

# RCA-8203

## POWER TRIODE

### Nuvistor

RCA Dark Heater

For Class C Service  
in Commercial and Military Equipment

All-Ceramic-and-Metal Construction

RCA-8203 is a power triode of the nuvistor type, especially useful in Class C rf power amplifier and oscillator service, dc pulse-amplifier applications, and as a frequency-multiplier tube. The 8203 is particularly suitable for use in equipment in which ability to withstand severe mechanical shock and vibration, compactness, and exceptional uniformity of characteristics are primary requirements.



The 8203 features all-ceramic-and-metal construction, a cantilever-supported cylindrical electrode structure, and the RCA Dark Heater for long life and dependable performance.

#### GENERAL DATA

##### Electrical:

##### Heater Characteristics and Ratings:

Voltage (AC or DC) . . . . . 6.3 ± 0.6 volts  
Current at 6.3 volts . . . . . 0.160 amp

Peak heater-cathode voltage  
(CCS<sup>a</sup> or ICAS<sup>b</sup> conditions):

Heater negative with respect to cathode . . . . . 100 max. volts

Heater positive with respect to cathode . . . . . 100 max. volts

##### Direct Interelectrode Capacitances (Approx.):

Grid to plate . . . . . 2.2 pf  
Input: G to (K,S,H) . . . . . 4.2 pf  
Output: P to (K,S,H) . . . . . 1.6 pf  
Cathode to plate . . . . . 0.26 pf  
Heater to cathode . . . . . 1.5 pf

##### Characteristics, Class A<sub>1</sub> Amplifier:

DC Plate Supply Voltage . . . . . 75 150 volts  
Grid Supply Voltage . . . . . 0 0 volts  
Cathode Resistor . . . . . 100 560 ohms  
Amplification Factor . . . . . 35 30  
Plate Resistance (Approx.) . . . . . 2700 5000 ohms  
Transconductance . . . . . 13000 6000 μmhos  
Plate Current . . . . . 11.5 7 ma  
Grid Voltage (Approx.)  
for plate μ<sub>a</sub> = 10 . . . . . -6.5 -15 volts

##### Mechanical:

Operating Position . . . . . Any  
Weight (Approx.) . . . . . 1.9 grams  
Maximum Overall Length . . . . . 0.800"  
Maximum Seated Length . . . . . 0.625"  
Maximum Diameter . . . . . 0.440"  
Envelope . . . . . Metal Shell MT4  
Dimensional Outline . . . . . JEDEC No. 4-4  
Socket . . . . . See SOCKET INFORMATION  
Base . . . . . Medium Ceramic-Wafer Twelvar 5-Pin  
(JEDEC No. E5-65)

#### RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy<sup>c</sup> and RF POWER AMPLIFIER — Class C FM Telephony

##### Maximum Ratings, Absolute-Maximum Values:

For operation at frequencies up to 250 Mc

|                                      | CCS                   | ICAS                  |       |
|--------------------------------------|-----------------------|-----------------------|-------|
| DC Plate Supply Voltage . . . . .    | 400 <sup>d</sup> max. | 400 <sup>d</sup> max. | volts |
| DC Plate Voltage . . . . .           | 250 <sup>d</sup> max. | 300 <sup>d</sup> max. | volts |
| DC Grid Voltage:                     |                       |                       |       |
| Negative-bias value . . . . .        | 100 max.              | 100 max.              | volts |
| Positive-bias value . . . . .        | 0 max.                | 0 max.                | volts |
| Peak-Positive Grid Voltage . . . . . | 5 max.                | 5 max.                | volts |
| DC Cathode Current . . . . .         | 25 max.               | 30 max.               | ma    |
| DC Grid Current . . . . .            | 5 max.                | 6 max.                | ma    |
| Plate Dissipation . . . . .          | 1.5 max.              | 1.8 max.              | watts |

##### Typical CCS Operation:

As rf power amplifier in cathode-drive circuit at 160 Mc

|                                         |                   |       |
|-----------------------------------------|-------------------|-------|
| DC Plate-to-Grid Voltage . . . . .      | 155               | volts |
| DC Cathode-to-Grid Voltage . . . . .    | 14                | volts |
| From a grid resistor of . . . . .       | 2700              | ohms  |
| DC Cathode Current . . . . .            | 21                | ma    |
| DC Grid Current . . . . .               | 5                 | ma    |
| Driver Power Output (Approx.) . . . . . | 0.4               | watt  |
| Useful Power Output (Approx.) . . . . . | 1.55 <sup>e</sup> | watts |

