

# ML-2C39A

General purpose application.

## DESCRIPTION

The ML-2C39A is a high-mu triode of the planar-electrode type designed specifically for use as an oscillator, frequency multiplier, or power amplifier in radio transmitting service from low frequency to above 2500 Mc. Features include low interelectrode capacitances, high transconductance, and high plate dissipation. Lead inductances and r.f. losses are minimized by a compact, rugged construction with ring type seals, making the tube ideally suited to

cavity type circuits as well as for parallel line operation. The cathode is an indirectly-heated, oxide-coated disc. The anode is forced-air cooled and is capable of dissipating 100 watts.

The ML-2C39A embodies the highest standards of this tube type. All parts are thoroughly processed by special Machlett techniques to assure efficient operation and long life.

## GENERAL CHARACTERISTICS

### Electrical

|                                                                    |        |         |
|--------------------------------------------------------------------|--------|---------|
| Heater Voltage .....                                               | 6.3    | Volts†  |
| Heater Current at 6.3 Volts .....                                  | 1.0    | Amps    |
| Heater Heating Time, minimum (Before Applying Plate Voltage) ..... | 60     | Seconds |
| Amplification Factor .....                                         | 100    |         |
| Transconductance                                                   |        |         |
| ( $I_b = 70$ mA, $E_b = 600$ v) .....                              | 24,000 | umhos   |
| Interelectrode Capacitances                                        |        |         |
| Grid-Plate .....                                                   | 2.0    | uuf     |
| Grid-Cathode .....                                                 | 6.60   | uuf     |
| Plate-Cathode, maximum .....                                       | 0.035  | uuf     |

### Mechanical

|                                        |             |
|----------------------------------------|-------------|
| Mounting Position .....                | Optional    |
| Type of Cooling .....                  | Forced Air* |
| Maximum Incoming Air Temperature ..... | 45 °C       |
| Required Air Flow on Anode .....       | 12.5 cfm*   |
| Maximum Anode Temperature .....        | 175 °C      |
| Net Weight .....                       | 2 oz.       |

†See Application Note, page 16, for optimum heater voltage.

\*See Application Notes, page 16 and also air cooling curves, page 83.

## MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

## R-F Power Amplifier and Oscillator

Key-down conditions per tube without amplitude modulation‡

## Maximum Ratings, Absolute Values

|                                               |      |       |
|-----------------------------------------------|------|-------|
| D-C Plate Voltage .....                       | 1000 | volts |
| D-C Grid Voltage .....                        | -150 | volts |
| D-C Cathode Current .....                     | 125  | mA    |
| D-C Grid Current§ .....                       | 50   | mA    |
| Peak Positive RF Grid Voltage .....           | 30   | volts |
| Peak Negative RF Grid Voltage .....           | -400 | volts |
| Plate Dissipation† (Forced-air Cooling) ..... | 100  | watts |
| Grid Dissipation .....                        | 2    | watts |

## Typical Operation

## Power Amplifier, Grid Separation Circuit — 500 Mc

|                                     |     |       |
|-------------------------------------|-----|-------|
| D-C Plate Voltage .....             | 900 | volts |
| D-C Grid Voltage .....              | -40 | volts |
| D-C Cathode Current .....           | 115 | mA    |
| D-C Plate Current .....             | 90  | mA    |
| D-C Grid Current, Approximate ..... | 30  | mA    |
| Plate Input .....                   | 64  | watts |
| Driving Power, Approximate .....    | 6   | watts |
| Useful Power Output .....           | 40  | watts |

## RF Oscillator — 2500 Mc

|                                                               |     |       |
|---------------------------------------------------------------|-----|-------|
| D-C Plate Voltage .....                                       | 900 | volts |
| D-C Grid Voltage (from grid-bias resistor)<br>(approx.) ..... | -22 | volts |
| D-C Plate Current .....                                       | 90  | mA    |
| D-C Grid Current .....                                        | 27  | mA    |
| Useful Power Output .....                                     | 17  | watts |

Note: These conditions are for a grid-blocking oscillator and conform to the minimum power output requirements as specified in such a test by the MIL-E-1 specification for 2C39A tubes.

Plate Modulated R-F Power Amplifier  
Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1.0.

