SMART **IN**

WHAT IS
3D TRANSISTOR?

Index

Telegram:

Your brain contains around 100 billion cells called neurons which are tiny switches that let you think and remember things. Computers contains billions of miniature called "brain cells" as well. They are called transistors and they're made of silicon, a chemical element commonly found in sand. Transistors have revolutionized electronics as they were the first invented inventions at Bell laboratories in New Jersey over half a century ago, by John Bardeen, Walter Brattain and William Shockley in 1947.Later they won noble prize in physics.

Fig 1: a replica of the first transistor

Though the transistors were made for the human wealth, it is also used as a weapon against 'Iran uranium nuclear power plant' in the summer of 2010.

The flash drive (commonly known as pen drive) invented in 1999 at Bell laboratories and M-sytems Isreal was armed with a specially virus called Stuxnet. During those cold war in Iran by the U.S government, the flash drive used this pendrive based computer virus to create great havoc in the uranium power plant. It disabled 1000 centrifuges temporarily to threaten the peoples of Iran.

From the scratch:

The team, led by Shockley, had been trying to develop a new kind of amplifier for the "US telephone system"—but what they actually invented turned out to have much more widespread applications. Bardeen and Brattain made the first practical transistor (known as a point-contact transistor) on Tuesday, December 16, 1947. Although Shockley had played a large part in the project, he was furious and agitated, being left out. Short lyafterward, during a stay in a hotel at a Physics Conference, he single-handedly figured out the theory of the junction

transistor—a much better device than the point-contact transistor.

What does a transistor actually do?

A transistor is really simple and omplex device. It is a miniature electronic component that can do two different jobs. It can work either as an amplifier or a switch.
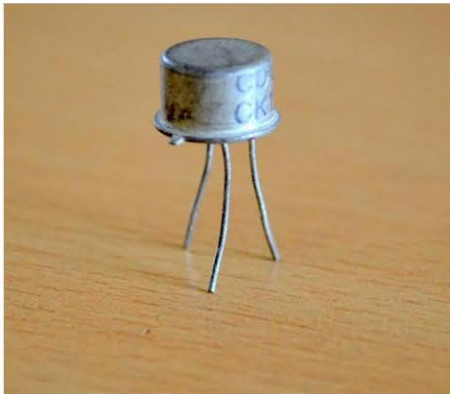

Fig 2: a transistor

Transistor as an amplifier, it takes in a tiny electric current at one end (an input current) and produces a much bigger electric current (an output current) at the other. In other words, it's a kind of current booster that comes in really useful in things like hearing aids, it was the first device for which the transistors were used for. A hearing aid has a tiny microphone in it that picks up sounds from the world around you and turns them into

fluctuating electric current. These are fed into a transistor that boosts them and powers a tiny loudspeaker, so you can hear a much louder version of the sounds around you. William Shockley, one of the inventors of the transistor, once explained transistor amplifiers to a student in a more humorous way: "If you take a bale of hay and tie it to the tail of a mule and then strike a match and set the bale of hay on fire, and if you then compare the energy expended shortly thereafter by the mule with the energy expended by yourself in the striking of the match, you will understand the concept of amplification."

Transistors can also work as switches. A tiny electric current flowing through one part of a transistor can make a much bigger current flow through another part of it. In other words, the small current switches on the larger one. This is essentially how all computer chips work. For example, a memory chip contains hundreds of millions or even billions of transistors, each of which can be switched on or off individually. Since each transistor can be in two distinct

states, it can store two different numbers, zero and one. With billions of transistors, a chip can store billions of zeros and ones and almost as many ordinary numbers and letters (or characters, as we call them). More about this in a moment.

(refer last page for answer)

How do transistors work in calculators and computers?

