

FOR TV SYNCHRONOUS DETECTOR AND BURST GATE APPLICATIONS

DESCRIPTION AND RATING

The 6AR8 is a miniature double-plate sheet-beam tube which incorporates a pair of balanced deflectors to direct the electron beam to either of the two plates and a control grid to vary the intensity of the beam. The resulting unique characteristics of this tube make it especially suited for service as a synchronous detector in color television receivers. In this application, relatively large, balanced output signals of both positive and negative polarities are developed which eliminate the need for phase-inversion functions in the matrix circuits. Other features of the 6AR8 synchronous detector circuit include low oscillator injection power requirements, freedom from the space-charge coupling effects which are present in dual-control pentodes and heptodes, linear output voltages, insensitiveness to variations in oscillator amplitude over a wide range, and a high ratio of plate to accelerator current. The 6AR8 is also suitable for service in the burst gate circuit of color TV receivers and a variety of other switching and gating applications.

GENERAL

Cathode—Coated Unipotential
 Heater Voltage, AC or DC 6.3 Volts
 Heater Current 0.3 Amperes
 Envelope—T-6½, Glass
 Base—E9-1, Small Button 9-Pin
 Mounting Position—Any

Direct Interelectrode Capacitances, approximate*

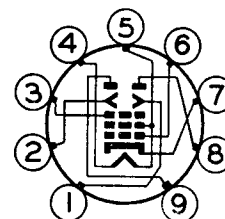
Deflector-Number 1 to A11	4.8	μμf
Deflector-Number 2 to A11	4.8	μμf
Grid-Number 1 to A11 Except Plates	7.5	μμf
Plate-Number 1 to A11	5.0	μμf
Plate-Number 2 to A11	5.0	μμf
Grid-Number 1 to Deflector-Number 1, maximum	0.040	μμf
Grid-Number 1 to Deflector-Number 2, maximum	0.060	μμf
Plate-Number 1 to Plate-Number 2	0.4	μμf
Deflector-Number 1 to Deflector-Number 2	0.38	μμf

MAXIMUM RATINGS

DESIGN-CENTER VALUES

Plate-Number 1 Voltage	300	Volts
Plate-Number 2 Voltage	300	Volts
Accelerator Voltage	300	Volts
Peak Positive Deflector-Number 1 Voltage	150	Volts
Peak Negative Deflector-Number 1 Voltage	150	Volts
Peak Positive Deflector-Number 2 Voltage	150	Volts
Peak Negative Deflector-Number 2 Voltage	150	Volts
Positive DC Grid-Number 1 Voltage	0	Volts
Plate-Number 1 Dissipation	2.0	Watts
Plate-Number 2 Dissipation	2.0	Watts
DC Cathode Current	30	Milliamperes
Grid-Number 1 Circuit Resistance		
With Fixed Bias	0.1	Megohms
With Cathode Bias	0.25	Megohms

BASING DIAGRAM

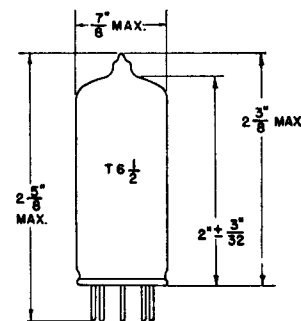


RETMA 9DP
BOTTOM VIEW

TERMINAL CONNECTIONS

- Pin 1—Deflector Number 2
- Pin 2—Deflector Number 1
- Pin 3—Accelerator
- Pin 4—Heater
- Pin 5—Heater, Internal Shield, and Focus Electrodes†
- Pin 6—Grid Number 1 (Control Grid)
- Pin 7—Cathode
- Pin 8—Plate Number 2
- Pin 9—Plate Number 1

PHYSICAL DIMENSIONS



RETMA 6-3

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS WITH DEFLECTORS GROUNDED

Plate-Number 1 Voltage	250 Volts
Plate-Number 2, Connected to Plate-Number 1	
Accelerator Voltage	250 Volts
Deflector-Number 1 Voltage	0 Volts
Deflector-Number 2 Voltage	0 Volts
Cathode-Bias Resistor	300 Ohms
Total Plate Current	10 Milliampères
Accelerator Current	0.4 Milliampères
Grid-Number 1 Transconductance	4000 Micromhos
Grid-Number 1 Voltage, approximate	
I_b (total) = 10 Microampères	-14 Volts

