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Features

GUARANTEED LOW NOISE FIGURE
2.2 dB Max. at 2 GHz, 1.8 dB Typical

HIGH GAIN
12.0 dB Typical Gain at NF Bias Conditions

RUGGED HERMETIC PACKAGE
Co-fired Metal/Ceramic Construction

Description

The 2N6618 (HXTR-6103) is an NPN bipolar transistor designed for minimum noise figure at 2 GHz. The device utilizes ion implantation techniques and Ti/Pt/Au metallization in its manufacture. The chip is provided with scratch protection over its active area.

These devices are supplied in the HPAC-100, a rugged metal/ceramic hermetic package, and are capable of meeting the environmental requirements of MIL-S-19500 and the test requirements of MIL-STD-750/883.

Electrical Specifications at $T_{CASE} = 25^\circ C$

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameters And Test Conditions</th>
<th>Test Conditions</th>
<th>Units</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$BV_{CES}$</td>
<td>Collector Emitter Breakdown Voltage at $I_C = 100\mu A$</td>
<td>MIL-STD-750</td>
<td>V</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$I_{CEO}$</td>
<td>Collector Emitter Leakage Current at $V_{CE} = 10V$</td>
<td></td>
<td>nA</td>
<td>500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$I_{CEO}$</td>
<td>Collector Cut Off Current at $V_{CE} = 10V$</td>
<td></td>
<td>nA</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$h_{FE}$</td>
<td>Forward Current Transfer Ratio at $V_{CE}=10V, I_C=3mA$</td>
<td></td>
<td></td>
<td>50</td>
<td>150</td>
<td>250</td>
</tr>
<tr>
<td>$F_{MIN}$</td>
<td>Minimum Noise Figure at 2 GHz</td>
<td></td>
<td>dB</td>
<td>1.8</td>
<td>2.2</td>
<td></td>
</tr>
<tr>
<td>$G_a$</td>
<td>Associated Gain at 2 GHz</td>
<td></td>
<td>dB</td>
<td>11.0</td>
<td>12.0</td>
<td></td>
</tr>
<tr>
<td>$M_{MIN}^{**}$</td>
<td>Minimum Noise Measure</td>
<td></td>
<td></td>
<td>1.90</td>
<td>2.35</td>
<td></td>
</tr>
</tbody>
</table>

$*300 \mu s$ wide pulse measurement at $\leq 2\%$ duty cycle.

$** M_{MIN} = 10 \log \left( 1 + \frac{F_{MIN} - 1}{1 - 1/G_a} \right)$ Noise measure ($M_{MIN}$) is the system noise figure of an infinite cascaded chain of identical amplifier stages. $F_{MIN}$ and $G_a$ specified as power ratios.
Recommended Maximum Continuous Operating Conditions

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCEO</td>
<td>Collector to Emitter Voltage</td>
<td>16V</td>
</tr>
<tr>
<td>VEOB</td>
<td>Emitter to Base Voltage</td>
<td>1.0V</td>
</tr>
<tr>
<td>IC</td>
<td>DC Collector Current</td>
<td>10 mA</td>
</tr>
<tr>
<td>PT</td>
<td>Total Device Dissipation</td>
<td>150 mW</td>
</tr>
<tr>
<td>TJ</td>
<td>Junction Temperature</td>
<td>200°C</td>
</tr>
<tr>
<td>TSTG</td>
<td>Storage Temperature</td>
<td>-65°C to +200°C</td>
</tr>
</tbody>
</table>

Notes:
1. Operation of this device in excess of any one of these conditions is likely to result in a reduction in device mean time between failure (MTBF) to below the design goal of 1 x 10^7 hours at T_J = 175°C (assumed Activation Energy = 1.5 eV). Corresponds to maximum rating for 2N6618.
2. T_CASE = 25°C.
3. Derate at 3.3 mW/°C, T_C ≥ 155°C.

