Service Source

PowerBook 200 Series

PowerBook Duo 210, PowerBook Duo 230, PowerBook Duo 250, PowerBook Duo 270c, PowerBook Duo 280, PowerBook Duo 280c, PowerBook Duo Floppy Adapter

Basics

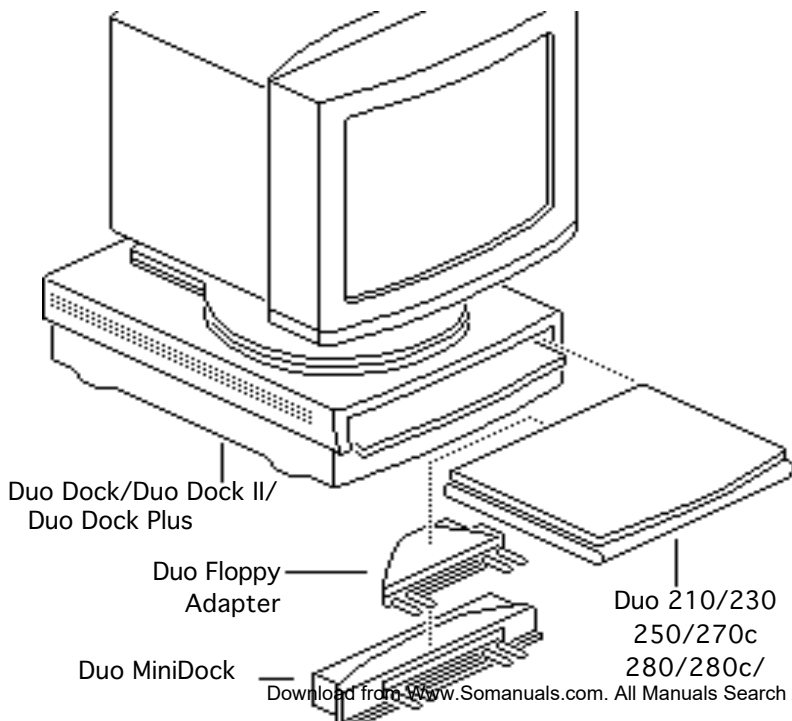## PowerBook 200 Series

System Overview

PowerBook Duo System

The PowerBook Duo system includes the following products:

- PowerBook 200 Series computer, shown at left (PowerBook Duo 210/ 230/250/270c/280/ 280c)
- PowerBook 2300 Series computer (PowerBook Duo 2300c)

PowerBook Duo 210/230/250/270c/280/280c

- PowerBook Duo Floppy Adapter
- PowerBook Duo Dock/ Duo Dock II/Duo DockPlus
- PowerBook Duo MiniDock

This manual includes information about the PowerBook 200 Series computers and the floppy adapter.

For information about the PowerBook 2300 Series, Duo Docks, or the Duo MiniDock, refer to the appropriate PowerBook Duo manual.

Duo Dock/Duo Dock II/ Duo Dock Plus

Duo Floppy Adapter

Duo MiniDock

Duo 210/230 250/270c 280/280c/

Repair Strategy

Service the PowerBook 200 Series computers through module exchange and parts replacement. Customers can request on-site service from an Apple Authorized Service Provider Plus (AASP+) Apple Assurance (US only), or request a courier through the Apple Canada Technical Answerline (Canada only). They can also choose carry-in service from an AASP.

Ordering

Apple Service Providers planning to support the computer systems covered in this manual may purchase Service modules and parts to develop servicing capability. To order parts, use the AppleOrder (US only) or ARIS (Canada only) system and refer to "Service Price Pages."

Large businesses, universities, and K-12 accounts must provide a purchase order on all transactions, including orders placed through the AppleOrder (US only) or ARIS (Canada only) system.

USA Ordering

US Service Providers not enrolled in AppleOrder may fax their orders to Service Provider Support (512-908-8125) or mail them to

Apple Computer, Inc.
Service Provider Support
MS 212-SPS
Austin, TX 78714-9125

For US inquiries, please call Service Provider Support at 800-919-2775 and select option #1.

Canadian Ordering

Canadian Service Providers not enrolled in ARIS may fax their orders to Service Provider Support in Canada (1-800-903-5284). For Canadian inquiries, please call Service Provider Support at 905-513-5782 and select option #3.

Warranty/AppleCare/ARIS

US Only

The PowerBook 200 Series computers are covered under the
Apple One-Year Limited Warranty. The AppleCare Service
Plan is also available for these products. Service Providers
are reimbursed for warranty and AppleCare repairs made to
these computers. For pricing information, refer to "Service
Price Pages."

Canada Only

The PowerBook 200 Series computers are covered under
first-year AppleCare. The Extended AppleCare Service Plan
is also available for these products. Service Providers are
reimbursed for first-year warranty and Extended
AppleCare repairs made to these computers. For pricing
information, refer to "Service Price Pages."
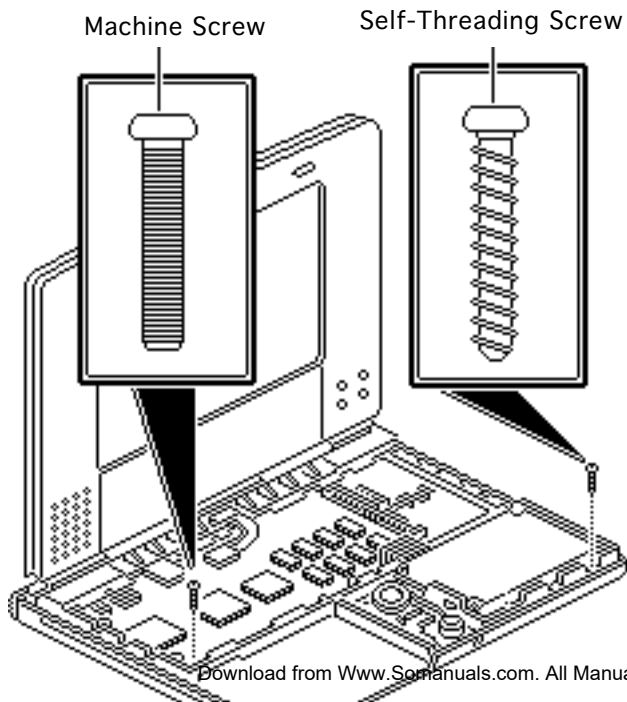
Machine Screw   Self-Threading Screw

Self-Threading Screws

Caution: Improperly installed self-threading screws could damage the PowerBook Duo. Thread the screws properly and do not overtighten them.

**Caution:** To prevent damage to the circuitry, do not use magnetic screwdrivers when working on Apple systems.

The PowerBook 200 systems use both machine screws and self-threading screws. Be aware when you are replacing a self-threading screw, and follow these guidelines:

- Never overtighten self-threading screws.
- Before tightening a self-threading screw, back the screw off slightly to be sure it is threaded properly.
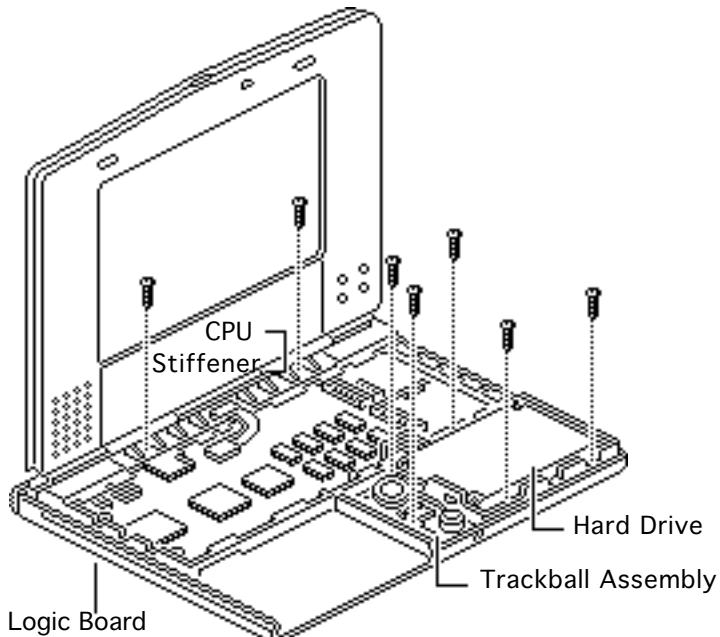
Self-threading screws are used to install the following modules and replacement parts:

- Hard drive
- Trackball assembly
- CPU stiffener and logic board

CPU Stiffener

Hard Drive

Trackball Assembly

Logic Board

Specifications

PowerBook 200 Series

Introduction

You can also find specifications information for this product in the Spec Database, which you can access in one of three ways:

— Launch it directly by double-clicking the Apple Spec Database runtime alias at the top level of the Main Service Source CD.

— Select "Apple Spec Database" from the Service Source drop-down main menu.

— Click the Acrobat toolbar icon for the database, which is near the right end of the toolbar with the letters "SP."

Processor

CPU 210   Motorola 68030 microprocessor
                         25 MHz

CPU 230/250/270c   Motorola 68030 microprocessor
                         33 MHz

CPU 280/280c   Motorola 68LC040 microprocessor
                         66/33 MHz

Coprocessor (270c   Motorola 68882 floating-point coprocessor
Only)

Addressing   32-bit internal registers
                        32-bit address/data bus supports 4 GB of address with justified
                            8-bit, 16-bit, and 32-bit data transactions

Memory

RAM 210/230/250   4 MB RAM soldered on the logic board
Expandable to 24 MB
Requires 70 ns or faster RAM chips

RAM 270c   4 MB RAM soldered on the logic board
Expandable to 32 MB
Requires 70 ns or faster RAM chips

RAM 280/280c   4 MB RAM soldered on the logic board
Expandable to 40 MB
Requires 70 ns or faster RAM chips

ROM   1 MB

PRAM   256 bytes of parameter memory

Clock/Calendar   CMOS custom chip supported by long-life (up to 2 years) lithium
                        battery

Disk Storage

Floppy Drive   External 1.4 MB floppy drive (same drive is used with PowerBook 100)
Requires Duo Floppy Adapter or Duo MiniDock

Hard Drive   2.5-in., internal, 17 mm high

I/O Interfaces

Docking Connector	152-pin processor-direct slot (PDS connector for attaching expansion devices 32-bit expansion bus
Serial	RS-422 serial port; mini DIN-8 connector
Modem	Optional internal modem/telephone jack RJ-11 domestic; mini DIN-8 international

I/O Devices

Keyboard   Built-in standard Apple keyboard
                      63 keys domestic; 64 keys ISO
                      Caps-locked LED
                      Soft power-on switch
                      2.5 mm travel, 18 mm vertical and horizontal pitch
                      Two-level tilt adjustment

Trackball   19 mm diameter, dua button
                      Apple Desktop Bus (ADB) interface

Microphone   Built-in electret, omnidirectional microphone

Sound and Video

Sound Generator   Apple sound chip provides four-voice/8-bit sound, sampled at 11
                          or 22 kHz
                          Monophonic sound in and sound out

Video Display 210/   9 in. (229 mm) diagonal screen
230   Flat-panel, film-compensated supertwist nematic (FSTN) liquid
                          crystal display
                          1, 2, and 4 bits per pixel
                          16 level grayscale at 4 bits per pixel
                          640 lines by 400 pixels
                          CCFL on-demand backlight
                          Adjustable brightness and contrast controls

Video Display 250   9 in. (229 mm) diagonal screen
Flat-panel, color, active-matrix, liquid crystal display
CCFL on-demand backlight
640 lines by 400 pixels; 16 shades of gray

Video Display 270c   9 in. (229 mm) diagonal screen
Flat-panel, color active-matrix, liquid crystal display
CCFL on-demand backlight
640 lines by 480 pixels; 8 bits; 256 colors

Video Display 280   9 in. (229 mm) diagonal screen
Backlit, active-matrix, grayscale display
640 lines by 400 pixels; 16 shades of gray

Video Display 280c   8.4 in. diagonal, backlit, active matrix color display
640 lines by 480 pixels for 256 colors, or 640 lines by 400
pixels for thousands of colors

Electrical

Main Battery 210/230

NiMH (nickel-metal-hydride), 0.95 Ah
Approximately 2-4 hours of usage before recharging (depending upon use)
Recharge time: approximately 2 hours
500 power cycles capacity

Main Battery 250/270c

NiMH (nickel-metal-hydride), 1.5 Ah
Approximately 2-3 hours of usage before recharging (depending upon use)
Recharge time: approximately 2 hours
500 power cycles capacity
Uses 4/5 A size battery cells

Main Battery 280/ 280c	NiMH (nickel-metal-hydride), 1.6 Ah
	Approximately 2-3 hours of usage before recharging (depending upon use)
	Recharge time: approximately 2 hours
	500 power cycles capacity
PRAM Battery	3 V lithium backup battery
	500 power cycles capacity
Power Adapter	Input: 85-270 VAC line voltage, 47-63 Hz
	Output: 24 VDC, 1.04 A
	Can be used anywhere in the world with the appropriate power cord

Physical

Dimensions 210/230/250/280	Height: 1.4 in. (36 mm) Width: 8.5 in. (216 mm) Depth: 10.9 in. (277 mm)
Dimensions 270c/280c	Height: 1.5 in. (36 mm) Width: 8.5 in. (216 mm) Depth: 10.9 in. (277 mm)
Weight 210/230/250/280	4.25 lb. (1.9 kg) with battery
Weight 270c/280c	4.8 lb. (2.1 kg) with battery

Environmental

Operating Temperature   50–104° F (10–40° C)

Storage Temperature   -40 to 116° F (-40 to 47° C)

Relative Humidity   20–95% noncondensing

Operating Altitude   0–15,000 ft. (0–4722 m)

Other

Express Modem   Internal 14,400-baud modem with fax send/receive capability at
                     9600 baud
                     300–14,400 bps data transmission rates
                     2400/4800/7200/9600 bps transmission rates
                     Full duplex operation; asynchronous or framed modes
                     Error correction: V.42 compliance (MNP2-4)
                     Data compression: V.42bis (4 to 1 compression) and MNP-5 (2
                     to 1 compression)
                     Requires 300K of system RAM
                     Built-in support for internal modem when in docking systems

SCSI Disk Adapter   Enables connection between PowerBook Duo computer and desktop
                         Macintosh (Duo system appears as a hard drive on desktop)
                         Requires Duo MiniDock

Troubleshooting

PowerBook 200 Series

General

The Symptom Charts included in this chapter will help you diagnose specific symptoms related to your product. Because cures are listed on the charts in the order of most likely solution, try the first cure first. Verify whether or not the product continues to exhibit the symptom. If the symptom persists, try the next cure. (**Note:** If you have replaced a module, reinstall the original module before you proceed to the next cure.)

If you are not sure what the problem is, or if the Symptom Charts do not resolve the problem, refer to the Flowchart for the product family.

For additional assistance, contact Apple Technical Support.

Power Manager Reset

If a unit crashes or experiences power problems, reset the power manager chip by pressing the rear power switch for 30-45 seconds.

If resetting the power manager chip does not solve the problem, reset the code for the power manager chip by removing all power sources and letting the unit sit for 10 minutes. (Take out the battery and disconnect the AC adapter and the internal backup battery.) This forces the PowerBook Duo to reload the power manager code from the system software.

Symptom Charts

Startup

RAM failure occurs
(eight-tone error
chord sequence
sounds after startup
chord)

1 Check RAM expansion card connection.
2 Replace RAM expansion card.
3 Replace logic board.
Note: When replacing the logic board, check that the EMI clips
are securely attached to the CPU stiffener. The "CPU Stiffener"
topic in Take Apart helps you locate and identify the two EMI
clips. If both clips are not secure, replace the CPU stiffener.

Hardware failure
occurs (four-tone
error chord sequence
sounds after startup
chord)

1 Disconnect hard drive data cable and reboot system. If
startup sequence is normal, reseat cable and retest.
2 Replace hard drive.
3 If the system is connected to an external floppy drive,
disconnect drive and reboot system. If startup sequence is

normal, reseat cable and retest.

Startup (Continued)

1   Replace floppy drive.
2   Replace logic board.

Note: When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener. The "CPU Stiffener" topic in Take Apart helps you locate and identify the two EMI clips. If both clips are not secure, replace the CPU stiffener.

Power

Screen is blank;
computer does not
respond

1 Simultaneously press <Command> <Control> <Power On> keys
  to reset computer.
2 Connect power adapter and reboot computer in 3-4 minutes.
3 Try known-good, charged main battery.
4 Check all logic board cable connections.
5 Replace logic board.

Note: When replacing the logic board, check that the EMI clips
are securely attached to the CPU stiffener. The "CPU Stiffener"
topic in Take Apart helps you locate and identify the two EMI clips.
If both clips are not secure, replace the CPU stiffener.

Power (Continued)

After you remove
main battery, some
Control Panel
settings are different

Replace backup battery.

Power adapter is
plugged in, but
battery DA does not
indicate charger is
connected

1   This is normal for fully charged battery.
2   Check power adapter connection.
3   Try known-good, charged main battery.
4   Try known-good power adapter.
5   Replace logic board.

Note: When replacing the logic board, check that the EMI clips
are securely attached to the CPU stiffener. The "CPU Stiffener"
topic in Take Apart helps you locate and identify the two EMI clips.
If both clips are not secure, replace the CPU stiffener.

Power **(Continued)**

Low-power warning
appears

1 Recharge battery or attach power adapter.
2 Remove external devices.
3 Try known-good, charged main battery.
4 Try known-good power adapter.
5 Replace logic board.

Note: When replacing the logic board, check that the EMI clips
are securely attached to the CPU stiffener. The "CPU Stiffener"
topic in Take Apart helps you locate and identify the two EMI clips.
If both clips are not secure, replace the CPU stiffener.

Power (Continued)

Computer runs when plugged into wall outlet but not when using battery power; battery voltage is within tolerance

1 Replace main battery.
2 Replace logic board.

Note: When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener. The "CPU Stiffener" topic in Take Apart helps you locate and identify the two EMI clips. If both clips are not secure, replace the CPU stiffener.

Power (Continued)

System powers off unexpectedly, system errors occur, or system hangs up. Symptoms usually occur in these situations: Keyboard is used while PowerBook Duo flip feet are down, PowerBook Duo is inserted in Duo Dock, or PowerBook Duo is attached to MiniDock.

Make sure that the logic board mounting screw that also serves as a battery contact is installed. (Screw should be installed on contact located on right side.)

Power (Continued)

System powers down unexpectedly, won't boot off battery, or powers down intermittently when running off battery. Or, battery won't charge.

1 Make sure battery is good battery.
2 Use Duo battery contact alignment tool to check alignment of battery contacts. If contacts are out of alignment, use tool to realign them.

Video

Row or partial row of pixels never comes on or is always on

PowerBook Duo 210/230:

1　Check display cable connection.
2　Replace display.
3　Replace logic board.
4　Return computer to Apple.

PowerBook Duo 270c/280c:

5　Check display cable connection.
6　Replace display cable.
7　Replace display (CPRC/Int'l only).
8　Replace logic board.
9　Return computer to Apple.

Video (Continued)

Thin white line is
always on at middle of
screen

PowerBook Duo 210/230:

1 Adjust screen contrast.
2 For FSTN screens, a thin white line is normal.

PowerBook Duo 250:

3 Adjust screen contrast.
4 Replace display (CPRC/Int'l only) or return computer to
   Apple.

Video (Continued)

Display is very light
or totally white

PowerBook Duo 210/230/250/280:

1   Adjust screen contrast.
2   Check logic board cable connections.
3   Duo 210/230: Replace display.
4   Duo 250/280: Replace display (CPRC/Int'l only).
5   Replace logic board.

Video (Continued)

PowerBook Duo 270c/280c:

1   Adjust screen contrast.
2   Check logic board cable connections.
3   Replace inverter board.
4   Replace display cable.
5   Replace display (CPRC/Int'l only).
6   Replace logic board.
7   Return computer to Apple.

Video (Continued)

No display, but
computer appears to
operate correctly

PowerBook Duo 210/230/250/280:

1   Adjust screen contrast.
2   Check logic board cable connections.
3   Connect power adapter.
4   Duo 210/230: Replace display.
5   Duo 250/280: Replace display (CPRC/Int'l only).
6   Replace logic board.
7   Return computer to Apple.

Video (Continued)

PowerBook Duo 270c/280c:

1 Adjust screen contrast.
2 Check logic board cable connections.
3 Connect power adapter.
4 Replace inverter board
5 Replace display cable.
6 Replace display (CPRC/Int'l only).
7 Replace logic board.
8 Return computer to Apple

Rainbow colors
visible from extreme
viewing angles

PowerBook Duo 210/230:
Such colors are normal for FSTN screens.

Video (Continued)

Screen brightness is
not uniform

PowerBook Duo 210/230:
For FSTN screens, some irregularity in screen brightness is
normal. Adjust contrast and brightness to diminish effect.

Display stopped
working or dimmed
but is fine now

PowerBook Duo 210/230:
Tighten loose display cable connectors. Otherwise, reaction is
normal for FSTN screens at extreme cold or hot temperatures
(approximately under 5 or over 40 degrees centigrade).

Video (Continued)

Backlight does not operate

PowerBook Duo 210/230/250/280:

1   Check display cable connection.
2   Duo 210/230: Replace display.
3   Duo 250/280: Replace display (CPRC/Int'l only).
4   Replace logic board.
5   Return computer to Apple.

Video (Continued)

PowerBook Duo 270c/280c:

1   Check display cable connection.
2   Replace inverter board.
3   Replace display cable.
4   Replace display (CPRC/Int'l only).
5   Replace logic board.
6   Return computer to Apple.

Screen goes blank   1   Press any key or press <Wake Up> key to wake computer
                            from system sleep.
                        2   Check display cable connection.
                        3   Replace cracked cable connectors.

Video (Continued)

Screen flickers

1. Some flickering is normal for grayscale displays.
2. Set display to 1-bit mode (black and white) in Monitors Control Panel.
3. Check display cable connection.
4. Duo 210/230: Replace display.
5. Duo 250/280: Replace display (CPRC/Int'l only).
6. Replace logic board.
7. Return computer to Apple.

Video (Continued)

Pixel is always white
or always black

1   PowerBook Duo 210 and 230: Replace display.
2   PowerBook Duo 250 and 280: If there are more than five
    voids (pixels that are always white), or two or more voids
    within one inch of each other, replace display (CPRC/
    international repairers only) or return computer to Apple.
3   PowerBook Duo 270c and 280c, color active matrix display
    only: Replace display (CPRC/ international repairers only)
    or return computer to Apple.

External Floppy Drive

Audio and video
present, but external
drive does not operate

1   Check floppy-adapter-to-PowerBook connection.
2   Try known-good floppy disk.
3   Check floppy drive cable connection.
4   Replace floppy drive cable.
5   Replace floppy adapter.
6   Replace floppy drive.
7   Replace logic board.

Note: When replacing the logic board, check that the EMI clips
are securely attached to the CPU stiffener. The "CPU Stiffener"
topic in Take Apart helps you locate and identify the two EMI clips.
If both clips are not secure, replace the CPU stiffener.

External Floppy Drive (Continued)

Disk ejects while
booting; display
shows Mac icon with
blinking X

1 Try known-good system disk.
2 Verify that trackball or mouse button is not stuck.
3 Check floppy drive cable connection.
4 Replace floppy drive cable.
5 Replace floppy adapter.
6 Replace floppy drive.
7 Replace logic board.

Note: When replacing the logic board, check that the EMI clips
are securely attached to the CPU stiffener. The "CPU Stiffener"
topic in Take Apart helps you locate and identify the two EMI clips.
If both clips are not secure, replace the CPU stiffener.

External Floppy Drive (Continued)

Disk does not eject

1   Switch off system and hold mouse or trackball button down while you switch system on.
2   Insert straightened paper clip into hole next to drive opening to eject disk.
3   Check floppy drive cable connection.
4   Replace floppy drive cable.
5   Replace floppy adapter.
6   Replace floppy drive.
7   Replace logic board.

Note: When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener. The "CPU Stiffener" topic in Take Apart helps you locate and identify the two EMI clips. If both clips are not secure, replace the CPU stiffener.

External Floppy Drive (Continued)

Disk initialization
fails

1 Try known-good floppy disk.
2 Check floppy drive cable connection.
3 Replace floppy drive cable.
4 Replace floppy adapter.
5 Replace floppy drive.

Read/write/copy
error

1 Try known-good floppy disk.
2 Check floppy drive cable connection.
3 Replace floppy drive cable.
4 Replace floppy adapter.
5 Replace floppy drive.

Hard Drive

Internal hard drive
does not operate

1   Check internal hard drive cable connection.
2   Replace internal hard drive cable.
3   Run Macintosh Hard Disk Test.
4   Use HD SC Setup to reinitialize drive.
5   Replace internal hard drive.
6   Replace logic board.

Note: When replacing the logic board, check that the EMI clips
are securely attached to the CPU stiffener. The "CPU Stiffener"
topic in Take Apart helps you locate and identify the two EMI clips.
If both clips are not secure, replace the CPU stiffener.

Peripherals

Cursor does not move when you are using trackball

1 Simultaneously press <Command> <Control> <Power On> keys to reset computer.
2 Clean ball and rollers of trackball.
3 Make sure display switch cable and battery cable are not impeding trackball.
4 Check logic board cable connections.
5 Replace trackball.
6 Replace logic board.

Note: When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener. The "CPU Stiffener" topic in Take Apart helps you locate and identify the two EMI clips. If both clips are not secure, replace the CPU stiffener.

Peripherals (Continued)

Cursor intermittently does not move or moves erratically

1 Clean ball and rollers of trackball.
2 Replace trackball.
3 Replace logic board.

Note: When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener. The "CPU Stiffener" topic in Take Apart helps you locate and identify the two EMI clips. If both clips are not secure, replace the CPU stiffener.

Peripherals (Continued)

Cursor moves, but clicking trackball button has no effect

1 Simultaneously press <Command> <Control> <Power On> keys to reset computer.
2 Check logic board cable connections.
3 Replace trackball.
4 Replace logic board.

Note: When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener. The "CPU Stiffener" topic in Take Apart helps you locate and identify the two EMI clips. If both clips are not secure, replace the CPU stiffener.

Peripherals (Continued)

No response to any
key on keyboard

1 Press <Power On> key or power button.
2 Adjust Battery Conservation setting in PowerBook Control Panel.
3 Check keyboard cable connection.
4 If you are using floppy adapter and external keyboard, replace keyboard cable.
5 Replace floppy adapter.
6 Replace keyboard.
7 Replace logic board.

Note: When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener. The "CPU Stiffener" topic in Take Apart helps you locate and identify the two EMI clips. If both clips are not secure, replace the CPU stiffener.

Peripherals **(Continued)**

Cursor does not move
when you are using
floppy adapter and
mouse

1 Check floppy adapter and mouse connections.
2 Simultaneously press <Command> <Control> <Power On> keys
  to reset computer.
3 Clean mouse ball and inside mouse.
4 Replace mouse.
5 Replace floppy adapter.
6 Replace logic board.

Note: When replacing the logic board, check that the EMI clips
are securely attached to the CPU stiffener. The "CPU Stiffener"
topic in Take Apart helps you locate and identify the two EMI clips.
If both clips are not secure, replace the CPU stiffener.

Peripherals **(Continued)**

Known-good serial
printer does not print

1 Verify that System is 7.1 or later.
2 Verify that Chooser and Control Panel settings are correct.
3 Check cables.
4 Replace printer interface cable.
5 Try known-good printer.
6 Replace logic board.

Note: When replacing the logic board, check that the EMI clips
are securely attached to the CPU stiffener. The "CPU Stiffener"
topic in Take Apart helps you locate and identify the two EMI clips.
If both clips are not secure, replace the CPU stiffener.

Peripherals **(Continued)**

Known-good
networked printer
does not print

1 Verify that System is 7.1 or later.
2 Verify that Chooser and Control Panel settings are correct.
3 Check cables.
4 Replace printer interface cable.
5 Try known-good printer. If printer works, troubleshoot
   network.
6 Replace logic board.

Note: When replacing the logic board, check that the EMI clips
are securely attached to the CPU stiffener. The "CPU Stiffener"
topic in Take Apart helps you locate and identify the two EMI clips.
If both clips are not secure, replace the CPU stiffener.

Peripherals (Continued)

Device connected to
mini-DIN-8 port
does not work

1 Verify that External Modem is selected in PowerBook Control
   Panel.
2 Verify that System is 7.1 or later.
3 Check cables.
4 Test device with known-good computer.
5 Replace logic board.

Note: When replacing the logic board, check that the EMI clips
are securely attached to the CPU stiffener. The "CPU Stiffener"
topic in Take Apart helps you locate and identify the two EMI clips.
If both clips are not secure, replace the CPU stiffener.

Peripherals (Continued)

I/O devices are
unrecognized or
garbage is
transmitted or
received

1   Verify that System is 7.1 or later.
2   Check floppy adapter and cable connections.
3   Test device with known-good computer.
4   Replace logic board.

Note: When replacing the logic board, check that the EMI clips
are securely attached to the CPU stiffener. The "CPU Stiffener"
topic in Take Apart helps you locate and identify the two EMI clips.
If both clips are not secure, replace the CPU stiffener.

Space bar is hard to
press and/or does not
work

Loosen keyboard screws. Over-tightening can warp keyboard and
restrict movement of space bar.

Internal Modem

Internal modem options do not appear in CDEV

1 Verify that System is 7.1 or later.
2 Remove and reseat modem card.
3 Replace modem card.
4 Replace logic board.

Note: When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener. The "CPU Stiffener" topic in Take Apart helps you locate and identify the two EMI clips. If both clips are not secure, replace the CPU stiffener.

Internal Modem (Continued)

Modem does not
respond properly to
AT command set
instructions

1 Verify that baud rate and data format settings of
   communications application are compatible with internal
   modem and remote modem.
2 Check phone cord connection and operation.
3 Verify that System is 7.1 or later.
4 Remove and reseat modem card.
5 Replace modem card.

Internal Modem (Continued)

Strange mix of
characters appears
on screen

1 Verify that baud rate and data format settings of
   communications application are compatible with internal
   modem and remote modem.
2 Check phone cord connection and operation.
3 Verify that System is 7.1 or later.
4 Remove and reseat modem card.
5 Replace modem card.
6 Replace logic board.

