

SOT223

SOT223 封装 (Small Outline Transistor 223) 是表面贴装技术 (SMT) 领域中, 专为**中功率应用**设计的经典封装形式。它在体积与散热能力之间取得了极佳的平衡, 因此在电源管理芯片和功率器件中被大规模采用。

The SOT223 package (Small Outline Transistor 223) is a classic package designed for medium-power applications in the field of Surface Mount Technology (SMT). It achieves an optimal balance between size and heat dissipation performance, so it is widely adopted in power management ICs and power devices.



封装介绍与结构特点

Package Introduction and Structural Features

- 物理尺寸与外观:

Physical Dimensions and Appearance

- SOT223 是一种四引脚 (4-pin) 的单列直插式布局封装, 但其内部实际上是三端器件。其典型外形尺寸约为长 6.5mm × 宽 3.5mm, 厚度通常在 1.6mm - 1.8mm 左右。
The SOT223 is a 4-pin single in-line package, while internally it functions as a three-terminal device. Its typical dimensions are approximately 6.5 mm in length and 3.5 mm in width, with a standard thickness ranging from 1.6 mm to 1.8 mm.
- 它的引脚间距较大 (通常为 2.3mm), 整体轮廓比常见的 SOT23 更加宽大、厚实, 但比 TO-252 等传统功率封装更为紧凑。

It features a relatively large pin pitch of typically 2.3 mm. The package is wider and thicker than the common SOT-23, yet more compact than traditional power packages such as TO-252.

- 核心结构特点 (自带大面积散热焊盘):

Core Structural Features (Integrated Large Thermal Pad)

- SOT223 最显著的特征是其拥有一个大面积的金属散热焊盘 (Exposed Tab / Pin 4)。这个焊盘通常不传输信号, 而是直接连接内部芯片的背面, 起到关键的电气接地与热传导双重作用。
The most prominent feature of the SOT223 package is its large exposed metal thermal pad (Exposed Tab / Pin 4). This pad generally carries no signals and is directly bonded to the backside of the internal die, serving dual critical functions for electrical grounding and heat conduction.
- 在实际 PCB 设计中, 这个散热焊盘必须通过多个散热过孔 (Thermal Vias) 连接至内

层或底层的大面积铜箔 (如 GND 铺铜), 以显著降低结到环境的热阻 (θ_{JA}), 从而提升芯片的负载能力和长期可靠性。

In practical PCB design, this thermal pad must be connected to large copper areas (e.g., GND copper plane) on inner or bottom layers via multiple thermal vias. This effectively reduces the junction-to-ambient thermal resistance (θ_{JA}), and improves the load capacity and long-term reliability of the chip.



在 LDO / MOSFET 产品中的封装优势

Package Advantages for LDO and MOSFET Products

对于低压差线性稳压器 (LDO) 和功率晶体管 (如 MOSFET) 来说, SOT223 的核心价值在于“**中等功耗下的最佳性价比**”。

For low-dropout regulators (LDOs) and power transistors such as MOSFETs, the core value of the SOT223 package lies in delivering the best cost-performance ratio for medium power dissipation.

1. 优异的散热能力 (低热阻):

Excellent Heat Dissipation (Low Thermal Resistance):

- 得益于底部的大面积散热焊盘, SOT223 的热阻表现非常出色。在优化 PCB 散热设计的情况下, 其结到环境热阻 (θ_{JA}) 可低至 $40^{\circ}\text{C}/\text{W}$ - $90^{\circ}\text{C}/\text{W}$, 能够轻松应对 0.5W 到 1.5W 左右的持续功耗。这意味着它可以在较小的贴片体积下, 稳定输出 1A 甚至更高的电流 (例如经典的 1117-3.3V 稳压芯片)。

Thanks to the large exposed thermal pad on the bottom, SOT223 features outstanding thermal resistance. With optimized PCB thermal design, its junction-to-ambient thermal resistance (θ_{JA}) ranges from $40^{\circ}\text{C}/\text{W}$ to $90^{\circ}\text{C}/\text{W}$, supporting continuous power dissipation of approximately 0.5W to 1.5W. It can stably output current of 1A or even higher in a compact SMT form factor, as exemplified by the classic 1117-3.3V voltage regulator.

