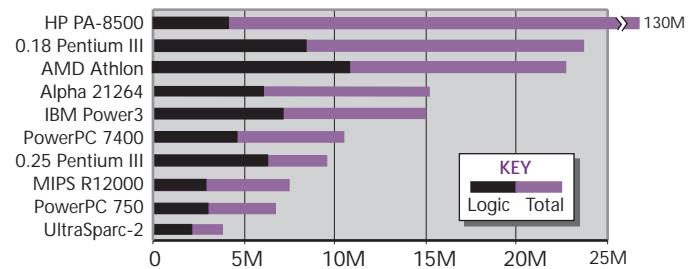


## CHART WATCH: WORKSTATION PROCESSORS

	Alpha 21264	AMD Athlon	IBM Power3	PowerPC 7400 (G4)	Sun Ultra-2	Sun Ultra-2i	HP PA-8500	HP PA-7300LC	MIPS R12000	Intel PIII Xeon
Clock rate	700 MHz	700 MHz	200 MHz	450 MHz	450 MHz	360 MHz	440 MHz	180 MHz	300 MHz	<b>733 MHz</b>
Cache size	64K/64K	64K/64K	32K/64K	32K/32K	16K/16K	16K/16K	<b>512K/1M</b>	64K/64K	32K/32K	16/16/256
Issue rate	4 issue	3 x86 instr	4 issue	3 issue	4 issue	4 issue	4 issue	2 issue	4 issue	3 x86 instr
Pipe stages‡	7/9 stages	9/11 stages	7/8 stages	4/5 stages	6/9 stages	6/9 stages	7/9 stages	5 stages	6 stages	<b>12/14</b>
Out of order	<b>80 instr</b>	72 ROPs	32 instr	5 instr	None	None	56 instr	None	48 instr	40 ROPs
Rename regs	<b>48/41</b>	36/36	16 int/24 fp	6 int/6 fp	None	None	56 total	None	32/32	40 total
BHT entries	<b>4K × 9-bit</b>	4K × 2-bit	2K × 2-bit	512 × 2-bit	512 × 2-bit	512 × 2-bit	2K × 2-bit	None	2K × 2-bit	≥512
TLB entries	128/128	<b>280/288</b>	128/128	128/128	64 I/64 D	64 I/64 D	120 unified	96 unified	64 unified	32 I/64 D
Memory b/w	<b>2.7 GB/s</b>	1.6 GB/s	1.6 GB/s	1.6 GB/s	1.9 GB/s	600 MB/s	1.5 GB/s	213 MB/s	539 MB/s	1.1 GB/s
Package	CPGA-588	CBGA-576	<b>SCC-1,088</b>	CBGA-360	CLGA-787	PBGA-587	LGA-544	CPGA-464	CPGA-527	PGA-370
IC process	0.25µ 6M	0.25µ 6M	0.25µ 5M	0.22µ 6M	0.29µ 4M	0.29µ 4M	0.25µ 4M	0.5µ 4M	0.25µ 4M	<b>0.18µ 6M</b>
Die size	205 mm²	184 mm²	270 mm²	83 mm²	126 mm²	150 mm²	<b>477 mm²</b>	259 mm²	204 mm²	106 mm²
Transistors	15.2 million	22 million	15 million	10.5 million	3.8 million	4.1 million	<b>130 million</b>	9.2 million	7.2 million	23 million
Est mfg cost*	\$160	\$105\$	\$320	\$35	\$70	\$85	<b>\$330</b>	\$95	\$140	\$40
Power (max)	<b>75 W</b>	58 W*	46 W	13 W	20 W	38 W	>40 W	15 W	20 W	24 W
SPEC95b†	<b>35/55</b>	32/24	13/28	21/20	16/24	12/17	31/49	8.6/9.2	16/26*	<b>35/27</b>
Availability	3Q99	4Q99	3Q98	3Q99	4Q98	4Q98	1Q99	3Q96	1Q99	4Q99
1K list price	\$2,296\$	\$849\$	Not public	\$345	\$4,249\$	\$470	Not public	Not public	Not public	\$826

