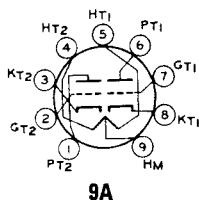


<b>6112</b>	Refer to chart at end of section.
<b>6136</b>	Refer to chart at end of section.
<b>6186</b>	Refer to chart at end of section.
<b>6186/6AG5WA</b>	Refer to chart at end of section.
<b>6186W</b>	Refer to chart at end of section.
<b>6189</b>	Refer to chart at end of section.
<b>6197</b>	Refer to chart at end of section.

**6201**INDUSTRIAL  
TYPE**HIGH-MU TWIN TRIODE**

Miniature type used in mixer, oscillator, and amplifier applications at frequencies up to 300 MHz. Outlines section, 6B; requires miniature 9-contact socket. For typical operation as a resistance-coupled amplifier, refer to Resistance-Coupled Amplifier section, type 12AT7 conditions.

**9A**

Heater Arrangement:	Series	Parallel	
Heater Voltage (ac/dc) .....	12.6	6.3	volts
Heater Current .....	0.15	0.3	ampere
Peak Heater-Cathode Voltage .....		±100 max.	volts
Direct Interelectrode Capacitances (Approx.):			
Grid-Drive Operation:			
Grid to Plate (Each unit) .....		1.6	pF
Grid to Cathode and Heater (Each unit) .....		2.5	pF
Plate to Cathode and Heater:			
Unit No.1 .....		0.45	pF
Unit No.2 .....		0.38	pF
Heater to Cathode (Each unit) .....		2.8	pF
Cathode-Drive Operation:			
Cathode to Plate (Unit No.1) .....		0.2	pF
Cathode to Plate (Unit No.2) .....		0.24	pF
Cathode to Grid and Heater (Each unit) .....		5	pF
Plate to Grid and Heater (Unit No.1) .....		1.9	pF
Plate to Grid and Heater (Unit No.2) .....		1.8	pF

**Class A<sub>1</sub> Amplifier (Each Unit)****MAXIMUM RATINGS (Absolute-Maximum Values)**

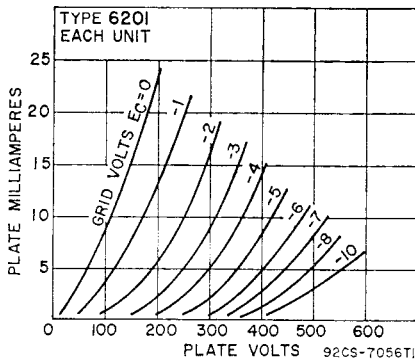
Plate Voltage .....	330	volts
Grid Voltage:		
Negative bias value .....	55	volts
Positive bias value .....	0	volt
Plate Dissipation .....	2.75	watts
Bulb Temperature (At hottest point on bulb surface) .....	180	°C

**MAXIMUM CIRCUIT VALUES**

Grid-Circuit Resistance:		
For fixed-bias operation .....	0.25	megohm
For cathode-bias operation .....	1.0	megohm

**CHARACTERISTICS**

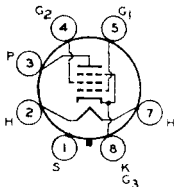
Plate Supply Voltage .....	100	250	volts
Cathode-Bias Resistor .....	270	200	ohms
Amplification Factor .....	57	60	
Plate Resistance (Approx.) .....	14300	10900	ohms
Transconductance .....	4000	5500	μmhos
Grid Voltage (Approx.) for plate current of 10 μA ..	-5	-12	volts
Plate Current .....	3.3	10	mA



**Special Ratings & Performance Data**

<b>SHOCK RATING</b>		
Impact Acceleration .....	600 max.	g
<b>FATIGUE RATING</b>		
Vibrational Acceleration .....	2.5 max.	g
<b>LOW-FREQUENCY VIBRATION PERFORMANCE</b>		
RMS Output Voltage .....	100 max.	mV
<b>HEATER-CYCLING LIFE PERFORMANCE</b>		
Cycles of Intermittent Operation .....	2000 min.	cycles
<b>AUDIO-FREQUENCY NOISE AND MICROPHONIC PERFORMANCE</b>		
RMS Output Voltage .....	100 max.	mV

Refer to chart at end of section.	<b>6202</b>
Refer to chart at end of section.	<b>6206</b>
Refer to chart at end of section.	<b>6211</b>
Refer to chart at end of section.	<b>6336A</b>
Refer to chart at end of section.	<b>6350</b>
Refer to chart at end of section.	<b>6360</b>
	<b>6360A</b>
Refer to chart at end of section.	<b>6386</b>
Refer to chart at end of section.	<b>6417</b>
Refer to chart at end of section.	<b>6485</b>



**7S**

**BEAM POWER TUBE**

**6550**

INDUSTRIAL TYPE

Glass octal type used in the output stages of high-fidelity audio amplifiers. Outlines section, 27C; requires octal socket. This tube should be adequately ventilated.

