

Apple iPhone 7

Complimentary Teardown Report with Additional Commentary

October 2016



Apple iPhone 7

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Apple iPhone 7 Highlights

Apple iPhone 7 Technical Features

| | |
|---------------------|---|
| TYPE: | Phone |
| MODEL: | Not Available |
| MANUFACTURER: | Apple iPhone 7 |
| DIMENSIONS: | 138.3 x 67.1 x 7.1 mm |
| WEIGHT: | 138 g |
| BATTERY SIZE: | Non-removable Li-Ion battery |
| SCREEN SIZE: | 4.7" |
| DISPLAY TECHNOLOGY: | LED-backlit IPS LCD |
| SCREEN: | 750 x 1334 pixels (~326 ppi pixel density) |
| FRONT CAMERA: | 7 megapixels |
| REAR CAMERA MAIN: | 12 megapixels |
| RAM: | 2 GB |
| INTERNAL STORAGE: | 32/128/256 GB |
| PLATFORM CHIPSET: | Apple A10 Fusion |
| CPU: | Quad-core |
| GPU: | Six-core graphics |
| CONNECTIVITY: | Wi-Fi 802.11 a/b/g/n/ac, HSPA, LTE, Bluetooth v4.2 A2DP LE, NFC, USB 2.0 |
| SENSORS: | Fingerprint, accelerometer, gyro, proximity, compass, barometer |
| SOUND: | Vibration, proprietary ringtones 3.5mm Jack - No |
| SPECIAL FEATURES: | Fingerprint, accelerometer, gyro, proximity, compass, barometer |
| OTHER NOTES: | Water resistant up to 1 meter and 30 minutes IP67 certified - dust and water resistant iOS 10 |

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We work with 37 of the top 50 US patent holders

The background of the slide is a photograph of a haystack under a clear blue sky. A single needle is stuck into the top of the haystack, pointing upwards. The text 'inside technology' is overlaid on the upper left, and a white speech bubble containing the text 'FOUND IT.' is positioned in the center-left.

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technology

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Apple iPhone 7 - Specifications

Specifications

- Manufacturer: Apple
- Product Name: iPhone 7
- Model Number: A1778
- Size: 4.7"
- System: iOS 10
- Purchased unlocked in North America for North American service providers



Specifications

| | | | | | | | |
|---------------|-----------------------|---|------------------------|--------------|-----------------------|--------------------|------------|
| BASIC | Product Name | iPhone 7, A1778 | | | | | |
| | Manufacturer | Apple Inc. | | | | | |
| | Minimum Size (mm) | 67.1 x 138.3 x 7.1 | | | | | |
| | Weight (g) | 138 | | | | | |
| BATTERY TIME | Standby (hours) | 3.9G: FDD-LTE: 240 | 3.9G: TD-LTE: – | 3G: WCDMA: ? | 3G: CDMA: – | 3G: TD-SCDMA: – | 2G: GSM: ? |
| | Voice Call (minutes) | 3.9G: FDD-LTE: ? | 3.9G: TD-LTE: – | 3G: WCDMA: ? | 3G: CDMA: – | 3G: TD-SCDMA: – | 2G: GSM: ? |
| | Video Call (minutes) | – | | | | | |
| | Digital TV (minutes) | – | | | | | |
| | Other | – | | | | | |
| | Battery (size in mm) | Li-Ion Polymer, 3.8V, 1960mAh (size unknown due to sample limitation) | | | | | |
| SYSTEM | OS | iOS 10 | | | | | |
| | CPU / ROM / RAM | CPU: Apple A10 Fusion, quad core, 2.33GHz Storage: 128GByte RAM: 2GByte | | | | | |
| DISPLAY | Main Display | 4.7-inch, 16,777,216 colors, 750 x 1334 dot, Retina HD IPS LCD | | | | | |
| COMMUNICATION | Protocol (MHz) | 3.9G: FDD-LTE: 700, 800, 850, 900, 1500, 1700, 1800, 1900, 2100, 2300, 2600 3.9G: TD-LTE: 1900, 2300, 2500, 2600 3G: WCDMA: 850, 900, 1700, 1900, 2100 3G: CDMA: - 3G: TD-SCDMA: - 2G: GSM: 850, 900, 1800, 1900 | | | | | |
| | HSDPA/HSUPA (Mbps) | 3G: 42.2/5.76 | | | LTE: 450/50 | | |
| | Wireless LAN | 802.11 a/b/g/n/ac | | | | | |
| | Bluetooth | 4.2 | | | | | |
| | GPS | Yes | | | | | |
| | Infrared | – | | | | | |
| | RFID/NFC | NFC/RFID | | | | | |
| | | | | | | | |
| CAMERA | Main Camera | 12.0MP CMOS with OIS and auto focus, LED flash | | | | | |
| | Sub Camera | 7.0 MP CMOS | | | | | |
| SENSOR | Motion | Accelerometer: Yes | Digital Compass: - Yes | | Gyroscope: Yes | Barometer: Yes | |
| | | Gesture Recognition: – | – | | – | – | |
| | Ambient | Light Sensor: Yes | Proximity Sensor: Yes | | Temperature Sensor: – | Humidity Sensor: – | |
| | Security | Fingerprint Sensor: Yes | – | | – | – | |
| | Healthcare | Heart Rate Monitor: - | | | | | |
| | Touch Panel | Capacitive, multi touch, 3D Touch | | | | | |
| OTHER | | | | | | | |
| | Waterproof/Anti-shock | IP67 | | | | | |

Apple iPhone 7 - Costing Information

Single Device Cost*

Apple iPhone 7

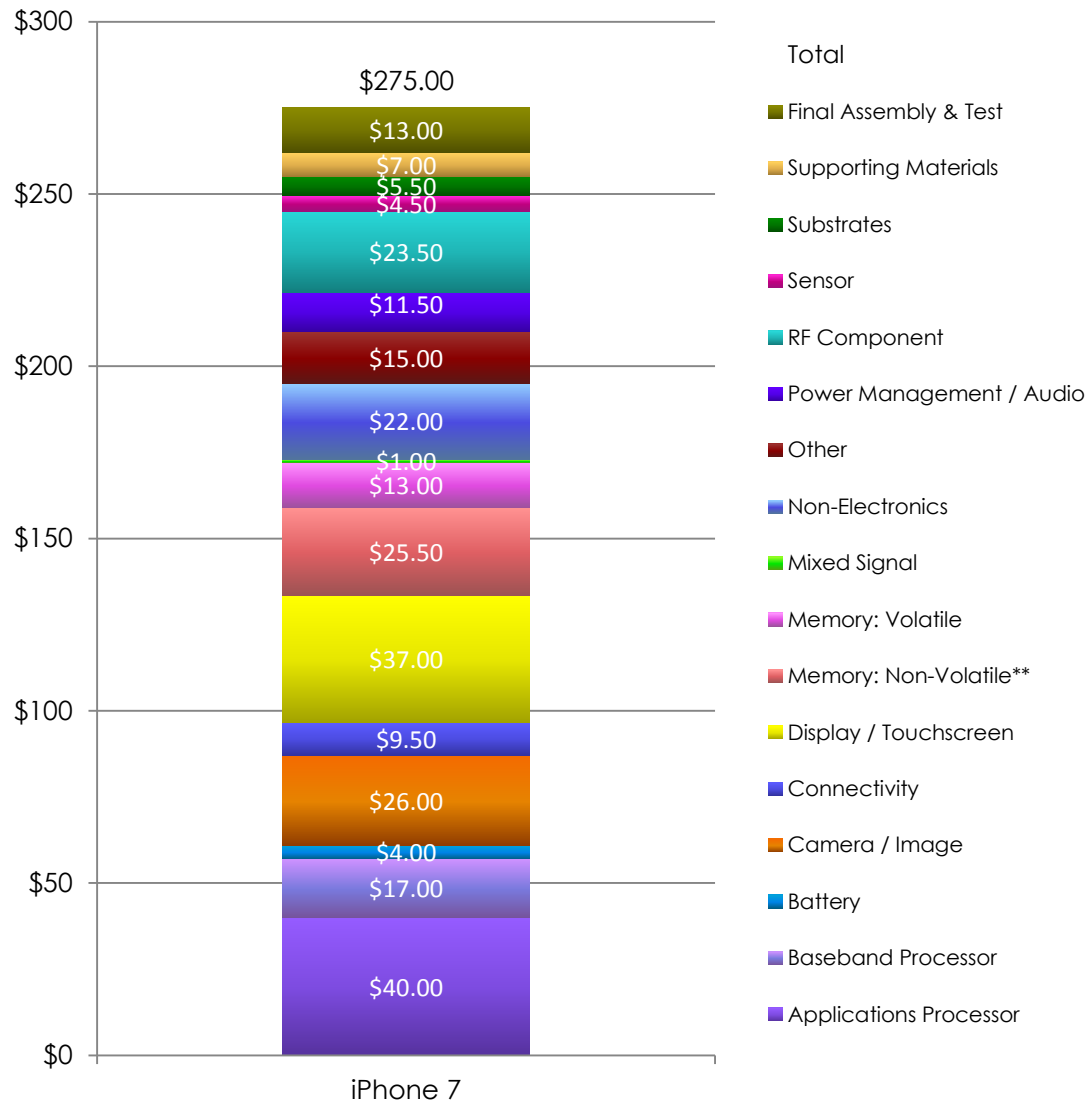
| | |
|-----------------------------------|----------------|
| Teardown Date | September 2016 |
| Applications Processor | \$40.00 |
| Applications / Baseband Processor | \$0.00 |
| Baseband Processor | \$17.00 |
| Battery | \$4.00 |
| Camera / Image | \$26.00 |
| Connectivity | \$9.50 |
| Display / Touchscreen | \$37.00 |
| Logic | \$0.00 |
| Memory: Mixed | \$25.50 |
| Memory: Non-Volatile | \$13.00 |
| Mixed Signals | \$1.00 |
| Non-Electronics | \$22.00 |
| Other | \$15.00 |
| Power Management / Audio | \$11.50 |
| RF Component | \$23.50 |
| Sensor | \$4.50 |
| Substrates | \$5.50 |
| Supporting Materials | \$7.00 |
| Final Assembly & Test | \$13.00 |

Total \$275.00

Costs are in USD

* Costs are based off of TechInsights Quick Turn estimates. The costs are likely to be different once full teardown analysis is performed.

