

ELECTRONICS ONLINE CHALLENGE SUBMISSION SPONSORED BY TEXAS INTRUMENTS

A Summary of Parts Found Inside of an iPad Air (1st gen.)

Team 91F Fantomex
VEXMEN Robotics

Contents

Introduction.....	3
Findings.....	3
<i>Apple A7 Chip</i>	3
<i>Qualcomm MDM9615M</i>	3
<i>SK Hynix H2JTEG8VD1BMR-BC A2</i>	3
<i>USI 339SO213 Wi-Fi Module</i>	4
<i>Elpida F8164A1MD</i>	4
<i>Apple 343S0655-A1</i>	4
<i>Broadcom BCM5976C1KUB6G</i>	4
<i>Qualcomm WTR1605L</i>	4
<i>TriQuint TQF6514</i>	4
Conclusion.....	4
References.....	5
Components.....	7
Photos.....	8

Introduction

The Apple iPad Air 1st gen. (model a1475) was chosen to explore the inner workings of electronics found in everyday devices, as well as to find how technology has advanced in the past eight years.

Findings

Note: Some components could not be identified due to unclear markings of model number or company

Apple A7 Chip

The Apple A7 Chip is a dual core central processing unit (CPU) and also supports integrated graphics. This chip was made by Samsung on a high-k metal gate (HKMG) 28 nanometer process (a nanometer process defines the distance between each transistor, higher the nm the better) with over one billion transistors on a die of 102mm². Samsung created two versions of this chip, the APL0698 and the one found in the iPad Air, the APL5698. The main difference is the APL5698 runs at a higher clock speed (1.4 GHz) and does not have a RAM cache built in.

Qualcomm MDM9615M

The Qualcomm MDM9615M is the baseband chip used in the iPad Air. It is a 28 nm LTE (FDD and TDD), HSPA+, EV-DO Rev B, and TD-SCMA modem and allows for multi-spectrum, multi-mode LTE support, otherwise known as the LTE Processor.

SK Hynix H2JTEG8VD1BMR-BC A2

This module by SK Hynix is a storage module, capable of storing 64 GB (gigabyte) of data. This storage module is a NAND flash, which is a type of storage technology which does not require power to retain data.

USI 339S0213 Wi-Fi Module

This module supports Wi-Fi and is what allows the iPad Air to connect to Wi-Fi.

Elpida F8164A1MD

This memory module from Elpida is a 1 GB LPDDR3 SDRAM for the iPad. LPDDR3 SDRAM (Low Power Double Data Rate 3 Synchronous Dynamic Random Access Memory) is the first generation of synchronous DRAM. Low power ram is used in this iPad to save battery life.

Apple 343S0655-A1

This chip is created by Chipworks and is the Dialogue Power Management Integrated Circuit (IC). This chip directly interacts with the battery as well as the charger port and controls power flow to different components within the iPad.

Broadcom BCM5976C1KUB6G

Apple has implemented a pair of these touch screen controllers, which are similar to those found in trackpads of MacBook laptops. This chip connects to the touchscreen below the plastic on the screen, and receives data from the whole screen, processes the data, and transmits that data to the A7 chip to where it can be further processed.

Qualcomm WTR1605L

This chip is an LTE/HSPA+/CDMA/EDGE/GPS Transceiver and works in tandem with the Qualcomm MDM9615M.

TriQuint TQF6514

The TriQuint TQF6514 is a (Radio Frequency) Power Amplifier Module which converts low power radio frequency signals into higher power signals. They are generally used in applications for driving the transmission power of an antenna.

Conclusion

Throughout this investigation, we identified many different ICs and defined all of their applications. We were unable to identify any TI electronics in an iPad, but the learning process was still there to help us understand more about ICs.

Final Summary Report Word Count: 500

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DRAM#:~:~text=SDRAM(synchronousDRAM)is~a,perform~in~a
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Components

Components	Part Number	Specifications	Manufacturer	Identified
Digitizer Glass				yes
Display	LP097QX2		LG	yes
Battery		8827 mAh, 3.73 Volts		yes
SIM Card Tray				yes
Motherboard			Apple	yes
CPU/GPU	APL5698	1.4 GHz, 28 nm,	Samsung	yes
LTE (FDD and TDD), HSPA+, EV-DO Rev B, and TD-SCMA modem	MDM9615M	28 nm, 1 GB DRAM	Qualcomm	yes
Storage	H2JTEG8VD1BMR-BC A2	64 GB, NAND flash storage	SK Hynix	yes
Wi-Fi Module	339S0213		USI	yes
Random Access Memory	F8164A1MD	1 GB LPDDR3 SDRAM	Elpida	yes
Dialogue Power Management Integrated Circuit	343S0655-A1		Chipworks	yes
Touchscreen Controller	BCM5976C1KUB6G	two (2) found in iPad	Broadcom	yes
LTE/HSPA+/CDMA/EDGE/GPS Transceiver	WTR1605L		Qualcomm	yes
Antenna Switch/Filter Module	227-LG		Murata	yes
RF Power Amplifier	TQF6514		TriQuint	yes
LTE RF Power Amplifier	SKY77	three (3) found in iPad	Skyworks	yes
LTE RF Power Amplifier	A79	two (2) found in iPad	Avago	yes
Lighting Port				yes
Wi-Fi/Bluetooth Antennas				yes
Front facing Camera				yes
Rear Facing Camera				yes
Headphone Jack				yes
Speakers				yes