Note: When replacing the logic board, check that the EMI clips
are securely attached to the CPU stiffener. The "CPU Stiffener"
topic in Take Apart helps you locate and identify the two EMI clips.
If both clips are not secure, replace the CPU stiffener.

Internal Modem (Continued)

Modem interferes
with system sound

1   Remove and reseat modem card.
2   Replace modem card.
3   Replace logic board.

Note: When replacing the logic board, check that the EMI clips
are securely attached to the CPU stiffener. The "CPU Stiffener"
topic in Take Apart helps you locate and identify the two EMI clips.
If both clips are not secure, replace the CPU stiffener.

Internal Modem (Continued)

Modem does not
respond to incoming
call

1 If computer is in sleep mode, verify that "Answer calls" is
   selected in PowerBook Control Panel.
2 Check phone cord connection and operation.
3 Replace modem card.
4 Replace logic board.

Note: When replacing the logic board, check that the EMI clips
are securely attached to the CPU stiffener. The "CPU Stiffener"
topic in Take Apart helps you locate and identify the two EMI clips.
If both clips are not secure, replace the CPU stiffener.

Internal Modem (Continued)

Modem has no sound output

1. Verify that Control Panel volume setting is 1 or above.
2. Replace modem card.
3. Replace logic board.

Note: When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener. The "CPU Stiffener" topic in Take Apart helps you locate and identify the two EMI clips. If both clips are not secure, replace the CPU stiffener.

Modem connects but does not communicate with remote modem

1. Verify that remote modem needs error correction (error correction is internal modem default).
2. Type AT &Q0 to disable error correction.

Miscellaneous

Screen goes blank and computer shuts down every few minutes

Adjust Battery Conservation setting in Control Panel or connect power adapter.

Application seems to run slower after few seconds

1   Adjust Battery Conservation Options setting in Control Panel or connect power adapter.
2   Connect power adapter.

Hard drive is slow to respond, or screen goes blank too often

Adjust Battery Conservation setting in Control Panel or connect power adapter.

Miscellaneous (Continued)

No sound from
speaker

PowerBook Duo 210/230/250/280:

1 Verify that Control Panel volume setting is 1 or above.
2 Check display cable connection.
3 Duo 210/230: Replace display.
4 Duo 250/280: Replace display (CPRC/Int'l Only).
5 Replace logic board.

Miscellaneous (Continued)

PowerBook Duo 270c/280c:

1 Verify that Control Panel volume setting is 1 or above.
2 Check display cable connection.
3 Replace display cable.
4 Replace speaker assembly.
5 Replace logic board.
6 Return computer to Apple.

Red light on battery recharger; battery won't charge

Replace Type 1 recharger with Type 2 recharger. Or replace Type 2 or Type 3 battery with Type 1 battery.

Note: Use only Type 1 batteries in a Type 1 battery recharger; Type 2 or Type 3 batteries will not charge. You can charge Type 1, Type 2, or Type 3 batteries in a Type 2 battery recharger.

Take Apart

PowerBook 200 Series
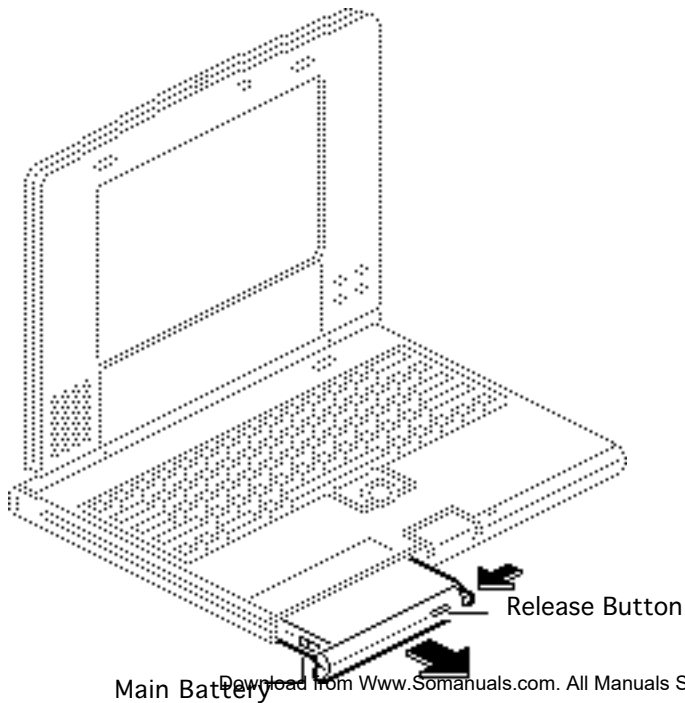
Main Battery

Before you begin, disconnect the power adapter.

Caution: If you fail to disconnect the power adapter and remove the main battery before attempting take-apart procedures, you could short out the logic board.

1 Depress the release button and slide open the battery door.

2 Pull out the main battery.

Release Button

Keyboard

Before you begin, do the following:

- Disconnect the power adapter
- Remove the main battery

Note: The following tools are required to disassemble a PowerBook Duo system:

- T-8 torx driver
- T-10 torx driver
- IC extractor
- Jeweler's flat-blade screwdriver
- Duo battery contact alignment tool
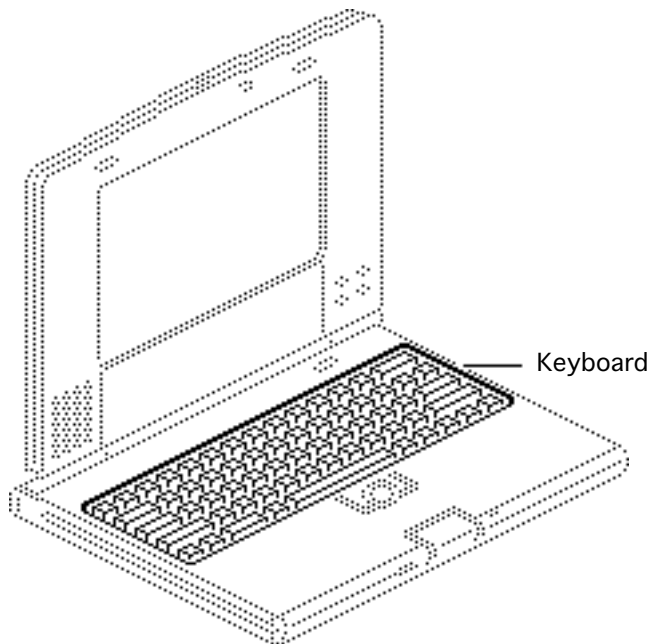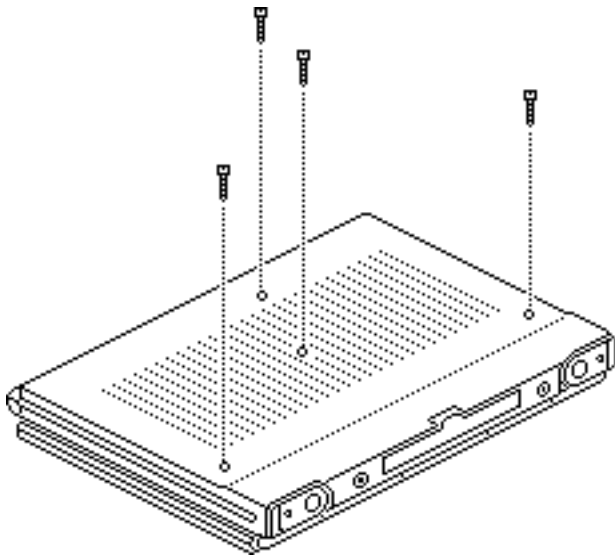
Keyboard

Caution: The PowerBook
Duo contains CMOS devices
that are very susceptible to
ESD damage. To prevent
damage, wear a grounding
wriststrap. Review the ESD
precautions in Bulletins/
Safety.

Caution: PowerBook Duo
cables are fragile and easily
torn or damaged. Handle all
cables with care.

Note: If you are removing the keyboard only, you do not need to remove the case screw nearest the front of the unit.

1   Close, latch, and turn over the computer. Remove the four case screws from the bottom of the computer.

Replacement Caution:
Don't overtighten the keyboard screws. Overtightening them could warp the keyboard and restrict key movement. After replacing the screws, always check the keys and space bar to make sure they work.

Cables   Palm Rest

2 Turn the computer upright and open the display.

Caution: Handle the keyboard carefully to avoid tearing cables connected between the keyboard and the logic board.

3 Carefully tilt the computer and lift out the keyboard. Turn the keyboard over and place it on the palm rest.
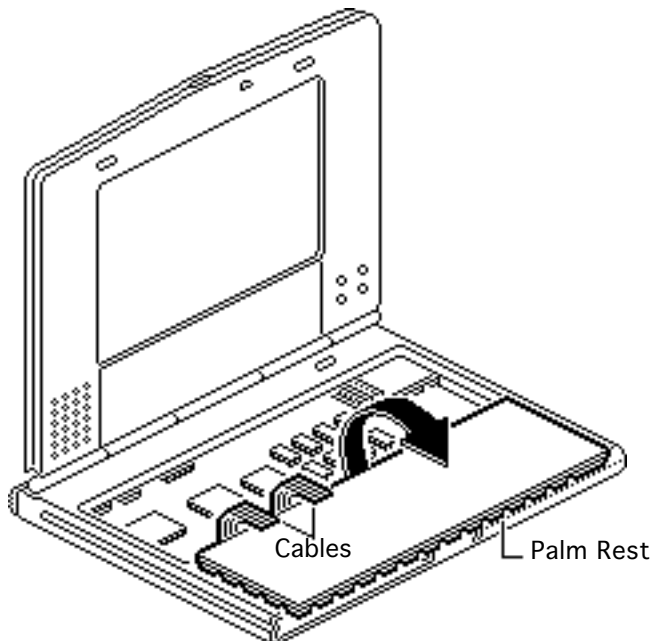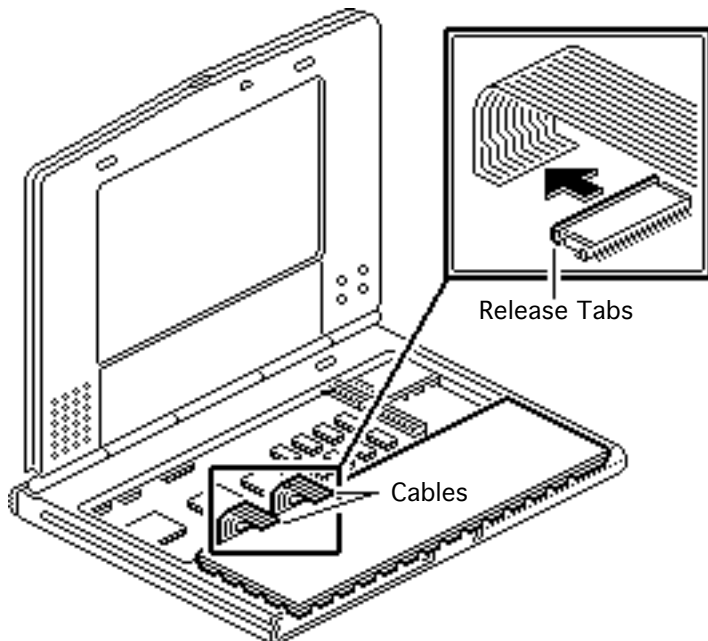
4 Using a jeweler's screwdriver, push out the release tabs and remove the two keyboard cables.

5 Set aside the keyboard.

Release Tabs

Cables

End Clutch Covers

Before you begin, do the following:

- Disconnect the power adapter
- Remove the main battery

Note: The end clutch covers are disposable. If you break or cosmetically damage the covers, replace them.

End Clutch Cover
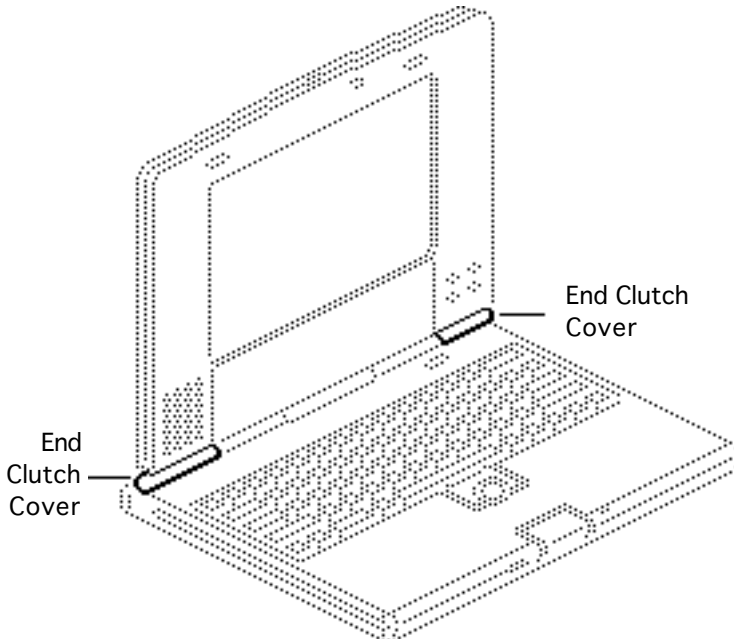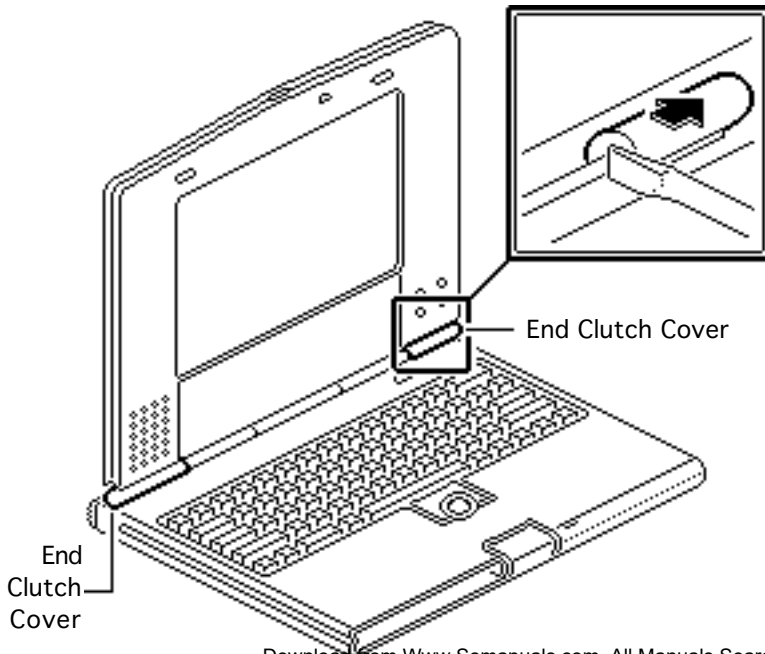
End Clutch Cover

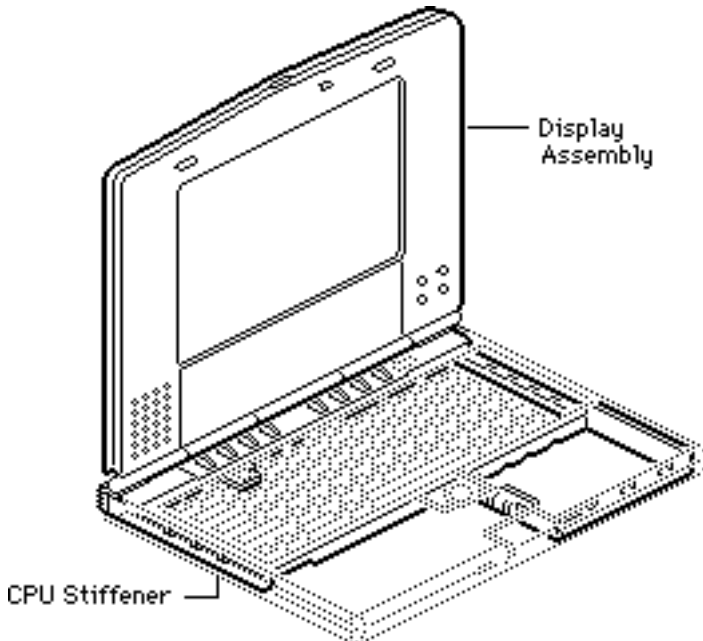1 Using a jeweler's screwdriver, push off the left and right end clutch covers.

End Clutch Cover

End Clutch Cover

Top Case

Before you begin, do the following:

- Disconnect the power adapter
- Remove the main battery
- Remove the keyboard
- Remove the end clutch covers
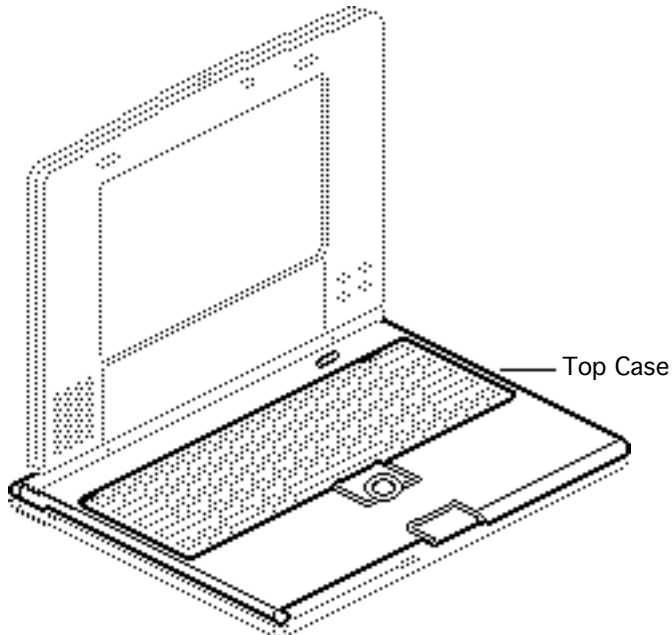
Top Case

Caution: The PowerBook Duo contains CMOS devices that are very susceptible to ESD damage. To prevent damage, wear a grounding wriststrap. Review the ESD precautions in Bulletins/ Safety.
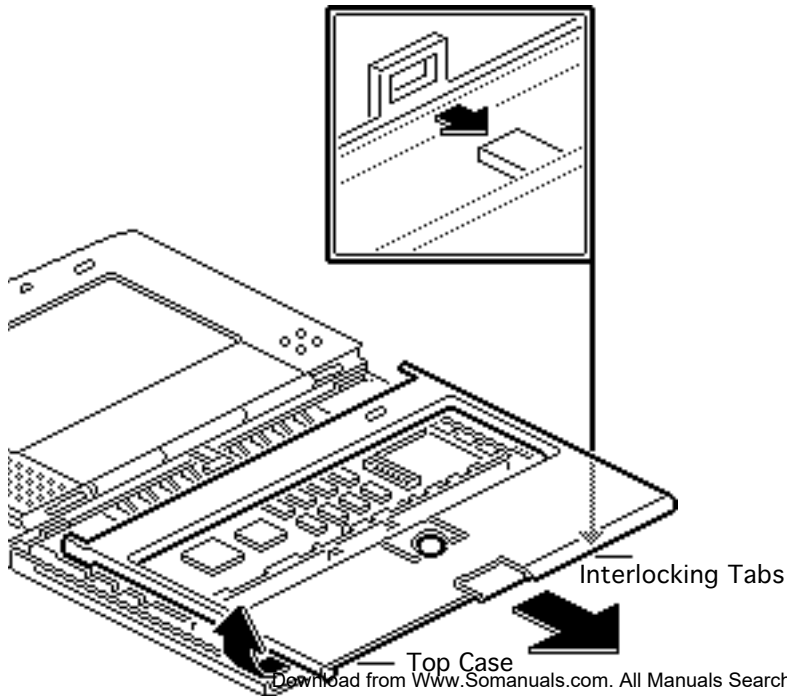
Caution: The top case is secured to the chassis by a snap at the left corner of the case and by four interlocking tabs along the front. Failure to unlock the four interlocking case tabs could damage the top case.

1 Raise the bottom left corner of the top case and release the case snap.

2 Slide the top case off the four interlocking tabs.

Interlocking Tabs

Top Case

3 Remove the two rubber bumpers from the chassis.

Replace the rubber bumpers with the notched ends aligned as shown.

Notch

Rubber Bumper

Rubber Bumper

Notch
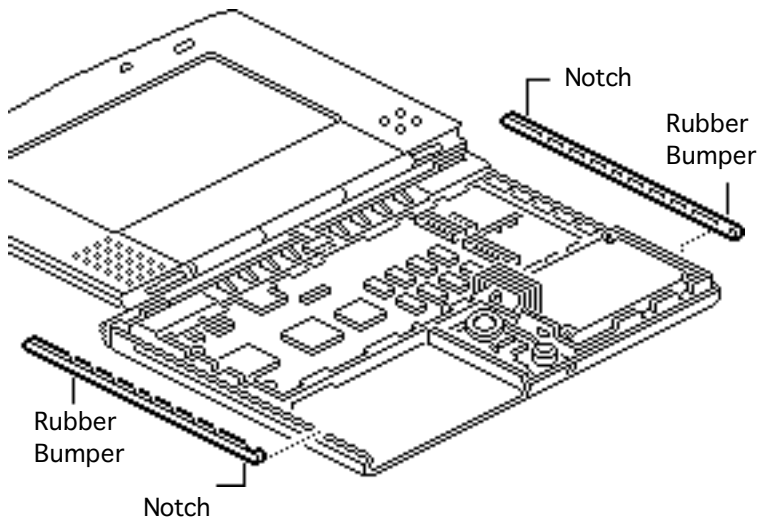
Hard Drive

Before you begin, do the following:

- Disconnect the power adapter
- Remove the main battery
- Remove the keyboard
- Remove the end clutch covers
- Remove the top case

Hard Drive
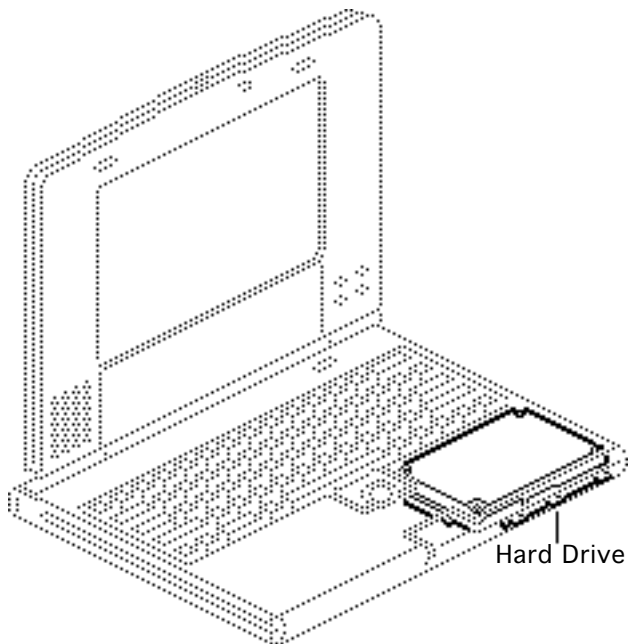
Caution: The PowerBook Duo contains CMOS devices that are very susceptible to ESD damage. To prevent damage, wear a grounding wriststrap. Review the ESD precautions in Bulletins/Safety.

**Caution:** PowerBook cables are fragile and easily torn or damaged. Handle all cables with care.
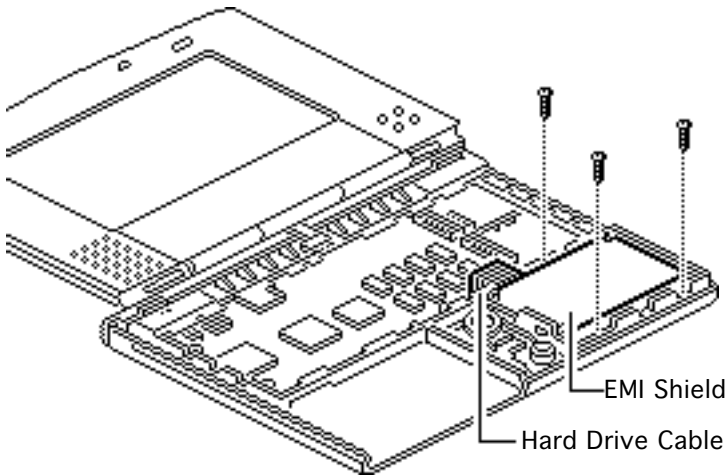
1   Remove the three self-
    threading screws that
    secure the hard drive to
    the CPU stiffener.

2   Using an IC extractor,
    disconnect the hard drive
    cable.

Replacement Note: Before
replacing the hard drive
mounting screws, place the
hard drive cable beneath the
EMI shield.

EMI Shield

Hard Drive Cable

3   Pull back the EMI shield
    and lift out the hard
    drive.

Hard Drive

EMI Shield
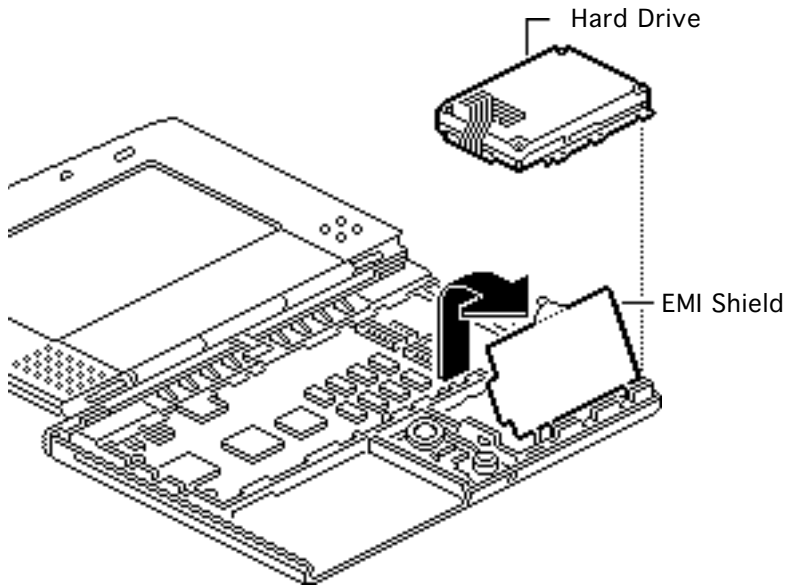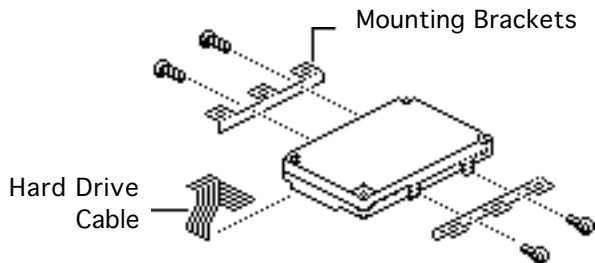
Note: Remove the mounting brackets only if you are returning a defective drive to Apple.

Note: On early production units, Phillips screws secure the mounting brackets to the hard drive.

Mounting Brackets

Hard Drive Cable

4   Using a T-8 torx driver, remove the four screws and the two mounting brackets from the hard drive.

5   Disconnect the hard drive cable.

# Backup Battery

Before you begin, do the following:

- Disconnect the power adapter
- Remove the main battery
- Remove the keyboard
- Remove the end clutch covers
- Remove the top case

Backup Battery
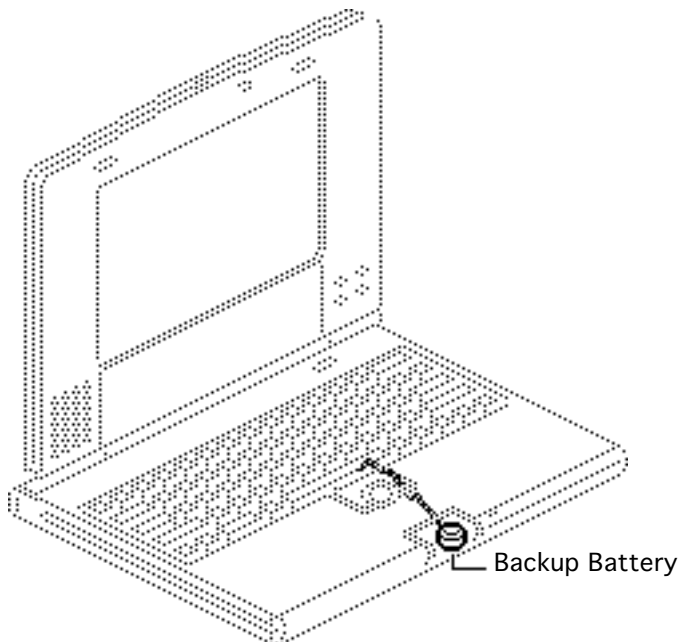
Caution: The PowerBook Duo contains CMOS devices that are very susceptible to ESD damage. To prevent damage, wear a grounding wriststrap. Review the ESD precautions in Bulletins/ Safety.

Caution: PowerBook cables are fragile and easily torn or damaged. Handle all cables with care.