Single Device Cost Graph*



Costs are in USD

* Costs are based off of TechInsights Quick Turn estimates. The costs are likely to be different once full teardown analysis is performed.

** 128GB configuration

Teardown.com

Teardown.com maintains the largest library of device teardown, design win, and bill of materials costing data in the consumer electronics, mobile and wearable electronics markets.

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A promotional graphic for Teardown.com. The background is a blurred image of a city skyline at sunset or sunrise, with a railing in the foreground. Overlaid on this is a semi-transparent white box containing text and a logo. The text reads: 'Interested in mobile device teardowns & bills of materials?' followed by a blue smartphone icon and the words 'MOBILE DEVICES CHANNEL SUBSCRIPTION'. In the bottom right corner of the graphic is a square logo with a stylized 'T' and a blue circuit-like pattern.

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 **MOBILE DEVICES**
CHANNEL SUBSCRIPTION

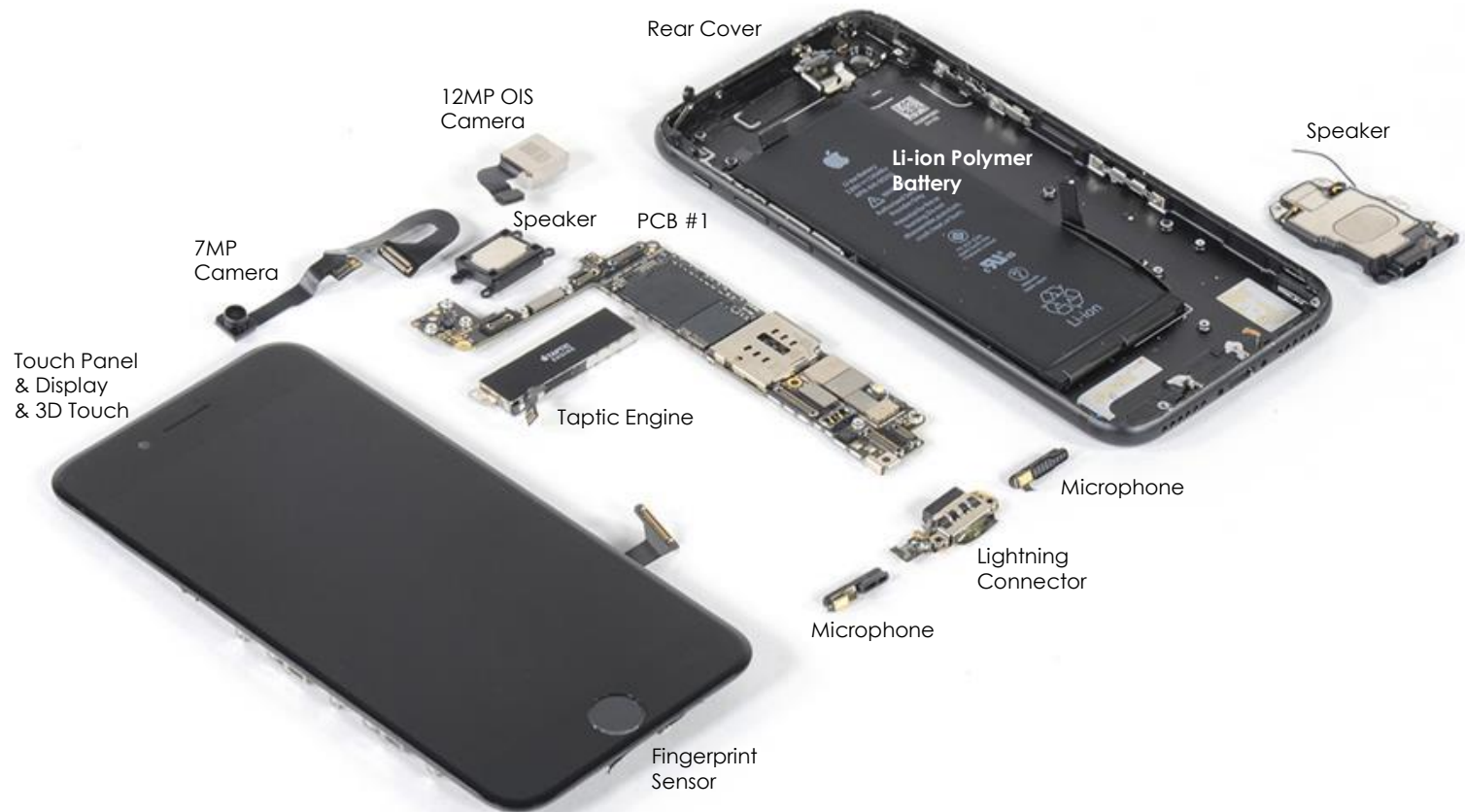


Apple iPhone 7 - Product Information

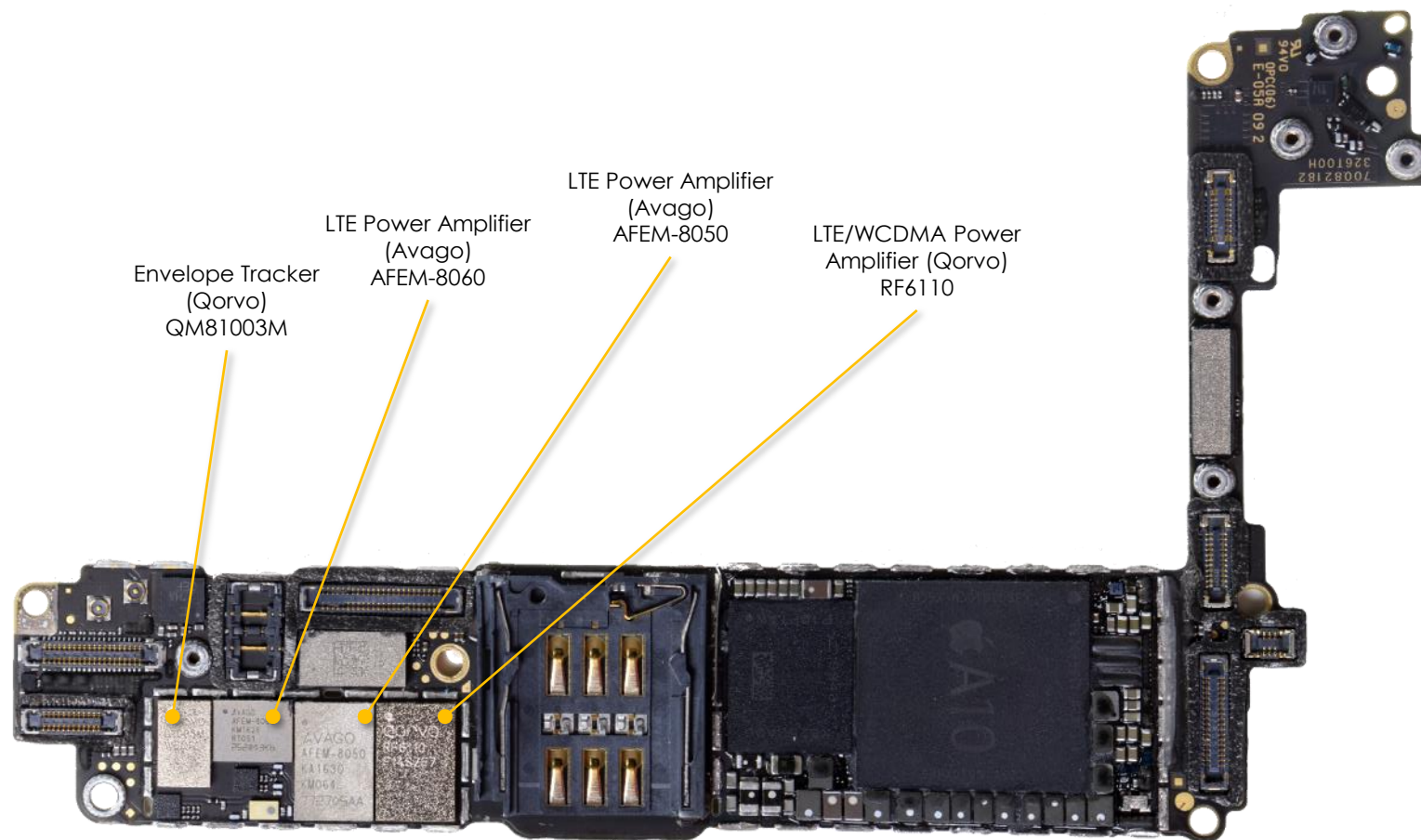
Product Information



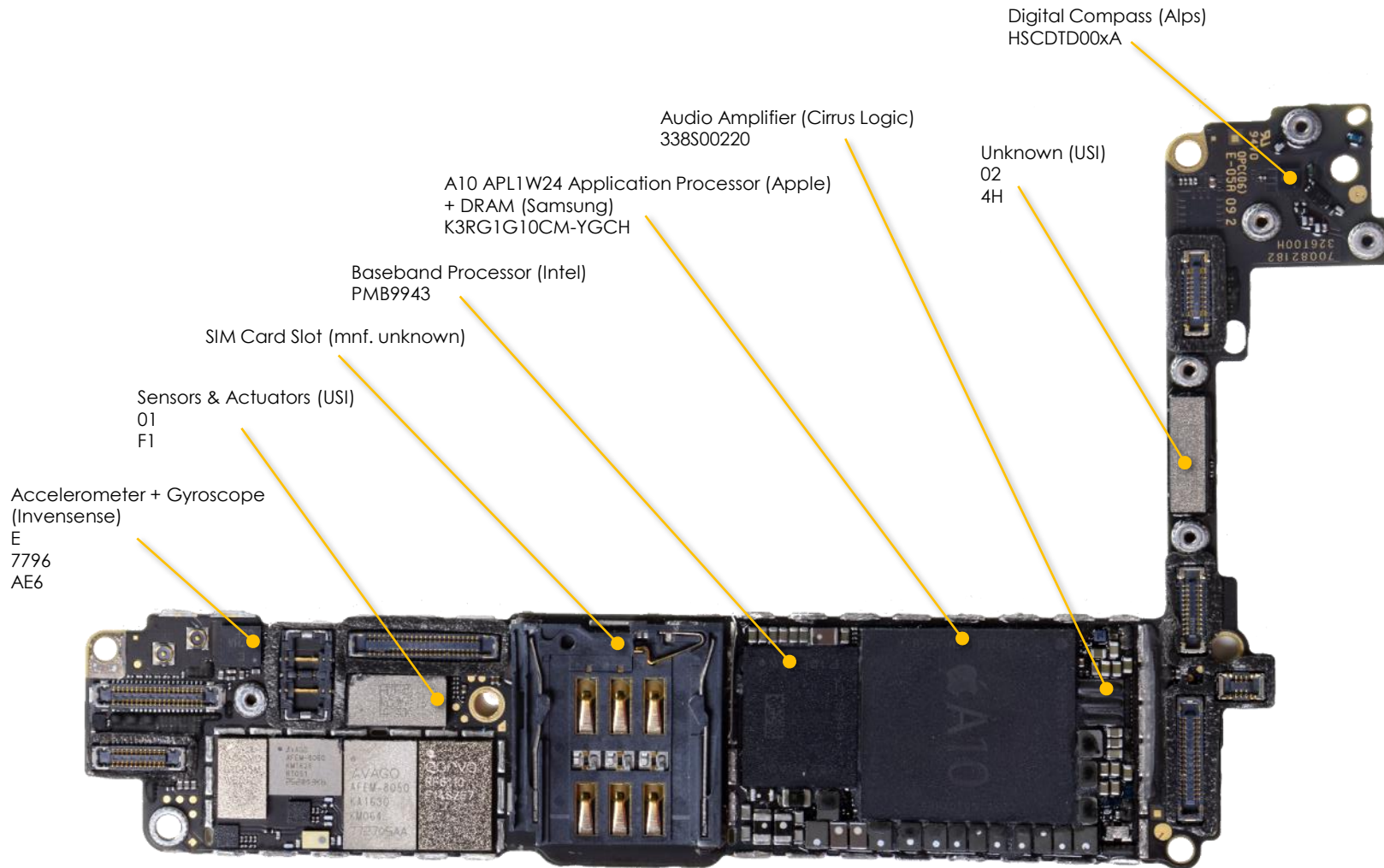
Teardown (Rear View)