As rf oscillator at 160 Mc

|                                         |                  |       |
|-----------------------------------------|------------------|-------|
| DC Plate Voltage . . . . .              | 100              | volts |
| DC Grid Voltage . . . . .               | -3.4             | volts |
| From a grid resistor of . . . . .       | 1500             | ohms  |
| DC Cathode Current . . . . .            | 18               | ma    |
| DC Grid Current . . . . .               | 2.5              | ma    |
| Useful Power Output (Approx.) . . . . . | 0.8 <sup>e</sup> | watt  |

##### Maximum Circuit Values:

Grid-Circuit Resistance (CCS or ICAS conditions):<sup>f</sup>  
For fixed-bias or cathode-bias operation . . . . . 50000 max. ohms



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Electronic Components and Devices  
Harrison, N. J.

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## FREQUENCY MULTIPLIER

### Maximum Ratings, Absolute-Maximum Values:

For operation at frequencies up to 250 Mc

|                                      | CCS                   | ICAS                  |       |
|--------------------------------------|-----------------------|-----------------------|-------|
| DC Plate Supply Voltage. . . . .     | 400 <sup>d</sup> max. | 400 <sup>d</sup> max. | volts |
| DC Plate Voltage . . . . .           | 250 <sup>d</sup> max. | 250 <sup>d</sup> max. | volts |
| DC Grid Voltage:                     |                       |                       |       |
| Negative-bias value. . . . .         | 200 max.              | 200 max.              | volts |
| Positive-bias value. . . . .         | 0 max.                | 0 max.                | volts |
| Peak-Positive Grid Voltage . . . . . | 5 max.                | 5 max.                | volts |
| DC Cathode Current . . . . .         | 20 max.               | 24 max.               | ma    |
| DC Grid Current. . . . .             | 3 max.                | 4 max.                | ma    |
| Plate Dissipation. . . . .           | 1.3 max.              | 1.5 max.              | watts |

### Typical CCS Operation:

As a doubler from 80 to 160 Mc

|                                        |                   |       |
|----------------------------------------|-------------------|-------|
| DC Plate Voltage . . . . .             | 125               | volts |
| DC Grid Voltage. . . . .               | -70               | volts |
| From a grid resistor of. . . . .       | 18000             | ohms  |
| DC Cathode Current . . . . .           | 22                | ma    |
| DC Grid Current. . . . .               | 4                 | ma    |
| Driver Power Output (Approx.). . . . . | 0.25              | watt  |
| Useful Power Output (Approx.). . . . . | 0.85 <sup>e</sup> | watt  |

### Maximum Circuit Values:

Grid-Circuit Resistance (CCS or ICAS conditions):<sup>f</sup>

For fixed-bias or cathode-bias operation. . . . . 50000 max. ohms

## DC PULSE AMPLIFIER

### Maximum Ratings, Absolute-Maximum Values

|                                                     |                        |       |
|-----------------------------------------------------|------------------------|-------|
| Peak Positive-Pulse Plate Voltage. . . . .          | 500 <sup>d</sup> max.  | volts |
| DC Plate Voltage . . . . .                          | 250 <sup>d</sup> max.  | volts |
| DC Grid Voltage:                                    |                        |       |
| Negative-bias value. . . . .                        | 100 max.               | volts |
| Positive-bias value. . . . .                        | 0 max.                 | volts |
| Peak Positive Grid Voltage . . . . .                | 5 max.                 | volts |
| DC Grid Current. . . . .                            | 5 max.                 | ma    |
| DC Cathode Current . . . . .                        | 18 max.                | ma    |
| Peak Cathode Current:                               |                        |       |
| For duty factors up to 1 per cent . . . . .         | 250 max.               | ma    |
| For duty factors between 1 and 50 per cent. . . . . | See PULSE RATING CHART |       |
| Plate Dissipation. . . . .                          | 1 max.                 | watt  |

### Maximum Circuit Values:

Grid-Circuit Resistance:<sup>f</sup>

For fixed-bias operation . . . . . 0.5 max. megohm  
For cathode-bias operation . . . . . 1 max. megohm

## CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

|                                                               | Note | Min.  | Max.  |         |
|---------------------------------------------------------------|------|-------|-------|---------|
| Heater Current . . . . .                                      | 1    | 0.150 | 0.170 | amp     |
| Direct Interelectrode Capacitances:                           |      |       |       |         |
| Grid to plate. . . . .                                        | 2    | 1.8   | 2.6   | pf      |
| Input: G to (K,S,H). . . . .                                  | 2    | 3.8   | 4.6   | pf      |
| Output: P to (K,S,H) . . . . .                                | 2    | 1.4   | 1.8   | pf      |
| Cathode to plate . . . . .                                    | 2    | 0.20  | 0.32  | pf      |
| Heater to cathode. . . . .                                    | 2    | 1.2   | 1.8   | pf      |
| Plate Current (1). . . . .                                    | 1,3  | 5.0   | 9.5   | ma      |
| Plate Current (2). . . . .                                    | 1,4  | -     | 50    | μa      |
| Transconductance . . . . .                                    | 1,3  | 4000  | 8000  | μmhos   |
| Reverse Grid Current . . . . .                                | 1,5  | -     | 0.1   | μa      |
| AC Emission. . . . .                                          | 6,7  | 10    | -     | ma      |
| Amplification Factor . . . . .                                | 1,3  | 20    | 40    |         |
| Heater-Cathode Leakage Current:                               |      |       |       |         |
| Heater negative with respect to cathode . . . . .             | 1,8  | -     | 5     | μa      |
| Heater positive with respect to cathode . . . . .             | 1,8  | -     | 5     | μa      |
| Leakage Resistance:                                           |      |       |       |         |
| Between grid and all other electrodes tied together. . . . .  | 1,9  | 1000  | -     | megohms |
| Between plate and all other electrodes tied together. . . . . | 1,10 | 1000  | -     | megohms |
| Useful Power Output. . . . .                                  | 1,11 | 0.9   | -     | watt    |
| Peak Cathode Emission Current (Pulsed) . . . . .              | 1,12 | 250   | -     | ma      |

Note 1: With ac or dc heater volts = 6.3.

Note 2: Measured in accordance with EIA Standard RS-191-A.

Note 3: With dc plate supply volts = 150, dc grid supply volts = 0, cathode resistor (ohms) = 560, cathode-bypass capacitor (μf) = 1000, and metal shell connected to ground.

Note 4: With dc plate volts = 150, dc grid volts = -15, and metal shell connected to ground.

Note 5: With dc plate supply volts = 100, dc grid supply volts = -1.7, grid-circuit resistance (megohm) ≤ 1 (the internal resistance of the current meter used for this measurement), and metal shell connected to ground.

Note 6: With ac or dc heater volts = 5.5.

Note 7: With dc plate supply volts = 50, dc grid supply volts = -5.7, 60-cps grid-signal volts (rms) = 7.5, dc resistance of transformer secondary winding in grid circuit ≤ 2 ohms, grid-voltage-supply bypass capacitor (μf) = 1000, and metal shell connected to ground. AC emission is measured as the dc component of plate current at these conditions.

Note 8: With dc heater-cathode volts = 100.

Note 9: With grid 100 volts negative with respect to all other electrodes tied together, and metal shell connected to ground.

<sup>a</sup> Continuous Commercial Service.

<sup>b</sup> Intermittent Commercial and Amateur Service. No operating or "ON" period exceeds 5 minutes and every "ON" period is followed by an "OFF" or stand-by period of the same or greater duration.

<sup>c</sup> Key-down conditions per tube without amplitude modulation. Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

<sup>d</sup> Under no circumstances should this absolute-maximum value be exceeded. For high-altitude operation the maximum permissible plate supply voltage and plate voltage for the 8203 are dependent on atmospheric pressure. See graph of LOW-PRESSURE VOLTAGE-BREAKDOWN CHARACTERISTICS OF NUVISTOR TRIODE BASE.

<sup>e</sup> Measured at load of output circuit.

<sup>f</sup> For operation at metal-shell temperature of 150° C. For operation at other metal-shell temperatures, see GRID-CIRCUIT RESISTANCE RATING CHART. Metal-shell temperatures are measured in Zone "A" (See DIMENSIONAL OUTLINE).

Note 10: With plate 300 volts negative with respect to all other electrodes tied together, and metal shell connected to ground.

Note 11: Measured at load in 250-Mc rf amplifier circuit with dc plate supply volts = 150, grid resistor (ohms) = 4700, driver power output (milliwatts) = 350, and plate milliamperes = 20.

Note 12: With dc plate supply volts = 250 and dc grid supply volts = -20. The grid is driven with pulse voltage, as follows: peak volts between grid and negative end of cathode resistor = 5, pulse repetition rate = 1000, pulse duration = 10  $\mu$ s, pulse rise time  $\leq$  1  $\mu$ s, and time of fall  $\leq$  1  $\mu$ s. Peak cathode current is measured with a high impedance oscilloscope or equivalent device connected across a 1-ohm cathode resistor.

