6ER5

HIGH-MU TRIODE

Miniature type with frame grid used in vhf tuners of color and black-and-white television receivers. Outlines section 5C; requires miniature 7-contact socket. Type 3ER5 is identical to type 6ER5 except for heater ratings.

<table>
<thead>
<tr>
<th></th>
<th>3ER5</th>
<th>6ER5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater Voltage (ac/dc)</td>
<td>2.8</td>
<td>6.3</td>
</tr>
<tr>
<td>Heater Current</td>
<td>0.45</td>
<td>0.18</td>
</tr>
<tr>
<td>Peak Heater-Cathode Voltage</td>
<td>±100 max</td>
<td>±100 max</td>
</tr>
</tbody>
</table>

Direct Interelectrode Capacitances:

<table>
<thead>
<tr>
<th></th>
<th>Unshielded</th>
<th>Shielded*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid to Plate</td>
<td>0.35</td>
<td>0.35</td>
</tr>
<tr>
<td>Grid to Cathode, Heater, and Internal Shield</td>
<td>4.4</td>
<td>4.4</td>
</tr>
<tr>
<td>Plate to Cathode, Heater, and Internal Shield</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Grid to Heater</td>
<td>0.28 max</td>
<td>0.28 max</td>
</tr>
<tr>
<td>Plate to Cathode</td>
<td>0.24</td>
<td>0.24</td>
</tr>
<tr>
<td>Cathode to Grid</td>
<td>3.1</td>
<td>3.1</td>
</tr>
<tr>
<td>Heater to Cathode</td>
<td>2.5</td>
<td>2.5</td>
</tr>
</tbody>
</table>

* With external shield connected to cathode except as noted.
<table>
<thead>
<tr>
<th></th>
<th>Unshielded</th>
<th>Shielded*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid to Plate</td>
<td>0.35</td>
<td>0.35</td>
</tr>
<tr>
<td>Grid to Cathode, Heater, and Internal Shield</td>
<td>4.4</td>
<td>4.4</td>
</tr>
<tr>
<td>Plate to Cathode, Heater, and Internal Shield</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Grid to Heater</td>
<td>0.28 max</td>
<td>0.28 max</td>
</tr>
<tr>
<td>Plate to Cathode</td>
<td>0.24</td>
<td>0.24</td>
</tr>
<tr>
<td>Cathode to Grid</td>
<td>3.1</td>
<td>3.1</td>
</tr>
<tr>
<td>Heater to Cathode</td>
<td>2.5</td>
<td>2.5</td>
</tr>
</tbody>
</table>

* With external shield connected to ground.

Class A1, Amplifier

MAXIMUM RATINGS (Design-Center Values)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Voltage</td>
<td>250</td>
</tr>
<tr>
<td>Grid Voltage, Negative-bias value</td>
<td>50</td>
</tr>
<tr>
<td>Cathode Current</td>
<td>20 mA</td>
</tr>
<tr>
<td>Plate Dissipation</td>
<td>2.2</td>
</tr>
</tbody>
</table>

CHARACTERISTICS

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Voltage</td>
<td>200</td>
</tr>
<tr>
<td>Grid Voltage</td>
<td>-1.2</td>
</tr>
<tr>
<td>Amplification Factor</td>
<td>80</td>
</tr>
<tr>
<td>Plate Resistance (Approx.)</td>
<td>8000</td>
</tr>
<tr>
<td>Transconductance</td>
<td>10500</td>
</tr>
<tr>
<td>Plate Current</td>
<td>1.0</td>
</tr>
<tr>
<td>Grid Voltage (Approx.) for transconductance of 500 μmhos</td>
<td>-3.8</td>
</tr>
<tr>
<td>Grid Voltage (Approx.) for transconductance of 100 μmhos</td>
<td>-5.6</td>
</tr>
</tbody>
</table>

MAXIMUM CIRCUIT VALUE

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-Circuit Resistance</td>
<td>1 megohm</td>
</tr>
</tbody>
</table>

6ES5

Refer to chart at end of section.

6ES8

Refer to chart at end of section.