1 Remove the backup
   battery from the
   trackball assembly.

2 Carefully disconnect the
   backup battery cable
   from the logic board.

Backup
Battery
Cable

Backup Battery

Trackball Assembly
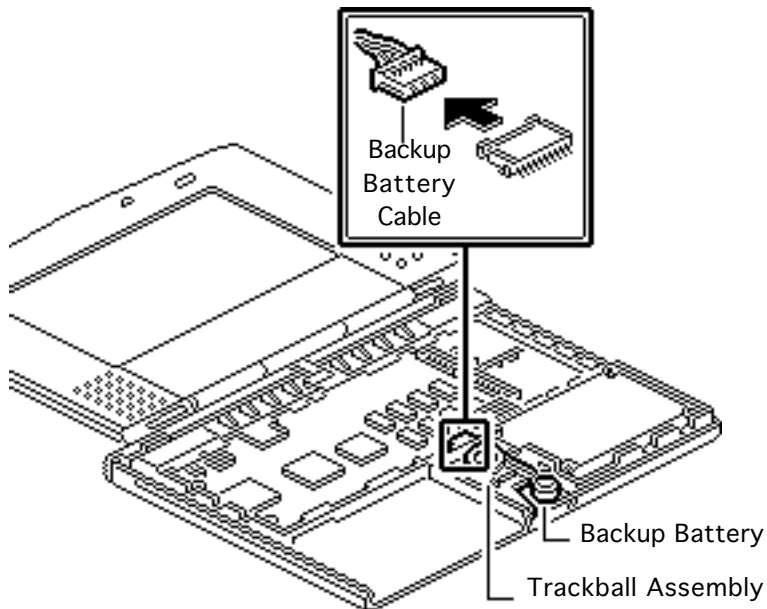
Trackball

Before you begin, do the following:

- Disconnect the power adapter
- Remove the main battery
- Remove the keyboard
- Remove the end clutch covers
- Remove the top case
- Remove the backup battery
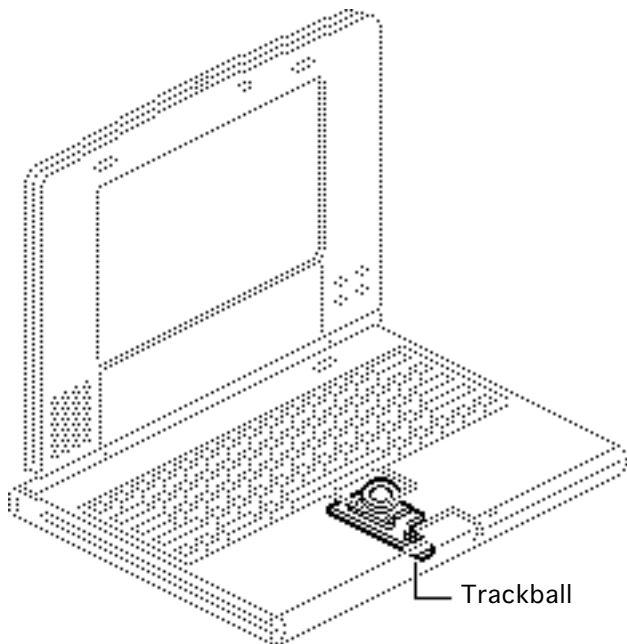
Trackball

Caution: The PowerBook Duo contains CMOS devices that are very susceptible to ESD damage. To prevent damage, wear a grounding wriststrap. Review the ESD precautions in Bulletins/Safety.

Caution: PowerBook cables are fragile and easily torn or damaged. Handle all cables with care.

1 Remove the two self-threading screws that secure the trackball assembly to the chassis.

2 Using an IC extractor, disconnect the trackball cable.

3 Lift out the trackball assembly.

Trackball Assembly
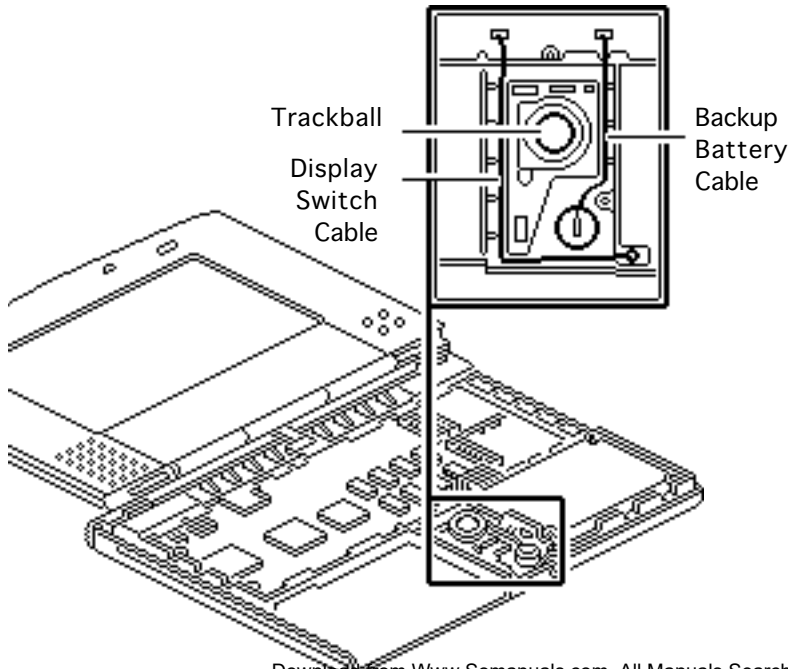
Replacement Note: When replacing the trackball assembly, be sure to route the display switch cable and the backup battery cable around the trackball.

Trackball

Display Switch Cable

Backup Battery Cable

Center Clutch Cover

Center Clutch Cover

Before you begin, do the following:

- Disconnect the power adapter
- Remove the main battery
- Remove the keyboard
- Remove the end clutch covers
- Remove the top case
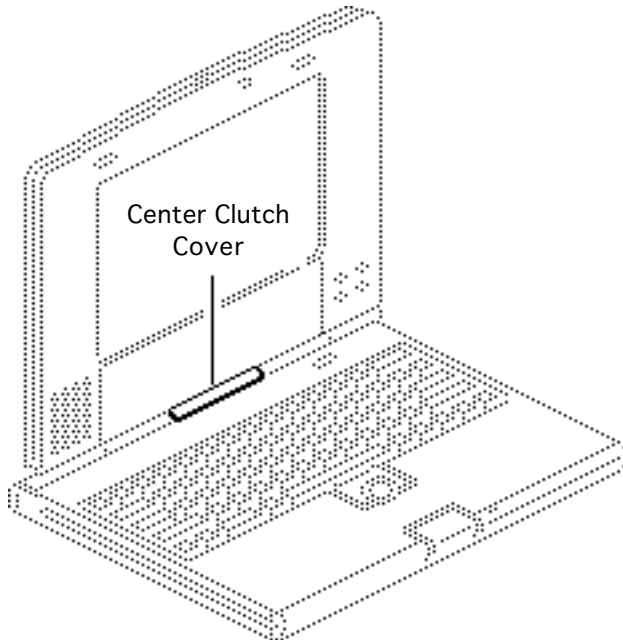
Caution: Removing the center clutch cover can exert unnecessary wear and tear on the display cable and plastics. Remove the cover only if you are replacing the CPU stiffener, display assembly, or rear cover.

Caution: When removing the center clutch cover, be careful not to tear the fragile display cable located beneath the clutch cover.

Note: The center clutch cover is disposable. If you break or cosmetically damage the cover, replace it.

Center Clutch Cover
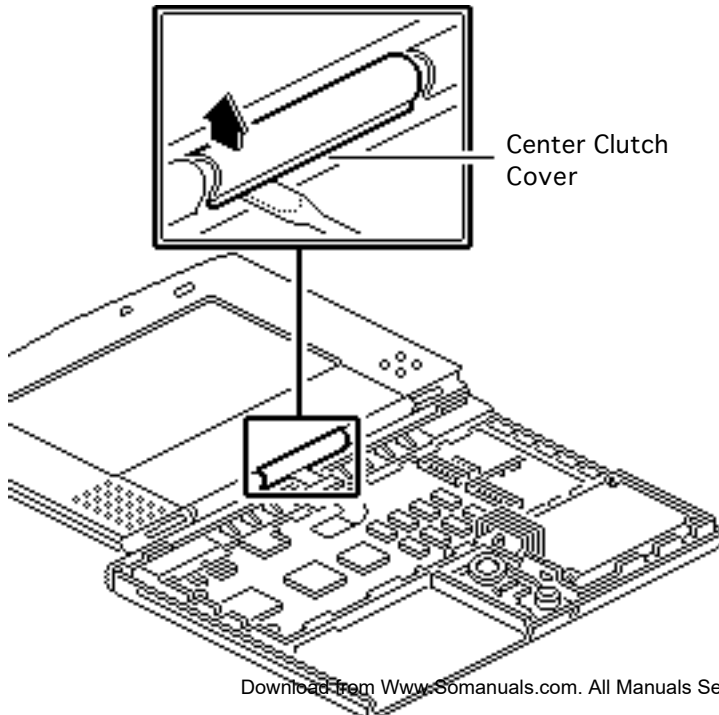
1 Using a jeweler's screwdriver, pry up the left side and then the right side of the center clutch cover. Carefully pull up the cover and remove it from the display.

Display Leg Assembly
Stiffener
Center Clutch Cover
Torsion Bar
Display Cable
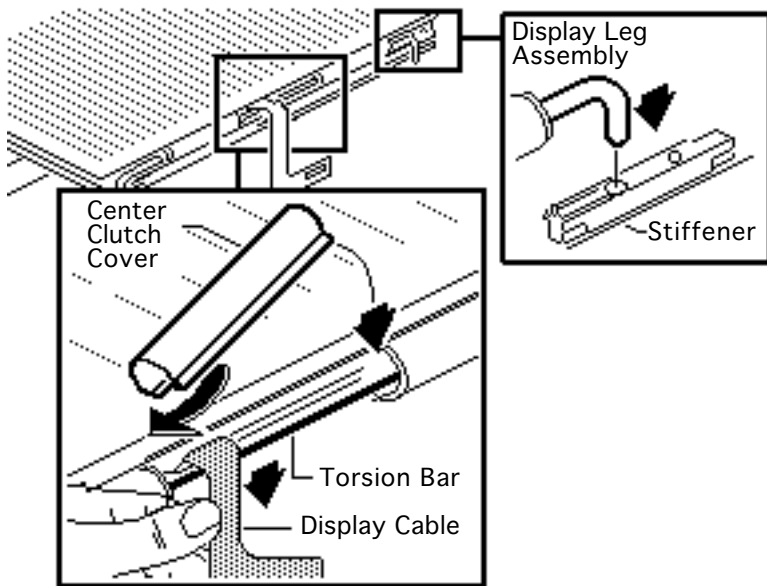
Replacement Note (for display assembly only):

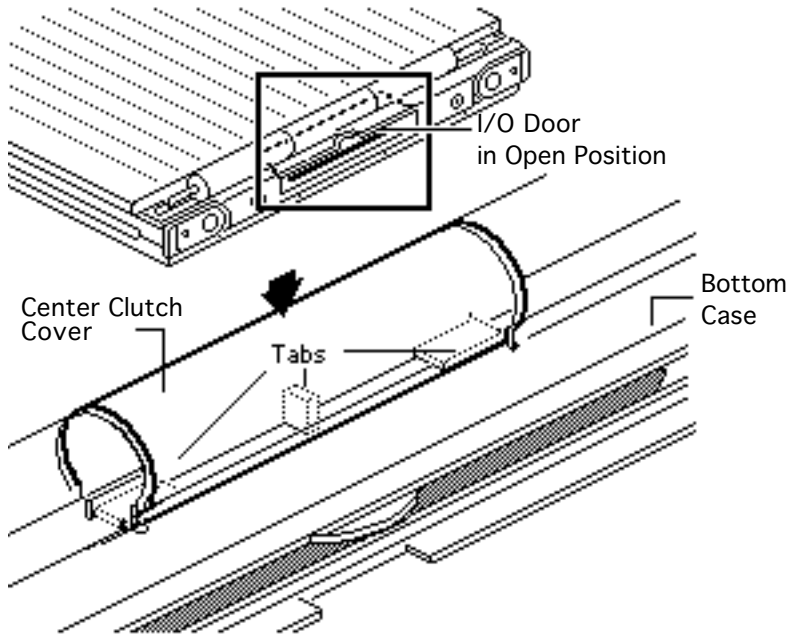Before reattaching the display assembly to a PowerBook Duo, install the center clutch cover. Place the display assembly face down, with the display cable freely hanging over the edge of a counter. Pull the display cable until it's snug on the torsion bar. With your other hand, turn the center clutch cover so the opening faces downward and then carefully slide it onto the torsion bar.

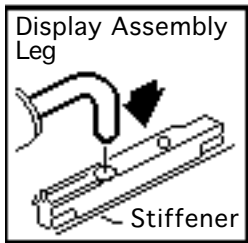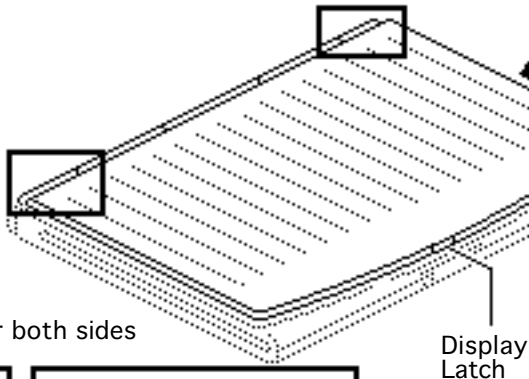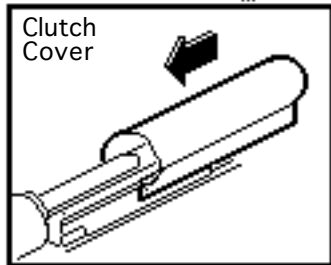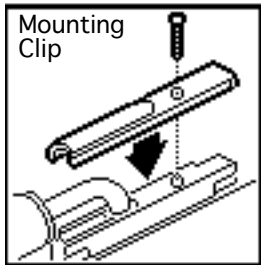Insert the display assembly legs into the holes in the stiffener and close the cover. For added support, raise the I/O door before snapping the center clutch cover into place.

I/O Door in Open Position

Center Clutch Cover

Tabs

Bottom Case
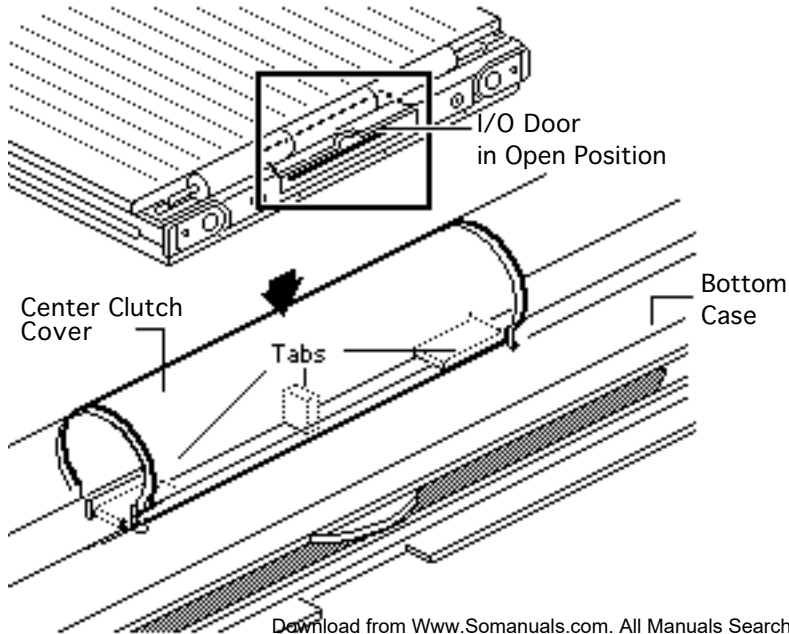
Display Assembly and CPU Stiffener

Before you begin, do the following:

- Disconnect the power adapter
- Remove the main battery
- Remove the keyboard
- Remove the end clutch covers
- Remove the top case
- Remove the hard drive
- Remove the backup battery
- Remove the trackball

Caution: The PowerBook Duo contains CMOS devices that are very susceptible to ESD damage. To prevent damage, wear a grounding wriststrap. Review the ESD precautions in Bulletins/ Safety.

Caution: PowerBook Duo cables are fragile and easily torn or damaged. Handle all cables with care.

Important: Follow this procedure only when removing the logic board and case bottom. In all other cases, remove the display assembly and CPU stiffener separately.

1 Using a jeweler's screwdriver, carefully disconnect the display switch cable.

Replacement Note: Route the display switch cable and the backup battery cable around the trackball.
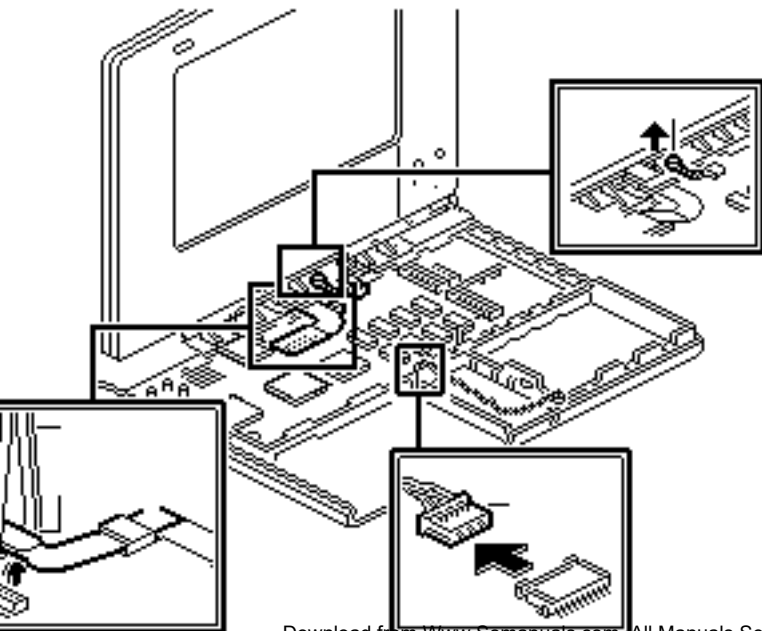
2 Using an IC extractor, disconnect the display cable.

3 Remove the microphone from the CPU stiffener.

Mounting
Screw/
Battery
Contact
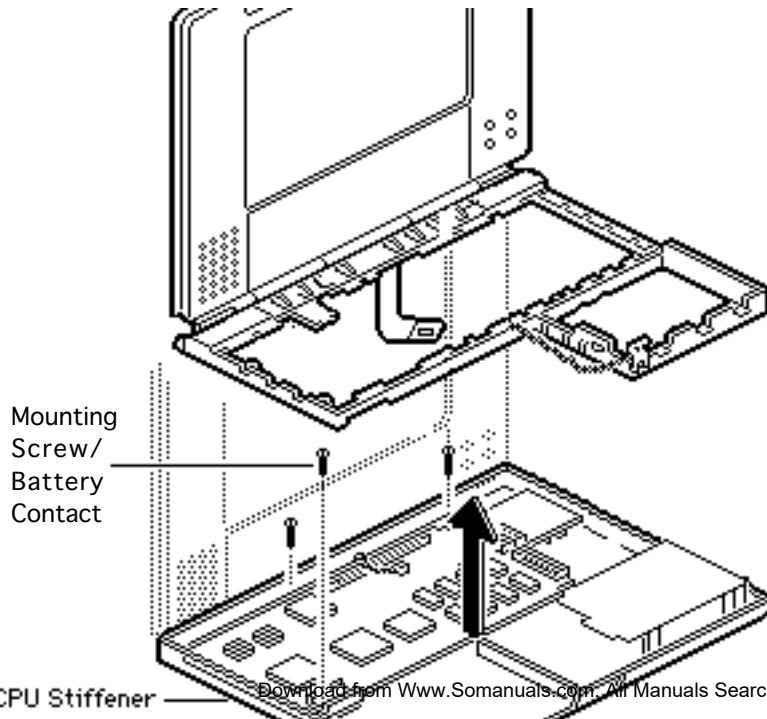
CPU Stiffener

4 Remove the three
   mounting screws that
   secure the CPU stiffener
   to the bottom case.

   Replacement Note: The
   left-most CPU stiffener
   mounting screw is also a
   battery contact. If you fail
   to reinstall this screw, the
   battery may not charge.

5 Lift the CPU stiffener
   and attached display
   housing straight up and
   remove the unit from the
   bottom case.
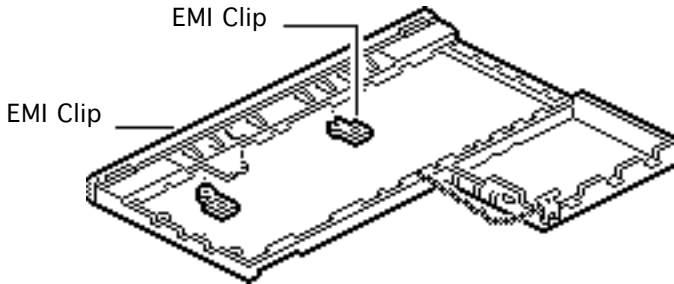
Important: Check that both EMI clips are securely attached to the CPU stiffener. If the clips are not secure, replace the stiffener.

Replacement Note: Move the display switch cable and microphone cable forward before reinstalling the display assembly/CPU stiffener unit. This will prevent them from being caught under the stiffener and possibly damaged.

EMI Clip

EMI Clip

Replacement Note: When reinstalling the display assembly/CPU stiffener unit, be sure to wrap the hard drive EMI shield around the outside of the stiffener.

Replacement Note: After reinstalling the CPU stiffener, use the Duo battery contact alignment tool to check the alignment of the battery contacts.

Display Assembly

Before you begin, do the following:

- Disconnect the power adapter
- Remove the main battery
- Remove the keyboard
- Remove the end clutch covers
- Remove the top case
- Remove the center clutch cover
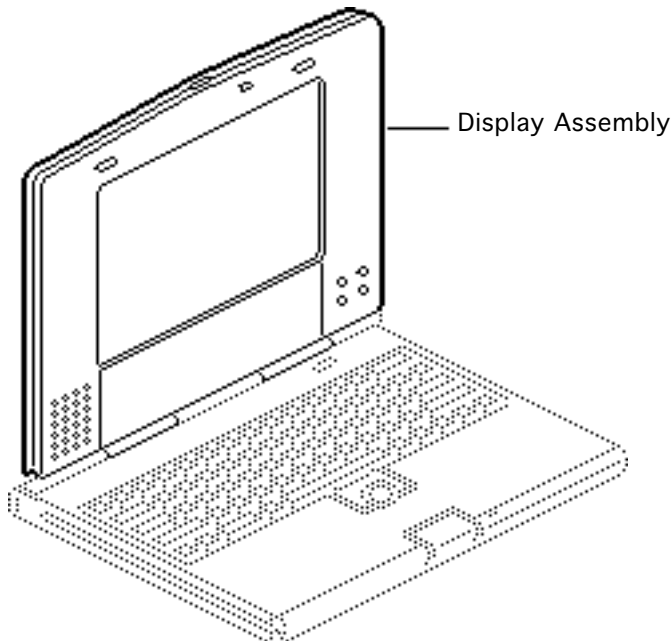
Display Assembly

Note: This topic includes procedures for removing the Duo 210/230/250/280 display assembly. CPRC and International repairers: See 270c/280c topics for removing the Duo 270c/280c display assembly.

Note: The PowerBook Duo 250, 270c, 280, and 280c display assemblies are available to CPRC and international repairers only.

Caution: PowerBook cables are fragile and easily torn or damaged. Handle all cables with care.

Display Cable

Ferrite Bead

Display Cable Connector
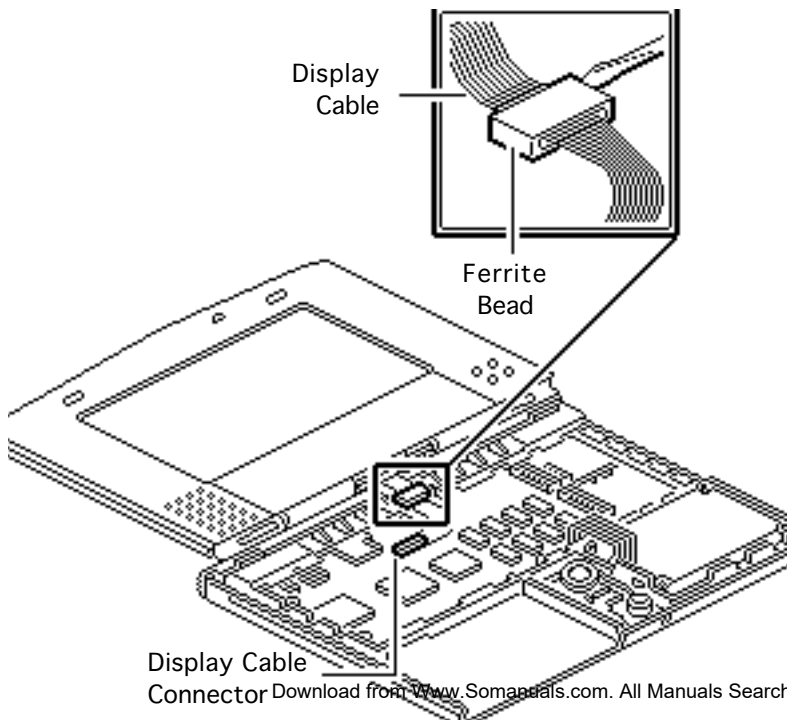
1 Using an IC extractor, disconnect the display cable.

2 Using a jeweler's screwdriver, pry the display cable ferrite bead off the CPU stiffener.

Replacement Note: When attaching the ferrite bead to the CPU stiffener of the Duo 210/230, use the adhesive tape available in the Clutch Cover Kit or a piece of two-sided tape.

3 Remove the two screws and the display mounting clips.

Display Mounting Clip

Display Mounting Clip
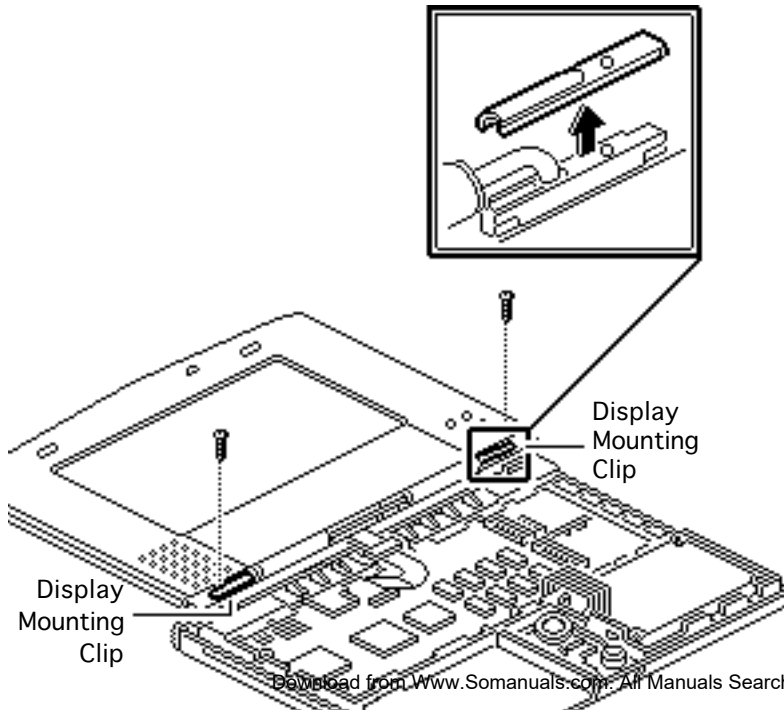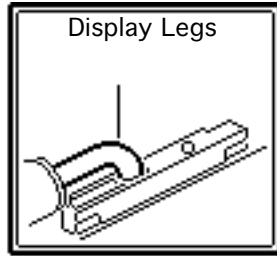
Display Legs

4 Gently lift the display legs out of the holes in the stiffener and remove the display assembly.
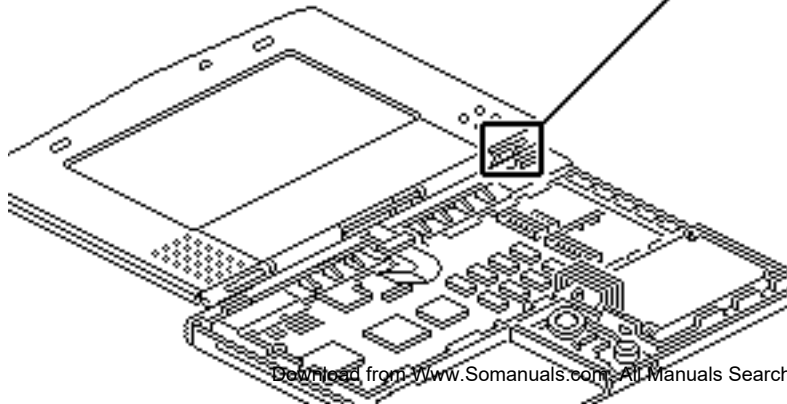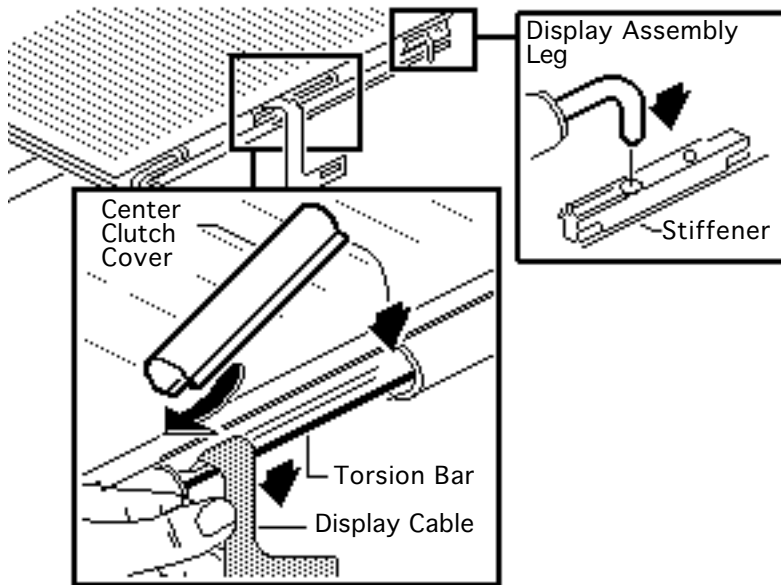
Replacement Note: Before reattaching the display assembly to a PowerBook Duo, install the center clutch cover.

Display Assembly Leg

Stiffener

Center Clutch Cover

Torsion Bar

Display Cable

Display Assembly
Leg

Stiffener

Center
Clutch
Cover

Torsion Bar

Display Cable

Place the display assembly
face down, with the display
cable freely hanging over
the edge of a counter. Pull
the display cable until it's
snug on the torsion bar.
With your other hand, turn
the center clutch cover so
the opening faces downward
and then carefully slide it
onto the torsion bar. Insert
the display assembly legs
into the holes in the
stiffener and close the cover.

For added support, raise the I/O door before snapping the center clutch cover into place.

I/O Door in Open Position

Center Clutch Cover

Tabs

Bottom Case

Display Assembly Leg

Stiffener

Typical for both sides

Mounting Clip

Clutch Cover

Display Latch

Replacement Note: When you reassemble the unit, ensure that the display latch is positioned correctly: Place the display assembly legs into the holes in the CPU stiffener and close the PowerBook Duo. With the front of the unit facing you, push the display assembly to the left so that it aligns with the top case and latch mechanism. Fasten the display mounting clips and slide the end clutch covers on.

