CETHERA CTHR-01 beta

Quantum-Inspired PCIe Security Accelerator

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The CETHERA CTHR-01 beta is a guantum-inspired PCIe security accelerator designed to deliver unprecedented cryptographic performance and protection for enterprise environments. Built on the proven AMD Alveo U50 platform with AMD Xilinx UltraScale+ XCU50 FPGA architecture, the CTHR-01 beta combines hardware-accelerated encryption with revolutionary quantum-inspired cryptography to address the evolving threat landscape facing modern data centers. The accelerator features proprietary Quantum Entanglement-Based Cryptographic Protocol (QE-BCP) technology that enables real-time key



evolution, zero plaintext exposure, and homomorphic encryption capabilities. This comprehensive security solution is designed for deployment in enterprise servers, data centers, and high-performance computing environments requiring advanced cryptographic protection.

Product Overview

Key Innovations

- Quantum-Inspired Security Architecture: Revolutionary cryptographic approach that eliminates static key vulnerabilities
- **Real-Time Key Evolution:** Sub-millisecond key mutation preventing key reuse and enhancing forward security
- Zero Plaintext Exposure: Hardware-enforced encryption boundaries ensuring data never exists unprotected
- Homomorphic Encryption Support: Enables computation on encrypted data without decryption
- Ultra-High Throughput Performance: 400+ GB/s cryptographic processing capability

Form Factor and Connectivity

- PCle Interface: Gen3 x16 primary, dual Gen4 x8 compatible
- Form Factor: Full-height, half-length single-slot card
- Network Connectivity: 1x QSFP28 (100 GbE), 2x SFP-DD ports
- Power Requirements: 75W maximum thermal design power

Detailed Specifications

Core Hardware Platform

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Quantum-Inspired PCIe Security Accelerator

Specification	CTHR-01 Beta
FPGA Architecture	AMD Xilinx UltraScale+ XCU50 (16nm)
Logic Elements	1.3 million system logic cells
DSP Slices	6,840 high-performance DSP slices
Memory Architecture	8 GB HBM2 (2 × 4 GB stacks)
Memory Bandwidth	Up to 460 GB/s peak
Memory Channels	32 HBM2 AXI channels
Internal SRAM	28 MB ultra-fast on-chip memory
Configuration Memory	1 Gb Quad SPI flash

Cryptographic Performance

Performance Metric	Specification
Cryptographic Throughput	400+ GB/s sustained
Key Mutation Rate	Sub-millisecond (< 1 ms)
Entropy Quality (Shannon)	0.987–0.994
Bit-Level Avalanche Ratio	>49% per 1-bit entropy change
Cryptographic Latency	Nanosecond-level response times
Concurrent Operations	Massive parallel processing capability

Connectivity and Interfaces

Interface Type	Specification
Primary PCIe	Gen3 x16 (128 Gb/s bandwidth)
Alternative PCIe	Dual Gen4 x8 configuration
Network Interface 1	1x QSFP28 (100 GbE, 40 GbE, 4x 25/10 GbE)
Network Interface 2	2x SFP-DD (4x 25/10 GbE)
Clock Precision	IEEE 1588 support

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Debug Interface	JTAG and UART access

Physical Characteristics

Physical Attribute	Specification
Card Height	68.90 mm (2.71 inches)
Card Length	167.65 mm (6.60 inches)
Card Thickness	Single slot
Weight	Approximately 300g
Connector Type	Standard PCIe edge connector
Cooling Solution	Passive aluminum heatsink

Power and Thermal Specifications

Parameter	Specification
Maximum Power	75W TDP
Typical Operating Power	60-70W under load
Power Rails	+12V primary, +3.3V auxiliary
Thermal Interface	Phase-change thermal material
Cooling Requirements	Passive cooling design
Heat Dissipation	Optimized for server airflow

Operating Conditions

Environmental Requirements

Condition	Operating Range	Storage Range
Ambient Temperature	0°C to 70°C	-40°C to 75°C
Relative Humidity	8% to 90% RH	5% to 95% RH
Dew Point	-12°C DP (non-condensing)	Non-condensing
Altitude	Up to 3,000m above sea level	Up to 12,000m

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Shock and Vibration	IEC 60068-2 compliant	IEC 60068-2 compliant