Heater Voltage (ac/dc) .....	6.3	volts
Heater Current .....	1.6	amperes
<b>Peak Heater-Cathode Voltage:</b>		
Heater negative with respect to cathode .....	300 max.	volts
Heater positive with respect to cathode .....	200* max.	volts

## Direct Interelectrode Capacitances (Approx.):

Grid No.1 to plate	0.85	pF
Grid No.1 to cathode and grid No.3, grid No.2, base sleeve and heater	14.0	pF
Plate to cathode & grid No.3, grid No.2, base sleeve, and heater	12.0	pF

## MAXIMUM CIRCUIT VALUES

Grid-No.1-Circuit Resistance:		
For fixed-bias operation	0.05	megohm
For cathode-bias operation	0.25	megohm

Class A<sub>1</sub> AF Power Amplifier

## MAXIMUM RATINGS (Design-Center Values)

Plate Voltage	600	volts
Grid-No.2 (Screen-Grid) Voltage	400	volts
Grid-No.1 (Control-Grid) Voltage:		
Negative-bias value	300	volts
Positive-bias value	0	volt
Cathode Current	175	mA
Grid-No.2 Input	6	watts
Plate Dissipation	35	watts
Bulb Temperature (At hottest point on bulb surface)	250	°C

## TYPICAL OPERATION AND CHARACTERISTICS

Plate Voltage	250	400	volts
Grid-No.2 Voltage	250	225	volts
Grid-No.1 Voltage	-14	-16.5	volts
Peak AF Grid-No.1 Voltage	14	16.5	volts
Zero-Signal Plate Current	140	87	mA
Max.-Signal Plate Current	150	105	mA
Zero-Signal Grid-No.2 Current	12	4	mA
Max.-Signal Grid-No.2 Current	28	18	mA
Plate Resistance (Approx.)	12000	27000	ohms
Transconductance	11000	9000	μmhos
Load Resistance	1500	3000	ohms
Total Harmonic Distortion	7	13.5	%
Max.-Signal Power Output	12.5	20	watts

Class A<sub>1</sub> Push-Pull AF Power Amplifier

## MAXIMUM RATINGS (Design-Center Values)

Same as for Class A<sub>1</sub> AF POWER AMPLIFIER

## TYPICAL OPERATION AND CHARACTERISTICS

Values are for 2 tubes

	Fixed Bias	400	600	Cathode Bias	400	volts
Plate Supply Voltage	400	600		400		volts
Grid-No.2 Supply Voltage	275	300		300		volts
Grid-No.1 Voltage	-23	-31		—		volts
Cathode Resistor	—	—		140		ohms
Peak AF Grid-No.1-to-Grid-No.1 Voltage	46	62		53		volts
Zero-Signal Plate Current	180	115		166		mA
Max.-Signal Plate Current	270	273		190		mA
Zero-Signal Grid-No.2 Current	9	4		7.5		mA
Max.-Signal Grid-No.2 Current	44	41		39		mA
Effective Load Resistance (Plate to plate)	3500	5000		4500		ohms
Total Harmonic Distortion	3	2.5		4		%
Max.-Signal Power Output	55	100		41		watts

\* The dc component must not exceed 100 vlots.

6626/0A2WA

Refer to chart at end of section.

6660/6BA6

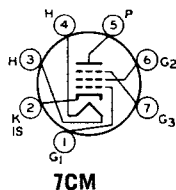
Refer to chart at end of section.

6661/6BH6

INDUSTRIAL  
TYPE

SHARP-CUTOFF PENTODE

Miniature type used as an rf amplifier particularly in mobile equipment where low heater-current drain is important. It is particularly useful in high-frequency, wide-band applications. Outlines section, 5C; requires miniature 7-contact socket.



Heater Voltage (ac/dc)	6.3 ±20%	volts
Heater Current	0.15	ampere
Peak Heater-Cathode Voltage	±100 max.	volts
Direct Interelectrode Capacitances:		
Grid No.1 to Plate	0.0035 max.	pF
Grid No.1 to Cathode, Heater, Grid No.2, Grid No.3, and Internal Shield	5.4	pF
Plate to Cathode, Heater, Grid No.2, Grid No.3, and Internal Shield	4.4	pF

**Class A<sub>1</sub> Amplifier**

**MAXIMUM RATINGS (Design-Maximum Values)**

Plate Voltage	330	volts
Grid-No.2 (Screen-Grid) Voltage	See curve page 300	
Grid-No.2 Supply Voltage	330	volts
Grid-No.1 (Control-Grid) Voltage:		
Negative-bias value	55	volts
Positive-bias value	0	volt
Plate Dissipation	3.3	watts
Grid-No.2 Input:		
For Grid-No.2 voltages up to 165 volts	0.55	watt
For Grid-No.2 voltages between 165 and 300 volts	See curve page 300	

**CHARACTERISTICS**

Plate Voltage	250	volts
Grid No.3	Connected to cathode at socket	
Grid-No.2 Voltage	150	volts
Cathode Resistor	100	ohms
Plate Resistance (Approx.)	1.4	megohms
Transconductance	4600	μmhos
Plate Current	7.4	mA
Grid-No.2 Current	2.6	mA
Grid-No.1 Voltage (Approx.) for plate current of 10 μA	-7.7	volts

**TRANSCONDUCTANCE AT REDUCED HEATER VOLTAGE**

Average Value	3600	μmhos
With heater volts = 5, plate supply volts = 250, grid No.3 connected to cathode at socket, grid-No.2 supply volts = 150, and cathode resistor (ohms) bypassed = 100.		

Refer to chart at end of section.

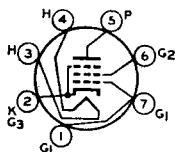
**6662/6BJ6**

Refer to chart at end of section.

**6663/6AL5**

Refer to chart at end of section.