6ES8/

VARIABLE-MU TWIN TRIODE

ECC189

Miniature type used as cascode-type amplifier in tuners of television receivers. Outlines section, 6B; requires miniature 9-contact socket.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater Voltage (ac/dc)</td>
<td>6.3</td>
</tr>
<tr>
<td>Heater Current</td>
<td>0.056</td>
</tr>
<tr>
<td>Direct Interelectrode Capacitances:</td>
<td>Unshielded</td>
</tr>
<tr>
<td>Grid to Plate (Each Unit)</td>
<td>1.9</td>
</tr>
<tr>
<td>Plate to Cathode (Each Unit)</td>
<td>0.18</td>
</tr>
<tr>
<td>Heater to Cathode (Each Unit)</td>
<td>3</td>
</tr>
<tr>
<td>Plate of Unit No.2 to Plate of Unit No.1</td>
<td>0.04 max</td>
</tr>
<tr>
<td>Plate of Unit No.2 to Grid of Unit No.1</td>
<td>0.003 max</td>
</tr>
<tr>
<td>Grid of Unit No.1 to Cathode of Unit No.2</td>
<td>0.002 max</td>
</tr>
</tbody>
</table>

* With external shield connected to cathode of unit except as noted.

* With external shield connected to ground.
Class A\textsubscript{i} Amplifier (Each Unit)

**CHARACTERISTICS**
- Plate Voltage: \(90\) volts
- Grid Voltage: \(-1.2\) volts
- Plate Resistance (Approx.): \(2500\) ohms
- Transconductance: \(12500\) \(\mu\)mhos
- Plate Current: \(15\) mA

**Cascode-Type Amplifier**

**MAXIMUM RATINGS** (Design-Maximum Values)
- Plate Supply Voltage with plate current of 0 mA: \(550\) volts
- Plate Voltage (Each unit): \(130\) volts
- Grid Voltage, Negative-bias value (Each unit): \(80\) volts
- Cathode Current (Each unit): \(22\) mA
- Plate Dissipation (Each unit): \(1.8\) watts
- Heater-Cathode Voltage:
  - Unit No.1: RMS voltage between cathode and heater: \(50\) volts
  - Unit No.2: RMS voltage between cathode and heater: \(50\) volts
  - DC voltage between cathode and heater: \(130\) volts

**TYPICAL OPERATION** in a cascode-type circuit:
- Supply Voltage: \(180\) volts
- Plate Current: \(15\) mA
- Transconductance: \(12500\) \(\mu\)mhos
- Noise Figure\*: \(6.5\) dB
- Grid Voltage (Approx.) for transconductance of 125 \(\mu\)mhos: \(-9\) volts
- Input Voltage for cross-modulation factor of 0.01 and transconductance of 125 \(\mu\)mhos: \(500\) mV

**MAXIMUM CIRCUIT VALUE**
- Grid-Circuit Resistance (Each unit): \(1.0\) megohm

* Grounded-cathode input unit—pins 6, 7, and 8.
* Grounded-grid output unit—pins 1, 2, and 3.
* Cathode positive with respect to heater.
* With grid of output unit connected to a voltage divider.
* Measured with tube operating in a television tuner.

Refer to chart at end of section.

**HIGH-MU TWIN TRIODE**

Miniature type used in high-gain, resistance-coupled, low-level audio-amplifier applications where low-hum and non-microphonic characteristics are important, such as microphone amplifiers and pre-amplifiers for phonographs. Outlines section, 6B; requires miniature 9-contact socket. For typical operation as a resistance-coupled amplifier, refer to Resistance-Coupled Amplifier section.

**6ET7**

**Heater Voltage (ac/dc)**: \(6.3\) volts
**Heater Current**: \(0.3\) ampere
**Heater-Cathode Voltage:**
- Peak value: \(\pm200\) max volts
- Average value: \(100\) max volts

**Direct Inter-electrode Capacitances (Each Unit, Approx.):**
- Grid to Plate: \(1.5\) \(pF\)
- Grid to Cathode and Heater: \(1.6\) \(pF\)
- Plate to Cathode and Heater: \(0.2\) \(pF\)

**Equivalent Noise and Hum Voltage (Referenced to Grid; Each Unit):**
- Average Value*: \(1.8\) microvolts rms

* Measured in "true rms" units under the following conditions: Heater volts (ac), 6.3; center-tap of heater transformer grounded; plate supply volts, 250; plate load resistor, 100000 ohms; cathode resistor, 2700 ohms; cathode bypass capacitor, 100 \(\mu\)F; grid resistor, 0 ohms; amplifier frequency range, 25 to 10000 Hz.
Class A\textsubscript{i} Amplifier (Each Unit)

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Voltage</td>
<td>330 volts</td>
</tr>
<tr>
<td>Grid Voltage:</td>
<td></td>
</tr>
<tr>
<td>Negative-bias value</td>
<td>55 volts</td>
</tr>
<tr>
<td>Positive-bias value</td>
<td>0 watts</td>
</tr>
<tr>
<td>Plate Dissipation</td>
<td>1.2 watts</td>
</tr>
</tbody>
</table>

