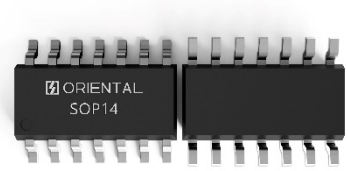
SOP14

SOP14（通常也称为 SOIC-14 或 SOP-14）是表面贴装技术（SMT）中非常经典且普及度极高的封装形式。它最大的特点是在一个紧凑的矩形外壳两侧，对称排列出多达 14 个引脚，完美解决了多通道模拟芯片的集成与布线需求。

SOP14 (also commonly referred to as SOIC-14) is a classic and widely adopted package for surface mount technology (SMT). It features 14 pins symmetrically arranged on both sides of a compact rectangular body, which perfectly accommodates the integration and PCB routing requirements of multi-channel analog chips.



封装介绍与结构特点

Package Introduction & Structural Features

- 物理尺寸与外观：

  Physical Dimensions & Appearance

  - SOP14 是一种双列直插的表面贴装封装，拥有 14 个引脚，呈“鸥翼”（Gull Wing）状分布在芯片主体的两侧。

    SOP14 is a dual in-line surface-mount package with 14 gull-wing pins arranged on both sides of the component body.
  - 它的尺寸有宽体和窄体之分，最常见的标准窄体尺寸约为 长 8.65mm × 宽 3.9mm，高度通常在 1.5mm - 1.75mm 左右。标准的引脚间距（Pitch）通常为 1.27mm。这种适中的体积和宽裕的引脚间距，使其在 PCB 布局时既节省空间，又便于手工焊接和返修。

    It comes in wide-body and narrow-body versions. The most common standard narrow-body measures approximately 8.65 mm in length and 3.9 mm in width, with a height ranging from 1.5 mm to 1.75 mm. Its standard pin pitch is 1.27 mm. Thanks to its moderate size and generous pin pitch, it saves PCB layout space and facilitates manual soldering and rework.
- 核心结构特点：

  Core Structural Features

  - SOP14 的核心在于其高密度的引脚排布。相比于常见的 SOP8，它多出的引脚数量使得单颗芯片能够容纳更复杂的内部电路（如四个独立的运算放大器），极大地提升了单板的功能密度。

    The core advantage of SOP14 lies in its high-density pin arrangement. Compared with the common SOP8 package, the extra pins allow a single chip to integrate

more complex internal circuits, such as four independent operational amplifiers, which greatly increases the functional density of the PCB.

在 LDO / OPA 产品中的封装优势

Package Advantages for LDO & OPA Products

对于电源管理芯片（LDO）和模拟信号链芯片（OPA）来说，SOP14 的核心价值在于**“高通道集成度”**。

For power management ICs (LDO) and analog signal chain ICs (OPA), the core value of the SOP14 package lies in its high channel integration.

1. 极致的多通道集成（四合一的完美载体）：

   Ultimate multi-channel integration (an ideal package for quad-channel integration)

   - 在运算放大器（OPA）领域，SOP14 是最经典的四通道运放封装（例如行业内耳熟能详的 LM324、LM358 的四路版本等）。一颗 SOP14 封装的芯片内部集成了 4 个独立的运放单元，共享正负电源引脚（通常第 4 脚为 VCC+，第 11 脚为 GND/VCC-），其余 12 个引脚刚好分配给 4 组输入输出。这极大减少了 PCB 上的元件数量和走线复杂度。

     In the field of operational amplifiers (OPA), SOP14 is a classic package for quad-channel op-amps, such as the quad versions of widely recognized LM324 and LM358. A single SOP14 device integrates four independent op-amp units, which share the positive and negative power pins (Pin 4 for VCC+ and Pin 11 for GND/VCC- in general). The remaining 12 pins are allocated to four sets of input and output terminals. This greatly reduces component count and routing complexity on the PCB.

   - 在 LDO 领域，虽然不如 OPA 普遍，但 SOP14 同样可用于封装多路输出的稳压芯片，或者带有复杂使能、反馈、状态指示等多引脚控制功能的高性能 LDO。

     While less commonly used for LDOs than for OPAs, the SOP14 package is also applicable to multi-output voltage regulators and high-performance LDOs equipped with multiple control pins for enable, feedback, status indication and other complex functions.

