INTRODUCTION

Transistors are basic building blocks in analog circuit applications like variable-gain amplifiers, data converters, interface circuits, and continuous-time oscillators and filters. The design of the transistor has undergone many changes since it debut in 1948. Not only have they become smaller, but also their speeds have increased along with their ability to conserve power. Transistor research breakthroughs will allow us to continue Moore's Law through end of decade. IC Industry is making transition from Planar to Non-Planar Transistors**.** This development has potential to enable products with higher performance that use less power. Effective transistor frequency scaling is an ever present problem for integrated circuit manufacturers as today's designs are pushing the limits of current generation technology. As more and more transistors are packed onto a sliver of silicon, and they are run at higher and higher speeds, the total amount of power consumed by chips is getting out of hand. Chips that draw too much power get too hot, drain batteries unnecessarily (in mobile applications) and consume too much electricity. This is a major problem. If this power problem is not addressed, Moore's Law will be throttled and futuristic applications such as real-time speech recognition and translation, real-time facial recognition (for security applications) or rendered graphics with the qualities of video will never be realized. These types of applications will require microprocessors with far more transistors than today, and running at much higher speeds than today also the aging architecture simply is not well suited to scaling to high frequencies.

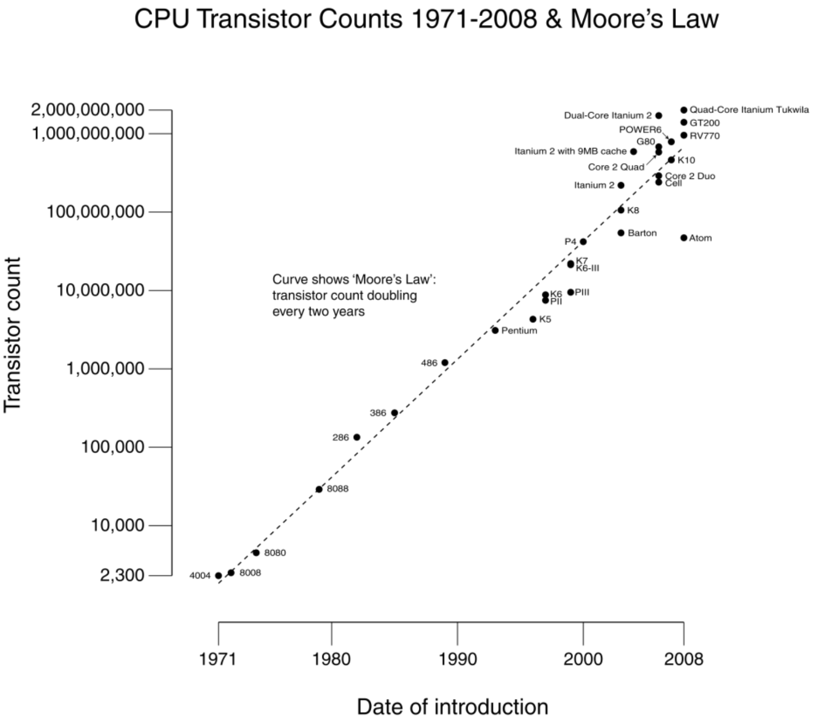
Engineers are already hard at work, developing new technologies to increase transistor efficiency and scaling. A recent dive through the Intel technology archives indicates that researchers are already forging ahead with exciting new architectures expected to deliver transistors capable of Terahertz operation by the end of this decade. Intel's researchers have developed a new type of transistor that it plans to use to make microprocessors and other logic products (such as chip sets) in the second half of the decade called "Terahertz" transistor. A Terahertz transistor is able to switch between its "on" and "off" state over 1,000,000,000,000 times per second (equal to 1000 Gigahertz.).That's why the name Terahertz transistor. The key problem solved by the Terahertz transistor is that of power, making the transistors smaller and faster is not feasible due to the power problem. Intel's new Terahertz transistor allows for scaling, and addresses the power problem. The goal with the TeraHertz transistor is that microprocessors will consume no more power than today, even though they will consist of many more transistors. The TeraHertz transistor has features, which solves the problems like unwanted current flow across gate dielectric, unwanted current flow from source to drain when transistor is "off" and High voltage needed and thereby increasing power usage.

Intel TeraHertz was Intel's new design for transistors. It uses new materials such as zirconium dioxide which is a superior insulator reducing current leakages. According to Intel, the new design could use only 0.6 volts. Intel TeraHertz was unveiled in 2001. As of 2010, it is not used in processors.

CHAPTER 1: EVOLUTION OF INTEGRATED CIRCUIT

The IC was invented in February 1959 by Jack Kilby of Texas Instruments. The planner version of IC was developed independently by Robert Noyce at Fairchild in July 1959. Since then, the evolution of this technology has been extremely first paced. One way to gauge the progress of the field is to look at the complexity of the ICs as a function of time.

