

## Beam Power Tube

CERMOLOX<sup>®</sup>

Full Input to 400 MHz

20.0 Kilowatt Peak Sync. Output Through

VHF-TV Band at 13 dB Gain

## ELECTRICAL

Filamentary Cathode, Thoriated-Tungsten  
Mesh Type

|                                                       |                             |   |
|-------------------------------------------------------|-----------------------------|---|
| Voltage <sup>a</sup> (AC or DC) .....                 | } 9.5 typ. V<br>10.0 max. V | V |
| Current .....                                         |                             | V |
| Typical value at 9.5 V .....                          | 153                         | A |
| Maximum value for starting<br>even momentarily .....  | 300                         | A |
| Cold resistance .....                                 | 0.01                        | Ω |
| Minimum heating time .....                            | 15                          | s |
| Mu Factor <sup>b</sup> (Grid No.2 to Grid No.1) ..... | 12.5                        |   |

Direct Interelectrode Capacitances:

|                                          |           |    |
|------------------------------------------|-----------|----|
| Grid No.1 to plate <sup>c</sup> .....    | 0.4 max.  | pF |
| Grid No.1 to filament .....              | 100       | pF |
| Plate to filament <sup>c,d</sup> .....   | 0.15 max. | pF |
| Grid No.1 to grid No.2 .....             | 85        | pF |
| Grid No.2 to plate .....                 | 20        | pF |
| Grid No.2 to filament <sup>d</sup> ..... | 4.0 max.  | pF |

## MECHANICAL

|                          |                         |            |    |
|--------------------------|-------------------------|------------|----|
| Operating Position ..... | Vertical, either end up |            |    |
| Overall Length .....     | (180.3 mm)              | 7.100 max. | in |
| Greatest Diameter .....  | (210.4 mm)              | 8.285 max. | in |
| Radiator .....           | Integral part of tube   |            |    |
| Weight (Approx.) .....   | (10.0 kg)               | 22         | lb |

## THERMAL

|                                                                  |          |    |
|------------------------------------------------------------------|----------|----|
| Seal Temperature <sup>e</sup> .....                              | 250 max. | °C |
| (Plate, grid No.2, grid No.1,<br>cathode-filament, and filament) |          |    |
| Plate Core Temperature <sup>e</sup> .....                        | 250 max. | °C |

**RF Power Amplifier****Class B Television Service<sup>f,p</sup>**

Synchronizing level conditions per tube unless otherwise specified.

**MAXIMUM CCS RATINGS, Absolute-Maximum Values:**

|                                         |            |   |
|-----------------------------------------|------------|---|
| DC Plate Voltage <sup>g</sup> .....     | 9,000 max. | V |
| DC Grid No.2 Voltage <sup>h</sup> ..... | 2,000 max. | V |
| DC Grid No.1 Voltage <sup>j</sup> ..... | -600 max.  | V |
| DC Plate Current .....                  | 6.0 max.   | A |
| Grid No.2 Input .....                   | 450 max.   | W |
| Grid No.1 Input .....                   | 250 max.   | W |
| Plate Dissipation .....                 | See Note m |   |

**Calculated CCS Operation:**In a cathode-drive circuit at 216 MHz and a bandwidth of 6.0 MHz<sup>k</sup>.

|                                    |       |          |
|------------------------------------|-------|----------|
| DC Plate Voltage .....             | 6,580 | V        |
| DC Grid No.2 Voltage .....         | 1,000 | V        |
| DC Grid No.1 Voltage .....         | -115  | V        |
| Zero Signal DC Plate Current ..... | 1.0   | A        |
| Effective RF Load Resistance ..... | 660   | $\Omega$ |

**DC Plate Current:**

|                           |      |   |
|---------------------------|------|---|
| Synchronizing level ..... | 4.82 | A |
| Blanking level .....      | 3.68 | A |

**DC Grid No.2 Current:**

|                           |     |    |
|---------------------------|-----|----|
| Synchronizing level ..... | 137 | mA |
| Blanking level .....      | 33  | mA |

**DC Grid No.1 Current:**

|                           |     |    |
|---------------------------|-----|----|
| Synchronizing level ..... | 437 | mA |
| Blanking level .....      | 131 | mA |

|                                          |      |   |
|------------------------------------------|------|---|
| Input Circuit Efficiency (Approx.) ..... | 92.5 | % |
|------------------------------------------|------|---|

