Apple Technician Guide

MacBook Pro (17-inch, Mid 2010)

MacBook Pro (17-inch, Mid 2010) and MacBook Pro (17-inch, Early 2011)

MacBook Pro (17-inch, Mid 2010)

Contents

Basics

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Manual Updates

Updated 26 August 2011

Take Apart
• Logic Board: Added reminder to remove headphone jack cap from replacement logic board and install it on original board before returning it to Apple
• Trackpad: Added step for cleaning the trackpad opening before installing the trackpad

Updated 21 July 2011

Basics
• Added section "Keyboards, Early 2011" covering new OS X Lion keyboard

Take Apart
• Logic Board: Added step for Blank Board Serializer tool at end of procedure

Views
• Exploded Views: Added new keyboard and top case part numbers to Early 2011 model

Updated 29 June 2011

Added Thunderbolt information to Basics and Troubleshooting chapters

Updated 24 February 2011

Troubleshooting, Take Apart, Views
• Added information for MacBook Pro (17-inch, Early 2011).

Take Apart
• General Information: Added cautions about handling locking-lever connectors and flex cables
• Memory: Added Early 2011 specifications to memory configuration
• Hard Drive: Added caution about flex cable and reminder to avoid moving it unnecessarily
• Logic Board: Added caution and new image about how to handle locking levers

Updated 16 December 2010

Troubleshooting:
• Symptom Charts: Display: Backlight Issue/No Backlight: Replaced steps 5 and 6 of Deep Dive

Updated 11 June 2010

Troubleshooting:
- General Troubleshooting: Resetting the System Management Controller (SMC): Updated steps 3 and 4

Updated 14 May 2010

Basics:
- Serial Number Location: Transfering the Serial Number: Added reference to serial number format article CP1099
- General Information: Required Tools: Updated versions of Apple Service Diagnostic and Apple Hardware Test
- General Information: Keycap Replacement: Added section about keycap replacement kit

Troubleshooting:
- Symptom Charts: Input/Output Devices: Built-In Keyboard Does Not Work Properly: Revised step 1 of Deep Dive table for keycap kit reference
- Symptom Charts: Input/Output Devices: Specific Keys Don't Work Properly: Revised step 5 of Quick Check table for keycap kit reference

Apple Technician Guide introduced 13 April 2010

Feedback

We want your feedback to help improve this and future Technician Guides!
Please email any comments to **smfeedback4@apple.com**

Apple Technician Guide

Basics

MacBook Pro (17-inch, Mid 2010)

Overview

Specifications

This technical guide covers both MacBook Pro (17-inch, MId 2010) and MacBook Pro (17-inch, Early 2011) computers. For full technical specifications, refer to AppleCare Tech Specs:
http://support.apple.com/specs/

What's New for MacBook Pro (17-inch, Early 2011)

The following sections in the technician guide are specific to MacBook Pro (17-inch, Early 2011):

Troubleshooting
- Functional overview
- Block diagram
- Graphic showing location of liquid contact indicators (applies to Mid 2010 and Early 2011)
- Logic board power-on pads

- Revised MRI section, including tables of thermal and electrical sensors and sensor map
- Sensor Symptom Charts (applies to Mid 2010 and Early 2011)

Take Apart
- Battery: The Early 2011 battery has a different battery connector.
- AirPort/Bluetooth card, card holder, and flex cable: A conductive wrap covers the Early 2011 AirPort/Bluetooth card, card holder, and flex cable connector. Instructions are included for handling the wrap and for replacing a thermal pad in the card holder.
- Microphone and left speaker: The Early 2011 microphone connects to the logic board to the side of the left speaker and can be removed without first removing speaker.

Views
- Exploded views
- Ports view
- Screw locations

Thunderbolt

MacBook Pro (17-inch, Early 2011) includes a new Thunderbolt port that connects Thunderbolt-compatible high-resolution displays and high-performance data devices for high-speed data transfer. Thunderbolt I/O technology sets new standards for speed, flexibility, and simplicity. Read more at **http://www.apple.com/thunderbolt/**

Important: Thunderbolt requires up-to-date software and firmware to function properly. Obtain the latest updates via Software Update.

Caution: The Thunderbolt port is keyed for cable insertion in only one direction. Be sure to insert cables with the correct orientation. Do not use excessive force if the cable does not fit.

Battery Precautions

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

WARNING: Every time you remove the bottom case, disconnect the battery cable.

WARNING: Because the battery is internal and connected to the logic board by a cable, it **MUST BE DISCONNECTED** before performing service procedures. If you fail to do so, live current from the battery will short circuit the components and render the logic board and/or LVDS cable unusable.
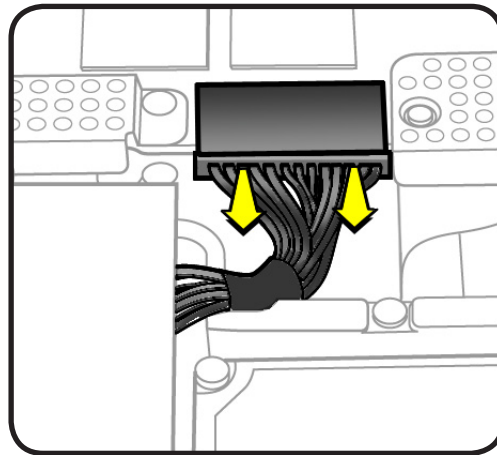
MacBook Pro (17-inch, Mid 2010)   MacBook Pro (17-inch, Early 2011)
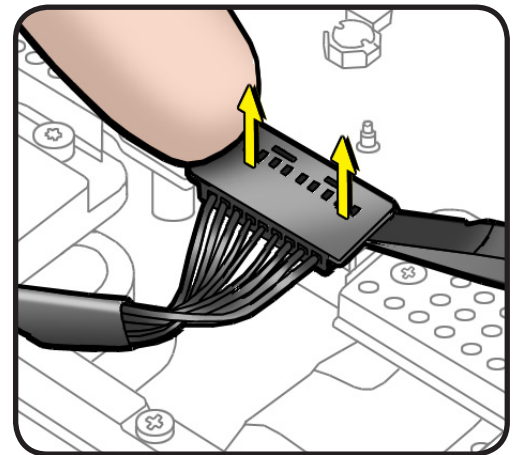
Battery Removal: Tri-Lobe Microstix #2 Screws

Important: Tri-lobe Microstix #2 screws secure the battery in place. Use a tri-lobe large #0 screwdriver (Apple part number 922-8991) for the battery screws.

Important: The **only** time the battery should be removed is when replacing these:
- battery
- trackpad
- top case

The Glass Panel

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

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

Keycap Replacement

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

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

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

For step-by-step instructions, refer to the relevant support article: **"MacBook/MacBook Pro: Black Keycap Replacement" (HT4002)** or **"MacBook: White Keycap Replacement" (HT4003)**.

For an overview of the differences among keycap procedures, refer to **"MacBook/MacBook Pro: Keycap Replacement Matrix" (HT4001)**.

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
- Large tri-lobe #0 screwdriver (Apple part number 922-8991)
- Black stick (Apple probe tool, part number 922-5065) or other nonconductive nylon or plastic flatblade tool
- EMI-safe plastic or nylon tweezers for installing flex cables (optional)
- Thermal grease (Apple thermal compound syringe, part number 922-7144)
- Alcohol wipes
- Permanent marking, felt-tip pen
- Pencil with eraser
- Foam wedge fixture for display assembly removal (Apple part number 922-8779)
- Kapton tape
- Magnifying glass, for reading serial number etched on bottom case
- Digital volt meter (troubleshooting)

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

   http://support.apple.com/kb/HT3452

In addition, the following software programs are required for troubleshooting:
- Apple Service Diagnostic (ASD), version 3S136 or later, Mid 2010
- Apple Service Diagnostic (ASD), version 3S144 or later, Early 2011
- Apple Hardware Test, version 3A185 or later, Mid 2010
- Apple Hardware Test, version 3A211 or later, Early 2011

Serial Number Location

Serial Number On Bottom Case

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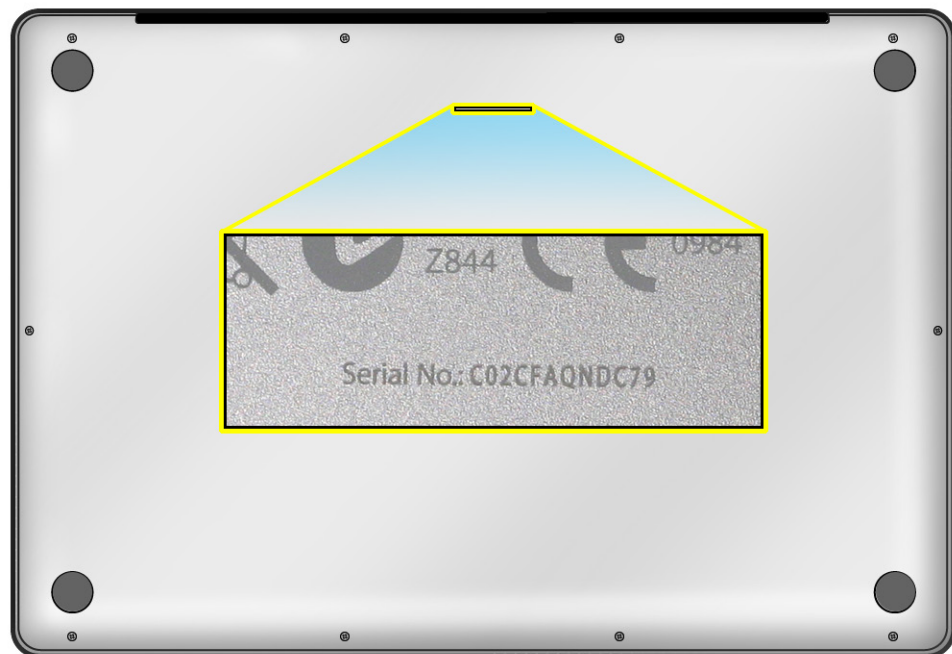
Transferring the Serial Number

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

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

W003X0123XXX
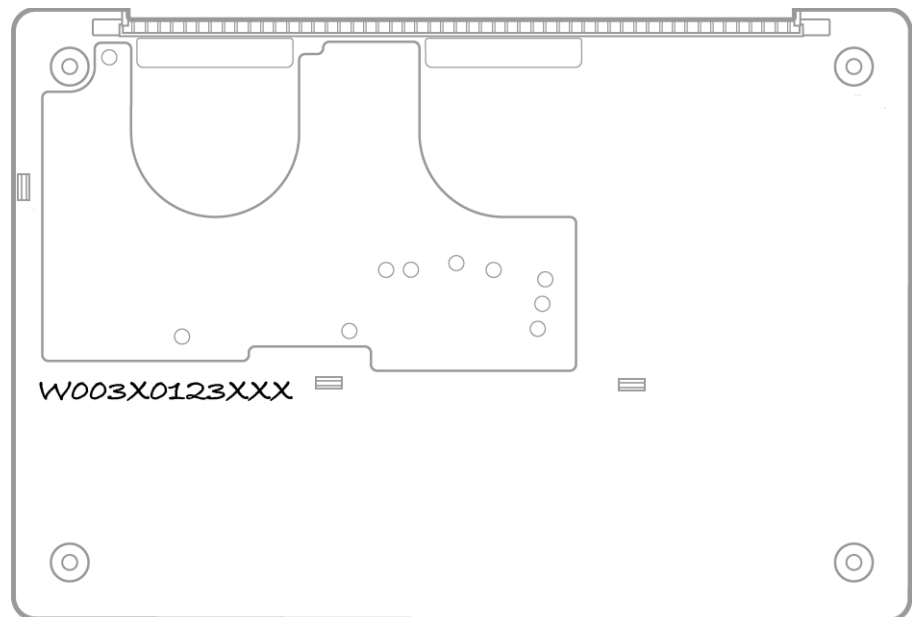
Note: If your repair site has a bar code reader, refer to the set of serial numbers on the memory card carrier (A = system; B = logic board). For information on the serial number format, go to **http://support.apple.com/kb/CP1099?viewlocale=en_US**

Important: Do not remove the label.

Serial No.C02CFAQNDC79

MLB No.: C02011601RQDCMRAD
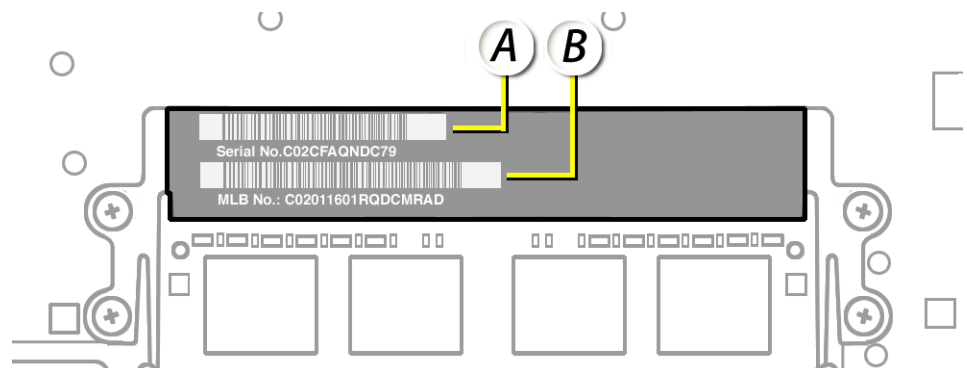
Keyboards

MacBook Pro (Early 2011) computers manufactured after OS X Lion shipped feature a new keyboard. Differences between the original keyboard and OS X Lion keyboard include glyph changes on the F3 and F4 keys.

Important: When performing a replacement of the top case or logic board, you must pair the correct version of the keyboard and logic board with the system serial number. Failure to do so could cause unexpected keyboard behaviors.

For more information, see **kBase #HT4797: MacBook Pro (Early 2011): How to select the correct keyboard and logic board version**

Original Keyboard

OS X Lion Keyboard

Apple Technician Guide

Troubleshooting

MacBook Pro (17-inch, Mid 2010)

General Troubleshooting

Update System Software & Firmware

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

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

Troubleshooting Theory

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

Hardware vs. Software

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

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

Temperature Concerns

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

Emerging Issues

For the latest on troubleshooting issues, refer to Global Service Exchange (GSX) and reference Service Source, Knowledge Base and the Service News tabs for product specific information.

Functional Overview: MacBook Pro (17-inch, Mid 2010)

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

To rotate this page in Preview for easier viewing, go to Tools menu and choose "Rotate Left".

Camera + camera LED + ambient light sensor:
- no camera
- no camera LED (when camera is on)
- no keyboard illumination (when ALS sensor is covered)

AirPort / Bluetooth card:
- any of these communications failing
- no startup (if flex cable is shorted)

AirPort / Bluetooth antennas:
- poor / no AirPort reception
- unable to reliably pair Bluetooth

SATA optical drive:
- no optical drive visible on Sata bus
- no boot from odd

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

Sleep LED + infrared sensor + magnetic sleep sensor:
- no sleep LED status
- no infrared reception
- no sleep when clamshell closed
- no video on internal display (sensor stuck)
- no power on (flex shorting SMC)

Trackpad + trackpad button + thermal sensor:
- no cursor movement
- no click action
- unit running slow (when no sensor input)

Keyboard + power on button:
- no power (unless shorting power on pads on logic board)
- dead keys

Battery (under logic board):
- not running with battery only
- no power on (without a correct model of AC adapter present)

ExpressCard:
- no ExpressCard seen (on either USB or PCI ExpressCard buses)

SATA hard drive:
- no hard drive visible on Sata bus
- no startup from hard drive

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

Keyboard backlight:
- no keyboard illumination (when ALS sensor is covered)

Memory:
- no startup, unresponsive, kernel panic
- video artifacts when integrated GPU is used (shared ram)

Fans:
- intermittent shutdown
- freezes (when too hot)
- noisy fan

LCD + LCD backlight:
- poor / no video on internal LCD
- no LCD backlight

Microphone:
- no integrated sound input

Left speaker:
- no left sound
- distorted left sound

Connectors located on the opposite side of the MLB:

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

Functional Overview: MacBook Pro (17-inch, Early 2011)

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

To rotate this page in Preview for easier viewing, go to Tools menu and choose "Rotate Left".

Sleep LED
+ infrared sensor
+ magnetic sleep sensor:
· no sleep LED status
· no infrared reception
· no sleep when clamshell closed
· no video on internal display (sensor stuck)
· no power on (flex shorting SMC)

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

SATA optical drive:
· no optical drive visible on Sata bus
· no boot from odd

AirPort / Bluetooth antennas:
· poor / no AirPort reception
· unable to reliably pair Bluetooth device

AirPort / Bluetooth card:
· any of these communications failing
· no startup (if flex cable is shorted)

Camera + camera LED + ambient light sensor:
· no camera
· no camera LED (when camera is on)
· no keyboard illumination (when ALS sensor is covered)

Keyboard backlight:
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Memory:
· no startup, unresponsive, kernel panic
· video artifacts when integrated GPU is used (shared ram)

Trackpad
+ trackpad button
+ thermal sensor:
· no cursor movement
· no click action
· unit running slow (when no sensor input)

Keyboard / power on button:
· no power (unless shorting power on pads on logic board)
· dead keys

Battery :
· not running with battery only
· no power on (without a correct model of AC adapter present)

ExpressCard:
· no ExpressCard seen (on either USB or PCI ExpressCard buses)

SATA hard drive:
· no hard drive visible on Sata bus
· no startup from hard drive

Fans:
· intermittent shutdown
· freezes (when too hot)
· noisy fan

LCD + LCD backlight:
· poor / no video on internal LCD
· no LCD backlight

Battery indicator LEDs
+ battery level button:
· no battery error indication
· no battery level while charging
· no battery level shown when button pressed

Left speaker
· no sound from left
· distorted left sound

Microphone
· no integrated sound input

Connectors located on the opposite side of the MLB:

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

Block Diagram: MacBook Pro (17-inch, Mid 2010)

Refer to this diagram to see how modules are interrelated.

Block Diagram: MacBook Pro (17-inch, Early 2011)

Refer to this diagram to see how modules are interrelated.

SNB
34X28

2.2/2.3GHz
4 core
8MB LLC

GT2
PCIe (Gen2)
EDP
FDI
DMI

60-pin XDP header
Routing to support 1600

1333 DDR3-SODIMM DRAM Chnl-0
1333 DDR3-SODIMM DRAM Chnl-1

Dual channel Memory Controller DDR3 1333/1600 1.5V only

Whistler dGPU
29x29

128 bits
64Mx32 GDDR5
1GB Frame Buffer

PCIE x8
PCIE x4

PCIE
LVDS
DP DP DP DP

NC

X4

2 X4 links 2.7Gbps

xp2 -5
GMux FPGA with HPD IRQ support
LVDS PANEL
Dual Channel 6-bit

Platform Environmental Control I/F (PECI)

Single SMBus shared between SPD and Mikey

Power/system management
SMBus
LVDS
DP/HDMI/DVI/SVDO   NC
DP/HDMI/DVI   NC
DP/HDMI/DVI   NC
RGB/TV Out   NC

DMI   FDI

Redriver
mux/ splitter
External Video mini DP Connector

Mikey

Line In/ Digital In
Line Out/ Digital Out Speakers

CS4206 Audio Codec

Mic

HDA

DP   DP
DP   CIO
LR   CIO
15x15   CIO
PCIE   CIO

Cougar Point mobile PCH
25X25

XDP header
DBG
GPIO

SMC Renesas 2117R

Fans

I/V Monitors
Temp Sensors

LPC

Clocks

SPI ROM Interface

ROM
8MB SPI ROM

SATA3 6 ports   USB 2.0 12 ports

SPI debug , Matt card connector

4 spare NC   USB

spare PCIE ports NC

GBE   NC

8 PCIE Gen1
8 X1, 4:4,
4:1:1:1:1

FW643E-02 FireWire Link/PHY   FW800

X19 AP/BT combo card
AirPort

Ethernet 10/100/1000 Mbit

BRCM Caesar4 MAC/PHY   RJ45 Connector

Express Card 34

ODD 1.5Gbps
HDD 3.0Gbps SSD 3.0Gbps (Routing Supports SATA3)

USB2514B USB Hub

Wellspring TP/KB

3 External USB

USB2514B USB Hub

IR Receiver

1x NC

Wave5 (HD) Camera

Liquid Contact Indicators

Liquid contact indicators (LCI) have been added to specific locations on current Mac portables to help determine if systems have been damaged by liquid. The sensors are only visible when the bottom case and some of the modules have been removed. Normally represented by small white dots, the LCIs turn red when they have come in contact with liquid, such as an accidental spill.

For more information, refer to Knowledge Base article HT3400: "About Liquid contact indicators (LCI) on portable computers." **http://support.apple.com/kb/HT3400**
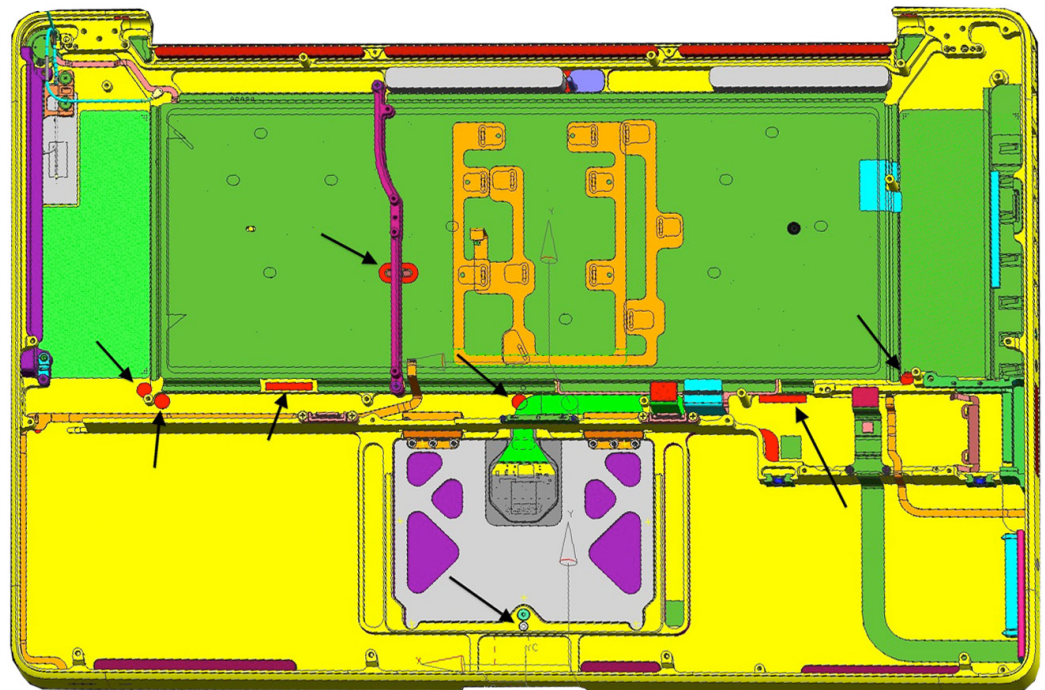
Common Reset Procedures

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 by choosing Shutdown from the Apple () menu.

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

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

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

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

For more information:

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

> HT3964—Intel-Based Macs: Resetting the System Management Controller (SMC) <**http://support.apple.com/kb/HT3964**>

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**>

Apple Service Diagnostic (ASD)

Run Apple Service Diagnostic to determine if any of the thermal sensors are malfunctioning. When sensors fail, replace the corresponding part. See table below for correlation between sensor name and system location.

The following ASD versions are required for troubleshooting:
- 3S136 or later for MacBook Pro (17-inch, Mid 2010)
- 3S144 or later for MacBook Pro (17-inch, Early 2011)

Mac Resource Inspector (MRI)

MRI is a troubleshooting tool that reports system errors and sensor readings that help you identify parts that need replacement. As you become familiar with the names and locations of system sensors, they will help you properly troubleshoot MRI and ASD reported errors.

Not all thermal sensors are on the logic board. Some are in the battery and one is in the trackpad. Without fully testing a system, do not assume the logic board requires replacement.

Important: Whenever you run MRI, use the power adapter rather than battery only to effectively verify battery charging circuitry.

The following tables show thermal and electrical sensors that MRI uses to check the computer's performance.

MacBook Pro (17-inch, Mid 2010) Thermal Sensors

Name	Location	MRI/ASD Name
TC0C	Logic Board	CPU Die Digital 2
TC1C	Logic Board	CPU Digital Core 0
TC0D	Logic Board	CPU 0 Die Analog
TC0P	Logic Board	CPU Proximity
TMCD	Logic Board	MCH Die - Digita;
TPOP	Logic Board	PCH Proximity
TG0D	Logic Board	GPU Die
TG0P	Logic Board	GPU 0 Proximity
TG0T	Logic Board	GPU 0 Die
Tm0P	Logic Board	MLB Proximity
Th1H	Logic Board	Right Fin Stack Proximity
Th2H	Logic Board	Left Fin Stack Proximity
TB0T	Battery	Battery TS MAX
TB1T	Battery	Battery TS 1
TB2T	Battery	Battery TS 2
Ts0P	Trackpad	Palmrest Proximity

MacBook Pro (17-inch, Early 2011) Thermal Sensors

Name	Location	MRI/ASD Name
TC0D	Logic board	CPU 0 Die Analog
TC0P	Logic board	CPU Proximity
TPCD	Logic board	PCH Die - Digital
TG0D	Logic board	GPU Die - Digital
TG0P	Logic board	GPU Proximity
Tm0P	Logic board	MLB Proximity
TC0C	Logic board	CPU Die - Digital Core 2
TP0P	Logic board	PCH Proximity
Th1H	Logic board	Right Fin Stack Proximity
Th2H	Logic board	Left Fin Stack Proximity
TB0T	Battery	Battery TS MAX
TB1T	Battery	Battery TS 1
TB2T	Battery	Battery TS 2
Ts0P	Trackpad	Palmrest Proximity

MacBook Pro (17-inch, Early 2011) Electrical Sensors

Electrical Sensor	Location	General Description	MRI/ASD Name
ALSL	Display	Ambient Light Sensor	ALS
VD0R	Logic Board	DC IN (Voltage)	DC In
VP0R	Logic Board	PBus (Voltage)	PBus
VC0C	Logic Board	CPU Vcore (Voltage)	CPU
VN0R	Logic Board	AXG Vcore (Voltage)	AXG Vcore
ID0R	Logic Board	DC In (AMON) (Current)	DC In
IB0R	Logic Board	Battery (BMON) (Current)	Battery
IC0R	Logic Board	Computing (Combined cores)	CPU VcoreVTT
IO0R	Logic Board	5V & 3.3V Others	Other <5V. 3.3.V>

Thermal Sensor Map

This map shows the general location of the thermal sensors (highlighted in gold) and their associated part within the computer housing.

Track pad
Ts0P
Palmrest

Ambient Light Sensor

Display Clamshell

Battery Indicators

SMC

Heatsink

CPU Proximity

TC0P

TC0D CPU Die
TC0C
MAX CPU Core Temp
CPU

Left Fin Stack

Th2H

Battery Charger

Sensors on MLB

TB0T TB1T TB2T

Sensors in Battery
Battery TS_MAX
Battery TS 1
Battery TS 2

GPU Proximity

TG0P

TG0D
GPU Die
GPU

TPCD
PCH Digital Die Temp
PCH with GPU

TP0P
PCH-T29 Proximity

Right Fin Stack

Th1H

TmOP
DC In Proximity

LEGEND

Thermal Sensor

SMC Monitored Device

Wired to External
– – – – – – ·
Sensor/Device

Logic Board Power-On Pads, Mid 2010

On the logic board of the MacBook Pro (17-inch, Mid 2010), there are two pads that can be shorted to power on the system. These pads are located at the lower left corner of the logic board. The power-on pads are shiny, silver, square, and larger than the other (mostly round) silver pads nearby.

Important: Only short these two pads and no other pads, or you may damage the logic board. The tip of a T6 screwdriver is about the right size to touch these two pads without touching other nearby components.
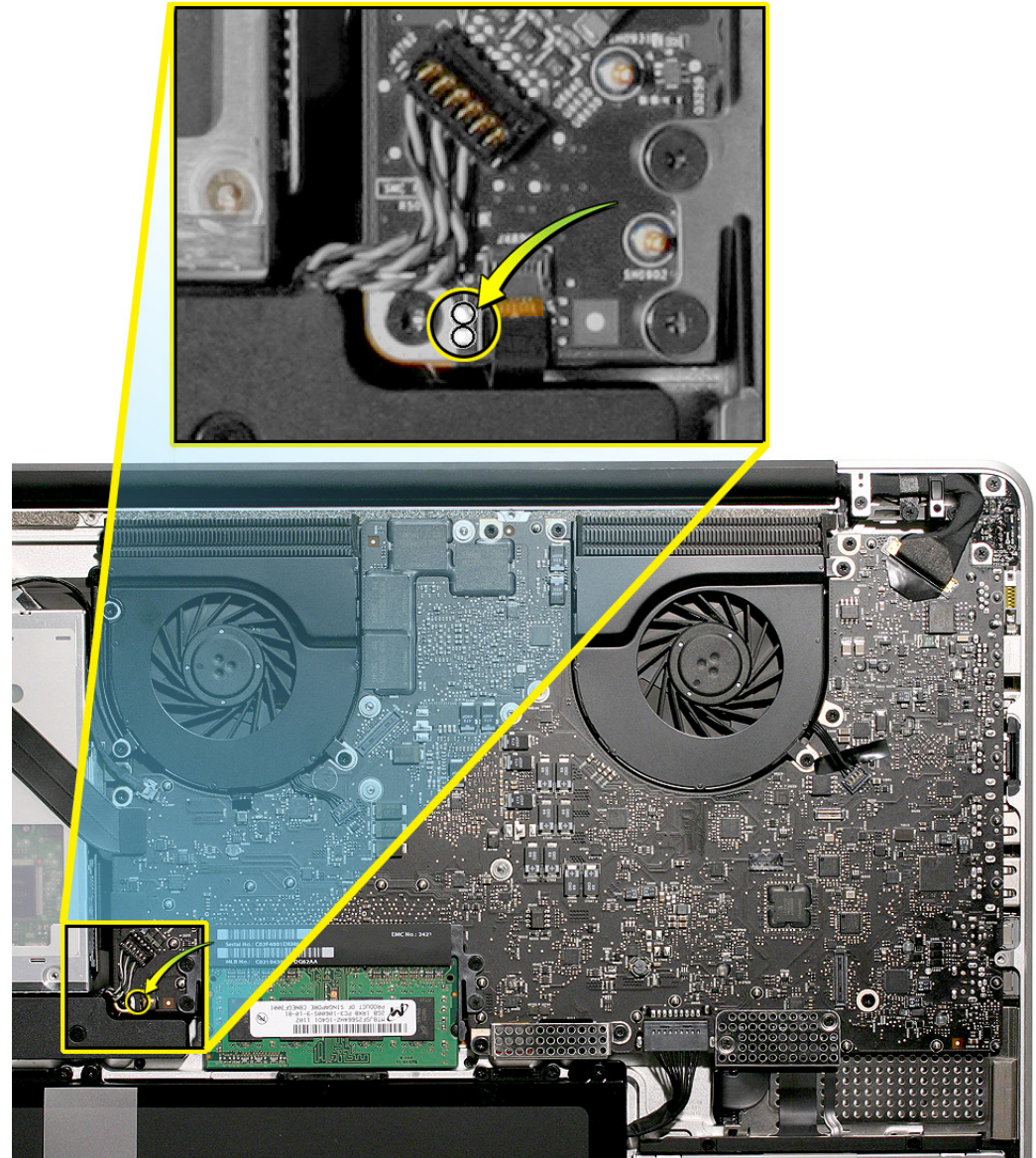
Logic Board Power-On Pads, Early 2011

On the logic board of the MacBook Pro (17-inch, Early 2011), there are two pads that can be shorted to power on the system. These pads are located to the left of the SMC chip. The power-on pads are shiny, silver, square, and larger than the other (mostly round) silver pads nearby.

Important: Only short these two pads and no other pads, or you may damage the logic board. The tip of a T6 screwdriver is about the right size to touch these two pads without touching other nearby components.
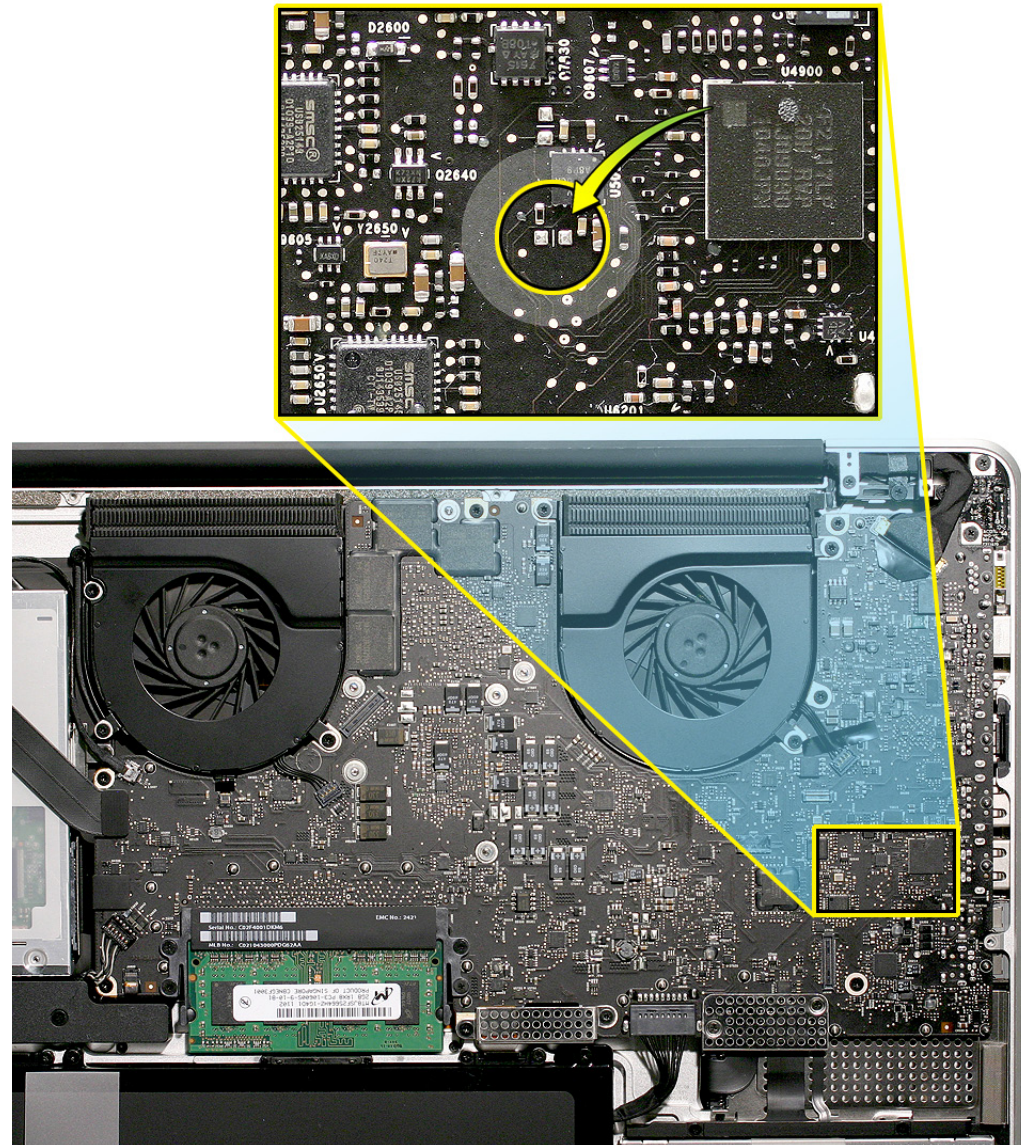
Display Issue: Pixel Anomalies

When displaying a single color over the screen area, the LCD panel might show one or more pixels that are not properly lit. To determine if the display has an acceptable number of pixel anomalies, follow the steps below:

1. Set the display image to one of the following colors: all-white, all-red, all-green, all-blue, or all-black display. Use the LCD Tester Diagnostic Utility to generate these patterns on the screen.

2. Using a jeweler's loupe, pocket microscope, or other magnifying device, identify and count each pixel anomaly:

    Bright subpixel anomaly = subpixel that is always on

    Dark subpixel anomaly = subpixel that is always off

3. The number of acceptable pixel anomalies for this computer is:

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

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

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

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

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

When speaking with customers, please use the following explanation:
- Active-matrix LCD technology uses rows and columns of addressable locations (pixels) that render text and images on screen. Each pixel location has three separate subpixels (red, green, and blue) that allow the image to be rendered in full color. Each subpixel has a corresponding transistor responsible for turning the subpixel on or off.
- There are typically millions of these subpixels on an LCD display. For example, the LCD panel used in the Apple Cinema HD display is made up of 2.3 million pixels and 6.9 million red, green, and blue subpixels. Occasionally, a transistor does not work perfectly, which may result in the affected subpixel being turned on (bright) or turned off (dark). With the millions of subpixels on a display, it is quite possible to have a low number of faulty transistors on an LCD. Therefore, a certain number of subpixel anomalies are considered acceptable. Rejecting all but perfect LCD panels would significantly increase the retail price for products using LCD displays. These factors apply to all manufacturers using LCD technology—not just Apple products.

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 • No power • No image • No startup chime • No fan or hard drive spin • No reset sound from optical drive • No sleep LED activity • No light if Caps Lock pressed • Non-operational	1. Verify AC power presence with MagSafe LED indicating on or charge state. 2. Test Adapter with Known Good AC Cord or duckhead. 3. Disconnect all peripherals from unit. 4. Check battery indicator light array (press button to activate) to verify battery level is not dead. 5. Check Sleep Indicator Light (on right side of top case in front) for any activity. Refer to Apple support article TA23609. 6. Reset System Management Controller (SMC) according to kBase #HT3964: "Intel-based macs: Resetting the System management Controller (SMC).

Deep Dive

Check	Result	Action	Code
1. Attempt to power on system pressing power on button. Does the system exhibit any signs of power activity, such as Fan or HDD spin, chime or Caps lock indicator activity?	Yes	Go to step 2.	
	No	Go to step 5.	
2. View system boot progress on internal LCD display. Does internal LCD display show video with back lit display?	Yes	No power issue resolved, run MRI to obtain latest test results to determine what might be confused as no power on.	
	No	Go to step 3.	
3. Use a flashlight to check for a video signal presence on LCD display. Is video visible with flashlight?	Yes	Go to No Backlight flow.	
	No	Go to step 4.	
4. Attempt to boot system with AST to test with MRI on external display. Will system boot to AST - MRI on internal LCD or external display?	Yes	No power issue resolved, run MRI to obtain latest test results to determine what might be confused as no power on.	
	No	Go to NO VIDEO flow	
5. Using KB HT2346 :"Intel-based Apple Portables: Identifying the right power adapter..." to verify the correct MagSafe adapter (wattage & type) is being used. Is the correct adapter being used?	Yes	Go to step 6.	
	No	Go to step 17	
6. Reset System Management Controller (SMC) according to kBase #HT3964: "Intel-based macs: Resetting the System management Controller (SMC)". Does issue remain after SMC Reset?	Yes	Go to step 7.	
	No	Stuck SMC State preventing system power on. Run MRI to verify system before returning to customer.	

7. Inspect Magsafe port and connector for contamination, dirt, stuck pins and debris. Clean if necessary. Does issue remain?	Yes	Go to step 8.	
	No	Power Issue likely related to dirty magsafe port contacts Run MRI to verify system before returning to customer.	
8. Use a known good & correct type/wattage Magsafe Adapter and AC cord connected to a known good AC outlet to test system. Does the system still exhibit the symptom with the KG adapter?	Yes	Go to step 9.	
	No	Likely faulty Magsafe adapter. Let system charge with Known good adapter, then verify suspected faulty adapter with NAD.	
9. Inspect the MPM board and port for damage, soot or visibly failed components. Are the MPM board and contacts free of damage and in good condition?	Yes	Go to step 10.	
	No	Replace MagSafe MPM connector assembly.	**X03**
10. Disconnect Keyboard flex cable from MLB to isolate power button. With display in open position, short MLB **power pads** to power on system. Does the issue remain?	Yes	Go to step 11.	
	No	Faulty top case power button or flex. Replace Top Case .	**X14**
11. Up to this point we are testing with battery still connected to get the unit to power on. Here we want to disconnect battery cable from MLB to determine if battery is preventing system power on. Disconnect battery connection to MLB. Again with display in open position, short MLB **power pads** to power on system. Monitor fan spin and sleep indicator for flash signal activity. Does the symptom remain?	Yes	Go to step 12	
	No	Faulty Battery or Battery cable is preventing system on. AppleCare is interested in capturing defective battery. Contact TSPS.	
12. Inspect camera cable connector to ensure conductive foam gasket does not short any pins/contacts on the MLB. Temporarily remove gasket & retest. Does the symptom remain?	Yes	Go to step 13	
	No	Gasket or metal threads causing MLB short. Replace with care. If gasket in poor condition, replace with new gasket.	

13. Inspect camera data cable orientation as per take apart instructions to ensure connector not reversed. Inspect surrounding area on MLB for signs of component damage. Is connector inserted correctly and in good condition?	Yes	Go to step 14	
	No	Replace MLB.	**M01**
14. Disconnect LVDS & camera data cable from MLB. With display in open position, short MLB **power pads** to power on system. Monitor fan spin and sleep indicator for flash signal activity. Does the no power symptom remain?	Yes	Go to step 15	
	No	Verify with Known Good display clamshell if available. Replace Display Clamshell Make sure that the Airport Card is transferred to replacement clamshell, and connected with correct connector orientation.	**L01**
15. Disconnect all cables from MLB except fan, speakers and external display. Remove memory and power on system by shorting **power pads**. Observe fan spin, no memory beep tones, sleep indicator LED for no memory flash code and view external display to verify signs of power on activity. Does the system power on?	Yes	Escalate to Apple TSPS	
	No	Replace MLB.	**M01**
16. Use a known good & correct type/wattage Magsafe Adapter and AC cord connected to a known good AC outlet to test system. Does the system still exhibit the no power symptom with the KG adapter?	Yes	Go to step 15	
	No	Issue resolved using correct AC adapter.	
17. Reset System Management Controller (SMC) according to kBase #HT3964: "Intel-based macs: Resetting the System management Controller (SMC)". Does issue remain after SMC Reset?	Yes	Go to step 19	
	No	Stuck SMC State preventing system power on. Run MRI to verify system before returning to customer.	

Won't Start Up

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

Quick Check

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

Deep Dive

Check	Result	Action	Code
1. Reset SMC and Clear PRAM to set default startup device to internal hard disk drive (HDD).	Yes	User hard drive bootable, issue resolved default settings.	
	No	System not starting up, go to step 2	
2. Verify if system is indicating a memory error with a repeated 1 or 3 flashes sequence of sleep LED or 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 original memory and/or swap in known-good memory to isolate bad memory and replace defective parts.	Yes	Original 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 original hard drive. Verify if system can start up from this drive.	Yes	System starting up from original hard drive. Startup issue resolved	
		No	Original 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. Verify if system can start up from OS install disc.	Yes	Starts up from optical drive; original 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 cable connection, optical cable failure or optical drive failure step by step: -Reseat optical drive cable and retest, -Replace with known-good optical drive cable and retest, -Test with known-good optical drive.	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. Verify if original hard drive is listed in Disk Utility.	Yes	Original 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 cable connection, cable failure or drive failure step by step: **-**Reseat hard drive cable and retest, **-**Replace with known-good hard drive cable and retest, **-**Test with known-good hard drive.	Yes	Reseat of hard drive cable now shows original hard drive visible in Disk Utility, go to step 10	
		Defective hard drive cable found and replaced, Now original hard drive is visible in Disk Utility, go to step 10	**X03**
		Suspect original hard drive defective, attempt OS restore, go to step 10	
	No	Known-good hard drive and known-good hard drive cable used, but still no hard drive seen. Replace logic board	**M19**
10. Boot system with Shift Key down. Verify if system boots in Safe Mode.	Yes	Go to software troubleshooting article	
	No	Go to step 11	
11. Use Disk Utility to repair original hard drive and repair permissions if system OS found on hard drive. Verify if hard drive is bootable after software repairs.	Yes	OS on original hard drive repaired, issue resolved.	
	No	Hard drive not bootable, perhaps missing OS, go to step 12	
12. Use Disk Utility to partition original hard drive with one GUID partition then restore Mac OS from product OS install disc. Verify if hard drive is bootable after OS instal.	Yes	Original hard drive now starts up from new OS image, issue resolved	
	No	Replace hard drive.	**H02**

Intermittent Shutdown

Unlikely cause: hard drive, optical drive

Troubleshooting Shutdown Issues

Before troubleshooting shutdown issues, always do the following:
- Run the available Apple diagnostics to check for cause of previous shutdown(s). Running ASD also helps isolate any abnormal value reading from a thermal, voltage, or current sensor or from a fan speed meter.
- Collect all available information from the user on shutdown details: periodicity, power state when issue happens, running applications, running time before shutdown.

User-related shutdowns

A computer shutdown may be caused by user operation. Shutting down the computer (by selecting the Shut Down menu, by pressing the power button for at least 4 seconds, or by programming a timed shutdown in the Energy Saver preferences) should not be considered as a failure unless the power button or the magnetic sleep sensors are found to be defective.

Suggested steps for troubleshooting:
- Reset SMC.
- Check Energy Saver preferences settings.
- Test top case button and magnetic sleep sensor operation and secure connection to logic board.

Activity-related system shutdowns

These shutdowns are linked to system settings, devices drivers, applications, or operating system freezes.
- System could not finish the standard shutdown process and had to force shutdown.
- An installed watchdog detected that an application did not respond within the specified time. (This watchdog can be enabled in Mac OS X Server Energy Saver preferences.)

Suggested steps for troubleshooting:
- Check the system logs and activity monitor utility for clues on the freezing process.
- Check for available software and firmware updates for installed device drivers, applications, or operating system.
- Start the system from a known-good and up-to-date bootable drive for issue reproduction.

Power-related system shutdowns

These shutdowns are due to power management, poor connections or defective power sources.
- External or battery power source was removed.
- Battery went empty while computer was on.
- Battery went empty while computer was asleep.

Suggested steps for troubleshooting:

- Reset SMC.
- Check that AC cable, AC adapter and battery connections are secure to logic board.
- Verify battery and power adapter sources using the Battery and Adapter test utility.

Hardware-related system shutdown

These shutdowns are due to temperature, voltage, current, fan speed or other hardware-related sensor values going out of range.

- One of the temperature sensors reached a specified temperature limit.
- One of the voltage sensors reached a specified voltage limit.
- One of the current sensors reached a specified current limit.

Suggested steps for troubleshooting:

- Check all sensors connections and values using Apple Service Diagnostics and other available Apple Service utilities.
- Confirm correct Apple-branded battery and power adapter are installed.
- Check for abnormal battery temperature.
- Check fan(s) operation.
- Confirm cleanliness of heatsink fins and air flows.
- Confirm heatsink is correctly seated on logic board and thermal material is present.

Quick Check

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

Deep Dive

Check	Result	Action	Code
1. Activity related shutdowns: Reset SMC and PRAM and verify that shutdown issue still happens.	Yes	Check with known-good bootable drive : go to step 2	
	No	Shutdown cause was related to SMC or Pram programmed shutdown settings or corruption, and was resolved by reverting them to default settings.	
2. Booting from known-good bootable drive , verify that shutdown issue still happens.	Yes	Go to Power related shutdowns on step 3	
	No	Shutdown events do not happen on known-good OS. Reinstall Mac OS on original hard drive, update OS with latest version and check if any firmware update is available.	
3. Power related shutdowns : verify that shutdown issue can ONLY be reproduced with user's battery and AC adapter.	Yes	Intermittent power issue means checking user's AC cable for intermittent connection, checking user's battery and AC adapter health,	
	No	Issue also happens with known-good battery and AC adapter. Go to step 4	
4. Reset SMC and PRAM, then verify if shutdown symptoms does not happen anymore.	Yes	Shutdown cause was related to SMC or Pram settings or corruption, and was resolved by reverting them to default settings.	
	No	Shutdown event still occurs. Go to step 5.	
5. Check system running on battery only. Use known-good charged battery. Verify if shutdown/reset/sleep issues disappear when known-good battery is used without AC adapter.	Yes	Recharge original battery and retest. Check for battery health in Apple System Profiler or run Battery & Adapter Test utility, and replace battery if its health is reported bad or consumed.	**P09**
	No	Symptoms unchanged - Go to step 6	

6. Check with known-good AC adapter source only Remove battery and use known-good AC adapter. Verify if the shutdown/reset/sleep issues disappear with known-good adapter.	Yes	Faulty user's AC adapter. Replace user's AC adapter if AC cable and duckhead were confirmed good.	**P14**
	No	Symptoms unchanged - Go to Hardware-related shutdowns on step 7	
7. Hardware-related shutdowns: Run ASD and verify if a sensor failure is reported.	Yes	-If a temperature or a fan sensor failure is reported, go to step 8 -If a voltage or a current sensor failure is reported in ASD w/known good AC adapter and batteries, replace logic board.	**M23**
	No	If no failure is found after burn in tests, return unit to customer for no failure found.	
8. Verify if a thermal sensor or fan failure is reported in ASD.	Yes	-If fan not running failure, check for fan cable seating and retest. If same failure after retest replace fan with known-good fan and retest. If issue does not happen with known-good fan, replace user's fan. -If an over temp failure reported, check for cause of over temp, like obstructed vent, dust in heatsink fin, clogged fan and retest. If still failing replace part where sensor is located (logic board, battery, or trackpad) according to the sensor location table . Go to step 9	**X22** **M23** **P17** **K99**
	No	Replace Thermal module Go to step 9	**X10**
9. Isolate if issue solved After part exchange verify if shutdown/issue still occurs.	Yes	Issue fixed	
	No	Replace logic board with corresponding symptom: -if for thermal error cause -if for other cause	**M18** **M08**

No Video/Bad Video

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

Quick Check

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

Deep Dive

Check	Result	Action	Code
1. Characterize video issue Define whether the issue is a bad image with backlight OR a no video issue. Verify if an image (even a distorted one) 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, and display adapters if present, and verify if 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 if video is displayed.	Yes	Video displayed - Brightness set to minimum, panel backlight was inadvertently turned off. If backlight returns to low check for stuck F1 key on keyboard.	
	No	Go to Step 4	
4. Reset SMC and verify if system video is displayed.	Yes	Corrupt SMC State preventing video.	
	No	Go to Step 5	

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

9. Check for No Backlight Condition. Power on unit. Using a lamp or low-heat light source, inspect for faint image, and verify if a faint image can be seen.	Yes	Logo image visible - check LVDS cable and inspect for damage near clutches: . if damaged, replace display assembly and go to step 11 . if cable is not damaged, run Clamshell Service Diagnostic utility and check for LCD panel presence, If not found, reseat LVDS cable and retest, then go to step 11	**L09**
	No	If symptom continues, go to step 10.	
10. Verify with Known good display assembly Connect known-good display assembly to system.	Yes	System is functioning with known-good display assembly. Replace display assembly using appropriate symptom code: - 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 if unit now has video and backlight.	Yes	Issue was only due to damaged display assembly or unseated cable.	
	No	Previous display cable damaged the logic board. Replace logic board.	**M25**

Battery Isn't Recognized or Won't Charge

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

Quick Check

Symptom	Quick Check
Battery isn't recognized or won't charge • AC adapter • No MagSafe LED indicator • No orange charge indication • Battery status LEDs: - flash 5 times from left to right and back again - all flash - no LED	**1.** Check battery level and test AC power. **2.** Reset SMC by pressing the (left) Shift-Control-Option keys along with the power button once. **3.** Test system, using Battery Diagnostic Utility.

Deep Dive

Check	Result	Action	Code
1. Verify if the MagSafe LED goes from 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, verify if any of the lights comes on.	Yes	Go to step 3	
	No	Go to step 11	
3. When battery level button is pressed, verify if battery status indicates a fully charged battery with all LEDs on.	Yes	Original battery charged, check health. Go to step 13.	
	No	Go to step 4	
4. Verify if battery status indicates 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. Verify if battery status indicates 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. Verify if battery status indicates battery charge and flash the next level 5 times.	Yes	Original 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. Verify if battery status indicates a low battery with a LED flashing rapidly indicating initial charging of battery.	Yes	Allow original 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. Verify if battery is recognized and charging.	Yes	Replace original battery (P10 not charging or P11 not recognized)	**P10 or P11**
	No	Go to step 9	
9. Inspect original battery contacts and battery cable connector, and verify any trace of corrosion or obstructions.	Yes	Clear obstructions or replace the battery if cable if corroded and recheck..	**X03**
	No	Go to step 10	
10. Reseat battery harness at logic board connector, and retest. Verify if battery is 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 for any button stuck or cable disconnected at logic board and reset SMC.	Yes	LED status now working. Go to step 3.	
	No	Go to step 12.	
12. Remove system battery status indicator ,and test with known-good battery status indicator assembly. Verify if LEDs now indicate a correct battery level.	Yes	Replace original battery LED indicator assembly. Go to step 3	**X03**
	No	Replace original logic board.	**M20**

13. Open Apple System Profiler and click on the Power Tab on the left. Verify if the battery cycles amount is over 1000 cycle counts.	Yes	Battery has been consumed, and customer will need to purchase a replacement.	
	No	Go to step 14.	
14. Verify that battery is 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, verify if the health of the battery is "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, verify if the health of the battery is "Good".	Yes	Battery functioning normal. Go to step 17.	
	No	Battery has premature capacity loss. Replace original battery.	**P08**
17. With battery charge greater than 20% verify if battery supports system operation without AC connected.	Yes	Original battery is good	
	No	Go to step 18	
18. Test with a known-good battery. Verify if a known-good battery supports battery-only operation.	Yes	Replace original battery for will not run system on battery alone	**P12**
	No	Replace logic board	**M20**

Kernel Panic/System Crashes

Unlikely cause: Battery, Power Adapter

Quick Check

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

Deep Dive

Check	Result	Action	Code
1. Isolate Peripherals as cause. Disconnect all peripherals, external devices, and display adapters if present and verify if issue does not happen anymore.	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 if 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 if kernel panic dependency is not linked to 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, camera, and Ambient Light Sensor). Camera cable can be disconnected without affecting startup and test. - Disconnect AirPort/Bluetooth card to isolate AirPort/Bluetooth functionality. - Disconnect optical drive cable to isolate optical drive. - Disconnect 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 Camera cable connection is crashing system, replace display module for damaged Camera/ALS cable. -If AirPort /BlueTooth card presence is crashing system, replace AirPort/BlueTooth flex cable and retest. If issue still happens with new cable, replace AirPort /BlueTooth card -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 Apple memory.	**L14** **X03** **N13** **X03** **J03** **X03** **H01** **X01**
	No	Symptoms unchanged, go to step 5	
5. Start up from optical drive or known-good OS. Attempt to start up with original or product install disc, or from an external hard drive with product OS installed, and verify if system starts without kernal panic.	Yes	Kernel panics stop alternate OS from running. Run ASD/DiskUtility to repair and test hard drive. If repair attempts fail, repartition hard drive and reinstall OS. Replace hard drive if restore fails.	**H03**
	No	Symptoms unchanged, go to Step 6	

6.	Disconnect display assembly and test with known-good display assembly or external monitor. Verify if system now starts up without kernel panic/freeze.	Yes	Replace display module.	**L14**
		No	Go to step 7	
7.	Check for thermal values and fan running speed Run ASD to check for fan and sensors test, and verify if ASD does not report any overtemp, failing sensor, or fan.	Yes	No thermal fail detected - Replace logic board with matching symptom: - If hang or freeze - If Kernel Panic/system crashes	**M05** **M06**
		No	If sensor test failed, reseat sensor connections on logic board and retest. If still failing, replace sensor or part where it is located (top case, display, other) : If top case sensor failed If display sensor failed If logic board sensor failed If fan test failed, replace fan. If overtemp , replace heatsink.	**X99** **L14** **M18** **X03** **X10**

Battery Run Time Too Short

Quick Check

Symptom	Quick Check
Battery Run Time Too Short Battery runs out of power very quickly (less than two hours)	1. Check if the battery is covered under a repair extension program. Use the "Portable Computer Battery Screening Process for Apple Service Providers" (**Knowledge Base CP165**). 2. Verify no applications have runaway processes with the CPU. See "Runaway applications can shorten battery runtime" (**Knowedge Base TS1473**). 3. Use "Apple Portables: Battery Life" (**Knowledge Base HT1466**) to screen for short battery run time. If replaced for run time too short, regardless of warranty coverage, use symptom code **P09** if replaced.

Won't Run on Power Adapter Alone

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

Quick Check

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

Deep Dive

Check	Result	Action	Code
1. With battery removed, verify if a known-good AC adapter starts up ,runs the system and shows 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. Verify if 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. Disconnect battery and verify if the unit also runs on a known-good power adapter.	Yes	Issue resolved.	**X03**
	No	Replace logic board..	**M01**

Power Adapter Issue

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

Quick Check

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

Deep Dive

Check	Result	Action	Code
1. Verify if the MagSafe LED is green or amber while connecting a known-good AC adapter on 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. Verfiy that the unit runs on a 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 system.	Yes	Bad MagSafe interconnect board. Issue resolved.	**X03**
	No	Go to step 4	
4. Verify if the original power adapter has stuck or bent pins on the MagSafe connector end.	Yes	Replace power adapter.	**P15**
	No	Go to step 5	
5. Verify if 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 original unit and troubleshoot source of error	
	No	Replace power adapter.	**P03**

Noise / Hum / Vibration

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

Quick Check

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

Deep Dive

Check	Result	Action	Code
1. Verify if the 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 connected 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. Verify if the noise comes from the optical drive usage.	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. Verify if the noise is coming 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. Verify if the noise is coming from the fan.	Yes	The fan(s) are generally running in a slow mode, but may accelerate when intensive processing is required (calculation, 3D gaming, or screen saver animation). If still beyond expected sound level, check for interference of fan with other mechanical element of system (foam, bracket, shield) before replacing a noisy fan.	**X03**
	No	Go to step 7.	**P04**
7. Noise maybe related to interference from other electrical devices operating near the computer, or on the same AC power source. Verify if noise is gone when operating in a different location on a different AC circuit.	Yes	Perhaps operating the unit with a surge suppressor will eliminate or reduce the noise. Change location of use or limit use of other device that is inducing the noise.	
	No	Replace logic board.	**M99**

Burnt Smell / Odor

Unlikely cause: Enclosure

Quick Check

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

Deep Dive

Check	Result	Action	Code
1. Verify if the source of the odor has been identified.	Yes	Replace the affected part.	**P08**
	No	Go to step 2	
2. Verify if there are any burn marks visible on components.	Yes	Replace the affected part.	**P08**
	No	Go to step 3	
3. Refer to **Liquid Contact Indicators**. Verify if any of the liquid spill sensors turned red.	Yes	For more information, refer to Knowledge Base article **http://support.apple.com/kb/HT3400**: "About Liquid contact indicators on portable computers.	
		Go to step 4	
4. Verify if the computer is operating normally.	Yes	This could be related to normal operation. Also check for accidental damage cause using Knowledge Base article **http://support.apple.com/kb/CP161**".	
	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 • Trackpad button does not work • Battery pack case has opened. • Bottom cover cannot be reinstalled	1. Check if the battery is covered under a repair extension program. 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**.

Uncategorized Symptom

Quick Check

Symptom	Quick Check
Uncategorized Symptom Unable to locate appropriate symptom code	Verify if 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 / Bluetooth card

Quick Check

Symptom	Quick Check
Ethernet Port/Device Issue • No Ethernet device present • Unable to access network resources • Ethernet device shows no connection • Ethernet device unable to get an IP address • Slow network performance	1. Check the network cable for damage, try a known good Ethernet cable – CAT5 or better recommended for 100Mbps+ connections. 2. Check Ethernet ports on Mac and wall/switch for dust, debris, damage or bent pins. 3. Ensure distance from networking infrastructure is less than 300 feet / 105 meters. 4. Verify port, cable and network hardware with a known good system. Isolate firewall, MAC address filtering or hardware access control devices. 5. Check system logs. Isolate OS by starting up from original product install media (10.6.x) or compatible known good Mac 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 MAC address filtering is not preventing address allocation. Note: DHCP allocation may not be instantaneous depending on network. Retest and verify if you obtain a valid IP address..	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. Verify if ping operation succeeds..	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/Bluetooth card connections, wait at least 5 seconds after shutdown before touching the AirPort/Bluetooth flex cable connections to card and to the logic board .Waiting less than 5 seconds before touching could damage the AirPort/Bluetooth card.

Quick Check

Symptom	Quick Check
AirPort or Bluetooth: Defective Wireless Devices • Unable to join networks or pair devices • Card not available or recognized • Intermittent device or connection dropouts	1. Open System Preferences and make sure AirPort or Bluetooth is turned on and (for AirPort) that a network is selected. 2. Ensure available software and firmware updates have been applied. 3. Reset PRAM 4. (AirPort) Using System Profiler,/AirPort channel list, check that installed AirPort card model supports the Base Station channel. 5. (AirPort) Check that base station is not using unsupported connection or encryption protocols. 6. (AirPort) Check for nearby interference sources such as microwave ovens or cordless phones (**Knowledge Base HT1365**) 7. (AirPort) Check the number of users trying to use AirPort in the area for possible network congestion. 8. (Bluetooth) Test with known-good Bluetooth device. 9. Isolate OS by booting from original install media (10.6.x). Attempt to connect to base station (AirPort) or pair with wireless keyboard (Bluetooth)..

Deep Dive

Check	Result	Action	Code
1. Open System Profiler, check to see if AirPort and Bluetooth are recognized.	Yes	If AirPort and Bluetooth interfaces are detected in System Profiler: - for Airport-related issues ensure that MAC address filtering is not enabled on the base station, and go to step 5. - for Bluetooth-related issues ensure that target devices are set to discoverable, and go to step 8.	
	No	If Airport or Bluetooth interfaces are not detected in System Profiler, go to step 2.	
2. Reseat both AirPort/Bluetooth flex cable connections to the card and to logic board and verify if card is seen in Apple System Profiler.	Yes	Loose flex cable connections to logic board or card side. Issue resolved	
	No	Replace AirPort/Bluetooth flex cable and go to step 3..	**X03**
3. With replaced AirPort/ Bluetooth flex cable, verify if card is seen in Apple System Profiler.	Yes	Defective AP/BT flex cable. Issue resolved	
	No	Replace AirPort/Bluetooth card and go to step 4..	**N18**
4. With replaced AirPort/ Bluetooth flex cable and card, verify if card is seen in Apple System Profiler.	Yes	Defective AP/BT flex card. Issue resolved	
	No	Replace logic board and retest	**M11**
5. (AirPort) Check that antenna connections to the AirPort card are not reversed or loose. Reseat both AirPort antennas connections and verify if the issue is fixed.	Yes	Loose connections or crossed antenna.	
	No	Check antenna for signs of damage or wear. If issue persists, go to step 6.	

6. (AirPort) Try a known-good Bluetooth/Airport card and verify if it fixes the issue.	Yes	Replace original Bluetooth/Airport card.	**N14**
	No	Continue to use known-good Bluetooth/Airport card, go to step 7.	
7. (AirPort) Install a known-good display module to test with known-good AirPort antennas Verify if it fixes the issue.	Yes	Replace original display module (Airport antennas are part of display module) and reinstall original Bluetooth/Airport card.	**L16**
	No	Issue is not hardware related. Retest with known-good system software.	
8. (Bluetooth) Install a known-good Bluetooth/Airport card. Enable Bluetooth and verify if Bluetooth connection issue is fixed	Yes	Replace original Bluetooth/Airport card.	**N15**
	No	Replace top case (Bluetooth antenna is part of top case) and reinstall original Bluetooth/Airport card.	**X03**

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 • Unable to find networks • Intermittent connection dropouts • Slow transfer speeds	1. Check for nearby interference sources in the 2.4/5 GHz range such as microwave ovens and cordless phones (**Knowledge Base HT1365**). 2. Check that computer is within base station range – move closer to base station. 3. Base station checks: a. Base station is not set to low-power transmission mode b. Base station is not using unsupported connection and encryption protocols c. Check for possible Wi-Fi channel overlap (nearby base stations using adjacent channel) 4. Isolate OS by booting from original install media (10.6.x). Attempt to connect to base station.

Deep Dive

Check	Result	Action	Code
1. Open System Profiler, check to see if AirPort card is recognized under Network: AirPort Card.	Yes	Use Software Update to make sure that all AirPort software and firmware updates have been applied. Ensure base station is not using MAC address filtering or creating a hidden network. Go to step 2..	
	No	If AirPort/Bluetooth card is not detected, go to previous Symptom table - AirPort/Bluetooth - Defective wireless devices.	

2. Verify if both antennas connections to the AirPort card are not reversed or loose. Reseat antennas connections.	Yes	Loose connections or crossed antenna	
	No	Check antenna for reversed connections or signs of damage or wear. If issue persists, go to step 3.	
3. Install a known-good AirPort/ Bluetooth card , retest and verify if issue is fixed.	Yes	Replace user's AirPort/ Bluetooth card.	**N18**
	No	Continue to use known good AirPort/Bluetooth card, go to step 4.	
4. Install a known-good display module to test with known-good AirPort antenna Verify if it fixes the issue.	Yes	Replace original display module (AirPort antennas are part of display module) and reinstall original Bluetooth/ Airport card.	**L16**
	No	Issue is not hardware related. Retest with known-good system software.	

Bluetooth Wireless Input Device Loses Connection

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

Quick Check

Symptom	Quick Check
Bluetooth Wireless Input Device Loses Connection	Check Bluetooth input device has fully charged batteries. Check with known-good Bluetooth input device Check that all system and device available software and firmware updates have been applied.

Deep Dive

Check	Result	Action	Code
1. System Profiler should list a Bluetooth radio device under system hardware. Verify if Bluetooth device info is available.	Yes	Bluetooth radio present, verify Bluetooth preference settings, go to step 2.	
	No	Go to Symptom - AirPort/ Bluetooth - Defective wireless devices	
2. System Preferences has a Bluetooth panel. Ensure Bluetooth is enabled and discoverable. Ensure that a known-good Bluetooth device is on, in close range and in discoverable mode. Verify if available Bluetooth devices are 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. Verify if computer can pair reliably with the known-good Bluetooth input device.	Yes	Pairing verified, connect with user's device, go to step 4	
	No	Attempt Bluetooth repair, go to step 5.	
4. Verify if computer can pair reliably with user's Bluetooth device.	Yes	Connection established, Continue testing for connection loss, go to step 8.	
	No	Check for available software updates for both computer & user's Bluetooth device.	

5.	Reseat Bluetooth antenna connector on AirPort/ Bluetooth card and retest. Verify if Bluetooth is enabled and can pair with a known-good device.	Yes	Loose Bluetooth antenna connection.	
		No	Go to step 6.	
6.	Install and test a known-good Bluetooth/Airport card and retest. Verify that Bluetooth is enabled and can pair with a known-good device.	Yes	Replace user's Bluetooth/ Airport card.	**N15**
		No	Go to step 7.	
7.	Continue to actively test with a known-good Bluetooth device to determine if there is a disconnect. Do not allow computer to sleep during this test. Verify if link is lost during test.	Yes	Check for software update, 2.4 GHz radio interference or device low battery. If still losing link, replace original top case (Bluetooth antenna is part of top case) and reinstall original Bluetooth/Airport card.	**X03**
		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. 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". Verify if link is lost during test.	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 • Kernel panic on boot • Kernel panic or freezing while attempting to connect to Wi-Fi networks • Kernel panic while transferring data on Wi-Fi networks.	1. Isolate OS by booting from original install media (10.6.x). Attempt to connect to Wi-Fi network. 2. Use Software Update to make sure all AirPort software and firmware updates have been applied.

Deep Dive

Check	Result	Action	Code
1. Use Software Update to make sure all AirPort/Bluetooth software and firmware updates have been applied. Ensure MAC address filtering is not enabled on the base station. Verify if kernel panic issue is resolved.	Yes	Software issue.	
	No	Go to step 2.	
2. Reseat both AirPort/Bluetooth flex cable connections to card and to logic board. Verify if kernel panic is resolved.	Yes	Go to step 4.	
	No	Go to step 3.	
3. Isolate AirPort/Bluetooth card by disconnecting the AirPort/Bluetooth flex cable from logic board. Verify if kernel panic is resolved.	Yes	Go to step 4.	
	No	Go to M06 Kernel Panic / System Crashes.	
4. Connect and test with a known-good AirPort/Bluetooth flex cable. Verify if kernel panic is resolved.	Yes	Replace AirPort/Bluetooth flex cable.	**X03**
	No	Go to step 5.	
5. Connect and test with a known-good AirPort/Bluetooth card. Verify if kernel panic is resolved.	Yes	Replace user's AirPort/Bluetooth card.	**N13**
	No	Replace logic board	**M11**

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 • Slow or stalled data transfers • Intermittent connection dropouts	1. Check for nearby interference sources in the 2.4/5 GHz 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 wireless performance with a known-good system/device. 5. (AirPort) Wireless base station checks: a. Base station is not set to low-power transmission mode. b. Base station is not set to a slower protocol mode (802.11b). c. Check for possible Wi-Fi channel overlap (nearby base stations using adjacent channel). 6. Isolate OS by booting from original install media (10.6.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 antennas are located 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. Refer to **Knowledge Base TS1809**. Verify if performance issue is fixed.	Yes	Possible AirPort interference from the Bluetooth card. Change AirPort base station channel. (**Knowledge Base TS1809**.)	
	No	-If AirPort-related issue, go to step 3. -If Bluetooth-related issue, go to step 6.	
3. (AirPort) Verify that antenna connections to the AirPort card are not reversed or loose. Reseat AirPort antenna connections and verify if performance issue is fixed.	Yes	Loose connection or crossed antenna. Issue resolved.	
	No	If the connectors are secure, antennas connections not reversed and show no signs of damage or wear, go to step 4	
4. (AirPort) Try a known-good AirPort/Bluetooth card and verify if performance issue is fixed.	Yes	Replace user's AirPort/ Bluetooth card.	**N14**
	No	Continue to use known good AirPort/Bluetooth card, go to step 5.	
5. (AirPort) Install a known-good display module and verify if performance issue is fixed.	Yes	Replace user's display module (AirPort antennas are part of display module) and reinstall original AirPort/Bluetooth card.	**L16**
	No	Tested with confirmed parts. Performance issue is not hardware related. Retest with known-good system software.	
6. (Bluetooth) Verify if Bluetooth antenna connection to the AirPort/Bluetooth card is not loose. Reseat antenna connection and verify if performance issue is fixed.	Yes	Loose Bluetooth antenna connection. Issue resolved.	
	No	Go to step 7.	
7. (Bluetooth) Try a known-good AirPort/Bluetooth card and verify if performance issue is fixed.	Yes	Replace user's AirPort/ Bluetooth card.	**N14**
	No	Replace user's top case (Bluetooth antenna is part of top case) and reinstall original AirPort/Bluetooth card.	**X03**

Wireless Input Device Doesn't Pair

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

Quick Check

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

Deep Dive

Check	Result	Action	Code
1. System Profiler should list Bluetooth radio device under system hardware. Verify if Bluetooth device is 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 that Bluetooth is enabled and discoverable. Ensure that known-good Bluetooth device is on, in close range and discoverable mode. Verify if available Bluetooth input devices are listed in pairing window.	Yes	Choose known-good Bluetooth device and establish a connection. Go to step 3.	
	No	Attempt Bluetooth repair, go to step 5.	
3. Verify if system can pair and works reliably with a known-good Bluetooth input device.	Yes	Pairing verified, connect with user's device, go to step 4.	
	No	Attempt Bluetooth repair, go to step 5.	
4. Verify if Bluetooth is pairing with user's Bluetooth device.	Yes	Issue resolved.	
	No	Check for SW update for both System and user input device.	

5.	Verify if Bluetooth antenna connection to the AirPort/Bluetooth card is not loose. Reseat antenna connection and verify if pairing issue is fixed.	Yes	Loose Bluetooth antenna connection. Issue resolved.	
		No	Go to step 6.	
6.	(Bluetooth) Install a known-good AirPort/Bluetooth card and verify if pairing issue is fixed.	Yes	Replace user's AirPort/Bluetooth card.	**N15**
		No	Replace user's top case (Bluetooth antenna is part of top case) and reinstall original AirPort/Bluetooth card.	**X03**

Uncategorized Symptom

Quick Check

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

Display

Display Anomalies

Quick Check

Symptom	Quick Check
Display Anomalies • Incorrect/missing colors • Distorted/blurred image • Pixel anomalies • Vertical/horizontal lines • Non-uniform brightness • Image flicker • Image persistence	1. Check display preferences for use of custom display profile. 2. Check brightness setting. 3. Check for Software Updates. 4. Clean glass panel while checking for dust/debris. 5. 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	Check for correct LCD identification. Go to step 4	
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 if the glass panel is free of contaminants.	Yes	Go to step 4.	
	No	Clean glass panel using approved method. Retest.	
4. Run Clamshell Service Diagnostic utility and check for LCD panel presence. If not found, reseat and check that LVDS cable is secure to the logic board. Verify if colors are restored.	Yes	Loose LVDS 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 needed with 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 user's display being tested.	Yes	Test needed with 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 internal video output. Verify if normal video is restored.	Yes	Replace user's display assembly.	**L02**
	No	Replace logic board.	**M04**

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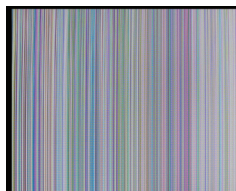
Check	Result	Action	Code
1. Sample image illustrates loss of LVDS data signals to LCD or a defective LCD panel, Inspect & reseat LVDS cable connection looking for damaged or bent pins. Verify if image is restored with the reseated cable connection.	Yes	Issue due to loose connection. Display issue resolved.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

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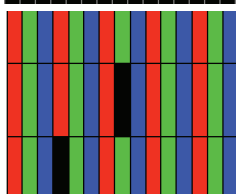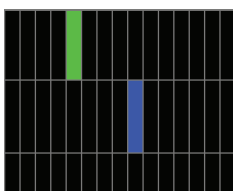
Check	Result	Action	Code
1. Determine if "defects" are dust/debris on surface of glass panel.	Yes	Clean glass panel.	
	No	Go to step 2.	
2. Determine if bright pixel defects exceed the acceptable number. See **Display Issue: Pixel Anomalies**.	Yes	Replace display assembly.	**L08**
	No	LCD meets bright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

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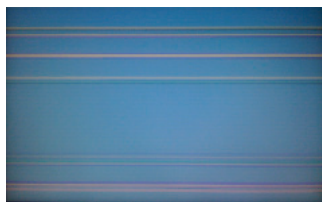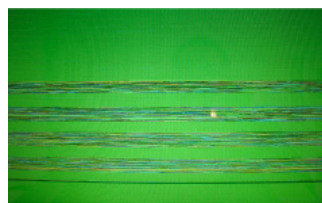
Check	Result	Action	Code
1. Horizontal lines may be related to a failing RAM module. Verify if video issue only happens AFTER the Apple logo and the spinning wheel has appeared.	Yes	Issue only happens AFTER Apple logo and spinning wheel appears. Go to step 2.	
	No	Issue happens since startup. Go to step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

Deep Dive: Non-uniform Brightness

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

Defective Camera / Built-in iSight Not Operating Correctly

Quick Check

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

Deep Dive

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

2. Run Clamshell Service Diagnostic utility and check for presence of all devices. If not found, inspect and reseat camera cable on logic board. Verify if iSight becomes listed in System Profiler:USB devices	Yes	Camera recognized. Go to step 3.	
	No	Go to step 4.	
3. Launch PhotoBooth. Verify if camera's green LED is on, and that image appears normal.	Yes	Issue resolved.	
	No	Go to step 4.	
4. Replace camera cable and verify if iSight camera operates properly.	Yes	Replaced camera cable solved issue.	**X03**
	No	Go to step 5.	
5. Substitute a known-good display assembly to test logic board camera connection. Verify if iSight camera operates properly.	Yes	Replace display assembly.	**L17**
	No	Replace logic board.	**M13**

Blank / No Video

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

Quick Check

Symptom	Quick Check
Blank / No Video • No video • No backlight • Video went blank at log in window • Video went blank going to desktop	1. Check brightness setting 2. Attach known-good supported external display. 3. Boot from Mac OS X install disc that came with computer 4. Verify system is not going to sleep during boot.

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 6.	
	No	Go to step 2.	
2. Did LCD display show OS logo and boot to log in dialog window or desktop then quickly turn off display and sleep with the sleep light pulsing?	Yes	Troubleshoot a possible stuck closed sleep mechanism. Go to step 8.	
	No	Go to step 3.	
3. Connect known-good supported external display. Start system and quickly close LCD display to force OS boot progress video to external display. Does system boot up and show desktop video on external display?	Yes	Go to step 4.	
	No	System does not present video to both internal or external displays. Go to step 9.	

4. Open computer display and open System Preference>Hardware>Displays and select Detect Displays. `Detect Displays` Wait 10 seconds, then select Detect Displays again. Now, select Gather Windows. Did a Color LCD control window appear behind your external display control window? **Note:** System will not acknowledge Color LCD if clamshell is closed. OS will reactivate Color LCD if display is functioning, display is open and Detect Displays is used in System Preferences.	Yes	System recognizes LCD panel presence. Go to step 5.	
	No	System does not recognize internal display. LCD electronic ID not present, LCD logic or power failure to LCD has occurred. Go to step 9.	
5. Is there a desktop image on LCD display? **Note**: You can adjust brightness controls in System Preferences>Hardware>Displays>Color LCD controls window. Disable ambient light changes and adjust brightness to full level.	Yes	Go to step 6.	
	No	Go to step 9.	
6. Does the LCD appear to have any display anomalies?	Yes	Go to Trouble Shooting steps for **Display Anomalies.**	
	No	Go to step 7.	
7. Is LCD backlight working properly?	Yes	No Video issue resolved.	
	No	Go to Troubleshooting section for **Backlight Issue / No Backlight**.	

8. A stuck sleep mechanism will make internal display unusable and system OS will shift boot image to external only. Learn to recognize system sleep behavior during use. Display may appear to be on temporarily or may present video without backlight before going to sleep. Is the system behaving like the sleep mechanism is stuck closed, forcing system to sleep and disabling internal display for user video?	Yes	Replace MLB for sleep wake issue.	**M22**
	No	Go to step 9.	
9. Inspect display video cable connection to MLB. Inspect for signs of connector damage on both the MLB or display video cable. Also, verify if problem was cable disconnect. Does video cable or MLB show any signs of connector or wire damage?	Yes	Replace MLB for connector damage. Replace Clamshell for video cable damage.	**M24** **L14**
	No	Go to step 10.	
10. Reseat display cable and test for internal LCD video. Is video restored with cable reseat?	Yes	Issue resolved.	
	No	Go to step 11.	
11. Test MLB using a known good display clamshell. Is video from MLB restored using a known good display clamshell?	Yes	Replace customer's display clamshell assembly.	**L03**
	No	Replace MLB for no video issue.	**M03**

Backlight Issue / No Backlight

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

Quick Check

Symptom	Quick Check
Backlight Issue / No Backlight • Display not illuminated • Flashing, unstable or non uniform background lighting • Poor backlight at some or all settings	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 or using the Clamshell Service Diagnostic utility .	Yes	Internal LCD panel detected by system. Go to step 3.	
	No	Go to step 2.	
2. Reseat the LVDS cable at the logic board. Verify again that LCD is listed in System Profiler or Clamshell Service Diagnostic utility.	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. Inspect LVDS connectors and cable under magnification for pinched cables and damaged or bent pins. Verify if any of the connections appear to be defective.	Yes	- Defective LVDS cable. Replace display assembly. - Defective LVDS connector on logic board. Replace logic board.	**L09** **M25**
	No	If connections are OK and secure and the display is still blank, go to step 5	

5. Remove logic board and locate F9800 fuse on board. For fuse locations, see **kBase #TS3600**. Using an **ohmmeter**, determine if fuse is burned out.	Yes	Fuse was probably burned out by a short in display cable or connection. Replace both - display assembly AND - logic board.	**L09** **M25**
	No	Replace customer's display assembly. Go to step 6.	**L09**
6. Verify that display and backlight operations are restored.	Yes	Issue resolved.	
	No	Backlight issue persists. Replace logic board and reinstall original display assembly.	**M25**

Noise / Unstable Flickering

Unlikely cause: battery

Quick Check

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

Deep Dive

Check	Result	Action	Code
1. Verify if user's issue is due to video flickering coming from display.	Yes	Suspected flickering issue, go to step 2.	
	No	Audible noise issue, go to step 5.	
2. Verify display listed in the System Profiler's Graphics/Displays device tree is not disappearing intermittently (refresh System Profiler to observe).	Yes	Power and LCD panel ID are OK. Go to step 3.	
	No	Go to No Video symptom code flow.	

3. Inspect and reseat the LVDS cable connection between display and logic board. Also test if brightness setting is a contributing factor. Verify if flickering has stopped.	Yes	Loose LVDS cable connection. Issue resolved.	
	No	Go to step 4.	
4. Substitute a known good display assembly to test internal logic board video output. Verify if flickering issue has disappeared.	Yes	Replace display assembly.	**L06**
	No	Replace logic board.	**M04**
5. Verify if source of the noise is the electrical as opposed to mechanical. Audio noise should not be a concern now that LCD components are all solid state devices including LED backlights.	Yes	Noises that are not audible from the normal user position are considered acceptable. Return unit to the user.	
	No	Noise from another source. Go to Noise/Hum/vibration Symptom table.	