**6664/6AB4**



**7BZ**

**BEAM POWER TUBE**

**6669/  
6AQ5A**  
INDUSTRIAL  
TYPE

Miniature type used as output amplifier primarily in mobile communications equipment. Outlines section, 5D; requires miniature 7-contact socket.

Heater Voltage (ac/dc)	6.3 ±20%	volts
Heater Current	0.45	ampere
Heater Warm-up Time (Average)	11	seconds
Heater-Cathode Voltage:		
Peak value	±100 max.	volts
Direct Interelectrode Capacitances (Approx.):		
Grid No.1 to Plate	0.4	pF
Grid No.1 to Cathode, Heater, Grid No.2, and Grid No.3	8	pF
Plate to Cathode, Heater, Grid No.2, and Grid No.3	8.5	pF

Class A<sub>1</sub> Amplifier

## MAXIMUM RATINGS (Design-Maximum Values)

Plate Voltage	250	volts
Grid-No.2 (Screen-Grid) Voltage	250	volts
Plate Dissipation	12	watts
Grid-No.2 Input	2	watts
Bulb Temperature (At hottest point on bulb surface)	225	°C

## TYPICAL OPERATION AND CHARACTERISTICS

Plate Voltage	250	volts
Grid-No.2 Voltage	250	volts
Grid-No.1 (Control-Grid) Voltage	-12.5	volts
Peak AF Grid-No.1 Voltage	12.5	volts
Zero-Signal Plate Current	45	mA
Max.-Signal Plate Current	47	mA
Zero-Signal Grid-No.2 Current	4.5	mA
Max.-Signal Grid-No.2 Current	7	mA
Plate Resistance (Approx.)	52000	ohms
Transconductance	4100	μmhos
Load Resistance	5000	ohms
Total Harmonic Distortion	8	%
Max.-Signal Power Output	4.5	watts

## MAXIMUM CIRCUIT VALUES

Grid-No.1-Circuit Resistance:		
For fixed-bias operation	0.1	megohm
For cathode-bias operation	0.5	megohm

Class AB<sub>1</sub> AmplifierMAXIMUM RATINGS (Same as for Class A<sub>1</sub> Amplifier)

## TYPICAL PUSH-PULL OPERATION

Unless otherwise specified, values are for 2 tubes

Plate Voltage	250	volts
Grid-No.2 Voltage	250	volts
Grid-No.1 (Control-Grid) Voltage	-15	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	30	volts
Zero-Signal Plate Current	70	mA
Max.-Signal Plate Current	79	mA
Zero-Signal Grid-No.2 Current	5	mA
Max.-Signal Grid-No.2 Current	13	mA
Effective Load Resistance (Plate to plate)	10000	ohms
Total Harmonic Distortion	5	%
Max.-Signal Power Output	10	watts

MAXIMUM CIRCUIT VALUES (Same as for Class A<sub>1</sub> Amplifier)

## POWER OUTPUT AT REDUCED HEATER VOLTAGE

Average Value	4.1	watts
With heater volts = 5, plate volts = 250, grid-No.2 volts = 250, grid-No.1 volts = -12.5, rms signal volts = 8.8, and load resistance (ohms) = 5000.		

6676/6CB6A

Refer to chart at end of section.

6677/6CL6

Refer to chart at end of section.

6678/6U8A

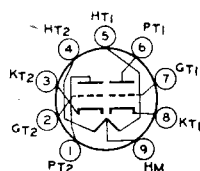
Refer to chart at end of section.

## 6679/12AT7

INDUSTRIAL  
TYPE

## HIGH-MU TWIN TRIODE

Miniature type used as a mixer, oscillator or amplifier in mobile communications equipment. Outlines section, 6B; requires miniature 9-contact socket. For typical operation as a resistance-coupled amplifier, refer to Resistance-Coupled Amplifier section, type 12AT7 conditions.



9A

Heater Arrangement:	<b>Series</b>	<b>Parallel</b>	
Heater Voltage (ac/dc)	12.6 ±20%	6.3 ±20%	volts
Heater Current	0.15	0.3	ampere
Peak Heater-Cathode Voltage		±100 max.	volts
Direct Interelectrode Capacitances (Approx.):			
Grid-Drive Operation:			
Grid to Plate (Each unit)		1.5	pF
Grid to Cathode and Heater (Each unit)		2.2	pF
Plate to Cathode and Heater:			
Unit No.1		0.5	pF
Unit No.2		0.4	pF
Cathode-Drive Operation:			
Cathode to Plate (Each unit)		0.2	pF
Cathode to Grid and Heater (Each unit)		4.6	pF
Plate to Grid and Heater (Each unit)		1.8	pF
Heater to Cathode (Each unit)		2.4	pF

**Class A<sub>1</sub> Amplifier (Each Unit)**

**MAXIMUM RATINGS (Design-Maximum Values)**

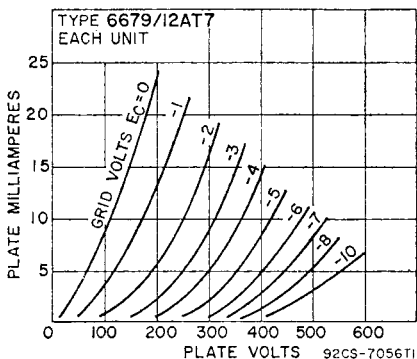
Plate Voltage	330	volts
Grid Voltage:		
Negative bias value	55	volts
Positive bias value	0	volt
Plate Dissipation	2.8	watts

**CHARACTERISTICS**

Plate Supply Voltage	250	volts
Cathode-Bias Resistor	200	ohms
Amplification Factor	60	
Plate Resistance (Approx.)	10900	ohms
Transconductance	5500	μmhos
Grid Voltage (Approx.) for plate current of 10 μA	-12	volts
Plate Current	10	mA

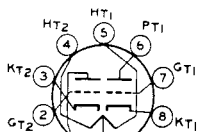
**TRANSCONDUCTANCE AT REDUCED HEATER VOLTAGE**

Average Value (Each unit)	4400	μmhos
With heater volts = 10 (Series connection), plate supply volts = 250, and cathode resistor (ohms) bypassed = 200.		



