



Service Source



MacBook Pro (15-inch, Late 2008)

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Manual Updates

Updated 21 October 2008

- Updated Features and Specs
- Take Apart: Reorganized topic sequence following Display Assembly chapter
- Added Caution notes to the Display Assembly and HD Front Bracket/IR/Sleep Cable chapters.
- Added Important replacement note to Logic board section about plugging in audio cable when main logic board is not mounted into top case.
- Added Replacement Troubleshooting tip to HD Front Bracket/IR/Sleep Cable chapter to reseal the IR/Sleep Cable if the system is having trouble going to sleep or stays asleep.

- **Manual introduced 14 October 2008**

Basics

MacBook Pro (15-inch, Late 2008)



Overview



The MacBook (15-inch, Late 2008) computer features both the NVIDIA GeForce 9400M integrated graphics processor and a high-performance NVIDIA 9600 GT graphics processor. Multi-Touch trackpad, and aluminum body. Refer to more features below.

Identifying Features

The main features and service differences include:

- Aluminum unibody enclosure, machined from a single piece of aluminum
- Ultrathin 15-inch LED-backlit glossy display, 1440 by 900 pixels
- Mini DisplayPort connector
- Express Card slot, 34mm
- 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 inside front edge, visible when the access door and battery are removed.



Product Configurations

The following table shows the MacBook (15-inch, Late 2008) model configurations at introduction:

| Feature | Better (MB470) | Best (MB471) |
|-------------------------------------|---|--|
| Intel Core 2 Duo processor | 2.4 GHz 3MB sharedL2 1066MHz frontside bus | 2.53 GHz 6MB shared L2 2.8 GHz 6 MB L2 CTO 1066MHz frontside bus |
| Graphics | NVIDIA GeForce 9400M (MCP79) + NVIDIA GeForce 9600M GT 256MB VRAM | NVIDIA GeForce 9400M (MCP79) + NVIDIA GeForce 9600M GT 512MB VRAM |
| Memory, DDR3 1066, SO-DIMMs | 2 GB (2 x 1 GB) | 4 GB (2 x 2 GB) |
| Hard Drive, Serial ATA 100 5400 rpm | 2.5" SATA, 250 GB, 5400 Option: up to 320GB at 7200 rpm or 128GB SSD | 2.5", 320 GB SATA , 5400 Option: up to 320GB at 7200 rpm or 128GB SSD |
| Optical Drive (SATA) | 8x DL Super, 9.5 mm | 8x DL Super, 9.5 mm |
| Housing | Aluminum | Aluminum |
| Display | 15.4-inch glass LCD, 1440 x 990 pixels, LED backlight, glossy finish | |
| I/O | USB: 2- USB 2.0 (1 high powered) FireWire: 1-FW800 Video I/O: Mini Display Port Audio I/O: Combo digital.analog in, Combo digital/analog/iPhone headset out, Microphone, Stereo speakers with subwoofer Camera: Wave 4 camera (f2.4, 3 micron pixel (640x480)) Other: IR, Battery Indicator Light, 34mm Express card | |
| Keyboard | Backlight | |
| Battery | Lithium-polymer battery, up to 5 hours | |
| Power Adapter | 85W MagSafe Power Adapter | |



Note About Images in This Manual

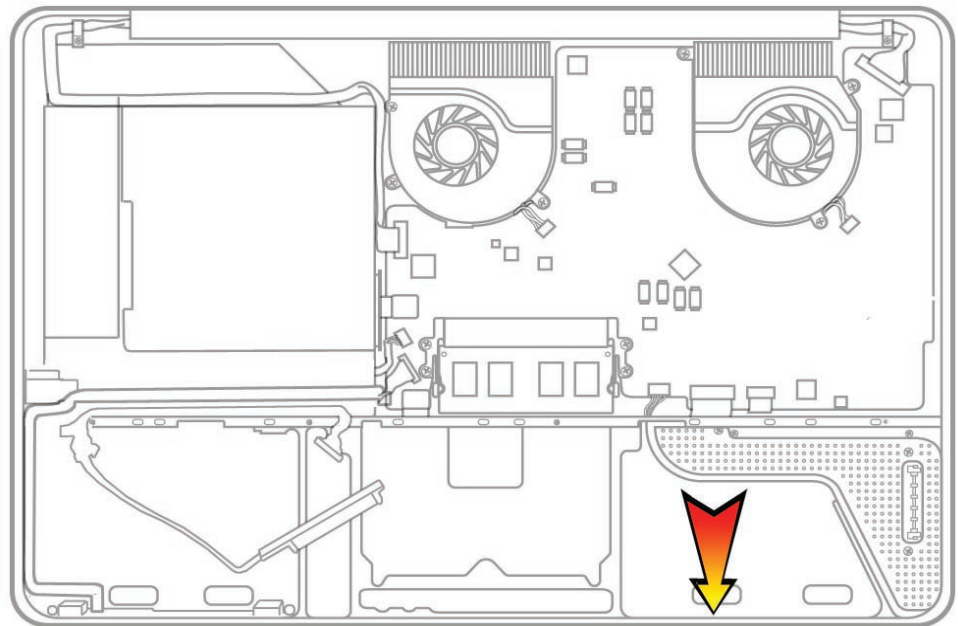
Because a pre-production or very similar model was used for most of the images shown in this manual, you may notice small differences in appearance between the image pictured and the computer you are servicing. However, although the appearance may differ, the steps and sequence are the same unless noted.

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

Before installing the replacement top case, transfer the serial number to the replacement top case. Peel up the original serial number label with a jeweler's flat blade screw driver and transfer it to the inside edge of the replacement top case (see arrow for location).



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
- Foam wedge fixture for display assembly removal (part number 922-8779)
- Kapton tape

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 Brilliantize anti-static spray cleaning solution. Alternatively, IPA (isopropyl alcohol) can be used.



Troubleshooting

MacBook Pro (15-inch, Late 2008)



General Troubleshooting



Update System Software

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

Test Points

There is no silkscreen text on final production logic boards. Test points mentioned in troubleshooting charts are solely for reference.

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

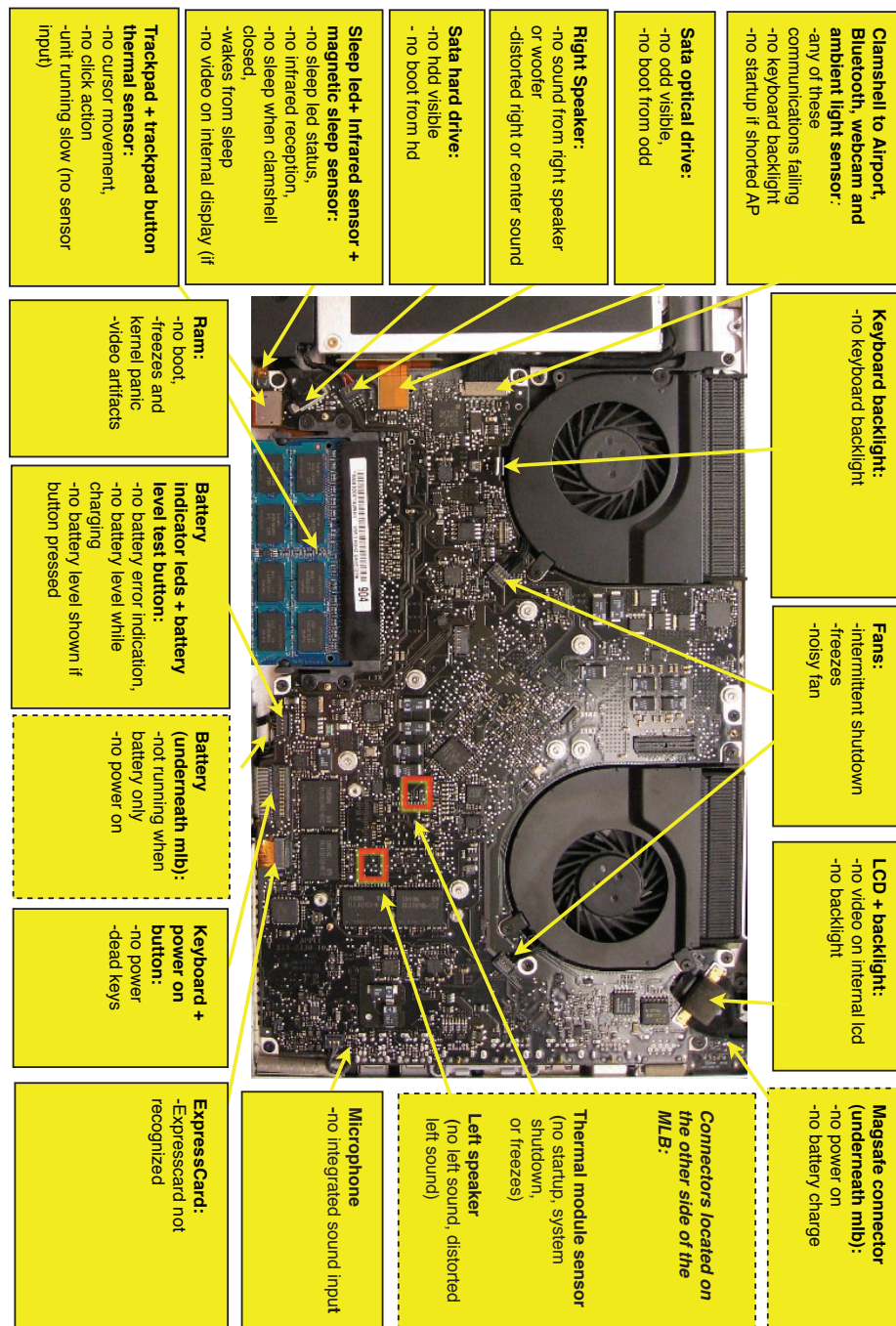
For the latest on troubleshooting issues, refer to:

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



Functional Overview

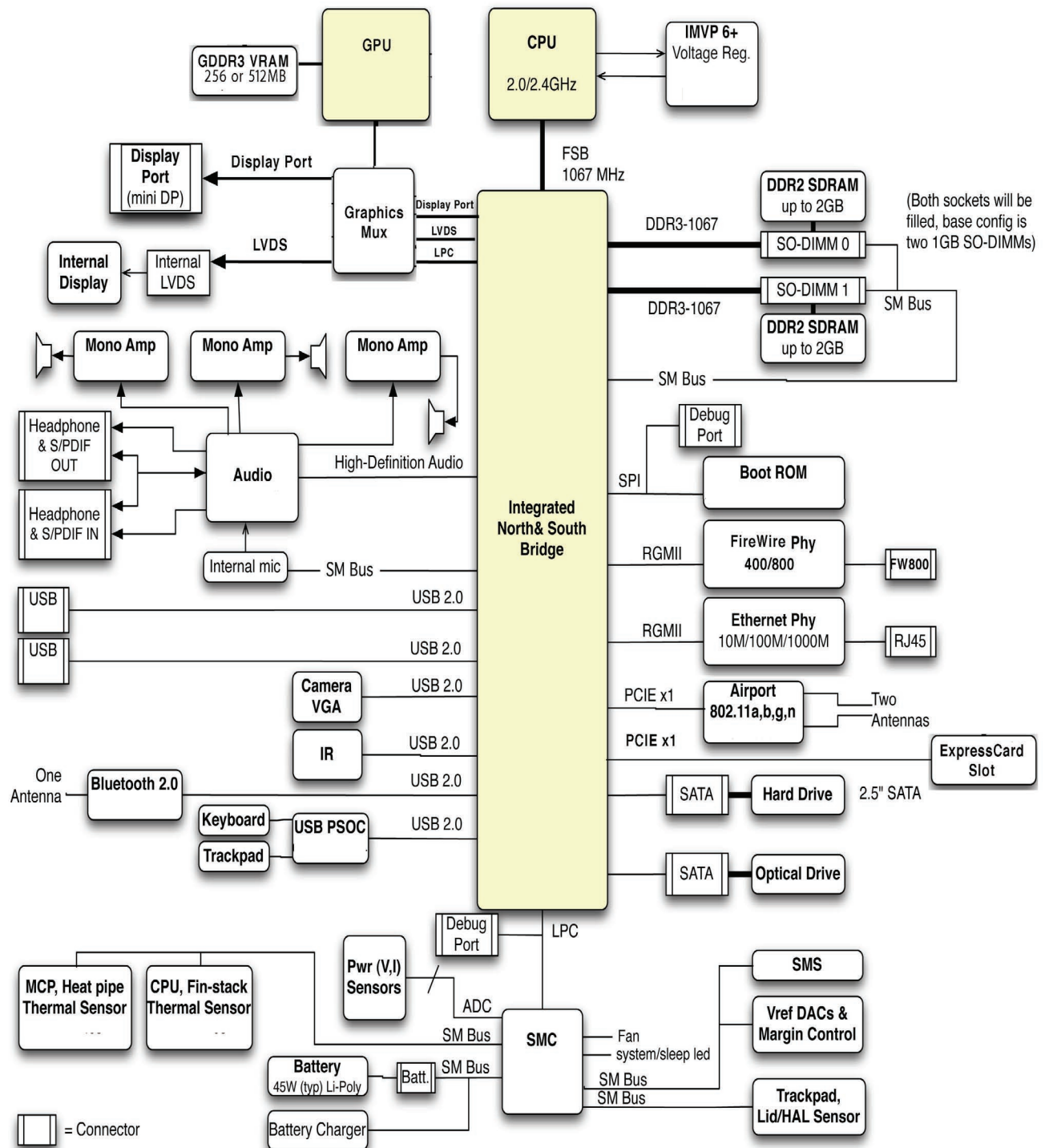
Refer to this diagram for symptoms related to MacBook Pro (15-inch, Late 2008) logic board connectors.





Block Diagram, MacBook Pro (15-inch, Late 2008)

Refer to this diagram to see how modules are interrelated.



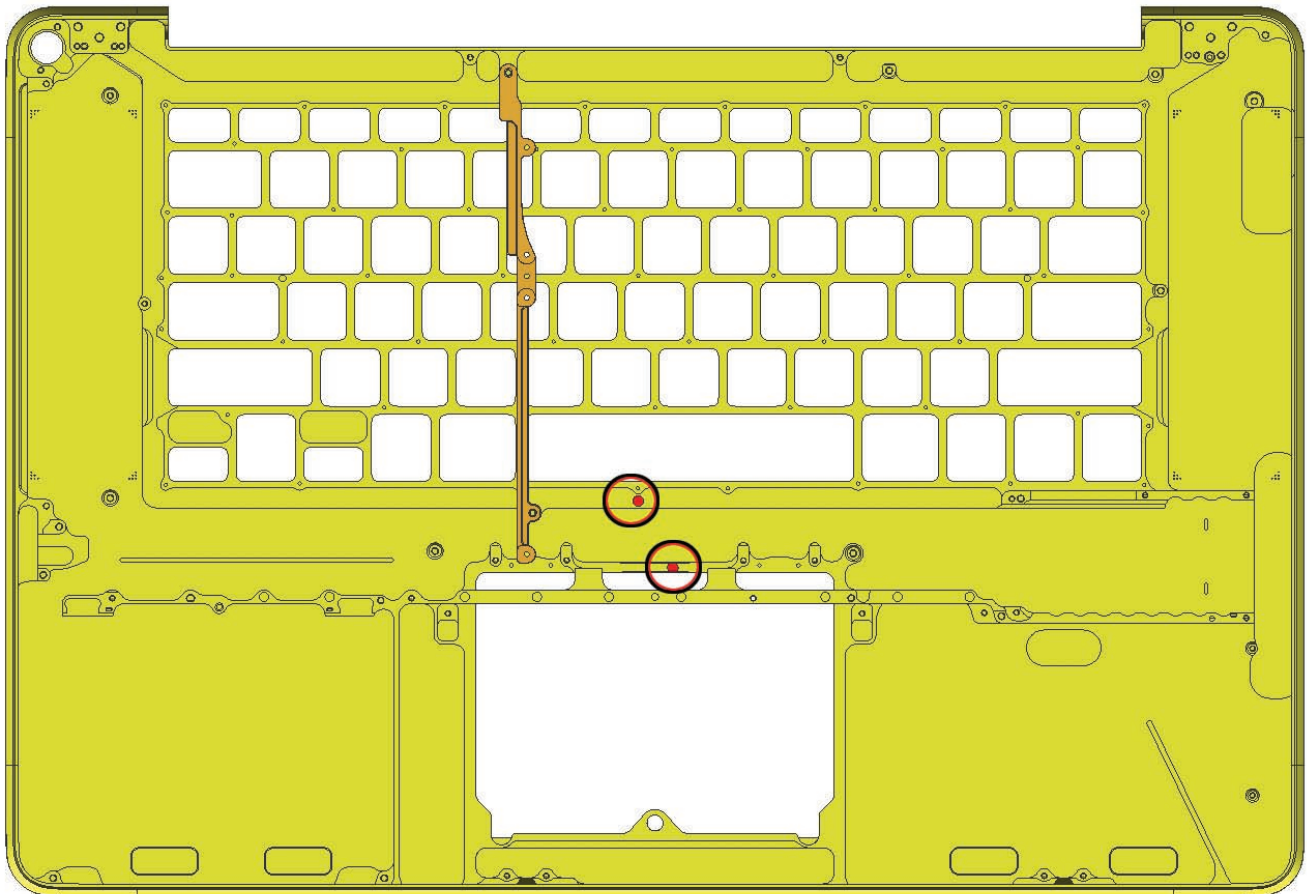


Liquid Submersion Indicators

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 tiny, round dots shown in the following graphics) when they have come in contact with liquid, such as an accidental spill.

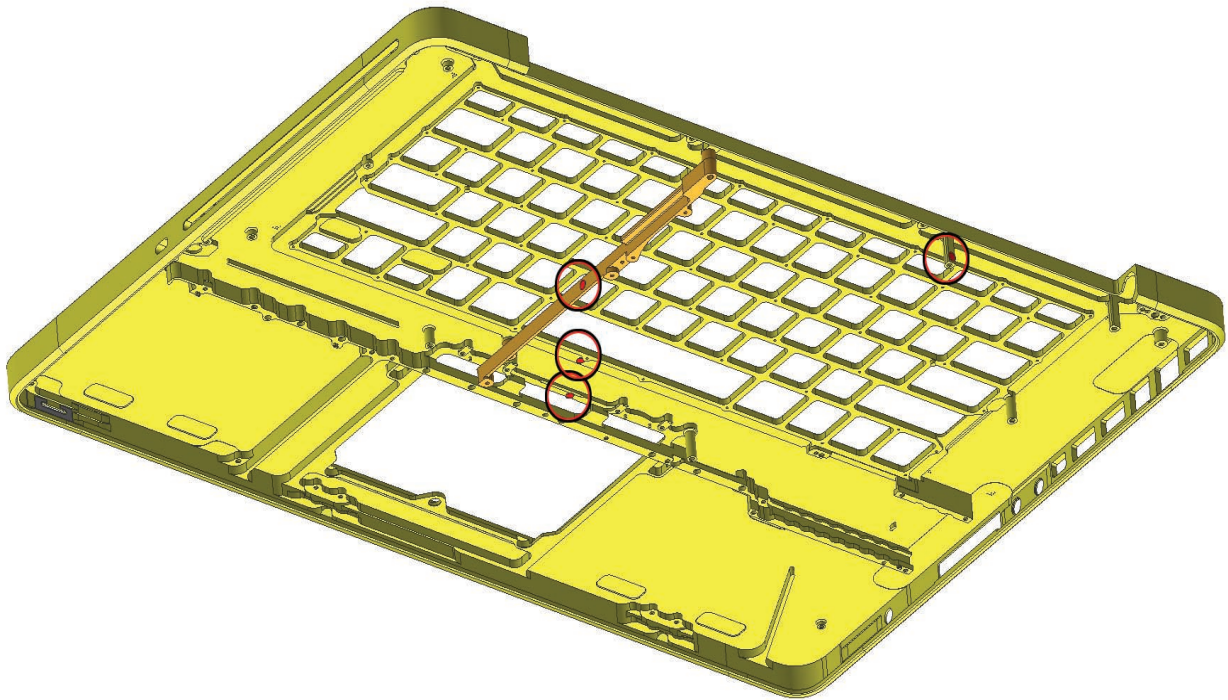
For more information, refer to Knowledge Base article TS2274: "MacBook (Early 2008) and later: Liquid submersion indicators (LSI)."

Liquid Submersion Indicator, Graphic #1





Liquid Submersion Indicator, Graphic #2





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>.

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

Startup and Power Issues

No Power

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

Quick Check

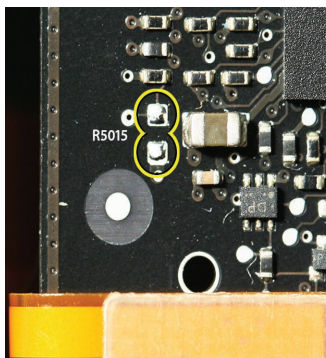
| Symptom | Quick Check |
|--|---|
| No Power / Dead Unit <ul style="list-style-type: none">No powerNo imageNo startup chimeNo fan or hard drive spinNo reset sound from optical driveNo sleep LED activityNo light if Caps Lock pressedNon-operational | <ol style="list-style-type: none">1. Verify AC power 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 reseal 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. Reseat or test known-good MagSafe cable to achieve power for logic board. | Yes | Logic board has power adapter energy to start system. MagSafe cable reseat or replacement resolved issue. If still no system power on indications, go to step 10 | X03 |
| | No | AC adapter power not going to logic board power supplies. Replace logic board. | M21 |
| 10. 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 pads R5015 on logic board just above optical flex connector. 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 resealed. | |
| | | Power on key appears to be stuck, had to remove keyboard cable to 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 <ul style="list-style-type: none">No startup chime, some video activity, Apple logo, startup spin dialStartup chime with possible beep tones.Fan, hard drive spin or optical drive reset soundSleep LED is on , blinking or went outCaps Lock LED toggles when pressed | <ol style="list-style-type: none">Reset SMC.Verify startup process passes initial memory checks – no beep errors or flashing sleep LED indicators. Display activity is starting up.Clear PRAM. Verify starts up from user drive.Connect known-good external bootable device and press Alt key during startup then select external startup device to bring up system for diagnostics.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 reseal 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 <ul style="list-style-type: none">• Powers off during startup• Powers off with desktop use | <ol style="list-style-type: none">1. Verify battery charge status2. Check AC adapter MagSafe connector and connection with system3. Reset SMC and PRAM4. Start up with shift key down for safe mode5. Startup from known-good bootable device6. Check system.log info for shutdown cause7. 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 article HT2331 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. -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 | M18 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 <ul style="list-style-type: none">• Power• No video• fan, hard drive spin, or optical drive reset sound• sleep LED is on or went on• light if Caps Lock pressed | <ol style="list-style-type: none">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. Verify Apple logo lights up on top case. | Yes | Logo image visible - check and reseal LED backlight cable connector on logic board (below right fan). Inspect cables for damage near clutches: . if damaged, replace display assembly and go to step 11 . if cable is not damaged, reseal 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 <ul style="list-style-type: none">• AC adapter• No MagSafe LED indicator• No orange charge indication• Battery status LEDs:<ul style="list-style-type: none">- single chase- all flash- no LED | <ol style="list-style-type: none">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 <ul style="list-style-type: none">• Display notice of system kernel panic during start up and desktop use.• System freeze during use.• System freeze upon wake from sleep. | <ol style="list-style-type: none">1. Reset SMC and clear PRAM2. 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 device6. Check panic.log info for crash cause7. 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 | |
| | 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 | |
| | Yes | Replace display assembly. | L14 |
| 6. Disconnect display assembly and test with known-good display assembly. Verify that system now starts up without kernel panic/freeze. | 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, reseal 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) | <ol style="list-style-type: none">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” (Knowledge 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. | <ol style="list-style-type: none">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 <ul style="list-style-type: none">No powerNo Power LEDNon-operationalStuck /broken pin | <ol style="list-style-type: none">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 MagSafe5. 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. | <ol style="list-style-type: none">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. | <ol style="list-style-type: none">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. | |
| | 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 <ul style="list-style-type: none">• Computer wobbles• Trackpad button does not work• Battery pack case has opened.• Access door will not close | <ol style="list-style-type: none">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 <ul style="list-style-type: none">No Ethernet device presentUnable to access network resourcesEthernet device shows no connectionEthernet device unable to get an IP addressSlow network performance | <ol style="list-style-type: none">Check the network cable for damage, try a known good Ethernet cable – CAT5 or better recommended for 100Mbps+ connections.Check Ethernet ports on Mac and wall/switch for dust, debris, damage or bent pins.Ensure distance from networking infrastructure is less than 300 feet / 105 meters.Verify port, cable and network hardware with a known good system. Isolate firewall, MAC address filtering or hardware access control devices.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 <ul style="list-style-type: none">• Unable to join networks or pair devices• Card not available or recognized• Intermittent device or connection dropouts | <ol style="list-style-type: none">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

Quick Check

| Symptom | Quick Check |
|--|---|
| No/Poor Wireless Signal <ul style="list-style-type: none">• Unable to find networks• Intermittent connection dropouts• Slow transfer speeds | <ol style="list-style-type: none">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:<ol style="list-style-type: none">a. Base station is not set to low-power transmission modeb. Base station is not using unsupported connection and encryption protocolsc. 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

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

Quick Check

| Symptom | Quick Check |
|---|--|
| AirPort Card: Kernel Panic <ul style="list-style-type: none">Kernel panic on bootKernel panic or freezing while attempting to connect to Wi-Fi networksKernel panic while transferring data on Wi-Fi networks. | <ol style="list-style-type: none">Isolate OS by booting from original install media (10.5.x). Attempt to connect to Wi-Fi network.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

Quick Check

| Symptom | Quick Check |
|---|---|
| Wireless Performance Issue / Slow Connection <ul style="list-style-type: none">• Slow or stalled data transfers• Intermittent connection dropouts | <ol style="list-style-type: none">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 system5. (AirPort) Wireless base station checks:<ol style="list-style-type: none">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 <ul style="list-style-type: none">Can't get the system to recognize the Bluetooth keyboard or mouse | <ol style="list-style-type: none">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. | L16 |
| | No | Replace logic board. Optional step 7. | M11 |
| 7. With the logic board replacement, is the Bluetooth now pairing? | Yes | Bad logic board. Issue resolved. | M11 |
| | No | All parts replaced. Try minimum configuration troubleshooting. | |

Uncategorized Symptom

Quick Check

| Symptom | Quick Check |
|---|--|
| Uncategorized Symptom Unable to locate appropriate symptom code | 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 <ul style="list-style-type: none">• Incorrect/missing colors• Distorted/blurred image• Pixel anomalies• Vertical/horizontal lines• Non-uniform brightness• Image flicker• Image persistence | <ol style="list-style-type: none">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 |

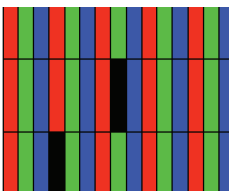
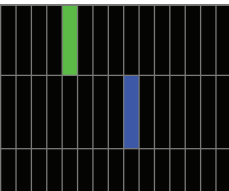


Deep Dive: Distorted/Blurred Image



| 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. | |

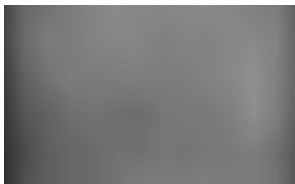


Deep Dive: Vertical/Horizontal Lines

| 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 <ul style="list-style-type: none">• Camera not detected• No green LED for camera• Excessive blooming• Poor white balance• Poor focus• Green image• Image distortion | <ol style="list-style-type: none">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 reseal 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 <ul style="list-style-type: none">No videoNo backlight | <ol style="list-style-type: none">Check brightness settingAttach known-good supported external display.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 an image is being displayed. | Yes | Image present but backlight is not on. Check logic board connections. Go to step 5. | |
| | No | Go to No Video symptom 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 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 <ul style="list-style-type: none">Image flickerAudible 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 reseal 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 <ul style="list-style-type: none">• Broken glass• Broken hinge• Stripped screw/head• Stripped screw boss• Dent or scratch to chassis | <ol style="list-style-type: none">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 <ul style="list-style-type: none">• Cracked LCD• Scorched or melted LCD• LCD impact damage | <ol style="list-style-type: none">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 <ul style="list-style-type: none">• Cannot save documents• Read/Write error message• Hang when accessing or saving data | <ol style="list-style-type: none">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 <ul style="list-style-type: none">Flashing question markBoots to grey screenBoots to blue screen | <ol style="list-style-type: none">Use a known-good mouse. Stuck mouse button will not allow boot.Boot from Install DVD. Verify S.M.A.R.T. status of drive using Disk Utility.Repair disk using Disk Utility.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 <ul style="list-style-type: none">Noise during start upNoise during operationNoise when drive is copying or saving data | <ol style="list-style-type: none">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 <ul style="list-style-type: none">• Cannot insert a disc into the drive• Cannot eject a disc placed into the drive | <ol style="list-style-type: none">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 <ul style="list-style-type: none">Errors when writing optical media.Errors when reading optical media.Hang when accessing or preparing to write data. | <ol style="list-style-type: none">Test optical media in another drive of the same type in same type of machine to rule out media issue.Check with known-good discs like the Install discs that came with the computer.For write issues, check with known-good media that performs well in another computer and optical drive of the same type.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 <ul style="list-style-type: none">Discs inject and eject, but do not appear in Finder | <ol style="list-style-type: none">Use Apple System Profiler ATA section to see if the optical drive appears.Serial-ATA section of Apple System Profiler will show any media inserted.Check Finder Preferences: General and make sure "CD's, DVD's and iPods" is checked under "Show these items on the Desktop."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 <ul style="list-style-type: none">Noise during bootNoise during operationNoise when drive is copying or writing data | <ol style="list-style-type: none">Test optical media in another drive of the same type in same type of computer to rule out media issue.Check with known-good discs. Install discs that came with the computer.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. | <ol style="list-style-type: none">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 | <ol style="list-style-type: none">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 <ul style="list-style-type: none">• Keystrokes not recognized• Locks up• Displayed characters don't match | <ol style="list-style-type: none">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 <ul style="list-style-type: none">• Keycap broken• Key switch broken• Sticky key• Key pressed not recognized | <ol style="list-style-type: none">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/warranty3. 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:<ul style="list-style-type: none">- Inoperative keys (K01)- Sticky keys (K05). |

Built-in Trackpad Does Not Work

Quick Check

| Symptom | Quick Check |
|--|--|
| Built-in Trackpad Does Not Work <ul style="list-style-type: none">• Cursor does not move.• Select button of trackpad inoperable• Multiple touch features inoperable | <ol style="list-style-type: none">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

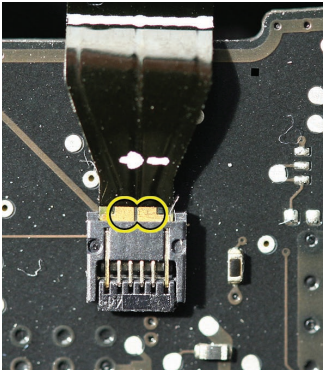
Quick Check

| Symptom | Quick Check |
|---|--|
| Built-in Keyboard Has Dim or No Backlight <ul style="list-style-type: none">In darkened room, keyboard backlight does not come on or is dim. | <ol style="list-style-type: none">Make sure this computer model has a keyboard backlight option by checking the configuration label in the battery bay.Make sure that keyboard backlight is turned on and brightness turned up.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 <ul style="list-style-type: none"> Keystrokes not recognized | <ol style="list-style-type: none"> Reset SMC. Press Caps Lock. If the Caps Lock light comes on that indicates at least a partial connection to the logic board. 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 <ul style="list-style-type: none">Cursor movement is random, uneven, or jumpy.Cursor hangs or stalls along path. | <ol style="list-style-type: none">Check for environmental factors such as humidity, hand lotion or jewelry. Check if user is touching the trackpad simultaneously with both hands.Clean the trackpad surface (with the computer off) using a clean, dry, lint free cloth.Make sure all software and firmware updates have been applied.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 <ul style="list-style-type: none">Remote is not recognized. | <ol style="list-style-type: none">The computer is on and awake.Check with known-good remote on user's computer and the user's remote on known-good computerRemote is used within 30 feet of the computer and unobstructed line-of-sight to the IR window.Clean the IR window.Open System Preferences: Security pane. Verify that "Disable remote control infrared receiver" is not checked.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 reseal 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. | <ol style="list-style-type: none">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 <ul style="list-style-type: none">Distorted audio | <ol style="list-style-type: none">Reset PRAM.Adjust sound output and level in System Preferences: Sound: Output, and use the Balance to locate a left, right, or woofer speaker distortion source.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 |



Express Card Will Not Insert Into Slot

Unlikely cause: LCD, MLB, hard drive

Quick Check

| Symptom | Quick Check |
|---|--|
| ExpressCard will not insert into ExpressCard Slot ExpressCard does not fully seat into the slot Slot door does not open completely | <ol style="list-style-type: none">1. The card must be a 34mm wide card with the top side oriented up and not be warped or damaged.2. Clear any obstruction in the slot. |

Deep Dive

| Check | Result | Action | Code |
|--|--------|---|------------|
| 1. Is the slot cover opening properly? | Yes | .Go to step 3 | |
| | No | Re-seat the ExpressCard Cage and inspect the slot cover. Go to step 2. | |
| 2. Does the slot cover open properly after the adjustments? | Yes | Issue resolved. | |
| | No | Replace top case. | X13 |
| 3. Can the ExpressCard slide completely into the slot? | Yes | Issue resolved. | |
| | No | Re-seat the ExpressCard Cage with the card already installed in the card cage.. Go to step 4. | |
| 4. Ejecting the ExpressCard and re-inserting it, does it completely slide into the slot? | Yes | Issue resolved. | X13 |
| | No | Replace the ExpressCard Cage. | M17 |



Express Card Not Recognized By System

Unlikely cause: LCD, MLB, HDD/ODD

Quick Check

| Symptom | Quick Check |
|---|---|
| ExpressCard is not recognized by the system. Card does not show up on the desktop or in System Profiler | <ol style="list-style-type: none">1. Check correct drivers are installed for the ExpressCard.2. Verify with known good USB and PCI Express based ExpressCards that the slot is good. |

Deep Dive

| Check | Result | Action | CSC |
|---|--------|--|------------|
| 1. Does the ExpressCard cable connection to the main logic board look secure? | Yes | Go to step 3 | |
| | No | Re-seat the ExpressCard Cage cable connection. Go to step 2. | |
| 2. Is the card recognized? | Yes | Bad connection. Issue resolved. | X04 |
| | No | Go to step 3 | |
| 3. Does the ExpressCard cage look damaged (connector or cage)? | Yes | Replace the ExpressCard cage. Go to step 5 | |
| | No | Remove the ExpressCard cage, install an ExpressCard (one fits completely inside), then re-installed the card cage. Go to step 4. | |



| | | | |
|----------------------------|-----|--|------------|
| 4. Is the card recognized? | Yes | Card cage mounting issue. Issue resolved. | X99 |
| | No | Replace the ExpressCard cage. Go to step 5 | X13 |
| 5. Is the card recognized? | Yes | Bad ExpressCard cage. Issue resolved. | X13 |
| | No | Replace the main logic board. | M17 |

FireWire Port Not Recognizing Known Devices

Unlikely cause: LCD,HDD/ODD

Quick Check

| Symptom | Quick Check |
|--|---|
| FireWire Port is not recognizing known devices Attached FireWire device like digital camera or mass storage drive not recognized by the system | <ol style="list-style-type: none">1. Check for latest software update.2. Use Apple System Profiler to verify the computer recognizes the FireWire bus.3. Test port by connecting to another computer using FireWire Target Disk Mode.4. Verify the FireWire cable is good.5. Verify a self powered FireWire device is getting power |

Deep Dive

| Check | Result | Action | Code |
|--|--------|---|------------|
| After resetting SMC, was the FireWire Port recognized? | Yes | Issue resolved. | |
| | No | FireWire port is bad. Replace main logic board. | M12 |



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 stating that a suitable symptom code could not be found. |



Mechanical Issues: Thermals and Enclosure

Reset/Power Button Stuck

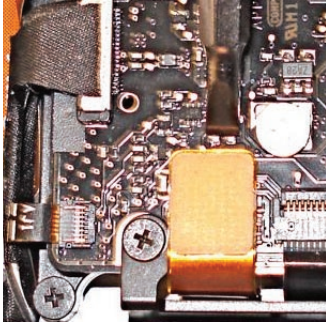
Unlikely cause: LCD, hard drive, optical drive

Quick Check

| Symptom | Quick Check |
|---|--|
| Reset/Power Button Stuck <ul style="list-style-type: none">• System will not power on• System sounds bootROM unlock tone during startup• System automatically starts up repeatedly | <ol style="list-style-type: none">1. Diagnose stuck button with SMC keyboard reset sequence2. 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 <ul style="list-style-type: none">• System feels very warm• Fan(s) not working• Fan(s) are full on | <ol style="list-style-type: none">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 performance5. 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 reseal connections to thermal sensors throughout the system, run test for sensor monitoring. | Yes | Thermal module or other sensor reseal 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. |



Take Apart

MacBook Pro (15-inch, Late 2008)



General Information

Connector Types on Logic Board

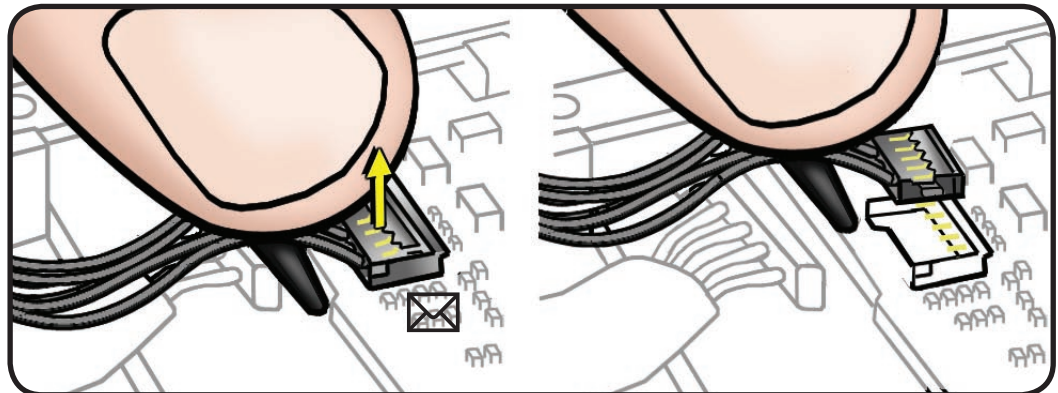
On the logic board are six types of connectors, each requiring special handling. Make sure you read these tips before disconnecting and installing the connectors.

Vertical Insertion (JST)

- Use black stick under cable to remove.
- Keep connector level to board when disconnecting and reconnecting.
- Press evenly when reconnecting or connector can be tipped up and not fully seated.

Examples:

- fan cable
- heatsink sensor
- left speaker on underside of board

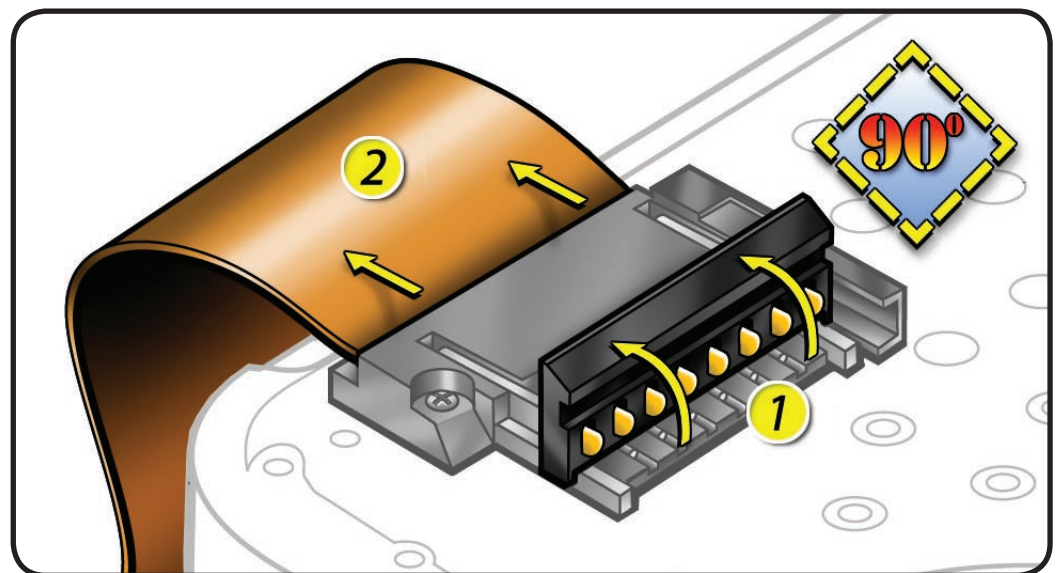


Locking Lever

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

Examples:

- IR/SIL flex cable
- keyboard flex cable





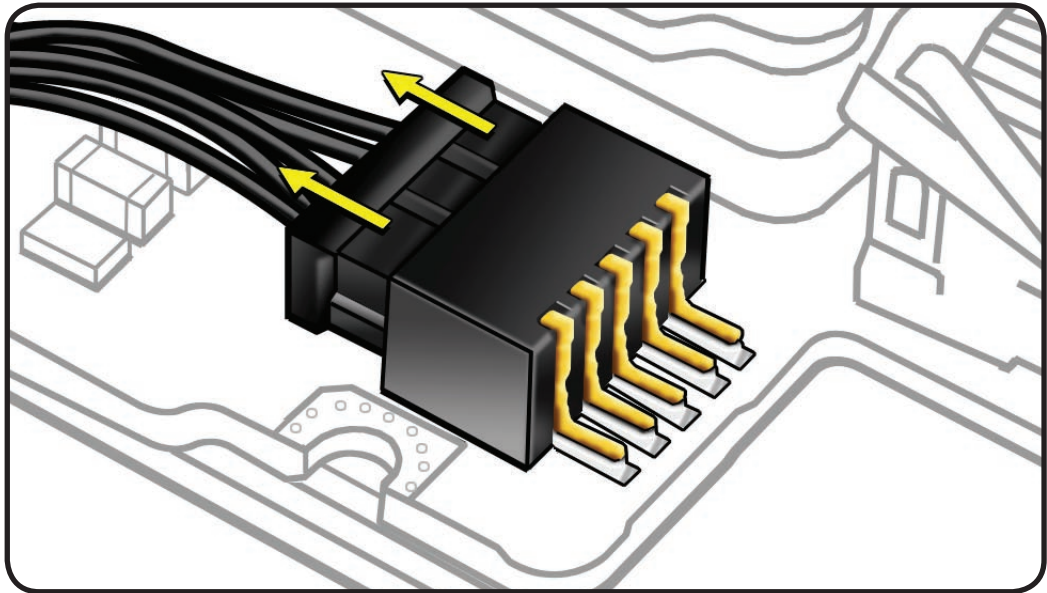
- keyboard
backlight flex
cable

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
- battery indicator
light cable on top
of board

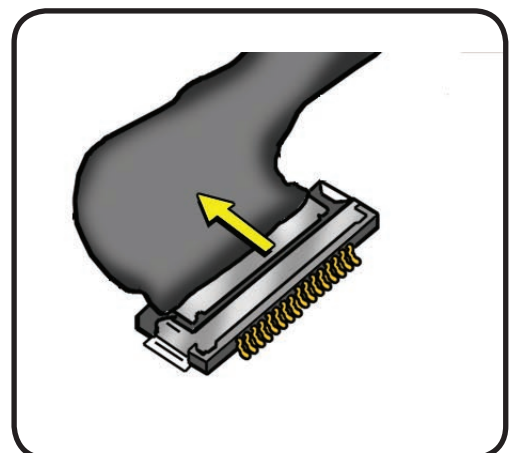
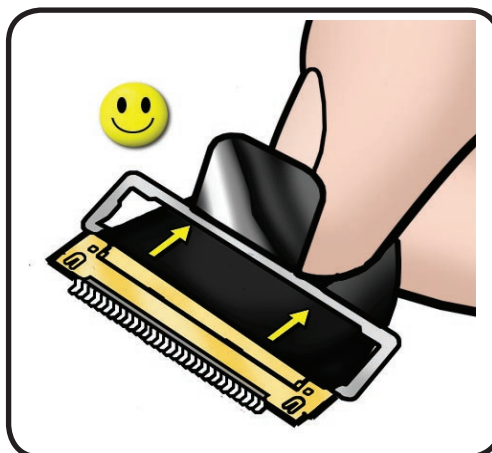


Thin, Multi-Pin Horizontal Insert

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

Examples shown:

- LVDS cable with
lock bar
- Camera/USB/
AirPort/Bluetooth
display cable



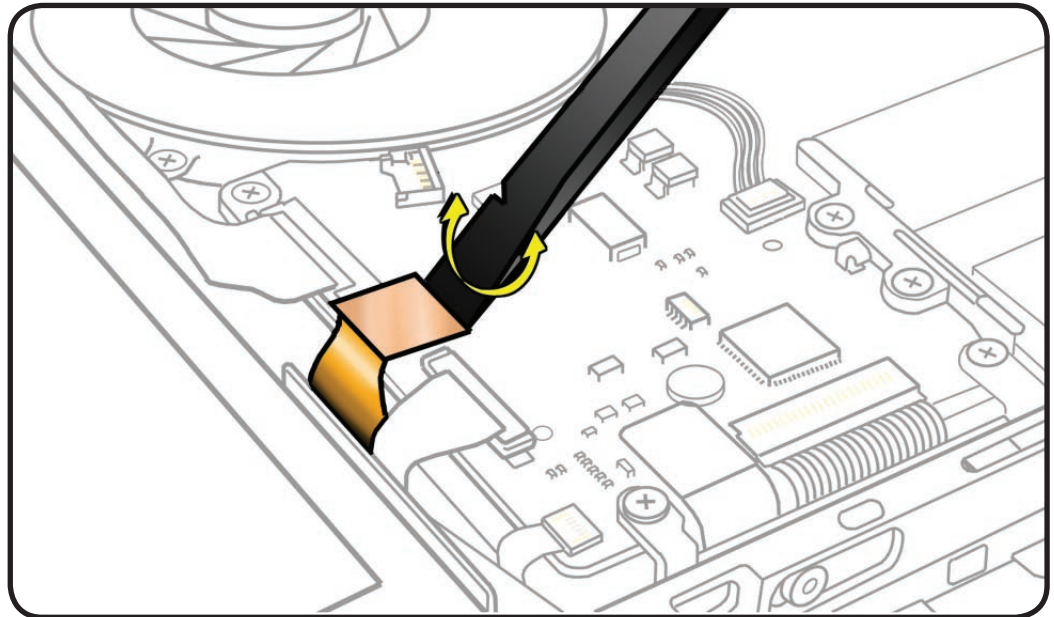


Low-Profile Solid Platform Flex

- 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

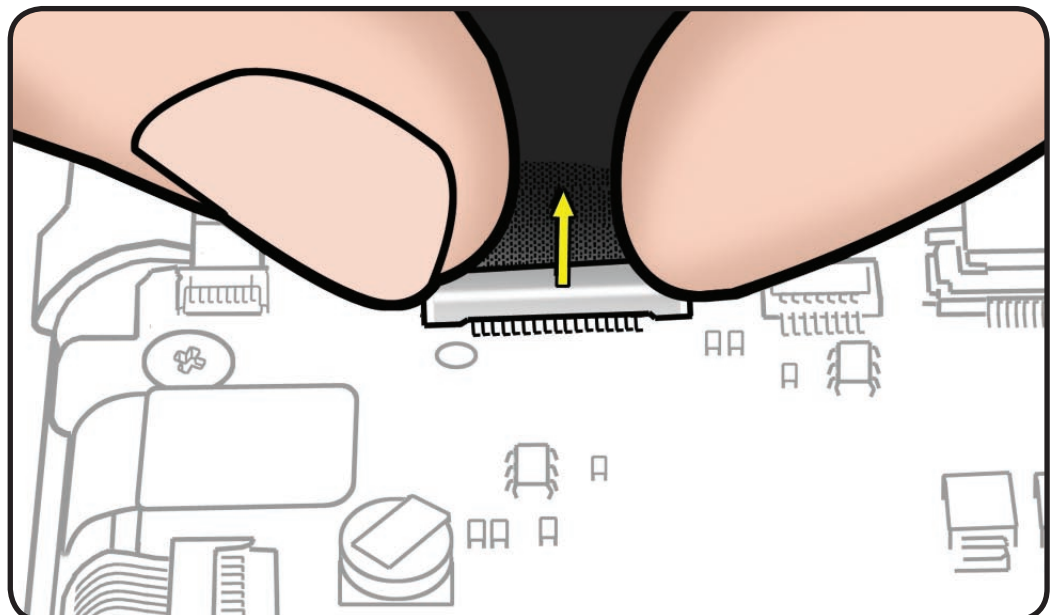


Multi-Pin Vertical Insert

- 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.



