

ASSIGNMENT-1

VLSI(Back End)-G14

1. List out the semi conductor products and its corresponding companies.

Semi conductor:

Semi conductor is a material that has an electrical conductivity between conductor and insulator.

They has negative temperature coefficient of resistance.

Semiconductors are brodly classified into two different types, They are:

1. Internsic semiconductor
2. Externsic semiconduTor

List of semiconductor products and there corresponding companies are:

S.no.	Company	Hardware products
1	Samsung	Memory, DRAM, SSD, CMOS Sensors, Displays, etc.,
2	Intel	Microprocessors, SSD, GPU, DRAM, etc.,
3	Micron	DRAM, NAND flash, NOR flash, managed NAND, Multichip package, etc.,
4	TSMC	Graphic cards, GPU, Fabless designs, Wafers
5	Texas Instruments	Integrated circuits, Analog chips, Embedded processors, Microcontrollers, Multi-core processors, etc.,
6	Media Tek	Chips for wireless communications, Navigations, SOC, Chipset, DSP, etc.,
7	AMD	CPU, GPU, Mother board chipset, SDRAM
8	Nvidia	GPU
9	Qualcomm	RF Modules, Chips, Digital Signal Processors
10	STMicroelectronics	ASIC, Microcontrollers
11	Motorola	Integrated circuits, microprocessors, DRAM, SRAM, Flash memory etc.,
12	IBM	Microprocessor
13	NEC	Microprocessors, personal computers
14	Toshiba	Mother boards, micro SD cards, USB flash drive, hard disk, integrated circuit etc.,
15	Infineon Technologies	Microcontrollers, integrated circuits, transient-voltage, supperssion diodes, telecommunications
16	NXP	PMIC, Media processor, MIFARE
17	ARM	Microprocessor
18	Sony	NAND flash memory, sensor, Pixel
19	kioxia	NAND flash memory, SSD
20	Apple	Apple silicon
21	Analog Devices	Amplifier, data converters, sensors, RF amplifier
22	Fujitsu	
23	SK Hyix	Flash memory, DRAM, SSD, CMOS sensor
24	Broadcom	Wifi, Broadband, Custom DSP & ARM CPU

2. What are the latest laptop processors from AMD, Intel and Apple : Frequency and node.

Processor:

A processor is an integrated electronic circuit that performs the calculations that run a computer. A processor performs arithmetical, logical, input/output(I/O) and basic instructions that are passed from operating system(OS).

Latest laptop processors from different companies:

AMD:

It is a semiconductor company. It includes microprocessors, motherboard chipsets, embedded processors and FPGAs for server workstations, personal computers and embedded system applications. The company has also expanded into new markets such as data centers & gaming markets & has announced plans to enter the highest-performance computing market.

The Ryzen family is an x86-64 microprocessor family from AMD, based on the Zen microarchitecture.

Latest AMD Ryzen processor is **Ryzen 7000 series**:

Ryzen Threadripper PRO:

- **96 Cores with 192 processing Threads**
- Built o latest **Zen 5nm architecture**
- Frequency **2.7 to 4.1GHz (5.10GHz)**
- Processor Technology for CPU Cores : **TSMC 5nm FinFET**

Threadripper PRO 7000 Series processors

AMD Ryzen Threadripper

- **7980x-----64 Cores with 128 processing Threads**

AMD Ryzen Threadripper

- **7970x-----32 Cores with 64 processing Threads**

AMD Ryzen Threadripper

- **7970x-----32 Cores with 64 processing Threads**

INTEL

It is one of largest semiconductor chip manufacturing company in world. Intel supplies microprocessors for most computer system manufacturers. It also manufactures motherboard chipsets, network interface controllers and integrated circuits, flash memory, graphics chips, embedded processors and other devices related to communications and computing.

Intel was an early developer of SRAM and DRAM memory chips.

