COETZER OPTICAL SYSTEMS (Pty) Ltd

Optical Random Number Module

Overview

Low-cost commercial optoelectronic components-driven quantum In this work, a feasible 64-Gb/s quantum random number generator (QRNG) scheme based on amplif.

Key Takeaways

Optical Random Number Modules generate true random numbers using quantum or optical phenomena, providing high-speed, secure, and unpredictable outputs for cryptography and simulations.Overview

Optical Random Number Modules (RNGs) exploit quantum randomness or optical effects to produce sequences of numbers that are inherently unpredictable, unlike conventional pseudo-random number generators. These devices are crucial for applications requiring high security, such as cryptography, secure communications, and stochastic simulations, because they provide true entropy that cannot be predicted or reproduced .

Key Technologies
• Quantum Random Number Generators (QRNGs) QRNGs use quantum processes, such as the random choice of a single photon between two paths, to generate random bits. Devices often employ single-photon detectors and optical fibers to measure photon arrival times, producing sequences with low correlation and high stability .

© 2026 COETZER OPTICAL SYSTEMS (Pty) Ltd - All rights reserved

• All-Optical Parametric Oscillators (OPOs) High-speed optical RNGs can use twin degenerate OPOs, where each oscillator randomly selects one of two phase states. An interferometer analyzes the relative phase, producing a binary output with equal probability. These systems can generate billions of bits without post-processing and maintain continuous operation for days .

• Brillouin Optomechanical Systems Some optical RNGs leverage Brillouin scattering in ring resonators. Thermal noise induces spontaneous transitions between stable states of a Brillouin laser, which are interpreted as binary random numbers. The generation rate and distribution can be controlled via pump and seed waves, and the output passes standard randomness tests like NIST SP 800-22 .

• Integrated Optical Chip RNGs Companies like Toshiba have developed mass-producible optical chip RNGs using photonic integrated circuits. These chips integrate optical components and photodetectors, achieving high-speed generation (e.g., 2 Gbps) while minimizing size and power requirements. Such chips are suitable for cryptography, simulations, and gaming applications .
Advantages
• True randomness: Based on quantum or optical phenomena, ensuring unpredictability.

• High speed: Capable of generating gigabits per second in modern implementations.

• Integration: Can be miniaturized into chips for embedded systems.

• Security: Resistant to attacks that exploit deterministic pseudo-random generators.
Applications
• Cryptography: Generating secure keys for encryption and secure communications.

• Simulations: Monte Carlo simulations and stochastic modeling in finance, physics, and biology.

• Gaming and lotteries: Ensuring fairness and unpredictability.

• Quantum key distribution (QKD): Providing high-quality entropy for secure quantum communications . Optical Random Number Modules represent a cutting-edge approach to generating high-quality randomness, combining quantum physics, photonics, and integrated circuit technology to meet the demands of modern secure systems.

© 2026 COETZER OPTICAL SYSTEMS (Pty) Ltd - All rights reserved

Article Content

All Optical Random Bit Generator | Explore Technologies

This true random number generator can be easily integrated and miniaturized, making it desirable for applications ranging from

Unbiased All-Optical Random-Number Generator

For random-number generation, the OPO is turned on and off by an optical chopper, which is installed such that it can inhibit the

Fast random number generator based on optical physical

We propose an approach for fast random number generation based on homemade optical physical unclonable functions (PUFs). The

Optical quantum random number generators: a comparative

Abstract Quantum random number generators give the opportunity to, in theory, obtain completely unpredictable numbers only

Optical Quantum Random Number Generator

A physical random number generator based on the intrinsic randomness of quantum mechanics is described. The random events are

High speed optical quantum random number generation

First designs of quantum random number generators used the spontaneous decay of radioactive nuclei as a non-deterministic

Unbiased All-Optical Random-Number Generator

The most crucial use of random numbers is strong cryptography { securing modern communication, money transfers, and storage of

© 2026 COETZER OPTICAL SYSTEMS (Pty) Ltd - All rights reserved

Contact Us

Continue your research online:

Website: https://coetzerinvestments.co.za
Technical inquiry: https://coetzerinvestments.co.za/contact.html

This document is for preliminary research. Verify specifications against current standards, product documentation and project requirements.

© 2026 COETZER OPTICAL SYSTEMS (Pty) Ltd - All rights reserved