

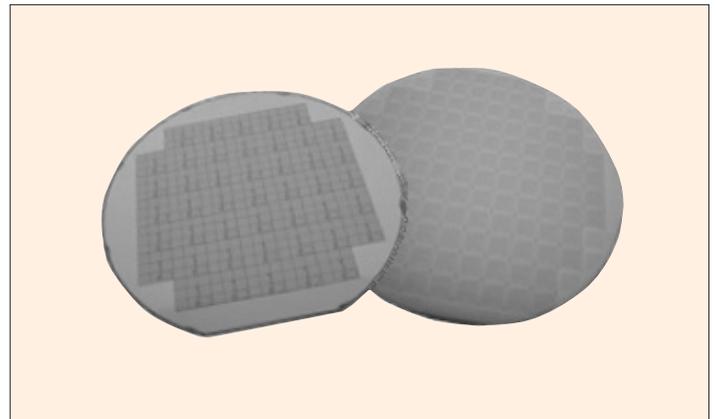
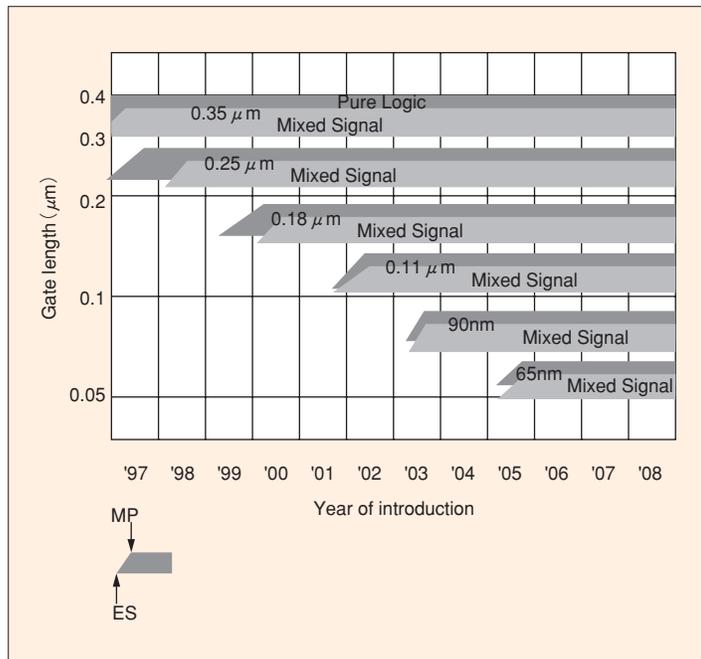
Introducing Our Wafer Foundry Service

FUJITSU's foundry services provide leading-edge, high-speed digital technologies and high-precision analog technologies. As an integrated semiconductor manufacturer, FUJITSU accomplishes full turnkey services covering every stage, from wafer production to testing and packaging.

Introduction

Since its establishment in the late 1980s, FUJITSU's wafer foundry service has been used by many domestic and overseas customers. Our three semiconductor wafer process plants in Iwate, Aizu-wakamatsu, and Mie produce LSIs up to the 0.13 μm generation. All three have delivered a stable supply

Figure 1 CMOS Technology Roadmap



Akiruno Technology Center (Akiruno City, Tokyo)

of high-quality silicon LSIs for over a decade, and will continue to do so in the future. The company is now developing 90nm-generation LSI at Akiruno Technology Center (**Photos 1 and 2**), and even more advanced technologies are already being developed.

Fig. 1 shows the CMOS technology development roadmap. This article introduces our wafer foundry service and its advantages to clients now considering the manufacture of new products.

Overview of the Foundry Service

The wafer foundry service produces LSI wafers for our customers. Compared to using an ASIC platform, the wafer foundry service offers more flexibility to customers in how to design their LSIs. A customer with the right abilities in

planning and design can effectively exploit the capabilities of the wafer foundry service to produce commercially competitive products.

