VACUUM TUBE VALLEY™

Issue 11
Spring 1999

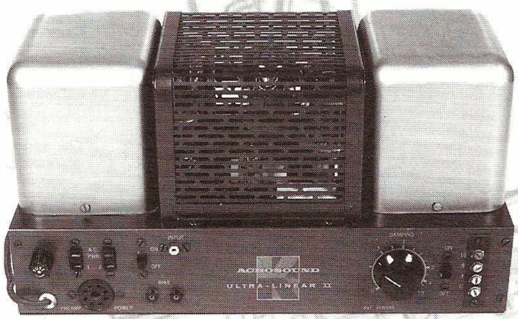
The Classic Electronics Reference Journal

Published Quarterly
Price $9.00

Driver of Choice: The 6SN7

Mid Priced Vintage Hi-Fi

Classic Components on a Budget



VTV Octal Line Stage

Simple, Accurate, and Sensual

ASUSA A-4 Kit Review

High Quality Kits Are Back

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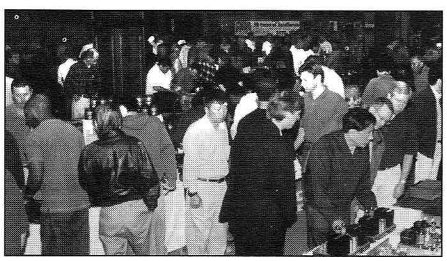
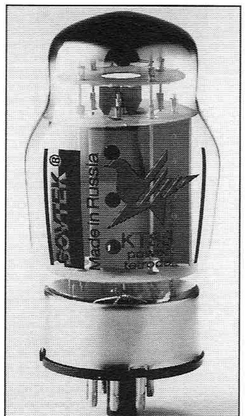
2/27-28/99 Southern California Tube Enthusiast Weekend a Success

There was a good showing at the VTV Tube School with several industry professionals in attendance. The Hi-Fi Swap on the following day was attended by about 1000 enthusiasts who found lots of tube gear, NOS tubes and parts. A great time was had by all!



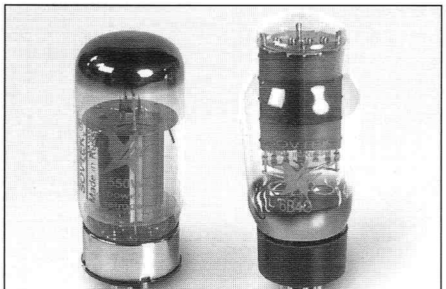
New tubes from Sovtek

New Sensor Corporation, New York, New York has recently introduced a number of tubes for the guitar amplifier and hi-fi applications. Their new KT66 and KT88 have the famous"coke bottle" shape reminiscent of the classic Tung-Sol 6550. According to New Sensor's press release, improvements have been made in grid and plate materials used in their output tubes.



Sovtek KT88

The new Sovtek 6550 comes in two versions, the 6550WD with a plastic base and the 6550WE with the familiar metal ring base. A new, octal based, directly heated triode, the 6B4G is also available from Sovtek. It is similar in appearance to the Sovtek 300B, but has a smaller bottle, octal base and a 6.3V filament. We have also learned that New Sensor will also be introducing a new 12AX7 type in late spring or early summer 1999. Apparently, this is an improved version of earlier Sovtek 12AX7 types. For more information, contact: New Sensor Corporation, 20 Cooper Square, New York, NY 10003 1-(800) 633-5477



Sovtek 6550WE and 6B4G

Svetlana SV300B MP

New 300B from Svetlana

Svetlana Electron Devices, Huntsville, Alabama, has announced the availability of their high-quality new SV300B power triode and its beautiful new packaging. Russian engineers at Svetlana have worked hard to bring the quality construction, materials, processing, aging and classic sound to their 300B type. The plate is carbonized, high-purity nickel and the filament oxide coating duplicates the original mixture. The gold-plated control grid minimizes grid emission and improves stability. It is available as a single tube or as a Svetlana Tested and Matched Pair (pictured). For more information, contact: Svetlana Electron Devices, 8200 South Memorial Parkway, Huntsville, AL 35802 (256) 882-1344

Vacuum Tube Valley Launches New Website

VTV recently uploaded its new website: **www.vacuumtube.com.** Our site now gets over 7,000 visits daily! The site has many new features and products including more information on and photos of VTV back issues, new tube links, buy-sell tube classifieds, etc. We have also expanded our Pro-Tube Shop catalog online with several new parts, accessories, tube amp kits and other goodies.

Cover illustration of 6SN7 structure by Kent Leech, a talented illustrator whose hobby is tube audio. If you are interested in high quality technical illustrations, contact Kent at 925-253-9757

Vacuum Tube Valley is published quarterly for electronic enthusiasts interested in the colorful past, present and future of vacuum tube electronics.

Subscription Rate: US$36/year (4 issues) US$43/Canada & US$66/Asia, US$53 Europe

US Bank Check,Credit Cards or Cash are accepted for payment.

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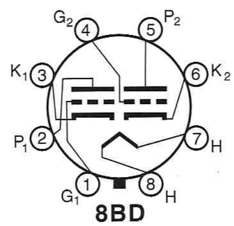
ISSN # 1095-4805

6SN7: Driver of Choice

By Eric Barbour

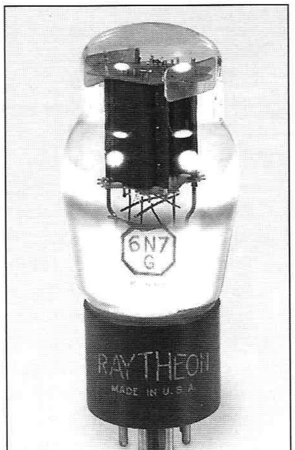


Why are we doing an article about this dual triode? It's not used in modern guitar amps, and it's not common in high-end equipment. This lack of use is not germane to its worth! The 6SN7 was a seminal audio type. First, it was the driver tube in the first American version of the Williamson amplifier. This was the first widely-used "hi-fi" amplifier design of the postwar era. Second, a good 6SN7GTB will give almost any other medium-mu triode a run for its money, in terms of linearity.

