



ELECTRONIC TUBE REFERENCE

12GN7A

Voltage - Pentode Sharp Cutoff (single) electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION
CONSTRUCTION
PENTODE

Frame-grid sharp-cutoff pentode designed for video-amplifier service in color and black-and-white television receivers. Its high transconductance and wideband response suit demanding television video stages.

GENERAL CHARACTERISTICS

BASE DESIGNATION	9BF	BASE PINS	9
NOMINAL HEATER	12.6 V / 300 mA	PARALLEL HEATER	6.3 V / 600 mA
HEATING	Indirect	SERIES OPERATION	Capable
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

9BF - TERMINAL PINOUT

TERMINAL	SECTION	ELEMENT	STATUS
PIN1 – K	A	K – Cathode	CONNECTED
PIN2 – G1	A	G1 – Control Grid	CONNECTED
PIN3 – G3	A	G3 – Suppressor Grid	CONNECTED
PIN4 – H	–	H – Heater	CONNECTED
PIN5 – H	–	H – Heater	CONNECTED
PIN6 – HCT	–	HCT – Heater Center Tap	CONNECTED
PIN7 – P	A	P – Plate (Anode)	CONNECTED
PIN8 – G2	A	G2 – Screen Grid	CONNECTED
PIN9 – G3	A	G3 – Suppressor Grid	CONNECTED

SECTION RATINGS

SECTION1 Pentode	
PLATE RESISTANCE	50000 Ω
TRANSCONDUCTANCE	0.036 S
MAXIMUM PLATE VOLTAGE	400 V
MAXIMUM SCREEN VOLTAGE	330 V
MAXIMUM PLATE DISSIPATION	11.5 W
MAXIMUM SCREEN DISSIPATION	1.5 W
Approved individual PDF contains only the entry heading/heater data and/or a reference to another type for ratings; no external electrical values were imported.	

12GN7A — Sharp-Cutoff Frame-Grid Pentode

Overview

The **12GN7A** (also designated as **12GN7-A** or in combination as **12HG7/12GN7A**) is a high-performance, sharp-cutoff miniature pentode featuring frame-grid construction. It is designed primarily for use as a video amplifier in both color and black-and-white television receivers. The frame-grid design allows for exceptionally high transconductance and favorable plate current characteristics, making it highly effective in wideband amplification applications.

The tube is housed in a standard miniature glass envelope and utilizes a 9-pin base. It is closely related to the **12HG7**, and in many applications, the two designations are treated as interchangeable or consolidated into a single dual-marked type. However, while the standard 12GN7A is a miniature type requiring a 9-pin miniature socket, certain variants or replacements are produced in neonval envelopes requiring a 9-contact neonval socket.

Heater and Cathode Configurations

The 12GN7A features a coated unipotential cathode and a versatile heater design consisting of two separate internal sections. These sections can be wired in either series or parallel configurations to accommodate different television receiver power supply designs, such as series-string or parallel-connected heater circuits.

Depending on the connection method, the nominal heater ratings are as follows:

- **Parallel Connection:** The two internal heater sections are connected in parallel, requiring a nominal heater voltage of **6.3 V** and drawing a nominal heater current of **0.6 A** (with some specifications listing **0.52 A**).
- **Series Connection:** The two internal heater sections are connected in series, requiring a nominal heater voltage of **12.6 V** and drawing a nominal heater current of **0.3 A** (with some specifications listing **0.26 A**).

The average heater warm-up time is **11 seconds** (specifically documented for the 6.3 V, 0.6 A operating condition).

To ensure reliable operation and prevent insulation breakdown, the voltage between the heater and the cathode must be kept within strict limits:

- **Heater Negative with Respect to Cathode:** A maximum of **200 V** (total DC and peak).
- **Heater Positive with Respect to Cathode:** A maximum of **100 V DC**, or a maximum of **200 V** (total DC and peak).

Physical Construction and Pinout

The standard 12GN7A is constructed in a **T-6 1/2** glass envelope with an **E9-1** small button 9-pin base, conforming to the **EIA 6-3** outline. It can be mounted and operated in **any position**. The physical dimensions of the standard miniature envelope are:

- **Maximum Diameter:** 0.875 inches
- **Maximum Overall Length:** 2.625 inches
- **Maximum Seated Height:** 2.375 inches

The tube utilizes the **9BF** basing arrangement, which provides the following pin connections (viewed from the bottom of the tube):

- **Pin 1:** Cathode
- **Pin 2:** Grid Number 1 (Control Grid)
- **Pin 3:** Grid Number 3 (Suppressor Grid) and Internal Shield
- **Pin 4:** Heater
- **Pin 5:** Heater
- **Pin 6:** Heater Center Tap
- **Pin 7:** Plate
- **Pin 8:** Grid Number 2 (Screen Grid)
- **Pin 9:** Grid Number 3 (Suppressor Grid) and Internal Shield

The inclusion of a heater center tap on Pin 6 is what enables the selection between series and parallel heater operation. Additionally, the suppressor grid (Grid Number 3) is internally tied to an internal shield and is accessible on both Pin 3 and Pin 9 to facilitate effective RF/HF grounding and minimize feedback.

A physical variant of the [12HG7/12GN7A](#) exists in a **neonoval** envelope (outline **10C**), which requires a 9-contact neonoval socket instead of the standard miniature 9-pin socket.