Latest Intel processors

13th generation core

Intel core i9 processor family

- Frequency—**2.6 to 5.4GHz**
- **Core 14** with **20 processing Threads**

Apple

It is one of largest company. The company's second computer, the Apple - II, became a best seller and one of the first mass-produced microcomputers. The **MacBook Pro** is a line of **Mac** laptops made by **Apple Inc.** Introduced in January 2006, it is the higher-end lineup in the **MacBook** family, sitting above the consumer-focused **MacBook Air**. It is currently sold with 14-inch and 16-inch screens, all using Apple silicon M-series chips.

Apple launched new MacBook Pro models with its latest Apple Silicon processor under the hood in October, and the successor to the MacBook Air M2, which will be priced lower than the Pro models, will soon be equipped with the M3 chip.

Latest Apple processors

Apple M3 series

- **M3**
Frequency---4.05GHz
Total Cores—8 & 8Threads
Efficiency of Cores-----4
Performance of Cores---4
- **M3 Pro**
Frequency---4.05GHz
Total Cores—12 & 12Threads
Efficiency of Cores-----6
Performance of Cores---5 & 6
- **M3 Max**
Frequency---4.05GHz
Total Cores----16 and 16 Threads
Efficiency of Cores-----4
Performance of Cores---10 & 12

3. What are the latest mobile processors available from Qualcomm and Media Tek : frequency and node.

Qualcomm:

It is not only largest semiconductor company. It primarily develops semiconductor ,wireless communication technologies and products. The company develops 5G modem for iphone and most recently credited with helping make satellite connectivity to phone reality. The company has its sights set on emerging technologies like augmented reality, artificial intelligence, Wi-Fi, and more.

Latest Qualcomm processors:

Snapdragon 7 Gen 3

- Frequency ---**2.63GHz**
- Fabrication —**4nm (TSMC N4)**
- Cores—**8**

Media Tek :

It is Taiwanese fabless semiconductor company that provides chips for wireless communication, high-definition television, handheld mobile devices like smartphones and tablet computers, navigation systems, consumer multimedia products and digital subscriber line services as well as optical disc drives. The company started out designing chipsets for optical drives and subsequently expanded into chips for DVD players, digital TVs, mobile phones, smartphones and tablets. In general MediaTek has had a strong record of gaining market share and displacing competitors after entering new markets.

Latest Media Tek processors:

Dimensity series 8300

- Frequency—3.35GHz
- Fabrication —4nm (TSMC N4)
- Cores --8

Dimensity series 9300 (MT 6989)

- Frequency —3.25GHz
- Fabrication —4nm (TSMC N4P)
- Cores —8

4. what are the different job roles available in VLSI field

VLSI field has different job roles:

1. Design Engineer

Design engineers in the field of VLSI (Very-Large-Scale Integration) are responsible for designing and developing integrated circuits (ICs) for a variety of applications. They use computer-aided design (CAD) tools to create schematics and layouts for ICs and work closely with other teams to ensure the smooth production of the ICs. Design engineers may also be involved in testing and verifying the functionality of the ICs they create.

2. Verification Engineer

Verification engineers in VLSI are responsible for ensuring that the ICs designed by design engineers meet the necessary specifications and function correctly. They use simulation and other testing tools to verify the functionality of the ICs and may also be involved in debugging any issues that arise.

3. Physical Design Engineer

Physical design engineers in VLSI are responsible for the physical implementation of IC designs. They use CAD tools to create detailed layouts of the ICs, taking into consideration factors such as manufacturing tolerances and performance requirements. They may also be involved in the optimization of the IC layout for improved performance or power consumption.

4. Process Integration Engineer

Process integration engineers in VLSI are responsible for ensuring that the manufacturing process for ICs is optimized for efficiency and yield. They work closely with the manufacturing team to understand the capabilities of the manufacturing equipment and develop process flows for the production of ICs. They may also be involved in the development of new manufacturing processes for advanced IC technologies.