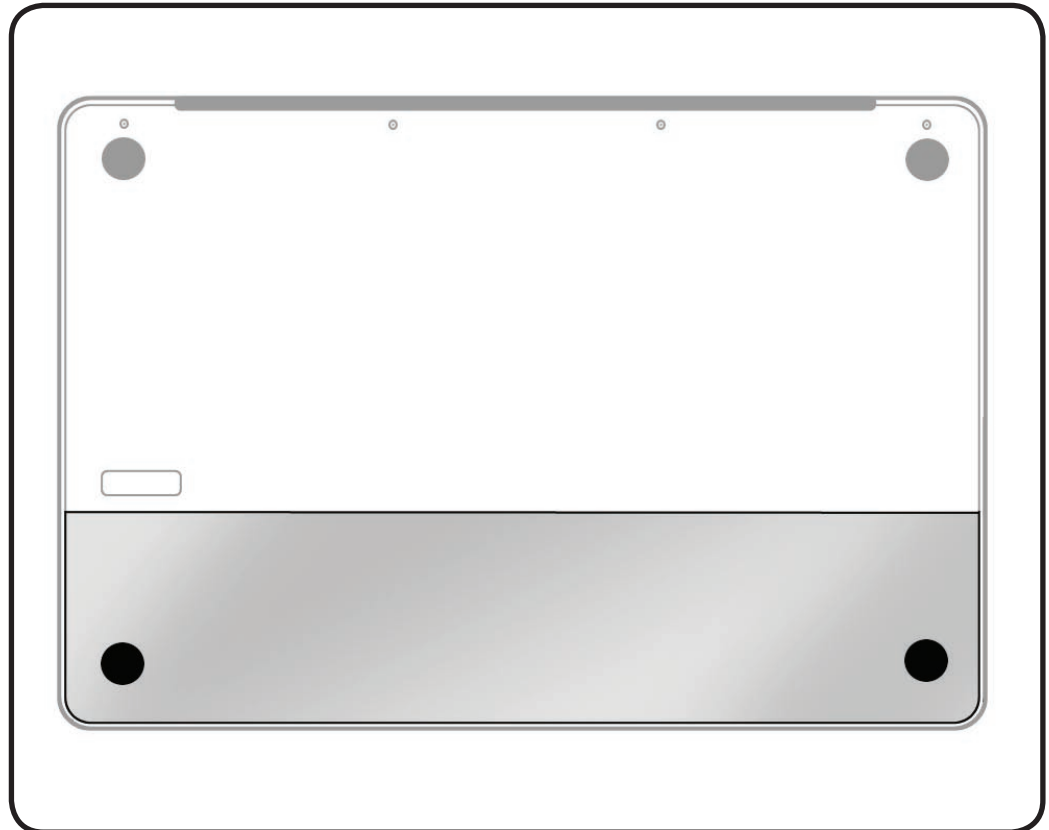
Access Door

First Steps:



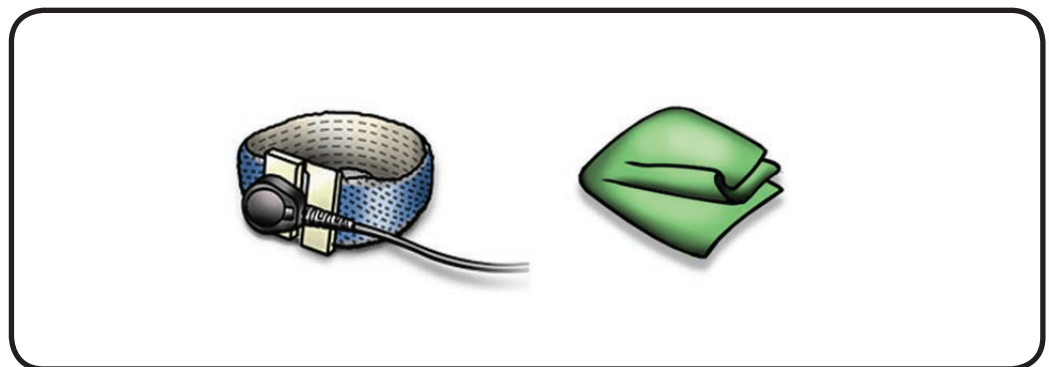
Warning:

- Shut down computer.
- Unplug all cables.
- Put on ESD strap.



Tools

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



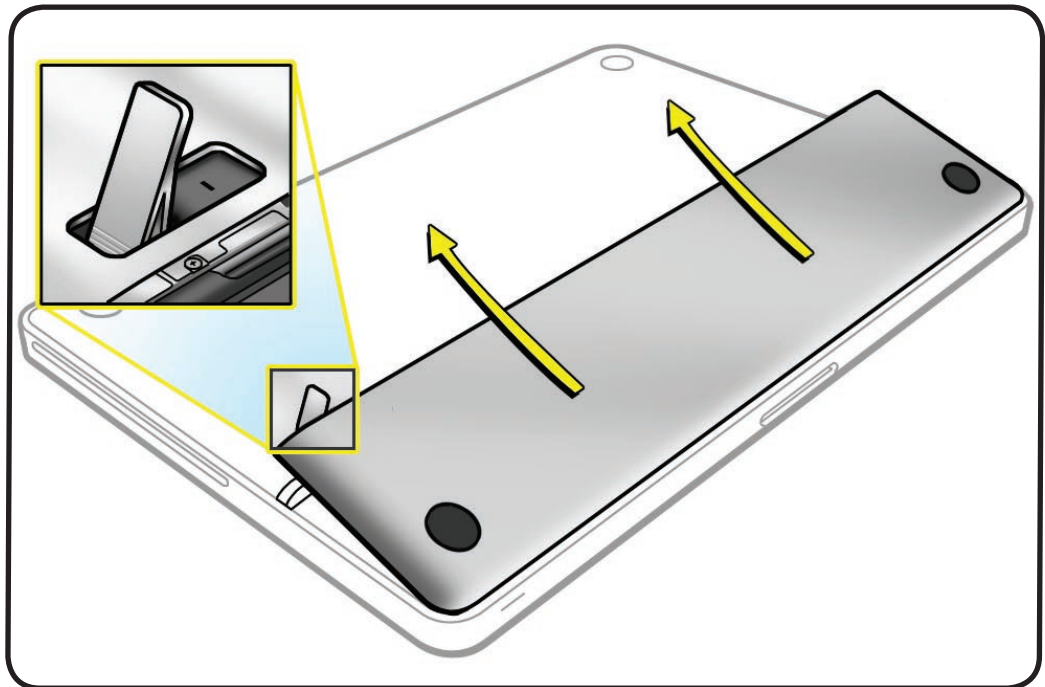


Removal

1 Press locking lever.

2 Lift off access door.

Replacement Note:
Align corners and
tabs on access door
with computer
housing.



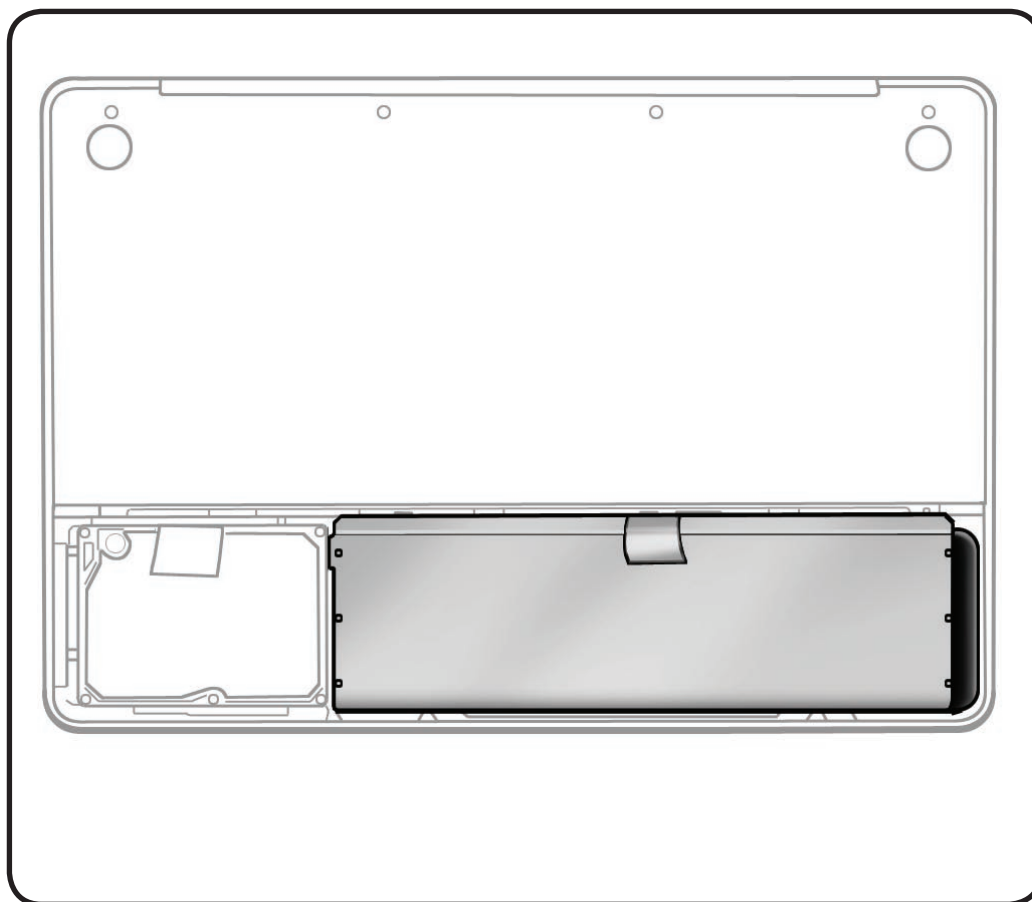


Battery

First Steps

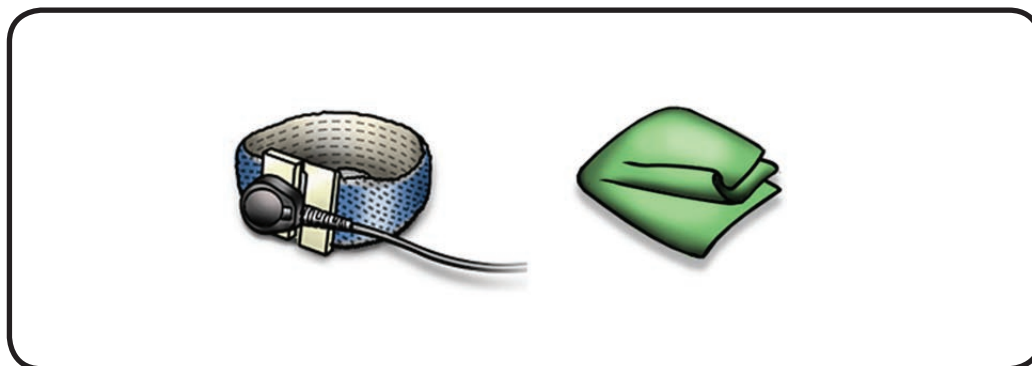
Remove:

- [Access door](#)



Tools

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

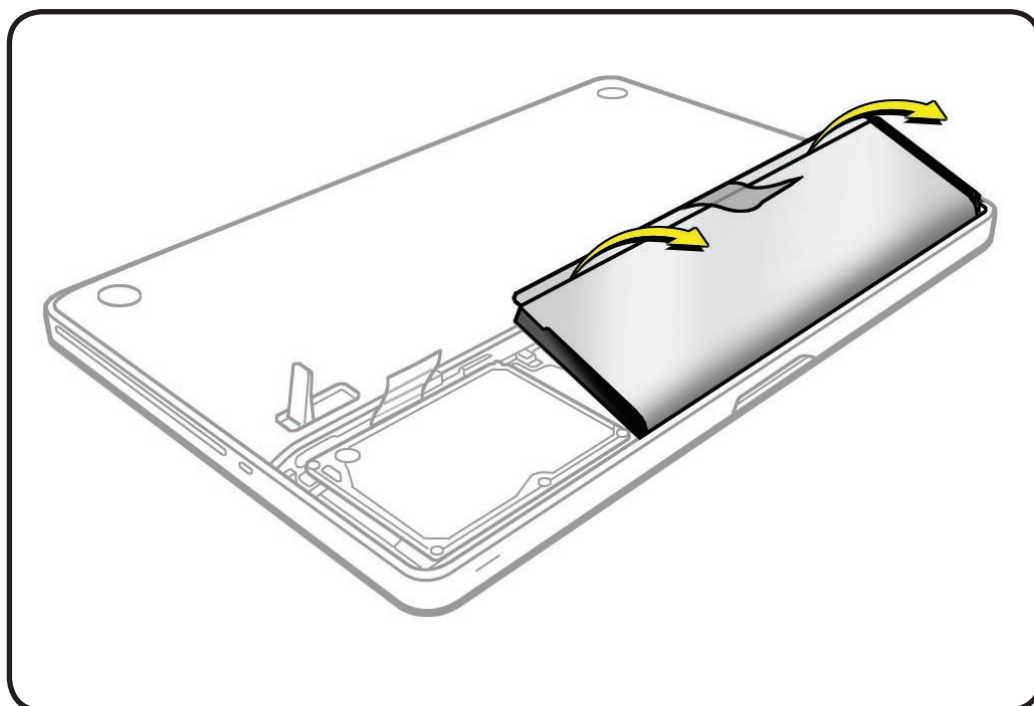




Removal

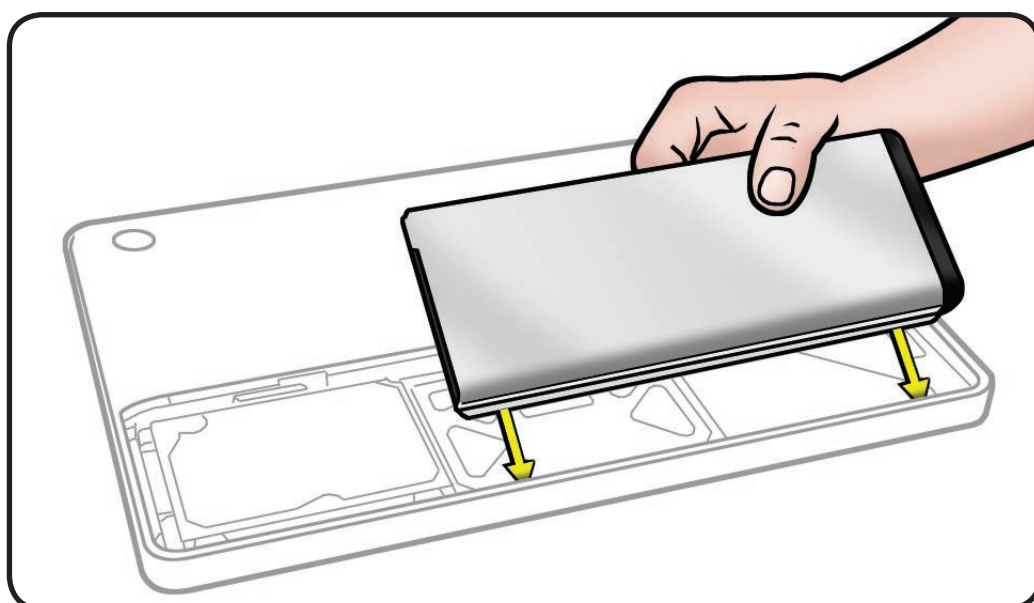
- 1 Make sure locking lever is up.

Pull battery tab to remove battery



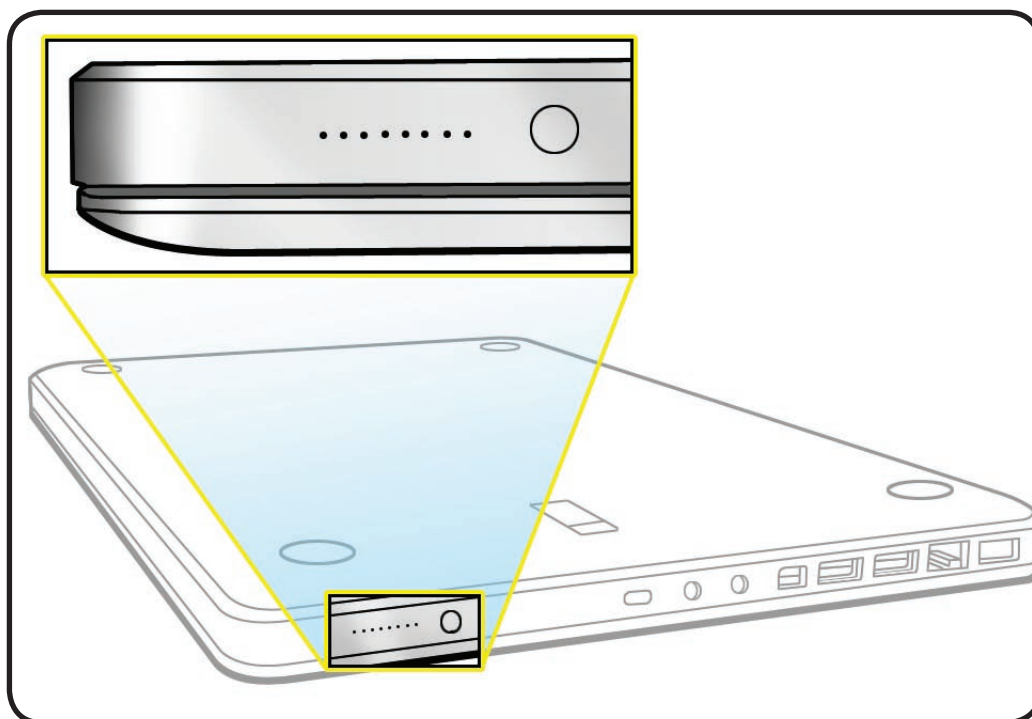
Replacement

- 1 Insert beveled edge of battery into battery bay.
- 2 Reassemble computer.





- 3** Press battery indicator light button to check charge level.





Hard Drive Bracket

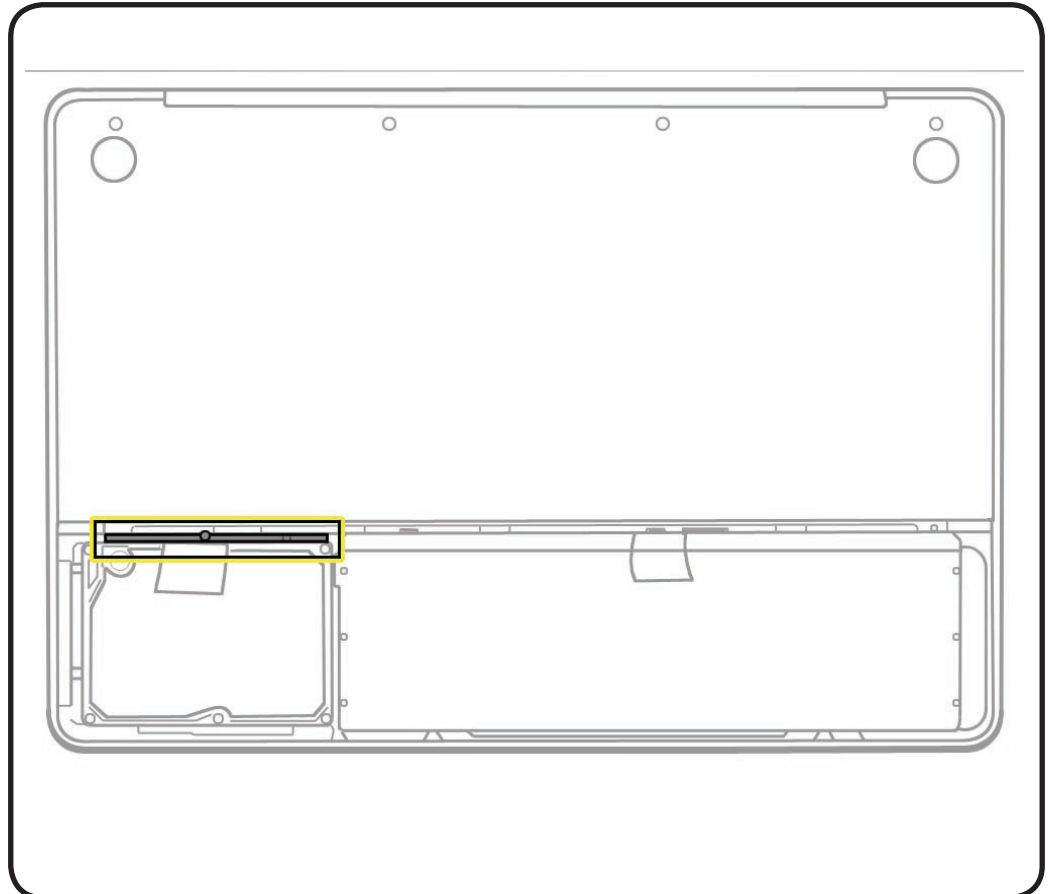
First Steps

Remove:

- [Access door](#)
- [Battery](#)

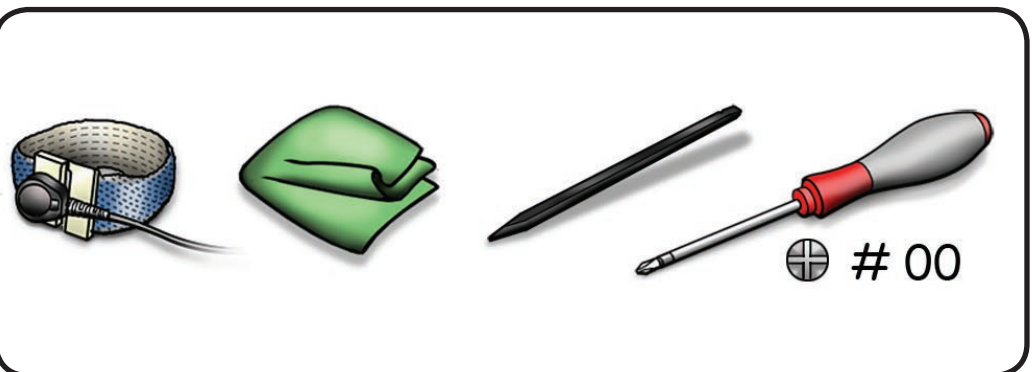


Caution: Make sure data is backed up before removing the hard drive.



Tools

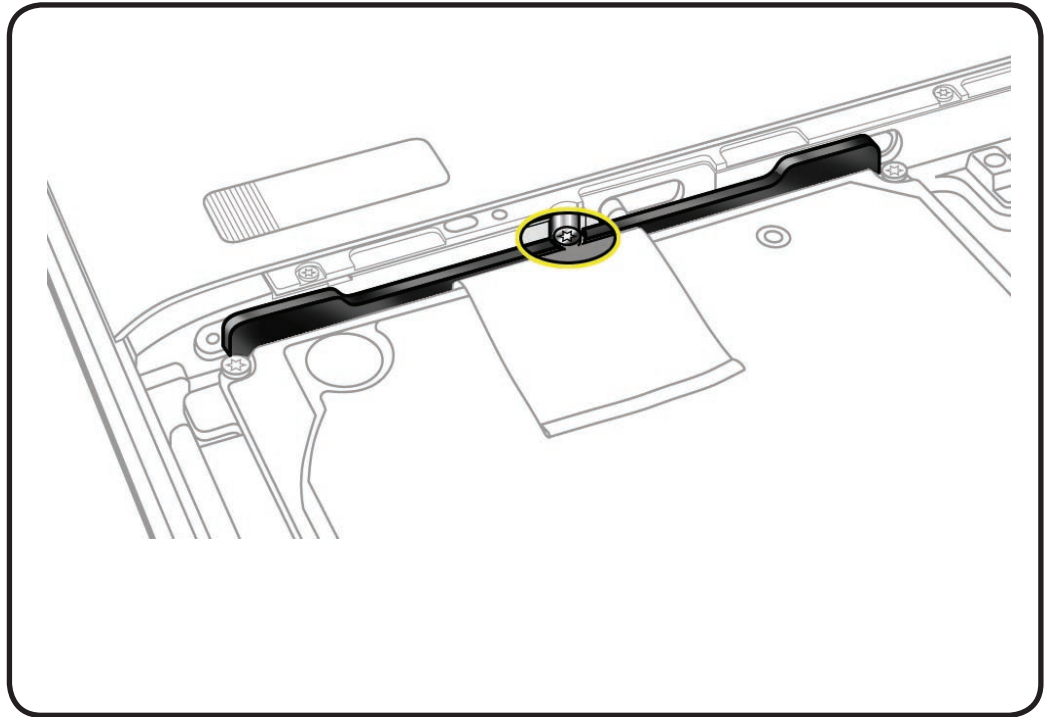
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver



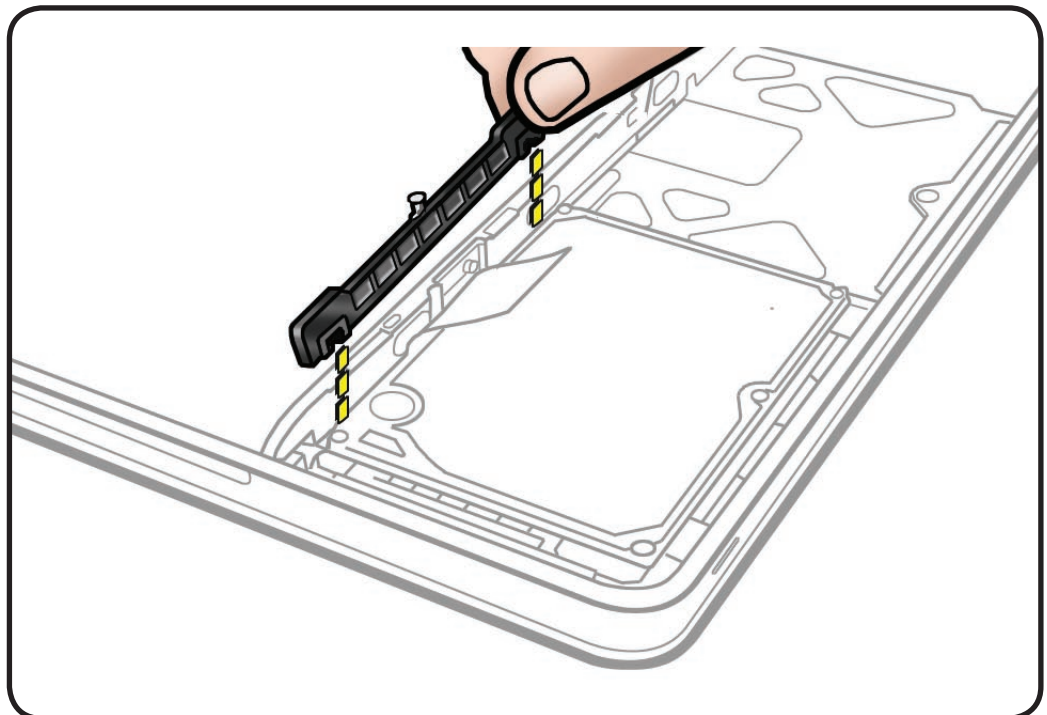


Removal

- 1 Loosen 1 captive screw.



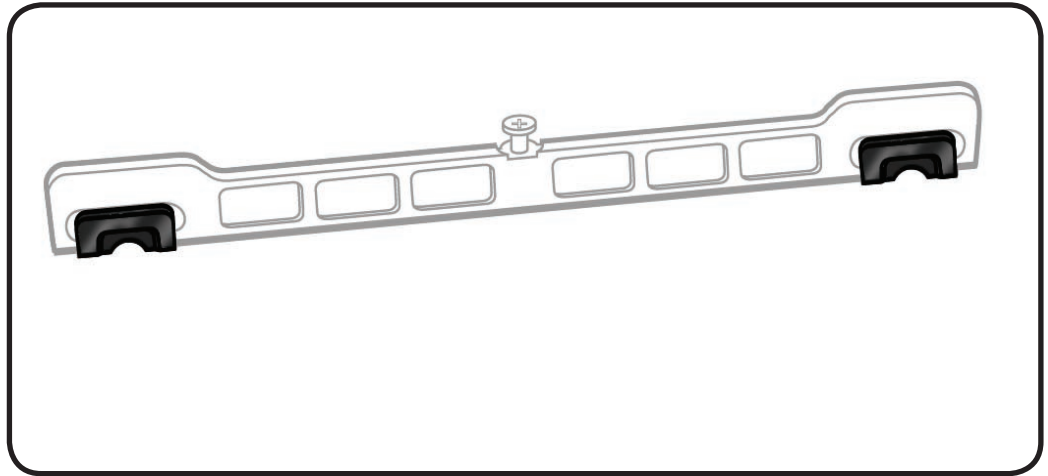
- 2 Lift out hard drive bracket.





Replacement

- 1 Make sure 2 rubber grommets are included in hard drive bracket before installing it.





a

Hard Drive

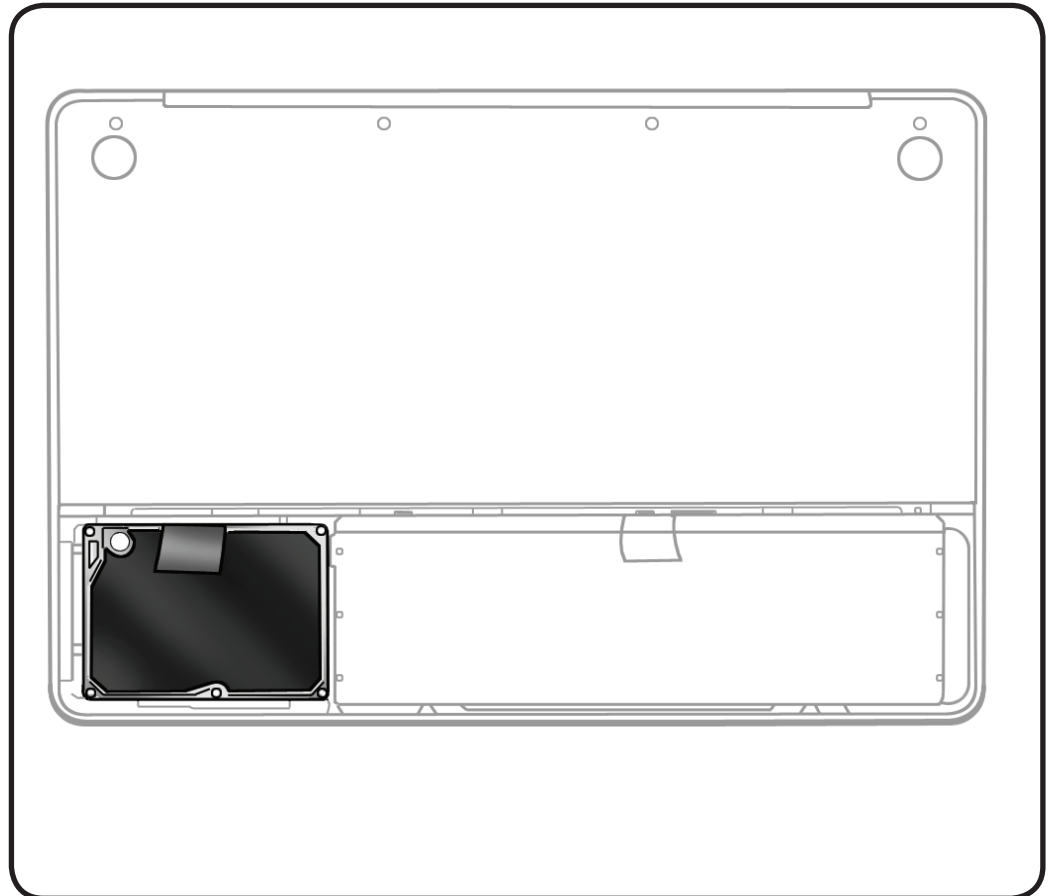
First Steps

Remove:

- [Access door](#)
- [Battery](#)
- [Hard drive bracket](#)

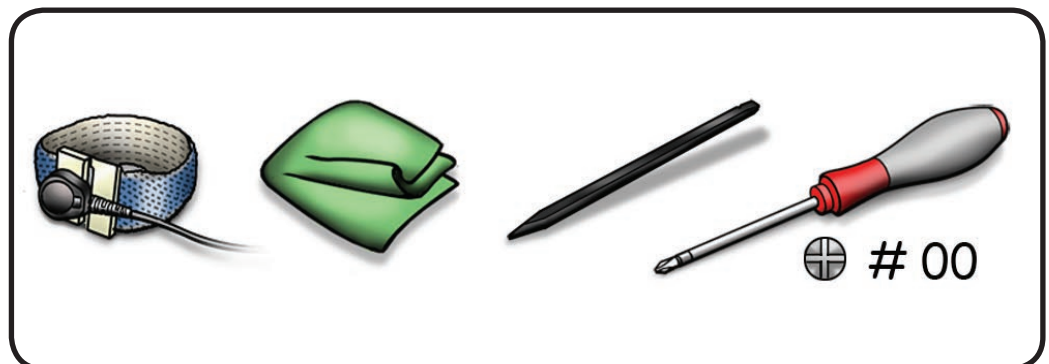


Caution: Make sure data is backed up before removing the hard drive.



Tools

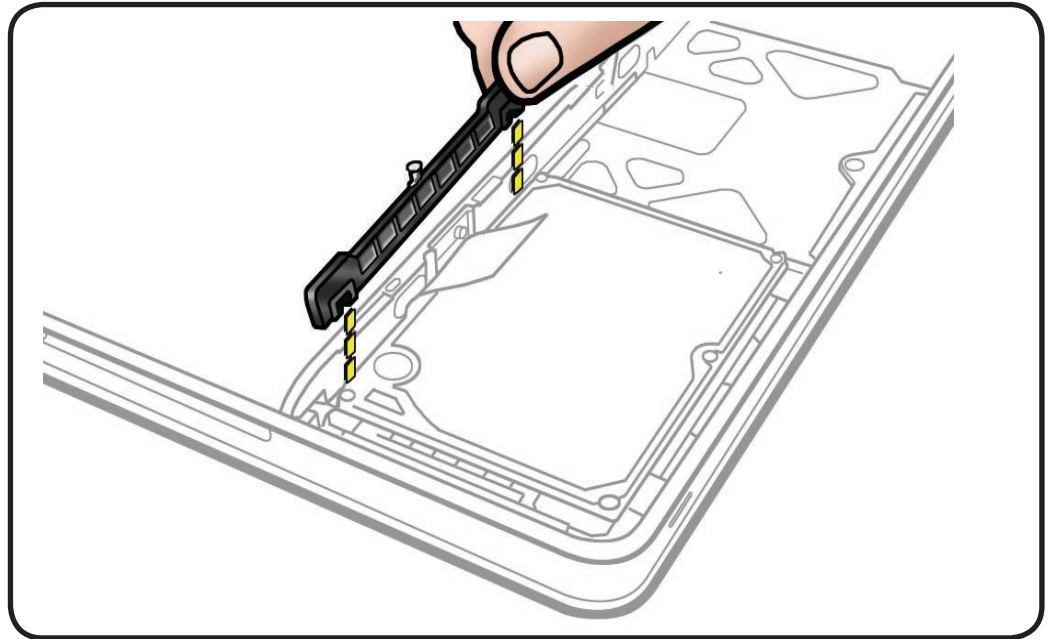
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver



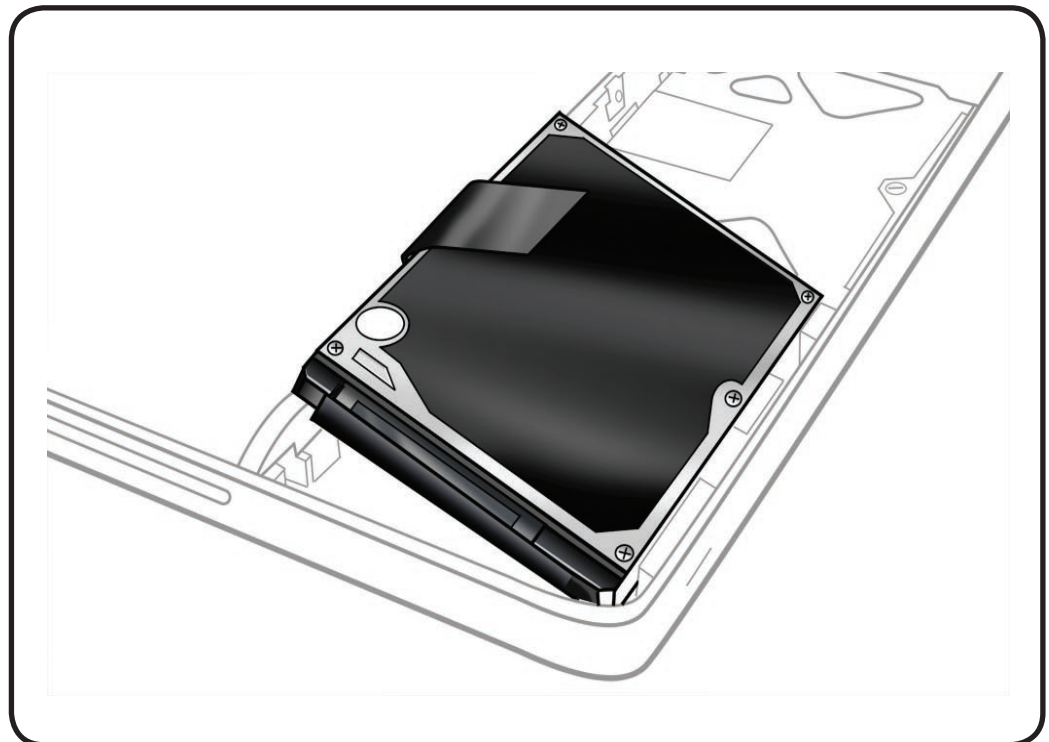


Removal

- 1 Make sure hard drive bracket is removed.

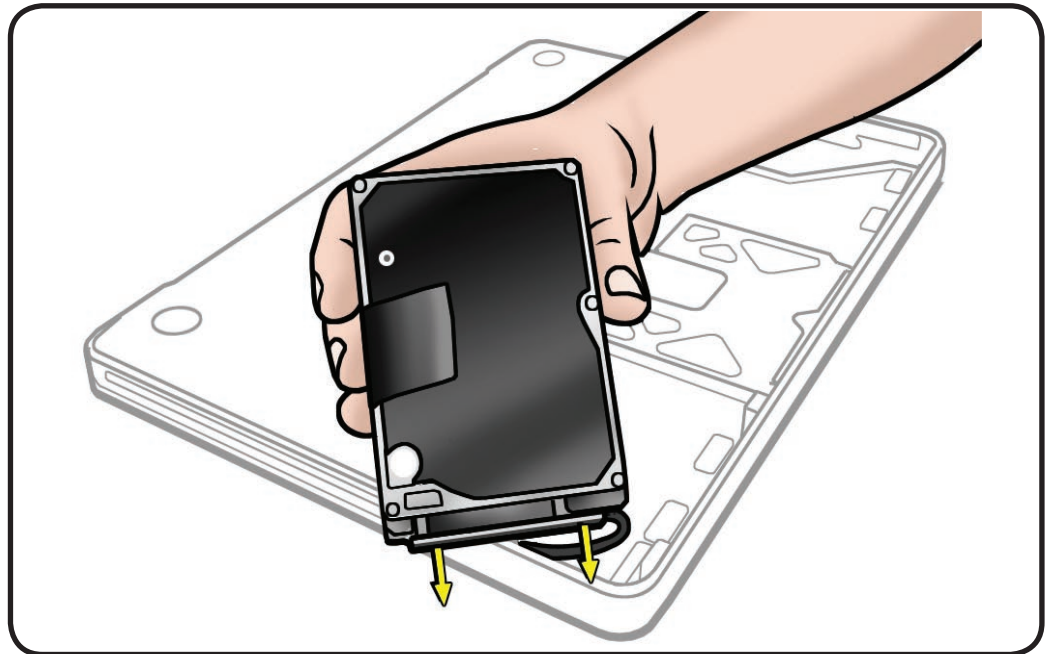


- 2 Use pull tab to tilt hard drive out.





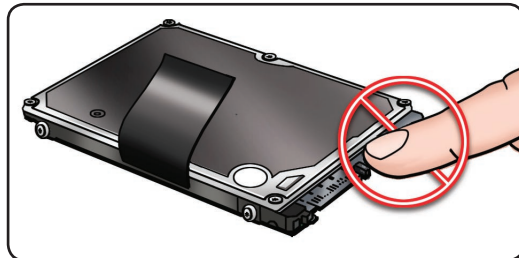
- 3 Hold hard drive by the sides only.
- 4 Disconnect hard drive connector.



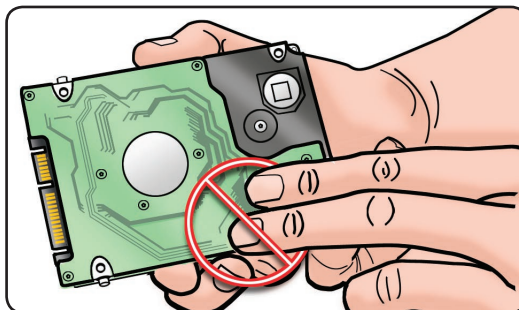
- 5 Follow safe handling:
 - Do not press drive



- Do not touch connector



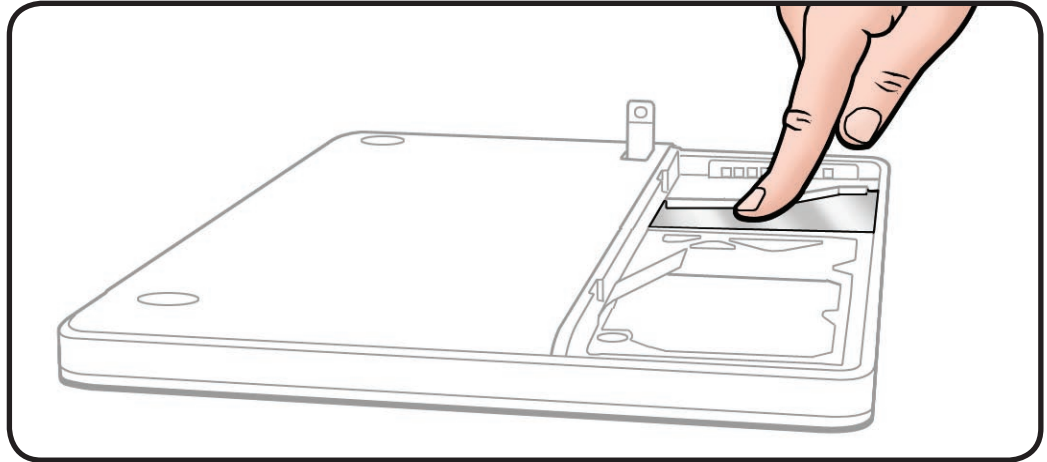
- Do not touch circuitry



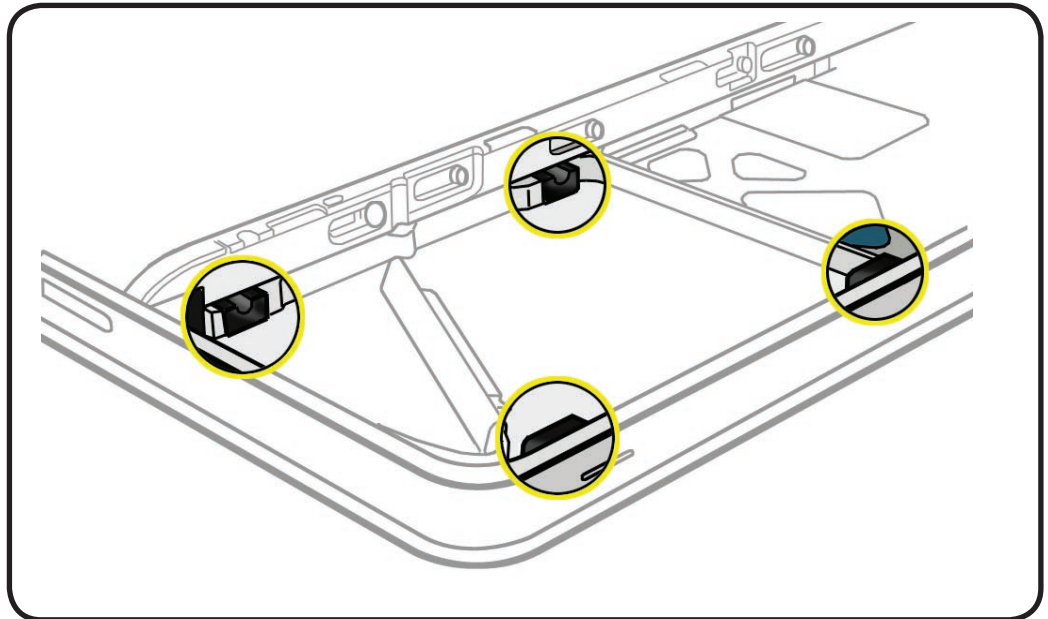


Replacement

- 1 Touch a metal surface inside battery bay to discharge static electricity.

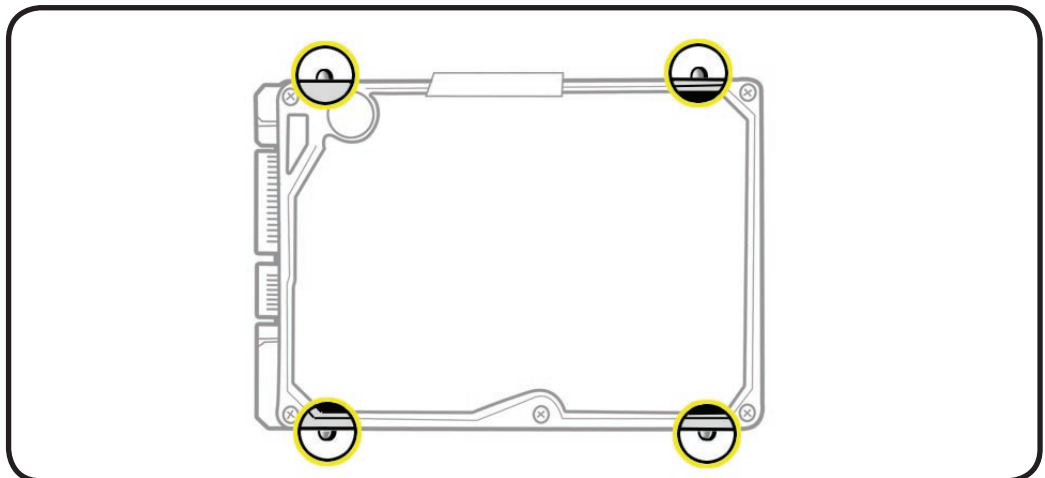


- 2 Make sure 4 rubber grommets are seated in top case before installing the hard drive.



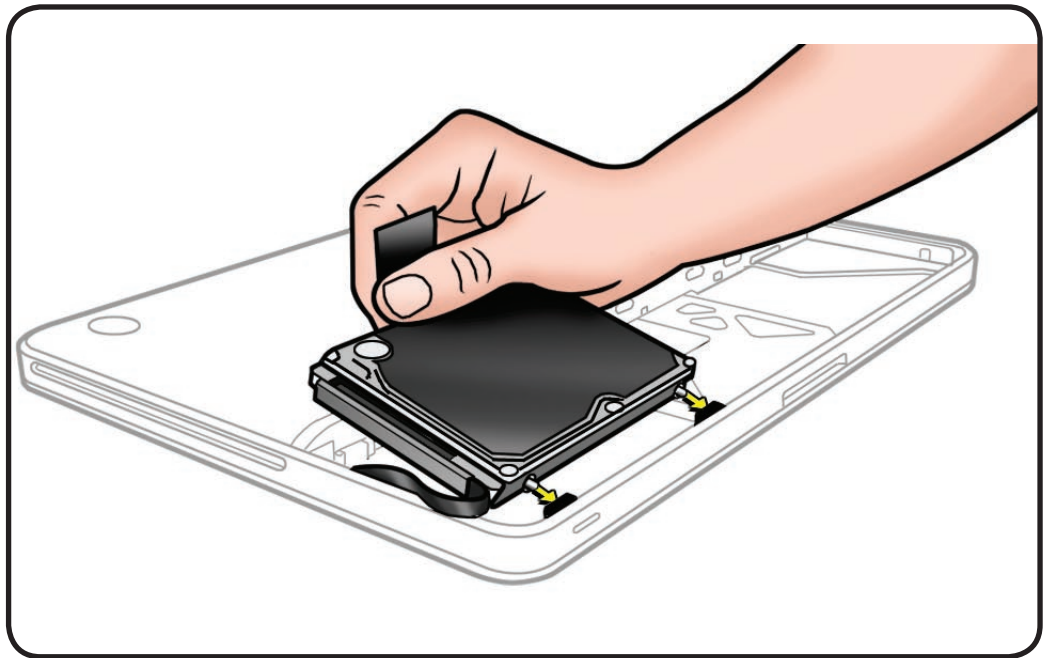
- 3 Make sure 4 Torx T6 mounting screws (922-8655) are installed on the drive.

If your 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.
- 5 Replace hard drive bracket.





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.