Photos

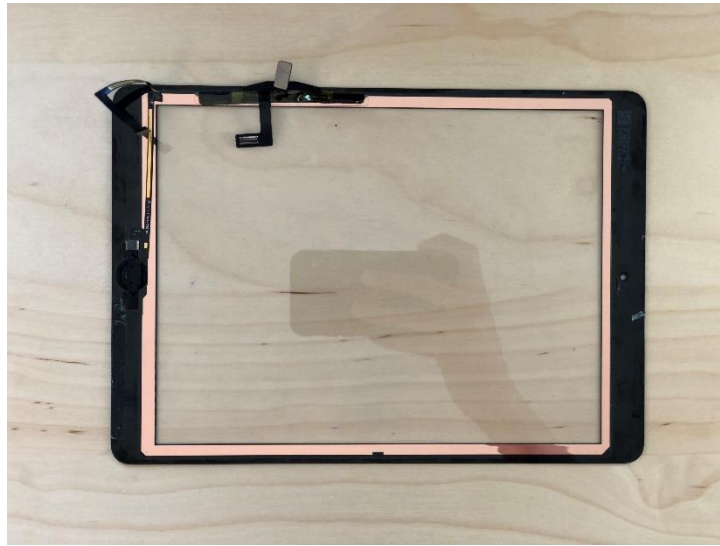


Figure 1 | Digitizer Glass



Figure 2 | LP097QX2 | LG | Display



Figure 3 | SIM Card Tray

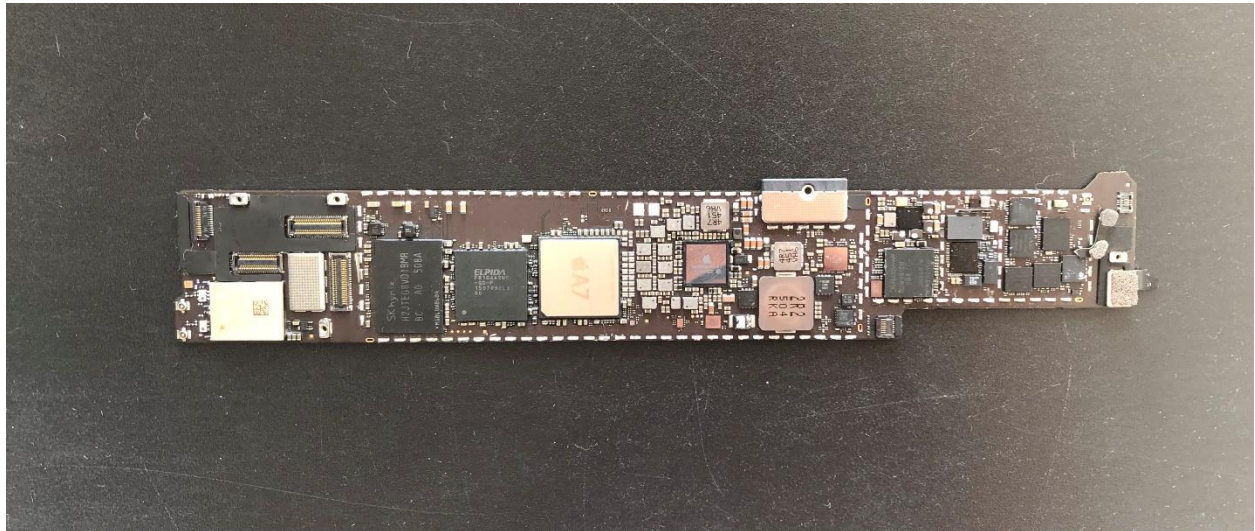


Figure 4 | Motherboard | Apple

