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Using quantum process tomography to characterize decoherence in an analog electronic device[1] COREY OSTROVE, BRIAN LA COUR, ANDREW LANHAM, GRANVILLE OTT, Applied Research Labs: UT Austin — The mathematical structure of a universal gate-based quantum computer can be emulated faithfully on a classical electronic device using analog signals to represent a multi-qubit state. We describe a prototype device capable of performing a programmable sequence of single-qubit and controlled two-qubit gate operations on a pair of voltage signals representing the real and imaginary parts of a two-qubit quantum state. Analog filters and true-RMS voltage measurements are used to perform unitary and measurement gate operations. We characterize the degradation of the represented quantum state with successive gate operations by formally performing quantum process tomography to estimate the equivalent decoherence channel. Experimental measurements indicate that the performance of the device may be accurately modeled as an equivalent quantum operation closely resembling a depolarizing channel with a fidelity of over 99%.

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