**6680/  
12AU7A**  
INDUSTRIAL  
TYPE

**MEDIUM-MU TWIN TRIODE**



9A

Miniature type used as a phase inverter or push-pull amplifier in mobile communications equipment. Outlines section, 6B; requires miniature 9-contact socket. For typical operation as a resistance-coupled amplifier, refer to Resistance-Coupled Amplifier section, type 12AU7A conditions.

Heater Arrangement	Series	Parallel	
Heater Voltage (ac/dc)	12.6 $\pm 20\%$	6.3 $\pm 20\%$	volts
Heater Current	0.15	0.3	ampere
Heater-Cathode Voltage:			
Peak value		$\pm 200$ max.	volts
Average value		100 max.	volts
Direct Interelectrode Capacitances (Approx.):	Unit No. 1	Unit No. 2	
Grid to Plate	1.5	1.5	pF
Grid to Cathode and Heater	1.6	1.6	pF
Plate to Cathode and Heater	0.4	0.32	pF

### Class A<sub>1</sub> Amplifier (Each Unit Unless Otherwise Specified)

#### MAXIMUM RATINGS (Design-Maximum Values)

Plate Voltage	330	volts
Grid Voltage, positive-bias value	0	volt
Plate Dissipation:		
Each Plate	3	watts
Both Plates (Both units operating)	6	watts

#### CHARACTERISTICS

Plate Voltage	100	250	volts
Grid Voltage	0	-8.5	volts
Amplification Factor	20	17	
Plate Resistance (Approx.)	6500	7700	ohms
Transconductance	3100	2200	$\mu$ mhos
Plate Current	11.8	10.5	mA
Grid Voltage (Approx.) for plate current of 10 $\mu$ A	---	-24	volts

#### MAXIMUM CIRCUIT VALUES

Grid-Circuit Resistance:		
For fixed-bias operation	0.25	megohm
For cathode-bias operation	1	megohm

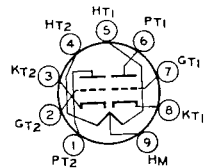
#### TRANSCONDUCTANCE AT REDUCED HEATER VOLTAGE

Average Value (Each unit)	1750	$\mu$ mhos
With heater volts = 10 (Series connection), plate volts = 250, and grid volts = -8.5.		

## 6681/ 12AX7A HIGH-MU TWIN TRIODE

INDUSTRIAL  
TYPE

Miniature type used as a phase inverter or twin resistance-coupled amplifier in mobile communications equipment. Outlines section, 6B; requires miniature 9-contact socket. For typical operation as a resistance-coupled amplifier, refer to Resistance-Coupled Amplifier section, type 12AX7A conditions.



9A

Heater Arrangement:	Series	Parallel	
Heater Voltage (ac/dc)	12.6 $\pm 20\%$	6.3 $\pm 20\%$	volts
Heater Current	0.15	0.3	ampere
Heater-Cathode Voltage:			
Peak value		$\pm 200$ max.	volts
Average value		100 max.	volts
Direct Interelectrode Capacitances (Approx.):	Unit No. 1	Unit No. 2	
Grid to Plate	1.7	1.7	pF
Grid to Cathode and Heater	1.6	1.6	pF
Plate to Cathode and Heater	0.46	0.34	pF

### Class A<sub>1</sub> Amplifier (Each Unit)

#### MAXIMUM RATINGS (Design-Maximum Values)

Plate Voltage	330	volts
Grid Voltage:		
Negative-bias value	55	volts
Positive-bias value	0	volt
Plate Dissipation	1.1	watts

**CHARACTERISTICS**

Plate Voltage	100	250	volts
Grid Voltage	—1	—2	volts
Amplification Factor	100	100	
Plate Resistance (Approx.)	80000	62500	ohms
Transconductance	1250	1600	$\mu$ mhos
Plate Current	0.5	1.2	mA

Refer to chart at end of section.

**6686**

Refer to chart at end of section.

**6688A**

Refer to chart at end of section.

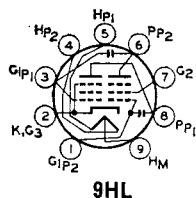
**6887**

Refer to chart at end of section.

**6922/E88CC**

**6939**

**INDUSTRIAL TYPE**



**9HL**

**TWIN-POWER PENTODE**

Miniature type twin power-pentode intended for use in communications equipment as a push-pull rf power-amplifier or frequency-multiplier at frequencies up to 500 MHz. Outlines section, 6E; requires miniature 9-contact socket.