Our standard service has just a few simple steps: we receive completely layout designed data from the customer, use that data to perform mask production and wafer processing, then deliver the processed wafers to the customer.

Fig. 2 compares the task distributions shared between FUJITSU and the customer in ASIC and wafer foundry. **Fig. 3** shows the standard and optional services of our wafer foundry service.

As an integrated semiconductor manufacturer, FUJITSU can also provide services such as wafer sorting, chip assembly, and LSI testing after wafer production. With our robust, well-proven lineup of packages and packaging technologies, we can meet customers' requests for various types of packages, from standard types to leading-edge types (**Photos 3 and 4**).

Photo 1
Sectional View of 90nm Transistor

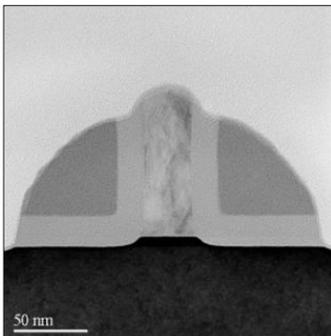


Photo 2
11-layer Wiring Structure Using 90nm Technology

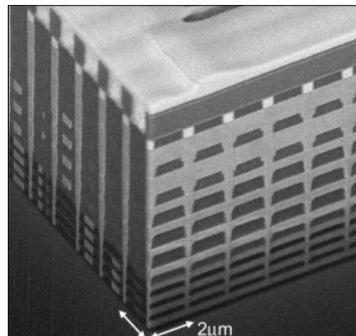


Photo 3
FC-BGA

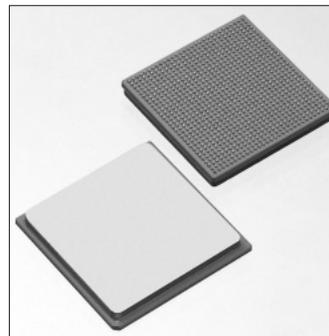


Photo 4
BCC

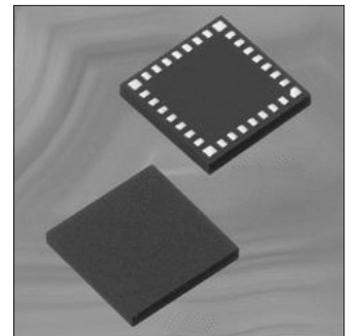


Figure 2 Wafer Foundry Service and ASIC

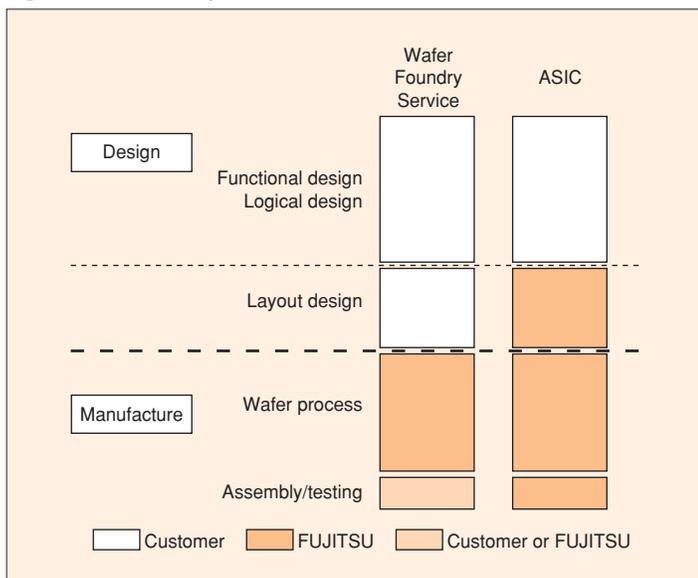
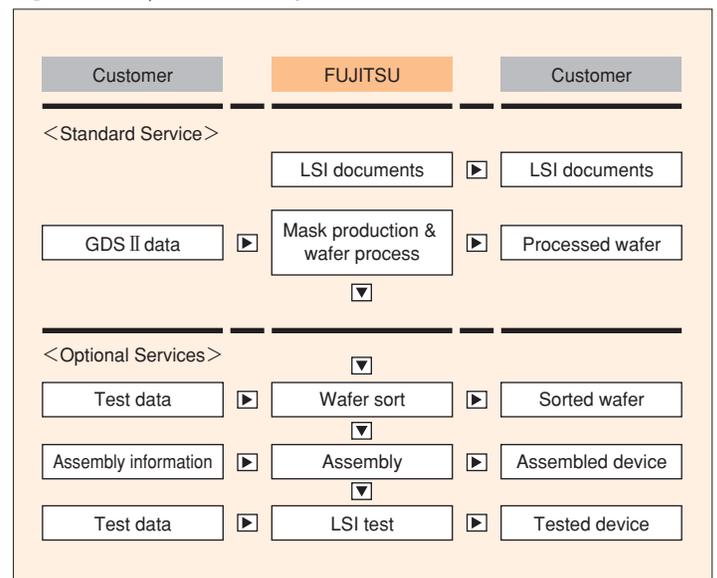