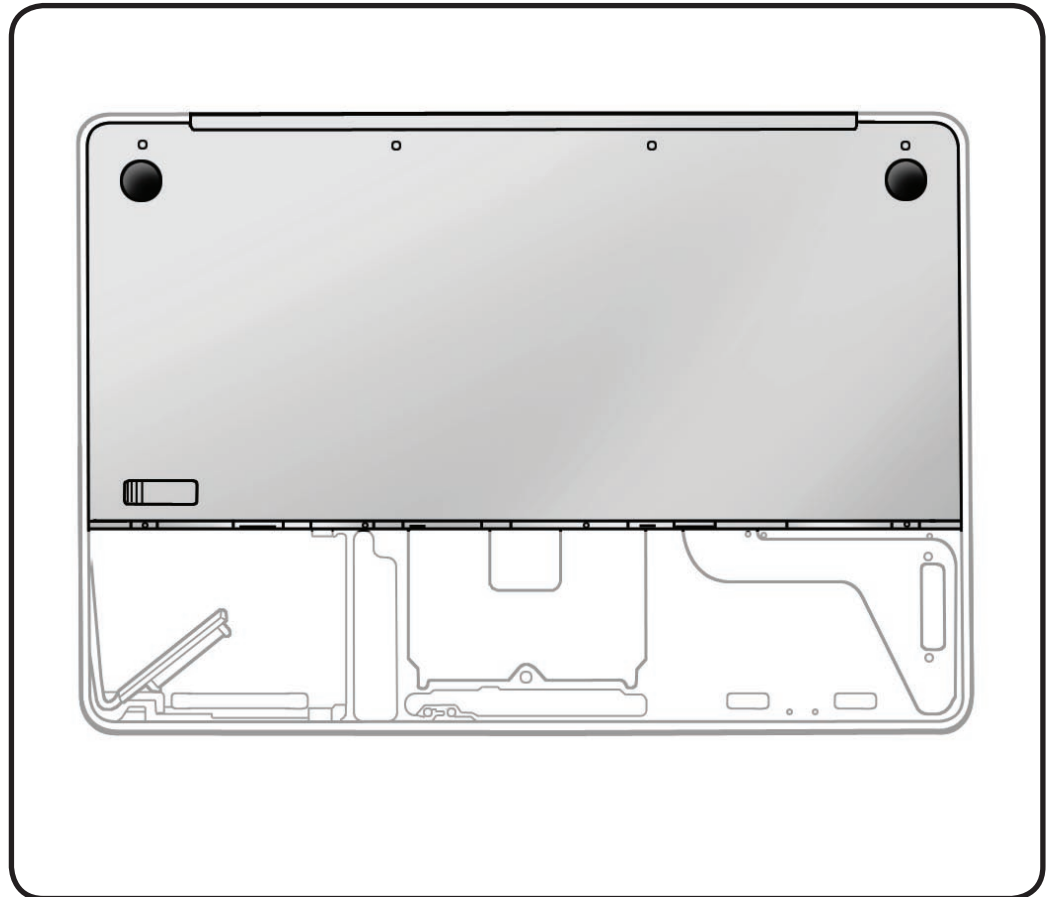


Bottom Case

First Steps

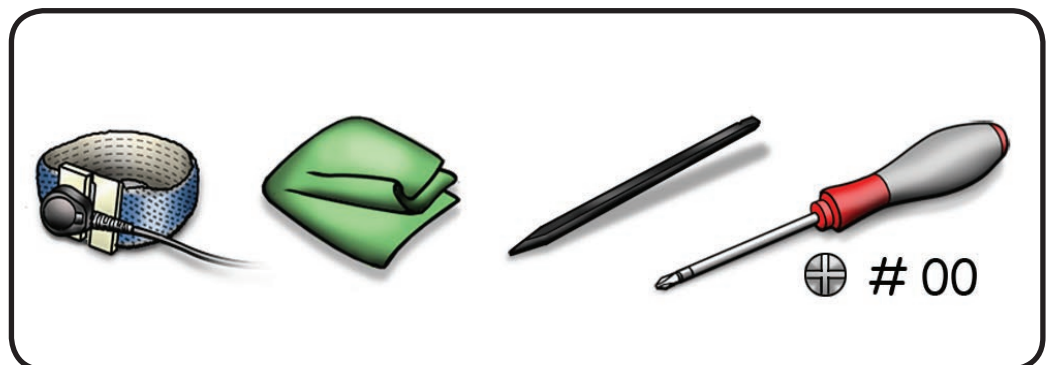
Remove:

- [Access door](#)
- [Battery](#)



Tools

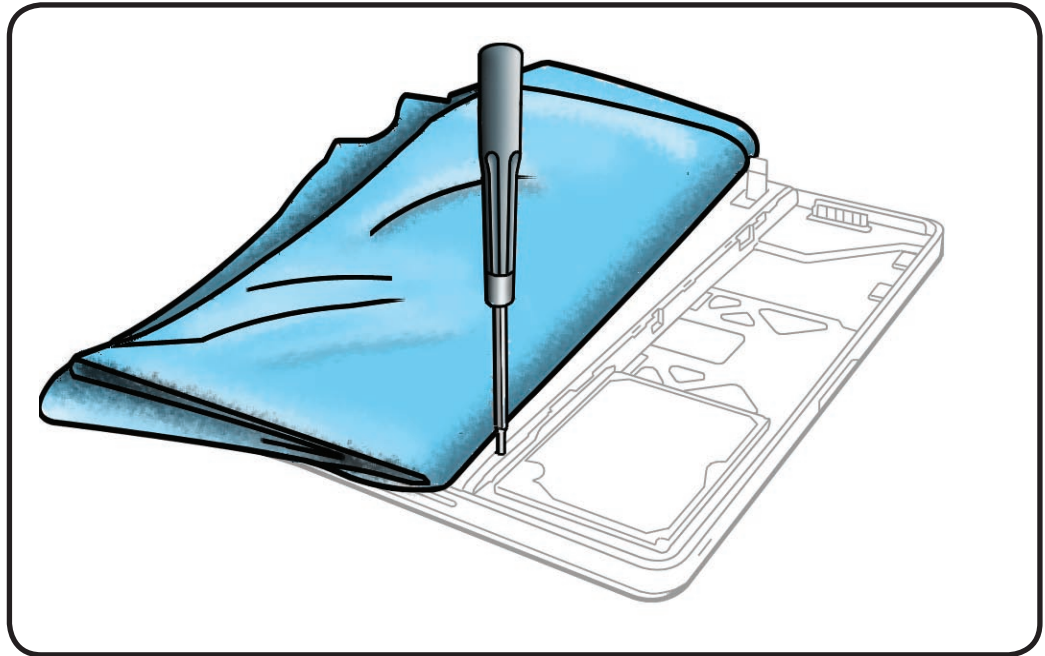
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetic Phillips #00 screwdriver





Removal

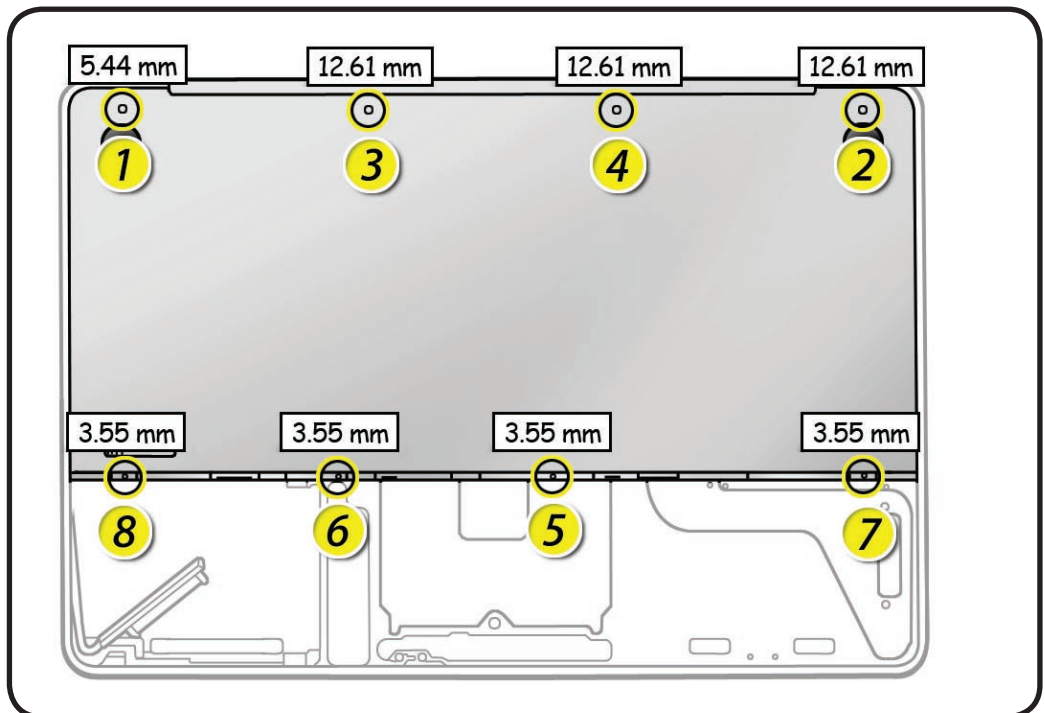
Caution: To prevent scratches, use a protective cloth.



- 1** Remove 8 screws:
 - 1 (5.44 mm) 922-8745
 - 3 (12.61 mm) 922-8666
 - 4 (3.55 mm) 922-8653

Replacement Note: Install screws in the order shown

- 2** With the locking lever pressed down, lift the entire front edge of the bottom case to remove.





Memory

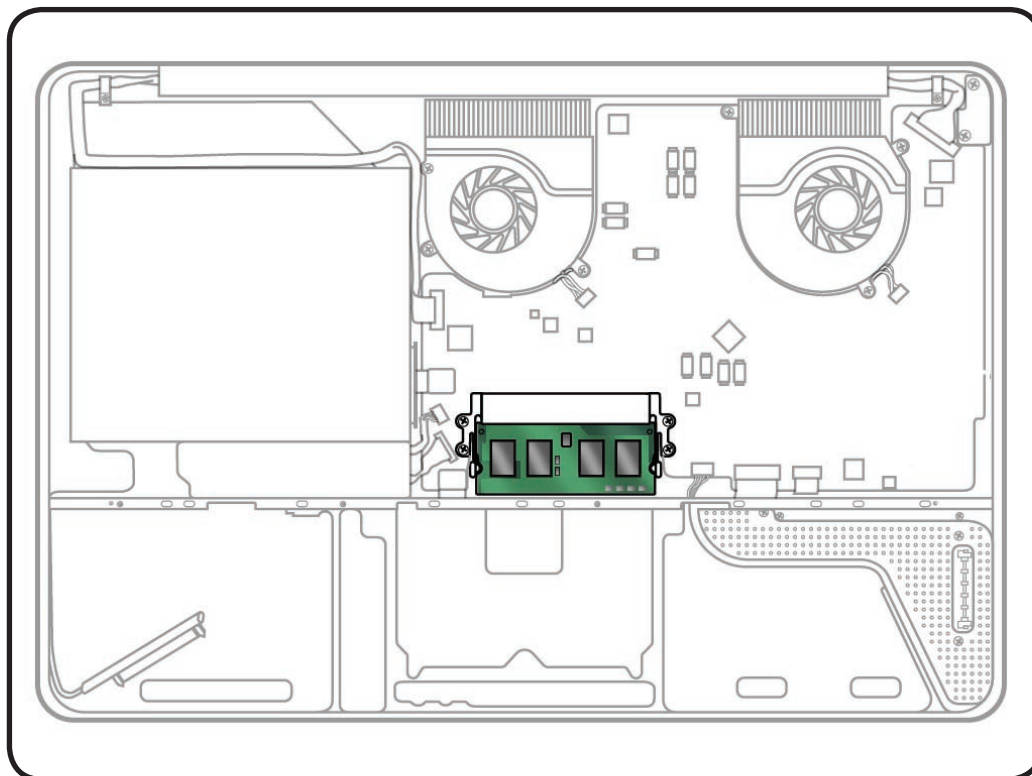
First Steps

Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)

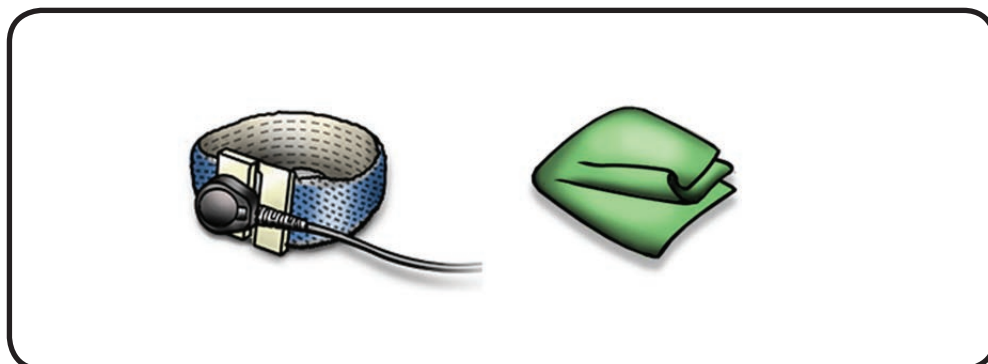


Caution: Avoid touching anything other than the memory area.



Tools

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





Memory Information

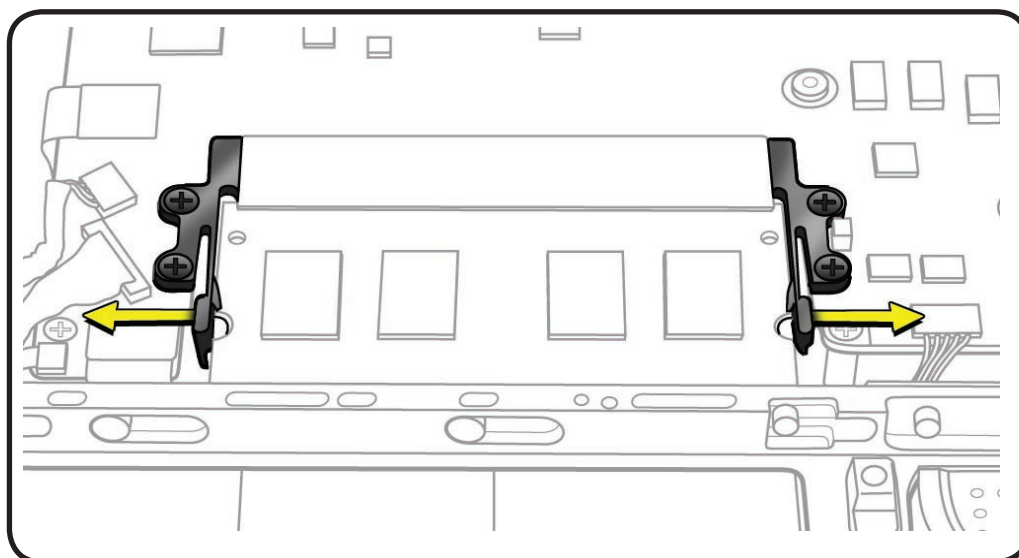
Memory cards must be:

- 1.25 inch (3.18 cm)
- 1 GB or 2 GB
- 200-pin
- PC-8500 DDR3, 1066 MHz RAM

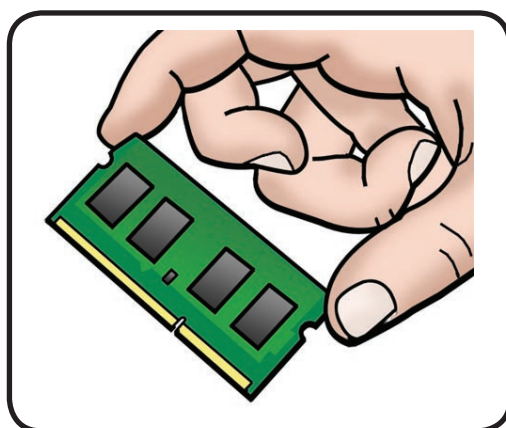
This computer comes with a minimum of 2 GB of 1066 GHz Double Data Rate (DDR3) Synchronous Dynamic Random-Access Memory (SDRAM) installed. Both memory slots can accept an SDRAM module that meets the specifications listed. The slots are stacked on the logic board under the bottom case. For best performance, 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.

Removal

- 1 Press out 2 ejection levers until the card tilts up.
- 2 Pull out the card from the slot.



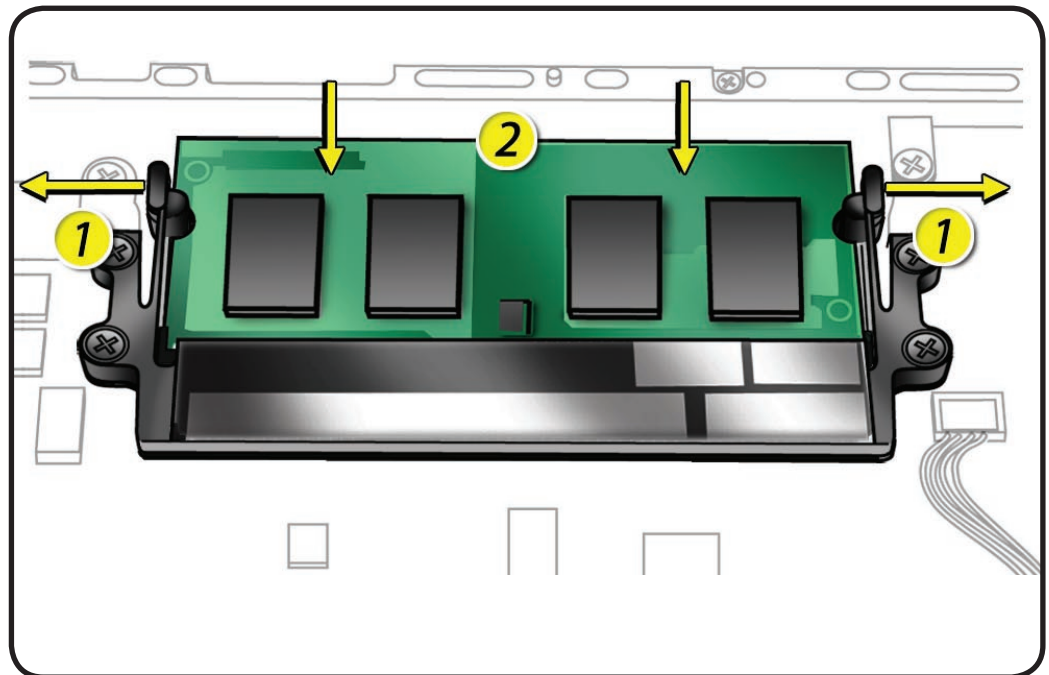
- 3 Hold the card by the edges.
- 4 Do not touch the gold connectors.





Replacement

- 1** If installing just one card, install it in lower slot.
- 2** Spread the ejection levers, and press card down.
- 3** You will hear a click when the memory is inserted correctly.
- 4** If you installed additional memory, check that the computer recognizes it.



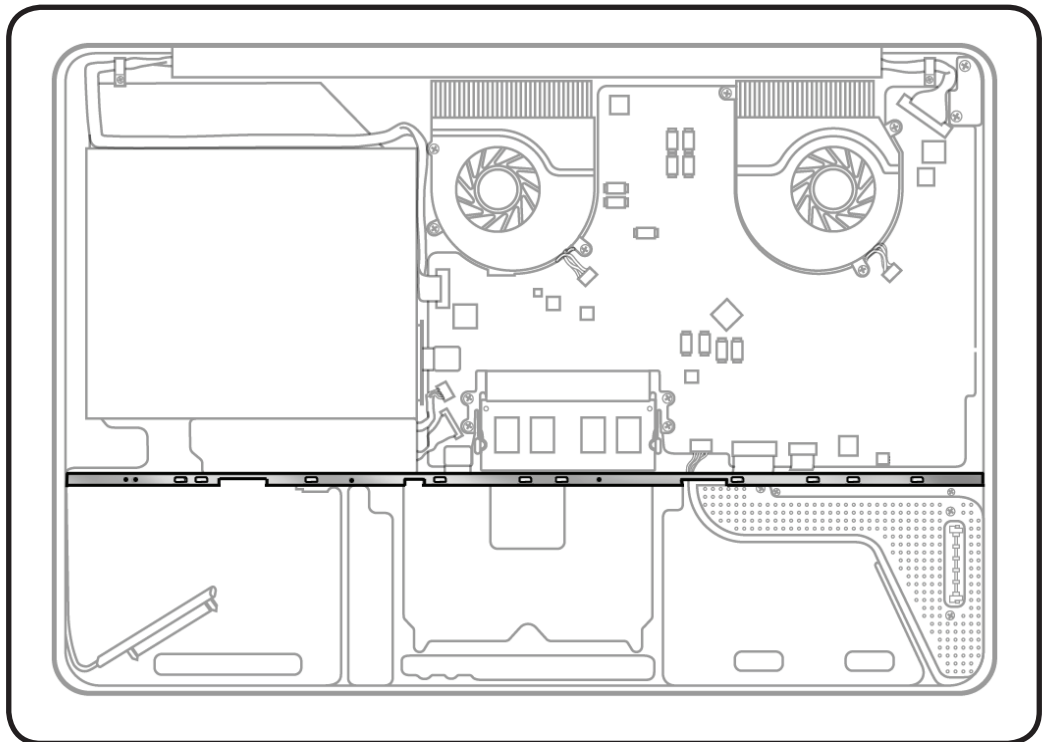


Midwall

First Steps

Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)



Tools

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

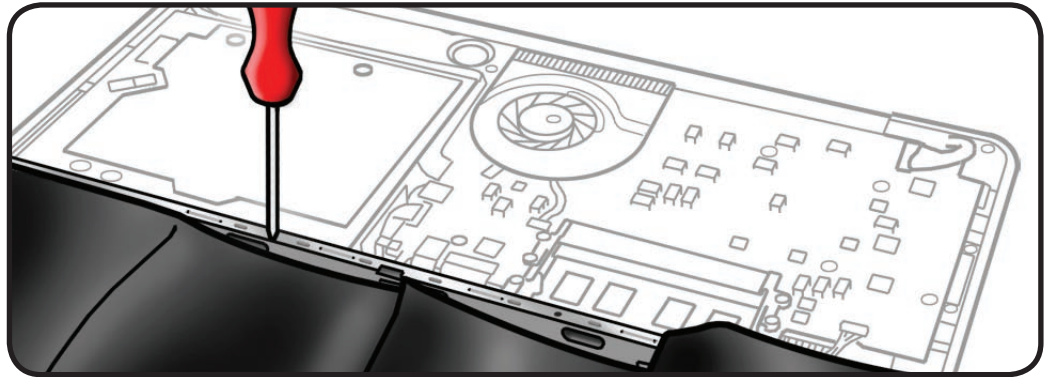




Removal

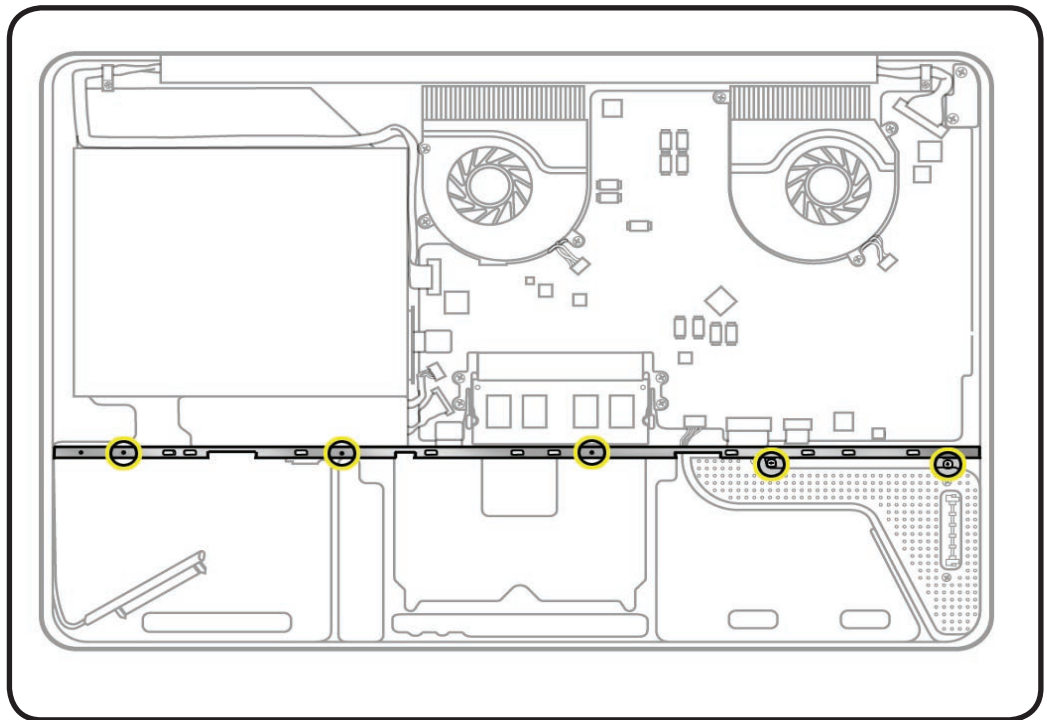


To prevent scratches to the computer housing, use a soft cloth when removing and installing screws.



- 1** Remove 5 screws:
 - 2 silver (3.7-mm) 922-8722
 - 3 black (10.5-mm) 922-8656

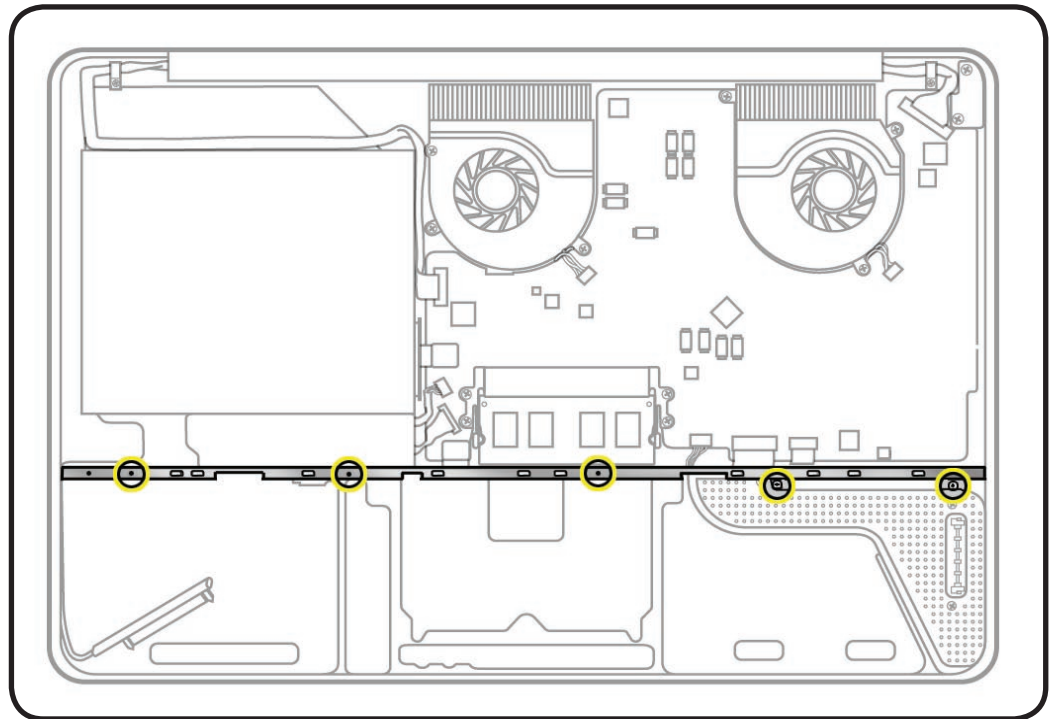
- 2** Lift out midwall.





Replacement

- 1** Line up two metal pins on the underside of midwall with openings in top case.
- 2** Install screws left to right, starting with the 3 (10.5-mm) black screws.



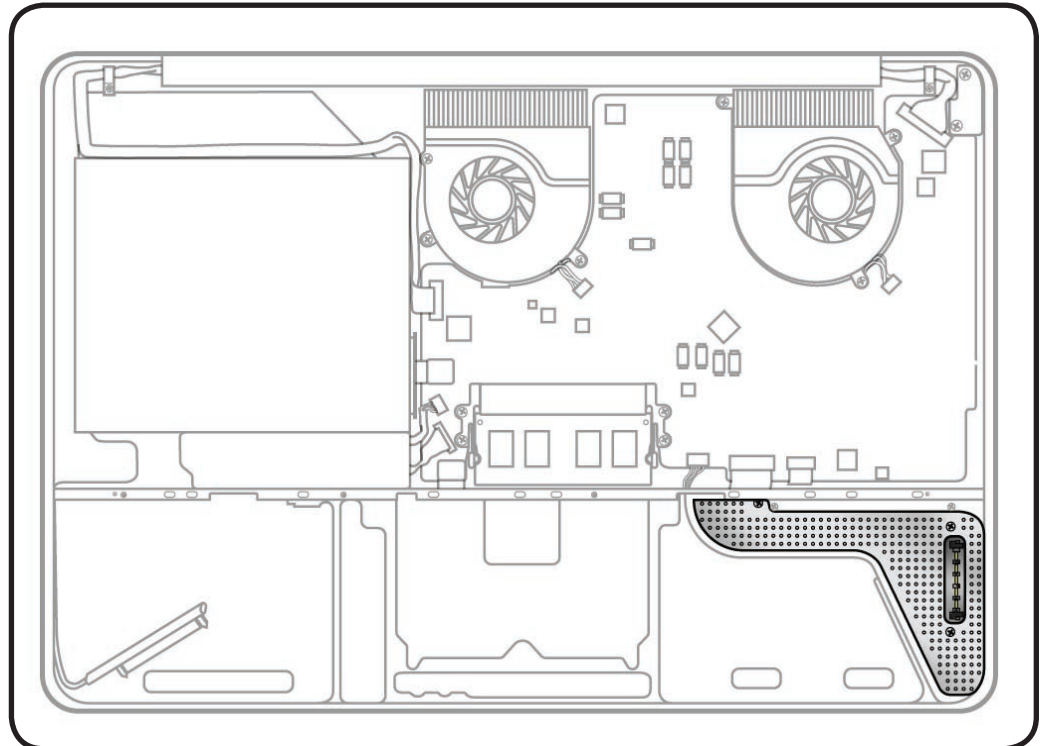


Battery Connector Cover

First Steps

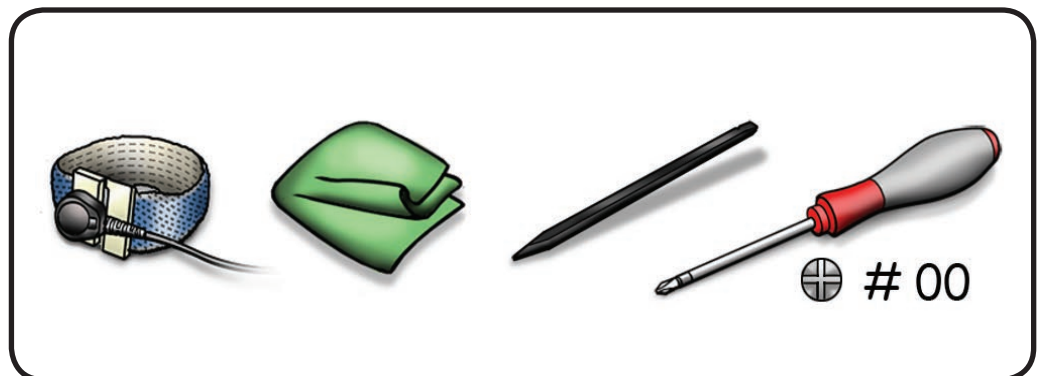
Remove:

- [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 identical silver (1.98-mm) screws (922-9755).



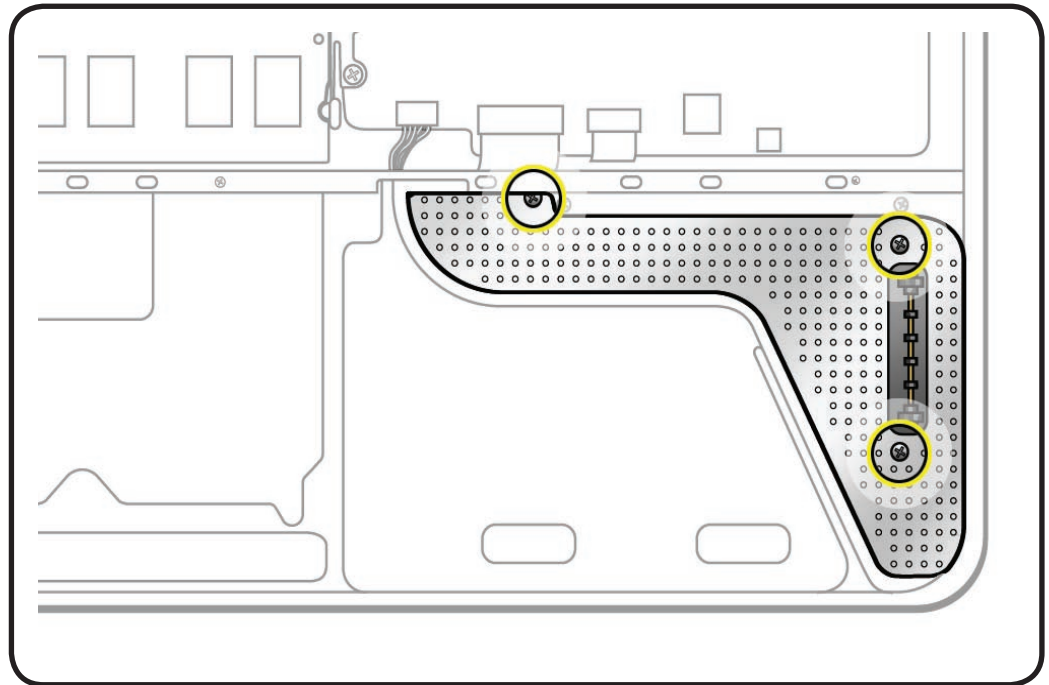
Caution: The adhesive on the cover is **very** strong.

- 2 Use a black stick to loosen adhesive on around the edges of the battery connector cover.



Important: DO NOT pull on the battery connector pins. They are not part of the battery cover and they can be damaged if pulled.

- 3 Lift out battery connector cover.



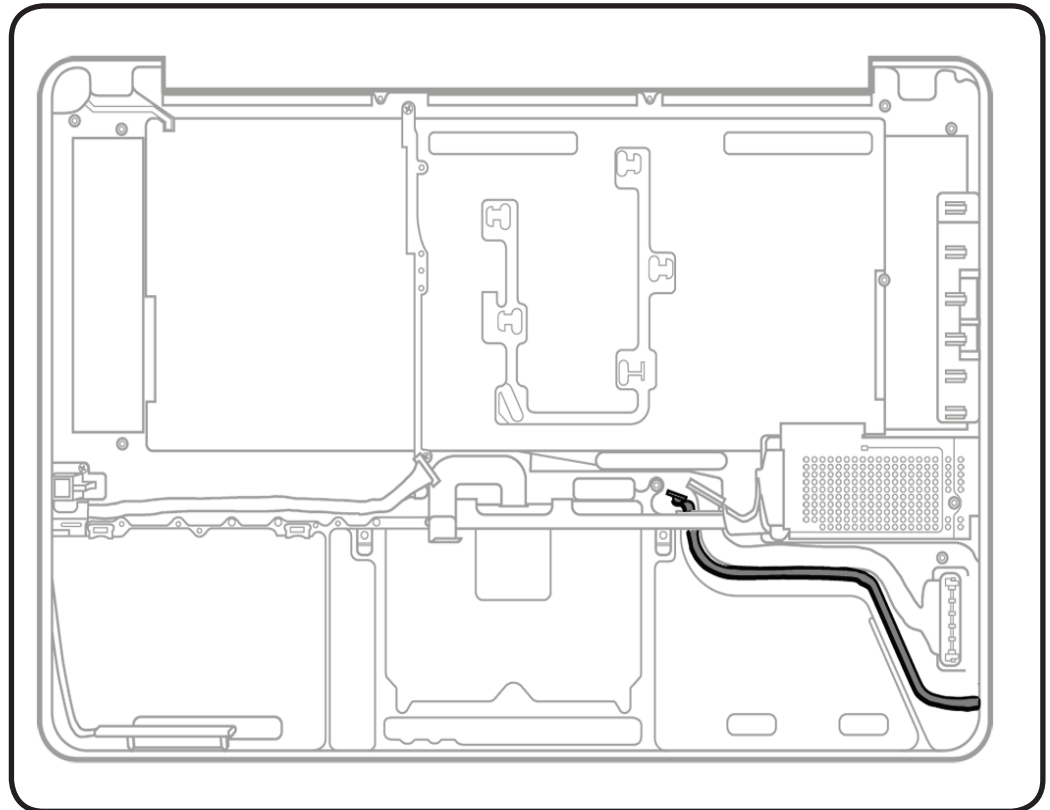


Battery Indicator Light Board

First Steps

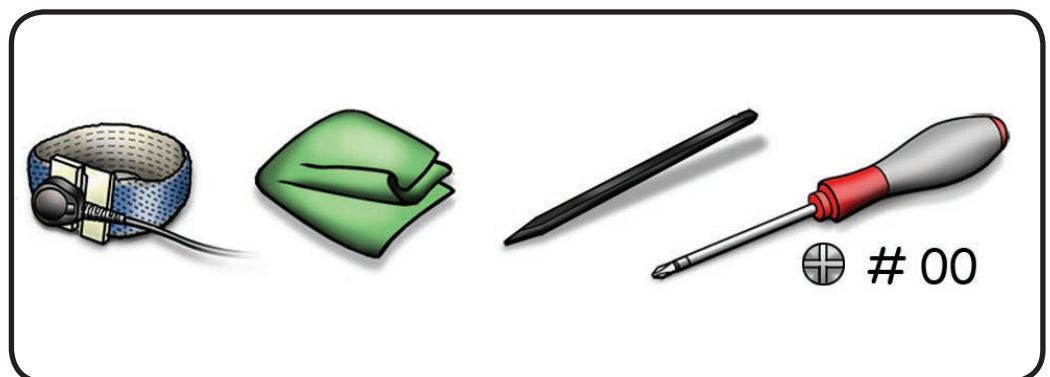
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Battery connector cover](#)



Tools

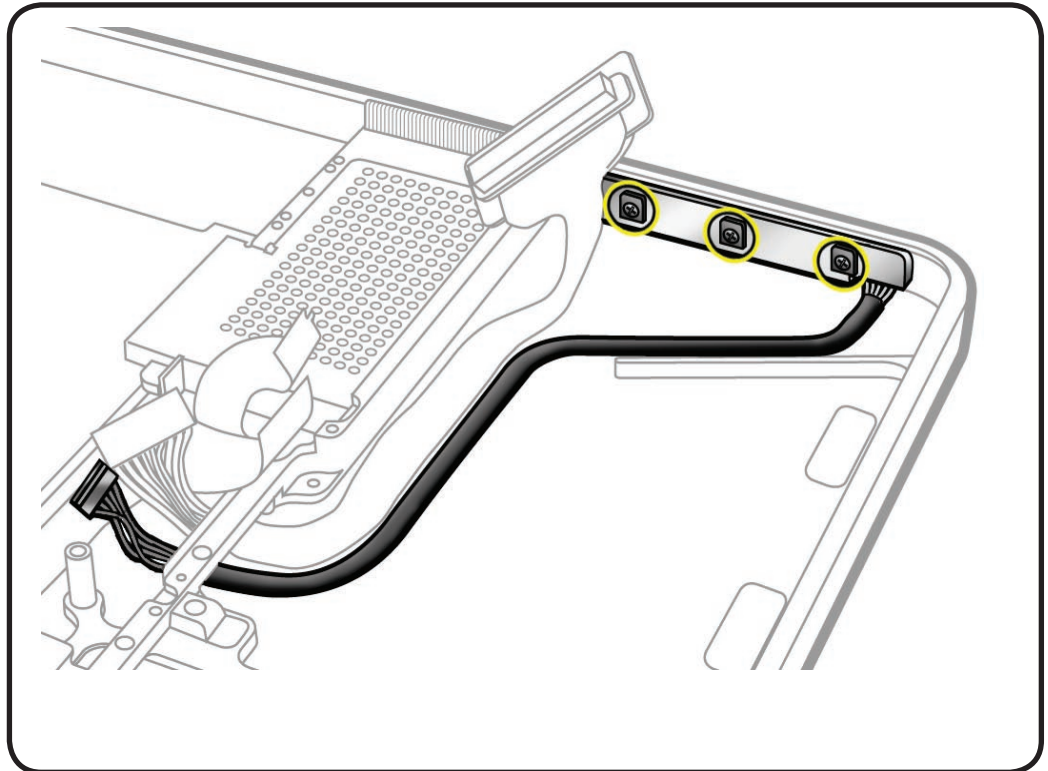
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Black stick





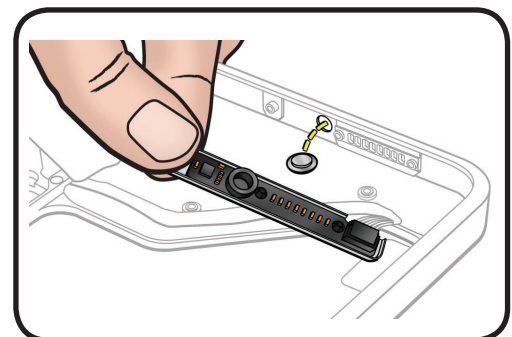
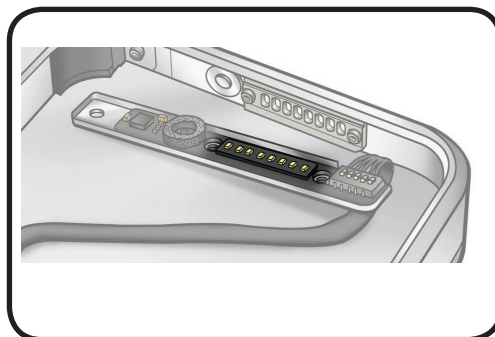
Removal

- 1 Remove 3 (2.62 mm) screws.
- 2 Pry the board from side of top case.
- 3 Disconnect cable from battery indicator light (BIL) board.



Replacement

- 1 Before replacing the board, check that:
 - the rubber gasket is assembled on top of the LEDs
 - the battery indicator light button is installed in the top case



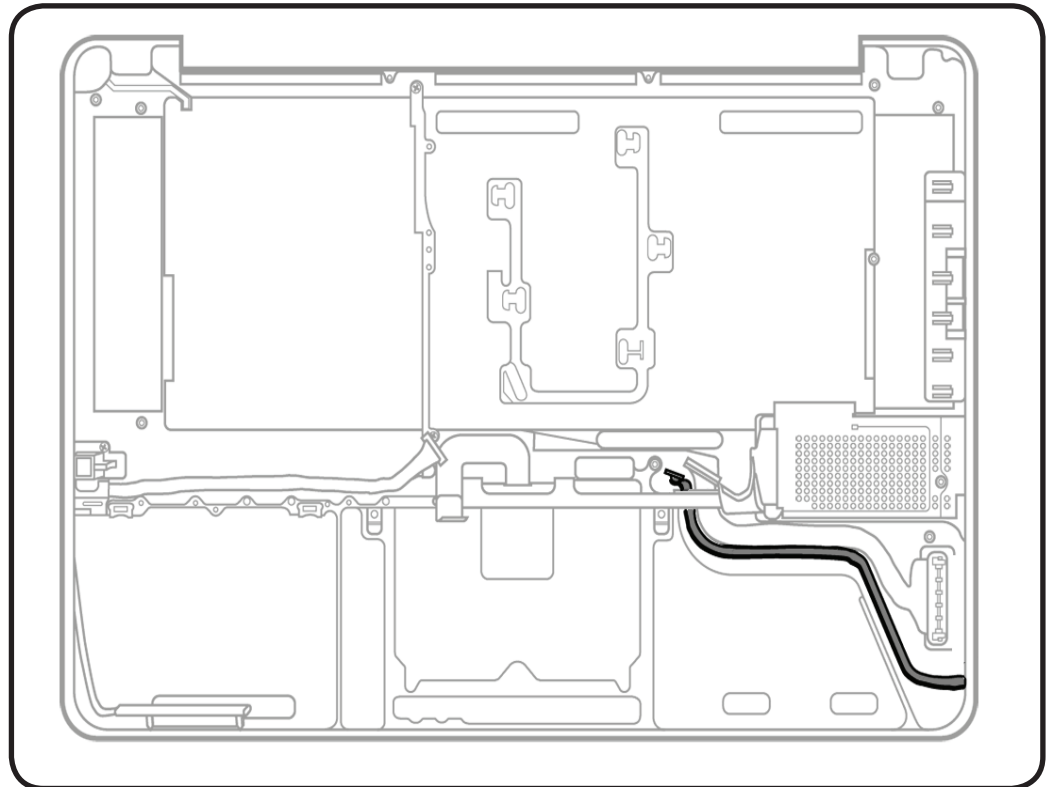


Battery Indicator Cable

First Steps

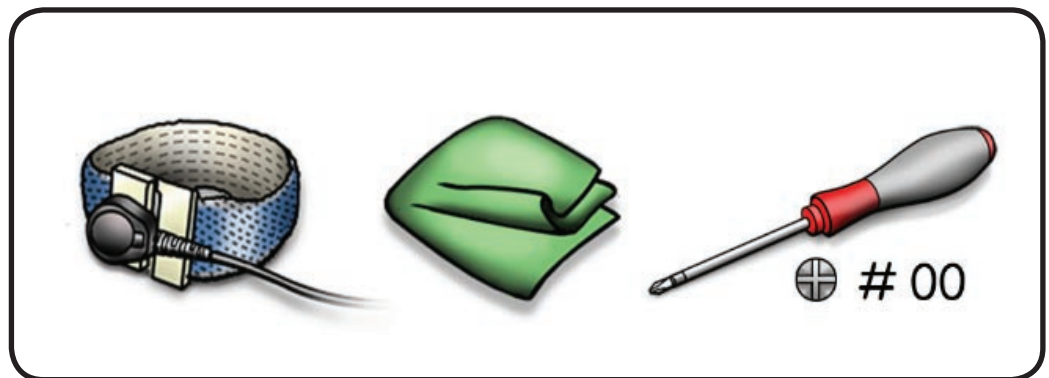
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Battery connector cover](#)



Tools

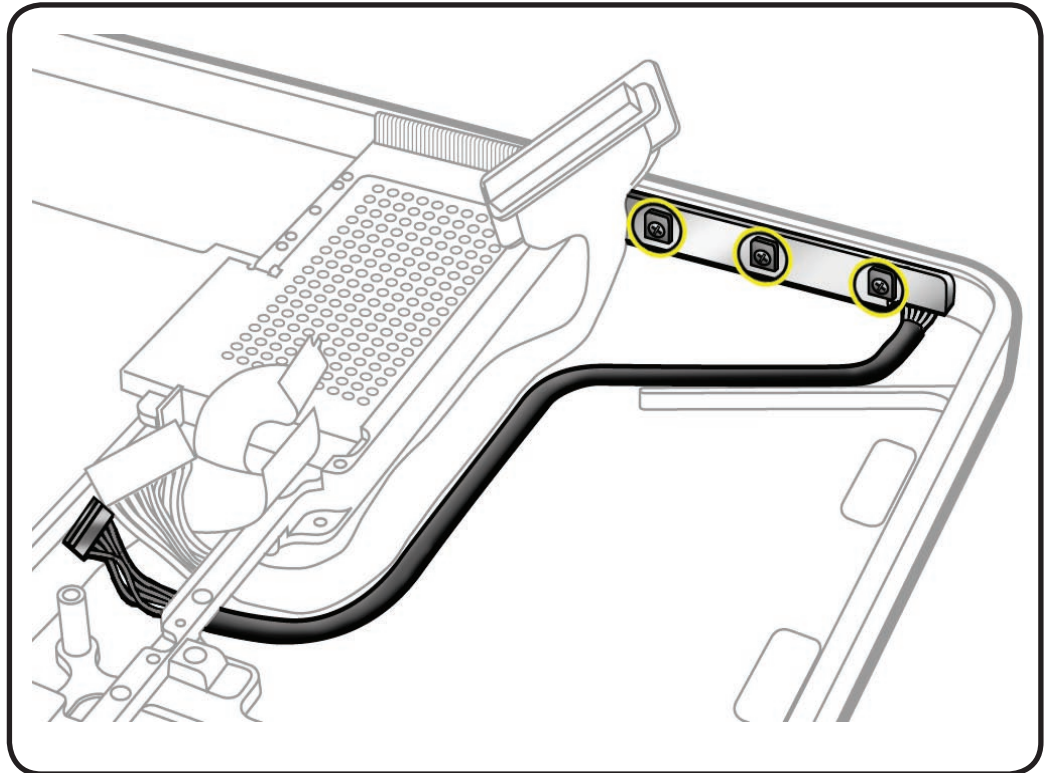
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver





Removal

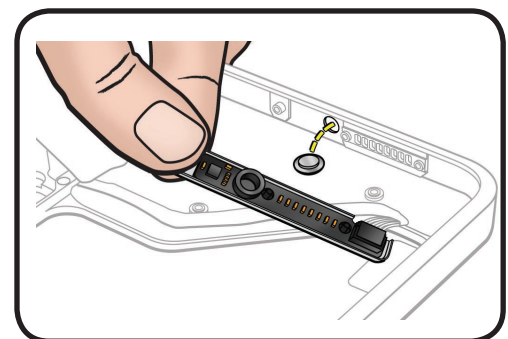
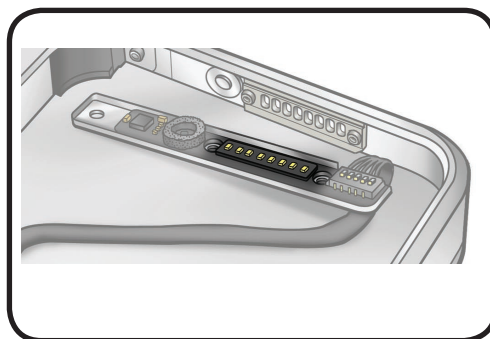
- 1 Disconnect cable from underside of logic board.
- 2 Route cable under midwall.
- 3 Remove 3 (2.62 mm) screws on battery indicator board.
- 4 Pry board from top case.
- 5 Disconnect cable from battery indicator light (BIL) board.



Note: The battery indicator light button may fall out of top case. Make sure you retain the button.

Replacement

- 1 Before replacing the board, check that:
 - the rubber gasket is assembled on top of the LEDs
 - the battery indicator light button is installed in the top case



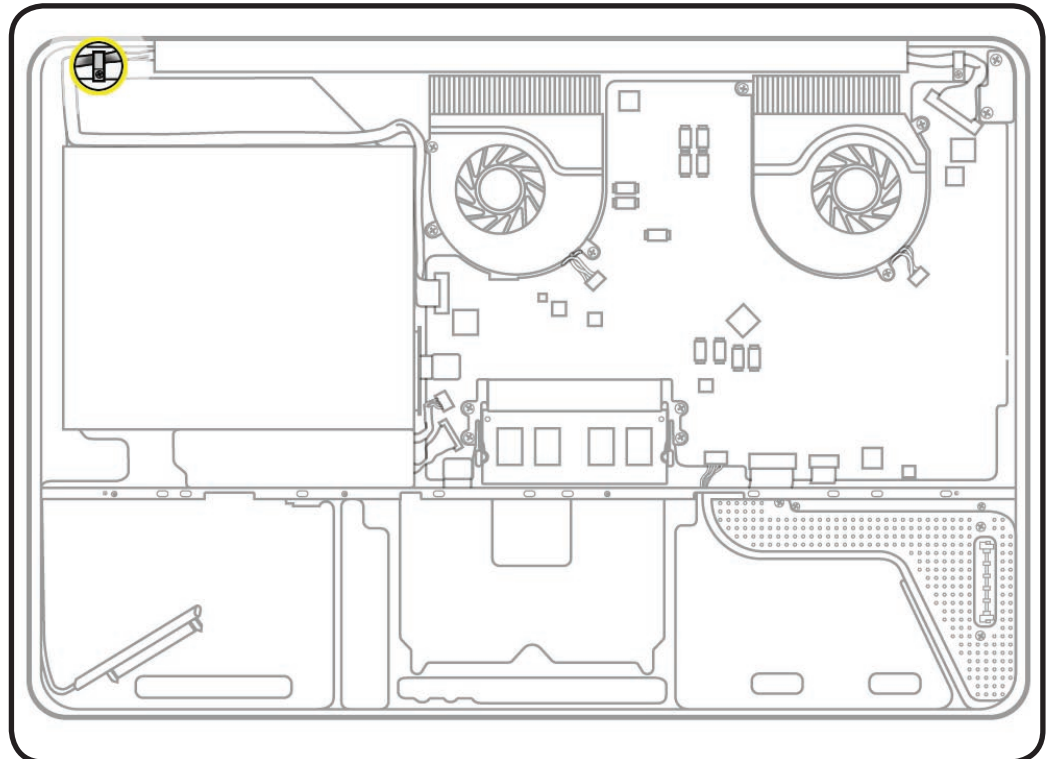


Camera Cable Guide

First Steps

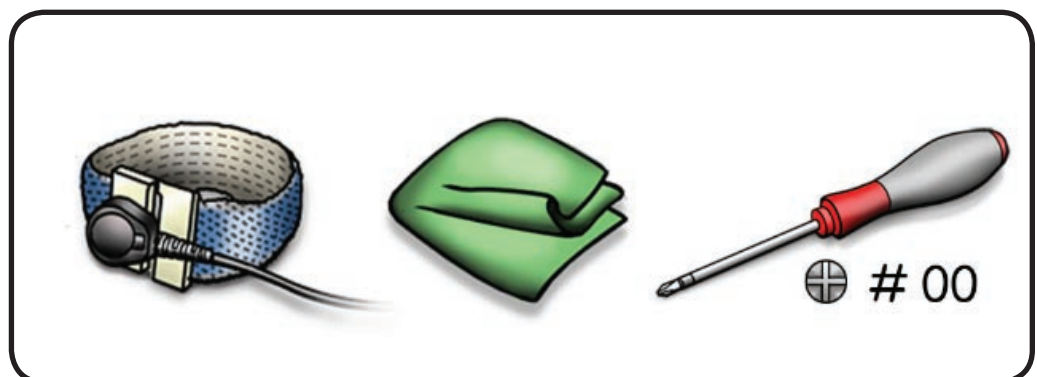
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)



Tools

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

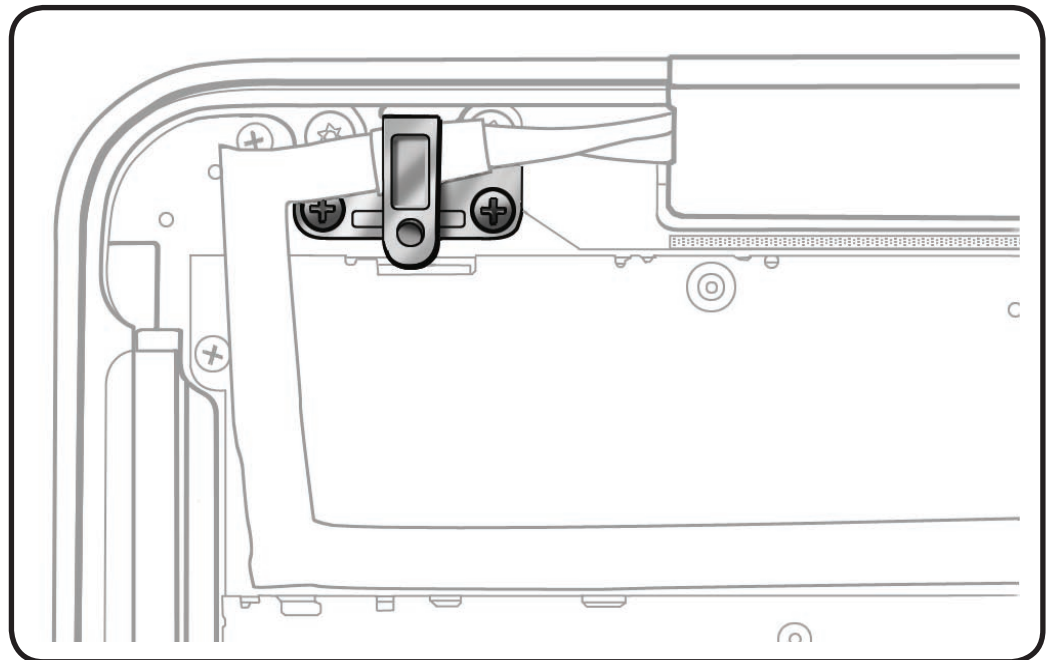




Removal

- 1 Remove 2 (8-mm) screws (922-8720).
- 2 Remove camera cable guide from the top case.