## Maximum Ratings, Absolute Values

|                                               |      |       |
|-----------------------------------------------|------|-------|
| D-C Plate Voltage* .....                      | 600  | volts |
| D-C Grid Voltage .....                        | -150 | volts |
| D-C Cathode Current .....                     | 100  | mA    |
| D-C Grid Current§ .....                       | 50   | mA    |
| Peak Positive RF Grid Voltage .....           | 30   | volts |
| Peak Negative RF Grid Voltage .....           | -400 | volts |
| Plate Dissipation† (Forced-air Cooling) ..... | 70   | watts |
| Grid Dissipation .....                        | 2    | watts |

## Characteristic Range Values for Equipment Design

|                                            | Min.  | Max.                |
|--------------------------------------------|-------|---------------------|
| Filament Current at 6.3 volts (Note 1).... | 0.95  | 1.1 A               |
| Plate Current (Note 2) .....               | 60    | 95 mA <sub>dc</sub> |
| Cut-off bias (Note 3) .....                | —     | -15 volts           |
| Transconductance .....                     | 20000 | 30000 umhos         |
| Grid-Plate Capacitance .....               | 1.86  | 2.16 uuf            |
| Grid-Cathode Capacitance (Note 4) .....    | 5.60  | 7.60 uuf            |
| Plate tuning range (Note 5) .....          | 1960  | 2030 Mc             |

Note 1 — For reduced filament voltage see filament volt-ampere characteristics on page 3.

Note 2 — Measured at a plate voltage of 600 volts and a cathode-bias resistor of 30 ohms.

Note 3 — Measured at 1 mA of plate current and a plate voltage of 600 volts.

Note 4 — Capacitance measurements are with the tube cold. When the filament is heated to proper operating temperature, the grid to cathode capacitance will increase by about 1 uuf, due to thermal expansion of the cathode.

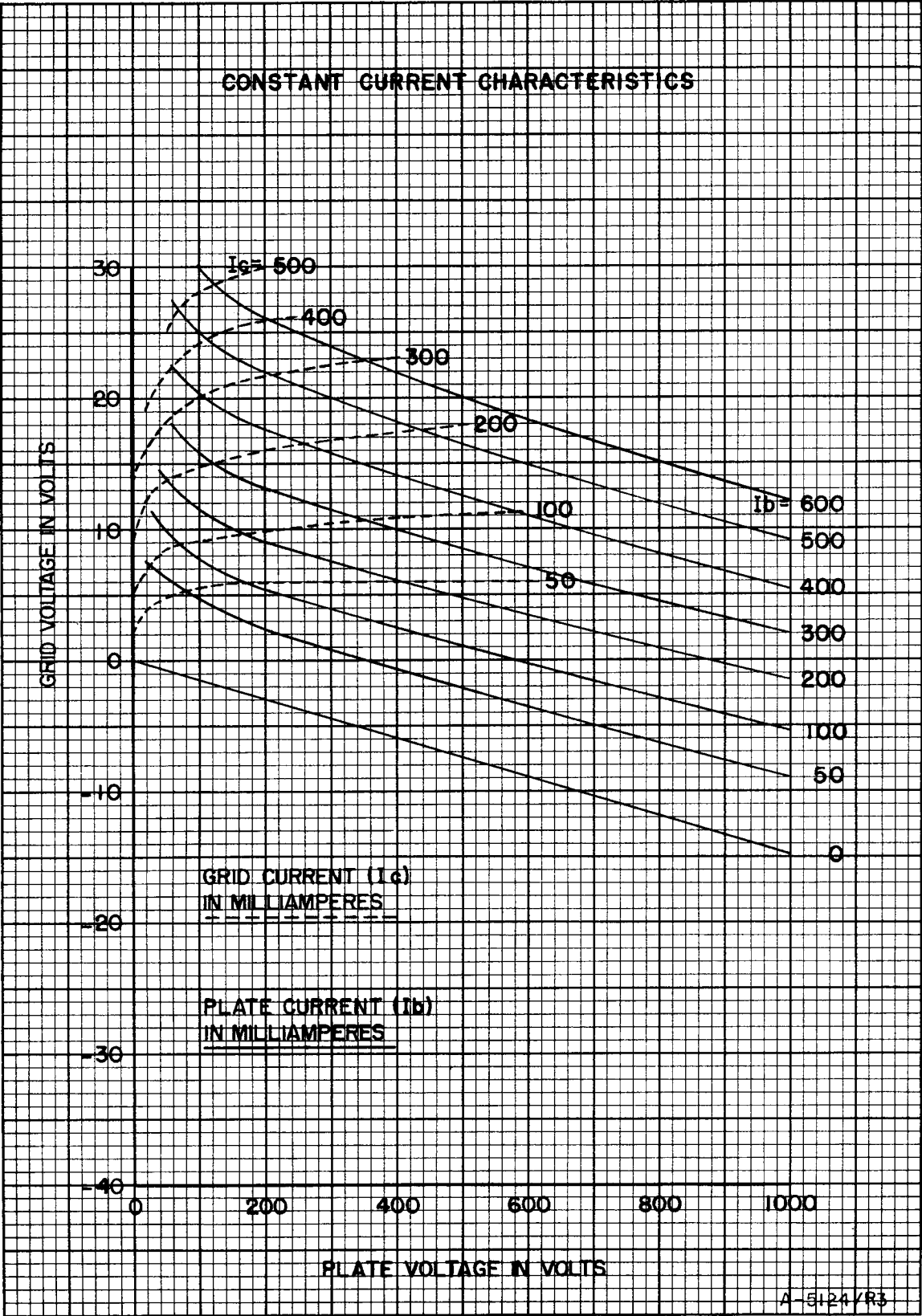
Note 5 — With a plate-grid coaxial cavity of fixed dimensions, all tubes will resonate within the specified frequency range.