**Driver Power Output:**

|                           |     |   |
|---------------------------|-----|---|
| Synchronizing level ..... | 865 | W |
| Blanking level .....      | 504 | W |

|                                           |      |   |
|-------------------------------------------|------|---|
| Output Circuit Efficiency (Approx.) ..... | 92.5 | % |
|-------------------------------------------|------|---|

**Useful Power Output:**

|                           |      |    |
|---------------------------|------|----|
| Synchronizing level ..... | 18.8 | kW |
| Blanking level .....      | 10.6 | kW |

**Linear RF Power Amplifier<sup>f,p</sup>****Single-Sideband Suppressed-Carrier Service**

Peak envelope conditions for a signal having a minimum peak-to-average power ratio of 2.

**MAXIMUM CCS RATINGS, Absolute-Maximum Values**

|                                            |        | Up to 400 MHz |    |
|--------------------------------------------|--------|---------------|----|
| DC Plate Voltage <sup>g</sup> .....        | 10,000 | max.          | V  |
| DC Grid-No.2 Voltage <sup>h</sup> .....    | 2,000  | max.          | V  |
| DC Plate Current at Peak of Envelope ..... | 6.0    | max.          | A  |
| DC Grid-No.1 Current .....                 | 500    | max.          | mA |
| Grid-No.2 Input .....                      | 450    | max.          | W  |
| Plate Dissipation .....                    | 15     | max.          | kW |

**MAXIMUM CIRCUIT VALUES**

Grid-No.1-Circuit Resistance Under Any Conditions:

|                                                             |                 |      |          |
|-------------------------------------------------------------|-----------------|------|----------|
| With fixed bias .....                                       | 5,000           | max. | $\Omega$ |
| With fixed bias (In Class AB <sub>1</sub> operation). ..... | 25,000          | max. | $\Omega$ |
| With cathode bias .....                                     | Not recommended |      |          |

Grid-No.2 Circuit Impedance .....

See Note h

Plate Circuit Impedance .....

See Note g

**Calculated Class AB<sub>1</sub> CCS Operation with "Two-Tone" Modulation**

In a grid-drive circuit at 7 MHz

|                                                  |            |          |
|--------------------------------------------------|------------|----------|
| DC Plate Voltage .....                           | 8,000      | V        |
| DC Grid-No.2 Voltage .....                       | 1,500      | V        |
| DC Grid-No.1 Voltage .....                       | -191       | V        |
| Zero-Signal DC Plate Current .....               | 1.0        | A        |
| Effective RF Load Resistance .....               | 978.5      | $\Omega$ |
| DC Plate Current (At peak of envelope) .....     | 3.91       | A        |
| Average DC Plate Current. ....                   | 2.49       | A        |
| DC Grid-No.2 Current (At peak of envelope) ..... | 137        | mA       |
| Average DC Grid-No.2 Current .....               | 53         | mA       |
| Peak Envelope Drive Power .....                  | See Note n |          |
| Output Circuit Efficiency (Approx.) .....        | 95         | %        |
| Useful Power Output (Approx.)                    |            |          |
| Average .....                                    | 8,750      | W        |
| Peak envelope .....                              | 17,500     | W        |

## Linear RF Power Amplifier<sup>f,p</sup> Class AB or Class B Telephony

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

### MAXIMUM CCS RATINGS, Absolute-Maximum Values

|                                   |            |      |   |
|-----------------------------------|------------|------|---|
| DC Plate Voltage <sup>g</sup>     | 10,000     | max. | V |
| DC Grid-No.2 Voltage <sup>h</sup> | 2,000      | max. | V |
| DC Plate Current                  | 3.0        | max. | A |
| Grid-No.2 Input                   | 300        | max. | W |
| Plate Dissipation                 | See Note m |      |   |

### Calculated CCS Operation

In a cathode drive circuit at 400 MHz.

|                                     |       |    |
|-------------------------------------|-------|----|
| DC Plate Voltage                    | 8,000 | V  |
| DC Grid-No.2 Voltage                | 1,500 | V  |
| DC Grid-No.1 Voltage <sup>f</sup>   | -235  | V  |
| DC Plate Current                    | 2.47  | A  |
| DC Grid-No.1 Current                | 0     | mA |
| DC Grid-No.2 Current                | 24    | mA |
| Driver Power Output                 | 500   | W  |
| Output Circuit Efficiency (Approx.) | 80    | %  |
| Useful Power Output                 | 5,000 | W  |

