



**TEXAS
INSTRUMENTS**
ELECTRONIC ONLINE
CHALLENGE 2018

Apple MacBook Air 11-inch Mid 2011



**Herricks High School
Robotics**

Team 11040A

HERRICKS HIGH SCHOOL

Table of Contents

Report	2
Layout	4
Main PCB	5
Battery	7
Mouse/Keyboard Logic Board	8
Small PCB	9
Charts of Chips	11

Report:

Our team scoured their houses and school for old electronics, finding multiple flagship phones with cracked screens, old PC tower running Windows '95, 2006 Nintendo Wii, and an old MacBook collecting dust. We decided to tear down the MacBook for numerous reasons. One, our members were interested in figuring out how laptops work as everyone uses them on a daily basis and the insides of a computer are typically hidden underneath a cover. Second, Apple is a well-known company, charging its products very high. We were eager to see what makes the MacBook more expensive than other laptops in the market. The MacBook we chose to disassemble was the MacBook Air 11-inch Mid 2011.

To get started, we flipped the MacBook upside-down and screwed out ten screws from the bottom plate. After removing it, we saw all the components wired together. Before eagerly tearing it apart, it is essential first to disconnect the battery from the circuit to prevent accidental shocks. The ribbon cables had to be detached by pulling up their pull tags. After that, we took out the main board first, then the extension board. We examined the chips and recorded their manufacturer and label numbers. By having this information, we were able to research each chip's role on the boards by looking up their respective datasheets.

Inside the MacBook, there are two printed circuit boards (or PCBs), one main board and another small attached to the main board via an OPC data cable and a 6-pin connector. The small board has 3 I/O ports (Input/Output): a 3.5 MM Headphone jack, USB 2.0 and MagSafe Power port. Two main chips were spotted, one of them being a Texas Instruments chip. Examining the main board was fun as there were lots of chips and components! We found many types of chips like CPU, RAM, a Toshiba 128 Giga-bytes SSD, 4 Gigabytes of RAM, and a network card. As for its I/O, it has a Thunderbolt 1.0 and another USB 2.0. There were seven different Texas Instruments chips on the main board, some, unfortunately, chips' datasheets and information were no longer found since these were obsolete. Since it was hard to read such

tiny text, a Sony HDR-XR520V provided us the macro lens to identify and take pictures of the chips.

We have learned a lot while disassembling this machine. We expected this MacBook to be complicated, but not knowing to such extent. It was also very modular. We now have a more extensive comprehension of how complex a laptop needs to be just to get along with tasks we humans throw at it every day. This fun teardown has sparked most of our members' interest to continue learning more about circuit boards and computer engineering.

*Final Summary Word Count: 458 words

Layout:

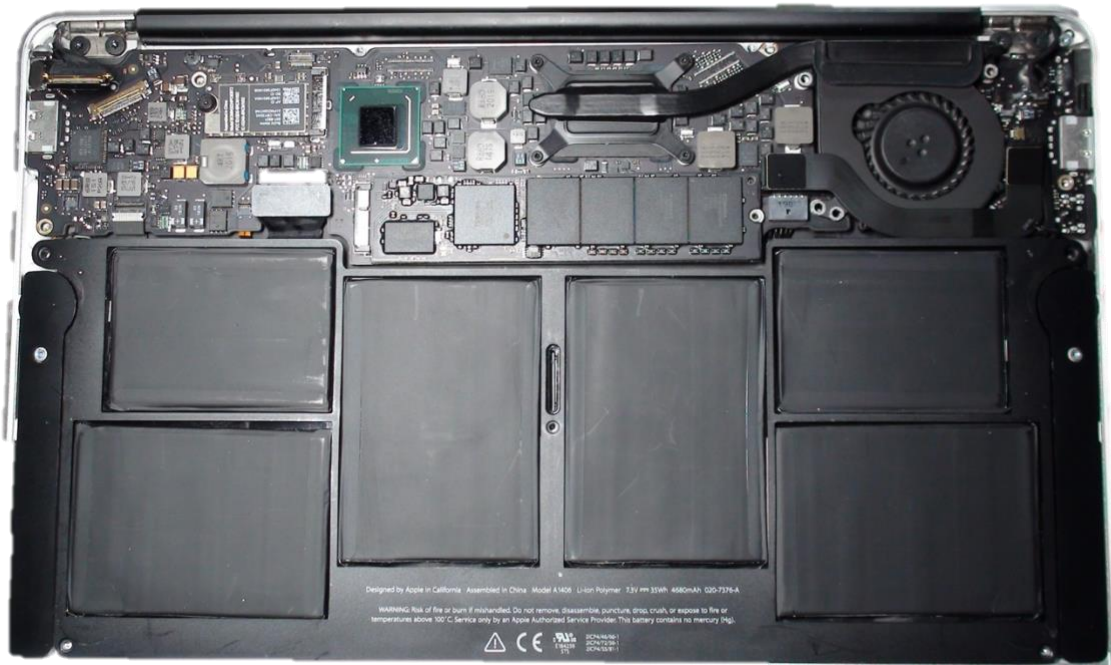
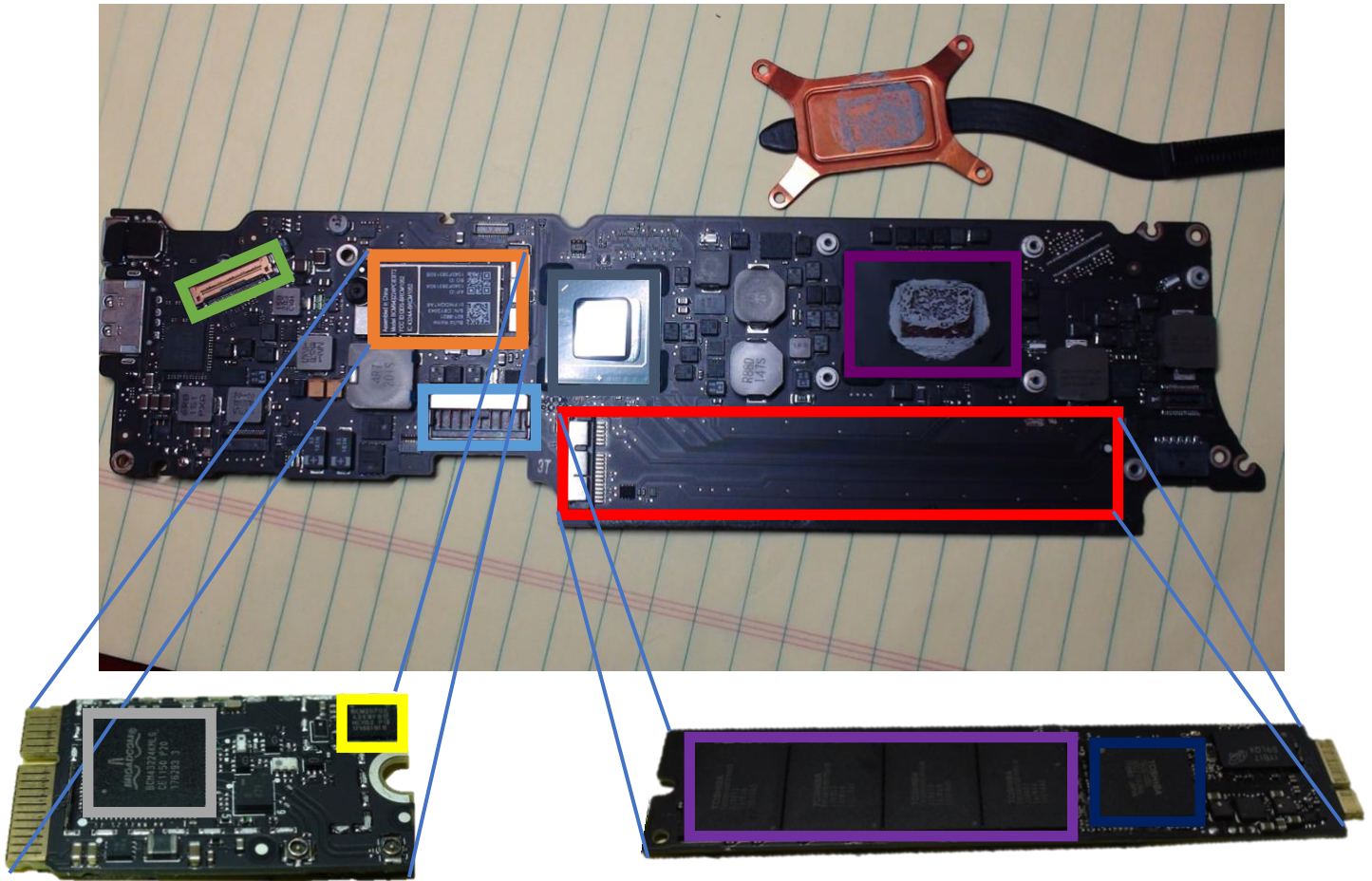


