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Enhanced Voltage Swing of RSFQ Output Amplifiers Equipped with Double-Stack SQUIDs

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We have enhanced voltage swing of an RSFQ distributed amplifier by replacing a SQUID, which works as a voltage generator, with a double-stack SQUID. A double-stack SQUID is a 4-junction SQUID with two superconducting loop. In other words, it is composed of two stacked SQUIDs sharing a sensing inductor. Because of its stack structure, a double-stack SQUID is expected to generate two-fold output voltage. We have designed 4-, 12-, and 24-stage RSFQ distributed amplifiers equipped with 4, 12, and 24 double-stack SQUIDs, respectively. The fundamental cell, of which the dimensions are 80 by 80 μm^2 , is compatible with an RSFQ digital cell library referred to as "CONNECT." Test chips were fabricated using a $25\text{-}\mu\text{A}/\mu\text{m}^2$ Nb integration process of the National Institute of Advanced Industrial Science and Technology, which was referred to as the AIST STP2. In measurements, a test chip was cooled in a liquid helium bath. The experimental output voltage swings of 4-, 12- and 24-stage RSFQ distributed amplifiers were up to 2.93, 8.34, and 14.50 mV, respectively.

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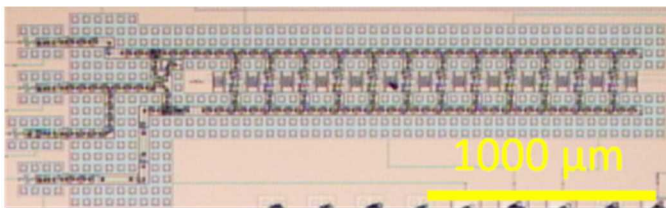
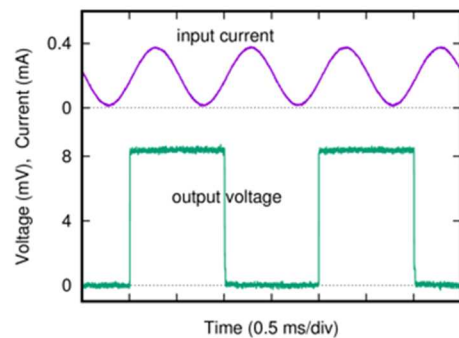


Fig. Photomicrograph and operation waveforms of a 12-stage RSFQ output amplifier equipped with double-stack SQUIDs.



Keywords: distributed amplifier, Nb/AlOx/Nb, RSFQ digital circuits, IO interface