SEMICONDUCTOR MEMORY DESIGN AND APPLICATION (TEXAS INSTRUMENTS ELECTRONICS SERIES) pdf

1: Components & parts from Cypress Semiconductor

*Semiconductor Memory Design and Application (Texas Instruments electronics series) [Jack Luecke, William N. Carr] on www.enganchecubano.com *FREE* shipping on qualifying offers. Cloth. Very Good/Very Good. 8vo - over 7Ã‚Â¾ - 9Ã‚Â¾ tall.*

McDermott was one of the original founders of Geophysical Service Inc. The company was reorganized and initially renamed General Instruments Inc. Because there already existed a firm named General Instrument , the company was renamed Texas Instruments that same year. Texas Instruments exists to create, make and market useful products and services to satisfy the needs of its customers throughout the world. Clarence Karcher and Eugene McDermott founded Geophysical Service, an early provider of seismic exploration services to the petroleum industry. In , the company reorganized as Coronado Corp. Erik Jonsson, Cecil H. Army , Signal Corps , and the U. In , the company changed its name to Texas Instruments, with GSI becoming a wholly owned subsidiary of the new company. Semiconductors[edit] In early , Texas Instruments purchased a patent license to produce germanium transistors from Western Electric Co. Gordon brought with him his expertise in growing semiconductor crystals. Adcock, who like Teal was a physical chemist , began leading a small research group focused on the task of fabricating "grown-junction silicon single-crystal small-signal transistors. Adcock later became the first TI Principal Fellow. Working independently in April , Gordon Teal at TI created the first commercial silicon transistor and tested it on April 14, The Regency TR-1 used germanium transistors, as silicon transistors were much more expensive at the time. This was an effort by Haggerty to increase market demand for transistors. The military grade version of this was the series. This was over-turned on June 19, in favor of TI [27] note: Intel is usually given credit with Texas Instruments for the almost-simultaneous invention of the microprocessor. First speech synthesis chip[edit] In , Texas Instruments introduced the first single-chip LPC speech synthesizer. They soon focused on speech applications. This resulted in the development the TMC one-chip linear predictive coding LPC speech synthesizer which was the first time a single silicon chip had electronically replicated the human voice. In TI left the speech synthesis business, selling it to Sensory Inc. Both had red LED-segments-numeric displays. TI continued to be active in the consumer electronics market through the s and s. Early on, this also included two digital clock models; one for desk, and the other a bedside alarm. Though these LED watches enjoyed early commercial success thanks to excellent quality, it was short lived due to poor battery life. LEDs were replaced with LCD watches for a short time, but these could not compete because of styling issues, excessive makes and models, and price points. The watches were manufactured in Dallas and then Lubbock, Texas. The company for years successfully made and sold PC-compatible laptops before withdrawing from the market and selling its product line to Acer in During the early s, Texas Instruments instituted a quality program which included Juran training, as well as promoting statistical process control , Taguchi methods and Design for Six Sigma. TI went on to produce side-looking radar systems, the first terrain following radar and surveillance radar systems for both the military and FAA. In TI developed a microwave landing system prototype. The first single-chip gallium arsenide radar module was developed. In , TI won the Harpoon missile Seeker contract. Military computers See also: In , TI developed the data systems for Mariner Program. In California, it also had Hughes infrared detector and an IR systems business. When again the US government forced Raytheon to divest itself of a duplicate capability, the company kept the TI IR systems business and the Hughes detector business. As a result of these acquisitions these former arch rivals of TI systems and Hughes detectors work together. Artificial intelligence[edit] Texas Instruments was active in the s, in the area of artificial intelligence. In addition to ongoing developments in speech and signal processing and recognition, it developed and sold the Explorer computer family of Lisp machines. AI application software developed by TI for the Explorer included the Gate Assignment system for United Airlines, described as "an artificial intelligence program that captures the combined experience and knowledge of a half-dozen United operations experts. It is now part of