Figure 1 Before Teardown



Figure 2 After Teardown

Main PCB:

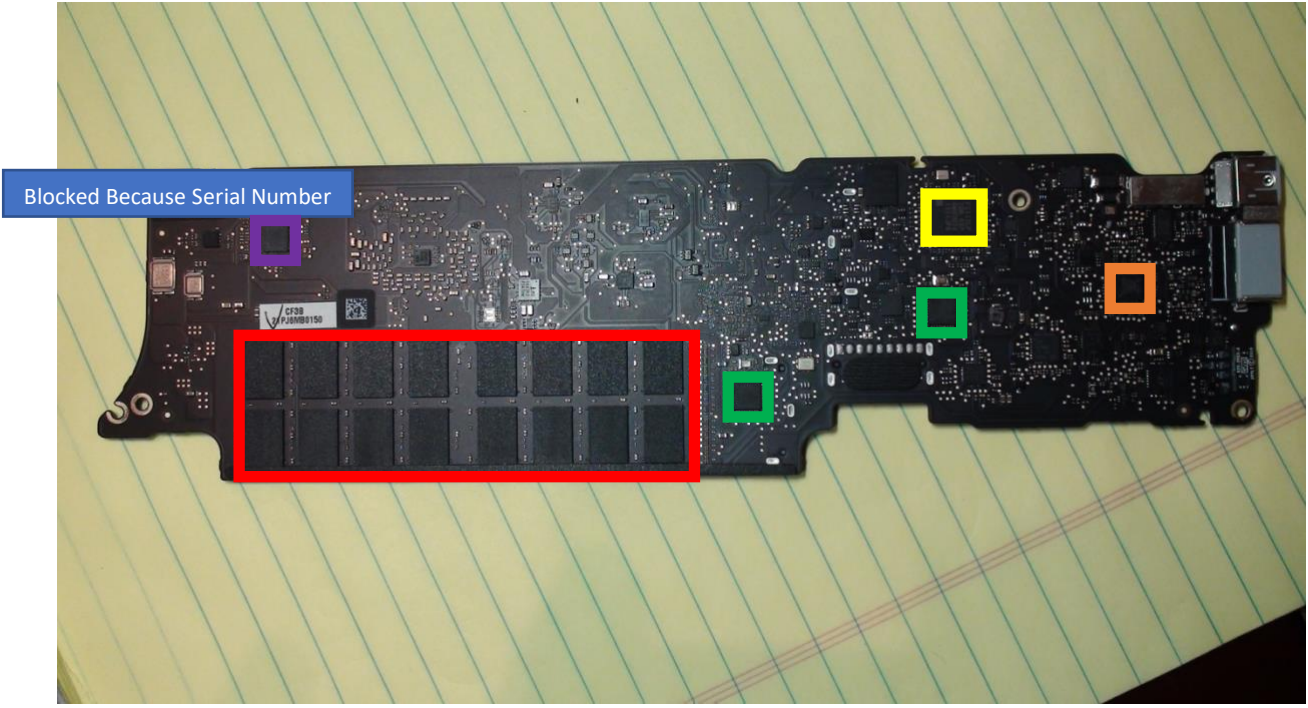


Broadcom BCM43224KMLG 802.11N Wi-Fi Transceiver
Broadcom BCM20702 Bluetooth 4.0 with BLE support

Display Ribbon Port
Network Card
7.3V Battery Port

Toshiba TH58NVG8D7FBASB 32GB Storage (4x)
Toshiba T6UG1XBG SSD Controller

Intel E78296 Platform Controller Hub
Toshiba 128GB SSD Bay
Intel i5M with Intel HD 3000 Graphics



Maxim 15092G Video Amplifier
Samsung SEC 149 HCH9 4GB DRAM
SMSC USB2513B USB2.0 Hub Controller

