

High-Mu Triode

OCTAL-BASED PENCIL TUBE

For RF-Power-Amplifier, Oscillator, and Frequency-Multiplier Applications at Altitudes up to 100,000 Feet Without Pressurization

Replaces Type 2C40A in Most Applications

ELECTRICAL

Heater, for Unipotential Cathode

| | | |
|-------------------------------|-----------|---|
| Voltage (AC or DC) | 6.3 ± 10% | V |
| Current at 6.3 volts. | 0.145 | A |

Cathode Warmup Time to reach 90 percent of

| | | |
|---|--------|---|
| Typical oscillator power output | 10 max | s |
| Operating dc plate current. | 15 max | s |

Amplification Factor. 30

Transconductance for dc plate mA = 18 and dc plate volts = 250. 5500 μ mhos

Direct Interelectrode Capacitances (Approx.)

| | | |
|---|----------|----|
| Grid to plate | 1.1 | pF |
| Grid to cathode | 1.8 | pF |
| Plate to cathode. | 0.05 max | pF |
| Cathode to rf cathode terminal. | 100 | pF |

MECHANICAL

Operating Position. Any

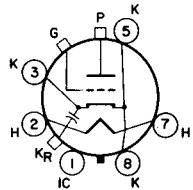
Maximum Overall Length. 3.125 in

Maximum Diameter. 1.312 in

Base. . . Small H-Wafer Octal 6-Pin (JEDEC Group 1, No. B6-108)

Terminal Connections **BOTTOM VIEW**

- Pin 1 - Do Not Use
- Pin 2 - Heater
- Pin 3 - Cathode
- Pin 5 - Cathode
- Pin 7 - Heater
- Pin 8 - Cathode
- KR - Cathode rf terminal (Cylinder adjacent to base)
- G - Grid (Flange between insulator sections)
- P - Plate (Cylinder adjacent to upper insulator section)



THERMAL

Plate Seal Temperature. 175 max °C

CLASS A₁ RF AMPLIFIER

Maximum CCS Ratings, Absolute-Maximum Values up to 2000 Mc/s

For Altitudes up to 25000 ft

| | | |
|---------------------------|------|----|
| DC Plate Voltage. | 300 | V |
| DC Grid Voltage | -100 | V |
| DC Plate Current. | 25 | mA |



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| | | |
|---|------|---|
| Plate Dissipation ^a | 6.25 | W |
| Peak Heater-Cathode Voltage | | |
| Heater negative with respect to cathode | 90 | V |
| Heater positive with respect to cathode | 90 | V |

Maximum Circuit Value

| | | |
|-----------------------------------|-----|----|
| Grid-Circuit Resistance | 0.5 | MΩ |
|-----------------------------------|-----|----|

RF POWER AMPLIFIER AND OSCILLATOR — CLASS C TELEGRAPHY

Key-down conditions per tube without amplitude modulation^b

Maximum CCS Ratings, Absolute-Maximum Values up to 2000 Mc/s

For Altitudes up to 25000 ft

| | | |
|---|------|----|
| DC Plate Voltage | 360 | V |
| DC Grid Voltage | -100 | V |
| DC Plate Current | 25 | mA |
| DC Grid Current | 8 | mA |
| Plate Input | 9 | W |
| Plate Dissipation ^a | 6.25 | W |
| Peak Heater-Cathode Voltage | | |
| Heater negative with respect to cathode | 90 | V |
| Heater positive with respect to cathode | 90 | V |

Typical CCS Operation

As oscillator in cathode-drive circuit

| | At 500 | 2000 | 3000 | Mc/s |
|---|--------|------|------|------|
| DC Plate-to-Grid Voltage | 262 | 252 | 252 | V |
| DC Cathode-to-Grid Voltage ^c | 12 | 2 | 2 | V |
| DC Plate Current | 23 | 23 | 25 | mA |
| DC Grid Current (Approx.) | 6 | 3 | 4 | mA |
| Useful Power Output (Approx.) | 3 | 0.45 | 0.1 | W |

As rf power amplifier in cathode-drive circuit at 500 Mc/s

| | | |
|---|-----|----|
| DC Plate-to-Grid Voltage | 326 | V |
| DC Cathode-to-Grid Voltage ^c | 51 | V |
| DC Plate Current | 23 | mA |
| DC Grid Current (Approx.) | 7 | mA |
| Driver Power Output (Approx.) | 2 | W |
| Useful Power Output (Approx.) | 5 | W |

Maximum Circuit Value

| | | |
|-----------------------------------|-----|----|
| Grid-Circuit Resistance | 0.1 | MΩ |
|-----------------------------------|-----|----|

