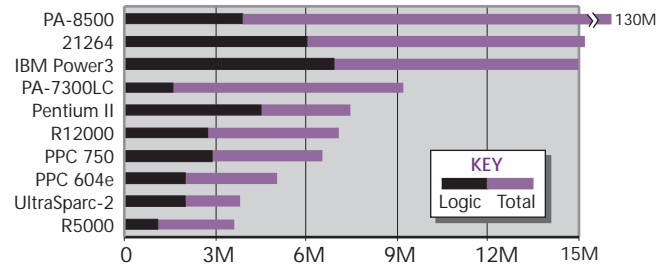


CHART WATCH: WORKSTATION PROCESSORS

	Digital 21264	Digital 21164	IBM Power3	PowerPC G4	Sun Ultra-2	Sun Ultra-2i	HP PA-8500	HP PA-7300LC	MIPS R12000	Intel Pii Xeon
Clock rate	575 MHz	600 MHz	200 MHz	400 MHz	400 MHz	300 MHz	440 MHz	180 MHz	300 MHz	450 MHz
Cache size	64K/64K	8K/8K/96K	32K/64K	32K/32K	16K/16K	16K/16K	512K/1M	64K/64K	32K/32K	16K/16K
Issue rate	4 issue	4 issue	4 issue	3 issue	4 issue	4 issue	4 issue	2 issue	4 issue	3 x86 instr
Pipe stages†	7/9 stages	7 stages	7/8 stages	4/5 stages	6/9 stages	6/9 stages	7/9 stages	5 stages	6 stages	12/14
Out of order	80 instr	6 loads	32 instr	5 instr	None	None	56 instr	None	48 instr	40 ROPs
Rename regs	48/41	None	16 int/24 fp	6 int/6 fp	None	None	56 total	None	32/32	40 total
BHT entries	4K × 9-bit	2K × 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	48 I/64 D	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	2.7 GB/s	~400 MB/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	800 MB/s
Package	CPGA-588	CPGA-499	SCC-1,088	CBGA-360	PBGA-521	PBGA-587	LGA-544	CPGA-464	CPGA-527	PBGA-528
IC process	0.35μ 6M	0.35μ 4M	0.25μ 5M	0.22μ 6M	0.29μ 4M	0.29μ 4M	0.25μ 4M	0.5μ 4M	0.25μ 4M	0.25μ 4M
Die size	298 mm ²	209 mm ²	270 mm ²	83 mm ²	126 mm ²	150 mm ²	475 mm²	259 mm ²	204 mm ²	118 mm ²
Transistors	15.2 million	9.3 million	15 million	10.5 million	3.8 million	4.1 million	130 million	9.2 million	7.2 million	7.5 million
Est mfg cost*	\$300	\$125	\$320	\$45	\$70	\$85	\$330	\$95	\$140	\$55
Power (max)	70 W	25 W	46 W	<8 W	20 W	38 W	>40 W	15 W	20 W	18 W*
SPEC95b†	26.0/40.9	19.2/26.6	12.5/27.6	18/18	14.0/22.8	11.9/17.1	30/50	7.3/7.4	17/27*	18.9/13.3
Availability	4Q98	2Q97	3Q98	2Q99	4Q98	4Q98	1Q99	3Q96	1Q99	4Q98
1K list price	Not public	Not public	Not public	Not avail.	\$4,249\$\$	\$470	Not public	Not public	Not public	\$824\$

†SPEC95 baseline (int/FP) ‡integer ALU/load §includes 512K L2 cache §§includes 4M 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	Digital 21264	Digital 21164	Intel Pii Xeon	HP PA-8200	PowerPC 604e	MIPS R10000	Sun UltraSparc	IBM Power3	Sun Ultra-2i	HP 7300LC
System	AlphaServer 8400 6/575	AlphaServ. 7310 6600	Dell Precision	HP9000 K580	RS/6000 43P-150	SGI Origin2000	Sun Ent. 450	RS/6000 43P-260	Ultra 10 Mod. 360	HP Visual. B160L
Clock rate	575 MHz	600 MHz	450 MHz	240 MHz	375 MHz	250 MHz	400 MHz	200 MHz	360 MHz	160 MHz
Ext. cache	4M	2M	512K	4M	1M	4M	4M	4M	2M	1M
099.go	28.8	19.7	18.7	17.3	16.4	14.3	15.5	14.4	13.1	9.80
124.m88Ksim	23.4	20.9	17.9	17.5	18.9	11.8	12.9	13.5	11.3	6.82
126.gcc	22.7	20.7	18.1	14.8	13.1	13.0	16.0	11.9	12.4	7.16
129.compress	21.3	17.5	17.0	16.2	11.1	14.9	15.9	13.1	14.2	6.24
130.li	22.2	17.3	19.8	16.4	12.7	12.2	11.7	10.8	9.9	7.43
132.jpeg	30.8	19.4	17.6	14.1	17.1	12.3	14.4	13.0	12.6	5.81
134.perl	31.3	20.0	20.7	14.0	15.9	16.7	12.2	10.9	10.9	8.08
147.vortex	29.8	18.5	21.6	22.0	12.4	19.6	13.8	12.9	11.2	7.91
SPECint95b*	26.0	19.2	18.9	16.4	14.5	14.1	14.0	12.5	11.9	7.32
101.tomcatv	71.6	34.9	18.9	39.5	10.8	28.8	32.3	45.2	23.7	11.1
102.swim	54.0	49.1	27.1	31.2	17.1	42.1	43.0	50.6	32.4	17.9
103.su2cor	17.8	15.6	8.92	17.7	4.76	14.1	15.3	16.9	11.5	3.66
104.hydro2d	32.2	19.5	8.16	14.3	4.29	15.6	15.5	22.0	9.32	3.86
107.mgrid	41.7	37.3	8.77	21.2	7.81	22.9	25.3	27.9	16.8	5.64
110.applu	22.1	9.4	8.18	18.7	5.60	14.4	12.8	18.0	10.6	4.99
125.turb3d	30.9	25.9	12.0	19.1	12.6	17.7	19.0	34.0	15.4	6.70
141.apsi	46.1	26.2	16.3	28.5	11.7	20.1	28.8	22.3	23.7	7.69
145.fpppp	75.4	43.2	23.2	42.6	35.6	35.2	23.4	37.3	17.3	12.4
146.wave5	59.1	33.0	14.7	37.7	9.07	32.0	27.4	20.8	22.7	9.54
SPECfp95b*	40.9	26.6	13.3	25.3	9.76	22.6	22.8	27.6	17.1	7.38

*SPEC95 baseline

(Source: SPEC)