

# TECHNICAL PAPER

## LED Lighting Interconnects Solutions

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### **Abstract**

Solid-state lighting (SSL) solutions based on the light-emitting diode (LED) and its organic relative (OLED) have become the standard for luminaires across a wide variety of application sectors. SSL performance with respect to luminous output, power efficiency, lifetime, and reliability is unmatched. Many of the challenges endured by early adopters, such as cooling, manufacturability, and form factor limitations, have largely been solved. By the year 2035, it is projected that 85% of all lighting installations will be solid-state (“2019 Lighting R&D Opportunities”).

## LED LIGHTING INTERCONNECT SOLUTIONS

### BACKGROUND

Solid-state lighting (SSL) solutions based on the light-emitting diode (LED) and its organic relative (OLED) have become the standard for luminaires across a wide variety of application sectors. SSL performance with respect to luminous output, power efficiency, lifetime, and reliability is unmatched. Many of the challenges endured by early adopters, such as cooling, manufacturability, and form factor limitations, have largely been solved. By the year 2035, it is projected that 85% of all lighting installations will be solid-state (“2019 Lighting R&D Opportunities”).

SSL lighting fixtures are often built from arrays of LED modules. Each module contains numerous LED’s that require delivery of DC power and possibly control signals for color and brightness. Modules are constructed on high-performance metal substrate PCB’s that have particular mounting requirements and height limitations to provide adequate cooling. Power is often delivered to the module through a hole in the PCB where discrete wires are inserted into a connector to cope with these restrictions, as shown in figure 1. This hole, the connector placement, and the height of the connector all have deleterious effects on the lighting performance and can result in a dark spot in the lighting plane.

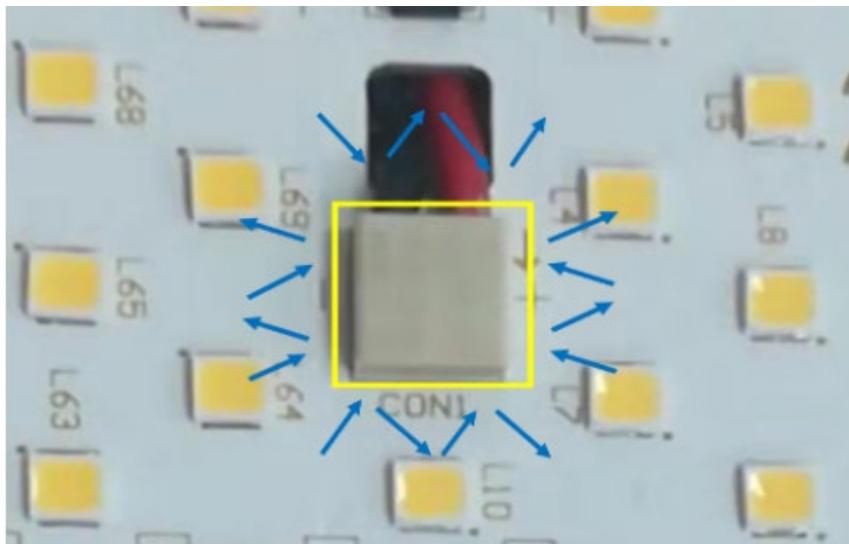


Figure 1: Example of LED array interconnect interfering with lighting performance. Image courtesy of AVX

Depending on the final luminaire design, module arrays may also be connected using direct soldering to PCB pads or using edge board-to-board connectors. In both cases, additional processing and cost are incurred in the manufacturing environment, and reliability can be compromised. To address these issues, AVX offers two types of connectors that simplify manufacturing, improve performance, and provide a highly reliable and cost-effective solution: the “poke-home” connector and the STRIPT “naked contact” system.

# LED LIGHTING INTERCONNECT SOLUTIONS

## POKE-HOME CONNECTORS

The poke-home connector was originally introduced as a highly reliable solution for connecting a small number of discrete wires to a printed circuit board assembly. A wire is first stripped, and it is then inserted into the connector. Integral wire guides and an end stop assure proper positioning of the wire during insertion. Dual-beam high force contacts provide extremely low electrical resistance and maximize wire retention. This makes the connector very cost-effective and termination friendly within the factory and in the field by electrical installers. An example of a horizontal poke-home connector is shown in figure 2.