Note: You do not have to open the PowerBook Duo to fasten the mounting clips.

CPU Stiffener

Before you begin, do the following:

- Disconnect the power adapter
- Remove the main battery
- Remove the keyboard
- Remove the end clutch covers
- Remove the top case
- Remove the center clutch cover
- Remove the hard drive

CPU Stiffener
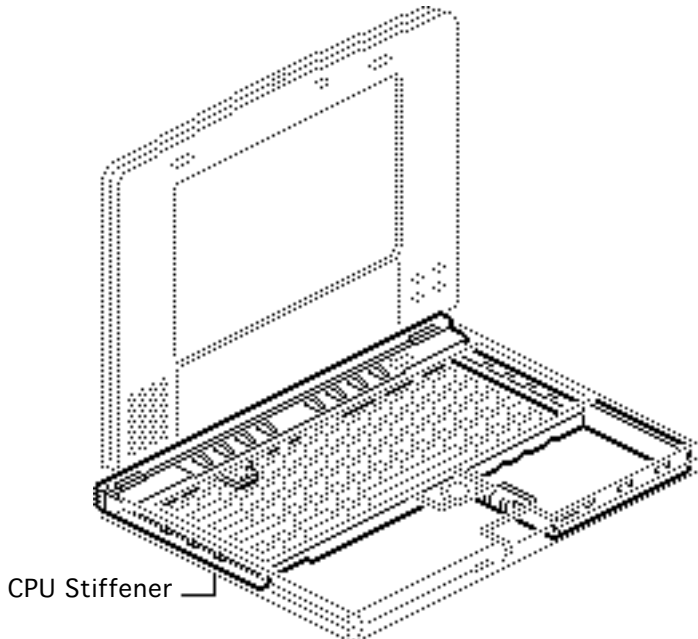
- Remove the backup battery
- Remove the trackball
- Remove the display assembly

Caution: The PowerBook Duo contains CMOS devices that are very susceptible to ESD damage. To prevent damage, wear a grounding wriststrap. Review the ESD precautions in Bulletins/ Safety.

Display Switch Cable

Microphone
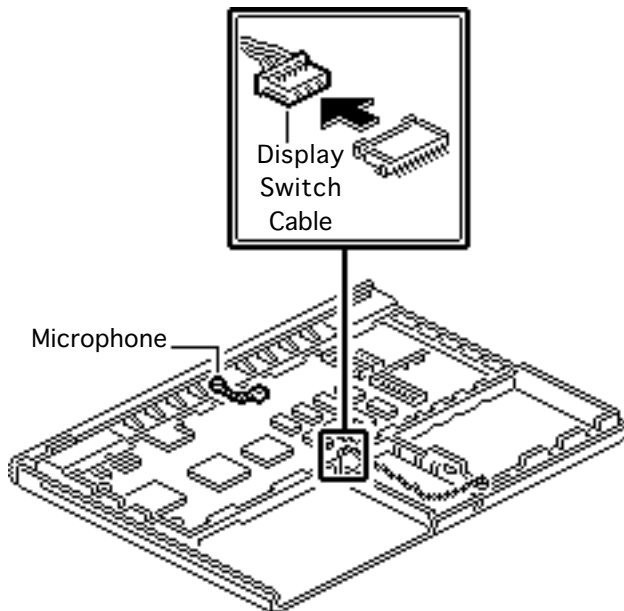
Important: If you are removing the logic board or case bottom, do not follow these procedures. Instead, follow the steps outlined in Display Housing & CPU Stiffener.

Caution: PowerBook cables are fragile and easily torn or damaged. Handle all cables with care.

1 Using a jeweler's screwdriver, carefully disconnect the display switch cable.

2 Remove the microphone from the CPU stiffener.

Display Switch Cable

Microphone

EMI Clips

CPU Stiffener

CPU Stiffener Mounting Screw/ Battery Contact

Bottom Case

EMI Shield
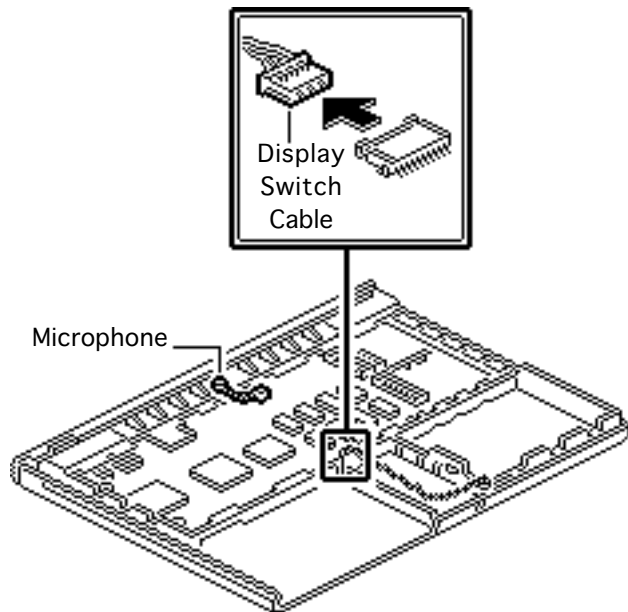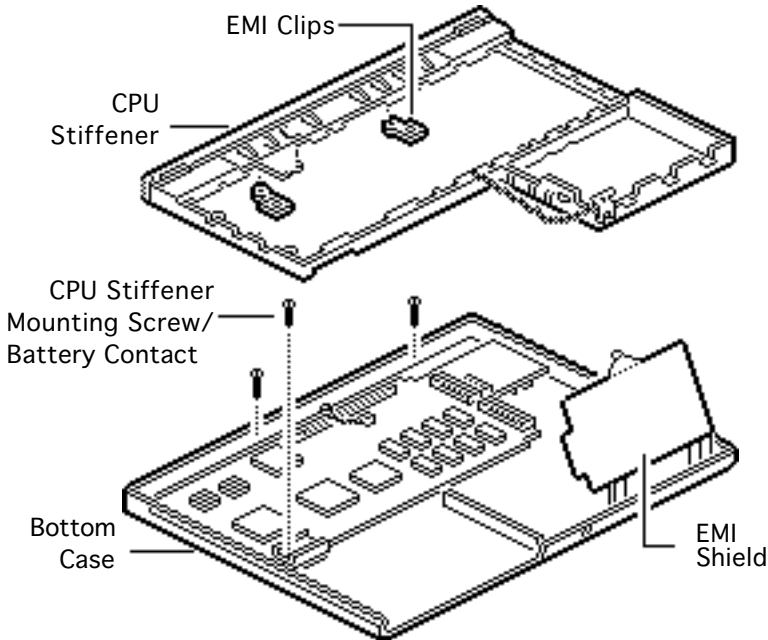
3 Remove the three mounting screws that secure the CPU stiffener to the bottom case.

Replacement Note: The leftmost CPU stiffener mounting screw is also a battery contact. If you fail to reinstall this screw, the battery may not charge.

4 Lift the CPU stiffener straight up and remove it from the bottom case.

Important: Check that both EMI clips are securely attached to the CPU stiffener. If the clips are not secure, replace the stiffener.
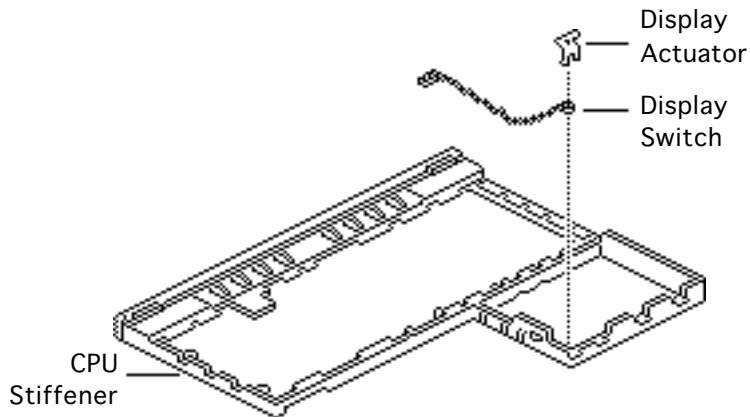
Replacement Note: Move the display switch cable and microphone cable forward before reinstalling the stiffener. This will prevent them from being caught under the CPU stiffener and possibly damaged.

Replacement Note: When replacing the CPU stiffener, be sure to wrap the hard drive EMI shield around the outside of the stiffener.
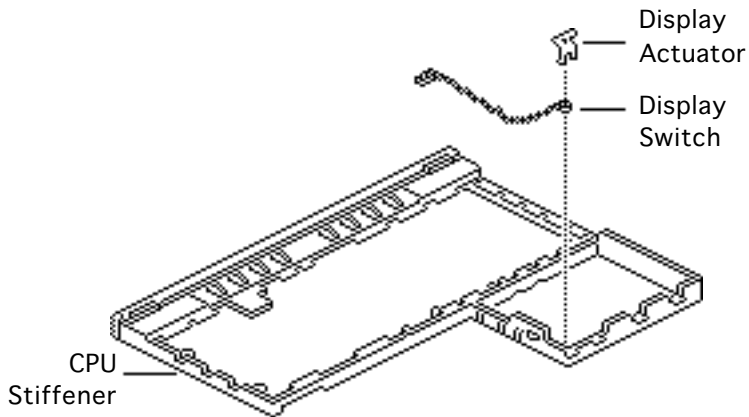
Display Actuator

Display Switch

CPU Stiffener

Replacement Note: After reinstalling the CPU stiffener, use the Duo battery contact alignment tool to check the alignment of the battery contacts.

Display Actuator

Display Switch

5   If you are replacing a damaged CPU stiffener, first remove the display switch and the display actuator. Return the stiffener with the rear cover attached.

CPU Stiffener

Duo 210, 230, 250, 270c   Duo 280, 280c

Heatsink   Heatsink

Replacement Note:
Replacement CPU stiffeners include the rear cover, I/O door, and feet. You can also replace separately the rear cover, I/O door, and feet.
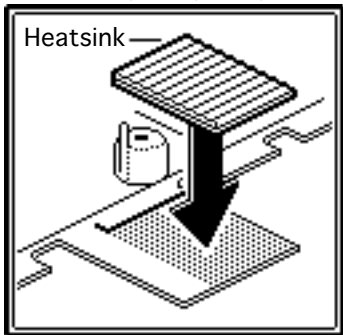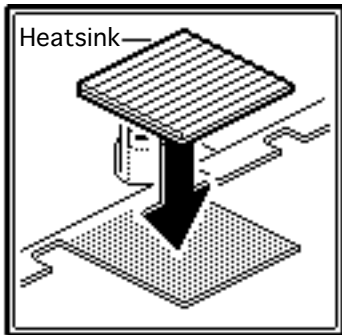
CPU Stiffener
(underside)

Duo 210, 230, 250, 270c   Duo 280, 280c
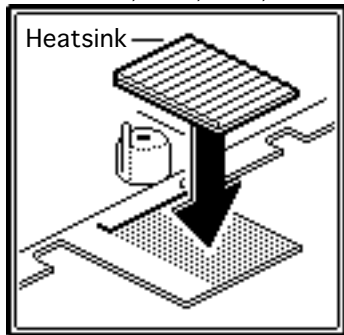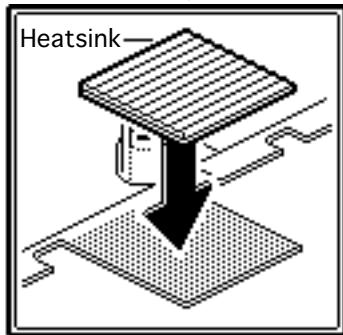
Heatsink   Heatsink

Replacement Caution: If you replace a CPU stiffener on a PowerBook Duo 210, 230, 250, or 270c, make sure you install a small foam heatsink under the tabbed area of the stiffener. Turn the stiffener upside down, align the edges of the heatsink with the lower right corner of the tab, and press the heatsink on.

Duo 210, 230, 250, 270c   Duo 280, 280c
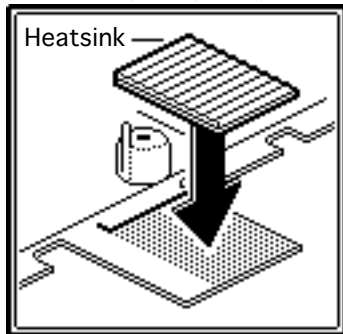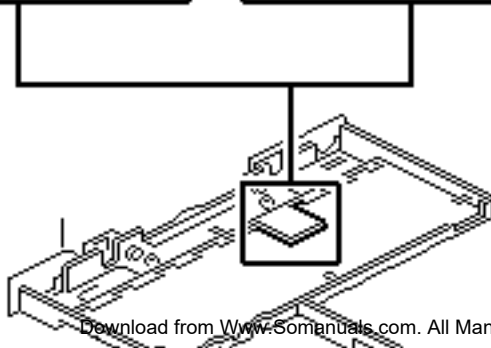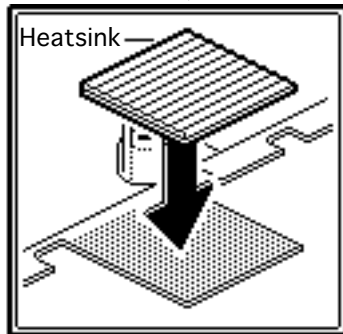
Heatsink   Heatsink

If you replace a CPU stiffener on a PowerBook Duo 280 or 280c, make sure you install a large foam heatsink under the tabbed area of the stiffener. Turn the stiffener upside down and install the heatsink on the entire tab.

Failure to install the correct heatsink could cause a short circuit and blow out the logic board.

Logic Board

Before you begin, do the following:

- Disconnect the power adapter
- Remove the main battery
- Remove the keyboard
- Remove the end clutch covers
- Remove the top case
- Remove the hard drive
- Remove the backup battery
- Remove the trackball
- Remove the display assembly & CPU Stiffene
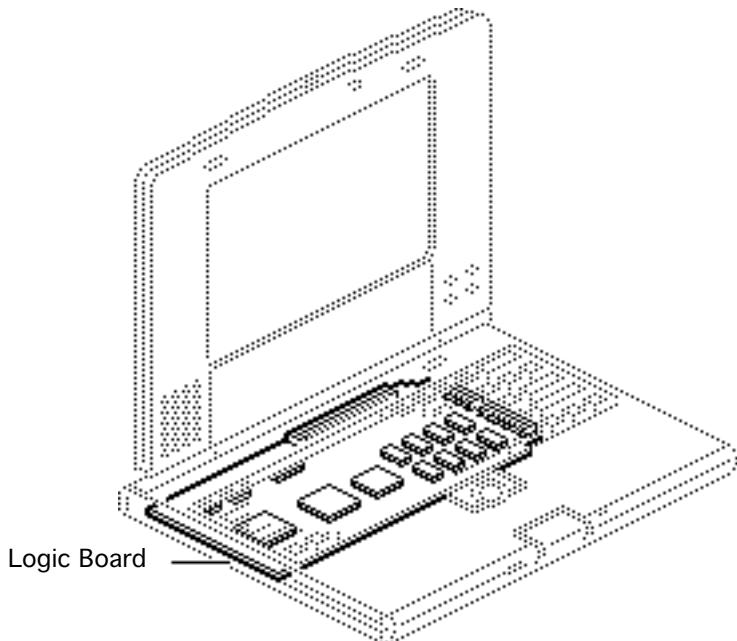
Logic Board ——

Caution: The PowerBook Duo contains CMOS devices that are very susceptible to ESD damage. To prevent damage, wear a grounding wriststrap. Review the ESD precautions in Bulletins/ Safety.
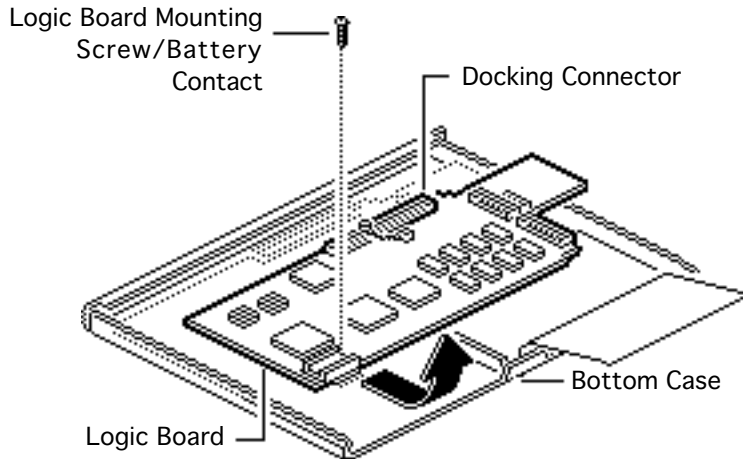
1   Remove the remaining
    logic board mounting
    screw.

Replacement Caution: This
mounting screw is also a
battery contact (one of two).
If you fail to reinstall it, the
battery may not charge.

Logic Board Mounting
Screw/Battery
Contact

Docking Connector

Bottom Case

Logic Board

2   Raise the side of the logic
    board opposite the 152-
    pin docking connector.
    Slide the docking
    connector out of the
    bottom case and remove
    the logic board.

Microphone Cable

On/Off Board

DRAM
Expansion Card
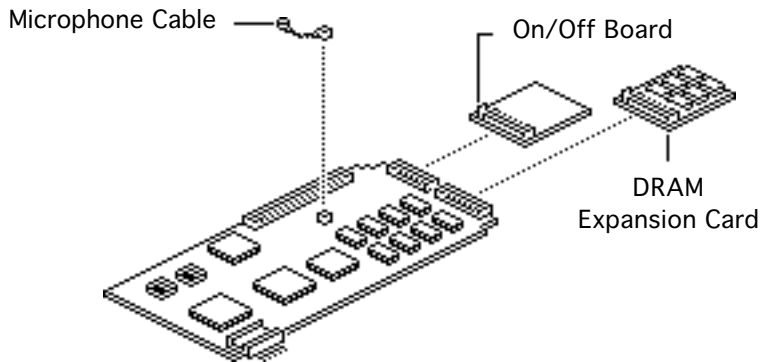
3 Carefully disconnect the microphone cable from the logic board.

4 Disconnect the on/off board (or modem board, if installed).

5 Disconnect the DRAM expansion card (if installed).

Replacement Note: When replacing the logic board, keep in mind that the PowerBook Duo won't work unless an on/off board or a modem card is connected to the logic board.

Replacement Note: If you are returning the logic board for repair, set aside the microphone, on/off board, and expansion card (if installed). Reinstall these parts on the replacement board.

Case Bottom

Case Bottom

Before you begin, do the following:

- Disconnect the power adapter
- Remove the main battery
- Remove the keyboard
- Remove the end clutch covers
- Remove the top case
- Remove the hard drive
- Remove the backup battery

- Remove the trackball
- Remove the display
  assembly & CPU Stiffener
- Remove the logic board

Caution: The PowerBook Duo contains CMOS devices that are very susceptible to ESD damage. To prevent damage, wear a grounding wriststrap. Review the ESD precautions in Bulletins/Safety.

270c Case Bottom

Gaskets

Logic Board Support

270c Case Bottom

Gaskets

Logic Board Support
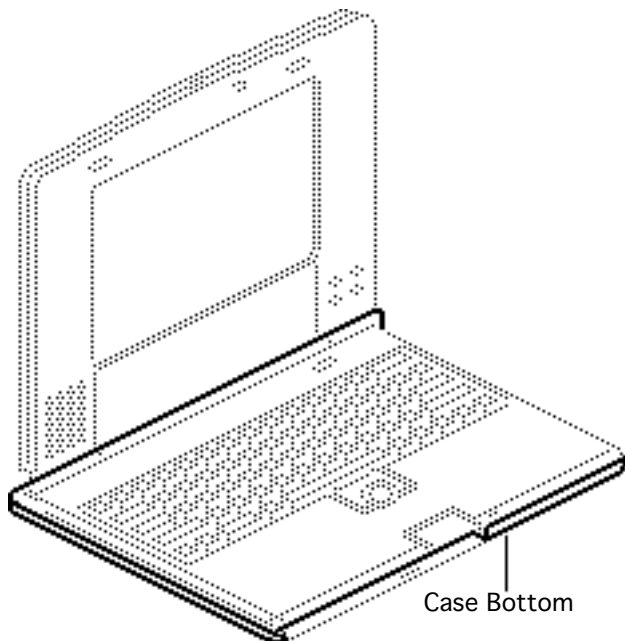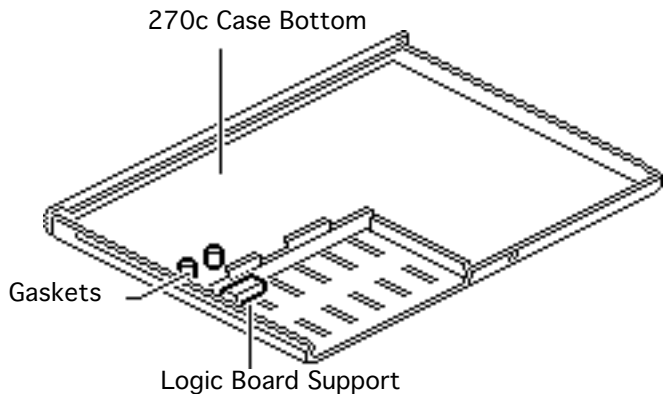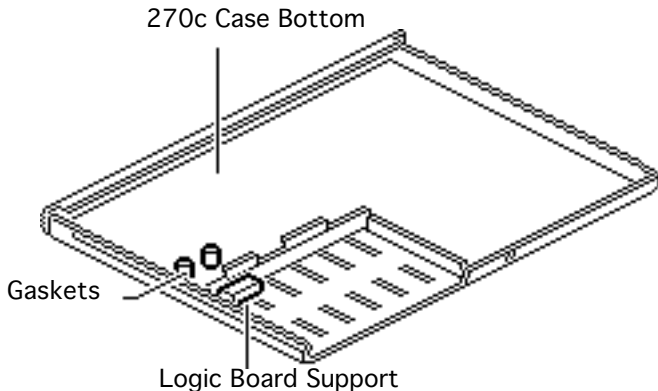
Replacement Note: When replacing the case bottom on the PowerBook Duo 270c, be sure to install the foam gaskets on the new case bottom. Gently press the gaskets into the two slots next to the white logic board support.
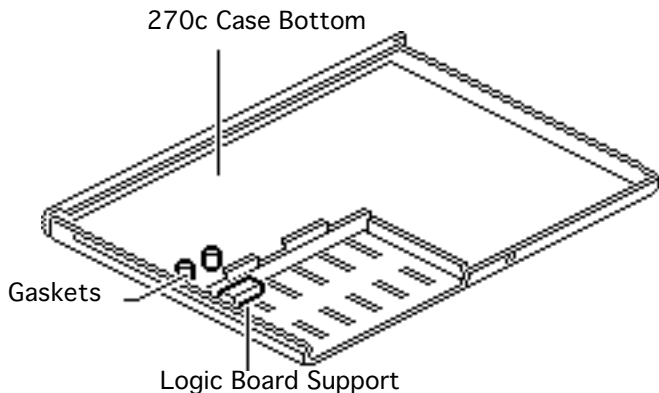
Replacement Caution: Do not install the foam gaskets when replacing the case bottom on the PowerBook Duo 210, 230, 250, 280, or 280c. The logic boards in these computers contain components that may be short-circuited by the gaskets.

270c Case Bottom

Gaskets

Logic Board Support

Display Housing

Display
Housing

Display Housing

Before you begin, do the following:

- Disconnect the power adapter
- Remove the main battery
- Remove the end clutch covers
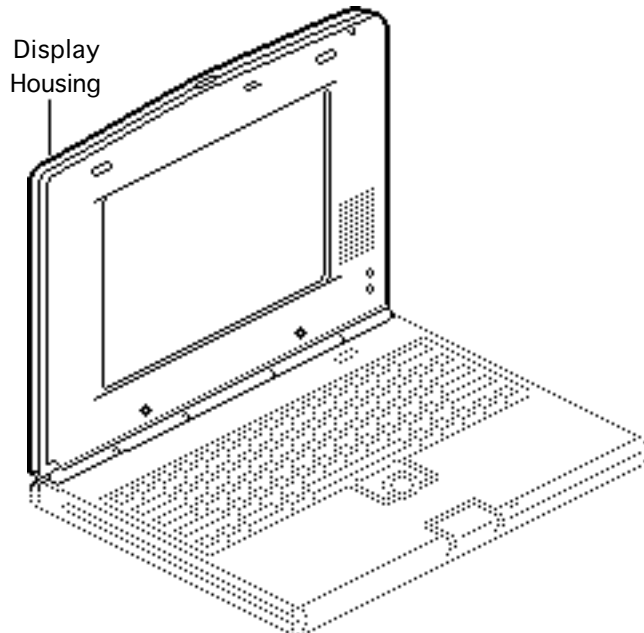
Caution: The PowerBook Duo contains CMOS devices that are very susceptible to ESD damage. To prevent damage, wear a grounding wriststrap. Review the ESD precautions in Bulletins/Safety.

Caution: The display cable is fragile and should be handled with care. Be particularly careful with the Duo 210/230 cable, which does not have a protective copper coating and is more likely to tear.

Note: The Duo 210/230/ 250/280 display housings are available to international and CPRC repairers only.

The Duo 270c/280c display housing kits, which are available to all repairers, include the housing and the bezel.

Screw Cover and
Mounting Screw
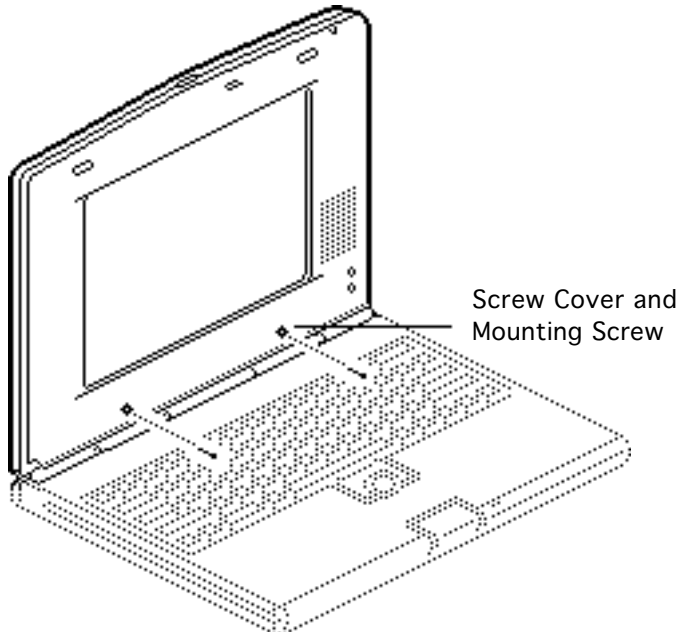
Note: The display housing is secured to the bezel by mounting screws.

1   Remove the two screw covers from the bezel. Using a T-6 torx driver, remove the mounting screws.

Replacement Caution: Do not overtighten the mounting screws or you will damage the screw inserts on the display housing.

Replacement Note: The screw covers are disposable. If they no longer stick, replace them.
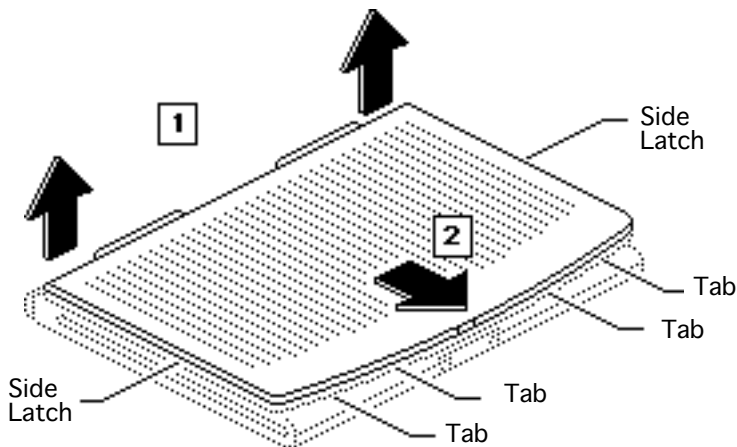
2   Close the display.

Note: The display housing is also secured to the bezel by side latches and front tabs.

3   Pull the display housing up and disengage the side latches. Gently slide the housing forward to disengage the four front tabs.

Caution: To avoid misaligning the display layers, remove the display housing very carefully.

Side Latch

Tab

Tab

Side Latch

Tab

Tab

Caution: Avoid touching the copper surface of the Duo 250/280 housing. When touched, the surface flakes or peels, which could cause the system to short.

4 Remove the display housing.
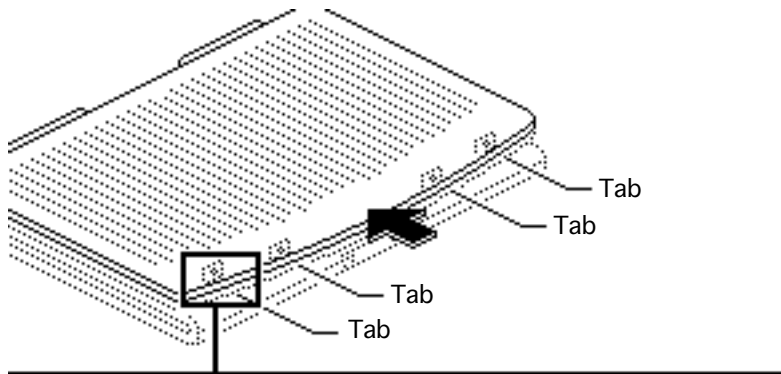
Replacement Caution:
Carefully engage the four tabs along the front of the housing. Failure to engage the tabs correctly may cause them to break, requiring replacement of the damaged bezel. Also, the exposed display may become contaminated.
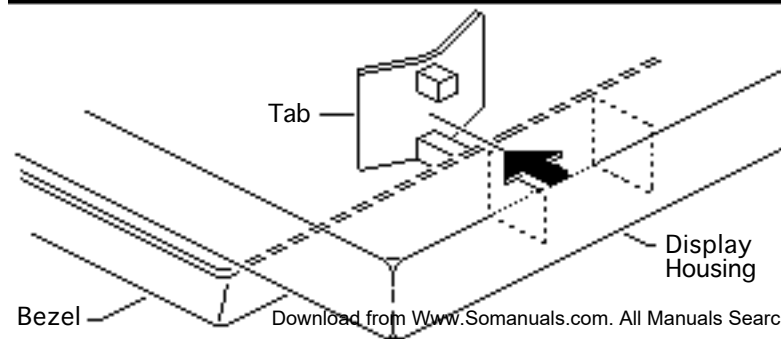
Replacement Caution: Make sure the display cable clears the center clutch opening before you snap the display assembly together.

