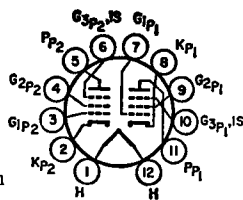


6BN11**SHARP-CUTOFF
TWIN PENTODE**

Duodecar type used as if-amplifier tube in television receivers. Outlines section, 8B; requires duodecar 12-contact socket.

**12GF**

Heater Voltage	6.3	volts
Heater Current	0.8	ampere
Heater Warm-up Time	—	seconds
Heater-Cathode Voltage:		
Peak value	±200 max	volts
Average value	100 max	volts

Class A₁ Amplifier (Each Unit)**MAXIMUM RATINGS (Design-Maximum Values)**

Plate Voltage	330	volts
Grid-No.2 (Screen-Grid) Supply Voltage	330	volts
Grid-No.2 Voltage	See curve page 300	
Grid-No.1 (Control-Grid) Voltage, Positive-bias value	0	volts
Plate Dissipation	3.1	watts
Grid-No.2 Input	0.65	watt

CHARACTERISTICS

Plate Voltage	125	volts
Grid No.3 (Suppressor Grid)	Connected to cathode at socket	
Grid-No.2 Voltage	125	volts
Cathode-Bias Resistor	56	ohms
Plate Resistance (Approx.)	0.2	megohm
Transconductance	13000	μmhos
Plate Current	11	mA
Grid-No.2 Current	3.8	mA
Grid-No.1 Voltage (Approx.) for plate current of 20 μA	-3	volts

MAXIMUM CIRCUIT VALUE

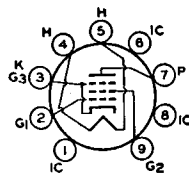
Grid-No.1-Circuit Resistance, for cathode-bias operation	0.25	megohm
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6BQ5

For replacement use type 6BQ5/EL84.

6BQ5/EL84**8BQ5, 10BQ5****POWER PENTODE**

Miniature type used in the output stage of audio-frequency amplifiers. Outlines section, 6G; requires miniature 9-contact socket. Types 8BQ5 and 10BQ5 are identical with type 6BQ5/EL84 except for heater ratings.

**9CV**

Heater Voltage (ac/dc)	6BQ5/EL84	8BQ5	10BQ5	
Heater Current	6.3	8	10.6	volts
Heater Warm-up Time (Average)	0.76	0.6	0.45	ampere
Heater-Cathode Voltage:				
Peak value	±100 max	±100 max	±100 max	volts
Average value	100 max	100 max	100 max	volts
Direct Interelectrode Capacitances:				
Grid No.1 to Plate			0.5 max	pF
Grid No.1 to Cathode, Heater, Grid No.2, and Grid No.3			10.8	pF
Plate to Cathode, Heater, Grid No.2, and Grid No.3			6.5	pF
Grid No.1 to Heater			0.25 max	pF

Class A₁ Amplifier**MAXIMUM RATINGS (Design-Center Values)**

Plate Voltage	300	volts
Grid-No.2 (Screen-Grid) Voltage	300	volts
Grid-No.1 (Control-Grid) Voltage, Positive-bias value	0	volts
Cathode Current	65	mA

Plate Dissipation	12	watts
Grid No.2 Input	2	watts

TYPICAL OPERATION

Plate Voltage	250	volts
Grid-No.2 Voltage	250	volts
Grid-No.1 (Control-Grid) Voltage	-7.3	volts
Peak AF Grid No.1 Voltage	6.2	volts
Zero-Signal Plate Current	48	mA
Maximum-Signal Plate Current	50.6	mA
Zero-Signal Grid-No.2 Current	5.5	mA
Maximum-Signal Grid-No.2 Current	10	mA
Plate Resistance (Approx.)	38000	ohms
Transconductance	11300	μmhos
Load Resistance	4500	ohms
Total Harmonic Distortion	10	per cent
Maximum-Signal Power Output	5.7	watts

MAXIMUM CIRCUIT VALUES

Grid-No.-Circuit Resistance:		
For fixed-bias operation	0.3	megohm
For cathode-bias operation	1	megohm