**CHARACTERISTICS**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Voltage</td>
<td>100 volts</td>
</tr>
<tr>
<td>Grid Voltage</td>
<td>-1 -2 volts</td>
</tr>
<tr>
<td>Amplification Factor</td>
<td>100 100</td>
</tr>
<tr>
<td>Plate Resistance (Approx.)</td>
<td>80000 62500 ohms</td>
</tr>
<tr>
<td>Transconductance</td>
<td>1250 1600 μmhos</td>
</tr>
<tr>
<td>Plate Current</td>
<td>0.5 1.2 mA</td>
</tr>
</tbody>
</table>

![Type 6EU7 Each Unit](image)

**6EU8**

Refer to chart at end of section.

**6EV5**

**SHARP-CUTOFF TETRODE**

Miniature type used as rf amplifier in vhf tuners of television receivers. Outlines section, 5C; requires miniature 7-contact socket.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater Voltage (ac/dc)</td>
<td>6.3 volts</td>
</tr>
<tr>
<td>Heater Current</td>
<td>0.2 ampere</td>
</tr>
<tr>
<td>Heater-Cathode Voltage:</td>
<td>±100 max volts</td>
</tr>
<tr>
<td>Peak value</td>
<td>50 max volts</td>
</tr>
<tr>
<td>Average value</td>
<td>0.035 max pF</td>
</tr>
<tr>
<td>Direct Interelectrode Capacitances (^A)</td>
<td>4.5 pF</td>
</tr>
<tr>
<td>Grid No.1 to Plate</td>
<td>2.9 pF</td>
</tr>
<tr>
<td>Grid No.1 to Cathode, Heater, Grid No.2, and Internal Shield</td>
<td></td>
</tr>
<tr>
<td>Plate to Cathode, Heater, Grid No.2, and Internal Shield</td>
<td></td>
</tr>
</tbody>
</table>

\(^A\) With external shield connected to cathode.

Class A\textsubscript{i} Amplifier

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Voltage</td>
<td>275 volts</td>
</tr>
<tr>
<td>Grid-No.2 (Screen-Grid) Supply Voltage</td>
<td>180 volts</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>See curve page 300</td>
</tr>
<tr>
<td>Grid-No.1 (Control-Grid) Voltage, Positive-bias value</td>
<td>0 volts</td>
</tr>
<tr>
<td>Cathode Current</td>
<td>20 mA</td>
</tr>
<tr>
<td>Plate Dissipation</td>
<td>3.25 watts</td>
</tr>
<tr>
<td>Grid-No.2 Input:</td>
<td></td>
</tr>
<tr>
<td>For grid-No.2 voltages up to 90 volts</td>
<td>0.2 watt</td>
</tr>
<tr>
<td>For grid-No.2 voltages between 90 and 180 volts</td>
<td>See curve page 300</td>
</tr>
</tbody>
</table>
CHARACTERISTICS
Plate Voltage ........................................... 250 volts
Grid-No.2 Voltage .................................... 60 volts
Grid-No.1 Voltage .................................... -1 volt
Plate Resistance (Approx.) .......................... 0.15 megohm
Transconductance ................. 8800 µmhos
Plate Current .................. 11.5 mA
Grid-No.2 Current .......... 0.3 mA
Grid-No.1 Voltage (Approx.) for transconductance of 100 µmhos 4.5 volts

MAXIMUM CIRCUIT VALUE
Grid-No.1-Circuit Resistance .................. 0.5 megohm

Refer to chart at end of section.

SHARP-CUTOFF PENTODE

Miniature type used in the gain-controlled picture-if stages of vhf color and black-and-white television receivers operating at an intermediate frequency in the order of 40 MHz. Outlines section, 5C; requires miniature 7-contact socket. Type 6EW6 is identical with type 6EV6 except for heater ratings.