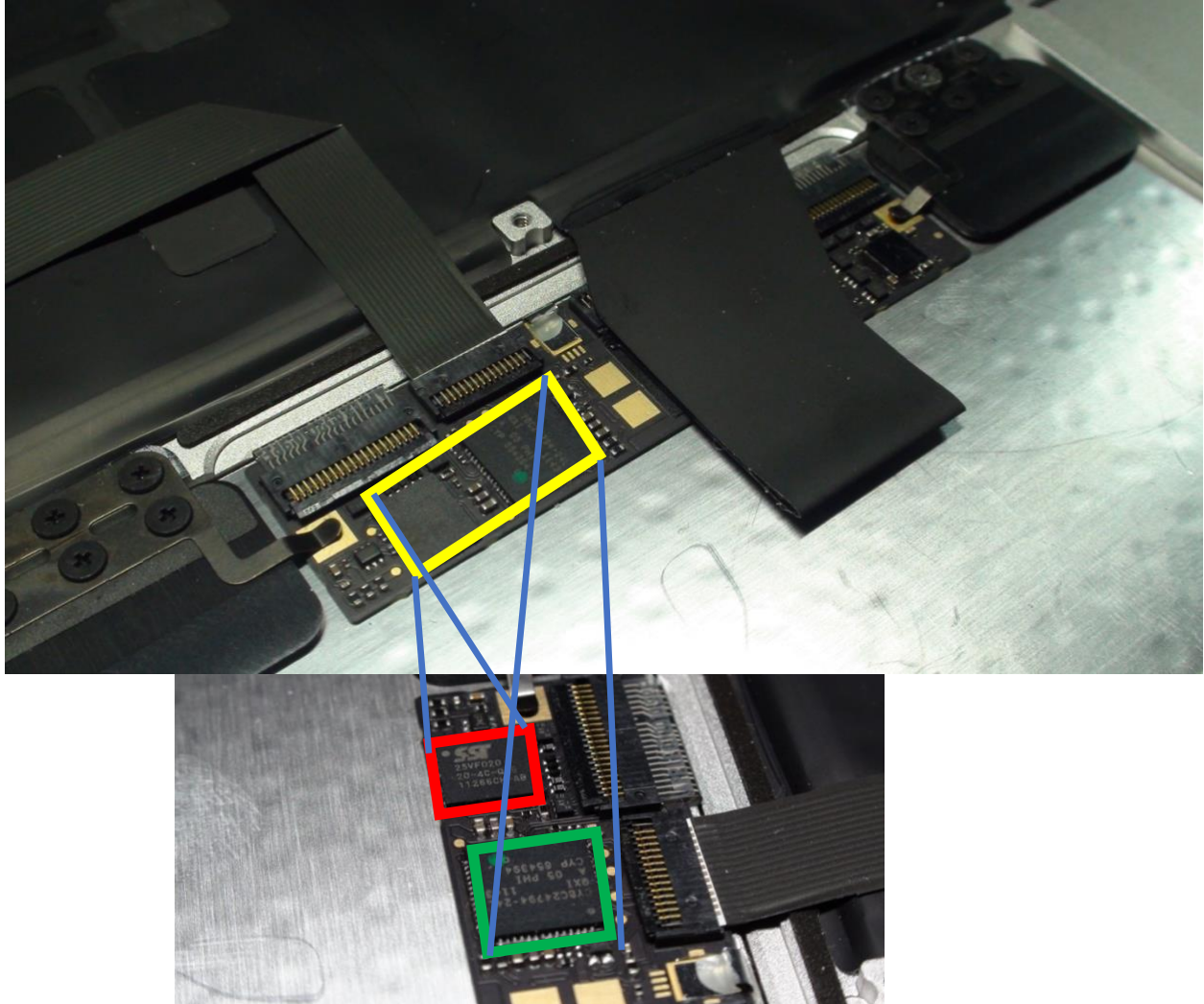
F2117LP 20H RVP
Parade PS8301 DisplayPort

Battery:



Figure 3 A 6-cell 4680mAh Battery

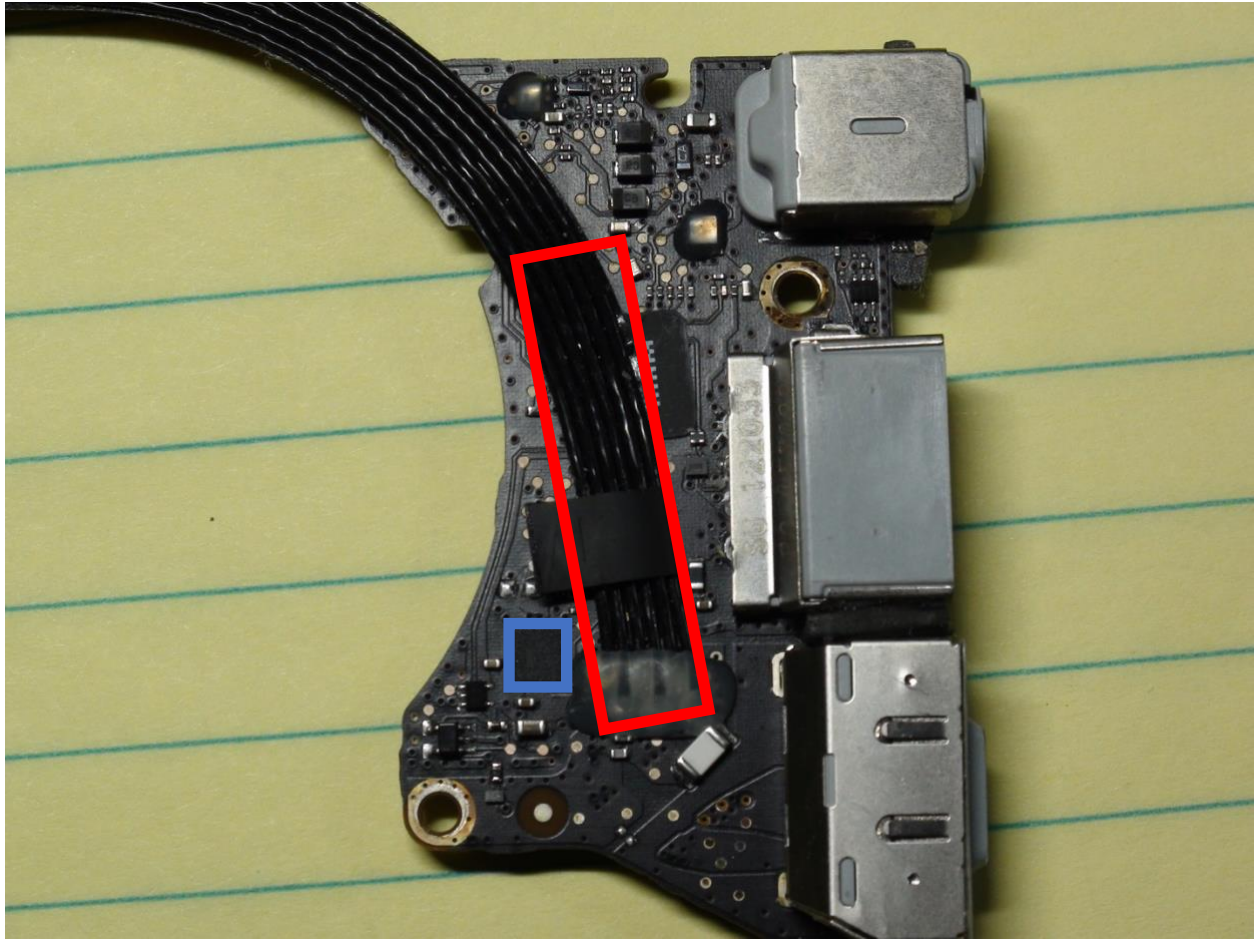
Mouse/Keyboard Logic Board:



SST 25VF020 2 Mbit SPI Serial Flash

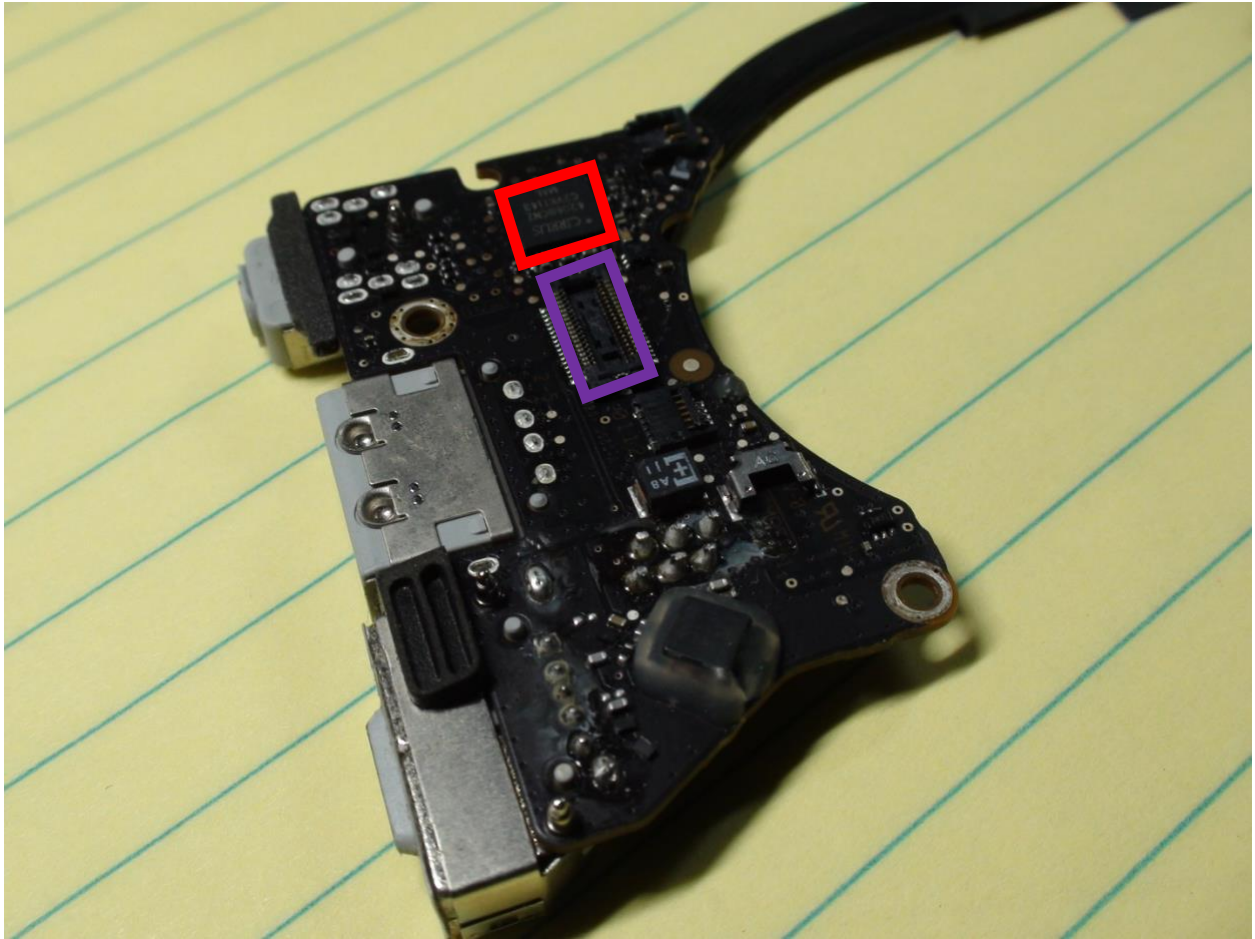
CY8C24794 PSoC Programmable System-on-Chip

Small PCB:



TI TPS2561 Dual Channel Power Switches

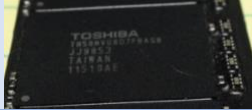
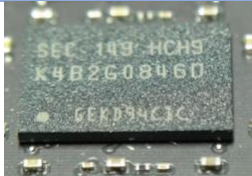

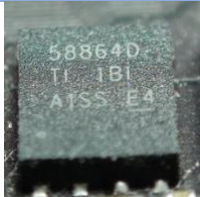




6-pin Power Cable


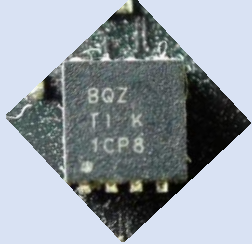





Cirrus 4206BCNZ Audio Controller

OPC Data Cable Port

Charts of Chips:

Count	Company	Number	Role	Info	Picture
4	Toshiba	TH58NVG8D7F9ASB	Data Storage	----	
16	Samsung	SEC 149 HCH9	RAM	----	
1	Texas Instruments	51916	DDR3 Power Supply	51916	
2	Texas Instruments	58864D	VCore Module	----	
1	Intel	DSL2310	Thunderbolt Controller	DSL2310	
1	Texas Instruments	2561	Programmable current-limit power switch	2561	
1	Texas Instruments	SN10100	----	----	
2	MicroChip	SMSC USB2513B	USB Hub Controller	USB2513B	
1	Texas Instruments	51980	Some sort of power switch (TPS)	----	

1	Maxim	15092G	Video Output	15092G	
1	Texas Instruments	BQZ	-----	-----	
1	Cirrus	4206BCNZ	Outputs audio (This chip is Apple's version of the Cirrus 4207)	Forum	
1	Parade	PS8301	Displaying to an external monitor via Thunderbolt	-----	
1	Texas Instruments	SN0903048DRG SN0903048 R33V	Power IC chip	-----	

* ----- indicates information wasn't available or wasn't able to be found.