Moore's law describes a long-term trend in the history of computing hardware. The number of transistors that can be placed inexpensively on an integrated circuit has doubled approximately every two years. The trend has continued for more than half a century and is not expected to stop until 2015 or later.



The capabilities of many digital electronic devices are strongly linked to Moore's law: processing speed, memory capacity, sensors and even the number and size of pixels in digital cameras. All of these are improving at (roughly) exponential rates as well. This has dramatically increased the usefulness of digital electronics in nearly every segment of the world economy. Moore's law describes a driving force of technological and social change in the late 20th and early 21st centuries.The law is named after Intel co-founder Gordon E. Moore, who described the trend in his 1965 paper. The paper noted that number of components in integrated circuits had doubled every year from the invention of the integrated circuit in 1958 until 1965 and predicted that the trend would continue "for at least ten years". His prediction has proved to be uncannily accurate, in part because the law is now used in the semiconductor industry to guide long-term planning and to set targets for research and development.

The history of ICs can be described in terms of different eras, depending on the components count. Small-scale integration (SSI) refers to the integration of 1-10^2 devices, medium-scale integration (MSI) to the integration of 10^2-10^3 devices, large-scale integration (LSI) to 10^3-10^5 devices, very large-scale integration (VLSI) to the 10^5-10^6 devices, and now Ultra large scale integration (ULSI) to the integration of 10^6-10^9 devices. Of course, these boundaries are somewhat fuzzy. The next generation has been dubbed *giga-scale integration* (GSI). Wags have suggested that after that we will have RSLI or "*ridiculously large-scale integration*".

CHAPTER 2: TRANSISTOR

The name *transistor* is a portmanteau of the term "transfer resistor".

A **transistor** is a semiconductor device used to amplify and switch electronic signals. It is made of a solid piece of semiconductor material, with at least three terminals for connection to an external circuit. A voltage or current applied to one pair of the transistor's terminals changes the current flowing through another pair of terminals. Because the controlled (output) power can be much more than the controlling (input) power, the transistor provides amplification of a signal. Today, some transistors are packaged individually, but many more are found embedded in integrated circuits.

The transistor is the fundamental building block of modern electronic devices, and is ubiquitous in modern electronic systems. Following its release in the early 1950s the transistor revolutionized the field of electronics, and paved the way for smaller and cheaper radios, calculators, and computers, amongst other things.

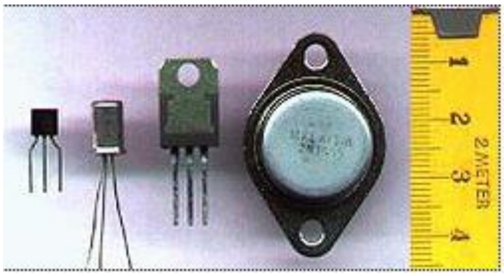


Figure 2.1: transistor

History

In 1947, John Bardeen and Walter Brattain at AT&T's Bell Labs in the United States observed that when electrical contacts were applied to a crystal of germanium, the output power was larger than the input. Solid State Physics Group leader William Shockley saw the potential in this, and over the next few months worked to greatly expand the knowledge of semiconductors. The term *transistor* was coined by John R. Pierce. According to physicist/historian Robert Arns, legal papers from the Bell Labs patent show that William Shockley and Gerald Pearson had built operational versions from Lilienfeld's patents, yet they never referenced this work in any of their later research papers or historical articles.

The first silicon transistor was produced by Texas Instruments in 1954. This was the work of Gordon Teal, an expert in growing crystals of high purity, who had previously worked at Bell Labs. The first MOS transistor actually built was by Kahng and Atalla at Bell Labs in 1960.

Types

Transistors are categorized by

- Semiconductor material: germanium, silicon, gallium arsenide, silicon carbide, etc.
- Structure: BJT, JFET, IGFET (MOSFET), IGBT, "other types"
- Polarity: NPN, PNP (BJTs); N-channel, P-channel (FETs)
- Maximum power rating: low, medium, high

- Maximum operating frequency: low, medium, high, radio frequency (RF), microwave (The maximum effective frequency of a transistor is denoted by the term f_T, an abbreviation for "frequency of transition". The frequency of transition is the frequency at which the transistor yields unity gain).
- Application: switch, general purpose, audio, high voltage, super-beta, matched pair
- Physical packaging: through hole metal, through hole plastic, surface mount, ball grid array, power modules
- Amplification factor h_{fe} (transistor beta)

Thus, a particular transistor may be described as *silicon*, *surface mount*, *BJT*, *NPN*, *low power*, *high frequency switch*.

Bipolar junction transistor

Bipolar transistors are so named because they conduct by using both majority and minority carriers. The bipolar junction transistor (BJT), the first type of transistor to be mass-produced, is a combination of two junction diodes, and is formed of either a thin layer of p-type semiconductor sandwiched between two n-type semiconductors (an n-p-n transistor), or a thin layer of n-type semiconductor sandwiched between two p-type semiconductors (a p-n-p transistor). This construction produces two p-n junctions: a base–emitter junction and a base–collector junction, separated by a thin region of semiconductor known as the base region (two junction diodes wired together without sharing an intervening semiconducting region will not make a transistor).