<table>
<thead>
<tr>
<th>5EW6</th>
<th>6EW6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater Voltage (ac/dc)</td>
<td>5.6</td>
</tr>
<tr>
<td>Heater Current</td>
<td>0.45</td>
</tr>
<tr>
<td>Heater Warm-up Time (Average)</td>
<td>11</td>
</tr>
<tr>
<td>Heater-Cathode Voltage:</td>
<td></td>
</tr>
<tr>
<td>Peak value</td>
<td>±200 max</td>
</tr>
<tr>
<td>Average value</td>
<td>100 max</td>
</tr>
<tr>
<td>Direct Interelectode Capacitances:</td>
<td>Unshielded</td>
</tr>
<tr>
<td>Grid No.1 to Plate</td>
<td>0.04 max</td>
</tr>
<tr>
<td>Grid No.2 to Heater, Grid No.2, Grid No.3, and Internal Shield</td>
<td>10</td>
</tr>
<tr>
<td>Grid No.3 to Cathode, Plate, and Internal Shield</td>
<td>2.4</td>
</tr>
</tbody>
</table>
* With external shield connected to cathode.

Class A1 Amplifier

MAXIMUM RATINGS (Design-Maximum Values)
Plate Voltage ........................................... 330 volts
Grid No.3 (Suppressor-Grid) Voltage, Positive value .................. 0 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:
For grid-No.2 voltages up to 165 volts .................. 0.65 watt
For grid-No.2 voltages between 165 and 330 volts ............... See curve page 300

TYPE 6EW6
GRID No.3 AND INTERNAL SHIELD CONNECTED TO CATHODE AT SOCKET, GRID-No.2 VOLTS 125
CHARACTERISTICS
Plate Supply Voltage
Grid No. 3 Connected to cathode at socket
Grid-No.2 Supply Voltage
Cathode-Bias Resistor
Plate Resistance (Approx.)
Transconductance
Plate Current
Grid-No.2 Current
Grid-No.1 Voltage (Approx.) for plate current of 20 $\mu$A
125 volts
56 ohms
0.2 megohm
14000 $\mu$hos
11 mA
3.2 mA
-3.5 volts

6EW7
10EW7, 15EW7
DUAL TRIODE
Miniature type used as combined vertical-deflection oscillator and vertical-deflector amplifier in television receivers. Outlines section, 6E, requires miniature 9-contact socket. For curve of average plate characteristics, Unit No.1, refer to type 6DE7 (Unit No.1). Types 10EW7 and 15EW7 are identical with type 6EW7 except for heater ratings.

<table>
<thead>
<tr>
<th>6EW7</th>
<th>10EW7</th>
<th>15EW7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater Voltage (ac/dc)</td>
<td>6.3</td>
<td>9.7</td>
</tr>
<tr>
<td>Heater Current</td>
<td>0.9</td>
<td>0.6</td>
</tr>
<tr>
<td>Heater Warm-up Time</td>
<td>—</td>
<td>11</td>
</tr>
<tr>
<td>Heater-Cathode Voltage:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak value</td>
<td>±200 max</td>
<td>±200 max</td>
</tr>
<tr>
<td>Average value</td>
<td>100 max</td>
<td>100 max</td>
</tr>
<tr>
<td>Direct Inter-electrode Capacitances (Approx.):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grid to Plate</td>
<td>4.2</td>
<td>9</td>
</tr>
<tr>
<td>Grid to Cathode and Heater</td>
<td>2.2</td>
<td>7</td>
</tr>
<tr>
<td>Plate to Cathode and Heater</td>
<td>0.4</td>
<td>1.2</td>
</tr>
<tr>
<td>Class A1 Amplifier</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CHARACTERISTICS
Plate Voltage
Grid Voltage
Amplification Factor
Plate Resistance (Approx.)
Transconductance
Plate Current
Plate Current for plate voltage of 60 volts and zero grid voltage
Plate Current for grid voltage of -25 volts
Grid Voltage (Approx.) for plate current of 10 $\mu$A
Grid Voltage (Approx.) for plate current of 100 $\mu$A
250 volts
-11
17.5
8750 ohms
2000 $\mu$hos
5.5 mA
—
95 mA
—
8 mA
-20 volts
—
-40 volts
Vertical-Deflection Oscillator and Amplifier
For operation in a 525-line, 30-frame system

MAXIMUM RATINGS (Design-Maximum Values)

<table>
<thead>
<tr>
<th></th>
<th>Unit No.1 Oscillator</th>
<th>Unit No.2 Amplifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Plate Voltage</td>
<td>330</td>
<td>330</td>
</tr>
<tr>
<td>Peak Positive-Pulse Plate Voltage#</td>
<td>—</td>
<td>1500</td>
</tr>
<tr>
<td>Peak Negative-Pulse Grid Voltage</td>
<td>6.0</td>
<td>250</td>
</tr>
<tr>
<td>Peak Cathode Current</td>
<td>77</td>
<td>175</td>
</tr>
<tr>
<td>Average Cathode Current</td>
<td>22</td>
<td>50</td>
</tr>
<tr>
<td>Plate Dissipation</td>
<td>1.5</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>volts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>volts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>watts</td>
</tr>
</tbody>
</table>