Computer Associates. TI still owns small pieces of software though such as the software for calculators like TI Interactive! During the same year, a separate online integrated circuit IC sample ordering system was launched to replace a physical room where orders were received via phone, fax, and email and then fulfilled by hand. In , the TI store inventory was expanded to include paid evaluation modules EVMs and a separate home-grown online evaluation module sample system was launched. This resulted in 3 separate eCommerce systems for TI: In , the TI store was completely redesigned using a new online platform. Additionally, sample evaluation modules were moved into the eStore from the home-grown application. In , at the TI store: These changes combined all evaluation and development modules, integrated circuits, and sample programs into one platform. In , the TI store increased its maximum order quantity from 99 to In December , Code Composer Studio v7 was released at no cost, as it included a new licensing model:

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2: Texas Instruments - Wikipedia

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By the s, some computational devices reached the level at which the losses from failures and downtime outweighed the economic benefits. During and immediately after World War II a phenomenon named "the tyranny of numbers" was noticed, that is, some computational devices reached a level of complexity at which the losses from failures and downtime exceeded the expected benefits. The invention of the transistor in led to the expectation of a new technological revolution. Fiction writers and journalists heralded the imminent appearance of "intelligent machines" and robotization of all aspects of life. On the contrary, dense packing of components in small devices hindered their repair. Jacobi disclosed small and cheap hearing aids as typical industrial applications of his patent. An immediate commercial use of his patent has not been reported. On May 7, , the British radio engineer Geoffrey Dummer formulated the idea of integration in a public speech in Washington: With the advent of the transistor and the work in semiconductors generally, it seems now to be possible to envisage electronic equipment in a solid block with no connecting wires. The block may consist of layers of insulating, conducting, rectifying and amplifying materials, the electrical functions being connected by cutting out areas of the various layers. Inductances L, load resistor Rk and sources are external. U - U output. Dummer later became famous as "the prophet of integrated circuits", but not as their inventor. In he produced an IC prototype by growth from the melt, but his work was deemed impractical by the UK Ministry of Defence, [8] because of the high cost and inferior parameters of the IC compared to discrete devices. Johnson described three ways of producing an integrated one-transistor oscillator. All of them used a narrow strip of a semiconductor with a bipolar transistor on one end and differed in the methods of producing the transistor. The strip acted as a series of resistors; the lumped capacitors were formed by fusion whereas inverse-biased p-n junctions acted as distributed capacitors. In , a variant of his proposal was implemented and patented by Jack Kilby. A MHz response could be achieved with two pentodes and six diodes per cell. This cell could be replaced by one thyratron with a load resistor and an input capacitor, but the operating frequency of such circuit did not exceed a few kHz. The works of â€” that used germanium thyristors were fruitless. In this register, one crystal containing four thyristors replaced eight transistors, 26 diodes and 27 resistors. The area of each thyristor ranged from 0. The circuit elements were isolated by etching deep grooves. Dimensions are shown schematically. Early transistors were made of germanium. By the mids it was replaced by silicon which could operate at higher temperatures. In , Gordon Kidd Teal from Texas Instruments produced the first silicon transistor, which became commercial in On December 1, , Jean Hoerni first proposed a planar technology of bipolar transistors. In this process, all the p-n junctions were covered by a protective layer, which should significantly improve reliability. However, in , this proposal was considered technically impossible. The formation of the emitter of an n-p-n transistor required diffusion of phosphorus, and the work of Frosch suggested that SiO_2 does not block such diffusion. Frosch used a thin oxide layer, whereas the experiments of â€” showed that a thick layer of oxide can stop the phosphorus diffusion. In , there was no way of forming many different electronic components in one semiconductor crystal. Alloying was not suited to the IC and the latest mesa technology had serious problems with reliability. There was no technology to electrically isolate components on one semiconductor crystal. There was no effective way to create electrical connections between the components of an IC, except for the extremely expensive and time-consuming connection using gold wires. It happened so that three different companies held the key patents to each of these problems. Sprague Electric Company decided not to develop ICs, Texas Instruments limited itself to an incomplete set of technologies, and only Fairchild Semiconductor combined all the techniques required for a commercial production of monolithic ICs. The only thing that a semiconductor company can successfully produce is semiconductors. All circuit elements, including resistors and capacitors can be made of a semiconductor. All circuit components can be formed on one semiconductor crystal, adding only the interconnections. Comparison of the oscillators by Johnson on the left, with an alloyed transistor, length: On August 28, , Kilby assembled the first prototype of an IC using discrete components and received approval for implementing it on one chip. He had access to technologies that