

# Willow Spec Sheet

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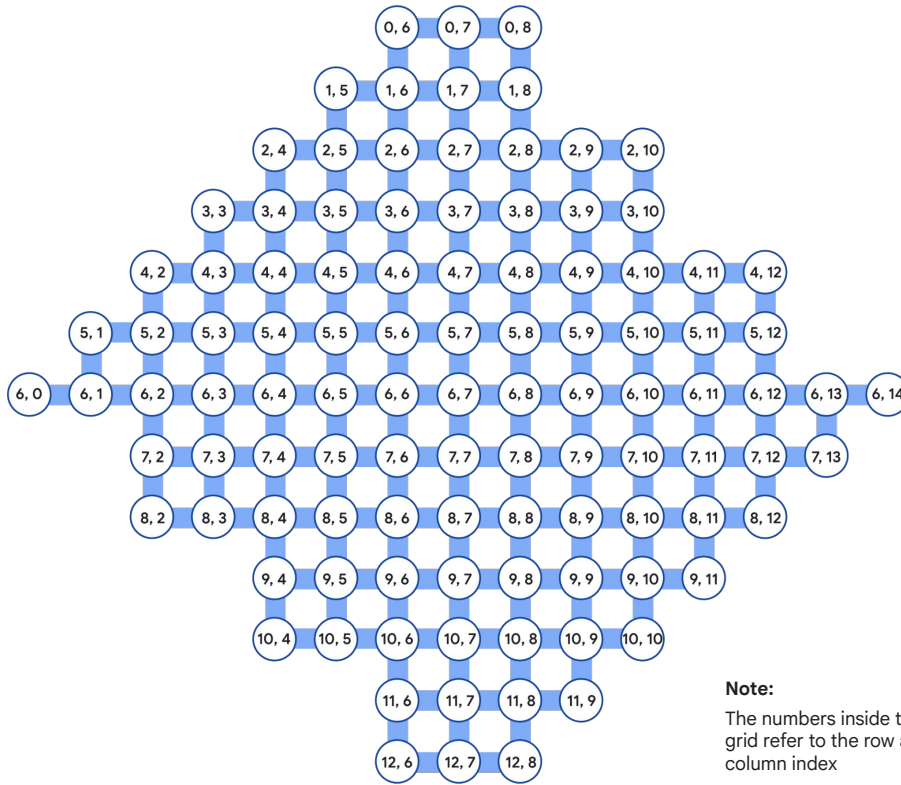
Willow, Google Quantum AI's latest quantum chip, features breakthrough improvements that enable major advances in quantum error correction and random circuit sampling. This spec sheet summarizes Willow's performance across key hardware metrics.

Willow System Metrics	
Number of qubits	105
Average connectivity	3.47 (4-way typical)
Quantum Error Correction (Chip 1)	
Single-qubit gate error <sup>1</sup> (mean, simultaneous)	0.035% ± 0.029%
Two-qubit gate error <sup>1</sup> (mean, simultaneous)	0.33% ± 0.18% (CZ)
Measurement error (mean, simultaneous)	0.77% ± 0.21% (repetitive, measure qubits)
Reset options	Multi-level reset ( 1> state and above) Leakage removal ( 2> state only)
T <sub>1</sub> time (mean)	68 μs ± 13 μs <sup>2</sup>
Error correction cycles per second	909,000 (surface code cycle = 1.1 μs)
Application performance	$\Lambda_{3,5,7} = 2.14 \pm 0.02$
Random Circuit Sampling (Chip 2)	
Single-qubit gate error <sup>1</sup> (mean, simultaneous)	0.036% ± 0.013%
Two-qubit gate error <sup>1</sup> (mean, simultaneous)	0.14% ± 0.052% (iswap-like)
Measurement error (mean, simultaneous)	0.67% ± 0.51% (terminal, all qubits)
Reset options	Multi-level reset ( 1> state and above) Leakage removal ( 2> state only)
T <sub>1</sub> time (mean)	98 μs ± 32 μs <sup>2</sup>
Circuit repetitions per second	63,000
Application performance	103 qubits, depth 40, XEB fidelity = 0.1%
Estimated time on Willow vs. classical supercomputer	5 minutes vs. 10 <sup>25</sup> years

<sup>1</sup>Operation errors measured with randomized benchmarking techniques and reported as "average error"

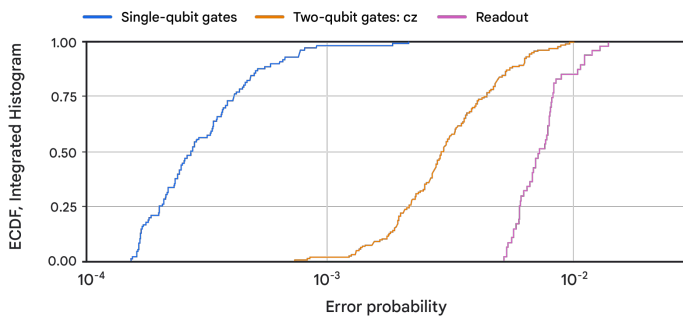
<sup>2</sup>Chip 1 and 2 exhibit different T<sub>1</sub> due to a tradeoff between optimizing qubit geometry for electromagnetic shielding and maximizing coherence

# Qubit grid

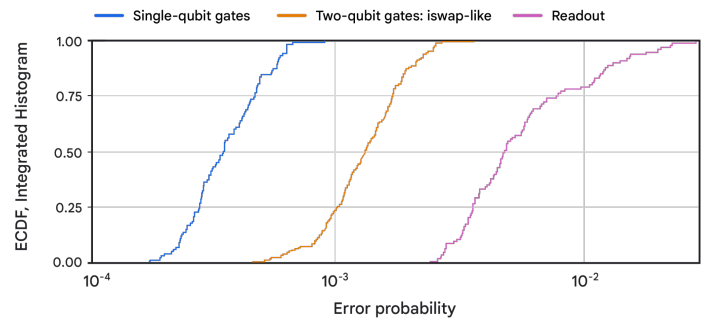


## Full Distributions

### Willow Chip 1: QEC



### Willow Chip 2: RCS



### Coherence