Replacement Note:
Make sure the black ground tab (on the camera cable) is placed over the right screw hole before installing the screw.



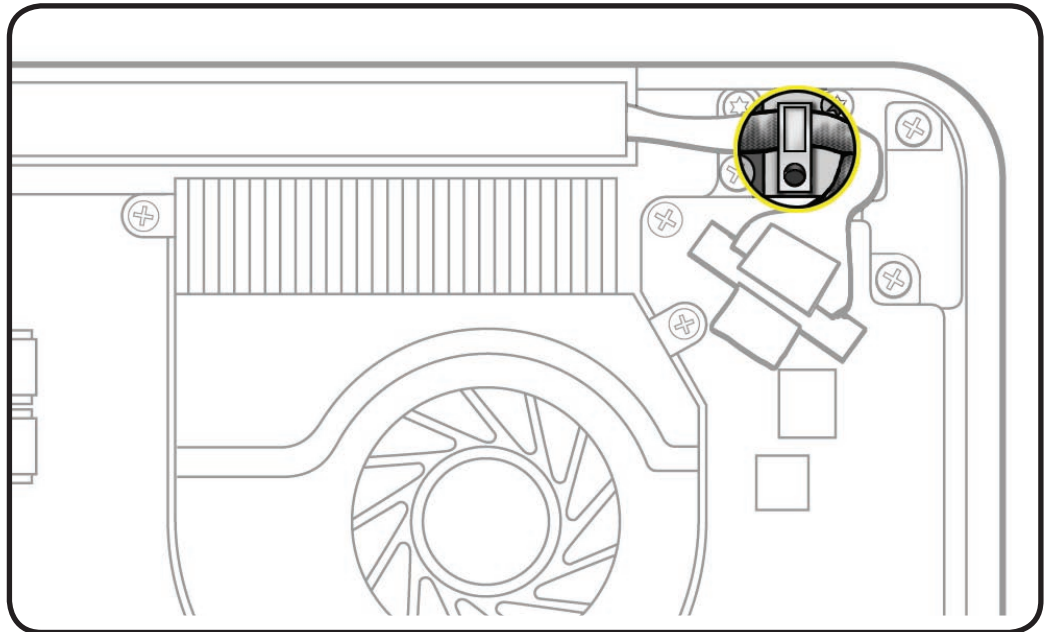


LVDS Cable Guide

First Steps

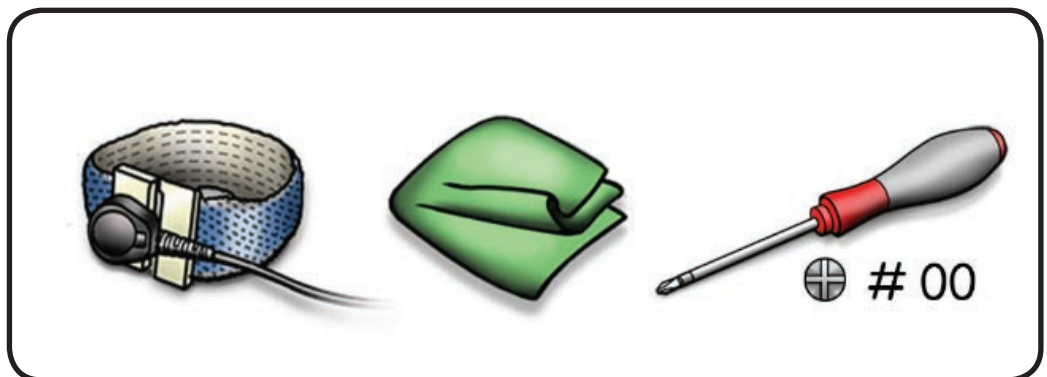
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)



Tools

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

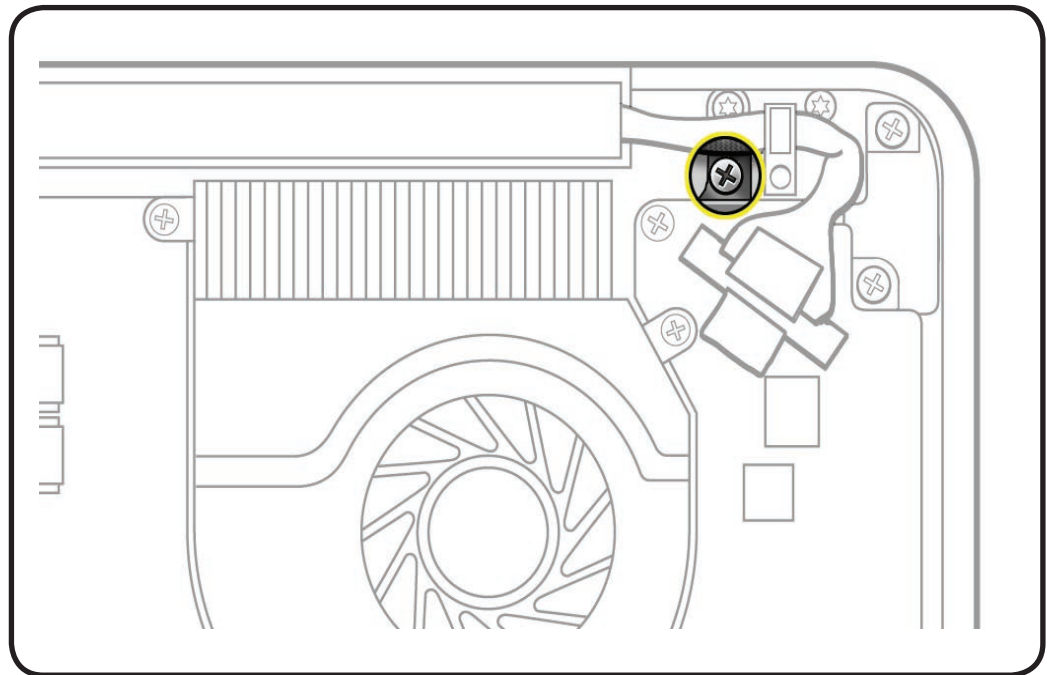




Removal

- 1 Remove 1 (7-mm) screw (922-8645).
- 2 Lift cable guide out of top case.

Replacement Note:
Align locator pin on cable guide to hole in top case



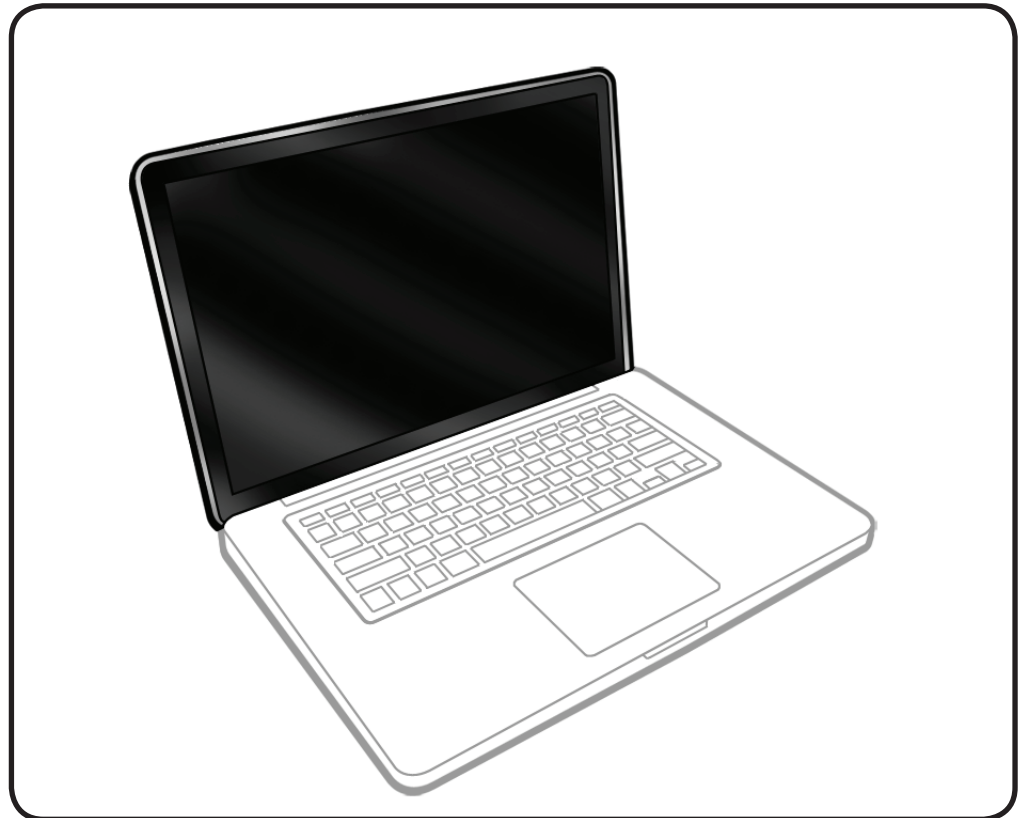


Display Assembly

First Steps

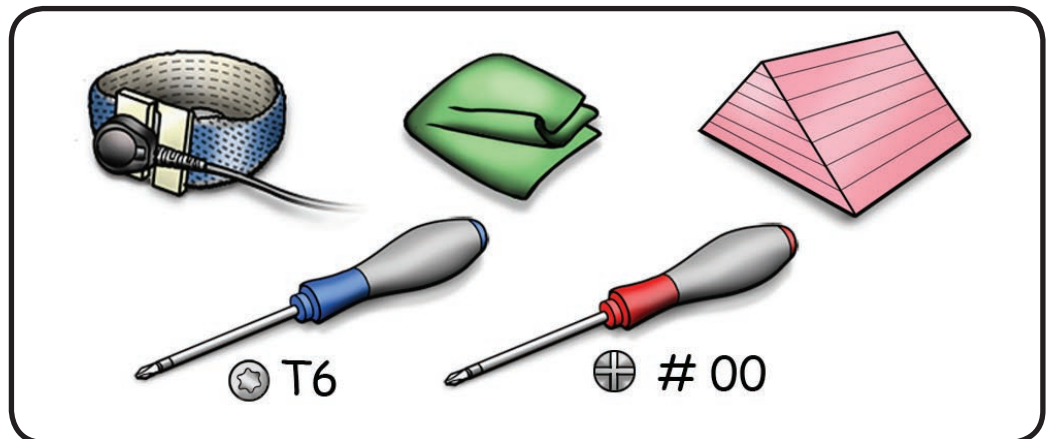
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Camera cable guide](#)
- [LVDS cable guide](#)



Tools

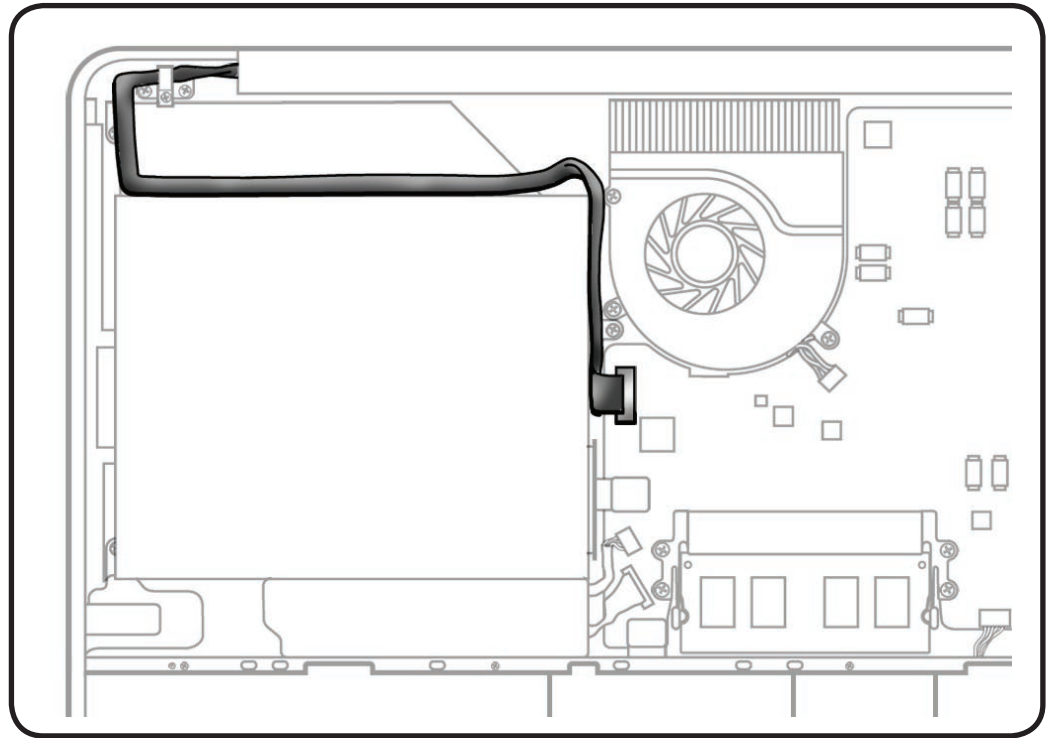
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Torx T6 screwdriver
- Foam wedge fixture





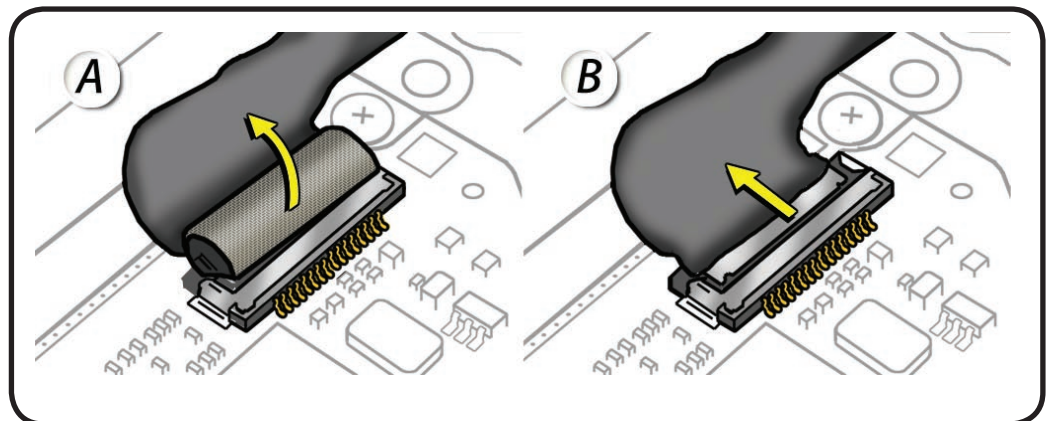
Removal

- 1 Locate camera cable.



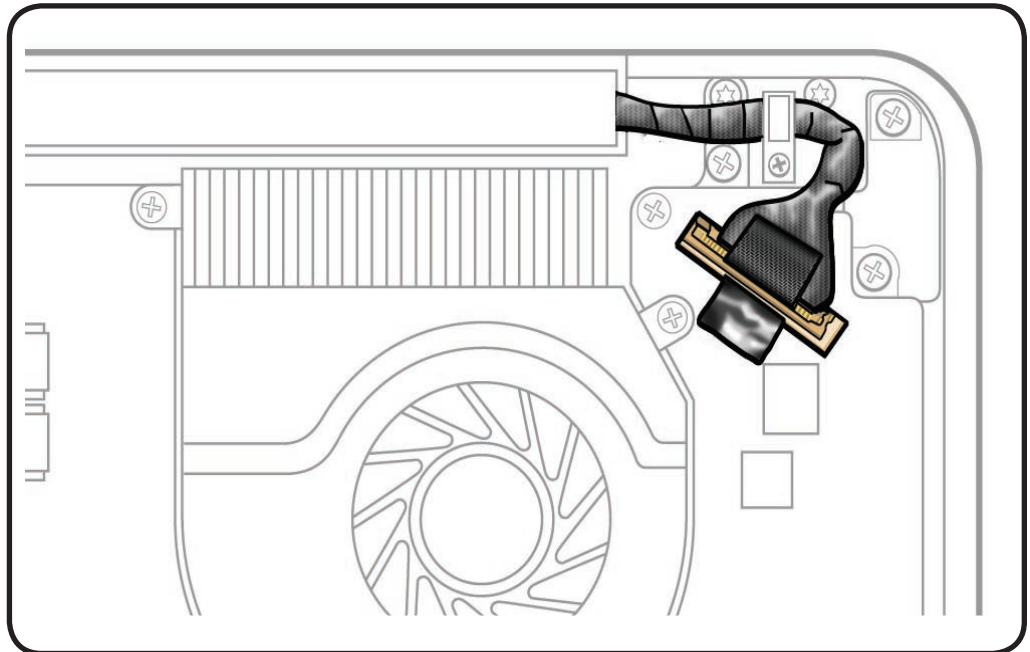
- 2 Peel EMI gasket off camera cable connector (A).

- 3 Disconnect camera cable from logic board (B). Pull cable on same horizontal plane as the logic board.



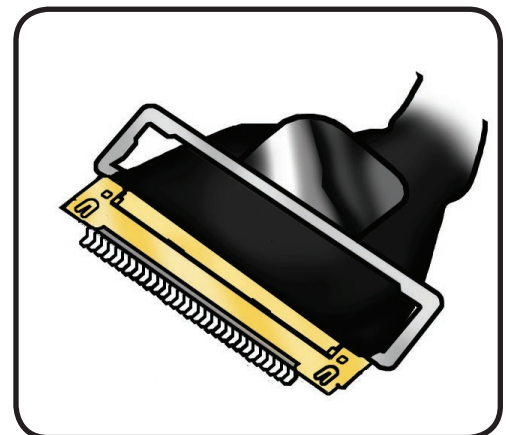


Caution: Do not pull on the black tab or the LVDS lock bar. Pulling on the tab to remove the LVDS cable will likely result in the metal LVDS lock bar being torn off the cable body. This bar is only to be used to disengage the lock from the LVDS connector. A broken lock bar results in a display assembly replacement.

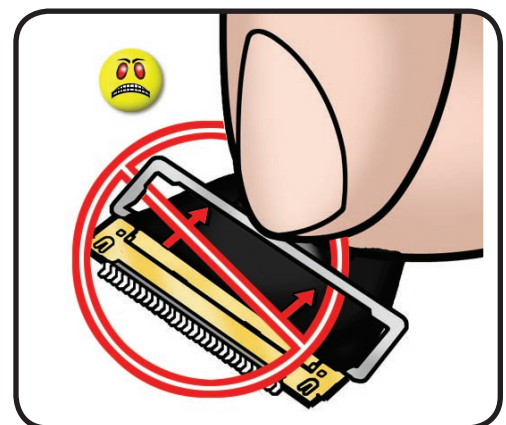


- 4 Remove EMI foam gasket on LVDS cable (shown above). Pull towards the fan.

- 5 To disconnect LVDS cable grasp black tab and gently swing LVDS lock bar up and back to unlock the cable.



- 6 Slide cable out of connector by pulling the cable. Do not pull the black tab or lock bar.



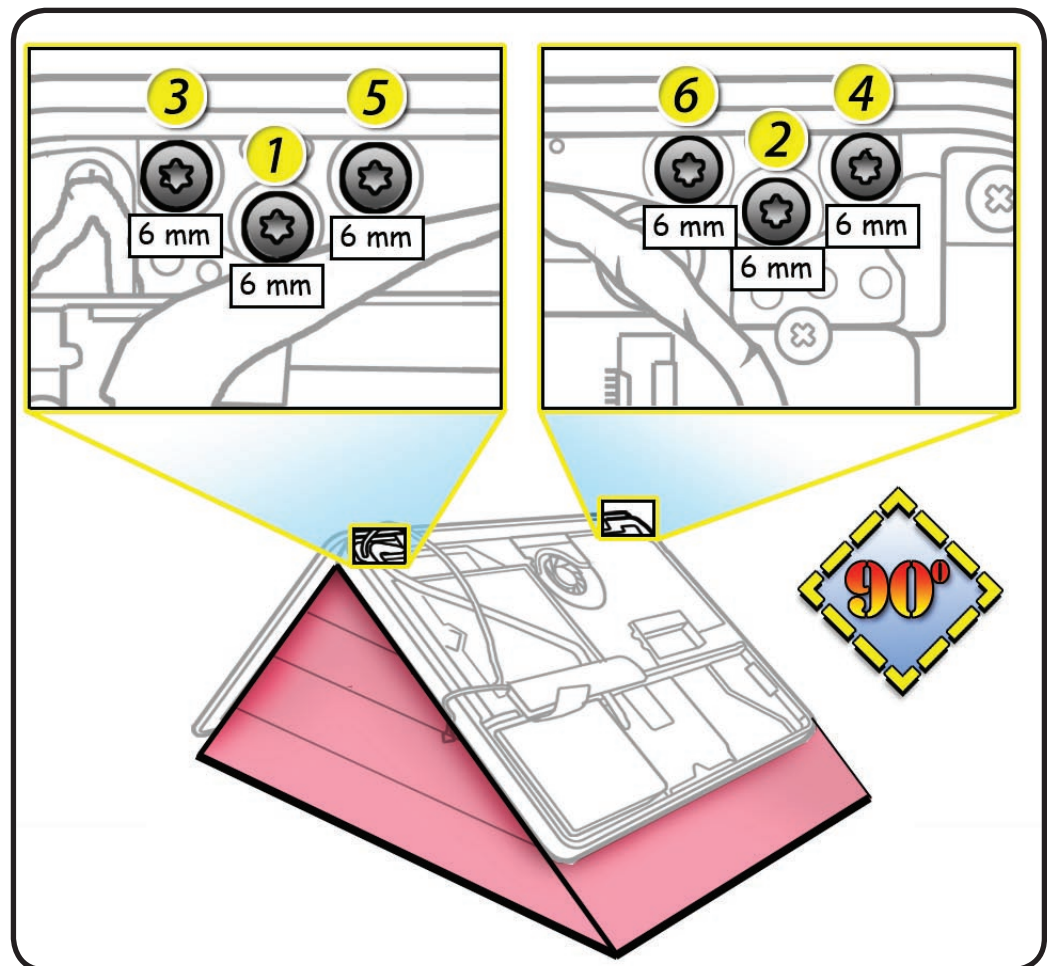


7 Open the display to 90 degrees, and place the computer on the foam wedge service fixture.

8 Remove 6 (6-mm) Torx 922-8646 screws:

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

9 Separate display assembly from top case.

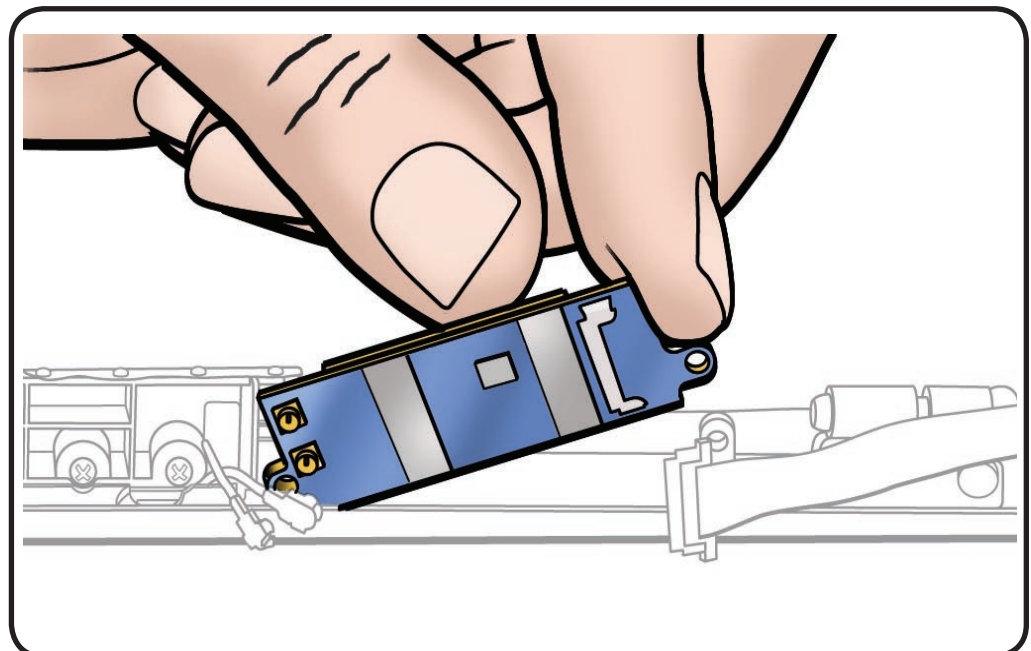


Replacement

Important: Before you return 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.



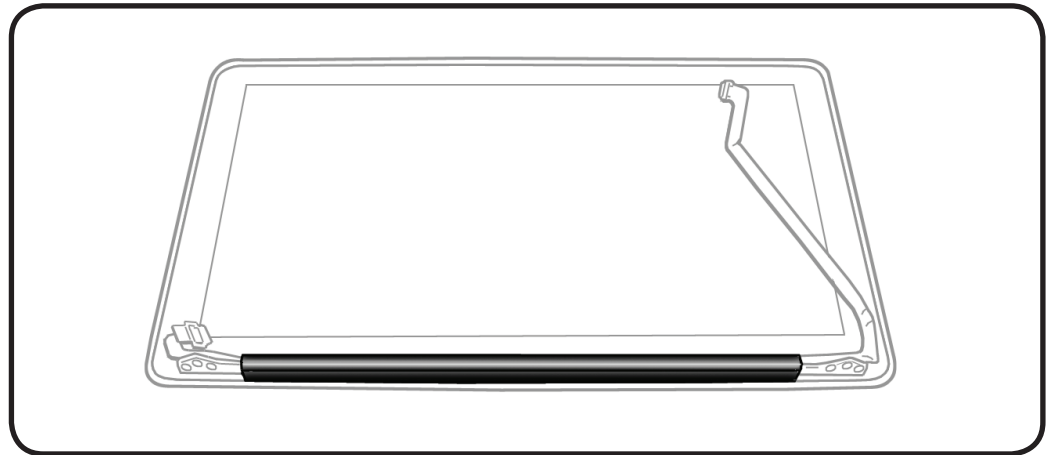


Display Clutch Cover

First Steps

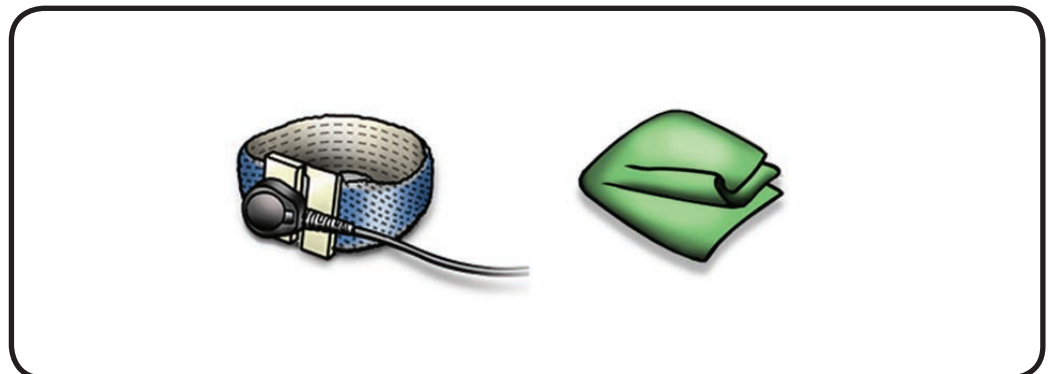
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Camera cable guide](#)
- [LVDS cable guide](#)
- [Display assembly](#)



Tools

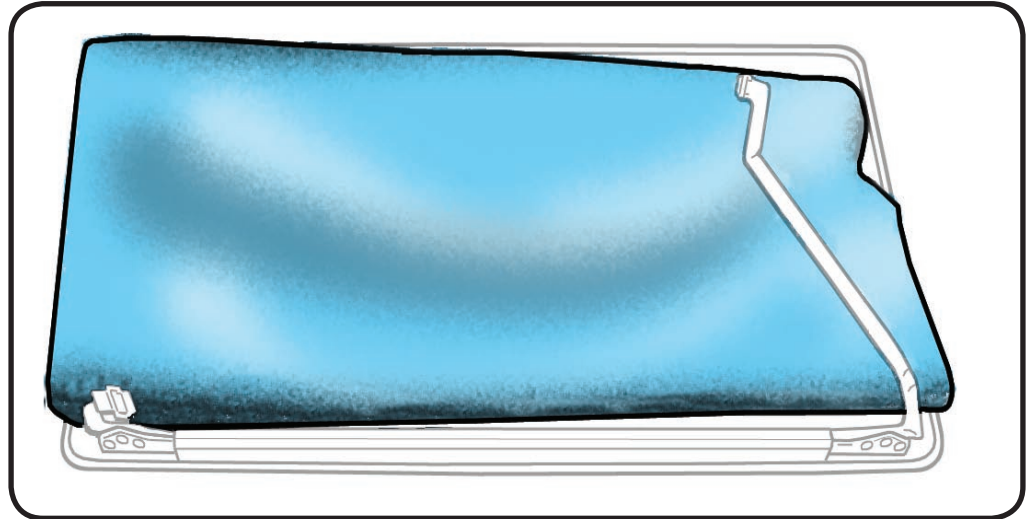
- Clean, soft, lint-free cloth
- ESD wrist strap and mat



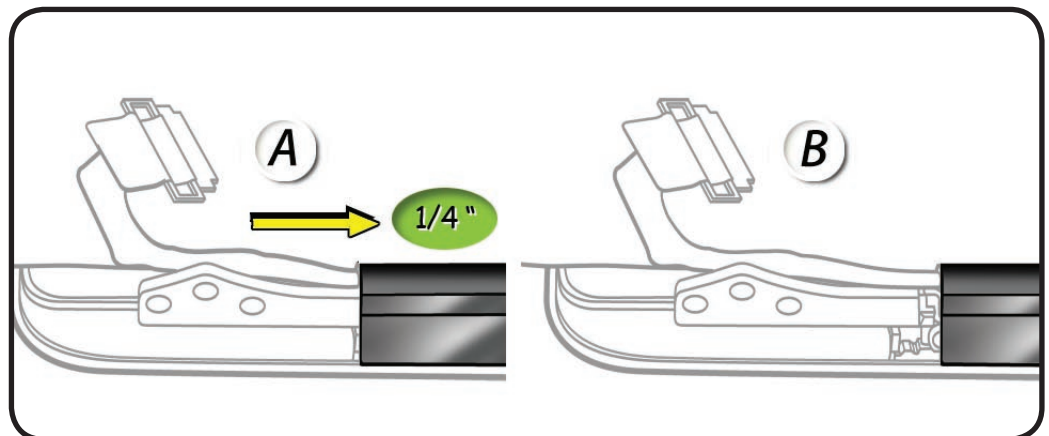


Removal

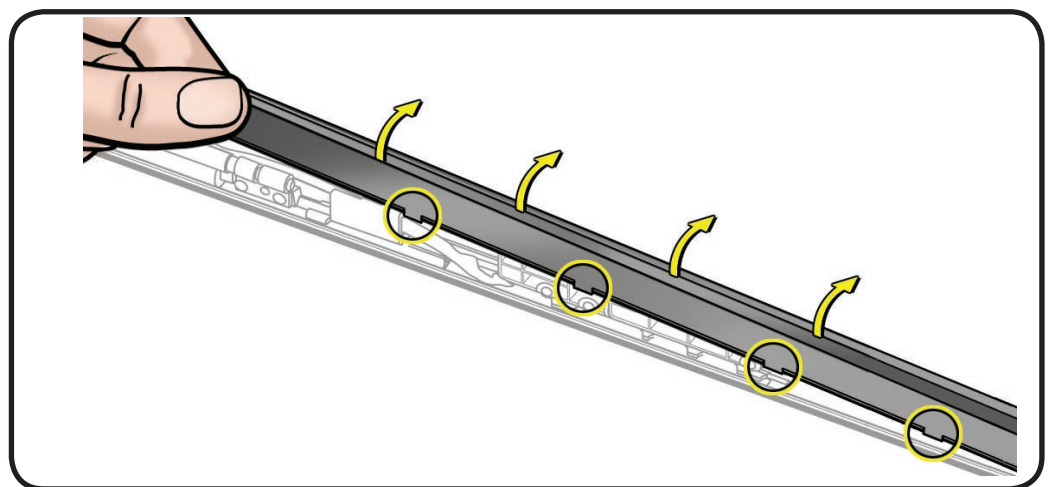
- 1 Cover display face with clean, soft cloth.



- 2 Holding left hinge, slide clutch cover 1/4 inch (6.35 mm) away from the LVDS cable.

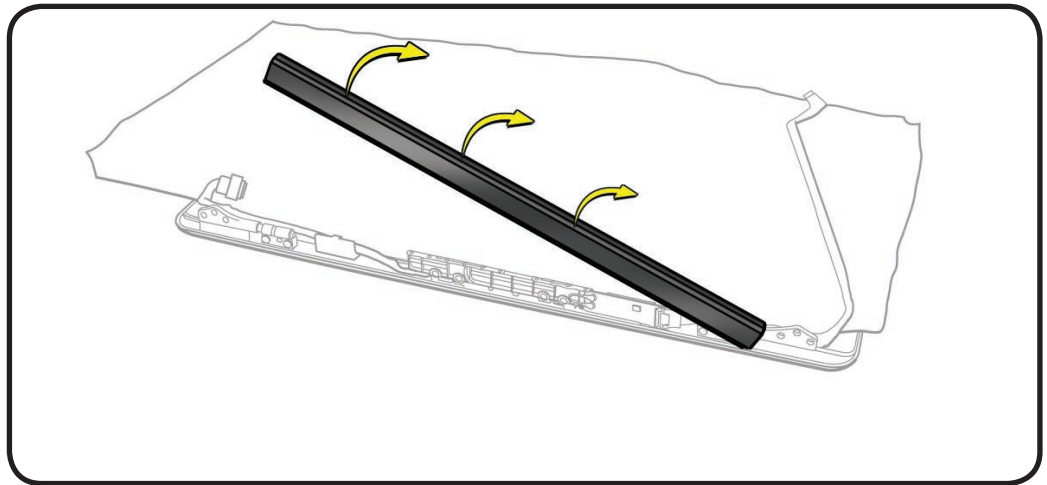


- 3 Press down on clutch cover to loosen 4 hooks inside.



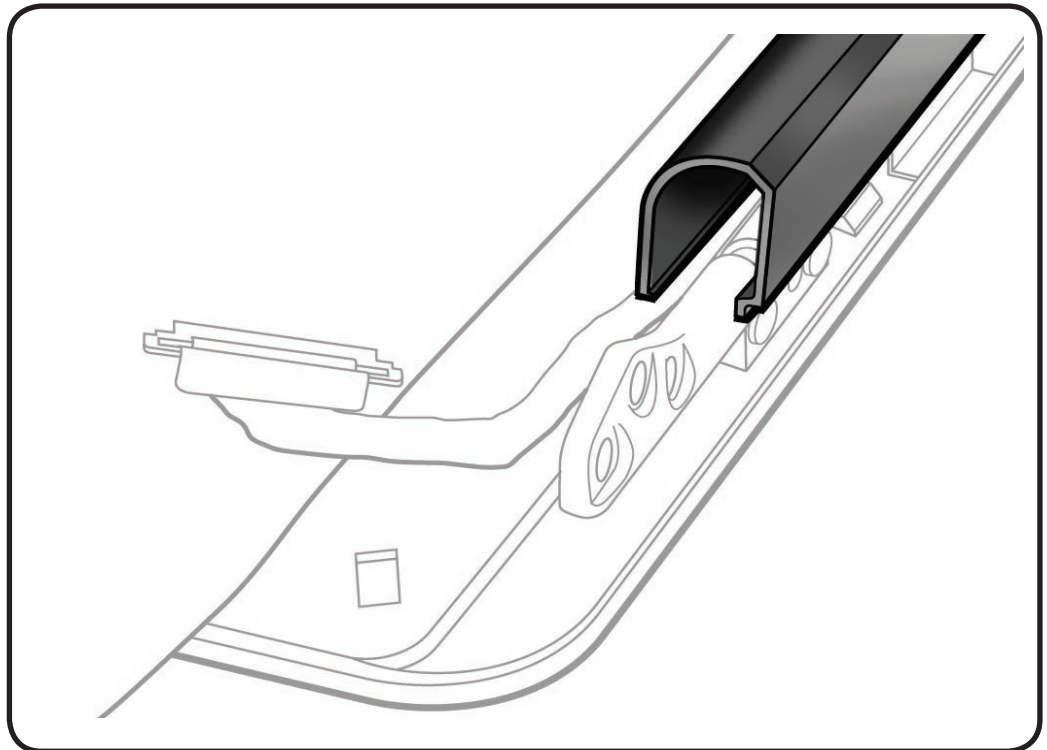


- 4 Tilt up end of clutch cover as you roll it toward display face.
- 5 Remove clutch cover.



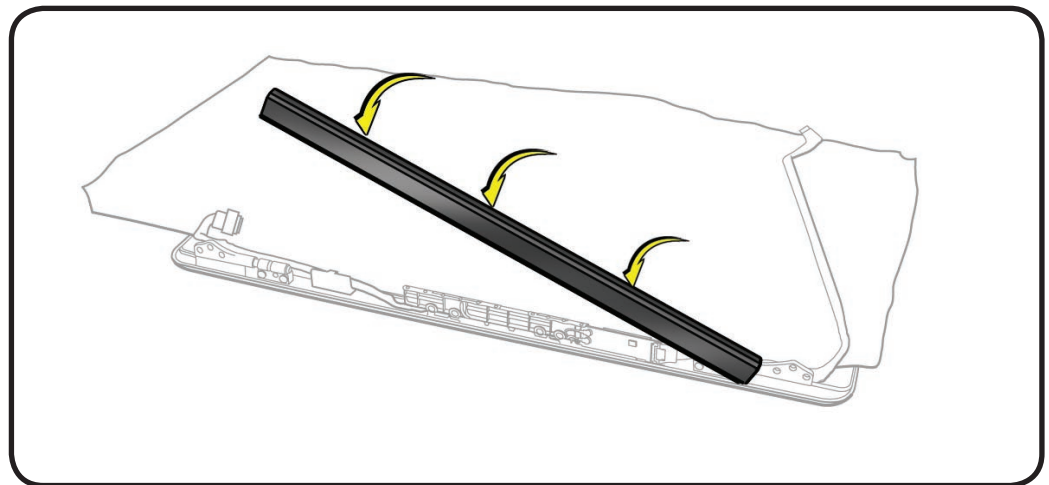
Replacement

- 1 Note shape of clutch cover:
 - flat at bottom
 - curved at top
- 2 Make sure flat edge is at bottom of display.





- 3** Position 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



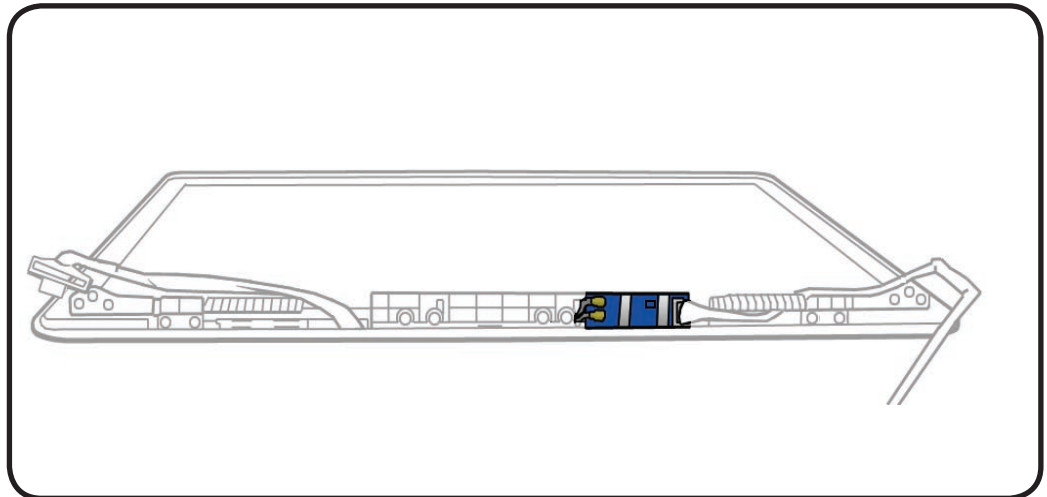


AirPort Card

First Steps

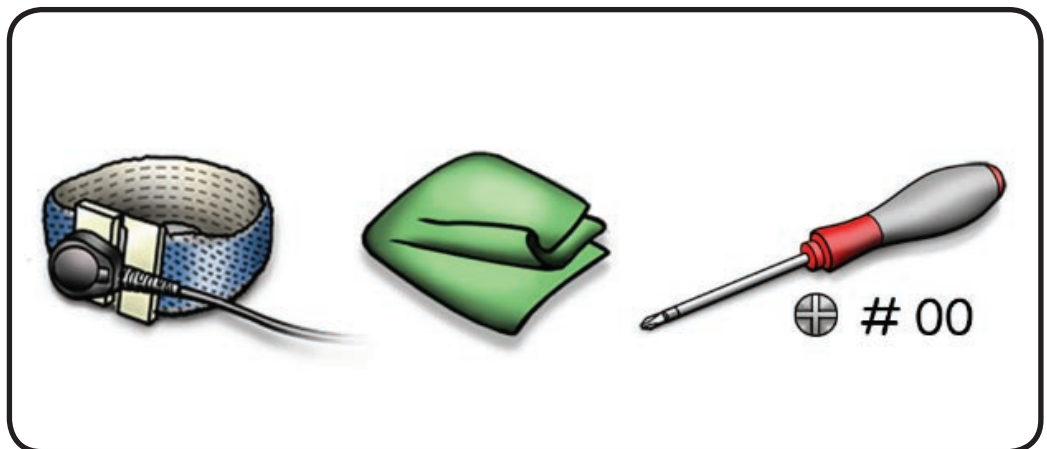
Remove:

- [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



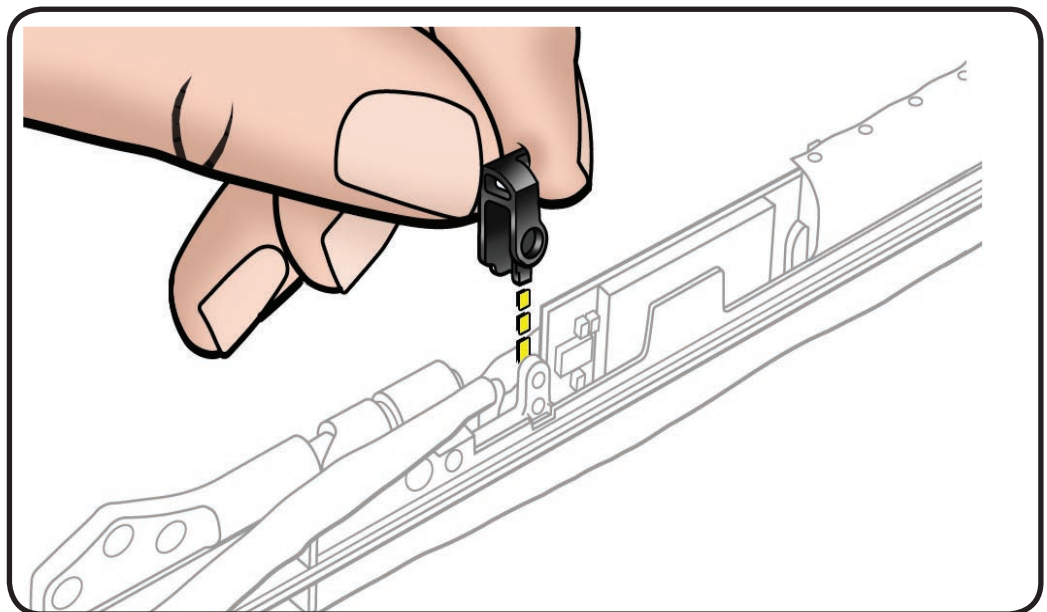
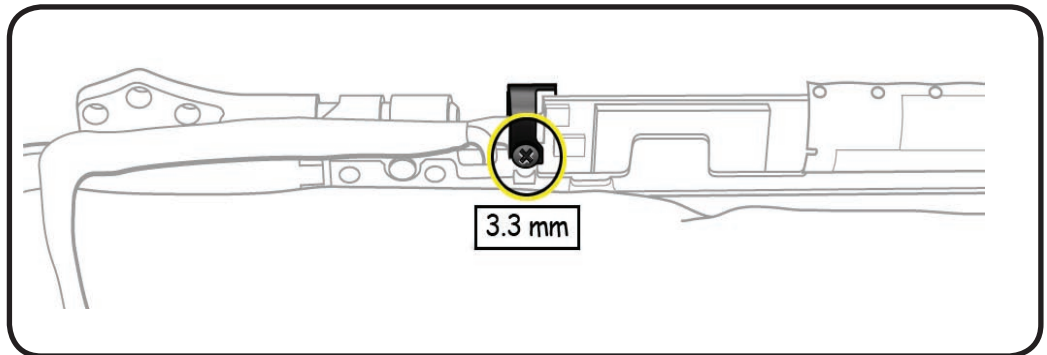


Removal

- 1 Cover display with clean, soft cloth.
- 2 Remove 3.3 mm screw from cable clip.

Note the wide head on this screw.

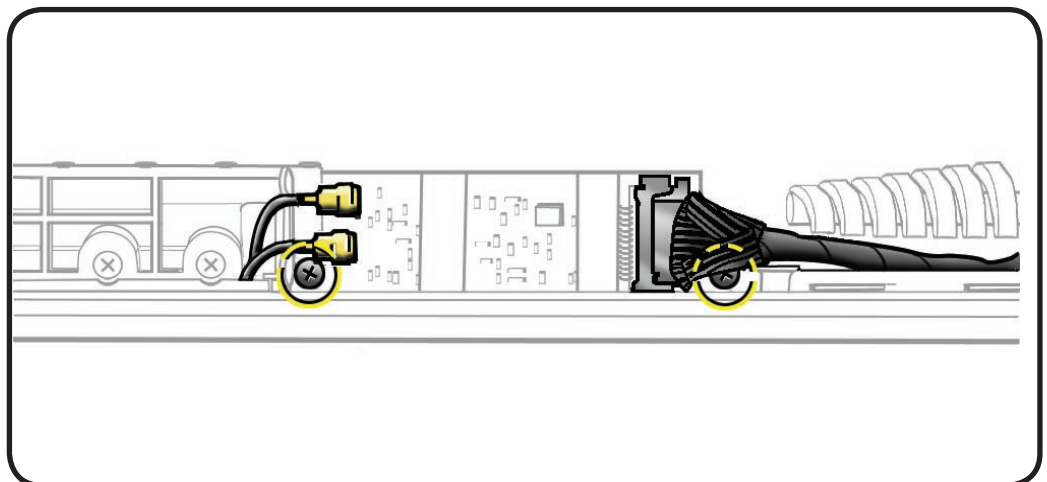
- 3 Lift up cable clip.



- 4 Disconnect AirPort cable.
- 5 Disconnect 2 AirPort antenna cables.

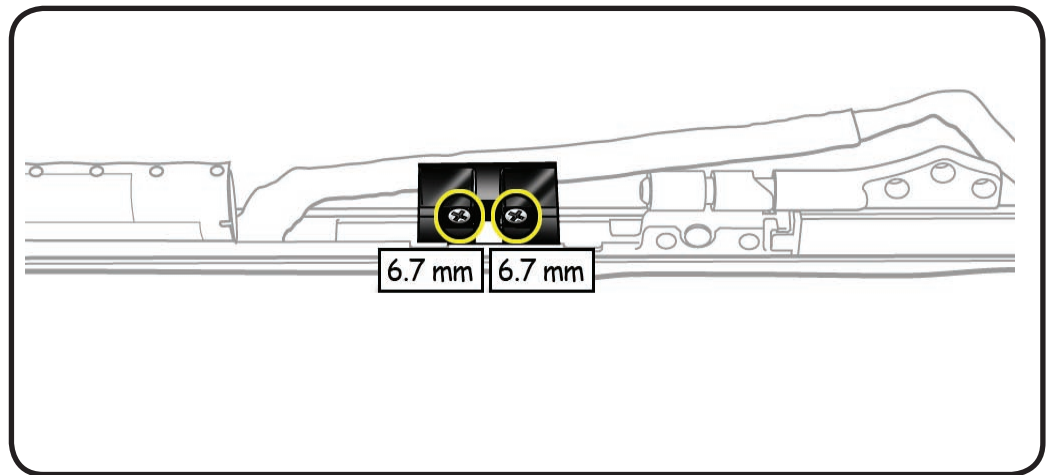
Replacement Note:
Shorter antenna is at bottom.

