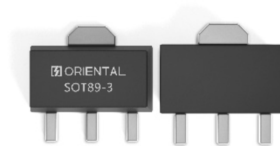
SOT89-3

SOT89 系列（包含 SOT89-3 和 SOT89-5）是表面贴装（SMT）封装家族中的“中功率担当”。它们最大的亮点在于**自带大面积散热焊盘**，在保持贴片小巧体积的同时，提供了远超普通小封装的散热能力。
The SOT89 series (including SOT89-3 and SOT89-5) are medium-power workhorses in the SMT package family. Featuring an integrated large thermal pad, they maintain a compact SMT footprint while delivering far superior heat dissipation compared with conventional small packages.



封装介绍与结构特点
Package Introduction & Structural Features

- 物理尺寸与外观：
  Physical Dimensions & Appearance
  - SOT89 的典型封装体尺寸约为 4.5mm × 2.5mm，高度通常在 1.5mm - 1.6mm 左右。相比常见的 SOT23，它的轮廓更加宽大、厚实。
    SOT89 typical body size is approximately 4.5mm × 2.5mm, with a height of 1.5mm to 1.6mm. Compared with common SOT23 packages, it has a wider and thicker outline.
  - 引脚间距（Pitch）较大，通常为 1.5mm。无论是 3 脚还是 5 脚版本，这种宽间距都极大地降低了 PCB 布局布线和手工焊接的难度。
    The pin pitch is relatively large at 1.5 mm. For both 3-pin and 5-pin variants, the wide pitch greatly eases PCB routing and manual soldering.
- 核心结构特点（自带散热片）：
  Core Structural Features (Integrated Thermal Pad)
  - SOT89 最显著的特征是其底部带有一个大面积的金属散热焊盘（Exposed Copper Pad / Tab）。
    The most distinctive feature of SOT89 is the large exposed copper thermal pad (tab) on its bottom side.
  - 这个金属散热片通常与芯片的特定引脚（如 GND、Vout 或 Vin）在内部电气连通。在实际应用中，它必须通过 PCB 上的大面积铺铜和散热过孔阵列，将热量高效地传导出去。
    This metal thermal pad is internally electrically connected to specific pins of the chip, such as GND, Vout or Vin. In practical applications, it shall dissipate heat efficiently via large copper areas and thermal via arrays on the PCB.

在 LDO / OPA / DC-DC 产品中的封装优势

Package Advantages for LDO, OPA and DC-DC Products

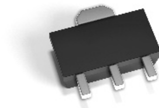
对于电源管理芯片（如 LDO、DC-DC）和模拟信号链芯片（如 OPA）来说，SOT89 的核心价值就是**"以小博大"**——在较小的贴片尺寸下，实现了接近直插式 TO-92 甚至更高的散热性能。

For power management ICs (LDO, DC-DC) and analog signal chain ICs (OPA), the core value of SOT89 lies in high performance in a compact form factor. It delivers heat dissipation performance comparable to or even better than through-hole TO-92 packages while retaining a small SMT footprint.

1. 卓越的散热能力（低热阻）:
   Excellent heat dissipation (low thermal resistance):
   - 得益于底部的金属散热片，SOT89 的热阻（RθJA）极低。例如在优化 PCB 散热设计后，其热阻可低至 30°C/W 左右，能够轻松应对 0.5W 到 1W 左右的持续功耗。这意味着在同样的功耗下，采用 SOT89 封装的芯片温升更低，能够稳定输出更大的电流（例如常见的 AMS1117、78Lxx 等 LDO 在此封装下可轻松提供 0.5A - 1A 的持续电流）。
     Thanks to the bottom metal thermal pad, SOT89 features an extremely low junction-to-ambient thermal resistance (RθJA). With optimized PCB thermal design, its RθJA can drop to approximately 30°C/W, easily handling continuous power dissipation ranging from 0.5W to 1W. This means chips in SOT89 packages generate less temperature rise under the same power consumption and can deliver larger output current stably. For instance, mainstream LDOs such as AMS1117 and 78Lxx can provide a continuous current of 0.5A to 1A when housed in this package.
2. 功能的灵活扩展（SOT89-5 的独特优势）:
   Flexible Function Expansion (Unique Advantages of SOT89-5):
   - SOT89-3：通常只能满足 Vin（输入）、Vout（输出）、GND（地）的基础连接，适合纯粹的线性稳压或简单的信号放大。
     SOT89-3 generally only supports basic connections of Vin, Vout and GND, suitable for simple linear regulation and basic signal amplification.
   - SOT89-5：多出来的两个引脚让芯片具备了复杂逻辑控制的能力。例如在 DC-DC 恒流驱动器（如 SL6015B、OC5265B）中，5 个引脚分别对应 Vin、SW（开关节点）、GND、DIM（调光/使能）、CS（电流采样），一颗小小的芯片就能独立构建一个完整的、支持 PWM 调光的降压电路。
     SOT89-5 comes with two extra pins, enabling the chip to support complex logic

control. For DC-DC constant current drivers such as SL6015B and OC5265B, the five pins correspond to Vin, SW, GND, DIM and CS respectively. A single chip can form a complete step-down circuit with PWM dimming function.

