

## Power Triode

## NUVISTOR TYPE

## ENVIRONMENTAL TESTS

## LIFE TEST

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.

## ELECTRICAL CHARACTERISTICS

## Bogey Values

Heater Voltage (AC or DC) . . . . .	$E_f$	6.3	V
Heater Current at $E_f = 6.3$ V. . . . .	$I_f$	150	mA
Heater Input. . . . .	$P_f$	0.95	W
Direct Interelectrode Capacitances			
Without external shield			
Input: K to (G,S,H). . . . .	$c_i$	6.0	pF
Output: P to (G,S,H) . . . . .	$c_o$	1.2	pF
Heater to cathode . . . . .	$c_{hk}$	1.4	pF

Class A<sub>1</sub> Amplifier

For following characteristics, see Conditions

Amplification Factor. . . . .	$\mu$	60	70	
Plate Resistance (Approx.). . . . .	$r_p$	6300	5400	$\Omega$
Transconductance. . . . .	$g_m$	9500	13000	$\mu\text{mho}$
DC Plate Current. . . . .	$I_b$	9	11.5	mA
Cutoff DC Grid Voltage for				
$I_b = 10 \mu\text{A}$ . . . . .	$E_c(\text{co})$	-	-5	V

## Conditions

Heater Voltage. . . . .	$E_f$	6.3	6.3	V
Plate Supply Voltage. . . . .	$E_{bb}$	150	110	V
Grid Supply Voltage . . . . .	$E_{cc}$	0	0	V
Cathode Resistor. . . . .	$R_k$	150	47	$\Omega$

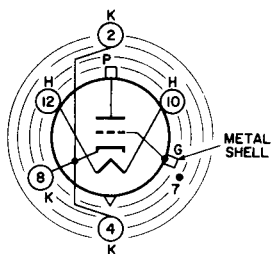
## MECHANICAL CHARACTERISTICS

Operating Position. . . . .			Any
Type of Cathode . . . . .		Coated	Unipotential
Minimum Overall Length ( $l_m$ ) . . . . .			0.985 in
Maximum Seated Length ( $l_{sm}$ ) . . . . .			0.780 in
Maximum Diameter ( $d_m$ ) . . . . .			0.440 in
Weight (Approx.) . . . . .			2.2 g
Dimensional Outline . . . . .			JEDEC No.4-6
Envelope. . . . .			JEDEC MT4
Top Cap <sup>a</sup> . . . . .		Small	(JEDEC C1-44)
Base <sup>b</sup> . . . . .	Medium-Ceramic-Wafer	Twelve	5-Pin (JEDEC E5-79)



Basing Designation for BOTTOM VIEW. . . . . 12CT

Pin 2 - Cathode  
 Pin 4 - Cathode  
 Pin 7<sup>c</sup> - 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

		CCS <sup>d</sup>	ICAS <sup>e</sup>	
Plate Supply Voltage. . . . .	$E_{bb}$	500	500	V
DC Plate Voltage. . . . .	$E_b$	250	300	V
Grid Voltage				
Peak positive value. . . . .	$e_{cm}$	4	5	V
DC positive value. . . . .	$E_c$	0	0	V
DC negative value. . . . .	$E_c$	-100	-100	V
Peak Heater-Cathode Voltage . . . . .	$e_{hkm}$	$\pm 100$	$\pm 100$	V
Heater Voltage, AC or DC. . . . .	$E_f$	5.7 to 6.9	5.7 to 6.9	V
Instantaneous Voltage . . . . .		See Breakdown-Voltage Characteristics Curve		
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

		CCS	ICAS	
Grid-Circuit Resistance	$R_g(ckt)$			
For fixed-bias or cathode-bias operation:				
For $T_E \leq 150^\circ C$ . . . . .		50	50	k $\Omega$
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 . . . . .	E <sub>f</sub>	6.3	6.3	V
DC Plate-to-Grid Voltage . . . . .	E <sub>bg</sub>	180	180	V
DC Cathode-to-Grid Voltage . . . . .	E <sub>kg</sub>	5.5	5.5	V
From grid resistor of . . . . .	R <sub>g</sub>	1200	1200	Ω
Average Plate Current . . . . .	I <sub>b(av)</sub>	20	20	mA
Average Grid Current . . . . .	I <sub>c(av)</sub>	4.5	4	mA
Driving Power (Approx.) . . . . .	P <sub>g</sub>	150	250	mW
Useful Power Output (Approx.) <sup>9</sup> . . . . .	P <sub>o</sub>	1.4	1.2	W