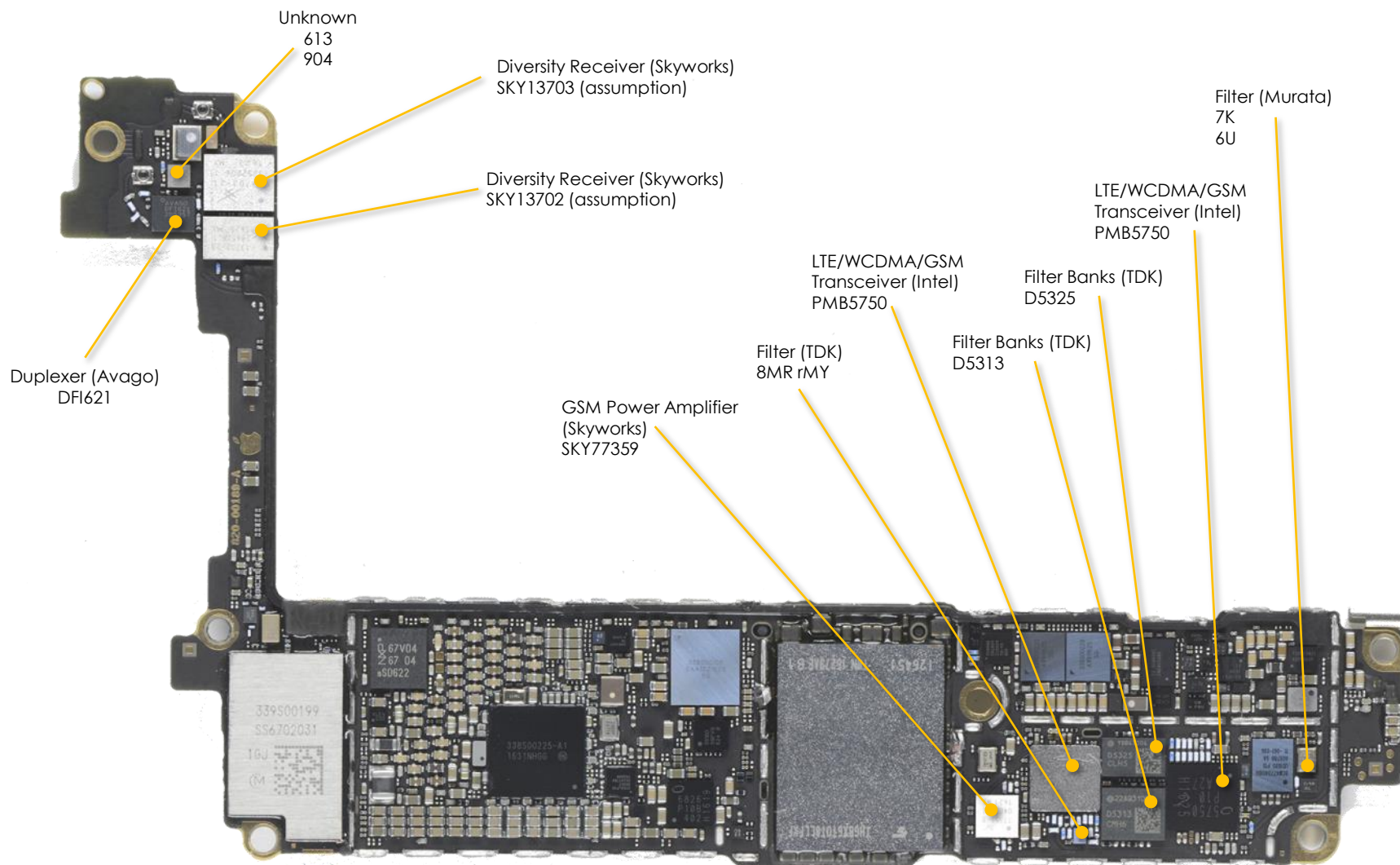
PCB #1 Display Side – Cellular



PCB #1 Display Side – Key Components



PCB #1 Battery Side – Cellular

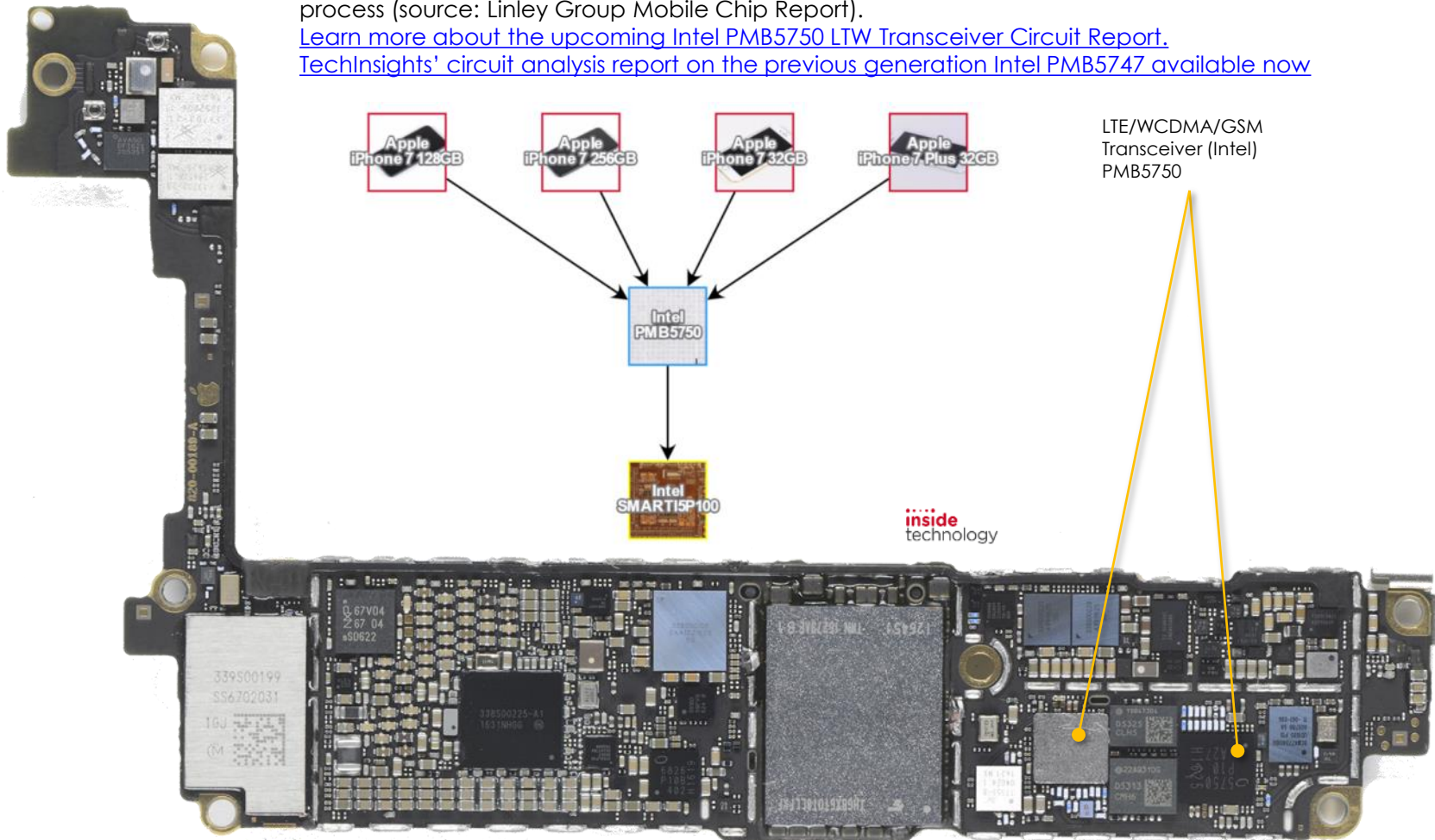


PCB #1 Battery Side – RF Transceiver

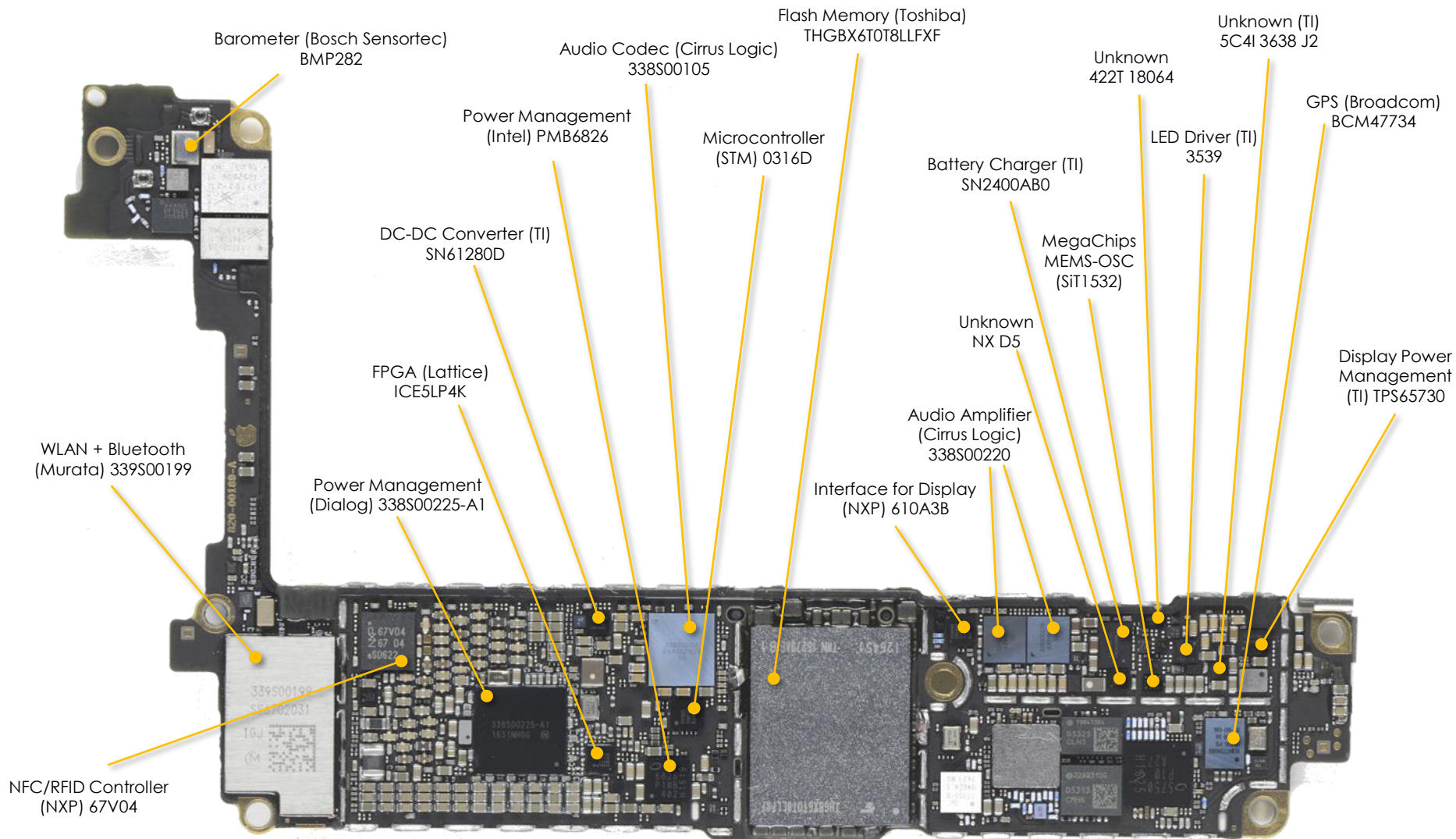
Intel continues their win in the iPhone 7 with two Intel PMB5750s, or what they call their **SMARTi 5 RF Transceivers**. Here again, TSMC wins as well, as the SMARTi 5 RF transceivers are built on TSMC'S 28nm process (source: Linley Group Mobile Chip Report).

