

## CHART WATCH: WORKSTATION PROCESSORS

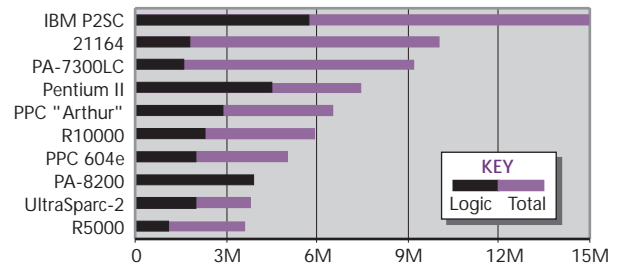
	Digital 21164	IBM P2SC	PowerPC "Arthur"	PowerPC 604e	Sun Ultra-2	HP PA-8000	HP PA-7300LC	MIPS R10000	MIPS R5000	Intel Pentium II
Clock rate	600 MHz	135 MHz	250 MHz	250 MHz	300 MHz	180 MHz	160 MHz	200 MHz	200 MHz	300 MHz
Cache size	8K/8K/96K	32K/128K	32K/32K	32K/32K	16K/16K	None	64K/64K	32K/32K	32K/32K	16K/16K
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	5 instr	16 instr	None	56 instr	None	32 instr	None	40 ROPs
Rename regs	None	22 fp	6 int/6 fp	12 int/8 fp	None	56 total	None	32/32	None	40 total
BHT entries	2K x 2-bit	None	512 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	128/128	128/128	64 I/64 D	96 unified	96 unified	64 unified	48 unified	32 I/64 D
Memory b/w Package	~400 MB/s CPGA-499	2.2 GB/s SCC-1,088	~180 MB/s CBGA-360	~180 MB/s CBGA-255	1.3 GB/s CPGA-521	768 MB/s LGA-1,085	213 MB/s CPGA-464	539 MB/s CPGA-527	~160 MB/s SBGA-272	528 MB/s PBGA-528
IC process	0.35μ 4M	0.27μ 5M	0.25μ 5M	0.25μ 5M	0.29μ 4M	0.5μ 4M	0.5μ 4M	0.35μ 4M	0.35μ 3M	0.28μ 4M
Die size	209 mm <sup>2</sup>	335 mm <sup>2</sup>	67 mm <sup>2</sup>	47 mm <sup>2</sup>	149 mm <sup>2</sup>	345 mm <sup>2</sup>	259 mm <sup>2</sup>	298 mm <sup>2</sup>	84 mm <sup>2</sup>	203 mm <sup>2</sup>
Transistors	9.3 million	15 million	6.4 million	5.1 million	3.8 million	3.9 million	9.2 million	5.9 million	3.6 million	7.5 million
Est mfg cost*	\$125	\$375	\$40	\$30	\$90	\$270	\$95	\$160	\$25	\$90
Power (max)	25 W	30 W	5 W	5 W	20 W	>40 W	15 W	30 W	10 W	30 W*
SPEC95bt	16.3/19.9	5.9/15.4	10.5/7.7	10.5/8.3*	10.4/14.5	13.7/20.1	7.3/7.4	10.7/17.4	4.7/4.7	11.6/6.8
Availability	2Q97	3Q96	3Q97	2Q97	2Q97	2Q96	3Q96	1Q96	1Q96	3Q97
1K list price	\$3,000*	Not public	Not avail	\$395	\$1,995	Not public	Not public	\$3,000	\$325	\$1,981†

†SPEC95 baseline (int/FP)

‡includes 512K L2 cache

(Source: vendors except \*MDR estimates)

The table above gives the vital statistics for the key RISC processors available today or by the fall. The table below provides performance data on the full SPEC95 benchmark suite for currently shipping processors that have reported SPEC95 results. The graph compares transistor counts for these devices for the logic (noncache) portion and the complete design.



Processor	Digital 21164	HP PA-8200	Intel Pentium II	MIPS R10000	Sun UltraSparc	PowerPC 604e	HP 7300LC	Intel P55C	IBM P2SC	MIPS R5000
System	AlphaSta. 600a	HP9000 K570	Intel "Portland"	Siemens RM400 C90	Sun Ultra 2 1300	RS/6000 E30	HP Visual. Mod B160L	Dell XPS	IBM 595 RS/6000	Siemens RM300 C40
Clock rate	600 MHz	200 MHz	300 MHz	200 MHz	300 MHz	233 MHz	160 MHz	200 MHz	135 MHz	180 MHz
Ext. cache	2M	4M	512K	4M	2M	512K	1M	512K	none	512K
099.go	19.0	14.6	10.8	11.1	11.2	11.8	9.80	7.19	8.00	4.99
124.m88Ksim	15.3	15.1	11.8	9.81	10.7	8.80	6.82	7.24	4.67	4.61
126.gcc	16.0	12.0	10.9	10.7	11.0	8.72	7.16	6.47	6.20	4.78
129.compress	16.5	13.5	9.06	11.1	11.8	7.40	6.24	4.55	5.55	4.63
130.li	15.3	14.5	12.4	10.7	8.89	7.05	7.43	7.18	5.21	4.52
132.jpeg	18.2	11.2	11.9	9.97	10.6	9.44	5.81	4.16	7.44	4.31
134.perl	17.3	13.6	13.7	11.7	9.22	7.96	8.08	9.17	5.33	6.21
147.vortex	13.6	15.5	12.9	10.9	10.0	7.39	7.91	6.79	5.40	3.89
SPECint95b*	16.3	13.7	11.6	10.7	10.4	8.46	7.32	6.41	5.88	4.70
101.tomcatv	24.3	31.9	9.21	24.5†	23.9	5.84	11.1	6.96	33.3	6.16‡
102.swim	28.1	25.6	15.0	32.2†	29.6	10.2	17.9	7.71	39.8	8.94‡
103.su2cor	10.8	14.3	4.08	10.5†	9.35	2.56	3.66	2.79	6.44	1.92‡
104.hydro2d	9.71	10.7	3.51	10.4†	8.46	2.15	3.86	2.66	8.34	2.08‡
107.mgrid	17.3	16.8	4.15	18.5†	13.6	4.56	5.64	1.87	12.9	4.11‡
110.applu	9.88	15.0	4.98	12.2†	8.68	3.26	4.99	1.99	12.9	3.60‡
125.turb3d	24.3	15.9	7.46	12.1†	13.9	7.59	6.70	4.15	13.7	4.66‡
141.apsi	24.7	19.9	8.73	15.9†	16.7	6.83	7.69	4.26	8.73	4.65‡
145.fpppp	48.4	34.9	9.28	26.8†	19.1	22.1	12.4	5.47	20.2	14.9†
146.wave5	27.9	31.2	8.43	25.3†	14.2	6.61	9.54	5.69	25.7	5.22‡
SPECfp95b*	19.9	20.1	6.79	17.4†	14.5	5.71	7.38	3.90	15.4	4.72‡

\*SPEC95 baseline results

†measured on SGI Origin 2000

‡measured on SGI Indy R5000

(Source: vendors, SPEC)