

New Busbar Technologies Provide Flexibility to Support an Expanding Range of Applications

Overview

Busbars have been a mainstay technology in power applications for many years. Sometimes also called bussbars or bus bars, these conductors provide the vital electrical pathways for conducting significant current flows between elements within sub-systems.

Busbars continue to play a key role in power, motor, industrial and automotive industries. However, the challenges of efficiently integrating busbars have become increasingly pertinent as power systems become smaller, faster and more complex. The evolution of these new application requirements is driving the need for both small-footprint busbar interconnects to PCBs and greater flexibility for configuration and production of the busbars themselves.

This Tech Bulletin provides an overview of new busbar technologies that offer configuration options through PCB interconnects like the compact BusMate™ power busbar connector, and busbar options such as laminated busbars and flexible busbars.

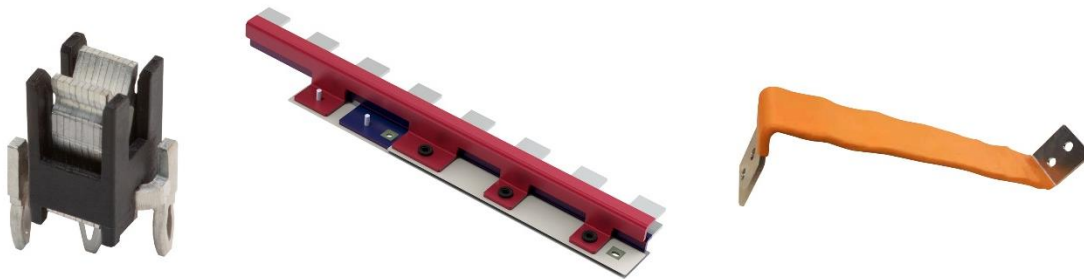


Figure 1 - New Busbar Technologies (L-R): BusMate™, Laminated Busbars, Flexible Busbars

Busbar Basics

In power-intensive electrical applications, a busbar is a critical element for conducting significant current levels between functions within the sub-system. Typically, they take the form of a strip, a bar or sometimes a tube made of copper, brass or aluminum optimized for the target application's current requirements and performance specifications.

While busbars primarily perform electrical rather than structural functions, designers should also consider how busbars mesh within the form factor constraints, as well as the heat dissipation parameters when in operation.

New BusMate™ Power Busbar Connector

New-generation power applications are increasing in complexity and manifesting themselves in more compact forms. As such, conventional methods for busbar attachment in larger power applications, such as bolting, welding, or clamping connections to busbars, are not always feasible.

Soldering can be problematic because a busbar's heat dissipation may not be compatible with mainstream automated assembly processes, instead requiring specialized secondary manual soldering steps. In addition, it can also be time consuming, costly, and risk exposure of populated sub-assemblies to the heat of secondary soldering processes.

Interplex's BusMate™ power busbar connector provides a small-footprint to minimize PCB real estate usage and maximize design flexibility, while also delivering excellent electrical interface characteristics. By enabling a compact, solderless and economical interface for connecting busbars to a variety of small PCBs, BusMate™ gives engineers a highly reliable and assembly-friendly solution for new power designs.

Key features of the BusMate™ Power Coupler include:

- Compact size: 8.4 x 6.0 x 9.9mm
- Excellent ampacity-to-size ratio
- Accommodates large assembly tolerances: ± 0.8 mating blade offset, twist or insertion depth
- Customizable and scalable for higher currents
- High temperature construction: 125°C



Figure 2 - BusMate™ Accommodates Large Assembly Tolerances

BusMate™ applications span across a variety of industries including, automotive, energy, transportation, industrial, datacom & telecom and medical & life sciences. It is especially useful for applications such as motors and pumps, hybrid vehicle power systems, electric power steering, charging systems, power mechatronics, Brushless Servo Motor (BLDC) systems, traction drive inverter busbar systems and other emerging power applications.

Laminated Busbars

Laminated busbar technology consists of a multi-layer composite structure connected with a platoon. The manner in which laminated busbars distribute current can be regarded as similar to how a highway distribution system distributes traffic. Laminating multiple circuits within a single custom-designed busbar provides both simplification for assembly and enhanced reliability.