[Learn more about the upcoming Intel PMB5750 LTW Transceiver Circuit Report.](#)

[TechInsights' circuit analysis report on the previous generation Intel PMB5747 available now](#)



PCB #1 Display Side – Key Components



PCB #1 Display Side – NFC/RFID Controller

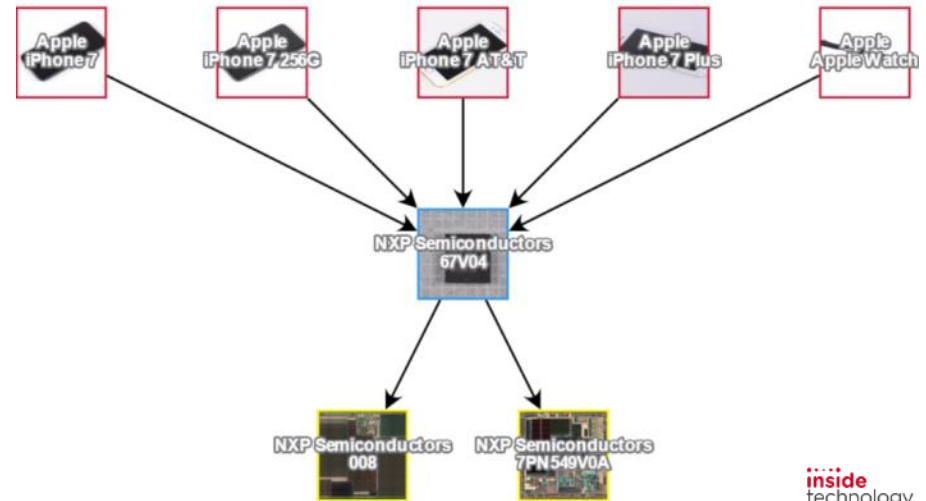


NFC/RFID Controller (NXP) 67V04

We found an NXP NFC Controller with package markings 67V04. Upon further analysis we see the NXP PN549 NFC controller.

For your reference, the previous iPhone 6S had the NXP PN66V10 NFC Controller, which has the die PN549.

