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## **Around 1965**

### **Development of resin-mold packages**

~ Packaging ~

The studies of plastic mold of transistors had been carried out early on after the invention of transistor. But since it was known that the performance of plastic molded transistors deteriorated during its operation by the influence of moisture, metal sealed TO type packages were used for the transistors before around 1965.

A silicon planar transistor was developed by Fairchild, in which the surface of the die was covered with a physiochemically stable silicon dioxide film. Engineers at Hitachi thought that it might be possible to use epoxy resin materials which were thermally stable and showed high adhesion characteristics for the planar transistors, and they started the technology development for its practical application from 1963.

Various molding methods including cast molding, transfer molding, epoxy pellet molding, dipping method were studied, and the transfer molding method was finally selected because of its stability in the mass production and its dimensional stability.

Along with the adoption of transfer molding, multiple-chip type lead frame was developed for which a metal thin plate was punched out in a comb-like shape by pressing, eliminating the holding jig for lead pins. In the preceding cast mold method, thin cylindrical rod-shaped lead pins were flattened at their tips by a metal mold, fixed with jigs, and die bonding and wire bonding of the chip were done at the flattened lead pin tips. The assembled element was then dipped in mold resin in a jig filled with the resin.

The idea of the multiple-chip type lead frame (multiple transistor devices are formed on one lead frame) was filed as the patent of "Semiconductor Manufacturing Method" in January 1964, divisional application in 1966, and publicly announced and registered in 1979, as Patent 1067103.

