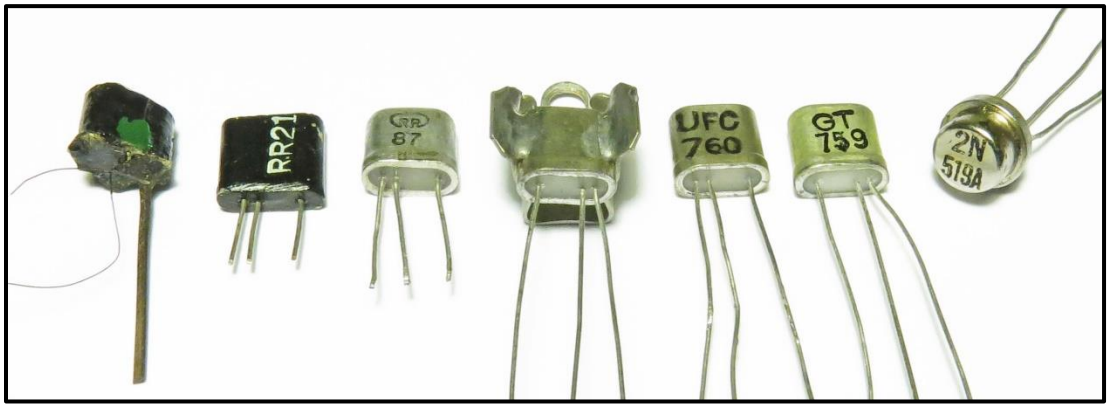
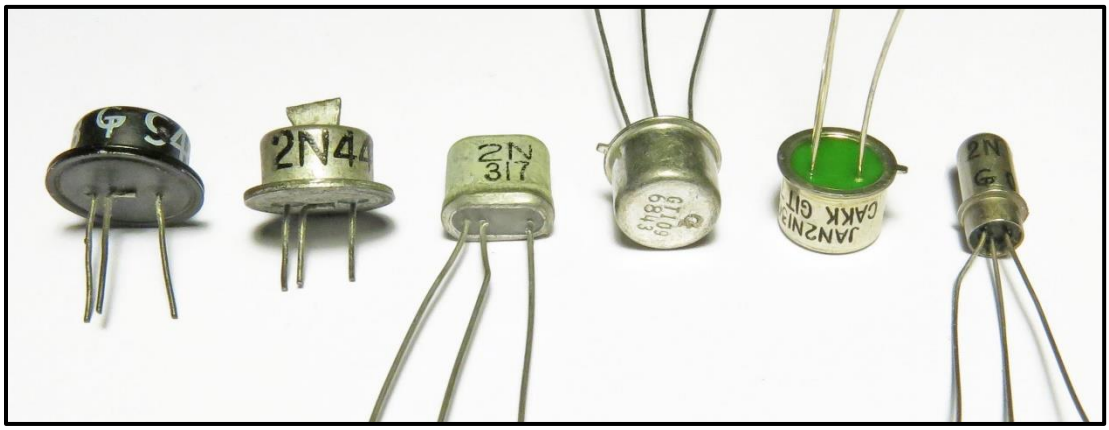
GENERAL TRANSISTOR/GENERAL INSTRUMENT





Historic Transistors from Radio Receptor, General Transistor and General Instrument:
General Transistor (GT) was one of the most successful and technologically advanced manufacturers of germanium computer transistors in the 1950s. This company also exemplifies the rapid changes in corporate ownership and spinoffs during the first days of transistor development. General Transistor was formed in 1954 by Herman Fialkov and others as a spinoff from Radio Receptor (RR), a small manufacturer of semiconductor products that had been one of the original 1952 licensees of transistor technology from Western Electric. Throughout the 1950s, until a corporate merger and name change with General Instrument (GI) in the early 1960s, General Transistor developed and sold millions of the most advanced germanium computer transistors available at the time. Shown above are examples of historic transistors manufactured by these three early transistor companies. At upper left is a very rare RR prototype point contact transistor from 1951/1952. The RR21 is a plastic-cased audio transistor introduced by Radio Receptor in 1953; the more advanced metal-cased RR87 followed in early 1955. General Transistor devices are shown at upper right beginning with the mid-1950s GT81 mounted in a soldered heat-sink. The UFC760 is dated 1956 and represents a major business success for GT in supplying large quantities of computer transistors to Univac (UFC is a designation for Univac File Computer). The GT759 and 2N519A GT transistors are from 1957 and 1958. The bottom row of devices illustrates additional examples of GT transistors from the late 1950s (2N43, 2N44 and 2N317) as well as the transition to General Instrument transistors in the 1960s (GT/GI109, GIT 2N1305 and GT/GI 2N501. The remarkable story of the advanced computer transistors produced by these intertwined and pioneering companies provides an important view into the technology and evolving corporate relationships of the first years of transistor history.

GENERAL TRANSISTOR/GENERAL INSTRUMENT

Germanium Transistors and Diodes

FOR EVERY PURPOSE!

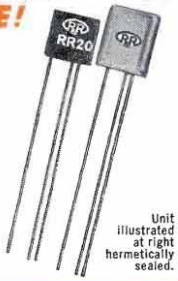
PNP JUNCTION TRANSISTORS

PNP JUNCTION TRANSISTORS
(Typical Characteristics at 25° C—Grounded Emitter)

TYPE NO.	RR14‡	RR20‡	RR21‡
Collector Voltage—volts	−1.5	−1.5	−15.0
Collector Current—ma	−0.5	−0.5	−3.0
Ico—Microamp.*	10	10	30
Current Amplification	25	40	25
Power Gain—db	30	40	—
Noise. Factor—db (1 Kc)	22	22	—
Power out—mw (10% Dist.)†	—	—	20.0

*Ie = o, Vc = −1.5 volts.
†With 1000 ohm driving impedance and 5000 ohm load.
‡RR14H, RR20H and RR21H are hermetically sealed types.

Tiny, stable high gain units, most economical of power, may be soldered in place or socketed in a recommended RTMA transistor socket. They are suitable for audio amplifiers, servo amplifiers and transformer coupled carrier amplifiers. Available in plastic or hermetically sealed in metal and glass.



Unit illustrated at right hermetically sealed.

POINT CONTACT TRANSISTORS

Available in a variety of stable controlled types suitable for both fast and medium speed switching circuits and high frequency amplifiers. Advanced mechanical design for economical production . . . Heat conducting metal case; standard basing, choice of solder-in or plug-in.

POINT CONTACT TRANSISTORS
Typical Characteristics at 25° C

SWITCHING TRANSISTORS		
TYPE NO.	R1698	R1734
Off Collector Current max. ma (I_e = 0)	−2.2 (@ V_c = 40V)	−0.7 (@ V_c = −7V)
On Collector Voltage max. volts (I_e = 3.0)	−4.0 (@ I_c = 5.5 ma)	−1.2 (@ I_c = −4.0 ma)
Collector Dissipation max. m w	120	120
Nominal cut-off Frequency m c	1.5	10.0

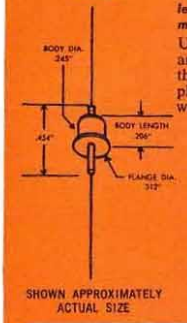
GENERAL PURPOSE TRANSISTOR	
TYPE NO.	R1729
Collector Voltage—volts	−30
Emitter Current—ma	1.0
Input Resistance (R_{11})—ohms	190
Output Resistance (R_{22})—ohms	6000
Current Amplification Factor	2.5
Nominal Cut-off Frequency—mc	5.0

Our engineers will be glad to offer suggestions regarding your Germanium Transistor and Diode applications without obligation . . . Write to Section T

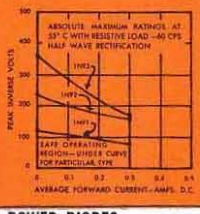
JUNCTION POWER DIODES

WITH THESE DISTINGUISHING CHARACTERISTICS:
• Very low forward drop • Low reverse leakage • Tiny •. Hermetically sealed in metal and glass.

Useful in power supplies, magnetic amplifiers and telephone systems, etc., they have the characteristics of large plate-type power rectifiers and size and weight of a small circuit component.



SHOWN APPROXIMATELY ACTUAL SIZE



JUNCTION POWER DIODES
Maximum Ratings at 55° C—Resistive Load

TYPE NO.	1N91	1N92	1N93
Peak Inverse Voltage (volts)	100	200	300
Peak Forward Current (ma)	470	310	230
D.C. Output Current (ma)	150	100	75
Voltage Drop at Full Load (volts)	0.5	0.5	0.5
Surge Current (amps)	25	25	25
Reverse Working Voltage (continuous volts)	30	65	100
Max. Freq. of Operation (kc)	50	50	50

Coming . . .

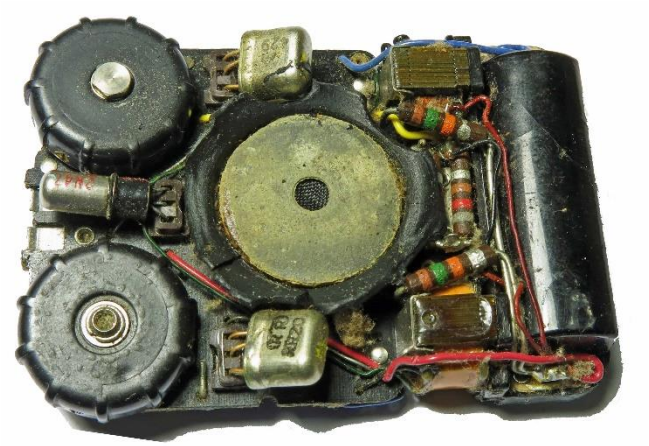
JUNCTION POWER TRANSISTORS
. . . For Audio power up to 2 watts

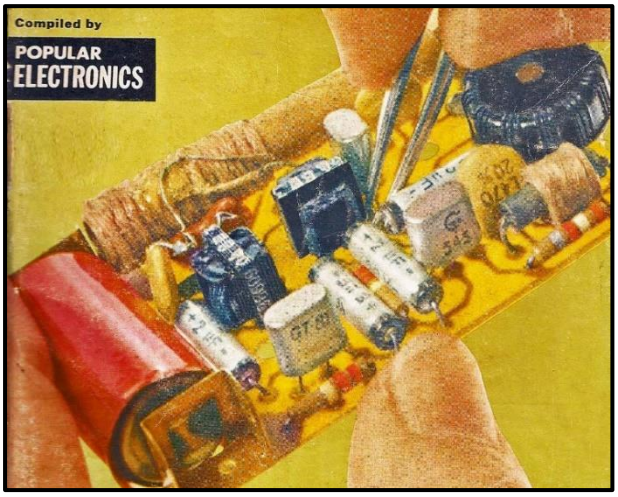
PHOTO TRANSISTORS
. . . To operate power relay with one junction transistor as DC amplifier.