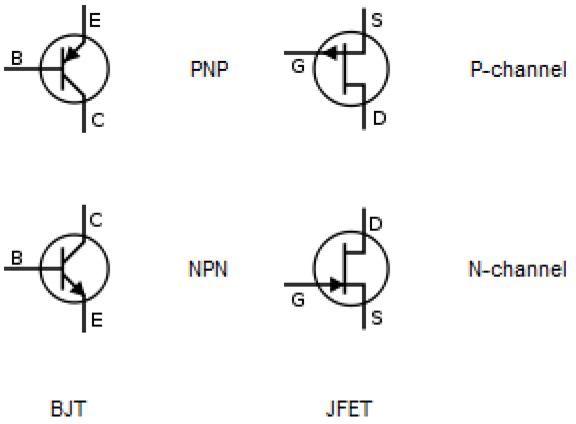


Figure 2.2: Symbol of BJT and JFET

The BJT has three terminals, corresponding to the three layers of semiconductor - an *emitter*, a *base*, and a *collector*. It is useful in amplifiers because the currents at the emitter and collector are controllable by a relatively small base current." In an NPN transistor operating in the active region, the emitter-base junction is forward biased (electrons and holes recombine at the junction), and electrons are injected into the base region. Because the base is narrow, most of these electrons will diffuse into the reverse-biased (electrons and holes are formed at, and move away from the junction) base-collector junction and be swept into the collector; perhaps one-hundredth of the electrons will recombine in the base, which is the dominant mechanism in the base current. By controlling the number of electrons that can leave the base, the number of electrons entering the collector can be controlled. Collector current is approximately β (common-emitter current gain) times the base current. It is typically greater than 100 for small-signal transistors but can be smaller in transistors designed for high-power applications.

Unlike the FET, the BJT is a low–input-impedance device. Also, as the base–emitter voltage (V_{be}) is increased the base–emitter current and hence the collector–emitter current (I_{ce}) increase exponentially according to the Shockley diode model and the Ebers-Moll model. Because of this exponential relationship, the BJT has a higher transconductance than the FET.

Bipolar transistors can be made to conduct by exposure to light, since absorption of photons in the base region generates a photocurrent that acts as a base current; the collector current is approximately β times the photocurrent. Devices designed for this purpose have a transparent window in the package and are called phototransistors.

Field-effect transistor

The *field-effect transistor* (FET), sometimes called a *unipolar transistor*, uses either electron (in *N-channel FET*) or holes (in *P-channel FET*) for conduction. The four terminals of the FET are named *source*, *gate*, *drain*, and *body* (*substrate*). On most FETs, the body is connected to the source inside the package, and this will be assumed for the following description.

In FETs, the drain-to-source current flows via a conducting channel that connects the *source* region to the *drain* region. The conductivity is varied by the electric field that is produced when a voltage is applied between the gate and source terminals; hence the current flowing between the drain and source is controlled by the voltage applied between the gate and source. As the gate–source voltage (V_{gs}) is increased, the drain–source current (I_{ds}) increases exponentially for V_{gs} below threshold, and then at a roughly quadratic rate($I_{ds} \propto (V_{gs} - V_T)^2$) (where V_T is the threshold voltage at which drain current begins) in the "space-charge-limited" region above threshold. A quadratic behavior is not observed in modern devices, for example, at the 65 nm technology node.

For low noise at narrow bandwidth the higher input resistance of the FET is advantageous.

FETs are divided into two families: *junction FET* (JFET) and *insulated gate FET* (IGFET). The IGFET is more commonly known as a *metal–oxide–semiconductor FET* (MOSFET), reflecting its original construction from layers of metal (the gate), oxide (the insulation), and semiconductor. Unlike IGFETs, the JFET gate forms a PN diode with the channel which lies between the source and drain. Functionally, this makes the N-channel JFET the solid state equivalent of the vacuum tube triode which, similarly, forms a diode between its grid and cathode. Also, devices operate in the *depletion mode*, they both have a high input impedance, and they both conduct current under the control of an input voltage.

Metal–semiconductor FETs (MESFETs) are JFETs in which the reverse biased PN junction is replaced by a metal–semiconductor Schottky-junction. These, and the HEMTs (high electron mobility transistors, or HFETs), in which a two-dimensional electron gas with very high carrier mobility is used for charge transport, are especially suitable for use at very high frequencies (microwave frequencies; several GHz).

Unlike bipolar transistors, FETs do not inherently amplify a photocurrent. Nevertheless, there are ways to use them, especially JFETs, as light-sensitive devices, by exploiting the photocurrents in channel–gate or channel–body junctions.