1. History

The first primitive directly-heated triodes were usually low-mu or medium-mu. Many kinds of cathodes were under development at the time, but their invention became dominant. It was a high-purity nickel tube coated with a mixture of barium and strontium oxides, binders and other agents. By inserting a wire heater into a ceramic tube (or, later and most commonly, coating it with aluminum oxide), and then slipping the heater into the nickel sleeve, the cathode could be heated to a suitable temperature to make the barium-strontium mixture emit electrons into the vacuum. The optimum surface temperature was found to be about 900-1100 degrees Celsius.

A major advantage of this scheme: the heater could be run from low-voltage AC, with minimum hum induction into the audio or radio circuit (especially in the critical detector stage of a TRF or superhet receiver). A side benefit was that plenty of electrons were emitted by the oxide mixture, as much as an oxide-coated filament. Result: good efficiency and low hum, plus a cathode that could be connected to its own bias resistor, allowing the tube to self-bias and eliminating the "C" bias supply.

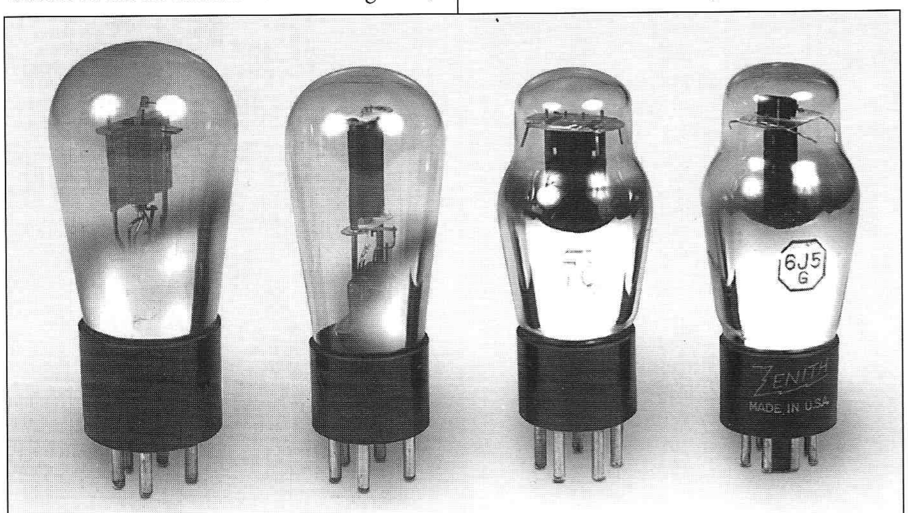


6N7G

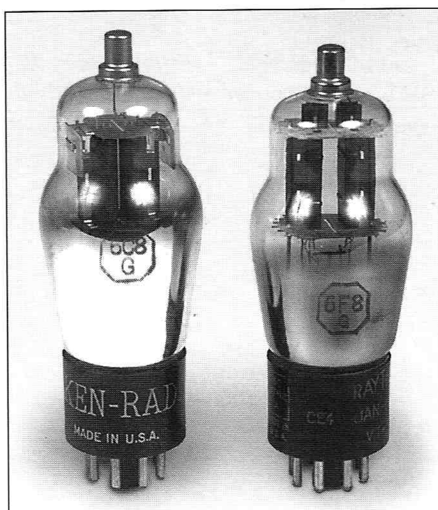
The Uni-potential indirectly heated cathode is credited to A.M. Nicolson of Western Electric and was first made in 1914. Its patent was applied for in 1915 and was issued in 1923. Its successor was the McCulloch/Kellogg 401 (1925). It was a plug-in replacement for the common 201-A triode, except with AC heater connections on a top cap. Thus, it could be plugged directly into an older TRF radio that used 201-As, while allowing operation of the heaters from an external filament transformer, and eliminating the "A" battery. Marathon, Sovereign, Cardon/Sparton and Arcturus made similar triodes during the 1926-28 period.

The Brits were a bit late here. Prominent engineer H. J. Round developed a similar cathode around 1922. Round's AC triode had space as the insulator between the bright emitter tungsten heater and the the cathode. This slow-warmup version was first developed into a product by MOV engineer C. W. Stropford and used in their KL1 triode (1927). However, the Stropford cathode's heater was wrapped around a silica rod and was not in direct contact with the nickel tube. Met-Vick engineer E. Yeoman Robinson produced a slip coated heater and nickel tube assembly which was a quick warm-up type. It was first used in Met-Vick's AC/R and AC/G triodes(1927). MOV later bought in this design and re-numbered it KH1, abandoning the KL1 and Round's design.

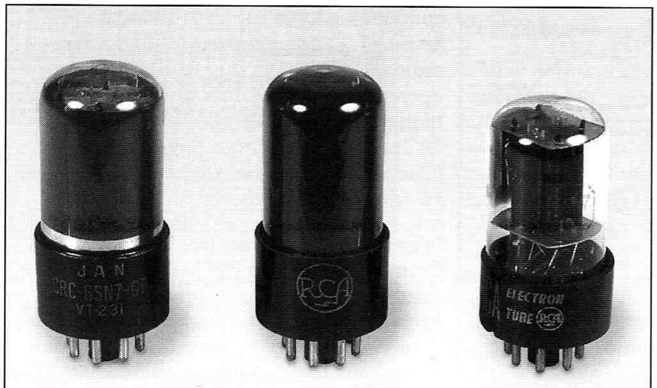
Standardization arrived with RCA's UY-227 (1927). Its design, and its five-pin base, became industry norms. The 227 was the father of all subsequent medium-gain triodes. Although used only as detector/audio preamp stages at first, it became critical to the development of television, radar, computers and a wide range of other electronic applications. A problem with RCA's ceramic cathode was an electrochemical reaction with the tungsten heater. The 2.5V early heater standard was a fix, but heavy heater current was a disadvantage. Of all the 27s around in the late 1920s, the Arcturus was thought



