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Intel® Ethernet Network Adapter E810-CQDA2T

High-precision timing synchronization with IEEE 1588 PTP, SyncE and GNSS

Key Features

- Dual Port QSFP28
- IEEE 1588 Precision Time Protocol (PTP)
- Synchronous Ethernet (SyncE)

- Onboard high-precision oscillator
- Optional GNSS mezzanine
- SMA, SMB, and U.FL connectors

Increasing growth in 5G RAN and edge deployments is driving demand for high-precision timing synchronization across the network. Meet these challenging requirements head-on with a standards-based PCIe adapter that provides greater flexibility at a lower price point than single-purpose timing appliances.

Most 5G RAN deployments use 1588 PTP, SyncE, or both to ensure required timing synchronization. Both of these synchronization methods are supported by the E810-CQDA2T, while additional hardware enhancements ensure reliability and accuracy, and provide greater flexibility and simplicity for timing synchronization deployments.
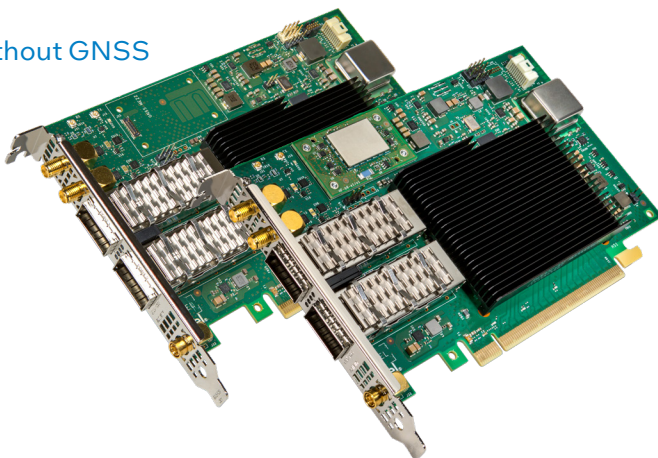
Support for synchronization

Synchronous Ethernet (SyncE) delivers frequency synchronization over Ethernet between SyncE-enabled devices. Extends traditional telecom timing architecture to commercial-off-the-shelf (COTS) Ethernet solutions.

IEEE 1588 PTP enables synchronization of systems on a network through the transfer of timing data (including frequency, phase, and time of day) with hardware timestamping in PTP packets.

Onboard high-precision oscillator maintains high accuracy during holdover (when the synchronization source is not available), providing up to four hours with less than +/- 1.5 microsecond of phase error.

Without GNSS

With GNSS

Hardware features for deployment flexibility

Optional GNSS mezzanine enables integrated support for frequency, phase, and time-of-day synchronization with Global Navigation Satellite Systems, including GPS, Galileo, GLONASS, BeiDou, and QZSS. Available on E810CQDA2TGG1 only. Subminiature version B (SMB) coaxial connector allows connection to an external active GNSS antenna.

Dual external SubMiniature version A (SMA) coaxial connectors allow connection to external 1PPS timing sources, such as GNSS signaling, devices and to timing recipients, enabling the network adapter to act as a grandmaster and as a timing source for other equipment. The output capability provides a way to audit the phase accuracy of each node.

U.FL connectors, embedded coaxial connectors, allow 1PPS signal connectivity between the adapter and motherboard or another adapter. Dedicated send and receive U.FL ports are embedded on the adapter.

Versatile Port Configurations

Each port can be programmed to act as many different physical network adapters, with a maximum throughput of 100Gbps. Using the Ethernet Port Configuration Tool (EPCT), this adapter supports 2x100Gb, 1x100Gb, and 8x10Gb configurations.

All 800 Series products include these technologies

Greater Predictability at Scale

As modern data centers scale, a key challenge is to provide scalable, predictable application-level performance. Application Device Queues (ADQ) technology improves performance scalability and predictability by dedicating queues to key workloads, delivering predictable high performance through dramatically reduced jitter.

Increasing the predictability of application response times by lowering jitter enables more compute servers to be assigned to a task and can allow more users to access the system, providing a better end-user experience. Even applications that are not large scale can benefit from higher consistency, enabling them to meet service-level agreements (SLAs) more easily.

