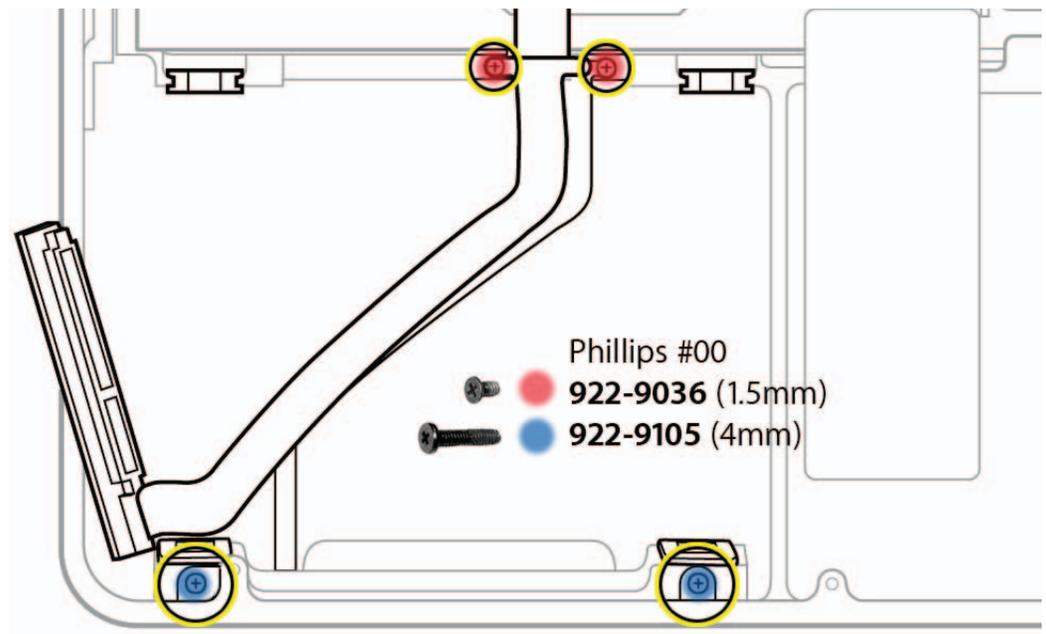
Mid 2010: Logic Board, MagSafe Board

3 mm

3 mm

Torx 6
🔴 **922-9452** (4mm)
🟣 **922-9453** (3mm)
⚪ **922-8924** (3.1mm)
🟢 **922-9524** bracket
🟠 **922-9455** (7mm)

