
# iPhone 14/14Pro New Features and Technologies

Department : 交大電信所

Student ID : 0007-310513008

Name : 楊士緯

# Outline

- **Introduction**
  - Product Evolution
  - New Features/Technologies
- **Spec**
- **iPhone 14 Series Teardown**
- **Technology Analysis Applications**
- **Industry Analysis**
  - Supply Chain
  - SWOT Analysis
- **Conclusion**
- **References**

# Outline

- **Introduction**
  - Product Evolution
  - New Features/Technologies
- **Spec**
- **iPhone 14 Series Teardown**
- **Technology Analysis and Applications**
- **Industry Analysis**
  - Supply Chain
  - SWOT Analysis
- **Conclusion**
- **References**

# Product Evolution (1/2)

- Timeline : 2007 – 2022

# Product Evolution (2/2)

- iPhone 14 series (Product release on 2022/9/16 )
  - iPhone 14 : NT$27,900~
  - iPhone 14 Plus : NT$31,900~
  - iPhone 14 Pro : NT$34,900~
  - iPhone 14 Pro Max : NT$38,900~

# New Features/Technologies

# Outline

- Introduction
  - Product Evolution
  - New Features/Technologies
- **Spec**
- iPhone 14 Series Teardown
- Technology Analysis and Applications
- Industry Analysis
  - Supply Chain
  - SWOT Analysis
- Conclusion
- References

# Spec (1/2)

| | iPhone 14 | iPhone 14 Plus | iPhone 14 Pro | iPhone 14 Pro Max |
|---|---|---|---|---|
| Screen Size | 6.1-inches | 6.7-inches | 6.1-inches | 6.7-inches |
| Refresh rate | 60 Hz | 60 Hz | 1-120 Hz | 1-120 Hz |
| CPU | Apple A15 Bionic | Apple A15 Bionic | Apple A16 Bionic | Apple A16 Bionic |
| Storage | 128 ,256, 512GB | 128 ,256, 512GB | 128 ,256, 512GB | 128 ,256, 512GB |
| RAM | 6GB | 6GB | 6GB | 6GB |
| Cameras | Dual 12MP (Wide, ultrawide) | Dual 12MP (Wide, ultrawide) | 48MP main, 12MP ultrawide, 12MP telephoto with 3x optical zoom | 48MP main, 12MP ultrawide, 12MP telephoto with 3x optical zoom |

# Spec (2/2)

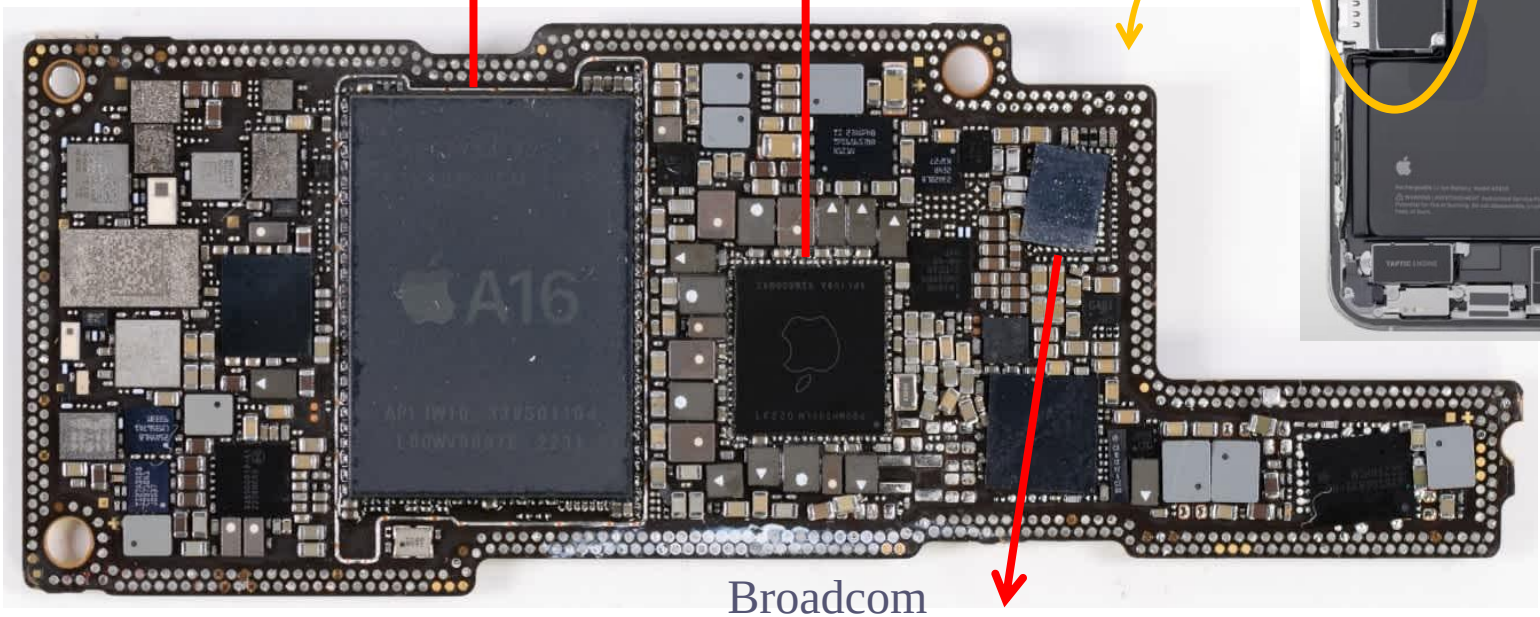
- Cellular and Wireless
  - 5G (sub-6 GHz and mmWave) with 4x4 MIMO
  - Gigabit LTE
  - Wi-Fi 6
  - Bluetooth 5.3
  - Ultra Wideband chip for spatial awareness
  - Precision dual-frequency GPS (GPS, GLONASS, Galileo, QZSS, and BeiDou)
  - VoLTE
- Sensors
  - LiDAR Scanner (only on 14 Pro, 14 Pro Max)
  - High dynamic range gyro
  - High-g accelerometer
  - Proximity sensor
  - Dual ambient light sensors
  - Barometer