- <sup>a</sup> Measured at the tube terminals. The filament may be subjected to rf heating as the frequency of operation is increased. It is recommended that the filament power be regulated at the lowest value that will give stable performance. For those applications where hum is a critical consideration, dc filament operation or hum bucking circuits are recommended.
- <sup>b</sup> For plate voltage = 2000 V, grid No.2 voltage = 1250 V, and plate current = 15 A.
- <sup>c</sup> With external flat metal shield 8" (200 mm) in diameter having a center hole 3" (76 mm) in diameter. Shield is located in plane of the grid No.2 terminal, perpendicular to the tube axis, and is connected to grid No.2.
- <sup>d</sup> With external flat metal shield 8" (200 mm) in diameter having a center hole 2-3/8" (60 mm) in diameter. Shield is located in plane on the grid No.1 terminal, perpendicular to the tube axis, and is connected to grid No.1.
- <sup>e</sup> See Dimensional Outline for Temperature Measurement Points.

- k The bandwidth of 6.0 MHz is calculated at the  $-1.0$  dB power points of a double tuned output circuit using two times the tube capacity and a damping factor of  $\sqrt{1.5}$ .
- m Permitted plate dissipation is a function of cooling. For specific ratings see Forced Air Cooling information.
- n Driver power output represents circuit losses and is the actual power measured at the input to the grid No.1 circuit. The actual power required depends on the operating frequency and the circuit used. The tube driving power is approximately zero watts.
- p The maximum voltage and air flow rates must be modified to obtain adequate holdoff voltage and cooling at temperatures in excess of  $35^{\circ}\text{C}$  and altitudes above 7000 feet.
- r Obtained from a fixed supply with an internal impedance of 695 ohms to provide necessary increase in bias at crest of modulating signal.

The following footnotes apply to the RCA Transmitting Tube Operating Considerations given at the front of this section.

- f See Section Class of Service.
- g See Section Electrical Considerations - Power Supplies and Plate Voltage Supply.
- h See Section Electrical Considerations - Grid-No.2 Voltage Supply.
- j See Section Electrical Considerations - Grid-No.1 Voltage Supply.

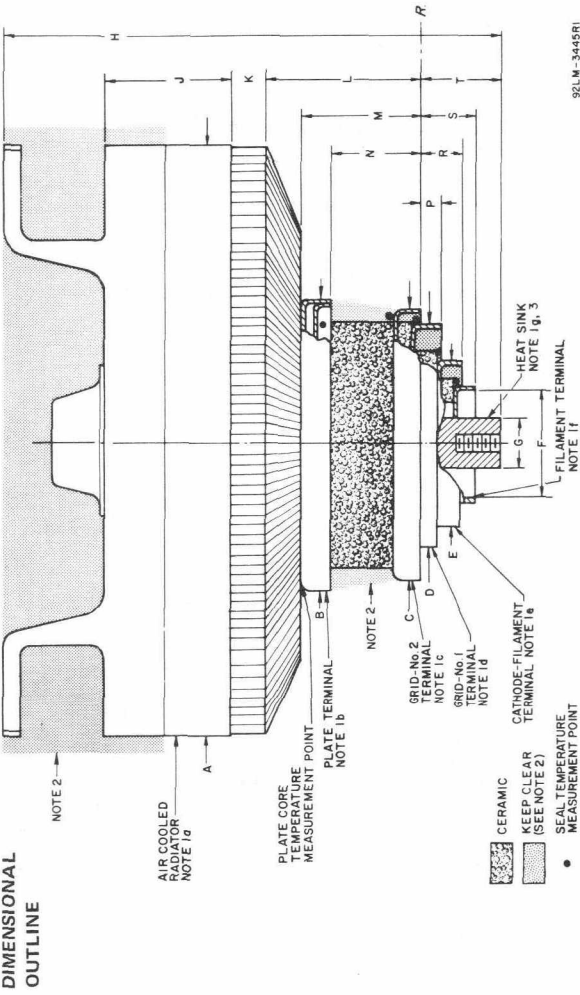
#### DIMENSIONAL OUTLINE NOTES

**Note 1:** The contact distance listed is the minimum, uniform, indicated length as measured from the edge of the terminal.

