

TRANSISTOR MUSEUM™

Historic Transistor Photo Gallery

U.S. Army Signal Corps Transistors from the 1950s/60s



Transistor Size (7/8" X 7/8" Base flange)
Date Code 6052 (1960, Week 52)
1963 Raytheon catalogue illustration at left
shows the rugged case construction.



Excellence in Electronics

The 2N1657 is a high power NPN, diffused base transistor. It features high DC base current gain, low saturation voltage, and low leakage current at high temperatures. Reliability is insured by means of a welded package.

The description above is from a Raytheon Technical Information Sheet, dated 5-15-1960, and noted as "Tentative". Power dissipation is listed at 55 Watts at 25C.

RAYTHEON 2N1657 DEVICE 15

TYPE

Silicon NPN Diffused Base Transistor

USAGE

High Power Audio

LISTING DATES

Sig C: FY 1956

JEDEC Registration: 1964

CASE STYLES

Standard TO-53

Silver Metal

AVAILABILITY

Rare (Limited Production)

HISTORIC NOTES

The 2N1657 transistor is an impressive example of early silicon power technology, and represents an important milestone in the Sig C PEM program. This device combines several important mid-1950s technologies that were key to the PEM program - **Diffusion:** This fabrication process was announced by Bell Labs in 1955 and resulted in transistors with low leakage current, thin base regions, and consistency in production; **Silicon:** Germanium had been used to fabricate the first transistors, and the use of silicon resulted in devices capable of performing at much higher operating temperatures; **Packaging:** Various case materials and designs were developed for early transistors, and the unique TO-53 case used for the 2N1657 maximized thermal transfer and high reliability. Although the 2N1657 was listed in the 1963 Raytheon semiconductor catalog, this device was not widely available commercially. The 2N1657 remains as a unique and historically significant transistor, and represents the best of early silicon high power transistor technology.

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RAYTHEON 2N1657

DEVICE 15

Company	Device Designation	Material	Polarity	Application	Power Dissipation	Frequency Response	Fabrication Technique
RAYTHEON	Device 15	Si	<i>n-p-n</i>	high power audio	55 watts @ 25°C case temp.	2.0 Mc f_{α}	DBT
	Device 25	Si	<i>n-p-n</i>	video amplifier	150 mw @ 25°C ambient temp.	30 Mc f_{α}	DBT

Materials *Fabrication Technique*
 Legend: Ge—germanium DBT—Diffused Base Transistor
 Si—silicon

The FY-56 Sig C PEM program lists two devices from Raytheon, as shown above. Both of these devices are diffused silicon types. Raytheon had achieved prominence as a first-tier germanium alloy transistor company in the 1950s, and the Sig C contract award for these silicon devices was a major accomplishment for Raytheon. For Sig C FY-55, Raytheon had developed low power silicon alloy transistors (2N327A/28A/29A) - the diffusion process for transistor fabrication was announced by Bell Labs in 1955, and the Sig C FY-56 program was intended to sponsor devices using this new process.

Accession Number : AD0262646
Title : INDUSTRIAL PREPAREDNESS STUDY ON TRANSISTORS. SILICON POWER TRANSISTOR (DEVICE 15)
Corporate Author : RAYTHEON CO NEWTON MASS
Report Date : 31 DEC 1960

Abstract : The development and production of a bulk diffused silicon, NPN, power transistor (Device 15) was successfully completed. The bulk diffused approach was adopted because of its ease in providing satisfactory and reproducible transistor characteristics. A major design problem encountered was the base ring contact, which is alloyed through the base. Although the present unit meets the specification, the use of a nonpenetrating type would ensure higher breakdown voltages derived from the diffused collector to base junctions. The processing required for Device 15 and the machinery required for semiautomatic production does not differ materially in principle from the processing and machinery required for silicon alloyed devices. (Author)

Descriptors : *MANUFACTURING, *TRANSISTORS, AMPLIFIERS, ELECTRICAL PROPERTIES, POWER AMPLIFIERS, PROCESSING, PRODUCTION, QUALITY CONTROL, SILICON, STANDARDIZATION, TRANSISTOR AMPLIFIERS.

Distribution Statement : APPROVED FOR PUBLIC RELEASE

The above scan is a summary of the Raytheon report for the Sig C Industrial Preparedness Study on Transistors - Silicon Power Transistor (Device 15). Several items of interest are apparent from this summary: (1) Silicon transistor technology in the late 1950s was still rapidly evolving, as evidenced by the discussion of silicon alloying. By the early 1960s, with the invention of silicon planar technology, existing approaches, such as alloyed junctions, quickly became obsolete. (2) The address for Raytheon listed in the summary is Newton Mass. By 1963, Raytheon had purchased Rheem Semiconductor in Silicon Valley to gain access to newer technologies, and most transistor work was transferred west at this time. (3) The date shown on the above summary is the last day of 1960, which coincides exactly with the date code stamped on the transistors from the production lot in this study (6052).