Tab

Tab

Tab

Tab

Tab

Display Housing
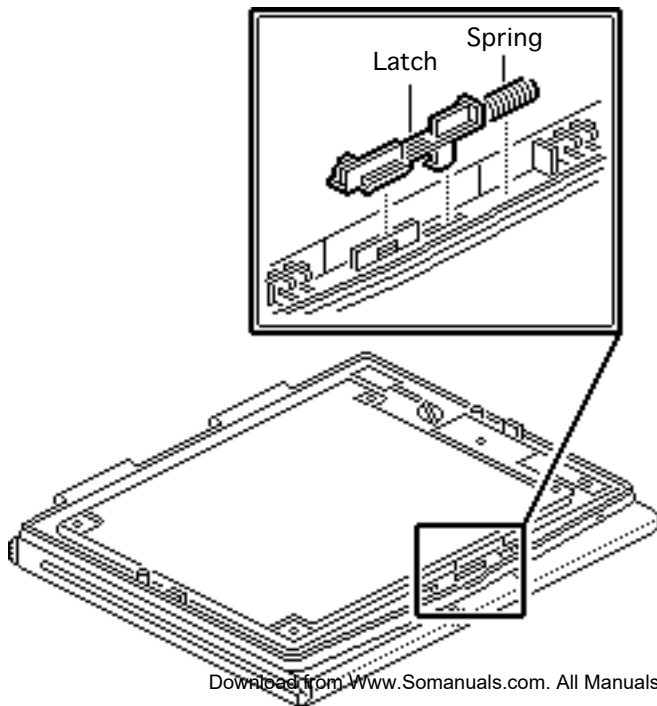
Bezel

Note: If the Duo 270c or 280c display housing kit includes the latch mechanism, replace the latch and spring whether or not they're broken.

5 If you are replacing the latch and spring, remove them from the bezel.

210/230/250/280 Dsply Cable

Before you begin, do the following:

- Disconnect the power adapter
- Remove the main battery
- Remove the keyboard
- Remove the end clutch covers
- Remove the top case
- Remove the center clutch case
- Remove the display assembly
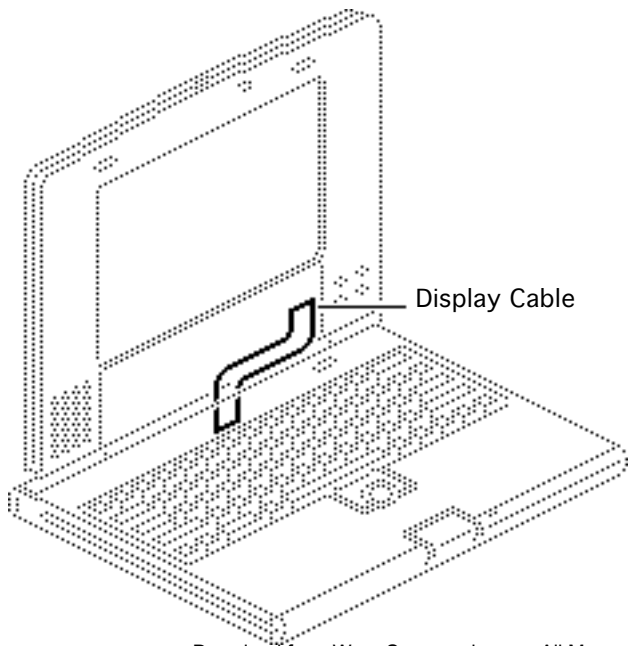
Display Cable

- Remove the display housing

Note: Graphics in the display housing topic show the display assembly attached to the unit; however, the display assembly is not attached when you are removing the cable.

Caution: The PowerBook Duo contains CSMOS devices that are very susceptible to ESD damage. To prevent damage, wear a grounding wriststrap. Review the ESD precautions in Bulletins/ Safety.

Note: The display cables for the Duo 210, 230, 250, and 280 systems are available to international and CPRC repairers only.

1 Place the display assembly on a clean, soft surface.

Display Assembly
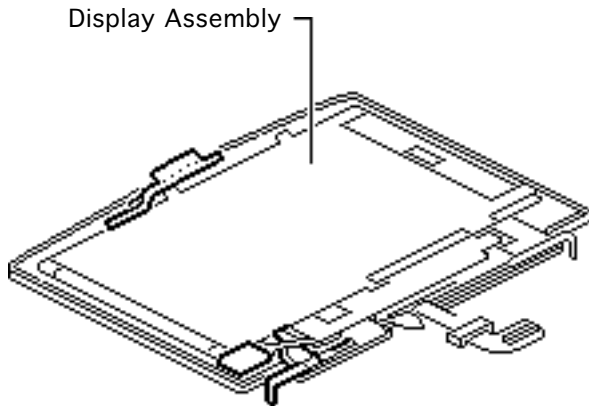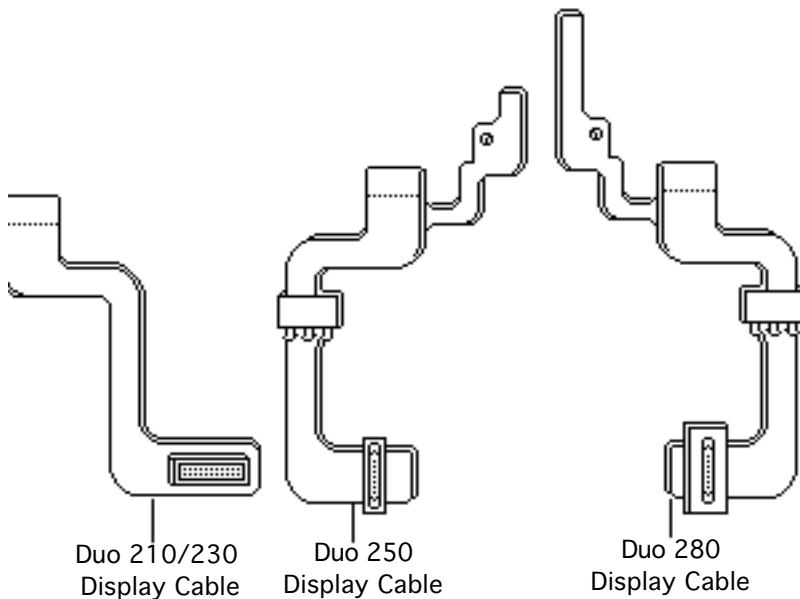
Note: The Duo 210/230, 250, and 280 display cables are different. Make sure you replace the correct cable.

Note: Because a Duo 250 may have been upgrade to a Duo 280, you cannot identify its configuration by the product label on the bezel. To make sure you are working on a Duo 250, check that the display cable matches the Duo 250 cable pictured.

Duo 210/230
Display Cable

Duo 250
Display Cable

Duo 280
Display Cable

Brightness Actuator Assembly
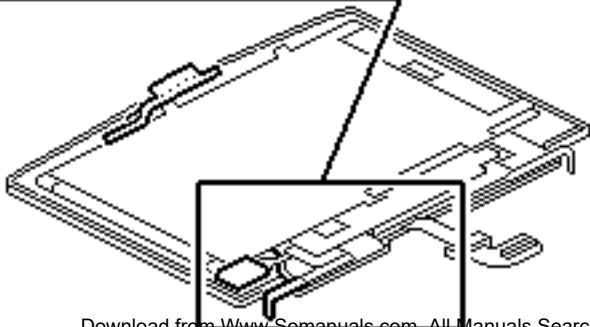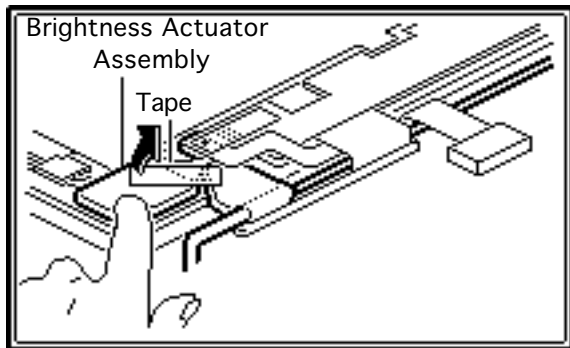
Tape

Note: The brightness actuator and the inverter board on the Duo 250/280 are each secured by tape. Note the placement of the tape so that you can replace it in its original location.

Note: To prevent the tape from curling after it's removed, stick it firmly onto your work surface.

Duo 250/280 only:

2 Hold down the brightness actuator and carefully remove the tape.

Brightness Actuator
Assembly

Tape
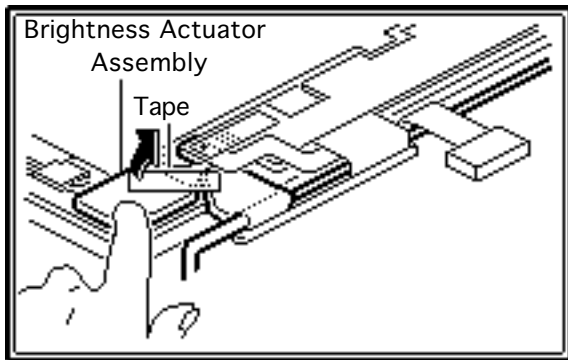
Duo 250/280 only:

3 Lift the brightness
actuator from the bezel.

Replacement Note: Make
sure the brightness
actuator cable is positioned
underneath the display
cable.
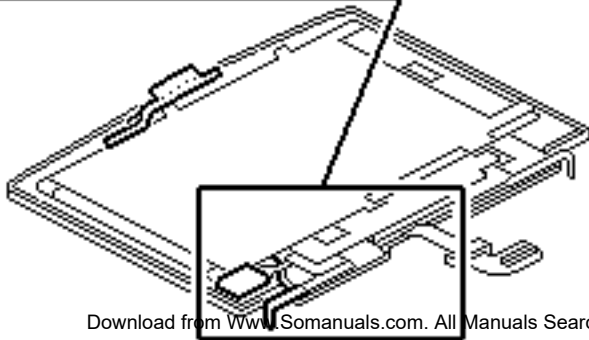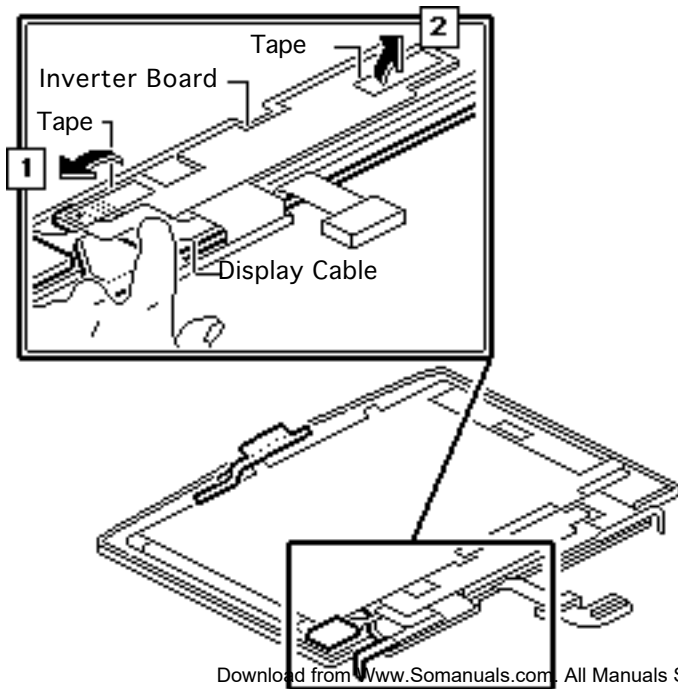
Replacement Note: Check the seating of the brightness actuator. If it is not firmly seated, the proper contact will not be made.

Caution: Be careful not to accidentally peel off any of the protective tape that covers the 250/280 inverter board. Removal could cause the inverter board to short.
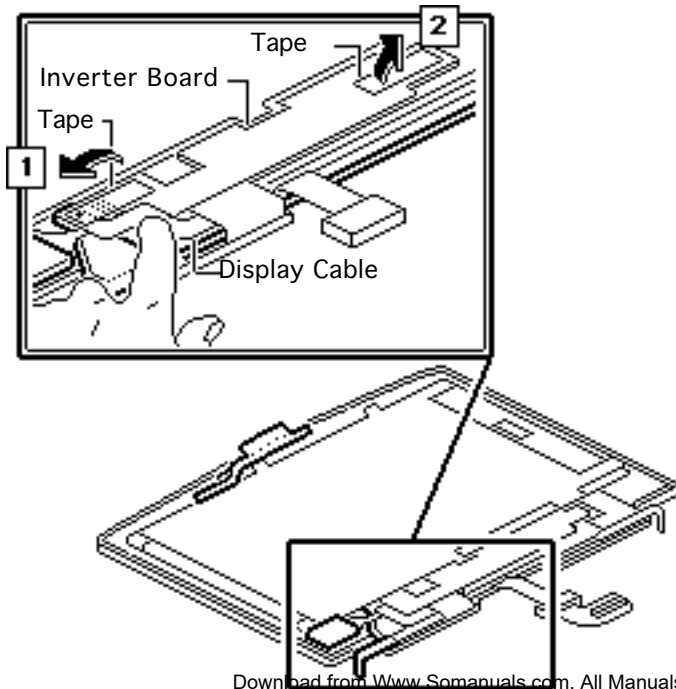
Duo 250/280 only:

4 While holding down the display cable, carefully remove the tape from the left side of the inverter board. Let go of the display cable.

Duo 250/280 only:

5 Remove the tape from the right side of the inverter board.

Replacement Note: Before reattaching the inverter board tape, push the backlight bulb cable (white) into its channel.

Replacement Note: If the inverter board became loose when you removed the tape, snap the board back into the two front tabs on the bezel.

Inverter Board

Tab

Tab
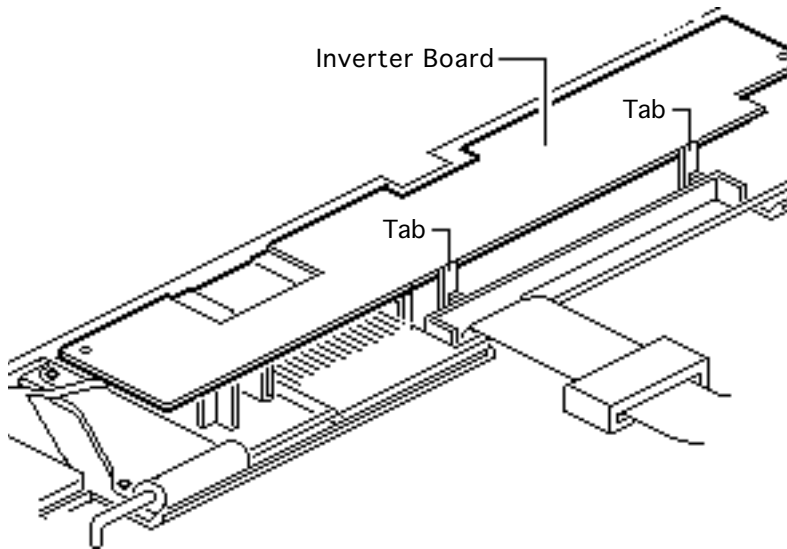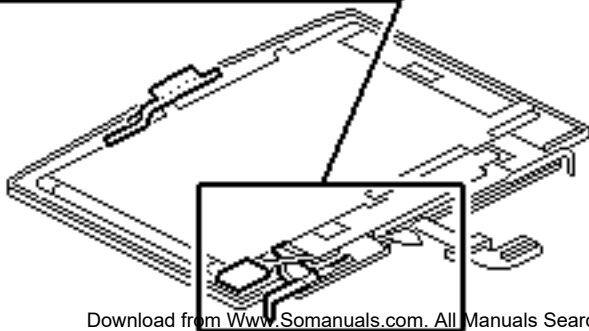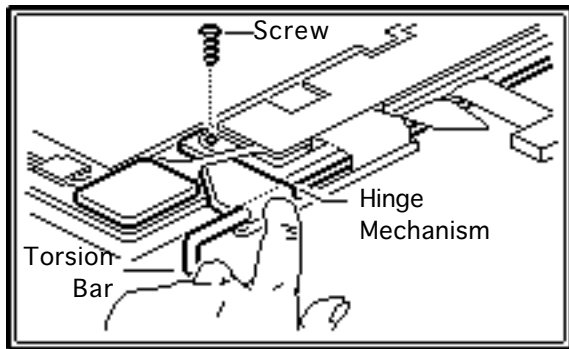
Duo 250/280 only:

6 Hold down the hinge mechanism on the torsion bar. Using a torx screwdriver, remove the ground screw for the display cable.

Replacement Caution: Do not overtighten the ground screw or you may tear the replacement display cable.

Duo 250/280 only:

7 Slowly release the torsion bar.

Release Tabs

Display Cable
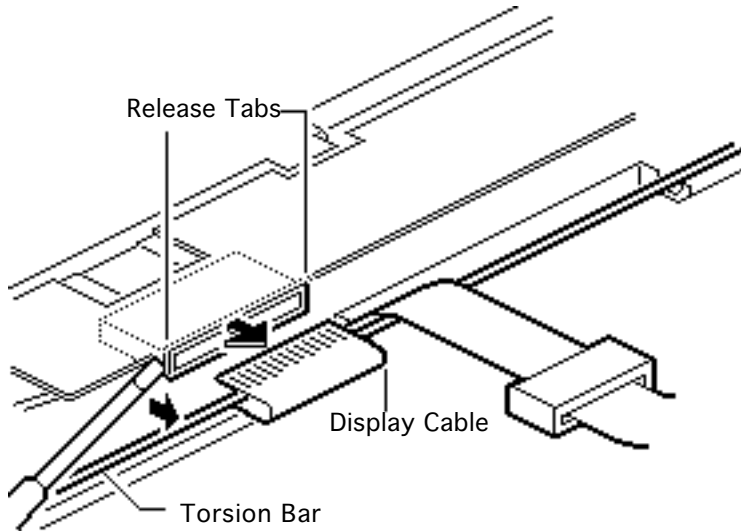
Torsion Bar

8 Using a jeweler's screwdriver, push out the release tabs on the display cable and disconnect the cable.

9 Unwind the display cable from the torsion bar and remove the cable.

Replacement Note: Before installing the new display cable, gently roll the cable so it can be wrapped around the torsion bar.

Display Cable

270c/280c Display Cable
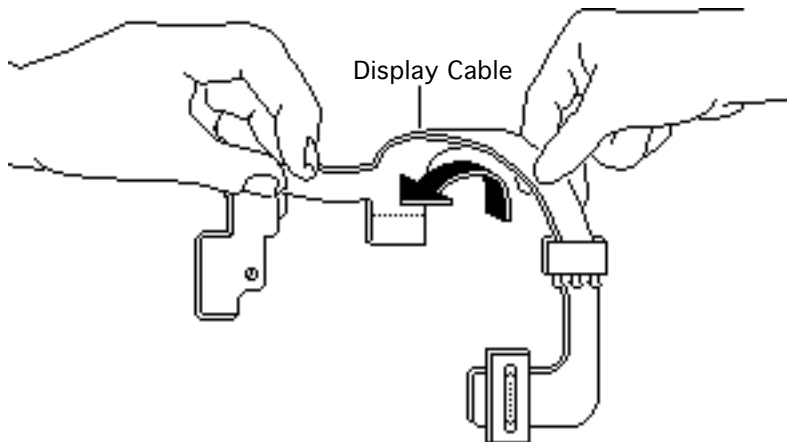
270c/280c Display Cable

Before you begin, do the following:

- Disconnect the power adapter
- Remove the main battery
- Remove the keyboard
- Remove the end clutch covers
- Remove the top case
- Remove the center clutch cover
- Remove the display assembly
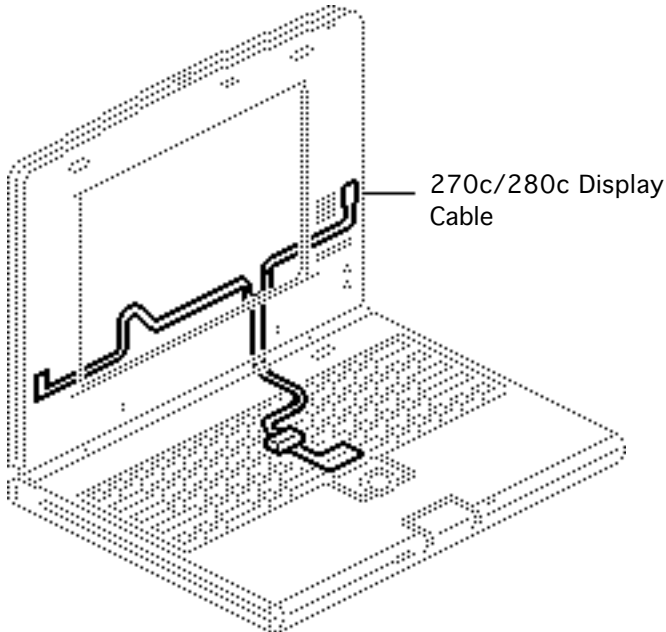
- Remove the display
  housing

Note: Graphics in the
Display Housing topic show
the display assembly
attached to the unit;
however, the display
assembly is not attached
when you are removing the
cable.

Caution: The PowerBook Duo contains CMOS devices that are very susceptible to ESD damage. To prevent damage, wear a grounding wriststrap. Review the ESD precautions in Bulletins/ Safety.

Display Driver Board Connector

Inverter Board Connector

Duo 270c/280c Display Cable
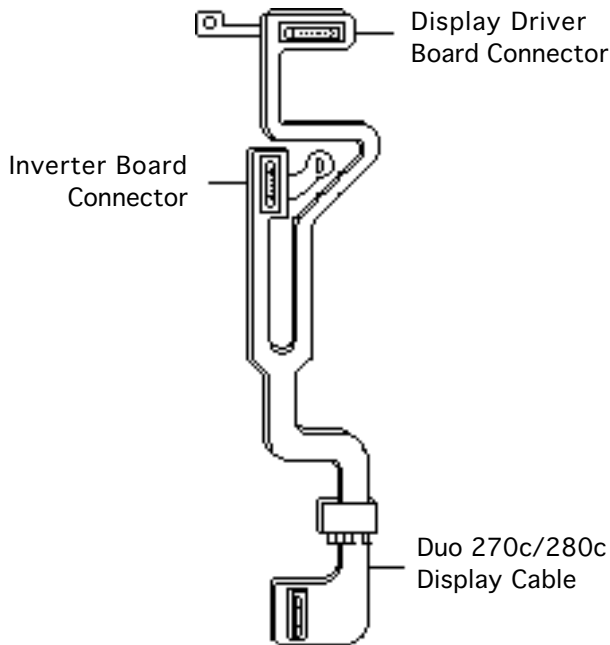
Note: The Duo 270c/280c display cable is available to CPRC and international repairers only.

Note: The Duo 270c/280c display cable has two connectors—one for the inverter board and another for the display driver board.

Mounting
Screw

Inverter
Board Shield
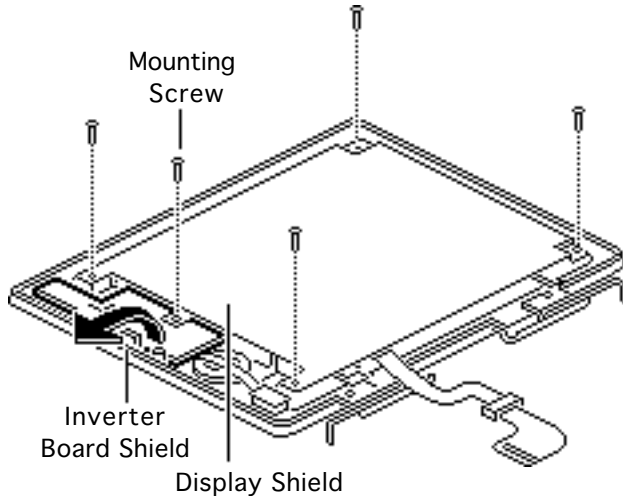
Display Shield

1. Using a T-8 torx driver, remove the inverter board mounting screw.

2. Remove the four screws securing the EMI display shield.

3. Slide the inverter board shield out from under the display shield.

4. Carefully fold back the display cable tab and the inverter board shield tab away from the mounting screw hole.

5 Lift up the inverter board and turn it on its left side to expose the cable connectors.

Replacement Note: Snap the inverter board onto its two plastic bezel mounts.

Note: The speaker cable is very short and may prevent you from raising the inverter board sufficiently. If necessary, disconnect the speaker cable.

Caution: The display cable is fragile and should be handled with care.

—IC Extractor

Display Cable Connector

Speaker Cable
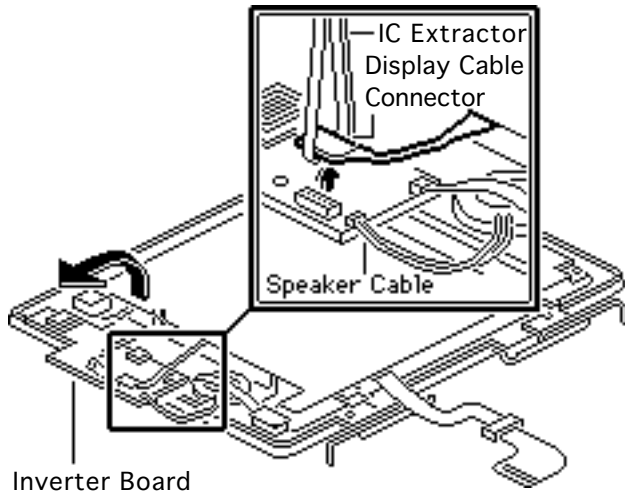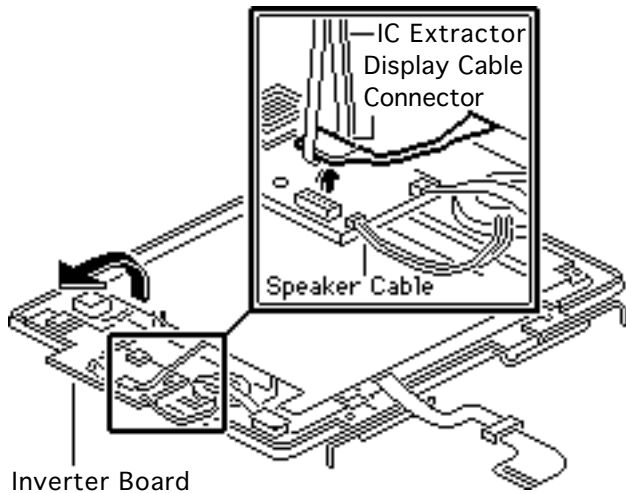
Inverter Board

6 Using an IC extractor, disconnect the display cable connector from the inverter board.

IC Extractor
Display Cable Connector
Speaker Cable
Inverter Board

EMI Shield

Display Frame

Adhesive Area

Display Driver Board

IC Extractor
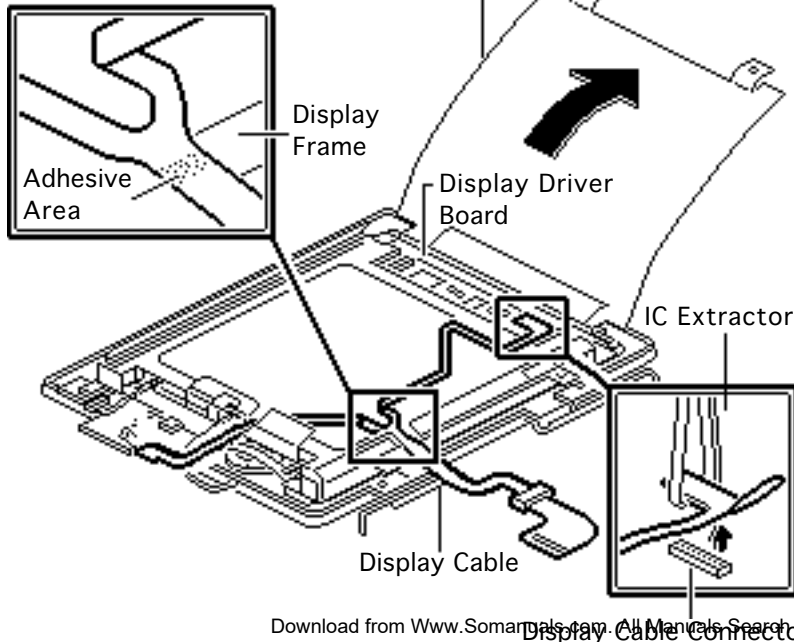
Display Cable

7 Peel back the EMI shield from the display.

8 Using an IC extractor, disconnect the display cable connector from the display driver board.

9 Gently remove the "Y" section of the display cable from the metal display frame.

Display Cable Connector

Replacement Note: The display cable is attached to the metal display frame with adhesive. Re-adhere the cable to prevent it from rubbing against the display and becoming worn.

Fold

Fold

Fold
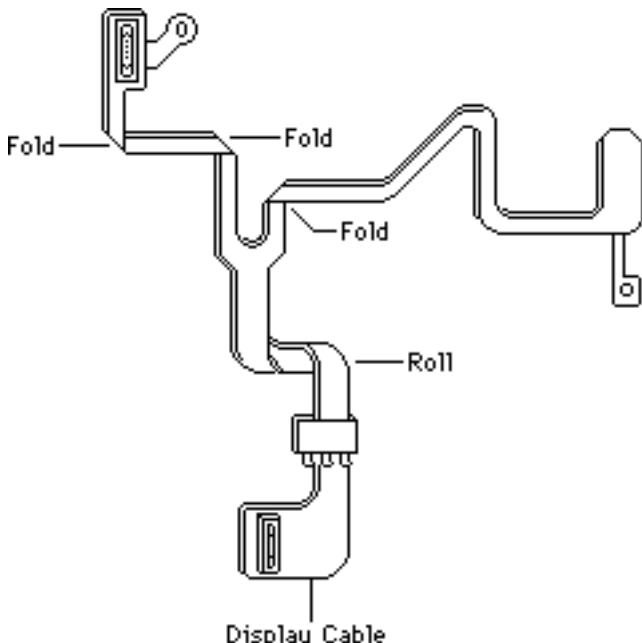
Roll

Display Cable

Note: Note the folds and roll in the display cable so you can duplicate them on the replacement cable.