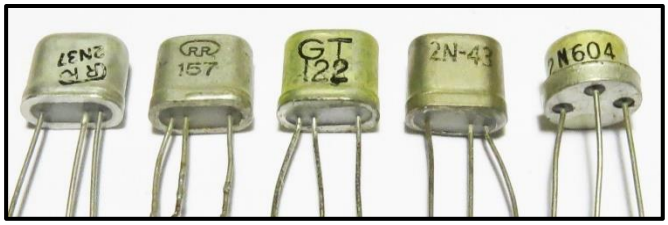
SELETRON & GERMANIUM DIVISION
RADIO RECEPTOR COMPANY, INC.
Since 1922 in Radio and Electronics
SALES DEPT: 251 W. 19th St., New York 11, N.Y. • FACTORY: 84 N. 9th St., Brooklyn 11, N.Y.

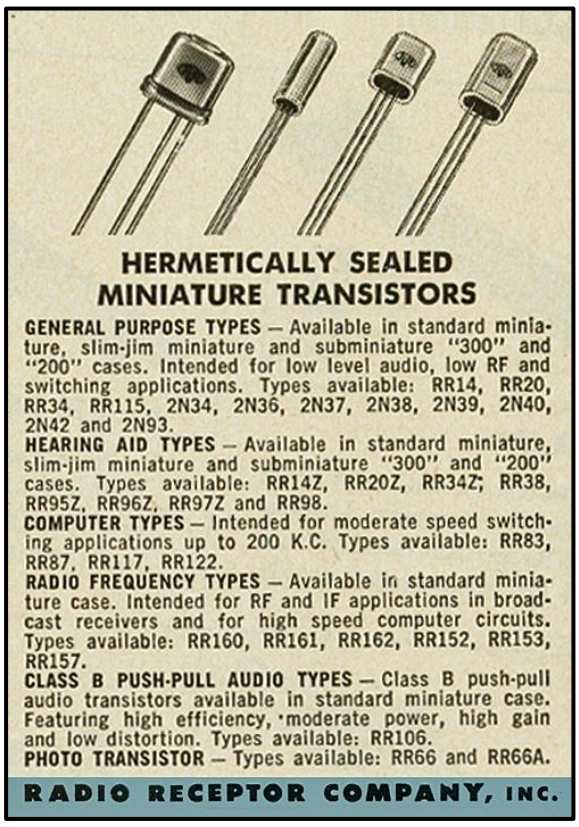
Early Radio Receptor Transistors: Above are sections of an ad from the June 1953 issue of Teletech magazine. The first commercial germanium junction transistors, such as the Raytheon CK722, were just becoming available at this time, and RR was an early leader with the RR14, RR20 and RR21 shown in the ad. Other RR devices featured in this ad include junction power transistors, photo transistors, and point contact transistors. This was a very broad product offering for such a small company and established RR as an important leader in early transistor research.

GENERAL TRANSISTOR/GENERAL INSTRUMENT



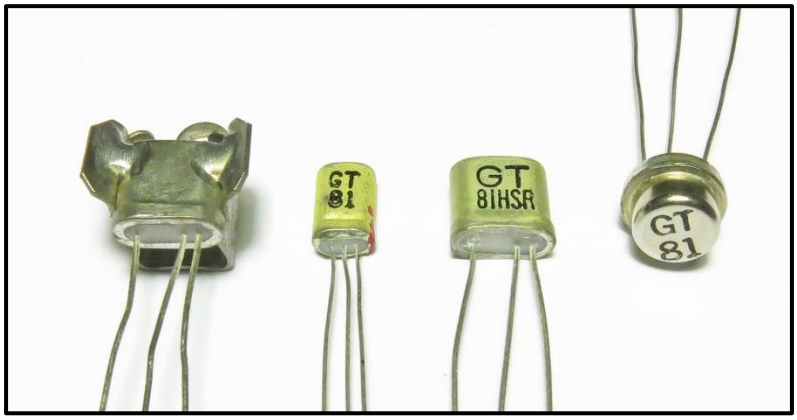


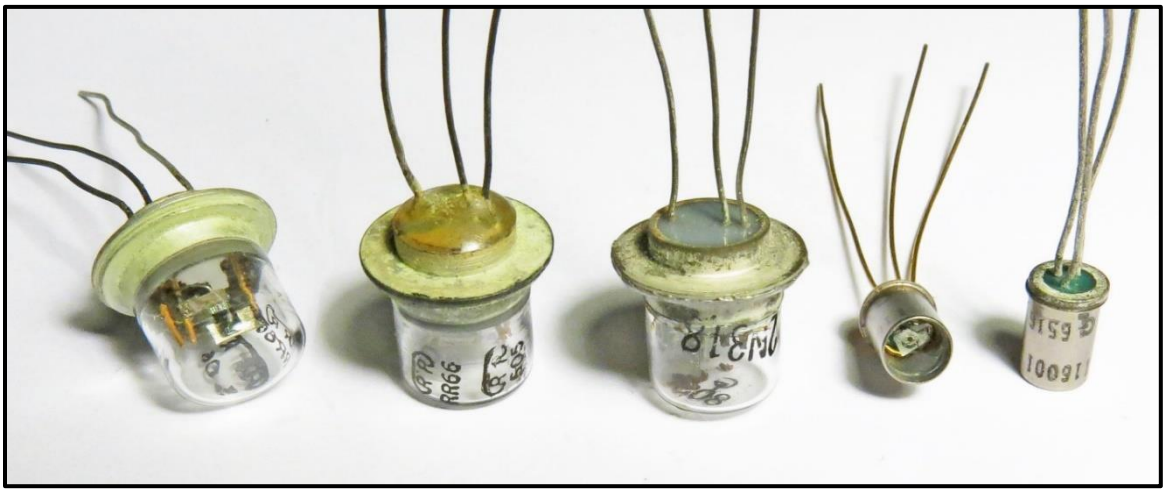




Hearing Aids, Radios and Computers: The first large scale commercial use of transistors was hearing aids. Most early transistor manufacturers developed low speed PNP alloy junction devices that were best suited for this market – shown at upper left is the component view of the Zenith "Royal M" hearing aid introduced in 1954. This particular unit uses two RR type RH20 transistors, dated 1954 week 29. A Philco 2N47 transistor is also used. Building on the hearing aid presence established by RR, General Transistor also sold devices for this application. For example, the Acousticon model A340 hearing aid was sold initially with RR transistors but continued in 1956 with GT devices. Unlike RR, GT supplied transistors to radio manufacturers, either as original types or as replacements. An interesting example is shown above on the cover of the 1957 edition of Electronic Experimenter's Handbook, which shows a hobbyist radio project with three GT 81 transistors. RR and GT used the proprietary "RR" and "GT" numbering systems as well as the more standard "2N" technique – see the 2N37 and RR157 above left and the GT 122, 2N43 and the 2N604 at right. RR advertised a series of computer transistors in 1955 (see ad at left). GT greatly expanded on the computer transistor lineup throughout the 1950s, and became known as a leading supplier of high speed switching types. The 2N604 above is an example of an advanced GT "drift" type computer device from 1961.

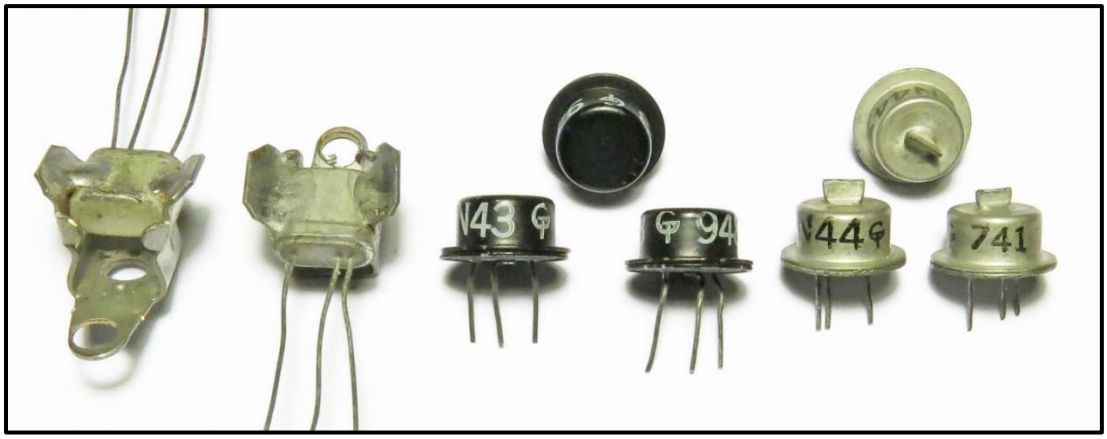
GENERAL TRANSISTOR/GENERAL INSTRUMENT





Evolution of RR, GT and GI Transistor Types: In addition to the industry standard "2N" numbering system, Radio Receptor and General Transistor also used the proprietary "RR" and "GT" sequence on many transistor types. These in-house numbers could be updated quite rapidly and were sometimes used inconsistently to identify different or evolving transistor types with similar numbers. For example, the top photo illustrates several versions of the GT81 transistor type that were produced by GT in the 1950s. The upper left unit mounted in the soldered heatsink was one of the first types sold by GT, appearing as early as 1955. This type was continued for several years, but the case type changed as shown by the TO-9 version at upper right, dated 1958. The smaller GT81, dated 1957 and sometimes labeled as GT81H, was intended for the hearing aid market. The GT81HSR, also dated 1957, was a high speed (HS) version of the GT81 – the "R" suffix was frequently used by GT to indicate a selected parameter or a type supplied in a different case type. The lower photo illustrates the evolution of a unique RR/GT/GI device, the phototransistor, from the first version, the RR66 at left, introduced in 1954/55, compared with the similar glass-cased GT 2N318 in center, dated 1958. Due to the popularity of this unique transistor type, GT introduced improved versions with a smaller metal case, labeled as 2N469 (not shown above). GI continued to manufacture this product type into the 1960s, as illustrated by the units at far right, dated 1965. This sequence of device types, beginning with the Radio Receptor RR66, through the later 1950s with the General Transistor 2N318 and 2N469, and finally with similar devices produced by General Instrument in the 1960s, well illustrates the unique and historic relationship for these early and influential transistor companies.

