



# PRODUCTIVITY+ PERFORMANCE

LNP™ KONDUIT™ COMPOUNDS

Product Environmental Summary



CHEMISTRY THAT MATTERS™

# LNP KONDUIT

## COMPOUNDS FOR LED HEAT SINKS PRODUCT ENVIRONMENTAL SUMMARY

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Making LED heat sinks using KONDUIT compounds can help manufacturers avoid time-consuming processes otherwise required when using die cast aluminum and can reduce associated costs as well as greenhouse gas (GHG) and energy footprints.

LEDs are energy efficient, breakage resistant, compact, and have a long life, making them a sustainable lighting solution. According to a US Department of Energy forecast, LEDs are expected to represent 74% of US general illumination lumen-hour sales by 2030, contributing to an annual primary energy savings of 3.4 quads in lighting.<sup>1</sup>

Cost of production is a key impediment to the growth of LEDs. Heat sinks – integral to the efficacy and longevity of an LED – constitute a significant portion of this cost.

SABIC's KONDUIT compounds are a cost-effective, resource efficient heat sink solution that can contribute to the scaling of LEDs.

### KEY BENEFITS\*

- No painting needed
- Electrical isolative, avoids extra housing
- 30% lighter than die cast aluminum
- Designed to use less material
- 69-87% lower energy and 67-87% lower GHG cradle to pre-use gate footprints
- Design collaboration with customers
- Cleaner chemistry compliance (RoHS, JIG, TCO, EU Ecolabel, Blue Angel, Nordic Swan, IEC 'halogen-free')

*\* see next page for full details*

### LEANER, LIGHTER, SAVES MATERIAL<sup>5, 6</sup>

Heat sinks made with KONDUIT compounds with an aluminum insert can be 30% lighter than heat sinks made out of die cast aluminum. KONDUIT compounds do not require extra housing otherwise needed for die cast aluminum parts. This can significantly free up internal space and may reduce material needs and total weight, contributing to processing and transportation cost reduction.

### NO PAINTING NEEDED

KONDUIT compounds come in multiple colors, which can eliminate the need for a separate painting process otherwise required for die cast aluminum.



### INCREASED RESOURCE EFFICIENCY<sup>4</sup>

Fabricating LED heat sinks with injection-molded KONDUIT compounds can result in a near-zero loss in plastic and aluminum compared to those fabricated with die cast aluminum, resulting in a more resource-efficient production.



**APPLICABILITY:** The following benefits are applicable to KONDUIT PX08321, PX08322, PX10323, PX11311, PX11313, OX10324, OX11314 and OX11315 compounds used in LED heatsinks.<sup>2</sup> Cases different from these may vary; please contact us to discuss your applications.

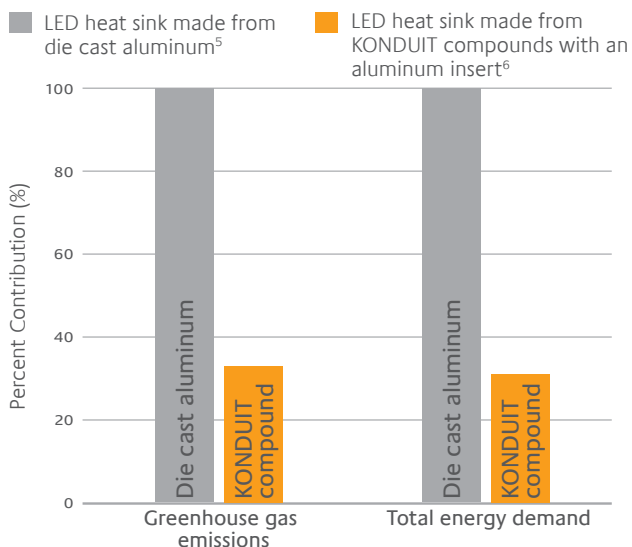
**LOWER GHG AND ENERGY FOOTPRINTS\*** <sup>3, 4, 5, 6</sup>

Manufacturing and fabricating an LED heat sink with injection-molded KONDUIT compound is less energy intensive than when using die cast aluminum. LED manufacturers can avoid material and processing costs and associated GHG and energy footprints.

