

## CASE STUDY: VS LIGHTING SOLUTIONS PANASONIC GROUP

# Pioneering more-reliable outdoor LED lighting modules with advanced optical silicones

### The challenge

VS Lighting Solutions, an independent brand within the Panasonic Group, is a leading developer of innovative components and solutions for next-generation lighting – due largely to its continuous pursuit of higher-performing LED illumination with simplified designs and lower cost of ownership. It was this pursuit of excellence that prompted VS Lighting Solutions to explore the cause of a browning phenomenon observed in its M-Class and S-Class roadway LED modules that led to reduced light output (lumen flux) over the lifetime of the devices.

“LED roadway lighting offers municipalities significant cost savings over conventional illumination, but – even for LED lighting – there is always room for improvement,” said Volker Neu, general manager for the LED business at VS Lighting Solutions. “Our mission as a company is to constantly find ways to further enhance the reliability and quality of light that our roadway luminaires produce to ensure we are providing our customers with the cost-effective next-generation lighting solutions they’ve come to expect from us.”

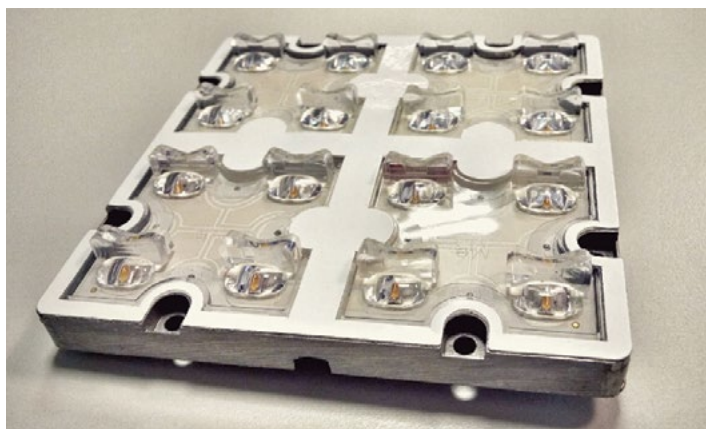
VS Lighting Solutions approached Dow, a global leader in silicones, silicon-based technology and innovation, to investigate the cause of the browning phenomenon in its LED modules and search for a solution. Working together, the two companies discovered that the source of the problem was volatile organic compounds (VOCs) trapped in the lighting cavity by the polymethyl methacrylate (PMMA) secondary optic lens. The VOCs were being released into the lighting cavity over time from the polyurethane potting materials used to seal the module housing. Prevented from escaping, these VOCs slowly reacted with the LED phosphor, resulting in discoloration and degradation of the light.

### The solution

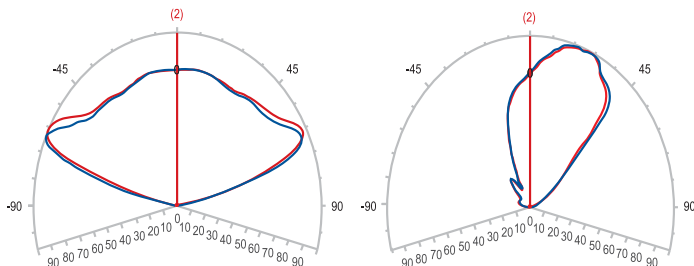
Unlike PMMA thermoplastics, moldable silicone materials used in secondary LED optics are permeable to VOCs. Recognizing this, VS Lighting Solutions and Dow developed an M-Class 16-LED array module incorporating four secondary lenses fabricated from SILASTIC™ MS-1002 Moldable Silicone and sealed with DOWSIL™ 3140 Transparent Adhesive.

SILASTIC™ MS-1002 Moldable Silicone is an optical-grade transparent silicone formulated to deliver low viscosity before cure, room-temperature processing, low-pressure injection-molding versus thermoplastics and high-temperature curing to achieve precise optic designs. In addition to delivering outstanding photothermal stability, it offers expanded design flexibility for fabrication of complex shapes, microscale optical structures, multifunctional parts and even undercuts that are difficult to achieve with organic polymers.

VS Lighting Solutions also used DOWSIL™ 3140 Transparent Adhesive to adhere the moldable silicone optic to the LED’s printed circuit board.



**Figure 1:** VS Lighting Solutions’ M-Class 16-LED array module incorporates four secondary lenses fabricated from SILASTIC™ MS-1002 Moldable Silicone and sealed with DOWSIL™ 3140 Transparent Adhesive.



**Figure 2:** Light distribution curves at 0° (left) and 90° (right) viewing angles for cold (30°C, blue lines) and hot (80°C, red lines) operating conditions.

In addition to the aforementioned material properties, both silicones provide strong resistance to ultraviolet light and impact. Most importantly to this application, they are permeable to VOCs, thus helping to prevent contamination of the LED die or its light-converting phosphor layer.

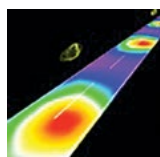
### The success

“Through its collaboration with Dow, VS Lighting Solutions was able to successfully analyze the performance issues with its M-Class and S-Class modules from different perspectives,” Neu said.

With the unique properties of moldable silicone materials from Dow, the lighting manufacturer was able to innovate a very cost-effective and robust new roadway lighting solution.

VS Lighting Solutions did not observe any browning of its new silicone-based M-Class modules in hermetic closed fixtures after operating them for several thousand hours at currents of 400 mA, 700 mA, 1,050 mA and 1,500 mA under controlled temperature conditions of either 18°C or 35°C.

The strong seal formed by DOWSIL™ 3140 Transparent Adhesive offered excellent protection against moisture to deliver ingress protection ratings of IP67 and IP69K for the new modules. In practical terms, that is sufficient protection to resist the high-pressure hot-water washes often used to clean street and roadway lighting. Salt spray resistance also was good for the new silicone lenses made of SILASTIC™ MS-1002 Moldable Silicone.



**Figure 3:** Despite silicone's comparatively higher coefficient of thermal expansion versus other materials, temperature changes at the silicone lenses' location did not cause any observable change in light output flux and distribution on the road.

VS Lighting Solutions and Dow also demonstrated that, despite silicone's relatively high coefficient of thermal expansion, temperature cycling from 30°C to 80°C did not adversely affect the lumen flux or light distribution of the new 16-LED module. Further, extended field testing in various indoor and outdoor environments showed no significant difference in light depreciation rates for secondary optics made from SILASTIC™ MS-1002 Moldable Silicone, PMMA and PC due to dirt or dust deposition.

“Competition in the outdoor LED lighting market is very fierce, making it critical to collaborate only with reliable global suppliers like Dow who bring advanced materials and expertise with a proven history of success,” Neu said. “VS Lighting Solutions is continuing to work with Dow to develop additional LED luminaire designs able to deliver the reliable, long-lasting and high-quality illumination now demonstrated by our newest M-Class module.”



**Figure 4:** LED streetlight fixtures from Ragni, a French public lighting designer and producer, incorporate an M-Class LED module that is designed to deliver durable, high-quality illumination. VS Lighting Solutions chose SILASTIC™ MS-1002 Moldable Silicone as the lens material.

### Learn more

We bring more than just an industry-leading portfolio of optics materials. As your dedicated innovation leader, we bring proven process and application expertise, a network of molding and optical experts, a reliable global supply base and world-class customer service.

To find out how Dow can support your lighting applications, visit [consumer.dow.com/lighting](https://consumer.dow.com/lighting).

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