Mechanical/Physical Damage

Quick Check

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

Cosmetic Defects

Quick Check

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

Uncategorized Symptom

Quick Check

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

Mass Storage

Hard Drive Read/Write Issue

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

Quick Check

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

Deep Dive

Check	Result	Action	Code
1. Start up from Restore DVD and launch Disk Utility. Verify if hard drive is available for Disk Utility to repair.	Yes	Go to step 2.	
	No	Go to step 3.	
2. Repair disk and permissions using Disk Utility and verify if hard drive was repaired successfully.	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. Reseat hard drive cable on logic board and drive ends and retest. If issue persists, substitute a known-good bootable hard drive, and verify if system starts 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 flex cable connections, verify if known-good hard drive boot to desktop.	Yes	Reinstall user's drive, go to step 2	
		No	Suspect hard drive flex cable, go to step 5.	
5.	Replace hard drive flex cable and verify if system boots to desktop with known-good hard drive.	Yes	Reinstall user's drive, go to step 2.	**X03**
		No	Replace logic board.	**M19**
6.	Verify if user's hard drive starts up successfully after Disk Utility disk and authorizations repairs.	Yes	Issue resolved.	
		No	Repair or replace hard drive, go to step 7.	
7.	Partition, erase & install Mac OS on user's hard drive. Verify if OS install completes without error and that system starts up successfully. Note: If media verification fails at beginning of install, suspect optical media or optical drive.	Yes	Issue resolved	
		No	Hard drive appears to be defective, go to step 8.	
8.	Replace user's hard drive. Verify if drive formats correctly with a GUID partition map and installs Mac OS without errors.	Yes	Issue resolved.	**H01**
		No	Hard drive cable verified or replaced and new hard drive installed, replace logic board.	**M19**

Hard Drive Not Recognized/Not Mounting

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

Quick Check

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

Deep Dive

Check	Result	Action	Code
1. Boot from Restore DVD and launch Disk Utility. Verify if hard drive is available for Disk Utility to repair.	Yes	Go to step 2.	
	No	Go to step 3.	
2. Verify if Disk Utility mounts drive and repairs disk and permissions successfully.	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. Reseat hard drive flex cable on logic board and drive ends and retest. If issue persists, substitute a known-good bootable hard drive, and verify if computer starts up to desktop.	Yes	Reinstall 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 hard drive flex cable connections, verify if known-good hard drive starts up to desktop.	Yes	Reinstall user drive, go to step 2.	
	No	Suspect hard drive flex cable, go to step 5.	
5. Replace hard drive flex cable, retest with known-good bootable hard drive and verify if system starts up to desktop.	Yes	Install user drive, go to step 2.	**X03**
	No	Replace logic board.	**M19**
6. Verify if 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. Verify if OS install completes without error and that system starts 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	Hard drive and flex cable replaced without success, replace logic board.	**M19**

Hard Drive Noisy

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

Quick Check

Symptom	Quick Check
Hard Drive Noisy • Noise during start up • Noise during operation • Noise when drive is copying or saving data	1. Start up from Install DVD. Verify S.M.A.R.T. status of hard drive and repair disk using Disk Utility. 2. Verify if any available firmware updates are available for the installed drive. 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. Verify if hard drive is available for Disk Utility to repair.	Yes	Go to step 2.	
	No	Go to Hard Drive Not Recognized/Not Mounting symptom table.	
2. Repair disk and permissions using Disk Utility and verify it completed successfully.	Yes	Restart computer. Go to step 3.	
	No	Go to step 4.	
3. Run all available software and firmware updates and verify if the system is 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. Verify it install process completed.	Yes	Restart computer. Go to step 3.	
	No	Replace hard drive. Go to step 5.	**H06**

5. After installing new hard drive, verify if the system is still noisy.	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 symptom table and Fan failures/Thermal symptom 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. Reinstall user drive.	
	No	Replace hard drive. Go to step 5.	**H06**

Optical Drive Won't Accept/Reject Media

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

Quick Check

Symptom	Quick Check
Optical Drive Won't Accept/Reject Media • Cannot insert a disc into the drive • Cannot eject a disc placed into the drive	1. Use Apple System Profiler ATA section to see if the optical drive appears. If not, see Optical Drive Not Recognized symptom table, 2. Restart computer and hold down mouse button or keyboard eject key to cycle optical drive. 3. Check for available firmware and software updates. 4. Inspect optical drive slot for obstructions

Deep Dive

Check	Result	Action	Code
1. Verify if optical drive is listed in the System Profiler device tree for serial-ATA devices.	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. Verify if optical drive is now listed in System Profiler.	Yes	Optical drive has power, inspect disc acceptance. Go to step 5.	
	No	Replace any damaged optical drive cable and retest. If connections are good and with no visible cable damage, go to step 3.	**X03**
3. Reseat optical cable on logic board and drive ends and retest. If issue persists, replace optical drive cable with a known good one. Verify if optical drive is now listed in System Profiler.	Yes	Replaced user optical drive cable. Issue resolved.	**X03**
	No	Go to step 4.	
4. Install and test a known-good optical drive with replacement flex cable. Verify if optical drive is now listed in System Profiler.	Yes	Replaced user optical drive. Issue resolved.	**J01**
	No	Replace the logic board.)	**M19**
5. Inspect optical drive slot for disc insert/eject. Verify if there is clearance for disc use.	Yes	Go to step 6.	
	No	Replace damaged optical drive or top case that interferes with disc use.	**J01** **(J05)** **X13**
6. Insert known-good optical media and test user's optical drive for acceptance of disc. Verify if optical media is read.	Yes	Go to step 7.	
	No	Media is ejected as soon as inserted : Replace the optical drive. (Mechanical damage to optical drive, if found) Go to step 9.	**J03** **(J06)**

7. Verify if optical media mounts on desktop.	Yes	Go to Eject Test step 8.	
	No	Go to Optical Drive Read/ Write Data Error symptom table.	
8. Verify if optical media is ejected properly from optical drive.	Yes	Issue resolved.	
	No	Replace optical drive or top case that interferes with disc ejection. Go to step 9..	**J02** **X13**
9. With replacement parts , verify if optical media is now recognized.	Yes	Issue resolved.	
	No	Replace optical drive. If drive has already been replaced, then replace logic board.	**J03** **M19**

Optical Drive Read/Write Data Error

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

Quick Check

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

Deep Dive

Check	Result	Action	Code
1. Verify if media is free to spin without optical drive scraping edge or surface of media.	Yes	Go to step 2.	
	No	Replace optical drive.	**J03**

2. According to optical drive model, verify if drive can read all supported types of known-good optical media (CD , DVD, etc)	Yes	Go to step 6	
	No	Reading CD only or DVD only indicates a laser issue, replace optical drive.	**J03**
		Optical drive cannot read any media reliably, go to step 3.	
3. Reseat optical cable on logic board and drive ends and retest. If issue persists, replace optical drive cable with a known good one. Verify if optical drive now performs the desired read/write operations.	Yes	Replace user optical drive cable. Issue resolved.	**X03**
	No	Go to step 4.	
4. Install and test a known-good optical drive with replacement flex cable. Verify if optical drive now performs the desired read/write operations.	Yes	Replace user optical drive. Issue resolved.	**J01**
	No	Replace logic board	**M19**

Optical Drive Not Recognized/Mount

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

Quick Check

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

Deep Dive

Check	Result	Action	Code
1. Verify that optical drive is listed in the device tree for SATA devices in System Profiler.	Yes	Issue resolved.	
	No	Go to step 2.	
2. Check that both connections of the optical drive flex cable between logic board and optical drive are secure. Visually inspect cables and connectors for any debris, damage, or bent pins. Verify if optical drive is 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. Replace optical drive cable with a known good one. Verify if optical drive is now listed in System Profiler.	Yes	Replace user optical drive cable. Issue resolved.	**X03**
	No	Go to step 4.	
4. Install and test a known-good optical drive with replacement flex cable. Verify if optical drive is now listed in System Profiler.	Yes	Replace user optical drive. Issue resolved.	**J01**
	No	Replace the logic board.	**M19**

Optical Drive Noisy

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

Quick Check

Symptom	Quick Check
Optical Drive Noisy • Noise during boot • Noise during operation • Noise when drive is copying or writing data	1. Test optical media in another drive of the same type in same type of computer to rule out media issue. 2. Check with known-good discs. Install discs that came with the computer. 3. Check to see if noise occurs without media in the drive. If so, check for hard drive and fan caused noise. 4. Check for available firmware /software updates.

Deep Dive

Check	Result	Action	Code
1. Verify if optical drive is 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	Replace optical drive if continuous activity occurs with no disc installed.	**J04**
	No	Continue and verify with media, go to step 2.	
2. Insert known good data CD. Check that media is free to spin without optical drive scraping edge or surface of media. Verify disc does not exceed maximum thickness specification.	Yes	Internal mechanical interference is affecting rotational spin of media, replace optical drive.	**J04**
	No	Continue and verify with media, go to step 3.	
3. Initial disc handling noise is normal. Disc spinning and head seek indicates disc is mounting to desktop. Seek noise should settle down once mounted. Verify if noise is above normal level 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. Verify if the noise is related to disc spin.	Yes	Go to step 5.	
	No	Go to step 6.	
5. Remove the optical drive and check for 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 optical media. Disc handling noise should be one pop of disc from motor hub and a motor gear sound driving disc out of optical drive. Verify if noise is above normal level 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 optical media on desktop. Media may be mounting on a defective internal spindle hub. Verify if the noise is related to disc spin. | Yes | Replace optical drive. | **J04** |
| | No | Noise does not appear to be related to optical drive. | |

Optical Drive Not Performing to Specs

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

Quick Check

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

Deep Dive

Check	Result	Action	Code
1. Check drive model and supported media types, and verify if optical drive can read all supported optical media types.	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.	**J03**
2. Reseat cable connections at logic board and optical drive. Verify if media is now recognized and reads reliably.	Yes	Reseat resolved issue.	**X03**
	No	Go to step 3.	

3. Disconnect optical drive by lifting optical drive cable at logic board and connecting a known-good drive. Verify if media is now recognized and reads reliably.	Yes	Reconnect user's optical drive cable. Go to step 4.	
	No	Replace logic board.	**M19**
4. Install and test with replacement optical drive flex cable. Verify if 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 optical 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 if 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

Thunderbolt Not Recognized

Unlikely cause: display clamshell, hard drive, fan, Airport/Bluetooth Card

Quick Check

Symptoms	Quick Check
Thunderbolt Not Recognized • Thunderbolt hardware not listed in System Profiler.	1. Check Apple Support article **HT1159: Mac OS X versions (builds) included with Intel-based Macs** to make sure system build is correct for this computer model. 2. Check for and apply the latest software and firmware updates. 3. Verify in System Profiler that Thunderbolt hardware is present.

Deep Dive

Check	Result	Action	Code
1. Check Apple support article **HT1159: Mac OS X versions (builds) included with Intel-based Macs** to make sure system build is correct for this computer model. Is Mac OS X version equal to or a newer than a version that will support Thunderbolt functionality?	Yes	Go to step 2.	
	No	Restore system from media shipped with product. **Note:** Always use product-specific restore media. Retail versions of the same OS may not have specific drivers to support this model. Check for and apply the latest software and firmware updates. Go to step 2.	
2. Check for and apply the latest software and firmware updates. Verify in System Profiler that Thunderbolt hardware is present, listing a unique UID number and latest revisions for controller and port micro firmware.	Yes	Issue resolved.	
	No	Go to step 3.	

3. Reset PRAM by holding down Command-Option-P-R keys while rebooting, until you hear the startup sound for the second time. Verify in System Profiler that Thunderbolt hardware is present.	Yes	Issue resolved.	
	No	Replace logic board.	**M33**

Thunderbolt Target Disk Mode Issues

Unlikely cause: display clamshell, hard drive, fan

Quick Check

Symptoms	Quick Check
Thunderbolt Target Disk Mode Issues • Thunderbolt hardware is present in System Profiler and Port Status does not show a connection to attached Target Disk Mode computer. • Target Disk Mode computer will not mount to user's desktop.	1. Check Apple Support article **HT1159: Mac OS X versions (builds) included with Intel-based Macs** to make sure system build is correct for this computer model. 2. Check for and apply the latest software and firmware updates. 3. Check if attached Thunderbolt device is listed in System Profiler > Hardware > Thunderbolt. 4. Substitute a known-good Thunderbolt to Thunderbolt (2m) cable.

Deep Dive

Check	Result	Action	Code
1. Check Apple support article **HT1159: Mac OS X versions (builds) included with Intel-based Macs** to make sure system build is correct for this computer model. Is Mac OS X version equal to or a newer than a version that will support Thunderbolt functionality?	Yes	Go to step 2.	
	No	Restore system from media shipped with product. **Note:** Always use product-specific restore media. Retail versions of the same OS may not have specific drivers to support this model. Check for and apply the latest software and firmware updates. Go to step 2.	

2. Start up a known-good, Thunderbolt-capable computer in Target Disk Mode (TDM) by holding the T key at startup until display shows Thunderbolt and FireWire icons. Reseat Thunderbolt to Thunderbolt (2m) cable on both TDM computer and user's computer. Start up user's computer and verify that TDM computer's hard drive has mounted on desktop of user's computer.	Yes	Go to step 3.	
	No	Go to step 4.	
3. Verify Thunderbolt connection by copying a file from TDM computer to user's computer. **Note:** File transfer speed is limited by internal hard drive limit of 3 Gbits/second. Are you able to copy a file across the Thunderbolt connection?	Yes	Issue resolved.	
	No	Go to step 4.	
4. Disconnect all connections to Thunderbolt port on user's computer. Check for and apply the latest software and firmware updates. Verify in System Profiler that Thunderbolt hardware is present, listing a unique UID number and latest revisions for controller and port micro firmware.	Yes	Go to step 5.	
	No	Replace logic board.	**M33**
5. Inspect both connector ends of Thunderbolt to Thunderbolt (2m) cable for cable/connector damage, then inspect wire for cuts, pulled strain relief or broken connector housing. Has Thunderbolt cable sustained any damage that would affect connectivity?	Yes	Replace Thunderbolt to Thunderbolt (2m) cable.	**X26**
	No	Go to step 6.	

6. Inspect Thunderbolt port on user's computer for physical damage or possible burn mark indicators suggesting a defective port. Does Thunderbolt port appear to be damaged?	Yes	Replace logic board.	**M24**
	No	Go to step 7.	
7. Check Thunderbolt to Thunderbolt (2m) cable connector alignment with port opening. Can the Thunderbolt cable be inserted into the port fully without interference or excessive force to seat it fully?	Yes	Go to step 8.	
	No	Logic board misaligned with port opening in top case. Realign logic board to top case. If Thunderbolt port shows signs of damage which make proper alignment impossible, replace logic board.	**M24**
8. Test user's computer with a known-good Thunderbolt to Thunderbolt (2m) cable. Does Thunderbolt port establish a TDM connection to a known-good, Thunderbolt-capable computer using a known-good Thunderbolt cable?	Yes	Go to step 9.	
	No	Replace logic board.	**M33**
9. Test user's computer with user's Thunderbolt to Thunderbolt (2m) cable. Does Thunderbolt port establish a TDM connection to a known-good, Thunderbolt-capable computer using a known-good Thunderbolt cable?	Yes	Issue resolved.	
	No	Replace Thunderbolt to Thunderbolt (2m) cable.	**X26**

Thunderbolt Target Display Mode Issues

Unlikely cause: LCD panel, hard drive, fan

Quick Check

Symptoms	Quick Check
Thunderbolt Target Display Mode Issues • Unable to activate remote computer to be target display for user's computer. • Unable to activate user's computer to be target display for a remote computer.	1. **Note:** Internal display of Mac portables are prohibited from being set to Target Display Mode. 2. Check Apple Support article **HT1159: Mac OS X versions (builds) included with Intel-based Macs** to make sure system build is correct for this computer model. 3. Check for and apply the latest software and firmware updates. 4. Verify in System Profiler that Thunderbolt hardware and any connected devices are present. 5. Substitute a known-good Thunderbolt to Thunderbolt (2m) cable.

Deep Dive

Check	Result	Action	Code
1. Check Apple support article **HT1159: Mac OS X versions (builds) included with Intel-based Macs** to make sure system build is correct for this computer model. Is Mac OS X version equal to or a newer than a version that will support Thunderbolt functionality?	Yes	Go to step 2.	
	No	Restore system from media shipped with product. **Note:** Always use product-specific restore media. Retail versions of the same OS may not have specific drivers to support this model. Check for and apply the latest software and firmware updates. Go to step 2.	
2. Reseat Thunderbolt to Thunderbolt (2m) cable on both user's computer and a known-good, Thunderbolt-capable iMac. Start up both computers to the desktop. Activate Target Display Mode (TDM) on the known-good iMac by pressing CMD and F2 keys momentarily. Does known-good iMac act as a target display to extend the desktop of user's computer?	Yes	Issue resolved.	
	No	Go to step 3.	

3. System Profiler > Thunderbolt device tree should display cable connections from user's computer to known-good iMac. Is the Port Status "Connected" and Link Status at "2"?	Yes	Go to step 9.	
	No	Go to step 4.	
4. Disconnect all connections to Thunderbolt port on user's computer. Check for and apply the latest software and firmware updates. Verify in System Profiler that Thunderbolt hardware is present, listing a unique UID number and latest revisions for controller and port micro firmware.	Yes	Go to step 5.	
	No	Replace logic board.	**M32**
5. Inspect both connector ends of Thunderbolt to Thunderbolt (2m) cable for cable/connector damage, then inspect wire for cuts, pulled strain relief or broken connector housing. Has Thunderbolt cable sustained any damage that would affect connectivity?	Yes	Replace Thunderbolt to Thunderbolt (2m) cable.	**X24**
	No	Go to step 6.	
6. Inspect Thunderbolt port on user's computer for physical damage or possible burn mark indicators suggesting a defective port. Does Thunderbolt port appear to be damaged?	Yes	Replace logic board.	**M24**
	No	Go to step 7.	
7. Check Thunderbolt to Thunderbolt (2m) cable connector alignment with port opening. Can the Thunderbolt cable be inserted into the port fully without interference or excessive force to seat it fully?	Yes	Go to step 8.	
	No	Logic board misaligned with port opening in top case. Realign logic board to top case.	
		If Thunderbolt port shows signs of damage which make proper alignment impossible, replace logic board.	**M24**

8. Test user's computer with a known-good Thunderbolt to Thunderbolt (2m) cable. Refresh System Profiler > Thunderbolt device tree. Does Thunderbolt hardware establish a connection to known-good iMac listed as "Macintosh" with Port Status "Connected" and Link Status "2"?	Yes	Go to step 9.	
	No	Replace logic board.	**M32**
9. Connect a known-good Thunderbolt to Thunderbolt (2m) cable to user's computer and known-good iMac. Start up both computers to the desktop. Activate TDM on the known-good iMac by pressing CMD and F2 keys momentarily. Does known-good iMac act as a target display to extend the desktop of user's computer?	Yes	Go to step 10.	
	No	Contact TSPS.	
10. Connect **user's Thunderbolt to Thunderbolt (2m) cable** to user's computer and known-good iMac. Start up both computers to the desktop. Activate TDM on the known-good iMac by pressing CMD and F2 keys momentarily. Does known-good iMac act as a target display to extend the desktop of user's computer?	Yes	Issue resolved.	
	No	Replace Thunderbolt to Thunderbolt (2m) cable.	**X24**

USB Port Does Not Recognize Known Devices

Unlikely cause: LCD, hard drive, optical drive

Quick Check

Symptom	Quick Check
USB Port Does Not Recognize Known Devices USB-wired keyboard/mouse or USB flash drive not recognized	1. Check the for latest software update. 2. Use Apple System Profiler to verify the computer recognizes the USB bus. 3. Test port with known good Apple keyboard or mouse. 4. Verify any USB hubs have sufficient power.

Deep Dive

Check	Result	Action	Code
1. Reset SMC and clear PRAM. Verify if USB device is recognized.	Yes	Issue resolved.	
	No	Go to step 2.	
2. Verify if USB device is receiving power from USB port. Note: first device to need >500mA will get 1000mA, all others will be limited to <500mA	Yes	Go to step 3.	
	No	Replace logic board.	**M15**
3. Verify if the latest Mac-compatible available driver for this USB device is installed.	Yes	Go to step 4.	
	No	Obtain Mac-compatible USB driver.	
4. Verify if USB device is working on a known-good similar computer.	Yes	Replace logic board.	**M15**
	No	Obtain service for the defective USB device.	

Built-in Keyboard Does Not Work Properly

Unlikely cause: LCD, hard drive, optical drive

Quick Check

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

Deep Dive

Check	Result	Action	Code
1. If specific keys are not working, confirm if they are physically broken.	Yes	Refer to **"MacBook/ MacBook Pro: Black Keycap Replacement" (HT4002)** or **"MacBook: White Keycap Replacement" (HT4003)**. If a keycap kit is available for this model, order kit and replace affected key(s). Go to step 4. If a keycap kit is not available for this model, replace complete top case. Go to step 4.	**K01**
	No	Go to step 2.	
2. Reseat keyboard flex cable to logic board and verify if all keys are functional.	Yes	Issue resolved.	
	No	Go to step 3.	
3. Disconnect and verify if 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 if keyboard now functions properly.	Yes	Issue resolved.	
	No	Replace top case. Go to step 5.	**K01**
5. Verify if all keys are functional using ASD interactive keyboard test.	Yes	Issue resolved.	
	No	Replace logic board.	**M15**

Specific Keys Don't Work

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

Quick Check

Symptom	Quick Check
Specific Keys Don't Work • Keycap broken • Key switch broken • Sticky key • Key pressed not recognized	1. Determine if damage caused by user/technician environment, accidental damage, or abuse. 2. Inform user/technician the failures are not covered by Apple warranties. Refer to **http://www.apple.com/legal/warranty** 3. Inspect keycap to remove debris trapped under it. 4. If the keycap is loose, check if clasp is still intact and reattach it. 5. Refer to **"MacBook/MacBook Pro: Black Keycap Replacement" (HT4002)** or **"MacBook: White Keycap Replacement" (HT4003)**. If a keycap kit is available for this model, order kit and replace affected key(s). If a kit is not available, replace complete top case (code **K01**).

Built-in Trackpad Does Not Work

Quick Check

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

Deep Dive

Check	Result	Action	Code
1. In System Preferences: Universal Access, turn off special Keyboard and Mouse & Trackpad settings. Set for normal use, enable and test multiple touch features. Verify if trackpad works now.	Yes	Settings issue resolved.	
	No	Go to step 2	
2. Verify if you see the Apple Internal Keyboard/Trackpad continuously listed on USB in Apple System Profiler.	Yes	Go to step 5.	
	No	Go to step 3.	
3. Reseat the trackpad flex cable to the logic board. Verify if trackpad works now.	Yes	Loose cable. Issue resolved.	
	No	Go to step 4.	
4. Verify if the trackpad connector on the logic board is damaged.	Yes	Replace logic board.	**M24**
	No	Go to step 5.	
5. Does the cursor move correctly when trackpad is used ? Clean trackpad surface and verify trackpad is moving cursor on screen.	Yes	Go to step 6	
	No	Test with known-good trackpad. Go to step 7	
6. Does the trackpad button click? Verify trackpad alignment is proper and click-depth set screw is at factory setting.	Yes	Test with known-good trackpad. Go to step 7	
	No	Go to step 7	

7. Verify if a known-good trackpad works.	Yes	Replace user trackpad according to symptom found. -No Mouse/trackpad response	K02
		-Trackpad cursor not tracking properly	K12
		-Trackpad click button issues	K13
	No	Replace logic board.	M16

Built-in Keyboard Has Dim or No Keyboard Backlight

Unlikely cause: LCD, hard drive, optical drive

Quick Check

Symptom	Quick Check
Built-in Keyboard Has Dim or No Backlight • In darkened room, keyboard backlight does not come on or is dim.	1. Make sure this computer model has a keyboard backlight option by checking the configuration label in the battery bay. 2. Make sure that keyboard backlight is turned on and brightness turned up. 3. Block the ambient light sensor to simulate darkened room.

Deep Dive

Check	Result	Action	Code
1. Cover the Ambient Light Sensor located near camera. Verify if the display dims	Yes	Ambient light sensor is working. Go to step 2.	
	No	Go to step 3.	
2. Cover the ambient light sensor again and press the F6 keyboard key. Verify if keyboard backlight works.	Yes	Issue resolved.	
	No	Go to step 4.	

3. In the Apple System Profiler, verify if you can you see the USB camera listed.	Yes	The Ambient Light Sensor shares its connection to logic board with camera and is likely correctly connected.. If issue persist, replace display assembly.	**L14**
	No	Go to step 6	
4. Check keyboard backlight cable and connector for damage and reseat keyboard backlight connection to the logic board. Verify if the keyboard backlight now works.	Yes	Issue resolved.	
	No	Go to step 5	
5. Cover the Ambient Light Sensor located near camera and press the F6 keyboard key .Measure the voltage between pin 4 and pin 2 of the keyboard backlight connector. Verify if voltage is present.	Yes	Replace top case.	**K10**
	No	Replace logic board.	**M99**
6. Check camera cable and connector for damage and reseat the camera cable connection to the logic board. Verify if the Ambient Light Sensor functionality now works.	Yes	Ambient Light Sensor functional. Retest for keyboard backlight functionality.	
	No	Replace top case and go to step 7.	**K10**
7. With replaced top case verify if the Ambient Light Sensor now works.	Yes	Ambient Light Sensor functional. Retest for keyboard backlight functionality.	
	No	Replace logic board	**M23**

Built-in Keyboard Is Not Recognized

Unlikely cause: LCD, hard drive, optical drive

Quick Check

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

Deep Dive

Check	Result	Action	Code
1. In Apple System Profiler do you see "Apple Internal Keyboard/ Trackpad" listed under USB hardware devices?	Yes	Go to step 3.	
	No	Go to step 2.	
2. Reset SMC and verify if Apple Internal Keyboard/Trackpad is now seen in the USB devices list of Apple System Profiler.	Yes	Go to step 3.	
	No	Replace logic board.	**M15**
3. If built-in keyboard is not recognized, verify if trackpad is still functional	Yes	Go to step 4.	
	No	Go to Built-In Trackpad Does not Work" symptom table.	
4. Check that keyboard flex cable is in good condition (no delamination, torn cable end, missing or cracked tracks).	Yes	Go to step 5.	
	No	Replace top case. Go to step 6.	**K11**
5. Check that keyboard flex cable is fully inserted and aligned with connector on logic board, and that connector lock is closed. Verify if keyboard now functions properly.	Yes	Issue resolved.	
	No	Replace top case. Go to step 6.	**K11**
6. Verify if all keys are functional using ASD.	Yes	Issue resolved.	
	No	Replace logic board.	**M15**

Built-in Trackpad Does Not Track Properly

Unlikely cause: LCD, hard drive, optical drive

Quick Check

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

Deep Dive

Check	Result	Action	Code
1. In System Preferences: Universal Access, turn off special Keyboard and Mouse & Trackpad settings. Verify if trackpad works now.	Yes	Settings issue resolved.	
	No	Go to step 2.	
2. Verify if you see the Apple Internal Keyboard/Trackpad continuously listed under USB in Apple System Profiler.	Yes	Trackpad communicating to system. Go to step 6	
	No	Go to step 3	
3. Verify if the trackpad looks damaged.	Yes	Test with known good trackpad. Go to step 6.	
	No	Go to step 4	
4. Reseat the trackpad flex cable on the logic board. Verify if the trackpad works now.	Yes	Loose cable. Issue resolved.	
	No	Go to step 5	
5. Verify if the trackpad connector on the logic board is damaged.	Yes	Replace logic board.	**M24**
	No	Go to step 6.	
6. Replace with known-good trackpad and verify if it works.	Yes	Replace user defective trackpad.	**K02**
	No	Replace logic board.	**M16**

Apple Remote Inoperable

Unlikely cause: LCD, hard drive, optical drive

Quick Check

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

Deep Dive

Check	Result	Action	Code
1. Open Photo Booth or iChat's Video Preview window. Point Apple Remote at the built-in iSight camera, press any button on the remote, and verify if (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 if you can pair the Apple Remote with a known-good system.	Yes	Go to step 3.	
	No	Replace the Apple Remote. Go to step 3.	**X04**
3. Go in Security settings of System Preferences. Uncheck the "Disable remote control infrared receiver" if checked, and verify if Apple Remote now works.	Yes	Issue resolved.	
	No	Check and reseat the HD/IR/Sleep LED cable connection at logic board. Go to step 4.	
4. Verify if the Apple Remote now works.	Yes	Issue resolved.	
	No	Replace the HD/IR/Sleep LED cable. Go to step 5.	**X03**
5. Verify if the Apple Remote now works.	Yes	Issue resolved.	
	No	Replace logic board.	**M15**

Built-in Speaker Has No Audio

Unlikely cause: LCD, hard drive, optical drive

Quick Check

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

Deep Dive

Check	Result	Action	Code
1. Remove any externally-connected speakers and verify if System Preferences: Sound: Output current setting is set to "Internal Speakers".	Yes	Internal Audio-out port is selected. Go to step 3.	
	No	"External Speakers" or "Digital Out," reported Go to step 2	
2. Play some music and plug known-good headphones /speakers in the audio output jack .Verify if you get audio through the external headphones/speakers.	Yes	Go to step 3	
	No	Replace logic board.	**M09**
3. Unplug headphone/speakers and verify if you now get audio through internal speakers .Cycle this plug /unplug operation several times and verify if audio gets back each time to the Internal speakers.	Yes	Issue resolved.	
	No	Check left and right speakers connections to logic board. -If disconnected, reseat connectors, -if damaged or missing, replace affected speaker., - otherwise, go to step 4	**X08**
4. Replace with known-good internal speakers. Verify if you now get audio through internal speakers.	Yes	Replace affected user's speaker Issue resolved.	**X08**
	No	Replace logic board.	**M09**

Distorted Sound from Internal Speaker

Unlikely cause: LCD, hard drive, optical drive

Quick Check

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

Deep Dive

Check	Result	Action	Code
1. Compare internal speakers with a pair of headphones and verify if the distortion is similar on both headphones and internal 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 adjust Balance and test the left and right speakers. If lower bass notes are distorted, the right speaker/subwoofer is likely to be defective. Verify if all speakers are free from distortion, and sounding clear and loud.	Yes	Issue resolved.	
	No	Adjust volume to test full range of volume settings. Go to step 3.	
3. Verify if affected speaker cable is properly seated and free from damage.	Yes	Go to step 4.	
	No	Reseat speaker cable or replace damaged speaker. Go to step 5.	**X09**

4. Verify if affected speaker membrane is 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 speaker(s).	**X09**
5. Verify if speaker enclosure is not damaged, is correctly installed in system, and does not create unneeded vibration when sound is played.	Yes	Speaker housing installation is good. Go to step 6.	
	No	Properly install/ replace affected speaker. Go to step 6.	
6. Verify if internal speakers no longer produces distorted sound.	Yes	Issue resolved.	
	No	Replace logic board.	**M09**

Audio: Microphone

Unlikely cause: LCD display, power supply, hard drive, optical drive, fans

Quick Check

Symptoms	Quick Check
Audio: Microphone • Microphone not working • Microphone audio garbled • No sound	1. Launch System Preferences and select Sound/ Input options. Verify that the sound input option is set to system's "internal microphone". 2. Launch System Preferences and select Sound/ Input options. Verify that the 'Input Volume' setting is not set at the minimum level. 3. Launch System Preferences and select Sound/ Input options. Verify that 'Input Level' indicator moves when speaking into the microphone.

Deep Dive

Check	Result	Action	Code
1. Verify if boot chime is present when system is powered ON. Note: make sure audio output preferences are not set to mute	Yes	Go to step 2	
	No	Reset Pram and retest.	

2. Check that no cable is inserted into the external sound input AND output ports. Launch System Preferences and select Sound/Input options. Verify if "Internal Microphone" is proposed and selected..	Yes	Go to step 3.	
	No	If "External Microphone" input is proposed in Sound Input preferences, replace logic board.	**M09**
3. Launch System Preferences and select Sound/Input options. Verify if 'Input Volume' is set above minimum sensitivity.	Yes	Go to step 4.	
	No	Set 'Input Volume' slider to the middle position. Retest.	
4. Launch System Preferences and select Sound input options. Verify if 'Input Level' indicator moves when speaking into the microphone.	Yes	Microphone and audio input functioning. Go to step 6.	
	No	Suspect bad microphone or connection. Remove logic board and check that microphone is present on left speaker assembly, that cable and connector are free from damage, that connector is correctly seated to logic board . Reassemble and retest. If issue persists, replace microphone. Go to step 5.	**X19**
5. Record sound sample using GarageBand or QuickTime Player. Verify if sound quality of sound sample is normal during playback.	Yes	Microphone circuitry OK. Return system to user.	
	No	Replace logic board	**M09**

Express Card Will Not Insert Into Slot

Unlikely cause: LCD, logic board, 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	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. 3. Test using a known-good ExpressCard

Deep Dive

Check	Result	Action	Code
1. Verify if the slot cover is opening properly.	Yes	Go to step 3	
	No	Reseat the ExpressCard Cage and inspect the slot cover. Go to step 2.	
2. Verify if the slot cover opens properly after readjustment.	Yes	Issue resolved.	
	No	Replace top case.	**X13**
3. Using a known-good ExpressCard, verify if the ExpressCard slides 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. Eject the ExpressCard and re-insert it, and verify it completely slides into the slot.	Yes	Issue resolved.	**X13**
	No	Replace the ExpressCard Cage.	**M17**

Express Card Not Recognized By System

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

Quick Check

Symptom	Quick Check
ExpressCard is not recognized by the system. Card does not show up on the desktop or in System Profiler	1. Check correct drivers are installed for the ExpressCard. 2. Verify with USB and PCI Express-based known-good ExpressCards that the slot is functional.

Deep Dive

Check	Result	Action	Code
1. Verify if the ExpressCard cable connection to the main logic board look is secure.	Yes	Go to step 3	
	No	Re-seat the ExpressCard Cage cable connection. Go to step 2.	
2. Using a known-good ExpressCard, verify if the card is recognized.	Yes	Bad connection. Issue resolved.	**X04**
	No	Go to step 3	
3. Verify if the ExpressCard cage looks 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. Using a known-good ExpressCard, verify if the card is recognized.	Yes	Card cage mounting issue. Issue resolved.	**X99**
	No	Replace the ExpressCard cage. Go to step 5	**X13**
5. Using a known-good ExpressCard, verify if the card is recognized.	Yes	Bad ExpressCard cage. Issue resolved.	**X13**
	No	Replace the logic board.	**M17**

Camera Issues

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

Quick Check

Symptoms	Quick Check
Camera Issues • Camera not detected • No green LED for camera • Excessive blooming • Poor white balance • Poor focus • Green image • Image distortion	1. Launch System Profiler and confirm that built-in iSight camera are visible. 2. Verify camera lens and glass panel are clean and free of contaminants. Use provided cleaning cloth to clean glass panel if needed. 3. Launch PhotoBooth to verify if the green indicator LED near the camera lens turns on and that the image quality is acceptable.

Deep Dive

Check	Result	Action	Code
1. Verify if he Built-in iSight camera is available in the Apple System Profiler USB list of devices.	Yes	Camera recognized. Go to step 2	
	No	Inspect and reseat camera cable connection on logic board. Go to step 2..	
2. Launch PhotoBooth. Verify if acquired image appears normal.	Yes	iSight camera functioning. Go to step 3	
	No	Clean glass for dust presence. Go to step 3	
3. Launch PhotoBooth. Verify if green LED near camera lens turns ON and image appears normal.	Yes	iSight camera functioning. Obtain additional information from user. Return system to user.	
	No	Replace display assembly (camera and cable are part of display) Go to step 4.	**L17**
4. Launch PhotoBooth. Verify if green LED near camera lens turns ON and image appears normal.	Yes	iSight camera functioning. Issue resolved	
	No	Replace logic board. .	**M13**

FireWire Port Not Recognizing Known Devices

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

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	1. Reset SMC 2. Check for latest software update. 3. Use Apple System Profiler to verify if the computer recognizes the FireWire bus. 4. Test port by connecting to another computer using FireWire Target Disk Mode. 5. Verify if the FireWire cable is good. 6. Verify if a self-powered FireWire device is getting power.

Deep Dive

Check	Result	Action	Code
After resetting SMC, verify if the FireWire Port recognized.	Yes	Issue resolved.	
	No	FireWire port is defective.. Replace main logic board.	**M12**

Uncategorized Symptom

Quick Check

Symptom	Quick Check
Uncategorized Symptom Unable to locate appropriate symptom code	Verify if 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 • System will not power on • System sounds bootROM unlock tone during startup • System automatically starts up repeatedly	**1.** Diagnose stuck button with SMC keyboard reset sequence **2.** Check for issue occurrence on battery and on AC power **3.** If on battery only, check battery using Battery Diagnostic Utility

Deep Dive

Check	Result	Action	Code
1. Reset SMC using keyboard 3 keys and power-on key. MagSafe LED can verify SMC reset. Momentary stop of battery charging will indicate SMC reset, orange LED will go green momentarily then return to orange.	Yes	Keyboard reset works while holding 3 keys and toggling power-on key, multiple press and release of power-on key works to show power-on key not stuck or fixed.	
	No	SMC keyboard reset not working, suggests power-on key is open circuit or stuck down. Go to step 2.	
2. Remove battery and AC power for 30 seconds to perform a manual SMC reset. Apply AC power. Verify if power-on key works 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 the keyboard flex cable on logic board connector. Verify if power key now works 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. Remove two screws on metal cable cover to access keyboard connector. -Plug in a known good powered AC adapter. -Try to power system using power key -If system does not power on, use a conductive tool to short power-on pads on logic board (see **Logic Board Power-On Pads**) . Make sure you don't touch any other pins . - Verify if system powers on.	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 from logic board and use a conductive tool to short power-on pads on logic board (see **Logic Board Power-On Pads**). Make sure you don't touch any other pins. Verify if system powers on.	Yes	Shorting power-on pads starts the system. Replace top case due to stuck power-on key.	**X14**
	No	Go to symptom table: No power/ not booting	

System Runs Hot

Unlikely cause: LCD, hard drive, optical drive

Quick Check

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

Deep Dive

Check	Result	Action	Code
1. Verify if the system is 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. Verify if there are 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 and verify if the fans are 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 any fan which is not spinning or replace logic board which is not spinning a known-good fan. Verify if fan(s) are 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. Verify if the heatsink is installed properly with no damage to heat fins.	Yes	Go to step 7.	
	No	Replace missing screws or damaged heatsink. Go to step 6.	**X10**
6. Verify if the system is running as expected.	Yes	Heatsink installed incorrectly. Issue resolved.	
	No	Go to step 7.	
7. Heatsink thermal grease possibly missing or improperly installed during previous repair. Verify if correct thermal grease is present.	Yes	Replace heatsink with correct thermal grease type and retest. Go to step 8	
	No	Replace heatsink with correct thermal grease type and retest.	**X10**
8. Run ASD/MRI tests for sensor monitoring.	Yes	Thermal module or other sensor reseat resolved issue.	
	No	Replace logic board if sensor error detected. Go to step 9.	**M23**
9. After logic board replacement, verify if the computer is running as expected.	Yes	Bad logic board. Issue resolved.	
	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 if 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.

Sensors

Thermal Monitoring Errors

Unlikely cause: display, HDD, SSD, AirPort/Bluetooth, speakers, microphone, keyboard

Quick Check

Symptom	Quick Check
Thermal Monitoring Errors • Fans on full speed • Thermal monitoring leading to reduced CPU performance or system shutdown. • MRI reported thermal sensor error • Battery internal thermal sensor error • Battery not connected will activate fans on full speed due to missing thermal sensors.	1. Validate thermal characteristics of system. Is there a thermal concern of a runaway CPU application that might be activating fans at full speed? 2. Reset SMC. SMC monitors thermal sensors and controls CPU performance and system cooling based upon sensor readings. 3. Verify cooling fans are operational. The fans should be running at all times, 2000 RPM minimum. Fans on full speed can be thermal limit or a sensor cannot read error. 4. Run MRI and review sensors flagged as erred. Reminder: Thermal sensors external to logic board are in the battery and trackpad.

Deep Dive

Check	Result	Action	Code
1. Reset SMC. Start up system on OS 10.6+ and characterize thermal concerns. If after warming up, does system show signs of thermal stress with fans running at excessive speed? Fan is always spinning. 2000 RPM is a minimum speed; excessive speed is above 4500 RPM.	Yes	Fans are on near full speed. Go to step 2.	
	No	Fans are normal at 2000 RPM or fans may not be spinning at all. Go to step 13.	

2. Is system exhibiting a valid thermal concern? (Warm air flowing from fans or warm top/bottom case)	Yes	Appears to be a system under stress, working to cool off while running OS applications. Go to step 3.	
	No	Fans are running fast for a system that does not appear to be overheating. Thermal monitoring may not be working correctly. Go to step 6.	
3. Inspect CPU processes using Activity Monitor to determine if specific application is in runaway mode: pushing CPU usage to the limit. Is there a CPU or GPU related application that is producing abnormal CPU processing and heating system?	Yes	Quit offending application to determine if root cause. Delete application system preference or restore application default settings and program code.	
	No	CPU process running normally. Thermal concern appears to be hardware related. Go to step 4.	
4. Verify sensor reading using a recent reading of thermal results from MRI. Is temperature approaching or over range limit, flagged red or yellow?	Yes	Device related to the thermal sensor above or near limit needs troubleshooting to determine fault. Go to step 5.	
	No	Thermal stress noted running OS is not seen exceeding MRI thermal monitoring with EFI version of MRI. Restore OS on system as hardware appears to be operating correctly.	
5. Inspect heatsink air vents, fan airflow, and heatsink thermal interface between CPU/GPU and heatsink if necessary to determine if cooling processes are working properly. Is heatsink or thermal interface part of the problem of thermal sensor(s) at or above thermal limit?	Yes	Replace heatsink and use proper amount of thermal grease.	**X10**
	No	Replace logic board.	**M18**

6. Does MRI report a thermal sensor error for Battery Pack (TB0T, TB1T, or TB2T)? These thermal sensors are physically away from logic board. Ensure battery and trackpad are connected to system during MRI testing. SMC will spin fans at full speed. MRI will label missing sensors as "can't read."	Yes	Reseat battery to logic board connector or replace battery should internal thermal sensor continue to fail.	**P19**
	No	Go to step 7.	
7. Does MRI report a thermal sensor error for missing or abnormal reading for Trackpad/Palmrest (Ts0P) sensor? The trackpad device may have an open connection or damaged device. Reseat flex cable while inspecting for cable or connector damage (on both logic board and trackpad flex cable.	Yes	Troubleshoot connections to thermal sensor on trackpad. Go to step 8.	
	No	Go to step 11.	
8. Is thermal sensor on trackpad restored by reseating trackpad flex cable? Ts0P sensor on trackpad assembly, aka Palmrest proximity sensor	Yes	Reseating trackpad flex cable restored connection–issue resolved. Replace cable if known-good cable restored sensor connection.	**X03**
	No	Defective sensor or open connection to sensor. Go to step 9.	
9. Disconnect display camera cable connection at logic board. Is thermal sensor on trackpad restored by removing camera cable from logic board?	Yes	Replace Display Clamshell.	**L17**
	No	Go to step 10.	
10. Substitute a known-good trackpad to verify known-good parts will restore Palmrest proximity sensor. Is this sensor now present and a value near ambient temperature?	Yes	Replace trackpad	**M18**
	No	Replace logic board.	**M18**

11. Does MRI report one or more thermal sensor(s) missing or can't read for logic board related thermal sensors? - CPU (TC0D, TC0P, TC0C) - GPU, (TPCD, TP0P, TG0D, TG0P) - logic board (Th1H, Th2H, Tm0P) The thermal sensors are located physically on logic board or inside the CPU / GPU.	Yes	Replace logic board for missing and failed thermal sensor(s).	M23
	No	Go to step 12.	
12. Inspect heatsink air vents, fan airflow, and heatsink thermal interface between CPU/GPU and heatsink if necessary to determine if logic board cooling processes are working properly. Is heatsink or thermal interface part of the problem of thermal sensor(s) at or above thermal limit?	Yes	Replace heatsink and use proper amount of thermal grease.	X10
	No	Replace logic board.	M18
13. Is MRI reporting fan speed slow (less than 2000) RPM or stuck at 0? Inspect fans for foreign material, fan housing damage, and fan cable connection to logic board.	Yes	Replace fans if damaged or connector and cable are broken. Go to step 14.	X22
	No	Fans appear to operate in normal range. Check repair by reviewing MRI thermal sensors. Go to step 6.	
14. Substitute a known-good fan and verify fan is spinning at 2000 RPM. Is logic board spinning a known-good fan at 2000 RPM or slightly higher? Again inspect fans for foreign material, fan housing damage, and fan cable connection to logic board.	Yes	Replace fan(s).	X22
	No	Replace logic board.	M18

Electrical Monitoring Errors

Unlikely cause: display, AirPort/Bluetooth, speakers, microphone, top case

Quick Check

Symptom	Quick Check
Electrical Monitoring Errors • MRI or ASD reports an electrical sensor error with value out of range. • MRI or ASD reports VP0R out of range due to test being performed on a battery only that is near empty.	1. Reset SMC. SMC monitors thermal sensors and controls CPU performance and core voltage settings based upon environmental evaluation. 2. Ensure battery capacity is at least 33% if MRI must run on battery only. Always use product AC adapter to verify battery charge circuity with MRI. 3. Always have a battery connected to system when testing MRI to verify battery charging circuits and battery internal thermal sensors.

Deep Dive

Check	Result	Action	Code
1. Reset SMC. Verify if MRI or ASD still reports a thermal or electrical sensor error. Is error result a thermal sensor error?	Yes	Go to **Thermal Monitoring Errors** troubleshooting steps.	
	No	If SMC reset resolved error, issue resolved else go to step 2.	
2. Running MRI on battery only that is near empty may lead to internal voltages reaching lower limits. VP0R sensor may trigger a low voltage reading should battery be low and no adapter is supporting test. Is VP0R voltage sensor your only error being reported and adapter was not used during test?	Yes	Run MRI again with AC adapter connected.	
	No	VP0R and/or other electrical sensors are failing while testing with adapter support the test. Go to step 3.	
3. Retest using a known good battery. Does any electrical sensor error remain?	Yes	Replace logic board.	**M23**
	No	Replace battery.	**P19**

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 **smfeedback4@ apple.com** stating that a suitable symptom code could not be found.

Apple Technician Guide

Take Apart

MacBook Pro (17-inch, Mid 2010)

General Information

Vertical Insertion (JST)

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

Examples:
- fan cables
- right speaker
- left speaker and microphone on underside of board

Horizontal Install

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

Examples:
- MagSafe cable on underside of board
- battery power cable on underside of board

Connector Types on Logic Board

On the logic board there are five types of connectors, each requiring special handling. Make sure you read these tips before disconnecting and installing the connectors.
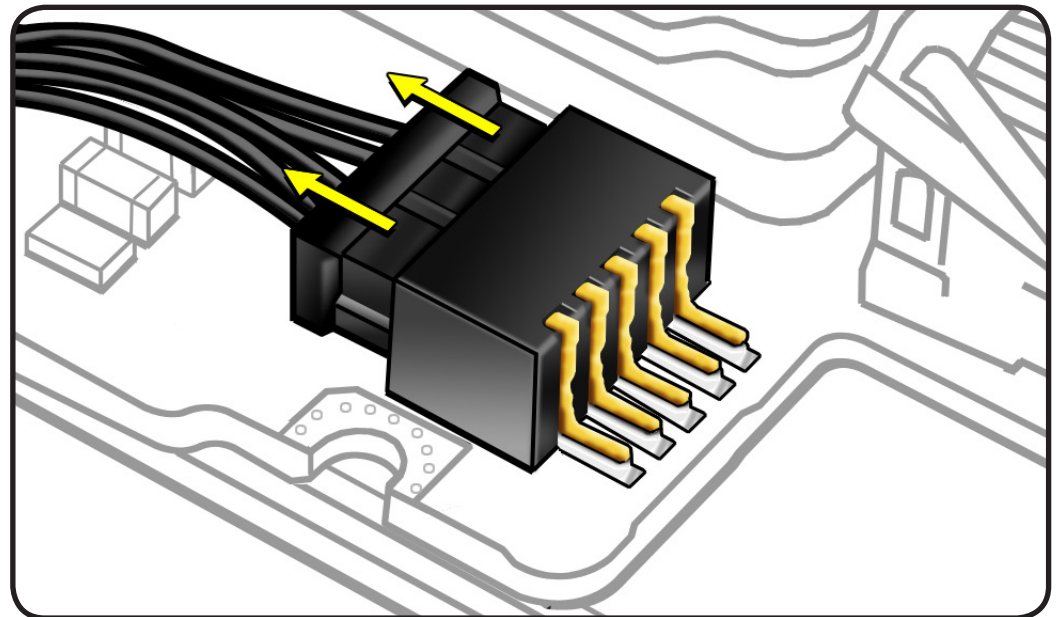
Thin, Multi-Pin Horizontal Insert

- Use fingernails or tweezers to remove evenly.
- Slide connector into receptacle on same horizontal plane as board.
- Remove LVDS cable gasket and flip lock bar **before** disconnecting LVDS cable
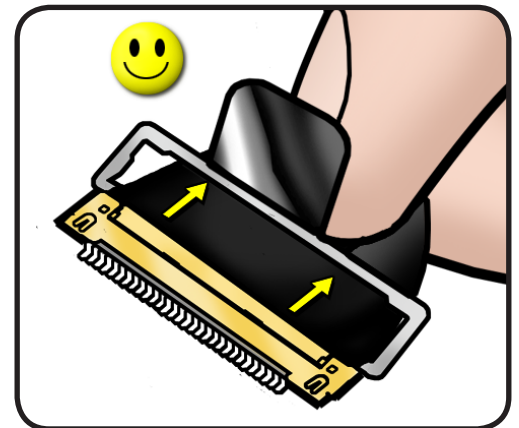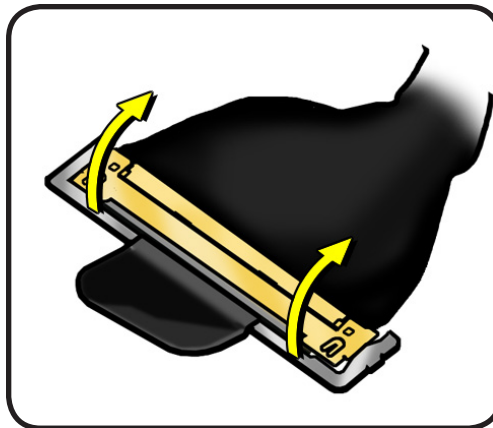
Examples:
- LVDS cable with lock bar
- camera cable

Note: Removing the mesh ground tab screw is optional, but it might allow more cable length to disconnect the LVDS cable.

Replacement Caution: Before replacing the LVDS gasket, make sure cable is fully installed—no gold traces visible. To prevent video "noise," a whining sound, no video, or a short to the logic board, be sure to place gasket on connector—**positioned precisely where shown**—**after** cable is fully connected to logic board.
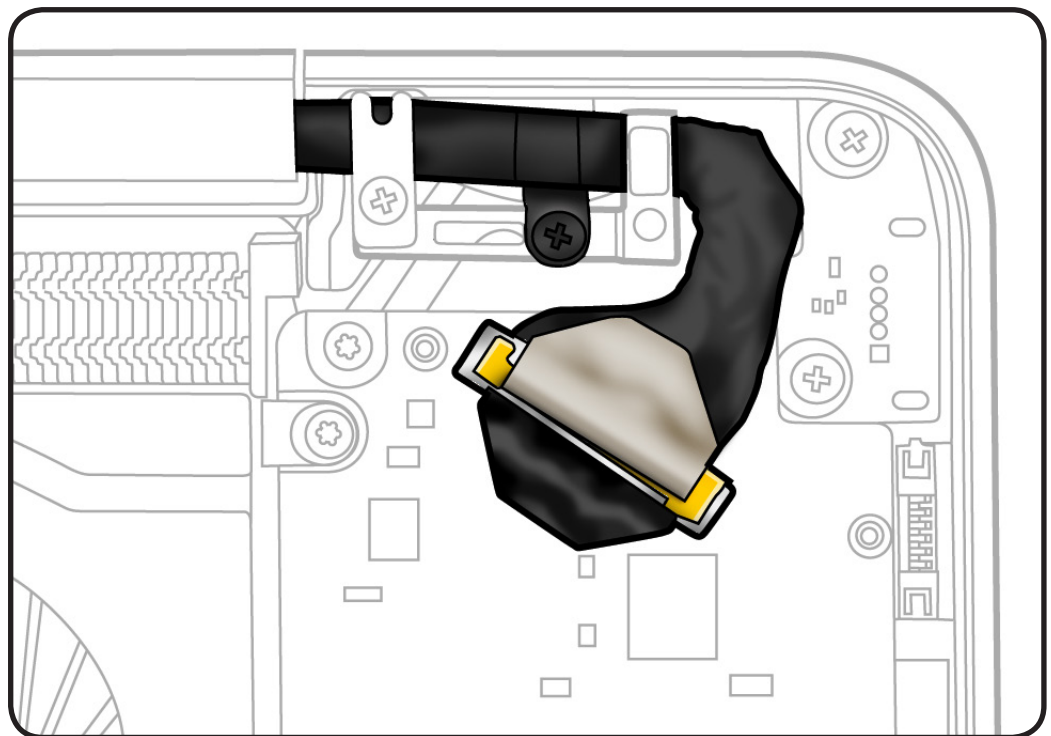
Note: When disconnecting camera cable, use two black sticks (or one black stick, alternating sides) to disconnect cable evenly.
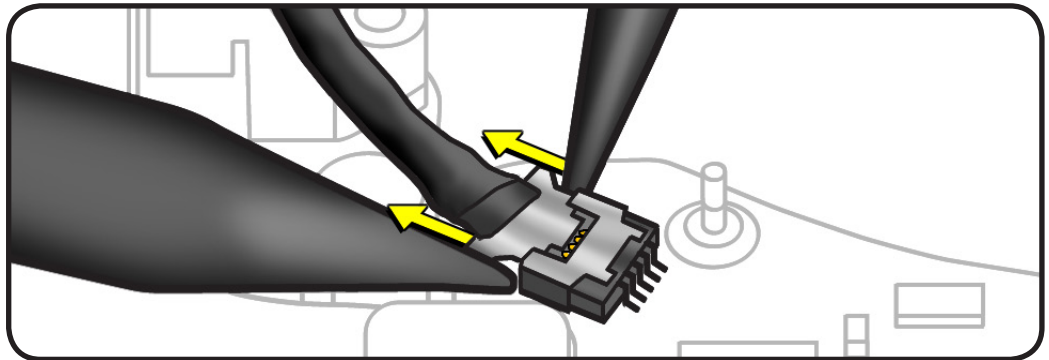
Reassembly Caution: Make sure cable is fully connected (no gold traces visible).
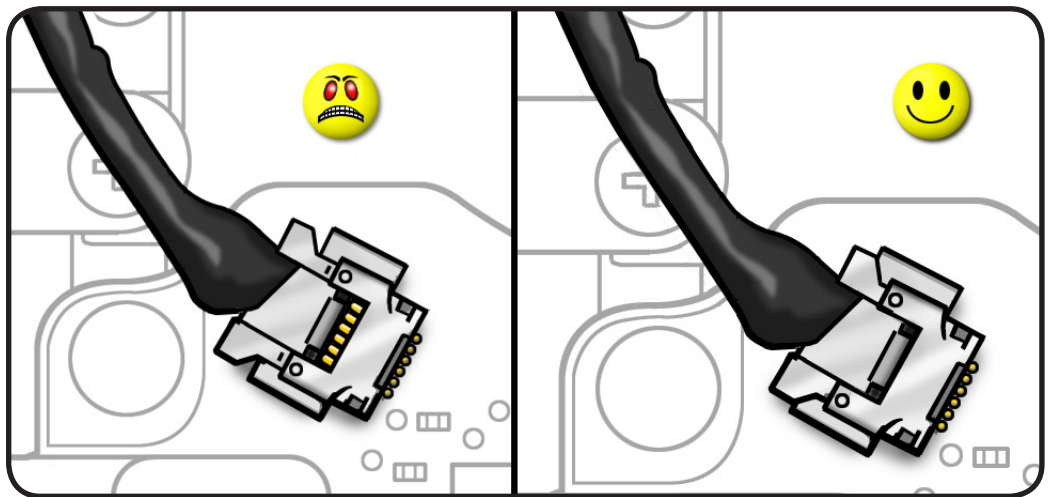
Low-Profile Solid Platform Flex

- 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:
- AirPort/Bluetooth flex cable
- optical drive flex cable
- trackpad flex cable
- hard drive connector
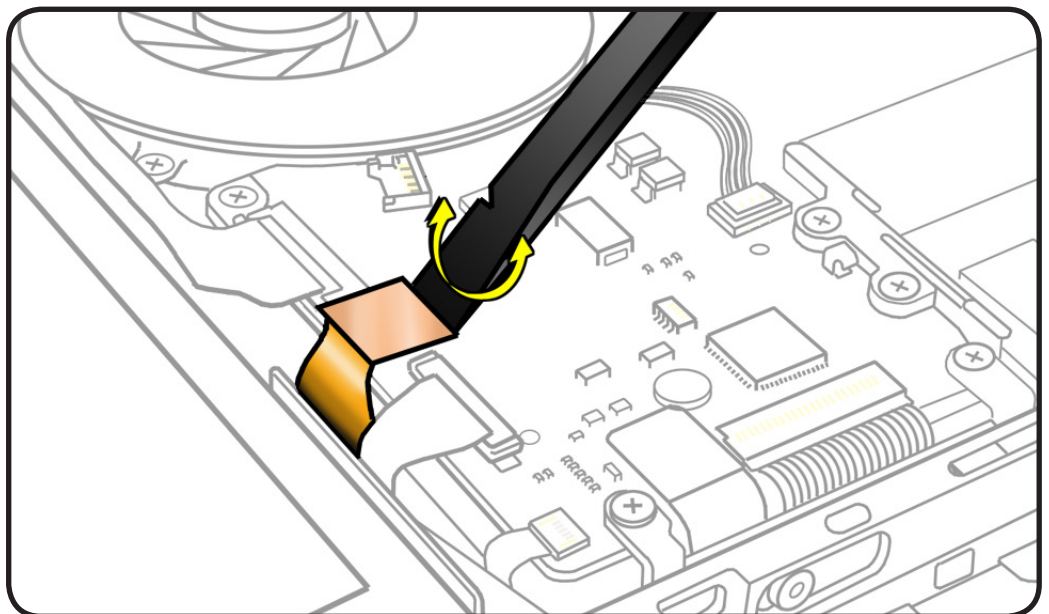
Locking Lever

- Flip up lever 90 degrees for removal.
- To protect the fragile levers during board handling and shipment, leave levers open after cables are removed.
- Slide connector into receptacle on same horizontal plane as board.
- Lock down lever after inserting cable.
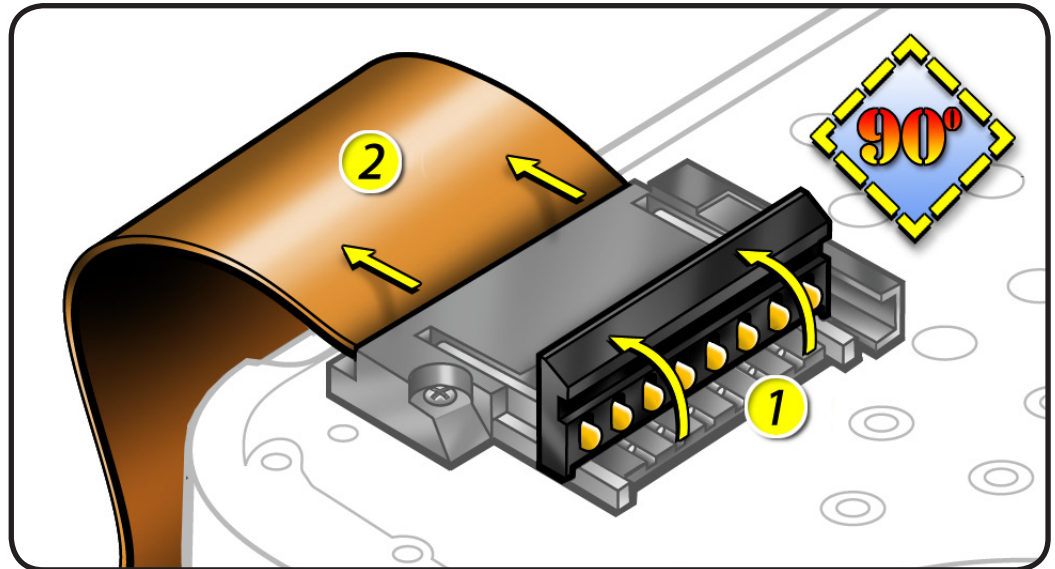
Examples:
- IR/SIL flex cable
- keyboard backlight flex cable
- Express Card cable
- BIL cable
- keyboard flex cable

Caution: Use black stick to push the keyboard flex cable **all the way** into connector to prevent "no power" symptoms.
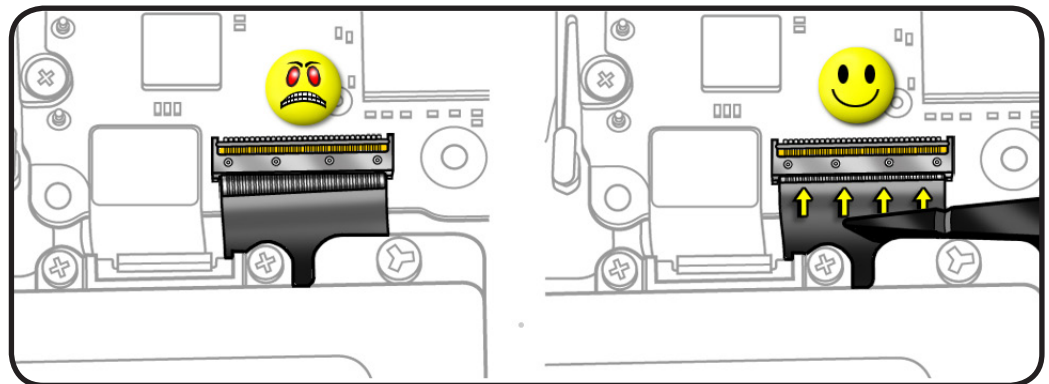
Flex Cable Handling

Caution: Be careful when handling flex cable. Do not flatten or reshape flex cable bends, and avoid moving cable unnecessarily. Repeated movement at cable bends may damage internal wiring and require cable replacement.
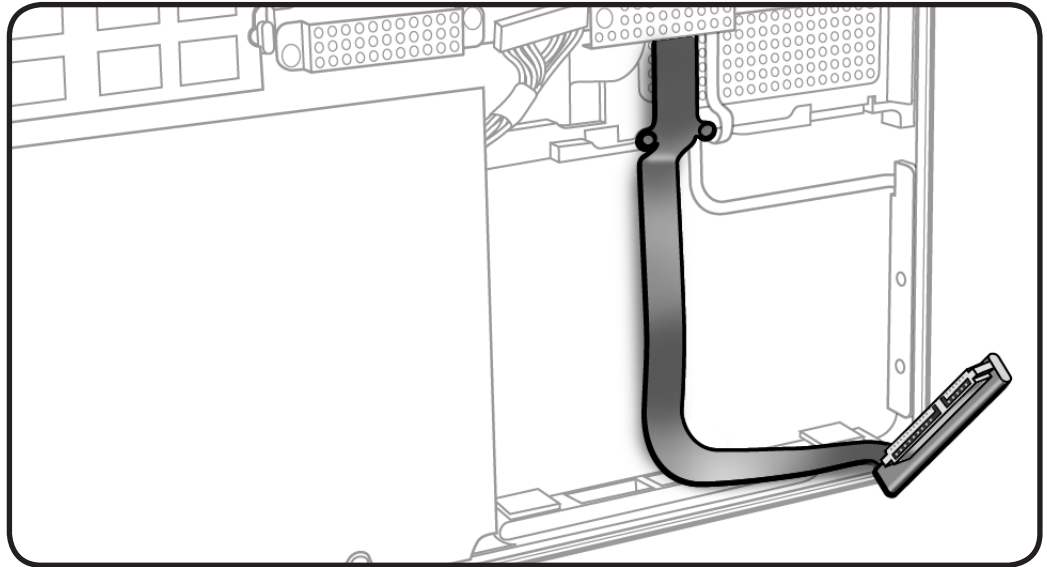
Icon Legend

The following icons are used in this chapter:

Icon	Meaning
	Warning or Caution
	Check mark; make sure you do this

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 HT1778 "Apple Portables: Operating temperature."

http://support.apple.com/kb/HT1778

Notes About Procedures and Images in This Guide

This manual covers both MacBook Pro (17-inch, Mid 2010) and MacBook Pro (17-inch, Early 2011). In most cases, the take-apart procedures for both computers are the same; these procedures use illustrations based on MacBook Pro (17-inch, Mid 2010). When the procedures differ, the model name is included in the procedure's title and the illustrations are specific to the model.

Note: Because pre-production units were used for the illustrations, you may notice small differences between the images pictured and the computer you are servicing.

Reassembly Steps

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

Screw Sizes

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

Bottom Case

First Steps

Warning:
- Shut down computer.
- Wait 10 minutes
- Unplug all cables.
- Put on ESD strap.
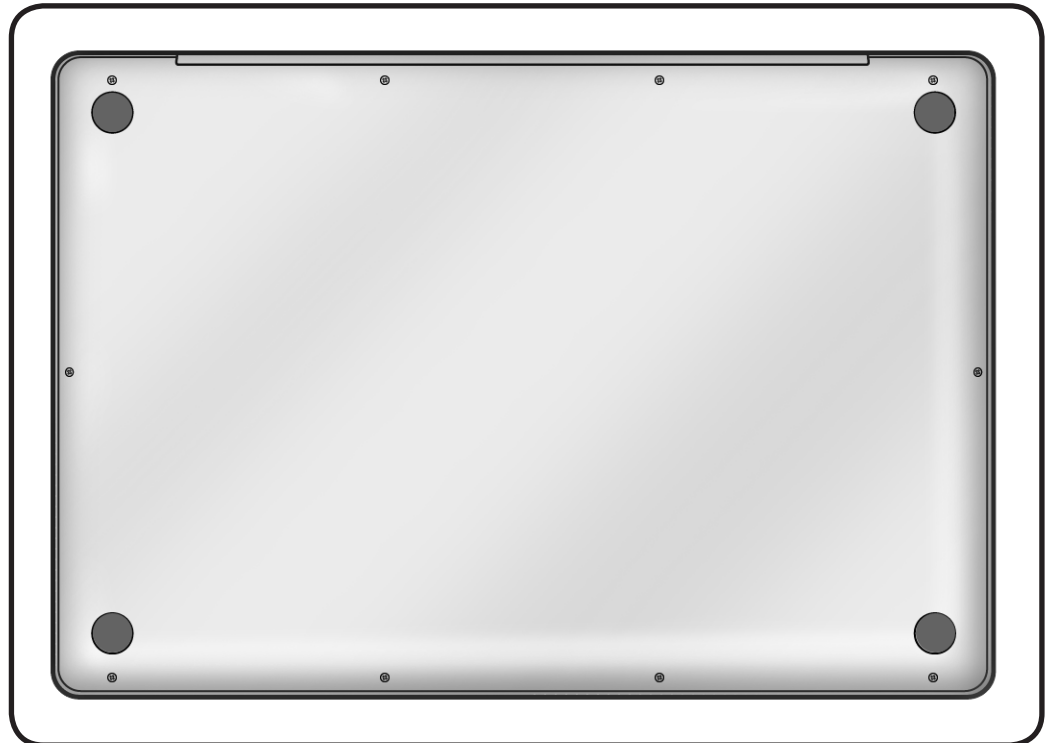
Tools
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Black stick
- Magnifying glass

⊕ # 00
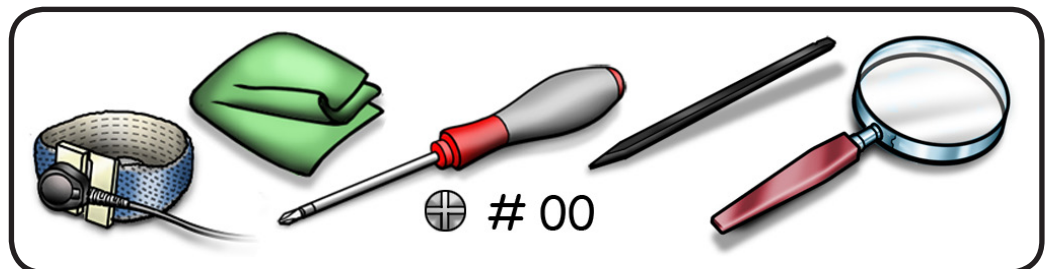
Removal

Caution: To prevent scratches, use a protective cloth when working with metal tools.
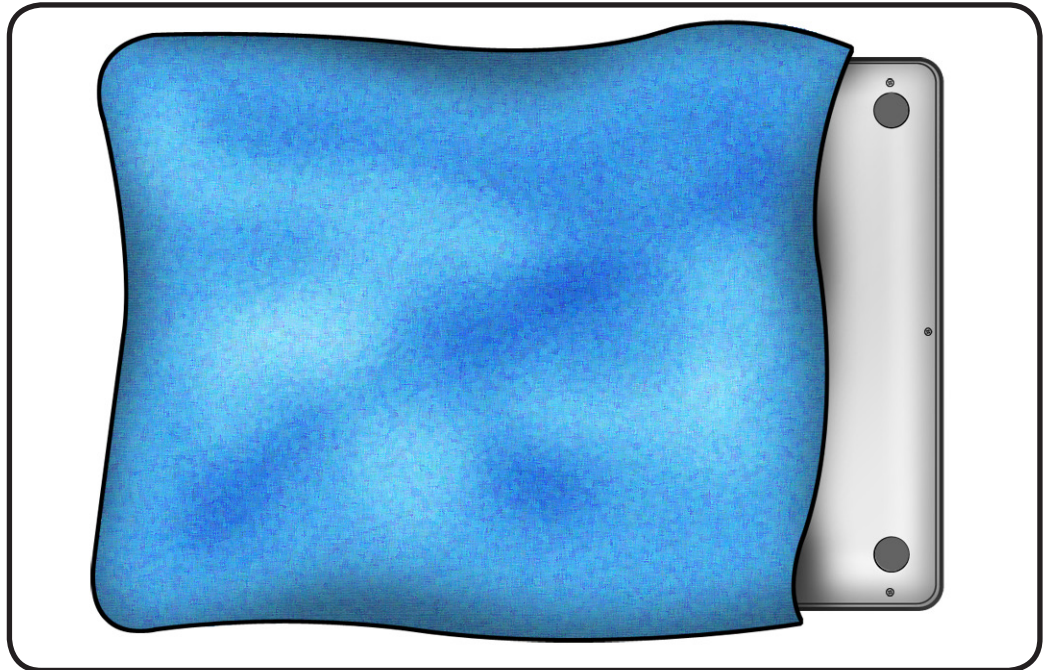
1   **Important:** The shorter screws must be removed and installed at an angle.
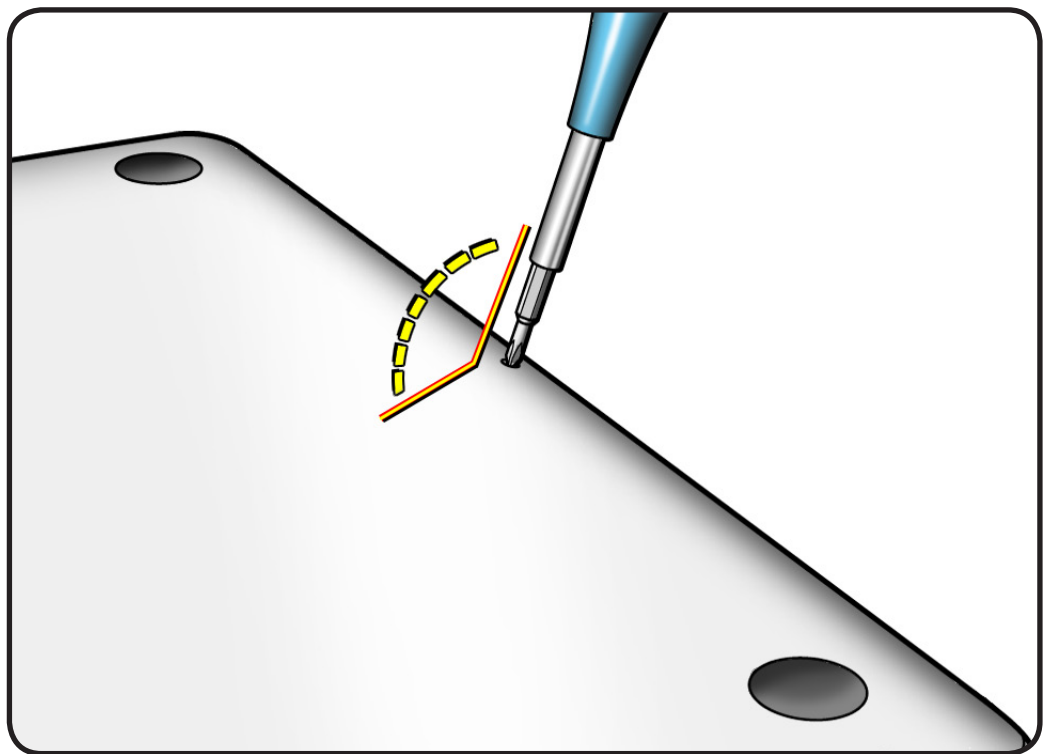
2 Remove 10 screws:

- 3 (14.3 mm) 922-9432
- 7 (3.5 mm) 922-9334

Reassembly Note: Install screws in the order shown.
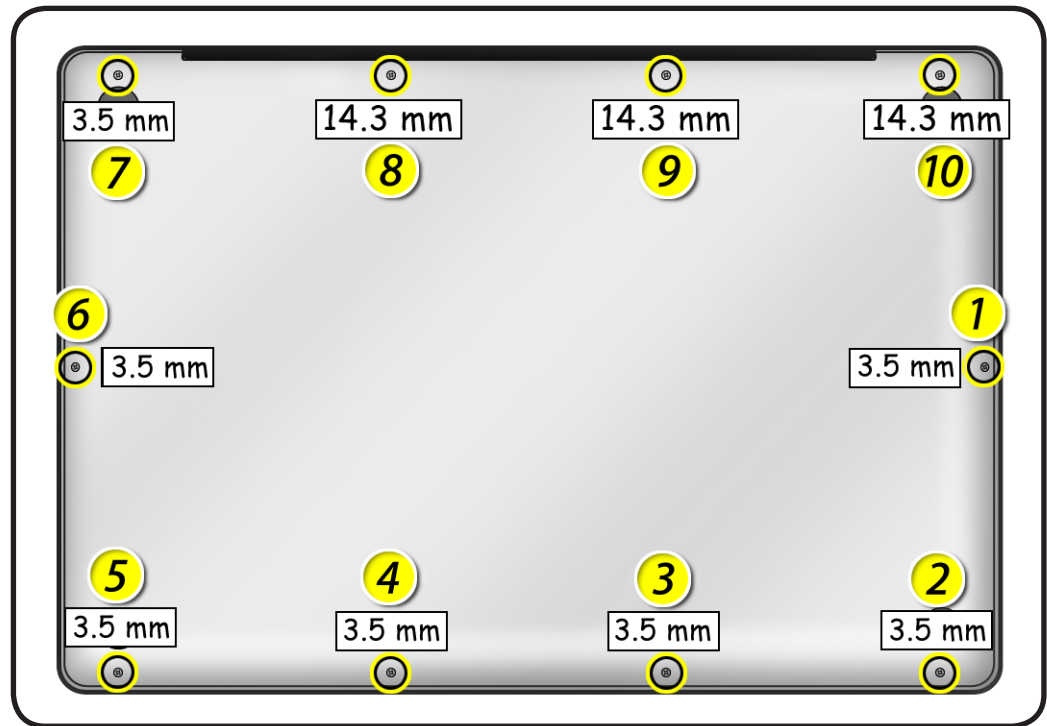
3 Use black stick to loosen and remove bottom case.
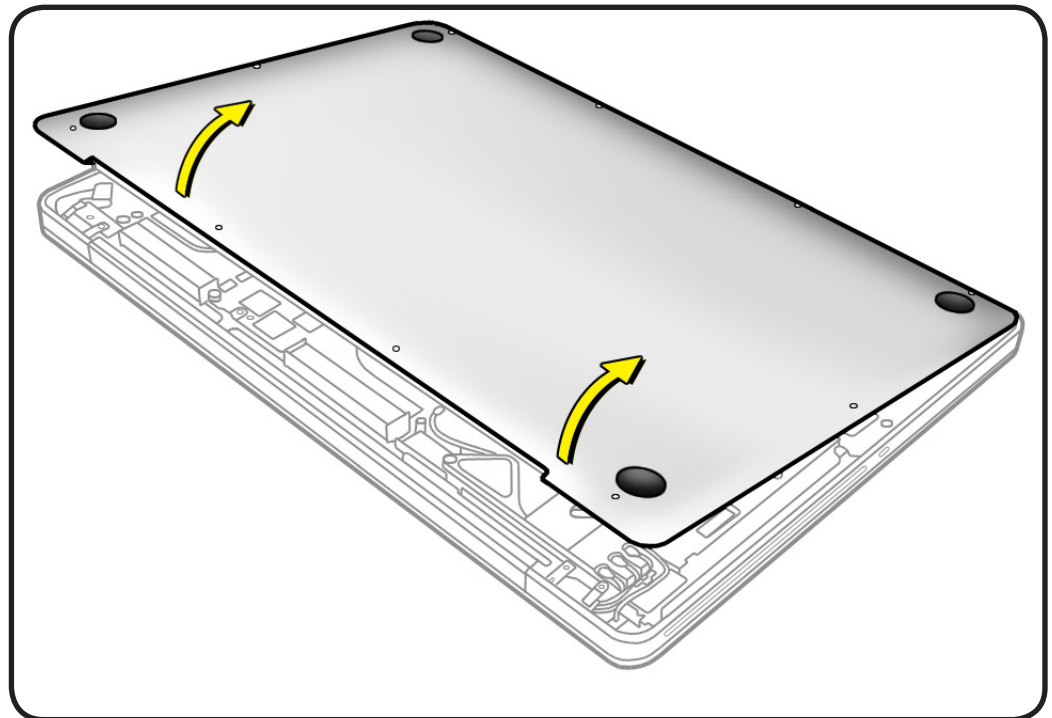
4 **Warning:** If
performing any other
repairs, be sure to
disconnect the
battery cable:

- MacBook Pro (17-inch, Mid 2010): Use the pull tab to disconnect cable.
- MacBook Pro (17-inch, Early 2011): Lift the platform straight up to disconnect cable.
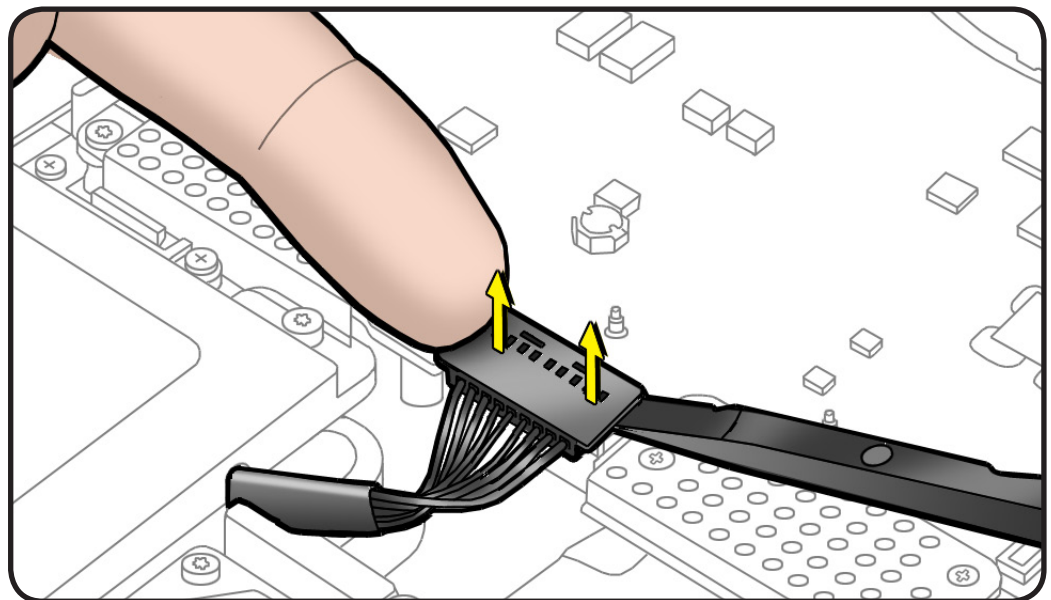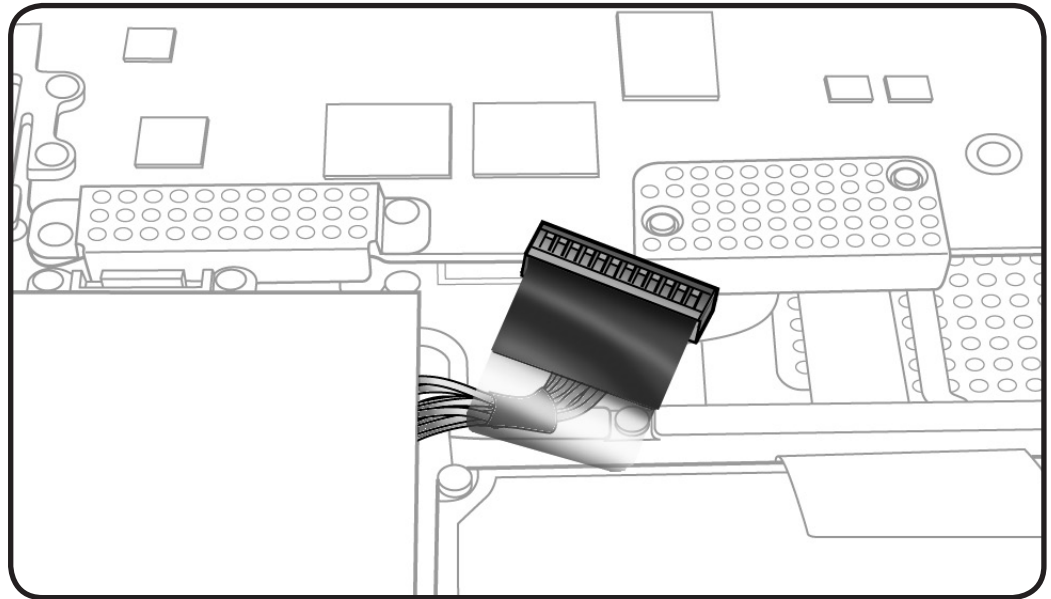
Reassembly

1 When replacing a bottom case, retain the customer's bottom case until the repair is complete. Before installing the replacement bottom case, write the serial number on the inside of the new bottom case. You might need a magnifying glass to read it. Refer to **Transferring the Serial Number**.

