

Reducing Inductance in Power Distribution Systems

The Features and Benefits of Laminated Busbars

The laminated bus construction is ideal for high power distribution. The interleaved conductors are thin and flat making excellent low magnetic flux emitting conduits. The dielectric materials used provide high voltage isolation with minimal distance between conductive materials.

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Cable Harnessing

The traditional solution for distributing power within an electronic system has been with cables or cable harnesses. The standard wiring solutions are fabricated with individual conductors or conductors bundled together to make an assembly. The high frequency switching applications (IGBT technology) require that special magnet wire called "LITZ" be used to reduce inductance. These bundles can be large and difficult to assemble due to the varnishing of individual strands.

The laminated bus construction is ideal for high power distribution. The interleaved conductors are thin and flat making excellent low magnetic flux emitting conduits. The dielectric materials used provide high voltage isolation with minimal distance between conductive materials. This combination of thin flat conductors with thin high dielectric insulation creates a low inductance power distribution system ideal for high frequency switching applications utilizing IGBT technology.

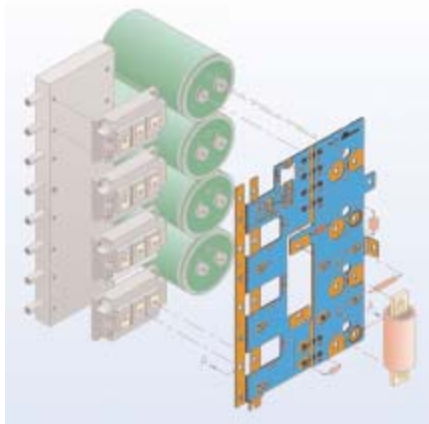


Figure 1: Inverter application for a motor drive

Optimizing Design

In this example, figure 1 shows an inverter application for a motor drive. Utilizing the low inductance of a busbar, the customer was able to eliminate the snubber capacitors from the assembly. This resulted in a direct cost savings through both the reduction of components and the labor to install them. The laminated conductor assembly resulted in a component reduction of 40% by eliminating the cabling required and mechanical hardware used originally to locate the individual cables.

Low Inductance Design

The section view in figure 2, illustrates the construction of the busbar.

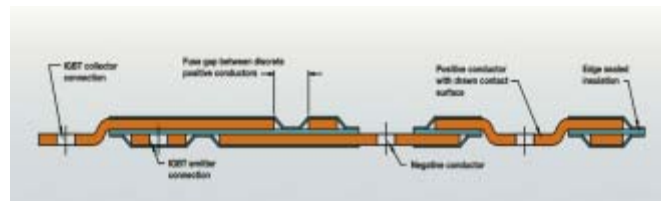


Figure 2: Construction of the busbar

The ability of the insulation to have a high dielectric breakdown resistance enables the conductor plates to be interleaved with a minimal spacing between plates, resulting in low inductance. This is very advantageous in systems using IGBT's.

The laminated conductors are fused together with Nomex® insulation coated with a flame retardant epoxy adhesive. The composite system is UL flame rated at 94 V-0 and meets all the requirements of UL 508c.

The insulation material was selected to enable the customer to wave solder discrete radial lead components to the assembly, further compacting the motor drive.

The drawn conductor (embossed) area eliminates the use of bushings to have coplanar contact surfaces for the component attachment. This is both a cost savings in the manufacture of the busbar and an electrical benefit. The bushing is attached using a filler metal that does not have the electrical conductivity of copper, resulting in a voltage loss at the joint.

The customer was able to reduce cost and space by edge sealing the conductor layers. This method optimizes the processing of the assembly, as it is created during the lamination sequence and not as a secondary process. The space is reduced by having the edges sealed electrically. The customer is

able to place components in closer proximity and reduce the size of the enclosure.

As evidenced by the above statements, the utilization of a laminated

busbar has many benefits. The electrical performance of the system is optimized resulting in fewer components. This directly correlates to cost reductions in both component and assembly time for the customer. The insulation material and conductor isolation reduces the footprint of the motor drive. This all produces a system design that allows the customer to market the drive more competitively with a higher profit margin.

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