

Trends in *Circuit Protection*

The future of LED lighting technology is certainly bright.

In spite of fluctuations in the economy and the general lighting industry, LED lighting occupies a significant portion of the overall lighting market. In fact, a 2013 article in Forbes reported that LED lighting holds 18 percent of the \$66 billion global lighting market. Industry analysts predict significant growth over the next decade.



*By Henry Yu
Technical Marketing Engineer
at Littelfuse*



Implementation of surge protection device (SPD) circuit protection, like the LSP05-LSP10 series from Littelfuse, helps outdoor lighting applications deliver their full return on investment.

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Electronics engineers and product development managers in the LED lighting segment strive to continue growing right along with the market trends. To succeed in developing LED designs that flourish in the current market, however, they must incorporate reliable circuit protection technologies that deliver a strong return on investment (ROI).



This up-to-date market overview reveals the current state of the LED market, trends for several LED segments, and forecasts for global growth. While emphasizing the need for industry-leading circuit protection solutions from a reliable manufacturer, it outlines the ideal fuses, varistors, surge protection modules, and transient voltage suppression (TVS) diodes for a variety of LED applications.

Current Market Condition

Statistical research from the past few years supports the pivotal position of LED technology in the global lighting market. According to IHS Technology, one out of every four dollars spent worldwide on LED drivers was used for lighting applications in 2013. In terms of market share among all end users of LED lighting, a 2014 article from MarketWatch revealed that the commercial segment was the largest and accounted for 52.5 percent of the market in 2012. The same article highlighted that Europe was the largest geographic market segment—accounting for 33.1 percent market share in 2012.



Some of the most common applications for LED lighting are outdoor, residential, and architectural. Outdoor LED lighting is quickly gaining popularity for tunnels and roadways. In fact, nearly two million LED luminaires were installed in tunnels and roadways in 2012, according to Strategies Unlimited. They are also being used in traffic lights, parking lots, and garages. A recent article from Reuters reported that nearly 70 percent of all traffic lights in the U.S. have been converted to LEDs. The article also stated that the adoption percentage for the European market is currently in the low teens, as of 2010.

Residential applications for LED lighting include lighting in kitchens, hallways, and bathrooms. A 2010 characterization report from Navigant Consulting published that the total number of LED lamps installed in U.S. stationary applications grew from just under 7 billion in 2001 to more than 8 billion in 2010. This statistic was especially significant because the majority of the growth occurred in the residential sector. Navigant's report also revealed

LED STREET LIGHT INSTALLATIONS WILL GROW BY 400 PERCENT OVER THE NEXT FIVE YEARS.

that residences account for 71 percent of all lamp installations in the U.S. for a total of 5.8 billion lamps.

According to MarketWatch, the architectural segment is the second largest end-user segment for LED lighting. For architectural applications, LEDs are used in both decorative and functional lighting. Decorative LEDs are used to illuminate fountains, pools, gardens and statues. For functional applications, such as building facades and landscaping, LEDs provide visibility and enhance safety on residential and commercial properties.



Future Market Growth

Where is the LED market headed? Forbes predicts that growth will continue throughout the next decade, with the global LED market share reaching about 70 percent by 2020. According to McKinsey's 2012 lighting market report, Asia will occupy about 45 percent of the global general lighting market by 2020. The report indicated that rapid penetration in Japan and China is driving Asia's market-leading position for transitioning to LEDs in general lighting. In Europe, the current LED value-based market share is approximately 9 percent, McKinsey reported. By 2020, the share is expected to rise to over 70 percent.

Outstanding growth is projected across various LED market segments, including the outdoor lighting industry. Strategies Unlimited forecasts that the global outdoor LED lighting market will reach \$1.9 billion by 2017. The organization also predicts that LED street light installations will grow by 400 percent over the next five years. According to Semiconductor Today, the market share of LEDs in street lighting worldwide will grow from 53.3 percent in 2014 to 93.8 percent in 2023.

LED lighting within residential and architectural industry segments is also expected to grow. Forecasts for LED growth in the residential segment are almost 50 percent for 2016 and over 70 percent for 2020, according to McKinsey. For architectural lighting, MarketWatch revealed that Japan and Europe are the fastest growing regions. McKinsey predicts that architectural lighting will remain the early adopter

for LED lighting, with its market share reaching almost 90 percent by 2020.

Circuit Protection

To keep up with the latest trends in LED lighting, electronics engineers and product development managers are continually innovating LED designs. Creating designs for LED lighting applications presents several challenges, including the need to protect the sensitive electronics and circuits within the LEDs against lightning, transient surges, and electrostatic discharge (ESD). These electrical threats may jeopardize the safety of personnel and endanger the consumer's ROI. If proper safeguards are not used, there could also be compliance issues with regulatory and safety standards related to overvoltage transients.

Circuit protection technologies are vital for safeguarding the vulnerable electronics and circuits within LEDs. To prevent LED lighting



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from experiencing failures within an investment payback period of about five years, high durability and reliability are essential. Before selecting a compatible circuit protection device, it is important to find a manufacturer with knowledge of LED lighting industry standards and the safety issues associated with designing LED retrofit lamps and outdoor luminaires.

Littelfuse, the global leader in circuit protection, recommends protection devices for LED driver and power converter circuits and performs testing to ensure compliance with industry standards. The company manufactures a variety of fuses, varistors, surge protection modules (combination of varistors), and TVS diodes for LED lighting applications. The table below indicates the ideal circuit protection device for various applications.

Conclusion

As the LED lighting market continues to grow across several application segments, the demand for high-reliability circuit protection technologies will continue to increase. Circuit protection is needed to safeguard sensitive LED electronics and circuits from electrical threats and meet industry standards for safety and reliability. In addition, circuit protection is vital for preventing LED lighting from experiencing failures within an investment payback period of five years. Industry-leading circuit protection solutions like fuses, varistors, surge protection modules, and TVS diodes are designed to protect several LED applications and maximize the lighting investment. [EE](#)

CIRCUIT PROTECTION TECHNOLOGIES ARE VITAL FOR SAFEGUARDING THE VULNERABLE ELECTRONICS AND CIRCUITS WITHIN LEDs.

LED LIGHTING APPLICATIONS CIRCUIT-PROTECTION-SOLUTIONS TABLE

LED Lighting Applications	Over-Current Solutions	Over-Voltage Solutions (primary front end)	Over-Voltage Solutions (secondary side-added clamping)	Details
LED Bulb	454 Series Fuse	CH Series Varistor	SMBJ TVS Diode	Complete SMT (surface-mount) OC and OV solutions for lowest cost and manufacturing efficiencies
LED Streetlight (North America)	328 Series Fuse	LSP10277S	1.5KE TVS Diode	Meets ANSI C136.2 and DOE MSSLC for 20kv/10ka high exposure, series indication
LED Streetlight (Europe, Asia)	219 Series Fuse	LSP05277P	P6KE TVS Diode	10kv/5ka, thermally protected surge immunity solution, CE Mark and Class I&II installation support
Area Lighting	209 Series Fuse	LSP05277NP	SMAJ TVS Diode	Lowest cost solution for low-exposure applications