10 Lift off the display cable.

270c/280c Inverter Board

270c/280c Inverter Board

Before you begin, do the following:

- Disconnect the power adapter
- Remove the main battery
- Remove the end clutch covers
- Remove the center clutch cover
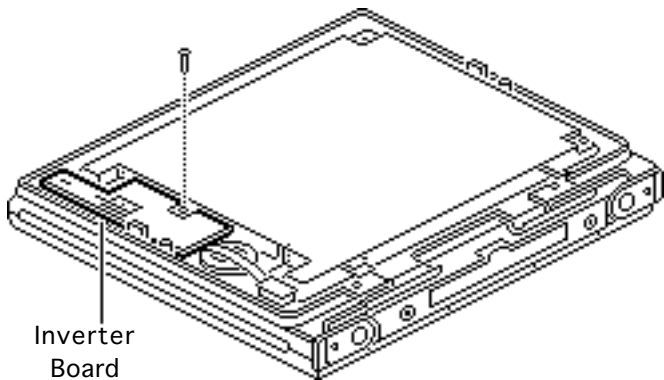- Remove the 270c/280c display housing
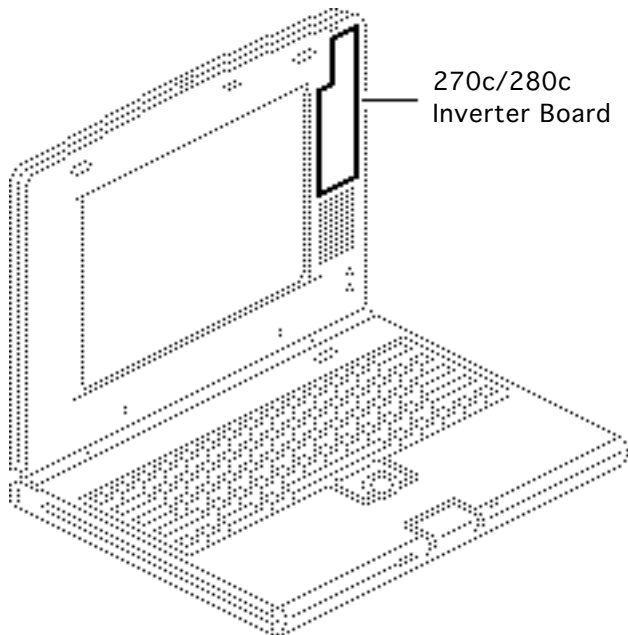
Caution: The PowerBook Duo contains CMOS devices that are very susceptible to ESD damage. To prevent damage, wear a grounding wriststrap. Review the ESD precautions in Bulletins/Safety.

Note: The PowerBook Duo 270c and 280c active-matrix display modules are available to CPRC and international repairers only.

1 Using a T-8 torx driver,
   remove the inverter
   board mounting screw.
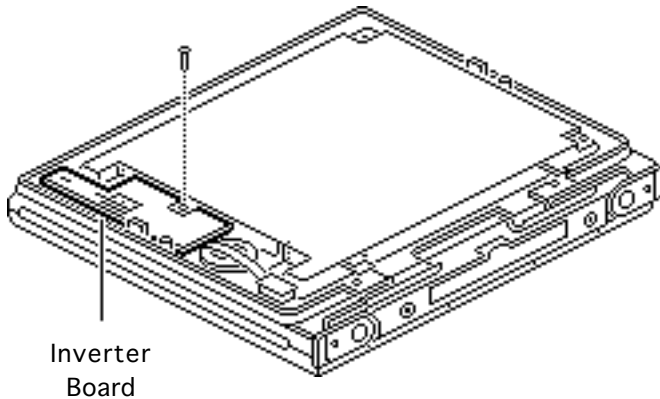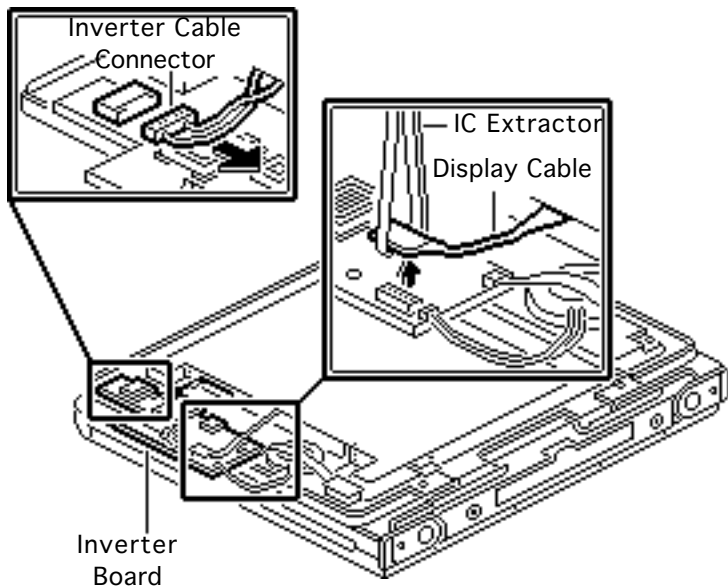
Inverter
Board

Inverter Cable Connector

IC Extractor

Display Cable

Inverter Board

2 Carefully turn the inverter board so that it is component-side up.

3 Using an IC extractor, disconnect the display cable.

4 Disconnect the inverter cable.

Replacement Note: Be sure to reconnect the inverter cable before reconnecting the display cable. Place the notched side of the inverter cable connector facing the inverter board.

Locking Tab
Actuator Assembly Cable
Speaker Assembly Cable
Inverter Board
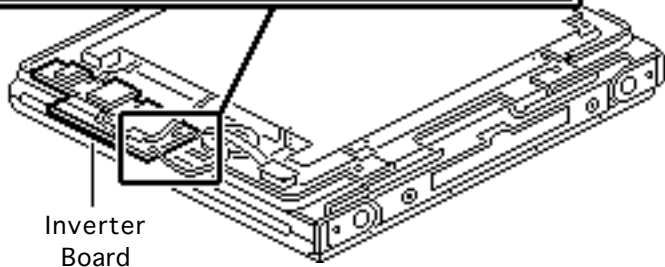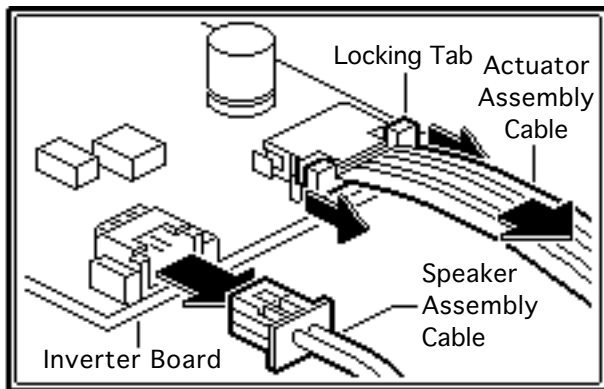
Inverter Board

5 Disconnect the speaker cable.

6 Lift the locking tab on the actuator cable connector and remove the cable.
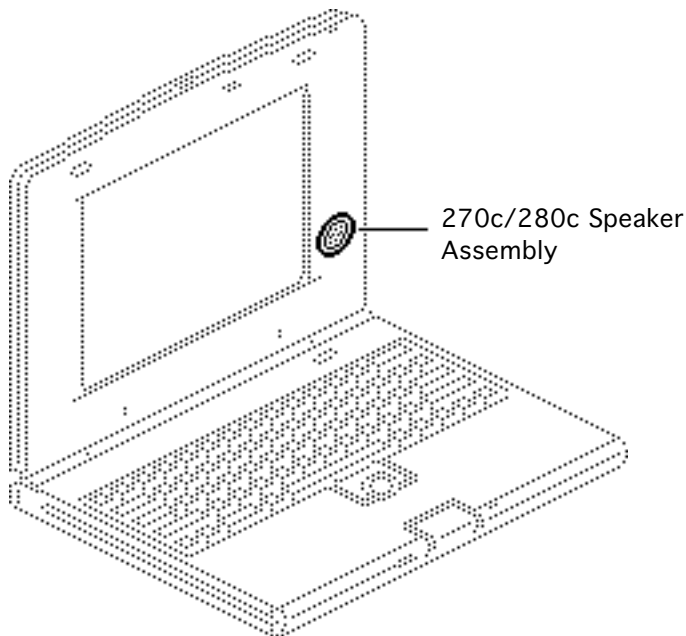
7 Lift out the inverter board.

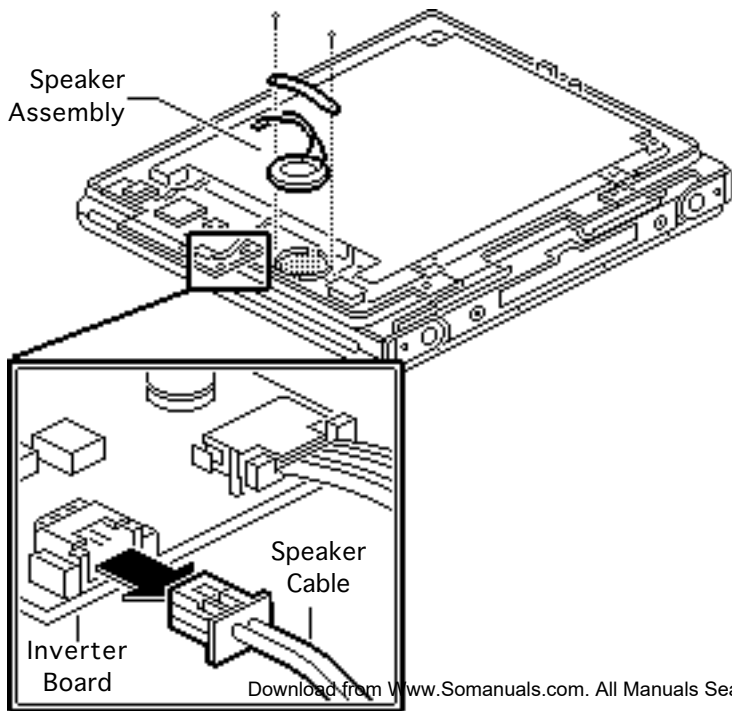## 270c/280c Actuator

Before you begin, do the following:

- Disconnect the power adapter
- Remove the main battery
- Remove the end clutch covers
- Remove the center clutch cover
- Remove the 270c/280c display housing

270c/280c
Actuator Assembly
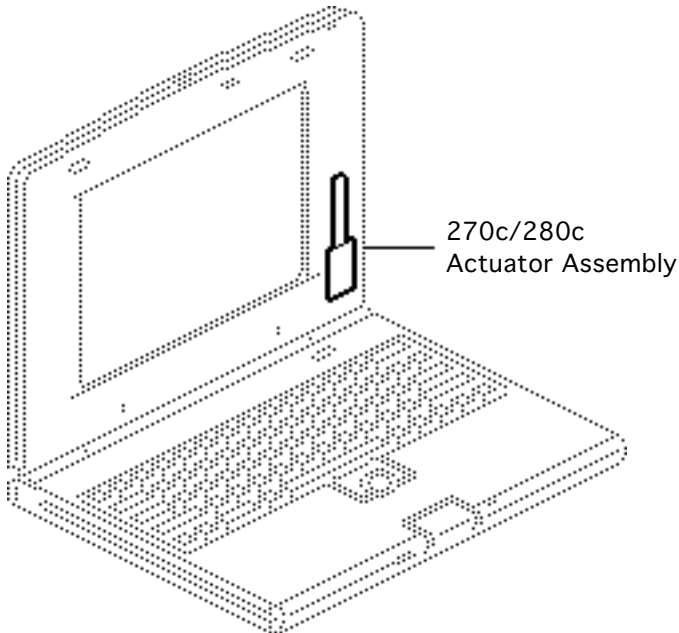
Caution: The PowerBook Duo contains CMOS devices that are very susceptible to ESD damage. To prevent damage, wear a grounding wriststrap. Review the ESD precautions in Bulletins/Safety.

Note: The PowerBook Duo 270c and 280c active-matrix display modules are available to CPRC and international repairers only.

1 Remove the inverter
board mounting screw.
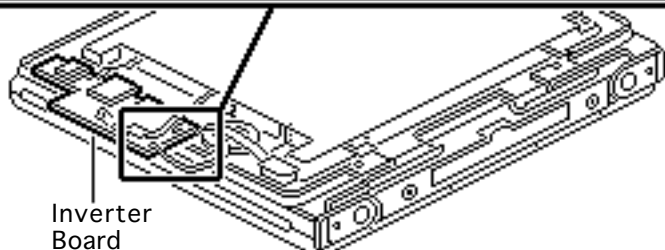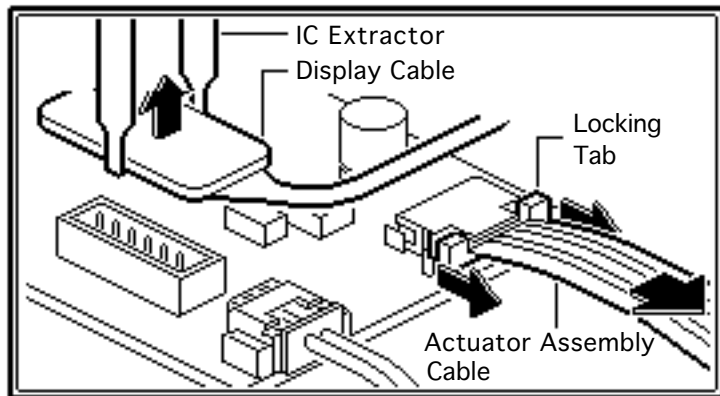
Inverter
Board

2 Carefully turn the inverter board so that it is component-side up.

3 Using an IC extractor, disconnect the display cable.

4 Lift the locking tab on the actuator connector and remove the actuator cable.
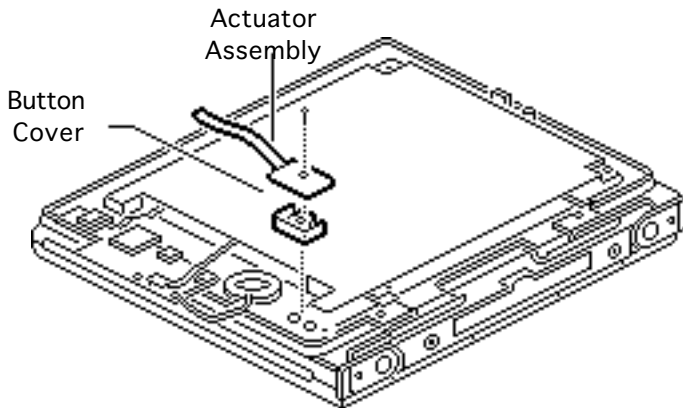
5 Using a jeweler's screwdriver, remove the actuator screw.

6 Lift out the actuator.

7 Lift out the actuator button cover.

Actuator Assembly

Button Cover

270c/280c Speaker

Before you begin, do the following:

• Disconnect the power adapter
• Remove the main battery
• Remove the end clutch covers
• Remove the center clutch cover
• Remove the 270c/280c display housing
• Remove the 270c/280c actuator

270c/280c Speaker Assembly

Caution: The PowerBook Duo contains CMOS devices that are very susceptible to ESD damage. To prevent damage, wear a grounding wriststrap. Review the ESD precautions in Bulletins/Safety.

Note: The PowerBook Duo 270c and 280c active-matrix display modules are available to CPRC and international repairers only.

1 Disconnect the speaker cable from the inverter board.

2 Using a jeweler's screwdriver, remove the two speaker mounting screws.

3 Remove the speaker retaining bar.

4 Lift out the speaker.

Feet

Before you begin, do the following:

- Disconnect the power adapter
- Remove the main battery

Foot

Foot
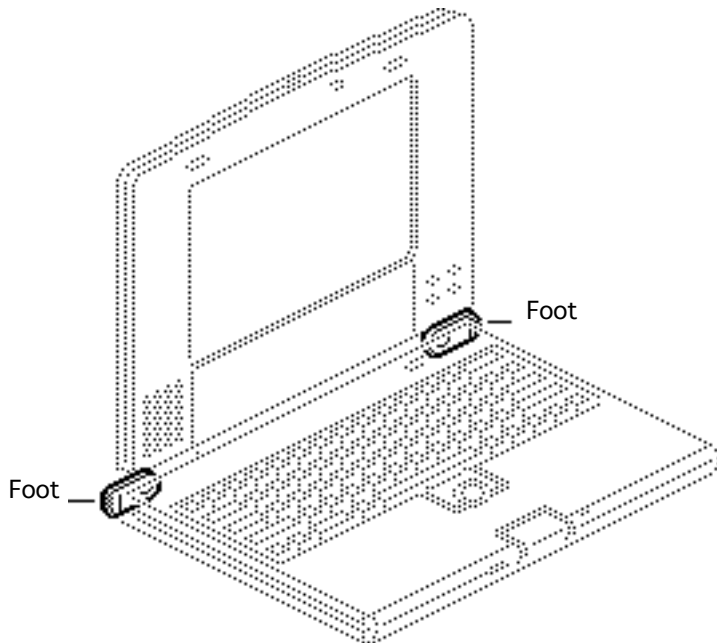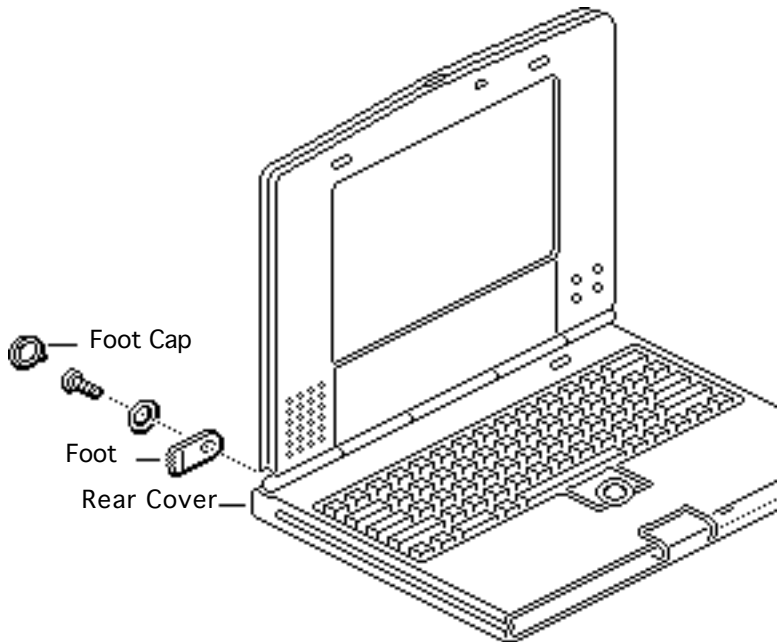
1 Using a jeweler's
   screwdriver, remove
   the caps from the left
   and right flip feet.

2 Remove the two screws,
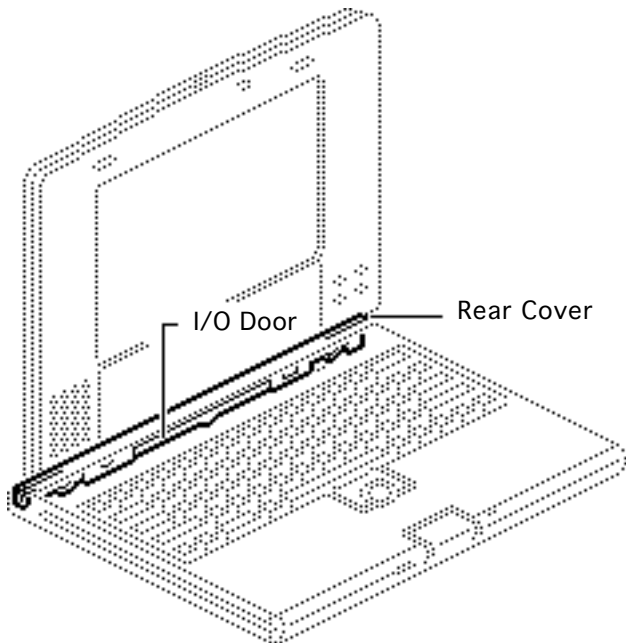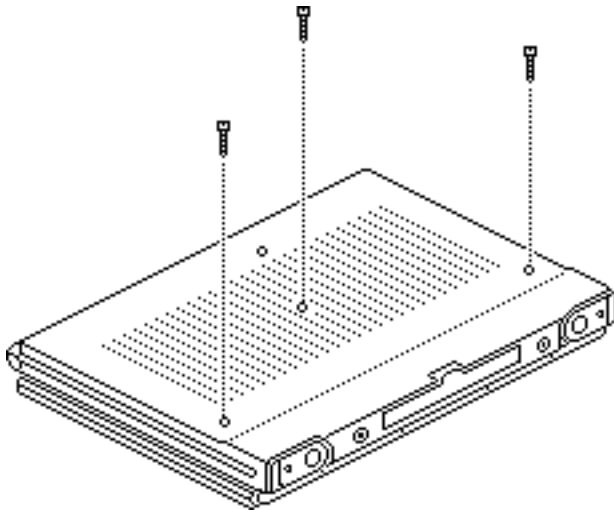   washers, and flip feet
   from the rear cover.

Foot Cap

Foot

Rear Cover

I/O Door

Rear Cover

Rear Cover & I/O Door

Before you begin, do the following:

- Disconnect the power adapter
- Remove the main battery
- Remove the feet
- Remove the end clutch covers
- Remove the center clutch cover

1 Close, latch, and turn
   over the computer.
   Remove the three case
   screws that secure the
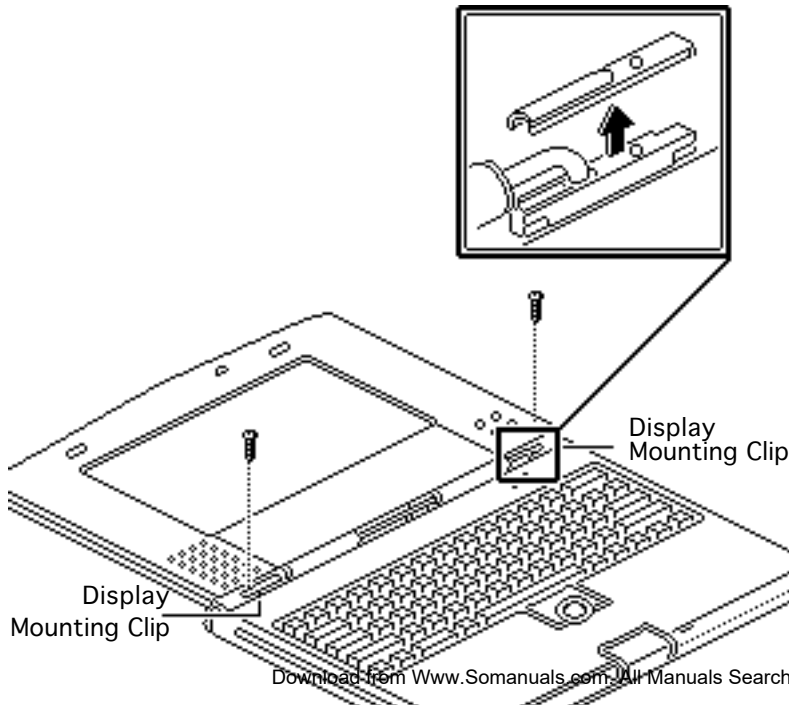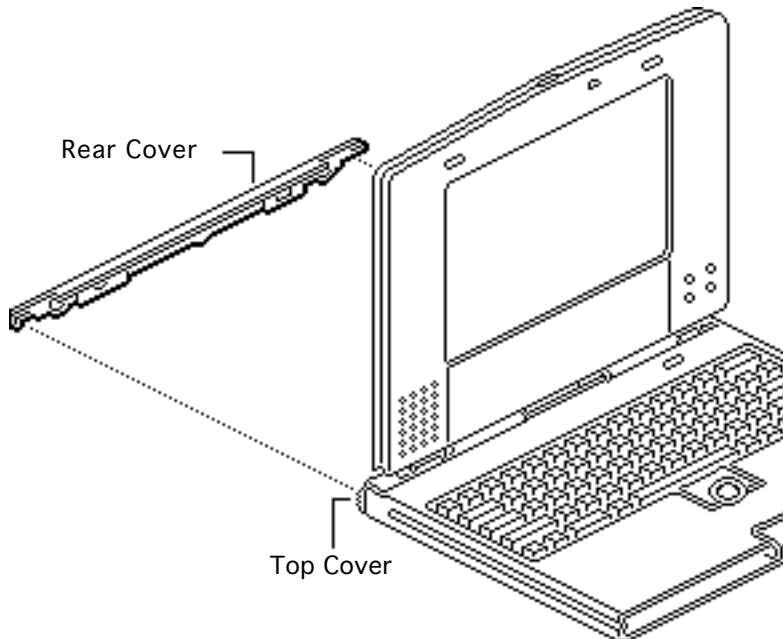   keyboard to the bottom
   case.

Replacement Caution:
Don't overtighten the
keyboard screws.
Overtightening could warp
the keyboard and restrict
key movement. After
replacing the screws,
always check the keys and
space bar to make sure they
work.

2 Remove the two screws and the display mounting clips.

Display Mounting Clip

Display Mounting Clip

Rear Cover

Top Cover

Note: Removing the keyboard case screws, the end and center clutch covers, and the two display mounting clips allows the top cover to separate slightly, and enables you to pull off the rear cover.

3   Push the rear corner of the top cover out slightly and pull out that corner of the rear cover. Remove the rear cover.

4   Unhook the metal link at one end of the I/O door. Remove the I/O door and attached link from the rear cover.
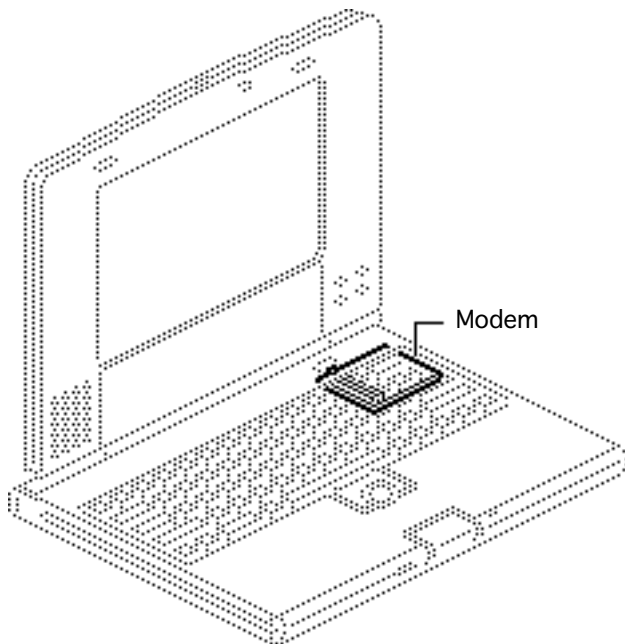
Metal Link

I/O Door
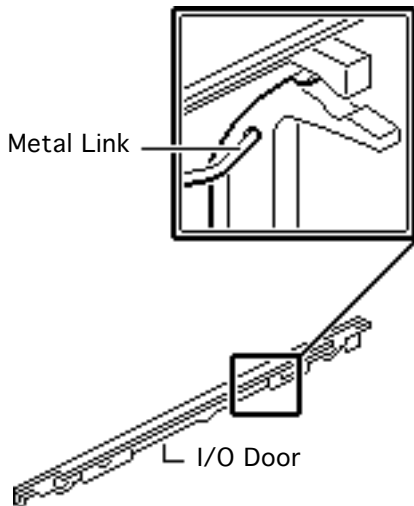
Upgrades

PowerBook 200 Series
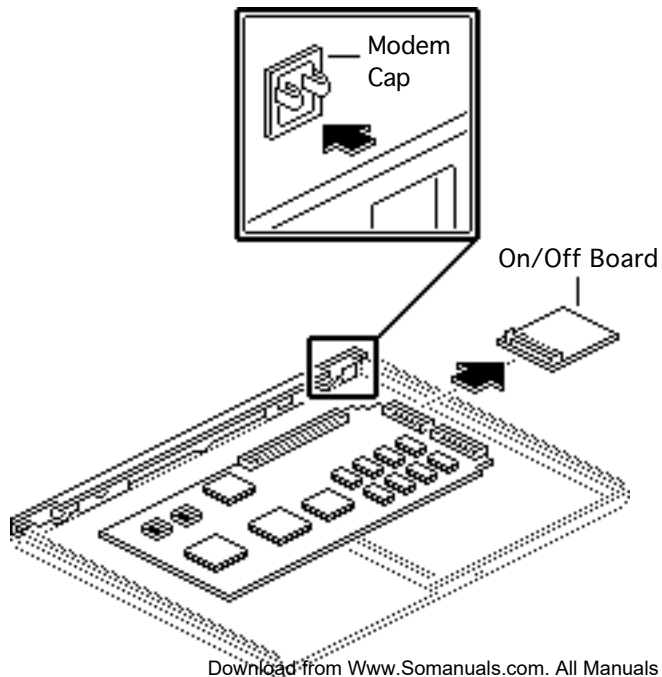
Modem

Before you begin, do the following:

- Disconnect the power adapater
- Remove the main battery
- Remove the keyboard
- Remove the end clutch covers
- Remove the top case
- Remove the center clutch cover
- Remove the hard drive
- Remove the backup battery
- Remove the trackball assembly

Modem

- Remove the display assembly
- Remove the CPU stiffener
- Remove the logic board

Modem Cap

On/Off Board

Caution: The PowerBook Duo contains CMOS devices that are very susceptible to ESD damage. Review the ESD precautions in Bulletins/ Safety.

Note: The modem is an option for all systems in the PowerBook Duo series.

1 Remove the modem cap from the rear cover.
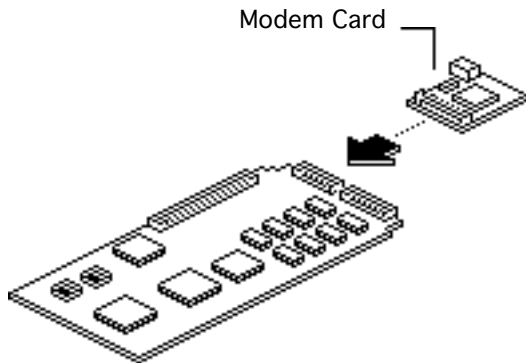
2 Disconnect the on/off board.

Note: The Apple modem
includes the on/off circuitry
provided by the on/off
board. After installing the
modem card, you may
discard the on/off board.

