TECHNICAL PAPER

Vertical Wire-To-Board Solutions for Solid State Lighting and Industrial Applications

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Abstract

Solid-state lighting (SSL) and industrial applications often must overcome more stringent constraints on environmental tolerance and physical form factor. Primarily, thermal issues of heat dissipation and high-temperature reliability. One popular solution to address these issues is the use of metal core circuit boards.

VERTICAL WIRE-TO-BOARD SOLUTIONS FOR SOLID STATE LIGHTING AND INDUSTRIAL APPLICATIONS

MARKET DEMAND

Solid-state lighting (SSL) and industrial applications often must overcome more stringent constraints on environmental tolerance and physical form factor. Primarily, thermal issues of heat dissipation and high-temperature reliability. One popular solution to address these issues is the use of metal core circuit boards.

While metalcore boards solve heat issues, they also introduce several new challenges. The circuits are typically confined to a single side, and only surface mount parts can be used due to the difficulty of creating a via through the conductive core. For SSL applications, this is especially troublesome because the power supply wires cannot run along or mount on the light-generating side of the board, lest they create shadows or uneven light distribution. Therefore, a vertical connector option is needed to bring in power orthogonally and ideally through the circuit board from the backside.

TRADITIONAL VERTICAL OPTIONS

Traditional vertical wire-to-board options include terminal blocks and two-piece mating connectors. Terminal blocks are often big, bulky, and can lack surface mount compatibility. Two-piece connectors, composed of a surface mount header and premade crimp-and-poke wire receptacles, are neither cost-effective nor flexible in size or pin count. As such, these types of wire-to-board connectors have not proven useful in most SSL designs and leave much to be desired in many industrial applications.

KYOCERA AVX VERTICAL OFFERINGS

KYOCERA AVX has developed more than 30 connector solutions to address the specific size, cost, configuration, and versatility demands of evolving market needs over the last ten years. For SSL and industrial requirements, in particular, a variety of vertical wire-to-board offerings have been introduced.

One such solution is based on the reliable dual-beam, high spring force, 3 mm box contact used in KYOCERA AVX's horizontal wire-to-board products. Available in both top-mount/top-entry and top-mount/bottom-entry flavors, these vertical connectors offer 1p to 6p pin counts to maximize their efficacy based on the number of power, ground, and signal wires required in the application.

These connectors can accept any combination of 18 AWG to 26 AWG wire, either solid or stranded, and handle up to 7 A of current, as shown in Figure 1. Additionally, the bottom-entry (or through board) connector has a flanged insulator and "jogged" PC tails that maximize the creepage and clearance distance required when connecting wires to metal core boards.

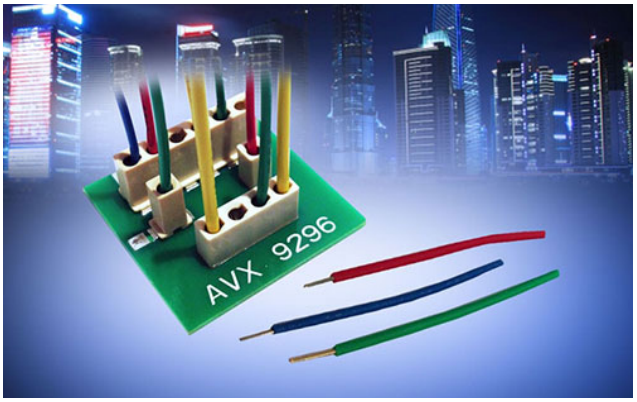

Figure 1 - Top entry and bottom entry multi-contact design

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In addition to the multi-terminal design above, the need arose to develop a single contact version. The primary design requirements were low profile, highly robust contact, top and bottom-entry options, and support for FR4 and metal core boards. To satisfy all these requirements, KYOCERA AVX developed a completely new dual-beam, poke-home contact geometry (Figure 2) that provides maximum wire retention, superior PCB attachment and stability, and an expanded current rating of up to 12 A for an 18 AWG wire. These contacts also feature “jogged” PC tails for enhanced metal core compatibility.

