Gen-Z Scalable Connector – A high-volume universal connector

Introduction

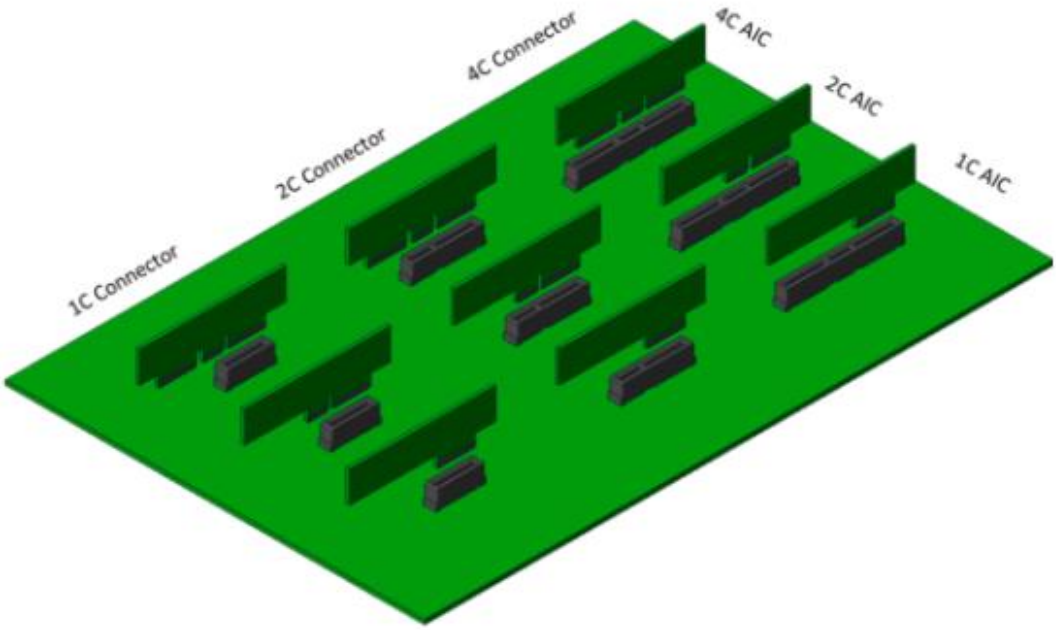
Gen-Z Consortium members set out to develop a high-volume universal connector capable of spanning multiple market segments. In keeping with its goal of establishing an open ecosystem, in June 2017, the Gen-Z Consortium publicly released a draft specification detailing the connector's numerous applications including memory, storage, I/O, cabling, etc. Multiple peer industry bodies requested that the specification be made available for their use, and in September 2017 the Gen-Z Consortium donated the mechanical and electrical portions of the specification to SNIA/SFF to ensure it is publicly available for all to reference and adopt. Within SNIA/SFF, this specification is called SFF-TA-1002. In addition to donating the mechanical and electrical specification, Gen-Z member companies worked through these industry bodies to align on a pinout and set of signals to maximize interoperability and volume.

SFF-TA-1002 Fundamentals

SFF-TA-1002 specifies four high-density connector sizes: 1C, 2C, 4C, and 4C+. The 1C connector acts as a common foundation for all other sizes. The 1C supports up to 80W of 12V main power and up to 3.3 Vaux power, a set of sideband and management pins, and up to 8 high-speed differential pairs. The 2C builds upon the 1C and provides up to an additional 16 high-speed differential pairs. Similarly, the 4C builds upon the 2C, and provides up to an additional 16 high-speed differential pairs. The 4C+ builds upon the 4C and provides additional pins for sideband and management unique to the Open Compute Project (OCP) Mezzanine NIC application. All SFF-TA-1002 connectors are discrete pin and may be

repurposed for additional applications that required high-speed signaling as needed.

To maximize interoperability, all combinations of connector sizes and add-in-card (AIC) edges are supported, for example, an AIC card edge can be inserted into any connector regardless of its size, as illustrated below:

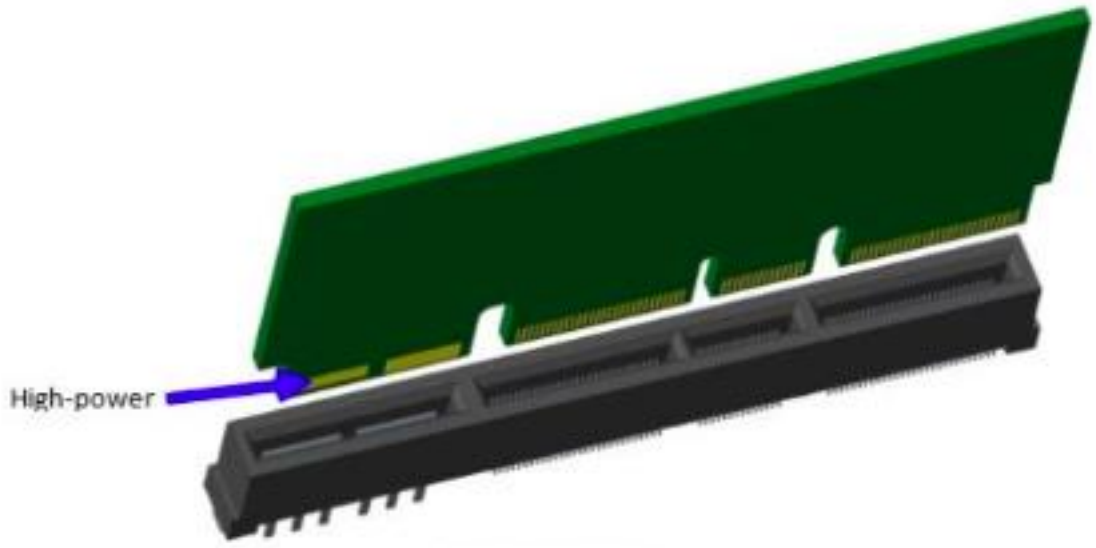


Full AIC edge/connector interoperability

The high-speed differential signal pins in SMT (surface mount) connector versions support signaling rates from 2.5 GT/s NRZ to 56 GT/s NRZ. These pins can support multiple physical layers including PCI Express® and 802.3. Further, these pins are protocol agnostic, and can support PCI Express, Gen-Z, and others.

The Gen-Z Scalable Connector specification provides additional functionality beyond SFF-TA-1002 that enables solutions to fully exploit this connector's potential, including support for 48V applications to improve power efficiency and reduce OPEX, support for new high-power solutions (12V up to 660W and 48V up to 1024), and new internal cable support.

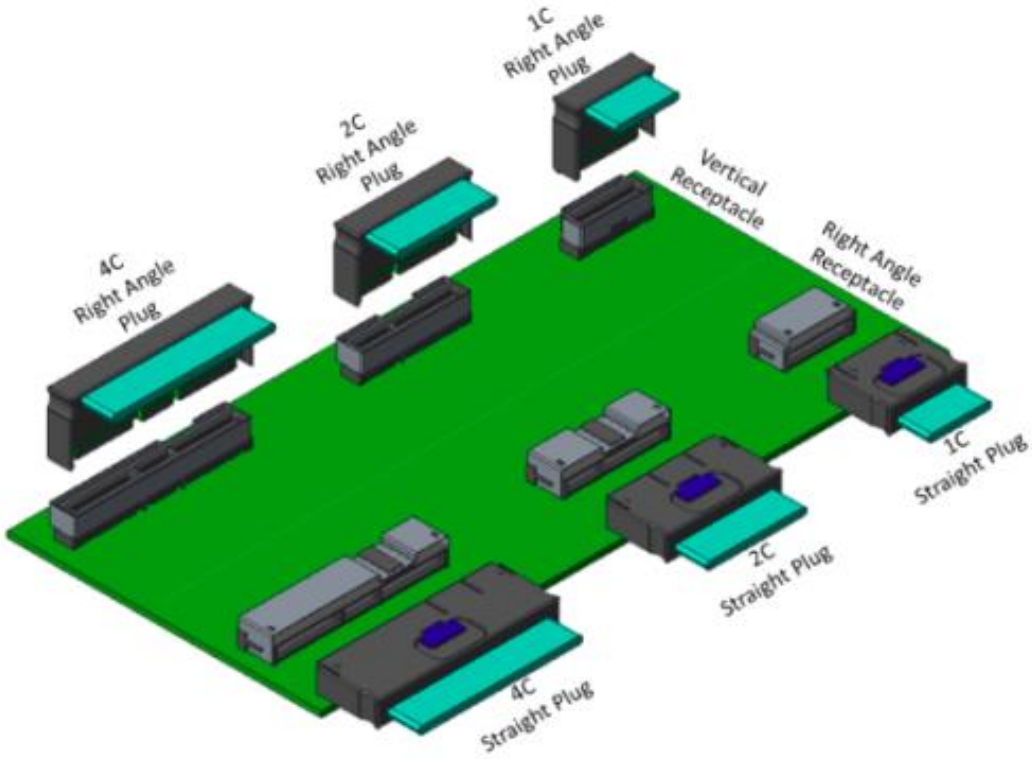
To support 48V and high-power applications, Gen-Z specifies a 4C-HP (high-power) connector that builds upon the 4C connector, and provides a new high-power interface, as illustrated below. If used in 48V applications, up to 1024W of power can be drawn through the high-power pin. If used for high-power 12V applications, up to 660W of aggregate power can be drawn through a combination of the 12V pins within the 1C portion of the connector and the high-power pin. The 4C-HP connector is keyed to prevent mixing of 12V and 48V pins.



4C-HP Connector

The move to high-speed signaling and high-bandwidth memory, storage, and I/O solutions is driving many to use cables to overcome the cost and complexity of low-loss board materials and/or retimers. To address this

need, the Gen-Z Scalable Connector supports a set of vertical and right-angle cable connectors that interoperate with the 1C, 2C, and 4C connectors. Cable assemblies can support passive or active copper or optical cables. Further, cables can support up to 80W of power and sideband signals. To ensure correct retention, the cable connector and the connector on the motherboard or mechanical form factor need to be the same size, e.g., a 1C cable connector can be inserted into only a 1C motherboard or mechanical form factor connector.