‡Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of the carrier conditions.

§See Application Notes on Determination of Proper Grid Drive.

†Up to 100 watts plate dissipation allowable with forced air sufficient to limit seal temperatures to 175°C. Recommended air flow is 12.5 cubic feet per minute with cowling.

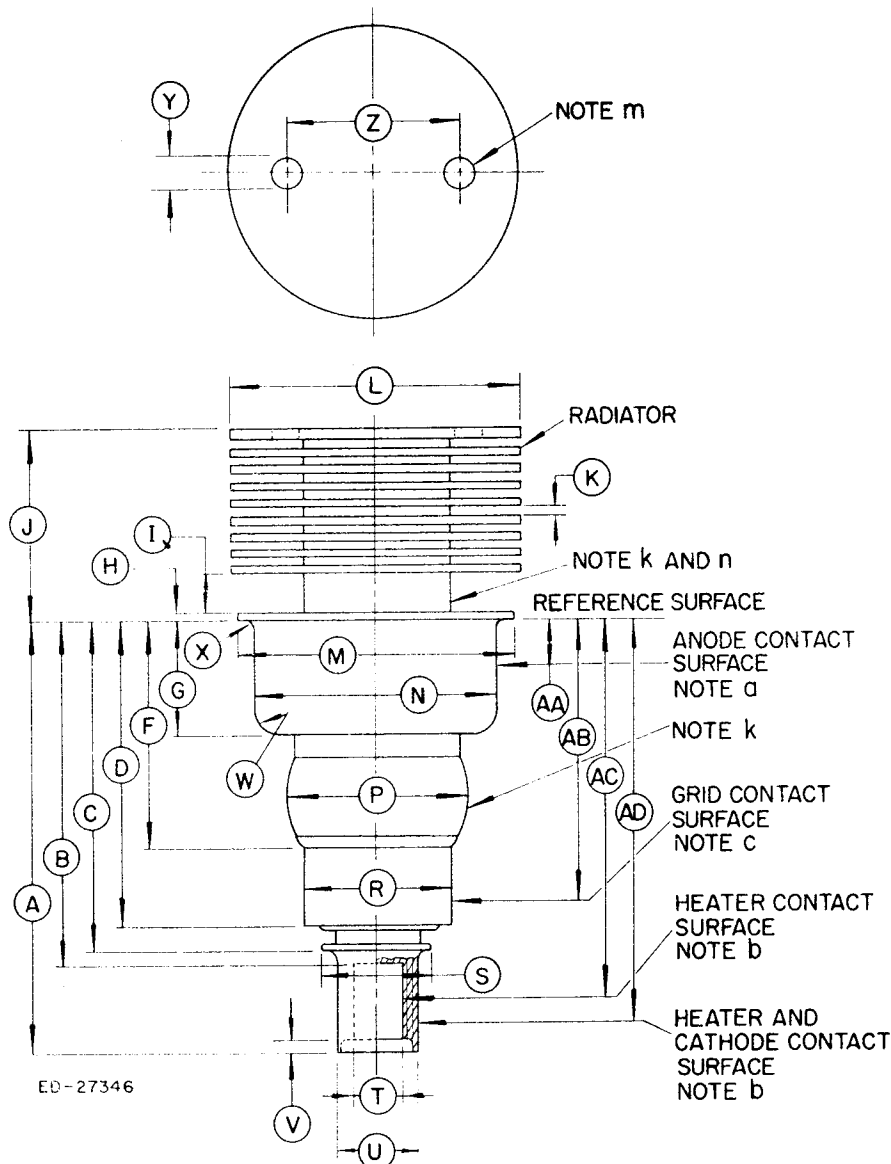
\*For modulation factors less than 1.0, a higher d-c plate voltage may be used if the sum of the peak audio voltage and the d-c plate voltage does not exceed 1200 volts.



