



## ELECTRONIC TUBE REFERENCE

# 12EQ7

Voltage - Radio Detector Converter electronic tube

CONSOLIDATED TECHNICAL DATA

**3 SECTIONS**

CONSTRUCTION

**DIODE-DIODE-PENTODE**

Double-diode pentode combining detector functions with a comparatively strong voltage-amplifier pentode. The paired diodes provide signal or control-voltage rectification while the pentode supplies subsequent receiver gain.

## GENERAL CHARACTERISTICS

|                     |                 |                      |               |
|---------------------|-----------------|----------------------|---------------|
| BASE DESIGNATION    | J               | BASE PINS            | 7             |
| NOMINAL HEATER      | 12.6 V / 150 mA | PARALLEL HEATER      | – / –         |
| HEATING             | Indirect        | SERIES OPERATION     | Not specified |
| CATHODE ARRANGEMENT | Common cathode  | SECTION CONSTRUCTION | Dissimilar    |

## SECTION RATINGS

|                                                                                                    |                 |
|----------------------------------------------------------------------------------------------------|-----------------|
| <b>SECTION1</b> Pentode                                                                            |                 |
| PLATE RESISTANCE                                                                                   | 250000 $\Omega$ |
| TRANSCONDUCTANCE                                                                                   | 0.0038 S        |
| AMPLIFICATION FACTOR                                                                               | 70              |
| MAXIMUM PLATE VOLTAGE                                                                              | 300 V           |
| MAXIMUM PLATE DISSIPATION                                                                          | 3 W             |
| <i>Remote-cutoff pentode section; published ratings/characteristics promoted where applicable.</i> |                 |

|                                                                                                 |      |
|-------------------------------------------------------------------------------------------------|------|
| <b>SECTION2</b> Diode                                                                           |      |
| NOMINAL OUTPUT CURRENT                                                                          | 1 mA |
| <i>Detector/AVC diode section; published ratings/characteristics promoted where applicable.</i> |      |

No fixed ratings recorded.

# 12EQ7 — Diode-Remote-Cutoff Pentode

The **12EQ7** is a multi-unit miniature vacuum tube containing a diode and a remote-cutoff pentode sharing a common unipotential cathode. Housed in a 9-pin miniature envelope, this device is specifically engineered for service in AM and AM/FM broadcast receivers. Its primary applications include functioning as a combined intermediate-frequency (IF) amplifier and AM detector. The pentode section is also highly suitable for radio-frequency (RF) or IF amplification, while the diode section is designed for detection or automatic volume control (AVC) duties.

## Physical Construction and Basing

The 12EQ7 is constructed using a T-6 1/2 glass bulb with a small button 9-pin noval base (designated JEDEC E9-1). The tube conforms to the JEDEC 6-3 outline drawing and utilizes the JEDEC 9LQ basing diagram. It is designed to operate in any mounting position.

The physical dimensions of the tube are as follows:

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

The 9LQ basing configuration provides the following pin connections, viewed from the bottom of the tube:

- **Pin 1:** Grid No. 3 (G3 / Suppressor Grid)
- **Pin 2:** Grid No. 1 (G1 / Control Grid)
- **Pin 3:** Cathode (K)
- **Pin 4:** Heater (H)
- **Pin 5:** Heater (H)
- **Pin 6:** Grid No. 2 (G2 / Screen Grid)
- **Pin 7:** Pentode Plate (1P)
- **Pin 8:** Diode Plate (2P)
- **Pin 9:** Internal Shield (IS)

## Heater Characteristics and Ratings

The 12EQ7 features an indirectly heated, coated unipotential cathode. The heater is designed for series or parallel operation with the following electrical specifications:

| Heater Parameter       | Value  |
|------------------------|--------|
| Nominal Heater Voltage | 12.6 V |

| Heater Parameter                | Value            |
|---------------------------------|------------------|
| Nominal Heater Current          | 150 mA (0.15 A)  |
| Heater Voltage Operating Limits | 12.6 $\pm$ 1.3 V |

## Maximum Heater-Cathode Ratings

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

- **Heater Negative with Respect to Cathode:** 200 V (Peak or Total DC and Peak)
- **Heater Positive with Respect to Cathode:** 200 V (Peak or Total DC and Peak), with the DC component restricted to a maximum of 100 V.