|                               | <u>Contact Distance</u><br>inch (mm) |
|-------------------------------|--------------------------------------|
| 1a. Radiator                  | 0.800 (20.32)                        |
| 1b. Plate Terminal            | 0.265 ( 6.73)                        |
| 1c. Grid No.2 Terminal        | 0.265 ( 6.73)                        |
| 1d. Grid No.1 Terminal        | 0.265 ( 6.73)                        |
| 1e. Cathode-Filament Terminal | 0.250 ( 6.35)                        |
| 1f. Filament Terminal         | 0.265 ( 6.73)                        |
| 1g. Heat Sink (post)          | 0.450 (11.43)                        |

**Note 2:** Keep all stippled regions clear. In general do not allow contacts to protrude into these annular regions. If special connectors are required which may intrude on these regions, contact RCA Power Tube Application Engineering, Lancaster, PA 17604.

**Note 3:** Tapped 1/4-20 NC x 0.5 in (12.7 mm) deep.



## DIMENSIONAL OUTLINE

## TABULATED DIMENSIONS

| Dimensions | Value<br>Inches  | Value<br>Millimeters   |
|------------|------------------|------------------------|
| A Dia.     | $8.250 \pm .035$ | $(209.5 \pm .9)$       |
| B Dia.     | $4.188 \pm .020$ | $(106.58 \pm .51)$     |
| C Dia.     | $3.915 \pm .015$ | $(99.44 \pm .38)$      |
| D Dia.     | $3.315 \pm .015$ | $(84.20 \pm .38)$      |
| E Dia.     | $2.696 \pm .015$ | $(68.48 \pm .38)$      |
| F Dia.     | $1.960 \pm .015$ | $(49.78 \pm .38)$      |
| G Dia.     | 0.810 max.       | $(20.57 \text{ max.})$ |
| H          | 7.10 max.        | $(180.3 \text{ max.})$ |
| J          | $1.750 \pm .030$ | $(44.5 \pm .8)$        |
| K          | 0.500 ref.       | $(12.7 \text{ ref.})$  |
| L          | $2.150 \pm .050$ | $(54.6 \pm 1.3)$       |
| M          | 1.775 min.       | $(45.1 \text{ min.})$  |
| N          | $1.420 \pm .030$ | $(36.1 \pm .8)$        |
| P          | $0.330 \pm .030$ | $(8.4 \pm .8)$         |
| R          | $0.650 \pm .038$ | $(16.5 \pm 1.0)$       |
| S          | $0.960 \pm .050$ | $(24.4 \pm 1.3)$       |
| T          | 1.200 ref.       | $(30.5 \text{ ref.})$  |

## FORCED-AIR COOLING

## AIR-FLOW

Through radiator — Adequate air flow to limit the plate-core temperature to 250° C should be delivered by a blower through the radiator before and during the application of filament, plate, grid-No.2, and grid-No.1 voltages.

For typical operation, the required air flow is as follows:

| Plate<br>Dissipation | Air<br>Flow | Pressure<br>Drop        |
|----------------------|-------------|-------------------------|
| Kilowatts            | CFM         | Inches H <sub>2</sub> O |
| 12.5                 | 350         | 1.75                    |
| 15.0                 | 425         | 2.50                    |
| 17.5                 | 550         | 3.50                    |

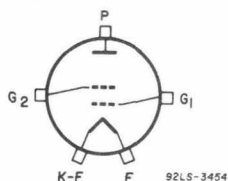
To Plate, Grid-No.2, Grid-No.1, Cathode-Filament, and Filament Terminals — A sufficient quantity of air should be

allowed to flow past each of these terminals so that its temperature does not exceed the specified maximum value of 250° C.