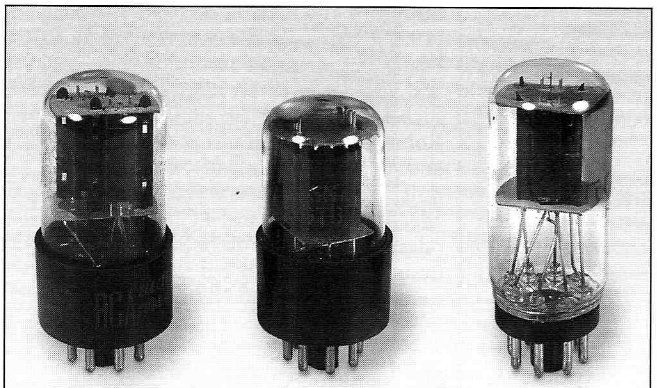
Types: 227, 56, 76 and 6J5G



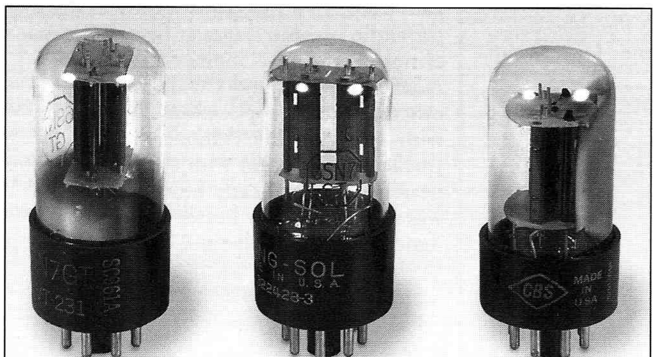
Types: 6C8G and 6F8G



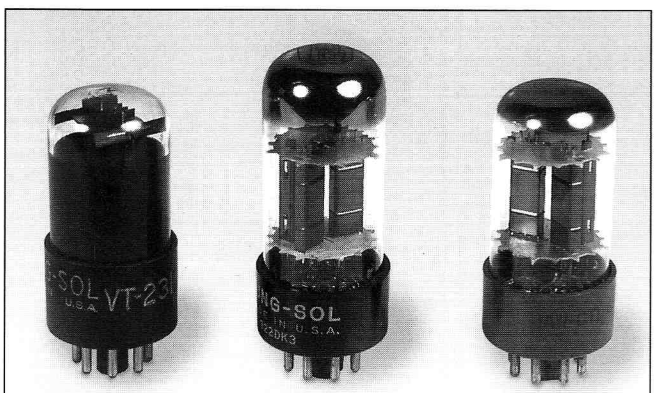
RCA 6SN7GT/VT-231 (1940s), 6SN7GT (1940s), 6SN7GTB (1960s)



RCA 6SN7GTA(1960), GE 6SN7GTB (1960s), RCA 6SN7GTB (1975)



KenRad 6SN7GT (1940s), Tung-Sol 6SN7GT (1950s), CBS 6SN7GTB (1950s)



Tung-Sol VT-231 (1945s), 6SN7GTB (1950s), 6SN7WGTB (1960s)

to be the best for quick heating and low hum.

The UY-227 led to the 27 and 37 (1932), which led to the 56 and the 76 (both 1932). The first such tube to use a 6.3V heater, the National Union NY67 (1931), did not enjoy as much success as the later type 76 did. The 6.3V figure was chosen to work off the extant automotive batteries (a typical lead-acid cell produces 2.1 volts when fully charged, and car batteries of the day had three cells). It became the most popular standard for parallel heater connections, even in radios not used in a car. To this day, "filament" transformers are made with secondaries in multiples of the same 6.3v figure--even though they usually run solid-state electronics nowadays, and not tube heaters.

The 56 and 76 were slowly pushed aside by the new-fangled octal base. It allowed many more connections to more complex tubes, setting the stage for multiple triodes and the like. RCA's 6C5 (1935) was the first octal triode. Early metal 6C5s were apparently just triode-connected 6J7 pentodes. Tung-Sol introduced the similar 6P5G (1936) as a competitor. Tungsram in Europe made a 6C5G with a true triode assembly a little later. Neither one was especially popular, since high-gain tetrodes and pentodes were much more useful in stages of a receiver other than the audio detector.

RCA's 6J5 (1937) enjoyed much more popularity, pushing aside the 6C5 in consumer equipment. It was also used in military equipment from World War II until the 1980s.

Shortly thereafter came the first medium-mu DUAL triode for small-signal use: RCA's 6F8G (late 1937). It had the grid of one triode connected to a top cap, apparently because radio engineers wanted to keep the detector stage's grid as far away from the AC heater power as possible. A similar type, with higher mu, was the RCA 6C8G (1937). Although the 6C8G was used in the first electronic computer, ABC, (see VTV #7 pp 28-30) these first octal duals were not big successes in other areas.

A peculiar development of 1938 was the National Union 6AE6. It contained two very different triodes, one having a variable-mu grid. It was designed to drive the 6AD6 eye tube directly in a radio circuit. Variable-mu tubes are unsuitable for high-fidelity use because of their high distortion.

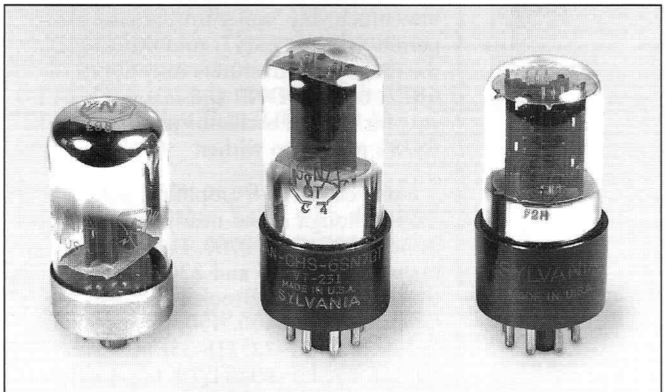
There were dual triodes long before the 6F8G. These were usually special power triodes of one type or another. One major line, which died out after WWII, was the Class-B push-pull dual triode family. It started with the 19 (1933) and went through many variations to the 6N7 (1936). Also predating the 6F8G were the many duals which had a driver triode and an output triode in the same envelope. Usually they were intended for direct coupling, with the power triode being designed for zero-bias operation. This included the Speed Triple-Twin and the 6AC6. We will go into high-mu triodes such as the 6SL7 in a future article; they came later than medium-mu types.

