

Specifying Connectors for Consumer LED Lighting

5 Key Considerations



A JAE White Paper



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The global LED lighting market will reach nearly \$26 billion dollars in 2015 and is expected to grow 45% per year through 2020. The former figure is according to [LEDInside](#); the latter, [WinterGreen Research](#). Additionally, a [study by the U.S. Department of Energy](#) (DOE) forecasts that by 2030 LED lighting will represent 74% of lumen-hour sales. Given the host of benefits offered by LED lighting – such as longer operating life, added brightness and intensity, energy savings and ecological benefits – and rapidly falling prices, these forecasts seem plausible. For example, according to the DOE study “annual site energy savings” from the use of LEDs could reach 300 terawatt-hours by the year 2030 and effectively reduce greenhouse gas emissions by 210 million metric tons of carbon. As for pricing, the cost of a standard LED bulb, which as recently as 2013 was \$10 USD, is now a little more than half that amount.

Reliable, high-functioning interconnect technology is of course essential for LED lighting applications. In this JAE white paper we offer five key considerations when specifying connectors for consumer LED lighting.

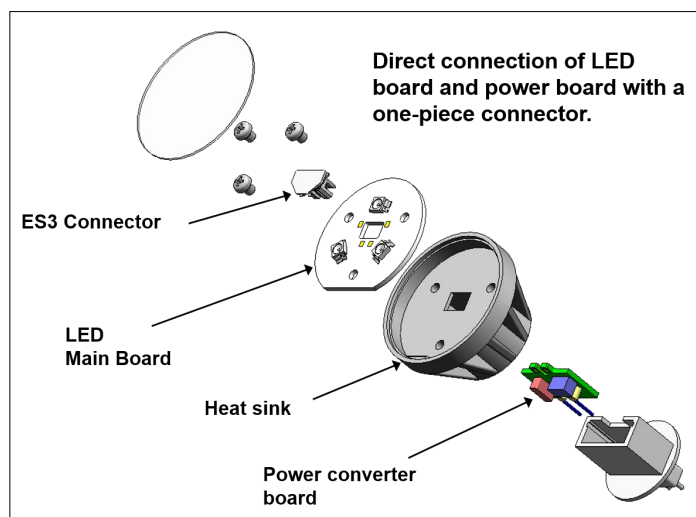
1. **Consider your connector choice early on in the design process** – This is a worthwhile consideration for any product design and particularly so for LED lighting. Choosing the optimum connector for your lighting product requires pairing application needs to the most suitable connector that best meets your parameters for performance and cost. And when considering cost, consider not only the cost of the connector itself but also the *applied* costs.

Take for instance hand soldering, still widely used to facilitate connections in consumer LED applications. While there's no connector cost with hand soldering there are associated labor costs. These labor costs, combined with costs associated with potentially higher defect rates and warranty charges may exceed the cost of a connector. For example, some lighting specific connectors require no soldering or crimping of wires and some have no insulator* and can be had, depending on the volume purchased, for just a few cents apiece. These connectors feature embossed reel packaging for hand mounting and of course the embossed reel packaging also facilitates high volume automated mounting as well.

It's also important early on to consider the layout of the driver and LED boards inside of the lights, especially for directional lighting such as down or ceiling lighting. For

instance, there are now connectors that enable direct connection of the LED board and driver board in a perpendicular orientation.** Compared to the cost of a typical wired connection this type of setup can help lighting manufacturers cut costs.

2. **Consider only UL-certified connectors** – As any connector used in consumer LED lighting fixtures will need to be UL-certified, it's imperative to determine beforehand that the connectors you're looking at have this certification. Failure to do so can result in added design expenses later on and can cause delays in product certifications and new product introductions. **NOTE:** Keep in mind that many connectors designated for use in LED lighting applications are simply retooled electronics connectors. As such, not all of them have the necessary certifications for use in UL-compliant lighting fixtures.



Be sure to consider all factors and components when choosing the right connector for your next LED light.

3. **Consider connector size, especially height** – As noted, LED lighting offers a host of benefits and these benefits combined with falling prices mean accelerating consumer sales for the foreseeable future. But while LED lighting technology continues to advance, the shape of the LED bulb remains much the same as the incandescent bulb it's rapidly replacing. For example, according to research firm IMS, by 2016 a majority of consumers will be using [A-line shaped LED bulbs](#) in their table lamps. While 2016 seems a little soon for this tipping point, one fact is evident. As is the case with many consumer electronics applications, the connector choice must deliver reliable, long-lasting functionality within the confines of an ultra-compact space.

Optimum connectors for these everyday LED bulbs will not only provide reliable, long-lasting functionality within an ultra-compact space, they will have been engineered to maximize light emission. In short, these connectors will have extremely low profiles (as low as 1.6 mm) so as to not interfere with *any* light emission. One recent innovation to reduce connector height in such applications is the introduction of board-to-cable connectors that go *through* the LED board to make the connection. In this connector design, because the component is actually below the board itself, a lot of height can be saved.

4. **Consider connector insulator color** – With LED lighting you don't want to waste *any* of the light that's being emitted. So, as many of the connectors are going to be mounted right next to the actual LEDs it's important – in order to maximize light emission – that your connector have white plastic molding. White plastic molding will reflect light whereas black and clear will absorb light. Plus, black can cause shadowing or dark spots.



JAE's ES3 Series card edge LED lighting connector is made with white plastic molding which maximizes light emission by reflecting light rather than absorbing it.

5. **Carefully consider connector specifications** - The operating temperature range required for an LED light bulb is always up to 105 degrees Celsius. Whereas, normal consumer connectors are only rated up to 75 or 85 degrees. So if you want to be able to get your connector qualified inside of an LED lighting device, you have to make sure that your connector can survive that 105 degree Celsius operating temperature.

Wire size and type is also important. The optimum wire size and type will ensure that the light fixture is compatible with existing drivers and can provide the necessary voltage drop performance. In addition, if you can use the same standard wires across multiple designs that will improve logistics and help cut costs. Not only the wire size, but the wire type, such as solid or stranded wire, is also a key concern. The reason being that there are connectors which will only work with one type or the other. So make sure the connectors being considered are compatible with the type of wire you are using.

For more information on JAE and its product line, including its complete line of precision-engineered connectors for manufacturers of consumer LED lighting, please call 949-753-2600 or visit www.jae.com.

* The JAE [ES10S001JF1](#) is an example of a connector with these features.

** The JAE [ES3B002WF1](#) is an example of a connector with these features.

About JAE Electronics

Japan Aviation Electronics Industries, Ltd. (JAE), designs, manufactures and markets electronic components, connectors for handheld devices, automobiles, waterproof electrical products, commercial energy storage systems and other digital systems. A global company, JAE is a recognized leader in providing solutions to complex design requirements. By combining divergent technologies from experience gained in the aerospace industry, JAE has been able to transfer these technologies into advanced connector designs. From connectors on Japan's Bullet Train, to the smallest hand-held video camera, JAE continues to meet the most demanding applications in the industry.