FETs are further divided into *depletion-mode* and *enhancement-mode* types, depending on whether the channel is turned on or off with zero gate-to-source voltage. For enhancement mode, the channel is off at zero bias, and a gate potential can "enhance" the conduction. For depletion mode, the channel is on at zero bias, and a gate potential (of the opposite polarity) can "deplete" the channel, reducing conduction. For either mode, a more positive gate voltage corresponds to a higher current for N-channel devices and a lower current for P-channel devices. Nearly all JFETs are depletion-mode as the diode junctions would forward bias and conduct if they were enhancement mode devices; most IGFETs are enhancement-mode types.

Simplified Operation

The essential usefulness of a transistor comes from its ability to use a small signal applied between one pair of its terminals to control a much larger signal at another pair of terminals. This property is called gain. A transistor can control its output in proportion to the input signal; that is, it can act as an amplifier. Alternatively, the transistor can be used to turn current on or off in a circuit as an electrically controlled switch, where the amount of current is determined by other circuit elements.

The two types of transistors have slight differences in how they are used in a circuit. A *bipolar transistor* has terminals labeled base, collector, and emitter. A small current at the base terminal (that is, flowing from the base to the emitter) can control or switch a much larger current between the collector and emitter terminals. For a *field-effect transistor*, the terminals are labeled gate, source, and drain, and a voltage at the gate can control a current between source and drain.

The image to the right represents a typical bipolar transistor in a circuit. Charge will flow between emitter and collector terminals depending on the current in the base. Since internally the base and emitter connections behave like a semiconductor diode, a voltage drop develops between base and emitter while the base current exists. The amount of this voltage depends on the material the transistor is made from, and is referred to as V_{BE}.

❖ Transistor as a switch

BJT used as an electronic switch, in grounded-emitter configuration. Transistors are commonly used as electronic switches, for both high power applications including switched-mode power supplies and low power applications such as logic gates.

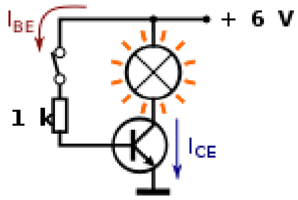


Figure 2.3: BJT used as electronic switch, in grounded-emitter configuration

In a grounded-emitter transistor circuit, such as the light-switch circuit shown, as the base voltage rises the base and collector current rise exponentially, and the collector voltage drops because of the collector load resistor. The relevant equations:

$V_{RC} = I_{CE} \times R_C$, the voltage across the load (the lamp with resistance R_C)
$V_{RC} + V_{CE} = V_{CC}$, the supply voltage shown as 6V

If V_{CE} could fall to 0 (perfect closed switch) then Ic could go no higher than V_{CC} / R_C, even with higher base voltage and current. The transistor is then said to be saturated. Hence, values of input voltage can be chosen such that the output is either completely off, or completely on. The transistor is acting as a switch, and this type of operation is common in digital circuits where only "on" and "off" values are relevant.

❖ Transistor as an amplifier

The common-emitter amplifier is designed so that a small change in voltage in (V_{in}) changes the small current through the base of the transistor and the transistor's current amplification combined with the properties of the circuit mean that small swings in V_{in} produce large changes in V_{out}.

Various configurations of single transistor amplifier are possible, with some providing current gain, some voltage gain, and some both.

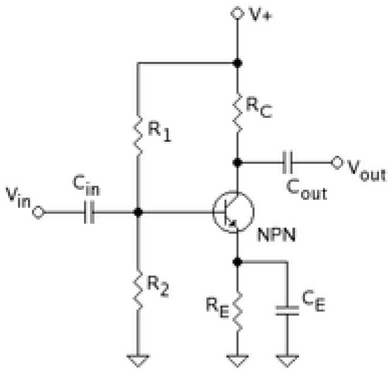


Figure 2.4: Amplifier circuit, common emitter configuration

From mobile phones to televisions, vast numbers of products include amplifiers for sound reproduction, radio transmission, and signal processing. The first discrete transistor audio amplifiers barely supplied a few hundred mill watts, but power and audio fidelity gradually increased as better transistors became available and amplifier architecture evolved.

Modern transistor audio amplifiers of up to a few hundred watts are common and relatively inexpensive.

What is suitable for Terahertz Transistor?

We have BJT and FETs. But FET has higher input resistance than that of BJT. FET is less noisy than BJT. FET is faster than BJT. FET is thermally more stable than the BJT sue to absence of minority carrier. Gain-Bandwidth product is greater for FET.

As Terahertz Transistor is a speedy device so, FET is the most suitable device for terahertz operation due to above parameters.

Limitation

The problem is that even the latest silicon-on-insulator or purified substrate technologies cannot sustain this growth model beyond the next two to three years. Using past development paths as an example, processor manufacturers would reach beyond a billion transistors per processor core by 2007. The level of sustained development is just not possible with today's Complementary Metal Oxide Switch transistors. A new CMOS design will be required if Moore's Law is to continue as a driving force in the semiconductor industry.

