

## 1954

### Release in Japan of the first commercial germanium transistors

#### ~ Discrete Semiconductor/Others ~

The point contact type transistor was invented by Bardeen and Brattain in 1947, but it was not practical, and it was a junction transistor invented by Shockley in 1951 that was actually commercialized.

Kobe Industry introduced the technology of p-n-p transistor developed by GE in 1951, in which Indium (In) dots were attached to both sides of a thin n-type Ge in alloy-reaction, and it started to produce alloy transistors in January 1954. Although it announced the first transistor radio in Japan in the same month, it did not go as far as commercialization.

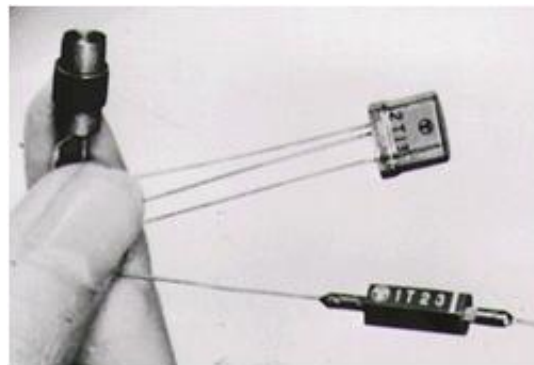
In 1953, Sony received a license from Western Electric which owned a transistor patent and began developing junction-type germanium transistors. It started the production in 1954. Following this, other semiconductor manufacturers in Japan also started the development and production of germanium transistors, receiving the technologies from RAC and others. The initial transistors had poor high frequency characteristics, and even though they could be used for the amplification of audio signal in radios, they could not be used for the radio signal receiving part. In 1953, Kroemer of RCA invented a drift transistor with improved high frequency characteristics, which subsequently led the way to Sony's world first commercialization of transistor radios. Commercialization of the transistor radio opened the transistor market, and other Japanese companies started mass production of germanium transistors, too, since the late 1950s, and the production volume of Japan in the 1950s became the world's top.

In March 1955, the first textbook in Japan on transistor circuits, "Transistor and Its Application" (Radio Technology Company) by Ken-ichi Owaki and Tetsuya Arizumi was published.

The germanium transistors were mainly manufactured in the alloy method (alloy type), but Sony manufactured the high-frequency transistors used for their initial transistor radios with a crystal growth method called grown type.

The concentration of impurities (dopant) was changed in the course of crystal growth in the grown type, and it is said that Esaki diode was invented from the analysis of defective transistors

caused by this concentration control.



Transistors made by Totsuko (the predecessor of Sony)

Point contact type at the top of photo, Junction type (middle) and Diode (bottom)