Service Source

MacBook (13-inch, Aluminum, Late 2008)

MacBook (13-inch, Aluminum, Late 2008)

Contents

Take Apart

Views

Manual Updates

Updated 19 October 2008

Corrected internal links

Updated 17 October 2008

- Corrected internal links
- Take Apart: Reorganized topic sequence following Display Assembly.
- Exploded View: Display Assembly: Corrected display assembly part number to 661-4820.

Manual introduced 14 October 2008

Service Source

Basics

MacBook (13-inch, Aluminum, Late 2008)

Overview

The MacBook (13-inch, Aluminum, Late 2008) computer features a powerful new NVIDIA GeForce 9400M graphics processor, Multi-Touch trackpad, and aluminum body. Refer to more features below.

Identifying Features

The main features and service differences include:
- Aluminum case
- Glass backlit, glossy, widescreen display panel
- Mini DisplayPort connector
- Battery indicator button on left side
- Illustrations for removing the battery, hard drive, and memory cards are pictured on the inner side of the access door.
- Product identification label is on top case front edge, visible when the access door and battery are removed.
- Logic board, MagSafe board, and some other components have a uniform black color with no component silkscreening.

Product Configurations

The following table shows the MacBook (13-inch, Aluminum, Late 2008) model configurations at introduction:

Feature	Better (MN466)	Best (MB467)
Intel Core 2 Duo processor	2.0 GHz	2.4 GHz
Memory, DDR3 1066, SO-DIMMs	2 GB (2 x 1 GB); up to 4 GB (2 x 2 GB)	2 GB (2 x 1 GB); up to 4 GB (2 x 2 GB)
Hard Drive, Serial ATA 100 5400 rpm	160 GB; up to 320 GB	250 GB; up to 320 GB
Optical Drive (SATA)	8x DL Super, 9.5 mm	8x DL Super, 9.5 mm
Keyboard	Backlight on configure-to-order	Backlight
Housing	Aluminum	Aluminum
Display	13.3-inch glass LCD, 1280x800, 114 dpi, LED backlight, glossy finish	
Battery	45-Whr Lithium Ion	
Power Adapter	60 W MagSafe	

Note About Images in This Manual

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

Screw sizes shown are approximate and indicate the total length including the screw head.

Serial Number Location

Serial Number On Top Case

Remove the access door and battery to see the serial number on the inside front wall of the top case.
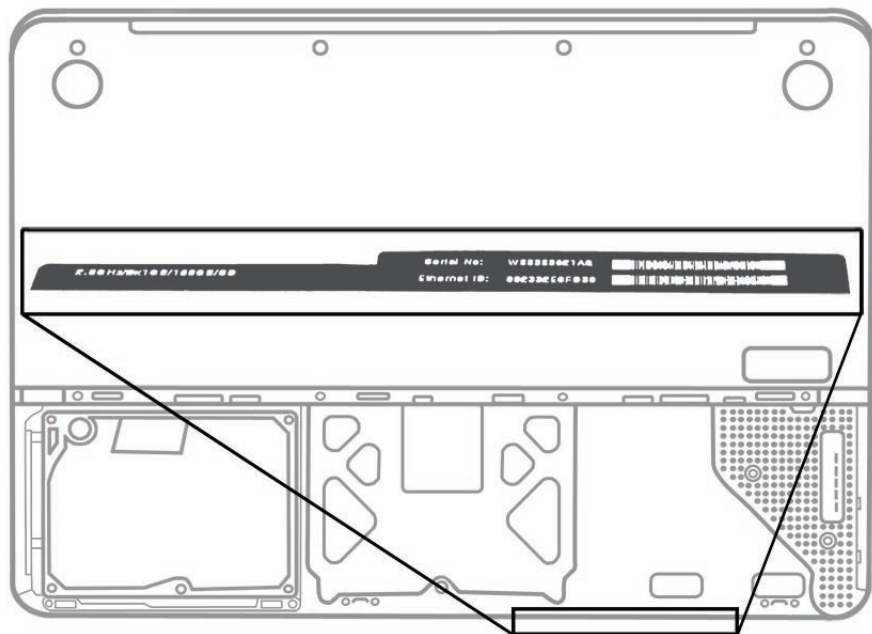
Transferring the Serial Number

When replacing a top case, retain the customer's top case until the repair is complete. Before installing the replacement top case, peel up the serial number label from the original top case and transfer it to the replacement.

General Information

Required 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 the computer:
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetic Phillips #0 screwdriver
- Magnetic Phillips #00 screwdriver (preferably with a long handle)
- Torx T6 screwdriver
- Black stick (Apple probe tool, part number 922-5065) or other nonconductive nylon or plastic flatblade tool
- Thermal grease (Apple thermal compound syringe, part number 922-7144)
- Alcohol wipes
- Permanent marking, felt-tip pen (optional)
- Pencil with eraser
- Foam wedge fixture for display assembly removal (Apple part number 922-8779)
- Kapton tape
- Digital volt meter (troubleshooting)

Refer to Knowledge Base article "Hand Tools for Desktop and Portable Repairs--AP/CA/EU/JP/LA/US" to purchase tools:

> **http://docs.info.apple.com/article.html?artnum=500200**

In addition, the following software programs are required for troubleshooting:
- Apple Service Diagnostic (ASD)
- Apple Hardware Test

The Glass Panel

Warning: The glass panel for this model is not a serviceable part. If the glass is broken or scratched, replace the display assembly. Attempting to remove the glass can permanently shatter the display face and damage other parts.

To clean the glass panel, use the Apple polishing cloth (922-8245) and iKlear Apple Polish or Brillianize anti-static spray cleaning solution. Alternatively, IPA (isopropyl alcohol) can be used.

Service Source

Troubleshooting

MacBook (13-inch, Aluminum, Late 2008)

General Troubleshooting

Update System Software

Important: Whenever possible before beginning troubleshooting, ensure the latest software and firmware updates have been applied.

Troubleshooting Theory

For general information on troubleshooting theory, refer to:

http://service.info.apple.com/service_training/en/006/troubleshoot/index.php?page=intro

Hardware vs. Software

For information on how to isolate a hardware issue from a software issue, refer to:

http://support.apple.com/kb/TS1388?viewlocale=en_US

TS1394—Mac OS X: Troubleshooting installation and software updates <**http://support.apple.com/kb/TS1394**>

HT2956—Troubleshooting Mac OS X installation from CD or DVD <**http://support.apple.com/kb/HT2956**>

For information on how to troubleshoot a software issue, refer to:

HT1199—Mac OS X: How to troubleshoot a software issue <**http://support.apple.com/kb/HT1199**>

Emerging Issues

For the latest on troubleshooting issues, refer to:

http://support.apple.com/kb/index?page=search&q=khot%20MacBook%20Emerging%20Issue

Functional Overview

Refer to this diagram for symptoms related to logic board connectors.

Camera (includes AirPort, Bluetooth, camera, and ambient light sensor):
- failure of any parts listed above
- no keyboard backlight
- no startup if AirPort cable short

Optical drive:
- no optical drive visible
- no startup from optical drive

Hard drive:
- no hard drive visible
- no startup from hard drive

Sleep LED, Infrared sensor, magnetic sleep sensor:
- no sleep LED status
- no infrared reception
- no sleep when display closed
- wakes from sleep
- no video on internal display (sensor stuck)

Trackpad, trackpad button thermal sensor:
- no cursor movement
- no click action
- runs slow (no sensor input)

Keyboard, power on button:
- no power
- nonresponsive keys

Keyboard backlight:
- no keyboard backlight

Memory:
- no startup
- pointer unresponsive and kernel panic
- video artifacts

Battery (under logic board):
- no power when battery only
- no power on

Battery indicator LEDs, battery button:
- no battery error
- no battery level while charging
- no battery level shown when button pressed

Microphone
- no integrated sound input

Left speaker
- no sound from left
- distorted sound on left

Heatsink thermal sensor
- no startup
- system shutdown
- pointer unresponsive

Connectors on the other side of logic board:

MagSafe connector (under logic board):
- no power on
- no battery charge

LCD, backlight:
- no video on internal LCD
- no backlight

Fan:
- intermittent shutdown
- freezes
- noisy fan

Right speaker/subwoofer:
- no sound from right speaker or subwoofer
- distorted sound from right or center

Block Diagram

Refer to this diagram to see how modules are interrelated.
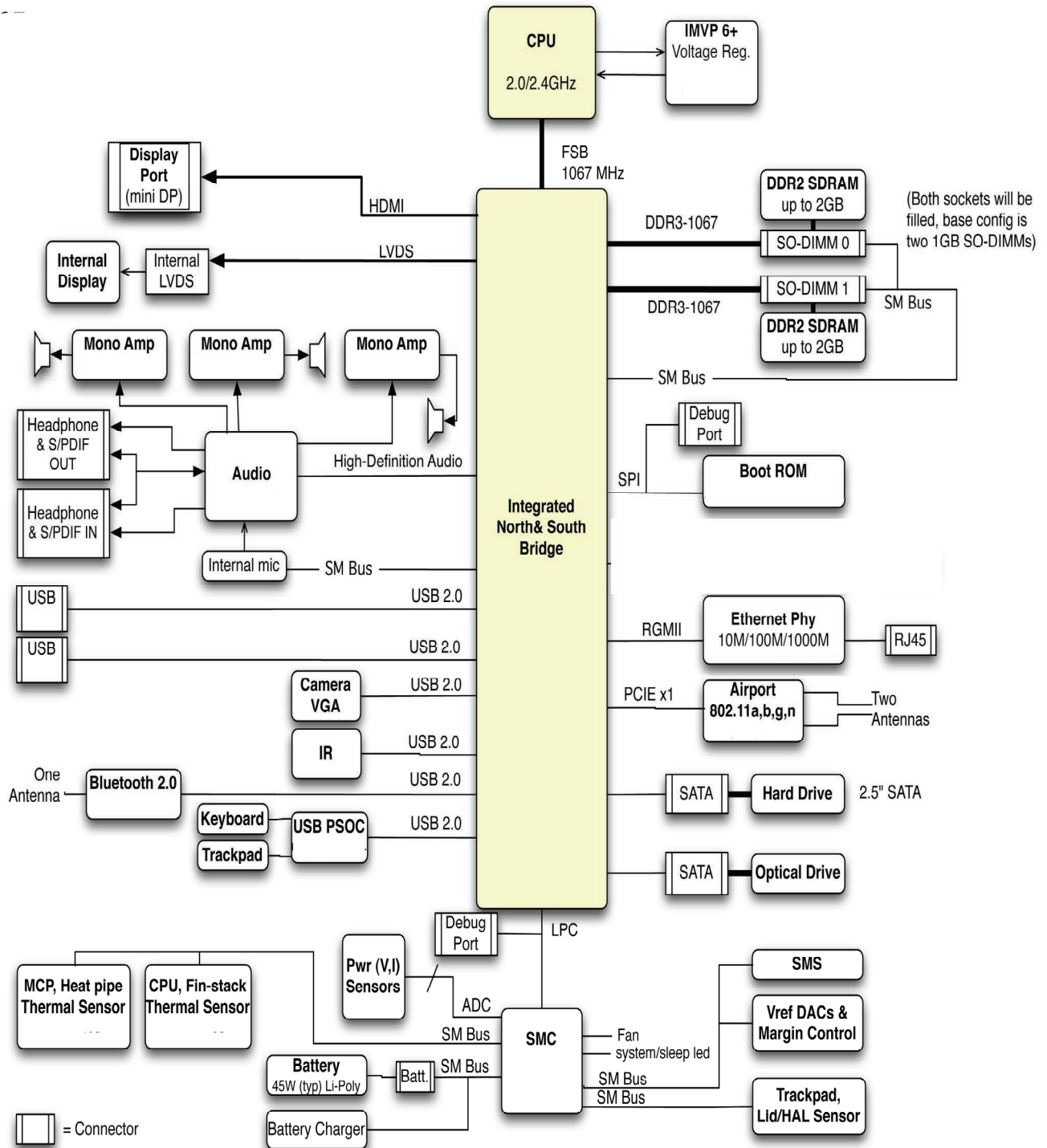
Liquid Submersion Indicators

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

For more information, refer to Knowledge Base article TS2274: "MacBook (Early 2008) and later: Liquid submersion indicators (LSI)."
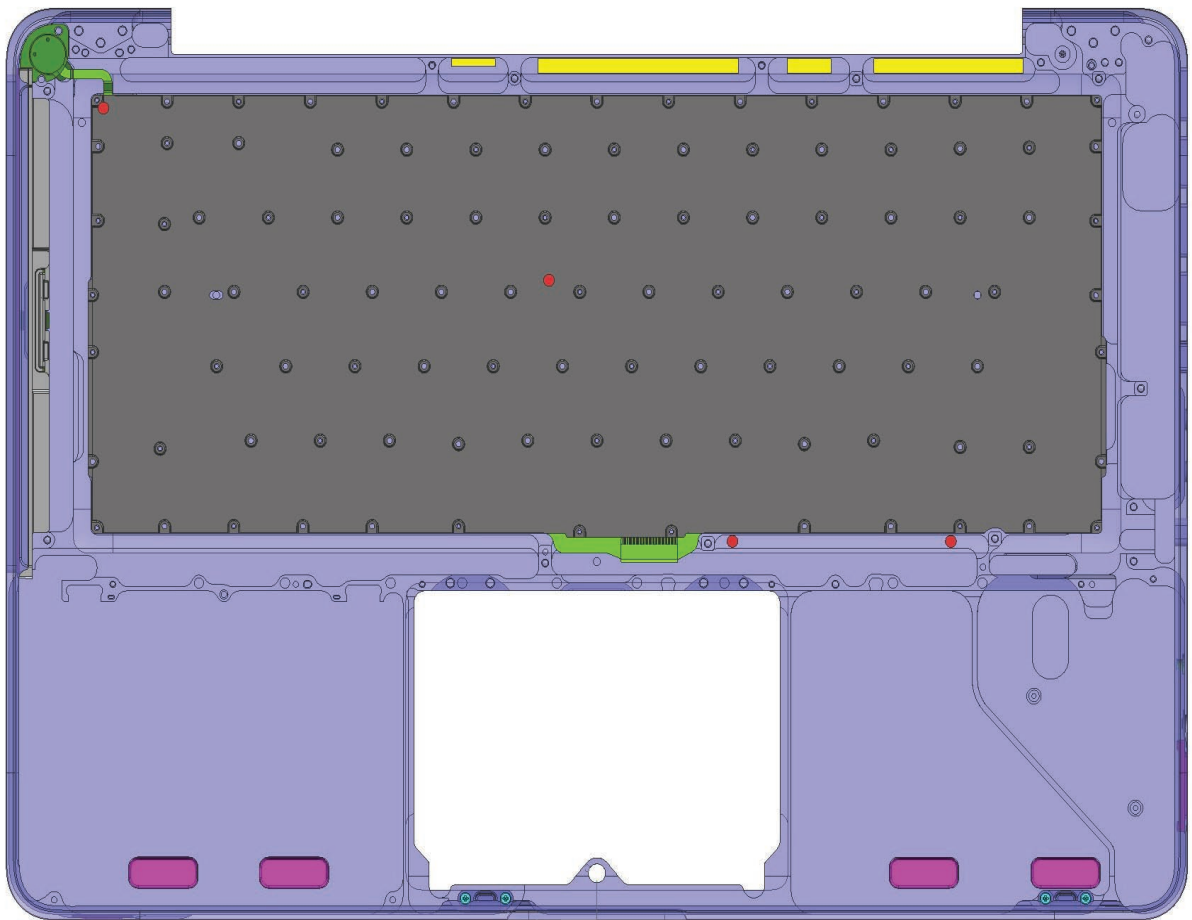
Common Reset Procedures

When a reset procedure is required for troubleshooting, follow the applicable steps:

Resetting the System Management Controller (SMC)

To reset power management via the SMC chip:

1. If the computer is on, turn it off.

2. Disconnect the power adapter and remove the main battery.

3. Hold the power button down for five seconds, then release.

4. Install the main battery and connect the power adapter.

5. Press the power button to restart the computer.

Resetting the SMC means you will also need to reset the date and time (using the Date & Time pane of System Preferences).

For more information:

> **http://www.apple.com/support**

> HT1411 — Apple Portables: Resetting the System Management Controller (SMC) <**http://support.apple.com/kb/HT1411**>

Resetting the Parameter RAM (PRAM)

To reset PRAM,

1. If the computer is on, turn it off.

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 the keyboard does not have an Option key, use the Alt key instead.

3. Turn on the computer.

4. Press and hold the Command-Option-P-R keys.

    Important: You must press this key combination before the gray screen appears.

5. Hold the keys down until the computer restarts and you hear the startup sound for the second time.

6. Release the keys.

For more information:

> **http://www.apple.com/support**

> HT1379 — Apple Portables: Resetting the PRAM <**http://support.apple.com/kb/HT1379**>

Starting Up in Safe Mode

A Safe Boot is a special way to start Mac OS X when troubleshooting. To start up into Safe Mode (Safe Boot),

1. Make sure the computer is shut down.

2. Press the power button.

3. Immediately after you hear the startup tone, press and hold the Shift key.

   Note: The Shift key should be held as soon as possible after the startup tone but not before.

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

For more information:

   http://www.apple.com/support

   HT1564—What is Safe Boot, Safe Mode? <**http://support.apple.com/kb/HT1564**>

   TS1884—Safe Boot take longer than normal startup <**http://support.apple.com/kb/TS1884**>

Symptom Charts

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

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

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 partly charged, charging with AC power. 3. If battery is not recognized, remove battery and try to run from AC only. 4. Reset SMC. 5. Verify with known-good battery.

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 shorting R5001 pads on logic board or removing all system power for 1 minute.) 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 -- customer battery possibly at fault or needs to be charged. Continue to verify customer 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. Customer battery may be run down, or not recognized. Verify customer battery in a known-good system is recognized and accepting a charge. Confirm customer battery is not consumed nor defective.	Yes	Battery is recognized, charging and health is good. Return to test unit with customer battery and AC adapter power. Go to step 6.	
	No	Replace customer battery for not charging (P10) or not recognized (P11). Customer 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 customer battery and AC adapter power. Go to step 6.	
	No	Logic board is expected to power on with battery only. Inspect and test power on key. 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 customer battery will also charge. Review battery health to ensure customer 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. With DVM, verify voltage presence of Q7001, pin 5 is 16.7Vdc with AC adapter connected. Reseat or test known-good MagSafe cable to achieve power for logic board.	Yes	Logic board has power adapter energy to start system, 16.7V found on Q7001. MagSafe cable reseat or replacement resolved issue. If still no system power on indications, go to step 10	**X03**
	No	No voltage measured on Q7001, AC adapter power not going to logic board power supplies. Replace logic board.	**M21**
10. Test and inspect Top Case Power Button. Stuck or open power on key or keyboard disconnect can disable the power on of system. If button does not work, locate R5015 pads on logic board just above trackpad connector, and short pads to power up logic board. If power on key is stuck, keyboard cable must be disconnected for R5015 to work. Does system power on? (Reconnect keyboard cable to confirm bad or intermittent connections.)	Yes	Power on key works fine, issue resolved.	
		Power on key works when keyboard cable is reseated.	
		Power on key appears to be stuck, had to remove keyboard cable for R5015 power on. Replace top case for stuck power on key	**K05**
	No	No logic board power on when shorting R5015 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 start up • No startup chime, some video activity, Apple logo, startup spin dial • 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 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 Clear PRAM to set default startup device to internal hard disk drive (HDD).	Yes	User hard drive bootable, issue resolved default settings.	
	No	Customer 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 customer memory and/or swap in known-good memory to isolate bad memory and replace defective parts.	Yes	Customer 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 Alt (Option) key during startup and verify there is a bootable hard drive shown in Startup Manager. Choose customer hard drive. Does start up from this drive work?	Yes	System starting up from customer hard drive. Startup issue resolved	
	No	Customer 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 - customer 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. Continue to verify hard drive issues, go to step 8	
		Defective optical drive cable found and replaced. Continue to verify hard drive issues, go to step 8	**X03**
		Defective optical drive found and replaced. Continue to verify hard drive issues, 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 customer hard drive listed in Disk Utility?	Yes	Customer 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 customer hard drive, is there a defective hard drive component to replace?	Yes	Reseat of SATA cable now has customer hard drive visible in Disk Utility, go to step 10	
		Defective hard drive SATA cable found and replaced, now has customer hard drive visible in Disk Utility, go to step 10	**X03**
		Suspect customer hard drive defective, attempt OS restore, go to step 10	
	No	Known-good hard drive and known-good hard drive 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 customer hard drive and repair permissions if system OS found on hard drive. Is hard drive bootable after software repairs?	Yes	OS on customer hard drive repaired, issue resolved.	
	No	Hard drive not bootable, perhaps missing OS, go to step 12	
12. Use Disk Utility to partition customer hard drive with one GUID partition then restore Mac OS from product OS install disc. Is hard drive bootable after OS install?	Yes	Customer hard drive now starts up from new OS image, issue resolved	
	No	Replace hard drive.	**H02**

Intermittent Shutdown

Unlikely cause: hard drive, optical drive

Quick Check

Symptom	Quick Check
Intermittent shutdown • Powers off during startup • Powers off with desktop use	1. Verify battery charge status 2. Check AC adapter MagSafe connector and connection with system 3. Reset SMC and PRAM 4. Start up with shift key down for safe mode 5. Start up from known-good bootable device 6. Check system.log info for shutdown cause 7. Run AHT /ASD for sensors + thermal test

Deep Dive

Check	Result	Action	Code
1. Identify shutdown code recorded in system log file. Open the system.log file with console application. Search for occurrences of "previous shutdown cause" return codes. Verify system log looking for codes that indicate abnormal shutdown events.	Yes	Check for sudden shutdown error code explanation in Knowledge Base and shutdown causes table in service manual to find expected cause of shutdown, and check item accordingly : -Intermittent power means checking battery health , AC source and MagSafe cable seating ; go to step 4 -Sleep means running sleep sensor test; go to step 7 -Overtemp means checking for clogged heatsink, shorted sensors cables or defective fan; go to step 8	
	No	system.log lists only normal shutdown codes, no codes related to heat sensors or power concerns. Go to step 2	

2. Reset SMC and clear PRAM; then monitor system performance to verify if system shutdowns cease. Are shutdown symptoms and events gone?	Yes	Shutdown cause related to SMC or PRAM resolved by changing to default settings.	
	No	Shutdown event still occurs. Go to step 3.	
3. Start up from product OS install disc or from an external hard drive with product Mac OS. Are shutdown symptoms and events gone while starting up from this known-good Mac OS?	Yes	Shutdown events cease on known-good OS. Reinstall Mac OS on customer hard drive and update OS with latest version and check if bootROM updates are available.	
	No	Symptoms unchanged - go to step 4	
4. Check system running on battery only. Use known-good charged battery. Verify that shutdown/reset/sleep issues disappear when known-good battery is used without AC adapter.	Yes	Recharge customer battery and retest. Check for customer battery health in Apple System Profiler or run battery testing utility, and replace if reported battery health is reported bad or consumed.	**P09**
	No	Symptoms unchanged - Go to step 5	
5. Check with known-good AC adapter source only Remove battery and use known-good AC adapter. Does the shutdown/reset/sleep issue disappear with known-good adapter?	Yes	Faulty adapter. Replace customer AC adapter if AC cable and duckhead were confirmed faulty.	**P14**
	No	Symptoms unchanged - Go to step 6	
6. Check if power removed error reported "improper shutdown detected" in system.log If shutdown error is related to power removed shutdown cause, run ASD and check for overvoltage sensor failure reported.	Yes	If power failure related, check adapter-related connections (stuck pins, cable damage, etc.). If so, replace MagSafe port connector.	**X03**
	No	Go to step 9	

7. Check if sleep event happens repeatedly in system.log If sleep/wake events are repeatedly reported, plug external monitor and run ASD to check for sleep sensor test. Verify if sleep sensor test is failing.	Yes	Check for intermittently shorted sleep sensor in top case. If damaged, replace sensor/cable of top case.	**X03**
		Check IR cable is properly seated	**X03**
		Reseat and retest sleep sensor with ASD. If failing again, check for presence of magnet in display assembly above sensor.	**X03**
		If magnet present, replace sensor/cable or top case and retest. If still sleep sensing failing, replace logic board	**M22**
		if magnet missing replace display assembly	**L15**
	No	Go to step 8	
8. Check if over temp cause reported in system.log If shutdown error is related to over temp shutdown cause, run ASD and verify that a sensor or fan failure is reported.	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 does not happen with known-good fan, replace fan.	**M18**
		-If over temp failure reported check for cause of over temp like obstructed vent, dust in heatsink fin, or clogged fan and retest. If still failing replace part where sensor is located (logic board, battery, display assembly or trackpad) according to the sensor location table of service manual. Go to step 9	**X03**
	No	Replace Thermal module Go to step 9	**X10**

9. Isolate if issue solved Verify that shutdown/issue does not happen anymore after part exchange.	Yes	Issue fixed	
	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 Alt 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 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	Reseat LVDS cable on logic board then retest. If symptom unchanged 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. 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 IR/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 IR/sleep cable (or enclosing top case)	**X13**
	No	Symptoms unchanged - Go to Step 9	
9. Check for No Backlight Condition. Power on unit. Using a lamp or bright light source, inspect for faint image, and verify that any faint image appears.	Yes	Image visible - check and reseat LED backlight cable connector on logic board, Inspect cables for damage near clutches: . if damaged, replace display assembly and go to step 11 . if cable is not damaged, reseat it 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 backlight 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. Test system with known-good battery.
	3. Test customer's battery in known-good system.

Deep Dive

Check	Result	Action	Code
1. Does the MagSafe LED go green to 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 for system (M01)	
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	Customer 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	Customer 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 customer 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 customer battery (P10 not charging or P11 not recognized)	**P10 or P11**
	No	Go to step 9	
9. Inspect customer battery contacts and battery cable connector for corrosion or obstructions.	Yes	Clear obstructions and replace the battery harness cable if 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 customer battery LED indicator assembly. Go to step 3	**X03**
	No	Replace customer logic board.	**M20**
13. Open Apple System Profiler and click on the Power Tab on the left. Is the battery over 300 cycle counts?	Yes	Battery has been consumed, and customer will need to purchase a replacement.	
	No	Go to step 14.	
14. Is battery less than a year old?	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. Customer 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 customer battery.	**P08**
17. With battery charge greater than 20% does battery support system operation without AC connected?	Yes	Customer 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 customer 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 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. Use the "Portable Computer Battery Screening Process for Apple Service Providers" (**Knowledge Base CP165**). 2. Verify no applications have runaway processes with the CPU. See "Runaway applications can shorten battery runtime" (**Knowedge Base TS1473**). 3. Use "Apple Portables: Battery Life" (**Knowledge Base HT1466**) to screen for short battery run time. 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. With the battery removed, unplug AC adapter, reset SMC by holding the power button for 5 seconds

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 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 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. Remove battery, unplug AC adapter, and reset SMC by holding the power button for 5 seconds.

Deep Dive

Check	Result	Action	Code
1. Verify that the MagSafe LED is green or amber while connecting a known-good AC adapter on customer 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 amber while connecting known-good power adapter on customer system.	Yes	Bad MagSafe interconnect board. Issue resolved.	**X03**
	No	Go to step 4	

4. Does the customer'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 customer 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 customer. 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.

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	Replace the affected part.	**P08**
	No	Go to step 3	
3. Refer to Liquid Submersion Indicators. Are any of the spill sensors red?	Yes	Refer to Knowledge Base article TS2274 "MacBook (Early 2008) and later: Liquid submersion indicators (LSI)."	
		Go to step 4	
4. Is the computer operating normally?	Yes	This could be related to normal operation. Refer to **Knowledge Base: 24947 Odors may be present short-term**.	
	No	Please refer to best related troubleshooting section. If after inspecting the unit you feel there is a possible safety issue with the computer or AC adapter, please notify Apple.	

Battery Leaking or Swollen

Quick Check

Symptom	Quick Check
Battery Leaking or Swollen • Computer wobbles • Trackpad button does not work • Battery pack case has opened. • Access door will not close	1. Check if the battery is covered under a repair extension program. Reference: MacBook, MacBook Pro (15-inch) or MacBook Pro (17-inch) with swollen battery article (**Knowledge Base TS2358**). 2. Use the "Portable Computer Battery Screening Process for Apple Service Providers" (**Knowledge Base CP165**) and use "Battery pack is visibly deformed" case under section 2E. Use symptom code **P13**. 3. Check locking lever mechanism.

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 customer. If not, document reported symptom and send feedback to **smfeedback@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 assembly, 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 install media (10.5.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 install media. Verify Network Link status active by using Network Utility on install DVD. If the 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 the same subnet. Ensure the target computer's IP address is valid, on the 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 the 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 the logic board.	**M10**

AirPort/Bluetooth: Defective Wireless Devices

Unlikely cause: power adapter, battery, speakers, optical drive, hard drive, fan, camera, 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. Check that base station is not using unsupported connection and encryption protocols. 3. Check for nearby interference sources such as microwave ovens or cordless phones (**Knowledge Base HT1365**) 4. Check the number of users trying to use AirPort in the area for possible network congestion. 5. Isolate OS by booting from original install media (10.5.x). Attempt to connect to base station (AirPort) or pair with wireless keyboard (Bluetooth). 6. Reset PRAM.

Deep Dive

Check	Result	Action	Code
1. Open System Profiler, check to see if AirPort or Bluetooth is recognized. Ensure software and firmware updates for AirPort and Bluetooth have been applied.	Yes	(AirPort) Ensure MAC address filtering is not enabled on the base station. (Bluetooth) Ensure target devices are set to discoverable.	
	No	If card is not detected or software updates do not resolve issue, go to step 2.	

2. Reseat the camera cable connection to the logic board.	Yes	Loose logic board connection.	**N04**
	No	AirPort issue, go to step 3, Bluetooth issue go to step 7.	
3. (AirPort) Verify the antenna connections to the AirPort card are not reversed or loose. Reseat antenna and I/O cable connections.	Yes	Loose connections or crossed antenna.	**N04**
	No	If the connectors are secure, antenna connections not reversed and show no signs of damage or wear, go to step 4.	
4. (AirPort) Try a known-good AirPort antenna.	Yes	Replace AirPort antenna.	**N14**
	No	Continue to use known-good antenna, go to step 5.	
5. (AirPort) Try a known-good AirPort card.	Yes	Replace AirPort card.	**N12**
	No	Go to step 6.	
6. (AirPort) Try a known-good display assembly if available.	Yes	Replace display assembly.	**L16**
	No	Replace logic board.	**M11**
7. (Bluetooth) Enable Bluetooth and try a known good display assembly if available. Bluetooth circuitry in the clamshell is not accessible.	Yes	Replace display assembly.	**L16**
	No	Replace logic board.	**M11**

No/Poor Wireless Signal

Unlikely cause: power adapter, battery, speakers, optical drive, hard drive, fan, camera, 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
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 (**Knowledge Base HT1365**). 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 install media (10.5.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	Use Software Update to 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	If card is not detected, go to M11 - AirPort/Bluetooth - Defective wireless devices.	

2. Reseat the camera cable connection to the logic board.	Yes	Loose logic board connection	N04
	No	Go to step 3.	
3. Verify the antenna connections to the AirPort card are not reversed or loose. Reseat antenna and I/O cable connections.	Yes	Loose connections or crossed antenna	N04
	No	If the connectors are secure, antenna connections not reversed and show no signs of damage or wear, go to step 4.	
4. Try a known-good AirPort antenna.	Yes	Replace AirPort antenna.	N14
	No	Continue to use known good antenna, go to step 5.	
5. Try a known-good AirPort card.	Yes	Replace AirPort card.	N12
	No	Continue to use known-good antenna & card; go to step 6.	
6. Try a known-good display assembly if available.	Yes	Replace display assembly.	L16
	No	Replace logic board.	M11

Wireless Input Device Loses Connection

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

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
Wireless Input Device Loses Connection	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. 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 assembly. Is the Bluetooth radio present, on and pairing with a known-good device?	Yes	Replace display assembly.	**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. | |

AirPort Card: Kernel Panic

Unlikely cause: power adapter, battery, speakers, optical drive, hard drive, fan, camera, 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 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 install media (10.5.x). 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. Use Software Update to make sure all AirPort/Bluetooth software and firmware updates have been applied. Ensure MAC address filtering is not enabled on the base station. Is kernel panic resolved?	Yes	Software issue.	
	No	Go to step 2.	

2. Reseat the camera cable connection to the logic board. Is kernel panic resolved?	Yes	Go to step 4.	
	No	Go to step 3.	
3. Isolate AirPort card by removing the I/O connection from the AirPort card. Reconnect camera cable connection to logic board. Is kernel panic resolved?	Yes	Go to step 4.	
	No	Go to M06 Kernel Panic / System Crashes.	
4. Connect and test with a known-good AirPort card. Is kernel panic resolved?	Yes	Replace AirPort card.	**N13**
	No	Replace display assembly.	**L16**

Wireless Performance Issue / Slow Connection

Unlikely cause: power adapter, battery, speakers, optical drive, hard drive, fan, camera, 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
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 (**Knowledge Base HT1365**) 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 install media (10.5.x). 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. Retest AirPort performance. Bluetooth circuitry in the clamshell is not accessible. Refer to **Knowledge Base TS1809**.	Yes	Possible AirPort interference from the Bluetooth card. Change AirPort base station channel. (**Knowledge Base TS1809**.)	**N06**
	No	Continue by checking connections, go to step 3	
3. Reseat the camera cable connection to the logic board.	Yes	Loose logic board connection	**N04**
	No	AirPort issue, go to step 4, Bluetooth issue, go to step 8.	
4. (AirPort) Verify the antenna connections to the AirPort card are not reversed or loose. Reseat antenna and I/O cable connections.	Yes	Loose connection or crossed antenna	**N04**
	No	If the connectors are secure, antenna connections not reversed and show no signs of damage or wear, go to step 5	
5. (AirPort) Try a known-good AirPort antenna.	Yes	Replace AirPort antenna.	**N14**
	No	Continue to use known good antenna, go to step 6.	
6. (AirPort) Try a known-good AirPort card.	Yes	Replace AirPort card.	**N12**
	No	Continue to use known-good antenna & card, go to step 7.	
7. (AirPort) Try a known-good display assembly if available.	Yes	Replace display assembly.	**L16**
	No	Replace logic board.	**M11**
8. (Bluetooth) Enable Bluetooth and try a known-good display assembly if available.	Yes	Replace display assembly.	**L16**
	No	Replace logic board.	**M11**

Wireless Input Device Doesn't Pair

Unlikely cause: display assembly, 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 or mouse	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. 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.	**L 16**
	No	Replace logic board. Optional step 7.	**M 11**
7. With the logic board replacement, is the Bluetooth now pairing?	Yes	Bad logic board. Issue resolved.	**M 11**
	No	All parts replaced. Try minimum configuration troubleshooting.	

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 **smfeedback@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. 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
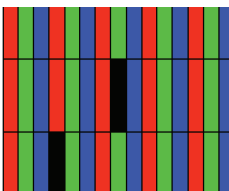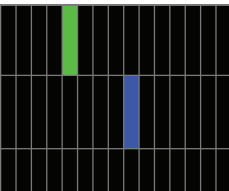
Check	Result	Action	Code
1. Determine if "defects" are dust/debris on surface of glass panel.	Yes	Clean glass panel.	
	No	Go to step 2.	
2. Determine if bright pixel defects exceed the acceptable number. See **http://support.apple.com/kb/HT1721**.	Yes	Replace display assembly.	**L08**
	No	LCD meets bright pixel defect specifications. Go to step 3.	
3. Determine if dark pixel defects exceed the acceptable number. See **http://support.apple.com/kb/HT1721**.	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 **http://support.apple.com/kb/HT1721**.	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. Vertical or horizontal line or group of lines are in this category. Verify if display 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. Reseat the LVDS cable to the logic board. Did lines in question go away?	Yes	Issue resolved by reseating loose LVDS cable.	
	No	Go to step 3..	
3. Substitute a known-good display clamshell to test logic board video output. Is normal video restored?.	Yes	Replace display assembly.	**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. 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

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 DVD 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 Apple logo on the back of display glows.	Yes	Image present but backlight is not on. Check logic board connections. Go to step 5.	
	No	Go to No Video symptom code flow.	
5. 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 code flow.	

Backlight Issue / No Backlight

Quick Check

Symptom	Quick Check
Backlight Issue / No Backlight	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. Unplug and 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 Apple logo on the back of display	Yes	Backlight operating. Go to step 5.	
	No	Go to step 4.	
4. Swap memory with known-good memory to determine if video.	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

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 P04 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	Verify whether existing symptom code applies to the issue reported by the user. If not, document reported symptom and send feedback to **smfeedback@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 Knowledge Base article "Apple Portables: Hard Drives and Noise " **http://support.apple.com/kb/TS2354**

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 H01 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 Eject Test step 8.	
	No	Go to Optical Drive Read/Write Data Error troubleshooting page.	

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)**

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 **smfeedback@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/mouse or 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.	

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 the Input Menu in the menu bar. Test the keyboard. 2. Confirm correct keyboard layout is selected. 3. Update to the latest system software. 4. Press Caps Lock, if the Caps Lock light goes on to show at least a partial connection to the main logic board.

Deep Dive

Check	Result	Action	Code
1. If specific keys are not working, confirm if they are physically broken.	Yes	Replace top case. Go to step 4.	
	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

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. Repair is a top case replacement. Use the following symptom code: - Inoperative keys (**K01**) - Sticky keys (**K05**).

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 correct and click-depth set screw is at factory setting.	Yes	Replace top case. Go to step 6.	
	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 top case work?	Yes	Replace top case.	**K02**
	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 this computer model has a keyboard backlight option by checking the configuration label in the battery bay. **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. Cover the ambient light sensor, located near 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**
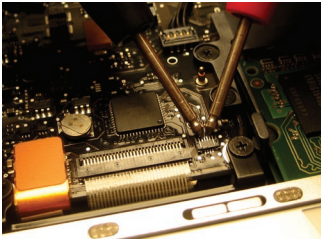
Built-in Keyboard Is Not Recognized

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 keyboard/trackpad is now seen in 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	Replace top case. Go to step 5.	**K11**
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 top case. Go to step 6.	**K02**
	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 top case work? | Yes | Replace top case for defective trackpad. Issue resolved. | K02 |
| | 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 "Pairing your Apple Remote with your computer" (**Knowledge Base HT1619**).

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.	Verify that Apple Remote now works.	Yes	Issue resolved.	
		No	Check and reseat IR/sleep LED board cable connection at logic board. Go to step 4.	
4.	Does the Apple Remote now work?	Yes	Issue resolved.	
		No	Replace the hard drive front bracket (includes IR/sleep 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	Verify whether existing symptom code applies to the issue reported by the user. If not, document reported symptom and send feedback to **smfeedback@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. Inspect keyboard connection to logic board. 3. Try logic board power-on pads to determine open or closed power-on key. Closed circuit will not allow on-board switch to work. 4. If stuck down or closed, remove keyboard cable from logic board and try on board switch again to determine if top case is defective. 5. If logic board will not power on with keyboard cable removed, troubleshoot no power/no boot.

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. Remove 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.	
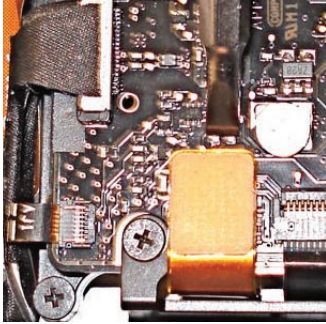
3.	Inspect keyboard flex cable for loose or damaged connections. Align and reseat to flex cable to ensure proper connections. Does power-on key now work correctly?	Yes	Cable reseat restored power-on key operation.	
		No	Power-on key still appears to be stuck or open. Go to step 4.	
4.	Use conductive tool to assert power on by touching power-on switch pads (R5015, located just above trackpad connector) on logic board.	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 the internal keyboard flex cable and assert power-on switch pads on logic board. 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 M01: No power/ not booting	

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 "Apple Portables: Operating Temperature" (**Knowledge Base HT1778**) to inform user it is operating normally.	
	No	Go to step 2.	
2. Are there runaway applications? See "Runaway applications can shorten battery run time" (**Knowledge Base TS1473**).	Yes	Check with the 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 the 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 the 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. Inspect and reseat connections to thermal sensors throughout the system, run test for sensor monitoring.	Yes	Thermal module or other sensor reseat resolved issue.	X99
	No	Replace logic board if sensor error. Go to step 9.	
9. After logic board replacement, is the computer running as expected?	Yes	Bad logic board. Issue resolved.	M23
	No	Use minimum configuration troubleshooting to isolate the issue.	

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 **smfeedback@apple.com** stating that a suitable symptom code could not be found.

Service Source

Take Apart

MacBook (13-inch, Aluminum, Late 2008)

General Information

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 tip up and not be fully seated.

    Examples:
    - fan cable
    - battery indicator light cable
    - heatsink sensor
    - left speaker cable
    - microphone cable (underside)

Connector Types on Logic Board

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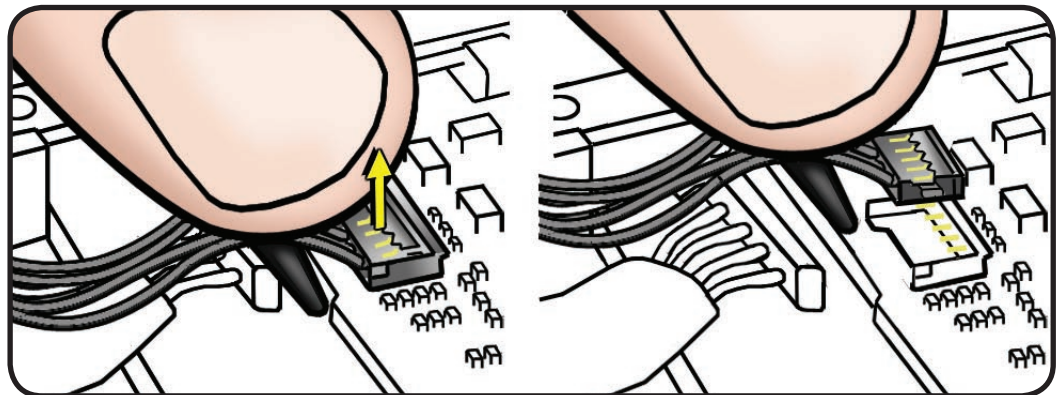
Locking Lever

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

    Examples:
    - IR/sleep cable
    - keyboard cable
    - keyboard backlight cable
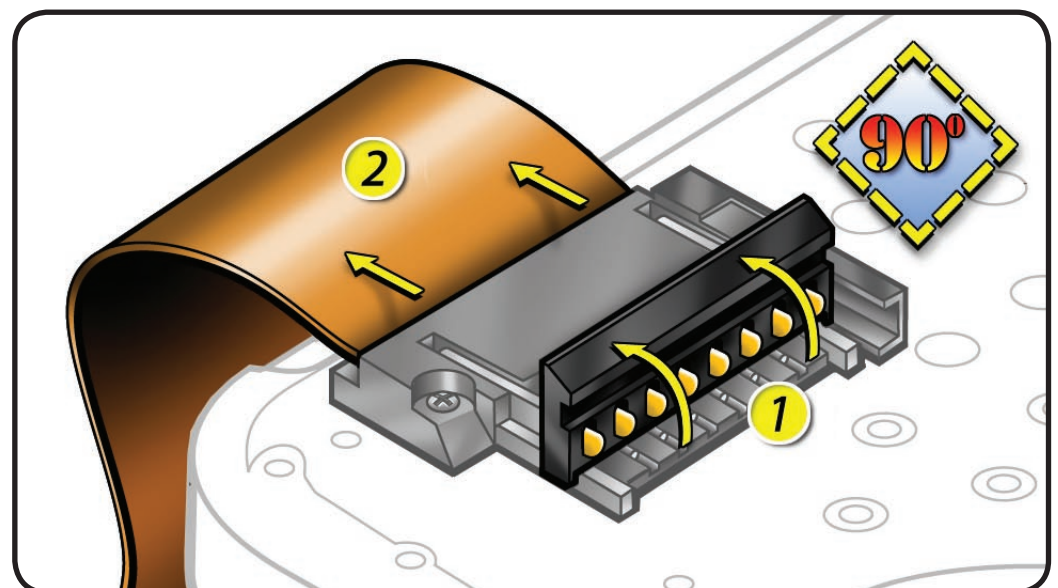
Horizontal Install

- Pull connector, not cable, to remove.
- Slide connector into receptacle on same horizontal plane as board.

    Examples:
    - right speaker/ subwoofer cable
    - MagSafe cable on underside of board
    - battery power cable on underside of board
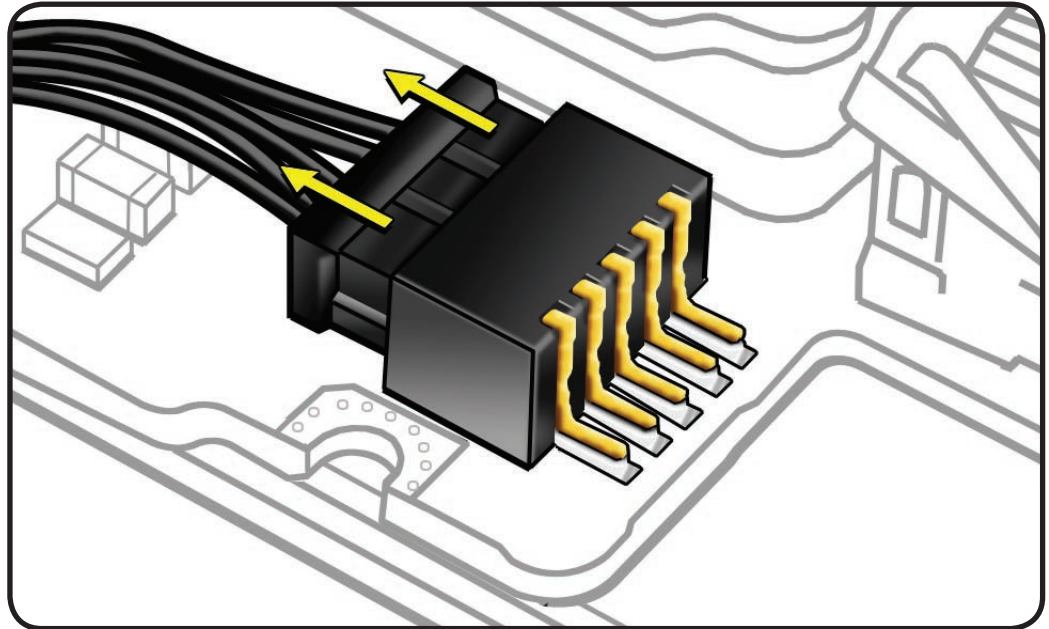
Thin, Multi-Pin Horizontal Insert

- Flip up locking bar, if present.
- Use fingers or tweezers to slide out cable evenly on same horizontal plane.
- Grasp cable—not locking bar nor connector—to disconnect.
- Slide connector into receptacle on same horizontal plane as board.
- Reseat locking bar, if present to secure connector

    Examples:
    - LVDS cable
    - Camera cable
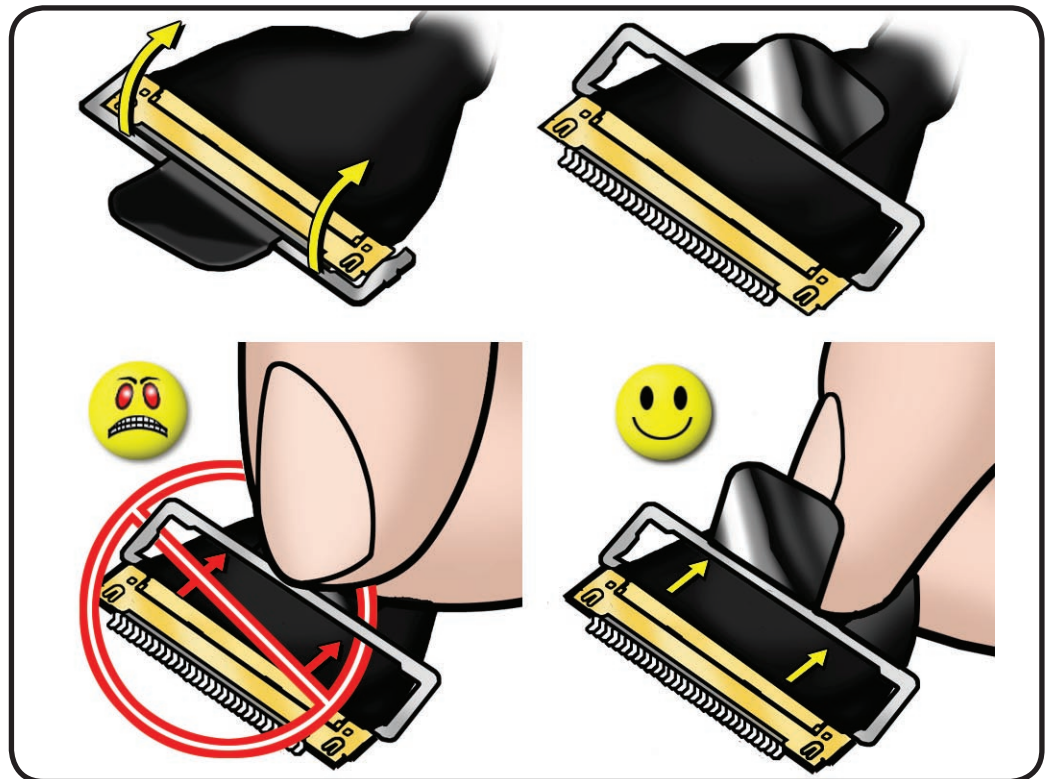
Low-Profile Solid Platform Flex

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

  Examples:
  - optical drive flex cable
  - trackpad flex cable
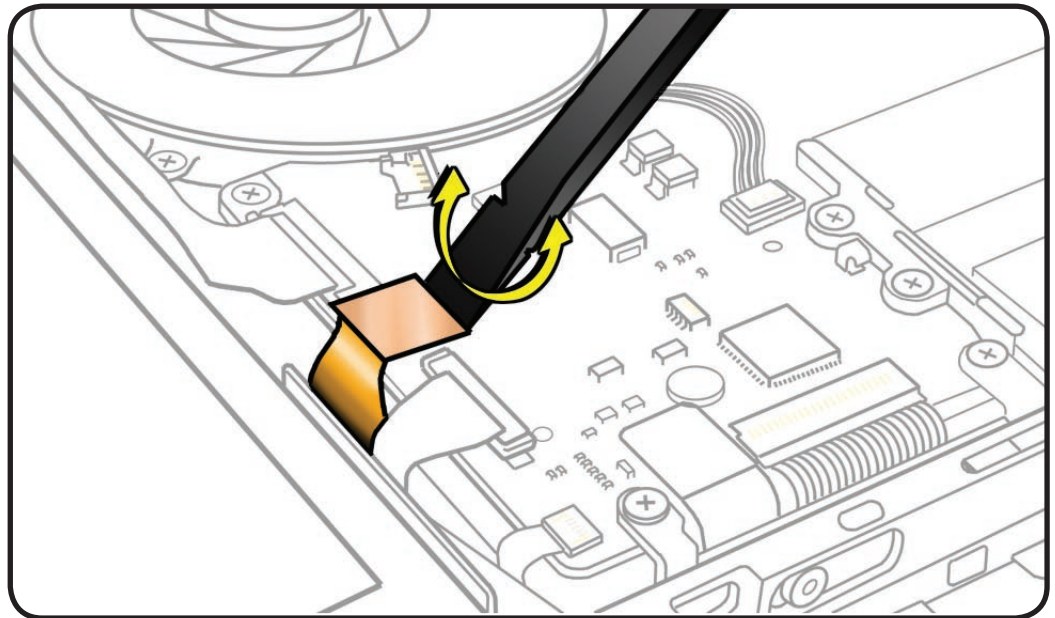
Multi-Pin Vertical Insert

- Use fingernails to remove evenly.
- Insert connector parallel to board.