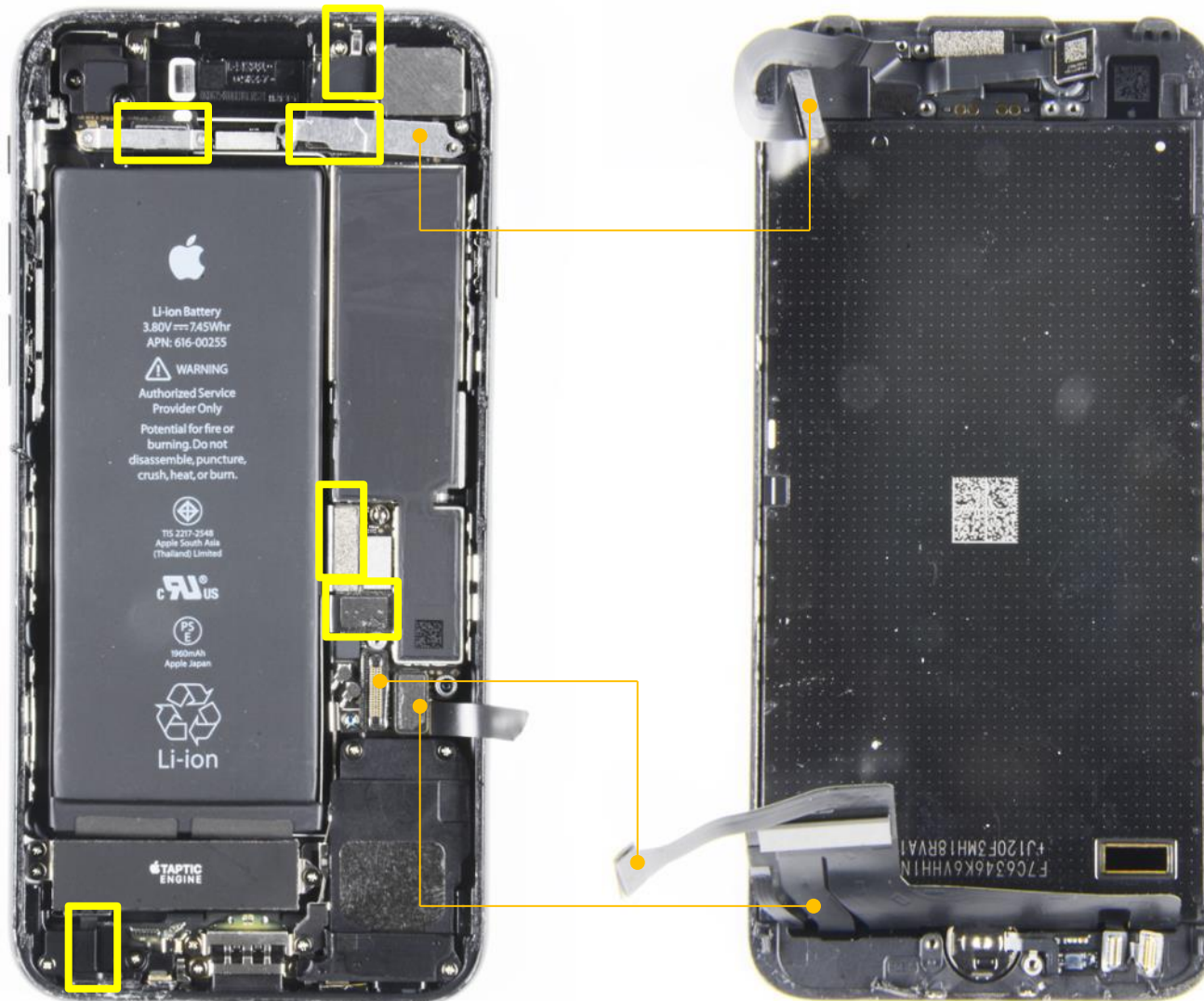
[TechInsights has done circuit analysis report of the NXP PN549.](#)



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NFC/RFID Controller
(NXP) 67V04

PCB #1 – Connectors Plugged



Others – Taptic Engine

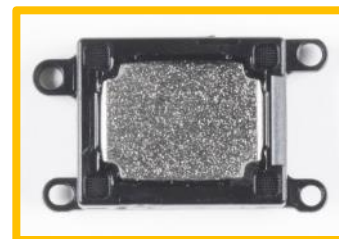


Others – Fingerprint Sensor



Others

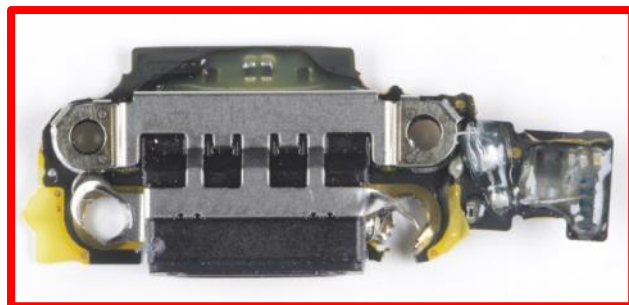
Speaker #1



Speaker #2



Lightning Connector

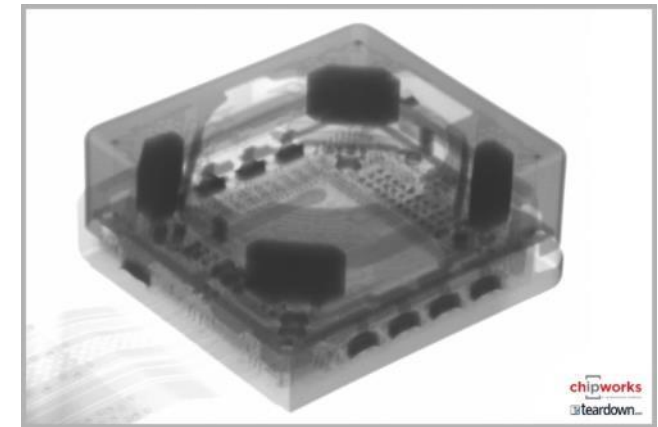


Camera

iSight Camera

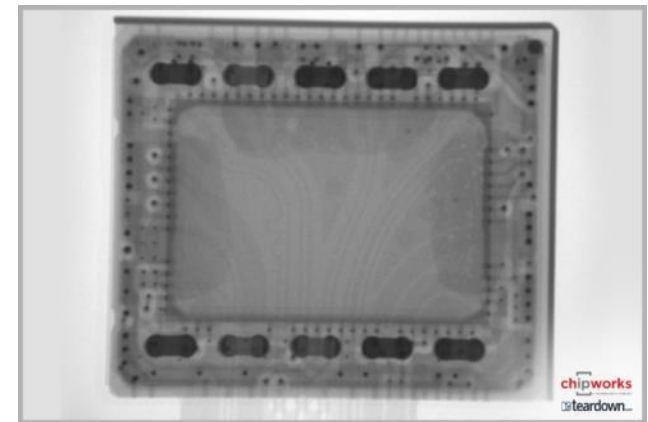
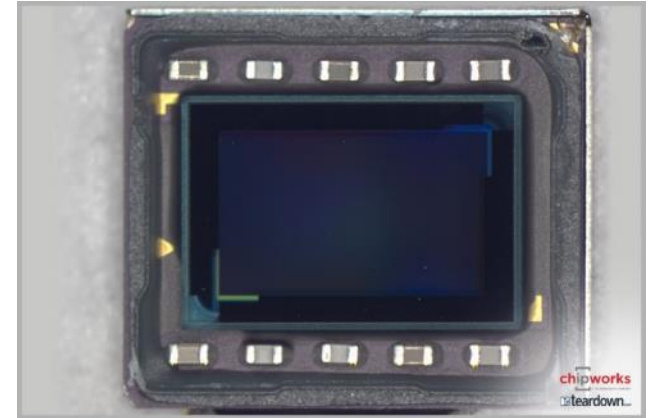
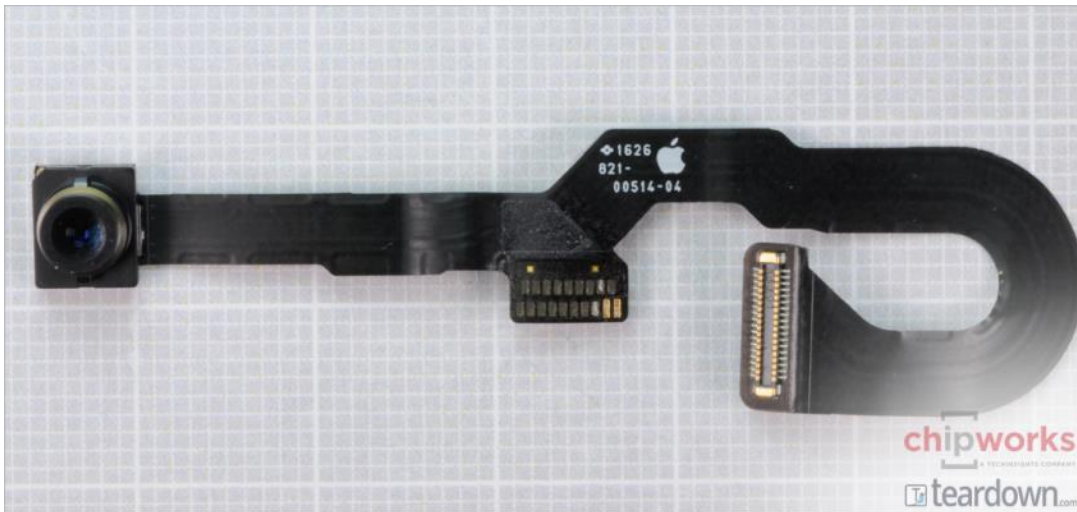
iPhone 7's iSight camera has a larger, $f/1.8$ aperture, as compared to the $f/2.2$ aperture used for iPhone 6s/6s Plus. The 10.6 mm x 9.8 mm x 5.7 mm thick iSight camera module features optical image stabilization (OIS) and a six-element lens. Although the 12 MP resolution and 1.22 μm pixel pitch hasn't changed, the iSight's camera chip is advertised as being 60% faster and 30% more efficient than its predecessor.