Push-Pull Class AB₁ Amplifier

MAXIMUM RATINGS (Same as for Single-Tube Class A₁ Amplifier)

TYPICAL OPERATION (Values are for two tubes)

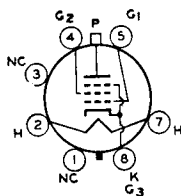
Plate Supply Voltage	250	300	volts
Grid-No.2 Supply Voltage	250	300	volts
Cathode-Bias Resistor	130	130	ohms
Peak AF Grid-No.1-to-Grid-No.1 Voltage	22.6	28.3	volts
Zero-Signal Plate Current	62	72	mA
Maximum-Signal Plate Current	75	92	mA
Zero-Signal Grid-No.2 Current	7	8	mA
Maximum-Signal Grid-No.2 Current	15	22	mA
Effective Load Resistance (Plate-to-plate)	8000	8000	ohms
Total Harmonic Distortion	3	4	per cent
Maximum-Signal Power Output	11	17	watts

MAXIMUM CIRCUIT VALUES

Grid-No.1-Circuit Resistance:		
For fixed-bias operation	0.3	megohm
For cathode-bias operation	1	megohm

Refer to chart at end of section.

6BQ6GT



6AM

BEAM POWER TUBE

6BQ6GTB

/6CU6

12BQ6GTB/12CU6,
25BQ6GTB/25CU6

Glass octal type used as horizontal-deflection amplifier in color and black-and-white television receivers. Outlines section, 14D; requires octal socket. This type may be supplied with pin No.1 omitted. Types 12BQ6GTB/12CU6 and 25BQ6GTB/25CU6 are identical with type 6BQ6GTB/6CU6 except for heater ratings.

	6BQ6GTB/ 6CU6	12BQ6GTB/ 12CU6	25BQ6GTB/ 25CU6	
Heater Voltage (ac/dc)	6.3	12.6	25	volts
Heater Current	1.2	0.6	0.3	ampere
Heater Warm-up Time (Average)	—	11	—	seconds
Heater-Cathode Voltage:				
Peak value	±200 max	±200 max	±200 max	volts
Average value	100 max	100 max	100 max	volts
Direct Interelectrode Capacitances (Approx.):				
Grid No.1 to Plate			0.6	pF
Grid No.1 to Cathode, Heater, Grid No.2, and Grid No.3			15	pF
Plate to Cathode, Heater, Grid No.2, and Grid No.3			7	pF

Class A₁ Amplifier

CHARACTERISTICS

Plate Voltage	60	150	250	volts
Grid-No.2 Voltage	150	150	150	volts
Grid-No.1 Voltage	0	-22.5	-22.5	volts
Mu-Factor, Grid No.2 to Grid No.1	—	4.3	—	
Plate Resistance (Approx.)	—	—	14500	ohms
Transconductance	—	—	5900	μmhos
Plate Current	260*	—	57	mA
Grid-No.2 Current	26*	—	2.1	mA
Grid-No.1 Voltage (Approx.) for plate mA = 1	—	—	-43	volts

* These values can be measured by a method involving a recurrent waveform such that the maximum ratings of the tube will not be exceeded.

Horizontal-Deflection Amplifier

For operation in a 525-line, 30-frame system

MAXIMUM RATINGS (Design-Center Values)

DC Plate Voltage	600	volts
Peak Positive-Pulse Plate Voltage# (Absolute Maximum)	6000†	volts
Peak Negative-Pulse Plate Voltage	1250	volts
DC Grid-No.2 (Screen-Grid) Voltage	200	volts
Peak Negative-Pulse Grid-No.1 (Control-Grid) Voltage	300	volts
Peak Cathode Current	400	mA
Average Cathode Current	110	mA
Plate Dissipation*	11	watts
Grid-No.2 Input	2.5	watts
Bulb Temperature (At hottest point)	220	°C

MAXIMUM CIRCUIT VALUE

Grid-No.1-Circuit Resistance 0.47 megohm

Pulse duration must not exceed 15% of a horizontal scanning cycle (10 microseconds).

† Under no circumstances should this absolute value be exceeded.

* A bias resistor or other means is required to protect the tube in absence of excitation.

6BQ7

Refer to chart at end of section.