  Examples:
  - hard drive connector cable
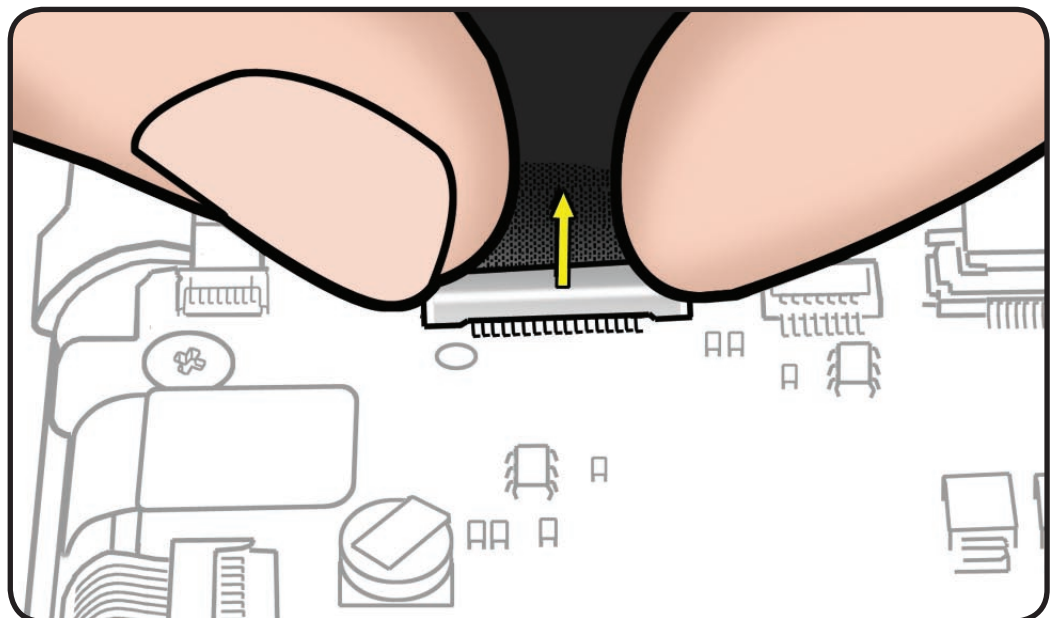
Icon Legend

The following icons are used in this chapter:

Icon	Meaning
	Warning or Caution
	Check mark; make sure you do this
	Challenging procedure; requires more thought and/or time until you are familiar with it

Temperature Concerns

The normal operating temperature of this computer is well within national and international safety standards. Nevertheless, customers may be concerned about the generated heat. To prevent an unneeded repair, you can compare a customer's computer to a running model, if available, at your repair site. For more information on temperature concerns and customer perception, refer to Knowledge Base article 30612 "Apple Portables: Operating Temperature."

http://docs.info.apple.com/article.html?artnum=30612

Replacement Steps

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

Screw Sizes

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

Access Door

First Steps:

Warning:
- Shut down computer.
- Wait 10 minutes
- Unplug all cables.
- Put on ESD strap.
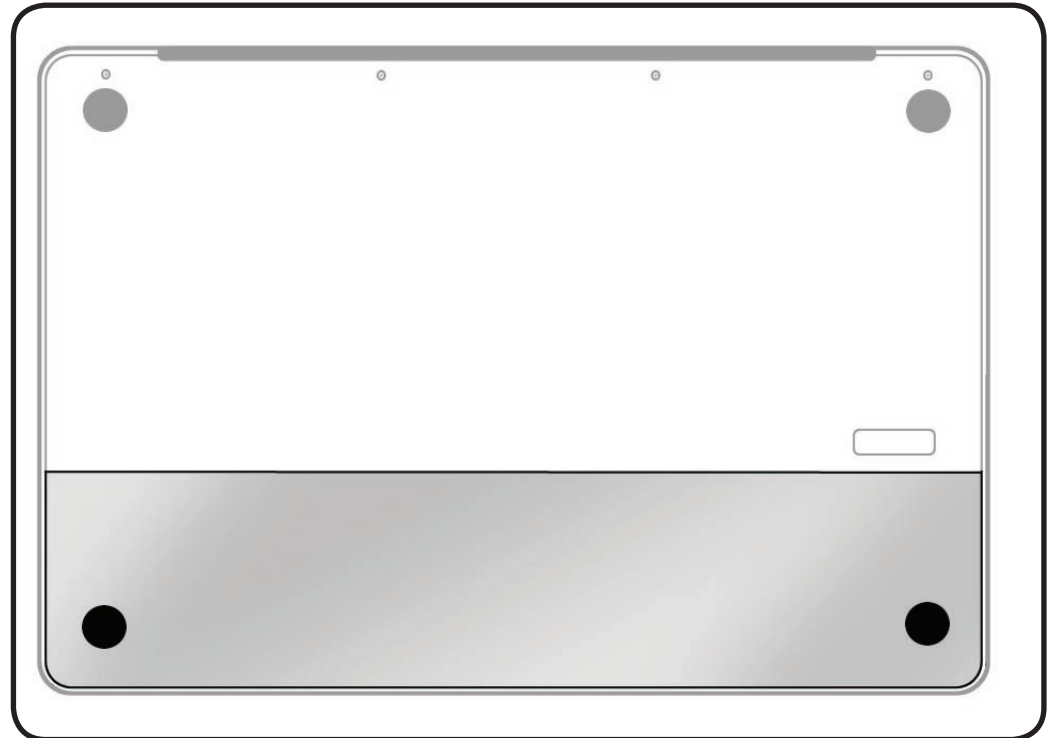
Tools

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

Removal

1 Press locking lever.
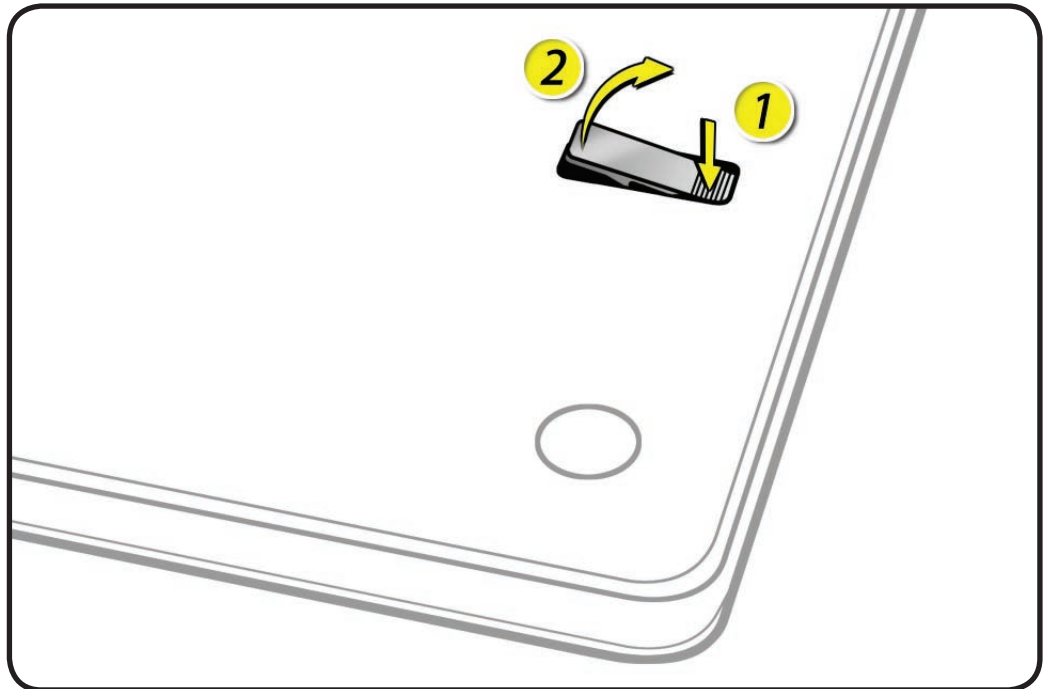
2 Lift off access door.
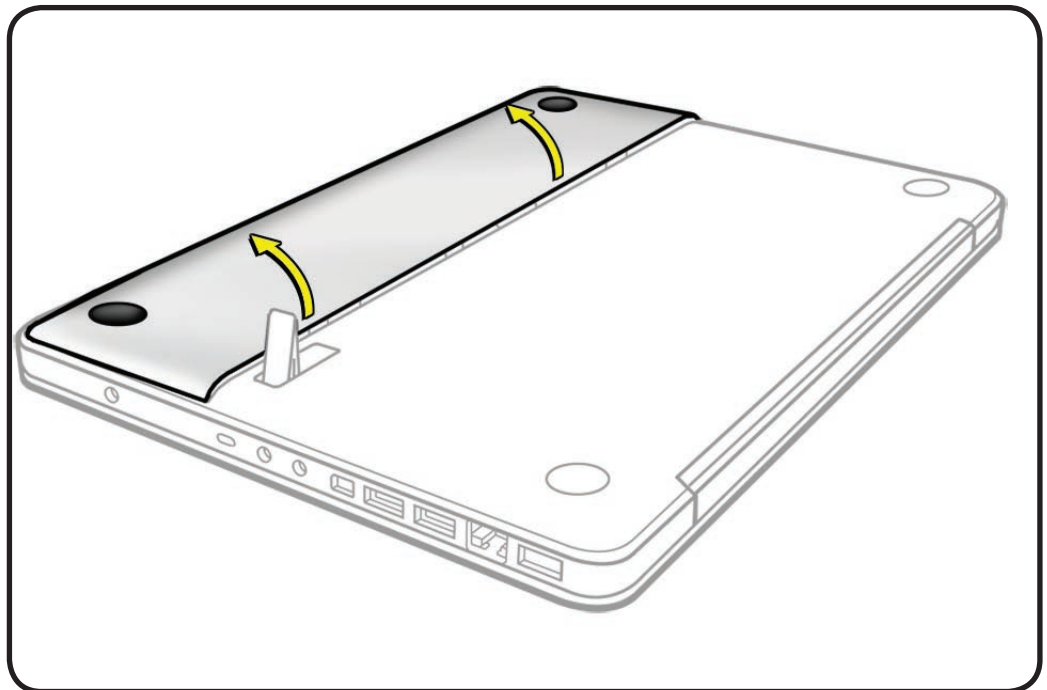
Replacement

1 Attach front of door.

2 Align corners and close door.

3 Close locking lever.
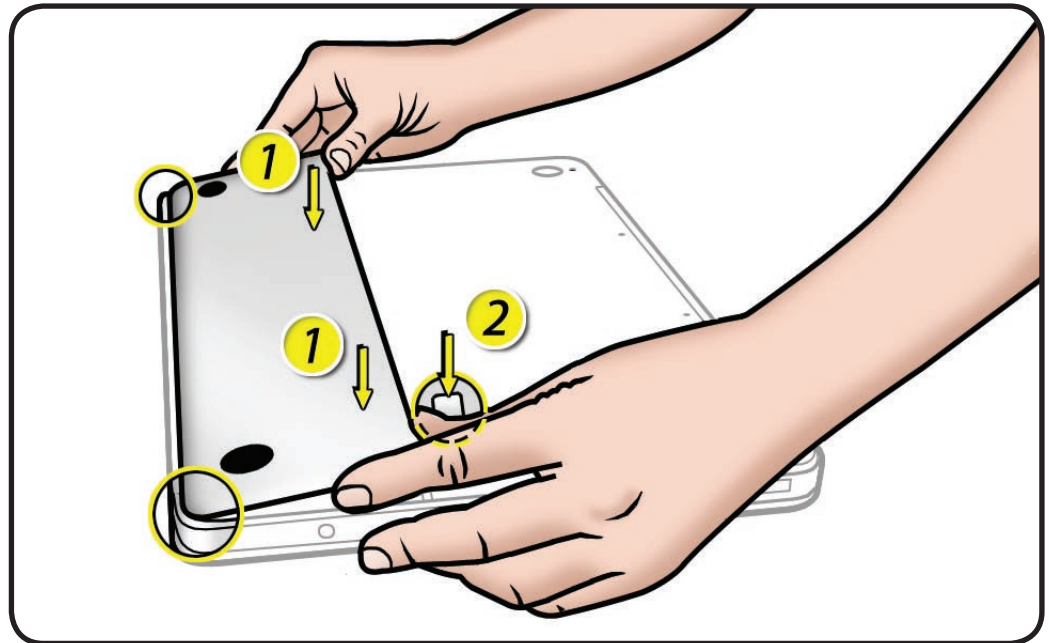
Battery

First Steps

Remove:
• **Access door**
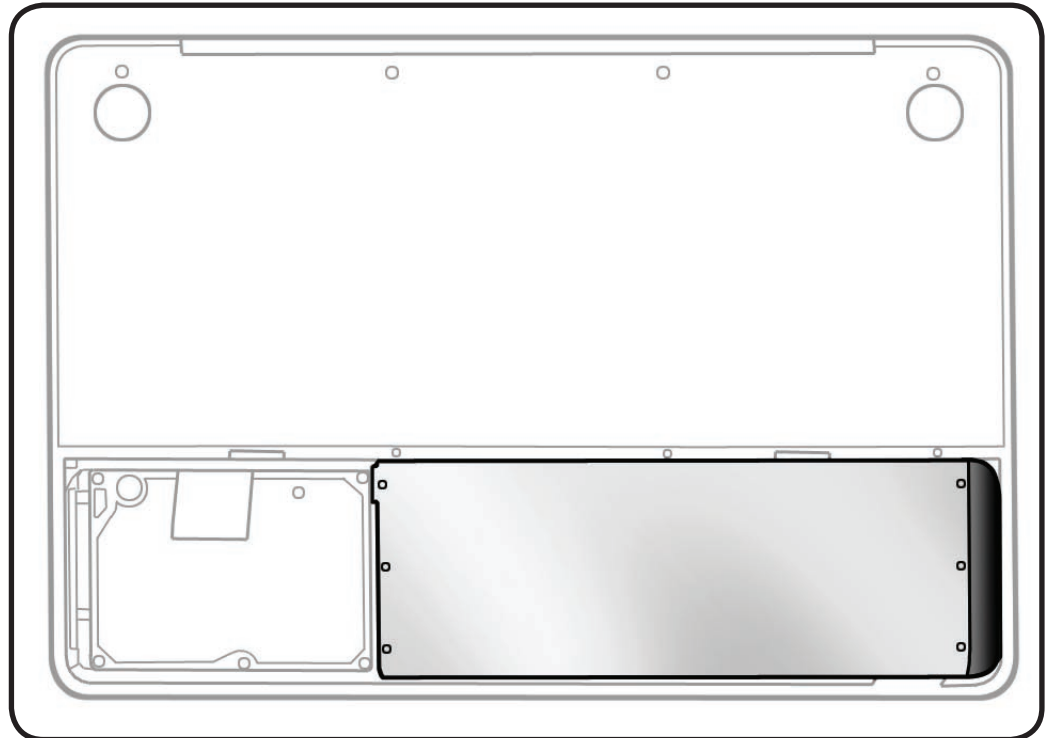
Tools

• Clean, soft, lint-free cloth
• ESD wrist strap and mat
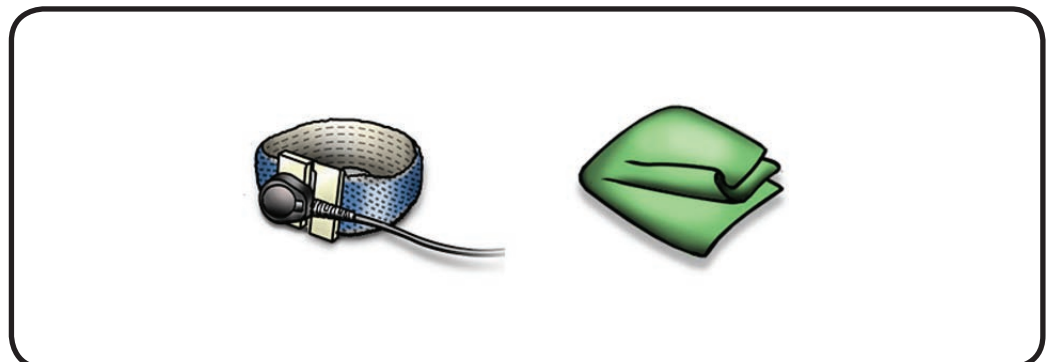
Removal

1 Make sure locking
lever is up.

2 Pull battery tab to
remove battery.
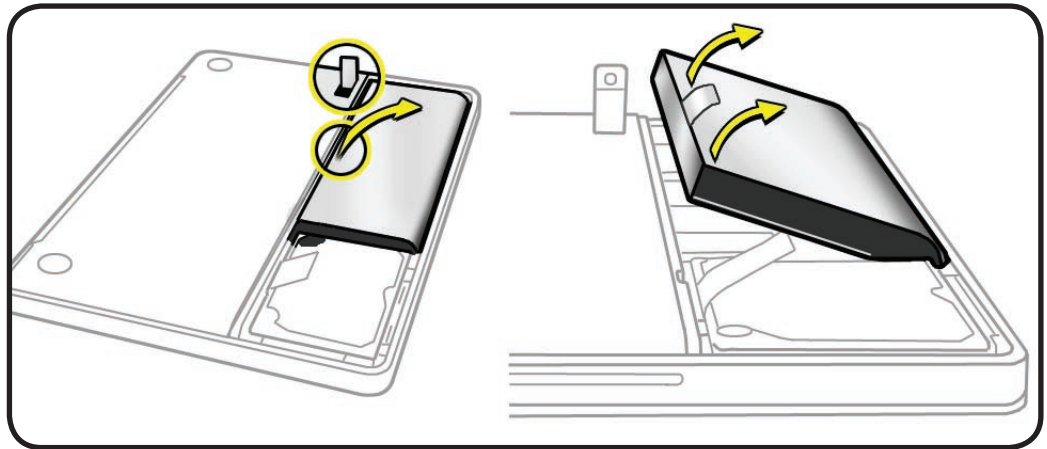
3 Press metal to
discharge electricity.
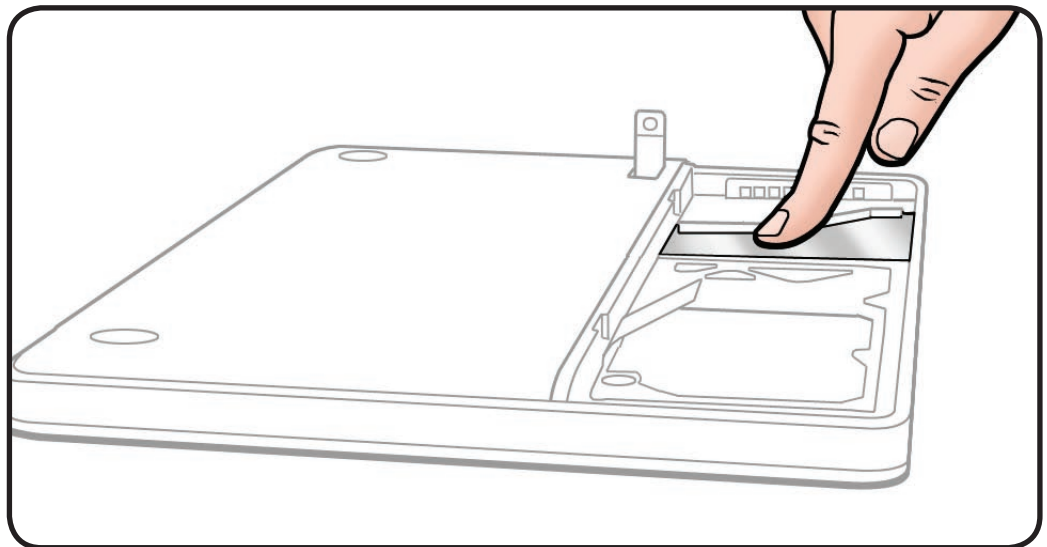
Replacement

1 Insert beveled edge of battery into battery bay.

2 Reassemble computer.
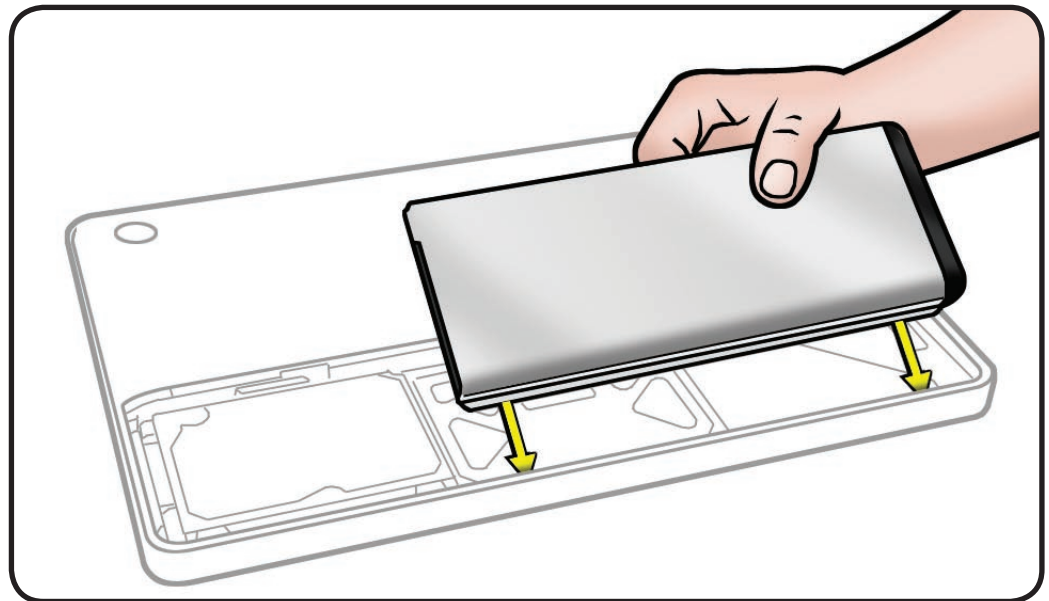
3 Press battery button to check charge level.
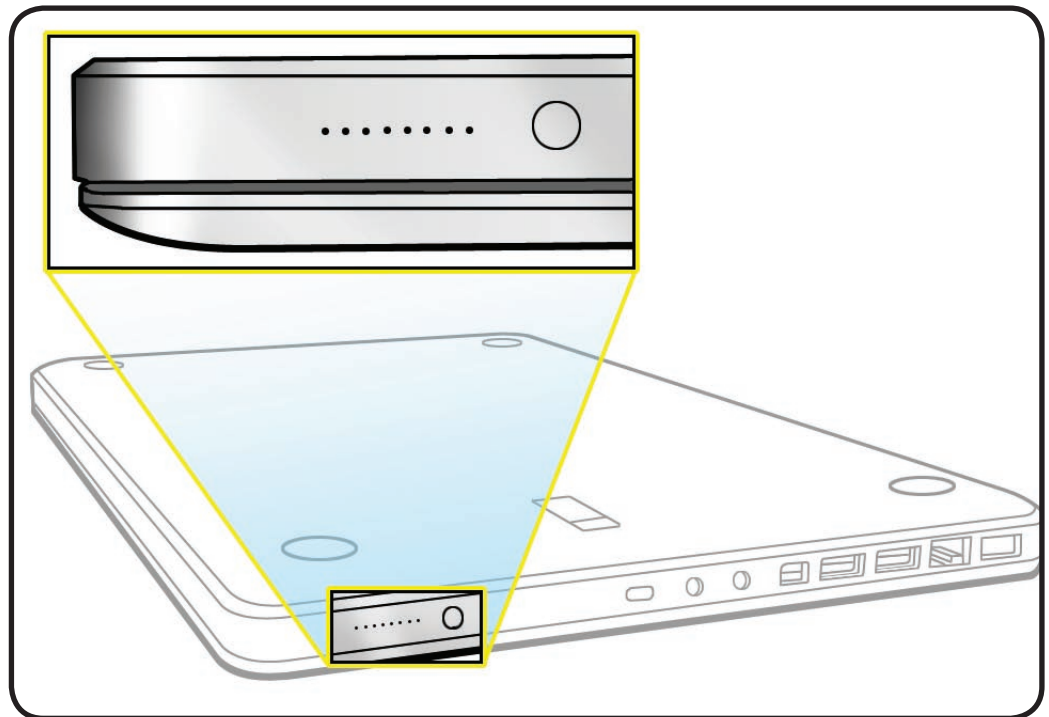
Hard Drive Bracket

First Steps

Remove:
- **Access door**
- **Battery**

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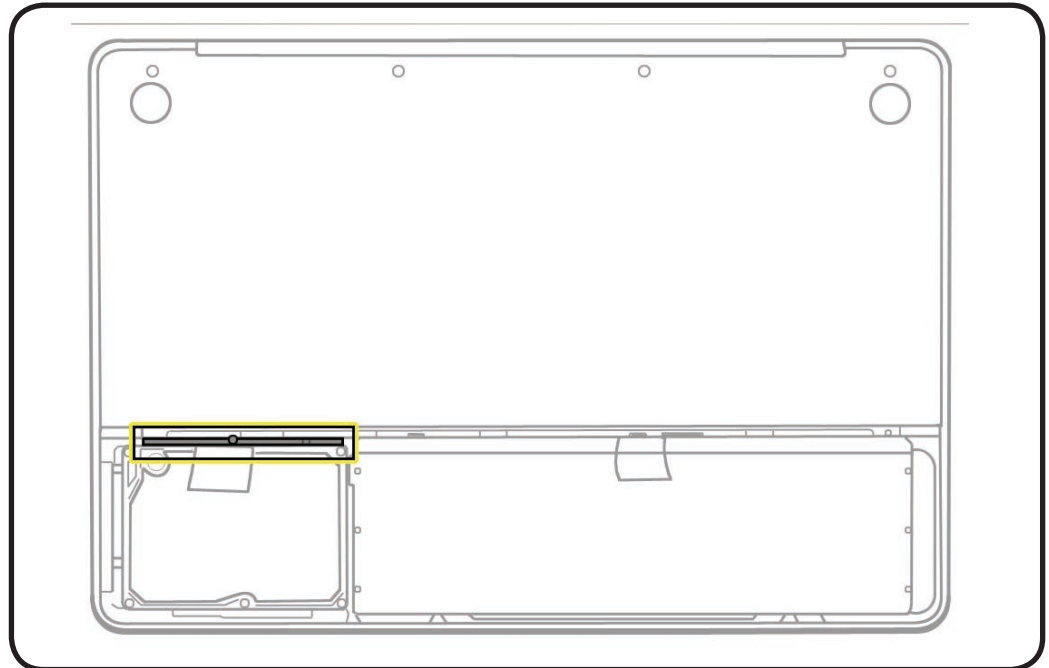
Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
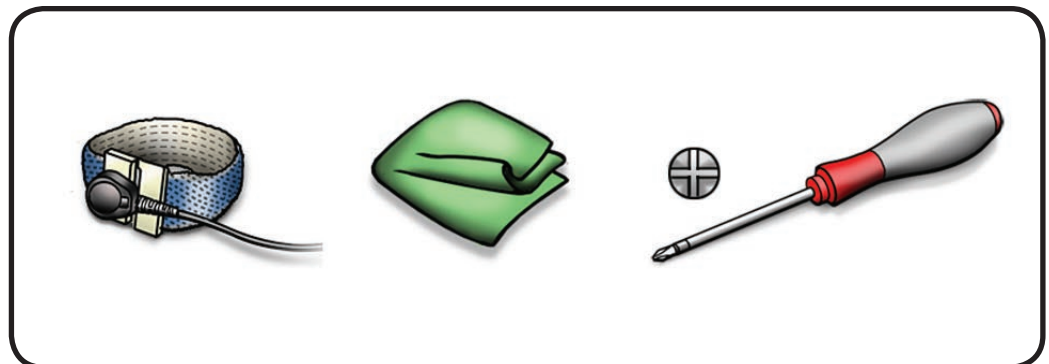
Removal

1 Loosen 1 captive screw.
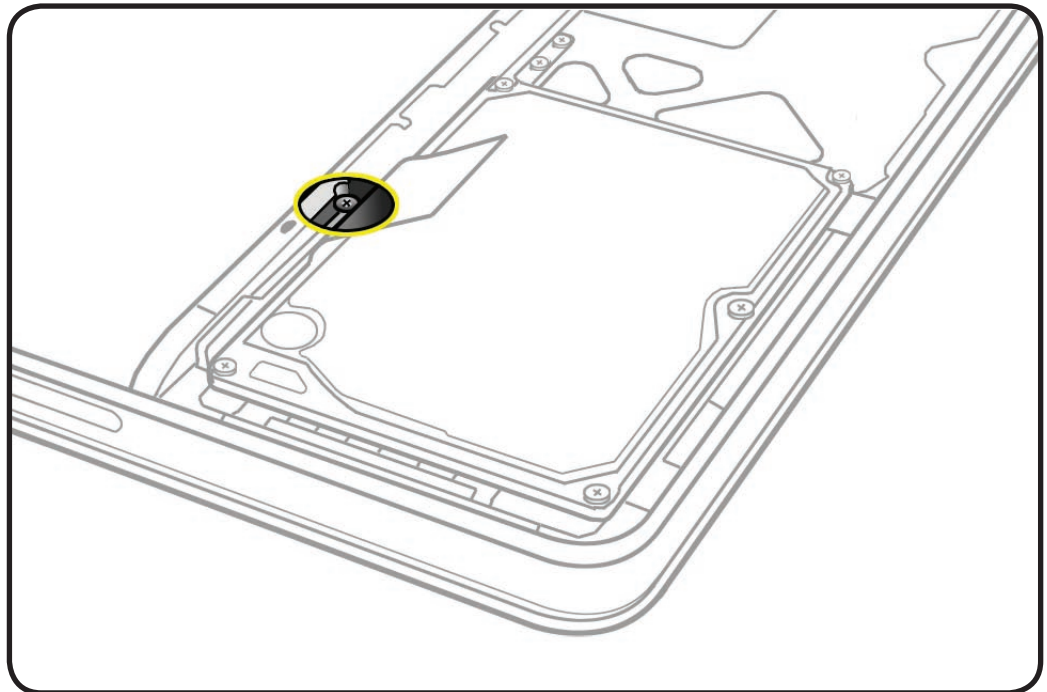
2 Lift out retaining bar.

Replacement Note: Make sure 2 rubber grommets are included in retaining bar before installing it.
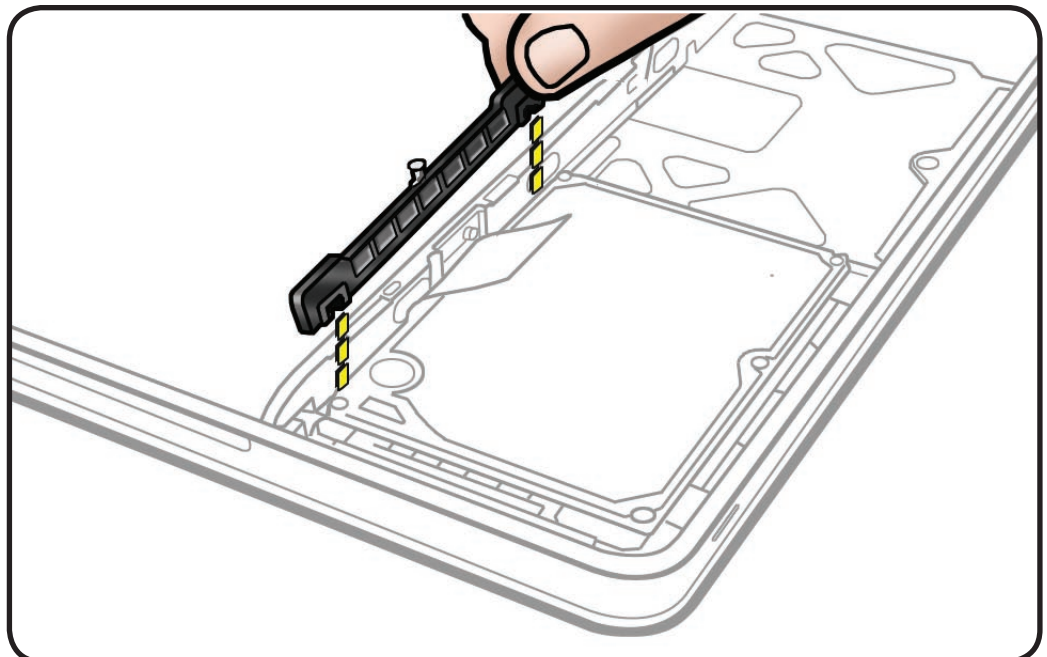
Hard Drive

First Steps

Remove:
- **Access door**
- **Battery**
- **Hard drive bracket**

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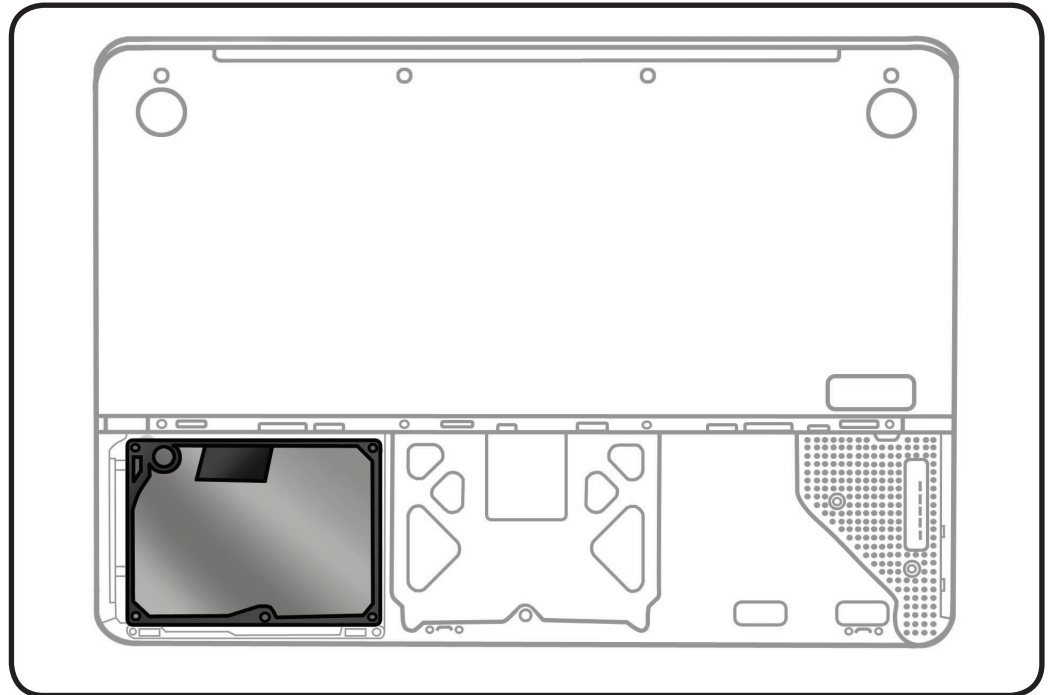
Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
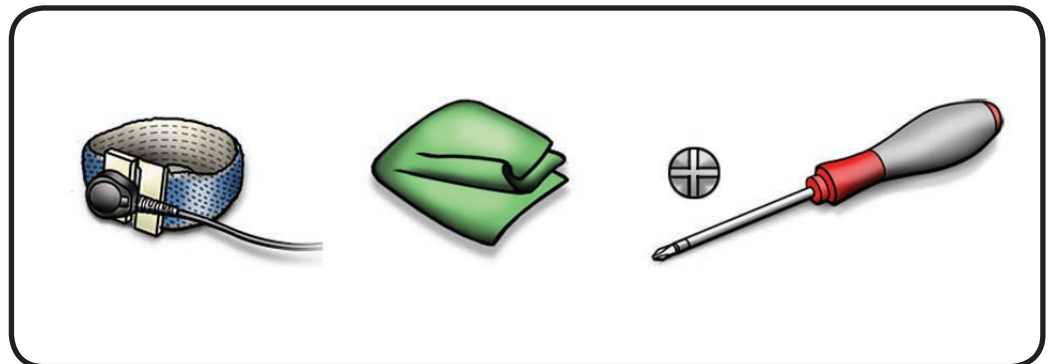
Removal

1 Make sure hard drive bracket is removed.
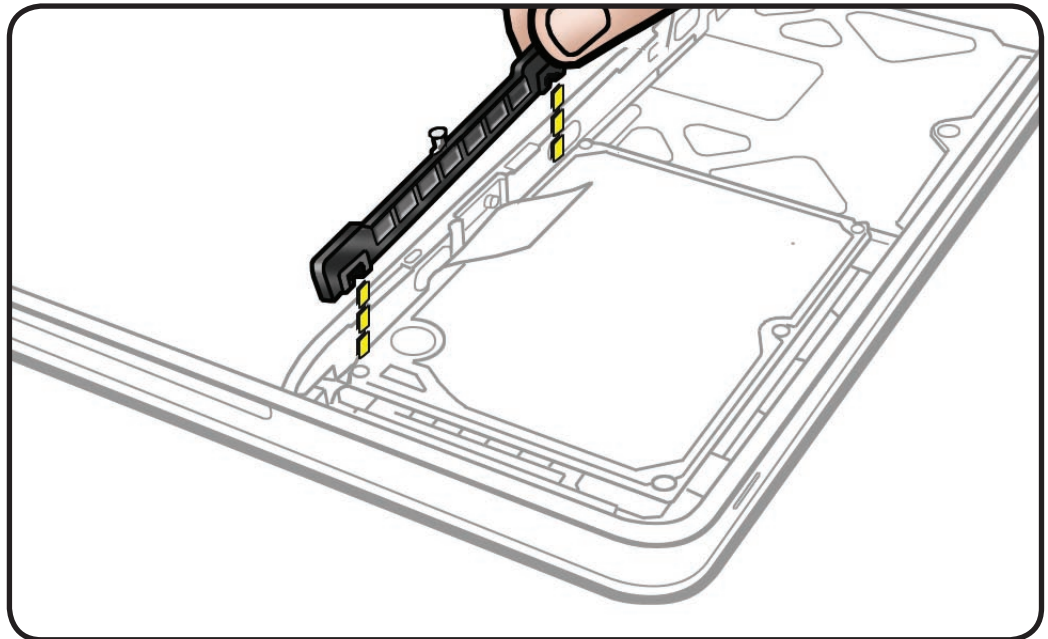
2 Use pull tab to tilt hard drive out.
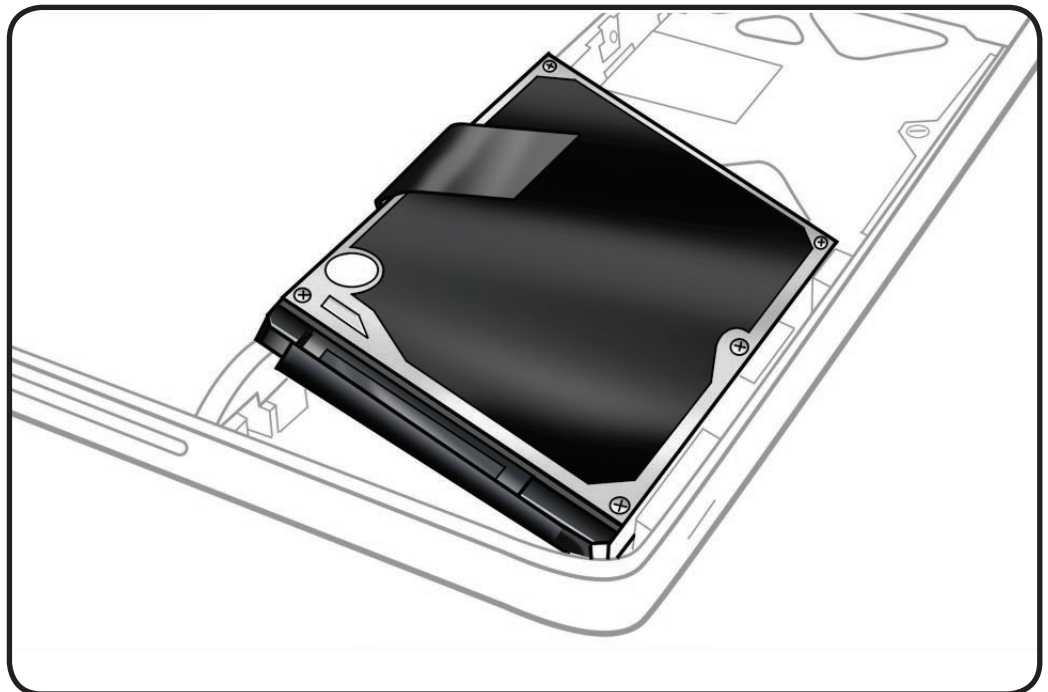
3 Hold hard drive by the sides only.

4 Disconnect hard drive connector.
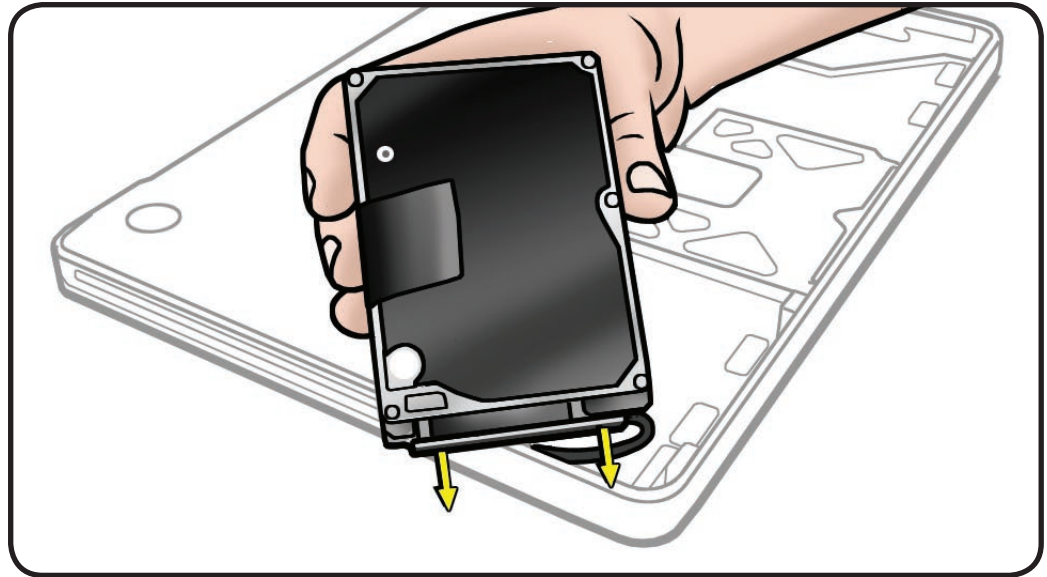
5 Follow safe handling:
- Do not press drive

- Do not touch connector
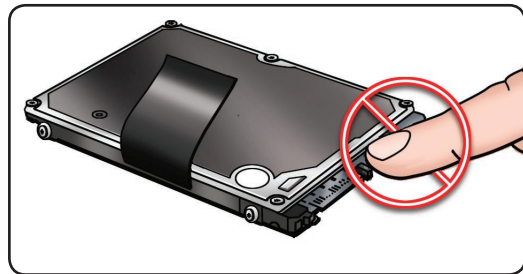
- Do not touch circuitry
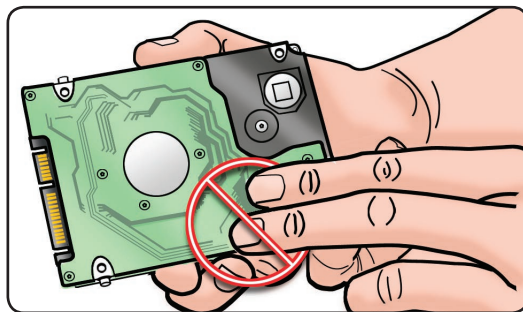
Replacement

1 Touch a metal surface inside battery bay to discharge static electricity.
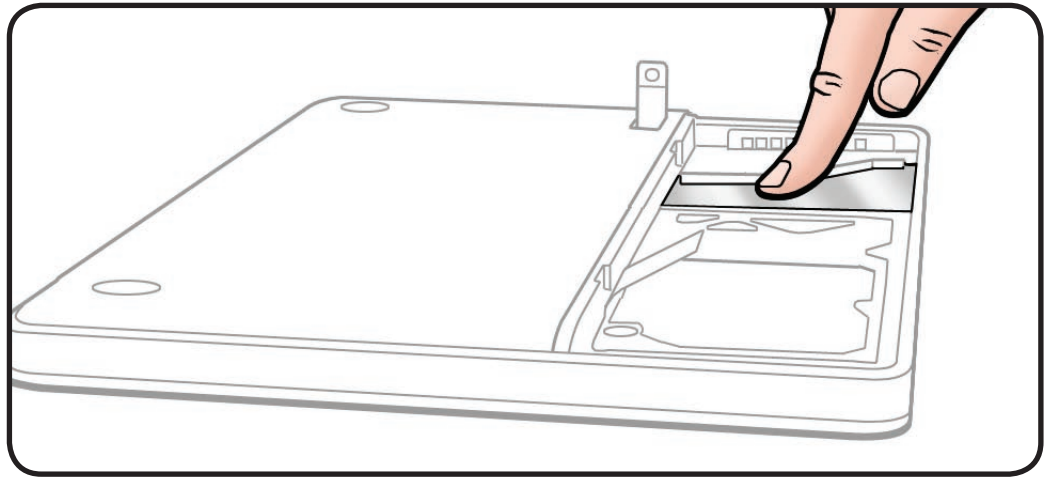
2 Make sure 4 rubber grommets are included in top case before installing the hard drive.

Note: The grommets might be a different color than shown.
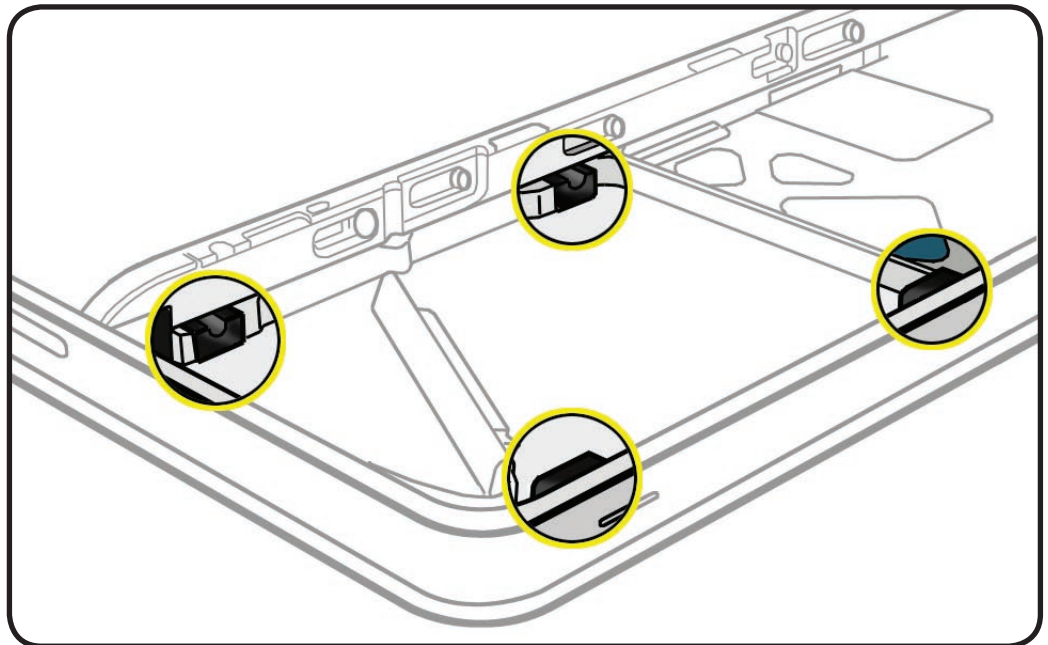
3 Make sure 4 Torx T6 (922-8655) mounting screws are installed on drive.

If replacement drive does not have mounting screws, transfer them from the old drive.
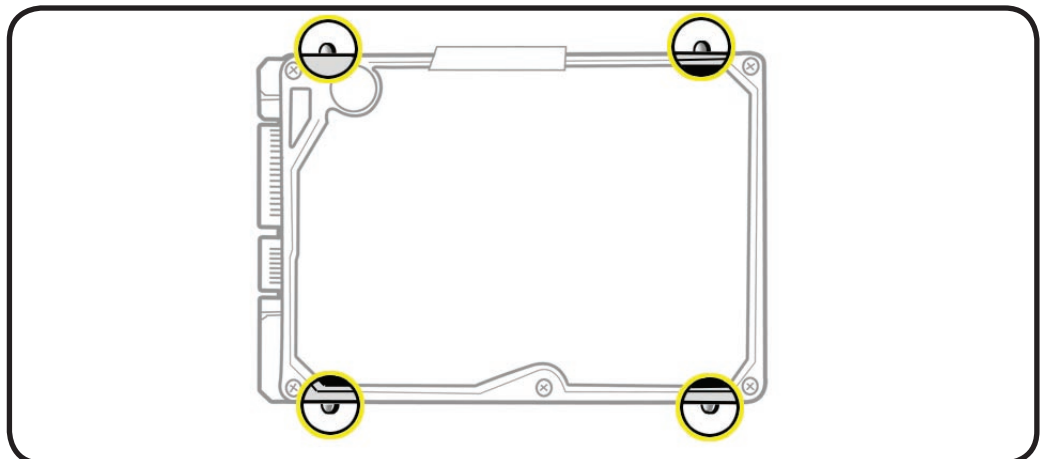
4 Attach connector, and tilt hard drive into front of top case.
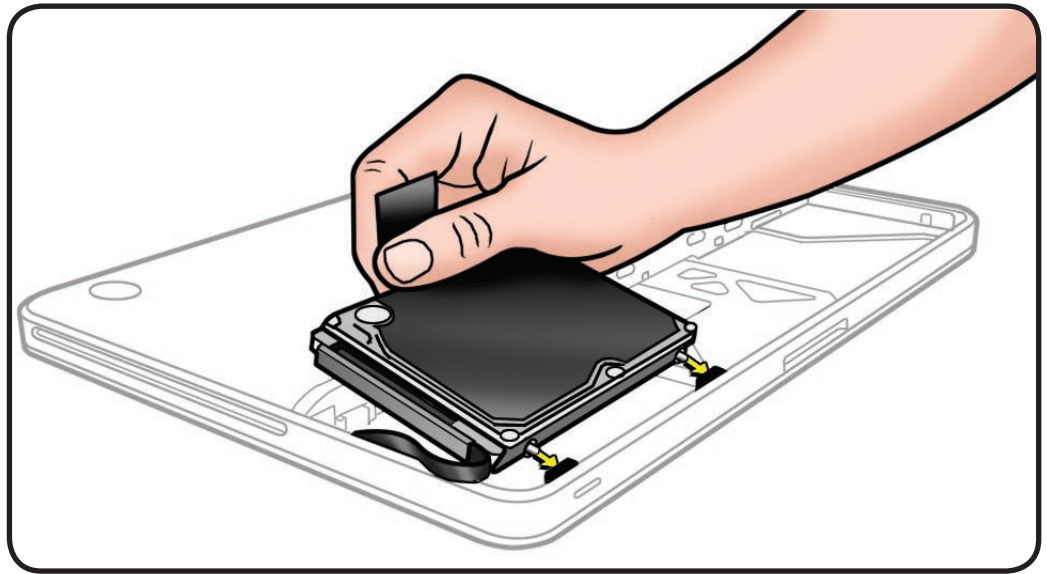
Reinstalling Software that Came with the Computer

Use the software install discs that came with your computer to install Mac OS X and the applications that came with your computer.

Installing Mac OS X and Applications

To install Mac OS X and the applications that came with your computer, follow these steps:

1. Start up from the Mac OS X Install Disc 1 that came with your computer, and choose your language.

2. From the menu bar, choose Utilities > Disk Utility.

3. Open Disk Utility and select the new drive in the list to the left.

    Note: If you are formatting the primary drive, use the Disk Utility program on the Install disc.

4. Click the Partition tab.

5. Click on Options, and verify GUID is selected if this is the startup drive.

6. Name the volume "Macintosh HD."

7. Apply the change by clicking the Partition button.

8. At this point, either
    - Quit the Disk Utility application, and proceed with the Mac OS X installation. Follow the onscreen instructions. After selecting the destination disk for installation, continue following the onscreen instructions. Your computer may restart and ask you to insert the next Mac OS X Install Disc 2. or
    - Leave the Disk Utility application open, and restore the backed up files from the image you created before removing the hard drive.

Installing Applications

To install just the applications that came with the computer, follow the steps below. The computer must have Mac OS X already installed.

1. Back up your essential files, if possible.

2. Insert the Mac OS X Install Disc 1 that came with your computer.

3. Double-click "Install Bundled Software Only."

4. Follow the onscreen instructions.

5. After selecting the destination disk for installation, continue following onscreen instructions. After restart, insert the next Mac OS X Install Disc 2.