## As RF Oscillator

Frequency . . . . .	f	1	Gc/s
Heater Voltage . . . . .	E <sub>f</sub>	6.3	V
DC Plate Voltage . . . . .	E <sub>b</sub>	180	V
DC Grid Voltage . . . . .	E <sub>c</sub>	-5.5	V
From grid resistor of . . . . .	R <sub>g</sub>	1200	Ω
Average Plate Current . . . . .	I <sub>b(av)</sub>	21	mA
Average Grid Current . . . . .	I <sub>c(av)</sub>	4.5	mA
Useful Power Output (Approx.) <sup>9</sup> . . . . .	P <sub>o</sub>	1.25	W

## As Cathode-Drive Frequency Doubler

Output Frequency . . . . .	f <sub>o</sub>	1	Gc/s
Heater Voltage . . . . .	E <sub>f</sub>	6.3	V
DC Plate-to-Grid Voltage . . . . .	E <sub>bg</sub>	180	V
DC Cathode-to-Grid Voltage . . . . .	E <sub>kg</sub>	8.5	V
From grid resistor of . . . . .	R <sub>g</sub>	1200	Ω
Average Plate Current . . . . .	I <sub>b(av)</sub>	18.5	mA
Average Grid Current . . . . .	I <sub>c(av)</sub>	3	mA
Driving Power (Approx.) . . . . .	P <sub>g</sub>	300	mW
Useful Power Output (Approx.) <sup>9</sup> . . . . .	P <sub>o</sub>	0.7	W

<sup>a</sup> Designed to mate with "1/4-inch" connector generally available from your local RCA Distributor.

<sup>b</sup> Designed to mate with Cinch Mfg. Co. socket No. 133 65 10 041, Cinch-Jones Sales-Division Distributor socket Designation SNS-3, or equivalent.

<sup>c</sup> Pin 7 is of a length such that its end does not touch the socket insertion plane.

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

<sup>e</sup> 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.

<sup>f</sup> Measured on metal shell in Zone "A" (See *Dimensional Outline*).

<sup>9</sup> Measured at load.

## INITIAL CHARACTERISTICS LIMITS

	Note	Min	Max	
Heater Current . . . . .	1	140	160	mA
Direct Interelectrode Capacitances	2			
Cathode to plate . . . . .	-	-	0.046	pF
Input: K to (G,S,H) . . . . .	-	5.0	7.0	pF
Output: P to (G,S,H) . . . . .	-	0.9	1.5	pF
Heater to cathode . . . . .	-	1.1	1.7	pF
Amplification Factor . . . . .	3	50	90	



	Note	Min	Max	
Transconductance (1) . . . . .	4	7500	11500	$\mu$ mho
Transconductance (2) . . . . .	3	10500	15500	$\mu$ mho
Plate Current (1) . . . . .	4	6.5	11.5	mA
Plate Current (2) . . . . .	3	8.5	14.5	mA
Cutoff Plate Current . . . . .	5	-	50	$\mu$ A
Useful Power Output . . . . .	6	1.1	-	W
Total Grid Current . . . . .	7	-	-0.1	$\mu$ A
Heater-Cathode Leakage Current . . . . .	8	-	$\pm 5$	$\mu$ A
<b>Leakage Resistance</b>				
Between grid and all other electrodes connected together . . . . .	9	5	-	$\Omega$
Between plate and all other electrodes connected together . . . . .	10	10	-	$\Omega$
Inoperatives . . . . .	11	✓		

Note 1: With  $E_f = 6.3$  V.

Note 2: Measured without external shield.

Note 3: With  $E_f = 6.3$  V,  $E_{bb} = 110$  V,  $E_{cc} = 0$  V,  $R_k = 47 \Omega$ ,  $C_k = 1000 \mu f$ .

Note 4: With  $E_f = 6.3$  V,  $E_{bb} = 150$  V,  $E_{cc} = 0$  V,  $R_k = 150 \Omega$ ,  $C_k = 1000 \mu f$ .

