TOLL（GaN）

1、封装特点

无引线设计：TOLL（Transistor Outline Leadless）封装采用无引线结构，通过底部金属片与电路板直接连接，减少了寄生电感和电容，有助于提高高频性能和开关速度。

底部散热：热量通过底部金属片传导至电路板，再通过电路板的散热结构（如散热器）散发。虽然散热路径相对较长，但能满足高功率应用的散热需求。

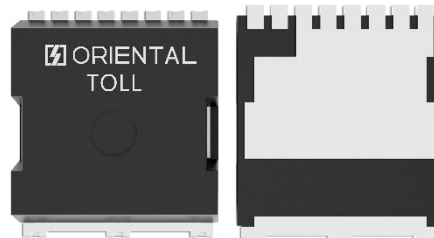
集成度高：部分 TOLL 封装的 GaN 器件集成了栅极驱动器、过流保护、过热保护等电路，减少了外部元件数量，简化了电路设计，提高了系统可靠性。

1. Package Features

Leadless Design: The TOLL (Transistor Outline Leadless) package adopts a leadless structure, connecting directly to the circuit board via the bottom metal tab. This design reduces parasitic inductance and capacitance, contributing to enhanced high-frequency performance and switching speed.

Bottom-side Heat Dissipation: Heat is conducted from the bottom metal tab to the circuit board, and then dissipated through the board’ s heat dissipation structures (e.g., heat sinks). Despite the relatively long heat dissipation path, it can meet the thermal requirements of high-power applications.

High Integration: Some GaN devices with TOLL packages integrate circuits such as gate drivers, overcurrent protection and overheat protection. This reduces the number of external components, simplifies circuit design and improves system reliability.



2、应用场景

数据中心电源：支持高频开关，可减小无源器件尺寸，提高电源转换效率和功率密度。

太阳能微型逆变器：适用于双向 DC/DC 转换和逆变器级，实现高效率、高功率密度的能源转换。

车载充电器（OBC）：满足电动汽车对高功率密度、高效率和小型化的需求，降低损耗，提高充电效率。

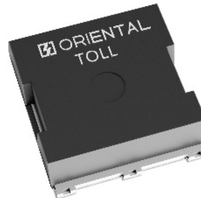
工业电源：如电机驱动、电源模块等，适用于需要高功率、高可靠性且空间受限的应用场景。

2. Application Scenarios

- **Data Center Power Supplies**: Supporting high-frequency switching, they can reduce

the size of passive components and improve power conversion efficiency and power density.

- **Solar Microinverters**: Suitable for bidirectional DC/DC conversion and inverter stages, enabling high-efficiency and high-power-density energy conversion.
- **On-Board Chargers (OBC)**: Meeting the requirements of electric vehicles for high power density, high efficiency and miniaturization, they reduce power losses and improve charging efficiency.
- **Industrial Power Supplies**: Such as motor drives and power modules, they are applicable to high-power, high-reliability and space-constrained application scenarios.



3、与 TOLT 封装的区别

散热方式：TOLL 封装采用底部散热，TOLT 封装采用顶部散热，TOLT 的散热路径更短，热阻更低，更适合对散热要求极高的应用。

占板面积：TOLL 封装因底部散热，驱动器无法布局在功率器件背面，占板面积相对较大；TOLT 封装可将驱动器布局在功率器件背面，减少布板面积，提高功率密度。

3. Differences from the TOLT Package

Heat Dissipation Method: The TOLL package adopts bottom-side heat dissipation, while the TOLT package features top-side heat dissipation. The TOLT package has a shorter heat dissipation path and lower thermal resistance, making it more suitable for applications with extremely high heat dissipation requirements.

PCB Footprint: Due to its bottom-side heat dissipation design, the TOLL package cannot have its driver placed on the back of the power device, resulting in a relatively large PCB footprint. In contrast, the TOLT package allows the driver to be arranged on the back of the power device, which reduces the PCB footprint and improves power density.

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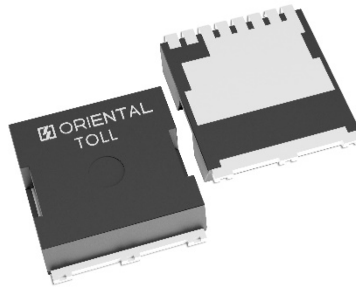

4、优势与挑战

优势：集成度高、寄生参数低、高频性能好，适用于高功率、高密度电源设计，可简化电路布局，提高系统效率和可靠性。

挑战：散热路径较长，对电路板的散热设计要求较高；封装尺寸相对较大，可能不适合对空间要求极高的小型化应用。

4. Advantages and Challenges

Advantages: It features high integration, low parasitic parameters and excellent high-frequency performance. Ideal for high-power and high-density power supply designs, it can simplify circuit layout and enhance system efficiency and reliability.

Challenges: The relatively long heat dissipation path imposes high requirements on the thermal design of the circuit board; the relatively large package size may render it unsuitable for miniaturized applications with extremely stringent space constraints.

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