









- A scientist
 - Physics, Electronics, Computer Engineering, Automation control
 - Basic knowledge of fabrication process
- An engineer
 - Analog and digital circuits
 - System design and architecture
 - EDA tools
 - Schematic, Electrical simulation, Analysis
 - HDL language, synthesis
 - Layout, P&R, LVS, post-layout analysis











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Talbert and Widlar's µA709 high-performance operational amplifier (1965)























	1.	1.	Histo	ry:	Play	ers	and	Ma	rket s	sha	re
۰E	lectror	nic S	Systen	n Co	mpani	es					
・I ・F	ntegra [.] oundrie	ted es a	, Device and Fat	e M oles	anufac s Comp	ture: Danie	er es				
		Тор	10 World	lwide	e Semico	nduct	or Sales	Leade	ers* (\$B)		
Rank	1990		1995		2000		2006		2014		2015F
1	NEC	4.8	Intel	13.6	Intel	29.7	Intel	31.6	Intel	51.4	Intel
2	Toshiba	4.8	NEC	12.2	Toshiba	11.0	Samsung	19.7	Samsung	37.8	Samsung
3	Hitachi	3.9	Toshiba	10.6	NEC	10.9	TI	13.7	Qualcomm**	19.3	Qualcomm**
4	Intel	3.7	Hitachi	9.8	Samsung	10.6	Toshiba	10.0	Micron	16.7	SK Hynix
5	Motorola	3.0	Motorola	8.6	п	9.6	ST	9.9	SK Hynix	16.3	Micron
6	Fujitsu	2.8	Samsung	8.4	Motorola	7.9	Renesas	8.2	п	12.2	п
7	Mitsubishi	2.6	TI	7.9	ST	7.9	Hynix	7.4	Toshiba	11.0	NXP/Freescale
8	TI	2.5	IBM	5.7	Hitachi	7.4	Freescale	6.1	Broadcom**	8.4	Toshiba
9	Phillips	1.9	Mitsubishi	5.1	Infineon	6.8	NXP	5.9	ST	7.4	Broadcom**
10	10 Matsushita		Hyundai	4,4	Philips	6.3	NEC	5.7	Renesas	7.3	51
Top 10 To	Top 10 Total (\$B)		86.3			108.1		118.2		187.7	
Semi Market (\$B)		54.3	154		218.6		265.5	354.8			
Top 10 % of Total Semi		59%	56%			49%	49% 45%			53%	
Source: IC Insights *Not including foundries **Fabless											



(I)	1.	1. Histo	ry: Pla	ayers	s and	l Ma	rket s	share
27 1H1	L5 To	p 20 Semicor	ductor Sa	les Lea	ders (\$I	M, Inclu	iding Fou	ndries)
1H15 Rank	1H15 2014 Rank Rank Company		Headquarters	2014 Tot Semi	1Q15 Tot Semi	2Q15 Tot Semi	2Q15/1Q15 % Change	1H15 Tot Semi
1	1	Intel	U.S.	51,400	11,632	11,946	3%	23,578
2	2	Samsung	South Korea	37,810	9,336	10,301	10%	19,637
3	3	TSMC*	Taiwan	24,976	6,995	6,629	-5%	13,624
4	6	SK Hynix	South Korea	16,286	4,380	4,233	-3%	8,613
5	5 4 Qualcomm** 5 5 Micron		U.S.	19,291	4,434	3,853	-13%	8,287
6			U.S.	16,720	4,061	3,800	-6%	7,861
7	7	т	U.S.	12,167	2,939	3,019	3%	5,958
8	8	Toshiba	Japan	11,040	2,720	2,780	2%	5,500
9	9 Broadcom**		U.S.	8,428	2,058	2,096	2%	4,154
10	10	ST	Europe	7,384	1,700	1,754	3%	3,454
11	13	Infineon	Europe	5,938	1,666	1,762	6%	3,428
12	15	Avago**	Singapore	5,644	1,621	1,690	4%	3,311
13	12	MediaTek**	Taiwan	7,032	1,506	1,528	1%	3,034
14	14	NXP	Europe	5,647	1,467	1,506	3%	2,973
15	11	Renesas	Japan	7,307	1,470	1,439	-2%	2,909
16	17	Sony	Japan	5,292	1,272	1,380	8%	2,652
17	20	GlobalFoundries*	U.S.	4,355	1,190	1,250	5%	2,440
18	18	Freescale	U.S.	4,548	1,169	1,180	1%	2,349
19	21	UMC*	Taiwan	4,350	1,140	1,180	4%	2,320
20	23 Sharp		Japan	3,515	1,137	1,086	-4%	2,223
		Ten 20 Tetal	-	050 100	63 803	64 410	10/	100 305























1.2. Microelectronic Technology: foundries, fabs and masks...

- Definitions (source Wikipedia, 2013)
 - An integrated circuit or monolithic integrated circuit (also referred to as an IC, a chip, or a microchip) is a set of electronic circuits on one small plate ("chip") of semiconductor material, normally silicon. This can be made much smaller than a discrete circuit made from independent components.
 - ICs can be made very compact, having up to several billion transistors and other electronic components in an area the size of a fingernail. The width of each conducting line in a circuit (the line width) can be made smaller and smaller as the technology advances; in 2008 it dropped below 100 nanometers and in 2013 it is expected to be in the tens of nanometers.
 - The front-end-of-line (FEOL) is the first portion of IC fabrication where the individual devices (transistors, capacitors, resistors, etc.) are patterned in the semiconductor. FEOL generally covers everything up to (but not including) the deposition of metal interconnect layers.

















































