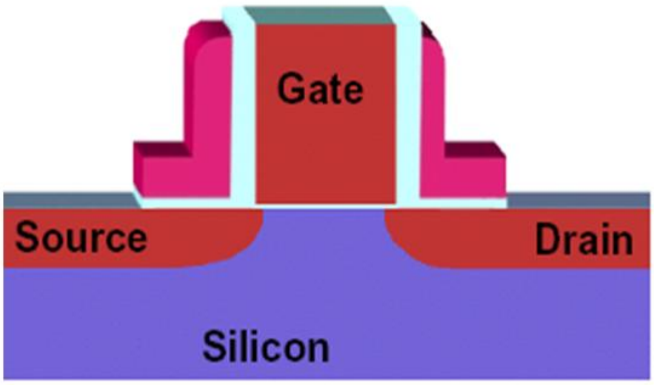


Figure 2.5: Normal MOS transistor

CHAPTER 3: FUNDAMENTAL CHALLENGE FOR THIS DECADE

Fundamental challenge for this decade is to continue Moore's Law without exponential increase in power consumption. This exponential rise in power consumption is driven by Transistor I_{off} Leakage, Transistor Gate Leakage, High Operating Voltage, Soft Error Rate, high source and drain resistance, high source and drain capacitance.

Transistor I_{off} leakage

Ideally, current only flows across the channel (directly beneath the gate) from source to drain when the transistor is turned ON. As transistors get smaller, current flows between the source and drain even when it shouldn't. If current flows under the channel when the transistor is turned OFF, it is called Off-state (or Sub-threshold) leakage. Sub-threshold leakage consumes power in the standby or off state. A leaky device requires a higher operating voltage.

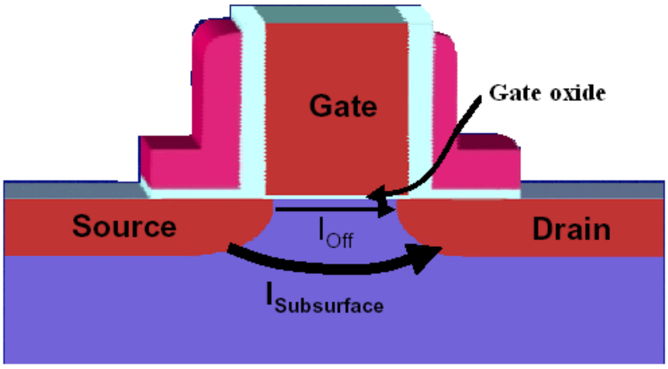


Figure 3.1: Transistor I_{off} Leakage

Transistor Gate Leakage

A gate dielectric is the material that separates a transistor's gate for its active region and controls the on and off switch. Current generation CMOS gate controllers operate with only a three atom thick dielectric layer for switching control. Thinner gates produce faster switching but are also responsible for current leakage, thus slowing the overall transistor efficiency due to capacitance issues. We have reached the limit of Gate Oxide (SiO2) scaling. 30nm transistor had 0.8nm gate oxide Thinner oxides leak more. Gate oxide can get so thin it no longer acts as a good insulator.

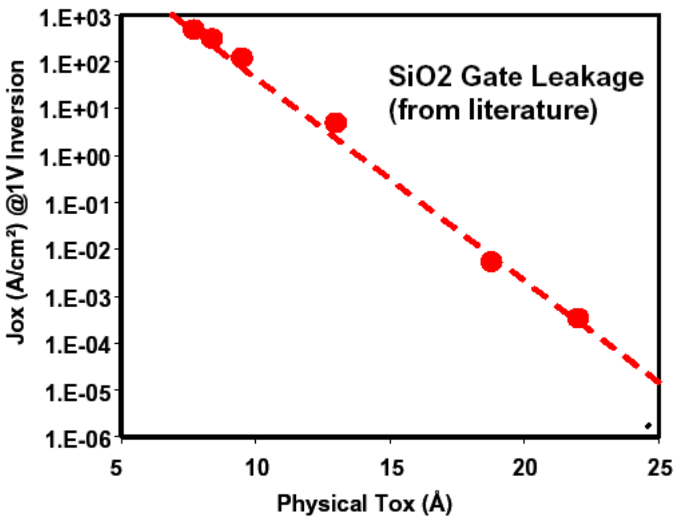


Figure 3.2: Current density(J_{ox}) vs Gate Thickness(T_{ox})

Soft Error Rate

Alpha particles (from atmosphere or package) strikes silicon. Impact causes ionization of charge carriers. This unexpected charge can cause a 'soft error' in the logic or memory cells. Smaller transistors are more susceptible to soft errors. Stray radioactive particles arrive from atmosphere or package which can lodge under transistor and affect its behavior. This is called Alpha Particle effect. Also charge can get trapped between the gate dielectric and the buried oxide layer, affecting behavior of the transistor. This is called "floating body" effect.