could form mesa transistors, mesa diodes and capacitors based on p-n junctions on a germanium but not silicon chip, and the bulk material of the chip could be used for resistors. Between February and May Kilby filed a series of applications: Patent 3,, , U. Patent 3,, and U. He suggested that the initial application was filed on February 6 and lost, and the preserved resubmission was received by the patent office on 6 May â€" the same date as the applications for the patents 3,, and 3,, The numbering corresponds to File: Each crystal is 5 mm long. In autumn , Texas Instruments introduced the yet non-patented idea of Kilby to military customers. This generated an opinion that ICs can only justify themselves for aerospace applications. Gold wires acted as interconnections. On his way back to Massachusetts, Lehovec found a simple solution to the isolation problem which used the p-n junction: Therefore, any desired degree of electrical insulation between two components assembled on the same slice can be achieved by having a sufficiently large number of p-n junctions in series between two semiconducting regions on which said components are assembled. For most circuits, one to three junctions will be sufficient Cross-section of a three-stage amplifier three transistors, four resistors from U. Lehovec tested his idea using the technologies of making transistors that were available at Sprague. His device was a linear structure 2. Layers and transitions were formed by growth from the melt. The conductivity type was determined by the pulling speed of the crystal: The collectors and emitters of the transistors were created by welding indium beads. All electrical connections were made by hand, using gold wires. Nevertheless, on April 22, he filed a patent application at his own expense, and then left the United States for two years. Because of this disengagement, Gordon Moore concluded that Lehovec should not be considered as an inventor of the integrated circuit. Patent 3,, the planar process and U. Patent 3,, the planar transistor. Noyce considered the IC manufacturing process as follows. It should start with a chip of highly resistive intrinsic undoped silicon passivated with an oxide layer. The first photolithography step aims to open windows corresponding to the planned devices, and diffuse impurities to create low-resistance "wells" through the entire thickness of the chip. Then traditional planar devices are formed inside those wells. After formulating his idea, Noyce shelved it for several months due to pressing company matters, and returned to it only by March According to the patent, the invention consisted of preserving the oxide layer, which separated the metallization layer from the chip except for the contact window areas , and of depositing the metal layer so that it is firmly attached to the oxide. The deposition method was not yet known, and the proposals by Noyce included vacuum deposition of aluminium through a mask and deposition of a continuous layer, followed by photolithography and etching off the excess metal. According to Saxena, the patent by Noyce, with all its drawbacks, accurately reflects the fundamentals of the modern IC technologies. However, Kilby favored thick coating layers of different metals aluminium, copper or antimony-doped gold and silicon monoxide instead of the dioxide. These ideas were not adopted in the production of ICs. This prototype was not monolithic â€" two pairs of its transistors were isolated by cutting a groove on the chip, [75] according to the patent by Last. Then the micron-thick crystal was glued, face down, to the glass substrate, and additional photolithography was carried on the back surface. Deep etching created a groove down to the front surface. Then the back surface was covered with an epoxy resin, and the chip was separated from the glass substrate. Robert Norman developed a trigger circuit on four transistors and five resistors, whereas Isy Haas and Lionel Kattner developed the process of boron diffusion to form the insulating regions. The first operational device was tested in September 27, â€" this was the first planar and monolithic integrated circuit. Vice president of marketing believed that Last was wasting the company resources and that the project should be terminated. David Allison, Lionel Kattner and some other technologists left Fairchild to establish a direct competitor, the company Signetics. Signetics released the diode-transistor family Utilogic back in , but fell behind Fairchild and Texas Instruments with the expansion of production. Fairchild was the leader in the number of ICs sold in â€", but Texas Instruments was ahead in the revenue: In late , Sylvania launched the first family of transistor-transistor logic TTL ICs, which became a commercial success. The situation changed in when Texas Instruments started to zealously pursue the real and imaginary infringers of their patents and received the nicknames "The Dallas legal firm" [86] and "semiconductor cowboys". Westinghouse In â€", when these companies have adopted the planar process, the Westinghouse engineer Hung-Chang Lin invented the lateral transistor. In the usual planar process, all transistors have the same conductivity type, typically n-p-n, whereas the invention by Lin allowed to create n-p-n and p-n-p transistors on one chip. TI filed a case, which was settled out of court. Sprague On April 10, , Lehovec received a patent for isolation by p-n junction. Texas Instruments immediately filed a court case claiming that the isolation problem was solved in their earlier patent filed by Kilby. Robert Sprague, the founder of Sprague, considered the case hopeless and was going to give up the patent rights, was convinced otherwise by Lehovec. However, Lehovec conclusively proved that Kilby did not mention isolation of components. His priority on the isolation patent was finally acknowledged in April Fairchild On May 20, , Jean Hoerni, who had already left Fairchild, received the first patent on the planar technology.