The iSight camera chip was sourced from Sony and fabricated using its Exmor RS technology platform. The 12 MP chip features a Bayer RGB color filter array (CFA) and embedded phase detection autofocus (PDAF) pixels. The die size is 5.16 mm x 6.25 mm (32.3 mm²) as measured from the edges of the die stack. We expect our planned analysis will show the CMOS image sensor (CIS) die to be fabricated by Sony in its 90 nm technology generation. The through silicon via (TSV) patterning tells us it's a 2nd generation Exmor RS sensor and not 3rd generation Exmor RS with direct bond interconnect (DBI). The TSVs are used to connect the CIS chip to an underlying image signal processor (ISP), which is not to be confused with the complementary ISP functions embedded within the A10 chip.



FaceTime Camera

iPhone 7's FaceTime camera resolution has been bumped up to 7 MP. The front-facing Facetime camera module is 6.8 mm x 6.0 mm x 4.3 mm thick and contains a Sony Exmor RS chip, also featuring 2nd generation TSVs. Our preliminary analysis of the 5.05 mm x 3.72 mm (18.8 mm²) FaceTime camera chip reveals a 1.0 μ m pitch Bayer RGB CFA.



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Noteworthy Patents Summary (tri-annually)

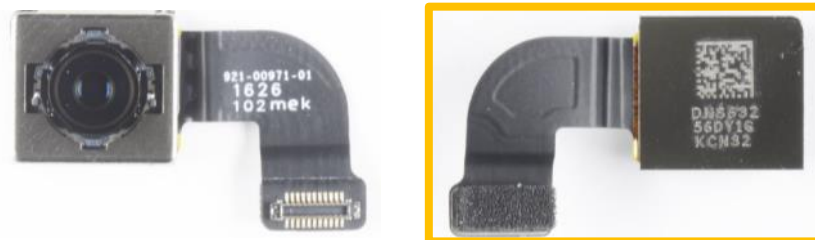
12MP OIS/7MP CMOS Camera



7MP CMOS Camera (Front)

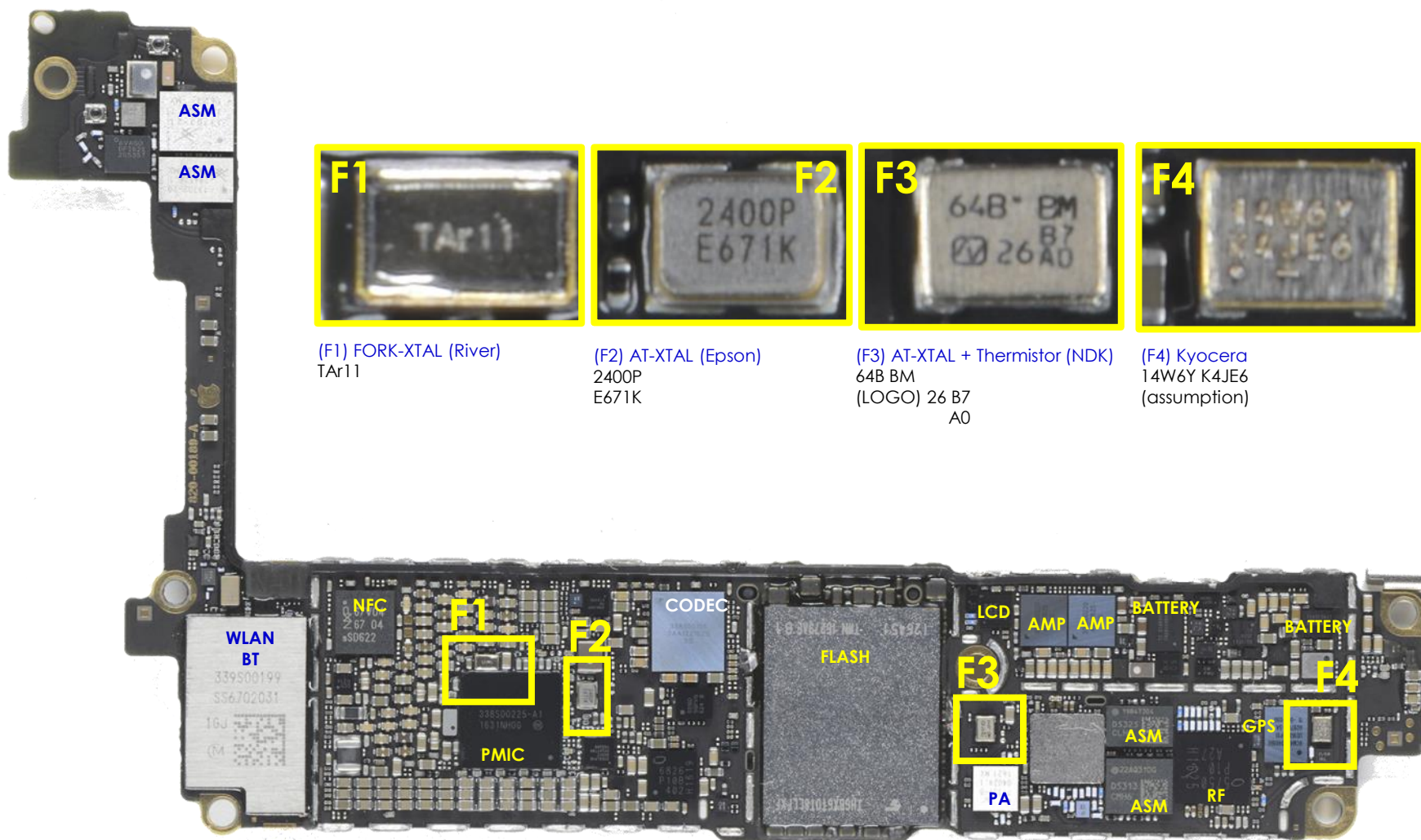


12MP OIS CMOS Camera (Rear)

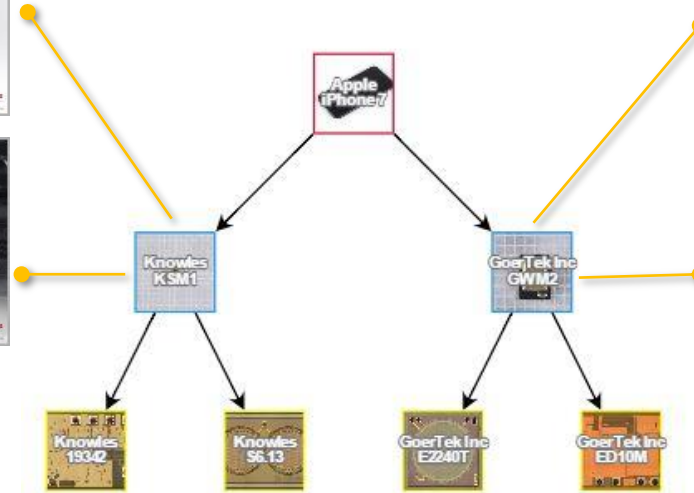


Components

Quartz – PCB #1 Battery Side



Microphones



As per normal multi-source philosophy of Apple, the microphones are being supplied by a few well known qualified vendors. In our model A1778, we have two microphones at the bottom of the phone and two up at the top.

The microphones at the bottom are sourced by Goertek and Knowles. The microphones on the upper part of the phone are Goertek and Knowles.

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Silicon Audio (Microphone)



Microphone (Goertek)
630
GWM1



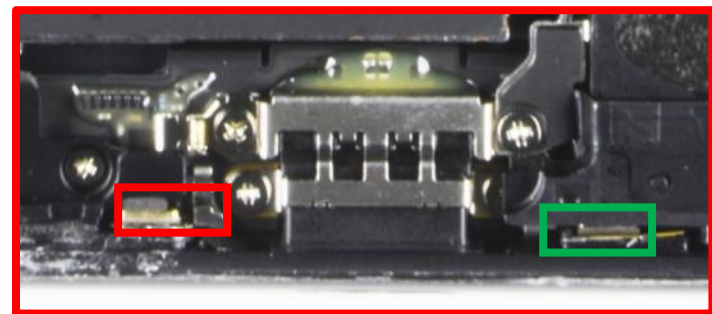
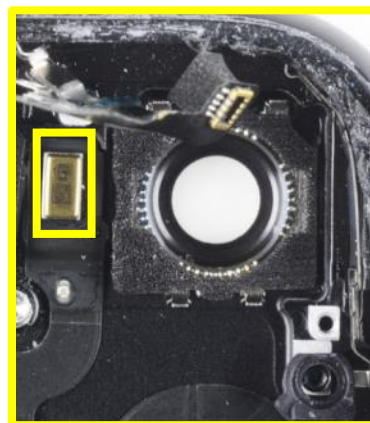
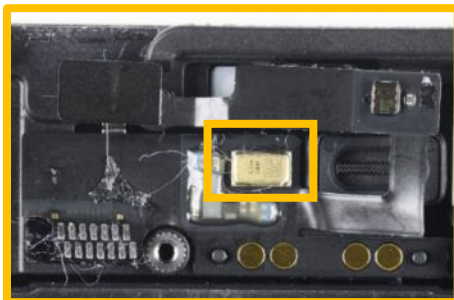
Microphone
(Knowles Acoustics)
627
KMM1
109