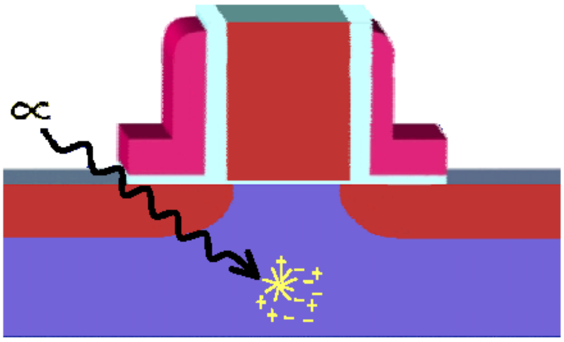


Figure 3.3: Soft Error Rate

High Operating Voltage

A high source and drain junction capacitance takes longer for the transistor to build up enough energy to switch on and off. Current "crowds" through thin source and drain regions, so they have more resistance. We can't lower the resistivity because Silicon doping density is at its saturation limit. When source and drains have high resistance, higher voltages are needed to move current carriers. A high source and drain junction capacitance takes longer for the transistor to build up enough energy to switch on and off.

Gate delay and Drive current

Gate delay is the time it takes for current to travel from the source to the drain (across the channel). Drive current is the amount of current that flows when the transistor is turned on. Smaller gate delay and larger drive current translates into FASTER transistors and circuits. To minimize gate delay and increase drive current high operating voltage is required.

CHAPTER 4: TERAHERTZ TRANSISTOR

Intel's researchers have developed a new type of transistor that it plans to use to make microprocessors and other logic products (such as chip sets) in the second half of the decade. The so-called "TeraHertz" transistors will allow the continuation of Moore's Law, with the number of transistors doubling every two years, each one capable of running at multi-TeraHertz speeds, by solving the power consumption issue. This will allow twenty-five more transistors than today's microprocessors, at ten times the speed. The transistors will also decrease in size with no additional power consumption. There will be approximately one billion transistors, which will be small enough to apply around ten million of them on the head of a pin. This transistor uses two brand new concepts. The TeraHertz transistor uses a depleted substrate transistor and a high k gate dielectric.

Depleted Substrate Transistor

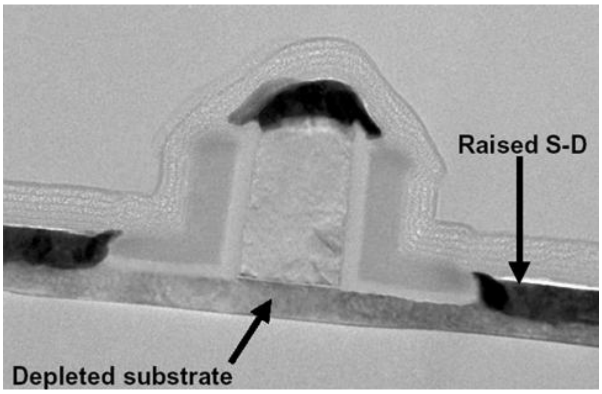


Figure 4.1: Depleted Substrate and Raised S-D

The depleted substrate transistor is new CMOS device where the transistor is built into a layer of silicon on top of a layer of insulation. This layer of silicon is depleted to create a maximum drive current when the transistor is turned on, which allows the switch to turn on and off faster. This ability to turn on and off faster maximizes the top clock speed of the processor and depletes power leakage by one hundred times. Addition of the oxide Layer in the depleted substrate transistor increases resistance in the source and drain. The Terahertz processor uses the high k gate dielectric.

Gate Dielectric

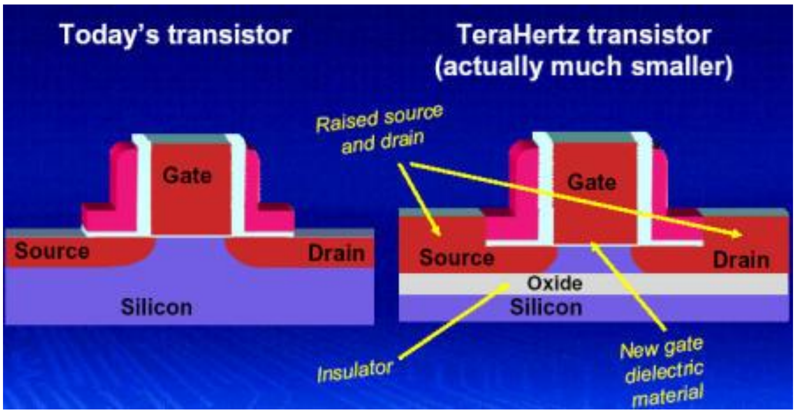


Figure 4.2: Structure of two different type of Transistor

All transistors have a gate dielectric. A gate dielectric is the material that separates a transistor's gate for its active region and controls the on and off switch. The high k gate dielectric is planned to replace the silicon dioxide which is currently the material used for the gate dielectric. This reduces gate leakage by more than ten thousand times, which is a major source of power consumption. This transistor will enable new applications sure as real-life voice and face recognition, computing without keyboards, and more compact devices.