W003X0123XXX
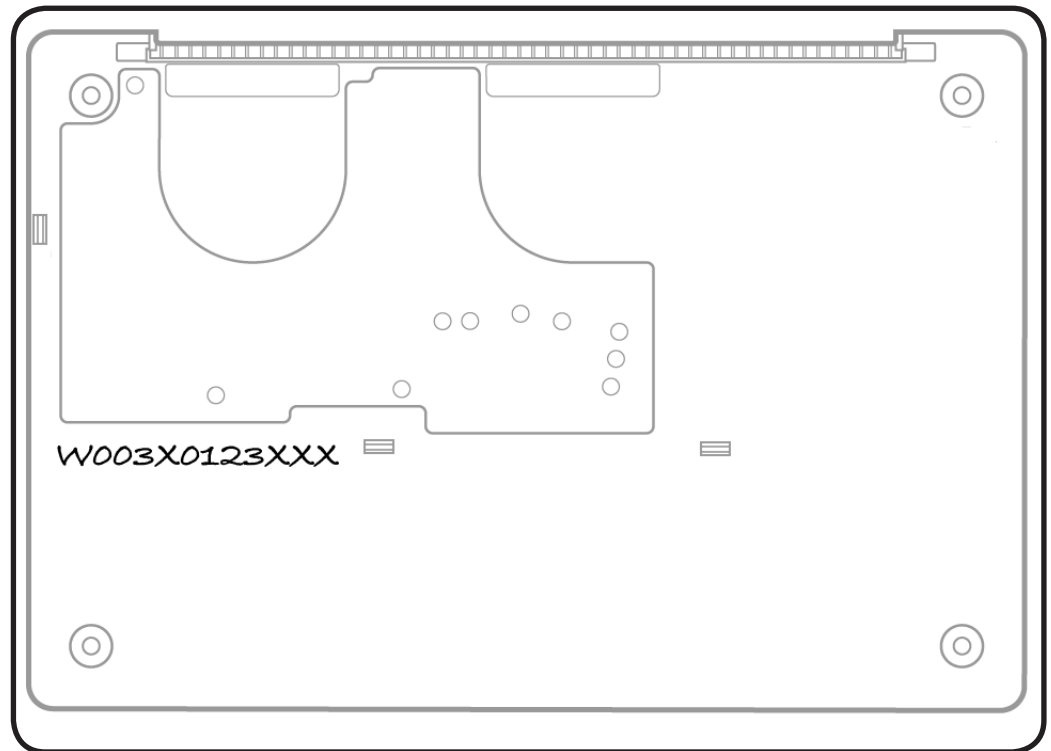
2 Install bottom case so that 3 clips snap onto top case.
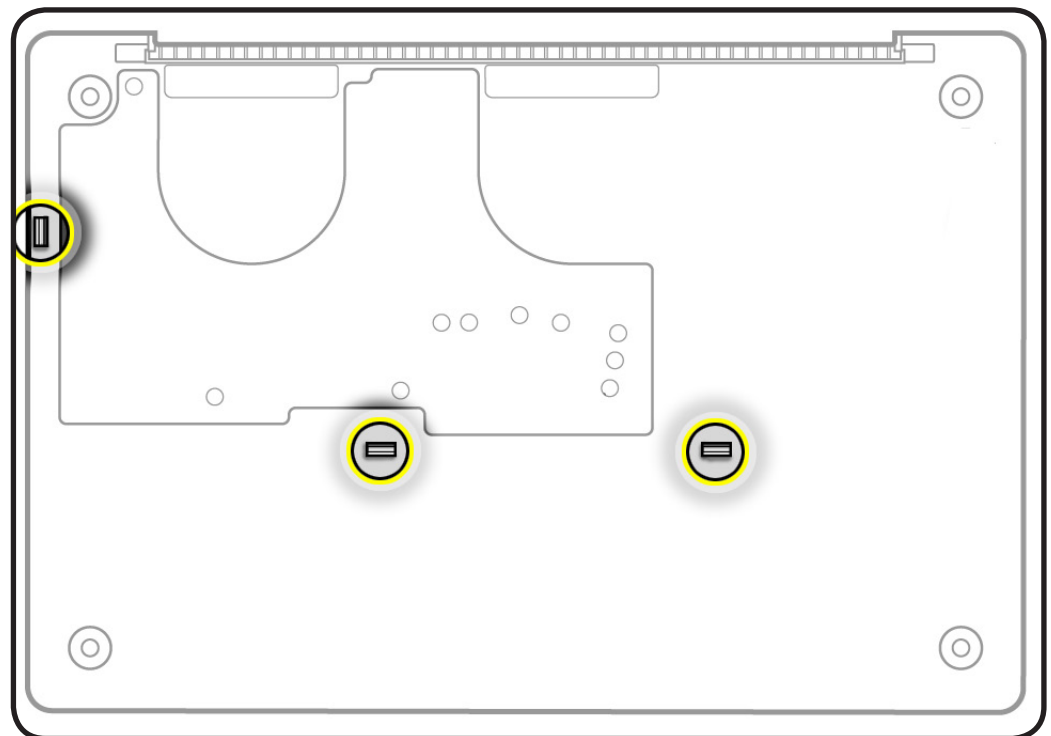
Battery

First Steps

Remove:
- Bottom case

Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.
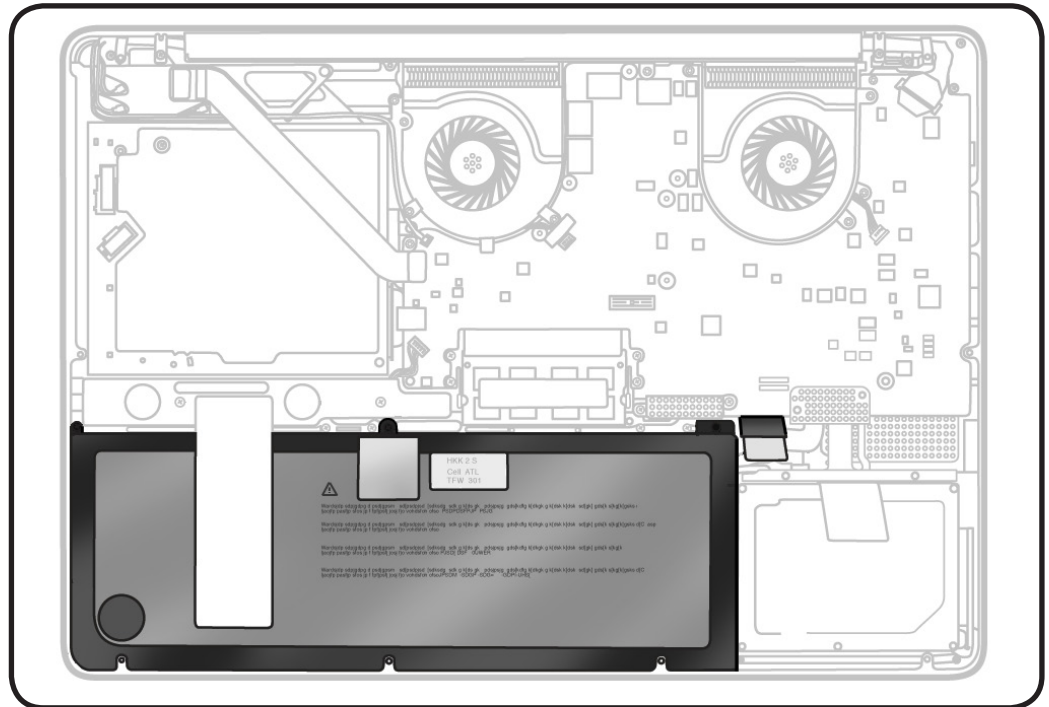
Tools
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Black stick
- Large tri-lobe #0 screwdriver (922-8991)
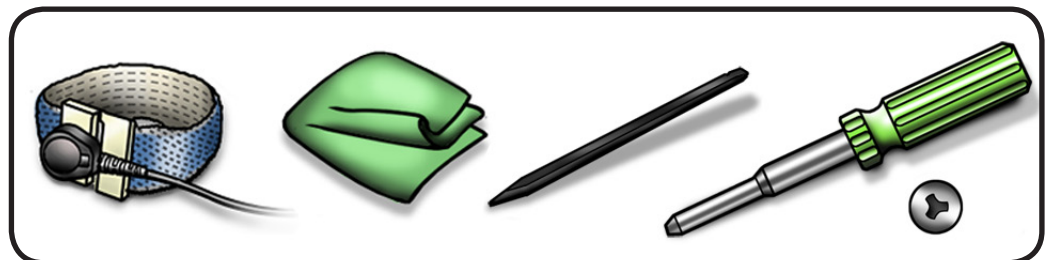
Removal

Important: Battery removal is only required when replacing the battery, trackpad, or top case. Other internal repairs require disconnecting the battery cable but not removing the battery.
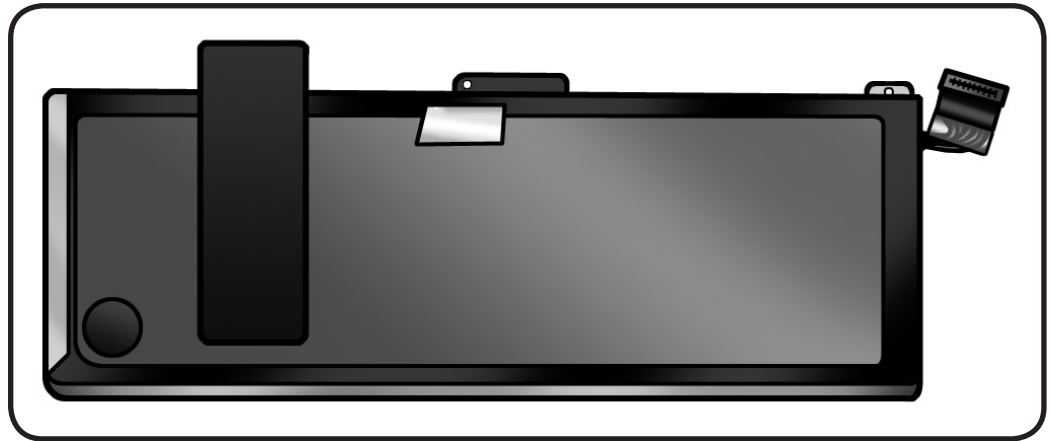
1   **T**o disconnect the battery cable:
*   MacBook Pro (17-inch, Mid 2010): Use the pull tab to disconnect battery cable.
*   MacBook Pro (17-inch, Early 2011): Lift the platform connector straight up to disconnect cable.
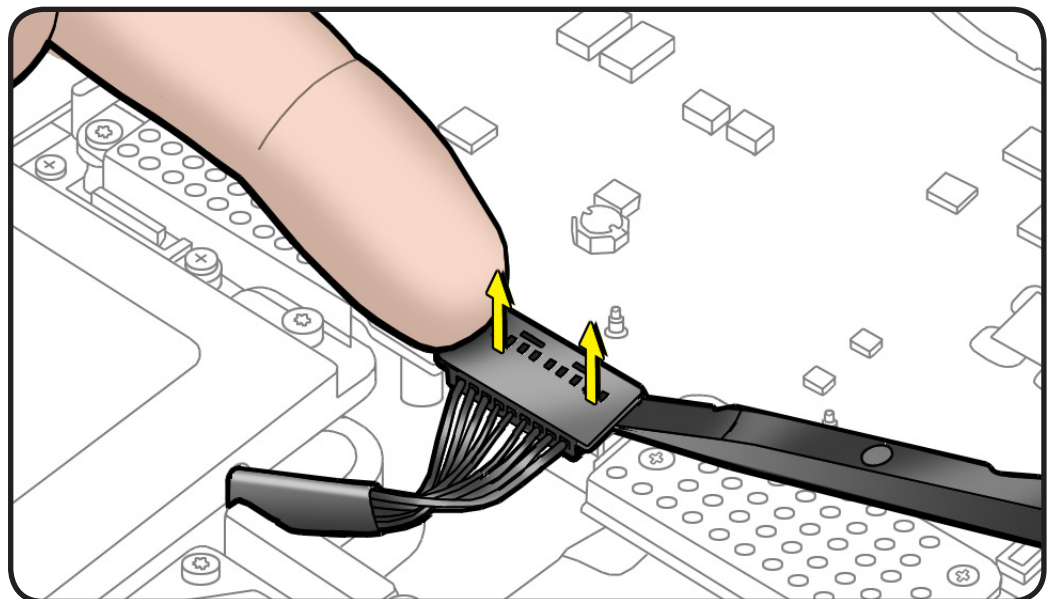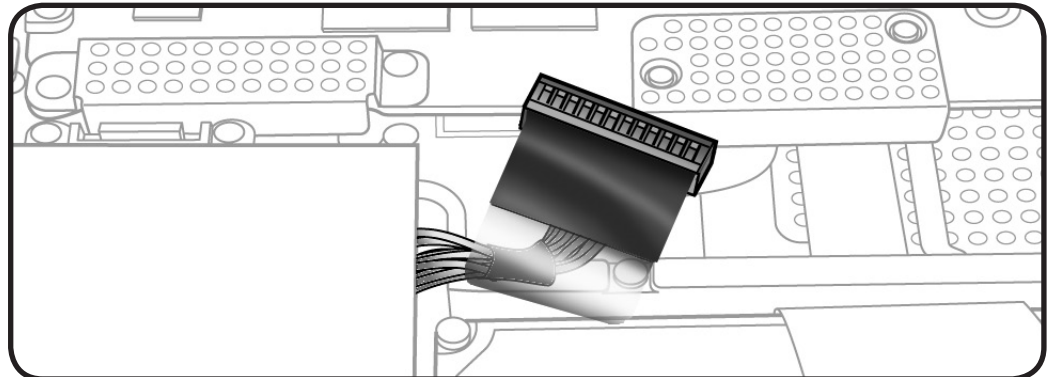
2 Remove 3 (6.4-mm) tri-lobe 922-9431 screws.

1 3 2

6.4 mm   6.4 mm   6.4 mm
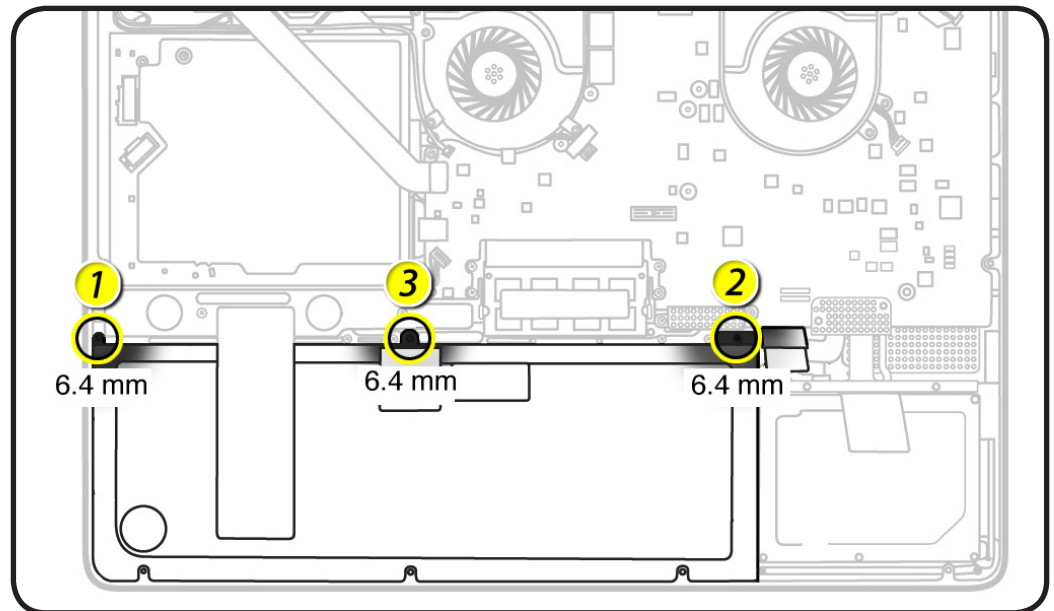
3 Peel up battery label, and discard it.

4 Remove any label residue from speaker, and from battery if it is to be reused.
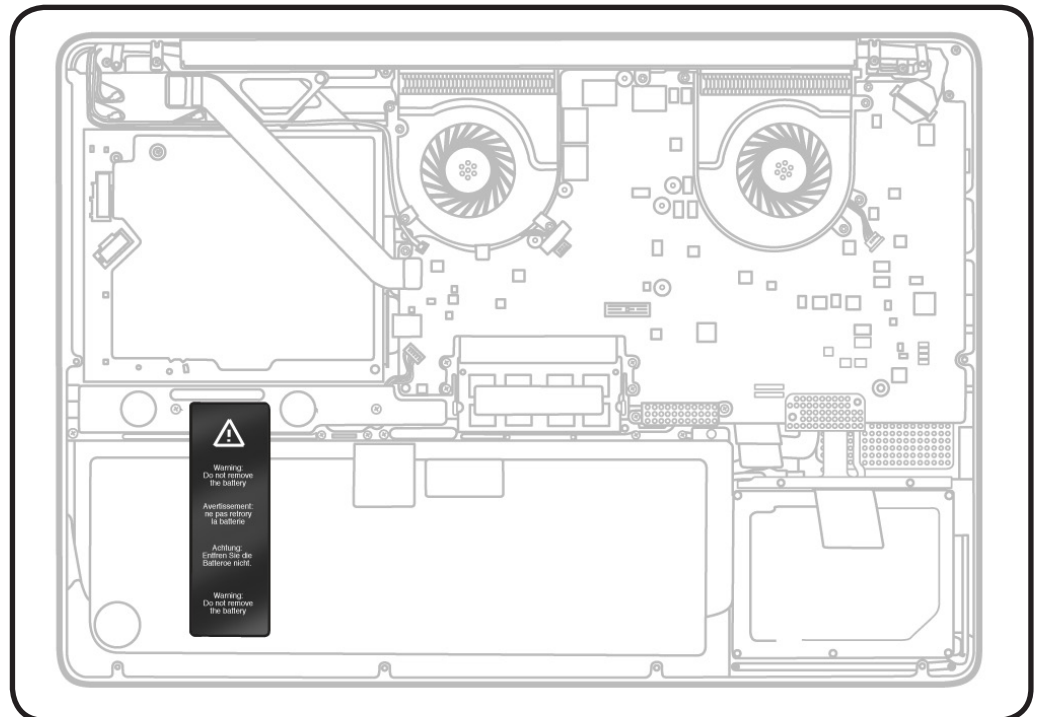
5 Without pulling cable, tilt out battery.

Warning: Underside of battery is soft.
- Do not puncture or press on battery.
- Hold battery by edges only.
- If setting battery aside, make sure surface is clean—free of dust, dirt, screws, etc.
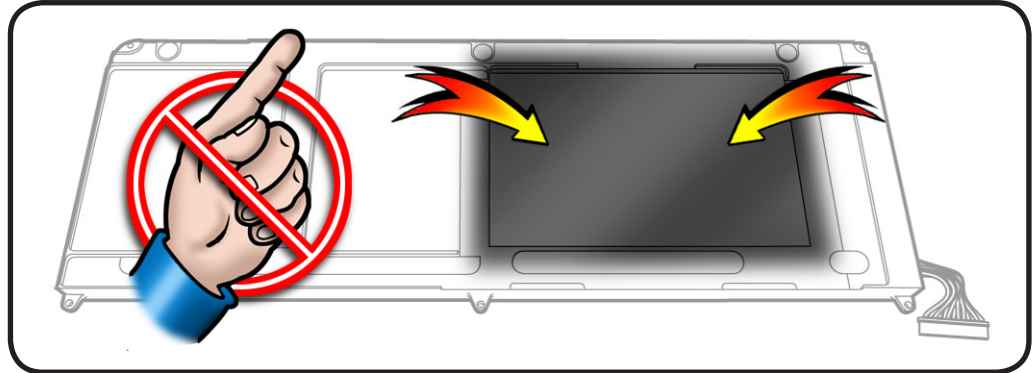
Warning: If mylar covering battery is punctured, do not re-use battery.

Reassembly

1 Slide front edge of battery under 3 tabs.

2 Install screws finger tight.

   Note: If installing new battery, attach the new battery label (refer to battery label inbox instructions).
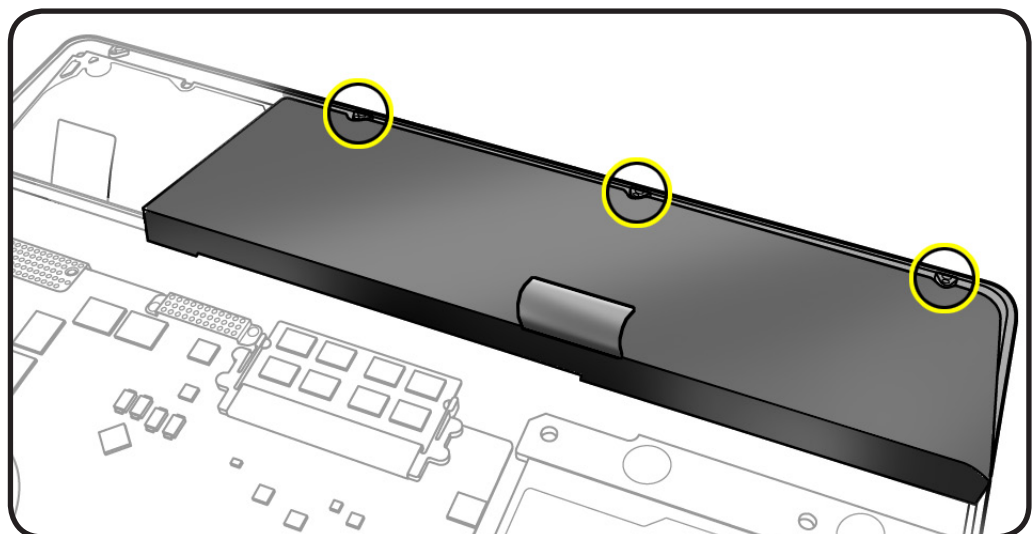
3 If performing other repairs, be sure to leave battery cable disconnected.
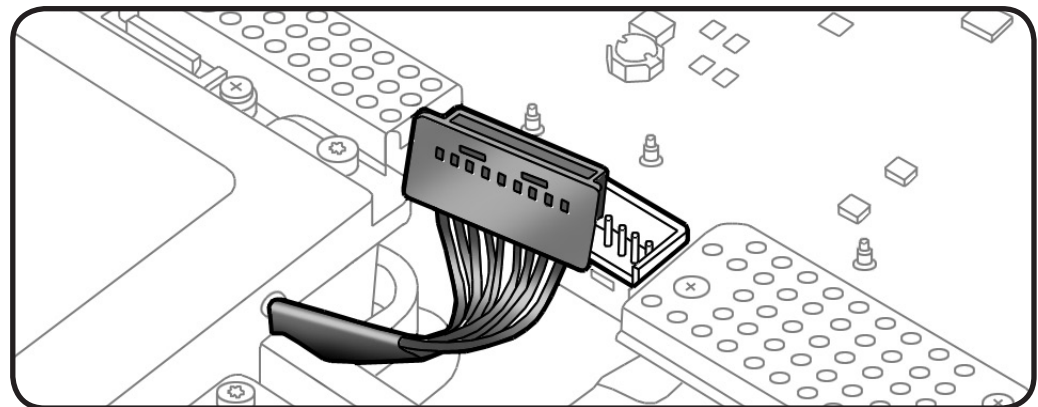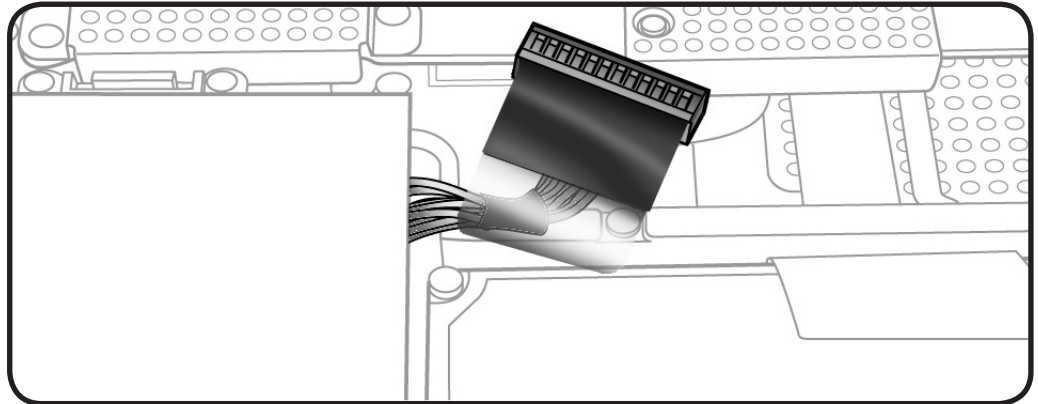
4 Otherwise, connect battery cable.

5 Reassemble computer.
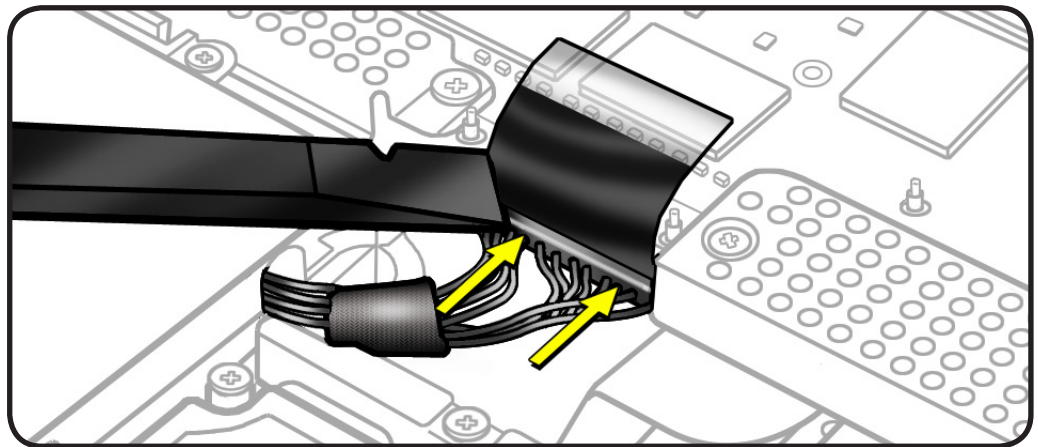
6 Press battery indicator light to check charge level.
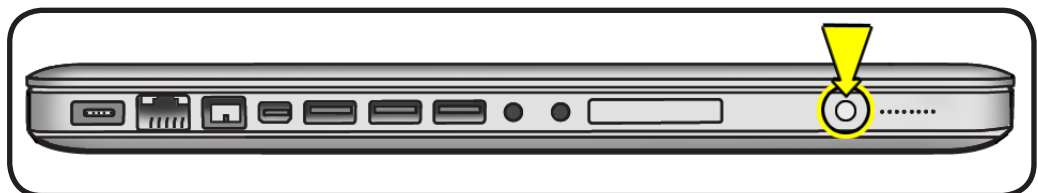
Hard Drive Bracket, Rear

First Steps

Remove
- Bottom case

Caution: Make sure data is backed up before removing the hard drive.
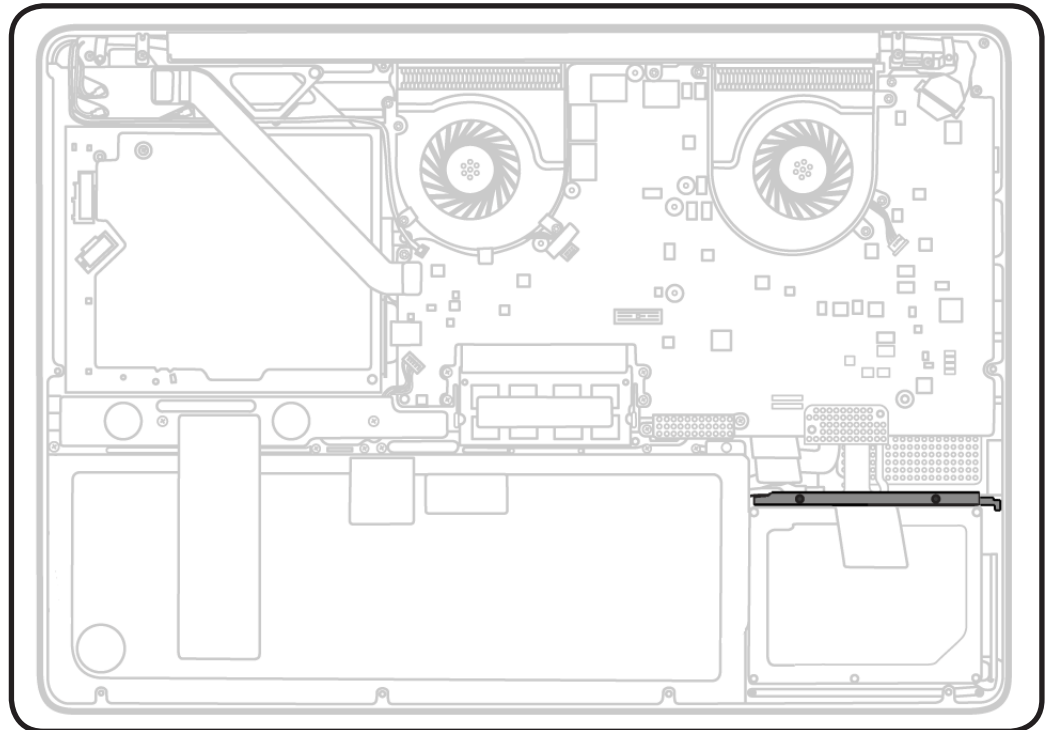
Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.
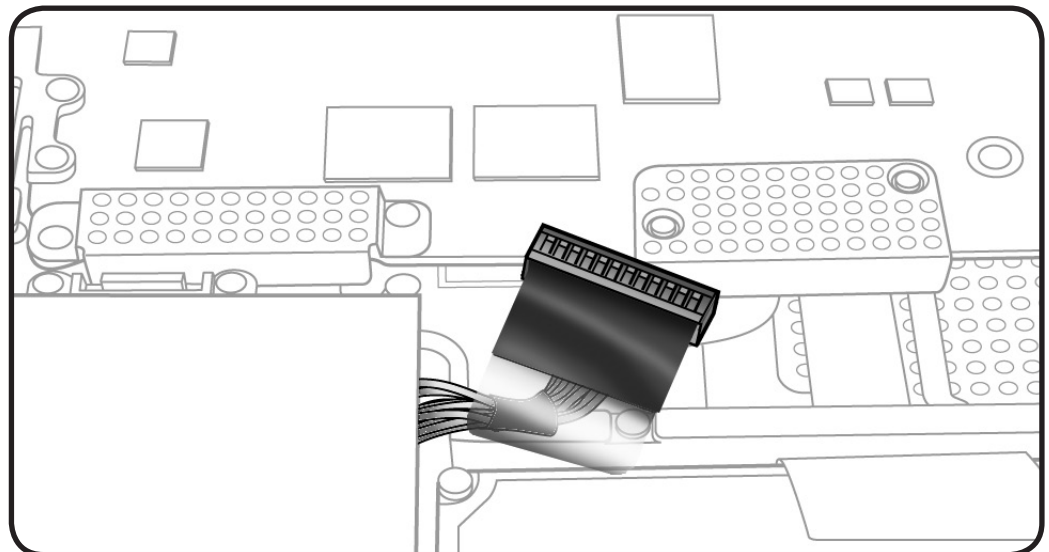
Tools

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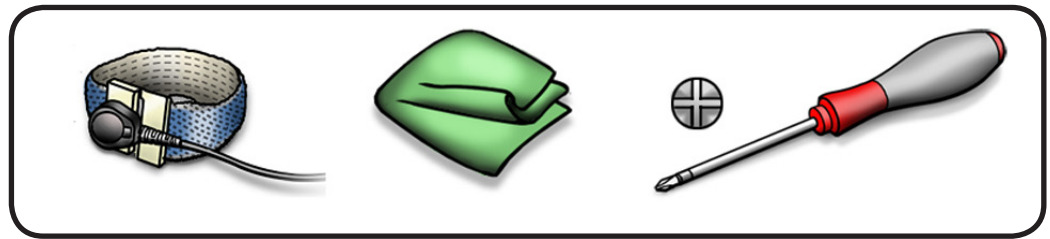
Removal

1 Loosen 2 (5.5 mm) captive screws.
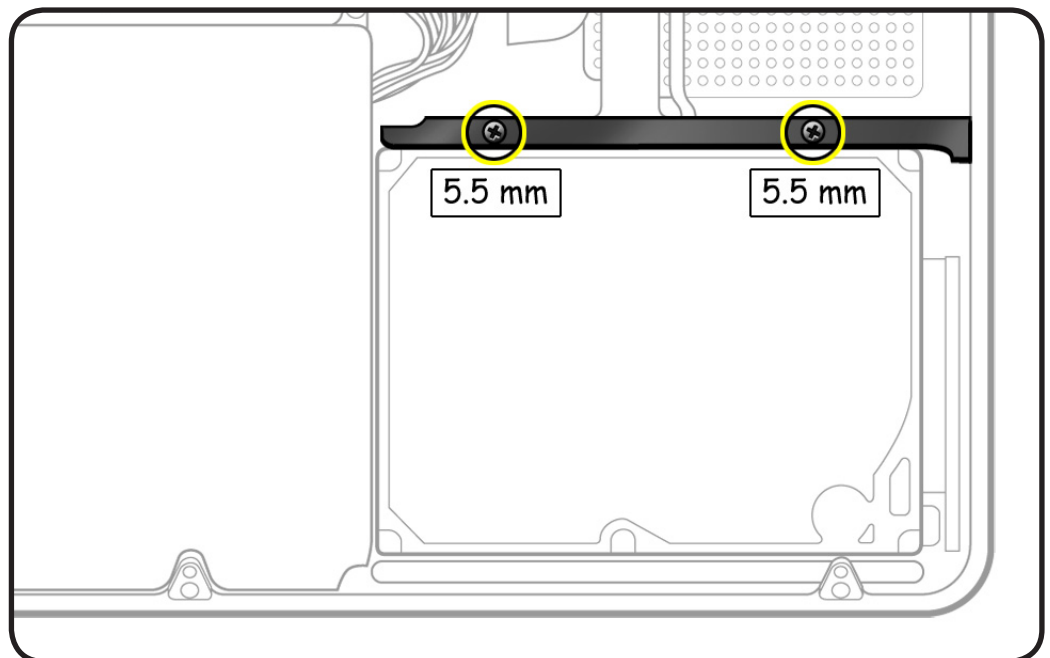
2 Lift out bracket.

Reassembly Note: Make sure 2 rubber grommets are included in bracket before installing it.
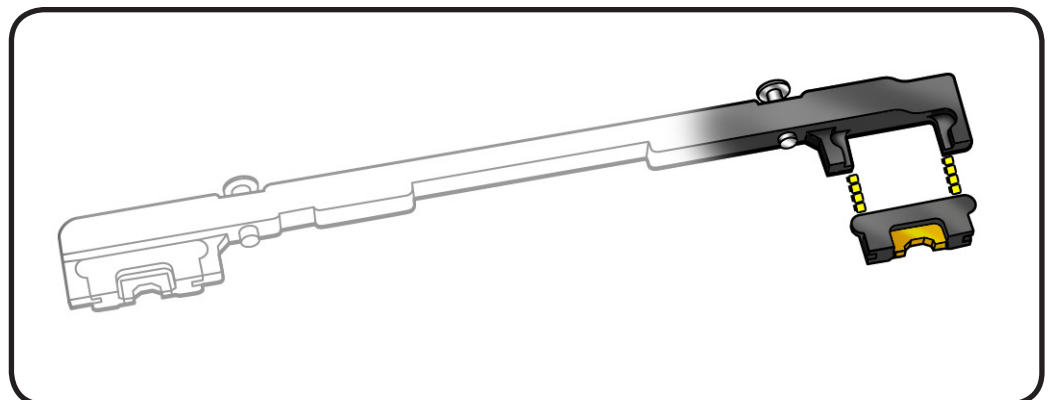
Hard Drive

First Steps

Remove:
- Bottom case
- Rear hard drive bracket

⚠

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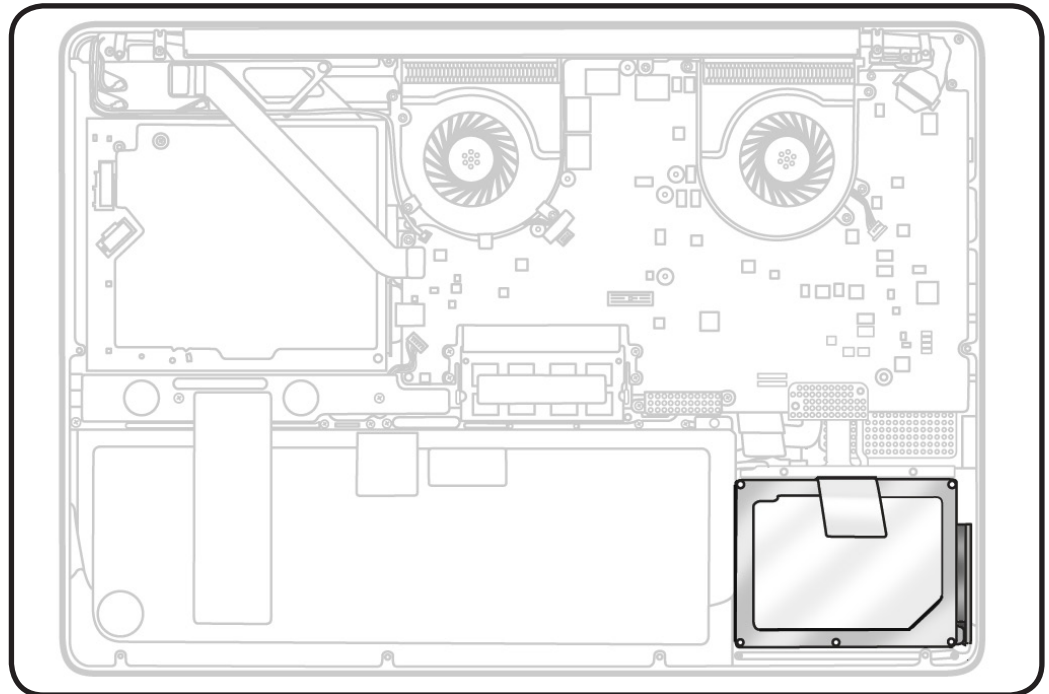
⚠

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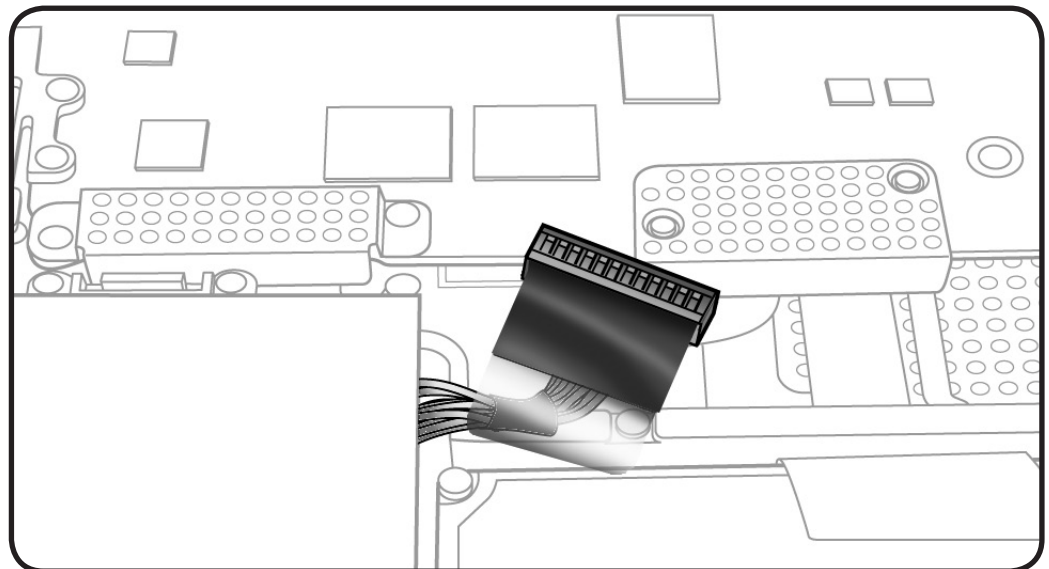
Tools

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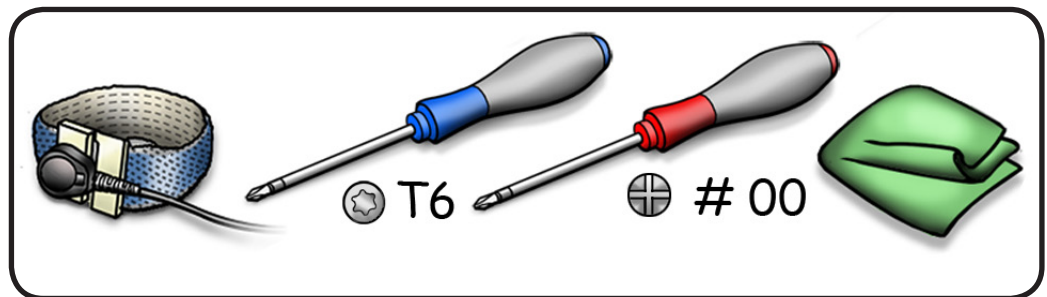
Removal

1 Make sure hard drive bracket is removed.

2 Use pull tab to carefully tilt up hard drive.
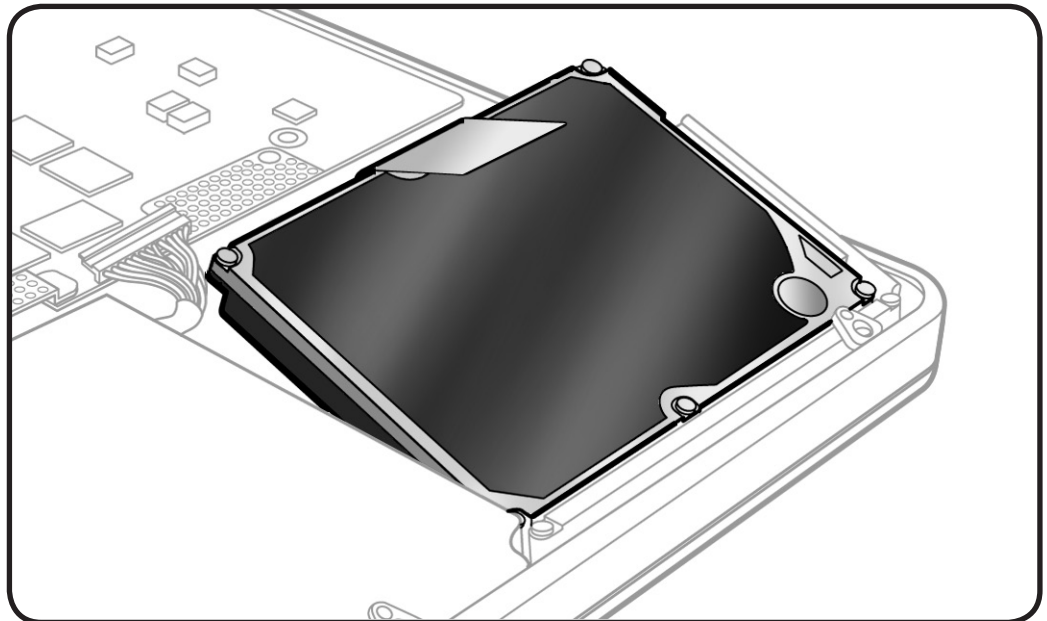
3 Without straining hard drive flex cable, hold hard drive by the sides only.

4 Disconnect hard drive connector.
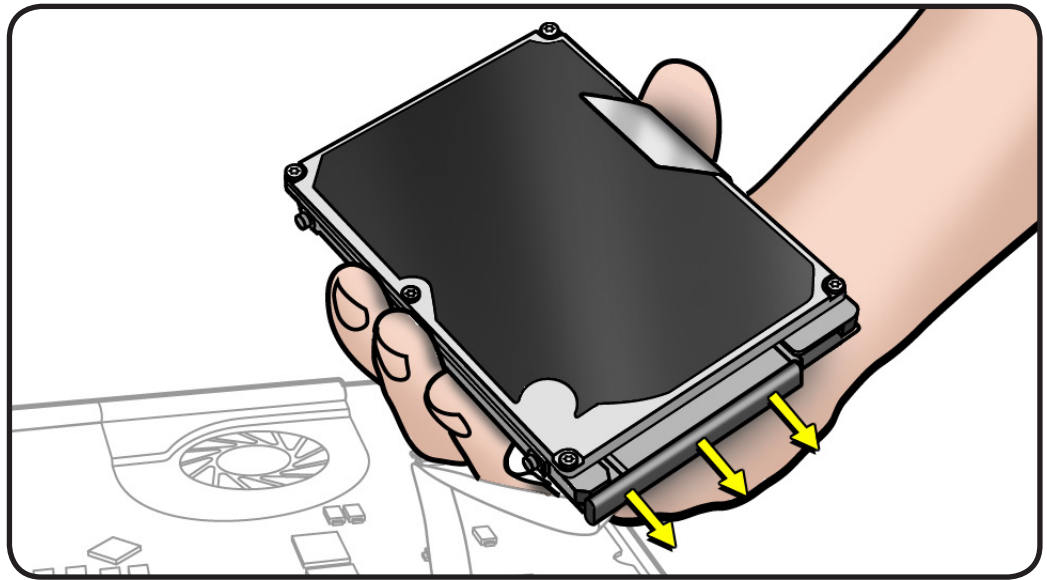
Caution: Be careful when handling hard drive flex cable. Do not flatten or reshape flex cable bends, and avoid moving cable unnecessarily. Repeated movement at cable bends may damage internal wiring and require cable replacement.
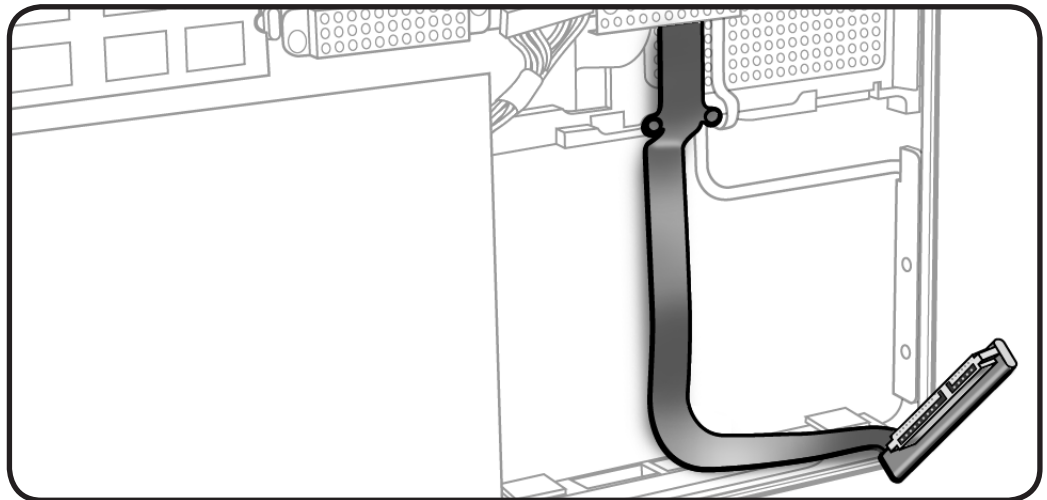
5 Follow safe handling:
- Do not press drive

- Do not touch connector
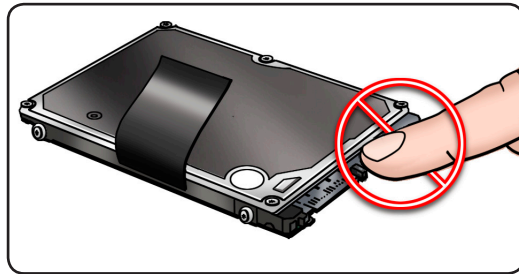
- Do not touch circuitry
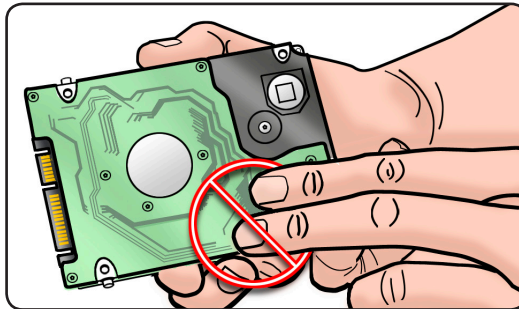
Reassembly

1 Make sure rubber grommets are included in top case before installing the hard drive.
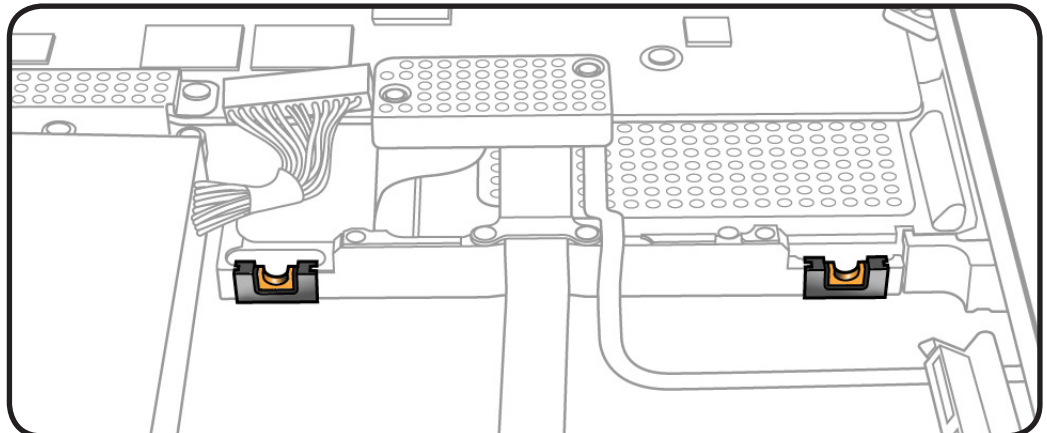
2   Make sure 4 Torx T6 mounting screws (not available separately) are installed on drive.

If replacement drive does not have mounting screws, transfer them from the old drive.
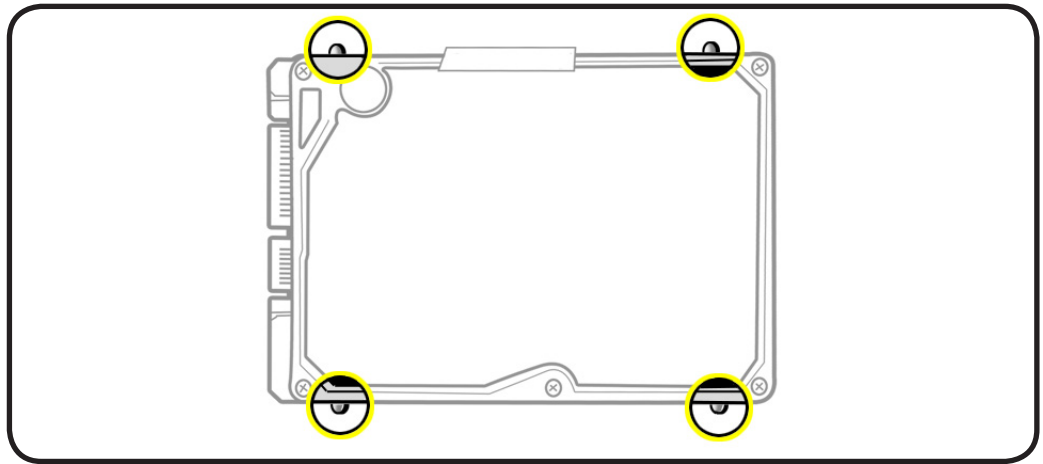
3   Attach connector, and tilt hard drive into front of top case.

4   Install rear hard drive bracket.
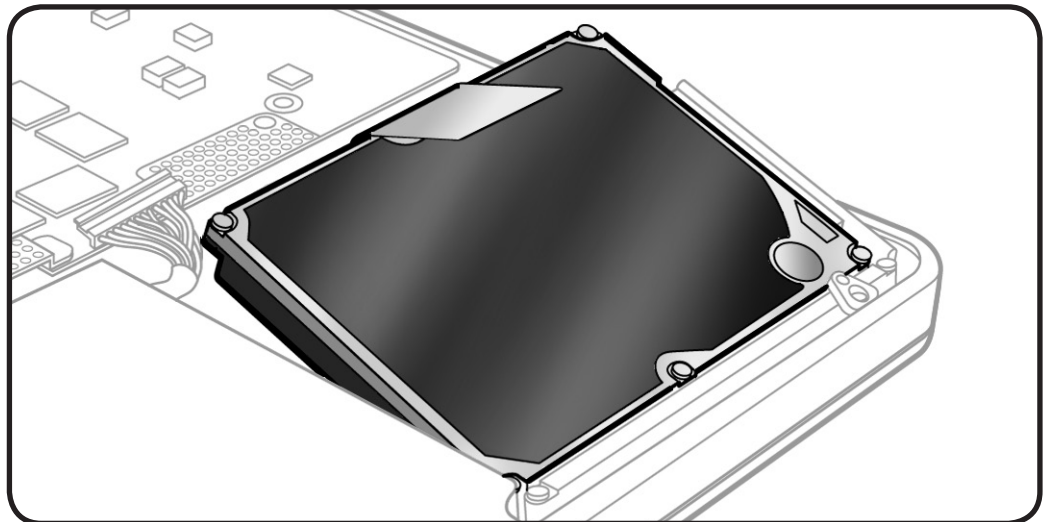
Reinstalling Software that Came with the Computer

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

Important: Apple recommends backing up data on the hard disk before restoring software. Back up essential files before installing Mac OS X and other applications. Apple is not responsible for any lost data.

For more details, refer to **http://support.apple.com/kb/HT3910**.
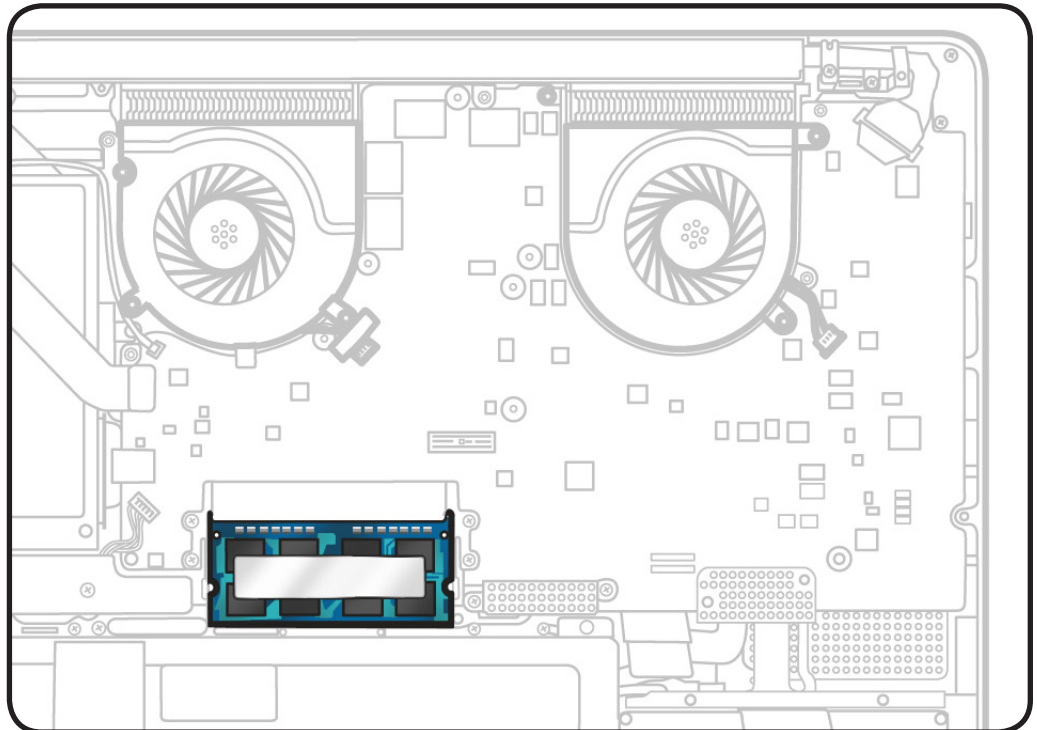
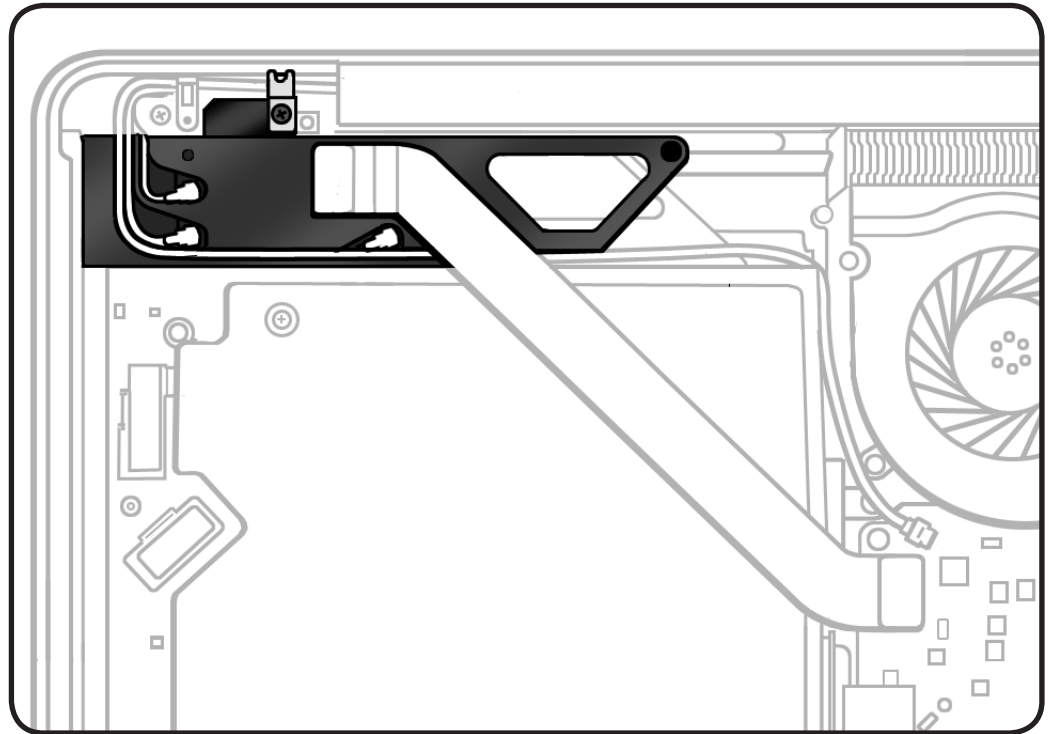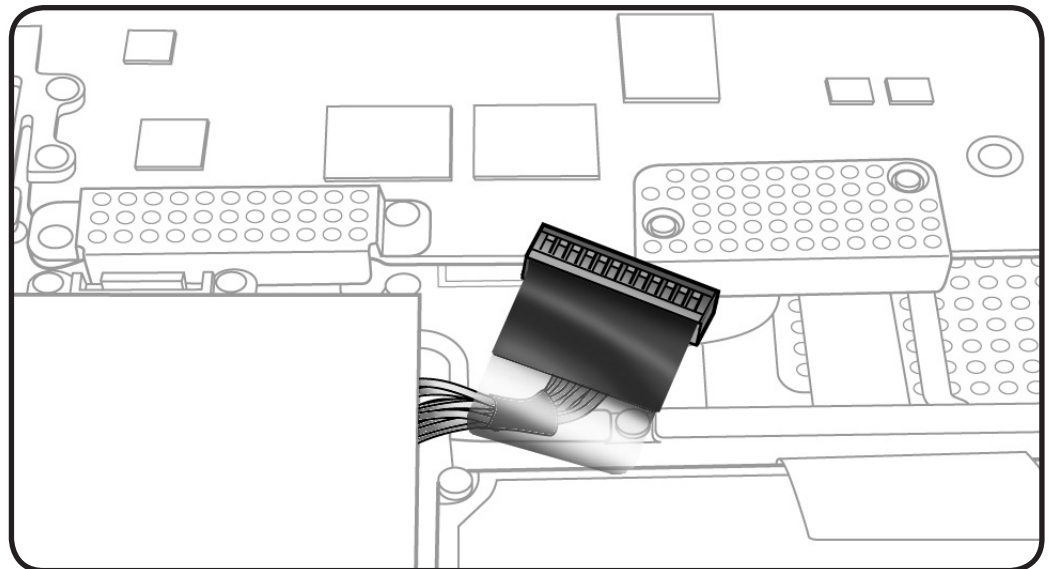# Memory
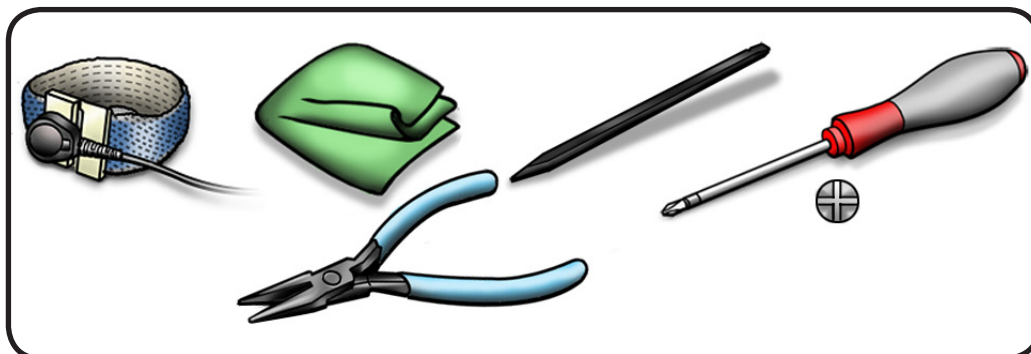
First Steps

Remove:

- Bottom case

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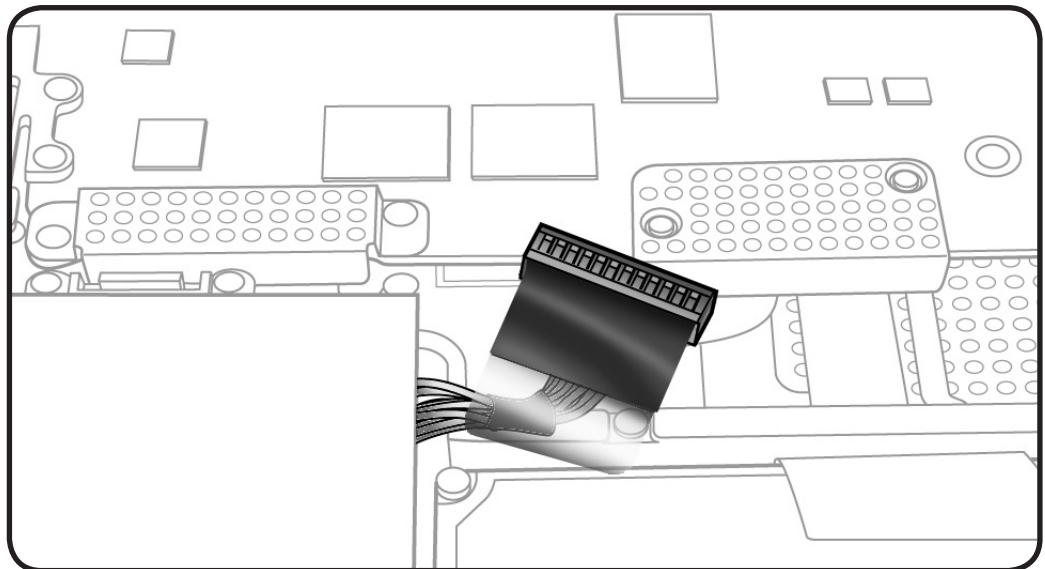
Tools

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

Removal

Memory cards must be:
- 30 mm (1.18 inch)
- 2 GB or 4 GB
- 204-pin
- PC3-8500 DDR3, 1066 MHz RAM (2010 model)
- PC3-10600S DDR3, 1333 MHz RAM (2011 model)

This computer comes with a minimum of 4 GB of 1066 MHz Double Data Rate 3 (DDR3) Synchronous Dynamic Random-Access Memory (SDRAM) installed. It has two slots that can accept SDRAM. The slots are stacked on the logic board under the bottom case. For best performance, memory should be installed as pairs with the same memory size in each slot. The maximum amount of memory for this computer is 8 GB, with a 4 GB DIMM installed in each slot.

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

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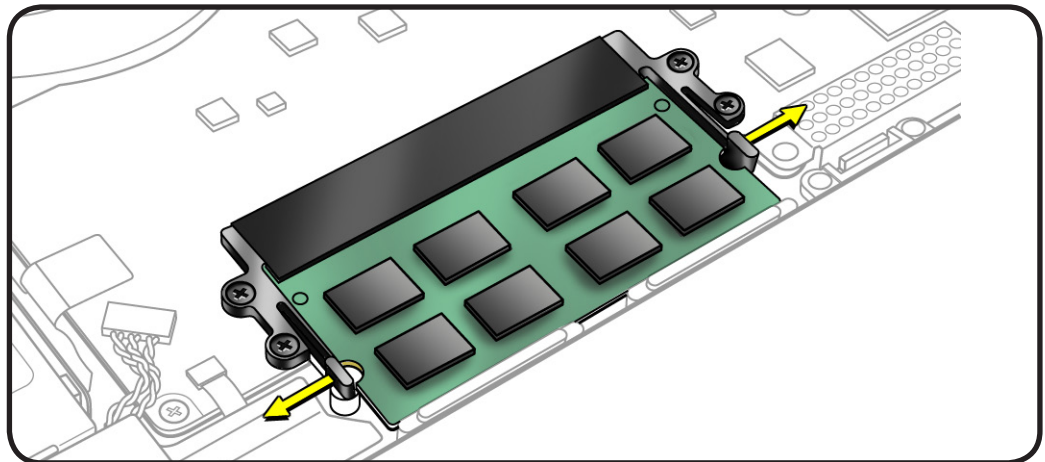
2 Pull out the card.

3 Hold card by edges.

4 Do not touch the gold connectors.

   Note: New cards might have a harmless white residue on the gold connectors.
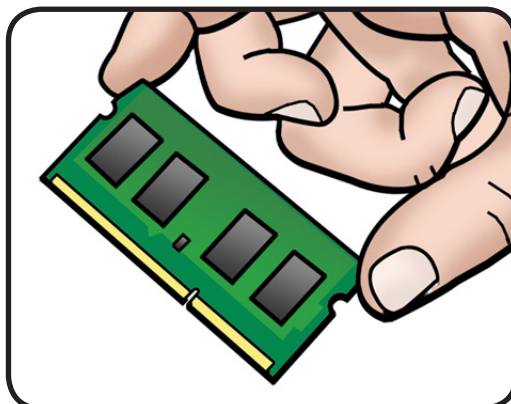
Reassembly

1 Install cards at an angle. If installing just one card, install it in lower slot.
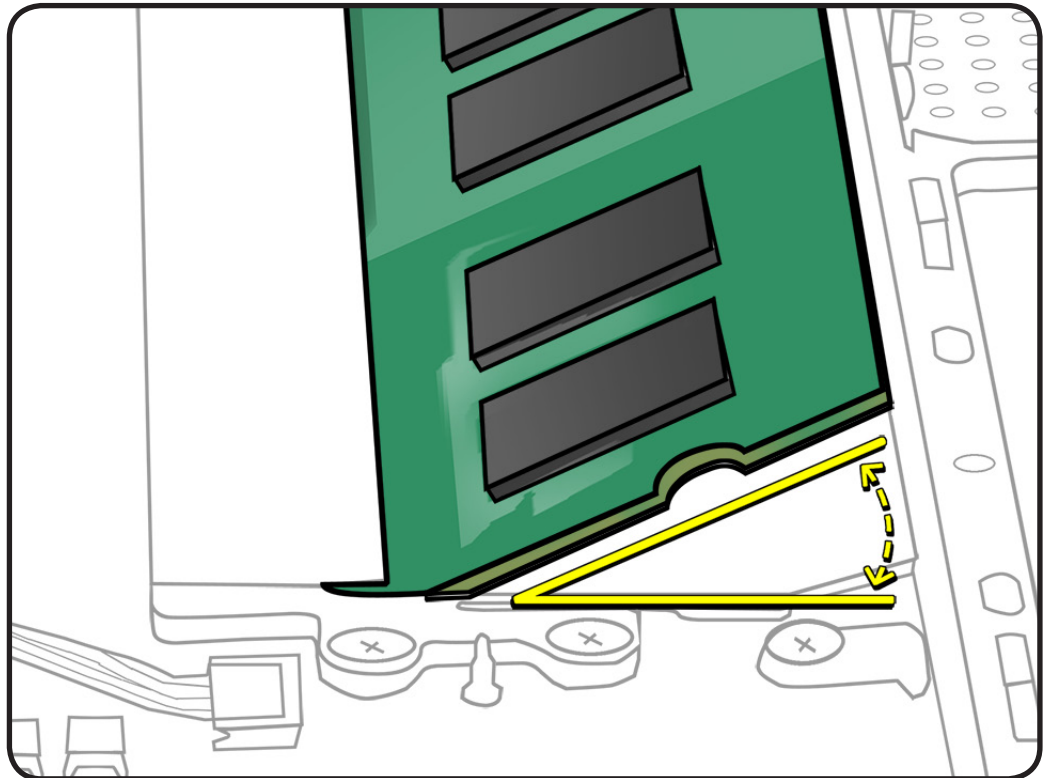
2 Press card down.

3 If you installed additional memory, check that computer recognizes it.
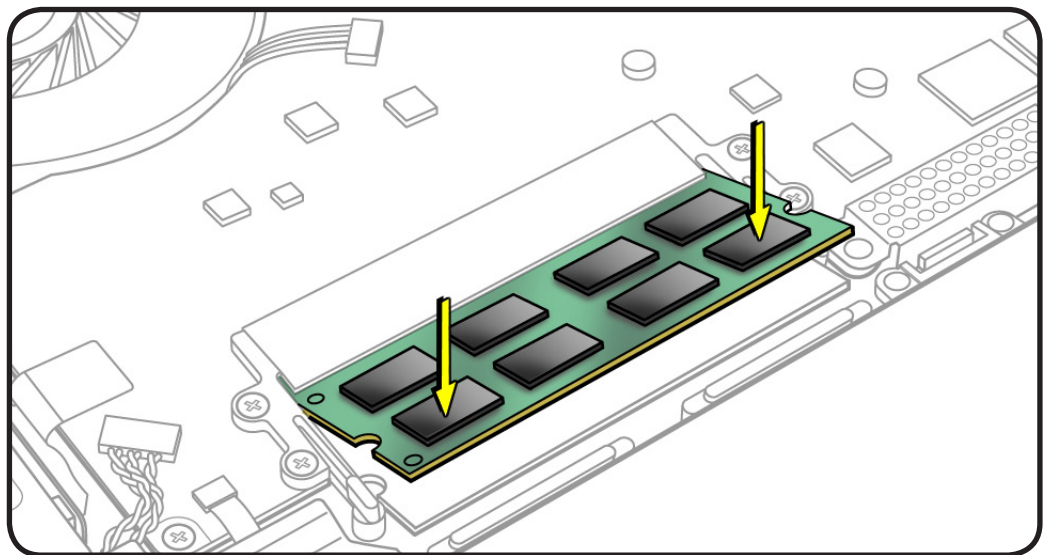
Camera Cable Guide

First Steps
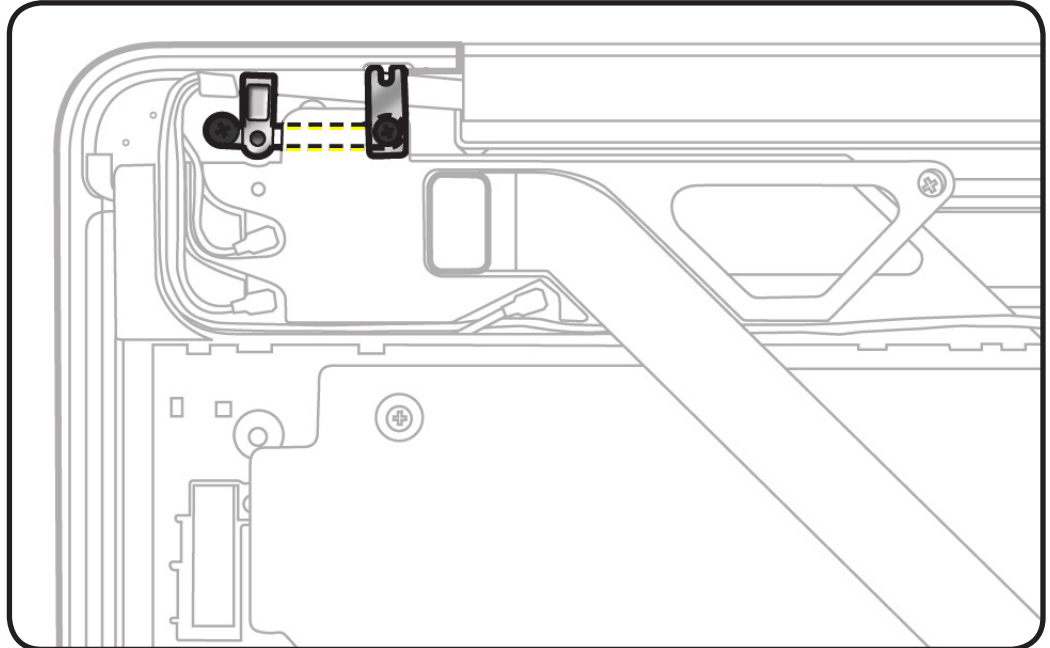
Remove:

• Bottom case

![warning triangle icon]
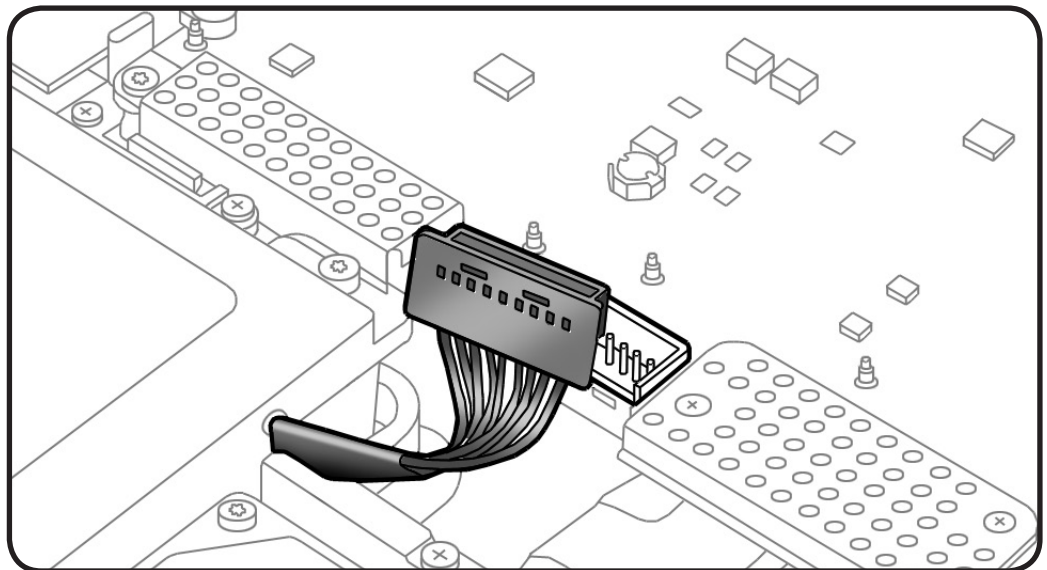
Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.
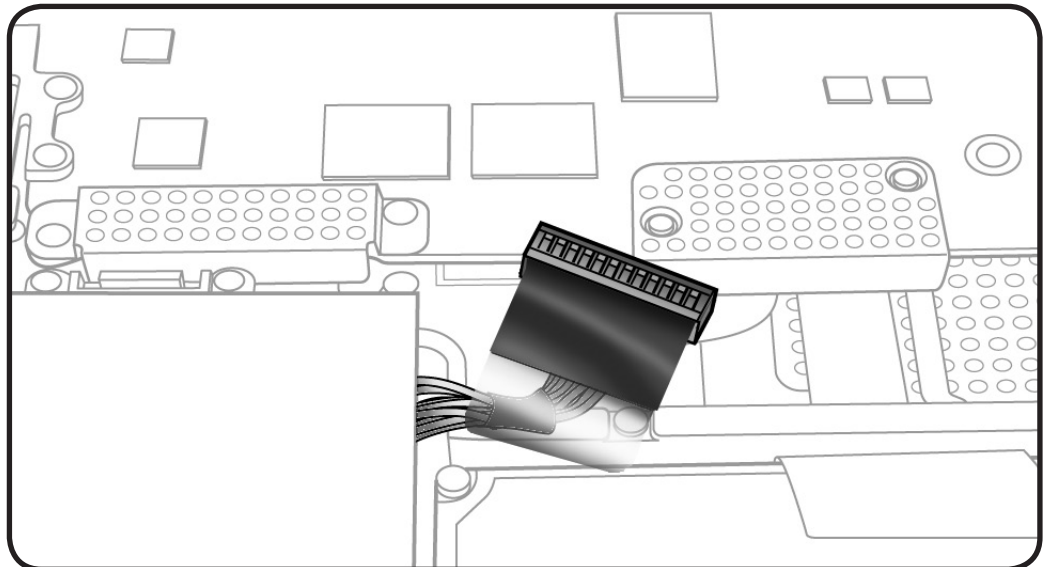
Tools

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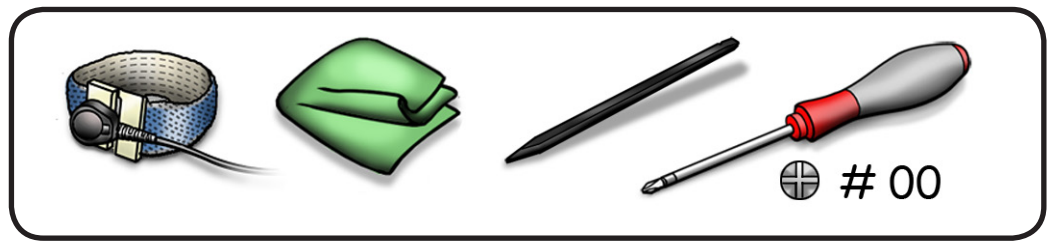
Removal

1 Disconnect:
- camera cable
- flex cable

2 Remove
- 10-mm (922-9333) screw
- 3.55-mm (922-8974) screw

Note: Do not remove metal grounding clip; it stays adhered on AirPort/Bluetooth holder.
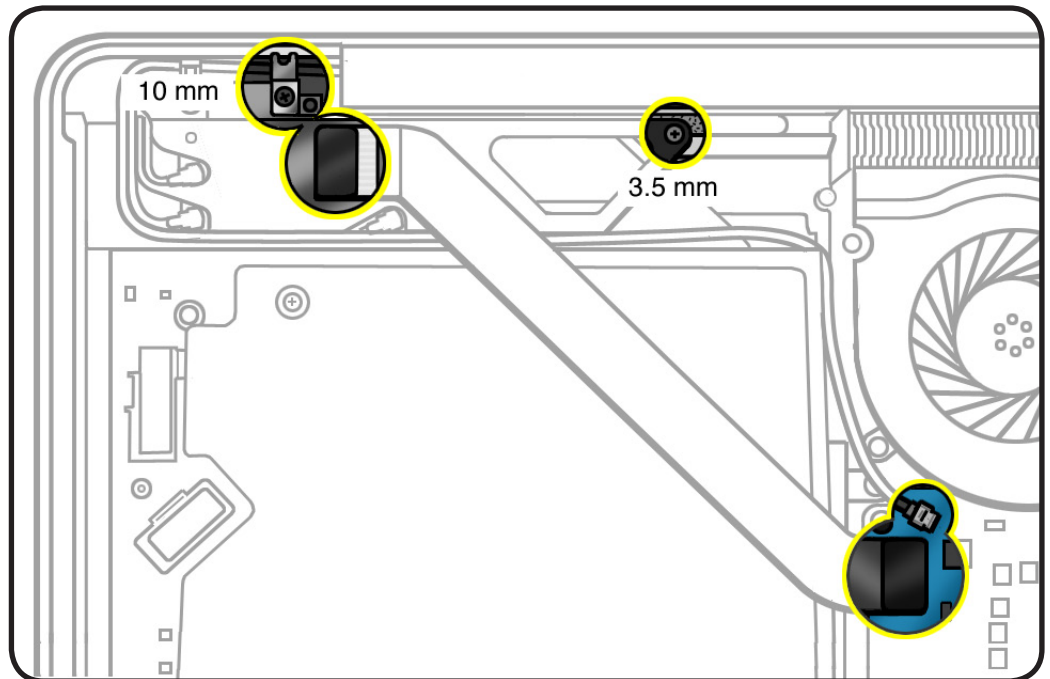
Reassembly Note: Camera cable is held in place with adhesive. Make sure cable is rerouted as illustrated. If possible, also secure it using original adhesive.
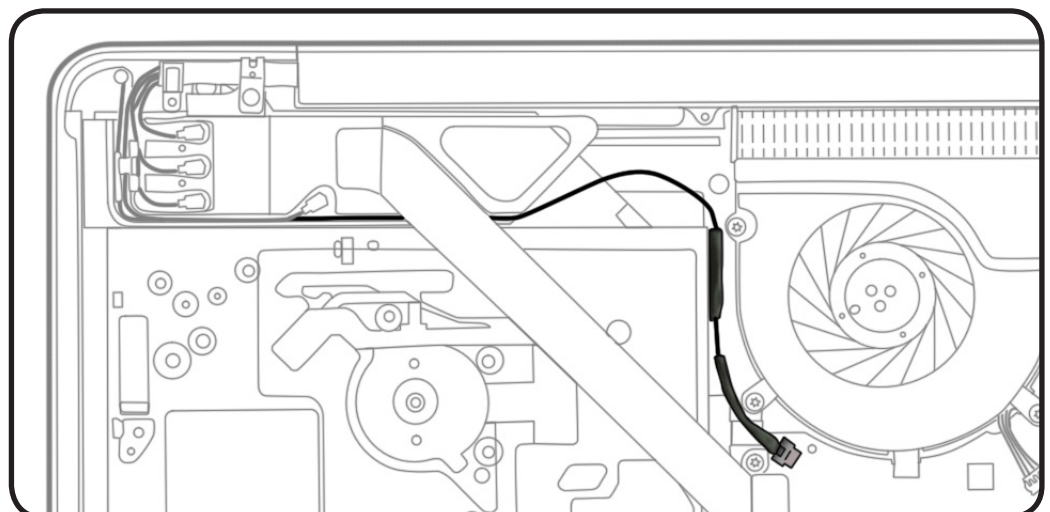
3 Flip over AirPort/
Bluetooth holder.
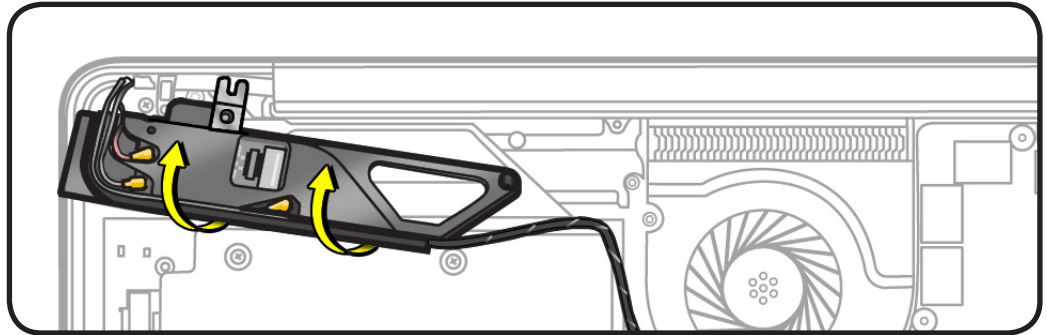
4 Remove 7.6-mm (922-
8929) screw.

7.6 mm
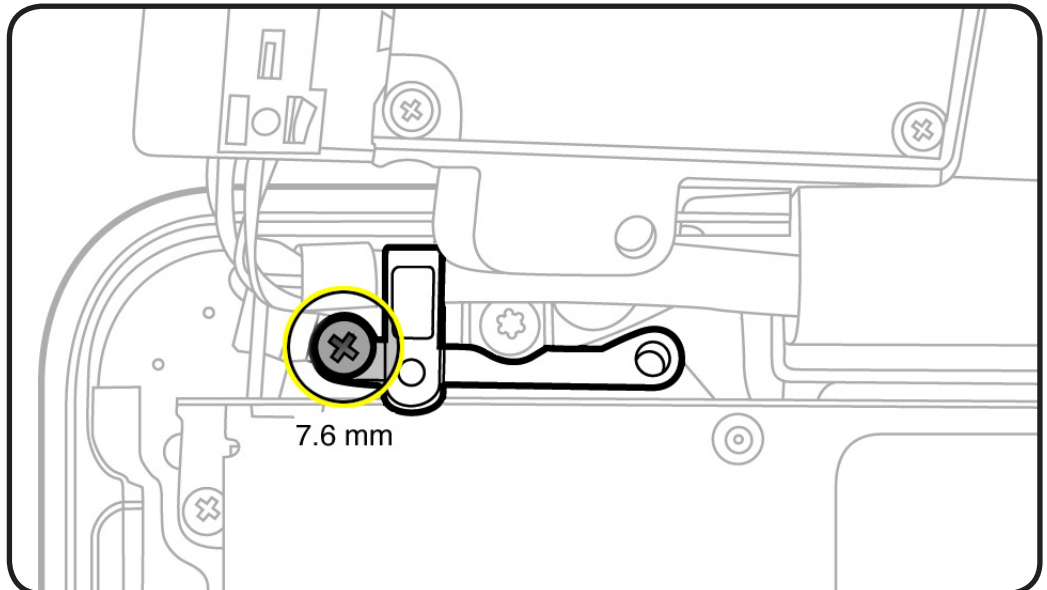
5 Remove the camera
cable guide.

Reassembly Note:
Be sure to anchor the
metal ground clip
when reinstalling the
screw near the top
corner.
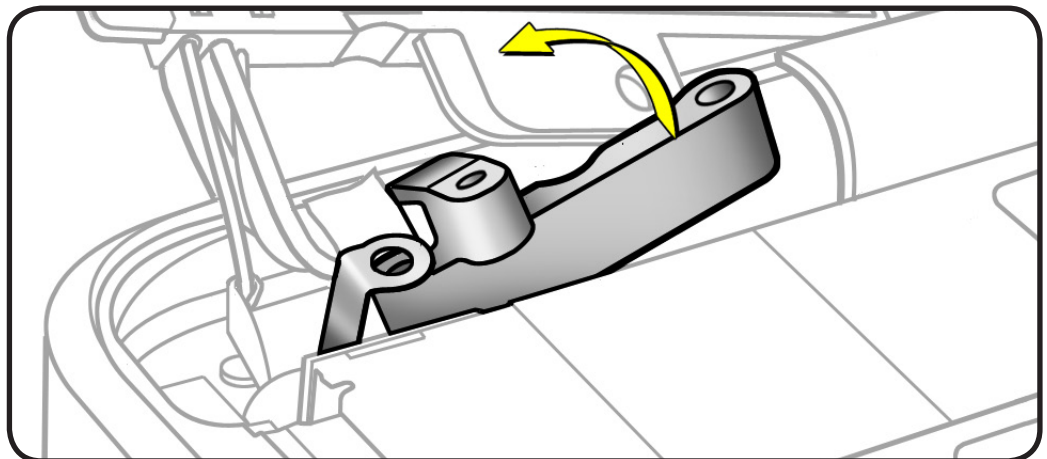
Reassembly Note: Be sure grounding clip fingers contact the small top case pocket. The fingers need to slightly overlap the top case, so hold the clip in place during installation.
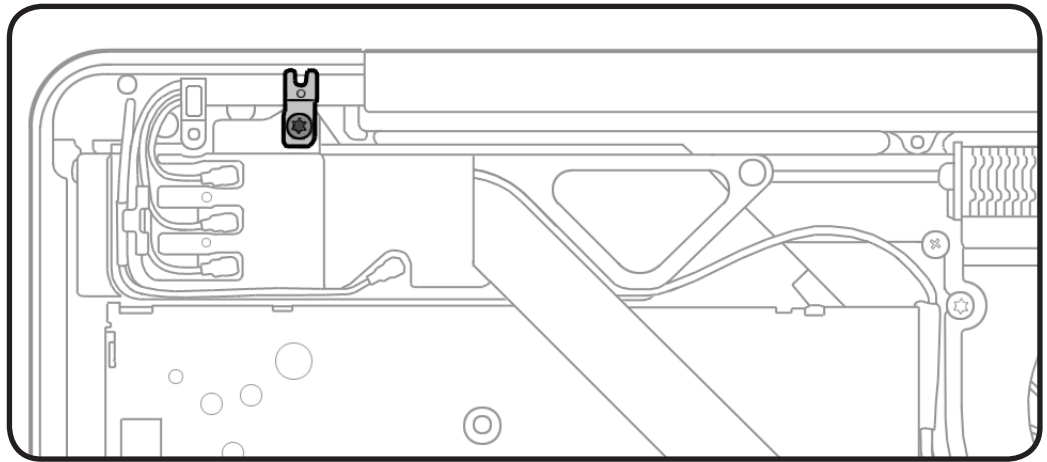
LVDS Cable Guide

First Steps
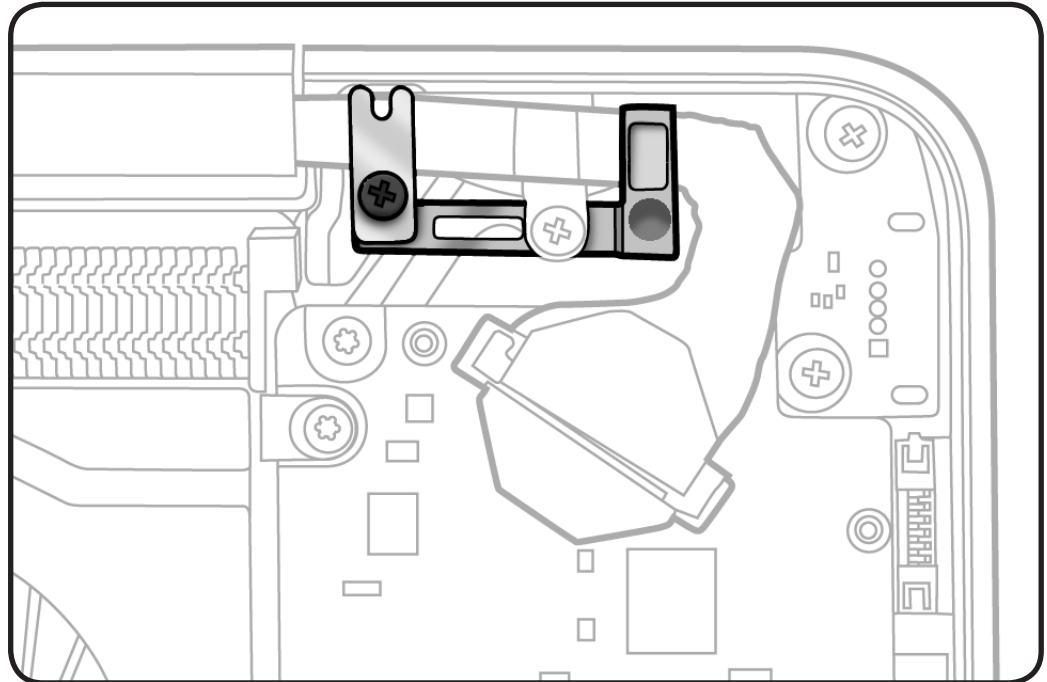
Remove:
• Bottom case

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

Tools

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

⊕ # 00
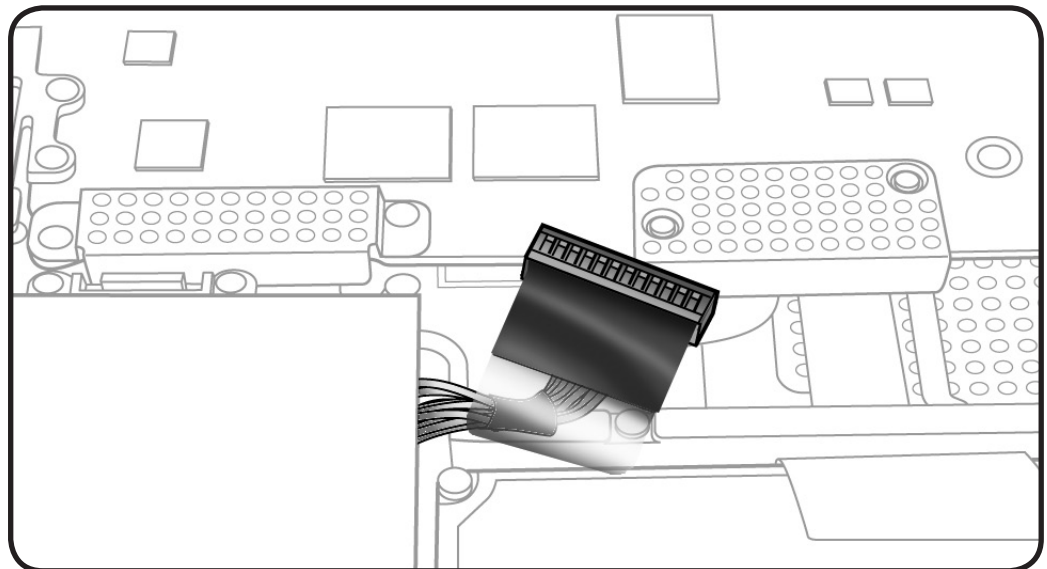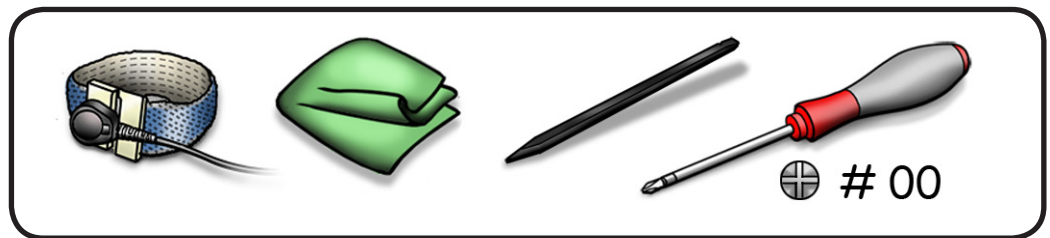
Removal

1 Note proper placement of LVDS gasket.

Carefully peel off gasket

Note: Removing the LVDS ground tab screw is optional, but it might allow more cable length to disconnect the LVDS cable.