# Outline

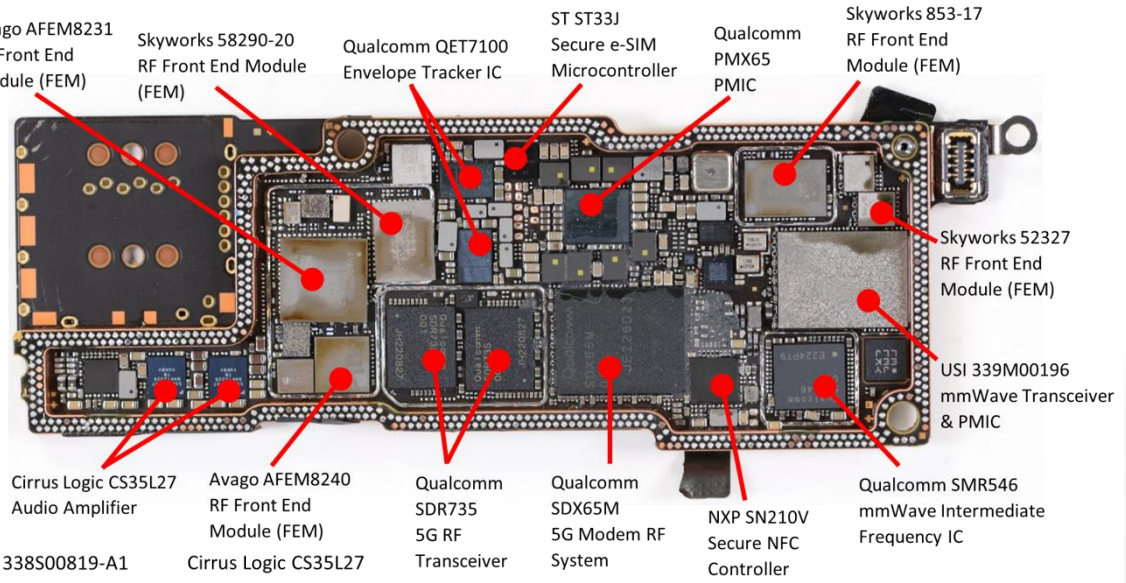
- Introduction
  - Product Evolution
  - New Features/Technologies
- Spec
- **iPhone 14 Series Teardown**
- Technology Analysis and Applications
- Industry Analysis
  - Supply Chain
  - SWOT Analysis
- Conclusion
- References

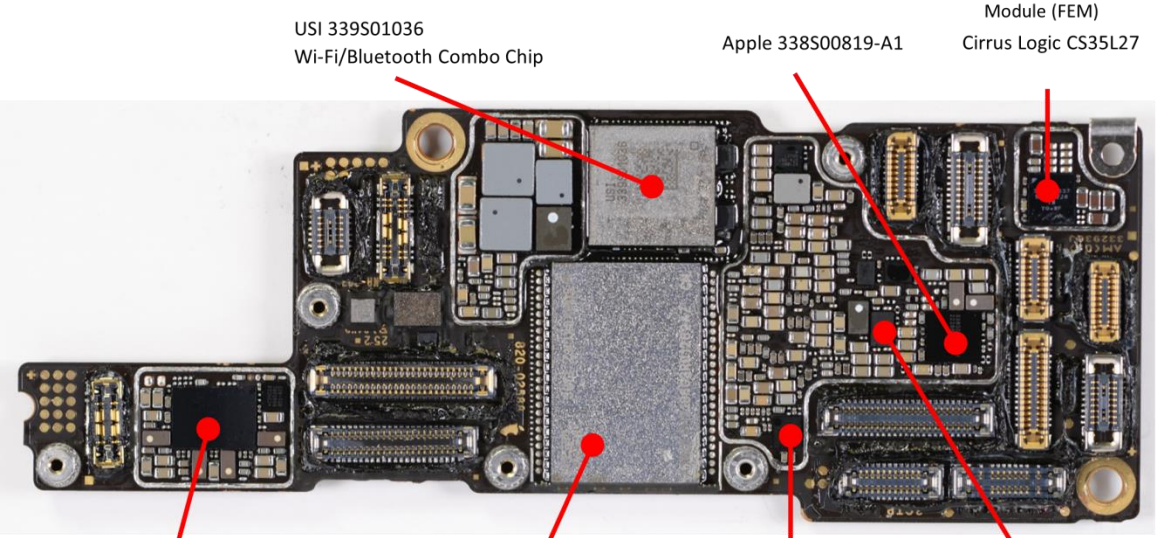
# iPhone 14 Series Teardown (1/2)