## SPECIAL TESTS

### Shock:

Peak Impact Acceleration . . . . . 1000 g

This test is performed on a sample lot of tubes to determine the ability of the tube to withstand the specified Peak Impact Acceleration. Tubes are held rigid in each of four positions (X<sub>1</sub>, X<sub>2</sub>, Y<sub>1</sub>, and Y<sub>2</sub>) in a Navy Type, High-Impact (Flyweight) Shock Machine, and, with tube electrode voltages applied, are subjected to 20 blows (5 in each position) at the specified Peak Impact Acceleration.

At the end of this test, tubes are criticized for Shorts and Continuity, Change in Transconductance, Reverse Grid Current, Heater-Cathode Leakage Current, and Variable-Frequency Vibration.

### Variable-Frequency Vibration:

This test is performed on a sample lot of tubes operated under the conditions specified in CHARACTERISTICS RANGE VALUES for Transconductance, with the addition of a plate-load resistor of 2000 ohms. During operation, tube is vibrated in the X<sub>1</sub> position through the frequency range of 3000 to 15000 cycles per second with a constant vibrational acceleration of 1g. During the test, tube must not show an rms output voltage across the plate-load resistor in excess of:

25 millivolts over the frequency range of 3000 to 6000 cps

500 millivolts over the frequency range of 6000 to 15000 cps

Post-Impact and Post-Sweep-Frequency Fatigue Vibration limits:

35 millivolts over the frequency range of 3000 to 6000 cps

700 millivolts over the frequency range of 6000 to 15000 cps

### Sweep-Frequency Fatigue Vibration:

This test is performed on a sample lot of tubes with only heater voltage of 6.3 volts applied. During operation, the tube is rigidly mounted and is vibrated through the frequency range of 5 to 500 cps and back to 5 cps. One such vibration

sweep cycle takes approximately 15 minutes. The tubes are vibrated for a period of 3 hours along each of 3 mutually perpendicular axes for a total of 9 hours. The longitudinal axis of the tube is coincident with one of the 3 axes. The vibrations are applied as follows:

a From 5 to 50 cps with a constant peak-to-peak displacement of 0.080 inch.

b From 50 to 500 cps with a constant acceleration of 10 g.

c From 500 to 50 cps and then to 5 cps follows the procedure shown in a and b, but in reverse.

At the end of this test, tubes are criticized for Shorts and Continuity, Change in Transconductance, Reverse Grid Current, Heater-Cathode Leakage Current, and Variable-Frequency Vibration.

### Low-Pressure Voltage Breakdown:

This test is performed on a sample lot of tubes to determine the ability of the tube to withstand high-altitude (low-air-pressure) conditions. Tubes are operated with 250 rms volts applied between the plate and all other electrodes and metal shell connected together. The tubes must not break down or show evidence of corona when subjected to air pressure equivalent to an altitude of 100,000 feet ( $8.0 \pm 0.5$  mm Hg).

### Shorts and Continuity:

This test is performed on a sample lot of tubes from each production run. Tubes are subjected to the Thyatron-Type Shorts Test described in MIL-E-1D, Amendment 2, Paragraph 4.7.7, except that tapping is done by hand with a soft rubber tapper (Specifications for this tapper will be supplied on request). The areas of acceptance and rejection for this test are shown in the accompanying graph, SHORTS-TEST ACCEPTANCE LIMITS. Tubes are criticized for permanent or temporary shorts and open circuits.

### Intermittent Conduction Life (1000 hours):

This test is performed on a sample lot of tubes from each production run to assure the high quality of individual tubes and to prevent epidemic failures due to excessive changes in tube characteristics. Tubes are operated with heater voltage of 6.3 volts cycled 110 minutes on and 10 minutes off, and plate dissipation = 1.5 watts (approx.), at a shell temperature of 150° C.

Tubes are criticized at 2 hours, 20 hours, and 100 hours for Inoperatives<sup>9</sup> and Transconductance, and at 500 hours and 1000 hours for Inoperatives<sup>9</sup> and Useful Power Output at 250 Mc.

**Oscillator Life (1000 hours):**

This test is performed on a sample lot of tubes to assure satisfactory operation of the tube as a 250-Mc oscillator. Tubes are operated with heater volts = 6.3 and plate dissipation = 1.4 watts.

Tubes are criticized at 500 and 1000 hours for Inoperatives<sup>9</sup> and Useful Power Output at 250 Mc.

