Design and Measurement of SFQ AND Gate for ALU

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We have designed and measured a SFQ(Single Flux Quantum) AND gate for ALU(Arithmetic Logic Unit). This AND gate circuit is a combination of two D Flip-Flop. D Flip-Flop and dc SQUID are in similar shape from the fact that it has the loop inductor and two Josephson junctions. For a operation and measurement of AND gate, we attach three DC/SFQ, two SFQ/DC and one RS Flip-Flop to AND gate. SFQ pulse.is generated from DC/SFQ and entered in AND gate. DC/SFQ circuit is used data and clock. Input frequency of 10kHz and 1MHz are entered in DC/SFQ. Output date from AND gate go to RS flip-Flop. We show output date of AND gate using oscilloscope that connect to RS Flip-Flop. We obtained operating margins through simulation and measurement. This simulation and layout of AND gate was used XIC, WRspice and Lmeter. We obtain operation margins of more than ±38% through simulation and more than ±25% through measurement. This circuit was measured to inside of liquid helium.

keywords : SFQ, AND-gate, superconductor