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3D Integration for Superconducting Qubits DANNA ROSENBERG, DAVID KIM, DONNA-RUTH YOST, JUSTIN MALLEK, JONILYN YODER, RABINDRA DAS, LIVIA RACZ, DAVID HOVER, STEVEN WEBER, ANDREW KERMAN, MIT Lincoln Laboratory, WILLIAM OLIVER, MIT Lincoln Laboratory; Research Laboratory of Electronics, MIT — Superconducting qubits are a prime candidate for constructing a large-scale quantum processor due to their lithographic scalability, speed, and relatively long coherence times. Moving beyond the few qubit level, however, requires the use of a three-dimensional approach for routing control and readout lines. 3D integration techniques can be used to construct a structure where the sensitive qubits are shielded from a potentially-lossy readout and interconnect chip by an intermediate chip with through-substrate vias, with indium bump bonds providing structural support and electrical conductivity. We will discuss our work developing 3D-integrated coupled qubits, focusing on the characterization of 3D integration components and the effects on qubit performance and design. This research was funded by the Office of the Director of National Intelligence (ODNI), Intelligence Advanced Research Projects Activity (IARPA) via MIT Lincoln Laboratory under Air Force Contract No. FA8721-05-C-0002. The views and conclusions contained herein are those of the authors and should not be interpreted as necessarily representing the official policies or endorsements, either expressed or implied, of ODNI, IARPA, or the US Government.

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