## Direct Interelectrode Capacitances

The direct interelectrode capacitances of the 12EQ7 are measured without an external shield. These values define the capacitive coupling between elements, which is critical for stable high-frequency RF and IF amplification:

| Capacitance Parameter                                                              | Value     |
|------------------------------------------------------------------------------------|-----------|
| Grid No. 1 to Plate (Max.)                                                         | 0.002 pF  |
| Input (Grid No. 1 to Cathode, Heater, Grid No. 2, Grid No. 3, and Internal Shield) | 5.5 pF    |
| Output (Plate to Cathode, Heater, Grid No. 2, Grid No. 3, and Internal Shield)     | 5.0 pF    |
| Grid No. 1 to Diode Plate (Max.)                                                   | 0.0015 pF |
| Pentode Plate to Diode Plate (Max.)                                                | 0.095 pF  |

## Maximum Ratings

The maximum ratings for the 12EQ7 are established under the Design-Maximum System. Operating the tube beyond these limits may impair performance or shorten its operating life.

### Pentode Unit (Class A1 Amplifier)

- **Plate Voltage:** 300 V
- **Grid No. 3 (Suppressor Grid) Voltage (Positive or Negative):** 300 V
- **Grid No. 2 (Screen Grid) Supply Voltage:** 300 V
- **Grid No. 2 Voltage:** See Rating Chart (dependent on operating conditions)
- **Grid No. 1 (Control Grid) Positive Bias Value:** 0 V

- **Grid No. 1 (Control Grid) Negative Bias Value:** 50 V
- **Plate Dissipation:** 3.0 Watts
- **Grid No. 3 Input:** 0.2 Watt
- **Grid No. 2 Input (for Grid No. 2 voltages up to 150 V):** 0.6 Watt
- **Grid No. 2 Input (for Grid No. 2 voltages between 150 V and 300 V):** See Rating Chart
- **Bulb Temperature (at hottest point on bulb surface):** 150 °C

## Diode Unit

- **Plate Current:** 1.0 mA (Design-Maximum continuous value; Sylvania lists a maximum rating of 3.0 mA)

## Typical Operating Characteristics

The typical operating parameters of the pentode unit under Class A1 amplifier conditions demonstrate its performance as a high-gain, remote-cutoff stage:

| Parameter                                                     | Value                          |
|---------------------------------------------------------------|--------------------------------|
| Plate Voltage                                                 | 100 V                          |
| Grid No. 3                                                    | Connected to cathode at socket |
| Internal Shield                                               | Connected to cathode at socket |
| Grid No. 2 Voltage                                            | 100 V                          |
| Grid No. 1 Supply Voltage                                     | 0 V                            |
| Grid No. 1 Resistor (Bypassed)                                | 2.2 MΩ                         |
| Transconductance                                              | 3800 μmhos                     |
| Plate Resistance (Approx.)                                    | 0.25 MΩ (250,000 Ω)            |
| Plate Current                                                 | 9.0 mA                         |
| Grid No. 2 Current                                            | 3.5 mA                         |
| Grid No. 1 Voltage (Approx.) for Transconductance of 40 μmhos | -20 V                          |

The remote-cutoff characteristic of the control grid is illustrated by the bias voltage required to reduce the transconductance. A negative bias of approximately -20 V reduces the transconductance from its nominal 3800 μmhos down to 40 μmhos, allowing effective automatic volume control (AVC) without introducing severe distortion on strong signals.

## Diode Unit Characteristics

The diode unit is characterized by its instantaneous voltage drop under typical detection or AVC conditions:

- **Tube Voltage Drop (for plate current of 2.0 mA):** 10 V
- **Average Diode Current (with 10 V DC applied):** 2.0 mA

## Related Designations

The 12EQ7 belongs to a family of identical multi-unit tubes designed with different heater configurations to accommodate various receiver power supply topologies:

- **6EQ7:** Identical to the 12EQ7 except for its heater ratings, which require a 6.3 V supply at a current of 300 mA (0.3 A).
- **20EQ7:** Identical to the 12EQ7 except for its heater ratings, which require a 20 V supply at a current of 100 mA (0.1 A).

These tubes share the same physical dimensions, 9LQ basing diagram, capacitances, and electrical characteristics for both the pentode and diode units, but they are not directly interchangeable without modifying the heater supply circuit.

## Technical Summary

The **12EQ7** is a versatile, 9-pin miniature **diode-remote-cutoff pentode** designed for AM and AM/FM broadcast receiver applications. Combining an IF/RF amplifier pentode and a detection/AVC diode in a single T-6 1/2 envelope, it optimizes space and component count in consumer electronics. With a **12.6 V, 150 mA** heater, the tube is well-suited for series-string heater arrangements. The pentode unit provides a transconductance of **3800  $\mu\text{mhos}$**  and a plate resistance of **0.25 M $\Omega$**  at a typical plate and screen potential of 100 V, while its remote-cutoff grid design allows for smooth gain control over a wide range of signal strengths.

## SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

# 1961 Tung Sol

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

## 1961 TUNG SOL

## Section 1 · Pentode

| OTHER          |                 |                              |
|----------------|-----------------|------------------------------|
| PARAMETER      | PUBLISHED VALUE | CONDITION / NOTE             |
| Heater voltage | 12.6 V          | Nominal                      |
| Heater current | 150 mA          | Nominal                      |
| Plate voltage  | 200 V           | Typical operating conditions |
| Screen voltage | 100 V           | Typical operating conditions |
| Plate current  | 1 mA            | Typical operating conditions |

## 1961 TUNG SOL

## Section 2 · Diode

| OTHER          |                 |                              |
|----------------|-----------------|------------------------------|
| PARAMETER      | PUBLISHED VALUE | CONDITION / NOTE             |
| Heater voltage | 12.6 V          | Nominal                      |
| Heater current | 150 mA          | Nominal                      |
| Plate voltage  | 200 V           | Typical operating conditions |
| Screen voltage | 100 V           | Typical operating conditions |
| Plate current  | 1 mA            | Typical operating conditions |

## 1961 TUNG SOL

## Section 3 · Diode

| OTHER          |                 |                              |
|----------------|-----------------|------------------------------|
| PARAMETER      | PUBLISHED VALUE | CONDITION / NOTE             |
| Heater voltage | 12.6 V          | Nominal                      |
| Heater current | 150 mA          | Nominal                      |
| Plate voltage  | 200 V           | Typical operating conditions |
| Screen voltage | 100 V           | Typical operating conditions |
|                |                 |                              |

| PARAMETER     | PUBLISHED VALUE | CONDITION / NOTE             |
|---------------|-----------------|------------------------------|
| Plate current | 1 mA            | Typical operating conditions |



SOURCE DATA APPENDIX

## SOURCE OPERATING CONDITIONS

SOURCE PDF

# 1966 Tung Sol Electronic Tubes 2 of 4

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

## 1966 TUNG SOL ELECTRONIC TUBES 2 OF 4

### Section 1 · Pentode

| OTHER                                |                 |                                     |
|--------------------------------------|-----------------|-------------------------------------|
| PARAMETER                            | PUBLISHED VALUE | CONDITION / NOTE                    |
| S MA                                 | 11 mA           | Published datasheet                 |
| DESIGN MA%                           | 1 mA            | Maximum ratings; published column 1 |
| DESIGN MA%                           | 2 mA            | Maximum ratings; published column 2 |
| PLATE VOLTAGE                        | 3 V             | Maximum ratings; published column 1 |
| PLATE VOLTAGE                        | 0 V             | Maximum ratings; published column 2 |
| POSITIVE VALUE                       | 3 V             | Maximum ratings; published column 1 |
| POSITIVE VALUE                       | 0 V             | Maximum ratings; published column 2 |
| NEGATIVE VALUE                       | 3 V             | Maximum ratings; published column 1 |
| NEGATIVE VALUE                       | 0 V             | Maximum ratings; published column 2 |
| GRID #2 SUPPLY VOLTAGE               | 3 V             | Maximum ratings; published column 1 |
| GRID #2 SUPPLY VOLTAGE               | 0 V             | Maximum ratings; published column 2 |
| POSIT'                               | 1 V             | Maximum ratings; published column 1 |
| POSIT'                               | 0 V             | Maximum ratings; published column 2 |
| NEGATIVE BIAS VALUE                  | 5 V             | Maximum ratings; published column 1 |
| NEGATIVE BIAS VALUE                  | 0 V             | Maximum ratings; published column 2 |
| PLATE DISSIPATION                    | 3 W             | Maximum ratings                     |
| GRID #3                              | 1 W             | Maximum ratings; published column 1 |
| GRID #3                              | 0.2 W           | Maximum ratings; published column 2 |
| FOR GRID #2 VOLTAGES UP TO 150 VOLTS | 0.6 V           | Maximum ratings                     |
| GRID #2 VOLTAGE                      | 100 V           | Typical operating conditions        |