ADQ enables application-specific data steering, signaling, and rate limiting using an optimized application thread to device data path. This ability to dedicate queues and shape network traffic not only increases performance, it reduces latency and improves throughput.

Increase Throughput and Lower Latency

Remote Direct Memory Access (RDMA) provides high throughput and low-latency performance for modern high-speed Ethernet by eliminating three major sources of networking overhead: TCP/IP stack process, memory copies, and application context switches. Intel Ethernet 800 Series Network Adapters support all Ethernet-based storage transport, including iWARP, RoCEv2, and NVMe over Fabric.

RoCE (RDMA over Converged Ethernet): RoCEv2 substitutes the InfiniBand physical layer and data link layer with Ethernet, operates on top of UDP/IP, and is routable over IP networks.

iWARP, IETF standard protocols based: Delivers RDMA on top of the pervasive TCP/IP protocol. iWARP RDMA runs over standard network and transport layers and works with all Ethernet network infrastructure. TCP provides flow control and congestion management and does not require a lossless Ethernet network. iWARP is a highly routable and scalable RDMA implementation.

Improve Packet Processing Efficiency

Dynamic Device Personalization (DDP) customizable packet filtering, along with enhanced DPDK, supports advanced packet forwarding and highly-efficient packet processing for both Cloud and NFV workloads.

The 800 Series firmware loads an enhanced DDP profile with many workload-specific protocols at driver initialization for greater flexibility. When multiple 800 Series adapters are present in a system, the pipeline on each adapter can be programmed independently with a different DDP profile.

Increase Timing Accuracy

Intel Ethernet 800 Series supports both IEEE 1588 PTP v1 and v2 with two-step option. The products provide increased accuracy at single-digit nanosecond level, and can report the reception time for every packet. This level of timing accuracy can help ensure tight synchronization across network deployments ranging from 5G RAN to financial services, industrial automation, and energy monitoring.

Protect, Detect, and Recover

Zero Trust is a security design strategy centered on the belief that organizations, by default, should not automatically trust any request for system access. This includes requests coming from outside, as well as inside its perimeters. Zero Trust demands that every access request be verified before granting access.

The 800 Series implements a design philosophy of platform resiliency with 3 attributes compliant with the NIST Cybersecurity Framework, including NIST 800-193 Platform Firmware Resiliency Guidelines: Protect, Detect and Recover. By design, the Hardware Root of Trust in the 800 Series protects the firmware and critical device settings with authentication for every access. Signed firmware updates and the Hardware Root of Trust protects and verifies critical device settings with built-in corruption detection and automated device recovery. Together these features ensure the device safely returns to its originally programmed state.

For more information about Intel® Ethernet Technologies, including videos and resource libraries, visit intel.com/ethernet

Intel® Ethernet 800 Series Network Adapters are designed with Intel® Ethernet Controller E810 and include these features[1].
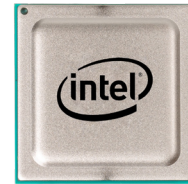
Host Interface
- Compliance with PCIe 4.0
- Concurrency for 256 non-posted requests

Software Interface
- Base mode VF compatibility with [Intel® Adaptive Virtual Functions Specification](#)
- Tx/Rx Queues
  - 2048 Tx queues and 2048 Rx queues
  - Dynamic allocation of queues to functions and VSIs
- Interrupts
  - 2048 interrupts vectors, allocated in a flexible manner to queues and other causes
  - Multiple interrupt moderation schemes
  - 20M interrupts/sec
- Control Queues (a.k.a. Admin Queues)
  - Mailbox Queues for PF-VF and driver-driver
  - Admin Queues for Software-Firmware control flows
  - Sideband Queues for Software to access IPs inside the E810
- 256 Tx Doorbell (DB) Queues
- 512 Tx Completion Queues
- Quanta Descriptor (QD) Queue per Tx queue. Quanta information is also embedded in the Tx doorbell
- Programmable Rx descriptor fields