†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	Alpha 21264	AMD Athlon	HP PA-8500	Intel PIII Xeon	Sun Ultra-2	MIPS R12000	Hal Sparc64	PowerPC 604e	IBM Northstar	IBM Power3
System	AlphaServ. GS140-6	Microstar MS-6167†	HP9000 N4000	Siemens Celsius 630	Ultra 60 Mod. 1450	SGI Origin2000	Fujitsu GP7000F	RS/6000 43P-150	RS/6000 H70	RS/6000 43P-260
Clock rate	700 MHz	700 MHz	440 MHz	550 MHz	450 MHz	270 MHz	296 MHz	375 MHz	340 MHz	200 MHz
Ext cache	8M	512K	none	512K	4M	4M	8M	1M	4M	4M
099.go	33.7	32.6	<b>34.0</b>	24.7	18.0	14.1	15.0	16.4	19.7	14.4
124.m88Ksim	<b>43.4</b>	35.2	33.3	25.3	15.1	14.0	11.9	18.9	11.6	13.5
126.gcc	25.9	20.9	<b>26.7</b>	22.1	18.2	13.5	18.0	13.1	15.3	11.9
129.compress	27.9	24.7	<b>29.1</b>	20.7	18.6	15.2	15.3	11.1	15.8	13.1
130.li	<b>35.4</b>	36.5	33.0	27.9	13.1	12.8	12.8	12.7	11.3	10.8
132.jpeg	<b>41.9</b>	26.1	24.9	21.8	16.6	13.5	15.4	17.1	11.6	13.0
134.perl	<b>33.7</b>	40.4	27.7	26.0	15.6	17.6	14.8	15.9	13.0	10.9
147.vortex	39.7	30.3	<b>40.0</b>	27.6	15.4	20.1	15.3	12.4	13.4	12.9
SPECint95b*	<b>34.7</b>	<b>31.7</b>	<b>30.8</b>	<b>24.4</b>	<b>16.2</b>	<b>14.9</b>	<b>14.7</b>	<b>14.5</b>	<b>13.7</b>	<b>12.5</b>
101.tomcatv	99.7	32.5	83.3	21.0	32.9	27.8	58.5	10.8	26.9	45.2
102.swim	85.8	52.8	<b>121</b>	30.1	44.2	39.3	67.9	17.1	24.0	50.6
103.su2cor	21.7	13.0	<b>29.0</b>	10.1	15.8	14.2	16.0	4.76	11.2	16.9
104.hydro2d	<b>51.8</b>	12.0	23.6	9.64	16.1	16.0	22.8	4.29	12.4	22.0
107.mgrid	73.2	15.0	39.7	10.3	25.3	24.5	26.4	7.81	20.2	27.9
110.applu	26.2	13.4	<b>33.4</b>	9.52	12.9	14.9	14.5	5.60	15.4	18.0
125.turb3d	30.9	17.0	<b>40.6</b>	14.4	20.7	19.3	18.4	12.6	23.0	34.0
141.apsi	<b>59.0</b>	24.4	40.1	19.3	30.4	23.4	20.7	11.7	17.7	22.3
145.fpppp	102	81.4	84.8	27.8	26.8	39.7	38.9	35.6	36.9	37.3
146.wave5	<b>67.7</b>	35.7	59.3	16.9	30.5	34.4	32.3	9.07	26.5	20.8
SPECfp95b*	<b>54.5</b>	24.0	<b>48.7</b>	<b>15.5</b>	<b>23.9</b>	<b>23.7</b>	<b>27.7</b>	<b>9.76</b>	<b>20.2</b>	<b>27.6</b>

\*SPEC95 baseline †motherboard

(Source: SPEC, AMD)