In practice, you don't need to know any of this stuff about electrons and holes unless you're going to design computer chips for a living! All you need to know is that a transistor works like an amplifier or a switch, using a small current to switch

on a larger one. But there's one other thing which is worth knowing: How does all this help computers store information and make decisions?
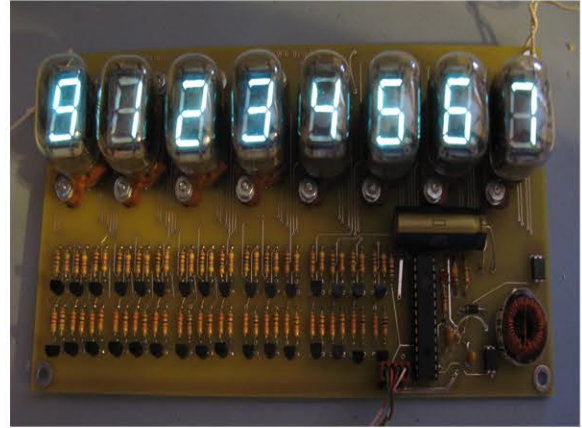

Fig 2.1: a calculator display

We can put a few transistor switches together to make something called a logic gate, which compares several input currents and gives a different output as a result. Logic gates let computers make very simple decisions using a mathematical technique called Boolean algebra. Your brain makes decisions in the same way. For example, using "inputs" (things you know) about the weather and what you have in your hallway, you can make a decision like this: "If it's raining AND I have an umbrella, I will go to the shops". That's an example of Boolean algebra using an AND "operator".

You can make similar decisions with other operators. "If it's windy OR it's snowing, then I will put on a coat" leaves an example of using an OR operator. Or how about "If it's raining AND I have an umbrella OR I have a coat then it's okay to go out". Using AND, OR, and other operators called NOR, NOT, and NAND, computers can add up or compare binary numbers. That idea is the foundation stone of computer programs- the logical series of instructions that make computers do things.
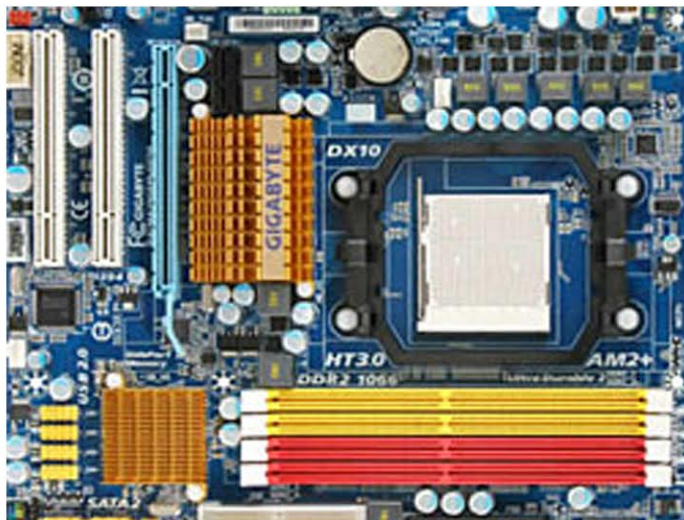

Fig 2.2: a motherboard

Normally, a junction transistor is "off" when there is no base current and switches to "on" when the base current flows. That means it takes an electric current to switch the transistor 'on' or 'off'. But transistors like

this can be hooked up with logic gates so their output connections feed back into their inputs. The transistor then stays on even when the base current is removed. Each time a new base current flows, the transistor "flips" on or off. It remains in one of those stable states (either on or off) until another current comes along a   flips it the other way. This kind of arrangement is known as a flip-flop and it turns a transistor into a simple memory device that stores a zero (when it's off) or one (when it's on). Flip-flops are the basic technology behind computer memory chips.

Do you know?

The longest word in any of the major English language dictionaries is *pneumonoultramicroscopicsilicovolcanoconiosis*, **a word that refers to a lung disease.The word was deliberately coined to be the longest word in English.**

Practicals:

Transistors are reduced to nanometer size by the use of Indium, Gallium, Arsenide which is made by the technique called molecular beam epitaxy, to grow a thin layer of Indium, Gallium Arsenide and electron beam lithography in fixed molybdenum to create gate source and drain. But drawback is that it is more expensive. It is used in 3D transistors and was discovered by Intel. Some of its applications include its usage in microphone ,hearing aids, pen drive, calculator and all electronic applications.
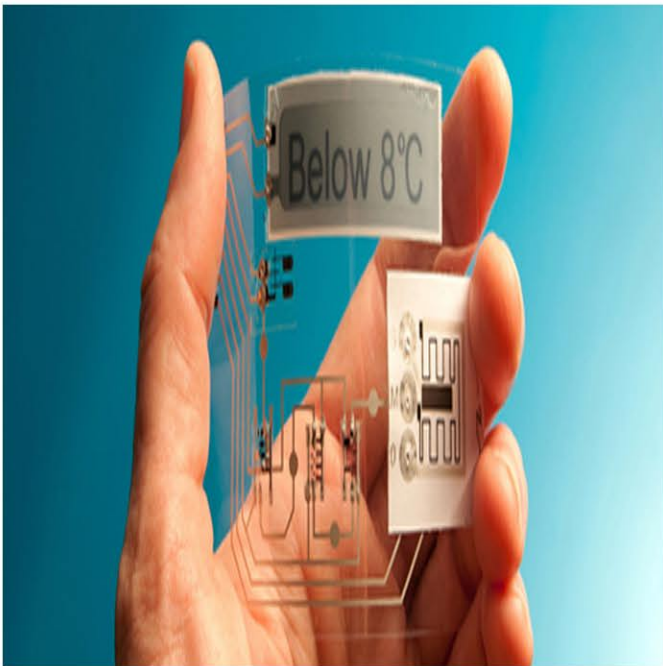

Fig 3: Temperature sensor in printed electronics display using transistor memory

Versatile Engineer:

Instrumentation is firing higher competitive world. In order to be successful we have to do some additional courses. One of them include radio frequency identification technology.

RADIO FREQUENCY IDENTIFICATION TECHNOLOGY:

Radio frequency identification (RFID) is a generic term that is used to describe a system that transmits the identity (in the form of a unique serial number) of an object or person wirelessly, using radio waves. It's grouped under the broad category of automatic identification technologies.
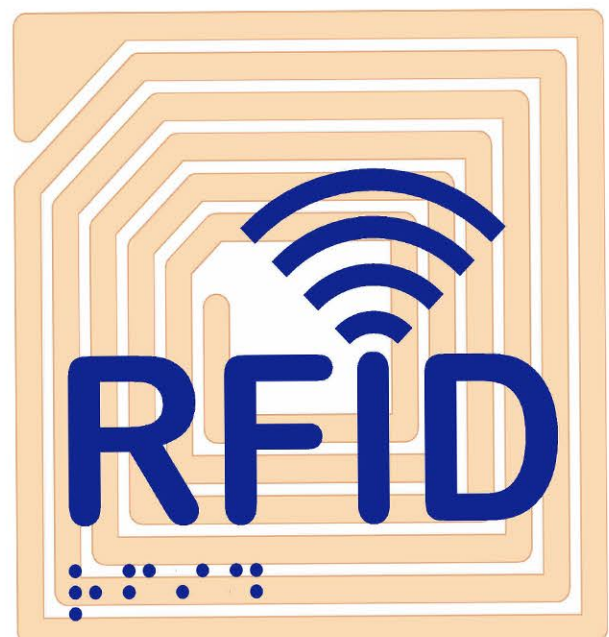
● Auto-ID technologies include bar codes, optical character readers and some biometric technologies, such as retinal scans. The auto-ID technologies have been used to reduce the amount of time and labor needed to input data manually and to improve data accuracy.

● Some auto-ID technologies, such as bar code systems, often require a person to manually scan a label or tag to capture the data. RFID is designed to enable readers to capture data on tags and transmit it to a computer system—without needing a person to be involved.

● A typical RFID tag consists of a microchip attached to a radio antenna mounted on a substrate.The chip can store as much as 2 kilobytes of data. For example, information about a product or shipment—date of manufacture, destination and sell-by date—can be written to a tag.
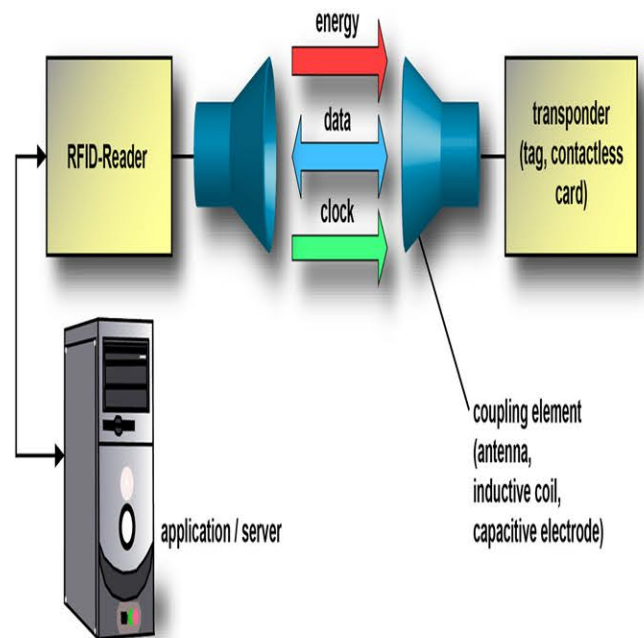

