

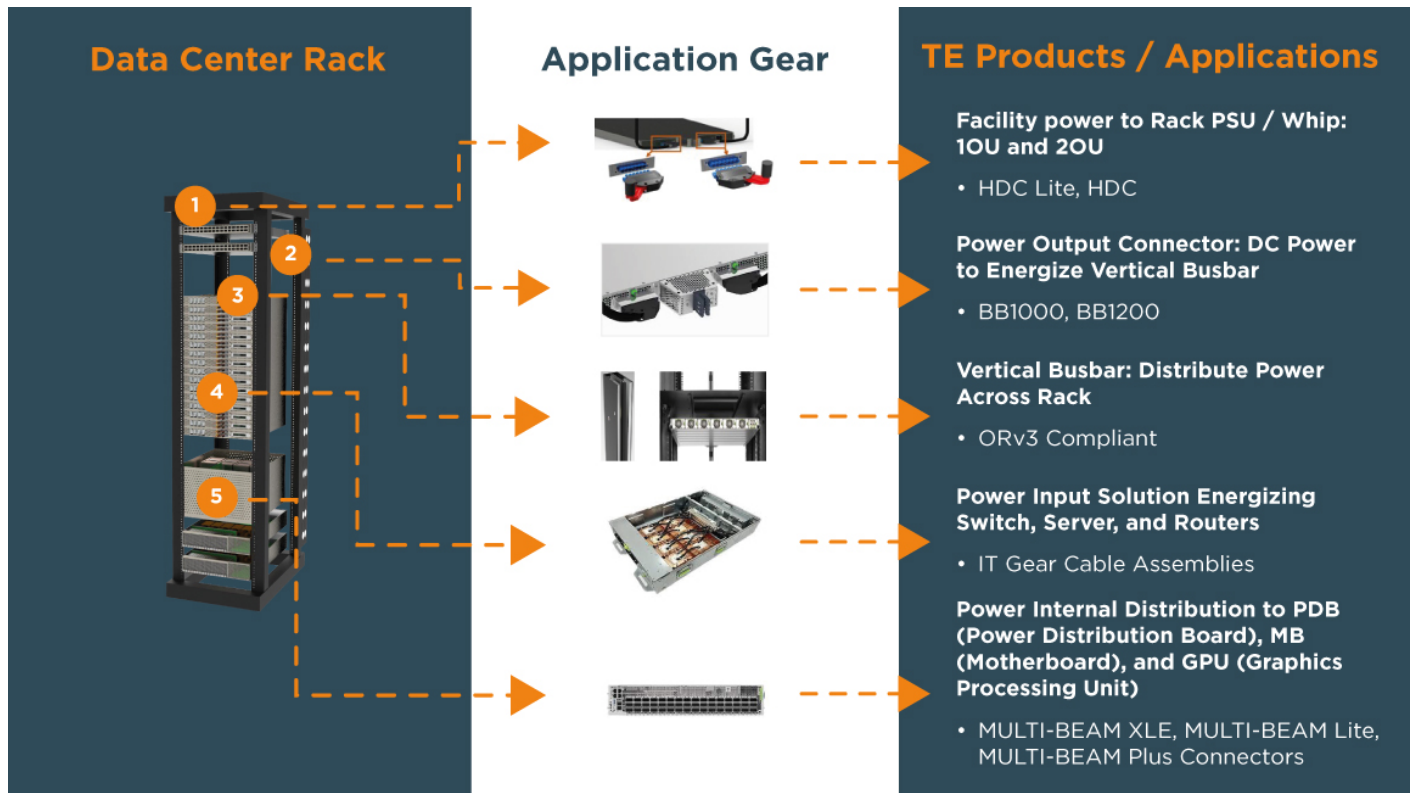


TE CONNECTIVITY POWER SOLUTIONS GUIDE FOR OPEN COMPUTE PROJECT'S OPEN RACK V3 (ORV3) APPLICATIONS



TE Connectivity's (TE) powers solutions portfolio for Open Compute Project (OCP) applications provide simple, yet customizable designs that enable a standardized platform capable of efficiently distributing up to 500A of power per UL and CSA criteria, while offering improved electrical performance. These plug-and-play solutions support 48V architectures, while offering low resistance and low milli-volt drop.