**Grid Pulse Life (1000 hours):**

This test is performed on a sample lot of tubes from each production lot. Tubes are operated with heater voltage of 6.3 volts cycled 110

minutes on and 10 minutes off, dc plate supply volts = 300, dc grid supply volts = -20, grid resistor (ohms) = 47, and plate-load resistor (ohms) = 330. The grid is driven with pulse voltage, as follows: peak grid-to-cathode volts = 5, pulse repetition rate = 1000, pulse duration = 10  $\mu$ s, pulse rise time  $\leq 1$   $\mu$ s, and time of fall  $\leq 2$   $\mu$ s.

Tubes are tested at 500 hours and 1000 hours for Inoperatives<sup>9</sup> and Peak Cathode Emission Current (Pulsed).

<sup>9</sup> An inoperative is defined as a tube having a discontinuity, permanent short, or air leak.

**SOCKET INFORMATION**

Information about the casting materials, contact materials, and finishes of the sockets listed below and of other available sockets for this nuvistor tube may be obtained from the manufacturers shown on this chart. Nuvistor sockets may also be available from other component manufacturers.

| Description           |                             | Manufacturer or Distributor and Part No.                 |                                                      |                                                   |
|-----------------------|-----------------------------|----------------------------------------------------------|------------------------------------------------------|---------------------------------------------------|
| Application           | Mounting                    | Cinch Mfg. Co. <sup>h</sup>                              | Cinch-Jones Sales Division <sup>j</sup> Distributors | Industrial Electronic Hardware Corp. <sup>k</sup> |
| General Purpose Type  | Crimp mounting              | 133 65 10 001                                            | 5NS                                                  | MSN 0905-1<br>MSN 0905-2<br>MSN 0905-3            |
|                       |                             | 133 65 91 034 <sup>m</sup><br>133 65 92 025 <sup>n</sup> | -<br>-                                               | -<br>-                                            |
|                       | Flange mounting             | 133 65 10 003                                            | 5NS-1                                                | -                                                 |
|                       | Printed Board ("Stand-off") | 133 65 10 009                                            | 5NS-2                                                | -                                                 |
| Heat Dissipating Type | Crimp mounting              | 133 65 10 041                                            | 5NS-3                                                | -                                                 |

<sup>h</sup> 1026 South Homan Avenue, Chicago 24, Illinois.

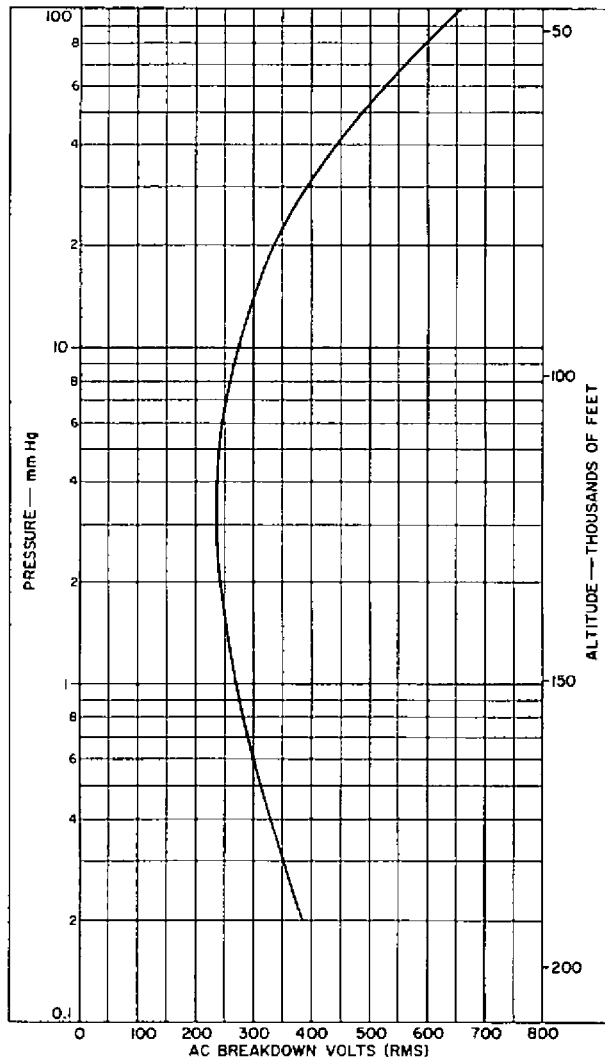
<sup>j</sup> Cinch-Jones Sales Division of Cinch Mfg. Co.

<sup>k</sup> 109 Prince Street, New York 12, N.Y.

<sup>m</sup> Low rf loss, high temperature, TEFLON socket.

