How lithography enables Moore's Law

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Moore's Law dictates that every 18 months the number of transistors on an integrated chip doubles. This is first and foremost enabled by optical lithography printing ever smaller transistor on an integrated circuit.

The ongoing shrink has been enabled by a combination of increased numerical aperture (*NA*) of the projection lenses and decreased wavelength. State-of-the art immersion lithography tools print >250 wafers/hour. The *NA* of 1.35 limits to resolution to 38 nm half-pitch, however much smaller resolutions are obtained by using multiple patterning.

Several technologies are being pursued to extend Moore's Law for the next decade. Extreme ultraviolet (EUV, corresponding to 13 nm light) has by far the most industry support and has printed sub-20 nm features at productivities sufficient to start R&D of the 10 nm node.

After a short introduction of IC-making in the past, we will discuss the present and future of lithography. This includes a comparison of potential future lithography technologies (electron beam, nanoimprint, as well as directed-self-assembly) followed by a discussion of critical EUV technologies (high-power sources, mask and resist).