OCP/ORv3 RACK/TE SOLUTIONS



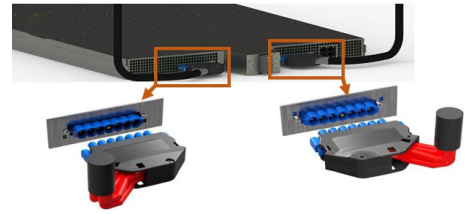
We help our customers realize operational and overall systems cost savings by providing power products that help support low energy consumption and address thermal concerns. These products are compatible with specifications for use in rack-level applications, including power shelves, battery backup units (BBU), IT trays, and server sleds.

TE Power Solutions support:

- Wide range of connectors that supply power throughout the rack to the shelves
- Highly versatile portfolio of medium to high power connectors and components that meet ORv3 standards
- End-to-end power solutions consisting of distribution, internal, power supply, busbar, and cable assemblies

1. FACILITY POWER TO RACK PSU / WHIP: 10U AND 20U

When connecting a data center rack to a building's facility power busway or main power feed, customer often utilize AC power connectors and cable assemblies known as power whips to make this connection to the data center rack's power shelf. TE Connectivity's (TE) extensive connector and cable assembly portfolio allows customer to choose the best solutions to address their AC input connector and power whip assembly needs - driving solutions on the power shelf.



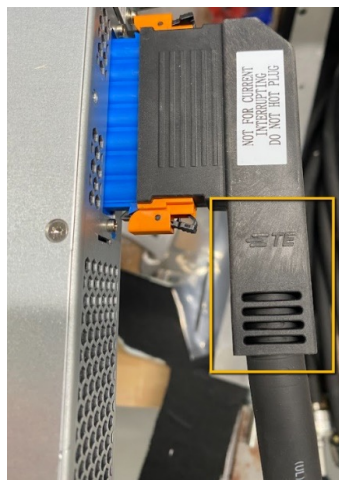
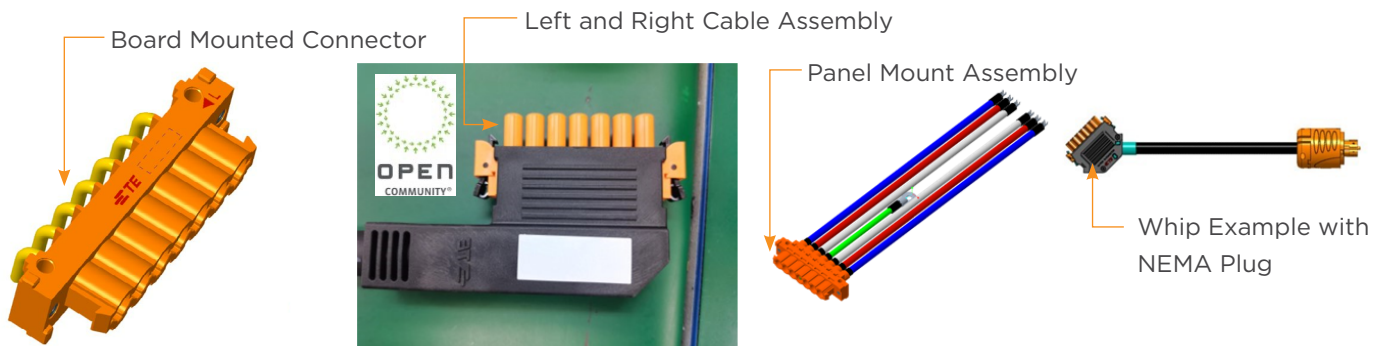
TE'S HIGH DENSITY CONNECTOR PORTFOLIO SOLUTIONS OFFER:

- 10U, 20U rack shelf sizes, and custom WHIP/AC connector skews to address your needs;
- High performance hoods and inserts that provide standard and high-density contact configurations, with electrical performance ranging from 2.2A @ 32V up to 650A at 12kV;
- Reliable loose-piece screw machined contacts and cost efficient stamped & formed contacts(on the reel) that are available for crimping, screw and cage clamp termination and offered in gold, silver, tin, and palladium plated options.