3 mm

4 mm

3.1 mm Torx

4 mm

3 mm

3 mm

Mid 2010: Battery

5.5 mm

13.5 mm

tri-lobe #0
🔴 **922-9227** (5.5mm)
🔵 **922-9226** (13.5mm)
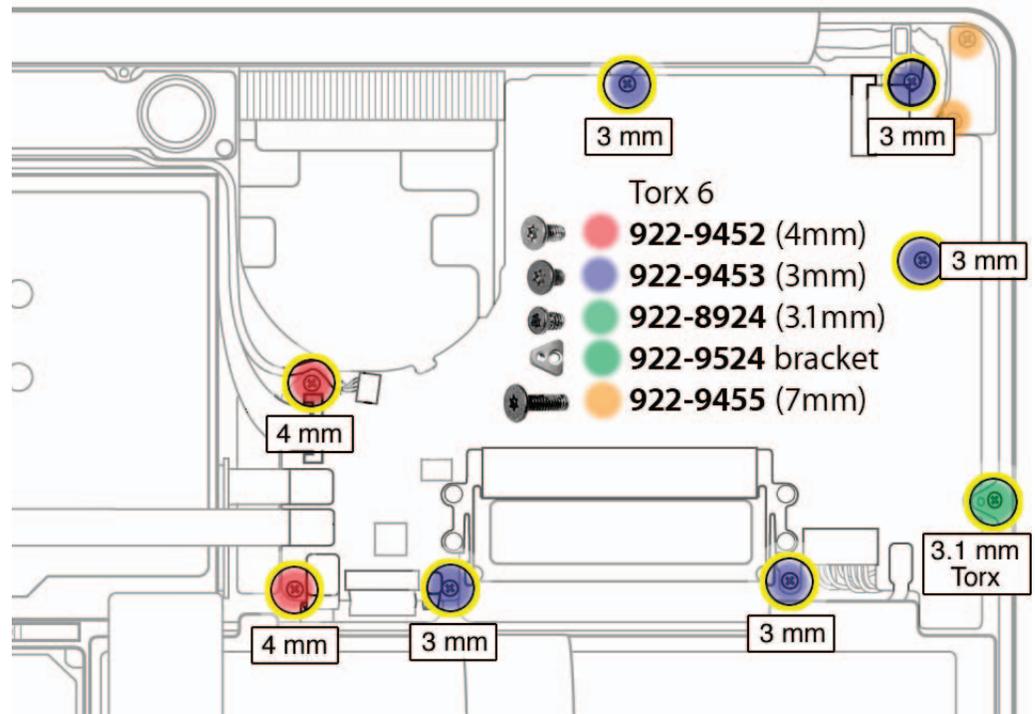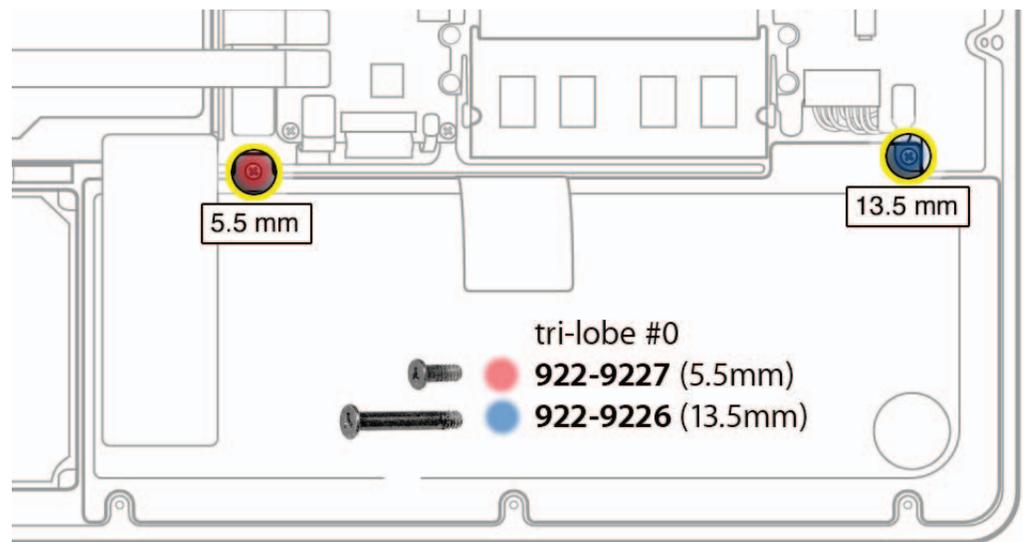
External Views

Front View

Slot View

Port View
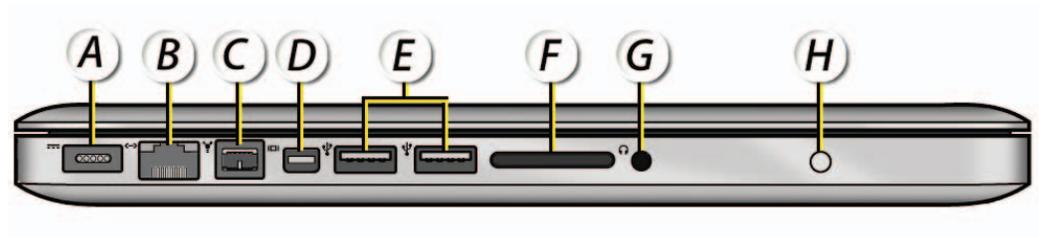
A = MagSafe Power

B = Gigabit Ethernet (10/100/1000 Base-T)

C = FireWire 800

D = Mini DisplayPort (video out)

E = USB 2.0

F = SD card slot

G = Headphone Out/Optical Digital Audio Out

H = Battery Indicator Light (BIL) Button

Internal Views

MacBook Pro (13-inch, Mid 2010)
Bottom Case Removed