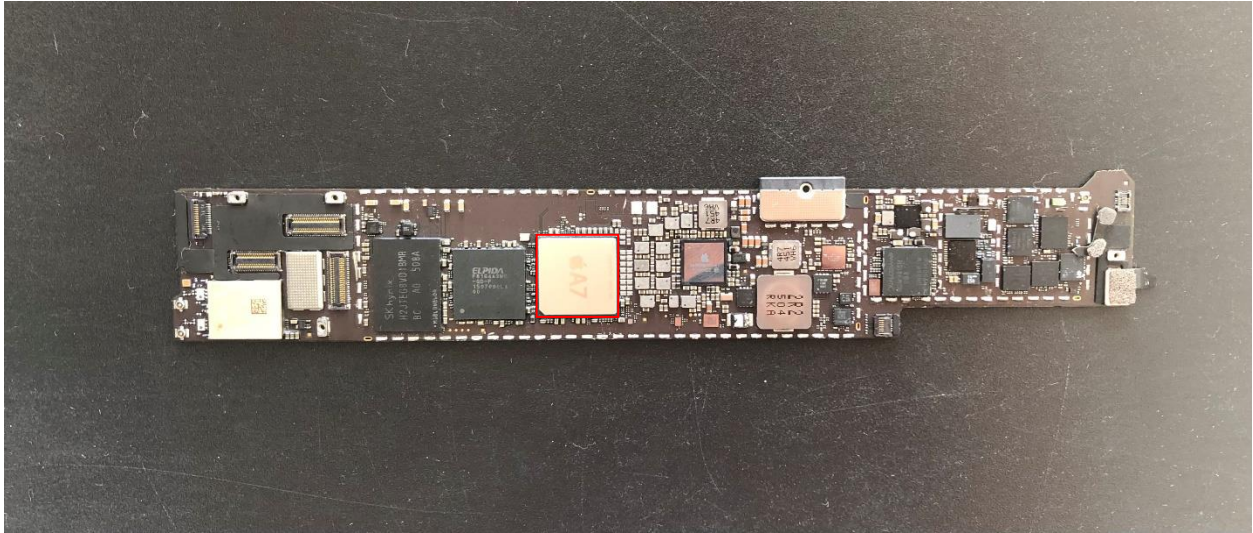


Figure 4.1 | APL5698 | Apple | CPU/GPU

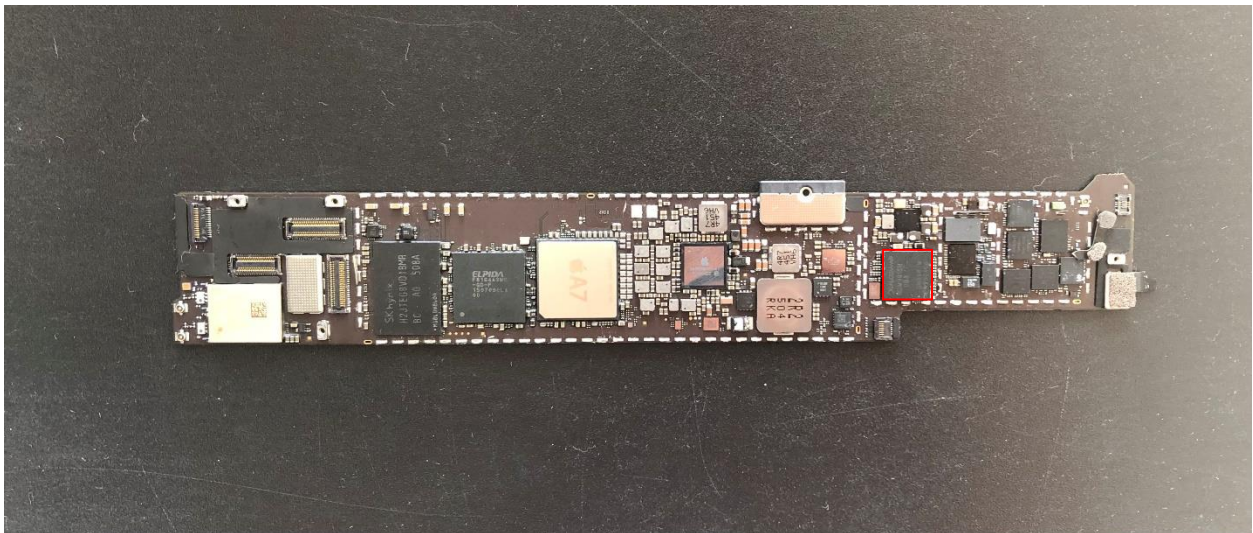


Figure 4.2 | MDM9615M | Qualcomm | Modem

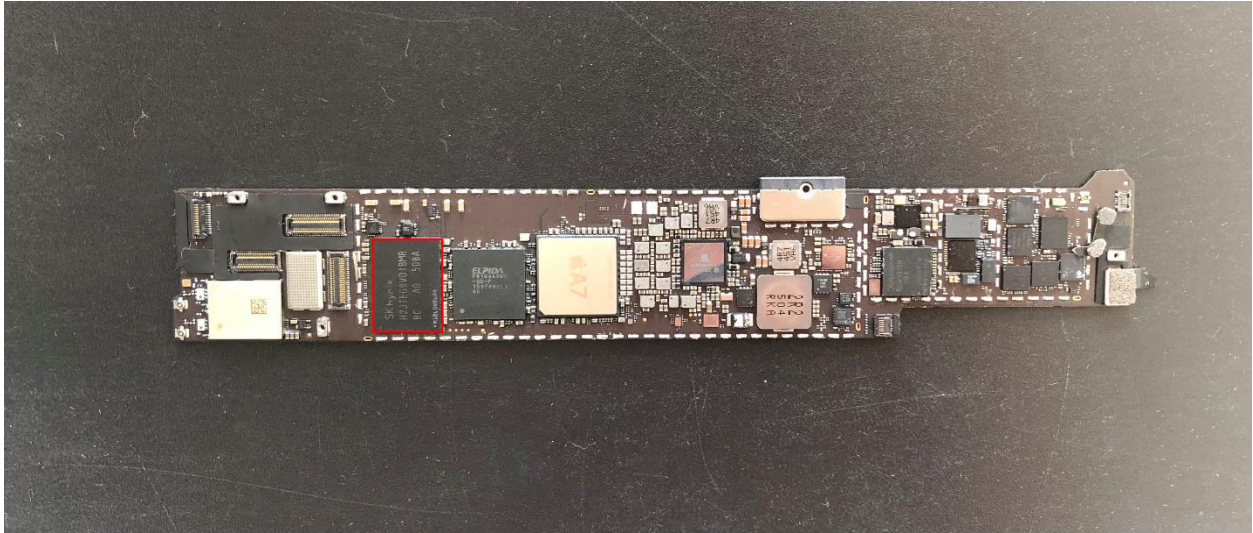


Figure 4.3 | H2JTEG8VD1BMR-BC A2 | SK Hynix | Storage