- iPhone 14 Pro Max main board




# iPhone 14 Series Teardown (2/2)



# Outline

- Introduction
  - Product Evolution
  - New Features/Technologies
- Spec
- iPhone 14 Series Teardown
- **Technology Analysis and Applications**
- Industry Analysis
  - Supply Chain
  - SWOT Analysis
- Conclusion
- References

# A16 Bionic Chip (1/4)

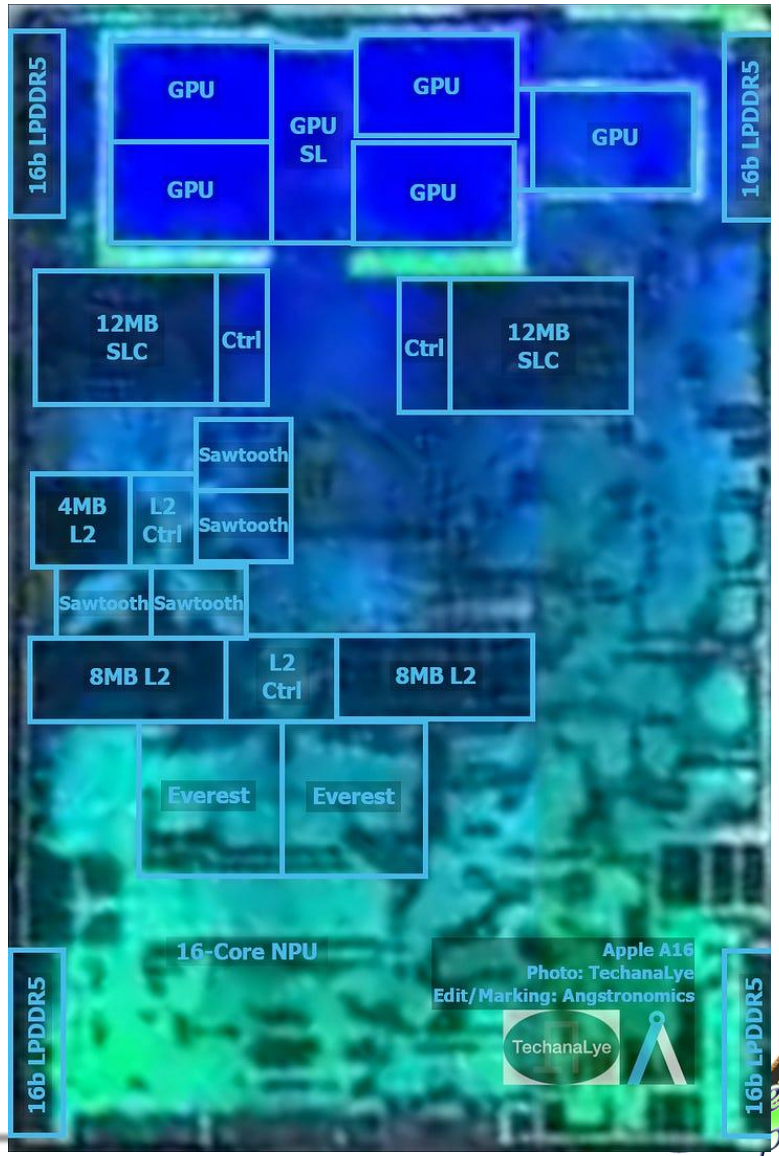
- Consists of 16 billion transistors
- CPU
  - 2 high-performance cores (codename Everest, up to 3.46 GHz)
  - 4 power-efficiency cores (codename Sawtooth up to 2.02 GHz)
- GPU
  - 5-core GPU design
  - Couple with 50% more memory bandwidth (due to LPDDR5)
- Neural engine
  - 16-core neural engine, capable of 17 trillion operation per second (TOPS)
- ISP and display engine
  - It was designed to handle the higher resolution image sensor, being capable of performing up to 4 trillion operations per photo.
  - The Display Engine is a first on Apple A-series, it handles task like the 1 Hz refresh rate, and enables a better functioning “Always on Display”