For replacement use type 6BQ7A/6BZ7/6BS8.

6BQ7A

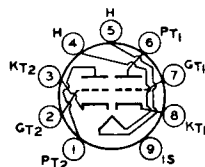
For replacement use type 6BQ7A/6BZ7/6BS8.

6BQ7A/
6BZ7/
6BS8

4BQ7A/4BZ7,
5BQ7A

MEDIUM-MU TWIN TRIODE

Miniature type used as a cascade amplifier in vhf color and black-and-white television tuners in push-pull cathode-drive rf amplifiers. Outlines section, 6B; requires miniature 9-contact socket. For typical operation as a resistance-coupled amplifier, refer to Resistance-Coupled Amplifier section. Types 4BQ7A/4BZ7 and 5BQ7A are identical with type 6BQ7A/6BZ7/6BS8 except for heater ratings.



9AJ

	4BQ7A/ 4BZ7	5BQ7A	6BQ7A/6BZ7/ 6BS8	
Heater Voltage (ac/dc)	4.2	5.6	6.3	volts
Heater Current	0.6	0.45	0.4	ampere
Heater Warm-up Time (Average)	11	11	—	seconds
Heater-Cathode Voltage:				
Peak value	±200*max	±200*max	±200*max	volts
Average value	100 max	100 max	100 max	watts

Direct Interelectrode Capacitances:*

	Unit No.1	Unit No.2	
Grid to Plate	1.2	1.2	pF
Grid to Cathode, Heater, and Internal Shield	2.6	—	pF
Cathode to Grid, Heater, and Internal Shield	—	5	pF
Plate to Cathode, Heater, and Internal Shield	1.2	—	pF
Plate to Grid, Heater, and Internal Shield	—	2.2	pF
Plate to Cathode	0.12	0.12	pF
Heater to Cathode	2.6	2.6	pF
Plate of Unit No.1 to Plate of Unit No.2	—	0.010 max	pF
Plate of Unit No.2 to Plate and Grid of Unit No.1	—	0.024 max	pF

* Rating may be high as 300 volts under cutoff conditions, when tube is used as a cascode amplifier, the two units are connected in series, and heater is negative with respect to cathode.

* With external shield connected to internal shield.

Class A₁ Amplifier (Each Unit)

MAXIMUM RATINGS (Design-Center Values)

Plate Supply Voltage	250*	volts
Cathode Current	20	mA
Plate Dissipation	2	watts

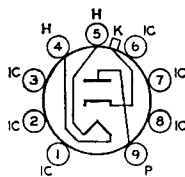
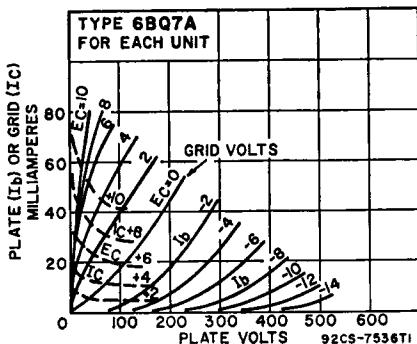
CHARACTERISTICS

Plate Supply Voltage	150	volts
Cathode-Bias Resistor	220	ohms
Amplification Factor	38	
Plate Resistance (Approx.)	5900	ohms
Transconductance	6400	μmhos
Plate Current	9	mA
Grid Voltage (Approx.):		
For plate current of 100 μA	-6.5	volts
For plate current of 10 μA	—	volts

MAXIMUM CIRCUIT VALUE

Grid-Circuit Resistance	0.5	megohm
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* Rating may be high as 300 volts under cutoff conditions, when tube is used as a cascode amplifier, the two units are connected in series, and heater is negative with respect to cathode.



9CB

HALF-WAVE VACUUM RECTIFIER

6BR3/
6RK19

17BR3/17RK19

Miniature type used as damper tube in horizontal-deflection circuits of television receivers. Outlines section, 7D; requires miniature 9-contact socket. Type 17BR3/17RK19 is identical with type 6BR3/6RK19 except for heater ratings.