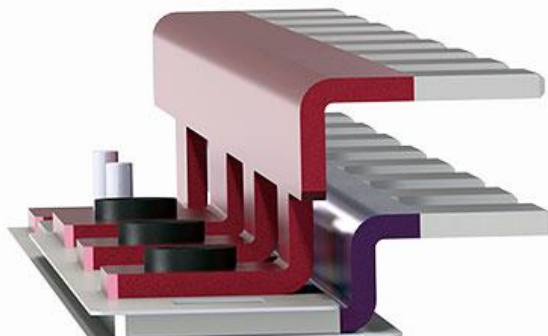


Figure 3 - Laminated Busbar

Characterized by low impedance and low inductance, the enhanced electrical performance of laminated busbars is repeatable and reliable. In contrast with traditional, time-consuming and cumbersome wiring methods, the use of modern laminated busbars enables design simplification and quick installation of well-structured power distribution systems.

Laminated busbars empower product designers with a space-efficient option for packaging, effectively delivering on overall electrical performance within the physical space constraints of a system. They are widely used across a multitude of industries and in an extensive range of applications, including but not limited to:

- **Automotive & Transportation** – Electric and Hybrid Vehicles, power and hybrid traction systems
- **Energy** – Power generation systems, power conversion modules of electric equipment, power switch systems
- **Datacom & Telecom** – Cellular communication, base stations, telephone exchange systems, large network servers, information storage systems, supercomputers
- **Industrial** – Welding systems, motor drives
- **Aerospace** – Aircraft, defense and military electronics

Flexible Busbars

Flexible busbar designs consist of high-conductivity copper foils (“lamels”) that are bonded together at the mounting areas, but provide flexibility throughout the rest of the busbar. Each foil lamel can be from 0.05 to 0.3mm thick, depending on the specific application requirements. Molecular diffusion welding is used to bond multiple sheets at the mounting area, while leaving the individual lamels separate along their length in order to provide flexibility.

Each lamel can slide against each other, allowing flexible busbars to be shaped, twisted and bent to adhere to the various space constraints of the particular system layout. In addition to making applications more pliable, flexible busbars also bring about a host of other benefits such as:

- Excellent vibration and shock absorption
- Improved electrical conductivity
- Increased power efficiency
- Maintains flexibility without compromising mounting strength or vibration absorption
- High tolerance for assembly mismatch/offset

Flexible busbars are a versatile and reliable option for engineers to create vibration-free connections for a myriad of power applications in various industries, including:

- **Automotive & Transportation** – Electric, Hybrid and Fuel Cell vehicles
- **Industrial** – Electrical connections in switch cabinets
- **Energy** – Power links for generators, transformers, charging stations

Interplex's flexible busbars are easily customizable for compatibility with specific assembly environments and end application requirements. As a leader in customized application solutions, our expertise covers end-to-end design, production and testing support for product engineers seeking to incorporate flexible busbars into power systems.



Figure 4 - Flexible Busbars Are Made Up of Copper Lamels

Key steps within the production and testing workflow include slitting, diffusion bonding, piercing of mounting holes, deburring, bending, cleaning and voltage testing. Prototypes can be created in as few as 7 days followed by rapid ramp-up to volume production.

Summary

As ever-smaller, more powerful and increasingly complex product designs require compact, efficient and reliable busbar interconnects, the underlying technologies and design approaches for implementing busbars are seeing a revolution in new capabilities. With these new busbar technologies, engineers no longer need to adapt their designs to fit a few limited busbar approaches, but instead can choose from a variety of busbar technologies to best fit their specific designs.

A critical factor for success with using new busbar technologies is to start early in the design process by working with a knowledgeable partner that can advise on a variety of approaches and can provide the best technology choice, along with the ability to support the design, prototype and production ramp-up phases of your product launch.

For more information, download our [BusMate™ brochure](#), [Flexible Busbar brochure](#), or drop us an email at communications@interplex.com.