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Analysis of ASIC Design Methodology in Advanced Digital System

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ABSTRACT: In our day to day life, we come across various types of electronic gadgets .“Integrated circuit” is one of the technologies that brought a revolution of changes in the production of electronics. With the invention of integrated circuits, the size of electronic products got reduced by increasing the density of logic gates per chip. As weobserve today we find plenty of IC’s designed for different purpose. IC’s can be used for one specific application while some IC’s can be reprogrammed and used for various applications. These typesof IC’s are named as ASIC’s. The term ASIC refers to an IC manufactured for a particular set of requirements and so contains circuits customized for those requirements. This paper deals with the ASIC importance in present technology.

KEYWORDS: ASIC, Integrated circuits, Logic gates

I.INTRODUCTION

Nowadays ASIC is spreading vast in every field such as medical, military, agriculture, aerospace, in electronic gadgets and so on.

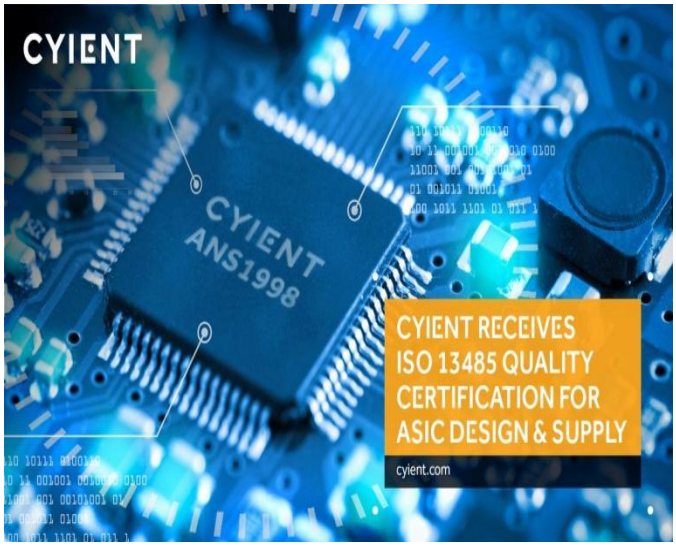
[1].The development of IC technology beyond the LSI level led to very large scale integrated (VLSI)Circuits .The term application-specific integrated circuit, or ASIC, refers to an IC manufactured for . It is designed to meet a particular set of requirements, and so contains circuits customized for those requirements, It may be designed for a particular end product provided by one manufacturer, for example, a portable music player, a toy, an automobile, a piece of military equipment, or an industrial machine. Alternatively, it may be designed for use in a range of products provided by manufacturers in a particular market segment. These kinds of ASIC are sometimes called application-specific standard products, or ASSPs, since they are treated as a standard part within the market segment, but arenot of use outside that segment. Examples include ICs for cell phones, which are used by a number of competing cell-phone manufacturers, but which are not of use in, say, and automobile control circuits.

[2]. One of the main reasons an ASIC is developed for a product is that, being customized for that application, it has lower cost per IC than a programmable component such as an FPGA. However, in order to achieve that level of customization, we need to invest much more design and verification effort. We must amortize the non-recurring engineering (NRE) cost over the entire product units sold.
Hence, it only makes sense to use an ASIC if our product sales volume is sufficiently large. The amortized NRE cost per unit should be less than the cost difference between an ASIC and a programmable part.

[3]. ASICs are quite different from other standard ICs like microprocessors or memories as these are designed to be used in a wide range of applications, an ASIC can only be used in the application it was specifically designed to run. Due to the application specific custom nature of the ASICs,they often pack more functionality at the same time being small in size, consuming less power and dissipating less power when compared to the standard IC solutions.

[4]. The main advantage of ASIC is chip size reduced as large number of functional units of a circuit are constructed over a single chip. Modern ASICs includes 32-bit **microprocessor**, memory blocks, network circuits etc…Such type of ASICs is known as **System on Chip**. With development in the manufacturing of technology and increased research in the design methods, ASICs with different levels of customization are developed. circuits are present side by side. So, minimal routing is needed to connect a various circuits.