Important: Do NOT remove the screw that secures the guide's metal grounding clip.
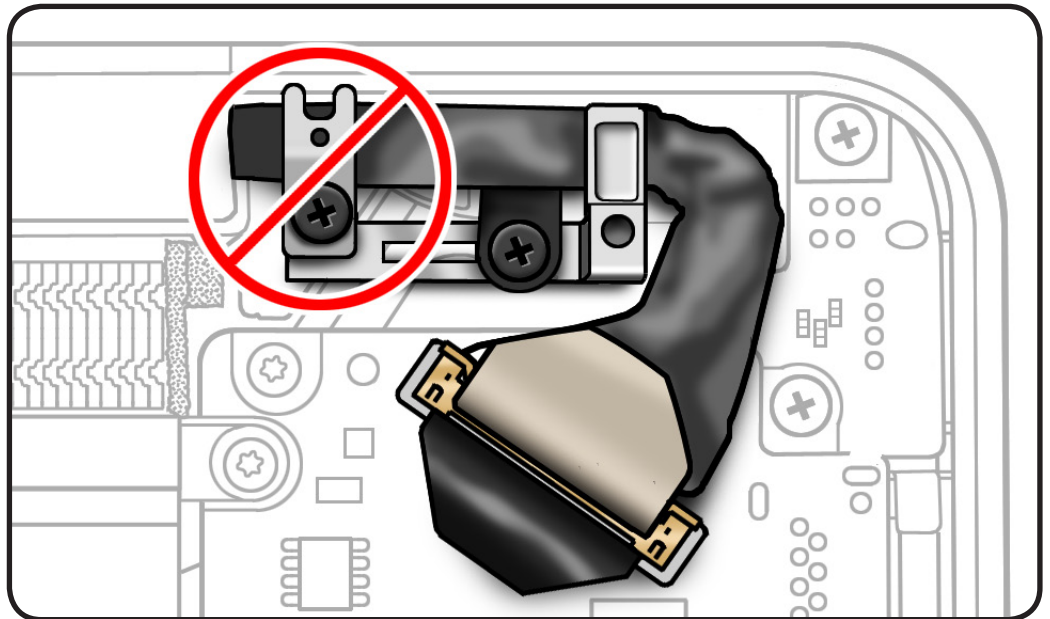
2 To disconnect LVDS cable, grasp black tab and gently swing LVDS lock bar up and back to unlock the cable.

3 Slide cable out of connector by pulling the cable. Do not pull the black tab or lock bar.
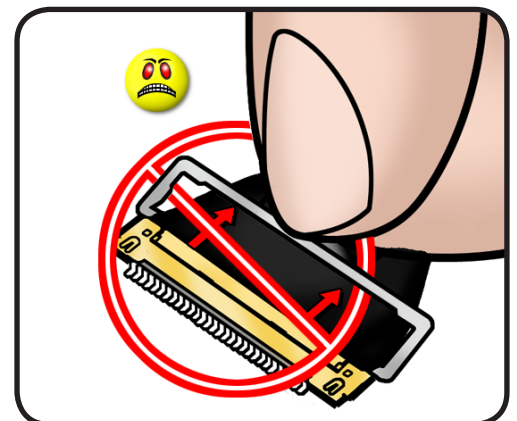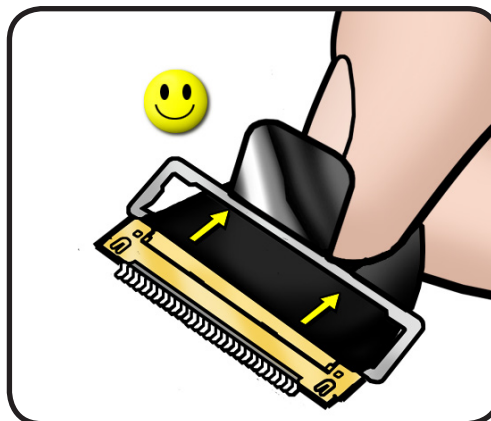
4 Remove 2 (7.1-mm) 922-8645 screws.

Important: When removing the LVDS cable guide, **do NOT remove the screw that secures the guide's grounding clip.** The clip is delicate and should remain with the guide. If the clip is damaged, install a new cable guide.

7.1 mm   7.1 mm
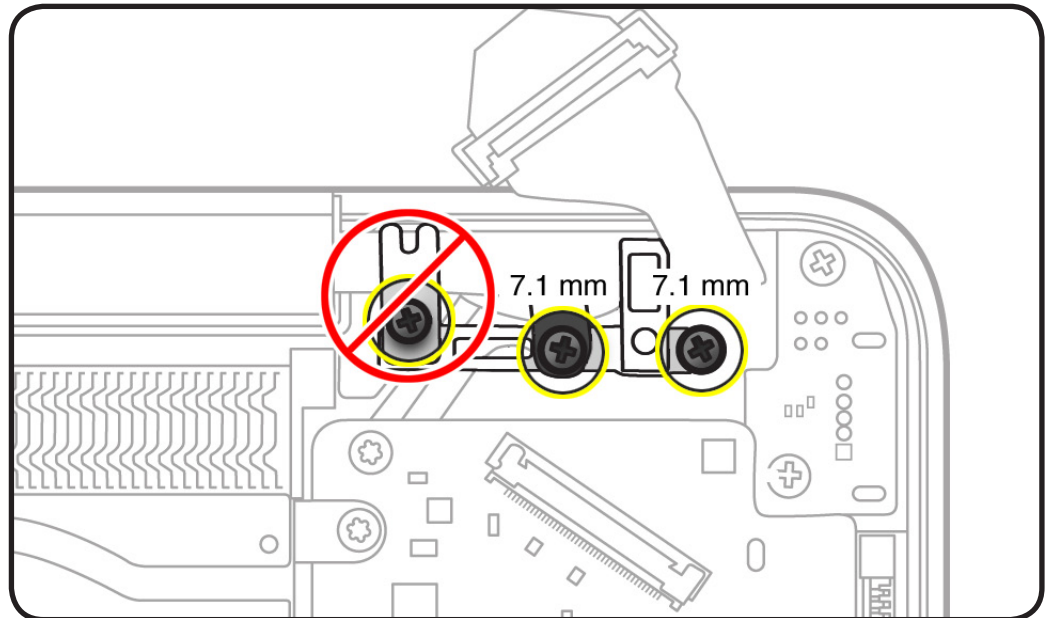
5 Remove the LVDS cable guide.

Reassembly Note: Be sure grounding clip fingers contact the small top case pocket, and be sure to anchor mesh ground tab at center screw. The fingers need to slightly overlap the top case, so hold the clip in place during installation.
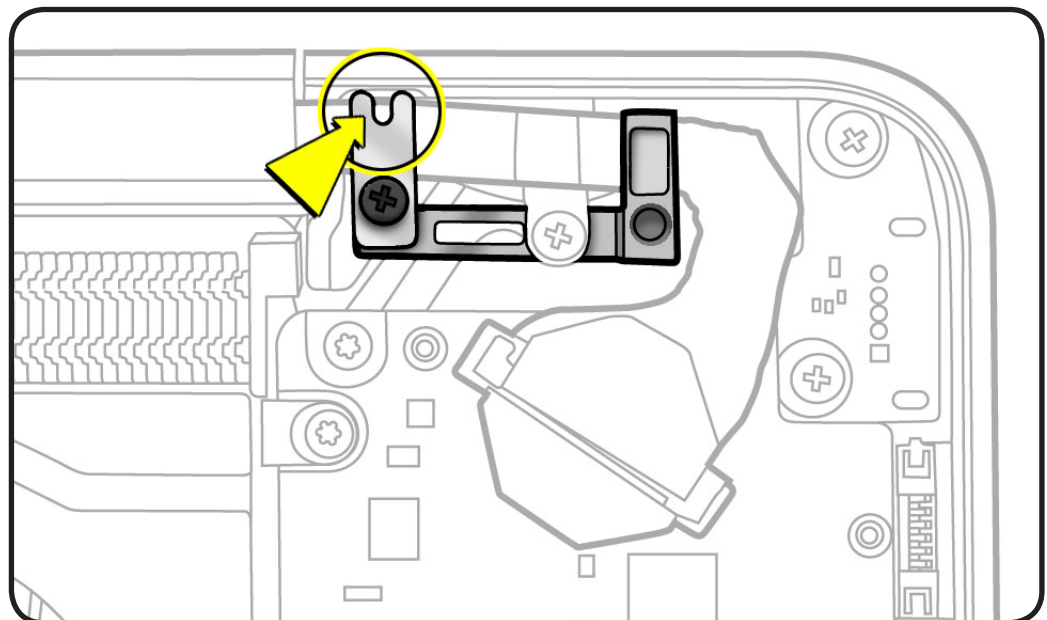
Fans

First Steps

Remove:
- Bottom case
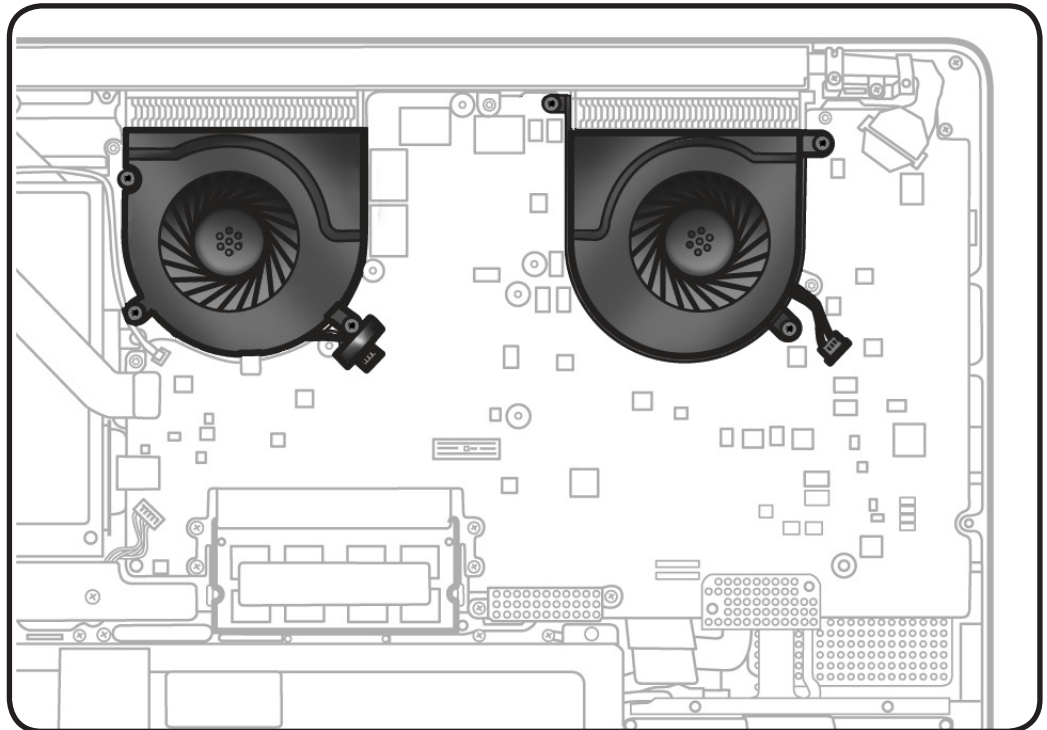
Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.
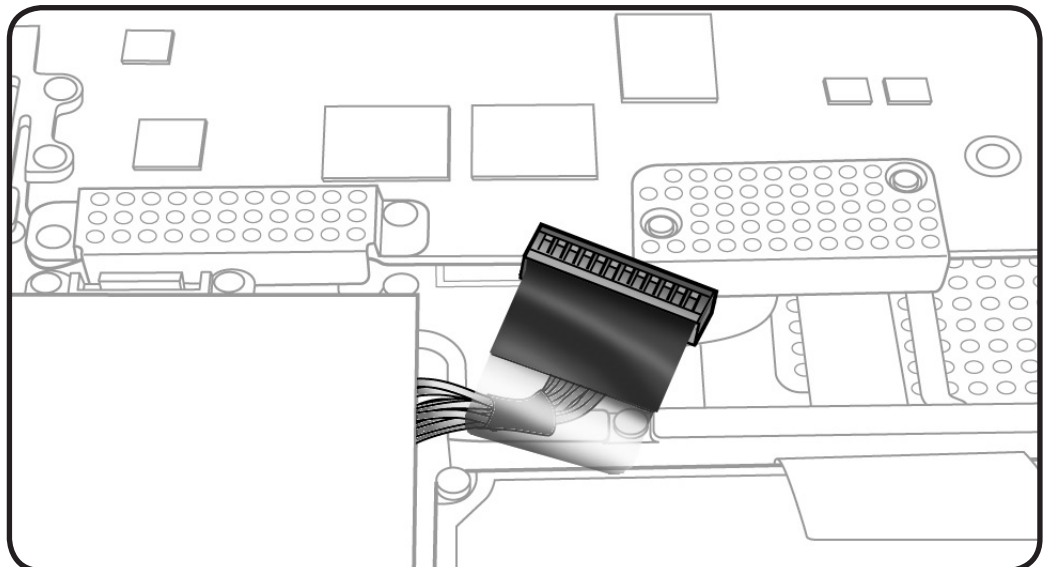
Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Torx T6 screwdriver
- Black stick
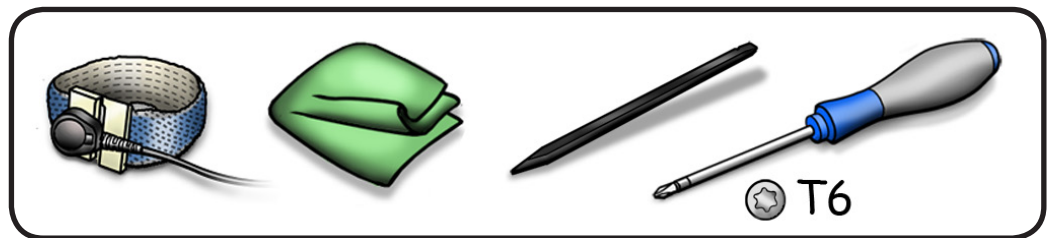
Removal

1 Disconnect each fan cable.

2 Remove 6 (3.3-mm) 922-9108 screws.

3 Remove fan(s) from top case.

Reassembly Note: To identify the fans for ordering parts,

- right fan is closest to optical drive
- left fan is closest to LVDS connector

Reassembly Note: Prevent cable pinching at left fan by installing screws first. Then route left fan cable between screws. If tape was present, reapply tape. If tape is damaged, use Kapton tape instead.
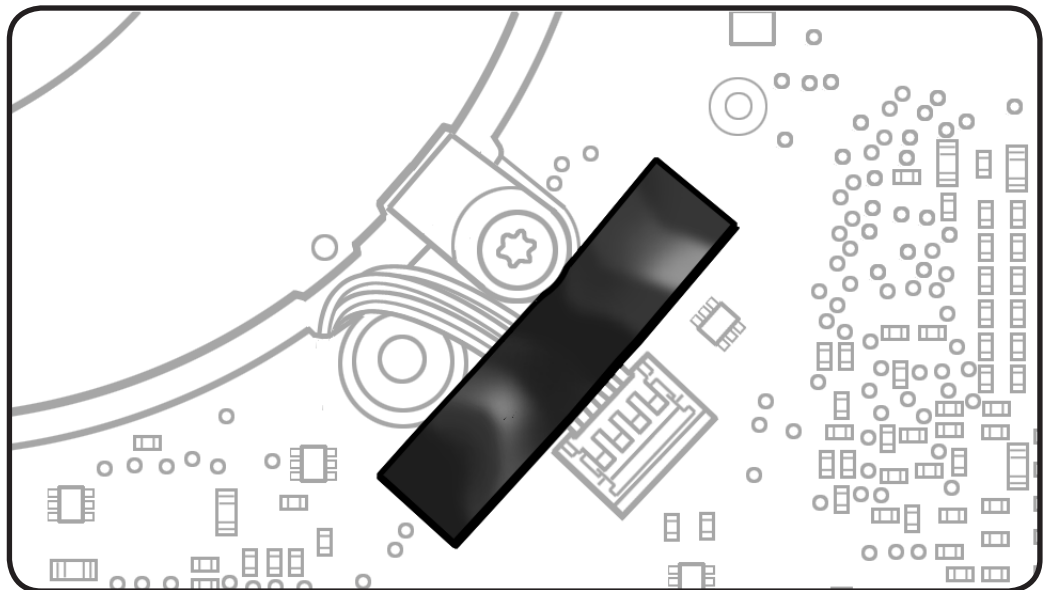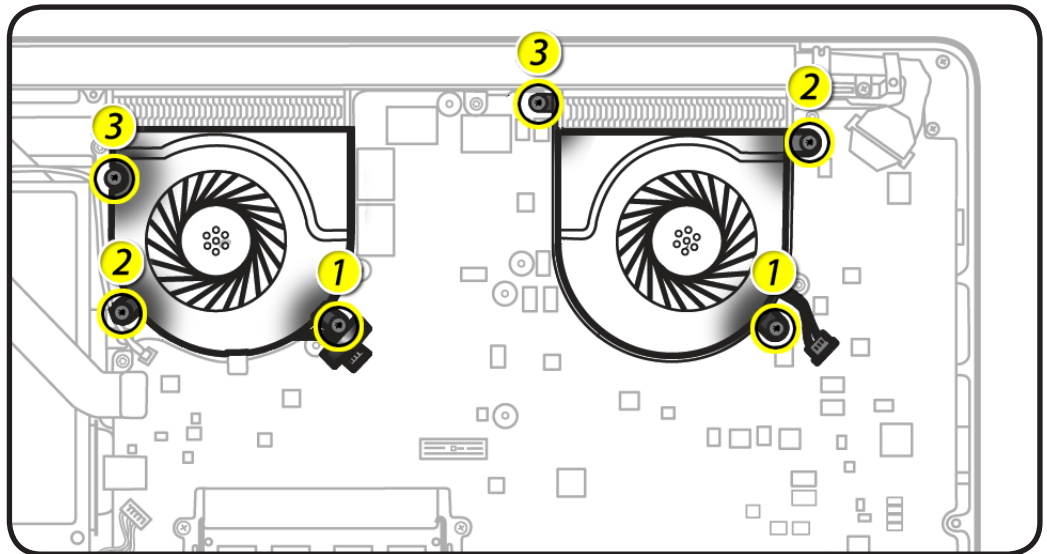
AirPort/Bluetooth Flex Cable, Mid 2010

First Steps
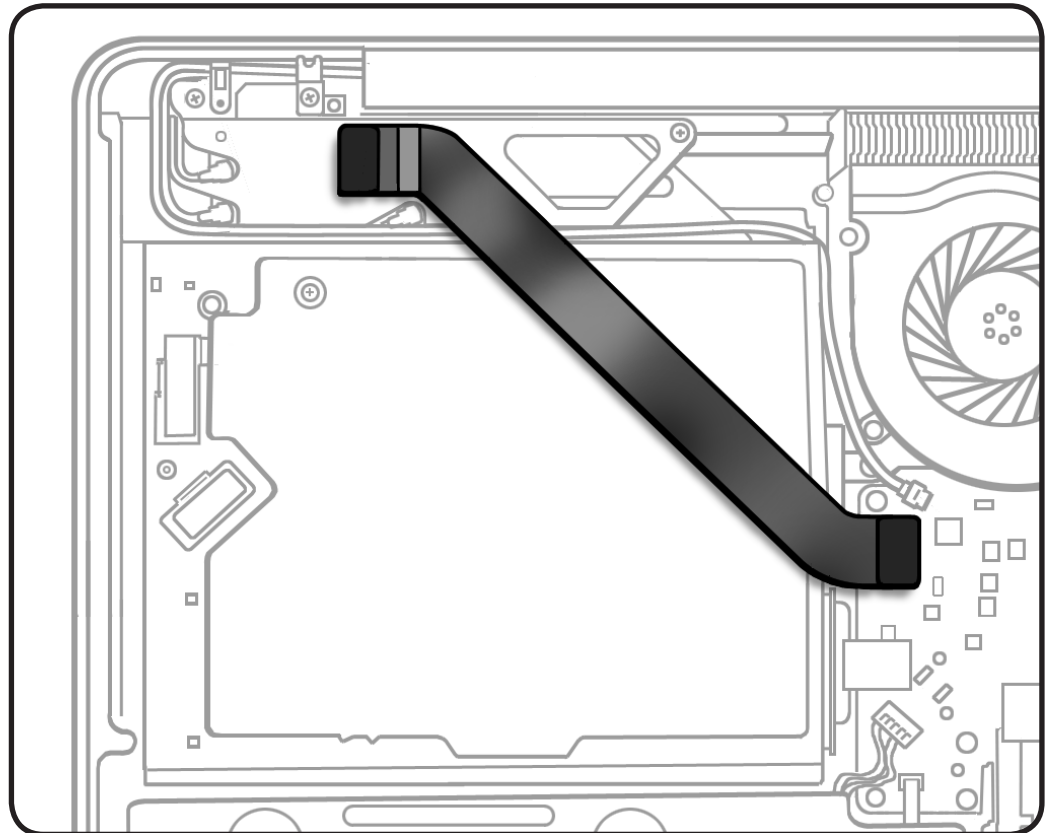
Remove:

• Bottom case

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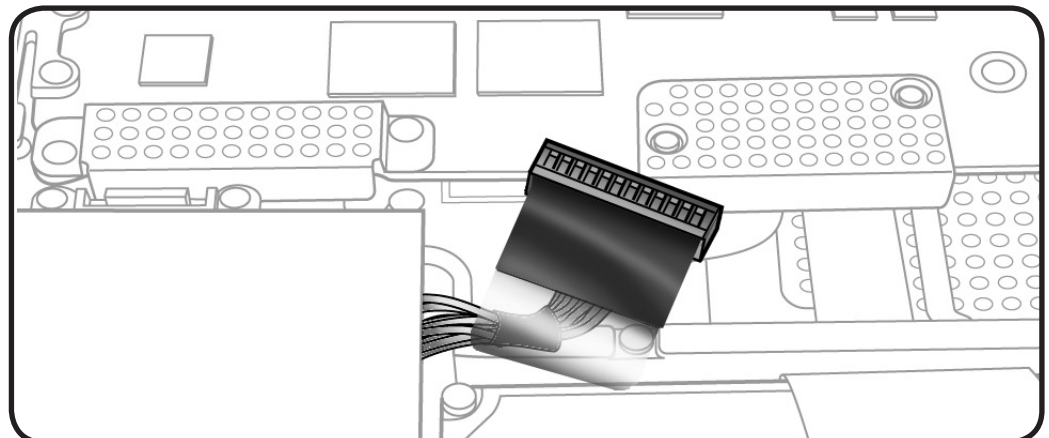
Tools

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

Removal

With a black stick, carefully pry both ends of flex cable straight up and off.

Reassembly Note: Install flex cable straight down onto board connectors.
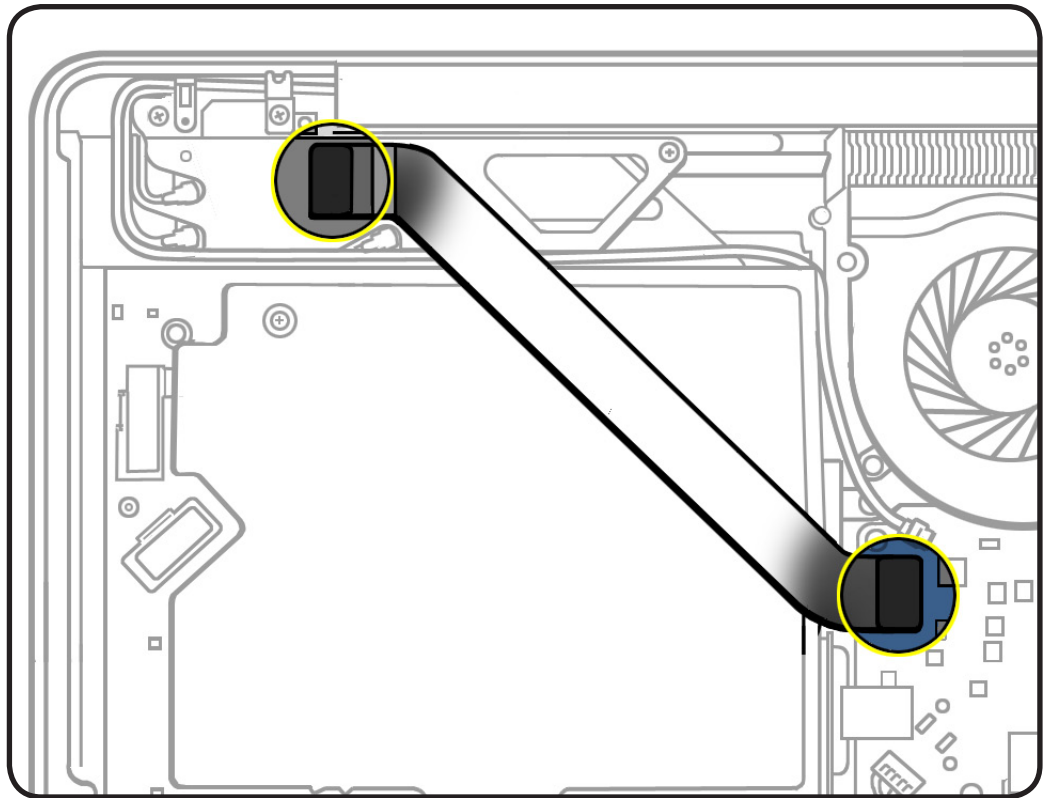
AirPort/Bluetooth Flex Cable, Early 2011

First Steps
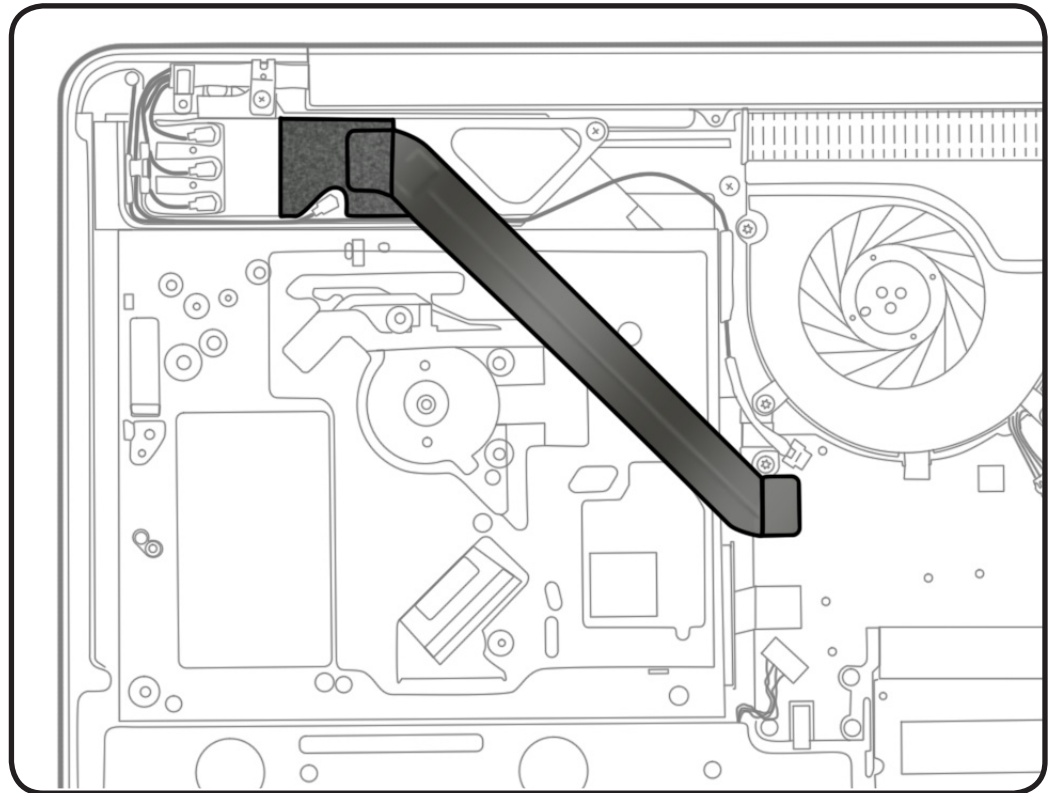
Remove:

• Bottom case

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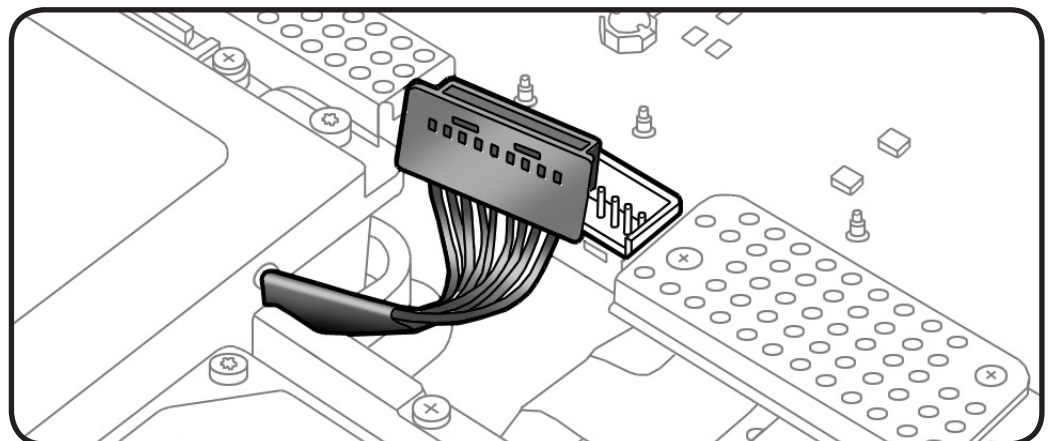
Tools

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

Removal

1 Carefully peel back conductive wrap covering flex cable's AirPort/Bluetooth card connector.

   Reassembly Note: Reinstall wrap over connector.
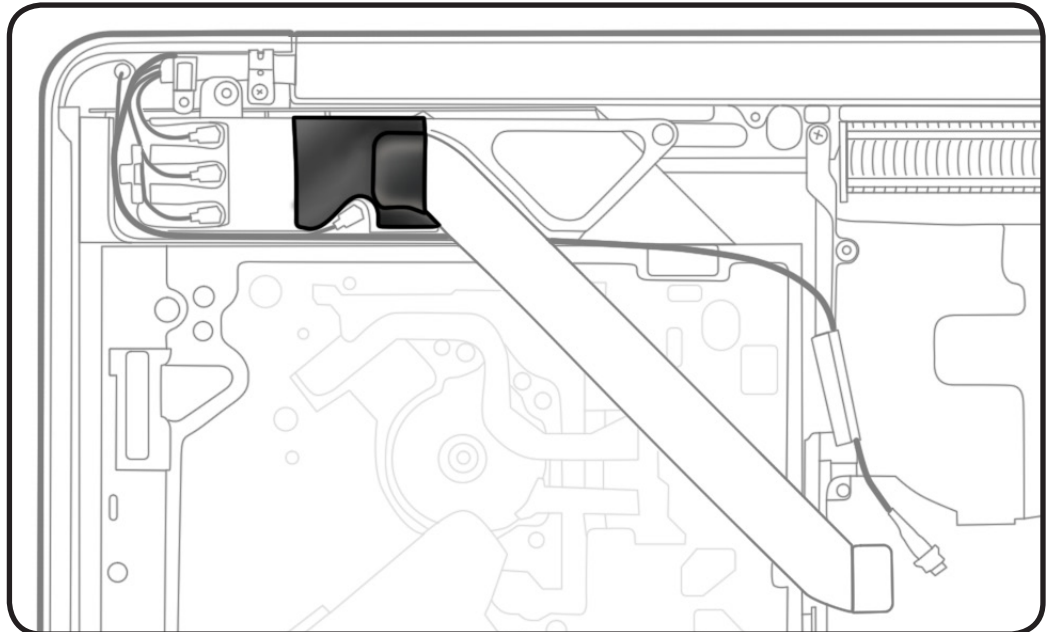
2 Disconnect cable from
- AirPort/Bluetooth card
- logic board

3 Remove cable from bottom case.
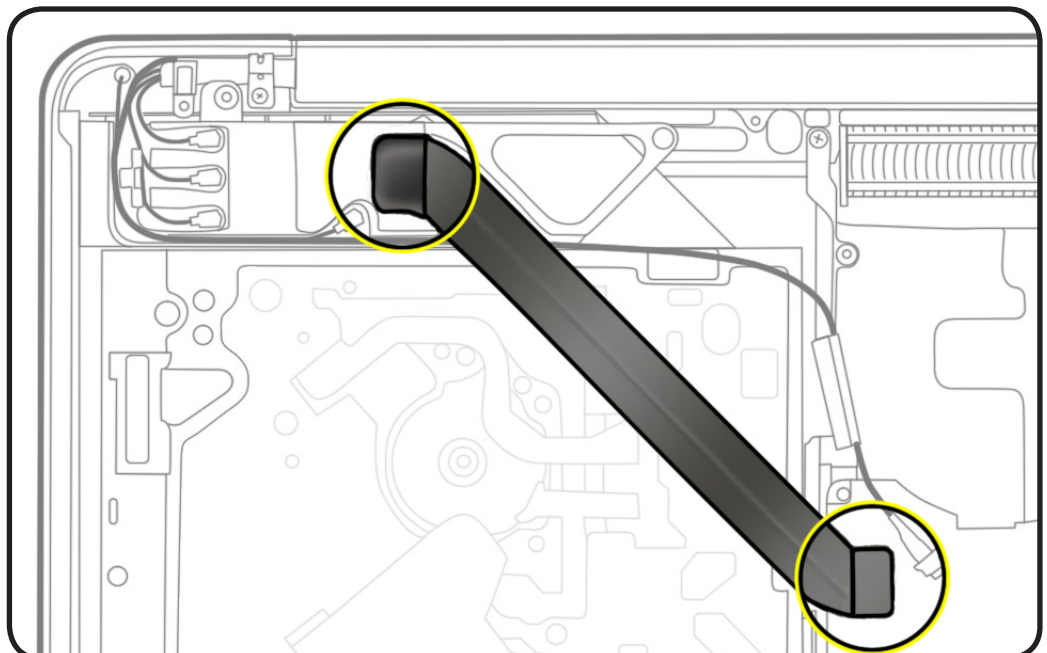
Reassembly Note:
Smooth down wrap on edge and top side of holder, being careful to cover flex cable connector.
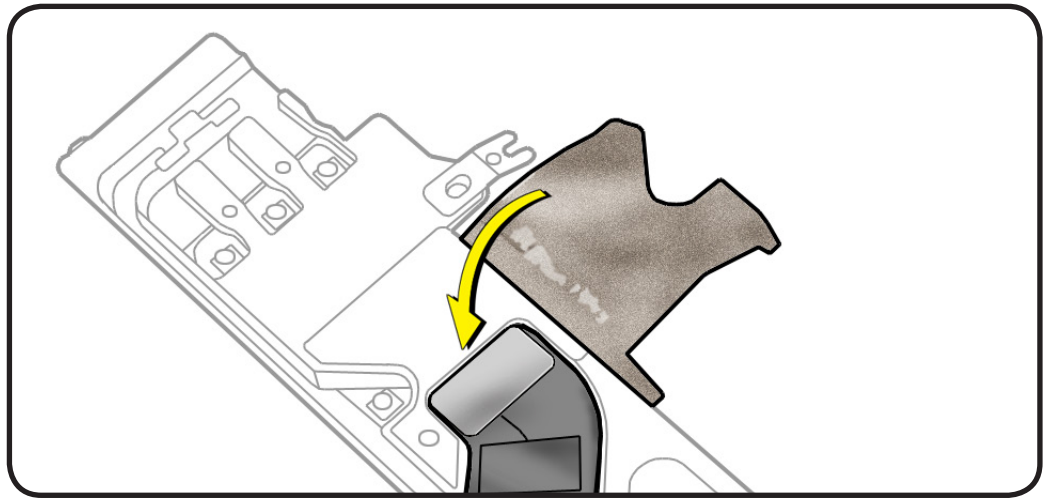
Optical Drive

First Steps

Remove:
- Bottom case

Caution: The optical drive is very fragile. Handle by the sides only.
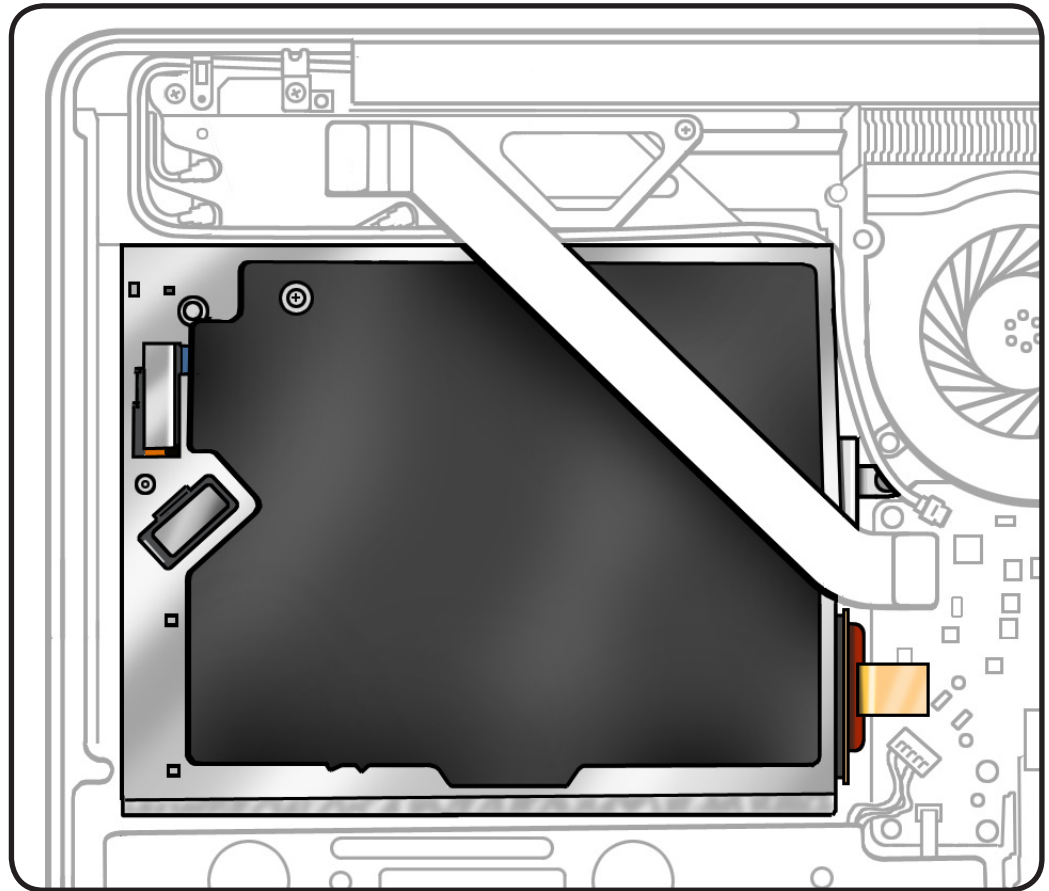
Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.
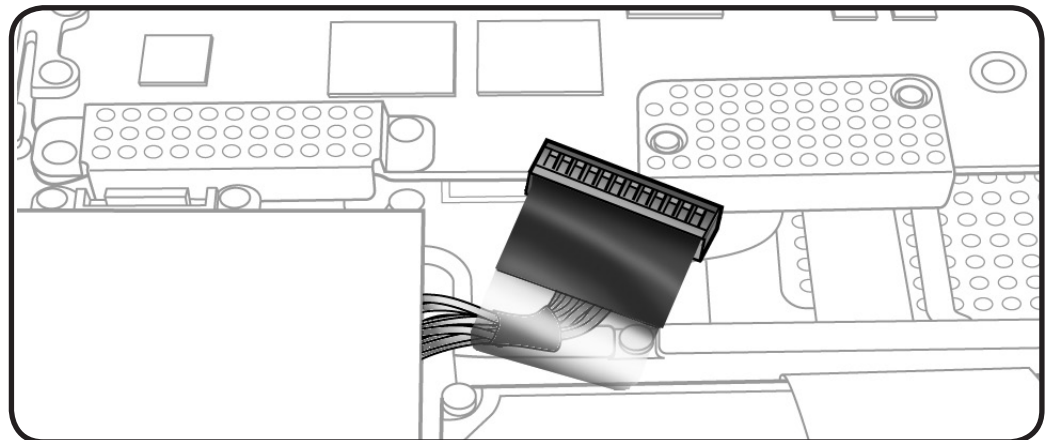
Tools

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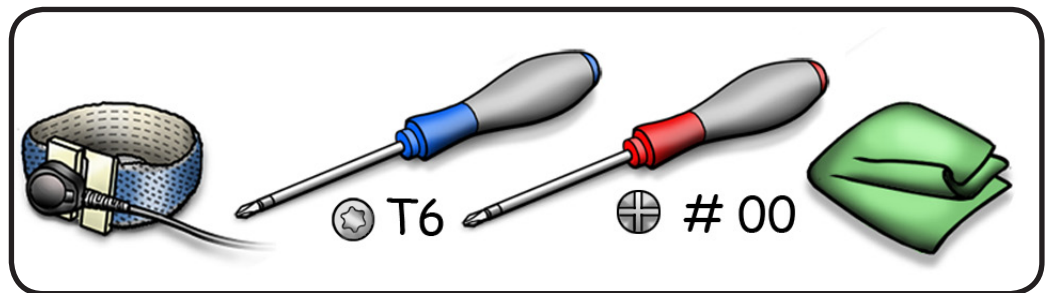
Removal

1 Disconnect
- camera cable
- flex cable end **at logic board only**

2 Remove 2 screws:
- 10-mm (922-9333)
- 3.5-mm (922-8719)

   Note: Do not remove metal grounding clip; it stays on AirPort/ Bluetooth holder.
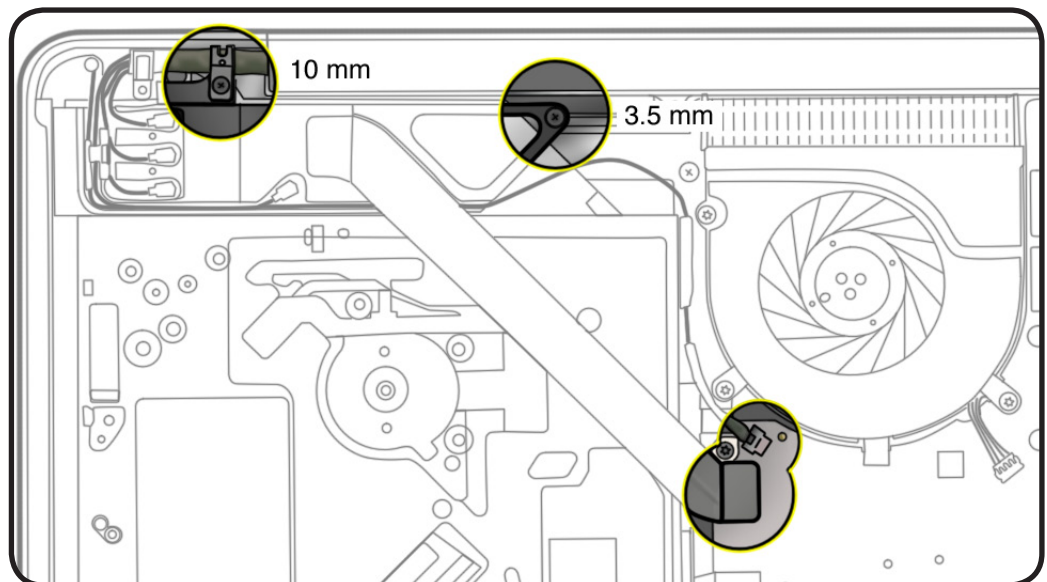
Reassembly Note: If camera cable has an adhesive strip, use the adhesive to keep the cable routed properly in the channel to the logic board.
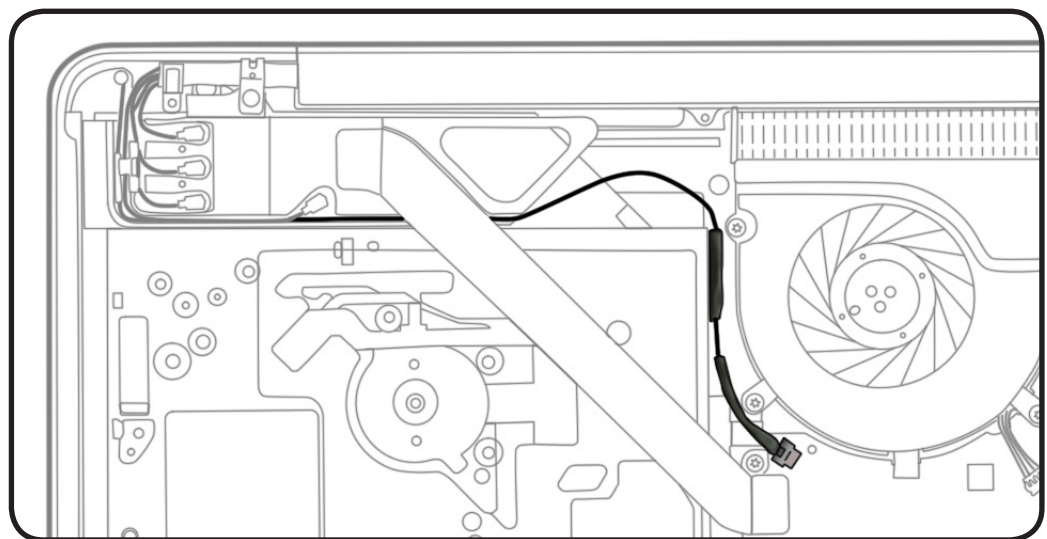
3 Flip over AirPort/
Bluetooth holder.
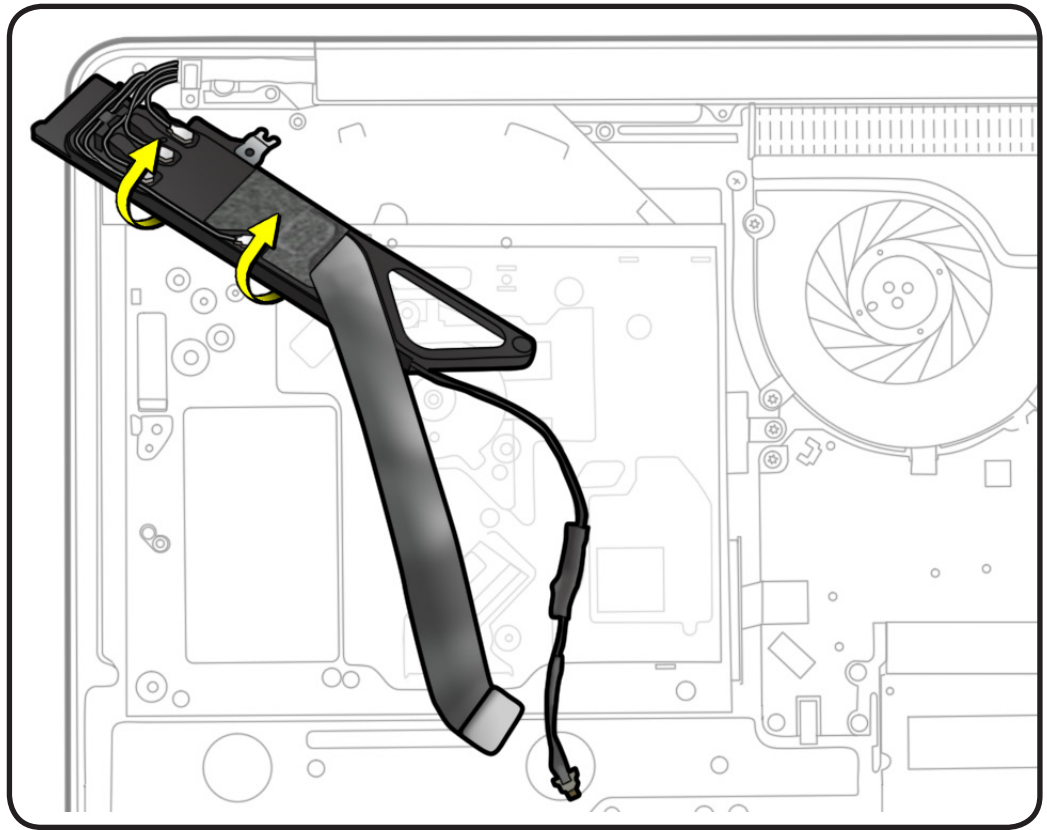
4 With a black stick, carefully pry optical drive flex cable straight up from logic board.

Important Reassembly Note: Install flex cable vertically onto logic board connector. If not, logic board pins could bend, causing an undetected disc symptom.

Reassembly Note: If there is a shim on the logic board under the optical drive cable, make sure it is in place when reconnecting the cable.
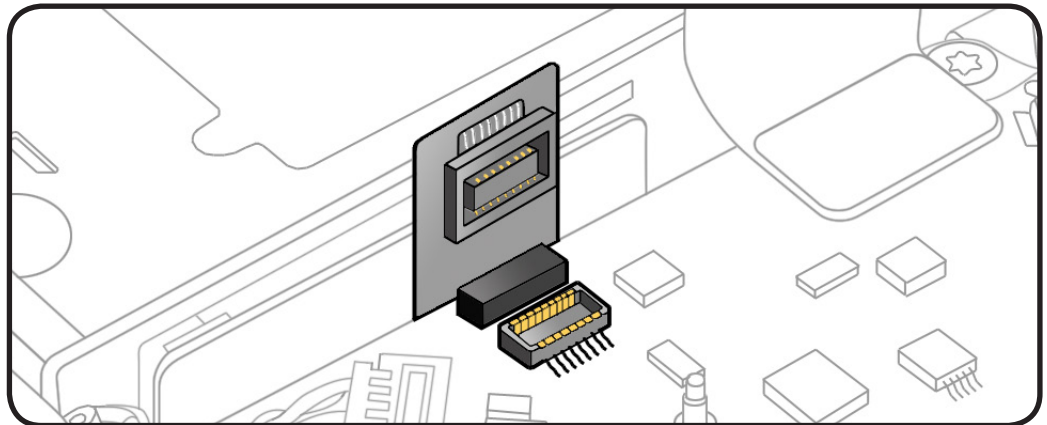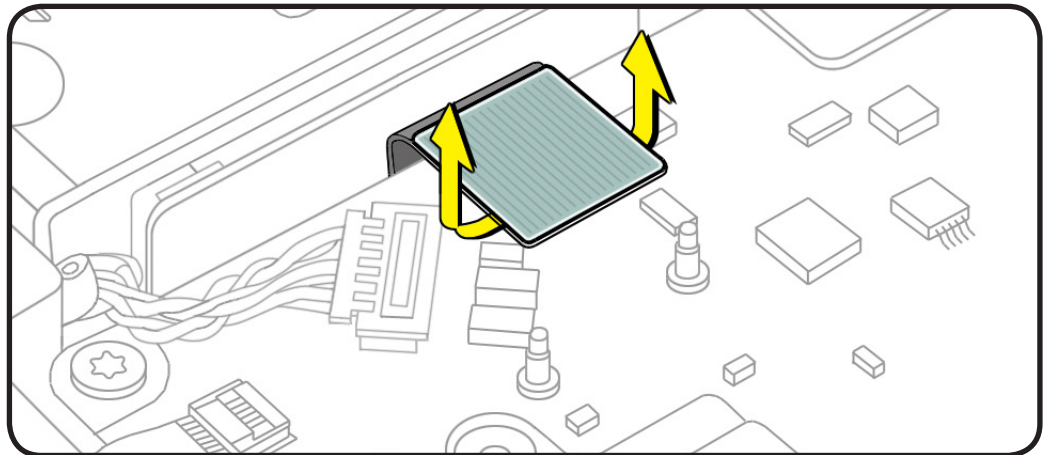
5 Remove 3 (3.5-mm)
922-8719 screws.

Reassembly Note:
Install screws in order
shown—align front 2
screws first.
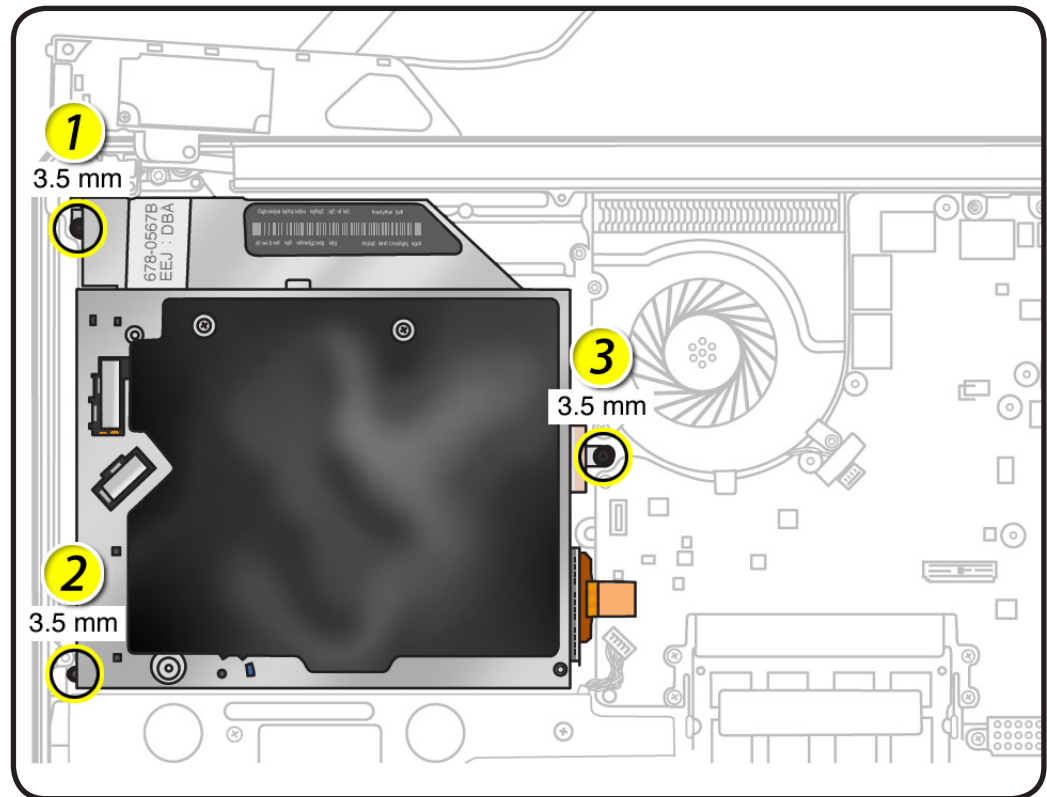
6 Tilt up optical drive.
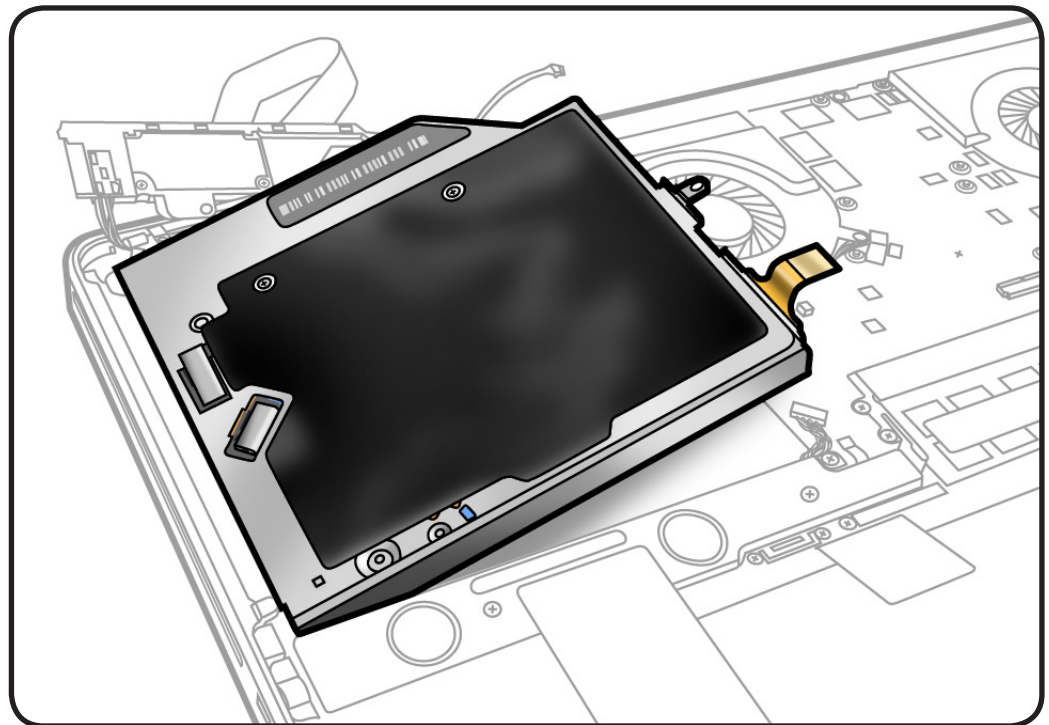
7 **Caution**: The optical drive is very fragile. Handle by the sides only!
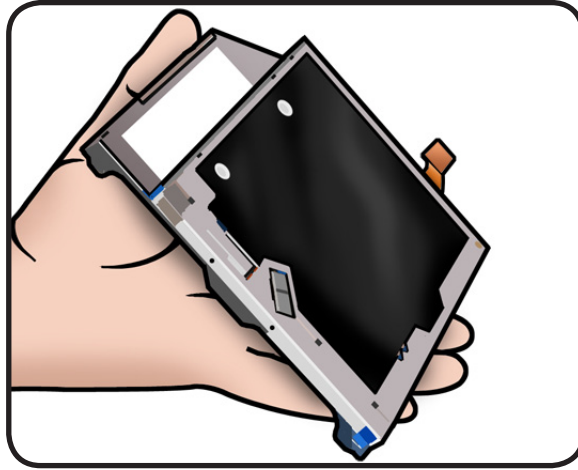
Optical Drive Flex Cable

First Steps

Remove:
- Bottom case
- Optical drive

Caution: The optical drive is very fragile. Handle by the sides only.
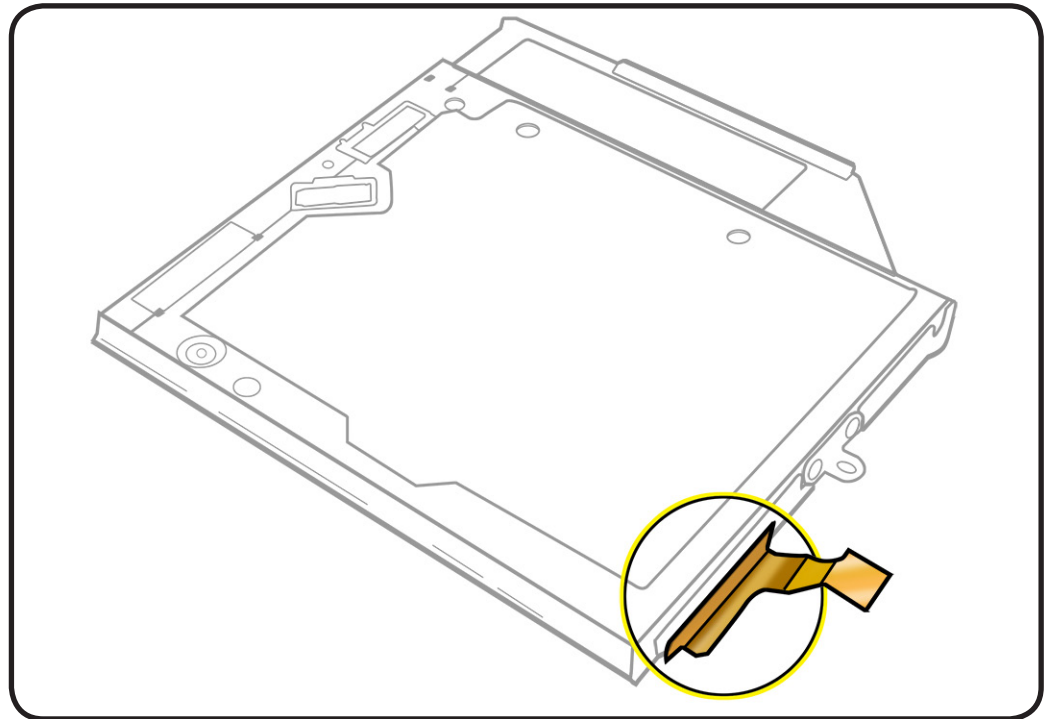
Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.
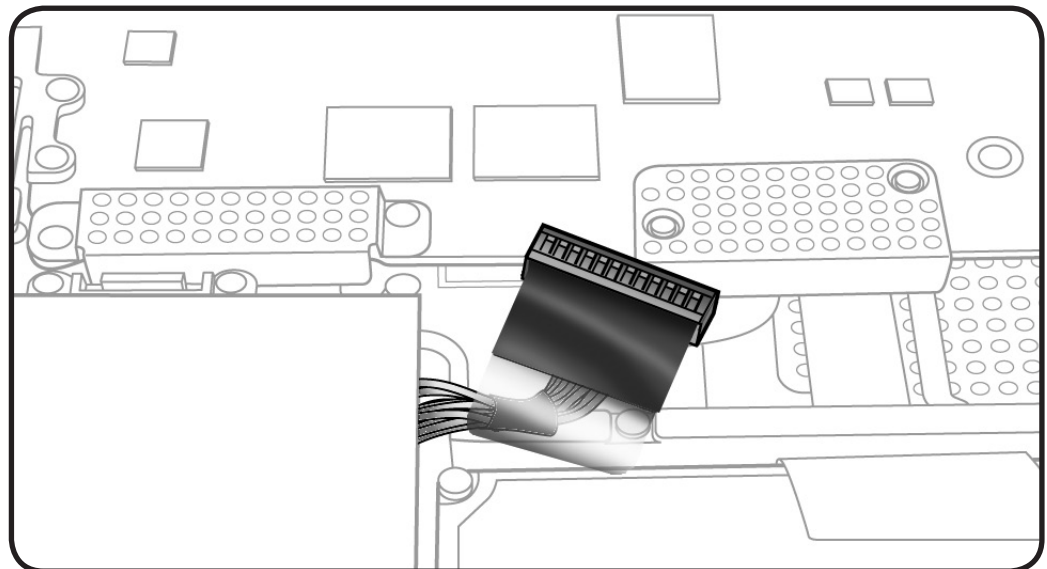
Tools

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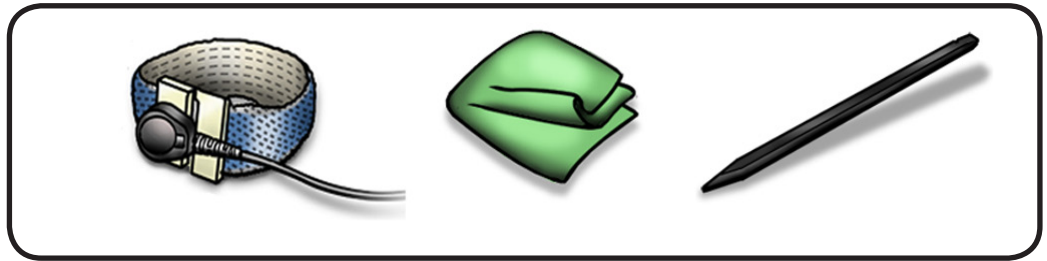
Removal

1 Handle optical drive by sides only.

2 With a black stick or fingernail, carefully wiggle flex cable off optical drive.
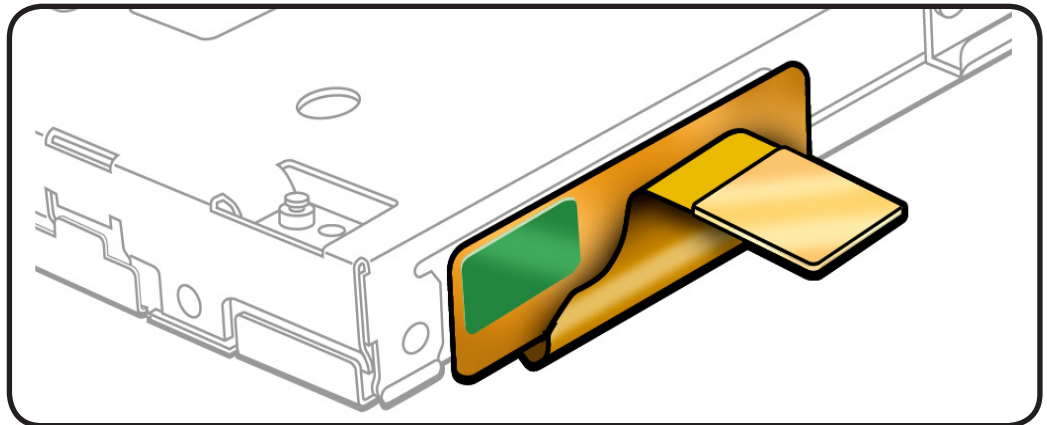
Reassembly Note: If there is a shim on the logic board under the optical drive cable, make sure it is in place when reconnecting the cable.
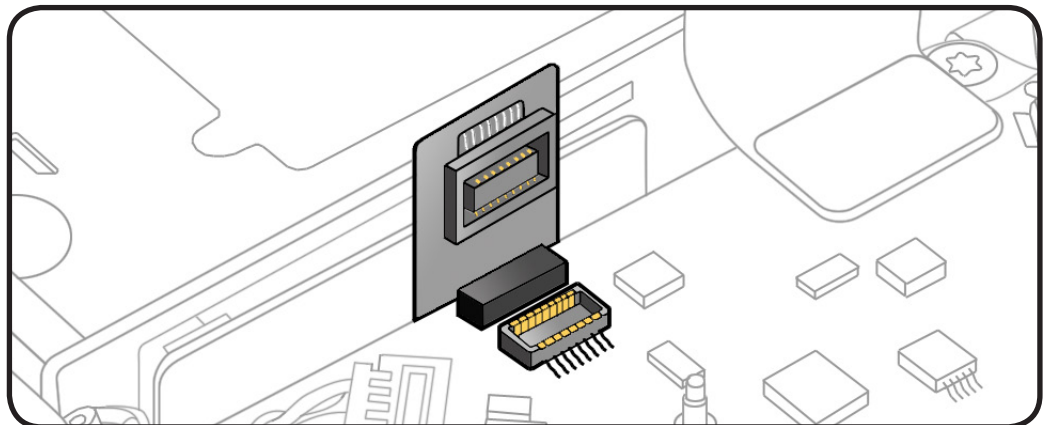
Hard Drive Connector Cable

First Steps

Remove:
- Bottom case
- Rear hard drive bracket
- Hard drive

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

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

Tools

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

⊕ # 00
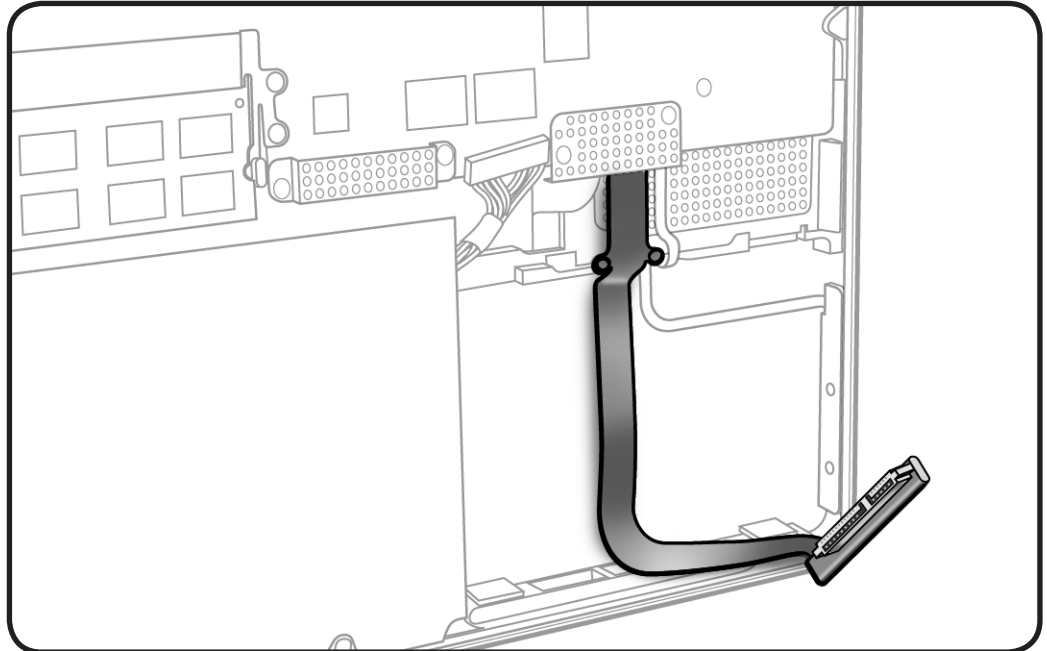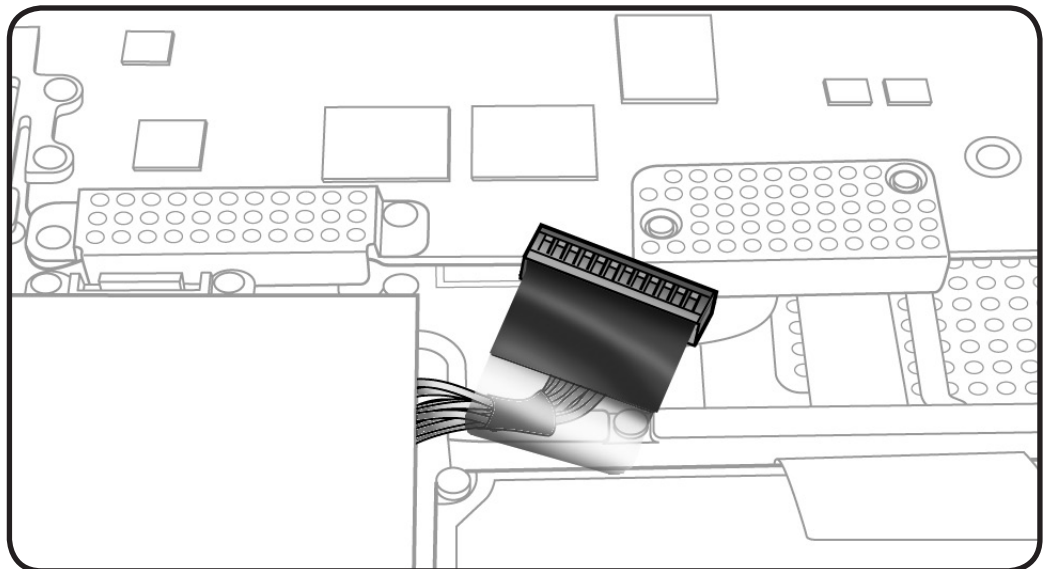
Removal

1 Remove 4 screws:
- 2 (1.8-mm) 922-8983 at shield
- 2 (2.2-mm) 922-8329 at cable

2 Remove shield.

1.8 mm

1.8 mm

2.2 mm   2.2 mm
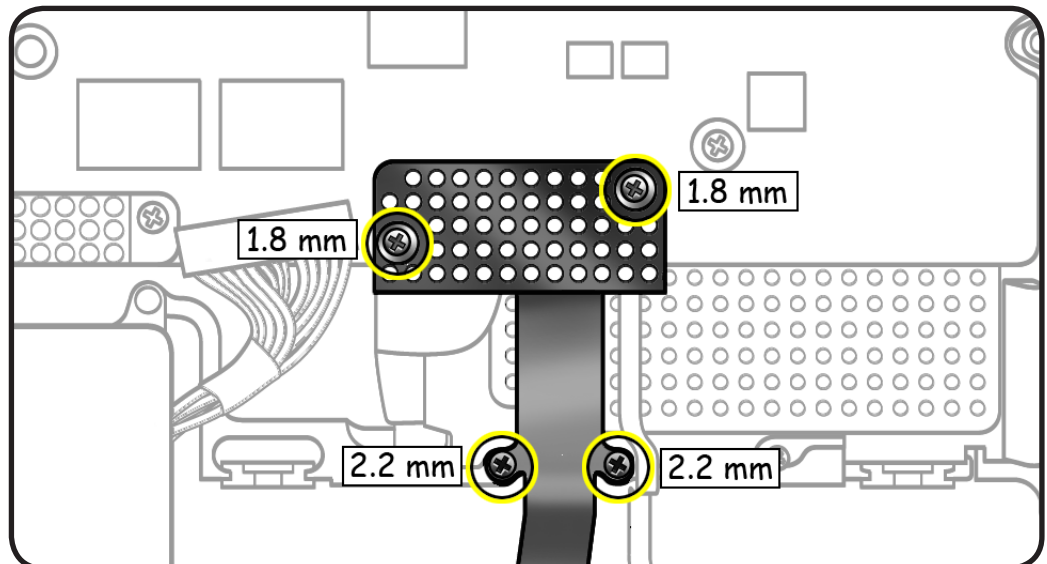
3 Use black stick to disconnect cable and carefully pry cable up from adhesive.
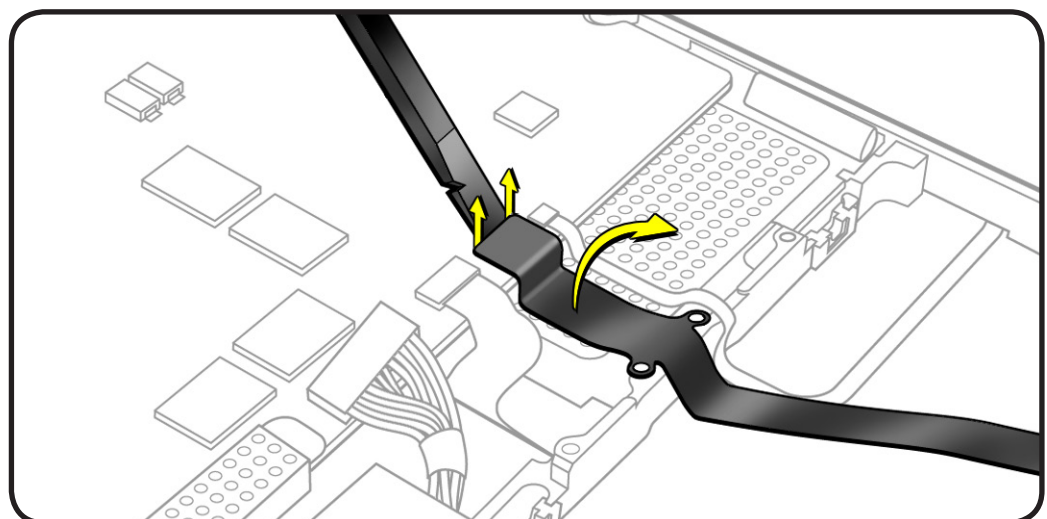
Caution: Be careful when handling hard drive flex cable. Do not flatten or reshape flex cable bends, and avoid moving cable unnecessarily. Repeated movement at cable bends may damage internal wiring and require cable replacement.
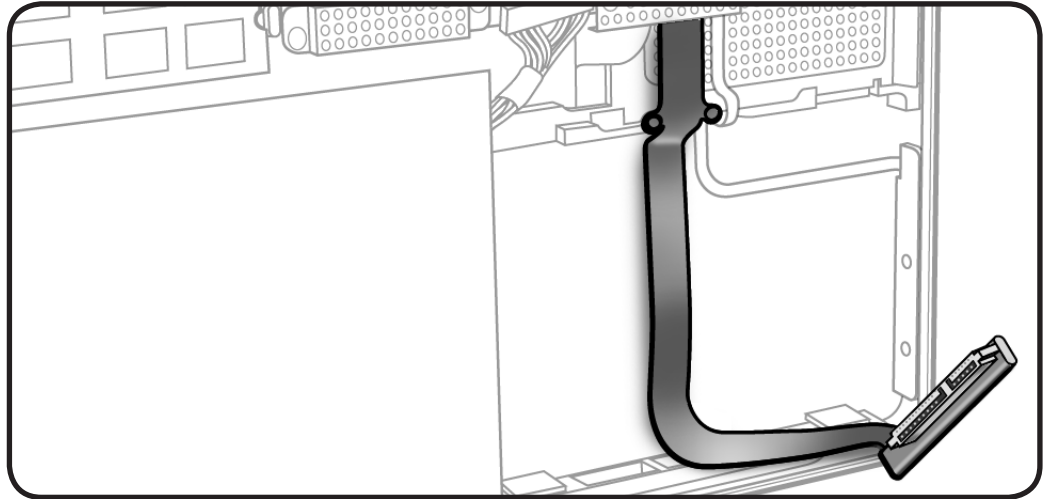
Battery Indicator Light (BIL) Cable and Board

First Steps

Remove:
- Bottom case
- Rear hard drive bracket
- Hard drive

Caution: Make sure data is backed up before removing the hard drive.
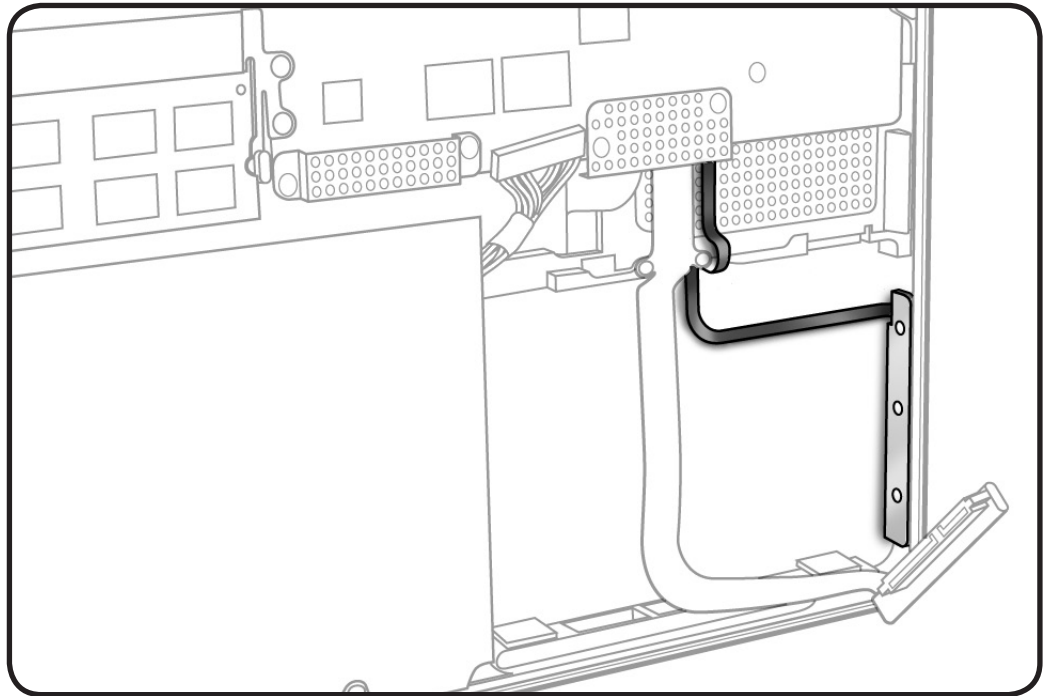
Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.
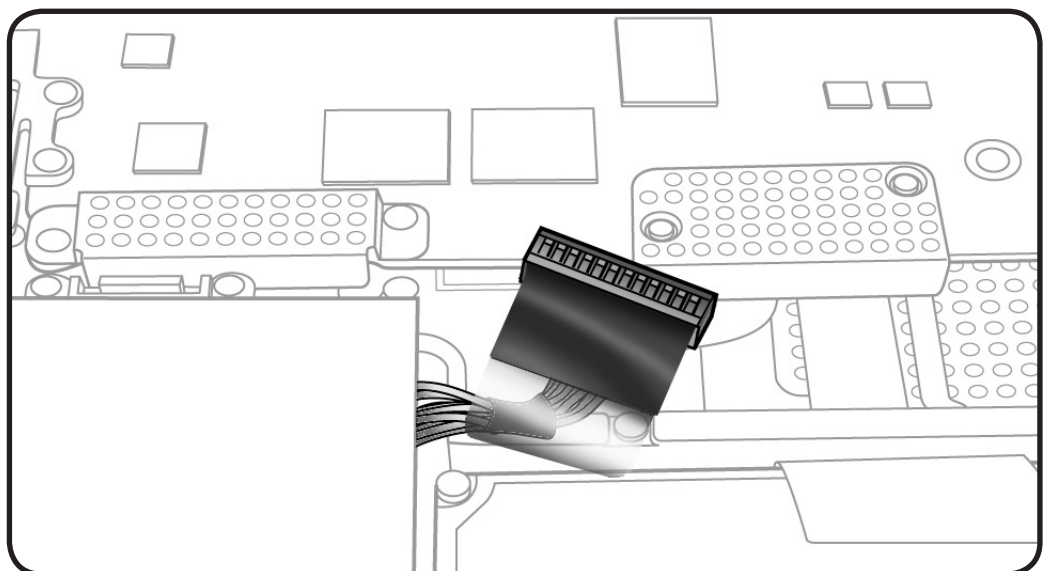
Tools

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

00

Removal

1 Remove 2 (1.8-mm) 922-8983 screws from the shield.

2 Remove shield.
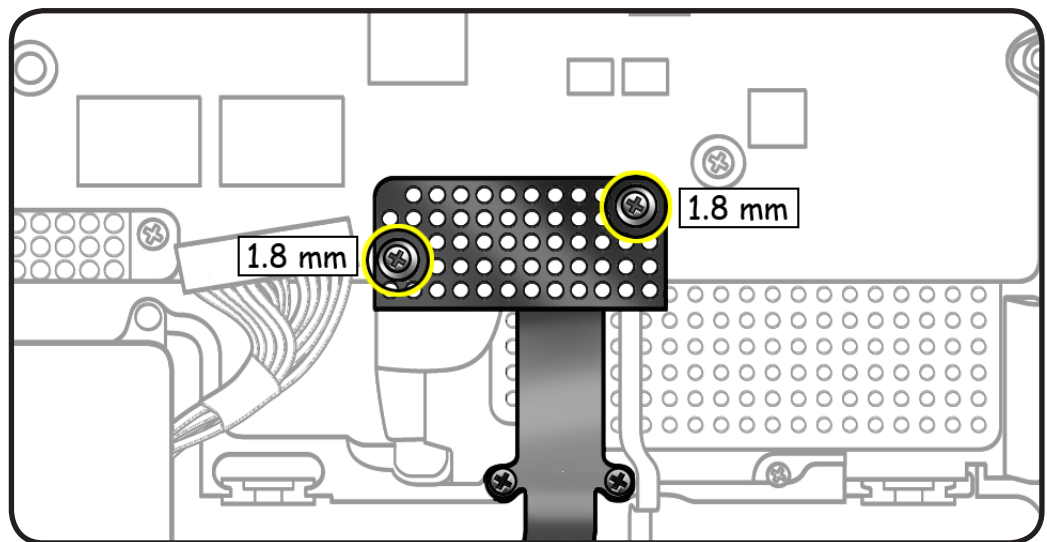
1.8 mm
1.8 mm

3 Place tape over BIL button on outside of top case.

4 Remove 3 (1.8-mm) 922-9069 screws from BIL board.

Reassembly Note: Replace screws in order shown.

