# Power Triode

**NUVISTOR TYPE**

**ENVIRONMENTAL TESTS**

*For Cathode-Drive, Low-Level Class-C RF-Power-Amplifier, Oscillator, or Frequency-Multiplier Applications to 1.2 Gc/s in Aircraft, Industrial, Military, and Other Equipment Operating Under Conditions of Severe Shock and Vibration.*

**LIFE TEST**

**ELECTRICAL CHARACTERISTICS**

**Bogey Values**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater Voltage (AC or DC)</td>
<td>6.3 V</td>
</tr>
<tr>
<td>Heater Current at Ef = 6.3 V.</td>
<td>150 mA</td>
</tr>
<tr>
<td>Heater Input.</td>
<td>0.95 W</td>
</tr>
<tr>
<td>Direct Interelectrode Capacitances</td>
<td></td>
</tr>
<tr>
<td>Without external shield</td>
<td>6.0 pF</td>
</tr>
<tr>
<td>Input: K to (G,S,H)</td>
<td>1.2 pF</td>
</tr>
<tr>
<td>Output: P to (G,S,H)</td>
<td>1.4 pF</td>
</tr>
</tbody>
</table>

**Class A Amplifier**

*For following characteristics, see Conditions*

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amplification Factor.</td>
<td>60 70</td>
</tr>
<tr>
<td>Plate Resistance (Approx.)</td>
<td>6300 5400 Ω</td>
</tr>
<tr>
<td>Transconductance.</td>
<td>9500 13000 μmho</td>
</tr>
<tr>
<td>DC Plate Current.</td>
<td>11.5 mA</td>
</tr>
<tr>
<td>Cutoff DC Grid Voltage for</td>
<td></td>
</tr>
<tr>
<td>$l_b = 10 \mu A$</td>
<td>$E_c(co)$ -5 V</td>
</tr>
</tbody>
</table>

**Conditions**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater Voltage.</td>
<td>6.3 V</td>
</tr>
<tr>
<td>Plate Supply Voltage.</td>
<td>150 110 V</td>
</tr>
<tr>
<td>Grid Supply Voltage</td>
<td>0 0 V</td>
</tr>
<tr>
<td>Cathode Resistor.</td>
<td>150 47 Ω</td>
</tr>
</tbody>
</table>

**MECHANICAL CHARACTERISTICS**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Position.</td>
<td>Any</td>
</tr>
<tr>
<td>Type of Cathode.</td>
<td>Coated Unipotential</td>
</tr>
<tr>
<td>Minimum Overall Length ($l_m$).</td>
<td>0.985 in</td>
</tr>
<tr>
<td>Maximum Seated Length ($l_{sm}$)</td>
<td>0.780 in</td>
</tr>
<tr>
<td>Maximum Diameter ($d_m$)</td>
<td>0.440 in</td>
</tr>
<tr>
<td>Weight (Approx.).</td>
<td>2.2 g</td>
</tr>
<tr>
<td>Dimensional Outline</td>
<td>JEDEC No.4-6</td>
</tr>
<tr>
<td>Envelope.</td>
<td>JEDEC MT4</td>
</tr>
<tr>
<td>Top Cap^a.</td>
<td>Small (JEDEC CI-44)</td>
</tr>
<tr>
<td>Base^b.</td>
<td>Medium-Ceramic-Wafer Twelvar 5-Pin (JEDEC E5-79)</td>
</tr>
</tbody>
</table>

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^a Small-sized component

^b Medium-sized component

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Electronic Components and Devices  Harrison, N. J.

