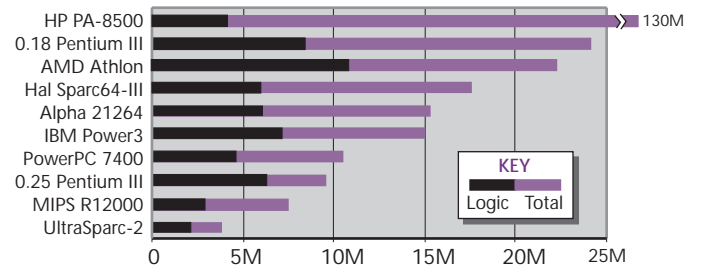


CHART WATCH: WORKSTATION PROCESSORS

	Alpha 21264	AMD Athlon	Intel PIII Xeon	MIPS R12000	HP PA-8500	IBM Power3	PowerPC 7400 (G4)	Sun Ultra-2	Sun Ultra-2i	Hal Sparc64-III
Clock rate	700 MHz	750 MHz	733 MHz	300 MHz	440 MHz	222 MHz	450 MHz	450 MHz	360 MHz	296 MHz
Cache (I/D)	64K/64K	64K/64K	16/16/256	32K/32K	512K/1M	32K/64K	32K/32K	16K/16K	16K/16K	64K/64K
Issue rate	4 issue	3 x86 instr	3 x86 instr	4 issue	4 issue	4 issue	3 issue	4 issue	4 issue	4 issue
Pipe stages‡	7/9 stages	9/11 stages	12/14	6 stages	7/9 stages	7/8 stages	4/5 stages	6/9 stages	6/9 stages	8/10
Out of order	80 instr	72 ROPs	40 ROPs	48 instr	56 instr	32 instr	5 instr	None	None	63 instr
Rename regs	48/41	36/36	40 total	32/32	56 total	16 int/24 fp	6 int/6 fp	None	None	34/32
BHT entries	4K x 9-bit	4K x 2-bit	≥512	2K x 2-bit	2K x 2-bit	2K x 2-bit	512 x 2-bit	512 x 2-bit	512 x 2-bit	8K x 2-bit
TLB entries	128/128	280/288	32 I/64 D	64 unified	120 unified	128/128	128/128	64 I/64 D	64 I/64 D	32/32/256
Memory B/W	2.66 GB/s	1.6 GB/s	1.06 GB/s	539 MB/s	1.54 GB/s	1.6 GB/s	1.6 GB/s	1.9 GB/s	600 MB/s	1.33 GB/s
Package	CPGA-588	CBGA-576	PGA-370	CPGA-527	LGA-544	SCC-1,088	CBGA-360	CLGA-787	PBGA-587	CLGA-957
IC process	0.25µ 6M	0.25µ 6M	0.18µ 6M	0.25µ 4M	0.25µ 4M	0.25µ 5M	0.22µ 6M	0.29µ 4M	0.29µ 4M	0.25µ 5M
Die size	205 mm²	184 mm²	106 mm²	204 mm²	477 mm²	270 mm²	83 mm²	126 mm²	150 mm²	240 mm²
Transistors	15.2 million	22 million	24 million	7.2 million	130 million	15 million	10.5 million	3.8 million	4.1 million	17.6 million
Est mfg cost*	\$160	\$105\$	\$40	\$140	\$330	\$320	\$45	\$70	\$85	\$250
Power (max)	75 W	58 W*	24 W	20 W	50 W*	46 W	13 W	20 W	38 W	50 W
SPEC95b†	35/55	32/24	36/31	18/30	31/49	13/28	21/20	16/24	12/17	15/28
Availability	3Q99	4Q99	4Q99	2Q99	1Q99	3Q98	3Q99	4Q98	4Q98	4Q98
1K list price	\$2,296\$	\$849\$	\$826	Not public	Not public	Not public	\$345	\$4,249\$	\$470	Not public

†SPEC95 baseline (int/FP) ‡integer ALU/load §includes 512K L2 cache ¶includes 2M L2 cache (Source: vendors, except *MDR estimates)

The table above gives the vital statistics for the key high-end processors available soon. The table below provides the best reported SPEC95 results for each shipping processor. The graph compares transistor counts for these devices for the logic (noncache) portion and the complete design.



Processor	Intel PIII Xeon	Alpha 21264	AMD Athlon	HP PA-8500	IBM Pulsar	MIPS R12000	Sun Ultra-2	Hal Sparc64	PowerPC 604e	IBM Power3
System	Compaq SP750	AlphaServ. GS140-6	Microstar MS-6167†	HP9000 N4000	Bull EPC2400	SGI Origin2000	Ultra 60 Mod. 1450	Fujitsu GP7000F	RS/6000 43P-150	RS/6000 9076-N80
Clock rate	733 MHz	700 MHz	700 MHz	440 MHz	450 MHz	300 MHz	450 MHz	296 MHz	375 MHz	222 MHz
Ext cache	256K	8M	512K	none	8M	8M	4M	8M	1M	4M
099.go	36.8	33.7	32.6	34.0	29.3	16.7	18.0	15.0	16.4	15.3
124.m88Ksim	38.8	43.4	35.2	33.3	16.9	17.7	15.1	11.9	18.9	14.2
126.gcc	33.3	25.9	20.9	26.7	19.9	17.7	18.2	18.0	13.1	12.3
129.compress	23.1	27.9	24.7	29.1	19.8	17.8	18.6	15.3	11.1	13.6
130.li	44.2	35.4	36.5	33.0	17.2	13.6	13.1	12.8	12.7	12.0
132.ijpeg	32.4	41.9	26.1	24.9	13.1	15.8	16.6	15.4	17.1	14.2
134.perl	38.8	33.7	40.4	27.7	18.8	21.0	15.6	14.8	15.9	9.32
147.vortex	42.2	39.7	30.3	40.0	20.3	27.0	15.4	15.3	12.4	12.9
SPECint95b*	35.6	34.7	31.7	30.8	19.0	18.1	16.2	14.7	14.5	12.8
101.tomcatv	52.9	99.7	32.5	83.3	26.9\$	36.7	32.9	58.5	10.8	45.2‡
102.swim	96.6	85.8	52.8	121	24.0\$	50.9	44.2	67.9	17.1	50.6‡
103.su2cor	16.7	21.7	13.0	29.0	11.2\$	18.0	15.8	16.0	4.76	16.9‡
104.hydro2d	17.6	51.8	12.0	23.6	12.4\$	24.4	16.1	22.8	4.29	22.0‡
107.mgrid	29.4	73.2	15.0	39.7	20.2\$	34.6	25.3	26.4	7.81	27.9‡
110.applu	17.6	26.2	13.4	33.4	15.4\$	17.8	12.9	14.5	5.60	18.0‡
125.turb3d	26.5	30.9	17.0	40.6	23.0\$	23.0	20.7	18.4	12.6	34.0‡
141.apsi	23.1	59.0	24.4	40.1	17.7\$	28.0	30.4	20.7	11.7	22.3‡
145.fpppp	40.5	102	81.4	84.8	36.9\$	47.9	26.8	38.9	35.6	37.3‡
146.wave5	37.0	67.7	35.7	59.3	26.5\$	39.7	30.5	32.3	9.07	20.8‡
SPECfp95b*	30.6	54.5	24.0	48.7	20.2\$	30.1	23.9	27.7	9.76	27.6‡

*SPEC95 baseline †motherboard §from Northstar-300 in RS/6000 H70 ‡from Power3-200 in RS/6000 43P-260 (Source: SPEC, AMD)