	6BR3/ 6RK19	17BR3/ 17RK19	
Heater Voltage (ac/dc)	6.3	16.8	volts
Heater Current	1.2	0.45	ampere
Heater Warm-up Time	—	11	seconds

Damper Service

For operation in a 525-line, 30-frame system

MAXIMUM RATINGS (Design-Maximum Values)

Peak Inverse Plate Voltage#	5500	volts	
Peak Plate Current	1200	mA	
Average Plate Current	200	mA	
Plate Dissipation	6.5	watts	
Heater-Cathode Voltage:			
Peak value	+300	—5500	volts
Average value	+100	—300	volts
Bulb Temperature (At hottest point)	180		°C

CHARACTERISTIC, Instantaneous Value

Tube Voltage Drop for plate current of 250 mA	19	volts
# Pulse duration must not exceed 15% of a horizontal scanning cycle (10 microseconds).		

6BR8

Refer to chart at end of section.

For replacement use type 6BR8A/6FV8A.

6BR8A

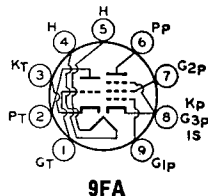
For replacement use type 6BR8A/6FV8A.

6BR8A/ 6FV8A

5BR8/5FV8

MEDIUM-MU TRIODE— SHARP-CUTOFF PENTODE

Miniature type used in color and black-and-white television receiver applications. Especially useful as combined triode oscillator and pentode mixer in vhf television tuners. Outlines section, 6B; requires miniature 9-contact socket. Except for basing arrangement and grid-No.1-to-plate capacitance of pentode unit, types 5BR8/5FV8 and 6BR8A/6FV8A are identical with types 5U8 and 6U8A, respectively.



9FA

6BS3

Refer to chart at end of section.

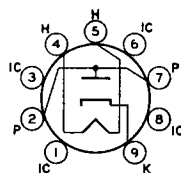
For replacement use type 6BS3A.

6BS3A

12BS3A/
12DW4A, 17BS3A
17BS3A/17DW4A

HALF-WAVE VACUUM RECTIFIER

Novar type used as damper tube in horizontal-deflection circuits of black-and-white television receivers. Outlines section, 30B; requires novar 9-contact socket. Socket terminals 1, 3, 6, and 8 should not be used as tie points; it is recommended that socket clips for these pins be removed to reduce the possibility of arc-over and to minimize leakage. These tubes, like other power-handling tubes, should be adequately ventilated. Types 12BS3A/12DW4A, 17BS3A, and 17BS3A/17DW4A are identical with type 6BS3A except for heater ratings.



9HP

	6BS3A	12BS3A/ 12DW4A	17BS3A/ 17BS3A/ 17DW4A	
Heater Voltage (ac/dc)	6.3	12.6	16.8	volts
Heater Current	1.2	0.6	0.45	amperes
Heater Warm-up Time (Average)	—	11	11	seconds
Direct Interelectrode Capacitances (Approx.):				
Plate to Cathode and Heater			6.5	pF
Cathode to Plate and Heater			9	pF
Heater to Cathode			2.8	pF

Damper Service

For operation in a 525-line, 30-frame system

MAXIMUM RATINGS (Design-Maximum Values)

Peak Inverse Plate Voltage#	5000	volts
Peak Plate Current	1100	mA
Average Plate Current	200	mA
Plate Dissipation	6	watts
Heater-Cathode Voltage:		
Peak value	+300	volts
Average value	+100	volts

CHARACTERISTIC, Instantaneous Value

Tube Voltage Drop for plate current of 140 mA	12	volts
# Pulse duration must not exceed 15% of a horizontal scanning cycle (10 microseconds).		

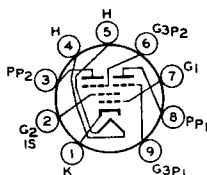
Refer to chart at end of section.
For replacement use type 6BQ7A/6BZ7/6BS8.

6BS8

6BU8

**3BU8/3GS8
4BU8/4GS8**

**SHARP-CUTOFF
TWIN PENTODE**



9FG

Miniature type used as combined sync separator, sync clipper, and agc amplifier tube in color and black-and-white television receivers. Outlines section, 6E; requires miniature 9-contact socket. Types 3BU8/3GS8 and 4BU8/4GS8 are identical with type 6BU8 except for heater ratings.