AVERAGE DEFLECTOR CHARACTERISTICS

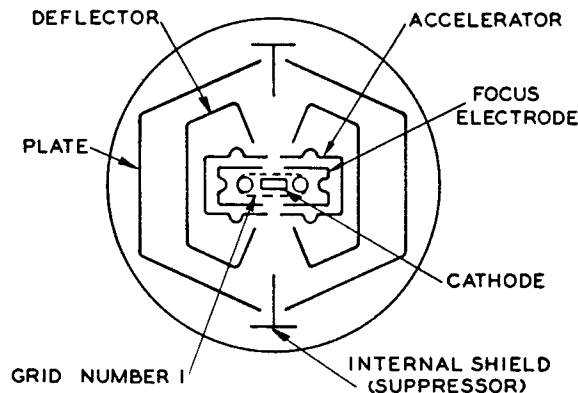
Plate-Number 1 Voltage	250 Volts
Plate-Number 2 Voltage	250 Volts
Accelerator Voltage	250 Volts
Cathode-Bias Resistor	300 Ohms
Deflector Switching Voltage, maximum†	20 Volts
Deflector-Bias Voltage for Minimum Deflector Switching Voltage‡	-8 Volts
Voltage Difference between Deflectors for $I_{b1} = I_{b2}$, approximate	0 Volts
Plate-Number 1 Current, maximum	
$E_{d1} = -15$ Volts, $E_{d2} = +15$ Volts	1.0 Milliampères
Plate-Number 2 Current, maximum	
$E_{d1} = +15$ Volts, $E_{d2} = -15$ Volts	1.0 Milliampères
Deflector-Number 1 Current, maximum	
$E_{d1} = +25$ Volts, $E_{d2} = -25$ Volts	0.5 Milliampères
Deflector-Number 2 Current, maximum	
$E_{d1} = -25$ Volts, $E_{d2} = +25$ Volts	0.5 Milliampères

* Without external shield.

† Pin 5 should be connected directly to ground.

‡ Deflector switching voltage is defined as the total voltage change on either deflector with an equal and opposite change on the other deflector required to switch the plate current from one plate to the other.

Note: The 6AR8 should be so located in the receiver that it is not subjected to stray magnetic fields.



OPERATING CONSIDERATIONS FOR THE 6AR8 (Cont'd)

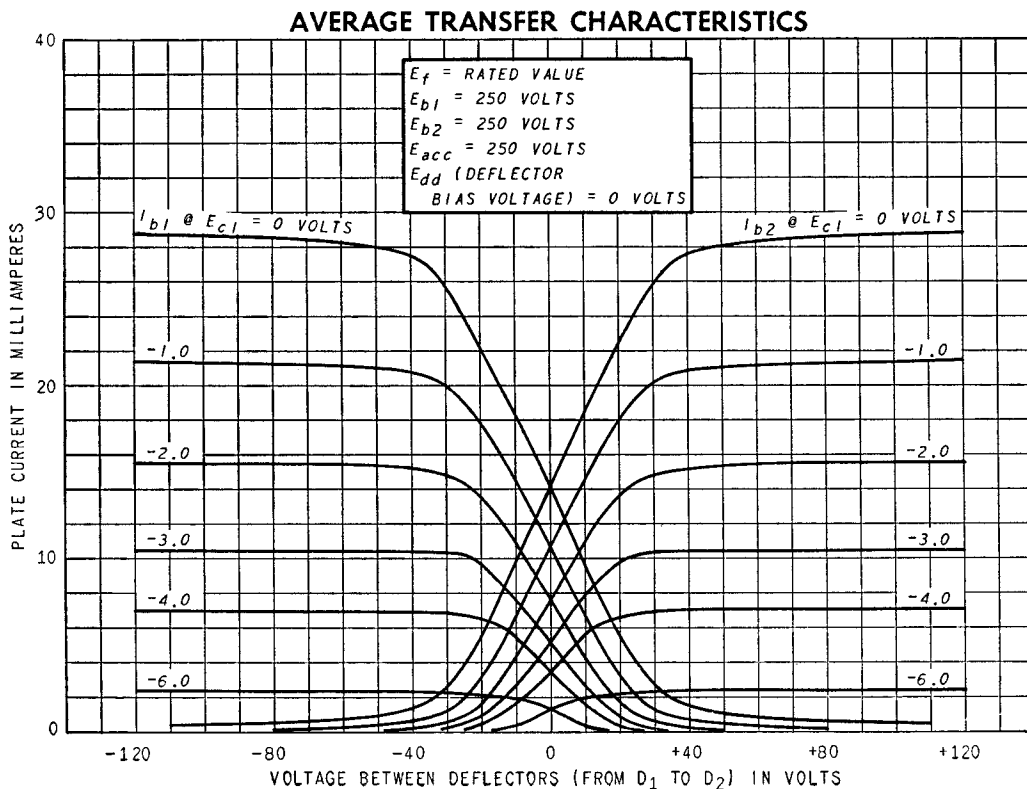
characteristic exhibits a broad maximum. Care should be exercised, nevertheless, to assure that defocusing effects are not present whenever the tube is operated at conditions other than those recommended.