3
1.8 mm
1
1.8 mm
2
1.8 mm
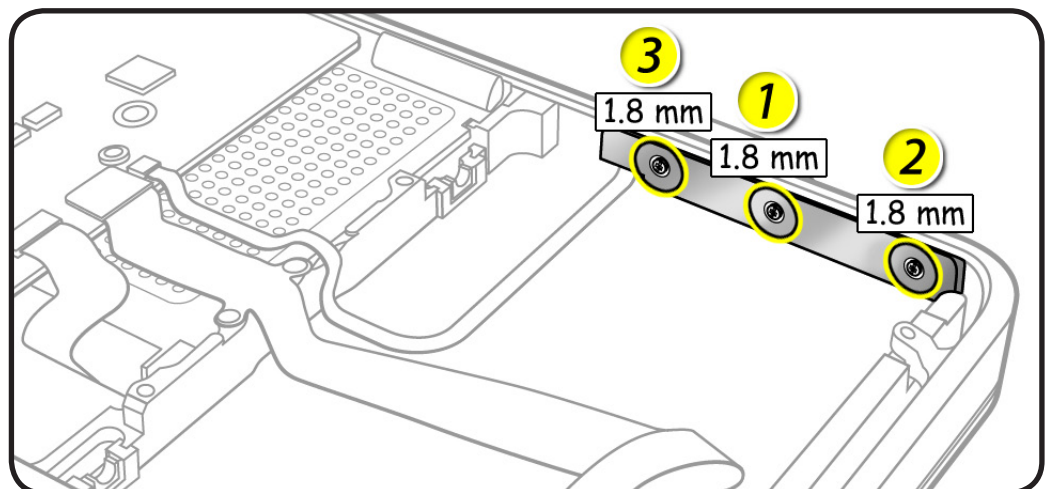
5 Flip over board.

6 Lift lever to disconnect cable from logic board.

>   **Note**: The tape will prevent the BIL button from falling out of top case.
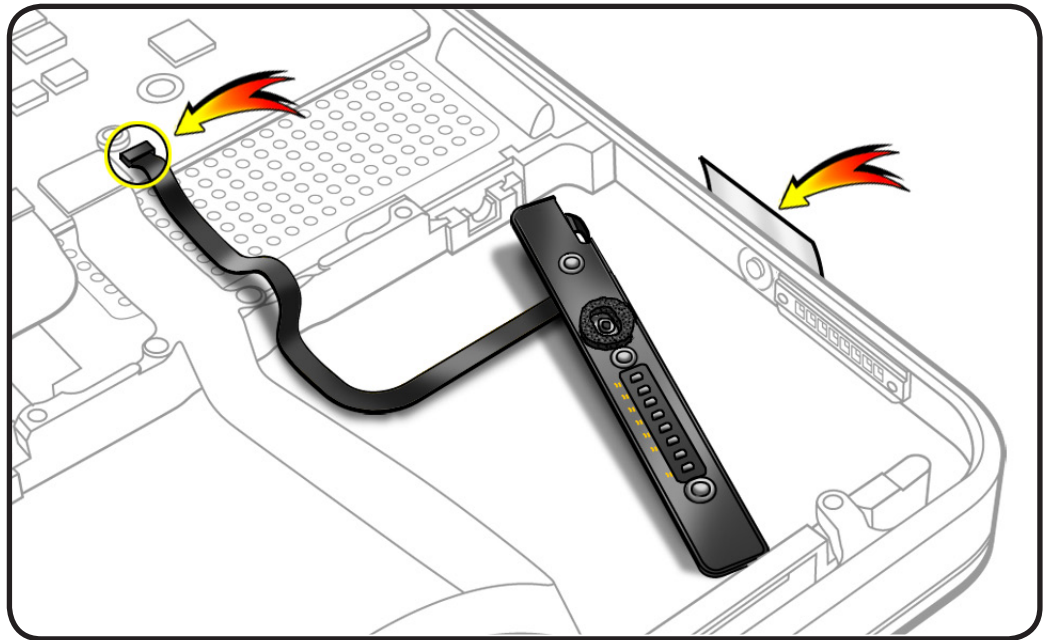
Reassembly Note: Before replacing the BIL board, check that:

- the long rubber gasket is assembled on top of the LED row
- the BIL button is installed in the top case
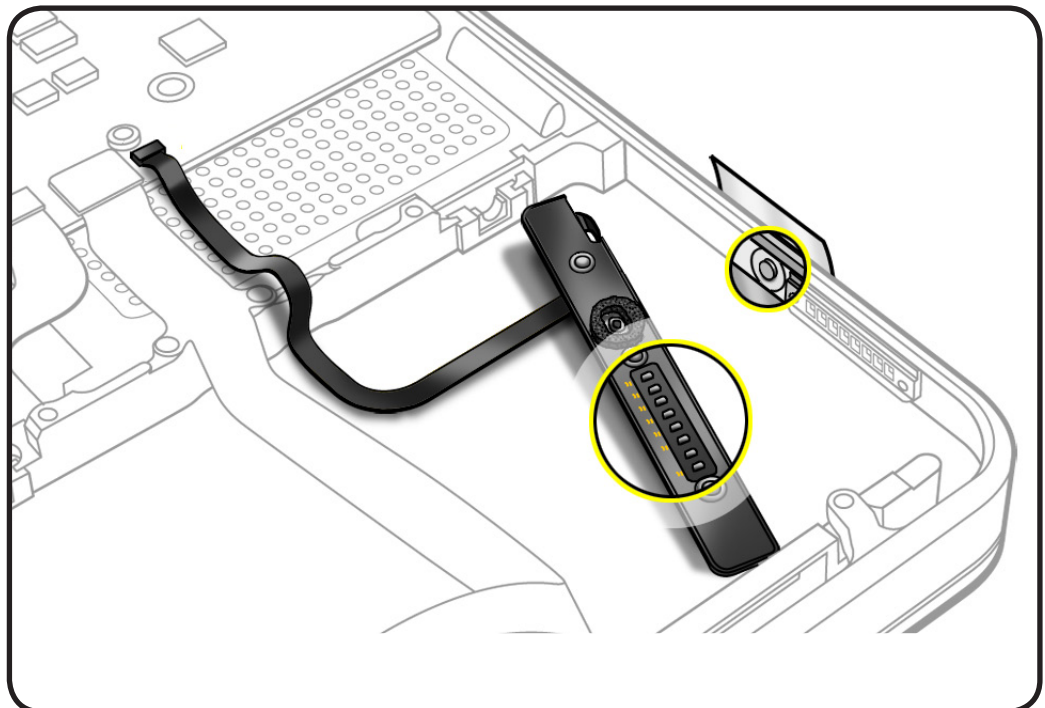
Hard Drive Bracket, Front

First Steps

Remove:
- Bottom case
- Rear hard drive bracket
- Hard drive

Caution: Make sure data is backed up before removing the hard drive.
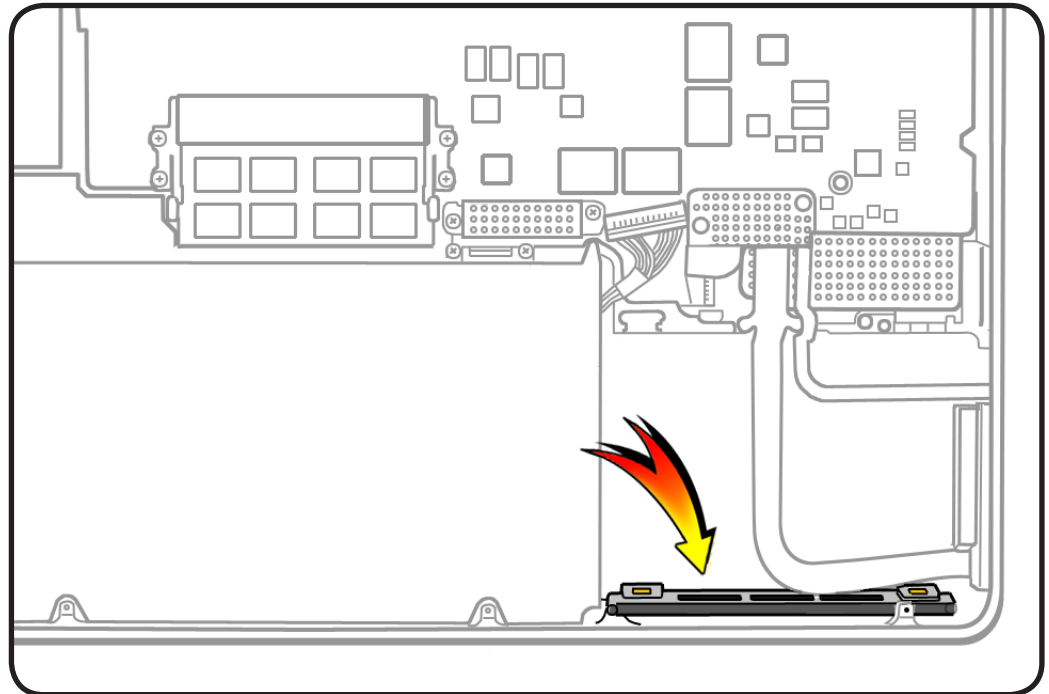
Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.
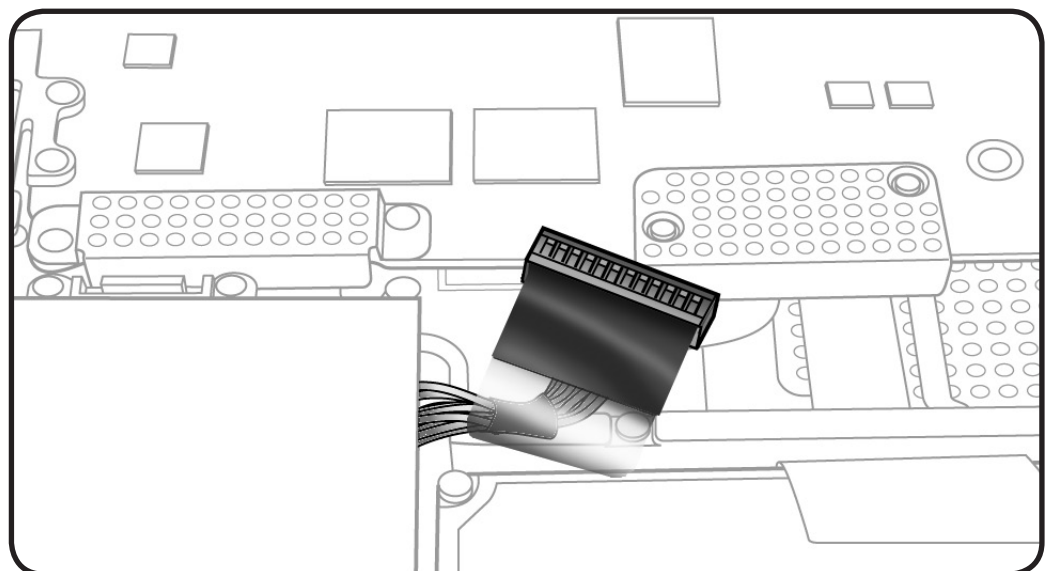
Tools

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

Removal

1 Remove 2 (10-mm) 922-8648 screws.
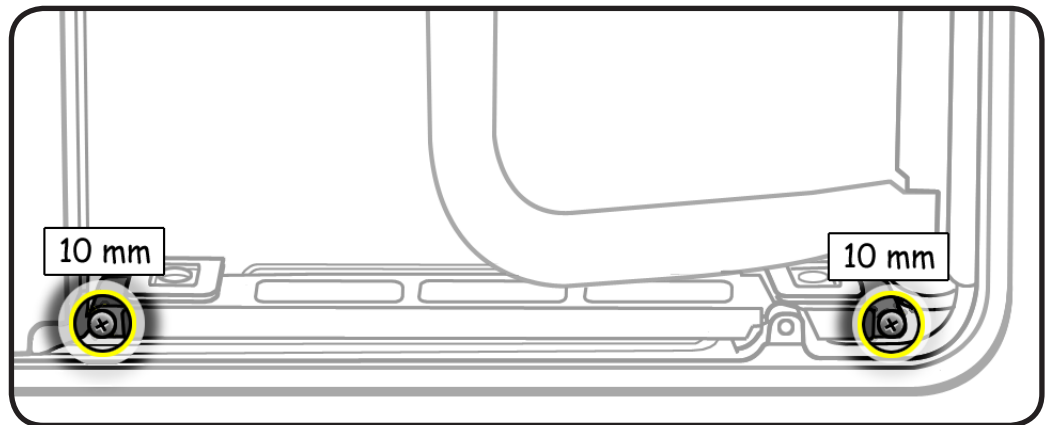
2 Tilt out bracket.

Reassembly Note: Make sure 2 rubber gaskets are installed before installing screws.
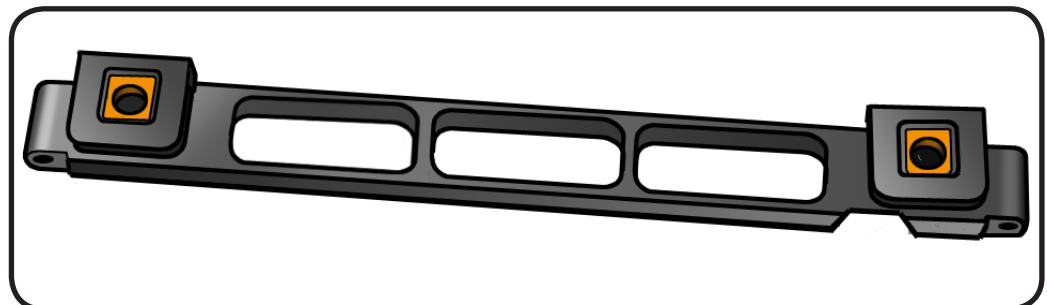
Display Assembly

First Steps

Remove:
- Bottom case
- Camera cable guide
- LVDS cable guide
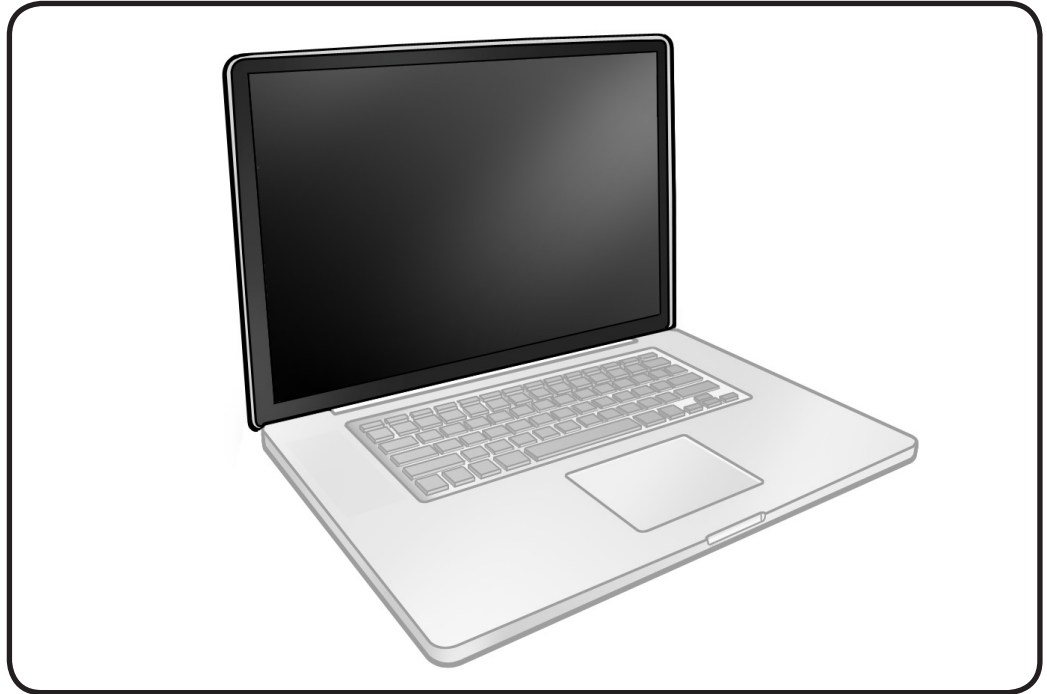
Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.
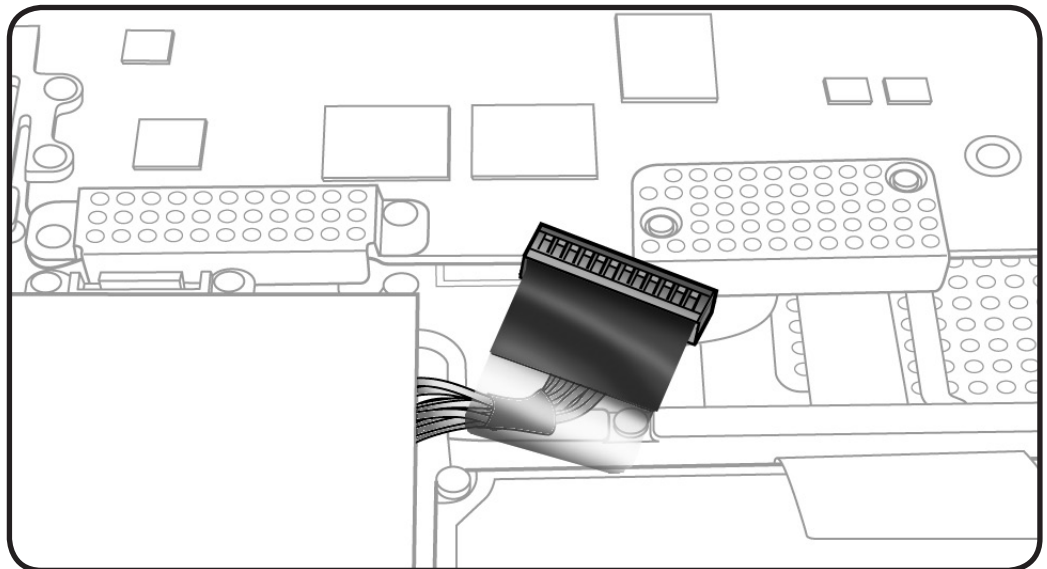
Tools

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

T6   # 00
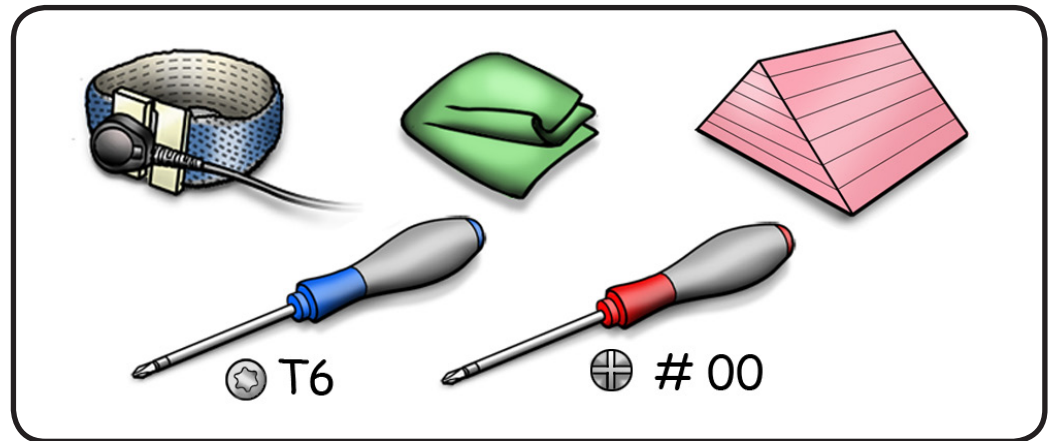
Removal

1 Remove camera cable and AirPort/Bluetooth cables from holder.

Note: Use needlenose pliers or tweezers to lift metal connectors straight up.

Use black stick or needlenose pliers to pry up cables from the holder's channels.
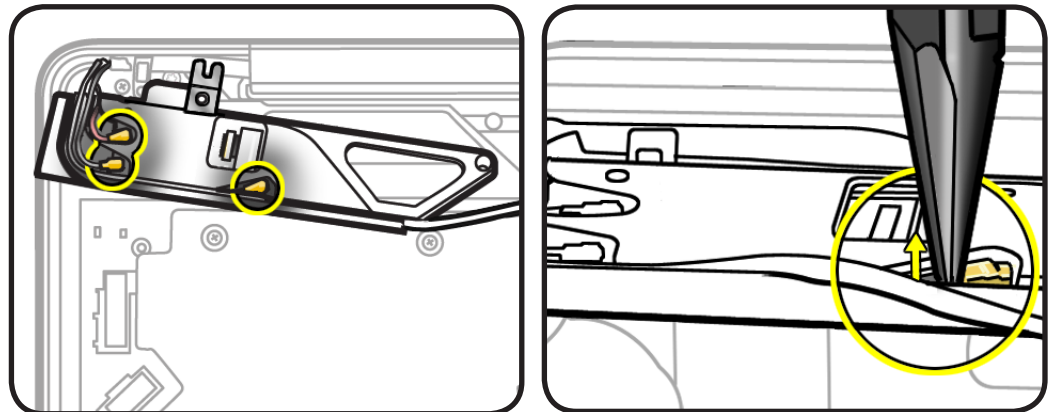
2 Open the display to 90 degrees, and place the computer on the foam wedge service fixture.

3 Remove 6 (6.5-mm) Torx 922-8925 screws:

4 Separate display assembly from top case.

6.5 mm

6.5 mm
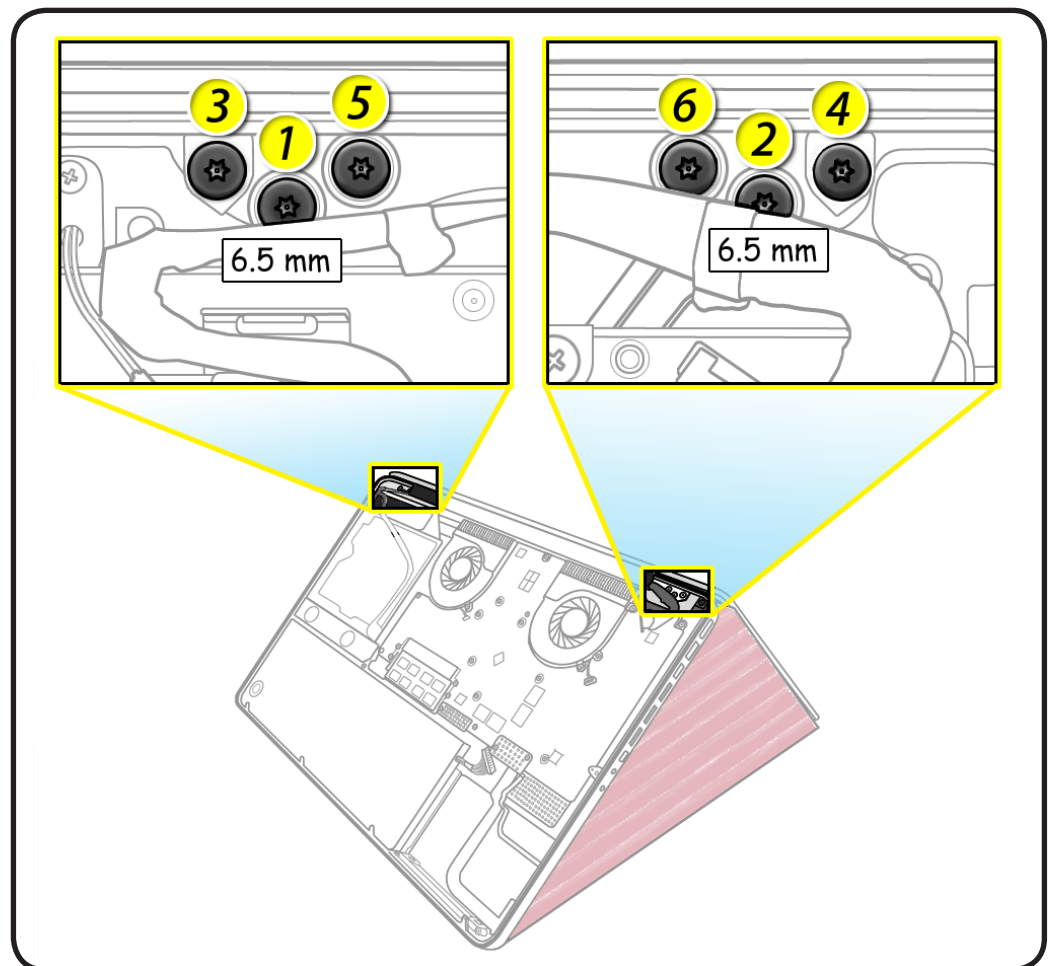
Reassembly

1 Place the display on the foam wedge service fixture.

2 Install only the center screws:

3 Move computer from wedge, and carefully close display.
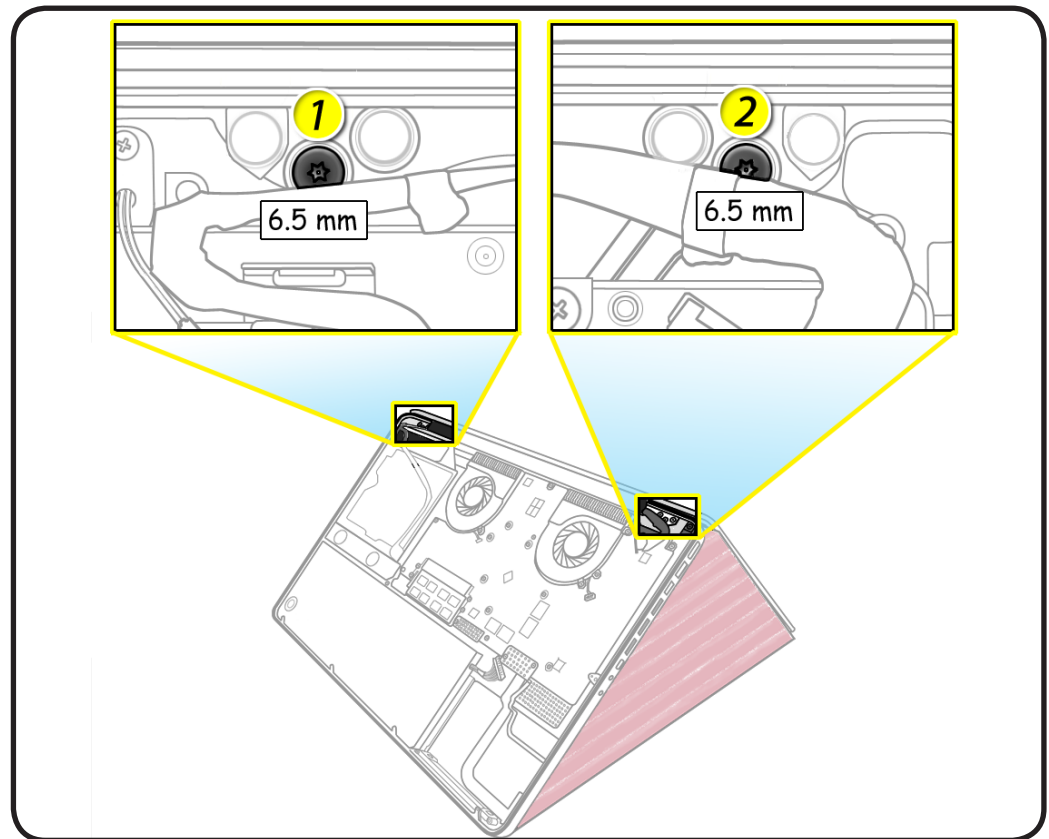
4 With computer closed and flat on table, check alignment where the display meets the top case.

5 If necessary, slightly loosen the two center screws, adjust alignment, and resecure screws.

6 With the proper alignment verified, install the remaining screws (3-6) in the order shown while the computer is still closed.

6.5 mm

6.5 mm
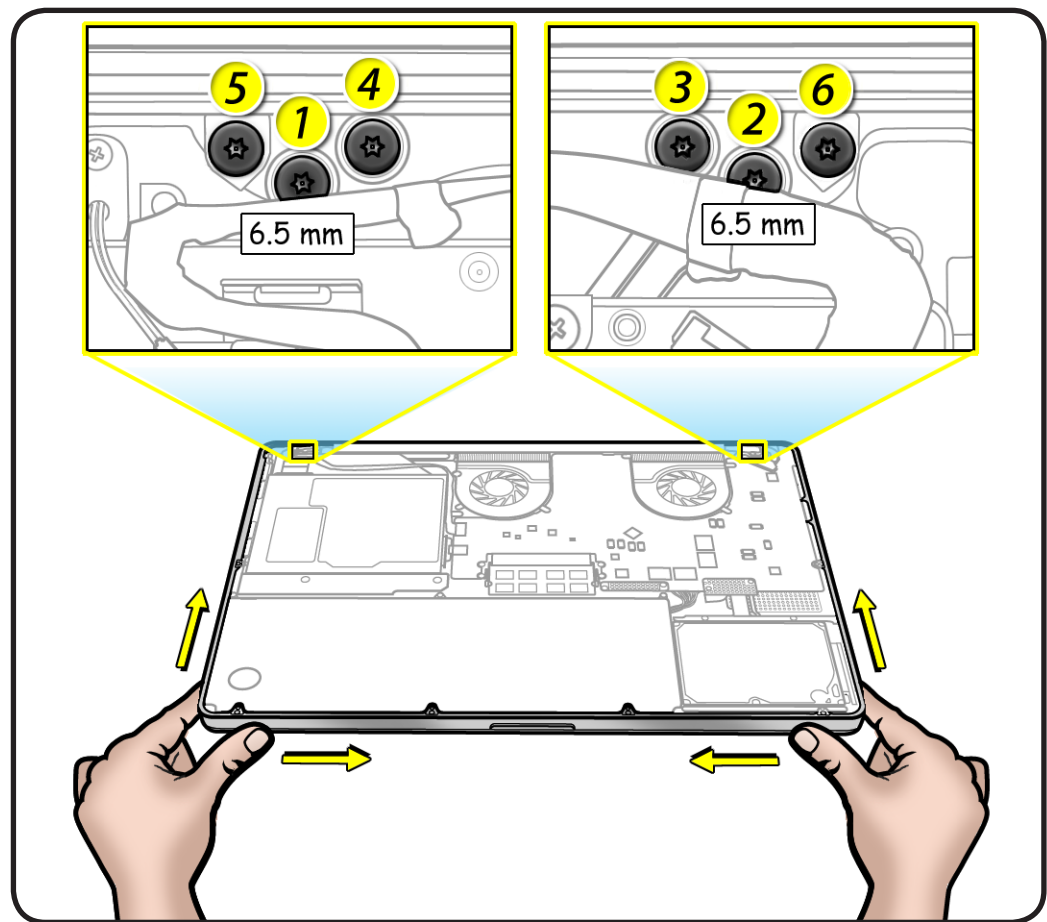
Reassembly Caution: When connecting the LVDS and camera cables, make sure they are fully connected.

Reassembly Caution: Make sure cable is fully connected (no gold traces visible).
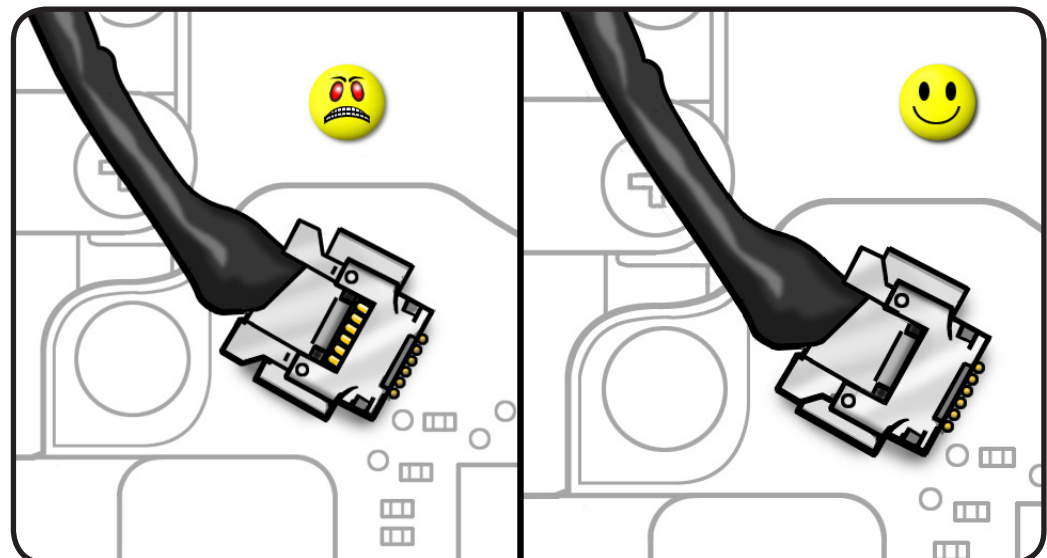
Reassembly Caution: To prevent no video or a short to the logic board, be sure to place EMI gasket on LVDS cable—positioned precisely where shown—**after** cable is fully connected to logic board.
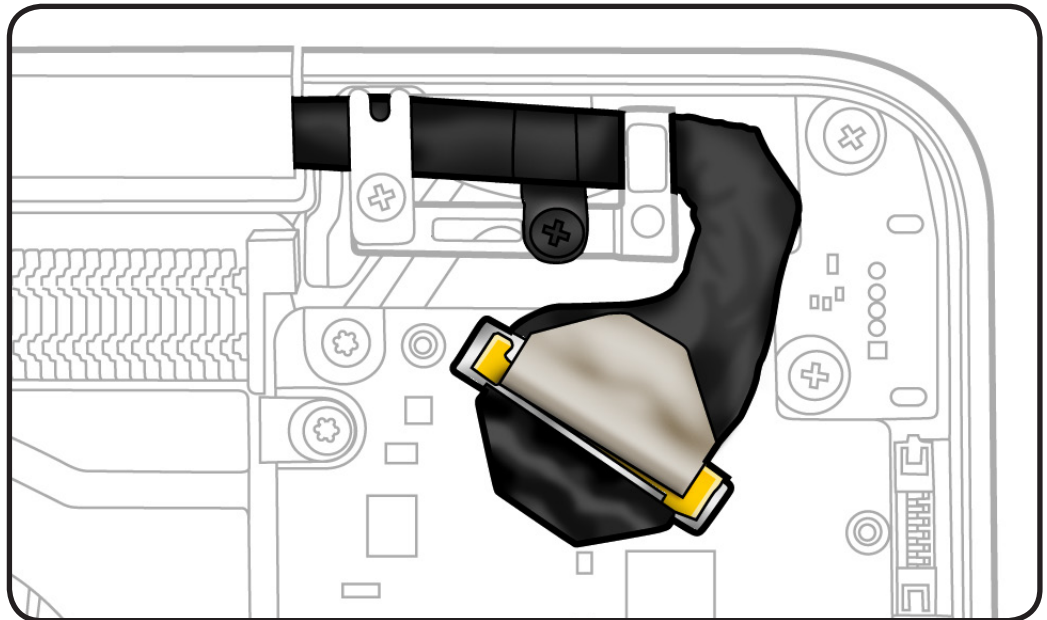
Display Hinge Behavior

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

Moving the display past vertical allows the hinges to release and the display to close. This is normal behavior and no repair is necessary. Refer to **http://support.apple.com/kb/HT3304** for more information and to watch a video of the hinge behavior.
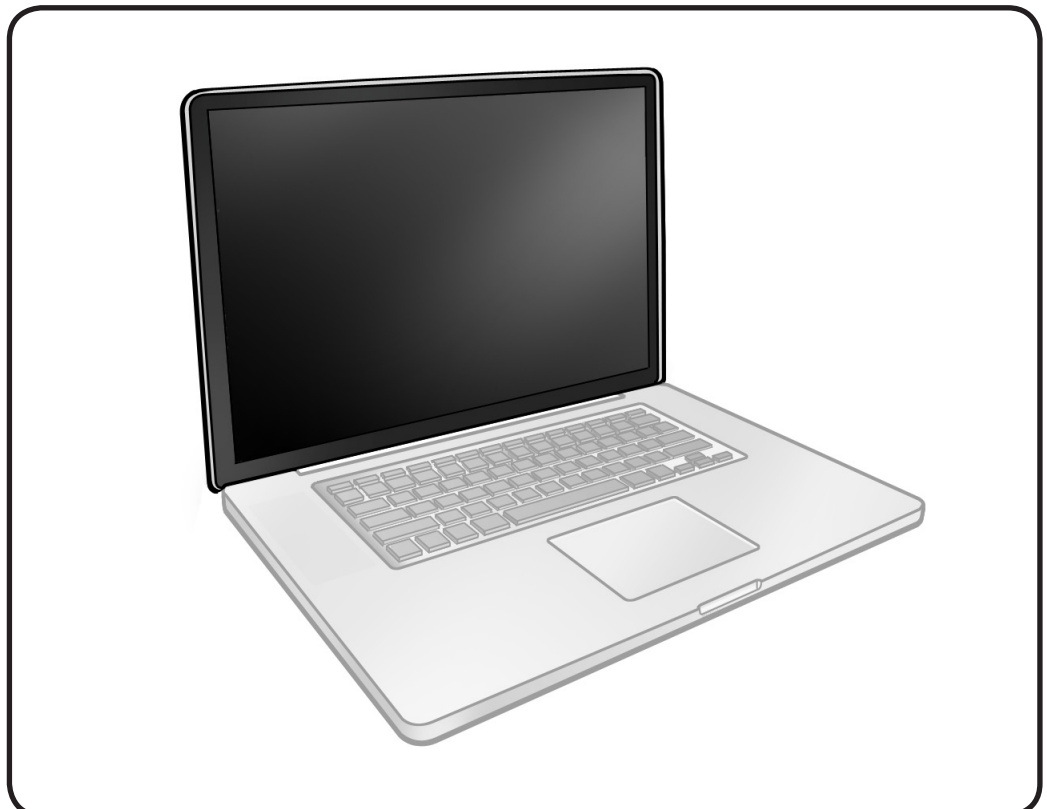
Display Clutch Cover

First Steps

Remove:
- Bottom case
- Camera cable guide
- LVDS cable guide
- Display assembly
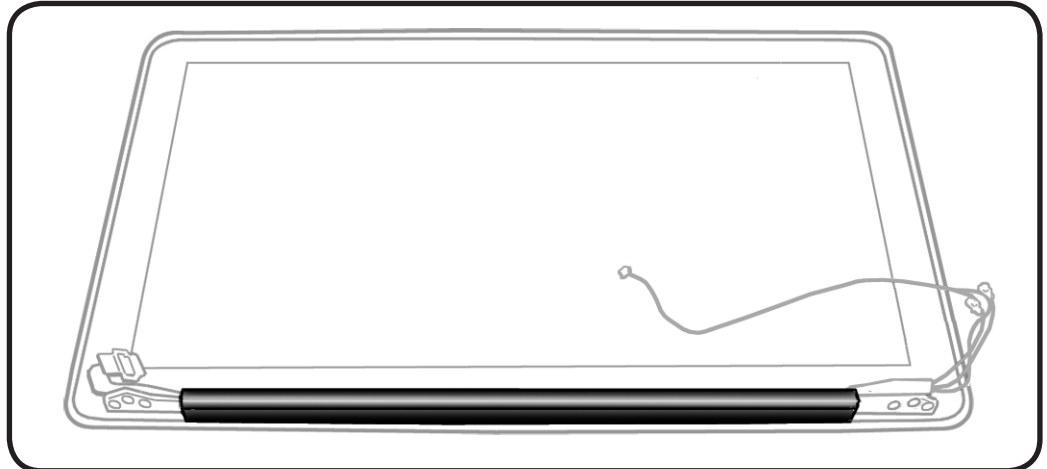
Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.
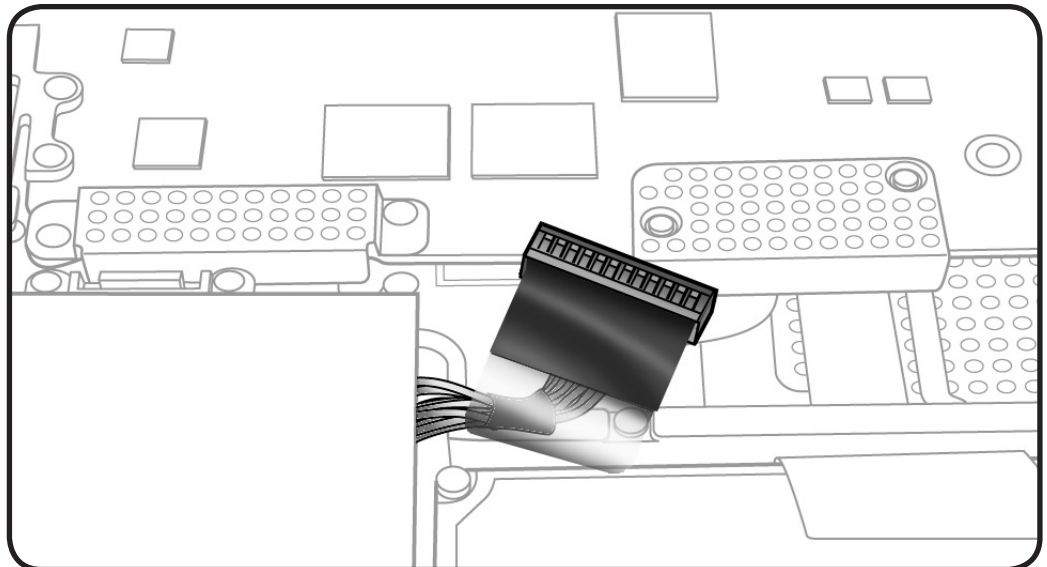

Tools

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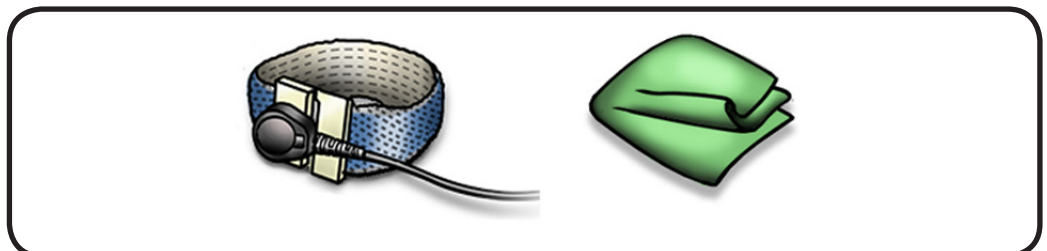
Removal

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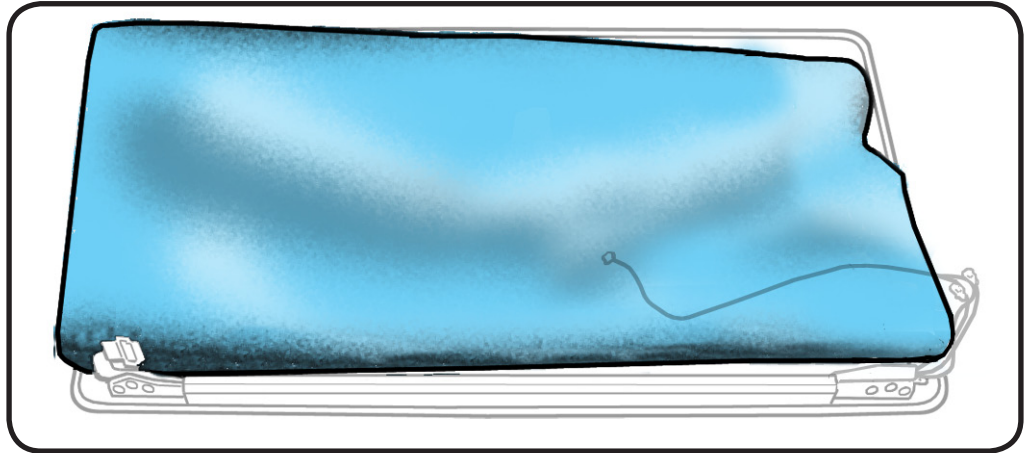
2 Holding left hinge, slide clutch cover 1/4 inch (6.35 mm) away from the LVDS cable.
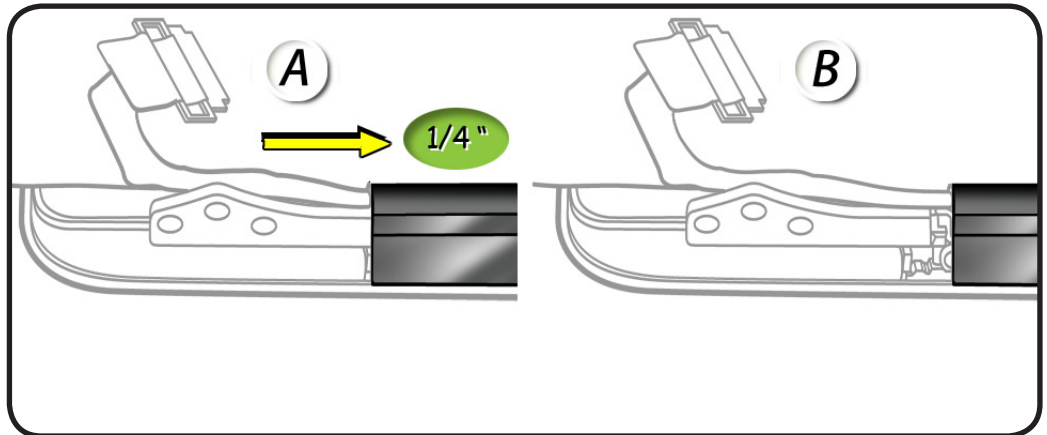
3 Press down on clutch cover to loosen 4 hooks inside.
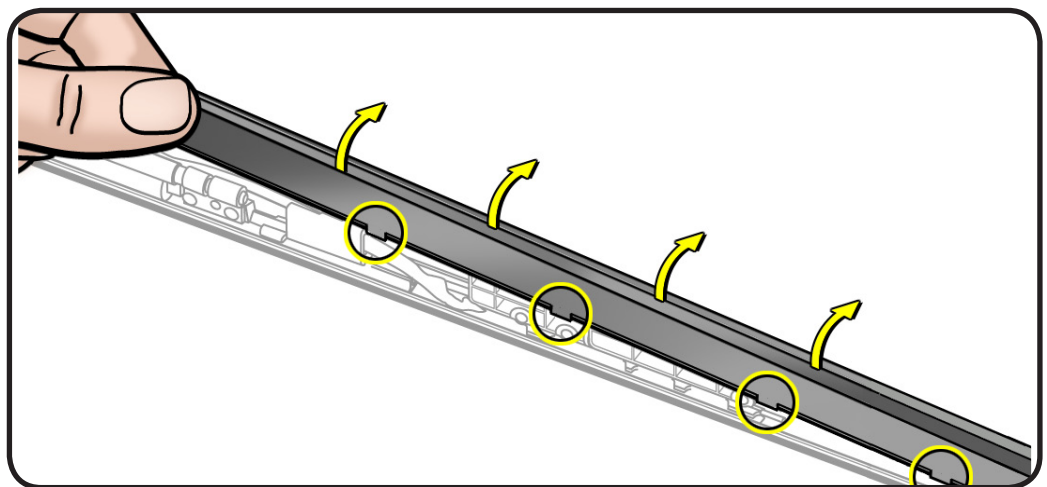
4 Tilt up end of clutch cover as you roll it toward display face.

5 Remove clutch cover.
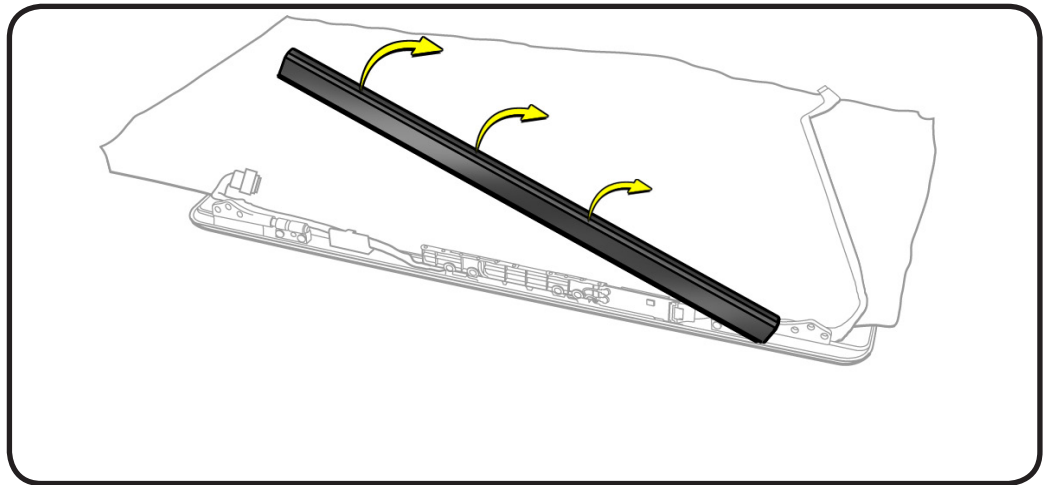
Reassembly

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

2 Make sure flat edge is at bottom of display.
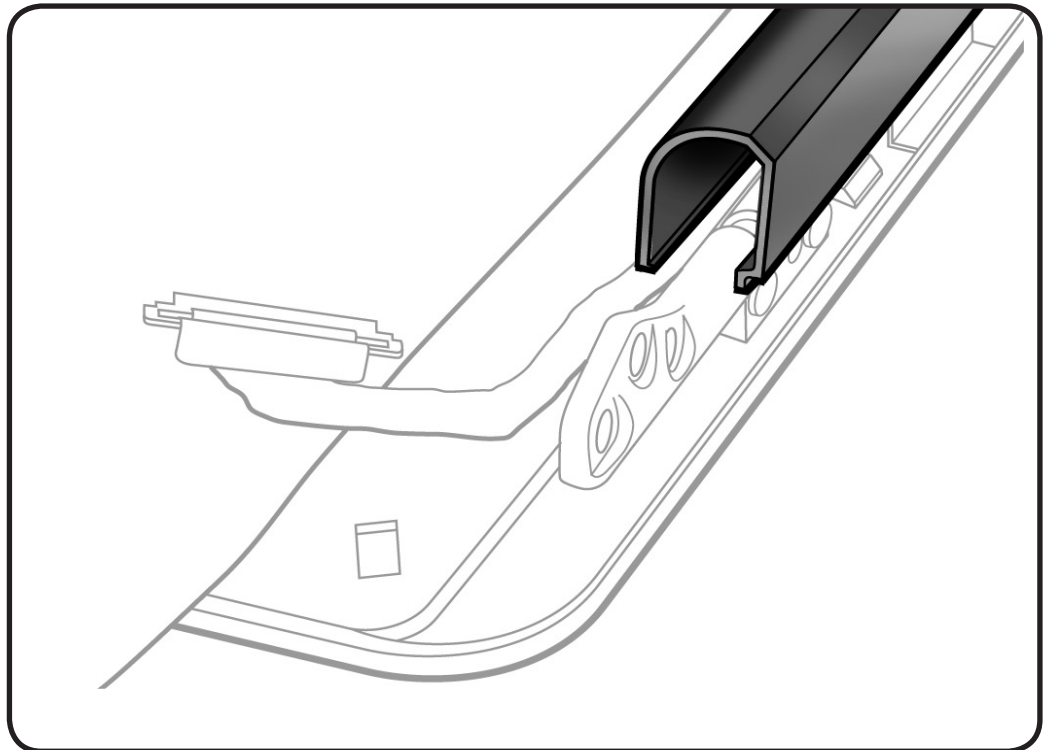
3 Check that cable routing at end of each end matches what is shown.
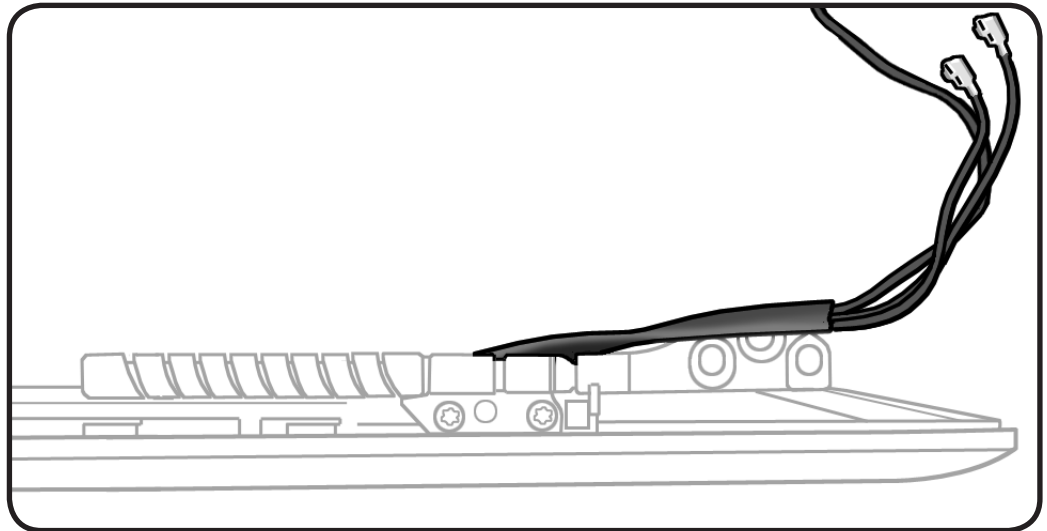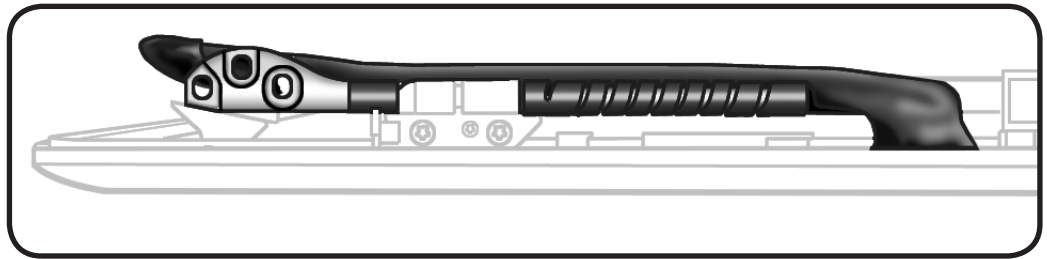
4 Position clutch cover onto end with longer cable.

5 Lower clutch cover onto display assembly.

6 Listen for snapping sound as hooks engage.
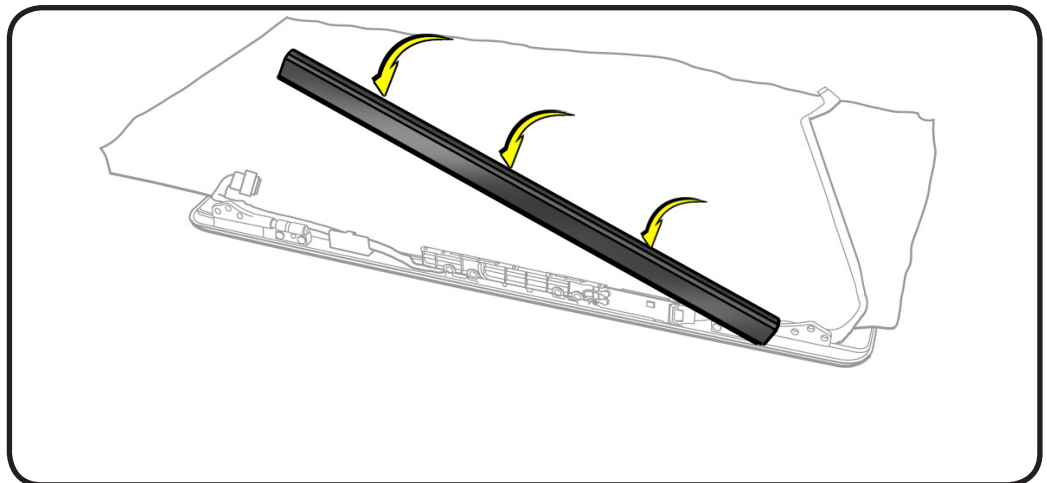
7 Check for good fit.
Avoid:

- gaps
- bulges
- pinched cables
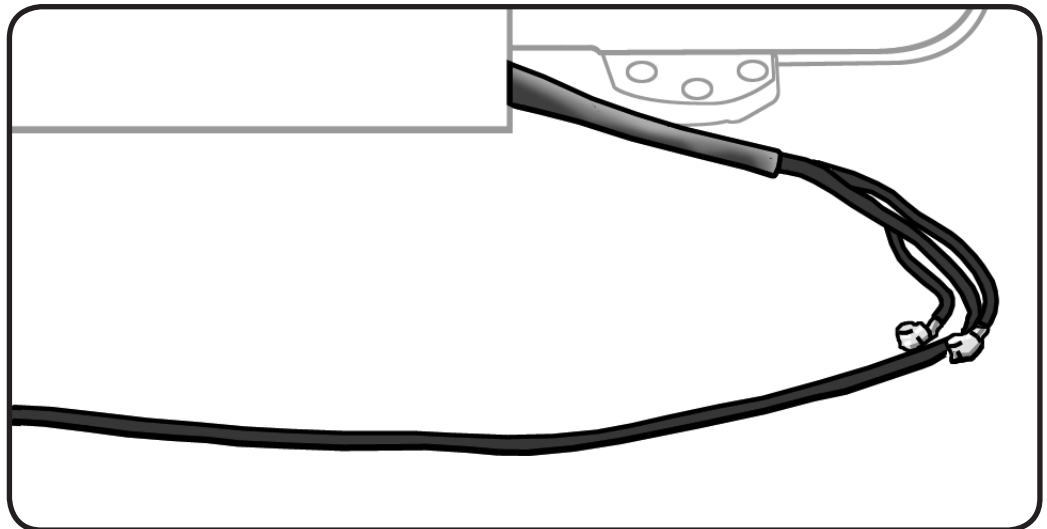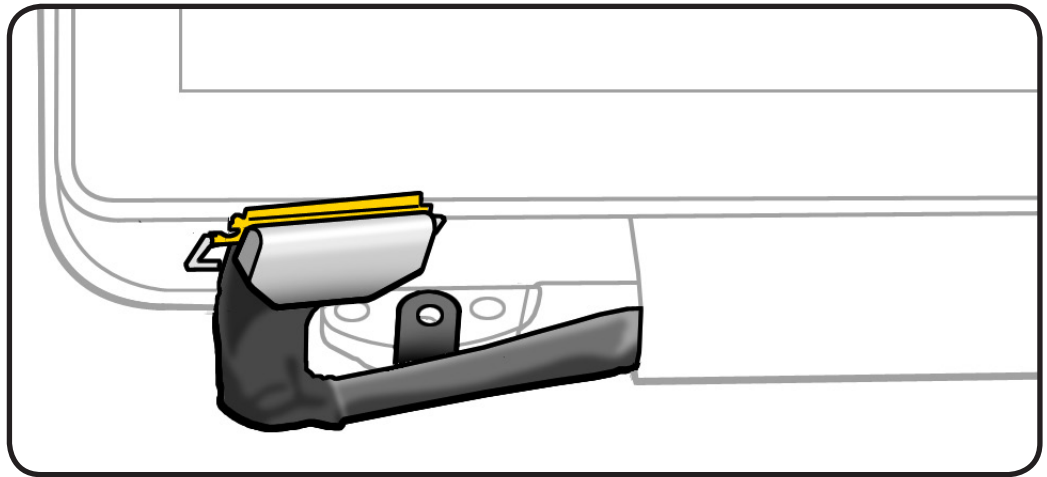
AirPort/Bluetooth Holder, Mid 2010

First Steps

Remove:

• Bottom case

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

Tools

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

Removal

1 Disconnect
- camera cable
- flex cable

2 Remove
- 10-mm (922-9333) screw
- 3.55-mm (922-8974) screw

Note: Do not remove metal grounding clip; it stays adhered on AirPort/Bluetooth holder.

10 mm

3.5 mm
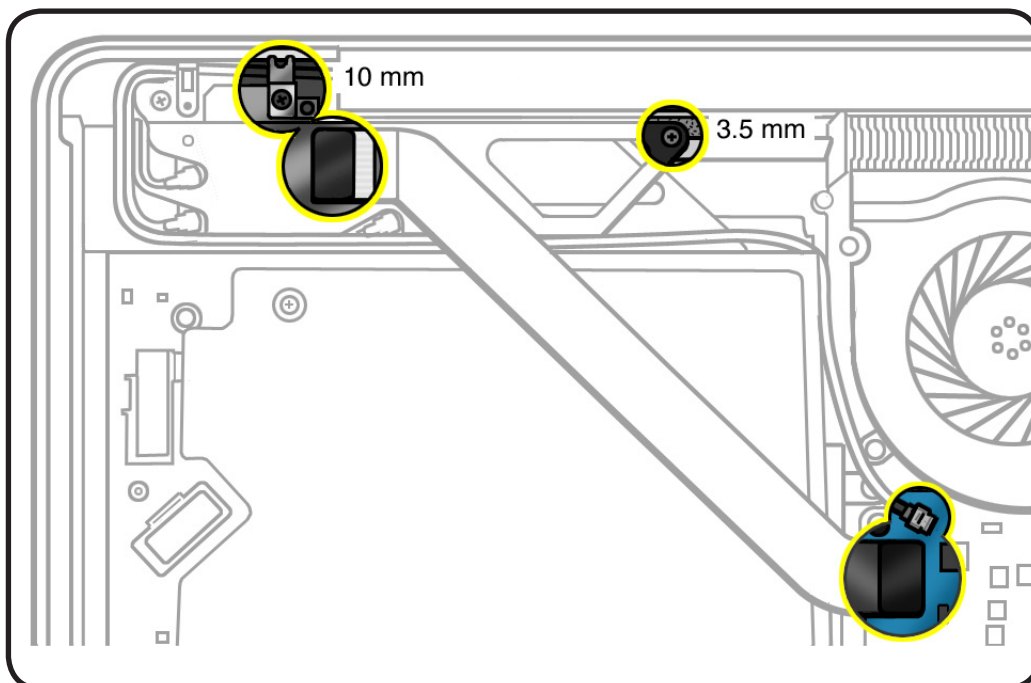
3 Disconnect Bluetooth cable and 2 AirPort cables.

Note: Use needlenose pliers or tweezers to lift metal connector of each cable straight up.

Use black stick or needlenose pliers to pry cables up from the holder's channels
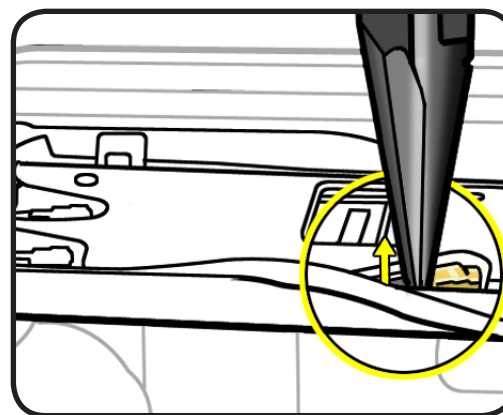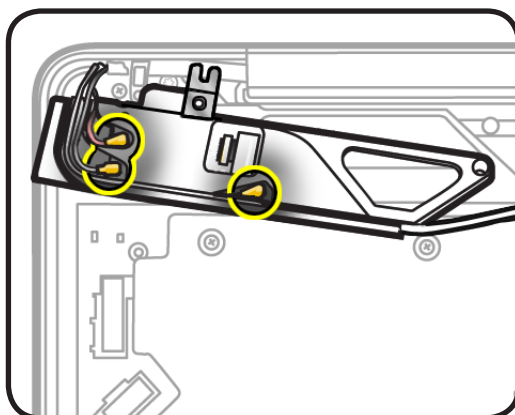
4 Lift out holder and turn it over.
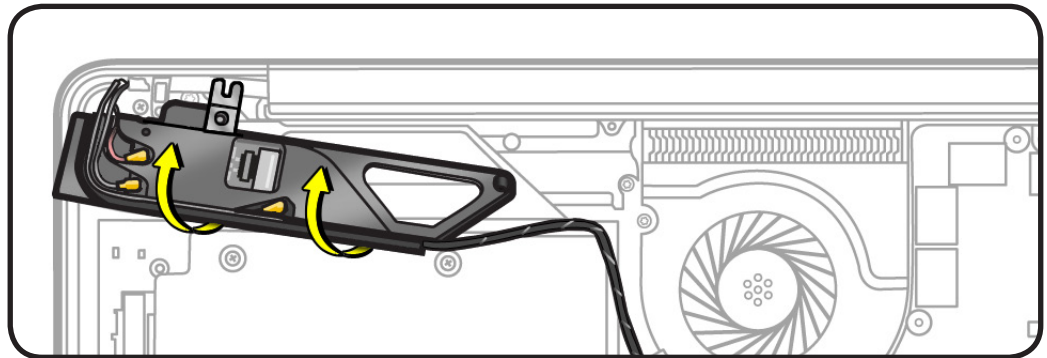
5 Remove 2 (3 mm) 922-9200 card screws.

6 Transfer card to new holder.
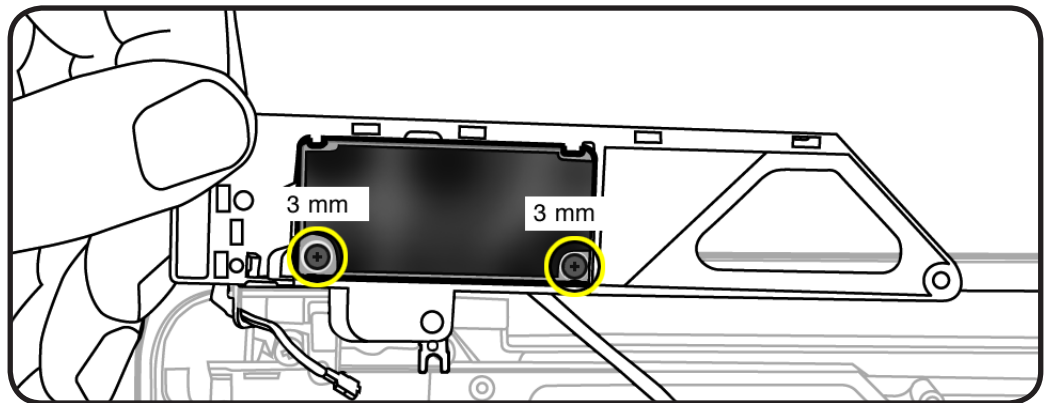
3 mm   3 mm

Reassembly Note: Make sure connectors are fully seated, and the length of the cables are tucked into their channels.

Reassembly Note: Be sure grounding clip fingers contact the small top case pocket.
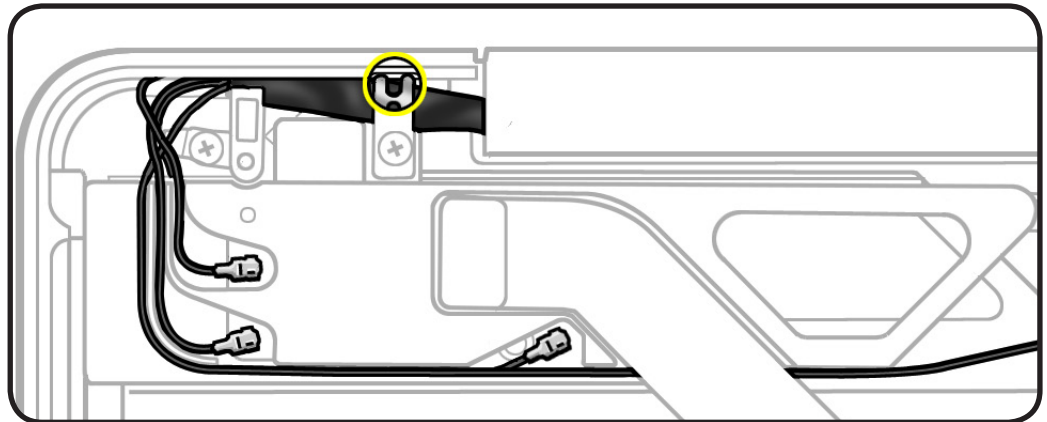
AirPort/Bluetooth Holder, Early 2011

First Steps
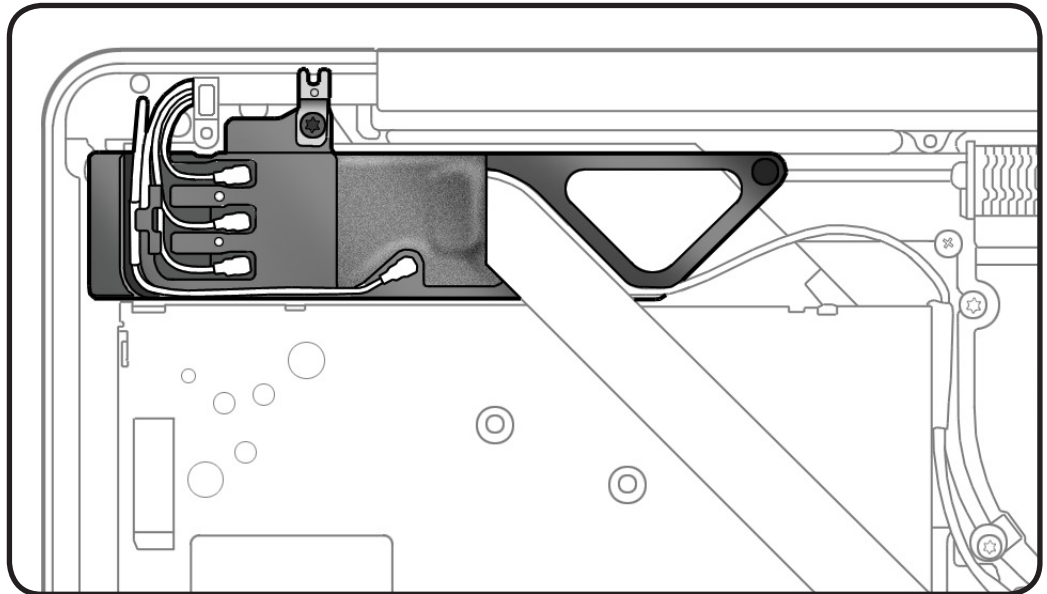
Remove:

- Bottom case

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

Tools

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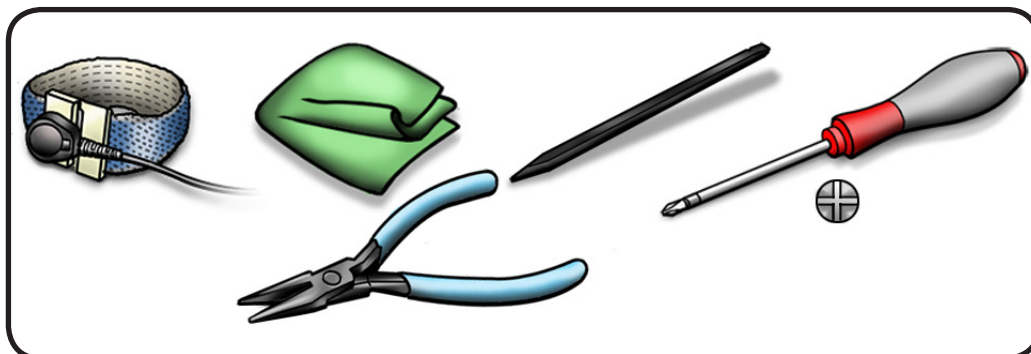
Removal

1 Disconnect
- camera cable
- flex cable end **at logic board only**

2 Remove 2 screws:
- 10-mm (922-9333)
- 3.5-mm (922-8719)

    Note: Do not remove metal grounding clip; it stays on AirPort/ Bluetooth holder.

10 mm

3.5 mm
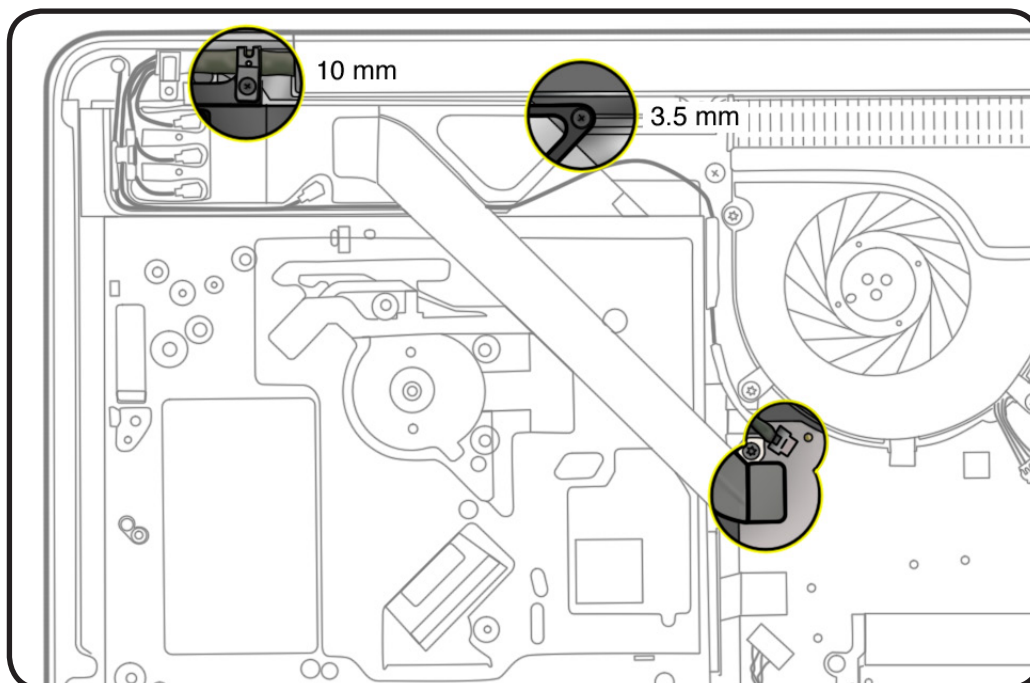
Reassembly Note: If camera cable has an adhesive strip, reuse the adhesive to keep the cable routed properly in the channel to the logic board.
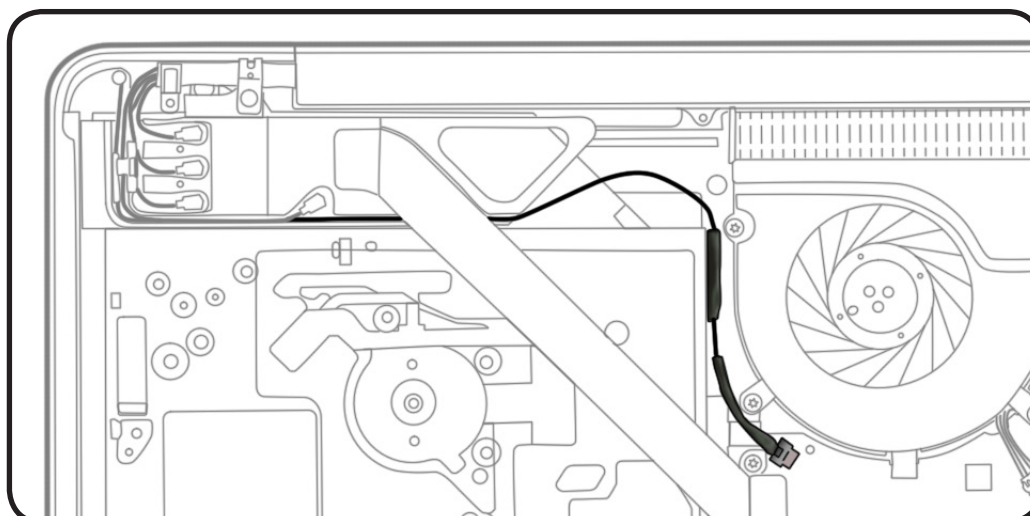
3 Disconnect antenna cables from card:
- 1 Bluetooth cable
- 3 AirPort cables

   Note: Use needlenose pliers or tweezers to lift metal connector of each cable straight up.
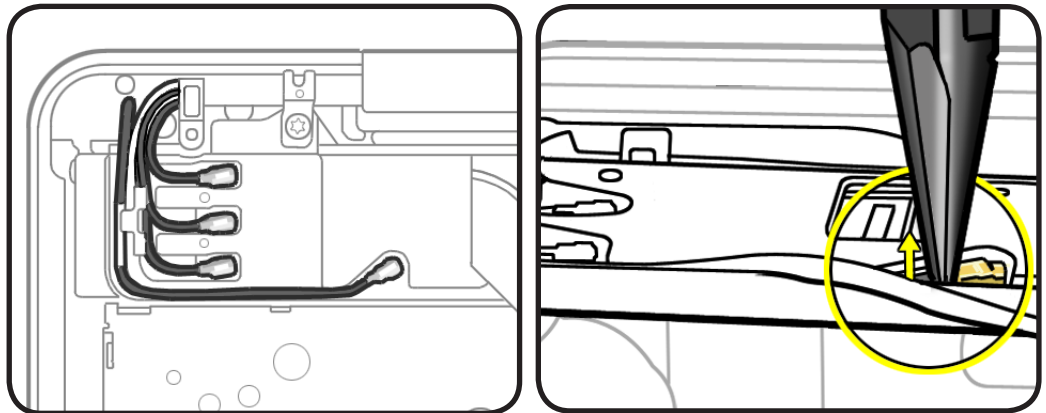
4 Peel back conductive wrap covering flex cable's connector.

5 Disconnect AirPort/ Bluetooth flex cable from card and set cable aside.
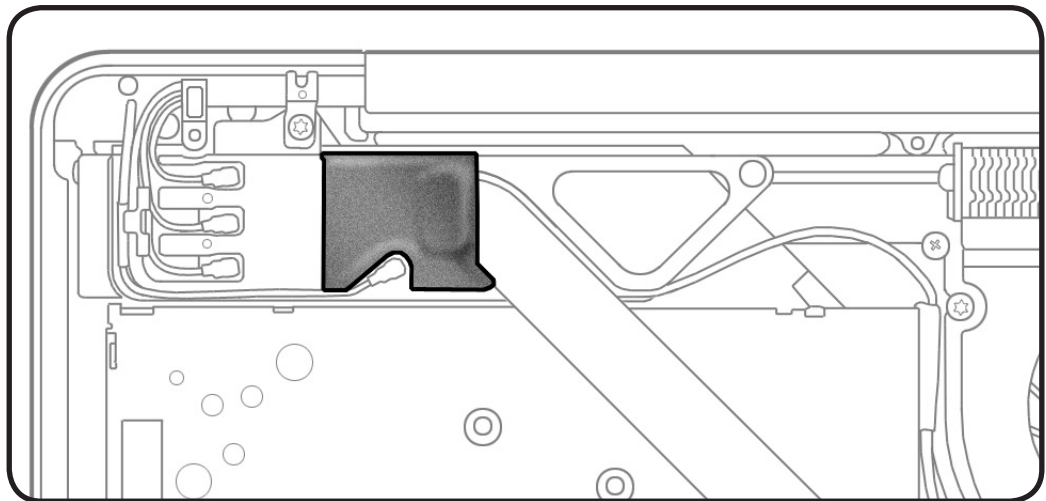
6 Rotate card holder back from bottom case.

7 Peel back conductive wrap covering card and underside of holder
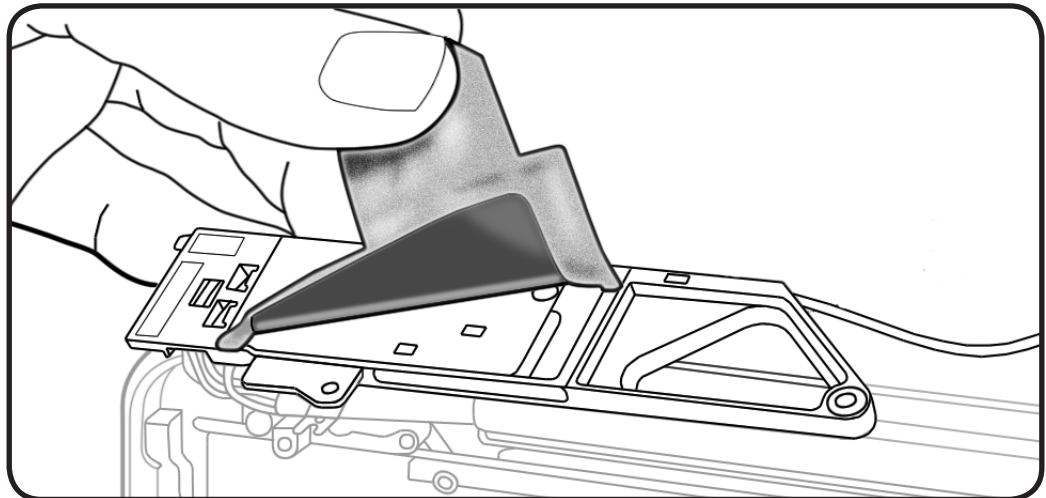
8 Remove 3 (3 mm) 922-9200 screws and lift card from holder.

Note: Perform next step only if you must remove card holder from top case.
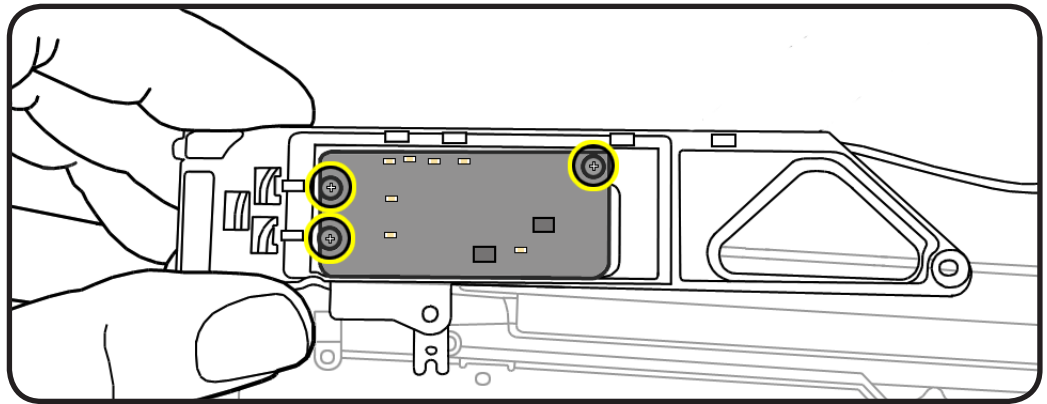
9 Use black stick or needlenose pliers to pry cables from channels, and remove card holder from case.

Reassembly Note: Reroute cables in card holder as shown.
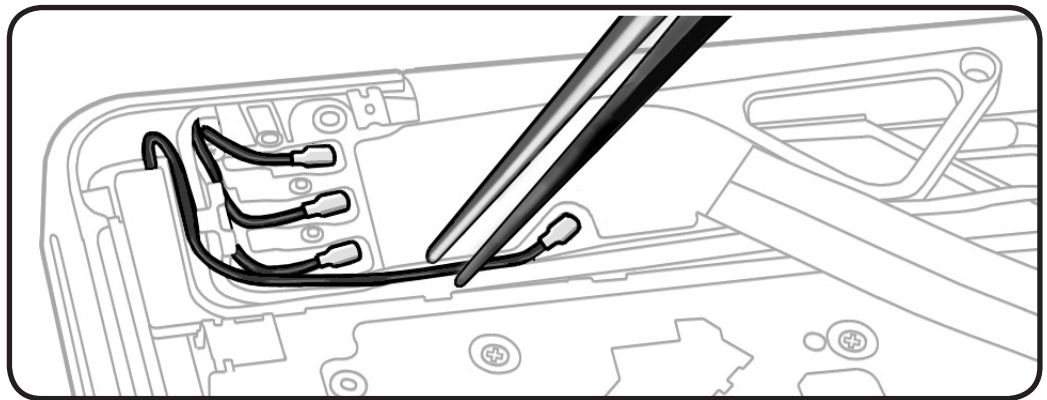
Reassembly

Important: Every time you install a replacement AirPort/Bluetooth card or card holder, you must also replace the card's thermal pad and conductive wrap.

- Cards and card holders are provided as kits, which include the thermal pad and 3 conductive wraps (designed for 3 different models).
- Use the illustration below to select the MacBook Pro (17-inch, Early 2011) wrap, marked with yellow arrow.
- Discard remaining 2 wraps.