Heater arrangement	<b>Series</b>	<b>Parallel</b>	
Heater Voltage (ac/dc)	12.6 $\pm$ 10%	6.3 $\pm$ 10%	volts
Heater Current	0.3	0.6	ampere
Peak Heater-Cathode Voltage		$\pm$ 100 max.	volts
Bulb Temperature (At hottest point on bulb surface)		225 max.	$^{\circ}$ C
Direct Interelectrode Capacitances (Approx., Each Unit):			
Grid No.1 to Plate		0.15	pF
Grid No.1 to Cathode & Grid No.3, Grid No.2, and Heater		6.4	pF
Plate to Cathode & Grid No.3, Grid No.2, and Heater		1.6	pF
Transconductance (Each Unit) for dc plate volts = 150, dc grid-No.2 volts = 150, and dc plate mA = 25		10500	$\mu$ mhos
Mu-Factor, grid No.2 to grid No.1 (Each Unit) for dc plate volts = 150, dc grid No.2 volts = 150, and dc plate mA = 25		31	

**Push-Pull RF Amplifier & Oscillator—Class C Telegraphy\* and Push-Pull RF Power Amplifier—Class C FM Telephony**

Values are on a per-tube basis unless otherwise specified

**MAXIMUM RATINGS (Absolute-Maximum Values)**

	Up to 500 MHz		
	CCS*	ICAS $\dagger$	
DC Plate Voltage	250	250	volts
DC Grid-No.2 (Screen-Grid) Voltage	200	200	volts
DC Grid-No.1 (Control-Grid) Voltage	—100	—100	volts
DC Plate Current	90	100	mA
DC Grid-No.1 Current	6	8	mA
DC Cathode Current	100	120	mA
Plate Input	12	14	watts
Grid-No.2 Input	3	3.5	watts
Grid-No.1 Input	0.2	0.24	watt
Plate Dissipation	6	7.5	watts

**TYPICAL OPERATION**

	At 500 MHz		
DC Plate Voltage	180	200	volts
DC Grid-No.2 Voltage	180	200	volts
DC Grid-No.1 Voltage	—20	—20	volts
From grid resistor for each grid No.1 of	27000	27000	ohms
Peak-to-Peak RF Grid-No.1 Voltage	50	50	volts
DC Plate Current	55	60	mA
DC Grid-No.2 Current	12.5	14	mA
DC Grid-No.1 Current	1.5	1.5	mA
Driver Power Output (Approx.)	1.2	1.2	watts
Useful Power Output (Approx.) $\dagger$	5	6	watts



### Plate-Modulated Push-Pull RF Power Amplifier—Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1  
Values are on a per-tube basis

#### MAXIMUM RATINGS (Absolute-Maximum Values)

	Up to 500 MHz		
	CCS*	ICAS†	
DC Plate Voltage	200	200	volts
DC Grid-No.2 (Screen-Grid) Voltage	200	200	volts
DC Grid-No.1 (Control-Grid) Voltage	-100	-100	volts
DC Plate Current	64	80	mA
DC Grid-No.1 Current	6	8	mA
DC Cathode Current	80	96	mA
Plate Input	8	10	watts
Grid-No.2 Input	2	2.3	watts
Grid-No.1 Input	0.2	0.24	watt
Plate Dissipation	4	5	watts

#### TYPICAL OPERATION

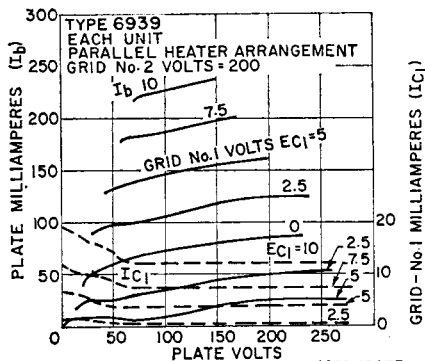
	At 500 MHz		
	CCS*	ICAS†	
DC Plate Voltage	180	180	volts
DC Grid-No.2 Voltage	180	180	volts
DC Grid-No.1 Voltage	-20	-20	volts
From grid resistor for each grid No.1 of	68000	27000	ohms
Peak-to-Peak RF Grid-No.1 Voltage	45	50	volts
DC Plate Current	40	55	mA
DC Grid-No.2 Current	9.5	12.5	mA
DC Grid-No.1 Current	0.6	1.5	mA
Driver Power Output (Approx.)	1	1.2	watts
Useful Power Output (Approx.)†	3.5	5	watts

### Frequency Tripler—Class C

Values are on a per-tube basis

#### MAXIMUM RATINGS (Absolute-Maximum Values)

	Up to 500 MHz		
	CCS*	ICAS†	
DC Plate Voltage	250	250	volts
DC Grid-No.2 (Screen-Grid) Voltage	200	200	volts
DC Grid-No.1 (Control-Grid) Voltage	-100	-100	volts
DC Plate Current	60	80	mA
DC Grid-No.1 Current	6	8	mA
DC Cathode Current	70	80	mA
Plate Input	8	10	watts
Grid-No.2 Input	3	3.5	watts
Grid-No.1 Input	0.2	0.24	watt
Plate Dissipation	6	7.5	watts



TYPICAL OPERATION

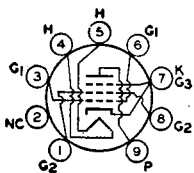
	Up to 500 MHz		
DC Plate Voltage	180	200	volts
DC Grid-No.2 Voltage (Approx.)	180	190	volts
Through resistor of	1200	1200	ohms
DC Grid-No.1 Voltage	-74	-74	volts
From grid resistor for each grid No.1 of	82000	82000	ohms
Peak-to-Peak RF Grid-No.1 Voltage	165	165	volts
DC Plate Current	40	46	mA
DC Grid-No.2 Current	9.7	11	mA
DC Grid-No.1 Current	1.8	1.8	mA
Driver Power Output (Approx.)	1.1	1.1	watts
Useful Power Output (Approx.) <sup>‡</sup>	1.8	2.2	watts

• Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

\* Continuous Commercial Service.