The 6F8G's child enjoys massive success, and is still being manufactured and used in new designs at the end of the millennium. RCA's 6SN7GT (introduced late 1939, officially registered with RMA 1941) was the right package at the right time. The grid cap was eliminated, as radio engineers realized that it was not really needed. It and the cognate 12SN7GT saw wide use in military equipment during the war.

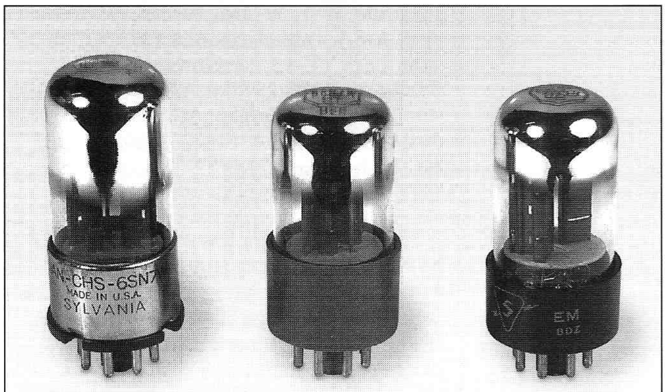
6SN7GT Ratings Escalation

Type	Vpmax	Diss (per triode)
GT (1939)	250v	2.5w
GTA (1948)	450v	5.0w
*GTB (1952)	450v	5.0w

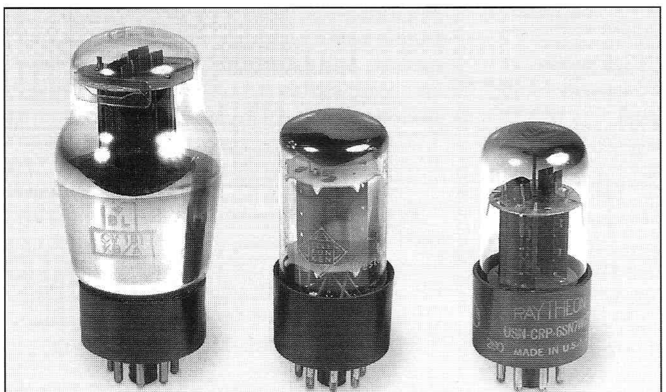
*(controlled warmup version)



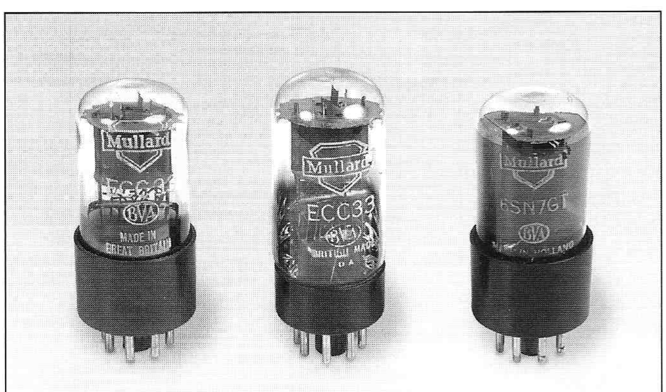
Sylvania 7N7 (1940s), 6SN7GT (1940s), 6SN7GT (1940s)



Sylvania 6SN7W (1942), 6SN7WGT (1950s), 6SN7GTB (1950s)



Mullard CV-181, Telefunken 6SN7GT, Raytheon 6SN7WGT(1950s)



Mullard ECC33 (1940s), ECC33 (1950s), 6SN7GT (1960s)

Special versions of the 12SN7GT were made for low-plate-voltage operation in battery and aircraft radios. These were often run from 26 volts, which was available from aircraft magnetos. To save the bother and maintenance headaches of using a dynamotor or vibrator to boost the voltage, many low-voltage tubes appeared. Aside from RF pentodes and beam-power types, this series included the Tung-Sol 6AH7GT and 12AH7GT (1941) and, after the war, RCA's 12SX7GT (1946).

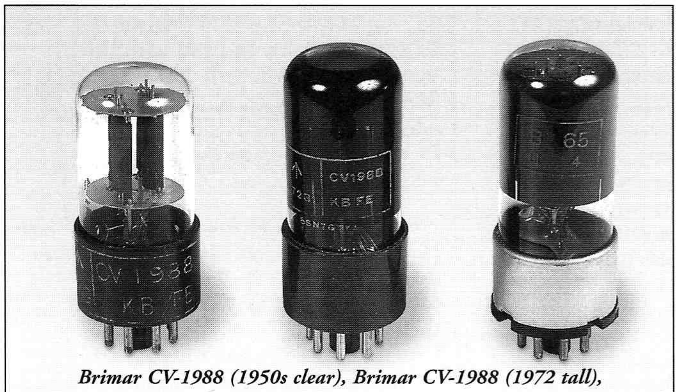
Sylvania was a determined competitor to RCA, and pushed their Loktal types hard. Even so, Loktals did not become standards to the same extent as the octal tubes. One of the first Loktals was the 7A4 (1939). Like many other Loktals, it was a blatant copy of a pre-existing octal tube (6J5). The 6SN7 copy was the 7N7 (1940). Both appeared in 12-volt heater versions, as 14A4 and 14N7. The 7A4 and 14N7 were also available in special low-capacitance versions, XXL and XXD.

