ABSTRACT

A METHOD AND MASK STRUCTURE FOR SELF-ALIGNING ION IMPLANTING TO FORM VARIOUS DEVICE STRUCTURES

A method for making self-aligned sub-micrometer bipolar transistors and FETs on a substrate for BiFET and BiCMOS circuits was achieved using a novel LOCOS structure as a self-aligned implant mask. This LOCOS structure uses a silicon nitride mask comprised of stripes with well defined widths and spacings to form a punchthrough oxide mask of varying thicknesses over the emitter, base, and collector of the bipolar transistor, while providing a thick field oxide elsewhere on the substrate. The oxide mask serves as a self-aligned implant mask for implanting the emitter, base, and collector of the bipolar transistor. The nitride mask can be patterned concurrently to form an implant mask for the FET. A series of ion implants is then used to form the emitter, base, and collector without requiring separate photoresist masks. An array of nitride stripes with well defined widths and spacings can be used to make larger transistors, such as bipolar power transistors. The method for simultaneously forming the bipolar and FET minimizes the thermal budget, and the collector implant can be adjusted to minimize the collector contact resistance. The partially recessed punchthrough oxide around the emitter region reduces the base current, and therefore improves the base transport factor (gain) of the bipolar transistor.

(FIGURE 1 IS SUGGESTED FOR PUBLICATION)