eMemory Q3 2021 Results – Earnings Call Q&A

November 10th, 2021

1. **Compared to the past, has the development process for advanced nodes, from initial development to mass production, accelerated or slowed down? Take, for example, the 28nm process node.**

   >> Compared to the past, the complexity of the design, the number of masks, production processes, and functional verification for advanced manufacturing processes have greatly increased. Therefore, the time from development to mass production will be much longer.

   However, because of our credibility from the past, once we have a production record for new technology and new process nodes, customers will speed up the adoption of our IPs. In addition, our license fee and royalties will also increase because the wafer ASP of advanced processes is much higher than that of mature processes. For example, the foundry wafer price and license fee of 28nm will probably be four or five times more than that of 0.18um, which will definitely increase our revenue.

2. **Will emerging memory MRAM and ReRAM replace eMemory's current OTP and MTP markets?**

   >> Emerging memory like MRAM and ReRAM target the traditional embedded flash market. Compared to embedded flash, ReRAM and MRAM require fewer mask layers and are much easier for process integration which can maintain the existing device model. Furthermore, they are applicable to more leading process nodes, especially after 28nm. Our OTP can work as a security and repair function to protect and correct the data stored in emerging memory. Therefore, these emerging memory help extend our technology portfolios but not replace our existing technologies.

3. **Along with traditional applications in DDI, PMIC, DRAM, and Multimedia, what other areas of applications can NeoFuse 12-inch grow significantly. What is the target market share of 12-inch in the future? (Excluding NeoPUF)**

   >> Besides those traditional applications, we also have NeoFuse OTP adopted in 12-inch wafer processes like ISP, CIS, TWS, WiFi, Network IC, SSD Controller, AI SoC, ADAS, and other applications. We expect they will have obvious growth in the near future. It will also help increase our royalty ASP and bring in more design license fees as well.

4. **How are the certification progress and implementation status for MRAM/ReRAM? Does eMemory own the IP? Is the business model still charging royalties?**

   >> As mentioned in our joint press release last week, our ReRAM IP was qualified on the UMC 40nm process. We are also working on 22nm process node for both ReRAM and MRAM technology development, and designs in ongoing projects. Fab customers license memory cells from patent owners (for example, IBM for MRAM or Panasonic for ReRAM). Based on the memory cell, we add the circuit design to become a complete IP. Our business model remains the same; we will charge the negotiated royalty rate of MRAM/ReRAM according to wafer price after the initial license.

5. **Does eMemory expect NeoFuse and NeoPUF to significantly mass-produce and increase the revenue and royalties in 2023 or 2024? Will it take longer?**

   >> NeoFuse's royalty has increased significantly already. We have also started to receive some royalty income from NeoPUF technology. With the production record, we expect more customer adoption to come and drive royalty growth.

6. **Are eMemory IPs applicable to Metaverse-related applications?**

   >> Yes. VR/AR devices will use DDI, power, sensor, low power embedded memory MCU, and the connection speed will require at least WiFi 6E, which will use our IP. For example, our IPs are already applied into HoloLens. After that, there will be security requirements, which will require PUF.

7. **The concept of Metaverse requires information security. What potential role can eMemory play in Metaverse?**

   >> As I mentioned earlier, besides the fact that our IPs will be applied to various chips, eMemory's role in Metaverse is mainly to provide chip hardware root of trust and co-processor solutions and help servers and connected devices by providing the unique identity, key generation and authentication, and encryption and decryption functions required for Metaverse's secure network connection.

8. **What are the target applications for automotive?**

   >> Our logic NVM and security IPs are used in automotive applications like ADAS, various kinds of sensors (for example, TPMS, CIS, temperature/light/motion sensors), PMIC, Infotainment Display and Security Protection applications. We offer IP solutions from 0.25um to 7nm, which all have customer adoption already.

9. **Top global companies like Apple, Tesla, Nvidia, etc. have split their stock prices after their share prices have increased exponentially in recent years. Does your company consider evaluating a potential stock split?**

   >> Our focus is to innovate and execute our technologies for our customers and market, and aim for a sustainable long-term growth model for our shareholders. Whether or not stocks are split does not change the fundamentals of a company, and is therefore not within our consideration.

10. **Looking at the history of eMemory, the business model has evolved. In the beginning, no one guessed that eMemory's technology could play such an important role in semiconductor applications. Can you discuss the company's development direction for the next ten years and beyond?**

    >> eMemory's business model has not changed since we launched our IP business. In the early days, our IPs were widely used in analog related chips. With our innovation into the security area, for the next ten years and beyond, we will continue developing technology and extending it to every IC. Security will be a tremendous driving force behind that!

11. **How does the current shortage of automotive chips affect eMemory's revenue? What is automotive's proportion in eMemory's revenue? Do you expect future growth in automotive applications?**

    >> We did not classify the automotive segment as some of our existing customers supplied their chips to all smartphones, industrial and automotive applications, for example, DDI for Infotainment, Sensor, and MCU, or PMIC for EV cars.