Fig 3.3: working of RFID

● To retrieve the data stored on an RFID tag, you need a reader. A typical reader is a device that has one or more antennas that emit radio waves and receive signals back from the tag. The reader then passes the information in digital form to a computer system.

Fig 3.2: Antennas read passive tags on cases stacked on a pallet

● This RFID technology is used in various domains to monitor machines, livestock sometimes it is even attached to cash and clothing. Hence this field has wide range of opportunities. This course is taught online at abisham.com

● According to payscale.com the salary offered for this job ranges from seventy thousand to two lakhs.
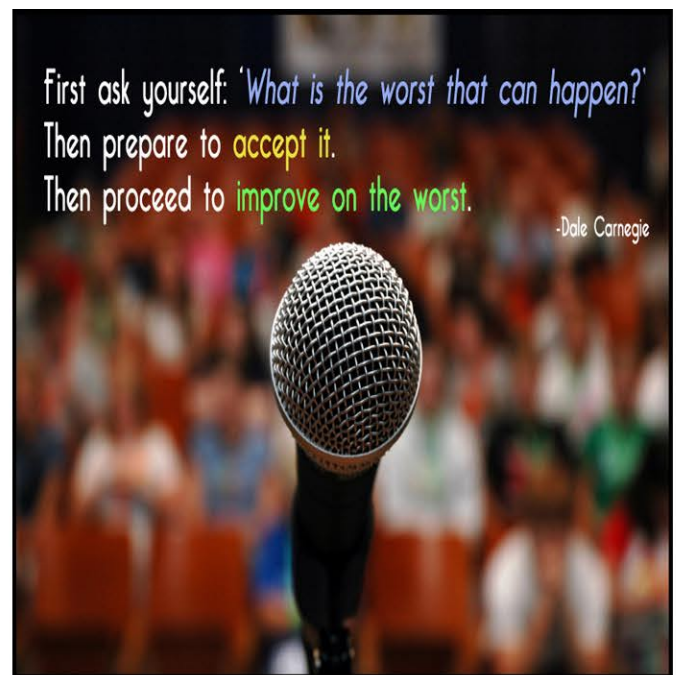
Communicable Engineer:

Fear during Public speaking or any other presentations is a simple issue but it may consume dangerous proportions, it hugely depends on the person undergoing fear or anxiety.

To overcome the fear of public speaking:

Our experts suggest some sort of methods to overcome fear, which include:

● The main issue as, don't treat your anxiety or fear as a dangerous one. It is a normal thing and it usually happens to every

person for quite a few minutes who is exposed to new environment.

First ask yourself: *'What is the worst that can happen?'* Then prepare to accept it. Then proceed to improve on the worst.
-Dale Carnegie

● Always keep in mind that anxiety or fear situation is an uncomfortable one and try to resolve it before the presentation.

● Don't try to fight and scare away your fear at the time of presentation, the more you try to fight, the more your anxiety increases.

● If you are a beginner you could memorize the first three lines of your speech keeping it as a constant template and as simple as possible.

● Try to Figure out which scares you the most and solve it at the time of preparation. This fear factor may include your pronunciation, non-verbal gestures, fluency, audience response etc.

Aptly aptitude:

Solving blood relation problems in resoning:

Blood relation problems play a major role nowadays. In order to make the blood relation problems easy there are some tricks. First, plot the five generation people starting from your grandparents to your grandchildren, include brothers and sisters. The members from your mother side are your maternal relationship while the members from your father side are called as paternal relationship. This tree gives you a better understanding on your family relations. The three methods to solve this technique include:

● Your success depends on the reaction of the audience. Instead of concentrating on your success you could concentrate more on your content, delivering style, confident level etc.