Mullard introduced the ECC30 series during WW2. The ECC31 came first, then the ECC32. The ECC31 is electrically the same as the ECC32, but has a common cathode. No ECC30 series are exactly equivalent to American 6SN7s, but there are some similarities. This includes the ECC33 (the μ is 35, not 20 like the 6SN7, however). The ECC32 (made by Mullard with the ST-shape) was used in early Lowther amplifiers, but otherwise, was an industrial triode, like the ECC31. The ECC32 and ECC35 were used by Pye and Leak, but no audio use of the ECC34 was known.

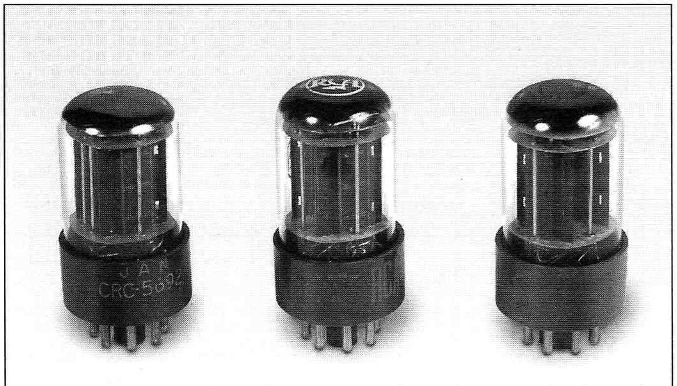
6SN7 variants included the British military CV181 and CV1988, plus the long-defunct MOV B65. There are a number of B65s branded by Osram or GEC, but they were all made by MOV if British. Note that the B65 has a unique structure and is not exactly a 6SN7. The CV181 appears to be the only member of the 6SN7 family to appear in an ST-shape envelope with a shoulder. 6SN7s were manufactured in Russia and China under the Russian designator 6N8S (looks like 6H8C, because it is in Cyrillic lettering). Manufacture of 6SN7s has been confirmed in Italy, France, Holland (by Philips), Australia, Germany, Japan, India, various countries in Eastern Europe, and even in South America. The original late 1940s British Williamson amplifiers used either an MOV L63 (6J5G) or the B65 as driver tubes.

After WWII, television and high fidelity came into the fore. Since low distortion was needed for both hi-fi and for the vertical oscillator circuits in TV sets, the 6SN7 saw some duty in both worlds. In fact, a 1958 article (see ref. 5 below) demonstrated that the 6SN7GTB was superior to the 12AU7 as a power tube driver in hi-fi amps. The 6CG7 (RCA 1954) was touted as a 9-pin equivalent of the 6SN7. It is notable in having an electrostatic shield separating the two sections. The later and more common 6FQ7 eliminated the shield, probably to cut costs. CBS-Hytron came out with the 12BH7 in 1950 as a higher transconductance 9-pin version of the 6SN7. Although eclipsed by the 6FQ7 later, this higher perveance version re-surfaced in the 1960s as a 6-volt version: the 6GU7, intended for color TV sets.

The only premium version of the 6SN7 to be made for critical applications in the USA is believed to be RCA's 5692 (1948), a member of the "Special Red" line. Intended for avionics and military applications, the 5692 was deliberately underrated to maximize its lifetime (provided the engineer stuck to the ratings). RCA may have developed this tube, yet it seems that GE actually manufactured it for them under contract. The distinctive red base is apparently unique to GE production. Many other firms (including Raytheon, CBS/Hytron, and Rogers in Canada) made their own 5692s, but always with



Brimar CV-1988 (1950s clear), Brimar CV-1988 (1972 tall), MOV B65 (1950s)



RCA JAN 5692 (1950s), RCA 5692 (1950s), CBS 5692 (1950s)

GE 6SN7 GTA/GTB Data Sheet (1954)

6SN7-GTB
6SN7-GTA
12SN7-GTA
ET-T899
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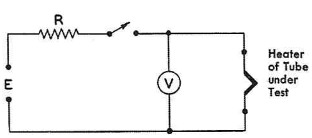
CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER, EACH SECTION

Plate Voltage	90	250	250	Volts
Grid Voltage	0	−12.5	−8	Volts
Amplification Factor	20	...	20	
Plate Resistance, approximate	6700	...	7700	Ohms
Transconductance	3000	...	2600	Micromhos
Plate Current	10	1.3	9.0	Milliamperes
Grid Voltage, approximate Ib=10 Microamperes	−7	...	−18	Volts

* Heater warm-up time is defined as the time required in the circuit shown at the right for the voltage across the heater terminals to increase from zero to the heater test voltage (V_1). For this type, E=25 volts (RMS or DC), V_1=5.0 volts (RMS or DC), and R=31.5 ohms.

† Without external shield.



‡ For operation in a 525-line, 30-frame television system as described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission. The duty cycle of the voltage pulse must not exceed 15 percent of one scanning cycle.

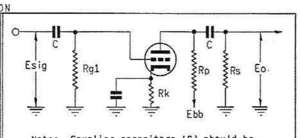
§ Value given is to be considered as an Absolute Maximum Rating. In this case, the combined effect of supply voltage variation, manufacturing variation including components in the equipment, and adjustment of equipment controls should not cause the rated value to be exceeded.

π In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube in the absence of excitation.

CLASS A RESISTANCE-COUPLED AMPLIFIER

EACH SECTION

Rp Meg.	Rs Meg.	Rg1 Meg.	Ebb = 90 Volts Rk	Gain	Eo	Ebb = 180 Volts Rk	Gain	Eo	Ebb = 300 Volts Rk	Gain	Eo
0.10	0.10	0.10	3900	10	10	3600	11	20	3500	11	30
0.10	0.24	0.10	5000	11	14	4700	12	27	4400	12	41
0.24	0.24	0.10	9400	11	13	8700	11	25	8700	12	38
0.24	0.51	0.10	11000	11	17	11000	12	32	11000	12	48
0.51	0.51	0.10	19000	11	15	18000	12	29	18000	12	43
0.51	1.0	0.10	24000	11	19	23000	12	37	23000	12	54
0.24	0.24	10	0	14	12	0	16	20	0	17	28
0.24	0.51	10	0	14	16	0	16	28	0	17	40
0.51	0.51	10	0	14	15	0	15	26	0	16	38
0.51	1.0	10	0	14	19	0	16	35	0	16	52



Note: Coupling capacitors (C) should be selected to give desired frequency response. Rk should be adequately by-passed.