PLATE-MODULATED RF POWER AMPLIFIER — CLASS C TELEPHONY

Carrier conditions per tube for use with a max modulation factor of 1

Maximum CCS Ratings, Absolute-Maximum Values up to 2000 Mc/s

For Altitudes up to 25000 ft

| | | |
|----------------------------|------|----|
| DC Plate Voltage | 275 | V |
| DC Grid Voltage | -100 | V |
| DC Plate Current | 22 | mA |
| DC Grid Current | 8 | mA |



| | | |
|---|------|----|
| Plate Input | 6 | W |
| Plate Dissipation ^a | 4.25 | W |
| Peak Heater-Cathode Voltage | | |
| Heater negative with respect to cathode | 90 | V |
| Heater positive with respect to cathode | 90 | V |
| Maximum Circuit Value | | |
| Grid-Circuit Resistance | 0.1 | MΩ |

CHARACTERISTICS RANGE VALUES

| | <i>Note</i> | <i>Min</i> | <i>Max</i> | |
|--|-------------|------------|------------|-------|
| Heater Current. | 1 | 0.130 | 0.160 | A |
| Direct Interelectrode Capacitances | | | | |
| Grid to plate | - | 0.8 | 1.3 | μF |
| Grid to cathode | - | 1.5 | 2.1 | μF |
| Plate to cathode. | - | - | 0.05 | μF |
| Heater-Cathode Leakage Current | | | | |
| Heater negative with respect to cathode. | 1,2 | - | 50 | μA |
| Heater positive with respect to cathode. | 1,3 | - | 50 | μA |
| Reverse Grid Current. | 1,4 | - | 1 | μA |
| Amplification Factor. | 1,5 | 22 | 38 | |
| Transconductance. | 1,5 | 4000 | 7000 | μmhos |
| Plate Current (1) | 1,5 | 13.5 | 24.5 | mA |
| Plate Current (2) | 1,6 | - | 55 | μA |
| Power Output. | 1,7 | 0.15 | | W |

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

Note 2: With 100 volts dc between heater and cathode, heater negative with respect to cathode.

Note 3: With 100 volts dc between heater and cathode, heater positive with respect to cathode.

Note 4: With dc plate voltage of 250 volts, dc grid voltage of -2.5 volts, grid resistor of 0.5 megohm.

Note 5: With dc plate-supply voltage of 250 volts, cathode resistor of 200 ohms, and cathode bypass capacitor of 1000 microfarads.

Note 6: With dc plate voltage of 250 volts and dc grid voltage of -25 volts.

Note 7: With dc plate voltage of 250 volts, grid resistor adjusted to give a dc plate current of 25 milliamperes in a cavity-type oscillator operating at 1800 ± 25 megacycles per second.

^a In applications where the plate dissipation exceeds 2.5 watts, it is important that a large area of contact be provided between the plate cylinder and the terminal to provide adequate heat conduction.

^b Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 percent of the carrier conditions.

^c Obtained from grid resistor.

SPECIAL TESTS AND PERFORMANCE DATA

Low-Pressure Voltage Breakdown Test

This test (similar to MIL-E-1D, par. 4.9.12.1) is periodically performed on a sample lot of tubes. Tubes are tested in a chamber at an air pressure equivalent to an altitude of 25,000 feet. Breakdown should not occur when a 60-cycle rms voltage



of 500 volts is applied between the plate cylinder and grid flange.

Low-Frequency Vibration Performance

This test (similar to MIL-E-1D, par. 4.9.19.1) is performed on a sample lot of tubes from each production run under the following conditions:

Heater voltage of 6.3 volts, dc plate-supply voltage of 250 volts, grid voltage of -2.5 volts, and plate load resistor of 10,000 ohms. The tubes are vibrated in a plane perpendicular to the tube axis at 25 cycles per second at an acceleration of 2.5 g. The rms output voltage across the plate load resistor as a result of vibration of the tube should not exceed 100 millivolts.