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



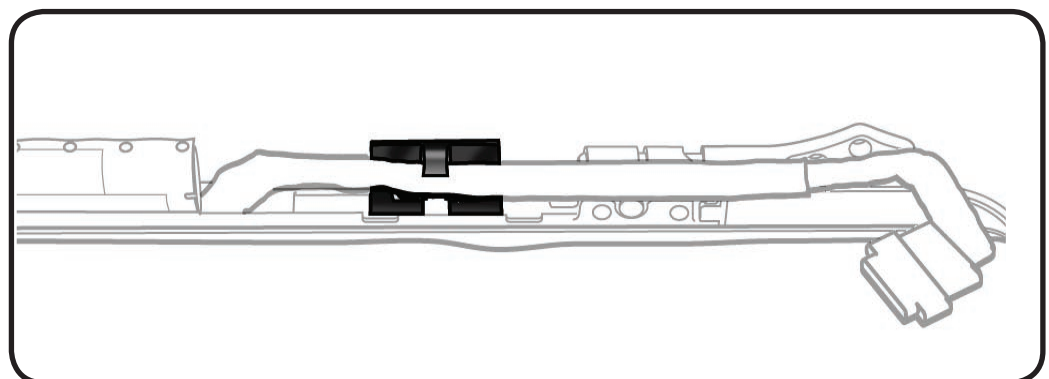
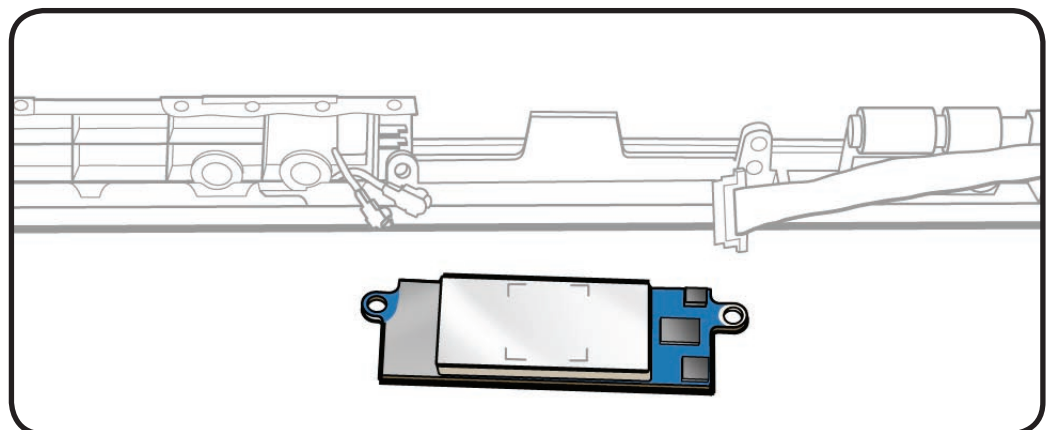


- 7 Remove 2 6.7-mm screws from the cable clip.
- 8 Lift out AirPort Card.



Replacement

- 1 Make sure thermal pad is centered on AirPort Card 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 wide-head screw.
- 3 Route the other end of cable under the other clip.
- 4 Replace 2 screws on clip.



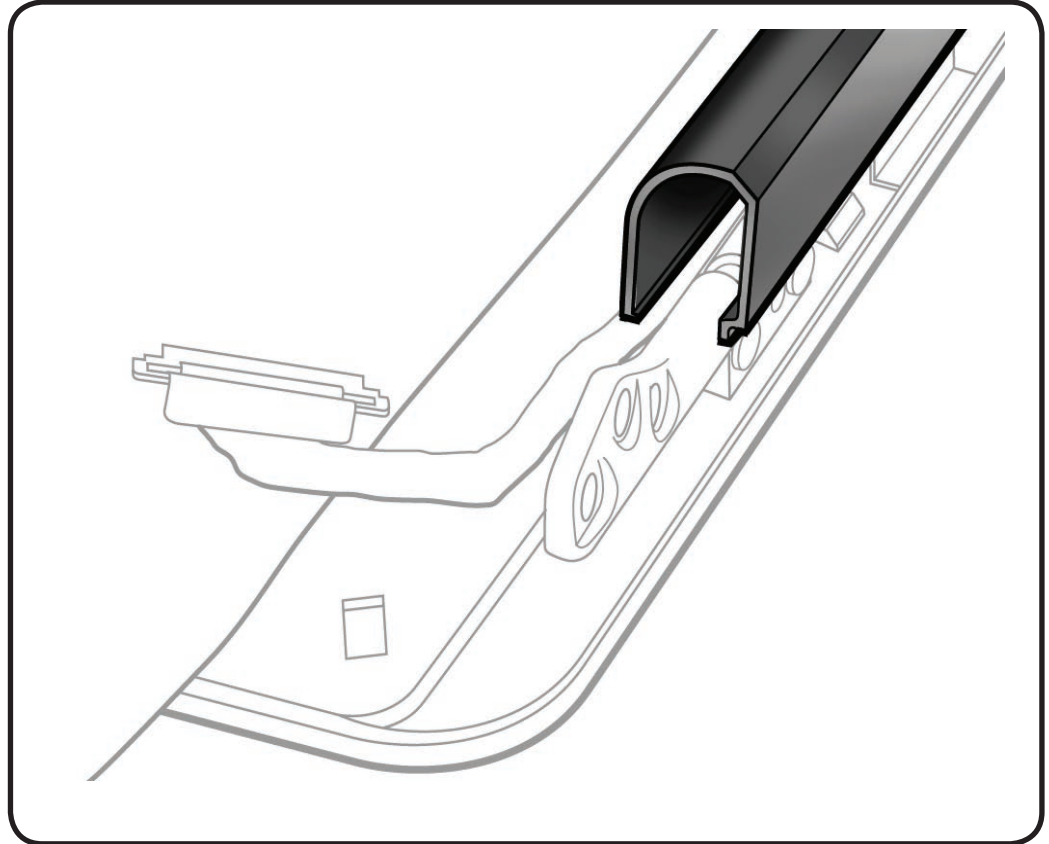


5 Replace clutch cover.

6 Reassemble computer.



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



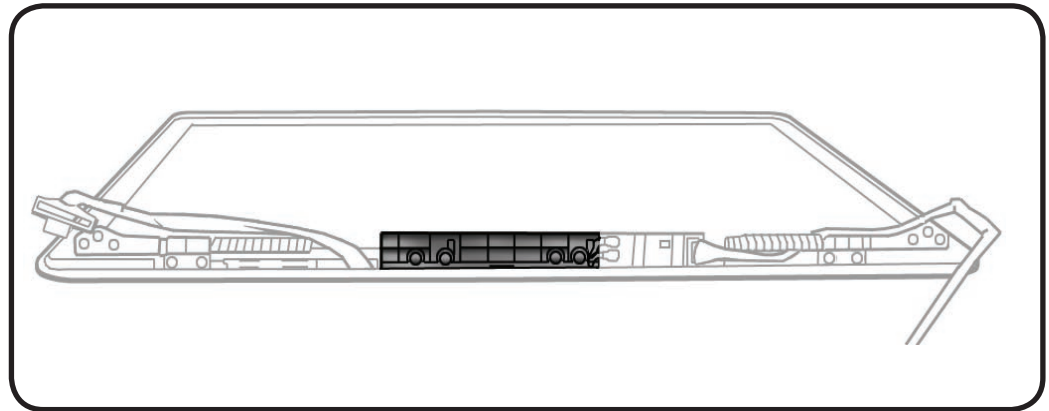


Antenna Board

First Steps

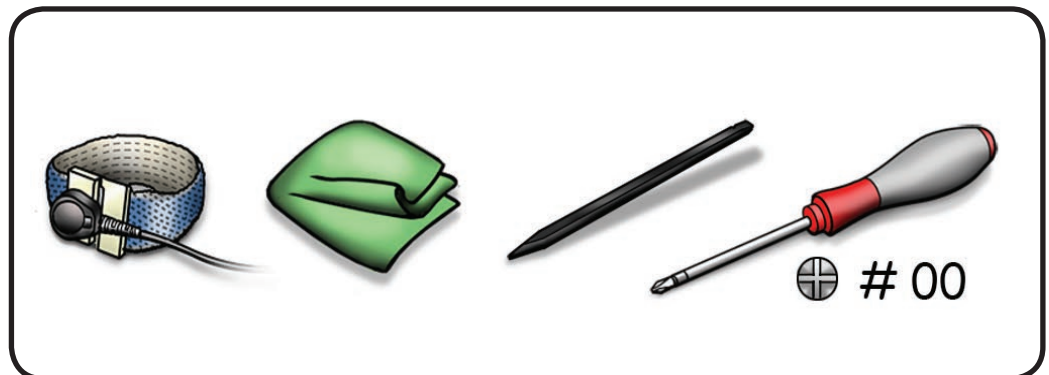
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Camera clutch cable guide](#)
- [LVDS cable guide](#)
- [Display assembly](#)
- [Display clutch cover](#)



Tools

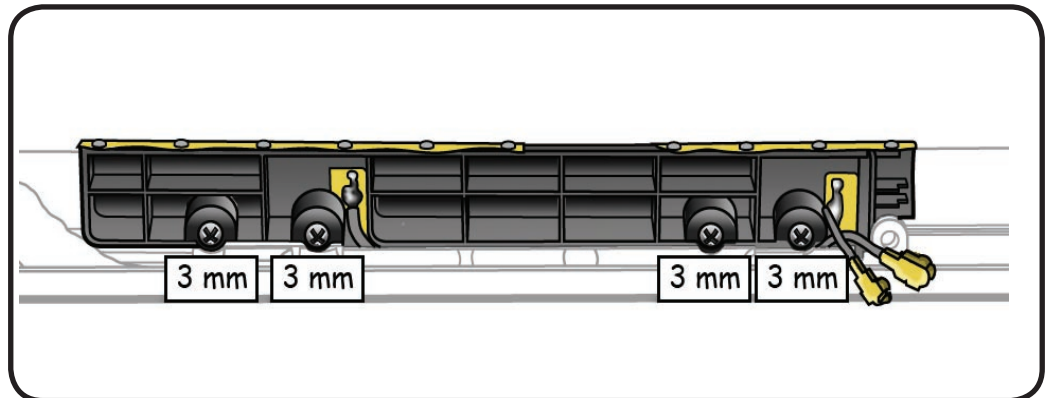
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Black stick
- Phillips #00 screwdriver





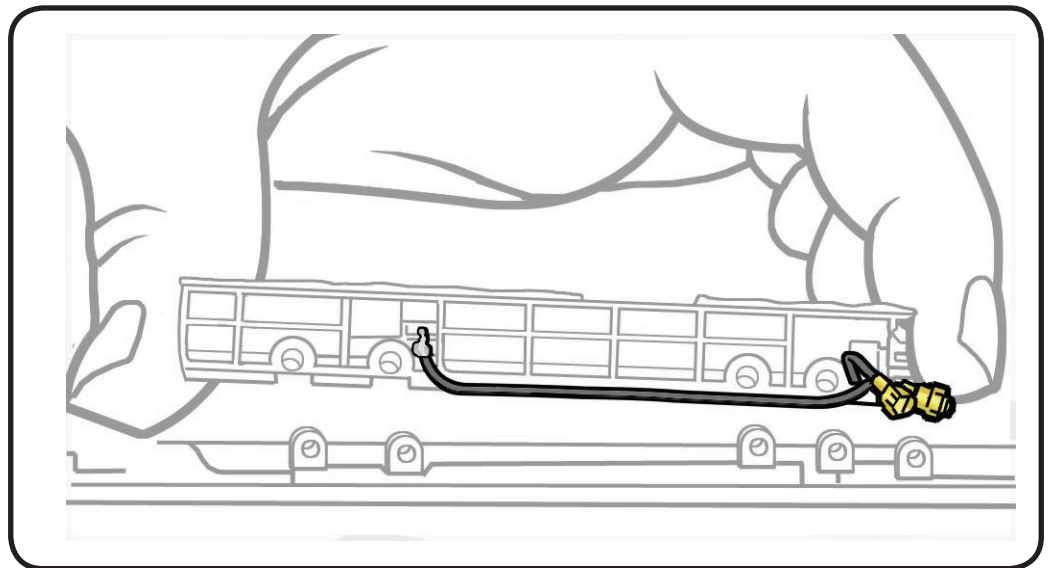
Removal

- 1 Disconnect antenna connectors.
- 2 Remove 4 (3-mm) screws (076-1326).
- 3 Lift out antenna board.



Replacement

- 1 Make sure the AirPort antenna cable is routed in its channel.
- 2 Make sure end of each antenna connector is secured in its channel.
- 3 Set the antenna board in the display assembly and install the screws.
- 4 Connect the antennas to the AirPort card.





Optical Drive

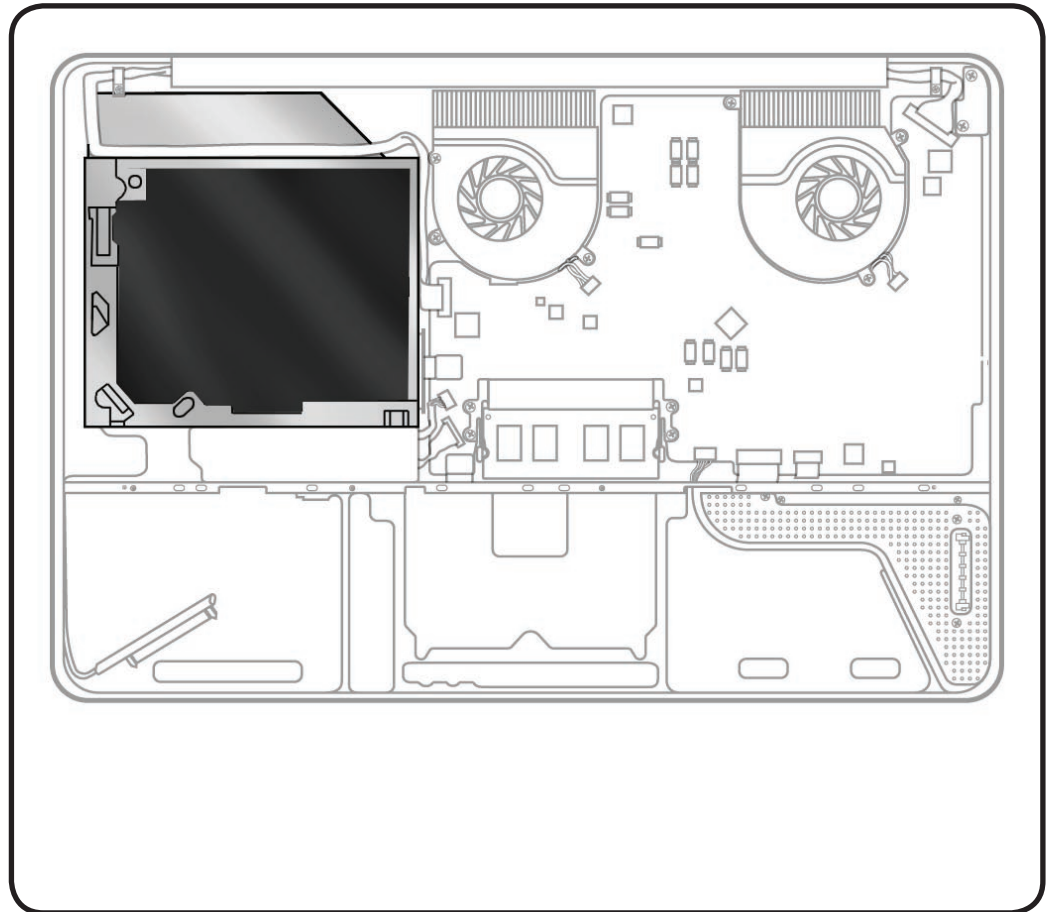
First Steps

Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Camera cable guide](#)

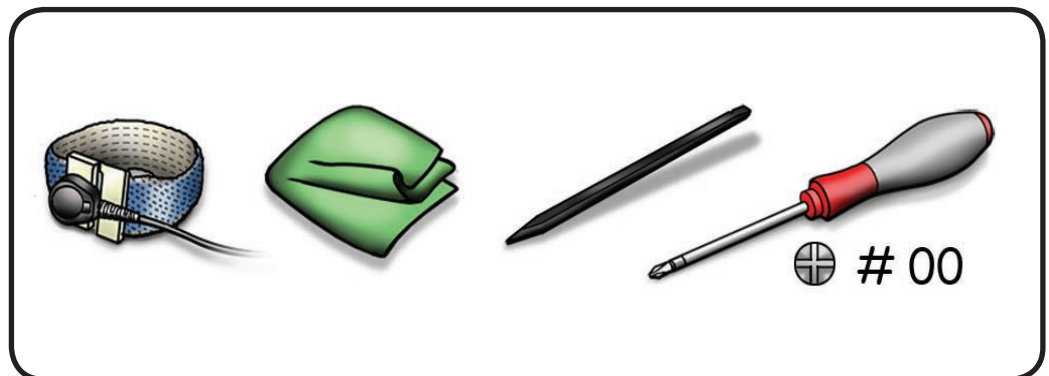


Caution: The optical drive is very fragile. Handle by the sides only.



Tools

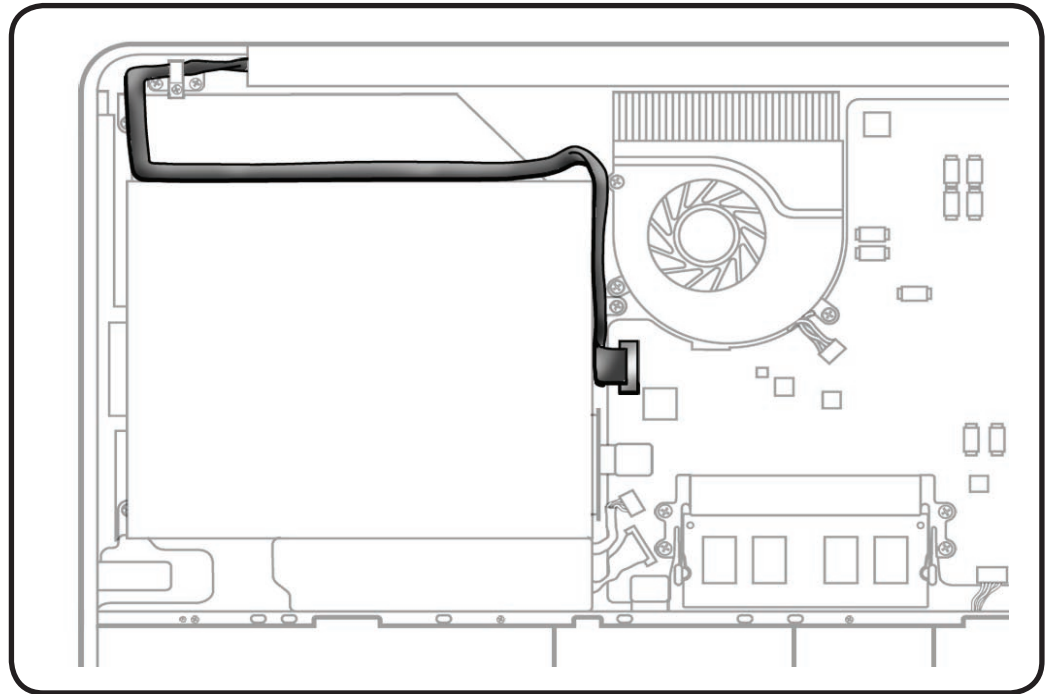
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Black stick



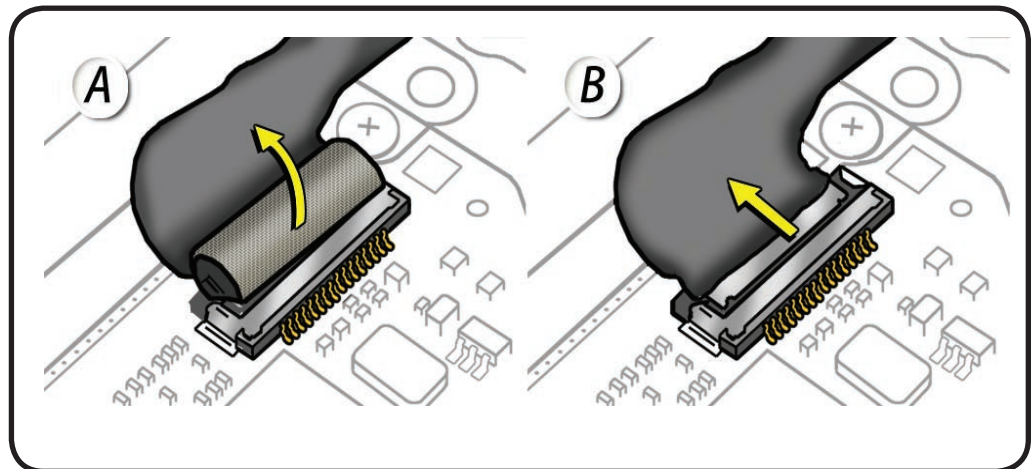


Removal

- 1 Locate camera cable connector.



- 2 Peel EMI gasket off top of the camera cable (A)
- 3 Disconnect camera cable from logic board (B).





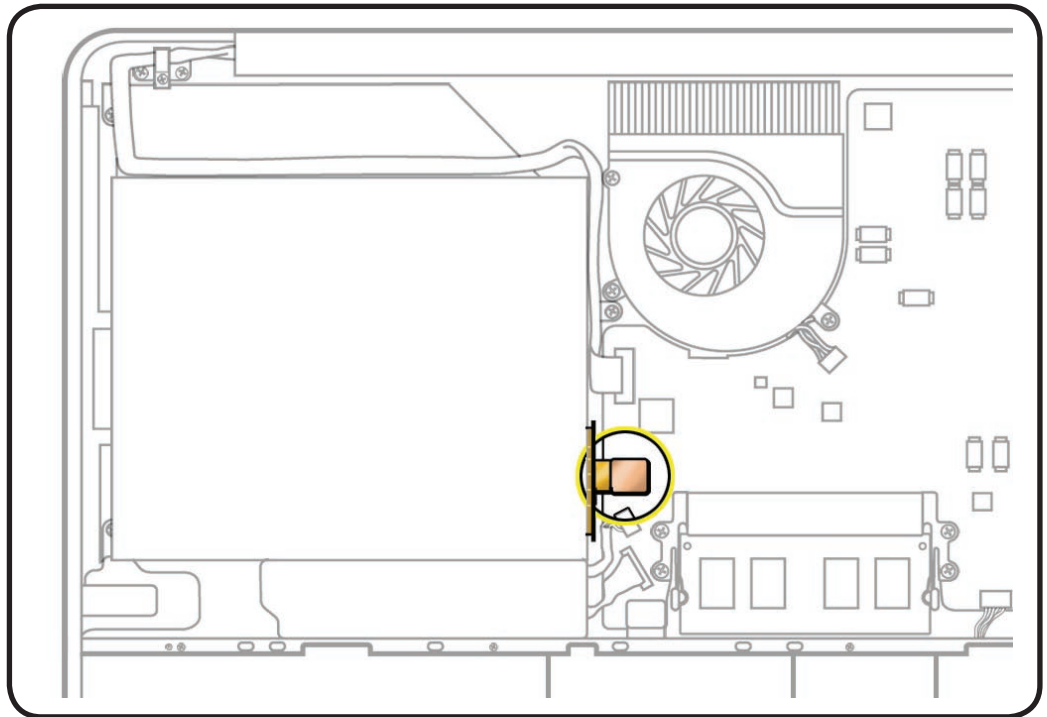
- 4 With a black stick, carefully pry optical cable straight up and off logic board.



Important

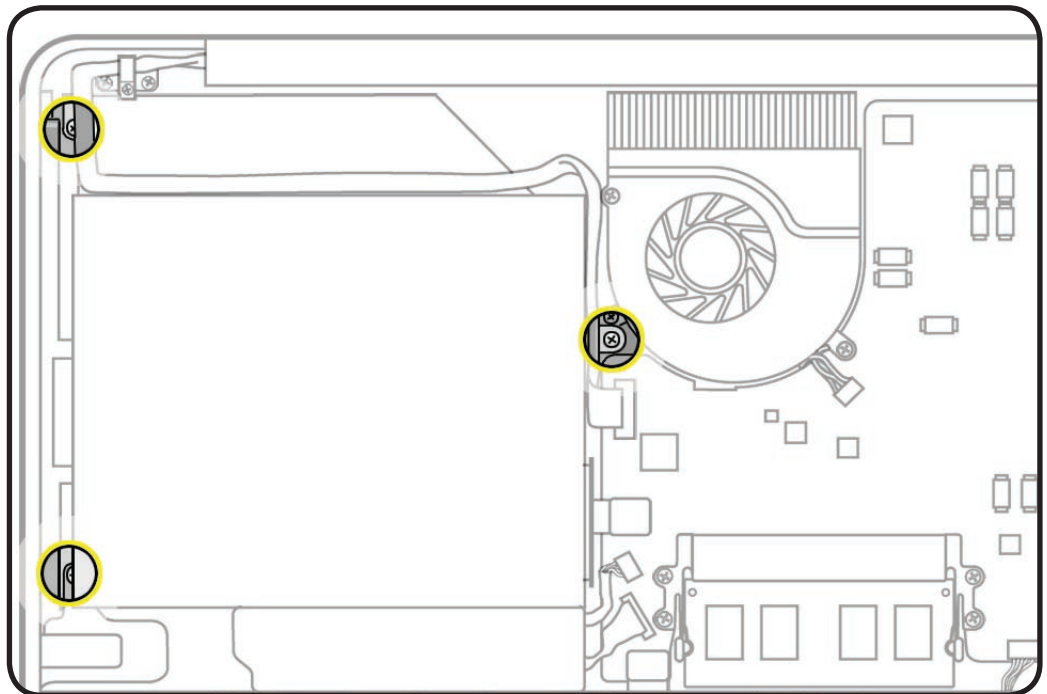
Replacement Note:

Install flex cable vertically onto logic board connector. Failure to do so could bend logic board pins and cause the system to not detect a disc when inserted.



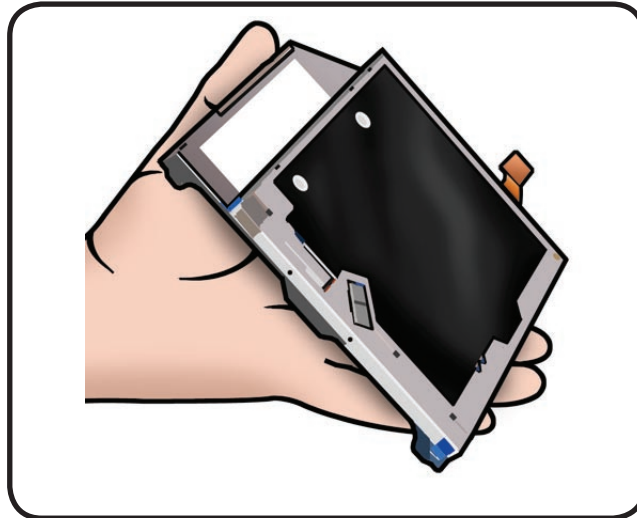
- 5 Remove 3 screws:
- 1 (3.5-mm) 922-xxxx
 - 2 (2.5-mm) 922-8719

- 6 Carefully pry the optical drive out of the top case.





- 7 Caution:** The optical drive is very fragile. Handle by the sides only!



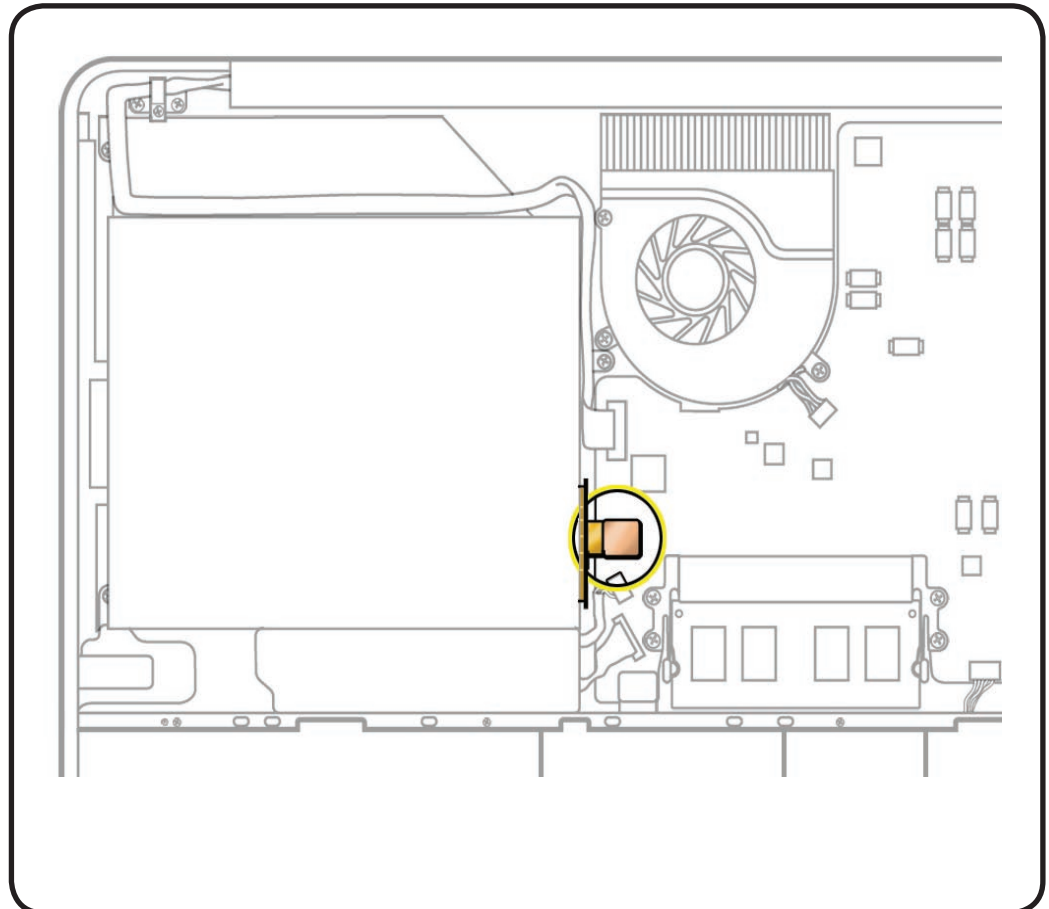


Optical Drive Flex Cable

First Steps

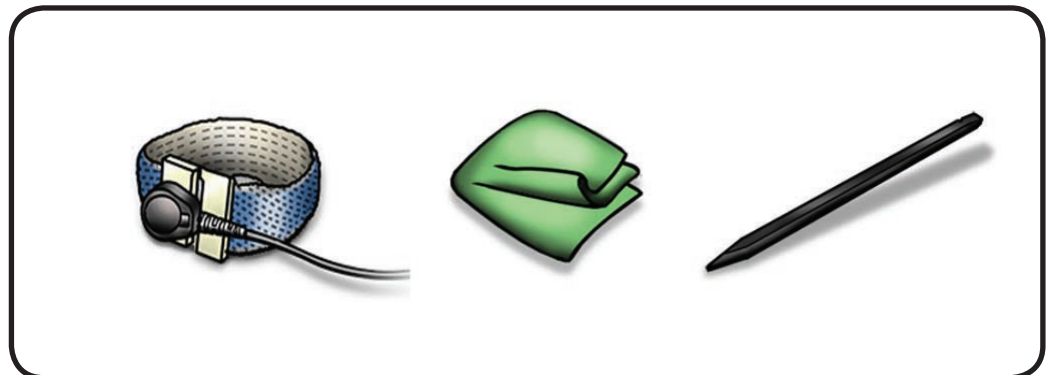
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Camera cable guide](#)
- [Optical drive](#)



Tools

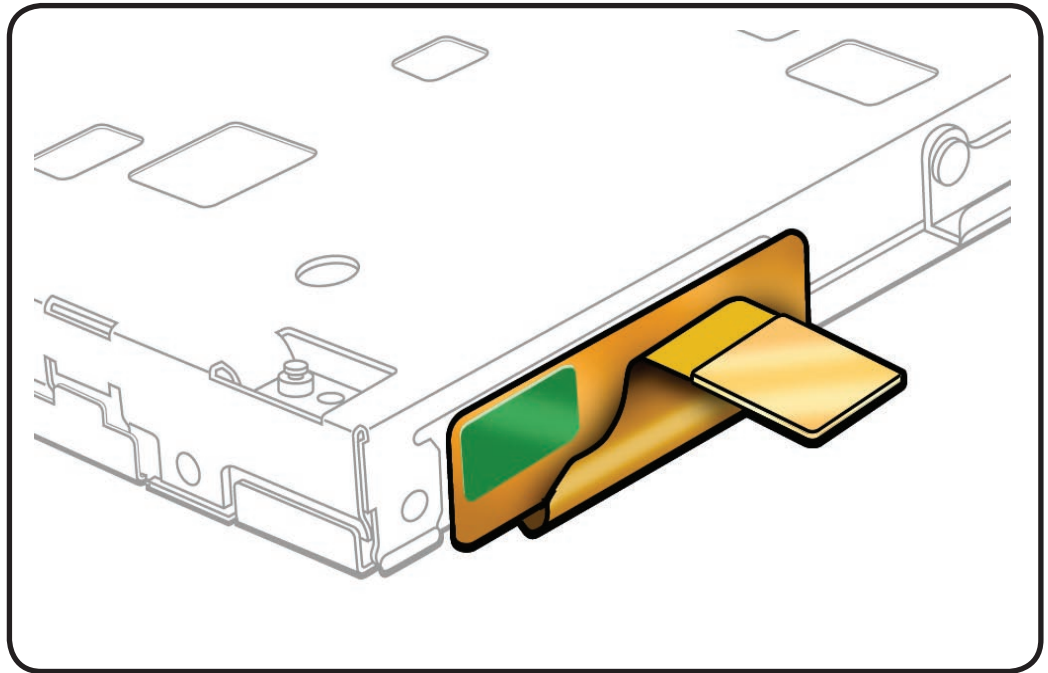
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Black stick





Removal

- 1 Handle optical drive by sides only.
- 2 With a black stick or fingernail, carefully wiggle flex cable off optical drive.



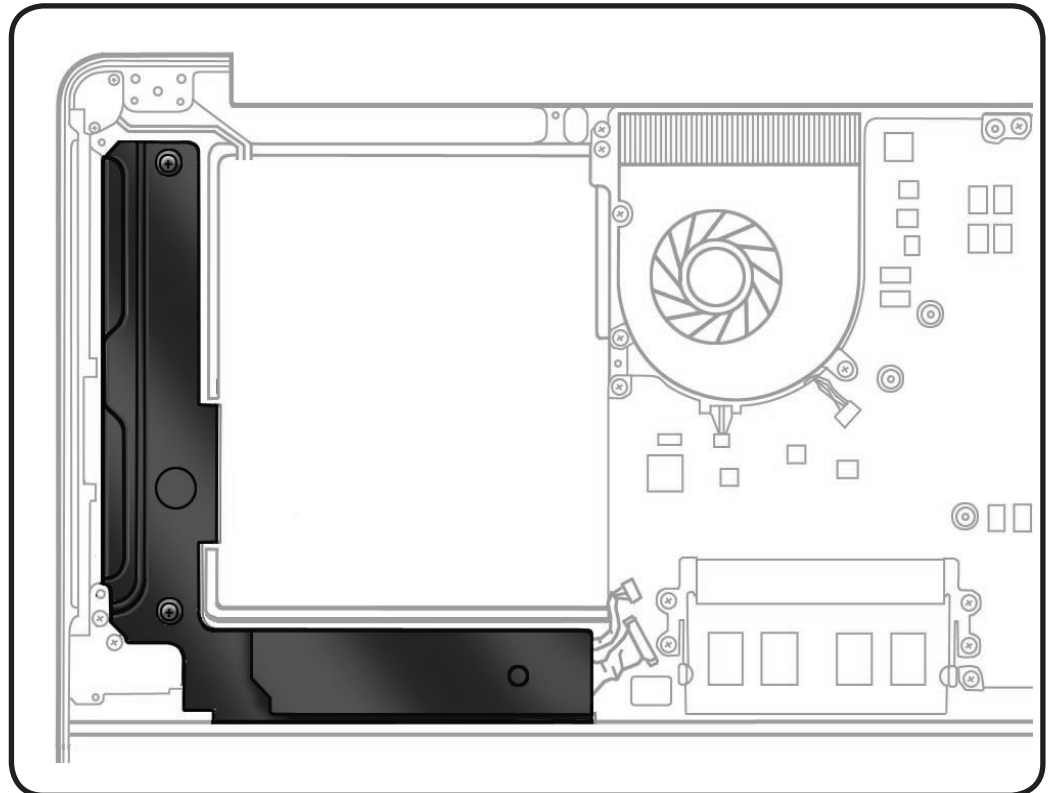


Right Speaker / Subwoofer

First Steps

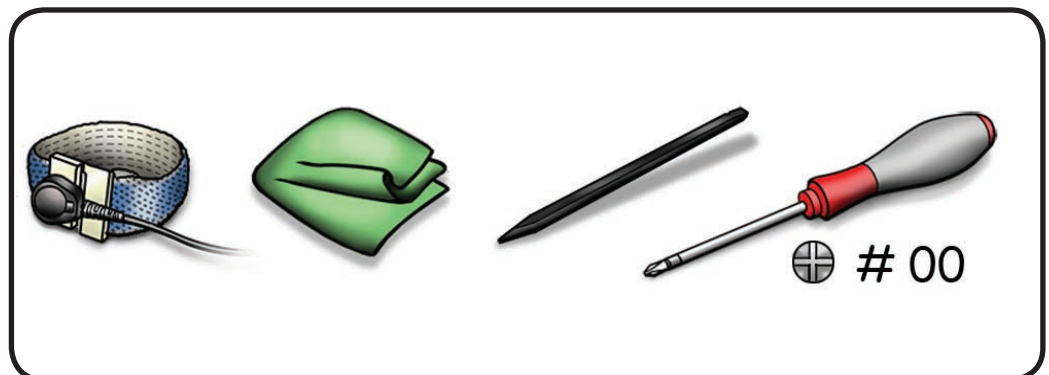
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Camera cable guide](#)
- [Optical drive](#)



Tools

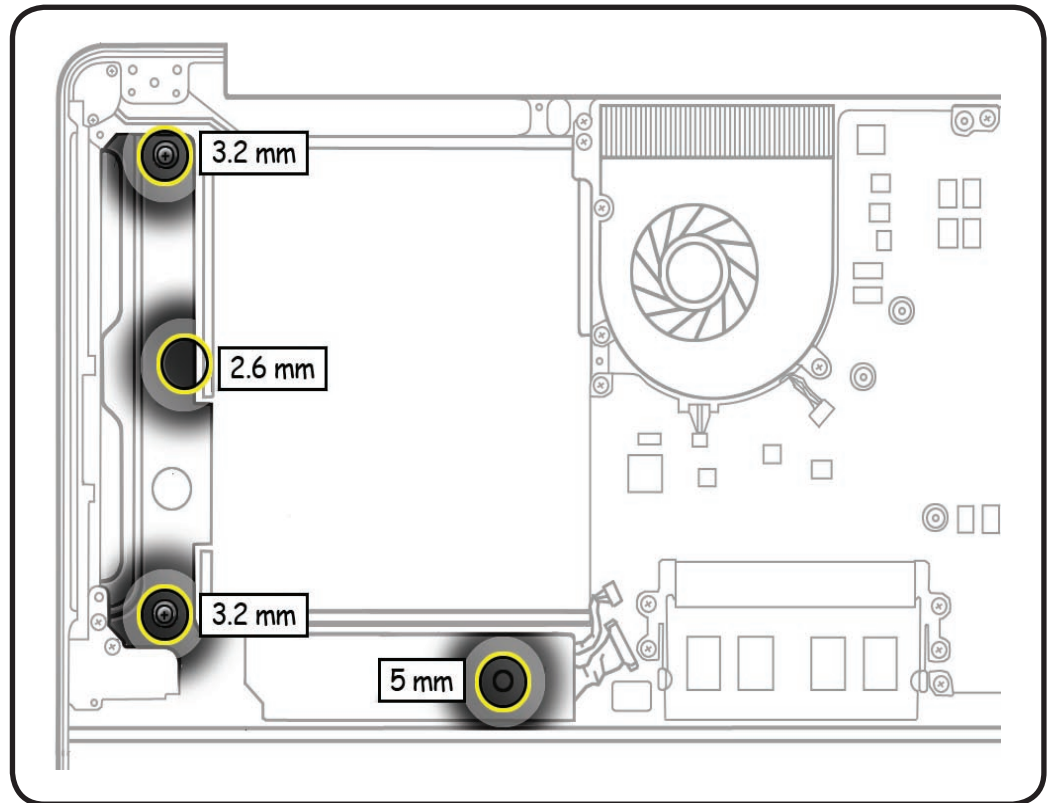
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Black stick
- Magnetized Phillips #00 screwdriver





Removal

- 1 Remove 4 screws:
 - 2 (3.2-mm), 922-8744
 - 1 (5.0-mm) 922-9754
 - 1 (2.6-mm), silver, 922-8747

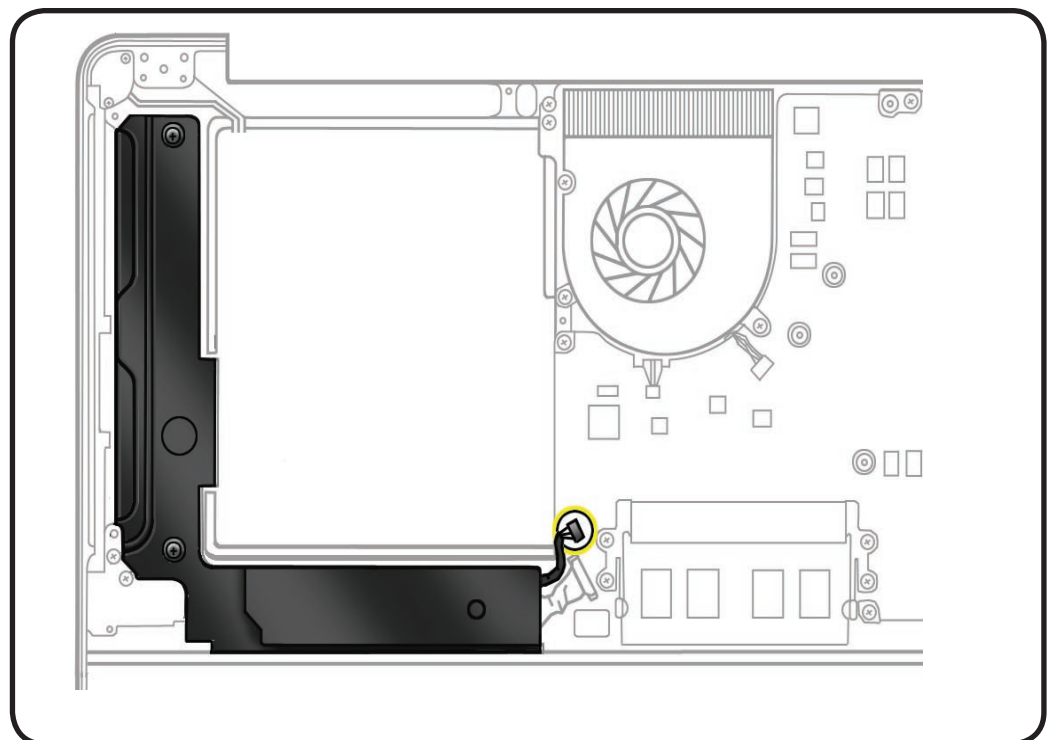


- 2 Disconnect speaker cable on logic board.

- 3 With a black stick, pry up speaker body to loosen adhesive.

Note: Pry around edges, or you will damage subwoofer.

Replacement Note:
If installing a new speaker, peel adhesive backing off speaker and install in top case



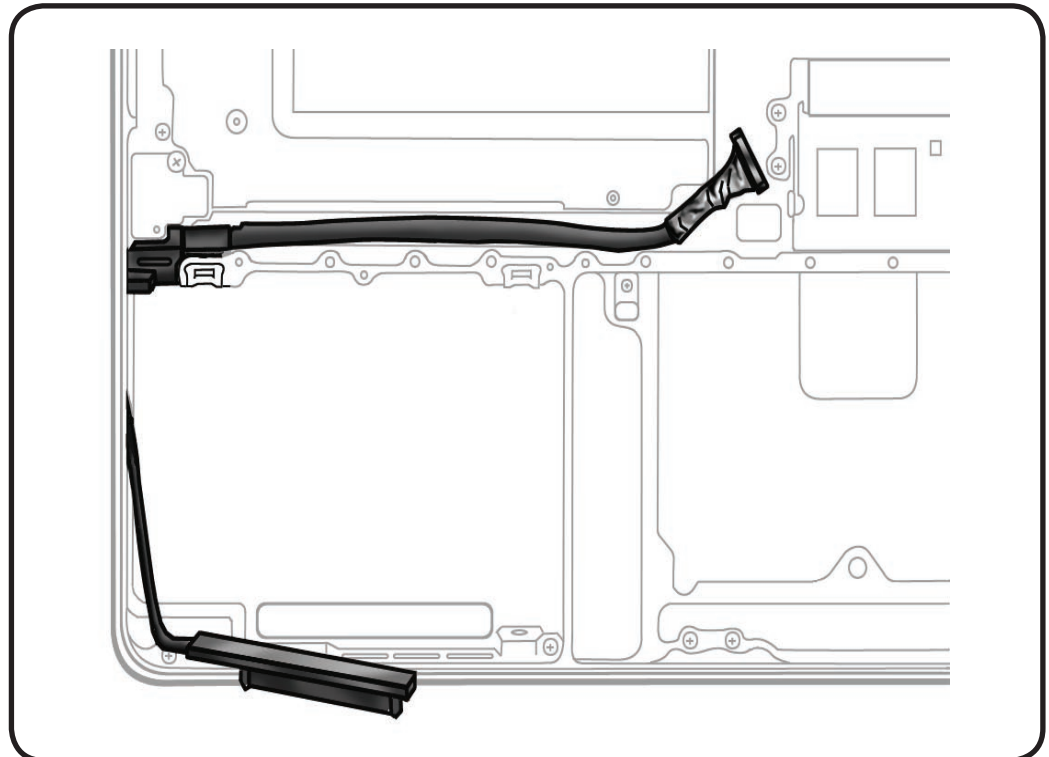


Hard Drive Connector Cable

First Steps

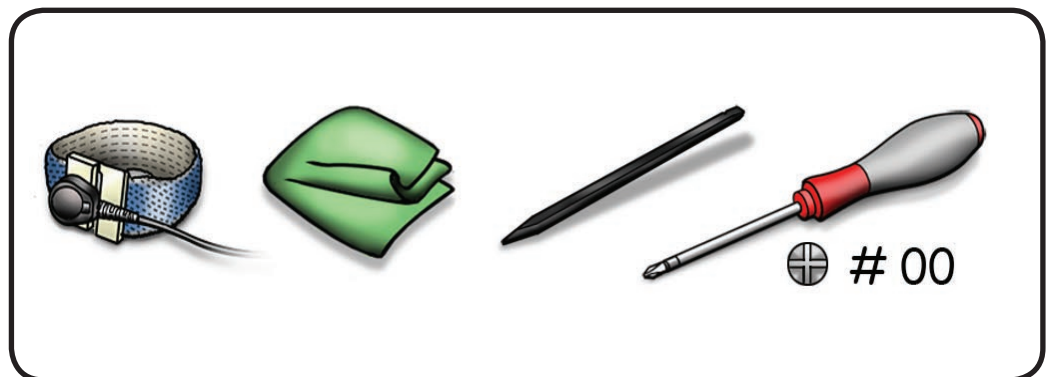
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Hard drive](#)
- [Midwall](#)
- [Camera cable guide](#)
- [Optical drive](#)
- [Right speaker/subwoofer](#)



Tools

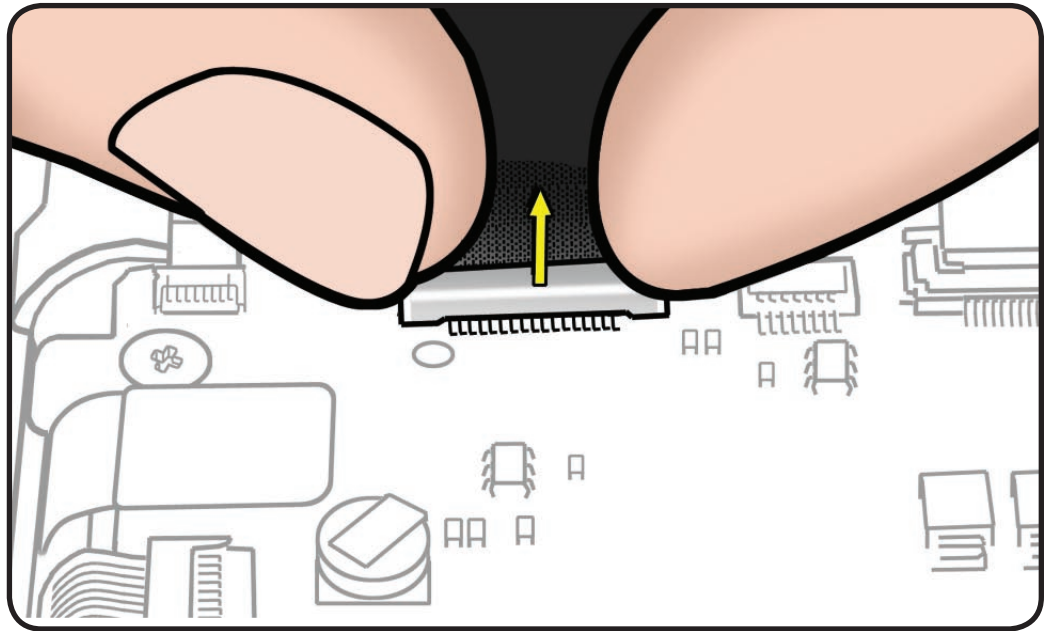
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Black stick
- Magnetized Phillips #00 screwdriver



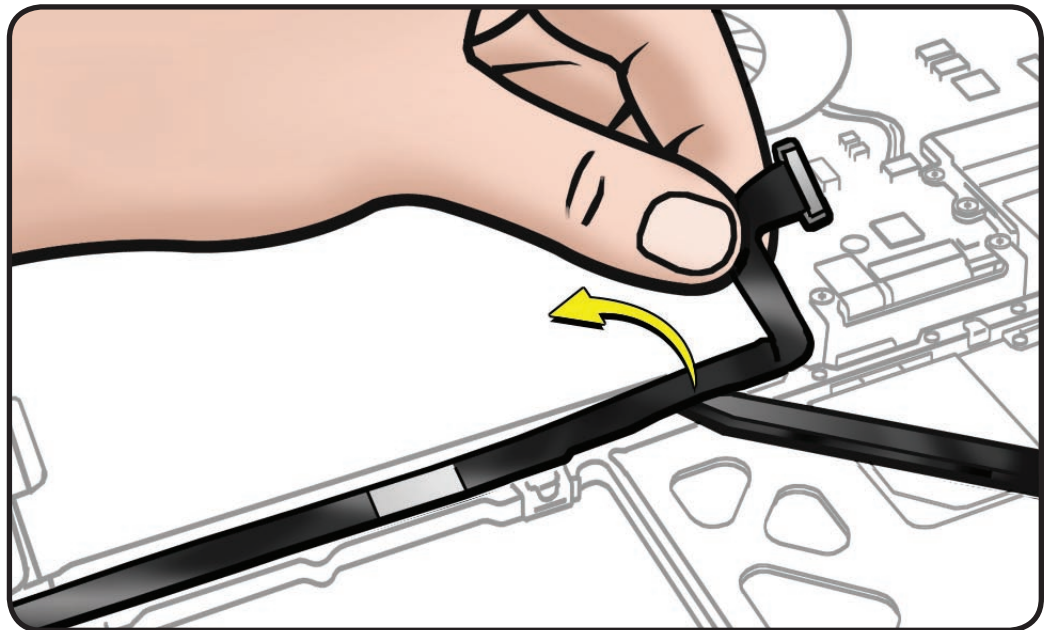


Removal

- 1 Pull straight up on connector on logic board to disconnect cable.