Notes: 1. Eo is maximum RMS voltage output for five percent (5%) total harmonic distortion. 2. Gain measured at 2.0 volts RMS output. 3. For zero-bias data, generator impedance is negligible.

brown Micanol bases. The 5692 was made in Sweden by Standard Electric as the 33S30. This tube was not widely used (and NEVER in audio, until the 1980s), except in one major application. Read ***THE SAVAGE ART*** article in the next issue of VTV for more on this.

Ironic--the current worship accorded to this tube by audiophiles is mainly due to the use of its high-mu brother 5691 in the MFA Luminescence preamp in the 1980s, followed by a 1992 article about it in ***Sound Practices*** magazine. There was a small following for "Special Reds" in Japan before this, but no known Japanese equipment specified it.

A highly obscure company, Sheldon Electric Co. of Irvington NJ, introduced a premium 6SN7 for use in TV sets in the mid-1950s. Most TVs before 1955 used a 6SN7 as the vertical oscillator. So, Sheldon introduced the "Hi-Po 6S78" for such use, claiming all kinds of supernatural performance advantages for this tube (along with a few other versions of common TV tubes which they tried to market at the same time). Sheldon claimed in the 6S78's box insert that it would "Make Pictures Bigger, More Stable!" than a standard 6SN7 without offering a shred of proof. It is amazing how much this "super tube" looks like a period Sylvania 6SN7. And unfortunately, the major manufacturers introduced the 6BL7, 6BX7, 6DN7 and many other variants for vertical oscillator use, causing the 6S78's market to wither.

Some classic hi-fi amplifiers used the 6SN7, though it had nearly disappeared in new designs by 1960. Examples would include: Bell 2145 and 2200, Bogen D010 and H010, Brook 10C and 12A, Craftsmen C-2, 400, 450, C500, C500A, C550, Eico HF-22, HF-35, HF-50, HF-60, HF-87, HF-89, ST-70, Grommes 215BA, Goodell ATB-3 and NSA-20, Harvey Radio HR-15 Williamson Amp, Heathkit W-1, W-2M, W-3M, W-4AM, A-7, A-8A, Interelectronics Coronation 100, Leak TL-12, McGowan WA325, McIntosh 20W-2, Pilot AA-901 and AA-904, Sargeant Rayment SR-570, Scott 210A, 210B, 220A, Stancor Williamson kit, Tech Master TM15A Williamson kit, UTC W-10 and W-20 Williamson kits.

Not to mention a few early FM tuners by Sargent-Rayment and Browning. Please note that most of the above models were top-of-the-line for those companies in the 1946-1956 period. It should be obvious that there was a strong reason to use the 6SN7...possibly that it was the best tube for the best amplifiers. Perhaps the miniature tubes took over for economic reasons, not for reasons of superior quality. And quite often, the manufacturers went over to the 6SN7's miniature cousins, the very similar 6CG7 (RCA, 1949) or the somewhat different 12BH7 (GE, 1950).

Few guitar amps and music devices used 6SN7s. Gibson was fond of using "unusual" types. The Gibson BR-6, BR-6F, BR-9, early GA-40, GA-50T and the Clavioline and GA-46 accordion amp had 6SN7s. So did some Hammond organs and Leslie speakers.

The big exception here is the pre-1956 PA amplifier. Literally scores of models had 6SN7 drivers for the power tubes. Included are models by Altec (1570 family, 1520A, 1530A, and A256), Bell, Bogen, International Projector Corporation, Masco (frequent use of either 6SN7s or 7N7s), Operadio, Newcomb, Rauland, RCA, Stromberg-Carlson, and Thordarson. It is shocking to see how often the 6SN7 or the high-mu 6SL7 was seen in these "low-quality" equipments.

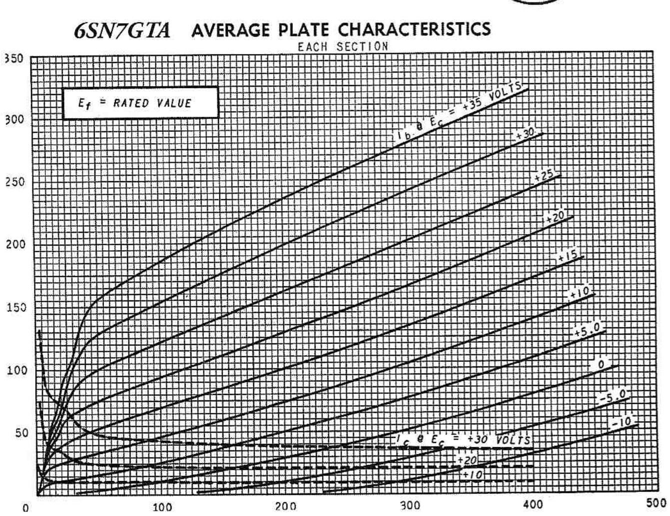
2. Tests

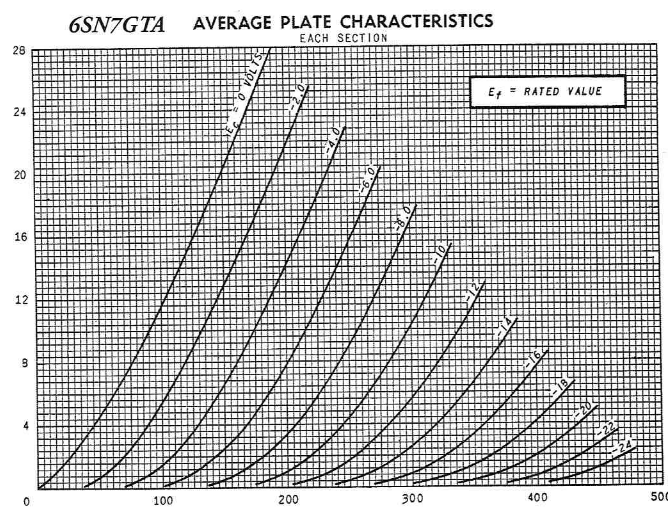
Table 1: distortion of medium-mu single and dual triodes.

