

CHART WATCH: WORKSTATION PROCESSORS

	Digital 21164	IBM P2SC	Exponential PPC x704	PowerPC 604e	Sun Ultra-2	HP PA-8000	HP PA-7300LC	MIPS R10000	MIPS R5000	Pentium Pro
Clock rate	500 MHz	135 MHz	533 MHz	233 MHz	250 MHz	180 MHz	160 MHz	200 MHz	200 MHz	200 MHz
Cache size	8K/8K/96K	32K/128K	2K/2K/32K	32K/32K	16K/16K	None	64K/64K	32K/32K	32K/32K	8K/8K
Issue rate	4 issue	6 issue	3 issue	4 issue	4 issue	4 issue	2 issue	4 issue	1+FP	3 x86 instr
Pipe stages	7 stages	5 stages	6 stages	6 stages	6/9 stages	7-9 stages	5 stages	5-7 stages	5 stages	12-14
Out of order	6 loads	5 instr	None	16 instr	None	56 instr	None	32 instr	None	40 ROPs
Rename regs	None	22 fp	None	12 int/8 fp	None	56 total	None	32/32	None	40 total
BHT entries	2K x 2-bit	None	256 x 2-bit	512 x 2-bit	512 x 2-bit	256 x 2-bit	None	512 x 2-bit	None	≥512
TLB entries	48 I/64 D	64 I/64 D	128 unified	128/128	64 I/64 D	96 unified	96 unified	64 unified	48 unified	32 I/64 D
Memory b/w	~400 MB/s	2.2 GB/s	~270 MB/s	~180 MB/s	1.3 GB/s	768 MB/s	213 MB/s	539 MB/s	~160 MB/s	528 MB/s
Package	CPGA-499	SCC-1,088	CBGA-359	CBGA-255	CPGA-521	LGA-1,085	CPGA-464	CPGA-527	SBGA-272	MCM-387
IC process	0.35μ 4M	0.27μ 5M	0.5μ 5M§	0.27μ 5M	0.29μ 4M	0.5μ 4M	0.5μ 4M	0.35μ 4M	0.35μ 3M	0.35μ 4M
Die size	209 mm²	335 mm²	150 mm²	96 mm²	149 mm²	345 mm²	259 mm²	298 mm²	84 mm²	196 mm²
Transistors	9.3 million	15 million	2.7 million	5.1 million	3.8 million	3.9 million	9.2 million	5.9 million	3.6 million	5.5 million
Est mfg cost*	\$150	\$375	\$90	\$40	\$90	\$290	\$95	\$160	\$25	\$175‡
Power (max)	25 W	30 W	85 W	15 W*	20 W	>40 W	15 W	30 W	10 W	35 W‡
SPEC95b†	12.6/18.3	5.9/15.4	12/10	9.0/8.5*	8.5/15	10.8/18.3	7.3/7.4	10.7/17.4	4.7/4.7	8.7/6.0‡
Availability	4Q96	3Q96	2Q97	2Q97	Limited	2Q96	3Q96	1Q96	1Q96	2Q96‡
1K list price	\$1,450	Not public	\$1,000*	\$433	\$1,995	Not public	Not public	\$3,000	\$325	\$1,035‡

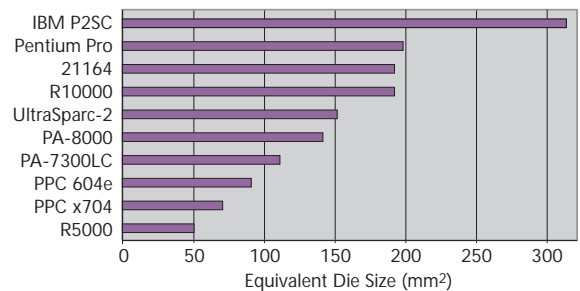
†SPEC95 baseline (int/FP)

‡includes 512K L2 cache

§bipolar + CMOS

(Source: vendors except *MDR estimates)

The table above gives the vital statistics for the key RISC processors available today or by midyear. The table below provides performance data on the full SPEC95 benchmark suite for currently shipping processors that have reported SPEC95 results. The graph attempts to compare processor die sizes as if all the chips were built in Intel's P854 (0.35-micron four-layer-metal) process.



Processor	Digital 21164	HP PA-8000	MIPS R10000	Intel PPro	PowerPC 604e	HP 7300LC	Sun UltraSparc	Intel P55C	IBM P2SC	MIPS R5000
System	AlphaSta. 500/500	HP9000 K460EG	Siemens RM400 C90	ICL J650i	Motorola 2604	HP Visual. Mod B160L	Sun Ultra 2/1200	Dell XPS 512K	IBM 595 RS/6000	Siemens RM300 C40
Clock rate	500 MHz	180 MHz	200 MHz	200 MHz	200 MHz	160 MHz	200 MHz	200 MHz	135 MHz	180 MHz
Ext. cache	2M	2M	4M	512K	256K	1M	1M	512K	none	512K
099.go	16.0	11.8	11.1	8.54	9.89	9.80	8.24	7.19	8.00	4.99
124.m88Ksim	12.6	11.6	9.81	7.80	7.12	6.82	5.89	7.24	4.67	4.61
126.gcc	10.7	9.33	10.7	8.22	7.63	7.16	7.76	6.47	6.20	4.78
129.compress	11.2	10.6	11.1	8.21	7.80	6.24	8.44	4.55	5.55	4.63
130.li	10.7	11.4	10.7	9.29	7.16	7.43	5.89	7.18	5.21	4.52
132.ijpeg	13.9	9.97	9.97	8.42	9.81	5.81	6.95	4.16	7.44	4.31
134.perl	14.3	10.4	11.7	9.11	9.01	8.08	5.92	9.17	5.33	6.21
147.vortex	12.1	11.5	10.9	10.3	7.71	7.91	6.71	6.79	5.40	3.89
SPECint95b*	12.6	10.8	10.7	8.71	8.20	7.32	6.90	6.41	5.88	4.70
101.tomcatv	24.2	30.4	24.5‡	8.91	10.1	11.1	20.1	6.96	33.3	6.16‡
102.swim	25.5	30.2	32.2‡	12.4	15.3	17.9	27.6	7.71	39.8	8.94‡
103.su2cor	10.3	12.8	10.5‡	3.89	4.39	3.66	7.88	2.79	6.44	1.92‡
104.hydro2d	13.7	10.6	10.4‡	3.69	4.51	3.86	6.44	2.66	8.34	2.08‡
107.mgrid	17.7	15.4	18.5‡	3.30	6.20	5.64	10.1	1.87	12.9	4.11‡
110.applu	8.30	15.2	12.2‡	3.28	6.23	4.99	7.02	1.99	12.9	3.60‡
125.turb3d	20.3	12.9	12.1‡	5.78	9.99	6.70	7.26	4.15	13.7	4.66‡
141.apsi	18.7	12.3	15.9‡	6.75	7.74	7.69	10.3	4.26	8.73	4.65‡
145.fpppp	37.4	32.1	26.8‡	10.7	18.7	12.4	14.8	5.47	20.2	14.9‡
146.wave5	22.7	28.3	25.3‡	7.74	7.05	9.54	12.5	5.69	25.7	5.22‡
SPECfp95b*	18.3	18.3	17.4‡	5.95	8.09	7.38	11.1	3.90	15.4	4.72‡

*SPEC95 baseline results

‡measured on SGI Origin 2000

‡measured on SGI Indy R5000

(Source: vendors, SPEC)