# A16 Bionic Chip (2/4)

- Detailed specification and Die photo

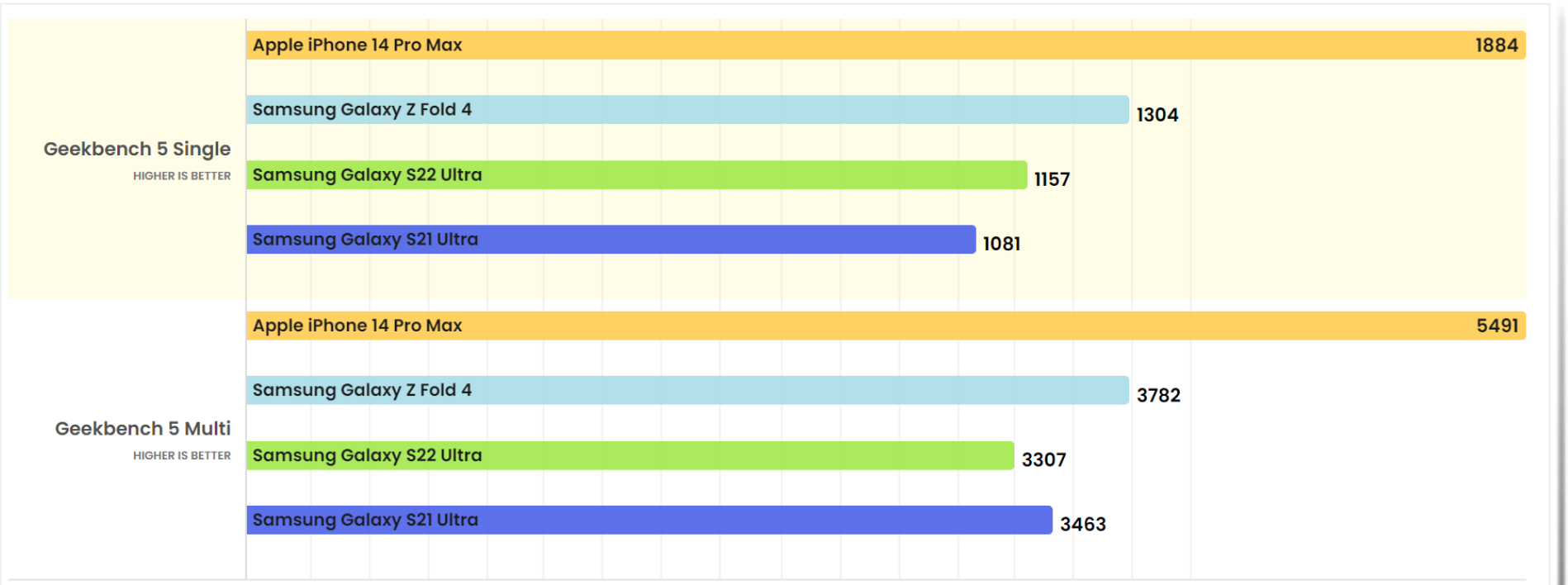
| CPU | |
|---|---|
| **Architecture** | 2x 3.46 GHz – Everest<br>4x 2.02 GHz – Sawtooth |
| **Instruction set** | ARMv9-A |
| **L1 cache** | 256 KB |
| **L2 cache** | 16 MB (performance core) |
| | 4 MB (efficient cores) |
| | 24 MB (system cache) |
| **Technology** | TSMC 4 nm |

| Memory | |
|---|---|
| **Type** | LPDDR5-6400 |
| **Max. Memory** | 6 GB |
| **Bandwidth** | 51.2 GB/s |



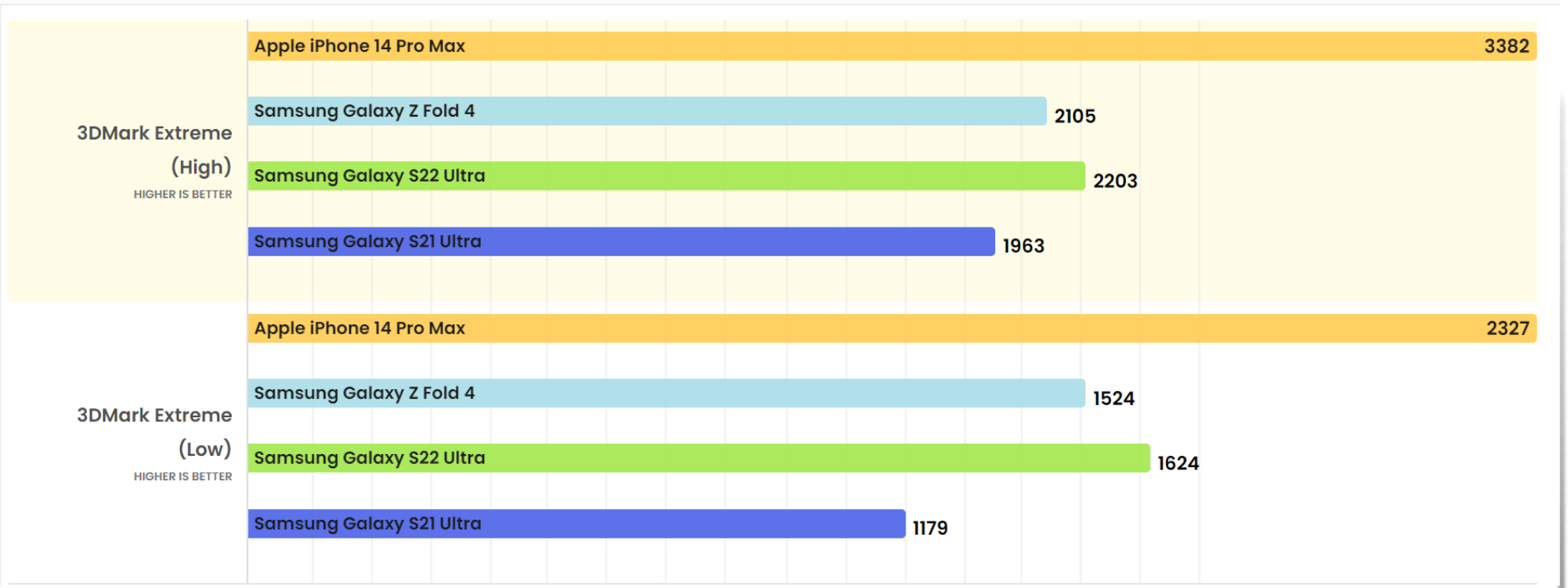
# A16 Bionic Chip (3/4)

- CPU performance comparison
  - It has an advantage of over 40%  in CPU task over the best competitor (Snapdragon 8Gen1)