	3BU8/3GS8	4BU8/4GS8	6BU8	
Heater Voltage (ac/dc)	3.15	4.2	6.3	volts
Heater Current	0.6	0.45	0.3	ampere
Heater Warm-up Time (Average)	11	11	—	seconds
Heater-Cathode Voltage:				
Peak value	±200 max	±200 max	±200 max	volts
Average value	100 max	100 max	100 max	volts
Direct Interelectrode Capacitances:				
Grid No.3 to Plate (Each Unit)			1.9	pF
Grid No.1 to All Other Electrodes			6	pF
Grid No.1 to All Other Electrodes (Each Unit)			3.6	pF
Grid No.3 to All Other Electrodes (Each Unit)			3	pF
Plate to All Other Electrodes			0.015 max	pF
Grid No.3 of Unit No.1 to Grid No.3 of Unit No.2				

Class A₁ Amplifier

MAXIMUM RATINGS (Design-Maximum Values)

Plate Voltage (Each Unit)	300	volts
Grid-No.3 (Suppressor-Grid) Voltage (Each Unit):		
Peak positive value	50	volts
DC negative value	50	volts
DC positive value	3	volts
Grid-No.2 (Screen-Grid) Voltage	150	volts
Grid-No.1 (Control-Grid) Voltage, Negative bias value	50	volts
Cathode Current	12	mA
Plate Dissipation (Each Unit)	1.1	watts
Grid-No.2 Input	0.75	watt

CHARACTERISTICS (With Both Units Operating)

Plate Voltage (Each Unit)	100	100	volts
Grid-No.3 Voltage (Each Unit)	-10	0	volts
Grid-No.2 Voltage	67.5	67.5	volts
Grid-No.1 Voltage	*	*	volts
Plate Current (Each Unit)	—	2.2	mA
Grid-No.2 Current	6.5	3.3	mA
Cathode Current	6.6	7.8	mA

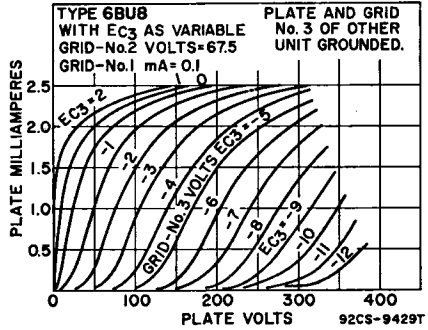
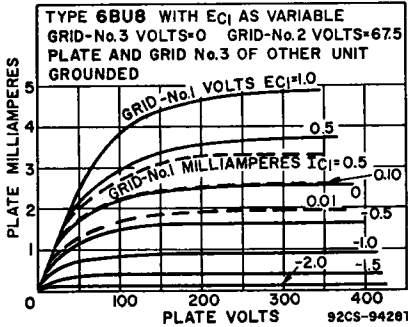
CHARACTERISTICS (With One Unit Operating)

Plate Voltage	100	100	volts
Grid-No.3 Voltage	0	0	volts
Grid-No.2 Voltage	67.5	67.5	volts
Grid-No.1 Voltage	0	*	volts
Grid-No.3 Transconductance	—	180	μmhos
Grid-No.1 Transconductance	1500	—	μmhos

Plate Current	—	2.2	mA
Grid-No.3 Voltage (Approx.) for plate current of 100 μ A	—	-4.5	volts
Grid-No.1 Voltage (Approx.) for plate current of 100 μ A	—	-2.3	volts

MAXIMUM CIRCUIT VALUES

Grid-No.3-Circuit Resistance (Each Unit)	0.5	megohm
Grid-No.1-Circuit Resistance	0.5	megohm
* Adjusted to provide a dc grid-No.1 current of 100 microamperes.		
† With plate and grid No.3 of the other unit connected to ground.		



6B8B

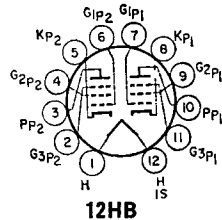
Refer to chart at end of section.

6BV11

12BV11

SHARP-CUTOFF TWIN PENTODE

Duodecar type used as color demodulators in color television applications. Grid Nos. 1 and 3 may be used as independent control electrodes. Outlines section, 8C; requires duodecar 12-contact socket. Type 12BV11 is identical with type 6BV11 except for heater ratings.