Note 5: With  $E_f = 6.3$  V,  $E_b = 150$  V,  $E_c = -7$  V.

Note 6: Measured at load in cathode-drive rf-power-amplifier circuit with  $f = 1$  Gc/s,  $E_f = 6.3$  V,  $E_{bg} = 175$  V,  $E_{kg} = 6$  V from  $R_g = 1200 \Omega$ ,  $I_{b(av)} = 23$  mA max,  $I_{c(av)} = 5$  mA max,  $P_g = 150$  mW, circuit tuned for maximum  $P_o(\text{useful})$ .

Note 7: With  $E_f = 6.3$  V,  $E_b = 150$  V,  $E_{cc} = -1.3$  V,  $R_g = 0 \Omega$ .

Note 8: With  $E_f = 6.3$  V,  $E_{hk} = \pm 100$  V.

Note 9: With  $E_f = 6.3$  V,  $E_{g\text{-all}} = -100$  V.

Note 10: With  $E_f = 6.3$  V,  $E_{p\text{-all}} = -300$  V.

Note 11: Tubes are criticized for Shorts, Discontinuities, and Air Leaks.

## ENVIRONMENTAL TESTS

### High-Impact, Short-Duration Shock

Peak Impact Acceleration . . . . . 1000 g

Duration of approximate half-sine-wave mechanical-shock pulse . . . . .  $0.8 \pm 0.2$  ms

#### Operating Conditions during Test

$E_f = 6.3$  V,  $E_{bb} = 150$  V,  $E_{cc} = -1.3$  V,  $R_g = 50$  k $\Omega$ ,  $E_{hk} = 100$  V

#### Post-Shock Limits and Rejection Criteria

	Min	Max	%
$\Delta I_{gm}$ . . . . .	-	$\pm 15$	
$I_c$ . . . . .	-	-0.1	$\mu$ A
$I_{hk}$ . . . . .	-	$\pm 10$	$\mu$ A

$E_{Rpm}$  (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 . . . . .	$11 \pm 2$	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 50 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

$E_f = 6.3$  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 $X_1$ position. . . . .	1	g
Period of 1 sweep cycle (3 to 15 kc/s). . . . .	7	s

#### Operating Conditions during Test

$E_f = 6.3$  V,  $E_{bb} = 150$  V,  $E_{cc} = 0$  V,  $R_k = 150 \Omega$ ,  $R_p = 2$  k $\Omega$

#### Limits

$E_{Rpm}$  over vibration-frequency range of:

	Min	Max	
3 to 6 kc/s . . . . .	-	80	mV
6 to 15 kc/s. . . . .	-	700	mV

## LIFE TESTS

### Heater Cycling

Duration of Test. . . . .	2000	cycles
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#### Operating Conditions

$E_f = 8.5$  V cycled 1 minute ON and 2 minutes OFF,  $E_{hk} = -180$  V continuously ON

#### Rejection Criteria

Heater-cathode shorts, and heater and cathode discontinuities



Intermittent Operation (2, 20, 100, 500, and 1000 Hours)

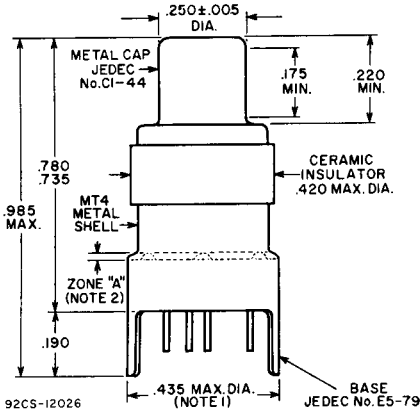
**Operating Conditions**

$E_f = 6.3$  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		h
	Min	Max	Min	Max	Min	Max	Min	Max	
1gm . . . . .	-	-	6700	-	-	-	-	-	$\mu$ mho
$\Delta$ 1gm/t. . . . .	-	$\pm 10$	-	-	-	-	-	-	%
$P_o$ (useful). . . . .	-	-	-	-	1.0	-	0.9	-	W
$I_c$ . . . . .	-	-	-	-0.2	-	-	-	-	$\mu$ A