# A16 Bionic Chip (4/4)

- GPU performance comparison

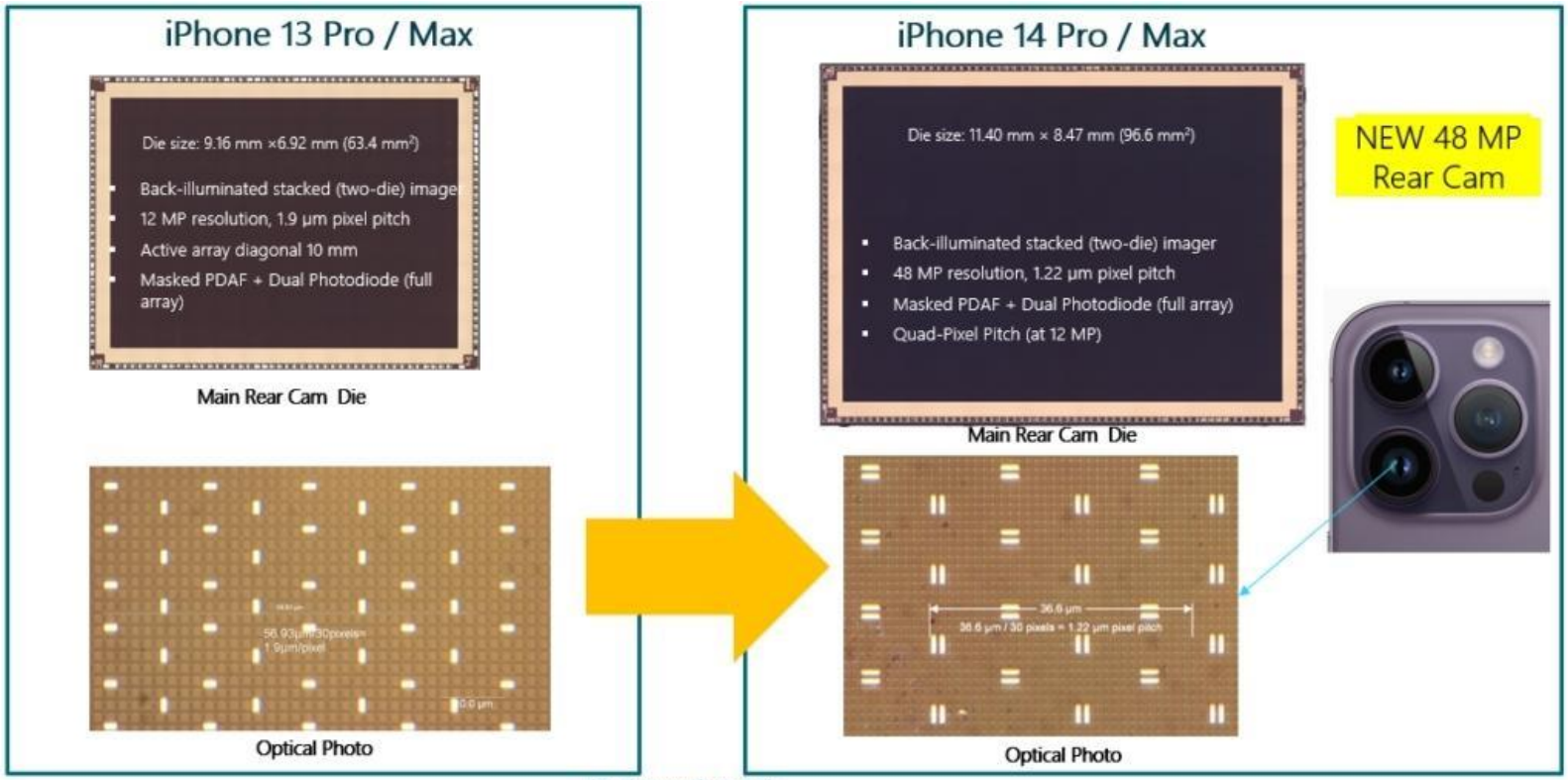


# Camera System (1/4)

- The new Photonic Engine improves the cameras, producing more detail in low-light shots.
- The main upgrade is the 48 MP main camera sensor
  - The camera bins pixels together in groups of 4, resulting in 12 MP photos with improved lighting
  - Enable ProRAW to capture full 48 MP photos
  - A new zoom step between wide 1x and telephoto 3x (by cropping into the new larger sensor for a 2x zoom)