*=good used tube. B+ was 250v regulated, frequency 1000 Hz. "Syl tri"=Sylvania triangle plate construction, "triode"=tested the triode in a triode-pentode. If the 3rd harmonic was less than 0.015%, it has been left blank.

Arranged in order of increasing second harmonic distortion. Tubes with the same distortion reading are not arranged in any particular order.

Type	Rp used	2nd	3rd
+76 Syl 40s*	37k	.002	
+5687 RCA 50s*	48k	.005	
6CG7 Syl 60s*	25k	.005	
+9002 KenRad 40s	48k	.005	
+76 RCA 40s	37k	.005	
12SX7 RCA 1955	37k	.005	
12SX7 RCA 1955	37k	.005	
+5687WB Syl 1983*	48k	.010	
+396A WE 60s	25k	.010	
6C5G TungSol 30s*	37k	.010	
76 Arcturus 40s	37k	.010	.017
+6GH8A tri Syl 80s	12k	.012	
5814A Syl 70s*	37k	.012	.015
6SN7WGTA Syl 82*	48k	.015	
6SN7WGTA Syl 78*	48k	.015	
+396A WE 60s	25k	.015	
+C-327 Cunn 20s	37k	.015	.017
+56 RCA 30s	37k	.015	
6CG7 JAN Syl 69*	25k	.015	
6SN7WGTA Syl 86*	48k	.020	
6SN7WGTA Syl 83*	48k	.020	
6SN7WGTA Syl 86*	48k	.020	
6SN7WGTA Syl 83*	48k	.020	
6SN7GTB Fuji 60s*	48k	.020	
6SN7GT CBS 54 clr*	48k	.020	
6SN7GTB GE 70s*	48k	.020	
B65 Genalex 1950s*	48k	.020	
6SN7W Syl 1940s*	48k	.020	
5692 RCA red*	48k	.020	





5692 CBS brwn 60s*	48k	.020	
5692 CBS brown 60s*	48k	.020	
6SN7GT GE 1945	48k	.020	
6SN7GT Syl 50s top*	48k	.020	
6SN7GT RCA 40s sd	48k	.020	
6SN7GTB West 1962	48k	.020	
+6J6 RCA 50s*	25k	.020	
6CG7 RCA 1959*	25k	.020	
+UY227 RCA 20s	37k	.020	.015
6SN7GTB Rayth 60s*	48k	.022	
6SN7GTA Tele 50s	48k	.022	
6S78 Sheldon 54?	48k	.022	
CV1988 Brimar 50s*	48k	.022	
CV1988 Brimar 50s	48k	.022	
CV1988 Brimar 50s	48k	.022	
5692 CBS brown 60s*	48k	.022	
+ECC33 Mul 60s blk base	48k	.022	
6SN7WGTA Syl tr 1986*	48k	.025	
6SN7GTA Tele 50s	48k	.025	
6SN7GTA Raytheon 50s*	48k	.025	
6SN7GT KenRad 40s	48k	.025	
5963 RCA 50s	25k	.025	.035
5814A JAN Syl 70s*	37k	.025	.025
+27 Philco/Syl 20s	37k	.025	
6J5GT TungSol 40s	48k	.025	
+ECC33 Mull 50s brn	48k	.025	
+ECC33 Mull 50s brn	48k	.025	
6SN7GTB GE 70s*	48k	.027	
6SN7GTB GE 66*	48k	.027	
6SN7GTB GE 58*	48k	.027	
+6BQ7A GE 70s	25k	.027	
6CG7 RCA 60s*	25k	.030	
6SN7GT Tung 50s	48k	.030	
6SN7GTB RCA 60s	48k	.030	
6J5G GE 30s*	48k	.032	
6SN7/6N8S Russ 90s	48k	.032	
6SN7WGTA Syl 80*	48k	.035	
+5687 RCA 50s*	48k	.035	
CV181 Mullard 52 ST	48k	.035	
CV181 Mullard 52 ST	48k	.035	
+6BQ7A Syl 60s	25k	.035	.015
5814A GE 5-Star 68	37k	.035	.035
5687WB GE 1965*	48k	.037	
+417A WE 60s	12k	.037	
6CG7 RCA clear 60s	25k	.037	
+5687 RCA 50s*	48k	.040	
+6BF7W Jan Syl 1964	37k	.042	.015
6SN7/6N8S Russ 90s	48k	.042	
+7199 triode GE 70s	37k	.045	.030
+5687WB JAN Syl 85*	48k	.055	
12BH7 Syl 60s*	48k	.055	

+= Tubes not related in characteristics to the 6SN7.

The results speak for themselves, but to summarize:

1) Old-stock 6SN7s were remarkably consistent from sample to sample--so much so that this test was not especially helpful in discerning different 6SN7s from each other.

2) Similar miniature dual triodes were usually less consistent and often had higher distortion than 6SN7s.

3) The forgotten 12SX7GT is VERY interesting.

4) So are the old radio types 27, 56 and 76, as some DIYers have already discovered.

5) As might be expected, the Russian Kaluga 6SN7 is inferior to old-stock units.

One other item: the British versions tended to have a little more voltage gain than the American tubes. Otherwise, their measurements were not especially different. This may account for the "vast" improvement in sound quality claimed for these tubes. Whether they are worth the extra money is up to the consumer.

3. Outro

The 6SN7 has enjoyed almost 60 years of manufacture. Even so, it is used only in a few high-end preamps and power amps today. The world consumption is less than 10,000 pieces per year--not enough to justify low-cost mass production. The only remaining source, Voskhod Kaluga in Russia, recently closed its doors due to the poor economic situation there and the low demand for the tube elsewhere. If audiophiles want to save this classic high-linearity tube for the future, they should get busy and start creating a viable demand for it.

