Overview

With the ever-increasing levels of integration, packing more circuitry into ever smaller packages, electronic systems now rely on semiconductor devices. Anything from a few circuit components (transistors, resistors, and capacitors) to complete computer systems can be placed on a single silicon die.

An integrated circuit is a package containing a single silicon (silicon germanium for RF circuits, or gallium arsenide for microwave frequency circuits) that forms either part of a larger electronic circuit or system or is a complete electronic system in its own right. When the IC forms a complete electronic system, it is commonly referred to as a system on a chip (SoC). Modern communications ICs are SoC designs.

An extension to the IC is the multichip module (MCM), which contains multiple dies; for example, when sensors and circuits are to be housed in a single package but which cannot be fabricated on a single die. Originally referred to as a hybrid circuit, the MCM consists of two or more ICs and passive components on a common circuit base that are interconnected by conductors fabricated within that base. The MCM helps with size reduction problem and helps alleviate signal degradation.

An extension to the MCM is the system in a package (SiP), on which devices are stacked vertically. Wire bonding to the substrate is common.

An extension to the SiP is the package on a package (PoP).
IC Package Types

The package that the IC uses is either a through-hole package or a surface mount package, made of either plastic or ceramic. Plastic packages are cheaper to manufacture, but ceramic packages have superior heat dissipation and environmental protection (from moisture creeping into the package). The following list identifies the more commonly used package types among the many that are available.

Through-Hole Device Package Types

CERQUAD, ceramic quadruple side
DIMM, dual in-line memory module
DIL or DIP, dual in-line package:
   CERDIP, ceramic DIP
   HDIP, hermetic DIP
   PDIL or PDIP, plastic DIP
SIP, single in-line package
ZIP, zig-zag in-line package
PGA, pin grid array:
   CPGA, ceramic PGA
   PPGA, plastic PGA
   SPGA, staggered PGA
TO, transistor outline package (single transistor)

Surface Mount Device Package Types

BGA, ball grid array:
   CBGA, ceramic BGA
   FBGA or FPBGA, fine pitch BGA
   PBGA, plastic BGA
   μBGA, micro-BGA
CGA, column grid array
LCC, leadless chip carrier*:
   CLCC, ceramic LCC
   PLCC, plastic LCC
LCC, leaded chip carrier*:
   JLCC, J-LCC
   CLCC, ceramic LCC
   PLCC, plastic LCC
QFP, quad flat pack:
   CQFP, ceramic QFP
   PQFP, plastic QFP
   QFJ, QFP (with J-lead)
   SQFP, small QFP
   TQFP, thin QFP
   VQFP, very thin QFP
SOIC, small outline integrated circuit:
   CSOIC, ceramic SOIC
SOP, small outline package:
   MSOP, mini-SOP
   PSOP, plastic SOP
   QSOP, quarter-sized SOP
   SOJ, small outline (package, with J-lead)
   SSOP, shrink SOP
   TSOP, thin SOP
   TSSOP, thin shrink SOP
   TVSOP, thin very SOP

* The leaded and leadless chip carriers are identified by the same abbreviation (LCC) and can be easily confused.

Packaging Standards

Packages are defined by the following standards:

Military Standards

- MIL-STD-1835 D, Electronic Component Case Outlines
- MIL-HDBK-6100, Case Details for Discrete Semiconductor Devices
- MIL-STD-2073-1D, Packaging of Microcircuits (Military Packaging)
Appendix C

- MIL-STD-1285D, Marking of Electrical and Electronic Parts
- MIL-M-38510, General Specification for Microcircuits
- MIL-STD-883, Test Methods and Procedures for Microelectronics
- MIL-STD-750, Test Methods for Semiconductor Devices

EIAJ Standards

- ED-7311, Standards for integrated circuits package