6. Restore the data by reinstalling the backed up files from your backup to the new drive.

Bottom Case

First Steps

Remove:
- **Access door**
- **Battery**
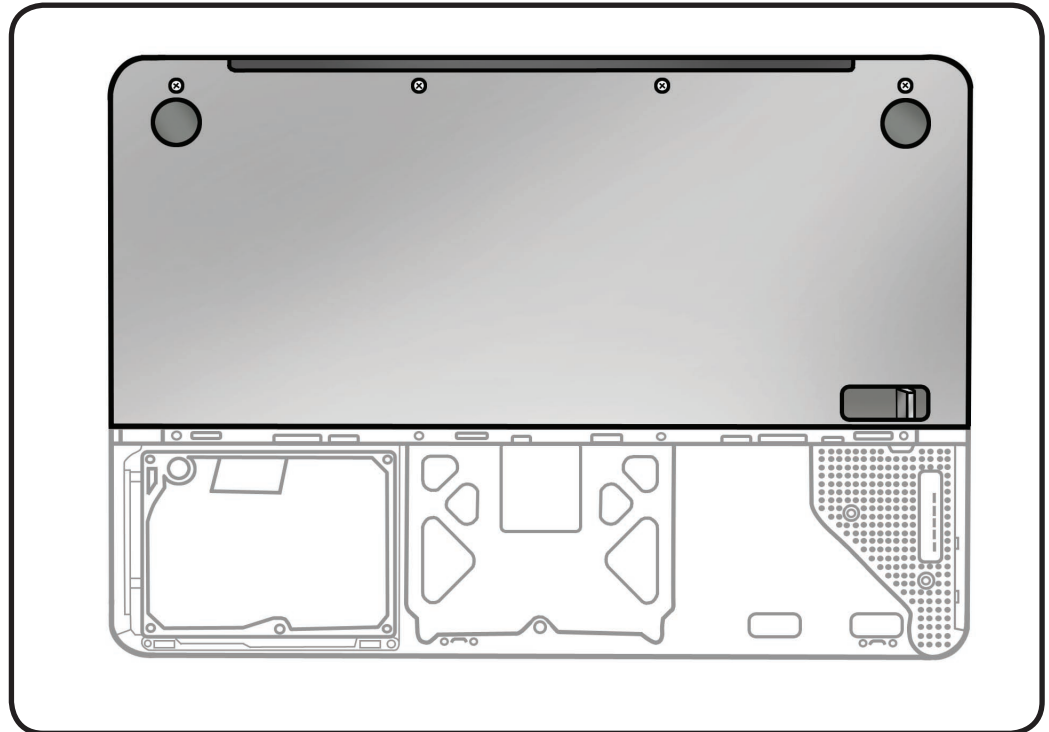
Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetic Phillips #00 screwdriver
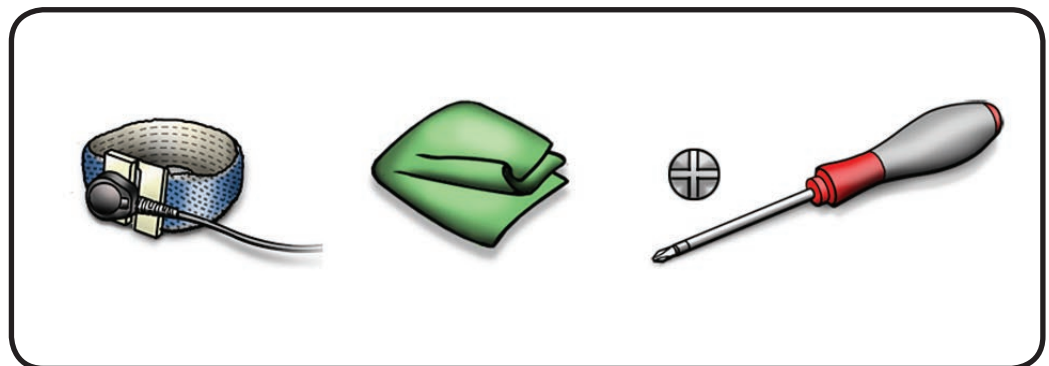
Removal

Caution: To prevent scratches, use a protective cloth when working with metal tools.
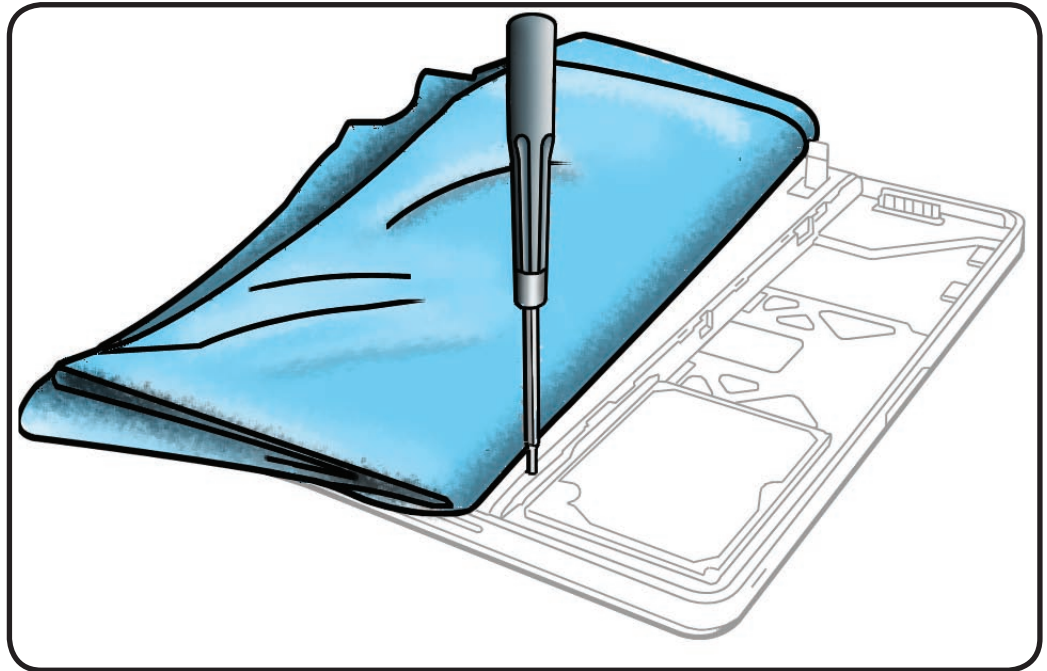
1 Remove 8 screws:
- 1 (3 mm) 922-8660
- 3 (13 mm) 922-8666
- 4 (3.55 mm) 922-8653

Replacement Note: Install screws in the order shown.
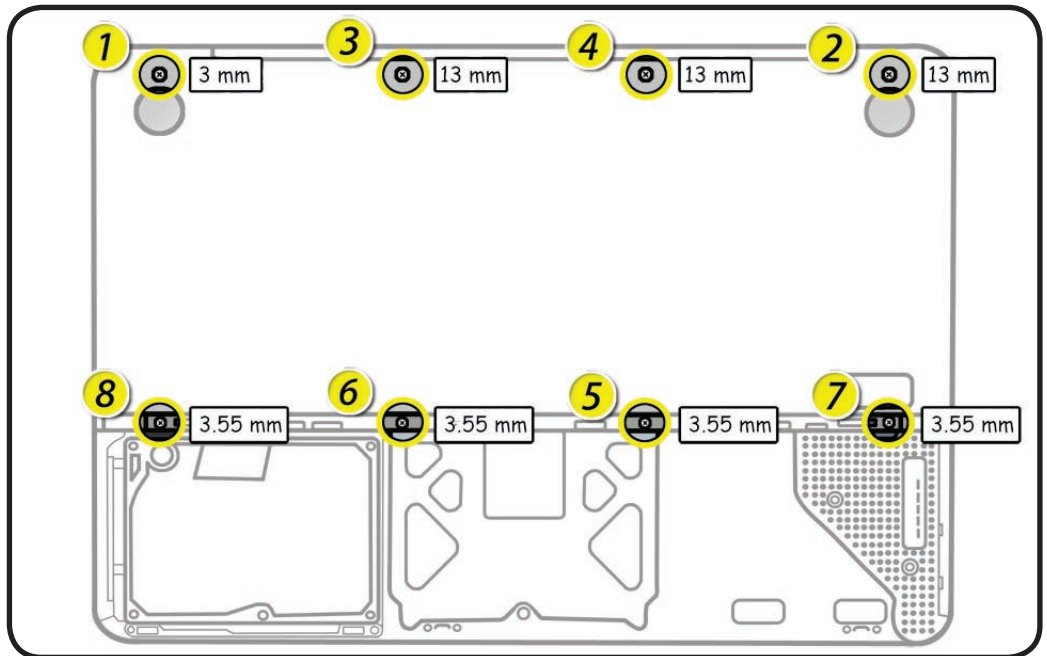
2 Grasp lever and tilt up bottom case.
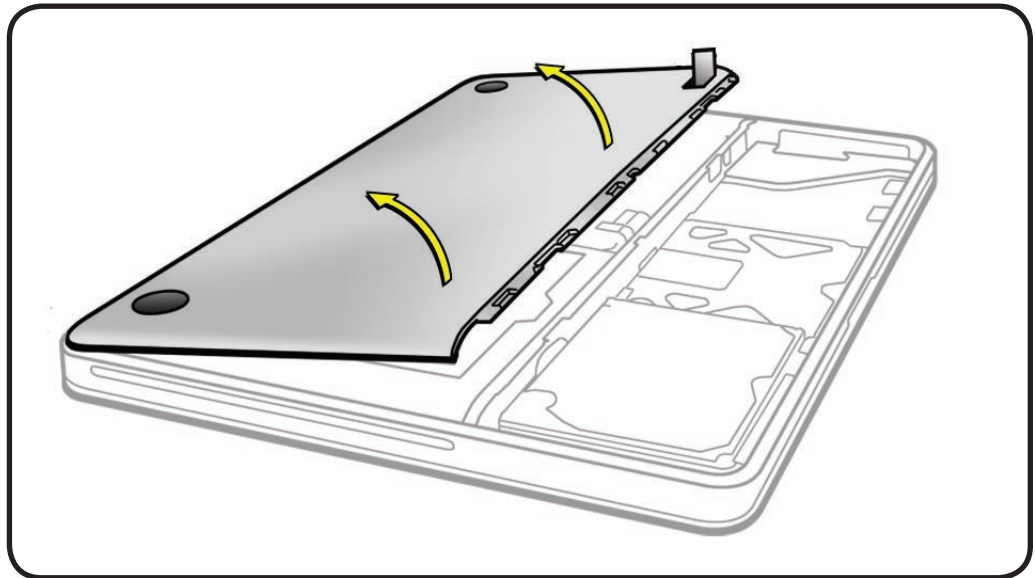
Replacement

1 Press corners to align bottom case to top case.

2 Check alignment as you install screws.
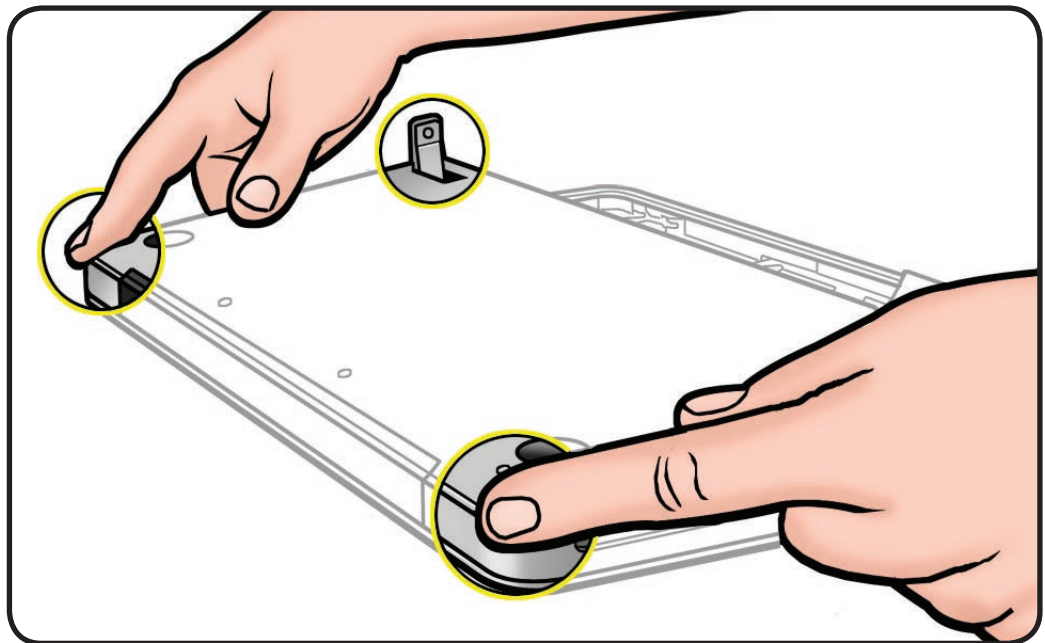
Memory

First Steps

Remove:
- **Access door**
- **Battery**
- **Bottom case**

Caution: Avoid touching anything other than the memory area.
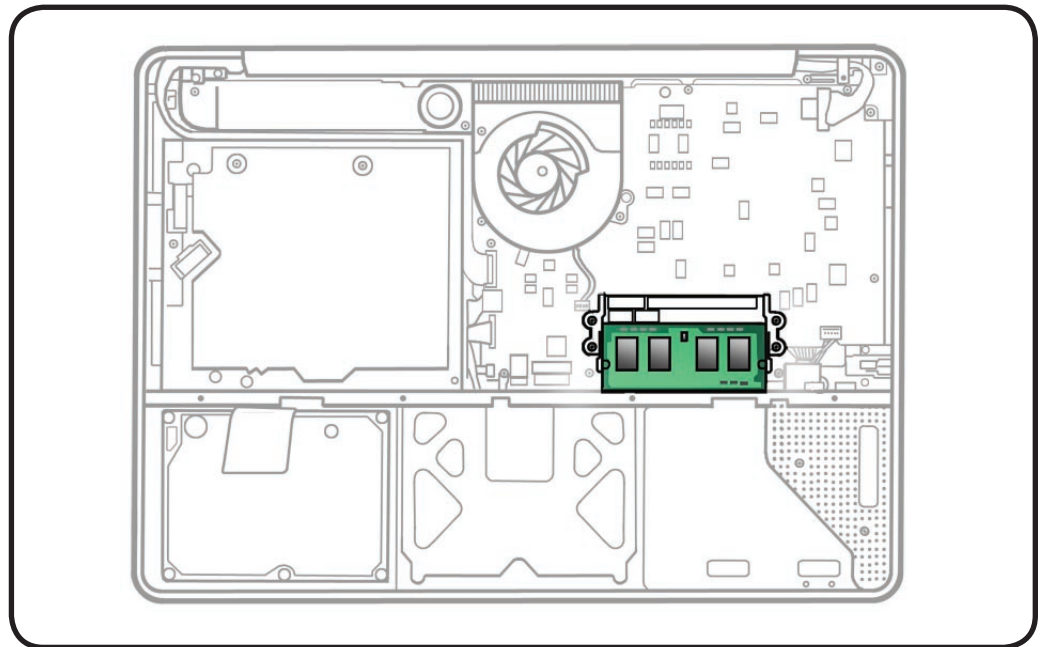
Tools

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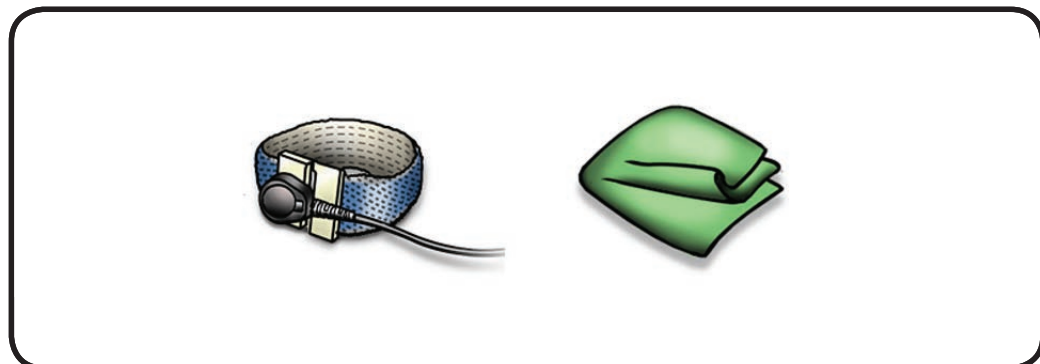
Removal

Memory cards must be:
- 1.25 inch or smaller
- 1 GB or 2 GB
- 200-pin
- PC-8500 DDR3, 1066 MHz RAM

This computer comes with a minimum of 2 GB of 1066 MHz Double Data Rate 3 (DDR3) Synchronous Dynamic Random-Access Memory (SDRAM) installed. It has 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 equal memory card in each slot. The maximum amount of memory for this computer is 4 GB, with a 2 GB DIMM installed in each slot.

1 Press out 2 ejection levers until the card tilts up completely,

The card tilts up at an angle. Before removing the card, make sure you see the half- circle notches. If not, press the ejection levers again.
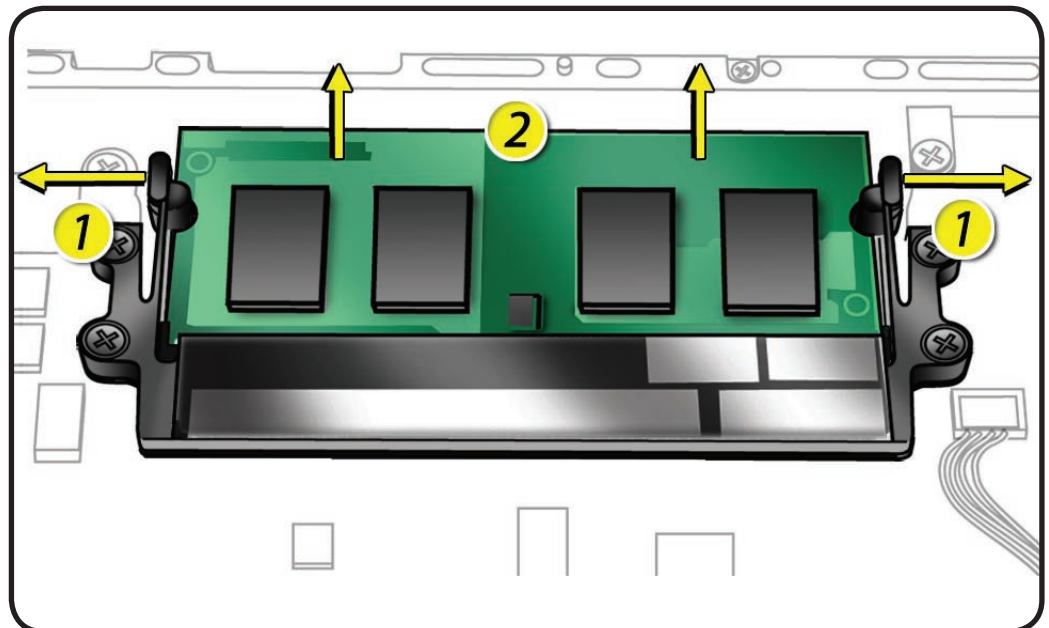
2 Pull out the card.

3 Hold the card by the edges.

4 Do not touch the gold connectors.
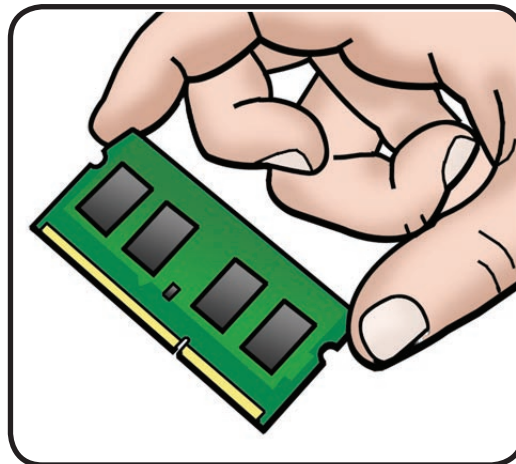
Replacement

1 Install cards at an angle. If installing just one card, install it in lower slot.
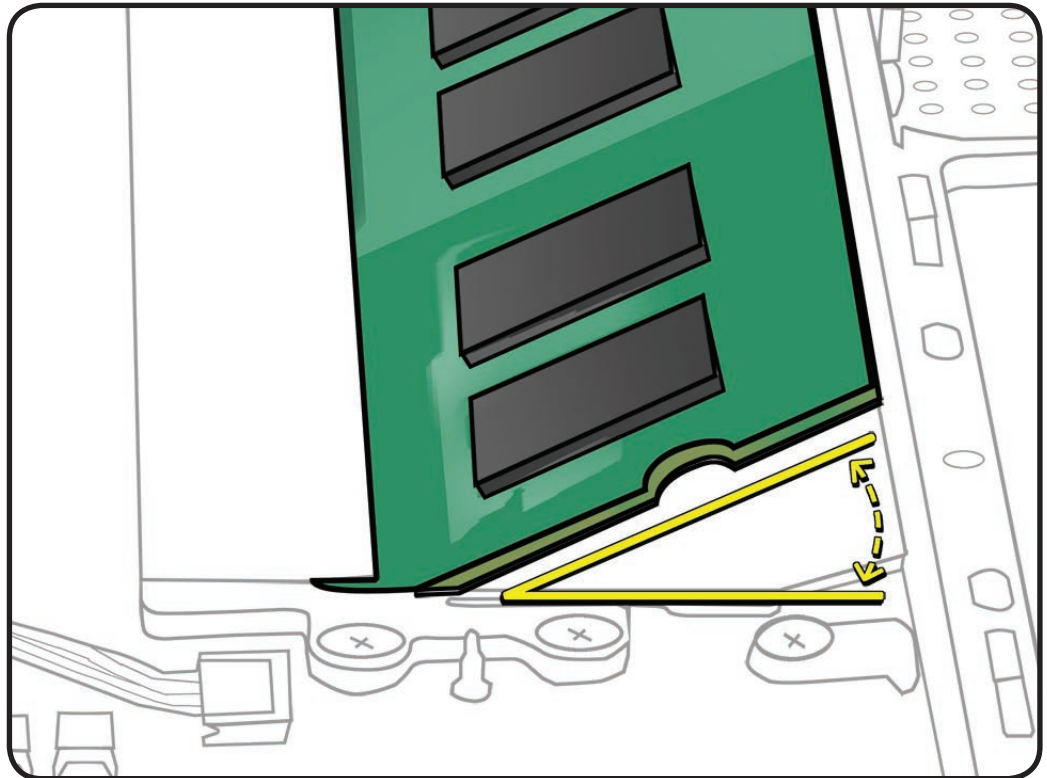
2 Spread ejection levers, and press card down.

> **Note:** New memory cards might have a harmless white residue on the gold connectors.

3 If you installed additional memory, check that computer recognizes it.
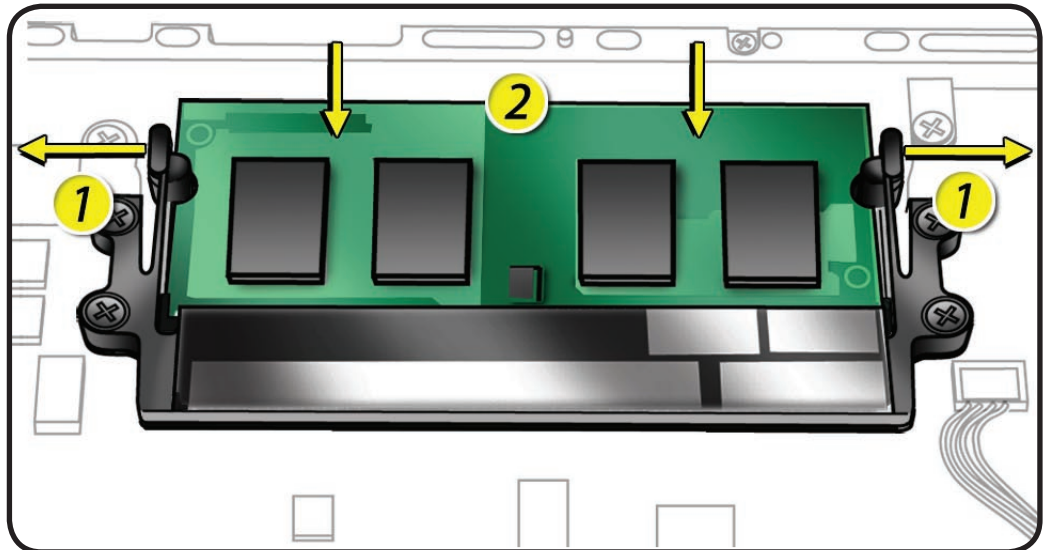
Mid Wall

First Steps

Remove:
- **Access door**
- **Battery**
- **Bottom case**
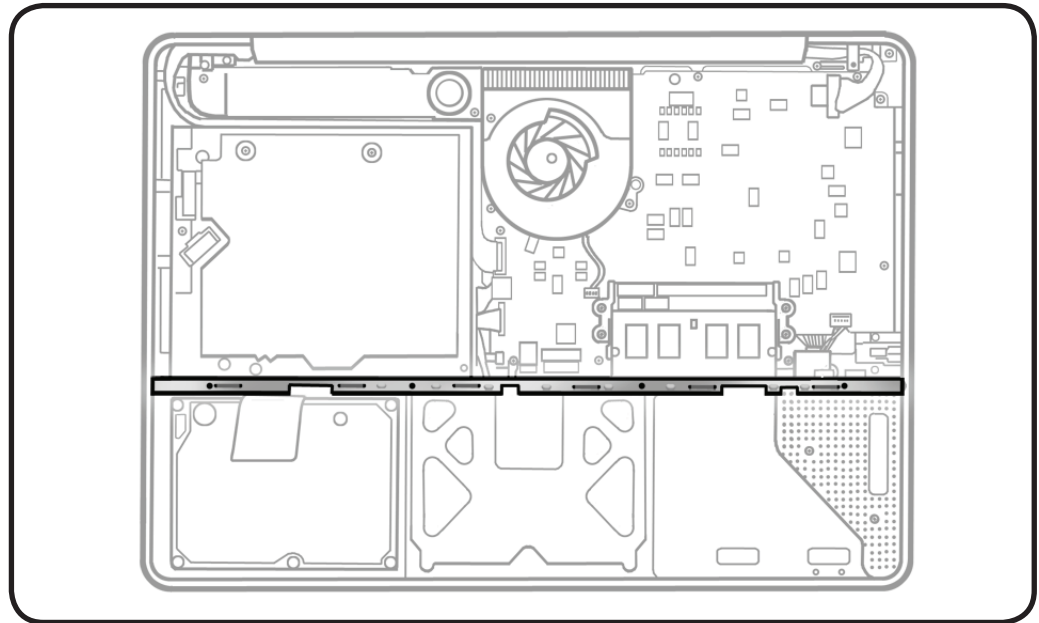
Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
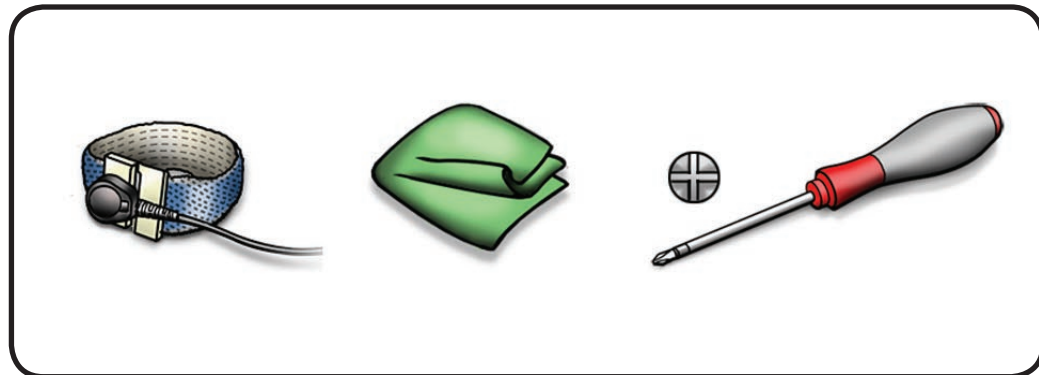
Caution: The screws for this procedure require a newer screwdriver. Using a dull screwdriver can damage the screw heads.

Removal

To prevent scratches to the computer housing, use a soft cloth when removing and installing screws.

1 Remove 4 (10.5-mm) 922-8656 screws in order shown.

Replacement Note: Install screws in order shown.

10.5 mm   10.5 mm   10.5 mm   10.5 mm
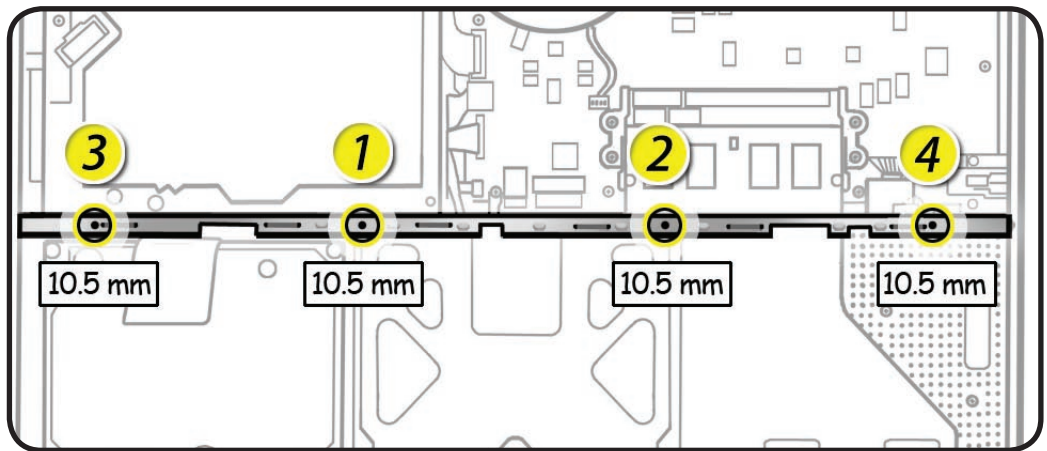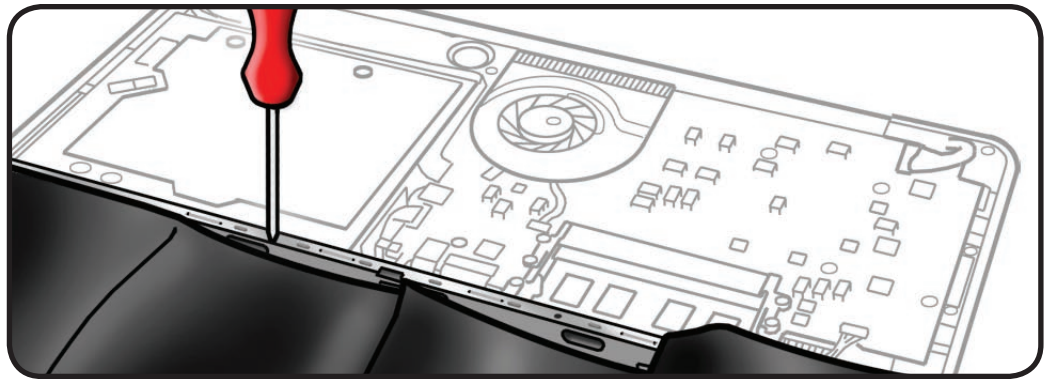
2 Lift out mid wall.
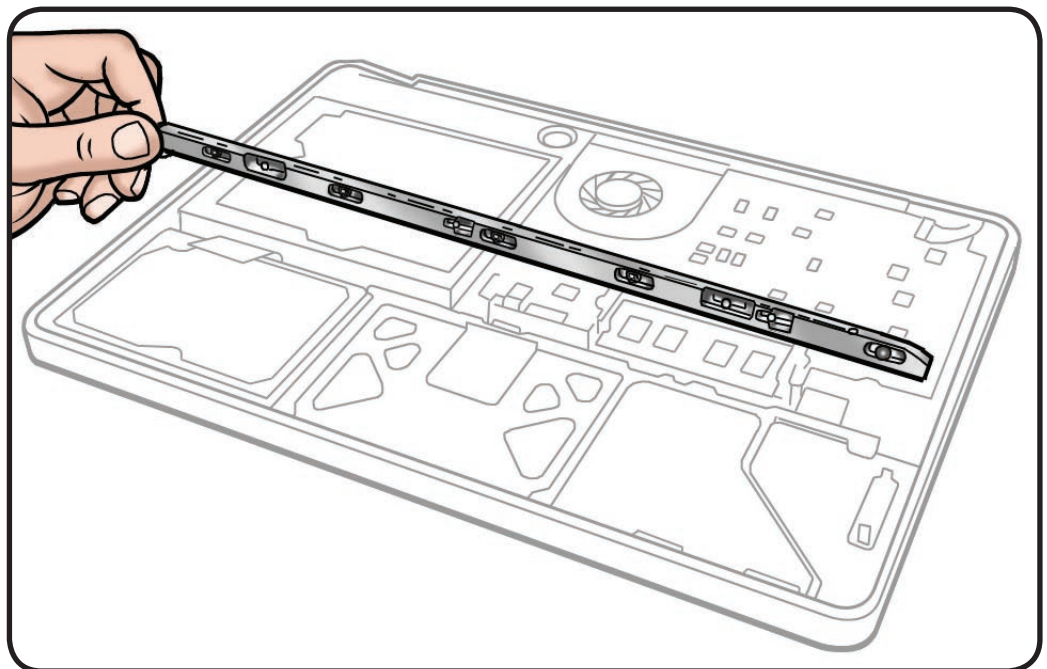
Battery Connector Cover

First Steps

Remove:
- **Access door**
- **Battery**
- **Bottom case**
- **Mid wall**

To prevent scratches to the computer housing, use a soft cloth when removing and installing screws.
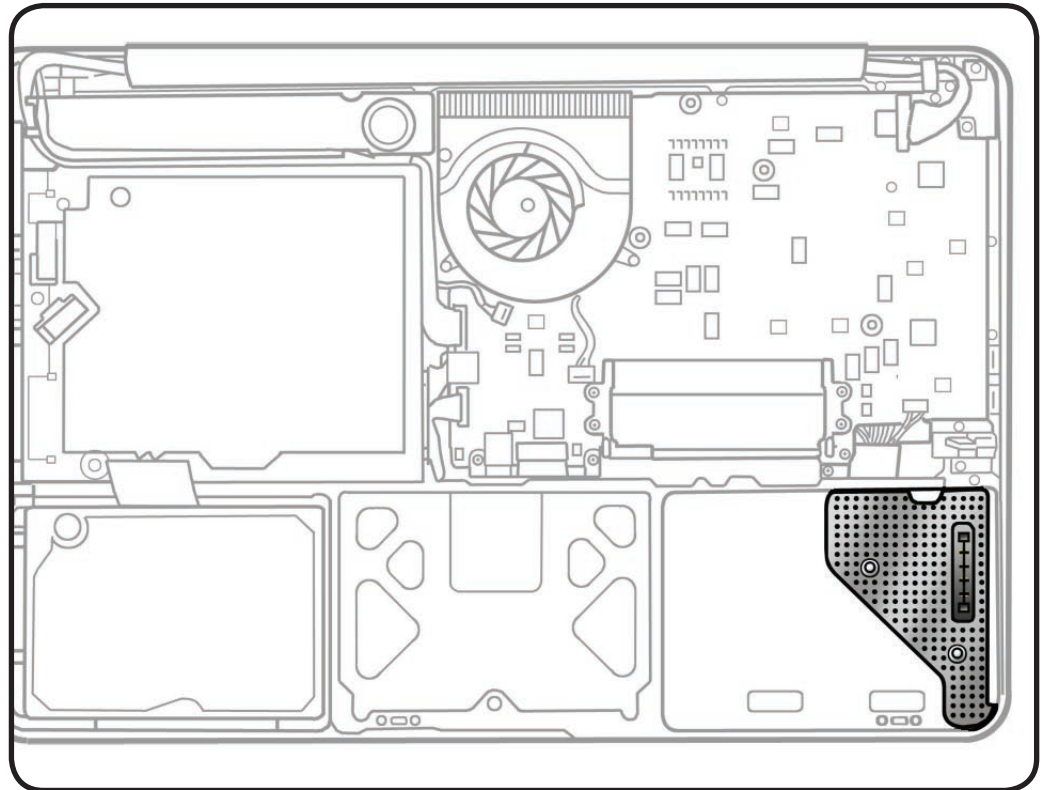
Tools
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Black stick
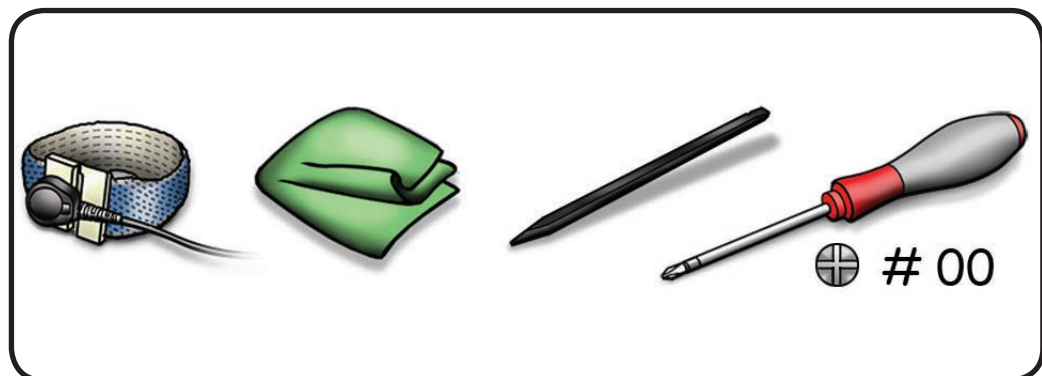
Removal

1 Remove 3 screws:
- 1 (2.5 mm) 922-8652
- 2 (1.5 mm) 922-8651

Replacement Note: Install screws in order shown.

2.5 mm

1.5 mm

1.5 mm
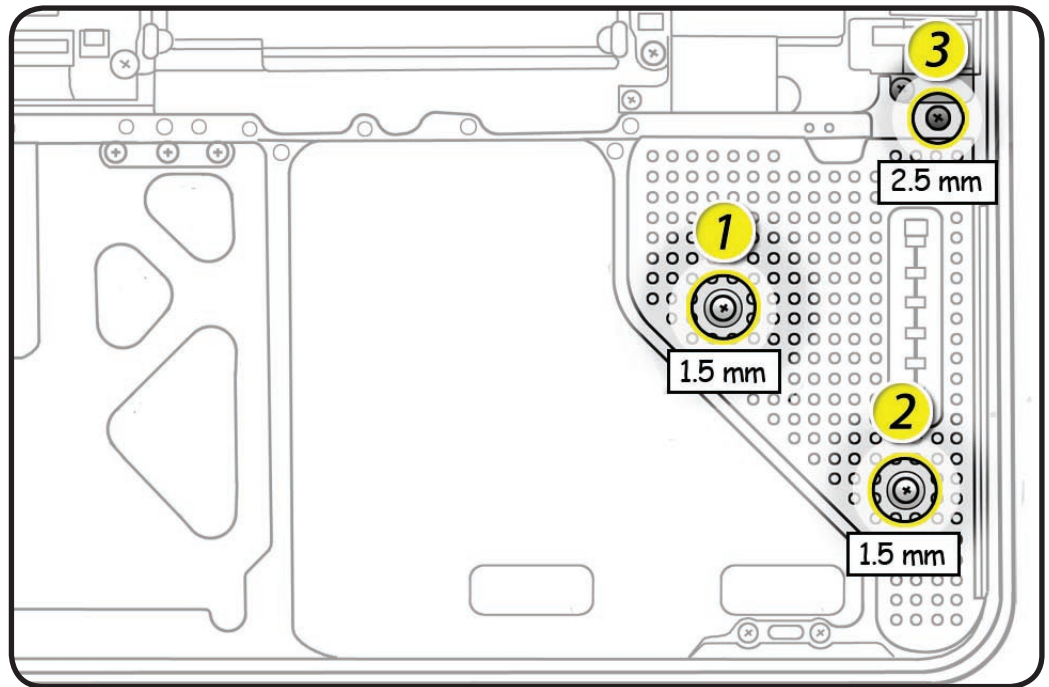
2 Lift out battery connector cover.
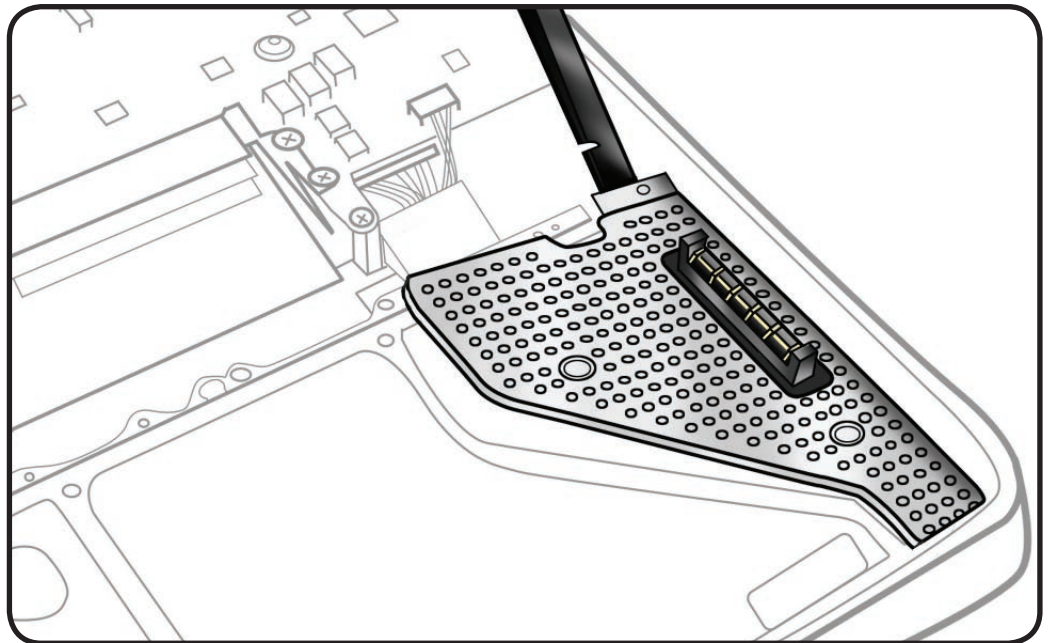
Battery Cable Guide

First Steps

Remove:
- **Access door**
- **Battery**
- **Bottom case**
- **Mid wall**
- **Battery connector cover**

To prevent scratches to the computer housing, use a soft cloth when removing and installing screws.
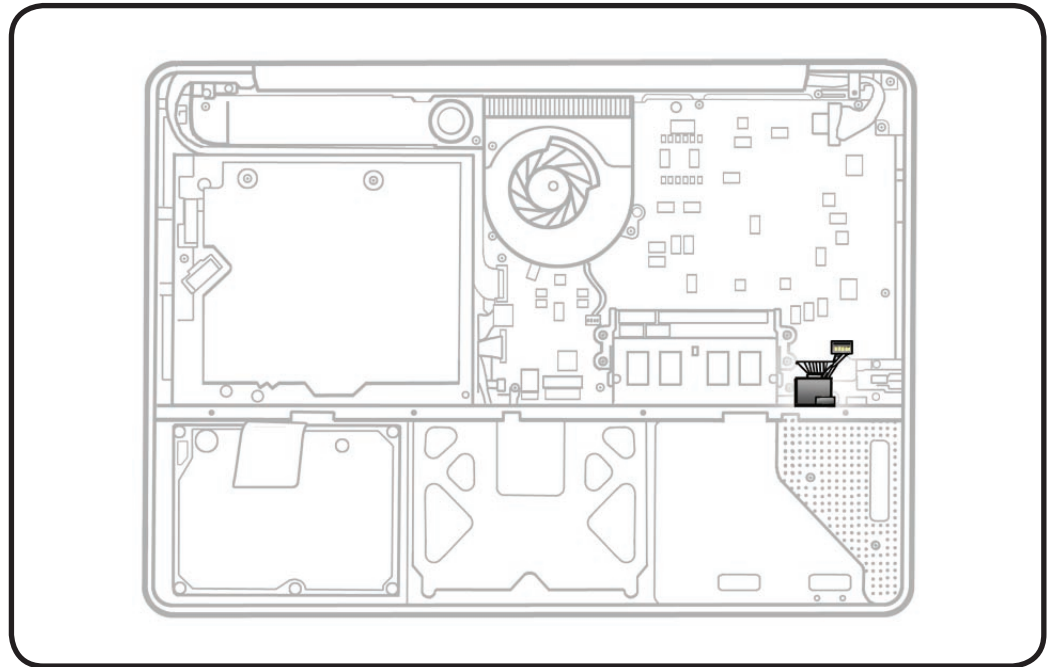
Tools
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
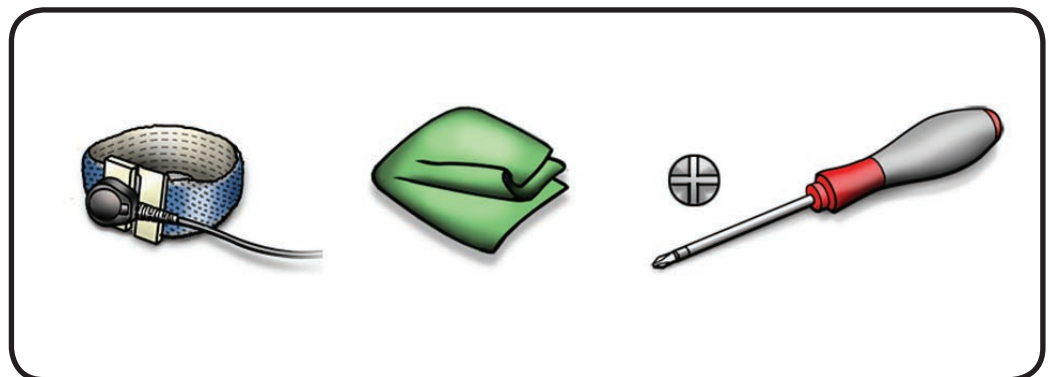
Removal

1 Remove 2.7-mm
(922-8661) screw.
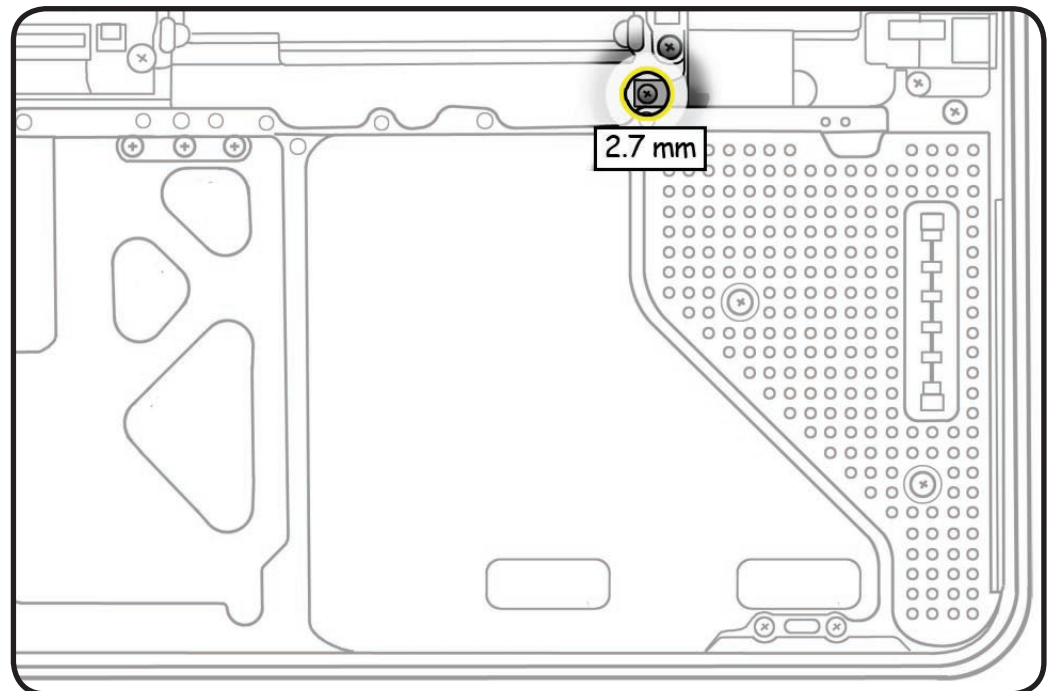
2 Lift out battery cable
guide.
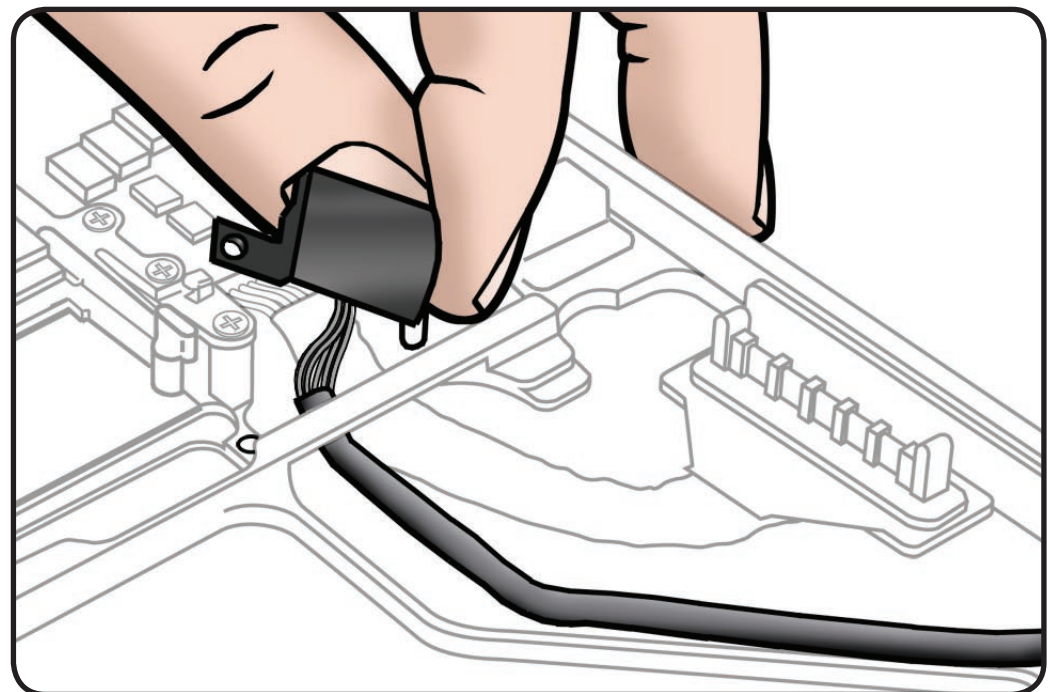
Battery Power Cable

First Steps

Remove:
- **Access door**
- **Battery**
- **Bottom case**
- **Mid wall**
- **Battery connector cover**
- **Battery cable guide**
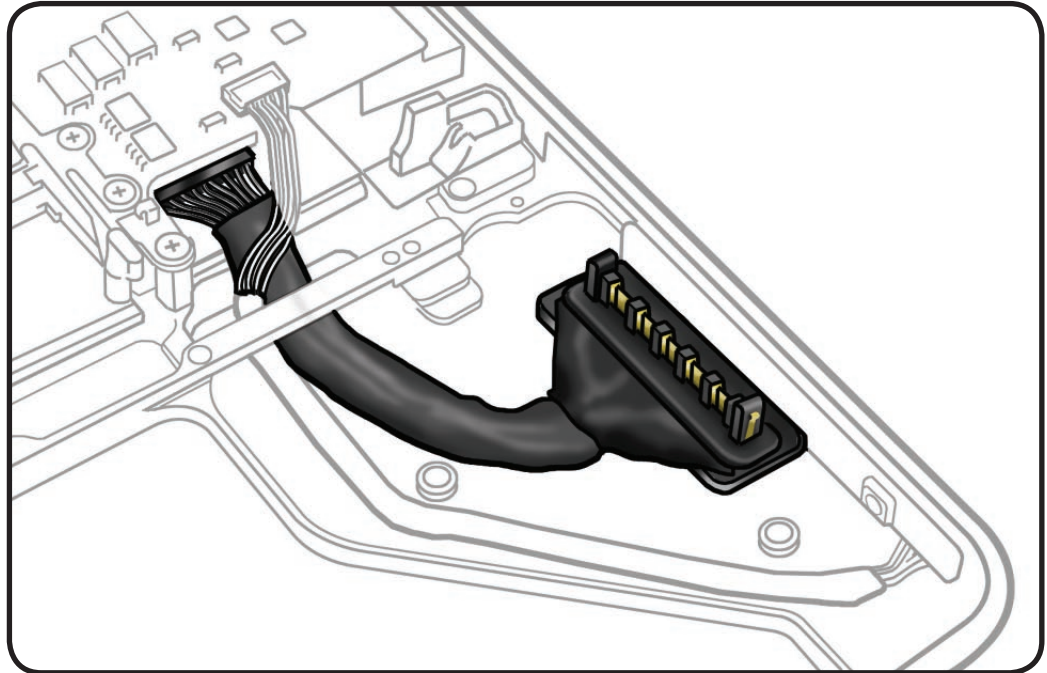
Tools
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
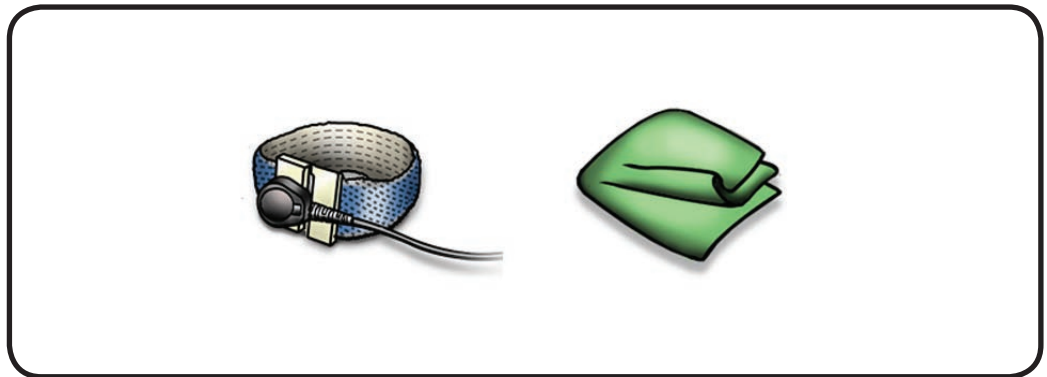
Removal

