OIF Hot Topic Fact Sheet –

Common Electrical I/O (CEI)-112

About OIF's Common Electrical I/O (CEI)-112 project: OIF has led the industry for the past 20 years in the development and publication of next generation electrical definitions for transmitters, receivers and channels to enable interoperable electrical links for chip to chip, chip to optical, line card to line card and equipment to equipment applications.

To support next generation rates, it may become necessary for equipment designs and architectures to transition from current materials and structures due to insertion losses as well as take advantage of newer and alternate materials and equipment designs. The electrical properties of these materials and structures are being considered as the CEI-112G documents are being drafted.

In addition to the development of the Implementation Agreement (IA) documents that define these interoperable systems, OIF is also currently engaged in interoperability testing that helps to ensure that as the documents mature, the work is validated.

Common Electrical I/O – 112G in MCM (started in January 2017)

This project will develop and produce an IA for a low power, ultra short reach (<= 25mm) electrical die-to-die interface @ 75-116 Gbps per pair of wires across a Multi-Chip Module (MCM) substrate, targeting wide-bus high bandwidth applications.

Common Electrical I/O – 112G-XSR (started in April 2018)

This project will develop IA specifications for die-to-die (D2D) and die-to-OE (D2OE) electrical I/O interfaces, extra short reach (<=50mm) which can be used to support Nx112G I/O links with significantly reduced power, complexity, and enhanced throughput density.

Common Electrical I/O – 112G-Very Short Reach (started in August 2016)

This project will develop IA specifications for very short reach (chip-to-module) interface which can be used to support optical modules (e.g., 112G, 224G and 448G) with reduced power, complexity and enhanced density.
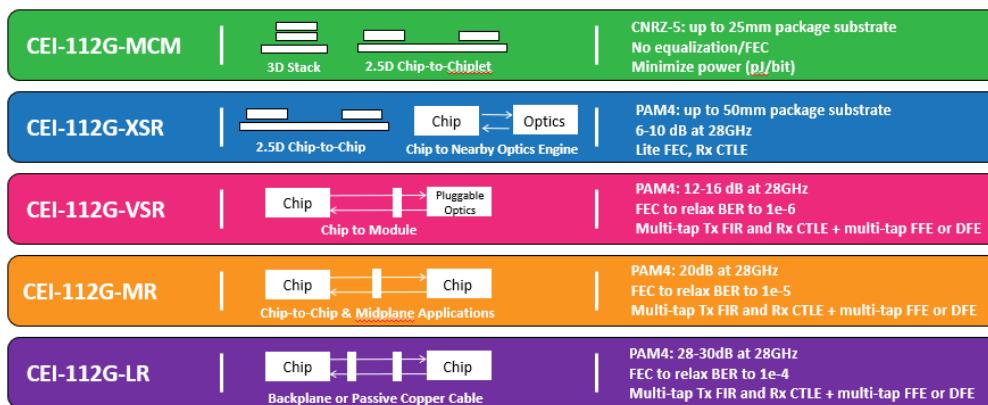
Content updated as of Q4 2019

Common Electrical I/O – 112G-MR (started in November 2017)

This project will develop and produce an IA for a Medium Reach electrical interface operating @ 75-116Gbps signaling over up to 500 mm of PCB with one connector.

Common Electrical I/O – 112G-LR (started in November 2017)

This project will develop and produce an IA for a Long Reach electrical backplane interface operating @ 75-116Gbps signaling over up to 1000 mm length of some combination of twinax cable and PCB traces with two connectors, or over a shorter length of PCB backplane trace.

