

CHART WATCH: WORKSTATION PROCESSORS

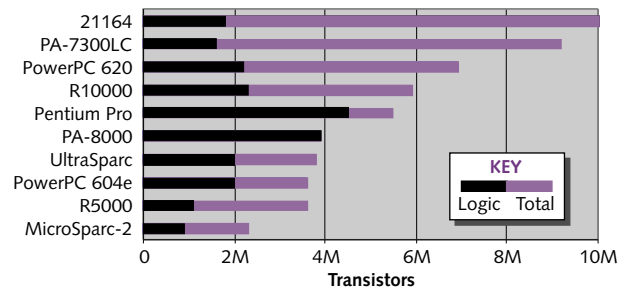
	Digital 21164	PowerPC 620	PowerPC 604e	Sun UltraSparc	Micro Sparc-2	HP PA-8000	HP PA-7300LC	MIPS R10000	MIPS R5000	Pentium Pro
Clock Rate	500 MHz	200 MHz*	200 MHz	200 MHz	110 MHz	180 MHz	160 MHz*	200 MHz	180 MHz	200 MHz
Cache Size	8K/8K/96K	32K/32K	32K/32K	16K/16K	16K/8K	none	64K/64K	32K/32K	32K/32K	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	CBGA-255	CPGA-521	CPGA-321	flip-chip	CPGA-464	CPGA-527	SBGA-272	MCM-387
IC Process	0.35µ 4M	0.35µ 4M	0.35µ 4M	0.42µ 4M	0.4µ 3M	0.5µ 4M	0.5µ 4M	0.35µ 4M	0.35µ 3M	0.35µ 4M
Die Size	209 mm²	240 mm²*	148 mm²	265 mm²	233 mm²	345 mm²	259 mm²	298 mm²	84 mm²	196 mm²
Transistors	9.3 million	6.9 million	5.1 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*	\$165	\$210	\$60	\$190	\$90	\$290	\$100	\$250	\$30	\$175‡
Power (max)	25 W	30 W	20 W*	30 W	9 W	>40 W	15 W	30 W	10 W	35 W‡
SPEC95bt	13/18*	9.0/9.0*	7.8/6.5	6.9/11.1	1.4/1.9	10.8/18.3	5.5/7.3	8.1/10.5	4.0/3.7	8.7/6.0
Availability	4Q96*	2H96	2H96	2Q96	2Q95	2Q96	3Q96	1Q96	1Q96	2Q96
1K List Price	\$2,000*	not avail	not avail	\$1,395	\$450	not public	not avail	\$3,000	\$365	\$1,217

†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 later this year. The graph compares the transistor counts for these devices for the logic (noncache) portion and the complete design. The table below provides performance data on the full SPEC95 benchmark suite for currently shipping processors that have reported SPEC95 results.



Processor	HP PA-8000	Digital 21164	Intel PPro	MIPS R10000	Sun UltraSparc	Intel Pentium	Hal Sparc64	PowerPC 604	MIPS R5000	Ross HyperSparc
System	HP9000 K460EG	AlphaSta. 500/400	Fujitsu ICL J650i	SGI Power Challenge	Sun Ultra 2/1200	Intel XXpress	Fujitsu Hal 300	RS/6000 Mod. 43P	SGI Indy R5000	Sun SS20/151
Clock Rate	180 MHz	400 MHz	200 MHz	195 MHz	200 MHz	200 MHz	118 MHz	133 MHz	180 MHz	150 MHz
Ext. Cache	2M	2M	512K	2M	1M	1M	none	512K	512K	512K
099.go	11.8	11.5	8.54	9.30	8.24	5.57	5.89	5.76	3.74	5.36
124.m88Ksim	11.6	9.92	7.80	8.60	5.89	6.10	3.32	4.50	4.94	3.28
126.gcc	9.33	8.63	8.22	8.28	7.76	5.30	5.49	4.36	3.76	3.74
129.compress	10.6	9.79	8.21	8.59	8.44	4.81	3.53	4.60	3.02	4.04
130.li	11.4	8.98	9.29	7.62	5.89	6.39	3.70	3.76	4.55	4.18
132.jpeg	9.97	10.7	8.42	8.00	6.95	3.91	5.60	5.63	4.22	4.03
134.perl	10.4	9.54	9.11	9.49	5.92	6.91	5.00	4.05	5.49	3.00
147.vortex	11.5	9.43	10.3	8.30	6.71	5.33	5.03	4.11	3.62	3.04
SPECint95b*	10.8	9.77	8.71	8.50	6.90	5.47	4.59	4.55	4.10	3.77
101.tomcatv	30.4	16.7	8.91	16.9	20.1	3.62	16.9	4.22	6.16	6.52
102.swim	30.2	20.7	12.4	20.6	27.6	4.28	24.8	4.93	8.94	11.3
103.su2cor	12.8	8.02	3.89	8.40	7.88	1.90	4.95	2.17	1.92	2.95
104.hydro2d	10.6	6.61	3.69	6.41	6.44	1.78	6.47	2.05	2.08	2.37
107.mgrid	15.4	7.82	3.30	11.4	10.1	1.69	4.85	3.49	4.11	3.31
110.applu	15.2	6.93	3.28	8.64	7.02	1.48	7.75	3.01	3.60	2.97
125.turb3d	12.9	15.0	5.78	9.57	7.26	3.46	4.91	4.52	4.66	4.97
141.apsi	12.3	15.4	6.75	14.5	10.3	3.65	6.38	4.30	4.65	4.54
145.fpppp	32.1	26.8	10.7	28.1	14.8	6.75	14.9	7.72	14.9	6.62
146.wave5	28.3	19.3	7.74	21.0	12.5	4.05	12.8	2.43	5.22	7.31
SPECfp95b*	18.3	12.8	5.95	13.1	11.1	2.92	8.87	3.59	4.72	4.73

*SPEC95 baseline results

(Source: vendors, SPEC)