Front of wrap

.
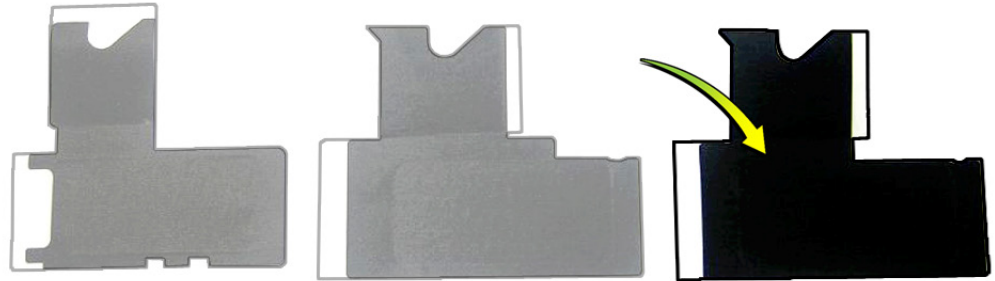
Back of wrap
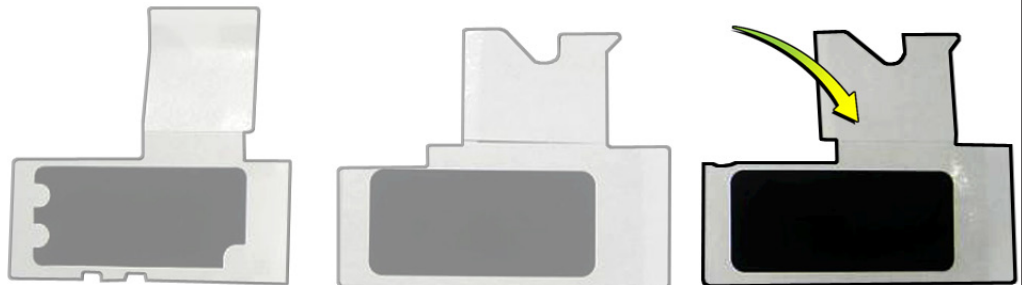
1 If you haven't already, remove original conductive wrap from card and card holder.
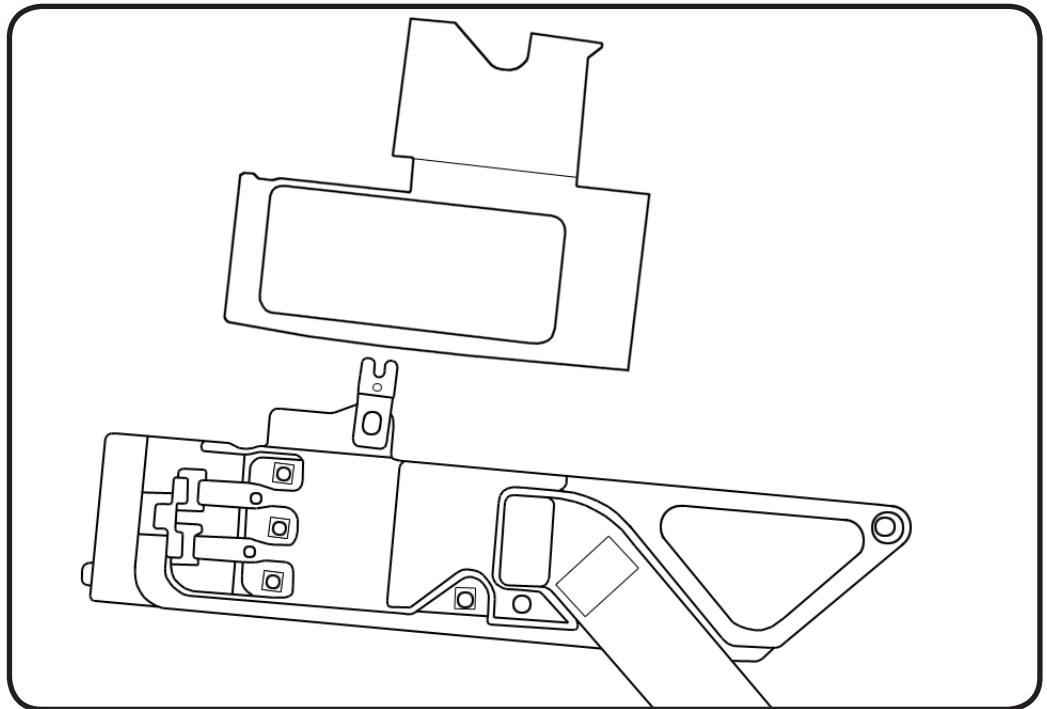
2 Peel off protective film from back of thermal pad and install pad in card holder as shown.
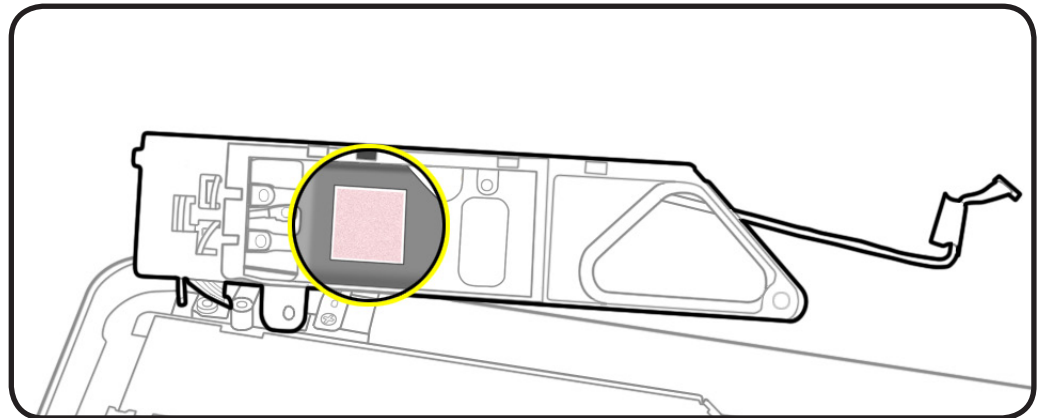
3 Install AirPort/ Bluetooth card in holder.
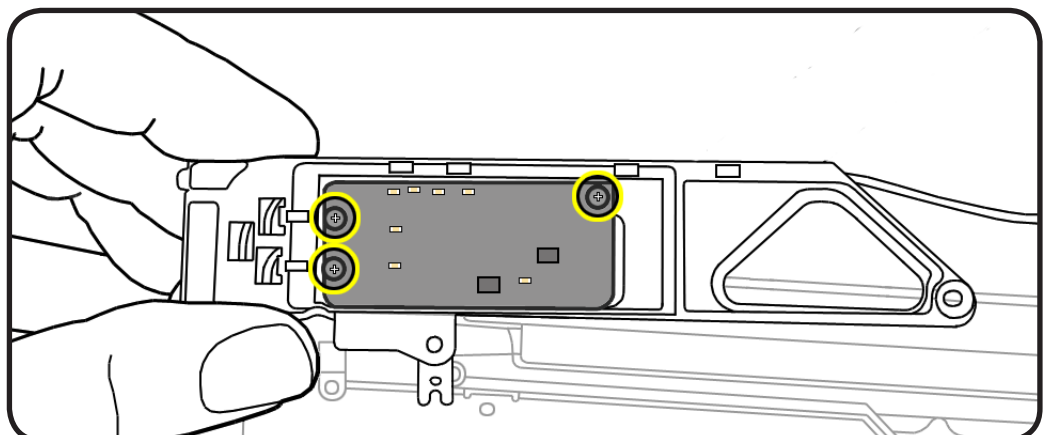
4 Connect AirPort/ Bluetooth flex cable to card.
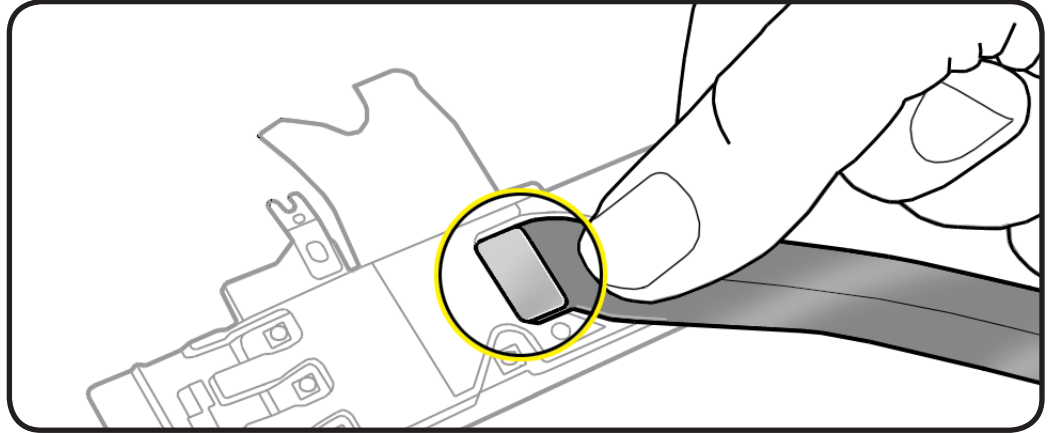
5 Do the following to install wrap included with replacement card (or card holder):

- Remove protective film from adhesive side of wrap.

- Place wrap over AirPort/Bluetooth card on underside of holder. Smooth down wrap so it adheres to card and holder.

- Continue to smooth down wrap on edge and top side of holder, being careful to cover flex cable connector.
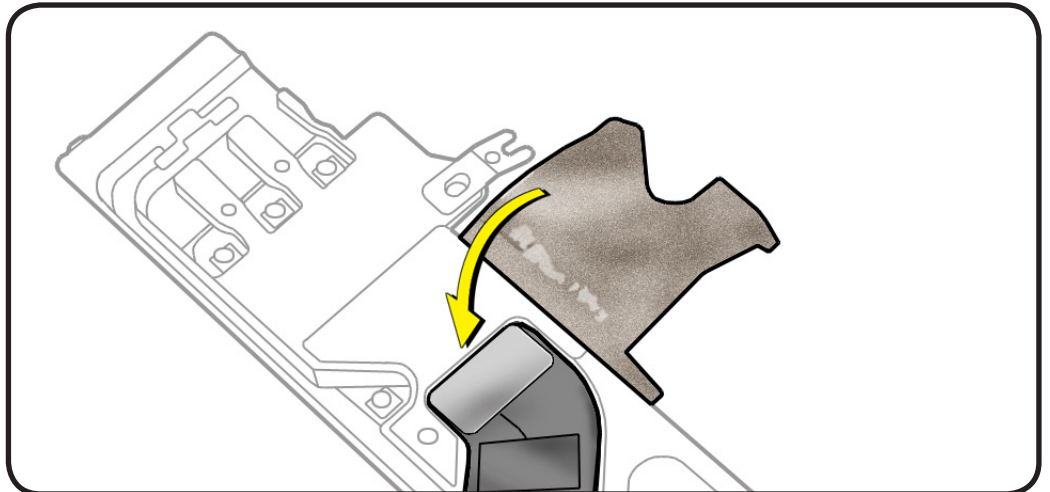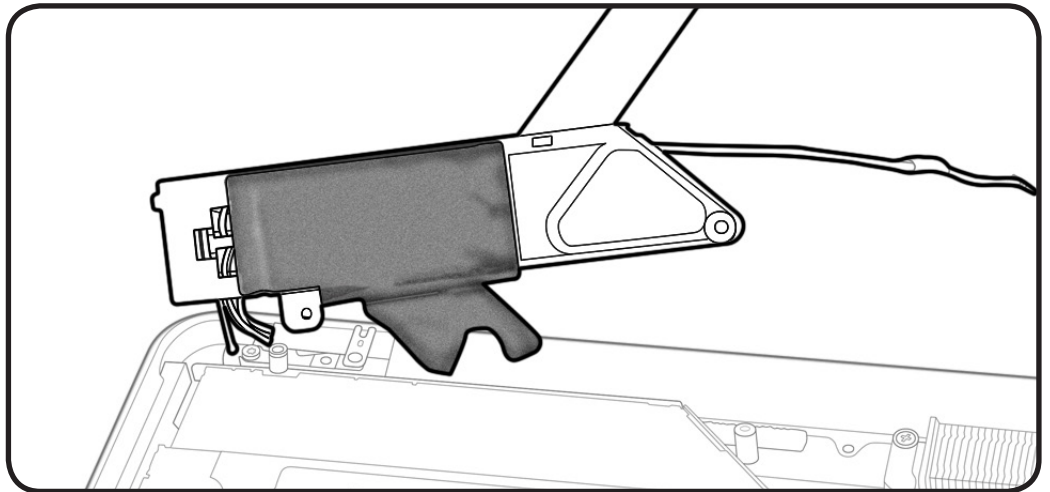
6 Connect antenna cables to card.
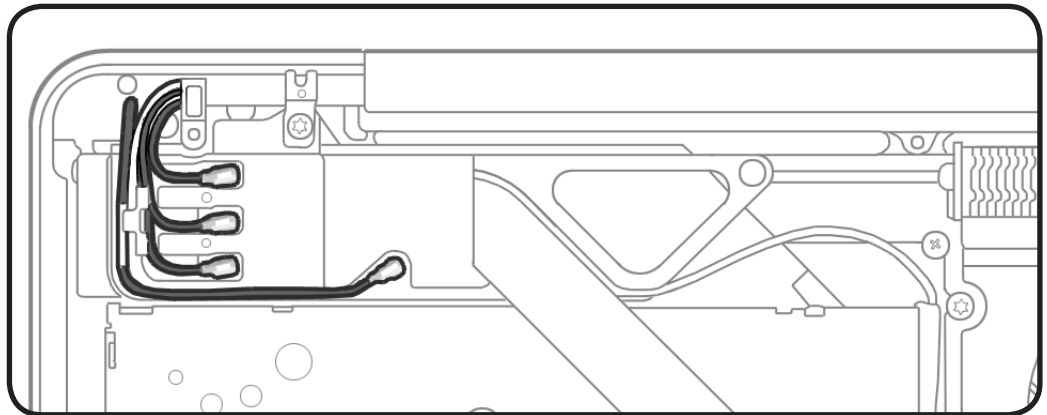
7 Install holder in top case.

10 mm

3.5 mm
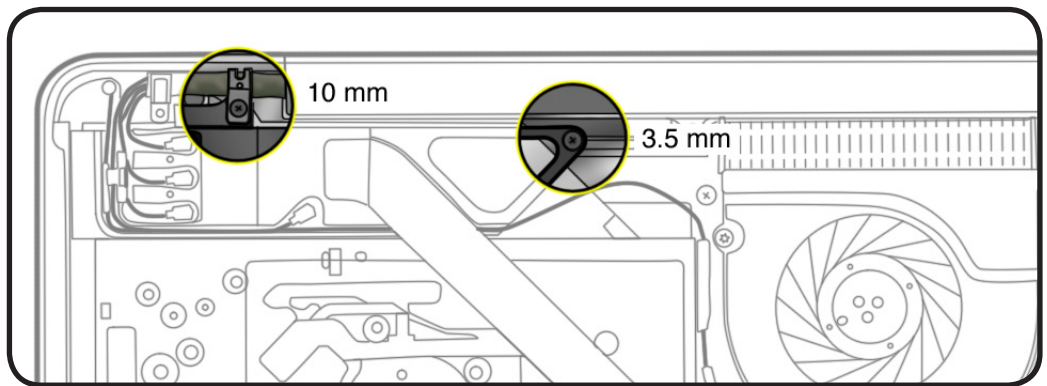
8 Make sure grounding clip fingers contact the small top case pocket.
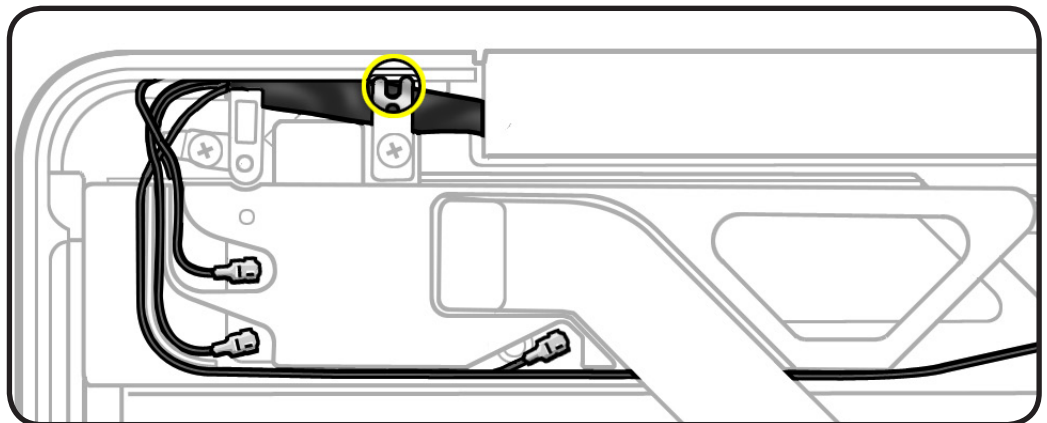
9 Connect camera cable and AirPort/Bluetooth flex cable to logic board.
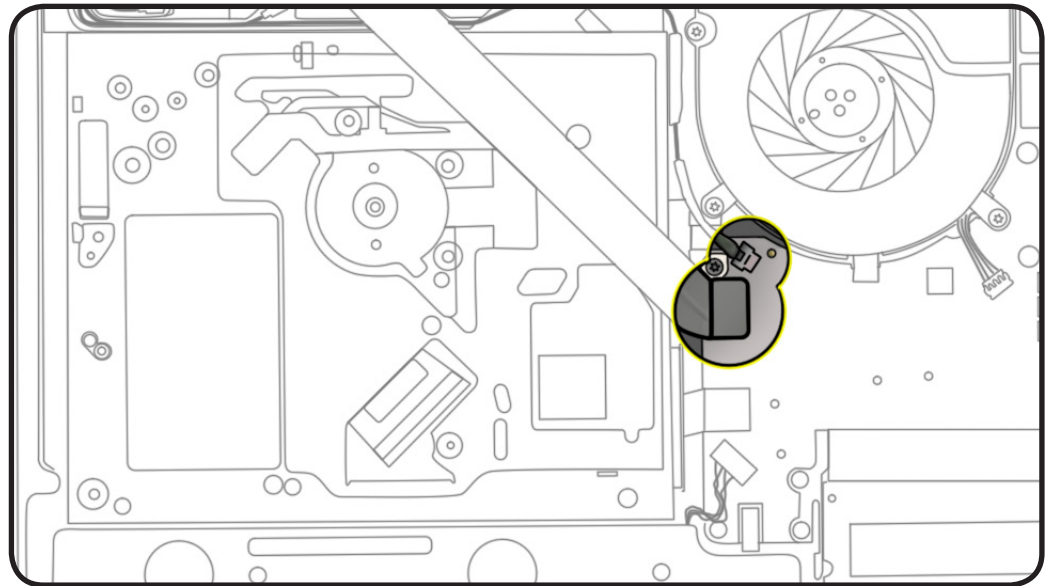
AirPort/Bluetooth Card, Mid 2010

First Steps

Remove:
- Bottom case

Refer to **AirPort/ Bluetooth Holder** to flip over (but not remove) holder
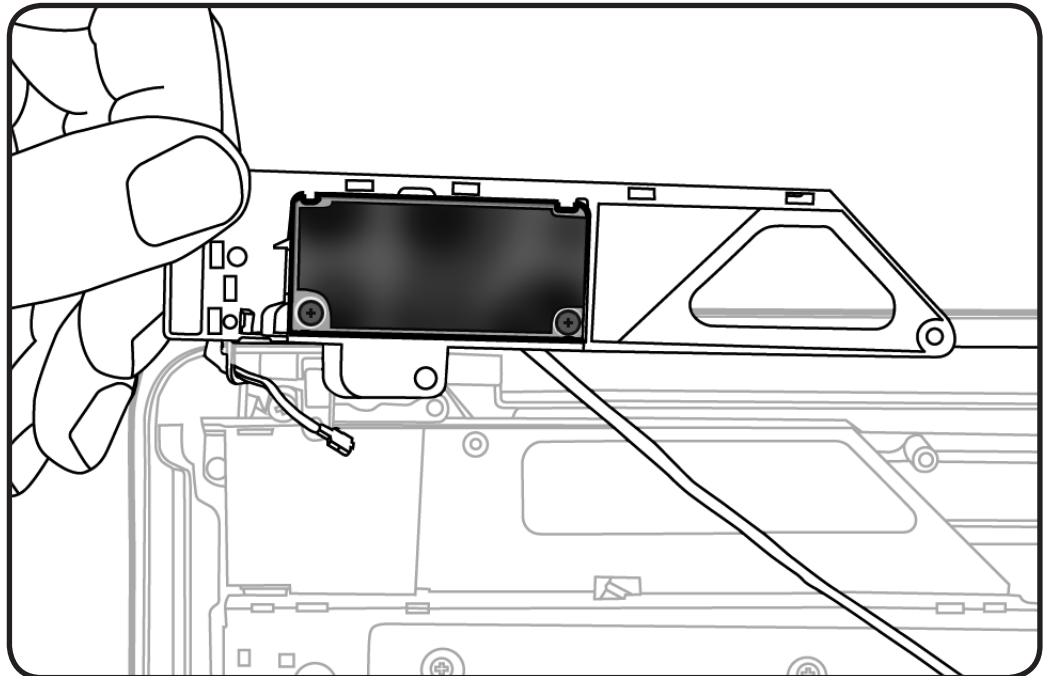
Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.
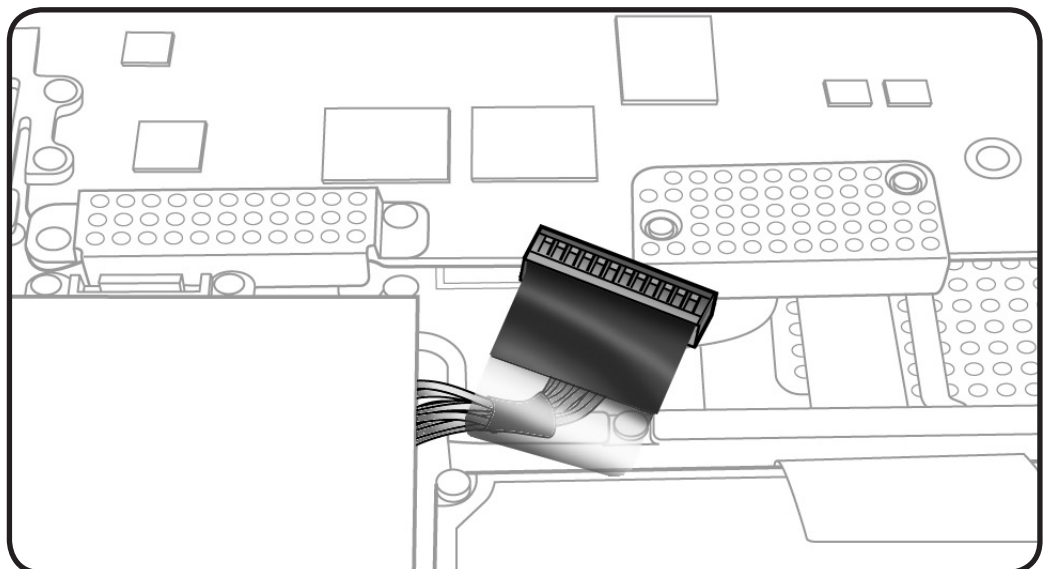
Tools

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

Removal

1 Remove 2 (3 mm) 922-9200 card screws.

3 mm   3 mm
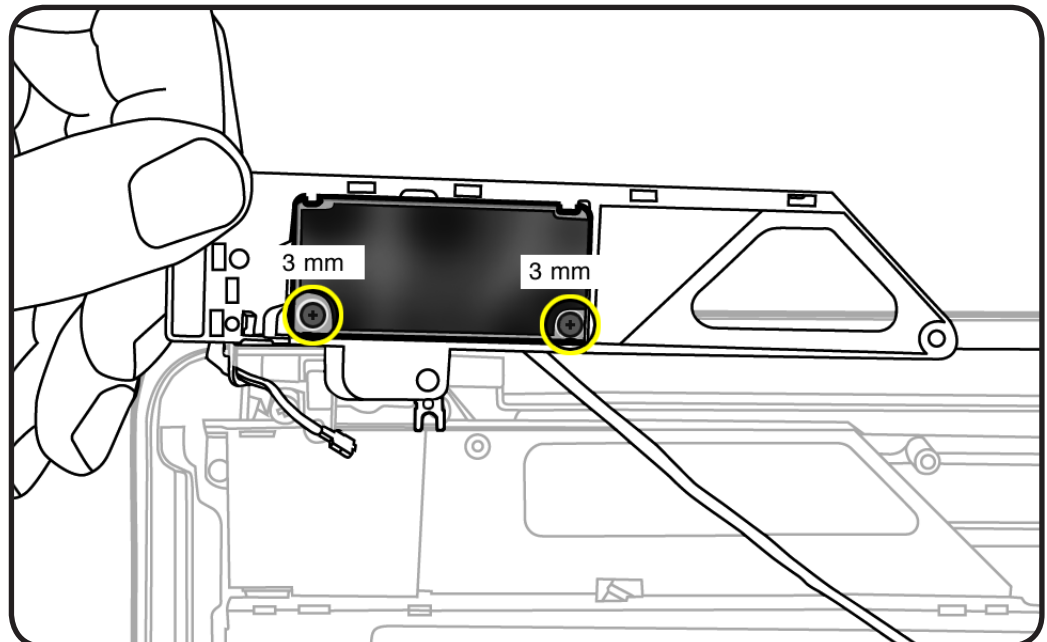
2 Transfer new card to AirPort/Bluetooth holder.
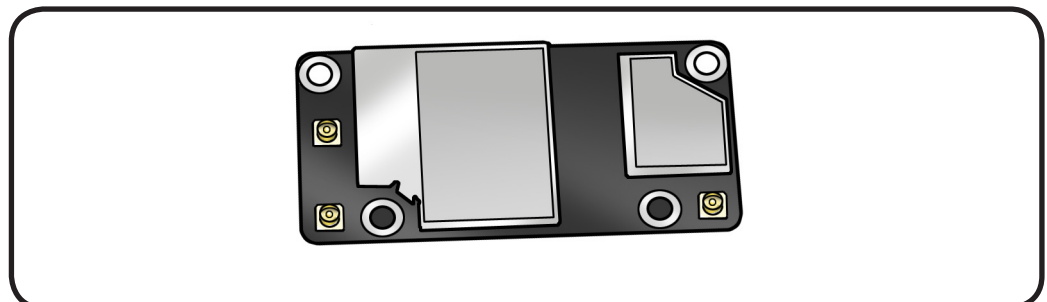
Reassembly Note: Make sure connectors are fully seated, and the length of the cables are tucked into their channels.

Reassembly Note: Be sure grounding clip fingers contact the small top case pocket.
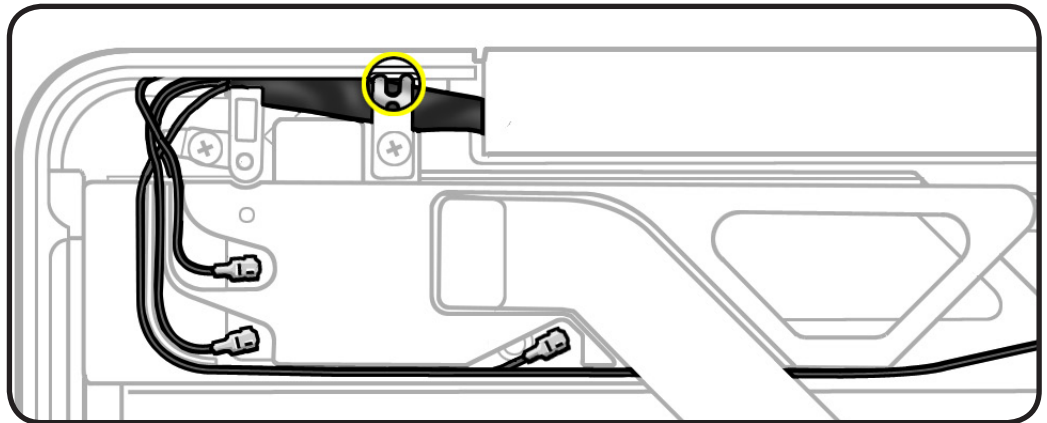
AirPort/Bluetooth Card, Early 2011

First Steps

Do the following:

- Remove bottom case
- Remove AirPort/
  Bluetooth flex cable
- Refer to **AirPort/
  Bluetooth Holder,
  Early 2011** to flip over
  (but not remove)
  holder
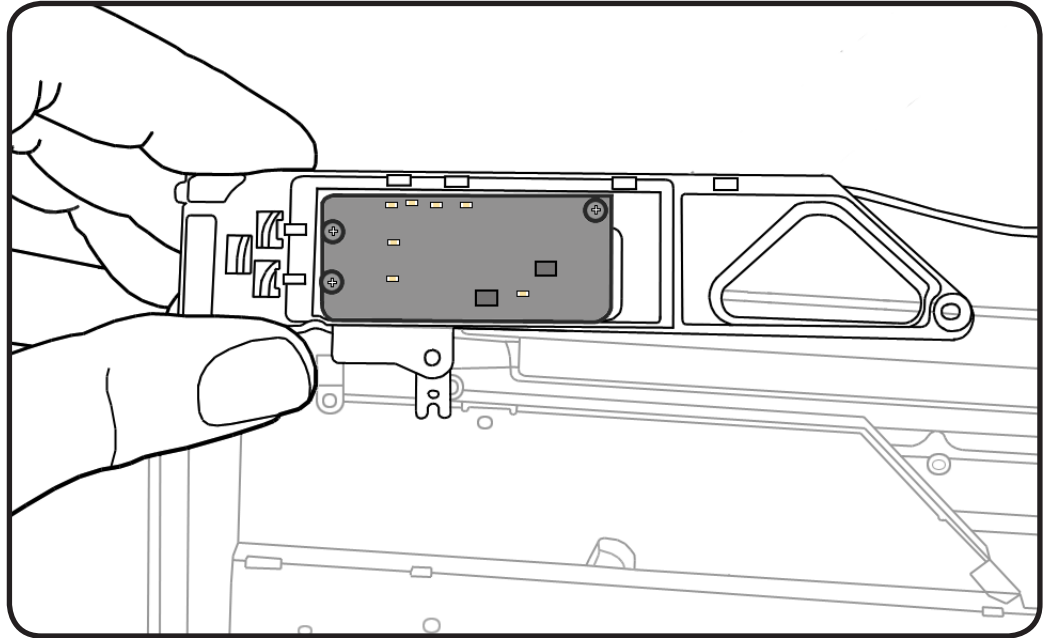
Before you begin this
procedure, disconnect
the battery from the
logic board. Failure to
do so could damage the
computer.
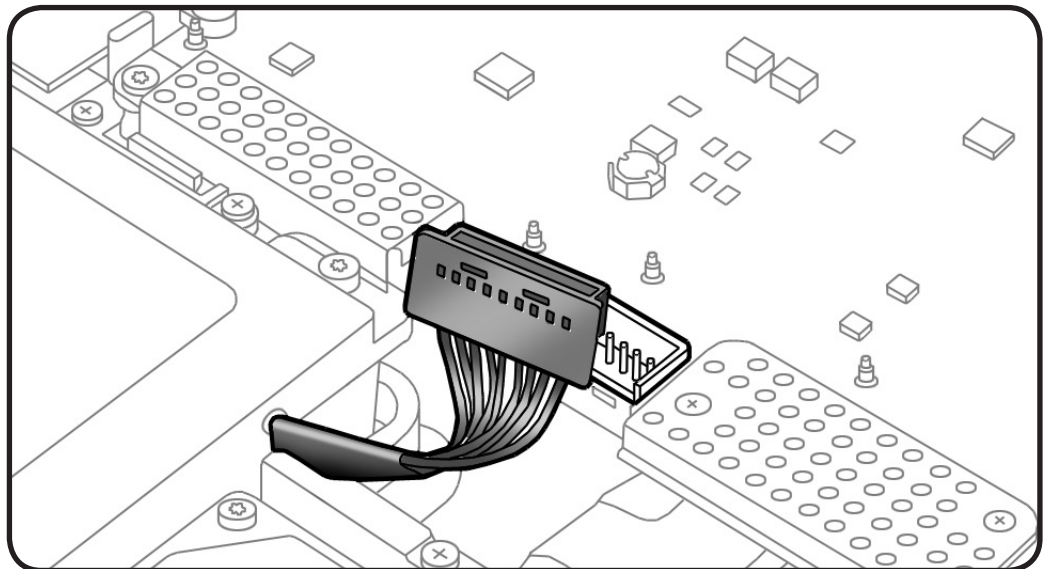
Tools

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

Removal

1 Remove 3 (3 mm) 922-9200 card screws.
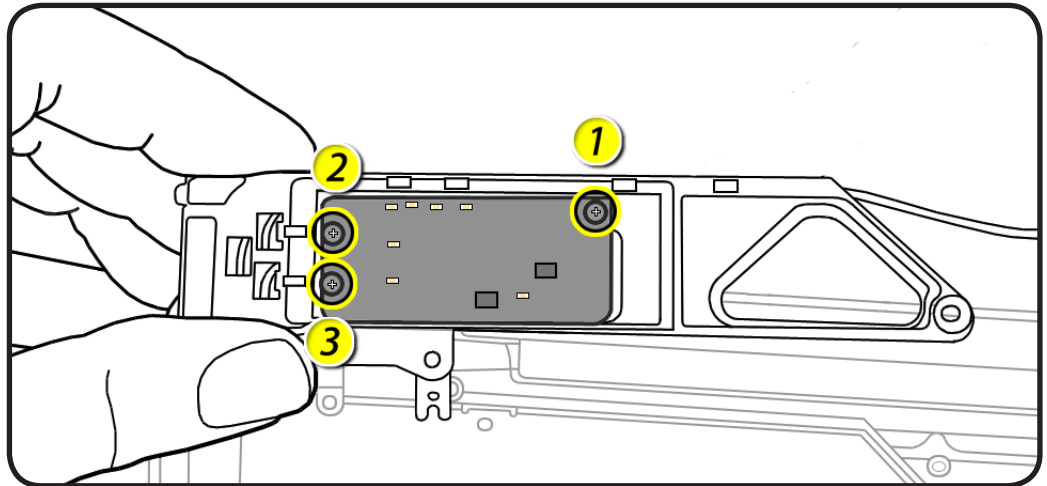
2 Lift card from holder.

Note location of thermal pad. It can stick to either the card or the holder.
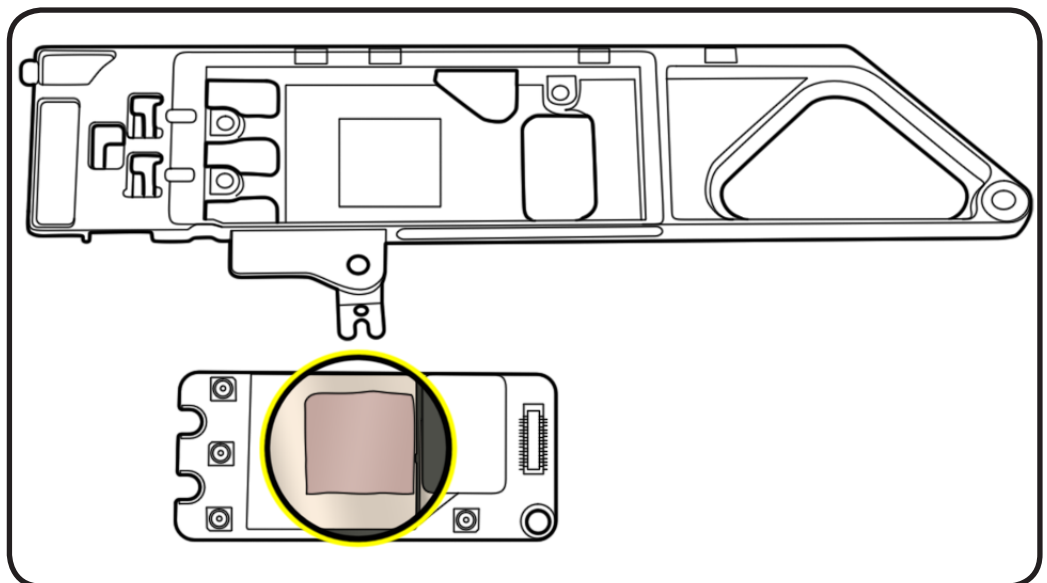
Reassembly

Important: Every time you install a replacement AirPort/Bluetooth card or card holder, you must also replace the card's thermal pad and conductive wrap. AirPort/Bluetooth cards and card holders are provided as kits, which include the thermal pad and three conductive wraps. Each wrap is designed for a different product. Use the illustration at right to select the correct wrap for the product you are servicing. (Discard remaining two wraps.)
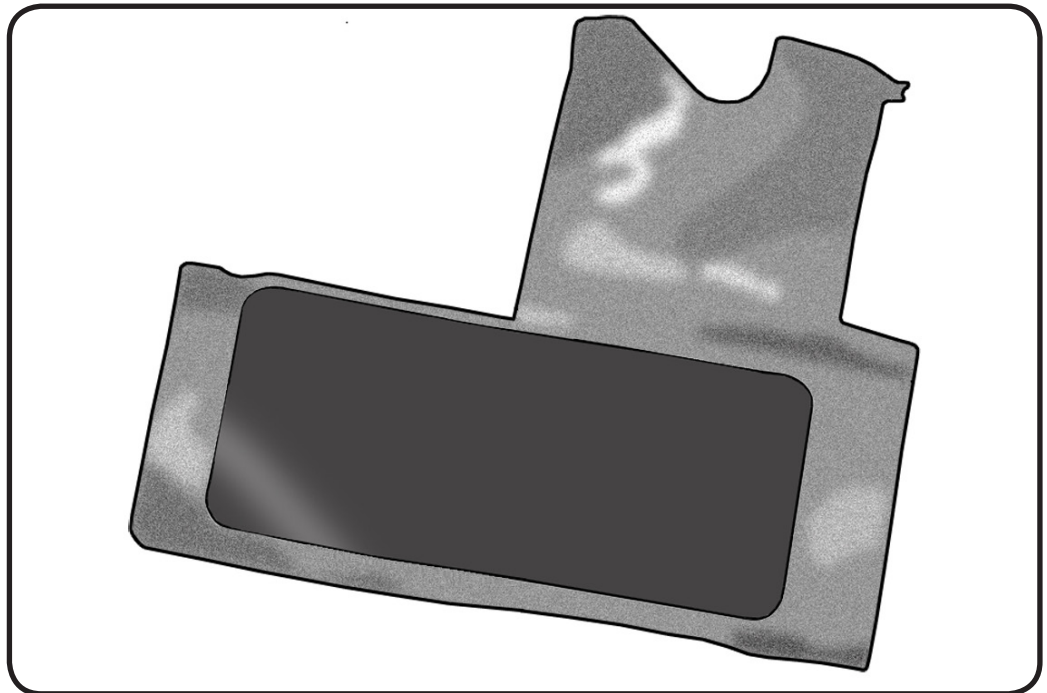
Reassembly Note: Refer to **AirPort/Bluetooth Holder, Early 2011** to replace conductive wrap. Make sure connectors are fully seated, and the length of the cables are tucked into their channels.
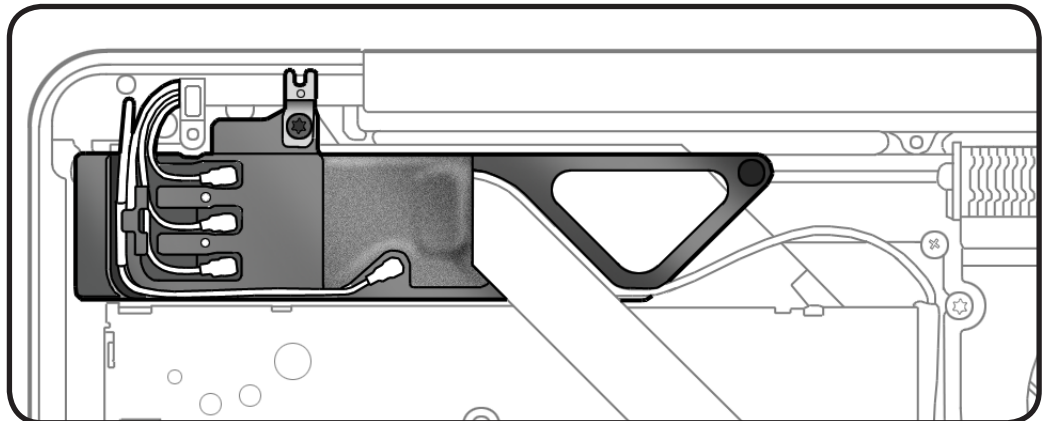
Reassembly Note: Be sure grounding clip fingers contact the small top case pocket.
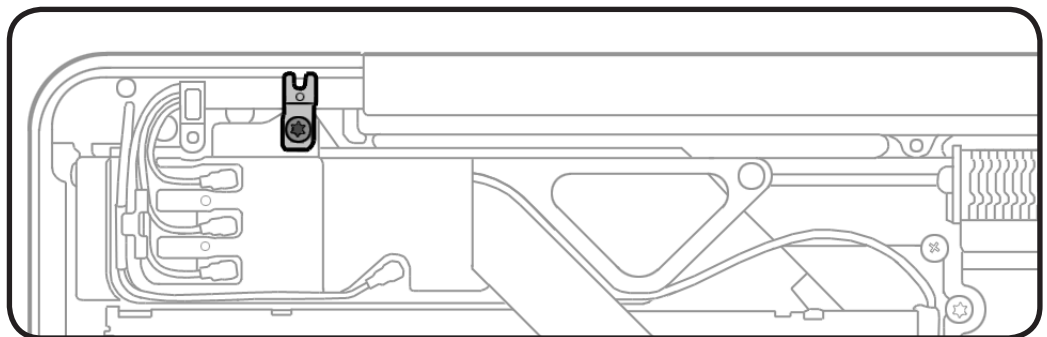
Right Speaker/Subwoofer

First Steps

Remove:
- Bottom case
- Optical drive
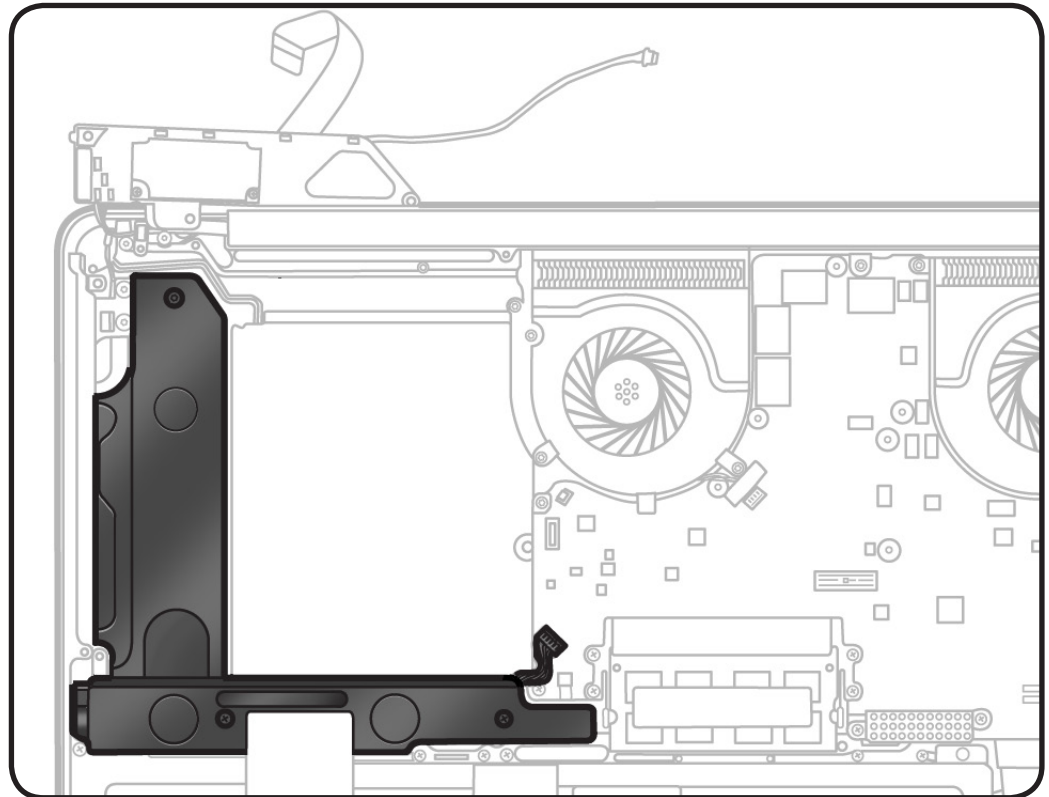
Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.
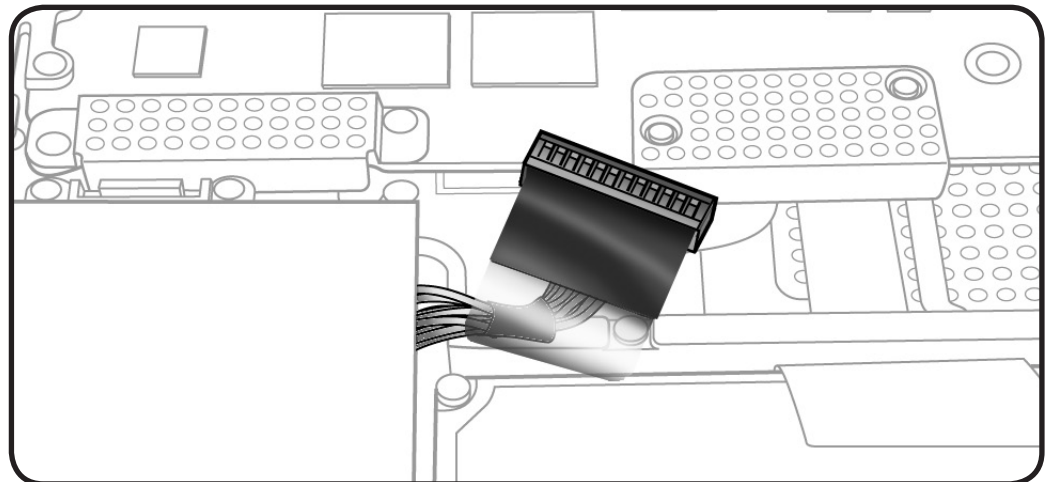
Tools

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

Removal

1 Remove 3 screws:
- 1 (2.75-mm) 922-8662 (922-9860, Early 2011)
- 2 (12.4-mm) 922-8982

2 Disconnect speaker cable from logic board.
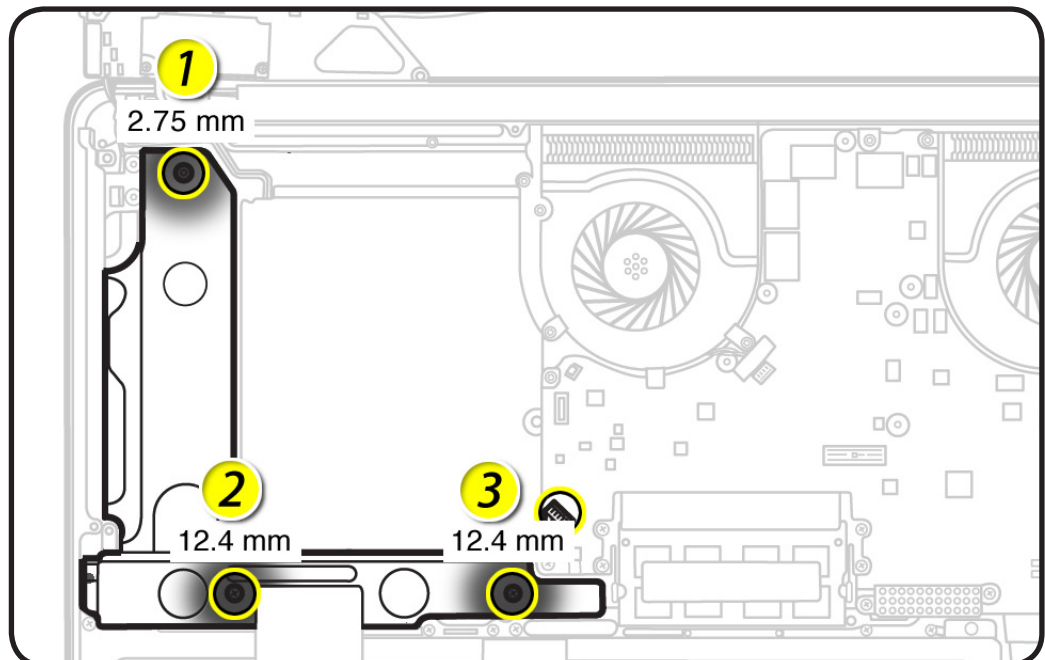
3 Loosen from adhesive at side, if provided, and remove speaker.
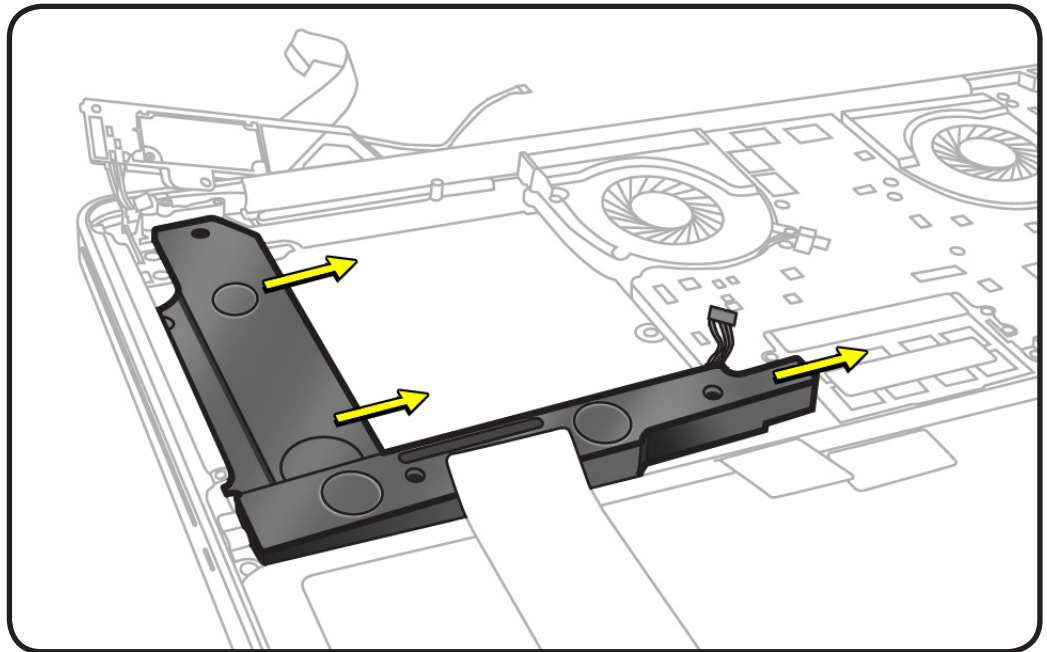
Reassembly Caution:
Do not touch sensitive speaker cones.
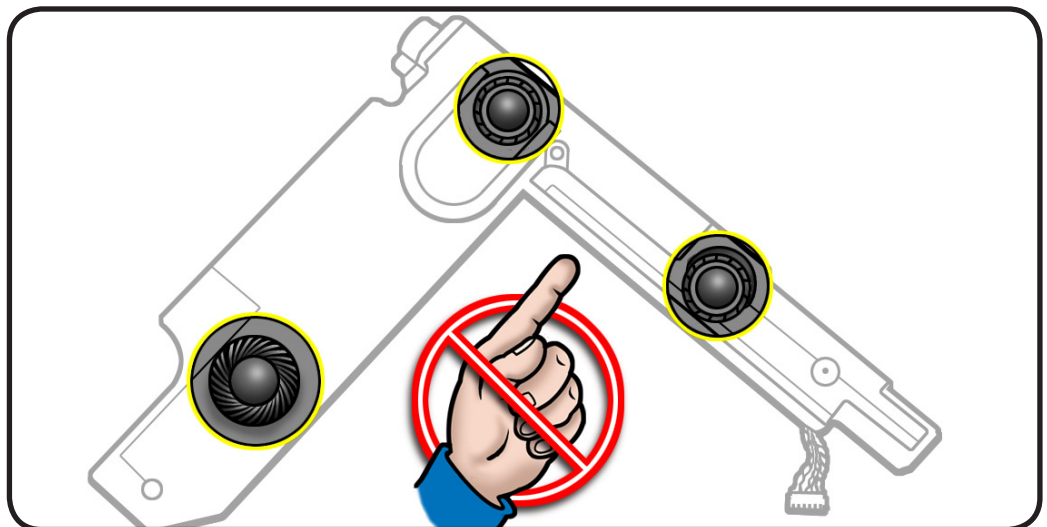
Logic Board

First Steps
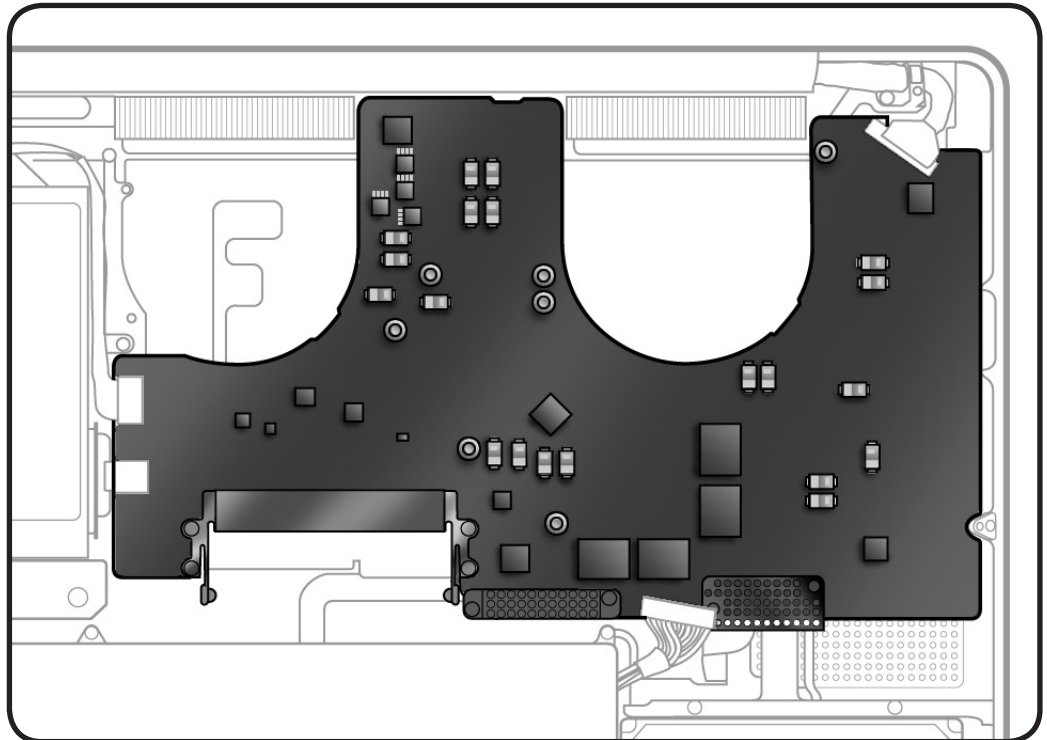
Remove:
- Bottom case
- Memory
- Fans

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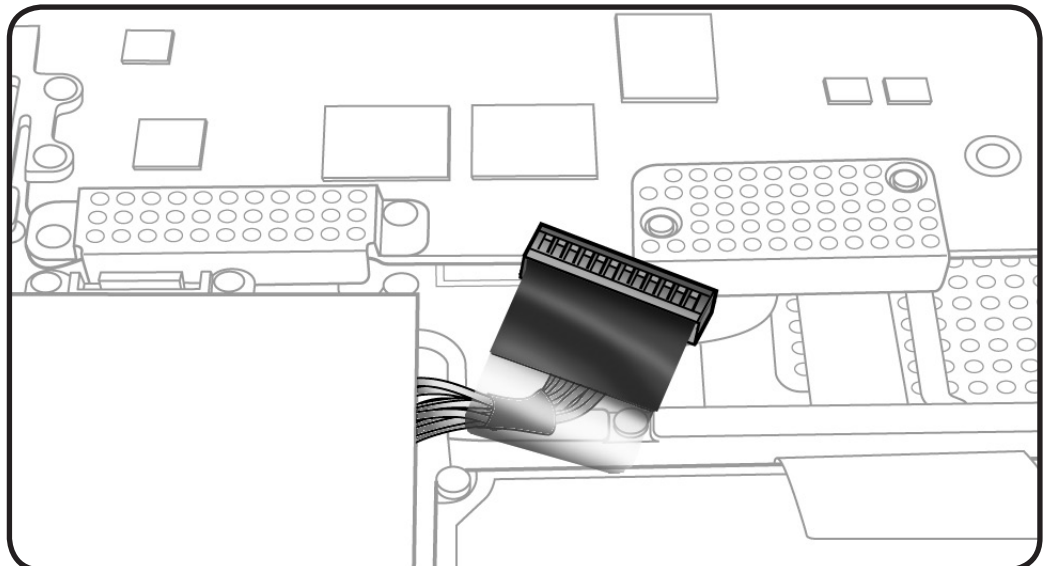
Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Black stick
- Torx T6 screwdriver
- Phillips #00 screwdriver

◎ T6   ⊕ # 00

Removal

1 Remove 4 screws:
- 2 T6 (3.3-mm) 922-9108
- 2 #00 (1.8-mm) 922-8983

2 Lift away 2 shields.

1.8 mm

3.3 mm

3.3 mm

1.8 mm
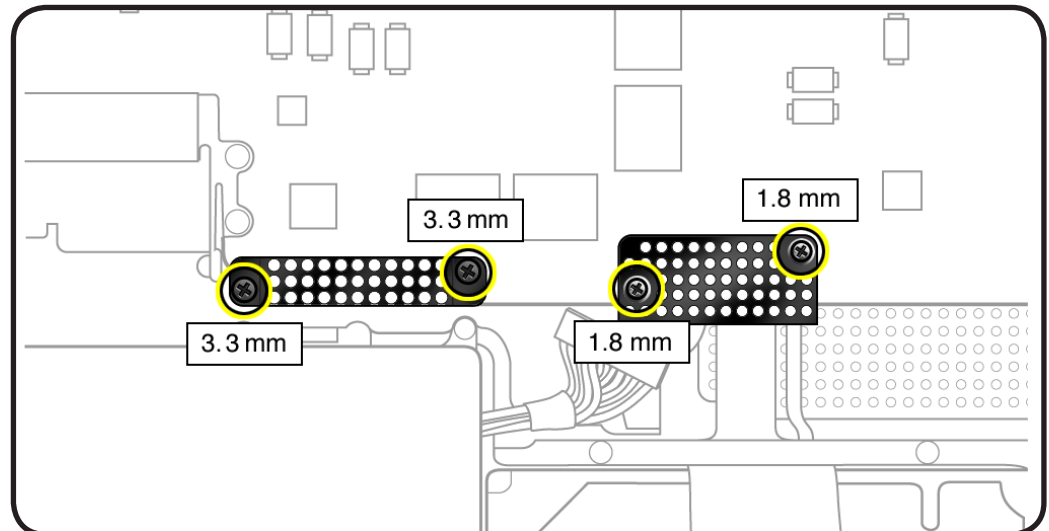
3 Refer to **Connector Types** to carefully disconnect 12 cables:

- LVDS
- keyboard backlight
- camera
- AirPort/Bluetooth
- optical drive
- right speaker
- IR/sleep
- trackpad
- keyboard power
- ExpressCard
- hard drive connector
- battery indicator light (BIL)
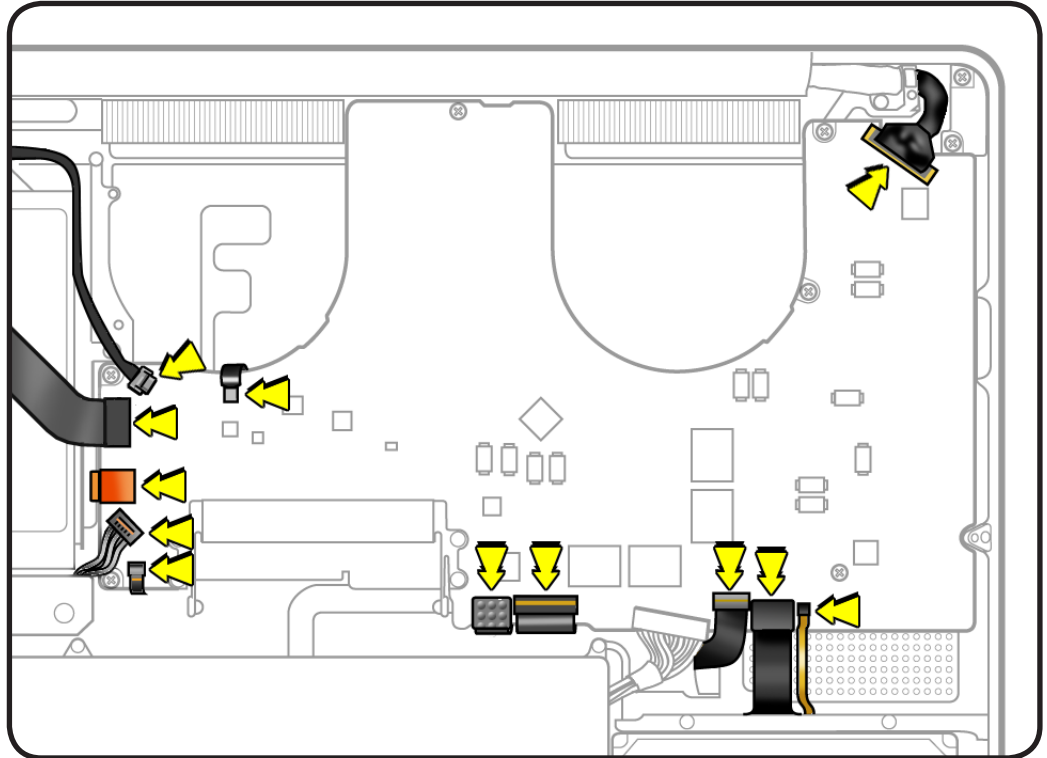
Reassembly Note:
These cables have pull tabs to assist with reinstallation:

- keyboard power
- ExpressCard

Before installing the two shields, fold the pull tabs over the connectors so they lie flat under the shields.
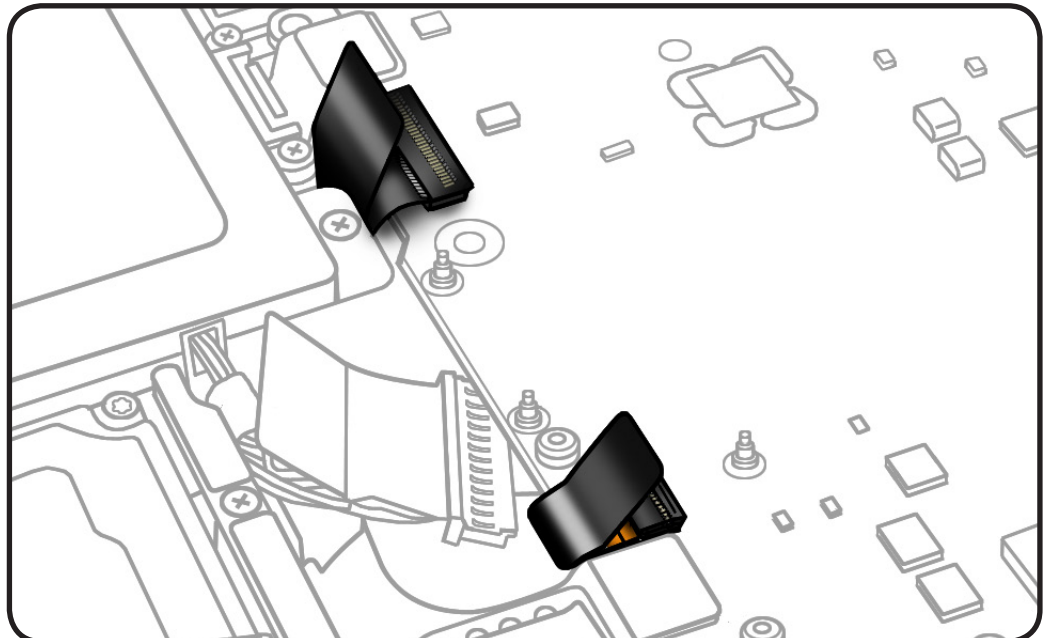
Caution: The locking levers at the cable connectors are fragile. To protect the delicate levers during handling or shipment of the logic board, **leave levers open after cables are removed.** Once the logic board is back in the top case and the cables are installed, be sure to lock down the levers.
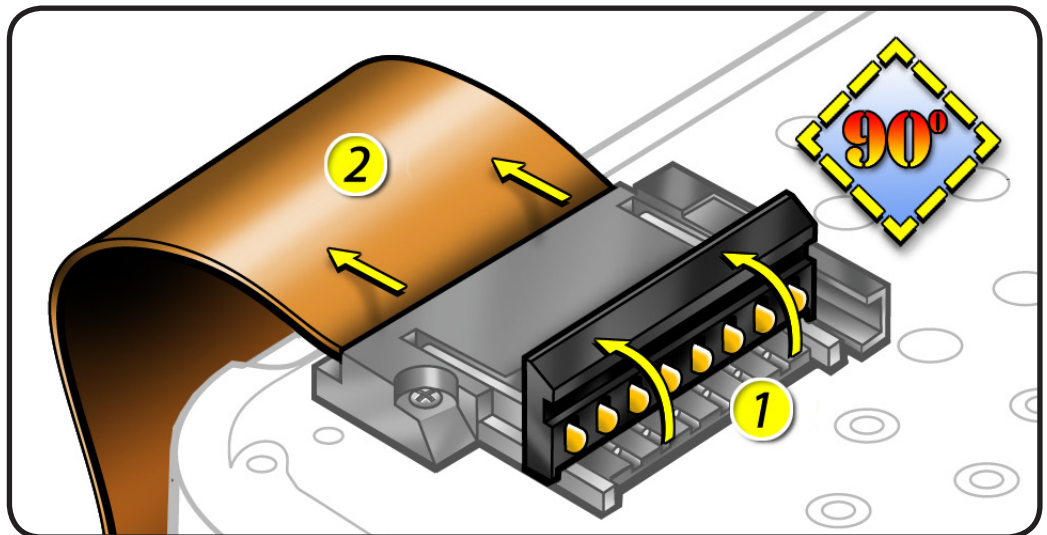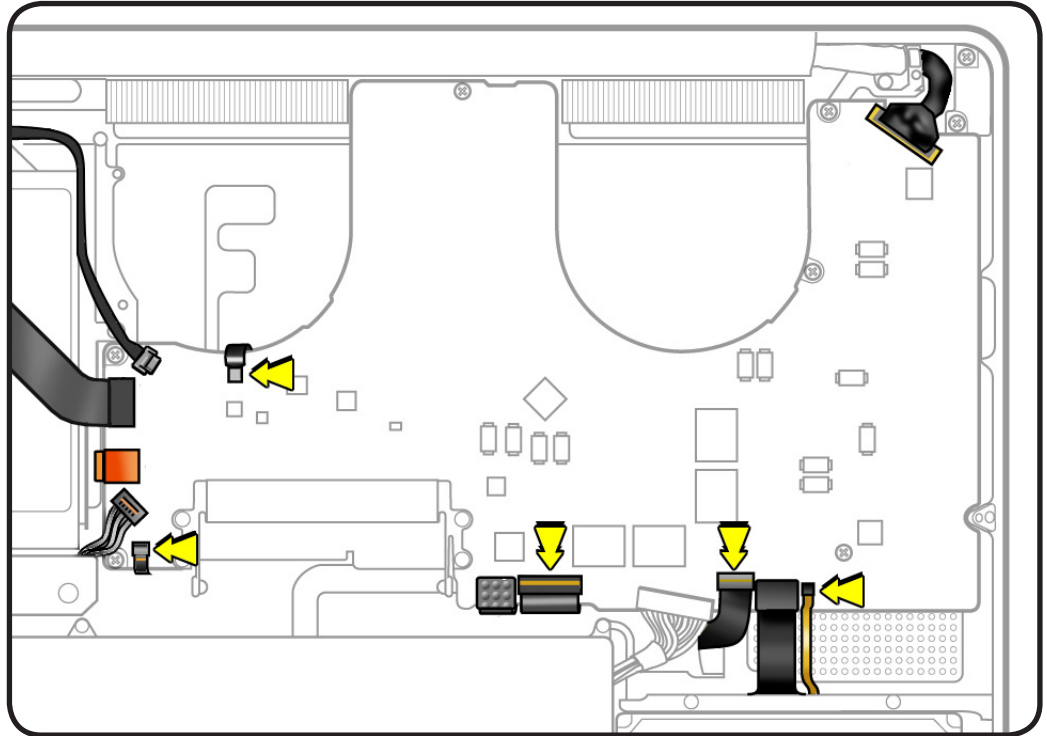
4 Remove 6 (3.3-mm) 922-9108 screws.

Reassembly Note: Install screws in order shown.
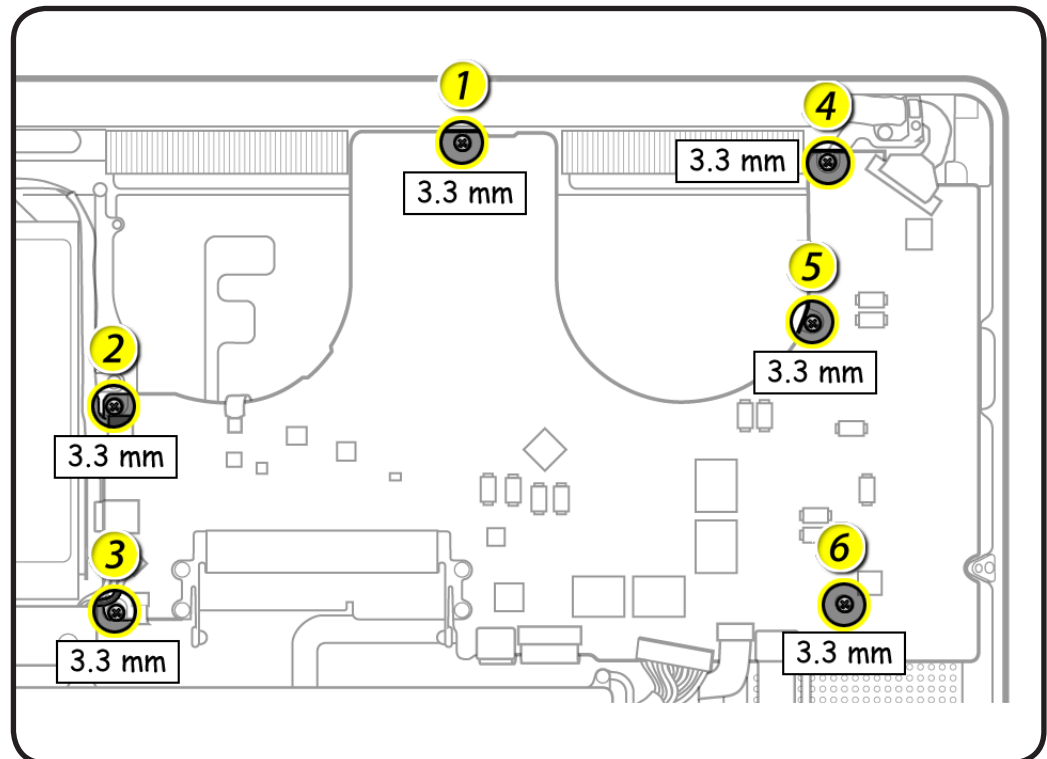
5 Tilt logic board away from ports.
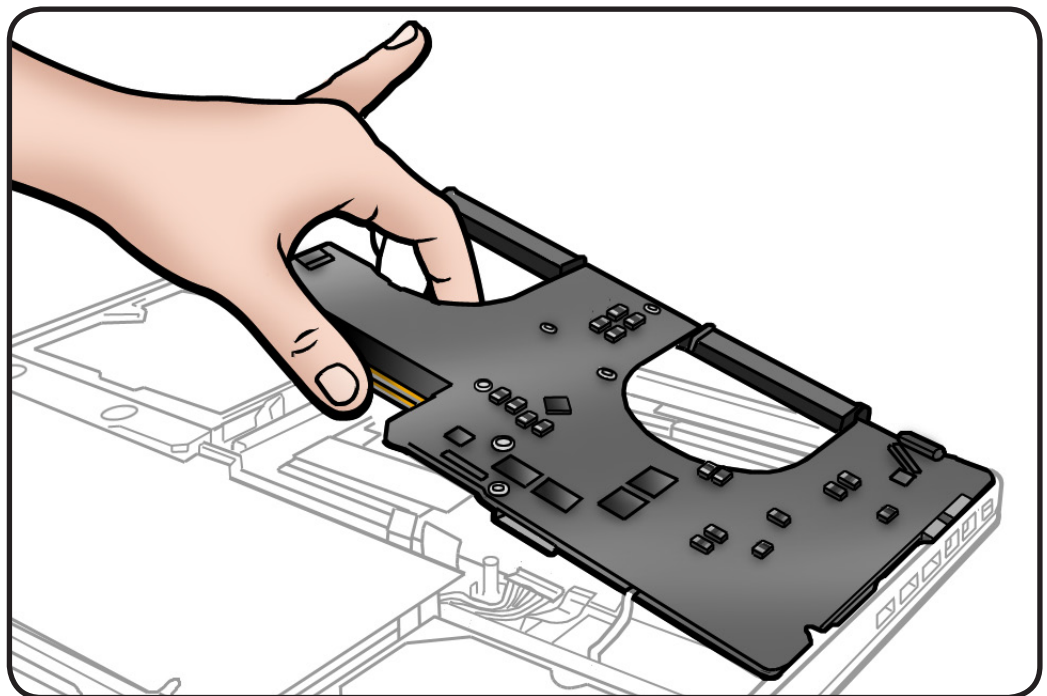
6 Holding board by edges, tilt it up and disconnect MagSafe connector.
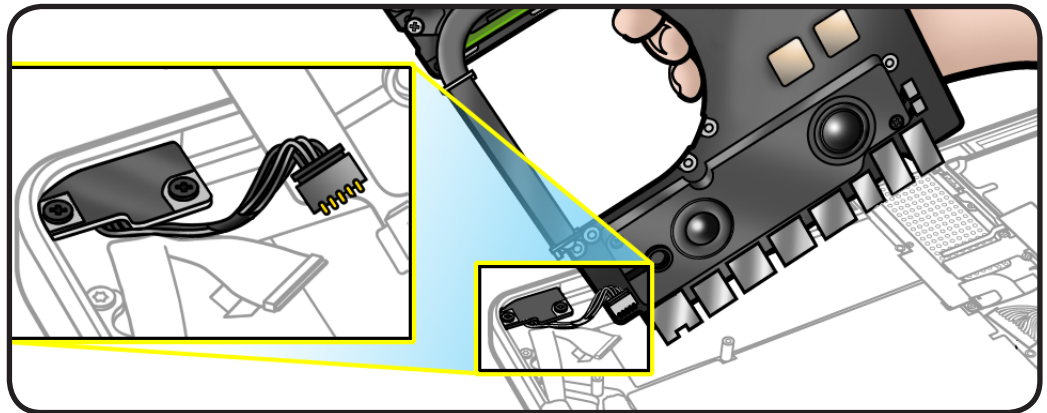
Reassembly

Note: If your repair site has a bar code reader, note the logic board serial number:

- A = system
- B = logic board

Or—to be sure—you can find the logic board serial number on the heatsink side of the board.

Important: Do not remove the label.

If replacing the logic board with a new one, transfer:

- left speaker
- microphone cable
- heatsink
- memory

A *B*

Serial No.C02CFAQNDC79

MLB No.: C02011601RQDCMRAD
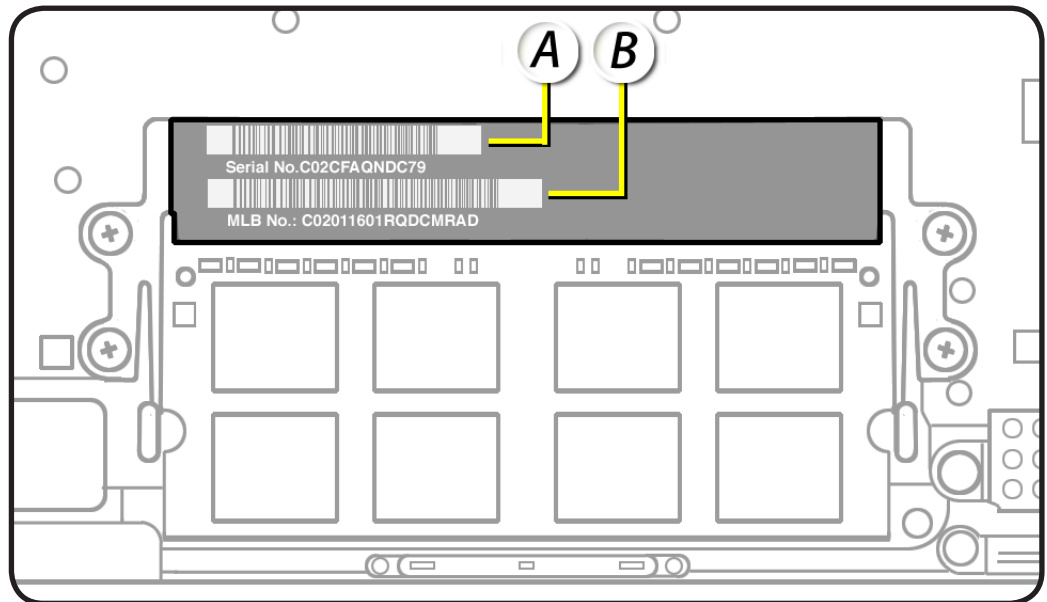
Note: New replacement logic boards may have a protective plastic cap installed on the headphone jack assembly.

Remove plastic cap before installing logic board. The logic board will not fit with the cap in place.
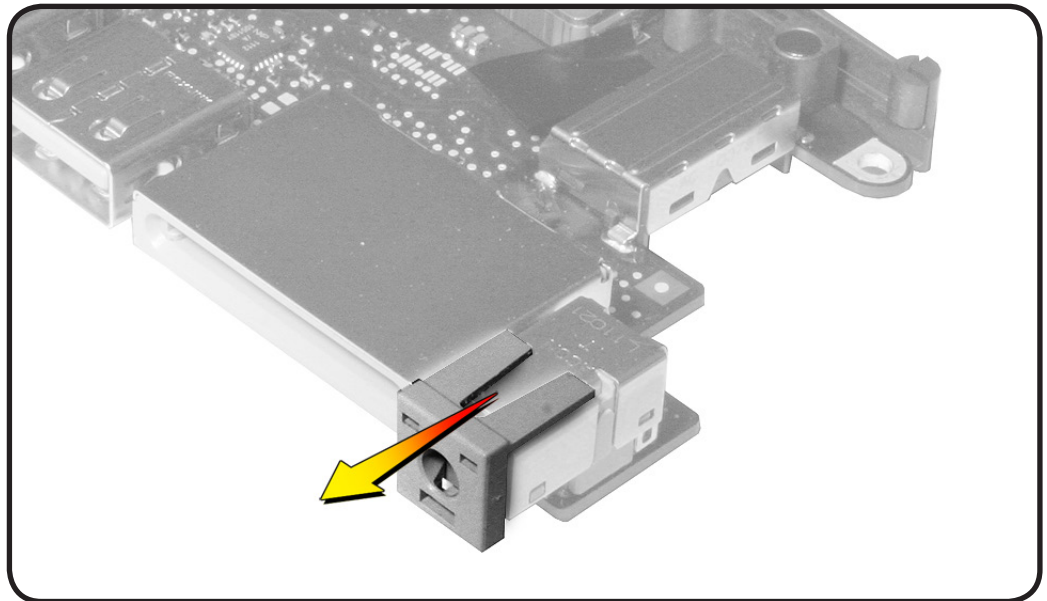
Transfer headphone jack cap to original logic board before returning it to Apple.
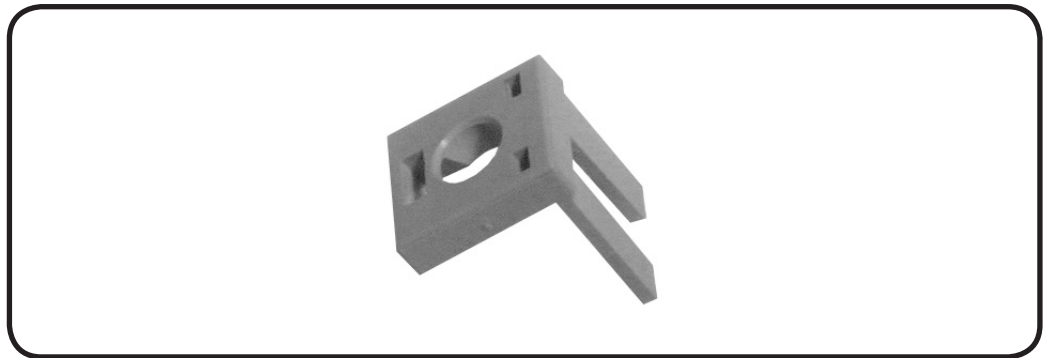
1 Connect MagSafe board connector.

2 Install 2 screws half way and check port alignment with the top case. Adjust board as needed to align screw holes and ports.
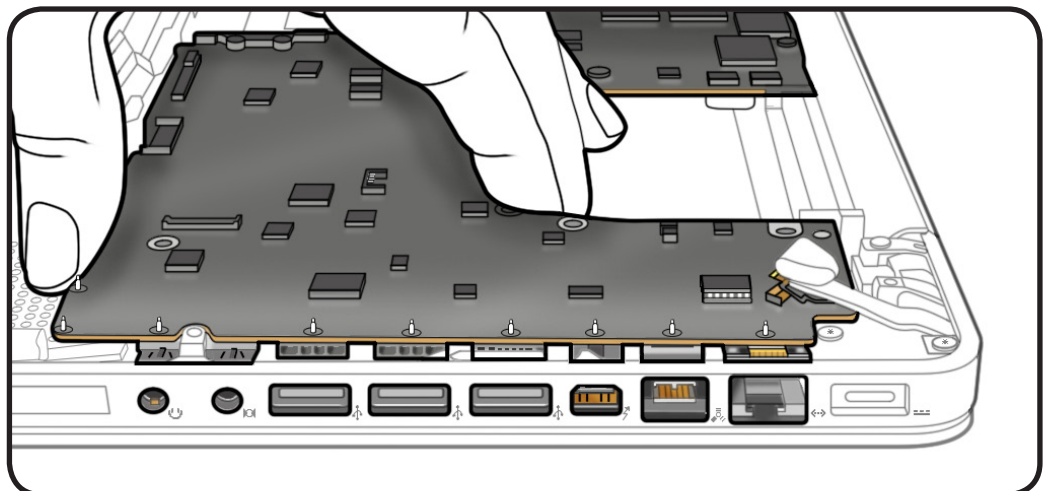
3 Keeping all cables away, install logic board screws in order shown.

1

3.3 mm

4

3.3 mm

2

3.3 mm

5

3.3 mm

3

3.3 mm

6

3.3 mm
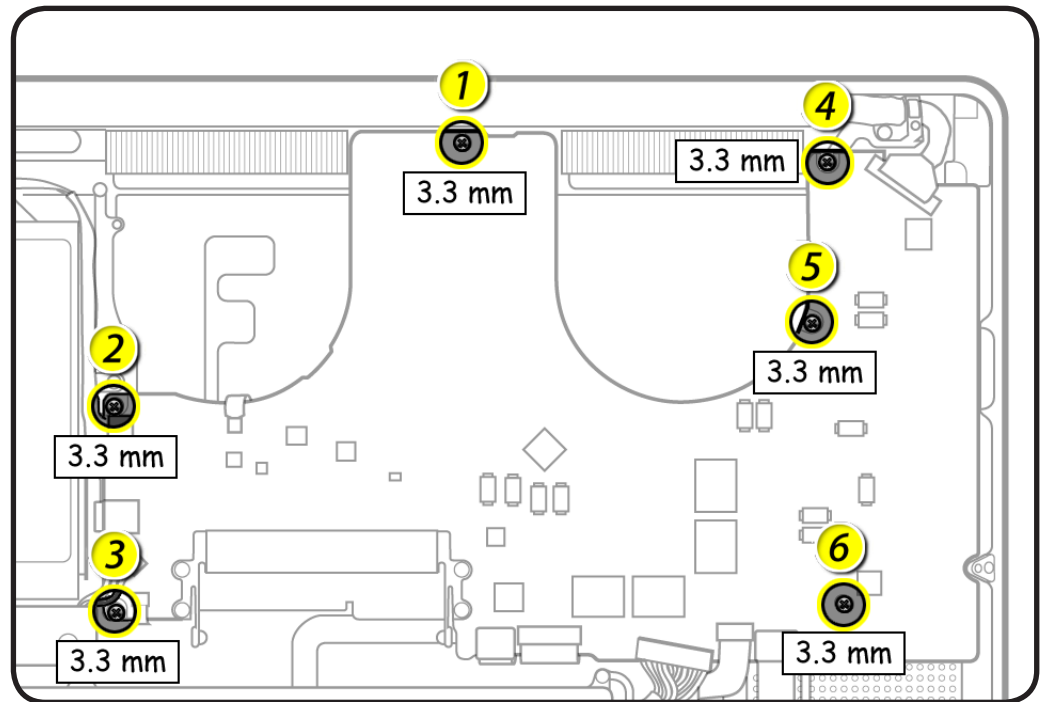
4 Connect cables securely following the instructions in **Connector Types**.

