UDC 621.382.049.774

PRESENT STATE OF FUJI ELECTRIC'S IC

Tsuneto Sekiya

1. FOREWORD

Fuji Electric's IC division is focusing on custom ICs, and they are vased on their technical features for the differentiation from other manufacturers of ICs. The Goal of Fuji Electric's ICs are to be the leader of quality and volume in the dedicated areas. Their targets of market segments are the information equipment and its peripherals which are now rapidly increasing in volume. In those areas, the current trend is to be smaller in its size, more flat in its shape, and more intelligent in its function in addition to personalization and high performance, so the close contacts and good relationships between the users and manufacturers of IC are essential for the joint development. The present state of Fuji Electric's IC are described as follows.

2. SHORT HISTORY OF FUJI ELECTRIC'S IC

Fuji Electric's IC has started from planar transistor technology in nineteen-seventies. Planar technology was vasic and common as the production method of signal transistors and ICs, but simultaneously it was situated as the key technology to develop power transistors in Fuji Electric, that is to say power transistor and IC of Fuji Electric are the twin devices which has started at the same time. Fuji's power transistors adopted triple diffused planar method and were dedicated to high power and high voltage switching areas, and established the new markets. On the other hand, Fuji's bipolar IC firstly penetrated into the non-contacts ignition system of automobile combining with power transistors, small motor control system and switch mode power supply. Aluminum gate p-channel MOS-IC were also into coin mechanical controller of auto vending machine. Consequently Fuji's high voltage CMOS IC has been developed, they are now increasing mainly in the area of information equipments and computer peripherals. *Fig. 1* shows technology and products flows of Fuji Electric's ICs.

3. THE FEATURES OF FUJI'S IC

It is important to differentiate from others from the viewpoint of technology or saling points as well as compatibility and standarization. The feature of Fuji's ICs are as follows.

3.1 High voltage CMOS technology

Conventionally the low power dissipation CMOS ICs are operated at lower than 5 V. In the case of Fuji's CMOS ICs have high withstanding voltage depending on their application fields. High withstanding voltage is also technical feature or saling point of Fuji's IC, and they are now improving in their ratings. *Fig. 2* shows the progress of withstanding voltage of CMOS adding with planing levels. In this figure BiCMOS means combined technologies of bipolar output transistors and CMOS logics. D/CMOS means also DMOS output transistors that is similar technology with power MOSFETs and CMOS logics. DMOS part of D/CMOS can be easily replaced by pilar one, but it depend on the balance of current and voltage capabilities. One of the main feature is that our DMOS part has the withstanding volt up to 300 V. 200 V types are under production and 300 V types have just developed.

3.2 Bump technology

For the demands of miniturization and flatening of electronic equipments, high density assembling technology became more important. User's needs are changing to bare chips in stead of packaged ICs. Chips before mounting can be also available as bare chip use, but in general special chips with bumps are more suitable for these applications. In these cases, assembling technology should be changed. The purpose of bare chip application is firstly the high density structure. It is more effective in case of IC with many pins. In addition to these effects, Die size of IC will be smaller, because of shorter pad pitches in comparison with wire-bonding type IC die.

Fuji's bump technology is devided to the two types, one is made by solder, the other by gold. Depending on applications they are used selectively. For example, solder bump dies are mainly to automobile use and gold bump dies to flat panell drivers or thermal head drivers. Concerning pads size and pitches, gold bump is much smaller than solder one. Less than several tens microns pitches are now

