

Late 1960s

Analog ICs produced for consumer use

~ Integrated Circuit ~

From the latter half of 1960, domestic semiconductor manufacturers began to develop analog ICs. A bipolar IC with a structure in which NPN and lateral PNP bipolar transistors, diffused resistors, small capacitance capacitors separated by PN junctions were arranged on P substrate and connected by AL interconnects. It aimed to make electronic set products compact, lightweight, high reliability, and low price.

Sony's AM radio IC developed in 1966, which was commercialized as a consumer IC, is shown in Figure 1. It was used for Sony's ultra-compact radio: ICR100, aiming at miniaturization.

Around 1967 ~ 1968, linear ICs were developed one after another, which actively utilized the characteristics of monolithic IC such as transistor pairing, high precision resistance ratio, and high-performance reference voltage source (band gap reference voltage source).

They were mostly compatible products with ICs from US manufacturers (ICs for intermediate frequency amplification and FM detection for FM, audio intermediate frequency amplification ICs for TV, video intermediate frequency amplification ICs, automatic frequency adjustment IC, chroma demodulation IC), but some original products were developed, too (Mitsubishi Electric: Car Audio OTL Output IC: M5102, Matsushita Electric: AN130, AM / FM Radio IC: Mitsubishi: M5105P, Toshiba: TA 7046P, Tokyo Sanyo: LA 1201).

Because most domestic semiconductor manufacturers were also set makers, they could get internal technology and monetary support, and also secured stable in-house demand. In addition, demand for TVs, radios, etc. increased in the 1970s and 1980s, together with the increase of global market share. New consumer equipment such as portable audio represented by Sony's Walkman and cassette VTR appeared one after another in this period, and analog IC product varieties and production increased dramatically.

The process technology of analog ICs also advanced greatly. After a 4 μ m process and a multilayer interconnect technology, each manufacturer developed a fine process of 2 μ m rule equipped with polysilicon resistor, silicon nitride film capacitor and I²L in the first half of the 1980s (in 1982, Toshiba: ANSA process. Matsushita: LOPAC process, etc.), by which highly integrated ICs for TV and VTR were realized. Using this process, one chip MSIs for color TV were developed (Mitsubishi: M51307SP, Toshiba: TA7777P in 1985, Matsushita: AN5155K in 1986, etc.). Moreover, due to the improvement of high frequency characteristics by this miniaturization process, the application range of analog IC expanded to GHz band, and IC for TV tuner operating in VHF band also appeared. (TV VHF tuner IC from Toshiba: TA7635P, in 1979)

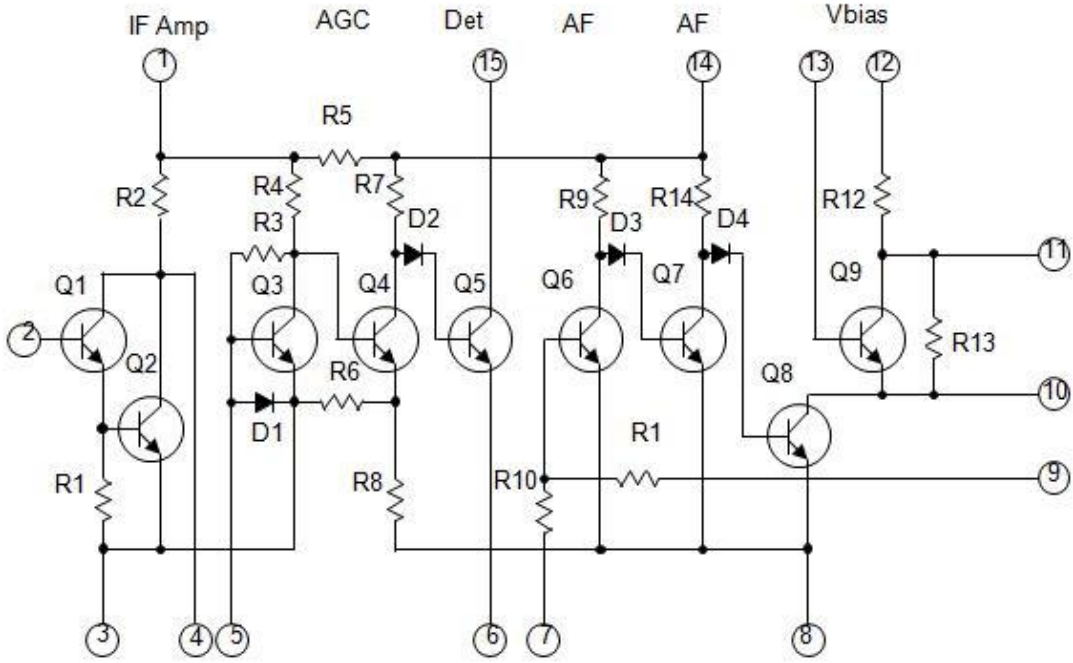


Fig.1. Equivalent circuit diagram of AM radio IC used for Sony's AM radio ICR100

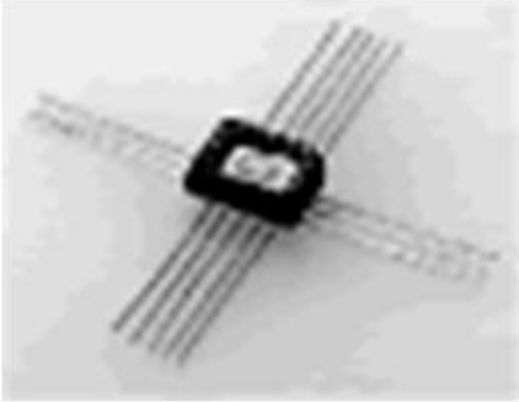


Fig.2 Monolithic IC for the world first portable radio developed by Sony in 1966