Texas Instruments Online Challenge 2018

Team 2886B- John Hardin High School

Team Members

Nathan Foullong- Captain

Noah Bohannon- Head of Building

Patrick O'Boyle- Head of Design

Connor Lewis- Head Programmer

Lucy Sonsalla- Head of Social Media

Jin Woo Lee- Assistant Programmer

Chase Croley- Head Scout

Texas Instruments Electronics Online Challenge

For our Texas Instruments online challenge, out of the millions of possible devices, we decided to disassemble and analyze an old iPhone 3GS. Because Apple is one of the largest and most iconic tech companies on the planet, we were interested in taking apart one of their earlier iPhones (the iPhone 3GS was released on June 19, 2009). The iPhone 3GS was also convenient for us; we had an old one on hand, and it's complicated enough to pose a challenge, but it doesn't have an overwhelming number of parts. The parts contained inside the iPhone 3GS will most likely be a unique set of varying components.

Disassembly/Analysis Summary

We found that the main PCB control board of the iPhone had a multitude of ICs (Internal circuits) and components. The most notable items were two large, dominating components– one of them being an Apple IC labeled APL0298. After some research, it was determined that this IC was the application processor, with a single core and 0.6 GHz of power. The second component was a seemingly out of place Samsung memory card, containing 16 GB of memory. We didn't find any Texas Instruments components in the device; although, after we did some research, we found that there were a multitude of other ICs from several different companies. These other companies included Infineon, which provided the baseband processor and an RF transceiver; Elpida, which provided 2Gb of SDRAM; Sony, which provided the battery cell; Numonyx, which provided a NOR Flash device; and UniMicron, which provided bluetooth services.

List of Figures

Figure 1:

Component	**Function**	**Quantity**	**Part Number-** **(* = Product Code)**
Lithium-Ion battery	Powers the device	1	616-0434
Dock connector	Provides an input to charge the battery, and contains the speakers.	1	821-0748
Camera	Provides the ability to take pictures.	1	***IF142-007-1**
Vibrator	Provides vibrate functions.	1	***IF137-015-1**
Headphone Jack Assembly	Wires electronic components together.	1	821-0732
Screws	Holds components together.	32	***IF137-019-1**
Display	Displays information and functions on the screen.	1	***IF142-001-1**
Front Panel	Holds the display, and connects to the back casing.	1	***IF142-000-1**
Power Button	Turns the device on or off when pressed.	1	***IF137-014-1**
Mute Button	Toggles volume settings (On or off).	1	***IF137-012-1**
Volume Button	Controls volume settings.	1	***IF137-012-1**
Sim Card	Connects to a service provider	1	73057 (AT&T Product)
Back Casing	Connects to the front casing, and holds internal components in place.	1	***IF137-018-1**

Figure 2:

*The first impressions of the device.

A photo of the full team 2886B

Figure 3:

The first impressions of the inner workings of the phone.

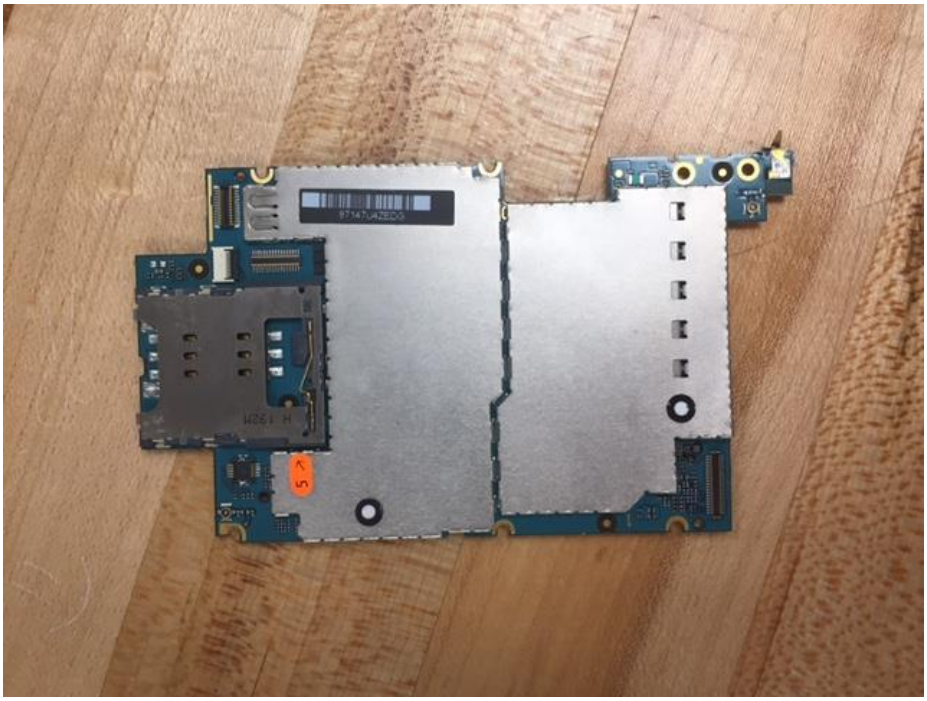
Figure 4:

An internal view of the phone after removing the PCB (Printed-Circuit-Board).