The circuit diagram for two 6AR8 tubes employed as synchronous detectors π in a color television receiver is shown. In this arrangement, positive voltages are applied directly to the accelerator grids and through load resistors R1, R2, R4 and R5 to each of the plates. The chrominance signal is applied to the control grid of each tube. The 3.58-megacycle reference signal is applied in push-pull between the deflectors of each tube. The small coupling capacitor, Cc, between the tuned driving circuits provides the necessary 90-degree phase shift for the I and Q detectors. Also each tube is biased with a cathode resistor, R3 and R6; resistor R6 is variable so that the relative gains of the two demodulators can be adjusted.

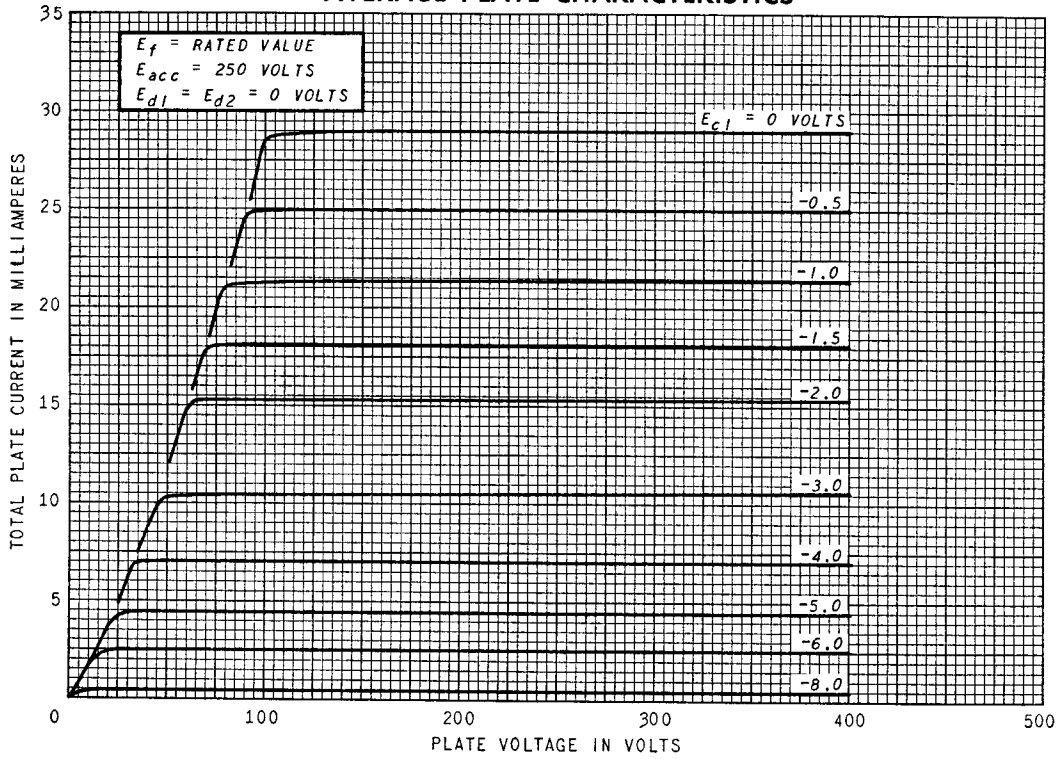
In principle, the 6AR8 circuit is a product-demodulator type of synchronous detector; however, because the circuit uses a double-plate sheet-beam tube rather than a dual-control pentode or heptode, certain significant operating features result. First the 6AR8 circuit is capable of delivering relatively large and balanced output voltages which exhibit good linearity. Because output voltages are available of both positive and negative polarities, the need for the incorporation of phase-inverter circuits in the matrix section of the color receiver is completely eliminated. Also, providing the oscillator reference voltage is adequate to switch the plate currents between the two plates, the circuit is insensitive to variations in the amplitude of the oscillator voltage over a wide range. Furthermore, unlike the pentode or heptode synchronous detector circuits in which the third grid is driven positive by the oscillator reference voltage, the deflectors of the 6AR8 require very little excitation power. Consequently, less power is required from the 3.85-megacycle reference oscillator in the sheet-beam tube circuit.

Another feature is that space-charge coupling effects, which are inherently present in dual-control pentodes and heptodes, are unnoticeable in the 6AR8. Also, unlike most dual-control pentodes and heptodes in which the screen current is an appreciable percent of the plate current, the accelerator current of the 6AR8 is less than one-twentieth of its plate current.

π R. Adler and C. Heuer, "Color Decoder Simplifications Based on a Beam-Deflection Tube," Trans. IRE, PGBTR-5, Jan. 1954.



AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