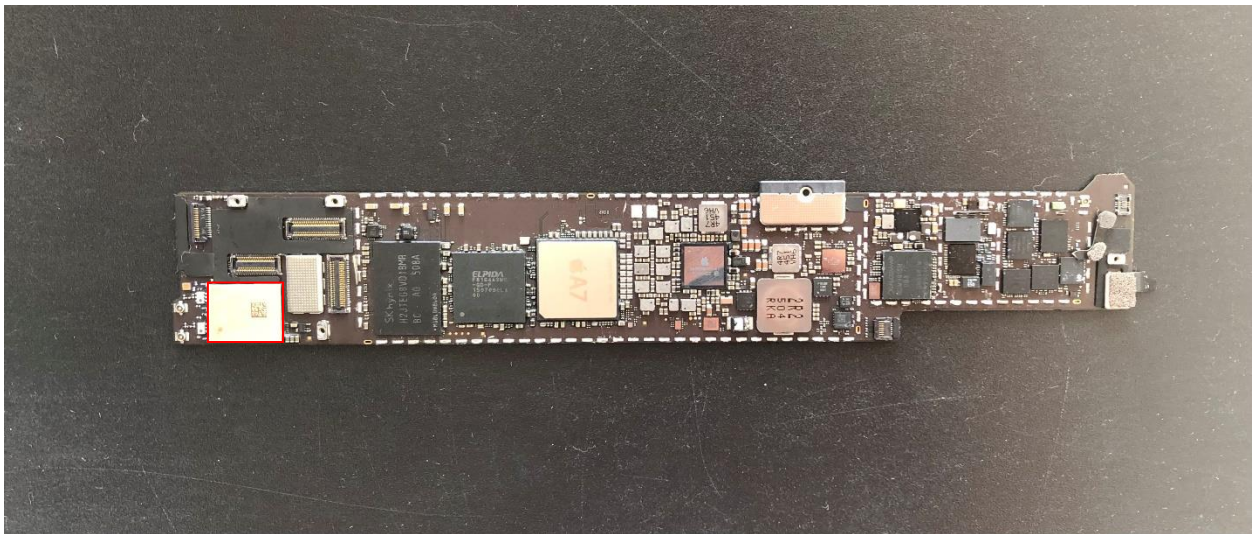


Figure 4.4 | 339SO213 | USI | Wi-Fi Module

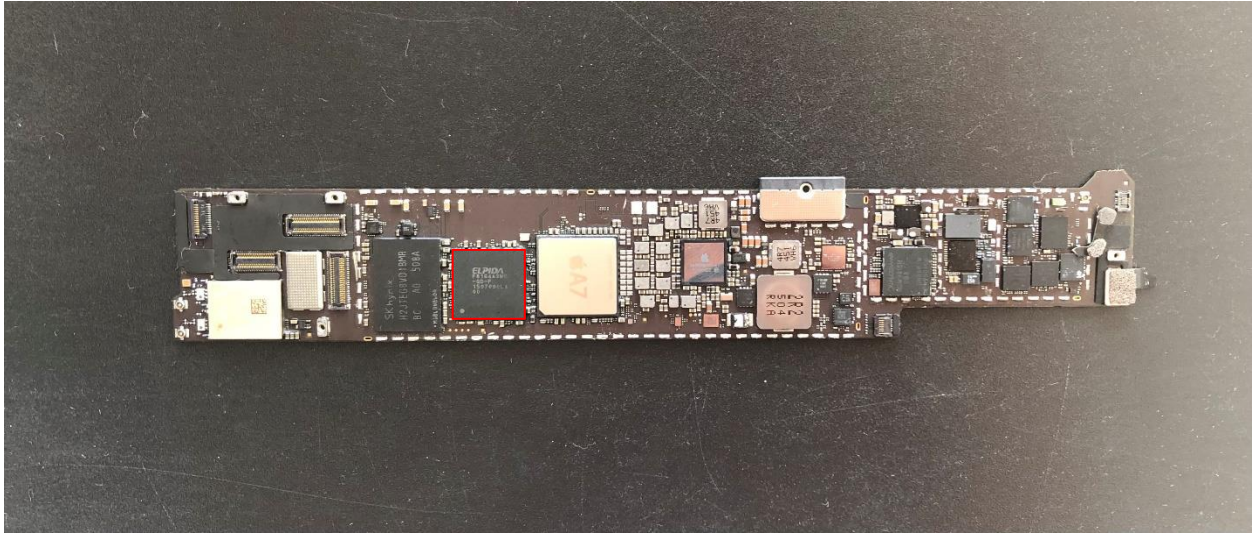


Figure 4.5 | F8164A1MD | Elpida | RAM

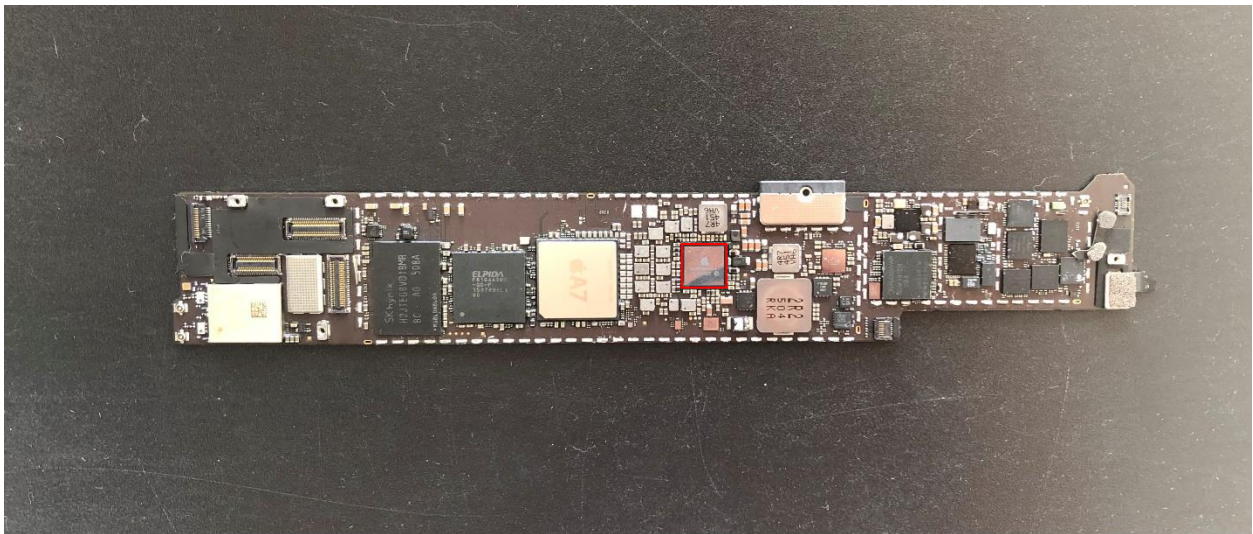


