

NTRS Roadmaps

The National Technology Roadmap for Semiconductors (NTRS) is regularly updated by the Semiconductor Industry Association and looks at the future of the circuit design challenges and complexities. The Roadmap is divided into two sections. The "Near Term Years" which are from 1999 to 2005 and the "Long-Term Years" which are the years 2008, 2011 and 2014. The Roadmap also divides the design field into three major categories : DRAM, Microprocessors and ASICs. We consider the figures for microprocessors in most of the cases unless mentioned otherwise. There are several sections in the Roadmap related to the overall scenario: the future interconnect parameters, chip size, power, issues related to the manufacturing process, yield and electrical defect density.

Year	1999	2000	2001	2002	2003	2004	2005	2008	2011	2014
Technology (DRAM) (nm)	180	165	150	130	120	110	100	70	50	35
Technology (μ P) (nm)	140	120	100	85-90	90	70	65	45	30-32	20-22
#Transistors	23.8M	—	47.6M	—	95.2M	—	190M	539M	1523M	4308M
Across chip clock (MHz)	1200	1321	1454	1600	1724	1857	2000	2500	3000	3600
Area (mm^2)	340	340	340	372	372	372	408	468	536	615
Wiring Levels	6-7	6-7	7	7-8	8	8	8-9	9	9-10	10

Table 1: Overall National Technology Roadmap for Semiconductors 1999 (courtesy : NTRS)

Year	1999	2000	2001	2002	2003	2004	2005	2008	2011	2014
Technology (μ P) (nm)	140	120	100	85-90	90	70	65	45	30-32	20-22
Wiring Levels	6-7	6-7	7	7-8	8	8	8-9	9	9-10	10
$J_{max}(A/cm^2)$	5.8E5	7.1E5	8.0E5	9.6E5	1.1E6	1.3E6	1.4E6	2.1E6	3.7E6	4.6E6
Local Wiring pitch (nm)	500	450	405	365	330	295	265	185	130	95
Local Wiring A/R (Al/Cu)	2/1.4	2/1.4	2.1/1.5	2.1/1.5	2.2/1.6	*/1.6	*/1.7	*/1.9	*/2.1	*/2.3
Intermediate Wiring pitch (nm)	640	575	520	465	420	375	340	240	165	115
Intermediate Wiring A/R (Al/Cu)	2.2/2.1	2.3/2.1	2.4/2.2	2.5/2.2	2.6/2.2	*/2.3	*/2.4	*/2.5	*/2.7	*/2.9
Global Wiring Pitch (nm)	1050	945	850	765	690	620	560	390	275	190
Global Wiring A/R (Al/Cu)	2/2.4	2.1/2.6	2.2/2.7	2.3/2.7	2.4/2.8	*/2.8	*/2.8	*/2.9	*/3.0	*/3.1
Interlevel metal Insulator effective dielectric constant	3.5-4.0	3.5-4.0	2.7-3.5	2.7-3.5	2.2-2.7	2.2-2.7	1.6-2.2	1.5	<1.5	<1.5

* - This technology will not exist for the feature size. A/R - Aspect Ratio

Table 2: Roadmap for the Interconnects (courtesy : NTRS)