[5]. The invention of ASIC has caused a tremendous change in the way of electronics used. We use ASICs in our daily life for various applications.
In this paper we will talk about the importance of ASICs in the present technology and the importance of ASICs in the different fields such as medical , military, agriculture , aerospace and so on.



II.ASIC IN MEDICALFIELD

A.ASIC IN MEMS TECHNOLOGY

Medical healthcare has become one of the fastest growing and largest industries in the world, and life has become very precious to each and everyone.The many reasons to consider analog ASICs in medical applications are striking and admittedly, for the uninitiated, the idea can be overwhelming. For example, analog ASICs can simplify the sensor conditioning and calibration because of the flexibility of their form factor.
The arriving of Application Specific Integrated Circuits (**ASIC**)-MEMS has created a replacementsolution for the **healthcare facilities** With the shift from **medical** devices from the hospital business to non public **use**, miniaturization(reduce the size) , reliability and battery life have become one of the new demands in the **healthcare** market.

Todays medical ASIC are used in implantable medical devices aimed at providing therapy for a number of conditions from pain management to elilepsy and phychological disorders.
ICs perform variety of supporting functions for implants medical devices,such has sensing , simulation , memory storage microprocessor, communication and power management .All of this functionality is delivered in a small integrated circuit with a smaller footprint than other solutions. And unlike the commercial use of integrated circuits which change with the new technology, integrated circuits for medical devices have a process maturity that is less likely to require revisions, provides more quality, and offers a strong and healthy solution that works.
Medical health technology has become one of the fastest growing in the world, Micro –electro-mechanical systems (MEMS) is one of the most revolutionary semiconductor components,The advent of ASIC -(MEMS) has created a new era for the healthcare industry.
Micro LED mainly uses the MEMS micro fabrication technology to micronized array and thin film the traditional led crystal film.It uses a transfer technology to mass transfer the crystalline film to the circuit board.The micro LED die is transferred to the circuit board in a large amount and the brightness and constant can be improved by integrating the micro lens array, an array displays images,micro LED panel , has scanning blood vessels positionsand perform blood vessel product (PPG) detection. ASIC-MEMS can be used by telemedicine providers in blood flow monitoring through micro LED arrays detecting blood flow through ASIC-MEMS can reduce the cost of medicine.This system is the fastest to reach data can be uploaded to the cloud,Data can be uploaded to the cloud , doctors in the remote places can evaluate the data.

The great advantage of this methodology is possibility of usage such tools like Cadence Spectre RF. It is important in case of charge-balanced front-ends because those front-ends are switched-capacitor circuits. So standard AC analyses cannot be used. And Spectre-RF gives possibility of proper dynamic analysis of circuit using PSS and PAC analysis. Also noise analysis using pnoise tool can be done

B.MEDICAL ULTRASOUND SYSTEM WITH ASIC

An Application-specific integrated circuit (ASIC) of special are used in ultrasonic probe array systems. Ultrasound imaging technology in the field of biomedical.Ultrasound is a non-radioactive non-invasive technology, high security.This system has been widely used in medical testing. Ultrasound of the image quality sophisticated. In the resolution and convenience is rising. There is a trend of sustained growth among them in the high-end 3D, 4D images and entry-level models Transducer in the vibration echo technology produced very short ultrasonic vibration medical ultrasound equipment currently used.

