



# **SNS COLLEGE OF TECHNOLOGY**

**(An Autonomous Institution)**



**19EET202 / ANALOG ELECTRONICS**

**II YEAR / III SEMESTER**

**UNIT-3: IC FABRICATION AND OPTO ELECTRONIC DEVICES**

10/21/2023

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**IC PACKAGING**



# What We'll Discuss



## TOPIC OUTLINE

Introduction  
IC Package Types  
Working  
Applications

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# Introduction



The final step in creating a semiconductor device is integrated circuit packaging, which involves encasing the semiconductor material block (on which a given functional circuit is fabricated) in a protective case to protect it from physical harm and corrosion.

There are many types of IC packages, each having unique dimensions, mounting styles, and pin counts..



## IC Package Types

- Dual In-Line Package (DIP)
- Small Outline Package (SOP)
- Thin Small Outline Package (TSOP)
- Quad Flat Package (QFP)
- Quad Flat Package-Extended (QFP-EP)
- Quad Flat No-leads (QFN)
- Ball Grid Array (BGA)
- Micro Ball Grid Array ( $\mu$ BGA)
- Ceramic Ball Grid Array (CBGA)
- Plastic Ball Grid Array (PBGA)
- Fine-Pitch Ball Grid Array (FBGA)
- Chip Scale Package (CSP)
- Dual Flat No-leads (DFN)
- Plastic Leaded Chip Carrier (PLCC)
- Small Outline Transistor (SOT)
- Small Outline Diode (SOD)
- Small Outline J-Lead (SOJ)
- Dual In-line Memory Module (DIMM)
- Single In-line Memory Module (SIMM)
- Quad Flat Package No-lead (QFN-ML)
- Ultra-Thin Quad Flat No-lead (UQFN)
- SOT-23
- SOT-223
- SOT-323
- SOT-363
- SOT-523



# IC Package Types





## Dual-in-line Package (DIP)

- It is the most common through-hole IC package used in circuits, especially hobby projects. This IC has two parallel rows of pins extending perpendicularly out of a rectangular plastic housing.
- The overall dimensions of a DIP package depend on its pin count. The most common pin counts are four, six, eight, fourteen, eighteen, twenty, twenty-eight, and forty pins. The pins on a DIP IC are spaced 2.54mm apart, which is a standard spacing, perfect for fitting into breadboards, veroboards, and other prototyping boards.
- A DIP IC can also be easily soldered on [PCBs](#). Sometimes, an IC socket is used instead of soldering an IC directly to the PCB. Using the socket allows for the DIP IC to be removed from and inserted into the PCB easily.





# Surface-mount Device (SMD)

- There are a variety of surface-mount packages including SOP, small-outline transistor (SOT), and QFP available in the market.
- SMD IC packages usually need custom PCBs, containing a matching pattern of copper on which they are to be soldered. Usually, special automated tools are used to solder these on PCBs.





# Small-outline IC (SOIC)

SOIC package is shorter and narrower than DIP. It is an SMD with all DIP pins bent outwards and shrunk down to size. Each pin is usually spaced about 1.27mm from the next.







## Small-outline Package (SOP)



- This is an even smaller version of the SOIC package. Similar to SOIC, the SOP family has a smaller form factor, with pin spacing of less than 1.27mm. Each SOP includes a plastic small-outline package (PSOP), thin small-outline package (TSOP), and thin-shrink small-outline package (TSSOP).



## Quad-flat Package (QFP)

- Unlike DIP having two sides, QFP IC has pins on all four sides. A QFP IC can have pins anywhere from eight per side (32 total) to upwards of seventy (300+). Pins on a QFP IC are usually spaced anywhere from 0.4mm to 1mm apart.
- Smaller variants of the standard QFP package include thin QFP (TQFP), very-thin QFP (VQFP), and low-profile QFP (LQFP) packages.



## Quad-flat no-leads (QFN)

- There is another QFP IC type, but with a different pin structure, called the QFN package. Pins on a QFN package are exposed on the bottom and sometimes on both sides and the bottom.



## Small-outline Transistor (SOT) Ball-grid Array (BGA)



- SMD devices such as rectangular transistors are available in SOT packages.

Advanced ICs are available in BGA packages. These amazingly intricate packages have small balls of solder arranged in a 2D grid on the bottom. Usually, putting these packages onto a PCB requires an automated procedure involving pick-and-place machines and reflow ovens. BGA packages are found on [pcDuino](#) and [Raspberry Pi](#) boards.

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