Absolute Maximum Ratings *

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCEO</td>
<td>Collector to Emitter Voltage</td>
<td>35V</td>
</tr>
<tr>
<td>VEOB</td>
<td>Emitter to Base Voltage</td>
<td>20V</td>
</tr>
<tr>
<td>IC</td>
<td>DC Collector Current</td>
<td>1.5V</td>
</tr>
<tr>
<td>PT</td>
<td>Total Device Dissipation</td>
<td>20 mA</td>
</tr>
<tr>
<td>TJ</td>
<td>Junction Temperature</td>
<td>300°C</td>
</tr>
<tr>
<td>TSTG</td>
<td>Maximum Storage Temperature</td>
<td>250°C</td>
</tr>
<tr>
<td></td>
<td>Lead Temperature</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Soldering 10 seconds each lead)</td>
<td>+250°C</td>
</tr>
</tbody>
</table>

*Operation in excess of any one of these conditions may result in permanent damage to this device.

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Figure 1. Typical G_A(max), F_MIN and Associated Gain vs. Frequency at V_CE = 10V, I_C = 3 mA.

Figure 2. Typical F_MIN and Associated Gain vs. Collector Current at 2 GHz for V_CE = 10V (Tuned for F_MIN).

Figure 3. Typical S_21E vs. Bias at 2 GHz.
Figure 4. Typical Noise Parameters at $V_{CE} = 10V$, $I_C = 3$ mA.

Typical S-Parameters $V_{CE} = 10V$, $I_C = 3$ mA

<table>
<thead>
<tr>
<th>Freq. (MHz)</th>
<th>$S_{11}$</th>
<th>$S_{21}$</th>
<th>$S_{12}$</th>
<th>$S_{22}$</th>
</tr>
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<tbody>
<tr>
<td>100</td>
<td>0.93</td>
<td>-11.5</td>
<td>16.2</td>
<td>6.46</td>
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<tr>
<td>200</td>
<td>0.89</td>
<td>-23.0</td>
<td>17.1</td>
<td>7.13</td>
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<tr>
<td>300</td>
<td>0.86</td>
<td>-34.0</td>
<td>16.4</td>
<td>6.58</td>
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<tr>
<td>400</td>
<td>0.83</td>
<td>-44.0</td>
<td>15.9</td>
<td>6.26</td>
</tr>
<tr>
<td>500</td>
<td>0.79</td>
<td>-54.0</td>
<td>15.6</td>
<td>6.02</td>
</tr>
<tr>
<td>600</td>
<td>0.75</td>
<td>-65.0</td>
<td>15.4</td>
<td>5.91</td>
</tr>
<tr>
<td>700</td>
<td>0.71</td>
<td>-73.0</td>
<td>15.0</td>
<td>5.62</td>
</tr>
<tr>
<td>800</td>
<td>0.68</td>
<td>-81.0</td>
<td>14.4</td>
<td>5.25</td>
</tr>
<tr>
<td>900</td>
<td>0.65</td>
<td>-91.0</td>
<td>14.0</td>
<td>4.99</td>
</tr>
<tr>
<td>1000</td>
<td>0.62</td>
<td>-97.0</td>
<td>13.5</td>
<td>4.72</td>
</tr>
<tr>
<td>1500</td>
<td>0.52</td>
<td>-129.0</td>
<td>11.4</td>
<td>3.71</td>
</tr>
<tr>
<td>2000</td>
<td>0.50</td>
<td>-151.0</td>
<td>9.3</td>
<td>2.93</td>
</tr>
<tr>
<td>2500</td>
<td>0.50</td>
<td>-169.0</td>
<td>7.8</td>
<td>2.45</td>
</tr>
<tr>
<td>3000</td>
<td>0.49</td>
<td>175.0</td>
<td>6.5</td>
<td>2.12</td>
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<tr>
<td>3500</td>
<td>0.54</td>
<td>155.0</td>
<td>5.4</td>
<td>1.87</td>
</tr>
<tr>
<td>4000</td>
<td>0.52</td>
<td>156.0</td>
<td>4.5</td>
<td>1.67</td>
</tr>
<tr>
<td>5000</td>
<td>0.53</td>
<td>140.0</td>
<td>2.6</td>
<td>1.35</td>
</tr>
<tr>
<td>6000</td>
<td>0.48</td>
<td>120.0</td>
<td>0.9</td>
<td>1.11</td>
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</table>