♦ Intermittent Commercial and Amateur Service.

‡ This value of useful power is measured at load of output circuit.



9EU

BEAM POWER TUBE

6973

Miniature type used as power amplifier in compact high-fidelity audio equipment. Outlines section, 6G; requires miniature 9-contact socket.

Heater Voltage (ac/dc)	6.3	volts
Heater Current	0.45	ampere
Heater-Cathode Voltage:		
Peak value	±200 max	volts
Average value	100 max	volts
Direct Interelectrode Capacitances:		
Grid-No.1 to Plate	0.4 max	pF
Grid No.1 to Cathode, Heater, Grid No.2, and Grid No.3	9	pF
Plate to Cathode, Heater, Grid No.2, and Grid No.3	6	pF

Class A<sub>1</sub> Amplifier

CHARACTERISTICS

Plate Voltage	250	volts
Grid-No.2 (Screen-Grid) Voltage	250	volts
Grid-No.1 (Control-Grid) Voltage	-15	volts
Plate Resistance (Approx.)	73000	ohms
Transconductance	4800	μmhos
Plate Current	46	mA
Grid-No.2 Current	3.5	mA
Grid-No.1 Voltage (Approx.) for plate current of 100 μA	-40	volts

Push-Pull Class AB<sub>1</sub> Amplifier

MAXIMUM RATINGS (Design-Maximum Values)

Plate Voltage	440	volts
Grid-No.2 Voltage	330	volts
Plate Dissipation	12	watts
Grid-No.2 Input	2	watts
Bulb Temperature (At hottest point)	250	°C

TYPICAL OPERATION (Values are for two tubes)

	Fixed Bias			Cathode Bias		
Plate Supply Voltage	250	350	400	300	310	volts
Grid-No.2 Supply Voltage	250	280	290	300	310	volts
Grid-No.1 Voltage	-15	-22	-25	—	—	volts
Cathode-Bias Resistor	—	—	—	230	270	ohms
Peak AF Grid-No.1-to-						
Grid-No.1 Voltage	30	44	50	48	55	volts
Zero-Signal Plate Current	92	58	50	80	77	mA
Maximum-Signal Plate Current	105	106	107	96	92	mA
Zero-Signal Grid-No.2 Current	7	3.5	2.5	6	5	mA
Maximum-Signal Grid-No.2 Current	16	14	13.7	14	14	mA
Effective Load Resistance (Plate-to-plate)	8000	7500	8000	5500	6000	ohms
Total Harmonic Distortion	2	1.5	2	2	4	per cent
Maximum-Signal Power Output	12.5	20	24	15	17	watts

**MAXIMUM CIRCUIT VALUES**

Grid-No.1-Circuit Resistance:		
For fixed-bias operation	0.5	megohm
For cathode-bias operation	1	megohm

**Push-Pull Class AB<sub>1</sub> Amplifier**

Grid No.2 of Each Tube Connected to Tap on Plate Winding of Output Transformer

**MAXIMUM RATINGS (Design-Maximum Values)**

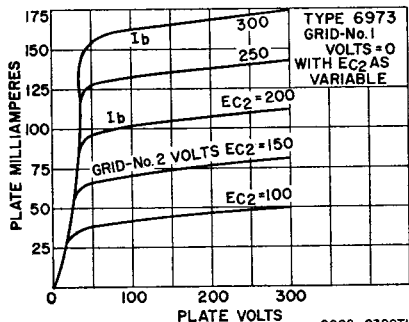
Plate and Grid-No.2 Supply Voltage	410	volts
Plate Dissipation	12	watts
Grid-No.2 Input	1.75	watts
Bulb Temperature (At hottest point)	250	°C

**TYPICAL OPERATION (Values are for two tubes)**

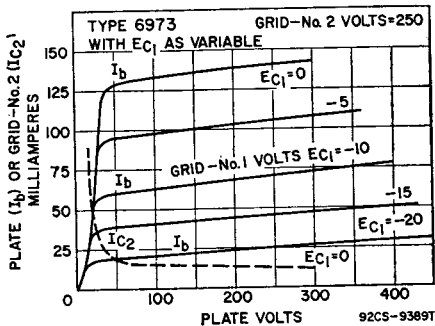
	Fixed Bias	Cathode Bias	
Plate Supply Voltage	375	370	volts
Grid-No.2 Supply Voltage	*	#	volts
Grid-No.1 Voltage*	-33.5	-	volts
Cathode-Bias Resistor	-	355	ohms
Peak AF Grid-No.1-to-Grid-No.1 Voltage	67	62	volts
Zero-Signal Cathode Current	62	74	mA
Maximum-Signal Cathode Current	95	84	mA
Effective Load Resistance (Plate-to-plate)	12500	13000	ohms
Total Harmonic Distortion	1.5	1.2	per cent
Maximum-Signal Power Output	18.5	15	watts

**MAXIMUM CIRCUIT VALUES**

Grid-No.1-Circuit Resistance:		
For fixed-bias operation	0.1	megohm
For cathode-bias operation	1	megohm



92CS-9380TI



92CS-9389TI

\* Obtained from taps on the primary winding of the output transformer. The taps are located on each side of the center tap (B+) so as to apply 50 per cent of the plate signal voltage to grid No.2 of each output tube.