Heater Arrangement	6BV11 Series	12BV11 Parallel	
Heater Voltage (ac/dc)	6.3	12.6	volts
Heater Current	0.9	0.45	ampere
Heater Warm-up Time	—	11	seconds
Direct Interelectrode Capacitances:			
Grid No.1 to Plate		0.1	pF
Grid No.3 to Plate		3.2	pF
Grid No.1 to Heater, Cathode, Grid No.2, Grid No.3, and Internal Shield		7	pF
Grid No.3 to All Other Electrodes		8.5	pF
Grid No.1 to Grid No.3		0.08	pF

Class A₁ Amplifier (Each Unit)

MAXIMUM RATINGS (Design-Maximum Values)

DC Plate Voltage	300	volts
Grid-No.3 (Suppressor-Grid) Voltage:		
Positive-bias value	25	volts
Negative-bias value	100	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	volt
Negative-bias value	50	volts
Plate Dissipation	1.7	watts
Grid-No.3 Input	0.1	watt
Grid-No.2 Input:		
For grid-No.2 voltages up to 150 volts	1	watt
For grid-No.2 voltages between 150 and 300 volts	See curve page 300	

CHARACTERISTICS

Plate Supply Voltage	150	volts
Grid-No.3 Voltage	0	volt
Grid-No.2 Supply Voltage	100	volts
Cathode Resistor	180	ohms
Plate Current	3.1	mA
Grid-No.2 Current	2.4	mA
Transconductance, Grid No.1	3200	μ mhos
Transconductance, Grid No.3	390	μ mhos
Plate Resistance (Approx.)	0.17	megohm
Grid-No.1 Voltage (Approx.) for plate current of 75 μ A	-3.5	volts
Grid-No.3 Voltage (Approx.) for plate current of 85 μ A	-5.5	volts
Amplification Factor	67	

MAXIMUM CIRCUIT VALUES

Grid-No.3-Circuit Resistance	0.68	megohm
Grid-No.1-Circuit Resistance:		
For fixed-bias operation	0.22	megohm
For cathode-bias operation	0.47	megohm

For replacement use type 6CG3/6BW3/6DQ3.

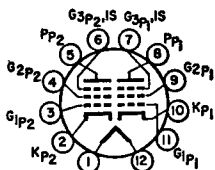
6BW3

Refer to chart at end of section.

6BW4

Refer to chart at end of section.

6BW8



12HD

**SHARP-CUTOFF
DUAL PENTODE**

6BW11

Duodecar type used in color and black-and-white television receiver applications. Unit No. 1 is used as a video amplifier; unit No. 2 is used in bandpass amplifier, burst amplifier, or sound-if or video-if applications. Outlines section, 8B; requires duodecar 12-contact socket. Heater: volts (ac/dc), 6.3; amperes, 0.8; maximum heater-cathode volts, ± 200 peak, 100 average.

Class A₁ Amplifier

MAXIMUM RATINGS (Design-Maximum Values)	Unit No.1	Unit No.2	
Plate Voltage	330	330	volts
Grid-No.2 (Screen-Grid) Supply Voltage	330	330	volts
Grid-No.2 Voltage	See curve page 300		
Grid-No.1 (Control-Grid) Voltage, Positive-bias value	0	0	volts
Plate Dissipation	4	3.1	watts
Grid-No.2 Dissipation	0.8	0.65	watt

CHARACTERISTICS

Plate Voltage	125	125	volts
Grid No.3 (Suppressor Grid)	Connected to cathode at socket		
Grid-No.2 Voltage	125	125	volts
Cathode-Bias Resistor	56	56	ohms
Plate Resistance (Approx.)	0.12	0.2	megohm
Transconductance	8500	13000	μ mhos
Plate Current	22	11	mA
Grid-No.2 Current	4.8	3.8	mA
Grid-No.1 Voltage (Approx.) for plate current of 20 μ A	-9.5	-3	volts

MAXIMUM CIRCUIT VALUES

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

Refer to chart at end of section.

6BX7GT

Refer to chart at end of section.

6BY5GA