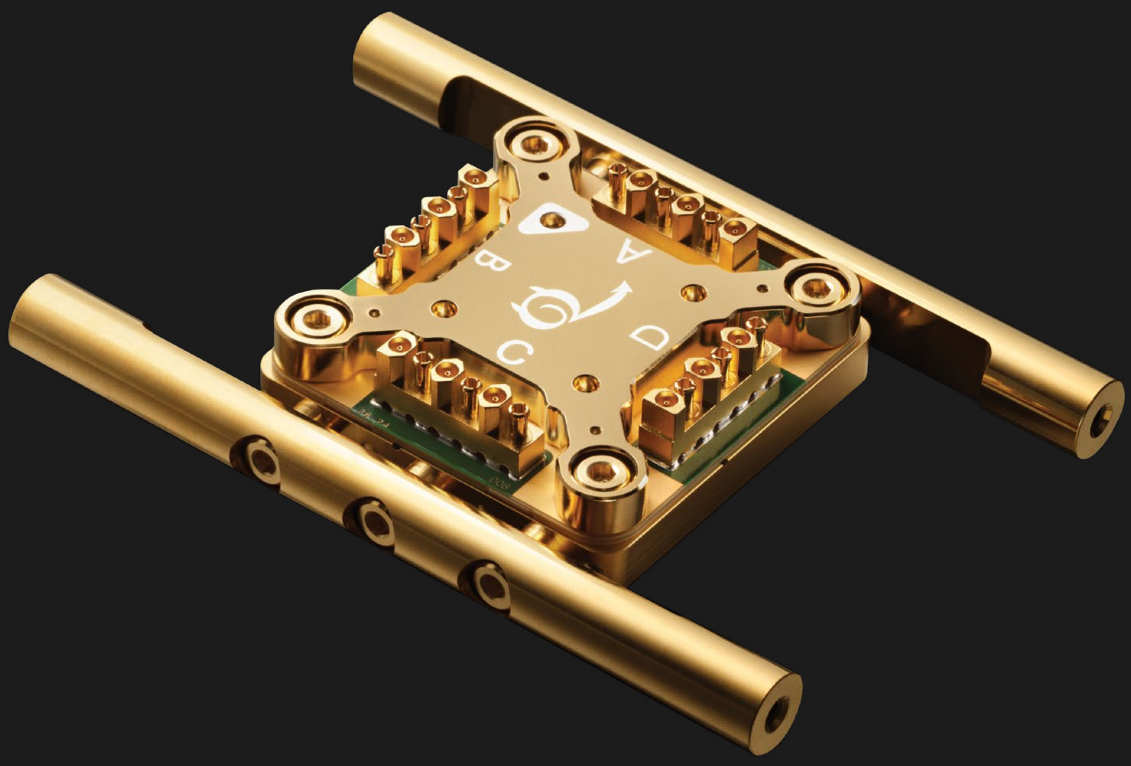
QUANTUM MACHINES

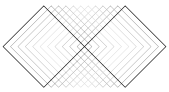


QCage.24 Core

Your Shortcut to State-of-the-Art Chip Packaging
for High-Fidelity Qubit Measurements

quantum-machines.co

Highlights



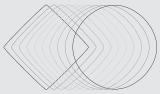
Provides essential functionality for packaging superconducting quantum devices, leveraging the established state-of-the-art capabilities of the QCage products. It includes the core PCB sample board and microwave cavity that enclose the chip in a well-defined and shielded electrostatic environment, while the all-surrounding superconducting aluminum casing has been omitted.

QCage.24 Core can be provided either as a stand-alone system for mounting in bottom-loaders or to custom fridge interfaces, or as a magnetically shielded assembly for mounting directly to a mixing chamber plate with 24-way SMA connectivity. The magnetic shielding consists of a mu-metal shield, while the inner thermalized superconducting Meissner shield from the full shielding solution has been omitted.

The QCage products have been benchmarked extensively with quality factors of superconducting resonators reaching as high as 200 million[1] and coherence times for Transmon qubits reaching over 1000 µs[2]. Meanwhile, for the QCage.24 Core (without the superconducting casing), the expected coherence times are in the hundreds-of-microsecond range, enabling high fidelity operation for most superconducting qubits.

