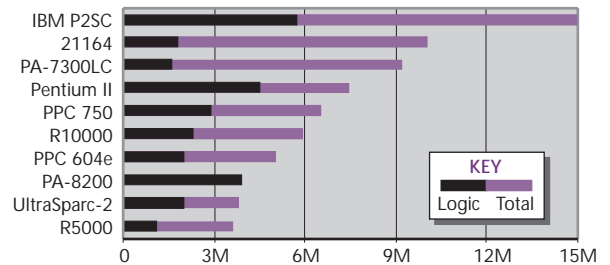


CHART WATCH: WORKSTATION PROCESSORS

| | Digital 21164 | IBM P2SC | PowerPC 750 | PowerPC 604e | Sun Ultra-2 | HP PA-8200 | HP PA-7300LC | MIPS R10000 | MIPS R5000 | Intel Pentium II |
|--------------------|---------------------|---------------------|--------------------|--------------------|---------------------|---------------------|---------------------|---------------------|--------------------|---------------------|
| Clock rate | 600 MHz | 135 MHz | 266 MHz | 350 MHz | 300 MHz | 236 MHz | 160 MHz | 250 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 | 1K 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 | 120 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 | 0.25μ 4M | 0.35μ 3M | 0.28μ 4M |
| Die size | 209 mm ² | 335 mm ² | 67 mm ² | 47 mm ² | 149 mm ² | 345 mm ² | 259 mm ² | 197 mm ² | 84 mm ² | 203 mm ² |
| Transistors | 9.3 million | 15 million | 6.4 million | 5.1 million | 3.8 million | 3.9 million | 9.2 million | 6.8 million | 3.6 million | 7.5 million |
| Est mfg cost* | \$125 | \$375 | \$40 | \$30 | \$90 | \$270 | \$95 | \$130 | \$25 | \$90 |
| Power (max) | 25 W | 30 W | 5 W | 7 W | 20 W | >40 W | 15 W | 16 W | 10 W | 30 W* |
| SPEC95bt | 16.3/19.9 | 5.9/15.4 | 10.5/7.7 | 12/7* | 10.4/14.5 | 16.3/23.0 | 7.3/7.4 | 13/22 | 4.7/4.7 | 11.6/6.8 |
| Availability | 2Q97 | 3Q96 | 3Q97 | 3Q97 | 2Q97 | 3Q97 | 3Q96 | 3Q97 | 1Q96 | 3Q97 |
| 1K list price | Not public | Not public | \$568 | \$695 | \$3,635§ | Not public | Not public | Not public | \$325 | \$851† |

†SPEC95 baseline (int/fp) ‡includes 512K L2 cache §includes 2M L2 cache (Source: vendors except *MDR estimates)

The table above gives the vital statistics for the key RISC processors available today. 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 | HP PA-8200 | Digital 21164 | Intel Pentium II | MIPS R10000 | Sun UltraSparc | PowerPC 604e | HP 7300LC | Intel P55C | IBM P2SC | MIPS R5000 |
|--------------|-------------|----------------|------------------|-------------------|------------------|--------------|----------------------|---------------|-----------------|-------------------|
| System | HP9000 C240 | AlphaSta. 600a | Intel "Portland" | Siemens RM400 C90 | Sun Ultra 2 1300 | RS/6000 E30 | HP Visual. Mod B160L | Intel LT430TX | IBM 595 RS/6000 | Siemens RM300 C40 |
| Clock rate | 236 MHz | 600 MHz | 300 MHz | 200 MHz | 300 MHz | 233 MHz | 160 MHz | 233 MHz | 135 MHz | 180 MHz |
| Ext. cache | 4M | 2M | 512K | 4M | 2M | 512K | 1M | 512K | none | 512K |
| 099.go | 17.3 | 19.0 | 10.8 | 11.1 | 11.2 | 11.8 | 9.80 | 7.80 | 8.00 | 4.99 |
| 124.m88Ksim | 18.0 | 15.3 | 11.8 | 9.81 | 10.7 | 8.80 | 6.82 | 8.41 | 4.67 | 4.61 |
| 126.gcc | 14.3 | 16.0 | 10.9 | 10.7 | 11.0 | 8.72 | 7.16 | 7.13 | 6.20 | 4.78 |
| 129.compress | 16.5 | 16.5 | 9.06 | 11.1 | 11.8 | 7.40 | 6.24 | 4.84 | 5.55 | 4.63 |
| 130.li | 17.0 | 15.3 | 12.4 | 10.7 | 8.89 | 7.05 | 7.43 | 8.02 | 5.21 | 4.52 |
| 132.jpeg | 13.4 | 18.2 | 11.9 | 9.97 | 10.6 | 9.44 | 5.81 | 4.66 | 7.44 | 4.31 |
| 134.perl | 16.0 | 17.3 | 13.7 | 11.7 | 9.22 | 7.96 | 8.08 | 10.3 | 5.33 | 6.21 |
| 147.vortex | 18.5 | 13.6 | 12.9 | 10.9 | 10.0 | 7.39 | 7.91 | 7.55 | 5.40 | 3.89 |
| SPECint95b* | 16.3 | 16.3 | 11.6 | 10.7 | 10.4 | 8.46 | 7.32 | 7.12 | 5.88 | 4.70 |
| 101.tomcatv | 32.6 | 24.3 | 9.21 | 24.5† | 23.9 | 5.84 | 11.1 | 7.36 | 33.3 | 6.16‡ |
| 102.swim | 31.8 | 28.1 | 15.0 | 32.2† | 29.6 | 10.2 | 17.9 | 8.29 | 39.8 | 8.94‡ |
| 103.su2cor | 16.4 | 10.8 | 4.08 | 10.5† | 9.35 | 2.56 | 3.66 | 3.05 | 6.44 | 1.92‡ |
| 104.hydro2d | 11.2 | 9.71 | 3.51 | 10.4† | 8.46 | 2.15 | 3.86 | 2.95 | 8.34 | 2.08‡ |
| 107.mgrid | 19.1 | 17.3 | 4.15 | 18.5† | 13.6 | 4.56 | 5.64 | 2.15 | 12.9 | 4.11‡ |
| 110.applu | 16.7 | 9.88 | 4.98 | 12.2† | 8.68 | 3.26 | 4.99 | 2.01 | 12.9 | 3.60‡ |
| 125.turb3d | 19.0 | 24.3 | 7.46 | 12.1† | 13.9 | 7.59 | 6.70 | 4.69 | 13.7 | 4.66‡ |
| 141.apsi | 23.8 | 24.7 | 8.73 | 15.9† | 16.7 | 6.83 | 7.69 | 4.81 | 8.73 | 4.65‡ |
| 145.fpppp | 41.6 | 48.4 | 9.28 | 26.8† | 19.1 | 22.1 | 12.4 | 5.65 | 20.2 | 14.9† |
| 146.wave5 | 36.9 | 27.9 | 8.43 | 25.3† | 14.2 | 6.61 | 9.54 | 6.03 | 25.7 | 5.22‡ |
| SPECfp95b* | 23.0 | 19.9 | 6.79 | 17.4† | 14.5 | 5.71 | 7.38 | 4.23 | 15.4 | 4.72‡ |

*SPEC95 baseline results †measured on SGI Origin 2000 ‡measured on SGI Indy R5000 (Source: vendors, SPEC)