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Direct Electron Beam Writing of Devices and  
Circuits on Silicon

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The Bell Laboratories Electron Beam Exposure System (EBES) has been combined with sensitive electron resists to produce functioning microwave bipolar transistors with features of one micron and functioning, high density, high-speed, N-channel MOS circuits, such as 4096-bit random access memories with minimum dimensions of 2 microns. Both negative poly (glycidyl methacrylate-co-ethyl acrylate) (COP) and positive poly (butene-1-sulfone) (PBS) resists were used. In some cases, the device processing required modification to accommodate the properties of the electron resist used. The transfer of the resist patterns into the circuit material employed wet and dry etching processes. The plasma etching characteristics of the resists and of some film materials commonly encountered in silicon technology will be presented. Results on the linewidth control of the etched patterns, the wafer distortion due to high temperature processing and the registration accuracy will be presented.