Figure 3 Lineup of Wafer Foundry Service



Technology Lineup

FUJITSU's wafer foundry service provides the following technologies and services. For details, please refer to the tables.

■ CMOS Standard Technology (Table 1)

The foundry service prepares various CMOS technologies to address the different needs of customers. The most advanced technology available is 0.13 μm generation (gate length 0.11 μm), but the foundry service can also handle the upcoming 90nm generation.

■ CMOS High-Voltage Technology (Table 2)

The demand for high-voltage products for display products

(LCD, organic EL, etc.) has been rising in recent years. To meet this demand, FUJITSU is currently developing high-voltage technologies.

■ LCOS (Photo 5)

LCOS (Liquid Crystal On Silicon) is a type of LSI that supports microdisplay, a new product claiming attention as a 21st century device for head mount displays and projection TV systems. Over the five years FUJITSU manufactured LCOS LSIs, many customers have praised them for their excellent smoothness and reflective properties of their uppermost metal layer.

■ CMOS Image Sensor

A process for the CMOS image sensor is now available. The

Table 1 CMOS Technology Lineup

CMOS Technology		0.11 μm	0.18 μm	0.25 μm	0.35 μm	0.5 μm
Supply Voltage (V)		1.2	1.8	2.5	3.3	3.3*1
Available Interface (V)		1.2/2.5/3.3	1.8/2.5/3.3	2.5/3.3	3.3/5.0	3.3/5.0
Poly/Metal Layers		1P8M*2	2P6M	2P5M	2P4M	1P3M
Substrate		P-sub				
Mixed-Signal Options*3	Triple-well	Available				—
	Diffusion Resistor	Available				
	Capacitor	Metal-Metal & Bulk-Poly	Poly-Poly & Bulk-Poly	Poly-Poly	Poly-Poly & Bulk-Poly	Bulk-Poly
Mass Production		Now				

* 1 : For application needs at a voltage of 5V, please consult us.

* 2 : "1P8M" means "1 Poly layer + 8 Metal layers."

* 3 : For Mixed-Signal Options, any combination of these devices is available.

Table 2 CMOS High-Voltage Technology

	0.65 μm	0.50 μm	0.35 μm			
Process	1P2M	1P3M	2P4M			
Standard Voltage	5.0V	3.3V	3.3V			
High-Voltage Resistance	20V	12V	12V	18V	25V	40V
Tapeout Acceptance	NOW	NOW	NOW			2003.6
Capacitor*	—	Bulk—Poly	Bulk—Poly /Poly-Poly			
Resistor*	—	Diffusion	Diffusion			