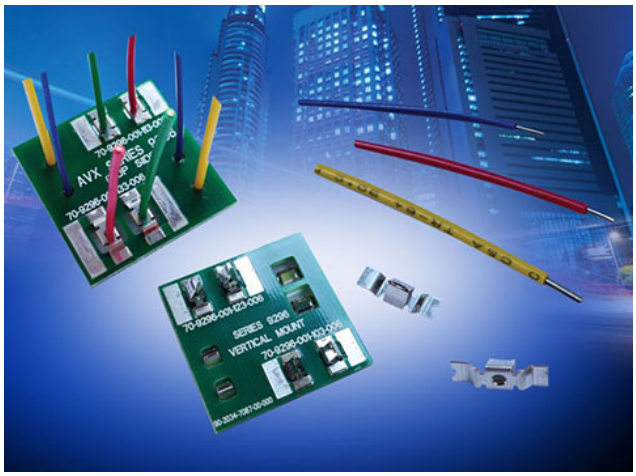

Figure 2 - Single contact top and bottom entry

In certain lower current applications, the need to support smaller gauge wires arose. Typical applications include machine controls for motors, drivers, solenoids, sensors, fans, and pumps. The solution is a micro-single vertical contact, shown in Figure 3, that supports both solid and stranded wires ranging from 22 AWG down to 26 AWG and current ratings as high as 8 A. The contact provides both top and bottom entry for FR4 and metal core printed circuit boards and comes in tape and reel packaged for automated SMT placement.

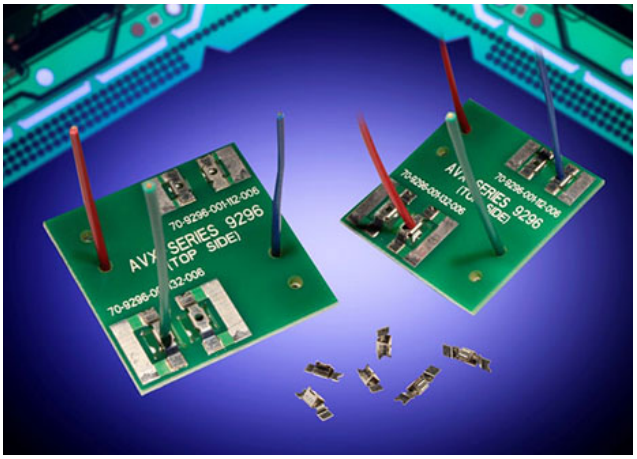

Figure 3 - Micro Single Vertical 22-26 AWG

A new 9296 single vertical entry connector was developed (shown in Figure 4) to support 18 AWG space-limited applications like LED driver power supplies and industrial control products. Pre-plated phosphor bronze contact material provides excellent spring performance with high fatigue and corrosion resistance. Tight tolerances and wire insulation stops help to prevent potting from flowing into the connector during common encapsulation processes, while an integral molded in flange provides a vacuum pick-up point for automated SMT placement.

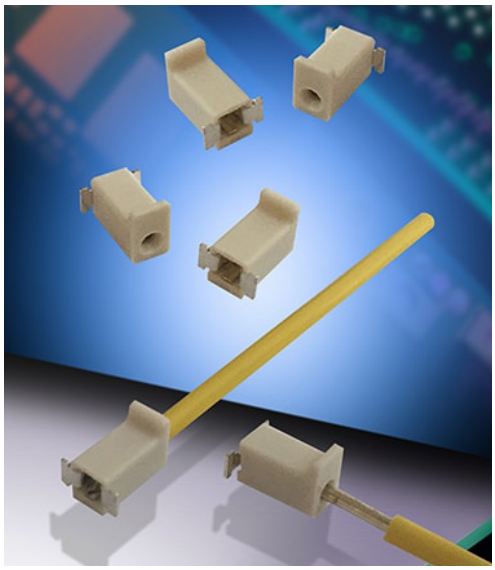

Figure 4 - Single Vertical Top Entry 18 AWG Solid

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As shown in Figure 5, a variant of the 9296 connector is also available for 18-22 AWG wire in a UL-approved color range to match individual wires for easy and accurate final product assembly. This connector can replace inconsistent hand-soldered perpendicular wire terminations onto PCBs in power supplies, LED drivers, and industrial motor controls.

Figure 5 - Standard vertical top entry for 18-22 AWG wire

CONCLUSION

Vertical through-board wire connectors are critical in solid-state lighting and industrial control applications. Traditional terminal block and two-piece connectors are simply inadequate in performance, form factor, and cost. KYOCERA AVX has developed a broad portfolio of single-piece connectors for various wire gauges and assembly requirements to address these needs. To learn more, visit the following online resources:

Vertical Top Entry 18-26 AWG: 00-9296

Inverted Thru Board 18-26 AWG: 00-9296

Single Vertical: 70-9296

Micro Single Vertical 22-26 AWG: 70-9296

Single Vertical Top Entry 18 AWG Solid: 58-9296

Standard Vertical Top Entry 18-22 AWG: 00-9296

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