Figure 5:

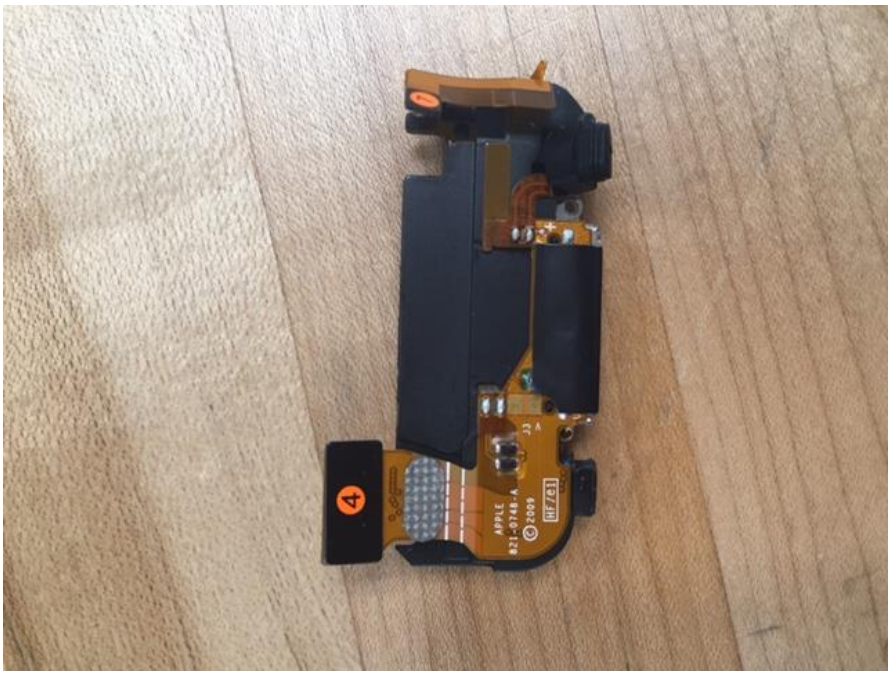
After removing the Dock Connector.

Figure 6:



A covered view of the PCB. The cover is meant to protect the fragile ICs from damage.

Figure 7:

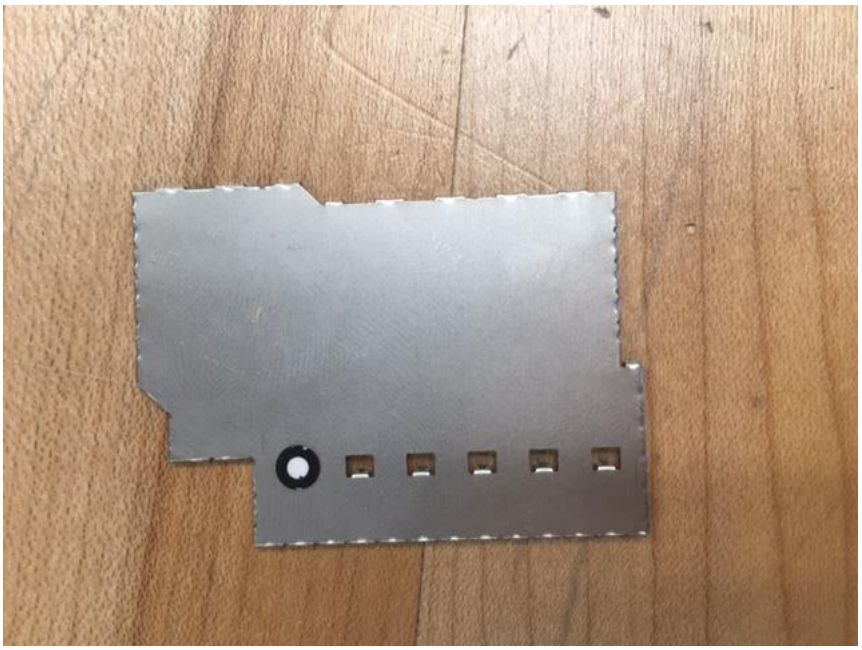


The Dock Connector. This serves as the charging port, and contains the internal speakers. It also contains the wiring for the bottom of the phone.

Figure 8:

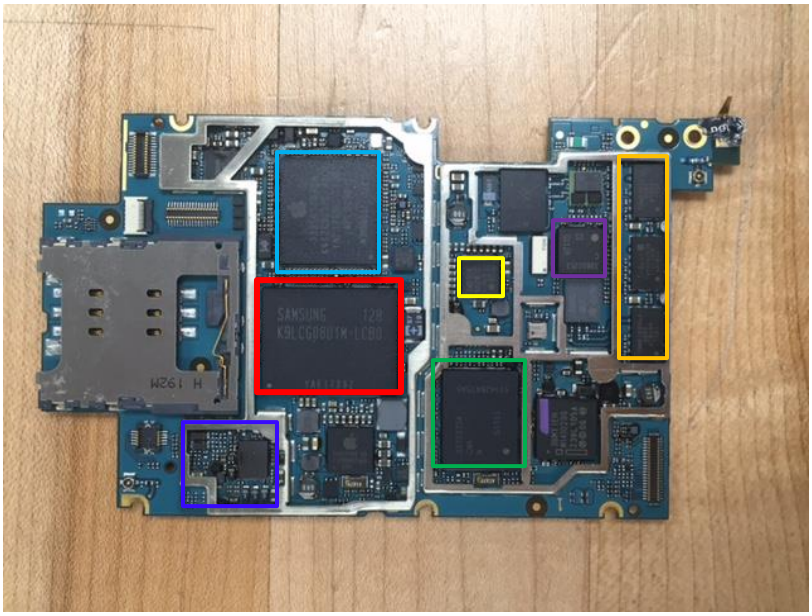
The Vibrator. This small component provides all vibration functions offered by the phone.

Figure 9:



One of the covers of the PCB.

Figure 10:



The uncovered PCB. All of the ICs are on this board. We simply had to pry off both of the covers to see them.

Samsung Memory Card Apple Application Processor Infineon Baseband Processor
Infineon RF Transceiver Numonyx NOR Flash Elpida SDRAM
UniMicron Bluetooth Microcontroller

Figure 11:

The volume button of the phone. We were unable to separate it from the casing.

Figure 12:

The front casing of the phone. The plexiglass was surprisingly durable, although this may just be characteristic of the earlier iPhone generations.

Figure 13:

The display was directly underneath the front casing, and was surprisingly thin.

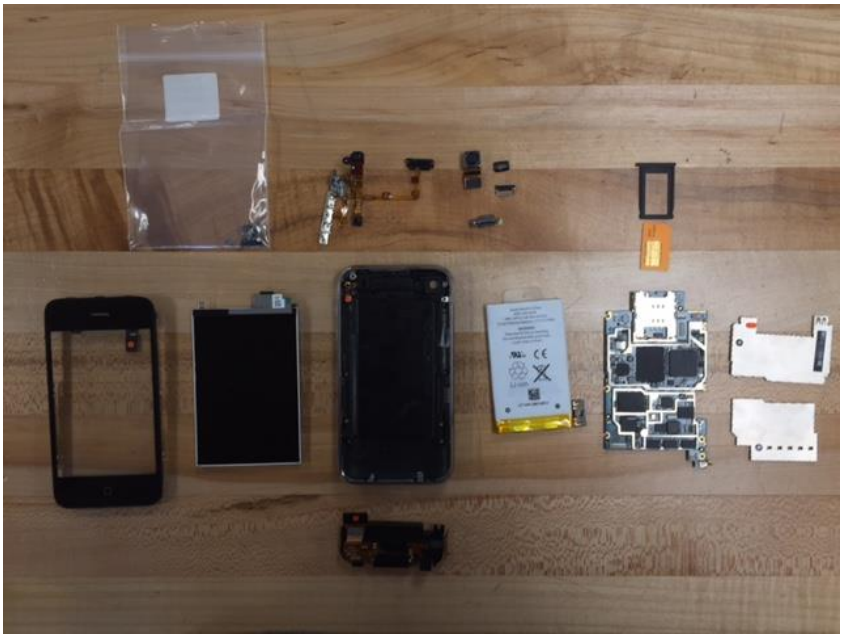
Figure 14:

The power and mute button; they were extremely difficult to disconnect.

Figure 15:

The Sim card. It wasn't a component that came with the phone, and was provided by AT&T.

Figure 16:



The fully disassembled phone.

*The bag contains the screws.

Conclusion

We learned several different lessons from this project: the first being expect the unexpected– finding a Samsung IC in an Apple phone was ironic, but it was still a large and important component in the device. We also discovered a lot about the internals of electrical components. None of us knew that many mass-produced electrical boards had internal soldering, meaning the IC's themselves are quite difficult to separate from the PCB. Another peculiarity is that small electronics like the iPhone weren't meant to be taken apart, which makes sense, considering the small size of the screws and the great difficulty we had with separating certain components like the buttons. We also found that many different companies and organizations, including Texas Instruments, contribute to the circuitry of sophisticated electronics like the iPhone. Overall, we learned a lot about how the internals of an electronic device function and how to deconstruct and analyze them.

Works Cited

Soules, L., Djuric, M., Galan, W., Bookholt, A., Ayala, S., Alhaddad, H., Wiens, K. (2009, June 14). *iPhone 3GS Teardown.* Retrieved from https://www.ifixit.com/Teardown/iPhone+3GS+Teardown/817

Deluca, B., Michelen, A., Emmino, N., Brown, P., Mathas, C., Slovick, M., Schweber, B., Baljko, J., Demeis, R., Dorsch, J., Harbert, T., Hyman, P., Leopold, G., Mannion, P., Mokhoff, N., Scheiber, S., Tippu, S. (2012, November 30). *Apple iPhone 3GS (16GB) Mobile Phone Teardown.* Retrieved from http://electronics360.globalspec.com/article/2178/apple-iphone-3gs-16gb-mobile-phone-teardown