



# Illuminated Signs

World's Thinnest Lighted Signs Fly at San Jose Airport with LUXEON-Based Noveseo Light Modules.

## Challenge

For a 21st century airport in the heart of California's Silicon Valley, nothing should be business as usual, including the signage. With that in mind Jacobs Carter Burgess—the architectural firm overseeing the expansion and renovation of the Mineta San Jose International Airport—put out a call for a fresh approach to building illuminated wayfinding signs that would essentially reinvent the category.

The architects were looking for a sleek, modern, eco-friendly sign design that fit the region's reputation for technology innovation as well as the overall vision for the airport facelift. The new signs also had to be illuminated by power LEDs made from the semiconductors that gave Silicon Valley its name. Those requirements led to a sign cabinet that is just 4" deep—half the 8" depth of models made with standard fluorescent, neon or LED backlights—and the slimmest double-faced illuminated sign ever produced.

The design hinges on a perimeter lighting concept utilizing minimum 100-lumen LUXEON® Rebel LEDs from Philips Lumileds installed in Noveseo™ LED light modules engineered specifically for the project by Silicon Constellations Inc. in Santa Clara. The use of solid-state lighting also provides energy efficiency, longevity and other benefits that advance San Jose's 'Green Vision' agenda for reducing the city's energy consumption as well as establishing the region as a role model for sustainable development.

## Thin Is In

The perimeter lighting scheme driving the new airport signs was cooperatively conceived by engineers at Silicon Constellations and Oakland-based Arrow Sign Company. The idea proposed to David Mastrandrea, architect at Jacobs Carter Burgess, was to illuminate the signs from within by placing LED modules along the top and bottom edge of each sign and use an acrylic diffuser panel behind the sign faces, creating

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the same effect as a backlight without requiring space in the cabinet to mount a backlight panel.

This strategy would shrink the standard signage depth by 50% and yield a sleek 4" silhouette barely thicker than a non-illuminated billboard—precisely what the airport's architects were looking for.

The challenge was to find an LED that would emit enough light to produce sufficient brightness from perimeter lighting without requiring too many LEDs or generating excess heat. The LUXEON Rebel product solved the problem with its minimum 100-lumen part and market-leading thermal efficiency. It also offered other technical advantages, including the best lumen maintenance of any power LED driven at high currents—in this case, 700mA.

"To deliver the brightness levels we needed for perimeter lighting, we required the best-performing LED we could get our hands on. We needed a combination of factors that included high flux, low forward voltage and peak thermal efficiency," said Bojan Silic, founder and CTO of Silicon Constellations. "The minimum 100 lumen LUXEON Rebel was the only LED on the market that met all of our requirements."

## **Noveseo Rebellious I LED Light Engines**

The Rebellious I LED light modules used in the new wayfinding signs at the San Jose International Airport are ideal for applications ranging from illuminated signs to channel letters and cove lighting. Part of the Noveseo family of LED solutions from Silicon Constellations and built with LUXEON Rebel LEDs, they provide a high-brightness, high-efficiency lighting solution offering long service lifetime, advanced thermal management, minimum 100 lumen/watt performance, and the ability to be driven up to 1.0A and deliver 195 lumens in constant-current configuration. A 1W/module constant-voltage configuration is also available.

Each Rebellious I module measures just 1" x 1.5" with 12" wiring between modules to provide maximum flexibility for lighting designers. The modules are available in custom wire lengths, in multiple colors, and with a variety of optional optics for addressing different light distribution applications. The Rebellious I module is UL-listed Type II, can be used for indoor and outdoor applications in dry, damp and wet conditions, and has a lifespan of 60,000+ hours even at an ambient temperature of 70 °C (158 °F).