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4: Texas Instruments - Transistor History

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Through the Second World War this business had declined and the company had survived on military electronics contracts. Jonsson knew they needed to diversify into new markets. Advanced parts manufacturing were considered. Click on these for full size images But those Type A Bell point contact transistors were fragile devices that did not deliver the promise of virtually infinitely long lifetime. But slowly, during and , a portion of it at least became clear to me, and this was that the future of electronics would be profoundly influenced by the knowledge already attained and the knowledge to be gained about materials at the structure of matter level. Get a license to the Bell transistor from Western Electric; Create a project engineering group to create, make and market semiconductors; and Establish a solid state physics research laboratory. Accordingly Olson, Jonsson and Haggerty pestered Western Electric for a license through without success. Due to the Korean War the US Military favoured secrecy around the transistor while the Department of Justice demanded commercial openness through an anti-trust action. GSI quickly signed up. On January 1st a new parent company was launched initially named General Instruments and GSI was relegated to a subsidiary. But the new name was already in use by an East Coast defence contractor and a year later the company was renamed Texas Instruments or TI for short. The transistor is a very new development, primarily of Bell Telephone Laboratories, which promises to revolutionise electronics. It is, in a general sort of way, a substitute for the vacuum tube Some attendees complained that the Symposium was unhelpful. They did a very good job; it was very open and really very helpful. After seeing the Bell design during the Symposium, Cornelison returned to his hotel room that night and made two sketches in the back of his spiral note book of what he had seen that day. Scan courtesy of Ed Millis Shepherd was appointed project manager of the Semiconductor Project Engineering Group and established a group of 15 engineers. Despite its enthusiasm TI had no semiconductors experience and it trailed behind other mainstream vacuum tube producers such as General Electric, Raytheon, RCA, CBS, Sylvania and others such as Transistor Products and who were already producing point-contact diodes and General Electric which also had a junction diode. And these companies were making good progress with transistors. Collection of early point-contact transistors in development in the period courtesy Joe Knight. For full legend see here. For example, by there were several point-contact transistors manufacturers in addition to Western Electric: At the same conference Bell discussed the development of their grown junction transistor; an approach that General Electric were also pursuing leading to their invention of the rate grown junction transistor. TI successfully pulled its first crystal in June using the last of two seed crystals supplied by Bell. By August TI was producing its first point-contact transistors. Having succeeded in obtaining a license and setting up its semiconductor project engineering group, Haggerty addressed phase three of his strategy: A solid state physics laboratory. Teal set out his agenda for a grown junction silicon transistor: I persuaded Dr Willis A Adcock, an able young scientist, to leave his catalysis studies in one of the oil industry laboratories and join TI to undertake these crystal growing investigations, which I believed to be the key to the achievement of a silicon transistor. I reasoned that going the grown junction route would avoid the differential expansion difficulties between silicon and an alloying electrode inherent in use of alloy junctions. Others were less favoured. At General Electric the inventor of the alloy junction transistor, John Saby complained: Other manufacturers concentrated on germanium alloy junction transistors which became the volume workhorse of the s due to their better adaptability to mass production. First Transistors Having made its first