- ≥4 W LED heat sinks made from KONDUIT compounds with an aluminum insert instead of die cast aluminum can typically avoid 69-77% of the energy consumed and 67-78% of the greenhouse gas emitted during the manufacturing and fabrication of an LED heat sink.
- <4 W LED heat sinks made with KONDUIT compounds instead of die cast aluminum can typically avoid 87% of the energy consumed and greenhouse gas emitted during the manufacturing and fabrication of an LED heat sink.

\* see reference four for full life cycle footprints comparisons

**FIGURE: CRADLE TO PRE-USE GATE GHG AND ENERGY FOOTPRINT COMPARISONS\*** <sup>3, 4</sup>



\* this example case reflects a comparison between KONDUIT OX10324 compound with an aluminum insert and die cast aluminum. Footprints will range across grades that have varying thermal conductivity designed to suit specific applications. Contact SABIC to discuss your needs.

**DESIGN COLLABORATION**

SABIC collaborates with our customers to unlock the design potential of our product for an application. We provide CAD modeling and processing expertise, and thermal and structural design support for LED housing.

**CLEANER CHEMISTRY<sup>7</sup>**

KONDUIT compounds are designed to comply with the RoHS Directive (2002/95/EC), the Joint Industry Guide (JIG), the IEC ‘halogen-free’ standard (IEC 61249-2-21), and ecolabels such as EU Ecolabel, TCO, Blue Angel, and Nordic Swan. Its formulation does not include any of the Substances of Very High Concern as specified under the REACH Regulation (EC 1907/2006) as verified on 10 January 2013.

**VERIFIED ENVIRONMENTAL PERFORMANCE**

SABIC partners with GreenOrder, a leading sustainability consulting firm, to provide third-party technical analysis and verification of Sustainability Solutions benefit claims.



**REFERENCES**

- 1) US Department of Energy. Energy Savings Potential of Solid-State Lighting in General Illumination Applications, January 2012. Prepared for Lighting Research and Development Building Technologies Program, Washington DC.
- 2) KONDUIT compounds offer thermal conductivity of up to 15 W/mK in combination with electrical isolation to pass industry electrical standard 6 KV breakdown tests.
- 3) The variations in greenhouse gas and energy footprints are due to differences in the composition of our 4 grades of KONDUIT compounds.
- 4) Scope of this LCA study includes material manufacturing, fabrication, and end of life with material recovery stages. The LCA study is performed based on ISO14040/44 framework. The functional units used in this study are: 1,000 heat sinks at 7 W and Tpeak temperature of 75C and lifetime of 25,000 hrs; 1,000 heat sinks at 2.5 W and Tpeak temperature of 70C and lifetime of 25,000 hrs.  
 ≥4 W LED heat sinks made with KONDUIT compound with an aluminum insert instead of die cast aluminum can typically avoid 49-67% of the energy consumed and 48-70% of the greenhouse gas emitted during the manufacturing, fabrication, and end of life phases of the heat sink.  
 <4 W LED heat sinks made with KONDUIT compounds instead of die cast aluminum can typically avoid 75% of the energy consumed and greenhouse gas emitted during the manufacturing, fabrication, and end of life phases of the heat sink.
- 5) Specifications of ≥4 W LED heat sinks made with aluminum: weight = 68.4 g, density = 2680 kg/m<sup>3</sup>.  
 Specifications of <4 W LED heat sinks made with aluminum: weight = 16.0 g, density = 2680 kg/m<sup>3</sup>.
- 6) Specifications of ≥4 W LED heat sinks made with KONDUIT compound with an aluminum insert: Aluminum insert weight = 12.4 g, density = 2680 kg/m<sup>3</sup>; KONDUIT compound weight = 34.1 g, density = 1630 kg/m<sup>3</sup>.  
 Specifications of <4 W LED heat sinks made with KONDUIT compound: weight = 9.72 g, density = 1630 kg/m<sup>3</sup>.
- 7) The Consumer Electronics Association Joint Industry Guide provides a list of substances and materials requiring declaration according to law or regulation. The International Electrochemical Commission's (IEC) definition of halogen-free, the Restriction of Hazardous Substances Directive (RoHS), the European Commission's EU Ecolabel, TCO Development's TCO Certification, the Jury Umweltzeichen's Blue Angel, and the Nordic Council of Ministers's Nordic Swan are internationally recognized environmental directives and certifications for hazardous materials.

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