Fig. 1 Technology and products flows of Fuji Electric's ICs

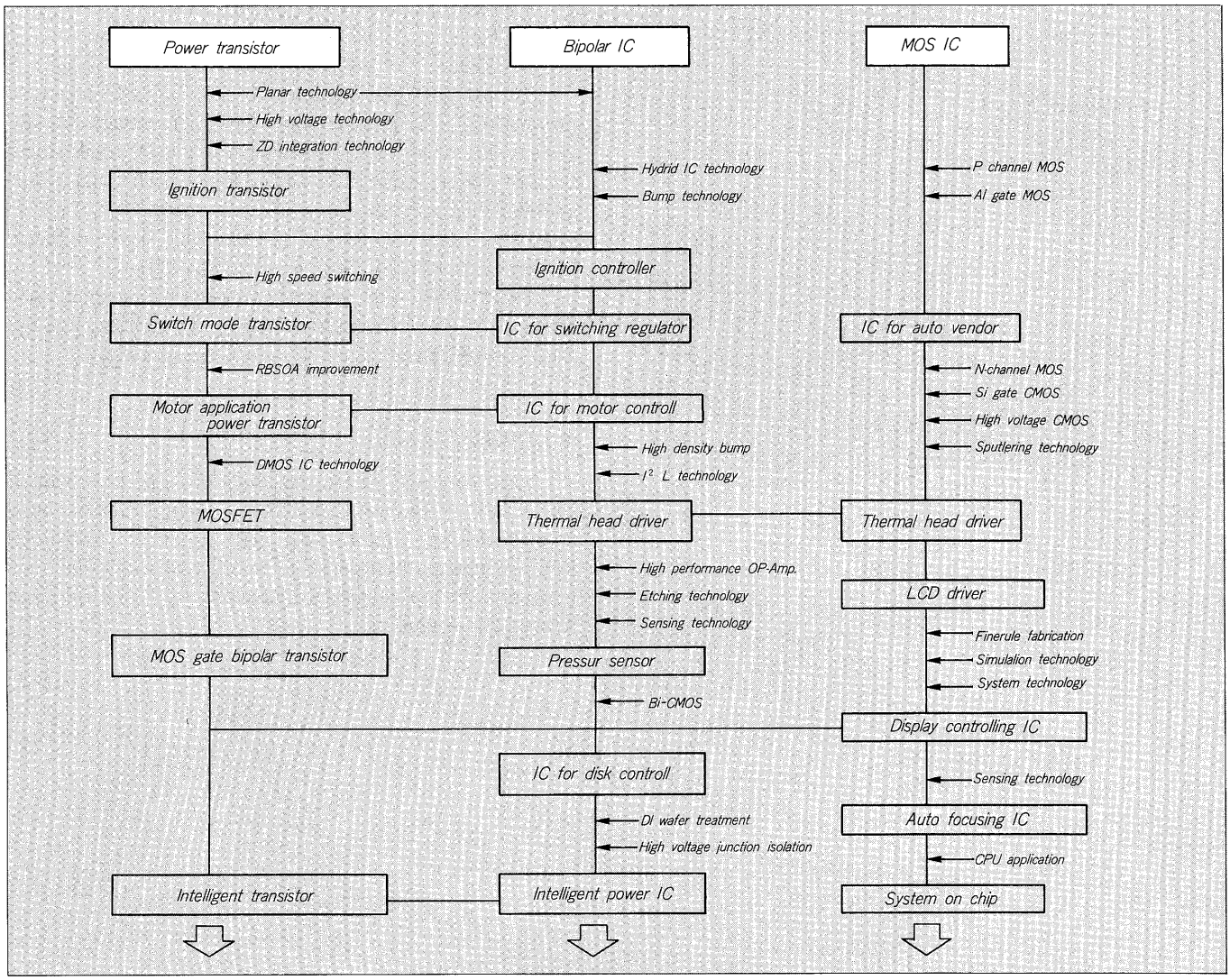
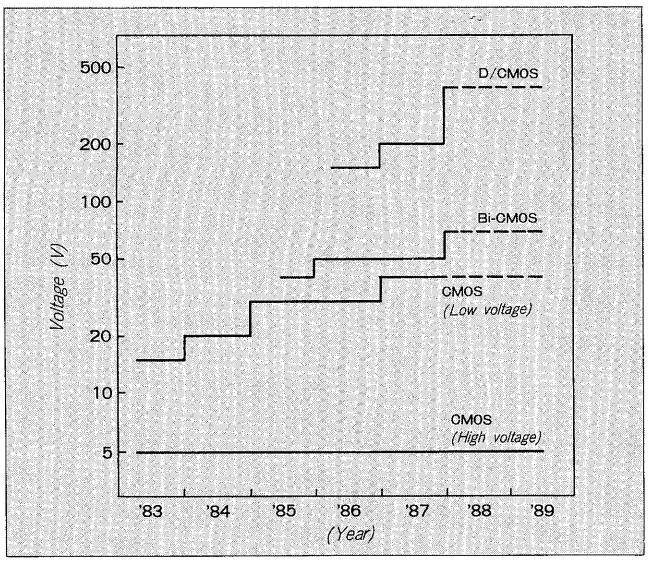


Fig. 2 Progress of withstanding voltage of CMOS



available.

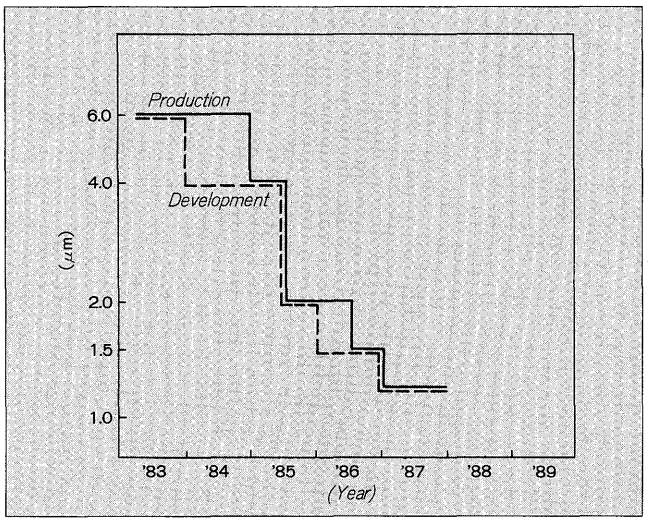
3.3 Sensor integrated monolythic ICs

Fuji electric has developed the multi-functional or system ICs. System IC is one of our business goals but immediate targets are the sensor integrated monolythic ICs. Integration of sensors needs highly brushed-up process technology and realization with reasonal cost is key point. One of our products is the pressure sensors for fuel injection controller of automobile and another example of products is the one chip autofocusing IC with distance sensor which measures the distance between the targets and camera. Touch sensor for robot hands is under development. Pressure sensor is also available as the volume controller for air and another gas besides fuel. Another application of Autofocusing IC is general purpose distance meters besides cameras.

3.4 Wafer process technology

Fuji's process technologies which are now available are:

Fig. 3 Progress of design rule



(1) silicon gate CMOS: 6~1.5 μm
(2) bipolar linear: 6 μm, 4 μm
(3) BiCMOS: 6 μm, 2 μm
(4) D/CMOS: 6 μm

Though the finest design rule is 1.5 μm which is under production, it is good enough for high voltage ICs. But system ICs need finer rule which is under development. Besides wafer fabrication technology, packaging, testing and analizing technologies and quality controle systems are improving day by day. Fuji Electric's semiconductors factory is awarded by Deming prize in 1983.

Fig. 3 shows the progress of design rule year by year. More than 30 V ICs adopt mainly 6 μm rule, and less than 10 V ICs adopt 1.5~2.0 μm rules respectively.

4. CONCLUSION

Fuji Electric's IC is focussed on custom products. Their key technologies are high voltage CMOS, bump application and multi-functional products. Customer's informations are indispensable to us, so please contact with us freely. We are delightful if this description will be your help of understanding.