MAXIMUM CIRCUIT VALUES

Grid-Circuit Resistance:
- For cathode-bias operation: 2.2 megohms
- For grid-resistor-bias operation: 2.2 megohms

# Pulse duration must not exceed 15% of a vertical scanning cycle (2.5 milliseconds).

DUAL TRIODE

Miniature type containing high-mu and low-mu triode units used as combined vertical-deflection oscillator and vertical-deflection amplifier in television receivers. Outlines section, 6E; requires miniature 9-contact socket. Type 13FD7 is identical with type 6FD7 except for heater ratings.

Heater Voltage (ac/dc) 6FD7 13FD7
Heater Current 6.3 13
Heater Warm-up Time (Average) — 11 seconds
Heater-Cathode Voltage:
- Peak value ±200 max ±200 max volts
- Average value 100 max 100 max volts

Direct Interelectrode Capacitances (Approx.)

<table>
<thead>
<tr>
<th></th>
<th>Unit No.1</th>
<th>Unit No.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid to Plate</td>
<td>4.5</td>
<td>10</td>
</tr>
<tr>
<td>Grid to Cathode and Heater</td>
<td>2.2</td>
<td>6.5</td>
</tr>
<tr>
<td>Plate to Cathode and Heater</td>
<td>0.4</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>pF</td>
<td>pF</td>
</tr>
</tbody>
</table>
Class A Amplifier

CHARACTERISTICS

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Unit No.1</th>
<th>Unit No.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Voltage</td>
<td>250</td>
<td>60</td>
</tr>
<tr>
<td>Grid Voltage</td>
<td>-3</td>
<td>0</td>
</tr>
<tr>
<td>Amplification Factor</td>
<td>64</td>
<td>6</td>
</tr>
<tr>
<td>Plate Resistance (Approx.)</td>
<td>40000</td>
<td>800</td>
</tr>
<tr>
<td>Transconductance</td>
<td>1500</td>
<td>7500</td>
</tr>
<tr>
<td>Plate Current</td>
<td>1.5</td>
<td>95*</td>
</tr>
<tr>
<td>Grid Voltage (Approx.): For plate current of 10 μA</td>
<td>-5.5</td>
<td></td>
</tr>
<tr>
<td>For plate current of 100 μA</td>
<td>-5.5</td>
<td>-40</td>
</tr>
<tr>
<td>Transconductance, For plate current of 1 mA</td>
<td>-5.5</td>
<td>50</td>
</tr>
<tr>
<td>Plate Current, For grid voltage of -25 volts</td>
<td>-5.5</td>
<td>6</td>
</tr>
</tbody>
</table>

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

Vertical-Deflection Oscillator and Amplifier
For operation in a 525-line, 30-frame system

MAXIMUM RATINGS (Design-Maximum Values)

<table>
<thead>
<tr>
<th></th>
<th>Unit No.1 Oscillator</th>
<th>Unit No.2 Amplifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Plate Voltage</td>
<td>330</td>
<td>330</td>
</tr>
<tr>
<td>Peak Positive-Pulse Plate Voltage*</td>
<td>1500</td>
<td>2500</td>
</tr>
<tr>
<td>Peak Negative-Pulse Grid Voltage</td>
<td>400</td>
<td>250</td>
</tr>
<tr>
<td>Peak Cathode Current</td>
<td>70</td>
<td>175</td>
</tr>
<tr>
<td>Average Cathode Current</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>Plate Dissipation</td>
<td>1.5</td>
<td>10</td>
</tr>
</tbody>
</table>

MAXIMUM CIRCUIT VALUES

Grid-Circuit Resistance:
  For grid-resistor bias or cathode bias operation 2.2 2.2 megohms

# Pulse duration must not exceed 15% of a vertical scanning cycle (2.5 milliseconds).

6FE5
Refer to chart at end of section.

6FG6/EM84
Refer to chart at end of section.

6FG7

MEDIUM-MU TRIODE—SHARP-CUTOFF PENTODE

Miniature type used as combined oscillator and mixer tube in vhf color and black-and-white television receivers. Outlines section, 6B; requires miniature 9-contact socket. Type 5FG7 is identical with type 6FG7 except for heater ratings.