* Optional

Table 3 Bipolar Process

Features	<ul style="list-style-type: none"> • Adoption of ESPER Tr*1 using a double layer poly process • Adoption of device separation using dielectrics • MIS capacitor and poly resistor mounted • Double layer wiring • fT 25GHz (typical) 	
Mounted Device	NPN-Tr	Effective emitter width 0.2 μm
	PNP-Tr	Lateral structure
	Resistor	Poly-Si
	Capacitor	SiN
Device Separation	Deep trench isolation	
No. of Wiring Layers	2	
Product Applications	<ul style="list-style-type: none"> • Radio frequency (RF) product • Quadrature modulator, MIX, etc. • High-speed logic product • CLK > 1GHz 	

* 1 : Emitter-Base Self-aligned Structure with Polysilicon Electrodes and Resistor

process has been used for FUJITSU's CMOS image sensor products.

Bipolar Technology (Table 3)

FUJITSU prepares technologies suitable for the development of products with high frequency operation, such as RF products.

Our wafer foundry service can also be used for the production of MEMS, in addition to usual LSIs made from the above process technologies.

Photo 5 LCOS

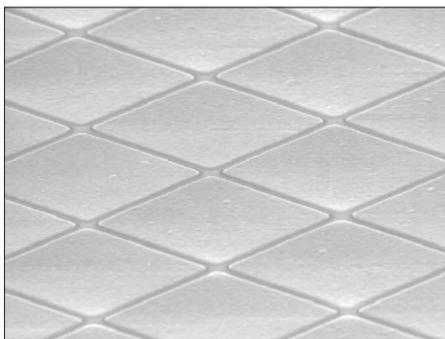
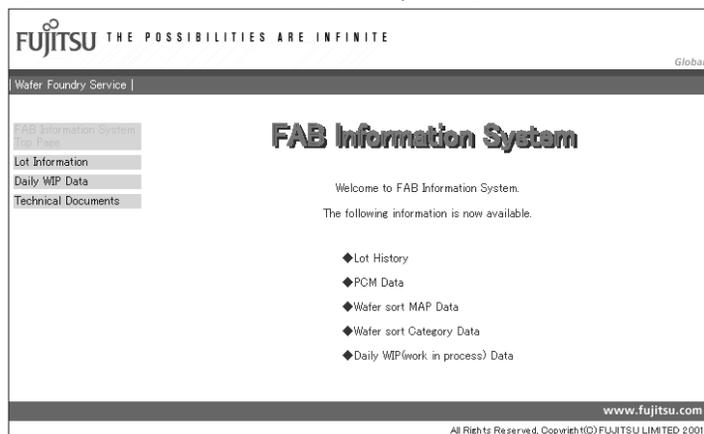


Figure 4 FUJITSU FAB Information System (Special Page for Customers)



SiExpress™

We also offer a service called SiExpress*¹ (silicon express) to manufacture prototype LSIs using the Multi-Project Wafer*² method. With this service, prototypes are produced more quickly in lower cost than usual by manufacturing LSI using our standard process. The product can be delivered in the form of a chip or as a complete packaged product. Customers who use SiExpress can develop their products much more rapidly than usual, provided their designs are acceptable to our standard process.

NOTES

- *1: SiExpress is a trademark of FUJITSU LIMITED.
- *2: A method of manufacturing multiple ICs on 1 piece of wafer by mounting several ICs on 1 mask.

FUJITSU FAB Information System

The FAB Information System provides manufacturing information on customer-developed products via the Internet (Fig. 4). Clients accessing the special page exclusively for each of them can view the progress of production, measurement data on the wafer PCM (Process Control Monitor), and other information.

Conclusion

Our wafer foundry service best meets the demands of the following types of clients. We invite clients to take full advantage of our manufacturing technologies to realize your outstanding designs.

- Clients specializing in LSI design
- Clients looking for a second source to meet their increasing needs
- Clients who need wafers delivered to permit original assembly at their facilities
- Clients who want to use FUJITSU's advanced cutting-edge packages *