Airflow Requirements

Temperature	Minimum Airflow (LFM)	Recommended Airflow (LFM)
50°C Inlet	200 LFM	300+ LFM
60°C Inlet	300 LFM	400+ LFM
70°C Inlet	400 LFM	500+ LFM

Cryptographic Features

Security Architecture

Security Feature	Description	
Quantum-Inspired Protocol	QE-BCP with non-repeating entropy topology	
Key Evolution	Real-time, continuous key mutation	
Entropy Source	Physical noise with non-Markovian memory	
Homomorphic Encryption	Computation on encrypted data	
Forward Secrecy	Dynamic key fragmentation	
Tamper Detection	Hardware-enforced key zeroization	

Supported Algorithms

Algorithm Category	Supported Standards
Symmetric Encryption	AES-128/192/256, custom quantum-inspired
Asymmetric Encryption	RSA, ECC, post-quantum ready
Hash Functions	SHA-256/384/512, custom implementations
Key Exchange	ECDH, quantum-inspired protocols
Digital Signatures	ECDSA, RSA-PSS, post-quantum schemes

Regulatory Compliance and Certifications

Pending Certifications

TECHNICAL DATASHEET CETHERA CTHR-01 beta

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Certification	Status	Timeline
FIPS 140-3	In progress	12-18 months
Common Criteria EAL4+	Planned	6-12 months
PCIe Compliance	Testing phase	3-6 months

Safety and EMC Standards

Standard	Compliance Status
FCC Class B	Planned certification
CE Marking	Planned certification
UL Safety	Based on Alveo U50 platform
RoHS Compliance	Component-level compliance
WEEE Directive	EU compliance ready

Installation and Compatibility

Server Compatibility

Server Type	Compatibility Notes
Enterprise Servers	Standard PCIe x16 slot required
Workstations	Compatible with an appropriate power supply
Data Center Racks	1U, 2U, and larger form factors
Cloud Infrastructure	Hyperscale deployment ready

Prerequisites

Requirement	Specification
PCIe Slot	Gen3 x16 or dual Gen4 x8
Power Supply	75W additional capacity
Cooling	Server-grade airflow

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Memory	Host system RAM for buffers
Network	Optional high-speed networking

Performance Benchmarks

Cryptographic Operations

Operation Type	Performance Metric
Bulk Encryption	400+ GB/s sustained throughput
Key Generation	Sub-millisecond generation time
Digital Signatures	Thousands per second
Hash Operations	Gigabit-level processing
Random Number Generation	High-quality entropy stream

System Impact

Metric	Improvement vs Software
CPU Utilization	90% reduction
Latency	10-100x improvement
Power Efficiency	5-10x better per operation
Scalability	Linear performance scaling

Ordering Information

Product Configuration

Part Number	Description	Price (USD)
CTHR-01-BETA	Complete accelerator card	\$8,650

Support and Services

Service Type	Description
Beta Support	Dedicated engineering assistance

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Technical Documentation	Comprehensive guides and APIs
Performance Tuning	Optimization consulting
Integration Support	Custom application assistance

Warranty and Support

Beta Program Terms

Aspect	Terms
Warranty Period	60-day satisfaction guarantee
Return Policy	100% refund for defective units
Technical Support	Direct engineering access
Software Updates	Regular firmware and driver updates

Long-Term Support

Support Element	Coverage
Hardware Warranty	1-year limited warranty
Software Support	Ongoing updates and patches
Security Updates	Critical security patches
Documentation	Continuous improvement

References and Additional Resources

Technical Documentation

- CTHR-01 Beta Installation Guide
- Quantum-Inspired Cryptography Technical Reference
- Performance Optimization Manual
- Security Configuration Guide
- API Reference Documentation

Development Resources

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- Software Development Kit (SDK)
- Example Applications and Use Cases
- Performance Benchmarking Tools
- Integration Best Practices Guide
- Troubleshooting and Diagnostic Tools

Legal Notices and Disclaimers

BETA PRODUCT DISCLAIMER: The CTHR-01 beta is a pre-release product provided for evaluation purposes. Performance characteristics and specifications are subject to change. This product is not recommended for production deployment without comprehensive testing.

EXPORT CONTROL: This product may be subject to export control regulations. Customers are responsible for compliance with applicable laws and regulations.

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