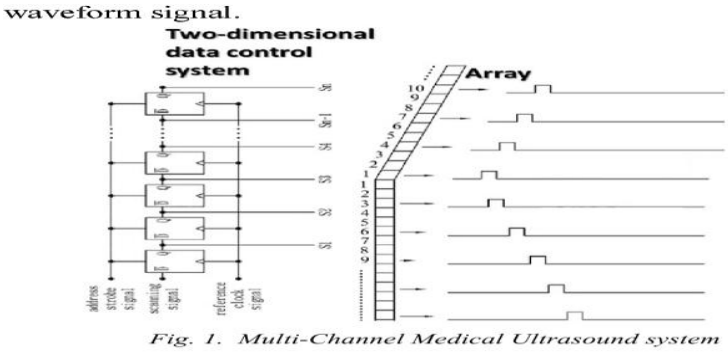


Fig. 1. Multi-Channel Medical Ultrasound system

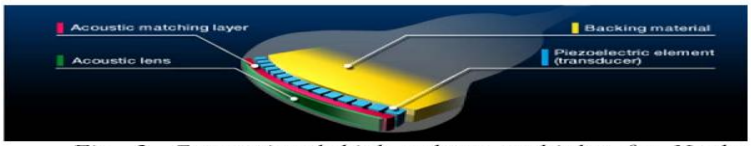


Fig. 2. Conventional high voltage multiplex for N channel scanner with M elements of linear probe (N < =M)

The odd probes and the even probes of the address parameters in numerical order to form an activation sequence as shown in figure.1 .For example the mode setting module arranges the odd probes of the address parameters in numerical order,such as 1,3,5,7,….,63,followed bby the even probes of the address parameters in numerical order,such as 2,4,6,..,64 to form the activation sequence 1,3,5,7,…,63,2,4,6,.
Alternatively,the sequence may be 2,4,6…,64,1,3,5,7,…,63. other embodiments.Conventional high voltage multiplex for N channel scanner with M elements of linear probe(N<=M) is shown in fig 2.

C.HIGH EFFICIENT POWER MANAGEMENT ASIC FOR HEARING AID

The power management ASICs are developed for the battery powered implanted hearing aids. The ASIC converts the power of both the single or stacked ZnO2 or Li-Ion batteries to power the audio capture chain including ADC, a class D audio driver chain and the digital audio processing. It also manages the inductive communication between the hearing aid and the implant.

FEATURES

- Versatile high-efficiency buck/boost DC-DC converter
- Digital Noise Reduction
- Digital feedback Reduction
- Audio capture chain (amps and 12-bit ADC)
- Multiple programs
- Self learning
- Frequency Shifting

- Audio quality class D output driver
- Directional Microphones
- Battery safety features and low leakage
- 0.1µm CMOS Technology
- Low power consumption

fig.3 .HEARING AID

GAS SENSOR DRIVER /READOUT ASIC WITH INTEGRATED MCU

The ASIC interfaces with the latest generation of MOX (Metal Oxide) gas sensors to measure VOCs (Volatile Organic Compounds). It contains heater drivers, a high-precision readout chain and an embedded MSP430 microcontroller core. The ASIC is meant towards low area and ultra-low-power consumption targeted to the mobile phone market.

FEATURES

- High-precision resistance measurement to detect gas concentrations
- Time-multiplexing to minimise silicon area
- 12-bit ADC
- MSP430 core for increased system flexibility
- Temperature ranges: -40°C – 100°C
- 0.18um CMOS (with embedded Flash)

Fig.4

OTHERTYPICAL HEALTHCARE/MEDICAL ASICs

- Motion and gait monitoring and analysis
- Neurological sensors
- Lab-on chip interfaces
- RFID and tags

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- Orthopedic sensors
- Glucose meters
- Ingestible sensor
- Neurological simulators

III. ASIC IN AUTOMOTIVE

ASIC in Automotive are adaptive. Some ICs drive the miniaturization of automotive electronic system. They are customized to individual applications and essential for functions such as Air bag System.ASCI are used in vehicle air bags, engine management ,transmission control system,advanced driver assistance, systems,in-vehicle communication and alternator electronics. ASCIs are used in automated valet parking Driver assistance systems for passenger cars,sense,think,act localization for automated driving.ASIC architecture that includes position control, speed control, timing control. In addition, these ASCIs must also meet strict standards for reliability and safety. ASCIs are used in tyre pressure monitor.

fig.5

Looking at domestic automakers, customer satisfaction results are mixed, but none of the Detroit Big Three improve from a year ago. The close race between Ford and General Motors continues, with the two deadlocked at 80. For GM, this score is stable whereas Ford sees a 1% decline.