5. Test Engineer

Test engineers in VLSI are responsible for developing and implementing test strategies and plans for ensuring the quality and reliability of ICs. They use specialized equipment and software to test the ICs and may be involved in the development of new testing methods for advanced IC technologies.

6. Product Engineer

Product engineers in VLSI are responsible for the entire lifecycle of an IC product, from development to manufacturing to end-of-life. They work closely with the design and manufacturing teams to ensure that the IC product meets the necessary specifications and is produced efficiently. They may also be involved in the evaluation of new IC technologies and the development of product roadmaps.

7. Technical Manager

Technical managers in VLSI are responsible for leading a team of engineers and technicians in the development and production of ICs. They may be responsible for managing budgets, resources, and timelines, as well as for providing technical guidance and mentorship to their team members. Technical managers may also be involved in the development of new IC technologies and the overall strategic direction of the company's VLSI efforts.

5. Why there is a shift from BJT - MOSFET - FINFET in detail.

BJT:

A bipolar junction transistor is a three-terminal semiconductor device that consists of two p-n junctions which are able to amplify or magnify a signal. It is a current controlled device. The three terminals of the BJT are the base, the collector, and the emitter. A signal of a small amplitude applied to the base is available in the amplified form at the collector of the transistor. This is the amplification provided by the BJT. Note that it does require an external source of DC power supply to carry out the amplification process.

MOSFET:

Metal Oxide Silicon Field Effect Transistors commonly known as MOSFETs are electronic devices used to switch or amplify voltages in circuits. It is a voltage controlled device and is constructed by three terminals.

FINFET

A FinFET is a type of field-effect transistor (FET) that has a thin vertical fin instead of being completely planar. The gate is fully “wrapped” around the channel on three sides formed between the source and the drain. The greater surface area created between the gate and channel provides better control of the electric state and reduces leakage compared to planar FETs. Using FinFETs, results in much better electrostatic control of the channel and thus better electrical characteristics than planar FETs.

There is shift of technology from BJT-MOSFET-FINFET:

FinFET technology is suitable for IC fabrication, as it has higher scalability for the given footprint area than MOSFETs. As chips are downsized, transistors also shrink. This compactness brings the drain and source closer and reduces the gate control over the channel carriers.

1. A large number of transistors can be incorporated into a single chip. FinFET technology is suitable for IC fabrication, as it has higher scalability for the given footprint area than MOSFETs.
2. As chips are downsized, transistors also shrink. This compactness brings the drain and source closer and reduces the gate control over the channel carriers. This type of short-channel effect can cause serious issues in MOSFETs. The presence of fins gives FinFETs better short-channel behavior.
3. To improve short-channel behavior, channel doping is common in planar MOSFETs. The wrap-around gate over the thin body makes channel doping optional in FinFETs. Therefore, no dopant-induced fluctuations are present in FinFETs.
4. The length of the gate is significant in reducing leakage current, and thereby leakage power. As the gate is wrapped around the drain-source channel, there is sufficient gate length in FinFETs and there is no leakage current when the gate is not energized. However, in MOSFETs, as the gate is scaled down, leakage current exists.
5. Leakage current and leakage voltage are responsible for leakage power in switching devices. Since FinFETs are devices with low leakage current, their power consumption is less than that of MOSFETs.

6. In planar MOSFETs, the device drive strength is dependent on the channel width, whereas a FinFET transistor's drive strength can be increased by incorporating multiple or longer fins.
7. A higher drive current can be reflected as fast switching times in FinFETs. Otherwise, it can be said that three-dimensional FinFETs are high-speed devices compared to planar MOSFETs.
8. It is easy to fabricate multi-gate devices using FinFET technology. Planar construction makes multi-gate construction tedious in MOSFETs.
9. FinFETs offer an excellent subthreshold slope and higher voltage gain than planar MOSFETs.

6. Evolution of memory technology.

Memory

Computer memory stores information, such as data and programs for immediate use in the computer. The term *memory* is often synonymous with the term primary storage or main memory.