CHAPTER 5: SOLUTION OF POWER PROBLEM WITH TERAHERTZ TRANSISTER

Solution of I_{off} Leakage

By placing an insulation barrier (oxide) between the CMOS gate and the base substrate we can reduce the power problem in to a significant amount. The insulator provides a boundary layer. No leakage path through substrate, i.e. the transistor is built into a layer of silicon on top of a layer of insulation. This layer of silicon is depleted to create a maximum drive current when the transistor is turned on which allows the switch to turn on and off faster. This ability to turn on and off faster maximizes the top clock speed of the processor and depletes power leakage by one hundred times.

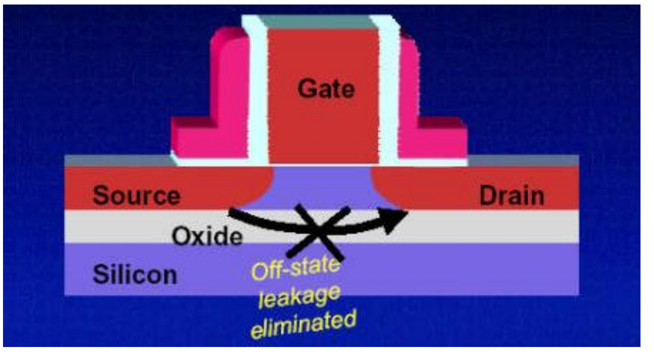


Figure 5.1: Solution of off-state leakage

Solution of Transistor Gate leakage by Gate Dielectric

Terahertz transistors propose the introduction of a new gate layer comprised of a high k dielectric material. The new material will replace today's silicon dioxide with a nano-fabricated dielectric material comprised of a Zirconium dioxide. The oxide layer blocks the path of this unwanted current flow. New material has same desired electrical properties but is physically thicker. ZrO2 is expected to offer several thousand times gate less voltage leakage, thus leading to lower power and higher frequency designs.

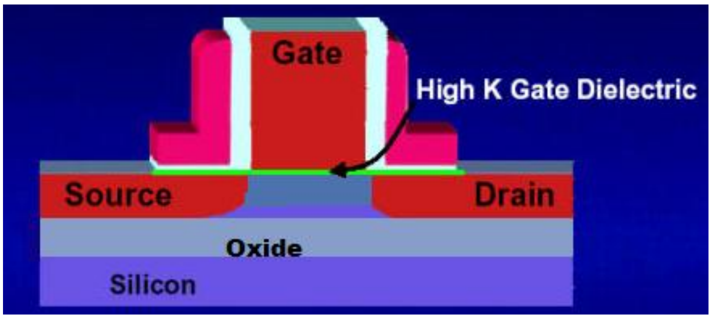


Figure 5.2: Solution of gate leakage

Resistance Reduction

An increase in the thickness of the electrical passage layer offers massive reduction in resistance, upwards of 30% in some situations. Thin passage ways have high resistance values due to

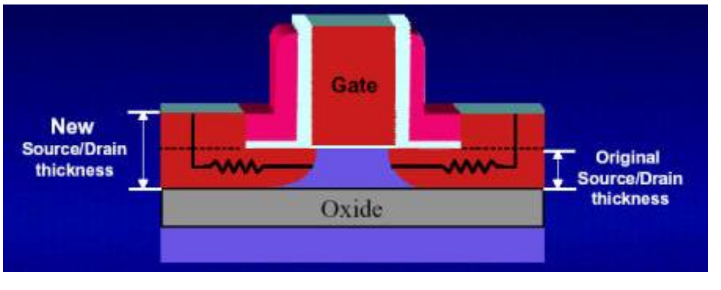


Figure 5.3: Increase of source and drain

electrons literally "crowding" the path, thus causing an electrical bottleneck. Higher voltages can be used to push the electrons through, but this also serves to increase the power demands of the transistor circuit. By increasing the transfer area, more electrons can pass through with less restriction, thus leading to decreases in resistance, switching latency, and power consumption.

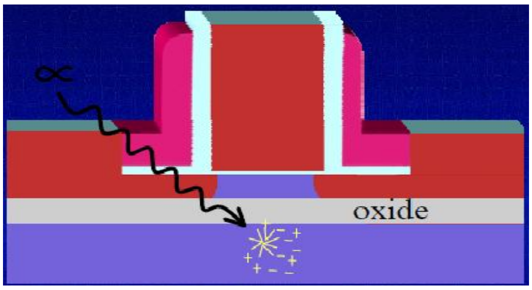


Figure 5.4: Solution of soft error

Solution of Soft Error Rate

Now the total substrate is in two regions. The upper region of the oxide layer is fully depleted. So, no chance for charge builds up in this region. For the other region below the oxide layer, alpha particles are absorbed deep into silicon where impact causes ionization of charge carrier. But this region is isolated from the transistor. So, ultimately soft error eliminates using DST technology.