Electrical Ratings and Design-Maximum Limits

The maximum ratings of the 12GN7A are established under the **Design-Maximum Rating System**. These limits represent the absolute boundaries of safe operation and must not be exceeded under the worst-case operating conditions of supply voltage variation, component tolerances, or signal excitation.

Parameter	Design-Maximum Value
Maximum Plate Voltage	400 V
Maximum Grid Number 2 (Screen-Grid) Supply Voltage	330 V
Maximum Grid Number 2 Voltage	See Screen Rating Chart
Maximum Positive DC Grid Number 1 Voltage	0 V
Maximum Plate Dissipation	11.5 W
Maximum Grid Number 2 Dissipation (for voltages up to 165 V)	1.5 W
Maximum Grid Number 2 Dissipation (for voltages 165 V to 330 V)	Restricted by Screen Rating Chart
Maximum Grid Number 1 Circuit Resistance	0.25 M Ω

Grid-to-Cathode Spacing Warning

Due to the frame-grid construction, the physical spacing between the control grid (Grid Number 1) and the cathode is extremely small. Consequently, designers and technicians must exercise extreme caution during testing. To prevent catastrophic internal arcing or physical damage to the grid structure, the voltage between Grid Number 1 and the cathode must never exceed **50 V DC** or **50 V peak AC** in commercial tube checkers or shorts-indicating devices. This precaution is especially critical when the tube is subjected to mechanical vibration or excitation.

Typical Operating Characteristics and Knee Values

Under typical Class A1 amplifier conditions, the 12GN7A exhibits exceptionally high transconductance, which is characteristic of frame-grid pentodes. The typical operating parameters are:

- **Plate Supply Voltage:** 250 V
- **Grid Number 2 Supply Voltage:** 150 V
- **Grid Number 1 Voltage:** 0 V
- **Cathode Bias Resistor:** 56 Ω
- **Approximate Plate Resistance:** 50,000 Ω (0.05 M Ω)
- **Transconductance:** 36,000 μ mhos
- **Plate Current:** 28 mA
- **Grid Number 2 Current:** 6.5 mA
- **Grid Number 1 Voltage (Approximate for $I_b = 100 \mu$ A):** -5.7 V

Instantaneous Plate Knee Characteristics

To characterize the tube's performance at the "knee" of the plate curves where plate voltage is low, instantaneous measurements are performed. Because operating the tube continuously at these high-current, low-voltage points would exceed the maximum dissipation ratings, these characteristics are measured using a recurrent waveform applied for a very short interval (**2 seconds maximum**):

- **Plate Voltage:** 50 V
- **Grid Number 2 Voltage:** 125 V
- **Grid Number 1 Voltage:** 0 V
- **Plate Current:** 70 mA
- **Grid Number 2 Current:** 24 mA

Interelectrode Capacitances

The direct interelectrode capacitances of the 12GN7A are measured without an external shield (unshielded). The approximate values are:

- **Grid Number 1 to Plate (g1 to p):** 0.12 pF
- **Input (g1 to h + k + g2 + g3 + i.s.):** 17.5 pF
- **Output (p to h + k + g2 + g3 + i.s.):** 4.0 pF

The low grid-to-plate capacitance (0.12 pF) combined with high input capacitance (17.5 pF) is highly beneficial for stable, high-gain video amplification, minimizing Miller effect feedback from the plate back to the input grid.

Characteristic Curves and Screen Dissipation

The published curves for the 12GN7A provide critical insights into its dynamic behavior:

- **Screen Rating Chart:** This chart defines the boundaries of permissible screen grid operation. For screen voltages up to 165 V, the maximum screen dissipation is flat at 1.5 W. For screen voltages between 165 V and 330 V, the maximum allowable dissipation decreases linearly, reaching 0 W at 330 V. Operating points must always fall within this shaded area of permissible operation.
- **Average Plate Characteristics:** The plate current curves plotted against plate voltage show a very sharp transition (knee) at low plate voltages (around 40–50 V). Above this knee, the curves are nearly horizontal, indicating a high plate resistance (approximately 50,000 Ω). At a control grid voltage of 0 V and a screen voltage of 150 V, the plate current exceeds 120 mA, while the screen current remains low.
- **Average Transfer Characteristics:** These curves plot plate current, screen current, and transconductance against Grid Number 1 voltage for a plate voltage of 250 V across various screen voltages (from 50 V to 175 V). The transconductance curves show that transconductance peaks sharply near a control grid voltage of 0 V, reaching the nominal 36,000 μmhos at a screen voltage of 150 V. As the control grid bias becomes more negative, the transconductance drops rapidly, illustrating the sharp-cutoff nature of the tube.

Technical Summary

The **12GN7A** is a highly specialized, miniature sharp-cutoff frame-grid pentode designed for demanding video amplifier service in television receivers. Featuring a versatile heater that can be configured for **6.3 V / 0.6 A** parallel or **12.6 V / 0.3 A** series operation, it provides exceptional transconductance of **36,000 μ mhos** and a plate dissipation rating of **11.5 W**. Its frame-grid construction delivers high gain-bandwidth performance but requires strict adherence to a **50 V** grid-to-cathode voltage limit during testing. Whether housed in a standard T-6 1/2 miniature envelope or a neonoval variant, the 12GN7A remains a classic example of late-era receiving tube design optimized for wideband voltage amplification.



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1968 General Electric Co

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1968 GENERAL ELECTRIC CO

Section 1 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Current	28 mA	AverageCharacteristics
Screen Current	6.5 mA	AverageCharacteristics

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