● Visualize only the positive aspects of your presentation and try to avoid the negative attitude.

● Assuming yourself in that situation:
Assume yourself as the given person in the question and try to connect to your relations. This gives you a better understanding and you will find it easy to solve the question.

● Finally, improve confidence on thyself. Your self-confidence helps you to achieve success.
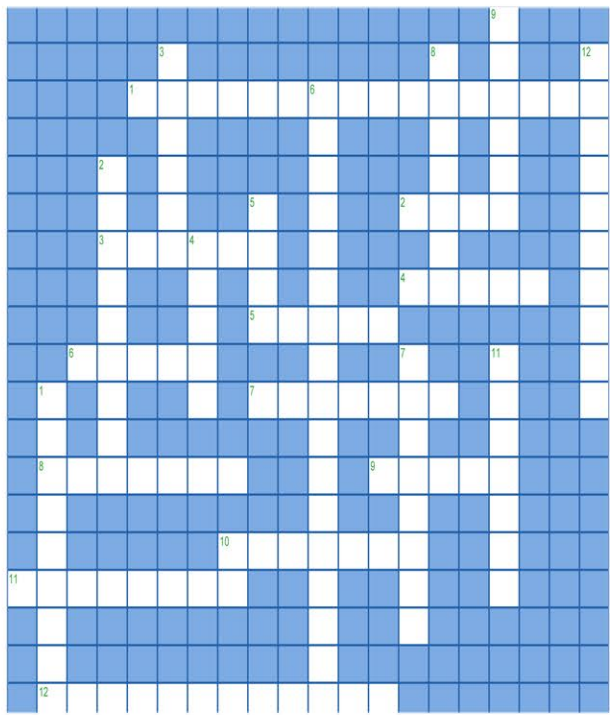
crossword:

(refer last page for answers)

clues for the cross-word:

Across:

1. Two resistors connected together, across a power supply (9, 7)
2. Process used to remove unwanted copper from a PCB (4)
3. Colour band used to indicate the number 7 (6)
4. Colour band used to indicate the number 0 (5)
5. Connects the components together on a PCB (5)
6. A component which allows current to flow only in one direction (5)
7. Makes a sound (7)
8. A collection of components, connected together (7)
9. The L in LED (5)
10. Flows through a circuit (7)
11. Electronics that works with real voltages (9)
12. Type of capacitor, which is polarised (12)

Down:

1. Shape of the schematic symbol for a resistor (9)
2. Stores charge (9)
3. Electrically joints components to a PCB (6)
4. Energy that allows the electronics to work (5)
5. Check the board works, after construction (4)
6. A chip / part with two row of pins (10, 7)
7. Component with coloured bands to determine it's value (8)
8. Something that can only be true / false, 0 or 1 (7)
9. Used to turn things on and off (6)
10. Letters used to mark commercial electronics sold in Europe (2)
11. Measured across components such as batteries (7)
12. A component that acts like an electronic switch (10)

● Make a step by step progress:

Other method include, writing the question in a sequence, interrupt and solving.

● Summarizing the entire content:

If the above two methods ends up in vain, this method is followed. Read the question twice, summarize the concept and try to answer.

Comparing the above methods the first analysis gives a better result. Though these techniques helps us in solving, we need continuous practice.

Questions:

1.Pointing to a photograph, Dilip said, "She is the daughter of my grandfather's only son." How is Dilip related to the girl in the photograph?

(1) Father   (2) Cousin
(3) Brother (4) Data inadequate

2.Pointing to a photograph Smita says, "This man's son's sister is my mother-in-law."

How is the woman's husband related to the man in the photograph?

(1) Son   (2) Nephew
(3) Grandson (4) Son-in-law

3.Ahmad said to Saira, 'Your only brother's son is my wife's brother'. How is Saira related to the Ahmad's wife?

(1) Mother in law (2) Sister
(3) Sister in law   (4) Aunt

4.If Nitesh   says, "Priya's mother is the only daughter of my mother", how is Nitesh related to Priya?

(1) Father   (2) Grand father
(3) Brother (4) Uncle

5.Pointing to a gentleman, Abdul said, "His only brother is the father of my daughter's father". How is the gentleman related to Abdul?"