TE'S AC CONNECTOR AND CABLE ASSEMBLY

- TE's 10U, 20U, and cable assemblies comply with ORv3 AC requirements. Products are available with board mount connectors, panel mount assemblies, 45° cable exit whip's and 90° over-molded whip assemblies
- Supports 8, 10, and 12 AWG wire
- Cable assemblies with TE's 10U connector to NEMA and IEC plug available

10U POWER SHELF WHIP / AC INPUT CONNECTOR



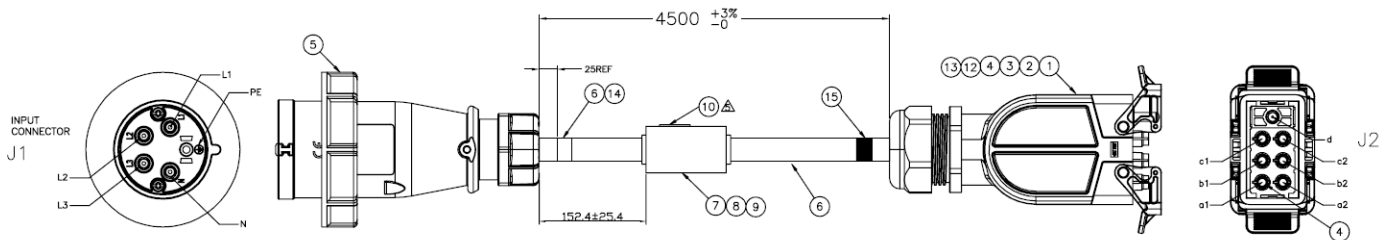
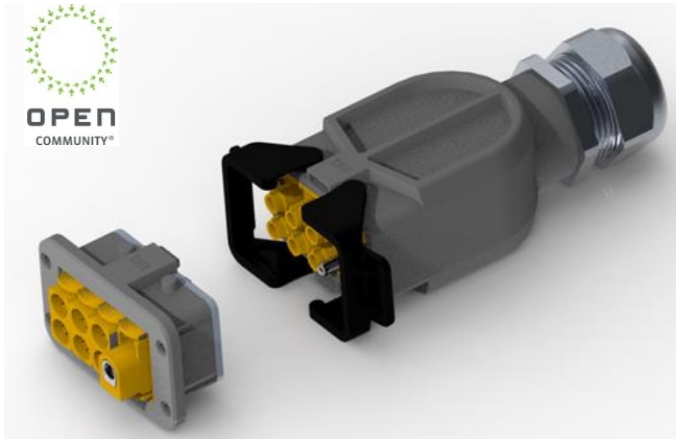
KEY PRODUCT FEATURES

- Available with 8 AWG, 10 AWG, and 12 AWG bulk cable designs
- Supports 50A-30A per pin
- Meets UL 1977, 62368-1, and 2875
- Tested for 100 mating cycles
- Operating Temp -5° to 70°C

TE VALUE PROPOSITION

- Vertically integrated for both connectors and cable assemblies
- Fully compliant with ORv3 connector design
- Full connector / assembly solution
 - Board mount connector
 - 45° and 90° External whip
 - Panel mount assembly
- Global manufacturing
- Custom kitting configuration for data center deployments

20U POWER SHELF WHIP / AC INPUT CONNECTOR



KEY PRODUCT FEATURES

- Current: 30A-100A/pin depending on configuration
- Multiple designs via TE's HDC (heavy duty connector) portfolio
- Standard 7 position product complies with OCP requirements

TE VALUE PROPOSITION

- Vertical integration for both connectors and cable assemblies
- Fully compliant with ORv3 connector design
- Part of broader HDC portfolio
- Customized options available
- Custom kitting configuration for data center deployments

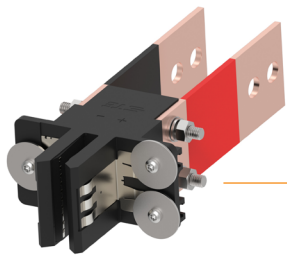
2. POWER OUTPUT CONNECTOR: DC POWER TO ENERGIZE VERTICAL BUSBAR

The power shelf in a data center rack is not only key to powering the vertical busbar, but also everything else within the rack. For Open Rack V3, the 48V architecture demands an output connector that can handle 1000A. TE Connectivity's (TE) dual-pole BB1000 range of connectors provide customers with the flexibility to distribute 1000A (500A per pole) using either welded cable assemblies or bolted down flexible busbar and cable assemblies.