1 Disconnect the battery cable, and peel it up from the top case.

2 Route the cable through the top case slot.
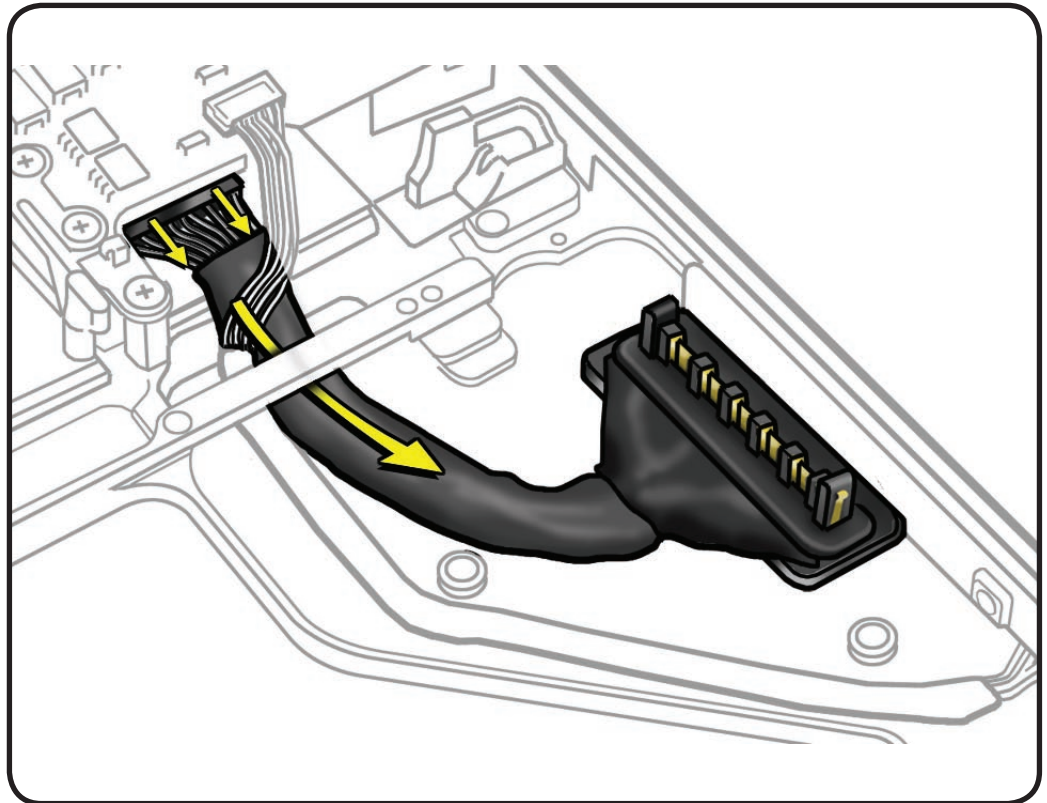
Replacement

1 Connect cable to logic board.

2 Press cable to top case so it lays flat.
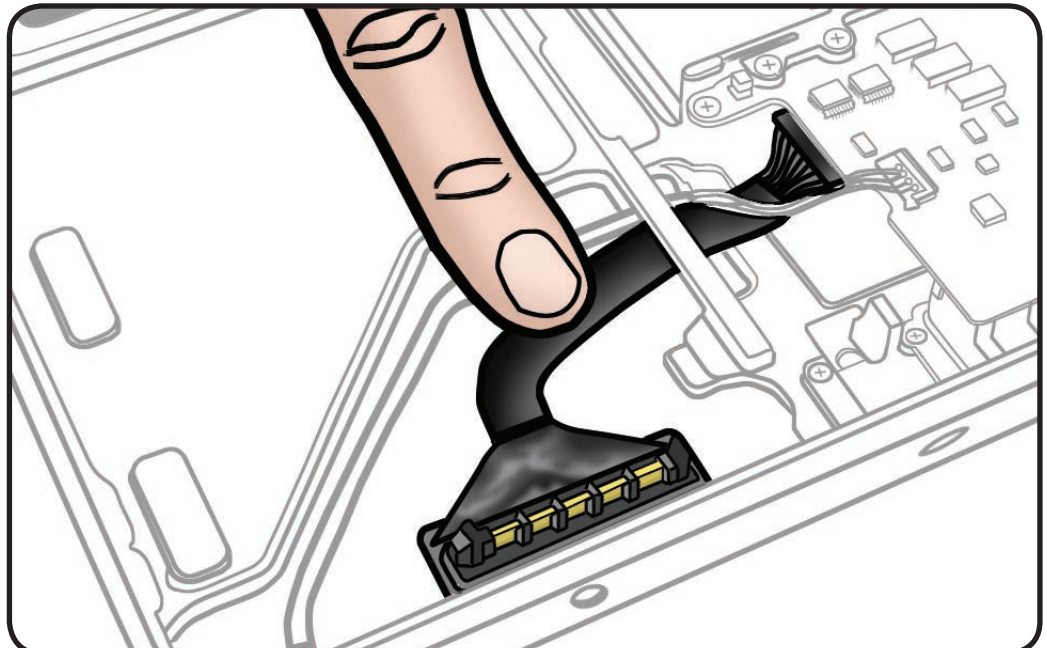
Battery Indicator Light (BIL) Cable

First Steps

Remove:
* **Access door**
* **Battery**
* **Bottom case**
* **Mid wall**
* **Battery connector cover**
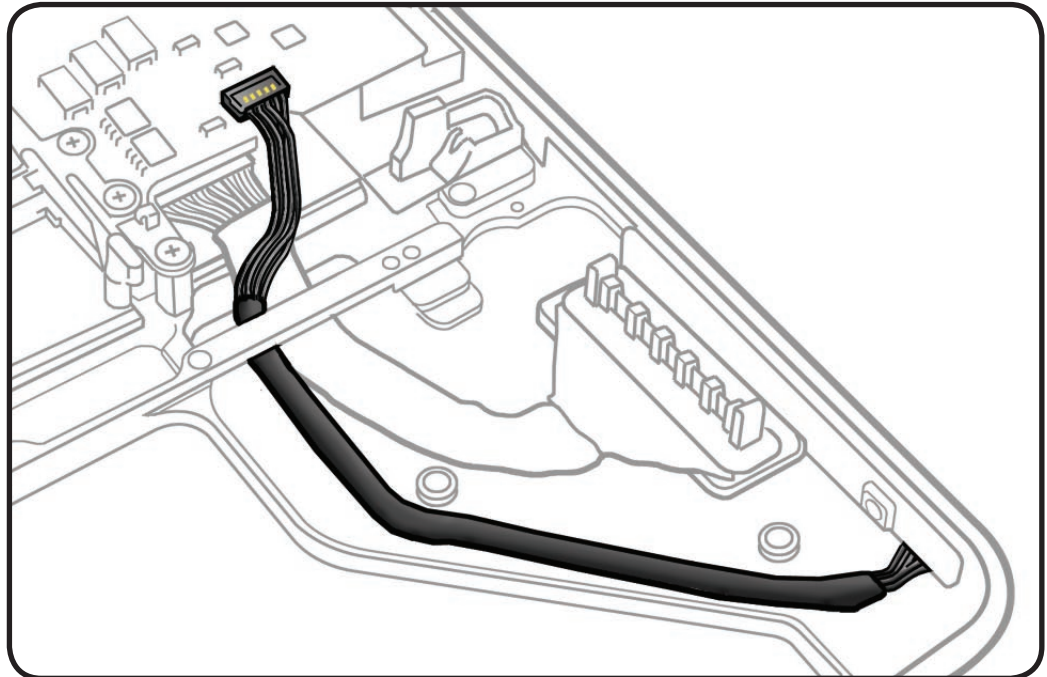
Tools

* Clean, soft, lint-free cloth
* ESD wrist strap and mat
* Magnetized Phillips #00 screwdriver
* Permanent marking felt-tip pen
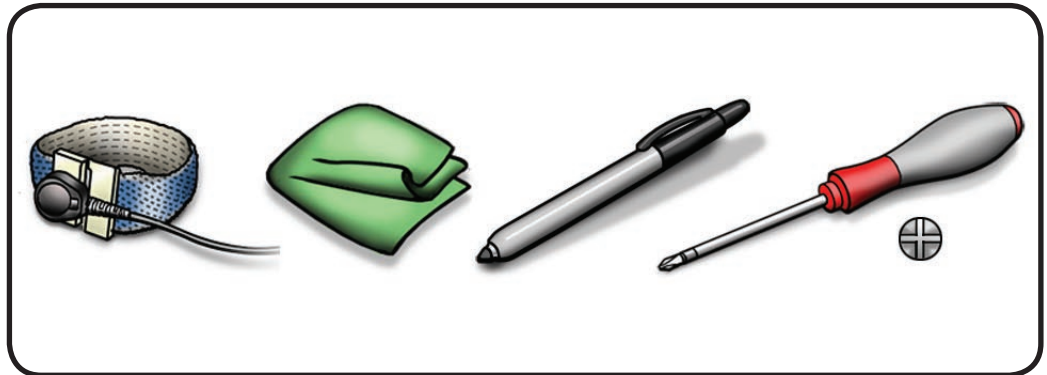
Removal

1 Draw line on inner edge of cable. to mark cable routing.

2 Remove 2.7 mm (922-8661) screw.

3 Disconnect cable from logic board.
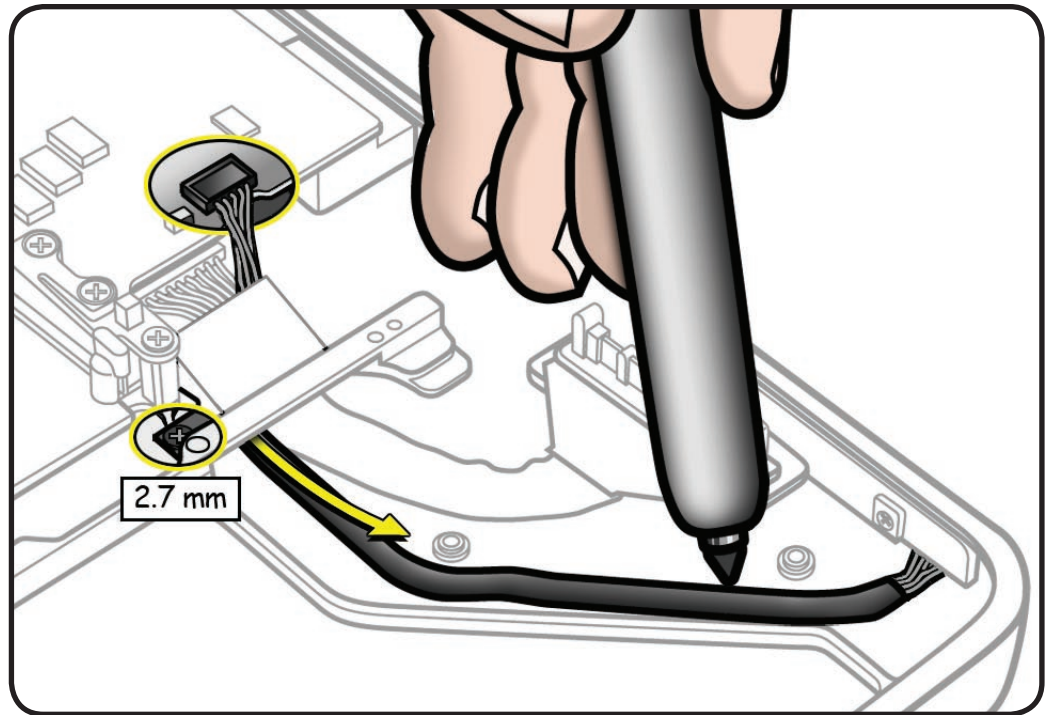
4 Remove **battery cable guide**.

5 Route cable through top case wall.
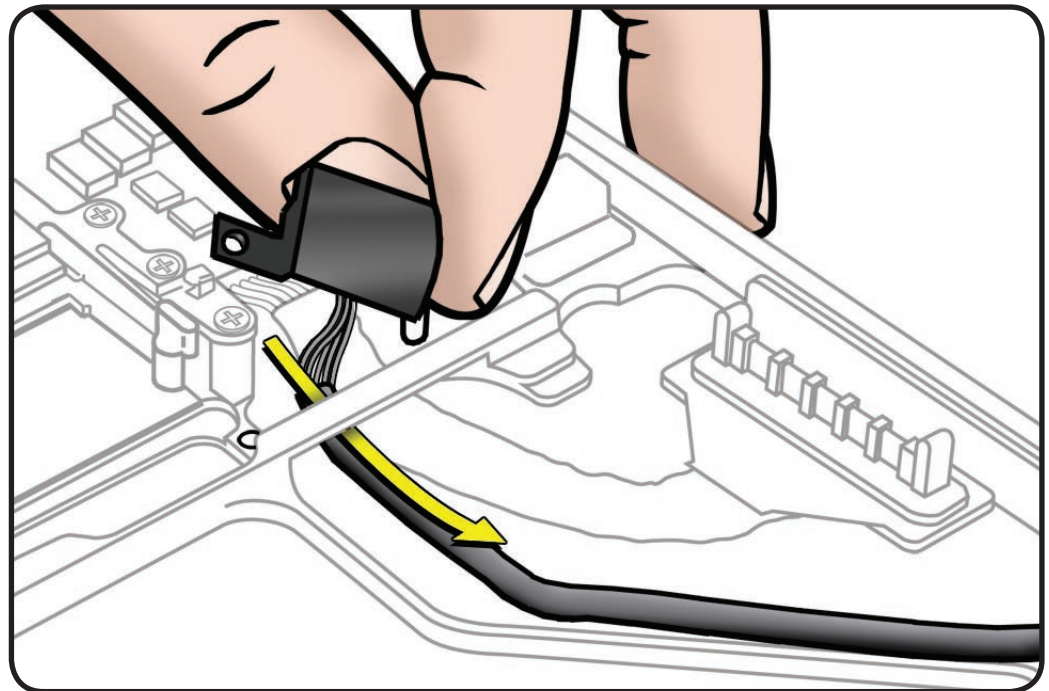
6 Remove 3 (3-mm) 922-8657 screws.

7 Lift up BIL board from side of top case.
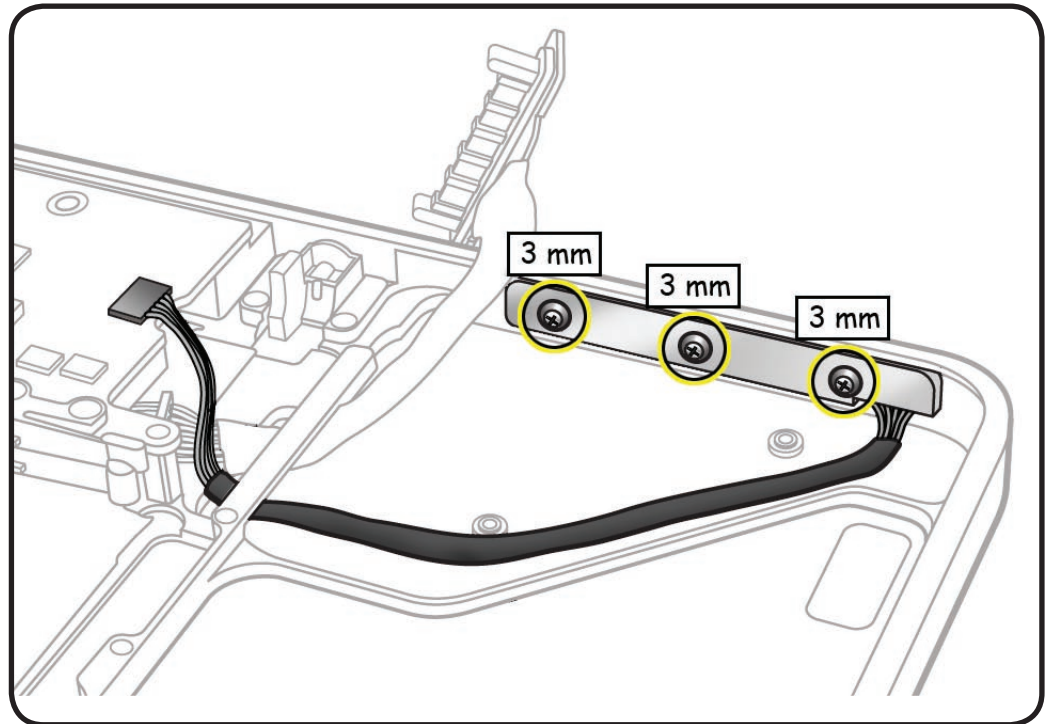
8 Disconnect cable from BIL board.

Note: With board removed, BIL button might pop out. Make sure you retain the BIL button.
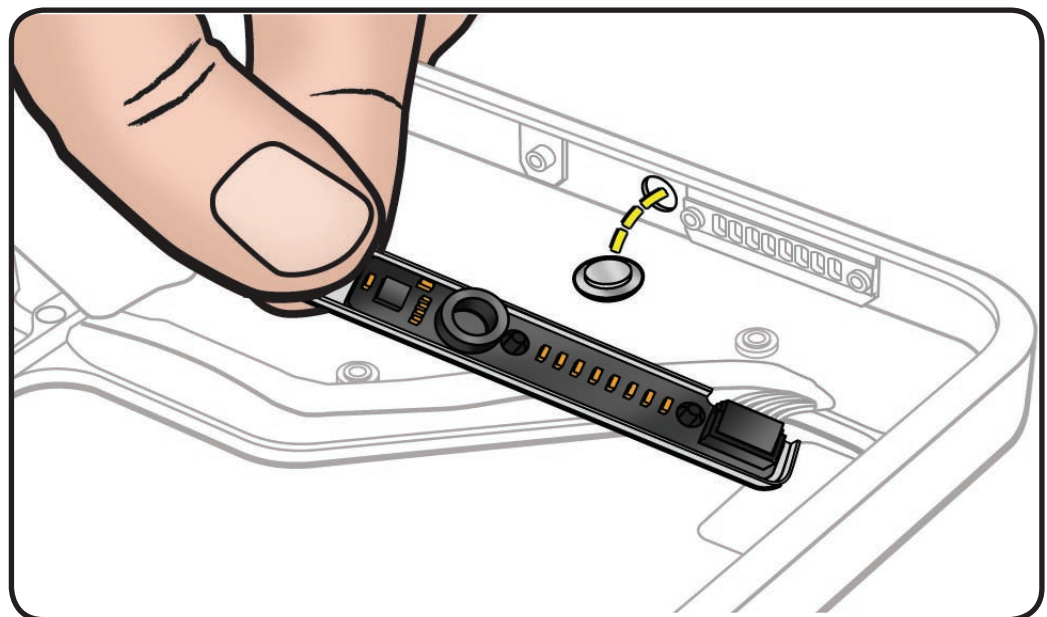
Replacement

1 Make sure rubber gasket is installed on inner side of BIL board.

2 Set and hold button in top case wall. Then install cable and BIL board.
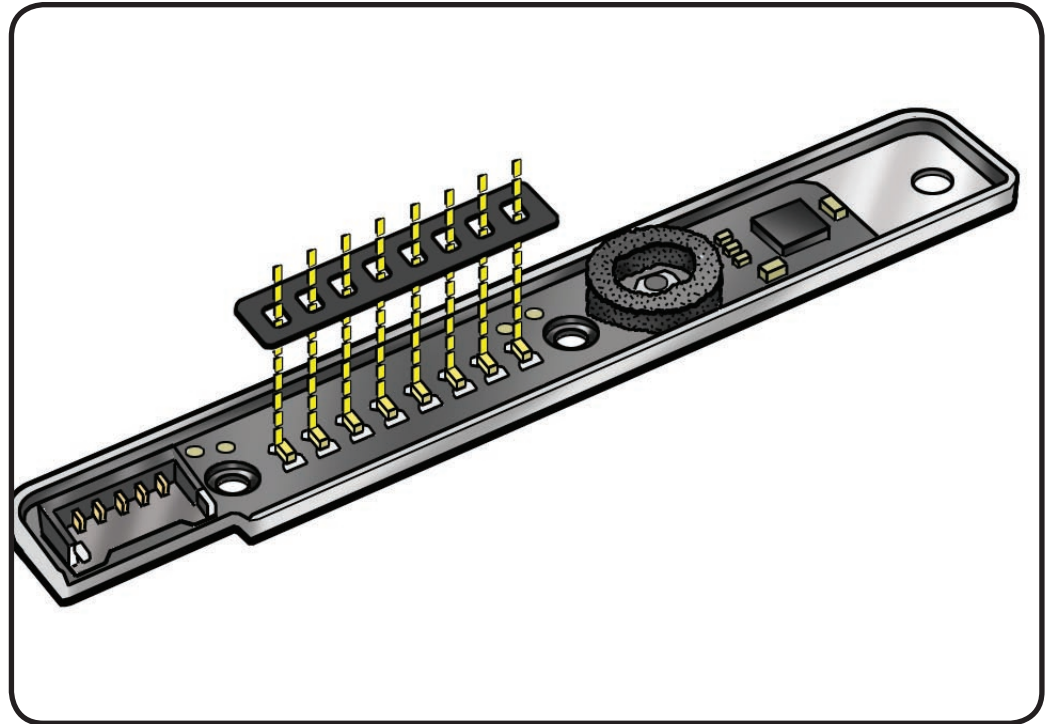
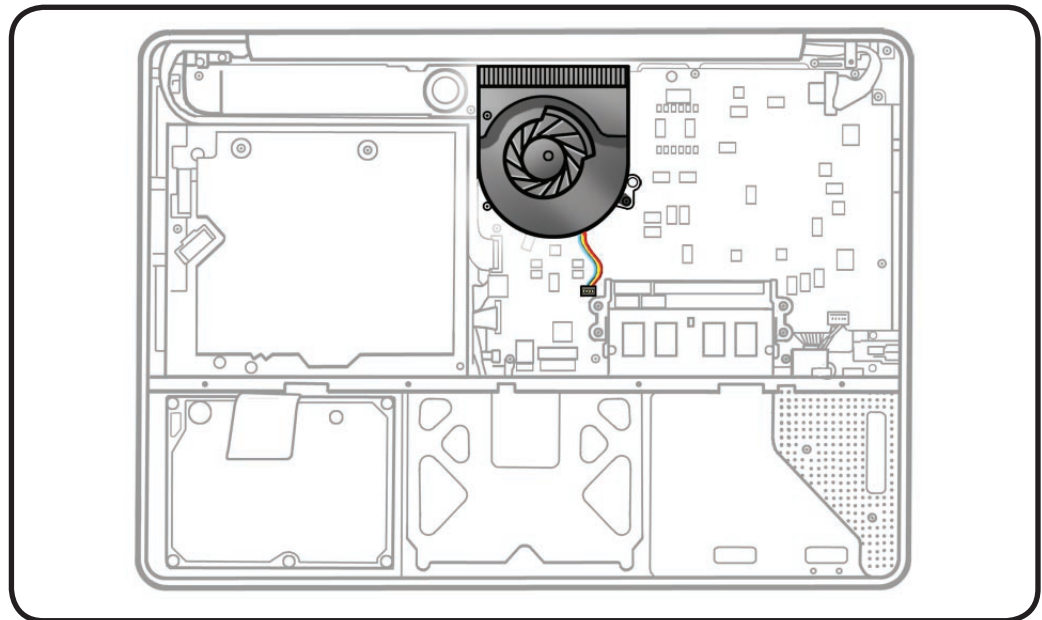**3** Press cable so it lays completely flat.
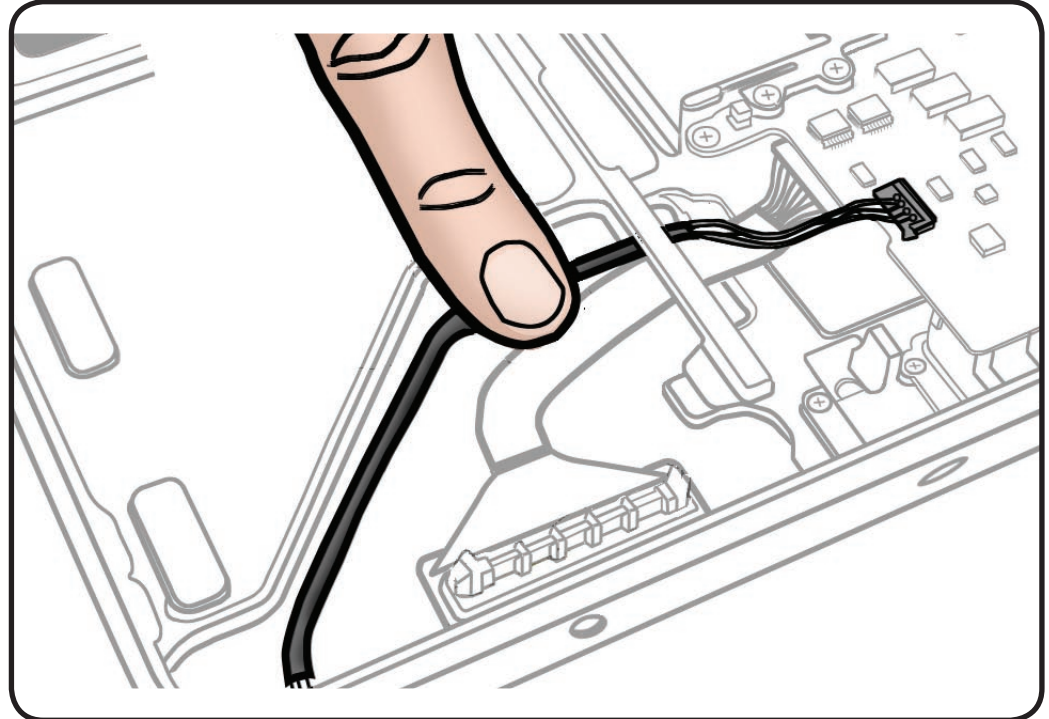
Camera Cable Guide

First Steps
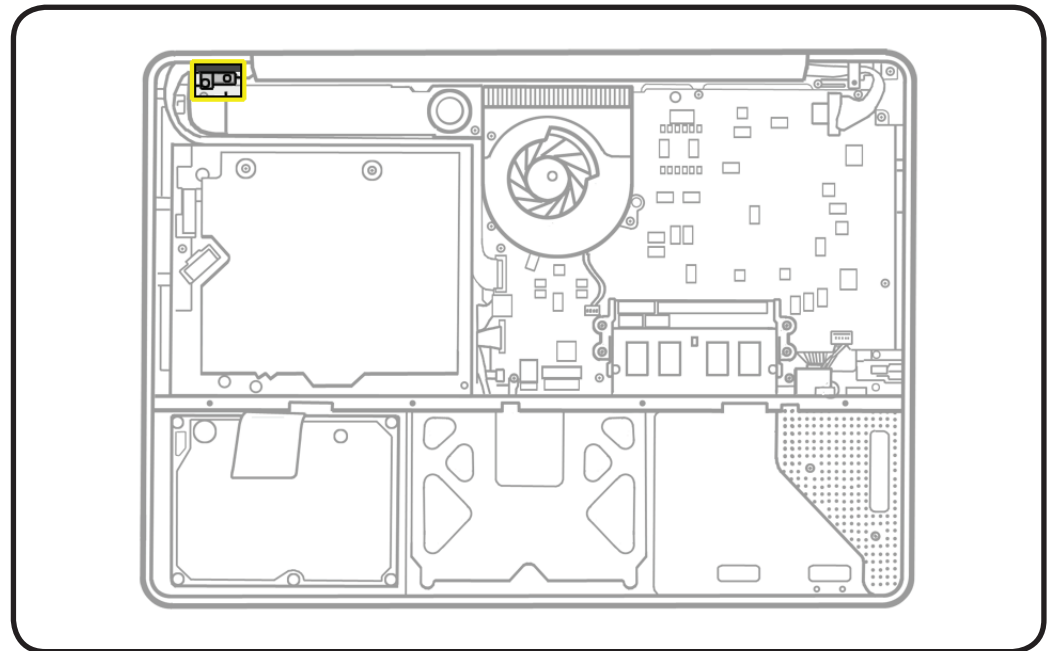
Remove:
* **Access door**
* **Battery**
* **Bottom case**

Tools

* Clean, soft, lint-free cloth
* ESD wrist strap and mat
* Magnetized Phillips #00 screwdriver
* Black stick
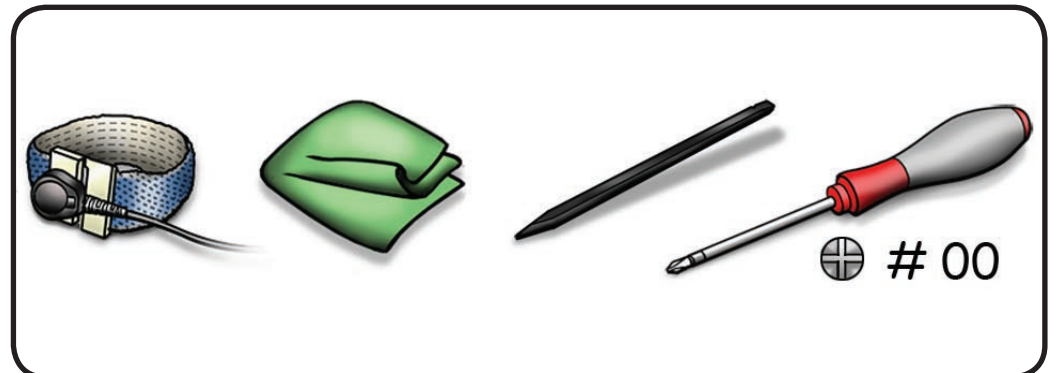
Removal

1 Remove 3 screws:
- 1 (4-mm) 922-8650
- 2 (8-mm) 922-8665

   Replacement Note:
   Install screws in order
   shown.
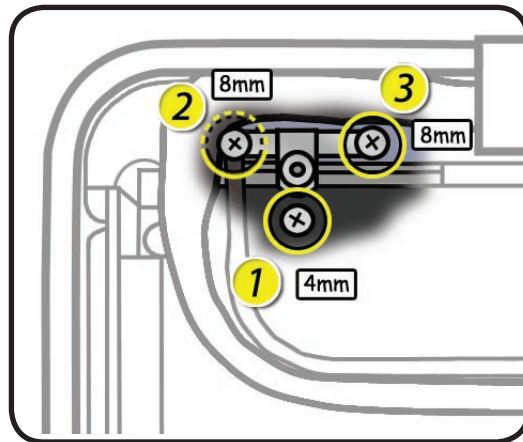
2 Use a black stick to tilt
out the camera cable
guide.
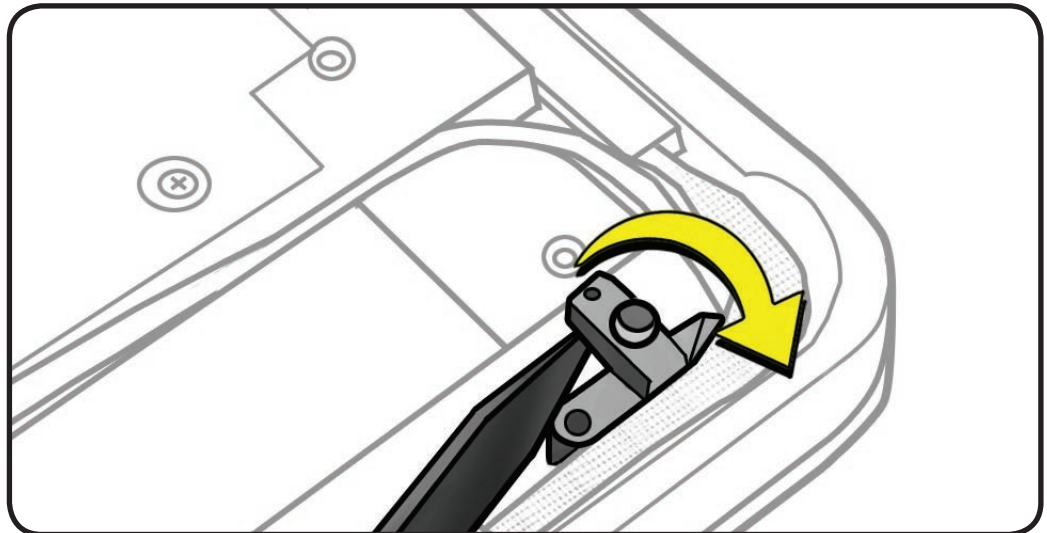
Replacement

1 **Important:** Insert the
cable guide under the
speaker and install
the 4-mm screw (922-
8650).

2 Make sure the ground
tab is over the cable
guide before installing
the 2 remaining
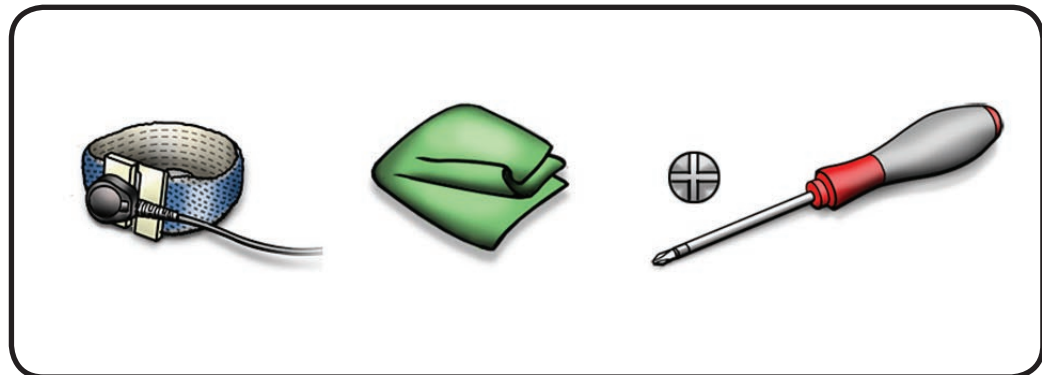screws.
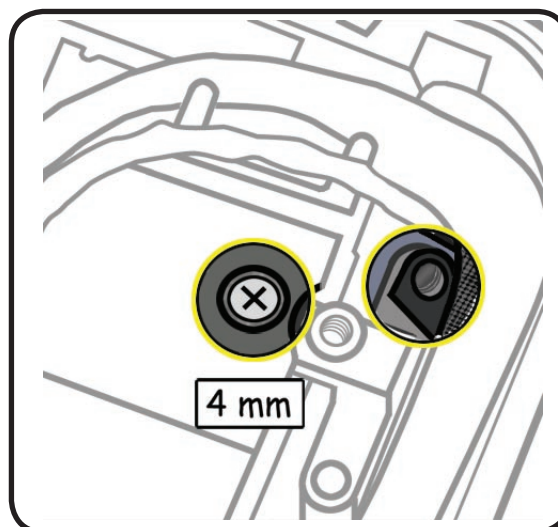
LVDS Cable Guide

First Steps
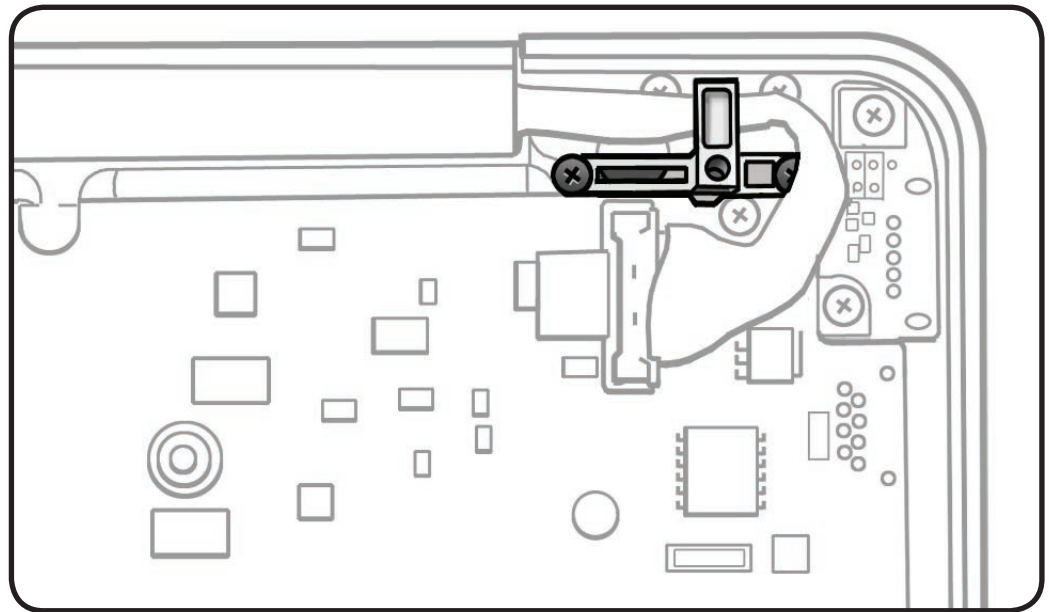
Remove:
* **Access door**
* **Battery**
* **Bottom case**

Tools

* Clean, soft, lint-free cloth
* ESD wrist strap and mat
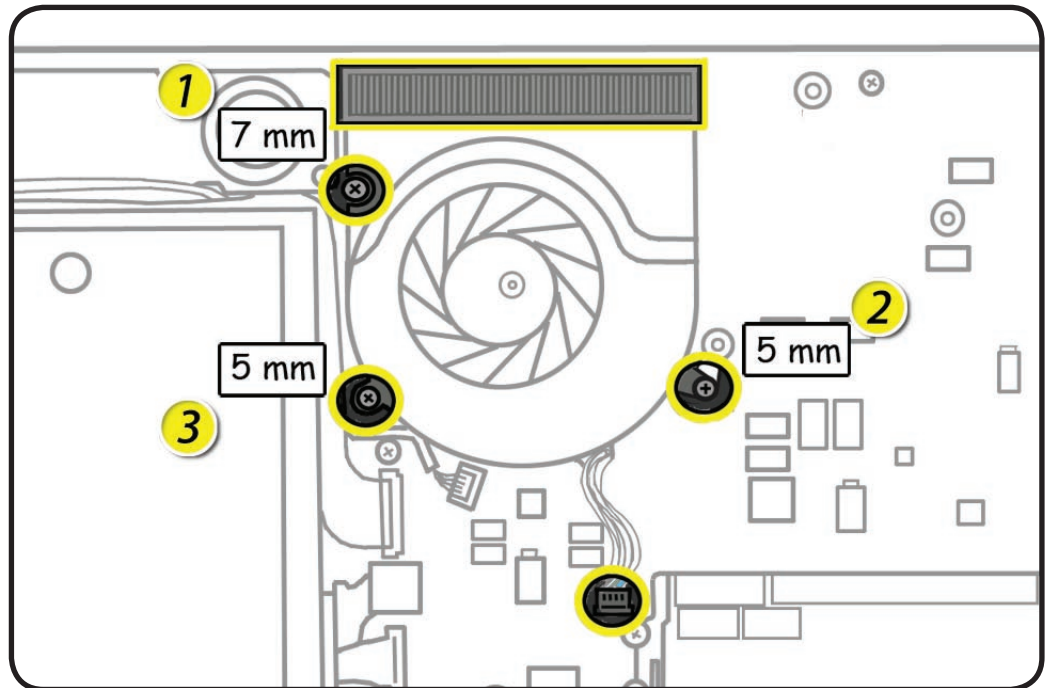* Magnetized Phillips #00 screwdriver
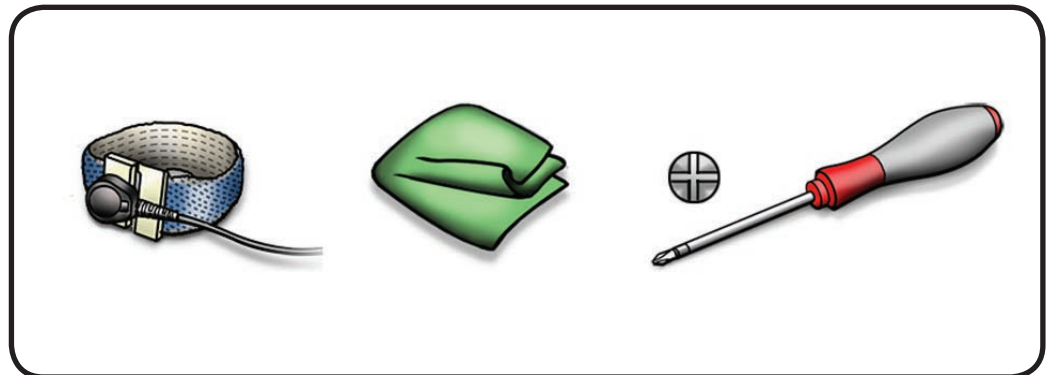
Removal

1 Remove 2 screws:
- 5-mm in corner (922-8658)
- 7-mm (922-8645)
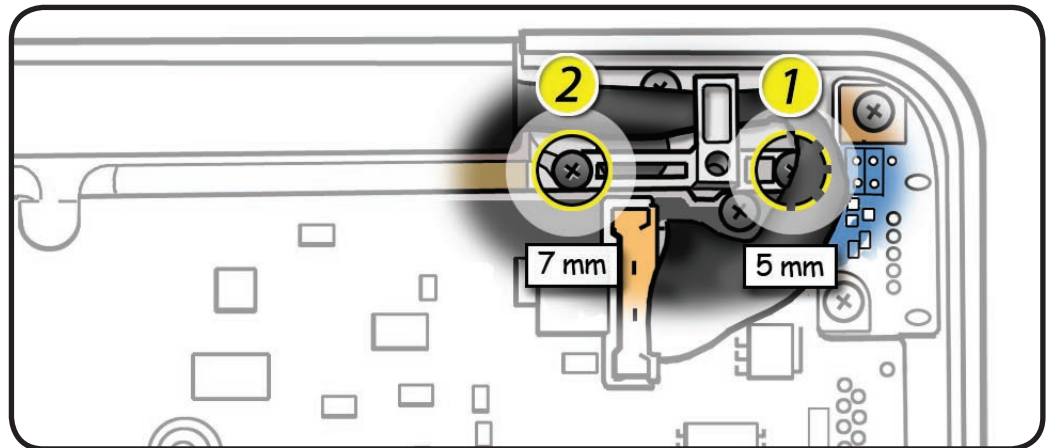
2 Lift out cable guide.

Replacement Note: Align locator pin to hole in top case.
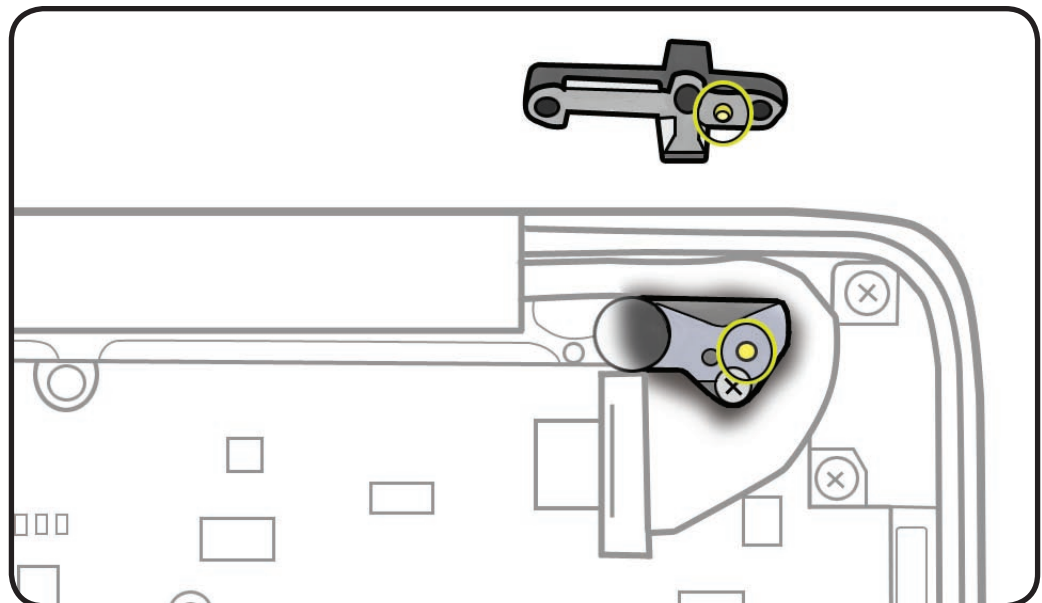
Display Assembly

First Steps

Remove:
- **Access door**
- **Battery**
- **Bottom case**
- **Camera cable guide**
- **LVDS cable guide**

Tools

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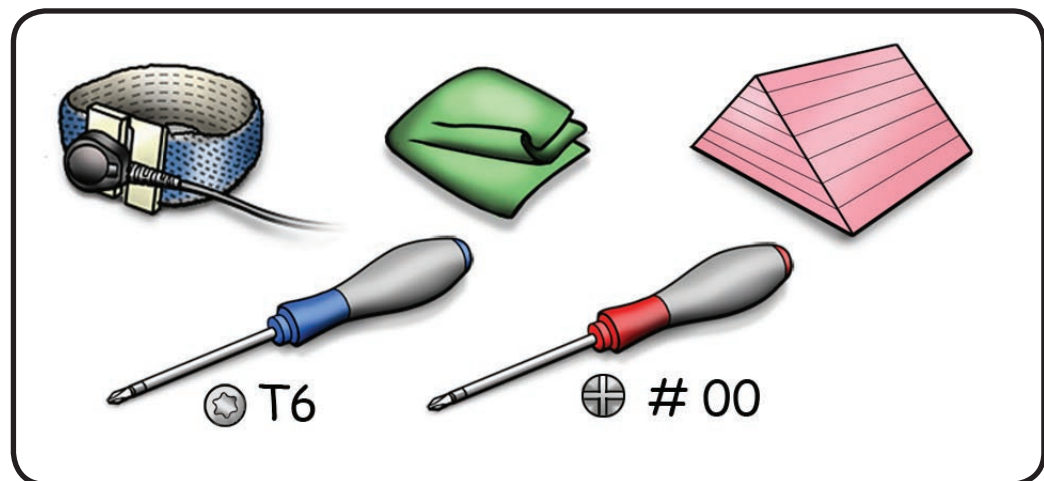
Removal

1 Close display and place on soft cloth.

2 In the direction shown, peel off foam gasket from the LVDS connector.

> **Caution:** Refer to **Connector Types** before disconnecting cables.
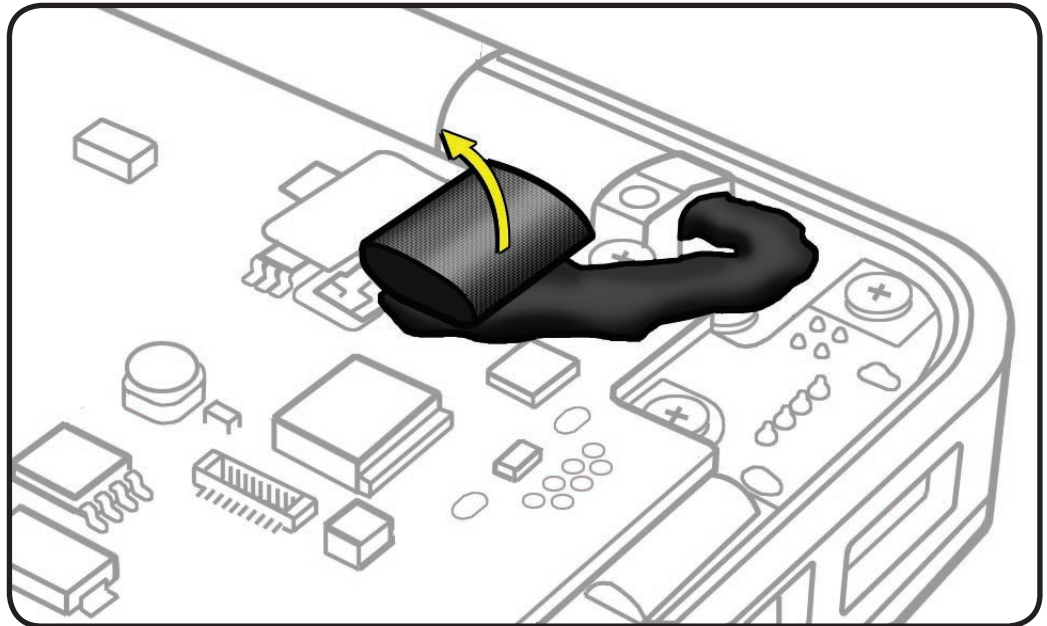
3 Disconnect and unroute 3 cables:

- subwoofer
- camera
- LVDS

4 Remove 4-mm screw (922-8644) from the subwoofer.

4 mm
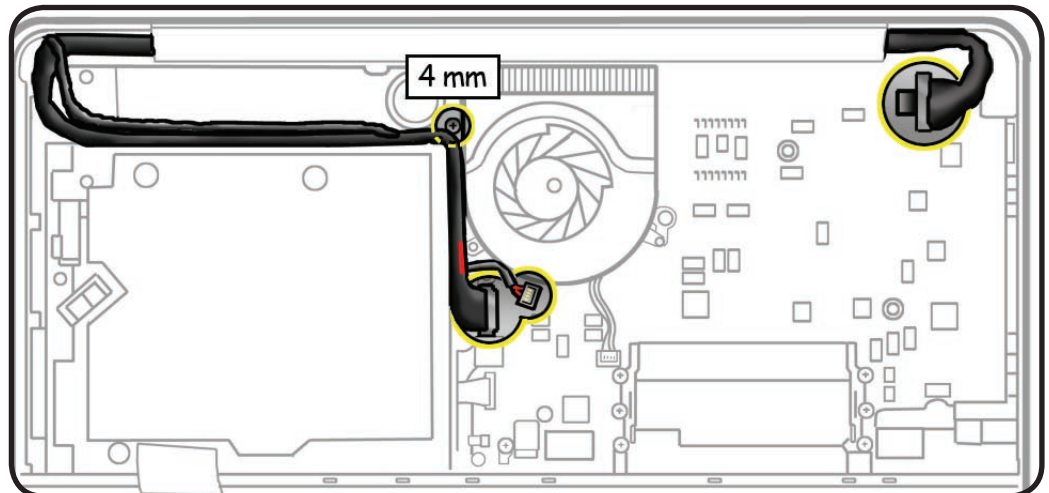
5 Without straining the subwoofer cable, rotate the subwoofer away from the right corner.

6 Open the display to 90 degrees, and place the computer on the foam wedge fixture.

7 Remove 6 (6-mm) Torx 922-8756 screws:

> **Replacement Note:** Install screws 1/2 way first; then tighten screws in the order shown.

