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High fidelity gates and states in a 5 Xmon qubit Josephson quantum processor, part I: architecture J. KELLY, R. BARENDS, A. MEGRANT, UC Santa Barbara, A. VEITIA, UC Riverside, E. JEFFREY, D. SANK, T. WHITE, J. MUTUS, J. BOCHMANN, B. CAMPBELL, Y. CHEN, Z. CHEN, B. CHIARO, A. DUNSWORTH, I. HOI, C. NEILL, P. O'MALLEY, C. QUINTANA, P. ROUSHAN, A. VAINSENCHER, J. WENNER, UC Santa Barbara, A. KOROTKOV, UC Riverside, A.N. CLELAND, J.M. MARTINIS, UC Santa Barbara — One of the greatest challenges in building a quantum architecture is to combine high fidelity logic gates with a multiqubit system. Here, we demonstrate high fidelity gates in a 5 Xmon qubit quantum processor using a multiqubit architecture which combines coherence, control and connectivity. The qubits are arranged in a linear chain with nearest neighbor coupling, have individual control and readout, and reach T_1 values up to 57 μs. We characterize single qubit gates with a fidelity above 99.9 % for all qubits. Using the frequency tunability of the qubits, we employ a novel implementation of a fast, adiabatic two-qubit controlled-phase gate, measuring fidelities up to 99.45 %.

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