48V BUSBAR OUTPUT CONNECTOR

Overlapped and interlaced contact design for maximizing energy density



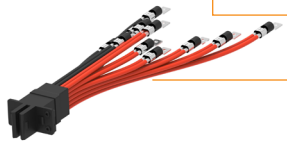
SCREW-MOUNTING TYPE

- Terminable to:
- Flexible busbar
 - Cabled lugs
 - Rigid busbar
- Also available as part of a busbar assembly solution

- #### KEY PRODUCT FEATURES
- 1000A+ current capacity (500A Load + 500A Return in 300 LFM @ 45 degC)
 - +/- 3mm panel float in X and Y axes
 - +/- 6.4mm gatherability on mating edge
 - Integrated housing chassis contacts for grounding to rack busbar cage
 - Heavy duty dual pole design



Chassis ground contact



CABLE-ATTACHED TYPE

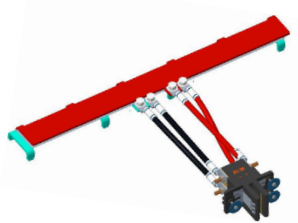
- Design allows for direct attach cable termination
- Offered as a customized cable assembly solution

- #### TE VALUE PROPOSITION
- Two different backends allow for flexibility in termination solutions (busbar assembly, cable assembly, etc.)
 - Extensive engineering support for testing and simulations
 - Connectors are currently tested for higher current carrying capabilities allowing scalability across programs

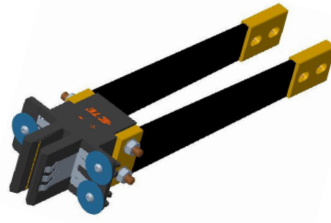
HORIZONTAL RIGID BUSBAR ASSEMBLY

BB1000 range of connectors provide customers with the flexibility to distribute 1000A (500A per pole) using either welded cable assemblies or bolted down flexible busbar and cable assemblies.

HORIZONTAL BUSBAR



FLEXIBLE BUSBAR ASSEMBLY



CABLE ASSEMBLY



3. VERTICAL BUSBAR: DISTRIBUTE POWER ACROSS RACK

TE's innovative busbar solutions can help customers to offer exceptional performance and dependable power distribution system with consistent quality, excellent electrical characteristics.



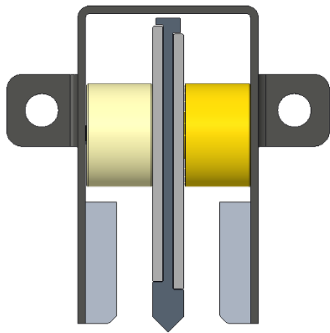
KEY PRODUCT FEATURES

- Current: 375A; 750A; 1200A
- Mounting method: OCP compliant
- ORv3 mating interface
- UL 62368 finger probe

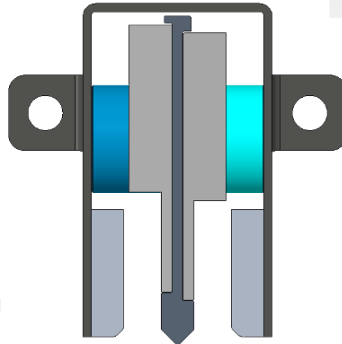
TE VALUE PROPOSITION

- Scalable power capacity (300A-1200A) with ORv3 platform
- Offering customizable designs based on ORv3 spec
- Quick prototype sample delivery and thermal analysis