(1) Uncle   (2) Brother-in-law
(3) Father (4) Grandfather

(refer last page for answers)

Watch out:
Current job openings in soliton:

Soliton is a company built on integrity, excellence and innovation. These values guide us, as we challenge ourselves to realize our dream of building a world-class Indian technology company. If you are highly moti vated individual dreaming of working with cutting edge technology and thrive on challenges, talk to us. We will provide you the freedom to aspire, create and achieve with us. The Soliton environment will nurture your skills and creativity, helping you develop professionally and personally.

Please send your application via email to *careers@soliton-tech.com.*
The subject line should start with the job code.

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● Lead a team of engineers through the entire life cycle of the project.
● Take up the ownership to grow existing customer accounts for Soliton.
● Participate in the recruitment and training to grow the project team.
● Participate in pre-sales and business development activities like proof-of-concept development, feasibility studies, and presentations to customers.

Desired Profile:

● Four or more years of experience in LabVIEW.
● Experience in leading teams is preferred.
● Proficiency in LabVIEW at the CLA level is required.

Semiconductor Test Automation Engineer (Austin,TX) (Job Code: SC-TA-0415)

• Engineering degree – B.E./B.Tech. in Electronics and Communication (ECE) / Electrical (EEE) / Electronics and Instrumentation (E&I) / Information Technology (IT). Masters degree is a plus.

• Excellent communication skills and the ability to guide and motivate team members.

• Interest and capability to quickly learn new programming languages and new technologies relevant to the Test & Measurement in automation domain.

Job Location:

The job location will be in Bangalore / Coimbatore with opportunities for onsite assignments in North America and Europe.

Soliton is a well regarded Engineering Services company with significant brand recognition and strong customer relationships in Texas. We are adding LabVIEW/TestStand engineers to the fast-growing semiconductor segment of our business. Candidate should be willing to explore and diversify their expertise as dictated by customer needs and be driven by a sense of integrity, strong team spirit and focus on customer delight. We are looking for go-getters with 1-3 years of hands-on experience who believe their technical and customer management skills are at the 3-5 years experience level. A strong command of engineering and architectural concepts, good communication skills and a can-do attitude are important traits.

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Key requirements for the current job profile:

- BSEE with 1-3 years of experience or MSEE with hands-on programming experience with LabVIEW, TestStand and/or PXI.
- Experience with Semiconductor Test (design validation or production test) is preferable, but not essential.
- Experience with Semiconductor ATE platforms such as Credence, HP, Advantec, Teradyne, LTX would be advantageous.
- Willingness to travel across North America and work briefly at customer sites during deployment and validation.
- Eagerness and ability to grow into an expert in Test Engineering for Semiconductor Production Test (and Semiconductor Validation) over time.
- Should be keen to augment skills in new allied technologies such as LabVIEW FPGA/Xilinx-/Altera based FPGA/ Microcontroller programming and system design.
- Strong Analytical, Learning and Communication skills.
- Deep desire to maximize value delivered to the customer and ensure customer delight.
- Align strongly with our core values of integrity and excellence.
- US Work authorization (US citizenship, Green Card or Visa) is required.

Responsibilities:

- Design, develop, test, optimize, deploy and validate test automation programs for high-volume production testing of ICs using the National Instruments Semiconductor Test System (NI STS is a new revolutionary platform)that is disrupting the multi-billion dollar semiconductor production test industry characterization and post-silicon validation of ICs in the lab.

Delivering innovation is a **shared passion** at Soliton.

● Collaborate with customers, National Instruments and colleagues located in geographically dispersed locations in different time zones to develop and deliver solutions.

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● Architect and develop modular software and infrastructure that enhances reuse.