| PARAMETER                 | PUBLISHED VALUE | CONDITION / NOTE                                 |
|---------------------------|-----------------|--------------------------------------------------|
| GRID #1 SUPPLY VOLTAGE    | 0 V             | Typical operating conditions                     |
| TRANSCONDUCTANCE          | 3800 $\mu$ S    | Typical operating conditions                     |
| PLATE RESISTANCE (APPR    | 0 ohm           | Typical operating conditions; published column 1 |
| PLATE RESISTANCE (APPR    | 250000 ohm      | Typical operating conditions; published column 2 |
| PLATE CURRENT             | 9 mA            | Typical operating conditions                     |
| GRID #2 CURRENT           | 3.5 mA          | Typical operating conditions                     |
| TRANSCONDUCTANCE          | 0 $\mu$ S       | Typical operating conditions; published column 1 |
| TRANSCONDUCTANCE          | 40 $\mu$ S      | Typical operating conditions; published column 2 |
| TRANSCONDUCTANCE          | -2 $\mu$ S      | Typical operating conditions; published column 3 |
| PLATE VOLTAGE             | 10 V            | Typical operating conditions                     |
| PLATE CURRENT             | 2 mA            | Typical operating conditions                     |
| Maximum plate voltage     | 300 V           | Published datasheet; promoted section value      |
| Maximum plate dissipation | 3 W             | Published datasheet; promoted section value      |

| CAPACITANCE                |                 |                                                 |
|----------------------------|-----------------|-------------------------------------------------|
| PARAMETER                  | PUBLISHED VALUE | CONDITION / NOTE                                |
| GRID #1 TO PLATE (MAX.)    | 2 pF            | Interelectrode capacitances                     |
| GRID #1 TO K, H, G2, G3, & | 1 pF            | Interelectrode capacitances; published column 1 |
| GRID #1 TO K, H, G2, G3, & | 5.5 pF          | Interelectrode capacitances; published column 2 |
| PLATE TO K, H, G2, G3, k   | 1 pF            | Interelectrode capacitances; published column 1 |
| PLATE TO K, H, G2, G3, k   | 5 pF            | Interelectrode capacitances; published column 2 |
| DESIGN MA%                 | 1 mA            | Interelectrode capacitances; published column 1 |
| DESIGN MA%                 | 2 mA            | Interelectrode capacitances; published column 2 |
| AVERAGE CHARACTERISTICS    | 12.6 V          | Interelectrode capacitances; published column 1 |
| AVERAGE CHARACTERISTICS    | 150 V           | Interelectrode capacitances; published column 2 |

| PARAMETER                               | PUBLISHED VALUE | CONDITION / NOTE                                |
|-----------------------------------------|-----------------|-------------------------------------------------|
| VOLTAGE                                 | 0 V             | Interelectrode capacitances; published column 1 |
| VOLTAGE                                 | 12.6 V          | Interelectrode capacitances; published column 2 |
| VOLTAGE                                 | 3 V             | Interelectrode capacitances; published column 3 |
| HEATER NEGATIVE WITH RESPECT TO CATHODE | 200 V           | Interelectrode capacitances                     |
| HEATER POSITIVE WITH RESPECT TO CATHODE | 2 V             | Interelectrode capacitances; published column 1 |
| HEATER POSITIVE WITH RESPECT TO CATHODE | 0 V             | Interelectrode capacitances; published column 2 |

| CHARACTERISTIC   |                 |                                             |
|------------------|-----------------|---------------------------------------------|
| PARAMETER        | PUBLISHED VALUE | CONDITION / NOTE                            |
| Plate resistance | 250000 ohm      | Published datasheet; promoted section value |
| Transconductance | 0.0038 A/V      | Published datasheet; promoted section value |

1966 TUNG SOL ELECTRONIC TUBES 2 OF 4

## Section 2 · Diode

| CAPACITANCE                   |                 |                             |
|-------------------------------|-----------------|-----------------------------|
| PARAMETER                     | PUBLISHED VALUE | CONDITION / NOTE            |
| GRID #1 TO DIODE PLATE (MAX.) | 15 pF           | Interelectrode capacitances |
| PENTODE PLATE TO DIODE PLATE  | 95 pF           | Interelectrode capacitances |

| OTHER                                |                 |                                             |
|--------------------------------------|-----------------|---------------------------------------------|
| PARAMETER                            | PUBLISHED VALUE | CONDITION / NOTE                            |
| Maximum/average diode output current | 1 mA            | Published datasheet; promoted section value |

| CHARACTERISTIC                      |                 |                  |
|-------------------------------------|-----------------|------------------|
| PARAMETER                           | PUBLISHED VALUE | CONDITION / NOTE |
| Average diode plate current at 10 V | 2 mA            | Diode unit       |

## TUBE TINKER

An independent reference for electronic tubes, vacuum tubes, and their source documents.