Figure 4.6 | 343S0655-A1 | Chipworks | Dialog Power Management IC

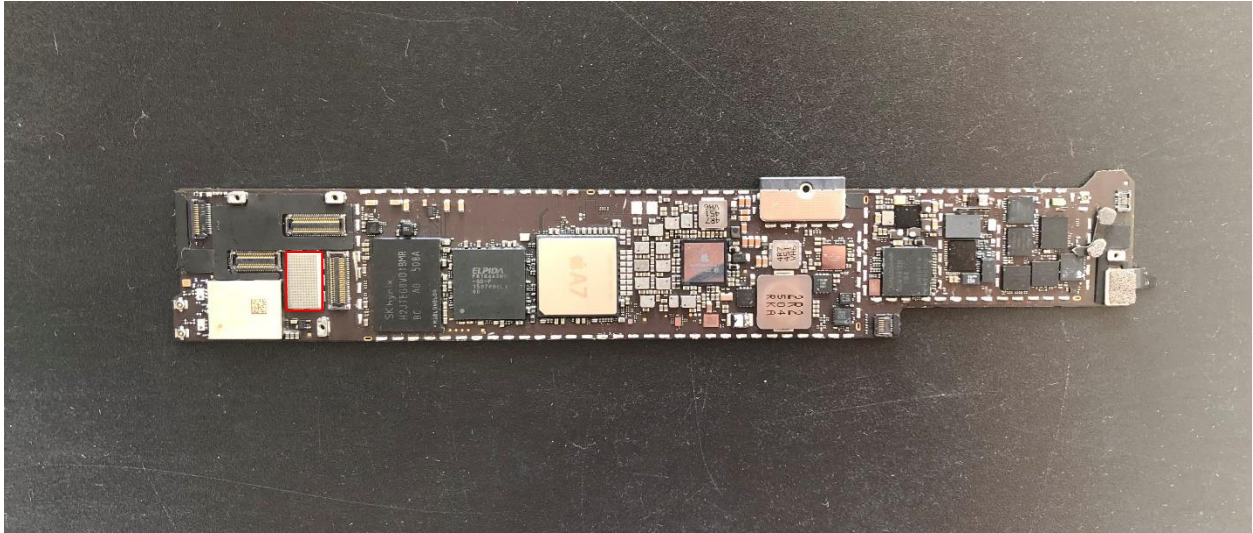


Figure 4.7 | BCM5976C1KUB6G | Broadcom | Touchscreen Controller

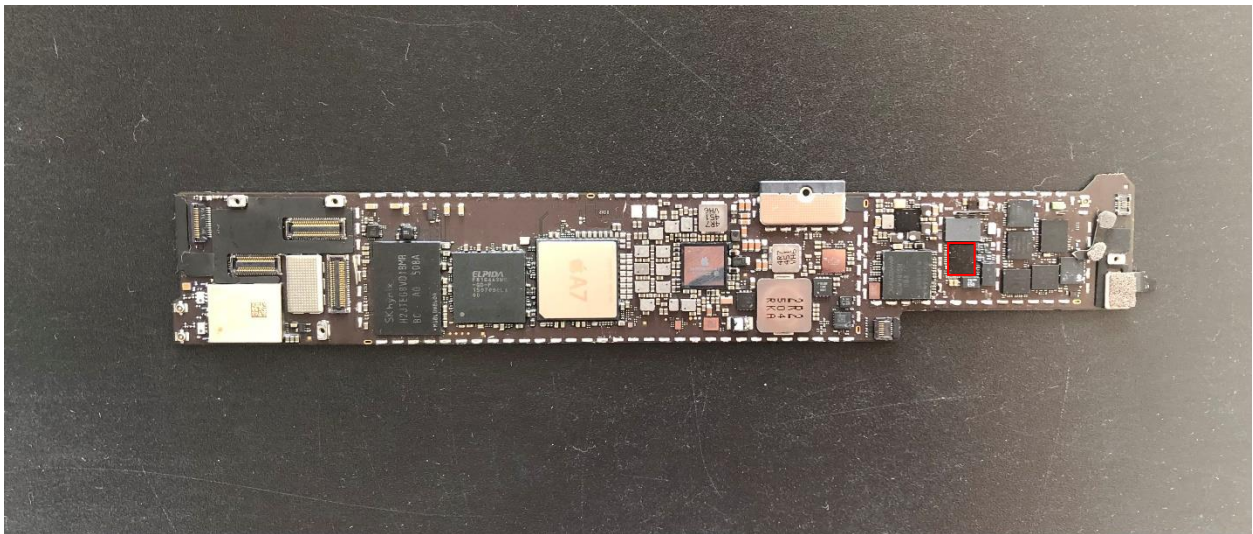