5 Use the **Blank Board Serializer tool** to set computer's serial number on new logic board.
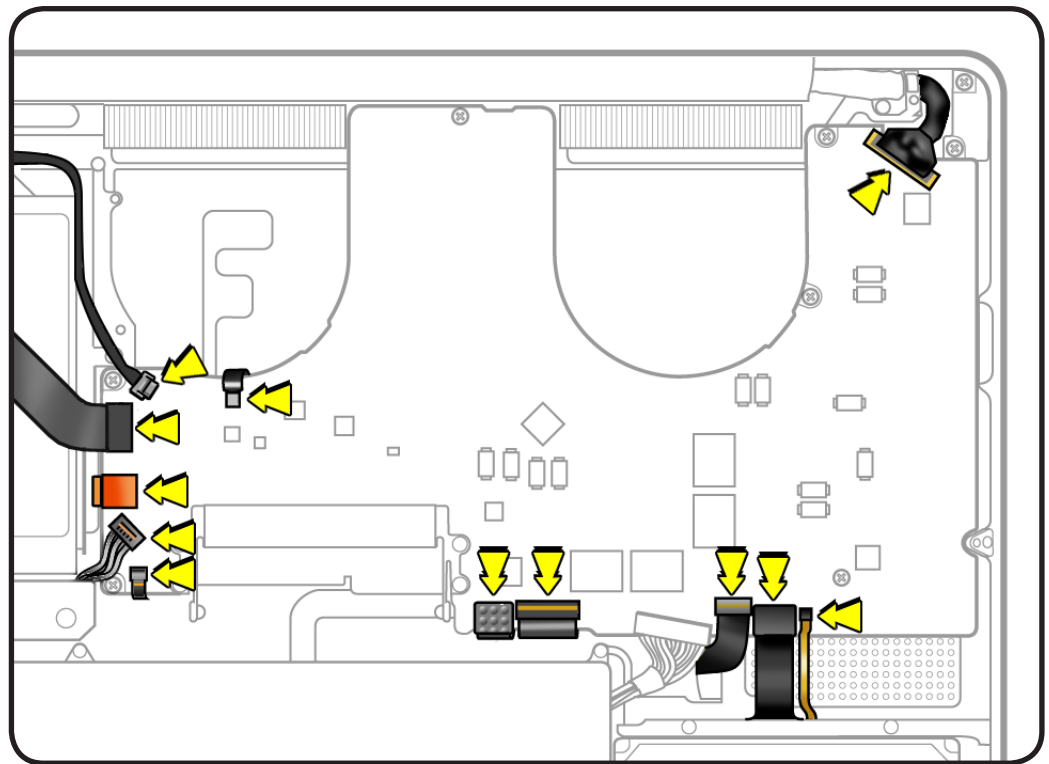
Trackpad

First Steps

Remove:
- Bottom case
- Battery
- Memory
- Fans
- Logic board

Trackpad Kit 922-9009 (922-9826, Early 2011)

includes:
- trackpad
- black label
- 10 bottom case screws
- 6 Phillips #000 (1.3-mm) screws
- 1 tri-lobe #0 set screw (1 Torx T6 set screw, Early 2011)
- 2 metal flexures
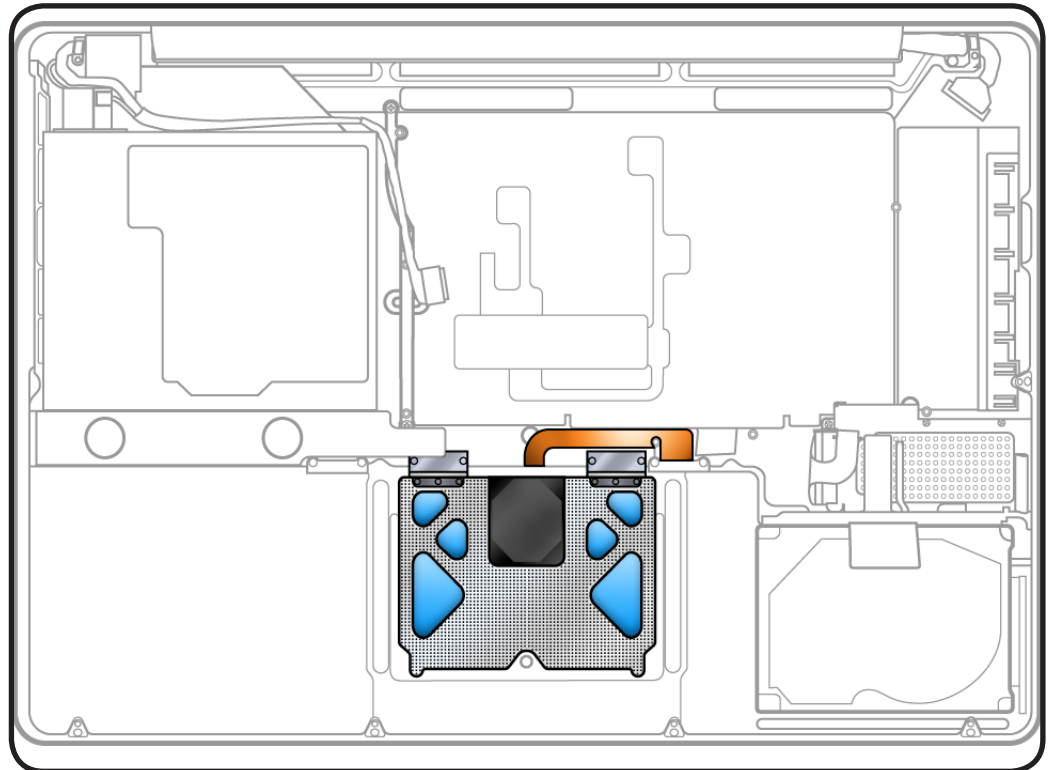
Tools

- ESD wrist strap and mat
- Sticky (Post-It) notes
- Black stick
- Large tri-lobe #0 screwdriver (922-8991)
- Magnetized Phillips #00 screwdriver
- Magnetized Phillips #000 screwdriver
- Magnetized Torx T6 screwdriver
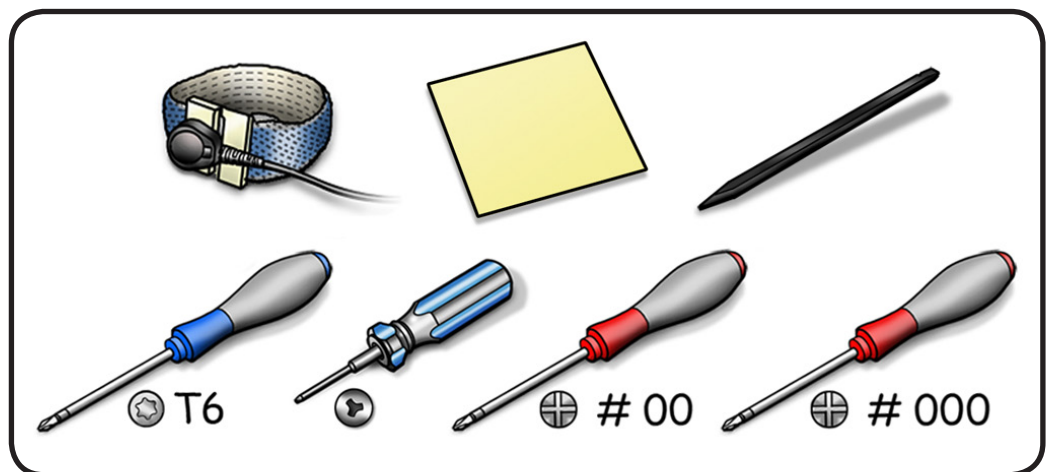
Removal

1 Remove 6 #000 (1.3-mm) Phillips screws from flexures. Discard old screws; they lose their ability to hold securely if reused.
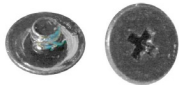
2 Remove 4 T6 (3.6-mm) 922-9539 screws from flexure stiffeners. Keep screws.

3 Remove 1 tri-lobe (T6, Early 2011) set screw. Discard old screw.

4 Slide out stiffeners and flexures. Keep stiffeners.

5 Dispose of flexures (thin metal pieces); they are matched to each individual trackpad by thickness.

3.6 mm		3.6 mm		3.6 mm		3.6 mm
2				**2**		
1.3 mm		1.3 mm		1.3 mm		1.3 mm
1				**1**		
1.3 mm				1.3 mm		

3
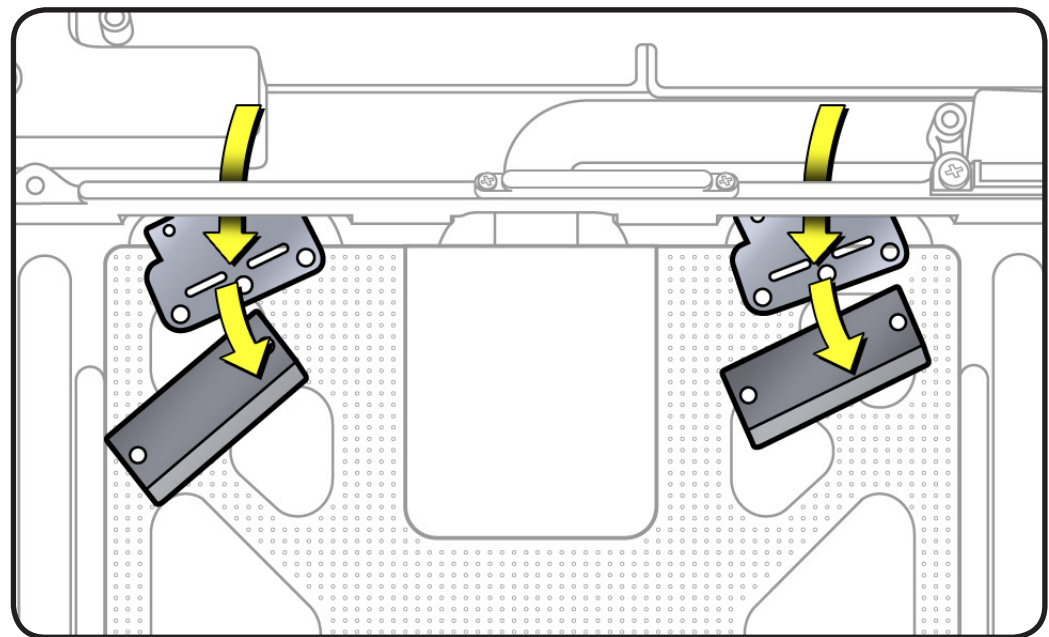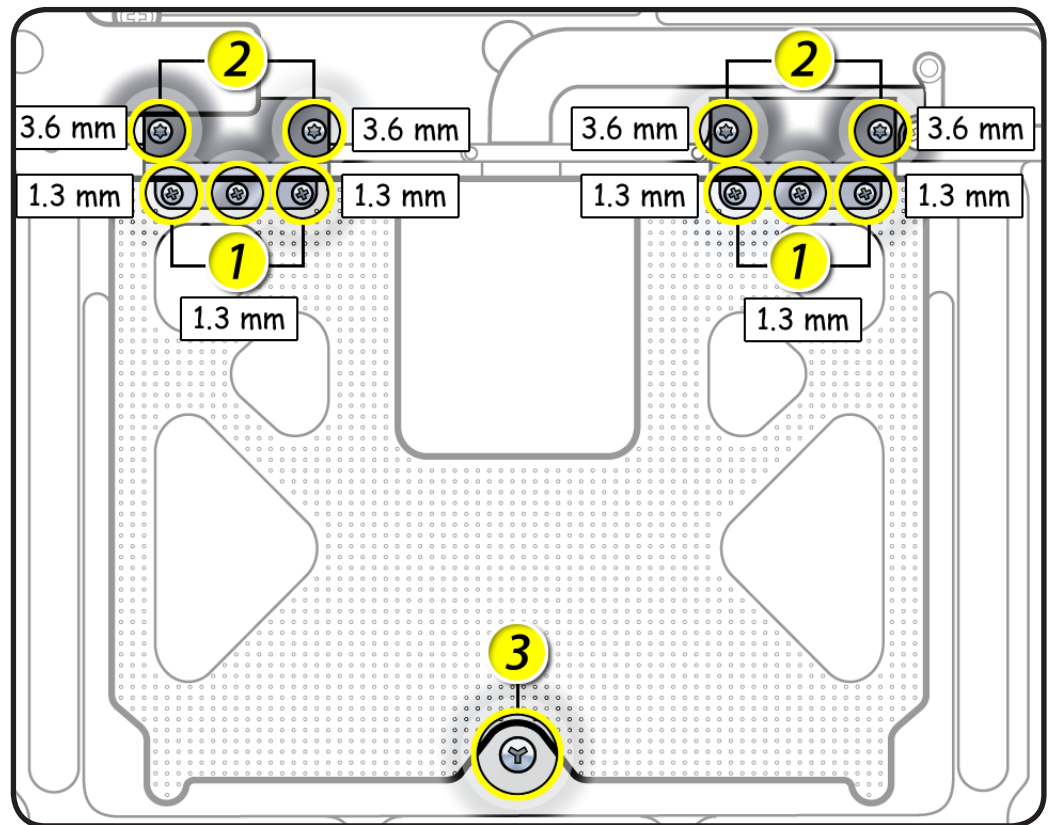
6 Carefully tilt up keyboard mylar as you peel up trackpad flex cable from adhesive on mounting ramp.

Note: If a bar code label stays stuck to adhesive, be sure to remove it.
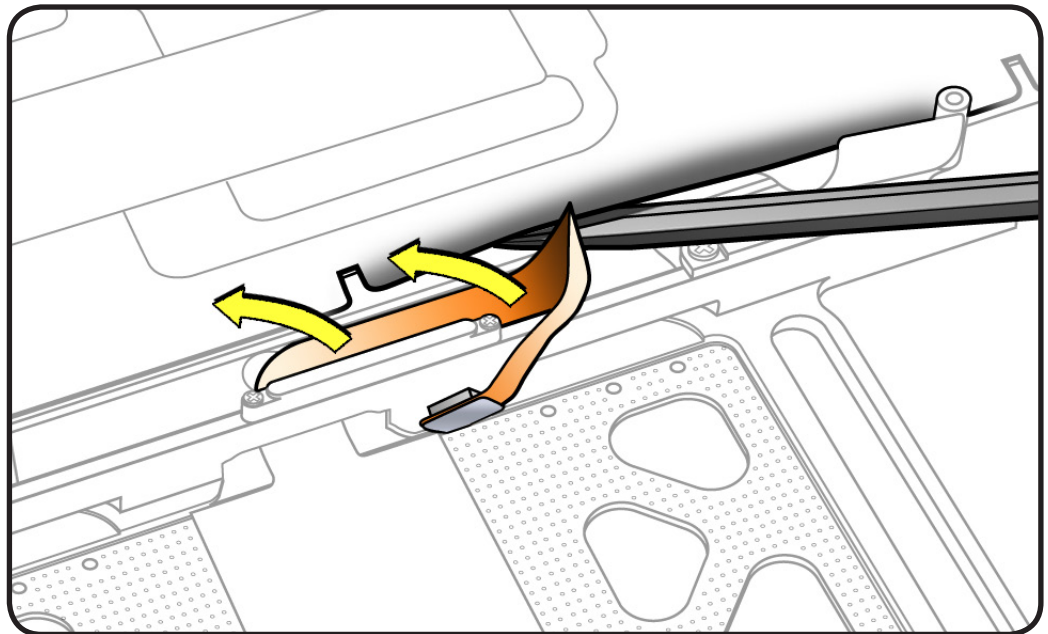
7 Hold trackpad and flex cable, and press down on edge closest to keyboard.

8 Slide trackpad down and back to clear supports in front edge of top case.
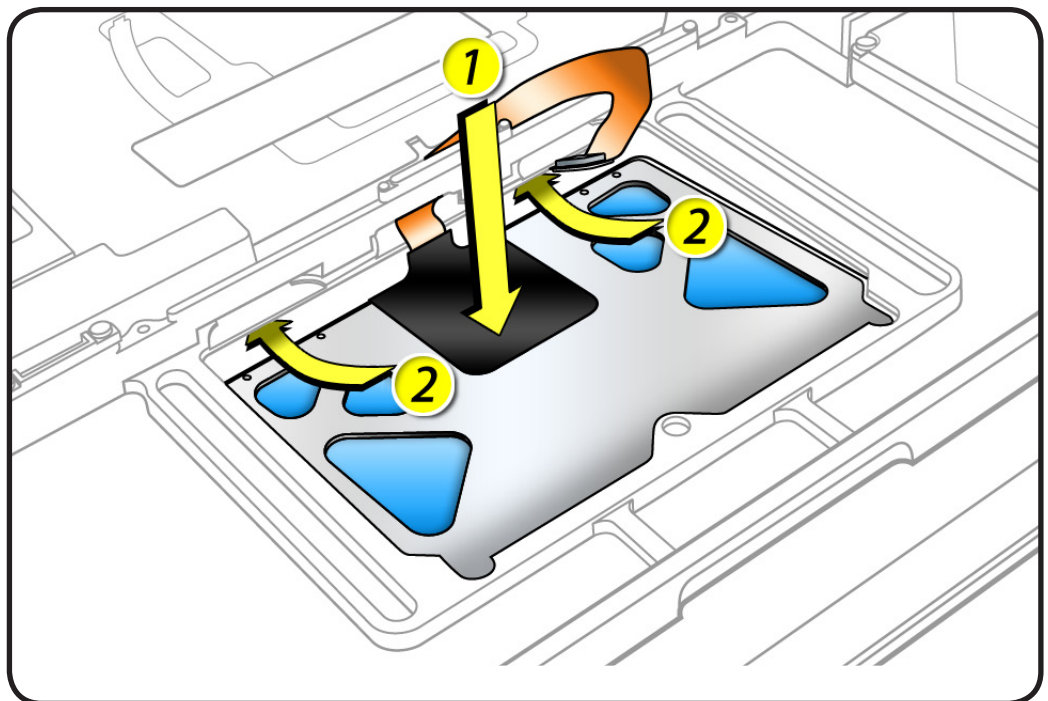
9 Tilt up top case, and spiral trackpad away from top case while carefully routing flex cable through hole.
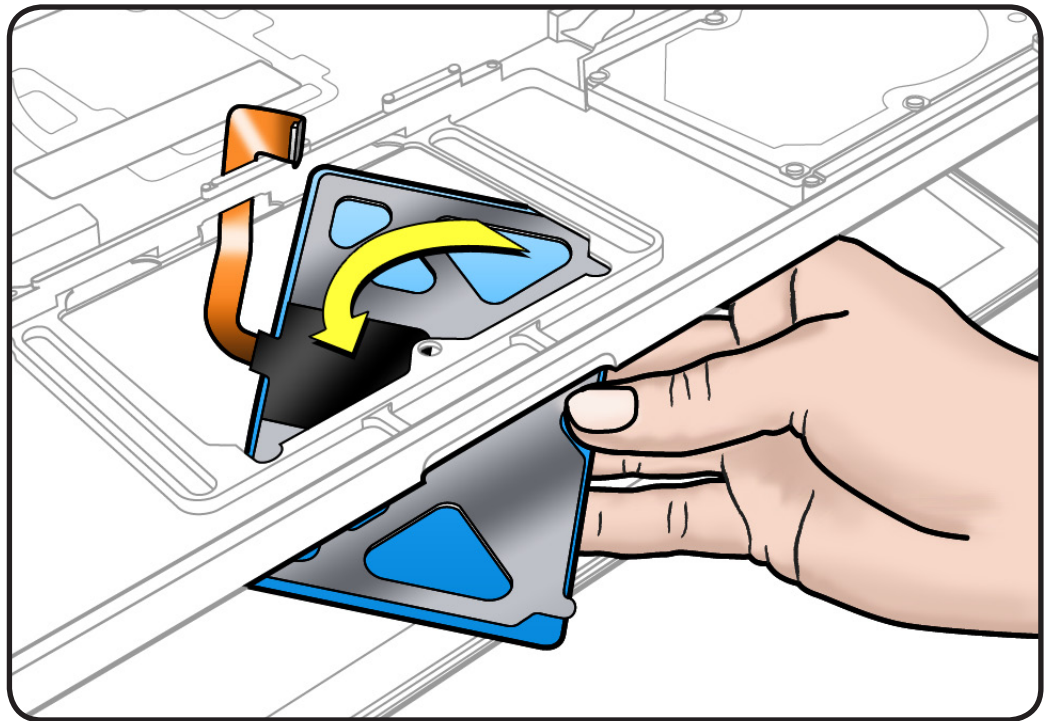
10 Clean the top case around the edge of the trackpad to eliminate accumulated debris. Debris may restrict trackpad movement and hinder clicking motion..
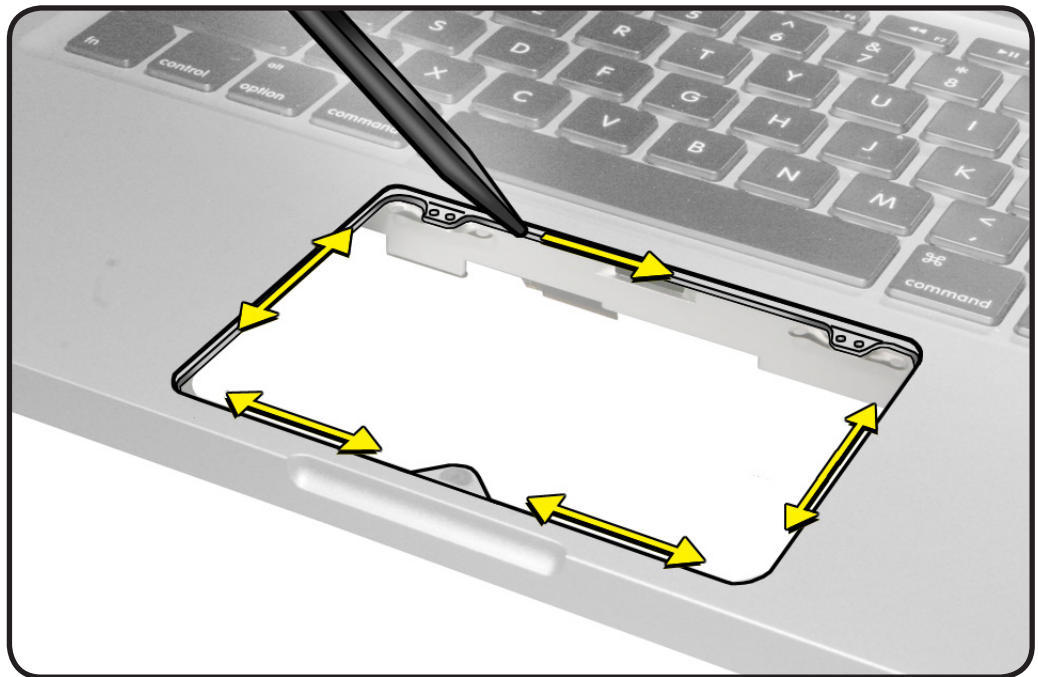
Reassembly

Important: Dispose of old flexures, 6 short Phillips screws, and 1 tri-lobe set screw, and only use new ones included with trackpad kit.

1 Peel and adhere black label (included with new trackpad) to cover trackpad stiffener as shown.
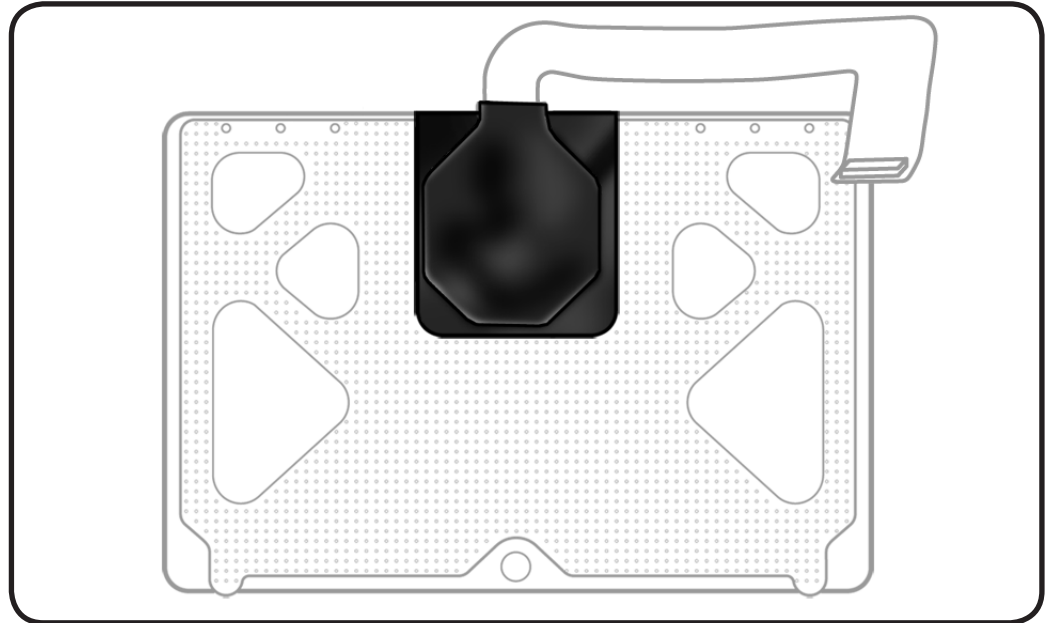
2 Align new flexures on positioning posts.

Note: This procedure will take patience and a steady hand. Try supporting the delicate flexures with a black stick.
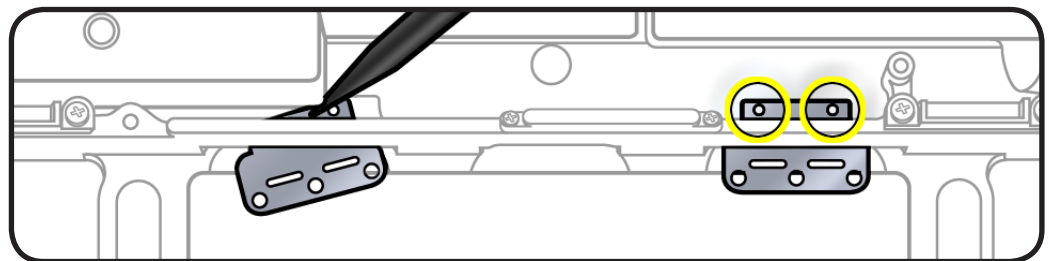
3 Slide stiffeners over the flexures and align the screw holes.
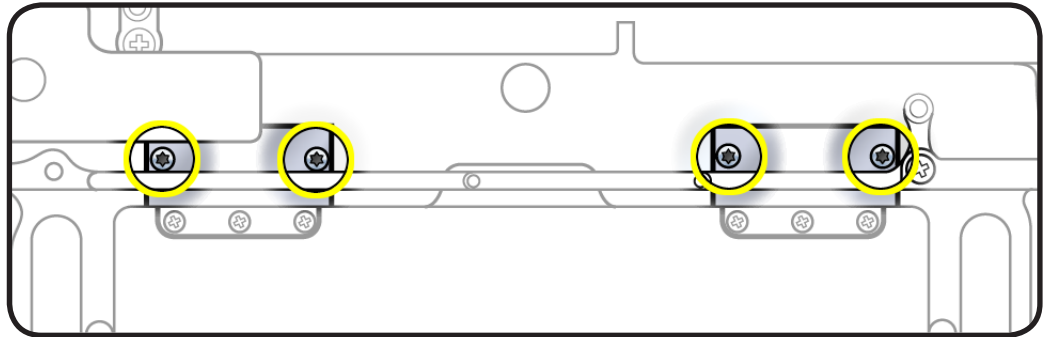
4 Tighten 4 Torx T6 screws on stiffeners.

5 Carefully route flex cable through guide hole.

6 Spiral and pivot trackpad into place, inserting front edge first.

Important: Minimize rubbing edges of trackpad against top case while installing. This could cause invisible cracks to form in the glass of the trackpad.
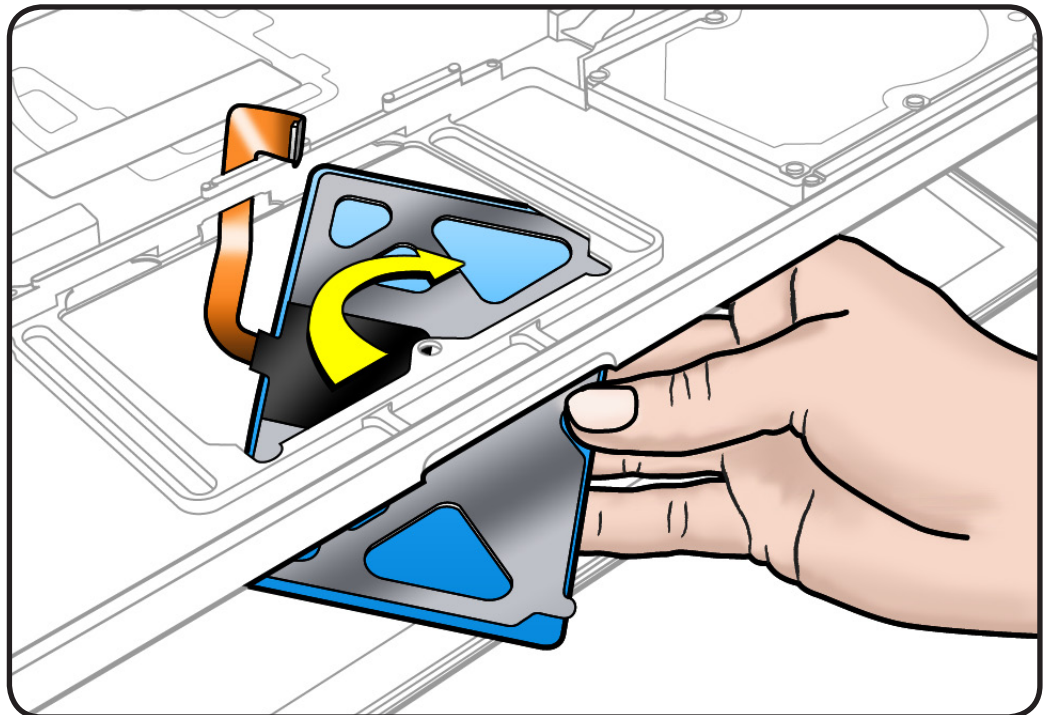
7 Loosely insert 6 short Phillips #000 screws into flexures. Do not tighten yet.
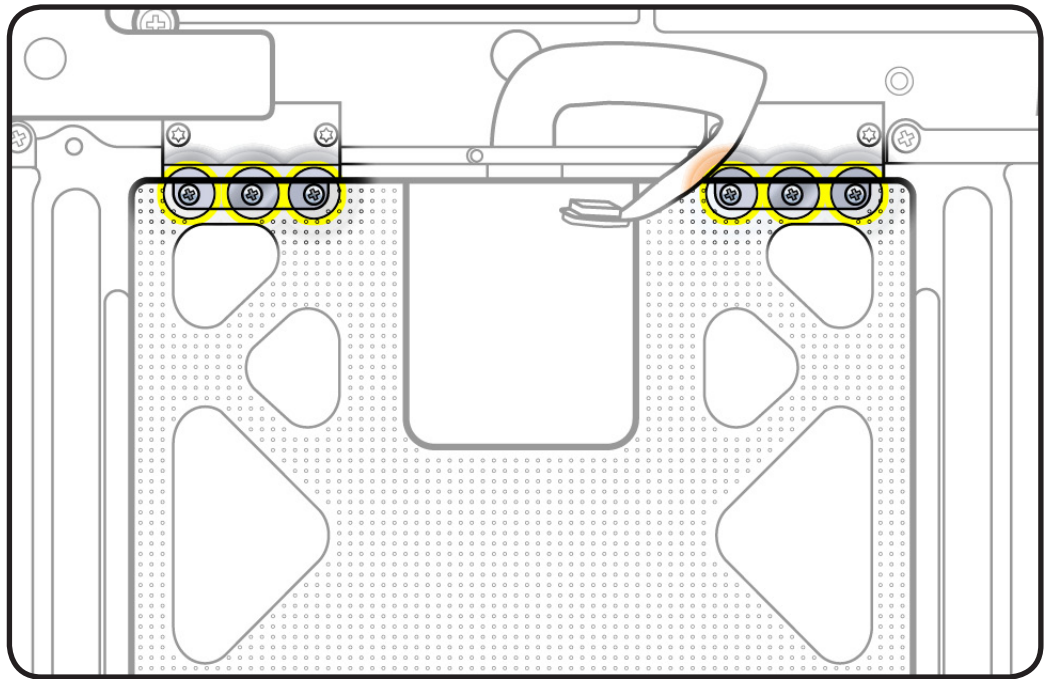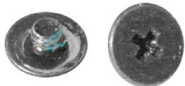
8 On the palm rest, insert one sticky (Post-It) note into gap on each of the four sides of trackpad.
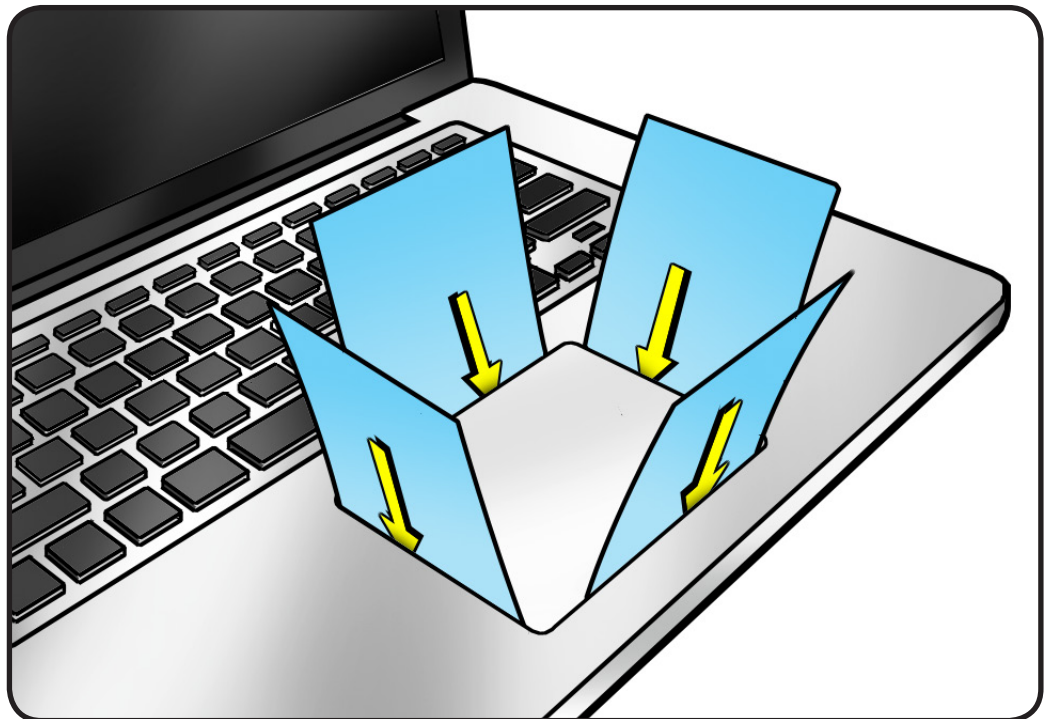
9 Fold sticky notes over so that top case can be laid flat.
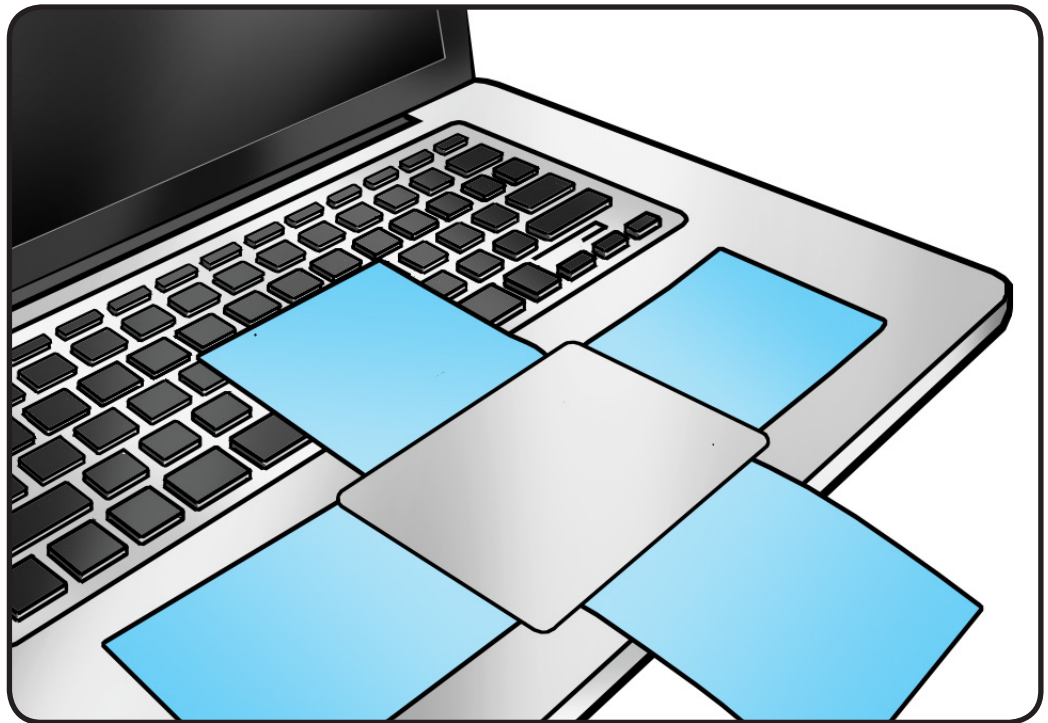
10 Tighten 6 short Phillips #000 screws at flexures.

11 Inspect that gaps between trackpad and top case are even on all sides. If not, loosen screws and adjust.
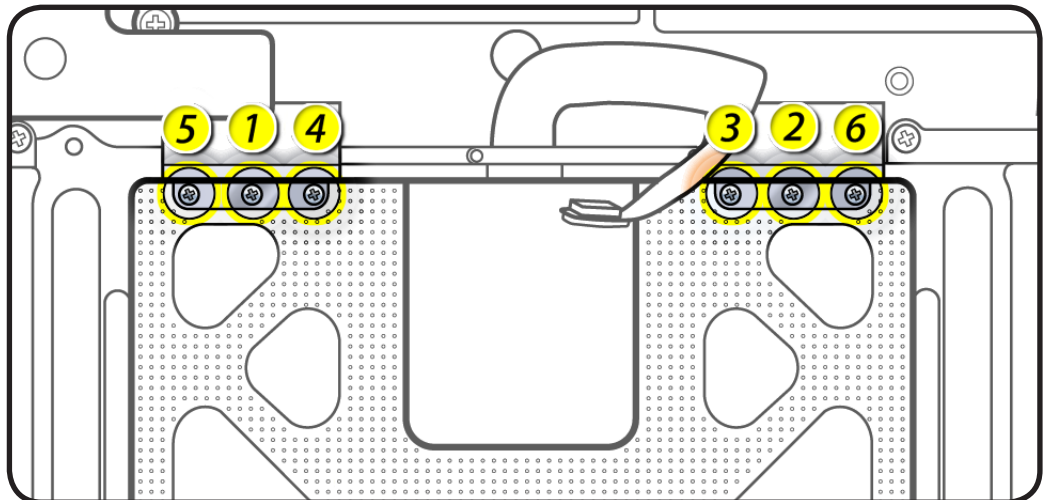
12 Insert tri-lobe #0 (Mid 2010) or T6 (Early 2011) set screw.

13 Slowly turn set screw in small increments until trackpad has a normal clicking motion.
Important: Do not overtighten set screw or you may damage trackpad.
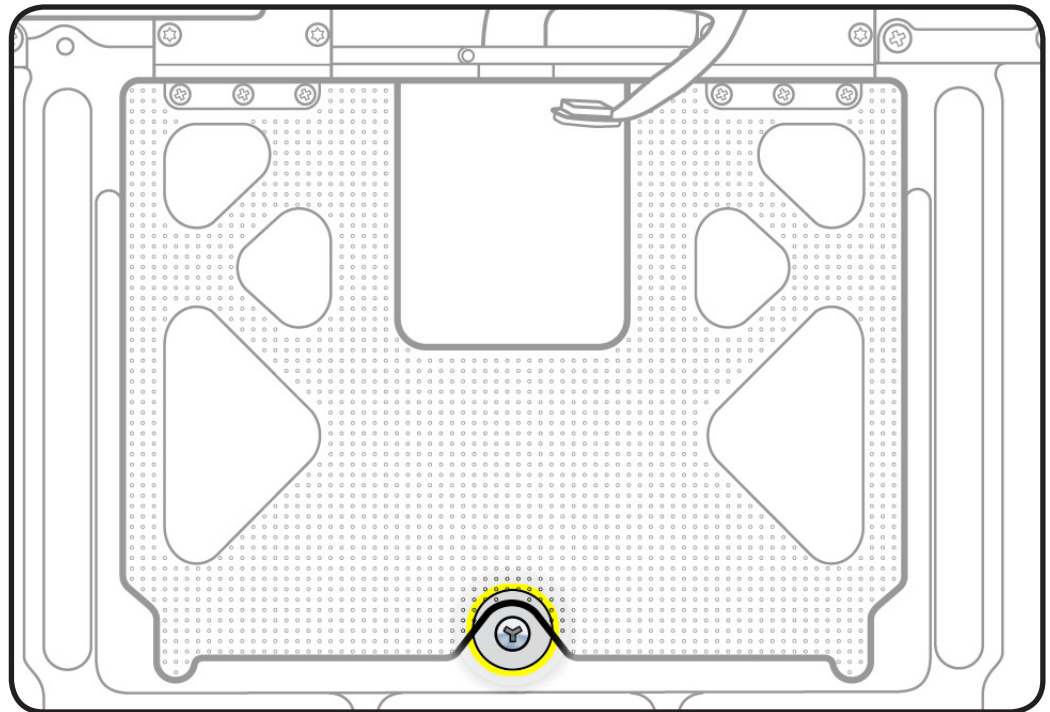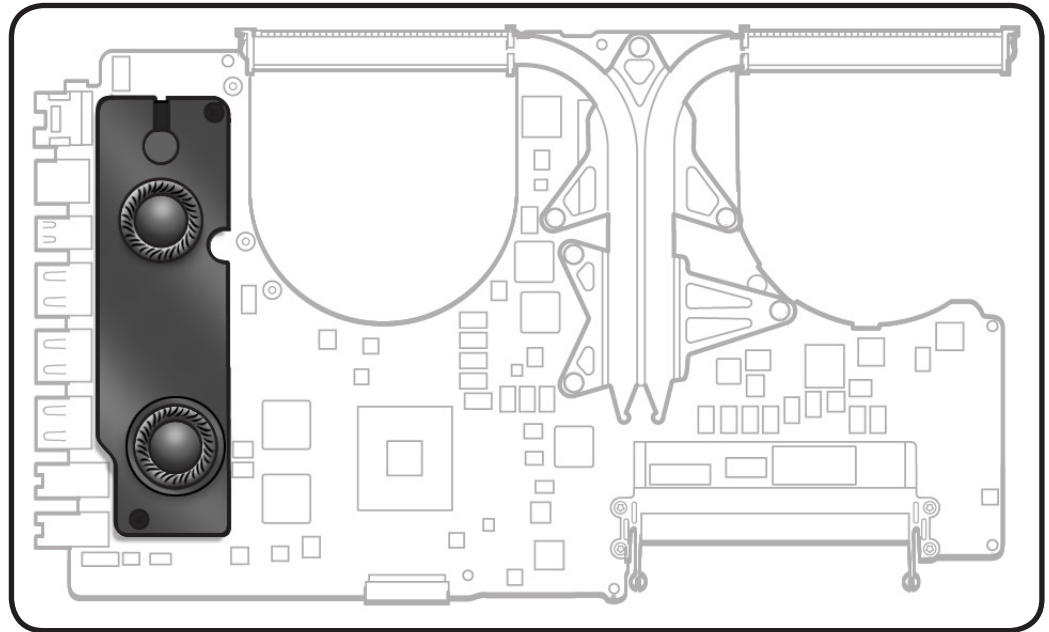
14 Adhere flex cable to mounting ramp.
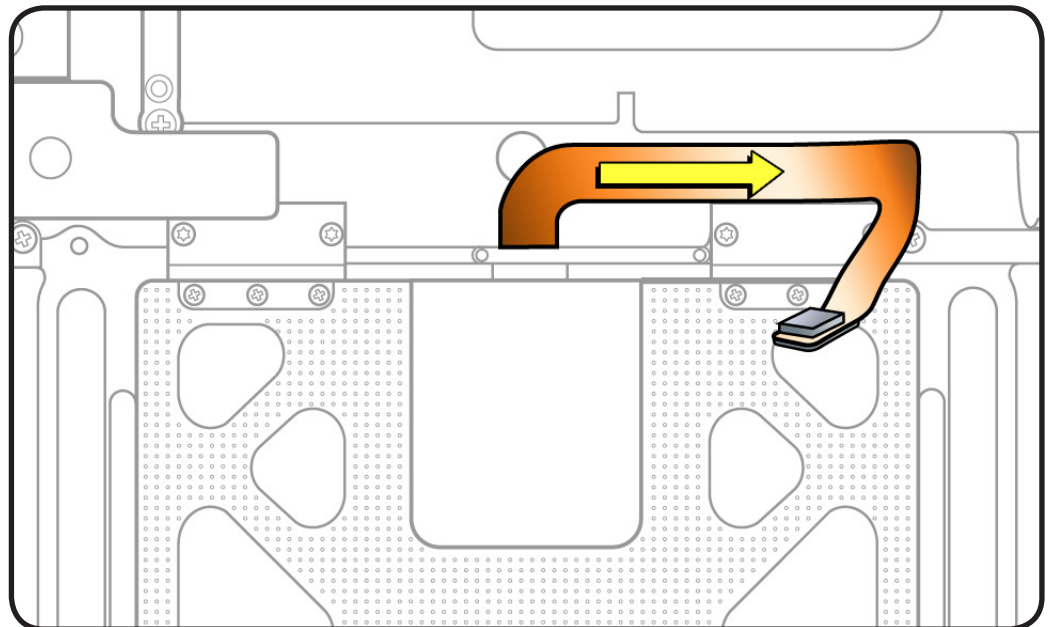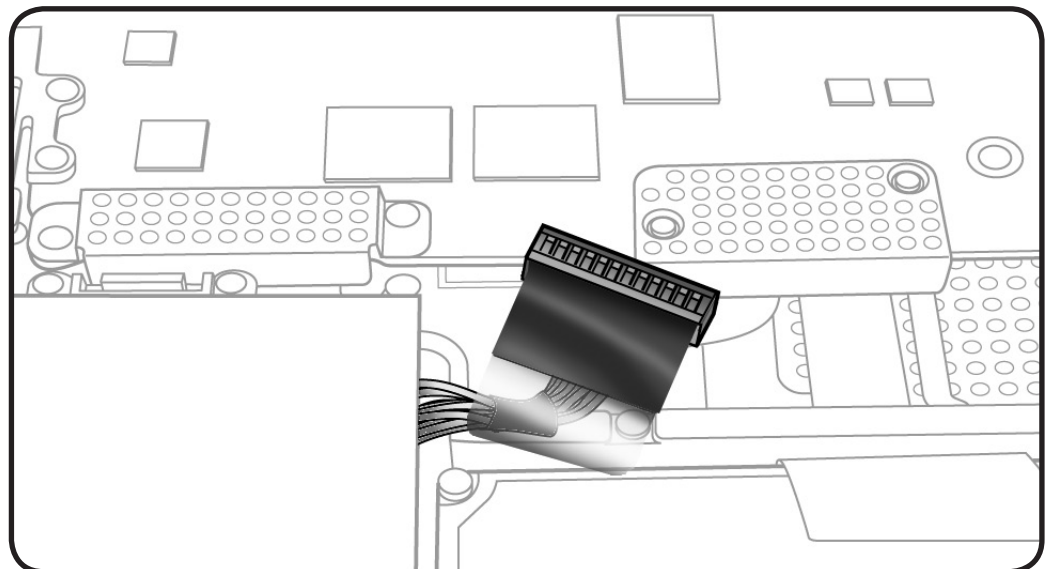
MagSafe Board

First Steps
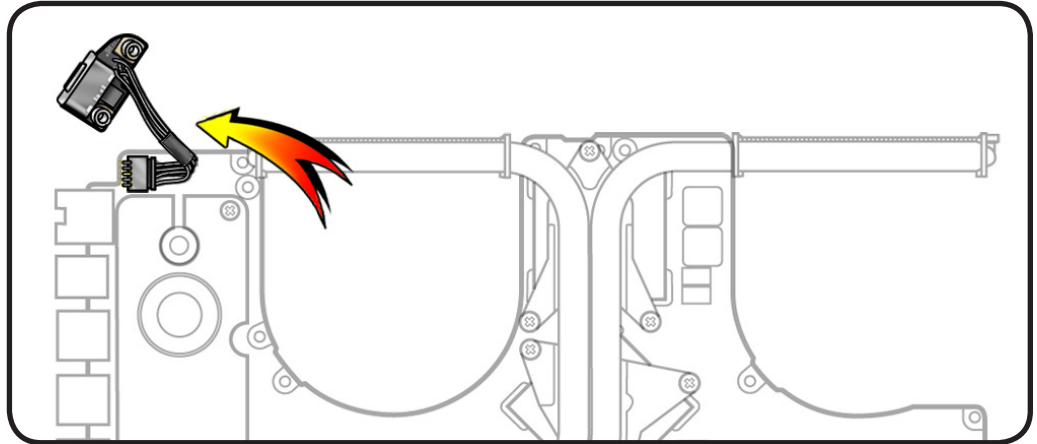
Remove:
- Bottom case
- Memory
- Fans
- Logic board

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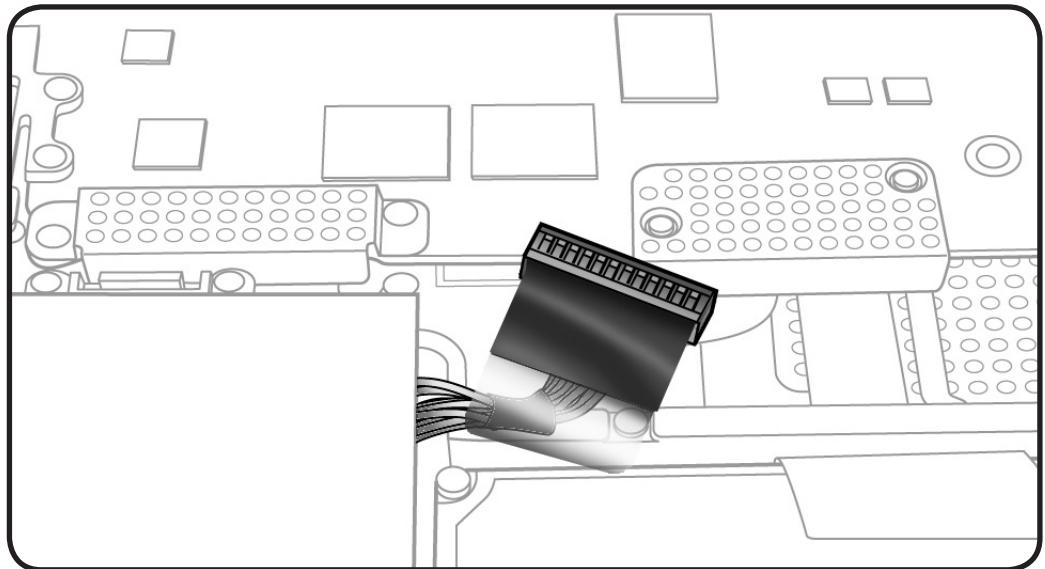
Tools

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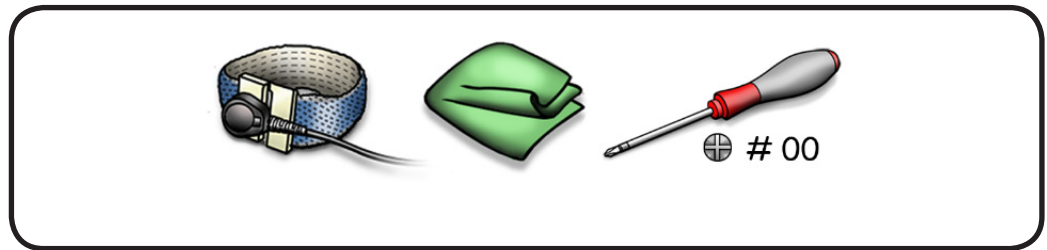
Removal

Note: Although logic board is pictured here in relation to MagSafe board, the logic board would already be removed.

1 Remove 2 (7.6-mm) 922-8929 screws.

2 Lift out MagSafe board.

7.6 mm

7.6 mm
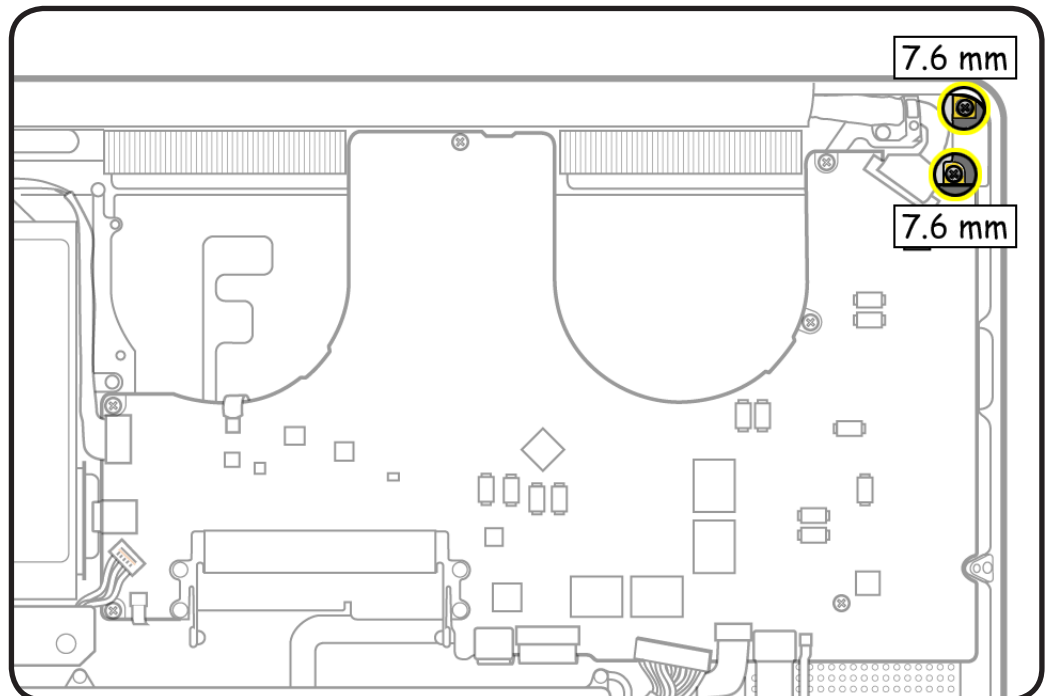
Reassembly

Caution: Plug in a **disconnected** adapter cable.

⚠️

1 Making sure power is cut off, install MagSafe board screws.

2 Test port alignment by plugging in power cable from 4 angles.
- If port is off center and cable does not seat securely, loosen MagSafe screws, realign port with cable in place, and secure screws.
- If port seats correctly, continue.

3 Connect MagSafe cable to logic board.

4 Install logic board and remaining parts.

5 With computer fully assembled, test power with power cable.
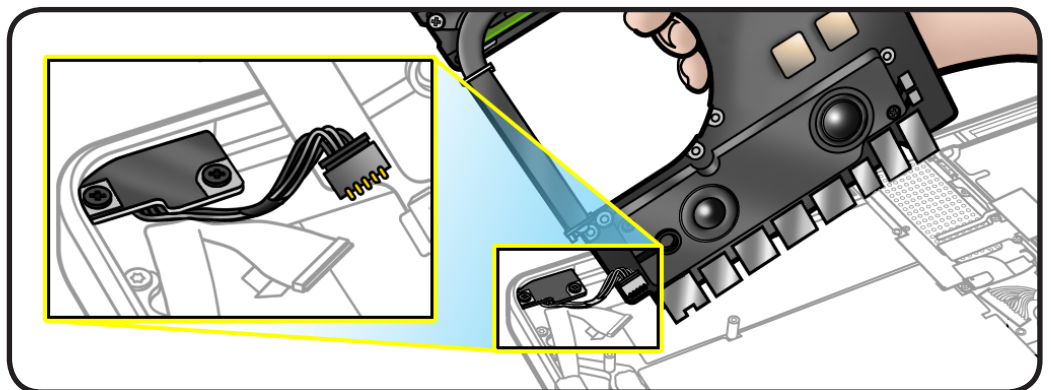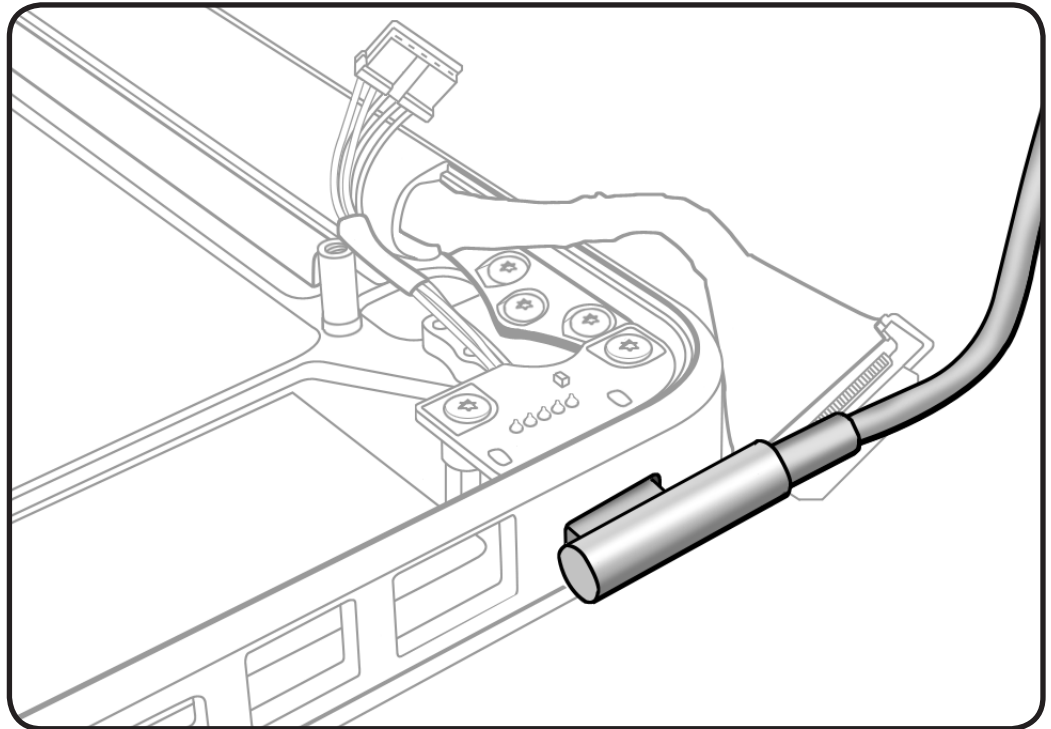
Heatsink

First Steps

Remove:
- Bottom case
- Memory
- Fans
- Logic board
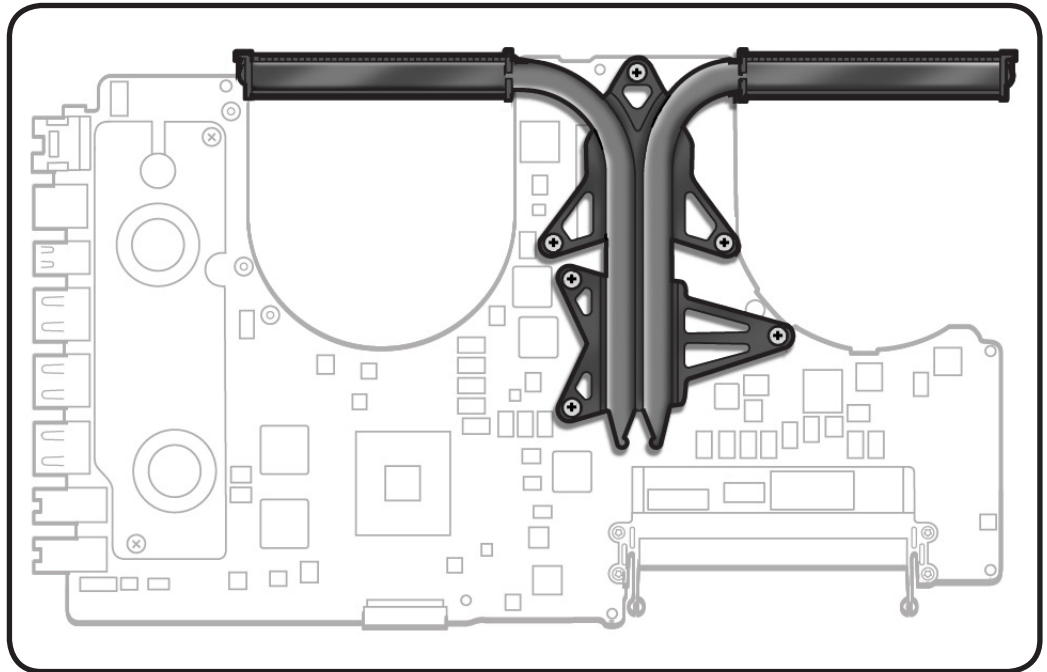
Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.
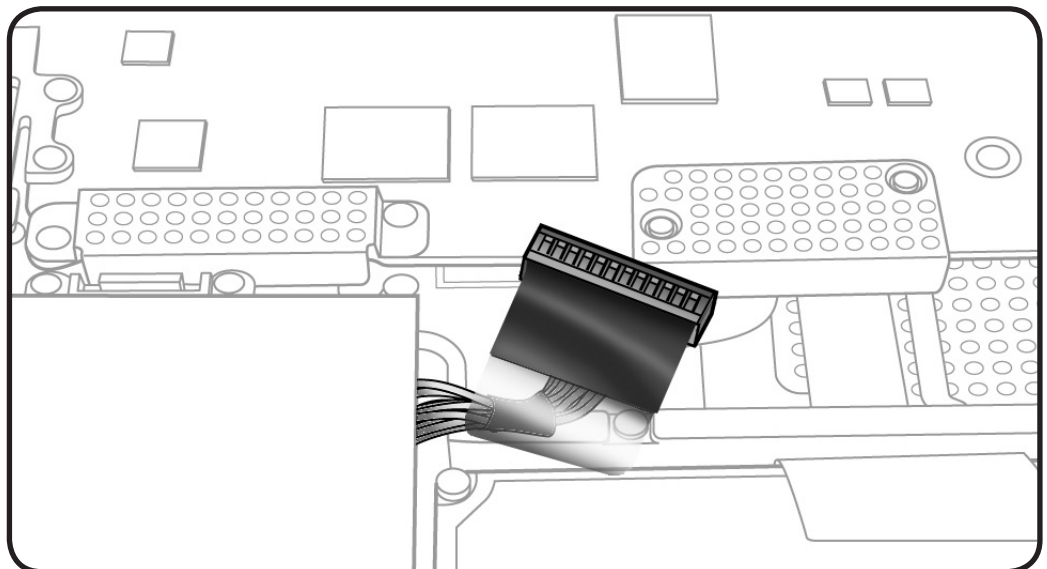
Tools

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

⊕ # 00 / 1
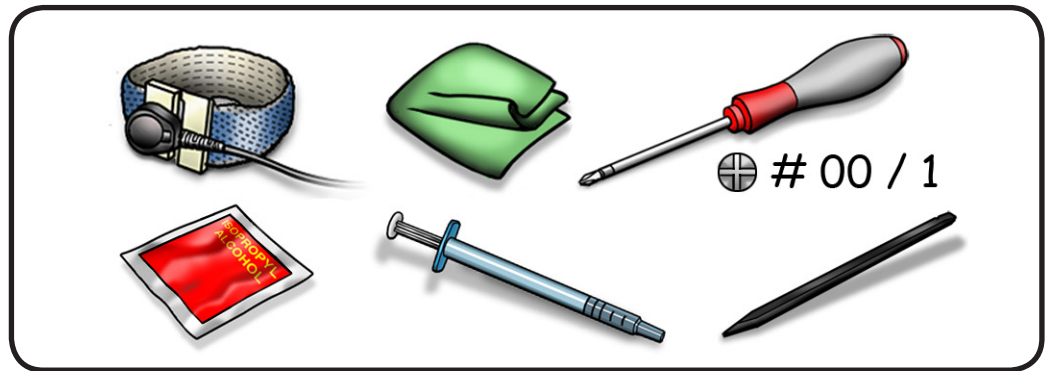
Removal

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

1 Remove 6 (8.35-mm) screws.

> **Note:** Screws are in heatsink kit and are not offered separately.
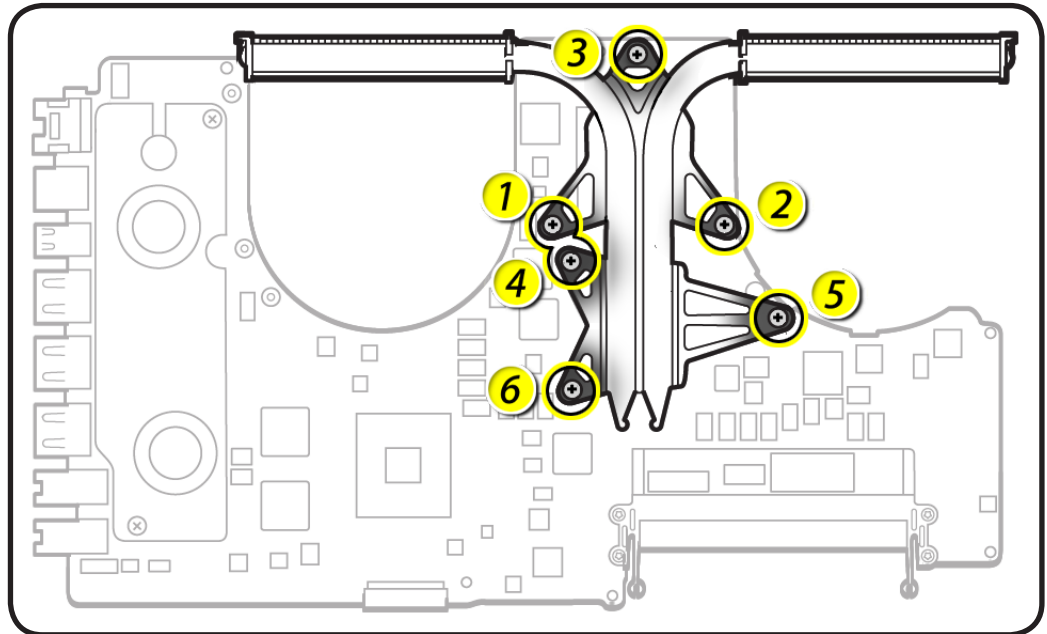
Important: The heatsink shape and screw sequence for the Early 2011 model is shown at right.
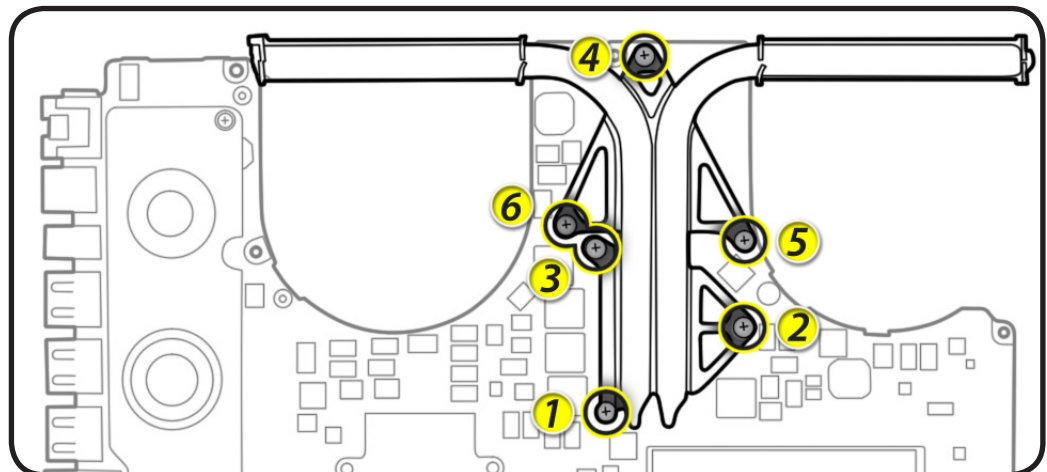
2 Keeping heatsink parallel to logic board, gently wiggle the heatsink to loosen the bond to the board.
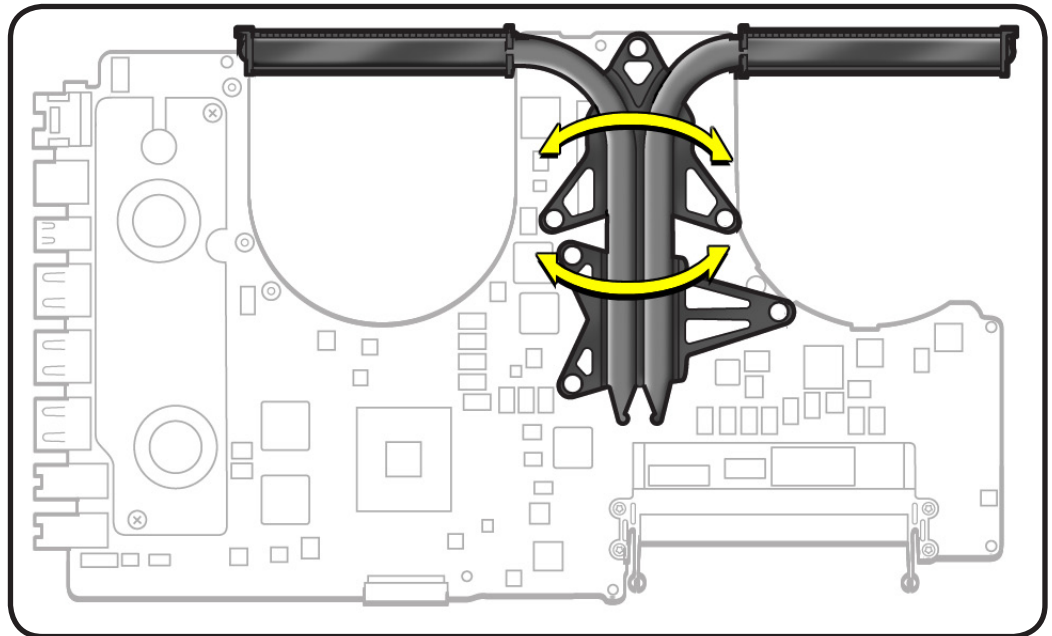
3 With a black stick, scrape off thermal grease and use alcohol pad to clean thermal pads and chips.
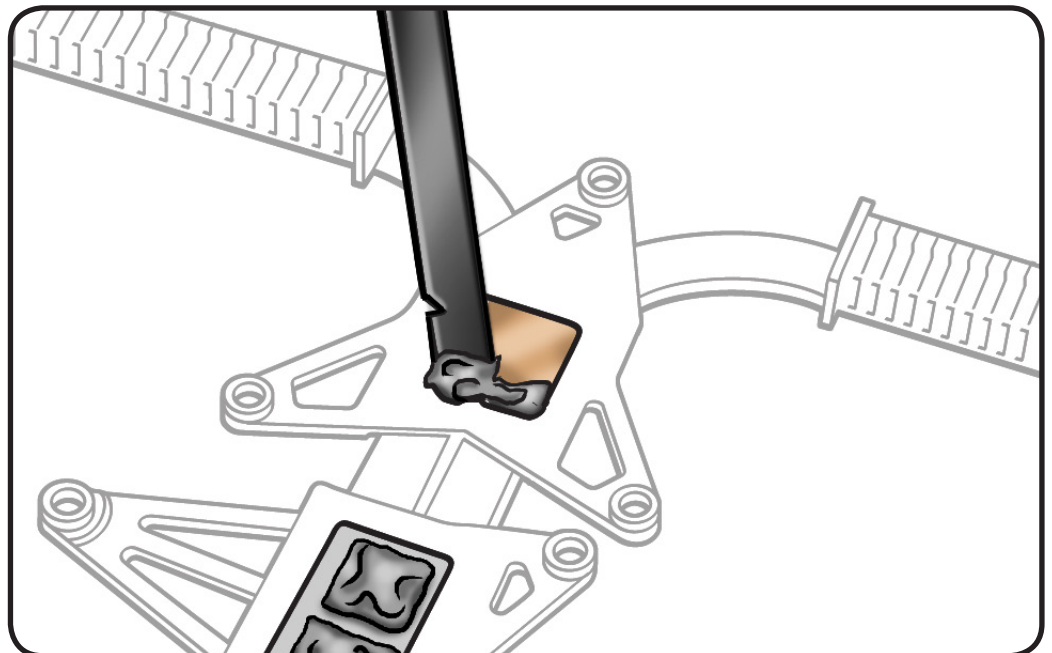
Reassembly

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 chips. Use a pen to mark the syringe in thirds.
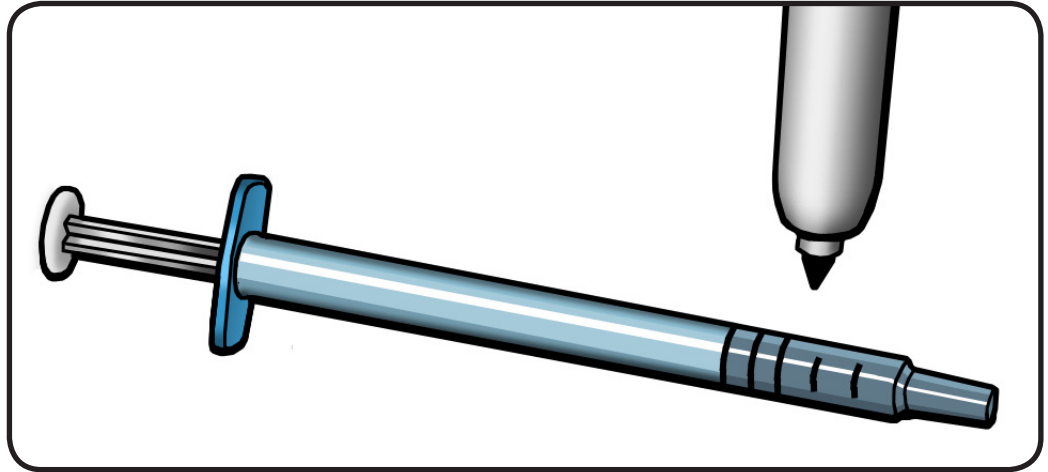
2   Inject 1/3 of grease on the center of each chip

3   Lower the heatsink over the logic board.
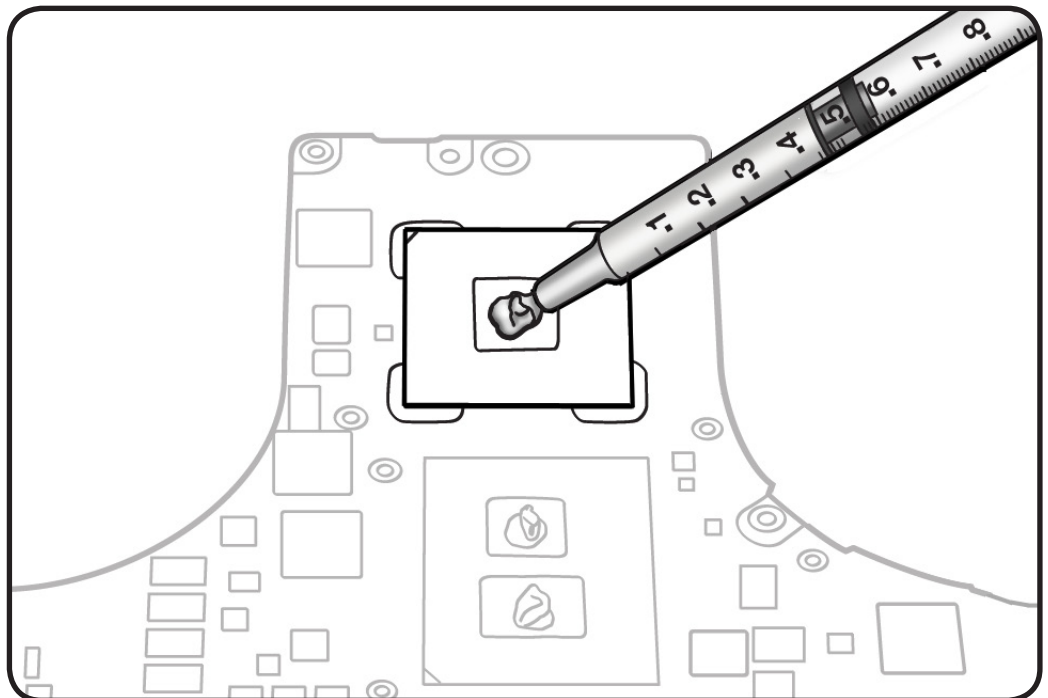
4 Install heatsink screws in order, 1/2 way first, then tighten the rest of the way.
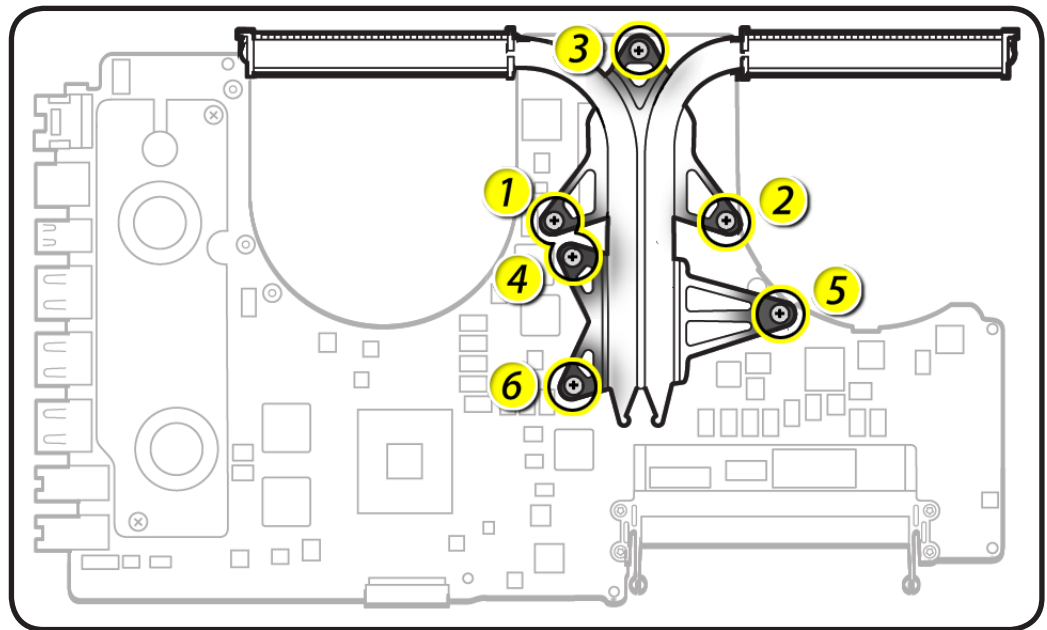
Screw Sequence, Early 2011
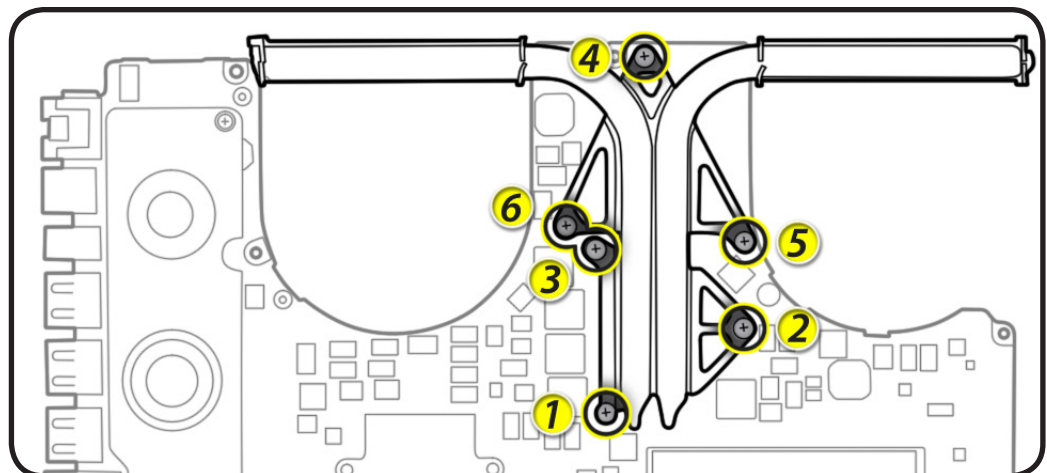
Left Speaker

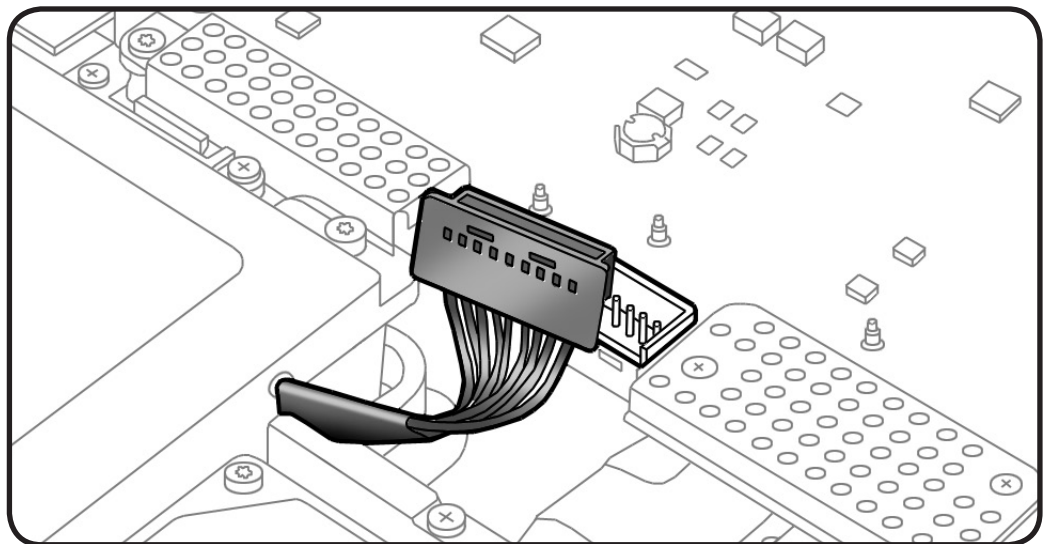## First Steps

Remove:
- Bottom case
- Memory
- Fans
- Logic board

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

Tools

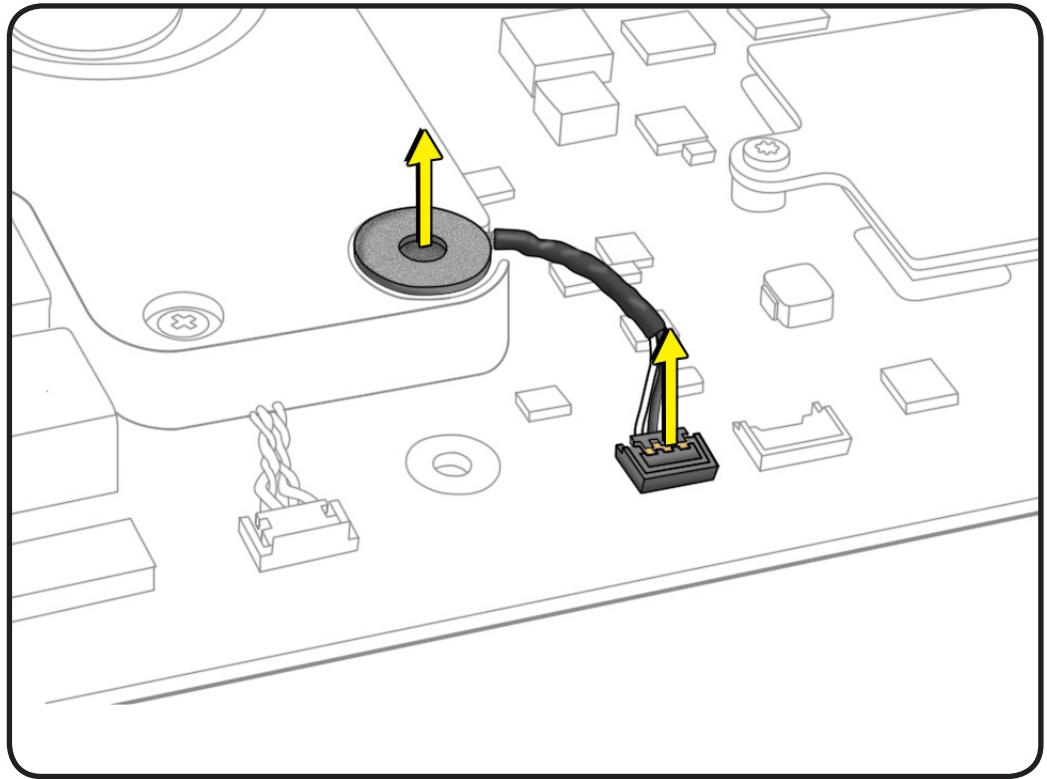- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Black stick

⊕ # 00

Removal

Note: Do not touch the soft speaker cone.