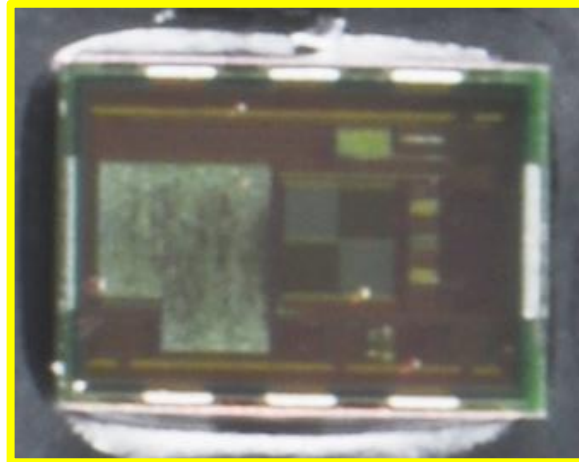
Microphone
(Knowles Acoustics)
630
KSM1
088



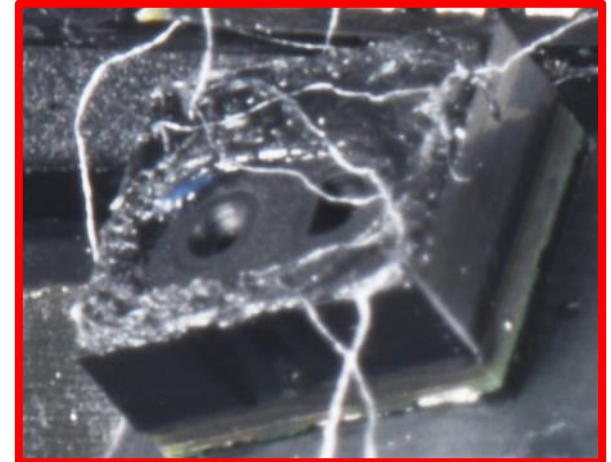
Microphone (Goertek)
T 631
GWM2



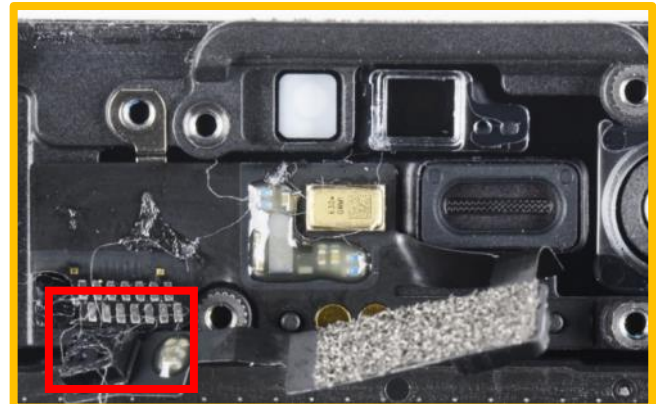
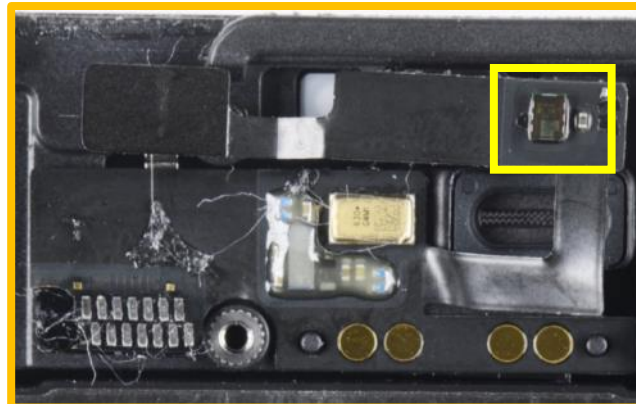
Ambient Sensor



Ambient Light Sensor (AMS)



Proximity Sensor (STM)



Antenna

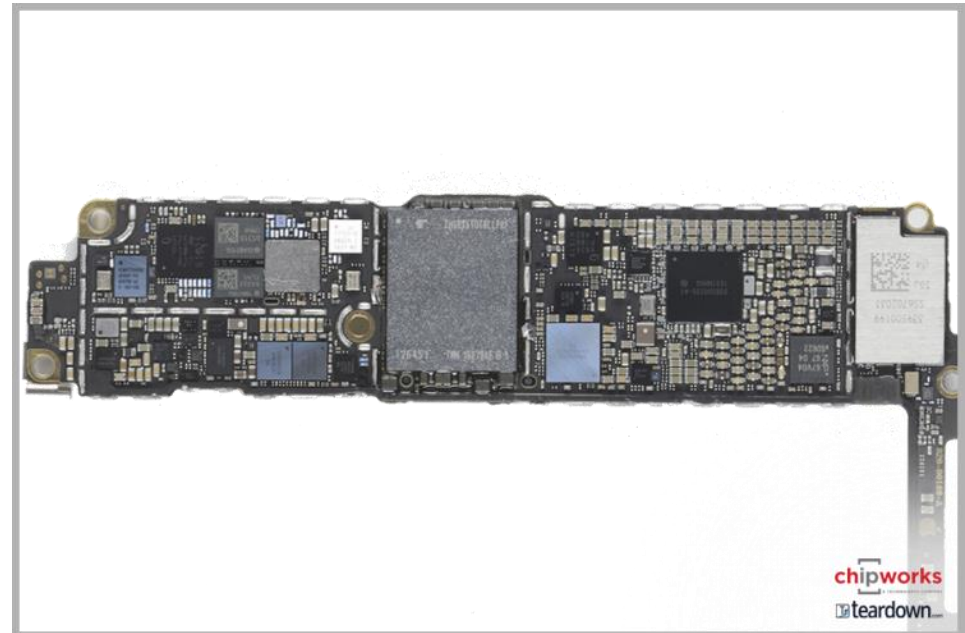
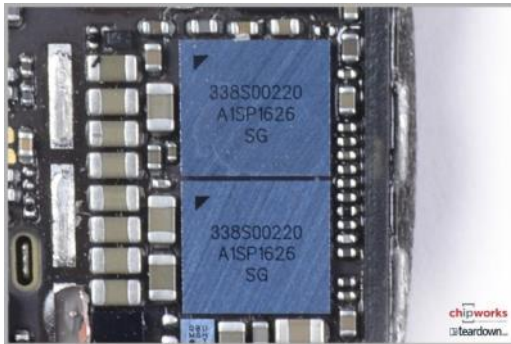
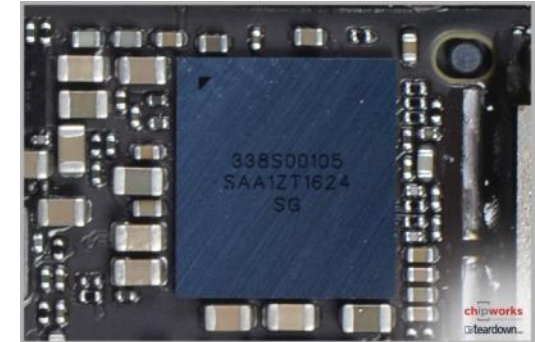


Audio ICs

The iPhone 7 still uses the same Apple/Cirrus Logic 338S00105 Audio Codec as in the iPhone 6S, but the Audio Amplifier has changed to the new 338S00220. (previously [338S1285](#))

We found not just 2 but 3 Audio Amplifiers - we speculate there is one audio amplifier for each of the two speakers, and the third amplifier is for the headphone via the Lightning port.

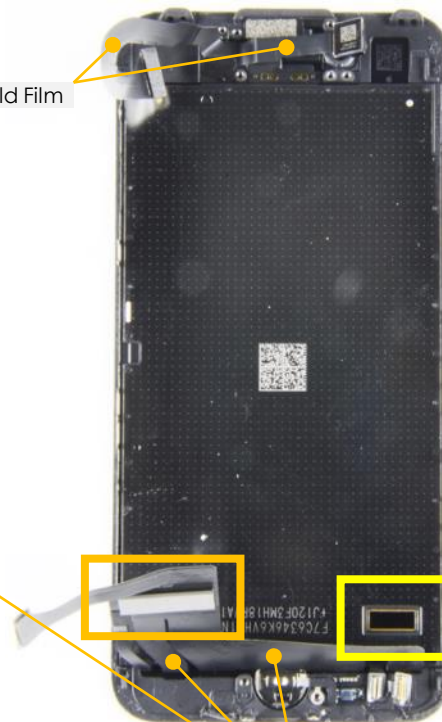
The third Audio amplifier is situated next to the Applications Processor Module with 3 black blobs on it. It was discovered during de-soldering of the A10 applications processor. When the blob was scraped off, it was an 'oh wow, there are 3 audio amps!' kind of discovery.