2. 优异的散热与功耗表现：

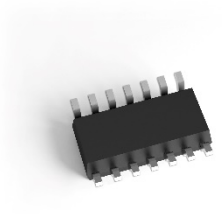
   Excellent Heat Dissipation and Power Consumption Performance

   - 虽然 SOP14 不像 SOT89 那样自带底部大散热焊盘，但其两侧密集的引脚本身就可以作为良好的散热通道。当芯片内部有多个通道同时工作时，热量可以通过 14 个引脚均匀地传导至 PCB 铜箔上散发，足以应对大多数中低功耗模拟电路的需求。

     Unlike the SOT89 package which features a large exposed thermal pad on the

bottom, SOP14 utilizes its densely arranged side pins as effective heat dissipation paths. When multiple internal channels operate simultaneously, heat is evenly conducted through the 14 pins to the PCB copper cladding and dissipated. It fully meets the requirements of most low-to-medium power analog circuits.

3. 成熟的供应链与低成本：
   Mature Supply Chain & Cost Advantage
   - SOP14 工艺极其成熟，物料成本低廉，且各大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 SOP14 package adopts highly mature manufacturing processes with low material costs. Major manufacturers maintain ample stock and it boasts excellent compatibility, making it ideal for mass production.



主要应用领域

Main Application Fields

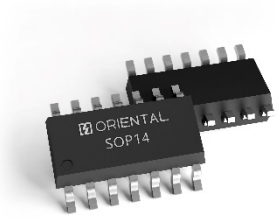
凭借其出色的多通道集成能力，SOP14 广泛应用于需要处理多个模拟信号的领域：

Thanks to its outstanding multi-channel integration capability, the SOP14 package is widely used in scenarios requiring multi-analog signal processing:

- 工业控制与自动化：广泛用于传感器信号调理（温度、压力、光敏等多路采集）、PLC 模块接口电路以及电机驱动器的信号放大。
  Industrial Control & Automation: Widely used for sensor signal conditioning (multi-channel acquisition of temperature, pressure, photosensitive signals, etc.), PLC module interface circuits and signal amplification for motor drivers.
- 消费电子与小家电：如微波炉、洗衣机、空调的控制板，以及音频前置放大、充电器电压电流检测等，一颗 SOP14 即可搞定整机的大部分模拟信号处理。
  Consumer Electronics & Small Household Appliances: Applied to control boards of microwave ovens, washing machines and air conditioners, as well as audio pre-amplification, voltage and current detection for chargers. A single SOP14 package can handle most analog signal processing tasks of the whole device.
- 汽车电子：用于车身控制模块（BCM）、车灯控制电路、电池管理系统（BMS）中的多路电压/电流采样（需选用符合 AEC-Q100 车规级的型号）。
  Automotive Electronics: Used in body control modules (BCM), lamp control circuits and multi-channel voltage/current sampling of battery management systems (BMS). AEC-Q100 qualified devices are required for automotive applications.
- 通信与医疗设备：在通信设备的模拟前端、医疗检测仪器的多路生物信号采集中，SOP14 也是主

流选择。

Communications & Medical Equipment: The SOP14 package is a mainstream choice for analog front-ends of communication devices and multi-channel biological signal acquisition in medical testing instruments.



优劣势分析总结

维度	优势（Pros）	劣势（Cons）
集成度与功能	完美适配四通道 OPA/LDO，单芯片实现复杂功能，大幅减少外围元件和 PCB 面积。	相比 SSOP/TSSOP 等更先进的缩小型封装，SOP14 的物理占用面积相对较大。
PCB 设计与生产	1.27mm 的标准引脚间距，焊盘设计简单，不易连锡，手工焊接和调试极其方便。	不适合极度追求轻薄短小的微型便携设备（如 TWS 耳机、超薄手环）。
散热与功率	依靠 14 个引脚协同散热，能满足常规多通道模拟芯片的中低功耗需求。	自身热阻相对较高，不适合大电流或高压差的功率型应用（此类场景更适合带散热焊盘的封装）。

Summary of Advantages and Disadvantages

Dimensions	Pros	Cons
Integration & Functionality	Perfectly suited for quad-channel OPA/LDO. A single chip delivers complex functions, greatly reducing peripheral components and PCB footprint.	Compared with compact packages such as SSOP and TSSOP, the SOP14 has a relatively larger footprint.
PCB Design and Production	With a standard pin pitch of 1.27mm, it features simple pad design and low bridging risk, enabling easy manual soldering and debugging.	It is not suitable for ultra-compact portable devices such as TWS earbuds and slim smart bands.
Thermal Performance & Power Rating	Heat is dissipated collectively via 14 pins, meeting the low-to-medium power requirements of conventional multi-channel analog chips.	It has relatively high thermal resistance and is not applicable to high-current or high-voltage-drop power applications. Packages with exposed thermal pads are preferred for such scenarios.