8 Separate display assembly from top case.
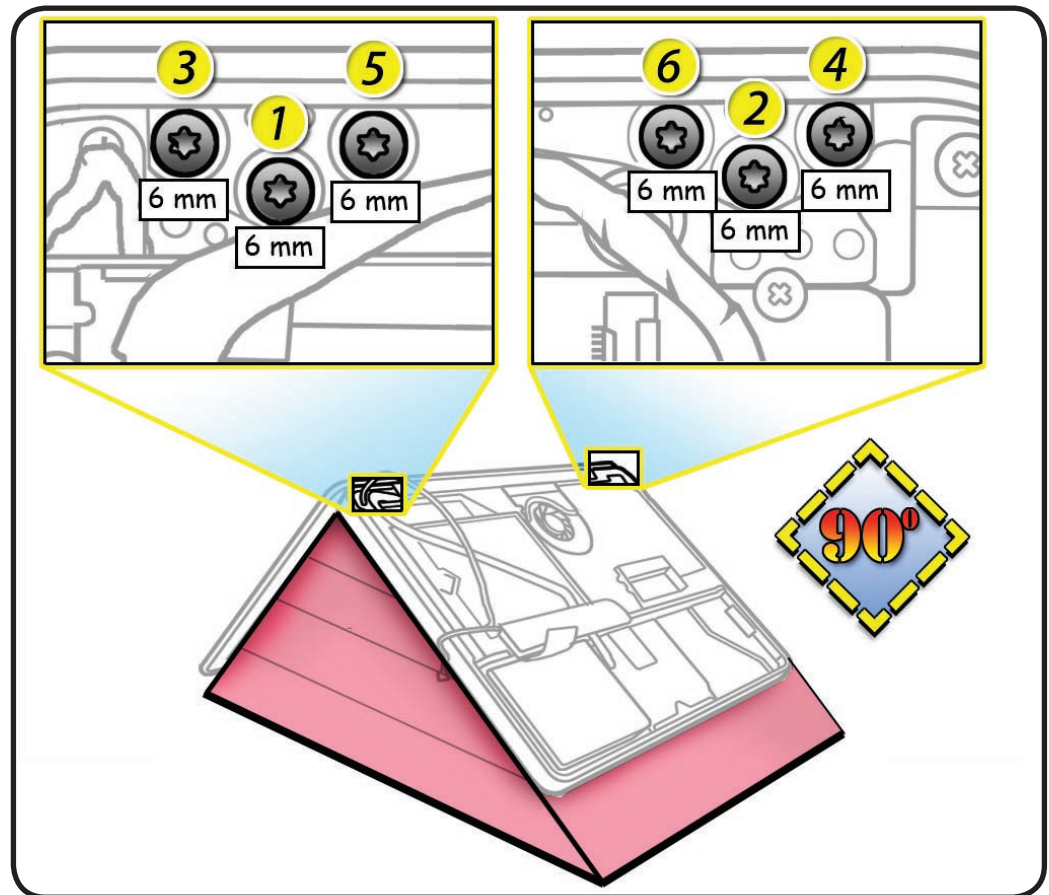
Replacement

Important: Before returning a display assembly, be sure to
- remove **clutch cover**
- remove **AirPort Card** and transfer it to the new display assembly
- reinstall **clutch cover**

Important: Before installing a new display assembly, be sure to install the **AirPort Card**. With the computer assembled, test the AirPort Card for normal operation.
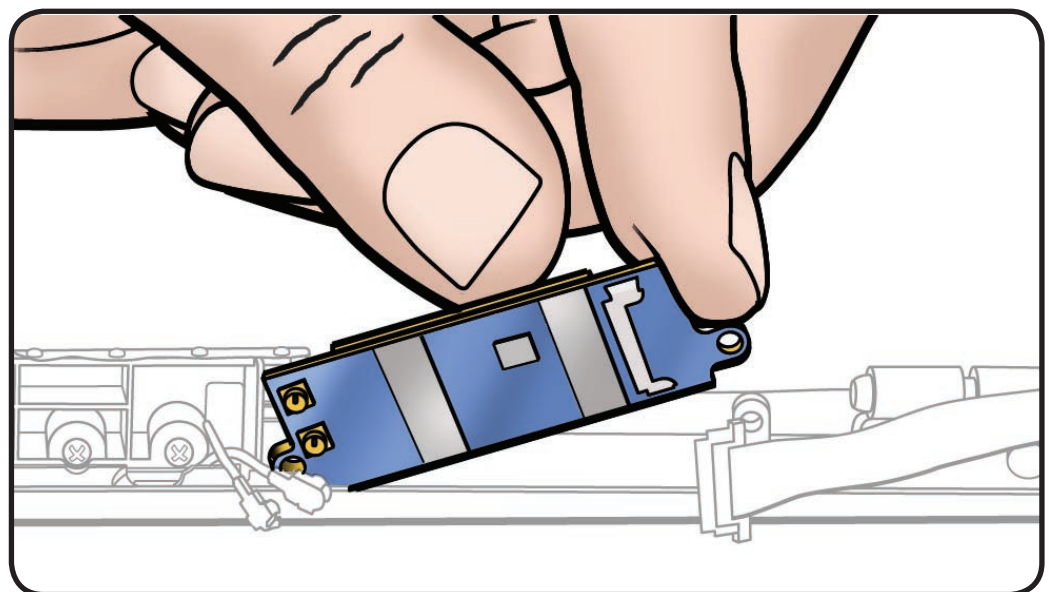
Display Clutch Cover

First Steps

Remove:
- **Access door**
- **Battery**
- **Bottom case**
- **Camera cable guide**
- **LVDS cable guide**
- **Display assembly**
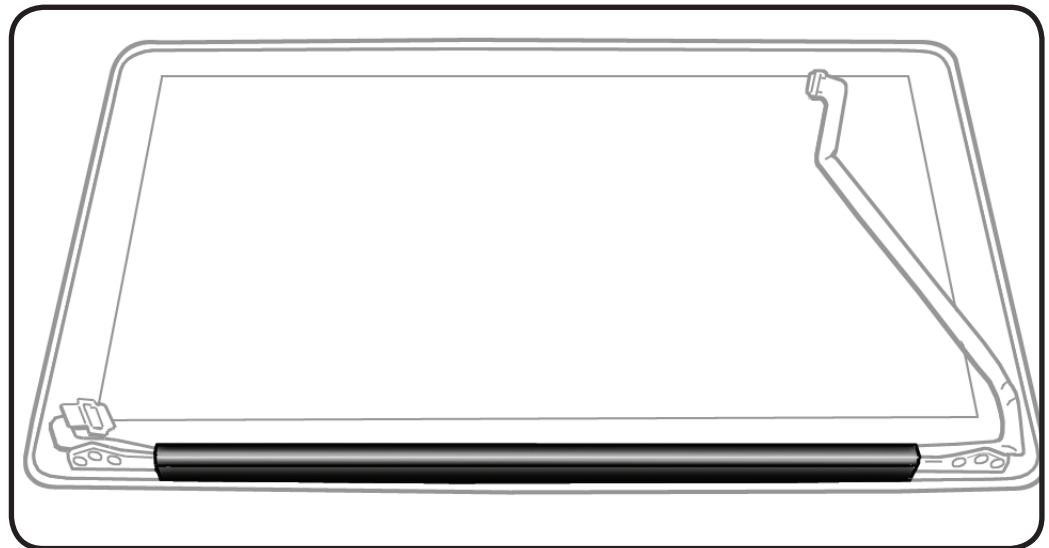
Tools

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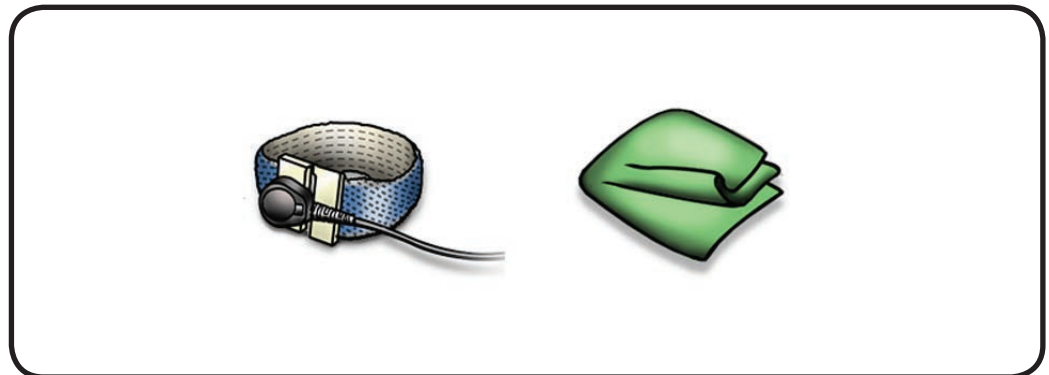
Removal

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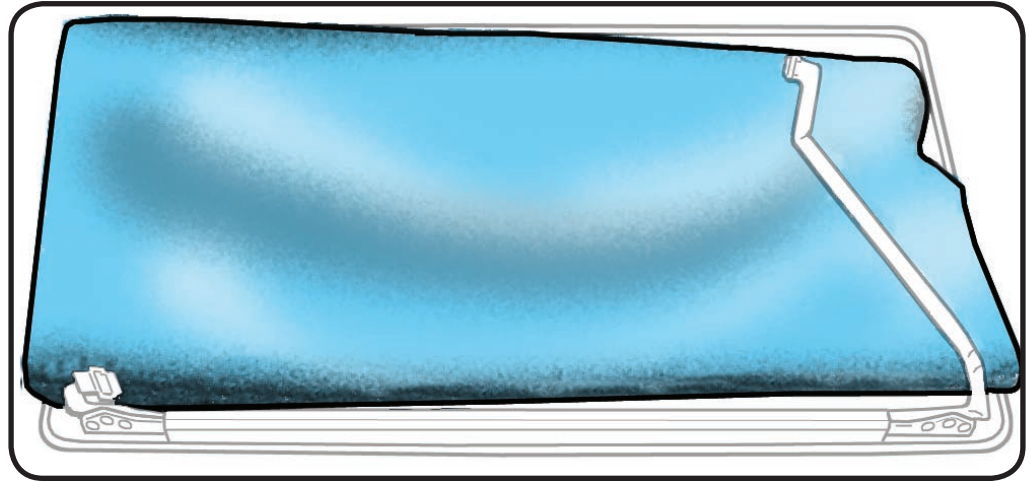
2 Holding left hinge, slide clutch cover 1/4 inch (6.35 mm) away from the LVDS cable.
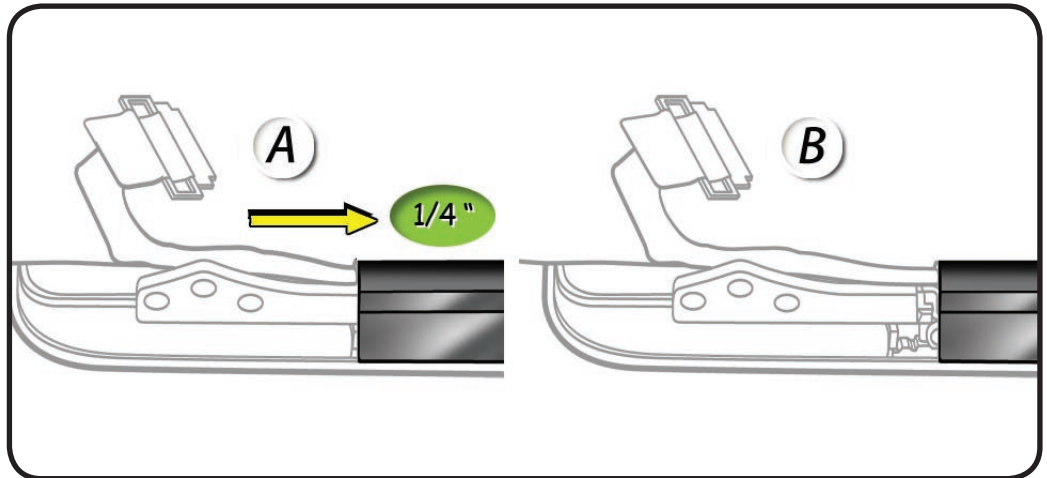
3 Press down on clutch cover to loosen 4 hooks inside.

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

5 Remove clutch cover.
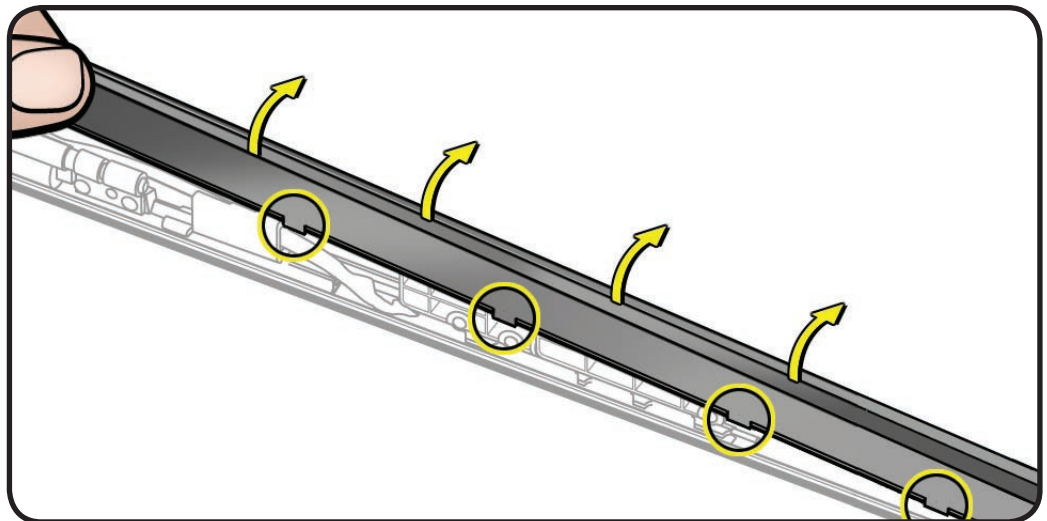
Replacement

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

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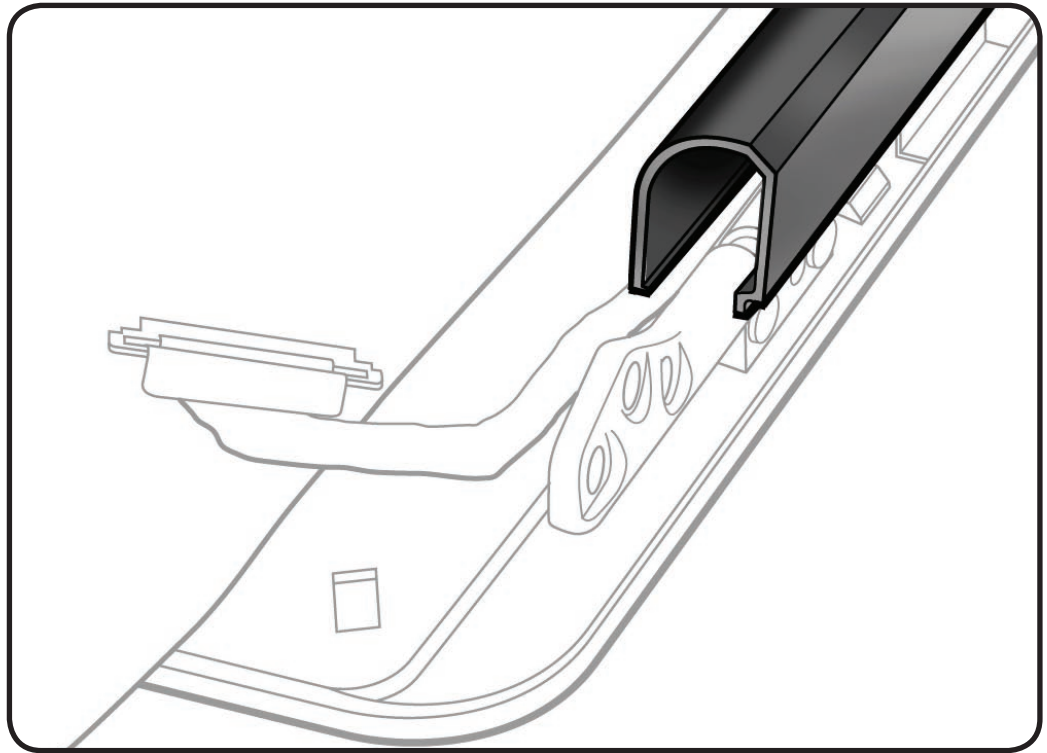
3 Tilt clutch cover onto end with longer cable.

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
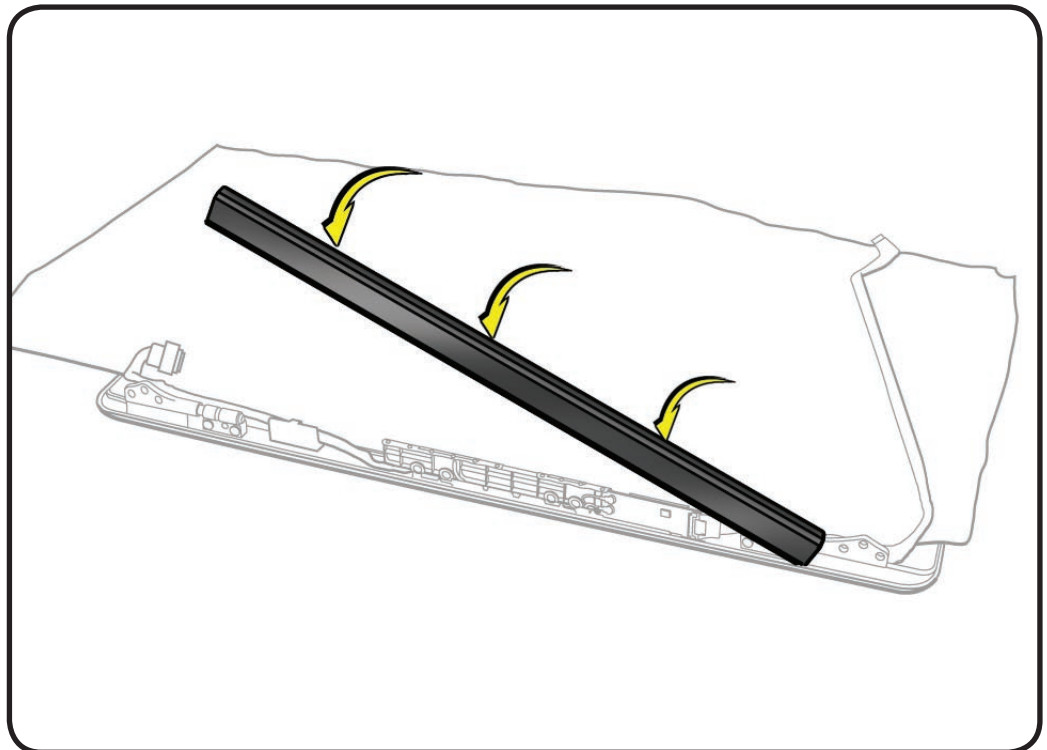
AirPort Card

First Steps

Remove:
- **Access door**
- **Battery**
- **Bottom case**
- **Camera cable guide**
- **LVDS cable guide**
- **Display assembly**
- **Display clutch cover**
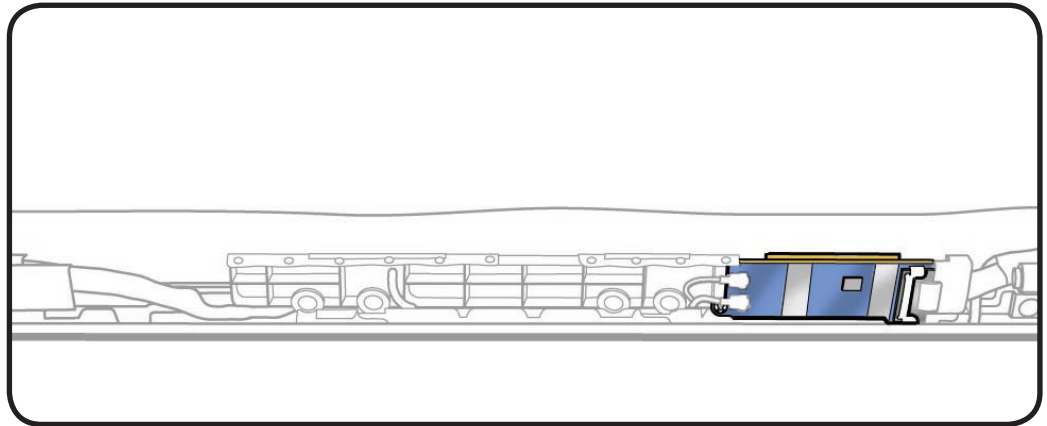
Tools

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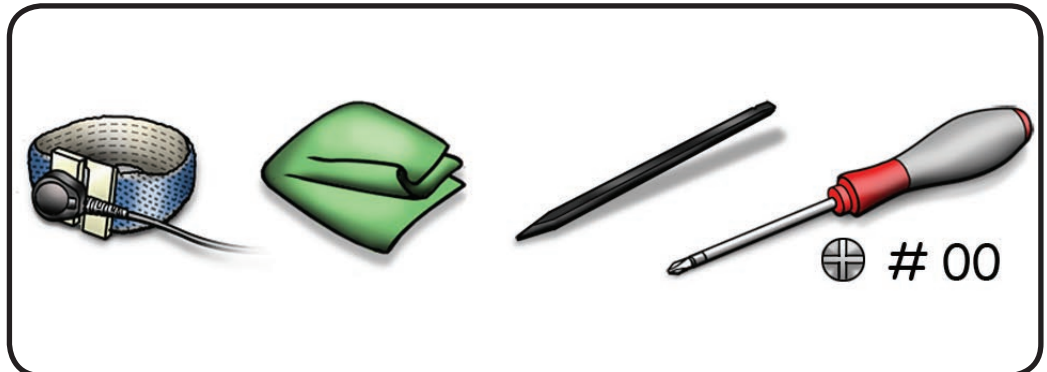
Removal

1 Cover display with clean, soft cloth.

2 Remove 3.3 mm screw (076-1326) from cable clip.

    Note the wide head on this screw.

3.3 mm
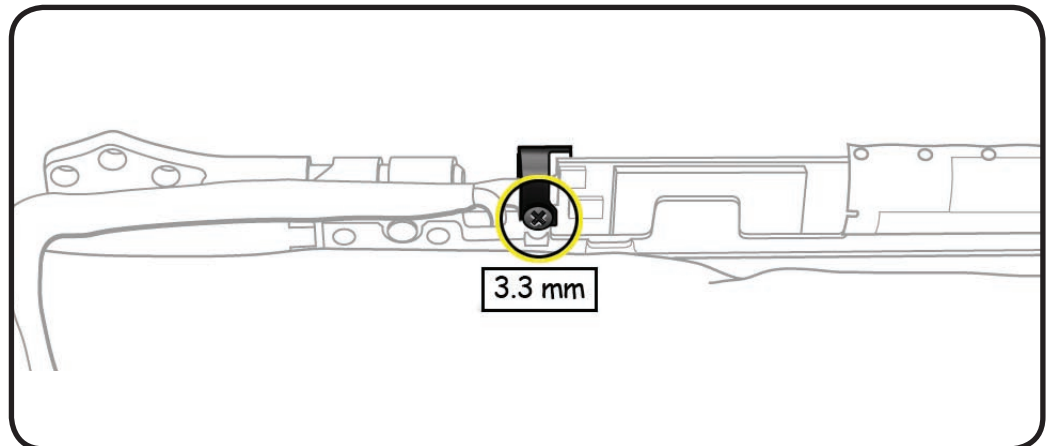
3 Lift up cable clip.
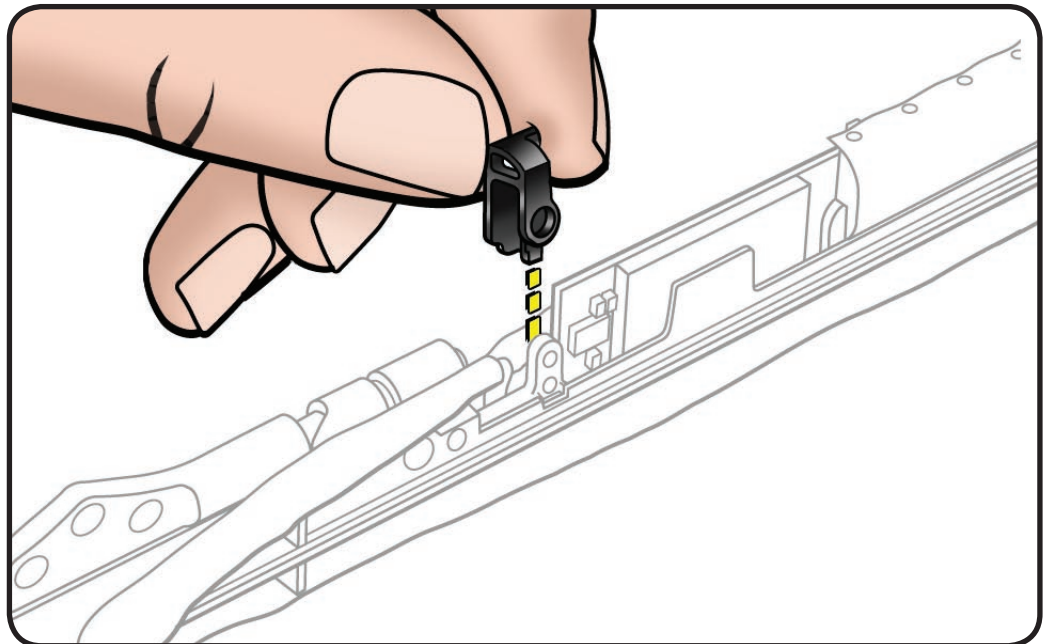
4 Disconnect AirPort cable.

5 Disconnect 2 AirPort antenna cables.

    Replacement Note: Shorter cable is at bottom.

6 Remove 2 (3-mm) screws (076-1326).

3 mm   3 mm
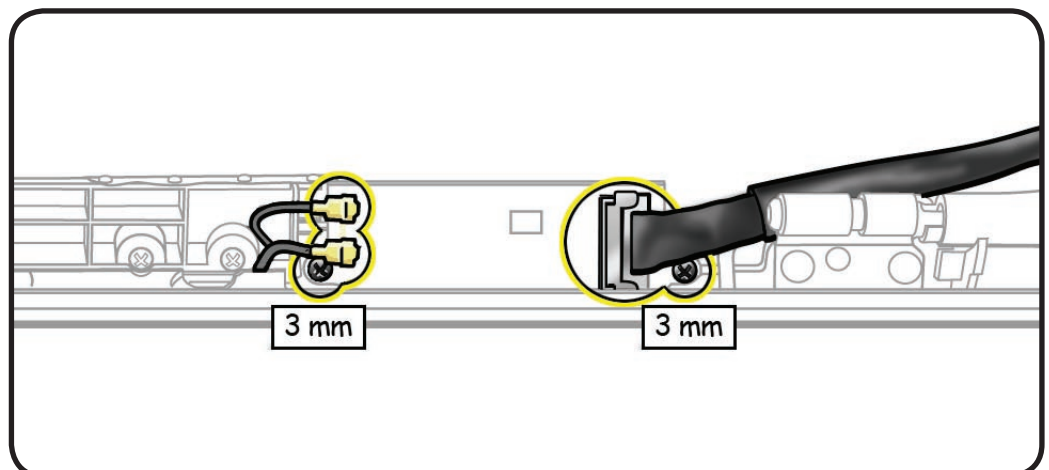
7 Lift out AirPort Card.
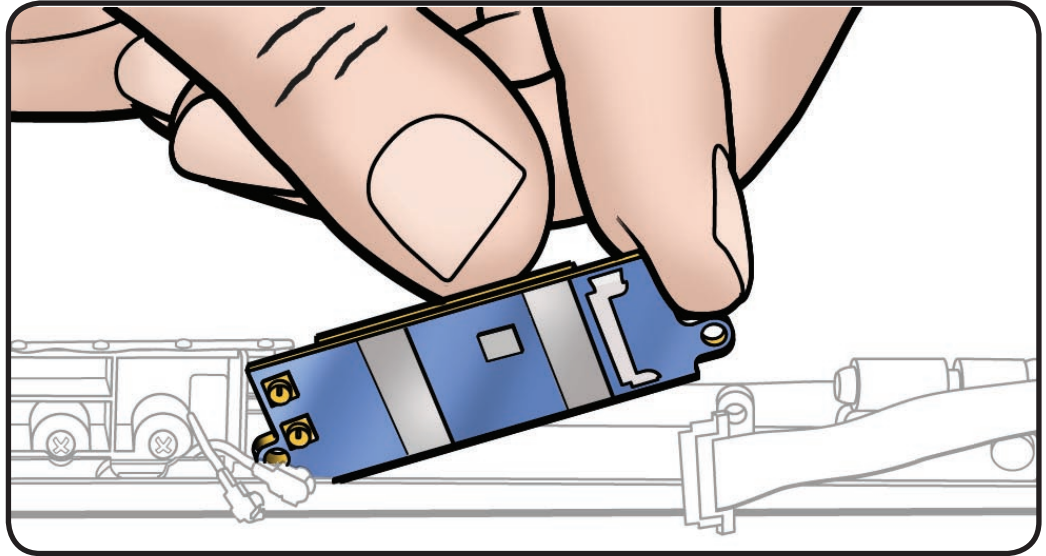
Replacement

1 Make sure thermal pad is centered on AirPort Card within 4 corner guides, rather than stuck to display assembly tab.

2 After installing the AirPort Card connectors and screws, be sure to install the cable clip with the wider head screw.
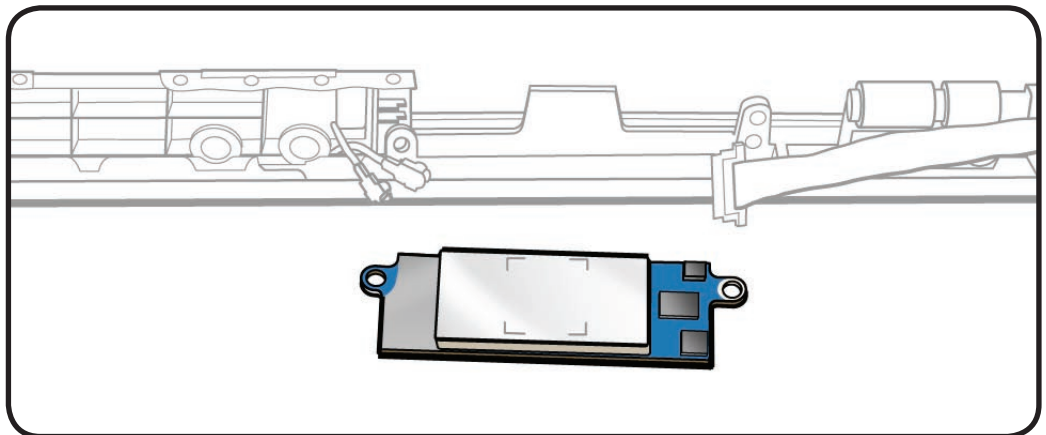
AirPort Antenna

First Steps

Remove:
- **Access door**
- **Battery**
- **Bottom case**
- **Camera cable guide**
- **LVDS cable guide**
- **Display assembly**
- **Display clutch cover**
- **AirPort Card**
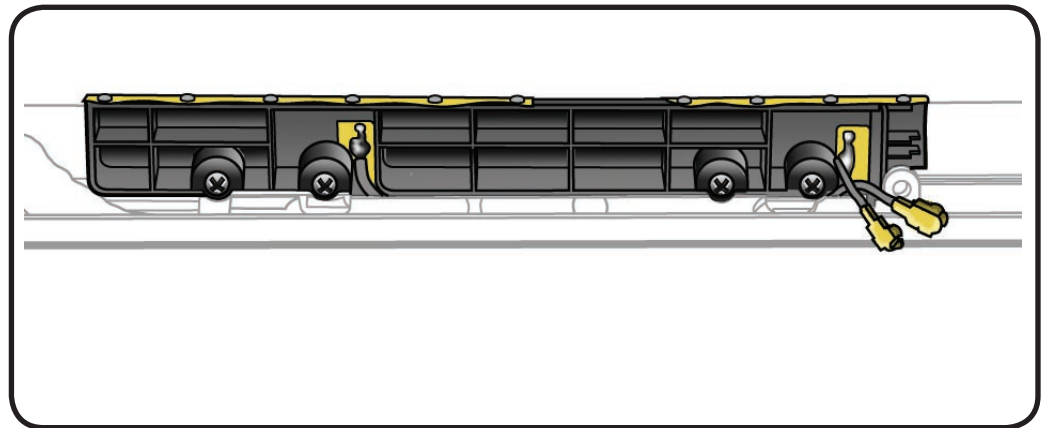
Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
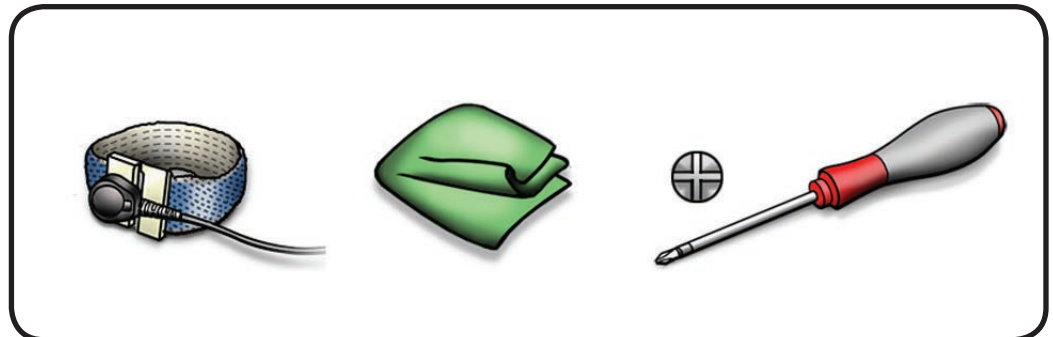
Removal

1 Remove 4 (3-mm) screws (076-1326).

2 Lift out card.
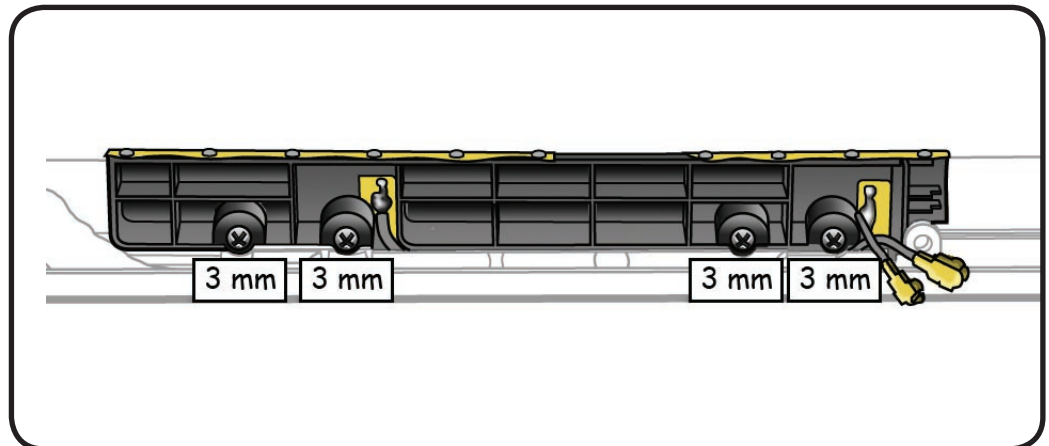
Replacement Note: Make sure the AirPort antenna cable is routed in its channel.
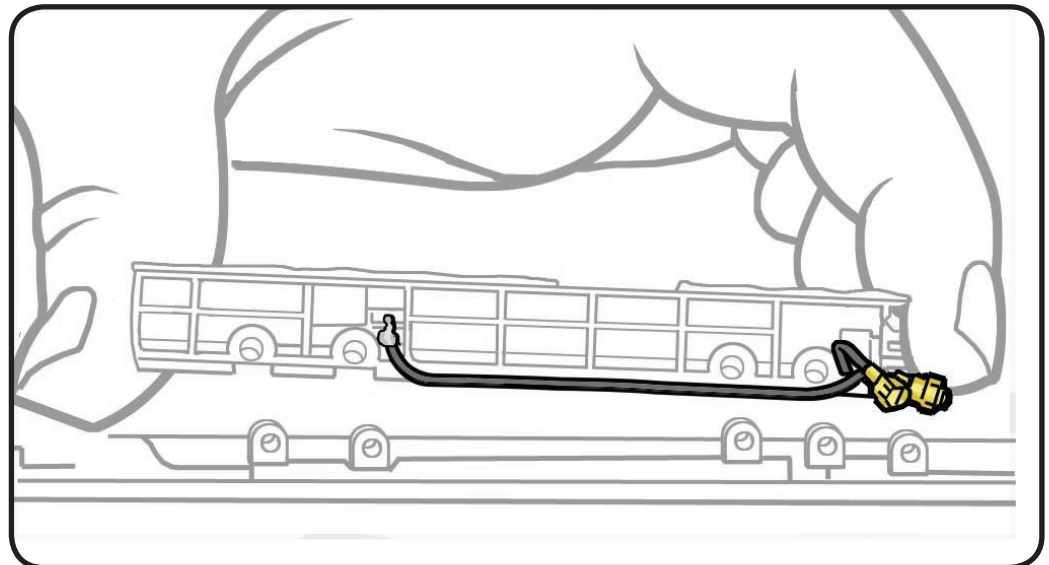
Optical Drive

First Steps
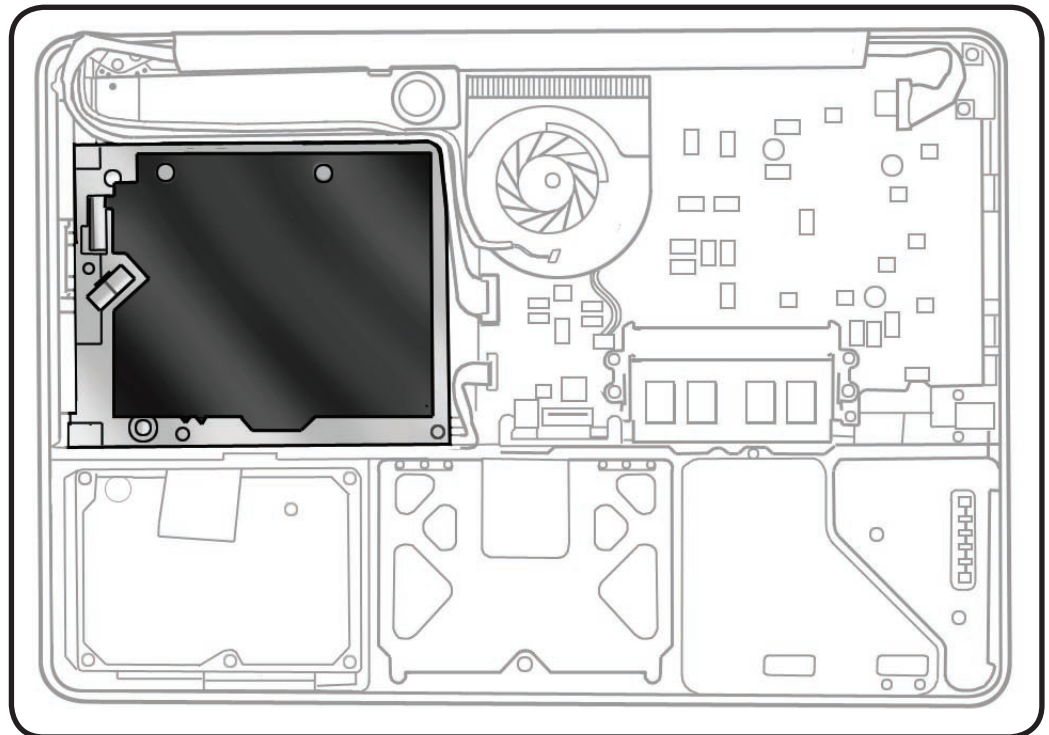
Remove:
- **Access door**
- **Battery**
- **Bottom case**
- **Camera cable guide**

Tools

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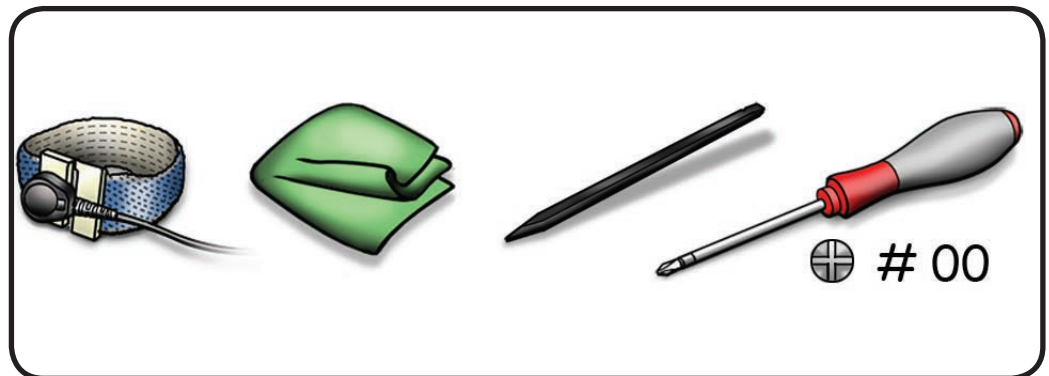
Removal

1 Disconnect cables:
- subwoofer
- optical drive

2 Remove screws:
- 1 (4-mm) subwoofer (922-8650)
- 3 (2.5-mm) optical drive (922-8662)

3 Disconnect optical drive cable from logic board.

Press cable straight down when installing.

4 Tilt up drive to remove.
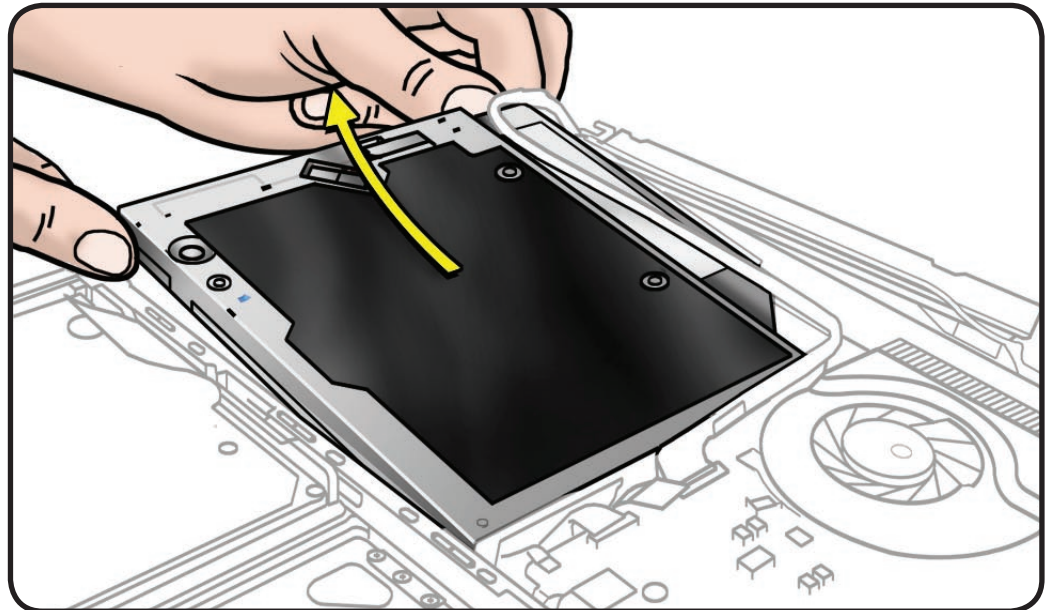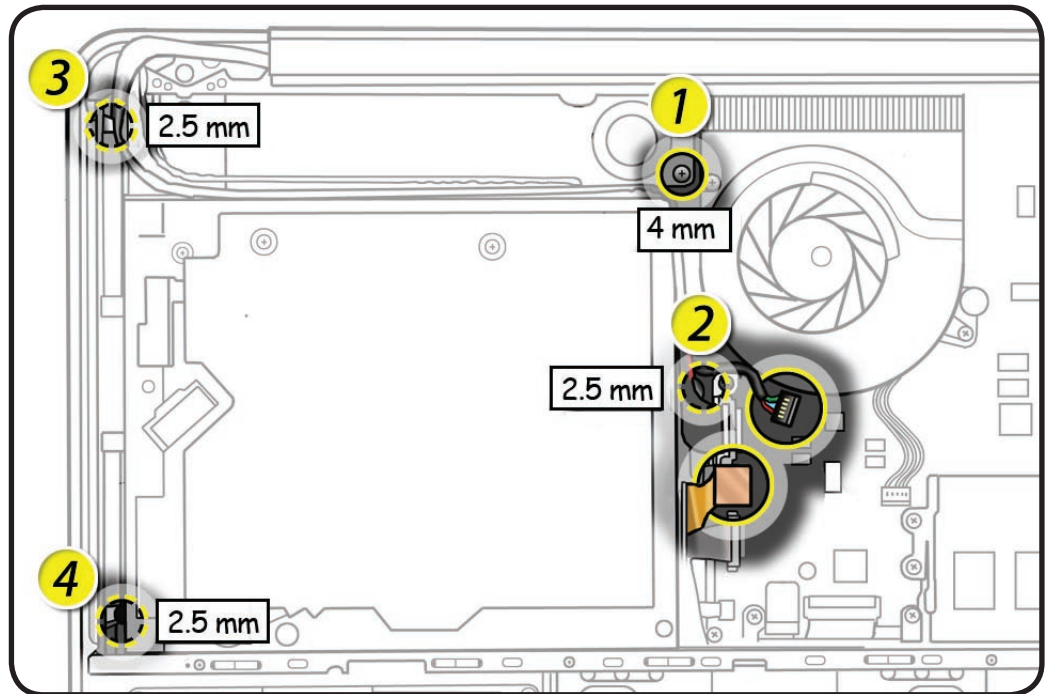
5 Handle drive by sides.

6 If replacing optical drive, make sure it has flex cable.
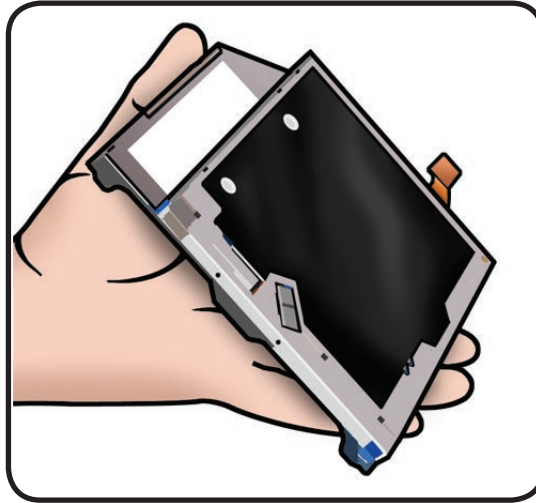
Replacement

1 Do not touch sensor on top case.
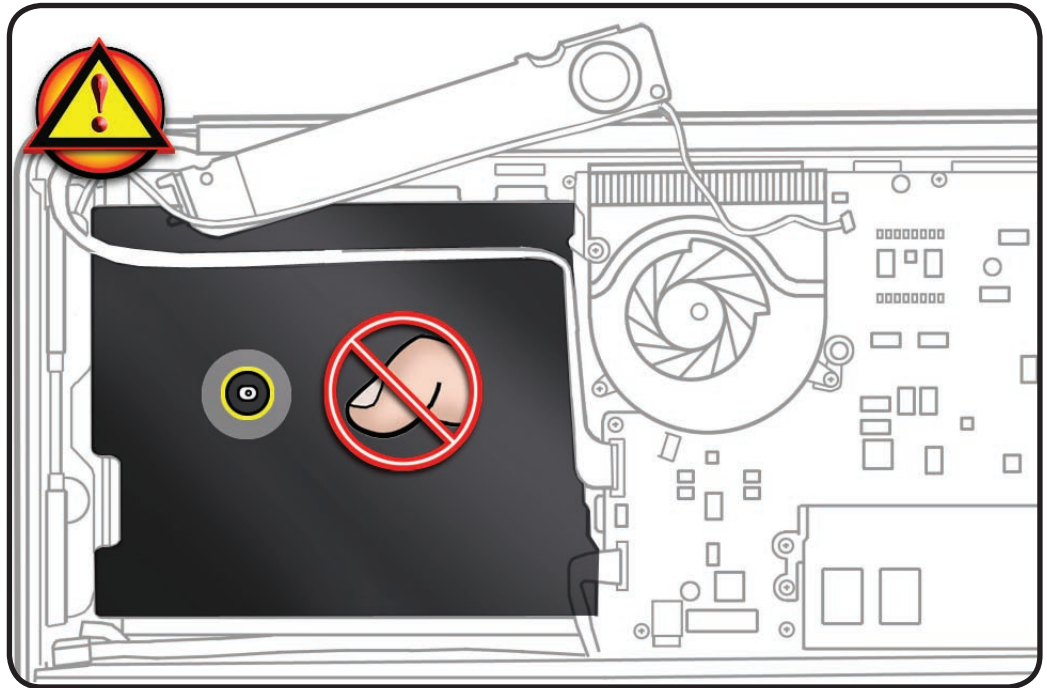
2 If installing a new optical drive, make sure it has the flex cable attached.