DATA 1
10-65
Basing Designation for BOTTOM VIEW. ............... 12CT

Pin 2 - Cathode
Pin 4 - Cathode
Pin 7e - Do Not Use
Pin 8 - Cathode
Pin 10 - Heater
Pin 12 - Heater
Metal Shell-Grid
Top Cap-Plate

INDEX = LARGE LUG
** = SHORT PIN-1C

ABSOLUTE MAXIMUM RATINGS

For Low-Level Class-C RF-Power-Amplifier, Oscillator, or Frequency-Multiplier Tube Operation at frequencies up to 1.2 Gc/s

<table>
<thead>
<tr>
<th></th>
<th>CCS d</th>
<th>ICAS e</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Supply Voltage</td>
<td>$E_{pb}$</td>
<td>500</td>
</tr>
<tr>
<td>DC Plate Voltage</td>
<td>$E_b$</td>
<td>250</td>
</tr>
<tr>
<td>Grid Voltage</td>
<td>$e_{cm}$</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>$E_C$</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>$E_C$</td>
<td>-100</td>
</tr>
<tr>
<td>Peak Heater-Cathode Voltage</td>
<td>$e_{hkm}$</td>
<td>±100</td>
</tr>
<tr>
<td>Heater Voltage, AC or DC</td>
<td>$E_f$</td>
<td>5.7 to 6.9</td>
</tr>
<tr>
<td>Instantaneous Voltage</td>
<td></td>
<td>See Breakdown-Voltage Characteristics Curve</td>
</tr>
</tbody>
</table>

Between top cap or base pins and metal shell

Average Grid Current $I_{c(av)}$ | 5 | 6 mA
Average Cathode Current $I_{k(av)}$ | 25 | 30 mA
Plate Dissipation $P_b$ | 2.5 | 2.7 W
Envelope Temperature $T_E$ | 200 | 200 °C

MAXIMUM CIRCUIT VALUES

<table>
<thead>
<tr>
<th></th>
<th>CCS</th>
<th>ICAS</th>
</tr>
</thead>
</table>
| Grid-Circuit Resistance $R_{g(ckt)}$ | $R_{g(ckt)}$ | 50 | 50 kΩ

For fixed-bias or cathode-bias operation:
For $T_E \leq 150^\circ C$ ....... 50 50 kΩ
For $T_E > 150^\circ C$ ....... See Grid-Circuit-Resistance Rating Chart
TYPICAL OPERATION — CCS

As Cathode-Drive RF Power Amplifier

Frequency .................................. f 1 1.2 Gc/s
Heater Voltage ................................ Ef 6.3 6.3 V
DC Plate-to-Grid Voltage .................. Ebg 180 180 V
DC Cathode-to-Grid Voltage .............. Ek 5.5 5.5 V
From grid resistor of ...................... Rg 1200 1200 Ω
Average Plate Current ...................... Ib(avg) 20 20 mA
Average Grid Current ....................... Ic(avg) 4.5 4 mA
Driving Power (Approx.) .................. Pg 150 250 mW
Useful Power Output (Approx.)9 .......... Po 1.4 1.2 W

As RF Oscillator

Frequency .................................. f 1 Gc/s
Heater Voltage ................................ Ef 6.3 V
DC Plate Voltage .......................... Eb 180 V
DC Grid Voltage ............................ Ec -5.5 V
From grid resistor of ...................... Rg 1200 Ω
Average Plate Current ...................... Ib(avg) 21 mA
Average Grid Current ....................... Ic(avg) 4.5 mA
Useful Power Output (Approx.)9 .......... Po 1.25 W

As Cathode-Drive Frequency Doubler

Output Frequency ........................... f0 1 Gc/s
Heater Voltage ................................ Ef 6.3 V
DC Plate-to-Grid Voltage .................. Ebg 180 V
DC Cathode-to-Grid Voltage .............. Ek 8.5 V
From grid resistor of ...................... Rg 1200 Ω
Average Plate Current ...................... Ib(avg) 18.5 mA
Average Grid Current ....................... Ic(avg) 3 mA
Driving Power (Approx.) .................. Pg 300 mW
Useful Power Output (Approx.)9 .......... Po 0.7 W

a Designed to mate with "1/4-inch" connector generally available from your local RCA Distributor.
b Designed to mate with Cinch Mfg. Co. socket No.133 65 10 041, Cinch-Jones Sales-Division Distributor socket Designation SNS-3, or equivalent.
c Pin 7 is of a length such that its end does not touch the socket insertion plane.
d Continuous Commercial Service.
e Intermittent Commercial and Amateur Service. No operating or ON period exceeds 5 minutes and every ON period is followed by an OFF or standby period of the same or greater duration.
f Measured on metal shell in Zone "A" (See Dimensional Outline).
g Measured at load.