Figure 4.8 | WTR1605L | Qualcomm | LTE/HSPA+/CDMA/EDGE/GPS Transceiver

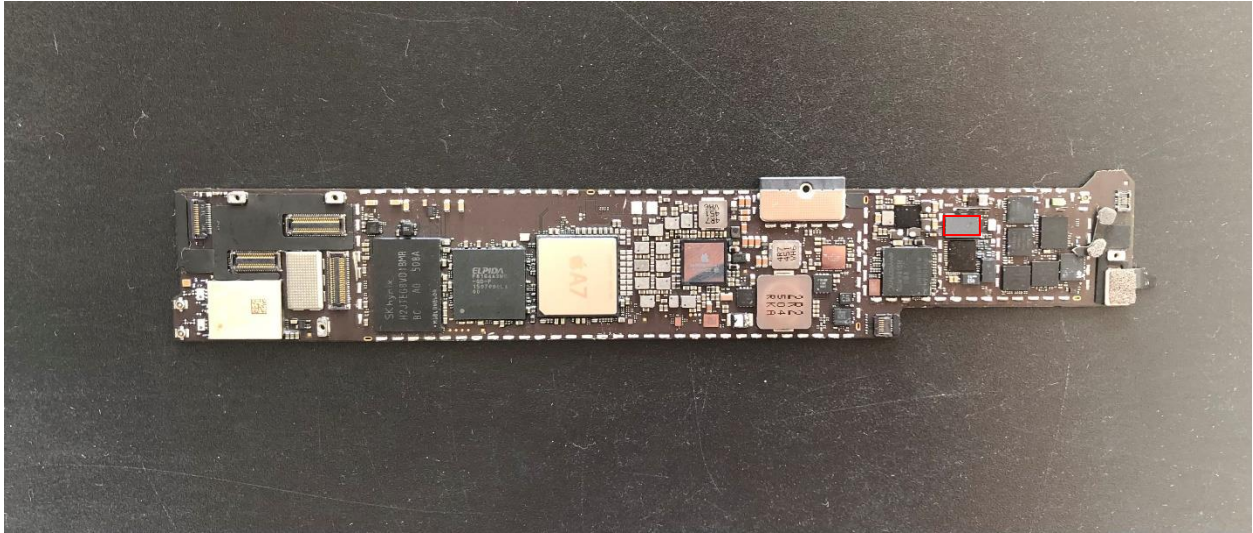


Figure 4.9 | 227-LG | Murata | Antenna Switch/Filter Module

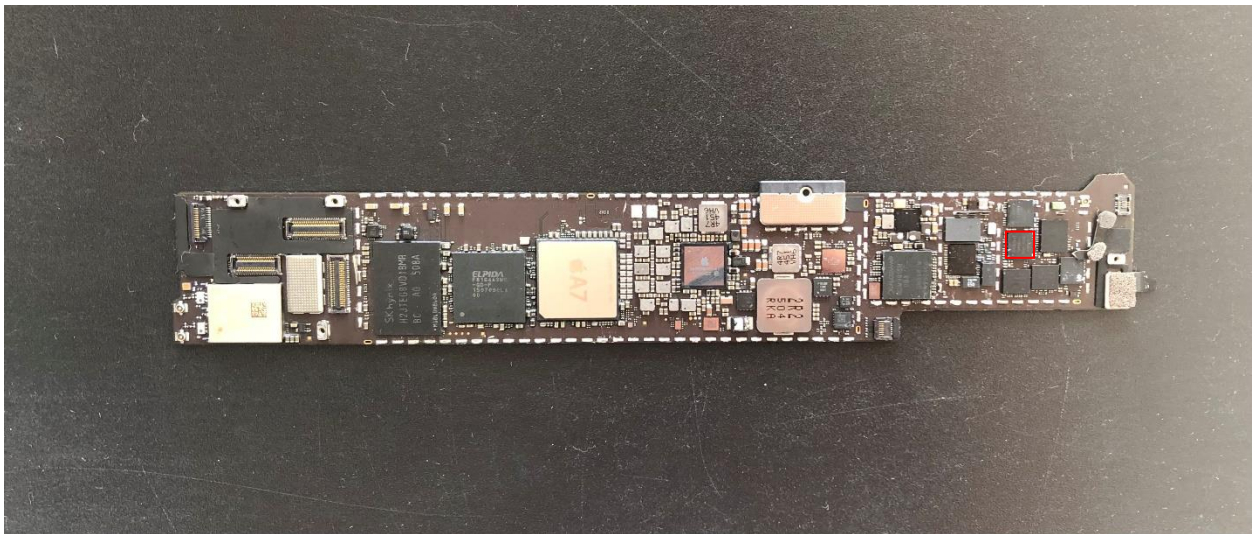