# Obtained from taps on the primary winding of the output transformer. The taps are located on each side of the center tap (B+) so as to supply 43 per cent of the plate signal voltage to grid No.2 of each output tube.

• The type of input-coupling network used should not introduce too much resistance in the grid-No.1 circuit. Transformer- or impedance-coupling devices are recommended.

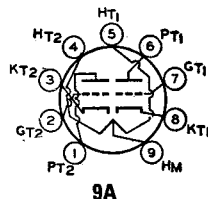
6977

Refer to chart at end of section.

7025

**HIGH-MU TWIN TRIODE**

Miniature type used as phase inverter or resistance-coupled amplifier in high-quality, high-fidelity audio amplifiers. Outlines section, 6B; requires miniature 9-contact socket. This type is identical with miniature type 12AX7A except that it has a controlled equivalent noise and hum characteristic. For operation as resistance-coupled amplifier, refer to Resistance-Coupled Amplifier section.



9A

**EQUIVALENT-NOISE AND HUM VOLTAGE REFERENCED TO GRID (Each Unit)**

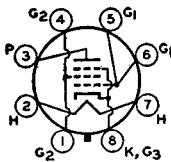
Average Value (rms)†	1.8	μV
Maximum Value (rms)*	7	μV

† Measured in "true rms" units under following conditions: heater volts (ac), 6.3 (parallel connection); center tap of heater transformer connected to ground; plate supply volts, 250; plate load resistor, 2700 ohms; cathode-bypass capacitor, 100 μF; grid resistor, 0 ohms; and amplifier covering frequency range between 25 to 10000 cycles per second.

\* Same conditions as for "Average Value" except cathode resistor is unbypassed and grid resistor is 0.05 megohm.

Refer to chart at end of section.

**7027**



**8HY**

**BEAM POWER TUBE**

**7027A**

Glass octal type used in push-pull power amplifier circuits of high-fidelity audio equipment. Outlines section, 9F; requires octal socket. This tube, like other power-handling tubes, should be adequately ventilated.

Heater Voltage (ac/dc)	6.3	volts
Heater Current	0.9	ampere
Heater-Cathode Voltage:		
Peak value	±200 max	volts
Average value	100 max	volts
Direct Interelectrode Capacitances (Approx.):		
Grid No.1 to Plate	1.5	pF
Grid No.1 to Cathode, Heater, Grid No.2, and Grid No.3	10	pF
Plate to Cathode, Heater, Grid No.2, and Grid No.3	7.5	pF

**Class A<sub>1</sub> Amplifier**

**CHARACTERISTICS**

Plate Voltage	250	volts
Grid-No.2 (Screen-Grid) Voltage	250	volts
Grid-No.1 (Control-Grid) Voltage	-14	volts
Plate Resistance (Approx.)	22500	ohms
Transconductance	6000	μmhos
Plate Current	72	mA
Grid-No.2 Current	5	mA

**Push-Pull Class AB<sub>1</sub> Amplifier**

**MAXIMUM RATINGS (Design-Maximum Values)**

Plate Voltage	600	volts
Grid-No.2 Voltage	500	volts
Plate Dissipation	35	watts
Grid-No.2 Input	5	watts

**TYPICAL OPERATION (Values are for two tubes)**

	Fixed Bias			Cathode Bias			
	400	450	540	400	380	425	
Plate Supply Voltage	400	450	540	400	380	425	volts
Grid-No.2 Supply Voltage	300	350	400	300	380	415	volts
Grid-No.1 Voltage	-25*	-30*	-38*	—	—	—	volts
Cathode-Bias Resistor	—	—	—	200	180	200	ohms
Peak AF Grid-No.1-to-Grid-No.1 Voltage	50	60	76	57	68.5	86	volts
Zero-Signal Plate Current	102	95	100	112	138	150	mA
Maximum-Signal Plate Current	152	194	220	128	170	196	mA
Zero-Signal Grid-No.2 Current	6	3.4	5	7	5.6	8	mA
Maximum-Signal Grid-No.2 Current	17	19.2	21.4	16	20	20	mA
Effective Load Resistance (Plate-to-plate)	6600	6000	6500	6600	4500	3800	ohms
Total Harmonic Distortion	2	1.5	2	2	3.5	4	per cent
Maximum-Signal Power Output	34	50	76	32	36	44	watts

**MAXIMUM CIRCUIT VALUES**

Grid-No.1-Circuit Resistance:		
For fixed-bias operation*	0.1	megohm
For cathode-bias operation	0.5	megohm

\* The type of input coupling network used should not introduce too much resistance in the grid-No.1 circuit. Transformer- or impedance-coupling devices are recommended.