INITIAL CHARACTERISTICS LIMITS

<table>
<thead>
<tr>
<th></th>
<th>Note</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater Current</td>
<td>1</td>
<td>140</td>
<td>160</td>
</tr>
<tr>
<td>Direct Interelectrode Capacitances</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cathode to plate</td>
<td>-</td>
<td>-</td>
<td>0.046</td>
</tr>
<tr>
<td>Input: K to (G,S,H)</td>
<td>-</td>
<td>-</td>
<td>5.0</td>
</tr>
<tr>
<td>Output: P to (G,S,H)</td>
<td>-</td>
<td>0.9</td>
<td>1.5</td>
</tr>
<tr>
<td>Heater to cathode</td>
<td>-</td>
<td>1.1</td>
<td>1.7</td>
</tr>
<tr>
<td>Amplification Factor</td>
<td>3</td>
<td>50</td>
<td>90</td>
</tr>
</tbody>
</table>
### Transconductance
- **Note 1:** Transconductance (1)...
  - Min: 4
  - Max: 7500 μmho
- **Note 2:** Transconductance (2)...
  - Min: 3
  - Max: 15500 μmho

### Plate Current
- **Note 3:** Plate Current (1)...
  - Min: 4
  - Max: 6.5 mA
- **Note 4:** Plate Current (2)...
  - Min: 3
  - Max: 8.5 14.5 mA

### Cutoff Plate Current
- **Note 5:** Cutoff Plate Current...
  - Min: 5
  - Max: 50 μA

### Useful Power Output
- **Note 6:** Useful Power Output...
  - Min: 6
  - Max: 1.1 W

### Total Grid Current
- **Note 7:** Total Grid Current...
  - Min: 7
  - Max: -0.1 μA

### Heater-Cathode Leakage Current
- **Note 8:** Heater-Cathode Leakage Current...
  - Min: 8
  - Max: ±5 μA

### Leakage Resistance
- **Note 9:** Leakage Resistance...
  - Min: 9
  - Max: GΩ

### Inoperatives
- **Note 10:** Inoperatives...
  - Min: 11
  - Max: √

### Environment Test Specifications
#### High-Impact, Short-Duration Shock
- **Peak Impact Acceleration:** 1000 g
- **Duration of approximate half-sine-wave mechanical-shock pulse:** 0.8 ± 0.2 ms

### Operating Conditions during Test
- **Ef = 6.3 V, Eb = 150 V, Ecc = -1.3 V, Rg = 50 kΩ, Eth = 100 V**

### Post-Shock Limits and Rejection Criteria
- **Min:**
  - ΔIgm...
  - IC...
  - IHk...
- **Max:**
  - ±15%
  - -0.1 μA
  - ±10 μA

#### ERpm (Variable-Frequency-Vibration Test Limits) over vibration-frequency range of:
- **3 to 6 kc/s:** 100 mV
- **6 to 15 kc/s:** 1000 mV

**Tap and Permanent Shorts, and Discontinuities:** √
Low-Impact, Long-Duration Shock

Peak Impact Acceleration: .................. 50 g
Duration of approximate half-sine-wave mechanical-shock pulse: ............ 11 ± 2 ms
Condition during Test
No tube-element voltages are applied.

Post-Shock Limits and Rejection Criteria
Same as those specified above for the High-Impact, Short-Duration Shock Test

Sweep-Frequency-Vibration Fatigue

Vibration-Frequency Range (Overall) ... 5 to 500 to 5 c/s
Peak Displacement (5 to 50 and 50 to 5 c/s) .... 0.040 in
Peak-to-peak value .................................. 0.080 in
Peak Vibrational Acceleration
(50 to 500 to 5 c/s) .................................. 10 g
Period of 1 sweep cycle (Approx.)
(5 to 500 to 5 c/s) .................................. 15 m
Duration of Test (Overall) ..................... 9 h
Along each of 3 mutually perpendicular axes: .................. 3 h
Operating Condition during Test
Ef = 6.3 V

