12FX5

**POWER PENTODE**

Miniature type used in output stages of audio amplifiers. Outlines section, 5D; requires miniature 7-contact socket. Types 19FX5 and 60FX5 are identical with type 12FX5 except for heater ratings.

<table>
<thead>
<tr>
<th>12FX5</th>
<th>19FX5</th>
<th>60FX5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater Voltage (ac/dc)</td>
<td>12.6</td>
<td>18.9</td>
</tr>
<tr>
<td>Heater Current</td>
<td>0.45</td>
<td>0.3</td>
</tr>
<tr>
<td>Heater Warm-up Time (Average)</td>
<td>11</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 Interelectrode Capacitances (Approx.):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grid No.1 to Plate</td>
<td>0.65</td>
<td>pF</td>
</tr>
<tr>
<td>Grid No.1 to Cathode, Heater, Grid No.2, and Grid No.3</td>
<td>17</td>
<td>pF</td>
</tr>
<tr>
<td>Plate to Cathode, Heater, Grid No.2, and Grid No.3</td>
<td>9</td>
<td>pF</td>
</tr>
</tbody>
</table>

**Class A, Amplifier**

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

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Voltage</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>Grid-No.2 (Screen-Grid) Voltage</td>
<td>130</td>
<td></td>
</tr>
<tr>
<td>Plate Dissipation</td>
<td>5.5</td>
<td>watts</td>
</tr>
<tr>
<td>Grid-No.2 Input</td>
<td>2</td>
<td>watts</td>
</tr>
<tr>
<td>Bulb Temperature (At hottest point)</td>
<td>225</td>
<td>ºC</td>
</tr>
</tbody>
</table>

**TYPICAL OPERATION**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Supply Voltage</td>
<td>110</td>
<td></td>
</tr>
<tr>
<td>Grid-No.2 Supply Voltage</td>
<td>115</td>
<td></td>
</tr>
<tr>
<td>Cathode-Bias Resistor</td>
<td>62</td>
<td>ohms</td>
</tr>
<tr>
<td>Peak AF Grid-No.1 Voltage</td>
<td>3</td>
<td>volts</td>
</tr>
<tr>
<td>Zero-Signal Plate Current</td>
<td>36</td>
<td>mA</td>
</tr>
<tr>
<td>Maximum-Signal Plate Current</td>
<td>35</td>
<td>mA</td>
</tr>
<tr>
<td>Zero-Signal Grid No.2 Current</td>
<td>10</td>
<td>mA</td>
</tr>
<tr>
<td>Maximum-Signal Grid No.2 Current</td>
<td>12</td>
<td>mA</td>
</tr>
<tr>
<td>Plate Resistance</td>
<td>12500</td>
<td>ohms</td>
</tr>
<tr>
<td>Transconductance</td>
<td>13500</td>
<td>mhos</td>
</tr>
<tr>
<td>Load Resistance</td>
<td>3000</td>
<td>ohms</td>
</tr>
</tbody>
</table>
Technical Data

Total Harmonic Distortion ........................................... 8 per cent
Maximum-Signal Power Output ....................................... 1.3 watts

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

Refer to chart at end of section.

12FX8
12FX8A
12GA6
12GB3
12GB6
12GB7
12GC6
12GE5
12GJ5
12GJ5A
12GN7
12GN7A
12GT5
12GT5A
12GW6/12DQ6B
12H6
12HE7
12HG7
12HG7

SHARP-CUTOFF PENTODE

Miniature types with frame grid used as video amplifier in color and black-and-white television receivers. Outlines section, 6E; require 9-contact miniature socket.

Heater Arrangement:
Heater Voltage (ac/dc) ............................................. 12.6 volts
Heater Current ...................................................... 0.26 ampere

Series  6.3
Parallel  0.62
Heater-Cathode Voltage:
Peak value .............................................. ±200 max volts
Average value ........................................... 100 max volts

Direct Interelectrode Capacitances:
Grid No.1 to Plate .............................. 0.15 max pF
Grid No.1 to Cathode, Heater, Grid No.2, Grid No.3, and Internal Shield ............................. 14 max pF
Plate to Cathode, Heater, Grid No.2, Grid No.3, and Internal Shield ............................. 4.4 max pF

Class A, Amplifier

MAXIMUM RATINGS (Design-Maximum Values)
Plate Voltage ........................................... 400 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 .......................................... 10 watts
Grid-No.2 Input:
For Grid-No.2 voltages up to 165 volts .................................................. See curve page 300
For Grid-No.2 voltages between 165 and 330 volts ......................................... 1 watt

CHARACTERISTICS
Plate Supply Voltage .................................... 300 volts
Grid No.3 (Suppressor Grid) Connected to cathode at socket
Grid-No.2 Supply Voltage ..................................... 135 volts
Grid No.1 Connected to negative end of cathode resistor
Cathode Resistor ........................................... 47 ohms
Plate Resistance (Approx.) .............................. 60000 ohms
Transconductance ......................................... 32000 µohms
Plate Current ............................................. 31 mA
Grid-No.2 Current ........................................... 4.8 mA
Grid-No.1 Voltage (Approx.) for plate current of 100 µA ................................- 4.5 volts

MAXIMUM CIRCUIT VALUES
Grid-No.1 Circuit Resistance:
For fixed-bias operation .................................. 0.1 megohm
For cathode-bias operation ................................ 0.25 megohm

12HL7 SHARP-CUTOFF PENTODE
Miniature type with frame grid used as a video output amplifier in color television receivers. Outlines section, 6E; requires miniature 9-contact socket.

