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Superconducting qubits with adjustable coupling, Part II: Fast two-qubit gates CHARLES NEILL, YU CHEN, PEDRAM ROUSHAN, RAMI BARENDS, BROOKS CAMPBELL, ZIJUN CHEN, BEN CHIARO, ANDREW DUNSWORTH, IOCHUN HOI, EVAN JEFFREY, JULIAN KELLY, ANTHONY MEGRANT, JOSH MUTUS, PETER O'MALLEY, CHRIS QUINTANA, DANIEL SANK, JIM WENNER, TED WHITE, ANDREW CLELAND, JOHN MARTINIS, UCSB — The g-mon architecture combines high coherence Xmon qubits with fast tunable coupling. In this work, we demonstrate the advantages of tunable coupling to high fidelity single and two-qubit gates. By suppressing the qubit-qubit interaction, we are able to achieve high-fidelity simultaneous single qubit operations without the need for substantial detuning. Turning on the qubit-qubit interaction allows for a fast two-qubit controlled Z with gate times less than 30 ns. By eliminating the frequency crowding issues associated with static coupling and achieving two-qubit gate times approaching that of single qubit operations, the g-mon architecture is a promising system for scalable quantum computation.

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