GENERAL TRANSISTOR/GENERAL INSTRUMENT



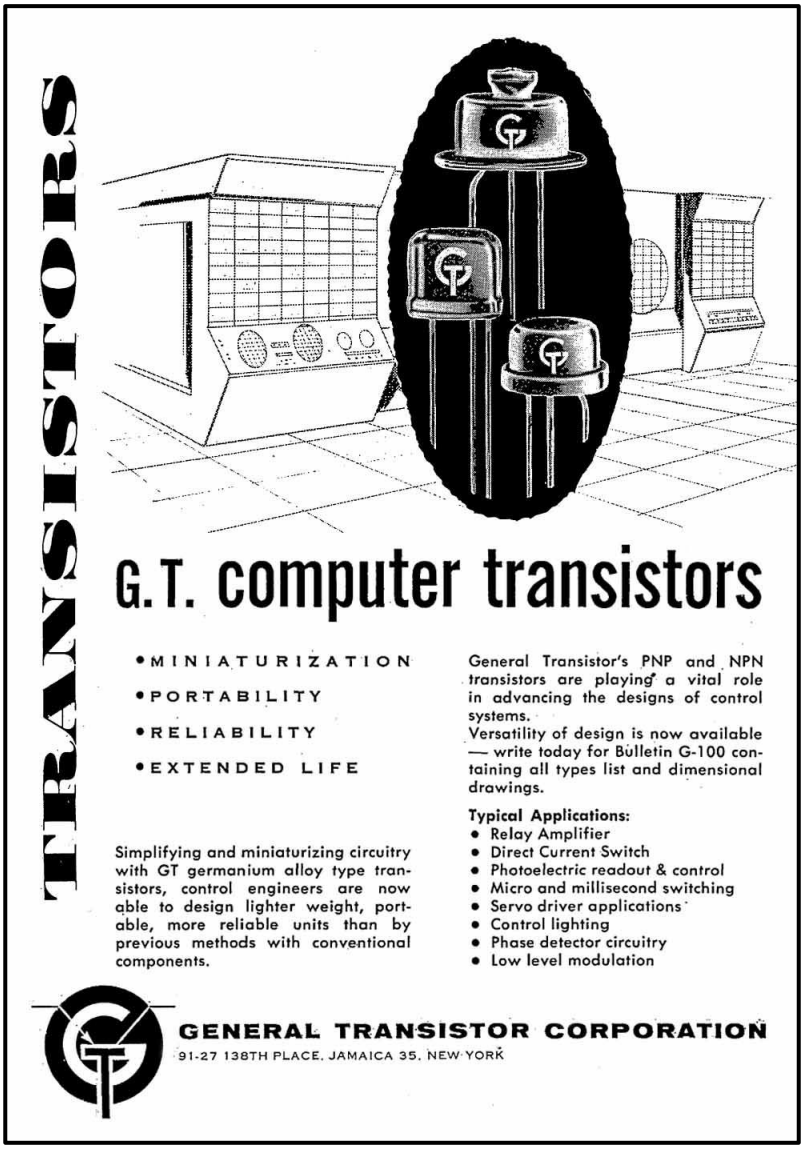
GT81: The first GT transistors began to appear in 1955, shortly after the corporate spinoff from Radio Receptor. The "Transistor Specification Chart", published in the September 1955 issue of Teletech magazine, is one of the first industry publications with available GT transistors listed. This list identifies the following General Transistor model numbers (GT 14, 20, 24, 34, 81, 81H, 760, 761, 762, 83, 87, 88 and 122) and (2N34, 36, 37, 38 39, 40, 42, 44, 45, 63, 64 and 65). The GT81 devices, shown above left, are very early examples of the first GT transistors. These units were originally packaged in a GT transistor box lot of 100, identified on the box as GT81. These early GT transistors were intended for low frequency switching, audio and general purpose use, with cross reference to such better known types as the RCA 2N109. Of special note is the soldered heat sink which would allow higher power output from these transistors, likely for use as audio output in a radio or phonograph, or low speed solenoid driver in a computer application. The GT81 included in your kit is a rare example of one of the first GT transistors.

2N43/2N44: Beginning with the first 1955 GT transistors, some of the important product types offered were popular model numbers developed by other transistor companies and second sourced by GT. For example, in 1953 General Electric introduced a very popular line of PNP alloy junction transistors, the 2N43, 2N44 and 2N45, which were widely used for many years in a variety of commercial, military and data processing applications. GT introduced its own versions of these transistors, which were part of the GT product line throughout the 1950s. The GT 2N44 shown above right is dated 1957, week 41, and the GT 2N43 shown above is dated 1959, week 48. Note the "pinched-top" case style of the 2N44. The original General Electric 2N43/44/45 series of transistors also had this case style, which was the result of an evacuated case with a remaining exhaust tube. GT copied this case style as shown above, but this appears to have been for cosmetic reasons only, with no actual case evacuation. In 1959, both GE and GT abandoned the "pinched-top" case and used the classic "top hat" style as shown with the 2N43 above.

TRANSISTOR MUSEUM
Historic Semiconductor Data
Device ID: GT81 transistor
Type: Germanium PNP alloy junction
Case Color/Style: TO-22 with heat sink
Vintage/Date Code: 1950s
Use: Low frequency general purpose
Notes: Very rare example of early General Transistor commercial device - 1955/56.

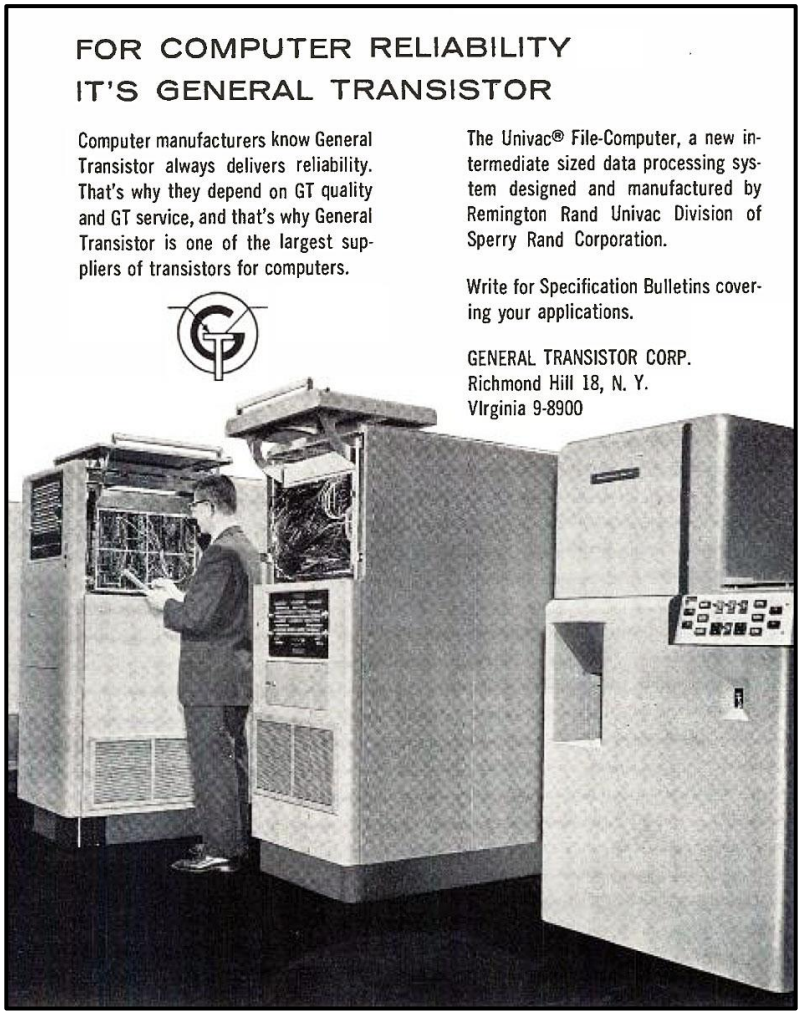
TRANSISTOR MUSEUM
Historic Semiconductor Data
Device ID: GT 2N43/2N44 transistor
Type: Germanium PNP alloy junction
Case Color/Style: Black/silver top hat
Vintage/Date Code: 1950s
Use: General purpose computer-industrial
Notes: GT 2nd source of widely used GE types. Note "pinched-top" on early units.