3 Tilt optical drive into top case, making sure cables are out of way..
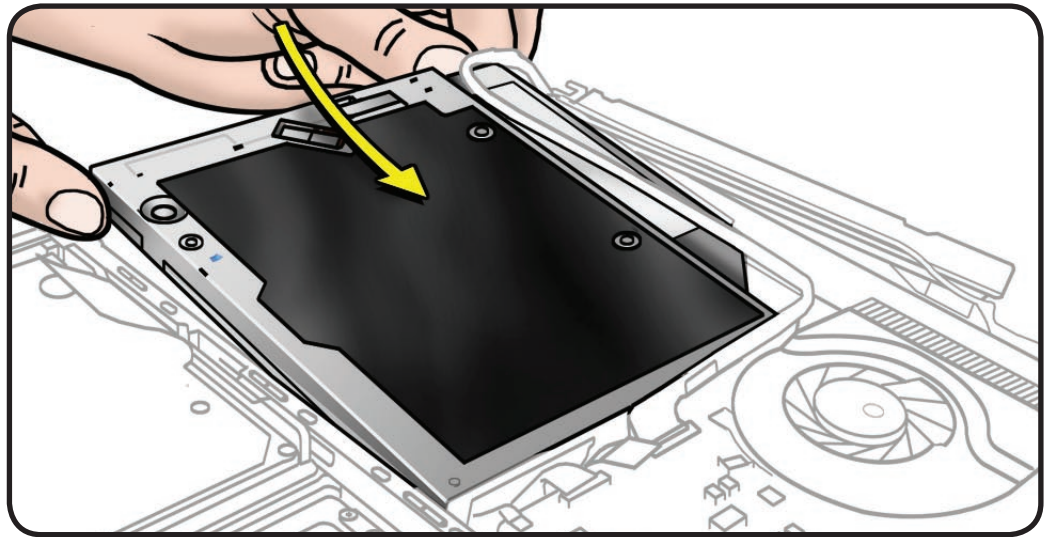
Optical Drive Flex Cable

First Steps

Remove:
- **Access door**
- **Battery**
- **Bottom case**
- **Camera cable guide**
- **Optical drive**
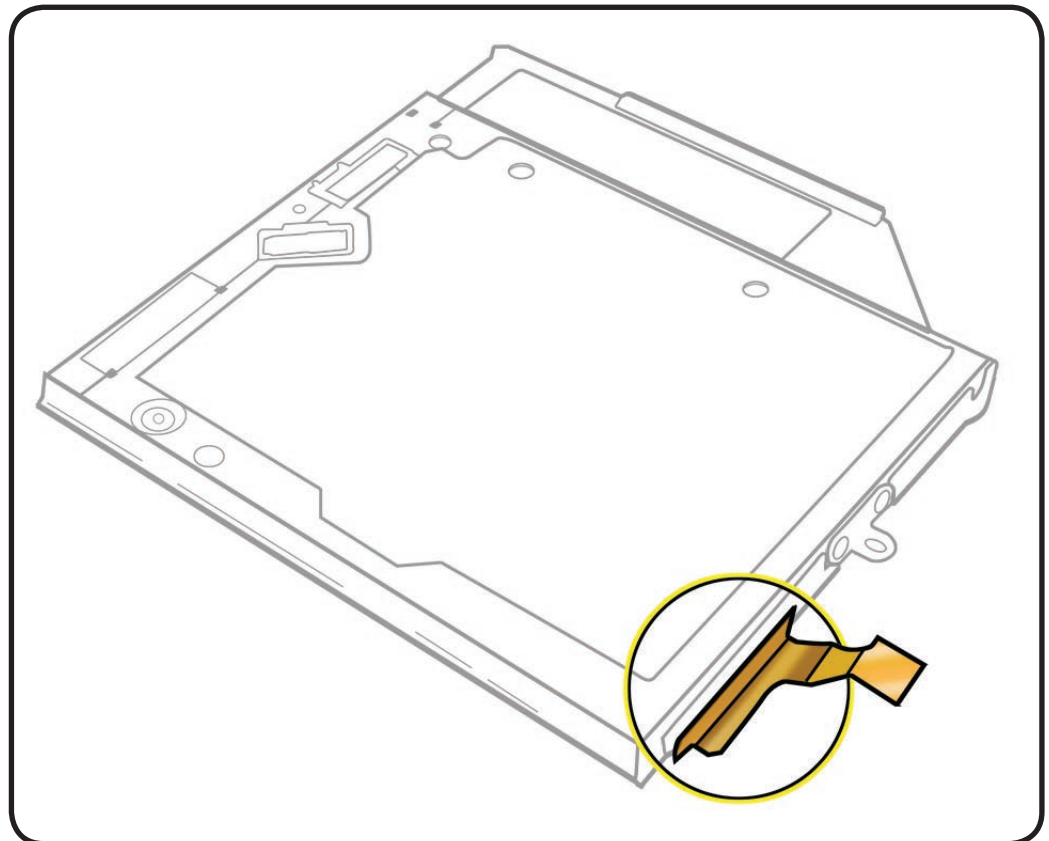
Tools

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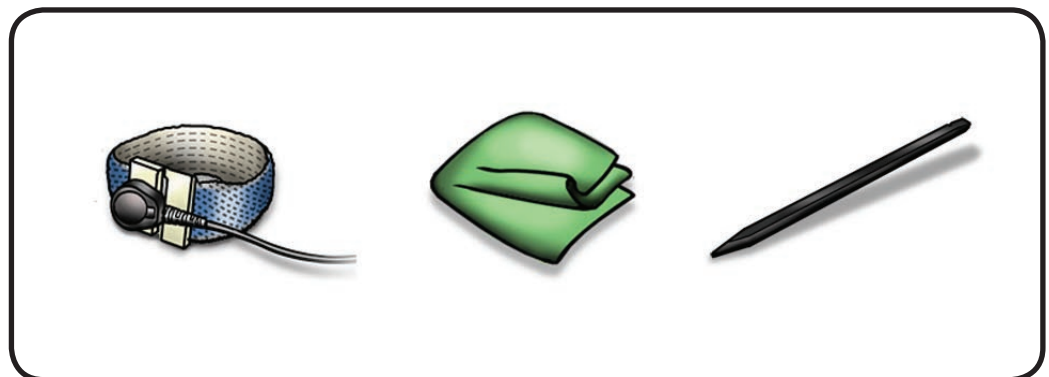
Removal

1 Handle drive by sides.

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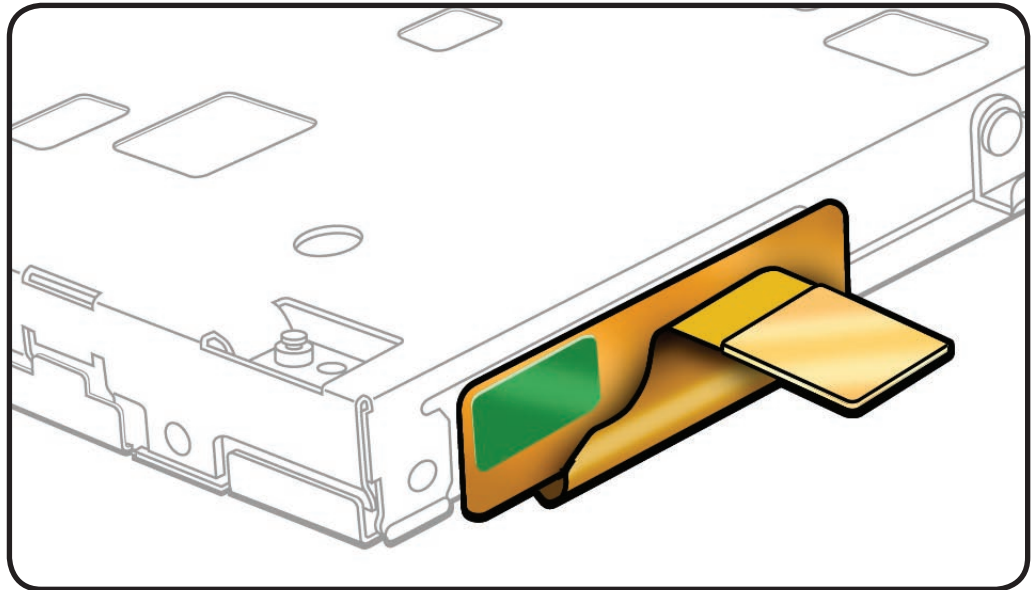
Right Speaker / Subwoofer

First Steps

Remove:
- **Access door**
- **Battery**
- **Bottom case**
- **Camera cable guide**
- **Optical drive**
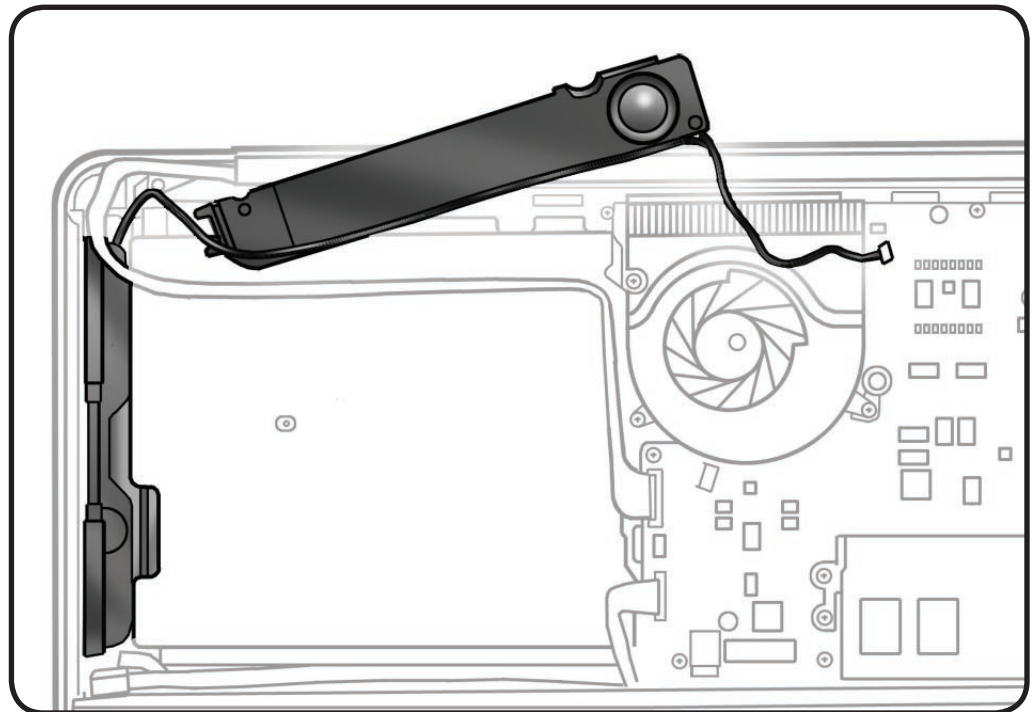
Tools

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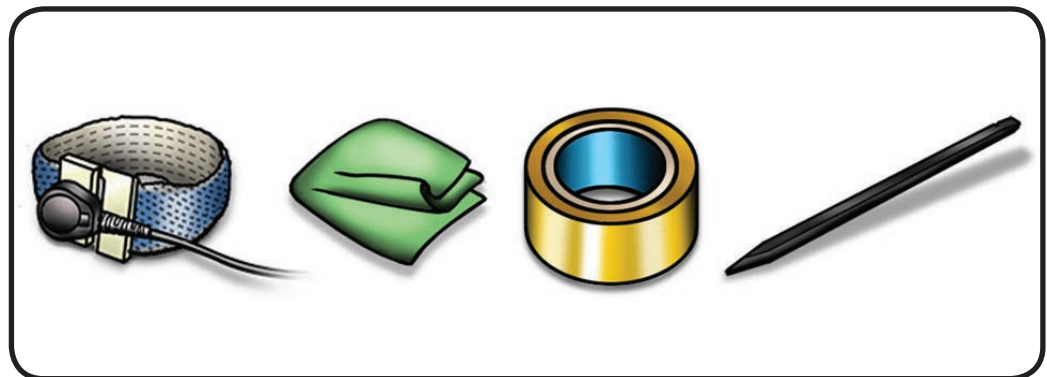
Removal

1 Break black tape to free subwoofer cable.

> **Replacement Note:** Apply Kapton tape.
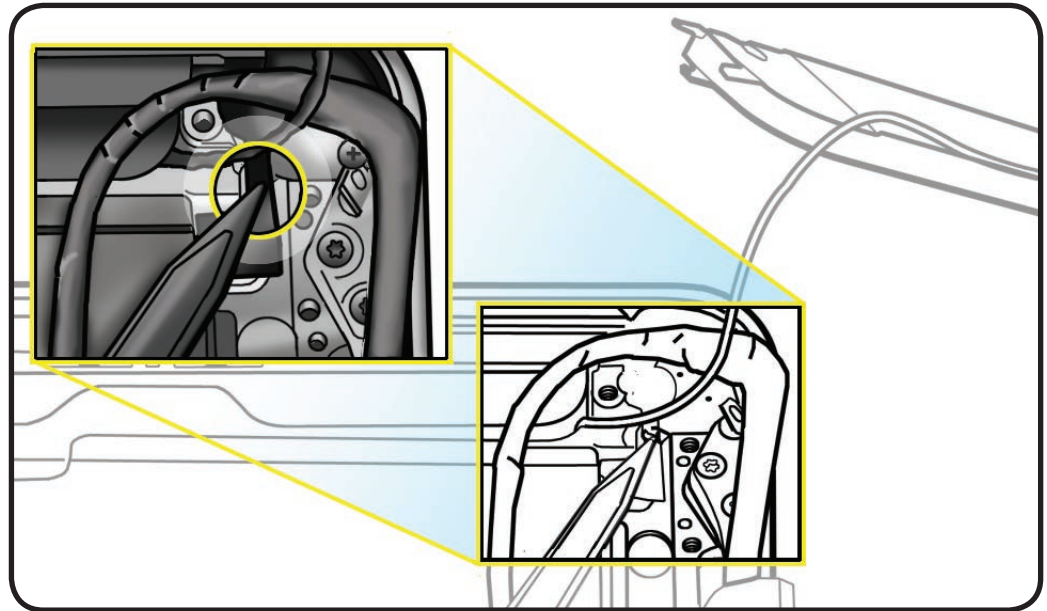
2 Pry up speaker body to loosen adhesive.
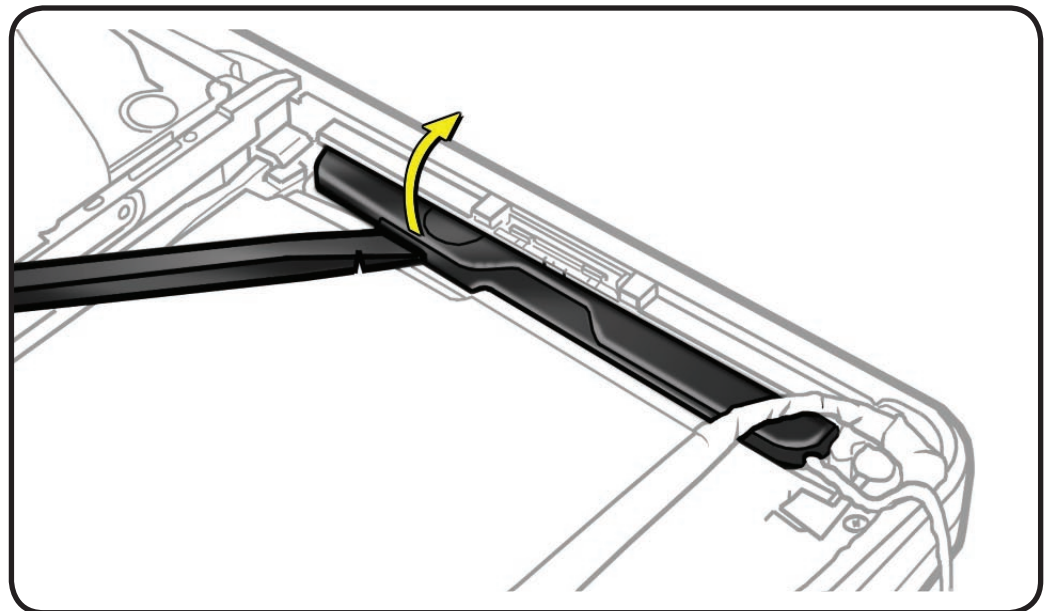
3 Route speaker under display cable.

Replacement

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

2 To finish installing subwoofer, follow steps in
- **Optical drive**
- **Camera cable guide**
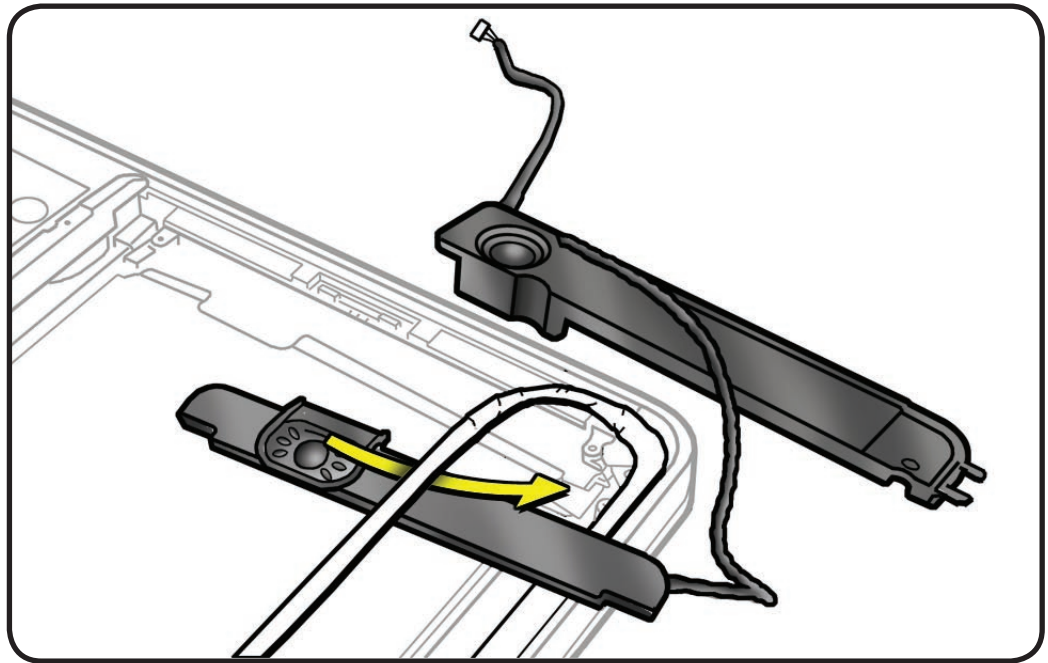
Hard Drive Connector Cable

First Steps

Remove:
- **Access door**
- **Battery**
- **Hard drive**
- **Bottom case**
- **Mid wall**
- **Camera cable guide**
- **Optical drive**
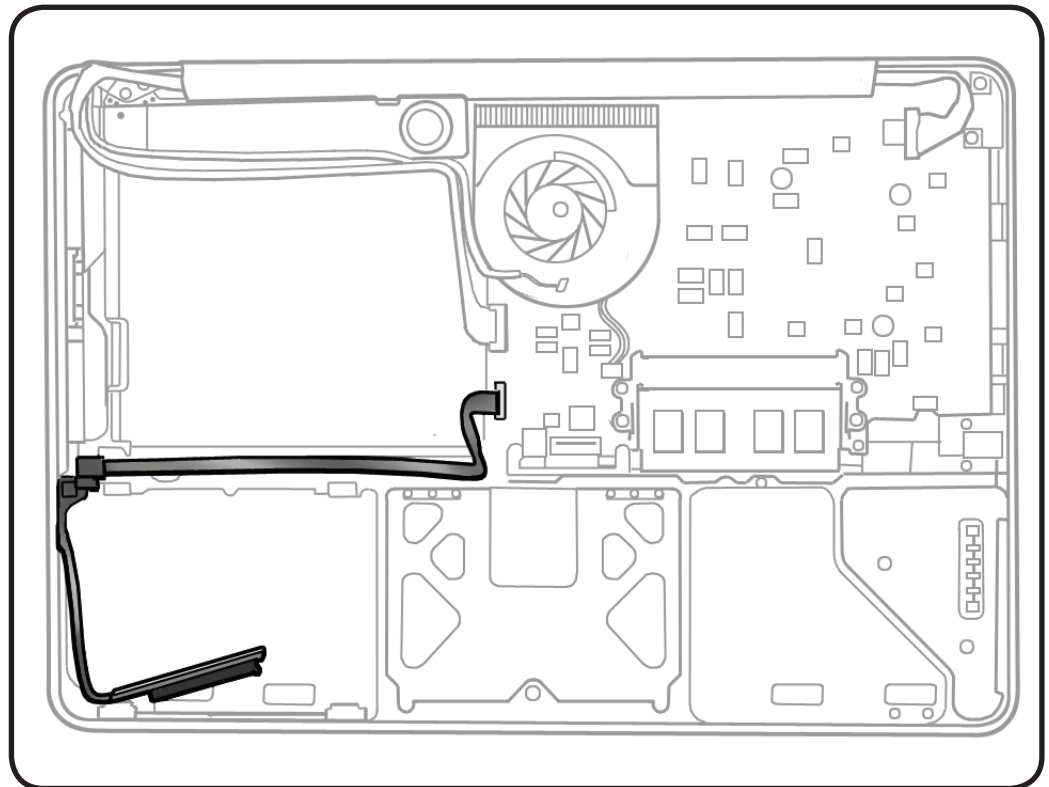
Tools

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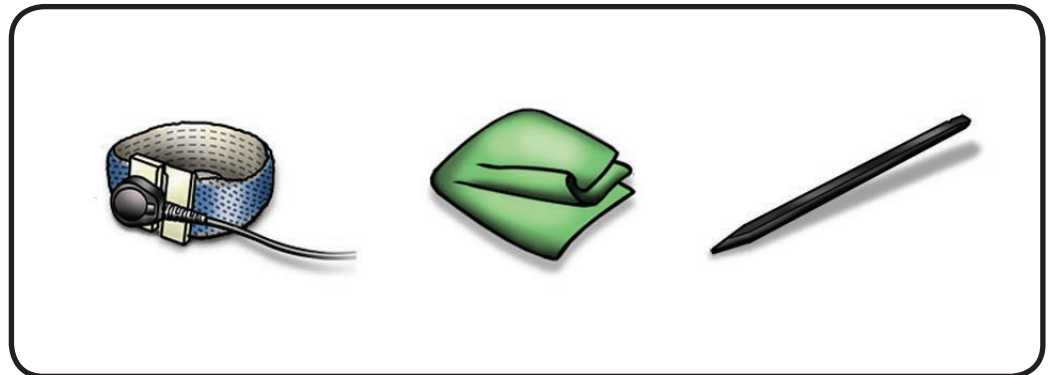
Removal

1 Pull straight up
on connector to
disconnect cable.
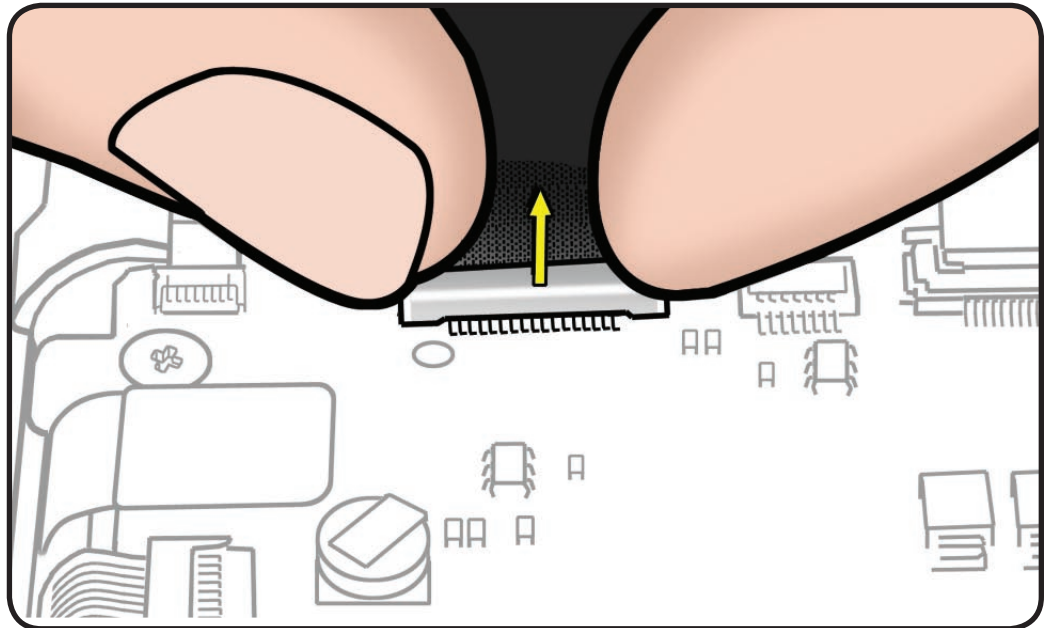
2 Peel up cable from top
case.
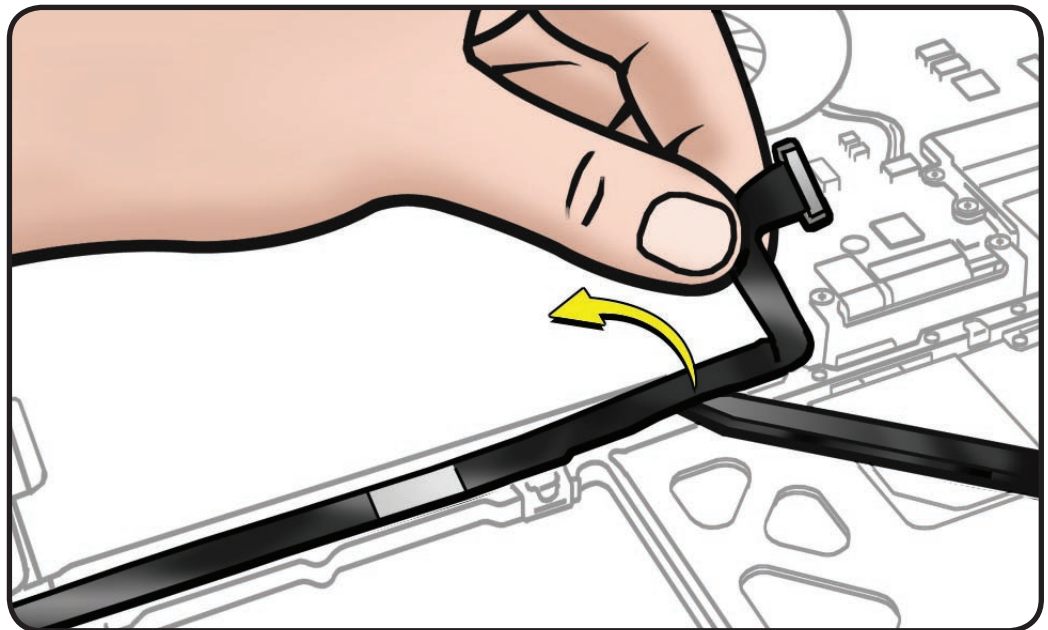
3 Lift up adhesive tab.

4 Twist strain relief out of top case.
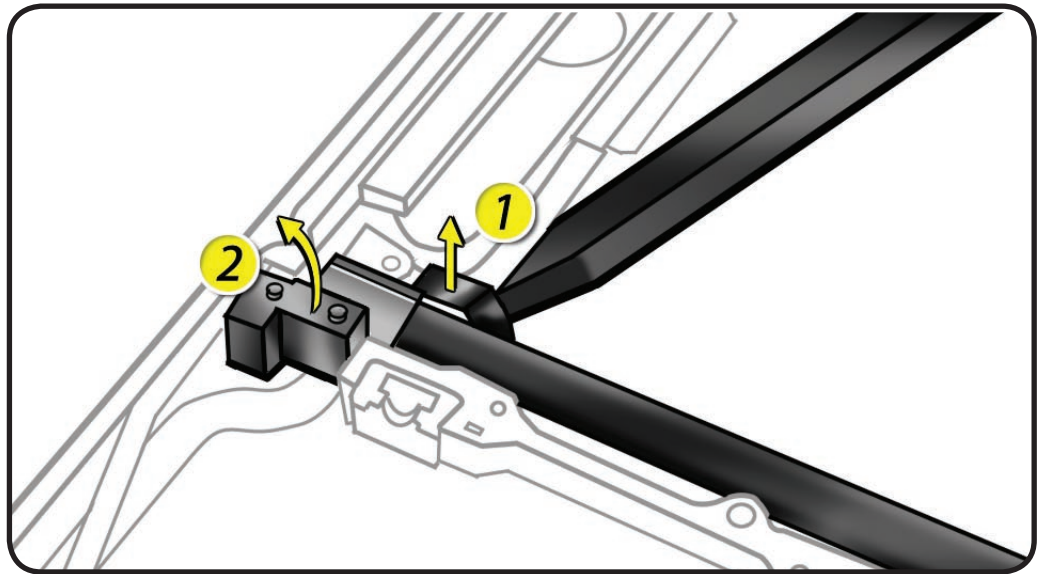
Replacement

1 Peel adhesive backing off cable.

2 Press cable so it lays flat in top case.

3 Connect cable to
- logic board
- top case
- hard drive
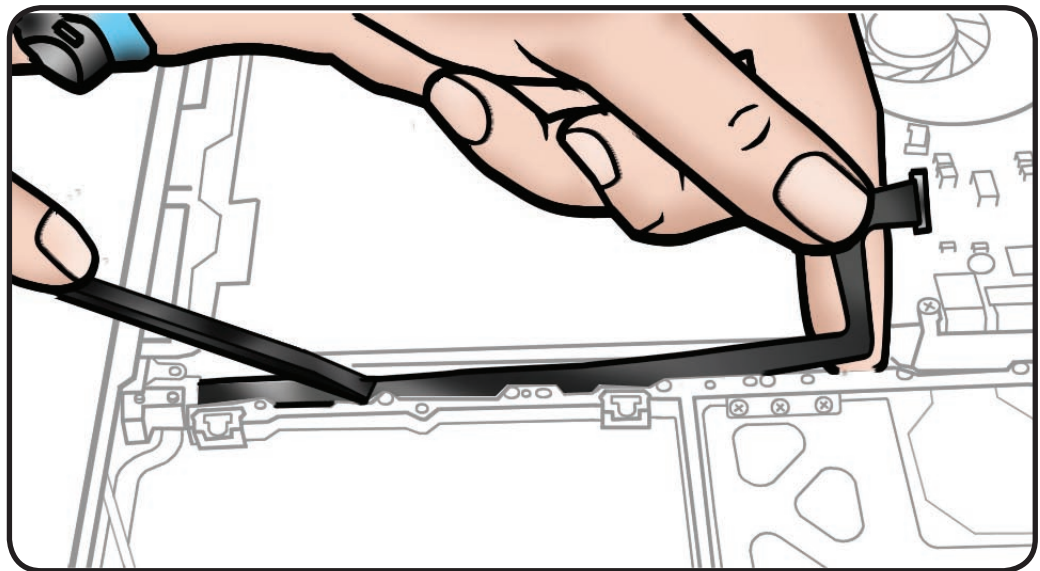
Fan

First Steps

Remove:
- **Access door**
- **Battery**
- **Bottom case**

Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver

Removal

1 Disconnect fan cable.

2 Remove 3 screws:
- 1 (7-mm) 922-8645
- 2 (5-mm) 922-8644

Caution: Do not touch heatsink:

Replacement Note: Install screws in order shown.

3 Tilt up fan.
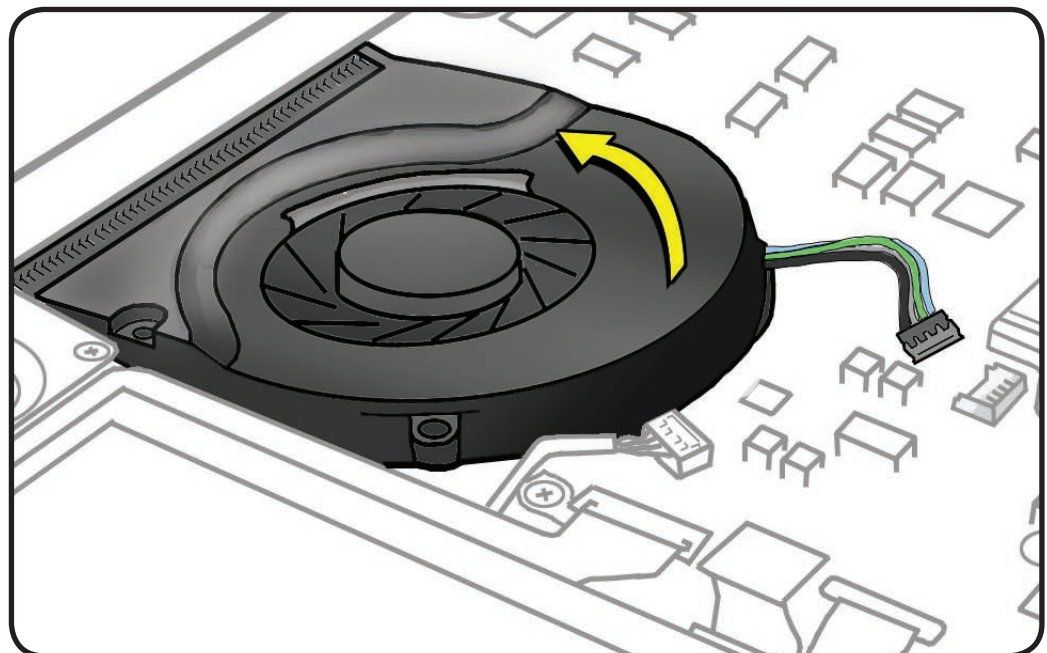
Keyboard Flex Bracket

First Steps
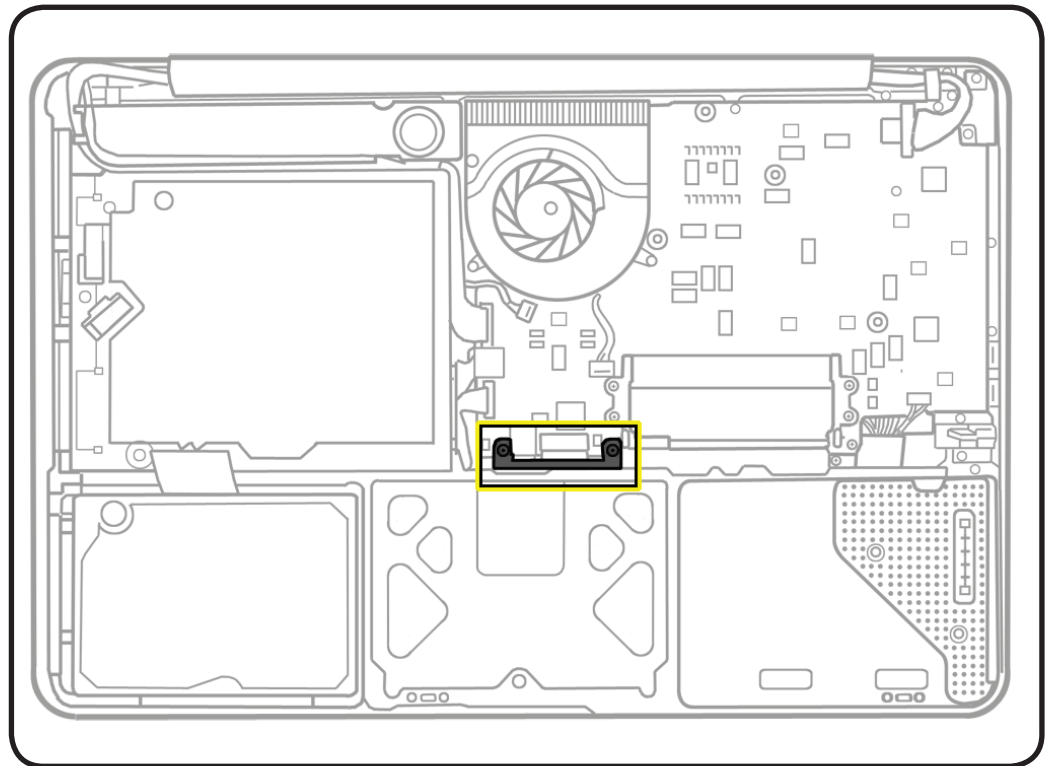
Remove:
- **Access door**
- **Battery**
- **Bottom case**
- **Mid wall**

Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
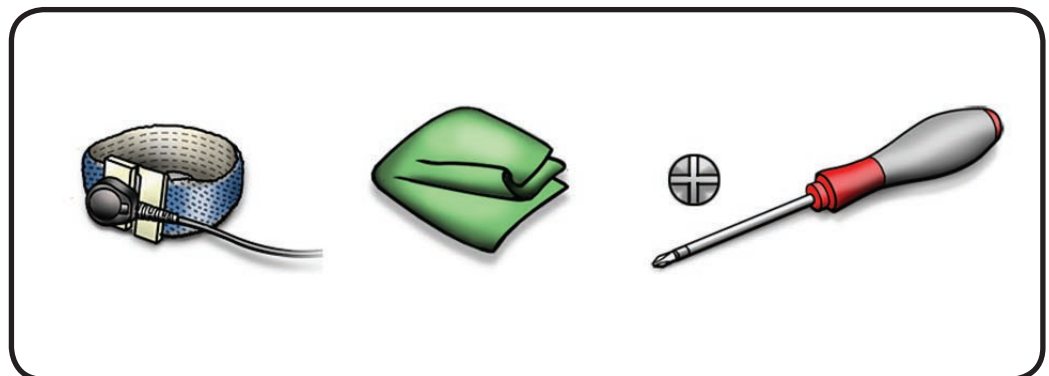
Removal

1 Remove 2 (5-mm)
922-8644 screws.
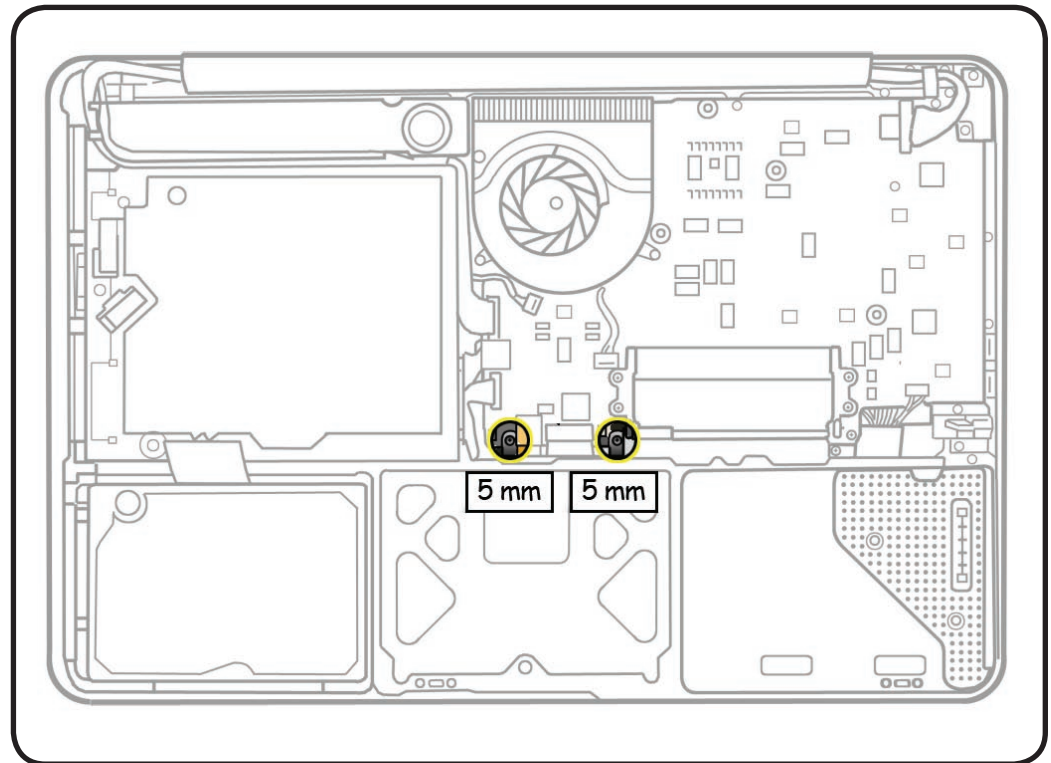
2 Lift out bracket.
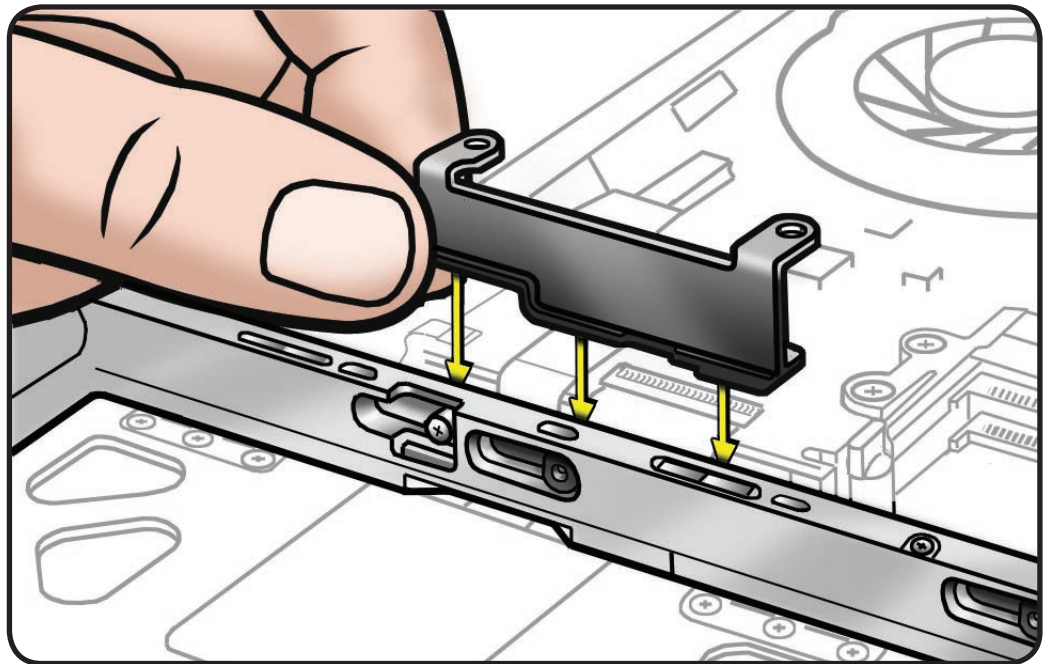
Logic Board

First Steps

Remove:
- **Access door**
- **Battery**
- **Bottom case**
- **Memory**
- **Fan**
- **Keyboard flex bracket**
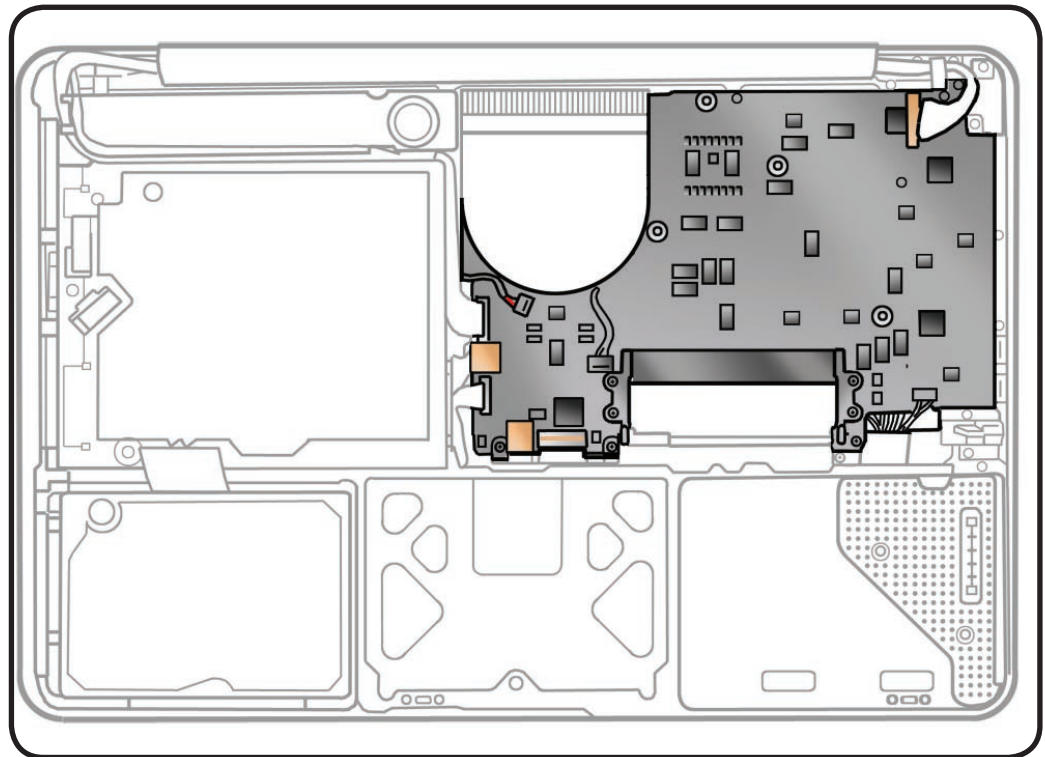
Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Tweezers
- Pencil with eraser
- Black stick
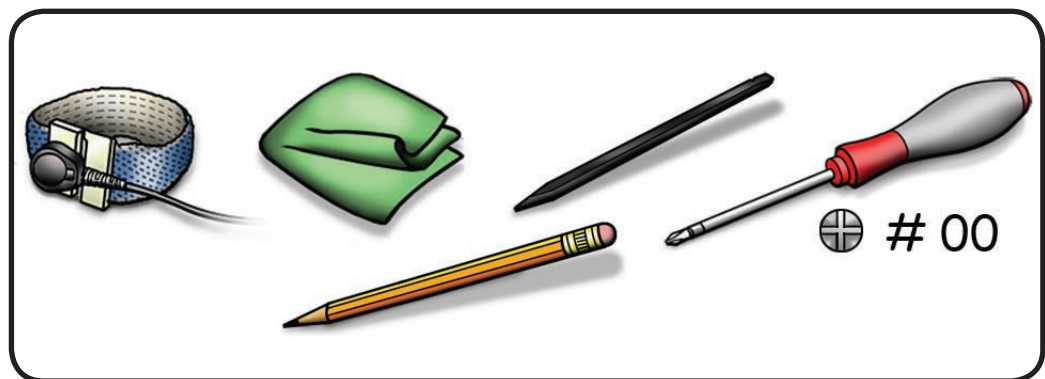
Removal

Caution: Do not touch heatsink or gold connectors:

Caution: Refer to **Connector Types** before disconnecting cables.

1 Disconnect 9 cables:
- 2 locking lever
- 2 platform flex
- 2 low-profile horizontal
- 3 vertical insert

2 Remove 5 screws:
- 1 (3.75-mm) 922-8654
- 4 (3-mm) 922-8663
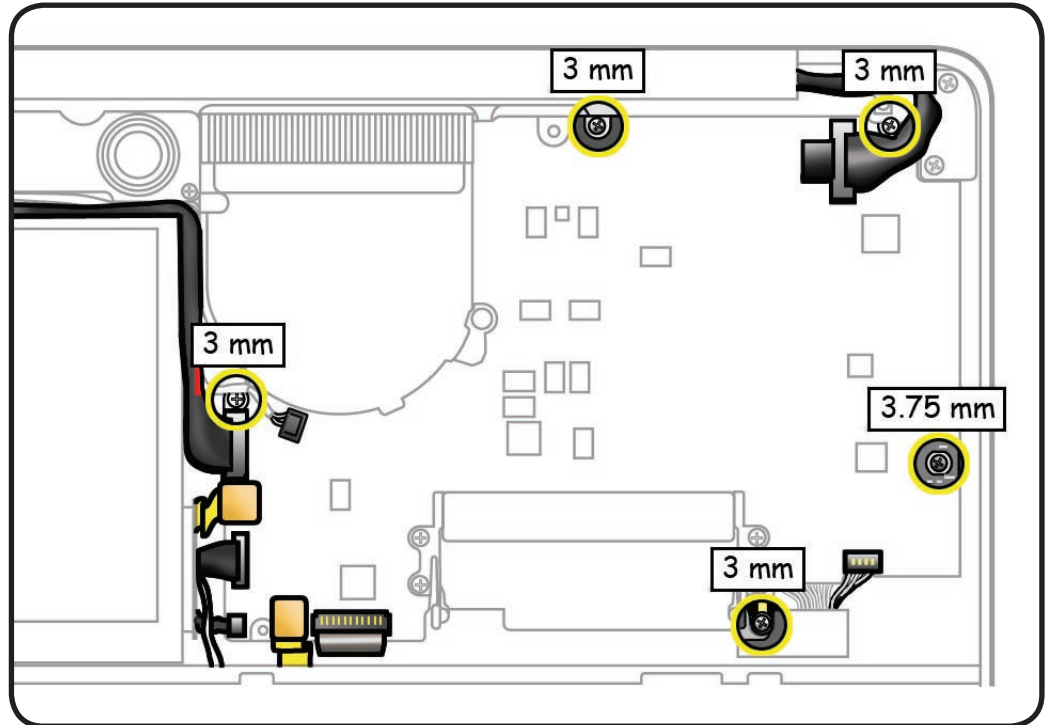
3 Caution: Make sure cables are not pinched.

4 Pivot logic board to free locking pin.
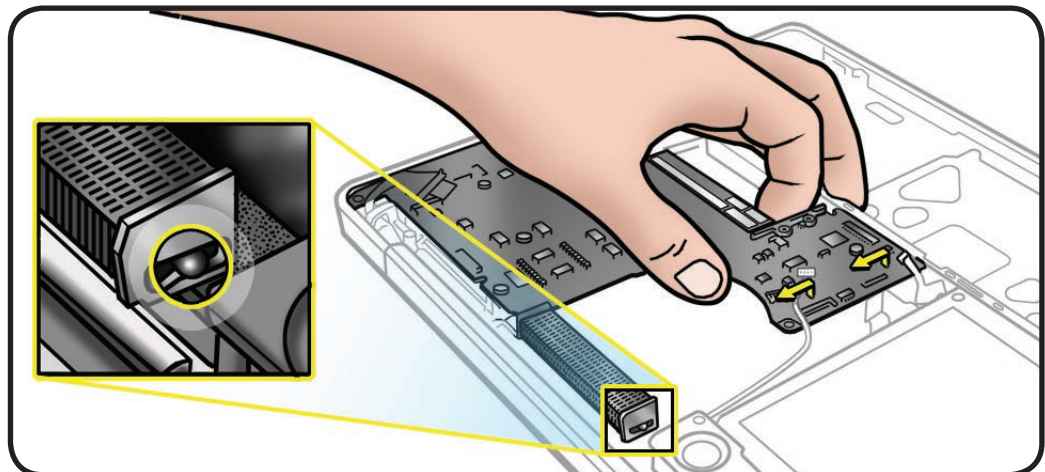
5 Disconnect battery
  connector from
  underside of logic
  board.
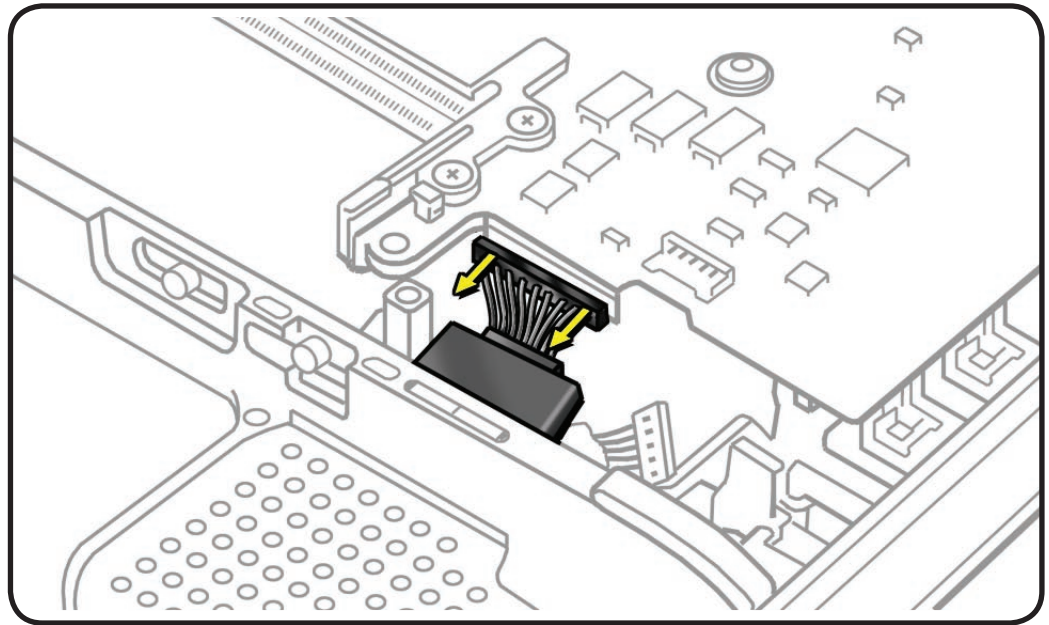
If necessary, remove
2.7-mm screw (922-
8661) and battery
cable guide to
disconnect battery
connector.

2.7 mm
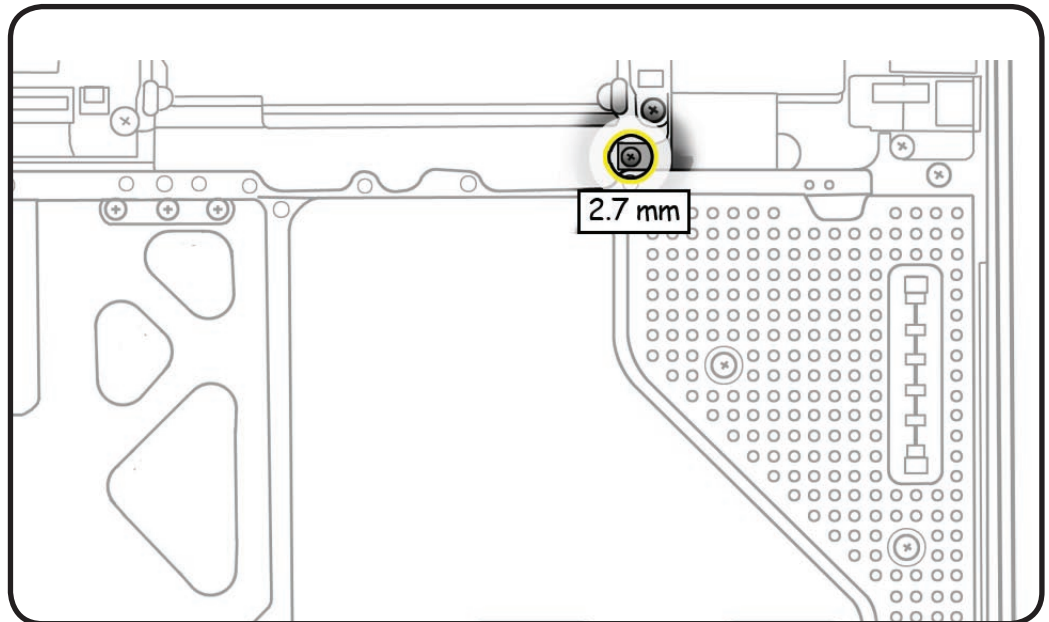
6 Tilt board vertically
and locate
· microphone cable
· MagSafe cable

7 Disconnect cables and
unroute microphone
cable from speaker.

Caution: Be careful not
to strain the microphone
cable.
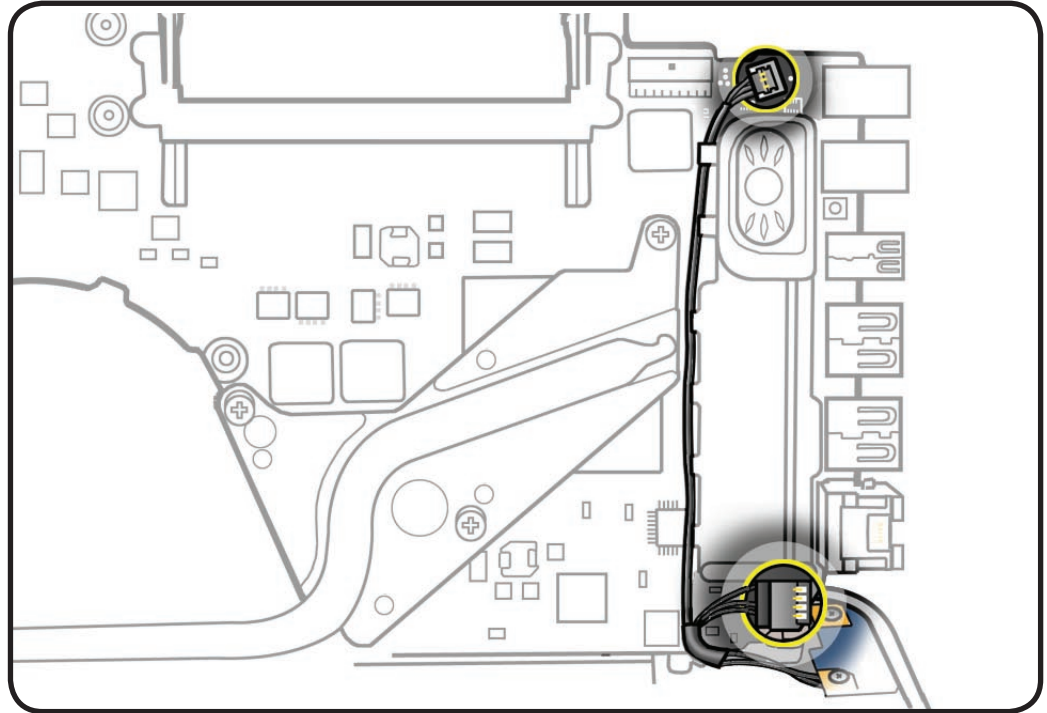
8 Do not remove the
speaker and heatsink
if reinstalling the same
logic board.