2. 极高的集成度与空间节省:

High Integration and Space Saving:

- 相比传统的直插式 TO-92 或较大的 TO-252 封装, SOT223 大幅缩减了占板面积 (例如相比 TO-252 面积可减少约 30%), 非常有助于实现电子设备的小型化和薄型化。同时, 其适中的体积也避免了像 DFN/QFN 等微型封装那样对 PCB 工艺提出极高要求。Compared with traditional through-hole TO-92 and larger TO-252 packages, the SOT223 greatly reduces board footprint (around 30% smaller than TO-252). It effectively enables miniaturization and thinning of electronic devices. Meanwhile, its moderate size avoids the extremely stringent PCB process requirements

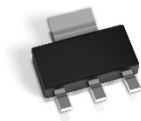
imposed by ultra-compact packages such as DFN and QFN.

3. 成熟的供应链与低成本:

Mature Supply Chain and Low Cost:

- SOT223 工艺极其成熟，物料成本低廉，且各大半导体厂商均有海量现货供应，兼容性极强，非常适合大规模量产。

The SOT223 features highly mature manufacturing processes and low material costs. It is abundantly stocked by major semiconductor manufacturers with excellent compatibility, making it ideal for high-volume mass production.



主要应用领域

Main Application Fields

凭借其出色的散热和适中的体积，SOT223 广泛应用于需要一定功率输出的场景：

Thanks to its excellent heat dissipation and moderate size, the SOT223 is widely used in applications requiring a certain level of power output.

- 电源管理与稳压电路：这是 SOT223 最核心的应用战场。广泛用于各类中功率 LDO (如 1117、317 等)、DC-DC 转换器的功率级，为 FPGA、MCU、Wi-Fi 模组等核心电路提供稳定的 3.3V 或其他电压供电。

Power Management and Voltage Regulation Circuits: This is the primary application area for the SOT223 package. It is extensively used for medium-power LDOs (such as 1117, 317, etc.) and the power stages of DC-DC converters, delivering stable 3.3V and other supply voltages for core circuits including FPGAs, MCUs and Wi-Fi modules.

- 工业控制与安防设备：用于工控系统中的电源优化、自动化控制面板指示灯驱动、传感器供电及局部电源管理。

Industrial Control and Security Equipment: It is applied to power optimization in industrial control systems, indicator light driving on automation control panels, power supply for sensors and local power management.

- 消费电子与小家电：如照明电源、空调、冰箱、微波炉等家电的控制板供电模块。

Consumer Electronics and Small Home Appliances: Used in power supply modules on control boards of lighting power supplies, air conditioners, refrigerators, microwave ovens and other household appliances.

- 通信与网络设备：路由器、交换机等设备中的局部电源管理和信号放大。

Communication and Network Equipment: Applied to local power management and signal amplification in routers, switches and other devices.

- 中大功率分立器件：除了 LDO，它也常被用于封装中功率的 MOSFET (如 ROHM 的 600V 耐

压 Super Junction MOSFET) 和三极管。

Medium & High Power Discrete Devices: Besides LDOs, this package is also commonly used for medium-power MOSFETs (e.g., ROHM 600V Super Junction MOSFETs) and bipolar transistors.



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 - 1.5W 的功耗，适合中功率 IC。	相比 D-PAK 等更大封装，其极限散热能力仍有差距；若 PCB 散热设计不良，极易导致过热失效。
PCB 设计与生产	引脚间距适中，焊盘设计相对简单，不易连锡，手工焊接和返修比较方便。	必须依赖 PCB 背面的大面积铺铜和过孔来辅助散热，对双层板或散热设计不良的 PCB 效果大打折扣。
功能与兼容性	完美适配带使能/反馈功能的 LDO 和中功率 MOSFET，工艺成熟，物料成本低，供应链完善。	占用 PCB 面积比 SOT23/SOT89 等封装更大，不适合极度追求轻薄短小的微型便携设备。

Summary of Advantages and Disadvantages

Dimensions	Pros	Cons
Thermal Performance & Power Rating	It comes with a large integrated thermal pad and features ultra-low thermal resistance. It can withstand power dissipation from 0.5W to 1.5W, making it ideal for medium-power ICs.	It lags behind larger packages such as D-PAK in maximum heat dissipation. Poor PCB thermal design may easily lead to overheating and device failure.
PCB Design & Manufacturing	The moderate lead pitch and simple pad design effectively prevent solder bridging, facilitating manual soldering and rework.	It relies heavily on large copper areas and vias on the PCB bottom for heat dissipation. Its performance drops significantly on double-layer PCBs or boards with poor thermal design.
Functions & Compatibility	It is perfectly compatible with LDOs featuring enable/feedback functions and medium-power MOSFETs. With mature processes, low material costs and a complete supply chain.	It occupies more PCB space than packages like SOT23 and SOT89, so it is not suitable for ultra-compact portable devices that prioritize miniaturization.