GENERAL TRANSISTOR/GENERAL INSTRUMENT



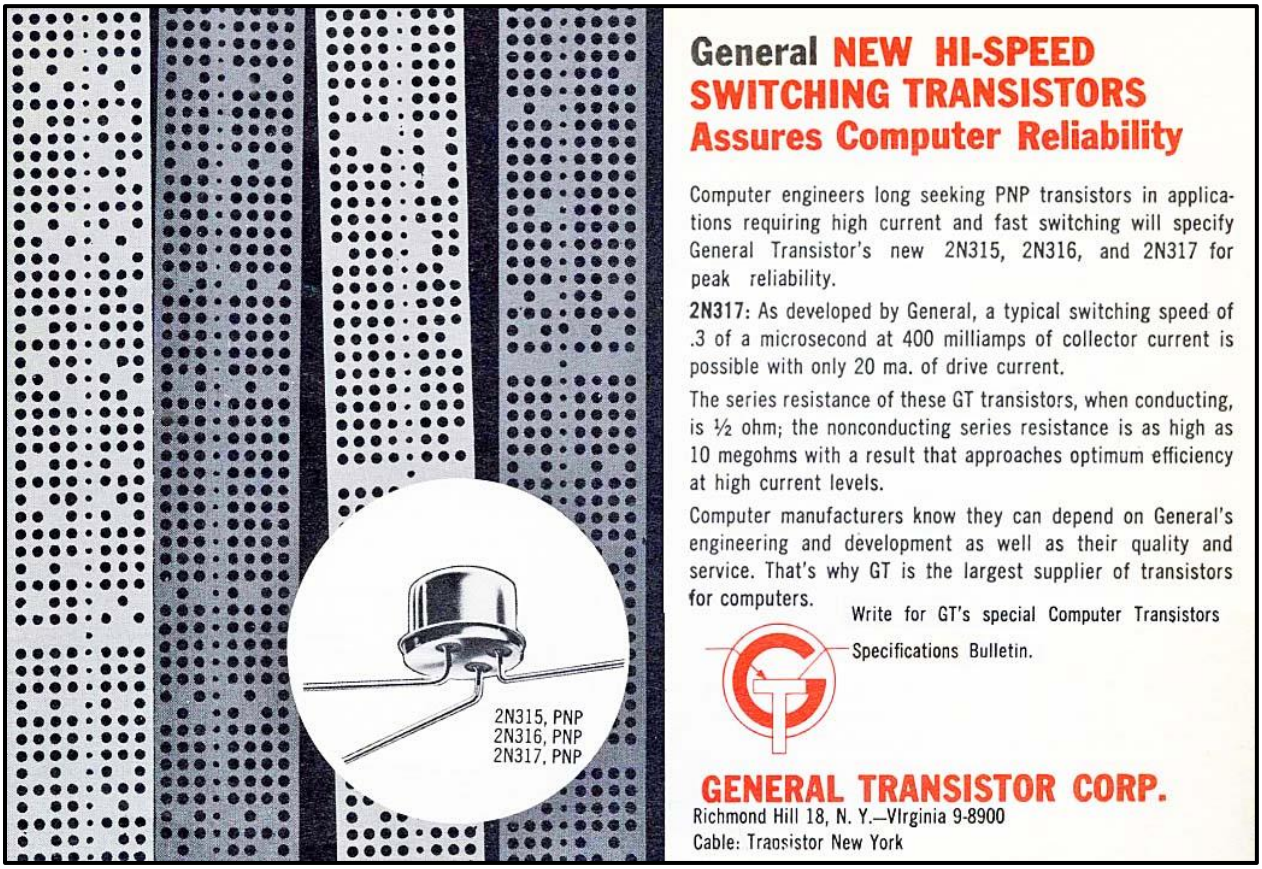
GT Computer Transistors in 1957: By the end of 1957, GT had greatly expanded its line of transistors beyond the approximately 25 types available in 1955. The October 1957 issue of Electronic Industries and Teletech contains a comprehensive list of the commercial transistors from U.S. companies, and the General Transistor listing identifies 60 or so specific transistor types. By this time, GT had begun to specialize in computer transistors. Note the ad above from the December 1957 issue of Computers and Automation magazine. Multiple case styles were manufactured by GT, and these are illustrated in the ad. For example, the "pinched-top" unit at top was developed initially in 1953 by General Electric and GT used this same case style for the GE types second-sourced by GT. The middle case style is similar to the more modern JEDEC TO-22 case and was used originally by Radio Receptor. The bottom transistor case is the most common 1950s GT case style and is similar to the JEDEC TO-9. Note also the extensive list of typical computer applications that these GT transistors could perform. With such a broad range of transistor types introduced by the end of 1957, GT had become a leading manufacturer of germanium computer transistors.

GENERAL TRANSISTOR/GENERAL INSTRUMENT



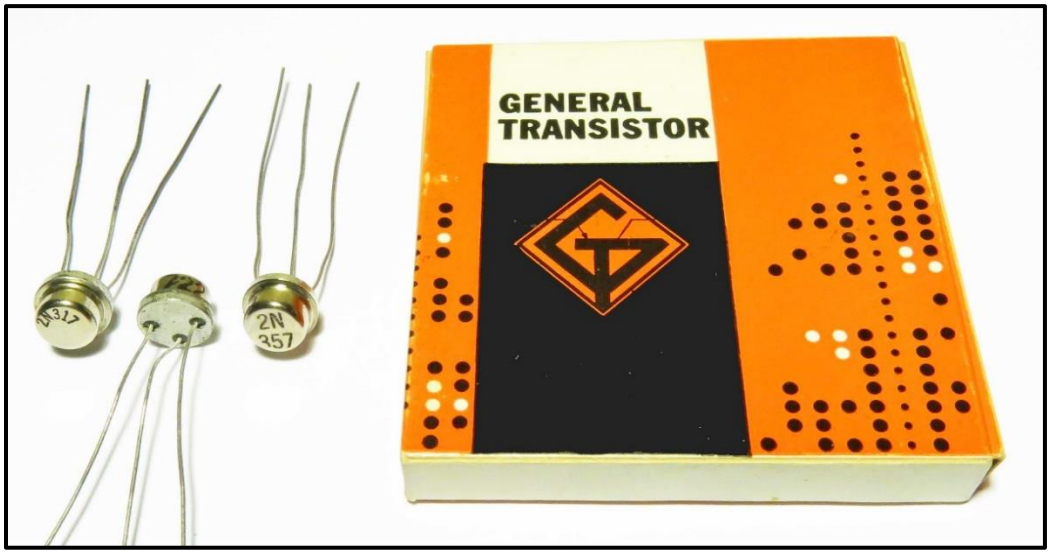
Univac File Computer and GT Transistors: Above are sections of an ad from the December 1956 Teletech publication, illustrating the importance of General Transistor to the reliable operation of the new Univac File Computer (UFC). Remington Rand Univac had begun work on the UFC in 1955, with the design goal of developing a computer combining data processing with large storage capacity and random access. This mid-1950s time frame coincided with the transition of first generation vacuum tube based computers to second generation solid state computers. General Transistor was well positioned to provide production quantities of both NPN and PNP high speed switching transistors to Univac for use in the UFC and other early solid state computers under development at that time – this was a successful relationship between the two companies, and Univac became the first major customer of General Transistor. A single Univac computer system, including the central processing or logic unit and associated peripherals, could contain tens of thousands of individual transistors, so this market provided the basis for rapid expansion by GT, beginning in 1956 and continuing throughout the 1950s until the emergence of the first IC based computers in the 1960s.

GENERAL TRANSISTOR/GENERAL INSTRUMENT



Early High Speed GT Computer Transistors: 1957 was a productive year for General Transistor, with many new computer transistors released for commercial sale. The February 1957 ad shown above, from the February 1957 Computers and Automation magazine, highlights some examples of the new types of GT computer transistors made available during this time frame. Tentative specifications for the 2N315/6/7 line of GT transistors were published in January 1957, and the formal registration with JEDEC by General Transistor of these types was done in March 1957. According to the GT technical material supplied to JEDEC, these three types were documented as PNP germanium alloy transistors intended primarily for applications where high speed, high current switching is of paramount importance. The performance of these three types is similar, with cutoff frequency/switching speed listed as ranging from 20MC for the 2N317, 12MC for the 2N316 and 5MC for the 2N315. The text of the ad provides some insight into 1950s germanium computer transistor design challenges, with comments related to drive current capability, series resistance, reliability and switching speed. Another interesting statement in the ad is the claim that "GT is the largest supplier of transistors for computers". Other semiconductor companies that were creditable competitors with GT for this large and expanding market of computer transistors were CBS, General Electric, Raytheon, Sylvania and Texas Instruments. It is likely that GT's large scale supply of computer transistors to Univac was a major factor in the success of General Transistor for this market.

GENERAL TRANSISTOR/GENERAL INSTRUMENT



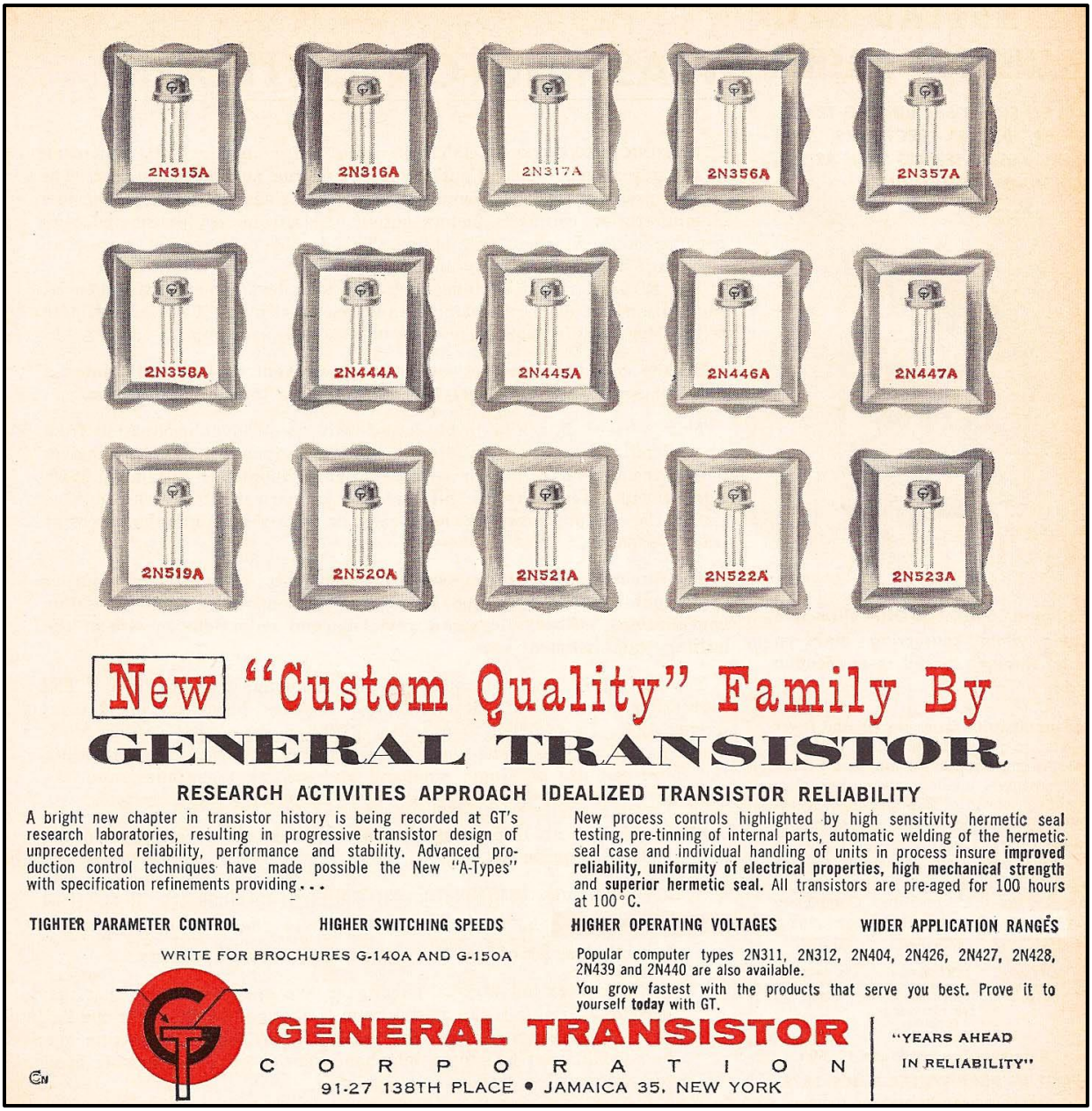
2N317/2N357: Unlike many other 1950s germanium computer transistor manufacturers, General Transistor produced both PNP and NPN alloy junction devices. This was an important technological advantage for GT because solid state computer circuit designers often used both types. The 2N317 shown above left is a PNP type and the 2N357 shown above center is an NPN type – these transistors represented product families (2N315, 2N316 and 2N317) and (2N356, 2N357 and 2N358) with similar performance characteristics, but opposite polarities (PNP vs NPN). The devices included in your kit are dated 1957 or 1958 and are early production examples of GT high performing germanium computer transistors. Your kit will contain either a 2N317 (PNP) or 2N357 (NPN). These transistors were designed for computer applications where high speed, high current switching was of paramount importance, and were used widely in commercial computers. Examples of computers using these transistors include the Norden Scribe II (2N317), SAAB Sank 1 (2N317 and 2N358) and the RCA 300 (2N357).