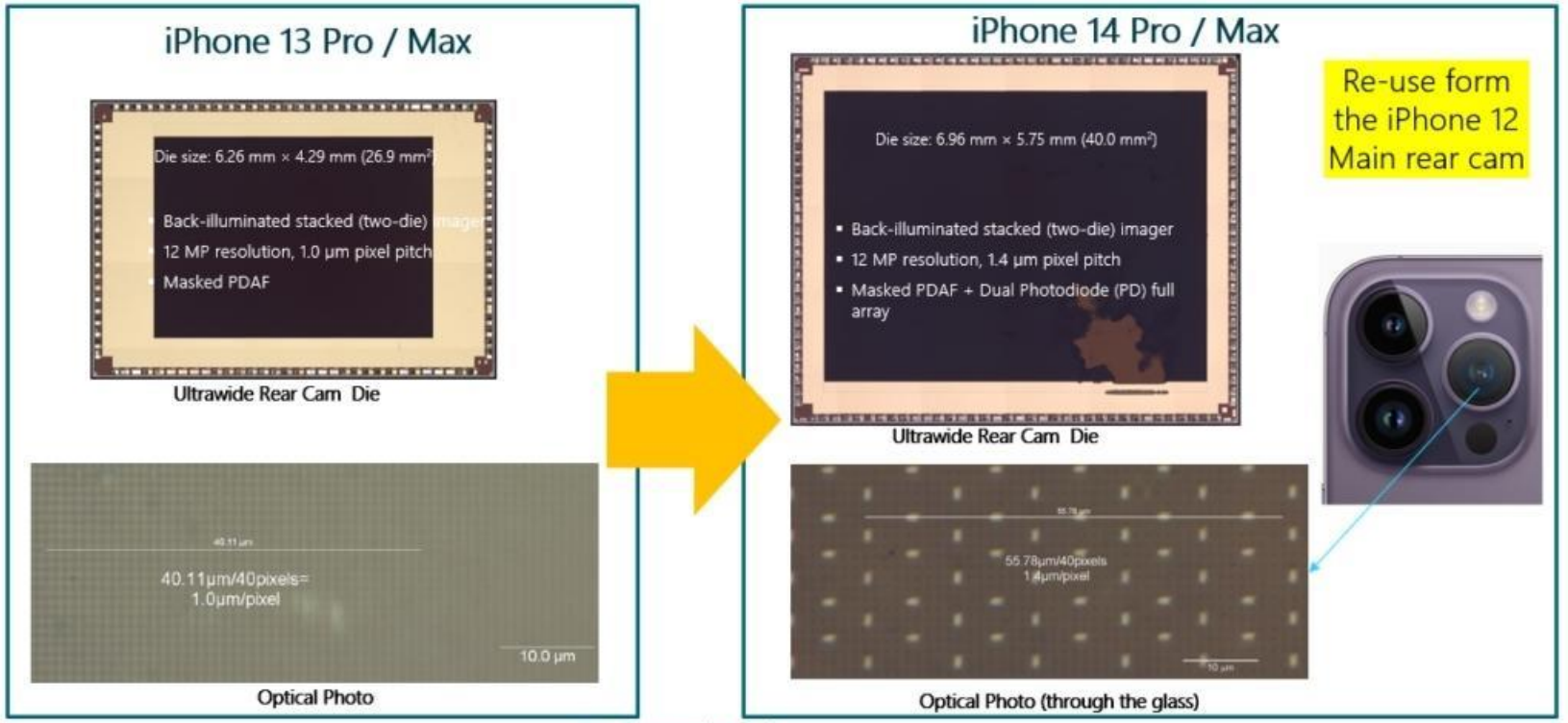
# Camera System (2/4)

- Masked PDAF (phase different autofocus)
  - Uses some of the pixels for imaging on the image sensor as pixels for phase detection.
  - Has a different Masked PDAF pattern compared to iPhone13 Pro/Max, including a new double metal pattern for each 2x2 pixel group



# Camera System (3/4)

- Ultrawide Rear camera
  - It reuse iPhone 12 pro wide-angle main camera and features Masked PDAF plus full array dual photodiode (DP)



# Camera System (4/4)

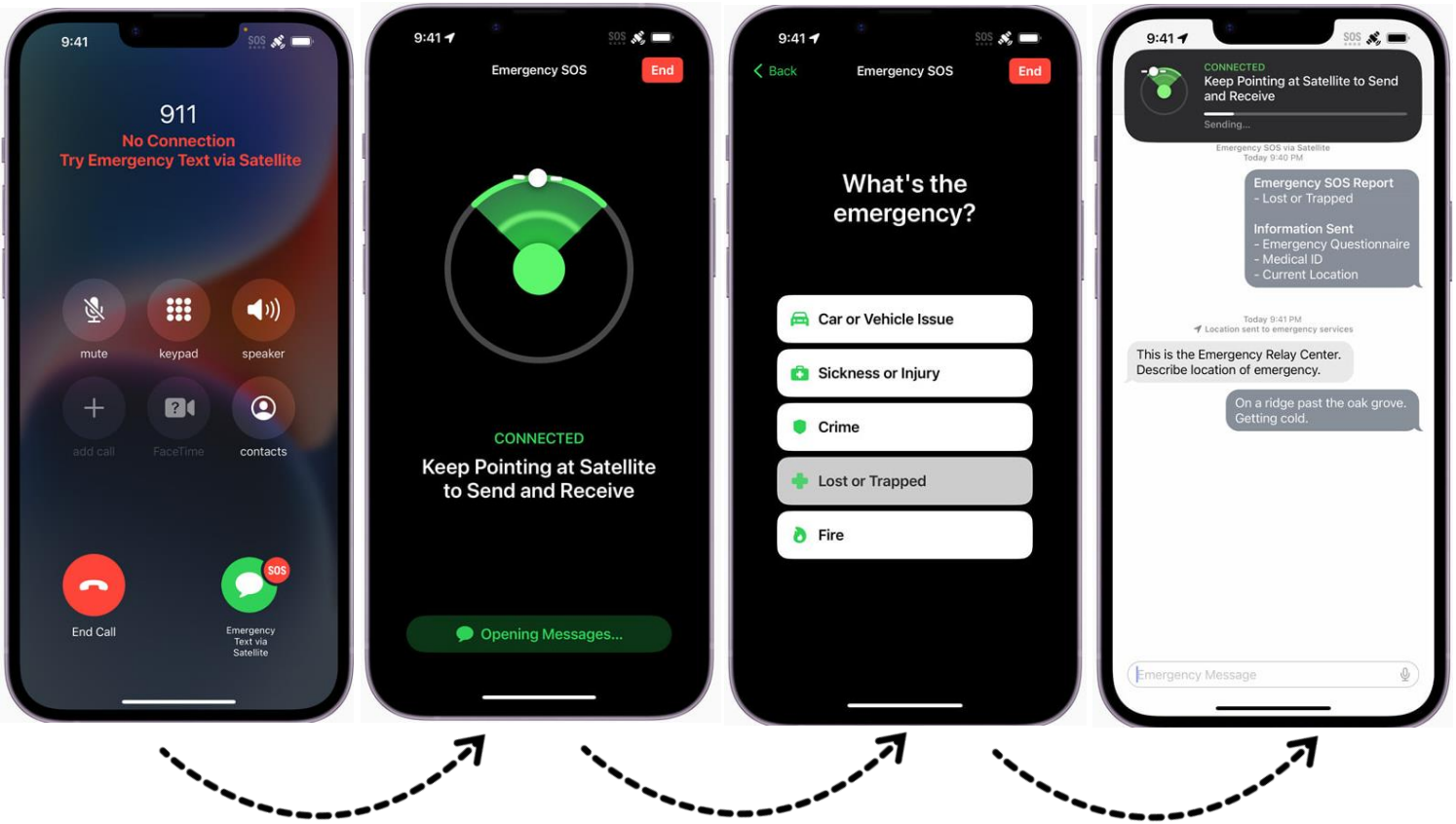
- Telephoto rear camera
  - It reuse iPhone 12 pro wide-angle main camera and features Masked PDAF plus full array dual photodiode (DP)
  - With a 12 MP, 1.0 µm pixel size
- Lidar camera
  - With a 0.3 MP, 10 µm pixel size
  - Improved low light AF speed and improve the quality of portrait mode
- Front camera
  - 12 MP, 1.0µm pixel size with a PDAF
- Video
  - Cinematic mode can now shoot in 4K at up to 30 fps
  - A new action mode, applies extreme video stabilization

