

# TECHNOLOGY

## GaN ON GaN

### GaN ON GaN



### SIMPLY PERFECT CRYSTALS

The main advantage of Soraa's GaN on GaN (Gallium Nitride on Gallium Nitride) LED material is that it allows reliable operation at very high current densities. With a 1000x fewer defects than conventional LEDs (which build GaN layers on cheaper foreign substrates like sapphire, silicon carbide, or silicon) Soraa's LED has a near-perfect crystal structure. This enables Soraa LEDs to emit more than 5x more light per unit area of LED material than conventional LEDs. GaN on GaN's optical transparency and high thermal and electrical conductivity also enable a very robust, simple LED design that delivers maximum light output and performance.

### RECORD-SETTING INNOVATION

Soraa's third generation GaN on GaN™ LED achieves world-record setting wall-plug-efficiency, outperforming the nearest competitor by 20% at normal operating conditions. In just one year, Soraa has achieved a remarkable 30% increase in white lumen per watt (lm/W) efficiency over its prior generation LED, setting a pace of technology evolution unrivalled in the LED industry. The company's Gen3 LED runs at 75% wall-plug-efficiency at a current density of 35A/cm<sup>2</sup> and a junction temperature of 85°C, efficiency levels that are out of reach for other LED manufacturers. Soraa leverages the properties of the native GaN substrate and a chip-on-board LED package design to create a very robust, single point source that enables excellent beam control.

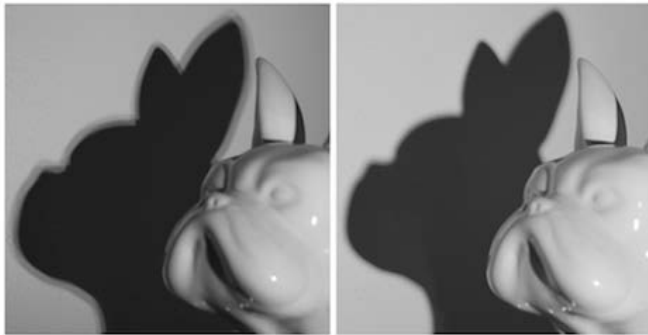


Source: Competitor data sheet, and Soraa internal data at 85°C junction temperature

# TECHNOLOGY

GAN ON GAN    VP<sub>3</sub> VIVID COLOR    VP<sub>3</sub> NATURAL WHITE    **POINT SOURCE OPTICS**

## POINT SOURCE OPTICS™



Competitor LED

SORAA LED

Clear single shadows with Soraa **POINT SOURCE OPTICS**

### SIMPLY PERFECT BEAMS

Directional lighting poses several stringent requirements which LED lighting manufacturers must meet: well controlled beam angles from 9 degrees to 60 degrees; tight form factors often established based on their halogen predecessors; uniform color across the beam; and sharp single shadows like halogen and incandescent lamps.

The relatively large size of most LED light sources makes this a challenge. Fundamental laws of optics dictate that large sources in small form factors result in wide beam angles. Color variations across the LED light source are often clearly seen in the beam. And the multiple-source-arrays of LEDs used to create sufficient lumen output cast multiple shadows, obscuring detail in colors and textures.

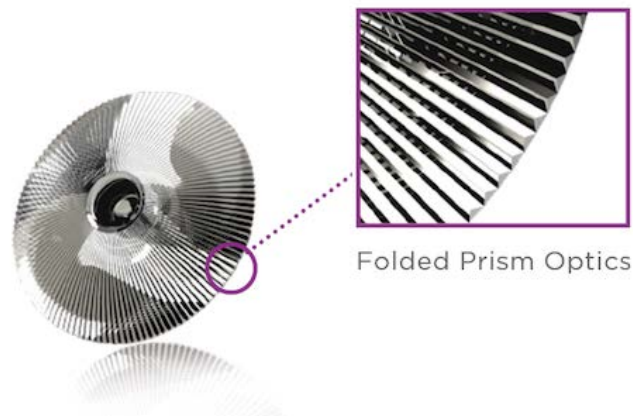
Soraa's answer to these challenges is a tour-de-force of integrated LED and optical engineering. Simply Perfect Beams. **POINT SOURCE OPTICS.**

## POINT SOURCE OPTICS™

The nearly flawless crystal structure of Soraa's GaN on GaN™ LED allows it to operate at currents that are more than five times higher than LEDs built on non-GaN substrates. As a result, Soraa's LED emits five times more light from a given LED area than any other LED.

A lot of light from a very small source means... a point-source LED! Those same laws of optics that hinder beam design with large multiple light sources become an asset with a small single source. To that, we add innovative folded optics with precision-cut prismatic lenses, which allows us to focus beams within a very compact optical envelope.

With a point source and sophisticated folded optics, Soraa creates very narrow beams in form factors as challenging as the compact MR16 and the low-profile AR111. Every one of them



Folded Prism Optics