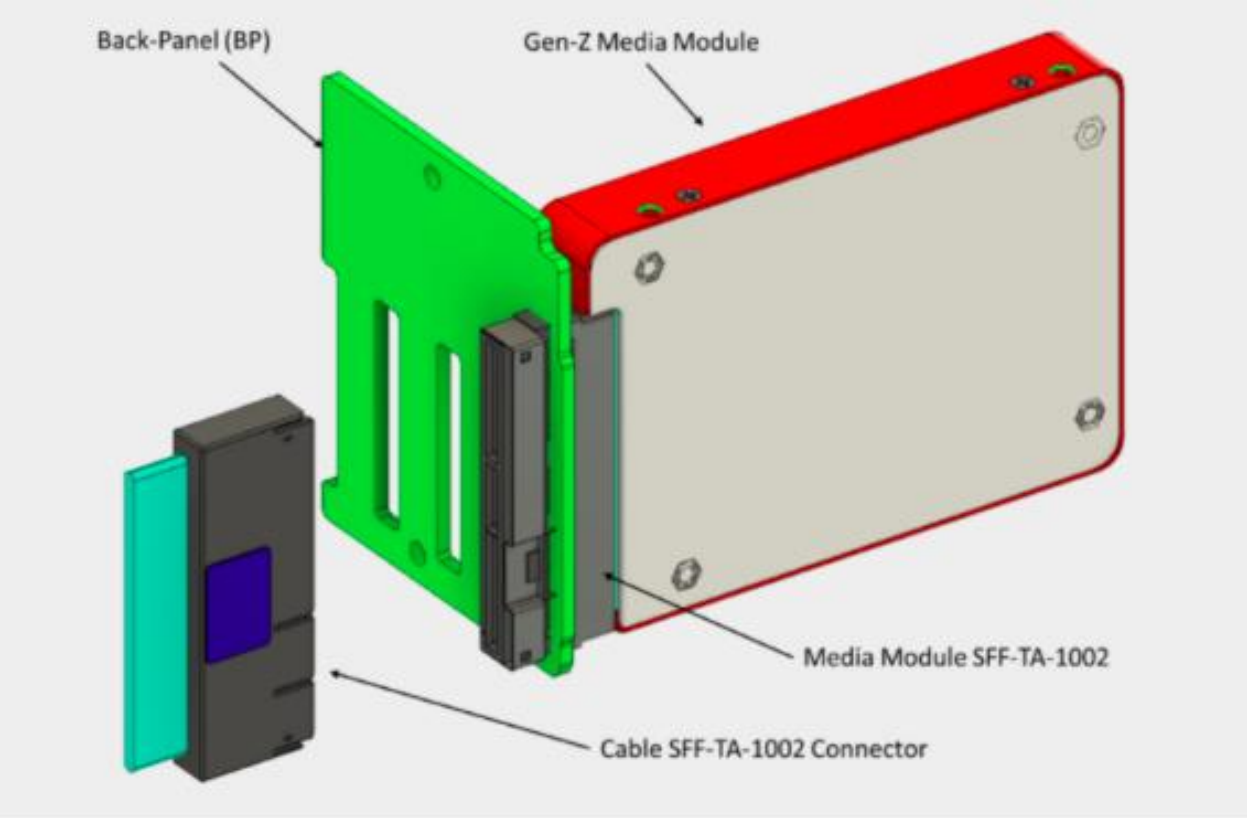


Gen-Z Scalable Cable Connectors

Simplifying Mechanical Infrastructure Composability & Flexibility

Since Gen-Z can support any component type, any connector slot can be attached to mechanical form factor or to a cable. As illustrated in the

following figure, a cable can be used to connect a connector slot immediately next to a processor to a media bay that contains memory, storage, or I/O modules. The combination of the Gen-Z Scalable Connector and cables simplifies mechanical infrastructure composability and solution flexibility.



Cabled Media Bay Application

Gen-Z Scalable Connector Benefits

The Gen-Z Scalable Connector provides the industry and customers with numerous benefits including:

- Solution Flexibility
  - Supports full AIC/connector interoperability
  - Supports enclosure internal AIC
  - Supports hot-pluggable modules
  - Supports passive and active copper and optical cable connectivity
- Reduces CAPEX
  - Full 1C, 2C, 4C, 4C+, and 4C-HP interoperability simplifies platform design and manufacturing
  - Signaling rates up to 112 GT/s PAM 4 enables high-volume adoption across multiple market segments to simplify and reduce supply chain costs
  - High-density, small size improves PCA yields
  - Surface mount improves signal integrity (reduces NRE and validation costs) and reduces manufacturing costs
  - Internal cables reduce platform cable management cost and complexity, and enable solutions to use low-cost board materials and eliminate the need for retimers
  - Cable-to-media module reduces platform design and material costs
  - 4C-HP eliminates need for discrete high-power cables and associated connector, simplifying platform cost and complexity
- Reduces OPEX
  - Small size reduces air flow impedance
  - Reduces service times — hot-plug, no high-power cables, etc.
  - Optimized signal integrity reduces potential for customer field problems and associated service and warranty costs