Post-Sweep-Frequency-Vibration-Fatigue

Limits and Rejection Criteria
Same as those specified above for the High-Impact, Short-Duration Shock Test

Variable-Frequency Vibration

Vibration-Frequency Range (Overall) .... 3 to 15 kc/s
Peak Vibrational Acceleration in X-direction: 1 g
Period of 1 sweep cycle (3 to 15 kc/s) ............. 7 s
Operating Conditions during Test
Ef = 6.3 V, Ebb = 150 V, Ecc = 0 V, Rk = 150 Ω, Rp = 2 kΩ

Limits

ERpm over vibration-frequency range of:
3 to 6 kc/s ........................................... 80 mV
6 to 15 kc/s ........................................... 700 mV

LIFE TESTS

Heater Cycling

Duration of Test ..................... 2000 cycles
Operating Conditions
Ef = 8.5 V cycled 1 minute ON and 2 minutes OFF, Ehk = −100 V continuously ON

Rejection Criteria
Heater-cathode shorts, and heater and cathode discontinuities
Intermittent Operation (2, 20, 100, 500, and 1000 Hours)

Operating Conditions

E_f = 6.3 cycled 110 minutes ON and 10 minutes OFF,
E_bb = 150 V, E_{cc} = 0 V, R_g = 50 k\Omega, P_b = 2.4 W,
T_E = 150^\circ C min

End-Point Limits At 2 and 20 || 100 || 500 || 1000
<table>
<thead>
<tr>
<th>Min Max</th>
<th>Min Max</th>
<th>Min Max</th>
<th>Min Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>1g_{m}</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>\Delta 1g_{m}/t.</td>
<td>\pm 10</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>P_{o(useful)}</td>
<td>-</td>
<td>-</td>
<td>1.0</td>
</tr>
<tr>
<td>l_{c} .</td>
<td>-</td>
<td>-</td>
<td>-0.2</td>
</tr>
</tbody>
</table>

\[ \mu \text{mho} \]
\[ \% \]
\[ \text{W} \]
\[ \mu \text{A} \]

DIMENSIONAL OUTLINE
JEDEC No.4-6

DIMENSIONS IN INCHES

Note 1: Maximum outside diameter of 0.440" is permitted along 0.190" lug length.

Note 2: Envelope temperature should be measured in zone "A".

MODIFIED BOTTOM VIEW
With Element Connections Indicated
and Short Pin Not Shown
Grid-Circuit-Resistance Rating Chart

ENVELOPE TEMPERATURE ($T_E$) — °C

MAXIMUM GRID-CIRCUIT RESISTANCE — kΩ

FIXED BIAS
OR
CATHODE BIAS

Breakdown-Voltage Characteristics

ALTITUDE — kft

AMBIENT TEMPERATURE ($T_A$) = 25°C
EFFECTS OF TUBE SOCKET, ENVELOPE TEMPERATURE, RADIATION, ETC. IGNORED.

INSTANTANEOUS BREAKDOWN VOLTAGE — V

TOP CAP TO METAL SHELL

BASE PINS TO METAL SHELL

AIR PRESSURE — mmHg

DATA 4
10-65
### Typical Constant-Current Characteristics

- $E_f = 6.3$ V
- $I_b$ = DC PLATE CURRENT
- $I_c$ = DC GRID CURRENT

<table>
<thead>
<tr>
<th>DC GRID VOLTAGE ($E_C$) — V</th>
<th>50</th>
<th>75</th>
<th>100</th>
<th>125</th>
<th>150</th>
<th>175</th>
<th>200</th>
<th>225</th>
<th>250</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC PLATE VOLTAGE ($E_B$) — V</td>
<td>50</td>
<td>75</td>
<td>100</td>
<td>125</td>
<td>150</td>
<td>175</td>
<td>200</td>
<td>225</td>
<td>250</td>
</tr>
</tbody>
</table>

92CM-13220

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DATA 4

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