Packet Processing
- Enhanced Data Plane Development Kit (DPDK)
- General
  - Stages of parsing, switching, ACLs, classification, packet modification
  - Programmable packet processing pipeline
  - Profile based
  - Programmable actions
  - Propagation of priorities between stages
- Parser
  - Parses up to 504B from packet header
  - Parse Graph based
  - Session-based parsing
  - Programmable parse engine
- Binary Classifier (VEB Switch)
  - 768 switch ports (VSIs)
  - Programmable forwarding rules
  - Storm Control

ACLs
  - 8K programmable TCAM entries
  - Tiling capability to n*40b width
- Classification Filters
  - Hash-based statistical distribution
  - Intel® Ethernet Flow Director (Intel® Ethernet FD) flow-based classification
  - Flow-based identification of iWARP and RoCE flows
  - Programmable rules
- Modifier
  - Insert (Tx), remove (Rx), and modify of packet VLANs
  - L3 and L4 checksums and CRC

Virtualization
- Host virtualization via VMDQ and SR-IOV
- Up to 256 SR-IOV Virtual Functions
- Stateless offloads for tunneled packets (network virtualization support)
- Malicious VF protection
- Virtual machine load balancing (VMLB)
- Advanced packet filtering
- VLAN support with VLAN tag insertion, stripping and packet filtering for up to 4096 VLAN tags
- VxLAN, GENEVE, NVGRE, MPLS, VxLAN-GPE with Network Service Headers (NSH)
- Intel® Ethernet Adaptive Virtual Function drivers

RDMA
- iWARP and RoCEv2
- 256K Queue Pairs (QPs)
- Send Queue Push Mode

Note: RDMA is not supported when the E810 is configured for >4-port operation.

QoS
- WFQ Transmit scheduler with nine programmable layers
- Pipeline sharing and starvation avoidance
- QoS via 802.1p PCP or Differentiated Services Code Point (DSCP) value
- Packet shaping

Manageability
- SMBus operating at up to 1Mb/s
- DMTF-compliant NC-SI 1.1 Interface at 100Mb/s
- MCTP over PCIe and SMBus
- Enterprise-level management schemes via local BMC
- SNMP and RMON statistic counters
- Watchdog timer
- PLDM over MCTP; PLDM Monitoring; PLDM firmware update; PLDM for RDE
- Firmware Management Protocol support

Power Management
- Supports PCI power management states D0, D3hot, D3cold

Time Synchronization
- Time stamp with each Rx packet
- Selective time stamps for Tx packets
- IEEE 1588 PTP v1 and v2 support
- Time synchronization signaling with other local platform ingredients

Pre-Boot
- Signed UEFI option ROM compatible with HTTPS boot

Security
- Hardware-based Root of Trust
- Authentication on NVM Read and Power On
- Built-in detection of firmware/critical setting corruption with automated device recovery

Adapter Features

Data Rate Supported	100/50/25/10GbE per port
Bus Type/Bus Width	PCIe 4.0 x8/x16 and PCIe 3.0 x16
Hardware Certifications	BSMI, CE, CMIM, FCC, ICES, KCC, RCM, UKCA, cURus, and VCCI
BMSI RoHS and RoHS-compliant	Product is compliant with Taiwan Bureau of Standards, Metrology and Inspection (BMSI), and EU RoHS Directive 2 2011/65/EU (Directive 2011/65/EU) and its amendments (e.g. 2015/863/EU)
Connectivity	Two QSFP28 ports
SubMiniature version A (SMA) connectors	Two coaxial connectors, each capable of being configured as a 1PPS (one pulse per second) input or output
SubMiniature version B (SMB) connector	One coaxial connector for connecting to an external active GNSS antenna
Controller	Intel® Ethernet Controller E810-CAM2
Bracket	Full height
Dimension	6.58 in x 4.37 in (167 mm x 111 mm) (Full-height, half-length)

Product Order Codes

Configuration	Product Code
Dual Port with GNSS mezzanine	E810CQDA2TGG1
Dual Port without GNSS mezzanine	E810CQDA2TG1