GT Transistor New in Box (NIB): Throughout the 1950s, it was common for transistor manufacturers to use individual cardboard/paper boxes or packages for each transistor, often developing highly colorful graphics as a marketing technique. General Transistor was known for its striking transistor packaging design, which was used to highlight the computer/data processing applications for GT transistors. Shown above right is an example of the classic orange and black GT transistor package, which was decorated with a computer punch card or paper tape reader dot pattern. Surviving examples of these 50 year old GT packages are quite rare. Your kit will include a package as shown above right, with a GT transistor inside. Some packages have writing from the original owner indicating actual performance measurements.

TRANSISTOR MUSEUM
Historic Semiconductor Data
Device ID: GT 2N317/2N357 transistor
Type: Germanium PNP/NPN alloy junction
Case Color/Style: Silver metal TO-9
Vintage/Date Code: 1950s
Use: High speed computer switch
Notes: Unique examples of PNP and NPN 1950s GT computer transistor technology.

TRANSISTOR MUSEUM
Historic Semiconductor Data
Device ID: GT New in Box transistor
Type: Germanium PNP/NPN alloy junction
Case Color/Style: Various early case types
Vintage/Date Code: 1950s
Use: Cardboard packaging for GT device
Notes: Rare 50 year old General Transistor classic orange/black transistor packaging.

GENERAL TRANSISTOR/GENERAL INSTRUMENT



GT Transistor Research and Improved "A-Types": General Transistor established an active computer transistor research program and developed a comprehensive series of improved transistor types in 1959, identified as the New "A-Types", which incorporated many of the design refinements implemented as a result of the research program. The above ad appeared in the January 1959 edition of Electronics magazine and documents many of new and improved GT "A-Types". Note the specific list of "popular computer types". All the devices listed in the ad had been developed by GT and registered with JEDEC in the 1957 timeframe. The improved "A-Types" were developed by GT, and were registered with JEDEC in the early 1960s by GI, shortly after the acquisition of General Transistor by General Instrument.

GENERAL TRANSISTOR/GENERAL INSTRUMENT

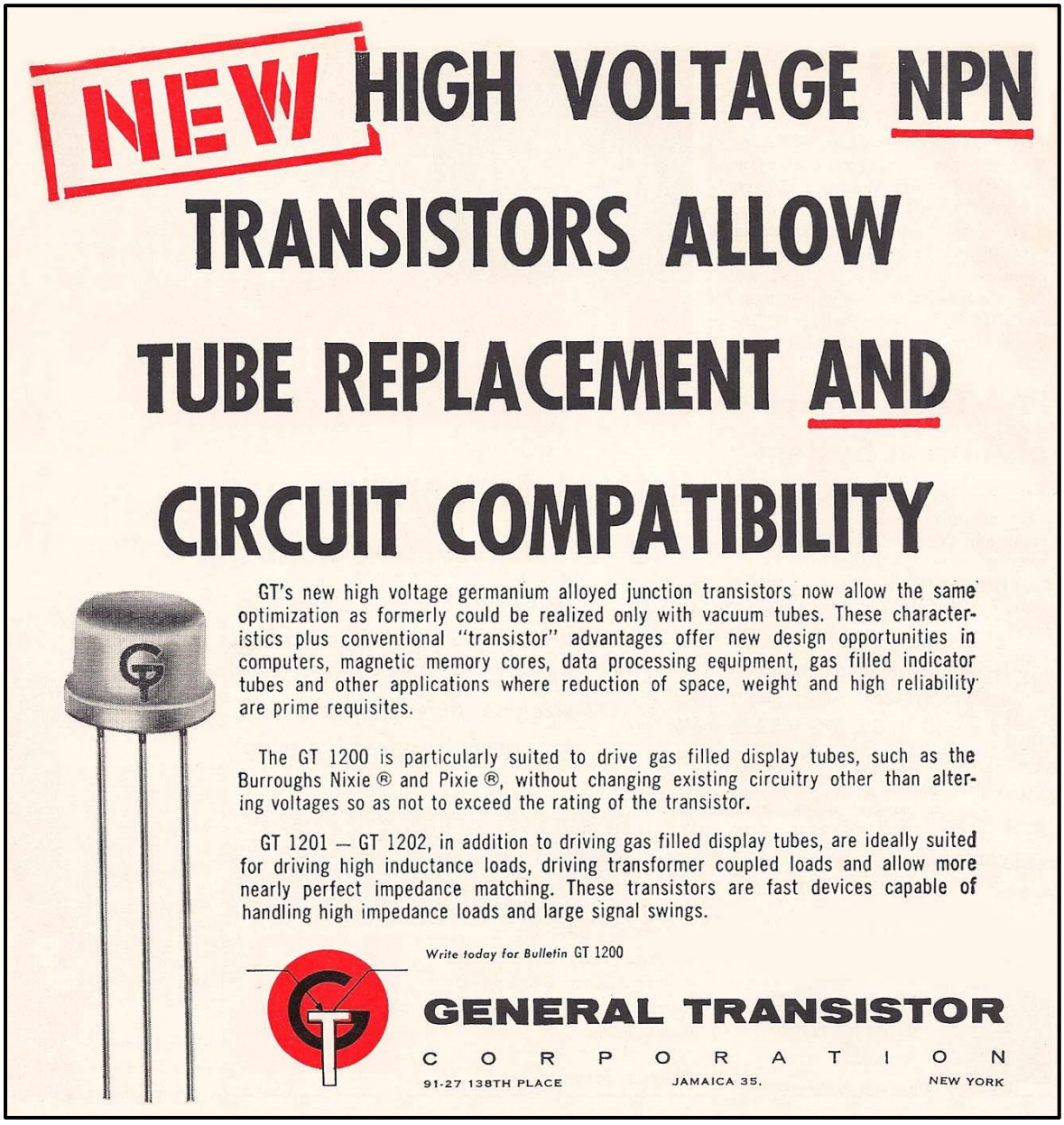
2N519A: General Transistor Corporation was a leading supplier of germanium computer transistors, beginning in the mid-1950s until 1960, when the company was acquired by General Instrument. GT registered the original 2N519 with JEDEC in 1958 as a PNP germanium alloy transistor particularly suited for both small signal and medium speed switching applications. The 2N519A was registered in 1961 as an improved version of the 2N519 by General Instrument. General Transistor devices typically used the unique TO-9 case style, which was common in the 1950s prior to the standardization by most manufacturers to the JEDEC TO-5. The 2N519A transistors at above left are TO-9, date code 1958 week 52, all identified with a small "GT" stamp. The 2N519A was a rugged industrial type transistor, although the low switching speed of .5 megacycles limited in use in higher speed computers. The 2N519A did find use in analog computer applications, as the basis for operational amplifier design. For example, patents 3187233 and 3206691 describe "op amp" circuits for the 2N519A.

RCA E2: General Transistor developed both PNP and NPN germanium transistors for the 1950s computer industry. This was a competitive advantage, and as a result, GT supplied transistors to a number of computer companies, including those large companies that also manufactured transistors. For example, shown at upper right are NPN transistors, marked as "GT" with a date code of 1957, and labeled as "RCA – E2". RCA was an early leader in the manufacture of transistor computers (for example the 501) and also in the manufacture of PNP computer transistors (for example the famous 2N404). RCA did not manufacture germanium NPN computer transistors, so its likely that the above devices were built to RCA specifications by GT and then subsequently used by RCA in their computer products. For example, the GT NPN type 2N357 was used in the RCA 300 computer. These "E2" types have similar characteristics to the GT 2N357 series and are extremely rare examples of a unique and early computer transistor.

TRANSISTOR MUSEUM
Historic Semiconductor Data
Device ID: GT 2N519A transistor
Type: Germanium PNP alloy junction
Case Color/Style: Silver metal TO-9
Vintage/Date Code: 1950s
Use: .5 megacycle computer switch.
Notes: Rare 1950s General Transistor Corp computer transistor. Classic TO-9 case.

TRANSISTOR MUSEUM
Historic Semiconductor Data
Device ID: GT "RCA-E2" transistor
Type: Germanium NPN alloy junction
Case Color/Style: Silver metal TO-9
Vintage/Date Code: 1950s
Use: Computer logic
Notes: Rare GT NPN computer transistor made to RCA specs - similar to 2N357.

GENERAL TRANSISTOR/GENERAL INSTRUMENT



NEW HIGH VOLTAGE NPN TRANSISTORS ALLOW TUBE REPLACEMENT AND CIRCUIT COMPATIBILITY

GT's new high voltage germanium alloyed junction transistors now allow the same optimization as formerly could be realized only with vacuum tubes. These characteristics plus conventional "transistor" advantages offer new design opportunities in computers, magnetic memory cores, data processing equipment, gas filled indicator tubes and other applications where reduction of space, weight and high reliability are prime requisites.

The GT 1200 is particularly suited to drive gas filled display tubes, such as the Burroughs Nixie ® and Pixie ®, without changing existing circuitry other than altering voltages so as not to exceed the rating of the transistor.