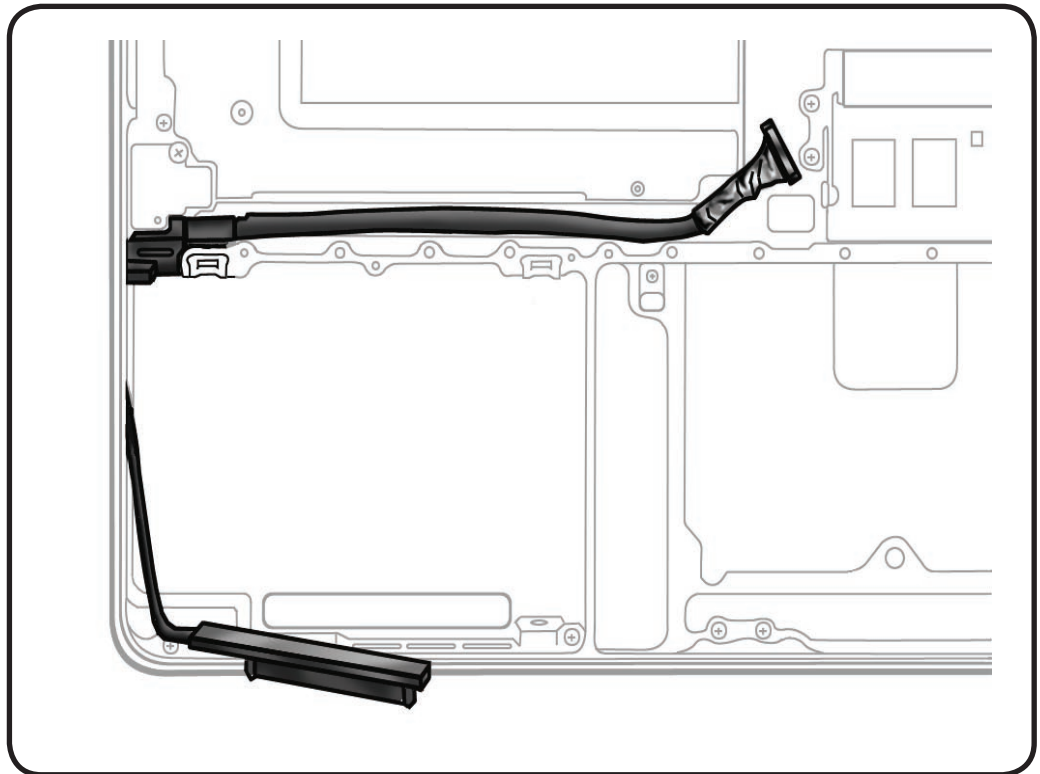


- 2 Peel up cable from top case.



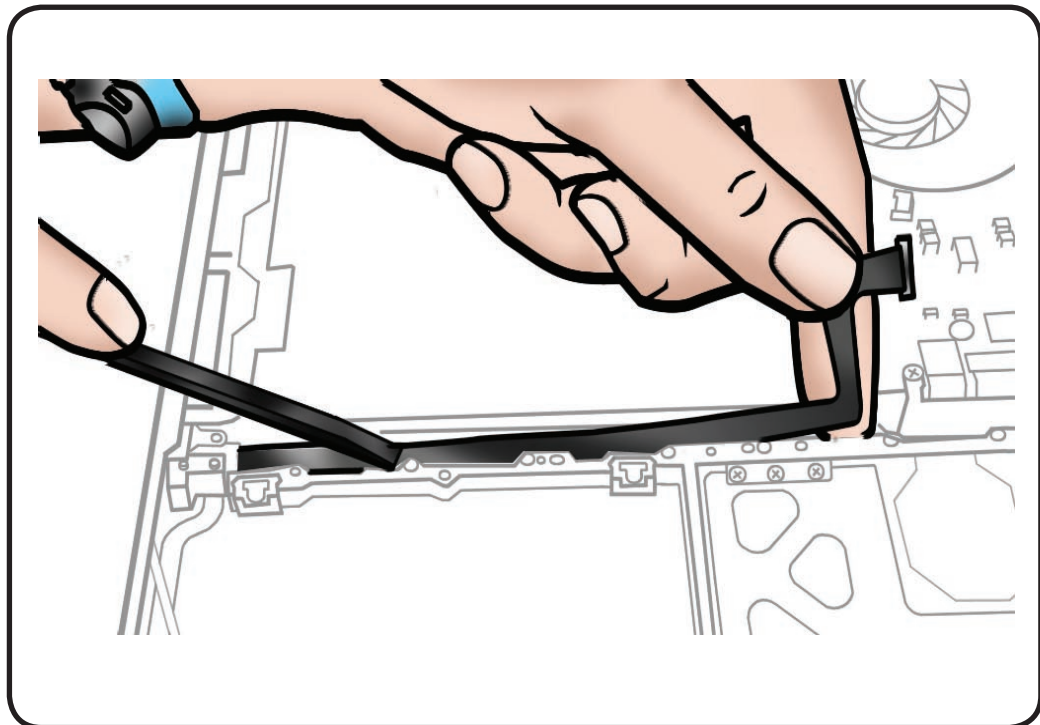


- 3 With a black stick, pry rubber bumper/cable out of top case.



Replacement

- 1 If installing new cable, peel adhesive backing off cable.
- 2 Press cable so it lays flat in top case.
- 3 Connect cable to logic board and hard drive.



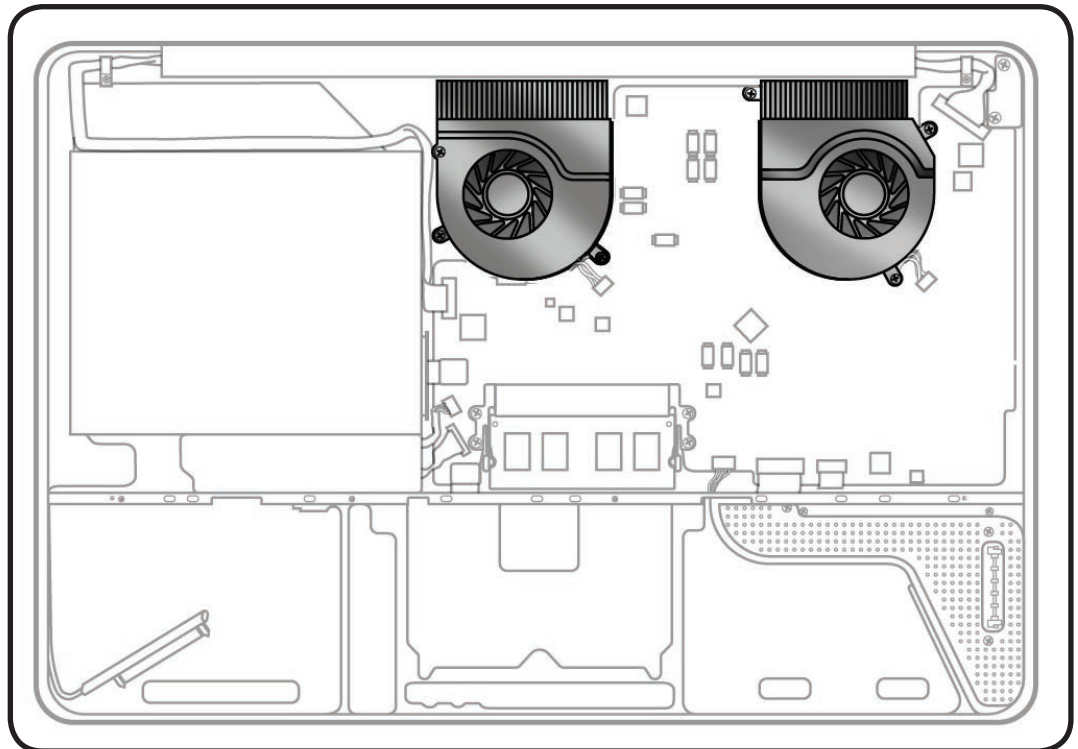


Fans

First Steps

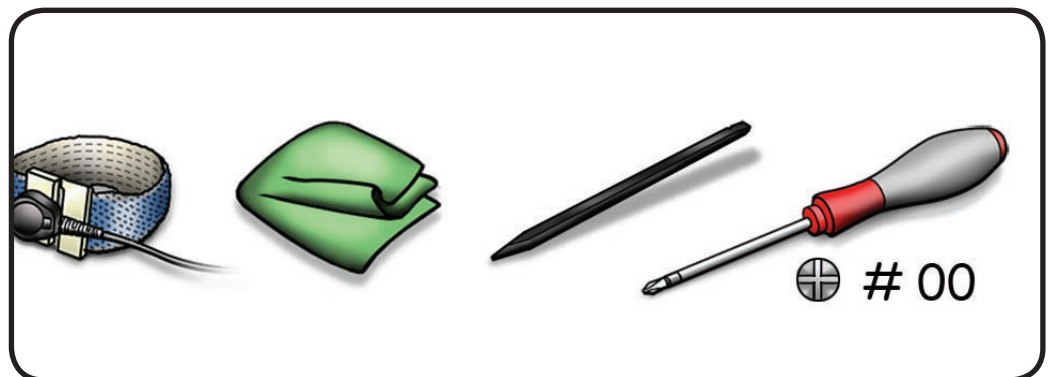
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)



Tools

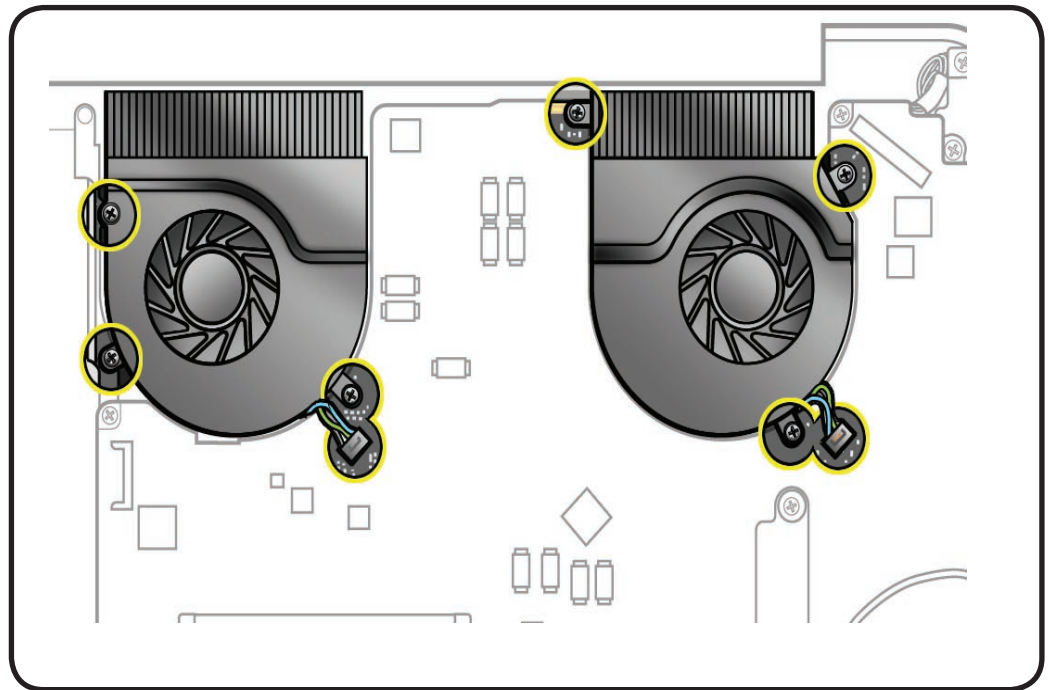
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver





Removal

- 1** Disconnect each fan cable.
- 2** Remove 6 identical (3.10-mm) screws (922-9754).
- 3** Lift fans out of top case.





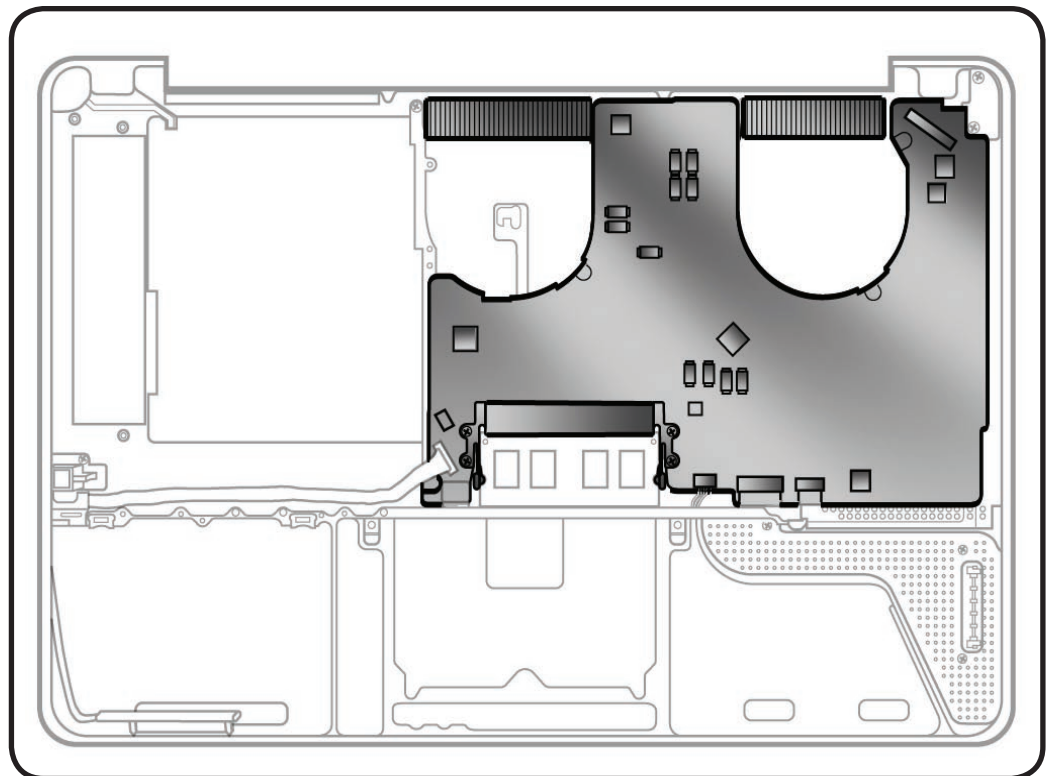
Logic Board



First Steps

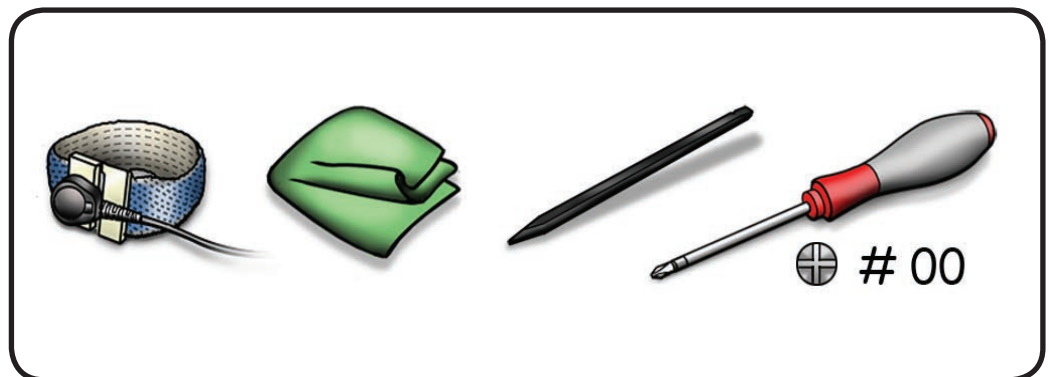
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Fans](#)
- [LVDS cable guide](#)
- [Memory](#)



Tools

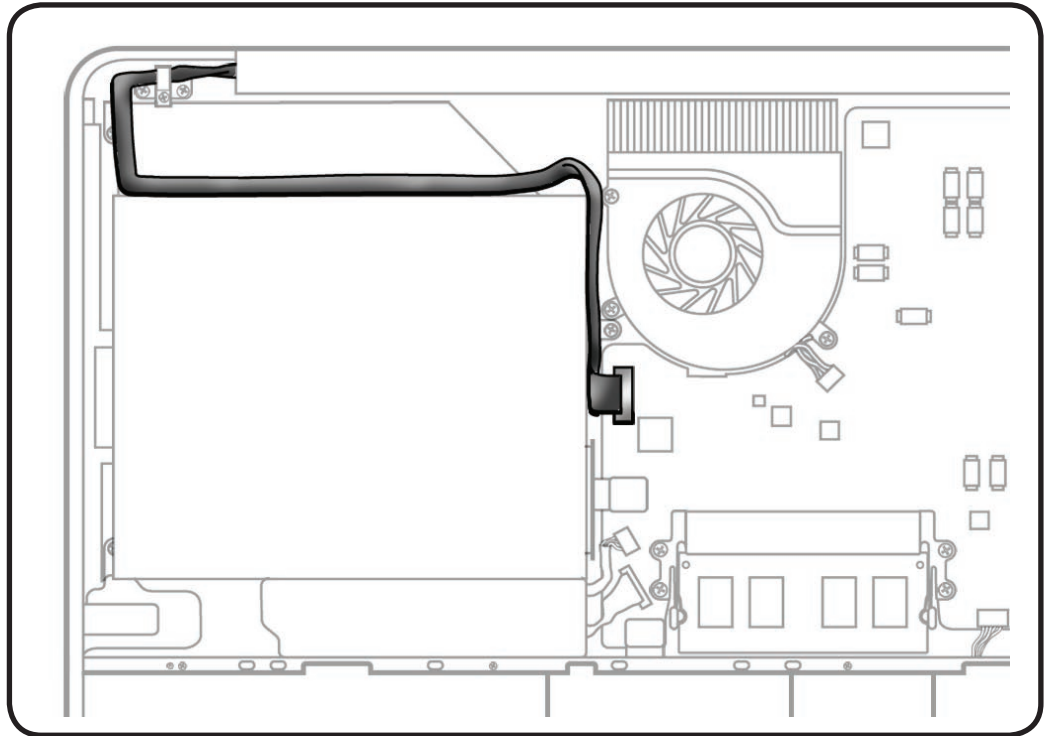
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Black stick





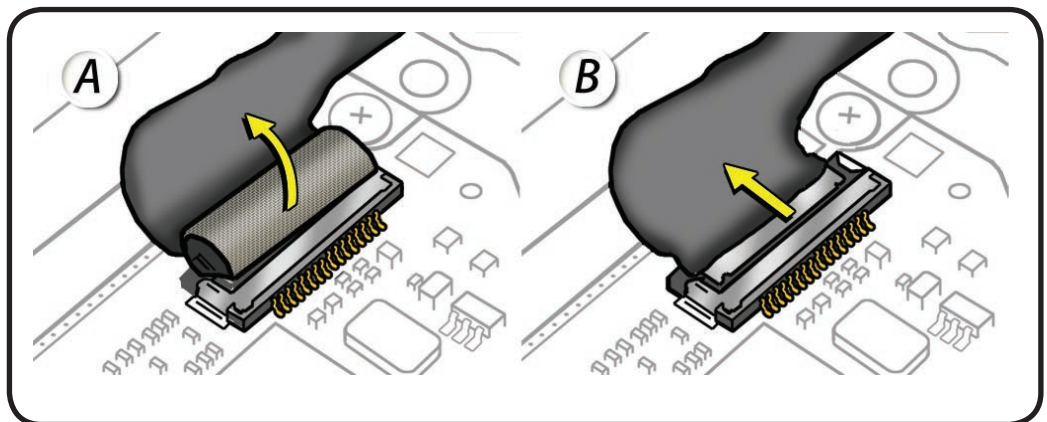
Removal

- 1 Locate camera cable.



- 2 Peel EMI gasket off camera cable connector (A).

- 3 Disconnect camera cable from logic board (B). Pull cable on same horizontal plane as the logic board.

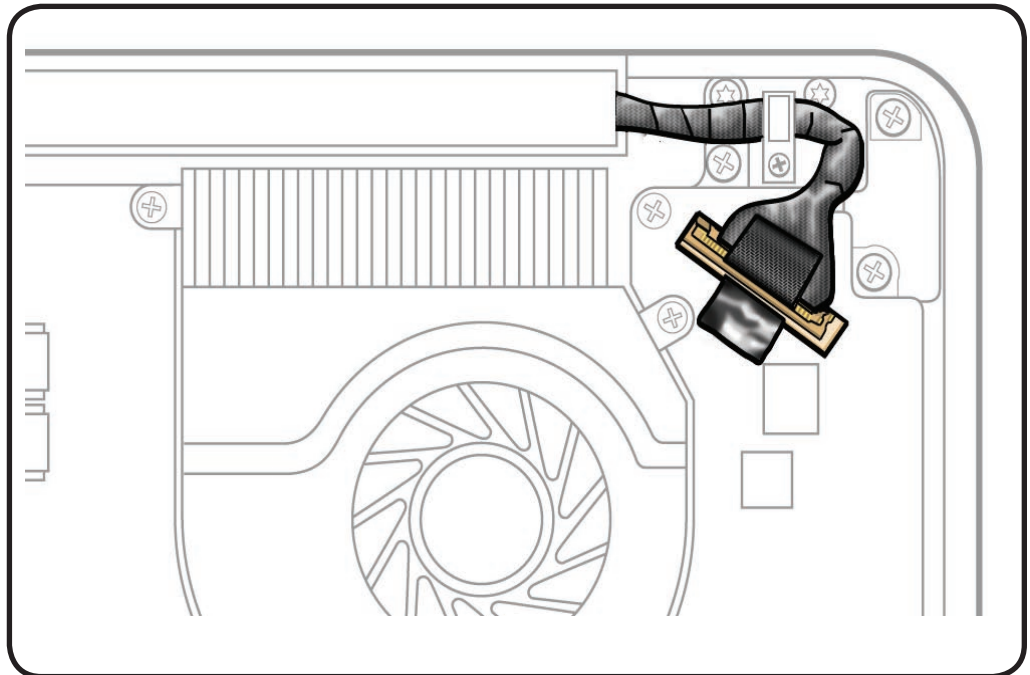




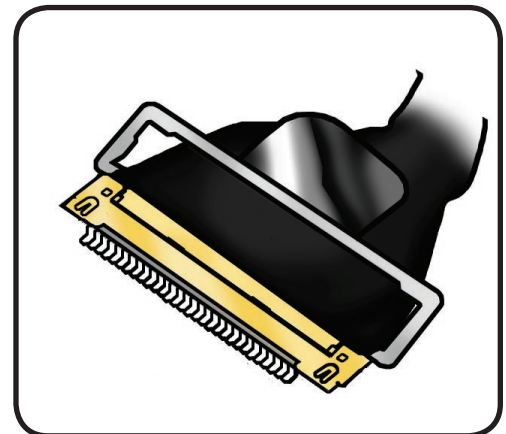
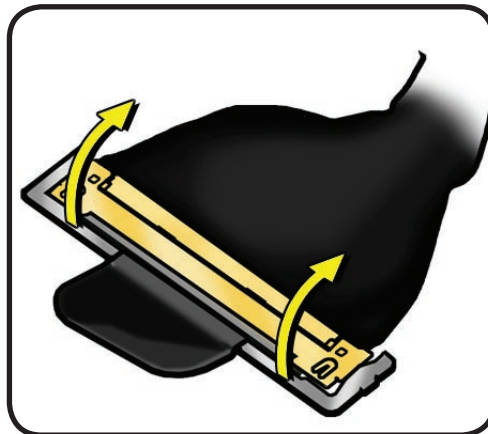
Caution: The LVDS cable/lock bar is very fragile, handle with care. A broken lock bar results in a display assembly replacement.



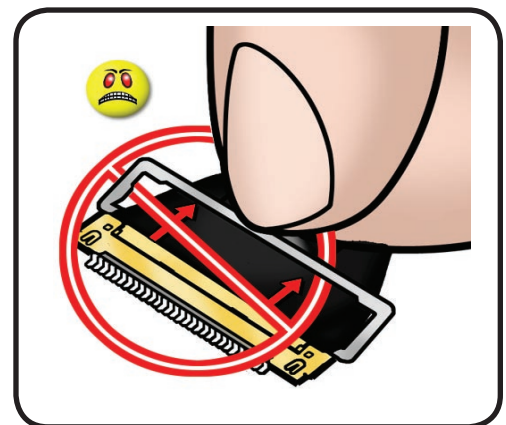
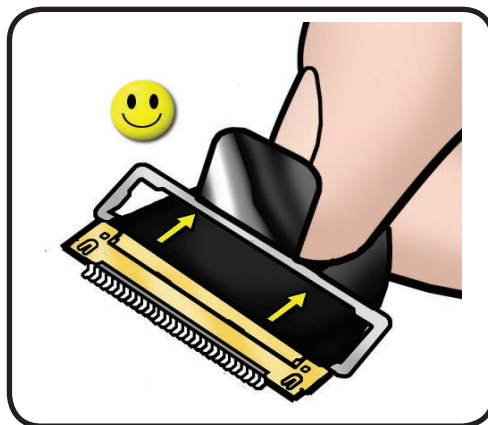
- 4 Peel EMI gasket off the top of LVDS cable, pull towards the fan.



- 5 To disconnect LVDS cable grasp black tab and gently swing LVDS lock bar up and back to unlock the cable

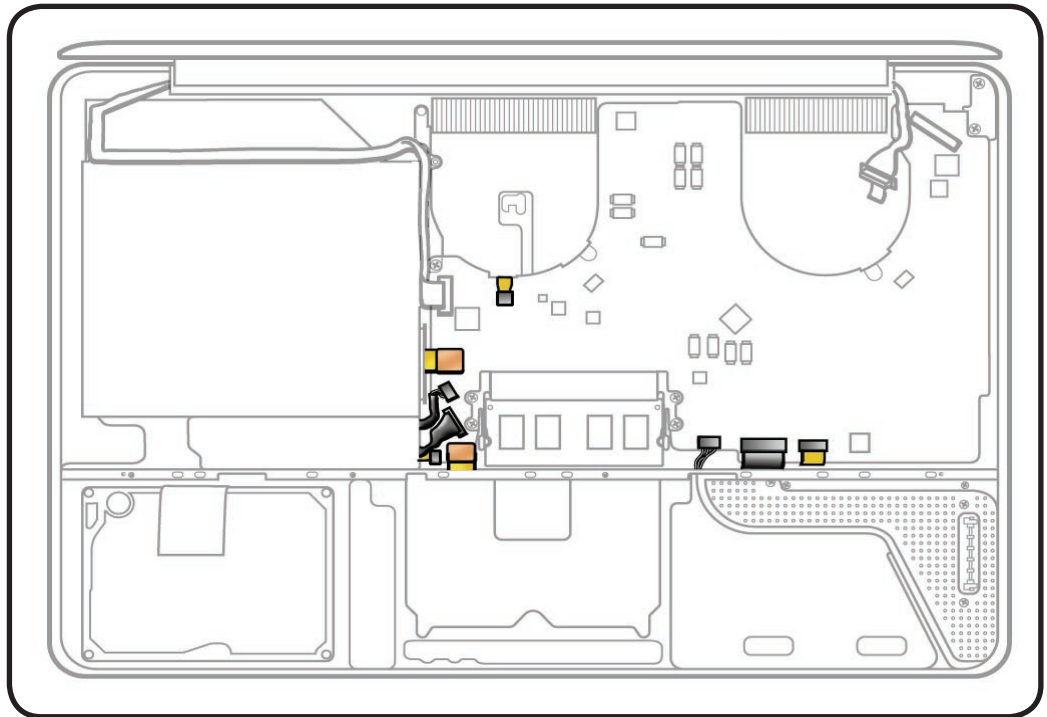


- 6 Slide cable out of connector by pulling the cable. Do not pull the black tab or lock bar..

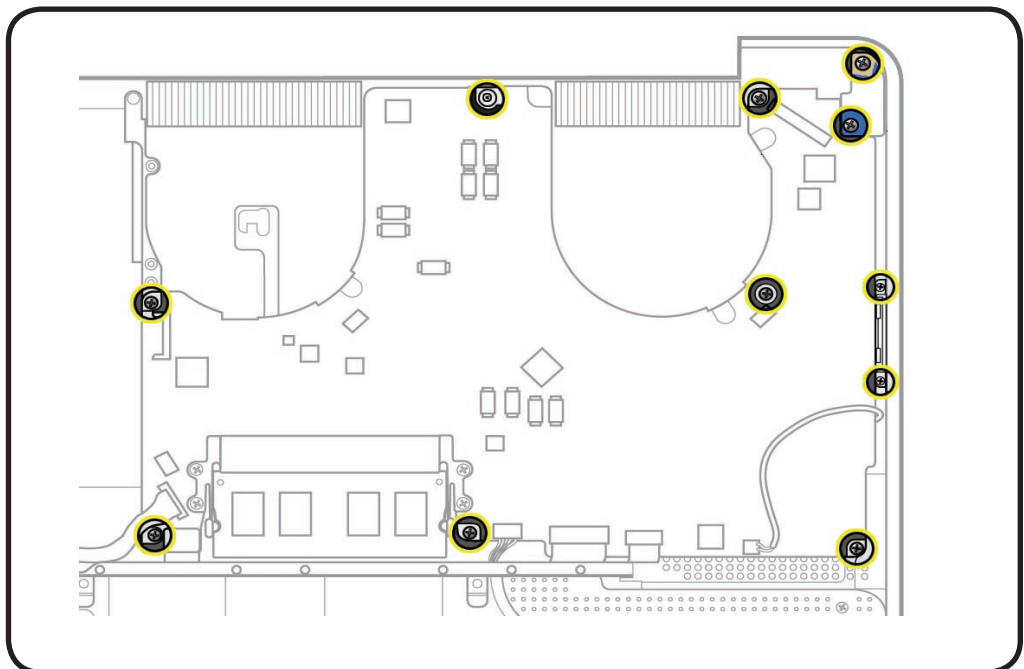




- 7 Caution:** Carefully disconnect 9 more cables (starting at top left, moving in counter clockwise direction):
- keyboard
 - optical drive
 - right speaker
 - hard drive
 - IR/sleep LED
 - trackpad
 - battery indicator light
 - battery power
 - express card cage

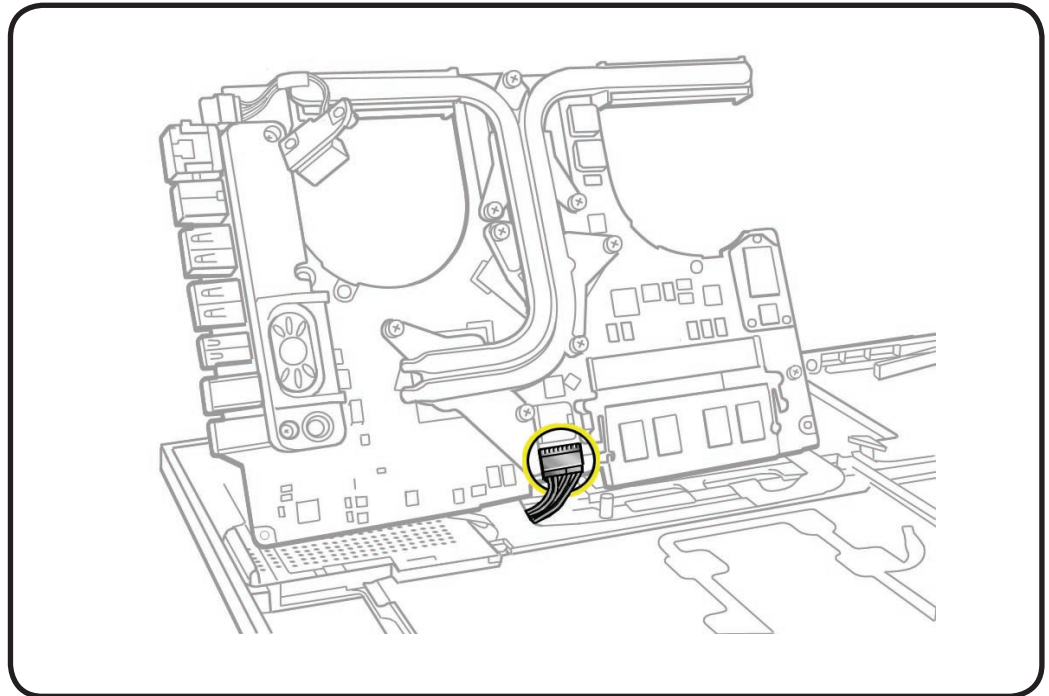


- 8** Remove 11 screws:
- 7 logic board (3.2-mm) 922-9754
 - 2 magnetic power module (7.09-mm) 922-8645
 - 2 shoulder 3.5-mm (922-8753) screws on I/O bracket.





- 9** Tilt board vertically and on the underside disconnect: the battery power cable.
- 10** Lift logic board from top case.
- 11** Do not remove the speaker, magnetic power module (MPM), microphone and heatsink if reinstalling the same logic board.
- 12** If replacing the logic board with a new one, transfer:
 - left speaker
 - microphone
 - heatsink
 - memory
 - magnetic power module



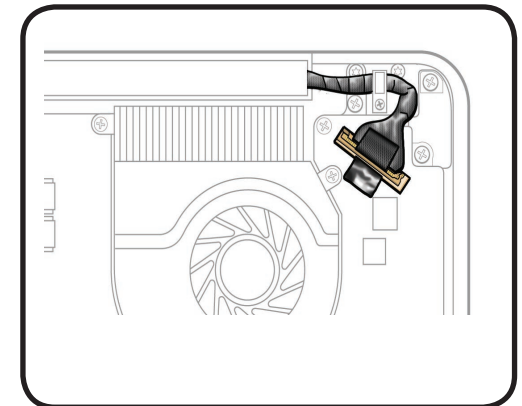
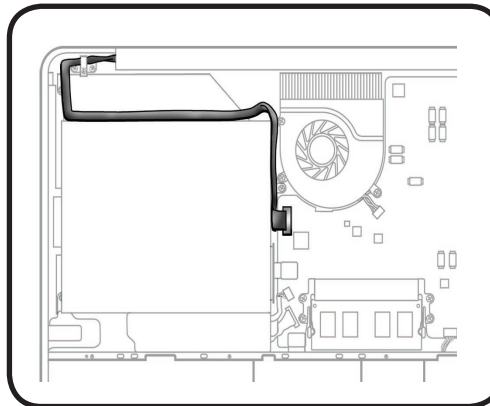
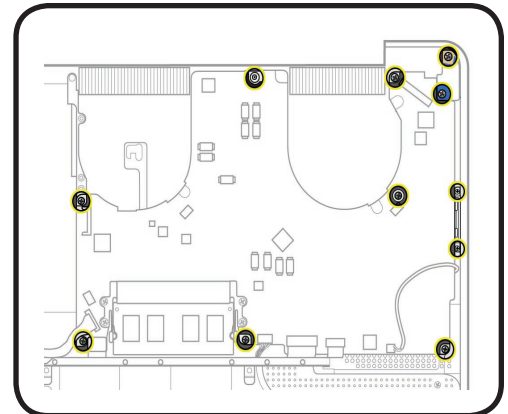
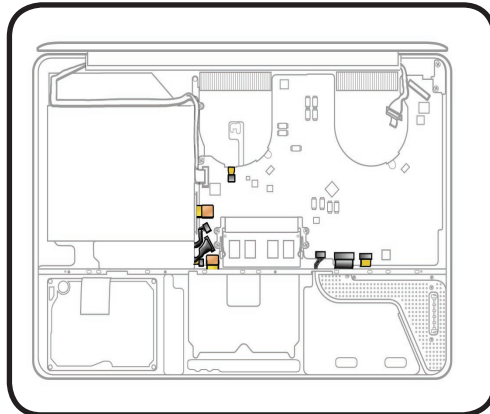


Replacement

- 1 Connect battery power cable to underside of board.
- 2 Connect 9 logic board cables.
- 3 Install 11 screws.
- 4 Carefully connect display cables.



IMPORTANT: Do NOT plug in any audio cables when the main logic board is not mounted into the top case. The top case prevents audio jacks from bending at an angle and pushing cables to far into the connector causing damage. The symptoms of a damaged connector are no audio or the connector reports the wrong state, like the plug is stuck.



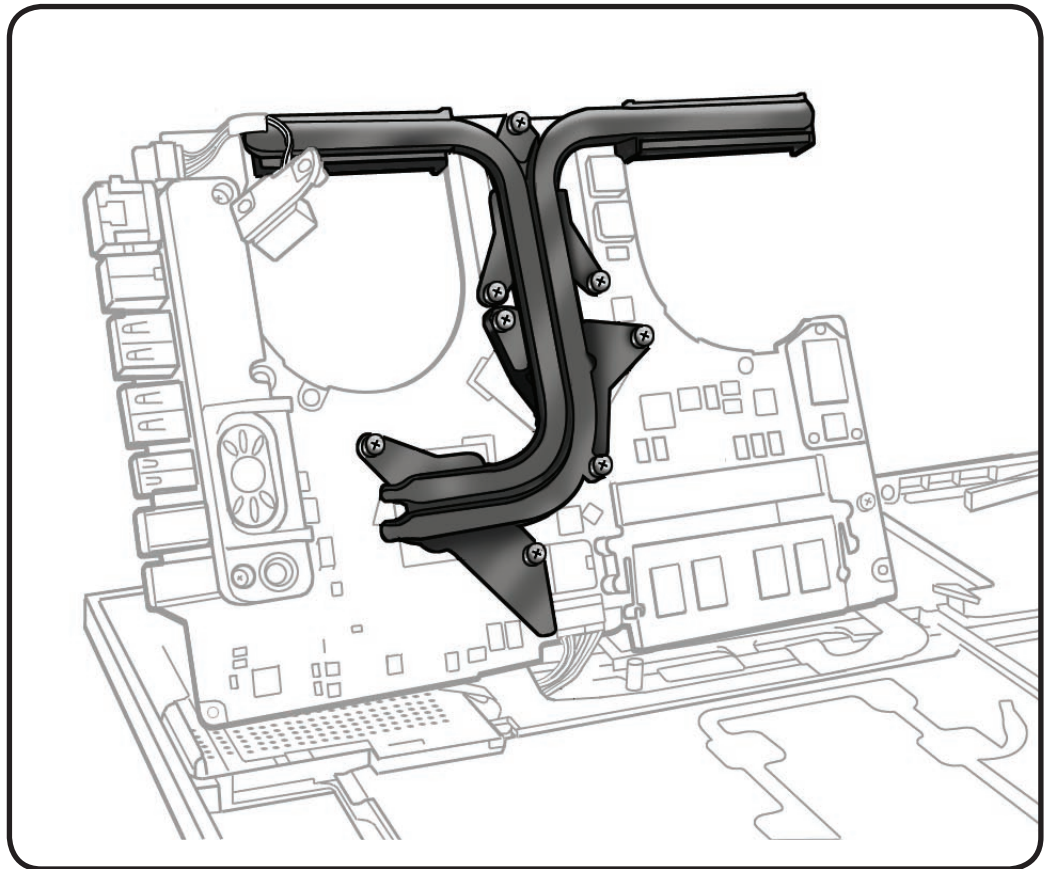


Heatsink

First Steps

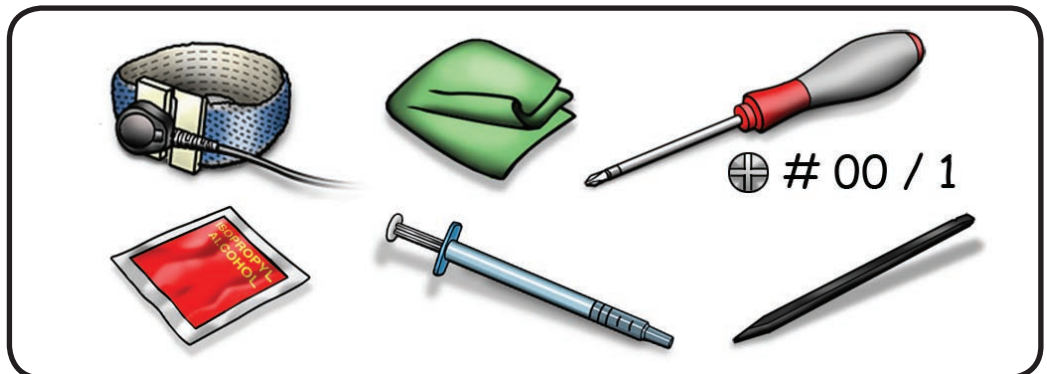
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Fans](#)
- [LVDS cable guide](#)
- [Memory](#)
- [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



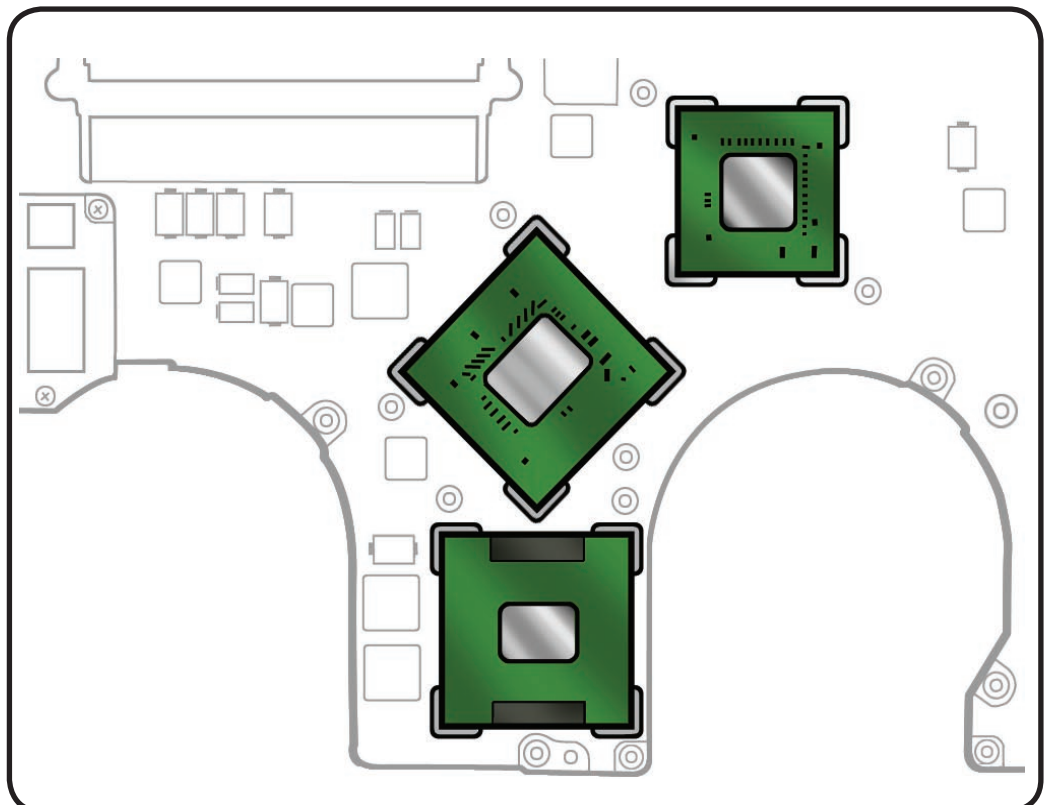
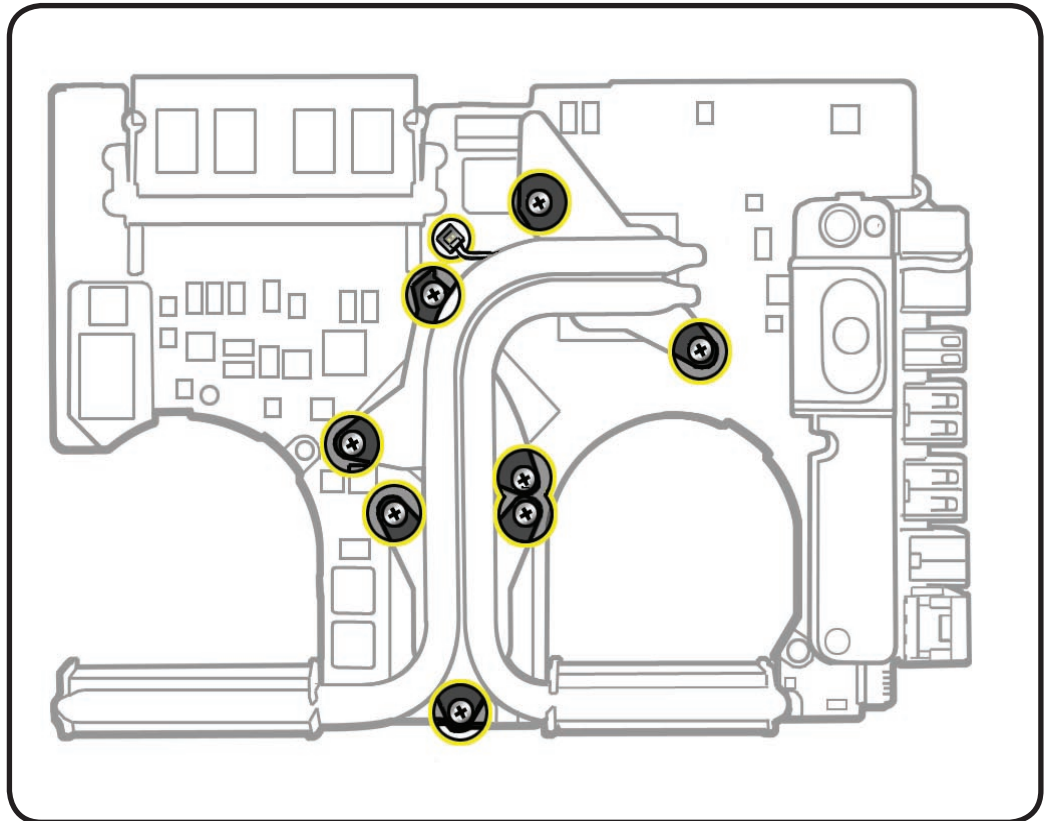


Removal



Caution: Hold heatsink by edges, not by the heat pipes:

- 1 Disconnect the thermal sensor.
- 2 Remove 8 (8.39-mm) screws.
- 3 Keeping heatsink parallel to logic board, gently wiggle the heatsink to loosen the bond to the board.
- 4 With a black stick, scrape off thermal grease and use alcohol pad to clean thermal pads and microprocessors.





Replacement

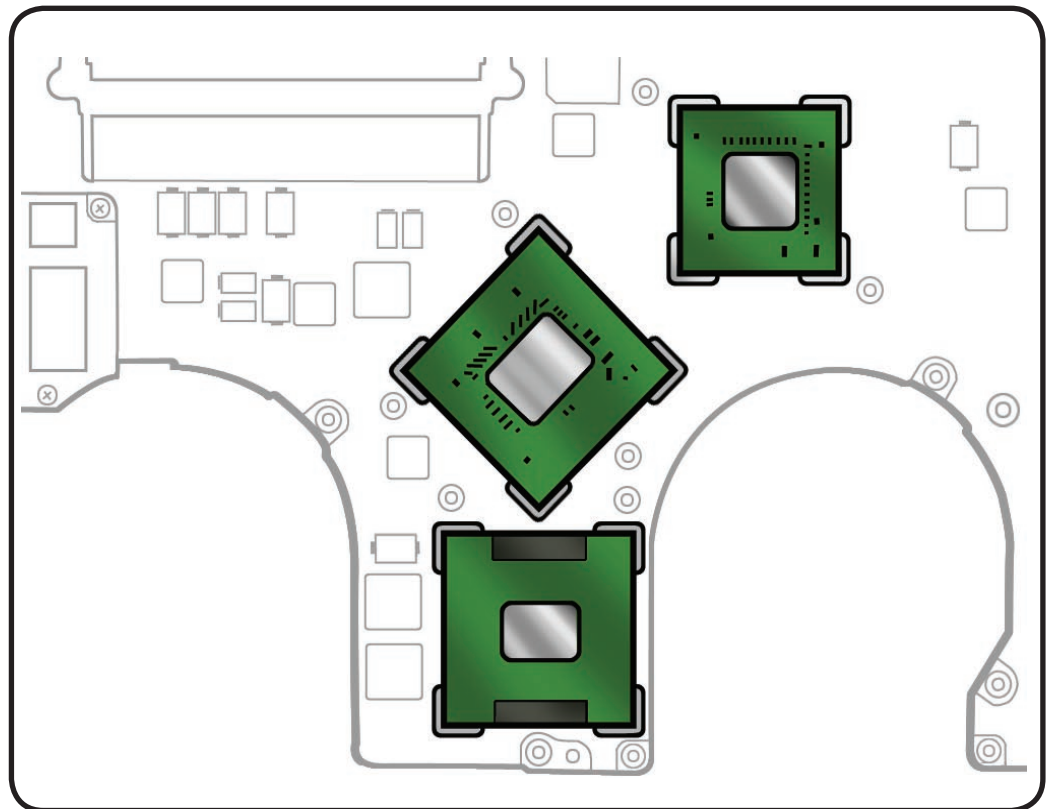
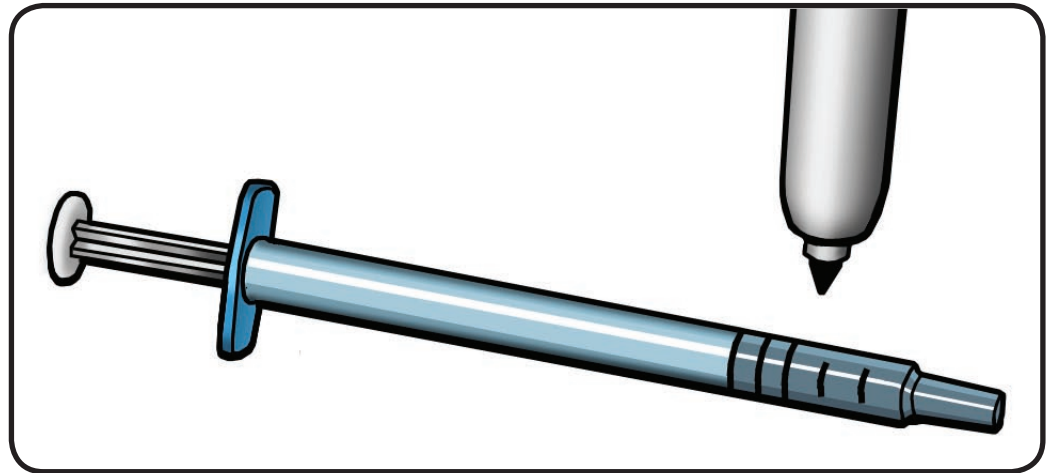
Important: New heatsinks include pre-applied thermal grease. Follow steps 1-2 only if re-installing the original heatsink.