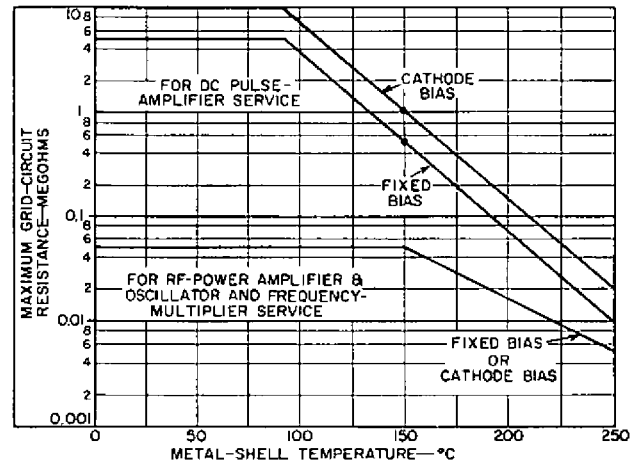
<sup>n</sup> Diall. socket for space applications.

### LOW-PRESSURE VOLTAGE-BREAKDOWN CHARACTERISTICS OF NUVISTOR TRIODE BASE



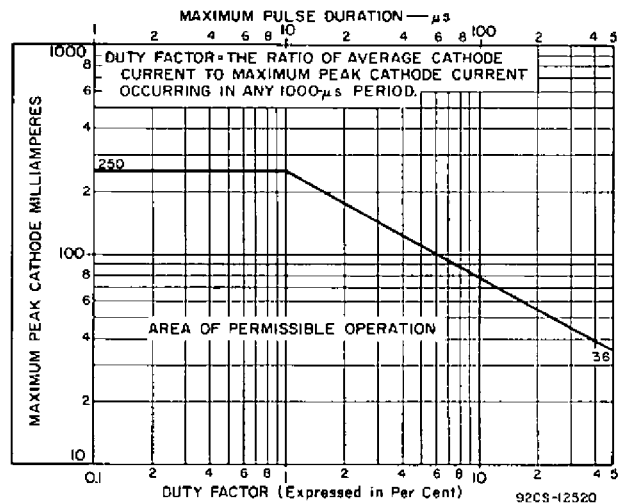
92CM-12509

### GRID-CIRCUIT-RESISTANCE RATING CHART



92CS-12521

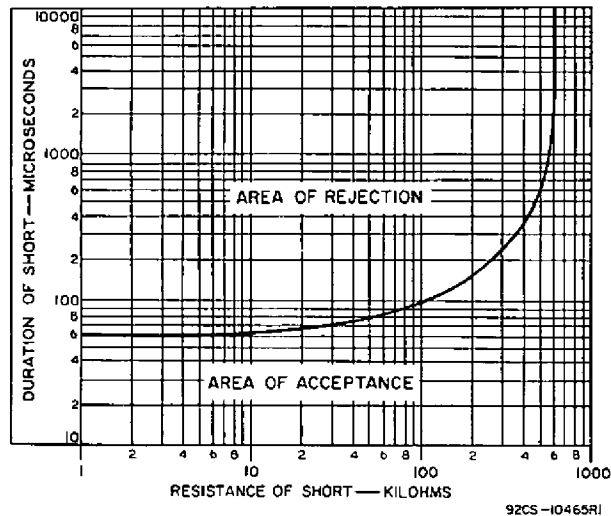
### PULSE RATING CHART



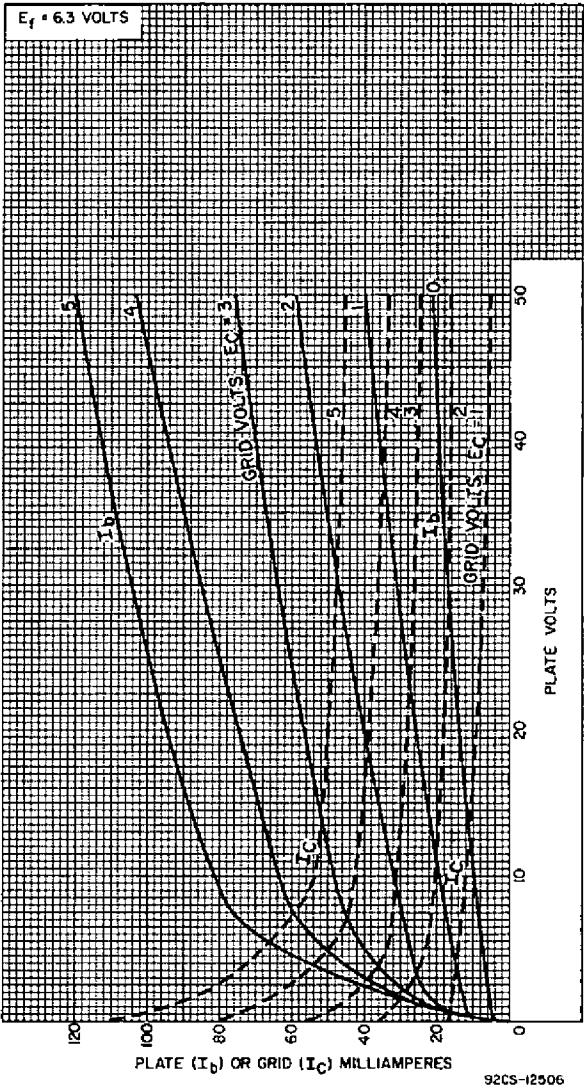
92CS-12520

This chart is based on the Typical Pulse Rating Chart shown in "A Guide for Pulse Rating Low Power Vacuum Tubes", JEDEC Publication No.41, dated September, 1963.