    In addition, as our technologies are ready in leading edge process nodes, we have expanded our IPs into the autonomous driving platform, which will be applied into ADAS and various networking chips. We do expect automotive contribution to be one of driving force for our growth in the future.

12. **In the past, management had predicted the market share for the 8" and 12" market. Can management also offer a prediction for eMemory's possible market share in hardware security?**

   >> For 5G and IoT relevant security needs, security is essential for particular processors, which are mainly in production on the 12-inch leading process node. Therefore, we believe our market share in 12-inch will be higher than in 8-inch as our solution is much better and more secure than existing eFuse solutions.

13. **Apple, Intel, and Nvidia will all be developing chips with RISC-V architecture. Besides cooperating with Andes on RISC-V, does eMemory plan to collaborate with other companies?**

   >> Yes. We already have a joint development and press release with Andes on their RISC-V CPU core, along with our PUF-based root of trust and Crypto Coprocessor.

   We are working with several other leading RISC-V-based CPU core companies in the US, China and other regions too, like Sifive and Verisilicon, to provide our OTP and PUF-based IP solutions to fulfill their security needs.

14. **Is there any progress in the FIPS 140-3 standard?**

   >> FIPS-3 is the certification for the CMVP encryption module required for the product design of eMemory's customers. The cryptographic algorithm developed by eMemory has passed the CAVP certification, which can help customers accelerate their CMVP certification.

15. **Based on the company's current partnership with PUF customers, what applications and process nodes are these customers targeting?**

   >> As mentioned earlier, our PUF-based security solutions are under progress in applications of IoT, Industrial IoT, AI, FPGA, Data Processor Unit (DPU), WiFi and Automotive fields. Their relevant process nodes range from 40nm to 7nm.

16. **Last year, eMemory mentioned transforming into a security as a service company. Is the goal of PUFsecurity to become a security as a service company, or do they have other plans?**

   >> I would like to clarify that it is not for business transformation. It is to expand our new business, which is based on our fundamental NeoPUF technology. We can provide an integrated one-stop shop for security solutions to customers.

17. What is the relationship between eMemory's IP and virtual currency? What can it be used for?

>> We have crypto-mining customers who adopted our NeoPUF, mainly for security functions. In addition, using NeoPUF as the private key for storing cryptocurrency is the most secure method, making PUF an ideal choice for implementation across various digital wallets. Furthermore, using the private key generated by PUF as a digital signature in different blockchain applications is the simplest, safest, and most convenient security method.

18. How does PUFsecurity plan to quickly educate its customers on how to use PUF and PUF-based solutions? What is the current progress of PUFsecurity's software development? How can the collaboration with ARM expand the product application base?

>> PUFsecurity regularly publishes new product information and security technology design white papers through social media, and webinars with various application themes. In addition, there is also the PUF Academy, which provides several hardware security-training courses to educate the market and help chip designers implement our solution into their design.

The software development is mainly aimed at developing and verifying various software/firmware and APIs required for PUF-based IP solutions.

Our subsidiary, PUFsecurity, is currently working with CPU IP vendors to develop the SoC chip security design architecture for their customers.

19. We know that security is essential in the 5G era. What is the estimated total market value for security in 2025? Moreover, what percentage of this total would you estimate would be for hardware security?

>> The connected world from 5G and IoT will need security IPs for ID setting, authentication and secure communication functions. For 5G and IoT markets, they are in the order of several billion devices per year. We believe that hardware security's protection function will perform much better than software. Hardware security will also play a major part in the long run.

20. Apple M1/AMD/Nvidia chips all emphasize the connection between processor and memory. Will eMemory's experience in memory development benefit from this trend?

>> Our OTP and PUF-based security IPs can be used for setting, configuration, encryption and data protection functions. We already have several projects ongoing with customers for relevant applications.

21. **What is the difference between NeoPUF and Synopsys' DesignWare tRoot H5 hardware security module?**

>> To compare with Synopsys tRoot, our PUF based solution is PUFcc, developed by our subsidiary, PUFsecurity. Synopsys's solution is pure digital design, which contains security algorithms. The key for root of trust is generated from algorithms and needs to be injected through an external security environment. Our PUFcc includes PUF, secure OTP, tRNG and anti-tampering design. For our PUF based root of trust, the key is inborn by the chip itself, which is more secure and cost-efficient.

22. **Palo Alto Networks can also use software to achieve a "zero-trust network access" from the cloud, and generate public and private keys. What are the advantages of eMemory compared to Palo Alto Networks?**

>> NeoPUF is a fingerprint that comes with the chip itself. This fingerprint can be used to generate the chip's genetic public and private keys. If the key pair is generated by software solutions, it needs to be stored into the chip. To do so, it must be injected through an external security environment, which is not secure, as mentioned before. In comparison, a genetic root of trust is more secure and cost-efficient.