3. 高可靠性与工作温度范围：
   High Reliability & Wide Operating Temperature Range:
   - 优秀的散热性能直接提升了系统的可靠性。许多采用 SOT89 封装的器件，其最高工作结温可达 150°C，非常适合在高温环境下长期稳定运行。
     Superior heat dissipation directly boosts system reliability. Most devices packaged in SOT89 feature a maximum junction temperature of up to 150°C, enabling long-term stable operation in high-temperature environments.



主要应用领域

Main Application Fields

凭借其出色的散热和适中的体积，SOT89-3/5 广泛应用于需要一定功率输出的场景：

With excellent heat dissipation and moderate size, SOT89-3/5 packages are widely used in scenarios requiring moderate power output:

- LED 照明驱动：这是 SOT89-5 的核心战场。广泛用于 LED 射灯、汽车内饰氛围灯、仪表盘背光及景观亮化等，支持高精度的 PWM 无频闪调光。
  LED Lighting Drivers: This is the prime application for SOT89-5. It is widely adopted in LED spotlights, automotive interior ambient lights, dashboard backlights and landscape lighting, supporting high-precision flicker-free PWM dimming.
- 电源管理与稳压电路：各类中功率 LDO（如 78Lxx 系列、AMS1117）、可编程输出的稳压器，以及便携式设备的电池供电模块。
  Power Management & Voltage Regulation Circuits: Various medium-power LDOs (e.g., 78Lxx series, AMS1117), programmable voltage regulators and battery power modules for portable devices.
- 工业控制与安防设备：自动化控制面板指示灯驱动、仪器仪表背光、传感器供电及局部电源管理。
  Industrial Control & Security Equipment: Indicator drivers for automation control panels, instrument backlights, sensor power supply and local power management.
- 通信与射频领域：用于蓝牙 PA（功率放大器）驱动、UHF 和微波放大器等，利用其良好的高频特性和散热表现。
  Communications & RF Applications: Used for Bluetooth power amplifier drivers, UHF and microwave amplifiers, leveraging its good high-frequency performance and thermal dissipation capability.

- 中大功率分立器件：除了 LDO/OPA，它也常被用于封装中功率的三极管和 MOSFET（N 沟道/P 沟道）。
  Medium & High Power Discrete Devices: Besides LDOs and OPAs, this package is also commonly used for medium-power bipolar transistors and N-channel/P-channel MOSFETs.

优劣势分析总结

维度	优势（Pros）	劣势（Cons）
散热与功率	自带大面积散热焊盘，热阻极低，能承受 0.5W - 1W 以上的功耗，适合内置 MOS 的中功率 IC。	相比 DFN/QFN 等先进无引脚封装，其寄生电感略大，不适合极高频率（如 >2MHz）的超高速开关应用。
PCB 设计与生产	引脚间距大（1.5mm），焊盘设计简单，不易连锡，手工焊接和返修极其方便。	占用 PCB 面积比 SOT23/SOT223 等封装更大，不适合极度追求轻薄短小的微型便携设备。
功能与兼容性	SOT89-5 提供了丰富的控制接口（如调光、使能、反馈），工艺成熟，物料成本低，供应链完善。	必须依赖 PCB 背面的大面积铺铜来辅助散热，若 PCB 散热设计不良，其功率承载能力会大打折扣。

Summary of Advantages and Disadvantages

Dimension	Pros	Cons
Thermal Dissipation & Power Rating	Comes with a large exposed thermal pad for extremely low thermal resistance. It can withstand power dissipation above 0.5W–1W, ideal for medium-power ICs with integrated MOSFETs.	Compared with advanced leadless packages like DFN/QFN, it has slightly higher parasitic inductance, making it unsuitable for ultra-high-speed switching applications above 2MHz.
PCB Design & Manufacturing	It features a large pin pitch of 1.5mm with simple pad layout. Solder bridging rarely occurs, making manual soldering and rework highly convenient.	It occupies more PCB space than SOT23/SOT223 packages, so it is not suitable for ultra-compact portable devices pursuing minimal size.
Function & Compatibility	SOT89-5 provides abundant control interfaces such as dimming, enable and feedback. It features mature manufacturing process, low material cost and a complete supply chain.	It relies on large copper areas on the reverse side of PCB for auxiliary heat dissipation. Poor PCB thermal design will significantly reduce its power handling capability.