**DIMENSIONAL OUTLINE**

JEDEC No. 4-6



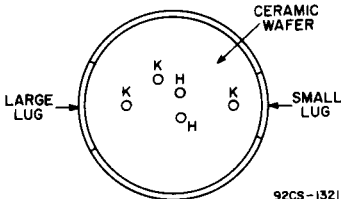
DIMENSIONS IN INCHES

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

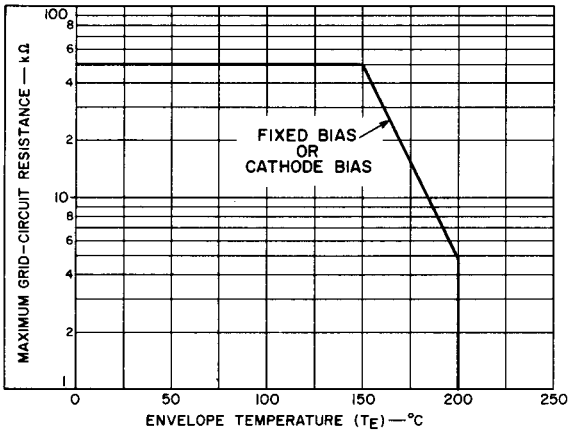
Note 2: Envelope temperature should be measured in zone "A".

**MODIFIED BOTTOM VIEW**

With Element Connections Indicated and Short Pin Not Shown

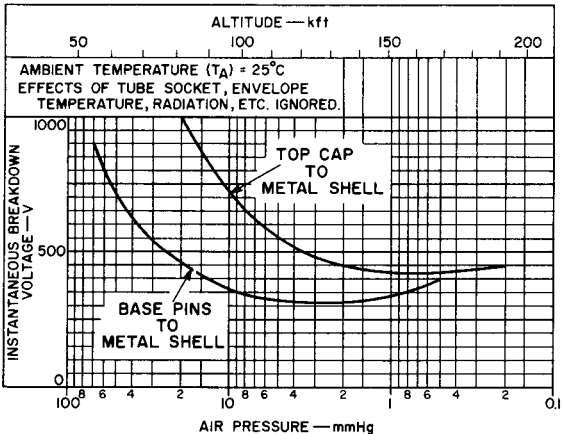


## Grid-Circuit-Resistance Rating Chart



92CS-13119RI

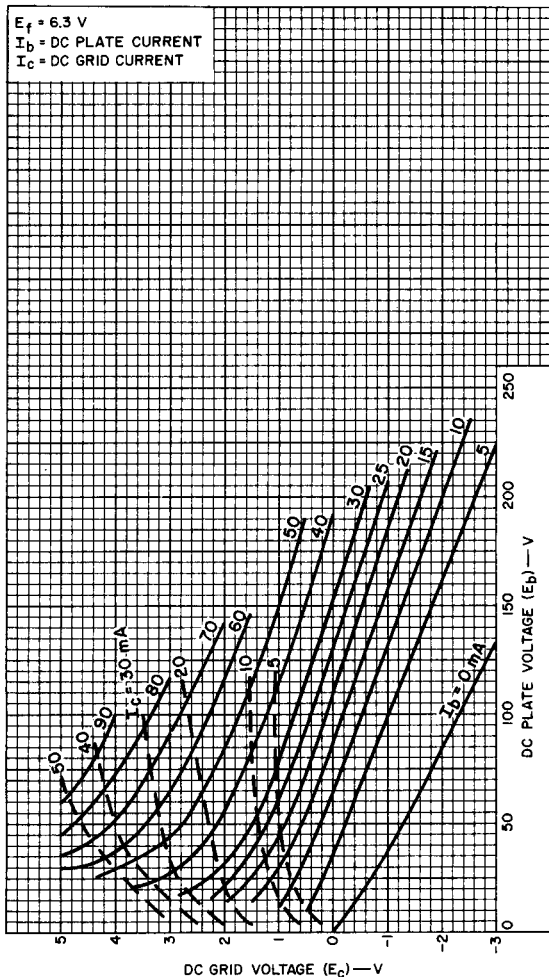
## Breakdown-Voltage Characteristics



92CS-13117RI



## Typical Constant-Current Characteristics



92CM-13220





## Typical Characteristics