### Push-Pull Class AB<sub>1</sub> Amplifier

Grid No.2 of Each Tube Connected to Tap on Plate Winding of Output Transformer

#### MAXIMUM RATINGS (Design-Maximum Values)

Plate and Grid-No.2 Supply Voltage	600	volts
Plate Dissipation	35	watts
Grid-No.2 Input	4.5	watts

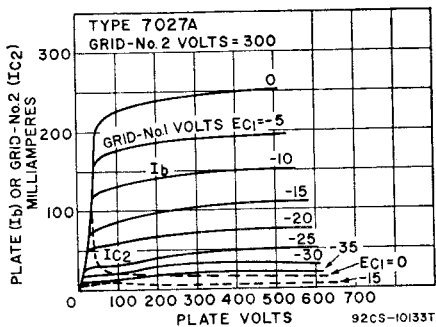
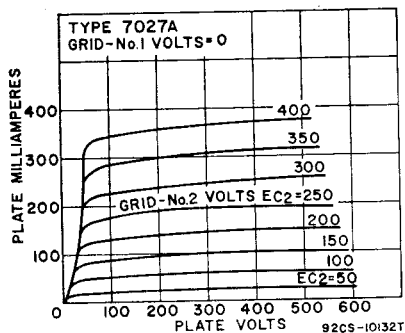
#### TYPICAL OPERATION (Values are for two tubes)

Plate Supply Voltage	410	volts
Grid-No.2 Supply Voltage	*	volts
Cathode-Bias Resistor	220	ohms
Peak AF Grid-No.1-to-Grid-No.1 Voltage	68	volts
Zero-Signal Cathode Current	134	mA
Maximum-Signal Cathode Current	155	mA
Effective Load Resistance (Plate to plate)	8000	ohms
Total Harmonic Distortion	1.6	per cent
Maximum-Signal Power Output	24	watts

#### MAXIMUM CIRCUIT VALUE

Grid-No.1-Circuit Resistance, for cathode-bias operation	0.5	megohm
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\* Obtained from taps on the primary winding of the output transformer. The taps are located on each side of the center tap (B<sub>1</sub>) so as to apply 43 per cent of the plate signal voltage to grid No.2 of each output tube.



7044

Refer to chart at end of section.

7054

Refer to chart at end of section.

7055

Refer to chart at end of section.

7056

Refer to chart at end of section.

7057

Refer to chart at end of section.

7058

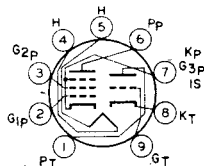
Refer to chart at end of section.

## 7059

INDUSTRIAL  
TYPE

### MEDIUM-MU TRIODE— SHARP-CUTOFF PENTODE

Miniature type medium-mu triode sharp-cutoff pentode for use as a combined oscillator and mixer in mobile communications equipment. Outlines section, 6B; requires miniature 9-contact socket.



9AE

Heater Voltage Range (ac/dc)	12 to 15	volts
Heater Current (Approx.) at 13.5 Volts	0.195	ampere
Peak Heater-Cathode Voltage	±120 max.	volts

	Unshielded	Shielded	
<b>Direct Interelectrode Capacitances:</b>			
<b>Triode Unit:</b>			
Grid to Plate .....	1.7	1.7	pF
Grid to Cathode, Heater .....	2.7	2.7	pF
Plate to Cathode, Heater .....	0.4	1	pF
<b>Pentode Unit:</b>			
Grid No.1 to Plate .....	0.15 max.	0.007 max.	pF
Grid No.1 to Cathode, Heater, Grid No.2, Grid No.3, and Internal Shield .....	5	5	pF
Plate to Cathode, Heater, Grid No.2, Grid No.3, and Internal Shield .....	2.5	3.4	pF
Heater to Cathode .....	3	3	pF

♪ With external shield connected to cathode of unit under test except as noted.  
 ■ With external shield connected to ground.

**Class A<sub>1</sub> Amplifier**

**MAXIMUM RATINGS (Design-Maximum Values)**

	Triode Unit	Pentode Unit	
Plate Voltage .....	300	300	volts
Grid-No.2 (Screen-Grid) Supply Voltage .....	—	300	volts
Grid-No.2 Voltage .....	See curve page 300		
Grid-No.1 (Control-Grid) Voltage, Positive-bias value .....	0	0	volt
Plate Dissipation .....	2.5	2.8	watts
Grid-No.2 Input:			
For grid-No.2 voltages up to 150 volts .....	—	0.5	watt
For grid-No.2 voltages between 150 and 300 volts .....	See curve page 300		

**MAXIMUM CIRCUIT VALUES**

<b>Grid-No.1-Circuit Resistance:</b>			
For fixed-bias operation .....	0.5	0.5	megohm
For cathode-bias operation .....	1	1	megohm

**CHARACTERISTICS**

Heater Voltage .....	13.5	13.5	volts
Plate Supply Voltage .....	150	250	volts
Grid-No.2 Voltage .....	—	110	volts
Cathode-Bias Resistor .....	56	68	ohms
Amplification Factor .....	40	—	
Plate Resistance (Approx.) .....	4700	40000	ohms
Transconductance .....	8500	5200	μmhos
Plate Current .....	18	10	mA
Grid-No.2 Current .....	—	3.5	mA
Grid-No.1 Voltage for plate current of 10 μA .....	-12	-10	volts

**Special Ratings & Performance Data**

**HEATER-CYCLING LIFE PERFORMANCE**

Cycles of Intermittent Operation .....	2000 min.	cycles
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**LOW-FREQUENCY VIBRATION PERFORMANCE**

RMS Output Voltage, Triode Unit .....	150 max.	mV
RMS Output Voltage, Pentode Unit .....	250 max.	mV