Touch Panel



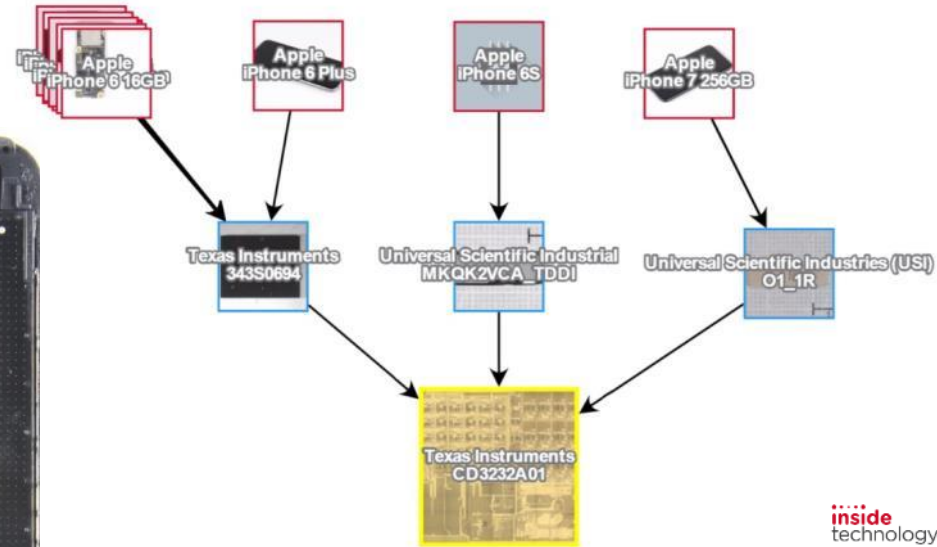
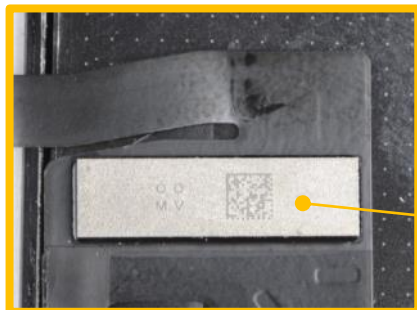
EMI Shield Film



EMI Shield Film

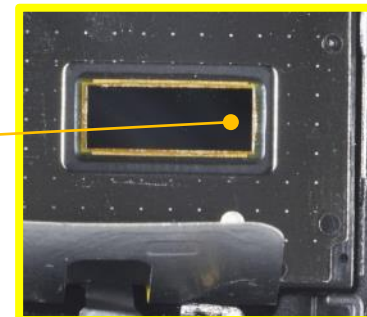
3D Touch Controller
(Analog Devices)
AD7149-1ACBZ

Touch Panel
Controller (USI)
OO
MV

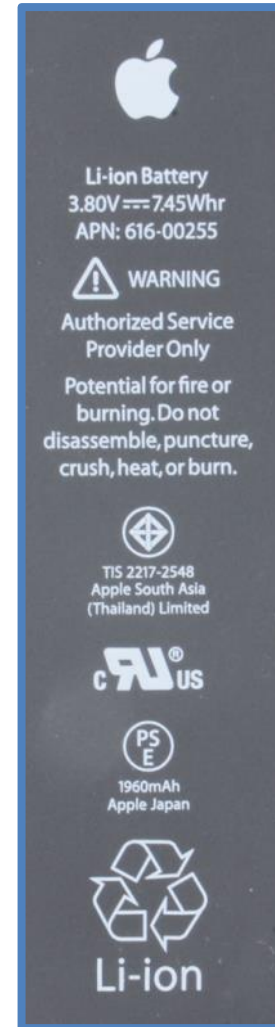


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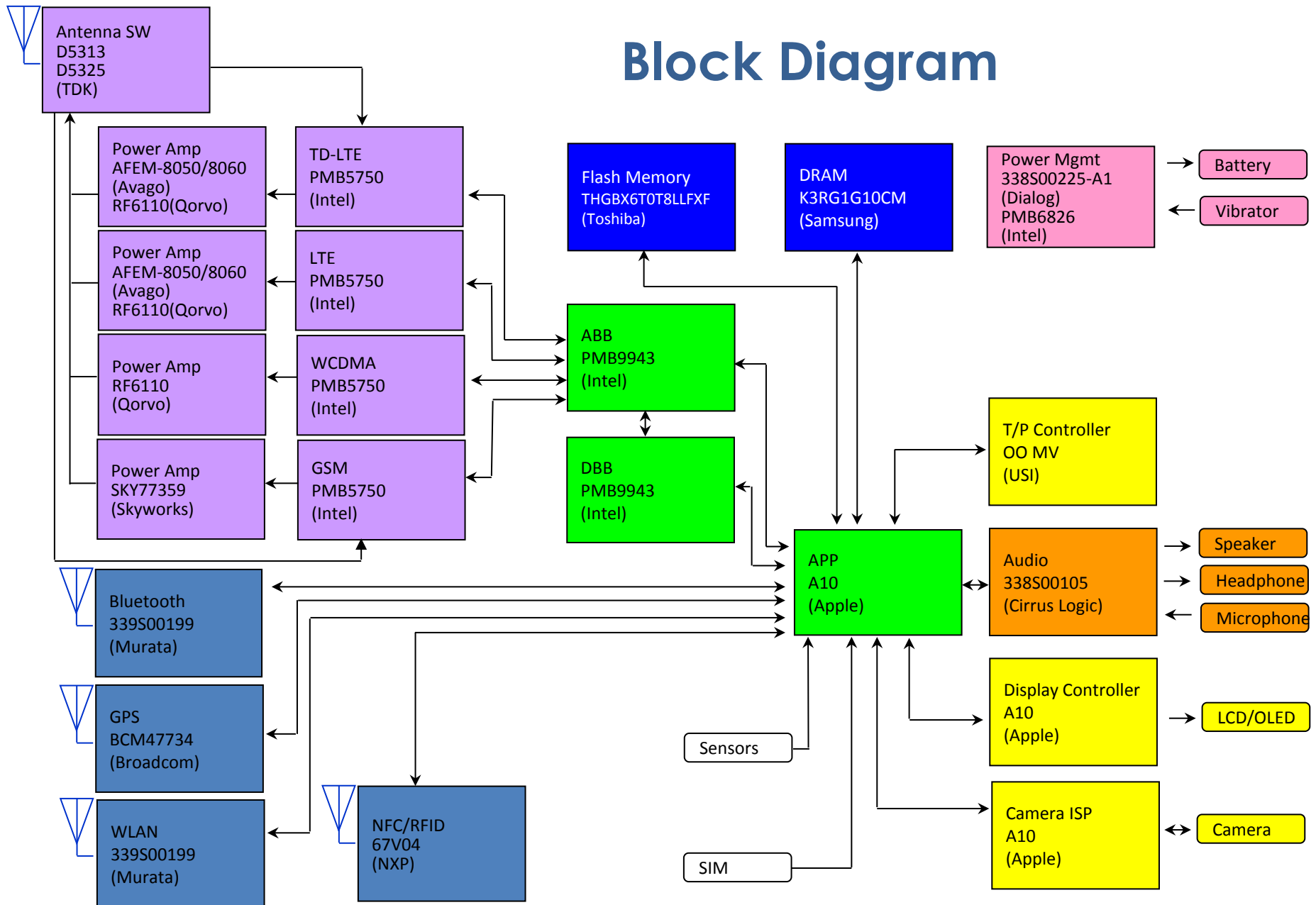
The Touch Controller for the iPhone 7 is manufactured by Universal Scientific Industries (USI) with markings O1 1R. It is the same as the iPhone 6S - a pressure-sensitive 3D Touch layer that buzzes slightly when you press and hold the screen/static home button. It was found under a metal shielding and though no markings were found on the IC, it is believed to be Analog Devices.



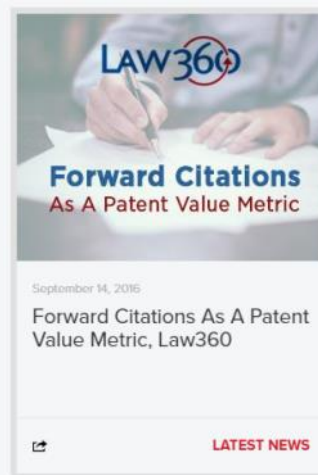
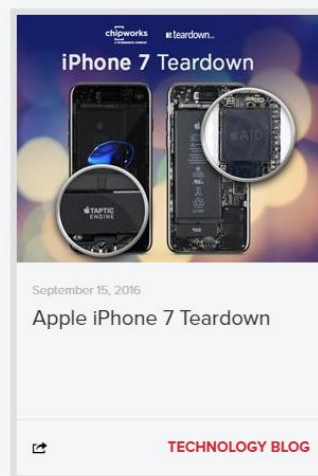
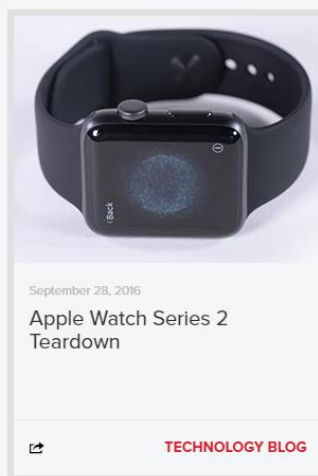
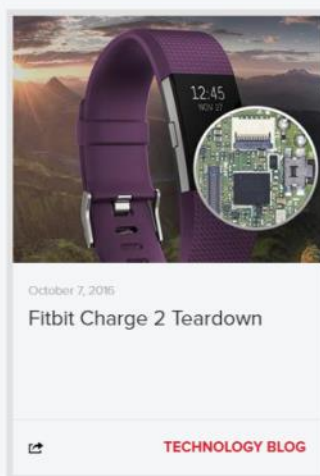
Power Source – Battery



Block Diagram



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