3   Holding the modem card
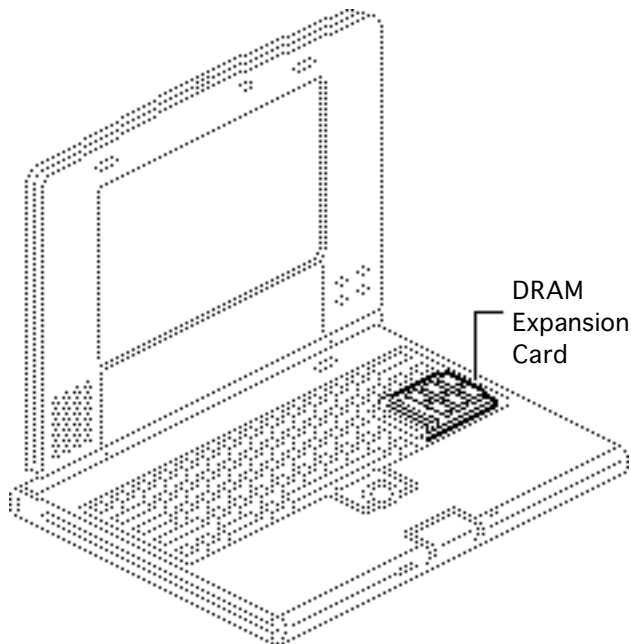   by the edges, connect it
    to the logic board.

Modem Card

Memory Expansion

Before you begin, do the following:
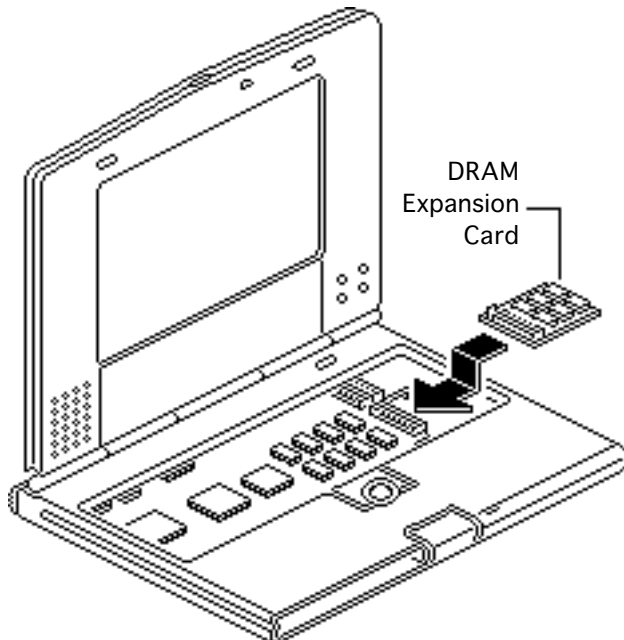
- Disconnect the power adapter
- Remove the main battery
- Remove the keyboard

DRAM Expansion Card

Caution: The PowerBook Duo contains CMOS devices that are very susceptible to ESD damage. Review the ESD precautions in Bulletins/Safety.

DRAM
Expansion
Card

Holding the DRAM expansion card by the edges, connect the card to the logic board.

Note: To verify that the upgrade is successful, check the Total Memory message (for systems with virtual memory switched off) or the Built-in Memory message (for systems with virtual memory switched on). The memory size should be 4 MB of DRAM plus the amount of DRAM on the expansion card. If the memory size is incorrect, reseat the DRAM card.

If the memory size is still incorrect, replace the DRAM
expansion card. If the memory size is still incorrect,
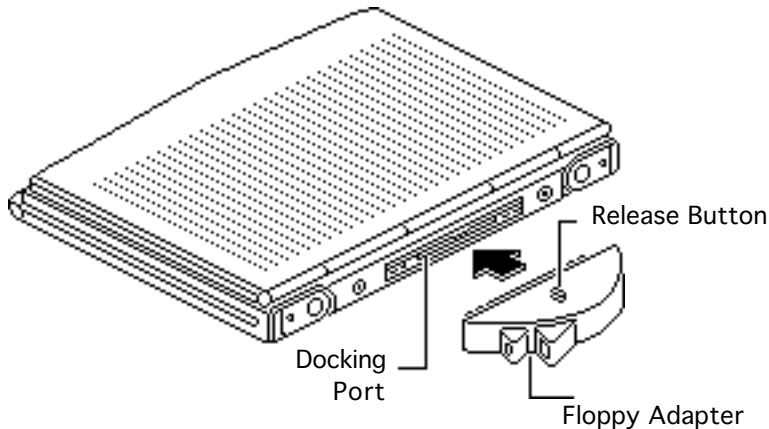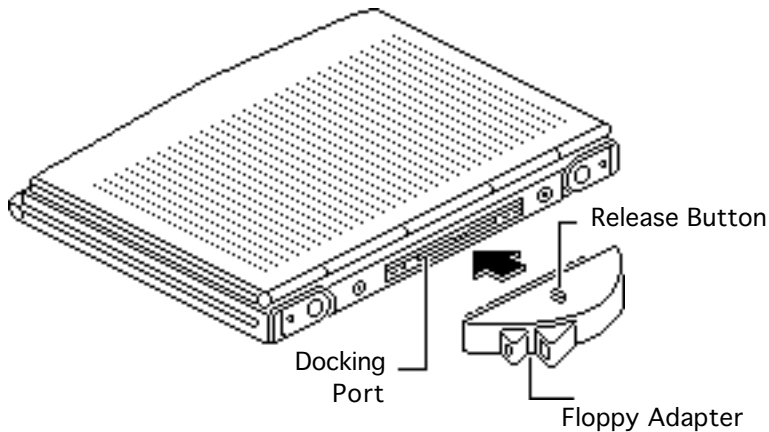contact Apple Technical Support.

Floppy Adapter

No preliminary steps are required before you begin this procedure.

Note: The PowerBook Duo Floppy Adapter attaches to the 152-pin docking connector and provides an external floppy drive (HDI-20) port and an ADB port. Replace defective floppy adapters by whole unit exchange.

Release Button

Docking Port

Floppy Adapter

1 To install the floppy adapter, raise the I/O door and push the adapter firmly onto the external 152-pin docking port. Make sure the floppy adapter release button is up.

2 To remove the adapter, depress the release button and pull off the adapter.
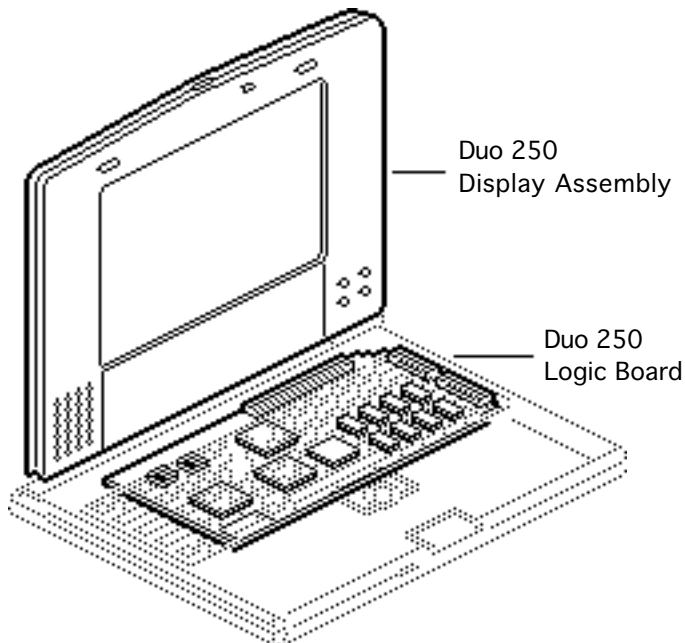
Release Button

Docking Port

Floppy Adapter

250 Upgrade

Before you begin, do the following:

- Disconnect the power adapter
- Remove the main battery
- Remove the keyboard
- Remove the end clutch covers
- Remove the top case
- Remove the center clutch cover
- Remove the hard drive
- Remove the backup battery
- Remove the trackball assembly

Duo 250
Display Assembly

Duo 250
Logic Board

- Remove the display assembly
- Remove the CPU stiffener
- Remove the logic board

Caution: The PowerBook Duo contains CMOS devices that are very susceptible to ESD damage. Review the ESD precautions in Bulletins/ Safety.

Note: A PowerBook Duo 250 upgrade kit upgrades a PowerBook Duo 210/230 to a PowerBook Duo 250. The upgrade kit includes a PowerBook Duo 250 logic board, display assembly, and minimal accessory kit.

1   Install the PowerBook 250 logic board and display assembly (see "Logic Board" and "Display Assembly" in Take Apart).
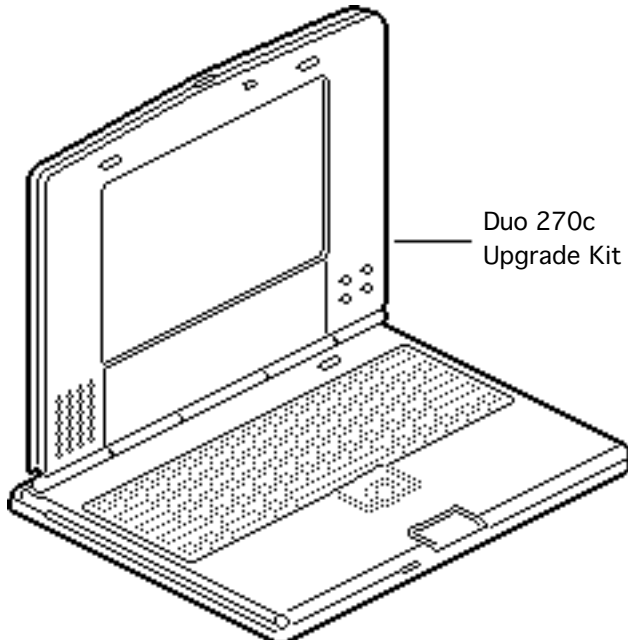
270c Upgrade

Before you begin, do the following:

- Disconnect the power adapter
- Remove the main battery
- Remove the keyboard
- Remove the end clutch covers
- Remove the top case
- Remove the center clutch cover
- Remove the hard drive
- Remove the backup battery
- Remove the trackball assembly

Duo 270c Upgrade Kit

- Remove the display assembly
- Remove the CPU stiffener
- Remove the logic board

Caution: The PowerBook Duo contains CMOS devices that are very susceptible to ESD damage. Review the ESD precautions in Bulletins/ Safety.

Note: A PowerBook Duo 270c upgrade kit upgrades a PowerBook Duo 210/230 to a PowerBook Duo 270c. The upgrade kit is an assembled PowerBook Duo 270c without the keyboard, trackball, and hard drive.

1   Install the PowerBook Duo 210/230 keyboard, trackball, and hard drive in the PowerBook Duo 270c upgrade kit (see "Keyboard," "Trackball Assembly," and "Hard Drive" in Take Apart).

Note: If a modem is installed
in the Duo 210/230, be
sure to transfer it to the Duo
270c kit.

280/280c Upgrade

Before you begin, do the following:

- Disconnect the power adapter
- Remove the main battery
- Remove the keyboard
- Remove the end clutch covers
- Remove the top case
- Remove the center clutch cover
- Remove the hard drive
- Remove the backup battery
- Remove the trackball assembly
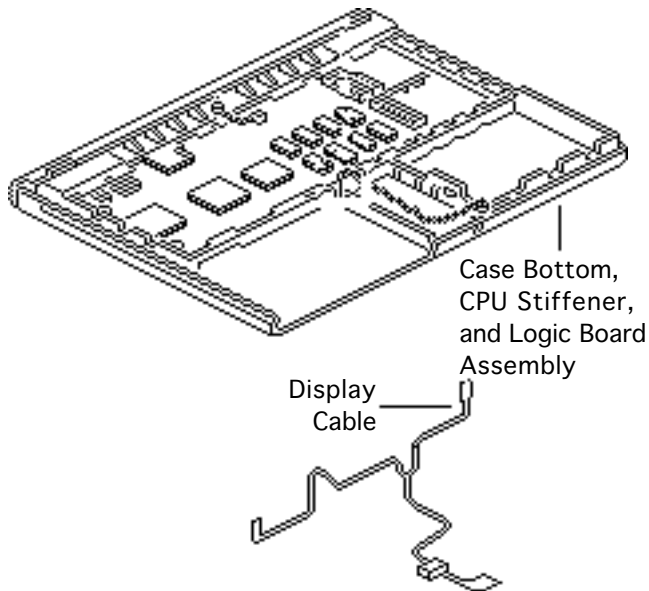
Duo 280/280c Upgrade Kit
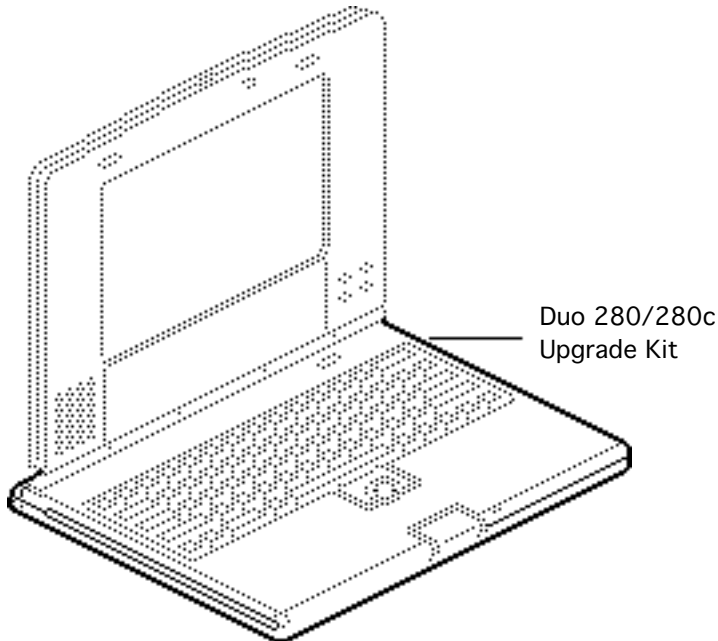
- Remove the display
  assembly
- Remove the CPU stiffener
- Remove the logic board

Caution: The display cable
is fragile and should be
handled with care.

Caution: The PowerBook
Duo contains CMOS devices
that are very susceptible to
ESD damage. Review the ESD
precautions in Bulletins/
Safety.

Case Bottom,
CPU Stiffener,
and Logic Board
Assembly

Display
Cable

Note: A PowerBook Duo 280/280c upgrade kit upgrades a PowerBook Duo 250 to a 280 or a PowerBook Duo 270c to a 280c. The upgrade kit includes a PowerBook Duo 280 case bottom (with new label)/logic board/CPU stiffener assembly. In addition, it includes a display cable, Type 3 battery, 36 W power adapter, and miscellaneous parts.
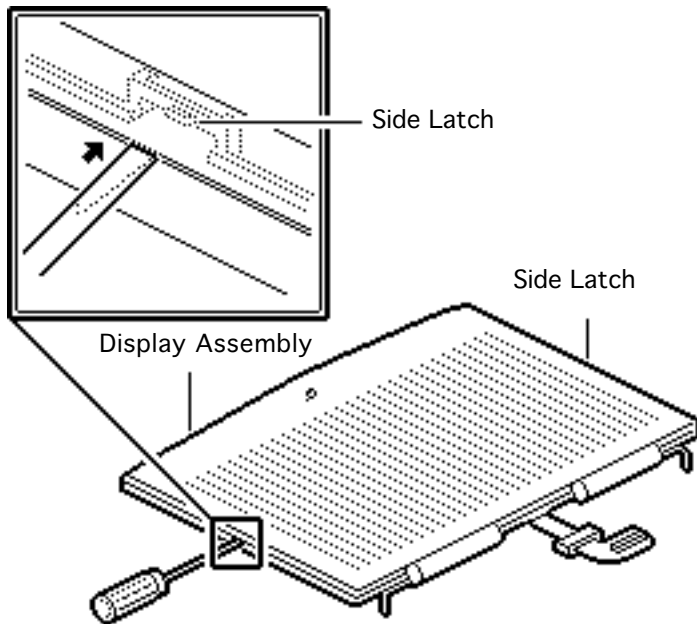
Screw Cover

Screw

PowerBook Duo
250 Display
Assembly
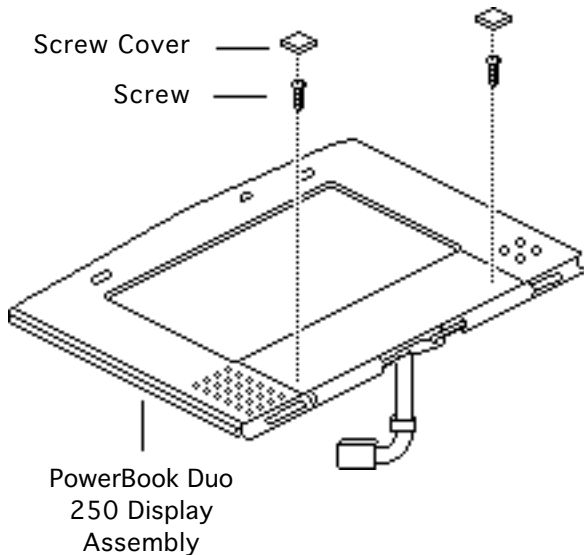
Note: The new display cable is required in the PowerBook Duo 250 only. Do not use this cable in a PowerBook Duo 270c.

Upgrading a Duo 250

1. Place the PowerBook Duo 250 display assembly with the bezel face up.

2. Remove the screw covers and screws from the bezel.

Side Latch

Side Latch

Display Assembly

3 Turn the display assembly over and place it on a clean, soft surface.

4 Insert a jeweler's screwdriver midway along the left side of the display and release the interior side latch. Repeat this procedure along the right side.
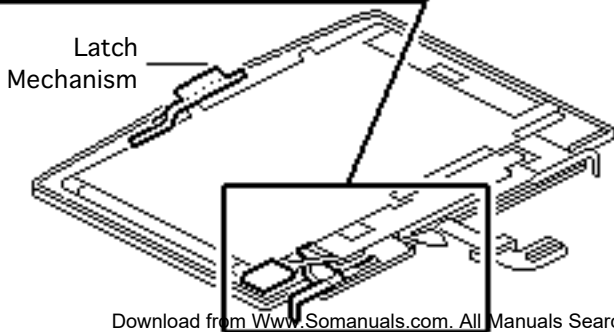
Caution: To avoid misaligning the display layers, remove the display housing very carefully.

5 Push the display housing forward and remove it.

Display Housing
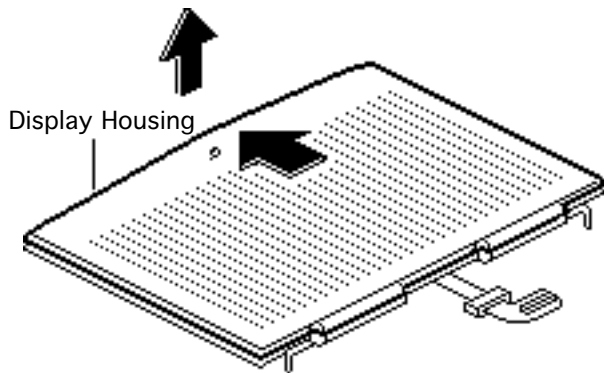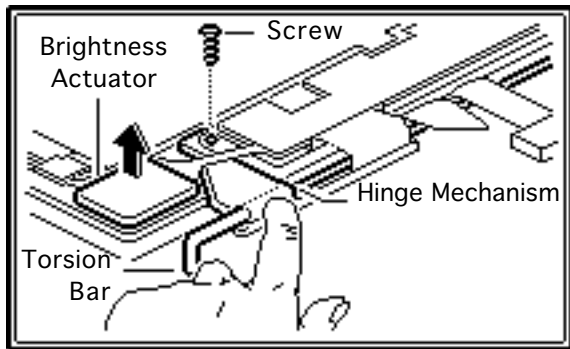
6 To avoid losing the latch spring, release the latch mechanism.

7 Carefully lift the brightness actuator assembly from the bezel.

8 Hold down the hinge mechanism on the torsion bar. Using a torx screwdriver, remove the ground screw for the display cable.

9 Slowly release the torsion bar.
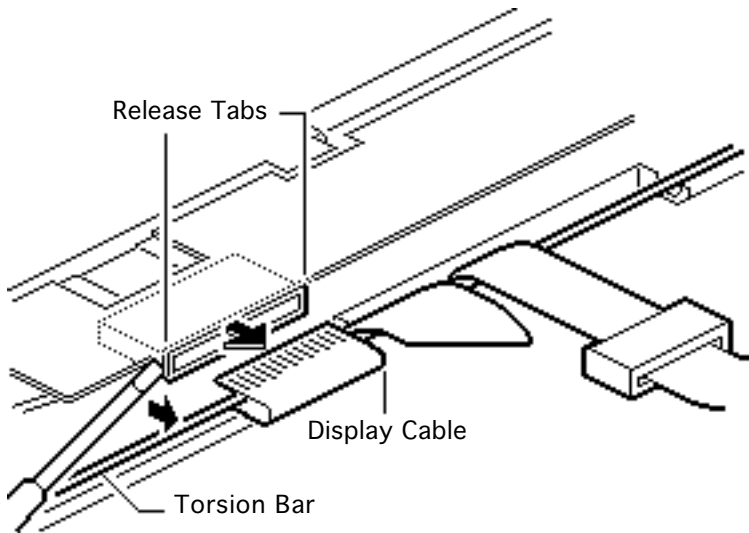
10 Using a jeweler's screwdriver, push out the release tabs on the display cable and disconnect the cable.

11 Unwind the display cable from the torsion bar and remove the cable.

Release Tabs

Display Cable

Torsion Bar

12 Before installing the new display cable, gently roll the cable so it can be wrapped around the torsion bar.

Note: The 280/280c display cable is slightly longer than the 250 display cable (from the screw hole beyond). Do not tape or screw down this additional length; leave it loose.

Additional Length on 280/280c Display Cable

Screw Hole

280/280c Display Cable

Release Tabs

Display Cable
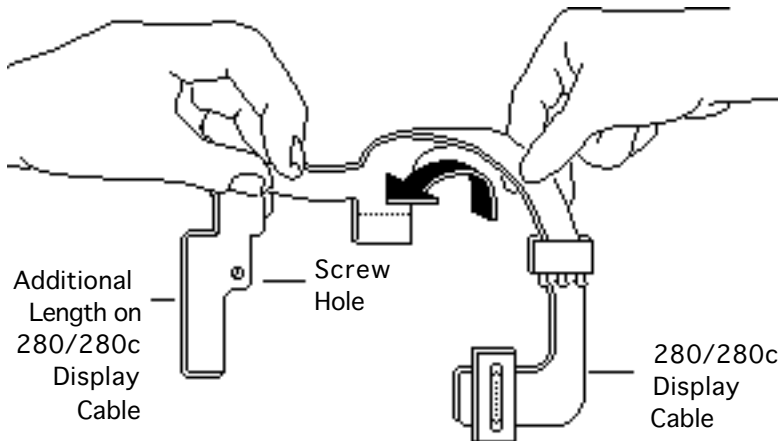
Torsion Bar

13 Install the new display
   cable by wrapping it
   around the torsion bar.
   Connect the cable and
   push in the release tabs.

14 Reassemble the display.
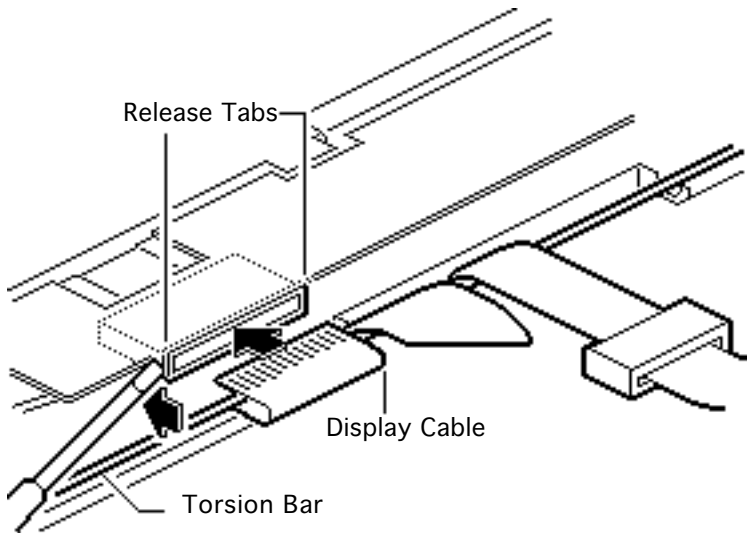
Upgrading a Duo 250 or 270c

1   Install the original trackball assembly, backup battery, and hard drive on the PowerBook Duo 280/280c case bottom/CPU stiffener/ logic board assembly (see "Trackball Assembly," "Backup Battery," and "Hard Drive" in Take Apart).

2   Reassemble the rest of the unit.

2300 Series Upgrade

PowerBook Duo 2300 Upgrade

Before you begin, do the following to disassemble the PowerBook Duo 200 being upgraded:

- Disconnect the power adapter
- Remove the main battery.
- Remove the keyboard
- Remove the end clutch covers
- Remove the top case.
- Remove the hard drive
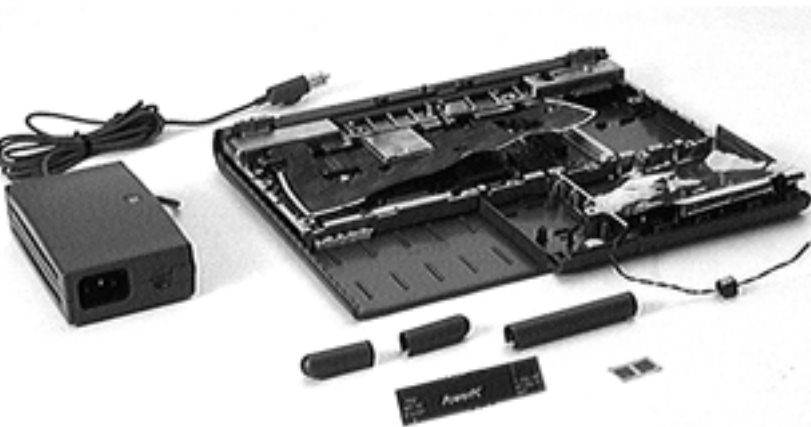- Remove the backup battery

- Remove the trackball
- Remove the display/CPU stiffener assembly
- Remove the logic board
- Remove the microphone cable, on-off board (or modem), and optional RAM from the logic board

Caution: The PowerBook Duo contains CSMOS devices that are very susceptible to ESD damage. Review the ESD precautions in Bulletins/Safety.

Caution: The display cable is fragile and should be handled with care.

Note: The PowerBook Duo 2300 upgrade kit upgrades a PowerBook Duo 210, 230, 250, 270c, 280, or 280c to a PowerBook Duo 2300c logic board. This upgrade, which uses a PowerPC 603e microprocessor, includes a PowerBook Duo 2300c case bottom/logic board/CPU stiffener assembly. It also includes a power adapter, PowerPC name plate, Macintosh PowerBook 2300

Components of PowerBook Duo 2300
Upgrade Kit

Series system software, and
miscellaneous parts (end
and center clutch covers and
display screw covers). A
trackpad is not included in
this upgrade.

.

PowerBook Duo 2300c
Logic Board

On-Off Board
(or Modem)

Microphone Cable
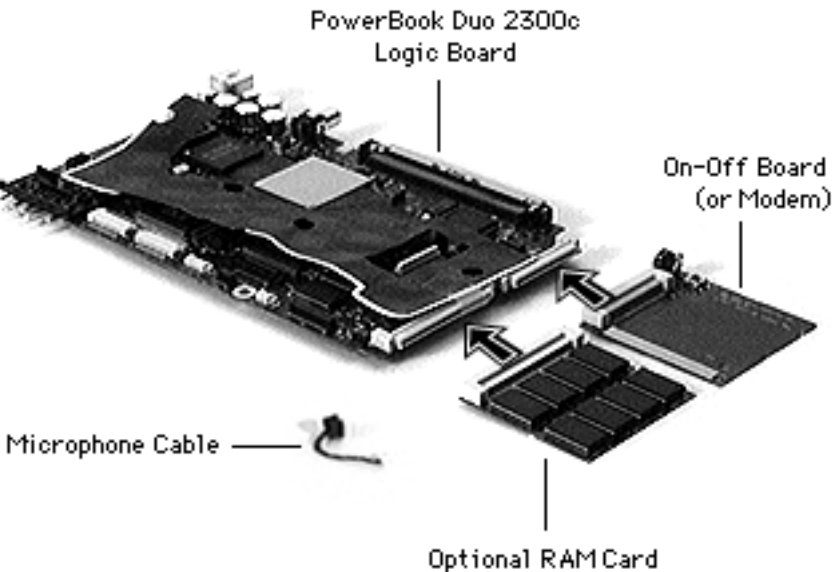
Optional RAM Card

To assemble the upgraded unit:

1   Remove the CPU stiffener from the PowerBook Duo 2300c case bottom/logic board/ CPU stiffener assembly.

2   Lift out the logic board and install the microphone cable, on-off board (or modem), and optional RAM card.

3 Reinstall the logic board and CPU stiffener.

SCSI
Connector

Hard Drive
Cable
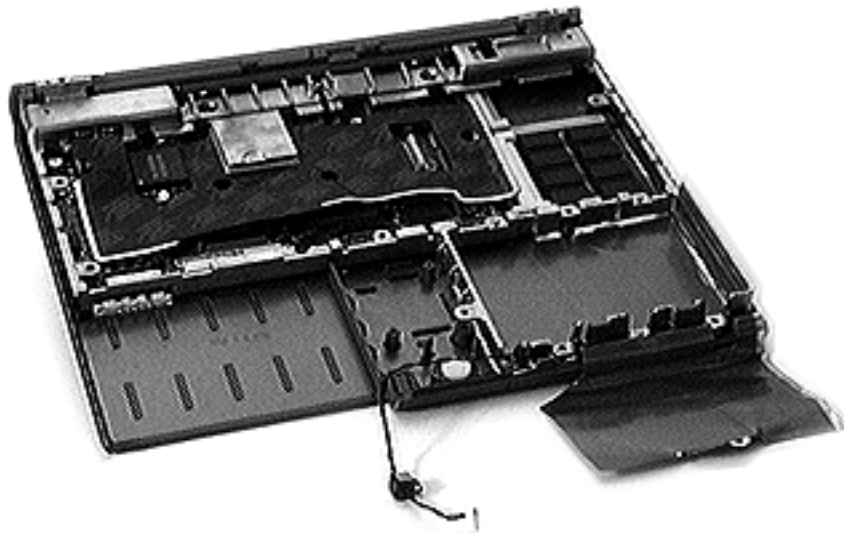
SCSI
Hard Drive

4   Install the SCSI hard
    drive and connect the
    hard drive cable to the
    SCSI connector on the
    logic board.
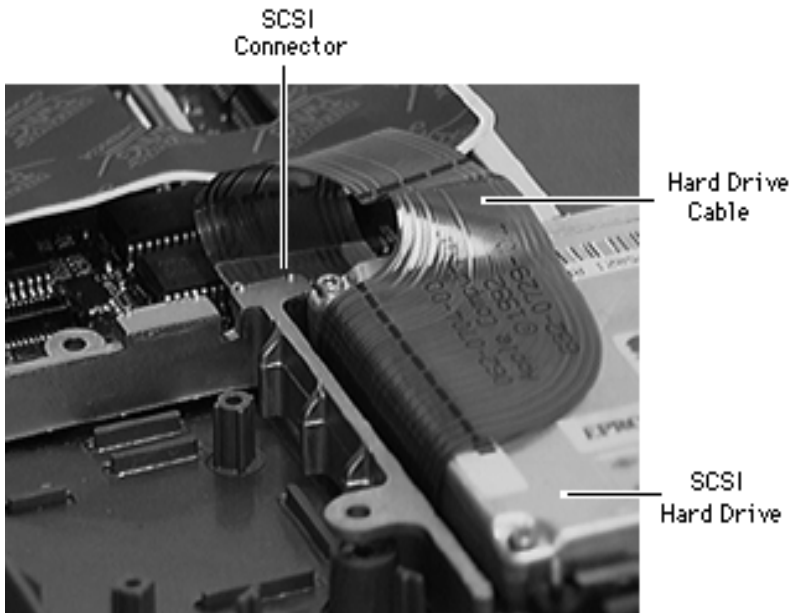
Caution: The following step should be performed with care. Refer to "Center Clutch Cover" in Take-Apart.