Heater Voltage (ac/dc) 4.7 6.3 volts
Heater Current 0.6 0.45 ampere
Heater Warm-up Time (Average) 11 11 seconds

Heater-Cathode Voltage:
  Peak value ±200 max ±200 max volts
  Average value 100 max 100 max volts

Direct Inter-electrode Capacitances:

Triode Unit:
  Grid to Plate 1.8 1.8 pF
  Grid to Cathode, Pentode Grid No.3, and Heater 3 3 pF
  Plate to Cathode, Pentode Grid No.3, and Heater 1.3 1.9 pF

Pentode Unit:
  Grid No.1 to Plate 0.02 max 0.01 max pF
  Grid No.1 to Cathode, Grid No.3, Grid No.2, and Heater 5 5 pF
  Plate to Cathode, Grid No.3, Grid No.2, and Heater 2.4 3.4 pF
  Heater to Cathode, and Pentode Grid No.3 6 6* pF

* With external shield connected to cathode except as noted.
* With external shield connected to ground.
### Class A<sub>1</sub> Amplifier

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Triode Unit</th>
<th>Pentode Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Voltage</td>
<td>380</td>
<td>380</td>
</tr>
<tr>
<td>Grid-No.2 (Screen-Grid) Supply Voltage</td>
<td>--</td>
<td>380</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Grid-No.1 (Control-Grid) Voltage, Positive-bias value</td>
<td>2.5</td>
<td>3</td>
</tr>
<tr>
<td>Plate Dissipation</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Grid-No.2 Input:</td>
<td>--</td>
<td>0.55</td>
</tr>
<tr>
<td>For grid-No.2 voltages up to 165 volts</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>For grid-No.2 voltages between 165 and 380 volts</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

**CHARACTERISTICS**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Triode Unit</th>
<th>Pentode Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Voltage</td>
<td>125</td>
<td>100</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Grid-No.1 Voltage</td>
<td>1</td>
<td>125</td>
</tr>
<tr>
<td>Amplification Factor</td>
<td>43</td>
<td>--</td>
</tr>
<tr>
<td>Plate Resistance (Approx.)</td>
<td>5700</td>
<td>--</td>
</tr>
<tr>
<td>Transconductance</td>
<td>7500</td>
<td>7400 6000</td>
</tr>
<tr>
<td>Plate Current</td>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td>Grid-No.2 Current</td>
<td>--</td>
<td>11</td>
</tr>
<tr>
<td>Grid-No.1 Voltage (Approx.)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>of 30 μA</td>
<td>--</td>
<td>7.5</td>
</tr>
</tbody>
</table>

---

### HIGH-MU TRIODE

Miniature type used as an rf amplifier in vhf tuners of color and black-and-white television receivers. Outlines section, 5C; requires 7-contact socket. Type 2FH5 is identical to type 6FH5 except for heater ratings.

**6FH5**

2FH5

<table>
<thead>
<tr>
<th>Parameter</th>
<th>2FH5</th>
<th>6FH5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater Voltage (ac/dc)</td>
<td>2.35</td>
<td>6.3</td>
</tr>
<tr>
<td>Heater Current</td>
<td>0.6</td>
<td>0.2</td>
</tr>
<tr>
<td>Heater Warm-up Time (Average)</td>
<td>11</td>
<td>0.2</td>
</tr>
<tr>
<td>Peak Heater-Cathode Voltage</td>
<td>±100 max</td>
<td>±100 max</td>
</tr>
<tr>
<td>Direct Interelectrode Capacitances (Approx.):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unshielded</td>
<td>0.52</td>
<td>0.52</td>
</tr>
<tr>
<td>Shielded*</td>
<td>3.2</td>
<td>3.2</td>
</tr>
<tr>
<td>Grid to Plate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grid to Cathode, Heater, and Internal Shield</td>
<td>3.2</td>
<td>4</td>
</tr>
<tr>
<td>Plate to Cathode, Heater, and Internal Shield</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* With external shield connected to Pin 1.