point-contact transistors in August of the Types and were soon available. They were made in small quantities supplied for use by engineers doing transistor circuit development. Visually they were very similar to Western Electric point-contact transistors. Indeed, package piece parts were obtained from Western Electric tooling. The Type was designed for switching and the Type as a high efficiency low-drain transistor for low frequency below 1 Mhz. The announcement noted that by May developmental quantities of junction transistors would be available. These transistors were for development only and due to problems in their manufacture were discontinued in April , soon after their introduction. Advertising from Electronics March courtesy Joe Knight. In September , TI introduced Types and in an improved hermetically sealed can. Previously a watchmaker, he had mastery of the delicate touch needed to assemble these fragile devices. The entire process was carried out manually. Once dried, we canned the transistors in oil for heat sink purposes. Then someone noticed that no point contacts had been sold in months. My short and easy career of being the foreman of the point contact transistor assembly line came to an end, as we soon ceased production of this type. The NPN transistors were grown by pulling crystalline germanium from a crucible of molten N-type germanium. At controlled intervals the germanium melt was changed to P then back to N creating an NPN block from which small bars could be sliced to make individual transistors. The first grown junction transistors produced by TI were the types and introduced in November, , and exhibited at the March, , IRE show. They were originally made in the tall cans used in the or point-contact types before standardising on the lower profile cans. This transistor was much more rugged, could dissipate more power, was more reliable and easier to build. The combination of these attributes opened up a wider range of potential uses and applications. It was assembled in a small case with a strap to resemble a wrist watch and produced a voice actuated signal. A conventional receiver several feet away picked up the signal and actuated a spark which cut the ribbon for the official opening. Advertisement from November Electronics Magazine courtesy Steve Reyer The power type had a copper heat sink soldered to the can for heat dissipation and was rated for 1 Watt at 25 degrees C. The bar size was. At first, this applications group consisted of two people â€” Jim Nygaard and Ed Millis if my memory is correct. The relatively small size and low power characteristics of the junction transistor led to the exploration of use in hearing aids with the Sonotone Corporation. At that time there was no experience in the electronics industry in the use and applications of transistors. We had the devices available, but no one outside the manufacturers of transistors knew how to use them. Sonotone ordered transistors for its hearing aids. These transistors were probably intended for the Sonotone hearing aid which was its first fully transistorised model and for which examples survive with original Texas Instruments transistors. Problems of quality control explains the lack of consistency in what could be used. As a result, we had to select devices from a manufactured batch that met a combination of gain and low noise sufficient to support the hearing aid business. We used a color code to identify the performance level of specific devices. Can you imagine using colored paint yellow, green and red to identify transistors that could be used to make a complete set for a hearing aid? Then a thin seed crystal was lowered into the molten germanium and spun while slowly withdrawn from the melt. By careful selection of the melt temperature and the rate of withdrawal a single crystal of very pure germanium could be pulled. Then the crystal was sliced into thin bars and mounted on a header each end providing the collector and emitter connections. Through a delicate operation a connection was made to the narrow base region and terminated to the base lead on the header.

5: Semiconductor Diodes - Engineering World

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