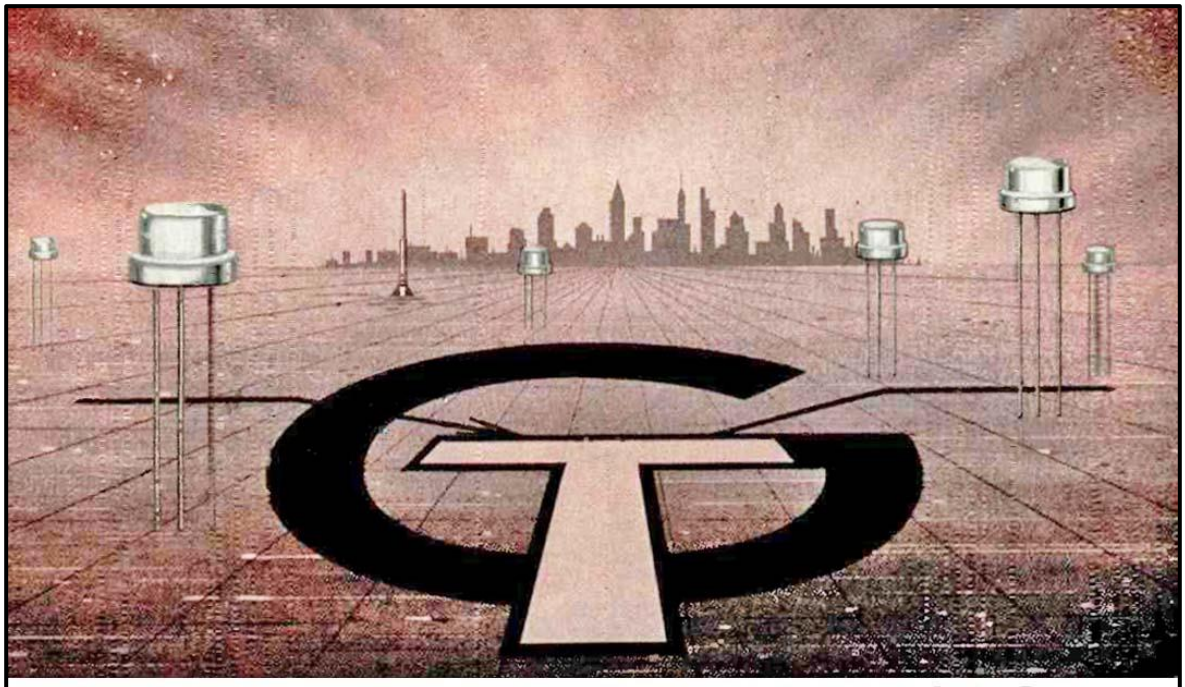
GT 1201 — GT 1202, in addition to driving gas filled display tubes, are ideally suited for driving high inductance loads, driving transformer coupled loads and allow more nearly perfect impedance matching. These transistors are fast devices capable of handling high impedance loads and large signal swings.

Write today for Bulletin GT 1200

GENERAL TRANSISTOR
CORPORATION
91-27 138TH PLACE JAMAICA 35, NEW YORK

High Voltage GT Computer Transistors for Tube Replacement: The January 1959 edition of Electronics magazine contained the above General Transistor ad for a unique set of specialized computer transistors. By the late 1950s, most electronic circuits used in computers had been implemented with solid state technology, but a few specialized applications still used the earlier electron tube technology. Such applications included drivers for gas-filled displays and drivers for high inductive loads such as printers and relays. This would likely have been a fairly small and short-lived market, since many transistor manufacturers were designing high voltage transistors at this time and the use of electron tubes in computers was rapidly waning. With unique devices such as these, and a very broad range more mainstream transistors, General Transistor maintained its leadership position in computer transistors into the 1960s.

GENERAL TRANSISTOR/GENERAL INSTRUMENT



BROADEN DESIGN HORIZONS

with new pnp drift transistors

TYPICAL APPLICATIONS
- TV CIRCUITS
- FM RADIOS
- SHORT WAVE RADIOS
- HIGH FREQUENCY OSCILLATORS
- VERY HIGH SPEED SWITCHING DEVICES

SEVEN NEW DRIFT TRANSISTORS FOR HIGH SPEED SWITCHING AND HIGH FREQUENCY AMPLIFIER APPLICATIONS

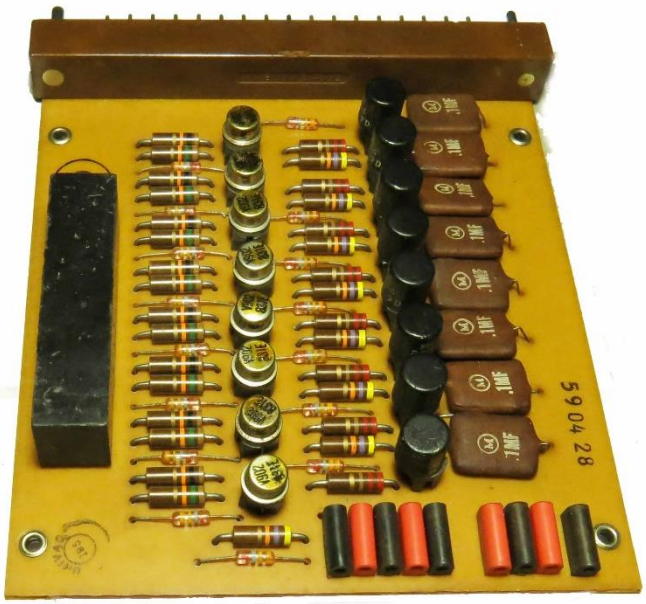
General Transistor's new 2N602, 2N603, 2N604 provide the design engineer with guaranteed switching parameters such as gain-bandwidth and DC current gain, while the 2N605, 2N606, 2N607 and 2N608 provide guaranteed power gains at high frequencies.
In addition to the great speed advantages offered by the drift transistor at no sacrifice of gain, such additional features as higher voltages and lower capacity are available. Thus one can now drive higher impedance loads with no sacrifice of speed or pulse power.
The complete control of G. T.'s Drift Transistor assures longer life and maximum performance while possessing complete reliability.
Other features include: high input-circuit efficiency, excellent high-frequency operating stability, good signal-to-noise ratio, good automatic-gain-control capabilities and the rugged mechanical construction of a positive hermetically sealed JETEC 30 case.

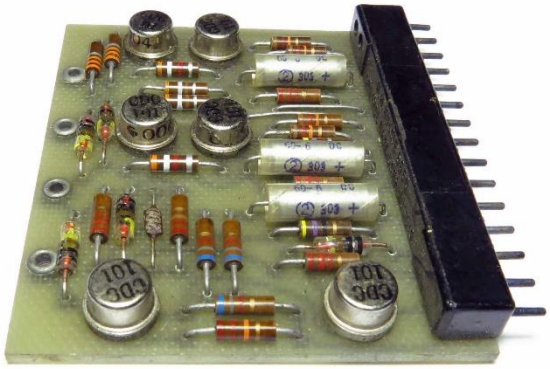
	DC Current Gain h_{FE}			Gain X Bandwidth			Power Gain K_p		
2N602 2N603 2N604	$V_{CE} = 1$ v $I_e = 0.5$ ma	*	25-100	$V_{CB} = 5$ v $I_C = 5$ ma	10-30 mc 30-50 50-70	2N605 2N606 2N607 2N608	$V_{CE} = 7.5$ v $I_C = 1$ ma $f = 2$ mc	20-25 db 25-30 db 30-35 db 35-40 db

GENERAL TRANSISTOR
CORPORATION

General Instrument Germanium Computer Transistors: Above are sections of an ad from the November 1958 edition of Electronics magazine documenting the technical details of a newly developed GT line of very high speed switching devices. These transistors used a technology known as "drift-field", which had been developed by Herbert Kroemer at RCA in the mid-1950s. GT registered these devices with JEDEC in July 1958 and GI continued to manufacture these high performing computer transistors well into the 1960s.