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>150</th>
<th>0</th>
<th>volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Voltage</td>
<td></td>
<td>0</td>
<td>volts</td>
</tr>
<tr>
<td>Grid Voltage, Positive-bias value</td>
<td>22</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Cathode Current</td>
<td></td>
<td>2.2</td>
<td>watts</td>
</tr>
<tr>
<td>Plate Dissipation</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

![Graph of TYPE 6FH5](92CS-10355TI)

---
### CHARACTERISTICS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Voltage</td>
<td>135 volts</td>
</tr>
<tr>
<td>Grid Voltage</td>
<td>-1 volts</td>
</tr>
<tr>
<td>Plate Resistance (Approx.)</td>
<td>5600 ohms</td>
</tr>
<tr>
<td>Transconductance</td>
<td>9000 μhos</td>
</tr>
<tr>
<td>Amplification Factor</td>
<td>50</td>
</tr>
<tr>
<td>Plate Current</td>
<td>11 mA</td>
</tr>
<tr>
<td>Grid Voltage (Approx.) for plate current of 100 μA</td>
<td>-5.5 volts</td>
</tr>
</tbody>
</table>

### MAXIMUM CIRCUIT VALUE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-Circuit Resistance, for cathode-bias operation</td>
<td>1 m degrade</td>
</tr>
</tbody>
</table>

### 6FH8 MEDIUM-MU TRIODE—THREE-PLATE TETRODE

Miniature type used in complex-wave generator applications and in television receiver applications. Sharp-cutoff tetrode unit has pair of additional plates. Outlines section, 6B; requires 9-contact socket.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater Voltage (ac/de)</td>
<td>6.3 volts</td>
</tr>
<tr>
<td>Heater Current</td>
<td>0.45 amperes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Capacitance Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triode Unit: Grid to Plate</td>
<td>1.4 pF</td>
</tr>
<tr>
<td>Grid to Cathode and Heater</td>
<td>2.6 pF</td>
</tr>
<tr>
<td>Plate to Cathode and Heater</td>
<td>1 pF</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Capacitance Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tetrode Unit: Grid No.1 to Plate No.2</td>
<td>0.06 max pF</td>
</tr>
<tr>
<td>Grid No.1 to Cathode, Heater, Grid No.2, Plate No.1A, and Plate No.1B</td>
<td>4.5 pF</td>
</tr>
<tr>
<td>Plate No.2 to Cathode, Heater, Grid No.2, Plate No.1A, and Plate No.1B</td>
<td>1.4 pF</td>
</tr>
<tr>
<td>Tetrode Grid No.1 to Triode Plate</td>
<td>0.36 max pF</td>
</tr>
<tr>
<td>Tetrode Plate No.2 to Triode Plate</td>
<td>0.008 max pF</td>
</tr>
</tbody>
</table>

*With external shield connected to cathode.

### Class A, Amplifier

**Triode Unit**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Voltage</td>
<td>100 volts</td>
</tr>
<tr>
<td>Grid Voltage</td>
<td>-1 volt</td>
</tr>
<tr>
<td>Amplification Factor</td>
<td>40</td>
</tr>
<tr>
<td>Plate Resistance (Approx.)</td>
<td>7400 ohms</td>
</tr>
<tr>
<td>Transconductance</td>
<td>5400 μhos</td>
</tr>
<tr>
<td>Plate Current</td>
<td>7.9 mA</td>
</tr>
<tr>
<td>Grid Voltage (Approx.) for plate current of 100 μA</td>
<td>7 volts</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tetrode Unit with Plates No.1A and No.1B Connected to Cathode at Socket</td>
<td></td>
</tr>
</tbody>
</table>

### MAXIMUM RATINGS (Design-Maximum Values)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate-No.2 Voltage</td>
<td>250 volts</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>250 volts</td>
</tr>
<tr>
<td>Grid-No.1 Voltage</td>
<td>-2 volts</td>
</tr>
<tr>
<td>Plate-No.2 Resistance (Approx)</td>
<td>0.75 meghohm</td>
</tr>
<tr>
<td>Transconductance, Grid No.1 to Plate No.2</td>
<td>4400 μhos</td>
</tr>
<tr>
<td>Plate-No.2 Current</td>
<td>7.3 mA</td>
</tr>
<tr>
<td>Grid-No.2 Current</td>
<td>1.4 mA</td>
</tr>
<tr>
<td>Grid-No.1 Voltage (Approx.) for plate-No.2 current of 100 μA</td>
<td>-7 volts</td>
</tr>
</tbody>
</table>