High-Frequency Vibration Performance

This test (similar to MIL-E-1D, par. 4.9.19.2) is performed on a sample lot of tubes from each production run. The tube is vibrated perpendicular to its axis, with no voltages applied to the tube. Vibration frequency is 40-60 c/s and acceleration is 10 g. At the end of this test, tubes should not show temporary or permanent shorts or open circuits and should meet the following limits:

Heater-Cathode Leakage Current 50 max μ A

For conditions shown under *Characteristics Range Values Notes 1, 2 and 1, 3.*

Low-Frequency Vibration (rms) 100 max mV

For conditions shown above under *Low-Frequency Vibration Performance.*

Transconductance 3900 min μ hos

For conditions shown under *Characteristics Range Values Notes 1, 5.*

Shorts and Continuity Test

This test (similar to MIL-E-1D, par. 4.7.3) is performed on all tubes from each production run. Voltage applied between adjacent elements of the tube under test should be between 20 and 70 volts dc or peak ac. Plate and cathode terminals are tied together and connected to the grid terminal through the shorts test equipment. Tubes are tapped with a rubber tapper three times in each of three mutually perpendicular directions. If a short indication is obtained, the tapping cycle is repeated two times for verification. Acceptance criteria is based on the "Resistance vs. Time Duration" curve shown in par. 4.7.7 of MIL-1-D, Amendment 5.

Glass Seal Fracture Tests

Fracture tests are performed on sample lots of subassemblies during manufacture.

1. Tubes (prior to final assembly) are placed on supports spaced $15/16 \pm 1/64$ inch apart with the grid flange centered



between these supports. Tubes should withstand gradual application, perpendicular to the tube axis, of a force of 30 pounds upon the grid flange without causing fracture of the glass insulation.

2. Tubes (prior to final assembly) are held by clamping to the cathode cylinder. Tubes should withstand gradual application of a torque of 12.5 inch-pounds upon the plate terminal without causing fracture of the glass insulation.

Dynamic Life Performance

This test (similar to MIL-E-1D, par. 4.11.3.2) is performed on a sample lot of tubes from each production run to insure high quality of rf performance. Each tube is life-tested in a cavity-type oscillator at 500 ± 15 Mc/s under the following conditions:

Heater voltage of 6.3 volts, plate-supply voltage of 300 volts, cathode resistor adjusted to give a dc plate current of 25 mA and value recorded, heater positive with respect to cathode by 100 volts, and plate-seal temperature of 175° C min.

At the end of 500 hours, the tube should not show permanent shorts or open circuits and will be criticized for the total number of defects in the sample lot and for the number of tubes failing to meet the following limit.

Power Output. 0.2 min W

For conditions shown under *Characteristics Range Values Notes 1, 7.*

OPERATING CONSIDERATIONS

Mechanical

The *maximum plate-seal temperature* of 175° C is a tube rating and is to be observed in the same manner as other ratings. The temperature of the plate seal should be measured on the plate seal. The temperature may be measured with temperature-sensitive paint, such as *Tempilaq*. The latter is made by the Tempil Corporation, 132 W. 22nd Street, New York 11, N. Y., in the form of a liquid or stick.

The *mounting* for the 4037A in cavity-type circuits should support the tube by the cathode cylinder which should make firm contact to the cavity surface. Connections to the grid flange and plate cylinder must be made by contacts with flexible leads to allow for variations in tube dimensions and eccentricities of the tube structure. In addition the plate connector should make firm, large-surface contact and be capable of conducting heat so that the plate-seal temperature will not exceed 175° C under any operating conditions. Contact should not be made to the 0.230-inch cap at the plate-terminal end of the tube as indicated on the *Dimensional Outline*.

Electrical

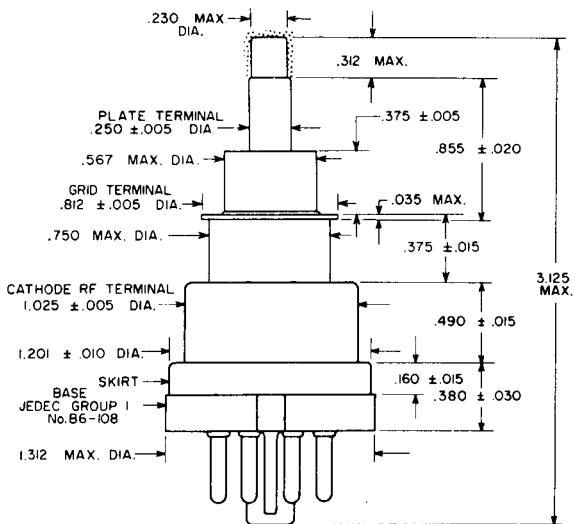
The *cathode* should preferably be connected to one side of the heater. When, in some circuit designs, the heater is not



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connected directly to the cathode, precautions must be taken to hold the peak heater-cathode voltage to the maximum values shown in the tabulated data.

DIMENSIONAL OUTLINE



STIPPLED REGION (NOTE 1)

92CM-11472R2

DIMENSIONS IN INCHES

Note 1: Keep all stippled regions clear. Do not allow contacts or circuit components to protrude into these areas.



Average Characteristics

