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All-microwave cavity-mediated three-qubit gate between superconducting qubits SOPHIA ECONOMOU, ED BARNES, Department of Physics, Virginia Tech — While single-qubit and entangling two-qubit operations are universal for quantum computing, in practice the availability of a single-shot multi-qubit entangling gate can be faster and of higher fidelity. For the case of three qubits coupled to a common cavity mode, we show that a high fidelity, fast CCZ gate can be implemented. Our proposal is based on partial spectrum engineering and pulse shaping. Because our approach does not rely on frequency selectivity, instead driving more than one transitions simultaneously, our three-qubit gate can be achieved on a timescale comparable to that of a two-qubit gate. Our protocol generalizes our recently introduced SWIPHT two-qubit gates.

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