### Complex-Wave Generator

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Triode Unit</th>
<th>Tetrode Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Voltage</td>
<td>275 volts</td>
<td></td>
</tr>
<tr>
<td>Plate-No.1A Voltage</td>
<td>-2 volts</td>
<td>200 volts</td>
</tr>
<tr>
<td>Plate-No.1B Voltage</td>
<td>-2 volts</td>
<td>200 volts</td>
</tr>
<tr>
<td>Plate-No.2 Voltage</td>
<td>-2 volts</td>
<td>275 volts</td>
</tr>
<tr>
<td>Grid-No.2 (Screen-Grid) Supply Voltage</td>
<td>-2 volts</td>
<td></td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>-2 volts</td>
<td>See curve page 300</td>
</tr>
<tr>
<td>Grid-No.1 (Control-Grid) Voltage:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative-bias value</td>
<td>-40 volts</td>
<td>-40 volts</td>
</tr>
<tr>
<td>Positive-bias value</td>
<td>0 volts</td>
<td>0 volts</td>
</tr>
<tr>
<td>Plate Dissipation</td>
<td>1.7 watts</td>
<td></td>
</tr>
<tr>
<td>Plate-No.1A Dissipation</td>
<td>0.3 watts</td>
<td></td>
</tr>
<tr>
<td>Plate-No.1B Dissipation</td>
<td>0.3 watts</td>
<td></td>
</tr>
<tr>
<td>Plate-No.2 Dissipation</td>
<td>2.3 watts</td>
<td></td>
</tr>
</tbody>
</table>
Grid-No.2 Input:
For grid-No.2 voltages up to 137.5 volts ........................................ 0.45 watt
For grid-No.2 voltages between 137.5 and 275 volts ......................... See curve page 300

TYPICAL OPERATION WITH SEPARATE PLATE OPERATION  Tetrode Unit
Plate-No.1A, No.1B, and No.2 Voltage ........................................ 100 volts
Grid-No.2 Voltage ............................................................................... 50 volts
Grid-No.1 Voltage .............................................................................. 1 volt
Plate-No.1A Current ................................................................. 0.04 mA
Plate-No.1B Current ................................................................. 0.04 mA
Plate-No.2 Current ................................................................. 1.6 mA
Grid-No.2 Current ........................................................................... 0.3 mA
Transconductance (Approx.):
Grid No.1 to Plate No.1A ..................................................... 70 μhmhos
Grid No.1 to Plate No.1B ..................................................... 70 μhmhos
Grid No.1 to Plate No.2 ......................................................... 2500 μhmhos

MAXIMUM CIRCUIT VALUES  Triode Unit  Tetrode Unit
Grid-No.1-Circuit Resistance, for fixed-bias operation ..................... 0.5 megohm

Refer to chart at end of section.

6FJ7

DUAL TRIODE  6FM7  13FM7/15FM7
Duodecar type used as combined vertical-deflection oscillator and vertical-deflection amplifier in color and black-and-white television receivers. Triode unit No.1 is used as an oscillator, and triode unit No.2 is used as an amplifier. Outlines section, 8C; requires duodecar 12-contact socket. Type 13FM7/15FM7 is identical with type 6FM7 except for heater ratings.

Heater Voltage (ac/dc) ......................................................... 6.3 13 volts
Heater Current .......................................................... 1.05 0.45 amperes
Heater Warm-up Time (Average) ........................................... 11 seconds
Heater-Cathode Voltage:
  Average value .................................................. ±200 max 100 max volts
  Peak value ......................................................... ±200 max 100 max volts

Class A1 Amplifier

CHARACTERISTICS  Unit No.1  Unit No.2
Plate Voltage .............................................................. 250 175 volts
Grid Voltage .............................................................. 3  25 volts
Amplification Factor ..................................................... 66 5.5
Plate Resistance (Approx.) ................................................ 3800 920 ohms
Transconductance .......................................................... 2200 6000 μhmhos
Plate Current ........................................................................... 2 40 mA
Grid Voltage (Approx.) for plate current of 20 μA ................. 5.8 — volts
Grid Voltage (Approx.) for plate current of 200 μA .......... — 45 volts

Vertical-Deflection Oscillator and Amplifier
For operation in a 525-line, 30-frame system

MAXIMUM RATINGS (Design-Maximum Values)  Unit No.1  Unit No.2
DC Plate Voltage .......................................................... 350 500 volts
Peak Positive-Pulse Plate Voltage# ...................................... — 1500 volts
Peak Negative-Pulse Plate Voltage ...................................... 400 250 volts
Peak Cathode Current ..................................................... — 175 mA
Average Cathode Current ................................................ 50 mA
Plate Dissipation† ........................................................ 1 10 watts

MAXIMUM CIRCUIT VALUES
Grid-Circuit Resistance:
  For fixed-bias operation ........................................... 1 1 megohm
  For cathode-bias operation .................................... 2.2 2.2 megohms

# Pulse duration must not exceed 15% of a vertical scanning cycle (2.5 milliseconds).
† A bias resistor or other means is required to protect the tube in absence of excitation.