9 If replacing the logic
board with a new one,
transfer
· **Left speaker**
· **Heatsink**
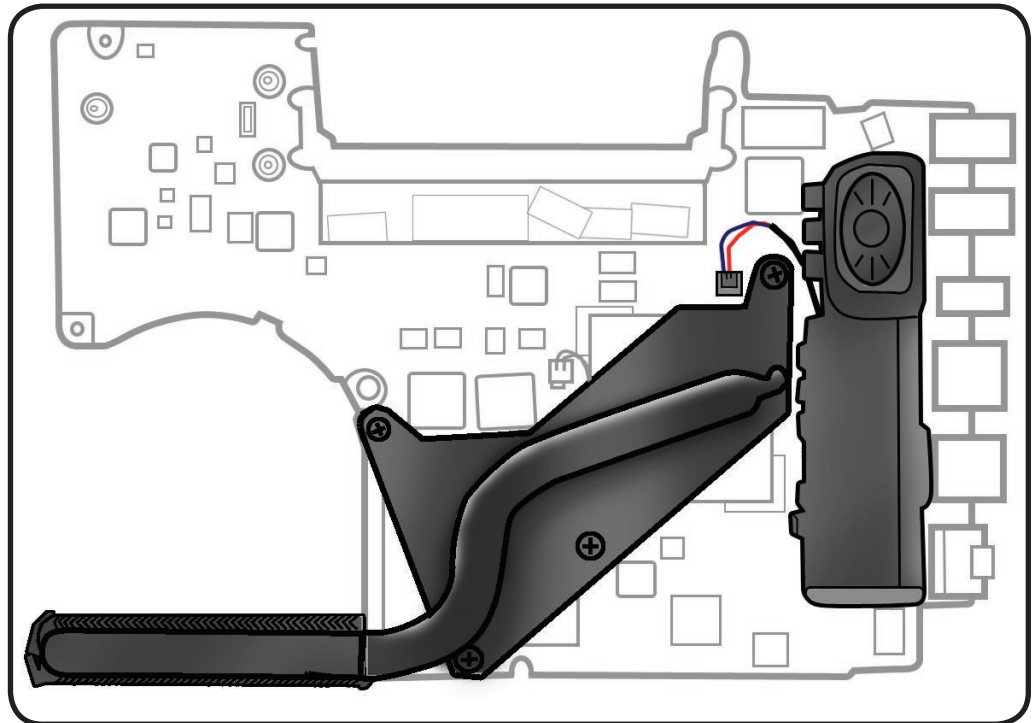
Replacement

1 From underside of
board, make sure to
connect:
- left speaker
- heatsink
- microphone cable
- MagSafe cable

2 When tilting board
into top case, keep
cables away.

3 Install 5 screws in
order shown
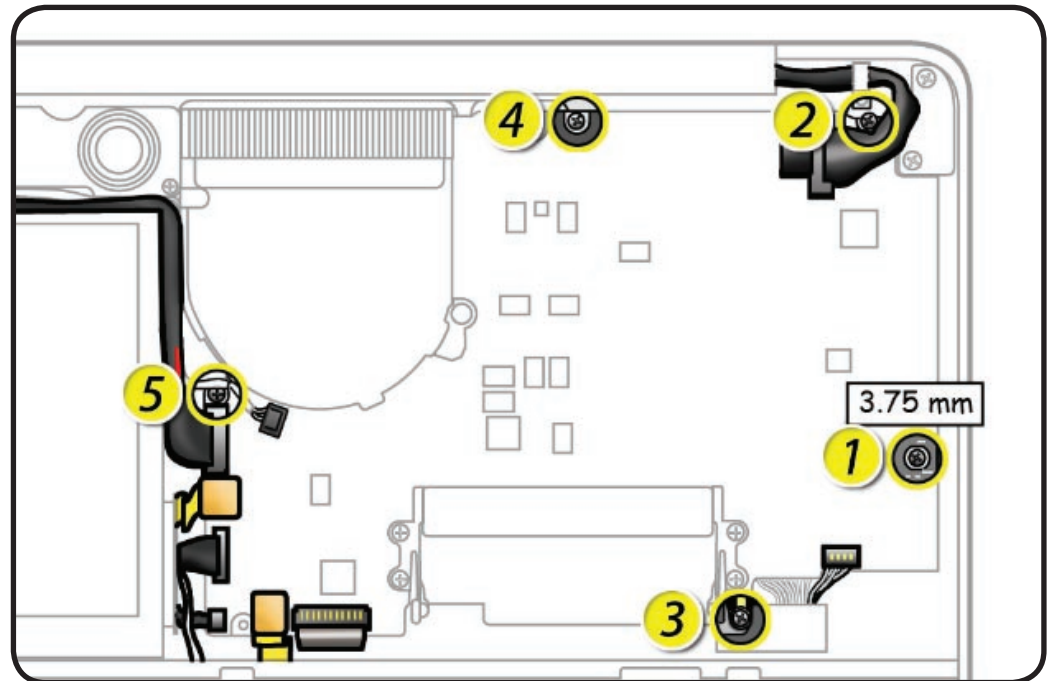
Important: New logic
boards include a loose
Ethernet ID label. When
replacing the logic board
with a new one, place
the label on the inside
front wall of the top case,
and use a permanent-ink
pen to strike out the old
Ethernet ID number.
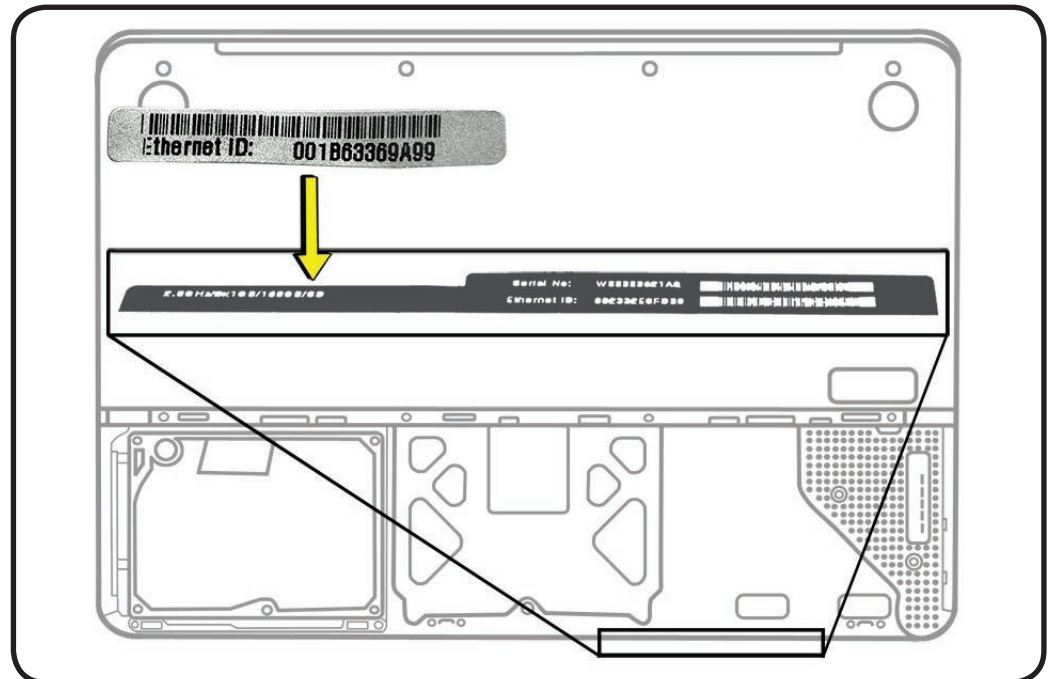
Left Speaker

First Steps

Remove:
- **Access door**
- **Battery**
- **Bottom case**
- **Memory**
- **Fan**
- **Keyboard flex bracket**
- **Logic board**
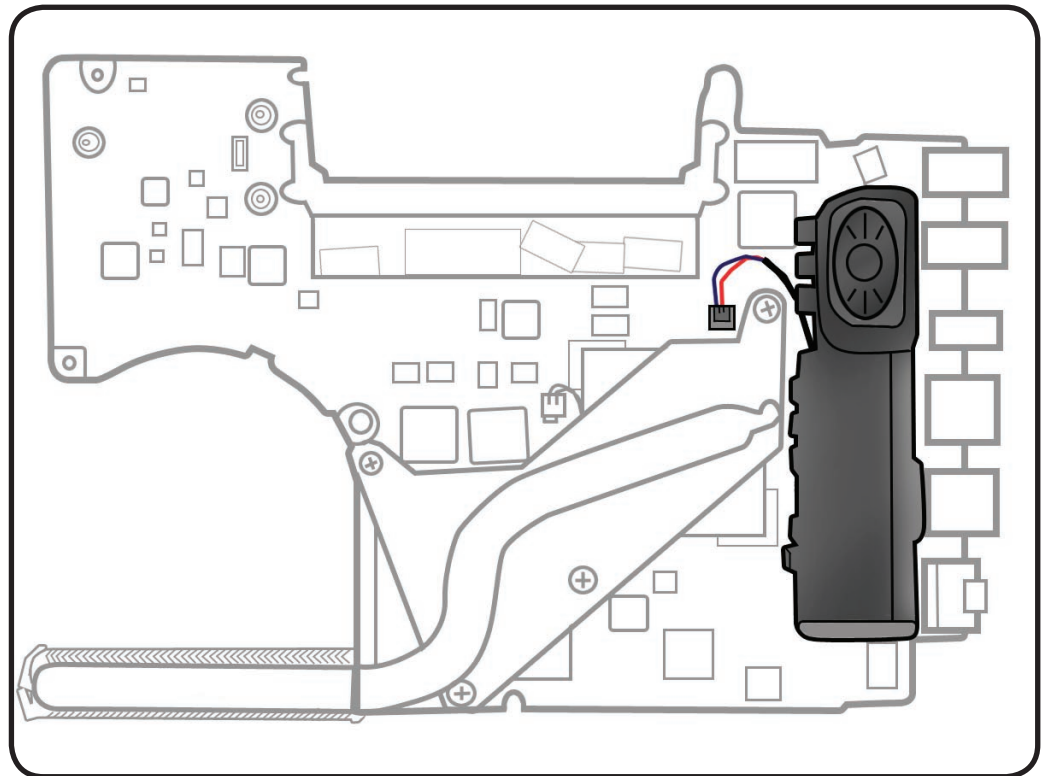
Tools

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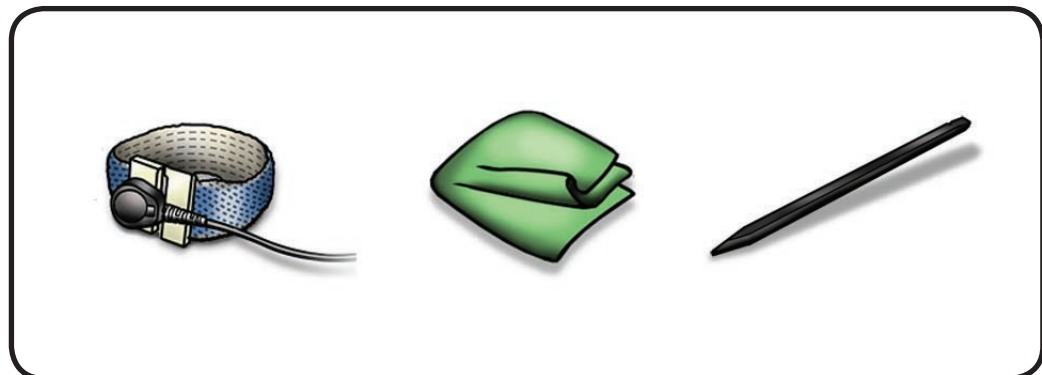
Removal

Caution: Do not touch heatsink or gold connectors:

1 Disconnect the speaker connector.

2 Caution: Do not touch the soft speaker cone.
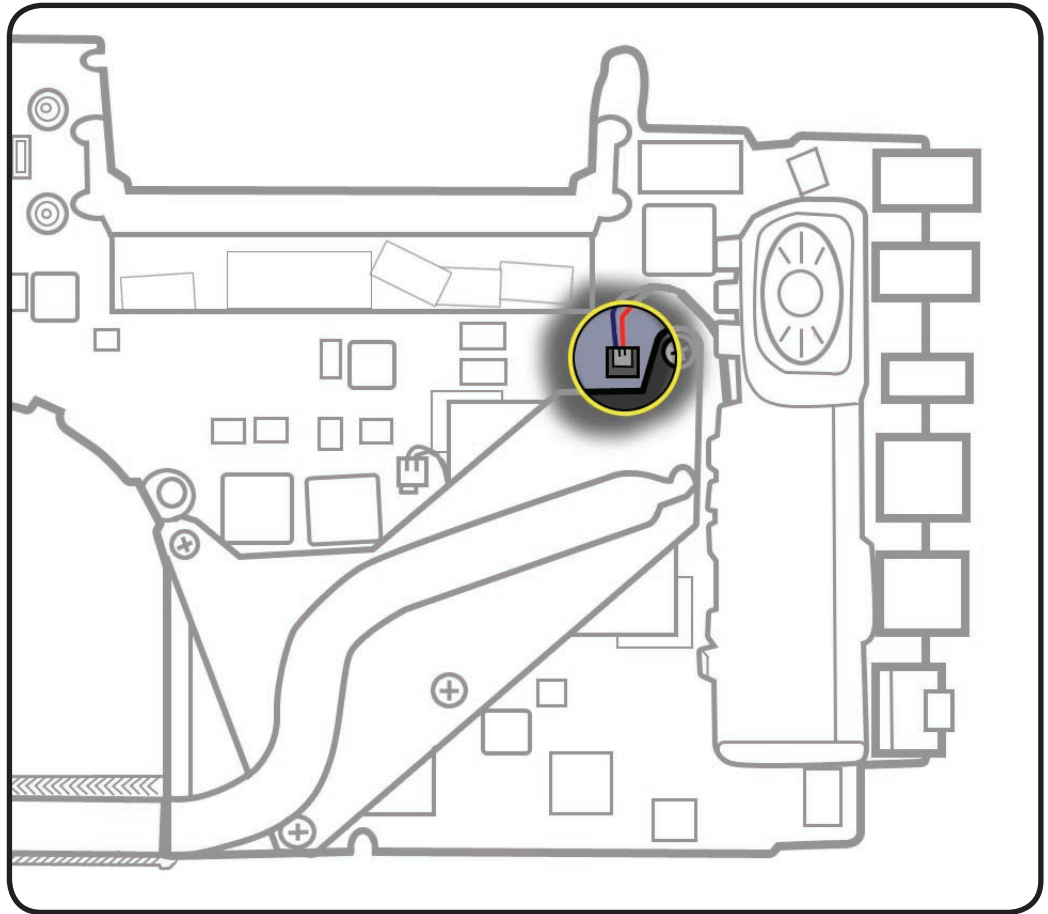
3 Remove speaker body.
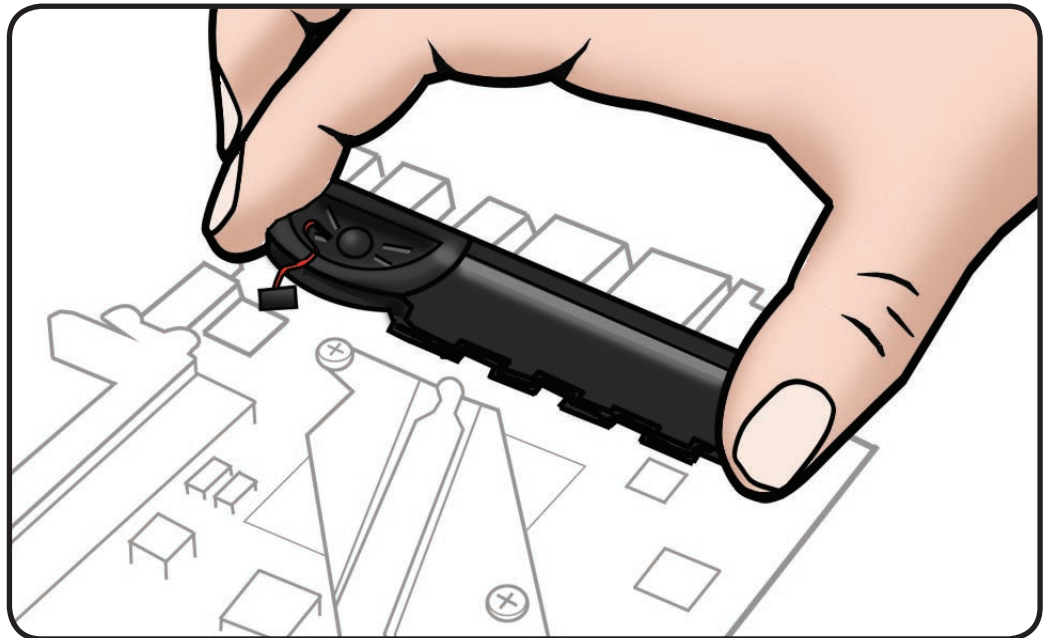
4 Notice the foam pad remnants on
- speaker body
- logic board
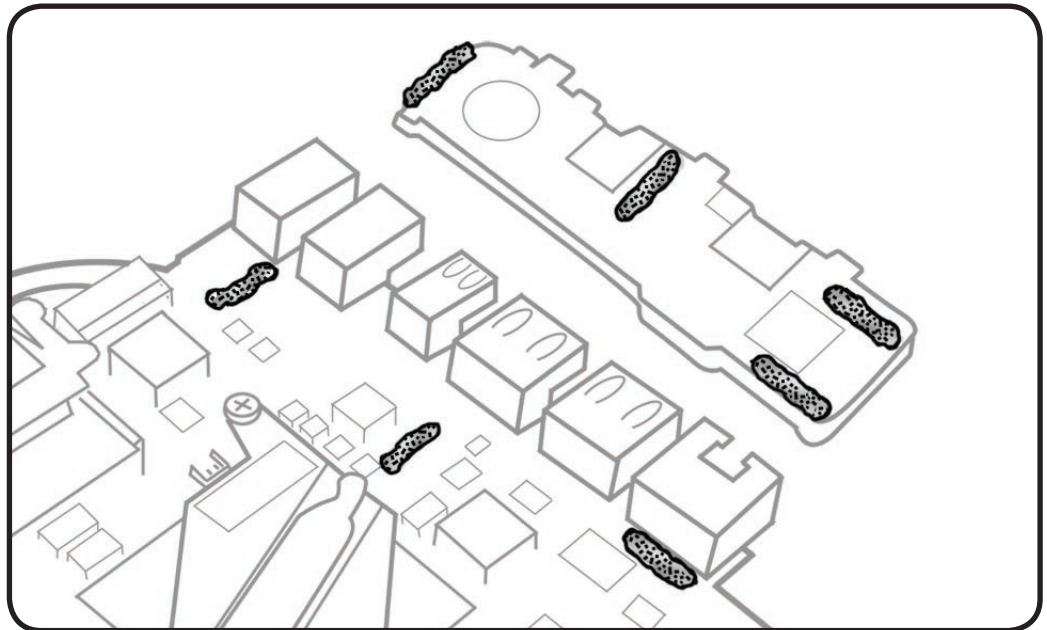
5 Carefully crape away remnants before installing new speaker.

Replacement

1 Make sure left speaker body and logic board are free of
- dust
- scratches
- plastic burrs
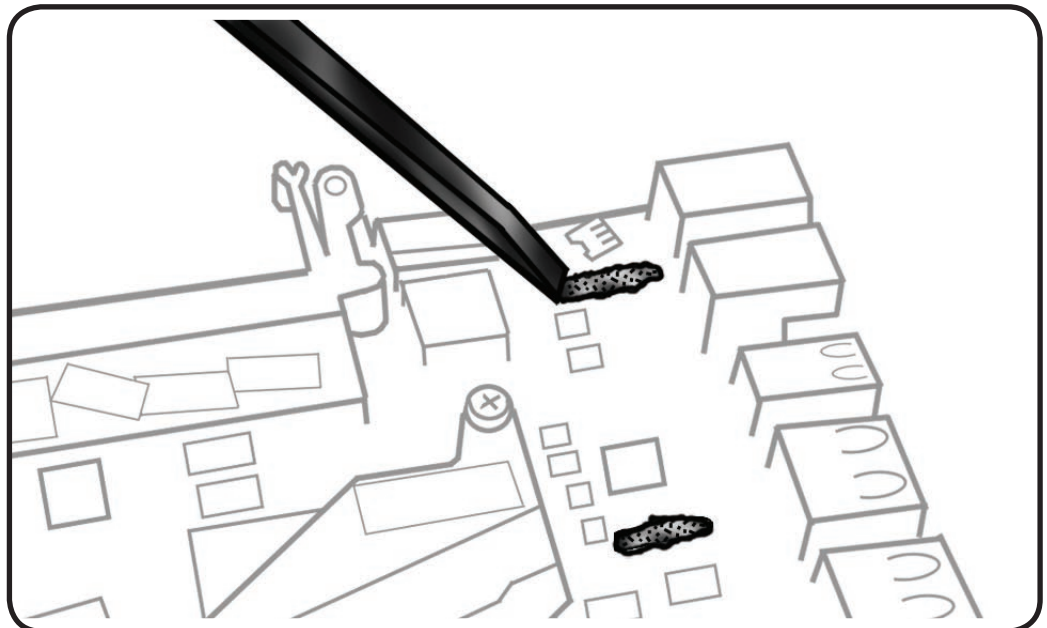
2 Connect speaker cable to logic board.

3 Remove paper backing from four foam pads, and press speaker onto port side of logic board.

MagSafe Board

First Steps

Remove:
- **Access door**
- **Battery**
- **Bottom case**
- **Memory**
- **Fan**
- **Keyboard flex bracket**
- **Logic board**
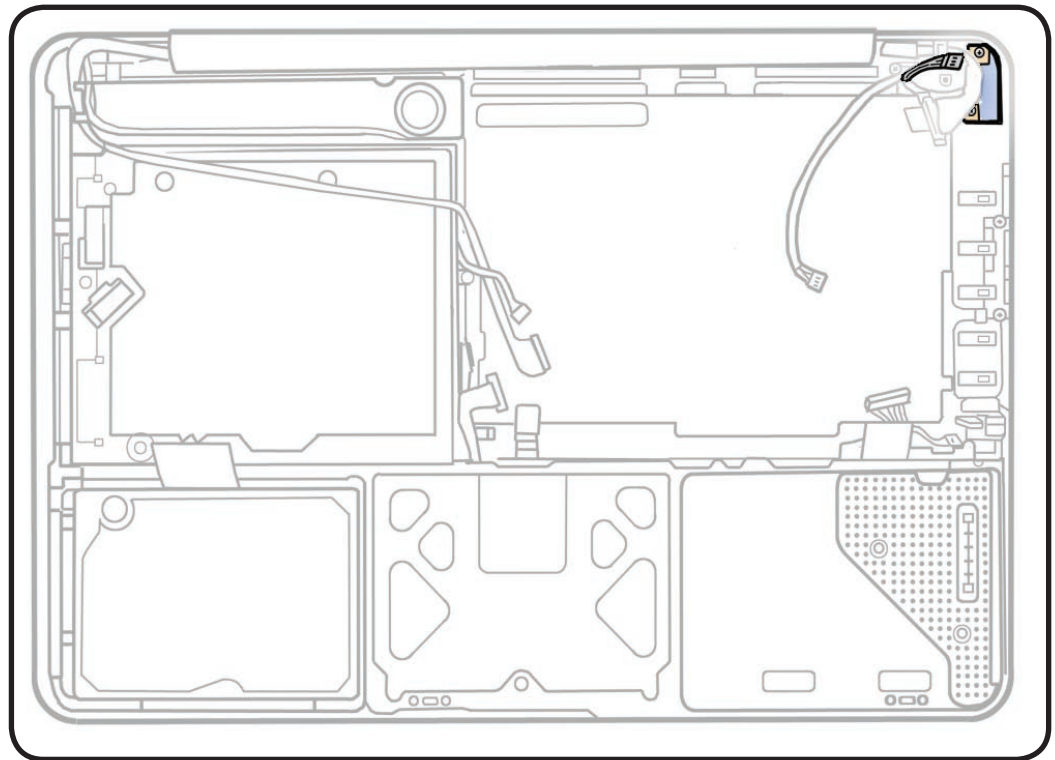
Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
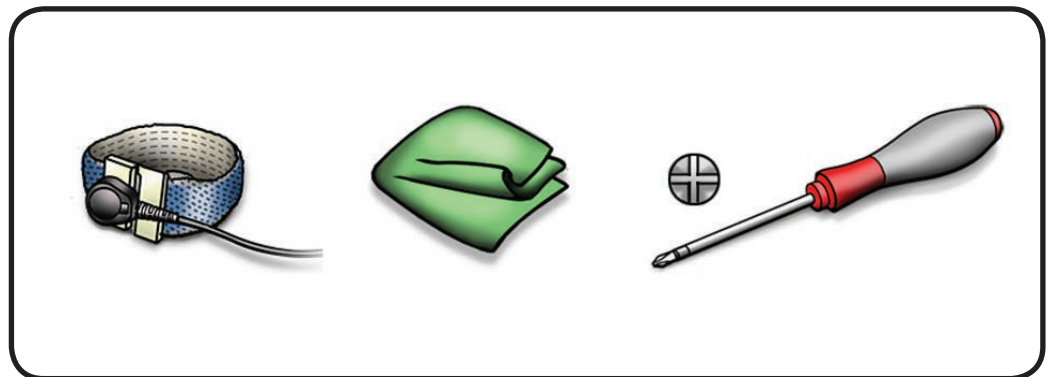
Removal

1 Remove 2 (7-mm) 922-8645 screws.

2 Tilt out MagSafe board.
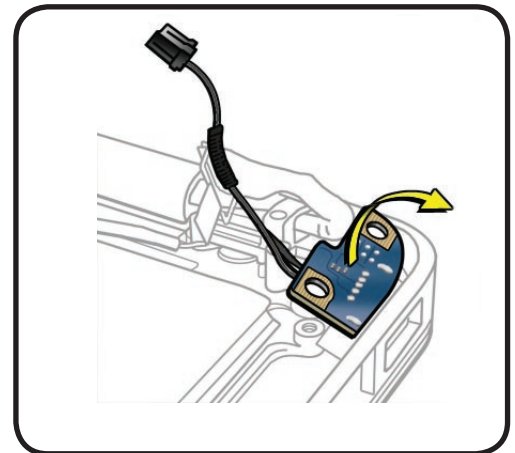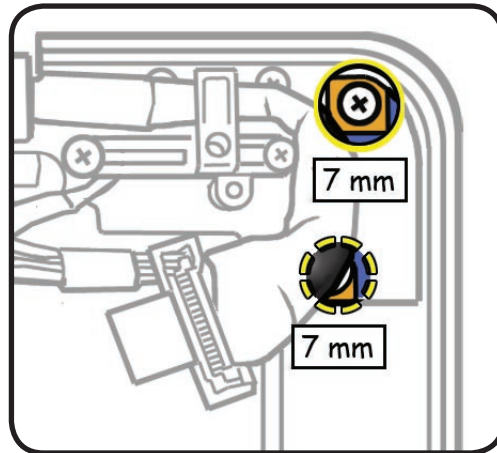
Replacement

1 Make sure MagSafe cable is routed away from screw standoff, as shown.

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

3 Install screws to MagSafe board before installing logic board.
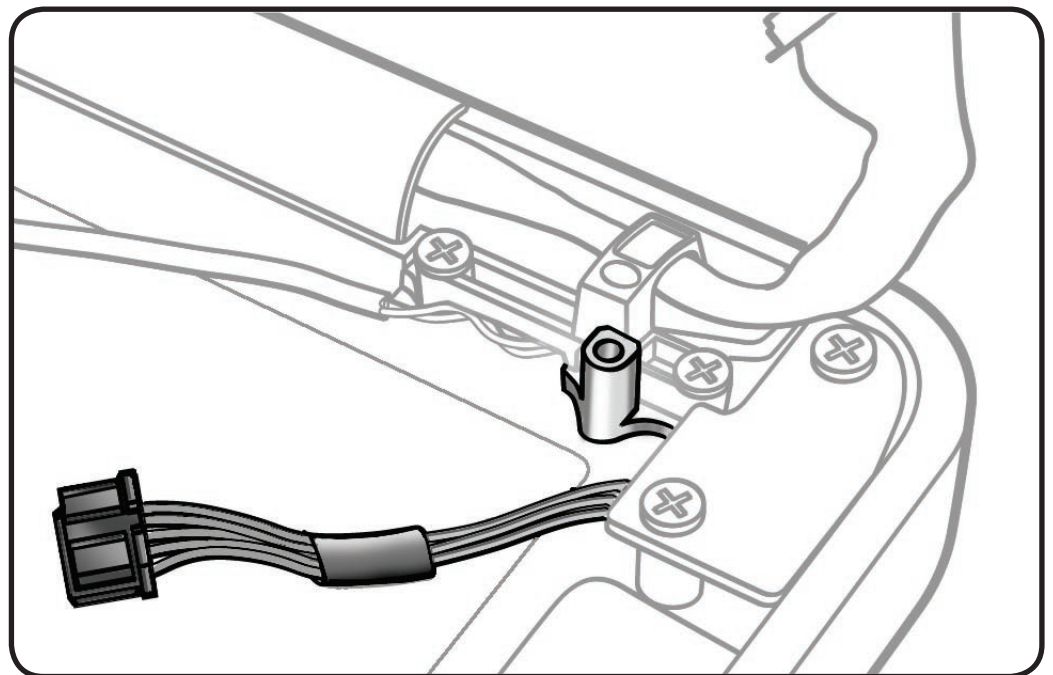
Heatsink

First Steps

Remove:
- **Access door**
- **Battery**
- **Bottom case**
- **Memory**
- **Fan**
- **Keyboard flex bracket**
- **Logic board**
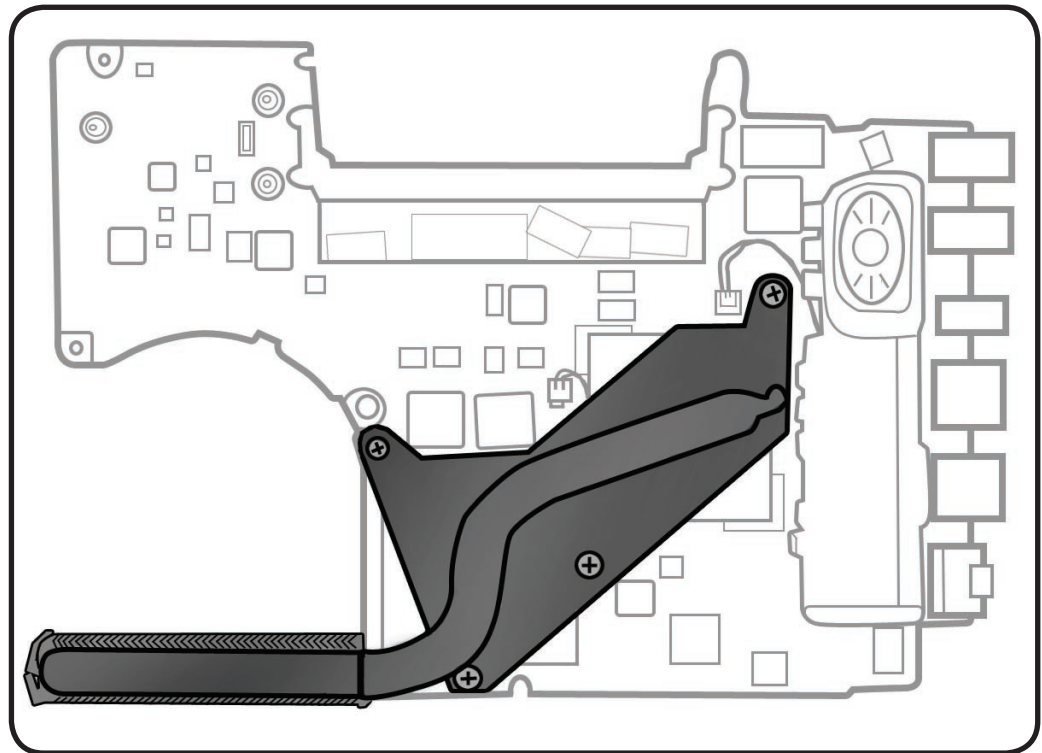
Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #0 or #1 screwdriver
- Thermal grease syringe
- Alcohol pads
- Black stick
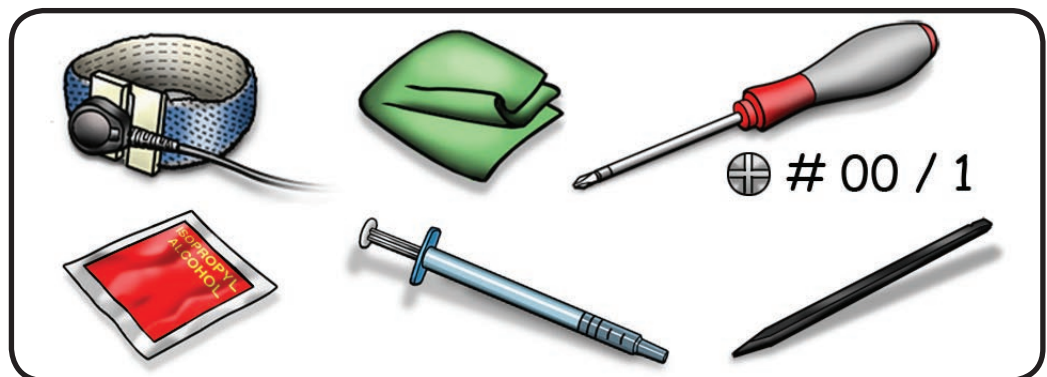
Removal

Caution: Do not grasp heatsink arm:

1 Disconnect thermal sensor.

2 Remove 4 (8.5-mm) 922-8692 screws in order shown.

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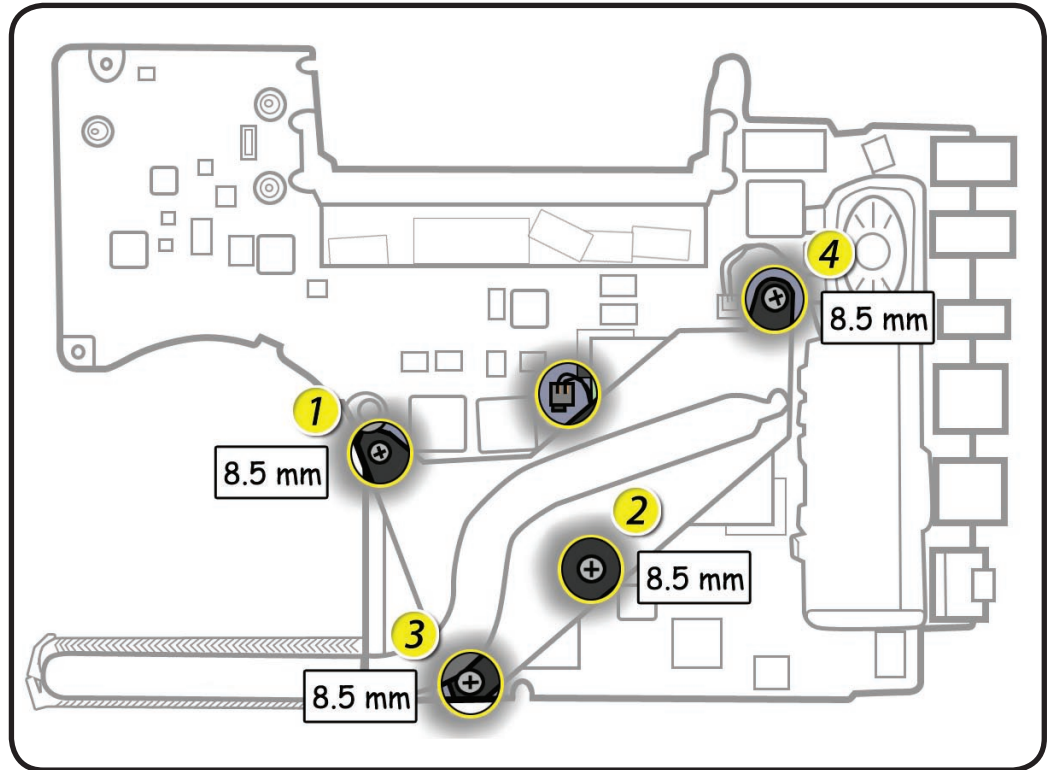
3 Keeping heatsink parallel to logic board, gently wiggle heatsink to loosen the bond to the board.

Caution: Do not pull heatsink

4 Keeping it level, lift heatsink away from board.
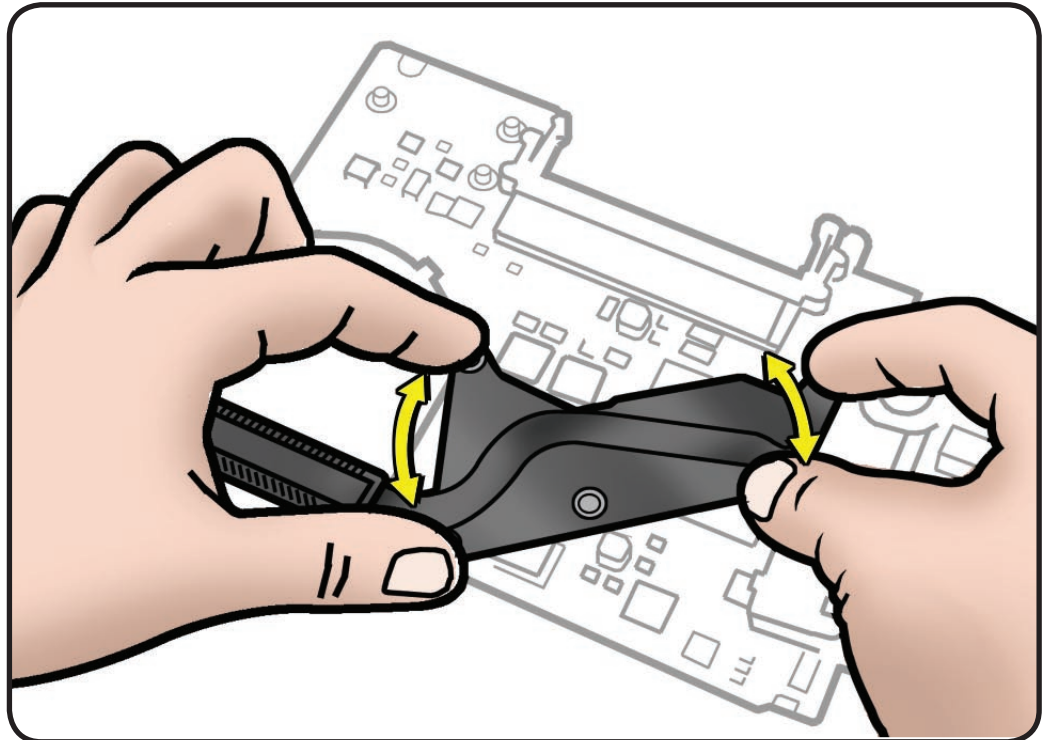
5 Scrape off thermal grease, and use alcohol pad to clean thermal pads and microprocessors.
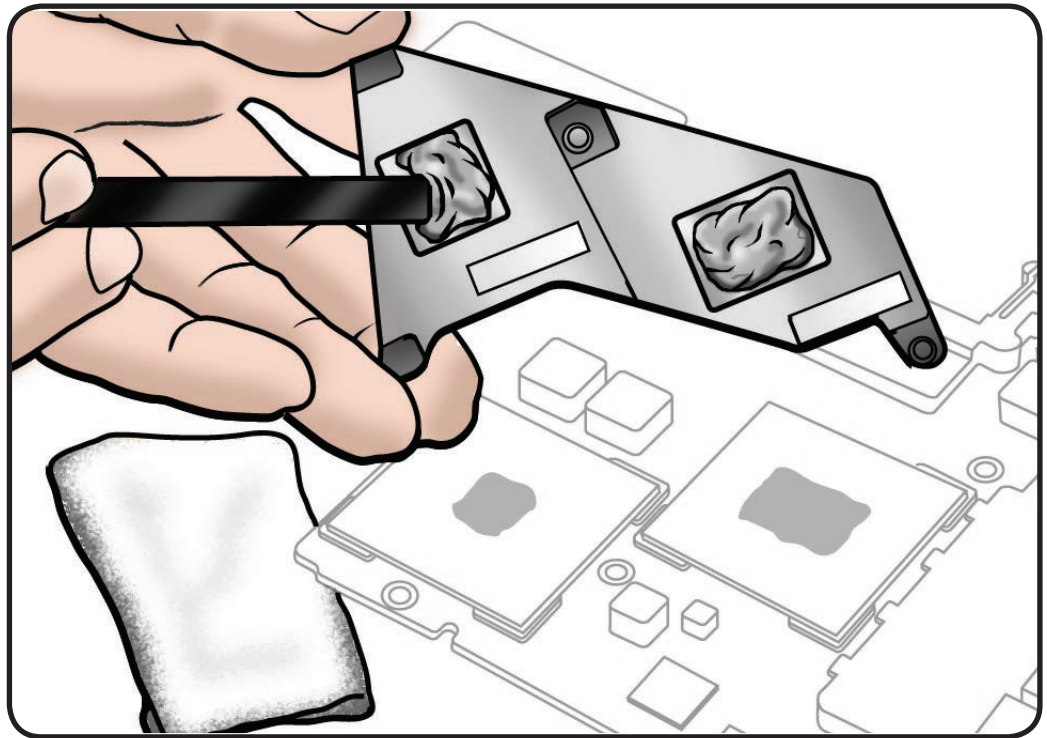
Replacement

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

1 **Caution:** The syringe contains enough thermal grease for 3 microprocessors. Because this computer has only 2 microprocessors, you must use only 2/3 of the syringe contents.

Use a pen to mark the syringe in thirds.
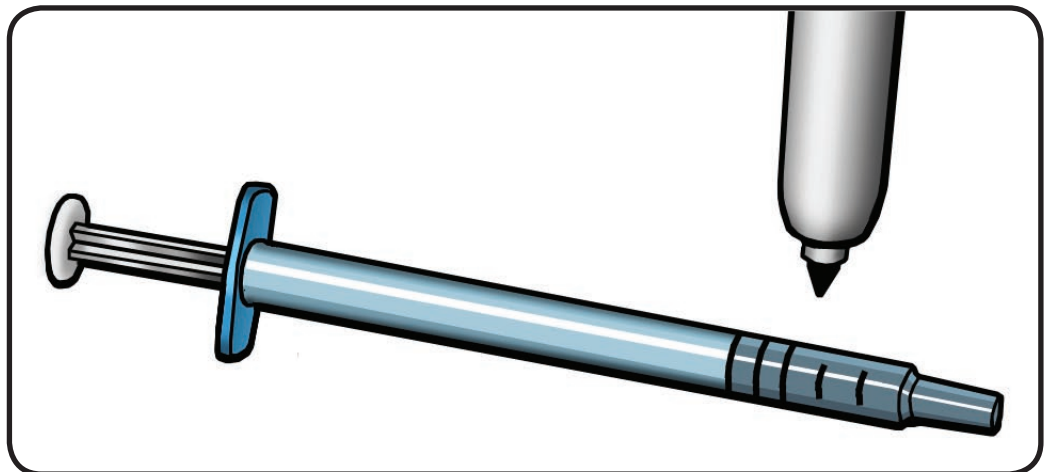
2 Inject 1/3 of grease on each microprocessor.
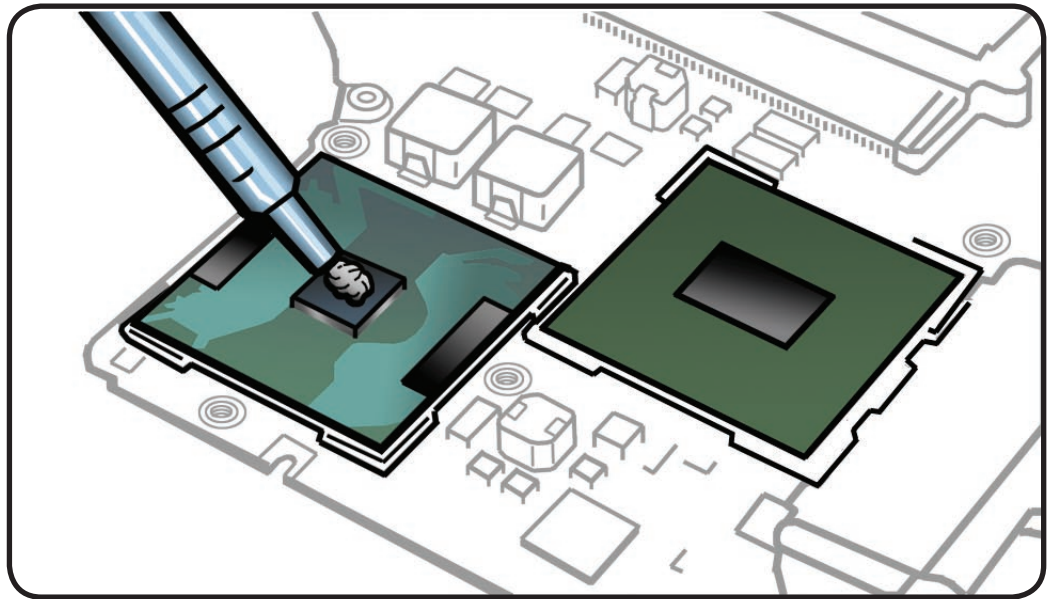
3 **Important:** Connect the thermal sensor.

4 Lower the heatsink over the logic board.
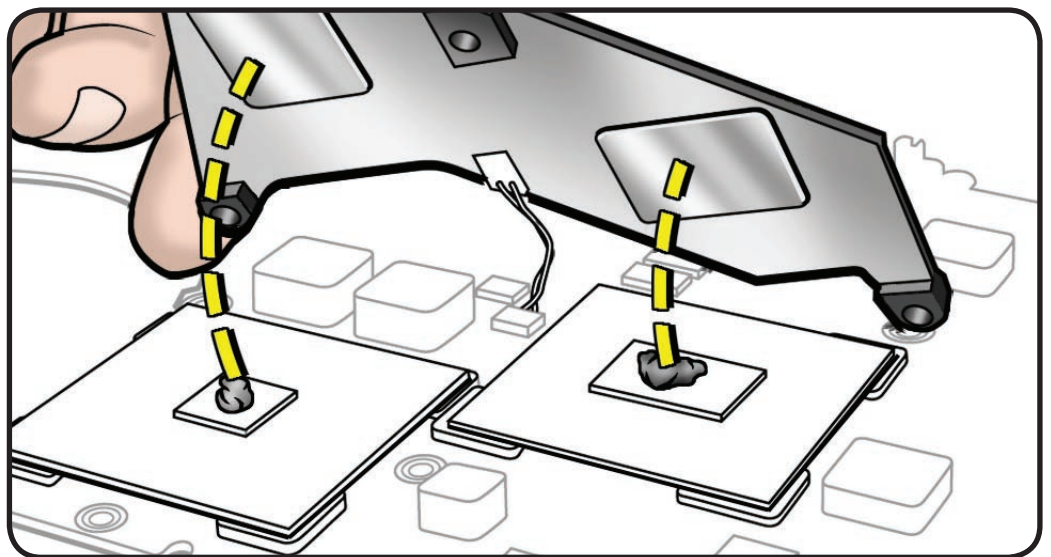
Microphone Cable

First Steps

Remove:
- **Access door**
- **Battery**
- **Bottom case**
- **Memory**
- **Fan**
- **Keyboard flex bracket**
- **Logic board**

Caution: Do not strain microphone cable.
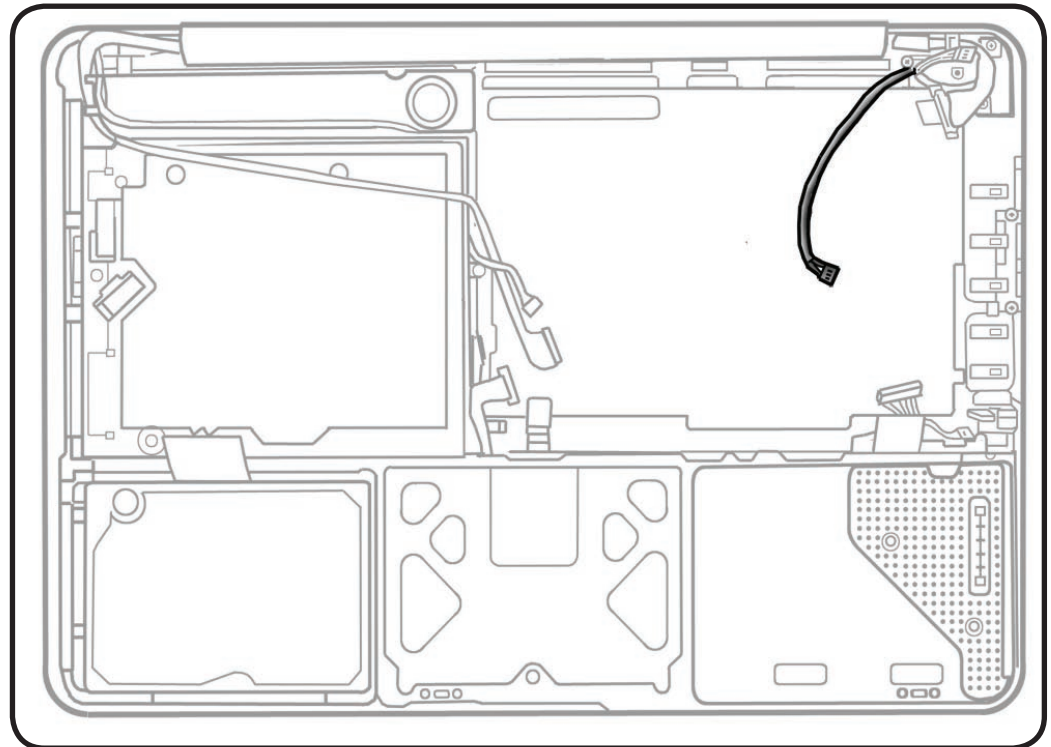
Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetic Phillips #00 screwdriver
- Black stick
- Pencil with an eraser
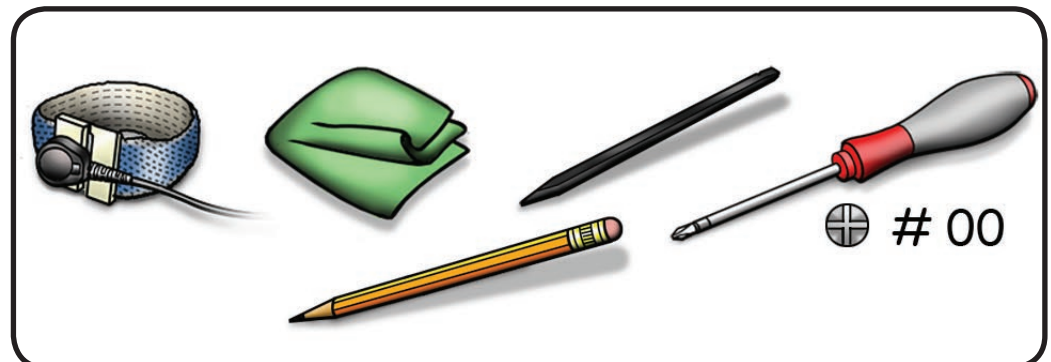
Removal

1 Remove 2 screws:
- 7 mm (922-8645)
- 5.5 mm (922-8658)

2 Remove LVDS cable guide.

Replacement Note: When installing the LVDS cable guide, seat the locator pin first.
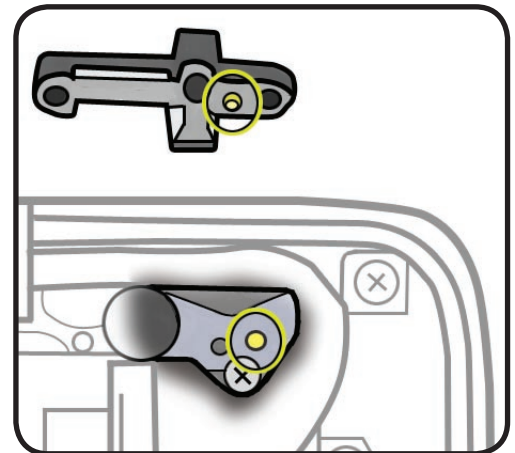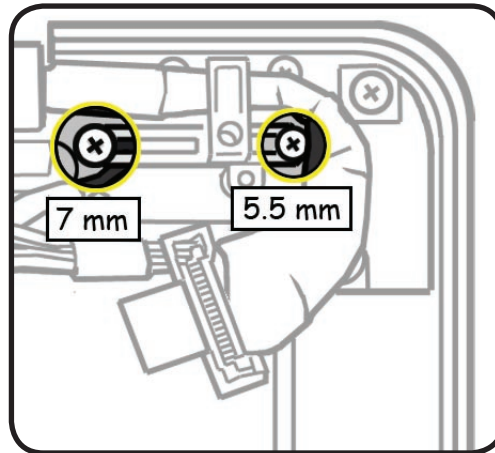
3 Use black stick to pry up microphone gasket.