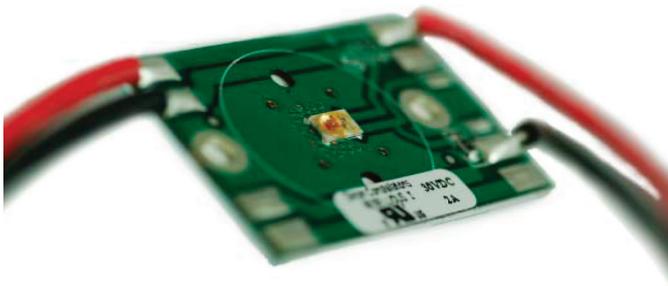
## Sign of the Times

With the basic concept in place, Silicon Constellations built a 1" x 1.5" light module consisting of a single cool white LUXEON Rebel LED mounted on a special board assembly that maximizes thermal dissipation and allows the body of the cabinet to be used as a heatsink. The module was named the Rebellious I™ after the LED that made it possible.

Arrow Sign Company then used sample modules to build a prototype of the sign for evaluation by airport architects. A live demo in early 2008 included side-by-side comparisons of the Rebellious I and four competing LED modules. The visible difference in performance helped seal the deal.

"The Rebellious I was twice as bright as the other modules. That helped assure the architects that our signs would deliver brightness levels equivalent to the existing signs," said Charlie Stroud, CEO of Arrow Sign Company. "The lean look of the box was a critical design element for the airport architects, but it wouldn't have mattered if we couldn't also show that we could meet the brightness benchmarks."

Additional design and engineering support was provided by Future Lighting Solutions, the exclusive supplier of LUXEON LEDs. Silicon Constellations utilized Future's proprietary Usable Light Tool to calculate how many LEDs would be required to light the signs. The firm also consulted with Future's engineers to identify appropriate dimmable LED drivers and an optic vendor that could provide the elliptical optic needed for the airport project as well as a full range of other optic solutions to suit different applications for the Noveseo product.



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## Lighting the Way

The first Noveseo-powered signs were installed in fall 2008 in the airport's outdoor ground transportation island. Like most of the approximately 300 signs which will ultimately be built to provide directional signage for airport visitors, the initial signs are 7 feet wide and 20 inches high, with two strings of seven Rebellious I modules running parallel to each other at the top and bottom edges of the cabinet. In total, then, just 14 LEDs were required to light a single seven-foot sign. Other form factors, both shorter and longer, will utilize the same parallel configuration with proportionately fewer or more LED modules based on cabinet size.

LUXEON Rebel's high flux levels coupled with the thermal management innovations of the Rebellious I module are allowing 12" placement between modules instead of the 2", 4" or 6" intervals used in other LED products, both lowering material costs and simplifying the assembly process. Each sign runs at a constant current drive of up to 700mA, requires just 2.25 watts of power per module, and is designed to be dimmable by remote control using Mark VII wired or ZigBee™ wireless dimming controllers.

With LUXEON LED technology leading the way, the signs also reduce energy consumption by more than 70% over fluorescent or neon backlight versions, further lower costs by lasting at least four times longer between bulb replacements, and provide a ROHS-compliant mercury-free and lead-free light source.

Beyond those 'green' advantages that are often associated with solid-state lighting applications, the major achievement of the San Jose airport wayfinding sign project remains the ultra-slim cabinet profile and the striking new look it offers for illuminated signage. Once again, Silicon Valley has given birth to technology and innovation that promises to spread around the world.

## Benefits

- Minimum 100 lumen flux
- Market-leading efficiency
- Support for 700mA operation or greater
- High thermal efficiency
- Energy savings over conventional light sources
- Binning for color temperature consistency
- 70% lumen maintenance >60,000 hours at 700mA
- ROHS compliant and mercury-free

## About Lumileds

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For 100 years, Lumileds commitment to innovation has helped customers pioneer breakthrough products in the automotive, consumer and illumination markets.

Lumileds is shaping the future of light with our LEDs and automotive lamps, and helping our customers illuminate how people see the world around them.

To learn more about our portfolio of light engines, visit [lumileds.com](http://lumileds.com).

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