Job Type : Full-time or Contract-to-Hire

Current Job Location : Austin (may involve travel or relocation)

Apply to careers.usa@soliton-tech.com

Updated version:
3D Transistor:

Intel has developed "Future Micro Processor 3D Transistor" to relentlessly pursue Moore's law (pace of technology advancement consumes expect can continue for years to come).
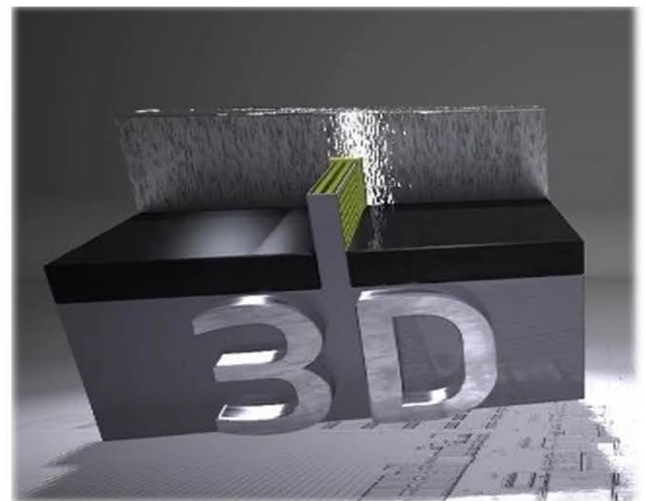
Days before 3D transistor, the core of microprocessor were 2D (planor) devices. The Intel 3D tri-gate transistor and the ability to manufacture it in high volume, make a drastic change in the fundamental structure of the computer chip. Based on this, the powering products can be leaded from the world's fastest super computers to very small mobile handhelds. Transistor's size and structure are at the very center of delivering the benefits of Moore's law to the user.

● The updaters predictably shrink its manufacturing technology in a series of world's first 45 nm with high-k/metal gate in 2007,32 nm in 2009 and now 22nm with the world's first 3D transistor in a high volume logic process, beginning in 2011.

● With a smaller 3D transistor, Intel can design even more powerful processor with incredible power efficiency. The new technology enables innovative micro-architecture system on chip (soI) designs, and new products from serves and pc's smart phones.

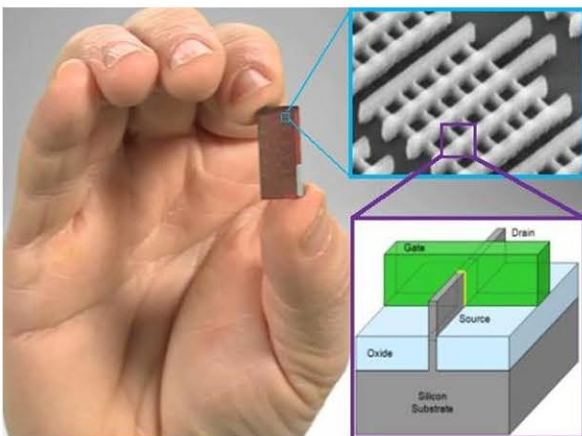## Transistors in the 3rd dimension:

Fig 8: a 3D transistors

3DTrigate transistors uses three gates wrapped around the silicon channel in a 3D

structure, enabling an unprecedented combination of performance and energy efficiency. Intel designedThe new transistors provide unique ultra low power benefits for use in handheld devices, like smart phones, tablets and so on.

Enabling processor innovation:

The new transistors are so impressively efficient at low voltages and specifically maximizes the benefit of the extremely low power 3D tri-gate transistor technology. This type of transistors have vertical current carrying channels whereas in older designs the channels lie flat under the gates.
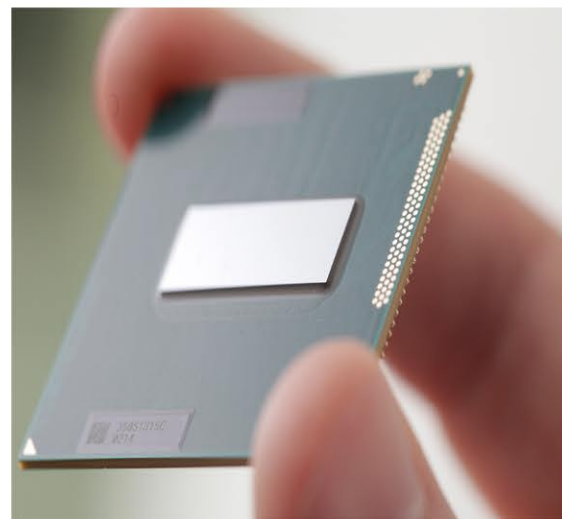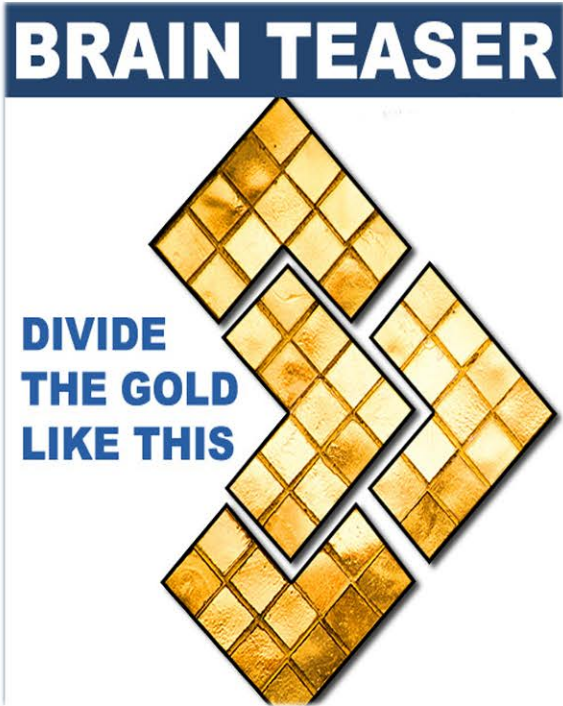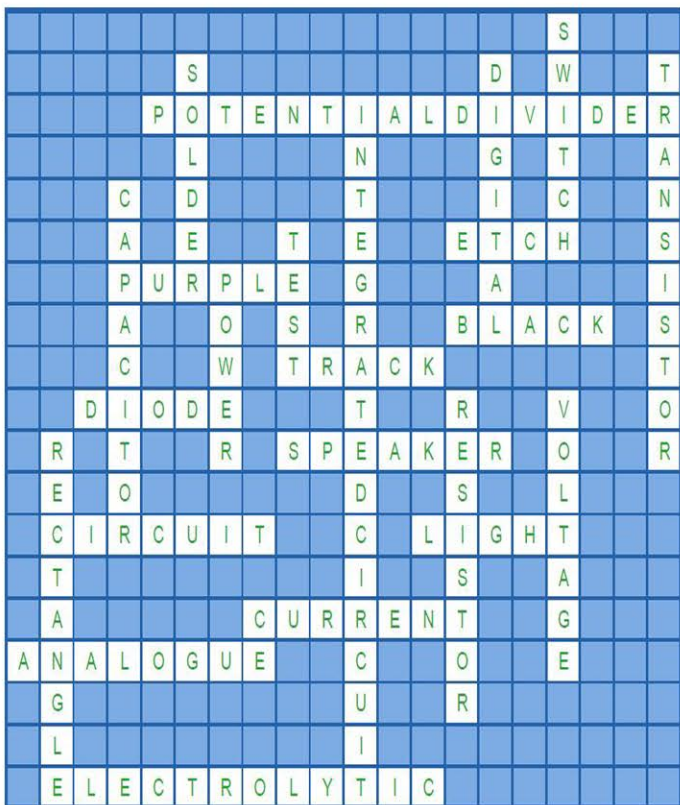

Fig 8.1: bridge processor incorporating tri gate transistor

Solutions:

BRAIN TEASER

DIVIDE THE GOLD LIKE THIS

Crossword:

Solutions:

1. Grandfather's only son i.e. father. Father's daughter i.e. sister. Dilip is, thus brother to the girl in the photograph. Hence, answer is (3) Brother.

2. Man's son's sister i.e. man's daughter. Man's daughter is the mother of Smita's husband i.e. he is the grandson of man in the photograph. Hence, answer is (3) Grandson.

3. Hence, Saira is Ahmad's wife's father's sister. i.e. "Aunt". Answer is (4) Aunt.

4. 'Only daughter of Nitesh's' mother means Nitesh's sister. Priya's mother is the Nitesh's sister. So, Nitesh is Priya's maternal uncle. Hence, answer is (4) Uncle.

5. 'Father of Abdul's daughter's father means-Abdul's father. Thus, the man's brother is Abdul's father or the man is the brother of Abdul's father i.e. Uncle of Abdul. Hence, answer (1) Uncle.

SMART IN TEAM

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