1 Disconnect 2 cables:
- microphone
- speaker
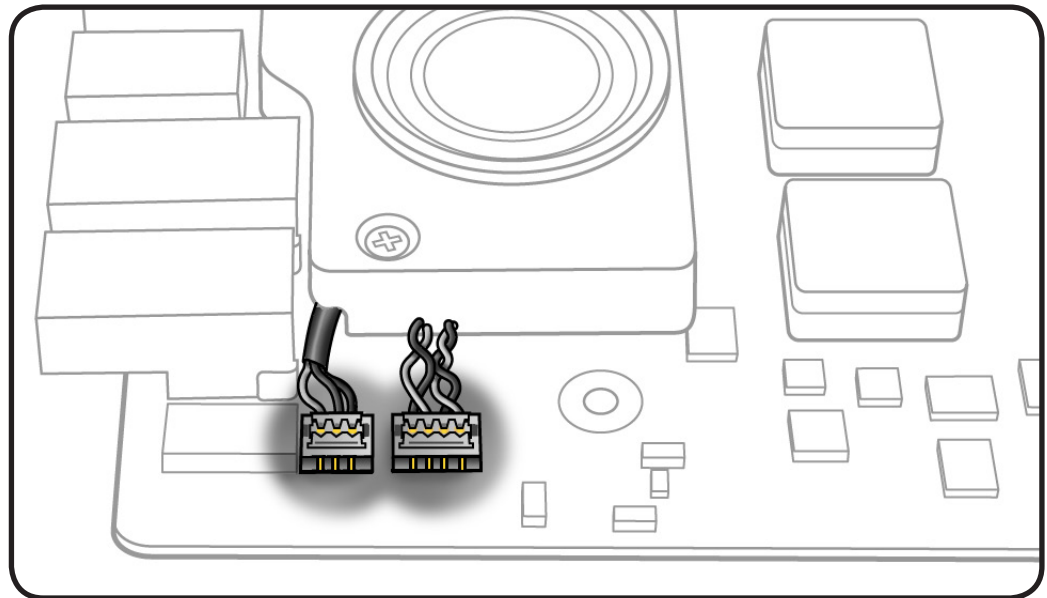
Important: The microphone location differs for the Early 2011 model, shown at right.
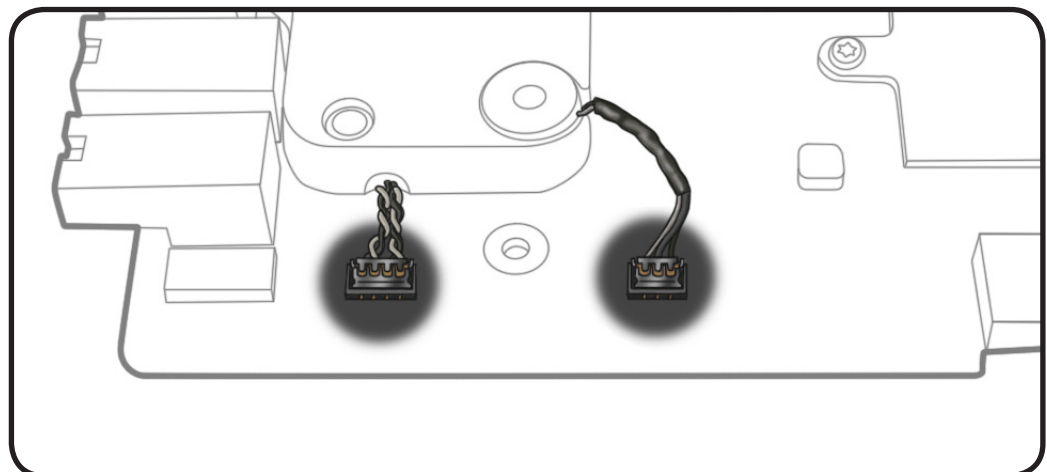
2 Remove 2 (8-mm) 922-8720 screws.

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

8 mm

8 mm
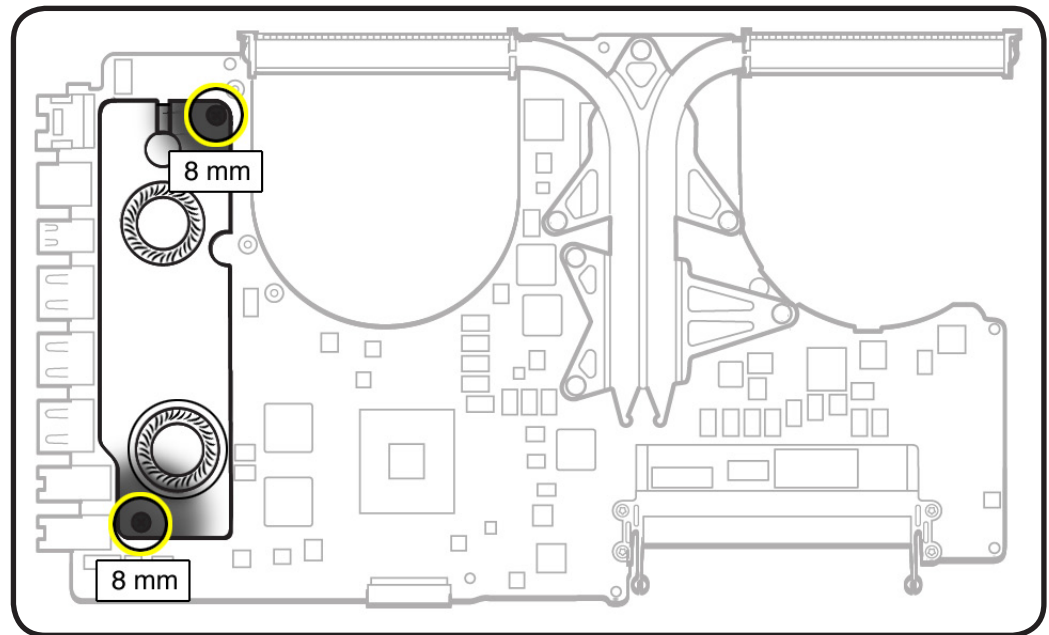
Microphone Cable, Mid 2010

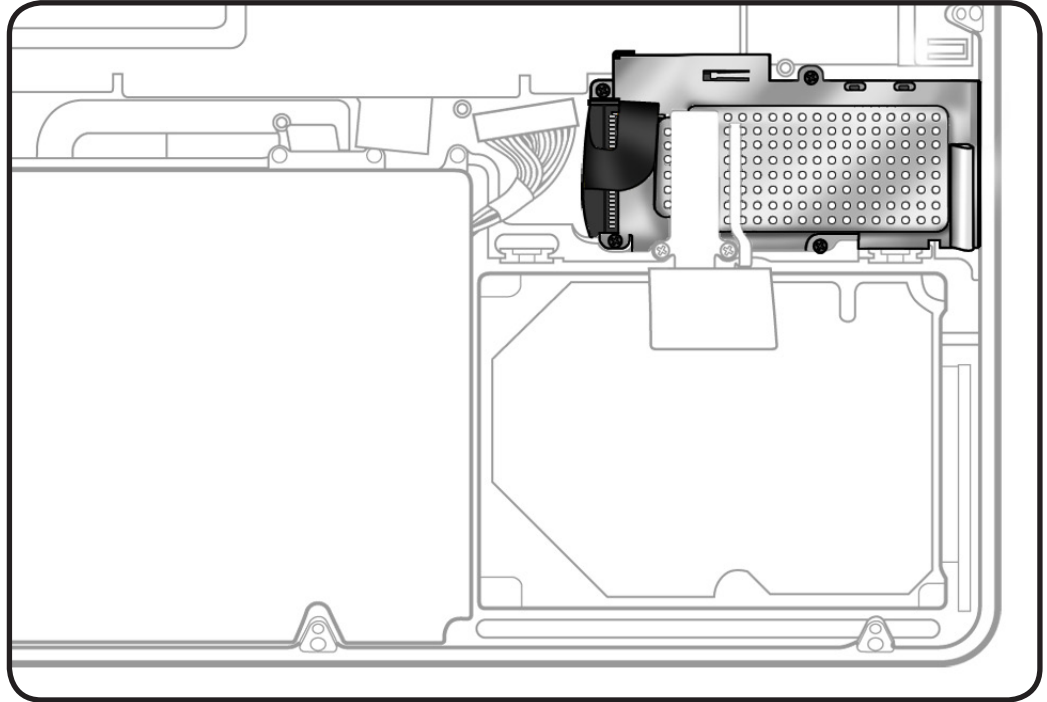## First Steps
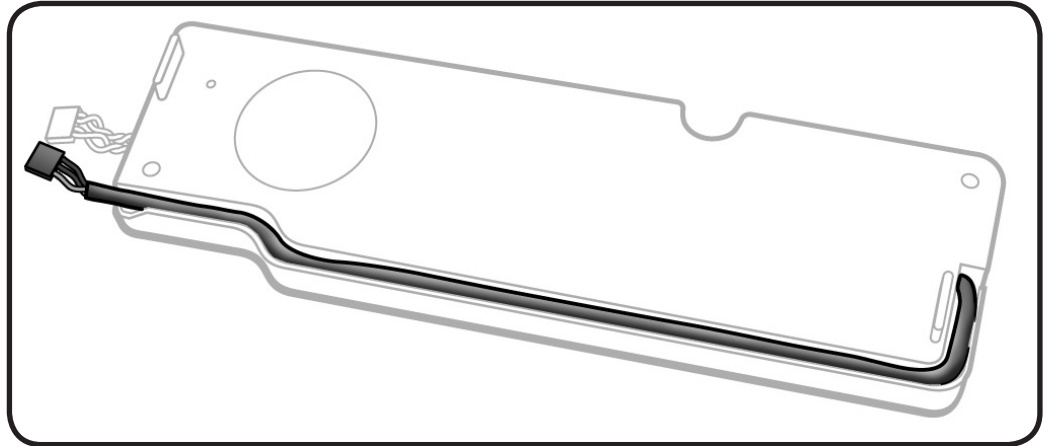
Remove:
- Bottom case
- Memory
- Fans
- Logic board
- Left speaker

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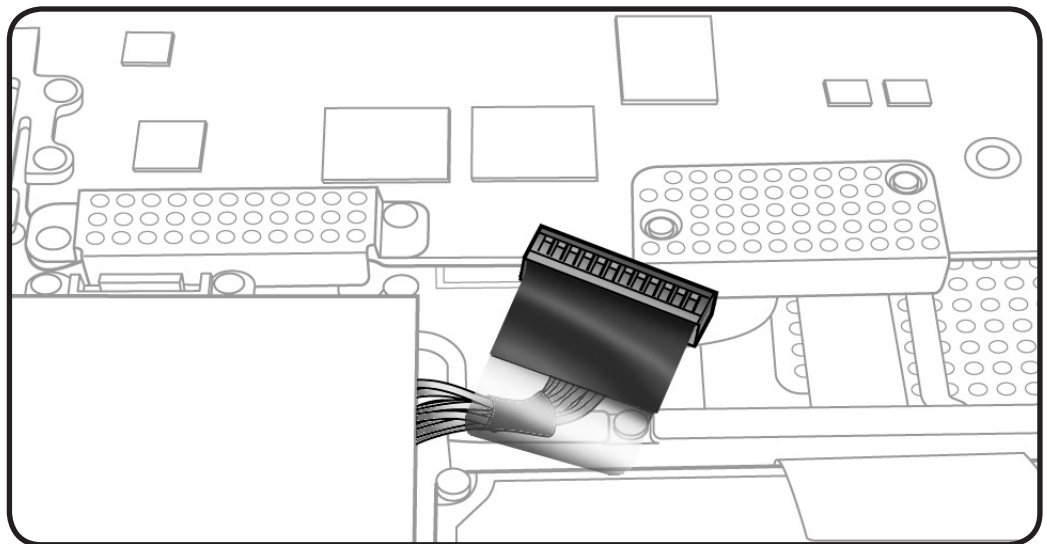
Tools

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

Removal

Note: Do not touch the soft speaker cone.

1 Unroute microphone cable.

   Reassembly Note: When transfering microphone cable to speaker, make sure cable is recessed within speaker body.
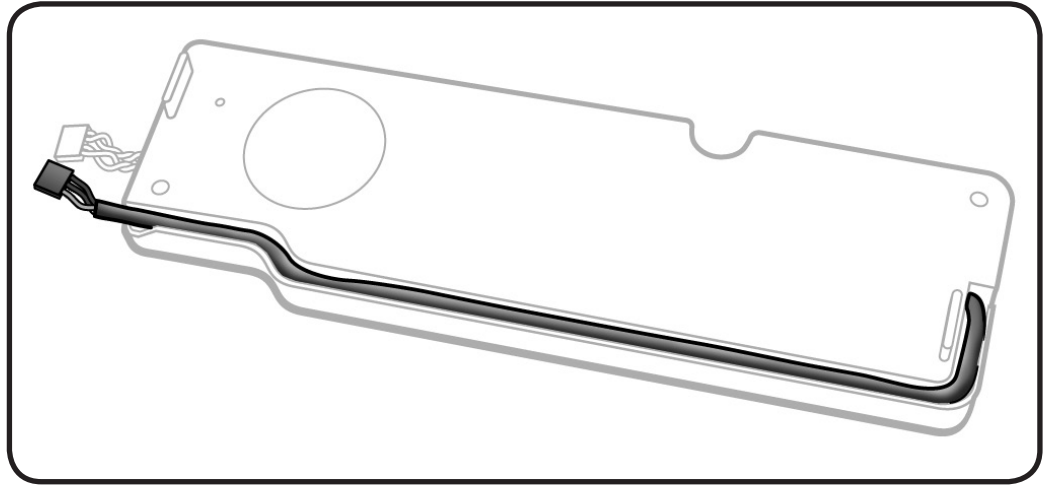
2 Turn over speaker, and carefully pry up the microphone gasket.
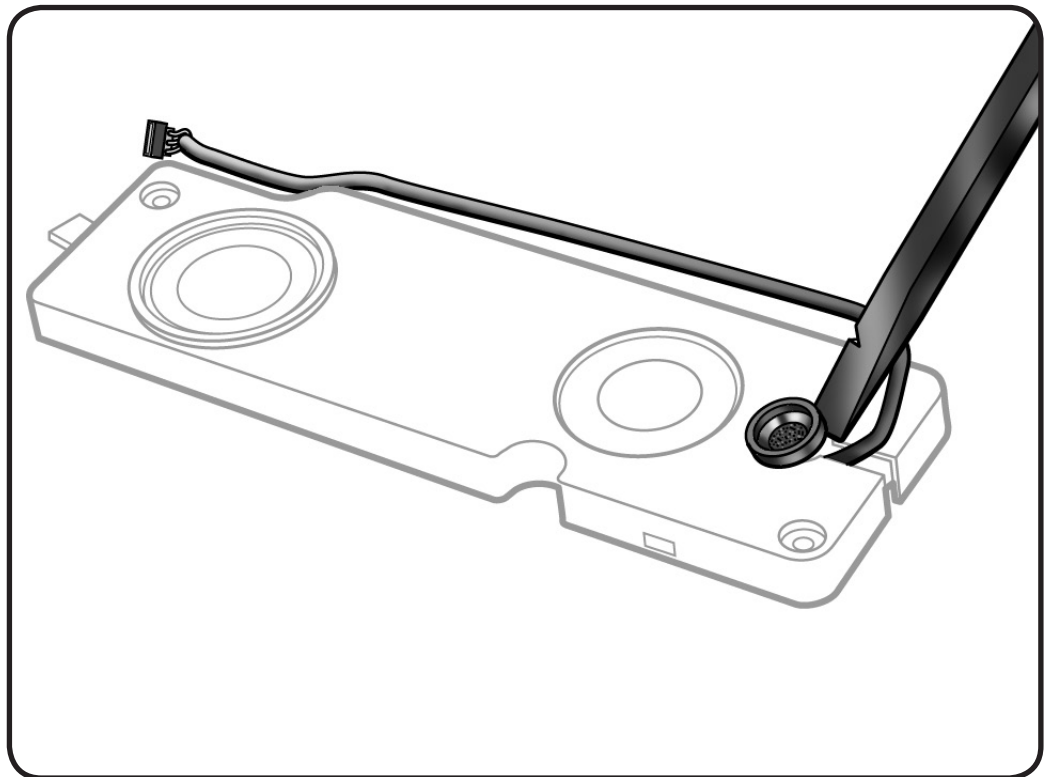
Microphone Cable, Early 2011

First Steps
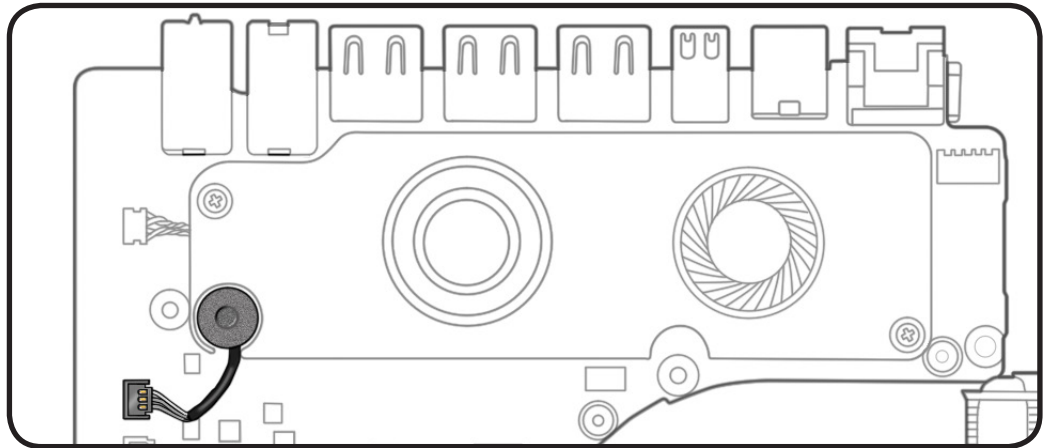
Remove:
- Bottom case
- Memory
- Fans
- Logic board
- Left speaker

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

Tools

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

Removal

Note: Do not touch the soft speaker cone.

Disconnect microphone cable and lift out gasket from speaker body.

ExpressCard Cage

First Steps

Remove:
- Bottom case
- Memory
- Fans
- Logic board
- Rear hard drive bracket

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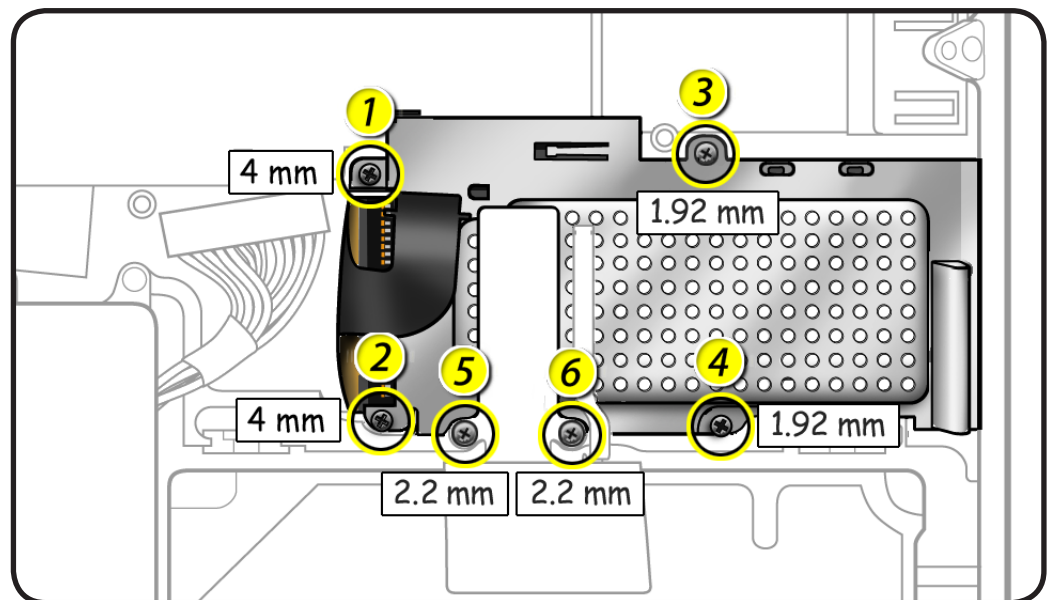
Tools

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

⊕ # 00
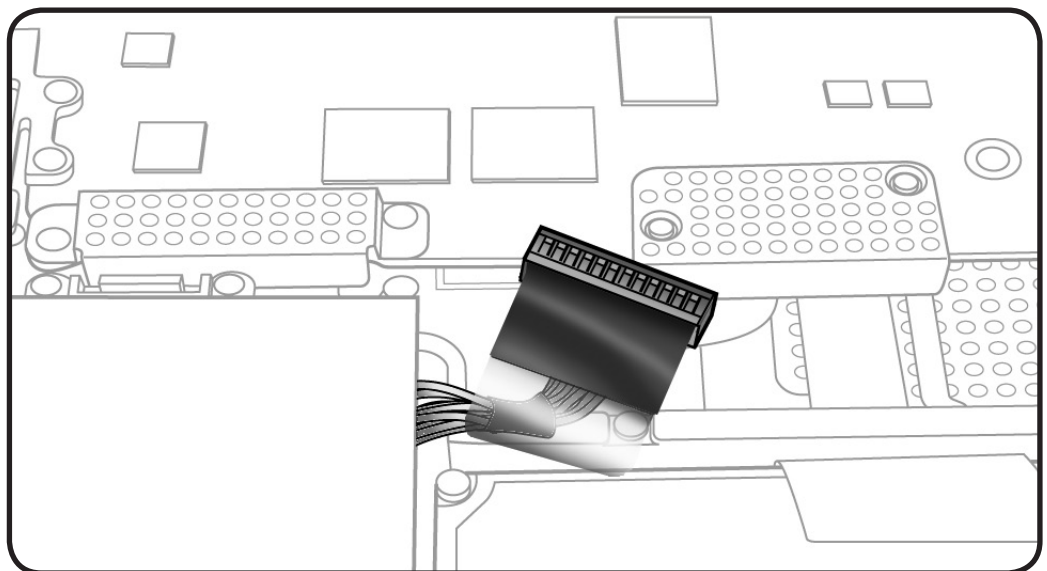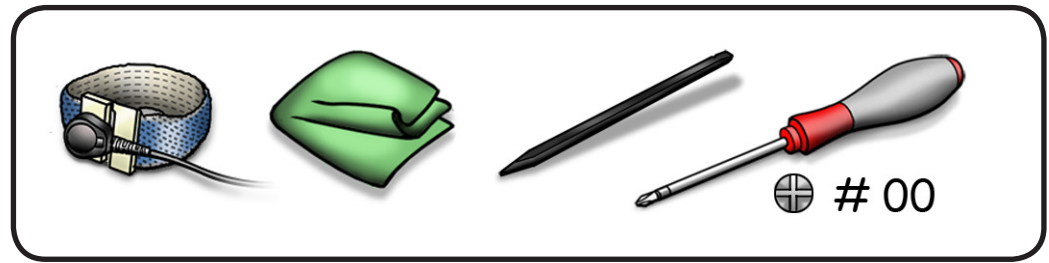
Removal

1 Remove 6 screws:
- 2 (4-mm) 922-8981
- 2 (1.92-mm) 922-8984
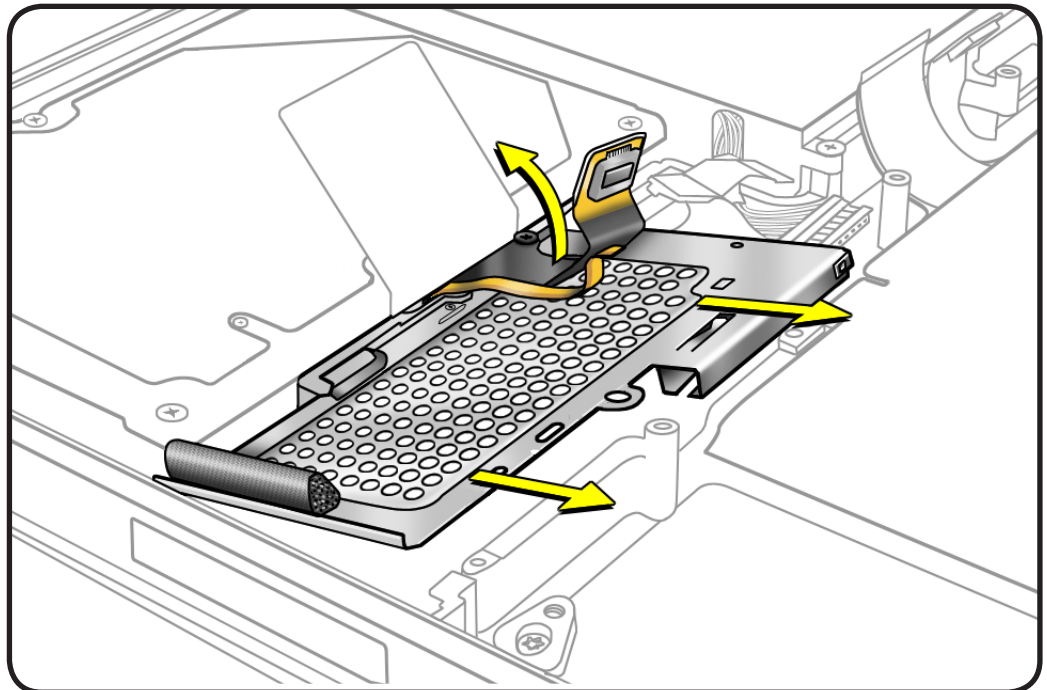- 2 (2.2-mm) 922-8329 (removal of these 2 is optional)

2 Use a black stick to unlatch the clip over the plastic tab, if present.
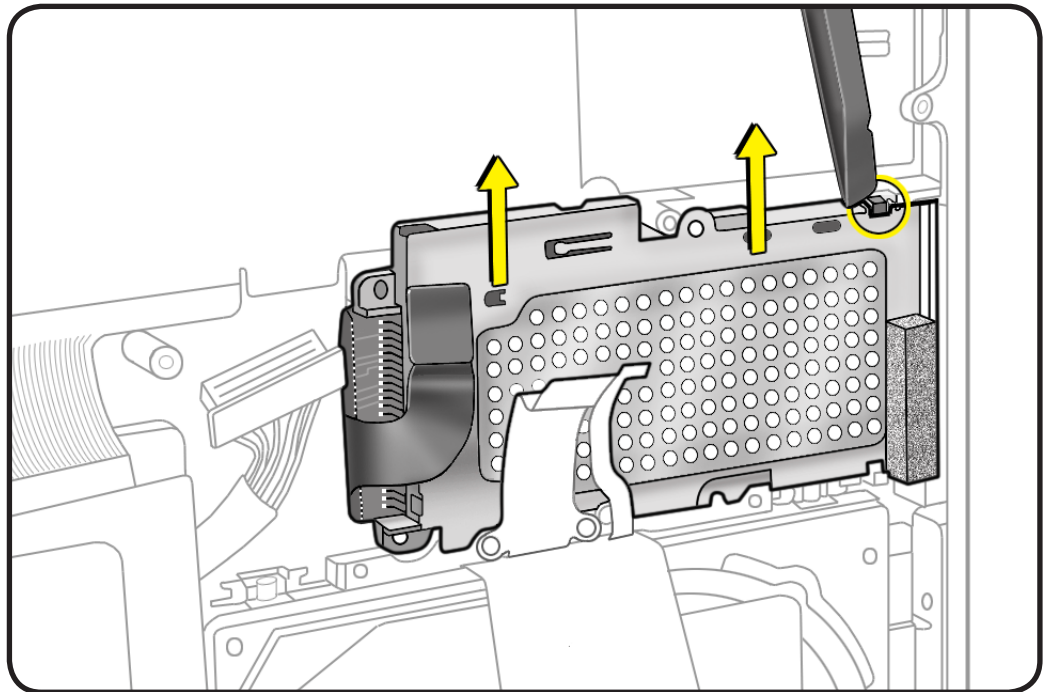
3 Carefully peel up flex cables from card cage.

4 Lift card cage from the top case.

Reassembly Note: Carefully move aside flex cables to slide card cage into place.

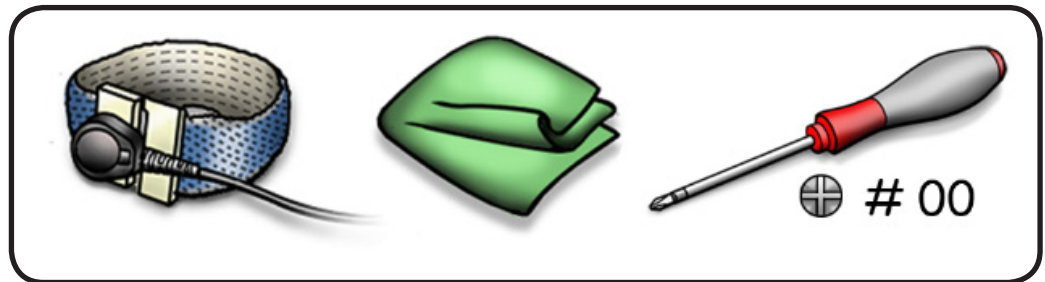# Top Case

First Steps

Remove:
- Bottom case
- Battery
- Rear hard drive bracket
- Hard drive
- Memory
- Camera cable guide
- LVDS cable guide
- Fans
- AirPort-Bluetooth holder
- AirPort-Bluetooth card
- Optical drive
- Display assembly
- Right speaker/ subwoofer
- Logic board
- Hard drive connector cable
- MagSafe board
- ExpressCard cage
- Front hard drive bracket

Tools

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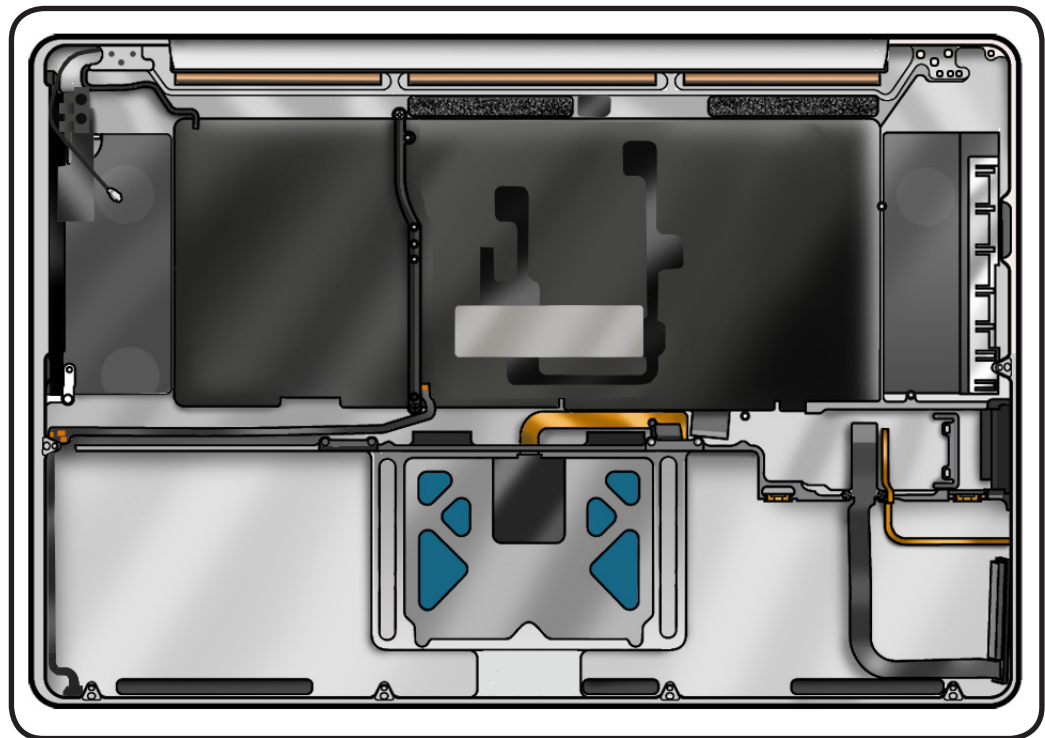- Magnetized Phillips #00 screwdriver.
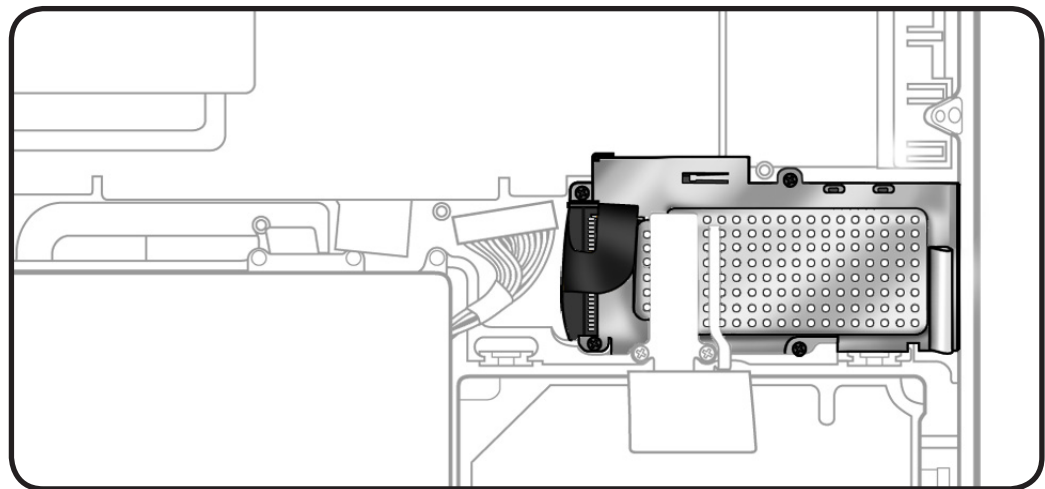

Removal

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

The top case includes:
- battery indicator light (BIL) board and cable
- IR/sleep indicator cable
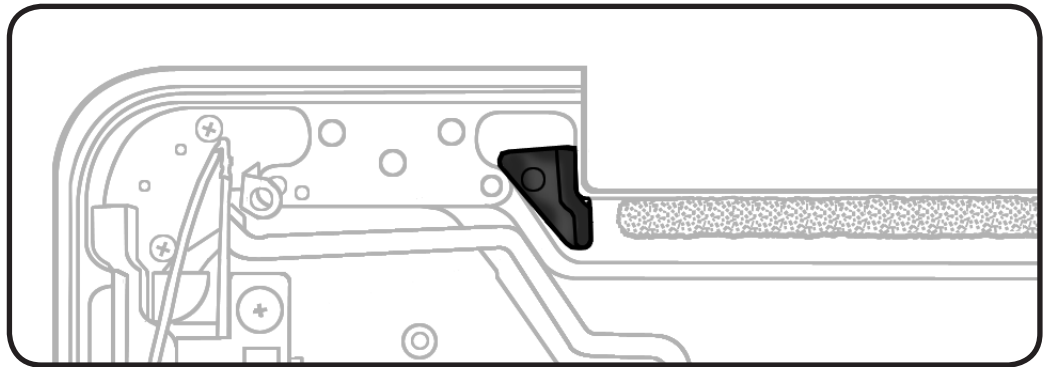- hard drive connector cable
- center bracket

Reassembly Note: Before assembling the computer, be sure to first transfer the **ExpressCard cage** to the new top case.
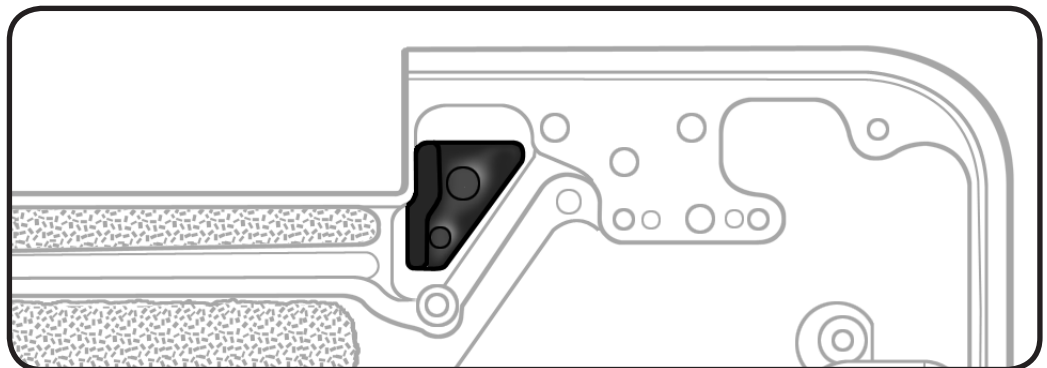
Reassembly Note: Before assembling the computer, be sure the top case includes 2 rubber shims.

If necessary, use a black stick to peel them up and transfer them to the new top case.

If you need to order replacement shims,
- top image = right shim
- bottom image = left shim

Apple Technician Guide
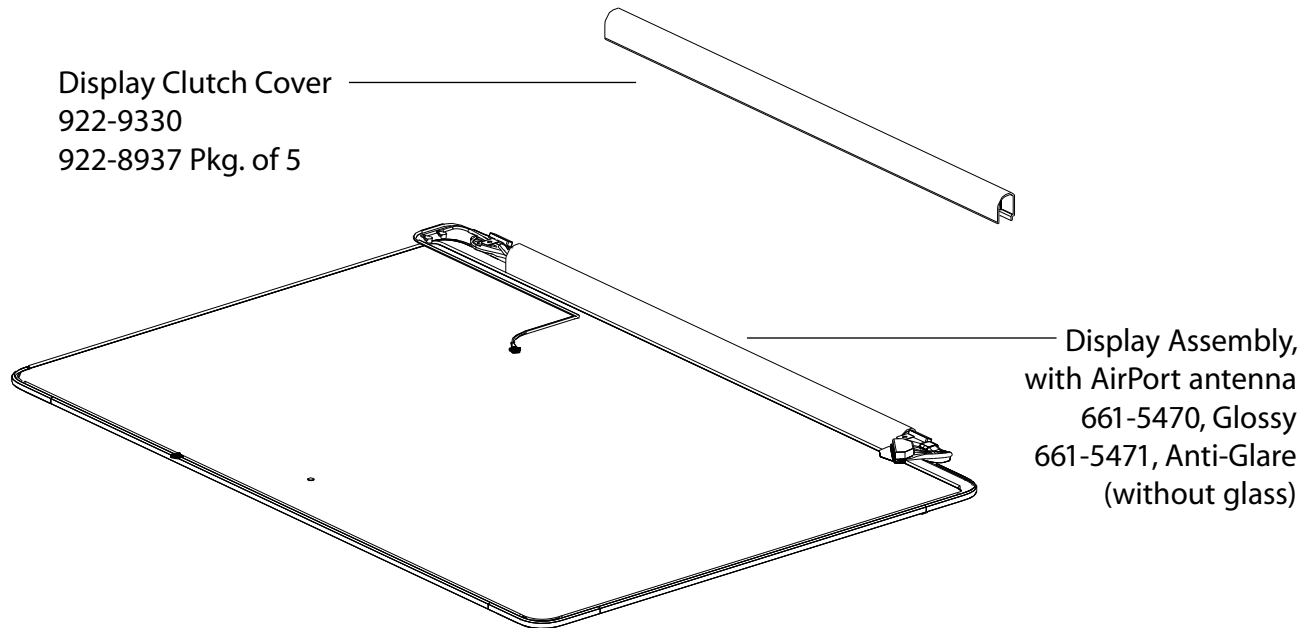
Views

MacBook Pro (17-inch, Mid 2010)

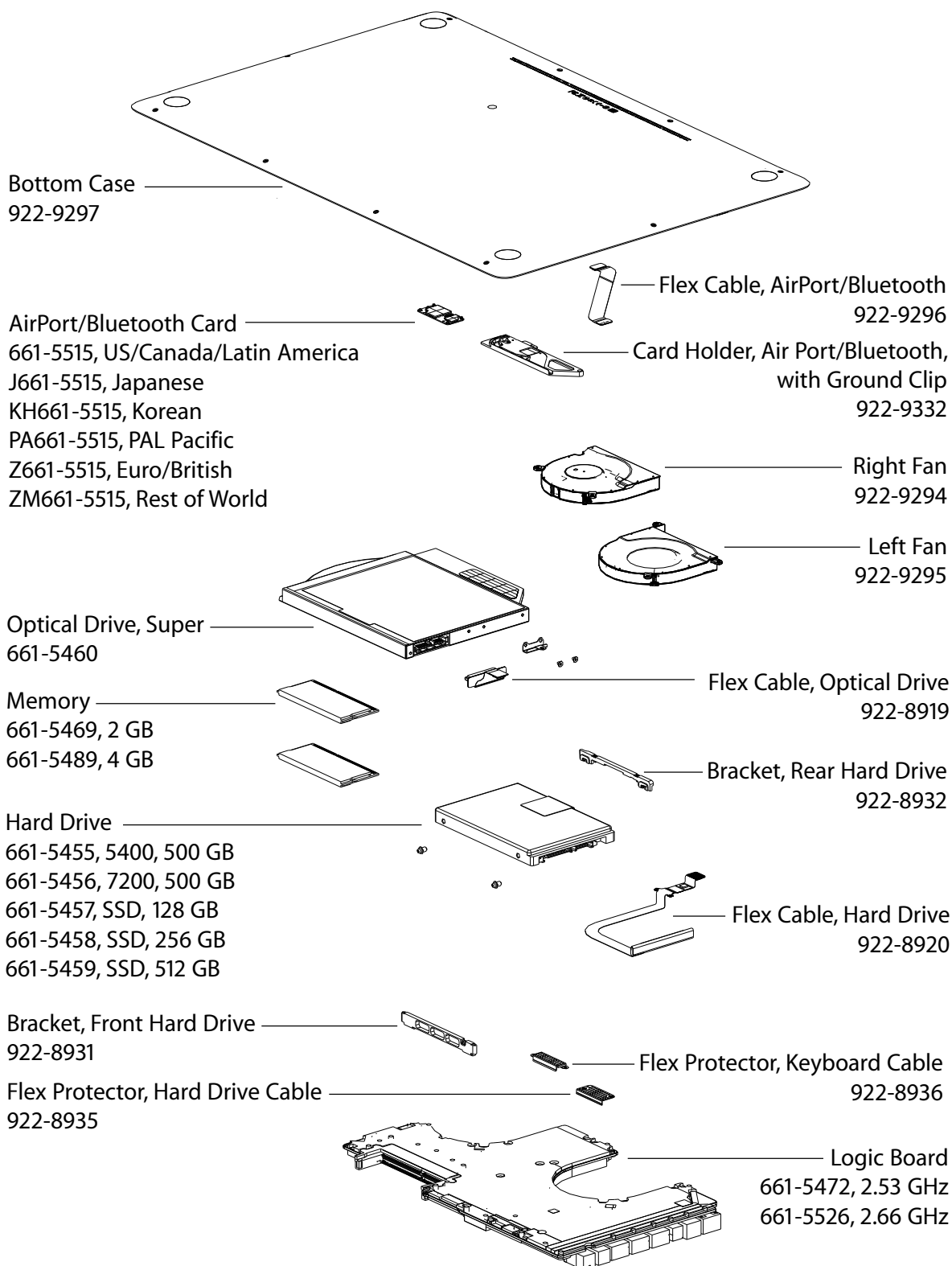# Exploded View

Display Assembly, Mid 2010

Display Clutch Cover
922-9330
922-8937 Pkg. of 5

Display Assembly,
with AirPort antenna
661-5470, Glossy
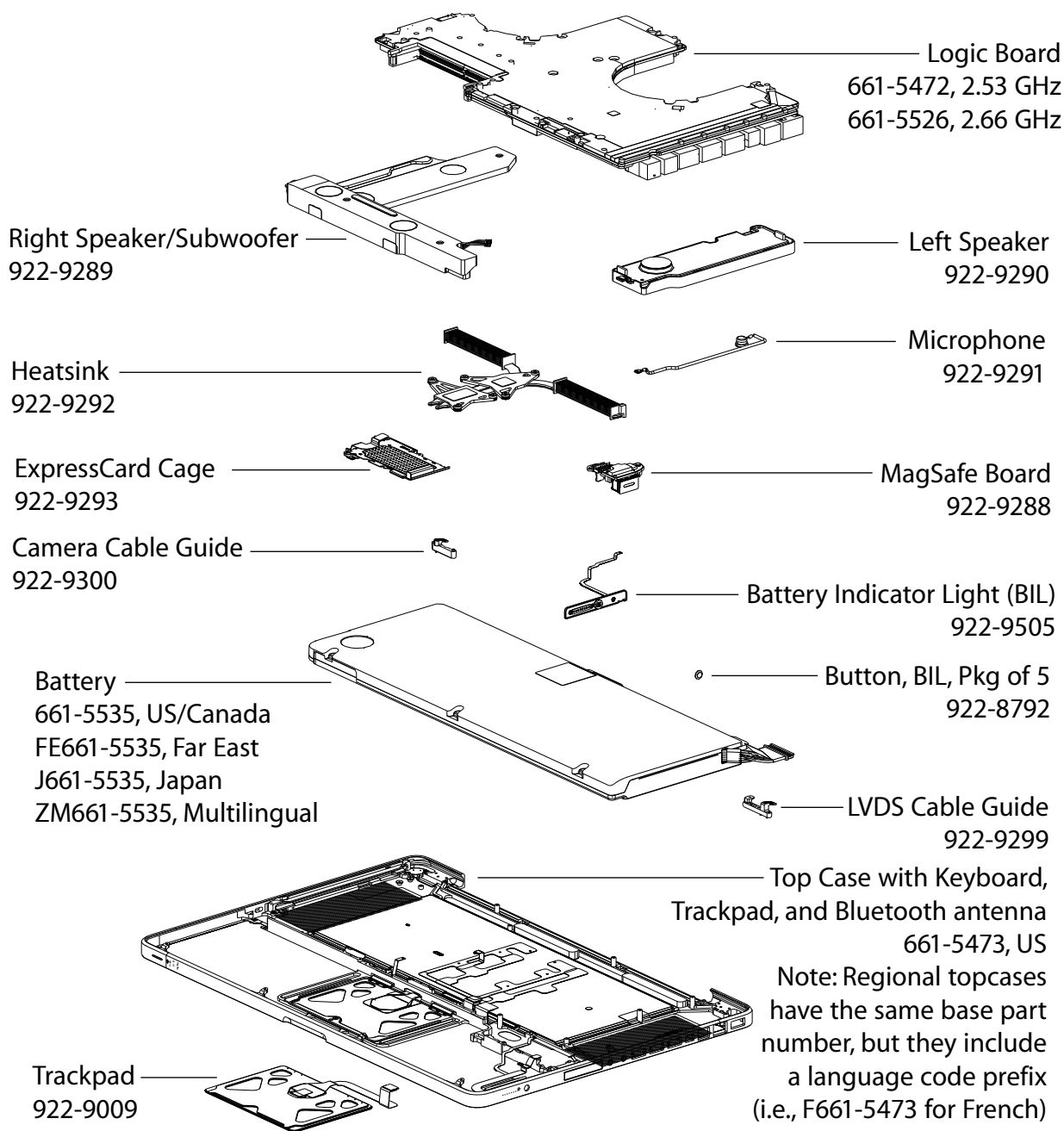661-5471, Anti-Glare
(without glass)
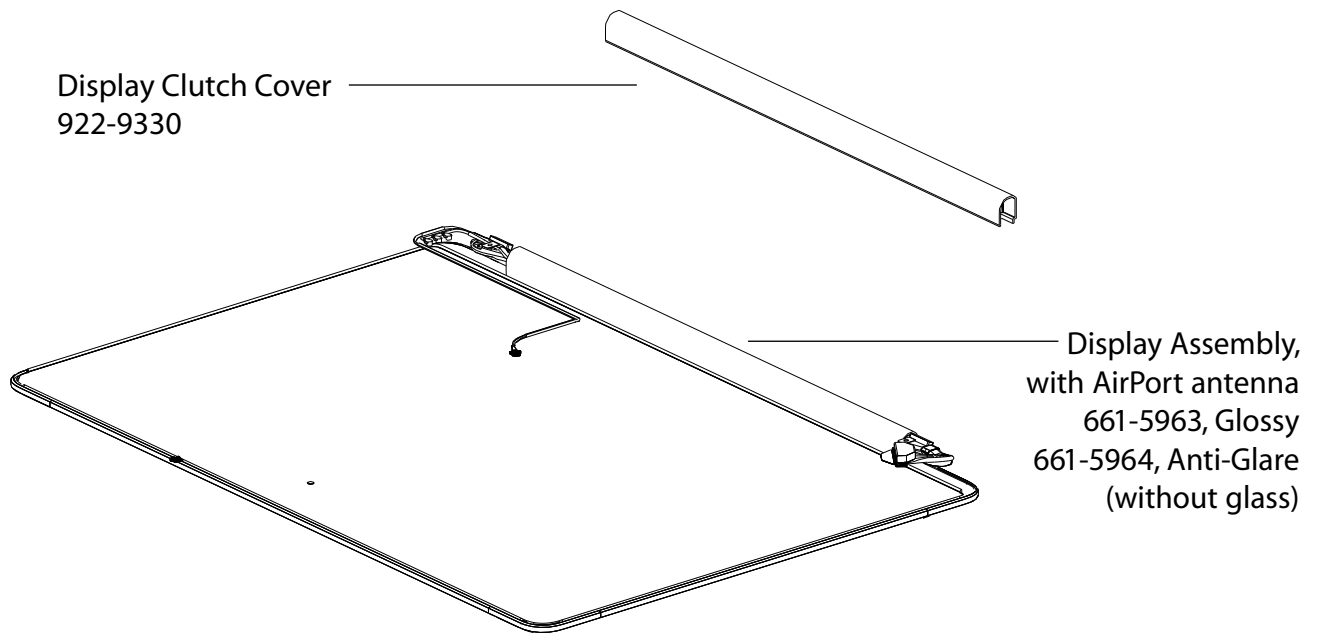
Main Assembly, Mid 2010, 1 of 2

Bottom Case
922-9297

Flex Cable, AirPort/Bluetooth
922-9296

AirPort/Bluetooth Card
661-5515, US/Canada/Latin America
J661-5515, Japanese
KH661-5515, Korean
PA661-5515, PAL Pacific
Z661-5515, Euro/British
ZM661-5515, Rest of World

Card Holder, Air Port/Bluetooth,
with Ground Clip
922-9332

Right Fan
922-9294

Left Fan
922-9295

Optical Drive, Super
661-5460

Flex Cable, Optical Drive
922-8919

Memory
661-5469, 2 GB
661-5489, 4 GB

Bracket, Rear Hard Drive
922-8932

Hard Drive
661-5455, 5400, 500 GB
661-5456, 7200, 500 GB
661-5457, SSD, 128 GB
661-5458, SSD, 256 GB
661-5459, SSD, 512 GB

Flex Cable, Hard Drive
922-8920

Bracket, Front Hard Drive
922-8931

Flex Protector, Keyboard Cable
922-8936

Flex Protector, Hard Drive Cable
922-8935

Logic Board
661-5472, 2.53 GHz
661-5526, 2.66 GHz

Main Assembly, Mid 2010, 2 of 2

Logic Board
661-5472, 2.53 GHz
661-5526, 2.66 GHz

Right Speaker/Subwoofer
922-9289

Left Speaker
922-9290

Heatsink
922-9292

Microphone
922-9291

ExpressCard Cage
922-9293

MagSafe Board
922-9288

Camera Cable Guide
922-9300

Battery Indicator Light (BIL)
922-9505

Battery
661-5535, US/Canada
FE661-5535, Far East
J661-5535, Japan
ZM661-5535, Multilingual

Button, BIL, Pkg of 5
922-8792

LVDS Cable Guide
922-9299

Top Case with Keyboard,
Trackpad, and Bluetooth antenna
661-5473, US
Note: Regional topcases
have the same base part
number, but they include
a language code prefix
(i.e., F661-5473 for French)

Trackpad
922-9009

Display Assembly, Early 2011

Display Clutch Cover
922-9330

Display Assembly,
with AirPort antenna
661-5963, Glossy
661-5964, Anti-Glare
(without glass)

Main Assembly, Early 2011, 1 of 2

Bottom Case
922-9828

AirPort/Bluetooth Card
661-5867, US/Canada/Latin America
J661-5867, Japanese
KH661-5867, Korean
PA661-5867, PAL Pacific
Z661-5867, Euro/British
ZM661-5867, Rest of World

Flex Cable, AirPort/Bluetooth
922-9825

Card Holder, Air Port/Bluetooth,
with Ground Clip
076-1382

Right Fan
922-9294

Left Fan
922-9295

Optical Drive, Super
661-5959

Memory, DDR3, 1333
661-5961, 2 GB
661-5962, 4 GB

Flex Cable, Optical Drive
922-9824

Bracket, Rear Hard Drive
922-8932

Hard Drive
661-5955, 7200, 500 GB
661-5954, 5400, 750 GB
661-5956, SSD, 128 GB
661-5957, SSD, 256 GB
661-5958, SSD, 512 GB

Flex Cable, Hard Drive
922-9823

Bracket, Front Hard Drive
922-8931

Flex Protector, Keyboard Cable
922-8936

Flex Protector, Hard Drive Cable
922-8935

Logic Board
661-5965, 2.2 GHz
661-5973, 2.3 GHz
661-6083, 2.2 GHz
661-6084, 2.3 GHz

Main Assembly, Early 2011, 2 of 2

Logic Board
661-5965, 2.2 GHz
661-5973, 2.3 GHz
661-6083, 2.2 GHz
661-6084 2.3 GHz

Right Speaker/Subwoofer
922-9289

Left Speaker
922-9821

Microphone
922-9822

Heatsink
922-9827

ExpressCard Cage
922-9293

MagSafe Board
922-9288

Camera Cable Guide
922-9830

Battery Indicator Light (BIL)
922-9505

Button, BIL, Pkg of 5
922-8792

Battery
661-5960, US/Canada
FE661-5960, Far East
J661-5960, Japan
ZM661-5960, Multilingual

LVDS Cable Guide
922-9829

Top Case with Keyboard,
Trackpad, and Bluetooth antenna
661-5966, US
661-6077, US
Note: Regional topcases
have the same base part
number, but they include
a language code prefix
(i.e., F661-5966 for French)

Trackpad
922-9826

External Views

Front Views

Port View, Mid 2010

A = MagSafe power

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

C = FireWire 800

D = Mini DisplayPort

E = USB 2.0 (3 high speed)

F = Audio in/digital audio In

G = Audio out/headphone out/digital audio out

H = ExpressCard/34 slot

I = Battery indicator light (BIL) button

Port View, Early 2011
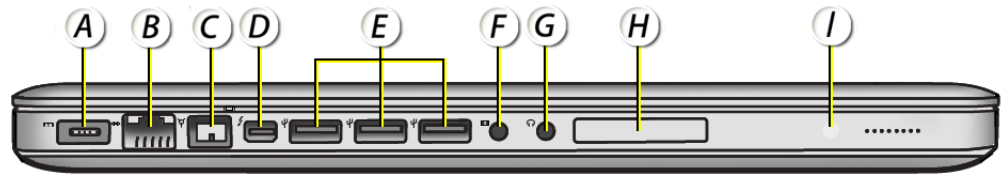
A = MagSafe power

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

C = FireWire 800

D = Thunderbolt*

E = USB 2.0 (3 high speed)

F = Audio in/digital audio In

G = Audio out/headphone out/digital audio out

H = ExpressCard/34 slot

I = Battery indicator light (BIL) button

* This port connects Thunderbolt-compatible devices for high-speed data transfer or an external display that uses Mini DisplayPort.

Slot Drive View

Rear View

Screw Locations

Bottom Case

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

3.5 mm = 922-9334

14.3 mm = 922-9432
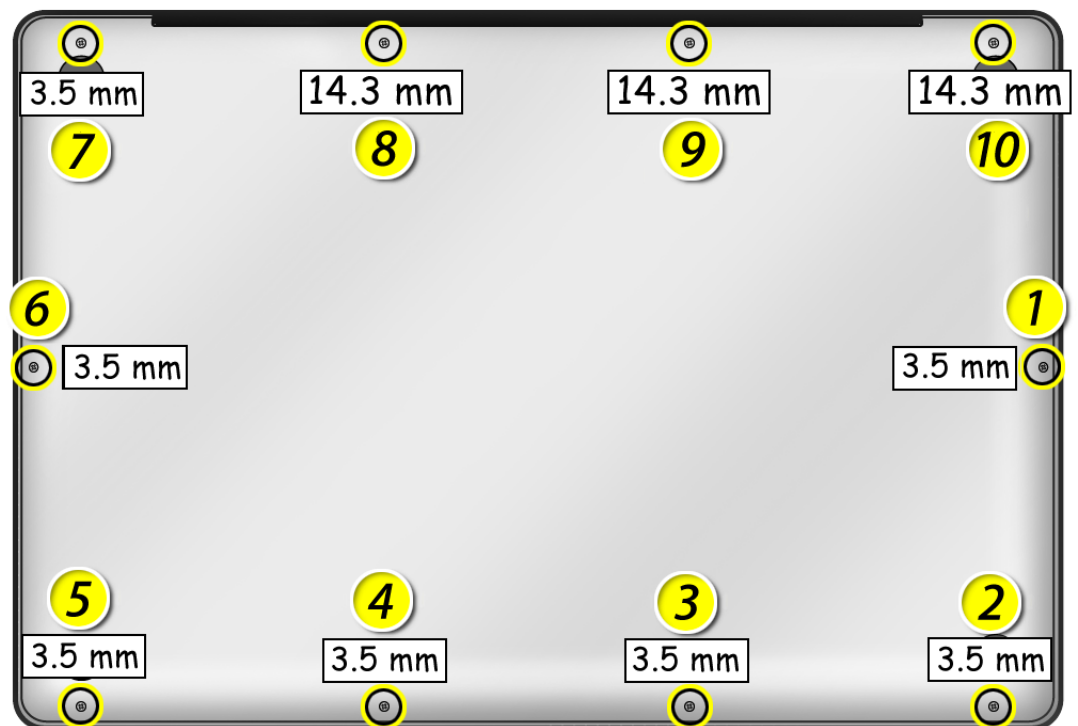
Battery, AirPort/Bluetooth Holder, Fans

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

3.3 mm = 922-9108

3.55 mm = 922-8974

6.4 mm = 922-9431

10 mm = 922-9333
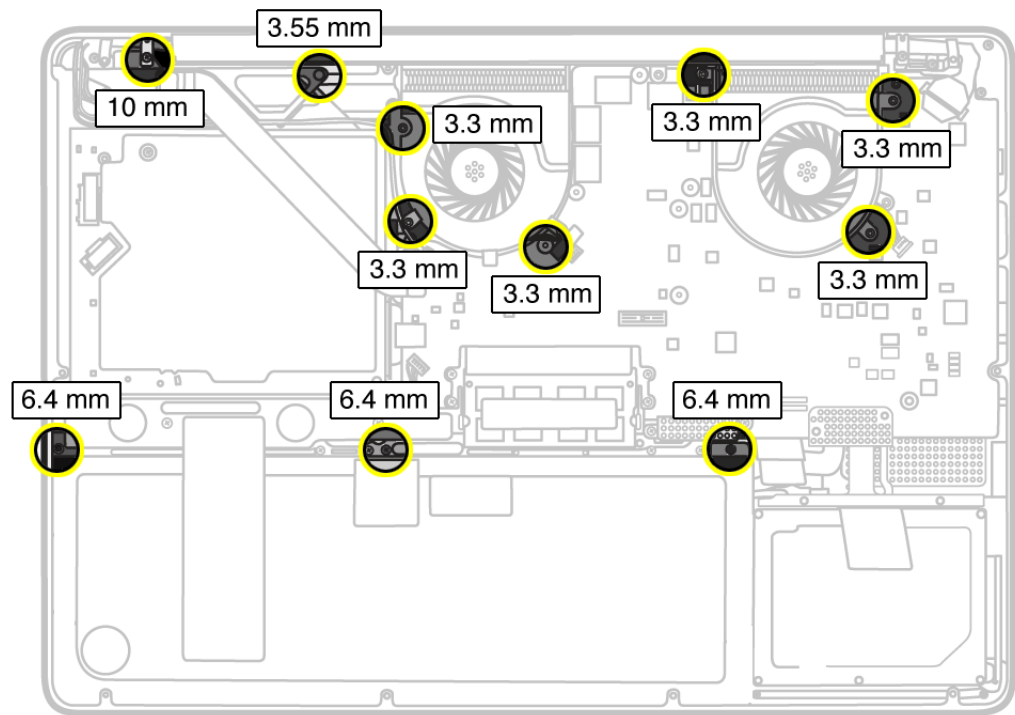
Optical Drive, AirPort/Bluetooth Card

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

3.5 mm = 922-8719

3 mm = 922-9200
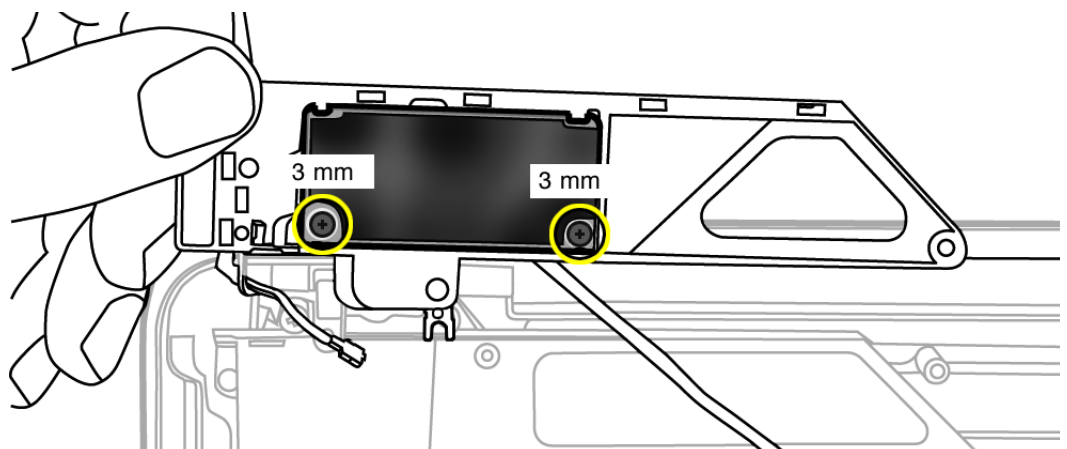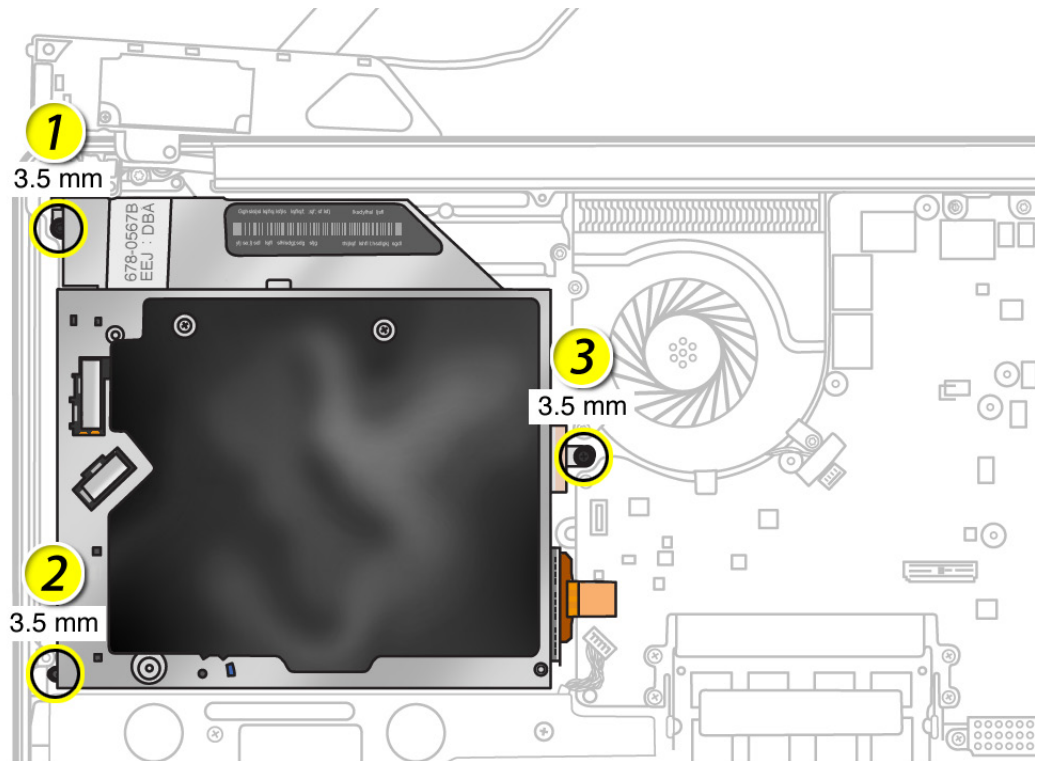
Logic Board

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

1.8 mm = 922-8983

3.3 mm = 922-9108
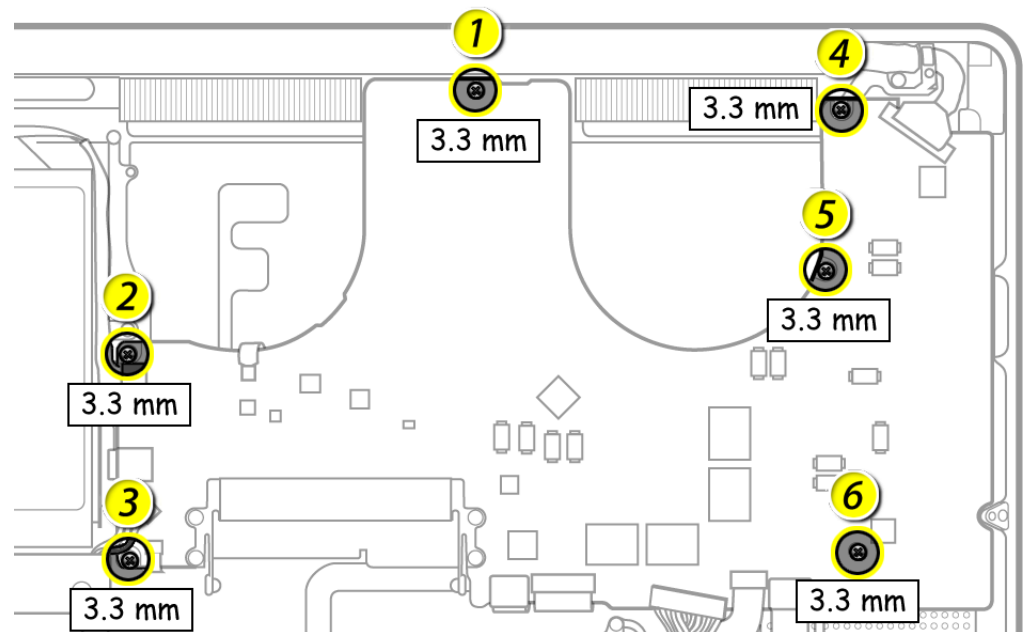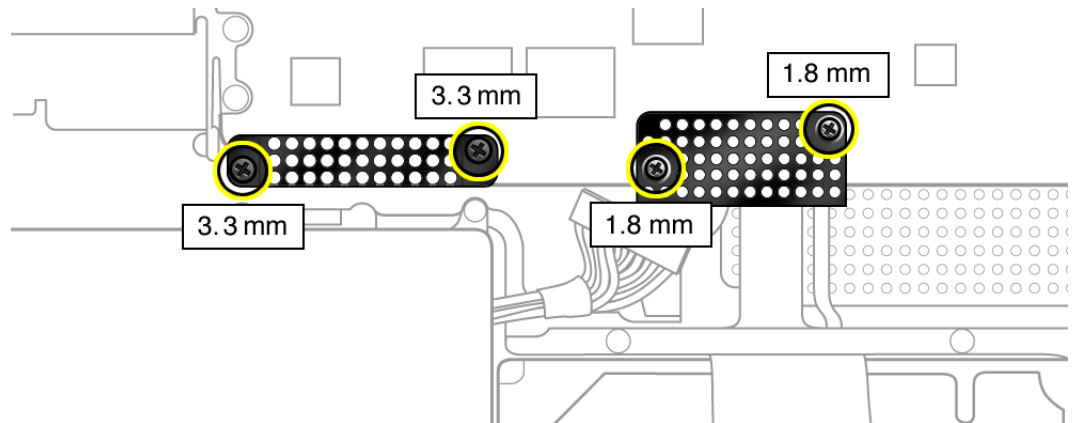
Battery Indicator Light (BIL), Heatsink

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

1.8 mm = 922-9069

8.35 mm = included with heatsink kit 922-8799, Mid 2010 (included with heatsink kit 922-9827, Early 2011)
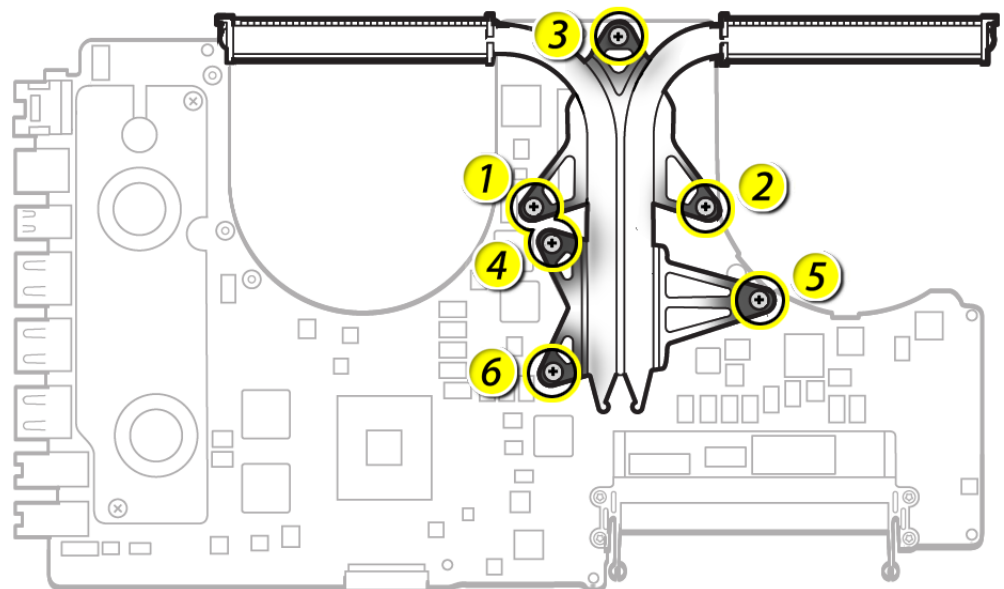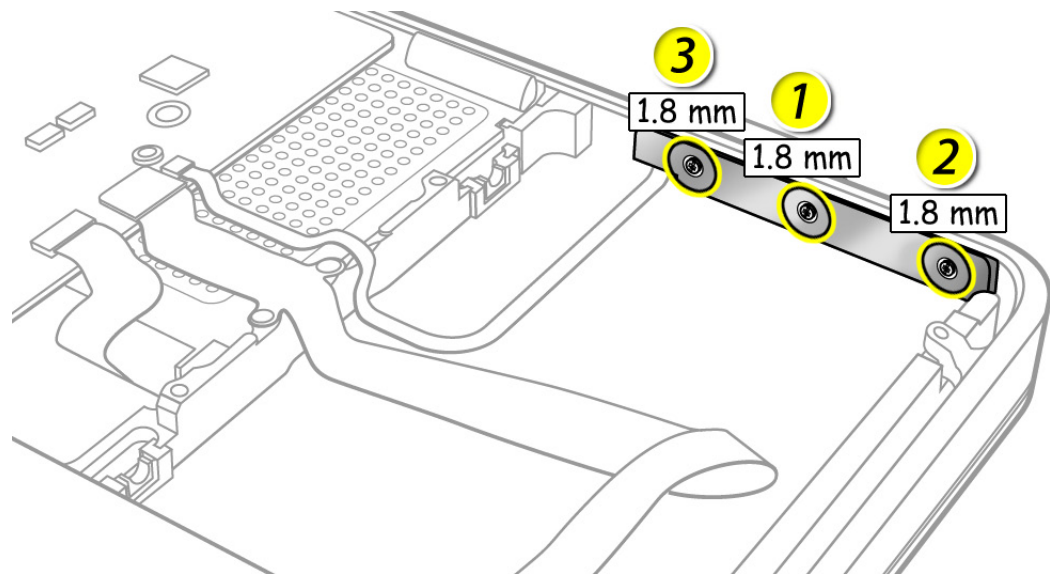
Left Speaker, Right Speaker

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

8 mm = 922-8720

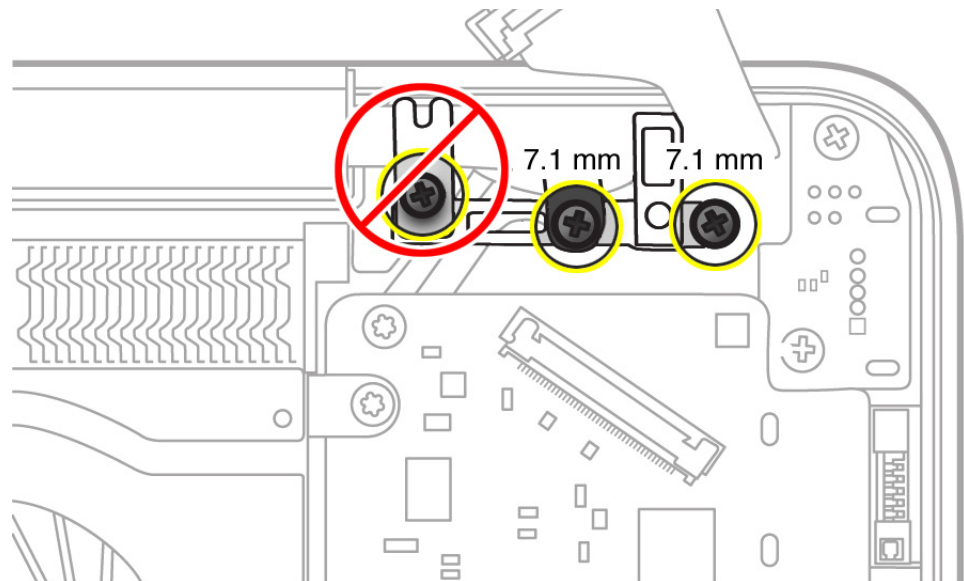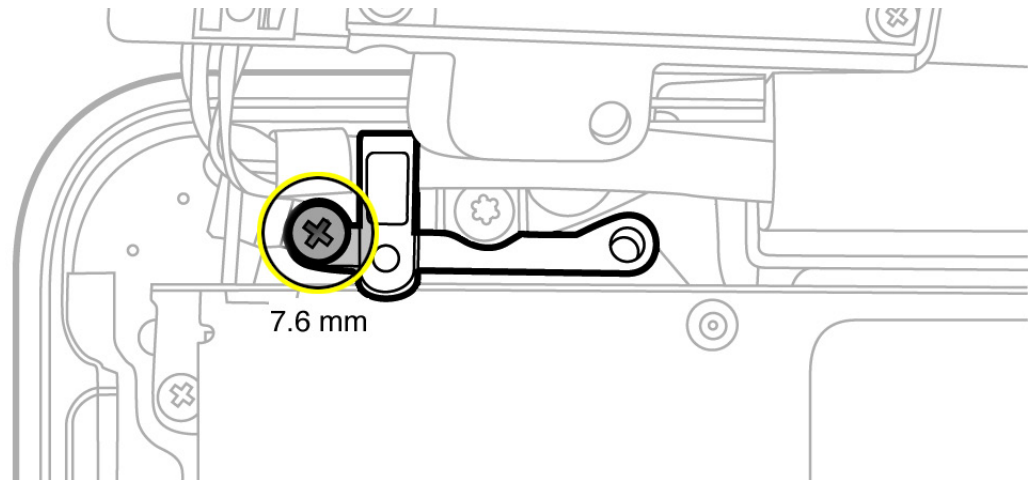2.75 mm = 922-8662, Mid 2010 (922-9860, Early 2011)

12.4 mm = 922-8982
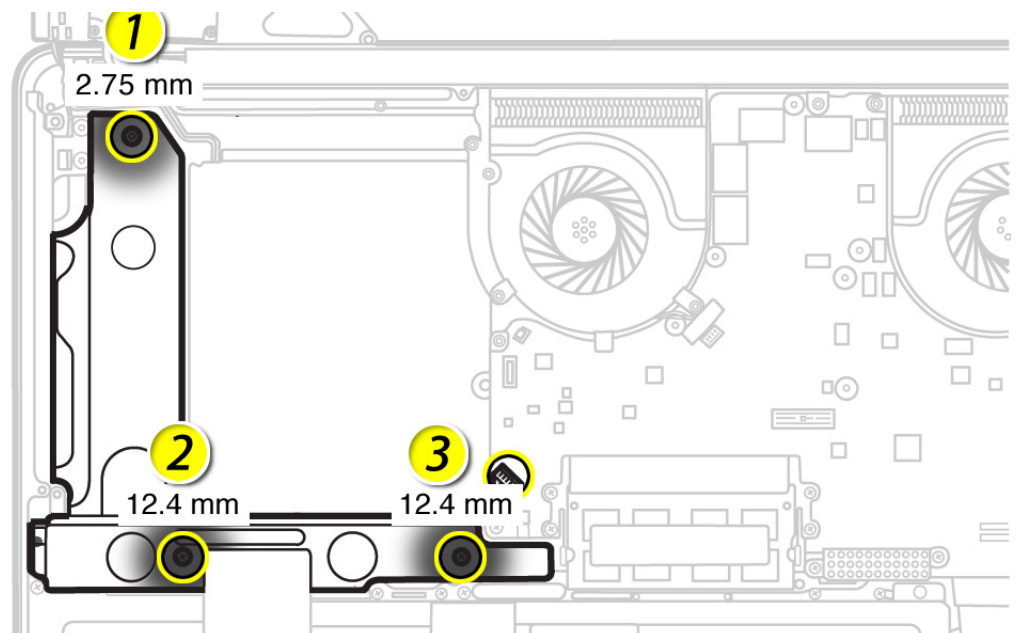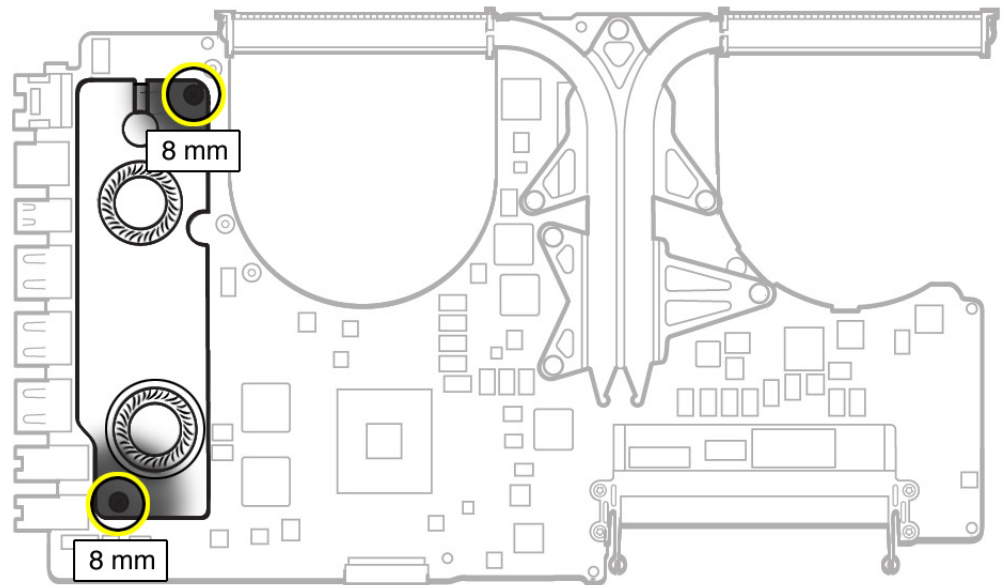
Cable Guides from Display

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

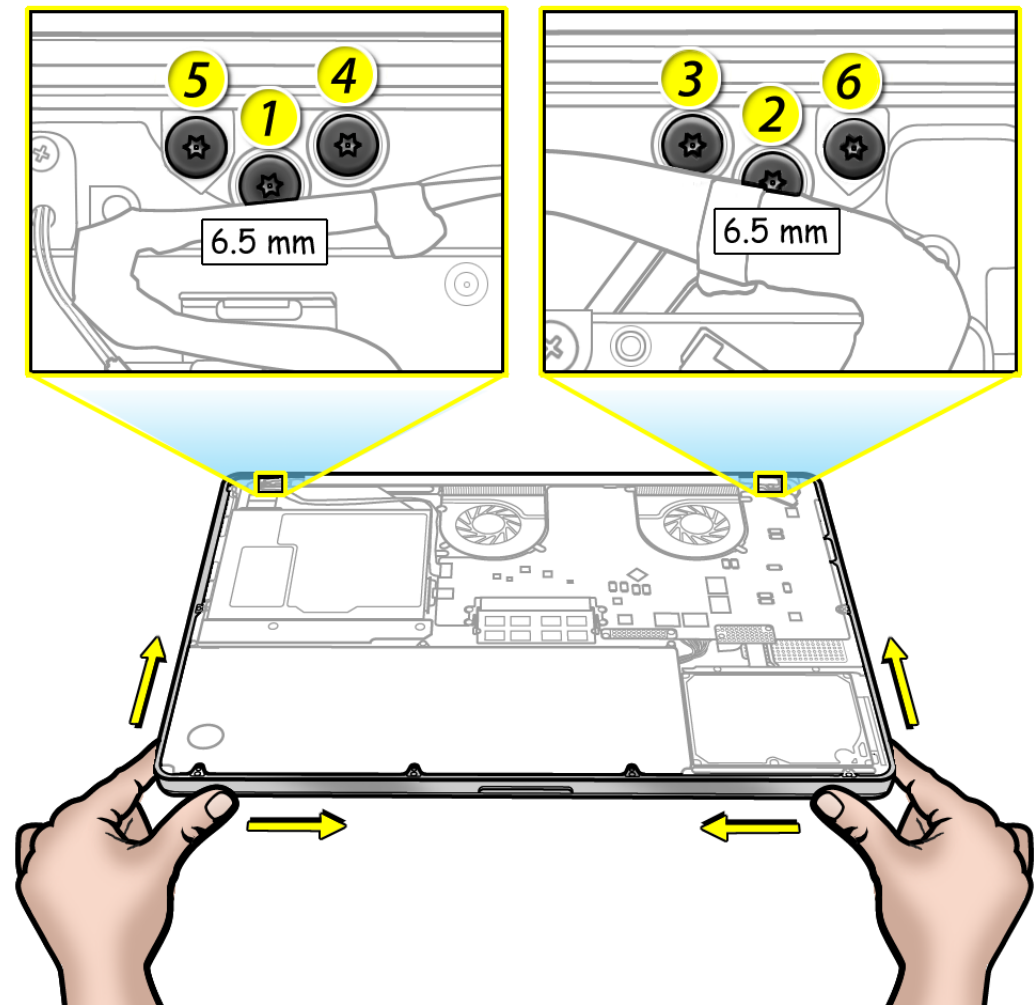7.6 mm = 922-8929

7.1 mm = 922-8645

Display Assembly

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

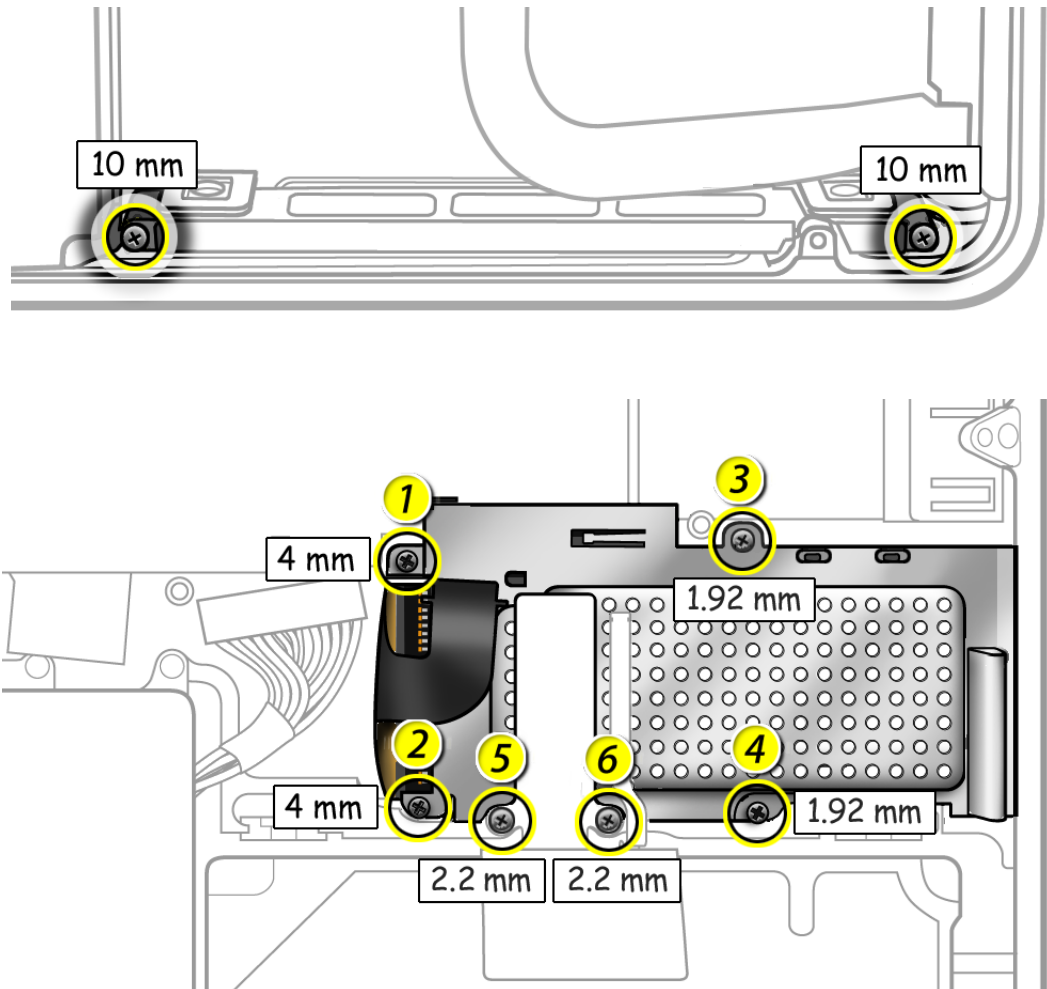6.5 mm = 922-8925

Front Hard Drive Bracket, ExpressCard

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

10 mm = 922-8648

4 mm = 922-8981

1.92 mm = 922-8984

2.2 mm = 922-8329

MagSafe Board, Trackpad

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

7.6 mm = 922-8929

1.3 mm = "1" = trackpad clamp to top case screw, reports to trackpad kit 922-9009, Mid 2010 (reports to trackpad kit 922-9826, Early 2011)

3.6 mm = "2" = T6 trackpad flexure screw = 922-9539

1.3 mm = "3" = tri-lobe trackpad set screw, reports to trackpad kit 922-9009, Mid 2010 (Torx T6 set screw, reports to trackpad kit 922-9826, Early 2011)