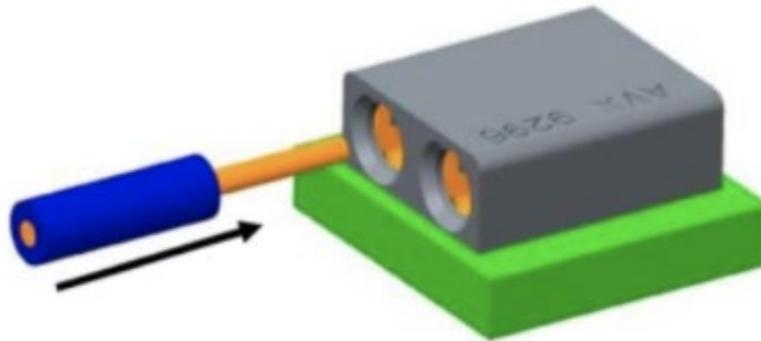


Figure 2: The horizontal poke-home connector from AVX. Image courtesy of AVX

In lighting applications, the AVX 9296-200 series offers the lowest height in the industry of only 2.5 mm. This is critically important when considering dark spot and optical interference issues. The connector accepts a wide range of solid and stranded wires from 20 AWG to 26 AWG. Housing insulation materials are available with high-temperature plastic rated to UL94 V-0 with different colors, including white, red, and black. Therefore, the resulting solution is well adapted to SSL lighting applications and provides a highly manufacturable, low-cost alternative to traditional connectors.

## STRIPT CONTACT SYSTEM

It is often assumed that wire-to-board connectors need plastic housing to insulate and position the contacts properly during insertion and operation. Interestingly, in many applications, the contact itself is necessary, and the housing can be eliminated to reduce costs even further. AVX offers various poke-home contacts that solder directly to PCB landing pads with no housing at all, often referred to as “naked connectors.” These devices offer significant cost savings while still meeting UL regulatory requirements and customer reliability demands. Naked poke-home contacts are available in horizontal, vertical, through board, and a new micro-vertical variant. As shown in the figure 3, the stripped wire or jumper pin is simply inserted into the contact.

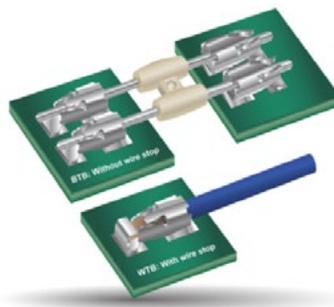


Figure 3: STRIPT Poke Home Contact without and with wire stops. Image Courtesy of AVX

# LED LIGHTING INTERCONNECT SOLUTIONS

## CONNECTOR MECHANICAL PERFORMANCE

AVX is a market pioneer of naked terminals. The AVX 70-9296 series has been designed for low-cost PCB surface mount applications to accept wires from 12 AWG to 28 AWG. When used without wire stops and board-to-board jumper pins, highly reliable connections can be made with tolerance to stack up variability and straightforward manufacturing processes. Again, this makes naked terminals very well suited to solid-state lighting applications and offers an attractive alternative to traditional connection methods.

It is also worth noting that in both the poke-home and STRIPT products, the wires can be removed, as shown in the figure 4. The wire must be simultaneously pulled and twisted as it slowly unscrews from the contact.

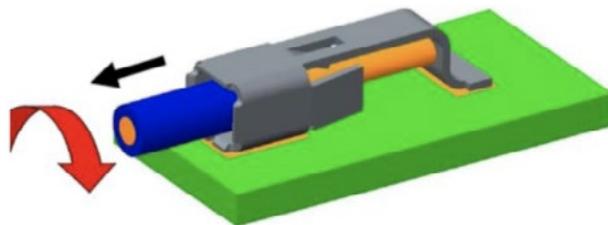


Figure 4: Wire removal procedure for poke-home and STRIPT contacts. Image Courtesy of AVX

## CONCLUSION

Solid-state lighting PCB's have a unique and demanding set of requirements for interconnection wiring. Z-height, manufacturability, UL approval, and reliability in high-temperature environments are just a few of the challenges presented. AVX's poke-home and STRIPT product lines provide a wide variety of products to meet these challenges head-on. To learn more, visit AVX's website:

- [Poke-Home Contacts – Single Horizontal](#)
- [Poke-Home Connectors – Low Profile Horizontal](#)



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