Heater Arrangement ........................................... Series
Heater Voltage ........................................... 12.6 volts
Heater Current ............................................ 0.3 ampere
Heater-Cathode Voltage:
Peak value: ±200 max
Average value: 100 max

Direct Interelectrode Capacitances:
Grid No.1 to Plate: 0.15 pF
Grid No.1 to Cathode, Heater, Grid No.2, Grid No.3, and Internal Shield: 15 pF
Plate to Cathode, Heater, Grid No.2, Grid No.3, and Internal Shield: 6 pF

Class A: Amplifier

MAXIMUM RATINGS (Design-Maximum Values)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Voltage</td>
<td>400 volts</td>
</tr>
<tr>
<td>Grid-No.3 (Suppressor-Grid) Voltage, Positive-bias value</td>
<td>0 volts</td>
</tr>
<tr>
<td>Grid-No.2 (Screen-Grid) Supply Voltage</td>
<td>330 volts</td>
</tr>
<tr>
<td>Grid-No.1 Voltage</td>
<td>See curve page 300</td>
</tr>
<tr>
<td>Grid-No.1 (Control-Grid) Voltage, Positive-bias value</td>
<td>0 volt</td>
</tr>
<tr>
<td>Plate Dissipation</td>
<td>10 watts</td>
</tr>
<tr>
<td>Grid-No.2 Input</td>
<td>1 watt</td>
</tr>
</tbody>
</table>

CHARACTERISTICS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Supply Voltage</td>
<td>50 to 250 volts</td>
</tr>
<tr>
<td>Grid-No.3 Voltage, Referred to negative end of cathode</td>
<td>— 0 volts</td>
</tr>
<tr>
<td>Grid-No.2 Voltage</td>
<td>125 to 150 volts</td>
</tr>
<tr>
<td>Grid-No.1 Voltage</td>
<td>0 to 0 volts</td>
</tr>
<tr>
<td>Cathode Resistor (Bypassed)</td>
<td>122 ohms</td>
</tr>
<tr>
<td>Plate Current</td>
<td>76 to 25 mA</td>
</tr>
<tr>
<td>Grid-No.2 Current</td>
<td>32 to 6 mA</td>
</tr>
<tr>
<td>Transconductance, Grid No.1 to Plate</td>
<td>— 21000 μmhos</td>
</tr>
<tr>
<td>Plate Resistance (Approx.)</td>
<td>— 55000 ohms</td>
</tr>
<tr>
<td>Grid-No.1 Voltage (Approx.) for plate current of 100 μA</td>
<td>— 7.2 volts</td>
</tr>
</tbody>
</table>

MAXIMUM CIRCUIT VALUES

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.1-Circuit Resistance:</td>
<td></td>
</tr>
<tr>
<td>For fixed-bias operation</td>
<td>0.1 megohm</td>
</tr>
<tr>
<td>For cathode-bias operation</td>
<td>0.25 megohm</td>
</tr>
</tbody>
</table>

Refer to chart at end of section.

Refer to chart at end of section.

Refer to chart at end of section.

Refer to chart at end of section.

Refer to type 6JB6A.

Refer to chart at end of section.

Refer to type 6JN6.

Refer to chart at end of section.

Refer to type 6JQ6.

Refer to chart at end of section.

Refer to type 6JT6A.

Refer to chart at end of section.

Refer to chart at end of section.

Refer to chart at end of section.

Refer to chart at end of section.

Refer to type 6MD8.

Refer to chart at end of section.

Refer to chart at end of section.

Refer to chart at end of section.
Refer to chart at end of section.

For replacement use type 12AF3/12BR3/12RK19.

Refer to chart at end of section.

Refer to chart at end of section.

Refer to chart at end of section.

Refer to chart at end of section.

Refer to chart at end of section.

Refer to chart at end of section.

Refer to chart at end of section.

Refer to type 6SL7GT.

Refer to chart at end of section.

Refer to type 6SN7GTB.

Refer to chart at end of section.

Refer to chart at end of section.

Refer to chart at end of section.

Refer to type 6T10.

Refer to chart at end of section.

Refer to type 6V6.

Refer to type 6W6GT.

Refer to type 6X4.

Refer to chart at end of section.

Refer to type 6CW4.

Refer to type 6DE7.

Refer to type 6DR7.

Refer to chart at end of section.

For replacement use type 13EM7/15EA7.

Refer to type 6EM7/6EA7.

Refer to type 6FD7.

Refer to type 6FM7.

Refer to chart at end of section.

Refer to type 6GB5/EL500.

Refer to type 6GF7A.