References

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5. "***Distortion In Audio Phase Inverter And Driver Systems***," W. B. Bernard, **IRE National Convention Record**, 1958, Part 7, P. 87.

Many thanks to Phil Taylor in England, Charlie, John Atwood and John Eckland for fact-checking and other information.

Listening to 6SN7s

By Charles Kittleson and Eric Barbour

There are literally hundreds of 6SN7 types, both domestic and foreign. For this listening test we auditioned several common US types and a few British types that were made available to us for this test by tube dealer Kevin Deal of Upscale Audio.

Our listening panel consisted of: Eric Barbour, Steve Parr, Dave Wolze and myself. It was conducted in the VTV listening studio with the following equipment: VTV Octal Line Stage, Pilot SA232 basic EL84 stereo amp (rebuilt), B&W DM110 speakers, Sony CD player and Monster Cable speaker wire.

As with the previous issue of VTV (#10), we are using a number to rate the tubes in this evaluation. Tubes rated in the 90s are musical and sound excellent, tubes in the 80s are very good, but have minor deficiencies, tubes in the 70s are only acceptable and anything below that is poor. Note that tubes from different batches and different years of manufacture can sound different even though they come from the same manufacturer and have the same structural design. This is due to material and quality issues. We have found that tubes made in the 1980s and 1990s are more primitive sounding than those made in the 1940s through 1960s.

Listening Results

Brimar CV1988 (brown base 1950s). Similar to the B65, but brighter and more detailed sounding. Rating 93

Brimar CV1988 (brown base 1972). An excellent sound stage with a very satisfying and musical presentation. Bass was not as tight as others, but still a top-rated tube. Rating 92

CBS 5692 (brown base 1959). This one had about average detail, but better bass than the RCA 5692s. Gain was a little low, but it was fast sounding with very sweet mids. Rating 92

GE 6SN7GTA (1953). A tube with nice imaging and a romantic, satisfying sound. In addition, it had powerful bass and detailed, accurate mids. Rating 94

GE 6SN7GTB (1960s). This tube was slightly more distorted that the GE 6SN7GTAs. It was less detailed and had thinner mids. However, the highs were not quite right and seemed somewhat congested. Rating 84

GE 6SN7GTB wafer base (1970s labeled RCA). The worst sounding 6SN7 we listened to in this test. Noisy as hell, sibilant and distorted with harsh highs. To add insult to injury, it was very microphonic. Rating 60.

MOV B65 (aluminum base 1950s). A tube with excellent mids and great detail. Very clean sounding with above-average bass and highs. Rating 90

Mullard CV181 (ST shaped 1952). This is a very well-balanced tube. Great detail and very romantic with zero harshness. It also had very deep bass. An exceptional tube. Rating 97

Mullard ECC33 (1955 thin brown base with very small plates). Slightly more gain than other Mullard types. This one is very detailed and fast with smooth response. Bass is flat and weak, which may appeal to some audiophiles. Rating 86

Mullard ECC33 (brown base 1957). Very prominent, but distorted bass, slightly bright with thin highs. Rating 84

Mullard ECC33 (smoked glass 1960s). A tube with somewhat less gain. Highs are a bit blunted, but midrange was warm. Rating 84

RCA 5692 (red base 1950s). This tube had low gain and somewhat weak mids. Detail was very good, bass was fat but indistinct. Transients were excellent. Rating 92

RCA 6SN7GTB (staggered black plates 1950s). A very romantic sounding bottle with somewhat distorted and fat mids. Highs were weak and recessed. This one might be a choice for listeners with sensitive horn speakers. Rating 85

Philips 6SN7WGTB (tri-plate 1986). This tube sounded slightly bright with good, but not 3D mids. Detail was good and bass response was tight. Last of the US made 6SN7s from the old Sylvania plant in Emporium, Pennsylvania. These are still available from many NOS dealers. Rating 87

Raytheon 6SN7WGT (brown base 1950s). A very musical tube with excellent detail, huge bass, mids were very revealing. This bottle was well-balanced and very fast. Consider this one a top performer. Rating 96

Sovtek 6SN7GT (1990s Russian**).** A bland and primitive sounding tube. Not very musically involving and nothing special. Used by tube amp OEMs due to its cheap price and ready availability. Rating 70

Sylvania 6SN7W (metal base ring, top getter early 1940s). An early type with a very smooth, well balanced sound. Presentation was clean, but there was less gain than others. Fantastic detail, very tight/clean bass with superb accuracy. Rating 97

Sylvania VT-231 (bottom getter WWII era 6SN7). A well-balanced sound with good imaging and forward mids. Presentation was very smooth and musical, but bass was a little weak. Rating 95

Sylvania 6SN7GT (top getter, black base early tri-plate 1950s). A musical and easy-to-listen to tube with sweet detailed highs. Bass was very good and imaging was excellent. Rating 95

Sylvania 6SN7WGT (brown base with green lettering, top getter early 1950s.) Very clean, dry and "military" sound. Sibilant highs with humped bass. However, it was extremely detailed and fast. Rating 89

Tung-Sol VT-231 (very early, round black plates, smoked bottle 1945). This tube had lower gain, was sibilant, but was very detailed and had excellent highs. Rating 92

Tung-Sol 6SN7GT (round mica side spacers 1940s). A tube with nice detail and musical mids. Bass and imaging were well above average. Rating 90

Conclusion

Without a doubt, the best sounding, most musical tubes in this test were the Sylvania 6SN7W (metal base 1940s) and the Brimar CV181 (ST shape 1950s). These tubes were exceptional performers in our listening setup. Unfortunately, they are very rare and can be expensive. A more readily available alternative would be either the GE 6SN7GTA (1950s) or the early Sylvania 6SN7GT (1950s). Later Sylvania 6SN7WGTs were not as "magical" sounding as their earlier versions. Another great sounding tube is the Raytheon 6SN7WGTA (1950s vintage).