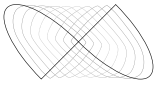
QCage.24 Core is future-proof, providing a starting point for measurements on superconducting quantum devices, with an upgrade path to the full QCage.24 configuration. This allows users to begin experimenting with low entry costs and later transition to the full state-of-the-art enclosure solution that delivers world-record results on both resonator losses and qubit coherence.

Features



- ✓ Sample chip fully enclosed and shielded inside microwave cavity for minimal interference
- ✓ Suspension of chip works to minimize losses and decoherence, ensuring higher qubit fidelities
- ✓ Cavity and PCB layout is optimized for resonance-free transmission up to 18 GHz
- ✓ Includes mounting hardware for most common dilution refrigerators
- ✓ Cabling options in multiple lengths with SMP or SMA connectors

Configurations



- ✓ Available as a stand-alone unit (for bottom-loaders or custom fridge interfaces) or as a magnetically shielded assembly (for direct fridge mounting)
- ✓ Includes two chip-holding cavity frames and five PCB sample boards
- ✓ Supplied with a wire bonding fixture plate for handling in the lab
- ✓ Excludes cabling for coaxial fridge line connections
- ✓ Upgradable to the full QCage.24 configuration with superconducting enclosure

1. Published by Kevin D. Crowley et. al. of Princeton University in PRX 13, 041005 (2023)
2. Published by Mikko Tuokkola et. al. of Aalto Univesity and VTT in arXiv:2407.18778

Specifications

Standard chip size	10.0 × 10.0 mm2 (± 0.5 mm) with 8.0 × 8.0 mm2 active circuit area
Standard die thickness	525 µm (± 50 µm)
Front-side cavity	10.5 × 10.5 × 2.5 mm3
Rear-side cavity	10.5 × 10.5 × 3.0 mm3
Lowest box-mode resonance	18.8 GHz (rear-side)
	20.0 GHz (front-side)
Insertion loss to bonding pads	- 1.5 dB to 8 GHz
	- 2.0 dB to 18 GHz
Reflection loss from cable end	-25 dB to 8 GHz
	-15 dB to 18 GHz
Neighbor line crosstalk	-60 dB to 12 GHz
	-40 dB to 18 GHz
Leakage across cavity	-90 dB to 12 GHz
	-60 dB to 18 GHz
Highest Q factors for superconducting resonators	> 5 million
Longest coherence times for transmon qubits	> 100 µs

Upgrade Options

QCage.24 Core comes with the option to later upgrade to the full QCage.24 product with superconducting casing. As such, it offers a shortcut to get started with measurements on superconducting quantum devices, with the option to upgrade to the full state-of-the-art solution that has delivered world-record results on both resonator losses and qubit coherence.

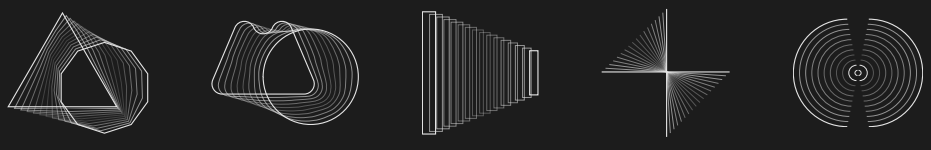
$12,690
stand-alone

$19,890
magnetic shielded

About Quantum Machines

Quantum Machines (QM) is driving the future of quantum computing through Hybrid Control, seamlessly integrating quantum and classical computing. Conventional controllers struggle with disjointed operations, creating friction that limits scalability. The Pulse Processing Unit (PPU), at the core of QM's innovation, is a special processor for quantum control, designed to eliminate this barrier by bringing classical computing closer to qubits, reducing latency and enabling real-time execution of quantum error correction, and other advanced algorithms. The hybrid development platform further streamlines development, empowering quantum computer builders to create efficient quantum-classical programs. OPX1000, QM's flagship controller, embodies this hybrid approach. It is a modular, high-density control platform with a cutting-edge quantum-led analog front end. OPX1000 is tailored for large-scale quantum computers, offering unparalleled performance, scalability, and ready HPC integration, including an ultra-fast interface to GPU/CPU accelerators for boosting quantum control. With hundreds of deployments worldwide, Quantum Machines' solutions are trusted by quantum computer builders, research labs, and HPC centers. For more information, visit **quantum-machines.co**.

** These specifications are given as-is and to the best of our knowledge. The full spec document, including relevant legal information and disclaimers is available upon request*



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