

CHART WATCH: RISC PROCESSORS

	Digital 21164	PowerPC 620	PowerPC 604	Sun UltraSparc	Micro Sparc-2	HP PA-8000	HP PA-7300LC	MIPS R10000	MIPS R5000	Pentium Pro
Clock Rate	300 MHz	133 MHz	133 MHz	167 MHz	110 MHz	180 MHz*	160 MHz*	200 MHz	200 MHz	150 MHz
Cache Size	8K/8K/96K	32K/32K	16K/16K	16K/16K	16K/8K	none	64K/64K	32K/32K	32K/32K	8K/8K
Issue Rate	4 issue	4 issue	4 issue	4 issue	1+branch	4 issue	2 issue	4 issue	1+FP	3 x86 instr
Pipe Stages	7 stages	5 stages	6 stages	6/9 stages	5 stages	7-9 stages	5 stages	5-7 stages	5 stages	12-14
Out of Order	6 loads	16 instr	16 instr	none	none	56 instr	none	32 instr	none	40 ROPs
Rename Regs	none	8 int/8 fp	12 int/8 fp	none	none	56 total	none	32/32	none	40 total
BHT Entries	2K x 2-bit	2K x 2-bit	512 x 2-bit	512 x 2-bit	none	256 x 2-bit	none	512 x 2-bit	none	≥512
TLB Entries	48 I/64 D	64 I/64 D	128/128	64 I/64 D	64 unified	96 unified	96 unified	64 unified	48 unified	32 I/64 D
Memory B/W	~400 MB/s	1.2 GB/s	~180 MB/s	1.3 GB/s	~100 MB/s	768 MB/s	213 MB/s	539 MB/s	~160 MB/s	528 MB/s
Package	CPGA-499	CBGA-625	CQFP-304	CPGA-521	CPGA-321	flip-chip	CPGA-464	CPGA-527	SBGA-272	MCM-387
IC Process	0.5μ 4M	0.5μ 4M	0.5μ 4M	0.5μ 4M	0.4μ 3M	0.5μ 4M	0.5μ 4M	0.35μ 4M	0.35μ 3M	0.5μ 4M
Die Size	298 mm ²	311 mm ²	196 mm ²	315 mm ²	233 mm ²	345 mm ²	259 mm ²	298 mm ²	84 mm ²	306 mm ²
Transistors	9.3 million	6.9 million	3.6 million	3.8 million	2.3 million	3.9 million	9.2 million	5.9 million	3.6 million	5.5 million
Est Mfg Cost*	\$340	\$300	\$95	\$340	\$120	\$450	\$140	\$250	\$50	\$260±
Power (max)	50 W	30 W	24 W	30 W	9 W	30 W	15 W	30 W	10 W	29 W±
SPEC95bt	7.8/12.4	5.6/5.6*	4.9/4.6	5.6/9.8*	2.2/1.8*	9.5/17.5	5.5/7.3	7.4/15*	5.0/5.0	6.1/4.8
Availability	2Q95	2Q96?	2Q95	4Q95	2Q95	1Q96	3Q96	1Q96	2Q96	4Q95
1K List Price	\$1,375	not avail	\$443	\$1,395	\$450	not avail	not avail	not avail	\$365	\$974

†SPEC95 baseline (int/FP) ‡includes 256K L2 cache

(Source: vendors except *MDR estimates)

The table above gives the vital statistics for the RISC processors expected to play key roles in 1996, plus Pentium Pro for comparison. The table at the right gives updated data for the 0.35-micron versions of parts expected to move to this process in 1996. The table below compares performance on the full SPEC95 benchmark suite for currently shipping processors that have reported SPEC95 results.

	PowerPC 604e	Digital 21164A	Ultra Sparc-2	Pentium Pro (P6S)
Clock Speed	166 MHz	417 MHz	300 MHz	200 MHz
IC Process	0.35μ 4M	0.35μ 4M	0.29μ 5M	0.35μ 4M
Die Size	148 mm ²	209 mm ²	149 mm ²	196 mm ²
Est Mfg Cost*	\$75	\$190	\$130	\$200±
SPEC95bt	6.0/5.3	11/17	11/18	8.1/6.0
Availability	2Q96	3Q96	3Q96	4Q95

†SPEC95 baseline (int/FP)

(Source: vendors except

‡includes 256K L2 cache chip

*MDR Cost Model)

Processor	Intel PPro	Digital 21164	Sun UltraSparc	PowerPC 604	HP PA-7200	MIPS R4400SC	Digital 21064A	HP PA-7150	IBM Power2	PowerPC 601
System	"Alder" board	AlphaSta. 600 5/300	Sun prototype	IBM prototype	HP9000 Mod J210	Siemens RM600	DEC 3000 Mod 900	HP9000 735/125	IBM 591 RS/6000	IBM C10 RS/6000
Clock Rate	200 MHz	300 MHz	167 MHz	133 MHz	120 MHz	250 MHz	275 MHz	125 MHz	77 MHz	80 MHz
Ext. Cache	256K sync	4M	2M sync	1M sync	512K	4M	2M	512K	256K	1M
099.go	8.11	10.4	6.4	6.49	7.40	5.79	5.99	6.87	4.91	3.15
124.m88Ksim	7.81	7.61	4.7	4.34	3.80	3.65	4.46	3.41	2.66	2.07
126.gcc	7.65	7.40	6.2	4.98	5.01	4.27	3.90	4.62	3.84	2.61
129.compress	6.99	6.72	7.0	5.11	4.34	4.16	4.20	3.94	4.90	2.69
130.li	8.62	6.77	5.1	4.27	4.28	4.76	3.50	4.12	3.03	2.18
132.jpeg	8.43	7.70	6.0	6.17	3.33	4.15	4.39	2.78	4.27	2.30
134.perl	8.21	7.35	4.1	4.06	3.90	4.53	4.38	3.53	3.10	2.07
147.vortex	9.14	8.70	5.8	4.47	3.94	3.19	3.54	4.10	3.37	2.07
SPECint95b*	8.09	7.75	5.6	4.92	4.37	4.26	4.24	4.04	3.67	2.37
101.tomcatv	9.64	16.3	19	5.62	14.0	—	8.39	5.05	23.1	4.41
102.swim	12.3	23.8	25	7.12	21.4	—	11.8	10.6	28.6	6.71
103.su2cor	3.70	7.62	5.8	3.18	3.25	—	3.98	2.19	8.20	2.25
104.hydro2d	4.16	8.22	6.5	2.71	4.26	—	3.83	2.19	5.40	1.54
107.mgrid	3.22	9.97	5.5	4.06	5.26	—	6.02	3.13	8.22	2.45
110.applu	3.29	6.60	7.0	3.57	4.47	—	3.71	2.88	8.28	2.25
125.turb3d	5.93	11.2	7.7	5.72	5.62	—	4.80	4.25	9.38	2.04
141.apsi	6.64	14.0	8.7	5.12	7.17	—	8.74	4.21	7.39	3.09
145.fpppp	10.6	20.7	15	7.93	12.1	—	8.85	11.1	13.3	4.53
146.wave5	7.41	16.3	12	3.95	12.5	—	7.73	8.23	17.0	3.29
SPECfp95b*	5.99	12.4	9.8	4.63	7.54	—	6.29	4.55	11.2	2.97

*SPEC95 baseline results

(Source: vendors, SPEC)