- 1 Caution:** The syringe contains enough thermal grease for 3 microprocessors.

Use a pen to mark the syringe in thirds.

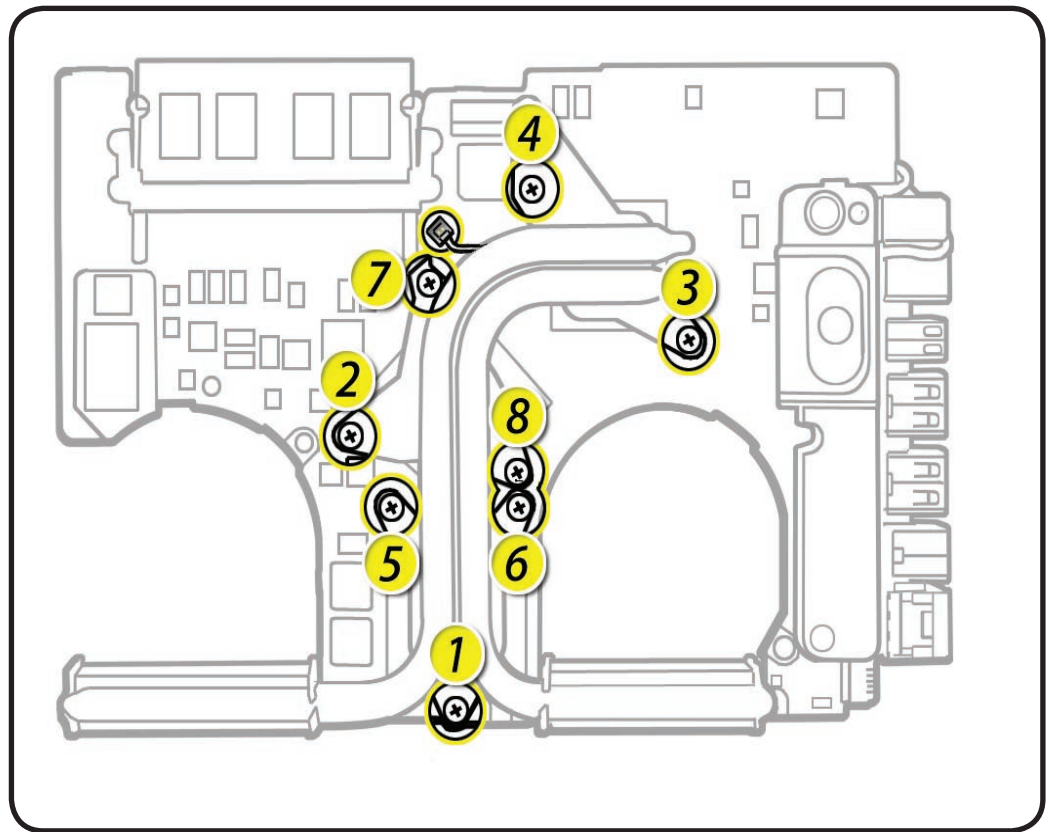


- 2** Inject 1/3 of grease on the center of each microprocessor.
- 3 Important:** Connect the thermal sensor. The computer will not function with the sensor disconnected.
- 4** Lower the heatsink over the logic board.





- 5** Install heatsink screws in order, 1/2 way first, then tighten the rest of the way.



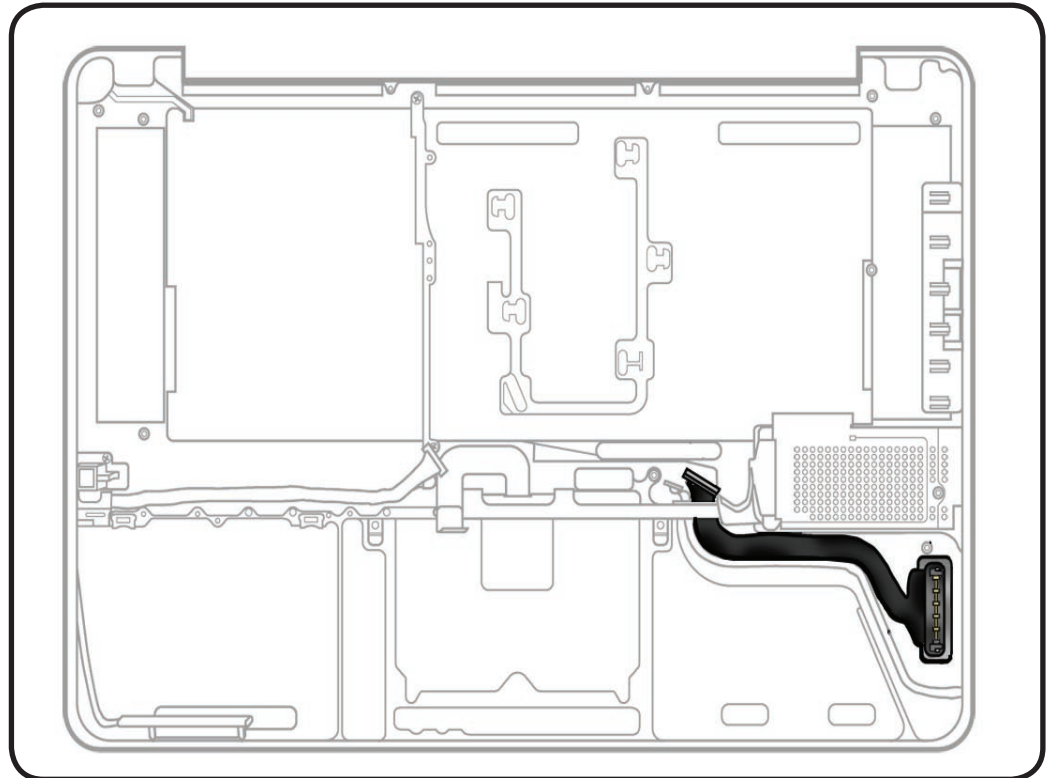


Battery Power Cable

First Steps

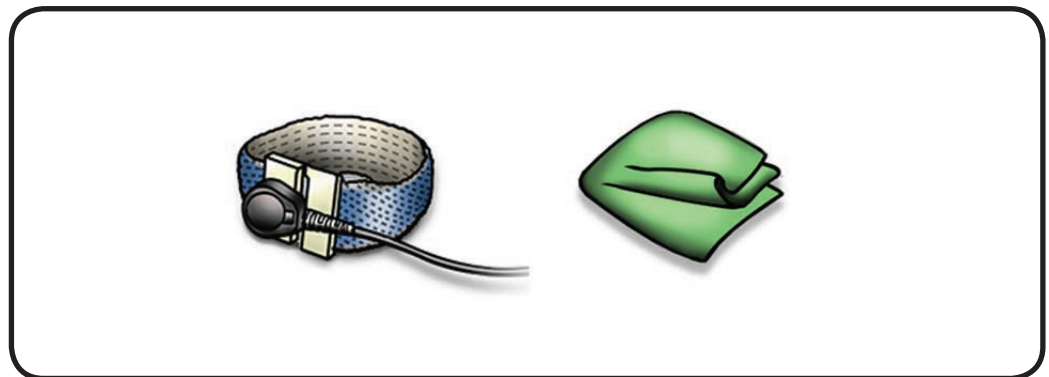
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Battery connector cover](#)
- [Logic board](#)



Tools

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

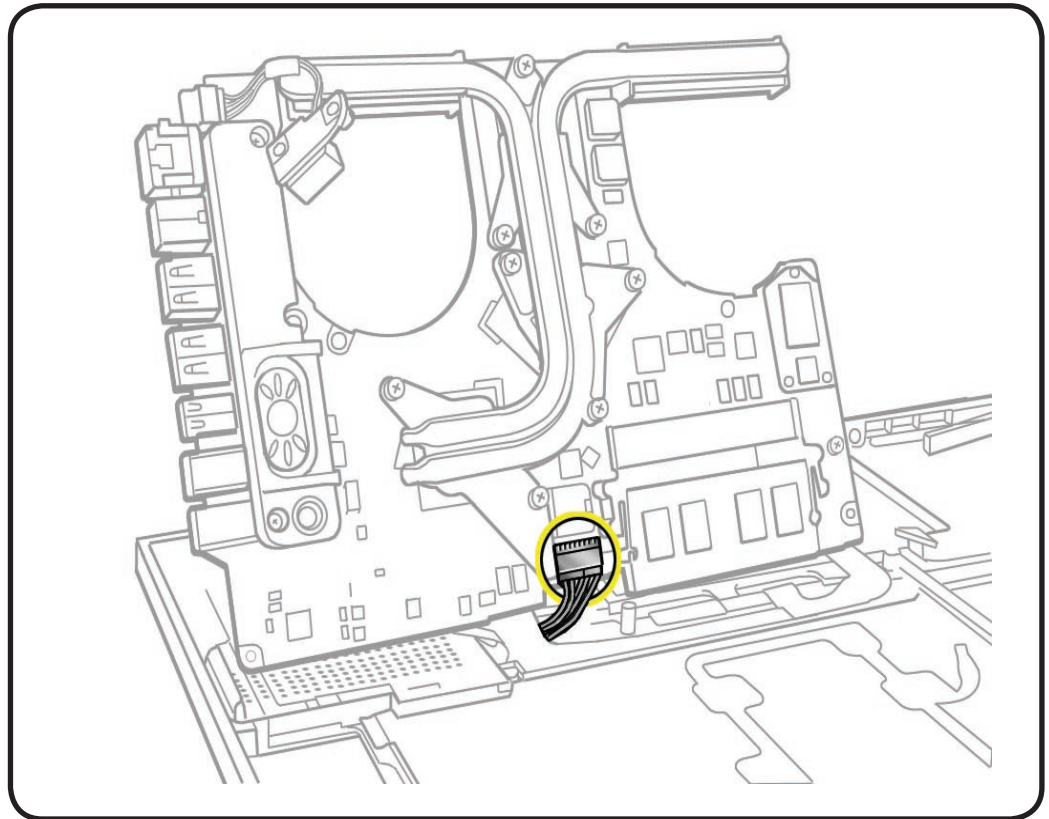




Removal

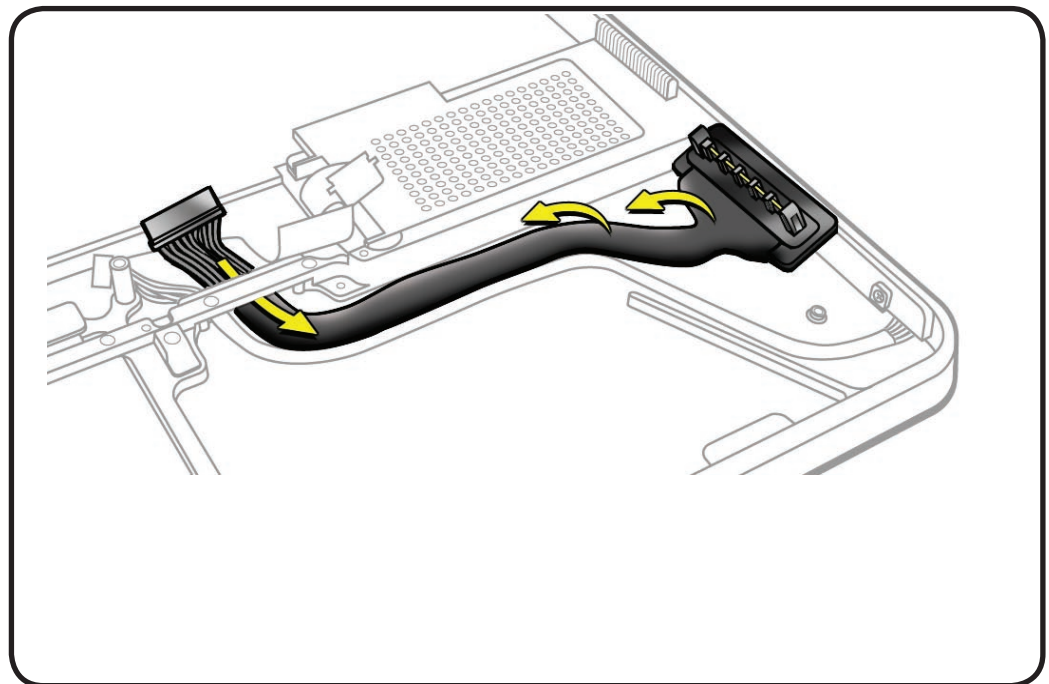
- 1 Disconnect the battery power cable, from the underside of the logic board.

Note: The cable can be disconnected without removing the logic board; however, to reconnect the cable, the logic board must be removed to access the connector.



- 2 Pull the cable under midwall and peel it up from the top case.

Replacement Note: Press cable to top case so it lays flat.



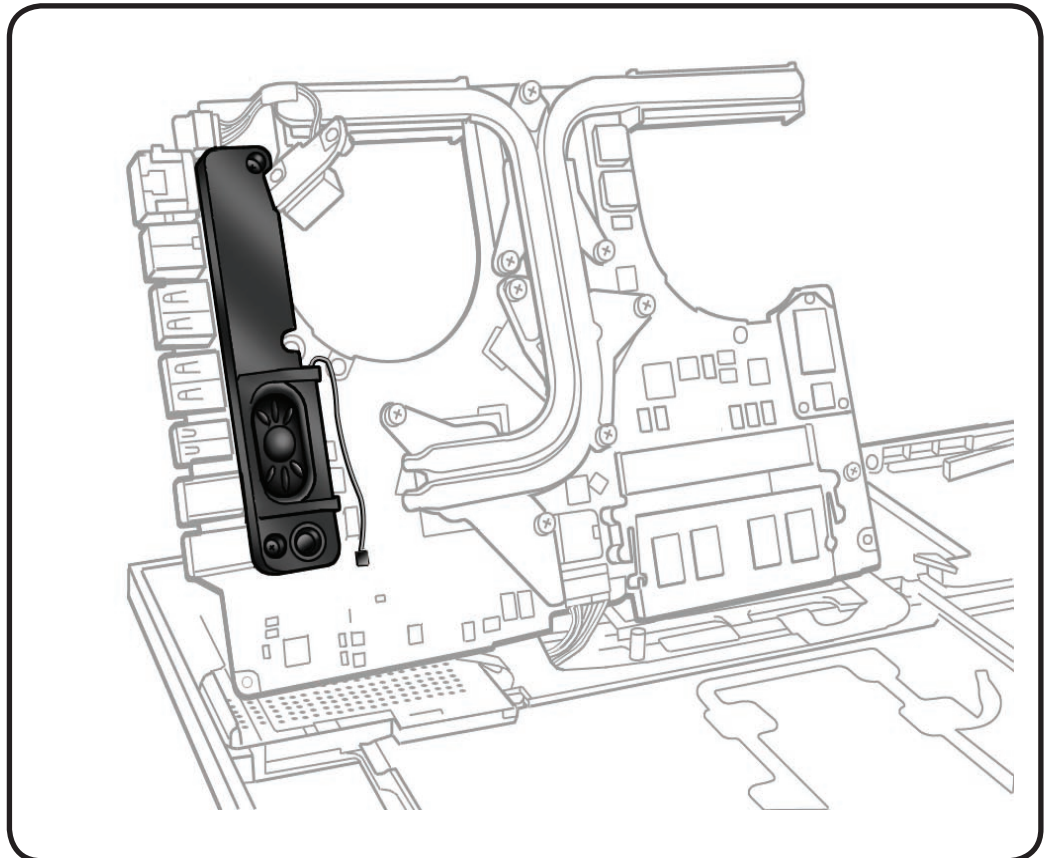


Left Speaker

First Steps

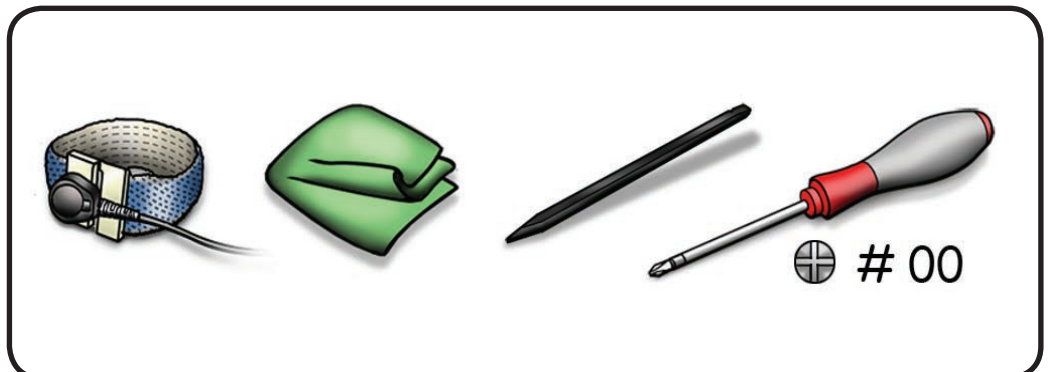
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Fans](#)
- [LVDS cable guide](#)
- [Logic board](#)



Tools

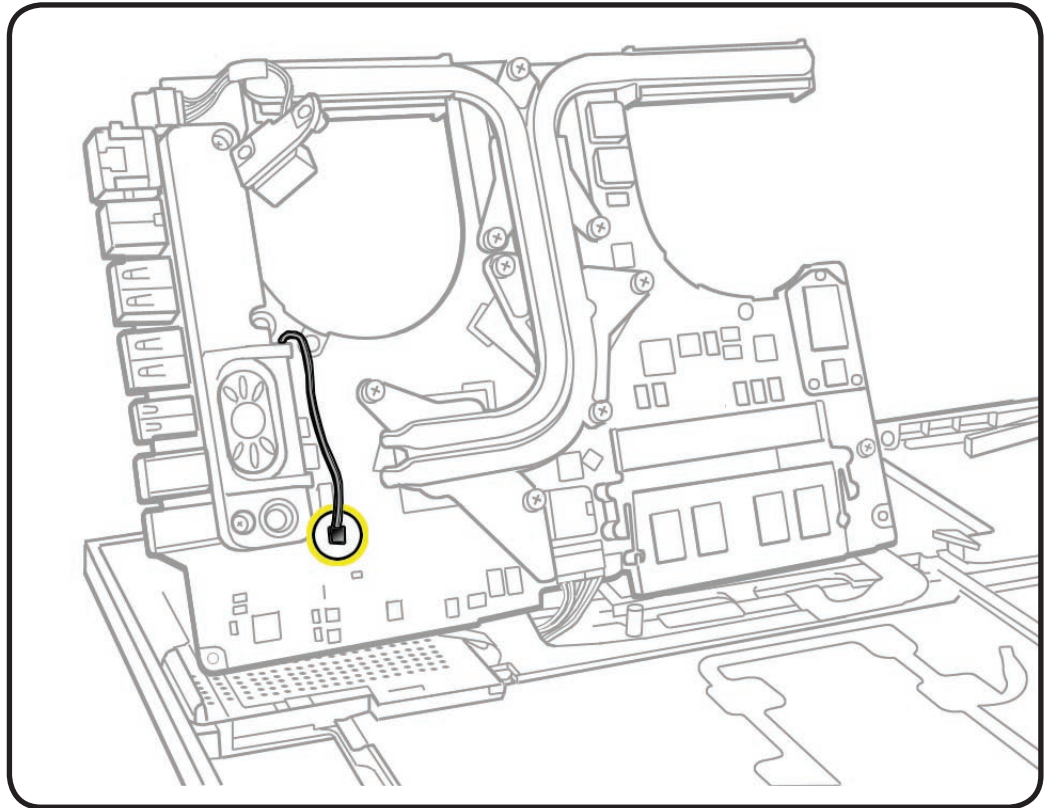
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetic Phillips #00 screwdriver



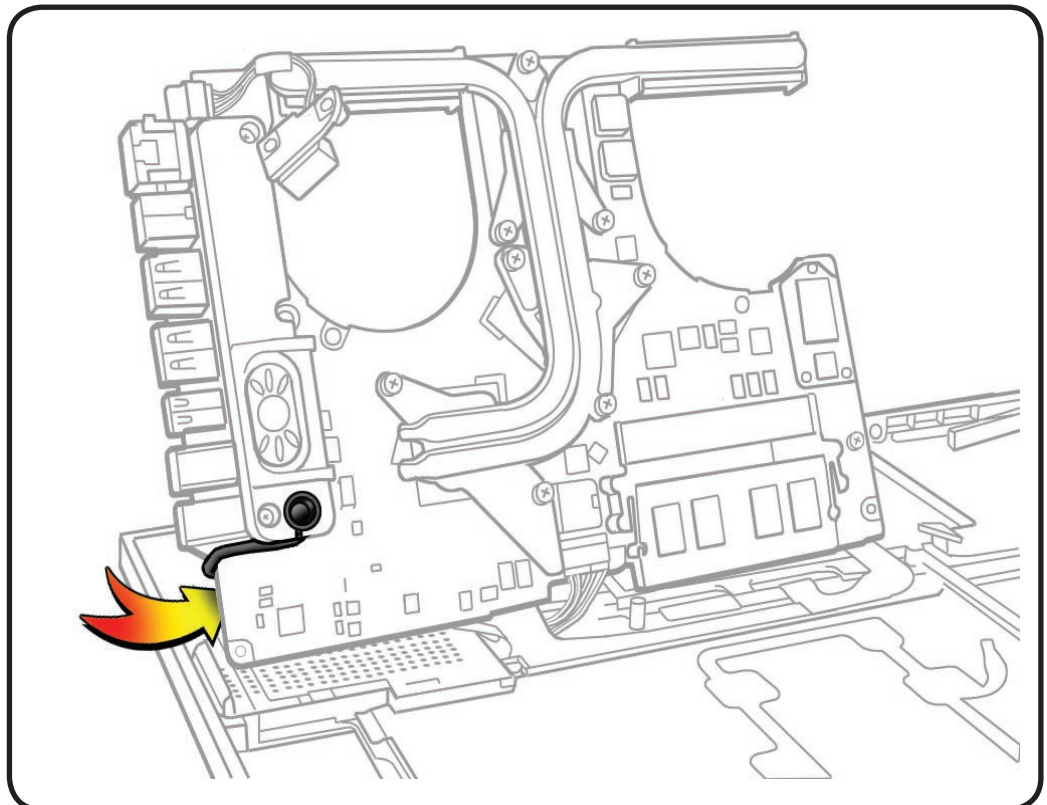


Removal

- 1 Disconnect the speaker cable from logic board.



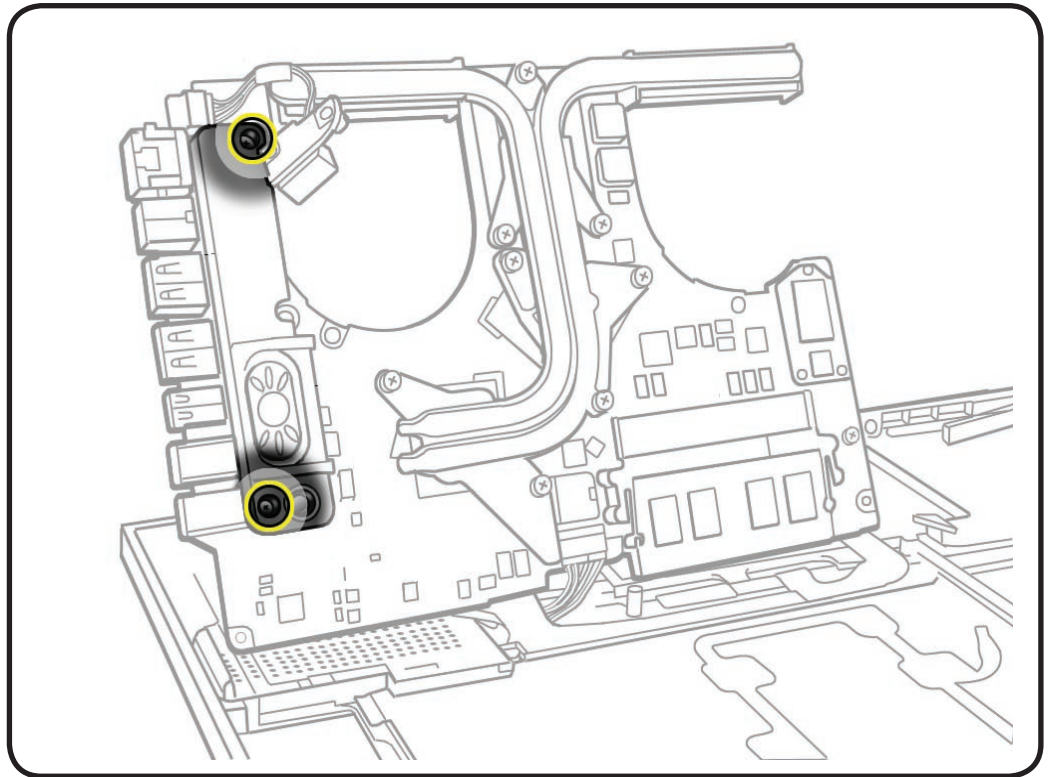
- 2 Disconnect microphone cable from the connector on top side of logic board.





- 3** Remove 2 (5-mm) screws 922-8744.
- Note:** Do not touch the soft speaker cone.

Replacement Note: If replacing the speaker, transfer microphone to replacement speaker.



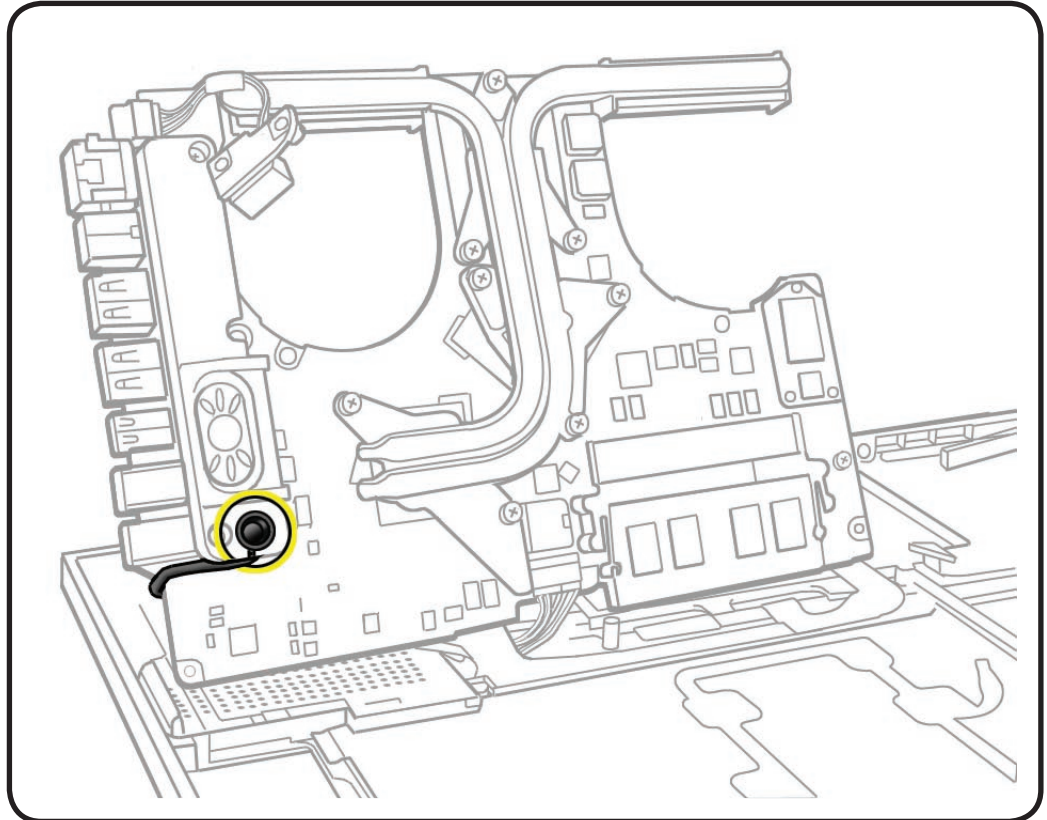


Microphone

First Steps

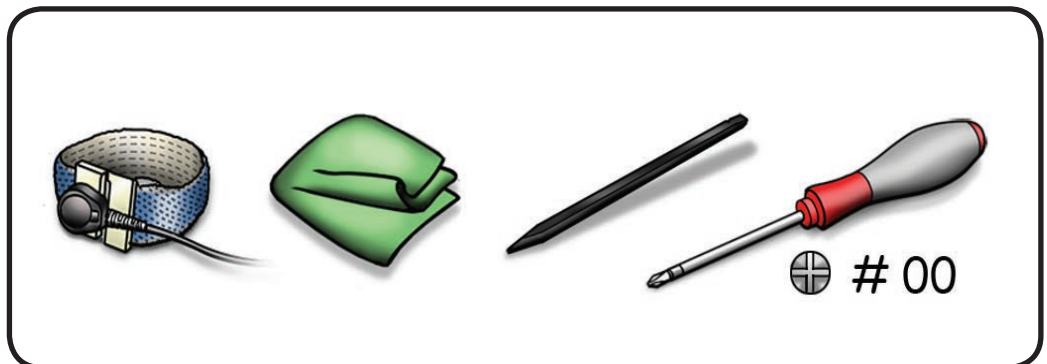
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Fans](#)
- [LVDS cable guide](#)
- [Logic board](#)



Tools

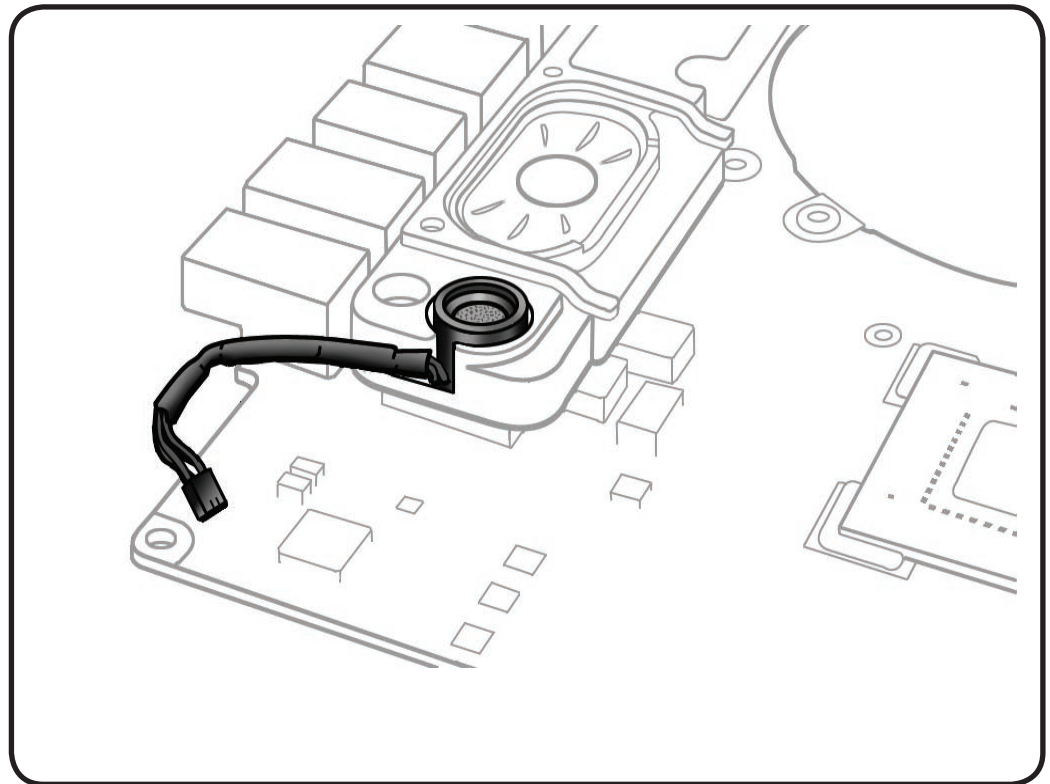
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 jeweler's screwdriver?
- Black stick





Removal

- 1** Disconnect microphone cable from top side of logic board.
- 2** Use black stick to pry microphone cable from groove on speaker assembly.



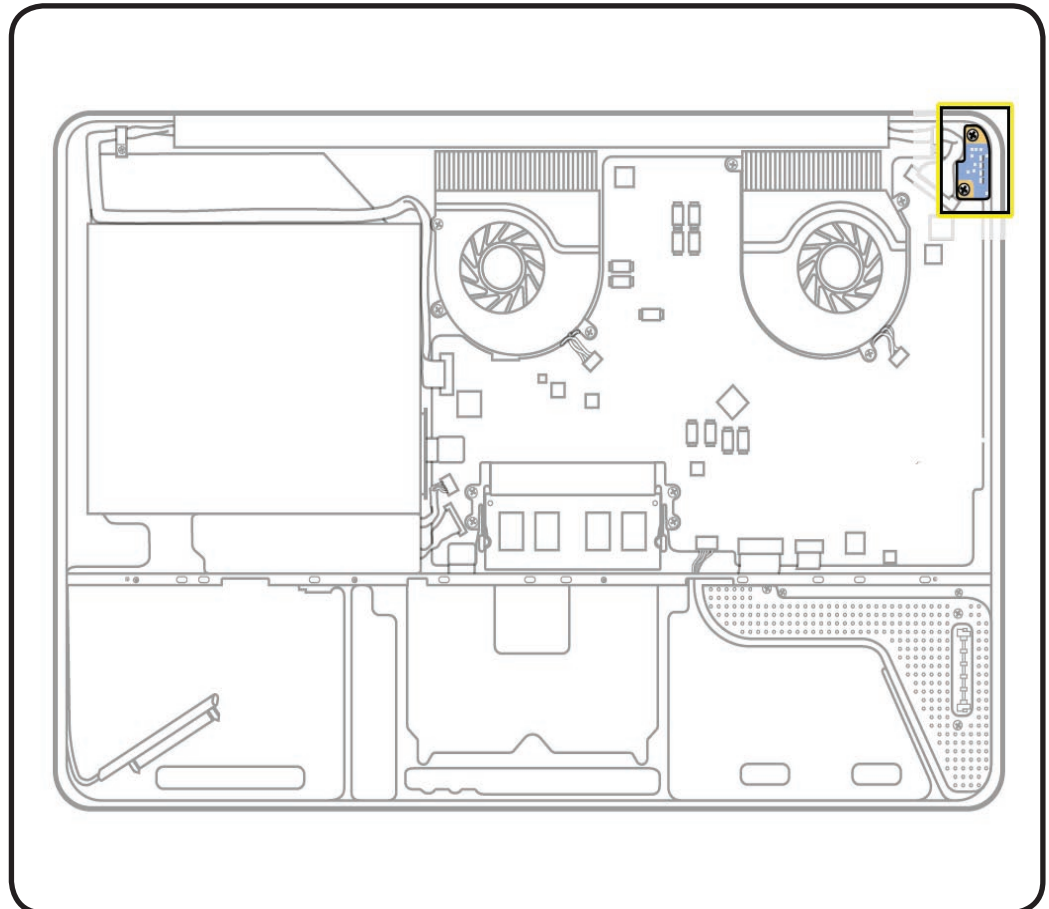


MagSafe Board

First Steps

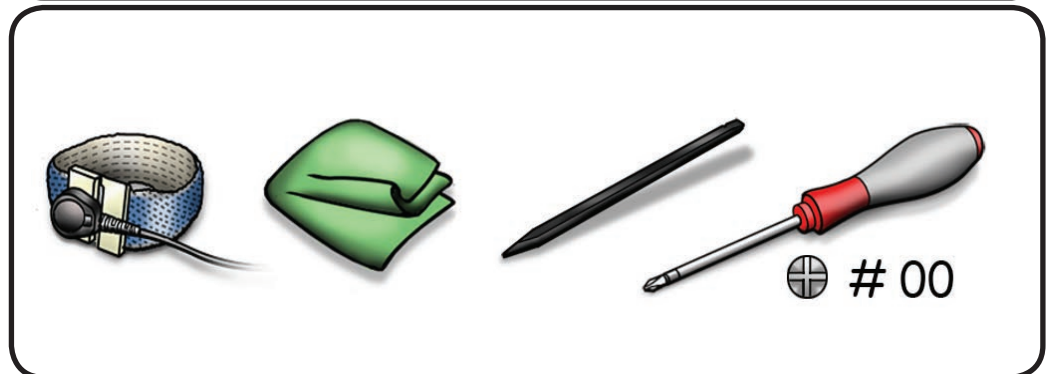
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Fans](#)
- [LVDS cable guide](#)
- [Logic board](#)



Tools

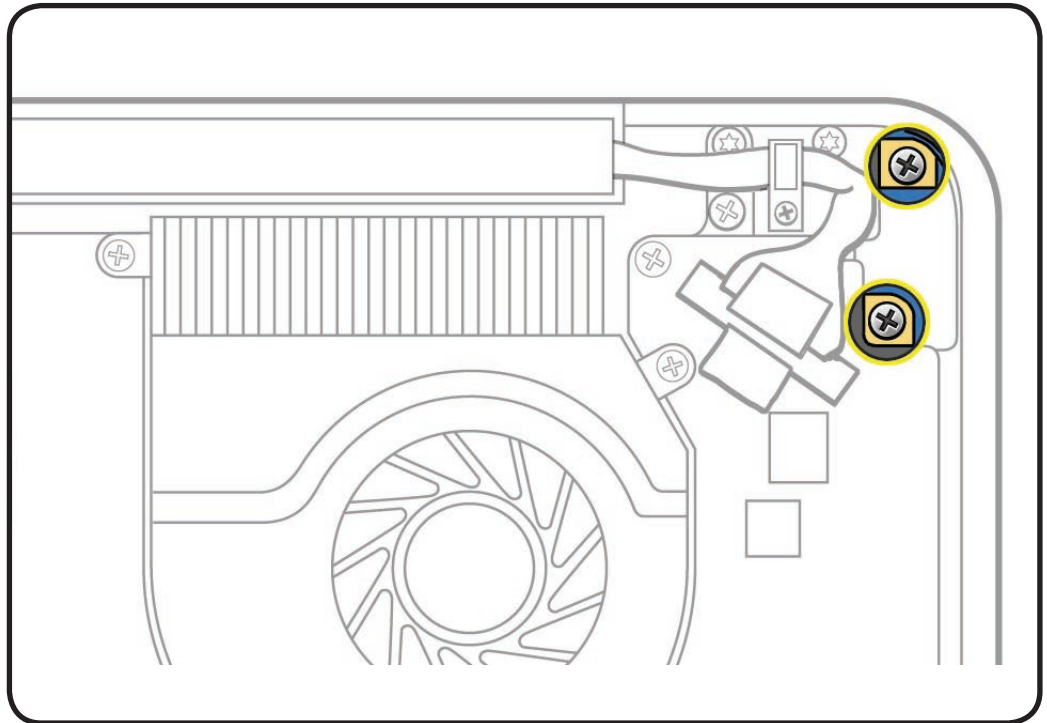
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver





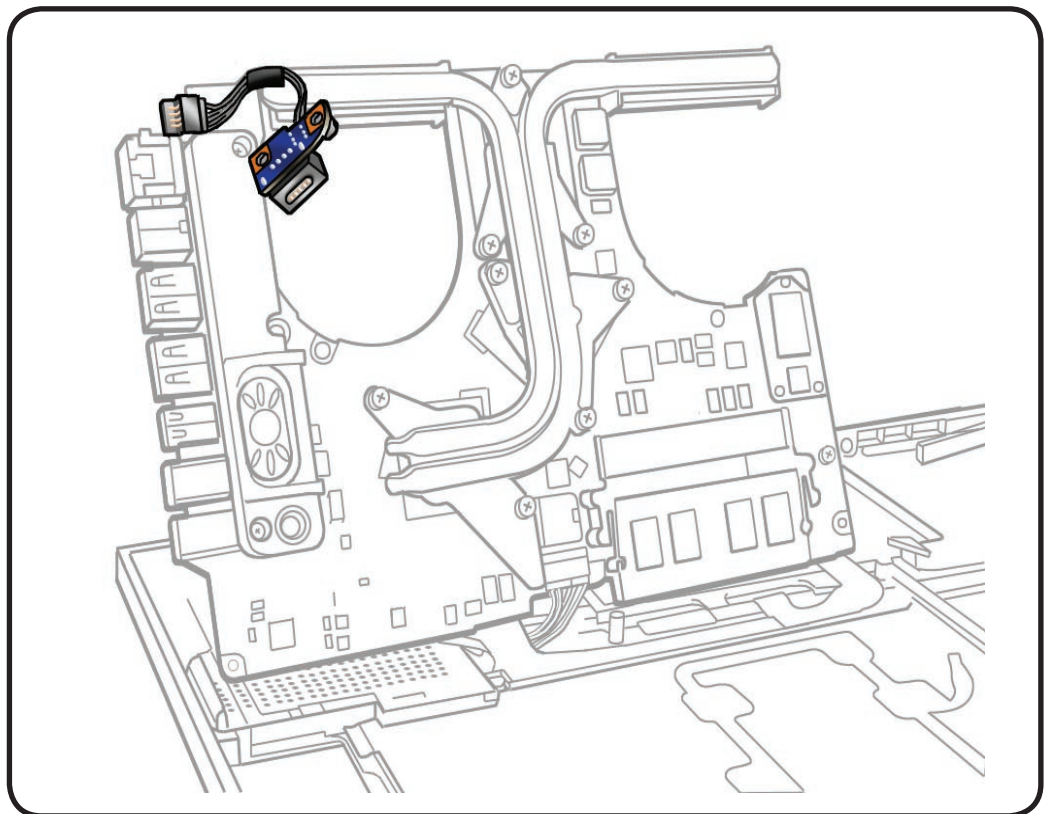
Removal

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



- 2 Tilt logic board to disconnect MagSafe cable from the underside of logic board.

Replacement Note:
Connect MagSafe cable before lowering logic board in place.



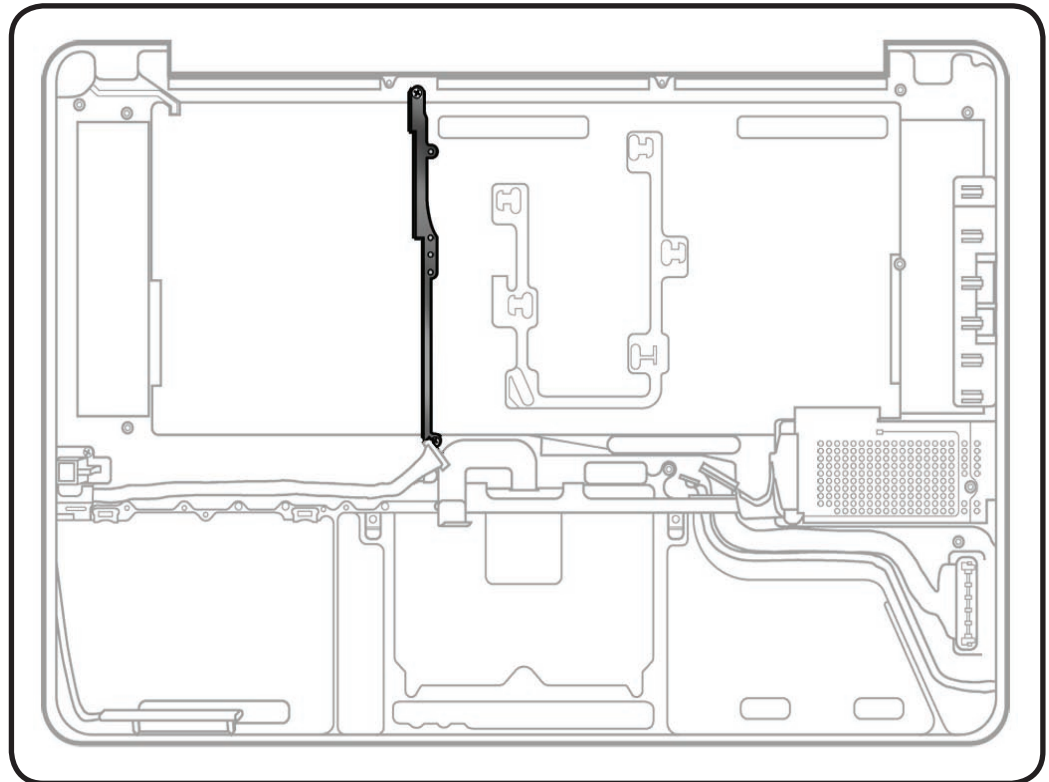


Center Bracket

First Steps

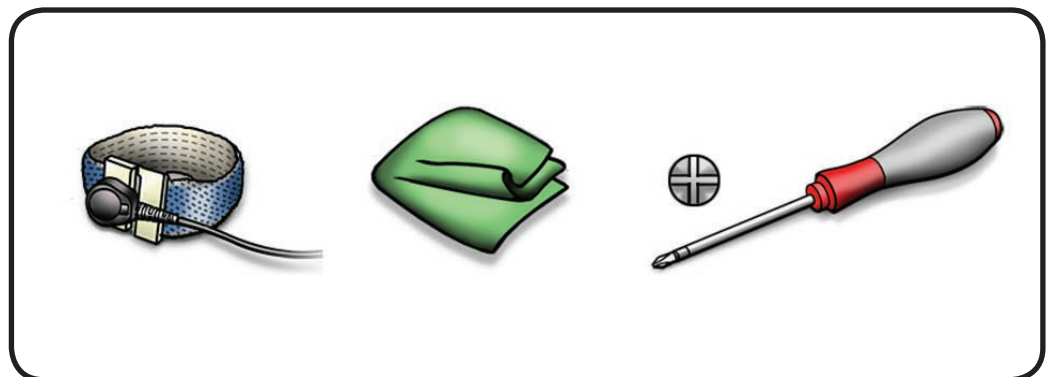
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Fans](#)
- [LVDS cable guide](#)
- [Logic board](#)



Tools

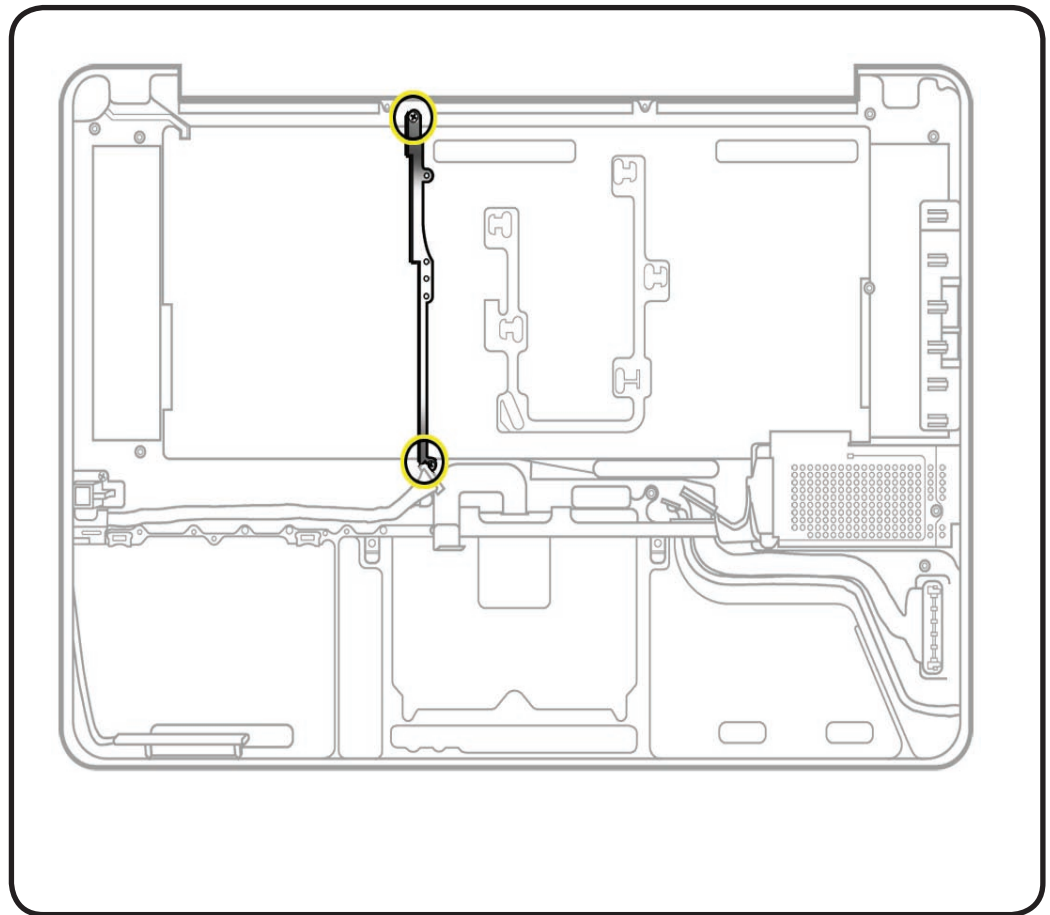
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver





Removal

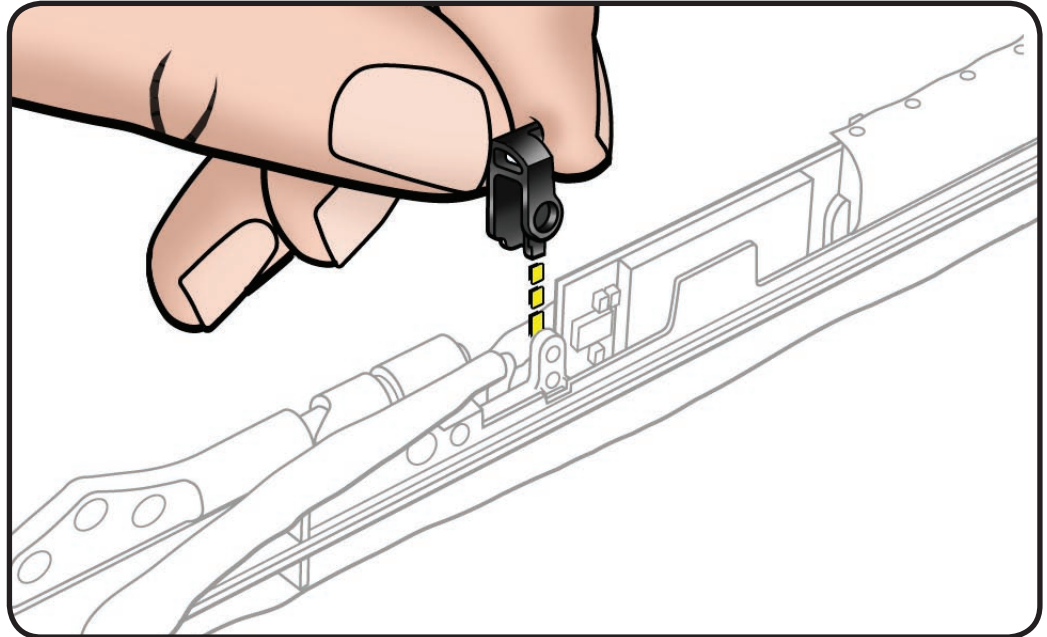
- 1** Remove 2 screws:
 - 10-mm (922-8648)
 - 6.2-mm (922-8725)
- 2** Remove center bracket.