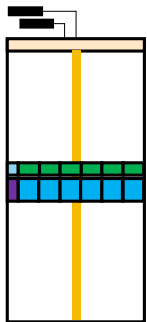
FLAT BUSBAR



STEPPED BUSBAR

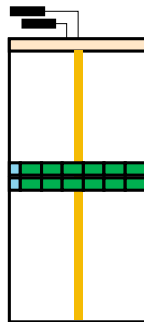


CONFIG A



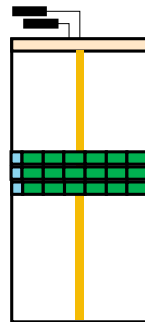
6x 3kW rectifier slots
15kW with 5+1
312.5A per rack
w/o battery backup

CONFIG B



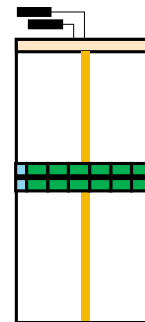
12x 3kW rectifier slots
18kW with 6+6
375A per rack
w/o battery backup

CONFIG C



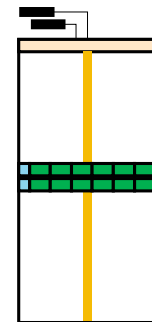
36x 3kW rectifier slots
54kW w/o redundant
48kW with N+2
1000-1200 A per rack

CONFIG D



12x 3kW rectifier slots
33kW with 11+1
687.5A per rack
w/o battery backup

CONFIG E

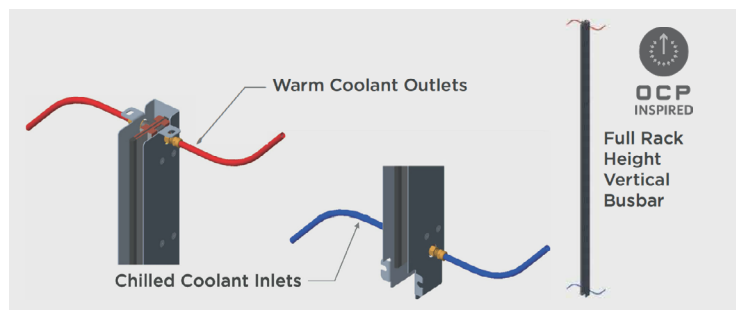


12x 3kW rectifier slots
36kW w/o redundant
750A per rack
w/o battery backup

Power Config	Power Capacity	Rack Height	ORv3 Compliance	Total Power Current
A and B	18kW	44 OU	Yes	375A
C	54kW	44 OU	Yes	1200A
D and E	36kW	44 OU	Yes	750A

ORv3 BUSBAR WITH LIQUID COOLING

- As rack level power requirements continue to increase, busbar capacity needs to increase
- Increase Liquid cooled infrastructure to cool the busbar has higher current capacity with less material usage



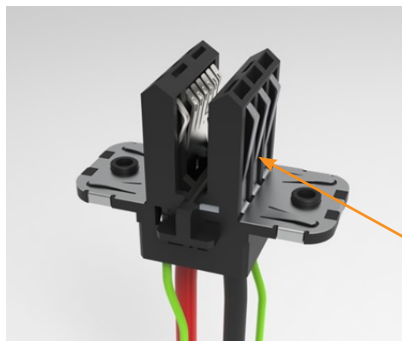
4. POWER INPUT SOLUTION ENERGIZING SWITCH, SERVER, AND ROUTERS

TE's ORv3 IT Gear solutions can provide lower power consumption in power distribution applications as either a power supply or battery back up connection. This solution was specifically designed to meet OCP application requirements but can often be used where a 100A connection is needed.

When distributing power from a data center rack busbar to the individual IT gear such as a server, storage, or switch shelf, customers are now considering ORv3 IT Gear 48V input connector solutions recently released as part of the Open Compute Project.