Solution of High Operating Voltage

Due to nullify the off-state leakage, gate leakage, floating body effect and low resistance required voltage is now very small about 0.6V.

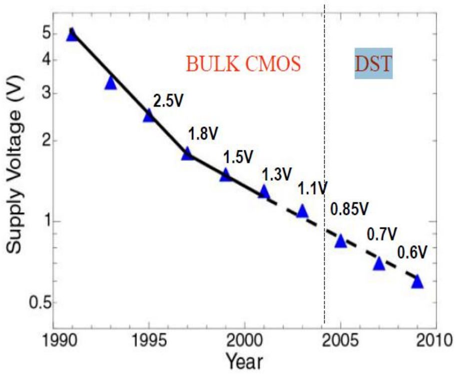


Figure 5.5: Operating voltage vs. year

Transistor Performance Comparison

Parameters	Bulk	SOI	DST
• **Si on Oxide Layer**	NA	~100nm	<30nm
• **Raised source-drain**	No	No	Yes
Junction Capacitance	Low	Lower	Lowest
Off-state leakage	Low	Lower	Lowest
Soft error rate	Low	Lower	Lowest
Floating body effect	No	Yes	No
Operating voltage	1.0x	1.0x	0.8x
Gate delay	1.0x	0.9x	0.7x

CHAPTER 6: ADVANTAGES OF TERAHERTZ TRANSISTER

1. Reduces leakage current by 10,000X for the same capacitance
2. Reduces unwanted current flow by 100X
3. Increased electron mobility
4. Increased reliability
5. High speed
6. Ease of circuit design
7. No leakage path through substrate
8. Lowest junction capacitance
9. Less voltage required to turn ON transistor
10. Eliminates subsurface leakage
11. Solves high resistance
12. Eliminates floating body effect
13. Minimizes soft error rates
14. 50% lower junction capacitance than that of Partially Depleted SOI

Chapter 7: Application

Due to its very difficult fabrication process the cost is high. So, these types of transistors are not used in general purpose. Intel launched world first THz transistor of speed 2THz in 2001.Also AMD, IBM made their first terahertz transistor in their lab of speed 3.3THz(AMD) and 2THz(IBM).Intel launched 10GHz processor in 2005 and their next processor of speed 20GHz will launched in upcoming year.

Today they are used in:

- Radio-telescopy and Sub-Millimeter Astronomy Devices
- Medical Imaging Devices
- Security Devices
- Manufacturing, Quality Control, and Process Monitoring

CHAPTER 8: NON-PLANER TRI-GATE TRANSISTER

The basic engineering approach to the Terahertz project is a planar transistor architecture, meaning it has a single gate control mechanism per transistor. A non-planar tri-gate transistor works via a three-dimensional design with three gate controllers per CMOS complex. Tri-gate transistors do not exhibit the substrate or gate layer thickness concerns presented earlier in for the planar Terahertz project. With more gates per transistor, the system is capable of sustaining higher voltage loads if required for specific implementations. A tri-gate arrangement allows for more electrons to be pushed through the transistor complex with further decreases in resistance, electrical leakage, and power consumption. Just think, Intel processors may attain frequencies well into the hundreds of Gigahertz, thus once again establishing the continuance of Moore's Law for at least another generation of upcoming semiconductor products.

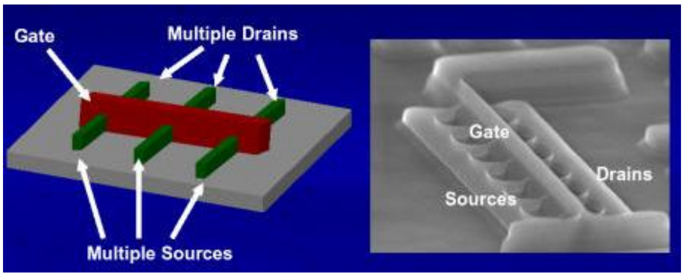


Figure 7.1: tri-gate transistor

CONCLUSION

In this paper we have defined new transistor architecture. The Terahertz transistor project is a culmination of several advanced research studies. The design will probably set the development path for integrated circuit technologies through 2010 and beyond. The Terahertz architecture offers increased frequency scaling, low latency, and significantly improved power efficiency. Intel is very excited about having developed the Terahertz transistor. By addressing the power problem, it paves the way for the continuation of Moore's Law through the end of the decade, and this will enable end user applications that are beyond our imagination today. As with any new technology, there are numerous technical issues that need to be resolved before volume production can begin. Intel believes that the Terahertz transistor architecture will be become the clear choice for the second half of the decade.

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