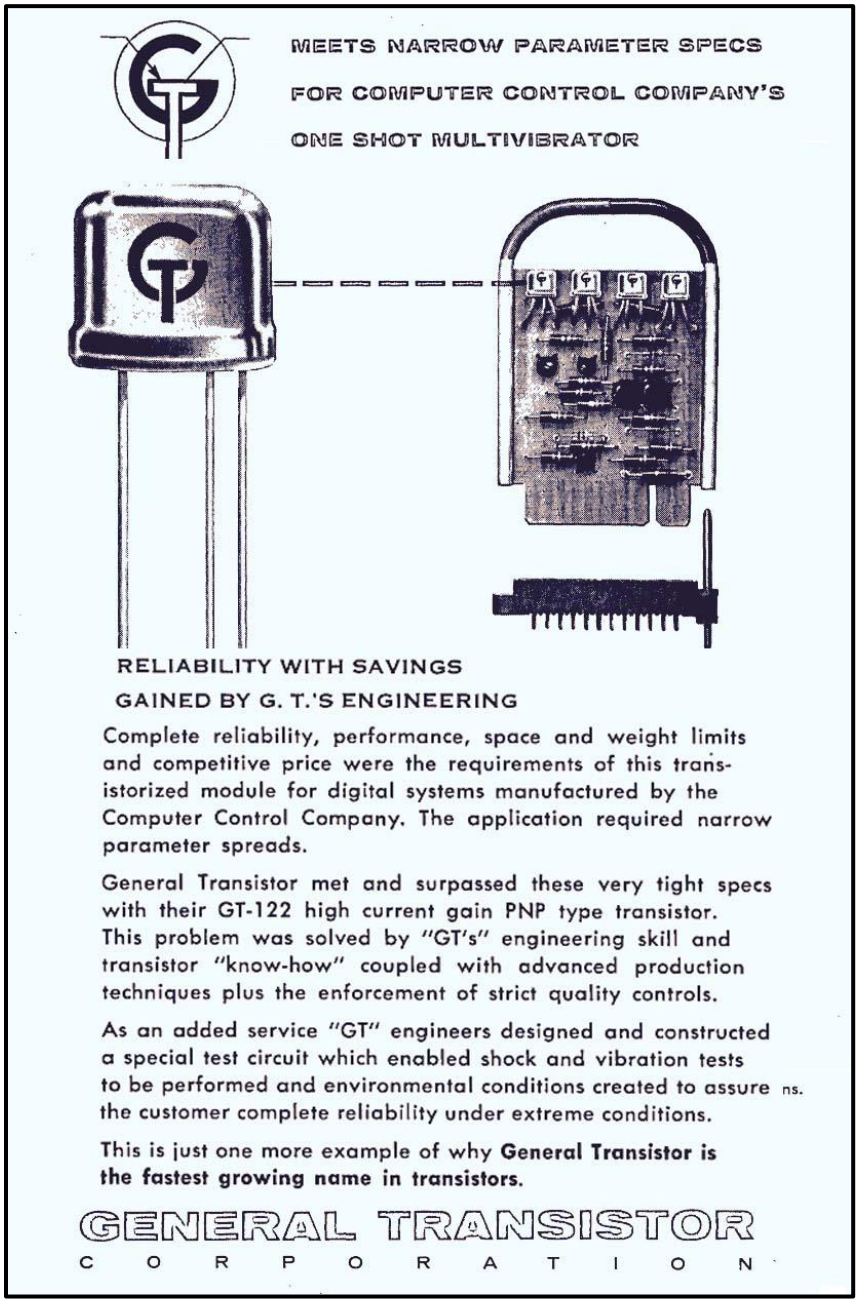
GENERAL TRANSISTOR/GENERAL INSTRUMENT





1950s and 1960s Computer Circuit Boards with GT Transistors: At upper left is a photo of a "495" series circuit board from the Univac File Computer system. This specific board is identified as a "Relay Puller" and is stamped with a 1959 date code. As shown in the enlarged view above, eight GT transistors are used – these are identified with Univac internal part numbers and are stamped "GT" with 1958 date codes. Note also that eight black RCA 2N586 transistors are used – these are larger, higher power devices that would be required to activate the relay coils. GT did not manufacture high power transistors, so devices from other companies would be required. The small circuit board at upper right is a transistorized module used in the Control Data CDC 160A computer and the related CDC 160 and 6400 computers, introduced in 1960 as the first transistorized high performance commercial computer system. The transistors on this board are stamped "GT" with date codes from 1959 and 1960. Note that CDC used its internal part numbers for these transistors (CDC 101). Other circuit boards from these computers used transistors labeled as CDC 102, 103 and 104. Both circuit boards shown above are examples of two major customers of General Transistor devices (Univac and CDC), and the computers sold by these companies likely accounted for millions of transistors manufactured by GT in the 1950s and 1960s.

GENERAL TRANSISTOR/GENERAL INSTRUMENT



MEETS NARROW PARAMETER SPECS
FOR COMPUTER CONTROL COMPANY'S
ONE SHOT MULTIVIBRATOR

RELIABILITY WITH SAVINGS
GAINED BY G. T.'S ENGINEERING

Complete reliability, performance, space and weight limits and competitive price were the requirements of this transistorized module for digital systems manufactured by the Computer Control Company. The application required narrow parameter spreads.

General Transistor met and surpassed these very tight specs with their GT-122 high current gain PNP type transistor. This problem was solved by "GT's" engineering skill and transistor "know-how" coupled with advanced production techniques plus the enforcement of strict quality controls.

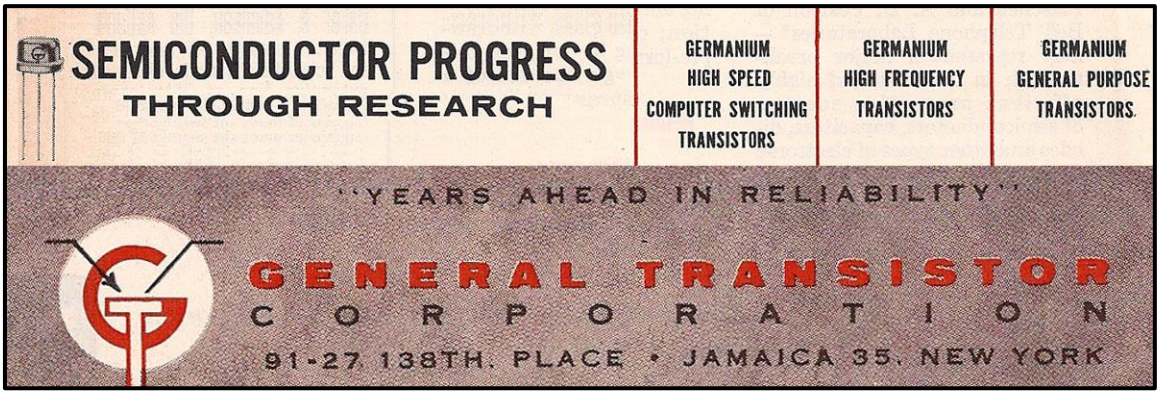
As an added service "GT" engineers designed and constructed a special test circuit which enabled shock and vibration tests to be performed and environmental conditions created to assure ns. the customer complete reliability under extreme conditions.

This is just one more example of why **General Transistor is the fastest growing name in transistors.**

GENERAL TRANSISTOR
C O R P O R A T I O N

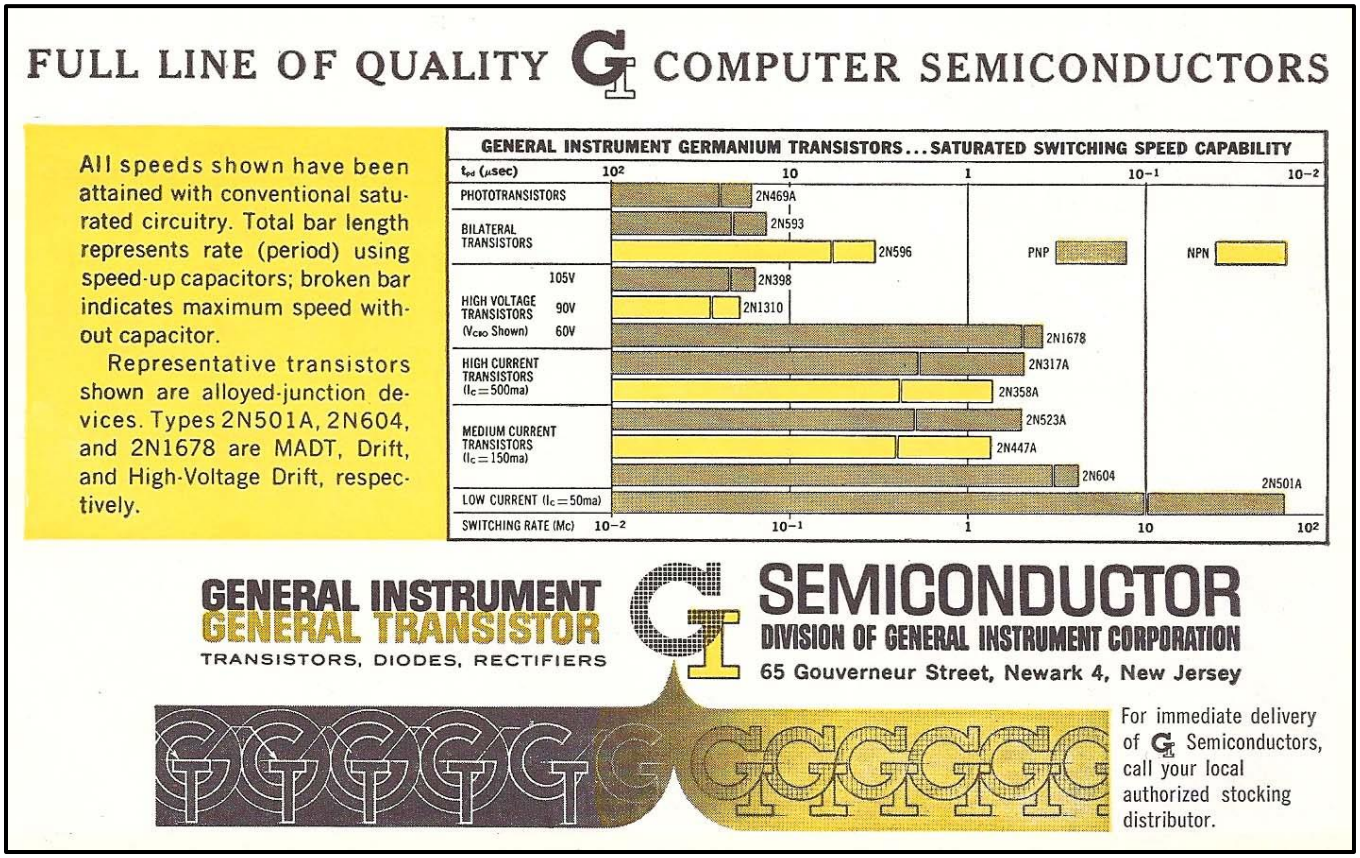
GT's Engineers Develop the GT-122 Computer Transistor: Computer Controls Company (3C) was a major manufacturer of minicomputers and computer logic modules in the 1950s and 1960s. The above ad from the June 1957 issue of Computers and Automation illustrates how General Transistor was eager to work with computer companies in developing transistors to meet specific requirements. Although originally developed for 3C, the GT-122 transistor was soon made available as a standard GT product, and was listed in the 1958 Electronic Industries Transistor Data Chart as a 5MC high performing computer transistor.

GENERAL TRANSISTOR/GENERAL INSTRUMENT



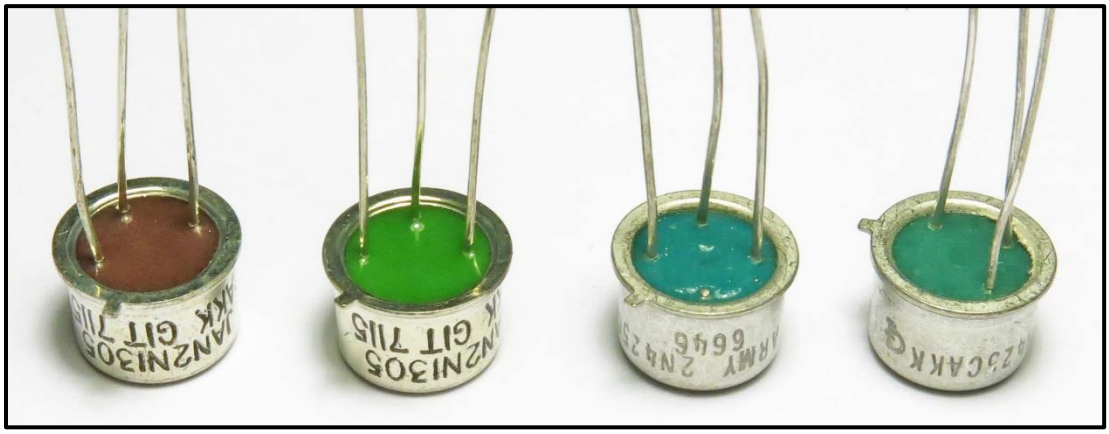
General Transistor Offers Broad Range of Transistors
General Transistor Corporation was an early leader in the design and production of germanium transistors. GT transistors were used extensively in 1950s commercial products including hearing aids, radios and computers. The scan shown above is a partial excerpt of a GT ad from the February 20, 1959 edition of Electronics magazine. In addition to the high speed and general purpose transistors mentioned above, other GT germanium transistor types highlighted in this ad included bilateral, drift, high voltage and phototransistors - gold bonded diodes and an early silicon transistor type are also noted. As further indication of the success of General Transistor and its expanding product line, the 1960 Lafayette Radio Semi-Conductor Directory documents over 120 available GT transistor types. GT transistors were used in large quantities by Univac, CDC and other 1950s computer companies. For example, the circuit board at left is a digital computer flip-flop module, which was manufactured by 3C (Computer Control Company) – this module uses three GT793 transistors, date coded 1958 week 44. General Transistor used both the standard "2N" identification system for its devices as well as a proprietary "GT" numbering system. The transistors in this module use the distinctive and easily identifiable TO-9 case style common to many GT transistors. General Transistor was acquired by General Instrument Corp in 1960, which continued to manufacture the broad range successful GT transistor types. At left are examples of the 1950s GT transistor packaging (note the data processing graphics) and a 1960s GI transistor package.