**During Standby Operation** — Cooling air is required when only filament voltage is applied to the tube.

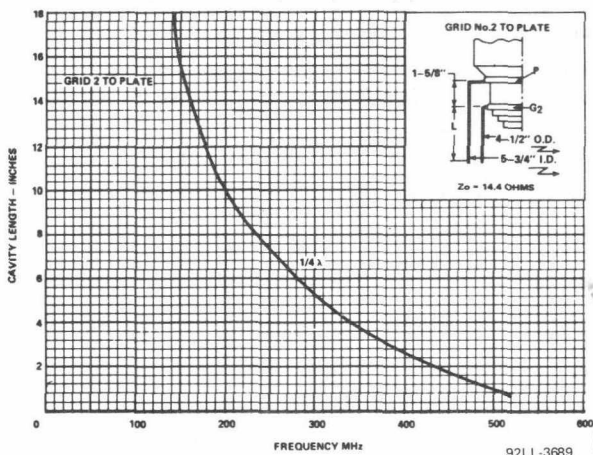
**During Shutdown Operation** — Air flow should continue for a few minutes after all electrode power is removed.

## TERMINAL DIAGRAM

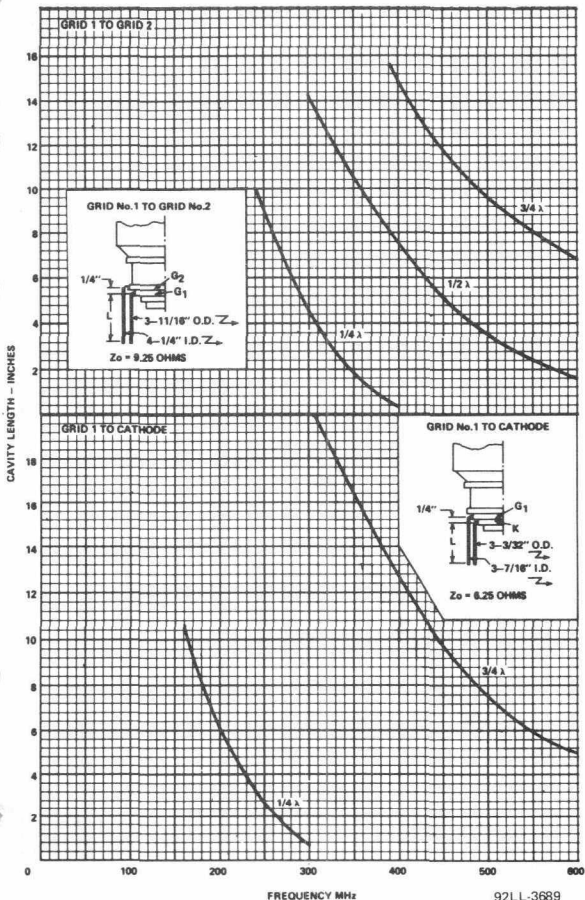


- P — Plate Terminal
- G<sub>2</sub> — Grid-No.2 Terminal
- G<sub>1</sub> — Grid-No.1 Terminal
- K-F — Cathode Filament Terminal
- F — Filament Terminal

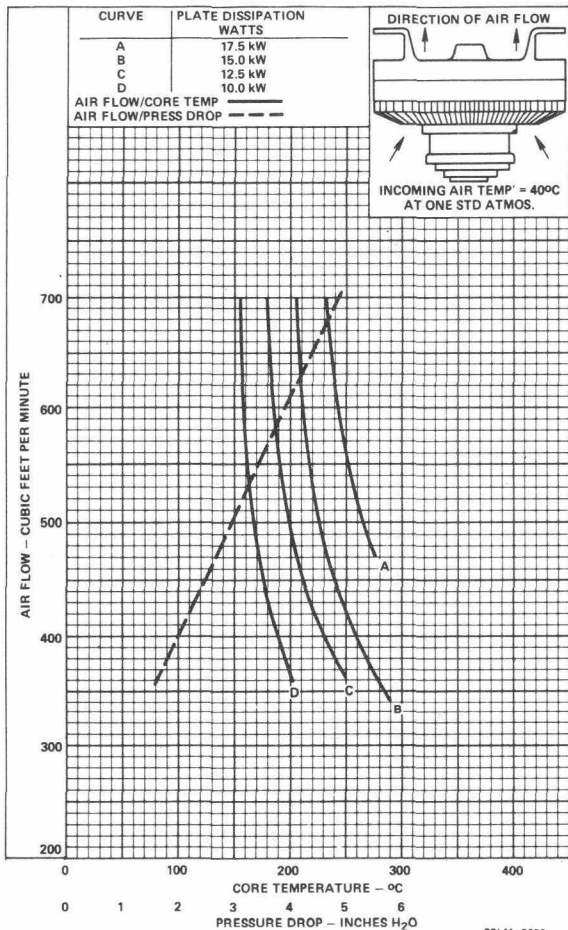
## ELECTRODE CAVITY TUNING CHARACTERISTICS



