Cahners
MICROPROCESSOR REPORT
www.mpronline.com
THE INSIDER'S GUIDE TO MICROPROCESSOR HARDWARE

TSMC Goes Copper

By Keith Diefendorff [1/17/00-03]

Taiwan Semiconductor Company *(www.tsmc.com)* has laid claim to being the first foundry to offer a fully qualified copper process to customers. The company's new CL018LV process is a true 0.18-micron process with metal pitches similar to leading-edge processes from its foundry rivals IBM (with CMOS-7SF) and UMC (with L180).

TSMC says it can build CL018LV with six layers of copper, but it expects most of its customers to opt for four layers of aluminum topped by two levels of copper. This alternative gains much of the advantage of copper, but it will cost less—at least until TSMC's fabs have been fully retooled for copper. The company expects to turn out 10,000 two-layer-copper wafers this year and 40,000 copper layers per month (approximately 6,000 all-copper wafers per month) in 2000.

Like IBM but unlike Intel, TSMC believes copper offers significant advantages in the 0.18-micron generation. The primary advantage it cites is reliability. With current densities mounting as transistor counts skyrocket and voltages fall, electromigration failure becomes a larger concern. TSMC says copper offers 30–50× better electromigration reliability than aluminum. TSMC also claims its copper layers have 1.6× lower sheet resistance and 5× lower via resistance than aluminum, resulting in a 15% reduction in RC delays.

CL018LV employs aggressive features, such as 27-Å gate oxides and cobalt-silicided poly and diffusions, to boost performance. At 1.5 V, TSMC says, the process is 100% denser and 30% faster, and consumes only one-third the power of its current 0.25-micron process. TSMC decided, however, to save low-*k* dielectrics for its 0.15-micron seven-layer-metal shrink, scheduled for risk production in 2Q00, and its 0.13-micron eight-layer-copper CL013LV process, which it hopes to deploy in the first half of 2001.

While TSMC's new process has impressive specifications, it is not clear by what criterion the company claims to be the first foundry to offer commercially available copper. UMC says it has been shipping copper for some time, a fact that one of its customers, Xilinx, has publicly confirmed. And IBM, which has already shipped over a million copper PowerPC microprocessors in CMOS-7S, will very soon offer two to six layers of copper in CMOS-7SF to its foundry customers.

But which company is first by what criterion is a moot point, other than for its marketing value. The simple fact is that all three of these foundries are entering production with 0.18-micron copper processes at about the same time. TSMC's process is clearly state of the art, and it will provide fabless semiconductor companies with a process capability that in many ways rivals the ones used by technology leaders IBM and Intel on their most advanced microprocessors