GENERAL TRANSISTOR/GENERAL INSTRUMENT



General Instrument Germanium Computer Transistors: Above are sections of an ad from the January 1961 Proceedings of the IRE, identifying some of the types of germanium computer transistors available at that time from the General Instrument Semiconductor Division of the General Instrument Corporation. There are a couple of historically important aspects of early computer transistor history reflected in this ad: (1) General Instrument (GI) had not been documented as a manufacturer of transistors in the 1950s, and this ad, from early 1961, is likely one of the first industry ads from GI indicating availability of transistors and (2) GI had acquired a leading transistor company, General Transistor, in 1960 and this acquisition was the primary approach used by GI to become a transistor manufacturer. Note the reference to General Transistor in the ad, both in the text below the graph, and also in the company "logos" at the bottom of the ad – "GT" becomes "GI". General Instrument used a somewhat ambiguous identification stamp on their transistors from the early 1960s, so that the stamp could be read as either a stylized "GT" or "GI". General Transistor had been an early leader in high speed germanium computer transistors from the mid-1950, and GI was surely interested in maintaining this business after the 1960 acquisition – note the focus of the ad on computer transistors. The transistor types listed in the above ad (2N469A, 2N593, 2N596, 2N398, 2N1310, 2N1678, 2N317A, 2N358A, 2N523A, 2N447A, 2N604 and 2N501A) had all been available from GT, so General Instrument was able to quickly position itself as major supplier of transistors. Throughout the 1960s, GI established a solid reputation as a second-source supplier of germanium transistors, primarily for military and industrial applications and, by 1966, developed and sold a broad range of semiconductors.

GENERAL TRANSISTOR/GENERAL INSTRUMENT



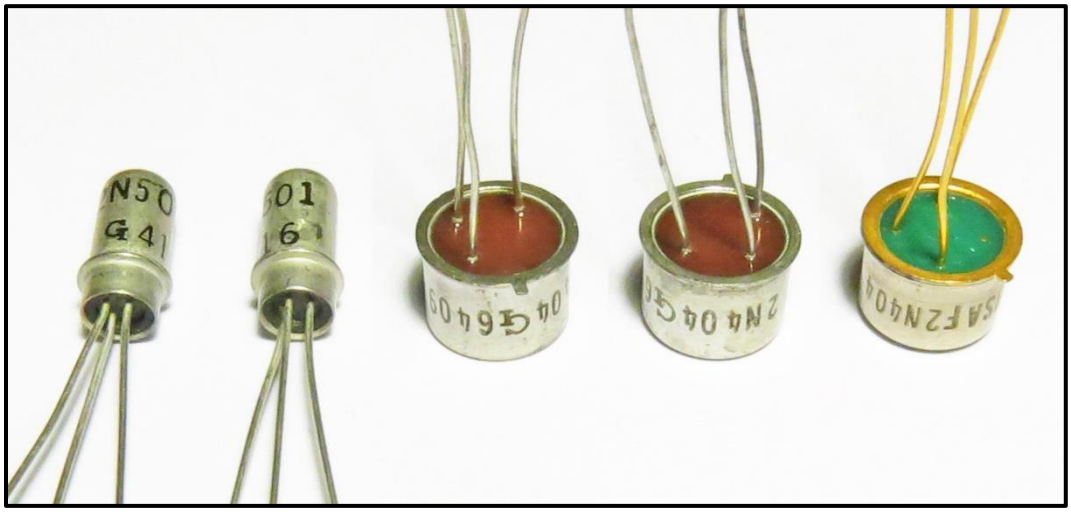
JAN 2N1305: The 2N1302 - 2N1309 series of transistors was originally developed by Texas Instruments in the late 1950s to provide a complementary range of NPN/PNP high-frequency transistors for computer and switching applications. The 2N1305 is the PNP complement to the NPN 2N1304 transistor, both of which will operate up to a cutoff frequency of 5MC. This series of transistors was very successful and was used extensively throughout the 1960s and 1970s in commercial and military computer applications. Several transistor manufacturers, including General Instrument, second-sourced this popular line of computer transistors, and the 2N1305s shown above left are devices from GI. These units are marked as "JAN 2N1305", which means this transistor type was manufactured and tested to meet the Joint Army-Navy specifications, and thus was qualified for military use. Note also the difference in the color of the glass/epoxy header material between the two leftmost units above. This color difference commonly occurred in germanium transistors from this timeframe, and it is unclear as to the significance, if any, of these differences. Finally, note the manufacturer ID "GIT" for General Instrument Transistor.

U.S. Army 2N425: The 2N425/6/7/8 line of computer transistors was registered with JEDEC by Raytheon in 1957 and was a very successful product line throughout the 1950s and 1960s. Many other transistor companies second-sourced these transistors, including General Instrument, as shown above right. Raytheon had originally developed these transistors under contract from the Army Signal Corps, and large quantities were later manufactured and tested to meet specific Army specifications. As shown above, these transistors were labelled "U.S. Army". The specific GI units shown have date code 1966 week 46, and appear somewhat crudely manufactured, especially when compared with the more refined case "finish and consistency" of the 1971 vintage GI 2N1305 transistors at upper left. Also, the GI 2N425 units are poorly stamped, and the type info is difficult to identify without magnification. The 2N425 type was used extensively in early computers, including the 1960 Univac LARC.

TRANSISTOR MUSEUM
Historic Semiconductor Data
Device ID: GI JAN 2N1305 transistor
Type: Germanium PNP alloy junction
Case Color/Style: Silver metal TO-5
Vintage/Date Code: 1960s/1970s
Use: High frequency computer switch
Notes: PNP complement to NPN 2N1304.
GI second source of successful TI series.

TRANSISTOR MUSEUM
Historic Semiconductor Data
Device ID: GI U.S. Army 2N425 transistor
Type: Germanium PNP alloy junction
Case Color/Style: Silver metal TO-5
Vintage/Date Code: 1960s/1970s
Use: High frequency computer switch
Notes: Originally developed by Raytheon for Army/Sig C. GI was high volume 2nd source.

GENERAL TRANSISTOR/GENERAL INSTRUMENT



2N501: The 2N501 transistor type was registered by Philco with JEDEC in 1959, with the following description: "The 2N501 is a hermetically sealed Micro Alloy Diffused-base Transistor (MADT) specifically designed for very high speed switching applications. Reliable operation of the 2N501 in switching circuits has been achieved at speeds in excess of 20 megacycles". Philco had established an early 1950s leadership position in high speed transistor design with the famous SBT (Surface Barrier Technology), and the MADT was an extension of this original type. Because of the excellent high speed performance, the 2N501 and related types were sold in large quantities. General Transistor had been licensed by Philco to manufacture MADT transistors and General Instrument continued to second source this popular product line well into the 1960s. The GI units shown at upper left are examples from 1964. These very high speed switching transistors were used in many historic computers, including the MIT TX-2 and the Univac LARC.

2N404: General Transistor in the 1950s, and later General Instrument in the 1960s, excelled in establishing second source manufacturing for computer transistors that had been developed initially by other companies. The GI 2N404 transistors shown at upper right are an example of this second source process. RCA introduced the 2N404 in 1957, and this robust general purpose computer transistor soon became an "industry standard" and sold in the millions for data processing, military and industrial switching applications. Because of the widespread acceptance of the 2N404, many companies became second source suppliers, including Raytheon, Sylvania, Tungsol, TI, GE, and General Instrument. Several versions of the 2N404 were developed, including the 2N404A (higher voltage capability) and the USAF 2N404 (qualified for military use) – see above far right GI USAF 2N404. The GI 2N404 transistor included in this kit is dated from the 1960s and is of type 2N404, 2N404A or USAF 2N404.

TRANSISTOR MUSEUM
Historic Semiconductor Data
Device ID: GI 2N501 transistor
Type: Germanium PNP MADT
Case Color/Style: Silver metal TO-30
Vintage/Date Code: 1960s
Use: 20+ megacycle computer switch.
Notes: 1960s high speed "workhorse" used in many computers. 1st developed by Philco.

TRANSISTOR MUSEUM
Historic Semiconductor Data
Device ID: GI 2N404 transistor
Type: Germanium PNP alloy junction
Case Color/Style: Silver metal TO-5
Vintage/Date Code: 1960s
Use: Medium speed switching circuits.
Notes: Widely used 1950s RCA computer transistor, 2nd sourced by GI in the 1960s.

GENERAL TRANSISTOR/GENERAL INSTRUMENT

General Instrument Builds on the Radio Receptor and General Transistor Semiconductor Legacy: The above is a scan of the cover of the 1962/1963 General Instruments Semiconductor product catalog. By this time, GI had completed the acquisition of the General Transistor Corporation and the extensive list of GI germanium transistors shown in the catalog reflect many model numbers originally developed by General Transistor. GI was also manufacturing germanium diodes and many model numbers shown in the catalog were originally developed by Radio Receptor, which General Instrument had acquired in the mid-1950s. The catalog also lists a small number of silicon transistors from GI. At this time in semiconductor history, NPN silicon mesa transistors, originally developed by Fairchild, were just becoming available and GI was active in second sourcing this new technology. Fairchild silicon planar transistors were also just becoming commercially available as were the first integrated circuits (developed by Fairchild and Texas Instruments). Although this catalog is too early to list planar transistors and integrated circuits, General Instrument did aggressively develop and manufacture these silicon devices in very large quantities, well into the 1970s and 1980s. Building on the historic 1950s germanium product types from Radio Receptor and General Transistor, General Instrument established and maintained a successful semiconductor business for many years.