5 Remove the display from the PowerBook Duo 200 CPU stiffener and install it on the upgraded unit.

PowerBook
270/280/280c
Display

TFT Display
Connector
(J7)

Logic Board
Heatsink

PowerBook 270c/280/280c
Display Cable
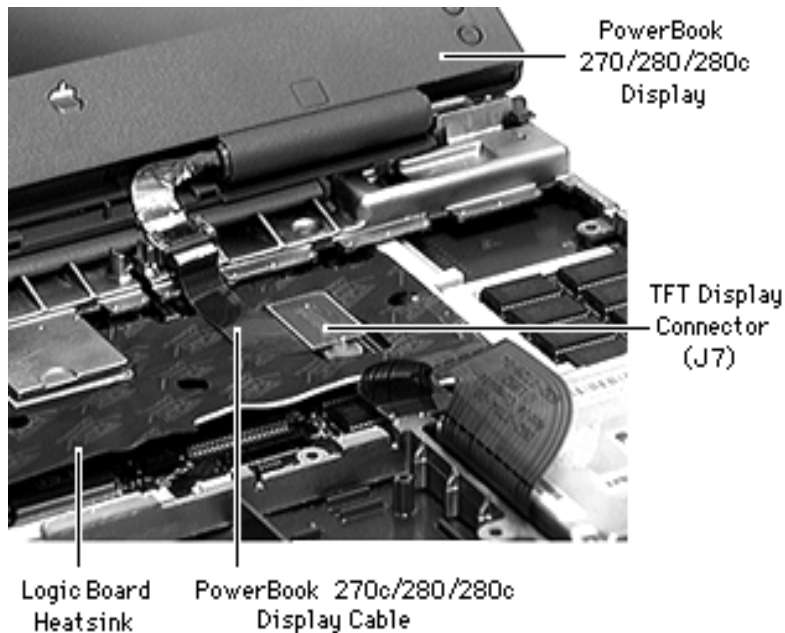
Note: There are two display connectors on the Power-Book 2300c logic board.

6 Connect the display cable to the appropriate connector on the logic board.

If upgrading a 270c, 280, or 280c, connect the display cable to the TFT connector (J7).

Logic Board Heatsink

PowerBook
210/230/250
Display

FSTN Display
Connector (J6)

PowerBook 210/230/250
Display Cable
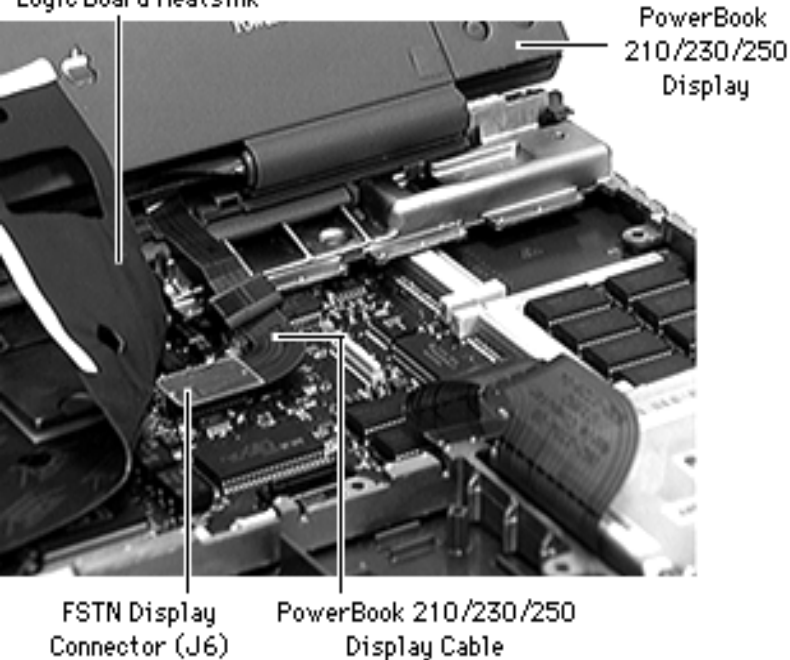
If upgrading a 210,
230, or 250, carefully
bend back the pliable
heatsink to connect the
display cable to the FSTN
connector (J6).

Replacement Note: On
an upgraded 210, 230,
or 250 unit, bend the
heatsink back into place
so that it lies flat.

PowerPC Label ———
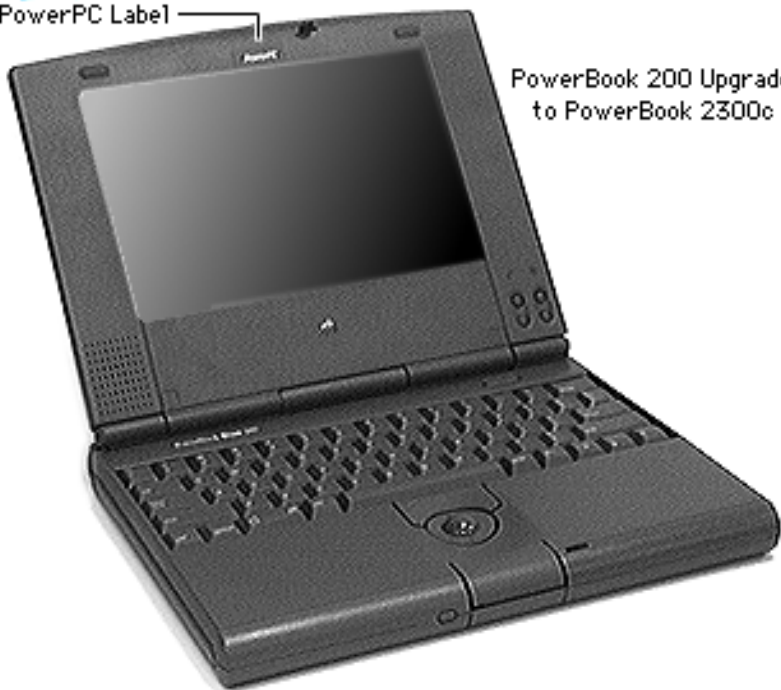
PowerBook 200 Upgraded
to PowerBook 2300c

7 Assemble the rest of the unit. (See "Trackball," "Backup Battery," "Top Case, "End Clutch Covers," and "Key-board" in Take-Apart.

8 Adhere the PowerPC name label to the bezel.

9 Perform a clean installation of the Macintosh PowerBook 2300 Series System Software.

10 If the unit has an Apple Express modem, install the new software for the modem, which is included in the upgrade kit.

Replacement Note: After reinstalling the CPU stiffener, use the Duo battery contact alignment tool to check the alignment of the battery contacts.

Note: Remind the customer to use the new power adapter included in the upgrade kit. The older power adapter is not for use in the upgraded system.

Service Source

Additional Procedures

PowerBook 200 Series

Battery Recharger

No preliminary steps are required before you begin this procedure.

Type 1 Battery (only)

Type 1 Recharger

1   Using the PowerBook Duo power adapter, plug the battery recharger into a power outlet and insert the main battery into the recharger.

Type 1
Battery
(only)
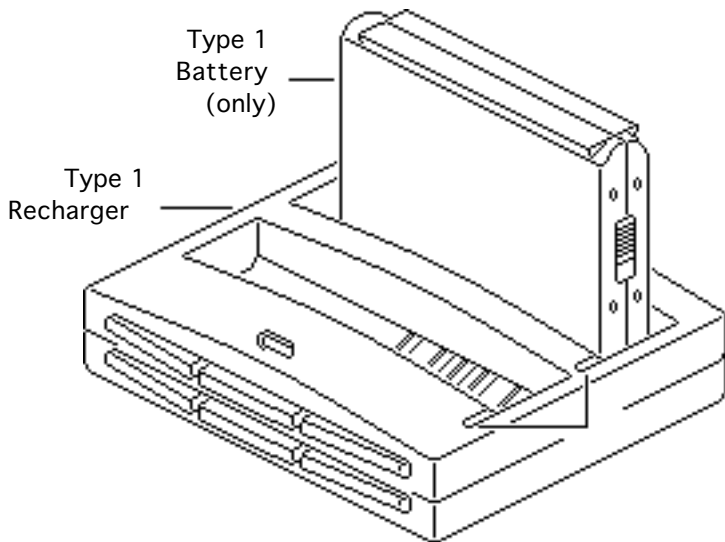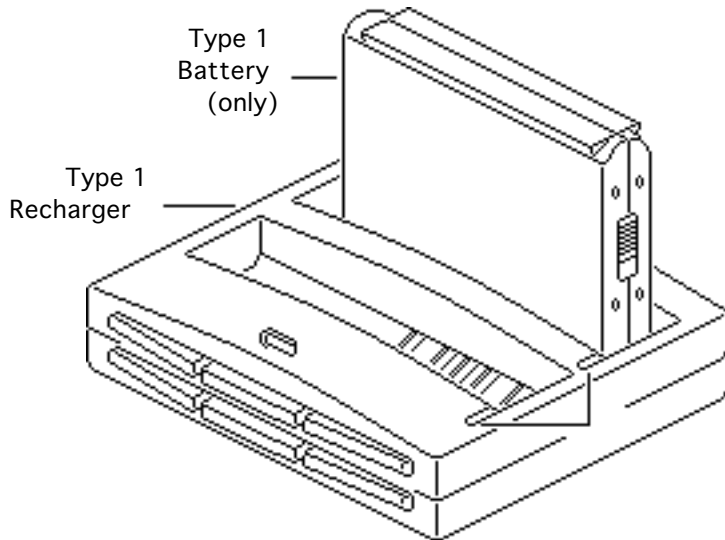
Type 1
Recharger

If the LED is

- Yellow, the battery is charging
- Green, the battery is ready to use
- Red, the battery is Type 2 or Type 3 and the recharger is Type 1 (the battery will not charge). Or, the Type 2 recharger has not been updated with software for a Type 3 battery (see Note below).

Type 1,
2, or 3
Battery

Type 2
Battery
Recharger
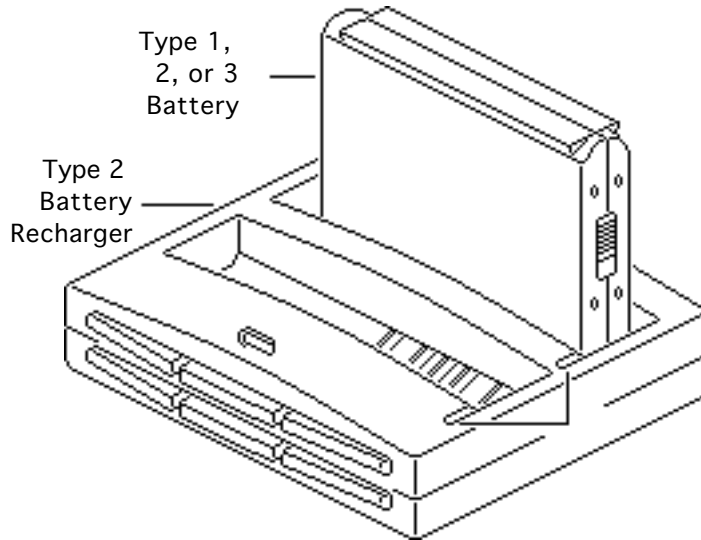
• Off, the recharger is
unplugged, the
battery is bad, the
power adapter is
defective, or the
recharger is defective

Note: Use only Type 1
batteries in a Type 1 battery
recharger; Type 2 or Type 3
batteries will not charge.

You can charge Type 1, Type 2, or Type 3 batteries in a Type 2 battery re-charger. However, the first time (only) that you charge a Type 3 battery in a Type 2 recharger, the recharger must be connected to a Duo with "Type III Battery" in the Extension folder. If you fail to do this, the Type 3 battery will not charge.

To identify types of battery rechargers, check the bottom of the recharger. A Type 1 recharger is imprinted with "Macintosh PowerBook Duo Battery Recharger." A Type 2 recharger is imprinted with "PowerBook Duo Battery Recharger."

Battery Handling

No preliminary steps are required before you begin this procedure.

Note: The PowerBook Duo main battery is a nickel-metal-hydride (NiMH) battery. To extend its longevity, follow the instructions below.

└─ Main Battery
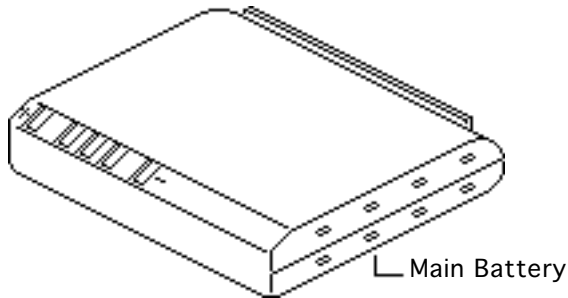
⚠ Warning: Return undamaged, dead NiMH batteries to Apple—do not discard dead batteries with other waste. If the battery is damaged, do not return it to Apple. Dispose of damaged batteries according to local ordinances. Review battery handling and disposal instructions in Bulletins/ Safety.

Note: To identify types of batteries, check the bottom of the battery. Type 3 batteries include the description "High-Capacity Type 3" in the upper-right corner. Type 2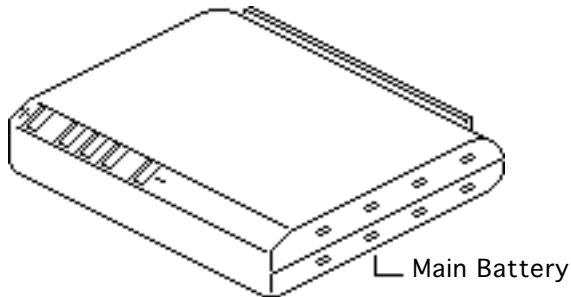 batteries include the description "High-Capacity Type 2" in the upper-right corner. Type 1 batteries do not include this description.

Main Battery

Note: Use only Type 1 batteries in a Type 1 battery recharger; Type 2 or Type 3 batteries will not charge. You can charge Type 1, Type 2, or Type 3 batteries in a Type 2 battery recharger.

Note: Before upgrading to a Type 2 battery, you must install the Finished Goods Type 2 or Type 3 software extension. Before upgrading to a Type 3 battery, you must install the Finished Goods Type 3 software extension.

1   Follow these guidelines
    for properly handling
    the NiMH battery:
    • Handle the battery
      carefully. Do not
      drop, puncture,
      disassemble,
      mutilate, or
      incinerate the battery.

PowerBook Duo Battery
Case with Battery
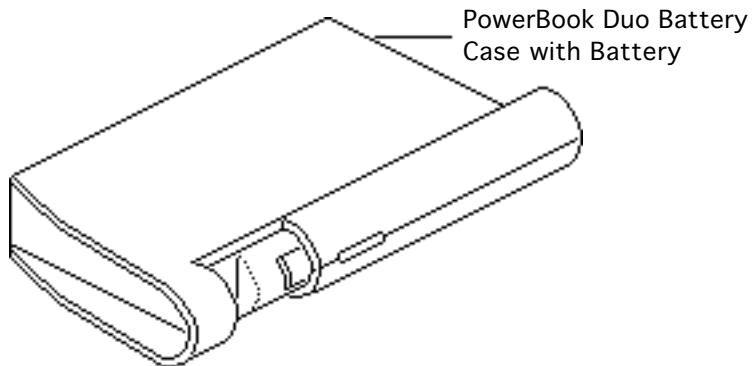
- Fully charge a replacement battery before using it; Apple ships batteries in a partially-charged state.
- Do not leave the battery in the computer for longer than a week without recharging.

- To maximize battery life, discharge and then recharge the battery once every 30 days. Use only the power adaptor or recharger supplied with the Macintosh Duo system.
- Store the battery in the protective battery case.
- Do not short-circuit the battery terminals. Keep the battery in a cool, dark place; do not store it for longer than 6

months without
recharging.

Align Battery Contacts

Before you begin, do the following:

- Disconnect the power adapter
- Remove the main battery
- Remove the keyboard
- Remove the end clutch covers
- Remove the top case

Caution: The PowerBook Duo contains CMOS devices that are very susceptible to ESD damage. Review the ESD precautions in Bulletins/Safety.

Duo Battery
Contact
Alignment
Tool

PB Duo
Battery Contact
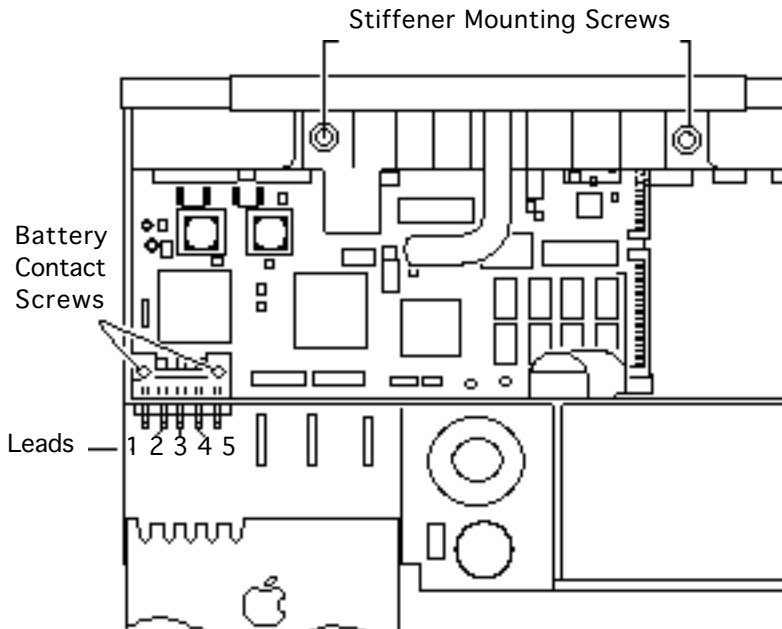Alignment Tool

1 2 3 4 5
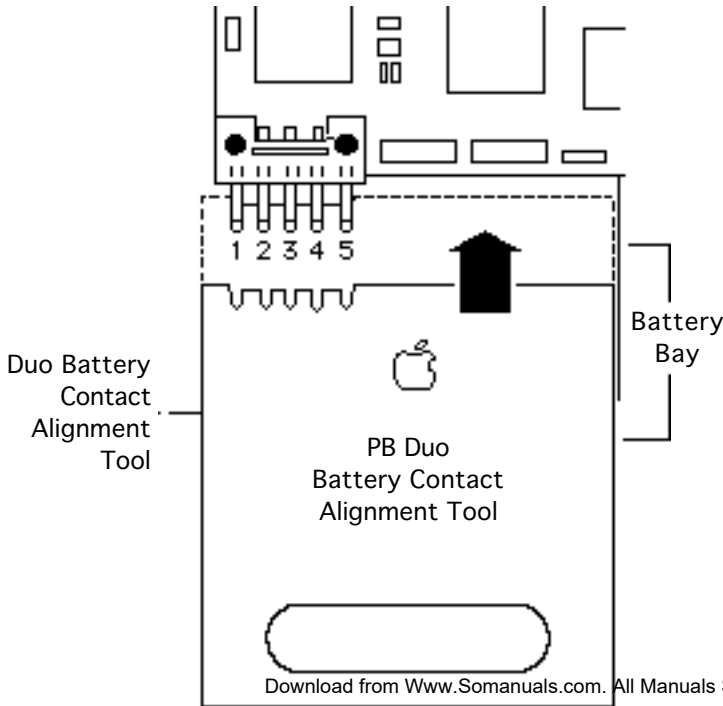
Battery
Bay

Note: Perform the battery contact alignment procedure when you replace a PowerBook Duo logic board or when a known-good battery has power problems. Use the Duo battery contact alignment tool to align the two outer battery contacts so they are perpendicular to the edge of the logic board.

1 Slide the Duo battery contact alignment tool into the battery bay.

Stiffener Mounting Screws

Battery Contact Screws

Leads — 1 2 3 4 5

Note: If leads 1 or 5 flex or offer resistance to the alignment tool, perform the following steps. If there is no resistance, the contacts are aligned.

2 Slide the alignment tool out of the battery bay and loosen the two battery contact screws and two CPU stiffener mounting screws.

3 Slide the tool back in and press it against the sides of the contacts.

4 Retighten all screws.

Note: The soldered center leads (2, 3, and 4) were already aligned by Apple. If any of the center contacts becomes misaligned, install a new logic board and return the old one to Apple.

Battery Verification

Before you begin, remove the main battery.

Note: The battery desk accessory is a general indicator of the battery charge. Use a voltmeter to determine the actual charge.

Main Battery
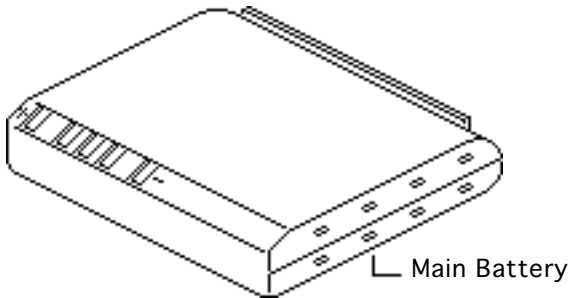
⚠ Warning: Return

undamaged, dead Ni-Hy
batteries to Apple—do not
discard dead batteries with
other waste. If the battery
is damaged, do not return it
to Apple. Dispose of damaged
batteries according to local
ordinances. Review battery
handling and disposal
instructions in Bulletins/
Safety.

Negative Probe
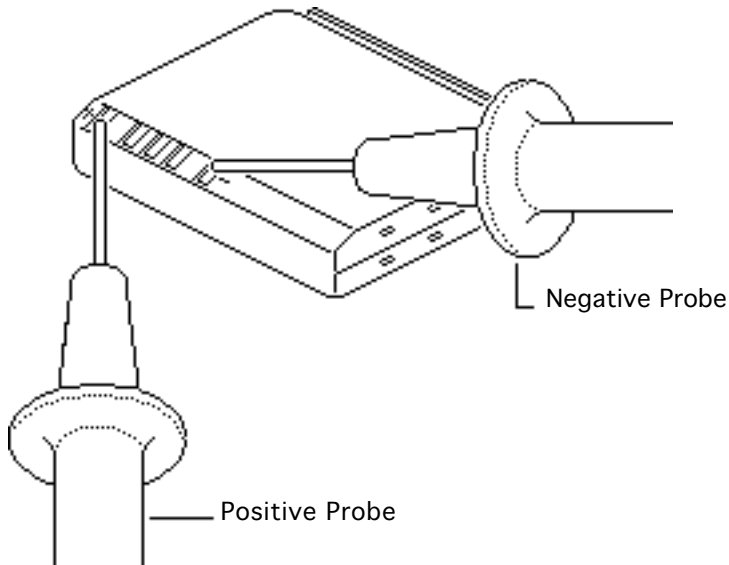
Positive Probe

1 Set a voltmeter to the 20 volts DC scale. Touch the positive probe of the voltmeter to the positive terminal and the negative probe to the negative terminal.

2 If the reading is not 12 volts, recharge the battery. If the reading remains below 6 volts, replace the battery.

AC Adapter Verification

No preliminary steps are required before you begin this procedure.

1 Plug in the AC adapter to a wall socket.

2 Connect the AC adapter plug to the PowerBook.

3 Set a voltmeter to the 200 volts DC scale.

Adapter Plug

Positive Probe
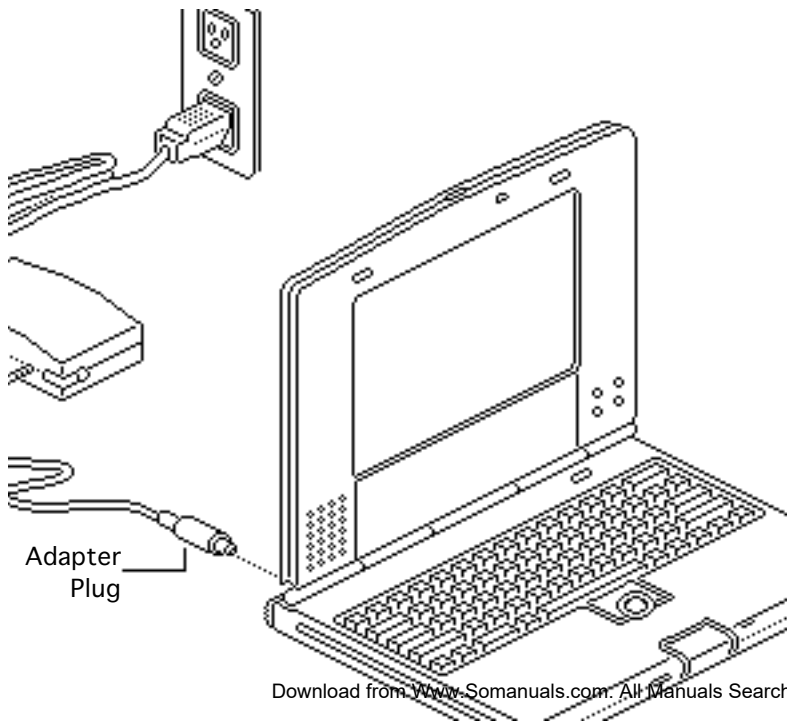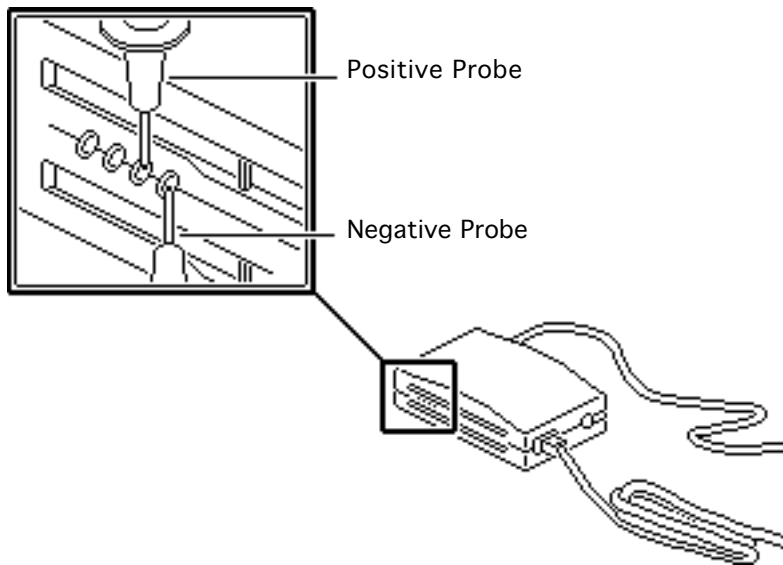
Negative Probe

4 Touch the negative voltmeter probe to the contact nearest the power plug and the positive probe to the contact second nearest the power plug. If the reading is not 24–25 volts, replace the adapter.

5   Also check the AC adapter under load. Switch on the PowerBook and repeat the voltmeter check. If the reading drops more than 1–2 volts, replace theq adapter.

Exploded View

PowerBook 200 Series

PowerBook Duo 200 Series

Display
(Refer to Service
Parts Database)

Screw Covers
922-2029

Keyboard
661-1652

Clutch Cover
Kit
076-0063

RAM Cards
661-1659 (4 MB)
661-1658 (8 MB)

Top Case
620-0045
(210/230/250/270c)
922-0792 (PB280)
922-0793 (PB280c)

Hard Drive
Assembly
661-1298

Logic Board
661-1653
(PB 210/230/250/270c)
661-1672 (PB 230/250)
661-1717 (PB 270c)
661-0051 (PB 280/280c)

CPU Stiffener
922-0433
(210/230/250 only)
076-0339

Trackball
Assembly
661-1654

Bottom Case
076-0419

Battery with Door
661-0053 (Type 3)

Free Manuals Download Website

http://myh66.com

http://usermanuals.us

http://www.somanuals.com

http://www.4manuals.cc

http://www.manual-lib.com

http://www.404manual.com

http://www.luxmanual.com

http://aubethermostatmanual.com

Golf course search by state

http://golfingnear.com

Email search by domain

http://emailbydomain.com

Auto manuals search

http://auto.somanuals.com

TV manuals search

http://tv.somanuals.com