# Emergency via SOS Satellite (1/2)

- Snapdragon X65 Modem
  - The world's first 10 Gigabit 5G and first 3GPP 16 support
  - 5G download speed zoom up to 130%  faster than iPhone 13 pro (X60)
  - Global 5G band support including the new n259 (41 GHz), n70 and **n53** bands
  - Advanced power-saving tech
- Cooperate with Globalstar
  - n53 band : 2.4 GHz
- iPhone 14 users can connect with emergency services
  - When cellular and Wi-Fi coverage are not available
  - A short questionnaire appears to help the user answer vital questions with a few simple taps
- Emergency SOS via satellite builds on existing features vital to iPhone users
  - Including Emergency SOS, Medical ID, emergency contacts, and Find My location sharing

# Emergency via SOS Satellite (2/2)

- How Emergency SOS via Satellite Works

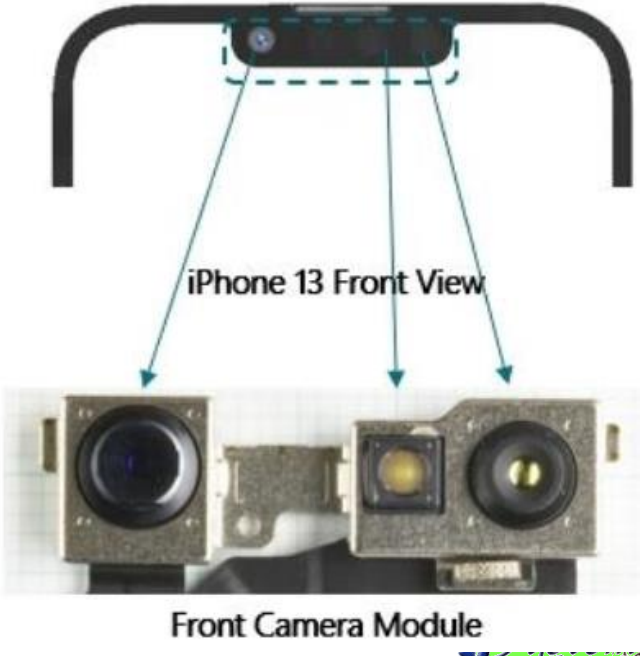



- Find my location

# Dynamic Island (1/2)

- By moving the proximity sensor under the display
  - Making the required cutout size smaller
  - Proximity sensor is part of the sensor family within the face ID notch


**iPhone 13 (+ Pro/Max)**



# Dynamic Island (2/2)

- What is Dynamic Island?
  - The Dynamic Island is an interactive notch that surrounds the iPhone's front camera and face ID sensor
  - It's possible to interact with certain types of content displayed in the Dynamic Island
  - Support live activities, third-party apps