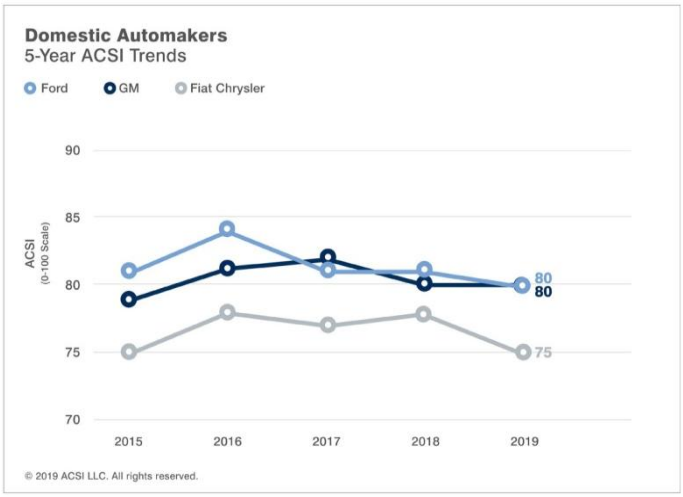

Fig.6 FIVE YEAR ASCI TRENDS

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OTHERAUTOMOTIVE ASCI APPLICATIONS

- Wireless charging and docking
- LED driver
- USB hub and charging control
- High accuracy and fast locking multistandard GNSS
- eMirrors
- Car alarm and security system
- Ethernet bridges and switches
- Edge processing of sensor data

IV.ASCI IN NAVY AND AEROSPACE

ASIC are helped in designing complex monolithic microwave integrated circuit (MMIC) application specific integrated circuit (ASICS) and printed circuit boards for advanced RF and microwave applications like radar,munitions guidance,and electronic warfare(EW). A MMIC ASIC is an microcircuit that operates at microwave frequencies between 300 MHZ and 300GHz.

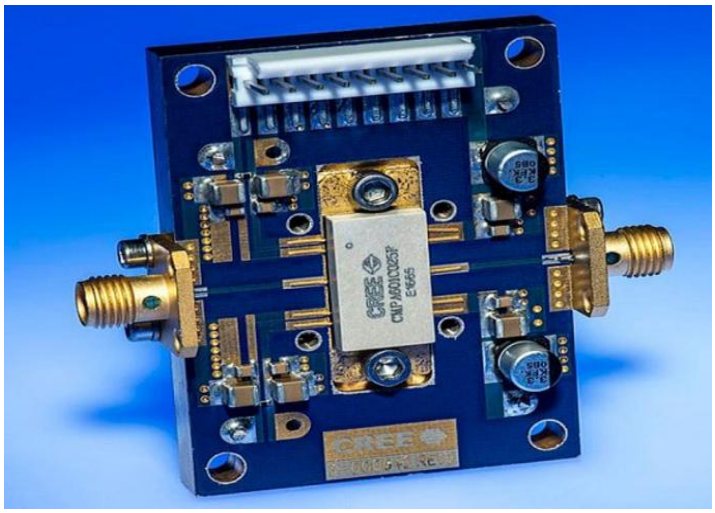

Fig.7

ASIC applications are critical for aerospace applications and products requiring rigorous FIT rates due to terrestrial radiation exposure. Because they are not field programmable they aremore radiation tolerant. An ASIC might also be the onlypossiblesolution when your system needs to reach a higher energy efficiency.

Fig.8

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V.RESULTS

The paper titled "Analysis of ASIC Design Methodology In Advanced Digital System" has covered and analysed the various application of ASIC in various fields and its importance. We have also studied about the performance of ASIC and its advantages. ASICi is becoming the upcoming trend in the world. This paper tells us that ASIC is the smart choice for various reasons ,it can shrink the products which size,cost will be less,more reliable,advantages like speed improvement and energy efficiency both of which results in opex cost savings.

VI.CONCLUSION

ASIC were designed in 1999, In ASIC design process it is possible to ,

- Reduce cost of unit.
- Improves performance of unit.
- Reduce size of unit and volume.

If errors occur continuously the ASIC cost for further development will be constantly increased. We experience ASIC technology from low voltage ,low power up to high voltage and high power.This includes work in Automotive, Medical, Aerospace, Navy etc.

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