SHORTS-TEST ACCEPTANCE LIMITS

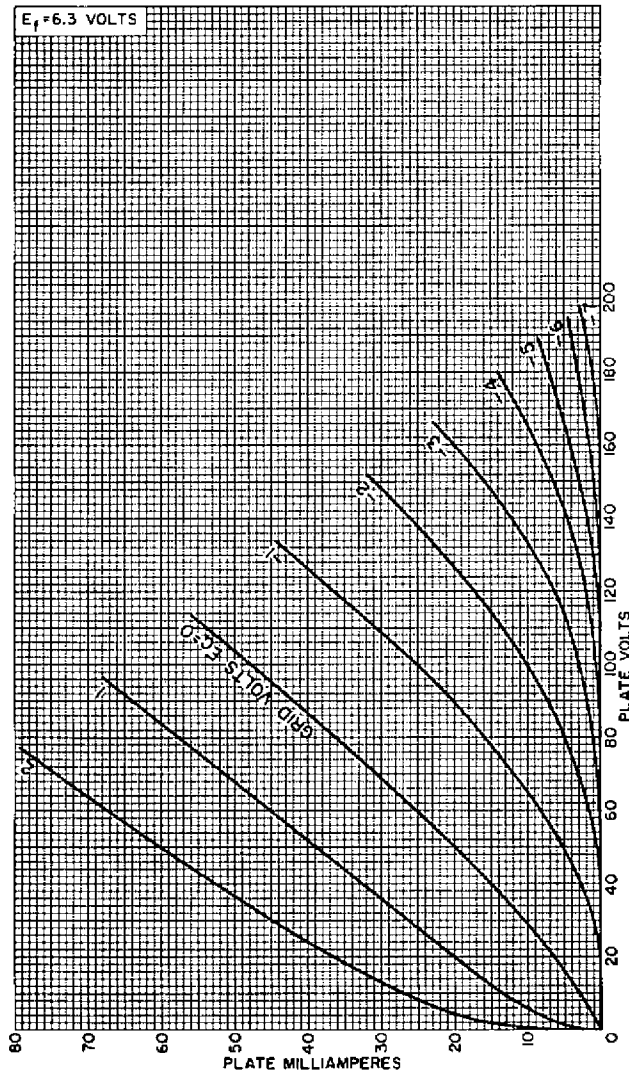


AVERAGE CHARACTERISTICS



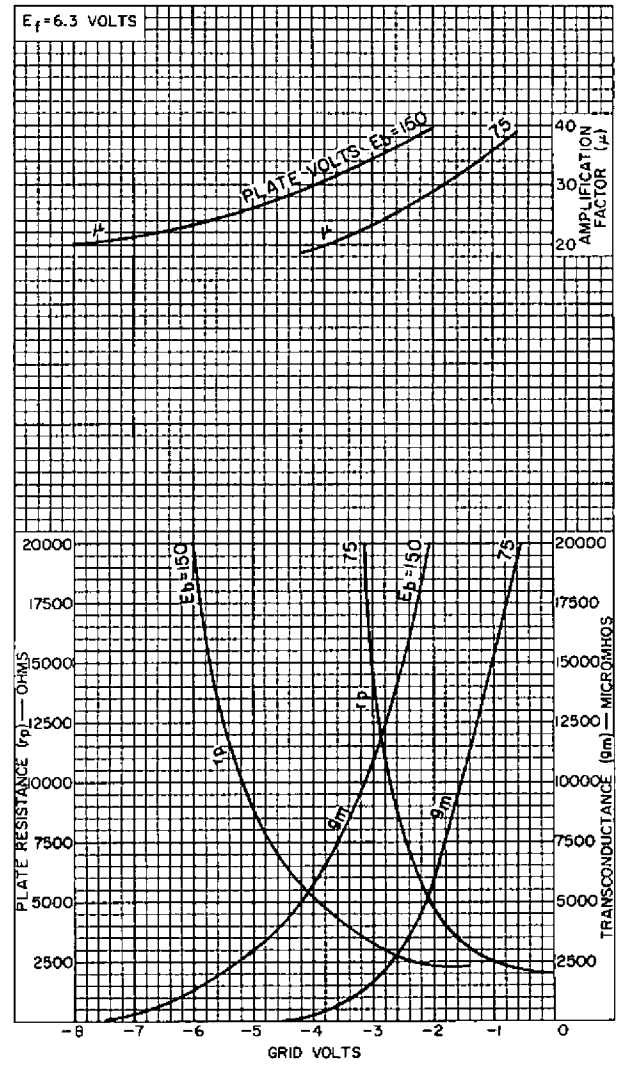
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## AVERAGE PLATE CHARACTERISTICS



92CM-12508

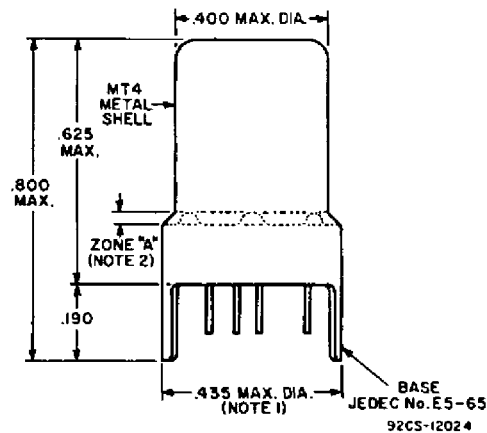
## AVERAGE CHARACTERISTICS



92CM-12507

# DIMENSIONAL OUTLINE JEDEC No. 4-4

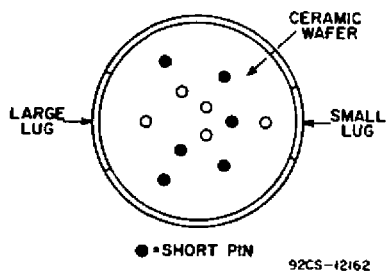
Dimensions in Inches



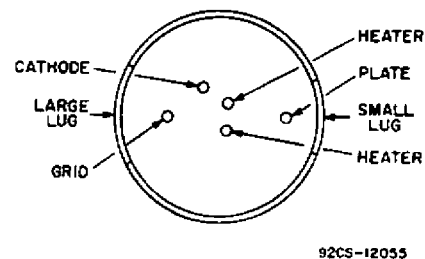
**NOTE 1:** MAXIMUM OUTSIDE DIAMETER OF 0.440" IS PERMITTED ALONG 0.190" LUG LENGTH.

**NOTE 2:** METAL-SHELL TEMPERATURE SHOULD BE MEASURED IN ZONE "A".

## BOTTOM VIEW Showing Arrangement of All 11 Base Pins



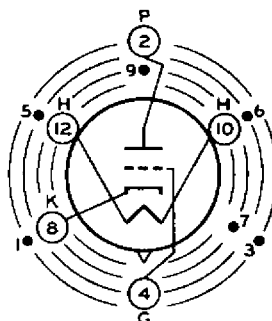
## MODIFIED BOTTOM VIEW With Element Connections Indicated and Short Pins Not Shown



## TERMINAL DIAGRAM

Bottom View

Pin 1  $\S$  - Do Not Use  
 Pin 2 - Plate  
 Pin 3  $\S$  - Do Not Use  
 Pin 4 - Grid  
 Pin 5  $\S$  - Do Not Use  
 Pin 6  $\S$  - Do Not Use



INDEX = LARGE LUG  
 ● = SHORT PIN; IC - DO NOT USE  
 JEDEC 12AQ

Pin 7  $\S$  - Do Not Use  
 Pin 8 - Cathode  
 Pin 9  $\S$  - Do Not Use  
 Pin 10 - Heater  
 Pin 11 - Omitted  
 Pin 12 - Heater

$\S$  Pins 1, 3, 5, 6, 7, and 9 are of a length such that their ends do not touch the socket insertion plane.