23. **For advanced packages such as CoWos, InFo and other 2.5D/3D packages, what functions or benefits can eMemory's IPs provide for customers who adopt?**

>>For multichip package, 1) eMemory's OTP IP provides the in-package repair function for DRAM, calibration function for Power Management, Display, and Image Sensors.

Therefore, in this aspect, our IP improves the yield of multichip package.

2) PUFsecurity IPs are for security functions in the security Chip of multichip package. In this aspect, our IPs enable the security of the subsystem.

24. **Are there any network effects with the adoption of NeoPUF? That is, are hardware security protocols easier to implement if everyone uses the same PUF? Such that if one leading company adopts NeoPUF, then others will follow and NeoPUF will become the industry standard?**

>> From our history, we always create new IP solutions to disrupt traditional usage. NeoPUF is new to the industry and will be used for security. If a leading company or multiple companies adopt this solution, it will provide better security to their hardware and the rest of the industry will start to follow. In other words, these companies will become the early adopters and the early majorities will follow, this is what you call the network effect. Therefore, the answer is yes.

25. What is the ratio for 28nm royalty in Q3?

>> The proportion for 28nm is 18%, compared to 7% in 2020.

26. Why did the licensing revenue for 0.11/0.13/0.18 licensing suddenly increase in Q3?

>> During Q3, we received NTO from automotive-related, IoT-related, and other applications in the legacy nodes. The other reason was that China localized power management and driver ICs so our licensing from China increased a lot.

27. Why has PUF licensing revenue declined YoY in Q3? How do you estimate the potential TAM for PUF? What is the root-of-trust chip's market size in hardware security?

>> Since most of our PUF customers involved change in their security architecture, engagement takes much longer time. This is why our revenue numbers are lower, but we are actively working with customers. In addition, some of NeoPUF's revenue was categorized under NeoFuse since we charged the same royalty if customers adopt NeoFuse and NeoPUF together. This was the same during the initial stages for NeoFuse, which is now a very successful technology.

Right now, with production records for PUF customers in 7nm FPGA, this is important for our breakthrough in the PUF market. In the future, you will see significant growths moving forward.

28. What process nodes/applications does PUF target?

>> The range is quite large since any applications that require security can adopt PUF. For example, 14nm for IoT applications, 55nm for MCU applications, 28nm for AI applications, 16nm for AI applications as well, and 7nm and below for GPU, FPGA and DPU. Further, 5nm and 3nm is for confidential computing. As you can see, there is a whole range of process nodes and applications for PUF as long as they require security.

29. What are the key risks to your continued growth success? Any emerging competitors?

>> Our biggest risk is the global economy. If the economy is not good, demand for electronic devices will decrease and chip companies will decrease production, which will affect our royalty. For emerging competitors, currently we are not afraid of competition because the basis of our technology is our OTP technology, which we spent 20 years building on more than 400 platforms worldwide.

Moreover, our PUF is based on NeoFuse, which is a hard IP. Hard IPs need to be verified at the foundry process the customer wants, which normally takes a very long time if starting from scratch. We do not think any emerging competitors can achieve this and so, we are confident that we will become a major player.

30. What are the advantages of your OTP-based PUF vs. SRAM PUF?

>> This is a question our customers always ask about when they are looking to switch over. SRAM PUF's random numbers are generated based on the mismatch of back-to-back inverters. Yet, as technology scales down, operating voltage will scale down. As a result, the threshold voltage control has to be very tight so that the mismatch in SRAM will be smaller. This affects the stability of the random numbers generated, leading to SRAM PUF to become instable and therefore risky for customers who are using it to store their secret key. Due to the instability, the system will lose the key and crash.

Our PUF is based on our OTP technology, which is already proven. Our PUF has a 10+ year's lifetime and since we have qualified our technology, there is no issue on the stability of the random numbers generated by PUF. Ultimately, our PUF is the most stable for use in private keys since the numbers generated by PUF are random, unique, and stable.

31. What applications do MRAM target for Chinese customers?

>> There is currently a big market in China for automotive and we all know that for the technologies in 28nm or below, traditional embedded flash is high-cost and difficult to become successful. That is why emerging memory, such as MRAM, is taking off to replace traditional embedded flash. One of the biggest advantages of MRAM is that it is subject to high-temperatures because the charge loss in MRAM is only affected by changes in the magnetic field. In China, they are trying to use embedded MRAM in high-end MCU to replace current embedded flash because automotive chips need to operate at higher temperatures than consumer devices.

32. Please comment on recruitment.

>> This question is probably concerning about the recruitment in Taiwan. Due to the shortage of talent, many companies are providing good deals to try to recruit engineers. For example, MediaTek, Novatek, etc. are looking to recruit digital and software designers.

Since we are a memory IP company, we deal with special memories in logic processes so we have not suffered from losing talent so far. In fact, our turnover rate is very low and many engineers are looking to transition from their current working environment to eMemory because they do more routine work and are looking for environments that are more innovative. Our culture is based on the belief that in order to innovate, you need room for more thinking and creativity, which is why we do not have problems hiring new talent.