Sense contact terminated to low speed signal contact, 18 AWG - 20 AWG



OPEN
Compute Project
Max (Baker-Hervey) OCP

Chassis ground contacts mate to busbar cage, shall carry 2X rated AC input current for 2 minutes

KEY PRODUCT FEATURES

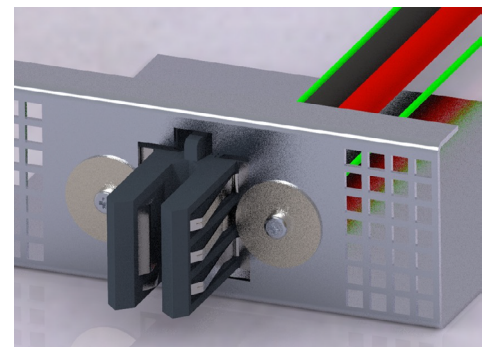
- Designed for 48V architecture
- Current capacity: 150A+
- Dedicated chassis ground contacts
- Sense Contact: mate last - break first
- Additional horizontal float: +/- 3.0mm
- Very low contact resistance <0.55mΩ
- Enhanced airflow design
- Cable routing options: rear and side exit

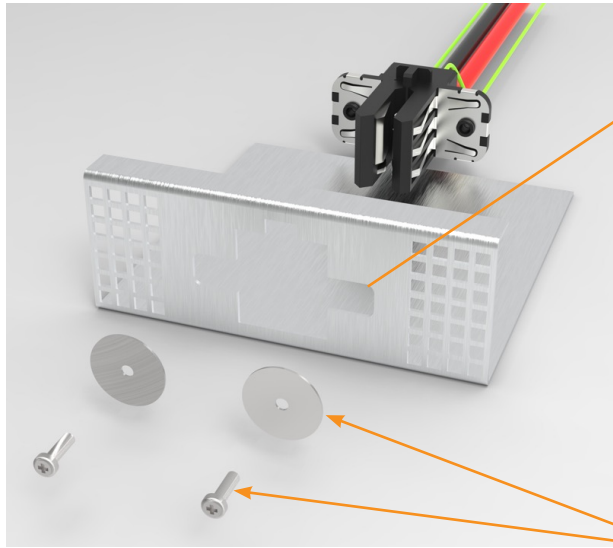
TE VALUE PROPOSITION

- Custom engineered cable assemblies
- Cable assemblies' solutions integrated with multiple TE power connectors i.e. MULTI-BEAM XLE, RAPID LOCK, ELCON Mini connectors, lugs, etc.
- Quick-turn design and sampling capabilities
- Global manufacturing footprint

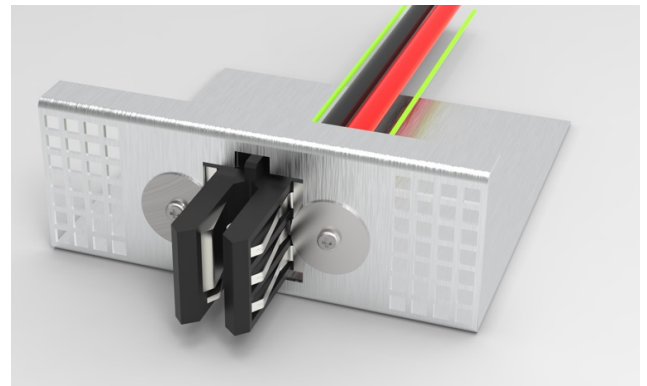
ORv3 IT GEAR POWER CONNECTOR SCREW MOUNTED IT GEAR CONNECTOR

- Derived from existing OCP 48V cable to busbar IT gear connector
- Dedicated chassis ground contact
 - Contact to busbar cage
 - Mate first - break last
 - Shall conduct 2x rated current for 2 minutes
- New sense contact
 - Mate last - break first
- Additional horizontal float
 - Was +/- 2.0mm horizontally, now ±3.0mm
- Increased current carrying capacity
 - ORv2 was 75A max, ORv3 is now 100A max per contact





Panel cutout allows $\pm 3.0\text{mm}$ horizontal and $\pm 2.0\text{mm}$ vertical float