# OUTLINE AND DIMENSIONS

## DIMENSIONS A ML-2C39A, ML-2C39WA, ML-2C41, ML-322, ML-7209, and ML-7210

### DIMENSIONS B ML-322



DIMENSIONS FOR OUTLINE (INCHES)

| Ref. | DIMENSIONS A |       | DIMENSIONS B |       |
|------|--------------|-------|--------------|-------|
|      | Min.         | Max.  | Min.         | Max.  |
| A    | 1.815        | 1.875 | 1.788        | 1.858 |
| B    | —            | 1.534 | —            | 1.517 |
| C    | —            | 1.475 | —            | 1.458 |
| D    | 1.289        | 1.329 | 1.252        | 1.292 |
| F    | —            | 0.980 | —            | 1.000 |
| G    | 0.462        | .477  | .459         | .479  |
| H    | —            | .040  | —            | .040  |
| I    | .125         | .185  | .125         | —     |
| J    | .766         | .826  | .736         | .826  |
| K    | .025         | .046  | .015         | —     |
| L    | 1.234        | 1.264 | 1.235        | 1.265 |
| M    | 1.180        | 1.195 | 1.788        | 1.199 |
| N    | 1.025        | 1.035 | 1.021        | 1.039 |
| P    | —            | 0.812 | —            | .812  |
| R    | 0.655        | 0.665 | .652         | .668  |
| S    | —            | .545  | —            | .545  |
| T    | 0.213        | .223  | .213         | .223  |
| U    | .315         | .325  | .312         | .328  |
| V    | —            | .086  | —            | .086  |
| W    | —            | .100  | —            | .100  |
| X    | —            | .035  | .105         | .145  |
| Y    | .105         | .145  | .650         | .850  |
| Z    | .650         | .850  | —            | —     |

DIMENSIONS FOR ELECTRODE CONTACT AREA (INCHES)

#### DIMENSIONS A

| Ref. | Dimensions    | Contact |
|------|---------------|---------|
| AA   | 0.198 ± 0.163 | Anode   |
| AB   | 1.225 ± .040  | Grid    |
| AC   | 1.631 ± .097  | Heater  |
| AD   | 1.645 ± .170  | Cathode |

#### DIMENSIONS B

| Ref. | Dimension    | Contact          |
|------|--------------|------------------|
| AA   | 0.195 ± .163 | Anode            |
| AB   | 1.210 ± .040 | Cathode & Heater |
| AC   | 1.610 ± .092 | Heater           |
| AD   | 1.623 ± .165 | Cathode & Heater |

#### NOTES

- The total indicated runout of the anode contact surface with respect to the cathode contact surface will not exceed 0.020 inch, except ML-322; 0.030 inch, ML-322.
- The total indicated runout of the cathode contact surface with respect to the heater contact surface will not exceed 0.012 inch, except ML-322; 0.018 inch, ML-322.
- The total indicated runout of the grid contact surface with respect to the cathode contact surface will not exceed 0.020 inch. Does not apply to ML-322.
- Do not clamp or locate on this surface.
- Hole provided for tube extractor through top fin only.
- Measure anode shank temperature here.