OIF CEI-112G Development Application Space

CEI-112G-MCM	3D Stack 2.5D Chip-to-Chiplet	CNRZ-5: up to 25mm package substrate No equalization/FEC Minimize power (pJ/bit)
CEI-112G-XSR	2.5D Chip-to-Chip Chip → Optics Chip to Nearby Optics Engine	PAM4: up to 50mm package substrate 6-10 dB at 28GHz Lite FEC, Rx CTLE
CEI-112G-VSR	Chip → Pluggable Optics Chip to Module	PAM4: 12-16 dB at 28GHz FEC to relax BER to 1e-6 Multi-tap Tx FIR and Rx CTLE + multi-tap FFE or DFE
CEI-112G-MR	Chip → Chip Chip-to-Chip & Midplane Applications	PAM4: 20dB at 28GHz FEC to relax BER to 1e-5 Multi-tap Tx FIR and Rx CTLE + multi-tap FFE or DFE
CEI-112G-LR	Chip → Chip Backplane or Passive Copper Cable	PAM4: 28-30dB at 28GHz FEC to relax BER to 1e-4 Multi-tap Tx FIR and Rx CTLE + multi-tap FFE or DFE

- PAM4 modulation scheme becomes dominant in OIF CEI-112 Gbps interface IA
- One SerDes core might not be able to cover multiple applications from XSR to LR
- For short reach applications, simpler and lower power equalizations are desired

Why is the CEI-112G project important for the market? Electrical interface/channel definitions are needed ahead of other elements of a new technology generation and can often be leveraged by multiple standards bodies allowing economies of scale and better use of resources. OIF understands timing needs and delivers CEI electrical channel IAs to industry on time.

The next data rate that the industry has indicated a desire to implement is 100 Gbps over a single differential pair to enable more efficient, dense, cost effective and faster equipment, systems and networks. The forecasted growth in networked and archived data requires that this next generation data rate become available in the very near future.

Relevance to (or in association with) other industry organization activities: Many organizations across the networking, compute and storage industries have relied on the OIF's CEI IA documentation at each new industry inflection point. These documents serve as the guidance and direction they need to develop system specifications that will benefit from a common baseline and interoperable components. Organizations that have leveraged the OIF CEI agreements in the past have included: IEEE 802.3 (Ethernet), T10 (SAS storage), T11 (Fibre Channel), InfiniBand and HMC. Many of these same organizations are actively engaged with on-going liaison communications regarding the OIF's current five CEI-112G projects.

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Status of projects: The five CEI-112G projects have all had a large number of member technical contributions which has enabled them to have editors assigned and develop baseline draft specifications that are in the process of undergoing iterative reviews and refinement. Developing definitions for electrical channels operating at 112 Gbps is challenging due to increased insertion loss per unit length with conventional materials as well as the signaling effects of typical channel elements such as PCB vias, creates the opportunity for OIF members to consider innovative alternate channel structures such as embedded twinax cabling, and multi-wire modulation schemes. All these new developments are in the process of being integrated into the current draft specifications.

The progress of the draft specifications has been on display at the OFC trade show in 2018 and 2019 and at the ECOC trade show in 2019. At each of these events OIF members were able to demonstrate interoperability amongst multiple silicon, connector, cable and channel providers.

Demo/showcase highlights: OIF's CEI-112G work was demonstrated as part of the OIF 2019 Physical and Link Layer Interoperability Demos at OFC 2019, and ECOC 2019.

OIF lead contact: Dave Stauffer, OIF Physical and Link Layer (PLL) working Group Chair – +1.802.316.0808, david@kandou.com, Nathan Tracy, OIF President – +1.717.986.7546, ntracy@te.com

More information: https://www.oiforum.com/technical-work/hot-topics/common-electrical-interface-cei-112g-2/

Recent project update PPT presentations: CIOE (China International Optoelectronic Exposition OIF Project Update – September 4, 2019, NGON 2019 OIF Optical Masterclass – May 21, 2019, DesignCon 2019 OIF 112-Gbps Electrical Interfaces: An OIF Update on CEI-112G – January 29, 2019

Recent articles about CEI-112G *:

> *EE Web:* https://www.eeweb.com/profile/martin-rowe-2/articles/112g-digs-in-at-designcon-2019

* articles do not represent OIF's views other than where OIF spokespersons are specifically quoted

About OIF: OIF is where the optical networking industry's interoperability work gets done. Building on 20 years of effecting forward change in the industry, OIF represents the dynamic ecosystem of 100+ industry leading network operators, system vendors, component vendors and test equipment vendors collaborating to develop interoperable electrical, optical and control solutions that directly impact the industry's ecosystem and facilitate global connectivity in the open network world. Connect with OIF at @OIForum, on LinkedIn and at http://www.oiforum.com.