Figure 4.10 | TQF6514 | TriQuint | RF Power Amplifier

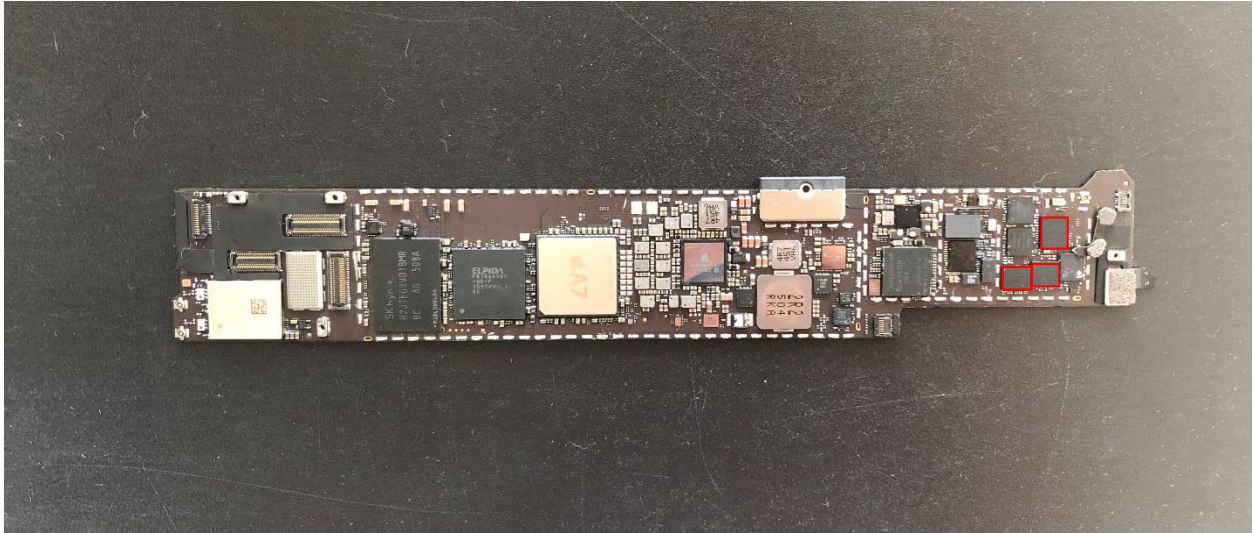


Figure 4.11 | SKY77 | Skyworks | LTE RF Power Amplifier

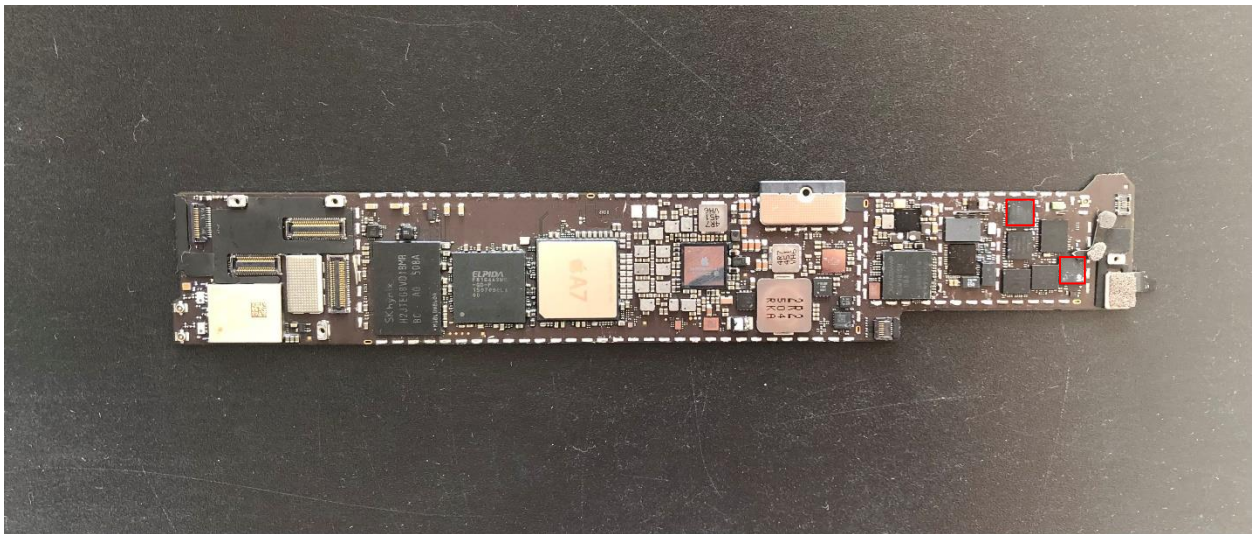


Figure 4.12 | A79 | Avago | LTE RF Power Amplifier



Figure 5 | Lightning Port



Figure 6 | Antenna Enclosure + Dual Microphone



Figure 6.1 | Wi-fi/Bluetooth Antennas



Figure 7 | Front Facing Camera



Figure 8 | Rear Facing Camera



Figure 9 | Headphone Jack



Figure 10 | Speakers