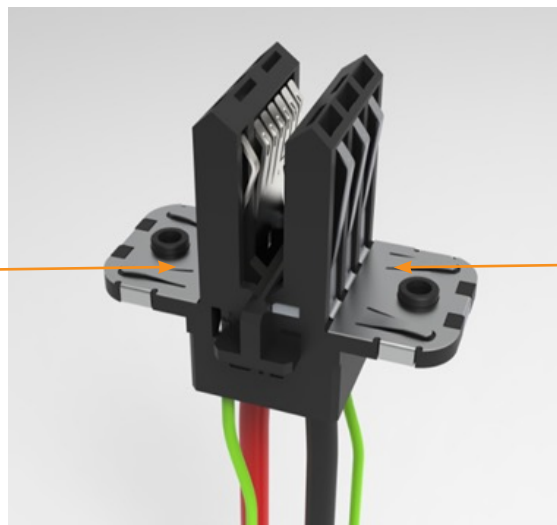


M3 Screws with 20mm diameter washers

TOOLLESS MOUNTED IT GEAR CONNECTOR

Panel cutout allows $\pm 3.0\text{ mm}$ horizontal and $\pm 2.0\text{ mm}$ vertical float

Locking feature



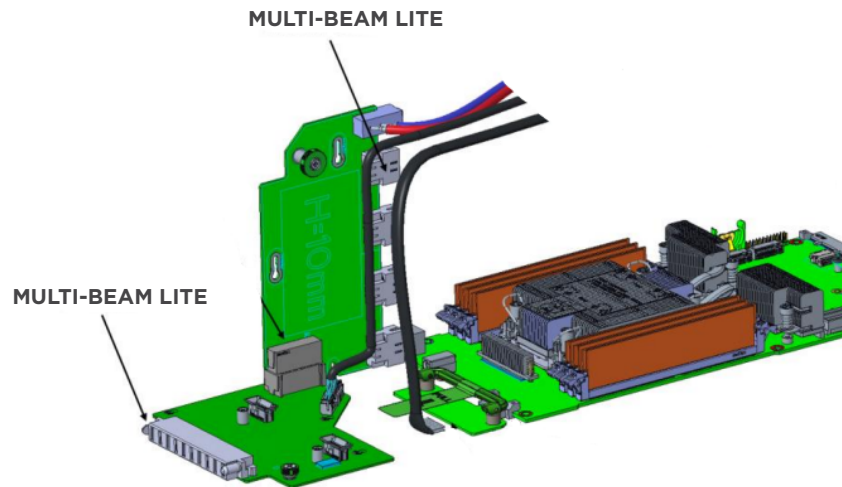
Anti-rotation/locking feature

5. POWER INTERNAL DISTRIBUTION TO PDU, MB, AND GPU

TE's MULTI-BEAM power connectors provide excellent power density with multiple current options. With a small size and low profile configuration, suitable for power supplies or distribution systems, MULTI-BEAM connectors provide considerable design flexibility while meeting next generation environmental requirements. With a wide variety of solutions available, TE offers supply chain stability and resilience while addressing the end user's requirements for power delivery and cooling.



INCREASING POWER DENSITY



KEY PRODUCT FEATURES

- MULTI-BEAM Plus connector offers 140A per contact, versus MULTI-BEAM XLE connector max. 75A per contact
- Standard height (12.6mm) above the board permits better air flow
- MULTI-BEAM Lite connector features a low profile PSU connector with 9.6mm height above the PC board, allowing for greater design flexibility

TE VALUE PROPOSITION

- Save space and reduce power consumption
- Scalable and flexible design
- Available as board & cable solution

WHY WORK WITH TE?



Our history in design engineering, global manufacturing prowess, materials science expertise and signal integrity analysis are benefits that contribute to the value of partnering with us. At TE, we view our role of consultant as a trusted advisor, who helps to bring value to our customers through innovative and customized solutions.



Partnerships that Enhance Innovation

We collaborate closely with customers and peers in the development of new technologies.



Faster, Flexible Service

TE's manufacturing and value-added services deliver top quality, highly efficient products to meet dynamic design cycles.



Sustainable Partnership

TE's engineering and manufacturing expertise, combined with our global footprint provides one of the largest connectivity and sensor portfolios.



Global Support Network

Dedicated engineer-to-engineer support enabling optimized performance.



Solutions for High Performance

Our products can support high-speed, energy-efficiency, and miniaturization in cloud, IoT end point and edge markets.



End-to-End Connectivity

TE offers a broad range of product options across data communications and IoT applications, giving customers the opportunity to consolidate their supplier base.



Total Power Portfolio Solution

Comprehensive portfolio, offering products tailored to industry-specific needs, meeting the most demanding specifications.

te.com

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