Power Consumption

DACs	Typical Power	
2 x 100GbE max througput	28.8 W	
2 x 100GbE, idle (no traffic)	13.9 W	
8 x 10GbE, max througput	21 W	
8 x 10GbE, idle (no traffic)	18.8 W	
Optics (Class 3)		
2 x 100GbE max througput	32.5 W	
2 x 100GbE, idle (no traffic)	30.7 W	
8 x 10GbE, max througput*	26.7 W	
8 x 10GbE, idle (no traffic)*	22.8 W	
Optics (Class 7)	Typical Power	Max Power
2 x 100GbE max througput	36.1 W	41 W
2 x 100GbE, idle (no traffic)	34.8 W	35.1 W
8 x 10GbE, max througput	30.4 W	32.4 W
8 x 10GbE, idle (no traffic)	25.3 W	27 W
QSFP28 Max Power Per Port*		5 W

*The max power per port is not an additional power requirement, it is included in the optics maximum power figures listed in the Power Consumption table.

*Tested with PSM4 modules

Linux Utilities

ptp4l	Allows synchronization of two Intel® Ethernet Network Adapters E810-XXVDA4T over 1588 PTP.
phc2sys	Enables synchronization between host time and adapter time.
ts2phc	Allows 1pps signal (from a GPS, for example) to regulate the clock in ptp4l; has the option to read GPS time of day from a serial port.
pmc	A management command for PTP that allows the extraction of statistics and other data.
synce4l	A new utility developed by Intel that provides ITU-T G.8264 ESMC support to communicate the pedigree of clocks in a SyncE network.

Supported Physical Layer Interfaces

	100GbE	50GbE	25GbE	10GbE
DACs	100GBASE-CR4	50GBASE-CR2 Consortium	25GBASE-CR 25GBASE-CR1 Consortium 25G	SFP+ 10G SFI-DAC
Optics and AOCs	CAUI-4		25G-AUI	10G SFI Limiting

Technical Specifications

Airflow*	**Extended Temp 5 W Optics*** 100 LFM at 25 °C Ambient 185 LFM at 35 °C Ambient 267 LFM at 45 °C Ambient 500 LFM at 55 °C Ambient 709 LFM at 61 °C Ambient 850 LFM at 65 °C Ambient	**Commercial Temp 5 W Optics*** 125 LFM at 25 °C Ambient 285 LFM at 35 °C Ambient 435 LFM at 45 °C Ambient 750 LFM at 55 °C Ambient 1022 LFM at 61 °C Ambient	**Direct Attach Cables** 100 LFM at 25 °C Ambient 150 LFM at 35 °C Ambient 188 LFM at 45 °C Ambient 351 LFM at 55 °C Ambient 511 LFM at 61 °C Ambient 750 LFM at 65 °C Ambient
Storage Humidity	Maximum: 90% non-condensing relative humidity at 35 °C		
Storage Temperature	-40 °C to 70 °C (-40 °F to 158 °F)		
Operating Temperature	0 °C to 55 °C (32 °F to 131 °F)		
LED Indicators	ACTIVITY (blinking) NO ACTIVITY (off) LINK SPEED (green = 100GbE; amber = less than 100GbE; off = no link)		

*Testing performed in a closed-loop wind tunnel at the temperatures listed in table. Operating temperature range: 0 °C to 55 °C. Non-operating ambient temperature range: -40 °C to +70 °C. Max case temp for Extended Temp Optics is 80 °C. Max case temp for Commercial Temp Optics is 70 °C.

Supported Operating Systems

Advanced timing features available in Linux only. For a complete list of supported network operating systems for Intel® Ethernet 800 Series Network Adapters visit: intel.com/support/EthernetOS

Intel® Ethernet Optics

Combine high-density Ethernet connections with Intel® Ethernet 800 Series Network Adapters for dependable interoperability and consistent performance across the network. Intel Ethernet Optics have been extensively tested for compatibility with Intel Ethernet Network Adapters. Learn more at intel.com/ethernetproducts

Warranty

Intel limited lifetime hardware warranty, 90-day money-back guarantee (US and Canada) and worldwide support.

Customer Support

For customer support options in North America visit:
intel.com/content/www/us/en/support/contact-support.html

Product Information

For information about Intel® Ethernet products and technologies visit: intel.com/ethernet

1. See the Intel® Ethernet Controller E810 Datasheet for the full list of product features.

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