Cable Clip for AirPort Card

Refer to [AirPort Card](#)





Front Bracket/Flex Cable with IR and Sleep Indicator LED

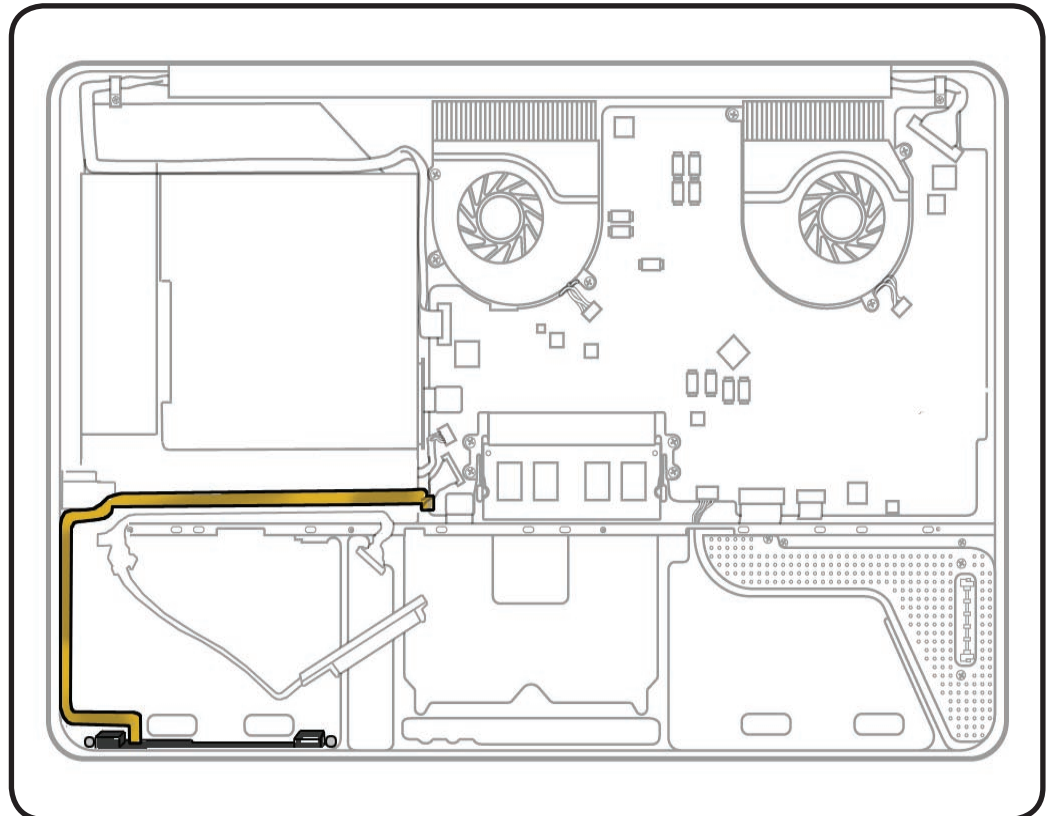
First Steps

Remove:

- [Access door](#)
- [Battery](#)
- [Hard drive](#)
- [Optical drive](#)
- [Right speaker](#)
- [Midwall](#)

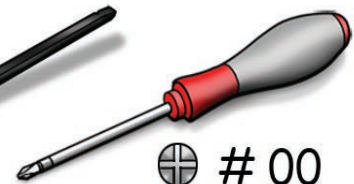


This cable is very fragile.
Be careful not to bend or
tear the cable.



Tools

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



⊕ # 00



Removal

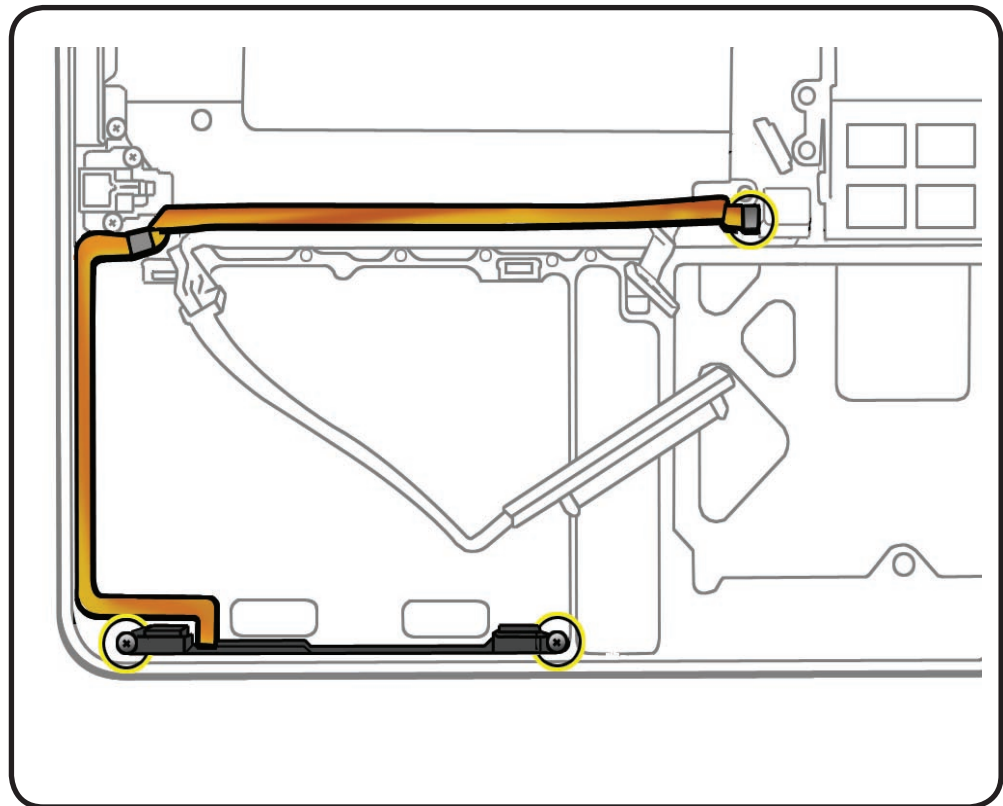
- 1 Remove 2 (3.3-mm) 922-7620 screws from front bracket.
- 2 Remove bracket from top case.
- 3 With a black stick, peel up flexible cable from top case.



- 4 Without straining cable, carefully disconnect IR/Sleep LED cable connector from the logic board. The cable is very fragile and could tear if mishandled.

Replacement Note:

Peel off adhesive backing from cable, press cable onto top case and carefully insert the cable into logic board connector.



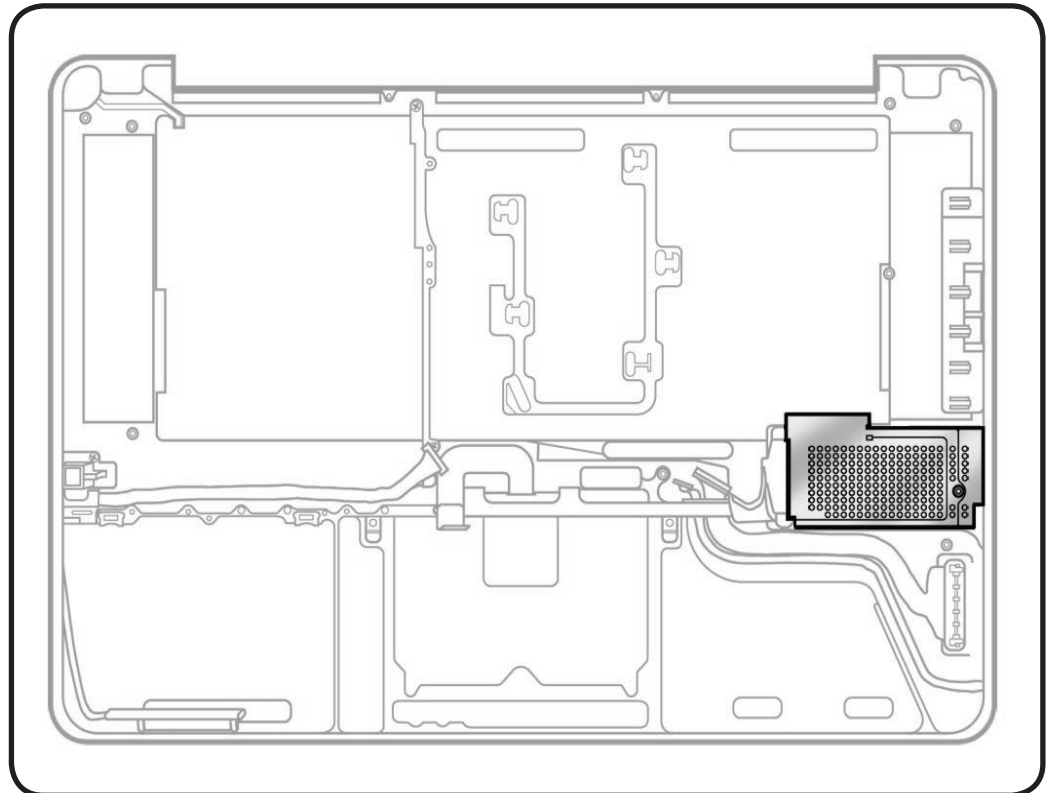


Express Card Cage

First Steps

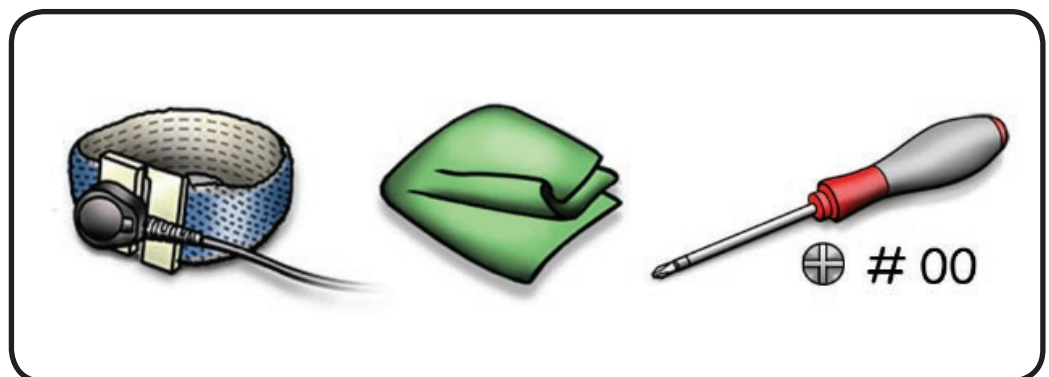
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [LVDS cable guide](#)
- [Logic board](#)
- [Midwall](#)



Tools

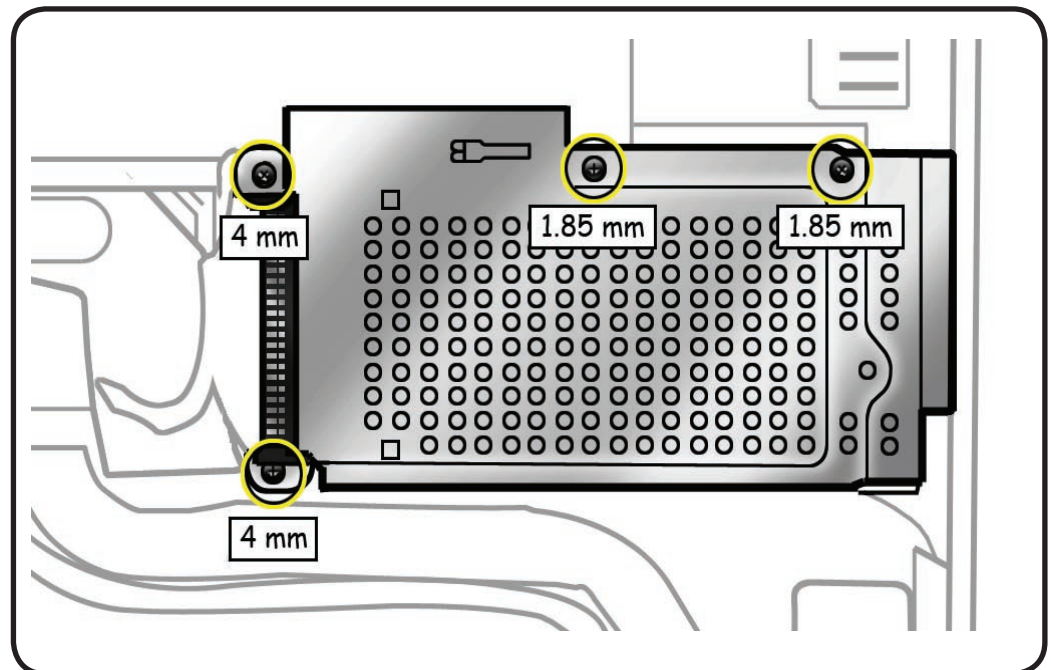
- Clean, soft, lint-free cloth
- ESD wrist strap
- Magnetized Phillips #00 screwdriver.





Removal

- 1** Remove 4 black screws:
 - 2 (4-mm) 922-8722
 - 2 (1.85-mm) 922-8723
- 2** Lift card cage from the top case.



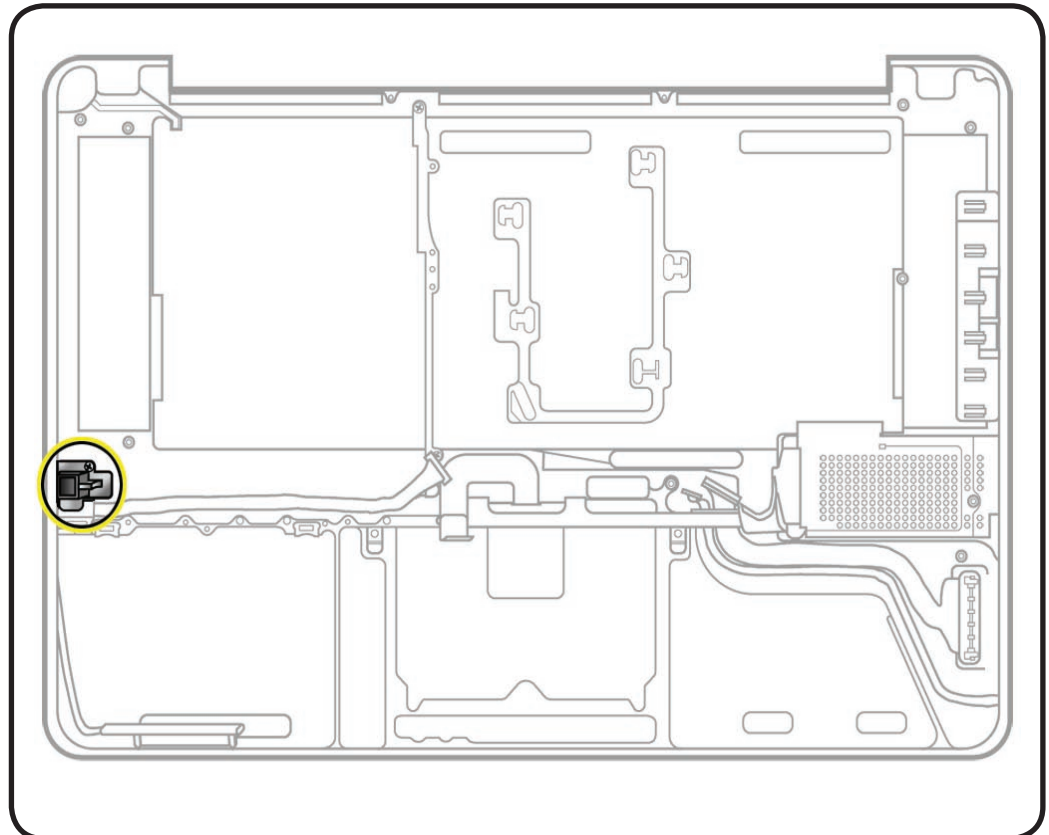


Kensington Lock

First Steps

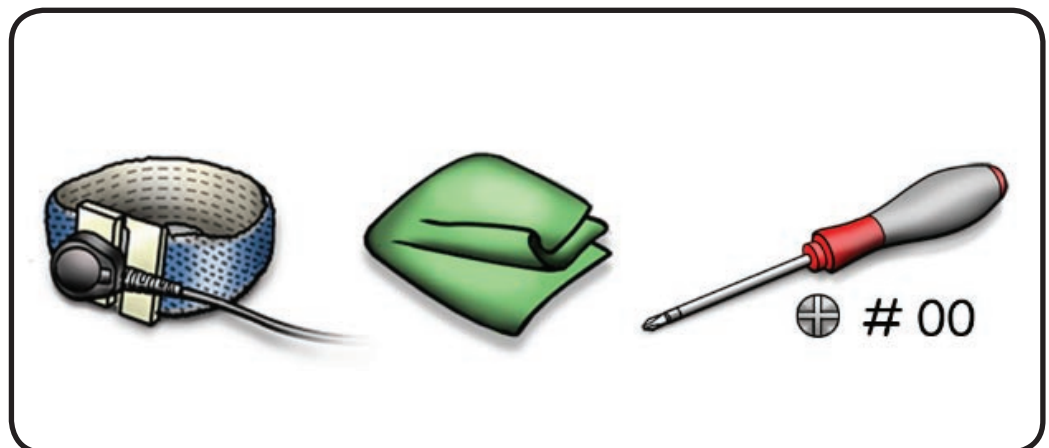
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)



Tools

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



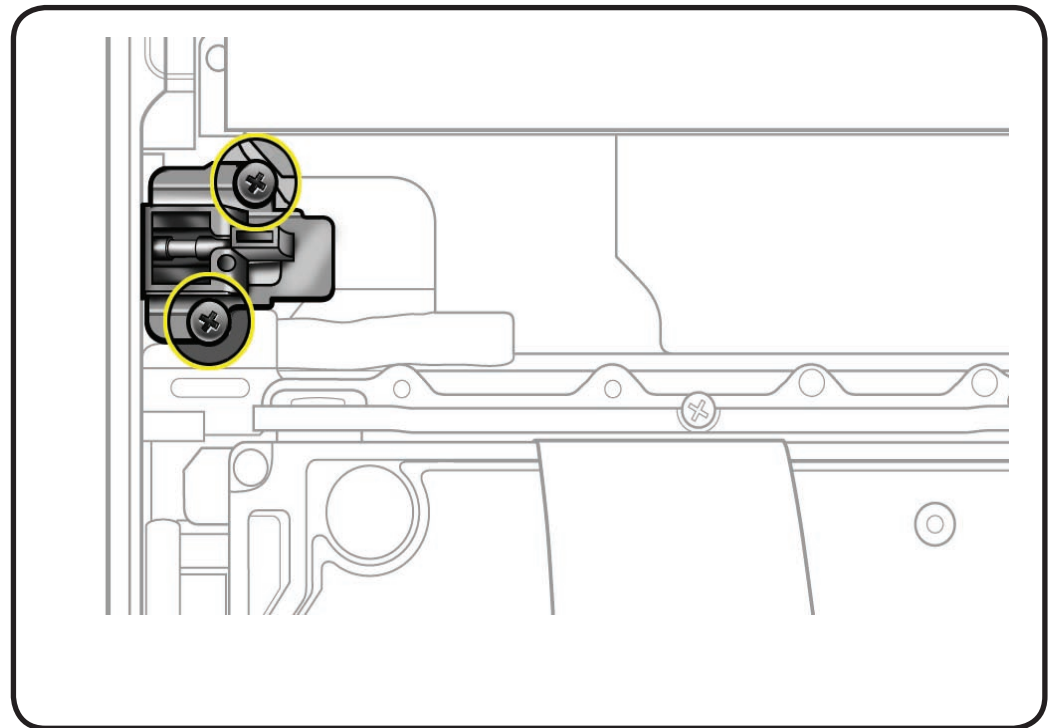


Removal

1 Remove 2 (4 mm) screw.

2 Lift out lock.

Note that the lock includes the plastic piece and metal shield.



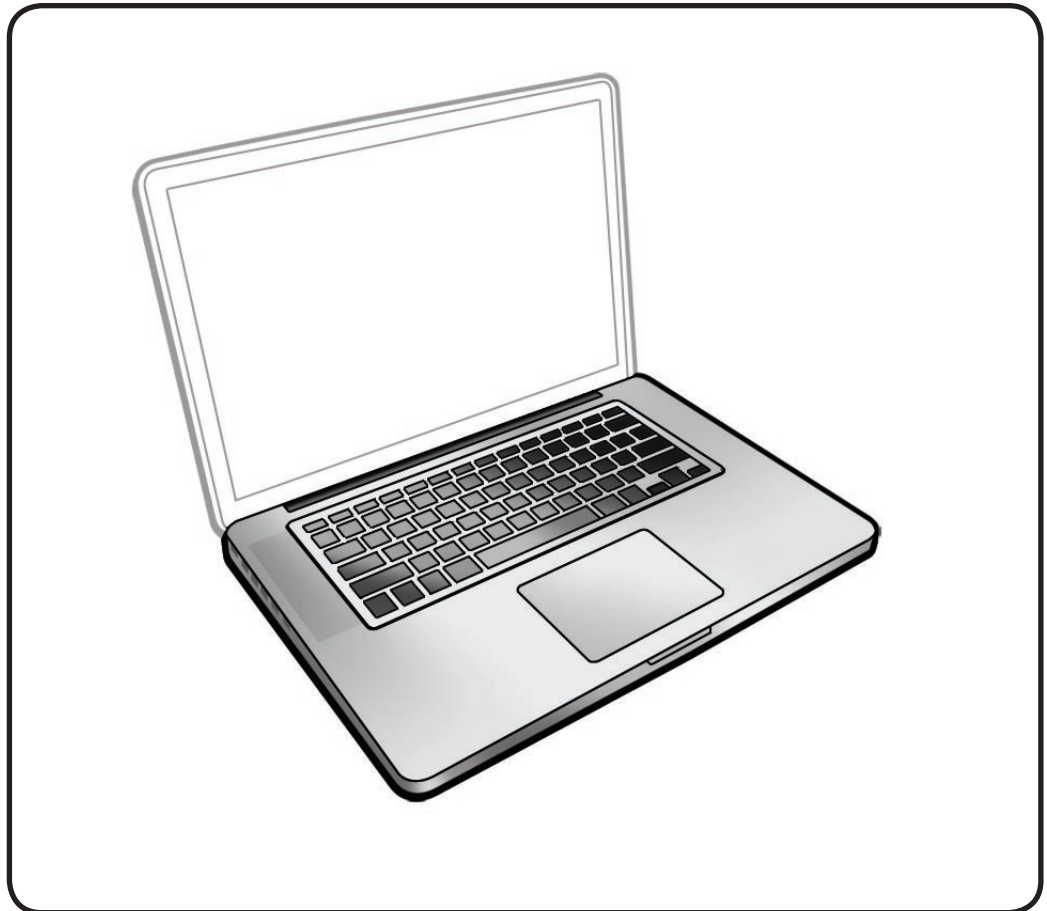


Top Case

First Steps

Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Optical drive](#)
- [Hard drive](#)
- [Fans](#)
- [Midwall](#)
- [Battery connector cover](#)
- [Camera cable guide](#)
- [LVDS cable guide](#)
- [Logic board](#)
- [Display assembly](#)
- [Right speaker](#)
- [Express card cage](#)
- [Center bracket](#)



Tools

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



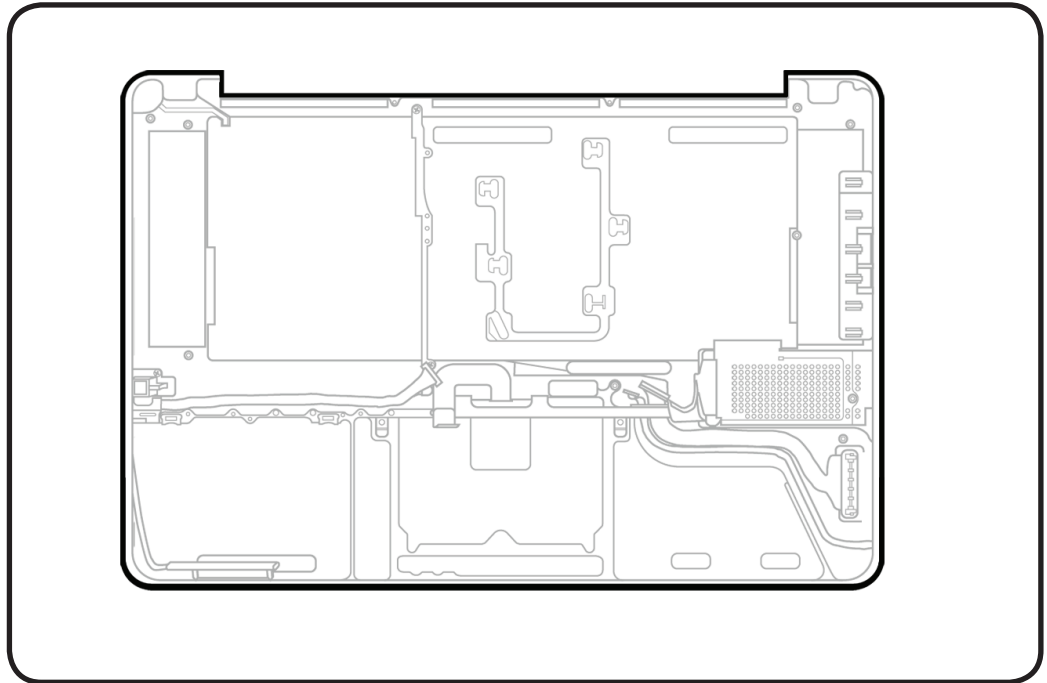


Removal

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

The top case includes:

- battery indicator light board and cable
- battery cable connector cover
- hard drive cable
- front bracket IR/sleep indicator cable
- Kensington lock

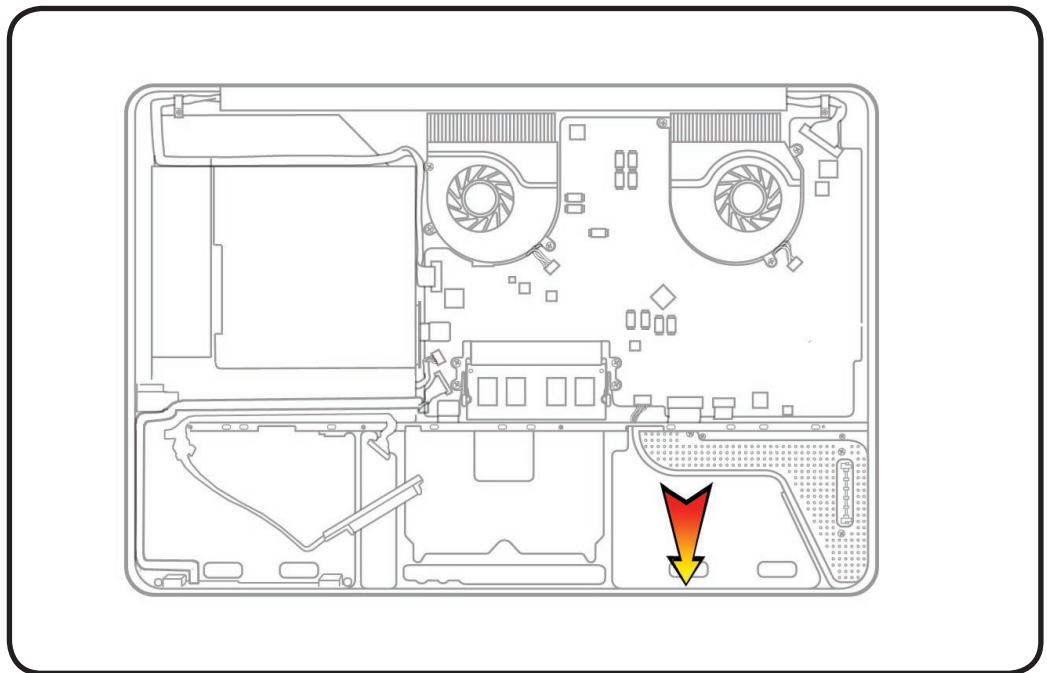


Replacement

1 Before assembling the computer, be sure to first transfer the following 3 parts to the new top case:

- center bracket
- express card cage
- midwall

2 Transfer the serial number to inside edge of top case (see arrow for location). Remove the original serial number label with a jeweler's flat blade screw driver and transfer it to the replacement top case.



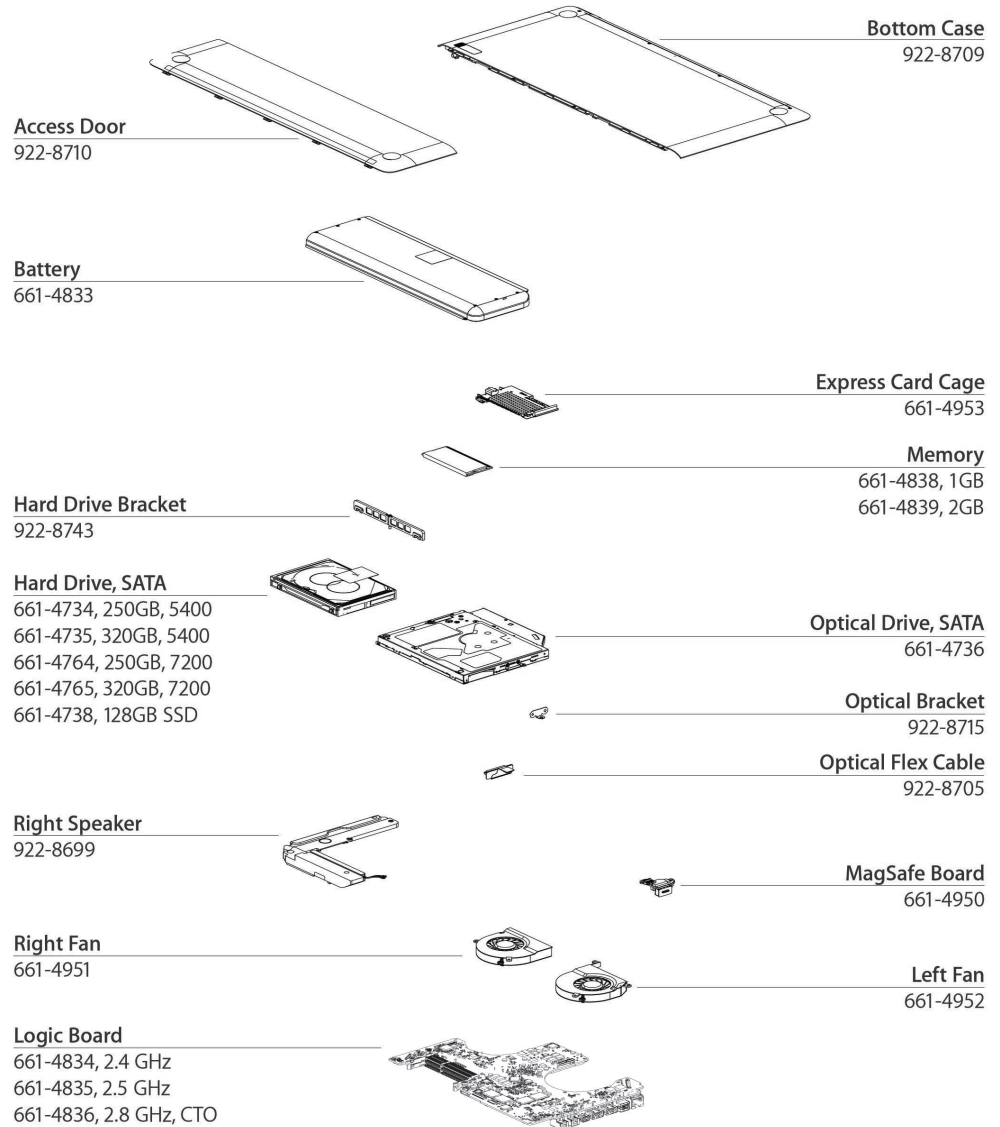
Views

MacBook Pro (15-inch, Late 2008)



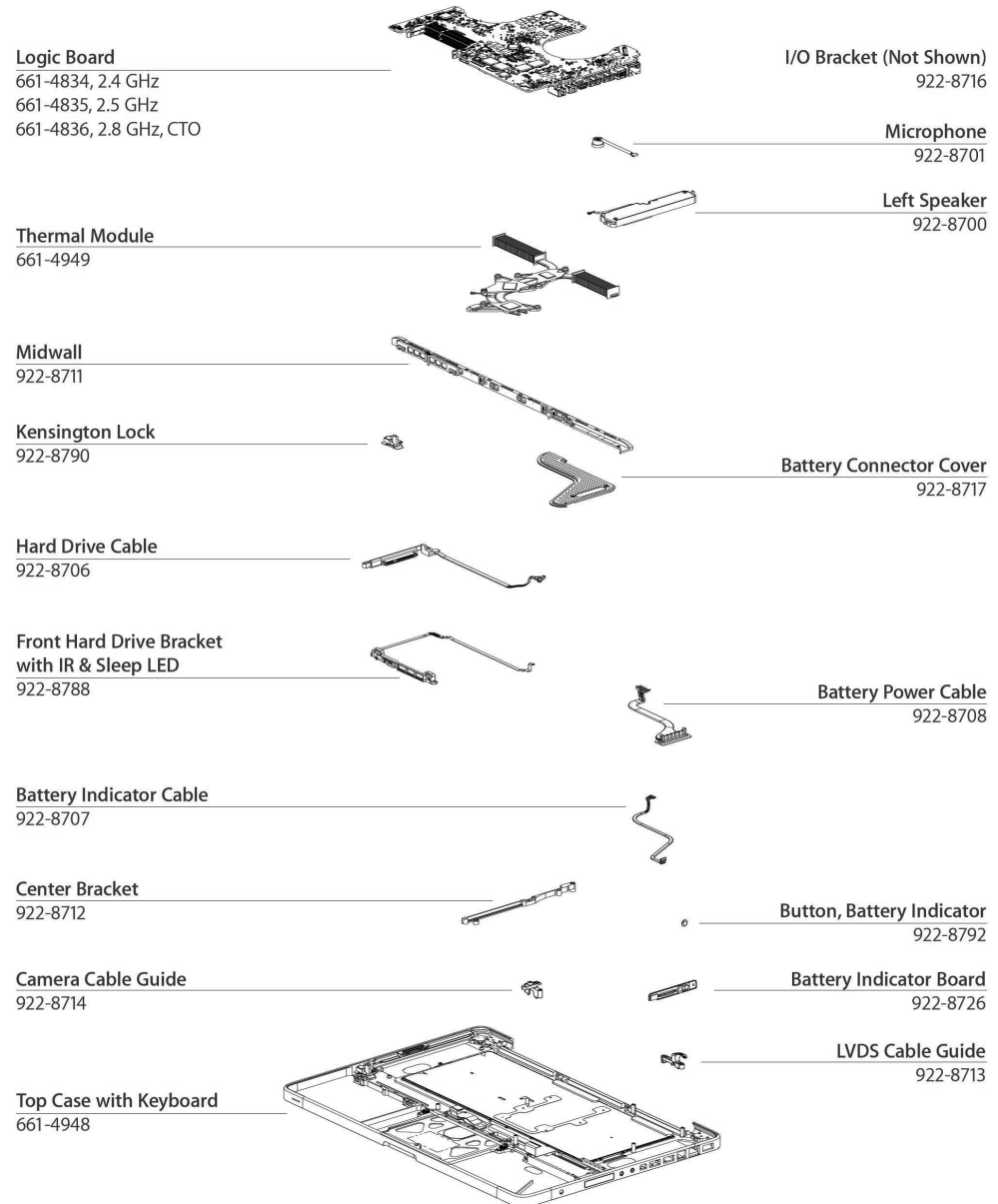
Exploded Views

Main Assembly 1



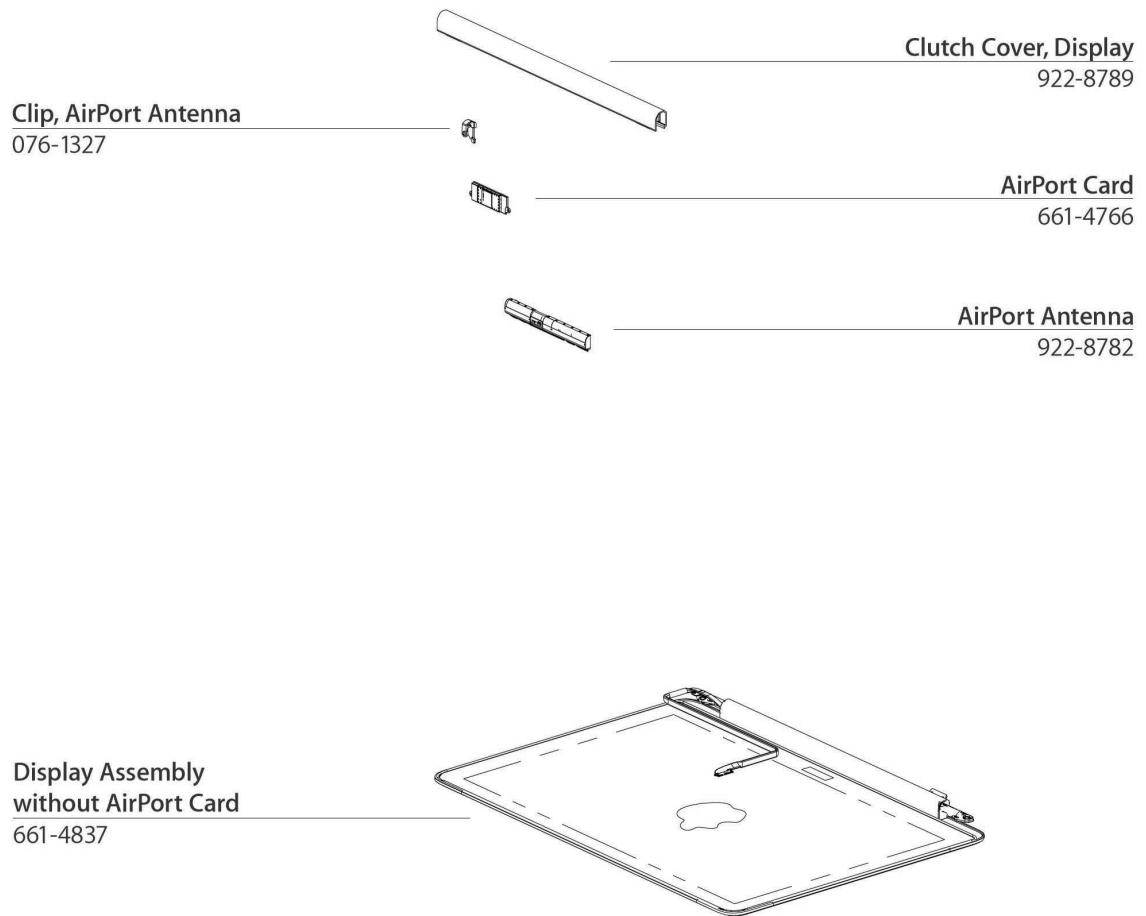


Main Assembly 2





Display Assembly





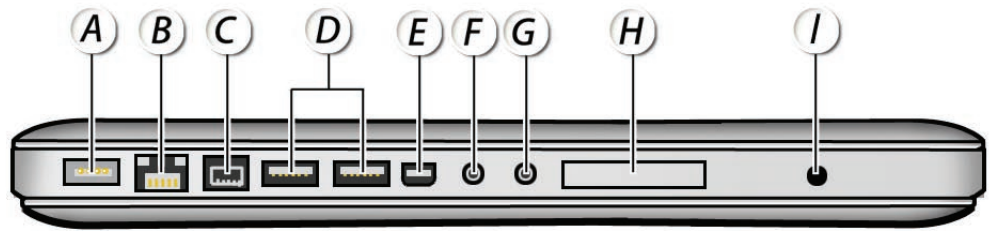
External Views

Front View





Port View



A- MagSafe

B - Gigabit Ethernet

C- FW 800

D- USB 2.0 (1 high powered)

E. Mini DisplayPort

F- Combo Digital/Analog In












G- Combo Digital/Analog Out

H- Express Card Slot









I- Battery Indicator Light Button



Screw Chart

| | | |
|--|---|--|
| 076-1321 Phillips #00  Included in Logic Board Kit: | 076-1327 Phillips #00  Included in AirPort Card Kit: antenna (4), card (2), cable clip (1) | 922-7620  Hard drive front bracket/IR/ Sleep LED (2) |
| 922-8645 Phillips #00  LVDS cable guide (1), MagSafe board (2) | 922-8646 Torx 6  Hinge to top case (6) | 922-8648 Phillips #00  Center bracket to top case (1) |
| 922-8653 Phillips #00  Bottom case (4) | 922-8656 Phillips #00  Midwall to top case (3) | 922-8666 Phillips #00  Bottom case to top (3) |
| 922-8719 Phillips #00  Optical drive , center (1), ODD plate to ODD bracket (2)r | 922-8720 Phillips #00  LVDS cable guide (1), camera cable guide (1) | 922-8722 Phillips #00  Express cage front (2) |

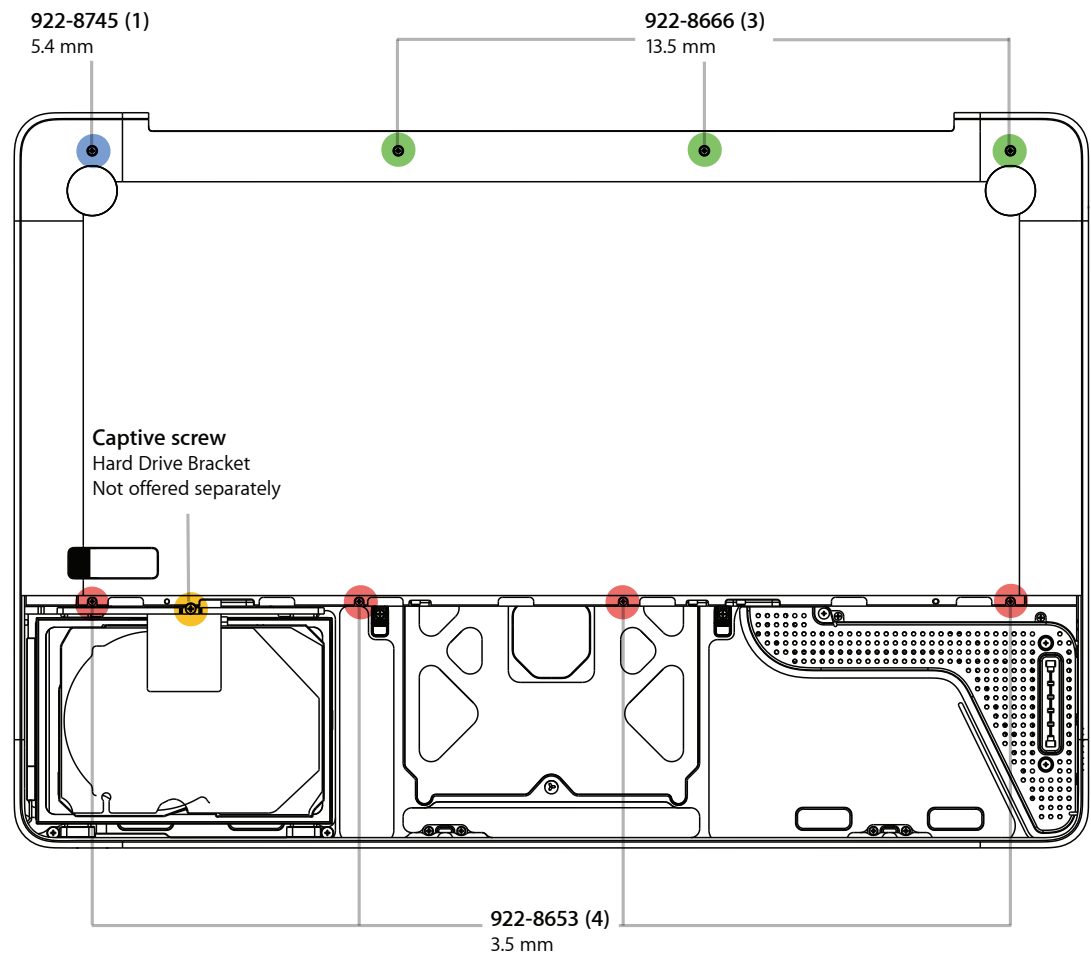


| | | |
|---|--|---|
| 922-8723 Phillips #00  Express cage to top (2) | 922-8725 Phillips #00  Center bracket to top case , bottom (1) | 922-8744 Phillips #00, 5-mm  Left speaker to logic (2), right speaker to top case (1) |
| 922-8745 Phillips #00  Bottom case to camera cable guide | 922-8747 Phillips #00  Speaker, center (1) | 922-8753 Phillips #00, shoulder  Bracket, snap, I/O port (2) |
| 922-8754 Phillips #00  Logic board (7), Fan (6), right speaker to top (2) | 922-8755 Phillips #00  Battery indicator screw (3) | 922-8756 Torx T6  Display assembly hinges (6) |
| 922-8799 Phillips #00  Heatsink and heatsink spring | | |



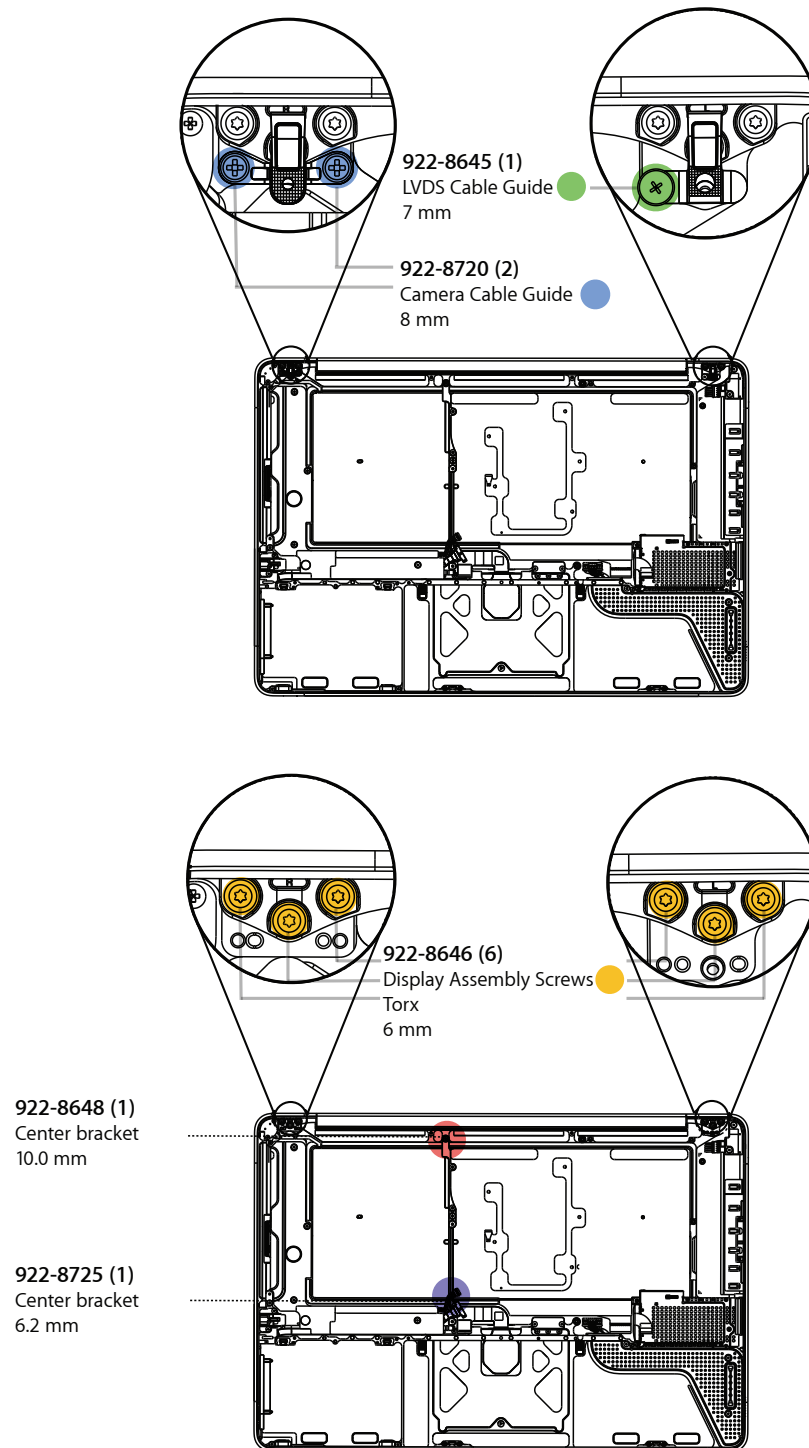
Screw Location Diagrams

Bottom Case Screws





Top Case to Display Assembly Screws





Main Modules to Top Case Screws

