

Digital Circuits Using Self-Shunted Nb/Nb_xSi_{1-x}/Nb Josephson Junctions

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Abstract - For the first time superconducting digital circuits based on Josephson junctions with amorphous niobium-silicon (a-NbSi) barriers have been fabricated and tested. Single-flux-quantum (SFQ) shift registers operated with $\pm 30\%$ bias margins, confirming junction reproducibility and uniformity. Static digital dividers operated up to 165 GHz for a single value of bias current, which was only marginally slower than circuits fabricated with externally shunted AlO_x-barrier junctions having a comparable critical current density of 4.5 kA/cm². In comparison, self-shunted a-NbSi junctions enabled a doubling in circuit density. This and their relatively thick 10 nm barriers could increase the yield of complex SFQ circuits.

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