Third-party apps

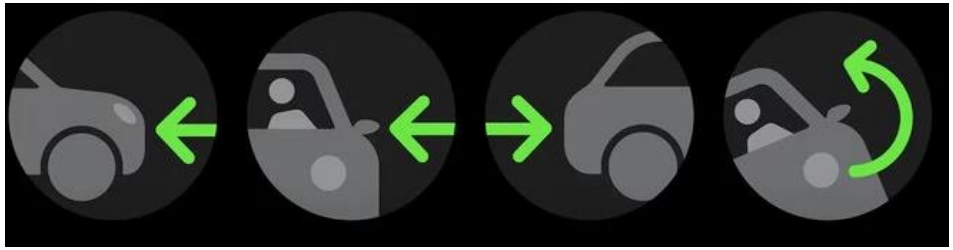


Split Island


Live activities

# Car Crash Detection

- iPhones can detect if you are in a severe car crash
- Use a sets of inputs to detect vehicle crash detection
  - Gyroscope, G-force accelerometer, GPS information, microphone, barometer
- By machine learning method
  - Fuse the multi-modal input to classify the car crashes
  - The model was developed using more than 1 billion hours of real world driving and crash data
- For types of car crashes can be detected
  - Front-impact
  - Side-impact
  - Rear-end collision
  - Rollovers



# Always on Display

- The iPhone 14 Pro and iPhone 14 Pro Max feature a more advanced OLED panel with a more variable refresh rate
  - The previous-generation iPhone 13 Pro has a variable refresh rate of between 10Hz and 120Hz
  - The new OLED panel in the iPhone 14 Pro can go as low as 1Hz to enable a new Low Power mode


# Outline

- Introduction
  - Product Evolution
  - New Features/Technologies
- Spec
- iPhone 14 Series Teardown
- Technology Analysis and Applications
- **Industry Analysis**
  - Supply Chain
  - SWOT Analysis
- Conclusion
- References

# Supply Chain (1/2)

- NAND flash – Sandisk
- LPDDR5 SDRAM - Samsung
- OLED Panel – Samsung Display
- Taptic engine driver – Analog Devices
- UWB module - Universal Scientific Industrial (環旭電子)
- RF front-end module – Broadcom, Skyworks
- Envelope tracker – Qualcomm, Qorvo
- NFC control component – NXP
- A16 bionic chip – TSMC
- CMOS image sensor (CIS) – Sony

# Supply Chain (2/2)

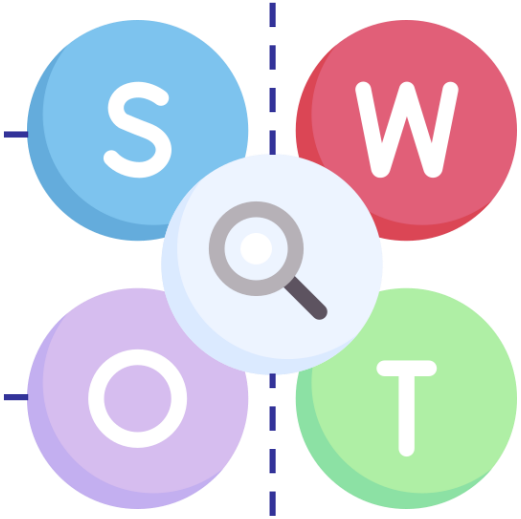
# SWOT Analysis

## Strength

- Apple ecosystem
- Powerful camera system
- Best performance in a smartphone
- Beautiful display

## Weakness

- Hefty
- High price
- Worse battery life than last year




## Opportunity

- Switch lightning to USB-C
- Dynamic Island application extention
- Eco-friendly for each stage of product life cycle

## Threat

- Samsung Galaxy S22/S22+/S22 ultra
- Samsung Galaxy Z Flip 4
- Google Pixel 7/7 pro

# Outline

- Introduction
  - Product Evolution
  - New Features/Technologies
- Spec
- iPhone 14 Series Teardown
- Technology Analysis and Applications
- Industry Analysis
  - Supply Chain
  - SWOT Analysis
- **Conclusion**
- References

# Conclusion

- Dynamic Island brings a new interface to interaction
  - Support third-party apps bring a potential to the market of apps developer
- The new 48 MP main camera provides better color fidelity and low-light performance
- The Always on Display feature on iPhone 14 Pro series is more useful than other Android competitor
- iPhone 14 Pros feel potentially more useful in unforeseen circumstances
  - Car crash-detection, Emergency SOS via satellite
- However, most of the new features/technologies mentioned above only on iPhone 14 Pro series
  - The iPhone 14 series is almost the same as the iPhone 13 series

# References


- https://kwingy.com/a-timeline-notable-revolution-of-the-iphone-from-apple/
- https://www.phonearena.com/news/A16-Bionic-explained-whats-new_id142438
- https://www.angstronomics.com/p/apple-a16-die-analysis
- https://zh.ifixit.com/Guide/iPhone+14+Pro+Max+芯片信息/153224
- https://www.notebookcheck.net/Apple-A16-Bionic-Processor-Benchmarks-and-Specs.652742.0.html
- https://www.cpu-monkey.com/en/cpu-apple_a16_bionic
- https://www.qualcomm.com/products/technology/modems/snapdragon-x65-5g-modem-rf-system
- https://www.apple.com/newsroom/2022/11/emergency-sos-via-satellite-available-today-on-iphone-14-lineup/
- https://www.macrumors.com/how-to/use-dynamic-island-iphone-14-pro/
- https://medium.com/mlearning-ai/how-apple-car-crash-detection-works-ai-modeling-analysis-49e9598494ac
- https://tw.stock.yahoo.com/news/外媒拆解iphone-14-pro-max-關鍵元件供應商曝光-044747750.html
- https://www.phonearena.com/news/iPhone-14-camera-what-to-expect_id140014
- https://www.tomsguide.com/reviews/iphone-14-pro

# Thank You!
# Q&A