4 Remove any adhesive remnants from top case.
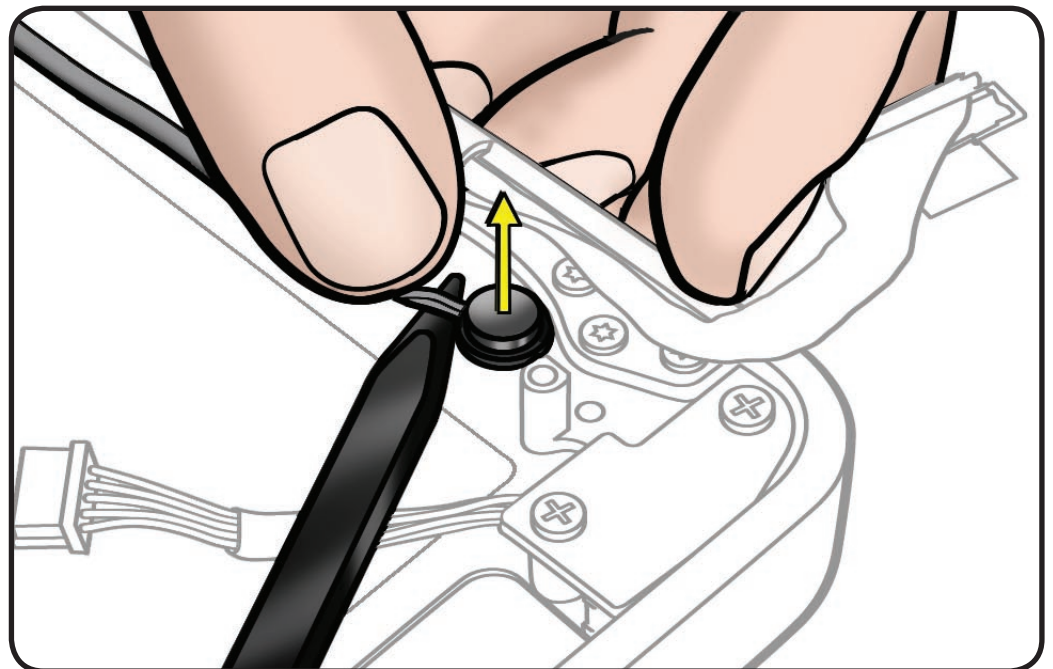
Replacement

1 Remove paper backing from gasket.

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

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

4 To route the microphone cable to the board, refer to **Logic board**.
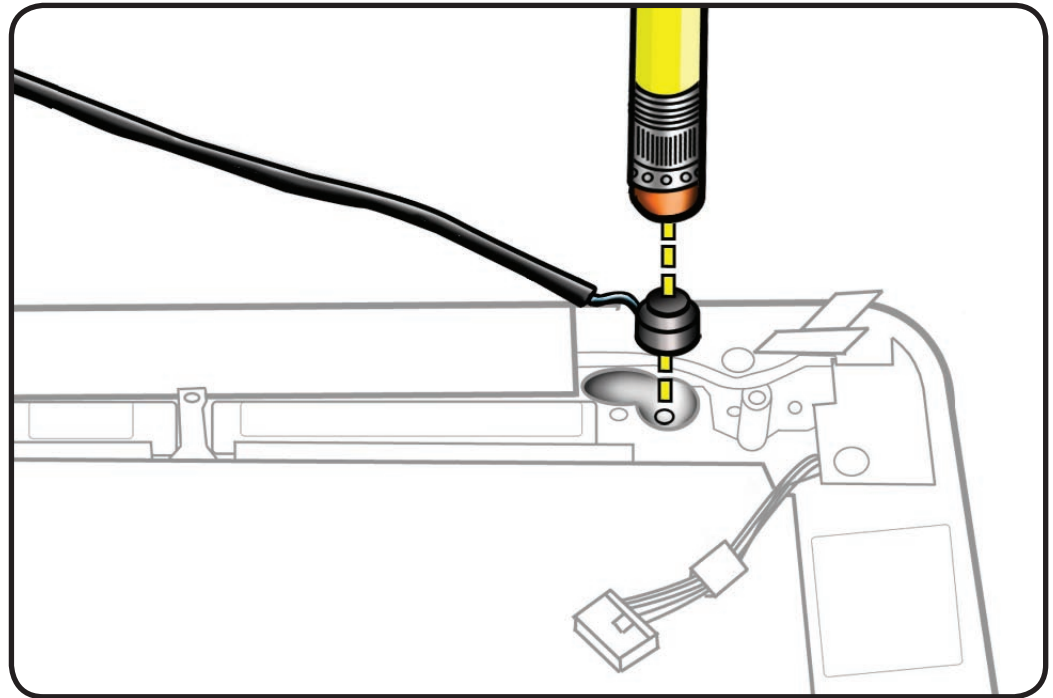
Center Bracket

First Steps

Remove:
- **Access door**
- **Battery**
- **Bottom case**
- **Memory**
- **Camera cable guide**
- **Optical drive**
- **Fan**
- **Keyboard flex bracket**
- **Logic board**
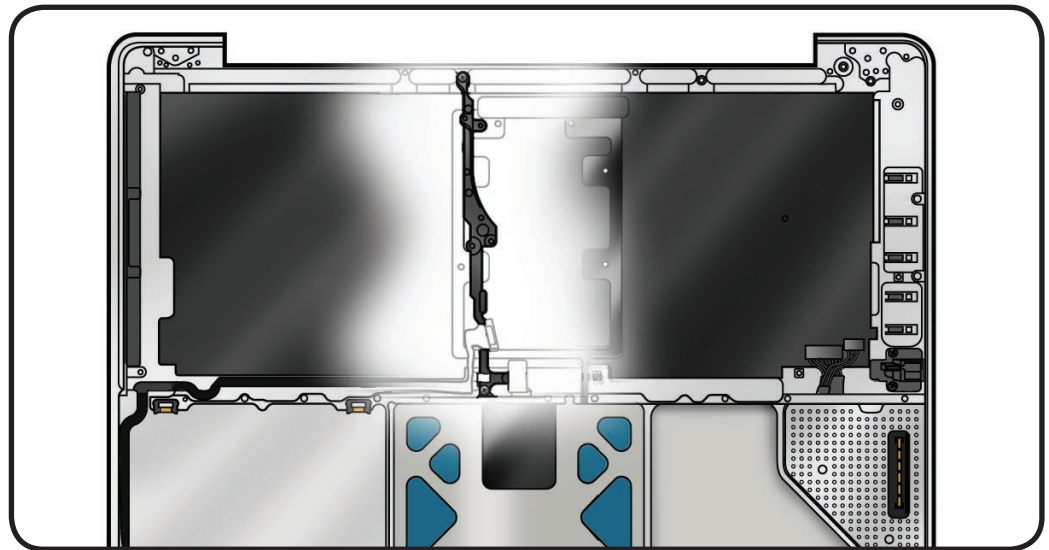
Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetic Phillips #00 screwdriver
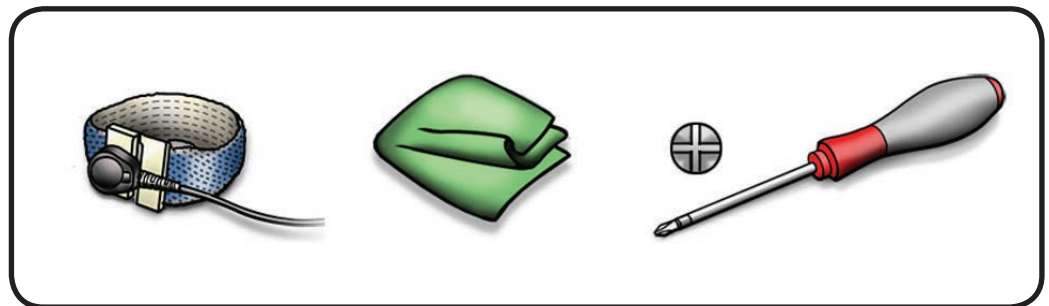
Removal

1 Remove 2 screws:
- 10-mm (922-8648) at top
- 6-mm (922-8644)

2 Remove center bracket.
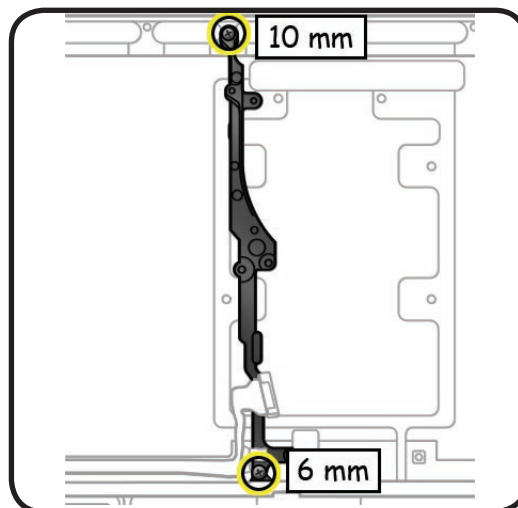
Kensington Lock

First Steps

Remove:
- **Access door**
- **Battery**
- **Bottom case**
- **Mid wall**
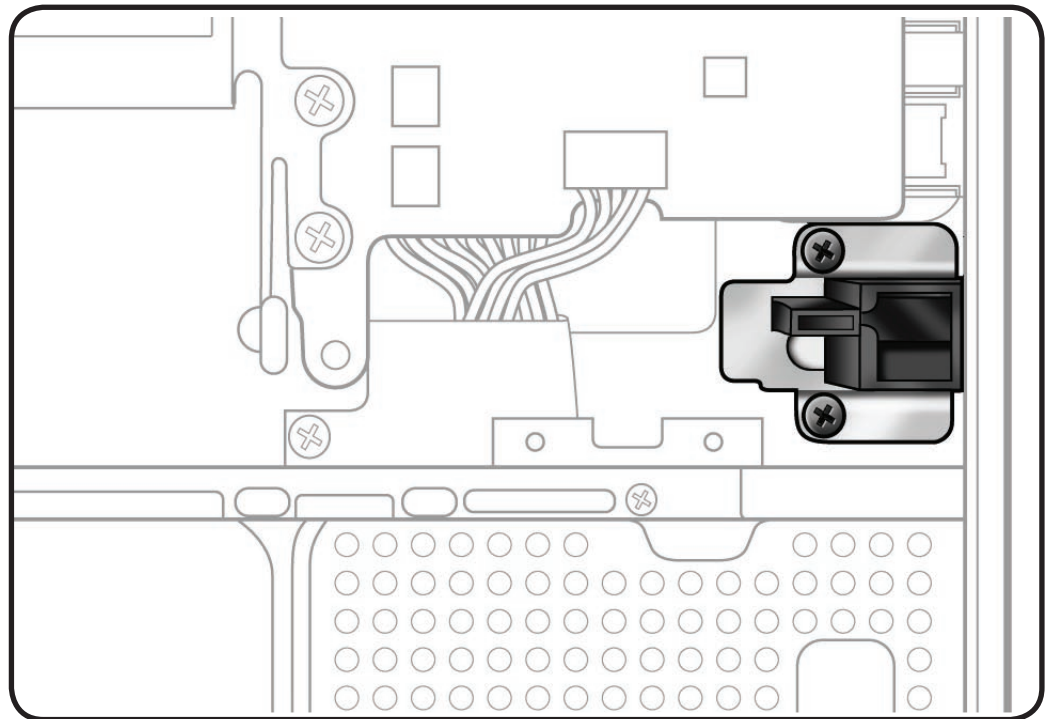
Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetic Phillips #00 screwdriver
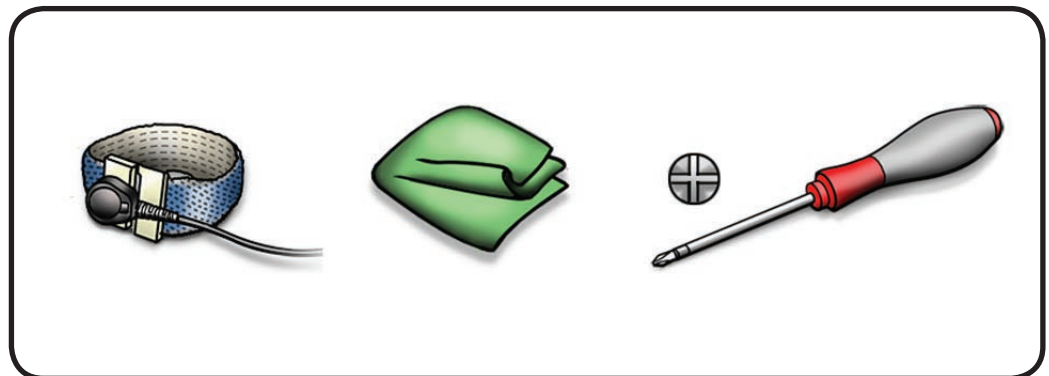
Removal

1 Remove 2 (3 mm) screws (screw part number not offered).

2 Lift out lock.

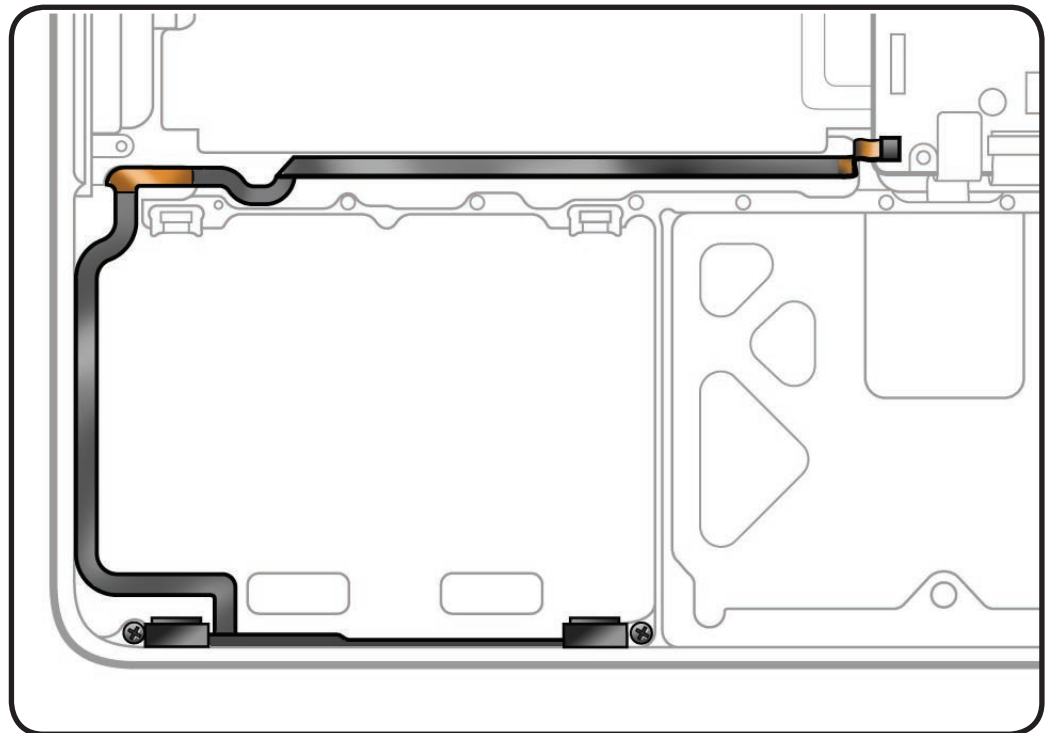Note that the lock includes the plastic piece and metal shield.
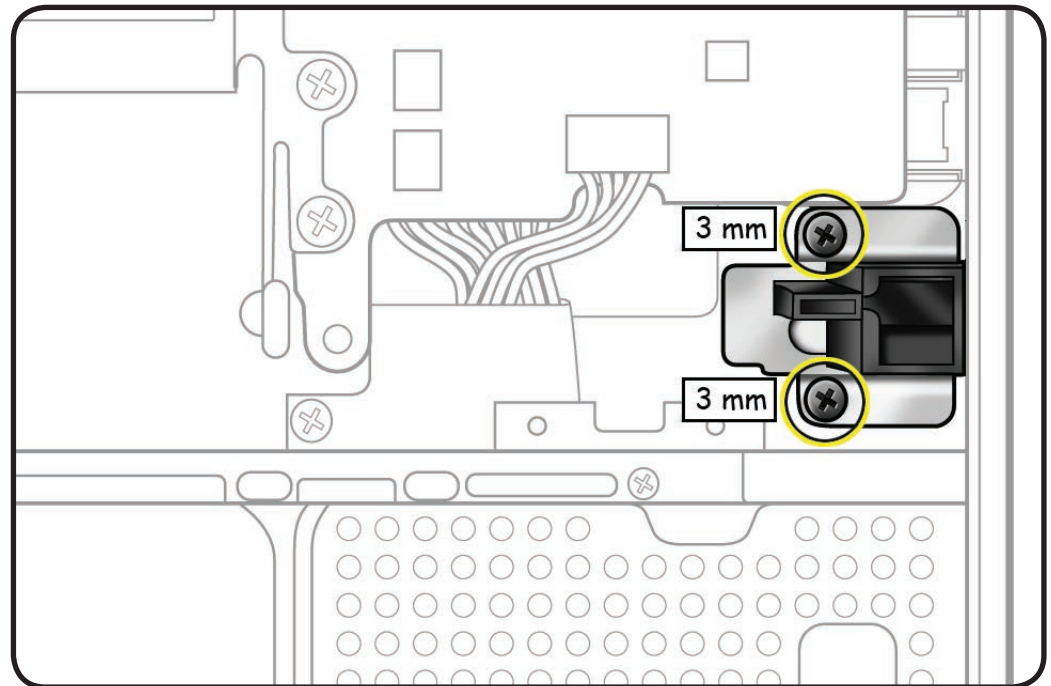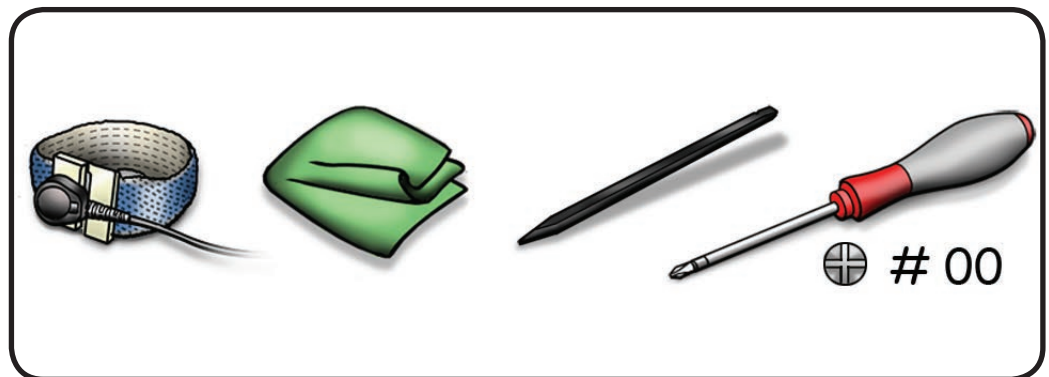
Hard Drive Front Bracket with IR/Sleep Cable

First Steps

Remove:
- **Access door**
- **Battery**
- **Hard drive bracket**
- **Hard drive**
- **Bottom case**
- **Mid wall**
- **Camera cable guide**
- **Optical drive**
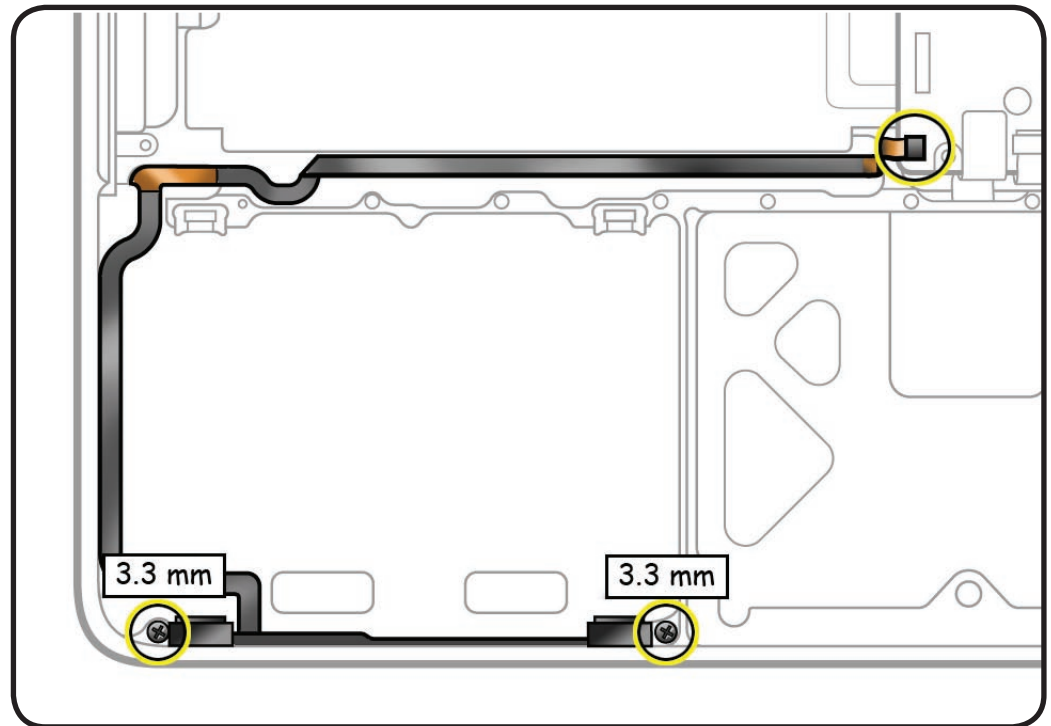- **Hard drive connector cable**

Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
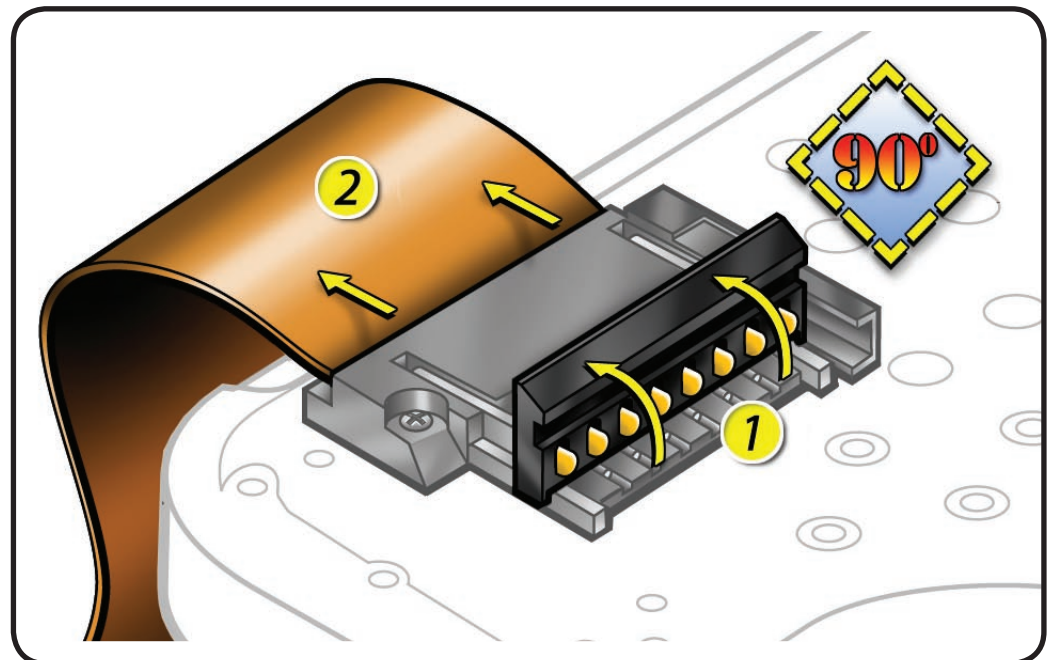- Black stick

Removal

1 Note routing of IR/ sleep light cable.

2 Remove 2 (3.3-mm) 922-8649 screws.

3 Tilt bracket away from top case.

4 Without straining cable, disconnect IR cable connector.

5 Peel up cable from top case.

Replacement Note: Peel off adhesive backing from cable, and press cable onto top case. Then finish the installation.
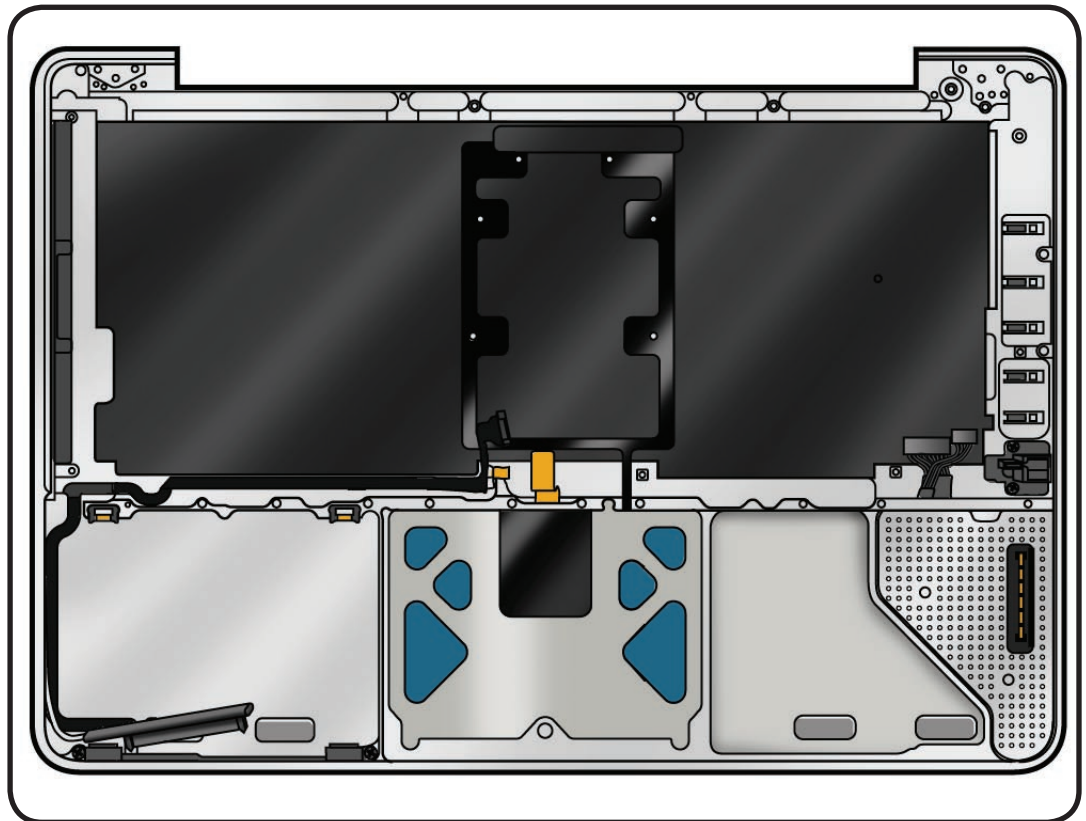
Top Case

First Steps

Remove:
- **Access door**
- **Battery**
- **Hard drive bracket**
- **Hard drive**
- **Bottom case**
- **Memory**
- **Mid wall**
- **Battery cable guide**
- **Camera cable guide**
- **LVDS cable guide**
- **Display assembly**
- **Optical drive**
- **Right speaker/ subwoofer**
- **Fan**
- **Keyboard flex bracket**
- **Logic board**
- **Microphone cable**
- **MagSafe board**
- **Center bracket**

Tools

No tools are required for this procedure.

Removal

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

The top case includes:
- battery indicator light board and cable

- battery power cable
- battery connector cover
- hard drive connector cable
- hard drive front bracket with IR/sleep cable
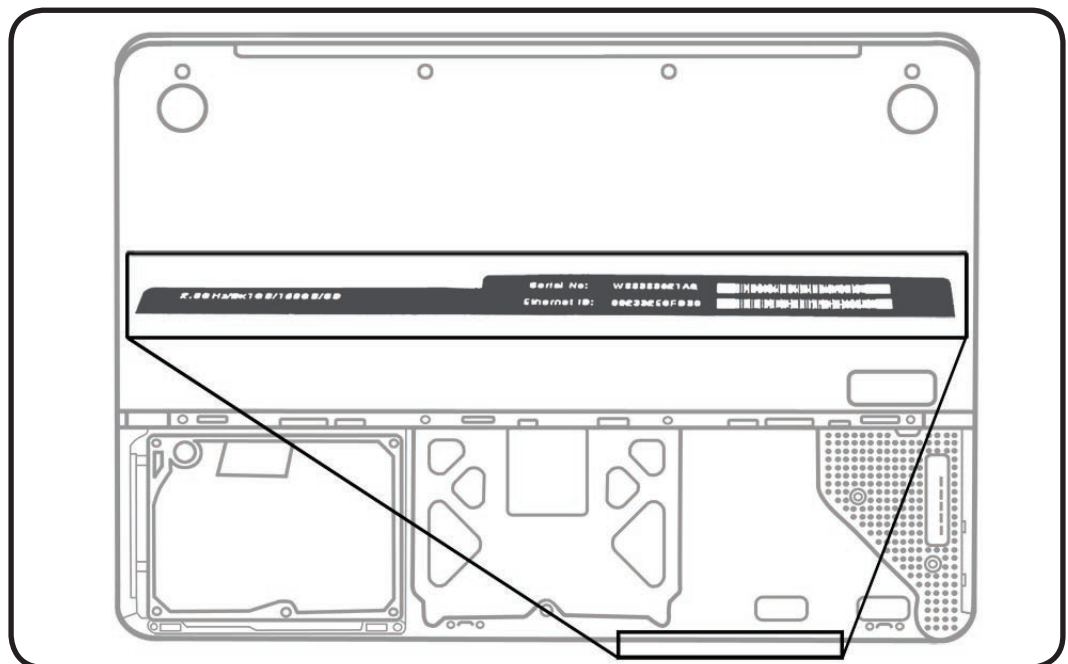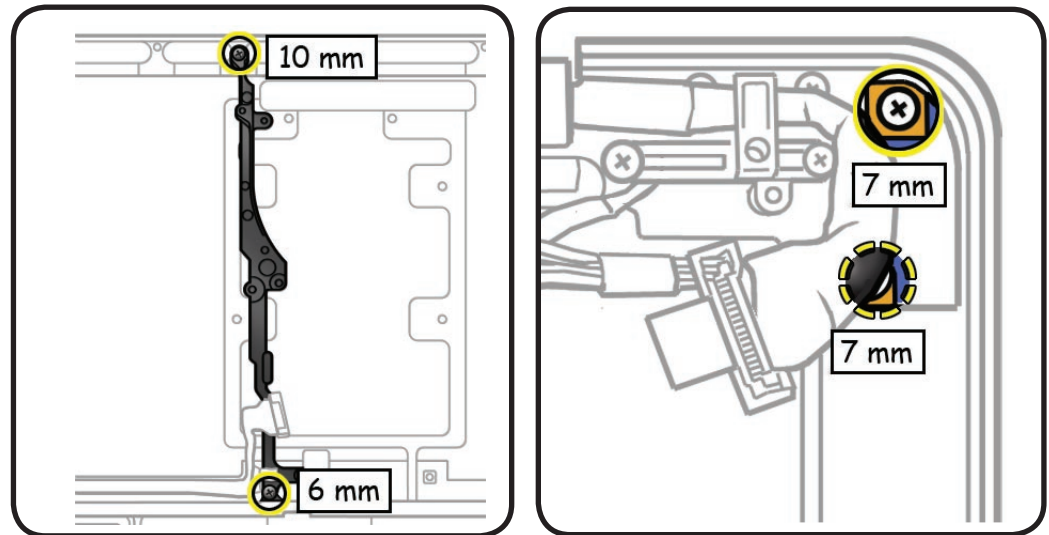- Kensington lock

Replacement Note:
Before assembling the computer, be sure to first transfer the following parts to the new top case:
- **Center bracket**
- **MagSafe board**

Replacement Note:
When replacing a top case, retain the customer's top case until the repair is complete. Before installing the replacement top case, peel up the serial number label from the original top case and transfer it to the replacement.
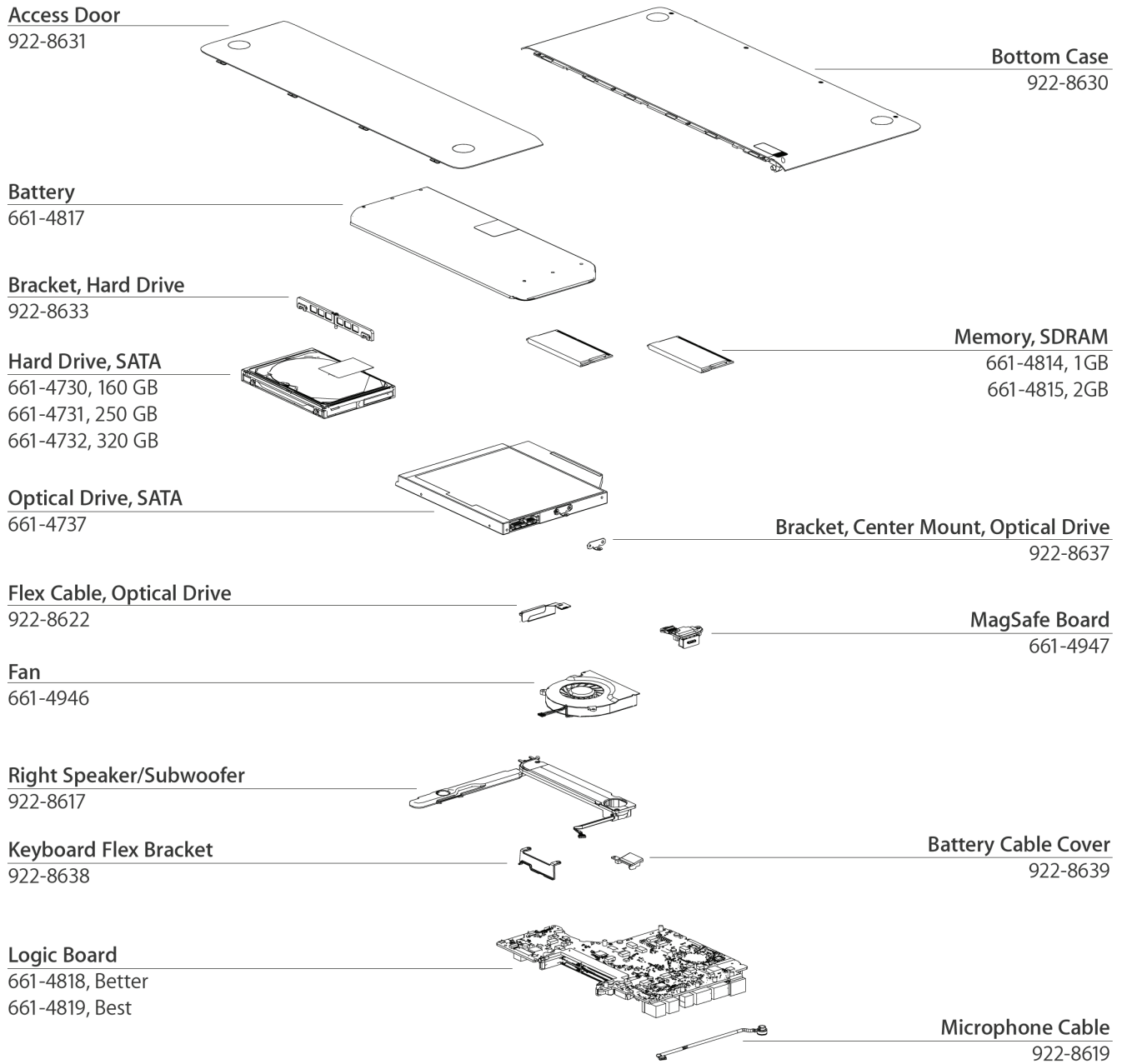
Service Source

Views

MacBook (13-inch, Aluminum, Late 2008)

Exploded Views

Main Assembly, 1 of 2

Access Door
922-8631

Bottom Case
922-8630

Battery
661-4817

Bracket, Hard Drive
922-8633

Memory, SDRAM
661-4814, 1GB
661-4815, 2GB

Hard Drive, SATA
661-4730, 160 GB
661-4731, 250 GB
661-4732, 320 GB

Optical Drive, SATA
661-4737

Bracket, Center Mount, Optical Drive
922-8637

Flex Cable, Optical Drive
922-8622

MagSafe Board
661-4947

Fan
661-4946

Right Speaker/Subwoofer
922-8617

Keyboard Flex Bracket
922-8638

Battery Cable Cover
922-8639

Logic Board
661-4818, Better
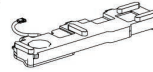661-4819, Best

Microphone Cable
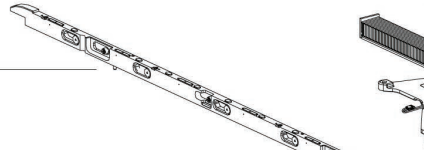922-8619

Logic Board
661-4818, Better
661-4819, Best

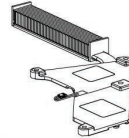**Left Speaker**
922-8618

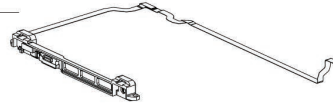**Mid Wall**
922-8632

Heatsink
661-4945

Hard Drive Connector Cable
922-8623

**Front Hard Drive
Bracket with IR/Sleep**
922-8783

Kensington Lock
922-8786

Cover, Battery Connector
922-8641

Battery Power Cable
922-8625

Battery Indicator Cable
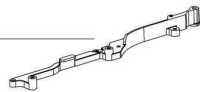922-8624

Button, Battery Indicator
922-8792

Battery Indicator Board
922-8727

Center Bracket
922-8634

Camera Cable Guide
922-8636

LVDS Cable Guide
922-8635

Top Case with Keyboard
661-4943, NBL-US
661-4944, BL-US

Display Assembly

Clutch Cover, Display
922-8785

Clip, AirPort Antenna
076-1326

AirPort Card
661-4766

AirPort Antenna
922-8782

Partial Assembly
Not Offered
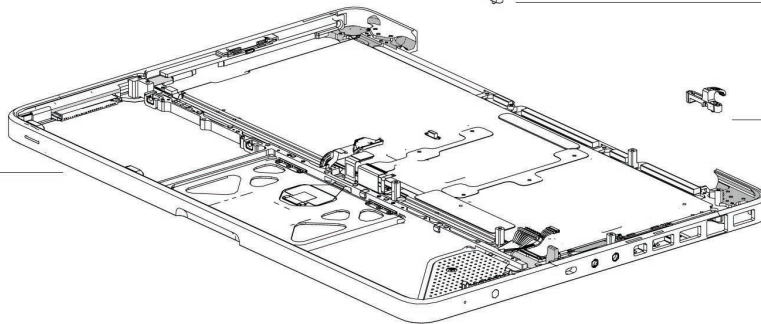
Display Assembly
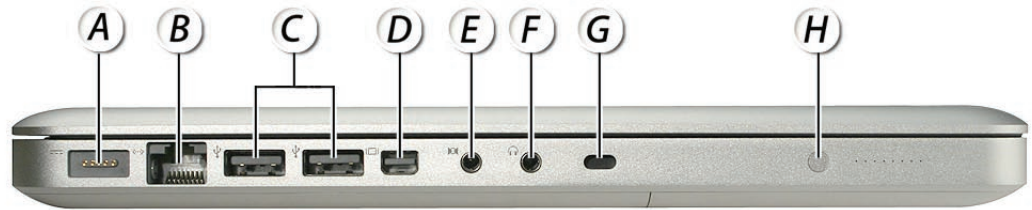without AirPort Card
661-4820
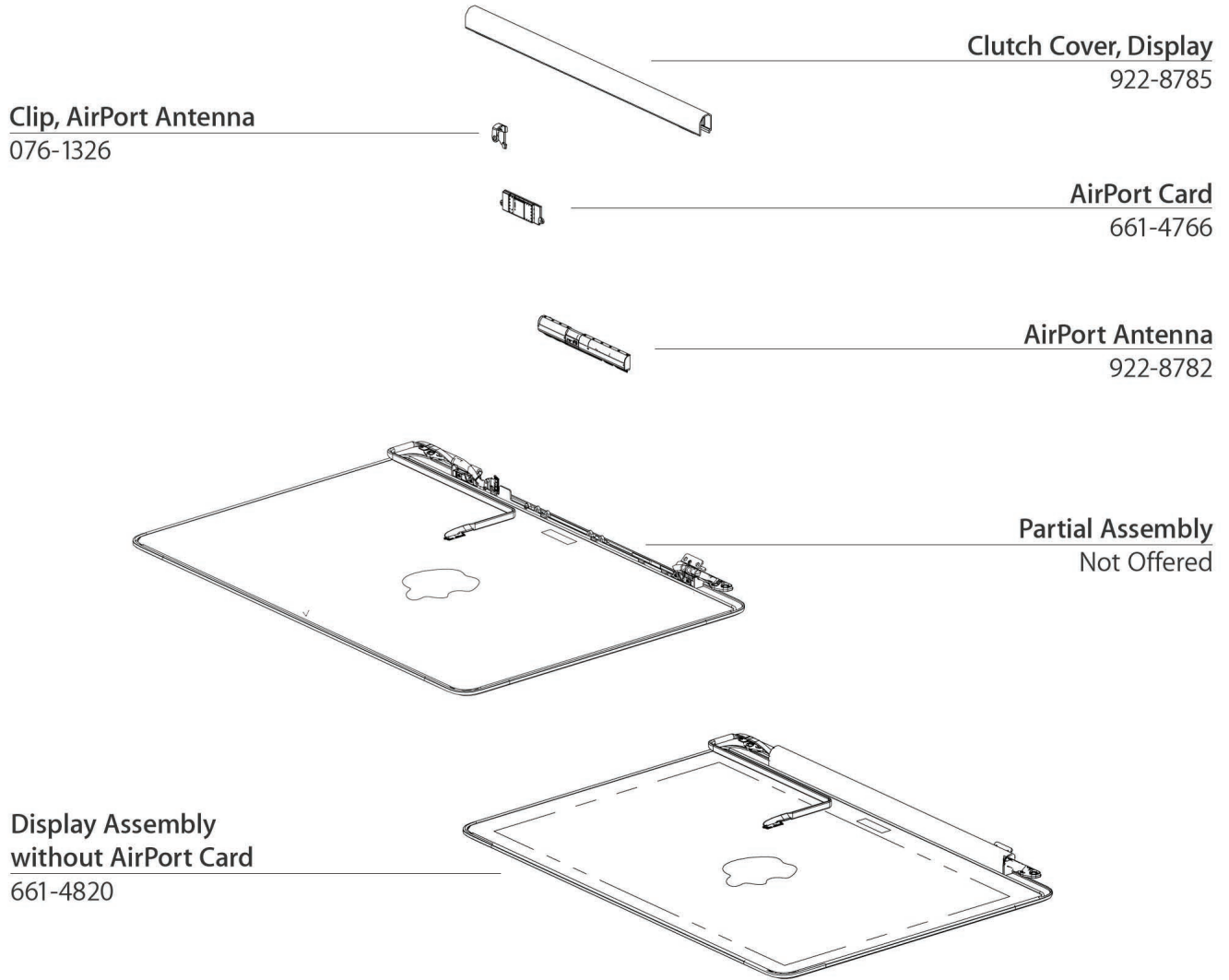
External Views

Port View

A = MagSafe Power

B = Gigabit Ethernet

C = USB 2.0 (1 high powered)

D = Mini DisplayPort

E = Combo Digital/Analog Audio In

F = Combo Digital/Analog Audio Out

G = Security Slot

H = Battery Indicator Light Button

Screw Chart

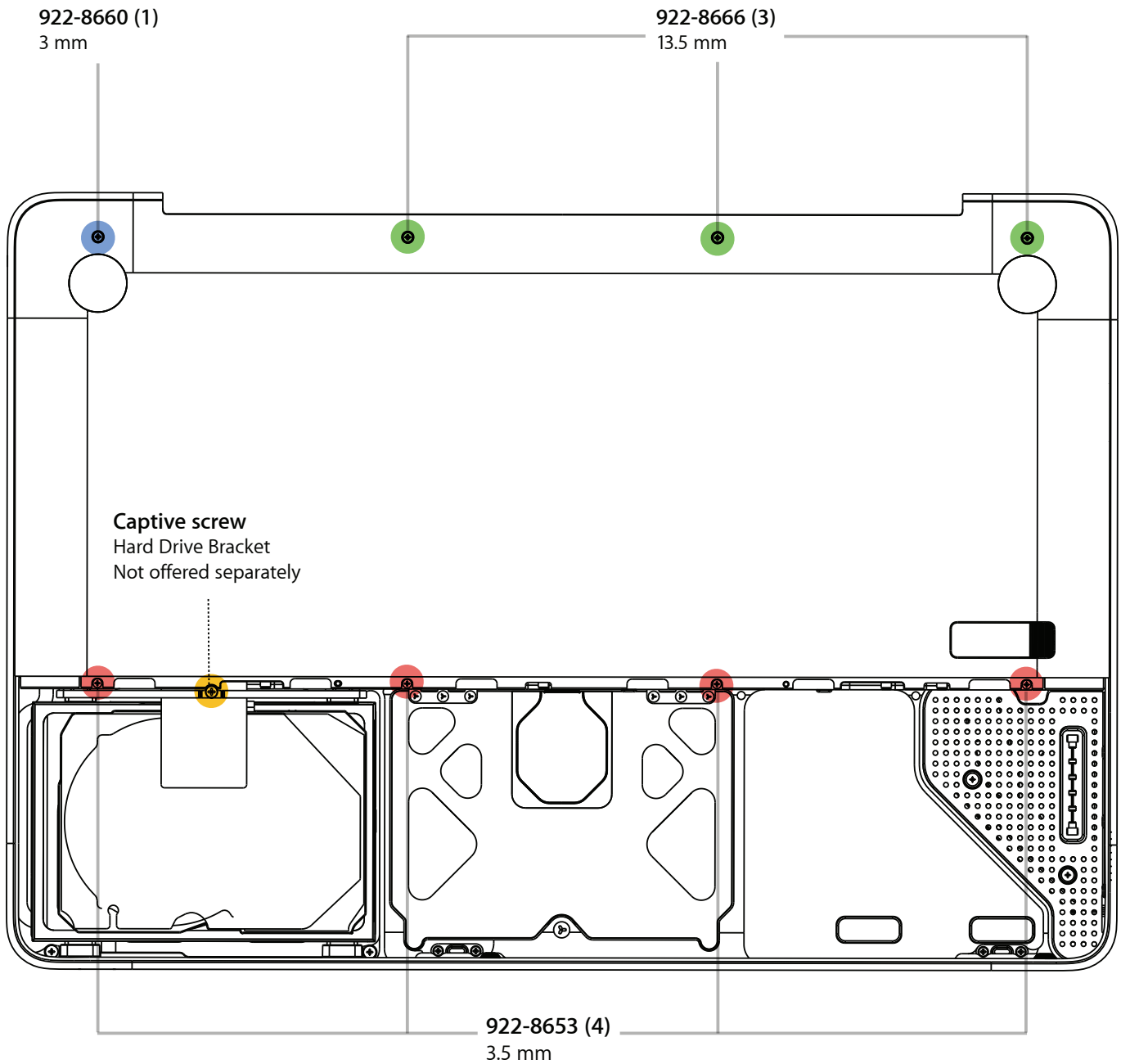|		
076-1320 Phillips #00 Included in Logic Board Kit	**076-1326** Phillips #00 Included in AirPort Card Kit: antenna (4), card (2), cable clip (1)	**922-8642** Spring Heatsink springs (4)
922-8644 Phillips #00 Center bracket, fan, optical drive, keyboard flex bracket	**922-8645** Phillips #00 Fan, LVDS cable guide, MagSafe board	**922-8648** Phillips #00 Center bracket (top)
922-8649 Phillips #00 Hard drive front bracket	**922-8650** Phillips #00 Camera cable guide, right speaker	**922-8651** Phillips #00 Battery connector cover (2)
922-8652 Phillips #00 Battery connector cover (1)	**922-8653** Phillips #00 Bottom case to mid wall	**922-8654** Phillips #00 shoulder Logic board (1)

922-8655	922-8656	922-8657
Torx T6	Phillips #00	Phillips #00
Hard drive	Mid wall	Battery indicator light (BIL) board
922-8658	**922-8660**	**922-8661**
Phillips #00	Phillips #00	Phillips #00
LVDS cable guide	Bottom case to top case (1)	Battery cable guide
922-8662	**922-8663**	**922-8665**
Phillips #00	Phillips #00	Phillips #00
Optical drive	Logic board (4)	Camera cable guide
922-8666	**922-8692**	**922-8756**
Phillips #00	Phillips #0 or #1	Torx T6
Bottom case to top case (3)	Heatsink (4)	Display assembly hinges

Screw Location Diagrams

Bottom Case

922-8660 (1)
3 mm

922-8666 (3)
13.5 mm

Captive screw
Hard Drive Bracket
Not offered separately

922-8653 (4)
3.5 mm

Display Assembly

922-8665 (2)
Camera Cable Guide ●
8 mm

922-8645 (1)
LVDS Cable Guide ●
7 mm

922-8658 (1)
LVDS Cable Guide ●
5 mm

922-8650 (1)
Rt Speaker/Subwoofer ●
4 mm

922-8742 (6)
Display Assembly Screws ●
Torx
6 mm

Top Case

922-8644 (2)
Fan
5 mm

922-8645 (1)
Fan
7 mm

922-8663 (4)
Logic Board
3 mm

922-8645 (2)
MagSafe
7 mm

922-8662 (3)
Optical Drive
2.5 mm

922-8650 (2)
Right Speaker
4 mm

922-8644 (2)
Fan
5 mm

922-8654 (1)
Logic Board
3.75 mm

922-8656 (4)
Midwall
10.3 mm

922-8649 (2)
HD Front Bracket with IR/Sleep
3.3 mm

922-8661 (1)
Battery Cable Guide
2.7 mm

922-8651 (2)
Battery Connection Cover
1.5 mm