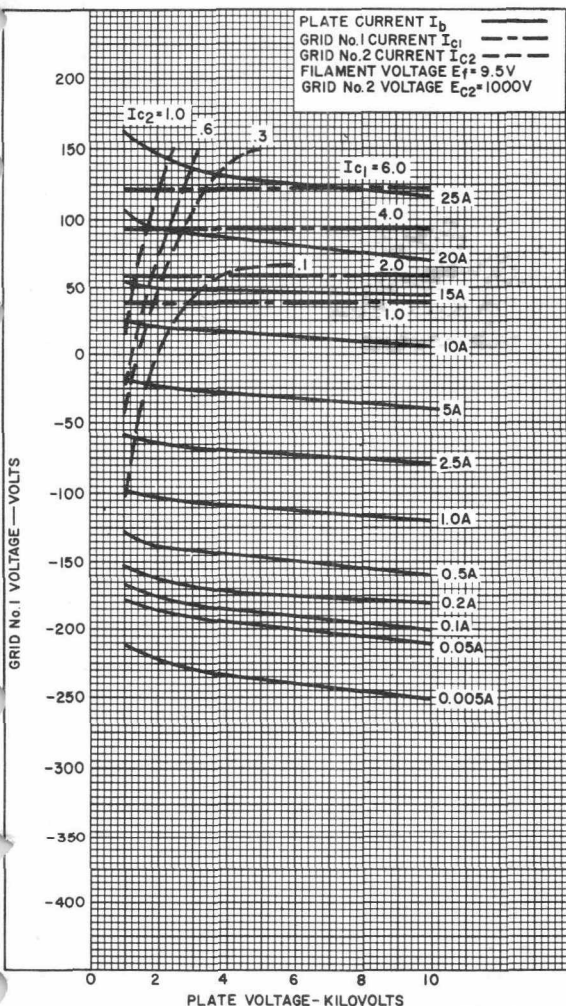
## ELECTRODE CAVITY TUNING CHARACTERISTICS (Cont'd.)



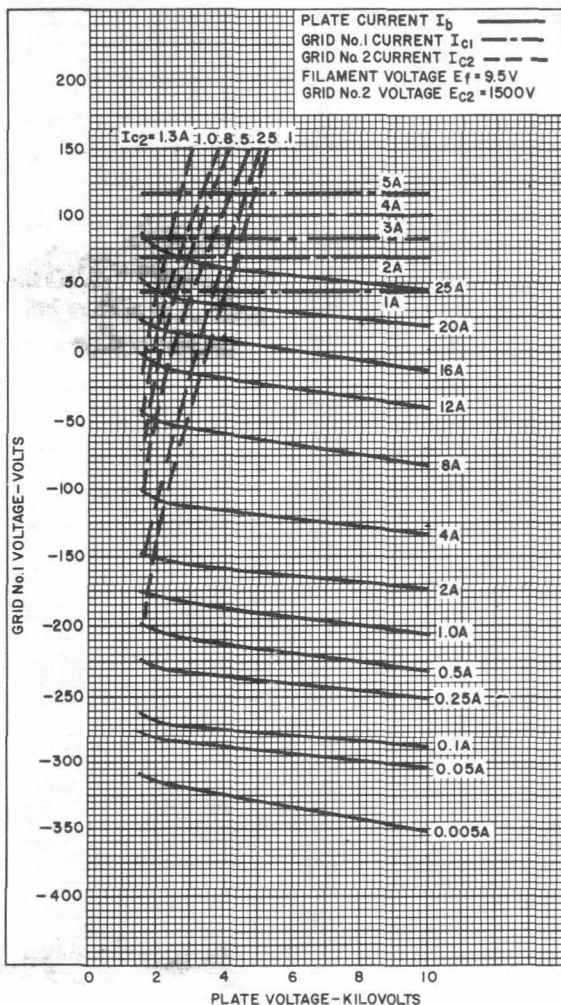
## TYPICAL COOLING CHARACTERISTICS



## TYPICAL CONSTANT CURRENT CHARACTERISTICS



## TYPICAL CONSTANT CURRENT CHARACTERISTICS



92LM-2658R3